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New Delhi

Mrs. Alka Das Gupta

Chairperson

BBD Group of Education

Message from Chairperson

The Department of Electronics And Communication Engineering has always been the gem of the Dr. Akhilesh Das Gupta Institute of Technology and Management. The perennial zeal of the Department has never left the achievements stagnant. The Department not only gives students the exposure to the regular engineering curriculum but also to the aspirations of today's corporate world, thus inculcating a professional aptitude in them. The dedication of the faculty members has strengthened the learning process ensuring an environment of collaboration, experimentation, imagination, and creativity. It is such a prodigious delight in watching the students cutting edge in technical exploration, enhancing their analytical skills and brushing themselves up for the rapidly changing sector, and establishing themselves as entrepreneurs and engineers.

The Department has always reached new heights and I am looking forward to more wonders and achievements. I wish the very best to the Department of ECE for the publication of the proceeding of International E-Conference on Recent Innovations In Engineering & Technology. The proceeding beautifully provides an overview of outcome of research done by faculty members and students.

Mr. Viraj Sagar Das Gupta

President, BBD Group

Message from President

I am extremely happy to witness the shaping up of the International E-Conference on Recent Innovations In Engineering & Technology.

A special mention to the Editorial Board, who were able to capture the noteworthy proceedings of the ECE Department of Dr. Akhilesh Das Gupta Institute of Technology and Management and were also able to present it in an alluring manner. I thoroughly enjoyed myself going through the pages of this conference.

This issue of the technical magazine is an insight to what campus life truly means, the surfeit events together represent the opportunities that one can take and augment their personalities up to the brim and be glorious predominantly.

I hope students and faculty members find this Edition as sound as I did. I congratulate the Department and the Editorial Board for this achievement.

Sh. S.N. Garg

Chief Executive Officer

Message from CEO

Even after so many batches passing under my supervision, the joy and happiness remain constant. ADGITM is exemplary both from the point of view of merit as well as from the placement perspective. Our students have been placed in the best organisations of the country and we strive to maintain such decorum by which the students are benefited the most. With an aim to remain quality conscious ADGITM has put in efforts for providing the best industrial exposure along with a professionally ethical environment, where one can develop himself / herself on multiple levels. As technology is advancing at a very rapid rate, we have an experienced and well-qualified faculty panel to adjust to the market requirements and guide the students as and when required. The only way to become technically stimulated is by receiving the proper exposure to the world and that is what we inculcate in our students. Our institution is technology-friendly and we don't restrain students from experimenting new technologies and work styles, that is how we inculcate self-reliance and tech-savvy mind.

Prof. (Dr.) Sanjay Kumar

Director, ADGITM

Message from Director

"Engineering is not only the study of the technical subjects, but it is about living an intellectual life."

As the Director of Dr. Akhilesh Das Gupta Institute of Technology and Management, I strongly believe that education is not only about imparting knowledge but more about opening the individual's mind to self-expression. I have been personally encouraging students to develop an overall sensibility and awareness. Encouraging them to, not try, but make it happen. I saw an overwhelming response by the students in not only technical domain but also in the branch of sports, art, dance, photography, music and a lot more. Students are our partners in our mission to set a new benchmark in the field of engineering. I am confident that with such a positive and progressive attitude they would be able to justify the credibility of the Department as well as the college by bringing laurels and what not.

I am immensely proud to observe a team of such enthusiasts. The proceeding of International E-Conference on Recent Innovations In Engineering & Technology of the Department of Electronics and Communication Engineering has been able to make a count of all the achievements, hard work and dedication of the faculty members and students alike. I wish them luck.

Dr. Yamini S.

Principal, ADGITM

Message from Principal

When it comes to the real world, everybody needs to be a go-getter. The onus of our institution is to enable the students not only to adapt to changes for the betterment of the society but also be the catalyst to make it more equitable. Dr. Akhilesh Das Gupta Institute of Technology and Management believes in this maxim and the institution has always worked to provide quality education.

We believe that the best way to learn something is actually by doing it, therefore practical education is of utmost importance to us which makes the students well-fortified with contemporary techniques and innovative practices. Our staff is highly committed and dedicated to provide an environment where one can freely think and burgeon their persona and also to help them encourage others to bloom.

The ADGITM family will stay united to bring glory to the institution and serve for the betterment of the society. One of my beliefs is a very famous quote by Albert Einstein that still motivates brilliance, "Never regard study as a duty, but as the enviable opportunity to learn".

Vision of the Institute

To produce globally competent and socially responsible technocrats and entrepreneurs who can develop innovative solutions to meet the challenges of 21st century.

Mission of the Institute

1. To provide value-based education through multi grade teaching methodologies and modern education facilities.

2. To sustain an active partnership program with industry and other academic institutes with an aim to promote knowledge and resource sharing.

3. To conduct value-added training programme to enhance employability.

4. To provide conducive environment for development of ethical and socially responsible technocrats, managers and entrepreneurs.

Vision of the Department

To produce World class Electronics & Communication Engineers through academic excellence and innovations, who would be competent Technocrats with work ethics to meet the needs of the society.

Mission of the Department

M1. To impart quality education for excelling in the field of Electronics & Communication Engineering to face real world challenges in existing and emerging domains.

M2. To provide a creative platform for promotion of innovations in the field of Electronics & Communication Engineering by keeping close proximity to industry.

M3. To provide conducive environment for development of work ethics and prepare socially responsible citizens.

Program Educational Objectives

PEO1: Graduates shall excel in the field of electronics and communication engineering by applying their acquired knowledge and skills to develop feasible and viable solutions to engineering challenges of the country.

PEO2: Graduates shall be adaptive to innovations and new technologies which shall lead them to professional excellence.

PEO3: Graduates shall manage resources skillfully and practice the profession with ethics, integrity and social responsibility.

Paper List

Free Space Optics: Applications and Challenges

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***Abstract*—Free space optics (FSO) is a rapidly evolving communication technology in which the free space behaves as the medium between the receiver and the source. The FSO technology prominently depends on the line-of-sight (LOS) technology. FSO transmits the optical signal as a source using air, vacuum, free space etc. as the media between transceivers. High unlicensed bandwidth and a very high data rate have made FSO one of the most popular communication technologies for data transmission. This paper discusses various applications and challenges faced by FSO systems.**

Keywords— Free space optics, optical communication, BER, SNR, LOS, data rate

I. INTRODUCTION

FSO (free space optics) is a communication technology which transmits optical signals or data with the help of light propagation over free space without any requirement of additional optical cables. It uses and implements light emitting diodes (LEDs) or optical lasers for the provision of transmission of data. It requires a line-of-sight (LOS) channel between the source and the receiver nodes. FSO principle is quite similar to OFC (optical fiber cable) systems where the latter communicate optical signals using OFC cores and fibers made of glass. FSO is a full duplex bidirectional communication technology providing very high bandwidth, high data rate and unlicensed spectrum [1].

FSO provides data rate as high as 2.5 Gbps for voice, video and other type of signals through the vacuum, free space or air , allowing full optical signal connectivity without the requirement of any kind of physical channel or spectrum licenses [2]. FSO uses the spectrum between 780 – 1600 nm wavelengths for the purpose of signal transmission. mainly consists of three main components: transmitter which sends of optical data through the optical channel, free space optical transmission channel and receiver at the receiving end [3] – [4].

The rest of the paper is organized as below: Section II presents the basic overview of the FSO systems Section III describes the major applications in the field of FSO. Section IV discusses main advantages of FSO. We discuss limitations of FSO in Section V. Section VI concludes the paper with some closing remarks.

II. SYSTEM OVERVIEW

FSO consists mainly of three major components: transmitter, LOS free space channel and receiver. The transmitter is an optical source consisting of laser diodes or LEDs to transmit of optical signal through the atmosphere. The selection of any source basically depends on various prominent factors such as price, availability of components, transmission lifetime, transmission wavelength, modulation safety of eye, physical and structural dimensions. The source modulates the information signal depending upon modulation techniques involved. The data is transmitted over the free space channel with air or vacuum as the underlying medium. The receiver consists of photo detectors converts the received optical signal back to electrical signal. The transmission and reception technique can be half duplex or full duplex [5].

III. APPLICATIONS OF FSO

FSO has huge applications in the domain of communication. They are discussed below:

A. Telecom applications: FSO is mainly involved in the area of telecommunication because of its unlicensed spectrum and high bandwidth.
B. Computer networking: Computer networking is emerging domain which requires unlicensed spectrum for the purpose of communication which is provided by FSO

C. Temporary installation for disaster recovery: In disaster situations, FSO links can be quickly and easily deployed, therefore, they act as a very useful system for communication in such situations.
D. Satellite communications: For robust communication over satellite links, FSO provide unbounded channel media.
E. Security systems: As FSO systems are LOS and secure, they are utilized in many security systems. They are not affected by the eavesdropping and provide safe transmission of data [6].
F. Military systems and applications: Since, FSO systems provide high bandwidth and secure communication link, they provide a very good support in military systems.
G. Enterprise connectivity: For the purpose of data transfer between two or more enterprises or buildings, provide a very high bandwidth channel.
H. Storage area network: FSO systems act as storage area networks (SAN) due to their high capacity and secure channel systems [7].
I. Last mile access: For the purpose of last mile and last inch connectivity, FSO systems provide high secure links due to their quick deployment. The LOS channel can be used to provide last mile connections to the end user.
J. Fiber backup for redundancy: They provide redundant networks in case of any issue with available fiber channel. They act as backhaul system in case of any issue with underlying fiber networks.
K. Backhaul for cellular telephone data: Cellular traffic can also be backhauled on the FSO channel since it provides high unlicensed spectrum.

IV. ADVANTAGES OF FSO

A. High speed data rates: FSO provides very capacity and high data rates upto Gbps.
B. Immune from electromagnetic disturbances: Since, it operates on LOS links using LEDs and diodes, therefore, they provide high immunity from atmospheric disturbances [8].
C. Invisible to human eyes: LASER emission and LED outputs are invisible to human eyes if the operating wavelength is not in the visible spectrum.
D. Safe for humans: FSO communication is safe humans.
E. Lower error rate: High capacity and high bandwidth provision in FSO links give rise to very low error rates, thus, increasing the overall throughput.
F. Long haul communication: FSO can be used for long distance transmission which can range in kilometers.
G. Quick deployment: FSO links are very quick install [9].
H. Low maintenance: FSO links are robust in nature so they do not require high maintenance.
I. Lower cost of installation: The installation of FSO systems require very low cost [10] – [11].
J. License free spectrum: They operate on license free spectrum.

V. CHALLENGES OF FSO

The transmission channel or the medium consists of atmospheric channel or air, therefore, FSO suffers from various un-avoidable environmental challenges. The troposphere regions is suffered from few disturbances which effectively deteriorates the overall capacity of the medium. where most of the atmospheric phenomenon occurred [12]. Temperature fluctuations in different atmospheric regions cause variation in the receiving amplitude. This gives rise to fluctuating power at the receiving end. The effect of scintillation is effectively restored by unique multiple beam system [13].

Apart from these, flying birds, flora, fauna and tall enterprise or buildings can potentially block the LOS FSO signal which can hamper the received BER or signal-to-noise ratio (SNR). Further, there are few geometric losses along the channel which are also referred as optical signal attenuation. These are produced in the system due to spreading of the optical beam. These losses reduce the received power level of signal during the transmission over the FSO channel [14]. Furthermore, absorption due to the presence of water particles suspended freely in the channel cause reduction in the power level as the power of the optical photons are absorbed by these suspended water particles. This gives rise to a decrement in the received SNR.

The atmospheric disturbance is caused by fluctuations in weather and environmental variations. This produces major fluctuations in the air density of air leading to the change in the refractive index of the air [15] – [16]. Turbulence can potentially lead to degradation in overall signal transmission. Atmospheric attenuation in FSO is basically due to presence of fog, haze, rain and dust particles in the medium. Attenuation due to haze conditions is dependent on the transmitted wavelengths whereas in the fog related situations, it is independent of any wavelength.

Scattering in the FSO channel results from the collision of optical signal beam and scatterers present in the system. It is a wavelength dependent phenomenon in which the energy of optical beam is remains unchanged. But, the directional redistribution of energy of the optical beam is created which gives rise to the reduction in the overall beam intensity for long haul communication [17]. Atmospheric attenuation is further divided into various types: (1)Rayleigh scattering: This type is also referred to as molecule scattering.(2)Mie scattering: This type of scattering is further known as aerosol scattering.(3)Non-selective scattering: It is also known as geometric scattering [18].

VI. CONCLUSION

FSO or free space communication system is advancing as a prominent technology which offers multitudes of advantages over existing technologies and techniques such as radio frequency (RF) communication and microwave transmission. It offers low cost deployment, high capacity, high bandwidth, high data rate and other features which attract the academia and industries. Optical equipment used in fiber optic environment can be re-used in FSO system with slight change and modification. Therefore, it also offers the re-using of optical fiber equipment. These advantages and merits of FSO communication systems and their applications in communication environment make them a very attractive technology. As with other communication systems, FSO also suffers from few limitations such as atmospheric turbulence and attenuation. Many studies are being carried out in this domain to further increase the data rate and decrease the overall attenuation in these systems.

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Aerial Manipulator : A review article on UAVs with Robotic arm

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***Abstract*— It has always been a challenge to put technology to use in case of disaster. Clearly ,because we cannot determine the situation and magnitude of destruction beforehand that a disaster might cause. There have been various instances, where the previously trained and tested models failed because the situations were not carefully examined or the environment in the disaster hit zones were not ambient for the system survival. Thus ,for a UAV system to be deployed successfully in such a situation we need to examine and take into consideration various factors. This review article will be focusing on the need for various factors to be considered before the actual deployment of the UAVs in the environment.**

Keywords—Quadcopters, Robotic Arm, UAVs, Degree of Freedom, Kinematic Algorithms, Disaster Management

I. INTRODUCTION

Aerial search and rescue(SAR) operations are always preferred in disaster zones. Earlier practices included sending large planes to the zones which was not an efficient method because it needs to be landed in the area of disasters. After world war 2 introduction of small planes and helicopters allowed the process to be more convenient and more efficient. However ,while combating search and rescue operations many rescuers lose their lives because of flying at low altitudes. During the last decade many adventure activities in Greenland , which is prone to avalanche increased exponentially .After the first usage of UAV in Greenland in the SAR operation in a snow avalanche near a snow activity site, there was no turning back, as it turned out to be the most efficient method of all. In one such example UAV equipped with thermal sensors has been used [1].The UAVs allows us to gather a better of the understanding of the situation by providing the images of the environment. Thus, enabling us to send help accordingly. This leads to lesser or no casualties of the rescuers. Globally,t here are many such instances where UAVs have been used by various rescue organisations during natural disasters. In India, the National Disaster Management Authority (NDMA), an apex body for disaster management, used drones for the first time during the Uttarakhand floods in 2013, and subsequently during the Kerala floods in 2018 [2].The UAVs have been serving military operations as well by dropping the munitions which is predefined or by firing through manned instructions [3]. Besides battlefield operations, UAVs have been extensively used in the US military research for information-warfare and security purposes[4].

A robotic arm is deployed for performing the desired activities like dropping and grabbing aids, food, etc. For this purpose a 3-Degree of Freedom(DOF) arm is usually equipped. However, while performing SAR operations ,a more complex instruction set might be needed .Studies and experimental surveys show that a 6-DOF system can show the best results in situations like disasters.

II. LITERATURE SURVEY

A. Components and material selection

Firstly, Thermal resistance of the frame of the UAV and that of the aerial manipulator needs to be considered as many disasters leads to major fire breakage .Thus ,choosing a material which can withstand heat of fire which can range from 2000 degree Celsius to 2500 degree Celsius. There have been researches that determine the best suited fibre or material for handling extreme temperature even in space that is it can withstand temperature of 4000 degree Celsius.[5]

Secondly, It is important that the fibre used is flexible and light. This is because while dealing in critical situations a slight damage to the body might lead to failure of the whole system and the fact that the drone has to carry the weight of the sensors and robotic arm will add on to the total weight. Thermoplastic polyurethane (TPU) is a class of plastics which exhibits maximum flexibility and it absorbs the vibrations that will result in more stable actions. Other strong materials includes nylon fibre and reinforced nylon which can absorb impacts and protect both the propellers as well as the impacted object.

Lastly, the sensors used should be precisely chosen as the live images used are not only used for taking action but also for

reporting purposes. The data collected will enable us to make more stable versions of the system.

B. Aerial manipulator

Take off and landing are a critical part of a UAV with a manipulator as the arm folds and wraps itself. While landing maneuvers there have been instances of failures while using a 3-DOF system considerably, due to less flexibility in motion. After careful study of robotic arm it can be clearly stated that, a 6-DOF arm is more efficient than a 3-DOF system in performing various operations in a disaster site.[6]Whereas a 3-DOF system can be deployed in case any aid is to be supplied and dropped aerially.

C. 6-DOF manipulator trajectory planning

After studying and conducting various surveys it was interpreted that for combating SAR operations a 6-DOF system might be sufficient .For this a robotic arm which is designed to look like a human hand with upper arm, forearm and hand or the gripper. The drone together with the arm determines the position and motion of the manipulator. The gripper (hand) of the manipulator is called end- effectors since the end effect is studied at this point. The grasping that is the opening & closing or a movement can be a mechanical mechanism. The movement is generally governed by a microprocessor.[8]

The aim of trajectory planning is to describe the requisite motion of the manipulator at a time sequence of end effectors location and derivatives of these locations, which are generated by 'interpolating" or "approximating" the desired path by a polynomial function this is generally programmed using MATLAB .The space curve that the manipulator hand moves along from an initial to final location is called path. These time base sequence locations, obtained from the trajectory planning serve as reference input or "control set points" to the manipulators control system, in turn assures that the manipulator executes the planned trajectories.[7]

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Capacitated Reliability Evaluation of Wireless Sensor Networks

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***Abstract*— Any intelligent control system relies heavily on sensors. Wireless sensor networks are one of the fastest-growing information systems, with a wide range of uses in Next Generation Networks, the Internet of Things, mission-critical and safety-critical applications. One of the most critical characteristics of such structures is their reliability. The assumption of mere connectivity in present day networks is not justifiable as these networks are bandwidth/flow restricted. A number of real-time wireless sensor networks can be modeled as flow networks with fixed capacity to analyze maximum flow from s (source) to t (terminal). Capacity Related Reliability (CRR) is an important performance index for such networks. There exist a number of CRR evaluation techniques in literature based upon the knowledge of path set/cutset, both path set and cutset and decomposition techniques and so on. In this paper we have proposed a technique that utilizes a direct method for Subset Cuts evaluation to reduce redundancy. This reduces the complexity of wireless sensor networks, as we get number of simplified subsystems. The specific characteristics of wireless sensor networks are described in this article, as well as a new approach for approximating the reliability of a capacity-constrained wireless sensor networks.**

Keywords*— *Wireless Sensor Networks, Capacity Related Reliability, Redundancy, Irredundant subset cut, Minimal Cut Set

I. INTRODUCTION

Wireless sensor networks (WSNs) are one of the fastest-growing information technologies, with a wide range of uses in Next Generation Networks (NGNs) and Cyber-Physical Systems (CPS). Sensor technology, signal processing, and wireless networking capabilities are all combined in Wireless Integrated Network Sensors. The term "cyber-physical system" refers to the tight relations and input controls between cyber components and physical components, with cyber components referring to sensing and communication systems and physical components referring to a variety of systems. Wireless sensor networks that are complex are an integral part of our everyday lives. For their stable and economically beneficial service, these complicated networks are supposed to have high-reliability results. The communication between the network's source and terminal nodes is referred to as source to terminal reliability. To assess source to terminal reliability, a variety of articles have been written and extensive testing has been conducted. For functional networks, source(s) to terminal (t) reliability is more critical. From s to t , probability of efficient contact between two network terminals (source and terminal nodes) is known as reliability. Initially, only the existence of a connection (path) from the source to the destination node was considered when evaluating s to t reliability. The likelihood that at least one operating path or connectivity exists between the source and destination nodes is known as source to terminal reliability. This method assumes that all links in the network can bear the requisite flow and that the network can relay any volume of data. However, a link's flexibility is constrained and is determined by the cost. Since networks are flow constrained, s to t reliability can be changed as the likelihood of successfully transmitting a specified volume of flow through the network [1], and this has been done termed as Capacity Related Reliability (CRR) [2]. The CRR of a large and complex communication network is calculated using a probabilistic graph G (N, L), in which nodes (N) represent communicating centres and ties (L) represent connectivity services. The literature [l-15] presents a variety of measurement methods for CRR assessment. The probability of a network successfully transmitting a specified minimum flow from a source to a terminal for a given period of time in a given operating environment is known as the CRR. Even if any of the nodes and/or connections in G (N, L) fail, one can successfully pass messages (packets) across the network as long as the network's "connectedness" property remains.

We looked at a number of cut-based and route-based techniques for CRR evaluation in the literature and discovered that some strategies only need path set information [3] to [7], some need both path set and cut set information [8, and some need only cut set information [9] to [13] for CRR evaluation. [3] proposed a simple method for evaluating a symbolic CRR expression based on minimal path sets. This approach generates a series of links by merging the network's minimum routes, with the success of these links ensuring the system's success.

For CRR assessment, a variety of approaches have been suggested. Aggarwal [4] proposed the idea of a weighted reliability index to specify the output of a telecommunication network, as well as a way to calculate it. Aggarwal [5] proposed a simple and quick algorithm for the symbolic reliability representation of CRR. For networks with multi-state connections, Varshney et al. [6] generalised the consistency metrics for reliability assessment of [4].

However, the equations for calculating full flow values is inaccurate. Lee and Park [7] proposed a framework for generating composite path sets based on the principles of additivity and eligibility. At each phase of the enumeration of composite routes, a minimum collection of links was added that increased the network's overall capacity flow the most. To test CRR, Rai and Soh [8] suggested a two-step computer solution. The simple paths were used to enumerate composite paths in the first step. The CRR composite paths were manipulated in the second phase to produce them. For computing the capacities of the generated composite paths, this method required both cut sets and path sets. However, in terms of network minimal paths, the time complexity of generating composite path sets is exponential. Since the number of cuts in most functional schemes is less than the number of routes, Aggarwal et al. [9] suggested a framework for evaluating the CRR reliability expression in terms of minimal cuts. In [10], a two-step cut-based method for evaluating CRR was suggested. Enumeration of subset cuts was performed in the first step based on a given minimum capacity requirement. Unreliability was determined using a Boolean technique from these subsets in the second process. The SCT algorithm [10] generated a large number of subsets as well as redundant subset cuts. Soh et al. [11] suggested a subset cut enumeration (SCE) strategy that significantly decreased the total number of enumerated subsets as well as the total number of redundant subset cuts. Chaturvedi [12], as well as Chaturvedi and Mishra [13], proposed methods for enumerating subset cuts groups (SCG) based on a priori knowledge of minimal cut sets. Suparna Chakraborty and Neeraj Kumar Goyal suggested an important strategy for evaluating the reliability of flow networks using irredundant subset cut enumeration [14]. CRR can be easily determined from these SCG using any sum-of-disjoint products form. These techniques [12]-[14] achieved a decline in redundancy, but increased a number of redundant subset cuts. The area of wireless sensor network reliability has a lot of study, and it's split into two categories: (1) communication based WSN reliability and (2) flow based WSN reliability. Many people are trying to figure out how reliable WSN is [16–21].

The following conclusions can be drawn from the aforementioned literature review:

• The CRR problem's major challenges are efficient enumeration of non-redundant composite paths from minimal path sets or subset cuts from minimal cut sets.

• Some techniques for enumerating subset cuts from minimum cut sets have been suggested. However, these approaches produce a vast number of repetitive internal and external words, which must be removed later.

To summarise, modern approaches are computationally and spatially unreliable, time-consuming, and complicated. The suggested solution eliminates the majority of these drawbacks. Over all, the procedure is straightforward and straightforward, yielding precise results. The rest of the document is laid out as follows. Acronyms and abbreviations of notations are used in sections II and III. The proposed approach's basic building blocks are defined in Section IV. In Section V, terminology is discussed. In section VI, an algorithm is explained. In Section VII, an example is given. Section VIII brings this paper to a close.

II. Accronyms and Abbreviations

CRR	Capacity Related Reliability
MCS	Minimal number of Cut Sets in a network
SCS	Subset Cut Sets present in a network
SCE	Subset Cut Enumeration

III. Notations

W_{min}	Required minimum capacity for flow through the Wireless Sensor network
W_{req}	Capacity required by minimal cut C_i to block flow of data through the wireless sensor network.
FL	Links with capacity less than W_{req}
RL	Links with capacity greater than W_{req}
| . |	Cardinality of cuts
SC	Subset cut of a minimal cut C_i with some Capacity

IV. Assumptions

The suggested analysis contains a few significant assumptions in order to carry out a systematic theoretical reliability analysis of WSNs in order to resolve the issue of computing node failure using a cut set approach. However, in real-world WSNs that collect sensory data from the outside world, node failure or environmental change may trigger topology switching, which affects the rate of data acquisition for each node. This study investigates the network's reliability analysis and will help WSN topology architecture, which involves the following assumptions:

• There are only two possible states for a link: usable and failed. Degraded capacity states are not taken into account.

• There are two-way links.

• Nodes are very consistent and reliable.

• There are no restrictions on node size.

• S-independent connection failures.

V. Basic Building Blocks

The generation of minimal cuts, the ordering of the minimal cut sets (MCS), and the enumeration of subset cuts from a minimal cut are all essential factors in irredundant subset cut enumeration. Minimal Cut Sets are cut sets with ties that, if any one of them fails, block the network's necessary traffic. When the discrepancy between the overall capacity of a cut and the required capacity is lower, we assume a limited number of links to fill the gap, i.e., removing a smaller number of links from the cut would result in a cut capacity reduction below Wreq. In addition, lower order MCS are required to produce lower order subset cuts. As a result, we'll start with first-order SCS, or cuts with just one part. Then we'll count how many marginal cuts have

more similarities. Finally, a lower order subset cut should be created before higher order subset cuts using a combination of two ordering mechanisms. In Table I, the proposed ordering scheme is defined. In Section C, the proposed subset cut enumeration approach enumerates the subsets of a minimal cut that are capable of blocking the necessary flow across the network.

VI. TERMINOLOGY

A graph can be used to describe a communication mechanism. A graph is a simple way to view a system, and computerised methods for studying different reliability-related output indices can be conveniently applied. G (N, L) is a graph in which N represents nodes and L represents path ties. This paper contributes a simple, computationally efficient approach to produce irredundant subset cuts from minimal cut sets of the network, with the goal of enumerating irredundant subset cuts of the network. To minimise redundant cut sets, the suggested solution does not use a decomposition process. Since the cuts after enumeration do not contain any subset that may be a superset or equivalent set to any already enumerated valid subset cut, this method prevents the generation of higher order redundant subsets of a cut. Furthermore, a cut ordering scheme is employed, which is intended to minimise the likelihood of producing lower order subset cuts after higher order subset cuts have been generated. The created cuts do not have a subset that is equal to any of the valid subset cuts that have already been enumerated.

A. Ordered management of MCS

When it comes to enumerating irredundant SCS, MCS ordering is crucial. Minimal cuts are arranged in increasing order of the difference between $W(C_i)$ and W_{req}, and cuts of the same cardinality are arranged in increasing order of the difference between $W(C_i)$ and W_{req}. By minimising the probability of producing lower order subset cuts after higher order subset cuts, this ordering scheme decreases the work required to enumerate irredundant subset cuts.

Fig. 1 shows a network with 7 nodes and 11 links, where the capacities of links are indicated in brackets. The minimum capacity requirement for the network in Fig. 1 to be successful at delivering a flow from s to t is 10, i.e., W_{req}. The ordered MCS for the network in Fig. 1 is given in Table I. In Table I, the first column gives the ranking number, the second column gives the minimal cut, the third column shows the cardinality of the cut C_i, the fourth column shows the capacity of the cut C_i, and the fifth column shows the difference between the capacity of the cut C_i and W_{req}.

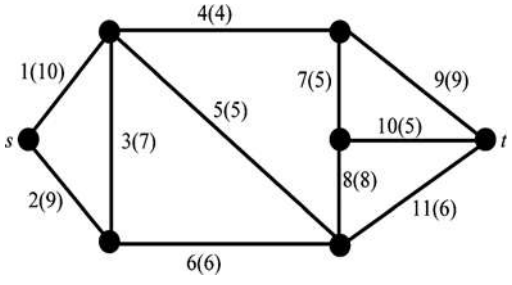

Fig. 1. A Network of 7 Nodes and 11 Links [12]. Link capacities are shown in parentheses, and link indices are shown outside.

TABLE I. ORDERED MINIMAL CUTSETS OF THE NETWORK IN FIG.1

i	C_i	$\lvert C_i \rvert$	$W(C_i)$	$W(C_i)$-W_{req}
1	1,2	2	19	9
2	4,5,6	3	15	5
3	4,8,11	3	18	8
4	9,10,11	3	20	10
5	1,3,6	3	23	13
6	4,7,10,11	4	20	10
7	2,3,4,5	4	25	15
8	5,6,7,9	4	25	15
9	7,8,9,11	4	28	18
10	5,6,8,9,10	5	33	23
11	2,3,5,7,9	5	35	25
12	1,3,5,8,11	5	36	26
13	1,3,5,7,10,11	6	38	28
14	2,3,5,8,9,10	6	43	33

B. Subset Cuts Enumeration

This method enumerates the subset cuts based on the ability to block flow through the network. Subset cuts are enumerated using:

Step 1 Enumerate single component SC using below mentioned procedure.

Lemma 1 If capacity of failed link is less than W_{req} and capacity of rest link or links present in a minimal cut C_i is are equal to W_{req}, then rest link will form a SC.

$$FL(C) < W_{req} \text{ and } RL(C) = W_{req}$$

*Example 1.*Consider minimal cut C1= {1,2}.

Solution. If we fail link {2} of C1 ,having capacity less than Wreq, then the RL ={1} have capacity equal to W_{req}.

So,SC = {1} i.e. FL.

Step 2 Enumerate more than one component SC using below mentioned procedure.

Lemma 2 If links of a minimal cut are in parallel and the capacity of failed link is less than W_{req} and capacity of rest link or links is also less than W_{req} than both failed link as well as rest link will form a SC.

$$FL(C) < W_{req} \text{ and } RL(C) < W_{req}$$

Example 2. Consider minimal cut C2 ={4,5,6}.

Solution. If FL ={6}, having capacity less than W_{req} and RL= {4,5} also have capacity less than W_{req}, then SC = {6} as well as SC = {4,5}.i.e. FL.

Lemma 3 1 If capacity of failed link or links is/are less than W_{req} and capacity of rest link present in a minimal cut C_i is greater than W_{req} ,then Rest links will form a SC.

$$FL(C) < W_{req} \text{ and } RL(C) > W_{req}$$

Example 3. Consider minimal cut C3 = {4, 8, 11}.Find its subset cut.

Solution. Apply Lemma 1on each individual link of C3. None of the individual link follows Lemma 1.

Now consider two links at a time and apply Lemma 2 if the links are in parallel otherwise apply Lemma 3 if we fail links one at a time i.e 4,8 and 11 one by one we will get

RL= ={8,11} {4,11}or{4,8} here capacity of failed link is less than W_{req} and capacity of rest links present in a minimal cut Ci is greater than W_{req}, then SC = RL =. {4,8}, {4,11},{8,11}. Then we will consider three links at a time i.e. {4,8,11}, and now we will fail two links at a time and then all the three links at a time, these combinations will not follow any lemma. So, they will not be considered as SC.

VII. ALGORITHM

*Step1.*Generate all minimal cuts and ordered them according to cardinality and capacity as mentioned in table 1.

*Step2.*Enumerate single component cut using the proposed method by applying Lemma1.

*Step3.*Enumerate more than one component cut and check redundancy.

*Step4.*Check redundancy, if any SC is subset of an already enumerated SC, then we will eliminate it.

*Step5.*Apply Lemma 2 and Lemma 3 on remaining minimal cuts.

Step6.Form a new SCS group by enumerating each minimal cut one by one.

*Step7.*Calculate CRR using sum of disjoint product method.

V. ILLUSTRATION

Fig 1 have 14 minimal cuts given in table 1 in an ordered manner. For every minimal cut we will find out SCs.

If we apply Lemma 1 on all minimal cuts we will get only two single component SC i.e. for only C1 and C2 SC are {1}and {6}.

Now we will apply Lemma 2 on all minimal cuts one by one.

C1={1,2} ,SC={1}(FROM LEMMA 1) as shown above in example 1 and now we will check redundancy and eliminate cuts C5,C12 and C13 because these minimal cuts have link {1}, which is a SC of an already enumerated SC C1.

C2={4,5,6},SC={6}and{4,5} (FROM LEMMA 2) as explained in example 2.

Here SC {6} is a subset of other two SC so we will eliminate them ,now we will have only two SC for C2 i.e. {6} and {4,5}.

Similarly, we will find out all the SCs by applying Lemma 2 and checking redundancy.

Final SCS is

SCS={1},{6},{4,5}{,4,8},{8,11},{4,11},{9,10},{10,11},

{9,11},{7,11},{4,7,10},{2,3},{5,7,9},{7,8,9}

Now, we can calculate CRR by using any of the sum of disjoint product method.

Assuming the reliabilities of links to be 0.9, and applying any Sum of Disjoint Products method [14] on the subset cuts, the CRR of the network is come out to be 0.7466321 which is same as CRR calculated in [15] because SCs are same as in [15].

TABLE II. COMPARISION

Nodes and Edges	IE Recursive	Proposed approach(SAT)
V=6,E=9	0.61089048	0.8967588
V=7,E=12	0.47509544	0.7896782
V=8,E=12	0.72987719	0.9734678
V=7,E=15	0.71898342	0.7889879

VIII. CONCLUSION

Several researchers have looked at connectivity as a factor in determining network stability in wireless sensor networks. There has been a lot of study into estimating WSN reliability, but much of it is focused on a path set and a spanning tree. The cut set solution, which is also a viable alternative, has received very little attention. The proposed method follows two step approach. It is very easy to find subset cuts from minimal cuts using this method. The number of subset cuts to be evaluated is not more than three at any stage. Our method gives equal number of terms in less time. The main visible advantage of the proposed approach is that it results in almost irredundant subset cuts of a network. Hence, the proposed method is reducing the possible generation of redundant subset cuts. The proposed method is straight forward and computationally and spatially efficient. This method can be combined with other methods for CRR evaluation.

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***Abstract*-- Harvest sicknesses are a significant danger to food security, anyway their speedy distinctive evidence stays inconvenient in various pieces of the world due to the non participation of the significant establishment. Rise of exact procedures in the field of leaf-based picture characterization has shown amazing outcomes. This paper utilizes Random Forest in distinguishing among sound and unhealthy leaf from the informational indexes made. Our proposed paper incorporates different periods of execution specifically dataset creation, include extraction, preparing the classifier and characterization. The made datasets of sick and solid leaves are all in all prepared under Random Forest to characterize the infected and sound pictures. For extricating highlights of a picture we use Histogram of an Oriented Gradient (HOG). In general, utilizing AI to prepare the enormous informational collections accessible freely gives us a reasonable method to recognize** .

***Keywords*—Diseased and Healthy leaf, Random forest, Feature extraction, Training,Image processing, Classification the infection present in plants in a giant scope.**

1. Introduction

Leaf location is a field of study under the picture acknowledgment field of PC vision. Perceiving leaves is of most extreme significance in biodiversity protection. The significant venture, location of sicknesses in leaves, is additionally another significant achievement in preserving biodiversity as well as saving harvests from infection spread. The issue of proficient plant infection assurance is firmly identified with the issues of feasible farming and environmental change . Exploration results show that environmental change can adjust stages and paces of microbe improvement; it can likewise alter have opposition, which prompts physiological changes of host-microorganism collaborations . The circumstance is additionally convoluted by the way that, today, illnesses are moved internationally more effectively than any other time. New illnesses can happen in where they were already unidentified and, inalienably, where there is no nearby aptitude to battle them . In this evolving climate, proper and opportune illness recognizable proof including early avoidance has never been more significant. There are a few different ways to identify plant pathologies. A few infections don't have any apparent manifestations, or the impact gets perceptible past the point where it is possible to act, and in those circumstances, a refined investigation is mandatory. Notwithstanding, most illnesses create some sort of indication in the apparent range, so the unaided eye assessment of a prepared proficient is the excellent strategy embraced by and by for plant infection discovery. To accomplish exact plant infection diagnostics a plant pathologist ought to have great perception abilities so one can recognize trademark indications . Varieties in manifestations demonstrated by infected plants may prompt an ill-advised finding since novice landscapers and specialists could have a larger number of troubles deciding it than an expert plant pathologist. A robotized framework intended to help distinguish plant sicknesses by the plant's appearance and visual indications could be of incredible assistance to beginners in the cultivating cycle and furthermore prepared experts as a check framework in infection diagnostics.

2. LITERATURE SURVEY

Horticulture is the biggest financial area and it assumes the significant part in monetary advancement of India. The manual ID and grouping strategies which are being utilized to recognize various sorts of leaf sicknesses that are depending on human asset. Since these methods are guided by human mediation, they are exposed to some sort of mistakes. Since people are exposed to sleepiness and because of the lack of works, robotized framework should be consolidated to limit the work and the mechanized framework additionally assists with decreasing the time devoured by manual methods Plant illnesses influence the development of their individual species, consequently their initial distinguishing proof is vital. Many Machine Learning (ML) models have been utilized for the recognition and order of plant sicknesses yet, after the progressions in a subset of ML, that is, Deep Learning (DL), this space of exploration seems to have incredible potential as far as expanded exactness. Many created/adjusted DL structures are carried out alongside a few representation strategies to identify and order the indications of plant illnesses. Additionally, a few presentation measurements are utilized for the assessment of these designs/methods. This audit gives an exhaustive clarification of DL models used to imagine different plant illnesses. Also, some examination holes are distinguished from which to acquire more

noteworthy straightforwardness for recognizing sicknesses in plants, even before their side effects show up plainly.

3. TOOLS

3.1 JUPYTER NOTEBOOK

The Jupyter Notebook is an open-source web application available on internet that allows you to create and share documents that contain live codes, equations, visualization and narrative texts. Uses include: data cleaning and transformation, numerical simulation, statistical modelling, data visualization, machine learning, and much more.

3.2 TENSORFLOW

Tensor Flow is a free and open-source software library for dataflow and differentiable programming across a scope of errands. It is a representative number related library, and is likewise utilized for machine learning applications such as neural networks .TensorFlow offers different degrees of deliberation so you can pick the correct one for your necessities. Fabricate and train models by utilizing the undeniable level Keras API, which makes beginning with Tensor Flow and AI simple. On the off chance that you need greater adaptability, anxious execution takes into consideration quick cycle and natural troubleshooting. For huge ML preparing assignments, utilize the Distribution Strategy API for appropriated preparing on various equipment setups without changing the model definition.

4. METHODS

The whole methodology of building up the model for plant infection acknowledgment utilizing profound CNN is depicted further in detail. The total interaction is isolated into a few important stages in subsections underneath, beginning with social affair pictures for grouping measure utilizing profound neural organizations.

4.1 DATASET

Datasets are required at all stages of image recognition, starting from training phase to evaluating the performance of recognition algorithms. All the images collected for the dataset were downloaded from Internet, searched by disease and plant name on various sources on internet.

In request to recognize sound leaves from ailing ones, one more class was added in the dataset. It contains just pictures of sound leaves. An additional class in the dataset with foundation pictures was valuable to get more precise arrangement. Along these lines, profound neural organization could be prepared to separate the leaves from the encompassing.

4.2 CONVOLUTION NEURAL NETWORK(CNN)

Convolution layers are made up of filters ,Filters can have different size as well as movements. When the features is presenting part of an image , the convolution operation between filters and that part of the image results in a real number with a high value. If the feature is not present, the resulting value is low.

Convolution layer contains various filters, each filter extracts different kind of features and gives one activation map, multiple activation maps are combined by stocking to form output volume In result CNN layers takes input as volume and produce output volume of different shapes.

4.3 IMAGE PROCESSING

Image acquisition is the representation of an image as an internal structure and to make copies of digitally formed image without and loss of pixels (image quality) and done image enhancement is used to adjust digital images so that the results are more suitable to display. If the image is corrupt or noisy, we restore it so that an estimating and clean image is formed. Then, image segmentation is processed for partition of an image into multiple segments, so that a clear pixel of segmented image is formed. Then, image recognisation is performed using computer vision.

5. RESULTS AND DISCUSSION

The outcomes introduced in this segment are identified with preparing with the entire information base containing both unique and increased pictures. As it is realized that convolution networks can learn highlights when prepared on bigger datasets, results accomplished when prepared with just unique pictures won't be investigated.

After adjusting the boundaries of the organization, a general exactness of 96.3% was accomplished, after the 100th preparing emphasis (95.8% without tweaking). Even after the 30th preparing cycle high precision results were accomplished with incredibly diminished misfortune, however after the 60th emphasis, the equilibrium in exactness and misfortune was done in high exactness. After each 10 thousand preparing cycles, the preview of the model was acquired. The blue line in the diagram addresses the misfortune during the preparation stage. Through preparing cycles, misfortune was quickly decreased.

6. CONCLUSIONS

There are many ways in computer vision plant disease detection and classification process. In this paper, we

approach of using deep learning method in order to automatically classify and detect plant diseases from leaf images. The complete procedure was described above, from collecting the images of leaf and to image preprocessing and augmentation and finally the procedure of training the deep CNN. Different tests were performed to check the performance of new created model

As the introduced strategy has not been abused, supposedly, in the field of plant illness acknowledgment, there was no examination with related outcomes, utilizing the specific procedure. In examination with different methods utilized and introduced in Section 2, tantamount or stunningly better outcomes were accomplished, particularly when considering the more extensive number of classes in the introduced study.

The main goal of our work is to develop a complete system consisting of server side components containing a full trained model and an application for mobile devices with features such as displaying recognized diseases in fruits, vegetables, and other parts of plants, based on leaf images captured by the mobile phone camera. This application will serve as an aid to farmers.

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Bitcoin Price Prediction using Long Short-Term Memory (LSTM)

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***Abstract* — The structure and delivery of project-based learning in computer science engineering as major project which adopts undergraduate creativities and emphasizes on real-world, open-ended projects is discussed in this paper. These projects substitute a wide range of abilities, not only those related to content knowledge or technical skills, but also practical skills. The aim for this innovative undergrad project is to show how a trained machine model can predict the price of a crypto currency if we give the right amount of data and computational power. It displays a graph with the predicted values. The most widespread technology is the kind of technological solution that could help manhood predict future events. With vast amount of data being generated and recorded on a daily basis, we have finally come close to an era where predictions can be accurate and be generated based on concrete factual data. Furthermore, with the growth of the crypto digital era more heads have turned towards the digital market for investments. This gives us an opportunity to create a model capable of predicting crypto currencies primarily Bitcoin. This can be accomplished by using a series of machine learning techniques and methodologies.**

Keywords — Bitcoin, Blockchain, machine learning, SVM, deep learning.

I. INTRODUCTION

Bitcoin price prediction is done using Neural Network (Multi-Layer Perceptron Regressor), PCA and Support Vector Regression (SVR). Bitcoin is an effective cipher currency introduced into the financial market based on its unique protocol and Nakamoto's systematic structural specification [1]. Unlike existing at currencies with central banks, Bitcoin aims to achieve complete decentralization. Participants in the Bitcoin market build faith relationships through the formation of Blockchain based on cryptography techniques using hash functions. Inherent features of Bitcoin derived from Blockchain technologies have led to diverse research interests not only in the field of economics but also in cryptography and machine learning.

Numerous studies have been steered recently on modeling the time series of Bitcoin prices as a new market variable with specific technical rules. Generalized Auto regressive Conditional Heteroskedasticity (GARCH) volatility analysis is performed to explore the time series of Bitcoin price[2]. Many studies on statistical or economical properties and characterizations of Bitcoin prices refer to its capabilities as a financial asset; these research focus on statistical properties, inefficiency of Bitcoin according to effective market hypothesis , hedging capability, speculative bubbles in Bitcoin, the relationship between Bitcoin and search information, such as Google Trends and Wikipedia and wavelet analysis of Bitcoin [3][4]. Relatively few studies have thus far been conducted on estimation or prediction of Bitcoin prices. Reference evaluates Bitcoin price formation based on a linear model by considering related information that is categorized into several factors of market forces, attractiveness for investors and global macro financial factors [5][6]. They assume that the first and second factors mentioned above meaningfully influence Bitcoin prices but with variation over time. The same researchers bound the number of regressors to facilitate linear model analysis.

Formation of Blockchain, a central technology of Bitcoin, differentiates Bitcoin from other currencies and is directly related to Bitcoin's supply and demand. To the best of our knowledge, in addition to macro-economic variables, straight use of Blockchain information, such as hash rate, difficulties and block generation rate, has not been examined to describe the process of Bitcoin price [12].

Bitcoin offers a novel opportunity for prediction due its relatively young age and resulting volatility. In addition, it is unique in relation to traditional currencies in terms of its open nature. In contrast, no complete data exists regarding cash transactions or money in flow of currencies. The well-known effective market hypothesis proposes the price of assets such as currencies react all available information and as a result trade at their fair value. Although there is an plenty of data available relating to Bitcoin and its network, the author argues that not all market participants will utilize all this information effectively and as a result it may not be reflected in the price.

Bitcoin is traded on more than 40 exchanges worldwide accepting more than 30 different currencies and has a current market capitalization of 9 billion dollars 4. Interest in Bitcoin has grown up significantly with over 250,000 transactions now taking place every day. In addition to the stable use of Bitcoin by private individuals, its lack of correlation with other assets have made it an attractive hedging option to investors. Some research has found that the price instability of Bitcoin is far greater than that of currencies [3]. This offers significant potential in comparison to mature financial markets.

The independent variable for this study is the closing price of Bitcoin in US Dollars taken from the Coin desk Bitcoin Price Index. Rather than focusing on one definite exchange this price index takes the average prices from five major Bitcoin exchanges; Bit stamp, Bitnet, Coin base, Ok Coin and It Bit. If one were to implement trades based on the signals, it would be helpful to focus on one exchange. However, the average price is more suitable for this research as some exchanges suffer isolated drops in price from internal issues such as Bitnex who were hacked recently. As a result, there is reduced noise in the averaged dataset.

II. SYSTEM DESIGN

McNally et al., demonstrated the ability of Long Short-Term Memory recurrent neural networks to generate both discrete and real-valued sequences with complex, long-range structure using next-step prediction. He has also presented a novel convolutional mechanism that allows a recurrent network to condition its predictions on an auxiliary annotation order and used this method to synthesize varied and truthful samples of online handwriting [1].According to Eyal et al., it is important to define the boundaries of a paper, including the scope [2]. Sutskever et al., showed that a large deep LSTM with a limited vocabulary can outperform a standard SMT-based system whose vocabulary is unlimited on a large-scale MT task. They confirmed that a simple, straightforward and a relatively unoptimized approach can outperform a mature SMT system, so further work will likely lead to even greater translation accuracies [3].

According to S. Nadarajah et al., The Bitcoin represents an important new phenomenon in financial markets. Relationships between social media and Bitcoin is inspected by considering the relative effect of different social media platforms and the dynamics of the resulting relationships using vector autoregressive and vector error correction models [4]. P. Katsiampa used bitcoin blockchain network features, as well as seconds-level historical bitcoin price in historical time deltas of 30, 60 and 120 minutes to develop features for supervised learning. Leveraging random forests, SVM and binomial logistic regression classifiers, price deltas 10 minutes in the future were predicted [6].

Bariviera et al., gives a new model for multi-period time series modeling, with input variable selection implemented by Bayesian sparse learning. They build a hierarchical latent variable model, where different layers have different transition steps, matching the inherent periods governing the dynamics of time series data [7].

Pavel Ciaian et al., find that an important determinant of BitCoin price (as price of any currency) is the interaction between BitCoin supply and demand. The supply of BitCoin determines the number of units in circulation and thus its scarcity on the market.Transaction demand as a medium of exchange for goods and services mainly determines the demand of BitCoin [8].

Tian Guo et al., proposed an adaptive gradient learning method for recurrent neural networks (RNN) in the context of online learning problem. The WG-Learning aims to incrementally learn the streaming time series and provide robust predictions adapting to the changing patterns as well as resisting to outliers. In the WG-Learning [9]. Fu Rui et al., presents a model called GRU NN is proposed for traffic flow prediction. They compared the performance of prediction on ARIMA, LSTM and GRU models and found that LSTM NNs and GRU NNs outperform ARIMA model in our experiment. In average, GRU NNs have reduced MAE at about 10% level than ARIMA model and 5% than LSTM NN model. In [11], Roman, Beck et al., empirically evaluated recurrent neural networks (RNN) with three widely used recurrent units, a traditional tanh unit, a long short-term memory (LSTM) unit and a newly proposed gated recurrent unit (GRU). Their evaluation focused on the task of sequence modeling on a number of datasets including polyphonic music data and raw speech signal data. The evaluation clearly demonstrated the superiority of the gated units; both the LSTM unit and GRU, over the traditional tanh unit [10].

Anne Haubo et al., explored the financial asset capabilities of bitcoin using GARCH models. The initial model presented several similarities to gold and the dollar indicating hedging capabilities and advantages as a medium of exchange. The asymmetric GARCH displayed that bitcoin may be useful in risk management and ideal for risk averse investors in anticipation of negative shocks to the market [12].

III. IMPLEMENTATION

Bayesian neural networks (BNN) are a transformed Multilayer perceptron (MLP) which is a universal term for ANNs in the fields of machine learning. The networks have been successful in many applications such as image recognition, pattern recognition, natural language processing and financial time series. It becomes known that much effective to denote the complex time series than the conventional linear models, i.e. autoregressive and moving average, etc. The structure of a BNN is built with a number of processing units classified into three categories: an input layer, an output layer and one or more hidden layers. Specifically, neural networks comprising more than one hidden layer can solve the exclusive OR (XOR) problem, which cannot be resolved by a single layer perceptron. Different from a single layer perceptron, which can only be linearly separated, they solve XOR problems by presenting backpropagation algorithms and hidden layers. The hidden layer mapping the original data to a new space transforms data that cannot be linearly disconnected into linearly separable data.

Weights of a BNN must be learned between the input hidden layer and hidden-output layer. Backpropagation points to the process in which weights of hidden layers are adjusted by the error of hidden layers propagated by the error of the output layer. An optimization method called delta rule is used to diminish the variance between a target value and output value when deriving backpropagation algorithm. In general, BNNs minimalize the sum of the following errors, *EB*, using backpropagation algorithm and delta rule.

BNNs comprises a Probabilistic Model and a Neural Network. The aim of such a design is to combine the strengths of Neural Networks and Stochastic modeling. Neural Networks display universal nonstop function approximator capabilities. Statistical models (also called probabilistic models) allows direct specification of a model with known communication between parameters to generate data. During the prediction phase, statistical models produce a complete posterior distribution and produce probabilistic guarantees on the predictions. Thus, BNNs are a sole combination of neural network and stochastic models with the stochastic model forming the core of this integration. BNNs can then produce probabilistic promises on its predictions and also generate the distribution of the parameters that it has learnt from the observations. That means, in the parameter space, the nature and distribution of the neural network's learnt parameters can be deduced.

These two features make them highly attractive to theoreticians along with practitioners.

In probabilistic modeling, one directly specifies a model for the previous parameters of the model and the likelihood, which are then joint to yield the posterior. This modeling assumes a knowledge of the interaction of the parameters in producing observed data. In that sense, this is a generative story - and the model parameters combine in a specifiable manner to produce the likelihood.

The crux of probabilistic modeling is probability conditioning, which is eminently articulated in Bayes Rule shown above. It is assumed that there is a set of unobserved parameters that define the model. In maximum likelihood modeling, one directly models the, which is the typical case in a neural network. That is, find the parameters that maximize the probability of the observed data. However, in a probabilistic approach, we use conditioning and assume that parameters of the model have some distribution according to our prior belief. The parameters and data, interact through the likelihood specification. As we observe data, we compute the posterior parameter distribution as the product of the prior and the likelihood, normalized by the probability of data (this is an intractable quantity, numerically for most interesting cases). The resulting distribution is the posterior distribution of given the observation. Note that this inference provides us a complete probability distribution and we don't have to deal with point estimates.

Traditionally in probabilistic modeling, the practitioner chooses conjugate prior for the likelihood, so that the posterior can be computed analytically (in a closed form mathematical expression). An example is the Beta prior for a Bernoulli likelihood yields a Beta posterior. Following is a sample entry of conjugate distributions (and parameters) for a few discrete.

A recurrent neural network (RNN) is a class of artificial neural network where connections occur between nodes form a directed graph along a temporal sequence. This allows it to exhibit temporal dynamic behavior. Unlike feed forward neural networks, RNNs can use their internal state (memory) to generate sequences of inputs. This makes them applicable to tasks such as unsegmented, connected handwriting recognition or speech recognition [2][3].

The term "recurrent neural network" has been used extensively to denote two broad classes of networks with a similar general structure, where one is finite impulse and the other is infinite impulse. Both classes of networks parade temporal dynamic behavior[4]. A finite impulse recurrent network is a directed acyclic graph that can be unrolled and exchanged with a strictly feedforward neural network, while an infinite impulse recurrent network is a directed cyclic graph that cannot be undone.

Both finite impulse and infinite impulse recurrent networks can have added stored state and the storage can be under straight control by the neural network.

The Independently recurrent neural network (IndRNN) is used to address the gradient vanishing and exploding problems in the traditional fully connected RNN.

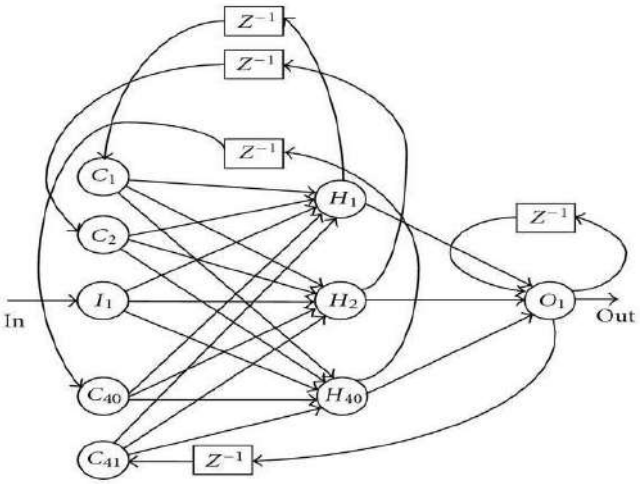

Fig. 1. Network in a directed acyclic graph

Long short-term memory is an artificial recurrent neural network, (RNN) architecture, that is utilized in the field of deep learning. Contrasting to standard feed forward neural networks, LSTM has feedback connections that make it a "general purpose computer" (that is, it can compute anything that a Turing machine can). It can not only process single data points (such as images), but also entire series of data (such as speech or video). For example, LSTM is appropriate for tasks such as unsegmented, connected handwriting recognition or speech recognition. Bloomberg Business Week wrote: "These powers make LSTM possibly the most commercial AI achievement, used for everything from predicting diseases to composing music.

A common LSTM unit comprises of a cell, an input gate, an output gate and a forget gate. The cell remembers values over arbitrary time intervals and the three gates regulate the flow of information into and out of the cell. LSTM networks are well-suited to classify, process and make predictions based on time series data, since there can be lags of unknown duration between important events in a time series.

LSTMs were established to deal with the exploding and vanishing gradient problems that can be encountered when training traditional RNNs. Relative insensitivity to gap length is an advantage of LSTM over RNNs, hidden Markov models and other sequence learning methods in various applications.

There are multiple architectures of LSTM units. A common architecture comprises of a cell (the memory part of the LSTM unit) and three "regulators", usually called gates, of the flow of information inside the LSTM unit: an input gate, an output gate and a forget gate. Some variations of the LSTM unit don't have one or more of these gates or maybe have other gates. For example, gated recurrent units (GRUs) don't have an output gate.

There are connections into and out of the LSTM gates, out of which, a few are recurrent. The weights of these connections, which are required to be learned during training, determine how the gates operate.

IV. TECHNOLOGY STACK

This project has been built primarily on Python. Python is a high-level programming language, which is very effective when trying to build machine-learning algorithms. Since it is an open source language, it has a handful of open source libraries built by third party institutions such as Google for example, which can facilitate in building of complex programs and algorithms. Complex programs can be written in lesser lines of code in python when compared to Java or other object-oriented programs due to python's modular features. It can also be used to code across wide range of platforms.

Anaconda is an open source distributor for Python. It focuses on providing IDE's and programming environments for data science and machine learning. Anaconda is widely used due to the custom packages that have been built. It is compatible with Windows, Linux and MacOS. Anaconda also has support for development in R programming and has a wide community base surround in the development in R and python development.

Spyder is one of the platform integrated development environment (IDE) available on Anaconda. It pulls together the powerful libraries required for data analysis and facilitates in building machine learning algorithm.

NumPy. NumPy is a library for the Python programming language, adding support for large, multidimensional arrays and matrices. To Embed Watermark Using Machine Learning originally created by Jim Hugunin with contributions from several other developers.

Pandas. Pandas is a software library written for the Python programming language for data manipulation and analysis. In specific, it offers data structures and operations for manipulating numerical tables and time series. It is free software released under the three-clause BSD license. The name is derived from the term "panel data", an econometrics term for data sets that include both time- series and cross-sectional data.

V. RESULT

LSTM managed to achieve the highest accuracy while the RNN achieved the lowest RMSE. The ARIMA prediction performed poorly in terms of accuracy and RMSE. This was expected. Upon analysis of the ARIMA forecast it predicted the price would gradually rise each day. There were no false positives from the model. One reason for this may be due to the class imbalance in predictive portion of the ARIMA forecast. This contributed to the specificity and precision being so high (specificity, precision= 1). This does not necessarily suggest good performance. Based on the results on the validation data it is apparent that all models struggled to effectively learn from the data. On training data, the model reduced error to below 1%. On validation data the LSTM achieved error of 8.07% while the RNN achieved error of 7.15%. The 50.25% and 52.78% accuracy attained by the neural network models is a slight improvement over the odds one has in a binary classification task.

The RNN was of no use when using a temporal length over 50 days. In contrast, the LSTM performed better in the 50 to 100-day range with 100 days producing the best performance. Both models were united to create a network with one LSTM and one RNN layers. This performed marginally worse to the pure LSTM model but required less training time. The ARIMA model appears to achieve well based on sensitivity, specificity and precision. However, on analysis of the high RMSE of the model its apparent its forecast was poor. The ARIMA model forecast followed a steady path with very slight variance. The fact that it appears to have achieved well in terms of specificity and precision accuracy appears to have been down to chance as it failed to recognize any trends in the data and predicted the price would rise in general. The figures listed are those that are thought to represent the generalizability of the model as proper prevention measures were taken in terms of overfitting. Dropout was significantly high on both hidden layers with the training dataset being shuffled in groups based on temporal window length. In addition, an early stopper was programmed into the model to stop training if the validation loss didn't improve for 5 epochs. Turning this of and it is possible to attain considerably better results but this is as a result of over fitting.

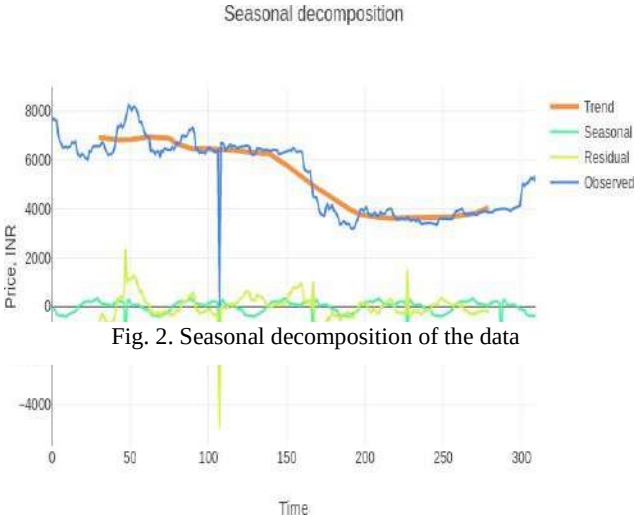

Fig. 2. Seasonal decomposition of the data

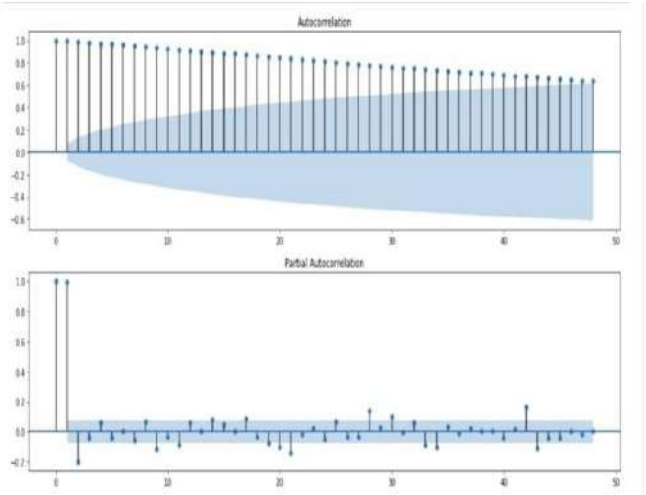

Fig.3 Decomposition over time

VI. CONCLUSION

Deep learning models such as the RNN and LSTM are clearly effective learners on training data with the LSTM more proficient for recognizing longer-term dependencies. However, a high variance task of this nature makes it difficult to transpire this into remarkable validation results. As a result, it remains a difficult task.

There is a line to balance between overfitting a model and preventing it from learning sufficiently. Dropout is a respected feature to support in improving this. However, despite using Bayesian optimization to optimize the selection of dropout it still couldn't promise respectable validation results. Despite the metrics of sensitivity, septicity and precision indicating good performance, the definite performance of the ARIMA forecast based on error was expressively worse than the neural network models. The LSTM outclassed the RNN marginally, but there was not significant deference in the results of both. However, the LSTM takes noticeably longer to train.

The performance benefits gained from the parallelization of machine learning algorithms on a GPU are evident with a 70.7% performance improvement for training the LSTM model on the GPU as opposed to the CPU. This established the findings indicated by the related work as it the unreasonable effectiveness of recurrent neural networks. They can reduce authentication error sufficiently low for a difficult task like this one. Looking at the task from purely a classification perspective one might be able to achieve better results. One restriction of the research is that the model has not been implemented in a practical or real time setting for predicting into the future as opposed to learning what has already happened.

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IoT Driven AI Module

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***Abstract*— Internet of Things i.e. IoT is the rapidly growing future technology that is basically enabling things or individual objects to communicate to each other in such a way to make human life easy, so when one think of IoT in day today life one thinks of home automation which is basically controlling the operation of home appliances over internet or using certain wireless communication protocols which may be WiFi, GSM, Bluetooth, ZigBee etc. Number of different home automation systems being implemented using these wireless communication protocols but they have their own limitations based on shorter range, unreliable connection, power issues, etc. But considering these we propose a IoT based AI module which can work in two different modes in which first mode allows manual control over appliances using touch / online app control and second mode automatic controls the appliances by means of human detection module which will in turn save a lot of electricity and protection against electrical accidents.**

Keywords—IoT, Home Automation, AI, Wi-Fi, Microcontrollers.

I. INTRODUCTION

Home automation is described as controlling home appliances both by using manual hardware and online application over the internet from a far place. All this can be implemented by using both embedded electronics which includes several electronic components which include micro-controllers, sensors, relays, switches, etc, and wireless communication protocols which includes Wi-Fi, GSM, Bluetooth, ZigBee etc, together. Nowadays,Automation is in the trend as it enables easy control over operation of different home appliances over fingertips, security against electrical mishappening, and easy to handle interface. Along with this home automation also includes smart use of resources that is efficient use of electricity which is also a global concern. Sometimes in day-to-day life we often forget to switch off appliances or lights which in turn causes a lot of electricity loss and also increases the chances of electrical accidents. Considering all these issues, in this paper we have proposed an Iot Driven AI Module which uses web server to control appliances and provides a complete solution according to the need of an individual room in all perspectives as it provides 5 touch control switches in which 2 are power switches, control using an android application over the internet, voice control using voice assistant Alexa over the internet, two different modes of operation, manual and automatic human detection mode which is implemented using machine learning algorithms, camera module, and microwave sensor.

In the following section, we will discuss some already implemented home automation models and find their advantages and limitations based on the wireless communication protocols or methods they have used in the implementations.

II. LITERATURE SURVEY

In [2], the authors R.Piyare and M.Tazil implemented a Bluetooth based home automation system. This home automation system uses Bluetooth technology to control the switches using a smartphone which works as a receiver device. The major advantage of this home automation system is that it incorporates Bluetooth technology which is very secure and low cost as well as it has a very high communication rate and it also comes with great protection but it has certain disadvantages which includes very short range of network i.e. approx. 10 meters only, that means when smartphones comes out of its range the connection will be lost and one will no longer have the control over the appliances and this is the major limitations of the Bluetooth based home automation module. The authors of [4], implemented a home automation system which is based on ZigBee for the purpose of communication. Usually ZigBee is used in cases which require low power applications and applied in research-based activities. Though ZigBee is very much related to Bluetooth technology as it also comes with a small range of network that is approx. 10 to 20 meters but it can be increased to 150 to 170 meters by the implementation of DSSS i.e direct sequence spread spectrum. Since its characteristics include low data rate ,less power requirement as it uses transceiver standards, so its applications are limited to research activities and for developing project prototypes only and not specifically for home automation purposes. In [5], the authors proposed a smart home automation system which uses GSM i.e Global System for Mobile communication for the purpose of wireless communication. In this type of home automation system the main communication is done using GSM text message service which is quite unreliable as in some areas we will not get the network and the communication will be stopped in this GSM text service there is no surety that the messages will be delivered in time, which is the major limitation of this GSM based home automation system.

III. IMPLEMENTATION SETUP

A. *Components / Tools required.*

1. ESP8266 Microcontroller
2. ESP32 cam module
3. Arduino Nano
4. RCWL 0516 Microwave radar sensor
5. FTDI programmer
6. Relays(3 6.0 amp.relays and 2 15.o amp. relays)
7. TTP223 touch sensors
8. Smd leds, capacitors, and resistances
9. Wires and cables
10. Arduino IDE (software)
11. Android Studio (for app)

B. *Description*

1. *ESP8266*

Fig.1. ESP8266 Nodemcu

The NodeMCU ESP8266 board consists of the ESP-12E module containing ESP8266 chip having Tensilica Xtensa 32-bit LX106 RISC microprocessor. This microprocessor supports RTOS and it can be operated at 80MHz to 160 MHzclock frequency. NodeMCU contains 128 KB RAM and 4MB of Flash memory to store related data and programs. Its high processing along with Wi-Fi and Bluetooth.

2. *ESP32 Cam Module*

Fig.2. ESP32 Cam Module

The ESP32-Cam contains a compact camera module with low power consumption, has multiple interfaces like SPI, UART, PWM and is suitable for large variety IoT applications for e.g. video surveillance, QR identification. It is derived from ESP32, has a 2 megapixel camera with integrated LED flash and SD slot with the capacity of 4GB memory and allowing images to be saved automatically to the memory card.

It is used in implementing Human detection algorithms.

3. *Arduino Nano*

Fig.3. Arduino Nano

Arduino nano is a microcontroller which is implemented for small project based applications and uses ATmega328. Its small size helps in a vast number of projects and its functionalities are same as arduino uno except the number of the I/O pins. Its operating voltage is 5V and its architecture is AVR based. It has 32 KB of flash memory and 2kb is used by the bootloader, it has 8 I/O analog pins and 22 digital I/O pins. In this project it is used to implement the hardware switching of the 5 switches present on the board.

4. *RCWL 0516 sensor*

Fig.4. RCWL 0516 sensor

This sensor module has been designed to overcome the common PIR motion sensors which are used in alarms and security lights. This sensor detects only movements within its range. This sensor has a microwave emitter instead of the black body radiation from a moving person, this sensor uses "microwave Doppler radar" technique to detect moving bodies. It has a range of approximately 10 meters and it is used in combination with ESP cam module.

5. *FTDI Programmer*

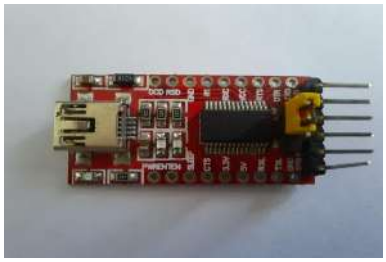

Fig.5. FTDI Programmer

The FTDI converts serial to USB or USB to serial. A com port on a computer could in theory just connect straight to the Atmega328P provided the voltage levels are TTL or that proper RS232. It is used in programming ESP32 cam modules.

6. *RELAYs*

Fig.6. 16A and 6A relay

The relay is the device for opening and closing the contacts to cause the operation of the other electric control i.e ON and OFF. It detects the unsupportable condition with an area and gives the commands to break the circuit to disconnect the affected area of interest. Thus protects the system from any kind of damage.

IV. PROPOSED SYSTEM

The proposed home automation system is implemented using ESP8266 (Nodemcu) as the main microcontroller which controls basically all the operation of this module, thus overcoming all the shortcomings of the existing systems. In the proposed module we have 5 switches to which we can connect 5 different appliances of a room in which 2 switches support 16A power and rest 3 switches support 6A power and combined they are well suited for all the applications of an individual room. In the first mode one can simply control all the switches by finger touch and notification lights are also available to show the current status of the switch, alsp all this can be easily done when the device is either online or

offline. Then for online control through an android application the device is connected to a Wi-Fi with internet connection and then one can control all the switches from anywhere in the world over the internet and all this is implemented using nodemcu and Arduino nano microcontroller.

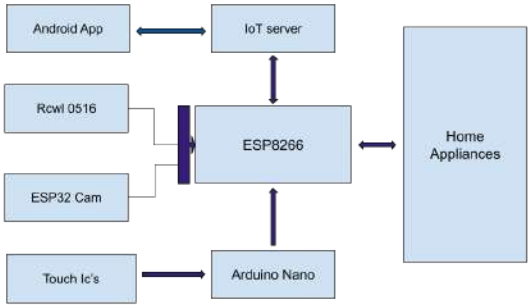

Fig.7. Block Diagram

The android app also provides a very user friendly interface in which one has to login with the credentials and then the device dashboard will be opened. This dashboard is created using Thinger.io cloud console which gives the control over the switches online. While in the second mode automatic human detection algorithm is enabled with the use of ESP 32 cam module and it is combined to work with the microwave radar sensor that is RCWL 0516, so when a human or object enters the room it will be detected using radar module which have large range of about 7 to 10 meters and when the human/object is detected then, the cam module is operated with human detection algorithm in which if it detect human presence it will turn on the lights / fan automatically and when the human leaves the room it will turn off the lights / fans. This feature is a very important part of the module as it provides protection against electrical accidents and in turn saves a lot of electricity which may be very much economical as well as environment friendly.

The basic block diagram of the proposed home automation system is presented in Fig. 7 which shows the basic working of the module in which an android app is connected to the esp8266 module through the IoT web server that is Thinger.io through the internet. In the automation part the microwave radar sensor that is RCWL 0516 is connected with the ESP 32 cam module and sends the signal to the ESP 8266 module. Next the touch ICs that are TTP223 are connected to the arduino nano and form the hardware switching part of the module and then final signal is sent to the ESP 8266 module to function. All this automation part works together to form a fully functional home automation module and it is also concluded that the ESP8266 module works as the main component of the module as all the signals are sent to it and it processes the required output. Further the main android application dashboard is shown in Fig.8.

A. Advantages

1. A low cost module which also helps in saving a lot of electricity that will in turn save money.
2. One can control appliances from far places and also reduces the risks of electrical accidents.
3. This module is highly secure as it requires login credentials for the android app.
4. A wide range of applications which includes homes, colleges, schools, offices, etc.
5. A perfect solution for an individual room's applications.

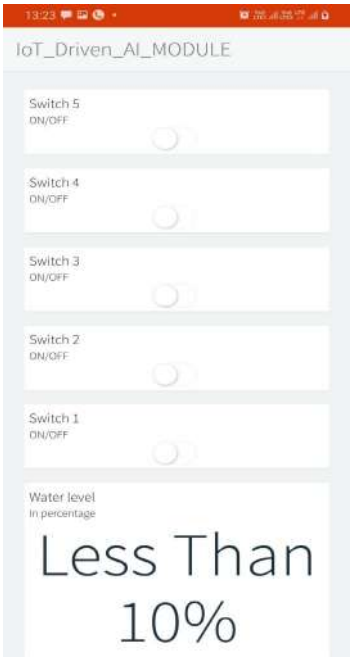

Fig.8. App Dashboard

V. RESULTS AND DISCUSSION

The results obtained after implementing the above module include that the touch control is running well and the application control is also running fine with an user-friendly interface. And also real time toggling of the device switches are observed. But in the human detection part the device works well in about 70% cases as there are scope of modifications in this part which is due to some lighting issues and full view issues of the cam module. In future scope we will implement this by using more advanced hardware and software in this part.

VI. CONCLUSION

This IoT driven AI module works well in both online and offline cases. This IoT based module is found to be capable of handling switches either using touch ICs or using android application and it is also found that it is fully capable of replacing the traditional switch boards present at our homes within a number of advantages over it and the human detection part also works quite well. However there is still a need of more research in the human detection part in order to get a more efficient resulting output.

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Blind Man Assist Helmet Using IOT

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***Abstract*— with the advancement of technology in the world, everybody wants to be independent, so why are visually impaired people left behind? This paper presents the idea of helmet that will act as their eyes and assist them to move freely in their surroundings. This helmet helps them identify the 3-D layout of their surroundings and guide them to avoid obstacles on their path to reach their destination. In addition to this, the helmet contains a SOS button, pressing which provides the current location of the man to the emergency contact stored in it and his/her location can be tracked easily.**

Keywords- Feedback, GPS, Computer Vision, Artificial Intelligence

I. Introduction

Our country is home to one-third of the world's blind population, with 39 million individuals blind. Visually impaired people face numerous challenges in their daily lives, including detecting impediments in the distance and navigating to places beyond their reach.

For navigating, visually impaired people rely on the assistance of humans, pets, and canes. The Blind Man Navigation Helmet with GPS Tracker and Audio Alert is a smart stick for visually impaired persons that uses audio feedback to steer them past obstacles and allows them to share their location in the event of an emergency. It proposes a theoretical model and a proposal for providing blind individuals with a smart navigation gadget. The system's goal is to deliver a comprehensive set of metrics, including artificial vision and object detection.

The overall goal of the system is to produce a low-cost and effective navigation assistance for blind people that provides them a sensation of artificial vision by giving information about the environment's static and dynamic items. Ultrasonic sensors are utilised to calculate the distance between the blind person and the obstructions in their way, guiding the user to the available path. The output is in the form of a voice that the blind person can understand, such as right, left, and so on.

The sensors are combined with a motorised helmet arrangement so that a blind person may identify objects at a certain height that a stick cannot detect. An Arduino UNO-based embedded system, an ultrasonic sensor, a servo motor

An audio playback board with speaker/headphone, and a GPS tracker make up the hardware. The code is written in Embedded C/C++ in Arduino software. An Audio playback module, which can store, record, and playback multiple messages, can generate the voice output. These messages can be customised to the user's taste for language and convenience. The helmet also includes a panic button and a GPS tracker. When a person clicks the panic button, the person's current location is notified by SMS to any pre-stored phone numbers. The helmet can also be tracked by making a phone call or sending an SMS to the device.

Internet of Things (IOT)

As the name suggests, the net of things is employed to attach everyday things like table, chair, water etc. to the web using sensors, so we are able to retrieve information from these items and process this information to switch them and to ease our life.

IOT extends the connectivity beyond standard devices and helps to interact with the items within the surrounding with one another. It helps to make a network of unrelated things exchanging information with one another.

Fig 1-Internet of Things(IOT)

II. Implementation:

In this helmet we have used the following components:

1. Arduino Nano
2. Servo Motor
3. DF Player Mini
4. Ultrasonic sensor
5. GPS
6. Flame Sensor

Arduino Nano

In this project we've used the Arduino Nano because of the microcontroller. This microcontroller will process the information from different sensors like ultrasonic sensor and flame sensor. After processing the data it'll provide the output to the speakers to direct the person. It also controls the movement of the servo motor and helps GPS to trace the situation. One in all the most important advantages of Arduino Nano is its small size. This makes our project handy.

Fig 2- Arduino Nano

Servo Motor

Servo motor is a form of motor which may rotate with great efficiency. These motors have an impact circuit which is answerable for the feedback which is chargeable for the rotation. Here we use a servo motor to rotate the ultrasonic sensor so we will provide a greater 3-D view of the encircling area to the person.

Fig 3- Servo Motor

DF Player Mini

The DFPlayer Mini MP3 Player for Arduino is a small and reliable MP3 module that provides output to the speaker. This module will help to provide the voice output of the person which will in turn guide the person in which direction to go without banging the obstacles.

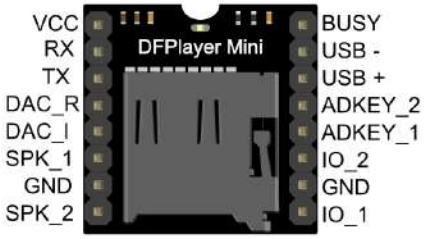

Fig 4- DFPlayer Mini Module

Ultrasonic Sensor

As the name suggests, an ultrasonic sensor uses the ultrasonic waves to leave the space or to detect the objects on the trail. The sensor has two heads one to emit waves and another to receive the reflected back waves from the target. Here the ultrasonic sensor is employed to detect the objects on the trail in order that the visually impaired man can travel avoiding the obstacles on the trail.

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Fig 5- Ultrasonic Sensor

GPS

A GPS module with the assistance of a microcontroller helps to trace the situation. During this project we've used the NEO-6 module. NEO-6 module series may be a family of stand-alone GPS receivers featuring the high performance u-blox 6 positioning engine. These flexible and value effective receivers offer numerous connectivity options in an exceedingly miniature 16 x 12.2 x 2.4 mm package. Their compact architecture and power and memory options make NEO-6 modules ideal for battery operated mobile devices with very strict cost and space constraints.

Fig 6- GPS Module

Flame Sensor

Flame sensor is an arduino compatible sensor that helps to detect the flame from a distance. It sends the information to the microcontroller which then takes the suitable actions. Flame sensors are the type of the sensors that not only detect but also. It contains an alarm system. Flame sensor will alert the person if there is any fire outbreak and helps him to dodge it.

Fig 7- Flame Sensor For Arduino

III. Schematic

The following diagram shows the connection of varied modules with one another. The sensors like Ultrasonic sensor and Flame sensor, servo motor and GPS modules are connected to the Arduino Nano board as shown within the figure. The output from the arduino board goes to the speaker with the assistance of the DFPlayer mini module.

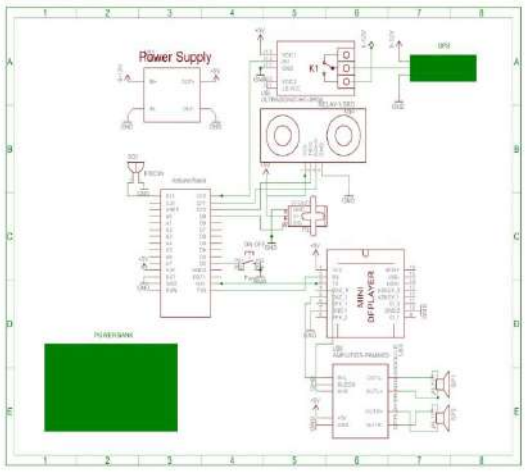

Fig 8 – Schematic

IV. Block Diagram

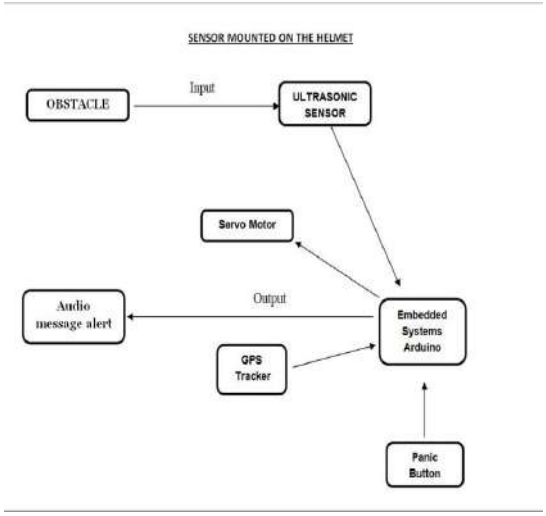

Fig 9- Block Diagram

V. Conclusion

We have successfully built a navigation helmet with GPS for visually challenged people as part of this project. It is a basic, cost-effective, adaptable electronic guidance system that is simple to use. It is intended to provide constructive assistance and support to blind and visually impaired people. This technology uses audio feedback to correctly steer them around all of the obstacles in their path and also allows them to share their location in the event of an emergency. The results reveal that the technology is effective and unique in spotting potential obstacles for blind people. It proposes a theoretical model and a proposal for providing blind individuals with a smart navigation gadget. The system's goal is to deliver a comprehensive set of metrics, including artificial vision and object detection.

Special training is not required for this suggested system. It also addresses the shortcomings of other systems that are related to mobility-related issues that have an impact on blind persons in their surroundings.

VI. Advantages

1. Object Detection of up to fifteen objects per frame

2 SOS Messages are often sent to registered mobile numbers together with this location of the user.

3. Direction to Home, audio direction to home from current location with both walking and transit mode depending upon the gap.

4. A helmet for a person with visual impairment involves identifying the layout of the 3D space around them.

5. Help to barter their way around obstacles en route to their destination

6. Make visually impaired people independent

VII. Future Scope

Future work on this helmet will be focused on improving the system's performance and decreasing the stress on the user, as well as adding new functions to make it a more efficient gadget. The project can be tweaked to assist visually impaired people in self-driving automobiles. The system will provide auditory guidance concerning traffic on the road, as well as help to indicate traffic signals, speed limits on the road, and vehicle speed information. It will provide you all of the information you need to drive the vehicle, such as when to use the brakes and so on.
This would help the person become completely self-sufficient, allowing him to travel wherever and whenever he desires. Face recognition abilities can be added to the smartphone, allowing it to retain the facial details of people close to the user, allowing him or her to distinguish between peers and strangers. The device may be adapted to recognise numbers, colours, and forms, making it more useful to the user even when they are outside.

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A Survey on

ACCIDENT AVOIDING SYSTEM WITH CRASH DETECTION & GPS NOTIFICATION

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Abstract : Arduino Based Vehicle Accident Alert System using GPS, GSM. GSM module send the alert message on your Mobile Phone with the location of the accident. The advancing technology has made our day to day lives easier. Since every coin has two sides similarly technology has its benefits as well as its disadvantages.
The rise in technology has increased the rate of road accidents which causes huge loss of life. The poor emergency facilities available in our country just add to this problem. Our project is going to provide a solution to this problem.
Keywords: Arduino, GPS, GSM, LCD, Piezoelectric Sensor

I. INTRODUCTION

The growing demand for automobiles has resulted in an increase in traffic congestion and road accidents. The people's lives are in grave danger. This is due to the lack of high-quality emergency services in our country. This study introduces an automatic car accident alert system. This design is a system that can identify accidents in a fraction of the time and delivers basic information to a first-aid centre in a matter of seconds, including geographic coordinates, time, and angle of the car accident. This alert message is transmitted to the rescue crew in a timely manner, allowing vital lives to be saved. In the unusual instance where there is no casualty, a switch is provided to stop the message from being sent, saving the medical rescue team valuable time. When an accident happens, an alarm message is sent to the rescue team and the police station automatically. The message is sent using the GSM module, and the accident location is determined using the GPS module. With the help of a vibration sensor, the accident can be precisely identified. The information from the Piezoelectric sensor can also be used to determine the angle of the car's rollover. This programme gives the best possible answer to substandard emergency services supplied in the event of a road accident. Over the last decade, the use of automobiles has increased linearly, increasing the risk of human life. This is due to a lack of adequate emergency facilities.

1.1 Problem Definition

GSM modem-based accident detection and vehicle messaging system that uses vibration sensors to identify accidents. When you need to detect vibration or a knock, a vibration sensor (Piezo components) comes in helpful. By monitoring the voltage on the output, these can simply be used as tap or knock sensors.

The vibration sensor aids in signal transmission to the Arduino controller. The Arduino controllers send the location-based alert message through GSM modem. If the individual is involved in a minor accident, the driver can terminate the message using switch to indicate that no more attention is necessary. This is done to avoid wasting the medical and police teams' time. GSM modems resemble cell phones but lack a display, keypad, and speakers. This device accepts a SIM card and is powered by a mobile operator's subscription.

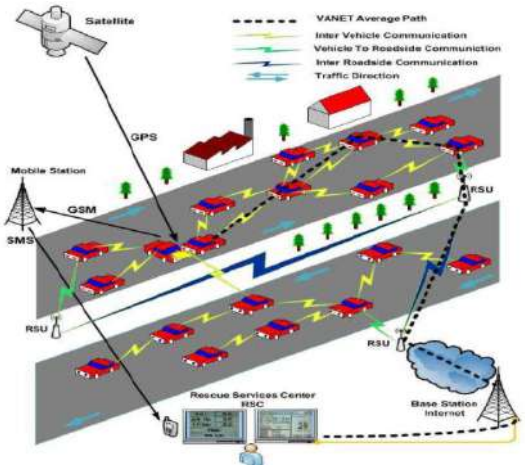

Figure 1: Proposed Mechanism of system [1]

II. LITERATURE SURVEY

There have been several efforts to avoid accidents, such as the development of accident prevention systems and mobile application ways to track down a missing vehicle. One of the techniques for classifying the cars involved in a collision allowed the two vehicles to share information at the time of the accident [1]. This system had a severe flaw in that car information was exclusively exchanged through RFID between vehicles, with no storing of car information in the Cops server's database or any other external unit. The methodology [2] explains how to use the Global Positioning System (GPS) and the Internet of Things (IoT) to show the accident location to the supplied contact person number as a means of sending accident information. This system method was unreal because it lacked active vehicle monitoring and archiving of vehicle paths, among other things, which are essential for catching a hit-and-run driver. The system described in this work [3] incorporates Internet cloud storage as well as a GPS-GSM module to provide an alert message with location to the Control Section, from which a message is sent to a nearby ambulance to provide medical assistance. The boundaries of [1] and [2] were overcome by this system [3]. However, it has limitations, such as delays in the time of installation, message delivery, and response since the network may not always give the best service and application support, as well as a slow speed of operation. Because the majority of traffic accidents are caused by human error, [4] gives a logical framework for examining the driver's behaviour in the face of all possible risks. By giving route geometry, weather circumstances, and detecting uncertain driving events as well as possible dangers, the driver behaviour sketching system [5] employs a meticulous logic to compute the score for dissimilar drivers. An algorithm was created to compute crash possibilities in order to detect collisions in road situations [6]. In terms of collision warning, crash evasion, and mitigation, this is effective. However, it does not offer assistance in the aftermath of an accident. The system [7] uses GPS and GSM to transmit a notification of a vehicle accident to the appropriate numbers, such as an ambulance or a police station. This system [8] would assist in locating the car that caused the hit-and-run accident as well as providing immediate medical assistance in order to reduce fatalities in road accidents. As a result, a driver who causes an accident that results in harm or death and then flees the scene of the

accident will face charges. Vehicles will be monitored continuously and at regular intervals, which will reduce the number of accidents on the roadways. This system [9] features accident avoidance technology, which reduces the likelihood of a car accident in congested regions. This car collision avoidance, disclosing, and aware system provides critical information to emergency responders as soon as possible. It is possible to minimise fatality rates by shortening the time between when an accident occurs and when it is discovered. This system [9] is a clever anti-theft system that employs GPS and GSM technology to prevent theft and determine the precise location of the vehicle. GPS module, GSM modem, relay switch, vibration sensor, DHT11 sensor, operational amplifier, buzzer, and high voltage mesh are all part of the system. Because GPS systems can only receive car position information from satellites, a GSM system is also installed in the vehicle to relay information to the vehicle's owner. This technology automatically sends a message to one's relatives requesting assistance. The car is equipped with defensive measures such as engine ignition cut off, gasoline supply cut off, electric shock system (placed on steering wheel), and paint spray system, all of which are controlled by the user or owner's GSM phone. With the use of SMS, the owner can lock or unlock his or her vehicle. This device is designed to provide great security to low-range vehicles. This study [10] finds the fastest route by directing traffic lights in the ambulance's favour. The time delay is shortened by this method, which uses RF technologies to pedal traffic signals. Service to the ambulance is prioritised based on server connectivity and queuing algorithms. This guarantees that the period between the accident and the hospital is as short as possible. This document explains how to install a framework in a moving vehicle to identify accidents and report them to the In Case of Emergency (ICE). The first responder is receiving attention.

III. METHODOLOGY

The Prototype of this Accident Detection and information passing technique uses the following steps:

1. A block diagram is used to represent the entire setup.
2. The Arduino gets notified when the Piezoelectric sensor detects the first incidence of the accident.
3. GPS is used to determine the latitude and longitude, which is then delivered as a message to the rescue squad through GSM.
4. The number of the message receiver is saved in the Arduino storage.
5. In order to eliminate erroneous messages, an OFF Switch is also provided

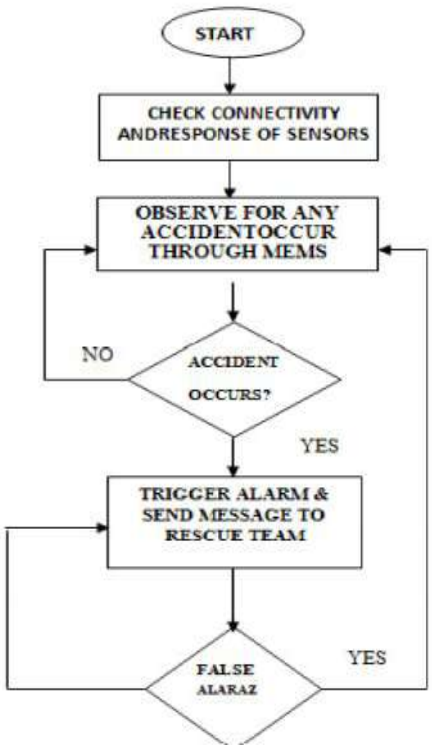

Figure 2 : Flow Method of system[2]

3.1 Global System for Mobile Communication (GSM)

By delivering a message, GSM is employed as a medium for controlling and monitoring the transformer load from anywhere. It has a deterministic personality of its own. By sending a message through a GSM modem, GSM is utilised to monitor and control the DC motor, Stepper motor, Temperature sensor, and Solid-State Relay. As a result, there is no need to waste time with manual operations or transportation. As a result, it is thought to be a highly efficient mobile communication system that will be used in industrial controls, autos, and appliances that can be operated from anywhere. It's also very cost-effective, hence GSM is the most popular choice for this way of control. As a result, this automated system is more efficient, less expensive, and easier to operate than was before conceivable. As a result, it may be a better means of communication for controlling purposes.

Figure 3: GSM module [3]

3.2 Global Positioning System (GPS)

Vehicles use GPS for both tracking and navigation. Tracking systems allow a base station to keep track of vehicles without the driver's assistance, while navigation systems assist the driver in arriving at their destination. Whether it's a navigation or tracking system, the architecture is nearly identical. When an accident occurs in any location, the GPS system tracks the vehicle's location and delivers the information to the appropriate person via GSM by sending an SMS or a phone call. The GPS module delivers data on the tracking position in real time, as well as a lot of other data in NMEA format.

Figure 4: GPS Module [4]

3.3 Arduino UNO

Arduino is an open-source electronics platform that uses simple hardware and software to make it easy to use. Arduino boards can take inputs - such as light from a sensor, a finger on a button, or a Twitter message and convert them to outputs such as turning on an LED, triggering a motor, or publishing anything online. By delivering a set of instructions to the board's microcontroller, we can tell it what to do. We employ the Arduino programming language (based on Wiring) and the Arduino Software (IDE), both of which are based on Processing.

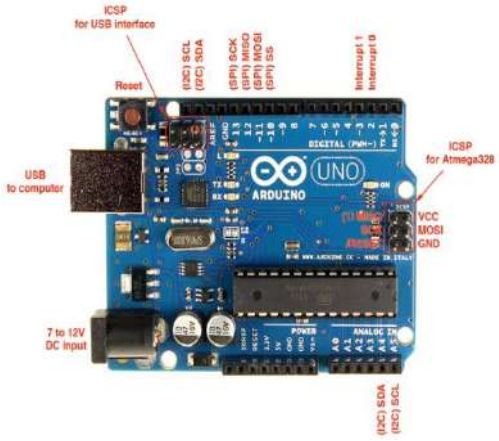

Figure 5: Arduino UNO [5]

3.4 Temperature and Humidity Sensor

The DHT11 is a low-cost digital temperature and humidity sensor. This sensor may simply be connected to any microcontroller, such as an Arduino or a Raspberry Pi, to measure humidity and temperature in real time. The DHT11 humidity and temperature sensor comes in two versions: a sensor and a module. A relative humidity sensor is the DHT11. This sensor employs a thermistor and a capacitive humidity sensor to measure the ambient air. Temperature Sensors monitor the amount of heat produced by an object or system, allowing them to detect or identify any physical changes in that temperature, and can output either analogue or digital data. The relative humidity in the air is sensed, measured, and reported by a humidity sensor. As a result, it can detect both moisture and temperature in the air. The more moisture there is in the air, the hotter it gets. It has the capacity to hold. Capacitive estimating, which is based on electrical capacitance, is used by humidity/dew sensors. The capacity of two nearby electrical Transmitters to create an electric field between them is known as the electrical limit. The sensor is made up of two metal plates with a non-conductive polymer sheet sandwiched in between.

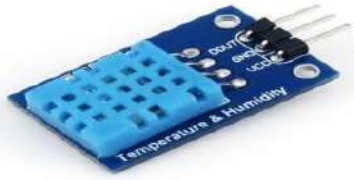

Figure 6: Temperature and Humidity Sensor [6]

3.5 Piezoelectric sensor

A piezoelectric sensor, also known as a piezoelectric transducer, is a device that converts pressure, acceleration, temperature, strain, or force into an electrical charge using the piezoelectric effect. The prefix piezo means "push" or "squeeze" in Greek. A piezoelectric effect is the ability of a piezoelectric substance to transform mechanical stress into electrical charge. The pressure applied to solid piezoelectric crystal materials determines the generated piezoelectricity. Piezoelectric ceramics (such as PZT ceramic) and single-crystal materials are the two basic sensing materials utilised in piezoelectric sensors (such as quartz). The ceramic mat's sensitivity

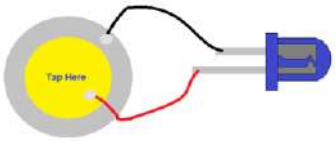

Figure 7: Piezoelectric sensor [7]

IV. DISCRIPTION

A considerable number of incidents are occurring on highways these days as a result of increased traffic and aggressive driving by vehicles. In many cases, family members, emergency crews, and police officers are unable to obtain information about the accident in a timely manner. As a result, the assistance that is most vital to the individual who has been injured in the accident is delayed. Our idea, an automatic accident car recognition and messaging system using a GSM modem, is designed to address this issue and to provide assistance to those who have been involved in an accident, as well as to save their lives by sending a message to the rescue team at the appropriate moment. We are using an accident detection device in our project, which has a vibration sensor installed in the car. For example, in the event of an accident, if the automobile collides with another vehicle or an object, the vibration sensor will detect the signal and send it to the Arduino. Our project's Central Processing Unit (CPU) is an Arduino. When the Arduino receives a signal from the vibration sensor, it immediately sends

the message to the GSM modem, which then begins the procedure. We used the reset button because it will be used by the driver if the accident is very common, such as if the driver hits the wall when parking. When the driver presses the reset button, the Arduino is informed that the system will not transmit SMS. However, if the driver is unable to hit the switch or if the accident is truly catastrophic, the driver will not push the reset button, and the system will send an SMS. We send SMS to family members and the rescue squad using a GSM modem. A buzzer can also be used to signal when an accident has happened by emitting a beep sound. As a result, the life of a victim of an accident has been identified.

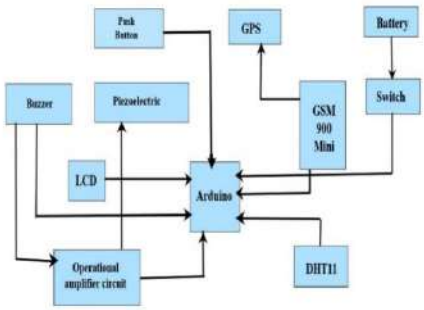

Figure 8: Block diagram of proposed system [7]

V. ADVANTAGES

- Both GSM and GPM are isolated.
- Accidents are reported to the police and medical units.
- It has a simple design and can be connected to other systems.
- System that is dependable.
- Keeps an eye on potential dangers and threats.
- Security that is sophisticated.
- Design that is both simple and reliable.

VI. APPLICATIONS

These systems are used for routing, security, dispatch, and gathering on-board data, among other things. These are also employed as fire detectors in large vehicles such as trains and buses, because trains carry a huge number of passengers, and issuing a warning in the event of a fire can save many lives.

1. Vehicle Scheduling - We can schedule our cars ahead of time so that drivers are familiar with them before entering accident-prone areas. We can also foresee and avoid heavy traffic, which is beneficial not only to their safety but also to the safety of all road users.

2. Path monitoring - We have a GPS position tracking system that also follows the route of the car, allowing us to keep watch of accident-prone locations and take actions to ensure safe travels.

3. Driver monitoring - A wireless webcam can be attached to this to capture images that will aid in offering support to drivers.

4. Accident analysis - In today's world, road accidents are the leading cause of human death. As the number of vehicles on the road grows, so does the number of collisions between vehicles. In this situation, this project serves the purpose of saving lives by first analysing the loopholes in existing systems. A system is needed to reduce time of action such as informing the police, informing the public, and informing the public.

5. Geofencing and geocoding are tools for determining geographic areas and borders, as well as for locating GPS devices. To set a geo fencing trigger, this technique uses physical location information. When a person or equipment enters a delineated region or boundary, an alert is generated .

VII. RESULT

The system detects a car accident and sends a message via the GSM module. Another GSM module receives the message. Module for Google Maps It shows you a Google map that shows you the exact location of the accident as well as its information. It receives a detailed SMS from the accident site. As a result, the coordinates have a tiny variance; the starting values of latitude and longitude are the same, but the fractional value varies with a slight variance.

VIII. SCOPE AND FUTURE WORK

This can be enhanced with a wireless webcam for gathering photographs and offering driver assistance. This can also be improved by automatically locking all of the brakes in the event of an accident. It usually becomes serious in accidents when the drivers lose control and fail to stop the vehicle. The vibration sensor will be triggered as a result of the vibrations received, and the CPU will process the data. When the brakes are triggered, the processor must be coupled to the devices that can lock the brakes. With this enhancement, we will be able to stop the vehicle and reduce the severity of the accident. This system can also be used in fleet management, food services, traffic infraction cases, and renegotiation agreements.

IX. CONCLUSION

Our concept is being utilised to detect accidents and automate emergency services. As a result, the system sends an SMS from the accident location to the nearest Emergency Assistance Service Provider. The growing demand for automobiles has resulted in an increase in traffic congestion and road accidents. The people's lives are in grave danger. This is due to the lack of high-quality emergency services in our country. In the event of a vehicle accident, an automatic alarm system is activated. This concept is for a system that can identify accidents in a fraction of the time and transmits the necessary information. This alert message is transmitted to the rescue crew in a timely manner, allowing vital lives to be saved. A switch is also available.

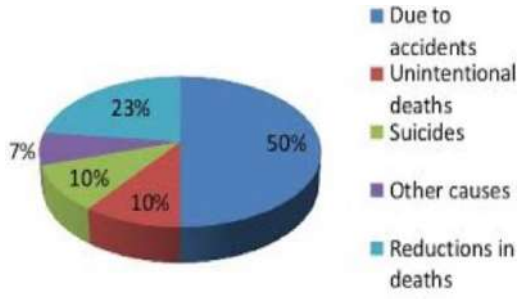

Figure 9: Chart indicating analysis of accidents occurred [8]

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Accident Detection and Alerting System

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***Abstract*— The Rapid growth of technology and infrastructure has made our lives easier. The advent of technology has also increased the traffic hazards and the road accidents take place frequently which causes huge loss of life and property because of the poor emergency facilities. Our project will provide an optimum solution to this draw back. An accelerometer, switch collision sensor and SOS button can be used in a car alarm application so that dangerous driving can be detected. It can be used as a crash or rollover detector of the vehicle during and after a crash. With signals from an accelerometer, a severe accident can be recognized. According to this project when a vehicle meets with an accident immediately Switch collision sensor will detect the crash signal or if a car rolls over, and accelerometer will detect the signal and sends it to Arduino controller. Microcontroller sends the alert message through the GSM MODEM including the location to police control room or a rescue team. So, the police can immediately trace the location through the GPS MODEM, after receiving the information. Then after conforming the location necessary action will be taken. If person is not in the condition of driving the vehicle, he can directly use the SOS button to notify the authorities about it, which could avoid a major accident.**

Key Words— ADXL Accelerometer, Accident Detection, FSR, GSM, GPS.

I. INTRODUCTION

Transportation has great importance in our daily life. The high demand of automobiles has also increased the traffic hazards and the road accidents. Life of the people is under high risk. This is because of the lack of best emergency facilities available in our country. This design is a system which can detect accidents in significantly less time and sends the basic information to first aid center within a few seconds covering geographical coordinates, the time and angle in which a vehicle accident had occurred. This alert message is sent to the rescue team in a short time, which will help in saving the valuable lives. A Switch is also provided in order to send a message in rare case where the driver is not in a condition of operating the vehicle it would avoid casualty, this can save the precious time of the medical rescue team. When the accident occurs the alert, message is sent automatically to the rescue team and to the police station. The message is sent through the GSM module and the location of the accident is detected with the help of the GPS module. The accident can be detected precisely with the help of both Micro electro mechanical system (MEMS) sensor and button sensors. It would be very useful in saving lives as it would cut down the time for the responding authorizes and many lives could be saved if this would be implemented in the vehicles.

II. PREVIOUS RESEARCH

At present criteria, we cannot detect where the accident has occurred and hence no information related to it leading to the death of an individual. The research work is going on for tracking the position of the vehicle even in dark clumsy areas where there is no network for receiving the signals. In this project GPS is used for tracking the position of the vehicle, GSM is used for sending the message and the Arduino controlleris used for saving the mobile number in the memory and sends the message to it when an accident has been detected. Hence with this project implementation we can detect the position of the vehicle where the accident has occurred so that we can provide the first aid as early as possible.

III. EQUIPMENTS USED

A. GPS Module

The Global Positioning System (GPS) is a multi-• functional system, which has high-precision, all-weather, and global radio navigation and positioning, timing functions. It used satellite network formed by 24 satellite transmit positioning signal to Earth, constantly firing. A GPS receiver anywhere on the Earth, as long as three or more satellite signals received, after calculating, you can report the location, time and state of motion of a GPS receiver.

Figure 1:GPS module[7]

B. GSM Module

GSM is a digital mobile telephone system that is widely used in most of the parts of the world. GSM uses a variation of Time Division Multiple Access (TDMA) and is the most widely used of the three digital wireless telephone technologies (TDMA, GSM, and CDMA). GSM digitizes and Compress data and send it to the channels of the stream

streams of user data, each in its own time slot. It operates at either the 900 MHz or 1,800 MHz frequency band. GSM is the de facto wireless telephone standard in Europe. GSM has over one billion users worldwide and is available in 190 countries. Since many GSM network operators have roaming agreements with foreign operators, users can often continue to use their mobile phones when they travel to other countries

Figure 2:GSM module[7]

C. Arduino Uno R3 Controller

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output activating a motor, turning on an LED, publishing something online. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

Arduino Uno R3 is one kind of ATmega328P based microcontroller board. It includes the whole thing required to hold up the microcontroller; just attach it to a PC with the help of a USB cable, and give the supply using AC-DC adapter or a battery to get started. The term Uno means “one” in the language of “Italian” and was selected for marking the release of Arduino’s IDE 1.0 software..

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Figure 3:Ardiuno R3[3]

D. Microswitch (SOS and collision sensor)

A miniature snap-action switch, also trademarked and frequently known as a micro switch, is an electric switch that is actuated by very little physical force, through the use of a tipping-point mechanism, sometimes called an "over-centre" mechanism.

Switching happens reliably at specific and repeatable positions of the actuator, which is not necessarily true of other mechanisms.

and up to 10 million cycles for heavy duty models. This durability is a natural consequence of the design.

Figure 4: Microswitch Sensor[3]

E. ADXL 335 ACCELEROMETER

The ADXL 335 is a small, thin low power, complex 3-axis accelerometer with signal conditioned voltage outputs. The product measures acceleration with minimum full range of ± 3g. It can measure the static acceleration of gravity in tilt sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration. The user selects the bandwidth of the accelerometer using C_x, C_y, C_z capacitors at the X_{out} , Y_{out} , Z_{out} pins. Bandwidths can be selected to suit the applications range. [4]

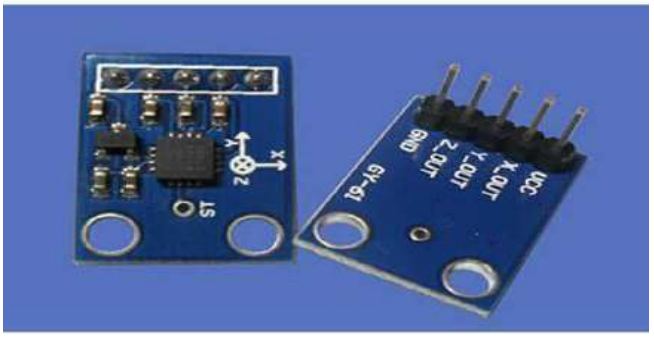

Figure 5:ADXL Accelerometer[3]

IV. PROPOSED METHODOLOGY

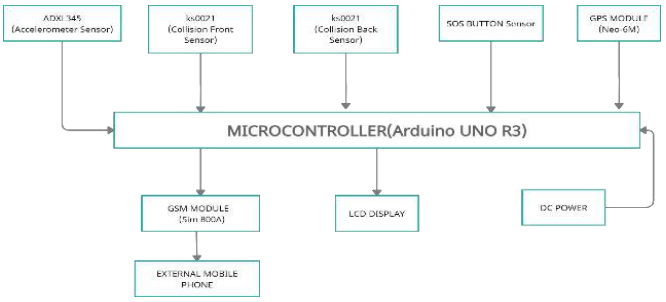

Figure 6:Block Diagram

The working of the entire project is described in following two steps. Whenever a crash is detected by the accelerometer or the collision switches which are being attached in the front and back of the vehicles the GPS module of the system is being activated and it would send the exact longitude and latitude of that place to the microcontroller. The message of the GPS would be shown on the LCD with the exact position the vehicles and exact cause of the accident detection by the sensors.

The second step would involve sending the message from the system to the response team. It would be done with the help of the GSM module, a pre saved mobile no in UNO.

Flow chart

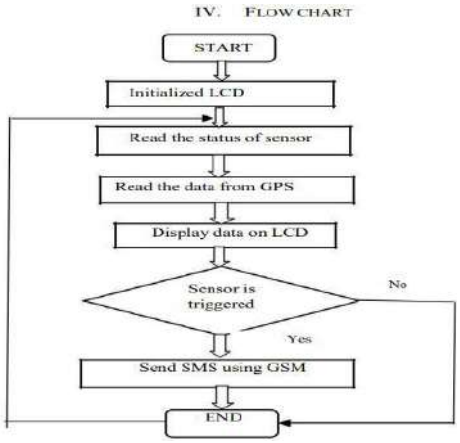

Figure 7:Flowchat[3]

The system would start with an initial power supply of 5V given directly to the microcontroller the power then used to activate the LCD and GSM module and the accelerometer. Then if there is any tilt of more than few degrees detected by the sensor it would consider it as an accident and would generate a signal to GPS would get activated and it would get the longitude and latitude of the exact location of that place. The same steps of would be repeated when the front, back or the SOS button is used to generated the same signals. The signal would be directly transferred to the GSM module it would be transferred directly to the pre-registered mobile no in microcontroller. If the signal is not detected the loop would get repeated util the power is being regulated in the microcontroller. If the sensor detects the signal is not any generating it would again return the entire process again.

V. RESULTS

Text message received by the hospital

Figure 8: Text message received through GSM[3]

In the above image, message which is being generated by the GSM which is being received by the mobile. In the message the longitude and latitude of the accident location could be seen. The latitude and longitude of that location could be manually entered in the Google maps and the location would be directly found by the emergency respondent.

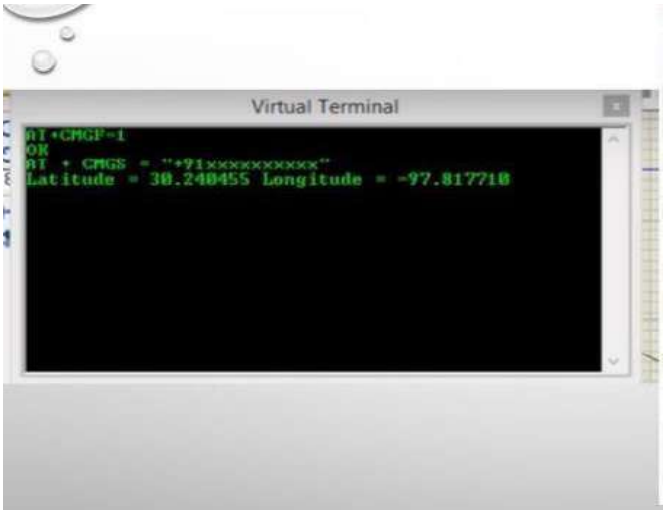

Figure 9: When the longitude and latitude of the system could be seen on the serial monitor[3]

The longitude and latitude of the generated location could be seen on the serial monitor. The GSM has to be activated by using the AT activation command of the GSM.

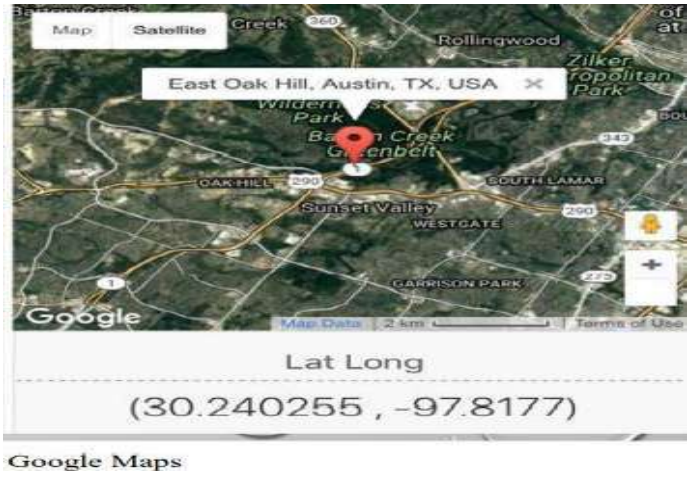

Figure 10: The longitude and latitude of the system could be used to find the exact location[3]

In this image it could be seen that the latitude and the longitude of that location could be directly entered in the Google Maps which would help to locate the position of the accident.

Advantages

- Isolates both GSM & GPM
- Alerts police and medical units about accidents.
- Simple design and can be interfaced with other systems.
- Easy to operate by the user.
- Reliable system.
- Easy to locate the point of accident.
- Monitors hazards and threats.
- Sophisticated security.

FUTURE SCOPE

The system can be improved by including a face recognition algorithm focusing on eyes of the driver, and continuously monitor consciousness of the driver. The designed system is implemented in a modelled vehicle; the same can be interfaced to a real-time vehicle to gather real-time data. The system can be made crash proof by providing casing to the sensors so that the impact is less when an accident occurs. The material used to protect the car battery can be made use of for the casing. India has earned the dubious distinction of having a greater number of fatalities due to road accident in the world. Road safety is emerging as a major social concern around the world especially in India. The system implemented by us aims at automatically detecting an accident and alerting the nearest hospital or medical services about the exact location of the accident. This system sends the basic information to the medical rescue team within a few seconds of an accident.

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Review of Challenges of MmW Active Antenna Systems in 5G Technology

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***Abstract*— In the fifth-generation mobile communication system (5G), the millimeter wave (MmW) band wireless communication is highly expected that it increases the network capacity drastically. The radio propagation characteristics in the millimeter wave (MmW) band are thought to be quite different from the microwave band that has been used for the current mobile wireless communication. With 5G and New Radio (NR) around the corner, utilization of the MmW for supporting very high data-rate communication has gained a lot of interest. A key technology necessary to utilize this part of the spectrum is active antenna arrays. However, the design of large, active antenna arrays and radio access in the MmW bands is facing difficulties due to limitations discussed in physics. In this review paper, we will discuss and review some of the challenges facing millimeter wave antenna (MmW) systems in 5G and NR.**

Index Terms - Antenna systems, power amplifiers, Long Term Evolution (LTE), local oscillators, propagation, channel modeling, radio access technology, new radio.

I. INTRODUCTION

In today's era with the rapidly growing need for data rates and the number of user equipments and other types of devices (computer, mobiles, television etc.) requiring connectivity [1], the available spectrum or bandwidth in the frequency bands today allocated for Long Term Evolution (LTE) will at some point become insufficient to support these needs. The wireless industry is therefore turning to a wide variety of advanced techniques in order to provide this connectivity. Different techniques such as, massive multi-user (MU) multiple-input multiple-output (MIMO) [2], which provides the capability of spatially multiplexing users at the same time frequency resource, are possible tools for a multiple times improvements in spectrum utilization at sub band of 6 GHz frequencies. During the last decade or so, a competing idea of using highly densified networks at millimeter wave (MmW) frequencies has been proposed [3-4]. These frequency bands have previously been utilized mainly for fixed, peer to peer (point to point) type communication such as backhauling due to physical limitations in both radio hardware technology and propagation. With the introduction of NR [5], these frequencies are considered for new applications in radio access, which in turn implies new challenges facing both the development of a suitable air interface and following radio hardware.

The paper is outlined as follows. First, we will discuss some of the new challenges imposed by propagation and some of the implications large arrays have on modeling of the radio channel. After this is followed by an overview of the current situation in the air interface development in terms of waveforms for multiple access, beam management, random access and mobility. Empirical stochastic propagation mathematical models fulfill typical conditions [7] are often used to develop standards and for initial performance assessment or investigation due to their simplicity and ease of comparability as compare to other mathematical model/system.

Generation	Speed	Technology	Key Features
1G (1970 –1980s)	14.4 Kbps	AMPS, NMT, TACS	Voice only services
2G (1990 to 2000)	9.6/ 14.4 Kbps	TDMA, CDMA	Voice and Data services
2.5G to 2.75G (2001-2004)	171.2 Kbps 20-40 Kbps	GPRS	Voice, Data and web mobile internet, low speed streaming services and email services.
3G (2004-2005)	3.1 Mbps 500- 700 Kbps	CDMA2000 (1xRTT, EVDO) UMTS and EDGE	Voice, Data, Multimedia, support for smart phone applications, faster web browsing, video calling and TV streaming.
3.5G (2006-2010)	14.4 Mbps 1-3 Mbps	HSPA	All the services from 3G network with enhanced speed and more mobility.
4G (2010 onwards)	100-300 Mbps. 3-5 Mbps 100 Mbps (Wi-Fi)	WiMax, LTE and Wi-Fi	High speed, high quality voice over IP, HD multimedia streaming, 3D gamming, HD video conferencing and worldwide roaming.
5G (Expecting at the end of 2019)	1 to 10 Gbps	LTE advanced schemes, OMA and NOMA	Super fast mobile internet, low latency network for mission critical applications, Internet of Things, security and surveillance, HD multimedia streaming, autonomous driving, smart healthcare applications.

www.rfpage.com

Figure 1 Generation wise comparison of wireless technology [17].

However, with 5G systems expected to utilize small cells because of densification to meet capacity needs and the increasing use of the MmW spectrum, the local environment in the vicinity of each node becomes important. Specific challenges related to the use of the millimeter wave spectrum include coverage, mobility (e.g. beam forming in a dynamically changing environment), channel resolution and the bounds on beam forming gain, and time dispersion. Each of these challenges put requirements on the propagation models. Beam forming and other interference mitigation techniques supported by antenna array systems will make the communication more dependent on, and adaptable to, the specific environment in each cell. Site-specific propagation modeling is therefore needed to complement the stochastic modeling when evaluating the performance of 5G systems. Furthermore,

5G systems are expected to use a range of frequency bands potentially covering sub band GHz up to 86 GHz which calls for a unified modeling approach across a wide range of frequencies. Site specific modeling on a large scale is most often equated with ray tracing [8], though one limitation of this approach is that it is impossible to model the complex propagation environment down to wavelength-level accuracy. To maintain a balance between sufficient accuracy and computational complexity, site-specific propagation models will thus require simplified models of the environment (terrain, buildings, foliage, etc.) and hence the results may become biased [9]. One approach to accounting for such deficiencies is to add heuristic or stochastic components, which can increase the fidelity of the predictions from a statistical point of view [15].

II. CHALLENGES IN PROPAGATION

A reliable and accurate representative propagation models are needed to support the development of the next generation of mobile communication systems [6].

A. Propagation in the presence of buildings and foliage

To address large problems it is desirable to use computationally efficient methods that are stable, continuous, and capture the asymptotic properties of the deterministic propagation channel, such as half-screen models [10] and the recursive micro-cell model [11]. Used separately and in combination [12], with these models provide a good prediction of the path loss in the presence of buildings. Trees, bushes, small buildings and other foliage also scatter and attenuate radio waves. There are many computational methods available in the literature, though a common approach is to determine the depth of the propagation path through the vegetation layer and apply a frequency dependent additional loss due to the foliage [13]. For both buildings and foliage, the predictions are further improved by the addition of models of specular reflections and diffuse scattering, which are particularly important at millimeter wave frequencies, where diffraction components have less of an impact [15].

B. Outdoor to indoor modeling

The indoor coverage is of particular importance and requires accurate modeling of outdoor to indoor propagation. The outdoor path loss to one or more external walls is determined using several candidate paths found with the models described in the preceding subsection, while a separate building entry loss model captures penetration loss and indoor loss for each wall point, e.g. using the models of [14].

C. Stochastic channel modeling

Site-specific and deterministic modeling as outlined in the preceding subsections can capture many aspects of the propagation channel such as the path loss and the channel dispersion in angle and delay. However, when comparing site specific predictions with channel measurements captured in comparable conditions it is often found that the predicted channels do not fully reproduce signal strength variability or that the channel contains too few multipath components and/or too low angular and delay spread [15].

When the propagation model is used to reflect channel conditions in e.g. radio network simulations it is important to account for the random variations in order to create realistic working conditions for the network. A fruitful approach is to add stochastic shadowing and propagation paths to complement the deterministic predictions. The parameterization of these stochastic additions need to be determined from validation measurement campaigns and may differ depending on the models used, the frequency of operation, and the level of detail in the description of the environment.

III. CHALLENGES IN RADIO ACCESS AND MOBILITY

A. Random Access, Mobility and Beam Management

To compensate for the adverse propagation conditions at mm-wave frequencies beamforming will be needed to achieve sufficient coverage. In the higher frequency bands beamforming only at the base station may not provide sufficient gain. Therefore, beamforming will also be needed in the terminals in some cases/scenarios. Beamforming the data channels has been an important feature already in LTE, but control and broadcast channels have been transmitted with wide beams covering the entire cell [15]. At mm-wave frequencies, also control and broadcast channels as well as synchronization signals need to be beamformed to assure sufficient coverage (to transmit system information in a lower frequency band, which could be LTE, while data is transmitted in a mm-wave band). Therefore, NR has a beam centric system design where more or less all channels and signals may be beamformed. Furthermore, mobility is treated as handover between beams rather than between cells. Another important design principle of NR is to minimize always on signals such as synchronization signals, reference signals and system information and transmit these only when needed and possibly also dedicated to specific users. This decreases the amount of system information that needs to be beamformed, improves energy efficiency and reduces interference.

Due to the challenges in mm-wave radio hardware design analog beamforming will be prevailing in the higher frequency bands. Although 3GPP specifications rarely dictate a specific hardware implementation, explicit support for analog beamforming is needed since an analog beamformer can only transmit or receive in one direction at a time. A fundamental difference between an analog and a digital beamformer is that the former cannot see the full dimension MIMO channel in a single time instant; it can only see the channel through the spatial filter that the analog beamformer acts as.

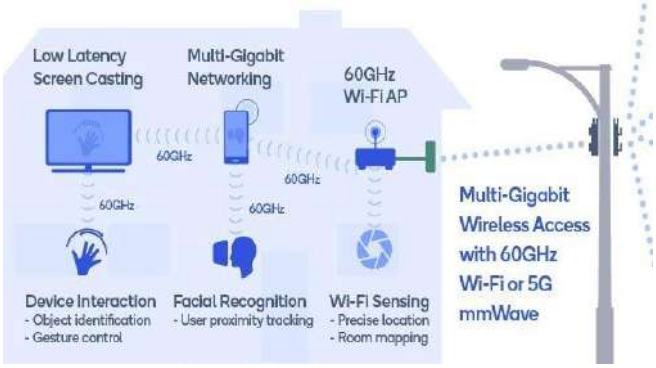

Figure 2 Schematic representation of wireless access of MmW 5G [16].

A challenge with analog beamforming is that the direction to a terminal needs be known so that the beam can be steered accordingly. Since the direction is not known a priori some kind of beam finding procedure is needed where several hypothesized directions need to be evaluated in a time sequential manner. If also the terminal uses beamforming, beam finding at both ends of the link is needed in order to establish a beam pair link.

Another challenge with analog beamforming using narrow beams in mm-wave frequencies is sensitivity to movement and rotation of the terminals as well as blockage caused by obstructing objects such as the user's hand, body or vehicles crossing the beam pair link's propagation path. To maintain a robust connection against blockage, multiple beam pair links that use different propagation paths can be established. Diversity in the data transmission can be obtained by having multiple active beam pair links, possibly connected to different base stations. Robustness can also be achieved by having a single active beam pair link for the data transmission while having control channels monitoring backup links for swift fallback if the active link is blocked. Continuous monitoring of candidate beams for the active beam pair link is also needed to support mobility so that beam switching can be performed when the terminal moves out of coverage of the currently active beam. The first release of the NR specification provides a number of hooks to support the design of features that can address the above mentioned challenges. For initial access, beamforming of synchronization and random access signals as well as system information is supported. The beam sweeping procedures during initial access can be used to attain information about the directions to different users. This information can be used to select beam for the data transmission or for subsequent beam refinement procedures [15].

IV. CHALLENGES IN MILLIMETER WAVE RADIO HARDWARE

As the operating frequency increases, fundamental limits in semiconductor physics become more pronounced and impacts the performance in terms of key radio parameters. Here, we will limit the discussion and for future prospects to discuss further three important subsystem components of any radio transceiver the power amplifier, the radio local oscillator and the data converter.

V. CONCLUDING REMARKS

We have here given a very short overview of some important technical challenges related to the implementation of radio access in the MmW bands. This included aspects of propagation properties, physical layer design and the implied impact on the analog radio front-end hardware in terms of power and radio carrier generation.

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A review on Human Activity Recognition using Machine Learning

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ABSTRACT: This review article surveys extensively the current progresses made towards video based human activity recognition. Three aspects for human activity recognition are addressed including core technology, human activity recognition systems and applications. In the core technology, three critical processing stages are thoroughly discussed mainly: human object segmentation, feature extraction and representation, activity detection and classification algorithms. The domains of applications are discussed in detail, specifically, on surveillance environments, entertainment environments and healthcare systems. Our survey, which aims to provide a comprehensive state-of-the-art review of the field, also addresses several challenges associated with these systems and applications. Moreover, in this survey, various applications are discussed in great detail, specifically, a survey on the applications in healthcare monitoring systems.

Keywords: Human activity recognition; segmentation; feature representation; security surveillance; healthcare monitoring;

I INTRODUCTION

In recent years, automatic human activity recognition has drawn much attention in the field of video analysis technology due to the growing demands from many applications, such as surveillance environments, entertainment environments and healthcare systems. In a surveillance environment, the automatic detection of abnormal activities can be used to alert the related authority of potential criminal or dangerous behaviours, such as automatic reporting of a person with a bag loitering at an airport or station. Similarly, in an entertainment environment, the activity recognition can improve the human computer interaction (HCI), such as the automatic recognition of different player's actions during a tennis game so as to create an avatar in the computer to play tennis for the player. Furthermore, in a healthcare system, the activity recognition can help the rehabilitation of patients, such as the automatic recognition of patient's action to facilitate the rehabilitation processes. There have been numerous research efforts reported for various applications based on human activity recognition, more specifically, home abnormal activity [1], ballet activity [2], tennis activity [3,4], soccer activity [5], human gestures [6], sport activity [7,8], human interaction [9], pedestrian traffic [10] and simple actions [11–15] and healthcare applications [16–20]. In this paper, the video based technologies for human activity recognition will be extensively reviewed and discussed.

The paper is organized as follows: a brief description of human activity recognition is given in section I following with the description of classification algorithms in section II. In section III the applications of human activity recognition are presented.. Conclusion is presented in section IV.

I. ANALYSIS OF HUMAN ACTIVITY RECOGNITION STAGES

For human activity recognition, the first stage is to do the object segmentation, i.e., the human objects are segmented from the background image. Based on the mobility of the camera, the object segmentation task can be divided into two categories, the static camera segmentation and the moving camera segmentation

2.1. Static Camera

In static camera segmentation, the camera is fixed in a specific position and angle. Since the background never moves, it is natural to build a background model in advance, so that the foreground object can be segmented from the image of the background model.

2.1.1. Background Subtraction

The most common method for static camera segmentation is background subtraction due to its simplicity and efficiency [21]. The background model contains only the stationary background scene without any foreground object, and any image change is assumed to be caused only by moving objects. Hence the foreground object can be obtained by subtracting the current image of the background image, followed by a magnitude thresholding to obtain the segmentation mask. The segmentation mask often contains rough and fractional foreground object(s) and usually requires some post-processing, such as closing and opening morphological operations. The background subtraction has been extensively applied in all kinds of scenarios with various improved modifications. For example, for real-time human body tracking [22], the color distribution of each pixel in the background is first modelled with a Gaussian with a full covariance matrix.

This background scene texture map is considered to be class zero. The foreground textures in different classes are grouped by the mean of a point and the covariance associated with that point. Another improvement is to discriminate moving objects [23], based on statistical assumptions, with object-level knowledge, of moving objects, apparent objects and shadows. Besides, in order to overcome the limitation of the background subtraction on stationary background, Seki et al. [24] proposes a method to handle the dynamic (waving) background. The method learns the chronological changes in the observed scene's background in terms of distribution of image vectors. Generally speaking, the background subtraction is simple and efficient, but the simplicity of the background model sometimes causes the inaccurate classification of the pixels. Continuous and effective updating of the background in response to gradual changes of background also poses some challenges.

2.1.2. Gaussian Mixture Model (GMM)

Instead of the simple one Gaussian per pixel background modelling, the pixel values at location (x,y) can be modelled as a more complicated form, such as a mixture of Gaussians, to accommodate different background scenarios. The Gaussian mixture model (GMM) has been extensively applied in many fields to allow the adaptation to the multi-modal environments. Generally, GMM is learned by the expectation maximization (EM) algorithm. The higher the probability of a pixel value in the GMM, the more likely the pixel belongs to the background. Therefore, for the image sequence, a pixel of the image is classified to belong to the foreground object if the probability of the pixel value is less than a predefined threshold. In [25], the GMMs are constructed over a variety of different colour and texture feature spaces. Instead of using EM, Permuter et al. apply the k-means clustering algorithm to reduce the high computation incurred by the EM algorithm. Although the likelihood value attained by the k means is slightly lower than that attained by the EM algorithm, with the same amount of data involved in training the background model, the difference of performance is insignificant. It is sometimes necessary to reduce the dimensions of the features to avoid the frequently encountered singular covariance problems when the training data are not sufficient [26].

2.2. Moving Camera

Unlike static camera with fixed location and angle, moving camera (e.g., the camera installed on cars, moving robots, flying vehicles, etc.), including the use of active camera (e.g., pan-tilt camera), is with dynamic location and angle. Moving camera segmentation is much more challenging than static camera segmentation because two questions are needed to be considered simultaneously, i.e., the motion of the background and the motion of each foreground moving object. Generally, camera motion decomposition is needed to separate the motion of the camera and the motion of the objects

2.2.1. Temporal Difference

The most common method for moving camera segmentation is the temporal difference between consecutive frames. Unlike static camera segmentation, where the background is comparably stable, the background is changing along time for moving camera; therefore, it is not appropriate to build a background model in advance. Instead, the moving object is detected by taking the difference of consecutive image frames t-1 and t. However, the motion of the camera and the motion of the object are mixed in the moving camera. Hence, the motion of camera is estimated first. In [27], Murray et al. propose a temporal difference method for the segmentation on pan-tilt active camera. The background compensation is first applied for apparent motion of the background caused by the camera motion, and for finding a relationship between pixels representing the same 3-D point in images taken from different camera orientations. Morphological operations, including erosion and dilation, are then applied to smooth the absolute difference between current frame and previous frame to obtain the motion edges, resulting in the detection the moving objects when combined with the object edge information. Moreover, Kim et al. [28] propose another temporal difference method to estimate the pan and tilt movements of the camera by edge features in consecutive frames. The estimated pan-tilt motion parameters are then used to transform the image coordinate. Consequently, a motion image is created by using the estimated difference value among three consecutive which a pixel is considered as a motion pixel if the difference with previous frame and the difference with next frame are larger than a predefined threshold The advantage of the temporal difference methods [29] is efficient due to computational simplicity. However, they need to first perform the camera motion compensation, which is generally sensitive to noise due to the consecutive image difference.

2.2.2. Optical Flow

Another category for segmentation on moving camera is optical flow, which denotes a displacement of the same scene in the image sequence at different time instant. The pixel-based local optical flow in image sequence can be robustly evaluated by the Lucas-Kanade-Tomasi (LKT) feature tracker [30], which effectively selects corner feature points of the reference image patch. In [31], Daniilidis et al. apply an FIR-kernel based LKT feature tracker to estimate the optical

flow and to infer the motion of objects. The spatial FIR-kernels are binomial approximations to the first derivatives of the Gaussian function. Moreover, Huang et al. [32] also apply the LKT feature tracker to obtain the optical flow. Those features points with similar optical flows (similar magnitude and orientations) are then grouped together. Finally, the detected moving object patch is validated by target's color histogram as well as contour outlier removing. Even though the optical flow can be estimated by the LKT feature tracker, which robustly captures the local descriptor, it will perform poorly when the reference image patch is occluded by the moving target, the feature points originally located at the background will be moved with the target and result in inaccurate estimation of the optical flow. To overcome this issue, the LKT feature points need to be updated every few frames.

Feature Extraction and Representation

The second stage for human activity recognition is feature extraction and representation, where the important characteristics of image frames are extracted and represented in a systematical way as features. Feature extraction and representation have crucial influence in the performance of recognition, therefore it is essential to select or represent features of image frames in a proper way. In a video sequence, the features that capture the space and time relationship are known as space-time volumes (STV). In addition to spatial and temporal information, discrete Fourier transform (DFT) [33] of image frames mainly captures the image intensity variation spatially. The STV and DFT are global features which are extracted by globally considering the whole image. However, the global features are sensitive to noise, occlusion and variation of viewpoint. Instead of using global features, some methods are proposed to consider the local image patches as local features. Ideally, the local features are designed to be more robust to noise and occlusion, and possibly to rotation and scale. Besides global and local features, other methods are also proposed to directly or indirectly model human body, to which the pose estimation and body part tracking techniques can be applied. Moreover, the coordinates of the body modeling can be further converted into lower-dimensional or more discriminative features, such as polar coordinate representation [34], Boolean features [35] and geometric relational features (GRF) [36], for effective recognition purpose.

3.1. Space-Time Volumes (STV)

The space-time volume (STV) is formed by temporally stacking frames over a video sequence as a 3D cuboid of spatial-temporal shape. Blank et al. [37] propose a method, by stacking segmented silhouette frame-by-frame, to form a 3D spatial-temporal shape, from which the space-time features such as local space-time saliency, action dynamics, shape structure and orientation can be extracted. Ke et al. [3] further uses the spatial-temporal shapes for shaped-based matching, including spatial-temporal region extraction and region matching. For region matching, an unsupervised clustering technique is applied to group the video into classes of 3D volumes of consistent appearance. In order to overcome the limitation of shape-based approaches, such as changes in camera view and variability in the speed of actions, Ke et al. [38] also incorporate Shechtman and Irani's flow-based features into the classifier to improve the performance. Moreover, Dollar et al. [39] applies a spatio-temporal interest point detector to find local region of interest in the cuboids of space and time for activity recognition. First, cuboids of spatio-temporally windowed data surrounding a feature point extracted from sample behaviors are clustered to form a dictionary of cuboid prototypes. The histogram of the cuboid types is then used as an activity descriptor for object recognition. Generally, the STV features provide a proper way to combine spatial and temporal information; however, STV features normally require good segmented silhouette and are sensitive to viewpoint and occlusion.

II Activity Detection and Classification Algorithms

After selecting proper features from image or video, activity detection and classification algorithms are the next stage under consideration for human activity recognition. To achieve good recognition performance, it is essential to choose a proper classification algorithm using the selected feature representation

The model-based algorithms can be divided into generative models and discriminative models. Generative models, that explicitly simulate the generation process of the data sequences as achieved by the hidden Markov model (HMM) and dynamic Bayesian network (DBN) learn the joint probability distribution P(X,Y) over observation X and label sequence Y, or equivalently the likelihood P(X|Y). On the other hand, discriminative models learn the conditional (posterior) probability distribution P(Y|X)over an unobserved fixed-length class label Y on a given observed fixed-length feature vector X, such as support vector machines (SVMs) relevance vector machines (RVMs) and artificial neural networks (ANNs). Some other popular classification algorithms are Kalman filter, binary tree, multidimensional indexing and K nearest neighbor (K-NN)

K-Nearest Neighbour (K-NN)

The K-nearest neighbour (K-NN) algorithm is a classification method based on the K, a predefined constant, closest training data in the feature space. A point/vector is classified to one label, which is the most frequent label among K nearest training points/vectors.

Since K-NN classification decision is based on K neighbourhood points/vectors, therefore K-NN can be easily used in multi-modal classification tasks. There are some advantages for K-NN. First, K-NN is a simple model with few parameters. Secondly, the computation time for testing phase is independent of the number of classes. Thirdly, K-NN is robust in the search space even for nonlinearly separable data. Kumari and Mitra [40] use DFT of the small image blocks as feature selection, and apply K-NN as the classifier for human activity recognition. The main drawback for K-NN is that the classification performance is sensitive to the selection of K. Different K values can be evaluated and validated during the training phase to decide the best K before performing classification.

III Applications

The goal of the last stage, i.e., applications, is to analyze classified activities so that their semantic meaning can be understood in specific domains. Activities can be simple actions such as walking, waving; complex single-person actions, such as ballet dancing, doing aerobics; the interactions between persons, such as hand shaking, hugging; or the interactions between humans and objects, such as preparing a meal, kicking a car door. Activity understanding requires expert knowledge to characterize the uniqueness accurately and to build the scenario suitable to each specific domain of applications. This makes the activity recognition techniques more valuable and widely used in diversified applications of our daily lives. In this section, we focus on three dominant applications, including surveillance environments, entertainment environments and healthcare systems.

Surveillance Environments

The application of human activity recognition in surveillance systems mainly focus on automatically tracking individuals and crowds, so as to support security personnel to observe and understand activities, resulting in recognition of the criminal and detecting suspicious activities. Most security surveillance systems are equipped with several cameras and require laborious human monitoring on screens for video content understanding. By applying automatic human activity recognition techniques to video-based surveillance systems, we can effectively reduce the workload of security staff as well as systematically creating an alert immediately when security events are detected in order to prevent potentially dangerous situations. Some typical scenarios are as follows. People detecting and tracking is one of the first objectives of a security surveillance system. Nakazawa et al. [41] propose a wide area human tracking method using network-connected vision systems that each consists of a camera and an image processing module. Each vision system carries out two tasks, the tracking task and the acquisition task. If there are humans in a visible region of a vision system, the tracking task system tracks the human position and broadcasts the results to the other systems. In case the vision system has no person in view, then the acquisition task system must find the person in their image to be tracked. Bodor et al. [42] use Kalman filters to track the position and velocity path for each pedestrian in high pedestrian traffic areas, then the tracking results are further exploited to detect suspicious behaviors, such as entering a “secured area,” running or moving erratically, loitering or moving against traffic, or dropping a bag or other items. Similarly, Fiaz and Ijaz also perform suspicious activity detection and tracking using ANNs. Besides this, some researchers perform detection of various kinds of violent behaviors such as fighting, punching. The main goal of video-based surveillance systems in detecting criminals and suspicious security events, they also aim to ensure safety of swimmers in pools. For example, Poseidon [43] is a commercial system developed for drowning detection. The system, equipped with a network of cameras mounted either above or below the surface of the water, can help lifeguards to systematically monitor swimmers’ trajectories and can alert them in seconds to a swimmer in trouble. This drowning detection system can increase the chance of saving a life and reduce the likelihood that a person will suffer long-term damage as a result of a drowning incident.

Human activity recognition can also be used to recognize entertainment activities, such as sport [44] and gaming [45], in order to enrich lifestyles. For the purpose of recognizing sportive activities, Yamato et al. applied HMMs to recognize the time-sequential images of tennis scenes, including six tennis strokes such as forehand stroke, backhand stroke, forehand volley, backhand volley, smash and serving. Luo et al. developed an object-based method for video analysis and interpretation of sports video sequences. The sport behaviours are effectively recognized which can generate a hierarchical description for video events, including bowling, downhill skiing, golf swing, pitching, and ski jumps recorded from real scenarios, with cluttered background and moving cameras. Ke et al. exploit the use of volumetric features for the recognition of actions such as serve, run right and return serve actions in the tennis sequences when combined with flow-based correlation techniques. By using an extended behavior-based similarity measure, Shechtman and Irani were successful in detecting dives into a pool during a swimming relay match. Despite the numerous simultaneous activities and despite the severe noise, this method is able to separate most dives from other activities.

IV. CONCLUSION

This review provides an extensive survey of existing research efforts on video-based human activity recognition systems, covering all critical modules of these systems such as object segmentation, feature extraction and representation, and activity detection and classification. Moreover, three application domains of video-based human activity recognition are reviewed, including surveillance, entertainment and healthcare.

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Lightly and heavily doped nmosfet design using TCAD

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***Abstract*— In sub micron technology doping plays key role in device and successively in circuit characteristics. In this paper we have designed lightly and heavily doped Nmosfet using TCAD. The selected technology node is 45nm. Device parameter extraction is also performed for comparison between lightly and heavily doped mosfet. Fabrication of the device is done in ATHENA. Parameters are extracted using ATLAS .**

Keywords—Lightly and heavily doped nMOSFET, ATLAS

I. INTRODUCTION

Device miniaturization is the key to present day VLSI design. MOSFET is the primer of any successful hierarchical design. The exponential decrease in the transistor size has resulted in system on chip environment. The short channel effects arise due to this device miniaturization. Four devices are virtually fabricated using TCAD. The doping variation effects the operation of devices. In deep sub micron technology, device degradation is the result of scaling [1]. While designing in nano regime hot carrier effects are pronounced and are major contributors to reliability issues[2-3]. In this paper we have compared the lightly and heavily doped nMOSFET, further we have extended our analysis for pMOSFET. Virtual fabrication of the devices is performed using ATHENA,while using ATLAS parameters are extracted for performance evaluation. Section II describes device fabrication. In section III parameters extraction is performed, in section IV results are discussed.

II. Device fabrication

Process simulation is performed to virtually fabricate four devices. Short channel effects are also included using the impact ionization model. The process steps for nMOSFET are taken from table 1. Dose is decided as per the type of substrate required. With shrinking feature size and increasing switching frequency, proper models [4] are to be included to generate the desired device characteristics. Parameters are extracted to verify that devices modeled are working properly. Threshold voltage in saturation (V_t sat) and linear region (V_t lin) are determined [3]. To determine the current driving capability of the device I_{on} and I_{off} are calculated. SS (sat/lin) define slope in saturation and in linear region. Calculated Drain induced barrier lowering (DIBL) accounts to the short channel effects in MOSFETs [5-7]. Table 2 shows the extracted parameters.

Table 1 NMOSFET process sheet

Process	Lightly doped NMOS	Heavily doped NMOS
Initial substrate	P-Type-1e15	P-Type-1e18
P well implant	Boron dose1e12/cm^2	Boron dose1e12/cm^2
Gate oxide thickness	1nm	1nm
V_t implant	Boron=1.5e13	Boron=1.5e13
Poly deposition	80nm	80nm
S/D implant	Arsenic=1e15	Arsenic=1e15
Halo implant	Boron 5e13 Energy 25 Angle 30^0 full rotation	Boron 5e13 Energy 25 Angle 30^0 full rotation
S/D implant (deep)	3e15,7.5Kev	3e15,7.5kev
RT Annealing	750-800 nitro for 1 min.	750-800 nitro for 1 min.
Metal deposition	Al-10nm	Al-10nm

Process parameters defined in table 1 defines the lightly and heavily doped nMOSFET. Figure1 and figure 2 provides the change in doping profile due to change in substrate doping. Figure 3 elaborates Overlapped devices with vertical cut line through centre of channel. From figure 4 we infer that the substrate doping in lightly doped nMOSFET is around 1e16 cm-3 and in heavily doped nMOSFET, it is 1e18cm-3

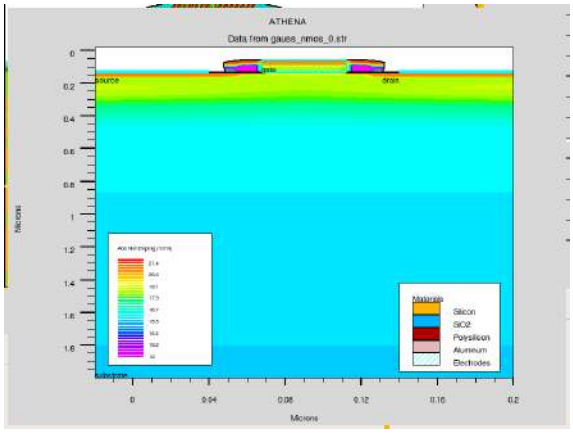

Figure 1 lightly doped nMOSFET

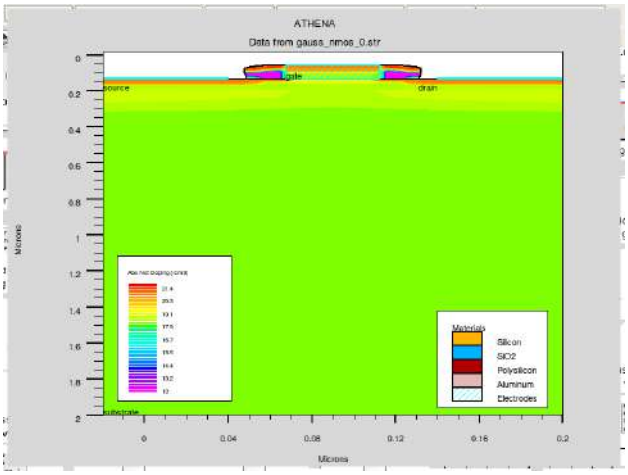

Figure 2 heavily doped nMOSFET

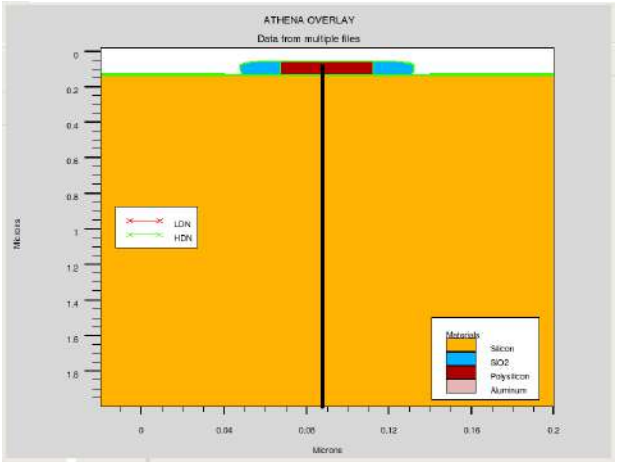

Figure 3 vertical cut line

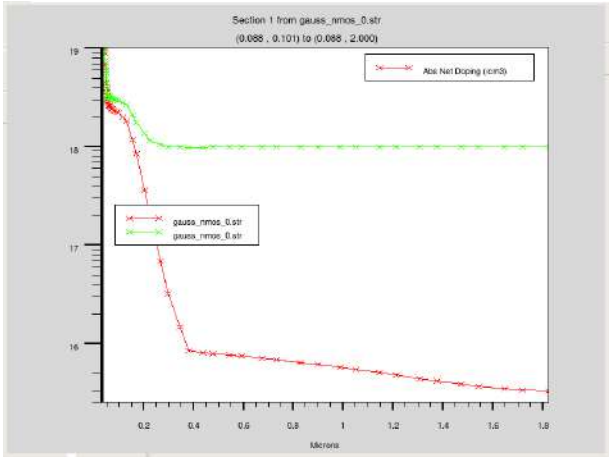

Figure 4 Doping variation

Section III Device parameter extraction

ATLAS simulator along with suitable models[8] is used to extract parameters of lightly and heavily doped nMOSFET. The extracted parameters define the operation of the devices. Following are the extracted parameters in table 2 for nMOSFET lightly and heavily doped

Table 2

Parameters	Lightly doped NMOS	Heavily doped NMOS
V_t sat	0.21164 V	0.224777 V
V_t lin	0.253492 V	0.261598 V
SS sat	0.0777042 V/dec	0.0784734 V/dec
SS lin	0.0792496 V/dec	0.0798562 V/dec
DIBL	0.036393 V/V	0.0320183 V/V
I_{on}	0.00213986 A	0.00188337 A
I_{off}	3.79865e-09 A	2.69667e-09 A

The results of ATHENA are made input to the ATLAS simulator. The resultant is device characteristics. We analyze the process parameters with respect to the device characteristics for accurate device modeling.

- **Model statement for NMOS (lightly doped) - LDN:**
- models hcte.el fermi hei cvt fldmob evsatmod=1 consrh ni.fermi temp=300 print
- mobility betan=2 vsatn=1.1e7
- impact selb length.rel lrel.el=0.02
- material taurel.el=0.2e-12 taumob.el=0.2e-12
- interface qf=3e10
- contact name=gate workf=3.9
- **Model statement for NMOS (Heavily doped) HDN:**
- models hcte.el fermi hei cvt fldmob evsatmod=1 consrh ni.fermi temp=300 print
- mobility betan=2 vsatn=1.1e7
- impact selb length.rel lrel.el=0.015
- material taurel.el=0.15e-12 taumob.el=0.15e-12
- interface qf=3e10
- contact name=gate workf=3.9

(IV) Conclusion

Lightly and heavily doped nMOSFET are designed. Their process and characteristics are compared for optimized design. Short channel has impact on device characteristics. Proper model inclusion is done so as to generate the desired effect in the devices.

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WATER MONITORING SYSTEM

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Abstract— **Water monitoring includes testing of water quality on regular basis, conventionally it is done by gathering samples from various places manually and testing and analyzing that samples on the basis of different parameters in the lab. This whole process is time consuming and required great amount of workforce and money to implement it properly. So, we implement a water quality monitoring system that checks the quality of water in real time using various sensors like pH sensor, turbidity sensor, and temperature sensor. In this system we can use Ultrasonic sensor which is used for flood check. The GSM and Wi-Fi modules in this system transfer the information of different parameters collected by microcontroller to mobile phones, computers and different Govt. management sites. This system keeps a check on the pollution of water resources and gives the warning of flood and provides an environment for safe drinking water.**

Keywords— ***Contamination, Physiochemical, Water quality, pH, Conductivity, Temperature, Turbidity***

I. Introduction

Water is one of the basic and most essential natural resources and an important need of mankind. Water is a need of all living organisms for many tasks and thus, causing scarcity as well as contamination. With rapid changes in our environment and increase in development, misuse, deterioration and contamination of water resources. In India, the Central Pollution Control Board (CPCB) is responsible for maintaining the quality and wholesomeness of water bodies. It ensures that the water quality is up to the mark or desired Ease of Use level. Central Pollution Control Board started National water quality monitoring under Global Environment Monitoring System (GEMS) by starting 24 surface water and 11 ground water stations. Water quality is defined and analysed for 28 parameters, 9 trace metals and 15 pesticides.

The system is designed for continuous onsite sensing and real-time reporting of water quality data where the officials can access the data on the smart phone/PC through internet. Our proposed system employs use of multiple sensors to measure the parameters, measures the quality of water in real-time for effective action, and is economical, accurate and required less manpower.

Fig 1. Uses of Water

Internet of Things

Internet of Things (IoT) is a system of interrelated computing devices, digital objects and other devices embedded with electronics, software, sensors, actuators which connect, collect and exchange data.

IoT extends internet connectivity beyond standard devices which are traditionally not related to interact. The concept of IoT creates a network of objects that can communicate, interact and cooperate together to enhance daily life uses. This helps in better decision making and tracking and monitoring our devices even from far away.

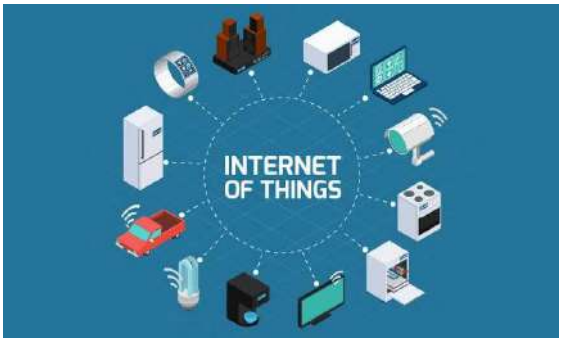

Fig 2. Internet of Things

II. IMPLEMENTATION

This system comprises of following 4 sensors-

- pH Sensor
- Temperature Sensor
- Turbidity Sensor
- Ultrasonic Sensor

Arduino (Mega) is being used as processing module microcontroller. The data is gathered by sensors in Analog form, which is being converted into digital form via Analog to Digital Convertor (ADC). The digital signal is then sent to microcontroller using Wi-Fi module to process and analyze the digital information. The different parameters of the water monitoring system is then sent to the Smart Phone, Computer, Govt. Monitoring sites, and is displayed on LCD. Global System for Mobile communication (GSM) is used to send the message regarding water quality check to the mobile phones. The whole process is executed via coding which is being done on Arduino IDE.

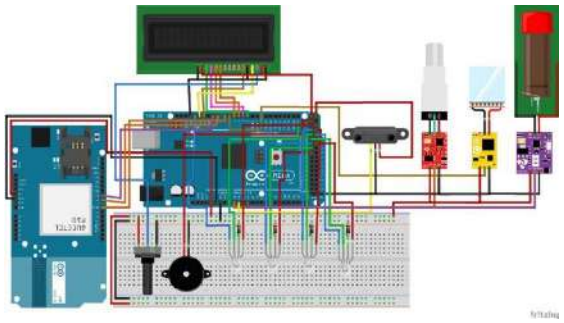

Fig 3. Connection of the system

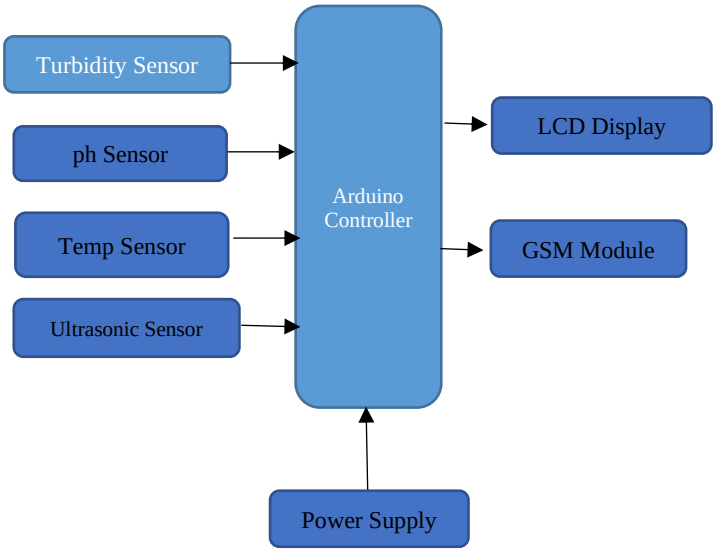

Fig 4. Block Diagram

SENSORS

A SENSOR IS A DEVICE WHICH CONVERTS A MEASURABLE PHYSICAL QUANTITY INTO ELECTRICAL QUANTITY.

- *pH Sensor*

pH stands for “Power of Hydrogen”. A pH sensor is a device which measures the pH of any liquid. pH scale ranges from 1 to 14, where 7 is for neutral. pH< 7 is said to be acidic.

- *Temperature Sensor*

The easiest way to explain temperature is: “How cold or hot something is?”. The temperature sensor detects the intensity of heat present in a substance. LM35 temperature sensing device gives an analog output voltage for corresponding temperature.

- *Turbidity Sensor*

Turbidity is a measure of the degree to which water loses its transparency due to the presence of suspended particles in it. Turbidity increases with increase in quantity of suspended in it. A turbidity meter works by determining the concentration of suspended particles in the given sample. It measures the light being scattered from sample. The scattered light is captured by photodiode which produces an electronic signal that is converted into turbidity. Its unit is NTU: Nephelometric Turbidity Units.

- *Ultrasonic Sensor*

An ultrasonic sensor is an instrument that measures the distance to an object using Ultrasonic Sound Waves. It uses a transducer to send and receive ultrasonic pulses that rely back information about an object’s proximity.

GSM Module

GSM (Global System for Mobile communication), is a standard developed by the European Telecommunication Standards Institute. A GSM Module is a chip or circuit that is used to establish communication between a mobile device or a computing machine and a GSM system.

Arduino Mega

Arduino Mega 2560 is a microcontroller board based on Atmega2560. It comes with more memory space and I/O pins as compared to other boards available.

Microcontroller	Atmega2560
Operating Voltage	5V
Input Voltage	7V – 12V
USB Port	Yes
DC Power Jack	Yes
Current Rating Per I/O Pin	20mA
Current Drawn from Chip	50mA
Digital I/O Pins	54
PWM	15
Analog Pins (Can be used as Digital Pins)	16 (Out of Digital I/O Pins)
Flash Memory	256KB
SRAM	8KB
EEPROM	4KB
Crystal Oscillator	16 MHz
LED	Yes/Attached with Digital Pin 13
Wi-Fi	No
Shield Compatibility	Yes

Arduino Mega 2560 Specifications

Fig 5. Specifications of Arduino Mega 2560

III. RESULT

The objective of the study was to investigate the status of pollution load in River Yamuna, Delhi.
13 different sites of river Yamuna were selected and the Physiochemical parameters such as pH, turbidity and temperature were determined for the same.

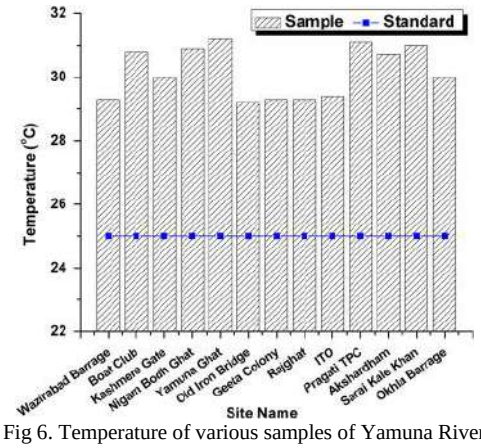

Fig 6. Temperature of various samples of Yamuna River

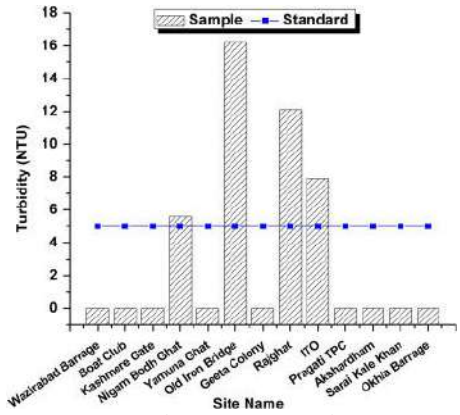

Fig 7. . Turbidity of various samples of Yamuna River

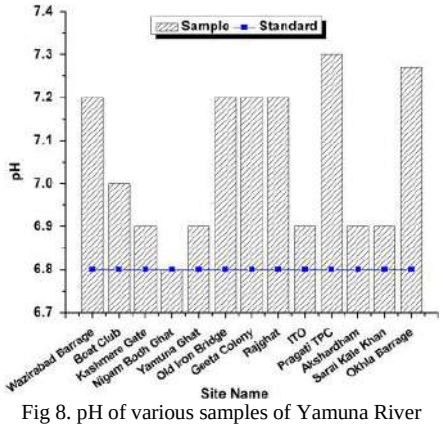

Fig 8. pH of various samples of Yamuna River

IV. CONCLUSION

Through this system, we can improve the traditional time consuming and less efficient method of checking water quality. IoT based system will ensure that officials are always updated and can take quick actions as and when required. The system can be easily implemented and quick action will help in immediate warnings and preventions. Hence, in betterment and well being of society.

FUTURE SCOPE

With increasing global warming, pollution and energy crisis, it is the need of the hour to find better, efficient and environment-friendly sources to perform our actions. The system can be powered by Solar Energy in Future.

Fig 9. Application of solar energy

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IOT Based Automatic Hydroponics Control and Monitoring System

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***Abstract*-** Hydroponics is the cultivation of plants by utilizing water without using soil by emphasizing the fulfillment of nutritional needs for plants. Deep Flow Technic (DFT) is a type of hydroponics that implements a continuous flow of nutrients and there is a pool of half of the diameter of the pipe that inundates the roots of the plant. A common obstacle experienced by DFT is the lack of maintenance of plant growth elements such as water circulation, light intensity, temperature, humidity and pH of the water which causes these plants not to grow optimally. Then it is necessary to monitor and control the circulation of water on DFT-based IoT hydroponics to anticipate changes in plant growth elements. Data on plant growth elements are acquired by sensors integrated with Microcontroller. In the monitoring process using the website will display data on plant growth elements in the form of pH, temperature, TDS and water level in the hydroponic reservoir. From the results of the tests that have been carried out, the Control system can monitor plant growth elements displayed on the website in real time to control water and various important factors automatically.

I. INTRODUCTION

With the advances in technology and the improvement of people's living standards, hydroponic plants become an integral part of daily life. However, traditional plant farming has been mainly performed in the soil. It is known that a series of drawbacks can be found for such a way. For an instance, regular watering and fertilizing may require more time and labour. With the development of various techniques, the soilless cultivation has become more mature and popular breeding choice such as hydroponic. Hydroponic is an environment-friendly system to cultivate crop without soil by utilizing aquaculture and hydroponics.

At present, hydroponics cultivation is mainly used in agricultural production. Modern people have been always scheduled in work and they have no time to look after hydroponic plants. Plants need watering and fertilization frequently. The whole process is compound and onerous. Based on the above shortcomings, the automatic control system is proposed. Unfortunately, present automatic control system is not steady, some unexpected faults occur, especially it is difficult to realize the remote monitoring and control. Consequently, it is very mandatory to design a smart monitor and control system, especially for people who travel often. The rapid development of sensor, Internet, communication and computer technology, smart life style will become a popular trend in our future. To solve the present shortcoming, this study designs a smart monitor and controlling system, which can make it easy to implement the connection of monitoring field and to remote monitoring centres. This system can monitor the environment of hydroponic device through some sensors in a real-time and stable way, and then accurately, automatically transmit the raw data values of temperature, humidity, light intensity, water level and pH level. Hydroponics is more efficient in areas that are limited green space. This makes hydroponics an urban agricultural solution. Both on an industrial scale and home scale for self consumption.

One type of hydroponics is Deep Flow Technic is a type of hydroponics that implements a continous flow of nutrients and there is a pool of half of the diameter of the pipe that inundates the roots of the plant. The DFT system aims to make the absorption of nutrients from plants more optimal. Special attention needs to be given to the growing elements of hydroponic plants in order to produce good and healthy plants. Hydroponic plant growth elements in the form of water circulation, light intensity, temperature, humidity, TDS and pH of water. Often the hydroponic activists fail during the plant growth process, due to lack of maintenance of plant growth elements that cause the plant to wither, to change the color of the plant leaves to yellow, to death. With so many plant growing elements, to make it easier to know the condition of the plant, it is necessary to monitor these elements regularly.

The development of communication technology is now increasing rapidly with the advent of the term Internet of Thing (IoT). IoT allows all objects to communicate with each other via the internet. The IoT concept can be applied to both conventional agriculture (soil media) and hydroponic agriculture. In this final project will design and build a Control system based on the needs of hydroponic plants. The system is designed to control the circulation of DFT hydroponic systems and monitor the growth of hydroponic plants such as pH, temperature, humidity, TDS and high water in hydroponic

II. OBJECTIVES

1. To study the hydroponics farming and related aspects.
2. To design and implement hydroponics Control system using IoT for monitoring and control various parameters such as pH level of water, nutrients contain in water, temperature and humidity.
3. To provide real time access of the hydroponics system on mobile app or Thingspeak to monitor and improve crop yield.
4. We are aiming to design a Control System for hydroponics which automatically control the various important parameters and these parameters can be accessed from anywhere and on any device with the help of IOT.

Growing with hydroponics comes with many advantages, the biggest of which is a greatly increased rate of growth in your plants. With the proper setup, your plants will mature up to 25% faster and produce up to 30% more than the same plants grown in soil. Plants will grow bigger and faster because they will not have to work as hard to obtain nutrients. Even a small root system will provide the plant exactly what it needs, so the plant will focus more on growing upstairs instead of expanding the root system downstairs

III. METHODOLOGY

Growing with hydroponics comes with many advantages, the biggest of which is a greatly increased rate of growth in your plants. With the proper setup, your plants will mature up to 25% faster and produce up to 30% more than the same plants grown in soil. Plants will grow bigger and faster because they will not have to work as hard to obtain nutrients. Even a small root system will provide the plant exactly what it needs, so the plant will focus more on growing upstairs instead of expanding the root system downstairs

Idea that would control the parameters automatically, also the cultivators can know the current conditions of the plants growth and control the parameters remotely using IoT technology.
Firstly collection of some values from hydroponics solution such as—

- pH of water
- TDS of water
- Temperature and Humidity of water

These values are collected by using

- pH water sensor
- Analog TDS Sensor/Meter for Arduino
- DS18B20 temperature sensor

Now designing a solution control mechanism which automatically maintain pH, TDS and other nutrients in solution.of hydroponics. For regulating the pH level and TDS, mini water pump are required. Each motor is connected separate solution container. And these container contain respective solutions as :---

- pH up solution (for decreasing the pH level)
- pH down solution (for increasing the pH level)
- Mixture of all nutrients which is fixed for a particular crop (for increasing TDS of water)
- Water (for decreasing TDS of water)

These pumps are controlled by Relay Module with the help of microcontroller. And final with help of wifi module above values received can be accessed from anywhere by using either Thinkspeak or application development. And this Control system get inputs from probes of pH sensor, TDS sensor and water temp sensor. Then Control system will release solutions with the help of mini pumps to maintain all these factor according of crop and environment for maximum yield. And the whole working can be monitored and controlled from anywhere.

IV. FUTURE PROSPECTS

House Gardening:- Hydroponically grown foods not only taste better and are more nutritional, we can change the properties of our food, monitor what goes into our food and pollutes less.
Research:- Hydroponic systems have been utilized as one of the standard methods for plant biology research and are also used in commercial production for several crops, including lettuce and tomato. Within the plant research community, numerous hydroponic systems have been designed to study plant responses to biotic and abiotic stresses.
Growing Medicinal Plants:- Medicinal plants are increasingly cultivated on a commercial scale to satisfy the large demand for natural remedies
Plant Nursery:- Plant nursery can be made using hydroponics system. Greenhouses and nurseries grow their plants in a soil less, peat- or bark-based growing mix. The nutrients then are applied to the growing mix through the water supply

Hydroponic growing has certain inherent advantages. Plants grown in a nutrient solution will mature up to 25 percent faster and deliver up to 30 percent more yield than plants grown in soil. IOT Based Automatic Hydroponics Control and Monitoring System is a key element of achieving these kinds of results
.IOT Based Automatic Hydroponics Control and Monitoring System can easily:
• Measure water conditions: pH, TDS, temperature, level, and flow.
• Measure air conditions: temperature, humidity etc.
• Control pumps to dispense specific volumes of solutions: acid, base and nutrients.
• Automatically adjust water to target pH range by dispensing acid/base solutions.
• Automatically adjust water to target electrical conductivity range by dispensing nutrient solutions.
• Alert notifications if select measurements fall outside acceptable ranges (e.g., temperature too high, water level too low, water flow has stopped, etc.)

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Iris : The Virtual Assistant

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Abstract *— Voice assistants represent the third key UI and technology platform shift of the past three decades, following the web in the 1990's and smartphones about 10 years ago. Each successive UI shift changed the way humans interacted with and accessed digital content. Web pages gave us "click," where we surfed using our mouse and activated buttons and hyperlinks. Smartphones introduced "touch," "swipe," and "pinch" to billions of consumers and replaced web pages with apps. Both of these transitions required consumers to learn a new language for interacting with technology. The shift to voice doesn't require any training. Users simply "speak" as they do naturally.[1]*

Keywords *— Artificial Intelligence, Natural language processing, online Information Services, Web Speech API, Voice.*

I. INTRODUCTION

We have forever had to learn the language of technology, be it keyboard, mouse or touchscreen. Voice Assistants have turned this around. With voice, technology has to learn to understand us, understand our language. Our understanding of voice assistants or voice-based products is typically limited to Siri, Alexa or Google Assistant style general-purpose Assistants.[5] The reality is there's a bigger picture out there that many of us are not familiar with. In this blog, we will present you a more holistic picture of Voice Assistants. The very complex process of writing and speaking that humans take for granted was a challenge for computer scientists to unravel and replicate.[3] The growing sophistication of natural language processing and natural language generation, subsets of artificial intelligence, take in data, process it and create natural language that sounds as if a human were actually speaking or writing it.[2] Natural language processing (NLP) is the ability of a machine to "read" or "understand" the content produced by humans, e.g. By writing or speaking. Natural language generation (NLG) refers to a machine's ability to create content in either written or spoken language so that it can be understood by humans. Every voice solution is not a voice assistant, but every voice assistant is a voice solution. To be called Voice Assistants, a voice solution needs to match these conditions:

1. **Voice as input:** Primary mode of input for a Voice Assistant should be through Voice.
2. **Conversational:** Voice Assistants should be able to have natural and contextual two-way communication with the user.
3. **Confirmational:** Voice assistants should be able to confirm, clarify and answer the user with context.[5]

II. LITERATURE SURVEY

This research could be a chunk of a bigger project concerning virtual voice assistant briefed by theories in human machine interaction. Moreover speech recognition has a brief history with numerous waves of innovations.[6]Voice recognition for dictation, hunt and voice command has become a vital feature on personal

devices: like wearable devices and smartphone's. This system was developed as a humanoid application that confirms the necessity of language rework that sends messages and also uses built-in applications by processing the commands given by the user to the system. Importantly smartphone gadget was way quicker followed by other wearable devices; so, many arrived to introduce in-voice virtual voice assistants with the importance of adopting and applying multiple smart technologies.[8] This system has some basic features and most importantly mailing and secondly calendar, where users have the privilege to mail and are able to create their required event by providing voice commands. For instance, if we use artificial intelligence we are able to turn off the lights without the instruction given by the user. Almost, Everyone has some knowledge about trending voice assistants like cortana for windows, and Siri for apple users, these virtual voice assistants aren't as brainy and intelligent as Ironman's Jarvis which appear in the superhero movie, but the intended actions are almost similar to virtual voice assistants. It's like you need to ask a question, and within a few fraction of seconds you will get an answer. It's just give a command and get the result.[7]

Here are some amazing Features of virtual voice assistant:

Open any website in the browser: If any user needs to open any website they just need to voice out "open nameofwebsite.com" or "open website.org". Consider examples:"open xhsj.com" or"hey requesting you please open zzz.com" .

Play song on VLC media player: Ask voice assistant to play a desired song in VLC media player :For instance user will ask voice assistant"can you please play me a song", whereas both will ask"what song shall a pay Sir/Madam?" and a voice assistant will transfer the required music to youtube, which is present in your local drive and it will stream the searched content in VLC media player , however if the user plays any new song, previously downloaded music will be automatically deleted.

Scan the Headlines: raise voice assistants to scan out daily headlines from news connected applications, where the user has the privilege to select the interested topics of his/her own alternative.

Send Email: If a user has prompted the word email in his/her commands then the voice assistant will ask the user for the recipient, If the user response is abc, then the assistant will use the phone's library for searching user data and then it is directed to email with the recipient 's name on it.

Tells you the current time: Using voice assistant users can ask the current time. For instance: "whats time right now" then assistant will report you the current time as per your time zone.therefore"current time is 1.14p.m."

Keep reported about the weather and temperature of any world: Voice assistants can report weather for the day and it also can give the minimum and maximum temperature of any city across the world. Users must just give commands like "what is the current weather in Mysore "or tell me the current weather in "India": you will be getting results within a fraction of seconds.

Answer your Desirable questions: Ask voice assistant some interesting facts or the new facts, solve some basic mathematical problems or we are also able to ask a joke[6]

III. METHODOLOGY

3.1 General Structure

Considering overall research, voice application will be used in the following three ways: Firstly, command to the computer whereas secondly, to input information to the computer, finally for communication with other people. In this section we will be discussing general components for voice application. As seen in Figure[1],voice will be divided into four different parts: front-end interface, end users, voice recognition System finally dictionary and text file database. Each section is explained as follows:[10]

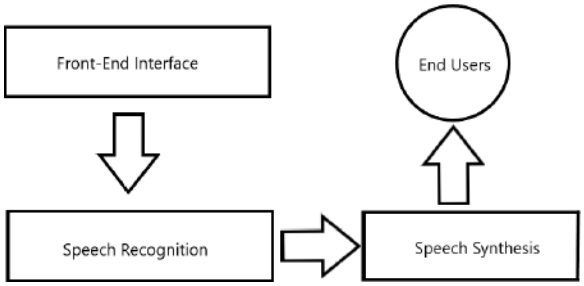

Fig. 1 General Structure of Voice Application

Front-End Interfaces

In front-end-interface, users will be having direct access to the interface and communication users by providing Input and Output with graphics designs and icon-based menus. It receives user prompt input voice and in return delivers users with a voice recognition system to detect voice inputs, and usually generates feedback of voice to users, after completion of commands by several other functions of the system.[9]

End Users

Basically end users refers to device users. They will be using this device for communication and feedback of voice with the use of application, and moreover end users are those who will be using this application with their personal devices like mobile and laptop users.[9]

3. Voice Recognition Systems

It is the heart of a Voice application system, which has the ability to understand voice input given by user, and make the application work in an efficient way and generate voice feedback to In a Nutshell, for clearly understanding user voice command and to get feedback from the system, we should consider a voice recognition system containing all the process by which the application system directs for building speech signals to text data and few forms of important meaning of speech.[9]

3.1 Voice Synthesis

Speech synthesis is accessed via the SpeechSynthesis interface, a text-to-speech component that allows programs to read out their text content (normally via the device's default speech synthesiser). Different voice types are represented by SpeechSynthesisVoice objects, and different parts of text that you want to be spoken are represented by SpeechSynthesisUtterance objects. You can get these spoken by passing them to the SpeechSynthesis.speak() method.[9]

3.2 System Architecture

The total design consists of these phases:
1) Collection of data which is in speech format.
2) Analyse the voice and convert it to text.
3) storing the data and processing it.
4) Speech generation from the text output that is processed[11]

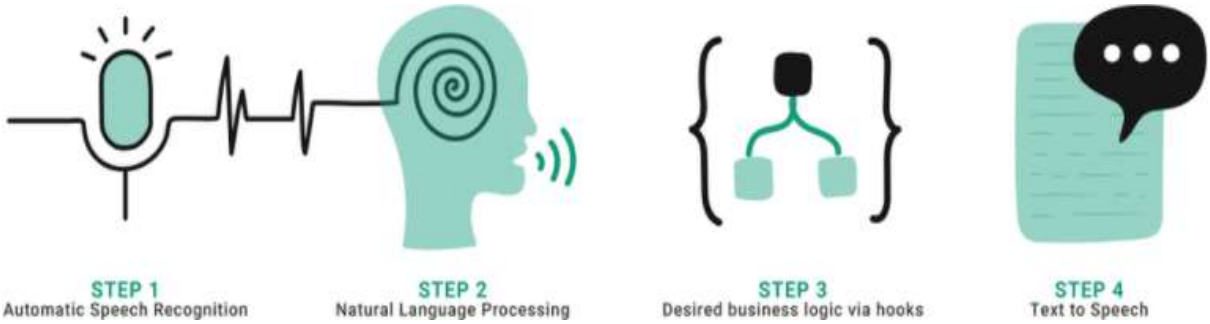

Fig. 2 System Architecture of Voice Controlled Personal Assistant [4]

The data that is collected in the speech form is stored and used as input for the next phase of the process. In the next phase, the input which is given in the form of voice is processed continuously and is converted into text by using STT. In the third phase, the text which is converted, is analysed by Python Script which processes it and identifies the action to be taken for the command. In the last phase, after the action to be taken is identified, output will be obtained from text to speech conversion using TTS.[10]

3.3 Data Flow Sequence

3.3.1 Initialize Device:- Device initialization does whatever steps are necessary to get a system into a working state. It set the unit in motion by calling its name. The process is specific for every device, there are no magic values that would initialize any device that you come across.[13]

3.3.2 Service Manager:-It helps in Command analysis and matches with Web service adapter and cloud server. The semantic description is used to match the command to the Web service adapter.[13]

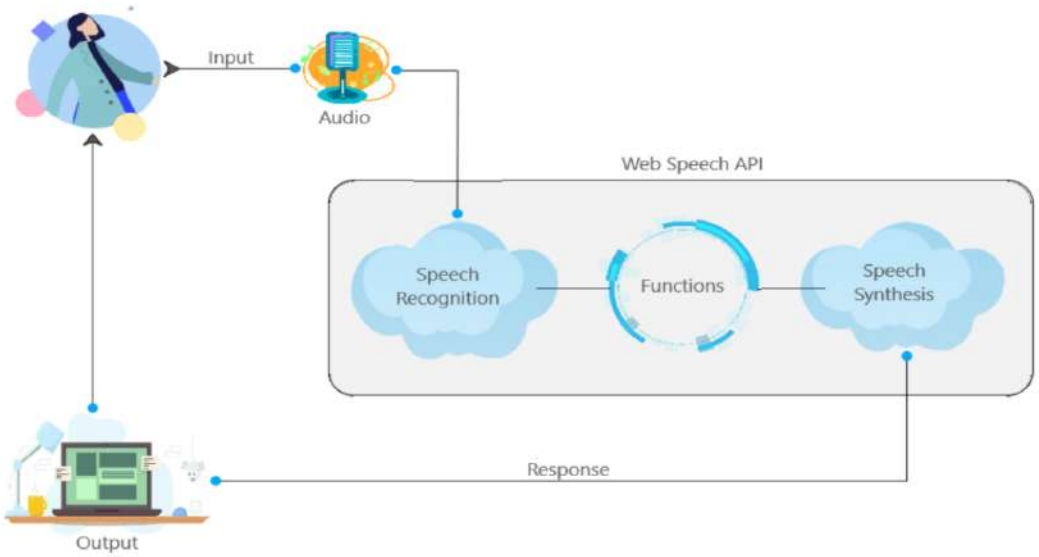

Fig 3. Data Flow Sequence

3.2.3 Web Speech API:- The Speech-to-Text and Text-toSpeech transfers are done by the web speech API. It provides a semantic description of what was spoken, which is passed into a service manager.

3.2.4 SpeechRecognition:- For speech output, a natural language (NLG) component and a text-to-speech (TTS) component is used.

3.3.5 Speech Synthesis:- For speech output, a natural language (NLG) component and a speech-to-text (STT) component is used.

3.3.6 Execute command : Run the Respective Javascript after you have found the match for the given order.[12]

IV. FEATURES

Here are the functionality that we have added in our webapp, as following:

1) Searches on Google, Youtube, Wikipedia etc.
2) Opens web apps like Google, Youtube etc.
3) Sends mail.
4) Search high quality unsplash images.
5) Plays Music.
6) Tells current date and time.
7) Narrates current weather conditions.
8) Performs basic mathematical calculation.
9) Can have a nice conversation.
10) It can also tell you a random quote.
11) Know the current covid details.
12) Also available in Dark Mode.

V. APPLICATIONS

There are a wide variety of services which are provided by the voice-enabled devices which range from simple commands like providing information about the weather of a place, general information from Wikipedia, movie rating from IMDB, setting an alarm or reminder, creating a to-do list and adding items to the shopping list so that we don't forget when we go shopping. It can also read books for the user or else play music from any streaming services depending on the device provider or user preference. It can also play videos from YouTube or else from any streaming services. In a recent study, voice assistants are also being used to assist public interactions with the Government and also a decrease of 30% work load on humans when voice assistants are used in call centers.[15]

VI. LIMITATIONS

The devices which use the human voice for interacting with the device use single commands as input for the device they usually consist of single phrases. When commands become ambiguous, the resulting actions can be misunderstood by the devices. There is only one-way communication between the user and the device because the device cannot talk back for clarification. The applications on the devices cannot reply back with the state of the process whether it is ongoing or completed. There are many cases where only specific tasks are allowed to be done by the voice-enabled devices because the stove top cannot/should not be turned on when there is no one in the kitchen/house. The devices can not integrate context data. They can not log any history about the queries made but they can be trained to learn about the user behavior and learn about the user's usage statistics and give a recommendation to the user according to the time, place, or by any other calculated parameters.[15]

VII. CONCLUSION

Voice-Controlled Devices use Natural Language Processing to process the language spoken by the human and understand the query and process the query and respond to the human with the result. The understanding of the device means Artificial Intelligence needs to be integrated

with the device so that the device can work in a smart way and can also control IoT applications and devices and can also respond to queries which will search the web for results and process it. It is designed to minimize human efforts and control the device with just a human Voice. The device can also be designed to interact with other intelligent voice-controlled devices like IoT applications and devices, weather reports of a city from the Internet, send an email to a client, add events on the calendar, etc. The accuracy of the devices can be increased using machine learning and categorizing the queries in particular result sets and using them in further queries. The accuracy of the devices is increasing exponentially in the last decade. The devices can also be designed to accept commands in bilingual language and respond back in the same language queried by the user. The device can also be designed to help visually impaired people.[14]

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Gesture Control Robot Car

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Abstract: In recent years, robotics is a demanding technology in the field of science. .To increase the use of robots where conditions are not certain such as security operations, robots can be made such that it will follow the instruction of human operator & execute the task. In this paper we have designed a basic robotic chassis which can be easily controlled with the help of accelerometer instead of using button control. Here the most significant device is accelerometer. This paper describes about the gesture control robot which can be controlled by your normal hand gesture. The accelerometer controls the movement of the car. The accelerometer is the 3 axis estimation gadget with +-3g range. Accelerometers are used to measure the angular displacement of human hand motion. It consists of mainly two parts, one is transmitter part and another is receiver part. The transmitter will transmit the signal according to the position of accelerometer attached on your hand and the receiver will receive the signal and make the robot move in respective direction. Here, the program is designed by using Arduino.

Keywords: Robot, Hand Gesture, RF Transmitter & Receiver, Accelerometer, Arduino, Hand Gestures.

1. INTRODUCTION

Robots are controlled using hand gesture because robots need a helping hand whether it may be any function, without human robots cannot be operated. The main purpose of using hand gestures is that it provides a more schematic way of controlling the robot and with this feature robot can be used as a wheelchair or as a spy robot or for vigilance. As human hand gestures are natural, with the help of wireless communication, it is easier to interact with the robot in a more-friendly way. The robot's movement depends on the gestures made by hand. The objective of this paper is to build a wireless, hand gesture controlled robot using an Arduino Uno, an accelerometer, and a RF transmitter and a RF receiver set. The Arduino Uno microcontroller reads the analog output values i.e., x-axis and y-axis values of the accelerometer and converts that analog value to respective digital value. The values are given a specific function by the use of the Arduino software. The digital values are processed by the Arduino Uno microcontroller and according to the tilt of the accelerometer sensor mounted on the hand, it sends the commands to the RF transmitter which sends the signal to the receiver and there these signals are processed by the receiver end which drives the motor to a particular direction in which we have set it to move. The robot moves forward, backward, right and left when we tilt our palm to forward, backward, right and left respectively and the robot stops when our palm is parallel to the ground. [11]

PROBLEM DEFINITION:

The objective of this paper is to portray the control of the robot using the accelerometer with the help of human hand gestures. Accelerometer signals are received and assisted with wired correspondence. The robot moves depends upon the signal made by your hand and from a separation. In this paper we describe approximately the gesture manage robot which may be managed through your everyday hand gesture Here, the program is designed by using Arduino Ide.

SOFTWARE SPECIFICATION:

Arduino Ide

HARDWARE REQUIREMENTS:

- Arduino UNO
- Accelerometer (ADXL335)
- RF Transmitter and Receiver Modules
- Motor Driver L293D IC
- DC Motors
- 12 Volt Battery
- Robot Chassis
- Wire

2. LITERATURE SURVEY

Ronny mardiyanto, heri suryoatmojo [1] "Development of hand gesture recognition sensor based on accelerator and gyroscope for controlling arm of underwater remotely operated robots". In this paper hand gesture sensor depends on accelerometer and gyroscope. Gyroscope is the sensor which is used to capture the position the operator hand when he is working in underwater operated vehicle and it is attached with a hand. The expert operator may use the joystick for aquatic manage system easily and it is little bit complex for the starting users. This system has two main part, ground station and aquatic remotely operated robot arm.in this paper the hand gesture recognising sensor used by the user and the floor station and he can able to control the arms of robot at the underwater. Here accelerator and gyroscope are fitted in arm joint, arms. The device assess the 3Dimensional spot of every part for making 3Dimensional spot of hand. Here we used the CAD software. This device can be operated without any training. Underwater application can be easily done with this device.

Anala pandit, Dhairya Dand [2] a simple wearable hand gesture device using institute of medical and early modern studies. Interacting with systems is done with the help touch screen, wired or wireless mouse and with the keyboard. In this paper people machine communicating device, most intuitive communicating device, to interact the device and the other appliance. In case of communicating to the machine commands re being implemented use of hand gesture. Here accelerometer used to migrate the touchpad to revolve 3Dimensional object. Accelerometer changed to wireless communication 3Dimensional graphics can be done easily. Effective interaction.

Christian manery [3] "hugging a wobot weird? Investigating the influence of robot appearance on user's perception of hugging". Humanoid robots are able to interact with humans using physical interaction like hugging and handshaking. Here the physical interaction has to be planned carefully as a user-friendly system which interact normally and minimize repulsion. The experiments consists of physical interaction between the participants and the humanoid robot ARMAR – lllb. It gives the best result after testing among the various factor. User-friendly, Easy to work.

Akitoshi harada [4] Robot finger design for myoeletric hand and recognition of finger motion via surface ElectroMyGraphy. In this paper, robots hand layout forcing to the software to a ME prosthetic hand and action of finger operation through ground ElectroMyoGraphy are detailed. The robots consists of index fingers or thumb fingers, is produced to apply basic actions needed in real time, holding or grabbing. A driven is operated to the system to follow the human's mechanism. For controlling each finger of the developed myoelectric prosthetic hand independently, Manpower is reduced in case of lifting objects. High weight can be lifted.

Jianhua Ren, Huichao Wang, [5] "A portable artificial robotic hand controlled by EMG signal using ANN classifier." In this paper, creating a transportable robots for the physically challenged humans to do primary actions. Electromygraphy input and output are gathered Muscle mass of human being arm to get the intensions of actions, where 6 types of Gesture are chose to exchange ideas. An ANN is skilled in steps with the feature took up from the ME signal. The robots hand is made with 7 stage of freedom and hardware with sign acquisition electricity control and microprocessor are designed. Wirelessly connected to the computer. Simple to use. Have no constraint. Efficient and accurate performance.

Vinayak kamanth, Sandeep Bhat [6] "Kinetic sensor based real-time robot path planning using gesture and clap sound." At present many of the indoor works like cleaning object reputation and so on. Are carried out by using the robotic. For the indoors works we must manage the course of a robots the use of gestures and clap sounds. Here superior approach is used for adjusting the clap sound gesture commands from kinetic sensor related to the computer and mobile phone is hooked up via RF hyper link. The hardware is predicted on microcontroller code to keep away from unessential motion of the robots. The clap sound is to actuate the gesture tracking mode to transport the robot and deactivate the gesture monitoring mode after last ceasing the robot.

3. COMPONENTS USED

Arduino Uno:

Arduino Uno It is a microcontroller board based on ATmega328 which has 14 digital I/O and 6 analog pins. It has everything that is needed to support the microcontroller. Simply connect it to the computer with a USB cable to get started with the Arduino Uno board. It is flexible, easy to use hardware and software. Arduino Uno can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators.

Fig 1: Arduino UNO [12]

Accelerometer (ADXL335):

The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. It has 6 pins. 3 pins is for X, Y, Z axis. First pin for power supply (VCC), second pin for ground (GND) and the last one for self- test (ST). It operates on 3.3V from the Arduino Uno board. X and Y axis pins are connected to A0 and A1 pin of Arduino Uno board respectively. It can measure the static acceleration of gravity from tilt sensing applications as well as dynamic acceleration resulting from motion, shock or vibration and gives corresponding analog values through X, Y, Z axis pins. The ADXL335 is available in a small, low profile, 4mm x 4mm x 1.45 mm, 16-lead, plastic lead frame chip scale package.

Fig 2: Accelerometer (ADXL335) [13]

Motor Driver (L293D):

Motor Driver works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to flow in either direction. As voltage need to change its direction for being able to rotate the motor in clockwise or anti-clockwise direction. Therefore H-bridge IC is ideal for driving a DC motor. In a single L293D chip there are two h-Bridge circuit inside the IC which can rotate two dc motor independently. Due to its size it is very much used in robotic application for controlling DC motors.

Fig 3: Motor Driver (L293D) [14]

DC Motor:

DC motor is used for the conversion of direct current into mechanical motion. The mechanical motion could be rotary or linear. The operation of DC motor is based on the principle that when a current carrying conductor is placed in a magnetic field, the conductor experiences a mechanical force. The speed of a DC motor can be controlled by changing the voltage applied to the armature or by changing the field current. DC motors can be used for the movement of the robotic car.

Fig 4: DC Motor [17]

RF Transmitter & Receiver:

The transmitter module is working on the frequency of 433MHz. In the circuit, Vcc pin is connected to the + terminal. The data pin is connected to the Arduino D12 pin that is transmitted data. The next pin is GND that is connected to the ground terminal. Now the last pin ANT this is connected to a small wire as an antenna.

The RF receiver module will receive the data which is transferred by the gesture device. It is also working as similar to the transmitter module- Connect the +Vcc pin to the 5volt terminal. Connect the ground pin to the ground terminal. The data pin is then connected to the Arduino D11 pin.

Fig 5: RF Transmitter [15] Fig 6: RF Receiver [16]

4. DESIGN OF SYSTEM

4.1 Proposed Work

The whole project is divided into two sections one is transmitter section and other is receiver section. The block diagram and the flow chart is shown in figure 7, and figure 8 respectively, and the transmitter section consists of one Arduino Uno, one 3-axis accelerometer and one RF transmitter module. The receiver section consists of one RF receiver module, one motor driver IC, two DC motor, two wheels. Here, two separate 9 volt power supply is applied to both the sections. Finally, the Arduino Uno reads the analog output values i.e., x-axis and y-axis values from the 3 axis accelerometer and converts the analog value to respective digital value. The digital values are processed by the Arduino Uno and send by the RF transmitter. On the receiving end, the information is received wirelessly via RF, demodulated and then passed onto the microcontroller which takes various decisions based on the received information. These decisions are passed to the motor driver IC which triggers the motors in different configurations to make the robot move in a specific direction. The robot moves forward, backward, right and left when there is tilt in the palm of user in forward, backward, right and left respectively.

4.2 Block Diagram

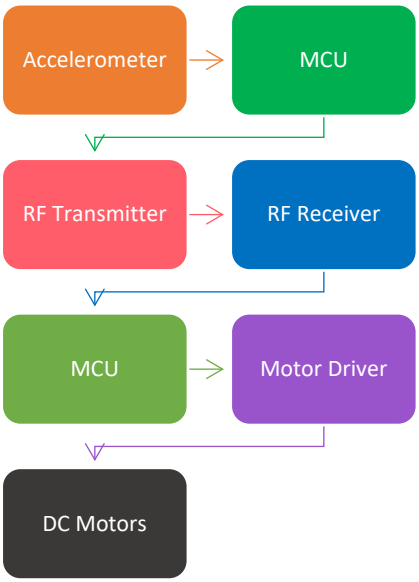

Fig 7: Block Diagram of the Project

4.3 Flow Chart

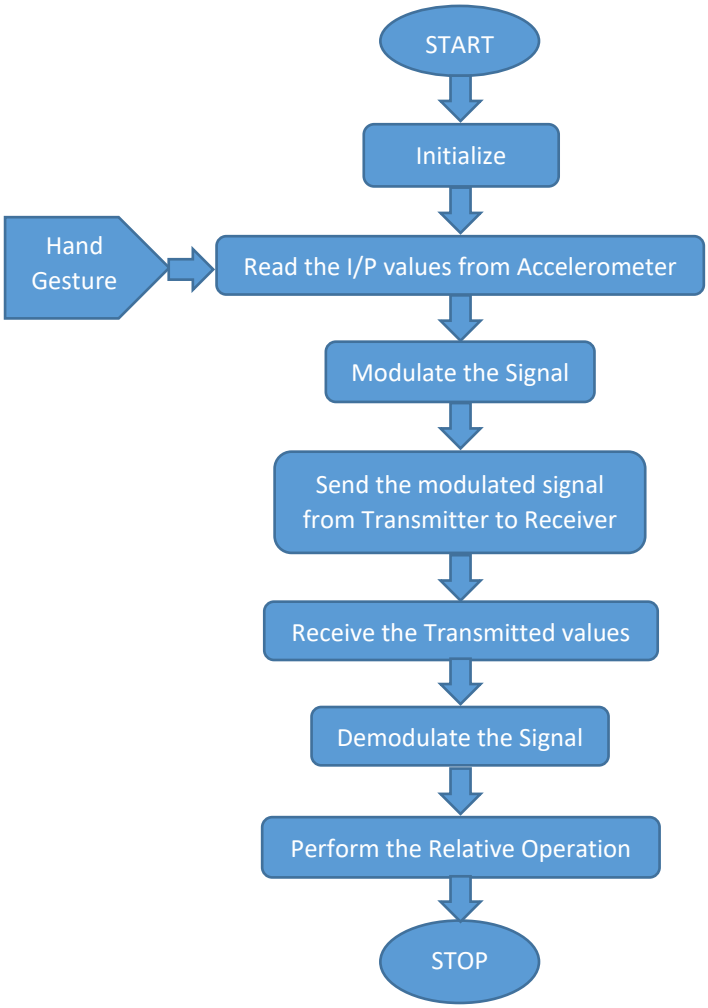

Fig 8: Flow Chart of the project

5. MODULES

The accelerometer is kept on the palm of the user and the robot moves in steps with the palm movement. In this paper we explained about 5 distinctive gestures role of the persons hand i.e. halt condition, front moving, backward moving and turns towards right and left.

STOP CONDITION:

The user holds the accelerometer towards parallel to the ground. At that time the signal from the accelerometer is sent to the Arduino and the robot stop moving. This state is referred here as stop condition.

If the x, y axes satisfies the condition 320<x < 380 & 310<y <390 the robot stops its motion.

FORWARD TILT:

The user holds the accelerometer and the accelerometer tilted towards the front the y axis value is sent to the Arduino.

If the y axes satisfies the condition y>=390 the robot moves forward.

BACKWARD TILT:

The user holds the accelerometer and the accelerometer tilted towards the back the y axis value is sent to the Arduino.

If the y axes satisfies the condition y<=310 the robot moves backward.

LEFT TILT:

The user holds the accelerometer and the accelerometer tilted towards the left the x axis value is sent to the Arduino.

If the x axes satisfies the condition x<=320 the robot rotates towards left.

RIGHT TILT:

The user holds the accelerometer and the accelerometer tilted towards the right the x axis value is sent to the Arduino.

If the x axes satisfies the condition x>=380 the robot rotates towards right.

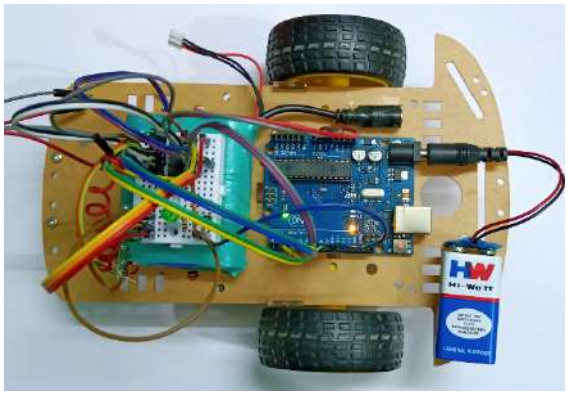

Fig 9: Model of Robot Control Using Human Hand Gesture (Receiver Module)

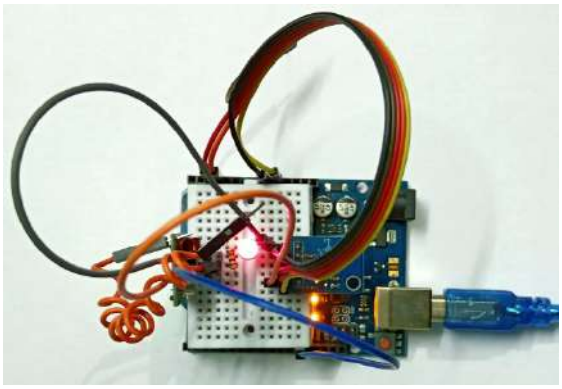

Fig 10: Model of Robot Control Using Human Hand Gesture (Transmitter Module)

6. RESULT AND DISCUSSION

Gesture Controlled Car is a robot which can be controlled by simple human gestures. We can control the car using accelerometer sensors connected to a hand glove. The robot and the Gesture instrument are connected wirelessly through radio waves. Whenever the user tilts his hand glove, the angles will be measured of that direction by an Arduino and command will send to the motor driver to turn ON corresponding motors and the robot car will start moving in the similar to the hand palm direction. Transmission through RF (Radio frequency) is better than IR(infrared) because of many reasons. Signals through RF can travel through larger distances. RF signals can travel even when there is an obstruction between transmitter & receiver. RF communication uses a specific frequency. This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (TX/RX) pair operates at 433MHz an RF transmitter receives serial data and transmits it wirelessly. The transmission occurs at the rate of 1Kbps-10Kbps. The transmitted data is received by an RF receiver operating at the same frequency as of TX.

7. CONCLUSION

In this paper, we introduced a hand-gesture-based interface for navigating a car-robot. A user can control a car-robot directly by using his or her hand motions. The system moves wirelessly in accordance with palm signal. The RF module is operating on the frequency of 433 MHz and consists of a circulate of 40-50 meters. We also want to add more hand gestures (such as the curve and slash) into the interface to control the car in a more natural and effectively way. This robot can be upgraded to detect human life in earthquake and landslide by implementing the sensor accordingly. It can also be upgraded to a bomb detecting robot by attaching a robotic arm that can lift the bomb. GPS system can be added to the robot by the help of which its location can be tracked.

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Nanotechnology in Food Packaging

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***Abstract*—Food is essential for human survival and development. Latest innovations in nanotechnology have converted a number of medical and commercial regions inclusive of the food enterprise. Packages of nanotechnology have emerged with growing need of nanoparticle uses in various fields of meals technology and food microbiology, along with food processing, food packaging, food safety, detection of food borne pathogens, and shelf-existence extension of food and/or food merchandise. The rapid development of nanotechnology has converted many domain names of food technology, especially those that involve the processing, packaging, storage, transportation, capability, and different safety aspects of meals. A extensive variety of nano-structured materials (NSM), from inorganic steel, steel oxides, and their nano-composites to nano-natural materials with bioactive agents, has been implemented to the meals industry. This evaluate summarizes the capability of nanoparticles for their makes use of within the food enterprise as a way to provide consumers a safe and contamination unfastened meals and to make certain the customer acceptability of the meals with more desirable functional residences.**

***Index Terms*—nanoparticles, NSM, nanocomposite material ,shelf existence**

I. Introduction

Food packaging maintains to adapt in response to the development of material technology and generation, in addition to the changing clients' demand. In these days's worldwide economic system, packaging no longer handiest is essential to permit effective distribution and renovation of meals and other customer products, but additionally to facilitate their cease-use comfort and conversation on the customer stages. With these essential capabilities, packaging has end up the 0.33 largest industry inside the international and it represents approximately 2% of gross countrywide product (gnp) in advanced international locations [1,2]. Packaging offers containment and protects food products at some stage in distribution and garage from external and internal unfavorable conditions, such as water vapor, microorganism, gases, odours, and dust. Due to customers' complicated and busy way of life inside the contemporary society, meals manufacturers are striving to increase purposeful packaging systems with superior give up use comfort functions. Nanostructured materials (NSMs) are being implemented inside the food industry as a nanosensor, new packaging cloth, and encapsulated food component. Despite the fact that nanotechnology has implemented inexperienced-synthesized NSMs in numerous approaches in the food quarter, on a few events, using NSMs has been debatable, as NSMs are scientifically uncertain and might impart long-term adverse consequences on human health and the environment .[3-5]

II. Nanotechnology in food packaging and Safety:

Food packaging procedures and practices ensure that the quality of food remains intact and are safe for consumption. Packaging provides physical protection keeping food products safe from external interference, temperature, and microbial infestation by eliminating oxygen and other gases that may lead to food spoilage.[6] Nanotechnology has put into place certain specific areas under packaging that have reduced environmental pollution through employing biodegradable materials for packaging. The introduction of antimicrobial, plastics with high barriers, and measures for detection of contaminants are some areas nanotechnology has considered during packaging. Food treatment and handling to prevent the loss of its characteristics is referred to as food preservation. Freezing, drying, and canning is some of the conventional ways of food preservation.[7,8] However, nanotechnology has come with better and more reliable techniques to help in food preservation such as use of nanosensors[9,10] , nanocomposites [11-13], and nanoparticle in packing [14-16].

A. Nanosensors

Nanosensors help in the detection of any changes in food color as well as any gasses produced due to spoilage. Sensors are usually sensitive towards gases such as hydrogen, hydrogen sulphide, nitrogen oxides, sulphur dioxide and ammonia [17]. In addition, nanosensors have a high sensitivity and selectivity to these changes making them more efficient than the conventional methods of sensor. The gas sensors are made of gold, platinum, and palladium. Aflatoxin B1 toxin that is found in milk can be detected by the gold-based nanoparticles [18-19]. In some cases, the packaging is made of DNA and single walled carbon nanotubes that greatly improves the sensitivity of the sensors. In agriculture, nanosensors help in monitoring the condition of the soil required for the growth of the crop .It can also be used to find pesticides on the surface of vegetables and fruits . Some nanosensors have also been used to identify carcinogens in food materials [20]. Reports suggest that these sensors have also been used for the detection of food- borne pathogens when the nanosensors were embedded with carbon black and polyaniline [21]. Nanosensors can also be installed at the packaging plant itself where they can

detect the microorganisms that usually infest the food. In this way the packaged food product does not need to be sent to the lab for sampling. These sensors alert the consumers regarding the quality of the food product with the help of colour changes. The commonly used sensors that are used in the food packaging industries are time-temperature integrator and gas detector. Several different types of nanosensors are used for example,array biosensors,nanoparticle in solution, nanoparticle based sensors, electronic noses.[22] Electronic noses are a type of sensor that uses several chemical sensors which is attached to a data processing system [23,24]. Since the sensor behaves like a human nose, the sensor is known as electronic nose. Along with the electronic nose, there are reports of electronic tongue sensors that work on a similar principle as that of an lectronic nose. It changes colour on coming in contact with any sign of spoilage in the food material thus declaring that the food is not fit for consumption [25]. For the electrochemical determination of the adulterants in food and beverages such as food dyes, for example, sunset yellow and tartrazine, carbon ceramic electrode is customized with multiwalled carbon nanotubes ionic nanocomposites [26]. Biosensors are also an emerging technology which is being applied successfully. Along with the nano-gas sensors.

B. Nanocomposites

A combination of nanoparticles with polymers makes the nanocomposites. Nanocomposites reinforce the polymers in the combination thus enhancing the property. The high versatility of the chemical functionality of nanocomposites makes them suitable for the development of high barrier properties. Nanocomposites aid in maintaining the food products fresh for some amount of time irrespective of the bacterial infestation of the food product. They minimize carbon dioxide leakages from carbonated beverages bottles by acting as gas barriers.[27] It thus increases the shelf life of the product. Manufacturing industries could use nanocomposites in place of cans and glass bottles to layer their bottles and save on cost in the process. Enzyme immobilization, a type of nanocomposite is widely used due to its faster rates of transfer and its large surface area. The enzymes are incorporated into the nano-clays and used for packaging [17,20]. Reports suggest that these sensors have also been used for the detection of food-borne pathogens when the nanosensors were embedded with carbon black and polyaniline [24]. Nanosensors can also be installed at the packaging plant itself where they can detect the microorganisms that usually infest the food. In this way the packaged food product does not need to be sent to the lab for sampling. These sensors alert the consumers regarding the quality of the food product with the help of colour changes. The commonly used sensors that are used in the food packaging industries are time-temperature integrator and gas detector.

C. Nanoparticles

One of the important advantages of nanoparticles in food processing is upgrading food stability, color, and property of flow. Previously, nanoparticles were used for drug delivery; now they are used in similar fashion in the food industry. Their effectiveness depends on their bioavailability. Silicate and other nanoparticles are used to limit oxygen flow in packaging containers [22]; moisture leakage is also checked and reduced hence the food remains fresh for a longer duration. Certain nanoparticles exist that selectively bind to pathogens thus removing them altogether in the process.

At nanoscale, nanoparticles serve several purposes in the processing of food. They help in improving the food's flow property, colour, and stability. The effectiveness of the nanoparticles in the food depends on its bioavailability in a system [27]. Previously, nanoparticles were used as delivery systems for drugs and now they find their use in food industry in a similar fashion. In the form of plastic films, nanoparticles, such as silicate nanoparticles, zinc oxide, and titanium oxide, are used to reduce the flow of oxygen inside the packaging containers [27]. They also help in reducing the leakage of moisture, keeping the food fresh for a longer time [27]. There are nanoparticles that aid in selective binding and hence lead to the removal of the pathogens or chemicals from food [11]. Silicon dioxide and titanium dioxide are the two most commonly used nanoparticles in food packaging. Silicon dioxide finds its use as an anticaking and a drying agent [15]. It helps in absorbing the water molecules in food, thus displaying hygroscopic application. Titanium dioxide is another nanoparticle which acts as a food colourant [13]. It is known as a photocatalytic disinfecting agent. Titanium dioxide is used as food whitener for food products such as milk, cheese, and other dairy products [5]. It finds its use as a barrier in food packaging for UV protection. Silver nanoparticles act as antibacterials and hence protect the food from microbial infestation [27]. Silver nanoparticles prove to be effective as antimicrobials as they have a broader spectrum of activity unlike other conventional metallic nanoparticles that act as antimicrobials [27].

III. SHORTCOMINGS OF EXISTING PACKAGING SYSTEMS

Non-sustainable production, lack of recyclability, insufficient mechanical and barrier properties are some of the ongoing challenges faced by the food and packaging industries. Although metal and glass are good barrier materials to prevent unwanted mass transport in food packaging, plastics are still popular due to their light weight, formability, cost effectiveness and versatile characteristics. As a result, packaging industry consumes more than 40% of the plastics with half of it for food packaging [28]. However, the majority of packaging materials are petroleum-based and not sustainable from a feedstock supply standpoint. Moreover, petroleum-based plastics are not biodegradable. Considering that approximately 30% of municipal solid waste in North America are derived from packaging [28], the large amount of solid wastes created has presented a pressing environmental issue. Weak barrier properties to water vapor and gases are other critical issues in food packaging. For example, fresh products that are alive (e.g., vegetables, fruits, meats) need to be packaged in O2 permeable materials with an optimal transmission rate,

whereas processed products do not require such mass transfer. Another challenge faced by many food producers is to achieve an adequate shelf-life for their products while maintaining the optimal quality and safety of the products. This is more so for producers in under-developed countries where efficient food distribution and preservation infrastructures are lacking.Over the past decade, intensive research and development activities in the academia and industry have been focused on exploiting nanotechnology to address many of the above mentioned challengers. Advancements in three areas, namely nanocomposite, active packaging, and intelligent packaging, are presented in the following sections[22].

IV. FUTURE PROSPECTS AND POTENTIAL RISKS

Recent century has observed exponential growth in the nanotechnology-food industry, in order to provide better services to the consumer. It helps in the detection of pesticides [14], pathogens [15], and toxins [16], and tracking-tracing monitoring helps in the maintenance of food quality.[29]

Chaudhary and collaborators highlighted the potential risks involved, when interaction between nanoparticles and biological parts take place. Maisanaba and collaborators Proposed the various risks involved, when humans inhale nano particles. These particles interact with tissues and cells and cause hazard to human health.[28,31] Once they enter, the human body, they interact with lipids, proteins and sugars and block their various bio-processes. Risks associated with nanoparticles have been constantly increasing(reference), and care needs to be taken. Shi and collaborators have shown that bioaccumulation due to food has taken place in humans and animals.

Knowing the risks involved we need to develop a sustainable system where least hazards are present.

V. CONCLUSION

Nanotechnology has brought forth a revolutionary effect on the food processing and preservation industry. There are definite advantages of the technology but the drawbacks are equally prominent. Several food industry giants are paying in millions to develop nanosystems that will help preserve the food better. Care should be taken while designing newer nanosystems so that they are both environment friendly and they do not have any toxic effect on the food. Thorough testing needs to be carried out in health claims of the products that are being launched. Rather than having a chemical approach towards designing the nanosystems, research should be carried out in trying to discover natural nano-systems for the delivery of drug or health supplements through food. Ecofriendly nanoparticles need to be designed which both can serve as antibacterial and also cannot cause harm to the environment. They need to be carefully followed so that the consumers do not get affected. The biggest drawback in the usage of the nanosystems in the food is that, they are still under study and have not been characterized thoroughly; therefore the extent of damage that they can actually cause to the biological systems is yet to be identified. Lastly, for the successful implementation of nanotechnologies at gigantic scale, consumer's approval is mandatory. Both benefits and risks assessment should be acknowledged undoubtedly. Accredited research bodies should come forward with appropriate labeling and set down common regulations that boost the consumer acceptability.

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Design and analysis of Voltage Converter for medium power applications.

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Abstract: In this work, analysis is conducted on voltage converter for medium power applications. Power electronics-based Buck-Boost converter is analysed which is capable of stepping up and stepping down the voltage. State space averaging and small signal analysis is done for this type of converter. Ratings of the components used in the converter circuit is also evaluated. State feedback-based controller is designed to improve the starting transient response of the converter. Circuit and controller designing is validated through MATLAB simulation.

Keywords: Buck-Boost Converter, State space averaging, Small signal analysis, Pole Placement, MATLAB

I. INTRODUCTION

DC to DC voltage converter circuit is widely used in telecommunications, electric vehicle, avionics and space applications [1]. These applications require variable DC voltage from a fixed voltage DC source. There are many voltage converter circuits reported in literature such as buck, boost, buck-boost, Zeta, SEPIC etc [2,3]. Among all these converters, buck-boost converter has a very simple topology which is capable of stepping up and stepping down the DC voltage. Buck-Boost converter is analysed in this work. Circuit diagram of Buck-Boost Converter is shown in figure 1.

State space modelling is a very powerful way of analysing and designing any system. State space model is used to design the controller for a system. Even the steady state and transient analysis can be easily done through this type of modelling. Application of State space averaging and small signal analysis to the power converters are found in the literature [4,5,6]. State feedback-based controllers are very effective in improving the transient response of the system. Pole placement technique is an example of state feedback-based controller designing [7,8].

In this work, state space mathematical equations are derived for Buck-Boost Converter. State space average modelling and small signal analysis are also done for the converter. Inductor and capacitor are the energy storing elements used in the converter. Their inductance and capacitance are evaluated based on ripple content in inductor current and capacitor voltage respectively. Electronics devices such as power MOSFET and Power Diode are the vital components of the converter. Their rating such as voltage stress and average current are also calculated in this work. Close loop control system based on pole placement technique is also developed for the Buck-Boost converter. Designed parameters obtained through above analysis and design are validated through MATLAB simulation.

This research article is divided into five section. Research background is established in the opening section. State space-based analysis of Buck-Boost converter is done in section II.

Designing procedure of the converter system is illustrated in section III. Simulation results are presented in section IV. Finally, the article is concluded in the last section.

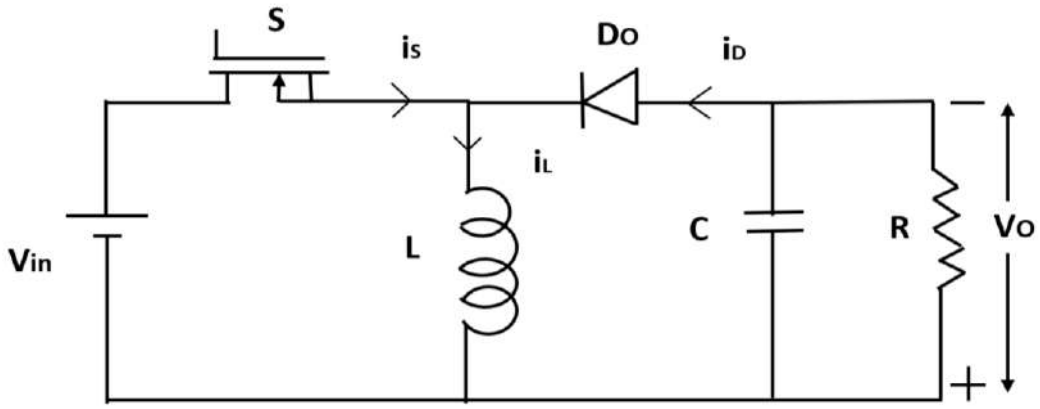

Fig. 1: Circuit Diagram of Buck-Boost Converter

II. STATE SPACE ANALYSIS

Voltage conversion is achieved by switching on and off the MOSFET switch. When switch, S is turned on, the inductor, L gets charged through input voltage source, V_{in}. When switch S is opened, the energy of inductor is released into the output port. State space equations for the Buck-Boost converter is derived from the fundamental Kirchhoff's law. Inductor current, i_L and capacitor (C) voltage, V_O are chosen as state variables. State equations under different switching conditions are presented in equation (1) and (2). R is the load resistor.

$$\frac{di_L}{dt} = \frac{V_{in}}{L} \qquad (1)$$

$$\frac{dV_O}{dt} = \frac{-V_O}{RC} \qquad \text{(When S is ON)}$$

$$\frac{di_L}{dt} = \frac{V_O}{L} \qquad (2)$$

$$\frac{dV_O}{dt} = \frac{i_L}{C} - \frac{V_O}{RC} \qquad \text{(When S is OFF)}$$

Equations (1) and (2) can be written in the state space model as (3). X is a state vector consisting of i_L and V_O. U is the input to the system. Here in this case, U is equal to V_{in}. A is system matrix and B is input matrix. State space averaging technique is applied to the converter to obtain the overall system matrix, A_O and input matrix, B_O. A_O and B_O are given by equation (4). A_1 and B_1 are the system and the input matrices respectively when switch S is ON. Similar matrices are given as A_2 and B_2 when switch S is OFF.

$$\dot{X} = AX + BU \qquad (3)$$

$$A_O = \frac{1}{T}[A_1 T_{ON} + A_2(T - T_{ON})] \qquad (4)$$

$$B_O = \frac{1}{T}[B_1 T_{ON} + B_2(T - T_{ON})]$$

In matrix form, the A_O and B_O are given by equation (5). T_{ON} is the ON time of switch, S. T is the switching time of one complete cycle. D is the duty cycle. D is represented as the ratio of

T_{ON} and T. Small signal analysis model is developed from state space average model. In small signal analysis, each state variable is composed of steady state DC value (represented as bar over top of state variable) and varying AC value (represented as cap over top of state variable). For small signal analysis, value of variables given by (6) are substituted in the state space average model. Small signal equations for Buck-Boost converter are given by (7).

$$A_O = \begin{bmatrix} 0 & \frac{(1-D)}{L} \\ \frac{(1-D)}{C} & \frac{-1}{RC} \end{bmatrix}; B_O = \begin{bmatrix} \frac{D}{L} \\ 0 \end{bmatrix} \quad (5)$$

$$i_L = \overline{i_L} + \hat{\imath}_L; V_O = \overline{V_O} + \hat{V}_O; \quad (6)$$

$$V_{in} = \overline{V_{in}} + \hat{V}_{in}; D = \overline{D} + \hat{D}$$

$$\dot{\hat{\imath}_L} = \left(\frac{1-\overline{D}}{L}\right)\hat{V}_O - \frac{\overline{V_O}}{L}\hat{D} + \frac{\overline{V_{in}}}{L}\hat{D} + \frac{\overline{D}}{L}\hat{V}_{in} \quad (7)$$

$$\dot{\hat{V}_O} = \left(\frac{1-\overline{D}}{C}\right)\hat{\imath}_L - \frac{1}{RC}\hat{V}_O - \frac{\overline{i_L}}{C}\hat{D}$$

III. DESIGN PROCEDURE

A. Inductor Designing

Inductor is designed based on permissible level of ripple content in inductor current. Inductance is given by (8). ΔI_L is the ripple content in inductor current and f is the switching frequency. Average value of inductor current can be obtained from state space averaging model by making the dX/dt term to zero. Average or steady state inductor current is given by equation (9)

$$L = \frac{V_{in}D}{\Delta I_L f} \quad (8)$$

$$\overline{i_L} = \frac{DV_{in}}{(1-D)^2 R} \quad (9)$$

B. Capacitor Designing

Value of capacitance is given by (10). Its value is chosen based on permissible level of voltage ripple content, ΔV_o in output voltage. Steady state output or capacitor voltage is given by equation (11). Negative sign in (11) indicates that the output is of inverting nature.

$$C = \frac{V_O D}{R(\Delta V_O) f} \quad (10)$$

$$\overline{V_O} = \frac{-DV_{in}}{(1-D)} \quad (11)$$

C. Rating of MOSFET switch

MOSFET switch conducts for only $0<t<T_{ON}$ period of time in each switching cycle. Instantaneous switch current, i_S is given by (12). Values of currents I_1 and I_2 used in (12) can be computed from the relation given in (13). Average value of switch current can be calculated from (14). Maximum voltage stress appearing across switch is equal to (V_{in} + V_o).

$$i_S = \begin{cases} \frac{(I_2 - I_1)}{T_{ON}} t + I_1 \\ 0 \; ; \; T_{ON} < t < T \end{cases} ; \; 0 < t < T_{ON} \quad (12)$$

$$I_2 - I_1 = \frac{V_{in} D}{Lf} \quad (13)$$

$$\overline{i_L} = \frac{I_2 + I_1}{2}$$

$$i_{S\_avg} = \frac{1}{T}\left(\int_O^T i_S \, dt\right) \quad (14)$$

D. Rating of Diode

Instantaneous diode, i_D current is given by (15). Average value of diode current can be calculated by equation number (16). Maximum voltage stress across diode in equal to (V_{in} + V_o). From average current and voltage stress, the rating of any electronic component can be easily evaluated.

$$i_D = \begin{cases} \frac{(I_1 - I_2)}{T - T_{ON}} (t - T_{ON}) + I_2 \; ; \; T_{ON} < t < T \\ 0 \; ; \; 0 < t < T_{ON} \end{cases} \quad (15)$$

$$i_{D\_avg} = \frac{1}{T}\left(\int_O^T i_D \, dt\right) \quad (16)$$

E. Controller Design

To improve the starting transient response, state feedback controller is designed. Pole placement technique is applied to place the eigen value of the system according to the desired location in left half of s-plane. Duty cycle, D is varied to control the output of the converter. Small signal model of the converter can be obtained from equation (7) and can be represented by (17). In small signal model, $\hat{V}_{in}$ is set to zero and $\hat{D}$ is given by (18). Control matrix, K is chosen in such a way so as to place the eigen value of (A_{11}-B_{11}K) according to desired location in left half of s-plane. Actual duty cycle will be sum of $\overline{D}$ and $\hat{D}$. $\overline{D}$ can be computed from equation (11) according to the target value of V_o.

$$\dot{\hat{X}} = A_{11}\hat{X} + B_{11}\hat{u} \quad (17)$$

$$\hat{X} = \begin{bmatrix} \hat{\imath}_L \\ \hat{V}_O \end{bmatrix}; \; \hat{u} = \begin{bmatrix} \hat{D} \\ \hat{V}_{in} \end{bmatrix}$$

$$\hat{D} = -K\hat{u} \quad (18)$$

IV. SIMULATION RESULTS

Designed converter is tested by conducting MATLAB simulation. Buck-Boost converter is simulated to boost the output voltage to 36V. Converter is energised through 24V DC voltage source. A 100W, 36V resistive load is connected at the output of the converter. Inductance is chosen equal to 20.6mH so as to limit the ripple content to 1% of steady state inductor current. From (9), the steady state value of inductor current is found to be 6.94A. Capacitance is selected to be 462.96 micro-Farad. Ripple content in output current is limited to 0.36V. The

open loop response is given in figure 2. Output voltage (V_o), inductor current (i_L), switch current (i_S) and diode current (i_D) are illustrated in figure 2.

It can be noticed in from figure 2, that start up of circuit operation contains transient response. Overshoot in inductor current and output voltage can be easily noticed. Pole placement technique is simulated to improve the start up transient response. Inductor current and output voltage are used in state feedback loop. Control gain matrix, K is evaluated from small signal model of the converter and is found to be K= [3.8951 0.0041]. Close loop poles are located at s=-1000 and s=-1500. Close loop response is given in figure 3. It can be easily seen from figure that overshoot in transient response is substantially reduced to zero and faster settling is achieved.

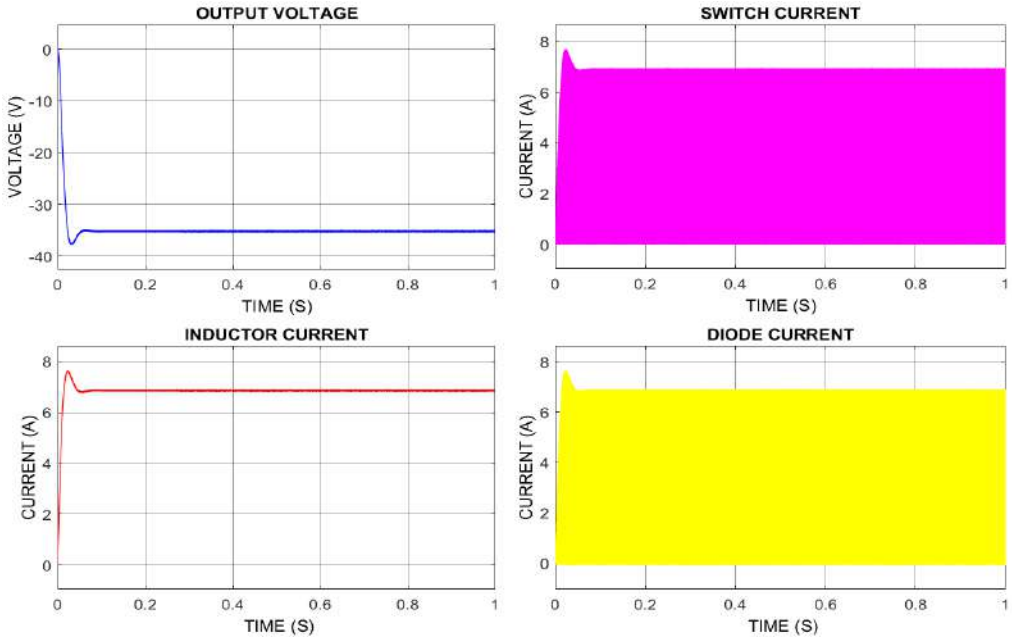

Fig 2: Open loop response of Buck-Boost Converter

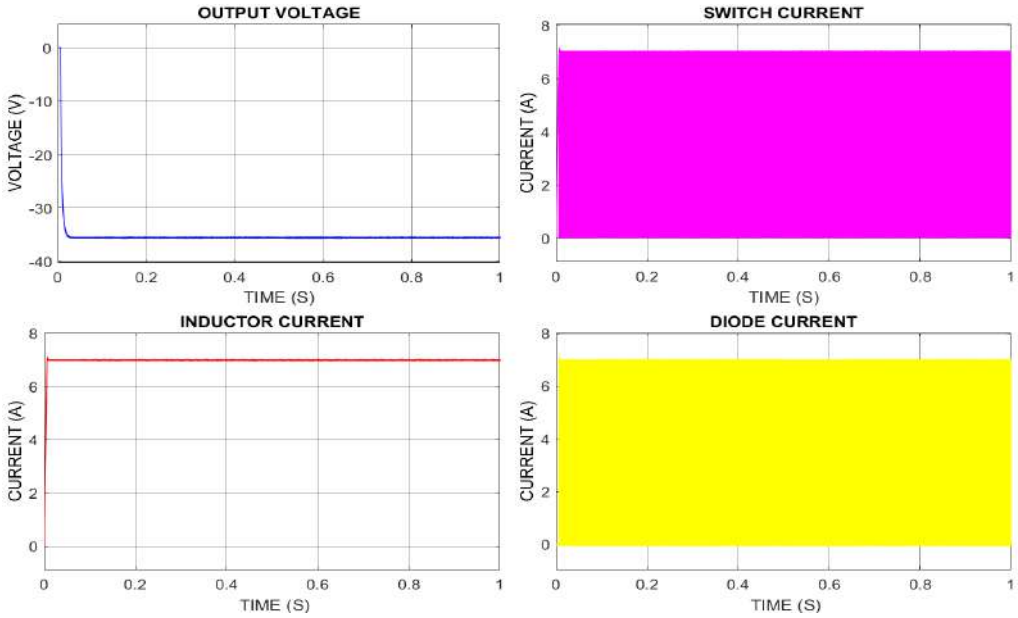

Fig 3: Closed loop response of Buck-Boost Converter

V. CONCLUSION

State space modelling is done for Buck-Boost converter. State space averaging and small signal analysis is performed for the converter. Design procedure is also illustrated. Inductor and capacitor are designed on the basis of permissible ripple contents. Rating of semiconductor devices is calculated. Pole placement-based state feedback control system is designed to improve the starting transient response of the converter. Faster settling and reduced overshoot in transient response is achieved through designed state feedback control system. MATLAB simulations are conducted to validate the design procedure for the converter.

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Periodic-SIW Leaky wave Broadside Antenna

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***Abstract*—In this paper we are going to demonstrate a Substrate Integrated Waveguide (SIW) Periodic Leaky wave Broadside antenna which transmit and receive signals at an angle of 360° or 0° narrow beam major lobes. The required characteristics of radiation pattern is obtained from the periodic and alternating pattern of unit cells consist of transverse slot pair (TSP) and linear slot (SL) through which the EM wave is leaking out. The result analysis after simulation of the unit cell shows that that the radiation pattern in which the major lobe is obtained at 360° or 0° about the axis of antenna which depicts the property of Broadside antenna. The feeding technique used is "tapered Feeding" in which the matching is much improved as in other reported work. The matching for 50Ω load impedance is obtained after simulation at 38Ω. The size of the antenna is 60x10.6x1.6 mm^3. The simulated results shows that the antenna is best suited for the applications of narrow beam patterns at the operating frequency of 12 GHz.**

Keywords— Substrate Integrated Waveguide (SIW), Leaky wave, Broadside antenna, Tapered feeding.

I. INTRODUCTION

The Broadside antenna with Substrate Integrated Waveguide (SIW) is the best technique which has many advantages over other wave guides. SIW is best suited for loss-less transmission of signal from one end to the other end of the antenna. Due to via holes in SIW that makes Electromagnetic Wave (EM Wave) to remains inside the waveguide because the via holes are rarer medium than the waveguide's medium, hence the EM wave deviates from rarer to denser medium due to which the EM wave remains inside the waveguide so that no leakage will takes place from corners.

It consist of a transverse slot pair (TSP) and one linear slot (SL) that repeats periodically in alternate fashion along the length of SIW through which the EM wave is leaked out and radiates at 360° or 0° about the axis that makes it Broadside antenna.

Leaky Wave Antenna (LWA) which is designed using SIW technique has attains various parameters like loss-less, easy fabrication, etc. which makes it best suited for antenna designing. LWA with periodic structure is able to radiate EM power with high order space harmonics [1].

This type of antenna analysed by [1] having gain around 11 dB at 12GHz frequency and having S_{11} is about -15 dB whereas the gain in [2] is improved, our simulated result for gain at 12.75 GHz frequency is 21.3 dB and efficiency is about 58.2% at operating frequency of 12.8 GHz.

II. DESIGNING OF ANTENNA.

Geometry of the periodic SIW leaky-wave broadside antenna. The SIW (substrate) is made up of FR4_epoxy material having ε_r = 4.4, length= 60 mm, breadth= 10.6 mm and thickness=1.6mm.It is covered by ground plane and patch made up of sheet. A transverse slot pair (TSP) and a longitudinal slot (LS) are etched on the patch. In this arrangement, one TSP and one LS are used to make one unit cell. This unit cell is etched till top of the substrate while the cylinders on the both side of unit cell are pierced through the structure which allows signal to pass complete through the structure.

The antenna consists of a patch, a substrate and a ground plane. The substrate is sandwiched between patch and ground plane. The vias holes are etched from substrate, path and ground plane along the x-axis on both the corner side of the antenna. Hence make it SIW. The vias holes are cylindrical in shape with radius= 0.5 mm and height= 1.6 mm. These holes contains air (having ε_o=1) which is less denser than the substrate material (FR4_epoxy [ε_r = 4.4]).

The patch consist of transverse slot pair (TSP) and linear slot (LS) which are etched from substrate. The patch is made up of conducting material having length= 40 mm and breadth= 10.6 mm. Whereas the bottom part ground plane is also make up of conducting material with length and breadth is same as the antenna have.

The unit cell consist of two transvers slot pair (TSP) having length= 4.2 mm and breadth= 0.4 mm. The distance between the TSPs is 4.5 mm. there are total 4 TSP on the patch of antenna. Linear slot (LS) having length 7.5 mm and breadth 0.4 mm each cell contains two LS which are etched from the patch responsible for transmitting the EM wave.

The feeding technique used is "Tapered Feeding" in which the port matching can be obtained with a great extent. In this antenna the matching for 50Ω input load is obtained at 38 Ω after simulation. The width of the microstrip line is calculated as 3.058 mm by using below equations.

$$If\ \left(\frac{W}{H}\right) < 1:$$

$$\varepsilon_{eff} = \frac{\varepsilon_R+1}{2} + \frac{\varepsilon_R-1}{2}\left[\frac{1}{\sqrt{1+12\left(\frac{H}{W}\right)}} + 0.04\left(1-\left(\frac{W}{H}\right)\right)^2\right]$$

$$Z_o = \frac{60}{\sqrt{\varepsilon_{eff}}} \ln\left(8\left(\frac{H}{W}\right) + 0.25\left(\frac{W}{H}\right)\right)$$

$$If\ \left(\frac{W}{H}\right) > 1:$$

$$\varepsilon_{eff} = \frac{\varepsilon_R + 1}{2} + \left[\frac{\varepsilon_R - 1}{2\sqrt{1 + 12\left(\frac{H}{W}\right)}}\right]$$

$$Z_o = \frac{120\pi}{\sqrt{\varepsilon_{eff}}\left[\frac{W}{H} + 1.393 + \frac{2}{3}\ln\left(\frac{W}{H} + 1.444\right)\right]}$$

The input impedance calculated (Z_o)= 5.13 kΩ. which is to be matched with 50 Ω load impedance at the operating frequency (f_o)= 12GHz. The reflection coefficient (S11) of the antenna is obtained after simulation at -16.4 dB with impedance matching (Z11) 38 Ω.

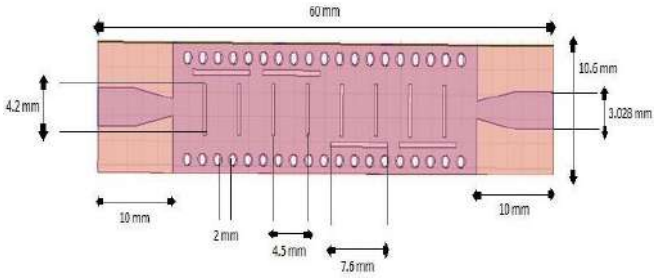

Fig. 1 : Block daigram of antenna

III. Result and Discussion

The simulated results for various parameters of the antenna are obtained and explained below:

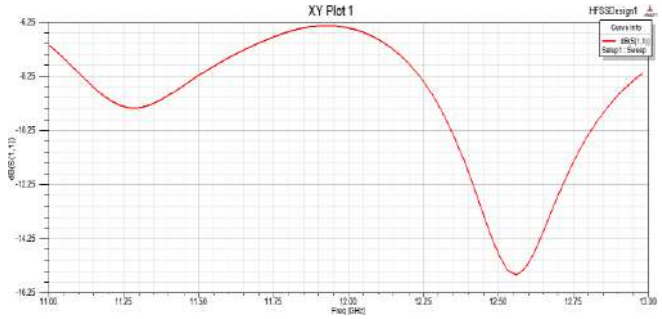

Fig.2: Reflection Coefficient (S11) graph

Fig. 2 shows the value of reflection coefficient i.e. S_{11} is -15.75dB at operating frequency (12.5Ghz) which is less than -10dB which indicates that the designed antenna is properly matched to the transmitter or receiver.

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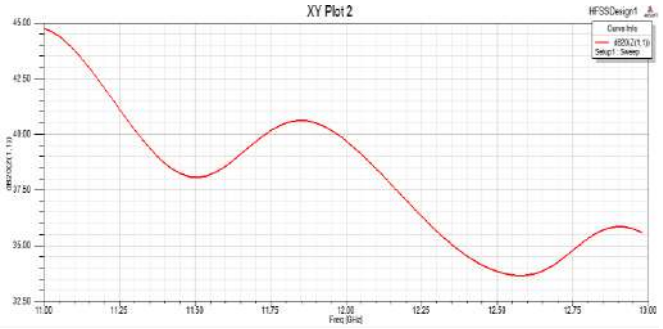

Fig. 3: Impedance matching (Z11) graph

Fig. 3 shows the value of Z-parameter i.e. Z_{11} is 38 ohms at operating frequency which also indicates the matching of designed antenna and for proper matching the Z_{11} should be 50 ohms.

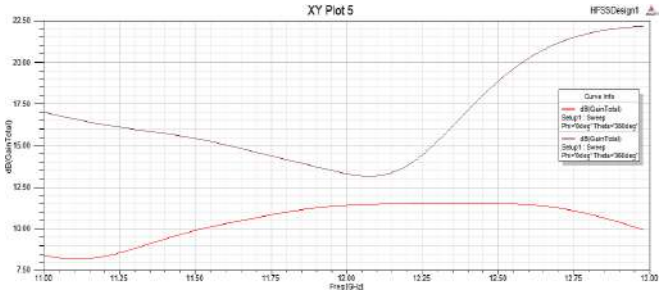

Fig. 4: Gain vs frequency plot

Fig. 4 shows the gain of designed antenna is around 21.8 dB at operating frequency which is indicates the ratio of output parameter to the input parameter. The graph is plotted for different value of theta i.e. at 360° and 350°.

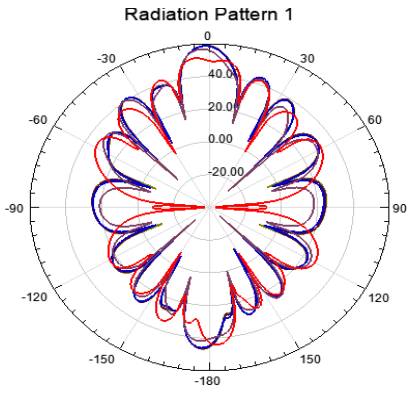

Fig. 5: Radiation Pattern of antenna

Fig. 5 shows the radiation pattern obtained is directional radiation pattern which indicates that the signal is radiated in a particular direction and maximum radiation is occurring along the axis of antenna. The major lobe of maximum radiation is obtained at theta 360°.

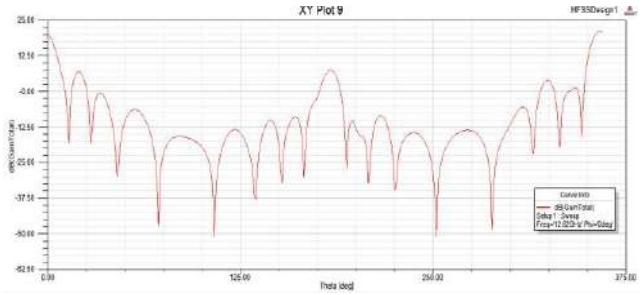

Fig. 6: Gain vs Theta graph

Fig. 6 shows that gain obtained at different values of theta, here the maximum gain obtained at theta 360° and 0° at the operating frequency of 12 GHz.

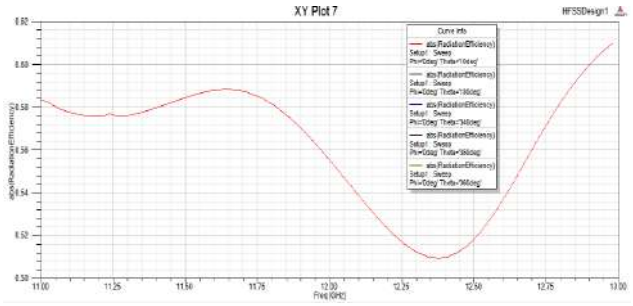

Fig. 7: Radiation Frequency of antenna

Fig. 7 shows the efficiency of designed antenna is nearly 58.2% at operating frequency of 12.8 GHz at the value of theta360°.

IV. Conclusion

We had designed and simulated structure of Periodic SIW Leaky wave Broadside antenna having unit cells each consist of two TSPs and two LSs. The design is use full for narrow beam application with operating frequency at 12 GHz. The operating bandwidth of the antenna is obtained under the range of 12 GHz - 12.8 GHz. The S11 graph is obtained at -16.2 dB and the Z11 is obtained at 38 Ω. The radiation pattern obtained for major lobe is at 360° or 0° about the axis which makes it a broadside antenna. The radiation efficiency is simulated as 58.2 %.

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Design of a Smart Hand Sanitizer Dispenser with Door Controller Using ESP8266

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***Abstract*— In this COVID-19 pandemic period which is a global outbreak, hand hygiene is the core preventive measure in the spread of the disease as advised by WHO (World Health Organization) which includes washing hands with water and soap regularly, hand sanitizing using hand sanitizers, etc. Hygiene refers to the practices conducive to maintaining health and preventing disease especially through cleanliness such as washing hands, coughing in the elbow etc. Its also helps to prevent any diseases that spread through contacts. In order to eliminate most of the germs on the hands, we need to apply a good hand washing practice. In most healthcare places, alcohol-based hand sanitizers are preferable to hand washing with soap and water because it can be easily tolerated and it is also more effective at reducing bacteria. Hand sanitizer is a liquid, gel, or foam generally used to decrease infectious agents on the hands.**

Keywords: **Hygiene, Hand sanitizer, Microcontroller, Cheap product, Servo motor, Body Temperature Sensor**.

1.0 Introduction

Hands are considered to be the primary mode of infectious diseases, especially for those living in close proximity such as college residence halls, shopping malls, bank halls, market areas etc. Because of the frequent contact with hands and multiple surfaces, the incidence of cross-contamination is significantly increased. Hand hygiene is a major requirement for human health and many infectious diseases can be emerged if proper hand hygiene procedures are not implemented. Hand washing is the simplest, important and cost effective way to improve hand hygiene in health care and support the prevention of infectious disease. Over recent years, there has been increasing availability and usage of hand sanitizing products. The main advantage of these products seems to be that they are more trusted, quicker and easier to use. In this research paper, we will design and implement a smart hand sanitizer dispenser.

1.1 Objectives

The main objective of this research paper is to design and implement a low cost touch free smart hand sanitizer dispenser with infrared thermal body temperature sensor that includes features such as Radio Frequency identification Tag, buzzer, LED and servo motor, based on Microcontroller. Sanitizing Proper hands and not touch everywhere is a must to prevent COVID-19. However, pressing the bottle nozzle, Open the door of offices, shops, and factories is unhygienic. Let's avoid and go touch less with Smart Sanitizer that will ensure that you maintain proper hygiene and health in public spaces and offices area.

1.2 Hardware Description

This system consists of two parts, Hardware and Software.

The Hardware parts include:

- Ardiuno Nano
- RC0522 (RFID Module)
- Servo motor
- LED & Buzzer
- Water Pump
- 2L2222 NPN Transistor
- 1K Resistor
- MLX90614 (Infra-Red Thermometer)

Software parts include:

- Arduino IDE

1.3 Working

In this research paper, the smart hand sanitizer is stationed at the entrance door and it is connected to the door in such a way that it controls it. That is to say, when a person wants to access the entrance door, they must first sanitizer their hands. With smart hand sanitizer dispenser, if you are employee first put your RFID tag near RFID scanner at the time of scanning parallel it's also check body temperature after that put hand under smart sanitizer then the sanitizer

outlet dropping some amount into your hands, If temperature is normal it commands to the micro-controller to turn on green led and allow a person to enter and in the other case if temperature is high so it will commands to the micro-controller to turn on red led ,then buzzer beeping for alert. All RFID tag names shown on display and temperature also.

1.4 Block Diagram:

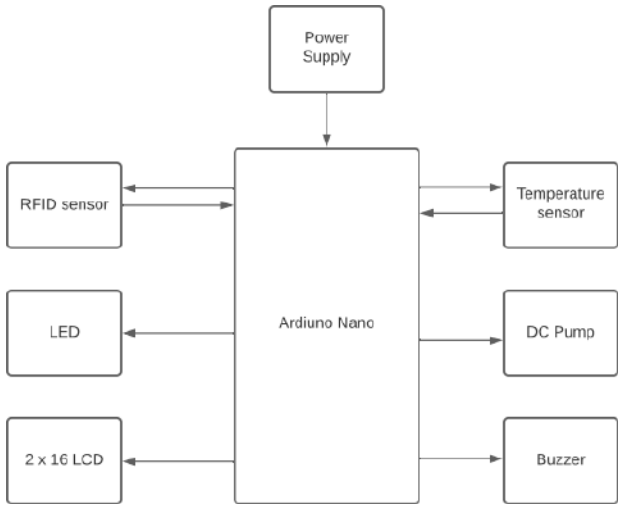

Figure2: Block diagram of smart hand senitizer

Flow chart:

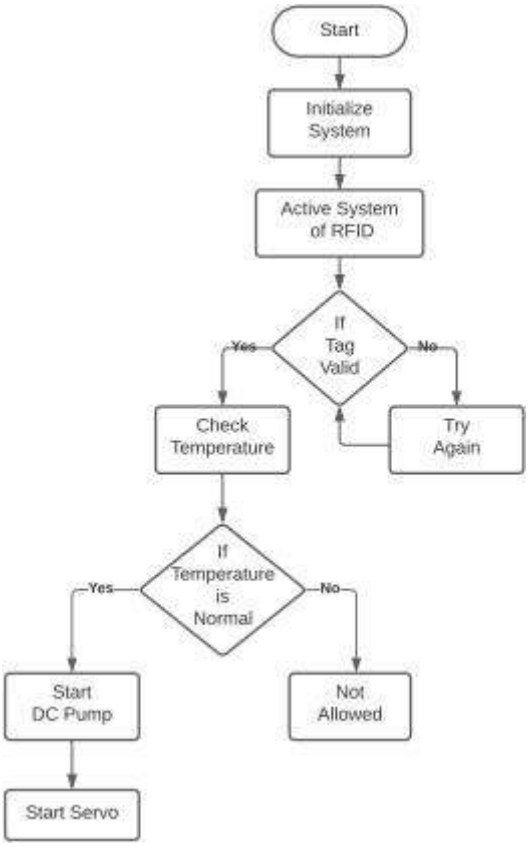

Figure3: Flow chart of smart hand senitizer

Status to showcase:

- Sanitizing hands is a must to prevent COVID-19. For factories, offices, hospitals, shops are increasing concerns regarding health safety and precautionary measures for wellness. This factor is expected to drive the market growth.
- Transformation of lifestyle of individuals resulting in increased healthcare expenditure and better health measures; this factor is expected to drive the growth of the market.
- Cost-effective and Employee attendance with health record track features even with purifying capabilities associated with this product is expected to drive the market growth To facilitate smooth usage, one can adjust the volume of the spray mist/sanitizer that will be dispenses. Also, its Zero Drop design minimizes leakage and ensures high precision for disinfecting hands. It sprays the right amount of sanitizer and also becomes ready for the next person quickly within seconds. Smart Sanitizer lowers the overall cost of using sanitizer in a premise.
- It results in lower pilferage and optimized consumption. Sanitizer can be purchased in bulk and environmental wastage of disposable sanitizer bottles can also be reduced.

Future scope:

- At this time we target Offices, Factories, Companies employees but in the upcoming version we add the functionality for a Visitor of any Shops, hotels, Banks, hospitals etc. so this machine will work for both employee of organization and Visitor also.
- Also add employee dashboard when the employee also Monitor their data.

Conclusion

The system surely helps in implementing the hand hygiene without any challenges as it is a must to sanitizer if you are to access any entry point. It is much safer and more recommended due to its touch less property which zeros down any chances for cross contamination. This is a user friendly system that anyone can make use of. It can be concluded here that the system has been successfully implemented and the aim is achieved without any deviations.

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RECOMMENDATION SYSTEM ON AMAZON DATASET

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Abstract— Data have grown up uncontrollably due to which there are large number of products that are listed on e-commerce website today. In a way through which users can quickly find a favorite item from big resources, the user requires such technology by which it can be automated so recommendation systems were introduced. Recommendation systems are mainly used by companies like ecommerce to help the user discover items they have to found out by them and increase the sales of the company. A recommender engine can recommend user interest products. In this paper the discussion various different recommendation system, evaluation techniques and also the challenges and problem in the system are discussed. Also using Amazon electronics data building of popularity-based recommender engine and recommender engine using collaborative filtering that is based on singular value decomposition is discussed. The goal of the model is to recommend users 5 top products to the user and performance of each model is evaluated.

I. INTRODUCTION

Recommendation systems had changed the way of interaction between user and websites and are increasingly important today. Recommender system enhance accesses and take charge to recommend appropriate items to users by in view of the users raised choices and objective behaviors. Being an online advertisement or e-commerce websites, recommender system cannot be avoided today. Every other company is trying to use the power of recommendation system. These systems have huge application in different sectors that are education, economy and researches. The rate of digital information is increasing rapidly due to rapid growth of information technology. The recommendation system has attained great results solving the problem of data overloaded. There is a very large number of products that are listed today on e- commerce websites like Flipkart, Amazon. Recommender system helps user when they face huge amount of choices. There are almost more than 30 million products present on Flipkart today. Due to which it has become tough for customers to choose their desired choice. The recommender system deals with many data present by filtering the most important information based on historical data of a user which takes care of the user's preference and interest. Recommender system can predict whether a particular user would prefer an item or not based on the user's profile. It can predict whether a user would prefer a product or not based on the user's historical data. Recommender systems are beneficial to both service providers and users. The quality and decisionmaking process has also improved through these kinds of systems. Recommender systems result in mainly things stated below:

- Benefits users in finding items of their interest.
- Help website improves user engagement.
- Personalized content.
- Identity products that are most relevant to the user.
- Help item providers deliver their items to the right user.

There are two books that are listed on Amazon. The first book is 'Touching the Void' which was written by a mountaineer in
1988. At that time Amazon started as online book seller. But unfortunately, the book did not get much attention from the people and as a result, there were not many sales for that book. After a few years in 1996, another book came up with the title 'Into thin Air' which had similar story and got popular and received huge sales. That was the time when Amazon started with off implementing recommender system. So, whosoever bought 'Into thin Air' book, Amazon started recommending them 'Touching the void' book, as a result, the sales of the old book surpassed the new book. This magic happened because of recommendation. This technology invention has proved to be a blessing for e-commerce retail stores as it is a proven tool for adding up and multiplying sales like never.

II. LITREATURE SURVERY

Many good numbers of researches have been performed in this domain of product recommendation. In previous works, collaborative filtering has been used in various different application which is solely based upon user-user and itemitem interaction. Some of the areas of recommendation using collaborative filtering are movies, articles and product recommendation . As, CF methods had some limitations there have

examination to make use of web mining techniques that ae based of web usage mining. It is defined as the process of applying data mining techniques to find out different patterns from the web data. These pattern findings include association rules, page clusters and other different pattern discovery methods. There was a recommendation system that was built based on web usage mining . The technique was to recommend products based upon the web usage data as well as taking in consideration about product purchase data. The idea behind the methods was to recommend product of user's interest. For this, they proposed a list of top-N recommended products for different customer at particular period of time. There was different experiment that were done with the web usage for the internet shopping mall for validation their proposed recommendation system. During evaluation they found that taking the right level of product and customer increases the quality of recommendations. There was another product recommendation technique that has combination of previous suggested system based on data mining techniques and group-decision making methodologies. They made use of analytic hierarchy process (AHP) to compute the relative weights of frequency, monetary (RFM) variable in making evaluation of the customers loyalty. Then they made use of clustering techniques to make a cluster of customers on the basis of the weighted RFM value. At last, they recommended product to each customer group using association rule mining. The conclusion was made that recommending many numbers of items helps to enhance the quality of recommendation system for loyal customers, but not for people having less loyalty.The recommendation system made use of mining methodologies to track the customer's purchasing behavior. The customer choice and product association were automatically taken from customers clock streams. Then there was the algorithm that used to combine the product association and customer preference that use to score individual product. Therefor system used to make a product 89 customers time for internet shopping and was giving good recommendation.

III. RECOMMENDER SYSTEM AND TYPES

A recommender system is used by every e-commerce website these days like Flipkart, Amazon. Also, companies Netflix and YouTube uses such technology to gain more engagement by the users. There are many different types of recommender system that are used at different platforms which are build according to their architecture. Different types of recommender systems are discussed below:

A. Popularity-based recommender system

This type of recommender system is a system that has been designed in such a way that it recommends the most popular products to a user. It checks about the products which are in trend. For example, if there is a product which is usually purchased by every new user then there is possibility that the user who just signed will also buy the same product. Generally, most popular products can be found based on several filters like user ratings, different locations, etc. Popularity based recommender system does not suffer from cold start problem because they can even recommend the most popular product to every new user based on different filters.

There is no need for the user's historical data. There are still few of the problems in these systems which includes not personalized system. They would recommend the same products to every new user who visited the website for the first time. The example of the popularity-based recommender system is Google news where news is filtered by top news that means the most popular news and trending videos in YouTube which are most popular videos.

B. Classification model

It is type of model that makes prediction whether a user will like a item or product or not considering features of both users as well as products. The outcome of the model can be either 1 or 0 that means it the user likes the product then it comes out to be 1 or else 0. Classification model are considered to be very tough task because there is need to have large amount of data of products as well as different users. Moreover, it this is also achieved then also it becomes difficult to generalize.

Classification model suffers from flexibility issues as well.

C. Content-based recommender system

It is a type of recommender engine which works on the principle of similar content. If a user is looking for a product the system will find similar products on the basis of different metrics and will recommend those products to the user. These systems are considered to a bit of personalized system because it recommends only those products which have similar content that means whatever the users will be recommended the product of their interest.

D. Collaborative system

It is a very intelligent recommender system. It works on the principle of similar users or similar items. This type of recommender system is widely used by YouTube, Netflix, and Amazon, etc. Performance of this system is more efficient if we have more information about items and users. There are various methods used for finding similar users and similar

items. Mainly there are two approaches which are used in collaborative filtering stated below:

i. User based nearest neighbor collaborative filtering:
based upon the purchase behavior.

ii. Item based nearest neighbor collaborative filtering: It recommends items that are like the items the user bought. Similarity between different items is computed based on the items and not the users for the prediction. fhgfhg

E. Singular value decomposition and matrix-factorixation It is a matrix factorization technique that reduces the features of the dataset by reducing dimensions from N to K(N>K). For recommendation only the matrix factorization is taken care of which is done on the user-item rating matrix. Vectors are used to represent item and user such that their dot product is out expected rating.

$$\text{Expected rating} = \hat{r}_{ui} = q_i^T p_u$$

and can be calculated in such a way that the square error difference between dot product of user and item and the original ratings in the user-item matrix is least.

$$\text{Min}(p,q) \sum_{(u,i)\epsilon k} (r_{ui} - q_i^T . p_u)^2$$ A very important aspect of any machine learning model is to avoid overfitting and for that purpose regularization is used. It removes out the risk of the model to get overfitted. A penalty term that is λ is used which is multiplied by user and item vectors and square sum of the magnitudes. SVD algorithm minimize the error between the actual value and the predicted value.

F. Hybrid Recommeder systems

Hybrid recommendation systems are those system that are build using combination of different recommender system. Studies shows that combination of collaborative filtering and content-based filtering could be more efficient in some of the cases. These systems can be built by many different methods like by making content based and collaborative prediction individually and then combining them by adding each potential to each other's approach. Studies shows that hybrid models have good performance if we compare it to pure content based or collaborative based approaches. Hybrid methods also get the better of common problems like cold start and sparsity problem in recommendation systems. Netflix is one of the good examples of hybrid models. Their system does recommendation by comparing the watching and taking in consideration about similar users i.e. collaborative filtering as well as by recommending movies that have similar content with the film rated more by the user.

IV. CHALLENGES AND PROBLEMS IN RECOMMEDER SYSTEMS

A. Cold Start

This is the problem that comes when a new user signs in or a new item gets a place into the system. In these sorts of cases, the new items cannot be rated or purchased nor the taste of the new users can be computed. This sort of problem can be resolved by taking the ratings of the user in the beginning or to ask about the user taste and recommending the users items on the basis of demographic information.

B. Synonymy

It is the problem that arises when a single item is displayed with different names or entities having similar meaning. In these sorts of cases recommender system is not able to understand whether it's the same item or different item. For example, a CF model will understand "comedy movie" and "comedy film" different. The usage of synonym words reduces the performance of the recommender system. The main reason if their ratings are present for the new product it would not be recommender. To conquer the problem, Singular value decomposition as well as Latent Semantic Indexing can be used.

C. Shilling Attacks

Consider a case if a spiteful user comes into system and start giving wrong ratings as to increase the popularity of an item or vice versa then this type of process if called Shilling Attack. These types of attack can disturb the quality as well as performance of the system. This is more seen in CF based recommender systems. There are various attack models like bandwagon, random, average, and reverse bandwagon attack which can detected by different methods like prediction shift and hit ratio.

D. Privacy

Providing personal information to the recommender engine will definitely give you good recommendations but it might lead do data security. Recommender system that ache from privacy issues, still User are resistant to put their data. So, recommender system should build a trust between the users. In CF based systems, the user's data that includes rating are kept in a centralized repository that can be compromised ensuring in data misuse. For this cryptographic method should be taken in use so that personalized recommendations can be made without using third parties.

E. Grey Sheep

Grey sheep occurs in pure CF systems where opinions of a user do not match with any group and therefore, is unable to get benefit of recommendations. These types of user can be recognized by clustering techniques like K means clustering can be used so as to get enhanced performance and minimized recommendation error.

F. Evaluation and Dataset Evaluation of recommendation system and Dataset

The evaluation metrics tells you about the performance of the model. Selecting evaluation techniques is considered to be problem in the case of recommender systems. Metrics like MAE, precision and F measures are used for evaluation by traditional recommender system. One more challenge with recommendation system is no benchmark dataset that can be used to evaluate the recommender system. These types of dataset inspire research and development of recommender.

V. CONCLUSIONS AND FUTURE SCOPE

Model-based Collaborative Filtering is a personalized recommender system, the recommendations are based on the past behavior of the user and it is not dependent on any additional information. The popularity-based recommender system is non- personalized, and the recommendations are based on frequency counts, which may be not suitable to the user. For enhancing more, the evaluation of the model "timestamp" column that was discarded can be made in use so that it can be checked whether the user have purchased the product or not. In present day, deep learning technology has remarkably doing great in the domains like speech recognition, computer vision and natural language processing. Also, recommendation can be benefited from deep neural networks. One of the main advantages of using deep neural network is their ability to lean or representation learning. So, for recommender system to perceive latent factors from complex data source, deep neural networks can a play a vital are Relu, Sigmoid and Tanh. It can easily learn the important representation from the input data and factors that are explanatory. It has the ability of being powerful when it comes to sequential modeling tasks and also possesses high flexibility. Deep neural networks can be used to improve the recommendations systems. YouTube used deep neural network architecture for doing recommendation.

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IoT BASED PATIENT HEALTH MONITORING SYSTEM USING ARDUINO

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Abstract – *Due to the outbreak of Covid-19, social distancing and quarantine are practices which are being followed throughout the world. In a populous country like India, it is a vital measure to be followed; thus, frequent visits to the hospitals are discouraged. Keeping this situation in mind, this system works on the 'Internet of Things' technology and uses multiple sensors. This system monitors patients pulse rate, vital sign and Body temperature. For any. Internet of Things (IOT) visualizes a way forward for something anyplace by anyone at any time. the knowledge and communication technologies facilitate in making a revolution in digital technology. With the growing demand of Smart-Homes, Smart-Cities, a remote health monitoring system can also prove to be very beneficial. IOT area unit identified for interconnecting numerous physical devices with the networks. This system will take basic inputs like body temperature and pulse rate from the patient and display it simultaneously on the display as well as the connected mobile device.*

Key Words*: *Arduino UNO, Pulse sensor, LM35 sensor, DHT11 sensor, Node MCU.

1. INTRODUCTION

Internet of Things (IoT) is now a reliable technological standard and a heavily researched field. Sensors are being used almost everywhere in the present time, from everyday products to industrial monitoring systems.

Internet of Things, IoT, is a growing and emerging technology which takes the very basic things around us and converts it into smart things which are capable of collecting data from their environment on their own and can analyze data as required and give the demanded output. The Internet of Things is powering a new era of science and technology and is transforming the way we work in businesses or even our habits. Its applications extend to all areas of computing, internet connectivity and our devices.

Internet of things IOT consists of two words Internet and Things. The term 'things' in IOT refers to various IoT devices having unique identities and have capabilities to perform remote sensing, actuating and live monitoring of certain sort of data. IoT devices are also enabled to have live exchange of data with other connected devices and applications either directly or indirectly, or collected data from other devices and process the data and send the data to various servers. The other term, 'Internet' is used to define a Global Communication Network, connecting a large number of computers across the planets enabling sharing of information. Systems of interrelated computing devices can be mechanical, electrical, digital objects with each other in which the hardware component of the IOT acts as a mediator that helps in exchanging data from one device or sensor to the other either by wired medium or by wireless medium. Traditional fields of embedded system wireless sensor networks, control systems, automation including home and building automations all together consists of the internet of things.

The Internet of Things is an emerging technology helping to shape a new era in technology. From a conceptual point of view, IoT builds on three foundations, one is smart objects to be recognizable, to communicate with each other and to interact among themselves. At least one name and address are related, it is a human readable definition that can be used for interface purposes. The address is a computer- readable Data which can be used to communicate with an entity. The primary challenge ahead of us is designing technologies and solutions to allow such vision. By using the internet of things, there are many advantages for companies. such as tracking their overall business, enhancing customer service, saving time and money. For example, if we choose a health sector, it depends on multiple activities and devices that can be automated and improved by various technologies, such as monitoring the compliance of patients with prescriptions and their records. In this project, we are also working on such a model which can tell us about our health factors without being in clinical settings, in the comfort of our home.

The Internet of Things is recognized as one of the most important areas of future technologies and is gaining vast recognition in a wide range of applications and fields related to smart cities, military, education, hospitals, homeland security systems, transportation and autonomous connected cars, agriculture, intelligent shopping systems, and other modern technologies. The smart home is one of the main applications that use the Internet of Things infrastructure to connect several sensors. The sensors can sense and collect surrounding information that is used to fully control different home systems such as lighting and security.

1.1 LITERATURE SURVEY

Internet [1] of things: remote patient monitoring using web services and cloud computing. The android application (called "ECG Android App") is developed for the healthcare domain which is based on internet of things & cloud .which provides the end user with visualization of their electrocardiogram (ECG) waves and data logging functionality in the background. The logged data can be uploaded to the user's private centralized cloud which can be monitor by patients as well as doctors. This paper gives some fundamental concepts of IoT. Further there are more technologies.

Darshan, K. R [2] addressed the various uses of IOT in the healthcare system and also explained the challenges faced by IOT in the healthcare. They have also performed a review on various works done in the research area of this field. They have explained how to detect any disorders at the early stage and the necessary medical aid to be taken before hand. They have provided the status of IOT in some of the various well-known technology firms like how Google, Microsoft, Intel, IBM, cisco and the government sector are using IOT for healthcare.

Patient [3] health management system using e-health monitoring architecture this system is based on an android application & a wireless network which will be used for monitoring patients health report in real time. This system is developed in a such way that it would be more useful in emergency conditions. With this system it will be possible to analyse patient using tele-monitoring. Sensors will be used to monitor patients health continuously and it will be updated on server. The patients medical history is being stored on cloud for global access. This system will be useful for patients at home as well as patients from hospitals. As it will be using smart system for accessing data it be low in cost security is an issue which has to be considered while storing data on cloud which can be accessible by only patients and relatives.

Yeh, Kuo-Hui [4] introduced how security is implemented in IOT based on healthcare system. They succeeded it by using BSN (Body Sensor Networks). In these infrastructures, they have used two processes of Authentication that satisfies the security for IOT in securing the healthcare. They have developed this model using the raspberry pi-2 development platform. They say that the system efficiency can be further enhanced if the crypto-has - modules are replaced by SHA-2 techniques. They have proved the robustness of their methodologies.

Health [5] gear: a real-time wearable system for monitoring and analyzing physiological signals a health gear presents a real time wearable system for monitoring, visualizing and analyzing physiological signals. Set of non-invasive physiological sensors are wirelessly connected to a cell phone, which stores, transmits and analyses the physiological data and then it presents it to the user in an appropriate way. Set of non-pervasive sensors are part of health gear. To monitor the users blood oxygen level and pule while sleeping, we focus on implementation of health gear using a blood oximeter. Also, the two different algorithms we use for automatically determining sleep Apnea Events And For Illustrating The Performance Of The Overall System In Sleep Study With 20 Volunteers.

Xican [6] reviewed on new advancements in radar sensors design system that offers low power healthcare, indoor real time positioning and different applications in IOT. To improve the detection accuracy, detection range and power consumption they have proposed different radar frontend architecture and digital processing methods. Some of the recent developments are beam forming and duty cycle. They say that CMOS technologies are used for low power and low cost radar sensors that can further studied for developing applications using IOT and WSN. They have compared the different radar architectures.

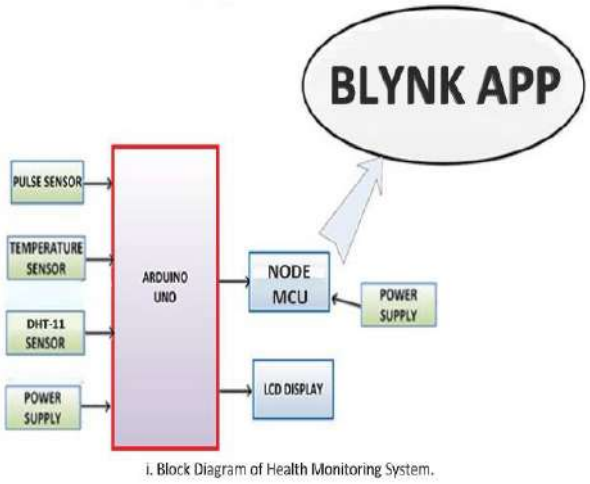
Design [7] and development of e-health care monitoring system as we are dealing with e-health care monitoring system, our system designs is based on the wireless sensor networks (WSN) and smart devices. It is very important to have strong networks between doctor, patient, and care givers judges the condition of the patient. Sensors are used to monitoring of patient surrounding as well as health, these sensors are medical and environmental sensors. Sensors are relayed to the prior devices through the transmitter and them to the end user. In this system doctor and care takers can observe patient without exactly visiting the patient actually. And furtherly they can upload medicines and medical reports on the web server which after can be accessed by the patient anywhere at any time. It is very much easy process and convenient for both the doctors and patient. With the help of this data doctors can understand and observe patient from private home patient to public health care center patient. This is the cost reducing technique. We have also define the sets of add on services which include real time health advice and action (retina) and parent monitoring.

Moosavi [8] implemented two architectures based on IOT for remote monitoring. The developed these two architectures with two different wireless technologies. One is using WI-FI and the other is by using Zig-bee. Their goal is to find the advantages and disadvantages of these systems. In zig-bee, the system contains different set of sensor nodes. The data is read from different medical sensors and processes it by sending through zig-bee to the server. The WI-FI sensor system accessed the bio-medical signals and updates the database in the server. In both the test cases, the servers collect the data and update the database. This database can be accessed and displayed in a web page for remote access.

2. METHODOLOGY

This project adopts a number of interconnected sensors to observe the health condition of the patient. A set of biomedical signals can be obtained, including the heartbeat and the body temperature. Another input obtained is the temperature and humidity in the environment and surroundings of the patient. The output is displayed on the LCD screen right away and can also be obtained on the connected smartphone with the help of internet connection

The input is obtained by the Pulse Sensor, DHT11 temperature and humidity sensor and LM35, the body



i. Block Diagram of Health Monitoring System.

Fig- 1 Block Diagram

temperature sensor; from the patient and his surroundings. The output is simultaneously provided on the 16x2 LCD display attached. The data is also uploaded on the Blynk App for further details. The details obtained by the sensors can also be obtained on the connected mobile device for easy approach for the patient.

The sensors take three inputs:

i.) Body temperature

ii.) Pulse Rate

iii.) Room temperature and humidity.

These three inputs go to the Arduino UNO and are processed according to the code.

Output goes to LCD as well as Node MCU for output on the mobile display.

The given flowchart explains the entire working of the project.

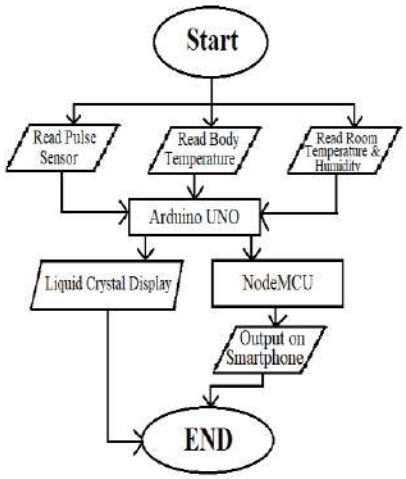


Fig- 2 Flow Chart

3. COMPONENTS USED

The following are the components used:

3.1 Arduino Microcontroller Arduino

The Arduino Uno is a microcontroller board. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), a 16 MHz ceramic resonator, a USB connection, a power jack, 6 analog inputs, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB or power it with an AC-to-DC adapter or battery to get started. The Wiring platform consisted of a printed circuit board (PCB) with an ATmega168 microcontroller. The Uno differs from all previous boards as it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

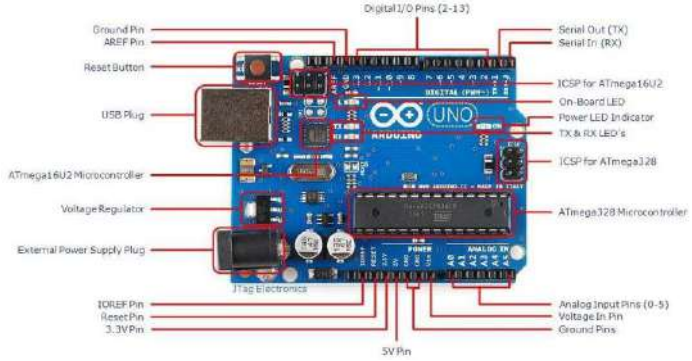


Fig- 3 Arduino Board

3.2 Node MCU

Node MCU V3 is an open-source firmware and development kit that plays a vital role in designing your own IoT product using a few Lua script lines. Multiple GPIO pins on the board allow you to connect the board with other peripherals and are capable of generating PWM, I2C, SPI, and UART serial communications. Open Source firmware gives you the flexibility to edit, modify and rebuild the existing module and keep changing the entire interface until you succeed in optimizing the module as per your requirements. A USB to UART converter is added on the module that helps in converting USB data to UART data which mainly understands the language of serial communication. The board incorporates a status LED that blinks and turns off immediately, giving you the current status of the module if it is running properly when

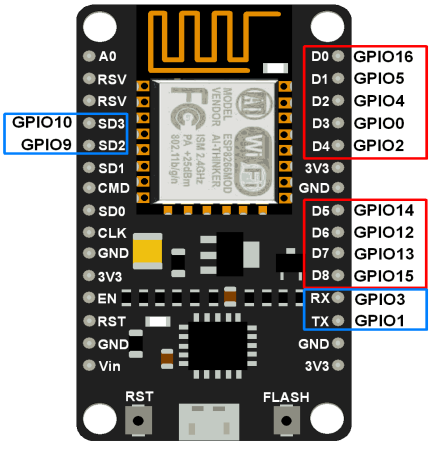


Fig- 4 Node MCU V3

connected with the computer.

3.3 LM35 Body Temperature Sensor

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device is rated to operate over a −55°C to 150°C temperature range, while the LM35C device is rated for a −40°C to 110°C range (−10° with improved accuracy).

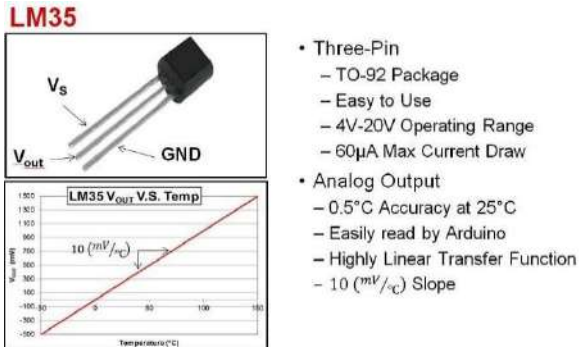


Fig- 5 LM35 Body Temperature Sensor

3.4 DHT11 Humidity-Temperature Sensor

The DHT11 is a basic, low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). DHT11 is a low-cost digital sensor for sensing temperature and humidity. This sensor can be easily interfaced with any micro-controller such as Arduino to measure humidity and temperature instantaneously. DHT11 sensor consists of a capacitive humidity sensing element and a thermistor for sensing temperature.

The humidity sensing capacitor has two electrodes with a moisture holding substrate as a dielectric between them. Change in the capacitance value occurs with the change in humidity levels. The IC measures, processes this changed resistance values and changes them into digital form. For measuring temperature this sensor uses a Negative Temperature coefficient thermistor, which causes a decrease in its resistance value with increase in temperature.

The temperature range of DHT11 is from 0 to 50 degree Celsius

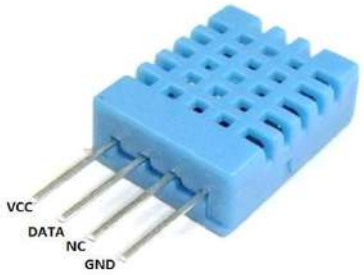


Fig- 6 DHT 11 Humidity-Temperature Sensor

with a 2-degree accuracy. Humidity range of this sensor is from 20 to 80% with 5% accuracy. The sampling rate of this sensor is 1Hz, i.e. it gives one reading for every second. DHT11 is small in size with operating voltage from 3 to 5 volts. The maximum current used while measuring is 2.5mA.

3.5 Pulse Sensor

Pulse Sensor is just another name for a sensor of heartbeats. Heart-rate is calculated by connecting the fingertip to the sensor. This sensor has two surfaces, on the first surface, the light-emitting diode & ambient light sensor is connected. Similarly, on the second surface, the circuit is connected which is accountable for the noise cancellation & amplification. The LED is located above a vein in a human body like ear tip or fingertip, however, it must be located on top of a layer directly. Once the LED is located on the vein, then the LED starts emitting light. Once the heart is pumping, then there will be a flow of blood within the veins. So if we check the blood flow, then we can check the heart rates also.

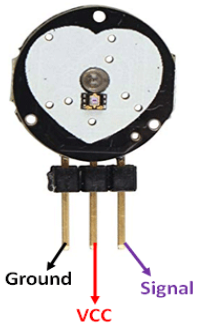


Fig- 7 Pulse Sensor

3.6 Liquid Crystal Display

LCD stands for liquid crystal display. The LCD Display used in this project is 16x2. 16×2 LCD is named so because; it has 16 Columns and 2 Rows. It has 16*2= 32 characters. Liquid crystal

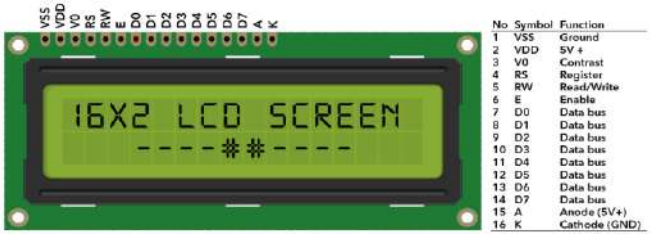


Fig- 8 Liquid Crystal Display

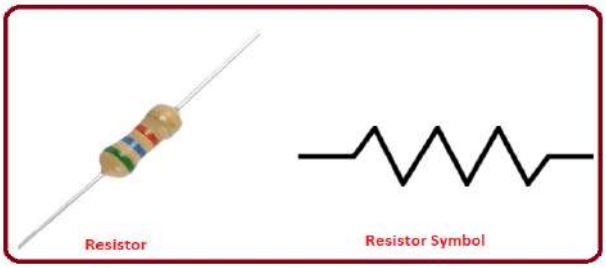


Fig - 9 Resistors

display is composed of several layers which include two polarized panel filters and electrodes. Light is projected from a lens on a layer of liquid crystal. This combination of coloured light with the grayscale image of the crystal (formed as electric current flows through the crystal) forms the coloured image. This image is then displayed on the screen.

The principle behind the LCDs is that when an electrical current is applied to the liquid crystal molecule, the molecule tends to untwist. This causes the angle of light which is passing through the molecule of the polarized glass and also causes a change in the angle of the top polarizing filter. As a result, a little light is allowed to pass the polarized glass through a particular area of the LCD. Thus that particular area will become dark compared to others. The LCD works on the principle of blocking light.

3.7 Resistors

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Electricity flows through a material carried by electrons, tiny charged particles inside atoms. Broadly speaking, materials that conduct electricity well are ones that allow electrons to flow freely through them. The resistor's resistance limits the flow of electrons through a circuit. They are passive components, meaning they only consume power (and can't generate it). Resistors are usually added to circuits where they complement active components like op-amps, microcontrollers, and other integrated circuits. Commonly resistors are used to limit current, divide voltages, and pull-up I/O lines. The electrical resistance of a resistor is measured in ohms.

3.8 Breadboard

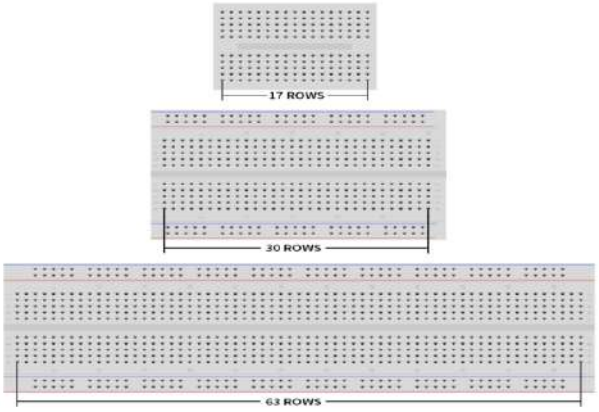


Fig - 10 Breadboard

A breadboard is used to make up temporary circuits for testing or to try out an idea. No soldering is required so it is easy to change connections and replace components. Parts are not damaged and can be re-used afterwards. A breadboard is a solderless device for temporary prototype with electronics and test circuit designs. Most electronic components in electronic circuits can be interconnected by inserting their leads or terminals into the holes and then making connections through wires where appropriate. The breadboard has strips of metal underneath the board and connects the holes on the top of the board. The metal strips are laid out as shown below. Note that the top and bottom rows of holes are connected horizontally and split in the middle while the remaining holes are connected vertically.

3.9 Light Emitting Diode

A light-emitting diode (LED) is a two-lead semiconductor light

Figure 11: Light Emitting Diode

source. It is a p–n junction diode that emits light when activated. When a suitable current is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the colour of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. LEDs (light emitting diodes) are solid-state lighting devices that produce light when a forward voltage is applied.

An LED consists of a semiconductor diode packaged in a clear epoxy or silicone gel. The diode contains two slightly different materials: a P-type semiconductor and an N-type semiconductor. The P-type semiconductor has "holes" created by a lack of electrons, producing a positive charge. Conversely, the N-type material has an excess of electrons, resulting in a negative charge. The P- and N-type semiconductors are placed in direct contact in the diode and the region where they meet is referred to as the P-N junction. When an electric current passes through the device, electrons flow toward the P region and holes flow toward the N region. Near the P-N junction, electrons and holes combine and the electrons shed the extra energy they acquired from the electric current. This energy is released in the form of a photon, the basic unit of light. In this way, an LED emits visible light. The photon energy determines the wavelength of the emitted light, and hence its colour. Different semiconductor materials with different band gaps produce different colours of light.

4. FUTURE SCOPE

The current model has features of obtaining body temperature, pulse rating and the temperature of surroundings along with humidity. The output is then given out on the display and can also be obtained on the connected device of the patient or the care-taker.

The very major and important measure to improve this model is by connecting the doctor's device to it. The inputs obtained can be uploaded on the cloud and subsequently obtained by the doctor. In case of any emergency, we can get alerts beforehand and can provide measures to avoid any major mishappening.

Another feature that can be added to this project is the addition of the medicine department. The doctor might directly send the required medical consultations and the notification will be sent to the connected pharmacy. This can help in home delivery of medicines. This feature will prove to be very beneficial for elderly people who live without helping hands or caretakers.

In addition to that, a GPS chip can be enabled. For critical conditions and emergencies, the nearest hospital might be informed and an ambulance can be sent to the location of the patient. This feature can prove to be serviceable and advantageous for extremities and crucial conditions.

5. CONCLUSIONS

The Internet of Things is considered now as one of the feasible solutions for any remote value tracking especially in the field of health monitoring. It facilitates that the individual prosperity parameter data is secured inside the cloud, stays in the hospital are reduced for conventional routine examinations and most important that the health can be monitored and disease diagnosed by any doctor at any distance. In this paper, an IoT based health monitoring system was developed. The system monitored body temperature, pulse rate and room humidity and temperature using sensors, which are also displayed on an LCD. These sensor values are then sent to a medical server using wireless communication. These data are then received in an authorized personals smart phone with IoT platform. With the values received the doctor then diagnose the disease and the state of health of the patient.

Doctors and Caregivers can interact with patients without their physical presence. The system automatically can generate the graph of body changes as an emergency SMS doctor gets EG. If a patient suffers from body temperature it will be easy for the doctor to recognize the problem and also save the time of check up. Our system is very much suitable for village health care centers and rural areas where lack of medical facilities are available. This system also keeps patient privacy at home as well as at hospital. This health monitoring system can be of great help for the health care of patients.

5. RESULT

In the very beginning, the pulse sensor takes up analog signal, following that the body temperature and room temperatures are used as input data. All of the data collected is then transferred to the Arduino UNO and is processed according to the code. For the final outcomes, the system follows two ideas: LCD Display and the output on mobile device. With the help of Node MCU and the Blynk App, the output and data gained by the sensors is processed and finally displayed on the authorized mobile device. This system can help reduce the rate of death. It can prove to be very beneficial in reducing

major issues by informing beforehand with the help of symptoms only. Thus, major issues can be avoided.

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OTP BASED WIRELESS SMART LOCKING SYSTEM

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***Abstract*—Security is a worldwide problem about which researchers are continuously working. Security is the most important aspect that is gaining importance nowadays. Previous research related with traditional secure locking system includes the systems those are based on hardware such as many sensors, GSM, microcontroller and so on. Biometric systems mostly used are iris recognition, face recognition, password, RFID and Smart Card based authentication. They are having their advantages and disadvantages. A symbolic OTP Based Security System is proposed to overcome the various drawbacks of various security systems. When the user wants to open the security, he has to send the request for Symbolic-OTP. Symbolic–OTP will be sent by the system to the user mobile through Email or its mobile app.**

***Index Terms*—Arduino IDE, IOT, Security, Symbolic-OTP, GSM**

I. INTRODUCTION

The technology of keys and locks remained the same for the last century while everything else is evolving exponentially. So why not use current technologies and apply them with old ones to build something new and innovative. Around 4000 years ago, the concept of Locks and Keys were invented and until today, regardless of some minimal variation in security and sustainability locks are installed indoors stimulated mechanically by the right key. Recently, the Internet was enhanced, and everything was connected to it (phones, television, laptops, tablets, cars and so on). This was done because we wanted to make systems smarter in another term a more productive. Why not do the same thing with Locks? Enhancing the locks mechanism by connecting them to the internet, making them more robust and productive. Today, the number of mobile device users including smartphone users has rapidly been increasing worldwide, and various convenient and useful smartphone applications have been developed. Now smartphones are not only used to send and receive phone calls, send text messages and perform mobile banking operations but they also are used to control various other devices in our real everyday lives. Through a mobile operating system and internal applications, we can remotely control a variety of external devices such as TVs, projectors, computers, cars, etc. People normally operate ordinary locks with keys or keyword locks such as a pin code. However, these locks have few drawbacks such as misplacing keys or forgetting passwords. Using smartphones, the remote lock can be easily managed. Furthermore, the proposed system has a wide range of applications and can be used for various types of locks and systems, such as lockers, bicycles, cars, etc. In this project, we are going to make a smart OTP-based locking system as you can see. This smart lock can generate a new password every time you unlock it, which further enhances your security level. This new device is much safer than the traditional key-based system and electronic wireless lock

system. If you are still using the key-based system, you are likely to land in a big problem if your key gets lost or stolen. The electronic wireless lock system is not safe either. You might forget the password and there is also a high risk of being hacked.
Contents discussed in this paper: Literature survey (II), Methodology(III), Implementation(IV), Result and Discussion(V), Conclusion, Future Scope and References.

II. LITERATURE SURVEY

This new device is much safer than the traditional key-based system and electronic wireless lock system. If you are still using the key-based system, you are likely to land in a big problem if your keys lost or stolen. The electronic wireless lock system is not safe either. You might forget the password and there is also a high risk of being hacked. This smart lock can generate a new password every time you unlock it, which further enhances your security level. Infrared Optical Wireless Communication for Smart Door Locks.

The working principle of an Arduino, Abuja, Electronics, Computer and Computation (ICECCO), 2014 11th International Conference, IEEE. This will give you the overall view of an arduino uno, that after reading this paper you will get the basic concept and use of an arduino uno [1].

Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board. [2]

The ability to communicate with people on the move has evolved remarkably since Guglielmo Marconi first demonstrated radio's ability to provide continuous contact with ships sailing the English Channel. That was in 1897, and since then new wireless communications methods and services have been enthusiastically adopted by people throughout the world. Particularly during the past ten years, the mobile radio communications industry has grown by orders of magnitude, fueled by digital and RF circuit fabrication improvements, new large-scale circuit integration, and other miniaturization technologies which make portable radio equipment smaller, cheaper, and more reliable. [4]

The purpose of the proposed system is to provide extra security measure that can be used in homes and offices. The proposed system is based on a 2 – way verification method. The password for security is initially stored in the Electrically Erasable Programmable Read Only Memory (EEPROM). If the user enters correct password then for the 2 – way verification, a randomly generated OTP is sent on the user's device via Bluetooth. If the entered OTP is matched then the system will be unlocked and the required task can be initiated. [5]

The RFID card reader detects and checks the user accessibility. When the card is brought near the reader, it identifies the radio frequency of the card and thus verifies the key but these systems are very expensive. The main aim for providing locks for our home, school, office, and building is for security of our lives and property. It is therefore important to have convenient way of achieving this. Lia Kamelia, Alfin Noorhassan S.R, MadaSanjaya and W.S., Edi Mulyana has implemented a "Door – Automation System Using Bluetooth", the implementation was on Android platform. So the implementation cost is less and affordable by a common user. With the use of wireless Bluetooth connection the system installation in more easy way. [6]

This paper is designed by using PIR (Passive Infrared Radial) sensor to provide high security in ATMs. The sensor is basically a pyroelectric device. When the PIR is exposed to infrared radiation, it generates an electric charge. This electric charge triggers the camera. Camera starts capturing video, and then this video is processed by DSP processor for abnormal incident detection (misbehavior with ATM system). Once it occurred, corresponding signal is sent to microcontroller. The microcontroller is programmed to send SMS through GSM & GPS module to the near police station, at this time door will automatically lock. Then the thief will be inside the ATM room. [8]

Home automation is becoming more important day by day due to its numerous advantages. Home automation technology provides essential security to homes and associated control operations. This paper deals with the design and implementation of secure home automation using Raspberry Pi. Methods/Statistical Analysis: The proposed technology is to design a basic home security application on Raspberry Pi through reading and posting of messages in social networking sites. This data can be shared to authorized user via social networking sites to achieve home automation. Findings: Raspberry Pi board is a flexible embedded processor and with the support of open source packages the required camera system and systems

for Facebook management and one time pass word management are implemented. The GPIO pins are sufficient for external control. Conclusion/Improvements: The system developed provides user friendly automation for security of home using Facebook and can be enhanced in future using bio metric authentication [9]. Lots of other research has been done by authors [10,11].

III. METHODOLOGY

A one-time password (OTP), also known as a one-time PIN or dynamic password, is a password that is valid for only one login session or transaction, on a computer system or other digital device. OTPs avoid several shortcomings that are associated with traditional (static) password-based authentication; many implementations also incorporate two-factor authentication by ensuring that the one-time password requires access to something a person has (such as a small keyring fob device with the OTP calculator built into it, or a smartcard or specific cellphone) as well as something a person knows (such as a PIN).

AIM OF THE PROJECT:

1. The main objective is to design a secure lock using the Arduino.
2. Designing a secured door lock to prevent unwanted access in the server room.
3. To Replace RFID based lock system with a smartphone.
4. To give the user hassle-free access without compromising security.
5. This system gives notifications about access to a user.

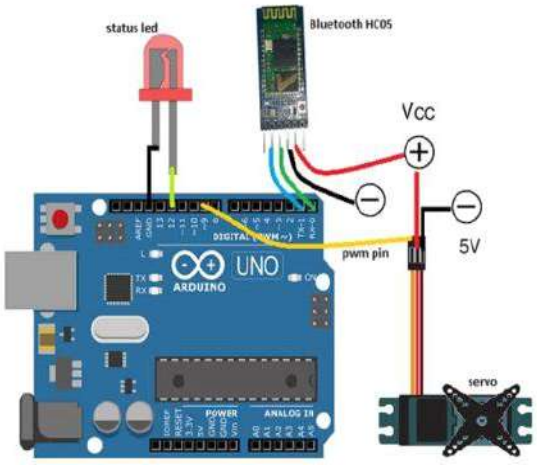

Fig 1: Circuit Diagram

DATA ANALYSIS

1. Components required: Hardware

- Bluetooth Hc05
- Arduino UNO
- LED
- Connecting wires (male to male and male to female)
- Android/IOS phone
- Servo Motor
- 5V Battery/Power Bank

2. Components required: Software

- Arduino IDE
- MIT app inventor
- Accessible Wi-Fi

Bluetooth Hc05

HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration as shown in Fig 2.

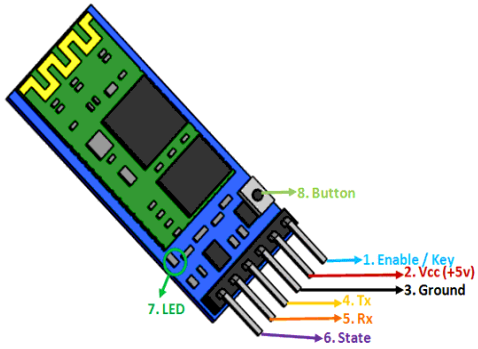

Fig 2: Bluetooth Hc05

Servo Motor

Fig 3 shows a servomotor that is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration.

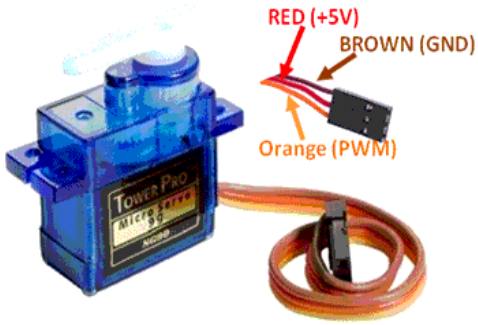

Fig 3: Servo Motor

Arduino UNO

Arduino is an open-source platform used for building electronics projects. Arduino has a physical programmable circuit board i.e. microcontroller and IDE. Fig 4 shows a labelled description of the components present in the Arduino board.

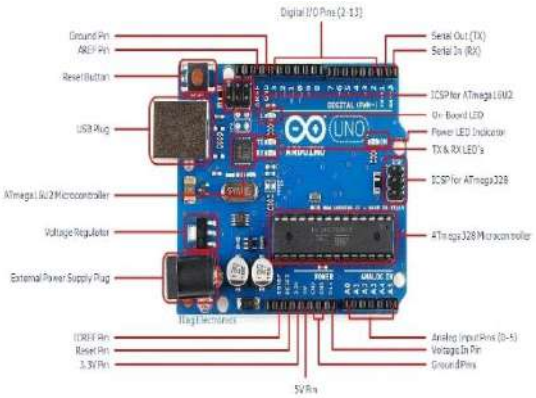

Fig 4: Arduino UNO

Arduino IDE

Arduino IDE (Arduino Integrated Development Environment) contains a text editor for writing code, a console, a toolbar with buttons for some common functions and a series of menus, a message area.

IV. IMPLEMENTATION

We can make App with two different platforms, either Android Studio or MIT app inventor. For this project, let's choose the MIT app inventor because it's easy to make an App with blocks without coding. App inventor lets you develop applications for android phones using a web browser and either a connected phone or emulator. The App Inventor servers store your work and help you keep track of your projects.

APP Building:

First, we need to create a layout as shown in the fig 5.

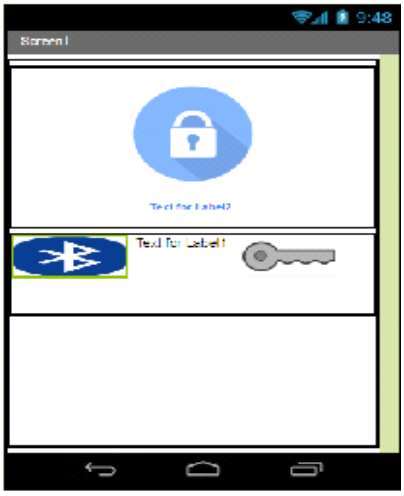

Fig 5: Layout of app in MIT app inventor

Now let's get into the code Blocks tab, for coding.

First, we need to initialize Bluetooth list available for connection. Then we have to set button function to send device id according to our Arduino Code as in the fig 6 below.

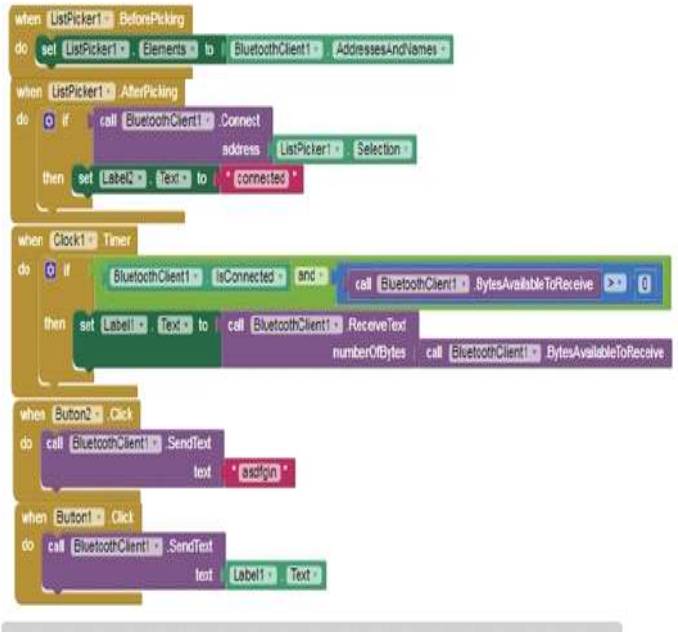

Fig 6: MIT app inventor coding blocks

Now, export app .apk and install it on your Android phone.

V. RESULTS AND DISCUSSION

Connecting Components:

Arduino Pins	Components and Pin
Arduino Pin 9(PWM)	Servo Yellow Wire (signal input wire)
RX	Bluetooth Module TX
TX	Bluetooth Module RX
GND	GND Bluetooth
VCC	Bluetooth VCC
Pin 12	LED
GND	Battery(-VE)

We have connected all the components now. You might not like to fry costly Arduino board with the wrong connection. So, always crosscheck your setup to ensure that all connections are ok.

Testing:

First, connect the Arduino and components to a power supply. Here I have used 5V Power Bank for it. Next, open the installed App, then turn on the Bluetooth of the phone. When you tap on the Bluetooth icon, you will get the list of Bluetooth connections for pairing. Now, tap on HC 05. On successful pairing, you will get a 'connected' message on the App as shown below in fig 7.

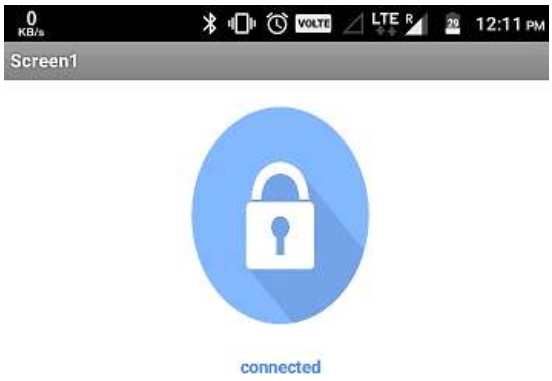

Fig 7: Showing connection status

After that, tap on the key icon to send device id to match. If the device id is matched, it will send an OTP to your app that you can see in App text bar between Bluetooth and lock icon. This function is operated through MIT inventor app shown in the fig 9.

Now, you can tap on the lock icon to unlock your Smart Lock. If everything is ok then servo moves unlocking mechanism and onboard LED of Arduino lights up indicating successful unlock. I have used servo because of its high torque, and also because we can control the angle of its movement that helps in unlocking mechanism of the lock.

Results are as follow:

Fig 8: Switching on/off servo motor

Fig 9: Operating through MIT Inventor app

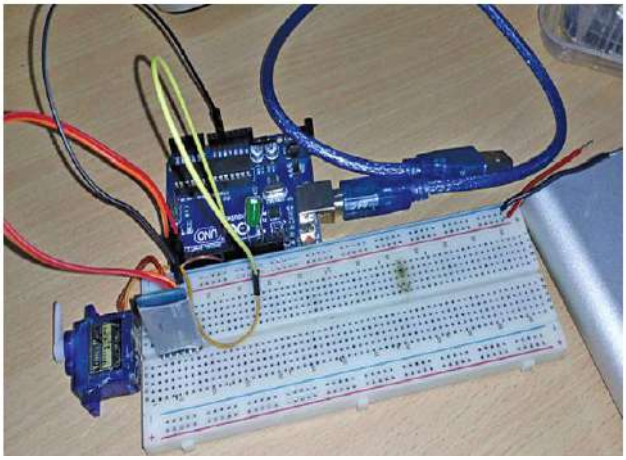

Fig 10: Complete circuit diagram

We have completed Arduino coding and android app development. Now, let's start our hardware setup and connections. The circuit connections with the Arduino Uno board and other components as given in the circuit diagram in fig 10. Next, let's crosscheck everything, including connections. Wrong connections can damage your costly Arduino board. Do not connect servo motor directly to the 5V pin of Arduino. It is not safe because Arduino has not been made for the amount of current that is required for servo motor to operate. Use a separate 5V DC supply for the servo motor. The operation of switching on/off servomotor is shown in fig 8.

VI. CONCLUSION

OTP based wireless smart locking system is used in the places where we need more security. It can also use to secure lockers and other protective doors. This smart lock can generate a new password every time you unlock it, which further enhances your security level. This new device is much safer than the traditional key-based system and electronic wireless lock system.

VII. FUTURE SCOPE

The security level can be increased by adding a biometric fingerprint sensor, we can interface sensors like Fire, LPG, and PIR motion detector to microcontroller. This simple circuit can be used at places like home to ensure better safety. With a slight modification, this project can also be used to control the switching of loads through password. It can also be used at organizations to ensure authorized access to highly secured places.

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DOOR LOCK SYSTEM USING RFID

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Abstract- ***The demand for Wireless secure system have been increasing day by day. Several different methodologies have been adopted by people for designing of access control system and RFID is one among them. Various applications of RFID (Radio Frequency Identification) are access control system, book tracking in libraries, tollgate system, supply chain management etc. that have been used in several industries. A door lock system using RFID and Arduino have been designed in this paper. In this system RFID technology have been combined with Arduino in order to complete the task. When RFID tag has been placed on RFID reader then the system captures the user unique identifier (UID) and compares it with the stored UID for a match. If the user UID matches with stored UID then access is granted and if not, access is denied. It provides secured and reliable means of access granted and denied.***

Keywords: *RFID, Unique Identifier, Arduino, door locking system*

I. INTRODUCTION:

RFID (Radio Frequency Identifier) is an inexpensive technology, also RFID is contactless technology that is more efficient and secure than other networks.

RFID door lock is simple to install and allow user to easily unlock the door with safety. RFID reader, RFID Antenna and transponder(tag) are basically the main components involved in RFID system. The function of RFID antenna is to generate high frequency electromagnetic field and each RFID tag has unique code programmed within it.

Whether door locks open or remain closed will depend on user using right RFID tag or wrong RFID tag. When the person having right RFID tag and contact this tag with RFID reader than its UID have been transferred to Arduino Microcontroller for comparison and it will grant access to the user by displaying on LCD display and door will open but when the person having wrong RFID tag and place the tag over RFID reader then its UID have been compared and because of unmatched UID it will show access denied on LCD display and door will remain closed. [2]

RFID technology have gained great attention as compared to simple door lock due to its feature of security and simplicity.

II. PROBLEM STATEMENT

Security now a days has become a great matter of concern. Since, the entrance of any organization should be secure, so in order to overcome the security faced by many organizations, Automatic door lock has become necessary.[5] The main objective of this paper is to design a digital security system which is used in the areas where there is need of security and only authorized person should get access. The aim is giving access to authorized personnel and denying access to unauthorized personnel such that security is maintained without the use of keys.

III. COMPONENTS REQUIRED

HARDWARE

ARDUINO PRO MINI

It is a microcontroller board based on ATMEGA 328. It performs specific task given by the instruction. It have 14 digital input/output pin out of which 6 pins are used as PWM (Pulse Width Modulation) output. From these 14 pins we get 40mA of current. There are 6 analog input pins in Arduino i.e., A0-A5. Arduino pro mini is generally used where we require flexibility, low cost, and small size. [6] It have minimum components due to which its cost is less. Arduino pro mini is programmed using Arduino software i.e., IDE(Integrated Development Environment).

Figure 1: Arduino Pro Mini

RFID READER

RFID module is based on MFRC522 controller. RC522 RFID reader module having 8 pins is of low power, low cost and easy to interface. RFID system consists of three main components i.e., RFID Reader, RFID Tag, and RFID Antenna. RFID reader comes with a RFID tag having 1KB of memory. RFID Reader are used to read information stored in RFID tag, this information is unique for each tag and cannot be changed. RFID reader are also known as transceiver. RFID reader consists of antenna which generates high frequency electromagnetic field. [8]

Figure 2: RFID reader

LCD DISPLAY

LCD (Liquid Crystal Display) are commonly to display data. 16*2 LCD is a basic module which we can use. It has 16 pins out of which 8 pins of data lines (pin7-14) , one for power and one for ground, 3 pins are used to control the operation of LCD, one is use to adjust the LCD screen brightness and two pins use to

power the backlight. In this system, we are using LCD display so that the person with wrong RFID tag didn't get access and with the help of LCD display we can say access denied. [7]

Figure 3: LCD display

SOFTWARE

ARDUINO IDE

Arduino IDE is an open source software. It is used with any Arduino board. Arduino board have to be connected to the computer via USB, where it connects with the IDE(Integrated Development Environment). Then, the user write the code in the IDE and upload that to the microcontroller which executes the code. Arduino language is based on C/C++ and for running the basic program needs two functions i.e., a setup() and a loop(). Setup() function will execute once in a code. [3] The actual code is written in the loop() function, it'll iterate continuously until the device is powered off.

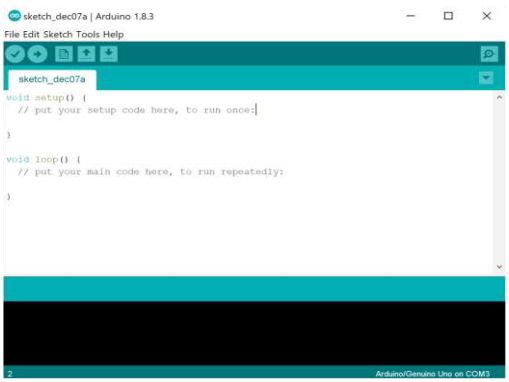

Figure 4: Arduino IDE

IV. BLOCK DIAGRAM

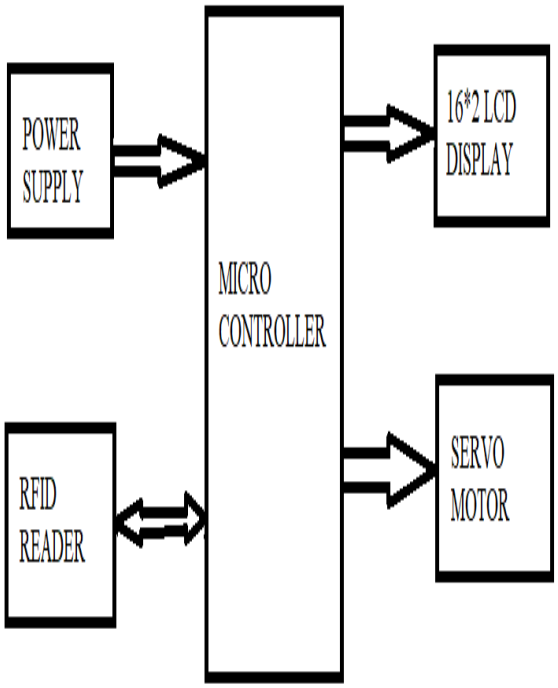

Figure 5: block diagram

V. WORKING OF THE SYSTEM

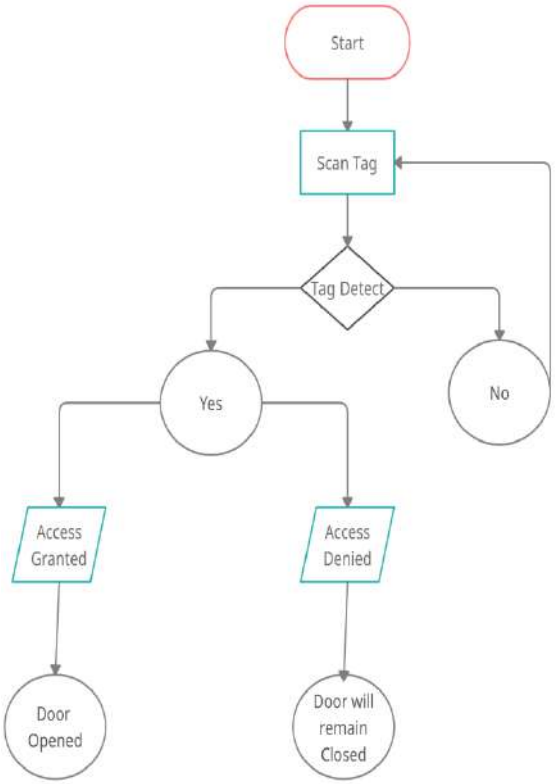

Figure 6: Control flow

RFID Door lock works on some simple concept. A new user is first registerd with the system and the corresponding information is rendered in the RFID tag. RFID reader consists of antenna which generates high frequency electromagnetic field. When the registered user place its RFID tag over RFID reader then RFID reader emits a low level radio frequency magnetic field that energises the tag. [1] The tag transmits the unique identification data(UID) to Arduino microcontroller for comparison. If it matches with already stored UID then access granted displayed on LCD Display and door will open after successful authentication else access denied displayed on LCD display and door will remain closed. [4]

VI. RESULT

A door lock system is driven by stepper motor which acts as actuator, which is able to open and close the door. User must have correct RFID tag. When the right RFID Tag comes in contact with the RFID Reader, then the system searches and matches the identity code with information stored in the host database or backend system, if the information is matched then only user gets access and the lock opens and access granted display on the LCD display and if the identity code not matches with the information stored in the data base then user don't get access and door remain closed. This system can be deploy in various secure places within an organization.

VII. CONCLUSION

In this Paper, we have implemented an automatic digital door locking system. This system uses RFID(Radio Frequency Identification) technology with Arduino. When the RFID tag place near the RFID reader then the reader matches the information with the stored UID on the Microcontroller. Then, the Microcontroller grant access on successful matching or deny access if matching failed. This system is used for security purposes and can be installed at the entrance of any organization such that only authorized person gets access and environment remain secured. [3]

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RFID Based Automatic Toll Collection System

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Keywords: *RFID Reader, RFID Tag*

Abstract

This study reviews the RFID BASED AUTOMATIC TOLL COLLECTION SYSTEM using ARDUINO which automatically collects toll tax with RFID Technology. The identification of vehicles with insufficient balance is made up with the help of radio frequency using the RFID tag which is a unique identification number provided by the controlling authority. This numerical module contains all the basic information and details related to the amount paid for the TOLL collection. The appropriate amount is deducted from the auto-registered account. In the event that a person has an insufficient balance, his or her updated balance will become negative. This system will then warn the authorities that this vehicle does not have enough balance and an immediate recharge is required. this system is based on prepaid model which is easy to use and saves time, low fuel consumption and is highly cost efficient.

[1] INTRODUCTION

The growing population across the globe ultimately leads to large amount of resource consumption. These resources can be in any form ranging from electronic devices, food, water etc. One such major resource consumption is in electronics industry which supports a wide range of automation. In todays world automation can be seen everywhere. Since there is an increase in the global population on a day to day basis, similarly is the increase in the number of vehicles required for travel. These can include Private or Public vehicles. Hence there is a need for Automation at the Toll Plazas also. [1]This objective can be achieved with the help of bar codes, smart cards, voice recognition, some biometric technologies (retinal scans, for instance), optical character recognition, and radiofrequency identification. One such great technology which can be used at Toll Plazas for automatic toll collection is RFID. Radio Frequency Identification (RFID) refers to a wireless system comprised of two components: tags and readers. The reader is a device that has one or more antennas that emit radio waves and receive signals back from the RFID tag. Tags, which use radio waves to communicate their identity and other information to nearby readers, can be passive or active. RFID tags can store a range of information from one serial number to several pages of data. Readers can be mobile so that they can be carried by hand, or they can be mounted on a post or overhead. Reader systems can also be built into the architecture of a cabinet, room, or building. These booths are simply the toll booths or toll naka. The money we pay is the tax for using the road known as the toll road or toll way. Since, most of the roads are built with the money that is raised by state or national government through the taxes [1]. The Toll is collected manually at many places around the globe these days. This paper proposes a way of collecting tax Automatically using RFID technology.

The system here is a smart card based toll booth system that is monitored using IoT. The Internet server maintains all the data of user accounts and also their balance. All vehicle owners would possess an RFID (Radio Frequency Identification) based card that stores their RFID number. The system at toll booths will monitor the cards scanned when a car arrives at the toll booth. When the vehicles comes at the Toll Booths the sensors detects the vehicle and allows the vehicle to pass forward. After which the Driver puts the RFID card at the RFID reader and the balance is deducted from the card. After which the toll gate opens for the vehicle. There is no manual work needed in this whole process and hence its very fast and time consuming also. The RFID Technology plays a vital role in this type of automatic design. RFID card has a unique identity for every user and thus has the information regarding the user. The system reads the card and authenticates the person to pass the toll gates after deducting a fixed amount from the registered account. The payment in this system is made through wireless mode which provides an ease. [2, 3]. Human effort and time is reduced. The technology used does not require line of sight. This Technology has less cost as compared to manual toll systems. It does not require building huge Tool Plazas, apart from this the maintenance cost of this system is also very low. As of now, we are planning of making this system more accurate. In the future we are looking to add features such as vehicle theft detection, signal breaking avoidance etc. by making the Tolls fully automated.

[2] HARDWARE AND SOFTWARE DETAILS

2.1 Software Details:

1. Arduino IDE: Arduino IDE is an open source software. It is used to write the code and upload the code in any microcontroller. In this project we write the code in Arduino IDE and upload the code in the Arduino Uno board.

2.2 Hardware Details:

1. Arduino UNO : It is a microcontroller which contain 32Kb of flash memory , 1kb of EEPROM and 2kb of SRAM. This board contain14 digital input\output pins and 6 analog input\output pins. In this project we programmed Arduino Uno with the help of Arduino IDE.

2. RFID Reader and 13.56 MHz RFID Tag: RFID reader and RFID tag are most important component of this project. RFID stands for Radio Frequency Identification. It uses electromagnetic field to track and identify the tags. It consists of radio transponder, transmitter and radio receiver.

3. Servo Motor: It is usually a simple DC motor used for specific angular rotation with the help of additional servomechanism. In this project we use the servo motor to lift the gate after the toll collected from the driver.

4. LCD Display: It is used to display all the messages in our project. When the car enters at toll plaza it will display the message "vehicle enter at toll plaza". When there will be a valid transaction then it will show the message "amount is deducted" and if there is invalid transaction then it will show the message "insufficient balance".

5. IR Sensor: It is used to detect the vehicle in this project. We have used two IR sensor in this project.

6. Buzzer: It is an audio signaling device. It is used as an alarm device and it is used to confirm that if we have taken input from user such as when RFID tag will be placed at RFID reader it will produce sound.

7. 10 K Potentiometer

8. 330 ohm Resistor

9. 4.7K Resistor

10. 1K Resistor

11. Veroboard

12. Jumper Wires

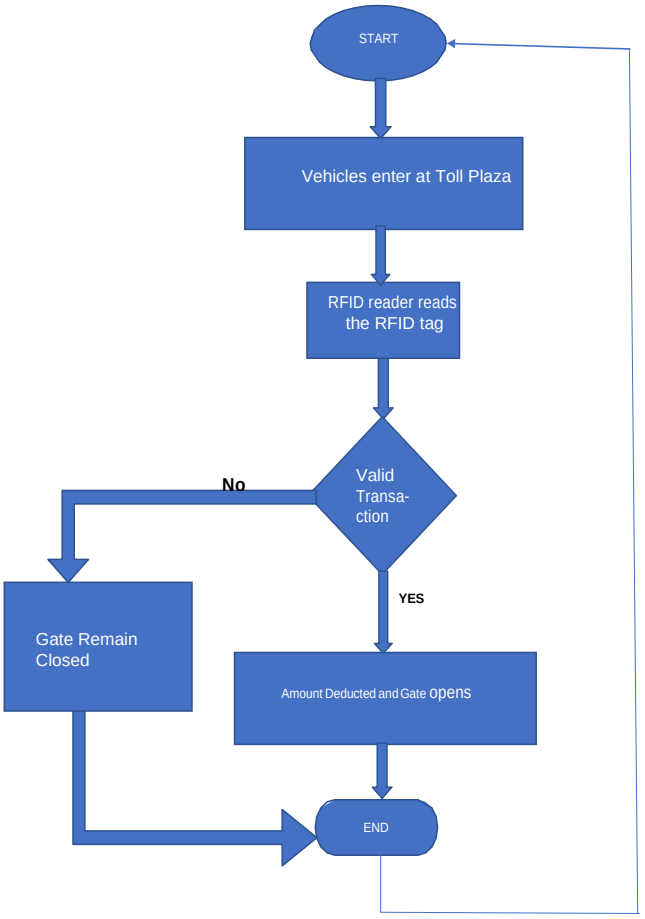

Fig. 1: Flowchart of Automatic Toll Collector.

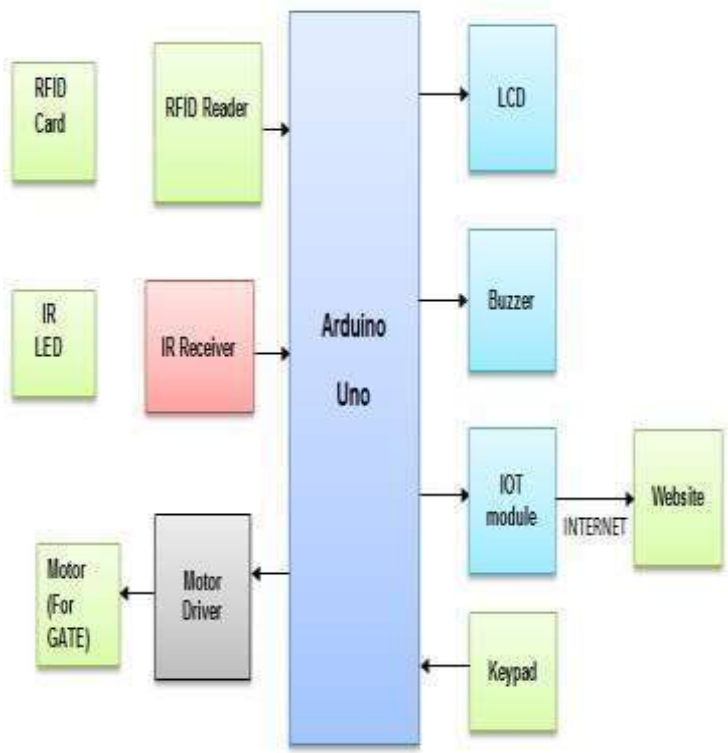

Fig. 2: Block Diagram for Automatic Toll Collection System.

[3] EXPERIMENTAL RESULTS

The project consists of IR Sensors, when the vehicle crosses these sensors, "Vehicle Detected" message is shown in the Lcd Display. Then LCD displays the message to show the RFID card. The card has to be then swiped on the Card Reader. After the card is swiped, the micro-controller: Arduino will check if the card is valid or not. If the card is valid then the micro-controller will check if the card has sufficient balance. The card balance is displayed on the LCD display. Once the micro-controller detects sufficient balance, the toll gate is opened and the vehicle is allowed to pass through. We have used an IR-sensor i.e. Infrared Sensor to indicate that the vehicle has crossed the toll gate and the gate will be closed.

Figure 3 shows the prototype of automatic toll collection. Figures 4–7 show the display of vehicle, Display of Remaining balance and insufficient balance on display. The vehicle is detected with the help of IR obstacle sensor. After which the user has to put the RFID card on the RFID Reader. Then the balance is deducted from the card and the user gets a message "Successfully paid your bill". The use of RFID readers and tags makes the toll tax collection system time efficient and hence reduces the traffic on the highways due to the toll tax collection manually. When the RFID reader detects the RFID tag by its 12-digit code, the money balance from the card is deducted for the toll tax and then only the vehicle is allowed to go further by making the gate open [6, 7].

Fig. 3: The Prototype of Automatic Toll Collection.

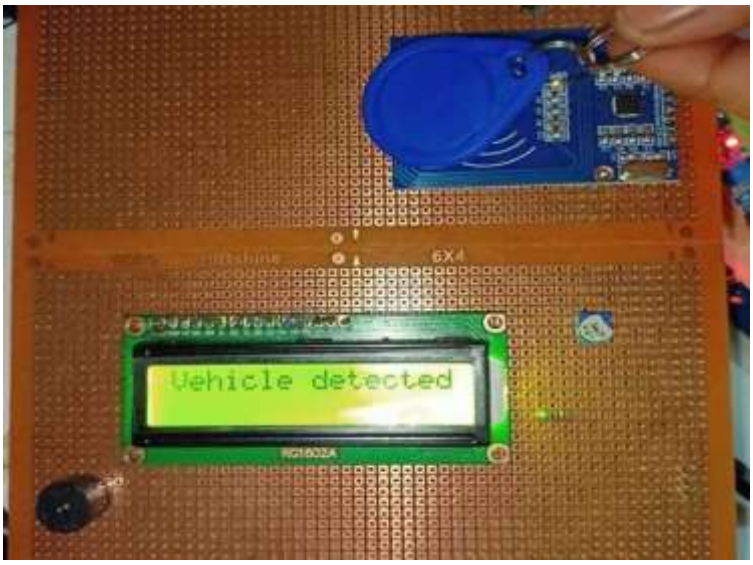

Fig. 4: Display of Vehicle Detected.

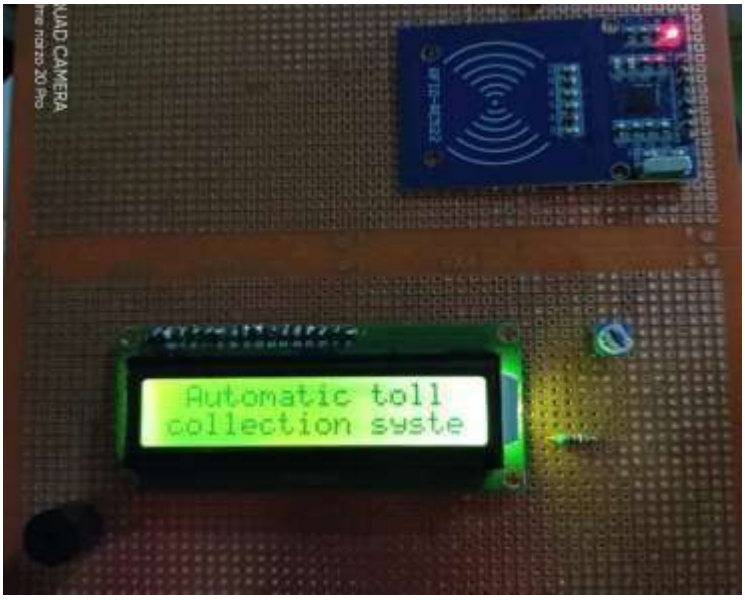

Fig. 5: Automatic Toll System.

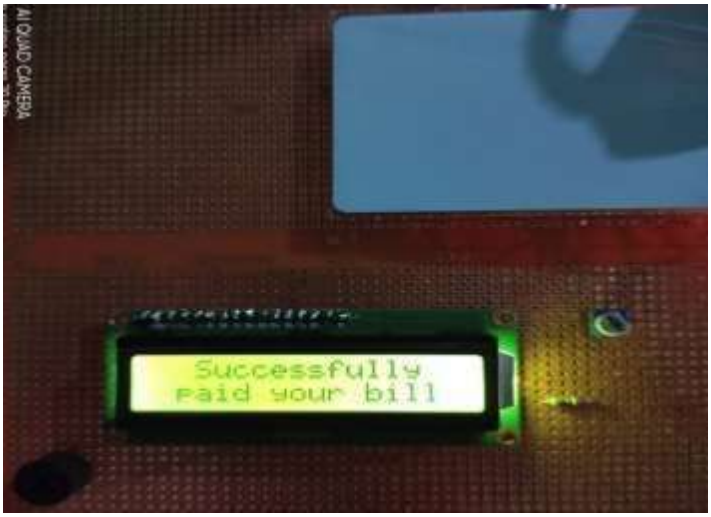

Fig. 6: Success message of toll payment.

Fig. 7: Display of Remaining Balance.

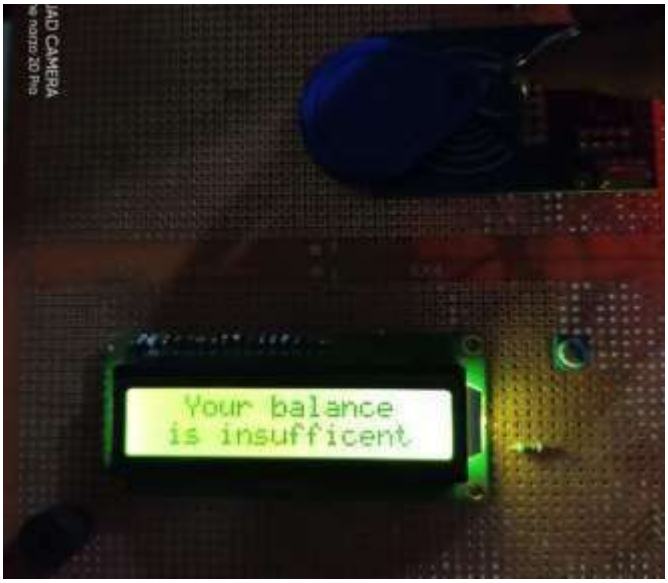

Fig. 8: Display of Insufficient Balance.

[4] CONCLUSION

Thus we have analysed various of current RFID based toll collection systems and to predict their practicality in real life conditions. We also encourage engineers who take this review as a baseline to continue to better the systems discussed for better performance, efficiency and reduced complexity.

[5] ACKNOWLEDGMENT

We would like to express our deepest appreciation to Mr. Manoranjan Kumar ,Assistant Professor (ECE Dept), ADGITM (GGSIPU) for providing suitable guidance and motivating us to research in the field of RFID. I Salman Khan (Co-Author), thanks Rohit Verma(Co-Author) and Shankar Kumar(Co-Author) for selecting such detailed research papers to analyse together and compile this review paper.

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Enhanced Contactless Attendance System

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***Abstract*—Biometric systems use scanners to verify the identity of human beings by measuring the patterns of their behavioral or physiological characteristics. Biometric systems such as fingerprint verification systems, require the user to make direct physical contact with the scanner for a specified duration for the biometric pattern of the user to be properly read and measured. This may increase the possibility of contamination with harmful microbial pathogens or of cross-contamination of food and water by subsequent users. Physical contact also increases the likelihood of inoculation of harmful microbial pathogens into the respiratory tract, thereby triggering infectious diseases. In this viewpoint, we establish the likelihood of infectious disease transmission through touch-based fingerprint biometric devices. As a replacement to traditional biometric systems, we made a contactless attendance system based on the QRCode and Bluetooth proximity based authentication.**

Keywords—API(Application Programming Interface),

Micropython(microcontroller framework written in python),

NoSQL(database), React Native(javascript library)

I. INTRODUCTION

The primary purpose of fingerprint recognition or identification systems is to provide trustworthy verification of users to control access to resources such as computers as well as to critical facilities such as offices and hospitals. These systems also provide useful data for generating summary periodic reports on usage statistics, including the number of participants inside a facility, frequency of entrances and exits, duration of stay, and other intelligence required for monitoring, surveillance, and security administration.

Despite their many benefits, fingerprint scanners are potential sources of disease transmission due to contamination from multiple touches by various users in a wide range of questionable hygienic conditions; as a result, these scanners pose potential transmission risks. Serial use of finger scanners in a given setting may play a more significant role in transmission, as latent prints left on the scanner surface by the deposition of finger moisture, sweat, or oils can soil the surface.

Unhygienic thumbs can potentially leave surviving bacteria, fungi, and viruses on the surface of the scanner after use, thereby increasing the possibility of transmitting germs that cause illnesses, including COVID-19, which is predominantly spread via droplets and contaminated hands or surfaces.

II. RELATED APPROACHES/WORK

There are many proposals for Automatic Attendance Systems in the literature and in the market. Most of them do focus on applications to be installed on the lecturer device, whether a smartphone or a laptop. In the section, we will briefly mention a few of these proposals.

Reference [2] proposes software to be installed in the instructor's mobile telephone. It enables it to query students' mobile telephone via Bluetooth connection and, through transfer of students' mobile telephones' Media Access Control (MAC) addresses to the instructor's mobile telephone; presence of the student can be confirmed.

Reference [3] is another example of a proposal that uses real time face detection algorithms integrated on an existing Learning Management System (LMS). It automatically detects and registers students attending a lecture. The system represents a supplemental tool for instructors, combining algorithms used in machine learning with adaptive methods used to track facial changes during a longer period of time.

On the other hand, in [4], the proposal uses fingerprint verification technique. They propose a system in which fingerprint verification is done by using extraction of minutiae technique and the system that automates the whole process of taking attendance.

III. METHODOLOGY

To achieve the above discussed objectives, a step-by-step methodology has been followed.
The details of methodology are given below:

- Develop an API capable of generating a QR code and marking the attendance by matching data with a NoSQL database.
- Develop an android app that scans the QR code and sends scanned and user data to the server.
- Program a microcontroller to display the QR code and verify proximity of students from it.

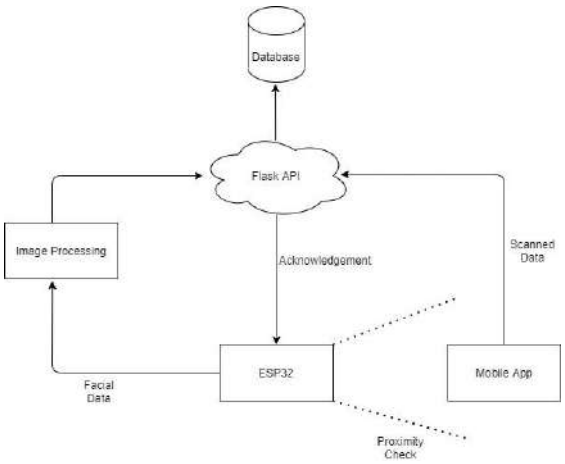

FIg. 1: block diagram

A. Software Required

- Python 3
- Node
- Micropython
- React-native library
- Android OS

B. Hardware Required

- ESP32
- Oled display
- Android Smartphone
- Local or cloud based server

C. Database

The database of student attendance is managed using Firebase realtime database (NoSQL). This database will have enrollment numbers, student's name, and attendance status. The database example is shown in below:

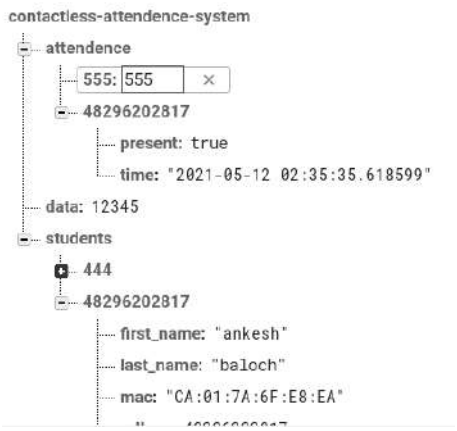

Fig. 2: Firebase NoSQL database

D. QR code Generation

QR codes are generated by using a micropython library - uqr which converts the string data into a matrix consisting of true and false values.

Generated QR code can be retrieved by ESP32 using '/getMatrix' API endpoint. This code then will be displayed on an oled display connected to the microcontroller through an spi interface.

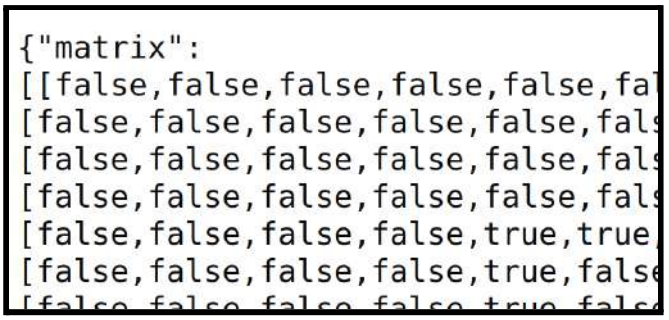

Fig. 3: a section of QR code matrix

E. ESP32 and OLED display

ESP32 is a microcontroller with inbuilt wifi and bluetooth, used in this project for connecting to the API and verifying the proximity of a student's smartphone respectively.

Some specifications of ESP32 microcontroller are

- CPU: Xtensa dual-core (or single-core) 32-bit LX6 microprocessor, operating at 160 or 240 MHz and performing at up to 600 DMIPS
- Ultra low power (ULP) co-processor
- Memory: 520 KiB SRAM
- Wi-Fi: 802.11 b/g/n
- Bluetooth: v4.2 BR/EDR and BLE
- 2 × 8-bit DACs
- 10 × touch sensors (capacitive sensing GPIOs)
- 4 × SPI
- 2 × I²S interfaces
- 2 × I²C interfaces
- 3 × UART

FIg. 4: ESP32 microcontroller

OLED Display

OLED (Organic Light-Emitting Diode) is a self light-emitting technology composed of a thin, multi-layered organic film placed between an anode and cathode. In contrast to LCD technology, OLED does not require a backlight. OLED possesses high application potential for virtually all types of displays and is regarded as the ultimate technology for the next generation of flat-panel displays.

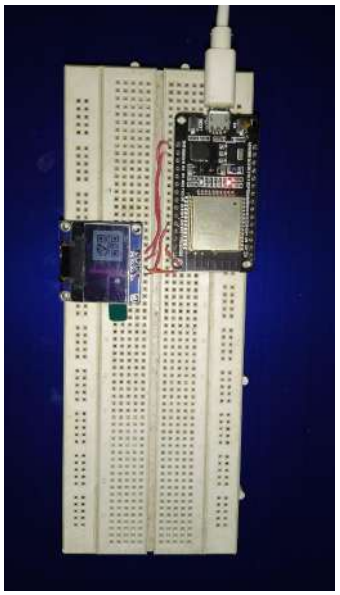

Fig. 5: QR code displayed on oled using ESP32

F. User Validation

User data is present in the database. The api gets the students data and matches the MAC address field with the one provided by the client application. If both fields match, a present is marked for the student and a response is generated which will be given to the client..

G. Attendance Process

Attendance process is as follows:

- Students will have to scan the QR code with their android smartphone.
- Android application will send the data required by the api.
- API will match the data with that in the database and send a response.
- Android application will let the user know if the process was successful or not.

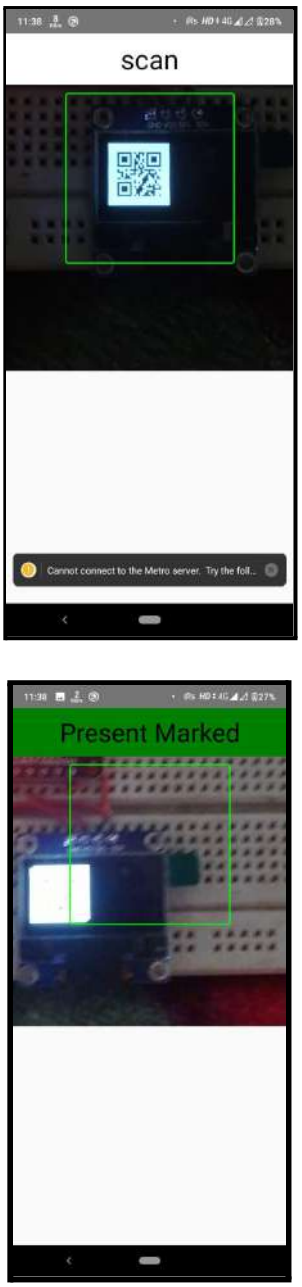

Fig. 6: before and after marking the attendance

If a student does not carry an android smartphone, they can use the facial recognition method by using another student's smartphone (student's facial data must be present on the database for this to work).

G. Exporting Data

If the request is accepted and attendance is marked, that information will be stored in the database.
The API at the same time will add this data to a spreadsheet to make it easily readable.

	A	B	C	D
1	name	roll no.	present	time
2	ankesh baloch	48296202817	yes	2021-05-12 02:35:35.693720
3				
4				
5				
6				

Fig. 7: exported spreadsheet

ADVANTAGES

- Contactless methods prevent the spread of contagious diseases
- Reduce paperwork and save time and money with mobile and cloud-based attendance management system
- It will speed up the process of taking attendance
- More accurate and reliable than traditional attendance system
- Cost-effective and feasible architecture.

LIMITATIONS

- Process depends on internet connectivity, slow connection can delay the process.
- Availability of smartphone is compulsory for marking attendance.

RESULT

The proposed Contactless Attendance System is implemented based on the QRCode and Bluetooth proximity based authentication and can be installed in offices and colleges to keep track of the attendance smoothly and also nullifying the requirement of physical contact in the process. This system is cost-effective and provides a secure interface.

CONCLUSION

Contactless attendance system is a necessary tool for taking attendance in a way which controls the spread of COVID-19. Physical contact has been proven to be the most common source of surface contamination, depositing harmful disease-causing pathogens from bacteria and fungi to viruses. As a way of controlling the spread of COVID-19, this project implement a contactless attendance system and removes the limitation in existing QRCode based system by integrating bluetooth proximity as a factor of authentication while marking attendance

FUTURE SCOPE

The following features can be added in future to make the system more advanced:

- Admin privileges for management
- Dashboard for smooth monitoring and analysis for attendance data
- Support for platforms other than Android OS
- Developing a single PCB unit to decrease the manufacturing cost and ease in installation

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Smart Auditorium With Security System

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Abstract*---In this era where technologies are getting advanced day by day in various field like from small devices to the largest devices and companies. The Smart auditorium with security system is basically used in auditorium, cinema hall or big rooms where there is big gathering of people. It uses IoT devices such as PIR Sensor, LDR (Light Dependent Resistor) and temperature sensor. The main purpose of this project is to reduce the wastage of electricity which is essential part of our lives. It controls the wastage of electricity used in electrical fitting in the auditorium. LED lights are set on auditorium and used even when there are smaller number of people, this can be managed using the smart auditorium with security system. "Security" word is used as to prevent any short circuit in the auditorium which can saves people life. From entry gate and exit gate metal detector are provided with fire alarm attached to it. All this helps in maintaining/ achieving less power supply, security in the auditorium area.

Keywords— Smart Auditorium, PIR Sensor, LDR, Temperature sensor, Security, Metal Detector

I. INTRODUCTION

Many accidents take place in cinema hall, auditorium because of shortage of electricity, especially in India [1]. The main purpose is to reduce the energy wastage caused due to the unnecessary working of electrical fittings when the auditorium is not full. There are many projects that are for smart controlling of electrical devices in the public places like shopping malls, cinema hall and auditorium as they can help in ensuring safety, giving guidance to the seat, power saving and number of seats available [3]. In this research paper design, proposed purpose is smartest way to utilize electricity and make the things easy using some components such as LED, LDR, Temperature Sensor, PIR Sensor which are part of IoT era [5]. Metal Detector are used in the entry and exit gate for the identifying the tools that are being carried to the hall because in many places there is report of loot, murder and terrorist attack in cinema hall and auditorium. LCD is used to display the number of people who are present at the location or auditorium. All this is attached to Arduino.

The main aim of this paper is monitoring power usage and guiding the audience to the un-occupied rows in any area with giving path to them using path light. Temperature and fan speed is maintained using temperature sensor and cooling fan devices.

II. COMPONENTS USED

A. PIR Sensor

PIR sensor provide the feature of sensing motion which detects whether human is moving in or of the sensing range. It is rectangular, small, low-power consumption and easy to use. They are also known as Pyroelectric, Passive Infrared or IR Motion. It is small therefore used in many appliances.

Figure 2.1: PIR Sensor

B. Metal Detector Sensor

It is an electronic device that detects the presence of metal nearby. It helps in finding out the hidden metals with an object. They are handheld devices. You can see these devices on security areas such as metro station entry gates, auditorium entry and exit gate. It has a simple structure and its sensitivity depends on the type of metal detector person is carrying.

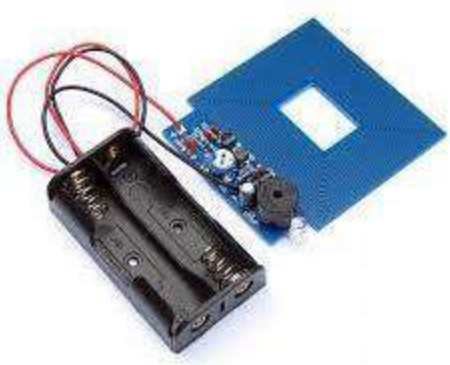

Figure 2.2: Metal Detector

C. LDR

It stands for Light Dependent Resistor which is light sensitive device. It is a sensor that is needed to sense the presence and absence of light level. Resistor use is to control the light intensity.

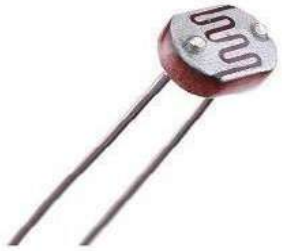

Figure 2.3: Light Dependent Resistor

D. Temperature Sensor

It is an electronic device that measures the temperature of it surrounding. Since temperature is most common factor for smart auditorium as it maintains the temperature of the auditorium according to the need. It is made up of two metals, that generates electrical voltage or resistance to notice the change in temperature.

Figure 2.4: Temperature Sensor

E. LCD

LCD stands for Liquid Crystal Display which is flat and rectangular in shape. In this project it will be used to display the status of the number of people present inside the hall and when is auditorium empty. LCD is also known as thin film transistor because of its active and passive matrix. LCD consume less power therefore used in many other projects and technologies.

Figure 2.5: LCD

F. Cooling Fan

For the cooling effect in big closed areas i.e., auditorium, function area cooling fan are used for providing cool effect inside and helps in keeping the area cool for longer period of time.

Figure 2.6: Cooling Fan

G. Buzzer

It is used with the metal detector for safety purposes as when the metal detector detects any metallic device the buzzer starts beeping automatically. Since it's small in size therefore its used in many small as well as big and basic projects. In this project the buzzer that can be used is piezoelectric buzzer or magnetic buzzer.

Figure 2.7: Buzzer

H. Arduino Uno

Arduino Uno is a microcontroller board that has different pins i.e., digital and analog pins with chargeable point that can be attached with any other devices. When the program is installed into it the Arduino using Arduino.cc, it start working and the devices connected to it gets into motion of their work.

Figure 2.8: Arduino Uno

III. IMPLEMENTATION

The project starts with the usage of metal detector with the buzzer at the entry and exit gate which detects the people and their belongings. The LCD display is to the other side of the gate which keeps the count of the number of people in the auditorium. The path light attached with LDR is used for guiding the people to their specific seats or vacant seat. Fan speed and controller switch is given to each side which automatically gets off and on according to the crowd present and temperature sensor is used for the controlling the temperature that senses the temperature inside. PIR sensor is used with the LCD screen as it detects the movement of the person at the entry and exit gate and lcd keeps on displaying the number of people present. When the auditorium is empty then LCD screen displays EMPTY and all the appliances goes to OFF.

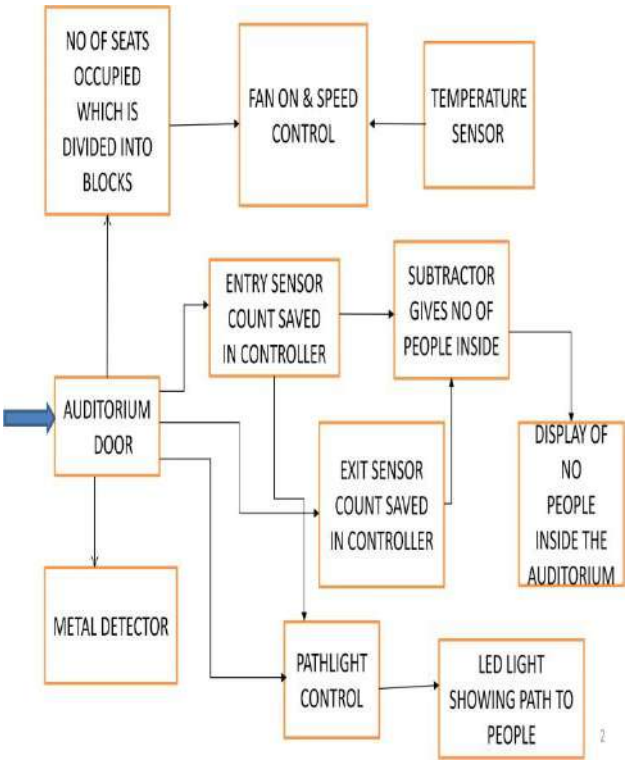

Figure 3.1: Block Diagram

IV. RESULT

In the end we get the value on the lcd display that how many people are still in the auditorium after subtracting the people who are leaving the auditorium. Path lights gets off after the auditorium goes empty. PIR sensor detects when the person enters and leave the auditorium. Metal detector on the other end detects the persons for the security and safety precautions.

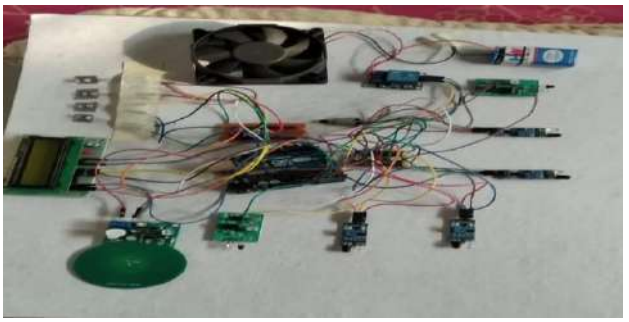

Figure 4.1: Result

V. CONCLUSION

This concept is developed for the real time model for controlling and monitoring the auditorium which is compatible for coming technologies. The power saving and security property of this project makes it more efficient for the use and can be adapted and extended with many others features. This paper shows the main advantages of the smart auditorium with its implementation and components required [2]. No human effort will be required in schools, cinema hall, college, theatre, shopping mall, meeting room, office gates and auditorium [4]. Interfaces of this project is little difficult because of usage of so many devices for its working. When people start entering the auditorium LCD starting counting the people entering and show it on screen from the electricity is turned on where required. The path light is used for guiding the person to the vacant seat. We can use QR scanner at the entry where person can see his/her desired seat. At last, when auditorium goes empty the fans and light automatically goes to OFF. By implementing this system, it will be easy in power conservation and help the future generation.

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GAS LEAKAGE MONITORING SYSTEM USING CLOUD

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Abstract – In the 21st century the trend is that the developments of Smart homes all round the world. Home automation has become very affordable nowadays and lots of people, industries has begun to get this. Gas monitoring system is a device that detects the existence of gases in our surrounding. This factor results in a necessity of a gas detection system to be installed at such accident-prone locations for continuous monitoring of any leakage which can't be detected by the human senses. The given system will continuously monitor our surrounding for any existence leakage. just in case of any leakage detection, it'll alert the user via a SMS.

Key Words: IOT (Internet of Things), SMS alert, MQ 6 gas sensor, cloud

I. INTRODUCTION

Safety is very important in today's world as accidents are susceptible to happen anywhere. Toxic gases causes very serious health impacts, but the are utilized in industries in large quantities. The system will detect the presence of any gas leakage by using the gas sensor module and it pass it to the Arduino board which can perform the later actions. The people within the neighbourhood also can be included just in case of an emergency. Many deaths round the world is caused due to gas leakage. Thus, it's ensured that one doesn't need to worry about the gas leakage becoming highly intense and out of control that it can be highly risky to life or the environment and also notifying and alerting the workers or residents about the gas leakage [1].

II. REQUIREMENT ANALYSIS

A. Gas Sensor

The electrical properties of the sensor changes with variations in gas concentration. Sensitive material of [2] MQ-6 gas sensor is SnO2, which with lower conductivity in clean air compared to MQ-3 and MQ-7. The sensors conductivity increases with the rising concentration of any gas. MQ-6 gas sensor has high sensitivity to Propane, Butane and LPG, also response to Natural gas while other sensors are less sensitive to LPG.

B. Temperature Sensor

The DHT11 [5] is a digital temperature and humidity sensor. It uses humidity sensor and a thermistor to measure the surrounding environment and gives out a digital signal on the data pin (no analog input pins needed). It is easy to use but careful timing is required to get a correct data. It gives new data after every 2 second. So, while using our library, sensor readings can be 2 seconds old but this is a negligible delay.

C. Arduino Uno

Arduino Uno [2] is a microcontroller that uses ATMEGA 32 IC as its brain. It is basically a development board developed in Italy. It contains 6 Analog pins A0-A5 and 14 Digital pins D0-D13 used for input and output operations. It can be interfaced with a lot of sensors like Bluetooth, Ultrasonic sensor, etc. It can operate with at 5V from USB plug or can also operate at 12V from external power supply.

D. GSM Module

A GSM module [4] is a chip or circuit that will be used to establish communication between a mobile device or a computing machine and a GSM or GPRS system. They have all the functionalities of a mobile phone through computer like SMS, MMS, making and receiving calls, etc. These are mainly employed for computer-based SMS and MMS services. GSM is a digital cellular technology which is used to transmit mobile voice and data services. It operates at 850MHz, 900MHz, 1800MHz, and 1900MHz frequency bands. This was developed using TDMA.

E. Cloud Analysis

On cloud, [2] analyse and store the data and communicate wirelessly for further analysis is possible. Anyone can access the leakage data from anywhere using any Internet enabled device like PC, tablet or smart phone, and analyse it.

III. BLOCK DIAGRAM

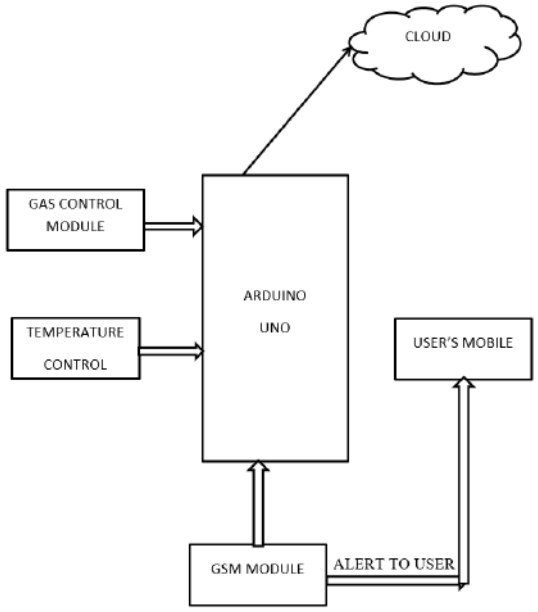

Fig 1. Block Diagram

IV. WORKING

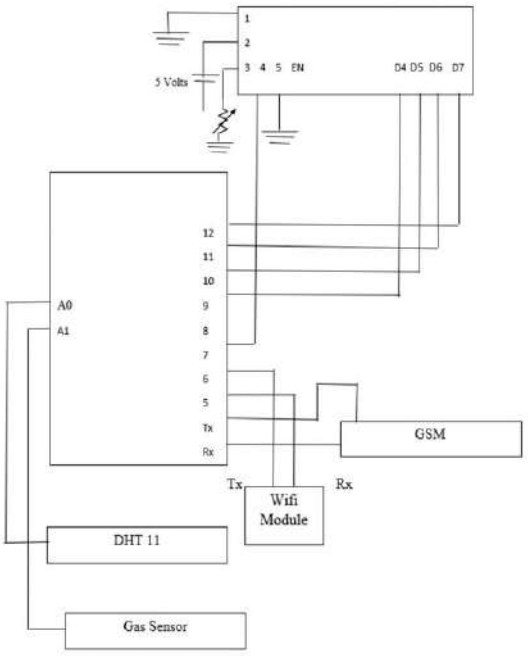

Fig 2. Circuit Diagram

V. HARDWARE IMPLEMENTATION

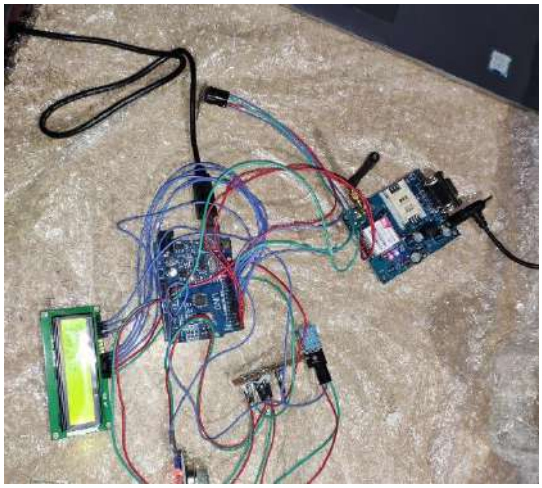

Fig 3. Project Hardware

IV. RESULT

In this project Arduino UNO is the main component. This proposed system is an intelligent system and it eliminates the need of continuous monitoring by human resource. This system continuously checks the status of place by sensors if there is any kind of leakage or fire. And sends the alert message to the owner. The data is also getting published in the cloud which also gives real time update. The gas concentration and the temperature value can be visualised in the form of graphs.

Fig 4. LCD Screen

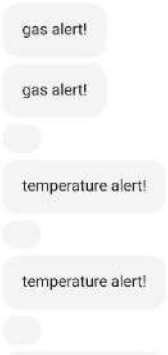

Fig 5. SMS Alert

Fig 6. Gas Concentration published on Cloud

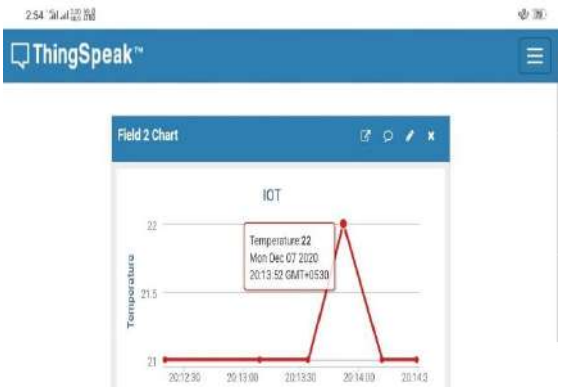

Fig 7. Temperature value published on Cloud

V. CONCLUSION

Gas leakage causes several accidents which results in material losses and human injuries. The main reason to Gas leakage is poor maintenance of equipments and lack of awareness to the people. Hence, LPG leakage detection is very much required to prevent accidents and save precious human lives. This paper provides these essential things.

Another advantage of this device is that even though if no one is present in the home and gas leaks occurs at that time, then GSM module is there which sends immediate messages to the users regarding the gas leak and thus it lowers the intensity of accidents. GSM modules gives the safety in this device. This gas leakage monitoring system is implemented successfully and is easy to use and also a low cost device. This system is very simple yet reliable.

VI. FUTURE WORK

A mobile gas sensing robot can be constructed to sense the leakage of gas through pipelines as the robot can move in a track which is built along the pipeline.

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Greenhouse Monitoring and Controlling System

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***Abstract*—In traditional farming, farmer has to visit the farming land regularly to measure the various environmental parameters such as temperature, humidity, light intensity and soil moisture to cultivate the right crops at right time in rightsoil. Even though this traditional farming system have been used for years, the system is hectic and fail to prove high productivity rate as farmer usually unable to measure all the parameter accurately. In contrast, greenhouse farming is a system where farmer cultivate crops in ecosystem environments where all environmental parameters are adjusted based on crops types. Automation in greenhouse is a method where farmer is able to monitor and control the greenhouse environment automatically from anywhere in the world any time. In this paper, authors proposed an automated greenhouse monitoring and controlling system that incorporate various sensors such as temperature sensor, humidity sensor, light sensor and soil moisture sensor to collect possible environmental parameters of greenhouse as well as integrate Arduino Uno R3 (to store and process data), GSM module (to send the measured value of the various parameters to the user cell phone via SMS to ensure efficient growth of plants), solar power system with rechargeable battery (to make sure continuous power supply to the greenhouse system). Moreover, Internet of Things (IoT) is used to store data to a database and process the collected data and finally send the information to the android apps which has been developed for monitoring and controlling of greenhouse by the user. Moreover, the authors compared the proposed greenhouse model with some recent works and found the proposed system cost effective, efficient andeffective by analyzing major environmental parameters. Finally, authors analyze the cost associated with the deployment of proposed greenhouse model which depict quite affordable for farmers and worth deploying.**

***Index Terms*—Arduino, Greenhouse, Sensors, Solar Power.**

I. Introduction

Greenhouse is a glass made structure that provides an adjustable environment in order to grow plants productively. In greenhouse system, the solar radiation from the sun isabsorbed by plants, soil and other things inside the greenhouse, as the glass is lucid. Planning in greenhouse environment is a process where an ideal environment is provided for crops to grow strong that in turns improves the quality of the crops and enhances the performance of thefarmers. A state of the art low cost greenhouse system that provide optimal environmental conditions could lead to tremendous farming productivity in countries where there are unfavorable climate conditions, infertile land or some externalrisk of pests. An efficient and effective greenhouse monitoring and controlling system can increase productivity, 1can reduce risk of production, and can provide food all year round by maintaining the intensity of light, the level of humidity, the level of temperature and the moisture level of soil.

Bangladesh is one of leading agricultural countries in the world where over 80% people actively or passively related to farming. Besides, the economic stability mostly depends on good productivity in farming. Ironically, Bangladesh is experiencing tremendous problems in farming and hence, alarming rate of food shortage for the people of Bangladesh day by day. Bangladesh is a densely populated country in the world and currently, the number of people is increasing exponentially. Therefore, the demand for land and food is enormous to accommodate those increasing number of people. People are occupying active farming land to build their house and to establish household related stuff. As a result, farming land is decreasing with the increasing demand of food for growing number of people. Besides, farmers of Bangladesh are experiencing extremely adverse climate conditions which cause poor growth of plants. Considering all the alarmingsituations, Greenhouses can be alternative solution to grow plants under natural environmental conditions. Various environmental factors are directly related for proper growth of plants. Out of various factors, factors like light, temperature, humidity, soil moisture are most essential for successful plant nourishing. The reason for damage plant due to disease is related to Poor or weak environment. So, overcome this problem primarily proper measuring climate factors and control that factors automatically may result lead to overcome this bad climate situation. Identifying those parameters that cause various diseases for plant growth are needed to be controlled to surpass these diseases. Hence, authors made an automatic greenhouse system which is efficient, timely and effective for monitoring the parameters of greenhouse in different types of environmental conditions.

II. Design of Greenhouse Monitoring & Controlling System

In order to develop a successful greenhouse system, the following parameters such as temperature, light intensity, humidity, and moisture of the soil should be adjusted in such a way that different plants can grow perfectly. Therefore, continuous monitoring of temperature, light intensity, humidity, and moisture of the soil is utmost important in greenhouse system. In this paper, four different sensors such as temperature sensor, light sensor, humidity sensor,

and soil moisture sensor have been used for collecting data of such four essential parameters continuously. The primary device of the greenhouse monitoring and controlling system is Arduino Uno R3 which is used to store the data collected by different sensors mentioned above as well as process the data. An android app has been developed in order to monitor and control the greenhouse information through Smartphone from anywhere in the world any time. Besides, if there are any changes inside the greenhouse system then users of greenhouse system will be notified by SMS which is done by GSM module. Moreover, the whole greenhouse system is powered by solar power system incorporating solar panel and a rechargeable battery. Here, rechargeable battery isused to store the power and deliver the continuous power supply to the different devices of greenhouse system. The following Fig. 1 depicts the block diagram of greenhouse monitoring and controlling system:

Fig. 1: Block Diagram of Greenhouse Monitoring System

A. *Hardware Description*

In order to monitor the complete greenhouse system environment different type sensors such as temperature sensor, humidity sensor, light sensor and soil moisture sensor are employed for designing hardware system for greenhouse. An Arduino Uno R3 has been used as a central device to store and process data. An LCD (Liquid Crystal Display) Module has been used to display the parameters to the user. Besides, a GSM (Global System for Mobile Communication) Module has been used to update user through SMS. Moreover, some Relays, converters (analog todigital and digital to analog), solar power system including rechargeable Battery have been used in this novel greenhouse monitoring and controlling system .

B. *Software Specification*

To show the parameters that are collected through different sensors and to monitor the complete greenhouse system a program has been developed in this paper. Different sensors will provide various measurements which comprise the reading of data, converting analog to digital values, showing in the LCD module and updating the user by sending short message. The program is written in Arduino IDE (1.8.3). The program will be loaded in the Arduino, once the program is successfully built in the IDE by using serial communication.

III. HARDWARE SYSTEM

In this paper, following hardware units have been used:

A. *Arduino Uno*

An Arduino Uno R3 is used in this project which is nothing but a microcontroller board based on the ATmega328. It consists of 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. All these modules are needed to support the microcontroller and simply established connection with the computer through a USB cable or power it with an AC-to-DC adapter or battery to getstarted. Together with this hardware, a database has been created with the implement of internet of things (IoT). The figure below shows the architecture of ATmega328.

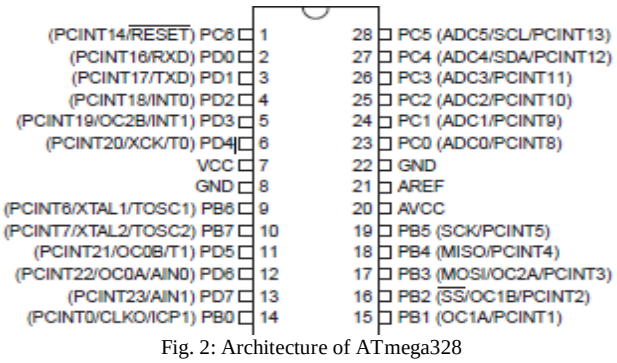

Fig. 2: Architecture of ATmega328

B. *Temperature Sensor*

In the proposed greenhouse system, a temperature sensor of which the main part named IC LM35 has been used. The LM35 series consist of precision integrated circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature. The LM35 device is operating over a −55°C to 150°C temperature range and the operating voltage is from 4V to 30V. When temperature crosses from a defined level or critical level, the system automatically turns on the fan. On the hand, if the measured temperature in case of normal range or comes below the defined level the fan turns off automatically.

C. *Humidity Sensor and Soil Moisture Sensor*

A Humidity Sensor Unit known as HSU-07 Series has been used to implement the proposed greenhouse system. Its operating voltage is 0-7 Volt, operating temperature range is -20~+60 ℃, and operating humidity range is 20-90% RH.

Soil moisture plays an important role for growing good plants. A soil moisture sensor has been used to determine the moisture of the soil. By placing two probes of soil moisture sensors inside the soil, value of moisture in the soil can be measured and the outcome is send to the owner of the greenhouse system using GSM via SMS.

D. *Light Sensor Module*

Light intensity also plays an important role in greenhouse system. Proper light intensity is essential for growth of the plants. Varying light intensity may result severe affect in plant growing and hence loss of productivity. There is aLDR in light sensor module which can help to detect light intensity. In this paper, artificial lights are used to resolve the problem of low light intensity inside the greenhouse

system. When light intensity is compared lower level with a defined level, the artificial lights automatically turn on. In case of normal range of light intensity can lead the artificial lights automatically turns off.

E. Liquid Crystal Display

A liquid crystal display (LCD) is a flat panel display or other electronically modulated optical device that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. In this system, we have used a 20×4 LCD and its operating voltage is 5V.

F. GSM

Global System for Mobile Communication (GSM) is communication modem which is an open and digital cellular technology responsible for transmitting mobile voice and data services operated at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands. In this paper, we have used GSM SIM900A Module which is operated at the 900/1800 MHz frequency bands. In order to operate the GSM module, A SIM card is to be inserted into modem and subscription is required from network operator.

G. Solar Panel

In this system, we have used a 12V (10Watt) solar panel for charging the battery for the purpose of uninterrupted monitoring and controlling of greenhouse system. The battery will be directly charged from the solar panel and that can be support continuous power supply to the system. With the aid of solar charge controller, the battery will be charge from the solar power .

H. Relay

A relay is an electrically operated switch that are used to control a circuit by a separate low-power signal or where several circuits must be controlled by one signal. In this system, we have used 6V relay to switch the fan and light when it is required to on or off.

IV. Implementation Of Greenhouse Monitoring System

A. Flow Diagram

The figure below shows the working flow of the proposed greenhouse monitoring and controlling system.

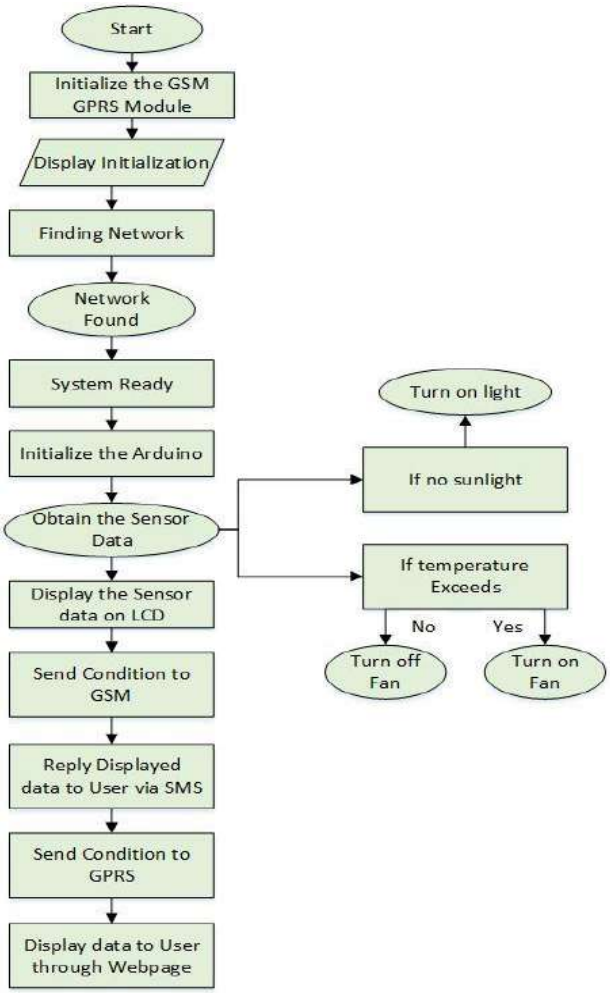

Fig. 3: Flowchart of the proposed system

B. Hardware Implementation

Fig. 4 shows the prototype of proposed automated greenhouse system. This is the simulated environment of greenhouse system where LCD displays the measurement of the parameter of various sensors.

Fig. 4: Prototype of proposed greenhouse system

Fig. 5 illustrates The proposed greenhouse system has been wired using jumper cables. A 5V DC power supply is provided for GSM module, four Sensors, and LCD. Besides, 12V DC power is provided for light and fan. And, 9V DC power is provided for Arduino Uno R3. A voltage regulator has been used to regulate the power to the different components connected to the system. Relays are used to switch the fan and light when

used to send the measured data to the owner's cell phone via SMS.

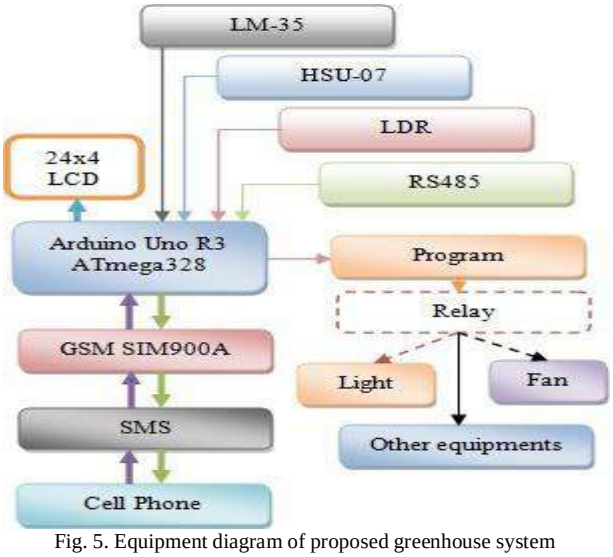

Fig. 5. Equipment diagram of proposed greenhouse system

C. Software Implementation

For software implementation, Fig. 6 demonstrates the flow chart of the program for the proposed greenhouse monitoring and controlling system. The program has been written in Arduino IDE for measuring the intensity of light, inside temperature, humidity, and moisture of the soil. The measured value of different parameters is sent to the owner's mobile phone as SMS via GSM module.

Fig. 6: Flowchart of the program for the proposed system

V. RESULTS AND ANALYSIS

Development of automatic greenhouse monitoring and controlling system using sensors and solar power is completed effectively. The system has been tested under simulated environment successfully and depicted the capability of monitoring and controlling the intensity of the light, humidity of the air and inside temperature and moisture level of the soil. The values of various parameters like temperature, humidity, soil moisture, and light intensity are measured successfully and the measured values are displayed on LCD that is attached with the system. The communication between Ardiuno Uno R3 board and various sensors is done accurately with no interference observed. It can be seen that the device is capable to send SMS that incorporate updated temperature, humidity, light intensity and moisture of soil using GSM module. The user has to send a code like *total# to the GSM. Then, the measured values are sent to the owner's mobile phone as SMS via GSM module. Fig. 7 shows a sample of SMS that has been sent to owner's mobile. In terms of light intensity, If the value exceeds, the light and fan are automatically switched on and when the value is in normal condition the fan and light remains off. Fig. 8, 9, and 10 provide graphical representation of humidity, temperature and soil moisture respectively in different times of the day. The graph has been created using the data from the database. The complete greenhouse system is powered by solar power system incorporating a rechargeable battery. The solar power ensures uninterrupted and continuous power supply to the greenhouse system.

Fig. 7: Sample SMS containing data of the working system

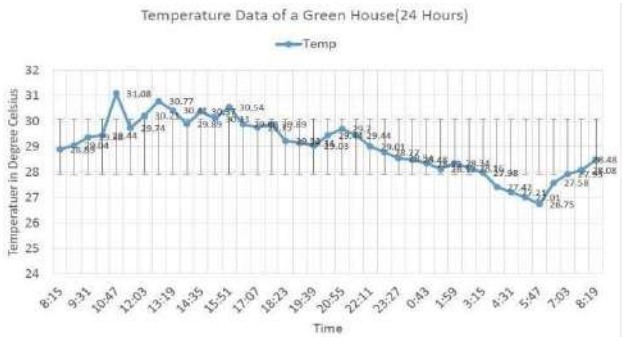

Fig. 8: Temperature data of greenhouse in various times of the day

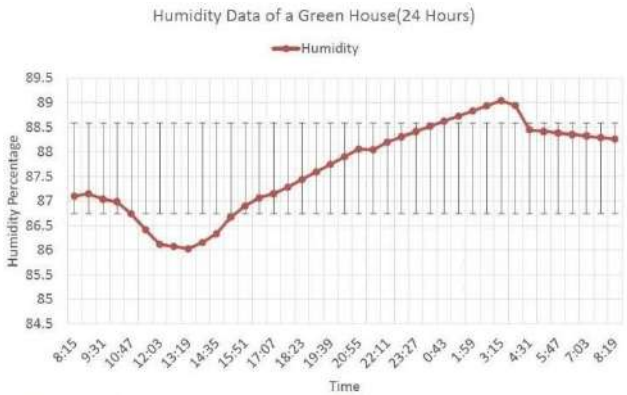

Fig. 9: Humidity data of greenhouse in various times of the day

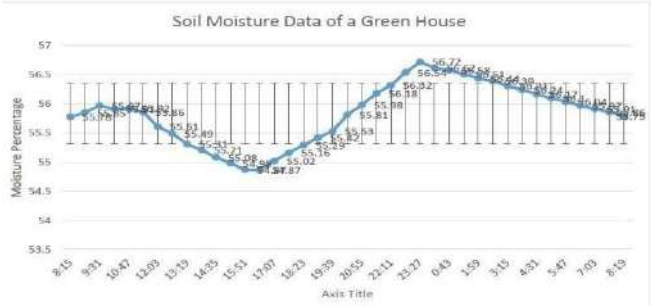

Fig. 10: Moisture value of soil in different times of the day

The table below illustrates how proposed greenhouse system offer automation along with all possible services in comparison with recent works related to greenhouse system by other researchers.

TABLE I: COMPARISON OF THE PROPOSED SYSTEM WITH RECENT WORKS

Ref. No.	Temperature Sensor	Humidity Sensor	LDR	Soil Moisture Sensor	GSM	Power Supply	Continuous operation of system
[1]	√	√	√	√		AC	Not possible
[6]	√	√			√	DC	Not possible
[9]		√				DC	Not possible
[17]	√	√	√			DC	Not possible
[20]	√	√	√			DC	Not possible
This Project	√	√	√	√	√	DC (Solar Power)	Possible

The following Table II illustrates the possible cost incurred for the deployment of proposed automatic greenhouse monitoring and controlling system in Bangladesh. It can be seen from the table that it is quite cheap and worth deploying compare with the higher productivity of this system.

TABLE II: COST ANALYSIS OF DEPLOYING AUTOMATIC GREENHOUSE SYSTEM

No.	Parts Name	Quantity	Amount (BDT)	Total (BDT)
1.	Arduino Uno R3	1	650	650
2.	GSM Module	1	4000	4000
3.	LCD	1	400	400
4.	Battery	1	1100	1100
5.	Solar Panel	1	900	900
6.	Charge Controller	1	300	300
7.	Temperature Sensor	1	150	150
8.	Humidity Sensor	1	400	400
9.	Soil Moisture Sensor	1	500	500
10.	Light Sensor Module	1	100	100
11.	Fan	2	70	140
12.	Light	2	40	80
13.	Voltage Regulator	6		82
14.	Capacitor, Resistor	6		28
15.	LED, Switch, Potentiometer	5		42
16.	Relay	2		75
17.	Diode	5		25
18.	Wires			250
19.	Vero board	4	25	100
20.	Glass Box	1	1500	1500
			In BDT	10,822

VI. CONCLUSION

The developed cost effective greenhouse model can be used to monitor and control temperature, light intensity, humidity and soil moisture of a greenhouse in order to increase productivity in farming especially in countries like Bangladesh where there is ample risk of insect infestation, harsh climate and increasing demand of food with the decrease of fertile land. The model is fully automatic and so, does not require human interaction to smooth monitoring the plant as it is operated by solar power system withrechargeable battery. In order to analyze the data, an Internetof Things based databases has included in this model. Besides, the authors presented a comparison table that clearly described the developed greenhouse model as state of the art greenhouse system. Moreover, a cost analysis tablehas added in this paper to depict affordable and cost effective greenhouse model for farmers. However, there are some future work needs to be done such as exact determination of soil texture and use of fertilizer aptly.

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A REVIEW PAPER ON ENERGY BLOCKCHAIN

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Abstract - This paper introduces a mechanism for peer-to-peer version of electronic cash that would allow online payments to be sent directly from one party to another without going through a centralized institution for doing sustainable practices. Since, blockchain technology can record and transfer information flow reliably, realize point-to-point transactions between suppliers and demanders to achieve "decentralization",. We propose a solution to incentivize users for doing environmental friendly activities by involving into a peer-to-peer lending network powered by intensive computational power.The system incorporates network timestamps transactions and a distributed database forming a digital record that cannot be forged without redoing the proof-of-work. The blockchain technology acts as a trust value machine, powering the ecochain backend business logic. The network itself requires minimal structure. At the same time, the paper looks forward to building a crypto based green energy ecosystem for future generations.

Key words: Blockchain, decentralization, peer-to-peer

1. INTRODUCTION

In today's era, blockchain technology is a breakthrough which has revolutionized peer-to-peer lending. The technology stores information reliably, in a decentralised manner with peer to peer networks.Various economic sectors use blockchain for a variety of economic transactions and record-keeping purposes, few of them are: technology, healthcare, accounting, consulting, and manufacturing. Digital cryptocurrencies are limited in demand, before the era of Bitcoin because Digital currencies are infinitely copyable. As we have an unlimited supply and limited demand so their natural value was (theoretically) zero before. Today the exchange of information works similarly to the exchange of value ; from point-to-point, involving middlemen and third parties. Just like the internet was a revolution for data transfer , cryptocurrencies are innovative and can create a boom in the coming few decades.Our Blockchain based project *Eco-chain* brings revolutionary changes in the consumer mindset globally and can enforce environmentally favoured practices. The application work as follows:
In a decentralized network the verification of data is an important aspect when building a data structure. To distinguish between valid data and malicious information participants need a reliable way. Hash functions are a first major building block of the technology and mathematical one-way functions used to verify data in blockchains Several important steps from creating an address, to proving ownership, and even verifying the integrity of the blockchain itself is done using them. A property of all hash functions is that they consume inputs of variable length and

produce an output of fixed length called the *hash value*. Another functionality used for creating blockchain systems are, The consensus mechanisms. It ensures that all participants maintain a consistent record of transactions. The peers agree on a common version of history with every block which is being added. There are various ways to achieve consensus in distributed networks. Public blockchains are commodities, meaning they are digital entities that anyone with an internet connection can access. Nobody owns these commodities, so there is no central keeper or provider for their infrastructure. Instead, the infrastructure is provided by many independent peers spread across the globe powered by the internet. Since, the nodes of the network run independently from one another, the infrastructure as a whole, the distributed *Peer-to-Peer network*, is highly performant and reliable.

By carrying out prescribed practises on the system users are rewarded with ecash which they can use for buying products or can use the crypto money as an investment. In order to make the system successful, few methods are behind the implementation, such as consensus algorithms on which people will be mutually co-operative, and believing them to be worth participating in and investing in eco-cash, the crypto money of the system. Social scalability will be one of the driving mechanisms behind the system.

2. LITERATURE SURVEY

Smart contracts: are most often discussed in the context of decentralized applications or dApps. A dApp can be pretty much everything, from a decentralized exchange to an auctioning platform or games. You can find an extensive overview of what is on the market today on State of the dApps.Most crypto tokens are issued on the Ethereum blockchain using the Ethereum Request for Comment (ERC-20) standard. A token is issued within a smart contract that defines the total supply and the conditions for token transfers, among other things. The ERC-20 token standard is a smart contract template that allows for easy issuance and integration with different wallets and exchanges. Smart contracts promise to significantly reduce the need for middlemen, such as lawyers or notaries, and thereby reduce the cost of transacting. Most importantly, they save participants time by disposing of intermediaries. Many use cases can be constructed that achieve just that. A dApp - or decentralized application - allows its users to perform a group of coordinated functions, tasks, or activities, just like any other application you are used to. Most traditional applications use API's - application programming interfaces - to communicate with their various components, such as social media integrations or underlying databases.

A dApp uses one or more smart contracts to communicate with its underlying blockchain. The smart contracts can be used to detect incoming payments from users, issue payments to its users, to serve as an escrow, or to trigger an action based on some form of submitted data. Smart Contracts can ensure objective execution on the basis of mutually agreed-upon terms enforced by code. They have the potential to reduce middlemen and thereby reduce cost and save time. They will most likely foster a closer connection between software developers and the judicial system. The creation of tokens and the deployment of state- and payment channel networks are the most common use cases for smart contracts. Before we can see widespread adoption, we have to overcome some hurdles. Scaling issues have to be addressed because smart contracts running entirely on-chain put a lot of stress on their underlying blockchain. Second layer technologies such as state channels or parallelization approaches like sidechains could solve this. For many

use cases, smart contracts need to learn about real-world events through oracles. Centralized solutions remove the killer feature of smart contracts - trustlessness - while prediction markets might create incentives around the probability of an event in a problematic fashion.[4]

3. TECHNOLOGY

[1] User Centred Frontend Architecture

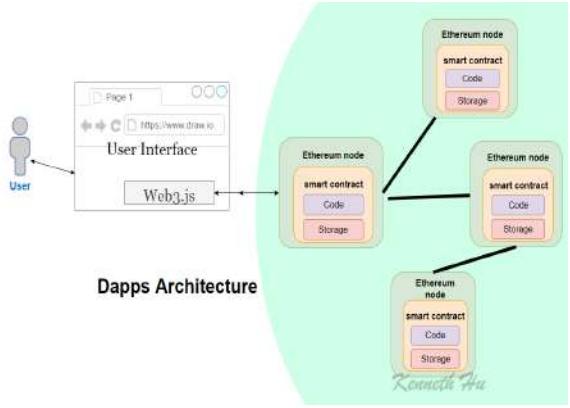

Fig.1 Frontend Architecture

The Application layer available to users are built using frontend technologies that interact with blockchain interoperable backends. As we are using Ethereum infrastructure, web3.js is being used. It is a collection of libraries that allow applications to interact with a local or remote ethereum node using HTTP, IPC or WebSocket.Web3.js provides state of the art features such as authorizations, binding interfaces, contract interfaces, etc. The user Interface is powered with React.js library for easy to use application.

[2] Backend Architecture

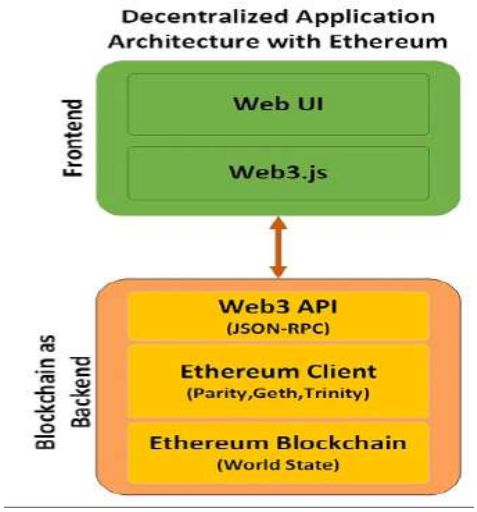

Fig.2 Backend Architecture

The backend consists of making smart eco-contracts with ethereum nodes, a client Api to connect to the global ethereum state, Systems are built on protocols. The Ethereum protocol itself exists solely for the purpose of keeping the continuous, uninterrupted, and immutable operation of this special state machine; It's the environment in which all Ethereum accounts and smart contracts live. The ecochain consists of smart contracts, written using solidity programming language that compiles to EVM bytecode. The web3Api interacts with an ethereum client that verifies all transactions in each block, keeping the network secure and the data accurate. They collectively store the state of the Ethereum blockchain and reach consensus on transactions to mutate the blockchain state. And the events are transmitted to the frontend via events triggering mechanism. [2]

4. CONCLUSION

The characteristics of the eco-chain are specifically described to show its advantages in the real world applications. As per sources, it has been concluded that the carbon market has reached a level, which will lay the foundation for eco-chain promotion. Since the technology being at a nascent-stage faces various hurdles,be it economically or socially. The system faces various complexities such as computing power and responsiveness in real time as well as the expensive nature of running the computational system and behavioral changes.The energy ecosystem is so complex, but with proper research and a considerable effort in the talent pool, the energy based blockchain system can be implemented.There is still a long way to implement the energy blockchain at global level.[3]

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Robotic LiDAR Mapping

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***Abstract*- During the last 45 years, robotics research has been aimed at finding solutions to the technical necessities of applied robotics. The evolution of application fields and their sophistication have influenced research topics in the robotics community. This evolution has been dominated by human necessities. In the early 1960s, the industrial revolution put industrial robots in the factory to release the human operator from risky and harmful tasks. The later incorporation of industrial robots into other types of production processes added new requirements that called for more flexibility and intelligence in industrial robots. Currently, the creation of new needs and markets outside the traditional manufacturing robotic market (i.e., cleaning, demining, construction, shipbuilding, agriculture) and the aging world we live in is demanding field and service robots to attend to the new market and to human social needs.**

***Keywords*- Mapping, imaging, robot, robotic vehicles, solar energy, LiDAR.**

I. INTRODUCTION

LIDAR (Light Detection and Ranging) is an optical remote sensing system which can measure the distance of a target by illuminating it with light. LIDAR technology is being used in Robotics for the perception of the environment as well as object classification. The ability of LIDAR technology to provide 2D elevation maps of the terrain, high precision distance to the ground, and approach velocity can enable safe landing of robotic and manned vehicles with a high degree of precision.

LIDAR consists of a transmitter which illuminates a target with a laser beam, and a receiver capable of detecting the component of light which is essentially coaxial with the transmitted beam. Receiver sensors calculate a distance, based on the time needed for the light to reach the target and return. A mechanical mechanism with a mirror sweeps the light beam to cover the required scene in a plane or even in three dimensions, using a rotating nodding mirror.

The objective of this project is to use electronic microcontroller systems on a framework of an autonomous robot car with smart sensor network to map its surroundings using LiDAR calculating the time of flight and measuring the distance between the robot and every object in its environment in those congested places where physical imaging is not possible.

II. LITERATURE OVERVIEW

The article 3D Camera and Lidar Utilization for Mobile Robot Navigation presents a navigation system based on 3D camera and laser scanner capable of detecting a wide range of obstacles in indoor environment. First, existing methods of 3D scene data acquisition are presented. Hence the new navigation system gathering data from various sensors (e.g. 3D cameras and laser scanners) is described in a formal ay, as well as exemplary applications that verify the approach.

The journal Design of an Autonomous Robotic Vehicle for Area Mapping and Remote Monitoring tells us about the increase of human needs which has pushed the robotics sector to evolve even more. One area that begins to bloom in robotic systems are semi-autonomous or autonomous monitoring and guarding vehicles from a distance. The present platform is an example of such a system. It will be the analysis of its design, construction and operation. The operator driving the vehicle will have video feed and additional information about the space monitor. This system could be the basis of a complete automated platform with more sensors that will cover more needs.

The article R&D of Mobile LIDAR Mapping and Future explains mobile terrestrial mapping systems which have seen remarkable developments recently. Fuelled by an unprecedentedly strong demand for high-resolution and accurate 3D geospatial data, these systems serve the probably fastest growing market segment: city modelling. In particular, the recent introduction of powerful mobile laser scanning systems is of main interest, as the direct acquisition of 3D data greatly simplifies downstream processing, where until now stereo based extraction was the most widely used feature extraction tool, requiring significantly more complex processing compared to the straightforward processing of explicit LiDAR data. This paper reviews the recent developments in Mobile Mapping Technologies with a special focus on the mobile laser-scanner sensor component.

III. METHODOLOGY ADOPTED

A. Hardware Overview

Detailed description of the hardware components used in carrying out this work will be provided in this section. The components used in designing the circuit are:

1) Arduino-Uno: Arduino Uno is a microcontroller board based on the Atmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery.

Fig. 1 Arduino-Uno

2) VL53L0X ToF Range Finder: The VL53L0X is a Time Of Flight distance sensor like no other you've used! The sensor contains a very tiny invisible laser source, and a matching sensor. The VL53L0X can detect the "time of flight", or how long the light has taken to bounce back to the sensor. Since it uses a very narrow light source, it is good for determining distance of only the surface directly in front of it. Unlike sonars that bounce ultrasonic waves, the 'cone' of sensing is very narrow. Unlike IR distance sensors that try to measure the amount of light bounced, the VL53L0x is much more precise and doesn't have linearity problems or 'double imaging' where you can't tell if an object is very far or very close. This is the 'big sister' of the VL6180X ToF sensor, and can handle about 50 - 1200 mm of range distance.

Fig. 2 Time of Flight Sensor

3) HC-SR04 Ultrasonic Sensor: the HC-SR04 Ultrasonic (US) sensor is a 4-pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that

Distance = Speed × Time

Fig. 3 Ultrasonic Sensor

The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module as shown in the picture.

4) Wi-Fi Module: The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fi-ability as a Wi-Fi Shield offers . The ESP8266 module is an extremely cost-effective board with a huge, and ever growing, community.

Fig. 4 ESP8266 Wi-Fi module

5) Motor driver L293D: The L293D is a popular 16-Pin Motor Driver IC. As the name suggests it is mainly used to drive motors. A single L293D IC is capable of running two DC motors at the same time; also, the direction of these two motors can be controlled independently. So, if you have motors which has operating voltage less than 36V and operating current less than 600mA, which are to be controlled by digital circuits like Op-Amp, 555 timers, digital gates or even Micron rollers like Arduino, PIC, ARM etc. this IC will be the right choice.

Fig. 5 L293D Motor Driver IC

The IC works on the principle of Half H-Bridge, let us not go too deep into what H-Bridge means, but for now just know that H bridge is a set-up which is used to run motors both in clock wise and anti-clockwise direction. As said earlier this IC is capable of running two motors at the any direction at the same time.

B. Software Overview

In depth description of the software component used in carrying out this work will also be provided in this section.

- The IDE (Integrated Development Environment) is a special program running on your computer that allows you to write sketches for the Arduino board in a simple language modelled after the processing (www.processing.org) language.
- It is designed to introduce programming to artists and other newcomers unfamiliar with software development.
- It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and is also capable of compiling and uploading programs to the board with a single click. A program or code written for Arduino is called a sketch.
- Arduino programs are written in C or C++. The Arduino IDE comes with a software library called "Wiring" from the original Wiring project, which makes many common input/output operations much easier.

The basic structure of the Arduino programming language is fairly simple and runs in at least two parts. These two required parts or functions enclose blocks of statements.

```
Void setup()
{ statements;
}
void loop()
{ statements;
}
```

Where setup() is the preparation, while loop() is the execution. Both functions are required for the program to work. The setup function should follow the declaration of any variable at the very beginning of the program. It is the first function to run in the program, it runs only once and is used to set pinMode or initialize serial communication. The loop function follows next and includes the code to be executed continuously – reading inputs, triggering outputs, etc. This function is the core of all Arduino program and does the bulk of the work.

C. Block Diagram

The block diagram of the proposed solar powered robotic LiDAR mapping system which includes ToF sensor, ultrasonic sensor, and a robot control is depicted in figure.

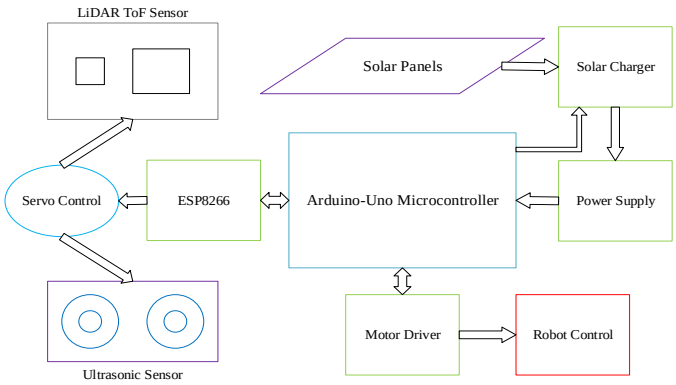

Fig. 6 Block Diagram

Simultaneous localization and mapping determine the location or pose of a robot and construct map of an unknown environment at the same time. Robot path and map are both unknown. There are various related works on localization, mapping, or both (SLAM). Most of this work focuses on exploring an information space of environment. An autonomous mobile robot must recognize its position and find the path for itself. Some of the SLAM mobile robot in the indoor environment uses digital magnetic compass and ultrasonic sensors. Multiple sensor technique makes use of ultrasonic sensor, infrared sensor, laser scanner, stereo camera, and electronic compass to solve SLAM problem. Robot need to plan a motion path through the environment to navigate without colliding with obstacles. Data obtained by ultrasonic range measurements is used to detect and avoid obstacles in environment

IV. MERITS AND APPLICATIONS

A. Advantages

1) Resolution and Accuracy: LiDAR generates instantaneous, massive amounts of measurements, and can be accurate to a centimeter.

2) 3D Mapping: LiDAR data can be easily converted into 3D maps to interpret the environment.

3) Low Light Performance: LiDAR is unaffected by ambient light variations, and performs well in low any light conditions.

4) Speed: LiDAR data are direct distance measurements that don't need to be deciphered or interpreted– thus enabling faster performance and reducing processing requirement.

5) Solar Energy: Solar energy is a truly renewable energy source. It can be harnessed in all areas of the world and is available every day. We cannot run out of solar energy, unlike some of the other sources of energy.

A. Applications

1) Geological mapping/imaging to monitor erosion or making accurate volumetric estimates of landfills

2) Autonomous vehicles. LiDAR works as an eye of the autonomous vehicle. Imagine if your eyes allowed you to see in all directions all the time. Imagine if, instead of guessing, you could always know the precise distance of objects in relation to you. LiDAR enables a self-driving car to view the surroundings with special powers.

3) Agriculture. LiDAR can be used to create 3D elevation map of a particular land. This can be converted to create slope and sunlight exposure area map. This information can be used to identify the areas which require more water or fertilizer and help the farmers to save on their cost of labour, time and money.River Survey: Water penetrating green light of the LiDAR can be used to see things underwater and helps create a 3D model of the terrain. Underwater information of a river can help understand the depth, width, and flow of the water. It helps in monitoring the floodplains.

4) Modelling Pollution. LiDAR wavelength is shorter. It operates in ultraviolet, visible region or near infrared. This helps to image the matter which is of the same size or larger than the wavelength. So, LiDAR can detect pollutant particles of carbon dioxide, Sulphur dioxide, and methane. This information helps researchers to create pollutant density map of the area which can be used for better planning of the city.

5) Archaeology and Building Construction: LiDAR plays an important role for the archaeologist to understand the surface. LiDAR can detect micro-topography that is hidden by vegetation which helps archaeologist to understand the surface. Ground-based LiDAR technology can be used to capture the structure of the building. This digital information can be used for 3D mapping on the ground which can be used to create models of the structure. It is very useful for maintaining a record of the structure.

V. CONCLUSION

- This project shows an attempt to built a cheap area 3D scanner using LiDAR time-of-flight sensor. The project is Arduino based with the ESP8266 board extension.
- The wiring of the components have to be done like this to work with the code.
- The scanned objects are displayed as a point cloud in the browser. The page can be stored using a desktop browser.
- The 3D mapping can also be generated using LiDAR toolkit in MATLAB.
- The project also uses a non-conventional source of energy providing the necessary power to all the components to the microcontroller system.

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Study on Image Classification using Neural Network

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***Abstract*—Image Classification involves the task of assigning an input image one label from a fixed set of categories. This is one of the core problems in Computer Vision that, despite its simplicity, has a large variety of practical applications. Since this task of recognizing a visual concept (e.g. cat) is relatively trivial for a human to perform, it is worth considering the challenges involved from the perspective of a Computer Vision algorithm. The paper introduces some relevant image processing concepts such as data augmentation, weight initialization and regularization applicable to convolutional neural network. For the experimentation, SVHN dataset, consisting of 10 classes, has been utilized. In order to obtain improved test accuracy from the neural model, dropout and batch normalization technique can be used, if necessary.**

Keywords—classification, weight initialization, dropout, batch normalization, CNN, SVHN

I. INTRODUCTION

Image Processing place a very essential role in numerous fields such as optics, computer science, mathematics and surface physics. In case of computer vision, its application include remote sensing, face detection and finger print detection. It is very evident that image processing has numerous applications across various domains [1].

Image classification refers to the tagging of images into one of a number of predefined classes. Manual classification between objects in an image (for large number of classes) would be a tedious process, therefore image classification has been an important task within the field of computer vision [2].

Keeping the importance of image processing, the concept of data augmentation, weight initialization, batch normalization and regularization are discussed in the paper followed by the implementation of Image Processing with deep neural networks.

II. IMAGE PROCESSING CONCEPT FOR IMAGE CLASSIFICATION

A. Data Augmentation

Image data augmentation is a technique that can be used to artificially expand the size of a training dataset by producing improved versions of images in the dataset. Training deep learning neural network models on additional data can result in more competent models, and the augmentation techniques can build variations of the images that can improve the ability of the fit models to generalize what they have learned to new images. Image augmentation artificially forms training images through different means of processing or combination of multiple processing, such as random rotation, shifts, shear and flips, etc [8]. The Keras

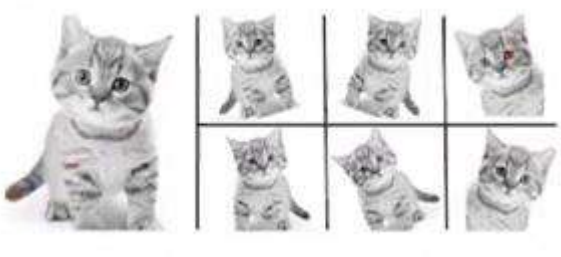

Fig. 1. Original image and augmented images of a cat

deep learning neural network library provides the capability to fit models using image data augmentation via the *ImageDataGenerator* class. The complete challenge for any neural network lies to gather various kind of information so that a developer can train a network. This is called as augmentation.

Assuming the original image of a Cat shown in Fig. 1 only is given as an input to the neural network for training. Now, if the input image is tilted, rotated, cropped or zoomed as depicted in augmented images of Fig. 1, then matching accuracy will get reduced because the pixel values at any particular location could not be same. Therefore, it is suggested that before giving a data to neural network, augmentation must be done properly. There might be a possibility of not getting a big dataset for which augmentation can be done to create more data. For this, certain functions are available within neural network that allow the developer to perform data augmentation which helps in regularizing the network.

In Fig.2, considering a case in which a colored image of a dog is transformed in to a gray scale image. The transformed image is, then provided to CNN, which in turn identifies the image easily. Now, considering another case in which cropped portion of a dog image is provided to CNN. Then, it would be quite difficult for the neural network to identify the dog image that it is a 'Husky'. In those cases, data augmentation would be quite helpful. Data augmentation techniques include horizontal flips, rotation, crop/scale, and color jitter. Other techniques involve random

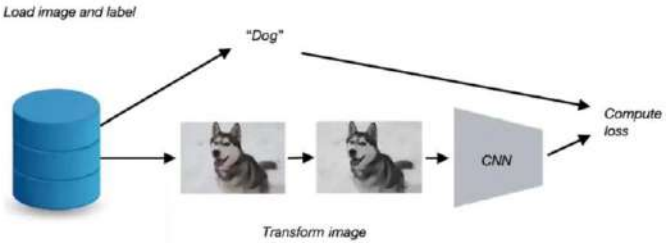

Fig. 2. Representation for data augmentation

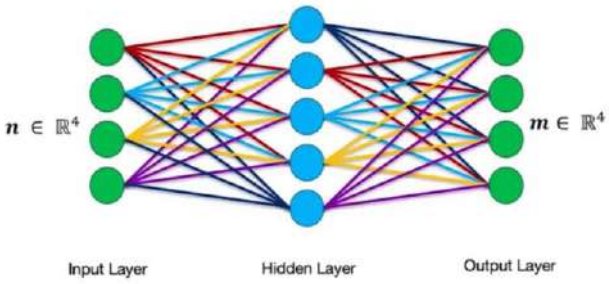

Fig. 3. Representation of neural network with input layer, hidden layer and output layer

combinations of translation (CovNet), rotation, stretching, shearing, and lens distortions [3].

B. *Weight Initialization*

Weight initialization is an key consideration in the design of a neural network model [8]. The nodes in neural networks are composed of parameters referred to as weights used to compute a weighted sum of the inputs. Neural network models are fit using an optimization algorithm called stochastic gradient descent that incrementally changes the network weights to minimize a loss function, resulting in a set of weights for the mode that is capable of making useful predictions. This optimization algorithm requires a starting point in the space of possible weight values from which to begin the optimization process. Weight initialization is a procedure to set the weights of a neural network to small random values that define the starting point for the optimization (learning or training) of the neural network model.

The aim of Weight Initialization is to prevent layer activation outputs from exploding or vanishing during the course of a forward pass through a deep neural network. If either occurs, loss gradients will either be too large or too small to flow backwards beneficially, and the network will take longer to converge [6, 8]. Following are some techniques generally practised to initialize parameters:

a) Zero Initialization: In general practice, biases are initialized with 0 and weights are initialized with random numbers. But if all the weights are initialized with 0, the derivative with respect to loss function is the same for every w in W[l], thus all weights have the same value in subsequent iterations. This makes hidden units symmetric and continues for all the n iterations i.e. setting weights to 0 does not make it better than a linear model. An important thing to keep in mind is that biases have no effect what so ever when initialized with 0.

b) Random Initialization: Assigning random values to weights is better than zero initialization. But in case of random initialization, two case arises i.e. (i) if weights are initialized with very high values the term `np.dot(W,X)+b` becomes significantly higher and if an activation function like sigmoid() is applied, the function maps its value near to 1 where the slope of gradient changes slowly and learning takes a lot of time, and (ii) if weights are initialized with low values, it gets mapped to 0, where the case is the same as above. This problem is often referred to as the vanishing gradient [7, 9].

c) He Initialization: Multiply random initialization with the following:

$$\sqrt{\frac{2}{size^{[l-1]}}}$$

$$W^{[l]} = np.random.randn(size\_l, size\_l - 1) * np.sqrt(2/size\_l - 1)$$

d) Xavier Initialization: It is same as He initialization but it is used for tanh() activation function, in this method 2 is replaced with 1.

$$\sqrt{\frac{1}{size^{[l-1]}}}$$

$$W^{[l]} = np.random.randn(size\_l, size\_l - 1) * np.sqrt(2/size\_l - 1)$$

These methods serve as good starting points for initialization and mitigate the chances of exploding or vanishing gradients. They set the weights neither too much bigger than 1, nor too much less than 1. So, the gradients do not vanish or explode too quickly. They help avoid slow convergence, also ensuring that we do not keep oscillating off the minima.

C. *Regularization*

It is a technique to avoid the model from overfitting by adding additional information to it. Sometimes the machine learning model executes well with the training data but does not with the test data. It means the model is not able to predict the output when deals with hidden data by introducing noise in the output, and hence the model is called overfitted. This problem can be deal with the help of a regularization technique [5, 9]. This technique can be used in such a way that it will allow to maintain all variables or features in the model by reducing the magnitude of the variables. Hence, it maintains accuracy as well as a generalization. It mainly regularizes or reduces the coefficient of features toward zero. Basically, in regularization technique, the magnitude of the features can be reduced by keeping the same number of features. Regularization can be achieved through batch normalization and dropout technique.

a) Batch Normalization: It is a process to make neural networks faster and more stable through adding extra layers in a deep neural network. The new layer performs the standardizing and normalizing operations on the input of a layer coming from a previous layer. A typical neural network is trained using a collected set of input data called batch. Similarly, the normalizing process in batch normalization takes place in batches, not as a single input. Batch normalization improves gradient flow through the network, allows higher learning rates and reduces the strong dependence on initialization.

b) Dropout: Dropout is a regularization method that approximates training a large number of neural networks with different architectures in parallel. During training, some number of layer outputs are randomly ignored or "dropped out". This has the effect of making the layer look-like and be treated-like a layer with a different number of nodes and connectivity the prior layer. In effect, each update to a layer during training is performed with a different "view" of the configured layer.

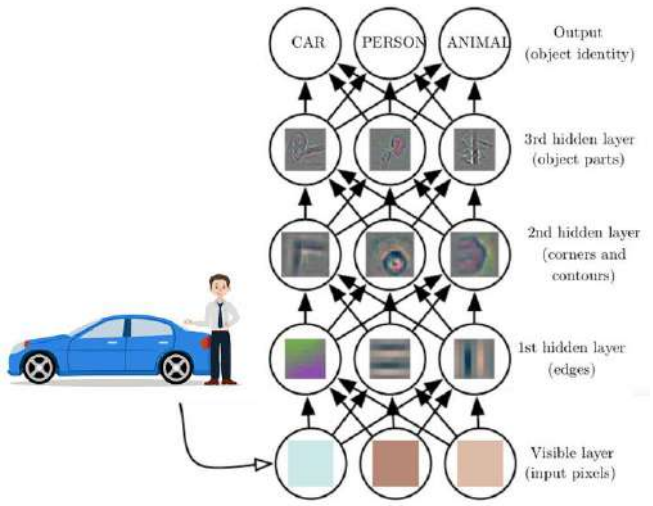

Fig. 4. Representation of CNN with input layer, three hidden layers and output layer

III. CONVOLUTIONAL NEURAL NETWORK

Convolutional neural networks are composed of multiple layers of artificial neurons. Artificial neurons, a rough imitation of their biological counterparts, are mathematical functions that calculate the weighted sum of multiple inputs and outputs an activation value [9, 10]. When you input an image in a ConvNet, each layer generates several activation functions that are passed on to the next layer.

The first layer usually extracts basic features such as horizontal or diagonal edges. This output is passed on to the next layer which detects more complex features such as corners or combinational edges. As we move deeper into the network it can identify even more complex features such as objects, faces, etc.

Based on the activation map of the final convolution layer, the classification layer outputs a set of confidence scores (values between 0 and 1) that specify how likely the image is to belong to a "class" [11]. For instance, if a ConvNet has to detect cats, dogs, and horses, the output of the final layer is the possibility that the input image contains any of those animals, as depicted in Fig. 4.

CNNs have two components:

1) The Hidden layers or Feature extraction part: In this part, the network will perform a series of convolutions and pooling operations during which the features are detected. If you had a picture of a zebra, this is the part where the network would recognise its stripes, two ears, and four legs.

2) The Classification part: Here, the fully connected layers will serve as a classifier on top of these extracted features. They will assign a probability for the object on the image being what the algorithm predicts it is.

IV. IMAGE CLASSIFICATION USING NEURAL NETWORK

Recognizing multi-digit numbers in photographs captured at street level is an important component of modern-day map making. A classic example of a corpus of such street level photographs is Google' Street View imagery comprised of hundreds of millions of geo-located 360 degree panoramic images. The ability to automatically transcribe an address number from a geo-located patch of pixels and associate the transcribed number with a known street address helps pinpoint, with a high degree of accuracy, the location of the building it represents.

More broadly, recognizing numbers in photographs is a problem of interest to the optical character recognition community. While OCR on constrained domains like document processing is well studied, arbitrary multi-character text recognition in photographs is still highly challenging. This difficulty arises due to the wide variability in the visual appearance of text in the wild because of a large range of fonts, colors, styles, orientations, and character arrangements. The recognition problem is further complicated by environmental factors such as lighting, shadows, specularities, and occlusions as well as by image acquisition factors such as resolution, motion, and focus blurs.

In the paper, dataset of images centered around a single digit is used to do the classification through CNN. Although, sampled data taken is simpler, but it is more complex than MNIST because of the distractors at the sides.

A. Dataset:

The Street View House Numbers (SVHN) is a real-world image dataset for developing machine learning and object recognition algorithms with minimal requirement on data preprocessing and formatting [12]. It can be seen as similar in flavor to MNIST (e.g., the images are of small cropped digits), but incorporates an order of magnitude more labeled data (over 600,000 digit images) and comes from a significantly harder, unsolved, real world problem (recognizing digits and numbers in natural scene images). SVHN is obtained from house numbers in Google Street View images.

The overview of the dataset is provided below:

- Total 10 Classes, 1 for each digits *i.e Label '9' for digit 9 and '10' for digit 0.*
- 73,257 digits for training, 26,032 digits for testing
- Available in two different formats

  (i) Original images with bounding box available for each character (may contain multiple characters in same images).

  (ii) MNIST like 32x32 cropped images having single character in each images.

V. RESULT AND DISCUSSION

Dataset is obtained from house numbers in Google Street View images [12]. Here, 32 x 32 cropped images given in format 2 have been classified using CNN architecture on Python. Few samples of the 32 x 32 cropped images along with their tags attached, out of 60,000 images available in dataset, are shown in Table I. It is found that the number of training images available is 42,000 and number of testing images available is 18,000.

In the proposed system, input the data to neural network along with target (tags). Then, train the neural network in such a way that when the testing data is passed on to the neural network, it should predict the tags as output. Due to limited size of system memory, implementation of training

TABLE I. SAMPLE IMAGES OF DATASET ALONGWITH TAGS ATTACHED

S.No.	*Sample images*	*Tags attached*
1.		2
2.		6
3.		7
4.		4
5.		4
6.		0
7.		3
8.		0
9.		7
10.		3

of neural network is not done, therefore, accuracy of the model is not provided.

VI. CONCLUSION

The paper presents a classification process using the ConvNet architecture which is frequently used to solve image processing problems. Moreover, image processing concepts such as data augmentation, weight initialization, and regularization have been discussed which is helpful in learning good features. Better test accuracy and speed performance could be obtained by applying dropout and batch normalization technique after each layer in the neural network, if required. In future work, the implementation of training of neural network would be performed in order to predict the incoming image with the tag.

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Face Detection and Recognition

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***Abstract* - With the advancement in technology in computer vision, face recognition has become important application of image analysis. As the time passes most of the systems developed this technology but it faces a great challenge in computer vision and pattern recognition researches. In recent years' people are more aware about face recognition techniques due to rising concern about security, biometric identity verification requirement, face recognition analysis, biometric feature, etc in organization's data management processes, due to people's urge to find comfort in life and most importantly to explore and learn various technologies. The virtual world will become popular sooner or later, and so we have to prepare ourselves for upcoming opportunities and challenges. So, here's the idea of virtual attendance, which uses facial recognition technique to obtain the desired results. This technique take the prior attendance system to the next level. More interesting applications are automatically tagging the recognized faces on social media, and identifying spam users.**

Keywords— Biometric, Face detection, Pixels, Gradient, Face Landmark Estimation

I. INTRODUCTION

We human beings can easily recognize a face without many efforts, it's a piece of cake to us but for computer vision, it is like a big hurdle. With time many technologies like automated face analysis, pattern recognition, machine learning, deep learning, and artificial intelligence evolved and made it possible to overcome this hurdle.
These technologies made an automated face recognition full of top-notch properties. These properties include touchless and non-invasiveness.
automated face recognition is a part of a biometric property that provides a wide range of applications.

The different biometric methods to identify face can be categorized into different parameters like physiological parameters (fingerprint, DNA, retina, face) and behavioural (keystroke, voice print) parameters. Out of these categories, physiological parameters are more solid and unalterable, except in severe conditions. Behavioural patterns are more conscious of human overall conditions, such as anxiety, depression, or emotional check and balances. Another reason, why we seek to use facial recognition is, despite the higher accuracy rate of Retinal
Recognition or Fingerprint recognition, facial recognition is taking over because unlike others, it does not need a close encounter with the device and ease of installation. One more plus point is, in the situation of the covid-19 pandemic, the fingerprint scans can cause the virus to spread as well as, retinal the scan also requires the user to stand very close which are both not advised by international organizations such as WHO.

The increasing reliability of facial recognition technology will help to prevent blunders caused by misidentification but on the other hand advancement of this technology will be a magnet to those who want to abuse the system.

The efficient use of computer vision in automatic facial recognition can be seen in our daily life. One such example is Facebook which can perform facial recognition with an accuracy of up to 98%. Whenever we upload a picture on Facebook it recognizes different people in the picture using facial recognition algorithms. Another example that we encounter in our day to day is the face lock in our smartphone. Whenever we present up ahead of the locked screen it gets unlock with the help of these techniques. This technology has brought wonders in our life and make our life easy. Nowadays, government agencies use this technology to suspected criminals, which increased the reliability of the national security system.

II. METHODOLOGY

- Observe the picture and try to detect the faces present over there.
- Focus on each face and try to understand that even if a face is turned or in a weird direction or improper lighting, it is still the same person.
- Be able to pick out unique characteristics of the face that you can use to differentiate from other people.
- Finally, compare the unique features of that face to all the people you already know to determine the person's name.

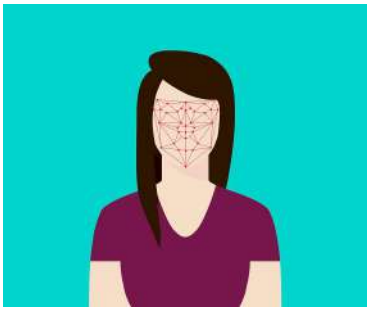

Fig 2 – Facial Feature Recognition

Step 1: Finding all faces

Clearly, there is a specific pattern here - different faces have unique dimensions like the ones shown above. The challenging part is to convert a particular face into numbers - Machine Learning algorithms only understand numbers. This numerical representation of a "face" (or an element in the training set) is termed as a feature vector.

A feature vector consists of various numbers in a particular order. As a simple example, we can map a "face" into a feature vector which comprises of various features like:

- Height of the face (cm)
- Width of the face (cm)
- Average color of face (R, G, B)
- Width of lips (cm)
- Height of nose (cm)

So, now we can represent our image in a vector form as (23.1, 15.8, 255, 224, 189, 5.2, 4.4). Of course, there could be many other features that could be derived from the image. The problem becomes much easier, after encoding each image into its feature vector. So, if we have two images of the same person, we will get somewhat similar feature vectors. Put it the other way, the "distance" between the 2 feature vectors will be quite small.

Fig 3 – Target Image

Computers are yet not capable of this type of high-level generalization, so we have to teach them how to perform each step in this process one by one.

We need to build a pipeline where each step of face recognition is solved separately and pass on the result of the current step to the following step.

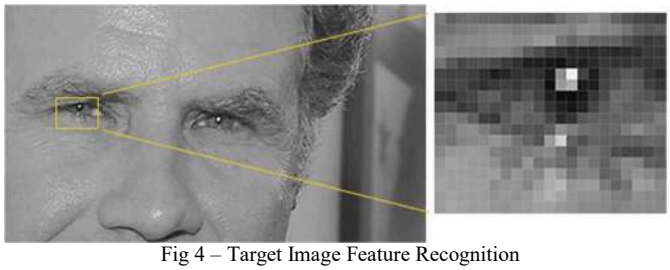

Fig 4 – Target Image Feature Recognition

Height of the face (cm)	Width of the face (cm)	Average color of face (RGB)	Width of lips (cm)	Height of nose (cm)
23.1	15.8	(255,224, 189)	5.2	4.4

Table 1 – Facial Feature Data

Face Detection is the initial step of the pipeline. Firstly, the faces are located in a photograph before these can be distinguished. From the past 10 years, we have seen face detection being used in cameras: Face detection is a great feature for cameras. When the camera can automatically pick out faces, it can make sure that all the faces are in focus before it takes the picture. But we'll use it for a different purpose — finding the Image areas we want to pass on to the next step in our pipeline. We will use a method called Histogram Of Oriented Gradients(HOG), invented in 2005.

To find faces in an image, we'll start by making our image black and white because colour data is not needed:

The original image is turned into a HOG representation that captures the major features of the image

Fig 7 – Target Image Structure Formation

Then every single pixel in our image will be checked one at a time.

For each pixel we have to look at the pixels that directly surrounds them.

The main motive is to decipher the darkness of the on-going pixel when compared

directly to the pixel surrounding it. Then an arrow is drawn indicating the direction of darkness of the picture.

If the process is repeated for each pixel in the image, then each pixel will be replaced by an arrow called gradient and these gradients show the flow from light to dark across the entire image:

This looks like a random thing to do but replacing pixels with gradients is really beneficial By analyzing pixels directly dark

and light images of the same person appear to be different But when we consider the direction of brightness only the both dark and bright images will have the same representation this will make the problem much easier.

But storing gradients for each pixel will be too detailed. A better way would be when we only see the normal brightness/darkness flow at greater level to observe the fundamental pattern of the image.
To do this, we'll break up the image into small squares of 16x16 pixels each. In each square, we'll count up how many gradients point in each major direction (how many points up, point up-right, point right, etc....). Then we'll replace that square in the image with the arrow directions that were the strongest.

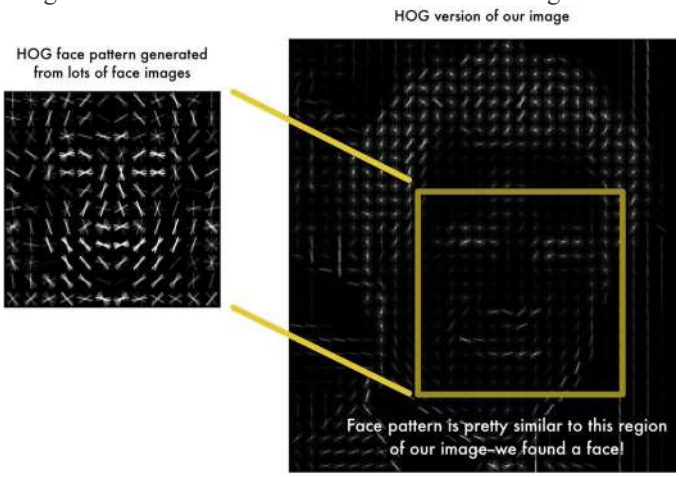

Fig 8 – Target Image's Face Recognition

When we transform the original image into a basic representation that comprises the fundamental structure of the image in a much simpler way is the end result.
For the detection of faces in HoG image if have to discover that part of the image that is akin to the familiar HOG pattern taken from the training set.
Using this technique, we can now easily find faces in any image.

Step 2: Posing and Projecting Faces

When, we isolated the faces in our image. But now we have to deal with the problem that faces turned in different directions look completely different to a computer.

For humans both the images of Will Ferrell will indicate towards one single person But for computer these pictures indicates entirely two different people.

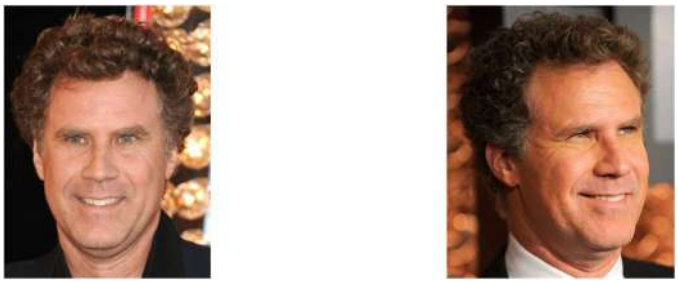

Fig 9 – Target Image's Possible Orientations

To report this problem we have to wrap the picture in such a order that features like eyes and lips will remain at the same place in every picture This will make comparison of faces much simpler in further steps

To apply this we will use the algorithm known as face land estimation The basic principle of this algorithm is that we will locate 68 specific points known as landmarks on each face These landmarks can be located on top of lips outside edge of ears etc Then machine learning algorithm will be trained to locate these points.

Fig 10 - Face Landmark Estimation

- **Step 3: Encoding faces**

It turns out that the measurements that seem obvious to us humans (like eye color) don't really make sense to a computer looking at individual pixels in an image.

Researchers have discovered that the most accurate approach is to let the computer figure out the measurements to collect itself. Deep learning does a better job than humans at figuring out which parts of a face are important to measure.

The solution is to train a Deep Convolutional Neural Network (just like we did in Part 3). But instead of training the network to recognize pictures objects like we did last time, we are going to train it to generate 128 measurements for each face.

- **Step 4: Finding the person's name from coding**

This last step is actually the easiest step in the whole process. All we have to do is find the person in our database of known people who has the closest measurements to our test image.

You can do that by using any basic machine learning classification algorithm. like simple linear SVM classifier, but lots of classification algorithms could work.

All we need to do is train a classifier that can take in the measurements from a new test image and tells which known person is the closest match. Running this classifier takes milliseconds. The result of the classifier is the name of the person!

III. IMPLEMENTATION

Installing libraries:

In order to perform face recognition with Python and OpenCV we need to install two additional libraries:

- Visual Studio
- OpenCV
- Imutils
- Cmake
- Dlib
- Face-recognition

Dataset:

- M.S Dhoni
- Narendra Modi
- Yuvraj Singh
- Shahrukh Khan

Libraries Used:

- **CV2**

Gary Bradsky developed OpenCV in 1999 and was released in 2000. It is supported by many languages for example C++, python, Java, etc. It is developed to solve computer vision problems and to accelerate the use of the machine approach. We can recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects, extract 3D models of objects, etc. using the algorithm. In this project, we have the latest version of open CV i.e., CV2 for image detection.
CV2 makes use highly optimized python library NumPy. NumPy is used for numerical calculations of an array. It returns everything as NumPy objects like an array and native python objects like list, tuples dictionary. For example, in this project when we load an image it is returned by CV2 as ndarray.

- **Face Recognition**

This library is used to detect and differentiate faces using python or command line. C++ is used to program the world's easiest face recognition library. This library uses trained facial feature detection and face encoding models used in this library.A large number of tasks can be performed like finding all the faces in the given picture, detect facial features in an image, real-time face recognition, etc. using this library.

- **Pickle**

Pickle is a library used to serialize and deserialize in python. It is used when we want to pile data on disk. It uses the "pickling" technique which means it first serializes the data by converting python objects like list, tuple etc., to stream of characters before writing it into the file. It is done so that it contains all the necessary information for reconstructing the file in another python script.

- **OS**

OS is used to operate upon the functionality of operating system.
Following are the functions performed by this library:
Open() is Used to read and write a file.
Os.path is Used to handle paths.
All the lines in the files on the command line can be read by using File input.
Temp file is Used to generate temporary files and directories.
The util is Used for high-level file and directory handling.

- **Glob**

Glob can be implemented to discover the pathnames with definite pattern according to the protocols defined by the Unix shell.

IV. RESULT

Face detection is successfully implemented using OpenCV and Deep Learning.

Fig 11 - Face Detection and Recognition

V. CONCLUSION

In this Project, we developed a Flask Based Attention system which correctly detects the individuals remotely from web. This system makes a detail list of registered users and monitors who reports to their work on time and specifies those individuals who haven't reported on a specific date in their attendance record.

VI. APPLICATIONS

- **Face Identification**: Face recognition systems uses facial images as the data input to identify the authority of the user. Face recognition systems ensures the presence of an authorized person rather than checking only if a valid identification (ID) or key is being used or whether the user knows the secret personal identification numbers (Pins) or passwords.

- **Surveillance**: Like security applications in public places, surveillance by face recognition systems has a low user satisfaction level, if not lower. Different lighting conditions, various possible face orientations and other factors conclusively make the deployment of face recognition systems for large scale surveillance a problematic task.

- **Prevent Retail Crime**: Face recognition is being put to use in instantly identifying people who are known shoplifters, organized retail criminals or have a history of fraud, enter retail establishments. Facial data of individuals is then matched against large databases of criminals so that loss prevention can be maximised and retail security professionals can get instant notification whenever a potential theat (fradulent customer) enters a store. According to our data, face recognition reduces external shrink by 34% and, more importantly, reduces violent incidents in retail stores by up to 91%.

- **Find Missing Persons**: Another application of face recognition system is to find missing children and those who are the victims of human trafficking. As long as facial data of missing individuals is being added to a database or is there in database already, concerned athorities can get alerts from various places the moment these children gets recognized by face recognition system installed at - airports, retail stores or any other public space. In fact, 3000 missing children were discovered in just four days using face recognition in our own nation - India!

- **Validate Identity At ATMs**: It seems likely that face scans will eventually replace ATM cards completely since face recognition is such a powerful identity authentication tool. But in the meantime, face recognition can be used to make sure that individuals using ATMs cards are who they say they are. Face recognition is currently being used at ATMs in Macau to protect peoples' identities.

- **Make Air Travel More Convenient**: Aviation industry have already adapted face recognition to help it's customers with baggage check in, checking in for flights and boarding process faster. It seems like we are quickly moving toward a future in which air travel is not only safer than ever before, but also more convenient than any period in history.

- **Hospitals**: Facial recognition offers a fast way to access the medical information and, in many cases, speed up the process to provide necessary medical care to those who have a medical history which can be any critical illnesses they are suffering now for a long time or diseases that require special treatment.

FUTURE SCOPE

Face Recognition Technology has a bright future in various aspects of life. Many Private industries, public buildings, schools, and government organizations are also welcoming this new innovative technology amidst the global pandemic in order to minimize contact-based attendance systems such as Biometric scan. A system in which registered and newly registered users' attendance is automatically updated in the database by the system through Face recognition applied on the image samples taken for every coming user On the

same model, Facial Expression Recognition system can also be made which can be used for medical sciences, more specifically, psychological science in order to study the behavior of human in different circumstances. Further studies can be laid down in the direction of gene matching to recognize the structural factors of the face (Parents to Child).

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Smart Mirror A Hub for Ambient IoT Environments

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Abstract— **This paper explores the idea of utilizing a smart mirror for entertainment, personalization and security in a home environment. The central idea revolves around making the smart mirror a hub to control one's home and to link up various services which result in an ease of access. Home automation works on a local server which is used to connect and communicate with the locally attached nodes. The security system integrates the video feed from the security cameras installed and also detects whether a person visiting is wearing a mask or not. Information is updated in real-time and the communication is based on the local host network. The entertainment system personalizes user experience via face recognition and emotion detection. Traversal of the mirror or accessing different features within the screen are implemented by either using voice commands or hand gesture detection which comprises of image processing mainly histogram computation and masking.**

Keywords— Smart mirror, ambient intelligence, IoT, image processing

I. INTRODUCTION (*HEADING 1*)

In today's world, ubiquitous computing has become one of the most important aspects of our everyday lives [1]–[3]. Ubiquitous computing aims at embedding computational capabilities into everyday objects and environments, allowing them to manage data and communicate. Thus, this IoT (Internet of Things) enabled environment is capable of understanding its surroundings, which consequently leads to improving our experience and quality of life [3]. This type of computing involves wireless communication and networking technologies, mobile devices, wearable computers, cameras, gaming consoles, radio-frequency identification (RFID) tags, etc.

Ubiquitous computing has expanded to further include smart furniture, walls, doors, as well as specialized rooms, equipped with sensors and computing devices for recognizing human activity and providing a variety of automated services [3]. This has evolved into a new paradigm, referred to as Ambient Intelligence (AmI), where we are surrounded by intelligent and natural interfaces, forming an environment capable of responding to human actions Though the technology for developing AmI systems through ubiquitous computing is growing rapidly, its seamless integration remains a challenge. Many attempts have been made towards the implementation of smart environment technologies [6]–[13], with the main focus being on integration of ubiquitous computing with the furniture. These systems utilize mirrors as smart devices to provide a user-friendly interface allowing intelligent interaction between the object and the user. This allows a commonly utilized object to process and display information in an intelligent and interactive manner. Some studies focus on developing interactive mirror-displays, which present information tailored to the user's personal preferences [4], [13]. Proposed automatic methods include face recognition [4], [10], [16], mask detection, emotion detection, [11]. Moreover, different methods for achieving interaction proposed in the literature include touch-based commands [4], voice commands [13]-[14], gestures [17], and physical widgets [11]. Most of the existing systems, mainly smart mirrors, do not fully integrate all of the main objectives of AmI services, Our implementation differentiates itself by integrating mask detection [19], security management, emotion detection and media controls all in one place.

Most of the proposed solutions rely on complex sensors, which can be energy-inefficient and computationally expensive. Also, these systems are often not scalable, nor adaptive, thus limiting the amount of offered services. This paper proposes an interactive mirror interface with highly scalable services, which is at the same time efficient in terms of computational cost and utilized resources. Our system especially emphasizes on security and safety features and interactivity through a simplified approach for user identification.

II. RELATED WORKS

Bowyer in their work [20], talked about facial recognition in the form of multiple nose region matching, in which they consider 3D data for extraction of important facial features. It uses both Principal Component Analysis (PCA) as baseline and Iterative Closest Point (ICP) as baseline for matching.

Pandey talked about real time face recognition, where images are obtained from live video [21]. For detection of eyes and face they combine the eigenface method using Haar-like features as well as use the Robert Cross edge detector for locating the human face position more efficiently.

V. Kazemi and J. Sullivan talk about the implementation of regression trees to detect facial features. They also talk about the problem that is faced for single face alignment in an

image. Another way for implementing face recognition [23] is by using the Viola and Jones algorithm for face detection.

S. Chidambaram [24] talks about emotion recognition by considering features of the mouth such as mouth width and height. Another feature taken into consideration are the eyes of the user. In this paper, the emotions that can be recognized are happy, surprised and sad.

III. Proposed Smart Mirror System

The proposed smart mirror system aims to provide the users with a scalable platform to which they can integrate customizable interactive services that automate their routine while making their life a bit more secure from the comfort of their room. These integrations might include:

- services oriented towards information like region specific news, calendar updates and weather updates
- services oriented towards entertainment and health like multimedia playback support and fitness tracking
- services oriented towards monitoring and controlling different aspects of a user's household environment.
- Hence the proposed systems act as a convenient interface for saving time and boosting overall efficiency of daily tasks like cooking food, exercising etc.

A. Salient Features of the Proposed System

- Interactive mirror surface that uses primitive, easy to learn hand gestures to navigate through the interface of the mirror or voice commands.
- Capability for the user to control all the electrical appliances (like Lamps, lights and fans) of the entire house that are integrated to the system (scalable).
- Capability for the user to monitor live CCTV footage of all the cameras connected to the security server from the comfort of their bedrooms.
- Real-time voice-based alerts via security cam for visitors not wearing masks(using face mask detection AI model [25]).
- Real-time regional updates for services like weather forecast and news feeds.
- Real-time notifications and voice-based alerts updates for upcoming calendar events scheduled on the user's cloud calendar.
- Music playback capability using internet music streaming service depending on the mood of the user (using Mood Detection AI Model) or predefined playlists by the user.

B. System Architecture

The Architecture of the proposed smart mirror system can be divided in two different branches of hardware and software/firmware components.

1) Software/Firmware Components:

- Live web server: The web server is responsible for streaming live video stream of all the cameras connected to the system and saving all of this data to a non-volatile hard drive for further analysis if needed, for applying additional machine learning driven filters for the detection of face masks on the faces of visitors [25] and hosting the resultant Boolean value (true if the visitor is wearing a mask, false if not depending on the confidence threshold) in real time for the Mirror firmware to access and notify the end user accordingly and finally for hosting a home automation dynamic database for storing the current states of all of the electrical appliances integrated in the system.

i. *Mirror firmware:* The mirror firmware consists of three major parts, the front-end module, gesture-based navigation module and machine learning based emotion classifier model.

- Front-end module provides a layout to the navigational interface of the proposed system and is responsible for updating all of the information of mirror screen in real-time using different APIs like news, weather, calendar events, multimedia streaming etc. and is responsible for retrieving and updating data to and fro the custom web server for mask flag updates, home automation database values and live video streams from the CCTV web server. Once this data is acquired the front-end further performs operations like validation of the data received and throwing GUI based notifications and speech-based alerts.
- Gesture-based navigation module provides the navigational capabilities to the system using video stream from a camera connected at the top of the mirror. This Module tracks the movement of the user's hands and moves the cursor inside the mirror over different GUI icons accordingly allowing the users to navigate swift using their hands.
- Machine learning based emotion classifier module estimates the mood of the user by processing video frames through a pre-trained machine learning model. Once this approximation is made, the front-end displays phrases according to the user's mood and suggests music to play on the dedicated streaming service.

ii. *Firmware for home automation networking nodes:* These networking nodes connect to each of the electrical appliances that the user wants to integrate in the home automation network. These modules connect to the web server locally and are responsible for constantly monitoring home automation databases hosted on the live server using http get requests and switching the respective devices on and off when the user changes the values.

2) Hardware Components:

i. *CCTV server:* CCTV server consists of a webserver hosted on a Raspberry Pi single-board micro processing unit. All of the cameras are connected directly to the Raspberry Pi using USB cables and the HDD (for

storing the recorded data permanently) is connected using a breakout USB to SATA shield.

ii. *Mirror design:* A two-way mirror is used for the designing the smart mirror since it allows passage to a certain amount of light while reflecting the rest. An LCD display is attached at the back to a two-way mirror at its partly transparent side. This makes the contents of the screen visible while the other side of the glass still retains its reflecting properties. Another Raspberry Pi is connected to the back of the display using a HDMI cable and the front camera required for gesture recognition and mood estimation is connected using a USB port. After the initial testing, the entire system is enclosed within a wooden frame.

iii. *Home automation networking hardware:* Networking nodes are designed by using ESP8266 SOCs (Wi-Fi modules) and relay switches. Relay switches are responsible for switching the device on and off when the appropriate signals are received by the Wi-Fi modules from the web server.

IV. METHODOLOGY

A. Hand Gesture Tracking

Fig. 1 and 2 explain the model used to identify the user's hand area. This is done by histogram computation, blocking the user's face, creating a frame of it and detecting the region of image that contains the color range of the user's skin. The algorithm then calculates the contours of the region by several image processing operations and estimates the centre of mass. The centre of mass is then used for tracking the mirror cursor and to navigate through the user interface.

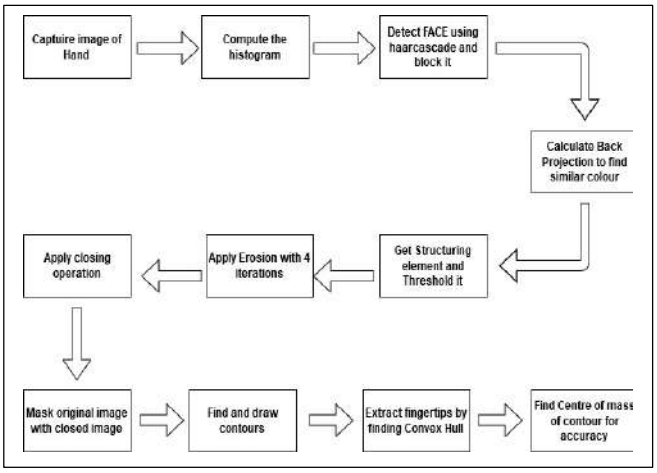

Fig. 1. Proposed model for detecting user's hands in live camera stream.

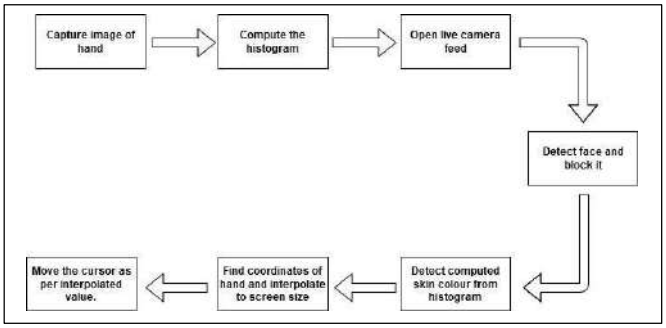

Fig. 2. Proposed model for controlling the mirror cursor by tracking user's hands in live camera stream

B. Security System and Mask Detection

Figure 3 explains the process of detecting faces and masks [19], updating the mask flag of corresponding endpoint and sending the live stream to the web server for further processing.

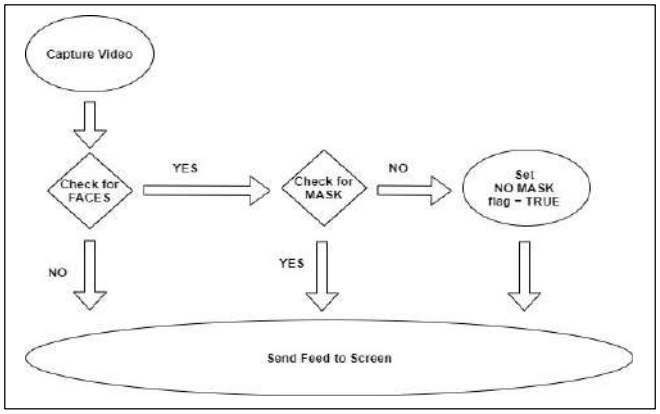

Fig. 3. Proposed model for detecting visitors, masks on their faces and updating mask notification flag.

C. Emotion Detection

Fig. 4 explains the user's facial emotion estimation whicj is used for displaying interactive quotes and suggesting music options by the dedicated streaming services.

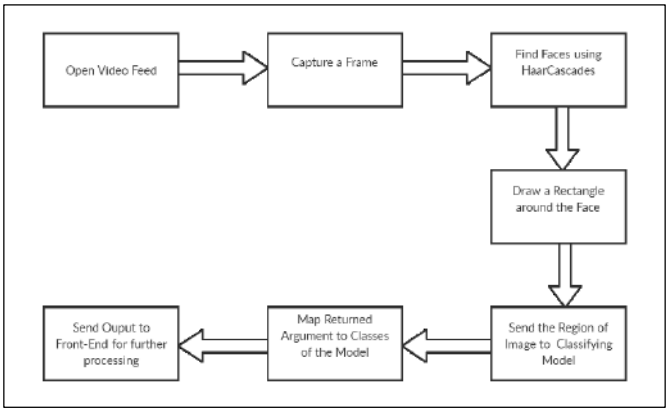

Fig. 4. Proposed model for detecting user's emotions at given point using their facial features.

V. RESULTS AND DISCUSSION

The proposed system employs the functionality and resourcefulness of a smart, customizable and interactive mirror platform, which allows the users to be notified about a variety of digital information, while the user follows their everyday schedule. Compared to other systems, the proposed platform is highly adaptable, scalable, easy-to-use, as well as efficient. The user is presented with a friendly navigation menu, shown in Fig. 8 and a highly coherent hand gesture-based interaction mechanism observed in Fig. 5. The most frequently used widgets and informational tabs are right there on the mirror screen at all times so that the user can view all of these services conveniently without going to the effort of accessing any other handheld device. The ability of the proposed smart mirror system to detect user's emotions and select suitable responses to interact with the user and suggest mood appropriate music as shown in Fig. 6 is an important

addition to the device and proves an interactive feature to the user to tinker around with during these times of social distancing. Integration of CCTV and home automation services allow users to carefully monitor their surroundings and actively interact with household electrical infrastructure. Security based alerts help the user to be notified about the visitors at the front door and whether they are wearing face masks or not as shown in Fig. 7.

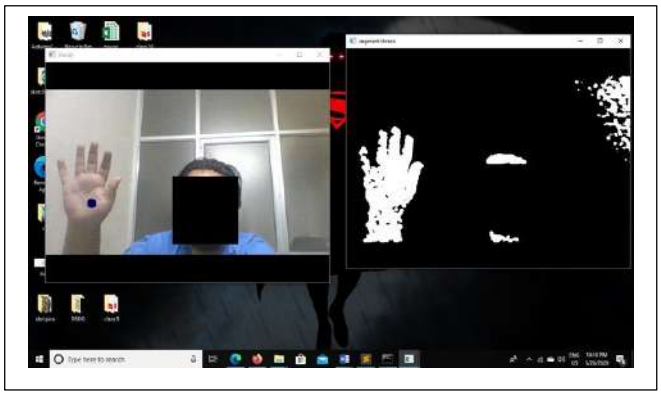

Fig. 5. Hand gesture tracking demonstration.

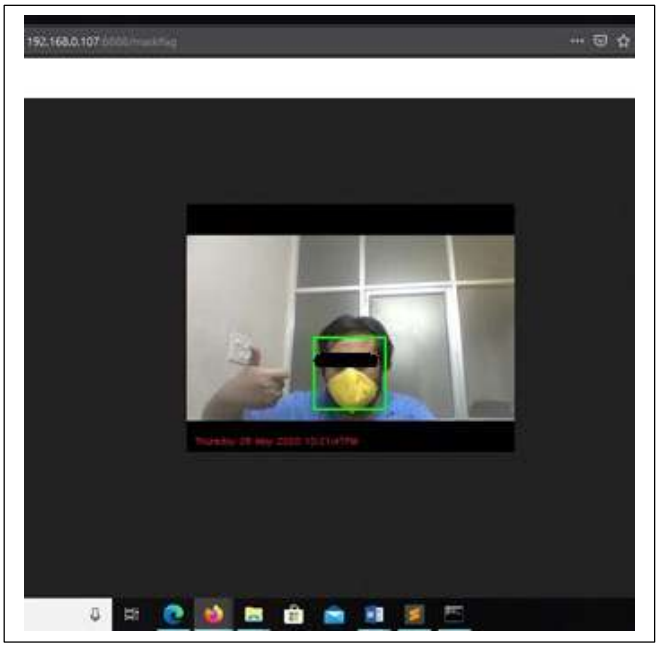

Fig. 6. Visitor face mask detection demonstration.

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EMOTION DETECTION RESULTS TEMPORARILY WITHDRAWN DUE TO REVIEW POLICY
****

Fig. 7. Emotion using user's facial expressions

Fig. 8. A glimpse of our GUI

VI. CONCLUSION

The system implemented in this paper is an optimum solution to provide ease of access and simplicity to the user. The mirror is utilized as a hub to control the home thus it provides an easy interface for centralization of ambient responses and sensor-actuation communication nodes which is difficult to introduce in IoT solutions. The system since it is dependent on the local network, is easily scalable in terms of IoT and Security. Implementation of pipeline filters such as mask detection and face detection is grounds for improvement in home security and the IoT scalability ensures systems which are ambient in nature and personalized at the same time.

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ARTIFICIAL INTELLIGENCE IN MEDICAL IMAGING

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Abstract— **Healthcare is the only field, which concerns all sections of the society, be it the rich, the poor or the middle-class. Hence efforts to improve healthcare facilities are ongoing. One such initiative is the application of AI in healthcare. Applying AI to healthcare, not only increases the accuracy, performance of many processes, but also reduces time consumption and human effort. We can use CNN models for better analysis of X-rays etc...Also, the complexity of medical data can be handled with better accuracy using AI. In the next chapters we discuss about how AI is implemented in healthcare.**

Keywords- CNN, AI, Deep learning

I. INTRODUCTION

AI has made many positive changes in the area of healthcare[1]. Ranging from better analysis of medical tests, to making better clinical decisions, AI has spread all over. Also chances are that AI doctors are soon going to replace human physicians and hence this would remove all human intervention.

1.1. Why AI?

AI or deep neural networks have great benefits because of their feature of 'learning' and predicting. The X-Rays or ultrasounds are studied properly by the algorithms and according to the learning, the decisions are made by the algorithm. The layers of the CNN (Convolutional Neural Network) model adjust their weights according to the input medical images, in the training dataset and hence predict the output according to it. Hence this results into very much accurate result and removes all human caused errors.

1.2. Growth of AI in Healthcare

Figure 1 is used to show the growth of AI in healthcare. Data is shown for the year 2918 and predicted till year 2025. It is clearly visible that demand of AI will increase in coming years.

1.3. Deep Learning: much more than ML

Deep learning is an extension to ML, and hence more versatile and accurate. One can view deep learning as a neural network with many layers, and therefore having better results. Also, more complexity and huge amount of data is well handled by Deep learning networks. In the medical applications, the commonly used deep learning algorithms include convolution neural network (CNN), recurrent neural network, deep belief network and deep neural networks.CNN is the most used model in healthcare [2].

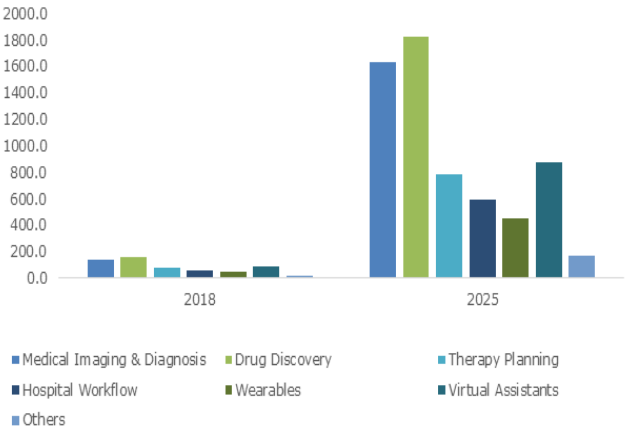

Figure 1 – Growth of AI in healthcare

1.4. About CNN

The CNN was first proposed and advocated for the high-dimensional image analysis by Lecun et al. 38 the inputs for CNN are the properly normalized pixel values on the images. The CNN then transfers the pixel values in the image through weighting in the convolution layers and sampling in the sub sampling layers alternatively. The final output is a recursive function of the weighted input values. The weights are trained to minimize the average error between the outcomes and the predictions. Recently, the CNN has been successfully implemented in the medical area to assist disease diagnosis. Long et al used it to diagnose congenital cataract disease through learning the ocular images.24 The CNN yields over 90% accuracy on diagnosis and treatment suggestion.

II. CNN (CONVOLUTIONAL NEURAL NETWORKS)

CNN is the type of neural network [3] which primarily focus on image classification. The layers within CNN comprised of neurons organised into three dimensions, the spatial dimensionality of the input (height and the width) and the depth.CNN consist of three types of layers. These are Convolutional layers, pooling layers and fully connected layers. When these layers are sacked a CNN if formed. Architecture of basic CNN is depicted in Figure 2.

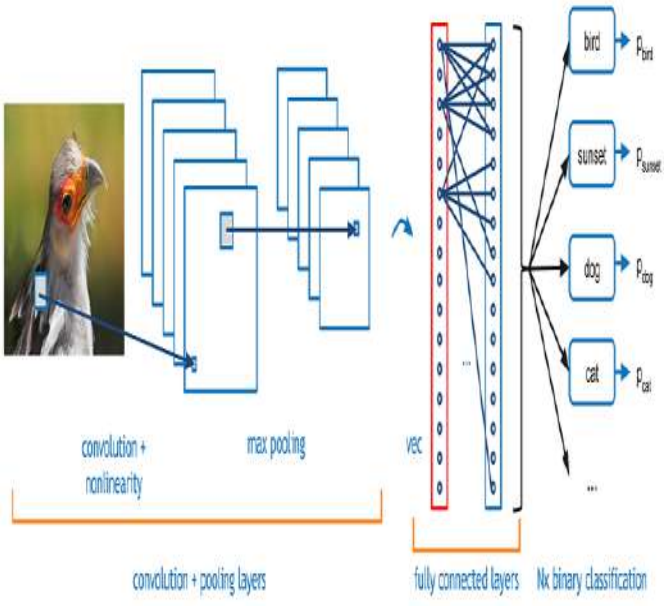

Figure 2 – CNN architecture

2.1. Convolutional layer

The Convolutional layer plays a vital role in how CNNs operate. It contains a set of filters whose parameters need to be learned. The height and weight of the filters are smaller than those of the input volume. Each filter is convolved with the input volume to compute an activation map made of neurons. In other words, the filter is slid across the width and height of the input and the dot products between the input and filter are computed at every spatial position as shown in the Figure - 3.

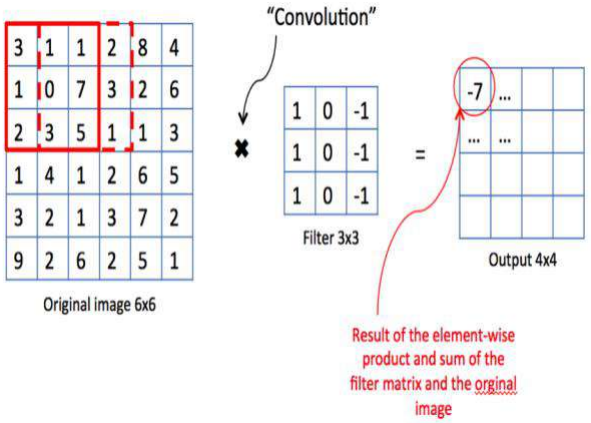

Figure 3 – Convolutional layer

Different types of Convolutional layers are:

1-Simple Convolution

2-Flatterned convolution

3-Seperable convolution

4-Grouped convolution

2.2. Pooling layer

Pooling layers aim to gradually reduce the dimensionality of the representation, and thus further reduce the number of parameters and the computational complexity of the model.

The pooling layer operates over each activation map in the input, and scales its dimensionality using the "MAX" function. In most CNNs, these come in the form of max-pooling layers with kernels of a dimensionality of 2 × 2 applied with a stride of 2 along the spatial dimensions of the input. This scales the activation map down to 25% of the original size - whilst maintaining the depth volume to its standard size. Usually, the stride and filters of the pooling layers are both set to 2 × 2, which will allow the layer to extend through the entirety of the spatial dimensionality of the input.

It is also important to understand that beyond max-pooling, CNN architectures may contain general-pooling. General pooling layers are comprised of pooling neurons that are able to perform a multitude of common operations including L1/L2-normalisation, and average pooling. However, this tutorial will primarily focus on the use of max-pooling. Max-pooling is shown in figure 4.

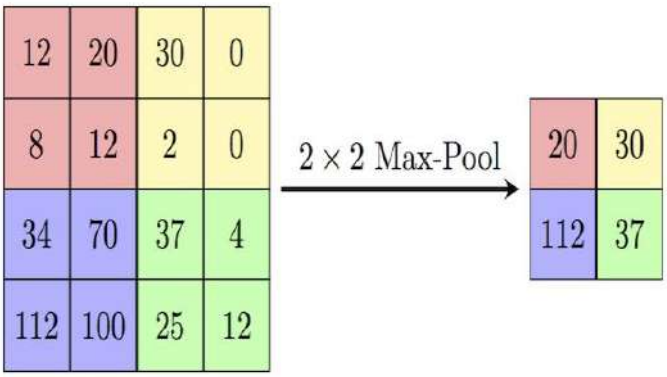

Figure 4 – Max-pooling

2.3. Fully connected layer

The fully-connected layer contains neurons of which are directly connected to the neurons in the two adjacent layers, without being connected to any layers within them. This is analogous to way that neurons are arranged in traditional forms of ANN (artificial neural network).

III. VARIOUS TYPES OF CNN NETWORKS

3.1. LeNet

No discussion of the CNN architectures can begin without this .A ground-breaking algorithm that was the first of its kind and capability, in-terms-of object classification. It comprises of 7 — layers, all made of trainable parameters. It takes in a 32 X

32 pixel image. The activation function applied is RELU function. The layers of LeNet are arranged as shown in figure 5.

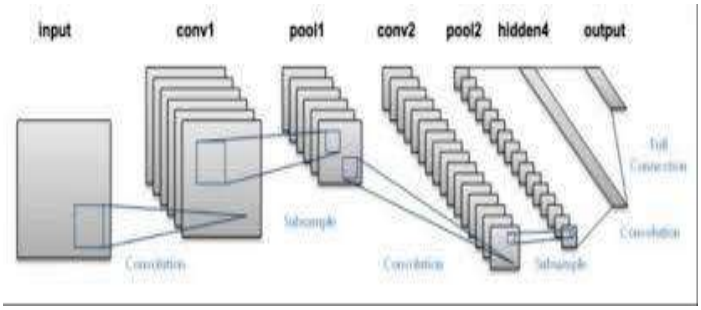

Figure 5 – LeNet architecture

However, when it came to processing large size image and classifying among a large no of classes of object, this network failed to be effective in terms of computation cost or accuracy.

3.2. VGGNet 16

This particular network architecture was the runners up of the ILSVRC-2014 competition, designed by Simonyan and Zisserman. The basic hyper parameters regarding the filter size and the strides for both of the convolution layer and the pooling layer are constant: CONVOLUTION LAYER has filters of size 3 X 3 and stride = 1 and the MAX-POOLING LAYER has filters of size 2 X 2 and stride = 2. These layers are applied in a particular order throughout the network. Only the no of filters defined for each convolution block differs. Architecture is shown in figure 6.

Figure 6 – architecture of VGGNet 16

3.3. GoogleNet / Inception

The GoogleNet or the Inception Network was the winner of the ILSVRC 2014 competition, achieving a top-5 error rate of 6.67%, which was nearly equal to human level performance. The model was developed by Google and includes a smarter implementation of the original LeNet architecture. This is based on the idea of inception module. The basic idea behind the modules is that, instead of implementing Convolutional layers of various hyper parameters in different layers, we do all the convolution together to output a result containing matrices from all the filter operations together. Figure 7 is showing a simple inception module with various Convolutional layers implemented together:

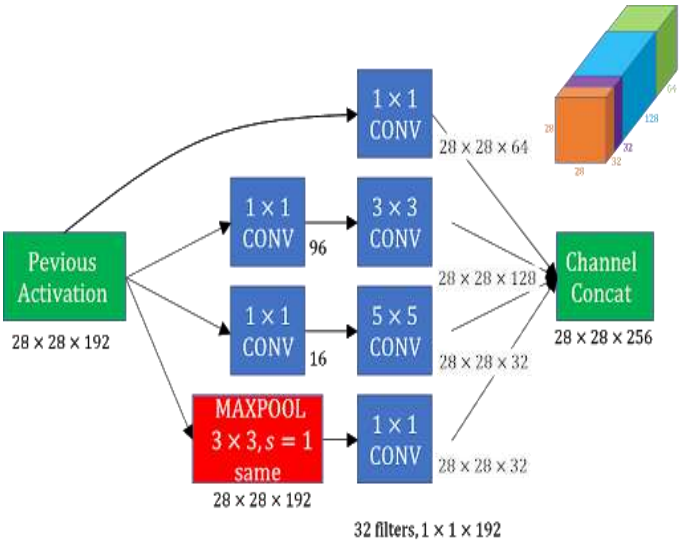

Figure 7 – example of a simple inception model

3.4. ResNets

This is based on the idea of "skip-connections" and implements heavy batch-normalization, that help it in training over thousands of layers effectively, without degrading the performance in the long run. Architecture is shown in figure 8

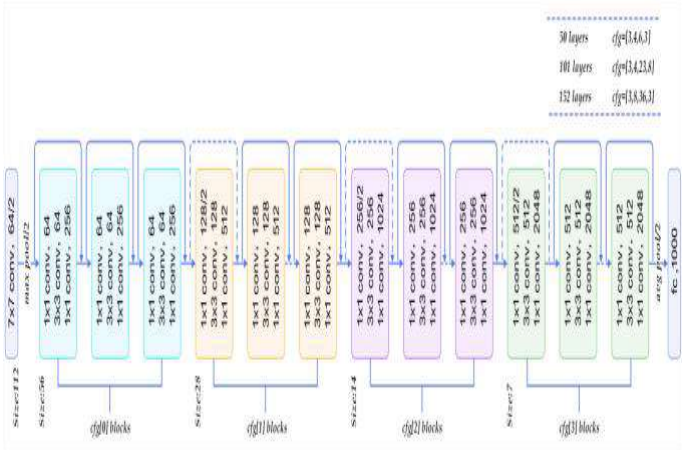

Figure 8 – Architecture of ResNets

This is based on the idea of skip-connections and implements heavy batch-normalization, that help it in training over thousands of layers effectively, without degrading the performance in the long run. The idea that was infused in this architecture was "identity shortcut connection" that implies transferring the results of a few layers to some deeper layers skipping some of the other layers in between as explained in figure 9. The intuition behind it was that the deeper layers should not produce higher training errors than its shallower counterparts. The skip-connections were done to implement this idea. The developers of this network implemented a pre-activation variant of the residual block, in which gradients can flow through the shortcut connection to the earlier layers, thus reducing the "vanishing gradient" problem. [4]

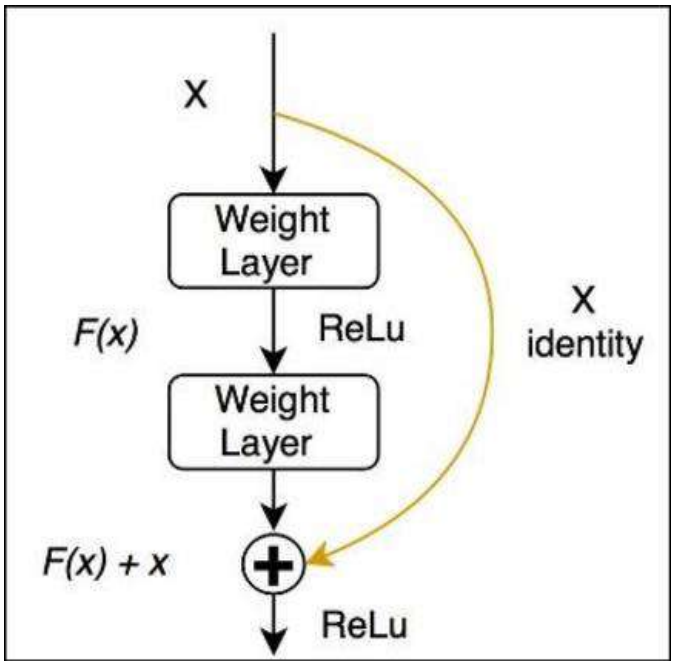

Figure 9 Algorithm

IV. DEEP LEARNING IN MEDICAL IMAGING

Many image diagnosis tasks require initial search to identify abnormalities, quantify measurement and changes over time. Automated image analysis tool based on machine learning algorithms are the key enablers to improve the quality of image diagnosis and interpretation by facilitating through efficient identification of finding. Deep learning is one extensively applied technique that provides state of the art accuracy. It opened new doors in medical image analysis that have not been before .Applications of deep learning in healthcare covers a broad range of problems ranging from cancer screening and disease monitoring to personalized treatment suggestions. Various sources of data today - radiological imaging (X-Ray, CT and MRI scans), pathology imaging and recently, genomic sequences have brought an immense amount of data at the physicians disposal. However, we are still short of tools to convert all this data to useful information. In the below discussion, we highlighted the implementation of deep learning in medical image analysis. [5]

4.1 Pneumonia Detection

Pneumonia is an inflammatory condition of the lung affecting primarily the small air sacs known as alveoli. Typically symptoms include some combination of productive or dry cough, chest pain, fever, and trouble breathing. Pneumonia is usually caused by infection with viruses or bacteria and less commonly by other microorganisms, certain medications and conditions such as autoimmune diseases. Risk factors include cystic fibrosis, chronic obstructive pulmonary disease (COPD), asthma, diabetes, heart failure, a history of smoking, a poor ability to cough such as following a stroke, and a weak immune system. Diagnosis is often based on the symptoms and physical examination. Chest X-ray, blood tests, and culture of the sputum may help confirm the diagnosis. The disease may be classified by where it was acquired with community, hospital, or health care associated pneumonia. Pneumonia affects approximately 450 million people globally (7% of the population) and results in about four million deaths per year. Effect of pneumonia is depicted in figure 10

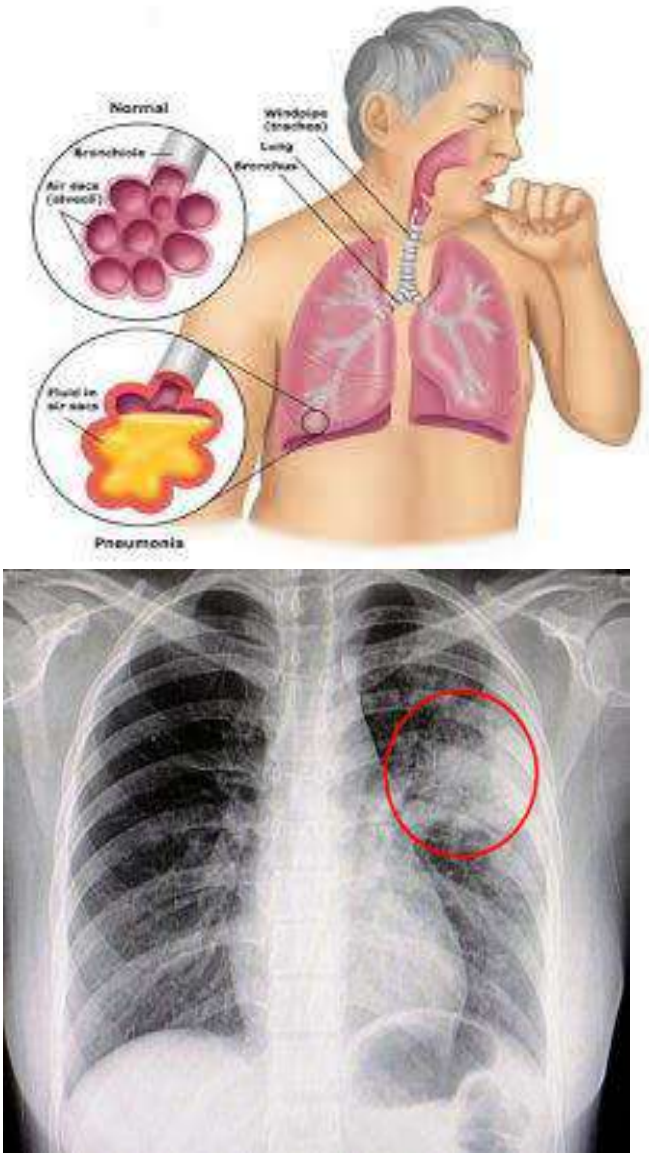

Figure 10 – Effect of pneumonia on lungs

In this, we are detecting pneumonia with the help of chest X-ray. We are training CNN model with the data set of 5856 images of 2 categories i.e. (normal, pnemoniatic).The dataset is divided into 3 parts train , test and validation. All of these three contribute in providing accurate results. Train dataset is used to train the model, and hence the model adjusts the weights according to the inputs. Validation data is used to reduce over fitting. Test data is used to test the trained model. Architecture of the model used is shown in figure 11.

Layer (type)	Output Shape	Param #
conv2d_46 (Conv2D)	(None, 298, 298, 32)	896
max_pooling2d_46 (MaxPooling	(None, 149, 149, 32)	0
dropout_45 (Dropout)	(None, 149, 149, 32)	0
conv2d_47 (Conv2D)	(None, 147, 147, 32)	9248
max_pooling2d_47 (MaxPooling	(None, 73, 73, 32)	0
dropout_46 (Dropout)	(None, 73, 73, 32)	0
conv2d_48 (Conv2D)	(None, 71, 71, 32)	9248
max_pooling2d_48 (MaxPooling	(None, 35, 35, 32)	0
conv2d_49 (Conv2D)	(None, 33, 33, 64)	18496
max_pooling2d_49 (MaxPooling	(None, 16, 16, 64)	0
dropout_47 (Dropout)	(None, 16, 16, 64)	0
conv2d_50 (Conv2D)	(None, 14, 14, 512)	295424
max_pooling2d_50 (MaxPooling	(None, 7, 7, 512)	0
dropout_48 (Dropout)	(None, 7, 7, 512)	0
flatten_10 (Flatten)	(None, 25088)	0
dense_19 (Dense)	(None, 512)	12845568
dropout_49 (Dropout)	(None, 512)	0
dense_20 (Dense)	(None, 2)	1026

Total params: 13,179,906
Trainable params: 13,179,906
Non-trainable params: 0

Figure 10 – Architecture of CNN used for pneumonia detection

After training the above shown model for 10 epochs, the % accuracy of the test dataset is 90.23.This accuracy is quite good.

While training we should keep in mind that model should not get over fitted. Over fitting is an unwanted phenomenon that leads to high training but low test accuracy. The literal meaning of over fitting is that the weights are highly adjusted according to training data and not generalise. We can avoid over fitting by techniques such as adding dropout layers, batch normalisation, increasing the size of data and filtering it.

V. CHALLENGES TO AI IN HEALTHCARE

AI like every other techonology, has its demerits. AI in certain cases, does not perform well and hence fails to replace human physicians and their accurate decisions. The following are the issues

1. Distributional shift — A mismatch in data due to a change of environment or circumstance can result in erroneous predictions. For example, over time, disease patterns can change, leading to a disparity between training and operational data.
2. Insensitivity to impact — AI doesn't yet have the ability to take into account false negatives or false positives.
3. Unsafe failure mode — unlike a human doctor, an AI system can diagnose patients without having confidence in its prediction, especially when working with insufficient information.
4. Automation complacency — Clinicians may start to trust AI tools implicitly, assuming all predictions are correct and failing to cross-check or consider alternatives.
5. **Reinforcement of outmoded practice** — AI can't adapt when developments or changes in medical policy are implemented, as these systems are trained using historical data
6. **Unsafe exploration** — In order to learn new strategies or get the outcome it is searching for, an AI system may start to test boundaries in an unsafe way [6].

VI. CONCLUSION

During the past few years, AI and its involvement in healthcare has only increased, reason being itscapability of providing good results which are at par with the decision making capability of any humanphysician. Despite its accuracy, chances of failure persist and which can have many reasons. For instancethe lack of availability of proper dataset, or unavailability of dataset which has all history , leading tothe failure of model, in case of any outliers. Hence having a proper dataset is really crucial. Also, lack ofawareness and faith among people towards AI based medical facilities can also be an hindrance to itssuccess .
In this chapter, we first discussed about the role of AI in medical imaging, along with its benefits, thenwe discussed about its practical implementation and the accuracy it fetches. We also have discussed thearchitecture of CNN model, and have presented the summary of all its layers.
Here, we have discussed only one approach, but there are many of these. The accuracy of the results isgood, nevertheless there's still a lot of improvement required.Along with the improvement of datasets, different combinations of models can also be tried to checkwhich gives the best results, also testing of the model's accuracy should be done on a dataset which covers every case, hence reducing the chances of failure.

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Web Application for Centralised Information for Blood Donation

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***Abstract*— As we all know Blood is a necessary element in the human body. Human body is incomplete without blood. According to scientist, about 7% to 8% of human weight is comprised of blood. Blood is the most precious gift that anyone can give to another person – the gift of life. People can donate blood via blood donation systems. Blood bank is an area where blood is collected as a result of the activity of blood donation by donors that is stored and preserved (maximum 28 days) for later transfusion. In India, most of the blood banks do not support an online database for blood donors. The number of voluntary blood donors are increasing every year and it is very difficult to maintain handwritten records for the same. Due to this huge rise in donors, an efficient and secure way of data management needs to be introduced for which online platform of blood donation can become a pavestone. Besides maintaining hand written records can be a tedious task as well as can lead to discrepancies. This paper will revolve around the study of a Web-Based Blood Donation Management System which will resolve all these issues.**

Keywords—Blood Donation, secure, authorized, donors, recipients

I. INTRODUCTION

Blood is a vitally important fluid for the body. It is thicker than water, and feels a bit sticky. The blood transports oxygen from the lungs to the cells of the body, where it is needed for metabolism. Blood donation is a voluntary procedure that can help save the lives of others. It is a way of giving "gift of life" to others. Millions of people need blood transfusions each year. Some may need blood during surgery. Others depend on it after an accident or because they have a disease that requires blood components. Blood donation makes all of this possible. There is no substitute for human blood — all transfusions use blood from a donor.

In a recent study done by Ohio University psychologists, has discovered the key reason that people are fearful about donating blood. It's not the pain, needles or sight of blood. It's the fear of fainting - even though this happens rarely after blood donation. People should not pollute their mind with these thoughts. Blood donation is safe. New, sterile disposable equipment is used for each donor, so there's no risk of contracting a blood-borne infection by donating blood.

If you're a healthy adult, you can usually donate a pint (about half a litre) of blood without endangering your health. To be eligible to donate whole blood, plasma or platelets, firstly you must be in good health. Secondly, you must be at least 16 or 17 years old, depending on the law in your state. Some states allow legal minors to donate with parent permission. While there's no legal upper age limit, policies may vary between individual donor centres and lastly, you must be at least 110 pounds (about 50 kilograms) and fit enough to be able to pass the physical and health-history assessments. Things that a person should keep in mind, is to eat a healthy meal, drink plenty of water and get plenty of sleep before donating blood. You should also check if any medications you are taking or recently took would prevent you from donating.

With the information provided above, one must be clear about what blood donation is and why it is important in our lives. Blood Donations in India are conducted by several organizations and hospitals by organizing blood donation camps. Donors can also visit blood banks in hospitals to donate blood or directly to a receiver. The number of voluntary donors have increased in the recent years. Blood donors in India donate about 350 millilitres of blood in a year. To maintain the record of these donors', hospitals need an efficient and secure system. The general idea of this study is to develop a Web-Based Blood Donation System which will help the hospitals to maintain a secure online database to store the records of the donors, display the list of available donors and also keep users updated about the previous as well as the upcoming events related to blood donation. In this pandemic situation, where everything is preferred to be done virtually, just by sitting at home people can find donors for themselves as well as remain updated about the blood donation camps held nearby.

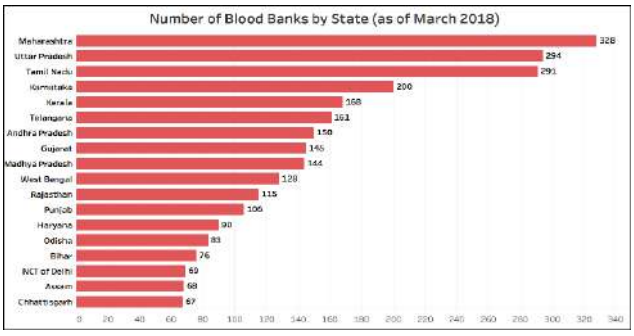

Fig. 1. Number of blood banks by state [13]

II. OBJECTIVE

The main purpose of creating a web-based blood donation system is to eliminate the need to keep handwritten records of available donors as well as to make it easy for people to search the required blood group donors for themselves. It will also keep people updated about the events like blood donation camps in their nearby localities. Any person who is willing to donate will have to register first as a donor providing details such as name, age, contact number, blood group and any health issues. In the user account, a person will be able to view the details of the donors available as well as the upcoming or previously held events. In case, if the user faces any issue, he/she can contact the hospital authorities in the 'Contact Us' section. Apart from this, we have used the concepts of database encryption to make sure that the donors' information is kept secure and confidential. This will help us to keep their records protected from any threats from individuals.

III. LITERATURE REVIEW

1. *Bharat Blood Bank in India [2005]:*

Bharat Blood Bank in India was developed in 2005 by Bharat Matrimony Group. It allowed the recipient to reach the donor. Anyone volunteering to donate blood can register to this site. To log in to Bharat Blood Bank the donor had to put his name, ID, password. The donor's account contains information such as their date of birth, blood group, gender status, weight, email ID, mobile no, city, address, state and information about kidney, cancer and heart disease, and date of his last blood donation. Those in need then can browse the site and look for the suitable blood donor. Bharat Blood Bank provide this service free of cost. The site allowed the recipient to search for the donor by location for easier access. The recipients could contact the donor through the phone numbers provided.

2. *Blood Banks Delhi in India [2003]:*

Blood Banks Delhi was developed in 2003 by XO InfoTech Ltd., Gurgaon. This website provides more than a single service. The blood donor can register online and the recipient can contact them through the information provided by the donor. This website is also known to update the users about the blood donation events such as blood camps in function. Blood Banks Delhi provides the necessary information and blood supply of different blood groups from various blood banks.

3. *Online Blood Donation Reservation and Management System in Malaysia [2006]:*

The given website was developed in 2006 in Malaysia by TehGeok Tuan. The major function of this website was explained as that it provided the data of the blood bank stock and the information about the donor available. The site was mainly for the manager from the National Blood Centre, people willing to donate blood and staff from the participating hospitals. This site was a great assistance to hospitals because now they could manage the blood donation stock and the donors. The website also promoted blood donation by online advertisements informing about recent blood donation events.

4. *Blood Bank Management System Using Rule-Based Method [2017]*:

This study was done in 2017 by Liyana F. It was observed that every hospital needs information on the blood banks' status, doing it manually resulted in faults and was of excessive labour time. For instance, one of the major difficulties faced was that every time a donor volunteered, the staff had to manually had to enter their information which sometimes caused faulty management or wrongly entered data. This web system used rule-based method. If needed the system could send message to the donors of the needed blood type. She developed this system through the cycle of phases. Although with many benefits some flaws were observed. System did not specify the availability of blood bags or the expiration of the blood bags or products.

5. *Wiqaih[2012]*:

This website was created in 2012 by Abdullah Akheriv, Msaad Rasheed, Hisham Aelkezlan Ibtisam Miqren, Mohamed Ibrahim and Nayef Aelkezlan in KSA. This website was created for the convenience for the donors and the recipients. It is easy to use and connected those who were willing to donate blood to the blood banks or regulators. The developers especially concentrated on the protection of the privacy of the donor and the recipient with the cooperation of both the sides.

6. *A Web-based blood donor MIS [2009]:*

Web-based blood donor MIS in 2009 was created in Uganda by Kanobe Fredrick BA, PGDCS. The main focus was the betterment of the weaker section of society in Uganda and supply of adequate blood to those in need. The study was focused on helping in the management of blood donors' records. With the help of IT, it is easier to access to the donors in time. This system helped to provide the blood to various regions of the country in accordance of the hospital demands. It can also be used to record the information on routinely collection of blood and readily available.

IV. METHODOLOGY AND TOOLS USED

HTML (Hypertext Markup Language): HTML is the standard markup language for documents designed to be displayed in a web browser. HTML describes the structure of a web page semantically and originally included cues for the appearance of the document. HTML provides a means to create structured documents by denoting structural semantics for text such as headings, paragraphs, lists, links, quotes and other items. We have used it to define the structure of our web pages. It is the basic skeleton of every website and decides how elements are arranged in our web page.

CSS (Cascading Style Sheets): Cascading Style Sheets (CSS) is a style sheet language used for describing the

presentation of a document written in a markup language such as HTML. Theme and colors we've used in our web pages are implemented through CSS. Beside this it is also used for positioning the elements. CSS in a separate .css file which reduces complexity and repetition in the structural content as well as enabling the .css file to be cached to improve the page load speed between the pages that share the file and its formatting.

JavaScript: JavaScript, often abbreviated as JS, is a programming language that conforms to the ECMAScript specification. Alongside HTML and CSS, JavaScript is one of the core technologies of the World Wide Web. Over 97% of websites use it client-side for web page behavior, often incorporating third-party libraries. All major web browsers have a dedicated JavaScript engine to execute the code on the user's device. We have used JavaScript to make our web pages interact with each other and to perform basic functionalities.

MySQL: MySQL is an open-source relational database management system (RDBMS). "SQL", the abbreviation for Structured Query Language. A relational database organizes data into one or more data tables in which data types may be related to each other; these relations help structure the data. SQL is a language programmers use to create, modify and extract data from the relational database, as well as control user access to the database. We have used it to store the data of authorized users and donors in a structured format.

Node.js: Node.js is an open-source, cross-platform, back-end JavaScript runtime environment and executes JavaScript code outside a web browser. Node.js lets developers use JavaScript to write command line tools and for server-side scripting—running scripts server-side to produce dynamic web page content before the page is sent to the user's web browser.

Express.js: Express.js, is a back end web application framework for Node.js, released as free and open-source software under the MIT License. It is designed for building web applications and APIs. Express is the back-end component of popular development stacks like the MEAN, MERN or MEVN stack, together with the MongoDB database software and a JavaScript front-end framework or library.

Programs used to implement blood bank website system:

Visual Studio Code: Visual Studio Code is a source-code editor that can be used with a variety of programming languages, including Java, JavaScript, Go, Node.js, Python and C++. Features include support for debugging, syntax highlighting, intelligent code completion, snippets, code refactoring, and embedded Git. The entire code of our project is implemented using VS Code.

GitHub: GitHub, Inc. is a provider of Internet hosting for software development and version control using Git. It offers the distributed version control and source code management (SCM) functionality of Git, plus its own features. It provides access control and several collaboration features such as bug tracking, feature requests, task management, continuous integration and wikis for every project.

V. BLOCK DIAGRAM

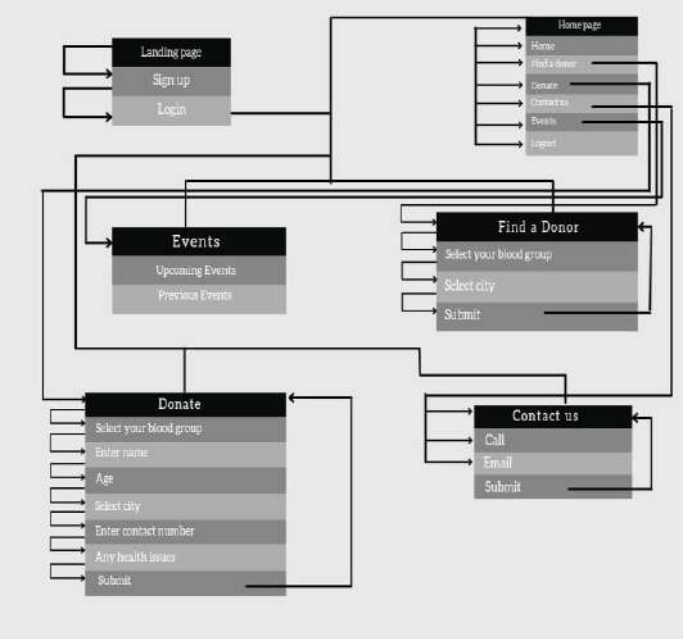

Fig.2. Block Diagram

VI. ADVANTAGES AND APPLICATIONS

India is the second most populated country and with yet increasing population there is a rise in the number of blood donors. Huge amounts of units of blood is donated on an average every year but the database of these donors and the blood units is not very efficient. Countries as populated as India should are in a dire need for an efficient online management system. And seeing the need of the same an automated and efficient way of data management is to be introduced with which online blood donation can come in existence.

The following are the Advantages of an Online Blood Donation management system:

- Manual entry of the blood donors and blood units have and can cause faulty information to be recorded. The dated entered manually can be outdated or typing errors could also occur. To solve this massive problem a study on automated blood banks has been conducted. Presently many vital information for blood donation is not recorded such as gender of the donor, last date of blood donation and frequency of blood donation per year. The study has shown these factors to be necessary for the recruitment in blood donation.
- Donors are encouraged to donate blood and save lives. As it is a web-based application, donors can

check for the blood donation camps taking place in different locations. Apart from this the hassle to attain information about the status of certain group type is reduced and one can check it with a single click from their phones.

- It provides login system which requires the donor to put the required information on his account and to access the site donor would be required to put his ID and password. All of this in turn will help the administrator to manage the data of the certain blood type.
- Blood banks with the help of this system can generate the reports on the status of the donors, recipients or the consumption of blood in particular period of time. These reports can be generated in the decided period of time such as monthly or even quarterly. This could also be great assistance to the blood banks as it will give them access to the data about the blood group in most demand or the blood group which is rarely available or that blood group which might be available in abundance but has a low demand. This information can help blood banks during the recruitment in blood donation.
- Recipients can save time and browse on sites about the availability of the blood group needed. They can search for the blood group or the donor or the regulators in accordance of the blood type or the location for easier access. To get information from blood banks would be much easier.
- Recipients can be aware of the blood which is or is not fit for the transfusion. They can acquire the blood in accordance of their need from the blood banks.
- Blood donation is encouraged and blood banks can upload the information of the on-going blood donation camps and events, this would help those users willing to donate blood and get all information needed.

VII. Conclusion

The main purpose of a secure online blood bank system is to simplify and automate the process of searching for blood in case of emergency and maintain the records of blood donors, recipients, blood donation programs and blood stocks in the bank in a safe, secure manner. To assist in the management of blood donor records, plan and share information in a more confidential, secure and convenient way using database security. To allow a quick and timely access to donor records. The benefit of easy registration and participation in any upcoming events aims to encourage more volunteers to take part in such activities. It is a very useful approach to help the hospitals to maintain an online database rather than maintaining handwritten files which can lead to discrepancies. It is easy to access and very beneficial especially in this pandemic situation where every work is preferred to be done virtually. Just by sitting at home people can search for the required donors and also come to know about the blood donation camps which are held nearby.

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Temperature Detection Entrance System with Sterilization Box

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***Abstract*— Nowadays, in this pandemic, the public areas are not safe because of the non-maintenance of the social distancing. When exposed to the covid-19 virus, the main symptom is high body temperature. The Objects like a mask, phone, Pen, etc., carried by the public contain infectious viruses. So, we are making this "Temperature detection entrance system with Sterillization Box" to detect the temperature at the entrance and maintain social distancing. Which also disinfects the objects using UV light in the sterilization box. This device can be at the entrance of public areas like Movie Theatre, Restaurant, Bank, Fitness Centre, etc.**

I. Introduction

We are living in a milieu of pandemic and vulnerable diseases. As Benjamin Franklin said, an ounce of prevention is worth a pound of cure, and to do so, we have designed a temperature detection entrance system with a sterilization box. It has two parts Auto temperature detection entrance, and a Sterilizer box & Bluetooth controlled robot.

When exposed to the covid-19 virus, the main symptoms are high body temperature detected by Auto temperature detection entrance. If the system detects entrance, it will check the person's temperature; if the temperature is less than the set temperature, the person is allowed entry; otherwise, the entry is denied.

Another concern is that is objects like phone, masks etc., can carry these viruses upto 12 hours that a Sterilizer box can sterilize. It provides 360-degree disinfection following automated timer-based shutoff and alerting it also Can Sterilize Mask, Packed Food, Electronics and many more things.

II. Objective

This project aims to sterilize the objects like phone, masks etc., that can carry these viruses upto 12 hours that a Sterilizer box can sterilize. It provides 360-degree disinfection following by automated timer-based shutoff and alerting. It also Can Sterilize Mask, Packed Food, Electronics and many more things.

And to maintain social distancing to measure body temperature that can be detected by Auto temperature detection entrance. Only a predetermined number of people are allowed in the room. If the system detects entrance, it will check the person's temperature; if the temperature is less than the set temperature, the person is allowed entry; otherwise, the entry is denied.

The main objective of this project is to make a device that helps maintain social distancing and simultaneously check body temperature. This also helps in sterilizing the objects that can carry the virus. This device can be used in Offices, Homes etc. measures proportionately more than is customary. This measurement and others are deliberate, using specifications that anticipate your paper as one part of the entire proceedings and not as an independent document. Please do not revise any of the current designations.

III. Literature Review

Mechanism of Action-

UV-C technology rapidly and cost-effectively deactivates viruses, mold, and bacteria that could otherwise threaten people's health.

UV-C energy passes through the cell walls of bacteria, viruses, and bacterial spores, and it is absorbed by the DNA, RNA, and proteins.

The primary mechanism of damage created by UV-C is fusing the strands of DNA, making what is known as "thymine dimers."

Once the DNA is Fused, the organism can no longer replicate and is no longer infectious. The technical term for this is "deactivation."

Type of ultraviolet light

The application of UV-C energy to deactivate microorganisms is known as Germicidal irradiation or UVGI.

Optimal wavelength varies for UV-C disinfection of different organisms. On average, wavelengths of 250-265 nm are where peak DNA absorption occurs.

Mercury Ultraviolet: It is the most familiar form of UV produced by mercury vapor lamps. In these lamps, the mercury vapor is ionized to create a UV-C of 254 nm.

Pulsed Xenon Ultraviolet (PX-UV) is produced by pulsing a Xenon lamp, which creates a broad spectrum UV (from 200nm to 320nm) covering the entire Germicidal UV band.

UV-C light unit significantly reduced aerobic colony counts and C.difficile spores on contaminated surfaces in patient's rooms.

UV-C technology eliminates more than 3-log10 vegetative bacteria (MRSA, VRE, and Acinetobacter baumannii) and more than 2.4-log10C. difficle seeded onto Formica surfaces in experimentally contaminated patient rooms.

There is ample evidence that no-touch systems such as UV-C light can reduce environmental contamination with healthcare-associated pathogens.

Germicidal irradiation or UVGI is very effective in decontamination of Acinetobacter baumannii from all metal surfaces, i.e., the complete killing of Acinetobacter baumannii from contaminated surfaces was achieved with ultraviolet C light.

Pulsed Xenon Ultraviolet light is an effective and efficient means of disinfecting surfaces contaminated with Clostridium difficle spores, MRSA, and VRE, providing an alternative means to bleach and other chemical disinfectants for use in clinical settings.

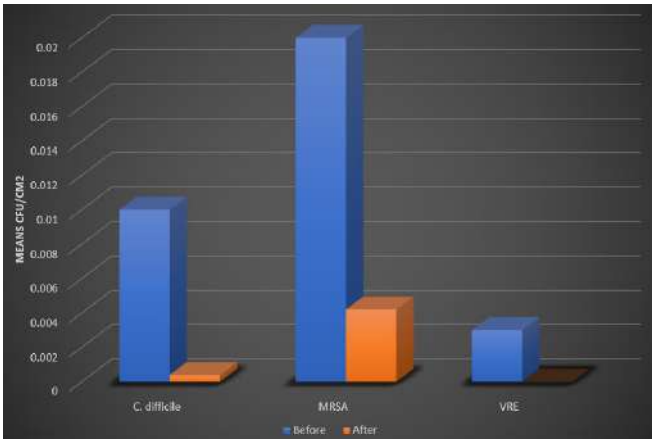

Figure 1: Mean number of colony-forming units(CFU) of C.difficile, MRSA, and VRE from contaminated surfaces in hospital room before and after disinfection with uv.

Two-hundred sixty total surfaces from 66 rooms were cultured, including call light, bedside table, telephone, and bed rails.

IV. METHODOLOGY

The temperature detection entrance system with a sterilization box has two parts.

A. Auto temperature detection entrance
B. Steriliser box & Bluetooth controlled robot

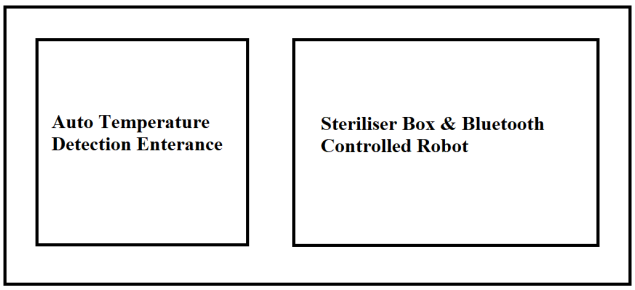

Figure 2: Block Diagram.

A. Auto temperature detection entrance

We have used Arduino uno as our mainboard, which is connected to the temperature sensor and LCD that can display the temperature.

If it detects the entrance of a person, then it will check the temperature of the person. If the temperature is less than the set temperature, the person is allowed entry; otherwise the entry is denied.

Only a predetermined number of people are allowed in the room. The allowed temperature, the number of people allowed in the room, and the number of people actively present in the room, can be set/viewed using an LCD.

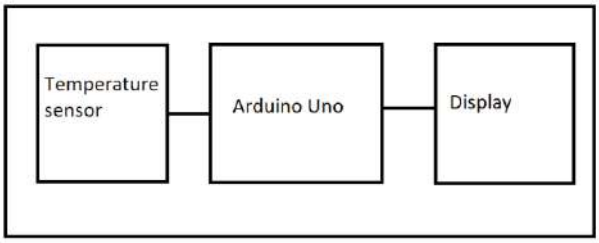

Figure 3: Block Diagram of Auto Temperature Detection Entrance.

B. Steriliser box & Bluetooth controlled robot

In this, our mainboard is Arduino uno which is connected to two modules:
The Bluetooth module.
The voice module.
The Arduino is connected to the motion sensor and the motor driver that controls the motor and gives a power supply to the UV light.
It can be controlled by phone with the help of Bluetooth.

The system makes use of 8 UV c tubes to achieve this task. Now UV C has been proven to kill all viruses within a matter of seconds.

The Arduino controller takes user input for time setting and starts sterilization when the start button is pressed. It automatically shuts off when the sterilization time is completed. Also, an automatic shutoff system shuts off the sterilization if the user between ongoing sterilization opens the lid.

This leads to confusion because equations do not balance dimensionally. If you must use mixed units, clearly state the units for each quantity you use in an equation.

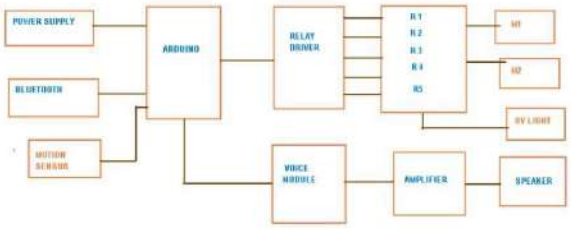

Figure 4: Block Diagram of Steriliser Box & Bluetooth Controlled Robot.

V. TOOLS USED

A. Arduino Uno

This board, based on ATmega328, consists of 14 digital and six analog pins. Apart from these pins, it also includes power pins such as GND and VCC. This tool is powered by 2kb SRAM and flash memory of 32kb. This hardware board includes open source libraries to interface it onboard the microcontroller. This gadget acts as a medium to connect between software and hardware. This 8-bit device can be interfaced with external components such as LED, motors, IR, sensors, and many more. This board consists of everything you need to support a microcontroller. It can be powered through a USB cable through a computer or an AC to DC adapter.

B. Non-Contact Temperature Sensor

These digital sensors work by detecting the infrared energy discharged by a body on a photodetector. These infrared energies are transformed into an electric pulse corresponding to the infrared energy that the body has emitted. As the infrared energy in correspondence to its temperature, the electric pulse comes up with precise data of the temperature of that body. These infrared rays are bounced into the sensors passing through a compartment made of plastic, which doesn't allow infrared frequencies to surpass it. This plastic protects the device from dust and other unnecessary elements.

C. Vtg Regulator IC

The Voltage regulator has a task to maintain a constant DC voltage. The voltage regulator produces a regulated output of DC voltage irrespective of fluctuation or variations in the input current.

D. Bluetooth Module (HC-05)

HC-05 is a Bluetooth serial port protocol that provides a transparent wireless serial connection setup. It is a fully qualified Bluetooth with a 3mbps modulation and a complete 2.4GHz radio transceiver. It further has a 12.7mm * 27mm small footprint.

E. Bluetooth Receiver

It consists of a Bluetooth serial interface module and an adapter. It is used in converting serial port to Bluetooth. This gadget has two modes that are master and slave devices. The device with an even number is termed as master or slaver when out of the producing unit. The device with an odd number can be adjusted as master or slaver by At commando as per requirement.

F. Motor Controller (L298)

The L298 is a high-powered integrated monolithic circuit. It functions of high voltage and is 15 lead multi watt and power SO20 packages. It is built to deal with heavy loads such as relay, solenoids, DC, and stepping motors. The emitters of transistors of each bridge are synchronized together. An additional supply input is provided to make the system work at lower voltage levels.

G. DC Motor

These are a means of converting energy. They take electric energy as an input and convert that into mechanical energy. They are used in hundreds of devices around us. From huge complicated machinery to small juicer blender, motors are meant everywhere.

H. UV-C Tubes

UV-C lights destroy germs such as viruses, pathogens, and bacterias by attacking their DNA. These are used in disinfecting water as they cause damage to the nucleic acid of these microorganisms.

I. VOICE RECORDER AND PLAYER

Voice Record Module is base on ISD1820, which a multiple-message record/playback device.It can offers true single-chip voice recording, no-volatile storage, and playback capability around 10 seconds. This module is easy to use which you could direct control by push button on board or by Microcontroller such as Arduino, STM32, ChipKit etc. From these, you can easy control record , playback and repeat and so on.

J. PIR Sensor

Passive infrared sensors, better known as the PIR sensor, are used to measure infrared light emitting from an object. These sensors are commonly used in motion detectors, security alarms, and automatic lighting appliances. PIR sensors consist of 3 pins that are.

- Pin 1 connects to the positive supply 5V DC.
- Pin 2 relates to the source terminal of the device.
- Pin 3 is connected to the ground.

K. SOFTWARE USED

Arduino IDE: After getting the hardware done, it’s time to test the hardware with the software. This includes the Arduino code written and uploaded to the Arduino UNO.

Arduino IDE was used to get the upload the software code on the Arduino UNO. For the basic solenoid circuit, a simple program was written which basically blinks the LED every 1sec.digital pin 0, 1, and 2 was defined initially which test the program and the circuit. So, when the program runs it makes all basic initializations, defines all the output pins in void setup 0 and then jumps into the void loop where it constantly runs and blinks LEDs on every sec. After that, a small program was written and uploaded to the Arduino UNO which gets the readings from the different sensor.

VI. ADVANTAGES

- Dry Sterilization Without Water or Chemicals
- 360 Degree Sterilization
- Proven for Bacteria and Virus Deactivation
- Adjustable Sterilization Time
- Automatic Safety Shutoff if opened untimely
- Easy to Test
- Zero Contact
- Faster testing
- No Manual Errors

VII. APPLICATION

1. This device can quickly measure and display a temperature reading so a large number of people can be evaluated individually at points of entry.

2. It can be used to maintain social distancing in Offices, Homes etc.

3. Using non-contact temperature measurement devices may help reduce the risk of spreading COVID-19 infections.

4. This device can sterilize mobiles, banknotes, wallets, ear pods, pens, etc by UV-C technique

5. The object can be placed inside the UV sterilisation box by gently opening and closing the lid. Once it fits into the chamber, the disinfection key in the front end of the box begins to disinfect once pressed. The UVC light inside the box penetrates through the viruses and bacteria on the surface of the object. Within three minutes of use, the indicator light stops flashing which means the object has been sanitised from all sides.

6. Disinfect your smartphone, accessories :-Tired of using sanitisers for car keys, wallets, money, or smartphones every time you step in or out of your vehicle? Just place everything inside this UV sterilizer box. This UV sterilizer claims to kill 99.9% of germs that live on the surface of your phones, earphones, wallets, keys, and other daily accessories and gadgets in three minutes.

VIII. CONCLUSION

The proposed " Temperature Detection Entrance System with Sterilization Box" prototype would be the initiative for a safe entrance to any public areas by checking the temperature touchless and Sterilize the things using sterilization box, which avoids the person to bring the infectious things in the area. The sterilization box sterilizes things using UV Rays/Light. It deactivates the DNA of bacteria, viruses, and other pathogens and thus destroys their ability to multiply and cause disease.

IX. FUTURE SCOPE

This project is to make a device that helps in maintain social distancing and simultaneously checking body temperature.
This also helps in sterilising the object that can carry the virus. This device can be used in fitness centers, banks, hospitals, etc.
This technology is not only in use now, but it is rapidly developing and maturing. UV sterilisation is a method that begs to be watched and studied as it has the potential to become a significant game-changer in the orthodontic sterilisation domain. For those whose practice branding emphasizes being technologically advanced, this is certainly in keeping with that philosophy. It can help deal with future deadly pandemics.

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Arduino based women safety device with audio recording feature

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***Abstract*— The main purpose of this paper is to introduce the concept of a women safety band which will send the emergency alert to the police and the guardian member. The SMS containing the GPS location will help the victim to get appropriate help. The device will help the women to get the required support in dangerous and vulnerable situations. This device also has audio recording feature which will later use as evidence in any case.**

Keywords: women, safety, danger, audio recording

Introduction

With all the present-day technologies available to us currently, we can make a device for the safety of women including emergency alarm and SOS message to family and friends. Using this information, the concerned people can reach the victim easily. We are operating this device using an Arduino Nano interfaced with GSM and GPS technology for sending emergency alerts and the location coordinates. We have used an RF transmitter and receiver for cordless communication between the band and the receiving device. We have also used the MAX9814 which is a low-cost, high-performance microphone amplifier with automatic gain control (AGC) and low noise microphone bias for recording audio.

Hardware

- Arduino Nano
- SIM900 Modem
- GPS module
- RF Transmitter and Receiver
- Button
- Battery
- Breadboard
- Jumpers
- MAX9814 Amplifier board
- SD card Module
- SD card

1) GPS Module

The GPS module which is being used is a popular GPS receiver with a built-in antenna which avails a strong satellite search capability. This device can sense locations and track 22 satellites. It identifies locations anywhere in the world. Onboard indicator can find the network status. It has a powerful data backup battery which helps to save the data when there is no power supply.
The core heart inside the GPS receiver is the NEO6MGPS chip. It can track 50 channels. It has a very impressive sensitivity level which is -161dBm. The 50- channel u-blox 6 positioning engine boasts a Time-To-First-Fix (TTFF) in under 1 second. This module supports the baud rate from 4800-230400 bps and has the default baud of 9600.

Features:

- Baud rate: 4800-230400 bps (9600 Default)
- Interface: UART
- Communication Protocol: NEMA
- Operating Current: 67 mA
- Operating voltage: (2.7-3.6) V DC

2) GSM Module SIM900

This device is GPRS enabled Q band cell phone that works on a frequency of 850/900/1800/1900MHz. It can easily access the internet, voice call and SMS. It works by AT command the baud rate is 1200 to 115200. The modem is having TCP-IP stack. This is an SMT type and the core processor AMR926EJ-S is very popular.

Technical Specifications:

- UART interface support
- Frequency bands: SIM900A Dual-band: EGSM900, DCS1800.
- Power saving mode: Sleep Mode power consumption=.5mA
- Supports MIC and Audio Input
- Operating Temperature: -30ºC to +80ºC
- Firmware upgrade by debug port
- Supply voltage: 3.4V – 4.5V
- Speaker Input

Fig:1 GSM Module SIM900A

3. **MAX9814 Amplifier board**

The main component of this project is the MAX9814 which is a high-performance and low-cost microphone amplifier having automatic gain control (AGC) and low noise microphone bias. This device consists of a low-noise front-end amplifier, an output amplifier, an AGC control circuit, a variable gain amplifier (VGA), and a microphone bias voltage generator; all are present in a single chip.

Fig:2 MAX9814 Amplifier board

Connection Diagram

Women Safety System with GPS Tracking and Alerts has parts Transmitter and receiver. Two individual parts help to minimize the size so that it can be worn easily on the wrist.

Transmitter Section

The RF transmitter bears SOS button along with 433MHZ frequency which transmits the data to the reciever wirelessely. When the SOS button is pressed a signal is sent to the receiver section.

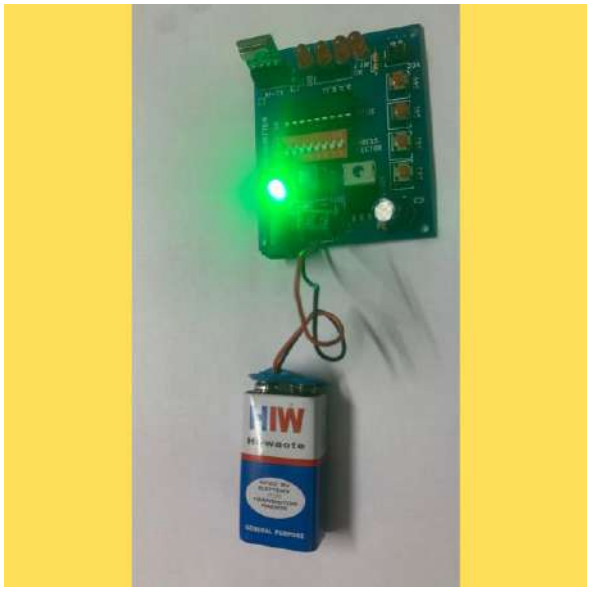

Fig:3 Transmitter section

Receiver Section:

The data transmitted from the wrist band is received by the receiver having 433MHZ frequency. The RF receiver sends the signal to Arduino. On receiving the signal, the Arduino nano processes it using the program flashed into it. Then Arduino sends a signal to SIM900 modem to send an SMS to Registered user.

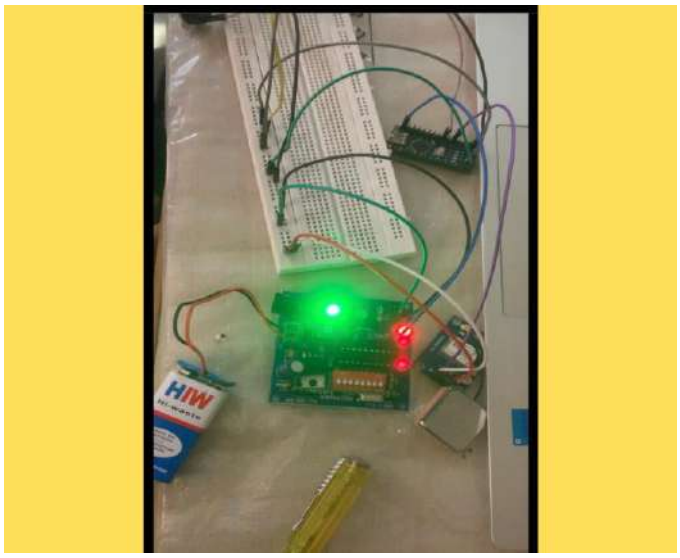

Fig:3 Receiver section

Result

1. By using nano size materials, the kit size gets reduced
2. Using wireless GPS module and wireless panic button the carrying of the kit can be avoided.
3. Audio recording can be later used as evidence .

Conclusion

1. The women's safety device is the most economical solution for the problems faced by women in India.
2. It provides the trusted contacts with real time location of the victim.
3. Using the women's safety device it is possible to prevent major casualties.
4. It uses low power rechargeable batteries can be used to make the device more Portable.

Future scope

1. We can also interface this system with smart phone or mobile and laptop.
2. We can use this safety device in hand bags, luggage, vehicle etc.
3. It is used for the safety of the women.
4. It will be used for child tracking during school time.
5. It can be used by the policemen and the army who go on missions.
6. It can be used in airbags of cars.

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WIRELESS POLLUTION SENSOR NETWORK

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***Abstract*—Knowing the exact level of pollutant is not a piece of cake as smelling to overcome this we are building sensor network consist of MQ9, MQ7, MQ135, Dust sensor, temperature sensors, one location access device. These sensors collect raw data in voltage form converting it to recognizable form i.e. ug/m3 and then making one algorithm in microcontroller to send this data with GSM based location footprint and capability to send packet data through 2G internet or we use Wi-Fi module if GSM not fit in that particular situation. This data stored in firebase real time database which support facility to store or fetch data in real time and easy with the framework called flutter as both are developed by Google also the firebase provide login / signup method which we used to give user personalized based service that is user interface home location. Now final user interface is latest flutter framework based application used as connection between client and server having feature to install in both Android and IOS platform no need to develop to applications separately and learn Java and Swift like language and flutter is not much older. Application provides current AQI, average AQI of the whole weak at a glance and interactive graph with location of device installed and graphical representation that is colorized cloud on icon to represent different AQI numbers and user profile data page use to login and signup.**

Keywords—AQI, sensor network, firebase, flutter-framework, firebase real time database, personalized based service, server.

INTRODUCTION

Development of Air quality Index with regular update of 1-2 hour daily regular basis to remove the unawareness covered to us

A network of the sensor to arrange in a pollution hotspot zone to measure level of concern. Level measured in AQI air quality index, there are various method and one of them which we used developed by David Holstius Senior Advanced Projects Advisor at Bay Area Air Quality Management District Along with this producing pollutant data like CO2 and O2 pm 2.5 pm10 can be more informative element in this. Developing a device with a microprocessor containing several pollution measuring sensors having a battery and GSM connection to send data to firebase server through which we put all the data in device in an app. This app have features to run on both android and iOS platform and develop with latest flutter framework for displaying all this information through this method we developing algorithm to calculate and study data from device to analyses pollution out there.

LITERATURE SURVEY

Developing a wireless sensor network for calculating air quality index(AQI) for people living in high polluted zone with a concept of IOT(Internet Of Things) to contribute a share in developing nation like smart city, home automation, etc. We know that getting the exact level of pollutant in air or knowing a pollution scale in our surrounding aware us to take some decisions. Now a days pollution becomes a major risk factor in our life in contrast with occurring 250,000 deaths annually according to the data provided by WHO. So by developing a real time sensor based network which provide air quality data every hour can reduce this risk effectively and people can become more concerned toward the air pollution.

When we talk about AQI measuring device then we have to spend very high amount to acquire these kind of devices but we are developing a system that hardly cost 1000 rupees for long scale production. Here we are developing a single application which can be used on both IOS and android platforms which is capable in managing two different platforms relatable to the Air pollution monitoring system(IOT enabled) by Yamunathangam in November 2018.A data driven analysis system which gives a hint in providing raw and processed data to local authorized governing body so the legal action can be taken in a systematic way as in survey paper on air pollution monitoring using IOT by Pattar Sunil Mahesh in 2018. As the whole system work as a unit to provide best awareness in society by interacting with ordinary citizens.

IMPLEMENTATION

A. Micro Contoller Logic

Major logic and operation done on microcontroller of Texas instrument MSP 430 Launchpad evaluation kit having supply voltage between 2.2 volt to 3.6 volt and 16 bit risk architecture up to 16.384 megahertz system clock and code composer studio and integrated development environment IDE for code processing that support microcontroller and embedded processor platform portfolio used in project in a logic design in C++ language support.

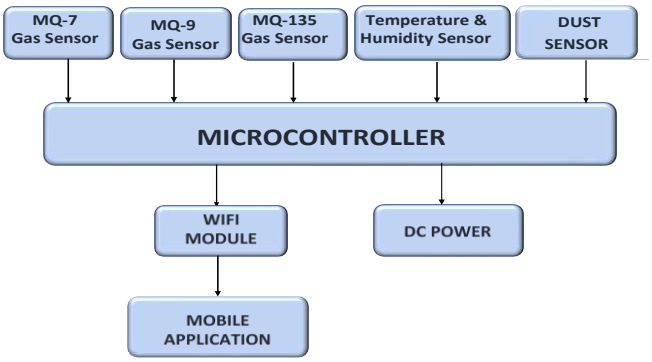

Fig. 1. Micro controller with all its components

B. *Application Logic*

server based logic and operation firebase for server related operation that is a platform developed by Google for creating mobile and web application that by Google having facility to serve real time traitor for logic and flow design in application using a computer application that support both Android and IOS platform flutter developed and back by Google initially release Alpha version 0.0.6 [May 2017] 4 year ago and today stable release 2.0.4 [April 2021] originally build and compile c c + +, dart. IDE we using for application development is visual studio code source code editor .

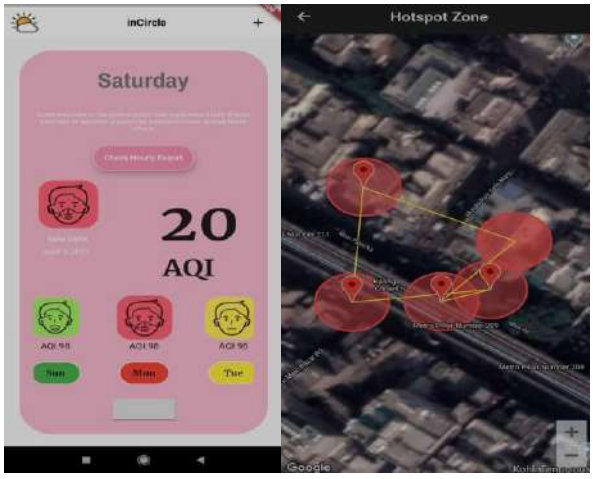

Fig. 2. Application Interface

C. *Sensors*

Using accurate sensor mq-9 Sensor detects carbon dioxide methane LPG gas sensor heated by 1.5 volt to 5.0 volt at high temperature mq7 simply carbon monoxide sensor CO2 gas concentration anywhere from 10 to 5000 PPM , MQ 135 for Air quality , NH3 NOx and alkyl benzene operating at 5 volt , optical depth sensor GP2Y1010205 as optical touch sensor using infrared heating diode and phototransistor sensitivity of 0.5 volt 0.1 milligrams per meter cube, temperature sensor, lm35 series related over -55 degree Celsius to 150 degree.

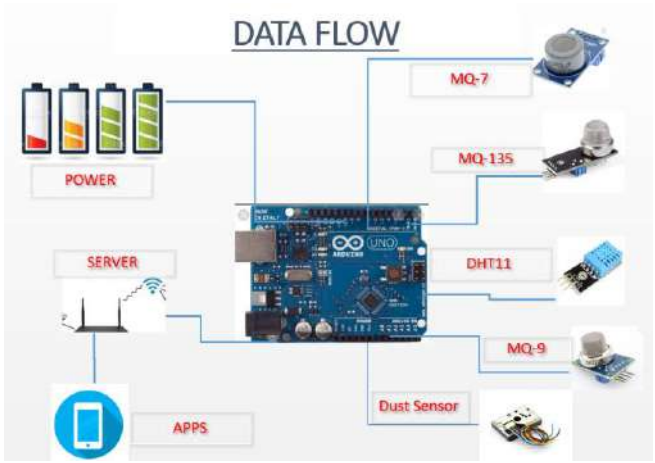

Fig. 3. Sensors attachements

D. *Color Code Algorithm Logic*

Defining the Air Quality Index (AQI) is a simple, color-coded level as a parameter done through USEPA Ranges from 0-500 used in this system.

$$AQI = \frac{(PM_{Obs} - PM_{Min}) \times (AQI_{Max} - AQI_{Min})}{PM_{Max} - PM_{Min}} + AQI_{Min}$$

- PMobs = observed 24-hour average concentration in µg/m^3
- PMmax = maximum concentration of AQI color category that contains PMobs
- PMmin = minimum concentration of AQI color category that contains PMobs
- AQImax = maximum AQI value for color category that corresponds to PMobs AQImin = minimum AQI value for color category that corresponds to PMobs

Defining the possible impact on health and its numerical value meaning i.e. shown in fig.4

Air Quality Index Levels of Health Concern	Numerical Value	Meaning
Good	0 to 50	Air quality is considered satisfactory, and air pollution poses little or no risk
Moderate	51 to 100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	151 to 200	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	201 to 300	Health warnings of emergency conditions. The entire population is more likely to be affected.
Hazardous	301 to 500	Health alert: everyone may experience more serious health effects.

Fig. 4. AQI color code

DISCUSSION

Using WSN for environmental monitoring and pollution control is advantageous as it's a more effective way of collecting data as the sensor nodes are light weight,

easy to install, low power and low cost. They can store a limited source of energy and have no hassle of cables and has portability. Hence the flexibility, high sensing fidelity, low power, low cost and rapid deployment is possible.

In future the device can be modified to be installed on a vehicle or a Drone, it will not only increase the range of device but help us in obtaining three dimensional data. With integration of appropriate mathematical logic we can find the source of the air pollution. There are many other application of our device and we will continuously look for most efficient and impactful way to use of our device for the real world application.

CONCLUSION

Pollution monitoring is very important for environmental protection. In this paper, a study on air pollution monitoring and localization using sensor networks is given. Firstly, the sensors and monitoring systems are explained then, the pollution detection methods using sensor networks are studied. Subsequently mapping of the AQI using google API and graphical analysis method used are explained. Finally challenges in pollution monitoring are presented.

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Distance Calculation for UndergroundCable Fault

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ABSTRACT

Cable faults are damage to cables which affects the resistance in the cable. If allowed to persist, this can lead to a voltage breakdown. To locate a fault in the cable, the cable must first be tested for faults. This prototype uses the simple concept of Ohm's law. The current would vary depending upon the length of fault of the cable. This prototype is assembled with a set of resistors representing cable length in Kilo meters and fault creation is made by a set of switches at every known Kilo meters (km's) to cross check the accuracy of the same. The fault occurring at what distance and which phase is displayed on a 16X2 LCD interfaced with the microcontroller.

The program is burned into ROM of microcontroller. The power supply consists of a step down transformer 230/12V, which steps down the voltage to 12V AC. This is converted to DC using a Bridge rectifier. The ripples are removed using a capacitive filter and it is then regulated to +5V using a voltage regulator 7805 which is required for the operation of the microcontroller and other components.

In this project, a way for sleuthing underground cable fault distance locator is done by using microcontroller. The target of this project is to work out the gap of underground cable fault through base station in kilometers. It uses the straight forward conception of Ohm's law, voltage drop can vary counting on the length of fault in cable, since the current varies. A group of resistors are used to represent the length of cable in kilometers and a dc voltage is fed at one end and the fault is detected the change in voltage using analog to voltage converter. The fault occurring at what distance is shown on LCD which is interfaced with the microcontroller that is used to make the necessary calculations.

Keywords---- *Microcontroller, Ripples,Bridge Rectifier,Volatge Regulator.*

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I. INTRODUCTION

This project proposes fault location model for power cable using microcontroller. The aim of this project is to determine the distance of cable fault from base station in kilometers. This project uses the simple concept of Ohm's law. When any fault like short circuit occurs, voltage drop will vary depending on the length of fault in cable, since the current varies. A set of resistors are therefore used to represent the cable and a dc voltage is fed at one end and the fault is detected by detecting the change in voltage using a analog to voltage converter and a microcontroller is used to make the necessary calculations so that the fault distance is displayed on the LCD display.

Till last decades cables were made to lay overhead & currently it is lay to underground cable which is superior to earlier method. Because the underground cable are not affected by any adverse weather condition such as storm, snow, heavy rainfall as well as pollution. But when any fault occur in cable, then it is difficult to locate fault. So we will move to find the exact location of fault. Now the world is become digitalized so the project is intended to detect the location of fault in digital way. The underground cable system is more common practice followed in many urban areas. While fault occurs for some reason, at that time the repairing process related to that particular cable is difficult due to not knowing the exact location of cable fault.

Fault in cable is represented as:

- Any defect, Inconsistency,
- Weakness or non-homogeneity that affects performance of cable.
- Current is diverted from the intended path.

II. LITERATURE SURVEY

Cable faults are damage to cables which affect a resistance in the cable. If allowed to persist, this can lead to a voltage breakdown. There are different types of cable faults, which must first be classified before they can be located. The insulation of the cable plays a significant role in this. While paper-impregnated cables are particularly susceptible to external chemical and thermal influences, in high-voltage PE or XLPE cables the polyethylene insulation of the conductor is affected, leading to partial breakdowns and cracks that "eat away" the insulation.

Screening faults

A contact between conductor and screen generates a varying resistance.

Phase faults

The contact between multiple conductors generates a varying resistance.

Sheath faults

Sheath faults are damage of the cable sheath that allows the surroundings contact with the cable screen.

Faults due to moisture

Water penetrates into the cable sheath and contacts the conductors. Impedance changes at the fault location make measuring more difficult. The resistance usually in the low-ohmic range.DisruptionsCombination of series and parallel resistances, usually in the form of a wire break. The voltage is interrupted, i.e. Ω=∞.

Cable testing

To locate a fault in the cable, the cable must first be tested for faults. Cable testing is therefore usually performed first in cable fault location. During the cable test, flash- overs are generated at the weak points in the cable, which can then belocalised.The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a softwarelibrary from the Wiring project, which provides much common input.

III. MATERIALAND METHODOLOGY

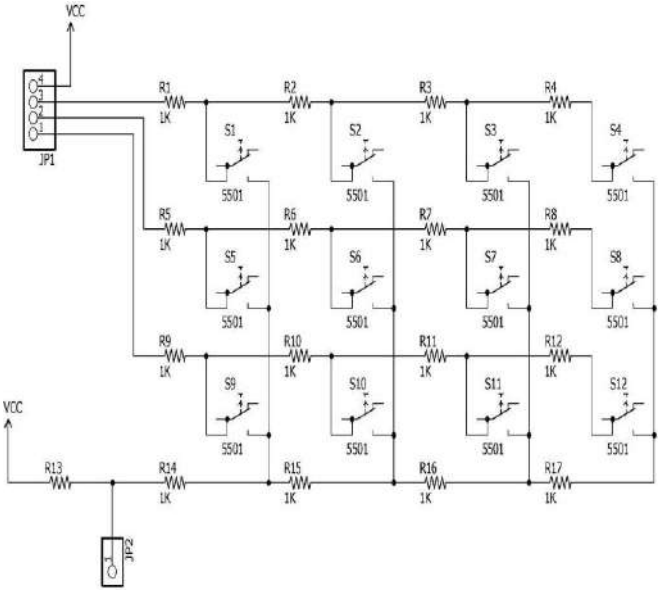
A). HARDWARE USED:-

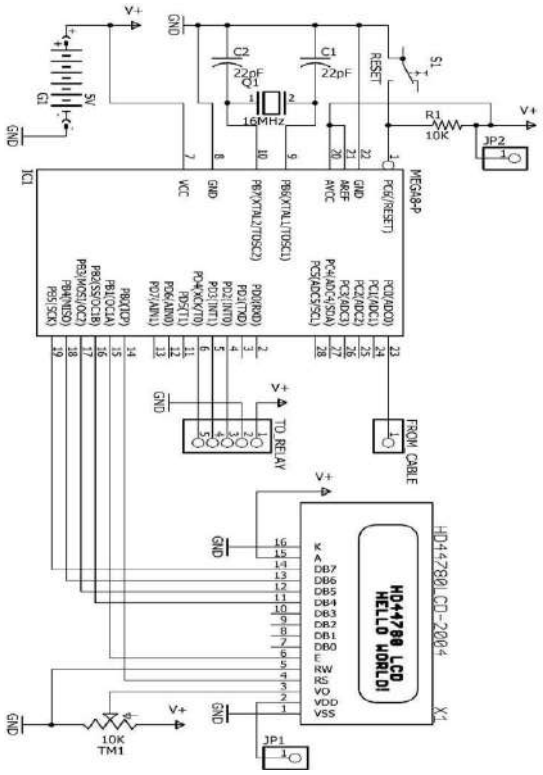
COMPONENTS	QUANTITY
DIODE	3
CAPACITOR	2
RESISTOR	20
RESISTOR	3
RESISTOR	1
LED	3
BJT(BC547)	3
MICROCONTROLLER ATmega 328P	1
CRYSTAL	1
RELAY	3
PUSH BUTTONS	13
IC BASE	1
PCB	1
WIRES	1
WIRES HOLDER	4

The objective of this project is to determine the distance of cable fault from the base station in kilometers. An underground cable system is quite common in many urban areas wherein it becomes very difficult to repair in case of any faults because finding the exact location of the fault in such cable system is quite difficult. With the proposed system, finding the exact location of the fault is possible.

This project uses a standard concept of Ohms law, i.e., when a low DC voltage is applied at the feeder end through series resistor (assuming them as cable lines), then the current would vary depending upon the location of the fault in the cable. In case of a short circuit (line to ground), the voltage across the series resistors changes which is then fed to an ADC, to develop a precise digital data that gets displayed on the LCD.

B). CIRCUIT DIAGRAM:-





IV. ADVANTAGES

This includes aesthetics, higher public acceptance, and perceived benefits of protection against electromagnetic field radiation (which is still present in underground lines), fewer interruptions, and lower maintenance costs. Failure rates of overhead lines and underground cables vary widely, but typically underground cable outage rates are about half of their equivalent overhead line types. Potentially far fewer momentary interruptions occur from lightning, animals and tree branches falling on wires which de-energize a circuit and then reenergize it a moment later.

- Lower storm.restoration cost

- Lower tree-trimming cost
- Increased reliability during severe weather (wind related storm damage will be greatly reduced for an underground system, and areas not subjected to flooding and storm surges experience minimal damage and interruption of electric service.
- Less damage during severe weather.
- Far fewer momentary interruptions Improved utility relations regarding tree trimming Improved Public Safety.
- Fewer motor vehicle accidents
- Reduced live-wire contact injuries
- Fewer Fires
- Improved aesthetics (removal of unsightly poles and wires.

V. RESULT

The hardware model of Underground Cable Fault Locator is implemented and favorable results were brought forward. This hardware model can locate the exact fault location in an underground cable. Further this project can be enhanced by using capacitor in an AC circuit to measure the impedance which can even locate the open circuited cable, unlike the short circuited fault only using resistors in DC circuit as followed in the above proposed project.

VI. CONCLUSION

This paper explains the importance of locating faults in the underground cables and reviews some of the cable fault locating methods along with the simple and convenient method i.e., by using ohm's law. There is a need to immediate indication about occurrence of a fault via remote communication; hence it needs to implement simple techniques which will help power utilities in immediate indication of fault occurrence and accurate methods for locating faults. To facilitate the development in society, the preliminary investigation requirements and the essential segments to be verified are presented in this paper.

VII. FUTURE SCOPE

In this project we detect not only the location of short circuit fault in underground cable line, but also detect the location of open circuit fault. To detect the open circuit fault, capacitor can be used in ac circuit to measure the change in impedance & calculate the distance of fault. This prototype is a basic model for underground cable fault detection which can be helpful in future for fault detection and correction purpose.

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PID Controller Chip Design Overview

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Abstract—In our paper we reviewed the current development and advancement in the field of VLSI which contributes to our development of a PID Controller Chip. PID Controller, widely needed in the industries and it would be a great advantage to lower the conventional bulky apparatus to nano scale sized chip. In our paper we explained the technologies, tools, software, platforms which could be used to design the final chip. We also discussed the methods to lower the power dissipation in the OpAmp as the PID chip would be designed from the transistor level. Thus, low power degeneracy significantly improves the output. We have also discussed about Open-Source EDA tools and software for chip designing. All this ideology together is required for the chip design of PID Controller.

Index Terms—Chip, PID, Open-Source, EDA

I. Introduction

It is required to put our attention towards the development of Open-source programs and tools. These EDA tools provides an ecosystem and environment for the research and academic purposes. Open-source tools provides the user, the researchers clarity and transparency with the constant development and upgradation in the software since it is open-source. [1]

The majority of the automated control loops in the process industries still depend on various types of the omnipresent PID controller which has been commercially accessible for over 70 years. For many bulk operations, the process supervision is achieved through rare manual adjustments by plant operators. Currently, the most frequently used control algorithm in the market is the PID control. The PID controllers are the most espoused in industrial settings because of the superior barter between cost and advantage they can provide.

Recently, the designation for control systems has grown to include a certain degree of intelligence. Thus, these systems must also be able to select the capable intelligent sensor, remote monitoring, and operation, and must be able to execute polished control algorithms that require adaptation. Consequently, to fulfil these amenities, a new way in terms of either hardware-software co-invent or evolvable hardware like FPGA that permit such a type of hardware/software co-design needs to take place. [2]

As the development in semiconductor technology increased, the importance and demand of the opensource EDA tools also increased. EDA tools are required to develop design-services to evaluate designs for manufacturing readiness. In our paper, we are working on an approach on designing of PID Controller as an SoC design i.e., converting the conventional bulky apparatus to a small Nanoscale sized chip.

Power usage in digital circuits is a very critical issue. Whether it is our laptops, mobile phones, tv, etc. power consumption needs to be reduced. To lower the power usage, we can follow the approach i.e., starting from the fundamentals i.e., reducing the power usage of the circuits at the fundamental levels i.e., GATE Level designing. [3]

Initial developments have contributed to the field of Automated Applications of Microprocessor power algorithms. These mathematical methods have pointed out the issues related to the usage of analog searches. Due to which they have versatile architecture and are significantly economical. Recently developed digital technologies like FPGA are achievable with technological development in microelectronics and are helpful for implementing digital control algorithms. Initially, FPGA circuits were considered an advancement of CPLDs.

Mainly, PID controllers are the manufacturing equipment controllers, this is the reason why PID algorithms must be digitized. Present computer control systems need superior and high-speed components for processing. This characteristic is achieved by using several new control algorithms like adaptive control, slider mode control, and fuzzy control. [4]

II. Discussion

The ordinary PID Controller continues to have the problems of insufficient speed and stability. The traditional machines use ARM or single chip-based microcomputer as a process which has slow arithmetic processing capabilities and insufficient dynamic loading control capabilities. [5]

First developments have been rendered in the automated application of microprocessor power algorithms. These mathematical methods have referred the issues relevant to

the use of analog searches. Due to which they have versatile architecture and are significantly economical. Recently developed digital technologies like FPGA are achievable with technological development in microelectronics and are helpful for implementing digital control algorithms.

FPGA is a variant of a semiconductor logic chip that can be programmed like PLDs to virtually remodel any sort of digitized network or circuit. Reprogramming can be done indefinite times for FPGAs, whereas it reduces to a certain number of times in the case of PLDs.

Configuration of FPGA architecture is done with the help of a language, for instance, Hardware Descriptive Language (HDL). FPGA is dominant to fixed-function Special Application Integrated Circuit Technology (ASIC) because of its various advantages. It takes around a month to manufacture ASIC, while FPGAs are manufactured in less than a second.

Alteration can be done in FPGA using RTL to acquire the preferred output. FPGA comprises three major building blocks, namely CLBs, IOBs, and SMs. CLB is a chief resource to get the target logic function. IOBs are responsible for controlling extrinsic connectivity and SMs provide configurable internal connectivity between the CLBs and IOBs within the FPGA. Because of the Programmable nature of FPGA, it has a variety of applications like embedded systems, automation systems, communication, and many more.

Owing to their remarkable high density, less configuration time and cheap prices SRAM-based FPGA has rule over the market. One flaw of SRAM-based FPGAs is that it requires an extrinsic non-volatile memory to reserve a netlist as SRAM is a kind of volatile memory. It is inescapable that the bitstream stocked in the extrinsic non-volatile memory should be shifted to the SRAM-based FPGA whenever the FPGA system is powered on.

Earlier, many studies about reverse engineering have tried to regenerate the original design after extracting the bitstream from the external memory while transferring it from non-volatile memory. Two Integrated development environment which Xilinx support are Xilinx ISE Design Suite and Vivado - to synthesize, simulate, and program FPGA chips. Low-cost FPGA chips, including Spratan-6 and Virtex-6, as well as their precursory families are compatible with Xilinx ISE Design Suite. [6]

III. TOOLS USED

A. Xilinx ISE Design Suite

It is a design software which is required for Xilinx design programming from entry level. It includes an Embedded Kit for development called EDK which is a combined product for designing processing systems. It is required for development and processing HDL designs and focusses on the development of FPGA and Xilinx CPLD IC families.

B. NI-Multisim

To Perform the simulations of 2 stage Op Amps and other Circuits developed from transistor level the software we have used is Ni Multisim. It is an electric design software platform to develop and simulate GATE level designs. It provides a Graphical Interface to design and simulate the circuits. It is fool proof, and the benefit is that the hardware components are not required for simulation of circuit. Every modification, designing and simulations can be done virtually.

C. Yosys

It is used for RTL synthesis for Verilog. It provides synthesis for different algorithm due to its Verilog-2005 support. It can analyse and process any synthesizable Verilog2005 design. It can also check properties with its built-in formal methods. It is required for Mapping to Xilinx 7-series. It can be used for Lattice iCE40 FPGAs and forms the foundation and front-end for custom flows.

D. Graywolf

Graywolf is a placement software build in Yale University by the name “TimberWolf.” The last opensource Graywolf version provides professional-grade placement in the design synthesis flow.

E. Qrouter

It connects a netlist in VLSI fabrication by generating metal layers. It places metal routes over the standard cells, generally packed together at minimum spacing. For input it uses LEF and for output it uses DEF formats. It analyses the geometry, contact points, route obstructions in each cell from the input file. Then it runs detailed route by reading the placement of the cell, netlist and writes an explained DEF file as output.

F. Netgen

It compares the netlists by the process called LVS. It makes sure that the geometry is matched with the expected circuits. It is mostly required for circuits having mixed signals as they cannot be processed in reasonable time.

G. Magic

It is a software used for layout developement in VLSI. It uses corner-stitched geometry i.e., it represents the layout as the stack of planes which consists of tiles. It works in combination with IRSIM and runs under linux.

H. Qflow

It is required to process a circuit design written in Verilog or written in VHDL into a physical circuit by providing the tools

and methods for digital synthesis flow. It can configure the code for FPGA or the code for the layout in specific fabrication technologies.

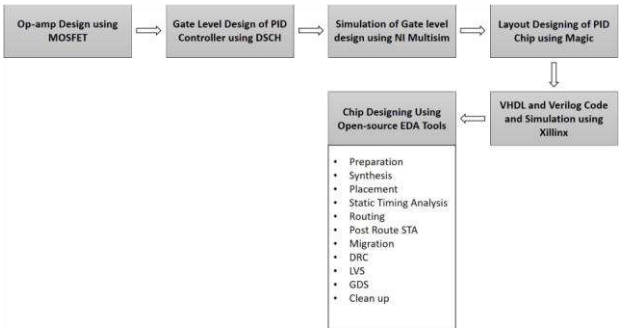

Fig. 1. Flow Chart

IV. Methodology

The Chip designing process we have proposed consists of the following steps:

A. Preparation & Synthesis

This is the process in which the circuit designed in a high behavioural level language like VHDL, or Verilog is turned into a physical circuit which can be layout into a specific fabrication technology process.

B. Static Timing Analysis & Placement

STA checks all the paths and routes for timing violations and validates the performance of design by verifying all the possible paths. After the path have been set placement takes place. Placement is the commencement of Physical implementation process i.e., to meet the timing, congestion and utilization placing the cells in standard cells rows.

C. Routing & Post Routing STA

The interconnections which are developed by finding the exact and correct paths for every net is called as routing. In Post Routing STA i.e., after the process of routing is completed, the design is checked for the routing interconnects logically.

D. Migration & Design Rule Check (DRC)

Migration or Electromigration (EM) is the optimization of IC interconnects to stop the electrochemical growth to prevents short circuiting. DRC check is the physical confirmation for metal width, and for the spacing requirements for different layers based on the technology nodes.

E. LVS & GDS

LVS stands for Layout vs Schematic and GDS stands for Graphic Data Stream. LVS is another physical verification after DRS. LVS checks the working and function of a design schematic by comparing the layout with design netlist. GDS shows the data like labels, shapes, or the information of the layer and 2D &3D layout content in a grouped format.

The component library of Multisim contains higher than 16000 modules to ensure the best possible results. It contains more than 10 virtual instruments like DSO, Function Generator, etc. which works the same way as practical instruments. The benefit of using Multisim is anyone can perform simulation by the conventional trial and error. We can make modifications to the circuits, compare the circuits with the modifications, add or remove components without worrying about damaging any component till we get the satisfactory results. [7]

V. Conclusion

So, the main intent of this project is to design a completely functional PID controller chip as a substitution for the bulky apparatus, so that the size reduces and so the cost. The chip is developed on nanotechnology, 180 nano-meter technology has been used here. Once the chip is designed, then its further tuning does not require an expert for the functioning, or we could say it reduces the manual labour. To fulfil the above stated objective, the following methodology has been followed: the first and the foremost step is Gate Level Designing from scratch which is done using Multisim. Then comes the layout designing part, Magic has been used for the same. Simulation of Verilog code is done using Xilinx. the final and the principal step, to design the chip has been executed using the Electronic Design Automation Tools (EDA Tools) which are Yosys, Graywolf, Qrouter, Netgen, and Qflow. In a nutshell, the nano-size chip has replaced the conventional bulky apparatus and has made our work facile.

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Coal Mine Safety Monitoring and Alert System

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ABSTRACT

Coal mine protection has increasingly evolved into a major concern for society and the country. At a time when multiple agencies are assisting in the rescue of 15 miners trapped in a rathole mine in Meghalaya, data previously tabled in the Lok Sabha revealed that 377 coal, mineral, and oil miners died in accidents between 2015 and 2017.
In 2017, 129 of the 377 deaths occurred. In 2016, there were 145 deaths, compared to 103 in 2015. Coal mines have had the largest number of fatalities as a result of mine accidents. More than half of the 377 were killed in coal mines (210). A creative approach is needed to increase mining efficiency and lower costs while also considering worker safety.
Coal mine safety monitoring systems on belts based on wireless sensor networks will represent the complex situation of workers in underground regions in a timely and accurate manner, allowing timely action to be taken, and additional Wi-Fi modules can aid in detecting the approximate position of the individual.

I. INTRODUCTION

Coal is a vital commodity and raw material for a variety of industries. It is used to generate electricity as well as recover a variety of by-product chemicals and

materials. The extraction of coal from a coal mine, on the other hand, is a difficult and dangerous operation. Many incidents occur in coal mines around the world, resulting in deaths and financial damages Miners' wellbeing is a significant concern. Miners' health and lives are jeopardised by a number of serious problems, including not just the working climate, but also its consequences. The use of cutting-edge smart technology will greatly minimise the risks and hazards.An strategy is needed to improve productivity while reducing the negative impact on worker health. Particulate matter and gases such as sulphur dioxide (SO2), nitrogen dioxide (NO2), and carbon monoxide (CO) are among the pollutants released by coal mines. Semiconductor gas sensors are used to measure the concentration levels of hazardous gases.

The method of extracting coal from the earth is known as coal mining. Coal is used as a fuel in the steel and cement industry to produce iron from iron ore and to make cement. Every parameter, such as methane gas, high temperature, fire incidents, and so on, must be controlled on a regular basis in the underground mining industry.Coal mines also have a low level of safe production; disasters in coal mines occur regularly, resulting in significant loss of property and life. Because of the complexity of the mine environment and the variety of work performed in coal mines, it is important to control the working environment of coal mines.

To address this problem, a coal mine safety monitoring system and alert system with audio and visual indications of situations in the mine, as well as indicating the location of the worker when necessary, has been designed..

II. LITERATURE SURVEY

1. Norliana Binti Yusof, Norhayati Soin, Siti Zawiah Md.Dawal, “Capacitive Interfacing for MEMS Humidity and Accelerometer Sensors,” IEEE, 2010. The paper suggests an early warning protocol for sand plugs that have been subjected to twofold logarithmic twist.. In the twofold logarithmic curve slant sand plug chance caution, the coupled time area analysis and GRNN figuring are used to estimate the oil weight and bundling pressure parameters right away. Furthermore, the inclination adjustment is used a short time later to interpret and denounce the sand plug, which can comprehend the early reprimand of sand fitting breaking.Finally, to increase the accuracy of twist slant tally, the improved AP gathering computation is used to divide the oil weight and weight twist, then twist fitting, while also calculating the inclination of the fitted curve. The paper's primary responsibilities are mentioned in the appendix.: (1)The paper constructs a laugh hysterically early counsel model for the twofold logarithmic twist of sand relation of making.. (2)In the early notification model, the time course of action inspection count is proposed, which can imagine the oil weight and bundling strain, and the GRNN calculation is used to update the desire realises the time space evaluation.. (3) To improve the precision of risk note, improved AP gathering computation is used to pack the watching data. The remainder of the paper is sorted as follows. Region 2 contains four logical models, including two-fold logarithmic twist models, a time game plan model, a GRNN,and enhanced AP gathering. Part 3 depicts a perceptive model for combining time plan and time zone analysis with GRNN. The enhanced AP packing early reprobation model is depicted in Territory 4. Section 5 assesses construction applications.

2. "A Wireless Gas Leakage Detection System for the Home," AyaBani-Salma, Nour Mani, LuayFraiwan, Khaldon Sweesy, LuayFraiwan, Khaldon Sweesy, LuayFraiwan, Khaldon Sweesy, LuayFraiwan, Khaldon Swee A remote security system for identifying gas spillage proof is proposed. The device is designed

for use in nuclear families where mechanical assemblies and radiators that use combustible gas and liquid oil gas (LPG) may be a source of hazard. The structure may also be used for a variety of company or plant applications that rely on LPG and combustible gas in their operations. The distinguishing proof and transmission module, as well as the tolerant module, are all necessary components of the structure setup. Using an exceptional distinguishing circuit, the ID and transmitting module detects the difference in the gas core. This module determines if a change in gas (es) gathering has outperformed a pre-selected edge. If the sensor detects a change in the gas core, it triggers a media warning and sends a signal to the authority module. The authority module serves as a versatile warning system that allows people to move around the building. The device attempted to use LPG, and the alarm was triggered by improvement in the middle.

3. Ravi Kishore Kodali and Aditya Valdas, "MQTT Based Environment Monitoring In Factories for Employee Safety," IEEE, 2017. One of the most significant advantages to be considered by associations is labourer prosperity in any industry, especially at the production line level. This is important, both for the delegates' well-being and the organization's overall success.It is common for episodes to occur in plant preparation where working conditions are harsh and agents must move with extreme caution when approaching their tasks. With tens of thousands of officers, it's important to remember that there's a level of protection in place to protect them from any potentially dangerous situations. We suggest a checking structure to be presented in mechanical offices as a solution to this issue. Through this arrangement, we will be able to screen basic security parameters of the work environment in these mechanical offices, allowing us to be more aware of the state of success and the prospect of misfortune. We use an ESP8266 Wi-Fi chip and a Node MCU microcontroller for the structure of this device. Three sensors are connected to this: a screen temperature and suddenness sensor (DHT sensor), an ultrasonic sensor (HC-04), and a smoke sensor (MQ2 sensor).These sensors continuously monitor the environment in the workplace and send data to the IoT Platform, which is one of the most innovative cloud platforms for analysing data and creating new game plans.

4 ."Worker Safety in Underground Coal Mines", 2014, IJAIEM, Mrs.R.R.Thorat, Dr. L. K. Ragha, Prof. R.D.Patane. Security best practises of any affiliation must be deeply embedded in the corporate culture and preserved from the top down through the ranks in order to be effective. Prosperity is a movement that involves all. This is particularly important in mining and other high-risk endeavours, where prosperity, treatment, and continuity are critical in preventing disasters, wounds, and fatalities. Mine managers and individual diggers must adhere to operational prosperity strategies with extreme caution.Directors must include the appropriate devices and prepare each agent in order to ensure the life, prosperity, and welfare of the workers, as well as the security of important work sites and properties. Making a stable working environment implies a dynamically useful and efficient mining movement, as driving mining affiliations are well aware. It also leads to higher levels of worker confidence and job satisfaction, which increases labourer retention. Taking a broad approach to strengthening professional security preparation and healthy work practises is a sound endeavour that will pay off in the long run.

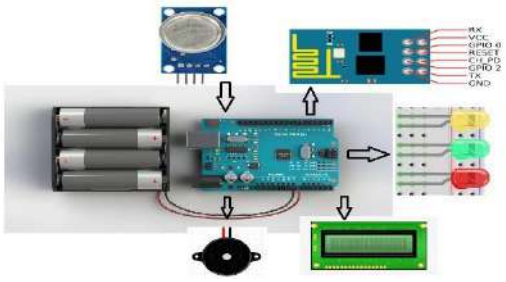
III. SYSTEM WORKING

The monitoring system is housed under the earth. The ability to predict outbursts using sensors and microcontrollers, as well as produce a warning system before critical atmospheric levels, is critical to preventing coal mine accidents.Continuous monitoring is needed, which necessitates the use of a reliable and accurate sensing device. This device includes a sensor module with a number of sensors that track real-time underground hazardous conditions such as dangerous gas concentrations.

A belt and extension wires to the wrist are part of the system. A battery bank can be used to power the device. A battery bank is small enough to fit in a pocket. The device will detect the gases and provide audio and video feedback as required. A small buzzer will be installed for audio indications, with two sounds, one for "Alert" and the other for "High Risk." Three LEDs will be installed on the wrist as video indicators. The presence of a blue LED indicates that everything is in order. "Alert" -> orange/yellow "High risk" is indicated by the red LED.

Wi-Fi modules can be added to the device, which can be used to get a "approximate understanding" of a person's position in some cases. Since mines are so huge, relative to the size of the mines, this can offer a fairly accurate indication of the person's location.

Fig 1 Block Diagram of system



A. BLOCK DIAGRAM EXPLAINED

The following sub-blocks and devices make up the project block diagram:

The methane gas sensor detects the presence of methane gas inside the mine.

- Inside the mine, the smoke sensor senses fire and smoke.
- The sensor data is displayed on the transmitter module's LCD panel.
- When any of the sensor values exceed a predetermined threshold, the buzzer sounds.
- In mine, the colour of the LEDs changes depending on the situation
- Esp8266 often detects the presence of miners in a given area.

IV. FLOW CHART

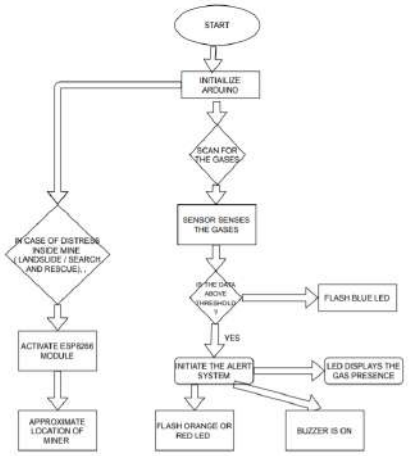


Fig 2 Flow Chart of the system

V. HARDWARE REQUIREMENTS

- Arduino MINI
- LCD
- Gas Sensor
- ESP8266
- Connecting Wires
- Buzzer
- LED

A. ARDUINO MINI

The Arduino Mini is a small microcontroller board based on the ATmega328P that was designed for use on breadboards and in situations where space is restricted. The Arduino Mini is a little more difficult to bind than a normal Arduino board due to its small scale.Due to the small size it could be embedded into the belt easily .

B. LCD

We will use a liquid-crystal display i.e a flat-panel display to show the visuals conditions in the mines so that the worker is aware when the condition gets harmful LCD will be used to give messages such as “EXIT IMMEDIATELY” or “NORMAL CONDITION” according to the environment.

C. LED

LEDs will also be mounted on the system as a source of indication.

3 LEDs will be used to indicate different messages which are

Blue LED = “OK SITUATION”

Yellow/Orange LED “WARNING”

Red LED = “HIGH RISK”

D. BUZZER

Buzzer will be used for audio indication in case the video indications are ignored in hustle .Buzzer will have two sounds, one for "Warning" and other for "High Risk".

E. ESP8266

The ESP8266 WiFi Module is a self-contained SOC with an integrated TCP/IP protocol stack that can provide access to your WiFi network to any microcontroller. The ESP8266 can either host an application or offload all WiFi networking functions to a separate application processor.

This module has sufficient on-board processing and storage capability to enable it to be integrated with sensors and other application-specific devices through its GPIOs with minimal creation and load during runtime.

VI. CONCLUSIONS

This proposed system would be compatible with the current safety protocols. This is a low-cost, simple-to-implement solution. This study examines mine hazards in India's underground and open-cast mines in great detail. The alerting system is effective in high-temperature, high-pressure mining environments. Flexible networking, easier implementation, and lower installation costs are just a few of the benefits.

VII. FUTURE SCOPE

With the advancement in technology, future work on this experiment may include further improvement of the device by incorporating other advanced sensors for underground monitoring. There are dangers. Furthermore, all underground operations can be performed from the ground level. New communication technologies are being developed that can

be used for high-speed data transfer in conjunction with smart sensors for mine sensing.

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SURVEY ON MAMMOGRAPHIC IMAGE CLASSIFICATION METHODS

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***Abstract*- Breast cancer poses a great risk to women's life and is genetically heterogeneous diseases. In medical area digital image processing facilitates in case of detecting and classifying the mammogram images. Classification of breast cancer in mammogram image is an important step to classify whether the patient is affected by cancerous (malignant) or non-cancerous (benign) tumors. Image classification is the task of correctly assigning an image to the class to which it belongs to. In this paper, classification (Normal/Benign/Malignancy) of two- view mammogram image have been reviewed using various different techniques like SVM (Support Vector Machine), ANN (Artificial neural network), Convolutional neural network, local features based deep learning. Tremendous success have been achieved for Convolutional neural network (CNN) in tackling various tasks of computer vision problems such as classification of images and recognition of objects. Some well-known scale and rotation invariant local features such as SIFT(Scale Invariant Feature Transform), SURF(Speed Up Robust Features), ORB(Oriented fast and rotated BRIEF), BRISK(Binary robust invariant scalable key points), KAZE have been observed, which of these have the strong potential to replace inclusively the convolutional layers of CNN Model. SIFT and SURF based features gives good accuracy for classification of image. The average accuracy of the model reaches 94.55%, which improves the accuracy of the benign and malignant classification of mammogram images. At the same time, it also proves that the model has good generalization and robustness.**

Keywords- Mammographic Images; Classification; SVM; ANN; CNN; SIFT; SURF; ORB; BRISK; KAZE.

I. INTRODUCTION

Image classification is basically performed in two steps. Extracting some information from the image and second is training the machine for the same. In order to assign a class to the query image a thorough study of relationship between the image and the class is required. To achieve this, various classifiers like- Support Vector Machine (SVM), Artificial Neural Network (ANN), Convolutional neural network (CNN) etc. are used. In two ways classification can be done: Supervised and Unsupervised. Unsupervised classification is based on the analysis of the image without having any prior-information. Supervised Classification is where human provides some the prior-information about the classes and train the machine with respect to that information.

A. Need of Image Classification

Image classification has a wide range of applications, for example, video surveillance, image and video retrieval, web content analysis etc. In image retrieval, once the class of the query image is identified then search has to be made only within that class for retrieval, using labeled dataset. Thus, in image retrieval image classification plays an important role.

B. Challenges in Image classification

To classify an image manually though it is very easy for human as just by seeing the image one can classify but when it comes to system it is a challenging task. There are two challenges, firstly extracting those features which represents the image in the best manner and secondly training the machine using those features. Different feature extraction approaches have different accuracy[3]-[9]. In literature it is found that SIFT and SURF based deep learning model [2] gives better results with accuracy of 95% in comparison to other classifier. The very obvious challenge is to justify that if there exists more than one object in the query image then to which class it should be classified to? How to decide which object is more prominent?

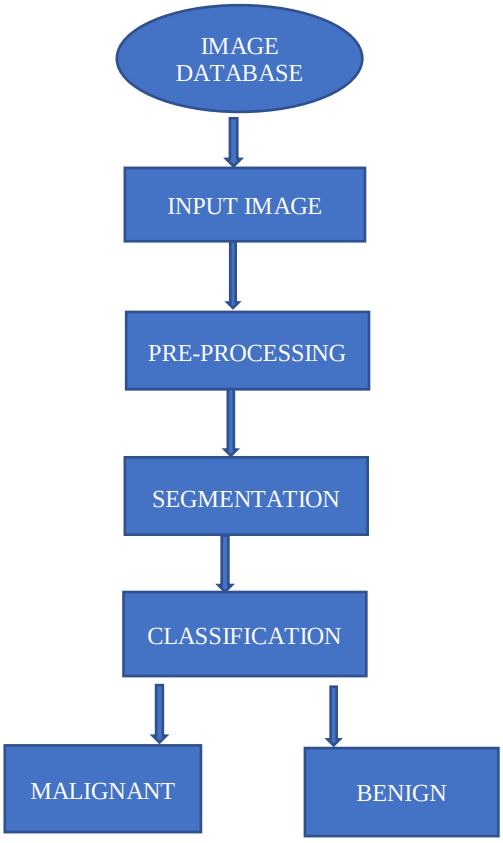

Fig. 1 Stages of Cancer detection

II. VARIOUS TECHNIQUES OF IMAGE CLASSIFICATION

A. SUPPORT VECTOR MACHINE

It is a supervised machine learning algorithm used for both regression and classification problem. When used for classification purposes, it separates the classes using a linear boundary.

Support Vector Machine (SVM) was first proposed by Vapnik [4] and has since attracted a high degree of interest in the machine learning research community. Several recent studies have reported that the SVM (support vector machines) generally are capable of delivering higher performance in terms of classification accuracy than other data classification algorithms[6]. SVM is a binary classifier based on supervised learning which gives better performance than other classifiers. SVM classifies between two classes by constructing a hyperplane in high-dimensional feature space which can be used for classification. Hyperplane can be represented by equation-

$$w.x + b = 0 \quad (1)$$

where, w is weight vector and normal to hyperplane. b is bias or threshold.

LINEAR SVM: Begin with the simplest case, in which the training patterns are linearly separable. That is, there exists a linear function of the form $f(x) = wTx + b(1)$ such that for each training example xi, the function yields ( ) ≥ 0 if x for = +1, i y and f(xi)<0 for yi = -1.

In other, training examples from the two different classes are separated by the hyperplane $f(x) = wTx + b = 0$ where w is the unit vector and b is a constant

For a given training set, while there may exist many hyperplanes that maximize the separating margin between the two classes, the SVM classifier is based on the hyperplane that maximizes the separating margin between the two classes (Fig.2).

In other words, SVM finds the hyperplane that causes the largest separation between the decision function values for the "borderline" examples from the two classes. In below Fig.1 SVM classification with a hyperplane that minimizes the separating margin between the two classes are indicated by data points marked by "Squares" and "circles". Support vectors are elements of the training set that lie on the boundary hyperplanes of the two classes.

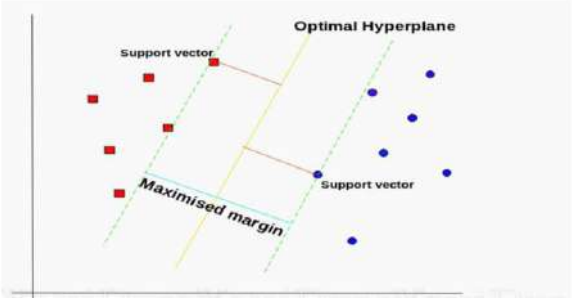

Fig. 2 Linear SVM

NON-LINEAR SVM: As the above case is discussed straight line or hyperplane is used to distinguish between two classes. But by drawing a straight line between two classes, datasets or data points are always not separated. So, Kernel functions are being used with SVM classifier.

Kernel function acts as bridge between from nonlinear to linear. Basic idea behind using kernel function is to map the low dimensional data into the high dimensional feature space where data points are linearly separable. There are many types of kernel function but Kernel functions used are given below:

1. Radial basis function (RBF) 2. Linear 3. Quadratic

RBF is the main kernel function because of following reasons:

1. The RBF kernel nonlinearly maps samples into a higher dimensional space unlike to linear kernel.
2. The RBF kernel has less hyper parameters than the polynomial kernel.
3. The RBF kernel has less numerical difficulties.

MERITS AND DEMERITS OF SVM:

The advantages of support vector machines are:

- Effective in high dimensional spaces.
- Still effective in cases where number of dimensions is greater than the number of samples.
- Uses a subset of training points in the decision function (called support vectors), so it is also memory efficient.
- Versatile: different Kernel functions can be specified for the decision function. Common kernels are provided, but it is also possible to specify custom kernels.

The disadvantages of support vector machines include:

- If the number of features is much greater than the number of samples, the method is likely to give poor performances.
- SVMs do not directly provide probability estimates, these are calculated using an expensive fivefold cross- validation.

B. ARTIFICIAL NEURAL NETWORK

Artificial neural network is a machine learning technique [9] used for classification problems. ANN is a set of connected input output network in which weight is associated with each connection. It consists of one input layer, one or more intermediate layer and one output layer. Learning of neural network is performed by adjusting the weight of connection. By updating the weight iteratively performance of network is improved[4]. On the basis of connection ANN can be classified into two categories: feed-forward network and recurrent network. Feed forward neural network is the network in which connections between units do not form cycle whereas in recurrent neural network connection form cycle. The behavior of neural network is affected by learning rule, architecture, and transfer function. Neurons of neural network are activated by the weighted sum of input. The activation signal is passed through transfer function to produce a single output of the neuron. Non linearity of network is produced by this transfer function. During training, the inter connection weight are optimized until the network reaches the specified level of accuracy. It has many

advantages like parallelism, less affected with noise, good learning ability.

The most favorable point associated with neural network is comprehensibility, tolerance to noisy data, parallelism, and learning from example. The parallelism increases the speed of network. But besides these advantages it has also many disadvantages. First, training of neural network is costly and time consuming. Training of neural network plays an important role in classification accuracy. There are many algorithm used for training of neural network. Neural networks have been criticized for their poor interpretability. For example, it is difficult for humans to interpret the symbolic meaning behind the learned weights and of "hidden units" in the network.

ANN is a complex adaptive system[9] which can change its internal structure based on the information pass through it. It is achieved by adjusting the weight of connection. Each connection has a weight associated with it. A weight is a number that control the signal between two neurons. Weights are adjusted to improve the result. Popular methods of learning are given as:

1. Supervised learning: This strategy involves a trainer which is smarter than the network.
2. Unsupervised learning: This strategy is used when there is not example data set with known answer.
3. Reinforcement learning: This strategy makes decision based on feedback from environment.

Artificial neural network is an example of supervised learning. Artificial neural network acquired the knowledge in the form of connected network unit. It is difficult for human to extract this knowledge. This factor has motivated in extracting the rule for classification in data mining. The procedure of classification is starts with dataset. The data set is divided into two parts: training sample and test sample. Training sample is used for learning of network while test sample is used for measuring the accuracy of classifier. The division of data set can be done by various method like hold-out method, cross validation, random sampling. In general learning steps of neural network is as follows:

- Network structure is defined with a fixed number of nodes in input, output and hidden layer.
- An algorithm is used for learning process.

The ability of neural network to make adjustment in structure of network and its learning ability by altering the weight make it useful in the field of artificial intelligence [8].

ALGORITHM

Input: dataset D, learning rate, network.
Output: a trained neural network.

Step1: receive the input.
Step2: weight the input. Each input sent to network must be weighted i.e multiplied by some random value between -1 and +1.
Step3: sum all the weighted input
Step4: generate output: the output of network is produced by passing that sum through the activation function

C. CONVOLUTIONAL NEURAL NETWORK

Computational models of neural networks have been around for a long time, first model proposed was by McCulloch and Pitts[2]. Neural networks are made up of a number of layers with each layer connected to the other layers forming the network. A feed-forward neural network or FFNN can be thought of in terms of neural activation and the strength of the connections between each pair of neurons. In FFNN, the neurons are connected in a directed way having clear start and stop place i.e., the input layer and the output layer. The layer between these two layers, are called as the hidden layers. Learning occurs through adjustment of weights and the aim is to try and minimize error between the output obtained from the output layer and the input that goes into the input layer. The weights are adjusted by process of back propagation (in which the partial derivative of the error with respect to last layer of weights is calculated). The process of weight adjustment is repeated in a recursive manner until weight layer connected to input layer is updated.

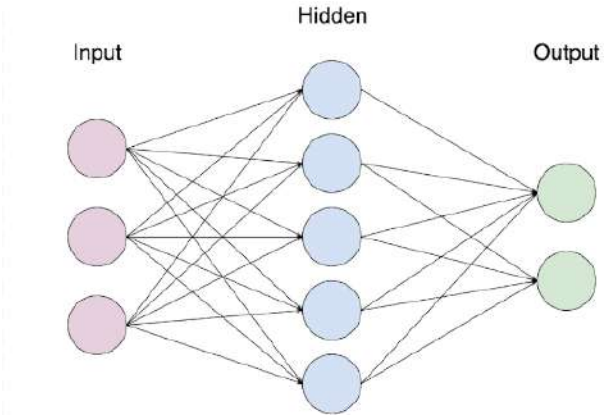

Fig. 3 Typical network architecture

Convolutional Neural Networks (CNN) is variants of Multi Layer Perceptron (MLPs) which are inspired from biology. These filters are local in input space and are thus better suited to exploit the strong spatially local correlation present in natural images. The network consists of three types of layers namely convolution layer, sub sampling layer and the output layer.

Working of CNN algorithm:

The input to the network is a 2D image. The network has input layer which takes the image as the input, output layer from where we get the trained output and the intermediate layers called as the hidden layers. As stated earlier, the network has a series of convolutional and sub-sampling layers. Together the layers produce an approximation of input image data. CNNs exploit spatially local correlation by enforcing a local connectivity pattern between neurons of adjacent layers. Neurons in layer say, 'm' are connected to a local subset of neurons from the previous layer of (m-1), where the neurons of the (m-1) layer have contiguous receptive fields.

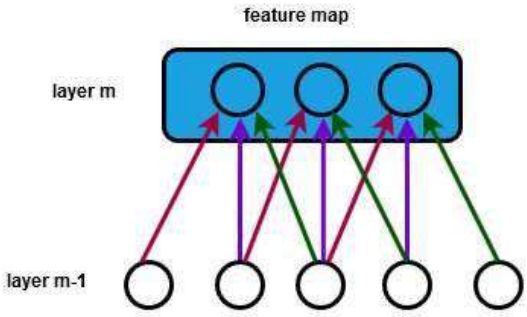

Fig. 4 Graphical flow of layers showing sharing of weights

In the CNN algorithm, each sparse filter is replicated across the entire visual field. These units then form a feature maps, these share weight vector and bias. Fig. 4, represents three hidden units of same feature map. The weights of same color are shared, thus constrained to be identical.
The gradient of shared weights is the sum of the gradients of the parameters being shared. Such replication in a way allows features to be detected regardless of their position in visual field. In addition to this, weight sharing also allows to reduce the number of free learning parameters. Due to this control, CNN tends to achieve better generalization on vision problems. CNN also make use of the concept of max-pooling, which is a form of non-linear down-sampling. In this method, the input image is partitioned into non-overlapping rectangles. The output for each sub-region is the maximum value.

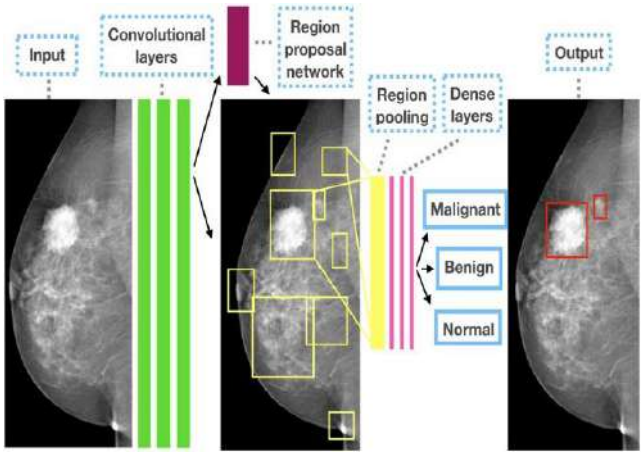

Fig. 5 Classification of Breast Lesion[10]

D. LOCAL FEATURES BASED DEEP LEARNING

Local features, as a rule, are more superior in contrast to the global features due to their capacity of recognizing important visual attributes of the picture. In like manner, local features methods give better classification or retrieval adequacy and have incredible discriminative force in unravelling the greater part of the computer vision issues than global features. Lowe in 2004 proposed another local feature identification scheme known as SIFT (scale-invariant feature transform). Utilizing SIFT[3], in spite of the fact that the picture is scaled or rotated and regardless of whether it experiences an adjustment in illumination the same local interest points, for example, corners and edges could at present be observed. SIFT like other local features procedures, for example, SURF (speed up robust features), ORB (oriented fast and rotated BRIEF), BRISK (binary robust invariant scalable key-points), and KAZE, by and large, includes two principal assignments - detecting local interest points and figuring its descriptors dependent on the region centered on the detected interest points. An attempt is to replace inclusively the convolutional layers of complicated CNN models with local features [3]. SIFT based local features and other similar local features such as SURF, ORB, BRISK, and KAZE are applied directly to fully connected layers of well-known CNN models such as VGG16 and MobileNetV2 to check whether they have the potentiality to replace the corresponding convolutional layers [3]. The computational experiments are facilitated by a Mini-MIAS database containing 322 grayscale mammographic images from 2 different severity, each of which has 1024x1024 pixels. We expect that by replacing inclusively the convolutional layers of a complicated CNN model, we would have a highly accurate and efficient local feature-based deep learning system.

III. RESULTS

The comparison based on the study is given in the table. The comparative analysis includes various advantages & disadvantages of various image classification methods.

TABLE 1. Comparatives analysis using different methods of image classification.

S. No	Methods	Advantages	Disadvantage
1.	Support Vector Machine	Uses a subset of training points in the decision function (called support vectors), so it is also memory efficient.	If the number of features is much greater than the number of samples, the method is likely to give poor performances.
2.	Artificial Neural Network	comprehensibility, tolerance to noisy data, parallelism, and learning. The parallelism increases the speed of network.	training of neural network is costly and time consuming.
3.	Computational Neural Network	tremendous success in tackling various tasks of computer	Less accuracy as compared to local feature based

		vision problems such as classification of images and recognition of objects. CNN is more efficient in terms of accuracy and an improvement of 60.29% is achieved	deep learning model, computation time is more.
4.	Local Features based Deep Learning	SIFT and SURF based features gives good accuracy or higher precision, Less computation time both in training and testing. SIFT and SURF based deep learning approach has more accuracy (85.165%) than CNN model (81.835%)	Computational complexity is high.

IV. CONCLUSION & FUTURE SCOPE

Image Classification is the challenging and active research area in the field of medical image processing. Mammogram Image classification is a challenging task and there is a need and huge scope for future research to improve the accuracy, precision and speed of classification methods. Thus, there is no single method which can be considered good for neither all type of images, nor all methods equally good for a particular type of image. Due to all above factors, image classification remains a challenging problem in image processing and computer vision and is still a pending problem in the world. Further works may be conducted to develop efficient classification methods.

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Artificial Neural Network (ANN) based control of nonlinear system using whale optimization algorithm (WOA)

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***Abstract*— All the practical systems are nonlinear in nature because of dynamic behavior of system parameters which changes with time. It is a challenging task to find a suitable and satisfactory results for nonlinear plants due its uncertain and dynamic behavior. In literature conventional PID controller are widely used for nonlinear systems but due to some limitations it has not given competent results. The Artificial neural network controller (ANN) has unique feature of adaptability which can handle the system nonlinearities and make system robust towards parameter variations.**

In this paper, ANN controller has been used with whale optimization algorithm (WOA) on nonlinear plant model[3]. The WOA algorithm optimizes the controller parameters and improve the performance. The performance has been evaluated in terms of time domain parameters and mean square error.

***Keywords*— Nonlinear plant, Artificial neural network (ANN), Whale Optimization Algorithm (WOA), MSE**

I. INTRODUCTION

Uncertainty and unpredictability are the inherent properties of nonlinear systems[1]. The dynamic behavior and parameter variations does not make system robust. To make system robust and improve performance various controllers has been used in literature[2]. PID controller are still the first choice of industries due to its simplicity [3]. In various case due to limitations it has not given satisfactory response. ANN is a powerful technique based on learning and neurological functions of brain [4]. Based on information neurons are trained which are able to handle complexity of the system[5]. Self adaptation is a unique feature of ANN [9 10] which made it superior to conventional methods. In literature several meta heuristics optimization algorithms has been used with ANN controller which not only optimizes the controller parameters but also minimizes the error to a very low value which further improves the system performance. Whale optimization algorithm is a nature inspired optimization algorithm which is based on bubble process. It is a very powerful algorithms and gave satisfactory results for every field of engineering.

In these paper Artificial neural network (ANN) controller has been used with WOA algorithm to improve the nonlinear plant [3] response. The Simulation results show the WOA based ANN controller not only improves the system performance efficiently but also minimizes the error effectively to a great extent.

II. MATHEMATICAL MODELING OF NONLINEAR PLANT

The problem chosen in this paper is a well known benchmark problem of neural network from the reference paper "Identification and Control of Dynamical Systems Using Neural Networks" by. Narendra Parthasarathy[3]. In this problem parameters are to be optimize such that they can improve the nonlinear plant model. Based on the conditions of both plant and model having the same output for any specified input [3].

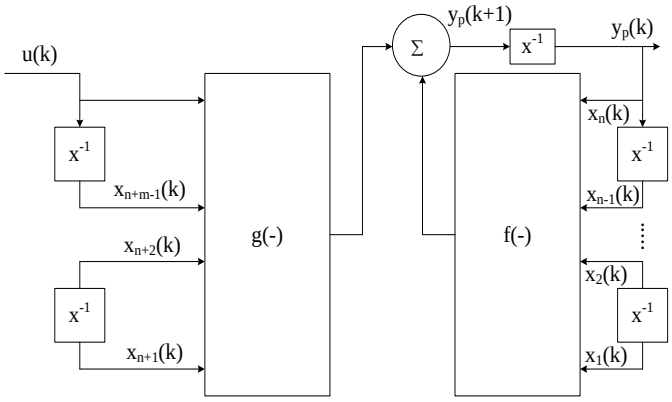


Figure 1: Nonlinear Plant Model

The mathematical equations are given as-

$$y_p(k+1) = \frac{y_p(k)}{1 + y_p(k)^2} + u^3(k) \qquad (1)$$

$$f[y_p(k)] = \frac{y_p(k)}{1 + y_p(k)^2} \qquad (2)$$

$$g[u(k)] = u^3(k) \qquad (3)$$

$$\hat{y}_p(k+1) = N_f[y_p(k)] + N_g[u(k)] \qquad (4)$$

Where u(k) is input, $y_o(k)$ is output, g is differentiable functions.

III. CONTROL SCHEME USING OPTIMIZATION ALGORITHMS FOR NONLINEAR PLANT

In this section ANN controller has been used with whale optimization algorithm (WOA). Whale optimization algorithm (WOA) optimizes the controller parameters i.e. weights and improve the performance. Figure 2 shows the control scheme for nonlinear plant.

A. ANN controller based Whale Optimization Algorithm

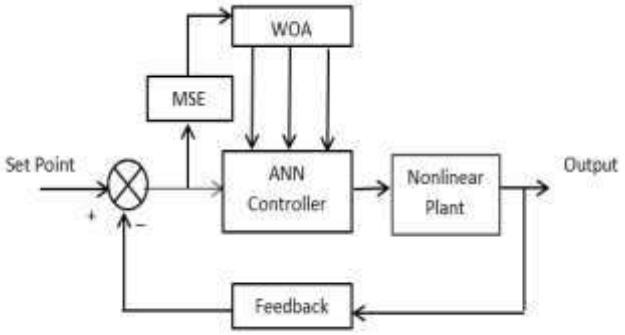


Figure.2 WOA based ANN control for nonlinear plant model

Whale optimization algorithm (WOA) is a population based meta-heuristic algorithm. It is motivated from the bubble-net hunting method of humpback whales. At the time of hunting process or encircling the prey humpback whale generates '9-shaped path' and finally construct the bubbles in a spiral shape which surrounding the prey and shift on the surface [15], which can be seen in figure 3 (a) and (b).

(a)

(b)

Figure.3 (a) 9-shaped path (b) Bubbles in spiral shape

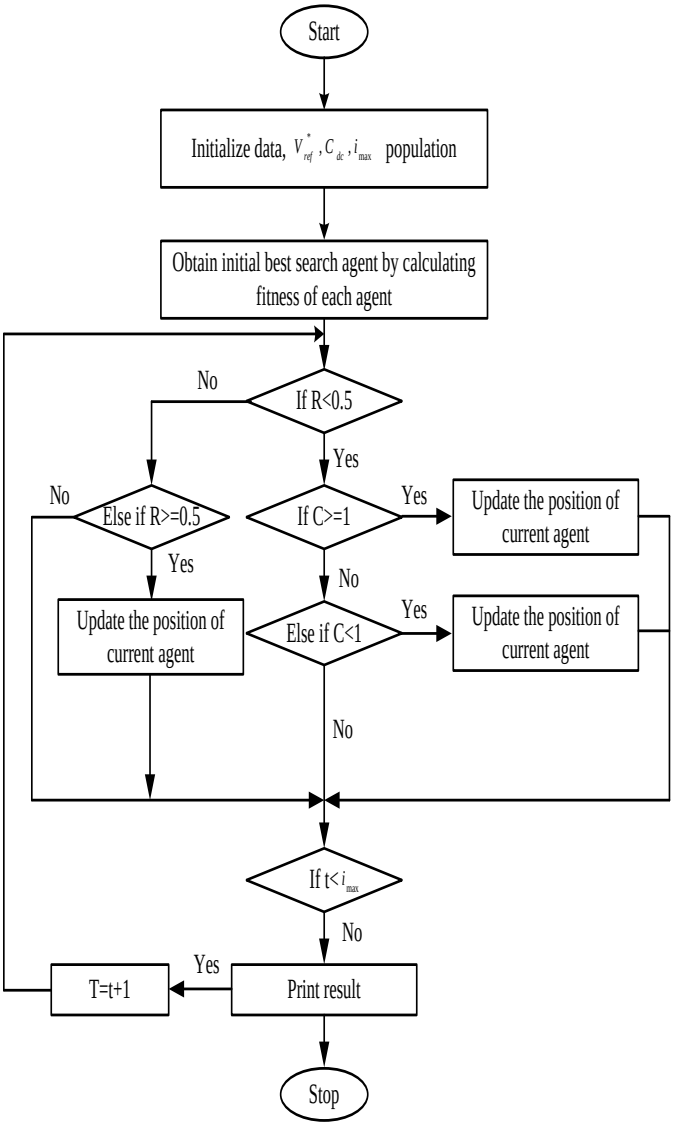
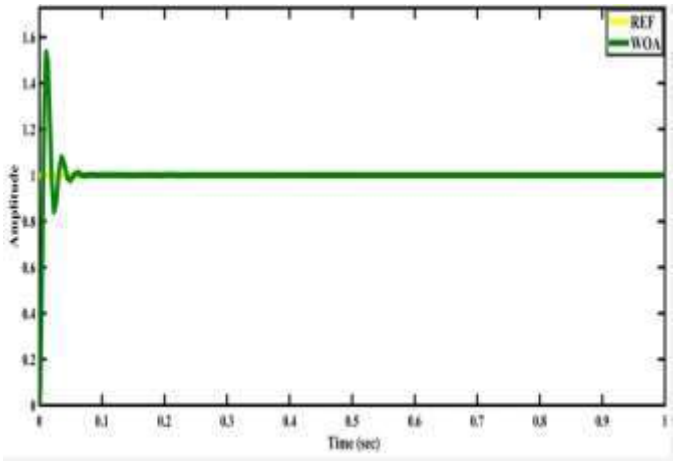


Figure 4: Flowchart of Whale Optimization Algorithm (WOA)

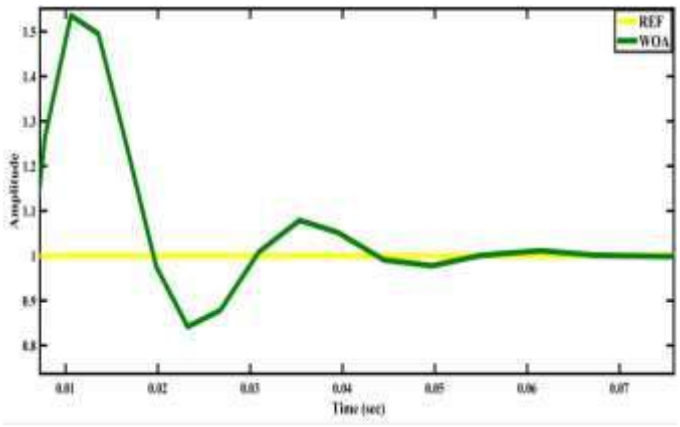
Initially ANN weights are initialize with some random values to initiate the process of optimization. The mean square error has been taken as objective function and optimized parameters of controller has been utilized to minimize it and enhance the system response.

IV. RESULTS

Whale optimization algorithm (WOA) has been implemented in combination with ANN controller on nonlinear plant model[3]. The performance of the nonlinear plant[3] has been evaluated in terms of time domain parameters, disturbance and mean square error (MSE). Figure 5(a), shows the plant response subjected to step input In figure 5(b),at t=1, a step disturbance has been applied, optimize ANN controller not only handles the disturbance but also quickly improves the response in terms of time domain parameters. ANN controller also minimizes MSE with the value "0.0000002156" in 304 epochs, which is shown in figure 5 (e). Figure 5 (f) to (h), shows, training, error histogram and regression respectively.



(a)



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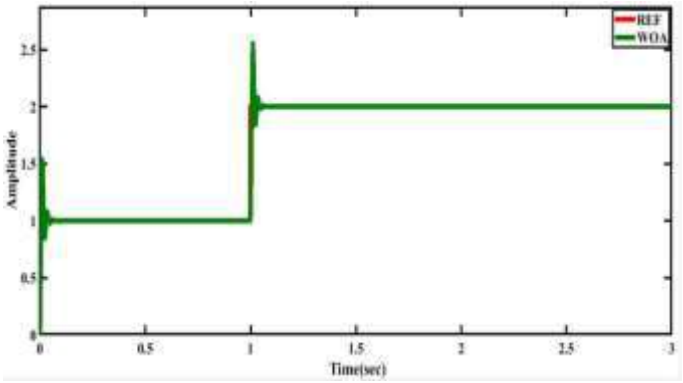
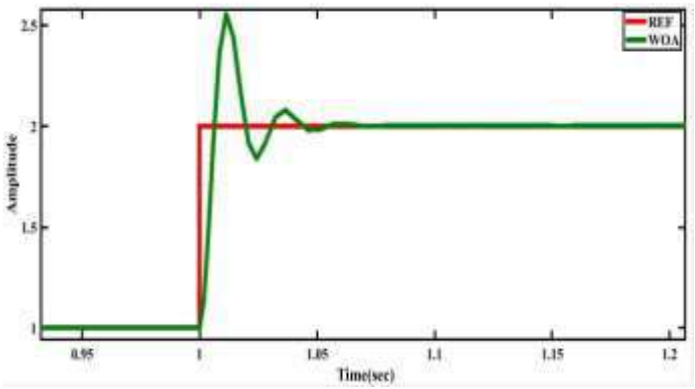
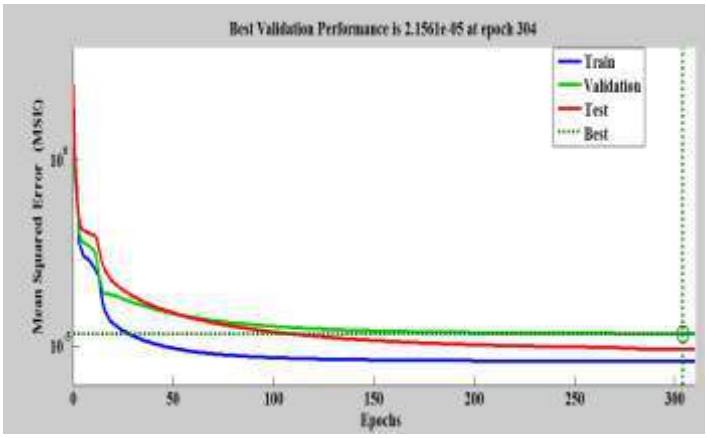


(c)



(d)



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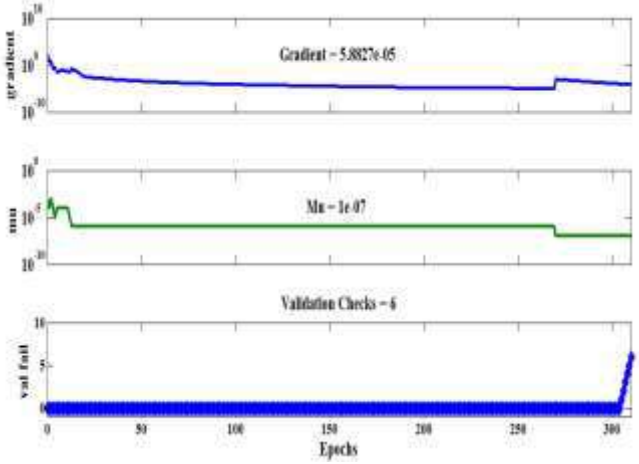
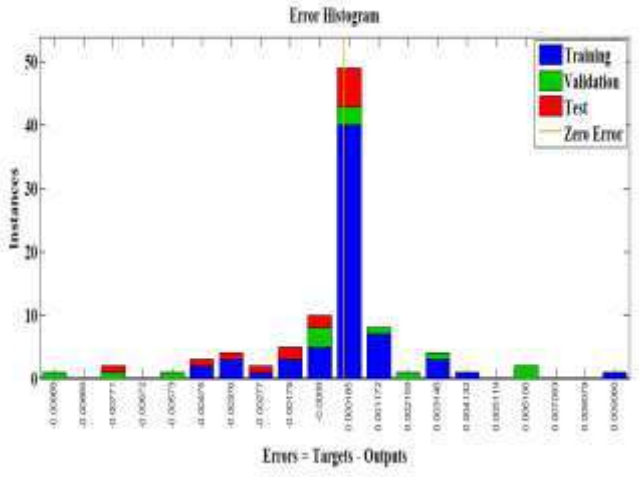
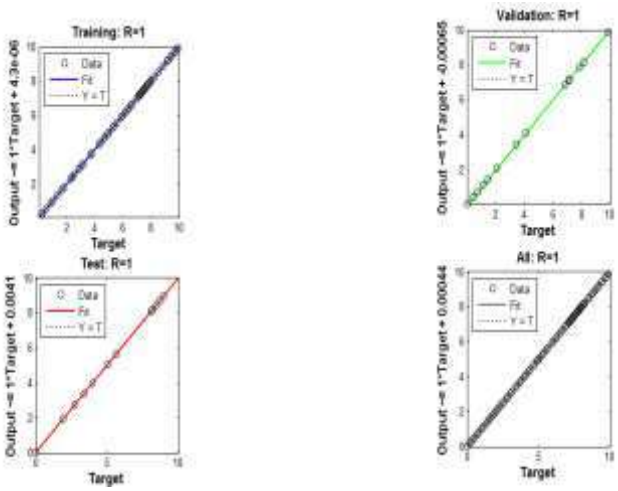


(f)



(g)



(h)

Figure 5 (a) Output response (b) Larger view of output response (a) (c) Plant response with sudden step disturbance (d) larger view of plant response with sudden disturbance (e) Mean Square Error (f) tanning (g) Error histogram (h) regression

TABLE 1- PERFORMANCE ANALYSIS OF WOA BASED ANN CONTROL

WOA Based ANN Control				
Systems	***Rise Time (sec)***	***Peak Time(Sec)***	***Peak value***	***settling Time (sec)***
Nonlinear Plant	1.18	0.010587	1.5448	0.06875

TABLE 2- MEAN SQUARE ERROR OF WOA BASED PID CONTROL

WOA Based ANN Control		
Systems	***Mean Square Error (MSE)***	***No. of Iterations***
Nonlinear PLant	0.0000002156	304

Table 1 and table 2 shows the plant performance in terms of time domain parameters and objective function i.e. MSE. It is clear from the table that optimized controller handles well the nonlinearity of the plant to a very good extent. As far as error is concerned it has been minimized significantly to a very low value which further improves the response.

V. CONCLUSION

WOA based ANN controller has been implemented on nonlinear plant model[3]. The self-adaptability feature of ANN controller and powerful WOA algorithm not only improves the system performance significantly but also handles the dynamic behavior to a very good extent. When a sudden change has been applied to the nonlinear plant, WOA based ANN controller handles the changes quickly and gave the robust response in terms of time domain parameters like rise time, settling time, peak time, peak value which can be shown in table 1. The objective function i.e. Mean square error has also been minimized to a very low value which {refer table2] further enhance the performance of the nonlinear plant.

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DEVELOPMENT OF AN INTELLIGENT SHOPPING CART SYSTEM

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***Abstract*—Supermarkets witness long queues during the peak of shopping period. These long queues have resulted in the loss of time both for the shoppers and the mall attendants. Hence, the goal of this paper is to design and develop an intelligent smart shopping cart with the sole objectives of minimizing shopping time and to maximize shopping experience in a supermarket. This paper presents an intelligent smart shopping cart system where the total amount the shopper wants to spend is imputed into the mini system embedded in the smart shopping cart. Each product picked has an RFID tag which has an assigned price. When the products dropped in the smart shopping cart reaches the maximum input amount or exceeds the maximum input amount, the red visual indicator starts to blink and the buzzer beeps to notify the shoppers of exceeding the price limit while shopping. The green visual indicator also blinks when a shopper shops below the imputed amount. If any product is removed from the smart shopping cart, the amount is deducted from the developed mini system embedded in the smart shopping cart and the buzzer also beeps to notify the shopper of the deduction. The components used for this research are RFID Tag, RFID Reader, Liquid Crystal Display (LCD), Push buttons/Switch, Reset button, Visual Indicator, Wi-Fi module, and a PIC microcontroller.**

Index Terms— RFID Tags, Reader, LCD, Wi-Fi Module, Microcontroller,

I. Introduction

Nowadays, supermarkets experience long queues while shoppers conduct transactions. The purpose of this research paper is to reduce the time it takes shoppers on queue to pay the total price for their products. This paper presents the development of an Intelligent Shopping Cart System where the total amount the shopper wants to spend is imputed into mini system on the smart shopping cart. Each product picked has an RFID tag which has its price attached to it. When products dropped in the intelligent shopping cart reaches or exceeds the maximum input amount, the red indicator starts to blink and the buzzer keeps beeping. When a shopper spends below the imputed amount, the green visual indicator blinks and the buzzer beeps once. Any product removed from the intelligent shopping cart also amounts to its price being removed from the developed mini system on the intelligent shopping cart and the buzzer also beeps. The billing is done on the trolley itself. Information of product is gotten through the RFID reader and displayed on the LCD which is in turn interfaced with the PIC microcontroller. Each shopping cart has a Product Identification Device (PID). The Product Identification device is made up of a PIC microcontroller, an RFID reader, LCD, Wi-Fi module. RFID Tag carries the price information of the tag, RFID Reader reads product information, Liquid Crystal Display displays product information, Push button/Switch is switched on before a shopping cart is used, Motion detector sensors senses the product, then allows the RFID reader to either add or remove price and a PIC microcontroller conducts the activities of the whole system. Each product Identification device is assigned a tag number for easy identification. While shoppers' shop, details of products shopped for is transferred to the main system via the Wi-Fi module. The Product Identification device can also be monitored while shopping is in progress from the main system though the Wi-Fi module. Once the intelligent shopping cart has been used, the switch button is pressed to pave way for a new shopper to use. The contribution of this paper is the development of a smart shopping cart that leads to an improved shopping experience by eliminating the need for shoppers to queue at the counter so that the total amount of items purchased can be calculated by the cashier. In

this work, RFID tags will be used to identify each product rather than the use of barcodes obtainable in most grocery stores.

II. Literature Survey

This paper proposes the smart trolley system whereas the customer scans the product in the trolley using barcode technology using RFID reader. Hence there is no need for the customer to wait in the queue having a membership card [1].

This project report reviews and exploits the use of barcode technology which is used for product identification. We have also learned the architecture of the system that can be used in the shopping systems for intelligent and easy shopping in the malls to save time, energy and money of the consumers. There are a few challenges/drawbacks that can be resolved to make the proposed system more robust. This issue will have to be resolved specifically with respect to billing to promote con card to browse the offers, deals and facility of payment within the cart by using swapping card can be used to make cart more advance provide better consumer experience [2].

This system is not only effective in eradicating the long queues but also manages the budget of the customer. With new technologies rapidly making every walk of life smart, shopping should be made smarter too [3].

The developed model has easy access, is economical and showcases an intelligent and easy shopping experience to reduce time, the energy of the consumers. There are a few challenges/drawbacks to being resolved to make the proposed system more robust, but there is also no doubt that with the RFID having a wide scope in supply chain management, the proposed model has the potential to improve and ease the basic retail experience to a great extent [4].

It proposed to develop an RFID active reader passive tag system in replacement of barcode, the mobile application is used for self–checkout [5].

It proposed to develop a product to assist a person in everyday shopping in terms of reduced time spent while purchasing. The main aim of the proposed system is to provide a technology-oriented, low-cost, easily scalable, and rugged system for assisting shopping in person [6].

The Automated Shopping cart system integrates a Shopping cart (trolley) with 2 sets of barcode scanners placed at 2 different checkpoints – the entry and exit points respectively. It facilitates the user to self-scan the barcode of the purchased products which he intends to purchase. Wrongful entries can be corrected by making use of a keypad that changes the functionality of the machine from the addition of products to the removal of products and activates the other barcode scanner at the opposite end [7]. Lots of research has been done by authors [8-11].

Fig. 1(a) Shopping Cart

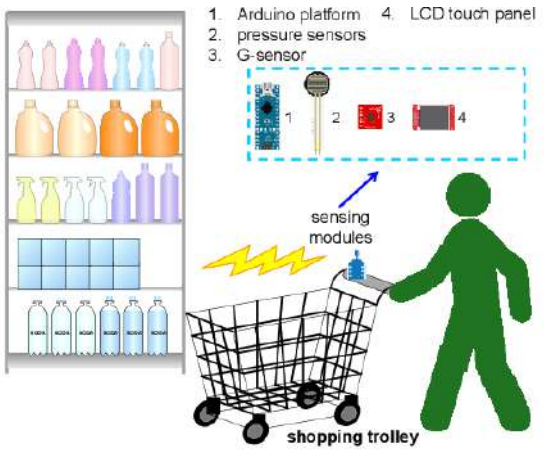

Fig.1(b) Shopping Cart

III. Motivation

We have seen long queues in the supermarket that takes most of the time. While shopping consumers face many problems like worrying that amount of money brought is

not sufficient, incomplete information about of the items 4. Other than this they have to select the best product out of thousands of products. Also, want to revolutionize the entire shopping mechanism in the supermarket and attract number of customers reduce the labor cost.

Table 1 : Comparison between RFID & Barcode

	RFID	Barcode
Read Rate	High throughput. Multiple tags can be read simultaneously.	Very low throughput. Tags can only read one at a time.
Line of Sight	Not required	Required
Read/Write Capability	Ability to read, write, modify and update.	Ability to read items and nothing else.
Durability	High. Much better protected	Low. Easily damaged, cannot be read if dirty or greasy.
Security	High. Hard to replicate. Data can be encrypted.	Low. Much easier to counterfeit or reproduce.
Event Triggering	Can be used to trigger certain events.	Not capable.

Why RFID?

Passive and Active these are the two categories of RFID tags. Passive tags have no battery life, and Active tags have battery life. Through the RFID implementation of mobile technologies and automatic recognition, technologies become easier for smart cart. With the help of wireless networks, RFID makes the conventional retail process fast, transparent and efficient.

Table 1 shows advantage and comparison of RFID with Barcode.

IV. Material Used

The materials involved in the smart shopping cart system involve the following electronics components:

1. Arduino Mega
2. Graphic LCD (16*2)
3. Real-Time Clock Module
4. RFID Reader Module
5. Bread Board
6. Jumper Wires
7. Buzzer
8. Wireless Transceiver

V. Technology Implemented

IoT (Internet of Things)

The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with Unique Identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. An IoT ecosystem consists of web-enabled smart devices that use embedded processors, sensors and communication hardware to collect, send and act on data they acquire from their environments. IoT devices share the sensor data they collect by connecting to an IoT gateway or another edge device where data is either sent to the cloud to be analyzed locally. Sometimes, these devices communicate with other related devices and act on the information they get from one another. The devices do most of the work without human intervention, although people can interact with the devices, for

instance, to set them up, give them instructions or access the data.

RFID Technology

RFID stands for radio frequency identification. Reader (RFID reader) is a device used to gather information from an RFID tag, which is used to track individual objects. Radio waves are used to transfer data from the tag to a reader. RFID is a technology similar in theory to bar codes. Automatic identification technology which uses radiofrequency electromagnetic fields to identify objects carrying tags when they come close to a reader. RFID methods utilize radio waves to accomplish this. At a simple level, RFID systems consist of three components: an RFID tag or smart label, an RFID reader, and an antenna. RFID tags contain an integrated circuit and an antenna, which is used to transmit data to the RFID reader (also called an interrogator). The reader then converts the radio waves to a more usable form of data. Information collected from the tags is then transferred through a communications interface to a host computer system, where the data can be stored in a database and analyzed at a later time. An RFID tag consists of an integrated circuit and an antenna. The tag is also composed of a protective material that holds the pieces together and shields them from various environmental conditions. The protective material depends on the application.

Arduino IDE platform

Arduino is an open-source computer hardware and software company, project, and user community that designs and manufacture single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application written in the programming language Java. It contains code editor which includes features like text cutting and pasting, text searching and replacing, automatic indenting, brace matching, and syntax highlighting and compile and upload programs on Arduino board by one click mechanism. Additionally, it contains a message area, text console, a toolbar with buttons for various functions and operations menu. It supports c and c++ languages. The smallest Arduino c/c++ program consist of only two functions. They are:

- Set up (): This function is called only once whenever sketch starts either after power-up or reset. It initializes variables, input and output pin modes and other libraries that are used in the sketch.

- Loop (): This function is executed repeatedly after setup (). It is used to control the board until the board is either power off or is reset.

Bluetooth HC-05

The HC-05 module is a Bluetooth SPP (Serial port protocol) module which means that it communicates with the Arduino through serial communication. This module is designed for wireless serial communication and it is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. The maximum range for wireless communication for this module is 10 meters. The HC-05 Bluetooth module is different from the other modules like HC-06 in a way that the HC-06 module can only be set as a slave while the HC-05 module can be set as a master as well as a slave which can enable the communication between the two microcontrollers like two Arduino boards.

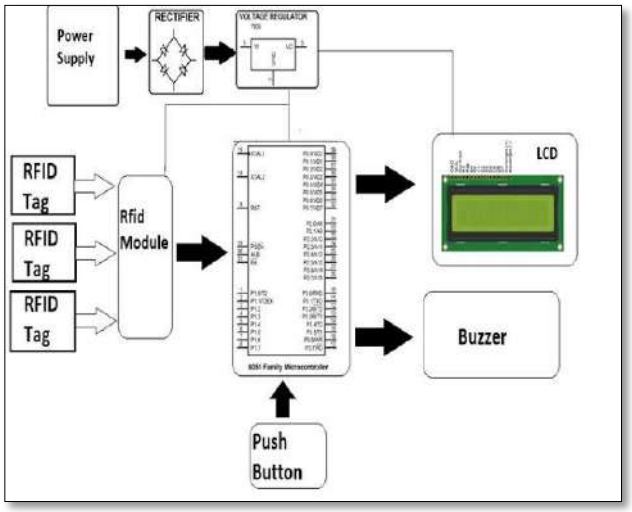

Fig. 2 Block Diagram

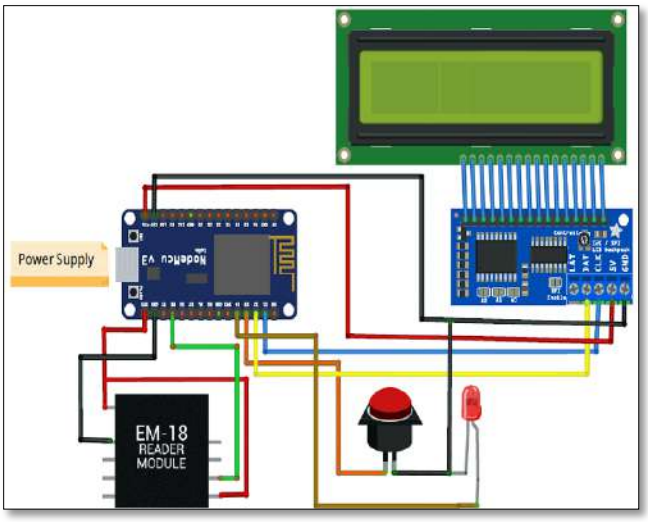

Fig. 3 Circuit Diagram

VI. Methods

The intelligent smart shopping cart system is linked with devices listed in the materials above. The start button is pressed when a shopper wants to buy products. Products are automatically scanned as they are dropped in the smart shopping cart via their RFID tag. The shopper inputs the total amount to be spent. As products are dropped in, prices for each product are added up and displayed on the LCD screen. When the price reaches the maximum inputted amount or exceeds it, the red indicator starts to blink and the buzzer starts beeping. The green indicator also blinks when the shopper shops below the imputed amount. When the shopper is done shopping, the end button is pressed while the list is sent to the server computer via the Wi-Fi module where a receipt is generated for the shopper. Fig 2 shows the block diagram of the smart cart while Fig 3 shows circuit diagram. Fig 4 is a snapshot of the C program written into the microcontroller and Fig. 5 is the system flowchart.

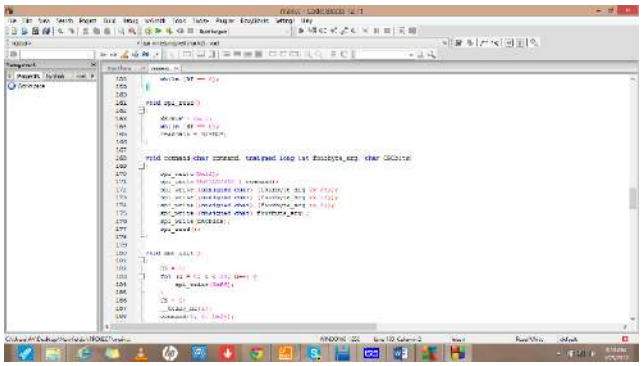

Fig. 4 Screenshot of Programming Language

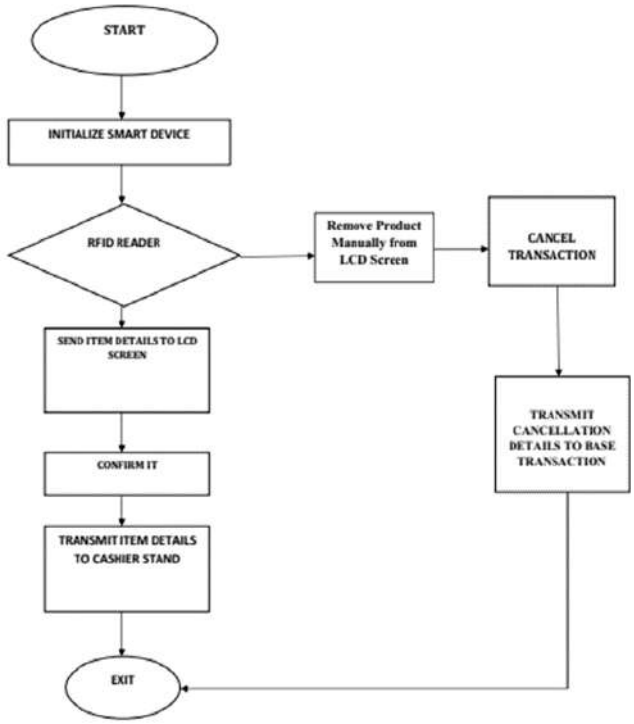

Fig. 5 System Flowchart

VII. Results & Discussion

A working prototype for an intelligent smart shopping cart system was constructed based on the circuit diagram shown in Fig.7and all parts functioned as intended. The diagram of the constructed prototype is displayed in Fig 6 in stages. The circuit components for the smart shopping cart system includes a voltage regulator, RFID reader, Buzzer, Keypad, LCD display and PIC18 Microcontroller. The microcontroller is where control algorithms are written to control the operation of the shopping cart system.

Fig. 6 & 7 represent the basic of the shopping cart.

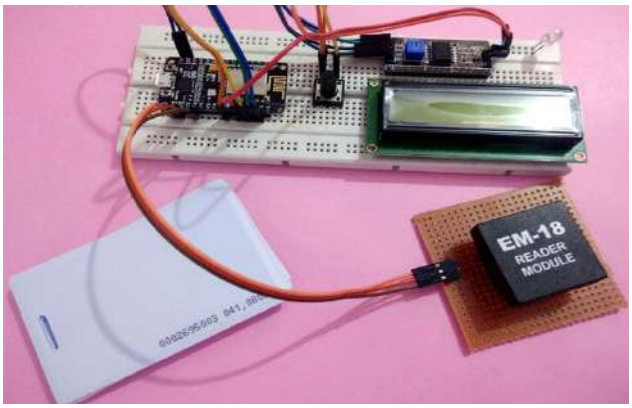

Fig. 6 First Diagram of Shopping Cart System

Fig. 7 Shopping Cart System

VIII. Conclusions

A working prototype for an intelligent smart shopping cart system was constructed based on the circuit diagram shown in Fig.7and all parts functioned as intended. The diagram of the constructed prototype is displayed in Fig 6 in stages. The circuit components for the smart shopping cart system includes a voltage regulator, RFID reader, Buzzer, Keypad, LCD display and PIC18 Microcontroller. The microcontroller is where control algorithms are written to control the operation of the shopping cart system. The use of LCD in this trolley makes it user friendly. LCD display the name of product, cost of product and total bill. Automatic billing is done in trolley so it saves the time of customer and reduce the rush at billing counter. It also reduces the man power. Because of the use of IOT it will also helpful to owner.

IX. Future Enhancement

By implementing RFID technology in the hypermarket door end, theft is avoided and also it increases the security for commodities. Promoting the application to the mobile phones of the customer. Payment method can be modified through customer debit or credit card. In future, the trolley may be implemented with audio O/P so that customer can hear songs track while shopping. If the weight of the trolley increased then the corresponding torque and power may be improved with a suitable motor.

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Neural Networks for Sign Language to Text Conversion: A Review and Evaluation

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***Abstract*—According to India's National Association of the Deaf estimates that 18 million people or close to 1 per cent of the Indian population are deaf or suffer from hearing loss. There have been several approaches and ideas being published based on Sign (or Gesture) Recognition using Deep Learning Neural Networks to facilitate the hearing and speech impaired people with a technical tool to make communication easier as there is a huge communication gap between the ones who use sign language and the others who do not. In order to investigate the various methods used, this review examines a collection of papers that report the application of Neural networks for Sign Language to Text Conversion for deaf and mute people in India. Apart from that, this review also explores the issues and challenges faced by the specially-abled people in India with the emergence of the Novel Corona Virus pandemic.**

Keywords—Computer Vision Technology, Image Processing, ASL, ISL, Sign to Text Conversion

I. Introduction

In recent years the main aim of the technology has been more centred towards engaging the computer towards solving problems that are based on the real-life of the users and that has been the reason we have seen a surge in the technologies that solve real-life problems like classification or trend analysis. Paradigms like Neural Networks have been designed with this requirement in mind. As the computers are getting more and more accessible to the general masses, be it in form of handheld devices or desktops the horizon for software has also increased and now most of us use many different types of software in our day-to-day life which has not only made the lives of the people easier but have also contributed in increasing the productivity of the users.

This paper is organized as follows. In Section II we give a short introduction to NN modelling. In Section III we briefly compare the approaches taken by each paper to the sign recognition and conversion to text problem, and we outline the choices and procedures reported in each paper for data pre-processing, NN design, implementation and validation. In Section IV we focus on the problems that have emerged with the onset of coronavirus pandemic and the potential scope of area for work to be in future to tackle these issues. Section V is the conclusion.

II. Brief Introduction to Neural Networks

A. Definition

Neural networks are based on the parallel architecture of neurons present in the human brain. It can be defined as a multiprocessor system with a very high degree of interconnections and adaptive interaction between the elements. The choice of neural networks to recognize the gestures automatically is due to the following aspects like adaptive learning (using a set of predefined database sets), self-organization from the training module, real-time operation with parallel computations, and high fault tolerance capability.

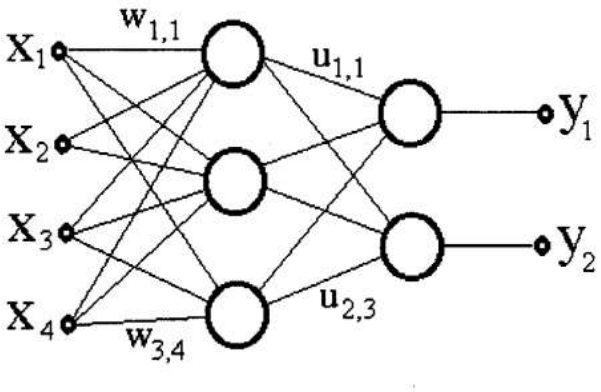

Figure 1: A two-layer feed-forward neural network

The Neural Network is constructed from 3 types of layers:

1. Input layer — initial data for the neural network.
2. Hidden layers — an intermediate layer between input and output layer and place where all the computation is done.
3. Output layer — produce the result for given inputs.

In Neural Network the activation function defines if the given node should be "activated" or not based on the weighted sum. Sigmoid Function is one of the most widely used activation function today. It equation is given with the formula below:

$$S(x) = \frac{1}{1+e^{-x}} = \frac{e^x}{e^x+1}.$$

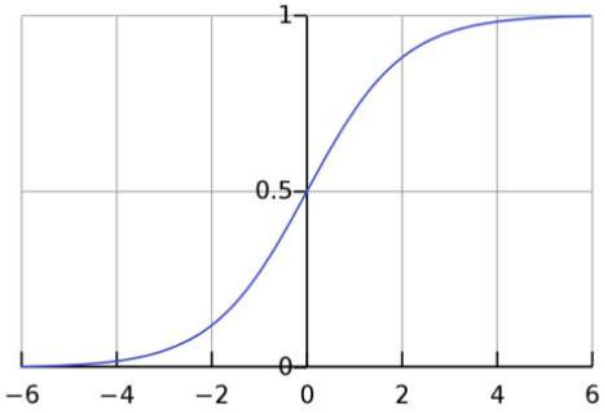

Figure 2: Sigmoid Function - Activation Function of NNs

III. Literature Survey

Gesture recognition is generally based on two different approaches. Primarily, glove-based analysis where either mechanical or optical sensors are attached to a glove that transforms finger flexions into electrical signals to determine the hand posture. Currently, vision-based analysis is used mostly, which deals with the way human beings perceive information about their surroundings. The database for these vision-based systems is created by selecting the gestures with predefined meaning, and multiple samples of each gesture are considered to increase the accuracy of the system.

Several approaches have been proposed previously to recognize the gestures using soft computing approaches such as artificial neural networks (ANNs), fuzzy logic sets, and genetic algorithms. Some statistical models used for gesture recognition include Hidden Markov Model (HMM) and Finite-State Machine (FSM). ANNs are the adaptive self-organizing technologies that solved a broad range of problems such as identification and control, game playing and decision making, pattern recognition medical diagnosis, financial applications, and data mining in an easy and convenient manner.

A. Equations

Forward Propagation Calculation-
The process of Forward propagation is getting the Neural Network output value based on a given input. This algorithm is used to calculate the cost value.

$$h_\Theta(x) = a_1^{(3)} = g(\Theta_{10}^{(2)} a_0^{(2)} + \Theta_{11}^{(2)} a_1^{(2)} + \Theta_{12}^{(2)} a_2^{(2)} + \Theta_{13}^{(2)} a_3^{(2)})$$

After the h(x) value (hypothesis) is obtained, the Cost function equation is used to calculate the cost for the given set of inputs.

$$x = a^{(1)} \tag{1}$$

$$z^{(j+1)} = \theta^{(j)} a^{(j)} \tag{2}$$

$$a^{(j+1)} = \sigma(z^{(j+1)}) \tag{3}$$

$$h_\theta(x) = a^{(L)} = \sigma(z^{(L)}) \tag{4}$$

Back Propagation Calculation-
The aim is to minimize the cost function J(θ) using the optimal set of values for θ (weights). Backpropagation is a method used in order to compute the partial derivative of J(θ). This partial derivative value is then used in the Gradient descent algorithm (“Image 23”) for calculating the θ values for the Neural Network that minimize the cost function J(θ).

$$\begin{aligned} &Repeat\ \{ \\ &\theta_j := \theta_j - \alpha \frac{\partial}{\partial \theta_j} J(\theta) \\ &\} \end{aligned}$$

IV. Issues Faced By the Community

There is a wide array of issues faced by the deaf and mute community, specially in India, such as the lack of enough representation and awareness about signed language and its relevance to the deaf and mute people. Along with that, new issues have come to light with the onset of the coronavirus pandemic.

From a technical perspective, most of the models generated in the earlier published papers are peforming significantly well with about 98.67% accuracy in sign recognition. But a problem with this, very much overlooked by many is that most of these models are trained on American Signed Language gestures while in India, ISL (or Indo-Pakistani Signed Language) is used for communication. Thus, these tools prove to be not of much use for the layman of India.

ISL (Indo-Pakistani Sign Language) not supported, instead ASL (American Sign language) or BSL (British Sign Language) used widely.

Sr. No.	*Application Name*	*Pros*	*Cons*
1.	Virtual Voice [9]	-Simple interface -Uses device's native language	-Needs external software support -Requires internet connection
2.	Note Speak Listen for Deaf [11]	-Synthesized speech feature	-Slow -Only serves literate -Does not support full communication
3.	Sign Language Interpreter [10]	-Converts Text to Sign -Audio output	-Uses ASL only
4.	Sign Short Message Service [12]	-On screen sign language keypad	-No support for ISL

Table 1: Existing applications on Google Play Store [9]

V. Conclusion

The application of artificial NNs to sign recognition problems has been much studied in recent times, and a great number of papers that report successful experiments and practical tests have been published. However, several problems have come forward which require more research to be done in this area. One of the main problems is the difference in sign languages used across the globe where ASL and BSL are widely used. The development of similar models in ISL(Indo-Pakistani Sign Language) is an immediate need of the hour. The pandemic has enforced this need of developing more sign language interpreters in Indian native signed language. This would not only lead to erradication of miscommunication but also be a boon for the dwaf and mute community of India.

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IOT BASED HEALTH MONITORING SYSTEM

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***Abstract*- The Internet of Things (IoT) makes smart objectsthe ultimate building blocks in the development of cyber-physical smart pervasive frameworks. The IoT has a variety of application domains, including health care. The IoT revolution is redesigning modern health care with promising technological, economic, and social prospects. This paper surveys advances in IoT based health care technologies and reviews the state-of-the-art network architectures/platforms, applications, and industrial trends in IoT-based health care solutions.**

In addition, this paper analyzes distinct IoT security and privacy features, including security requirements, threat models, and attack taxonomies from the health care perspective. Further, this paper proposes an intelligent collaborative security model to minimize security risk; discusses how different innovations such as big data, ambient intelligence, and wearables canbe leveraged in a health care context; addresses various IoT and health policies and regulations across the world to determine how they can facilitate economies and societies in terms ofsustainable development; and provides some avenues for future research on IoT based health care based on a set of open issues and challenges.

Keywords: Internet of things, Health care, Sensors.

I INTRODUCTION

Recent years have seen a rising in wearable sensors and today several devices are commercially available for personal health care and activity awareness. A recent health care system should give better health care services to people at any time anywhere in an affordable andpatient friendly way.

Currently, the health care system going to change from a traditional approach to a modernized patient centered approach. In the traditional waythe doctors play the major role. For necessary diagnosis and advising they need to visit the doctor. There are two basic problems related to this approach. Firstly, the health care professionals must be in place of the patient all the time, the patient remains admitted in the hospital, wired to bedside biomedical instruments, for a long period. In order to solve these two problems, the patient-oriented approach has been received. Medical research found that above 80% of the age people older than 65 suffers from at least one chronic disease making them to have difficulty in taking care of themselves. Accordingly, providing a decent quality of life become a serious social issue at that moment. The rapid proliferation of information and communication technologies is enabling innovative healthcaresolutions and tools that promise in addressing the above challenges.

Now, Internet of Things (IOT)[1] has become one ofthe most powerful communication paradigms of the 21st century. In the IOT environment, all objects in our daily life become part of the internet due to their communication and computing capabilities. Heart rate is one of the fundamental physiological limits, essential formonitoring and diagnosis of patients. To keep people effective and healthy, a readily accessible modern health care system is proving to be effective in saving costs, reducing illness andprolonging life. In this paper, an enhanced healthcare monitoring system is described.

We are living in Internet age where every physical object may be connected to each other for sharing information

purpose. Due to enhanced wireless technologies like 6LoWPAN, Wi-Fi, Bluetooth & ZigBee, many things or objects around us have the ability to exchange information automatically. This network of things or objects that are connected to each othervia Internet, local area network or Wireless Sensor Networks [1] is called Internet of Things (IoT). IoT is made of two words one is Internet and second is The Things.

A. *HEALTH MONITORING SYSTEM*

Remote Patient Monitoring arrangement empowers observation of patients outside of customary clinical settings (e.g. at home), which expands access to human services offices at bringdown expenses. The core objective of this projectis the design and implementation of a smart patient health tracking system that uses Sensors to track patient health and uses internet to informtheir loved ones in case of any issues. The objective of developing monitoring systems is toreduce health care costs by reducing SMS based patient flourishing viewing and IOT based patient checking framework. In IOT based framework, subtle parts of the patient flourishing can be seenby different clients.

B. *INTERNET OF THINGS (IOT)*

Internet of Things (IOT) driven health and wellness monitoring system enables remote and continuous monitoring of people, with applications in chronic conditions, such as obesity, hypertension, diabetes, heart failure, stress, preventive care and wellness. Medical careand healthcare represent one of the mostattractive application areas for the IOT.

Digitization and the increasing connectivitybetween devices, citizens and their meaningful way. Smart manufacturing becomes the norm in industry 4.0, where intelligent machines are network so they can exchange and respond to data to independently manage industrial production. The internet of things is atransformational concept. In 1999, Kevin Ashton, co-founder of the Auto-ID Centre at the Science Institute of Technology, envisioned an Internet ofThings based on RIFD chips[2] that could enable “things” to communicate with each other.

IOT breaks the confines of traditional computer networks and establishes connections directly with objects in the physical world. The core concept of this phenomenon is that IOT allows for “things” to connect to the Internet, ranging from the significant –airplanes, elevators, solar panels, medical equipment-to the mandate toys, soap dispensers and porch lights.

The IOT paradigms can play a significant role inimproving the health and wellness of subjects by increasing the availability and quality of care, andgrammatically lowering the treatment costs and frequent travel.

Internet is network of networks that are connected world widely via some standard protocols. Things refers to any Physical Object that may be involved in connectivity. IoT uses many technologies like Radio Frequency Identification (RFID) tag, Sensors, Actuators andSmart phone and cloud computing support etc. By using IoT, we can connect anything, can access any service and useful information of anyobject from anywhere and anytime.

The IOT driven healthcare system employs networked by biosensors to simultaneously collect multiple physiological signals andwireless connectivity to share or send gathered signals directly to the cloud diagnostic server and the caregivers for further analysis and clinical review. Further, The IOT enabled remote monitoring applications can significantly reduce travel, cost and time in long term monitoring applications.

In the health and wellness monitoring environment, the IOT has emerged as one of the most powerful information gathering and sharingparadigms for personalized healthcare systems, ambient assisted living, uses posture detection, and activity recognition.

Compliance with treatment and medication at home and healthcare providers is another important potential application. In this paper, thecore concept is based on IOT, the information sensed from the sensors are gathered and transmitted to the smart phone through IOT.

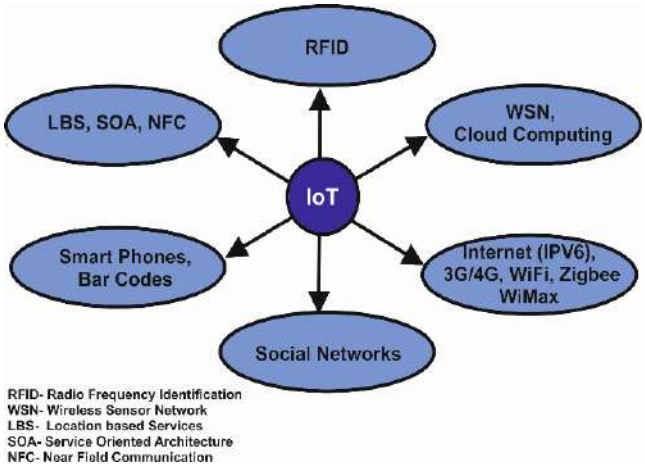

Fig.1 Network Architecture

II. PROPOSED METHODOLGY

The core objective of this project is the design and implementation of a smart patient health trackingsystem[3]. Fig. shows the overview of the proposedsystem. The sensors are embedded on the patientbody to sense the temperature and heartbeat of the patient [2]. These sensors are connected to a control unit, which calculates the values of all thefour sensors. These calculated values are then transmitted through a IoT cloud to the base station. From the base station the values are thenaccessed by the doctor at any other location.

Thus, based on the temperature and heart beat values and the room sensor values, the doctor candecide the state of the patient and appropriate measures can be taken.

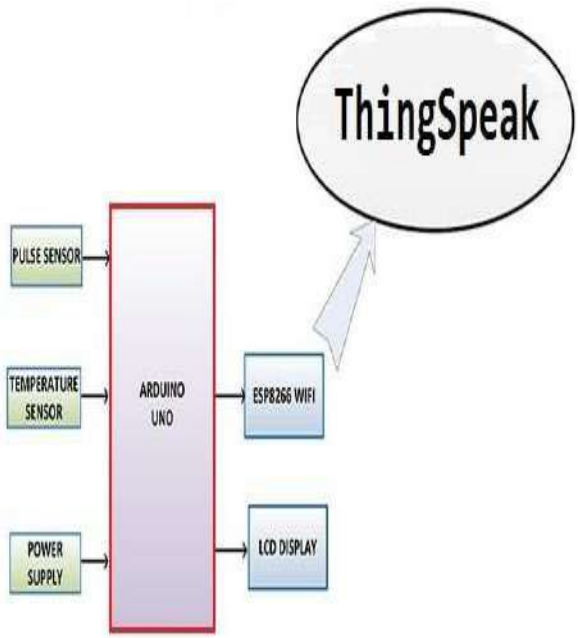

Fig. 2 Proposed System Model

A. *Patient Health Monitoring System using ESP8266 & Arduino*

With tons of new healthcare technology start-ups, IoT is rapidly revolutionizing the healthcare industry. The IoT platform used in this project isThingSpeak. ThingSpeak is an opensource Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network.

This IoT device could read the pulse rate and measure the surrounding temperature. It continuously monitors the pulse rate and surrounding temperature and updates them to an IoT platform. The Arduino Sketch running over the device implements the various functionalities of the project like reading sensor data, converting them into strings, passing them to the IoT platform, anddisplaying measured pulse rate and temperature on character Lcd. The Arduino processes the code and displays it to16*2 LCD Display. ESP8266 Wi-Fi module connects to Wi-Fi and sends the data to IoTdevice server. The IoT server used here is ThingSpeak. Finally, the data can be monitored from any part of the world by logging into the ThingSpeak channel.

B. *Arduino Uno*

Arduino Uno is a microcontroller board based on 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists other components suchas crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. Arduino Uno has 14 digital input/output pins (out of which 6 can be used as PWM outputs), 6 analog input pins, a USB connection, A Power barrel jack, an ICSP header and a reset button.

The 14 digital input/output pins can be used as input or output pins by using pinMode(), digitalRead() and digitalWrite() functions in arduino programming. Each pin operates at 5V and can provide or receive a maximum of 40mAcurrent, and has an internal pull-up resistor of 20-50 KOhms which are disconnected by default. Out of these 14 pins, some pins have specific functions as listed below:

Serial Pins 0 (Rx) and 1 (Tx): Rx and Tx pins areused to receive and transmit TTL serial data. They are connected with the corresponding ATmega328P USB to TTL serial chip.

External Interrupt Pins 2 and 3: These pins can beconfigured to trigger an interrupt on a low value,a rising or falling edge, or a change in value

PWM Pins 3, 5, 6, 9 and 11: These pins provide an 8-bit PWM output by using analogWrite() function.

SPI Pins 10 (SS), 11 (MOSI), 12 (MISO) and 13(SCK): These pins are used for SPI communication.

In-built LED Pin 13: This pin is connected with a built-in LED, when pin 13 is HIGH – LED is on and when pin 13 is LOW, its off.

Along with 14 Digital pins, there are 6 analog input pins, each of which provide 10 bits ofresolution, i.e.1024 different values. Theymeasure from 0 to 5 volts but this limit can be increased by using AREF pin with analogReference () function.

Analog pin 4 (SDA) and pin 5 (SCA) also used for TWI communication using Wire library Arduino Uno has a couple of other pins as explained below.

AREF: Used to provide reference voltage foranalog inputs with analogReference() function

Reset Pin: Making this pin LOW, resets the microcontroller.

Arduino can be used to communicate with a computer, another Arduino board or other microcontrollers. The ATmega328P microcontroller provides UART TTL (5V) serialcommunication which can be done using digital pin 0 (Rx) and digital pin 1 (Tx). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer.

The ATmega16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. There are twoRX and TX LEDs on the arduino board which will flash when data is being transmitted via the USB-to serial chip and USB connection to the computer (not for serial communication on pins 0and 1).

A Software Serial library allows for serial communication on any of the Uno's digital pins. The ATmega328P also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2Cbus.

A 16 MHz crystal. This is to produce accurate timekeeping for time sensitive tasks, like sendingand receiving serial data. You don't have to havea crystal, as there is an internal but less accurate clock. You can use the internal clock (especially if you are programming the bare Atmega 328), and you can calibrate the internal clock to work with serial data. But it is nice to not have to calibrate anything with an accurate crystal.

Various header sockets that provide an easy way to connect wires to and from a breadboard, or to attach add on boards (shields) if you don't want to do wiring to a breadboard.

An ICSP header (In-Circuit Serial Programming).This can be used as an alternate way to program the Arduino, without using the normally used Arduino bootloader. You won't use this as a beginner. However, this header is common in programming the ATtiny series of AVR microcontrollers. You can still use the Arduino IDE, but it requires a $10 programmer and ribboncable to program those smaller (as few as 8 total pins for the ATtiny85) microcontrollers via the ICSP header.

C. SENSORS

We live in a World of Sensors. We can find different types of Sensors in our homes, offices, cars etc. working to make our lives easier by turning on the lights by detecting our presence, adjusting the room temperature, detect smoke or fire, make us delicious coffee, open garage doors as soon as our car is near the door and many othertasks.
All these and many other automation tasks are possible because of Sensors. Before going in to the details of What is a Sensor, What are the Different Types of Sensors and Applications of these different types of Sensors, we will first takea look at a simple example of an automated system, which is possible because of Sensors (and many other components as well).

There are numerous definitions as to what a sensor is but I would like to define a Sensor as an input device which provides an output (signal) with respect to a specific physical quantity (input).

The term "input device" in the definition of a Sensor means that it is part of a bigger system which provides input to a main control system (like a Processor or a Microcontroller)

Another unique definition of a Sensor is as follows: It is a device that converts signals from one energy domain to electrical domain. Thedefinition of the Sensor can be better understoodif we take an example in to consideration.

D. Pulse Sensor

The Heartbeat rate information knowing is very useful while doing exercise, studying, etc. But the heartbeat rate can be complicated to calculate.To overcome this problem, the pulse sensor or heartbeat sensor is used.

This is a plug & play sensor mainly designed forArduino board which can be used by makers, students, developers, artists who can utilize the heartbeat information into their projects. Thissensor uses an easy optical pulse sensor along with amplification & cancellation of noise to make a circuit[4].

By using this circuit, we can get fast and reliableheartbeat readings. This circuit can be operated with 4mA current and 5V voltage to use in mobileapplications. The Pulse Sensor is a plug-and play heart-rate sensor for Arduino. It can be used by students, artists, athletes, makers, and game & mobile developers who want to easily incorporate live heartrate data into their projects. The essence is an integrated optical amplifying circuit and noise eliminating circuit sensor. Clip the Pulse Sensor to your earlobe or fingertip and plug it into your Arduino, you can ready to read heart rate. Also, it has an Arduino demo code thatmakes it easy to use. The pulse sensor has three pins: VCC, GND & Analog Pin.

WORKING: The pulse sensor [3] working principle is very simple. This sensor has two surfaces, on the firstsurface, the light emitting diode & ambient light sensor is connected. Similarly, on the second surface, the circuit is connected which is accountable for the noise cancellation& amplification.

The LED is located above a vein in a human bodylike ear tip or fingertip, however, it must be located on top of a layer directly. Once the LED is located on the vein, then the LED starts emitting light. Once the heart is pumping, then there will be a flow of blood within the veins. So if we check the blood flow, then we can check theheart rates also. If the blood flow is sensed then the ambient light sensor will receive more light asthey will be reproduced by the flow of blood.

This small change within obtained light can be examined over time to decide our pulse rates. This sensor used in straight forward, however connecting it in the correct way matters. Because all types of electronic components are directly exposed to the sensor. So, it is mandatory to envelop this sensor by using hot glue, vinyl stripotherwise other types of non-conductive materials.

These sensors cannot be operated with wet hands. The sensor's smooth side must be located on the pinnacle of the vein & press it. Generally, Velcrotapes or clips are utilized to get this force.

This sensor can be used by connecting it to the Arduino board. Once it is connected, then give the power supply with the help of VCC pin and GND pins. The operating voltage of this sensor is +5V or 3.3V. Once the sensor is connected to thedevelopment board such as Arduino, then we canuse the readily accessible Arduino code to make things easier. Please refer to Arduino site for interfacing of Arduino with pulse sensor and its coding.

APPLICATIONS: The applications of pulse rate sensor include the following:

- This sensor is used for Sleep Tracking
- This sensor is used for Anxiety monitoring
- This sensor is used in remote patientmonitoring or alarm system
- This sensor is used in Health bands
- This sensor is used in complex gaming consoles

Thus, this is all about Pulse Sensor (Heartbeat / Heartrate Sensor). it is opensource and plug-and-play hardware. This sensor can easily include liveheartbeat information into their model.

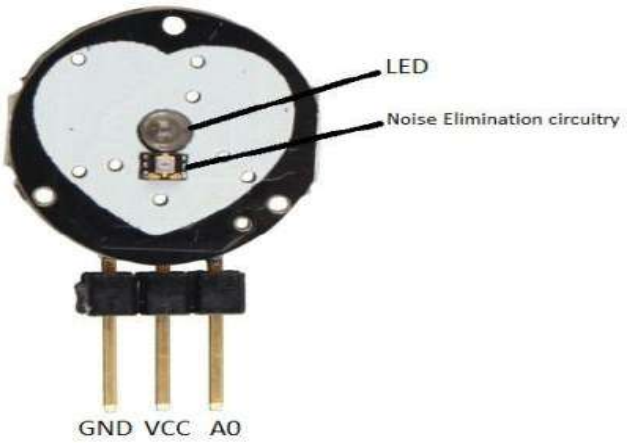

Fig.3 Pulse Sensor

This sensor includes two circuits like an optical amplifying & a noise eliminating. The connectionof this sensor on earlobe otherwise fingertip can be done using a Clip, and connect it to Arduino board. So that heart rate can be easily measured. These sensors are used by developers, students, makers, athletes, artists, etc.

E. Wi-Fi Module

Wi-Fi is a wireless media that implements Ethernet protocol via two-way radio. It's not generally called a "Wi-Fi module" because it has two components: the radio transmitter and receiver, and the digital device supporting the Ethernet protocol. TCP/IP packets are contained within the Ethernet Frames, which wrap the TCP/IP packets with an Ethernet header and trailer. Together, the radio and Ethernet support are called a Wi-Fi access point, or client adapter,or repeater, depending on how it is configured[5].

A router has a totally different function, which isto interpret the headers of incoming TCP/IP datapackets, decide where they go next, and re- transmit them on other ports. The incoming and outgoing ports could be of many different types -physically and logically - as long as they containTCP/IP packets as data elements. The common home router now uses physical rj45 ports (that look like slightly bigger telephone plugs) and cat6 twisted pair cables (improperly referred to as "Ethernet cables"), but it wasn't too long ago thethey used coaxial cable. Commercial routers often use fiber optic.

Since so many people want to use Wi-Fi as a transmission method for their internet access, many manufacturers have combined the router and Wi-Fi access point. In this case, the "port" istotally internal, and connects the router to the Wi-Fi access point. This reduces the number of boxes, power supplies, and cables needed. ISPs will usually provide such a combined box, but charge extra for turning on the Wi-Fi

radio because people are willing to pay extra for the convenience. Most technically inclined people will save the rental fee and buy their own combined Wi-Fi access point and router, which is commonly called a "Wi-Fi Router".

F. ESP8266

The ESP8266 is a very user-friendly and low-costdevice to provide internet connectivity to your projects [2]. The module can work both as an Access point (can create hotspot) and as a station(can connect to Wi-Fi), hence it can easily fetch data and upload it to the internet making theInternet of Things as easy as possible[7].

It can also fetch data from the internet using API's hence your project could access any information that is available on the internet, thusmaking it smarter. Another exciting feature of this module is that it can be programmed using the Arduino IDE which makes it a lot more user friendly.

The ESP8266 module works with 3.3V only,anything more than 3.7V would kill the module hence be cautions with your circuits.

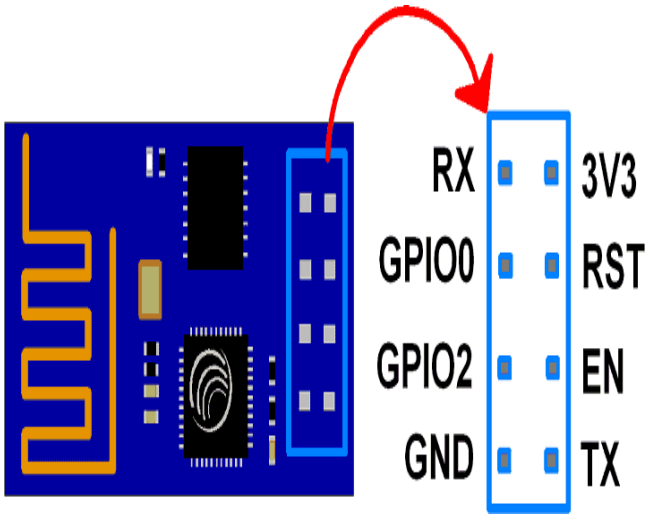

Fig.4 ESP 8266

G. DHT11 TEMPERATURE SENSOR

The DHT11 is a commonly used Temperature and humidity sensor[3]. The sensor comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data. The sensor is also factory calibrated and hence easy tointerface with other microcontrollers.

The sensor can measure temperature from 0°C to50°C and humidity from 20% to 90% with an accuracy of ±1°C and ±1%. So, if you are lookingto measure in this range then this sensor might bethe right choice.

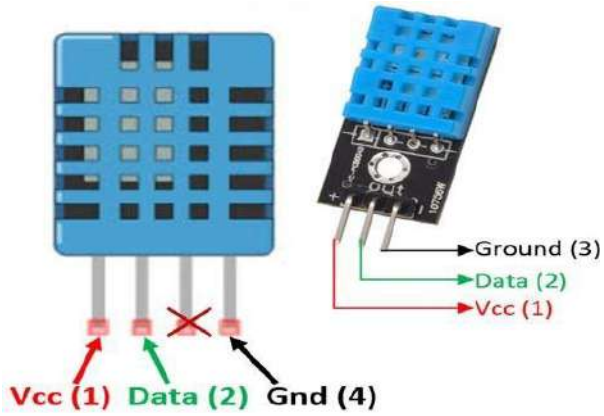

Fig. 5 Temperature Sensor

H. OXIMETER

Pulse Oximeter is a noninvasive and painless test that measures your oxygen saturation level, or theoxygen levels in your blood. It can rapidly detecteven small changes in how efficiently oxygen is being carried to the extremities furthest from theheart, including the legs and the arms. The pulse oximeter is a small, clip-like device that attaches to a body part, like toes or an earlobe. It's most commonly put on a finger, and it's often used in a critical care setting like emergency rooms or hospitals. Some doctors, such as pulmonologists, may use it in office.

The purpose of pulse oximetry is to check how well your heart is pumping oxygen through your body. It may be used to monitor the health of individuals with any type of condition that can affect blood oxygen levels, especially while they're in the hospital.

During a pulse oximetry reading, a small clamp-like device is placed on a finger, earlobe, or toe. Small beams of light pass through the blood in thefinger, measuring the amount of oxygen. It does this by measuring changes of light absorption in oxygenated or deoxygenated blood. This is a painless process.The pulse oximeter will thus be able to tell oxygen saturation levels along with your heart rate.

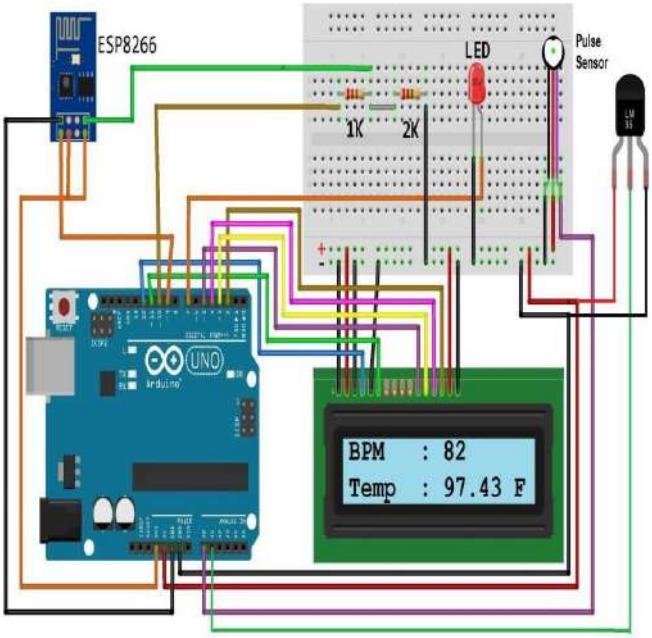

Fig. 6 Circuit Diagram Of Proposed System

III. ThingSpeak (IOT Application)

ThingSpeak provides a very good tool for IoT based projects. By using the ThingSpeak site[4], we can monitor our data and control our system over the Internet, using the Channels and web pages provided by ThingSpeak.

API keys. This key is required for programming modifications and setting your data.

Email alert from THINGSPEAK:

ThingSpeak has added an alerts API to let you to send emails from your ThingSpeak account. ThingSpeak offers email alerts.

Use the new alerts API key to trigger emails and check the sent email history using MATLABcode or another HTTP client. With MATLAB code in ThingSpeak, we can read and analyze channel values and then respond with an email. We can even add information in the email about the condition that triggered the email.

IV. RESULTS

The body temperature sensor, pulse rate sensor, oxygen levels are calibrated using the microcontroller. The complete prototype of the health monitoring system with the sensors and where it shows the output values of the sensors are calculated and displayed in a LCD display, so that these values are visible even to the patient.

These sensor values are then sent to the databaseserver (THINGSPEAK). These data can be accessed from cloud by the authorized users using the IoT application platform. The sensor values of the patient is displayed in the application.

Based on these values received, the disease of the patient is diagnosed and appropriate action can besuggested by the doctor even from a distance. So,for all combinations of the input sensors, the output health state can be simulated and diagnosed using IOT specifications.

TABLE 1. Body Temperature table:

Body temperature	**State**
97.0 °F – 99.0 °F	Normal
> 99 °F	High
< 97°F	Low

TABLE 2. Blood Oxygen level, Saturation SpO2 table:

SpO2 %	**State**
95 % – 100 %	Normal
80 % – 85 %	Hypoxia
< 85 %	Severely Hypoxic

TABLE 3. Pulse rate table:

Body temperature	**State**
60 BPM – 100 BPM	Normal
>100 BPM	High
<60 BPM	Low

The corresponding results of proposed system is shown in Fig. 7 and Fig. 8.

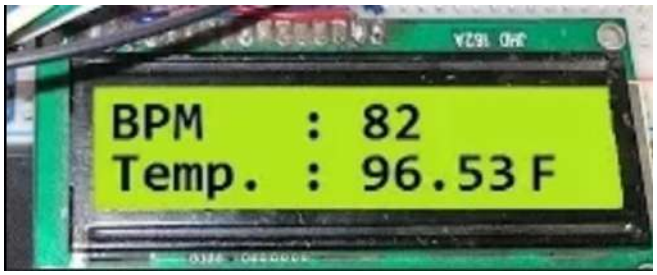

Fig. 7

Fig. 8

V. CONCLUSION

Internet of things technology is in its starting face but it have potential to impact human healthcare and associated market at a massive scale. Due to high speed internet access and advanced sensor technology it is possible to track human and other objects. Researcher have start to discover many technological solutions to improve healthcare system. This paper offers deeper insights of Internet of things-based healthcare applications, enabling technologies, current challenges and issues of healthcare.

In this paper, various mechanisms and algorithms were discussed for healthcare monitoring using IOT. This system overcomes the disadvantages from the existing mechanism by making it a more efficient method to monitor the health parametersof patients. This system has the advantage of less cost, less analysis, time, and low power consumption. By this, the accurate and effective measurement of heart rate of patients is possible and makes an efficient system in the field like medical.

VI. FUTURE SCOPE

This project can be induced into low-cost e-healthmonitoring system in near future. The system offers remote capabilities that enhance the level of medical support the patient receives whileenabling them to be monitored in the comfort of their home. Using web or mobile application, patients' data can be collected easily and efficiently, at the same time providing access to them from any location.

Visualisation of this data as well as tracking the progress and facilitating communication betweenpatients and doctors, are considered as a great advantage in near future. Taking the medicine on time is considered to be a high priority for patients. Failure to take the medicine on time cannot only delay recovery, but can worsen the symptoms of an existing illness or cause serious side effects. In this context the use smart TV application for showing reminders and notifications, can be used. Our next step should be conducting the evaluation study with the users in order to do further system improvement.

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A Survey on Altitude Measurement and Blood Oxygen Level Monitoring System

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Abstract: ***Maintaining Oxygen Levels when travelling to high altitude places is important for the health of a person. In this present work, we have created a system using off-the shelf electronics components to measure blood oxygen level,body temperature and altitude. The main objective is to check whether the measured blood oxygen level is in normal range with the measured altitude and based on that warn the person to take precautions and help prevent severe health conditions caused on high altitude places. Using an infrared temperature sensor a person's body temperature can also be measured. The system is built around ESP8266 and can also display ambient temperature and humidity using a separate sensor and shows weather forecasts when connected to Wi-Fi.***

Keywords: I2C, MAX 30100, BMP180, Temperature, heart rate and SpO2, Node MC

I. INTRODUCTION

High altitude oxygenation is a method of improving oxygenation or enriching the body with additional oxygen at high altitudes.[1] According to the Society of Mountain Medicine (Effects of high altitude on humans), there are three altitude regions:

- High Altitude = 1500 to 3500 meters above sea level (4900-11500 ft.)
- Very high altitude = 3500 to 5500 meters above sea level (11500 to 18000 ft.)
- Extreme altitude = above 5500 meters above sea level (18000 ft.)

These three altitude regions correspond with different levels of low oxygen in the atmosphere. High altitudes can cause low oxygen saturation levels or desaturation of an individual's blood. It happens because of low atmospheric pressure at high altitudes Oxygen saturation levels refer to the extent hemoglobin is bound or saturated to oxygen.[2]

High altitudes produce low blood oxygen levels because of thin air. In turn, low oxygen produces a narrowing of the pulmonary arteries, a condition called pulmonary artery hypertension. The condition develops slowly with symptoms such as fatigue which is usually overlooked. As the blood oxygen level keeps on decreasing it could be fatal if precautions are not taken on time. The normal acceptable ranges of SpO2 are from 95 to 100 percent. The allowable range of SpO2 for patient having hypoxic drive problem lies between 88 to 92 percent.[3]

Peoples are homoeothermic and human body temperature is regulated at about 37ºC ±1ºC. The fundamental purpose behind looking at body temperature is to trace for any indication of foundational disease or inflammation in the body as body temperature rises or falls down in presence of a fever.[4]

We have designed a system using which one can check their blood oxygen level and body temperature to check for conditions such as hypothermia which is common at high altitude places. The system is incorporated with small,energy efficient and reliable sensors. While the sensors used are not the gold standard in their field, they can be used easily by any person without any much medical and technical knowledge. The system also measures and gives readings on altitude thus to check if the health stats of the person are in normal range at that altitude.

II. METHODOLOGY

The major sensor MAX30100 pulse oximeter comes with an inherent problem of not working properly, The MAX30100 IC uses 1.8V for VDD and uses two regulators to achieve this voltage, the SCL and SDA pins are pulled-up via the 4.7k ohm resistors to 1.8V. This means it does not work with microcontrollers with higher logic levels. Thus it requires disassembling the factory pull-up registers and creating a new pull-up circuit for interfacing.

Secondly, when MAX30100 is active it occupies the entire I2C bus, this happens because of its faster rate of taking readings and imperfect stock libraries, this makes it very difficult to use it along other I2C sensors.

We have come with three methods to solve this problem:

A. Multiple-Master Multiple-Slave Method:

In this method we build a common I2C bus for all sensors controlled by two microcontrollers, one microcontroller controls the MAX30100 while the second microcontroller controls all the other Sensors, The LCD display is controlled by both.
This requires entangling and complicated programming as both microcontrollers need to poll when they need control over the bus and only if the other is off the bus one can take over.

B. Separate Activation Method:

In this method the entire I2C bus is controlled by a single microcontroller using Single-Master Multiple-Slave technique and we create a separate function in the firmware for MAX30100 along with a hardwired On/Off switch. This approach is a hit or a miss as the system refuses to work accordingly due to interfacing and programming errors on several instances. Although this method is cheaper and smaller, it is not robust.

C. Dual Microcontroller Dual Display Method:

In this method MAX30100 is controlled separately by a microcontroller with an LCD display for results and all the other sensors share the I2C bus with another microcontroller and an OLED display. Both the microcontrollers communicate using serial communication. This method is the most expensive of all three but is reliable and easy to interface and program. We have used this method in our work after trying all three methods as it gave the most robust results.

1. Block Diagram of the System

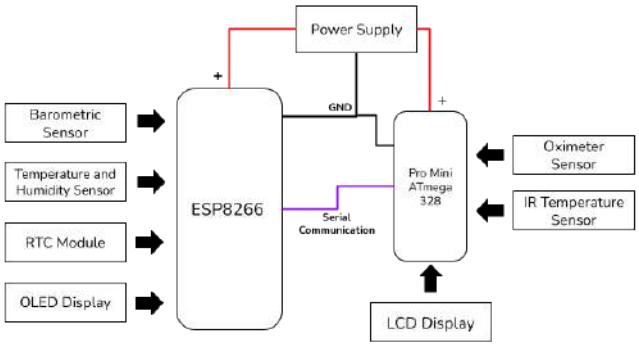

Fig. 1: Block Diagram of the System

III. HARDWARE USED

A. Sensors

1. Pulse oximetry and Heart rate sensor:

The MAX30100 is an integrated pulse oximetry and heart-rate monitor sensor solution. It combines two LEDs, a photo detector, optimized optics, and low-noise analog signal processing to detect pulse oximetry and heart rate meter.[5] MAX30100 works from 1.8V and 3.3V power supply and can be powered down through programming with insignificant standby current, allowing the power supply to stay associated consistently.[6] For efficient power management and savings, it has programmable sample rate(50 to 1000 samples per second) and LED current , and ultra-low shutdown current (typically 0.7µA). Other important features include high Signal to Noise Ratio (SNR), integrated ambient light cancellation, and high sample rate capability.[7]

Fig.2 Pulse oximetry and Heart rate sensor[8]

2. Barometric Pressure Sensor:

Altitude and air pressure are correlated. Altitude can be measured by measuring the air pressure. This is called indicated altitude, and is measured by a barometric pressure sensor.Indicated altitude is the reading on the altimeter when it is set to the local barometric pressure at mean sea level. As altitude rises, air pressure drops. The indicated altitude rises or drops depending upon the atmospheric pressure.

BMP180 is a barometric pressure sensor that detects atmospheric pressure. It is a silicon-based piezo-resistive type Sensor.: Piezoelectric Effect is the ability of certain materials to generate an electric charge in response to applied mechanical stress.[9] In BMP180 this mechanical stress is caused by atmospheric pressure.

Fig.3 Barometric Pressure sensor[10]

3. Infrared Temperature Sensor:

MLX90614 is a non-contact infrared temperature measurement device well suited for measuring body temperature. It uses a low-noise amplifier, 17 b A/D converter and powerful DSP processing unit with high temperature resolution and measurement accuracy. The thermometer temperature range is -40~+125℃. The working principle of MLX90614 is to transform the infrared radiation signal collected from the objects and bodies into electrical signals, send the electrical signal into converter after noise amplification processing by amplifier, then the electrical signal is converted to digital signals.[11] In our tests it worked accurately when pointed towards forehead with less than 5cm distance and took approximately one minute for the readings to stabilize.

Fig.4 Infrared Temperature Sensor[12]

4. Ambient Temperature and Humidity Sensor:

DHT11 sensor module is a combined module for sensing humidity and temperature which gives a calibrated digital output signal.This sensor has a resistive type humidity measurement component and NTC type temperature measurement component with an 8-bit microcontroller inbuilt which has a fast response.[13] It uses a single wire interfacing for its serial communication to the microcontroller which makes it easy to connect.

Fig.5 Ambient Temperature and Humidity Sensor[14]

B. Processing Units

1. ESP8266:

NodeMCU ESP8266 is a Wi-Fi SOC (system on a chip). The ESP8266 is a low-cost Wi-Fi chip developed by Espressif Systems with TCP/IP protocol. The GPIO pins allow Analog and Digital input/output, plus PWM, SPI, I2C. NodeMCU uses an on-module flash-based SPIFFS(Serial Peripheral Interface Flash File System) file system. NodeMCU is implemented in C and is layered on the Espressif NON-OS SDK. The firmware was initially developed as is a companion project to the popular ESP8266-based NodeMCU development modules, but the project is now community-supported, and the firmware can now be run on any ESP module.[15] ESP8266 can be used as an external Wifi module, using the standard AT Command set Firmware by connecting it to any microcontroller using the serial UART, or directly serve as a Wifi-enabled microcontroller, by programming a new firmware using the provided SDK.

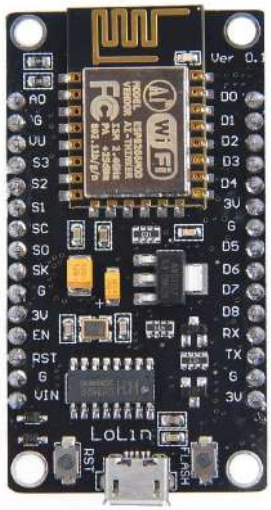

Fig.6 ESP8266[16]

2. ProMini ATmega328

Arduino Pro Mini is one of the smallest microcontroller boards based on the ATmega328. It comes with 14 digital input/output pins, 6 of these digital pins can be programmed for PWM output and it has 6 analog inputs including pin A4 and A5 which works for I2C interfacing. Along with this it supports UART and SPI communication.[17]

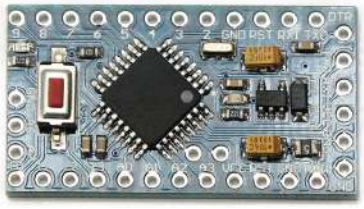

Fig.7 ProMini ATmega328[18]

IV. SCHEMATIC

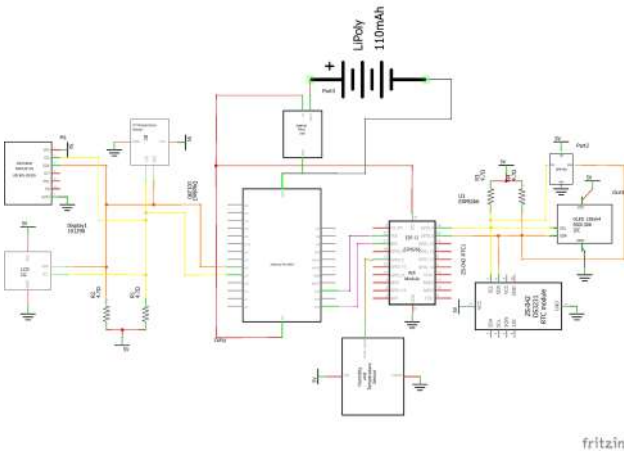

Fig.8 Schematic Circuit

V. OUR EXPERIMENTAL SETUP

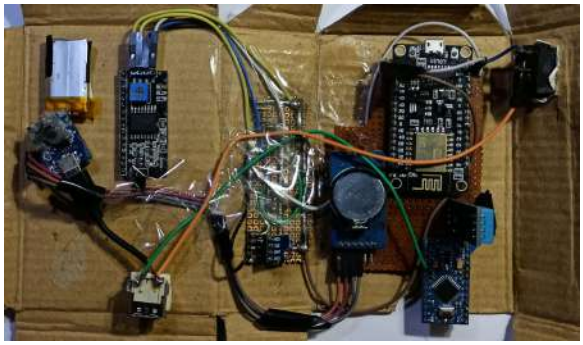

Fig.9 Photograph of the setup

Fig.10 Photograph of Setup showing Readings

Fig.11 Photograph of Setup showing body temperature

VI. CONCLUSION

A Node MCU based portable system is designed to measure altitude and monitor Blood Oxygen level and body temperature. The system can be charged with an USB charger of 5V. The system is created as such a person with rudimentary technical knowledge can operate it. The abilities of the system can be used in

- In Travel equipment for high altitude places.
- In aviation service.
- For medical professionals to have a portable blood oxygen meter device.

Using the RTC module and wireless capabilities of ESP8266 along with its 4MB flash memory, measurements can be recorded with specified date and time. As the system was built around the idea of a gadget to take along mountain trips, when connected to Wi-Fi it can show the weather forecast using an API key from OpenWeatherMap.

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Smart Tidal Flow Warning System

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***Abstract*—Life is a precious gem with a priceless worth. Life provides us an opportunity to experience the tangibles and the intangibles. But our life is vulnerable to many unforeseen natural calamities. Thus, it becomes essential to take appropriate precautions and exhibit preparedness. India has witnessed a high death toll due to the floods. Loosing life in this manner is very dreadful since technology has reached such a level that these situations can be dealt better. Hence to combat these disasters, it is crucial to identify the potential threat to all life-forms and inform them in advance. A prototype for the detection and notification of flood using Arduino Uno and GSM has been designed. Real time monitoring of water levels in the areas which have a continual supply of water, such as the rivers, glaciers and dams have been the area of focus. Arduino has been integrated with the ultrasonic sensor and OLED to determine and display the parameter of distance between the sensor and water. Along with this a stream time is displayed on the OLED display. Notification is sent in the form of Short Message Service (SMS) to the concerned authorities when the water increases above a pre-determined level using GSM Module. A safety alarm in the form of buzzer beeps when a potential threat is observed, enabling the population in the close vicinity to prepare for evacuation. Also an LED glows when the water exceeds the safe level. The real time distance monitored is recorded in the form of a line graph using the MS Excel Data Streamer.**

Keywords—Floods, Arduino Uno, GSM Module, Ultrasonic sensor, OLED, LED, Buzzer, MS Excel Data Streamer

I. INTRODUCTION

Occurrence of flood is sighted due to climatic changes or western disturbances which cause heavy rainfall and other phenomenon like melting of ice and snow on mountains, increase in water carrying capacity of the lakes, rivers or sea account for the same. In recent times, India has been worst hit by floods which ruined not only the lives but the livelihoods too. India has a Central Water Commission (CWC) which maintains a regular flood situation report, and according to 2020 the statistics show that the south west monsoon season rainfall was 8.74% above normal, hence giving rise to higher chances of flooding. Advancement in electronic devices towards the Nano-dimensions has led to improvement in microcontroller architecture and its ability in processing data [1].This extension is being used in weather forecasting, flood detection, monitoring system by making use of sensing devices, modeling software, Internet and mobile technology [2]. Now with the growing of technology, and currently witnessing Industrial Revolution 4.0 which comprises of Mobile Devices, Internet of Things platforms and much more as its key components, we engineers have been bestowed with finding solutions to the existing problems in a less complicated manner. The Internet of Things (IoT) software platform is being utilized for bringing together different sensors, data and services together, using the components in conjunction for the development of quality of social and environmental services [3]. Use of this developing technology is the need since, keeping a close check on the probability of happening of flood, is not an easy job for the local residents. Therefore, a robust flood warning system is the key to keep a check and reduce the loss.

This paper illustrates a system which aims to provide a Tidal Warning to the concerned authorities through an SMS and alerts the residents through a beep sound produced by the buzzer. A data record is maintained and updated on the MS Excel Data Streamer. The prototype will hence enable early detection and warning.

II. COMPONENTS USED

A. Arduino Uno

It is an open source electronics platform which comes with an easy to use hardware and software. It provides a user friendly programming environment. It is a microcontroller board which allows the user to build gadgets. It functions as a bridge to interface devices.

Fig 1. Arduino UNO

B. Ultrasonic Sensor

It is an electronic device that measures distance of the object placed in front of it by sending ultrasonic sound waves and in turn receiving electrical signal. It works like an Analog to Digital (A2D) Converter. It is notably used as a level sensor, in order to figure out the distance from a source.

Fig 2. Ultrasonic Sensor

C. Organic LED (OLED)

It is a display device similar to that of an LCD, except for the fact that it does not use any backlight. This device's thickness is lesser as compared to the LCD. It is efficient in terms of energy and power consumption. This module provides great user interface and is easy to use.

Fig 3. Organic LED

D. Buzzer

It is also known as a beeper, and it behaves as an audio signaling device. Despite of its small size, it has a high sound producing capacity. Hence it is used in applications which need an alerting mechanism.

Fig 4. Buzzer

E. GSM Module

It is a module which is used to enable communication between a microcontroller and the GSM Network. It provides a hardware device that uses the GSM mobile technology to provide a data link to a remote network. It is widely used because of a good connectivity and extensive coverage.

Fig 5. GSM Module

F. LED

It's a device with high brightness and intensity. It is efficient in terms of energy and has a long life. It is used for the purpose of lighting in order to signal a happening. It glows on encountering a flow of current through its terminals.

Fig 6. LED Bulb

III. FRAMEWORK

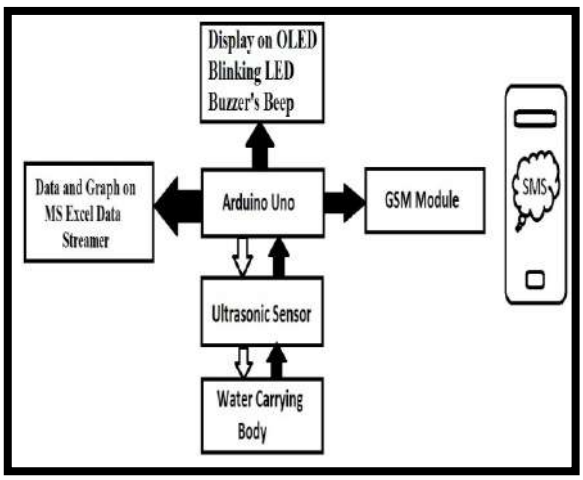

Fig 7. Proposed Working Mechanism

The above figure depicts the interdependence and linkage of the components on each other. By integrating the knowledge of Internet of Things (IoT) a system is constructed mainly by the use of Arduino Uno, ultrasonic sensor and the GSM. The data so obtained is communicated wirelessly in the form of an SMS. The system is interconnected in a pre-defined manner so as to provide faithful results. Once these results are obtained they are further sent to the MS Excel Data Streamer which streams the incoming data and plots a graph of the variations observed.

IV. IMPLEMENTATION

The system activates as soon as the compilation of the code takes place. The ultrasonic sensor transmits the signal to sense the water level and sends the received data to the Arduino Uno [4]. Arduino Uno reads the signal received and displays the result obtained on the OLED. This trigger induced by the water sensing sensor further activates the GSM module for sending message in the form of an SMS to the authorities, thereby enabling everyone to be prepared and cautious about increasing water level [4]. The notification so received gives information about the water level when it rises above the safe condition.

An LED starts blinking when the water level increases higher than the expected range. Also a 4V-8V Buzzer has been used to warn with a beep about the progressive increase in the water above a critical level, so that people around the area are aware of the same, thereby, reducing the chances of mishap.

The readings obtained are recorded and displayed on the MS Excel Data Streamer so that we can take a note of it for future. The values on the plot keep varying as the water trend varies, hence facilitating real time monitoring of the data and their trends via graph. The variations seen on the system can be saved as a .csv file, which can be reviewed and analyzed at any time instant. Therefore, enabling statics maintenance of data at all times.

Fig 8. Circuit Prototype

V. RESULT

On successful establishment of the circuitry, we have obtained desirable results. Their tabulations have been done to indicate the various levels of water along with the classification of their threat levels and the way in which the system performs in accordance to it.

Table I. System Indicatives

Water Indication	Indication Light	Indication Alarm	Alert Message
SAFE	No Light	No Sound	No Message
RISK	Light Always ON	No Sound	DANGER: Water Level Rising
CRITICAL	Light Blink	Beep	DANGER: CRITICAL SITUATION, EVACUATE

Fig 9. Results on OLED Display

Table II. Results Obtained

Distance(in centimeters)	Stream time (in Seconds)	Water Level Indicative
12	17.49	SAFE
9	13.12	RISK
4	5.83	CRITICAL

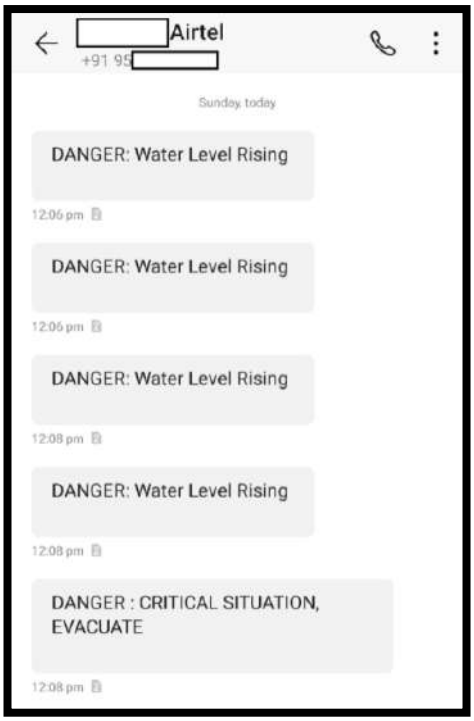

Fig 10. Alerts received on mobile

The graph plot below represents the real time water level being observed on the MS Excel Data Streamer. The newest value is being displayed on the yellow row. Along with the updation of the row, the second table below contains a set of fifteen values which have been monitored. All these values are found to be plotted on the graph with the continuous variations being reflected on the tables as well as the graph.

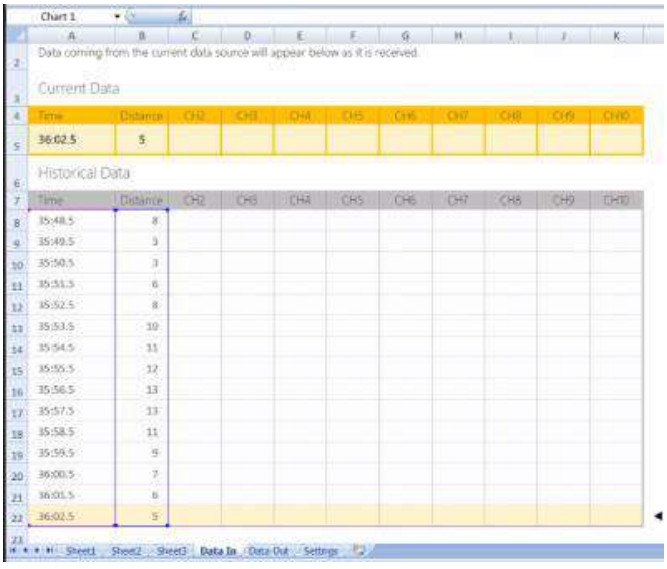

Fig 11. Data collected on MS Excel Data Streamer

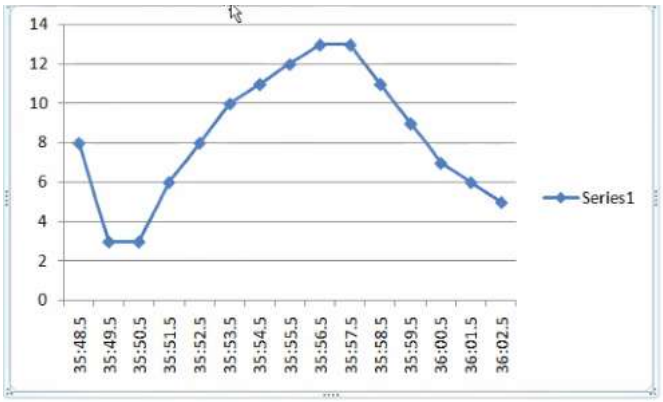

Fig 12. Graph Plot using Data Streamer

VI. CONCLUSION

On working with the ultrasonic sensor, it properly displayed the values on the OLED. The LED is observed to function when water rises above the normal level. The message sent as an SMS to the authorities is of two categories. One is when water gradually rises above normal, the message sent is "DANGER: Water Level Rising." The other message will be sent when the water is exceeding the pre-determined critical level, where the message is read as "DANGER: CRITICAL SITUATION, EVACUATE." When the water reaches the critical level then the buzzer also starts to beep, indicating the nearby residents to relocate to a safer place at the earliest. All the statistics which have been observed during monitoring are recorded and represented graphically for easier referencing.

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Review paper of localization in Wireless Sensor Networks

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Abstract— Localization is the process of finding a Sensor node's position in space. This paper explains the procedure for locating nodes in wireless sensor network, including the techniques for estimating inter –node distances and angles and how compute their positions using trilateration or triangulation. It centers around the numerical idea hidden limitation. Running based limitation calculations use triangulation for assessing the actual area of just those remote nodes that are inside one-hope distance from the anchor nodes. Multi-hop localization algorithms, on the other hand, aim at localizing the wireless nodes that can physically be residing at multiple hops away from anchor nodes. These latter algorithms have attracted a growing interest from research community due to the smaller number of required anchor nodes. One such algorithm, known as DV-Hop (Distance Vector Hop), has acquired prevalence because of its straightforwardness and lower cost.

Keywords— Wireless Sensor Network, DV-Hop, RSSI

I INTRODUCTION

A Wireless sensor network (WSN) [1] is composed of plenty of sensor nodes. These nodes have the capacity of detecting, calculation, and wireless communication. Because of its incredible capacity and low energy cost, the WSN has been generally utilized . In various domains, such as national defense and military affair, environment inspection, traffic management, long distance control of dangerous region, and so on, WSN has shown its impotance and capability in application in WSN, the position information is requiredl. When an abnormal event occurs, the sensor node detecting the event needs the position information to locate the abnormal event and report to the base station. Consequently, the position data is generally inserted in the report message created by the sensor node. Without position data, WSN can't work as expected . In practice, sensor nodes are often deployed by random bestrewing (airplane bestrewing for example). And for the high-cost, only a few nodes are equipped with Global Positioning System (GPS) which can capture their position after being bestrewed. All the other nodes cannot acquire such information. Therefore how to obtain the position information of unknown nodes, which is called localization problem, has become a hot topic in WSN. One of the well-known multi-hop localization algorithms is the distance vector-hop (DV-Hop) algorithm [2]. This algorithm works in the following way. It first estimates the average distance per hop between all pairs of anchor nodes. Then, every sensor node estimates its distance from an anchor node by multiplying its hop-count from that anchor node and the average distance per hop. Once a sensor node's distance from at least three anchor nodes becomes available, one can apply the triangulation method to calculate its estimated location. The DV-Hop algorithm results in poor localization accuracy because it uses average distance per hop that might be different from actual distance between the pair of sensor nodes. Moreover, in DV-Hop, if two nodes have the same hop-counts from anchor nodes, both will be assuming the same physical position, which may not be the correct estimate of their locations .We propose an enhanced DV-Hop algorithm, named as Hybrid DV-Hop algorithm calculation to lighten these issues.

II RELATED WORK

(A) Overview of Wireless Sensor Networks

A sensor network is an ad-hoc network composed of hundreds or even thousands of nodes. Nodes are capable of sensing environmental phenomenon such as light intensity, temperature, humidity, seismic waves, etc. Besides sensing the environment, sensor nodes also have computational power and memory to process the data. Information can be exchanged between sensors through wireless communication links.

(B) Localization Approaches

To determine the position of sensor node there are two main approaches:

Proximity: It is the simplest technique to exploit the finite range of WSN. It can be used to decide whether a node that wants to determine its position or location in the proximity of an anchor.

Geometrical Approach: When the distances between an object and a number of nodes are measured, it is also required to find the actual position of nodes by combining the distance measurements. The most used methods for distance measurements from three or more nodes are: Triangulation Trilateration ,,Multilateration

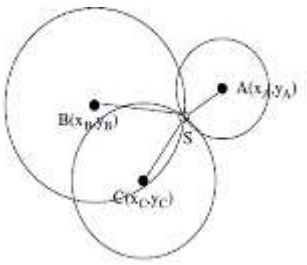

Fig.1: Trilateration

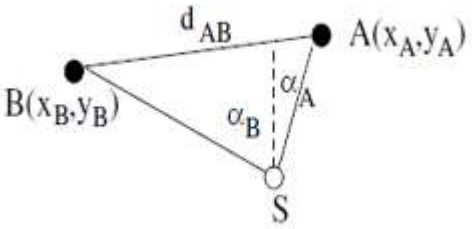

Fig. 2 Triangulation

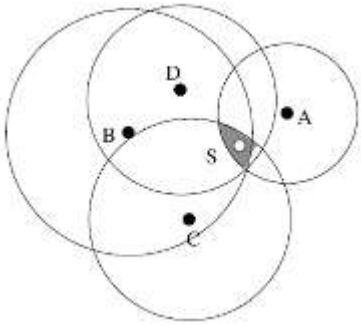

Fig.3 Multilateration

(C)Range-based Localization Algorithms

Time of Arrival (TOA) [3] [4], Time Difference On Arrival (TDOA) [5] [6], Angle Of Arrival (AOA) [4] are all popular Range-based methods. They require additional hardware support and thus, are very expensive to be used in large scale sensor networks. RSSI [4] is the most fundamental method .Both theoretical and empirical models are used to translate signal strength into estimated distance. Due to its easy implementation and there is no need for additional hardware,RSSI has been widely used.

Time of Arrival (TOA): **Require very accurate hardware to measure the actual received time of the beacon signals. Time Difference On Arrival (TDOA):** The difference between the receive times of two separate signals can be used to estimate the distance between nodes. Angle Of Arrival (AoA): Direction of received signal is estimated with signal strength and time .Higher complexity antenna arrays are required for direction measurement, which increases the cost .Provide high localization accuracy.

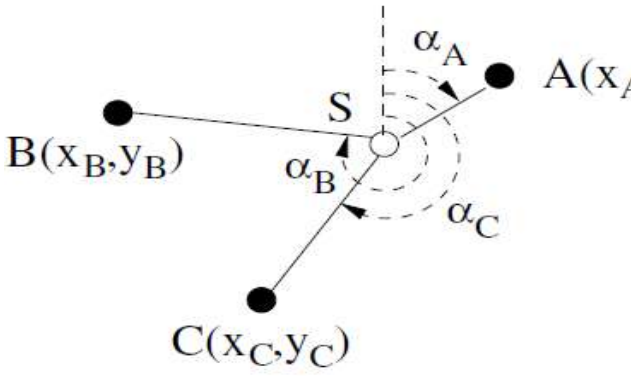

Fig.4 AoA measurements for three beacon nodes A, B, and C, and a node S with unknown location [3]

The triangulation technique can then be used to estimate the physical position of the target node. It is worth mentioning that every target node must have at least three anchors as its one-hop neighbors for it to be localized in two dimensions. Another approach, popular with research community, due to its inexpensive and simple nature, is to use the received signal strength indicator (RSSI) for estimating the distance between the transmitter and receiver nodes [7,,8,9]. Under the dynamic environmental influences, significant fluctuations in the target metric (e.g., RSSI) take place resulting in large variations in the estimated distances. RSSI-based localization methods can be classified as those based on fingerprinting and those using signal propagation modeling. The latter aspect requires better propagation model that captures the interference and fading caused by multi-path propagation and shadowing in a specific deployment area [10]. The use of fingerprinting normally consist of two phases, i.e., an off-line phase, which is used to carry out RSSI measurements at pre-specified locations in the deployment area, and an on-line phase during which wireless sensor nodes are localized.

Specifically, during the localization phase, the target node receives the beacons from anchor nodes, computes the corresponding RSSI, and sends it to a localization server, which, in turn, estimates the mobile node's position.

(D)Range free Localization Algorithms

Although range-based localization can achieve high accuracy, these algorithms require additional hardware (thus increasing the cost) and consume more energy. That bodes not so well for the wireless sensor nodes that are supposed to be low cost and have limited resources. Therefore, several localization solutions have proposed while using range free algorithms. These algorithms aim at estimating the location of a target node without requiring to estimate the pair-wise distances between the wireless nodes. One of the commonly used range free localization algorithm is DV-Hop [11].

DV-Hop (Distance Vector-Hop) algorithm is divided into three steps:

In the first step, all ANode broadcast a beacon message to other nodes, the format of the beacon message is {*_id, x_i, y_i, HopCount* } and then it flooded through the whole network. The initial value of hop count is zero. Each receiving node maintains an ANode information table and keeps the minimum hop count value from other nodes. Beacon message with higher hop count values to a particular anchor will be ignored. Then each receiving node increase the hop count with 1 before they transmit to the other neighbor nodes. After a period of time, all nodes in the network get the minimum hop count to other nodes[12].

In the second step, the Anodes get minimum hop count value to other ANode according to the result in the first step. Then it can estimate average hop size to other ANode on the basis of the minimum hop count and distance between ANode[5]. The average hop size of ANode is defined by

$$\text{Hopsize}_{Ai} = \frac{\sum_{i \neq j} \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2}}{\sum_{i \neq j} \text{hops}_{ij}}$$

Where *n* is the number of ANode, (x_i , y_i) and (x_j , y_j) are the coordinates of ANode *i* and *j* , $hops_{ij}$ the minimum hop count value between ANode *i* and *j* .Every ANode broadcast its average hop size to the whole network. Each UNode receive all ANode's average hop size ,and select the hop size of an ANode, which has the minimum hop count value to this UNode, as its average hop size[6]. In the end, we can calculate the distance of every UNode to Anode by

$$dij = HopSize_i \times HopCount_{ij}$$

Where d_{ij} is the distance of UNode *j* to ANode *i* , *HopCount* is the minimum hop count of the UNode *j* to ANode In the third step, after three or more distances with Anodes received, the UNode calculates its coordinate through triangulation method or maximum likelihood method.

The DV-Hop algorithm completely avoids estimating the actual distances between the one-hop neighbor nodes and exploiting these distances for more accurate localization in large scale wireless sensor networks. Hybrid algorithm uses two additional steps while localizing wireless nodes using DV-Hop algorithm. In the first step, we use the RSSI values for estimating distances between the anchor nodes and their one-hop neighboring sensor nodes and then use these distances thus estimated rather than using the average hop distance as done in the original DV-Hop algorithm.

The localization process consists of three phases: (1) the Flooding phase; (2) the average distance per hop estimation; (3) the sensor node position estimation. Phase (1) and (2) are done by anchor nodes, however; phase (3) is done by the sensor node to be localized.

The flooding phase and the Calculating Average Distance per Hop phase. After the end of these phases, each node knows the list of reachable anchor with their coordinates, their Hopsize , and the number of hop-count away from each reachable anchor. Then, the localization process of unknown nodes is initiated by the anchors. More precisely, each anchor send a LocStartMsg message to their neighbors in order to start the localization. The LocStartMsg message contains mainly the following field: LocStartMsg = {node ID, Type, nodeCoordinate},where node ID represents the identity of the node sending the message, Type specifies either the node is anchor or no and nodeCoordinate the coordinates of the node, which are real coordinates for anchor nodes and estimated coordinates for other sensor nodes. Each node receiving this message ,first estimates its position and then forwards the message to their neighbors.

III .CONCLUSION:

This paper focuses on the concept of wireless sensor network, including the techniques for estimating inter –node distances and angles and how compute their positions using trilateration or triangulation. Range-based Localization Algorithms and Range free Localization Algorithm.

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Review Paper on Wireless Sensor Networks

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Abstract— A wireless sensor network (WSN) has important applications such as remote environmental monitoring and target tracking. These sensors are equipped with wireless interfaces with which they can communicate with one another to form a network. In this paper, an overview of the broad research issues and challenges involved in the design of WSNs are presented. Energy conservation emerges as one the most critical aspect in hardware and software related design issues, and puts a question mark on the overall practicability of WSNs. Besides, other related main issues include specialized hardware, software and operating system, synchronization, QoS, security, architecture and data collection related aspects with minimum communication and computation costs. This paper provides an insight into various such design issues for the better understanding of this field for the overall benefit of the research community working in this area.

Keywords— Wireless Sensor Network, Protocols, Sensor Network Services, QoS.

I.INTRODUCTION

Wireless sensor networks (WSNs) have gained worldwide attention in recent years, particularly with the proliferation in Micro-Electro-Mechanical Systems (MEMS) technology which has facilitated the development of smart sensors [1]. These sensors are small, with limited processing and computing resources, and they are inexpensive compared to traditional sensors. These sensor nodes can sense, measure, and gather information from the environment and, based on some local decision process, they can transmit the sensed data to the user.

The availability of low-cost hardware such as CMOS cameras and microphones has fostered the development of Wireless Multimedia Sensor Networks (WMSNs), i.e., networks of wirelessly interconnected devices that are able to ubiquitously retrieve multimedia content such as video and audio streams, still images, and scalar sensor data from the environment [2].

Wireless multimedia sensor networks will not only enhance existing sensor network applications such as tracking, home automation, and environmental monitoring, but they will also enable several new applications such as:

- Multimedia surveillance sensor networks. Wireless video sensor networks will be composed of interconnected, battery-powered miniature video cameras, each packaged with a low-power wireless transceiver that is capable of processing, sending, and receiving data. Video and audio sensors will be used to enhance and complement existing surveillance systems against crime and terrorist attacks. Large-scale networks of video sensors can extend the ability of law enforcement agencies to monitor areas, public events, private properties and borders [3].

- Storage of potentially relevant activities. Multimedia sensors could infer and report potentially relevant activities (thefts, car accidents, traffic violations) and make video/audio streams or reports available for future query [4].

- Traffic avoidance, enforcement and control systems. It will be possible to monitor car traffic in big cities or highways and deploy services that offer traffic routing advice to avoid congestion. In addition, smart parking advice systems based on WMSNs will allow monitoring available parking spaces and provide drivers with automated parking advice, thus improving mobility in urban areas. Moreover, multimedia sensors may monitor the flow of vehicular traffic on highways and retrieve aggregate information such as average speed and number of cars. Sensors could also detect violations and transmit video streams to law enforcement agencies to identify the violator, or buffer images and streams in case of accidents for subsequent accident scene analysis [5].

- Advanced health care delivery. Telemedicine sensor networks can be integrated with 3G multimedia networks to provide ubiquitous health care services. Furthermore, remote medical centers will perform advanced remote monitoring of their patients via video and audio sensors, location sensors, motion or activity sensors, which can also be embedded in wrist devices [6].

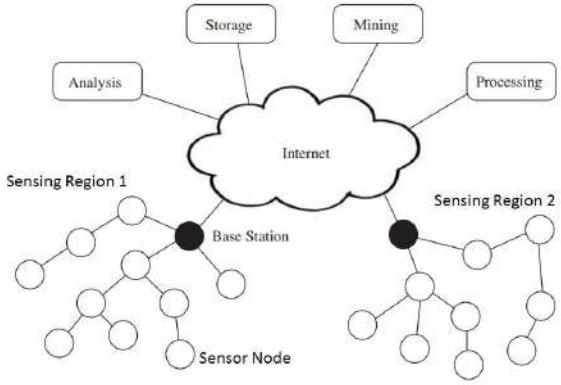
- Automated assistance for the elderly and family monitors. Multimedia sensor networks can be used to monitor and study the behavior of elderly people as a means to identify the causes of illnesses that affect them such as dementia. Networks of wearable or video and audio sensors can infer emergency situations and immediately connect elderly patients with remote assistance services or with relatives [7].

- Environmental monitoring. Several projects on habitat monitoring that use acoustic and video feeds are being envisaged, in which information has to be conveyed in a time-critical fashion. For example, arrays of video sensors are already used by oceanographers to determine the evolution of sandbars via image processing techniques.

- Person locator services. Multimedia content such as video streams and still images, along with advanced signal processing techniques, can be used to locate missing persons, or identify criminals or terrorists [8].

- Machine vision is the application of computer vision techniques to industry and manufacturing, where information can be extracted and analyzed by WMSNs to support a manufacturing process such as those used in semiconductor chips, automobiles, food or pharmaceutical products. For example, in quality control of manufacturing processes, details or final products are automatically inspected to find defects [9]. In addition, machine vision systems can detect the position and

orientation of parts of the product to be picked up by a robotic arm. The integration of machine vision systems with WMSNs can simplify and add flexibility to systems for visual inspections and automated actions that require high-speed, high-magnification, and continuous operation [10].



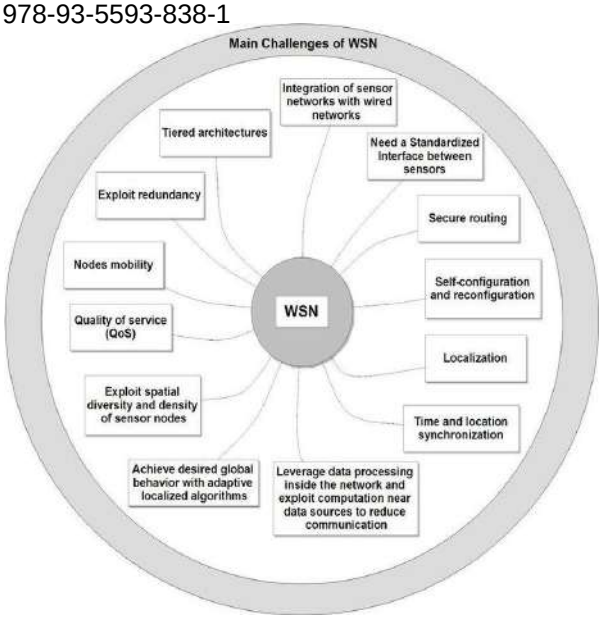
II. CHALLENGES IN WSN

A. Challenges in real time:

WSN deal with real world environments. In many cases, sensor data must be delivered within time constraints so that appropriate observations can be made or actions taken. Very few results exist to date regarding meeting realtime requirements in WSN. Most protocols either ignore real-time or simply attempt to process as fast as possible and hope that this speed is sufficient to meet deadlines. Some initial results exist for real-time routing. To date, the limited results that have appeared for WSN regarding real-time issues has been in routing. Many other functions must also meet real-time constraints including: data fusion, data transmission, target and event detection and classification, query processing, and security. New results are needed to guarantee soft real-time requirements and that deal with the realities of WSN such as lost messages, noise and congestion. Using feedback control to address both steady state and transient behavior seems to hold promise. Dealing with real-time usually identifies the need for differentiated services, e.g., routing solutions need to support different classes of traffic; guarantees for the important traffic and less support for unimportant traffic. It is important not only to develop real-time protocols for WSN, but associated analysis techniques must also be developed.

B. Challenges in power managements:

Low-cost deployment is one acclaimed advantage of sensor networks. Limited processor bandwidth and small memory are two arguable constraints in sensor networks, which will disappear with the development of fabrication techniques. However, the energy constraint is unlikely to be solved soon due to slow progress in developing battery capacity. Moreover, the untended nature of sensor nodes and hazardous sensing environments preclude battery replacement as a feasible solution. On the other hand, the surveillance nature of many sensor network applications requires a long lifetime; therefore, it is a very important research issue to provide a form of energy-efficient surveillance service for a geographic area. Much of the current research focuses on how to provide full or partial sensing coverage in the context of energy conservation.



C. Network Scale and Time-Varying Characteristics of WSN

Under severe energy constraints, Sensor nodes operate with limited computing, storage and communication capabilities [12]. Depending upon the application, the densities of the WSNs may vary widely, ranging from very sparse to very dense. In these sensor nodes the behavior of sensor nodes is dynamic and highly adaptive, as the need to self organize and conserve energy forces sensor nodes to adjust the behavior constantly in response to their current level of activity. Furthermore, the sensor nodes may be requires adjusting the behavior in response to the erratic and unpredictable behavior of wireless connections caused by high noise levels and radio-frequency interference, to prevent severe performance degradation of the application supported.

D. Management at a Distance:

Sensor nodes will be deployed at our door field such as a subway station. It is difficult for managers or operators to manage the network directly. Thus the framework should provide an indirect remote control/ management system.

III. Routing Protocols in Wireless Sensor Networks

The sensor nodes are constrained to limited resources itself, so the current research mainly focuses on how to design an effective and energy-awareness protocols in order to prolong the lifetime of the whole networks for specific application environments. Because the physical layer and data link layer are independent of specific application, our attention should focus on the energy-awareness protocols, especially the network layer with energy efficient routing protocols. However, the design of routing protocols in the network layer depends on the specific application and is constrained to the nodes' limitations, such as energy, memory and computing power. Since sensor nodes are not given a unified ID for identification, and much redundant data get together in destination nodes, there exist the following aspects: Energy Efficiency, Scalability, Latency, Fault-Tolerance, Accuracy, and Quality of Service (QoS), which we must carefully consider when we design or choose the routing protocols in WSNs. Yet the common aim is to build a steady transmission path in a quick-rapid and low cost manner.

From plenty of current routing protocols, on the basis of the network structure in WSNs and data transmission model, in general, we can classify routing protocols into three categories: Flat-based routing (Flooding), Hierarchical-based routing (Clustering) and Location-based routing (Geographic).

1) Flat-based routing (Flooding).

In flat-based routing, all nodes are typically equal and acts the same functionality. Each node not only can collect the data from the interesting events, but also can relay the information data by serving as a relaynode. The initial routing table is builded by flooding. According to whether the establishment and maintenance of routing table is initially sponsored by the sink nodes, flat-based routing can be classified into three modes:

a) Traditional flooding mode: the most fundamental flooding, sensor nodes transmmit the received messages to their neighbor nodes by brodcasting until the messages reach the sink nodes.
b) Event-driven mode: when the sensor nodes sense the interesting data, they actively broadcast those messages to sink nodes and choose the next hop according to routing table.
c) Query-drive mode: sink node broadcasts a application-specified request (interest) to its neighbor nodes by flooding the entire network. The requested nodes then choose a appropriate path to answer this query.

2) Hierarchical-based routing (Clustering).

Nodes play different roles in the network. Clustering alogrithm mainly includes two-layer routing where one layer is used to select clusterheads and the other layer is used for routing. Algorithm is based on the large number of high-density sensor nodes and focus on the routing scalability. The main features is to divide the whole WSNs into a number of clusters in terms with the specific rules.

3) Location-based routing (Geographic).

Usually assuming that sensor nodes knowing or able to computer their location, so the transmitting data can be directly sent to the designated zone. Thereby those algogithms can avoid data transmission problems such as broadcasting storm caused by flooding.

A. FLAT-BASED ROUTING (FLOODING)

A. Traditional flooding model

Flooding and gossiping [2] are the most basic traditional network routing. They do not need to know the network topology. Each sensor nodes will transfer those messages received to their neighbors nodes, and this process will be repeated until the messages arrive at sink nodes or is overtime due TTL (usually defined as the largest hop in WSNs). Gossiping improves flooding algorithm in some ways, and each sensor nodes only transfer the messages to a random neighbor node. However, even though flooding and gossiping is very simple and suitable for any network structure, but both algorithms are not practical in application-specified network, and they can easily bring implosion and overlap problems.

B. Event-driven mode

1) Sensor Protocols for information via Negotiation (SPIN):

SPIN [3] is the first data-centric routing protocol. The protocol considers the similarity of the data sensed by neighbour nodes; and every sensor node only broadcasts the unique data that neighbor nodes do not own. In this way, SPIN eliminates redundancy of transmitted data and thus effectively reduces energy consumption. At the same time, every node uses meta-data to name their data, and every node can make its communication decisions based on both application-specified knowledge of the data and knowledge of the available resources, which enables the sensor nodes to efficiently distribute data with limited energy.

SPIN uses three Message Data: ADV, REQ, and DATA. ADV is used to broadcast their own meta-data to the adjacent nodes for interesting event nodes; REQ give a notice to the neighbor nodes that the nodes will send the raw data; DATA refers to the original data.

Before any data is really transmitted, a node performs metadata negotiation. The negotiation is done by exchanging ADV and REQ messages between the sender and the receiver.

As SPIN don't need maintain neighbor information; it can adapt itself to the situation that nodes will often moved in a certain degree; simulation results show that SPIN is more energy-efficient than the traditional model. However, the algorithm can not ensure that the data certainly reach the target node, especially not suit for high-density distribution of nodes.

2) Rumor Routing [4]

Each node maintain a event table, the table entries contain the basic description of events, source node, last hop node; in addition, there exists a long lifetime message, which is used to broadcast the description of events in WSNs. Rumor routing is the same as SPIN in essence; the main difference is that it maintain a list of events information table, therefore it maintains a path to source nodes. So after initialization of flooding, corresponding path information has been established. Thus it avoids a large number of flooding process in SPIN, and then significantly save energy.

The protocol is mainly applied to those scenarios with a large number of queries and a small number of events. If network topology frequently changes, performance of rumor routing will be substantially reduced.

3) Energy-aware routing

Energy-aware routing [5] considers that if all data are transmitted through several optimal paths, energy of the nodes related with those paths will be exhausted soon. So in the process of establishing routing path, a number of suboptimal paths and probability model will be maintained at the same time. Then we select transmission paths based on the probability value of each path to make the initial network load balancing; thereby the whole network lifetime will be prolonged. The disadvantage is that energy-aware routing needs to exchange local information between neighbor nodes and all nodes have a unified address, which enlarges the price of building routing paths. And the failure of single node has not been fully considered, it is not suitable for sensor nodes with mobile features.

C. Query-driven mode

1) Directed Diffusion

After named, data will be directly transmitted between nodes, and sponsored by sink nodes.

In Directed Diffusion, there exist Interest messages, in an attribute-value way, which contains the relevant attributes for query and gradient field, which will be continuously updated in the process of transmission. A query is transformed into an interest that is diffused or flooded towards nodes in the interested region. When a sensor node in that region receives the interest, it activates its sensors and begins to monitor interested events. The sensed data are then returned in the reverse path of the interest propagation. Interest issued by the sink node through flooding will reach all sensor network nodes; then nodes maintain interest messages in the local cache. If the data are fit for interest request, then it will be forwarded along the path.

The most obvious feature of Directed Diffusion is to broadcast query interest messages in advance and build paths between sink node and all other sensor nodes in a flooding way. However, this also limits the scope of the application of this protocol. For example, when specific application requires sink node can access various types of data, then the cached cost maintained by each sensor node will increase dramatically.

2) Gradient-based Routing

The algorithm [6] makes an improvement on Directed Diffusion, in order to get the total minimum hop numbers other than the total shortest time. In the process of transmitting Interest messages, the algorithm takes the minimum hops between sink nodes and sensor nodes as its height value, and calculates the height difference with its neighbor node as a link Gradient of two nodes. When routing data, nodes select the link with the largest Gradient to forward data. While being flooded, Interest messages record the number of hops taken. This allows a node to discover the minimum number of hops to sink, called the node's height. The difference between a node's height and that of its neighbor is considered the gradient on that link. A packet is forwarded on the link with the largest gradient. Although the techniques to increase the network lifetime are built upon GBR, the main principles are general enough to also apply them to other ad-hoc routing protocols.

The algorithm also introduced some complementary measures, such as data integration and load balancing to increase the maximum life cycle in WSNs.

B. HIERARCHICAL-BASED ROUTING(CLUSTERING)

A. Single-layer Mode (single-tie)

1) LEACH(Low-Energy Adaptive Clustering Hierarchy)

The algorithm [7] is mainly based on the idea of choosing a node as Cluster Head during a group of nodes. The Cluster Head is responsible for communicating with sink node and data aggregation of its group nodes. In this way, the amount of data for exchanging during sensor nodes is largely reduced. Therefore this algorithm has an effect upon saving energy. The node becomes a cluster head for the current round if the number is less than the threshold. Each elected CH broadcast an advertisement message to the rest of the nodes in the network that they are the new cluster-heads.

LEACH is fully distributed and its data transmission delay is very small. However, the algorithm take the assumption that all the Cluster Head can directly communicate with the sink, so the assumption may not be practical, and then it cannot be much suitable for large-scale applications. At the same time, this approach of dividing clusters may bring additional costs and overlay issues.

2) PEGASIS and Hierarchical-PEGASIS

Taking account of the overhead of dividing clusters, PEGASIS makes an improvement on LEACH by constructing a node chain instead of cluster group. In all sensor nodes, only one chose node as a gateway to communicate with sink, the other nodes in the chain take turn to be gateway. After receiving message, each node takes an aggregation with its own sensing data. At last those data are transmitted to gateway node.

Although PEGASIS [8] performs better than LEACH by eliminating the overhead of dynamic cluster formation, because transmission is asynchronous, the time of transmission will be prolonged too much. Hierarchical-PEGASIS conducts a further improvement, it allows concurrent transmission when the nodes are not adjacent.

Compared with LEACH, the two algorithms eliminate the overhead of forming cluster, but both of them do not take the energy condition of next hop into consideration when choosing a routing path, so they are not suitable for heavy-loaded network. When the amount of nodes is very large in WSNs, the delay of data transmission is very obvious, so they do not scale well and also are not suitable for sensor networks where such global knowledge is not easy to obtain.

B. Hierarchical Mode (Hierarchical-tie)

1) TEEN and APTEEN

Based on LEACH, TEEN (Threshold sensitive Energy Efficient sensor Network protocol) [9] divides sensor nodes twice for grouping cluster in order to detect the scene of sudden changes in the sensed attributes such as temperature. After the clusters are formed, TEEN separates the Cluster Head into the second-level Cluster Head and uses Hard-threshold and Soft threshold to detect the sudden changes. Hard-threshold is used to trigger a sensor node when the sensing value of an attribute responses to the data query; Soft-threshold will further reduce the number of transmissions if there is little or no change in the value of sensed attribute.

TEEN is not suitable for the applications model that needs periodic report. APTEEN (Adaptive Threshold sensitive Energy Efficient sensor Network protocol) makes an improvement aiming at supporting periodic report for timecritical events. The main disadvantages of the two algorithms are the overhead and complexity of forming clusters.

2) Energy-aware for cluster-based networks

The algorithm [10] is also an extension to LEACH and introduces a kind of resource-unlimited Gateway nodes. By means of two-level cluster, Gateway node can aggregate data and change node’s state: dormancy, sensing or relay in accord with detected energy of sensor node.

In order to overcome ambiguity in signal propagation or get a better routing performance in terms of network throughput and end-to-end delay, many variants of this routing approach has been proposed. Due to limited space, here we do not analyze them one by one.

C. LOCATION-BASED ROUTING (GEOGRAPHIC PROTOCOL)

Those algorithms require location information for sensor nodes.

We assume sensor nodes can directly obtain their position or calculate the distance according to other positionknown nodes. It is worth noting that there have been many location-based protocols in Ad Hoc networks and it makes great effects when we transplant those research achievements for wireless sensor networks in some ways.

A. GEAR (Geographic and Energy Aware Routing)

The idea is to restrict the number of Interest in Directed Diffusion and add geographic information into Interest packet by only considering a certain region rather than sending Interest to the whole network by means of flooding. GEAR [11] uses energy aware and geographically informed neighbor selection heuristics to route a packet towards the target region. Therefore GEAR save energy consumption significantly in this way.
GEAR introduces an estimated cost and a learning cost and chooses next hop by calculating the difference between the estimated cost and the learning cost.

B. MECN (Minimum Energy Communication Network)

MECN [12] is firstly designed for wireless networks and found that it also can be directly applied to WSNs by the researchers. It is noticed that the cost of direct communication between two nodes is higher than forwarding data by several relay-nodes. So MECN identifies a relay region for every node, which consists of all relay-nodes that are more energy efficient than direct transmission. When two nodes need to exchange messages, MECN will choose a minimum energy path to transmit data according to Bellman-Ford shortest path method.

Thus, MECN is self-reconfiguring and can dynamically solve the node's failure problem or the deployment of new sensors. However, the algorithm is best applicable to sensor networks which are not mobile; under the circumstance of mobility in WSNs, the energy cost of calculating path in the relay region will rise sharply

There exist lots of other location-based routing protocols such as GEDIR, GOAFR and SPAN which can be directly applied to wireless sensor networks. However those algorithms will not be discussed by this paper for the restriction of length and content.

IV. CONCLUSION

Wireless Sensor Networks (WSNs) consist of small nodes with sensing, computation, and wireless communications capabilities. Many routing, power management, and data dissemination protocols have been specifically designed for WSNs where energy awareness is an essential design issue. As wireless sensor networks are still a young research field, much activity is still ongoing to solve many open issues. As some of the underlying hardware problems, especially with respect to the energy supply and miniaturization, are not yet completely solved, wireless sensor networks are having certain short comings, which are to be solved.

In recent years, the routing protocol in WSNs has become one of the most important research area, and there have been existed a large number of research achievements. In this paper, we make a great deal of analysis and research, and classify the routing protocols into three categories: Flat-based routing (Flooding), Hierarchical-based routing (Clustering) and Location-based routing (Geographic) on the basis of network structure. There are also a number of researchers from other point of view, who give other kind of taxonomy that we are not discussed here as for restriction of length and content.

Nevertheless, there still exist a series of challenges for routing protocols in WSNs.

As our study reveals, it is not possible that a routing algorithm is suitable for all scenarios and for all applications. Although many routing protocols have been proposed in WSNs, many issues still exist and there are still many challenges that need to be solved in the sensor networks. The following parts describe some of those issues and challenges:

- Effectiveness: how to effectively utilize bandwidth and energy for specific application; how to efficiently divide the whole networks into clusters and coordinate the workloads of all sensor nodes.
- Adaptability: how to adapt the mobile sensor networks and make sensor nodes self-organizing and self reconfigurable.
- Scalability: how to satisfy dense sensor networks with a large number of nodes and try to prolong the lifetime.
- Security: how to make routing protocols secure in WSNs and assure that the transmitted messages are not eavesdropped and tampered.

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Covid 19 Crowd Detection Camera

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ABSTRACT-The world is going through a tough time due to the highly contagious COVID-19 pandemic. The ongoing COVID-19 corona virus outbreak has caused a global disaster with its deadly spreading. Due to the absence of effective remedial agents and the shortage of immunizations against the virus, population vulnerability increases. It is essential to maintain social distance and avoid large public gatherings at one place to break the chain of corona infection. Physical distancing, as a measure to contain the spreading of Covid-19, is defining a "new normal". The authorities need reliable technology that can survey such places to prevent any unnecessary movement. Our COVID-19 Crowd Detection Camera can help in isolating the people by keeping an eye on them and indicating the safer distance between them. This paper aims to provide a framework that consists of a physical distancing system by leveraging some existing futuristic technologies, including deep learning and AI systems. We are using a camera that will take a live video of the people and image processing will be done followed by the object detection. Distance will be calculated between the people and will be marked as safe or not safe. If the calculated distance between the people is safe, no action will be taken, otherwise a buzzer or bulb can be used to alert the authorities. Smart COVID-19 Crowd Detection Camera will keep a watchful eye on all illegal activities and detect any crowd/person/vehicle on the road. The device also can alert the authorities regarding unnecessary gatherings. It keeps in track the account of the people in the scene. Human tracking is achieved by indicating the direction of movement of the person. The results of the analysis will be helpful in managing the crowd in any area with high density of crowds. The obtained results show the applicability and efficiency of our proposal in providing timely notification of social distancing violations.

Keywords- Deep learning, Crowd detection camera, Human tracking, Image processing, Object detection

INTRODUCTION

COVID-19 belongs to the family of coronavirus-caused diseases, firstly reported in Wuhan, China at the end of December 2020. China has announced its first death from the virus on January 11, a 61 years old man. On March 11, the World Health Organization (WHO) declared it pandemic due to its spread over 114 countries. With the tremendous growth in the world's population, there is a tendency to gather in communities for common interests such as workplaces, restaurants, music festivals, sport events, religious gatherings, and more. As a consequence, populations are vulnerable to many natural and human-made disasters, especially highly infectious and fast-spreading diseases similar to what we have witnessed in the coronavirus pandemic (COVID-19), which spreads quickly and more efficiently from person to person through respiratory droplets when an infected person coughs, sneezes, or talks.

This paper aims to mitigate the effects of coronavirus disease along with minimum loss of resources; this disease has badly impacted the global economy. Secondly, to provide a highly accurate solution for the detection of people to help out in monitoring social distancing. Based on the information from the World Health Organization, social distancing is the best practice where individuals can minimize physical contact with possible COVID-19 carriers by maintaining a certain distance between one person and another. The main target is to provide a comprehensive tool and effective technologies that can be utilized to enforce social distancing. Technologies could play an important role to facilitate social distancing practice. In such a context, Artificial Intelligence (AI) and information and communication

technology (ICT) can be used in addressing this challenge.

Figure 1: Social Distancing [1]

According to the defined requirements by the WHO, the minimum distance between individuals must be at least 6 feet (1.8 m) in order to observe an adequate social distance among the people. Recent research has confirmed that people with mild or no symptoms may also be carriers of the novel coronavirus infection. Therefore, it is important all individuals maintain controlled behaviours and observe social distancing.

The main purpose is to outline public health and social measures useful for stopping the spread of COVID-19 at national or community level. Most importantly, the ultimate aim is to 'walk back' community transmission to clusters, sporadic cases, and down to no cases at all, and to begin gradually lifting social measures. To be effective, crowd detection must be implemented with full engagement. All measures should be accompanied with clear, accessible and regular risk communication to explain the response strategy and enable people to make informed decisions to protect themselves and help achieve the public health goal of ending the outbreak.

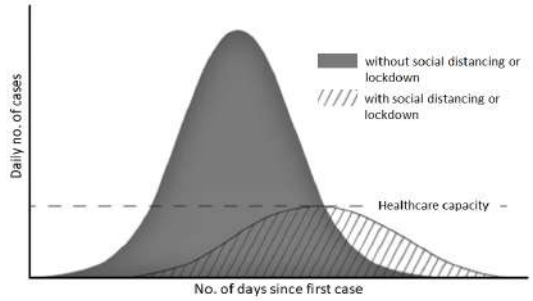

Figure 2: An outcome of social distancing as the reduced peak of the epidemic. [2]

LITERATURE REVIEW

After the rise of the COVID-19 pandemic since late December 2019, Social distancing is deemed to be an utmost reliable practice to prevent the contagious virus transmission.

Many countries have used technology-based solutions to overcome the pandemic loss. Several developed countries are employing GPS technology to monitor the movements of the infected and suspected individuals. Nguyen et al. (2020)[3] provides a survey of different emerging technologies, including Wi-fi, Bluetooth, smartphones, and GPS, positioning (localization), computer vision, and deep learning that can play a crucial role in several practical social distancing scenarios.
some provides an smart healthcare system for pandemic using Internet of Medical Things (Chakraborty, 2021; Chakraborty et al., 2021). Prem et al. (2020)[4] studied the social distancing impacts on the spread of the COVID-19 outbreak. The studies concluded that the early and immediate practice of social distancing could gradually reduce the peak of the virus attack. As we all know, although social distancing is crucial for flattening the infection curve, it is an economically unpleasant step. In Adolph, Amano, Bang-Jensen, Fullman, and Wilkerson (2020)[5], Adolph et al. highlighted the United States of America's condition during the pandemic. Due to a lack of general support by decision-makers, it was not implemented at an initial stage, starting harm to public health. However, social distancing influenced economic productivity; even then, numerous scholars sought alternatives that overcame the loss.
Researchers provide effective solutions for social distance measuring using surveillance videos along with computer vision, machine learning, and deep learning-based approaches. Punn et al. (2020b)[6] proposed a framework using the YOLOv3 model to detect humans and the Deepsort approach to track the detected people using bounding boxes and assigned ID information. They used an open image data set (OID) repository, a frontal view data set. The authors also compared results with faster-RCNN and SSD. Ramadass et al. (2020)[7] developed an autonomous drone-based model for social distance monitoring. They trained the YOLOv3 model with the custom data set. The data set is composed of frontal and side view images of limited people. The work is also extended for the monitoring of facial masks. The drone camera and the YOLOv3 algorithm help identify the social distance and monitor people from the side or frontal view in public wearing masks.

From the literature, we concluded that the researcher had done a considerable amount of work for monitoring of social distance in public environments. But, most of the work is focused on the frontal or side view camera perspective. Therefore, in this work, we presented an overhead view social distance monitoring framework that offers a better field of view and overcomes the issues of occlusion, thereby playing a key role in social distance monitoring to compute the distance between peoples

TOOLS USED

ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions [8]. The term may also be applied to any machine that exhibits traits associated with a human mind such as learning and problem-solving.

The ideal characteristic of artificial intelligence is its ability to rationalize and take actions that have the best chance of achieving a specific goal. A subset of artificial intelligence is machine learning, which refers to the concept that computer programs can automatically learn from and adapt to new data without being assisted by humans. Deep learning techniques enable this automatic learning through the absorption of huge amounts of unstructured data such as text, images, or video.

DEEP LEARNING

Deep learning is an artificial intelligence (AI) function that imitates the workings of the human brain in processing data and creating patterns for use in decision making. Deep learning is a subset of machine learning in artificial intelligence that has networks capable of learning unsupervised from data that is unstructured or unlabelled. Also known as deep neural learning or deep neural network [9].

One of the most common AI techniques used for processing big data is machine learning, a self-adaptive algorithm that gets increasingly better analysis and patterns with experience or with newly added data.

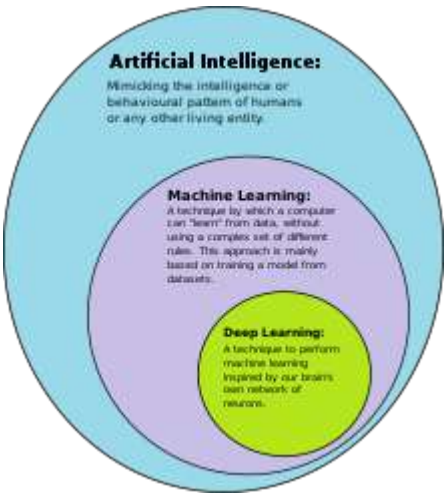

Figure 3: Deep learning

PYTHON

Python[10] is an interpreted, high-level, general-purpose programming language. Created by Guido van Rossum and first released in 1991, Python's design philosophy emphasizes code readability with its notable use of significant whitespace. Its language constructs and object-oriented approach aim to help programmers write clear, logical code for small and large-scale projects. Python is dynamically typed and garbage-collected. Python is often described as a language due to its comprehensive standard library. Python uses dynamic typing and a combination of reference counting and a cycle detecting garbage collector for memory management. It also features dynamic name resolution, which binds method and variable names during program execution. Some of the libraries of python are: TensorFlow ,Scikit-Learn, Numpy Keras PyTorch LightGBM SciPy Theano Pandas etc

Python libraries used

OPENCV

OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product, OpenCV makes it easy for businesses to utilize and modify the code. The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms[11].

OpenCV is written in C++ and its primary interface is in C++, but it still retains a less comprehensive though extensive older C interface. All of the new developments and algorithms appear in the C++ interface. There are bindings in Python, Java and MATLAB/OCTAVE. The API for these interfaces can be found in the online documentation. Wrappers In several programming languages have been developed to encourage adoption by a wider audience. In version 3.4, JavaScript bindings for a selected subset of OpenCV functions was released as OpenCV.js, to be used for web platforms.

NUMPY

NumPy [12] is a Python library used for working with arrays. It also has functions for working in the domain of linear algebra, Fourier transform, and matrices. It was created in 2005 by Travis Oliphant. It is an open-source project and you can use it freely. It stands for Numerical Python. In Python we have lists that serve the purpose of arrays, but they are slow to process. NumPy aims to provide an array object that is up to 50x faster than traditional Python lists. The array object in NumPy is called ndarray, it provides a lot of supporting functions that make working with ndarray very easy.Arrays are very frequently used in data science, where speed and resources are very important.NumPy is a Python library and is written partially in Python, but most of the parts that require fast computation are written in C or C++.

ARGPARSE

The argparse module makes it easy to write user-friendly command-line interfaces.The program defines what arguments it requires and argparse will figure out how to parse those out of system.

YOLO

YOLOv3 (You Only Look Once, Version 3) is a real-time object detection algorithm that identifies specific objects in videos, live feeds, or images. Versions 1-3 of YOLO were created by Joseph Redmon and Ali Farhadi. The first version of YOLO was created in 2016, and version 3, which is discussed extensively in this article, was made two years later in 2018. YOLO is implemented using the Keras or OpenCV deep learning libraries.

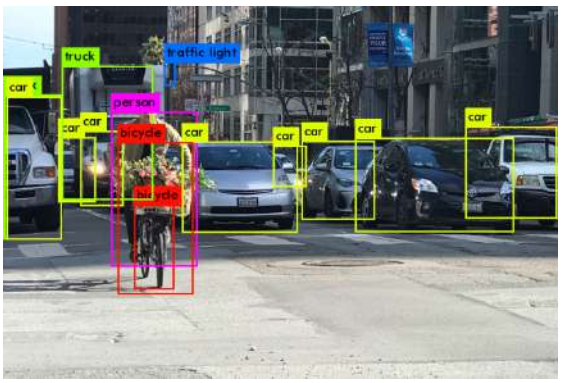

Figure 4: YOLOv3 Computer Vision Example[13]

YOLOv3: COMPUTER VISION EXAMPLE

Object classification systems are used by Artificial Intelligence (AI)[12] programs to perceive specific objects in a class as subjects of interest. The systems sort objects in images into groups where objects with similar characteristics are placed together, while others are neglected unless programmed to do otherwise.

YOLO is a Convolutional Neural Network (CNN) for doing object detection. CNN's are classifier-based systems that can process input images as structured arrays of data and identify patterns between them. YOLO has the advantage of being much faster than other networks and still maintains accuracy.

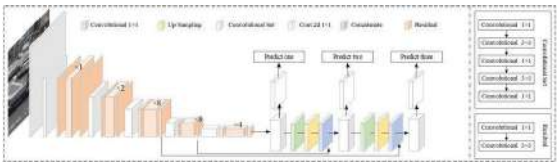

Figure 5: yolo: convolutional neural network (cnn)

RESULT

In this proposed system, a deep learning-based social distance monitoring framework is presented using an overhead perspective. The pre-trained YOLOv3 paradigm is used for human detection. The model is trained on an overhead data set, and the newly trained layer is appended with the existing model. To the best of our knowledge, this work is the first attempt that utilized transfer learning for a deep learning-based detection paradigm, used for overhead perspective social distance monitoring. The detection model gives bounding box information, containing centroid coordinates information. Using the Euclidean distance, the pairwise centroid distances between

detected bounding boxes are measured. To check social distance violations between people, an approximation of physical distance to the pixel is used, and a threshold is defined. A violation threshold is used to check if the distance value violates the minimum social distance set or not. Furthermore, a centroid tracking algorithm is used for tracking people in the scene. Experimental results indicated that the framework efficiently identifies people walking too close and violates social distancing; also, the transfer learning methodology increases the detection model's overall efficiency and accuracy. For a pre-trained model without transfer learning, the model achieves detection accuracy of 92% and 95% with transfer learning. The tracking accuracy of the model is 95%. The work may be improved in the future for different indoor and outdoor environments.

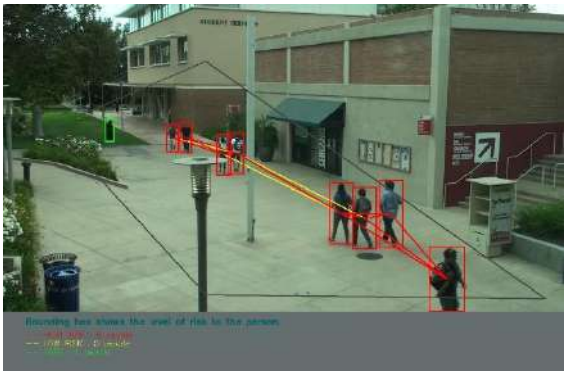

Fig 6: Result of our project

CONCLUSION

Social distancing is one of the important precautions in addition to vaccination and wearing a face mask in reducing physical contact with the infected one that may lead to the spread of coronavirus.

In this paper, we proposed an approach that uses Python and OpenCV libraries to help maintain a secure environment and ensure individuals protection by automatically monitoring public places to avoid spread od COVID-19 virus.

Thus, the solution has the potential to significantly reduce violations by real-time interventions, so the proposed system would improve public safety through saving time and helping to reduce the spread of coronavirus. This solution can be used in places like temples, shopping complexes, metro stations, airports, etc.

FUTURE WORK

Covid 19 Crowd Detection Camera can be used to ensure that people are spread out as mandated. Upon detection of non-compliance audio or visual alerts can be triggered to warn the customers.

It can help monitor and enforce face mask usage in public areas such as retail environments, banks, and post offices which are deemed essential and thus remain open during this time. It can be used to detect people not wearing face masks, with ultimate flexibility in response actions after detection.

It can identify customers who are not following the marked directions; Immediate action can be taken to remind customers, such as triggering audio alarms to warn and remind customers of correct direction of travel or triggering signage to flash

Used to detect people not wearing face masks, with ultimate flexibility in response actions after detection.

Crowd detection has various advantages in various fields like population counting, analysis whether norms are followed during pandemics, Detection of suspicious activities and many more.

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We also would like to acknowledge the support of Dr Surender Dhiman, without whom we would not have been able to take this forward.

3D INTEGRATED/VIRTUAL HOME AUTOMATION SYSTEM USING UNITY 3D ENGINE

(Interfacing conducted using Arduino Microcontroller)

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Abstract:

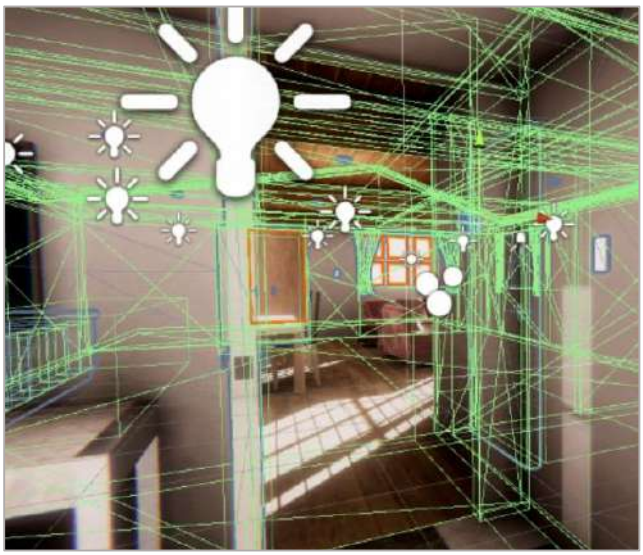
This paper demonstrates a creation and production of a virtual 3D environment for a smart home fully developed using Unity 3D Engine, consisting of multiple devices and electronic appliances throughout the render. This 3D system is interfaced and connected to a microcontroller belonging to Arduino family which has several devices attached to it which correspond and react to events triggered by the programmed GUI itself catering to mixed reality domain. Making it a pragmatic and handy approach to a Smart home device automation system.

Keywords: *virtual, mixed reality, unity engine, microcontroller, 3D render.*

1. Introduction:

The notion for the project was the vision of intelligent/smart house control in a mixed reality. MR which is short for mixed reality, basically is the integration of virtual and real worlds for the production of new domains and visualizations where physical, electronic and digital objects co-exist under the influence of a 3D rendered environment and interact as well as interface with each other in real-time by sequential transfer of information back and forth triggered by GUI

3D Home automation is a system to control things around the home such as a door, a light, surveillance systems and consumer electronics by using a 3D rendered replica of the house itself made in Unity 3D engine enabling full interaction with every controllable aspect of the house. A user can control a variety of home devices with the help of this rendered 3D environment using voice enabled commands as well. To provide better functionality and easy to use

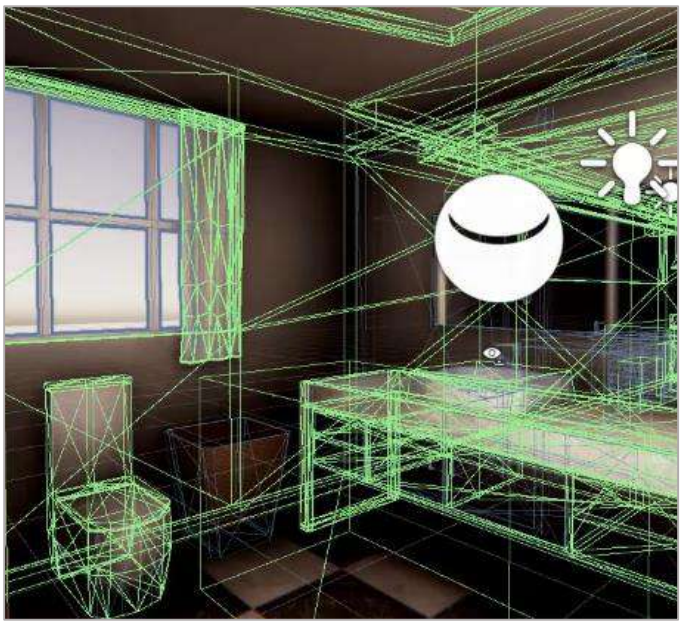


interface one can jump on to the overhead view of the house and monitor any device, given it is programmed and interfaced using a simple microcontroller. Remote operation and keeping track of the all the devices under observation makes it a pragmatic and effortless to use.

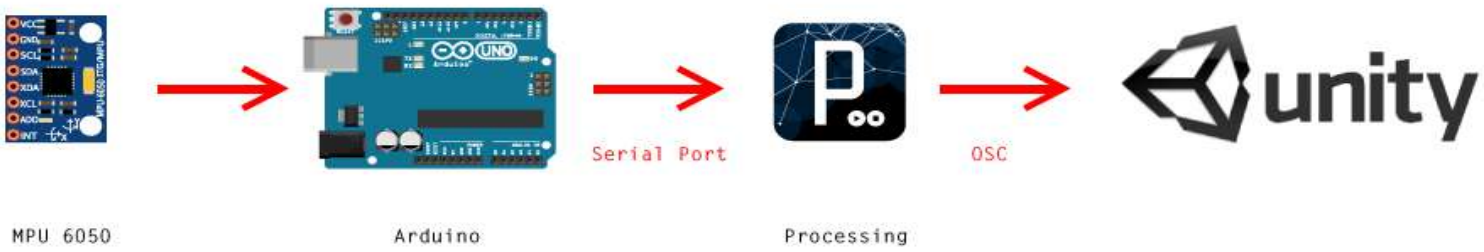
There are other simple automation systems which are very crude and primitive and lack user-friendliness, neither intuitive nor realistic. To improve the user-friendly interface a 3D rendered environment is endorsed as the controlling interface for the home automation.

2. Proposed Vision:

With the help of 3D virtual system, a user having control over the programmed interface can monitor the status of home devices linked with Arduino and control them intuitively anywhere and anytime using a computer or a phone. The advance home automation system can initiate a 3D local network service by linking and integrating the virtual world to the real world. As it uses a Virtual graphic interface makes it a very convenient and untroublesome system for altering and tweaking devices around the house. It can also be used for home design remodeling by reshaping and varying usage of different assets used in the Unity engine.



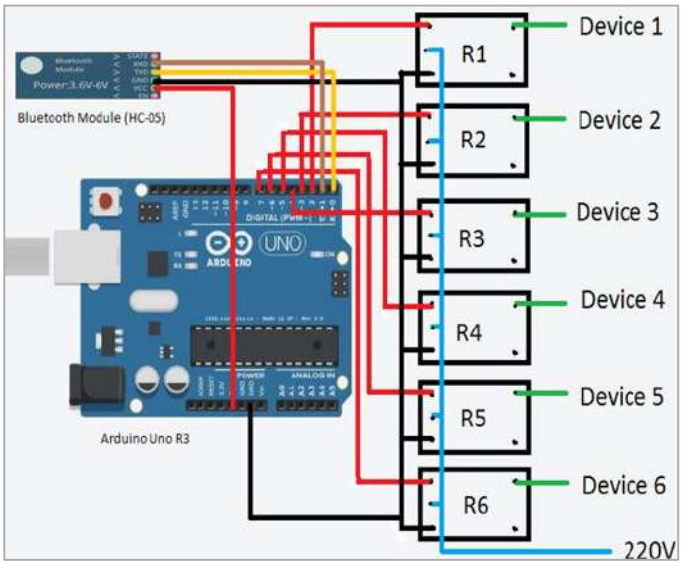
To improve the user-friendliness of the interface, a 3D view interface is designed of a particular house. In this Project to provide a more realistic interface, a 3D virtual world is adopted as the user interface for a home automation system. Additionally, a home server can be used as a controller for home devices or they can be directly paired and communicated to the engine given the functionality of the system active and in working order. For the information and data exchange format between the virtual and the real world, a control protocol that works under a pre-programmed standardization process is introduced. With the help of a 3D rendered environment, a user can control and keep track of home devices via a user-friendly GUI that works both intuitively and realistically anywhere and anytime through the local network directly. A custom design and render of the environment for any house can be fabricated using Unity engine, the locations of all the electronics and controlled devices then can be



Visualized and assembled around the house using the GUI thus creating a virtual domain of active and inactive assets which are bound to the physical devices following a certain protocol linked to the microcontroller which directly communicates with Unity engine.

3. Interfacing Unity with Arduino MC

The link between Arduino UNO and the unity engine is mediated using the serial port. This method is the default one which is used to upload sketches, so using serial port all the triggers and messages are initiated and transferred using the engine having the scripted files for the particular device. We have a class named SerialPort which is used to mediate information throughout unity using C#. Unity doesn't generally include the necessary libraries which are required to use it. To compensate for this drawback, Unity is forced to include NET 2.0 libraries along with the executables in it. The information from devices will come from Arduino in a continuous stream .Therefore it is important to regulate the data format so that it can be easily recognized by the sensor/device and what value the sensor has captured. On the microcontroller side an uninterrupted cycle takes place, and on the Unity side, the C# programming language scripts will provide parsing functions, which will be used to process the transferred information thus performing the necessary functionality in the network itself.



Block Diagram for Arduino having multiple relays

On the hardware side we have an Arduino UNO microcontroller which is used to mediate data to unity from the attached devices using multiple relays.

Relays R1-R6 are connected to pins 1-7

Y pin of every relay is then interconnected to GND

T1 pins are then interconnected and one pins to 220V. USB connection is fed to the engine.

4. Scripting and GUI in Unity 3D

The menu and interface for manipulating the devices connected to the sub system is as necessary as the mere parsing of information back and forth using the serial port. For the virtual 3D render in accordance to the equivalent real world home, First person view (FPV/FP) comes in handy as it offers the most rational and realistic experience for viewing and tweaking the electronics as required. It is very much possible to move around in the virtual environment having free degree of movement and interaction with every device. Making it possible to get an overhead view of the house and boundaries easily thus making automation pragmatic and reliable to operate.

```
private void Start()
{
    m_CharacterController = GetComponent<CharacterController>();
    m_Camera = Camera.main;
    m_OriginalCameraPosition = m_Camera.transform.localPosition;
    m_FovKick.Setup(m_Camera);
    m_HeadBob.Setup(m_Camera, m_StepInterval);
    m_StepCycle = 0f;
    m_NextStep = m_StepCycle/2f;
    m_Jumping = false;
    m_AudioSource = GetComponent<AudioSource>();
                    m_MouseLook.Init(transform , m_Camera.transform);
}


// Update is called once per frame
private void Update()
{
    RotateView();
    // the jump state needs to read here to make sure it is not missed
    if (!m_Jump)
    {
        m_Jump = CrossPlatformInputManager.GetButtonDown("Jump");
    }

    if (!m_PreviouslyGrounded && m_CharacterController.isGrounded)
    {
        StartCoroutine(m_JumpBob.DoBobCycle());
        PlayLandingSound();
        m_MoveDir.y = 0f;
        m_Jumping = false;
    }
    if (!m_CharacterController.isGrounded && !m_Jumping && m_PreviouslyGrounded)
    {
        m_MoveDir.y = 0f;
    }

    m_PreviouslyGrounded = m_CharacterController.isGrounded;
}
```

Sample script for fps control in unity engine

5. Applications and Advantages

1. Manipulating the 3D environment to view various devices at once using the over-head view

2. Option to go first person view to examine the surroundings

3. Ability to turn on/off light in rooms by using the GUI

4. Triggering the fans when required

5. Option to toggle the TV switch using IR maintaining a certain distance

6. Option to view the log data of all the devices under operation

7. Enabling door alerts by pinging to the software

Modern forms of visualization are now realized on the basis of the development of new MR technologies (interactive applications made in 3D engine or mixed reality). Visualization of process modelling, identification and control of complex mechatronic systems, elements and drives using virtual and mixed reality allows user to get a much better and quicker understanding of the environment having various devices as compared to conventional and primitive home automation.

Over-head view of the virtual house with all the operational devices

6. Conclusion

The trend of using the Interactive 3D applications such as virtual reality, mixed reality and AR is potentially a feasible as well as a convenient way of changing the perspective and interaction with the digital world which works in accordance to the real one, one can outstretch his/her imagination to different levels using these tools which are beneficial to the whole functionality of various schemes and designs fabricated by the engineering designer. This paper describes the interactive applications which one can make use of that respond to the different perceptions and alterations in the environment. The cost saving, handiness, utilization and practical functionality are some of the basic attributes of this particular project. Serviceability and efficacy this might bring in the near future is something to look forward to.

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ECO-FRIENDLY POWER GENERATION

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***Abstract*— Since the inception of civilization man has been involved in making his life smoother and comfortable. It has been categorized in two categories i.e. renewable and non-renewable. Renewable simply stands for the energy which is derived from natural processes that are replenished constantly. In its various forms, it is derived directly from the sun, or from heat generated deep within the earth. This solar energy is not only used on the Earth but also used in space stations where no electrical power is available.**

Keywords—&, D1, V, Ah, DC, AC

I. INTRODUCTION

Solar concept is not new for us. As non-renewable energy sources are decreasing, usage of solar energy is increased. This solar energy is not only used on the Earth but also used in space stations where no electrical power is available. We have limited natural resources and that too we are using in generating Electricity. That's why there is lot of emphasis is given on generating and using clean energy.

Today in this paper, we will see how electricity can be generated from the sunlight, how it can be stored in the form of DC, and then how it is converted into AC to drive home appliances.

II. SOLAR BATTERY CHARGING CIRCUIT &PRINCIPLE

Solar battery charger operated on the principle that the charge control circuit will produce the constant voltage. The charging current passes to LM317 voltage regulator through the diode D1. The output voltage and current are regulated by adjusting the adjust pin of LM317 voltage regulator. Battery is charged using the same current.

This solar charger has current and voltage regulation and also has over voltage cut off facilities. This circuit may also be used to charge any battery at constant voltage because output voltage is adjustable.

Circuit must have adjustable voltage regulator, so Variable voltage regulator LM317 is selected. Here LM317 can produce a voltage from 1.25 to 37 volts maximum and maximum current of 1.5 Amps. Adjustable Voltage regulator has typical voltage drop of 2 V-2.5V.Solar panel is selected such that it has more voltage than the load. Here I am selecting 17v/5w solar panel. Lead acid battery which is used here has specification of 12v/1.3Ah. Schottky diode is used to protect the LM317 and panel from reverse voltage generated by the battery when it is not charging. Any 3 A diode can be used here.

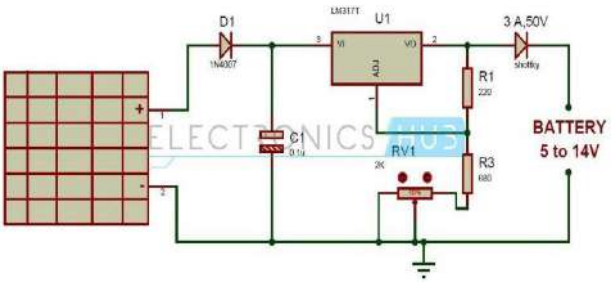


Fig.1. Solar Battery Charger Circuit Diagram

III. SOLAR BATTERY INVERTER CIRCUIT

In a solar power plant, solar energy is converted into electrical energy by using photovoltaic solar panels and then generated DC (Direct Current) is stored in batteries which are further converted by into Alternating Current (AC) by solar inverters. Then this AC is fed into commercial electrical grid or can be directly supplied to the consumer. In this tutorial, we will show how to make a Small Solar Inverter Circuit for Home Appliances.

Here SG3524 chip is the primary component to build a Solar Inverter. It has complete circuitry for Pulse Width Modulator (PWM) control. It also has all the functions to construct a Regulated Power Supply. SG3524 chip offers improved performance and requires less external parts while building switching power supplies.

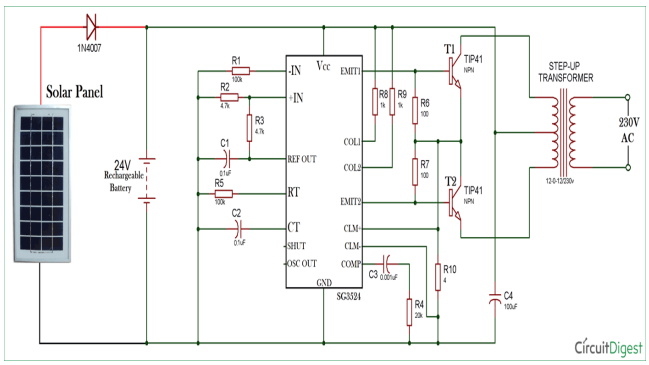
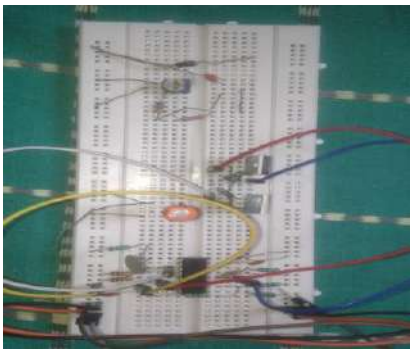


Fig 2 . Circuit Diagram of Inverter circuit.



Initially, the solar panel is charging the rechargeable battery and then the battery is supplying voltage to the inverter circuit. To know more about charging a battery using solar panel follow this circuit. The circuit consists of IC SG3524 which operates at a fixed frequency, and this frequency is determined by 6th and 7th pin of the IC which is RT and CT. RT set up a charging current for CT, so a linear ramp voltage exists at CT, which is further fed to the inbuilt comparator.

For providing reference voltage to the circuit SG3524 have an inbuilt 5V regulator. A voltage divider network is created by using two 4.7k ohm resistors which feeds the reference voltage to the inbuilt error amplifier. Then the amplified output voltage of error amplifier is compared with the linear voltage ramp at CT by the comparator, hence producing a PWM (Pulse Width Modulation) pulse.

This PWM is further fed to the output pass transistors through the pulse steering flip flop. This pulse steering flip flop is synchronously switched by the inbuilt oscillator output. This oscillator pulse also acts as a blanking pulse to ensure that both the transistors are never turned ON simultaneously during the transition times. The value of CT controls the duration of the blanking pulse.

Now, as you can see in the circuit diagram pin 11 and 14 are connected to the TIP41 transistors for driving the step-up transformer. When output signal at pin 14 is HIGH, transistor T1 turns ON and current flows from the source to the ground via the upper half of the transformer. And, when output signal at pin 11 is HIGH, transistor T2 turns ON and current flows from the source to the ground via the lower half of the transformer. Therefore, we receive Alternating Current at the output terminal of the step-up transformer.

IV. SPECIFICATION OF COMPONENTS

This part discusses the components that used on this research.

A) Module Photovoltaic

The module photovoltaic is used to harvest sunlight and actively convert it to electricity. The conversion of sunlight to become a usable electrical energy is called the 'photovoltaic effect'. Solar cells are also called photovoltaic cells are typically constructed with crystalline silicon and arranged in a grid-like pattern on the surface of the solar panel. The more amounts and quality of solar cells in a solar panel, the more total electrical output the solar panel will produce. It's difficult to give an exact value of output because different types of solar panel will come out with distinct output and average percentage of efficiency. For this project, types of mono crystalline silicon cells are suitable for use as an input generating electric. Mono or single crystalline silicon cells are made from very pure mono crystalline silicon and have a single and continuous crystal lattice structure with almost no defects or impurities. This type of solar panel is most efficient (17%) as in converting the sunlight absorbed into electricity. Therefore, it is the most expensive. It can do better in lower light condition than the other types of solar panel.Figure 4 shows the solar panel mono crystalline silicon cells and Table 1 shows the specification of solar panel.

Fig4. Mono crystalline silicon cells

Table 1.Specification of solar panel.

Max Power P_{max}	5W
Max Power Voltage V_{mp}	17.00V
Max Power Current I_{mp}	0.56A
Open–Circuit VoltageV_{oc}	22.24V
Short-Circuit Current I_{sc}	0.59A
Cell Efficiency	17%
Temperature Coefficients of P_{max}	-0.45%/°C
Temperature Coefficients of V_{oc}	-0.35%/°C
Temperature Coefficients of I_{sc}	0.05%/°C

B) Battery Lead Acid

A battery is a device that converts chemical energy contained in its active material into electricity. A battery consists of two or more cells connected in series or parallel. However the term "battery" is also used for single cells. A typical battery cells consist of a liquid, paste or solid electrolyte, a positive electrode and a negative electrode. The electrolyte is an ionic conductor. When the electrodes are connected to load, one of the electrodes will react and producing electron, while the other will accept electrons. This

action will cause electrical current flows through the load. Batteries, in which the chemicals cannot be reconstituted into their original form once the energy has been converted or battery has been discharged are called primary cell or voltaic cells. Batteries in which the chemicals can be reconstituted by passing electric current through them in the direction opposite that of normal cell operation are called secondary cells, rechargeable cells, storage cells or accumulators. Lead acid battery which is shown in Figure 5.

Fig 5. Battery lead acid

1) Power Dissipation:

In this project, power is limited because of the thermal resistance of LM317 voltage regulator and the heat sink. To keep the temperature below 125 degree Celsius, the power must be limited to 10W. LM317 voltage regulator internally has temperature limiting circuit so that if it gets too hot, it shuts down automatically.

When battery is charging, heat sink becomes warm. When completing the charging at maximum voltage, heat sink runs hot. This heat is because of excess power that not needed in the process of charging a battery.

2) Current Limiting:

As the solar panel provides constant current, it acts as a current limiter. Therefore the circuit does not need any current limiting.

3) Solar Charger Protection:

In this circuit, capacitor C1 protects from the static discharge. Diode D1 protects from the reverse polarity. And voltage regulator IC provides voltage and current regulation.

V. SOLAR BATTERY INVERTER CIRCUIT

We have limited natural resources and that too we are using in generating Electricity. That's why there is lot of emphasis is given on generating and using clean energy. Today in this project, we will see how electricity can be generated from the sunlight, how it can be stored in the form of DC, and then how it is converted into AC to drive home appliances.

In a solar power plant, solar energy is converted into electrical energy by using photovoltaic solar panels and then generated DC (Direct Current) is stored in battery, which is further converted by into Alternating Current (AC) by solar inverters. Then this AC is fed into commercial electrical grid or can be directly supplied to the consumer. In this tutorial, we will how to make a Small Solar Inverter Circuit for Home Appliances.

Here SG3524 chip is the primary component to build a Solar Inverter. It has complete circuitry for Pulse Width Modulator (PWM) control. It also has all the functions to construct a Regulated Power Supply. SG3524 chip offers improved performance and requires less external parts while building switching power supplies.

SG3524 - Regulating Pulse- Width Modulators

Fig 6:.Layout of SG 3524 pin.

SG3524 incorporates all the necessary functions to design a switching regulator and inverter. This IC can also be used as a control element for high-power applications.

Some of the applications of SG3524 IC are:

- Transformer-coupled DC-DC converters
- Voltage doublers without using transformer
- Polarity-converter applications
- Pulse-width modulation (PWM) techniques

This single IC consists of on-chip regulator, programmable oscillator, error amplifier, pulse-steering flip-flop, two uncommitted pass transistors, a high-gain comparator, and current-limiting & shut-down circuitry.

TIP41 High Power NPN Transistor

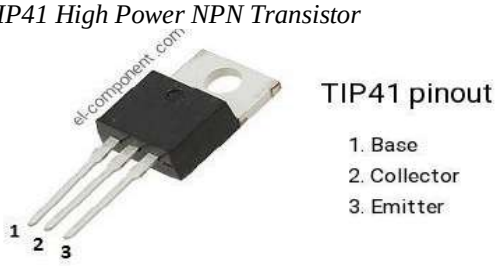


Fig 7. TIP41 Transistor.

TIP41 is a general purpose NPN Power transistor with high switching speed and improved Gain, mainly used for medium power Linear Switching Applications. Due to high rating of VCE, VCB and VEB which is 40V, 40V and 5V

respectively, we have used this transistor for inverter circuit. Also, it has a maximum collector current of 6A.

Here, in this circuit these transistors are used for driving the 12-0-12 Step-up transformer.

Material Required

- SG3254 IC
- Solar Panel
- TIP41 High Power NPN Transistor
- Resistors (4 ohm, 100k, 1k, 4.7k, 10k, 100k)
- Capacitors (100uf, 0.1uf, 0.001uf)
- 12-0-12 Step-Up-transformer
- Connecting Wires
- Breadboard

Circuit Diagram

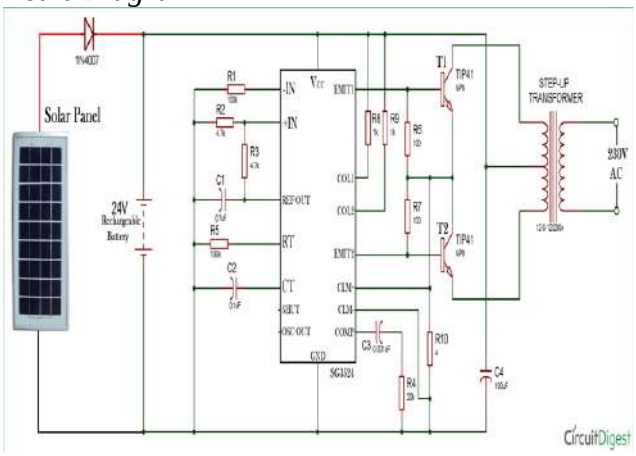


Fig 8. Circuit Diagram of Inverter circuit.

Working of Solar Inverter Circuit

Initially, the solar panel is charging the rechargeable battery and then the battery is supplying voltage to the inverter circuit. To know more about charging a battery using solar panel follow this circuit. Here, we are using RPS instead of rechargeable battery.

The circuit consists of IC SG3524 which operates at a fixed frequency, and this frequency is determined by 6th and 7th pin of the IC which is RT and CT. RT set up a charging current for CT, so a linear ramp voltage exists at CT, which is further fed to the inbuilt comparator.

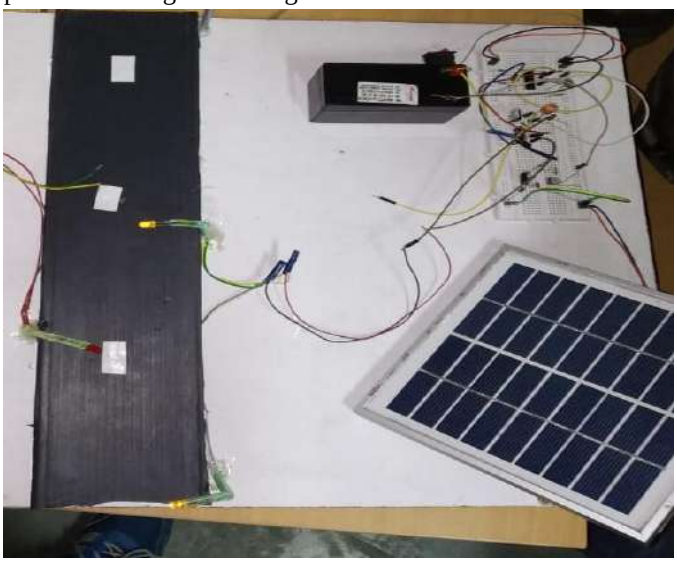
For providing reference voltage to the circuit SG3524 have an inbuilt 5V regulator. A voltage divider network is created by using two 4.7k ohm resistors which feeds the reference voltage to the inbuilt error amplifier. Then the amplified output voltage of error amplifier is compared with the linear voltage ramp at CT by the comparator, hence producing a PWM (Pulse Width Modulation) pulse.

This PWM is further fed to the output pass transistors through the pulse steering flip flop. This pulse steering flip flop is synchronously switched by the inbuilt oscillator output. This oscillator pulse also acts as a blanking pulse to ensure that both the transistors are never turned ON simultaneously during the transition times. The value of CT controls the duration of the blanking pulse. 9 Now, as you can see in the circuit diagram pin 11 and 14 are connected to the TIP41 transistors for driving the step up transformer. When output signal at pin 14 is HIGH, transistor T1 turns ON and current flows from the source to the ground via the upper half of the transformer. And, when output signal at pin 11 is HIGH, transistor T2 turns ON and current flows from the source to the ground via the lower half of the transformer. Therefore, we receive Alternating Current at the output terminal of the step up transformer.

Solar batteries are one of the power tools to make the device function efficiently. As the non-renewable energy sources are decreasing there is a need to increase the usage of solar power. Solar batteries play crucial role to make it happen within no time.

But the thing is when you get the solar batteries you need to have the electronic device that supports the solar batteries. My best suggestion is to purchase the **Solar Lights Kits** that can affix to home gardens, walkways and on the walls.

They come at very affordable prices and make the outdoor look more beautiful and romantic especially at night times. You can spend some time with your beloved ones in the presence of bright white light.



VI. ADVANTAGES AND DISADVANTAGES OF SOLAR ENERGY IN INDIA

A) ADVANTAGES OF SOLAR ENERGY IN INDIA

Some of the advantages of solar energy which makes it all the more suitable for India are as follows:

- This is an inexhaustible source of energy and the best replacement to other nonrenewable energies in India.
- Solar energy is environment friendly. When in use, it does not release CO2 and other gases which pollute

the air. Hence, it is very suitable for India, India being one of the most polluted countries of the world.

- Solar energy can be used for variety of purposes like as heating, drying, cooking or electricity, which is suitable for the rural areas in India. It can also be used in cars, planes, large power boats, satellites, calculators and many more such items, just apt for the urban population.
- Solar power is inexhaustible. In energy deficient country like India, where power generation is costly, solar energy is the best alternate means of power generation.
- You don't need a power or gas grid to get solar energy. A solar energy system can be installed anywhere. Solar panels can be easily placed in houses. Hence, it is quite inexpensive compared to other sources of energy.

B) *DISADVANTAGE OF SOLAR ENERGY IN INDIA*

Some of the disadvantages of solar energy which needs further researches are as follows:

- We cannot generate energy during the night time with solar energy.
- And, also during day time, the weather may be cloudy or rainy, with little or no sun radiation. Hence, this makes solar energy panels less reliable as a solution.
- Only those areas that receive good amount of sunlight are suitable for producing solar energy.
- Solar panels also require inverters and storage batteries to convert direct electricity to alternating electricity so as to generate electricity. While installing a solar panel is quite cheap, installing other equipments becomes expensive.
- The land space required to install a solar plant with solar panel is quite large and that land space remains occupied for many years altogether and cannot be used for other purposes.
- Energy production is quite low compared to other forms of energy.
- Solar panels require considerable maintenance as they are fragile and can be easily damaged. So extra expenses are incurred as additional insurance costs.

VII. FUTURE OF SOLAR ENERGY IN INDIA

In solar energy sector, many large projects have been proposed in India.

- Thar Desert has some of India's best solar power projects, estimated to generate 700 to 2,100 GW.
- On March 1st, 2014, the then Chief Minister of Gujarat, Narendra Modi, inaugurated at Diken in Neemuch district of Madhya Pradesh, India's biggest solar power plant.
- The Jawaharlal Nehru National Solar Mission (JNNSM) launched by the Centre is targeting 20,000 MW of solar energy power by 2022.
- Gujarat's pioneering solar power policy aims at 1,000 MW of solar energy generation.
- In July 2009, a $19 billion solar power plan was unveiled, which projected to produce 20 GW of solar power by 2020.
- About 66 MW is installed for various applications in the rural area, amounting to be used in solar lanterns, street lighting systems and solar water pumps, etc.

VIII. RESULTS AND ANALYSIS

A) Analysis Solar Panel

From this analysis, the value that can be generated by solar panels with practically almost on the specifics of the solar panels. This means that solar panels used in good condition. In addition, the solar panel voltages value depends on the weather e.g: bright or cloudy.

Meanwhile, the current changes in solar panel changes depending on the temperature. The maximum voltage of solar panel is on 25th October 2019.

B) Results of Battery Charging

From this analysis, the battery charge is dependent on weather conditions. Therefore, the peak time is chosen from 9am until to 3pm. Besides that, the battery charging without load the voltage rises more than the battery charging using loads e.g. mobile phone or laptop.

•Set the output voltage to 14.5 V (This voltage is specified on the battery as cycle use.)

•Charging current = Solar panel wattage/Solar Panel Voltage = 5 / 17 = 0.29A.

•Here LM317 can provide current up to 1.5A .So it is recommended to use high wattage panels if more current is required for your application. (But here my battery requires initial current less than 0.39Amps. This initial current is also mentioned on the battery).

•If the battery requires initial current more than 1.5A, it is not recommended to use LM317.

•Time taken for charging = 1.3Ah/0.29A = 4.44hours.

Table2. Voltages at differnt time

Time	Voltage battery Charging circuit
9am	12.0
10am	12.1
11am	12.2
12pm	12.0
1pm	12.3
2pm	12.0
3pm	12.0

C) Results of Converter Circuit 5VDC

In analysis data 12V DC converter circuit by using equipment i.e. the multi-meter.

Table3. Data measured by multimeter

Measurement	Value
Voltage	230V
Frequency	50HZ

IX. CONCLUSION

Solar batteries are one of the power tools to make the device function efficiently. As the non-renewable energy sources are decreasing there is a need to increase the usage of solar power. Solar batteries play crucial role to make it happen within no time. But the thing is when you get the solar batteries you need to have the electronic device that supports the solar batteries. The inverter device is capable to produce output for loads especially for electronic and electrical equipment. This project has reached its goal of producing a solar system that can generate output AC and DC as well as convenient to be carried anywhere.

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Intelligent Venue Monitoring System

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Abstract: Crowd management in venues, like banks and hospitals, is essential in order to ensure that each individual's needs are catered to efficiently. To achieve this via manual means is a cumbersome and expensive task. On the other hand, employing automation to fulfil this objective will make it much more cost effective, highly accurate and time saving. Moreover, the ongoing COVID-19 pandemic has made it obligatory to enforce strict crowd management practices so as to keep the healthy population safe. The Intelligent Venue Monitoring System aims at minimising the role of human intervention in managing large crowds by implementing social distancing with the help of automation as well as employing the use of non-contact thermal scanning for temperature measurement in order to ensure that a person is not infected.

This research paper highlights how Arduino Microcontroller has been used for automating the process of social distancing and allocating slots to people who enter the venue through the micro-servo motor controlled gate. The availability of slots is indicated with the help of a LED Display panel and non-contact thermal screening is carried out before entering the venue.

Keywords: **Automation, Social Distancing, Non-contact thermal scanning, Arduino UNO, Arduino IDE, Infrared Sensors, Micro-Servo Motor, LED panel and Serial Monitor.**

I. INTRODUCTION

Technology has been advancing at a meteoric rate consistently and has enabled mankind to figure out innovative ways for handling problems which tend to hinder growth and development.

Fields like 'automation' have proven themselves to be a boon for resolving numerous issues. Automation is the creation and application of technologies to produce and deliver goods and services with nominal human interference. The implementation of automation technologies, techniques and processes improve the efficiency, reliability, and/or speed of many tasks that were previously performed by humans [1]. Automation has brought significant gains in a range of industrial and experimental works. Less personnel and smarter machines mean less operating and labour costs while increasing the quality of the products or services offered [2].

Another field which has an immensely important role to play in multiple industries is 'temperature measurement'. From health industry to metal industry, temperature measurement is employed for arriving at

pivotal decisions. It can be of two types- Contact based and Non-Contact Temperature measurement.

With constant advancements in technology, the future held a lot of promise until the COVID-19 pandemic brought life to a standstill. The risk of contracting the life threatening disease is extremely high and this has forced the governments across the world to impose nation-wide lockdowns repeatedly. This measure has had a huge impact on everyday lives of the people. Growth and development have taken a back seat and societal interactions have got limited to virtual means. With the economy getting burdened excessively and depleting livelihoods of people, the governments had to remove the lockdown in a phased manner. This has been done with extreme caution so that people remain safe and therefore, a few healthcare measures have been made mandatory. Among these measures, the most significant ones were – Social distancing and Temperature screening.

Being a viral disease, the COVID-19 can easily spread through air, surfaces or close contact. In order to limit its spread, a medically advised distance of *six feet* needs to be maintained via social distancing between any two individuals [3]. Social distancing is a set of non-pharmaceutical interventions or measures intended to prevent the spread of a contagious disease by maintaining a physical distance between people and reducing the number of times people come into close contact with each other [4]. This prevents the healthy population from contracting the disease from the infected people or asymptomatic people.

High body temperature is the earliest and most frequent manifestation of COVID-19, and therefore, temperature screening has been a focal point in identification of possibly infected individuals [5].

Taking these key points into consideration, the "Intelligent Venue Monitoring System" has been designed to automate the process of social distancing and carry out non-contact thermal scanning for screening infected individuals. It will reduce the risk of developing the infection to a great extent. The need for human intervention becomes minimal.

The Intelligent Venue Monitoring System enables social distancing with the help of a microcontroller (Arduino), which restricts the number of people entering a venue, occupying the venue and exiting a venue. Slots have been designed for the people in such a manner that the advised distance between two people is maintained and every person gets the required amount of attention and time while being kept out of the harm's way.

Using conventional methods of temperature measurement amid this pandemic may result in fatalities, thus, non-contact thermal scanning is used for screening out possibly infected individuals. For this purpose, a variety of sensor system already exist, but for maintaining cost efficiency and keeping in mind the scale of operation, the Intelligent Venue Monitoring System uses a fast infrared based temperature screening method [6].

The Intelligent Venue Monitoring System is meant to be deployed in venues like banks, restaurants, and hospitals etc. which are frequently visited by numerous people at the same time. However, its utility is not limited to pandemic situations only. Even in non-

pandemic situations, it can be used for crowd management and healthcare monitoring.

II. APPARATUS REQUIRED

The designing of this project combines aspects of both hardware and software. The main software tool employed in the making of this project is Arduino IDE. Various hardware tools which were employed in the making of this project have been mentioned ahead:

1) Arduino UNO board
2) Proximity Infrared sensors
3) Micro servo motor (SG-90)
4) MLX (90614) Infrared Temperature Sensor Module
5) BJT BC 547 (Transistor)
6) Light Emitting Diodes (LEDs) and 330 ohms resistors
7) Connecting wires

(a) Arduino UNO

Arduino boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards ('shields') or breadboards (for prototyping) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers [7]. The C and C++ programming languages are used for programming the microcontrollers, using a standard API which is also known as the "Arduino language". Arduino can interact with buttons, LEDs, motors, speakers, GPS units, cameras, the internet, and even a smart-phone or a TV [8].

Fig.1 Arduino UNO Board

(b) Proximity Infrared sensors

An IR proximity sensor works by applying a voltage to a pair of IR light emitting diodes (LED's) which in turn, emit infrared light. This light propagates through the air and once it hits an object it is reflected back towards the sensor [9]. If the object is in proximity, the reflected light will be stronger compared to the one which is far away. The sensing unit, in the form of an integrated circuit (IC), detects the reflected infrared light, and if its intensity is strong enough, the circuit becomes active.

Fig.2 IR Proximity Sensor Module

(c) Micro Servo Motor (SG-90)

Servo motor is part of a closed-loop system and is a self-contained electrical device that rotates parts of a machine with high efficiency and with great precision. The

output shaft of this motor can be moved to a particular angle, position and velocity that a regular motor does not have [10]. The Servo Motor utilizes a regular motor and couples it with a sensor for positional feedback.

Fig.3 Micro Servo Motor (SG-90)

(d) MLX (90614) Infrared Temperature Sensor Module

MLX90614 is an infrared thermometer which is useful for non-contact temperature measurement. It can provide high accuracy and resolution in temperature measurement since it has an integrated infrared thermopile detector, a dedicated DSP, a low noise amplifier and a 17-bit ADC [11]. The key feature of MLX90614 is that it is a contactless IR temperature sensor with high accuracy.

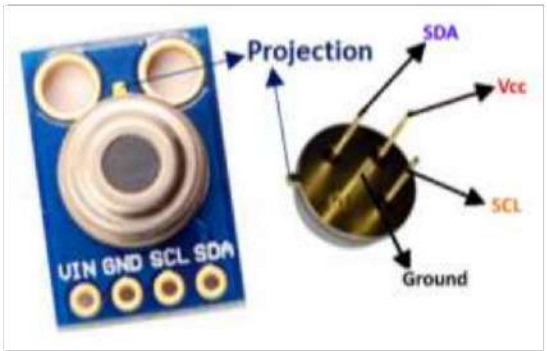

Fig.4 MLX (90614) Infrared Temperature Sensor Module

(e) BJT BC-547

BC-547 is a NPN transistor and acts as an Amplifier when operating in Active Region. It can amplify power, voltage and current at different configurations. BC547 has a gain value of 110 to 800; this value determines the amplification capacity of the transistor [12].

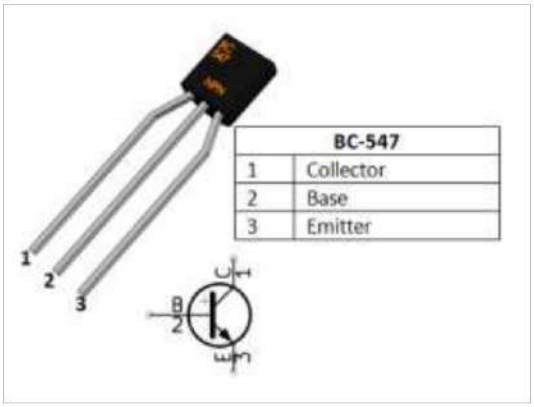

Fig.5 Bipolar Junction Transistor BC-547

(f) LEDs

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The colour of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor [13].

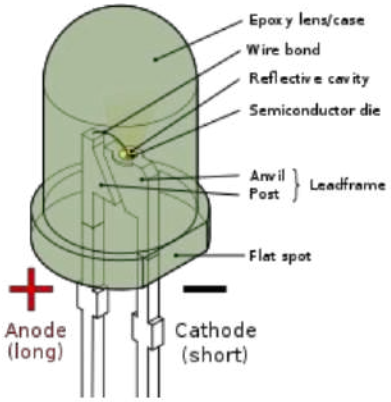

Fig.6 Light Emitting Diode (LED)

III. BLOCK DIAGRAM

The block diagram drawn ahead represents the components of the project and represents the relationship present between these components:

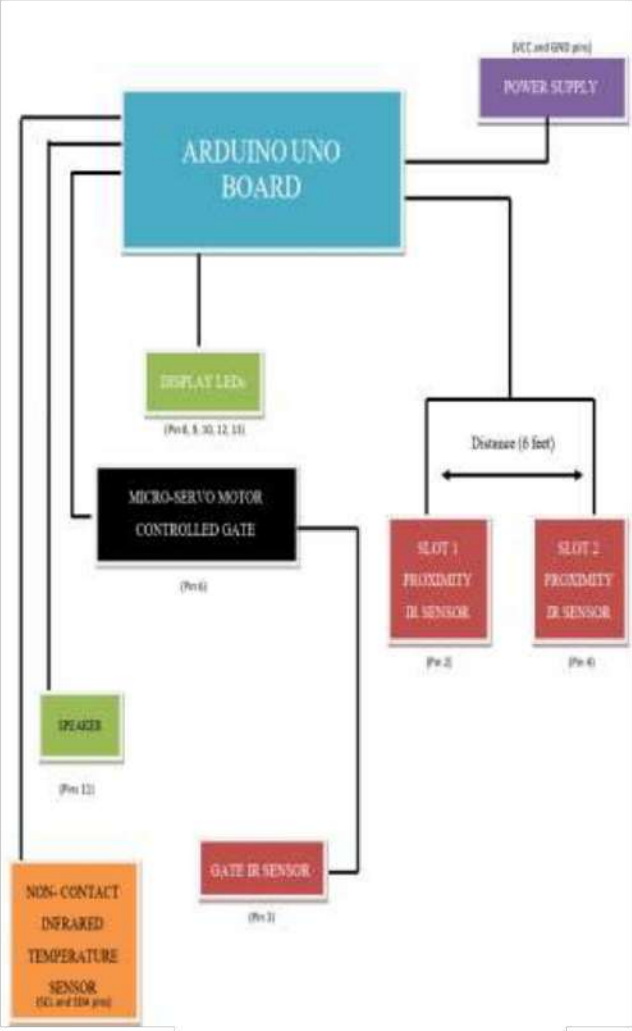

Fig.7 Block Diagram

IV. FUNCTIONING OF THE PROJECT

The steps mentioned ahead describe how the project functions:

1. When a person stands in front of the Non-Contact IR thermal sensor, it measures the temperature and accordingly an LED blinks to indicate whether the temperature range is acceptable or not (Should be between 36°C-38°C).
2. When the Proximity IR sensor at the gate does not detect any person, the gate remains closed.
3. If the Gate Proximity IR sensor detects the presence of a person who wishes to enter the venue, it informs the microcontroller (i.e. Arduino in this case). The microcontroller checks for the availability of free slots within the venue.
4. The Proximity IR sensors positioned in the slots inform the microcontroller about the vacancy of their respective slots.
5. If a slot is vacant, a green signal is emitted by the LED (in the LED display panel) and the servo motor controlled gate allows the person to enter the venue.
6. However, if the slots are full, a red signal is emitted by the LED (in the LED display panel) and the servo motor controlled gate remains closed until a slot becomes vacant.
7. The slots are separated by the medically advised distance to keep the people safe.

The following flowchart summarises the working of the project:

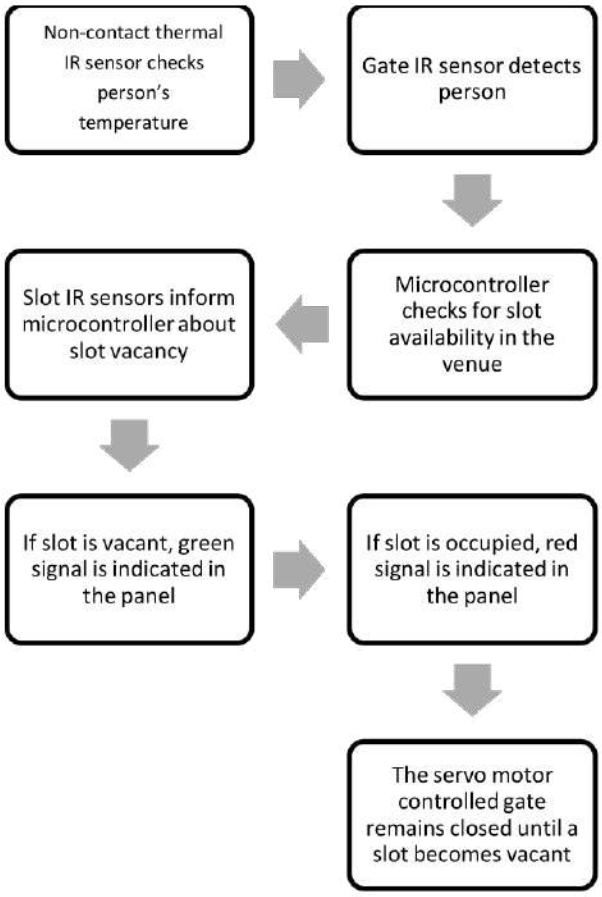

Fig.8 Flowchart showcasing the working

V. OBSERVATION AND RESULT ANALYSIS

The various observations and their corresponding results have been described in the table ahead:

S.NO.	OBSERVATION	RESULT
(1)	Gate IR Proximity Sensor detects person	Arduino microcontroller alerted.
(2)	Temperature within acceptable range (36°-38°C)	Person allowed to go ahead
(3)	Temperature out of acceptable range (lower than 36°C or greater than 38°C)	Person is warned by the speaker and not permitted to move forward
(4)	Slot IR Proximity sensors check for availability of slots	Inform Arduino microcontroller
(5)	Slot 1 IR Proximity sensor senses no-one	Slot 1 vacant and hence, micro servo motor controlled gate opens and person is permitted to enter the venue.
(6)	Slot 2 IR Proximity sensor senses no-one	Slot 2 vacant and hence, micro servo motor controlled gate opens and person is permitted to enter the venue.

(7)	Slot 1 and Slot 2 IR Proximity sensors sense people	Hence, Slot 1 and Slot 2 are occupied and hence, micro servo motor controlled gate remains closed and person is denied from entering the venue.

Therefore, we see that a person is allowed to enter the venue only when his/her body temperature is in the acceptable range and the slots are available. This method minimises the need for human intervention to a great extent.

Below are the screenshots of the Serial Monitor in the Arduino IDE which show the simulation results:

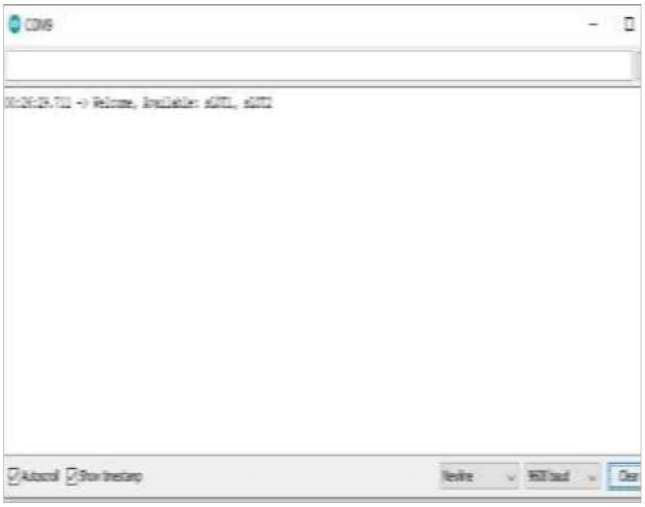

Fig .9 Serial Monitor Output when both slots empty

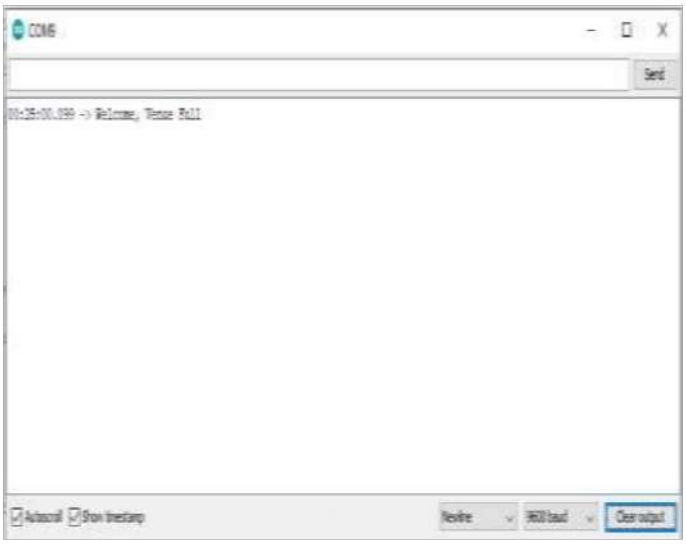

Fig .10 Serial Monitor Output when both slots full

Fig .11 Serial Monitor Output when one slot is vacant (in this case, Slot 2)

VI. ADVANTAGES OF THE PROJECT

Numerous merits attributed to this project are enlisted ahead:

1. During a pandemic situation, social distancing (through automation) helps in protecting the healthy population from the infected or asymptomatic population thereby saving many lives.
2. Even in a non-pandemic situation, this system prevents crowding of venues and helps in maintaining the decorum.

3. Automation helps in reducing the operational costs, improves worker safety, increases productivity and efficiency, decreases time consumption, helps in better planning and leaves behind smaller environmental footprint.

4. No need of physical contact thereby reducing the chances of infection in case of a healthy individual or any sort of mechanical damage or contamination.

5. Minimal maintenance costs and increased efficiency over contact based thermal scanning.

6. Wide range of temperature measurement.

7. Fast response time (ms range), user gets more information per time period.

8. No influence of objects with high thermal conductivity where object temperature would change if contact occurs (e.g. glass, wood, small or very thin objects).

VII. APPLICATIONS OF THE PROJECT

The varied applications related to the Intelligent Venue Monitoring System are:

1) **Banks:** Intelligent Venue Monitoring System enables only a restricted number of people to enter the bank at a time as per slot availability without any human interference. Overcrowding is avoided; efficiency increases and people remain safe.

2) **Airport/Railway ticket counters:** Ticket counters at airports and railway stations are always hindered by crowding of people. Intelligent Venue Monitoring System prevents this from happening and saves time as well as resources. Limited people access the counters at a time which leads to smoother functioning.

3) **Restaurant takeaway/order counters:** Similar to airport scenario, the restaurant ordering counters face a lot of hassle. Intelligent Venue Monitoring System enables smoother functioning by restricting the number of people and also leads to customer satisfaction.

4) **Hospitals:** Hospitals host people from all walks of life including the young, old, healthy and diseased. In order to keep everyone safe from the risk of contracting infection, Intelligent Venue Monitoring System is put to use.

5) **Temperature measurement:** Human body temperature measurement becomes a lot easier (without involving any infection transmission risk).

6) **Industrial applications:** Non-contact thermal scanning is also used in large range of process applications including metal industry, mineral industry, paper industry and plastics industry.

VIII. CONCLUSION AND FUTURE SCOPE

In the light of prevailing uncertainty pertaining to the efficacy of variegated

measures adopted to enforce social distancing, utility of this project cannot be overemphasized.

It is also a remarkably cost effective measure, ensuring its implementation in various situations/places without any hindrance.

Furthermore, Intelligent Venue Monitoring System has immense potential for growth and possesses excellent capacity for being applied in any domain. The future scope for this project is extremely vast.

It can be applied with the same ease in Pandemic and Non-Pandemic situations. During pandemics situations, like the ongoing COVID-19 pandemic, it can help in enforcing social distancing thereby safeguarding the healthy population from the infected or asymptomatic population. During non-pandemic situations, it can be applied for crowd management practices in venues like airport counters or restaurant take away counters, which generally tend to be crowded. This will help in saving time and resources.

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A REVIEW PAPER ON IOT BASED VEHICLE SAFETY SYSTEM

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Abstract:

Numerous accidents are happening on a daily basis. In India the number of people dying in road accidents is about 1lakh 51 thousand (2019) annually which is far more than the number of deaths due to Covid 19 pandemic. According to stats of 2019, the people who lost their lives in road accidents were mostly of younger age.Reasons of accidents could be possibly large but being practical there are 4 to 5 main reasons of these accidents. Alcohol drink and drive, overheating of car engine sometime which results in fire, pollution emission or air quality.

To tackle this, we implemented a prototype version, which consists of alcohol detector sensor, temperature sensor, gas sensor. All these sensors will collectively send their data to microcontroller, the data received can be seen on LCD 7 segment display with the help ofWiFi module over internet. LCD would display the values received. If the received values are above the threshold values then a notification or warning with buzzer sound will be sent. This is designed to ensure the safety of persons sitting inside the car or vehicle.

Introduction:

Road safety is a big social concern around the world especially in India. Drinking and driving is a serious issue which probably would emerge as one of the most significant problems in the near future Driving under the influence of alcohol has affected and killed countless people. If we drink and drive, not only do we possibly put ourselves at risk, but all passengers, pedestrians, and other people, who are on the roads.

Drivers of commercial vehicles such as truck drivers are under the influence of alcohol especially at night which causes lots of mishaps.

Similarly overheating of engines of cars, trucks, buses can cause wear and tear of the mechanical parts. Engine overheating could be the possible consequences of several problems including a blocked radiator, cracked cooling system, botched water pump, or a bad thermostat. Most car engines operate between 195°F and 220°F range. Any defect with these components can cause this temperature to rise beyond the normal level, ultimately causing damage of the vehicle and sometimes even leading to fire outbreaks which can be fatal.

Moreover, Air pollution in India is a serious health issue. Of the most polluted cities in the world, 21 out of 30 were in India in 2019. Vehicular emission encompasses a significant portion of total pollution. Hazardous gases & multifarious harmful fumes such as oxides of nitrogen, sulphur dioxide, carbon monoxide, and particulate matter are emitted from automobiles which are exceptionally damaging to the human body when inhaled regularly.

So,we have implemented a prototype which aims to tackle the above issues. It is a comprehensive vehicle safety system. It provides an effective solution for alcohol detection, engine overheating and pollution monitoring in vehicles. Using a combination of sensor network and internet of things (IOT), it aims to improve the safety of lives, property and environment.

Existing System: In India, generally traffic policemen uses the manual device to detect and analyse whether the driver is drunk or not. In India with such enormous number of people on road, it become impossible for concerned authorities to check, measure and monitor each and every person on road to avoid any miss-happening. So, it could be useful for government authorities to avoid accidents and drink and drive cases.

Literature Survey:

[1] ThakareBhagyashri S, V. V. Joshi, SonawaneBhagayshree U., RupwateSuvarna P., Department of Electronics & Tele-communication Engineering, Sandip Foundation Nashik – “India Alcohol Detection using Pic Microcontroller”, IJSTE - International Journal of Science Technology & Engineering | Volume 3 | Issue 09 | March 2017 ISSN (online): 2349-784X. The authors have discussed the problem of drunken driving and have proposed a system to solve it. However, they have used a PIC microcontroller which is expensive when compared to Arduino Uno which is cheap and also open sourced. Also, we have also

included provision for engine overheating and pollution monitoring using IOT. Also, we have a system for engine auto locking and message notification to owner of vehicle

[2] Deeksha Srivastava, AwanishKesarwani, Shivani Dubey, Department of Computer Applications, JSS Academy of Technical Education, Noida, India "Measurement of Temperature and Humidity by using Arduino Tool and DHT11", International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056, p-ISSN: 2395-0072, Volume: 05 Issue: 12, Dec 2018. In this paper a system is designed to detect overheating. A DHT11 sensor senses the temperature and humidity levels and the data is sent on a webpage using NodeMCU by Wi-Fi. However, there is no provision for alcohol detection and pollution monitoring.

[3] Poonam Pal, Ritik Gupta, Sanjana Tiwari, Ashutosh Sharma, Electronics and Communication Dept. of Acropolis Institute of Technology and research, M.P, India "IOT BASED AIR POLLUTION MONITORING SYSTEM USING ARDUINO", International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056, p-ISSN: 2395-0072, Volume: 04 Issue: 10, Oct -2017. The author proposes a system for pollution monitoring. MQ135 sensor monitors air quality and the data is sent on a webpage using Wi-Fi. When the threshold level is crossed then arduino detects it and a buzzer blows.

[4] Prathamesh Dixit, RushirajChavan, Abhishek Shirke, SonaliSarade, Prof. Dr. G. M. Bhandari, Department of Computer Engineering, JSPM's BhivarabaiSawant Institute of Technology and Research, Wagholi, Pune-412207, SavitribaiPhule Pune University "Driver Safety with Smart Alcohol Detection and Control System", © 2019 IJRTI | Volume 4, Issue 1 | ISSN: 2456-3315.The author proposes a system for alcohol detection on engine overheating. Here a MQ3 sensor senses alcohol content and the data is sent on a webpage using NodeMCU using Wi-Fi. Also when the sensor value crosses threshold set then arduino locks the system.

[5] Pahlavan, Kaveh.,Krishnamoorthy, Prashant. Principles of Wireless Networks -A united approach, Pearson Education (2nd edition) (2002). In this paper, authors state that, this technology allows data packets over the internet from one IP address to another IP address. In a nutshell voice over IP provides the users with the opportunity to not only make calls but also perform other communication activities .

Discussion:

A sensor network comprised of MQ3, MQ135 & DS18B20 sensors is setup.Using ESP8266, real time sensor data is sent on a Thing Speak web-page via WiFi. If any of the sensor crosses the threshold value then a notification is sent to the owner of vehicle.

If the level of alcohol or engine temperature is above the threshold value, then Arduino also locks the engine and simultaneously a buzzer blows. For any activity the status is displayed on the LCD.

A 12V DC geared motor is used to represent the engine. Motor driver L293D is used for controlling the motor.

The entire circuitory is powered by LM 2596 power supply.

Whenever driver is there on driving seat and key is entered for ignition of engine, at the same time , the prototype system consisting of sensors get activated. The sensors present on board are MQ3 for alcohol detection, MQ13J for pollution/air quality checking, DS18B20 for temperature sensing and ESP8266 for WiFi to transmit data over the internet,Arduino Uno microcontroller which will control and manage the system.

- **MQ3 Alcohol sensor** will detect the level of alcohol through the air exhale by the person and will send the data to Arduino Uno. If the person is not drunk then it is ok, there will be no notification or warning but when the person starts consuming alcohol in midway then sensor will detect it and the driver will receive an warning with buzzer, while the same data will be displayed on the LCD display. The sensor will detect the exhale after every 30 seconds.

- **DS18B20 Temperature sensor** will measure the temperature of the car engine and will contact arduinouno with the resulted values. If the values is greater than the threshold values, the engine will shut down after the warning of 10 seconds with the buzzer sound.

- **MQ135 Gas Sensor** will measure the level of gases present around, in which the harmful gases emits from car’s exhaust will also be mentioned. Values of gases measured going above the threshold values will result in clear warning notification with buzzer.

Conclusion:

From various paper we have cited, we can conclude that it is an effective solution to avoid accidents on roads or atleast there would be some declination in the numbers of accidents on roads. We can add more features like facemask detection inside the vehicle, to avoid the spreading ofcovid 19 pandemic in present tough time. We can also implement it with the addition of GPS system which will provide accurate position of vehicle which would surely enhance the reliability and safety of vehicle.

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Design of a Smart Hand Sanitizer Dispenser with Door Controller Using ESP8266

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***Abstract*— In this COVID-19 pandemic period which is a global outbreak, hand hygiene is the core preventive measure in the spread of the disease as advised by WHO (World Health Organization) which includes washing hands with water and soap regularly, hand sanitizing using hand sanitizers, etc. Hygiene refers to the practices conducive to maintaining health and preventing disease especially through cleanliness such as washing hands, coughing in the elbow etc. Its also helps to prevent any diseases that spread through contacts. In order to eliminate most of the germs on the hands, we need to apply a good hand washing practice. In most healthcare places, alcohol-based hand sanitizers are preferable to hand washing with soap and water because it can be easily tolerated and it is also more effective at reducing bacteria. Hand sanitizer is a liquid, gel, or foam generally used to decrease infectious agents on the hands.**

Keywords: **Hygiene, Hand sanitizer, Microcontroller, Cheap product, Servo motor, Body Temperature Sensor**.

1.0 Introduction

Hands are considered to be the primary mode of infectious diseases, especially for those living in close proximity such as college residence halls, shopping malls, bank halls, market areas etc. Because of the frequent contact with hands and multiple surfaces, the incidence of cross-contamination is significantly increased. Hand hygiene is a major requirement for human health and many infectious diseases can be emerged if proper hand hygiene procedures are not implemented. Hand washing is the simplest, important and cost effective way to improve hand hygiene in health care and support the prevention of infectious disease. Over recent years, there has been increasing availability and usage of hand sanitizing products. The main advantage of these products seems to be that they are more trusted, quicker and easier to use. In this research paper, we will design and implement a smart hand sanitizer dispenser.

1.1 Objectives

The main objective of this research paper is to design and implement a low cost touch free smart hand sanitizer dispenser with infrared thermal body temperature sensor that includes features such as Radio Frequency identification Tag, buzzer, LED and servo motor, based on Microcontroller. Sanitizing Proper hands and not touch everywhere is a must to prevent COVID-19. However, pressing the bottle nozzle, Open the door of offices, shops, and factories is unhygienic. Let's avoid and go touch less with Smart Sanitizer that will ensure that you maintain proper hygiene and health in public spaces and offices area.

1.2 Hardware Description

This system consists of two parts, Hardware and Software.

The Hardware parts include:

- Ardiuno Nano
- RC0522 (RFID Module)
- Servo motor
- LED & Buzzer
- Water Pump
- 2L2222 NPN Transistor
- 1K Resistor
- MLX90614 (Infra-Red Thermometer)

Software parts include:

- Arduino IDE

1.3 Working

In this research paper, the smart hand sanitizer is stationed at the entrance door and it is connected to the door in such a way that it controls it. That is to say, when a person wants to access the entrance door, they must first sanitizer their hands. With smart hand sanitizer dispenser, if you are employee first put your RFID tag near RFID scanner at the time of scanning parallel it's also check body temperature after that put hand under smart sanitizer then the sanitizer

outlet dropping some amount into your hands, If temperature is normal it commands to the micro-controller to turn on green led and allow a person to enter and in the other case if temperature is high so it will commands to the micro-controller to turn on red led ,then buzzer beeping for alert. All RFID tag names shown on display and temperature also.

1.4 Block Diagram:

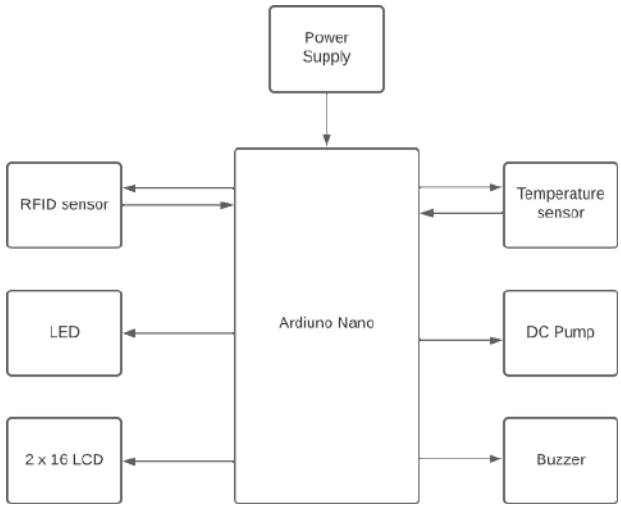

Figure2: Block diagram of smart hand senitizer

Flow chart:

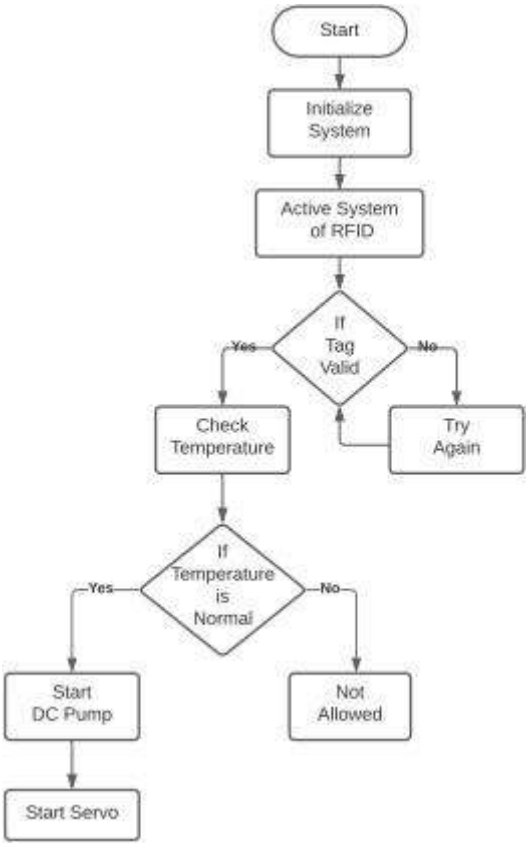

Figure3: Flow chart of smart hand senitizer

Status to showcase:

- Sanitizing hands is a must to prevent COVID-19. For factories, offices, hospitals, shops are increasing concerns regarding health safety and precautionary measures for wellness. This factor is expected to drive the market growth.
- Transformation of lifestyle of individuals resulting in increased healthcare expenditure and better health measures; this factor is expected to drive the growth of the market.
- Cost-effective and Employee attendance with health record track features even with purifying capabilities associated with this product is expected to drive the market growth To facilitate smooth usage, one can adjust the volume of the spray mist/sanitizer that will be dispenses. Also, its Zero Drop design minimizes leakage and ensures high precision for disinfecting hands. It sprays the right amount of sanitizer and also becomes ready for the next person quickly within seconds. Smart Sanitizer lowers the overall cost of using sanitizer in a premise.
- It results in lower pilferage and optimized consumption. Sanitizer can be purchased in bulk and environmental wastage of disposable sanitizer bottles can also be reduced.

Future scope:

- At this time we target Offices, Factories, Companies employees but in the upcoming version we add the functionality for a Visitor of any Shops, hotels, Banks, hospitals etc. so this machine will work for both employee of organization and Visitor also.
- Also add employee dashboard when the employee also Monitor their data.

Conclusion

The system surely helps in implementing the hand hygiene without any challenges as it is a must to sanitizer if you are to access any entry point. It is much safer and more recommended due to its touch less property which zeros down any chances for cross contamination. This is a user friendly system that anyone can make use of. It can be concluded here that the system has been successfully implemented and the aim is achieved without any deviations.

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SOLAR TECHNOLOGY: EFFICIENCY ANALYSIS OF TRACKING AND FIXED SOLAR PANEL WITH RECENT ADVANCEMENTS

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***Abstract*—Energy conservation in today's scenario have scaled up immensely due to the fear of exhausting resources in order to generate electrical power which today is in high demand. In past few years the generation has switched from conventional source of energy to non-conventional and renewable sources which are gifted by nature in abundance. Amongst all the sources of energy, solar energy is rated highest in terms of availability on earth and is almost 10,000 times more than the requirement of mankind. Therefore, in this paper the technologies developed to harness solar energy in most efficient manner has been discussed. It covers fixed solar panel, solar tracker and its statistical comparison based on data and graphs to understand which method is better and have high efficiency. Further, latest innovation in advancement of solar applications along with recent material developed to make solar cells achieve high efficiency, keeping in mind different factors like cost, flexibility etc. is discussed. This paper overall talks about different innovations and respective advancements in the most versatile form of energy i.e. solar energy.**

***Keywords*- Solar Panel, Solar Tracker, Solar panel- Materials, latest innovation-solar technology.**

I. INTRODUCTION

This is the generation of technological advancements and mankind has always wanted more in order to satisfy its need. Electric power is one which has always been in requirement and till now all of us have covered a long way exhausting a lot of it, in means to obtain energy and convert it into electricity. Conventional sources of energy covering fossil fuels, coals, etc. are the ones which take thousands of years to produce and get exhausted in no time provided their efficiency is also not up to the requirement. Hence mankind has switched to non-conventional sources of energy in today's time which includes wind energy, solar energy, etc. But amongst all, solar energy is the most abundant form of energy. It's interesting to know that 1, 73, 000 TW (Tera Watt) of solar energy strikes on a planet which is 10,000 times the requirement of mankind. Hence, advancements in technology took place to harness solar energy at its best by the invention of solar panels. While dealing in solar technology it is important to note that a panel converts light into electricity and not heat into electricity so a very hot day doesn't mean that it's a great solar day, also too much heating of panel results into loss of efficiency hence reduction in output power. Rather a cool winter day with bright sun is better for solar panel.

A. Solar Technology in today's scenario-

According to IRENA (International Renewable Energy Agency) doubling the shares of solar, wind and other renewable sources, in the mixture of all such energies present, will boost the global economic growth by 1.1% by 2030 and the gain generated will be up to $ 1.3 trillion, which will come from increased investment [1]. Recently, our country (India) has ranked 5th in the world in solar power deployment. It is because solar power capacity has increased by more than 11 times in the past five years, astonishingly from 2.6 GW in March 2014 to 28.18 GW in March 2019. Hence, with effective and planned technological improvements, economy of scale and reduction in solar cell prices and solar tariff in

India is now raised to a competitive level achieving grid parity [2]. On other hand 8% of installed PV worldwide has a performance of 15% and if the panels are not trapped by sun then the average loss (annual tilt) combines up to 70%. Due to many advances in photovoltaic technology over recent years, the average panel conversion efficiency today has increased from 15% to 20%. This significantly large jump in efficiency resulted in the power rating of a standard size panel to increase from 250W up to 370W. Hence two types of technology come into play which has occurred due to major advancement in technology and innovation, i.e., fixed solar panel and solar tracker. It is observed that, tracking the sun from east in the morning to the west in the evening will increase the efficiency of the solar panel by 30-35% as compared to fixed solar panel system which remains in same position throughout [3].

B. Evolution and advancement in Installation Technology-

To harness abundant amount of solar energy present around us, it's really important to have such setup which can provide solar energy in the form of electricity which can further be stored and used for different applications. Hence, tracing the evolution in innovation of solar technology it's noted that on April 25, 1954, Bell Labs announced the invention of the first practical silicon solar cell. These possess about 6% efficiency, which was later achieved to 11% [4][5]. Photovoltaic effect has been the major working principle behind the working of solar cell to convert solar energy to electricity. PV Technology has been known from two centuries though its technological development started in 1950's [6]. Further the advancement in Photovoltaic (PV) Technology and usage in practical solar panels proved solar energy as limitless energy of the sun. Major leap into this technology took after the advancement in methods to harness solar energy in innovative manner to increase the efficiency and overall performance of the system. Hence, two types of systems are observed as per the advancement of time i.e. fixed solar panel type system and solar trackers.

C. Fixed solar panel system-

Fixed solar panel system is an arrangement in which Solar Panels are set at a fixed angle which is usually the optimum tilt. To obtain maximum efficiency from the solar panels they need to be adjusted in the direction that captures most of the sun rays. As these are motionless and have uncomplicated construction, it's easy to design and maintain. In this case solar panels have best output when they are perfectly perpendicular to the sun. There is only one moment every day when the panels are perpendicular to the sun and harness all the available energy, the remaining time they cannot operate in full capacity due to the position restriction. It's observed that manually adjusting the panel twice a year can add 5% to 15% to the output of system depending on the geographical location of the system but will require extra human efforts. Apart from this the next factor which is very important while setting up the fixed solar panel is the tilt angle. This tilt is decided by two factors that is azimuthal angle and elevation angle which helps us know the sun's position according to which the solar panel should tilt to have maximum efficiency.

Figure: 1.Fixed Solar Panel [7].

D. Solar Tracker-

Solar trackers are automated systems that move continuously the entire day adjusting it to maximize solar exposure and power output. These systems keep the panels perpendicular to the sun so that overall output increases by 10-25%. Solar trackers have been divided into two major categories – Single- axis And Dual-axis, based on their axial movements.

1) Single Axis Solar Tracker-: Single-axis trackers have only one axis of movement (horizontal (most common), tilted, or even vertical), usually aligned with North and South. This allows the panels to move from east to west, tracking the sun as it rises and travels through the sky and sets. It is basically a closed loop system working on algorithm to track sun to harness most of the solar energy to convert it to electricity. Here, horizontal single axis trackers are most commonly used type. This axis of rotation is horizontal, usually orientated North-South with the panels facing the East in the morning and the West in the afternoon. It is common for the maximum allowed angle to be 45° from horizontal. Thus in the early morning and late afternoon the tracker does not move and remains at a 45° tilt angle. Some tracking systems even use a technique called "backtracking" which avoids row-to- row shading, where the tracker reverses its direction in the beginning and end of the day. Single-

axis trackers cost less than dual-axis and offer more reliability and a longer lifespan as they have lesser moving parts. However, they have lower energy capture efficiency than dual-axis systems. These single axis-trackers are most effective at equatorial latitudes where the sun is often overhead at noon. Due to the annual motion of the earth the suns direction also changes as it moves in the north and south direction depending on the season and due to this the efficiency of single-axis is reduced. Since the single- axis tracker only tracks the movement of sun from east to west, during cloudy days the efficiency of the single axis tracker is nearly equal to that of fixed panel. The power efficiency calculated for the single-axis solar tracker in comparison to fixed solar panel is said to be 13% more [8].

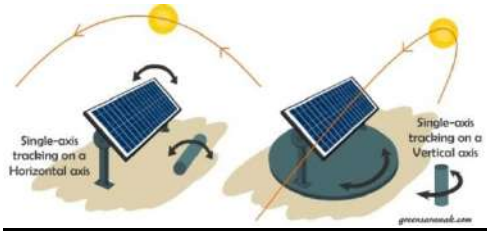

Figure: 2.Single axis solar tracker [9].

2) Dual Axis Solar Tracker-: Dual axis trackers have two parameters that act as axes of rotation. These axes are ordinarily normal to one another. The fixed axis to the ground is the primary axis and the other moving part is secondary axis. There are many common implementations of dual axis trackers as they allow for optimum solar energy levels due to their ability to track the position of Sun vertically and horizontally which maximizes overall energy production. No matter what is the position of Sun is in the sky, dual axis trackers are able to angle themselves to be in direct contact with it. The power efficiency calculated for the dual-axis solar tracker is said to be 25% more than that of the fixed solar system. They also have a higher degree of mechanical complexity, which makes them more expensive and hence require more maintenance over their installed lifetime. Both single-axis and dual-axis are highly efficient in terms of output power when compared to the fixed solar system. Dual-axis tracking system works more efficiently during cloudy days when compared with single-axis tracker. Hence the efficiency of dual-axis tracker system is higher when compared with single-axis tracker system. Even though the hardware complexity is more in the dual axis tracker when compared with fixed and single tracker, but it provides a higher efficiency. Dual axis is a bit more expensive and few don't even provide great range, therefore most solar panels operate on a single axis only.

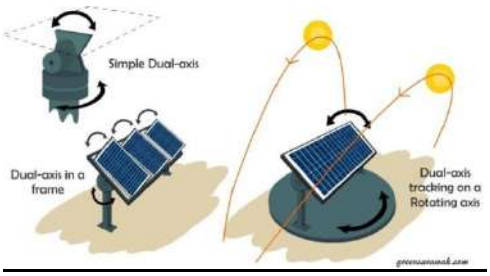

Figure: 3.Dual Axis Solar Tracker [10].

E. Advancement in Solar Technology-

In today's world there is innovation and advancement in every vertical of technology, in which solar technology has also grown immensely, proving its existence at best. Solar trackers and stationary solar panels comes in huge competition, hence, it's important to decide which setup is better to use today. So, in this paper it's discussed that how solar trackers are better in efficiency as compared to conventional solar panels (stationary). Also, as earlier solar panels were seen mounted just on rooftops or in open huge land area, now they are also seen over water bodies, on clothes and even as building material. Moreover, use of new materials to fabricate solar panels which exhibit high efficiency and even possess better quality is discussed. Perovskite, thin films, quantum dots are some of these materials used as per latest innovation. Solar panel efficiency is determined by two main factors, the photo-voltaic (PV) cell efficiency, which is based on the cell design and silicon type (material used), and the total panel efficiency, based on different factors like the cell layout, configuration and panel size. These factors are taken care into consideration and are worked upon in today's advanced manufacturing.

II. Formulas and Statistical Analysis

A. Solar panel Tilt angle -

In solar panel system, incident solar light should be perpendicular to the panel in order to achieve efficient energy conversation. For this it's important to have appropriate tilt angles of the panel which includes azimuthal and elevation angle. Also, one must calculate and know these values appropriately before installing solar panels. The azimuthal angle is the angle in the horizontal plane which measured from true north to the horizontal projection of the sun ray.
Its formula is shown in Equation (1) [11], where Φ is the

latitude of the location, δ is the solar declination angle, and θ denotes the hour angle.

$$\text{Azimuthal angle} = \tan^{-1} \frac{(\sin\theta)}{(\cos\theta \sin\varphi) - (\tan\delta \cos\varphi)} \quad \text{--------(1)}$$

On the other hand, the elevation angle is the angular height of the sun in the sky which is measured from the horizon of the object. This angle changes throughout the day depending on the day of the year and latitude of a particular location. Its formula is represented in Equation 2. [11].

$$\text{Elevation angle} = \sin^{-1}[(\sin\delta \sin\varphi) + (\cos\delta \cos\varphi \cos\theta)] \quad \text{---(2)}$$

B. Stationary Solar panel and Solar Tracker Statistical Comparison –

Statistical analysis to compare performance of fixed solar panel and solar tracker—

1) Fixed Solar Panel-: As per the efficiency analysis by Samaulah [12] , it is observed that while the solar panel is kept stationary or say fixed at one position and then its efficiency and working observation recorded are as follows–

1.1) Time vs. Intensity:

Time	**Intensity(W/m^2)**
8:00	246.64
9:00	294.72
10:00	424.12
11:00	398.87
12:00	394.01
13:00	336.36
14:00	329.27
15:00	259.51
16:00	177.43
	P(max)=424.12

Table: 1.Time vs. Intensity (W/m^2) of fixed solar panel [12].

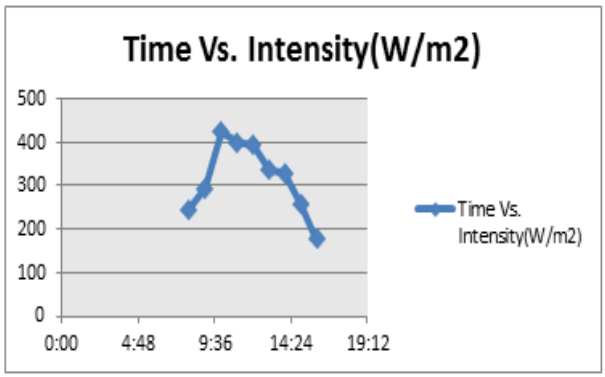

Figure: 4.Time vs. Intensity graph for fixed solar panel.

The above Table: 1 contains Intensity recorded at specific time intervals throughout the day between 8a.m and 4p.m, incident on the panel. The recorded Intensity of sun's radiation falling on the panel is in W/m^2. .Figure: 4 depict the line graph created to understand and analyze this criterion. It's clearly visible that from 8a.m to 10a.m intensity of incident light increased significantly, hence the highest data is recorded at 10.am, after which the intensity decreased till 4p.m.

1.2) Time vs. Output power:

Time	**Output Power(Watt)**
8:00	13.78
9:00	18
10:00	27.95
11:00	26.76
12:00	28.38
13:00	21.99
14:00	21.21
15:00	16.34
16:00	9.96

Table: 2.Time vs. Output power (Watt) of fixed solar panel [12].

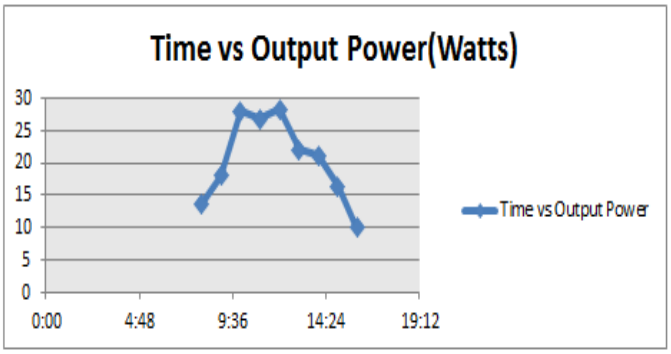

Figure: 5.Time vs. Output Power for fixed solar panel.

The above Table: 2 contain output power recorded at specific time intervals throughout the day between 8a.m and 4p.m, incident on the panel. The recorded output power is in Watt .Figure: 5 depict the line graph created to understand and analyze this criterion. It's clearly visible that from 8a.m to 12p.m output power recorded have increased significantly, recording highest output power at 12p.m. after which the power decreased till 4p.m.

1.3) Efficiency:

First calculation and observation of efficiency on timely basis is done for fixed solar panel.

Efficiency has been calculated using the formula-

$$Efficiency = \frac{Output\ Power(Po)}{Input\ Power(Pi)} \quad -(1)$$

Input power is considered to be-

$$Input\ Power = (Radiation * Panel\ Area)watts \quad -(2)$$

Time	Intensity (W/m^2)	Input power= E.A(Pi)	Output power(Po)	Efficiency= (Po/Pi)
8:00	246.64	129.98	13.78	10.6
9:00	294.72	155.32	18	11.59
10:00	424.12	223.51	27.95	12.5
11:00	398.87	210.2	26.76	12.73
12:00	394.01	207.64	28.38	13.67
13:00	336.36	177.26	21.99	12.41
14:00	329.27	173.53	21.21	12.22
15:00	259.51	136.76	16.34	11.95
16:00	177.43	93.51	9.96	10.65

Table: 3.Fixed solar panel Efficiency [12].

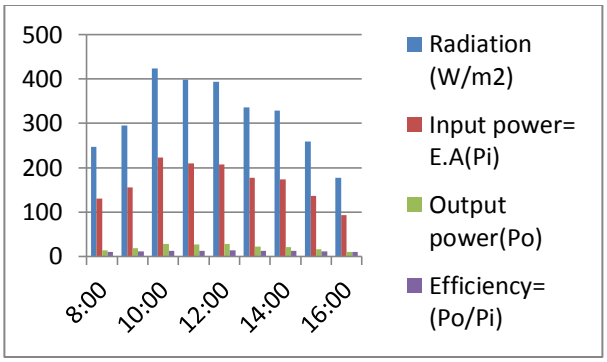

Figure: 6.Bar graph for Time vs. Radiation/ Input power/ output power/ Efficiency- Comparison chart for Stationary panel.

In the above Table: 3 all the data is provided for fixed solar panel system which includes Intensity, input power, output power and efficiency, where efficiency and input power are calculated as per their respective formulas (1) and (2). Figure: 6 depict a bar graph showing a clear comparison of these parameters with respect to each other.

Concluding that radiation was highest at 10a.m and hence were all the values of input power, output power and efficiency high at that time as analyzing from the bar graph.

2)Solar Tracker- As per the efficiency analysis by Samaulah [12] , the solar tracker's efficiency and working measured is observed and recorded as follows –

2.1) Time Vs. Intensity:

Time	Intensity(W/m^2)
8:00	326.46
9:00	362.47
10:00	464.4
11:00	431.9
12:00	454.21
13:00	399.47
14:00	439.75
15:00	355.46
16:00	320.87

Table: 4.Time vs. Intensity (W/m^2) of solar tracker [12].

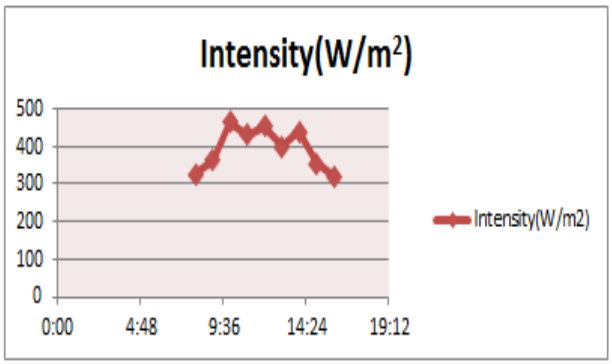

Figure: 7.Time vs Intensity of Solar Tracker.

The above Table: 4 contain Intensity recorded at specific time intervals throughout the day between 8a.m and 4p.m, incident on the solar tracker. The recorded Intensity of radiation falling on the tracker is in $W/m^{2.}$ .Figure: 7 depict the line graph created to understand and analyze this criterion. It's clearly visible that from 8a.m to 10a.m intensity of incident light increased significantly; hence the highest data is recorded at 10 a.m.

2.2) Time Vs. Output Power:

Time	Output Power(Watt)
8:00	22.83
9:00	25.26
10:00	32.68
11:00	29.54
12:00	33.7
13:00	27.58
14:00	28.4
15:00	23.15
16:00	22.26

Table: 5.Time vs. output power of solar tracker [12].

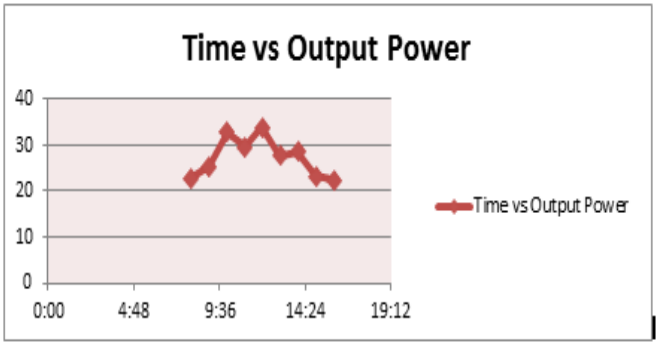

Figure: 8.Time vs. Output power for solar tracker.

The above Table: 5 contain output power recorded at specific time intervals throughout the day between 8a.m and 4p.m, incident on the solar tracker. The recorded output power is in Watt. Figure: 8 depict the line graph created to understand and analyze this criterion. It's clearly visible that output power is highest at 12p.m. after which the power decreased.

2.3) Efficiency:

First calculation and observation of efficiency on timely basis is done for fixed solar panel.

Efficiency is calculated using the formula-

$$Efficiency = \frac{Output\ Power(Po)}{Input\ Power(Pi)} \quad -(3)$$

Input power is considered to be-

$$Input\ Power = (Radiation * Panel\ Area)watts \quad -(4)$$

Time	Radiation (W/m^2)	Input power= E.A(Pi)	Output power(Po)	Efficiency= (Po/Pi)
8:00	326.46	172.04	22.83	13.27
9:00	362.47	191.02	25.26	13.22
10:00	464.4	244.74	32.68	13.35
11:00	431.9	227.61	29.54	12.98
12:00	454.21	239.37	33.7	14.08
13:00	399.47	210.52	27.58	13.1
14:00	439.75	231.75	28.4	12.25
15:00	355.46	187.33	23.15	12.36
16:00	320.87	169.1	22.26	13.16

Table: 6.Solar tracker Efficiency [12].

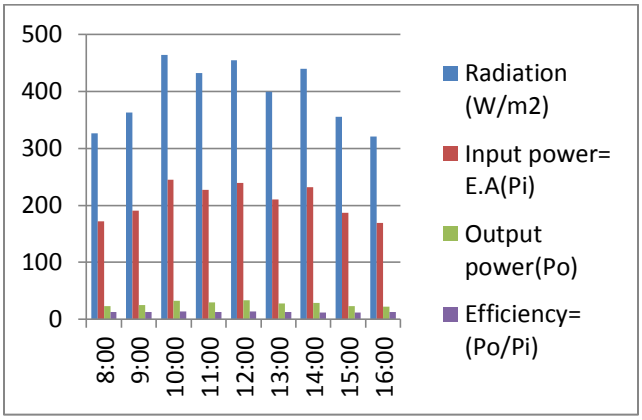

Figure: 9.Bar graph for Time vs. Radiation/ Input power/ output power/ Efficiency- Comparison chart for solar tracker.

In the above Table: 6, all the data is provided for solar tracking system which includes Intensity, input power, output power and efficiency, where efficiency and input power are calculated as per their respective formulas (3) and (4). Figure: 9 depict a bar graph showing a clear comparison of these parameters with respect to each other.

Concluding that radiation and input power was highest at 10a.m and output power and efficiency was highest at 12p.m. hence these are the results which are observed from the above analysis.

3) Comparison between Stationary solar panel and tracking type solar panel:

Many factors are considered to compare the two types of systems to analyze which type is better.

3.1) Time Vs. Intensity:

Time	Stationary Panel Intensity	Tracking Panel Intensity
8:00	246.64	326.46
9:00	294.72	362.47
10:00	424.12	464.4
11:00	398.87	431.9
12:00	394.01	454.21
13:00	336.36	399.47
14:00	329.27	439.75
15:00	259.51	355.46
16:00	177.43	320.87

Table: 7.Intensity Comparison [12].

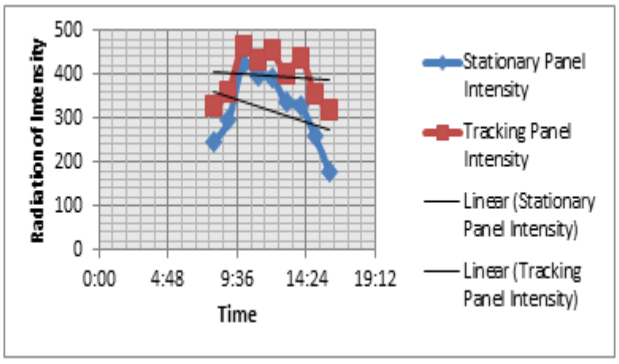

Figure: 10.Time vs. Intensity graph for stationary and tracking panel.

Table: 7 shows the values of intensity by both the stationary and tracking panel, with respect to time. By plotting these points on a time vs. intensity graph, the above figure is obtained, from which it is clearly observed that radiation of intensity of a tracking panel is greater than that of stationary panel. Hence tracking panel shows better performance.

3.2) Time Vs. Output Power:

Time	Stationary system Power	Tracking system Power
8:00	13.78	22.83
9:00	18	25.26
10:00	27.95	32.68
11:00	26.76	29.54
12:00	28.38	33.7
13:00	21.99	27.58
14:00	21.21	28.4
15:00	16.34	23.15
16:00	9.96	22.26

Table: 8.Output Power [12].

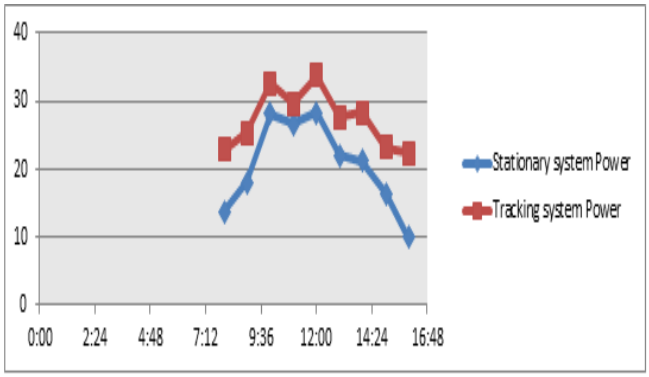

Figure: 11.Time vs. Output power of Stationary and Tracking system.

Above Table: 8 show the value of output power produced by both the stationary and tracking panel, with respect to time. By plotting these points on a time vs. output power graph, Figure: 11 is obtained, from which it is clearly observed that power generated by a tracking panel is greater than that of stationary panel. Hence tracking panel shows better performance.

3.3) Time Vs. Output Power:

Time	Efficiency of Stationary Panel	Efficiency of Tracking Panel
8:00	10.6	13.27
9:00	11.59	13.22
10:00	12.5	13.35
11:00	12.73	12.98
12:00	13.67	14.08
13:00	12.41	13.1
14:00	12.22	12.25
15:00	11.95	12.36
16:00	10.65	13.16

Table: 9.Efficiency Comparison [12].

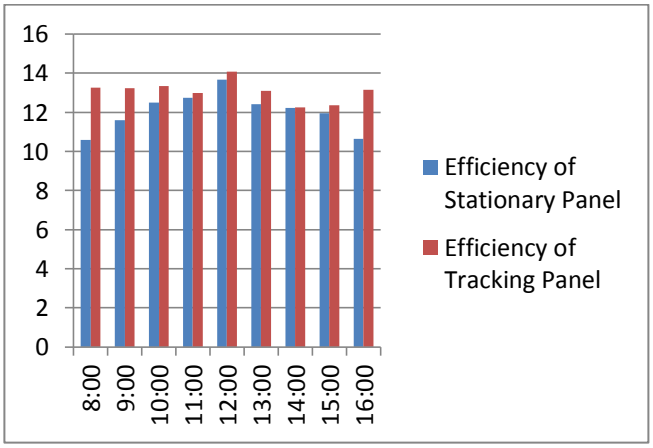

Figure: 12.Efficiency comparison bar graph for stationary and tracking panel.

It's clearly observed that solar tracker have performed much better in comparison to stationary panel, as its efficiency is comparatively higher. This is even clear from the above bar graph and overall statistical graph analysis.

III. LATEST ADVANCEMENTS IN THE FIELD OF SOLAR TECHNOLOGY AND MATERIALS USED TO MANUFACTURE HIGH EFFICIENCY SOLAR PANELS:

A. On the basis of technological applications being innovated-

1) Floatovoltaics-: It is the new method proposed in which solar photovoltaic systems are installed over the Water bodies. It's system of installation does not waste the land but it mainly uses the water bodies that already existed such as fresh and waste water basins, hydro-electric basins (already equipped and grid connected) , lagoons (Bays, Ponds etc.) etc. Here, the Photovoltaic systems are made to float on the water body by using various floating methods. Like the conventional land based photovoltaic systems, here also we have components like PV modules, power converters (DC-DC converter, DC-AC converter), string boxes, transformers, and electrical storage systems like battery or other on-board storage facilities [13]. Besides producing clean solar power, floating solar farms also helps with water management. They reduce the loss of water due to evaporation as they limit air circulation and block sunlight from the surface of the water. These floating solar farms prevent poisonous and toxic algae production, lowering water treatment costs. Further, the water beneath solar panels is kept clean and minimizes energy waste.

Figure: 13.Floatovoltaics [14].

2) BIPV (Building-Integrated Photovoltaics) : Building-Integrated photovoltaics (BIPV) are photovoltaic materials that are used to replace conventional building materials in parts of the building such as the roof, skylights, or facades. The BIPV module is a prerequisite for the integrity of building functionality. If the integrated PV module is dismounted, then they have to be replaced by an appropriate construction product. The photovoltaic PV glasses installed as building materials act as an energy-generating device and even allow natural light inside homes and offices, similar to conventional architectural glasses. The advantage of integrated photovoltaics over more common non-integrated systems is that the initial cost can be managed by reducing the amount spent on building materials and labor that's normally used to construct the part of building that the BIPV modules replace. These advantages make BIPV one of the fastest growing sectors of the photovoltaic industry. This technology when used on the building's facades, atrium, terrace floor and canopies provides increase in energy efficiency, high thermal and sound insulation along with zero carbon footprints [15] [16].

Figure: 14. BIPV [17].

3) Solar Fabric-: Solar Fabric/ Photovoltaic (PV) textile are designed to provide a sustainable and fully embedded energy solution for different applications of wearable and mobile electronic devices which can convert solar energy into electricity, this uses a network of discrete miniature solar cells (SCs) embedded within the fibers of the textile. These solar fibers/filaments can be embedded into our clothes like t-shirts, winter coats, or any other clothing to help one keep warmer; generating energy to power our phones too can be one of the applications. These are created in a very aesthetic way which is comfortable to wear; these are durable and can even be washed. Also, solar fabricated household clothing can help one save on solar panel mounting and cost for installation [18].

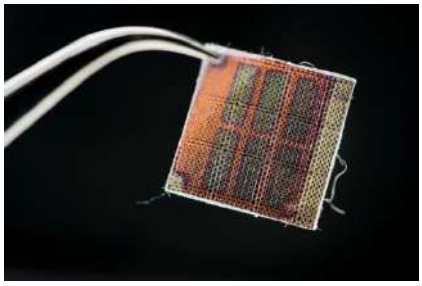

Figure: 15.Solar Fabric [19].

4) PVNB (Photovoltaic Noise Barrier)-: A photovoltaic noise barrier (PVNB) system, integrates a PV system with a noise barrier, it is considered as one of a best source for harvesting solar energy to overcome the problem of having limited land available for solar panel installations. Traffic noise has been recognized by the World Health Organization as one of the important factor contributing to the pollution of the environment (Noise Pollution). Hence, this technology aims for dual cause which at the same time provides with photovoltaic panels designed to produce renewable energy and also lowers noise levels between noise sources and sensitive receptors like hospitals, schools and residential areas [20].

Figure: 16.PVNB [21].

B. On the basis of advancement in Solar Cell material-

1) Perovskite Solar Cells-: Perovskite solar cell has electro-optical properties of perovskite materials which makes the system much more stable at high temperatures and even makes it consistent and clean to fabricate into solar cells. Its major advantages are that it is low-cost, efficient, lightweight, flexible and semitransparent because of crystal structure and electro-optical properties (as it can convert even ultra-violet rays into electricity). Among the next-generation solar cells, hybrid metal halide perovskite solar cells (PSCs) have drawn a huge attention because of their low price, thinner design, low-temperature processing, and excellent light absorption properties (good performance under low and diffuse light). Its thin films can also be printed, leading to scalable high-production manufacturing; a recent printed roll of PSC has reached 12.2% efficiency, this is highest among printed PSCs. As of now, combined perovskite and Si-PV materials have shown a record efficiency of up to 28% under laboratory conditions. As stability and durability have remained a major concern, a recent low-cost polymer-glass stack encapsulation system has enabled PSCs to operate under standard operating conditions [22].

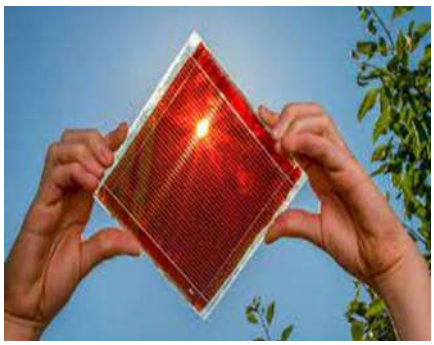

Figure: 17.Perovskite Solar Cell [23].

2) Thin Films-: Thin-film solar cells are one of the most encouraging PV technologies due to their properties such as narrow design (350 times smaller light-absorbing layers as compared to basic Si-panels), light weight, flexibility, and easy installation. Typically there are four types of materials which are used in its construction: cadmium-telluride (CdTe), amorphous silicon, copper-indium-gallium-selenide (CIGS), and gallium-arsenide (GaAs). Though CdTe relates to toxic concern due to the presence of cadmium but the CIGS solar cells now a days are turning out to be the more promising high-efficiency and economic for both residential and commercial area of installation with efficiency up to 21%. [24].Typical fabrication of thin-film solar cells can be modified for efficient, high and parallel production of organized arrays of micro solar cells. These combine with micro lens arrays to deliver micro-concentrator solar modules with a similar form factor to present day flat-panel PV. Such thin-film micro-concentrator PV modules uses considerably less semiconductor solar cell material (which reduces the use of critical raw materials) and lead to a higher energy production (by means of concentrated sunlight), with the potential to open to low level cost of electricity.

Figure: 18.Thin Films [25].

3) Interdigitated Back Contact (IBC)-: "Interdigitated Back Contact" solar cells, known as IBC solar cells, offer more efficiency, energy yield and reliability than other solar panel technologies. These require interdigitated (or striped doping) doping which can be achieved by masked diffusion, masked ion-implantation or laser doping. As, per manufacturing implementation and advancement over basic solar cells, they have silicon wafer based structure. This technology is more complicated than other solar cells, but the added value per cell makes it desirable. Instead of front contact energy conversion, this technology has back contact energy conversion. This allows for the entire front of the cell to absorb sunlight, without any issue of shading from the metal ribbons, like those on PERC cells, converting more incident photons to generate energy. Most efficient standard-measure solar panels use high-performance N-type IBC which can achieve up to 22.6% panel efficiency generating an impressive 380 to 400 Watts (knowing: 310 W mono PERC has 19% efficient and approx. 1.64 m²)[26].

Figure: 19.IBC [27].

4) Crystalline Silicon-: Photovoltaic (PV) conversion of solar energy gives a good contribution to power generation in many places having more than 90% of the global PV market which rely on solar cells based on crystalline silicon (c-Si). The current efficiency recorded of c-Si solar cells is 26.7%, which is against an intrinsic limit of 29%. Crystalline silicon (c-Si) is the most used semiconducting material in solar panels; it occupies more than 90% of the global PV market, although its efficiency is considerably under the theoretical limit (30%). Hence, solar cells made of alternative low- cost and high-efficiency materials are emerging and are in demand. The National Renewable Energy Laboratory (NREL) in a drive of development of high-efficiency crystalline PVs included III-V multi-junction materials (with target efficiency of (30%) and hybrid tandem III-V/Si elements as good and efficient, where its six-junction III-V solar cells have reached an efficiency of 47.1% under concentrated light. Additionally, Si-based bifacial technology can harvest solar energy from both sides of the panel, with 11% more efficiency compared to standard panels [28].

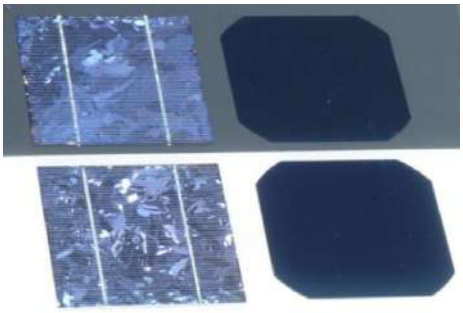

Figure: 20.Crystalline Silicon [29].

5) Colloidal Quantum Dot Solar Cell-: Quantum dots – nanoparticles of semiconductor material carry charges which have been investigated for the solar cell potential in various materials from a long time and have made a great progress since the first reported cell efficiency for the technology [30]. As, it harvests multiple portions of solar spectrum it directs improved efficiency. It has developed from 2.6% to 16.6% efficiency achieved by synthesizing a quantum dot solar cell from a halide perovskite, improving on the record for such a device by almost 25% (relative efficiency). Compared to other emerging PV technologies, such as perovskite thin-film solar cells, the QD [quantum dot] PV technology developed by latest has the advantage of colloidal [evenly distributed] synthesis and industrially- compatible processing at room temperature. This has led to the most convenient and rapid manufacturing by decoupling grain crystallization from film deposition. Mostly it's suggested to use in flexible applications. Furthermore efforts are being made to scale up quantum dot technology with a large scale printing process and pushing efficiency even higher.

Figure: 21.Colloidal Quantum Dots [31].

IV. Conclusion

In this paper an overview is presented of the latest innovation and advancement in solar technology. It traces through the concept and analysis, and comes to a conclusion that solar trackers are more efficient and their output power received is much better as compared to stationary solar panels. But as they are a bit costly its use in personal home setup is not seen much, rather in commercial application it has been of great success. Further, floatovoltaics, solar fabric etc. have raised the bar of existence of basic solar panels. These are advanced application of solar panels which meets the demand of todays need. This paper is winded up by talking about the advancement in material and technology used in fabricating/ manufacturing solar panels in order to increase the overall efficiency along with other factors such as cost, temperature, flexibility.

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Image and Text Transmission Using Li-Fi

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Abstract — The overdependence on Wireless Fidelity (Wi-Fi) for data transmission overflowed the need for an alternate and more reliable means of communication, hence, Light Fidelity (Li-Fi). It involves the use of Light Emitting Diode to transmit data by blinking (i.e., switching them On and Off) at a speed not noticeable to the eye, this needs use of modulation technique such as ON-OFF keying or Pulse position modulation. This paper proposed the development of the Li-Fi system using off the shelf electronic components. This also reviews the pre-existing information and research of other people. The proposed system utilizes an embedded system with dual-core AVR microcontroller ATmega16L interfaced to input/output circuits comprising of the light emitting diode (LEDs), Operational Amplifier and a photodiode. Also, by developing a user (Receiver PC) interface using Embedded C programming, the sample data (text, voice and image) transferred was monitored and the speed, efficiency, security and capacity of the system was examined and discovered to be top notch. This would make the system an indispensable means of communication in the nearest future. This data transmission system is different from those in existence because expensive components were not in the design, invariably reducing the overall cost of the implementation.

I. Introduction

Light Fidelity (Li-Fi) is a high-speed, wireless communication using visible light. It falls under the category of optical wireless communications. Data transmission takes place through Light Emitting Diode (LED) bulbs whose intensity varies. Based on this variation, communication occurs digitally. This technology has vast applications where the use of Wi-Fi is limited or banned. It also takes out the adverse health effects of using electromagnetic waves. Unless light is , data can't be hacked and so data transmission is secure. Data transmission is typically in terms of Gigabytes per second. The use of light as a means to transmit data has been coined Li-Fi. The high-speed communication technology is similar to Wi-Fi but is faster, allowing you to send and receive more data in less time. By swapping incandescent bulbs with LEDs - which have electronic properties - Li-Fi could bring Internet access to more areas and could revolutionize the telecommunications industry. The speed of data transmission is about 10 Mbps, though it is aimed to improve up to 100 Mbps. Recently, wireless technology has bloomed to a great extent such that wireless technology requires a large amount of data to transmit every day. Nowadays, wireless communications have become important in the communication process. The main means of transmitting wireless data is by using electromagnetic waves i.e., radio waves. However, radio waves can support less bandwidth because of compact spectrum availability and intrusion. The solution to this is data transmission using Visible Light Communication (VLC). Wi-Fi deals with wireless coverage within premises, whereas Li-Fi is perfect for high compactness wireless data coverage in a defined area and for mitigating radio interference issues. Li-Fi focuses on transmitting multimedia data between two terminals using LEDs.

Fig1: Li Fi

II. Literature Survey

Beautifully explained the use of infrared radiations for high-speed wireless data communication at low cost and made us aware that multipath fading does not occur in infrared radiation as it occurs in radio waves communication. This article majorly provided us the idea that infrared LEDs can be used in LI-FI transmission for our prototype and the infrared spectra do not interfere with the visible lights available around us due to their different spectrum.

Provided us the practical details about implementing LI-FI prototype, the paper threw light on the fact that we can use UART protocol for transmitting the data and gave us the idea of hardware designing. This paper in the end also provided us with the knowledge of finding the bit error rate of our schemed prototype.

Provided us all the basic concept about the upcoming technology which includes the understanding of what LI-Fi is actually, its basic working principles and how the technology is going to be different from the existing ones and what is its current development and the future scope.

Technology in Wireless Data Communication" provided the details of various data encoding style that can be used in LI-FI along with the disadvantages and advantages of each encoding style and the applications of LI-FI.

III. Motivation

In today world communication between the devices is much common. These devices are using radio waves for short range wireless transmissions. Wi-fi and Bluetooth are currently the two prominent short range wireless technologies. The radio wave spectrum has certain key limitations which includes bandwidth consumption, efficiency, availability and security. This presents the disadvantages such as - In radio wave spectrum data transmission security is very less, Lot of data cannot be transferred simultaneously, Health issues. Bandwidth usage is limited. Li-Fi is a new technique of data transmission. Li-Fi data is transmitted by modulating the intensity of the light, which is then received by a photo detector. VLC(Visible Light Communication) technology consists of a light source as a transmitter and photo detector as receiver. In transmitter the electrical signals are converted into optic signals and transmitted through LED. The receiver contains photo detector. The photo detector converts the made sophisticated by using more than one led at a given time. By this way more information can be passed and hence a faster data communication is possible. This proposes advantages over established Wi-Fi technology as follows - More security and vulnerable to unauthorized access, Availability of data is increased, less power is required, provides faster communication, less harmful to humans.

Table1: Comparison between Li-Fi and Wi-Fi

Sr. No	**Parameter**	**Wireless Technologies**	
		Light Fidelity	**Wireless Fidelity**
1.	Speed for data transfer	Faster transfer speed (>1Gbps)	Data transfer speed (150Mbps)
2.	Medium through which data transfer occurs	Use Light as carrier	Use Radio spectrum
3.	Spectrum Range	Visible light spectrum has 10,000 times broad spectrum in comparison to radio frequency	Radio frequency spectrum range is less than visible light spectrum
4.	Cost	Cheaper than Wi-Fi because free band doesn't need license and it uses light	Expensive in comparison to Li-Fi because it uses radio spectrum
5.	Network topology	Point-to-point	Point-to-point
6.	Operating frequency	Hundreds of Tera Hz	2.4GHz

IV. Material Used

The materials involved in image transmission using Li-Fi involve the following electronics components:

1. Universal PCB
2. Power Supply
3. Max232
4. LCD
5. UART
6. VLC Transmitter
7. Graphic LCD
8. Jumper Wire
9. Infrared Sensor
10. LED

V. Technology Implemented

A. Li-Fi Technology:

Li-Fi is established on the fundamental of visible light communication(VLC) i.e., it avails visible spectrum for data communication and the spectrum stretches from 300 GHz to 700 THz (wavelength between 1mm to 700nm). Plainly, any packet or piece of information that can be transferred using light can be regarded as VLC.

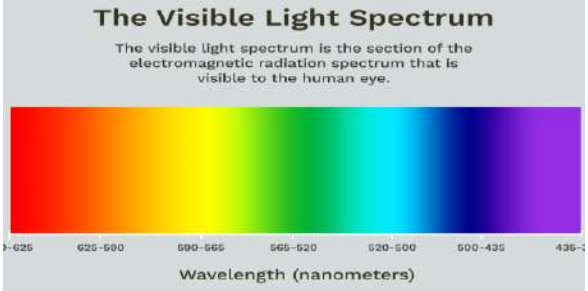

Fig2: Visible Light Spectrum

This suggests that light waves are modulated by the packet of Data and Encoding of the Data is done using various modulation techniques that Li-Fi adopts. For the last decade, researchers have refined current digital modulation techniques which can be adopted in OWC applying LEDs. IM/DD is based on the primitive principle that is the intensity of the light is varied according to the information or data to be transferred. Therefore, higher order techniques such as M-level quadrature Amplitude Modulation (MQAM) is vital for delivering data rates that are closed to Shannon Capacity limit.

Fig3: Lifi symbol

Few of the conventional Modulation techniques exercised in the Li-Fi are:

i. On-Off Keying :OOK also known as amplitude shift keying is the simplest of the digital modulation technique where there is only one energy carrier which is switched on or off depending upon the stream of data provided on the input side. That means if input side contains symbol 0 no signal is transmitted and vice versa. The essential objective of using OOK is simplicity in generation and detection. The major drawback is its sensitive towards the additive white Gaussian noise.

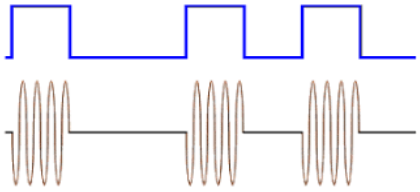

Fig4: OOK Waveform

ii. Pulse Position Modulation : PPM is the scheme of modulation in which the amplitude and width of the pulse are kept constant but the position of each pulse differs in proportion to the amplitude of the input signal. The position of each pulse is changed w.r.t to the reference pulse.

iii. Orthogonal Frequency Division Multiplexing : OFDM is a form of signal modulation that divides a high data rate modulating stream placing them onto many slowly modulated narrowband close-spaced subcarriers and in this way is less sensitive to frequency selecting fading. OFDM is the main focal point for many new wireless technologies because of the various blessings or return it offers such as effective use of the bandwidth, low interferences, keeps a strong check on ISI and immunity to fading.

iv. Pulse Width Modulation : In PWM the width of the modulated pulses varied in accordance with the amplitude of the input signal that has to be modulated. The amplitude and frequency of a PWM signal remain constant only the Width of the signal changes with time. Since the width is the variable parameter, therefore, PWM is least affected by noise as the additive noise mostly alter the amplitude of the signal and another major advantage is no synchronization needed between a transmitter and receiver.

B. IoT (Internet of Things)

The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with Unique Identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. An IoT ecosystem consists of web-enabled smart devices that use embedded processors, sensors and communication hardware to collect, send and act on data they acquire from their environments. IoT devices share the sensor data they collect by connecting to an IoT gateway or another edge device where data is either sent to the cloud to be analysed locally. Sometimes, these devices communicate with other related devices and act on the information they get from one another. The devices do most of the work without human intervention, although people can interact with the devices, for instance, to set them up, give them instructions or access the data.

C. Arduino Platform

Arduino IDE platform Arduino is an open-source computer hardware and software company, project, and user community that designs and manufacture single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application written in the programming language Java. It contains code editor which includes features like text cutting and pasting, text searching and replacing, automatic indenting, brace matching, and syntax highlighting and compile and upload programs on Arduino board by one click mechanism. Additionally, it contains a message area, text console, a toolbar with buttons for various functions and operations menu. It supports C and C++ languages. The smallest Arduino C/C++ program consist of only two functions. They are:

setup(): This function is called only once whenever sketch starts either after power-up or reset. It initializes variables, input and output pin modes and other libraries that are used in the sketch.

loop(): This function is executed repeatedly after setup(). It is used to control the board until the board is either power off or is reset.

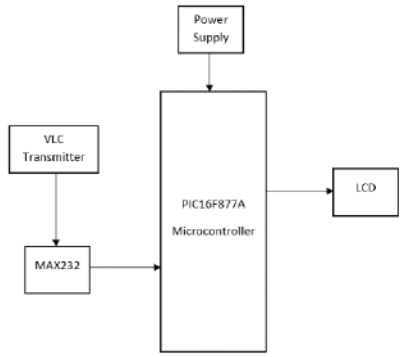

Fig5a: Li-Fi Transmitter

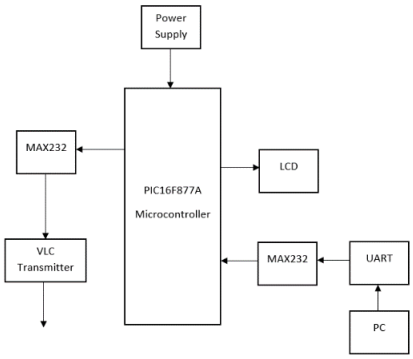

Fig5b: Li-Fi Receiver

VI. Methodology Implemented

Data must be converted from electrical to optical signals in order to transmit. The data will be converted as a binary value and the data will be transmitted through light using Li-Fi transmitter. The light from the transmitter side is received by the photo detector (li-fi receiver). Again, the binary values are converted into optical signals. And convert the optical signals to electrical signals. So, the user can view their results using PC's. By using visible light communication technology. No data loss occurs. The data can be transferred safe and sec.

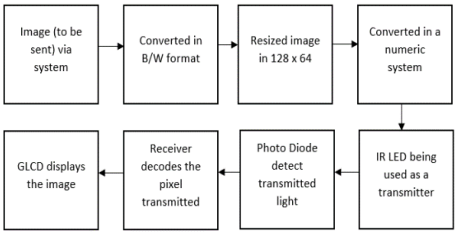

Fig6: Flowchart of Implementation

The On-Off keying modulation technique is being used in the scheming of the prototype by us. Next off the working of Li-Fi is ideally smooth to understand, As the whole of the concept revolves around visible light and LEDs. When the LED is switched on (by supplying constant current for efficient use) We transmit a digital 1 and during the off state of the LED digital 0 is transmitted. The LED is made to flicker as faster as possible so that the data can be transmitted without coming into the concern of the human eyes. Mainly, the transmitter section requires a LED and controller that can encode any kind of data like text and image in the form of fluctuation of a LED signal as mentioned above. On the Receiver side a light sensitive device i.e., photodetector or phototransistor receives the data transmitted by LED and decodes the fluctuations of LED and convert it into the data the user has sent by the use of chosen microcontroller then the received data is displayed on the desired output device.

VII. Benefits and Limitations

Benefits:

- Higher data transmission rates than Wi-Fi: light range has a transmission capacity that is multiple times bigger than whole radio recurrence and microwave range.
- Inexpensive deployment: the current operational ideas and trial utilizations of Li-Fi innovation focus on the utilization of LED lights. This implies that a Li-Fi organization can be incorporated effectively with existing LED lighting frameworks. Basically, any place there is a light source, there can be admittance to the Internet.

- Higher security for the transmission: light waves can't enter through dividers and entryways. They additionally have a more limited reach. Equivalent is valid for infrared light and bright radiation. The signs transmitted by a Li-Fi item and information it communicates stay limited to a shut territory.
- No signal interference: Li-Fi being insusceptible from electromagnetic impedances that influence radio-based remote correspondence advancements. The innovation is likewise helpful in territories that are electromagnetic delicate.

Limitations:

- Limited range issue: Actual boundaries, for example, dividers and entryways limit operational extent of a Li-Fi-empowered LED light. Wi-Fi switch has more extensive and longer reach than a Li-Fi switch.
- Incompatible devices for technologies: Current gadgets, for example, PCs, cell phones, and tablet PCs actually use equipment for Wi-Fi organizing. These gadgets would not promptly work with a Li-Fi network since they don't have the essential equipment details.
- Interference between light transmission: Daylight can meddle with light signals created by a Li-Fi-empowered LED light. The relating recipient may struggle handling these signs. Web interference is conceivable.

VII. Applications

1. Education systems: Li-Fi is the latest technology that can provide fastest speed for Internet access. So, it can augment/replace Wi-Fi at educational institutions and at companies so that the people there can make use of Li-Fi with the high speed.
2. Medical Applications: Operation theatres (OTs) do not allow Wi-Fi due to radiation concerns. Usage of Wi-Fi at hospitals interferes/blocks the signals for monitoring equipment. So, it may have hazardous effect to the patient's health, due to improper working of medical apparatus. To overcome this and to make OT tech savvy Li-Fi can be used to access internet and also to control medical equipment.
3. Cheaper Internet in Aircrafts: The passengers travelling in aircrafts get access to low speed Internet that too at a very high price. Also, Wi-Fi is not used because it may interfere with the navigational systems of the pilots. Li-Fi can easily provide high speed Internet via every light source such as overhead reading bulb, etc. present inside the airplane.
4. Underwater applications: Underwater ROVs (Remotely Operated Vehicles) operate from large cables that supply their power and allow them to receive signals from their pilots above. If their wires were replaced with light — say from a submerged, high-powered lamp — then they would be much freer to explore. They could also use their headlamps to communicate with each other, processing data autonomously and sending their findings periodically back to the surface.
5. Disaster management: Li-Fi can be used as a powerful means of communication in times of disaster such as earthquake or hurricanes. The average people may not know the protocols during such disasters. Subway stations and tunnels, common dead zones for most emergency communications, pose no obstruction for Li-Fi.
6. Applications in sensitive areas: Power plants need fast, inter-connected data systems so that demand, grid integrity and core temperature (in case of nuclear power plants) can be monitored. The Radio communication interference is considered to be bad for such sensitive areas surrounding these power plants. Li-Fi can offer safe, abundant connectivity for all areas of these sensitive locations. Also, the pressure on a power plant 12 own reserves (power consumption for Radio communications deployments) will be lessened.
7. Traffic management: In traffic signals Li-Fi can be used to communicate with passing vehicles (through the LED lights of the cars etc) which can help in managing the traffic in a better manner resulting into smooth flow of traffic and reduction in accident numbers. Also, LED car lights can alert drivers when other vehicles are too close.
8. Mobile Connectivity: Mobiles, laptops, tablets, and other phones can easily connect with each other. The short-range network of Li-Fi can yield exceptionally high data rates and higher security.

IX. Result

This review paper contributed towards upcoming new technology i.e., data communication using light, which was proved by successful transmission of an image by using light as an intermediate medium. Also, provides the insight to technology and problems and advantages to this useful technique of data transmission

X. Conclusion

This work proves that we can use light as a medium for data transmission wirelessly from one point to another. The project deals with designing a simple and low-cost data communication system using IR LED transmitter and Photodiode receiver, GLCD and microcontroller unit that controls the process and force components to work according to the UART protocol. Although this technology is still in its infancy, with further studies and development its far-reaching applications will only get better. VLC technology is all about using LED light bulbs meant for illumination to also send data simultaneously. It is best suited as an alternative for data transfer where radio transmission networks are not desired or possible. In future, we will be able to transmit an image, audio and even a high-definition video using LED light bulbs.

Features such as high bandwidth, non-interference with radio waves (in electromagnetic-sensitive areas) and non- hazardous to health has made VLC an attractive technique for future communication. Li-Fi is 100 times faster than analogous Wi-Fi, which uses RF for communication. The optical wireless communication system is a good replacement for the regular communication system. VLC is a rapidly growing segment in the field of communication. The purpose of Li-Fi technology is to provide a highspeed data communication using visible light spectrum. Now Li-Fi is on-going of research, it has a potential advantage that can make a supplement RF communication and can be used to improve wireless network performance. Although Li- Fi has a good performance in the transfer rate, Li-Fi is not good enough when deploy in an outdoor in sunlight or other condition. Li-Fi will probably not completely replace Wi-Fi, these two technologies can be used together to achieve more efficient and secure network.

XI. Future Scope

This technology can be enhanced or worked for video communication and for setting up internet connection. The possibilities are numerous and can be explored further. If this technology can be put into practical use, every light source can be used something like a Wi-Fi hotspot to transmit wireless data and we will proceed towards the cleaner, safer and brighter future. The concept of Li-Fi is currently attracting a great deal of interest, not least because it may offer a genuine and very efficient alternative to radio-based wireless communication. Number of subscribers is rising rapidly as a consequence number of devices that needs access to wireless internet is rocketing. So, the radio waves are becoming increasingly clogged, making it more and more difficult to get a reliable, high-speed signal. This technology may solve issues such as the shortage of radio-frequency bandwidth and also allow internet where traditional radio-based wireless isn't allowed such as aircraft or hospitals.

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Energy Recuperation Using Piezoelectric Effect and its practical usage.

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Abstract: Piezoelectric Effect is the ability of certain materials to generate an electric charge in response to applied mechanical stress. The word Piezoelectric is derived from the Greek piezein, which means to squeeze or press, and piezo, which is Greek for "push".
Was discovered by Paul-Jacques Curie and Pierre Curie experimentally in 1880.
Whereas Piezoelectricity is the electric charge that accumulates in certain solid materials (such as crystals, certain ceramics, and biological matter such as bone, DNA and various proteins) in response to applied mechanical stress. And in this paper, we shall study how we can harness electricity through it.

Keywords: piezoelectricity, piezoelectric ceramics, energy harvesting using piezoelectric effect, applications

I. INTRODUCTION

As in today scenario where climate of earth is rapidly increasing and has increase on an average of 2 degree Celsius. There is a need for alternative fuels and ways to harness electricity, energy for human needs as the main cause of this climate change is rapid burning of fossil fuels which is the main source of energy on earth.
Moreover, at present pace of using the fossil fuel they will run out in near future.
So, as an alternative of this we will research about as alternative method of harvesting electricity using piezoelectric effect.
For this first we must study about the material which possess piezoelectric effect which are

commonly called as **piezoelectric ceramics,** some are naturally occurring, and some are human made with the advancement of science and technology.

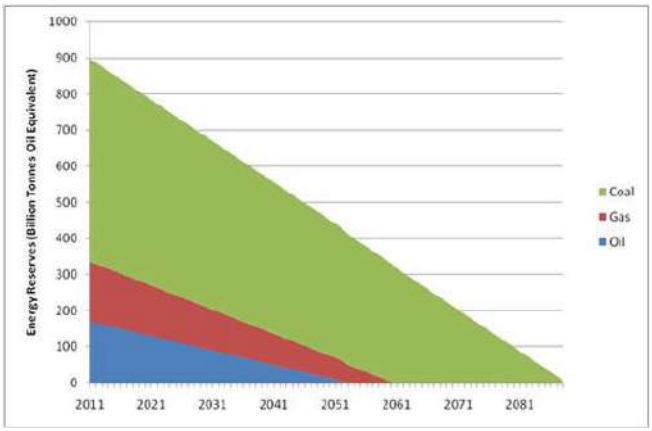

Figure 1 Graph showing future energy reserves for coal, gas, and oil [1]

II. PIEZOELECETRIC CERAMICS/MATERIAL

Piezoelectric materials/ceramics are materials that can generate internal electrical charge from applied mechanical stress.

Some of piezoelectric material are

Naturally occurring crystals:

Quartz(A stable crystal used in watch crystals and frequency reference crystals for radio transmitters), **Sucrose** (table sugar), **Rochelle salt**(Produces a large voltage with compression; used in early crystal microphones), **Topaz, Tourmaline**, **Berlinite ($AlPO_4$)**(A rare phosphate mineral structurally identical to quartz.)

Man-made crystals:

Gallium orthophosphate ($GaPO_4$) (a quartz analog), **Langasite ($La_3Ga_5SiO_{14}$)** (a quartz analog),

Piezoelectric ceramics:

Barium titanate ($BaTiO_3$)(The first piezoelectric ceramic discovered), **Lead titanate ($PbTiO_3$)**, **Lead zirconate titanate (PZT)**(Currently the most commonly used piezoelectric ceramic) ,**Potassium niobate ($KNbO_3$)**, **Lithium niobate ($LiNbO_3$)**, **Lithium tantalate** ($LiTaO_3$)**, Sodium tungstate (Na_2WO_4)**

Biological piezoelectric materials:

Tendon, Wood, Silk, Enamel, Dentin, Collagen

Piezoelectric polymers

Piezopolymers are lightweight and small, thus growing in popularity for technological application.[2]

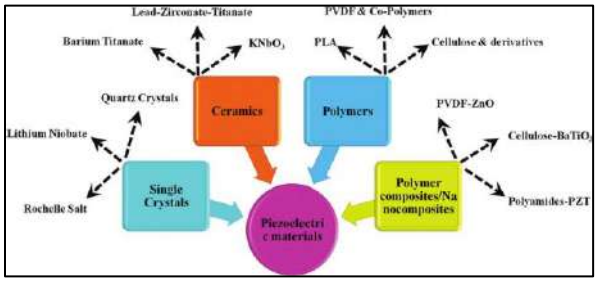

Figure 2 piezoelectric material [3]

III. WHAT CAUSES PIEZOELECTRICITY?

In most crystals (such as metals), the unit cell (the basic repeating unit) is symmetrical; in piezoelectric crystals, it isn't. Normally, piezoelectric crystals are electrically neutral: the atoms inside them may not be symmetrically arranged, but their electrical charges are perfectly balanced: a positive charge in one place cancels out a negative charge nearby. However, if you squeeze or stretch a piezoelectric crystal, you deform the structure, pushing some of the atoms closer together or further apart, upsetting the balance of positive and negative, and causing net electrical charges to appear. This effect carries through the whole structure so net positive and negative charges appear on opposite, outer faces of the crystal.[4]

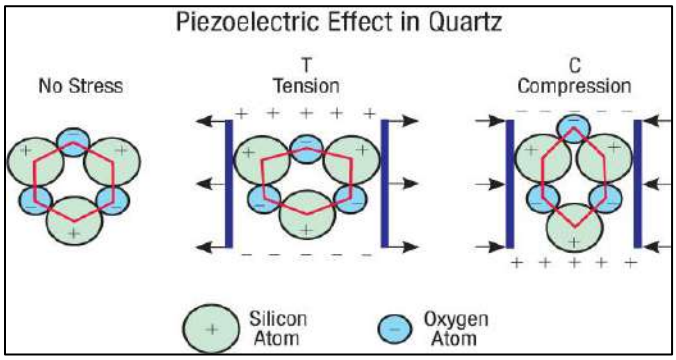

Figure 3 Causes of piezoelectric effect in crystal i.e. tension and compression [5]

Applying mechanical energy to a crystal is called a **direct piezoelectric effect** and works like this:
A piezoelectric crystal is placed between two metal plates. At this point the material is in perfect balance and does not conduct an electric current.

1. Mechanical pressure is then applied to the material by the metal plates, which forces the electric charges within the crystal out of balance. Excess negative and positive charges appear on opposite sides of the crystal face.
2. The metal plate collects these charges, which can be used to produce a voltage and send an electrical current through a circuit.[6]

Let us now look about the simple mathematical aspect of piezoelectricity.

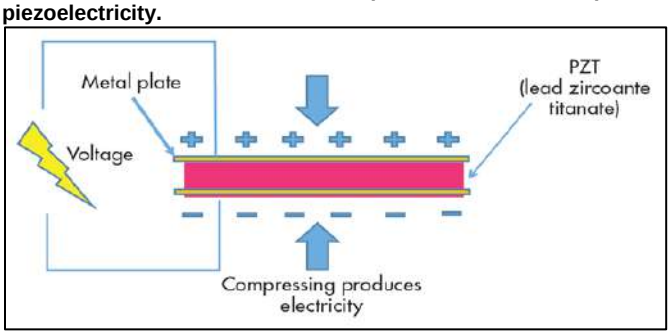

Figure 4 how piezoelectricity generated [7]

When placed under stress, the piezoelectric crystal produces a polarization, *P*, proportional to the stress that produced it.

The **main equation of piezoelectricity is P = d × stress**, where *d* is the piezoelectric coefficient, a factor unique to each type of piezoelectric material. The piezoelectric coefficient for quartz is 3×10^{-12}. The piezoelectric coefficient for lead zirconate titanate (PZT) is 3×10^{-10}.

Small displacements of ions in the crystal lattice create the polarization observed in piezoelectricity. This only occurs in crystals that do not have a center of symmetry.[8]

IV. ENERGY HARVESTING USING PIEZOELECTRIC EFFECT

Typically, an energy harvesting system has three parts

- **The energy source**: represents the energy from which the electrical power will be scavenged— this energy can be ambient (available in the ambient environment, e.g., sunlight, ambient heat or wind) or external (energy sources that are explicitly deployed, e.g., lightning, human heat or vibrations)

- **The harvesting mechanism** consists of the structure which converts the ambient energy into electrical energy.

- **The load**: the sink which consumes or stores the electrical output energy. [8]

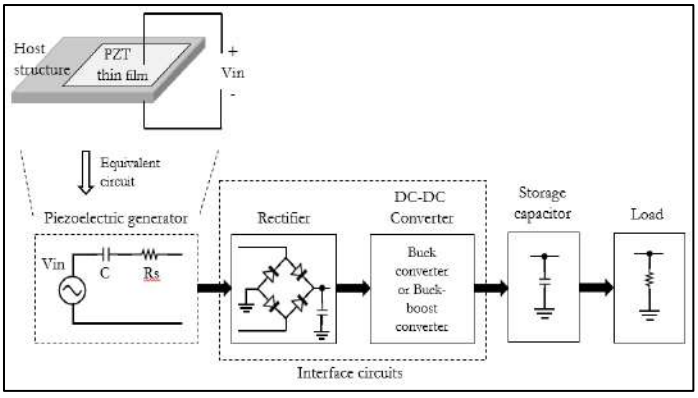

Figure 5 Block diagram of energy harvester using piezoelectric effect [9]

The classic (high efficiency) energy harvester system consists of an **energy generator, capture, storage, management electronics and load** designed to be powered by the harvester, typically a wireless sensor network. In the block diagram above a piezoelectric crystal membrane is shown as the energy generator.

1. The piezoelectric generator/ sensor transforms mechanical vibrations, strain, or stress into electrical voltage/current. This mechanical strain can come from many different sources including human motion, bridge or other low-frequency seismic vibrations, aircraft or vessel vibrations and acoustic noise are everyday examples. Theses generator/ sensor are available in various configuration, they are listed below [10]

2. Full-bridge rectifier(**Buck Boost convertor** (the main objective of a buck-boost converter is to receive an input DC voltage and output a different level of DC voltage, either lowering or boosting the voltage as required by the application)) is commonly used as rectifier circuits to convert the AC output of a piezoelectric into a DC voltage. The rectifying circuits consist of 4 diodes. The voltage needs to

rectify due to the need for constant supply of voltage light up the series of LED placed in parallel.

3. Step 2 initiates the capture and storage operation. The detector can accept instantaneous input voltages ranging from 0.0V to +/-500Vac and input currents from 200nA to 400mA in either a steady stream of pulses or intermittent and irregular manner with varying source impedances. Early harvester electronics required a minimum of 4V input to capture and store the energy from PZT and other generators. More recent designs feature a front-end voltage booster and claim to initiate capture and energy storage with voltage inputs aslow as 100mV.[11]

4. The energy is stored in **super capacitor /Li-on battery,** which when charged get utilize by load (which can a low energy consuming device)

V. APPLICATION OF PIEZOELECTRIC EFFECT

- harvesting electricity is the one of the major applications of piezoelectric effect.
- MEMS devices have become more commonplace as more integrated capabilities are required in smaller packages, such as cell phones, tablet computers, etc. The advantage of MEMS devices is that gyroscopes, accelerometers, and inertial measuring devices can be integrated into chip-sized packages. To accomplish such a feat, piezoelectric actuators and sensors are often used.
- In the field of small robotics, small power-efficient mechanical actuators and sensors are needed. With the use of piezoelectric actuators, building something as small as a robotic fly that can crawl, and fly is technically feasible.
- Many acoustic-electric stringed instruments utilize piezoelectric pickups to convert acoustic vibrations to electric signals.
- Some microphones (such as contact microphones for percussion instruments) use piezoelectric materials to convert sound vibrations to an electrical output.
- This is, perhaps, the most well-known and ubiquitous use of piezoelectricity. In a piezoelectric ignitor, a button or trigger is used to cock and release a spring-loaded hammer, and the hammer is used to strike a rod-shaped piezoelectric ceramic.
- Piezoelectric speakers are featured in virtually every application that needs to efficiently produce sound from a small electronic gadget. These types of speakers are usually inexpensive and require little power to produce relatively large sound volumes.
- Piezoelectric buzzers are like piezoelectric speakers, but they are usually designed with lower fidelity to produce a louder volume over a narrower frequency range.[12]

VI. RECENT DEVELOPMENTS IN FIELD OF PIEZOELECTRICITY IN INDIA.

1. Researchers at Bengaluru-based Indian Institute of Science have developed piezo-electric material using ceramic. Piezo-electric materials, which change their shape when an electric field is applied, have a wide range of applications from use in inkjet printers to ultrasound machines. [13]

VII. SOME IMFORMATION ABOUT OUR PROJECT

- Our project is about generation of energy from moving object on road and storing it for street lighting and other electrical usage on road.

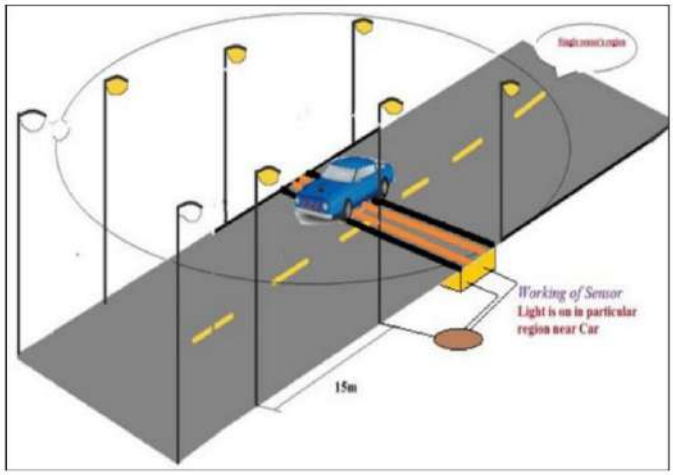

Figure 6 overview of the project [14]

- Piezoelectric crystals can be embedded underneath the asphalt layer to utilize the energy generated due to the vehicle motion, as illustrated in Figure 6 and 7.
- As the vehicles move over the asphalt layer, the wheels exert a force or
- pressure into the crystals and thus deform. This deformation will absorb the force and undergo the process of power generation to be stored in batteries. The use of storage is essential at this stage, since street lights are operated for 12 h per day. Therefore, the energy can be dispersed when required.
- Energy Generated: Power asphalts used to provide electrical power to streetlights was tested in Heifer intersection, Israel. The set up involved piezoelectric devices lay beneath asphalt roads, at a total distance of 10 m only.
- The setup has generated electrical power of two Kilowatt-Hours (KWh) [15]. Another test has been conducted by POWERleap, a licensed technology manufacturer, has provided a data proving the reliability of power asphalts. The experiment involves 1 Km stretch power asphalt with vehicle passing rate of 200-400 in 16 h. Based on this experiment, the total electrical energy generated range between 400 KWh - 600 KWh. The revealed as a main source of energy as it saves cost and reduces fossil fuel consumptions.[14]

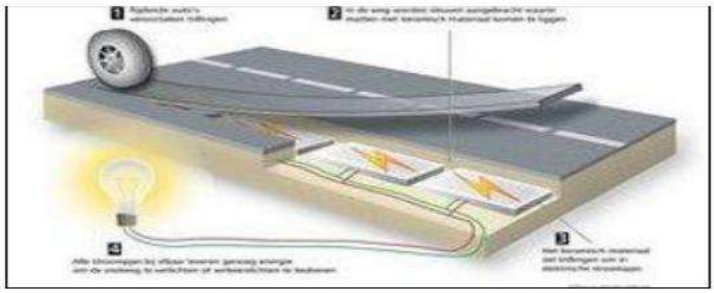

Figure 7 Placement of photoelectric sensor

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LASER BASED SECURITY ALARM SYSTEM AND ITS APPLICATIONS

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Abstract: Security is a most important factor today. I decided to make a laser based security alarm system. The work used laser light for covering of entire area. When any person or object crossover the laser line the security alarm will ringing and also the focus light will “on” to focus the entrance of unauthorized person. It is helpful an invisible boundary of proposed area of the work. The system has built with the low cost and high performance. The prosed work consumed very less power.

Keyword: Laser, Security System, LDR, Buzzer, Breadboard, Battery and Connecting wires.

INTRODUCTION:

Security is a most important factor today. Technology develops day by day in the world. The criminals are also developing their technology to perform operations. Therefore, technology must be latest to protect them of their crime works. So, we decided to make a security project. The work used laser light for covering of entire area. Laser light fall for long distance with losses. It is visible at the both source and destination.This modern is designed with the help of these properties, which may name as “laser security”. If any person come across the same then alarm will ring.

In this security system inexpensive laser torch is used with key ring facility. The advantage of this security locks is that you can use any laser torch or pointer that easily available. It uses input keys for security.

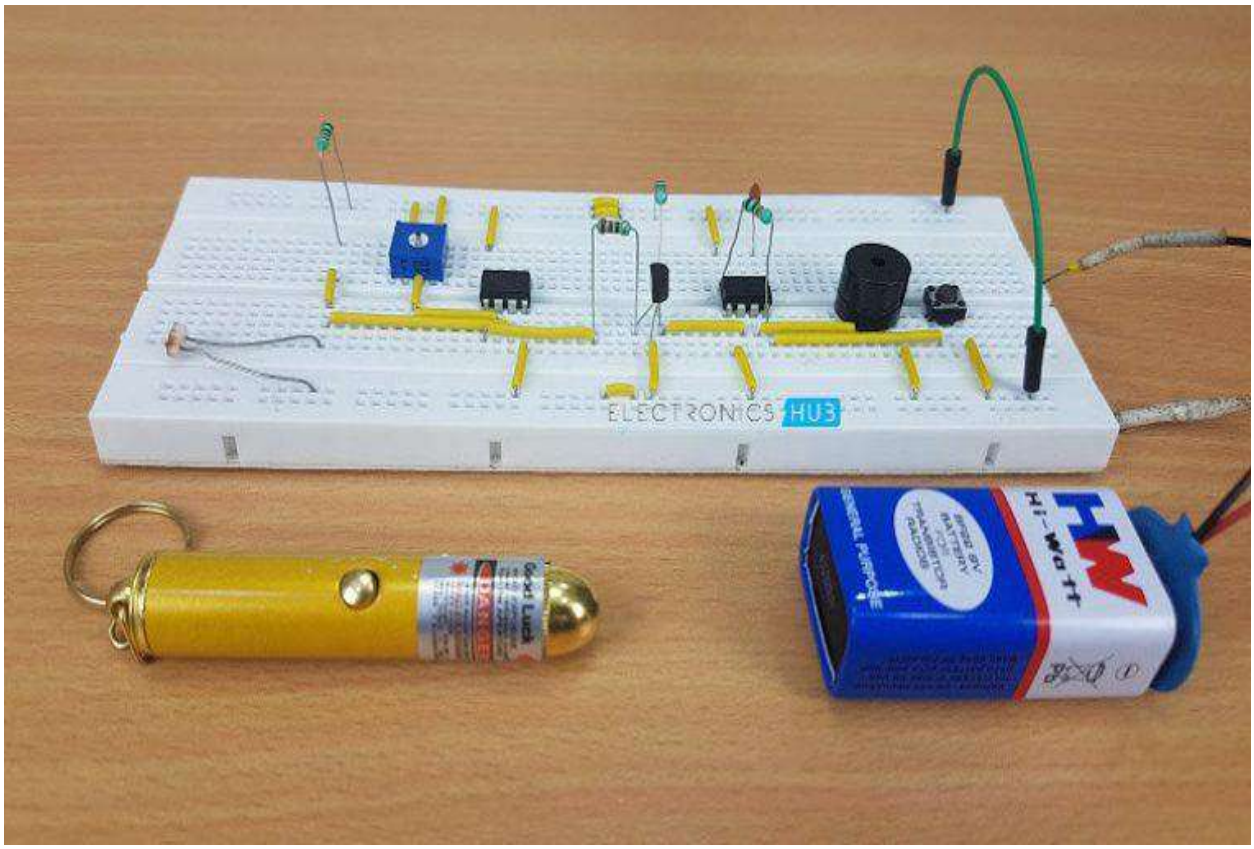

Figure 1: Block diagram

COMPONENTS/MATERIALS REQUIRED:

Breadboard- A Breadboard is also known as protoboard. It is a type of solder less electronic circuit building. You can build a electronic circuit on the breadboard without any soldering.

LDR- A photo resistor is also called the light dependent resistor or photocell is a light control variable resistor. The resistance of a photo resistor decreases with increase in incident light intensity.

Resistor-It is passive component. It has two terminals. It is used to resistance flow of current in the circuit. It is also used to adjust current flow, divide voltages and biasing elements. It is also used to terminate lines with other users.

Transistors- A transistor is a semi-conductor device used to amplify or switch electronic signals and electronic power. It is the main component to design any modern or basic circuits.

Laser Pointer- A laser pointer or laser pen is a small handheld device with a power source and laser diode emitting a very narrow coherent low-powered laser beam of visible light.

Push button- A push to make switch allows electricity to flow between its two contacts when held in.

LED- A light emitting diode is a semiconductor device that emits light when an electric current is passed through it. Light is produced when the particles that carry the current combine together with the semiconductor material.

Battery- A container consisting of one or more cells, in which chemical end is converted into electricity and used as a source of power.

Wire – It is cylindrical, flexible and other rod of metal. It is used to connect components through metal, hole in a die and plate.

Buzzer- An electronic device that makes a buzzing noise and isused for signaling.

Battery -It is used useful element to operate any devices.

EXPERIMENTAL SETUP:

- Connect a photocell to a 4 x resistor. It is used to pick up laser light for alarm.
- Use a transistor to link the resistor. The attached schematic should demonstrate how the part come together. Use a breadboard to hold them in a place and make sure the board is a small enough to fit in.
- We can use tape, glue and other material.
- It requires 9 V battery.
- Turn the laser on which the toggle switch and make sure it lines up perfectly with the photo cell. The alarm is now activated.

WORKING:

- This circuit is based on LDR(Light Dependent Resistor), variable resistor in which the resistance varies according to the light intensity falling on it.

- LDR and resistor forms a potential driver network which is the main part of our security alarm circuit.
- The voltage drop across the LDR is used to drive the transistor switch. When the voltage drop is above cut in voltage, the transistor is turn ON.
- It needs LDR with low resistance. Since the LASER light is continuously allowed to fall on the LDR surface.
- The beep sound from the security alarm gives the indication of some security alarms.

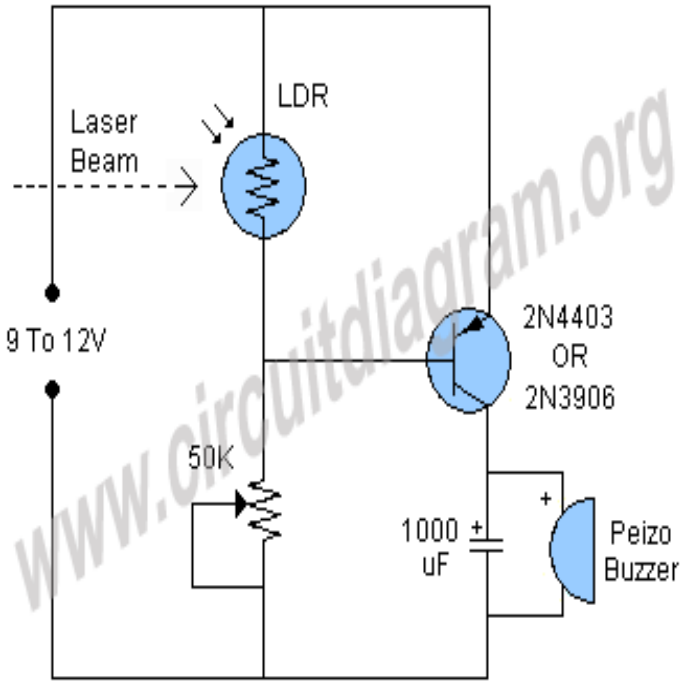

Figure 2: Circuit diagram

CONCLUSION:

- Home security is rapidly growing field and there are new and improved burglar alarms popping up every day.
- With the rapid advancement of technology the field is turning out to be an area full of scope and new changes can be made to make it's more efficient.
- It is very important security system to all.

FUTURE SCOPE:

- Cost of the work can be reduced by technology.
- This system also help to more reliable to the enduser.
- It has ability to work continuously : it is not only human but also a small animal or any other movable objects.

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AUTOMATIC ROOM LIGHT USING ARDUINO AND PIR SENSOR

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Abstract:

Automatic Room light controller using Arduino and PIR sensor can be used to turn on and off the illumination system of home office routinely by sensing the existence of human [1]. Such automatic room lights system can be can be implemented in your classrooms, faculty cabins, garages, staircase, bathrooms, etc. where we do not need constant light but only when individuals are existing [1]. Also, with the assistance of this system, we can save the energy bill as power will be consumed only when human is present when required lights will be spontaneously turned on or off. This paper proposed system automatic room light controller using Arduino and PIR sensor and relay module. PIR sensor will spot the human activity and based on response of PIR sensor unit will control the switching action.

Keywords: Arduino uno, PIR sensor, Relay unit, room light.

INTRODUCTION

Scientific discovers delivered and comforts. Technology has become vital and essential part of our lives. advancement in technology is last few years. Electrical energy has become and part of human life. In recent years the people are looking forward for the automation in their daily life, and even now the people are excited to save energy consumed to reduce the expenditures. Generally, in public and private sector companies, offices, school and colleges most of the people are not interested to switch off the electronic machines like fan light, etc. while going out of the room [1].

The Automatic room light using Arduino and PIR sensor is a simple Project, where the lights in the room will automatically turn on upon detecting a human motion and stay turned on until the person has left or there is no motion. As a Result, the output of the PIR sensor becomes high.

Such automatic room lights can be implemented in staircases, bathrooms, etc. where we do not need continuous light but only when we are present.

Automatic room light controller using Arduino and PIR sensor can be used to turn on off and the illumination system of home/office by sensing the existence of human [1]. Such automatic room lights system can be implemented in your classrooms, faculty cabins, staircases, bathrooms, etc. where we do not need constant light but only when individuals are exiting [1]. also, with the assistance of this system, we can save the energy bill as power will be consumed only when human is present. when required lights will be spontaneously turned on or off. This paper proposed system of automatic room light controller using Arduino and PIR sensor and relay module.

PIR sensor will spot the human activity and based on response of PIR sensor unit will control the switching action.

The main parts of the proposed system are Arduino, PIR sensor and the relay module. This system can be considered as a major application of PIR sensors.

The remaining paper is ordered as: section 3rd purpose system description about hardware and software design.

COMPONENTS REQUIRED FOR AUTOMATIC ROOM LIGHTS USING ARDUINO PROJECT

1. Arduino board
2. Bread board
3. PIR SENSOR
4. Relay module
5. Holder
6. Male and female wires

BLOCK DIAGRAM OF AUTOMATIC ROOM LIGHT USING ARDIUNO AND PIR SENSOR

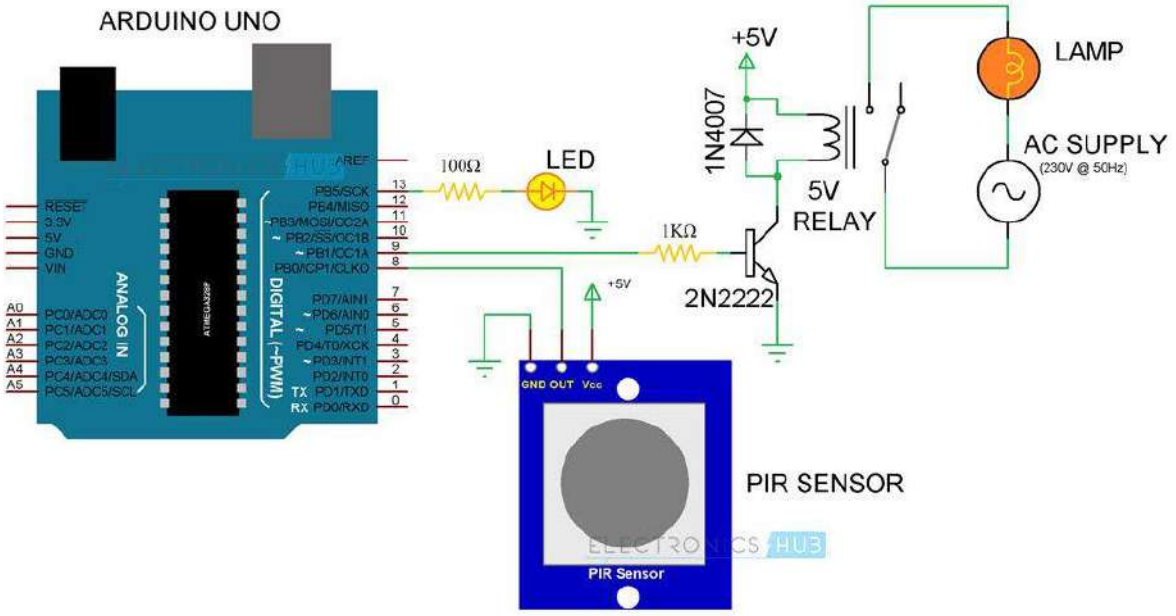

Fig 1 . Arduno

Whenever PIR sensor detects any body movement, its output pin becomes high, which applies the voltage to the base of the transistor gets on, and current started flowing through the coil. Coil in relay get energies and create electromagnetic field.

the permits much larger current (220v Ac) to flow, which turns on the bulb. You can increase or decrease the bulb on duration by setting up PIR Sensor.

Component of Description

1.PIR SENSOR

We have already seen about PIR sensor in the PIR motion sensor in the tutorial and also implemented in a variety of projects like home security system and automatic door opener.

The passive infrared alarm does not release energy to space but relies on receiving infrared from the human body to make an alarm. Any object with temperature is constantly radiating Infrared to the outside world.

FIG. 2 PIR SENSOR

2. ARDUINO BOARD

The Arduino uno is an open -source microcontroller board based on the microchip ATmega328p microcontroller and developed by Arduino.cc. the board is with sets of digital and Analog input/output (I/o) pins that may be interfaced to various development boards (shields)and other circuits. The board has 14 digital I/o pins (six capable of the PWM o/p)6 Analog I/o pins, and is programmable with the Arduino IDE (integrated development environment via a type b USB cable.

it can be powered by the USB cable or by an external 9volt battery. It also has 16mhz ceramic resonators, a USB connection jack, an ex

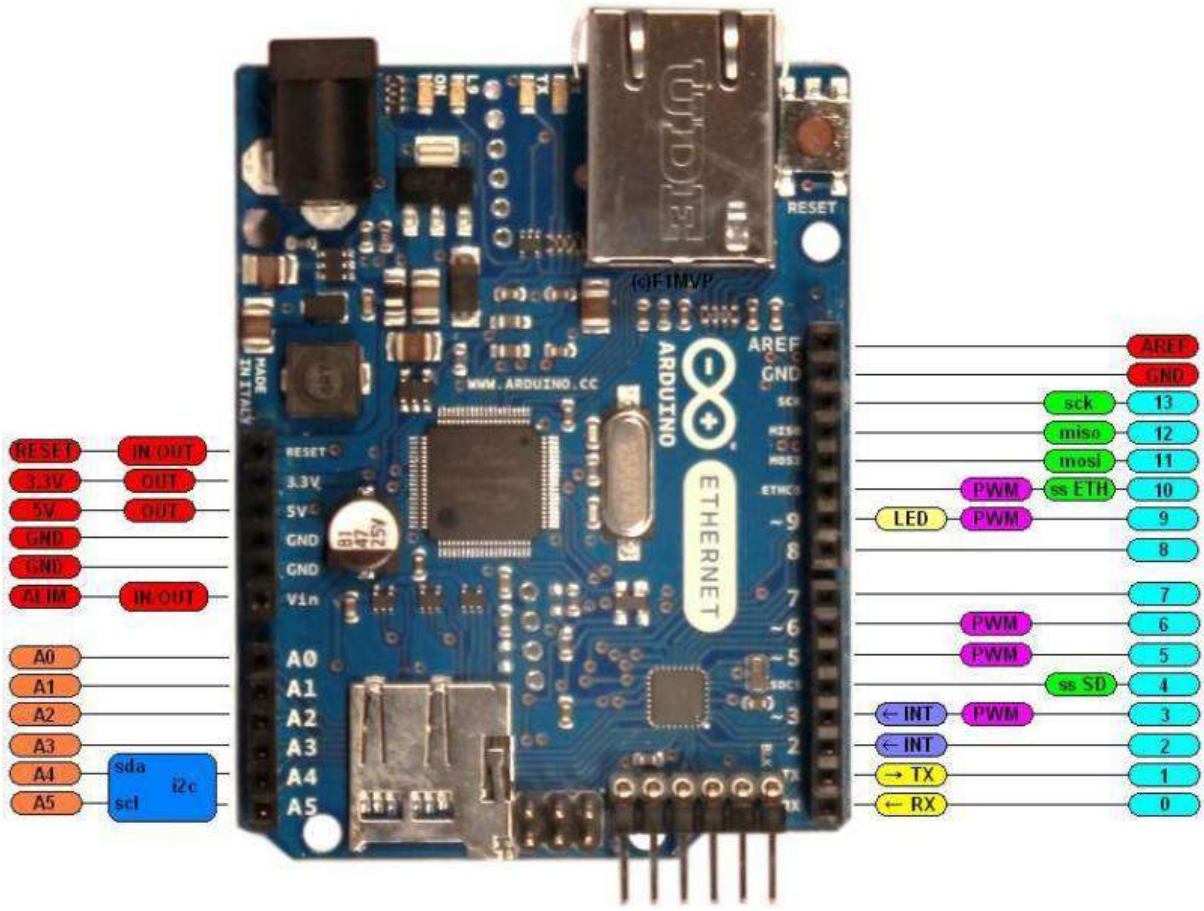

Fig. 3 ARDUINO BOARD

ternal power supply jack (in circuit serial programmer) header and a reset button. Its operating voltage is 5v, input voltage 7 to 12v (limit up to 20v).

3. RELAY MODULE

The relay module is a distinct hardware device used for remoting switching. the relay module houses Relays and one wide voltage range, optically isolated input. These are brought out to up type terminals blocks for easy field wiring. Relays are switch that open and close circuits electromechanically or electronically.

Relays control one electrical circuit by opening and closing contacts in another circuits.

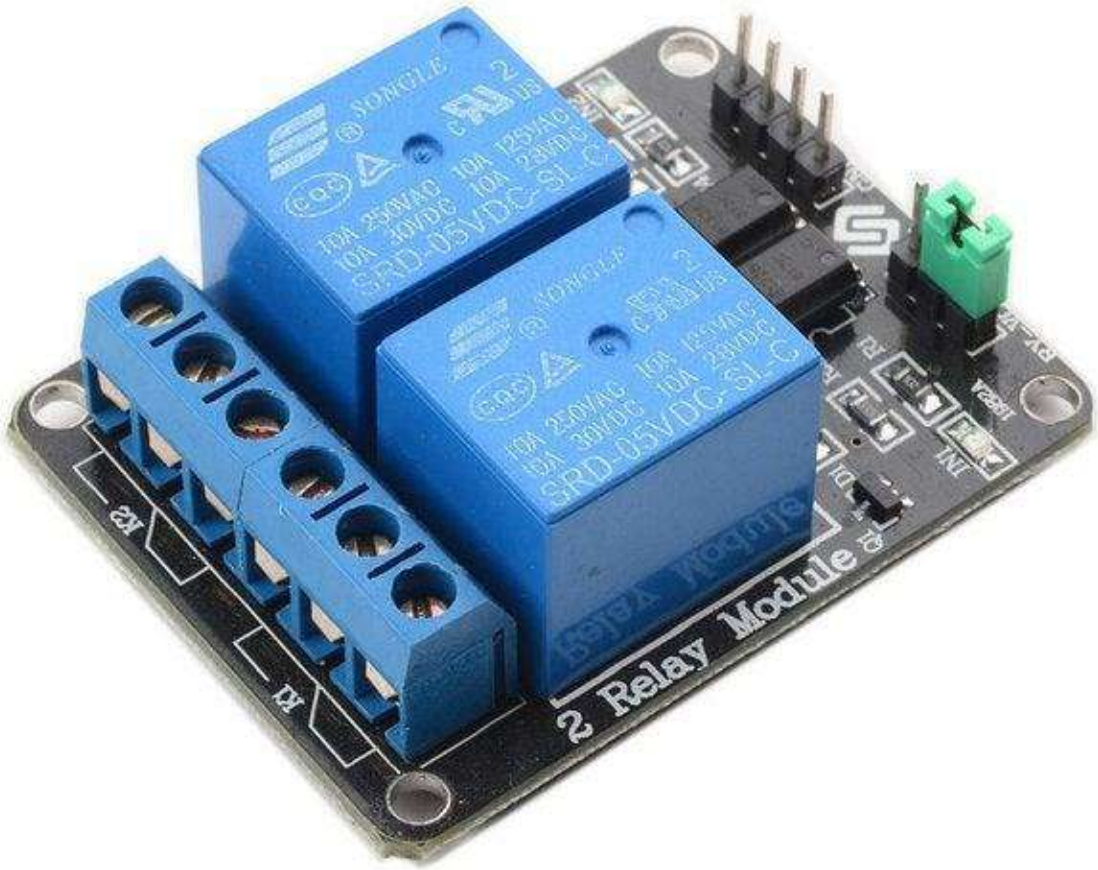

FIG.4 RELAY MODULE

APPLICATIONS

I already mentioned a few applications of the automatic room lights concept. some of them are;

Bathroom lights

1. Hand dryers
2. Toilet flushers
3. security

WORKING OF THE PROJECT

the automatic rom lights using Arduino and PIR sensor is sample project, where the lights in the room will automatically turn on upon detecting a human motion and stay turned on until the person has left or there is no motion.

Working of this project is very simple and is explained here.

Initially, when there is no human movement, the PIR sensor doesn't detect any person and its out pin stays low. as the person enters the room, the change in infrared radiation in the room is detected by the p sensor.

As a result, the output of the PIR sensor becomes high. Since the data out of the PIR sensor is connected to digital pin 8 of Arduino, whenever it becomes high, Arduino will activate the relay by making the relay pin low (as the relay module is an active low module).

This will turn the light on. The light stays turned on as long as there on as long on as there is movement in front of the sensor.

CONCLUSION AND FUTURE SCOPE

In the proposed system decision are taken based on presence of human but here we can also interface LDR (light dependent resistor) along with PIR sensor for better working of the system. this system can also be controlled from the mobile by just single click. Application of this system are;

1.it can be used in college labs, school, etc.

2. it an also be used in bathrooms, staircases, etc, in the house.

FUTURE SCOPE

From the proposed system we can conclude that an approach is taken to control. the room lights using various devices, as a now days enormous amount of energy is wasted in daily life. With the help of this system the energy wastage can be preserved and can be contribute to large wastage amount of power saving. The total effective cost of system is very less.

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Fingerprint Sensor Based Car Door Handle Design

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Abstract—Automotives are a major necessity for everyone in their daily lives. For the very same reason, protecting the vehicle against theft and damage also becomes very important Security systems besides fingerprint technology are RFID, Information, security Electronic Circuit Units Boards (ISECUB), Automatic Cop caller Mechanisms, but each have limitations like keyhole malfunctioning, network delays, improper capturing of photos, etc. Till now, the best form of security is through biometrics techniques. Within the past decades, humans have evolved their security systems by implementing biometrics techniques using technologies like face unlock, scanned signatures, QR code systems, etc. Nowadays, fingerprint technologies are flourishing in the market and, thus they are being utilized for detecting and authorization purposes in industries and other wide areas of applications to provide secure access. Fingerprint technology has now become the greatest and most successful process for person's identification, as for each individual fingerprints are unique because of minutiae; which essentially are lines which follow a particular track and end up at the joining of other tracks.

Index Terms—Fingerprint, Design, Automobile, Handle

I. Introduction

In the field of fingerprint identification, vast amounts of researchers and works have already been done so far. From a research by Spiceworks, 62 percent of organizations have already implemented biometric authentication, while 24 percent were planning to utilize this in the coming years. The latter findings also indicate that fingerprint authentication is 10% secure as compared to other traditional methods, such as passwords, PINs numbers, and other confidential questions. Fingerprint and face scanners are currently the most widely used security techniques in phones and organization. The studies showed around 57 percent of organizations were using fingerprint technology, and 14% were using facial recognition technology. Besides these, other fingerprint methods includes hand architecture recognition (5%), iris scanning (3%), voice recognition (2%), and hand-vein recognition (2%).

Fingerprints not only uniquely identify each individual but they also represent biological characteristics. The biological characteristics include the physical body parts like fingerprint, face, DNA, retina scanning, etc, while the habitual actions rely on actions performed by an individual in life like Voice recognition, and signature-scan.

The fingertip consists of a combination of many lines or ridges, known as minutiae. These points are actually the points whose structure changes or bifurcates [1].

According to the types of loops, there are various kinds of fingerprints. Nearly 65% patterns are loops, 30% are whorls and the rest 5% consists of arches and tented arches. The complete process of identifying fingerprints via patterns is called Fingerprint Identification/ Recognition System (FIS/ FRS) [2].

Fingerprint authentication systems depend on following modes: Registration and Recognition phase. In the Registration mode, the sensor acquires the user fingerprints and its identity and keeps it in a directory for recognition and identification.

This phase is sub-divided into verification and identification phases. In the former phase fingerprints of one person are verified and cross checked from the stored database using algorithms. The process is (1:1) Matching. In second mode, the sensor requires the fingerprint data instead of data which is already updated in the directory to identify and detect user identity. This method is called (1: N) matching- used to seek and track thefts and criminals.

Fingerprint recognition process depends on 2 factors namely non rivalness and stability. Uniqueness of fingerprint means that every individual has a non rival fingerprint. No two human-beings including twins cannot have identical fingerprints. These biometrics features are constant in life till aging, and are called stability or permanence.

This paper emphasizes on approaches for automatic identity detection, namely fingerprint recognition and various vehicle security systems. This paper describes how we can create a keyless entry in a car for the driver using his/her fingerprint, thus replacing entry with key feature which earlier was more prone to thefts and damage. This feature increases the security of the automobile, and also improves user experience [3].

The major components include a fingerprint sensor, a nodemcu. Fingerprint recognition using an optical sensor measures highly precise and accurate digital images of the fingerprint [4].In order to add a new user (other than the driver) to allow access to the car, we have also imposed a

time delay strategy. Besides this, a secure web and android application system is developed to display the list of the total number of people eligible to unlock the car.

II. Project Design

A. Tools Used

1) NodeMcu: The module named "Nodemcu" is actually formed from 2 words "node" and "MCU" (microcontroller unit). The system's runs on ESP8266 WiFi System on the Chip from Espressif organisation, and it's hardware comprises of ESP-12 wifi module. For programming, Lua scripting language is used [5].

2) R305 Fingerprint Module: A fingerprint sensor module is a module which consists of TTL UART interface. It functions by storing fingerprint image in the module. This module can configure the data in two formats i.e 1:1 or 1: N mode for identifying the person. It can be directly interfaced with 3v or 5V microcontroller.

Following are different fingerprint sensors: Optical sensor, Capacitance sensor, Ultrasonic sensor, and Thermal sensor. A general scanner works by obtaining an image of person's fingerprint and then finding a match for it in its database. Fingerprints are measured in dots/inch.

1. Optical scanners operates by taking a visual imprint of tip of finger using a digital scanner.
2. Capacitive sensor scanner also called CMOS scanners take help of capacitors to generate current to generate a fingerprint image. Such kind of scanner are very good in precision.
3. Ultrasound sensor scanners uses higher frequency sound signals which penetrate inside the outermost skin layer to generate digital images.
4. Thermal scanners operates by sensing the temperature differences on the contact surface, in between fingerprint lines and ridges and then generates a final digital image.

3) 3DS Max: It is the software used for 3D graphics, models, animations, games designing. The software provides different view points i.e. top view, perspective view, Left and the Front view on a single screen. It has many features like dynamic simulation, map creation, customizable interface, etc. Thus we used this software to design the handle of the car door.

B. Architecture

We have worked towards building the car door handle containing the fingerprint sensor and other modules for successfully unlocking the car via fingerprint (biometric) authentication. To accomplish this we have use NodeMCU which controls the system. To store the information of the fingerprints which will be added by the user, we have developed a local server on our machine using XAMPP Server. Then, we created a database on local server and provided the user with CRUD options within the database. To make these option accessible to user and user friendly we have also created a website running on the XAMPP server. This provides the user proper feel of performing the operations. All the Options are accessible by a click.

We have converted the same website to android app so that user can perform any operation via mobile device or via web search. This project also records the activity i.e. the data of the people who uses the system and record their details with a timestamp. All these details are stored inside our database. User can access the details anytime on the webpage or app and he also has the option to select details for a particular date. Besides this the user can export these details to an excel (.csv) file by just one click.

Pairing a fingerprint for a new person is very simple. First, the user have to register on the webpage, then after registration he/she needs to double tap on the Fingerprint sensor to enable the pairing mode and the hold the finger for 5 seconds to record their fingerprint. The R305 sensor used in this project can store 127 different fingerprints.

When the user tries to open the door, he holds the car door handle and thus the thumb gets placed on the fingerprint sensor. The R305 fingerprint sensor then records the fingerprint and send it to NodeMCU which sends it and compares with the database. If the record is found i.e. a match is found then the relay is triggered which is further connected to central locking and thus the car door gets unlocked. If the match is not found then the car remained Lock. The above process takes only milliseconds to complete thus, providing the user instantaneous door unlock operation.

III. Evaluation and Results

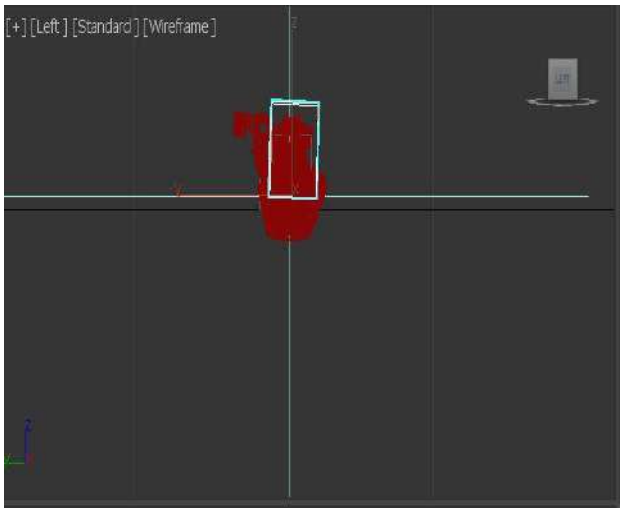

Fig. 1. Left View of Handle

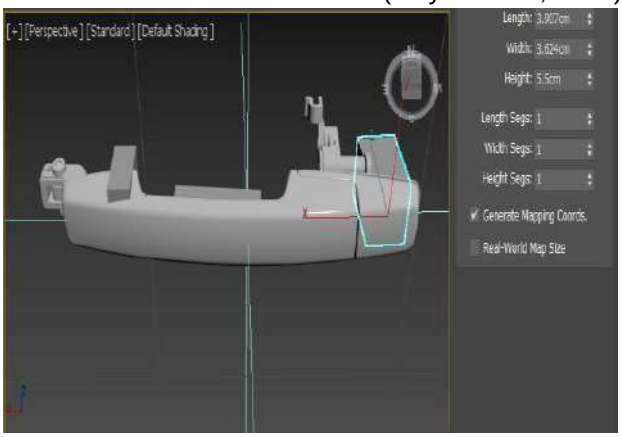

Fig. 2. Perspective View of Handle

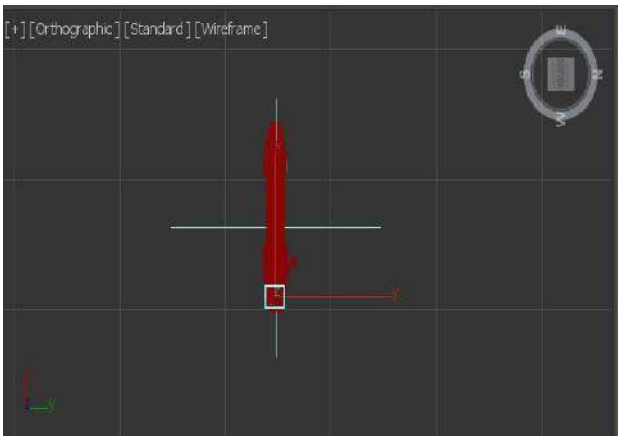

Fig. 3. Top View of Handle

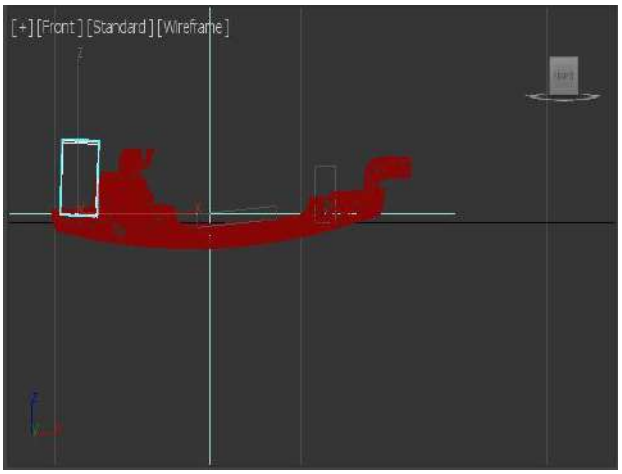

Fig. 4. Front View of handle

The car door handle designed (Fig. 1-4) using 3Ds max contains the embedded slot for fingerprint sensor R305, Nodemcu and a Relay. Thus all the modules will be fit inside the handle and thus the user have to just install the handle in the car. The slot for fingerprint sensor is designed according to its dimensions i.e. 5.44 cm height and the base dimensions of 2.5cm * 3.2 cm. The figure (Fig. 5 and 6) shows the web

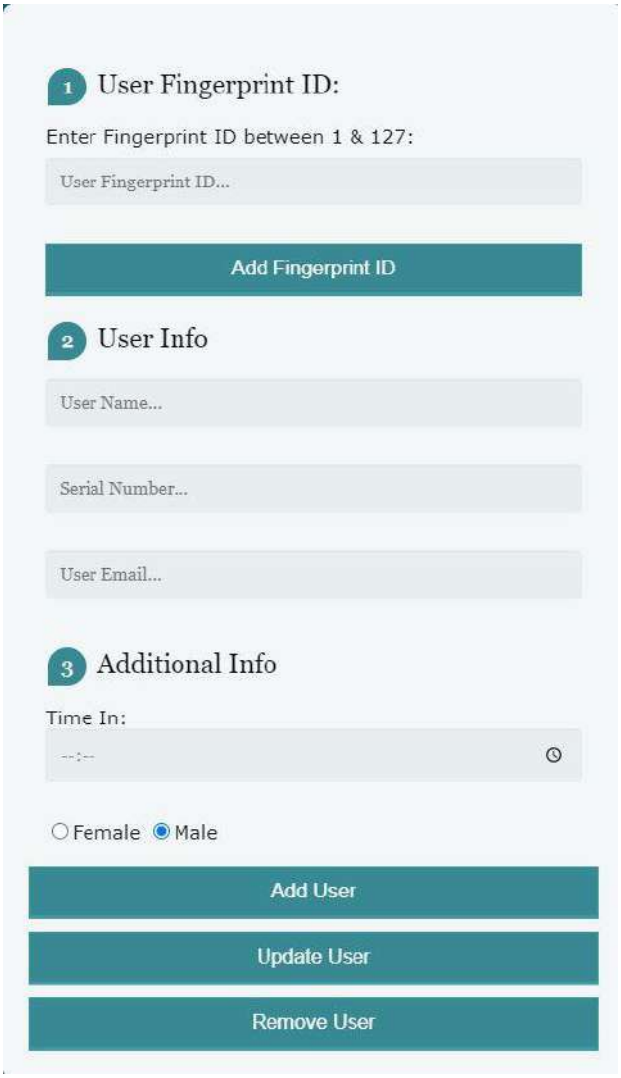

Fig. 5. User Operation Window

Fig. 6. User View Window

interface where the user have the option to add or remove the fingerprints or update the same as per his convinence.

IV. Advantages and Applications

A. Faster than Traditional Methods

While other methods of unlocking your car might take a few moments, a fingerprint sensor can authorize the vehicle to unlock in a few milliseconds.

B. Easy Monitoring

With the help of the website and android app it will easy to monitor who is accessing your vehicle. It also has the capability to determine how long someone is using the vehicle.

C. Convenient

As the fingerprint sensor provides keyless entry to your vehicle, it is much more convenient for people who often forget their keys. This will also remove the necessity to carry a key.

D. Secure and Accurate

As every person's fingerprint is different it is almost impossible for any unauthorized person to unlock your vehicle. As the research on the fingerprint sensor has increased over the past few years it has increased the accuracy of the sensor. This provides a high level of security.

V. Conclusion

As the dependence on automotives has increased so has the need for the security of our vehicles, and like everything else the technology for security has also evolved. While RFID, ISECUB, and other technologies are out there to use as a security option for vehicles; they all have their shortcomings. With the invention of fingerprint technology the security systems in most fields have been revolutionised and similarly the automotive industry has followed suit. As fingerprint identification is much more secure as compared to the other methods of security it is perfectly suited for implementation and integration with automotives. Not only is it highly secure but also provides a smoother user experience as there is no need to look for your keys anymore just a swipe of your finger. In our paper we worked towards implementing a car door handle that contains a fingerprint sensor for unlocking the car. In our take on this topic we are using a NodeMCU to control the system which also stores the data in a database on our local server. This database can be utilized by the end user to add and remove authorized fingerprints and to monitor the activity of the people who use the system. This database is easily available on a website and an android app so that there is easy access to the data in addition to the add and remove fingerprint feature. Our design of this system should potentially be compatible with most vehicles.

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Gas Leakage Detection System

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Abstract---Gas leakage has become a serious problem in our country's daily activities. So in this evolving world with technology, Home automation becomes affordable. Lots of people and industries are automating their homes and industries. Their daily routine work has been automated like fan, lights, temperature etc. Adding a gas leakage detection to it makes it a great asset. It decreases the chances of gas explosions which may cause huge damage to the life and property. It increases the security as whenever there is a leakage of gas detected by the gas sensor (MQ 6) in the home or in the neighbour it alerts the user via a buzzer.

Keywords---Gas sensor, Microcontroller, GSM module, Gas Leakage, Monitoring, security.

I. INTRODUCTION

Now a days gas leakage has become a serious problem in places like industries, residence etc. The Liquefied Petroleum Gas (LPG) is a mixture of hydrocarbon gases which is used as a fuel in many applications like automobiles, industries, homes etc. It has been noticed that the leakage of such gases causes the harmful and dangerous accidents. Bhopal Gas Tragedy is an example of such leakage of gases. The Methyl Isocyanate gas got leaked and over around 500000 people were exposed to it. In recent Years these accidents are increasing and the reason for such explosions are sub-standard cylinders, not regular checking of cylinders and sometimes there is no awareness of handling gas cylinders. These accidents results in material losses as well as human injuries. In homes this LPG is mainly used for cooking purposes. By the leakage of gas home fires have been occurring frequently and as a result of such fires the threat of human lives and property has been grown in recent years. These gases can catch fire easily because it is composed of propane and butane which are highly flammable.

As the risks of explosions have increased the safety plays a crucial role in today's world as accidents are susceptible to happen anywhere. Therefore an odorant has been added to the LPG gas so that in case if there is any leakage it can be detected easily by most of the people. But this detector will not work for those who have reduced their sense of smell. So, a Gas Leakage Detector become vital and crucial to protect the people from the dangers of the gas leakage.

II. COMPONENTS USED

A. Arduino Uno

Arduino Uno is an open source microcontroller board based on the microchip ATmega328P. IT has different pins i.e., digital and analog input/output (I/O) pins with chargeable point that can be attached with any other devices. When the program is installed into it the Arduino using Arduino.cc starts working and the devices connected to it gets into the motion of their work.

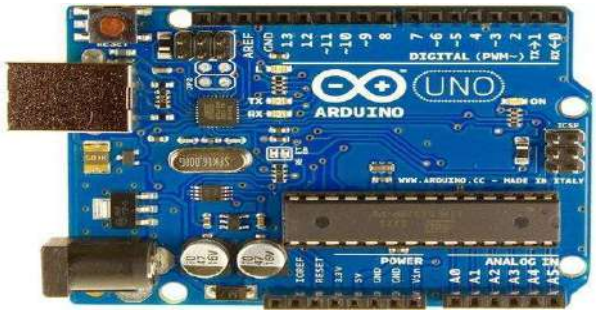

Figure 2.1: Arduino Uno

B. Buzzer

It is used with the metal detector for safety purposes as when the metal detector detects any metallic device the buzzer starts beeping automatically. Since it's small in size therefore it's used in many small as well as big and basic projects. In this project the buzzer that can be used is piezoelectric buzzer or magnetic buzzer.

Figure 2.2: Buzzer

C. LCD

LCD stands for Liquid Crystal Display which is flat and rectangular in shape. In this project it will be used to display the status of the number of people present inside the hall and when is auditorium empty. LCD is also known as thin film transistor because of its active and passive matrix. LCD consume less power therefore used in many other projects and technologies.

Figure 2.3: LCD

D. Gas Sensor

The MQ-6 Gas sensor can detect or measure gases like LPG and butane. The MQ-6 sensor module comes with a Digital Pin which makes this sensor to operate even without a microcontroller and that comes in handy when you are only trying to detect one particular gas.

Figure 2.4: Gas Sensor

E. GSM Module

A **GSM** modem or **GSM** module is a hardware device that uses **GSM** mobile telephone technology to provide a data link to a remote network. From the view of the mobile phone network, they are essentially identical to an ordinary mobile phone, including the need for a SIM to identify themselves to the network

Figure 2.5: GSM Module

III. METHODOLOGY

Methodology is the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge. Typically, it encompasses concepts such as paradigm, theoretical model, phases and quantitative or qualitative techniques. A methodology does not set out to provide solutions—it is therefore, not the same as a method. Instead, a methodology offers the theoretical underpinning for understanding which method, set of methods, or best practices can be applied to a specific case. Through a methodology, we are achieving the knowledge about planning, design, and implementation and testing.

A. Description of Methodology

The entire workflow is divided into 6 steps. These are as follows:

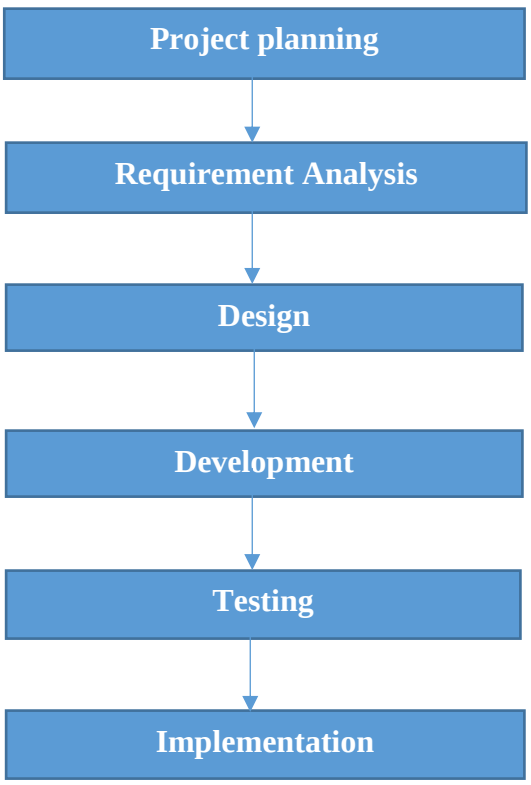

Figure 3.1: Flow chart of Methodology

A. Circuit Diagram

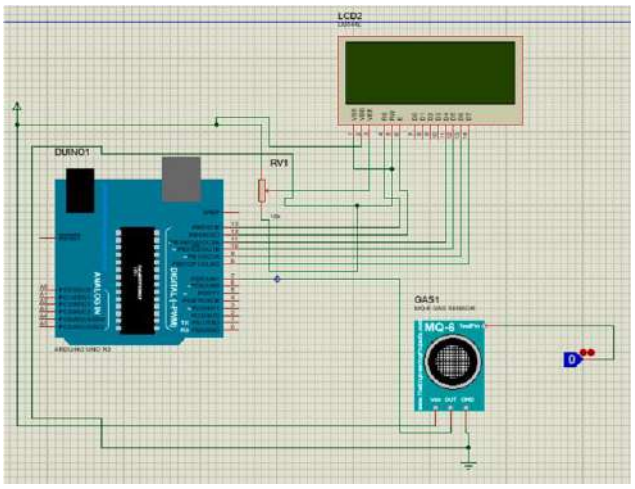

Figure 3.2: Circuit Diagram

B. Working Principles

In the proposed system, gas leaks are detected by MQ 5 sensor connected by Arduino, when Gas leak detected by MQ 5 sensor the motor goes in and the displays a warning message on the LCD display, at the same time a notification will be sent to the user via mobile connected via Wi-Fi. Plus, it works of the proposed program below Load a cell also known as pressure the sensor is used to detect gas weight and the result will be displayed via LCD display If the weight of the cylinder is less than limit, booking confirmation the message will be sent to the user via mobile phone The limit range will be embedded again often developed using C Programming Wi-Fi modem is able to send again receiving messages The message will be sent from the user to the LPG agency and you receive a notification to return that LPG is delivered. However, as part of this program, too detects gas leaks in LPG models through sensors. The LPG gas sensor will generate a signal in UC and here automatically turn off maximum power supply. LCD is used to display a warning message that is “LPG leak detected” is indicated when the leak is detected by a sensor.

IV. RESULTS

The proposed program is designed to find and watch LPG, where a small amount of The LPG is brought closer to the MQ5 sensor, showing the message on LCD meaning “OPEN GAS” during Gas leaks and system check LPG Level also indicates a message that is, “HIGH or DOWN.” As in recent times, the

problems they face Is an LPG gas buyer for gas leaks and reservations News, an improved system will help file for Customer. It helps them to improve their safety practices and major disaster prevention services. It also helps to protect life and property from physical dangers. The main purpose of the proposed program is therefore Detecting gas leaks detected even though it is electric Sensor and user should be notified to prevent damage or The second goal is to gain weight for The residual gas can be made Through the weight sensor. Therefore, the proposed system Helps LPG gas customers live a healthier life.

V. CONCLUSION

The Internet of Things has become very popular in it recent days due to its various distribution of applications with a smooth, safe and simple paved mode of human living style. One such place for applications include gas bookings and gas leaks to find domestic and commercial purposes. Although, several strategies are in place similarly, for now gas leak detection is one of the major problems and a constant challenge. Sensor used in this model can detect and detect gas leaks, and the user receives a notification about the stay the percentage of gas in the cylinder and the specific action it can be taken to pre-book a new cylinder without any obstacle. This unit can be easily integrated into the alarm unit, or visual indicator for LPG awareness of the proposed program can assist in commercial sectors such as hotels, shops etc. The key purpose of this work is to ensure a safe and easy way gas reservation and detection of gas leaks to avoid potential disasters due to negligence.

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Research Paper Summarizer using Feature Extracting API

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***Abstract*—This paper introduces the method of automatic summarization of the research/scientific paper using Feature Extracting API(Application Programming Interface), with the help of Natural Language Processing(NLP) tools.**

Keywords—Python, Extractive Summarization, Preprocessing, API, Natural Language Processing, NLTK, RESTful APIs.

I INTRODUCTION

Natural Language Processing(NLP) is a branch of Artificial Intelligence which enables the computers to understand and process the statements written in human languages. It is devoted to interpreting and making meaningful results out of human languages since all users may not be good at learning machine language. It has various applications in fields like medicine, automation, chatbots etc. One of the applications discussed in this paper, where NLP can be leveraged, is Text Summarization.

With the advent of technology, the importance of databases within a few years has increased the demands of text tools which help the users to extract the information from the database more precisely and smartly that may take only a few seconds for implementation. Here comes the most effective use of text mining and text summarization tools which not only gives a quick insight of the cited paper but also returns the keywords and topics(bag-of-words) more related to the input database.

For the implementation of automatic summarization,the unstructured and unlabeled data has to be preprocessed using the methods appropriate for the desirable output. Natural Language Processing(NLP) has recently gained attention and come up with various tools and libraries having commendable accuracy for pre and post processing outcomes. This paper introduces the development of the automatic extractive summarization tool with the help of NLP.

II OBJECTIVE

The objective of this project is to provide a method that can help the students, researchers, scientists and the working professionals to extract the precise information from the original research papers, articles, reports within a few seconds of time span using text mining and information extraction tools.

Currently, there exist many automatic text summarizers each using different techniques. The most popular approach is finding the statistical data from the word frequency and predicting the probability of word sequence and their importance within the document. On the basis of probability,word vs frequency metrics are prepared to distinguish the frequent,rare and important words within the corpus.

The approach in this project utilizes NLP tools to determine whether or not a sentence should be a part of the summarization. By tokenizing the text, phrases, sentences and analyzing each sentence through libraries, one might be able to create a comprehensive summary.

III METHODOLOGY

Two types of summarization methods are:

A. Extractive Summarization

B. Abstractive Summarization

A. Abstractive Summarization

In this method,words are selected on the basis of semantic understanding of the text,including those words that may not appear in the source documents. The aim of abstractive summarization is at producing the important material which should be syntactically and semantically correct.

It is similar to the way a human reads a text document and then summarizes it in their own words.

Input(corpus) → understanding the context → semantics interpretation → create your own summary.

This method is usually used where defining the meaningful summary is more emphasized than extracting information of a conversation or general stories and literature eg-Novels,literature,history etc).

B. Extractive Summarization

This method attempts to summarize the text by selecting a subset of words or phrases from the source document itself. This approach weights the important part of the input corpus and uses the same to form the summary. Different algorithms and techniques are used to define weights for the sentences from the corpus and further rank them based on importance,frequency and similarity among each other.

Input(corpus) → defining the sentence similarity → weight sentences → select sentences with higher rank or score.

This method is used for summarizing the research or scientific papers,technical articles where one would desire to extract the important information from the corpus and may not be much interested in a meaningful overall general summary of the document.

IV APPROACH

A. Preprocessing and Exploratory Data Analytics

Preprocessing and Exploratory Data Analytics(EDA) are the most initial steps in the Text Summarization Process. EDA is the process of studying the data and looking for the patterns it reflects to choose the appropriate methods and tools required for further information that can be extracted from the data. EDA includes, defining the data description,data info and basic data visualization. Data info is understanding the data through the total number of counts it has, analysing the training versus testing data, data dimensions(single or multiple). Basic visualization can help with identifying patterns within the data using graphs and pie charts. This can be easily done by Seaborn and Matplotlib libraries in python.

The input corpus includes the raw and unstructured data which needs to be pre-processed before implementing the NLP methods because good and processed input data corresponds to better output results. Natural Language Processing has introduced many tools and softwares for preprocessing steps with good accuracy measures.Some of the steps are:

- Noise Cleaning: It is the removal of special characters which can interfere with text processing steps eg-removal of "(< >" etc.
- Lowercasing: It is the conversion of text into lowercase.
- Tokenization: It splits all the words and characters used in the text and tokenizes them.
- Spell Checking: It is used to correct the misspelled words in the data.
- Contraction Mapping: In this process, the words which are contracted have to be expanded through their mapping.eg- converting "It's" into "it is".
- Stemming & Lemmatization: It is used to convert the text into canonical or standard form eg-conversion of the word "troubled" into "trouble".
- Stop-word removal: It is the removal of words which are frequently used and are not so important eg-in,the,are etc.
- Normalization: Mapping of most near identical and correct word.eg- conversion of the word "gud" into "good".
- Augmentation: Text enrichment/augmentation provides more semantics to your original input, thereby improving its predictive power and the depth of analysis.

B. Techniques Used

Feature Engineering:Features are the parameters that can categorise the data for better and quick insights. Feature Engineering techniques are used to convert features of the text into matrices(or vectors) because Machine Learning Algorithms cannot work directly with raw text,the algorithms can only process the numeric representation of an actual text. Three popular methods of feature engineering are:Bag-of-words, TF-IDF and POS tagging.

Part-of-speech(POS)Tagging: POS tagging is splitting and chunking the text into words and assigning them with a tag or token. It is also called grammatical tokenization as each word is defined as noun,pronoun,conjunction,adjective etc with their respective abbreviation.It is done to solve word disambiguation, machine translation, text to speech conversion and information retrieval.

Term frequency-inverse document frequency(TF-IDF): The goal of Tf-IDF is to convert text documents into vector models on the basis of frequency of the word in the document,without considering the order. TF-IDF is a method used for information retrieval and defines the importance of a word in the input corpus to decide whether it should be used in the final summary or not.

The formula used for calculating term frequency is:

$$\mathbf{tf(w,d) = log(1+f(w,d))}$$

The formula used for calculating inverse document frequency is:

$$\mathbf{idf(w,D) = log((N/f(w,D))}$$

where,

N = number of documents in our input dataset

d = given document used for calculating TF-IDF

w = given word analyzed in the formula

D = collection of all documents

The multiplication of the score we get from the above two equations is the final score of TF-IDF.

Bag-of-words: This model is concerned with the known word in the corpus irrespective of its order or structure. The general intuition is that similar documents usually have similar content. It is used in document classification where each word is used as a feature for training the classifier eg-sentimental analysis.

Semantic and Syntactic Analysis:Semantic Analysis is the process of meaningful understanding, interpretation of the text and signs within the sentence to form a basic

sentence structure while syntax is the grammatical structure of the text. A sentence which is syntactically correct may not always be semantically correct. This is the basic parameter that is considered for developing a NLP method for text interpretation.

Shallow Parsing: It is the process of dividing the whole text into non-overlapping contiguous subsets of tokens and labels the multi-token sequence. It is crucial to create sub-components from the text like person,location etc.

Named Entity Recognition(NER): NER is the technique of identifying the specific entities that can represent real world objects like people, places, organisation etc Eg- Name of organisations like WHO,UNICEF etc are present in the trained model and on that basis it would be able to label the other organisations depending on the similarity between the training and testing data. Methods used for NER extraction are:Lexicon approach, Rule based approach, Machine learning-based systems.

N-grams: It is a type of language model which finds the probability distribution over the word sequence. It defines the probability of occurrence of a particular word on the basis of conditional probability of one preceding word.

Document Similarity: Document similarity uses the technique of measuring the distance between the two documents to identify how similar they are,on the basis of features extracted with TF-IDF and bag-of-words. Popular methods used for finding the document similarity are: Euclidean distance,Cosine Similarity,Topic models atc.

Word Embeddings: Embeddings are types of knowledge representation where words or phrases from the vocabulary are mapped to vectors of real numbers. This mathematical embedding is done from a space of multiple dimensions to a lower dimension of vector space. Vector space model has information about how many documents contain a term, important terms of each document, dimensions of a vector, word correlations etc. Methods used for word embeddings are Word2Vec and Glove(stands for "Global Vectors").
Word2Vec,introduced by Google, finds the relationship between the words on the basis of syntax, semantics and the context of the document in which that word is used on the basis of local information, affected by only surrounding context in the document. It is a feed forward shallow neural network(fall in prediction based embeddings) that can transform the unlabeled raw corpus into labeled data and learns the representation of words in classification tasks. It has the potential to fill the blanks in a paragraph by recognizing the context of the document. Unlike Word2Vec, Glove derives the context and semantic relationships between the words on the basis of the ratio of probability of the words in co-occurrence matrix.

C. Post processing

Post Processing is usually done to improvise the model to avoid the mistakes done by it after the implementation of the functions used while making the model. It is a type of rule-based approach which requires the inclusion of some features for more accuracy and model optimization. Post processing is done after the final generation of the output. Word Embedding technique falls under post processing steps. Post processing via Variance Normalization and Dynamic Embedding are the two post processing methods that are still under study.

V SOFTWARE USED

1. **NLTK(Natural Language toolkit)**: NLTK is a python package which is used to implement some natural language processing methods like POS(part-of-speech)tagging, Tokenization, Stemming, Lemmatization, Classification, tagging, parsing of the sentences in the document. After tokenization, shallow parsing is done which identifies the relationship between the words with the help of tokens assigned to the words.This is done by producing metrics of the tokens of each word in the text with the help of NLTK.

2. **SpaCy**: SpaCy is a free,open source library used for advanced Natural language Processing methods in python. SpaCy provides the overall package and pipelines for the implementation of the processes like Phrase detection, Similarity detection, NER(Named entity Recognition, Word Embedding(word2vec). SpaCy can also be used for linguistic annotation but it is more generally used for abstractive summarization than extractive summarization.

3. **Scikit-learn**: Scikit-learn is the most important library used for machine learning in python. It has many efficient tools and is used for statistical modeling like regressions, classification, clustering etc. In this project,scikit-learn is used for the implementation of TF-IDF(term-frequency inverse document frequency).

4. **Flask**: Flask is a python framework which is used for developing web applications. It provides the tools and libraries required to make web applications like web pages, blogs, commercial websites etc. In this project, flask is used to implement keyword extraction algorithms through existing third-party APIs.
   In this project, Flask is used for developing the feature extracting API that will help the user to get the final summary as the output on the display. A simple web page or window can be created and hosted on the local server for the ease of use of the Summarizer .The API would help to redirect the output of the functions written in python by using the NLP libraries in the local editor on the web page.

5. **Pandas**: Pandas is an open source python package used mainly in Machine learning. Pandas helps in preprocessing steps like data cleaning ,transforming, visualization, data mining etc. It helps to get the dataframe from the raw unstructured input data which can later be used for

implementation of various functions like count, describe etc.

6. **Pyspellchecker**: This open source package is used for normalization of the text in the input corpus. It helps to check the spelling and also correct the candidate spelling automatically by providing the most identical correctly spelled suggestions.

7. **Gensim("Generate Similar")**: It is an open source python library mainly used for unsupervised topic modeling having several pre-trained models. It is used for performing word embedding processes through the Word2Vec method. Gensim has the phrases module which lets the user automatically detect the phrases longer than a single word using collocation statistics.

VI ADVANTAGES

- The perusing time is reduced bySummarization of the document.
- During investigation of reports,outlines with the help of summarization make the determination procedure simpler.
- Summarization improves the adequacy of ordering.
- Human summarizers are more biased as compared to the calculation done by these summarization techniques.
- Question Answering systems use the summarization methods for precise outcomes.
- Easy and faster Implementation.
- Utilizing programmed frameworks can empower business administration for developing the number of content archives.

VII APPLICATIONS

1.Question Answering bots: Personal assistants are being widely used in many applications and smart homes as well. Large collection of the precise documents related to the queries and their summarization can assemble a cohesive answer in the form of a multi-document summary.

2.Newsletters: Summarizers can be used for topic modeling and creating the headlines from multiple documents from different sources eg- Google News. Summarization would allow organizations to enrich newsletters with a stream of summaries and the related links, which can be a particularly convenient format in mobile.

3.Media Monitoring:The problem of database and information overload can be tackled by using summarizers that can condense the continuous load of information into smaller pieces of information.

4.Video Scripting: Video has become the most important form of media marketing eg-YouTube,LinkedIn. Videos in the form of input data can be used for the summarizers to produce content related to the video. Summarizers can also predict the graphical information from the video input data that can be further used for analytical purposes.

5.Books and Literature: Researchers have recently come up with the summarization of the novels which can help the buyers to choose the desired book,as part of their buying process.

6.E-learning:Many teachers and lecturers use case studies and news to frame their content for research or teaching purposes. Summarization can help them to easily update their content with recent changes in a particular area of research.

VIII CONCLUSION

An automatic Research Paper Summarizer is created using Natural language Processing tools and libraries which can return the summary ,important information and related documents after uploading a desirable research paper, required to be summarized. A dynamic webpage is created using Flask framework for easy of use and display of the output we get from the Summarizer.
This summarizer would help the researchers to get the quick insight of the research paper and also helps them to get the related documents similar to the uploaded research paper.

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ACKNOWLEDGMENT

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Review Paper on voice controlled smart car

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***Abstract* - The paper is designed to control a robotic vehicle by voice commands for remote operation. An ARM series microcontroller is used together with an Android Application for the desired operation. The Android Application is connected to the Bluetooth module (HC-05)present on the Robot via Bluetooth. The commands are sent to the robot using push buttons or voice commands present on the android application. At the receiving end two dc servo motors are interfaced to the microcontroller where they are used for the movement of the vehicle. The RF transmitter of the Bluetooth can take either switch press or voice commands which are converted to encoded digital data for the advantage of adequate range (up to 100 meters) from the robot. The receiver decodes the data before feeding it to another microcontroller to drive DC motors via motor driver IC for necessary work. This technology has an advantage over long communication range as compared to RF technology. Further the project can be developed using IoT technology where a user can control the robot from any corner of the world.**

Keywords- Bluetooth module, Android Application, IoT (Internet of things), DC Servo motor.

I. INTRODUCTION

The Objective of this research is to allow users to control a car using speech Recognition. “In this proposed design, we tried to control the movements of the vehicle using voice commands from the user. These commands will be issued at the Android Application on the user’s phone which is connected to the robot using a Bluetooth Module(HC-05). The commands issued will then be relayed over an RF channel and will be received by the Module itself. The goal of Voice Controlled Smart Car (VCSC) is to listen and act on the commands received from the user. Here, the system will require the training from the user (for the accent) after which the device will start understanding the commands issued. This is done by adding commands to the controller through a code.”

1.1 All about Voice Recognition

The process of enabling a computer to identify and respond to sound produced in human speech. Voice recognition is the process of taking spoken word as an input to the program. Voice recognition is the ability of the machine to receive and decode dictation, or to understand and carry out spoken commands.

1.2 Voice Recognition

People who historically have difficulties with driving, such as disabled people and older citizens, as well as the very young, would be able to experience the freedom of car travel.

1.3 Briefing

The proposed topic involves voice recognizing. Voice recognition is the process of capturing spoken words and commands using a microphone and converting them into a digitally stored set of words. Two factors decide the accuracy of the proposed voice recognition system: Accuracy in detecting the human words and processing those words at the desired speed so that the commands are executed with the least delay.

II. ROBOT DESCRIPTION

2.1 Transmitter

On the Transmitter section, commands are given to the Mobile Application through the microphone of the mobile handset. This mobile handset is connected to the moving vehicle via Bluetooth module. The mobile application used, is programmed in such a way that the voice commands given to the handset are received by the micro-phone and these analog voice commands are converted to digital word sequences (A to D conversion). These stored sequences are than transmitted to the robot via Bluetooth transceiver module and are sent to the transceiver controller (MAX 232).

2.2 Receiver

MAX 232 transceiver is used to decode the received signal and for serial communication with the Bluetooth module. The controller compares these digital signals with the stored programme commands in it and converts them into voice strings. The voice strings are then used to run the servo motors for the

desired interval of time.

2.3 Arduino Uno

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable.
CPU: Microchip AVR (8-bit)

Memory: SRAM

Storage: Flash, EEPROM

2.4 HC-05 Bluetooth Module

HC-05 Bluetooth Module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup.HC-05 Bluetooth module provides switching mode between master and slave mode which means it is able to use neither receiving nor transmitting data.

III. Review Of Recent Work

3.1. Speech Controlled Car

The main objective of this project is to design and implement a voice control car using RF Technology for wireless data transmission it is capable of accurately identifying a single sound while remaining simple and fast. Linear Predictive Coding is prototyped and tested using MATLAB. RF module is interfaced with microcontroller.
Speech recognition is performed by an app.
The system as though looks astonishing for lay man and could be a small step for helping BLIND & DISABLE people to solve their everyday problem**s.**

3.2 Trust in Driverless cars: Investigating key factors influencing the adoption of driverless cars

The purpose of this study is to investigate the key factors influencing the adoption of driverless cars. Drawing on quantitative evidence, significant concerns included privacy(autonomy, location tracking and surveillance) and security (from hackers). The paper provides implications for firms developing the next generation of car features and early implementation sites.

3.3 System Architecture of a Driverless Electric Car in the Grand Cooperative Driving Challenge

This paper presents the complete system architecture of a connected driverless electric car designed to participate in the Grand Cooperative Driving Challenge 2016. One of the main goals of this challenge was to demonstrate the feasibility of multiple autonomous vehicles cooperating via wireless communications on public roads. Several complex
cooperative scenarios were considered, including the merging of two lanes and cooperation at an intersection. We describe in some detail an implementation using the open source PACPUS framework that successfully completed the different tasks in the challenge. Our description covers localization, mapping, perception, control, communication and the human-machine interface. Some experimental results recorded in real-time during the challenge are reported

3.4 Method of voice control functions of the UAV

A method of the voice control over UAVs functions, which is based on semantic identification of the voice commands is developed. The proposed method of semantic identification of the voice commands, which is based on the cepstral analysis, can improve the efficiency of recognition of voice commands' semantic features. The results of experimental studies suggest the feasibility of further practical use of the developed method of the voice control over UAVs functions, which is based on semantic identification of the voice commands.

3.5 A voice command system for autonomous robots guidance

In this paper, a voice guidance system for autonomous robots is proposed as a project based on microcontroller. The proposed system consists of a microcontroller and a voice recognition processor that can recognize a limited number of voice patterns. The commands of autonomous robots are classified and are organized such that one voice recognition processor can distinguish robot commands under each directory. Thus, the proposed system can distinguish more voice commands than one voice recognition processor can. A voice command system for three autonomous robots is implemented with a microcontroller from Microchip PIC16F876, a voice recognition processor RSC364 from Sensory and a set of radio frequency emitters-receivers. The possibility to increase the number of robots to be controlled is also described

IV. BLOCK SCHEMATIC AND DESCRIPTION

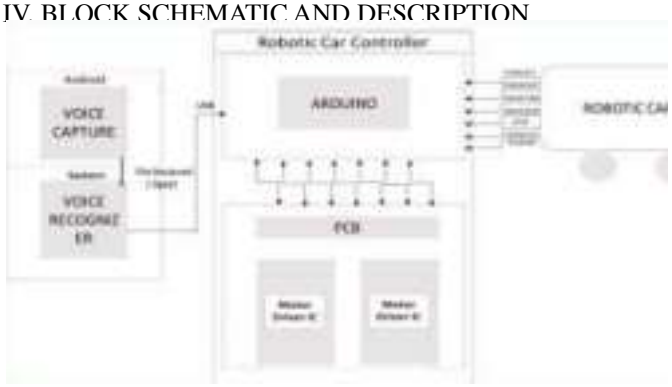
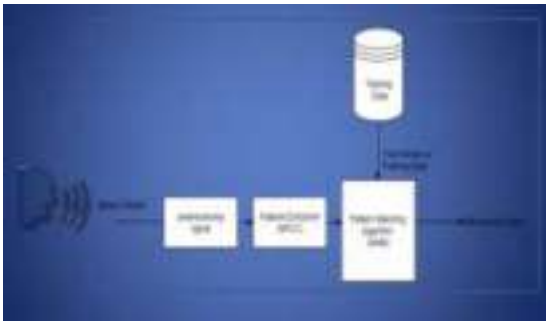


Figure 1: Schematic diagram

4.1 ALGORITHM

1. Start
2. Establish Bluetooth connectivity between Android Application and the Bluetooth module on the car.
3. Check whether the device is connected.
4. If connected, give the predefined instructions/commands to the microphone of the mobile handset.
5. The voice commands should be trained to the EasyVR module.
6. Then the stored voice commands are represented in the form of binary numbers such as move forward – 001, move backward – 010 etc.
7. These binary values are transmitted via the zigbee module which is a transceiver.
8. The transmitted binary values are then received by another zigbee module which is present on the receiver side.
9. Microcontroller will take those binary values and perform action(servo motors) according to the binary values.
10. If failed to connect at step 3 then again go to step2.
11. Stop.
12. Speech Recognition System Components
13. This research work has been narrowed down to a short range Bluetooth module. Using a long range module and other connectivity devices will result in connectivity with the robot for long distances.
14. Power Optimization such sleep and wakeup schedules can be incorporated.
15. Image processing can be implemented in the robot to detect the color and the objects.
16. A thermal camera can be installed to sense the heat emitted by bodies useful in military purposes to detect enemies on the lines.
17. Automatic Targeting System can be implemented in the robot for tracking the target.



(a)

(b)

Figure 2: Algorithm based block diagram

It converts a speech signal into a sequence of acoustic feature vectors to identify the components of linguistic content and discard all the other stuff which carries information like background noise, emotion etc.

V. CONCLUSION AND SCOPE OF FUTURE

This project completely reforms the robotic smart car and gives it a new dimension. It can easily recognize the voice commands and runs smoothly.
Further enhancement in the project can be used for Home security and military purposes where the commands can be given to robotic car without risk by increasing the range and by installing cameras.

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Smart Car Parking System Using IOT

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***Abstract*— In this work we have design, analyze and implement "IoT based sensor enabled car parking system. This enables the user to reserve parking slot from remote place with the help of mobile application which reduces parking issues in urban areas. This system typically obtains information about available parking spaces in a particular geographic area and process it in real-time to facilitate vehicle parking at available positions. The system can monitor the state of every parking slot by deploying a sensor node on the slot. Accordingly, sensor senses the status of parking slot and send status to central node server controller. The Node MCU collect the data from all sensor node and upload to the server where user can check the parking status from anywhere using internet via android application. User can also check the parking slot in by creating their profile on the blynk application. At the end, the paper discusses the working of the system in form of a use case that proves the correctness of the proposed model.**

Keywords—Parking system, Arduino Board, Node MCU(ESP8266), LCD display, IR Sensor, Servo Motors.

I. INTRODUCTION

In the Smart Car Parking System Using IoT, here IoT is prominent of two words are that "Internet" and "Things". Internet means a vast global network of connected servers, computers, tablets and mobiles using the internationally used protocols and connecting systems. Internet enables sending, receiving, or communicating of information.

Now, today's main problem in rush areas, function halls and working places etc. in urban areas is parking and it is due to lack of sufficient parking spaces around us. Now a days the vehicles in a family are greater than the head count of the family members, and due to this the vehicles are also increased in the country, which leads to the parking scenario which is unhappily falling short to the current requirements in the country. In most of the parking places, the basic technique for finding a parking spot is manual and at times during holidays and festival events, the driver more often than not finds a parking space in the road or other places through luck and experience. This procedure requires energy and time and if the driver is looking for a parking space in a high vehicle density city, the worst case is that they may failing to find any parking slots so that we have designed a model for solving these problems. Problems pertaining to parking and traffic congestion can be solved if the drivers can be informed in advance about the availability of parking spaces at and around their intended destination. Recent advances in creating low-cost, low-power embedded systems are helping developers to build new applications for internet of things. Followed by the developments in sensor technology. The smart parking system using Arduino and Node MCU that we propose is implemented using a mobile application that is connected to the cloud. The system helps a user know the availability of parking spaces on a real time basis. And rest of the things are organized below in different sections.

II. IOT (Internet of Things)

The concept of Internet of Things (IoT) started with things and identity communication devices. The devices could be tracked, controlled or monitored using remote computers connected through Internet. The internet of things has different definitions. In Short it is defined as the things present in the physical world or in an environment are attached with sensors or with any embedded systems and made connected to network via wired or wireless connections. These connected devices are called as smart devices or smart objects. And it consists of smart machines, which communicate, interact with other machines, environment, objects etc. And these can be processing by using some processors such as network processor, hybrid processor MCU/MPU etc. And the devices are connected by using some technologies called GPS, Wi-Fi, BT/BTLE, RFID etc.

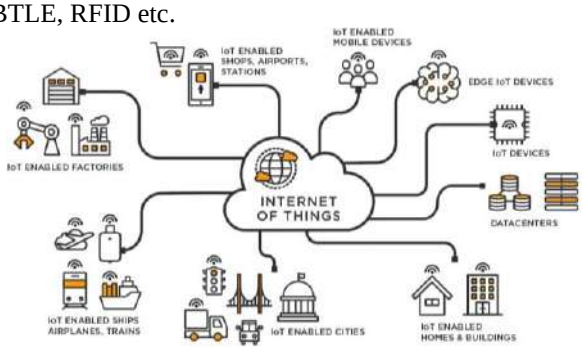

Fig: 1 IOT

III. LITERATURE OVERVIEW

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-The development and high growth of the Internet of Things (IoT) have improved quality of life and strengthened different areas in society. Many cities worldwide are looking forward to becoming smart. One of the most popular use cases in smart cities is the implementation of smart parking solutions, as they allow people to optimize time, reduce fuel consumption, and carbon dioxide emissions. Smart parking solutions have a defined architecture with particular components (sensors, communication protocols, and software solutions). Although there are only three components that compose a smart parking solution, it is important to mention that each component has many types that can be used in the deployment of these solutions.

This paper identifies the most used types of every component and highlights usage trends in the established analysis period. It provides a complementary perspective and represents a very useful source of information. The scientific community could use this information to decide regarding the selection of types of components to implement a smart parking solution.

Trends of usage in terms of sensors, protocols and software solutions are analyzed and discussed in every section. In addition to the trends of usage, this paper determines a guide of complementary features from the type of components that should be considered when implementing a smart parking solution.

IV. AIM of PROJECT

[1]. The main aim of this project to develop a smart parking system.
[2]. To detect an available and empty slot via LCD display and android application.
[3]. Reduces the risk of finding the parking slots in any rush areas.

V. TOOLS DESCRIPTION

This system consists of two parts, Hardware and Software-

A. *Hardware*

- Arduino UNO Microcontroller Board
- Node_MCU (ESP8266)
- Servo Motor
- Arduino Cable
- LED (Green/Red)
- LCD display 16x2
- IR Sensors
- Jumper Wires
- Potentiometer 10k
- Buzzer
- Breadboard
- 5V Power Supply

B. *Software*

- Arduino IDE
- Blynk application

[1] Arduino uno

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output pins that may be interfaced to various expansion boards and other circuits. The board has 14 digital pins, 6 analog pins, programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by the USB cable or by external 9-volt battery.

Fig:2 Arduino uno

--Technical Specification of Arduino Uno

- ✓ Microcontroller: Microchip ATmega328P
- ✓ Operating Voltage: 5 Volts
- ✓ Input Voltage: 7 to 20 Volts
- ✓ Digital I/O Pins: 14 (of which 6 provide PWM output)
- ✓ Analog Input Pins: 6
- ✓ DC Current per I/O Pin: 20 mA
- ✓ DC Current for 3.3V Pin: 50 mA
- ✓ Flash Memory: 32 KB of which 0.5 KB used by boot loader
- ✓ SRAM: 2 KB
- ✓ EEPROM: 1 KB
- ✓ Clock Speed: 16 MHz
- ✓ Length: 68.6 mm
- ✓ Width: 53.4 mm

[2] LCD display

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

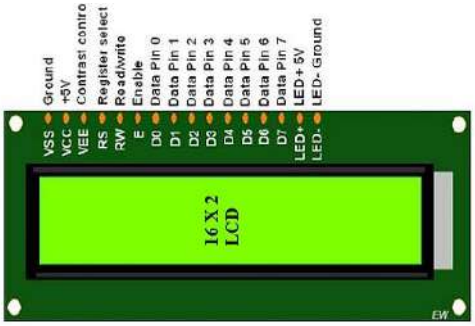

Fig:3-LCD_display

[3] WIFI-Module

In this project we have used Node MCU (Micro Controller Unit). The Node MCU contains Wi-Fi as well as a Node microcontroller.

Node microcontroller has 3mb of ROM which can be used to upload a program. ESP8266 is an impressive, low-cost Wi-Fi module suitable for adding Wi-Fi functionality to an existing microcontroller project via a UART serial connection. The module can even be reprogrammed to act as a standalone Wi-Fi connected device–just add power! The feature list is impressive and includes:

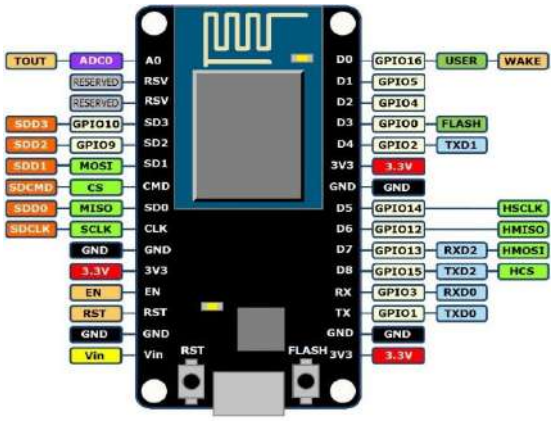

Fig:4 Node Mcu (ESP8266)

[4] IR sensor

Infrared Obstacle Sensor Module has two-part IR transmitter and IR receiver that sends out IR energy and looks for reflected IR energy to detect presence of any obstacle in front of the sensor module. The module has on board potentiometer that lets user adjust detection range. The sensor has very good and stable response even in ambient light or in complete darkness.

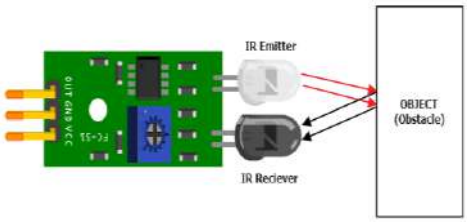

Fig:5 IR sensor

[5] Blynk application

Blynk is a new platform that allows you to quickly build interfaces for controlling and monitoring your hardware projects from your iOS and Android device.

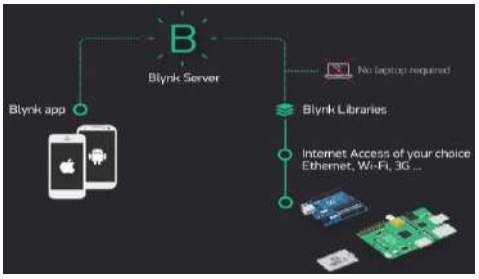

Fig:6 Blynk application

VI. METHODOLOGY

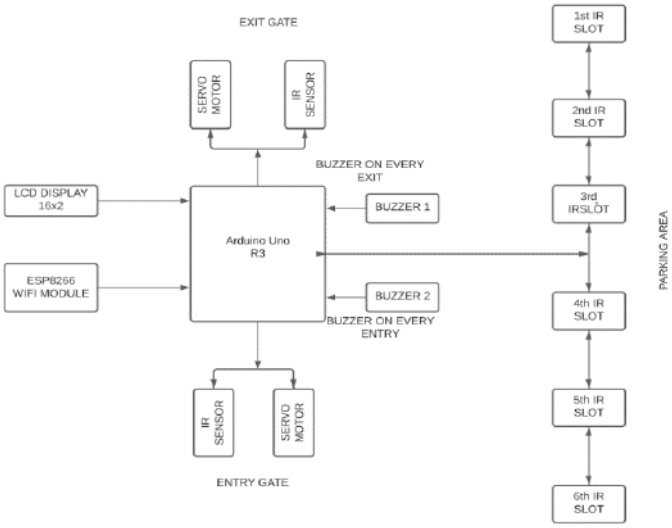

Fig:7 Block diagram of this project

The smart parking system consist of Arduino microcontroller, infrared sensor, servo motor and LCD display as the main components. Arduino is use as the main microcontroller for the project. The microcontroller will be program as a counter use to count the number of cars entering and exit an indoor parking space and buzzer will be active every car enters and exit. Besides that, there are two automatic gates at the entrance and at the exit way that will be controlled by the Arduino microcontroller. LCD display show the location of empty and busy places on screen.

Communication between this stratification is done using the ESP8266 module to send data to the main controller to control the data and show the empty places inside the parking lot so that the car drivers know the empty places quickly on the Blynk android app by using IOT to achieve the best efficiency and performance of the proposed system.

VII APPLICATION & ADVANTAGES

A. Applications: -

- Office/College
- Industrial areas
- Working sites
- Shopping mall
- Restaurants
- Theatres
- Rush places etc.

B. Advantages: -

[1] One goal of Smart Parking is to reduce the time taken and the hassle factor of locating an available parking space. Being able to accurately direct a driver to an available space has many environmental benefits; it reduces CO2 emissions, noise and other pollutants. Smart Parking can be combined with Smart Environment, measuring air quality and parking space availability.

[2] Reduced Traffic when a driver knows exactly where they need to go; it reduces idling and unnecessary driving – therefore optimises traffic flows in built-up areas.
[3] Safety decreased searching for spaces can reduce accidents by ensuring drivers maintain their attention rather than browsing for spaces or making rash manoeuvres.
[4] Reduction in time and fuel spent by road user searching for parking.
[5] Proper selection of vehicle according to the availability of parking space.
[6] Online parking results in higher revenues and profitability for parking facilities.

VIII CONCLUSION

- ✓ This project focuses on implementation of car parking place detection using Internet of Things.
- ✓ The system benefits of smart parking go well beyond avoiding time wasting.
- ✓ Developing a smart parking solution with in a city solves the pollution problem.

IX. FUTURE SCOPE

- ✓ The future of the smart parking system is expected to be significantly influenced by the arrival of automated vehicles (AVs). Several cities around the world is already beginning to trial self-parking vehicles, specialized AV parking lots, and robotic parking valets

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Smart Waste Monitoring System using IOT

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***Abstract* - Solid Waste Management has always been one of the major problems that the world has faced over the years, irrespective of the country being developed or underdeveloped. Overflowing garbage bins can easily be witnessed along the roadsides, near markets and other developmental and residential areas. This makes the surroundings very filthy and unhygienic, and the foul smell makes it very difficult for anyone to stay near that area for a long time. This also gives birth to some deadly diseases and causes human illness. Most of the time, this waste is not properly segregated and therefore not processed properly. So, this paper aims to review the system for garbage management and propose a method which will take care of all the above mentioned problems. The proposed system makes use of an Arduino as the controlling board, an ultrasonic sensor to sense the level of garbage in the bin, and an LED to indicate that an alert message has been sent. The officials can monitor the status of garbage bins and can store this data in their database.**

Keywords— Internet of Things, Waste Management, Garbage Monitoring

I. INTRODUCTION

The Internet of Things (IoT) is a network that comprises physical objects capable of gathering and sharing electronic information. The IoT includes a wide variety of "smart" devices; where smart refers to those things that can communicate over the internet. It can be viewed as a system of interrelated devices or machines, having the ability to transfer data and manipulate devices to work according to you over a network without requiring human-to-human or human-to-computer interaction. The devices used in IOT are provided with Internet protocol (IP), the same protocol that identifies computers over the world wide web and allows them to communicate with one another. The main reason for using the Internet of things is to have devices that self-report in real-time, improving efficiency and bringing important information in notice much quicker than a system depending on humans.

A Smart Home is the best example of IOT. Home appliances like the A/c, smoke detectors, security alarm, water heater and doorbell can be interconnected to share data with the user over a mobile application. The user can therefore get a detailed insight into the working of the devices around him/her.

IOT can be used as a solution to the various problems we face today. Waste management is an issue of genuine worry in the present day urban situation with exponentially rising populace. Aside from the need to lower the expenses caused in trash administration, the region, in the meantime, needs to guarantee a sheltered and solid condition for the subjects.

The fact is that mismanagement of anything is as harmful to the environment as is overuse of the resources and in order to keep the society clean at a very basic level, dustbins are the need of the hour.

This paper proposes a better garbage management system using IOT that works by sending an alert message to the garbage department of the society about the location of those dustbins that are filled to the threshold level. The waste management team can therefore track and take care of all those areas that need attention.

II. RELATED WORKS

In [1] the author talks about a system which will notify the corporations to empty the bin on time. In this system, a sensor put on top of the garbage bin will detect the total level of garbage inside it according to the size of the bin. When the garbage reaches the threshold level, a notification will be sent to the authority's office where the employees can take further actions to manage the dustbin.

The authors in [2] talk about dustbins being interfaced with an arduino based system having a load cell which is used to sense the garbage level. The current status of garbage will be shown on a Php web page through Wi-Fi. A major part of this project depends upon the working of the Wi-Fi module, and therefore a constant availability of internet which is essential for the implementation of this project.

The main aim of the authors in [3] is to offer a cost-effective and efficient waste collection and management system. The proposed system is dependent on the wireless sensor network [WSN]. In this model there are three major components: A Hardware Interface, a Communication Interface and a Data storage and verification component. Once the garbage tanks start to fill, the rate of filling is calculated and based on that the estimated number of garbage tanks can be employed in that region. In case of rain, the tank will be closed automatically. Information about the order in which the tanks must be cleaned is also intimated to the monitoring station. Another main component is the solar cells which are used for the batteries. And, with the help of a solid Wi-Fi connection, the garbage tank can be monitored periodically and the information is stored in the cloud.

The main aim of the authors in [4] is to design a system based on arduino for monitoring garbage from a particular area to avoid pollution, unhygienic condition, bad smell, etc. The dustbins are interfaced with a microcontroller based system having an ultrasonic sensor showing the current status of garbage on an android device. When garbage reaches the level of the sensor, then that indication will be given to the microcontroller unit and the microcontroller will send a signal to the user through GSM. So uninterrupted monitoring of garbage bins is presumed to keep the environment clean.

III. COMPONENTS USED

The most significant part about this project is its minimal use of circuitry, because of which not only its cost reduces but also its implementation becomes very easy and simple.

A. Arduino Uno

Fig. 1 Arduino Uno

Arduino Uno is a microcontroller board based on the ATmega328P microcontroller and developed by Arduino.cc. It is equipped with a set of 14 digital input/output pins. Of these, 6 can be used as PWM outputs and 6 are analog inputs. There is a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button.

B. Ultrasonic Sensor

Fig. 2 Ultrasonic Sensor

The Ultrasonic sensors measure the distance between them and the target by using the concept of sonar using ultrasonic waves. The HC-SR04 sensor head emits an ultrasonic wave at the target and receives the wave reflected back from the target. These sensors measure the distance to the target by measuring the time between transmission and reception.

The distance can be calculated with the following formula:

Distance L = 1/2 × T × C

where L is the distance, T is the time between the transmission and reception, and C is the sonic speed. (This value is multiplied by 1/2 because T is the time taken by waves to travel the complete distance.)

C. LED

Fig. 3 LED

An LED, short for light-emitting diode, is a semiconductor device that emits light when current flows through it. The process involves the recombination of electrons with electron holes inside the semiconductor, releasing energy in the form of photons. The color of the light of the LED, which is corresponding to the energy of the photons, is determined by the energy required for electrons to cross the band gap of the semiconductor. In order to obtain white light, multiple semiconductors or a layer of light-emitting phosphor is used on the semiconductor device.

D. Breadboard

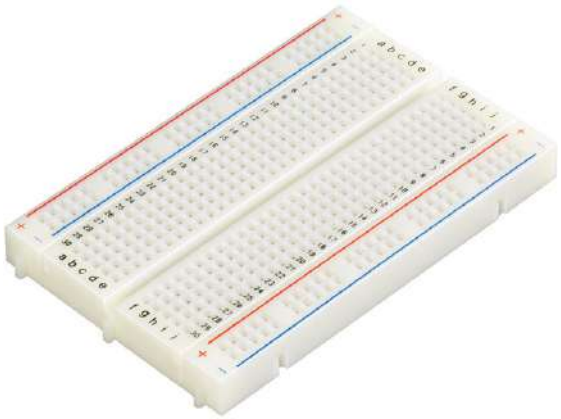

Fig. 4 Breadboard

A breadboard is a solderless electronic device used for building a temporary prototype with electronic equipment and test circuit designs. Most of the components in electronic circuits are built such that they can be interconnected by inserting their terminals into the holes of the breadboard, making appropriate connections through wires. The breadboard has got strips of metal underneath the board, connecting the holes on top of the board, through which the current flows. The metal strips are laid out as shown below. It can be noted that the holes on the top and the bottom rows are connected horizontally and are split in the middle, while the remaining holes are connected vertically.

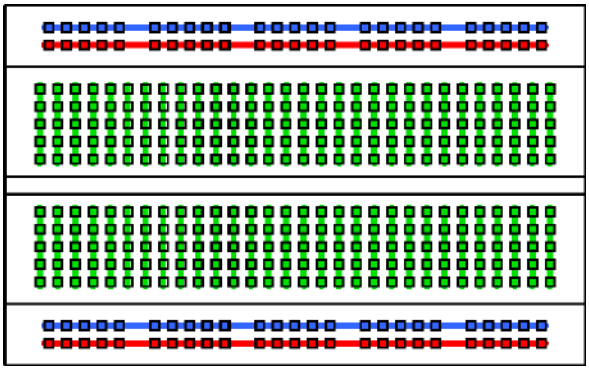

Fig. 5 Breadboard Connection

E. Jumper Wires

Fig. 6 Jumper Wires

Jumper wires are simple wires that have connector pins at each end, which allows them to be used to connect two points to each other without soldering. These wires typically come in three versions: male-to-male, male-to-female and female-to-female. The difference between these types lies in the end point of the wire. The male ends have a pin protruding outwards and can be plugged into other things, while the female ends do not have any such protrusion and are used to plug things into.

F. Arduino IDE

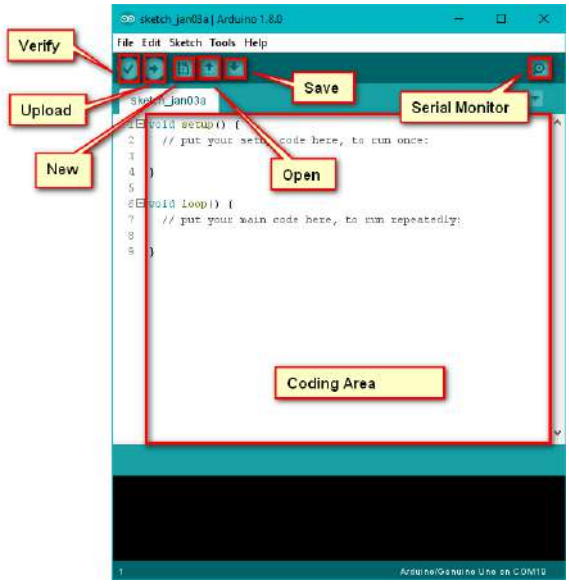

Fig. 7 Arduino IDE

The Arduino IDE, short for Integrated Development Environment, is a cross-platform application which is written in C and C++ languages embedded with a large number of libraries and a lot of examples to get started. It is used to write and upload programs to Arduino compatible boards and comes in the form of a downloadable file on the Arduino website.

G. PLX-DAQ

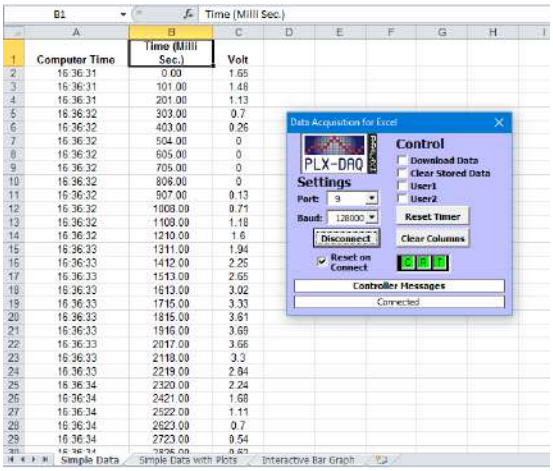

Fig. 8 PLX-DAQ

PLX-DAQ, short for Parallax Data Acquisition tool, is a software add-in for Microsoft Excel Spreadsheet which acquires up to 26 channels of data from any Parallax microcontrollers and drops these numbers into columns as and when they arrive. PLX-DAQ provides an easy spreadsheet analysis of the data collected in the field or laboratory analysis of sensors and real-time equipment monitoring. The microcontrollers connected to any sensor and the serial port of a PC can now send data directly into Excel. PLX-DAQ has the following features:

1. It plots data simply or on a graph as and when it arrives in real-time using Microsoft Excel.
2. It can record up to 26 columns of data in the spreadsheet
3. It marks data with real-time timestamps (hh:mm:ss) or seconds since reset
4. It can read/write any cell on the Excel worksheet

5. It can read/set any of the 4 checkboxes on the control interface
6. It provides an example code for the BS2, SX (SX/B) and makes Propeller available
7. Baud rates up to 128K are accepted
8. It supports Com1-15

IV. METHODOLOGY

In this project, we will use an ultrasonic sensor in the dustbin. When garbage reaches the threshold value, an SMS/alert will be sent to the respective Municipal/Government authority person who can then take necessary action.

A. System Architecture

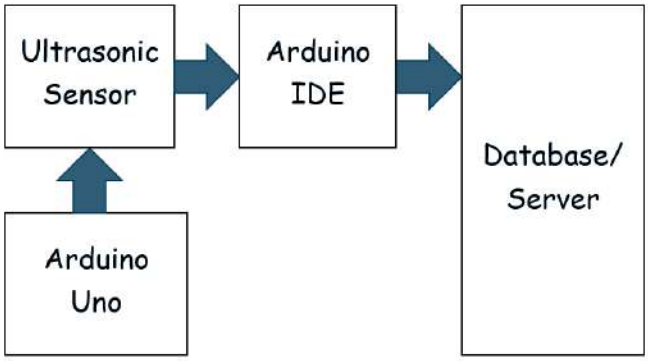

Fig. 9 Methodology

As shown in Fig 9, an ultrasonic sensor will be placed on the interior side of the lid. As the amount of trash increases, the distance between the ultrasonic sensor and the trash decreases. This live data is sent continuously to the microcontroller. Our microcontroller will then process the data and store it in the Database/Server.

B. Working

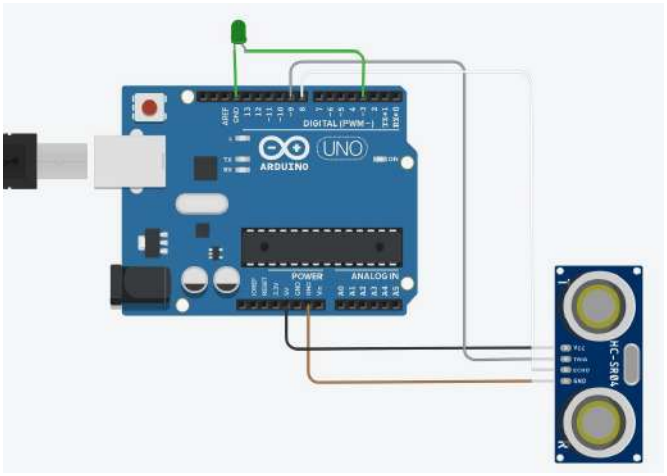

Fig. 10 Working

1. To start with, we will first enter the height of the dustbin. This will help us generate the percentage measurements of trash in the trash can.
2. Then, we will set a threshold/maximum value below which the amount of trash will be permitted, and on reaching the threshold level an alert will be sent to the concerned person.
3. Another criteria that will need to be satisfied will be the tolerance level. If suppose a particular trashcan fills up by 20% and then for a week this value doesn't change, it comes into our second criteria, time.
4. With time, even a small amount of garbage will start to rot, leading to a foul smell. So to avoid this, a tolerance level will be set at 3-4 days which will make sure that the trashcan is emptied even if the garbage level is less than the threshold value.

C. Code

The code implemented is given below:

```
float inches = 0.0;
float cm = 0.0;
float percentage = 0.0;
float height = 0.0;
int count = 0;
long readUltrasonicDistance(int triggerPin, int
echoPin){
```

```
  pinMode(triggerPin, OUTPUT);  // Clear the trigger
  digitalWrite(triggerPin, LOW);
  delayMicroseconds(2);

  // Sets the trigger pin to HIGH state for 10
microseconds
  digitalWrite(triggerPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(triggerPin, LOW);
  pinMode(echoPin, INPUT);

  // Reads the echo pin, and returns the sound wave
travel time in microseconds
  return pulseIn(echoPin, HIGH);
}
void setup(){
  Serial.begin(9600); // Baud Rate set to 9600
  pinMode(13, OUTPUT);

  //Excel Commands
  Serial.println("CLEARDATA");
  Serial.println("LABEL,Time,Empty Percentage,Alert
Messages");
  Serial.println("RESETTIMER");
}
void loop(){
  // Set the Height in cm
  height = 10.0;
  cm = 0.01723 * readUltrasonicDistance(9, 8);

  // Convert to inches by dividing by 2.54
  inches = (cm / 2.54);
  percentage = (100 * (inches / height));

  Serial.print("DATA,TIME");
  Serial.print(" ,");
  Serial.print(percentage);
  if (percentage <= 20 || count>=120) {
    Serial.print(" ,");
    Serial.print("****** Please Empty the Dustbin
******");
    Serial.println(" ,");
    digitalWrite(13, HIGH);
  }

  Serial.println();
  count += 1;
  delay(5000); // Wait for 3600000 milliseconds (1
Hour)
  digitalWrite(13, LOW);
}
```

D. Flowchart

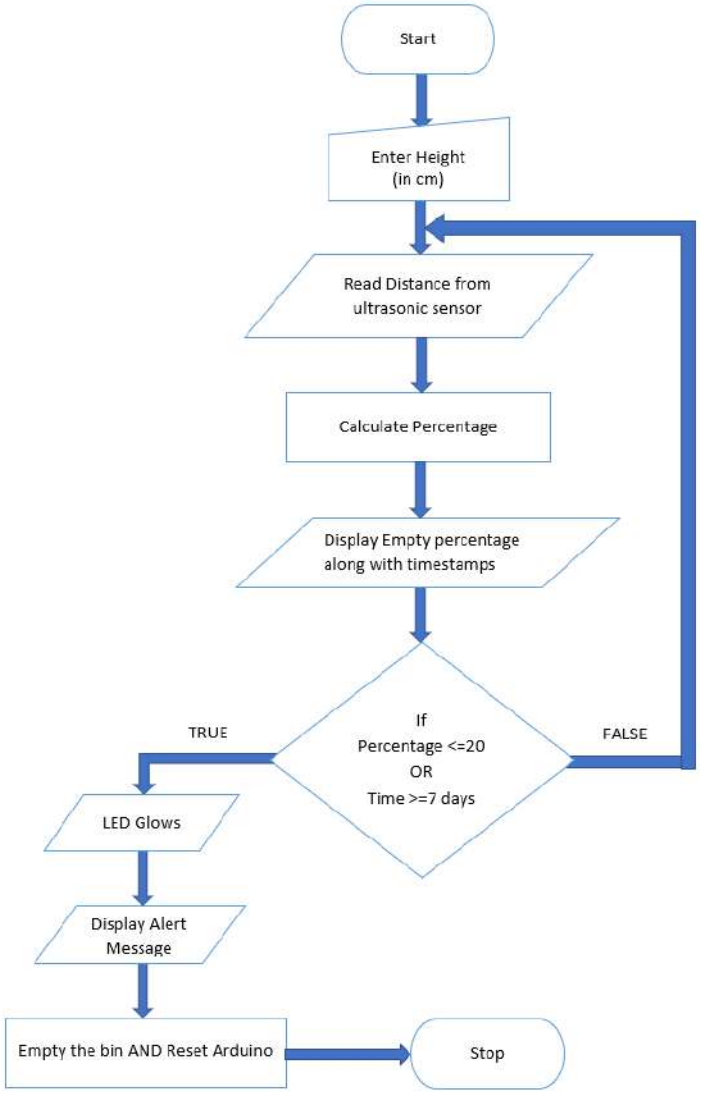

Fig. 11 Flowchart

V. CONCLUSION

This paper presents a practical implementation of monitoring the level of garbage in the dustbins which are placed at public places. It will prevent dustbin from overflowing and help in reducing the pollution and maintaining clear surroundings. This system will help keep a track of the status of dustbins, so that the waste management team can send the garbage collector to pick up the garbage when the dustbin is on the verge of being full. This will reduce the fleet cost, man power and indirectly reduce the traffic in the place.

IV. FUTURE ENHANCEMENT

To further extend the capabilities of this system we can use GPS (Global Positioning System) modem which will help in tracking the location of the dustbins. Then, we can simply visualize the status of the dustbins on a map. Also, we can use GSM (Global System for Mobile Communication) for getting all the updates regarding the dustbins on our mobile phones which will reduce the computer system maintenance cost.

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Thermostat in ovens controlled through GSM Technology

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ABSTRACT If you are using wireless internet in a coffee shop, stealing it from the guy next door, or competing for bandwidth at a conference, you might get frustrated at the slow speeds you face when more than one device is connected to the network. To solve this issue, a German Physicist- Harald Haas has introduced a new technology known as "data through illumination" which means transmission of data through LED lights which vary in intensities faster than the human eye can follow. According to him, this technology is based on the intensity and potential of the light emitting diode. This paper draws its attention on construction and working of Li- Fi based system and compares its performance with the existing wireless network technologies.

INDEX TERMS Li-Fi, Wi- Fi, VLC (Visible light communication), LED (Light emitting diode), RF (Radio frequency)

I. INTRODUCTION

We all are dependent on internet directly or indirectly for the fulfilment of our daily requirements. It is impossible to think of a day in our lives, when we are not "connected" to the "net". We use the web for an assortment of purposes, boss among them being sharing of data. In the today's scenario we are sharing lots of data so the good data sharing capacity is required. In 2011, Professor Harold Haas from the University of Edinburgh in the UK suggested an idea about the new form of wireless network technology which is named as "Data through illumination" [3]. And to implement this he used fiber optics to send data through LED light bulbs. Although light modulation is not so new concept, but Haas is looking to move things forward and enable connectivity through simple LED bulbs. In Li-Fi technology, we can connect the internet with the help of an LED beam in a finite range. With this technology we would be able to transmit data even using our car headlights. There are various network topologies but new one's are emerging, as the network spectrum is increasing. Li-Fi is a new technology uses visible light for communication rather than radio waves which is used in various conventional communication technologies; it refers to 5G Visible Light Communication systems. In Li-Fi technology, LED act as a medium to high-speed communication in a similar manner as Wi-Fi [5]. It can help to conserve a large amount of electricity by transmitting data through light bulbs and other such lighting equipment's. LiFi uses visible light as a carrier at the place of radio waves as in Wi-Fi. As the visible light cannot be penetrating through the walls so it is (Li-Fi) considered as secure means of data transmission system. We fix LED bulbs at the downlink transmitter [1]. If the LED current is varied at a very high speed then we can vary the yield at high speeds. This is the guideline of the Li-Fi. The working of the Li-Fi is very simple-if the Driven is ON, the sign transmitted is a computerized 1 while if it is OFF, the signal transmitted is a

digital 0. By changing the rate at which the LEDs flash, we can encode different data and transmit it.

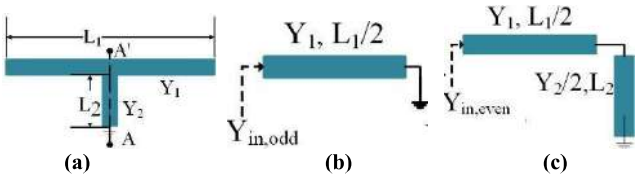

FIGURE 1. Basic (a) Equivalent T-shaped model of the proposed triple-band BPF with equivalent (b) odd-mode (c) even-mode model

II. WORKING TECHNOLOGY OF LI-FI

This brilliant idea was showcased by Harald Haas coming from University of Edinburgh, Great Britain, in his TED Worldwide talk on

VLC. He or she explained, “Very simple that if the LED is on then a digital ‘1’ is transmitted in case the LED is off then a digital ‘0’ is transmitted. The LEDs can be switched on and off very quickly, which gives great open gateways for sending data”. So, a few LEDs furthermore to a controller that code info into those LEDs are essential. We have to just vary the rate of which the LED’s flicker based on the data to be encoded. Further enhancements may be made in this process, which involves the variety of LEDs for parallel info transmission, or using mixtures of red, green and blue LEDs to correct the light’s frequency with each frequency encodes the data of various channels. Such advancements promise any theoretical speed of 10 Gbps – which means that one can download an entire high-definition film in just 30 seconds. Simply great! But blazingly fast info rates and depleting bandwidths worldwide usually are not the only reasons that offer this technology a higher hand. Since Li-Fi employs just the light, it is usually used safely in aircrafts and hospitals which are susceptible to interference from radio dunes. This can even operate underwater where Wi-Fi neglects completely, thereby throwing open up endless opportunities for army operations. Imagine only needing to hover under a street lamp for getting public internet access, or downloading a movie from your lamp on your workplace. A new technology is introduced in the area which could, quite literally along with metaphorically, 'throw light on' how to meet the ever-increasing require for highspeed wireless on the web connectivity. Radio waves are replaced by light waves in a very new method of data transmission which can be being called Li-Fi. The rate of switching of LED is faster than the rate which our eye can detect, causing the light source to seem to be on continuously. A flickering light may be incredibly annoying, but has ended up to have its upside, being precisely what enables us to use light for instant data transmission. Light-emitting diodes (commonly referred to as LEDs and found throughout traffic and street lighting, car brake lights, remote control units along with countless other applications) can be switched on and off greater than the eye can detect, causing the light source to seems to be on continuously, even though it is actually ‘flashing’. This imperceptible on-off action empowers a kind of data transmission using binary unique codes. When the LED is started up then a logical ‘1’ is indicated and when the LED is turned off then a logical ‘0’ is indicated. Information can therefore be encoded inside light by varying the rate of which the LEDs flicker on and off to give different guitar series of 1s and 0s. This technique for utilizing quick heartbeats of gentle to transmit information wirelessly is technically termed as Visible Light Communication (VLC), even it’s potential to tackle conventional Wi-Fi has inspired the widely used characterization Li- Fi[6]. Visible light communication (VLC)-“A potential solution to the global wireless spectrum shortage” Li-Fi (Light Fidelity) is normally a fast and cheap optical edition of Wi-Fi and its technology will depend on Visible Light Communication (VLC). VLC is usually a data communication medium, which in turn uses visible light concerning 400 THz (780 nm) in addition to 800 THz (375 nm) as optical carrier for information transmission and illumination. It utilizes fast pulses of light for your communication and the transmission of data is performed wirelessly [7]. The fundamental components of this communication system areA top brightness white LED, Which acts as being a communication source. A silicon photodiode which indicates great reaction to unmistakable wavelength region plays the role of receiving element. LED can be switched on and off to generate digital guitar strings of 1s and 0s.Data is usually encoded in the light to get a new data flow by varying the flickering rate from the LED. The LED illumination can be employed as a communication origin by modulating the LED light while using data signal more specifically. As the glimmering rate can be so quick, the LED output appears constant towards human eye. Data rate can even be increased by parallel information transmission using LED arrays wherever each LED transmits some other information stream. There are motivations to incline toward LED as the light source in VLC, though many other light gadgets like fluorescent light, radiant light etc. are available [8].

III. COMPARISION BETWEEN LI-FI & WI-FI

Li-Fi is needed to describe visible light communication technology put on high speed wireless transmission. The name is acquired due to the similarity to Wi-Fi.

	LI- FI	WI- FI
SPEED	1-3.5 Gbps	54-250 Mbps
RANGE	10 meters	20-100 meters
IEEE STANDARD	802.15.7	802.11b
SPECTRUM RANGE	10000 times than WI-FI	Radio spectrum range
NETWORK TOPOLOGY	Point-to-Point	Point-to-Multi Point
DATA TRANSFER MEDIUM	Use light as a carrier	Use radio spectrum
FREQUENCY BAND	100 times of THz	2.4 GHz

Table 1: Comparison between Li-Fi and Wi-Fi

IV. APPLICATIONS OF LI- FI

Health Technologies: Your Wi-Fi emits radio waves which are very harmful for the patients and the radio waves interpreting the actual medical instruments. Thus you can use internet in running rooms by Li-Fi technology. For no longer time period now medical technology would lag behind those other entire wireless world. Till now operating rooms did not facilitate Wi-Fi over radiation concerns, and there was also a complete lack of dedicated selection.

Airlines: In Airlines passengers concur to pay additional quantity of cash for the dial up service within the craft. Li-Fi might simply introduce "high-speed" transmission service which might be interruption free and differs from alternative wireless signals on the board.

Li-Fi uses light rather than radio frequency signals. Under water in sea Wi-Fi does not work at where Li-Fi will work.

There are around 19 billion bulbs worldwide, they simply should be supplanted with LED ones that transmit data, we reckon VLC is at a factor of ten, cheaper than Wi-Fi. Security is another benefit, since light does not penetrate through walls.

Street Light: Cars have semiconductor diode primarily based headlights, semiconductor diode primarily based backlights, and automobile will communicate one another and stop accidents within the method that they exchange data. Traffic signal will communicate to the automobile then on. Li-Fi may solve issues such as the shortage of radio frequency bandwidth.

V. ADVANTAGES OF LI- FI

Capacity: As we know that light is a voluntarily accessible form of energy so most of the portion of EM spectrum can be covered by it. Spectrum of visible light is 10000 times more than the spectrum of radio wave.

Efficiency: Li-Fi data bits can be transmitted parallel which brings about the expanding efficiency.

Availability: Light is available in every part of the world which makes each individual to work on the internet in airplanes.

Data rate: It is possible to get more than 10Gbps, theoretically permit a top quality motion picture to be downloaded in 30sec. This leads to the fast and easy communication.

Cost: Due to the use of LEDs in Li-Fi its cost is well-organized.

Bandwidth: The principle point of interest of Li-Fi is that its data transfer capacity is 10,000 more than the Wi-Fi.

VI. RECENT ADVANCEMENT

Li-Fi for smart cities:

The simplicity on the li-fi technology using LED lamps to transmit data, including high speed data connections that could be served from street lights could boost emergence of smart locations.

In the future, topology matters the most:

Researchers published worldwide indicate that a future network is going to be faster but capacity complications could still remain. It further reveals of which topology – the cosmetics of transmitters providing the network signal is going to be increasingly important for conference demand in denselypopulated places.

Reliable communication and improved networking in a LiFi network:

Li-Fi is a high-speed, bi-directional and fully networked broadband wireless technology that's aimed at offloading the present Wi-Fi technology. A Li-Fi access level can serve multiple users simultaneously inside the area of its insurance coverage, and this is called as optical at to cell.

Light brings users super-fast wireless internet: Lighting in shop windows, cars and classrooms can often access the wireless web. Li-Fi could prove to get seven times faster than Wi-Fi as well as enable to download a complete HD movie in several seconds.

VII. CONCLUSION

The probabilities are numerous and therefore for the exploration can be done. If his technology might be put into practical utilize, every bulb can supply something like a WiFi hotspot to help transmit wireless data and we will precede toward the solution,

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greener, safer and better future. The concept of Li-Fi is currently attracting lots of interest, not least because it may offer a genuine and also efficient alternative to radio-based Wi-Fi. As a growing number of individuals and their many device access wireless internet, the airwaves have grown to be increasingly clogged, making it increasingly more difficult to get an honest, high-speed signal. This may solve issues like the shortage of radiofrequency bandwidth furthermore permit web where conventional radio based remote isn't allowed for example aircraft or hospitals. Among the shortcomings however is whose only work in direct distinct sight?

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