"Empowerment through quality technical education"

AJEENKYA
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Charholi (Bk), Via Lohegaon, Pune, Maharashtra, India.
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4th
International Conference on Recent Advancements In Engineering & Technology (ICRAET- 2025)

Conference Date: : May 9th & 10th, 2025

Editors

Dr. F. B. Sayyad (Principal)
Dr. S. M. Khairnar (HoD)

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ORGANIZED BY
AJEENKYA DY PATIL SCHOOL OF ENGINEERING, PUNE

IN COLLABORATION WITH

EDITORS

Dr. F. B. Sayyad (Principal)
Dr. S. M. Khairnar (HoD)

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Chairman's Message

I am pleased to know that ICRAET-2025, the international conference for Scholars, Researchers, Academician and Scientist is organized by Ajeenkya DY Patil School of Engineering for various streams of Engineering. This conference provides a national forum for researchers, developers and solutions to exchange their valuable ideas and showcase the ongoing works which may lead to path breaking foundation of the futuristic engineering. I, on behalf of Ajeenkya DY Patil School of Engineering, heartily welcome eminent guests, academicians, delegates & all the participants to ICRAET-2025.

The main objective of the international conference is to provide a forum for presenting the developments and implementation of emerging, technologies in the field of engineering. I am confident that the discussions & publications of ICRAET-2025 proceeding will bring opportunities among academicians & students to present their innovative ideas.

I would like to congratulate faculties & staff of Ajeenkya DY Patil School of engineering for organizing ICRAET-2025.

I take this opportunity to wish grand success to the ICRAET-2025 and memorable time for all the participants at ICRAET-2025.

Hon. Dr. Ajeenkya DY Patil
Chairman
Ajeenkya DY Patil Group of Institutions

Advisor's Message

I am extremely delighted to know that Ajeenkya DY Patil School of Engineering has organized ICRAET-2025 conference on emerging trends in Science, Engineering and Technology. I congratulate all staff and students of the college for undertaking such an onerous responsibility of organizing such national conference.

An educational institution has a profound role in building an individual, the nation and the society. It is a job of soaring responsibility when the recipient of that education is slated to perform roles of high responsibility. At ADYPSOE, we believe in holistic education, which prepares our students for the real world. The conference provides a platform to Researchers, Academician, Practitioners and Policy makers to interact and exchange their views and learn from each other. The theme of the conference encompasses all the vital components of Science, Engineering and Technology. I am sure the presence of eminent speakers, researchers, faculty members and students would add splendor to the deliberations during conference. I wish the conference a grand Success.

Dr. Sushant V. Patil
Advisor & Trustee

Executive Vice President’s Message

Ajeenkya DY Patil School of Engineering established in 2010 and affiliated to Savitribai Phule Pune University is emerging as quality education institute in the state of Maharashtra. We, at Ajeenkya DY Patil School of Engineering, constantly strive for quality and perfection. We take ample care to produce industry ready engineers.

ICRAET-2025 is the International conference organized by Ajeenkya DY Patil School of Engineering, Pune. It is excellent platform for all Scholars, Researchers, Academician and Scientist to demonstrate their research work and contribute towards development of the modern society. The platform will definitely help to share innovative ideas and get input of the experts from the industry and academia to improve work and solve real world problems.

I would like to express my sincere gratitude to Hon. Dr. Ajeenkya DY Patil, Chairman, Ajeenkya DY Patil Group of Institutions, Dr. Sushant Patil, Trustee, Ajeenkya DY Patil School of Engineering and all committee members of ICRAET-2025.

Dr. Kamaljeet Kaur
Executive Vice-President-ADYPG

Principal’s Message

Ajeenkya DY Patil School of Engineering is the flagship college of the prestigious Ajeenkya DY Patil Group of Institutions. Over past 14 years the institute has earned its repute with quality of education and excellence in the field of engineering. The college is committed to provide high quality to its students and transform them into competent professionals who have domain knowledge and skills, management skills, mental maturity and understanding of professional advancements.

ICRAET-2025 is an exceptional platform which will give opportunity to the UG, PG students, academicians and industry personnel to showcase their research to the experts from engineering field.

I would like to express my sincere gratitude to Hon. Dr. Ajeenkya DY Patil, Chairman, Ajeenkya DY Patil Group of Institutions, Dr. Sushant Patil, Trustee, Ajeenkya DY Patil School of Engineering, Hon. Dr. Kamaljeet Kaur, Executive Vice Preseident-ADYPG and all committee members of ICRAET-2025.

Dr. F. B. Sayyad
Principal,

Convener’s Message

At the outset we congratulate all the faculty members of Ajeenkya DY Patil School of Engineering for organizing ICRAET-2025 for various streams in Science and Technology. The international conference is most awaited for all researchers to demonstrate their work in various fields.

It is an excellent networking platform for all the experts of various domains to stimulate the research dimension of participants. Ajeenkya DY Patil School of engineering has a perfect blend of infrastructure and human resource with rich experience and competent qualification to achieve good academic culture and conducive working environment for research and development.

We would like to express our sincere gratitude to Hon. Dr. Ajeenkya DY Patil, Chairman, Ajeenkya DY Patil Group of Institutions, Dr. Sushant Patil, Trustee, Ajeenkya DY Patil School of Engineering, Hon. Dr. Kamaljeet Kaur, Executive Vice President-ADYPG, Hon. Dr. F. B. Sayyad, Principal, Ajeenkya DY Patil School of Engineering, all HoDs, all Deans and all committee members of ICRAET-2025.

Dr. S. M. Khairnar
Convener, ICRAET-2025

Conference Coordinator's Message

The International conference ICRAET-2025 has received a fantastic response and I am happy to share that the delegates are participating in the conference from many countries. I am glad to note that the participants are presenting their articles on wider areas in Science, Engineering and Technology.

We at ADYPSOE are delighted to have such a diverse and knowledgeable group of professionals, researchers and enthusiasts joining us for the conference. Your presence will undoubtedly contribute to meaningful discussions and innovative ideas that will shape the future of the students and participants.

I, as the coordinator for ICRAET-2025, am thrilled to welcome you as part of the esteemed community of researchers and scholars. Your contributions are invaluable, and we are dedicated to ensuring that your work receives the recognition which it deserves through this conference proceeding.

Prof. Mamata Jiwankar
Assistant Professor
Engineering Sciences Department, ADYPSOE

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Automatic White Board Cleaner

Dnyanesh Bhosale, Ganesh Wayal, Bhavesh Damiwal, Neel Bihani, Devesh Deshmukh,

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ABSTRACT: Automation plays a major role in contributing for the societal development and to deliver best engineering solutions. The present project aimed to develop automated board cleaner to reduce the time consumed for board cleaning during teaching process and to increase lecture deliver time. With this motivation, the construction and model of automated board cleaner is done through manual & Auto cad software and validated for the dimensional accuracies for each component. The assembly process is initiated through the designed Auto cad model. Components such as White board, duster, frames, rods, lead screw, servo motor, bush, switch and copper wires were used for the assembly process. The "Automated White Board Cleaner" is a superb alternative to the "Manual Duster" and can be recommended for practical use to lessen the work required of users of the boards as well as to implement the same in the classroom with an automation system that further enhances the quality of smart classrooms.

I. INTRODUCTION

Education is the back bone of a nation. Education comprises of teaching and learning. The resources and materials used in teaching becoming updated along with the teaching and learning techniques. Writing was earlier done on sand, walls, slates made out of wood, chalkboards and in recent times on white boards and electronic boards. Chalk dust scatter causes serious health problems. Because of these reasons white board has been widely implemented into many other sectors of human endeavour besides teaching.. Many variations had been done on cleaning of whiteboard surfaces. Remote control motorized cleaners are made in which the dusters are operated with the help of remote control. This type of cleaner moves horizontally by means of motor mechanism and erase the board with the help of dusters attached to it but it could not create sufficient pressure on board. This limitation was solved by using rolling whiteboard surface and fixed dusters. Instead of moving the dusters the whiteboard surface is moved around the rollers. The friction produced between fixed dusters and rolling surface creates sufficient pressure to erase the written data on it but this process is too time consuming to clean the board. This drawback was overcome by using microcontroller and sensors but the longevity of board is short because it acts as flat belt. Remote control motorized cleaners makes use of belts which have low wear and tear resistance and with the frequent operation of cleaning process, the belt is likely to cut and hence makes the device or the cleaner less useful. Instead of belt, chain had been used to improve the cleaning procedure but it creates too much noise. Using cord and pulley arrangement the wiper bar connected to the motors can erase writings on the board which creates less noise but it requires four motors and two motor drivers causing too much cost. These limitations have been overcome by the proposed design in this paper. Arduino is using for wireless control and it helps in quick process.

Blackboards require a lot of time to get rubbed which increase the demand for whiteboards. The first whiteboards were very expensive and were made of enamelled steel but seeing the growing demand in the market cheaper whiteboards made of steel with polyester or acrylic coating of white color on it was launched. Here a marker pen is used as pen medium and as duster a piece of cloth or a foam duster. As the whiteboard has the advantage of not creating the dust as it only makes the duster dirty and it is very much comfortable using marker pen as it comes in different colors. Across the world now the whiteboard is the best writing medium. Different types of whiteboards like laminated chipboard, high-pressure laminated boards, and porcelain boards were launched in the market for cheaper alternatives. Now almost everything is automated and the automation system has the capacity to reduce the human effort and to make any arrangement easier. Modifications were also done in cleaning and rubbing methods of whiteboards. Remote control motorized cleaners were innovated to reduce the human efforts required for cleaning. This type of cleaner is operated by motors and is controlled by the switch.

Many researches and testing had been done on white board from a long time. Many variations had been done on cleaning of whiteboard surfaces. Remote control motorized cleaners are made in which the dusters are operated with the help of remote control. This type of cleaner moves horizontally by means of motor mechanism and erase the board with the help of dusters attached to it but it could not create sufficient pressure on board. This limitation was solved by using rolling whiteboard surface and fixed dusters. Instead of moving the dusters the whiteboard surface is moved around the rollers. The friction produced between fixed dusters and rolling surface creates sufficient pressure to erase the written data on it but this process is too time consuming to clean the board. This drawback was overcome by using microcontroller and sensors but the longevity of board surface is short because it acts as flat belt. Remote control motorized cleaners makes use of belts which have low wear and tear resistance and with the frequent operation of cleaning process, the belt is likely to cut and hence makes the device or the cleaner less useful. Instead of belt, chain had been used to improve the cleaning procedure but it creates too much noise. Using cord and pulley arrangement the wiper bar connected to the motors can erase writings on the board which creates less noise but it requires four motors and two motor drivers causing too much cost. These limitations have been overcome by the proposed design in this paper. Only one motor and one motor driver with rack and pinion mechanism is used instead of belts and large amount of pressure has provided by rack and pinion mechanism with necessary supports.

II. LITERATURE REVIEW

Sonia Akhter and Moudud Ahmad[1] overcome the problem erasing with a system in which only one motor and driver with rack and pinion mechanism are used instead of belts and a large amount of pressure has provided by rack and pinion mechanism with necessary supports.

S.Joshibaamali And K.Geetha Priya[2] explained that the cleaning process in three steps as first it cleans the left side of the board, second, it cleans the right side of the board and in the third mode, it cleans the whole area of the board. The machine uses two stepper motors to move duster in horizontal (x-axis) and vertical (y-axis) direction. To move the duster in up and down direction linear motor is used. The infrared transceiver is used to detect the horizontal direction of the motor. Four limit switches are used to detect the boundary of the board.

Mr. Sunil R. Kewate et. al. [3] explained in their paper the design and principles of sliding type wipe mechanism and also carried out the implementation and experimentation for motion analysis. The mechanism automatically detects the blackboard chalk stains and erases the font. This system consists of two motors, three guide rails, and three sliders.
S.nithyananth et. al. [4] has explained about rack and pinion mechanism with the application of steering mechanism. In the steering mechanism, the author is trying to tell that the rotational motion applied to pinion will cause the rack to slide up to the limit of its travel.

Dong Yeop Kim et. al. [5] proposed a limit switch module as a mechanical sensor method. In this system, there are two limit switches. Their combination is translated to building wall shape information. The ARS sensor and the height sensor are used to mapping to 3D localization of the robot. If ARS sensor and height sensor is attached to another place of the gondola, the sensor data is needed to send to this limit switch module process algorithm.

Mojtaba Khaliliana et. al [6] used a direct torque control technique to control the torque instantaneously and improve the performance of the hybrid stepper motor. Then by taking the model reference adaptive system scheme, which uses a hybrid stepper motor itself as the reference model, the speed of the motor is estimated. The sensorless control of a hybrid stepper motor based on MRAS with Matlab software is built and simulated. The results show that the control technology is simple and effective and accuracy is considerably high [7]. The electric board cleaner and the automatic whiteboard cleaner make use of belts. Most belts have low wear and tear resistance and with the frequent operation of the duster (i.e. the cleaning process), the belt is likely to cut and hence makes the device or the cleaner-less useful. In the process of trying to change the belt, the whole components may have to be loosened which is time-consuming. However, as for the case of the electric board cleaner, the idea of applying manual effort still comes in. The difference being that effort applied is less since it is powered electrically.

This project is aimed at modifying the automatic whiteboard cleaner by replacing the belts and chains with rack and pinion gear which will improve the efficiency and effectiveness of the cleaner. The objective of this project is to reduce the stress of cleaning the board by using an automated duster.

III. METHODOLOGY

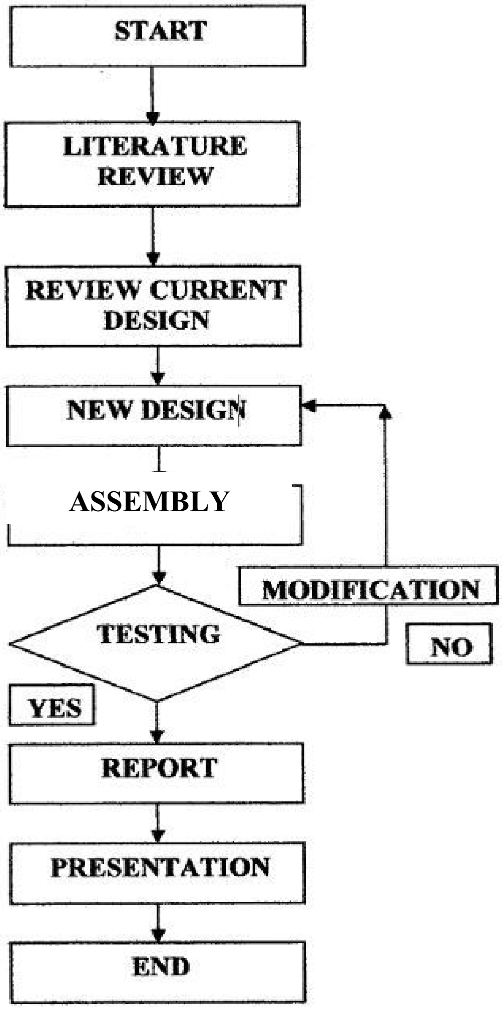

FIG:- 3.1 FLOWCHART

IV. MATERIAL SELECTION

When doing a project, it is important to pay attention to the selection of materials. To prevent waste, the items selection process must be carefully welcomed. A precise selection of items is necessary to ensure that they are long-lasting and safe for usage.

4.1.Rack & Pinion :- Used to move the duster form left to right for cleaning the board.

FIG:-4.1:- Rack & Pinion

4.2.DC Motor :- In this project, the gears are rotated or moved by DC motors. It is powered by 12 volts and runs at 10 rpm.

FIG:-4.2 :- DC Motor

4.4.Duster:- Used for cleaning the whiteboard and blackboard in schools, colleges & offices.

FIG:-4.3 :-Duster

4.4.Whiteboard:- Used is schools colleges and offices for writing.

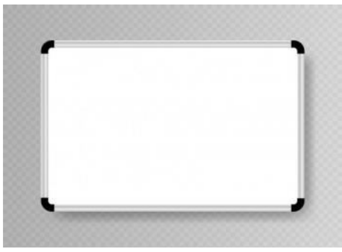

FIG:-4.4 :- Whiteboard

4.5.Connecting Rod:- In this project the connecting rod is used to connect the two gears for moving the two gears parallel to each other.

FIG:-4.5 :- Connecting Rod

4.6Aluminium Frame:- Since aluminium is known to be lightweight and resistant to corrosion, that is the sort of material we have chosen for the frame.

FIG:-4.6 :- Aluminium Frame

.**4.7 Charger:-** The primary energy source for the "Fan Blade Cleaner" is Charger with a 12 volt capacity.

Fig:- 4.7 :- Charger

4.8 Working Model: - This model work with the help of motor the motor moves forward and reverse with the aluminium frame and the dusters attached to the frame moves with it to clean the board.

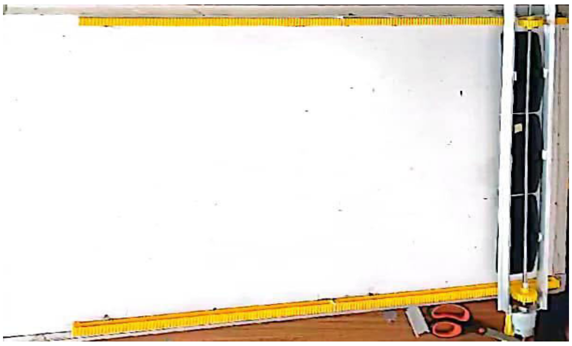

FIG:- 4.8 :- Working Model

V. CONCLUSION

The objective of this work which is to design an automated whiteboard cleaner has been achieved to an extent. There is a need for further assembly works. The structures of the chains and sprocket were conceived to fit properly into the cleaning mechanism, but due to inadequate tensioning, prevented the automated duster from performing the required function adequately. The gear mechanism could have been used to reduce the speed of the motor, but considering the weight which it might have on the machine, variable speed regulators were inculcated instead. Due to the forward motion of the duster, the sensor was needed to trigger off the motor whenever the duster gets to the end of the board. This can be used to prevent damage to the motor. Finally, the automated duster when fully completed will give effective cleaning after two to three sweeps. It is recommended that the machine be improved in terms of tensioning of the chains to ensure effective cleaning and that rollers are placed at the base just in front of the duster, creating a groove where it can move. Finally, proper fitting of bearings on the sprocket is put in place to reduce the load on the electric motor.

It is concluded that automatic whiteboard cleaner has successfully designed. The system has designed with innovative features which reduces human efforts and makes teaching efficient. This type of whiteboard could be very effectively used in schools, colleges and universities as it increases the interest of the students to study with different technology. The machine has reduced both time and human effort. The construction of automatic whiteboard cleaner consists of arduino microcontroller which is very user friendly in programming. On the other hand to construct the main structure, very simple tool work is needed, and the materials used in this project is cheap and easily available in market. So it is not complicated to construct this machine and it will help to introduce an automation system. The system can be further developed by integrating a bluetooth remote for controlling the switch. Infrared sensors can be used to convert this system to a smart white board cleaner. Aesthetic looks of the whiteboard can also be improved .

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Piezoelectric Mobile Charger - A Sustainable Energy Harvesting Solution

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ABSTRACT: Growing demand for sustainable energy solutions. Piezoelectric mobile chargers harness mechanical energy for power generation. This research covers material selection, circuit design, and real world applications. The goal is to create an alternative to traditional battery charging In spite of great advances in cell phone technology, the rapid discharge of phone batteries remains a widespread problem. One solution may be recharging phones with movements of the body, such as with energy harvesting shoes. Soft-soled impact-absorbing shoes are best for the feet and for general health. Energy harvesting from shoes have been of interest for decades, but the technology is still in the research phase. Piezoelectric voltage generation at shoes is made more feasible with recent advances in flexible piezoelectric materials. The characteristics of energy conversion at shoes have been studied. Shoes connected through wires on the legs to power electronics can charge a phone at the waist. An extra battery source at the power electronics would be an inconvenience, and a simple full wave rectifier with filter is proposed for initial testing. The resulting large time constant implies the need for a large capacitor. The design considerations in this paper may be the basis of further research and experimentation

I. INTRODUCTION

Piezoelectric shoes represent an innovative intersection of wearable technology and sustainable energy solutions. The fundamental principle behind piezoelectricity lies in the ability of certain materials to generate an electrical charge in response to applied mechanical stress. This phenomenon occurs due to the displacement of positive and negative charges within the material's crystalline structure when pressure is exerted, effectively converting kinetic energy into electrical energy. In the realm of footwear, the integration of piezoelectric materials opens up exciting possibilities for energy harvesting. As individuals walk or run, the pressure and movement exerted on the shoes create mechanical stress that can be harnessed to generate electricity. This harvested energy can then be used to power small electronic devices, such as fitness trackers, smart watches, or even LED lights embedded in the shoes.

The prospect of self-powered footwear not only enhances user convenience but also contributes to reducing reliance on traditional battery sources. The applications of piezoelectric shoes extend beyond personal convenience. In various fields, such as sports science, healthcare, and smart city initiatives, the data collected from the generated energy can be utilized for monitoring and analysis. For instance, athletes can benefit from real-time feedback on their performance metrics, while healthcare professionals might leverage the technology to monitor patients' mobility and activity levels, providing critical insights into rehabilitation processes.

Moreover, the environmental impact of integrating piezoelectric materials into footwear cannot be overlooked. By harnessing energy from everyday activities, piezoelectric shoes present a sustainable alternative to conventional energy sources, potentially leading to a reduction in carbon footprints associated with battery production and disposal. As research and development in this area continues to progress, the relevance of piezoelectric shoes in promoting energy efficiency and enhancing quality of life becomes increasingly apparent In the recent years there has been an increasing interest in research and development of advanced smartphone technology. But as technology evolves so are the problems associated with it, and one among those is the fast draining of batteries. Almost every smartphone user wishes he had more battery life. Now, imagine your phone getting charged wherever you go.

This is possible by Piezoelectric wireless power transfer mobile charging technique. The keys to this technique are the piezoelectricity and Wireless power transfer (WTP). Harvesting mechanical energy from human motion is an attractive approach for obtaining clean and sustainable electric energy Piezoelectricity is electrical energy produced from mechanical pressure (such as walking, running). When pressure is applied to an object, a negative charge is produced on the expanded side and a positive charge on the compressed side of the piezoelectric crystal. Once the pressure is relieved, electrical current flows across the material.

Wireless power or wireless energy transmission is the transmission of electrical energy from a Power source (piezoelectric Power) to a load (such as any electrical device) without any physical connector such as wires or conductors. Energy is harvested from the human movements and is transmitted wirelessly through wireless power transfer technique and is used to charge the mobile battery.

II. LITERATURE REVIEW

The AC Source in the simulation represents the piezo electric generator which harnesses the energy from the human motion. Simulation Circuit (Matlab - Simulink). The AC power which is generated from the piezo electric generator is then converted into DC using Rectification circuit which in our prototype is a bridge rectifier. This power is further filtered using filtering elements. This power is regulated using regulator, then this power is converted into high frequency AC using high frequency inverter. Just before the power is transmitted using wireless power transfer method it is discharged through a super capacitor. [1]

Apart from the first piezoelectric material quartz, many other natural piezoelectric materials have been found and also many new artificial piezoelectric materials were synthesized and developed for a variety of applications. These can be classified into piezoelectric inorganic ceramics, piezoelectric polymers, bio-piezoelectric materials, and two-dimensional (2-D) materials. The power transmitted using wireless power transfer, here Resonant Coupling technique is used to transmit the power efficiently. This power is the received in the Rx (Receiver Coil) and the obtained power is further rectified using bridge rectification circuit. Since the output voltage received from the rectification circuit is insufficient low for charging electronic device. The power is boosted using DC-DC converter, interleaved boost converter as shown The proposed model is designed to input Volts to the boost converter and at the output it can be seen that the voltage is boosted to 12 Volts the graphical representation of the output after rectification unit.[2]

The X axis represents the time in Seconds and the Y axis represents the voltage in volts. Illustrates the Output voltage after the power obtained from piezo electric generator is rectified using a bridge rectifier. The voltage after rectification is 3 Volts DC. The constant output obtained from the regulator is then converted to AC using a high frequency inverter. The output from the high frequency inverter is shown is It is essential to input a high frequency AC to wireless power transfer unit. explains the input at the coil Tx of the wireless power transfer unit.Various designs and prototypes The human body expends a significant portion of energy while performing different daily activities. Some of these activities involve breathing, speaking, arms lifting, walking, eating, etc. However, all these strain and kinetic energies cannot be used for energy harvesting.[3]

A rule of thumb in designing harvesters scavenging energy from the human body is that they should not intervene in normal activities and add to the metabolic cost. These restrictions make it necessary to determine the energy Commercial products/patents 'Now Energy' commercialized a piezoelectric smart shoe, in which the sole is incorporated with a piezoelectric ceramic energy harvester, which converts the mechanical pressure on the insole into electrical energy. The shoe is capable of generating electrical energy with each walking step. Thus, the product is capable of measuring the real-time workout matrices of a wearer during running. In addition to this, a number of technologies based on piezoelectric shoe energy harvesting have been.[4]

The human body expends a significant portion of energy while performing different daily activities. Some of these activities involve breathing, speaking, arms lifting, walking, eating, etc. However, all these strain and kinetic energies cannot be used for energy harvesting. A rule of thumb in designing harvesters scavenging energy from the human body is that they should not intervene in normal activities and add to the metabolic cost. These restrictions make it necessary to determine the energy.[5]

III. METHODOLOGY

3.1Material Used

3.1.1 Rectifier Circuit:

Converts the AC voltage generated by the piezoelectric material into DC voltage. Storage Unit: Typically, a super capacitor or rechargeable battery stores the harvested energy. Boost Converter: Steps up the voltage to meet mobile charging requirements.

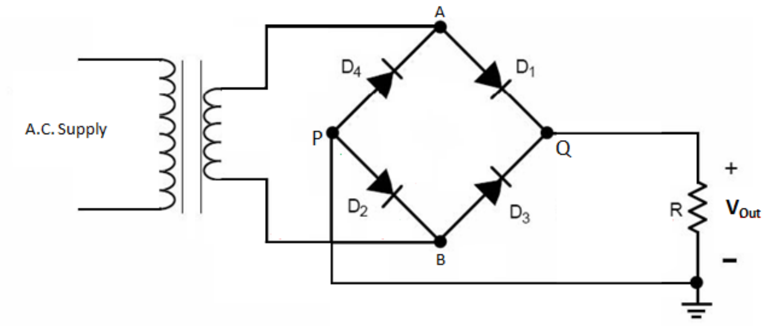


Fig 3.1.1: Rectifier Circuit

3.1.2 Voltage Regulator:
Ensures a stable power supply to prevent fluctuations in charging. Key Considerations in Power Management: Energy Loss Energy is lost during AC-to-DC conversion and storage. High-efficiency rectifiers minimize losses.

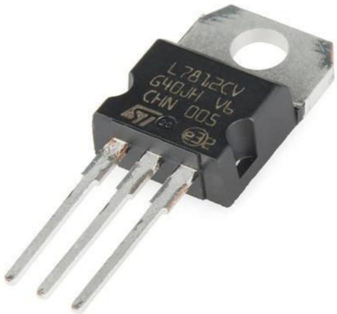


Fig 3.1.2: Voltage Regulator

3.1.3Piezoelectric plates:

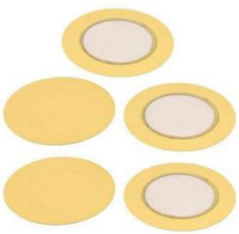


Fig 3.1.3: Piezoelectric plates

3.1.4 Led:

Fig 3.1.4: Led

3.1.5 PCB:

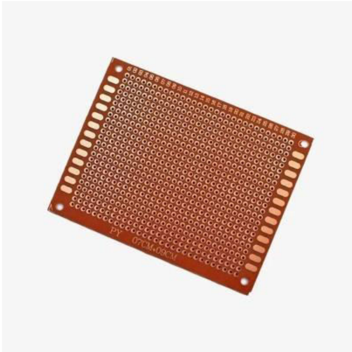


Fig 3.1.5: PCB

3.1.6 Resistor:

Fig 3.1.6: Resistor

3.1.7 Rechargeable Battery:

Fig 3.1.7: Rechargeable Battery

3.1.8 USB Cable:

Fig 3.1.8: USB Cable

3.1.9 Diode:

Fig 3.1.9: Diode

3.1.10 Wire:

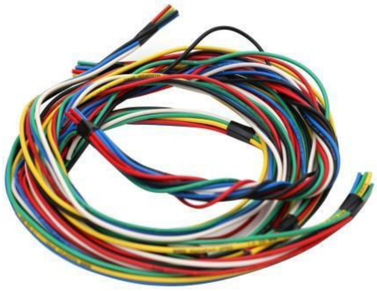


Fig 3.1.10: Wire

3.1.11 USB Port:

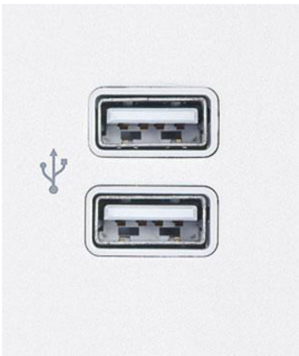


Fig 3.1.11: USB Port

3.1.12 Shoe:

Fig 3.1.13: Shoe

3.2 Working Principle:

Fig 3.2: Working Model

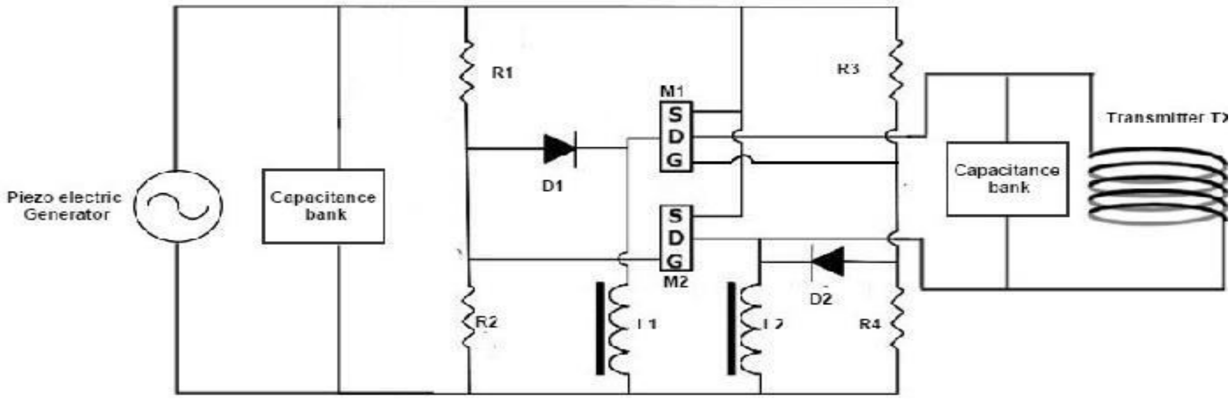
Piezoelectric materials generate electricity when subjected to mechanical stress. Energy sources include human movement, vehicle vibrations, and industrial machinery. Common applications include: Smart shoes that generate electricity while walking. Self-powered wearables such as smartwatches. Roads and sidewalks that produce electricity from foot traffic. Efficiency depends on material properties, frequency of stress, and circuit optimization.. In this research, the system works by having mechanical stress applied to a PZT piezoelectric disc 25mm to 37mm in size to produce ambient vibration by walking and is then converted into electrical energy via mechanical deformation of the piezoelectric elements. Then, the AC voltage is converted into DC through AC-DC rectifier circuit consisting of 1N4007 diodes. The supplied power is then stored in an external storage before being connected into a rechargeable mobile device via USB cable. Two different sizes of 27mm and 35mm in Figure 3.2 of piezoelectric disc was tested using a multimeter and the AC voltage generated from each disc during 8 continuous stepping based on the type of steps applied to it. Every test was done twice to find the average mean of AC voltage and current values is then recorded. The piezoelectric ceramic was hooked together in parallel or series before connected to the bridge rectifier.

Load Balancing: Managing power delivery to match mobile device consumption without overloading Circuit

Optimization: Smart IC controllers are used to improve efficiency and extend battery lifespan.Real-World
Modern piezoelectric energy harvesters integrate MPPT (Maximum Power Point Tracking) [3]techniques to maximize output. Hybrid Circuits combine piezoelectric charging with solar or kinetic energy sources for greater efficiency. Wearable devices use low-power microcontrollers to regulate energy flow effectively- Piezoelectric energy harvesting is widely used in different industries:Wearable Technology Smartwatches, fitness bands, and biomedical implants powered by body movements. - Smart Infrastructure: Roads, pavements, and bridges generating power from traffic vibrations. - Industrial Monitoring Wireless sensors operating in remote locations without batteries. Automobile Sector Cars utilizing tire vibrations to generate auxiliary power. Hybrid Energy Systems Combining piezoelectric harvesting with wind and solar power for maximum efficiency. Research is also focusing on biodegradable piezoelectric materials for eco-friendly energy solutions.Various piezoelectric footwear power generators have been developed over the past two decades to convert mechanical energy under the foot to usable electricity. To fit in the limited space between the foot and the ground, the structures of piezoelectric transducers were designed diversely. A majority of the designs are for directly harvesting the plantar foot pressure and ground reaction forces, such as the piezoelectric insole and sole energy harvesters.

Because shoe soles bend during walking, the insole and sole piezoelectric energy harvesters are usually designed with flexible structures and soft piezoelectric materials, such as PVDF. Stiffer structures could lead to discomfort and invasiveness, or even change the gait pattern during human walking. The locations of piezoelectric transducers inside shoes mainly depend on the energy sources targeted to harvest. While insole harvesters are designed to harvest foot pressure, piezoelectric stacks and thunders are particularly favored for scavenging ground reaction forces and are therefore usually placed in the heel and forefoot To improve the power generation performance, piezoelectric transducers with force amplifiers are developed to amplify the ground reaction force.

Figure 4: Circuit Diagram



IV. CONCLUSION AND FUTURE WORK

Piezoelectric chargers provide an innovative and sustainable power solution. - They reduce dependence on fossil fuels and enable self-powered devices. - Future research aims to: - Improve material efficiency and increase energy output. - Develop hybrid energy harvesting systems. - Enhance durability and integration into daily-use devices. - Implement AI-driven energy management for optimized power distribution. - With further advancements, piezoelectric technology could revolutionize portable and The societal impact of widespread adoption of piezoelectric shoes could be profound. By reducing reliance on traditional battery sources, this technology aligns with global sustainability goals and offers a practical solution to energy consumption challenges. Furthermore, the potential for integrating these shoes into smart city frameworks could lead to more efficient urban ecosystems, where data from individual movements could inform city planning and environmental monitoring efforts. In conclusion, the trajectory of piezoelectric shoes highlights an exciting intersection of technology and sustainability. As advancements continue, the integration of piezoelectric technology into everyday life could not only enhance user convenience but also foster a broader cultural shift towards energy efficiency and innovation.

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Line Following Robot with Automatic Unloading Mechanism

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ABSTRACT: With rapid advancements in robotics and automation, autonomous robots have gained significant importance in industrial and logistics applications. These robots play a crucial role in streamlining operations, reducing human intervention, and improving overall efficiency in warehouses, manufacturing units, and supply chain management. Among various types of autonomous robots, line-following robots have emerged as a fundamental solution for material transportation and automated handling. This paper presents the development and implementation of a Line Following Robot with an Automatic Unloading Mechanism. The robot is specifically designed to follow a predefined path using infrared (IR) sensors and autonomously unload its contents at a designated location. A third sensor, which can be a color sensor or a proximity sensor, is utilized to detect the unloading point. Upon reaching the marked unloading zone, the robot activates a servo-controlled hinge mechanism that facilitates the smooth and efficient release of materials. The system integrates multiple hardware components, including an Arduino microcontroller, motor drivers, and sensor modules, to create a robust and reliable solution for automated material handling. The IR sensors play a vital role in tracking the predefined line, ensuring precise navigation, while the additional sensor helps in identifying the correct unloading point, eliminating the need for manual intervention. This research highlights the potential of autonomous robotics in improving industrial automation, showcasing how a simple yet intelligent system can contribute to enhancing operational efficiency. The Line Following Robot with an Automatic Unloading Mechanism stands as a testament to the growing synergy between robotics, automation, and artificial intelligence in shaping the future of industrial processes.

I. INTRODUCTION

The goal of this project is to create a simple and smart robot that can follow a line without needing human control. This type of robot, known as a Line Following Robot, is designed to move along a predefined black line on a white surface using infrared (IR) sensors. The robot detects the line and adjusts its wheels accordingly to stay on track. This concept can be extremely useful in places like factories, schools, hospitals, libraries, and warehouses, where a robot can carry items or perform routine navigation tasks. What makes this project special is that it is both affordable and beginner-friendly, making it suitable for students, hobbyists, and educators.

Right now, robots that follow lines are mostly seen in advanced industries or labs, and they usually cost a lot. But with easily available components like an Arduino UNO board, IR sensors, L298N motor driver, 2WD car chassis, and a battery pack, we can build a working version at home or in the classroom. Traditional methods of moving goods or guiding paths often require human effort, which can lead to inconsistency and fatigue. This robot helps reduce human effort, provides consistency, and introduces automation in a very simple way. It can be used for educational demonstrations, mini delivery systems, or as the base of bigger automation projects.

The robot works by constantly checking if it's on the black line using its two IR sensors. Based on the sensor readings, the motor driver changes the movement of the motors to keep the robot following the line accurately. The use of a microcontroller (Arduino) makes the system smart and easy to program or update. This project not only teaches important concepts of electronics, robotics, and programming, but it also opens doors to more advanced ideas like automatic unloading, object detection, or smart navigation in future versions. This robot is a small step toward learning real-world automation and robotics with a fun and practical approach.

II. LITERATURE REVIEW

The field of autonomous robotics has seen significant advancements in recent years, with researchers exploring various sensor-based navigation and material handling techniques to improve efficiency in industrial and logistics applications. Several studies have provided valuable insights into the development and implementation of such systems, laying the groundwork for this project.

The key innovations and improvements introduced by this system include:
Multi-Sensor Integration: The combination of IR sensors for line-following and an additional color/proximity sensor for unloading detection The field of autonomous robotics has seen significant advancements in recent years, with researchers exploring various sensor-based navigation and material handling techniques to improve efficiency in industrial and logistics applications. Several studies have provided valuable insights into the development and implementation of such systems, laying the groundwork for this project.

"Autonomous Line-Following Robots" - Lee et al. (2020):
This study examines different sensor-based navigation techniques used in autonomous robots, particularly focusing on infrared (IR) sensors, ultrasonic sensors, and camera-based vision systems for precise movement and obstacle detection. It highlights the challenges of maintaining path accuracy in dynamic environments, offering solutions such as adaptive path correction algorithms and multi-sensor integration.

"Smart Transport Systems for Automated Warehouses" - Kim et al. (2021):
Explores the use of embedded control systems for autonomous material handling, emphasizing the role of microcontrollers like Arduino and Raspberry Pi in managing robotic navigation.
Discusses how AI-based predictive models and machine learning algorithms can optimize movement patterns, reduce congestion, and enhance efficiency in warehouse automation.
Addresses the energy efficiency of autonomous robots, proposing solutions like optimized motor control algorithms to extend battery life.

"Sensor-Based Robotics for Industrial Applications" - Wang et al. (2022):
Contribution and Innovation of This Project:
Building on the findings of these studies, this project integrates advanced sensor-based ensures highly accurate and autonomous material transportation.
Automated Unloading Mechanism: Unlike conventional line-following robots that require manual intervention for unloading, this system features a servo-controlled hinge mechanism that enables precise, hands-free unloading at designated points.
Real-Time Path Correction: By leveraging sensor fusion techniques, the system dynamically adjusts its path in response to minor deviations, reducing navigation errors and improving operational stability.
Scalability and Adaptability: The system can be customized for various industrial applications, including smart warehouses, automated factories, and large-scale material transport operations.
Cost-Effective and Energy-Efficient Design: The use of low-cost microcontrollers and efficient motor drivers ensures affordability without compromising performance, making it a viable option for businesses seeking automation solutions on a budget..

III. METHODOLOGY

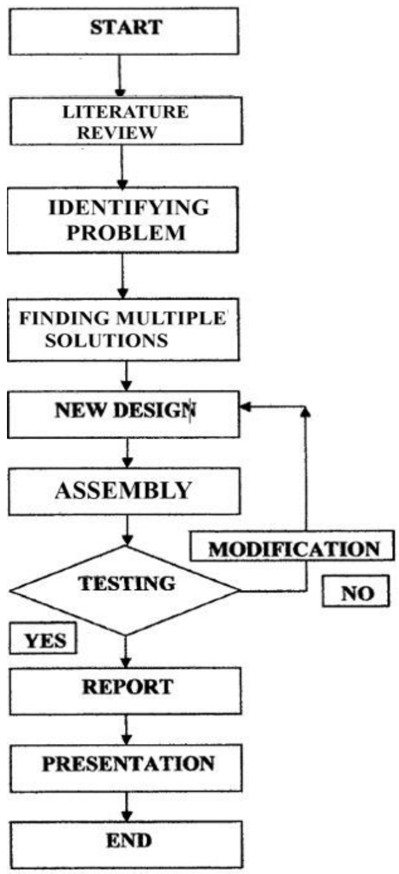

Fig. 3.1 Flow Chart

IV. MATERIAL SELECTION

When doing a project, it is important to pay attention to the selection of materials. To prevent waste, the items selection process must be carefully welcomed. A precise selection of items is necessary to ensure that they are long-lasting and safe for usage.

4.1 Arduino UNO

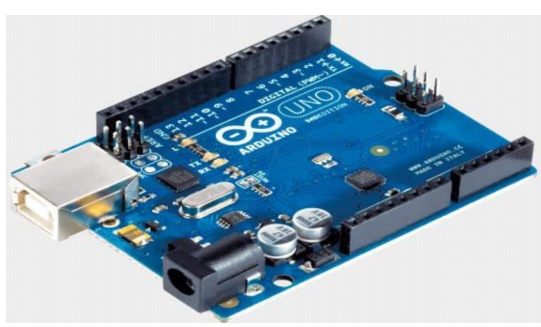

Fig.4.1 Arduino Uno

The Arduino UNO is essential for the line-following robot because it acts as the brain, processing sensor inputs and controlling motors. It provides easy code execution, pin compatibility, and PWM control, making it ideal for robotics and automation projects.

4.2 Motor Driver Module

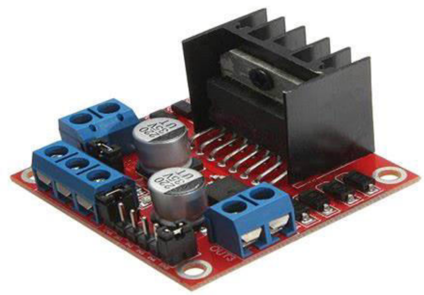

Fig. 4.2 L298N Motor Driver Module

The L298N motor driver is crucial for controlling the robot's motors, allowing the Arduino UNO to manage speed and direction efficiently. It provides high current handling, dual motor control, and PWM support, making smooth movement and precise turns possible.

4.3 IR Sensor

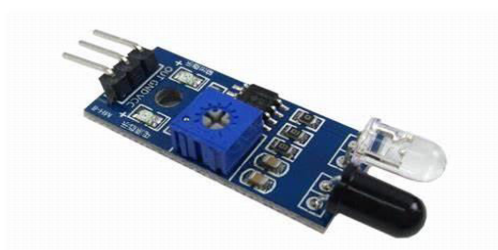

Fig. 4.3 IR Sensor

The IR sensors detect the black line by measuring light reflection. They send signals to the Arduino UNO, which adjusts the motors accordingly. This ensures the robot stays on track, making real-time corrections for smooth and accurate line following.

4.4 AAA Battery

Fig. 4.4 AAA Batteries

The battery powers the Arduino Uno, motor driver, and sensors. A stable voltage supply ensures consistent performance. The right battery capacity prevents power drops, ensuring smooth motor operation and uninterrupted line-following functionality for an extended period.

4.5 Car Kit

Fig. 4.5 2WD Car Kit

The 2WD car kit provides the chassis, wheels, and motors, forming the robot's foundation. Its gear motors enable movement, while the universal wheel aids stability. A sturdy chassis ensures all components stay securely mounted, allowing smooth and efficient line-following performance.

V.RESULT

5.1 Working Principle

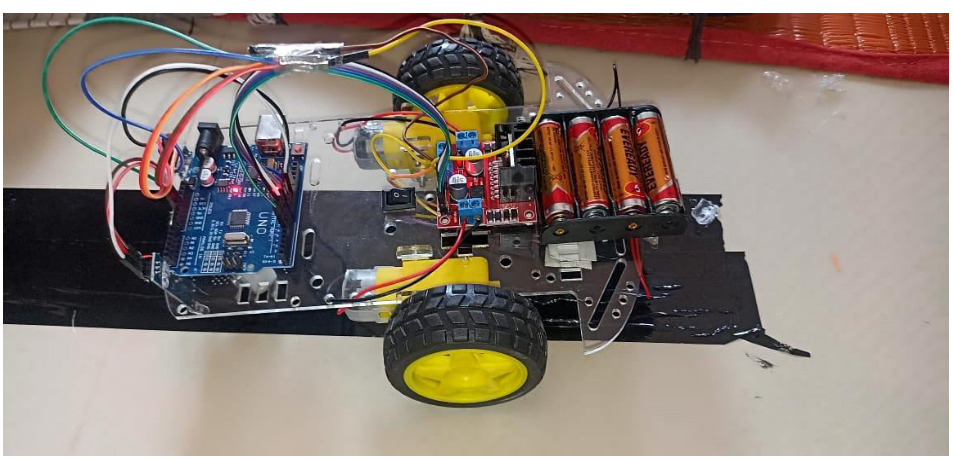

Fig. 5.1 Working Model

The line-following robot relies on two IR sensors to detect the black line against a white background. These sensors send signals to the Arduino Uno, which processes the data and decides how to adjust the movement. The L298N motor driver controls the 2WD motors, ensuring the robot stays on track. A battery powers the entire system, providing the necessary voltage for continuous operation. As the robot moves, the IR sensors detect changes in contrast, sending signals to the Arduino. If the robot veers off the line, the Arduino instructs the motor driver to adjust speed and direction. This allows the robot to self-correct and stay on the path without human intervention.

The L298N motor driver acts as an interface between the Arduino and motors, allowing precise speed and directional control. The 2WD car kit provides the necessary chassis, motors, and wheels, ensuring smooth movement. The battery pack supplies stable power, enabling the robot to function efficiently. Overall, the system works seamlessly by processing sensor inputs, adjusting motor speeds, and using real-time feedback to follow the line. This combination of sensors, processing, and control makes the robot autonomous and efficient in navigation.

VI. CONCLUSION AND FUTURE SCOPE

The line-following robot is a fundamental autonomous system that demonstrates the practical application of sensors, microcontrollers, and motor control. By integrating IR sensors, an Arduino Uno, an L298N motor driver, and a 2WD chassis, the robot efficiently follows a predefined path. This project enhances understanding of embedded systems, robotics, and automation, making it an excellent starting point for beginners in electronics and AI-driven robotics. Its precise movements and real-time corrections highlight the importance of feedback mechanisms in autonomous navigation.

Advancements can enhance the robot's functionality, such as adding more sensors for obstacle avoidance, integrating machine learning for adaptive path correction, or using wireless communication for remote control. By upgrading the power source and motors, it can handle rough terrains or perform industrial automation tasks. Future modifications may allow swarm robotics applications, warehouse automation, and AI-powered navigation, making this simple robot a stepping stone toward more sophisticated, intelligent robotic systems.

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Hospital Management System

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ABSTRACT: The rapid advancement in Information and Communication Technology (ICT) and the widespread use of the Internet have significantly transformed global healthcare delivery. E-Hospital Management Systems (E-HMS) offer streamlined operations, improved administration, better patient care, cost efficiency, and increased profitability. Compliance with standards like HIPAA and HL7 is essential for data privacy and interoperability. This qualitative, descriptive study explores the performance indicators, standards, and components of Hospital Information Systems (HIS), using secondary data and case studies to highlight success factors and challenges. It also presents a generic module-based E-HMS framework to aid researchers and professionals. A prototype RFID-based Healthcare Management System (RHMS) was developed and tested to demonstrate the practical benefits of RFID in optimizing healthcare processes. Additionally, the study investigates Quality Management System (QMS) implementation across the Netherlands, Hungary, and Finland, emphasizing the role of national policies. The need for electronic consent systems, such as the iPad-based RPMS developed by the Health Sciences of South Carolina, is also examined to replace inefficient paper-based methods. Lastly, a system implemented at Murab Hospital, Nigeria, using HTML, CSS, PHP, and MySQL, showcased improved patient services and information infrastructure over the traditional system.

I. INTRODUCTION

Hospital Information Systems (HIS) are increasingly in demand to meet the growing healthcare needs of the population and assist doctors and hospital staff in delivering precise and timely care. These systems are essential for streamlining operations such as patient data management, billing, diagnostics, immunization records, and prescription handling. While many off-the-shelf HIS solutions exist, they often require customization to suit individual hospital workflows and user requirements. This study explores the key components and performance indicators of E-Hospital Management Systems (E-HMS) to establish a benchmark for successful implementation. Hospitals, being complex administrative organizations, play a crucial role not only in patient care but also in medical education and research. The adoption of information technology has significantly improved intra-organizational communication, allowing for faster and more accurate processing of clinical data.

A robust HMS should support role-based access, efficient data retrieval, error handling, and secure storage, while enabling scalability and interactivity across hospital departments. Prior studies indicate that while some systems retrieve and manage patient records effectively, they often lack functionalities like multi-format data export or holistic hospital management features. The use of innovative technologies like RFID is increasingly being explored to transform healthcare services by enhancing patient safety, automating data capture, and reducing operational inefficiencies. RFID, already adopted in various industries like logistics and manufacturing, holds promise for healthcare applications, particularly in patient tracking, medication management, and asset monitoring. The healthcare industry, being one of the largest and fastest-growing globally, demands IT systems that offer higher business value, improve care delivery, and maintain data integrity.

One of the critical aspects of healthcare IT is managing informed consent, a legal and ethical requirement for medical treatment and research participation. Traditional paper-based consent forms present challenges in data retrieval, patient comprehension, and research participant identification. To address these gaps, the Health Sciences South Carolina (HSSC) developed the Research Permissions Management System (RPMS)—an electronic platform designed to manage informed consents more effectively. RPMS enables indexing, searchability, and integration of educational media to enhance understanding and compliance. By digitizing consent processes, RPMS aligns with HIPAA and Common Rule regulations, supporting the secure and ethical use of patient data and tissues for research. This system not only preserves patient autonomy but also fosters innovation by streamlining research participant recruitment across healthcare institutions.

II. LITERATURE REVIEW

The study adopts a qualitative and descriptive research approach, primarily relying on secondary data sources, including published survey reports and documented case studies. This methodology is well-suited to the broad and multifaceted nature of the research topic, where relevant data is dispersed across various institutions and geographic regions. By analyzing existing survey data alongside well-documented, successful case studies of Hospital Information Systems (HIS), the study aims to develop a comprehensive understanding of E-Hospital Management. This combined approach provides valuable insights into performance benchmarks, implementation strategies, and critical success factors, thereby enabling a more accurate and holistic response to the research questions posed.[1]

RFID technology enables wireless data storage and automatic retrieval, offering significant advantages over traditional barcode systems in terms of object identification, tracking, and inventory management. While RFID has seen successful applications in industries like logistics and manufacturing, its adoption in healthcare is still evolving. Several studies have explored its use for tracking medical equipment, monitoring patient location, and improving workflow efficiency. Despite these promising outcomes, challenges remain, including compliance with health standards, concerns about staff surveillance, and limited theoretical frameworks to guide system design. The lack of mature, plug-and-play RFID solutions highlights the need for continued research and development—particularly design science research—to fully realize RFID's potential in healthcare environments.[2]

The Quality Act in the Netherlands provides a framework for hospitals to develop their own Quality Management Systems (QMS), allowing flexibility in choosing methods such as peer reviews, audits, and satisfaction surveys. However, hospitals are required to publish an annual quality report for accountability. Increasingly, hospitals are adopting NIAZ accreditation standards, which ensure that quality care is systematically regulated rather than left to individual discretion. While some departments hold ISO certifications, full hospital ISO certification is uncommon and not financially incentivized. Additionally, the Individual Health Care Professions Act mandates quality assurance among practitioners through protected titles, registration, and ongoing evaluations to safeguard patients and uphold professional standards.[3]

In all four test conditions, patients and hospital staff followed a consistent procedure. Each session began with a researcher briefing both parties separately, followed by consent and a short demographic questionnaire. Participants then completed the consenting process at the registration office, with the researcher recording completion time and errors. Afterward, a retrospective think-aloud session captured user concerns. Participants filled out the IBM-CSUQ for usability feedback, while patients completed a semantic questionnaire to assess their understanding of the consent form. Hospital staff also completed the NASA-TLX workload assessment. This process was repeated across all conditions with different patients, concluding with a final preference ranking by the hospital staff. Each session lasted around 80 minutes.[4]

Testing was conducted on individual system modules to ensure they met essential functional requirements such as user authentication, on-demand report generation, and administrative capabilities like record deletion. Following module-level validation, integration and system testing were performed to confirm compatibility and ensure that all components functioned cohesively as a unified, fully operational system.[5]

III. METHODOLOGY

Case Study Selection and Objectives -Murab Hospital in Ilorin, Kwara State, Nigeria was selected for this study due to convenient access to its medical data and personnel. The goal was to evaluate the hospital's current management system and explore ways to enhance its efficiency. Researchers conducted onsite visits, interviewed medical staff to understand their roles and challenges, and reviewed various documents including bills, receipts, and test reports. This helped identify how the hospital organizes records using a "System of Number" for referencing and storing data, and how manual processes could be digitized.

Assessment of Existing System -The hospital currently operates with a fully manual, one-directional information flow. Patients are referred from reception to doctors, then to pharmacists, and vice versa. Drug dispensing and inventory records, as well as payments and staff receipts, are handled entirely on paper. Key challenges include time-consuming data entry, difficulty retrieving information, and high risk of data loss or tampering. The paperwork-heavy process significantly reduces efficiency and delays medical reporting.

System Design and Implementation -To address these challenges, a new system was designed using a relational database (RDBMS), implemented with MySQL, PHP, HTML, and CSS. WAMP was used as the runtime environment. The RDBMS structure supports flexible and organized data management, while data dictionaries defined tables and field attributes. The user interface was developed for ease of access and interaction. The minimum system requirements included a 1.2GHz processor, 128MB RAM, 60GB storage, and an 800x600 display, running Windows 2000 or later.Experimental Testing and Setup- An empirical study was conducted with 40 patients (aged 18–77) and 10 experienced hospital registration staff (aged 23–74). Participants were divided across four consent environments: paper-based, Topaz electronic signature, touchscreen, and iPad. Each staff member facilitated sessions for all four systems, while each patient used only one. The study used a mixed experimental design: a within-subject approach for staff and a between-subjects approach for patients. Consent interfaces were tested for usability, efficiency, and user understanding, with the order of system usage randomized to minimize bias.

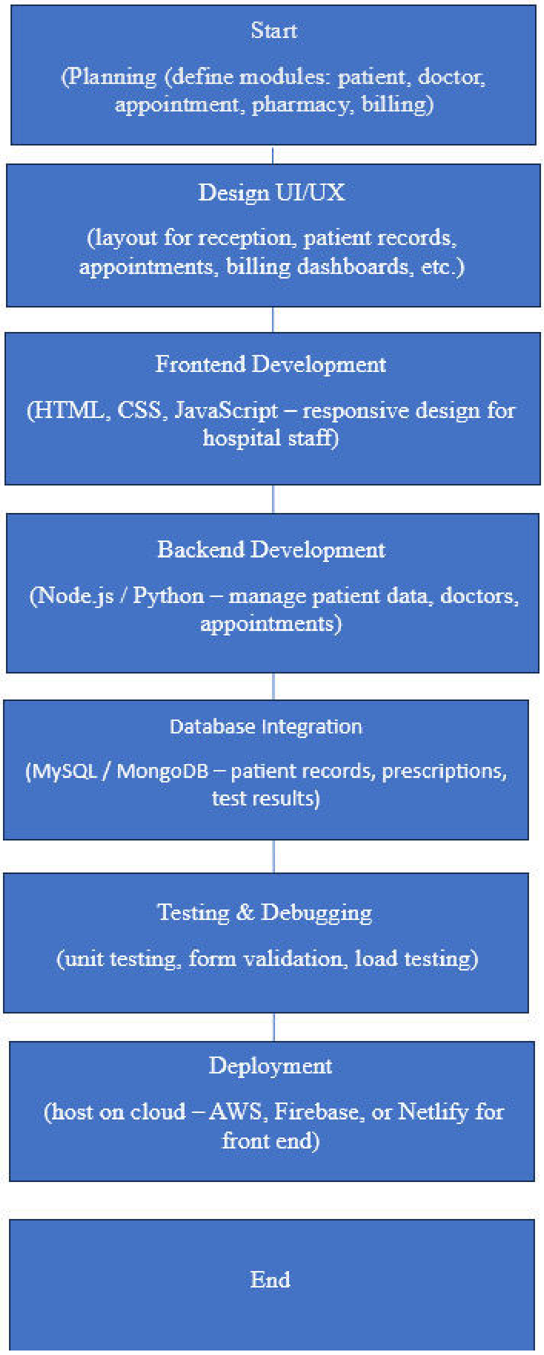

Fig 3.1 Flow Chart

IV. RESULTS AND DISCUSSION

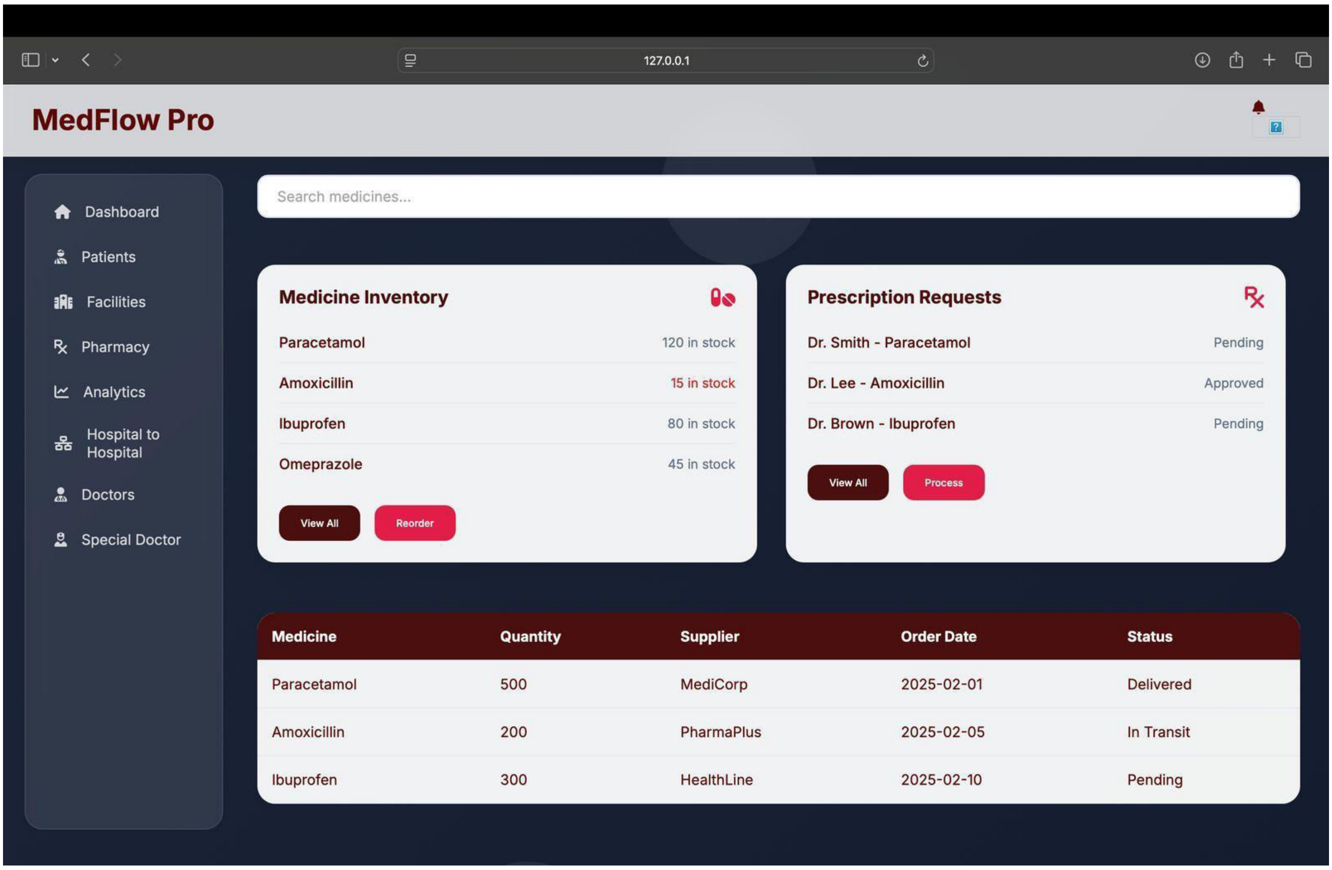

Fig.4.1 Med Flow Pro Website

Fig.4.2 Analysis of data

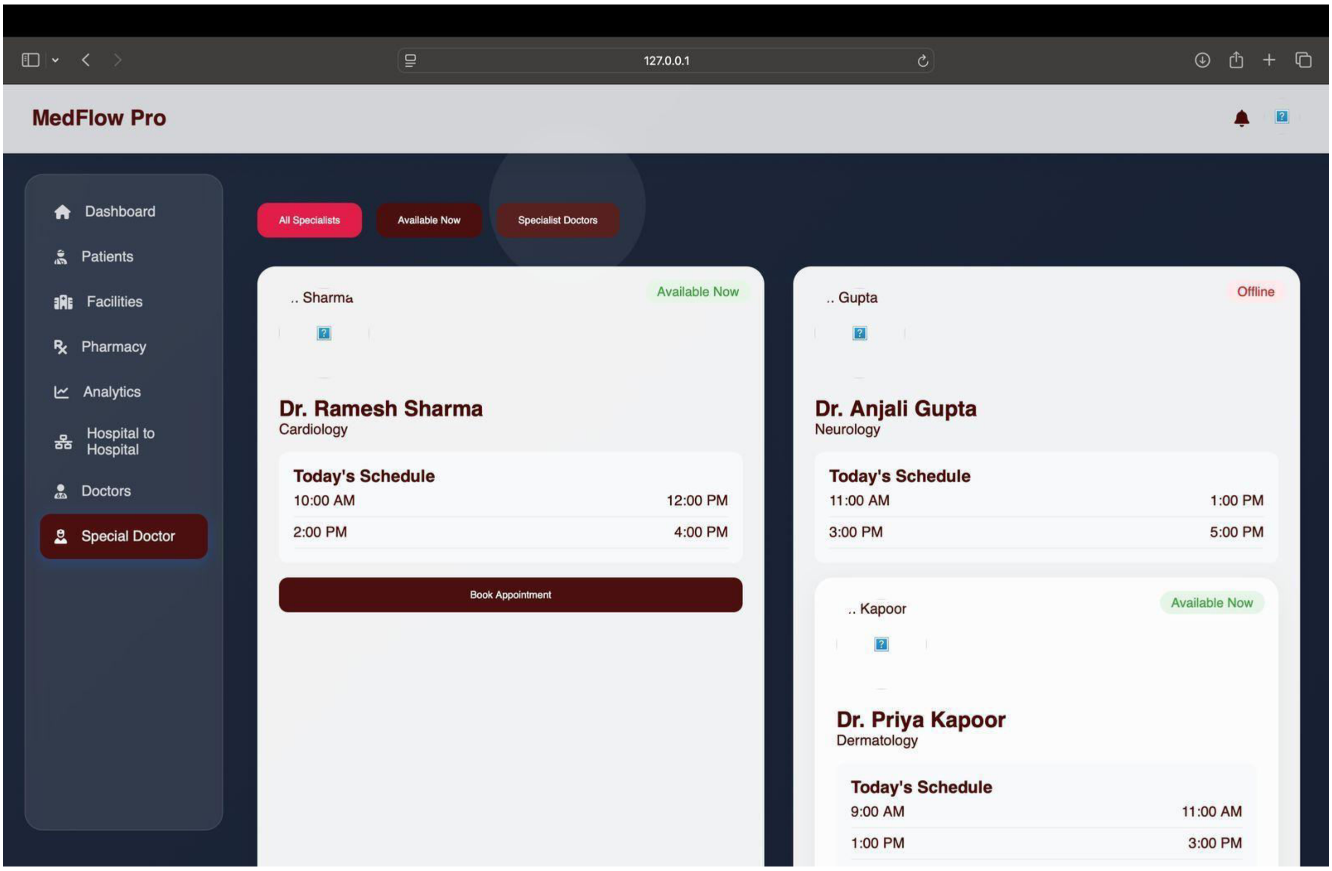

Fig.4.3 Special Doctor Information

V. CONCLUSION AND FUTURE WORK

The success of Electronic Hospital Management Systems (E-HMS) and Hospital Information Systems (HIS) is heavily influenced by several key factors, including leadership support, staff training, ease of technology adoption, and system usability. Compliance with global standards—such as the Health Insurance Portability and Accountability Act (HIPAA) and the HL7/Reference Information Model (RIM)—plays a crucial role in ensuring data security, privacy, and interoperability. These frameworks not only serve as benchmarks for regulatory adherence but also provide the structural foundation needed to implement robust, scalable, and secure hospital management solutions worldwide.

A prototype system for a Radio Frequency Identification-based Hospital Management System (RHMS) was developed using an Information Systems Design Theory (ISDT) approach. This prototype, validated through extensive user testing, showed strong potential in enhancing patient safety, improving medication tracking, optimizing pharmaceutical inventory, and facilitating real-time patient identification and location tracking within hospitals. The ISDT methodology guided both the design and evaluation of the system, contributing to a deeper understanding of RFID application development in healthcare. The results demonstrated not only the technical feasibility of the RHMS but also its practical value in addressing long-standing challenges in hospital operations.

Despite its strengths, the current RHMS prototype lacks features such as automated alerts for drug expiration and comprehensive coverage of departments like security and asset management. Addressing these gaps represents a valuable direction for future research and system enhancement. Furthermore, the increasing complexity of clinical research and the demand for broader patient participation call for tools like Research Permissions Management Systems (RPMS), which support centralized policy implementation and electronic consent. Such innovations promise to streamline patient recruitment, improve data accessibility, and enhance integration across hospital networks—paving the way for a more connected and responsive healthcare ecosystem.

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GSM based Home Automation System

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ABSTRACT: - This study introduces a home automation system based on Bluetooth and Arduino technology. Its purpose is to enable users to remotely monitor and control various household appliances using their Bluetooth-enabled mobile devices. The system comprises a Bluetooth connectivity model, an Arduino board, and powerful sensors. The Arduino board acts as the central management component, receiving commands from the user's mobile devices and transmitting signals to the corresponding appliances. Through Bluetooth connectivity, the system facilitates wireless communication between the Arduino boards and the user's mobile device, enabling the detection and control of multiple home applications such as air conditioning and lighting.

The system is designed with user-friendliness, cost-effectiveness, and energy efficiency in mind. By employing this technology, users can enjoy the convenience and comfort of managing their home appliances remotely. Experimental results demonstrate that the proposed approach is both reliable and effective in regulating and monitoring home appliances using Bluetooth technology. In summary, this Bluetooth-based Arduino home automation system has the potential to significantly enhance daily life by offering convenient and comfortable control over various household appliances. It can find practical applications in the realm of smart homes.[2]

KEYWORD: Arduino, Home automation, Bluetooth, Smart phone, Security

I. INTRODUCTION

Bluetooth-based home automation using Arduino is a system that enables wireless control of home appliances using Bluetooth technology. The system typically consists of the following components:

Arduino board: The Arduino board acts as the brain of the system, responsible for receiving commands from the mobile phone and controlling the appliances accordingly. It can be an Arduino Uno, Arduino Mega, or any other compatible board.

Bluetooth module: A Bluetooth module, such as the HC-05 or HC-06, is connected to the Arduino board. This module allows wireless communication between the Arduino board and the mobile phone.

Relay module: The relay module is used to switch the appliances on and off. It is connected to the Arduino board and provides the necessary electrical isolation and capability to handle higher voltages and currents.

Home automation using Bluetooth, Modbus, and GSM (Global System for Mobile Communications) is a system designed to control and monitor various home devices remotely. Here’s a breakdown of each component and how they work together in a home automation system:

1. Bluetooth for Home Automation:

Overview: Bluetooth is a wireless technology commonly used for short-range communication. In home automation, it allows devices such as lights, fans, or security systems to be controlled via a smartphone, tablet, or other Bluetooth-enabled devices.

How It Works: The user can connect their mobile device to Bluetooth modules (such as HC-05, HC-06, etc.) integrated into home appliances. Apps or custom software on the mobile device send signals to the Bluetooth module, which then controls the connected device (e.g., turning lights on or off).

Advantages:
Low power consumption
Easy to set up

Simple communication range (usually up to 100 meters)

2. Modbus for Home Automation:

Overview: Modbus is a communication protocol commonly used in industrial applications, but it is also used in home automation systems to connect various devices like sensors, controllers, and actuators.
How It Works: Modbus typically uses RS-485, Ethernet, or Wi-Fi to send commands or data between devices (such as lights, thermostats, or security systems). It allows different devices from different manufacturers to communicate with each other.

Advantages:
Reliable for large systems and multiple devices
Allows integration with various devices and sensors
Supports long-distance communication (up to several kilometers with RS-485)

3. GSM for Home Automation:

Overview: GSM (Global System for Mobile Communications) is used for long-distance communication. It allows users to control home devices via SMS (text message) or voice call through a mobile network.
How It Works: A GSM module (like SIM800 or SIM900) is integrated with a microcontroller or home automation system. The user sends an SMS or makes a voice call to the GSM module, which interprets the message or call and performs the necessary action (e.g., turning on a water pump or activating a security system).

Advantages:
Can work remotely, without needing an internet connection
Wide coverage as it uses mobile networks
Ideal for emergency alerts (e.g., sending SMS if the security system is triggered)
Integration of Bluetooth, Modbus, and GSM:

How They Work Together:
Bluetooth can be used for short-range, local control (e.g., controlling lights or doors).
Modbus is better suited for connecting and controlling multiple devices over longer distances, often in more complex systems (e.g., integrating HVAC systems or industrial controllers).
GSM provides long-range control and monitoring, especially useful when you are away from home. It can be integrated to send notifications or control devices remotely.
A typical setup might involve a Bluetooth module for controlling local devices, a Modbus network for more extensive control (e.g., integrating various home appliances), and GSM for sending alerts and control commands when you're not near the home.
Applications:
Security Systems: GSM for SMS alerts, Bluetooth for local control of cameras, and Modbus for integrating sensors.
Smart Lighting: Bluetooth for controlling individual lights or rooms, GSM for emergency control, and Modbus for managing large lighting setups across the house.
Climate Control: Modbus for managing HVAC systems, Bluetooth for local control, and GSM for remote temperature management.
In summary, combining Bluetooth, Modbus, and GSM in home automation allows for flexible, reliable, and versatile control of a wide variety of home systems and devices.

1. Literature review of gsm automation:-

- Defination of GSM: GSM (Global System for Mobile Communications) is a standard used for mobile telephony. Initially developed for voice communication, GSM now supports data services like SMS (Short Message Service), GPRS (General Packet Radio Service), and EDGE (Enhanced Data Rates for GSM Evolution).
- GSM and Automation: The integration of GSM with automation allows remote control, monitoring, and data transmission, making it invaluable for various industries, especially in environments requiring remote operations.

2. Historical Development of GSM in Automation

- Early GSM Applications: Initially, GSM technology was primarily used for mobile communication. However, its potential in automation became clear in the early 1990s, particularly for remote monitoring.
- Advent of M2M (Machine-to-Machine) Communication: The use of GSM for M2M communication enabled devices to autonomously exchange data over cellular networks, marking a significant shift towards automation in areas like industrial control and smart home systems.

3. Applications of GSM in Automation

- Home Automation: GSM allows users to control and monitor household devices like lighting, alarms, and HVAC systems remotely. For example, systems like GSM-based lighting control use SMS to turn lights on/off from a mobile device.
- Industrial Automation: GSM is used for remote monitoring and control in industries such as manufacturing, energy, and water treatment. It enables operators to manage equipment and machinery without being physically present at the site, improving operational efficiency.
- Agricultural Automation: In agriculture, GSM technology is used for applications such as smart irrigation systems, temperature/humidity monitoring, and livestock tracking, improving efficiency and reducing water waste.
- Transportation and Fleet Management: GSM is widely used in logistics for vehicle tracking, fleet management, and automated reporting. GSM modules embedded in vehicles send real-time data to central systems for monitoring and route optimization.

Mobile phone: A mobile phone with a Bluetooth application installed serves as the user interface for controlling the home appliances. The Bluetooth application can be developed using various programming languages depending on the mobile phone's operating system (Java for Android, Swift for iOS, etc.).

The system allows users to send commands from the mobile phone to the Arduino board via Bluetooth. These commands can include turning specific appliances on or off, adjusting settings, or activating predefined scenarios. The Arduino board receives the commands and controls the relay module to switch the corresponding appliances accordingly. The Bluetoothbased home automation system can be expanded by integrating sensors to automate the appliances based on specific conditions. For example, temperature and humidity sensors can be used to automatically control air conditioners or fans. Motion sensors can trigger lights or security systems. The possibilities are virtually limitless, depending on the sensors and components integrated into the system.

Overall, Bluetooth-based home automation using Arduino provides a convenient and cost-effective solution for controlling home appliances wirelessly. It offers flexibility, energy savings, and the ability to customize and expand the system according to individual needs and preferences.

II. METHODOLOGY

A home automation project using Bluetooth as the communication protocol can be approached in several steps. Here's a general methodology to follow:

Define the project scope and requirements: Identify the devices to be controlled and the desired functionalities for each device.

Choose Bluetooth devices: Select Bluetooth modules or chips based on range, data rate, power consumption, and other project requirements. Select a microcontroller or single-board computer (SBC): Determine the control platform (e.g., Arduino, Raspberry Pi, ESP32) responsible for managing Bluetooth devices and implementing the home automation logic.

Write the code: Develop code to handle Bluetooth communication and implement the home automation system's logic. Use languages like C, Python, or Arduino to program the microcontroller or SBC.

Build the hardware: Assemble the hardware components, including the microcontroller/SBC, Bluetooth modules, sensors, actuators, and power supply. This can be done on a breadboard or custom PCB.

Test the system: Verify Bluetooth communication functionality and ensure the home automation system works as expected.
nstall the system: Deploy the system in your home and configure it to control the devices effectively.

Maintain the system: Regularly maintain the system to ensure proper functioning, address any issues, and incorporate updates or enhancements as needed.

By following this methodology, you can create a Bluetooth-based home automation system to control various devices, providing convenience and potential energy savings.[1]

Bluetooth-based home automation allows for controlling and monitoring home appliances and systems wirelessly through Bluetooth-enabled devices such as smartphones or tablets. The methodology for setting up a Bluetooth-based home automation system typically involves several stages, including system design, hardware selection, software development, and integration. Below is a detailed breakdown of the methodology for Bluetooth-based home automation:

1. System Design and Requirement Analysis

Before developing the system, the first step is to define the requirements and objectives of the home automation system. The following aspects need to be considered:
- Devices to Control: Identify the home appliances to be controlled, such as lights, fans, air conditioners, and security systems.
- Control Mechanism: Decide how the system will control these devices—typically through a smartphone or tablet.
- User Interface: Define the user interface for controlling the devices. It can be a custom app on a mobile phone or a simple control panel on a computer.
- Security: Implement necessary security measures to prevent unauthorized control of the system.

2. Selection of Hardware Components

For Bluetooth-based home automation, the main hardware components required are:

- Bluetooth Module: Commonly used modules include the HC-05 or HC-06 Bluetooth modules, which are simple to use and communicate with microcontrollers (e.g., Arduino or Raspberry Pi).
- Microcontroller: The most common microcontroller used is Arduino. It is affordable and easy to program, making it ideal for controlling appliances through Bluetooth.
- Relays/Actuators: Relays are used to interface with high-power devices like lights and fans. When the microcontroller receives a Bluetooth signal, it triggers the relay to activate the appliance.
- Sensors (optional): Additional sensors, such as temperature or motion sensors, can be added for automation based on environmental conditions (e.g., turning on a fan when the temperature exceeds a certain threshold).
- Power Supply: Ensure that the system is powered appropriately, depending on the devices being controlled.

3. Bluetooth Communication Setup

- Bluetooth Pairing: The mobile device (smartphone or tablet) needs to pair with the Bluetooth module (e.g., HC-05). Pairing involves configuring the Bluetooth module and ensuring the device can send and receive signals.
- Bluetooth Range: Bluetooth typically supports a range of up to 100 meters. Ensure that the devices to be controlled are within the Bluetooth range or set up multiple Bluetooth modules if needed.

4. Software Development

The software development for a Bluetooth-based home automation system can be divided into two parts:

4.1 Mobile Application Development

- App Design: Design a mobile application that can communicate with the Bluetooth module. This app should have a simple, intuitive interface to control the home appliances.
- Bluetooth Communication in the App: Use libraries (like BluetoothAdapter in Android or CoreBluetooth in iOS) to establish a connection between the mobile device and the Bluetooth module.
- Send Commands: Once connected, the mobile app sends control commands to the microcontroller. These commands can turn appliances on/off, adjust settings (e.g., dimming lights), or even trigger certain events (e.g., activating a security alarm).
- Programming Languages: For Android, Java or Kotlin is commonly used. For iOS, Swift or Objective-C is used.

4.2 Microcontroller (Arduino) Programming

- Control Logic: Write the logic that allows the microcontroller to interpret commands from the mobile device. This involves setting up Bluetooth communication on the Arduino and programming it to respond to commands sent from the mobile app.
- Use libraries such as SoftwareSerial for communication between the Bluetooth module and the microcontroller.
- Use the Relay module to control appliances. The microcontroller receives Bluetooth signals (such as turning on/off devices) and sends a control signal to the relay to power the connected device.
- Programming Environment: Use the Arduino IDE to write and upload the code to the Arduino board.

5. Device Control and Automation

- Controlling Home Appliances: The microcontroller processes the commands from the mobile app. For example, when the user presses a button to turn on the light, the app sends a signal to the microcontroller via Bluetooth, which then activates the relay connected to the light.
- Automation Based on Conditions: You can also set conditions or automation rules. For example:
- Timer-Based Automation: The system can be set to turn off the lights after a specified time.
- Environmental Conditions: For example, using temperature sensors to automatically control the fan or air conditioner.

6. Testing and Debugging

Once the system is developed, it is important to test and debug:
- Unit Testing: Test individual components such as the Bluetooth connection, relays, and sensors.
- System Testing: Test the entire system end-to-end by simulating user interactions with the mobile app and ensuring the correct appliance behavior.
- Debugging: If issues arise, use debugging tools in the Arduino IDE (e.g., serial monitor) and mobile app debugging tools (e.g., Android Studio) to identify and fix any bugs.

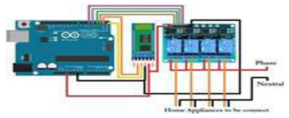
7. Final Integration and Deployment

After testing the system:
- Integration: Integrate all components into a working home automation system. Ensure the hardware is connected securely, and the app is functioning properly.
- Deployment: Deploy the system for regular use, ensuring that the Bluetooth module and microcontroller are placed in optimal positions within the home to ensure smooth communication and control.

8. Future Enhancements

- Internet Connectivity: While Bluetooth is used for local control, integrating Wi-Fi or Zigbee could allow for remote access and control through the internet.
- Security Features: Enhance security by adding authentication features in the mobile app, such as passwords or biometric authentication, to prevent unauthorized control.
- Voice Control: Integrating voice assistants (e.g., Google Assistant or Amazon Alexa) for hands-free control of the system.

The methodology for a Bluetooth-based home automation system involves a combination of hardware selection, Bluetooth communication setup, software development, and testing. By using simple components such as Bluetooth modules, microcontrollers (like Arduino), and mobile applications, a user-friendly and effective home automation system can be developed. This methodology provides flexibility for both local control and automation of home devices, offering users greater comfort and convenience.



III. ARCHITECTURE OF THE DEVICE

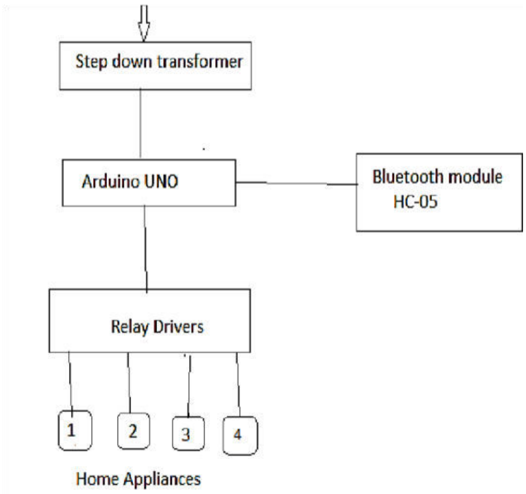


Fig. 3(a)- Architecture of Home Automation

The architecture of a Bluetooth-based home automation project using Arduino can be broadly divided into three parts: hardware, software, and communication.

Hardware: The hardware setup typically consists of an Arduino board, a Bluetooth module, and the necessary sensors and actuators used to control different home automation devices. The Arduino board serves as the central processing unit, while the Bluetooth module enables wireless communication between the Arduino and other devices. Sensors such as temperature sensors, motion sensors, and light sensors can be used to gather data from the environment, while actuators like relays, motors, and lights are responsible for controlling various home automation devices.

Software: The software part of the project involves writing code using the Arduino Integrated Development Environment (IDE) or any other suitable programming environment. The code enables the Arduino board to interact with the Bluetooth module, sensors, and actuators. It includes functions for reading sensor data, implementing control algorithms, and handling Bluetooth communication. The code defines how the system responds to sensor inputs and how it controls the connected devices based on the received commands.

Communication: The communication part of the project involves establishing a wireless connection between the Arduino board and the Bluetooth module. Bluetooth is commonly used for short-range wireless communication. The Arduino and the Bluetooth module communicate using specific commands and protocols defined by the Bluetooth standard. This allows data exchange between the Arduino and other devices like smartphones, tablets, or computers that can act as the control interface for the home automation system. Bluetooth Low Energy (BLE) is often used in home automation projects due to its low power consumption.

It's important to note that while Bluetooth is a popular option for wireless communication in home automation projects, other protocols such as ZigBee or Wi-Fi can also be used depending on the specific requirements of the project, such as range, power consumption, or compatibility with existing devices.

In summary, the hardware, software, and communication components work together to create a Bluetooth-based home automation system using Arduino. This system enables wireless control and automation of various devices in a smart home environment, providing convenience and flexibility to the users.

IV. DESCRIPTION OF HARDWARE

Arduino Uno is an open-source microcontroller board developed by Arduino.cc. It is based on the ATmega328P microcontroller and is a popular choice among hobbyists, students, and professionals. The board features 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button.

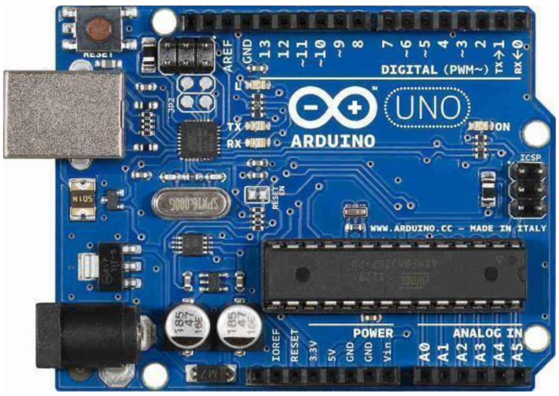
One of the key features of Arduino Uno is its ease of use. It comes preloaded with a bootloader, which allows users to easily upload new code to the board without the need for an external programmer. The Arduino IDE (Integrated Development Environment) is used to write and upload code to the board. The IDE is a cross-platform application available for Windows, macOS, and Linux.

The digital pins on the Arduino Uno can be configured as either inputs or outputs. This flexibility allows users to interface with various digital devices such as LEDs, buttons, and switches. Additionally, six of the digital pins (3, 5, 6, 9, 10, and 11) can function as Pulse Width Modulation (PWM) outputs, enabling control of devices that require variable levels of intensity or speed.

The six analog pins on the board allow for analog input readings. This capability is useful for interfacing with sensors that provide continuous voltage levels, such as light sensors, temperature sensors, and potentiometers.

The Arduino Uno supports expandability through shields. Shields are additional boards that can be plugged into the Arduino Uno, providing additional features and functionalities. There are shields available for motor control, wireless communication, display interfaces, and more. This modularity makes it easy to customize and enhance projects without complex wiring or soldering.

The Arduino Uno serves as the reference model for the Arduino platform and is the first board in a series of Arduino boards. It can be powered via the USB connection or an external power source, making it versatile for various applications. Overall, Arduino Uno is a versatile, user-friendly, and widely adopted microcontroller board. Its open-source nature encourages collaboration and sharing of projects, making it a favorite among makers and electronics enthusiasts.



1. Bluetooth Module:-

Bluetooth is a widely used technology standard for short-range wireless communication between devices. It enables the connection of peripherals such as headsets, keyboards, mice, and other accessories to computers and electronic devices. However, Bluetooth's capabilities extend beyond peripheral connections.

Bluetooth operates on the 2.4GHz radio frequency and uses spread spectrum frequency hopping to minimize interference from other devices. This technique allows for secure and reliable communication between devices.

Bluetooth technology has evolved through different versions, with the latest being Bluetooth 5.2, released in December 2020. Each version introduces new features and improvements. Bluetooth 5.2 offers a range of up to 400 meters and faster data transfer rates compared to previous versions. It also enhances security measures to protect wireless communications. In addition to connecting peripherals, Bluetooth is used for various applications. It enables wireless internet access, file sharing, and media streaming, allowing devices to communicate and share data seamlessly. Bluetooth is commonly used for wireless audio streaming, enabling connections with speakers, headphones, and car stereos.

Furthermore, Bluetooth technology facilitates wireless gaming by connecting controllers to gaming consoles or mobile devices. It also finds applications in home automation, IoT (Internet of Things) devices, and healthcare devices, among others.

Bluetooth has become an integral part of modern connectivity, providing convenient wireless communication options for a wide range of devices and applications. Its versatility and widespread adoption make it a popular choice for short-range wireless connections.

2. Relay Drivers:-

Relay drivers are electronic devices used to control the operation of relays. A relay is an electrical switch that is typically activated by an electrical current. It is commonly used to control the flow of power to various devices or circuits.

Relay drivers are designed to provide the necessary power and control signals to activate and deactivate the relay. They act as an interface between the controlling circuit, such as a microcontroller or another circuit, and the power circuit that the relay is connected to.

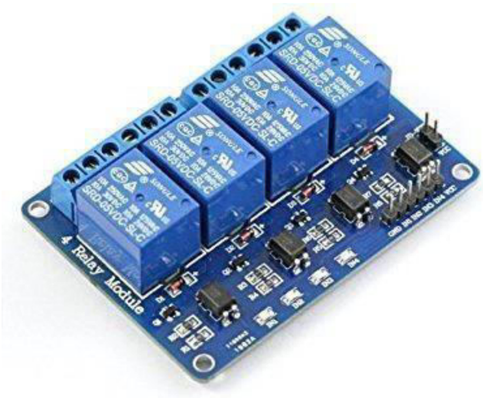
One important function of relay drivers is to isolate the control circuit from the power circuit using an opto-isolator. This isolation ensures that any potential electrical faults or surges in the power circuit do not affect the control circuit, providing safety and protection against electric shock.

In addition to isolation, relay drivers also supply the appropriate voltage and current levels required to activate the relay coil. Once the relay is energized, the relay driver maintains the necessary current to keep the relay contacts closed or open, depending on the desired state, until it receives a signal to deactivate the relay.

Relay drivers come in digital and analog versions, allowing for compatibility with different types of control signals. Digital relay drivers accept binary signals, typically in the form of logic levels (high or low), to control the relay's state. Analog relay drivers, on the other hand, can accept continuous voltage or current signals for precise control.

To protect the relay and other components in the system, many relay drivers incorporate built-in protection features. These may include over-current protection to prevent excessive current flow, over-voltage protection to guard against voltage spikes, and other safeguards to ensure the reliable and safe operation of the relay and the connected devices.

Overall, relay drivers are essential components in various applications, including home automation systems, industrial control systems, automotive electronics, and more, where the control of relays is necessary for switching and controlling electrical loads.



V. ADVANTAGE

In the context of Bluetooth-based home automation projects using Arduino, there are several disadvantages to consider: Limited Range: Bluetooth connections have a limited range, typically around 30 feet. This range can be further reduced by environmental factors such as walls or obstacles, which may hinder the signal strength and limit the coverage area of the home automation system.

Interference: Bluetooth operates in the 2.4 GHz frequency band, which is a crowded spectrum shared by various wireless devices, including Wi-Fi networks, cordless phones, and microwaves. This shared frequency can lead to interference, affecting the stability and reliability of the Bluetooth connection in a home environment.

Security: Bluetooth connections, particularly the earlier versions of the Bluetooth protocol, have been known to have security vulnerabilities. Unauthorized users may potentially intercept or tamper with the data being transmitted over the Bluetooth connection, posing a risk to the security and privacy of the home automation system.

Cost: Implementing Bluetooth connectivity in home automation projects requires additional hardware components such as Bluetooth modules and antennas. These components add to the overall cost of the project, which may be a consideration for budget-conscious users.

It's important to weigh these disadvantages against the specific requirements and constraints of the home automation project before deciding on the use of Bluetooth technology.

VI. RESULT

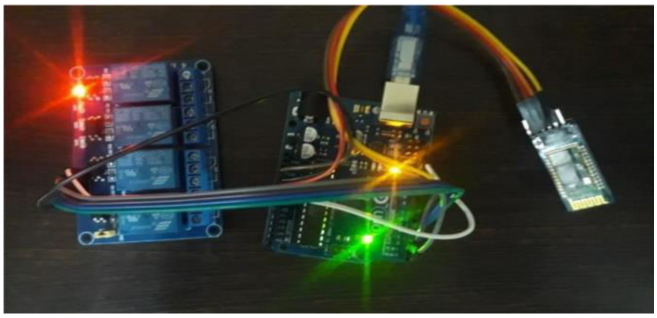
In the context of a Bluetooth-based home automation project using Arduino, the desired outcome would be to automate and control various aspects of the home using Bluetooth technology. Here are some potential results of such a project:
Automated Control: The project allows for the automation and control of lights, appliances, and other devices within the home. Users can remotely turn on/off or adjust the settings of these devices using Bluetooth-enabled devices such as smartphones or tablets.

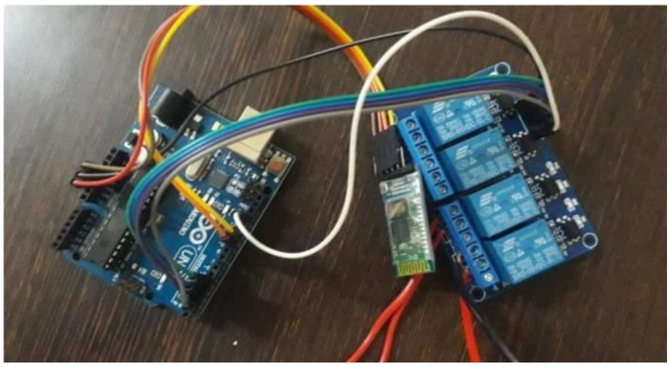
Convenience and Accessibility: Bluetooth connectivity provides a wireless and convenient means of controlling the home automation system. Users can easily access and manage their devices without the need for physical connections or direct line of sight.

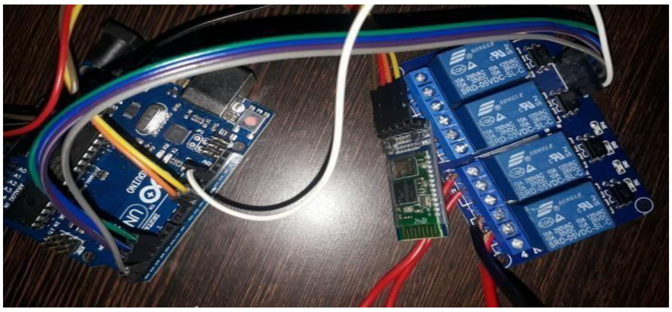
Customization and Flexibility: Arduino-based projects offer flexibility in terms of customization and expansion. Users can tailor the functionality of their home automation system to meet their specific needs, adding or modifying features as desired.

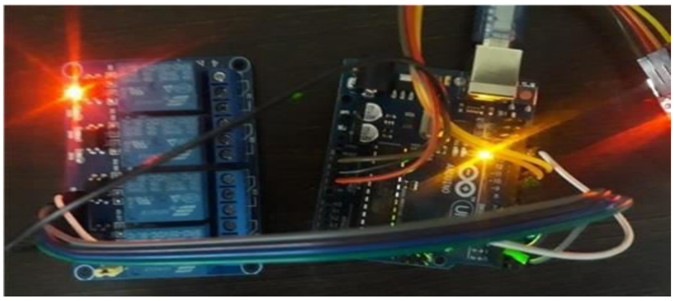
Energy Efficiency: With the ability to control devices remotely, users can optimize energy usage in their homes. They can turn off lights or appliances when not in use, adjust temperature settings for efficient heating and cooling, and create schedules to automate energy-saving actions.

Integration with Other Systems: Arduino-based home automation projects can be integrated with other systems or technologies, such as voice assistants (e.g., Amazon Alexa or Google Assistant) or IoT platforms, enabling enhanced control and interaction options. It's important to note that the specific features and outcomes of a Bluetooth-based home automation project using Arduino will depend on the design, programming, and components used in the project.









VII. CONCLUSION

The research paper explores the use of Arduino in Bluetooth-based home automation systems. It discusses the integration of Bluetooth technology as a means of communication between users and the home automation system. The paper delves into the features and advantages of Arduino, including its components, programming language, and its suitability for home automation projects. The advantages of using Arduino in Bluetooth-based home automation are highlighted, such as its affordability, low power consumption, and compatibility with a wide range of Bluetooth devices. These factors contribute to Arduino's popularity and effectiveness in implementing home automation solutions. The paper emphasizes that Arduino offers a user-friendly platform that allows for the creation of robust and reliable home automation systems. It also acknowledges the potential for utilizing advanced Bluetooth technologies like BLE (Bluetooth Low Energy) and Bluetooth Mesh to further enhance the capabilities of Arduino in home automation applications. In conclusion, the research paper affirms that Arduino is a viable and suitable choice for Bluetooth-based home automation. Its affordability, versatility, and ease of use make it a powerful tool for developing efficient and effective home automation systems. The paper also suggests that Arduino is likely to remain a prominent option in the future as Bluetooth technology continues to advance.

Future Enhancement

In the context of the Home Automation project, further development can be achieved by integrating internet connectivity. This would enable remote control and monitoring of the home automation system from anywhere, using devices such as smartphones, PCs, or laptops with internet access. Here are some potential enhancements:

1. Remote Control: Users can remotely control their home automation system through an internet connection. They can turn devices on/off, adjust settings, and create schedules or automation rules.
2. Enhanced Security: By setting passwords and implementing secure authentication mechanisms, only authorized users can access and control the home automation system remotely, ensuring privacy and security.
3. Expandability to a Larger Scale: The home automation project can be extended to automate larger environments like schools. Automated attendance systems, for instance, can be implemented to streamline attendance tracking processes.
4. IoT-Based Wireless Technology: Instead of relying solely on Bluetooth, the project can leverage IoT-based wireless technologies like Wi-Fi or Zigbee. These technologies offer broader range and connectivity options, allowing for remote control from anywhere in the world.
5. Alert System: The system can be enhanced with an alert mechanism that sends notifications to users in case of specific events or conditions. For example, alerts can be triggered for intrusions, abnormal environmental conditions, or equipment malfunctions.
6. Energy Optimization: The software controlling the system can include features that provide insights into energy consumption patterns. This information can be used to optimize energy usage, identify inefficiencies, and suggest practical ways to reduce energy costs.
7. By incorporating these developments, the Home Automation project can provide increased convenience, security, and energy efficiency for users, while allowing for remote access and control from anywhere with an internet connection.

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Online Gaming Website: Play Fusion

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ABSTRACT: Play Fusion is an interactive online gaming platform that offers a diverse collection of casual and competitive games designed to entertain players of all ages and skill levels. With a focus on easy accessibility, Play Fusion features a range of engaging games such as Rock-Paper-Scissors**,** Click on Target**,** Stick Hero**,** and OX Game (Tic-Tac-Toe)**.** These games are simple to learn but provide endless opportunities for strategic thinking, fast reflexes, and problem-solving. Games like Rock-Paper-Scissors and OX Game engage players in quick, strategic decision-making, where players can test their luck, memory, and tactical skills against either the system or other global players. In contrast, click on Target and Stick Hero require precise coordination and fast reaction times, catering to players looking for more reflex-based challenges. Each game offers a unique experience, yet all share a common goal: to provide a fun, accessible, and competitive environment. Play Fusion also emphasizes multiplayer gameplay, allowing users to interact with other players in real-time, whether competing against friends or meeting new players from around the world. This fosters a dynamic ,global gaming community where social interaction and competition blend seamlessly. The platform's combination of casual gameplay, strategic depth, and multiplayer features makes Play Fusion an ideal destination for quick gaming sessions, social interactions, and light-hearted competition. This abstract introduces Play Fusion as a versatile online gaming space that merges entertainment, skill-building, and social engagement in a user-friendly environment, offering players an enjoyable and immersive experience.

I. INTRODUCTION

Play Fusion is an online gaming platform designed to offer a wide variety of casual games that appeal to players of all ages and skill levels. With its simple, engaging gameplay and easy-to-navigate interface, Play Fusion provides an ideal environment for both new and experienced gamers seeking fun, interactive, and competitive experiences. The platform features a selection of popular games such **as** Rock-Paper-Scissors**,** Click on Target**,** Stick Hero, and OX Game (Tic-Tac-Toe)**,** each providing unique gameplay experiences that cater to diverse preferences.

Rock-Paper-Scissors is a classic game that has been digitized for online play, where players compete against one another by choosing rock, paper, or scissors in a battle of chance and strategy. Its fast-paced nature and simplicity make it accessible to everyone, from casual players to those seeking quick, strategic challenges . In Click on Target, players are challenged to click on moving targets within a time limit, testing their reflexes and hand-eye coordination. The game is designed to be fast and engaging, with progressively difficult levels that keep players coming back for more.

Stick Hero introduces a strategic element, where players must extend and adjust the length of a stick to bridge gaps between platforms. It is a game that requires both precision and quick thinking, making it an exciting challenge as players advance through the levels. Finally, the OX Game (Tic-Tac-Toe) brings the timeless puzzle game into the digital world, allowing users to compete in a classic game of X's and O's. Despite its simple concept, Tic-Tac-Toe remains a game of strategy and foresight, offering players an opportunity to enjoy a quick and engaging experience.

What sets Play Fusion apart is its commitment to providing not only fun games but also opportunities for social interaction. Many of the games feature multiplayer options, allowing users to compete against friends or challenge others around the world. The platform fosters a vibrant community where players can engage with each other, share experiences, and participate in friendly competition.

In summary, Play Fusion is an online gaming platform that brings together simplicity, accessibility, and fun in a competitive, interactive environment. Whether you're looking for a quick game of Rock-Paper-Scissors, testing your reflexes in Click on Target, strategizing in Stick Hero, or enjoying a game of OX Game, Play Fusion offers something for everyone. With its focus on user-friendly design and multiplayer capabilities, it is a dynamic platform that continues to engage players worldwide.

II. LITERATURE REVIEW

Platforms like Play Fusion focus on games such as OX Game (Tic-Tac-Toe) and Rock-Paper-Scissors, which are easy to learn but still provide an engaging and competitive experience for players. Casual games have become a staple in the gaming industry due to their ability to engage a wide audience. In the study by Lazzaro (2004), the social aspect of casual games was highlighted as a key element of their appeal. Online platforms like Play Fusion, where players can engage with one another, rely on these principles to build a sense of community and encourage participation through multiplayer features [1].

Games like Click on Target challenge players to hone their reflexes, testing their reaction times and hand-eye coordination. Research on reflex-based games has shown that such games can have cognitive benefits, including improvements in attention, memory, and problem-solving skills. According to Green and Bavelier (2003), action-oriented games improve visual selective attention and the ability to process information quickly, which are important skills in various aspects of life. Similarly, Dye et al. (2009) found that playing fast-paced games.[2]

The social aspect of online gaming is one of its defining features. Games like Rock-Paper-Scissors, OX Game, and Stick Hero allow players to connect with others, compete in real-time, and share experiences. Multiplayer games offer opportunities for social interaction, which has been shown to enhance user engagement and increase player satisfaction. Vorderer et al. (2016) note that the social context of gaming—whether cooperative or competitive—can significantly impact how players experience and enjoy games. Players often engage with others to build relationships, share strategies, and challenge one another.[3]

The design of casual games plays a crucial role in determining their appeal. Simple, intuitive interfaces and easy-to-understand mechanics are key factors that contribute to user satisfaction. According to Vella (2017), effective game design in casual games centers around accessibility, clarity, and immediate feedback, ensuring that players of all skill levels can enjoy the experience. Stick Hero, for example, uses simple mechanics, but the challenge comes from the timing and precision needed to successfully cross gaps, creating an engaging experience that increases in difficulty as players progress.[4]

While casual games are often designed for short, enjoyable sessions, the competitive element adds an extra layer of engagement. Platforms like Play Fusion leverage the competitive nature of games such as OX Game and Rock-Paper-Scissors to increase player involvement and satisfaction. Research by Yee (2006) on online gaming communities found that competition in games motivates players to keep playing and improves engagement. Competitive features, such as multiplayer modes, leaderboards, and rewards, encourage players to return to the platform and continue challenging others.[5]

Player motivation is a key factor in understanding how players interact with online gaming platforms. Ryan et al. (2006) suggest that players are motivated by intrinsic factors such as enjoyment, mastery, and the desire for social connections. Casual games on platforms like Play Fusion cater to these intrinsic motivations by offering quick, rewarding experiences that are both fun and satisfying. The competitive multiplayer elements further enhance player engagement, fostering a sense of achievement when players perform well.[6]

III. METHODOLOGY

The proposed survey aims to gather feedback from users of the Play Fusion online gaming platform to assess their experiences, preferences, and satisfaction with the games provided. The survey will focus on the four key games offered on the platform: Rock-Paper-Scissors, Click on Target, Stick Hero, and OX Game (Tic-Tac-Toe).Survey Design- The survey will consist of both closed-ended and open-ended questions. Closed-ended questions will provide quantitative data, while open-ended questions will offer qualitative insights. The key areas to be covered in the survey include: Player demographics, Game preferences, User experience, Multiplayer experience, Suggestions for improvement.

3.1 Target Population- The survey will target registered users of Play Fusion, with a mix of active and inactive users. Active users will be invited to participate directly through in-game pop-ups or notifications. Inactive users will be contacted through email to encourage participation.

3.2 Data Collection Method- The survey will be administered online using tools like Google Forms or SurveyMonkey.

3.3 Analysis Approach- The collected data will be analyzed using basic statistical techniques for quantitative questions, and thematic analysis will be used for open-ended responses. This will help identify patterns in player preferences, gameplay satisfaction, and potential areas for improvement.

3.4 Timeline- The survey will be distributed over a period of 3 weeks, with an additional week for data analysis and reporting. Ethical Considerations- Participants will be informed about the purpose of the survey and will give their consent before participating. All responses will be anonymous, and personal data will not be collected.

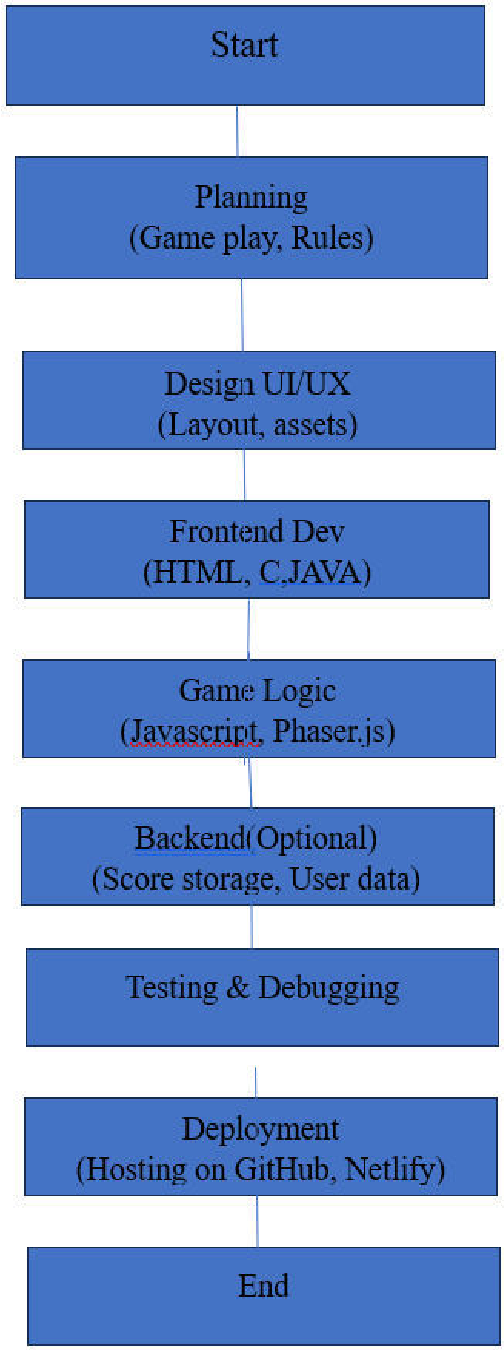

Fig 3.1 Flow Chart

V. RESULTS AND DISCUSSION

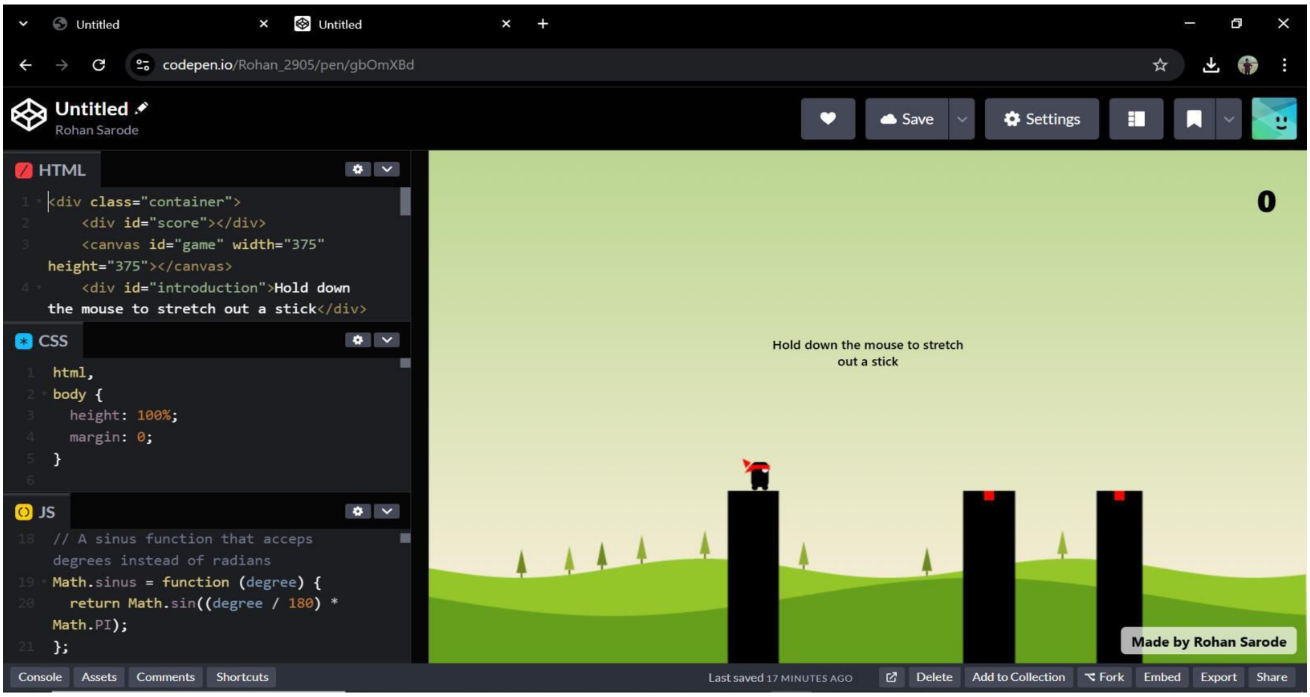

Fig.4.1 Stick Hero Code

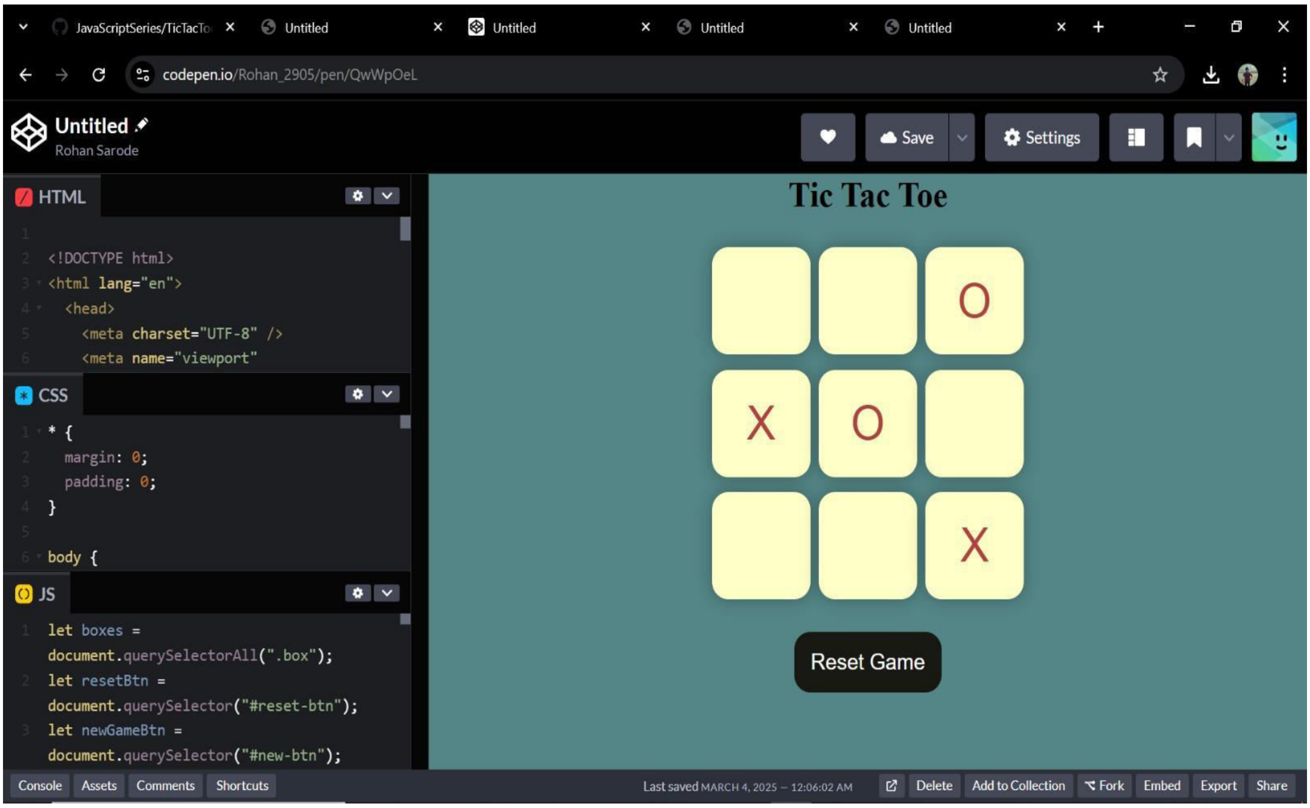

Fig.4.2 Tic Tac Toe Code

V. CONCLUSION AND FUTURE WORK

In conclusion, Play Fusion is an innovative and engaging online gaming platform that offers a diverse range of casual games, such as Rock-Paper-Scissors**,** Click on Target**,** Stick Hero**,** and OX Game (Tic-Tac-Toe). These games are designed to appeal to players of all ages and skill levels by offering simple yet enjoyable gameplay experiences. The platform's emphasis on accessibility, multiplayer features, and quick sessions ensures that it remains both engaging and user-friendly for a wide range of users.

The survey conducted as part of this study aims to provide valuable insights into user preferences, gameplay experiences, and satisfaction. The data collected will help to identify the strengths and weaknesses of the platform, offering concrete recommendations for improvement. By analyzing player feedback, Play Fusion can optimize game mechanics, enhance the user interface, and implement additional features that align with player needs and desires.

Based on the findings from the survey, future improvements can focus on several key areas such as game development**.** Based on user feedback, new games or enhanced versions of existing games can be developed. This could include adding more challenging levels, introducing new gameplay mechanics, or incorporating elements that users find more enjoyable, Multiplayer Features**.** There is potential to expand the multiplayer features, such as adding leaderboards, in-game chat, or cooperative modes to increase player interaction and foster a more competitive environment, Customization and Personalization: Allowing users to personalize their experience by customizing avatars, themes, or game settings could enhance engagement and satisfaction, Mobile Compatibility: Expanding the platform's accessibility on mobile devices could increase user engagement, as players would be able to access the games on-the-go, Data-Driven Enhancements**:** Continuous monitoring of player behavior and feedback will help inform future updates. Analytics tools could be used to understand which games are most popular, the average session duration, and player retention rates. By implementing these improvements and continuing to gather user feedback, Play Fusion can solidify its place in the competitive online gaming space while delivering a superior, personalized gaming experience to its users.

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Fan Cleaning Machine

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ABSTRACT: In order to address the frequent need for fan maintenance, this project attempts to automate the routine maintenance for ceiling fans using a simpler and more economical way. It presents a unique method that may be particularly helpful in places with plenty of ceiling fans, such factories, universities, schools, hospitals, etc. The project also has the potential for residential applications due to its cost-effectiveness. As of right now, there isn't a technology in place that's expressly made to automate ceiling fan cleaning. The goal of the project is to provide a durability evaluation for the latest ceiling fan edge cleaning using finite elements. One of its goals is to design a cleaning tool that is simple to use, ergonomic, portable, and multifunctional. The study investigates the application of plastic materials and sponges that are often used in industry. Findings show that using a sponge to wipe the ceiling fan blades' two sides successfully removes dust and cobwebs, which are then collected in a litter-box beneath. The results of the durability evaluation are essential for improving component design in the first phases of development. These results might lead to considerable cost and time-to-market reductions, improved product dependability, and increased consumer trust.

I. INTRODUCTION

The goal of this project is to make cleaning ceiling fans easier and faster. It introduces a new way to clean fans automatically, which can be useful in places with many ceiling fans, like factories, schools, universities, and hospitals. It can also be used at home because it's affordable. Right now, there's no machine made specifically for automatic ceiling fan cleaning, so this idea is new and useful. Traditionally dust buildup on ceiling fans is removed by hand by pushing a pole equipped with a brush. This approach is labor-intensive and not always effective, particularly in settings like schools or hospitals where there are a lot of fans. Health risks can result from neglecting fan cleaning, especially in government institutions where patients are more susceptible. Human laziness is possible to overcome and regular fan maintenance may be ensured by automating the process of cleaning.

The Fan Cleaning Machine addresses these challenges by providing an efficient and user-friendly solution. It is designed to clean fan blades thoroughly without the need for disassembly, reducing the risk of damage and ensuring better hygiene. The machine typically consists of rotating cleaning brushes or pads, a dust collection mechanism, and a motorized system to handle the cleaning process with minimal effort from the user. This project aims to develop a prototype of a Fan Cleaning Machine that is easy to operate, lightweight, and effective in removing dust and debris.
This project is about creating a new type of machine that can clean ceiling fan blades more easily and effectively. The goal is to make a cleaning tool that is light, easy to use, and flexible. The machine uses a sponge to clean both sides of the fan blades, removing dust and cobwebs. The dirt is collected in a box below the machine. These results help improve the design of the machine early on, which reduces costs, speeds up production, and makes the product more reliable and trusted by customers.

II. LITERATURE REVIEW

Cleaning fan blades is important for keeping them working well and saving energy in homes and industries. Machines that use DC motors and brushes are helpful for cleaning fan blades efficiently. This review looks at the progress, challenges, and uses of these cleaning systems.DC motors have improved a lot over the years, making them more efficient, reliable, and easier to control. Studies by Li et al. (2019) and Zhang et al. (2020) show how brushless DC motors (BLDC) are being used in industrial automation systems. These improvements make fan blade cleaning machines work better and use less energy.[1]

The design of the brush used in cleaning machines is very important for good cleaning results. Wang et al. (2018) studied how different brush features, like the material, length, and stiffness of the bristles, affect cleaning efficiency. Chen et al. (2021) suggested ways to improve the contact between the brush and fan blades to make cleaning more effective.[2]

Fan blade cleaning machines that use DC motors are more energy-efficient than traditional cleaning methods. Research by Liu et al. (2019) and Guo et al. (2020) examined how much energy different cleaning methods use and their environmental impact. Their studies show that using DC motor-based systems helps save energy and reduce pollution, making them more eco-friendly.[3]

Making sure that fan blade cleaning machines are safe and reliable is very important to prevent accidents and damage. Jiang et al. (2017) discussed safety features like overload protection and emergency stop buttons that are added to these machines. Xu et al. (2021) studied how well the brushes and machines perform under different conditions, helping improve the durability and reliability of the system.[4]

Applications in Different Industries: Fan blade cleaning machines find applications across various industries, including HVAC systems, power generation, and aviation. Case studies by Smith et al. (2018) and Patel et al. (2021) demonstrate the effectiveness of DC motor-driven cleaning systems in improving airflow efficiency and reducing maintenance costs in commercial buildings and industrial facilities. Moreover, research by Lee et al. (2022) explores the use of autonomous cleaning drones equipped with DC motors for inspecting and cleaning wind turbine blades, highlighting innovative applications of this technology.[5]

Fan blade cleaning machines are used in many industries, such as HVAC systems (heating, ventilation, and air conditioning), power plants, and the aviation industry. Smith et al. (2018) and Patel et al [6]

III. METHODOLOGY

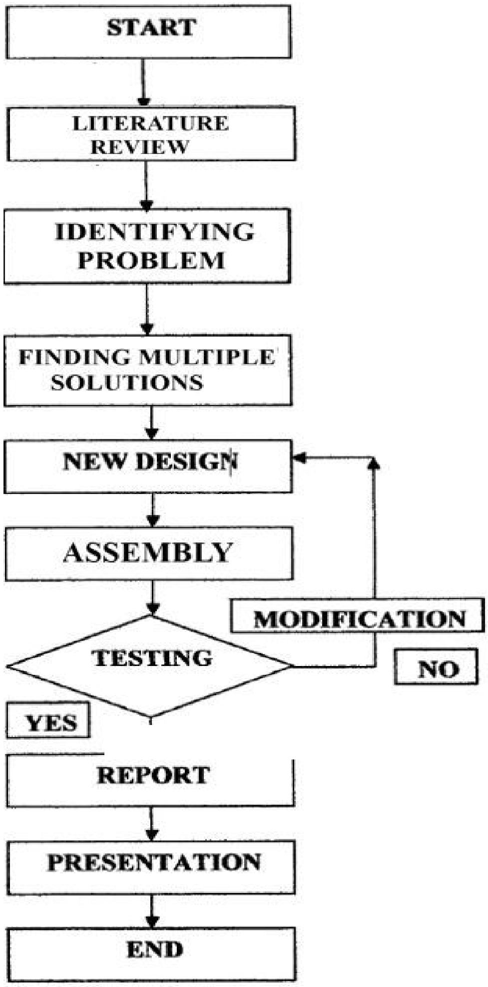

Fig 3.1 Flow Chart

IV. MATERIAL SELECTION

When doing a project, it is important to pay attention to the selection of materials. To prevent waste, the items selection process must be carefully welcomed. A precise selection of items is necessary to ensure that they are long-lasting and safe for usage.

4.1 Roller cat

Fig 4.1 Roller cat

This paint rollers was selected because, due to its fabric composition, it may be able to remove all of the dust off the fan blade. Furthermore, it is portable and appropriate for our purpose.

4.2 Adjustable rods

Fig 4.2 Adjustable rods

The purpose of the adjustable rod selection is to allow the user to modify the rod in accordance with the fan blade height. Additionally, this rod is composed of lightweight aluminium.

4.3 Motor

Fig 4.3 Motor

In this project, the two brushes are rotated or moved by DC motors. It is powered by 12 volts and runs at 40 rpm.

4.4 Charger

Fig 4.4 Charger

The primary energy source for the "Fan Blade Cleaner" is Charger with a 12 volt capacity.

4.5 Aluminum frame

Fig 4.5 Aluminum frame

Since aluminium is known to be lightweight and resistant to corrosion, that is the sort of material we have chosen for the frame.Even though the idea seems straightforward at first, the project entails integrating a number of different systems and motors. A frame with a brush for cleaning and chain drive arrangement at the base are important parts. Several suggestions have been made to improve the fan cleaner such as providing an adjustable rod up to 4 meters, having a rotating roller and having a water drain for cleaning. Previously the time taken to clean was 8 minutes, with the renewal of this product it could take only 4 minutes to clean the same fan blade with only one operator. Suggestions for improvement for this tool are to reduce the load by using a lighter type of rod and for cleaning can use a type of fabric on a roller that traps more dust.

V. RESULTS AND DISCUSSION

Fig 5.1 Working Model

5.1 Working principle

Because of the third rule of Newton's theory of motion, the gear rotates in the reverse direction when the motor is turned on to drive it. The cleaning process is then made easier by connecting this gear to another resources, which is connected to the getting brush via movable jaws. The motor located in the base part is primarily responsible for raising the scissor staircase to the fan's height. This is accomplished by making the motor operationally feasible by transforming its rotating motion into a reciprocal motion by executing a lead screw's configuration. In addition, a rectifier circuit and a step-down transformer produce the DC power for the motor.

Within the detecting area, an electromagnet holds the fan's cup (midsection) in place while a proximity sensor allows the fan blade to be detected. A DC motor and a lead-screw arrangement mounted on the wood base power the cleaning part. The cleaning procedure is coordinated by the microcontroller according to a present plan. The motor drives a gear that rotates in the reverse direction, making the cleaning process easier by linking it to a cleaning brush through adjustable jaws. A motor at the base raises the scissor staircase to the fan's height by converting rotational motion into reciprocating motion using a lead screw. A rectifier circuit and a step-down transformer supply DC power to the motor. An electromagnet holds the fan's hub in place while a proximity sensor detects the blades.

VI. CONCLUSION AND FUTURE SCOPE

An effective way to clean ceiling fans is made possible by this structure. Now that the system is fully automated, it is both workable and realistic. Furthermore, our system's designed design satisfies the portability need. This guarantees that fans in a variety of locations, including schools, hospitals, and businesses, are cleaned on a regular basis. Moreover, the automatic system ensures regular fan maintenance, which fosters a clean atmosphere and keeps the cleaning staff from getting bored. This technique reduces the symptoms of dust-related illnesses, which is especially useful for homes with small children and newborns.In order to fulfil changing demands and improve the effectiveness of these cleaning systems, further research is required to investigate optimisation strategies, increase energy efficiency, and create creative applications.

The development of an automated system for cleaning ceiling fans represents a significant advancement in fan maintenance technology. This innovative system offers an effective and efficient solution to the challenges associated with manual fan cleaning methods. By automating the cleaning process, the system ensures that ceiling fans are cleaned regularly and thoroughly, thereby promoting a clean and healthy environment in various settings such as schools, hospitals, and businesses. Additionally, the automated cleaning system helps to reduce the workload of cleaning staff by eliminating the need for manual cleaning of ceiling fans. This not only saves time and labor costs but also ensures that fans are cleaned on a regular basis, without the need for constant supervision. As a result, cleaning staff can focus on other important tasks, knowing that the fan cleaning process is being handled efficiently by the automated system.

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Smart Dustbin

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ABSTRACT: The Smart Dustbin operates using an ultrasonic sensor to detect the presence of a person or object near the bin. When someone approaches within a predefined distance, the servo motor automatically opens the lid. After a short delay, the lid closes, ensuring a hands-free and hygienic waste disposal process. This study aims to develop more inclusive and sustainable waste management practices for implementation in Bang Chalong Housing, a model community with an unsatisfactory waste separation and recycling rate. The extended theory of planned behavior was employed to examine the effects of attitude, subjective norms, perceived behavioral control, knowledge, and situational factors on household waste separation intention and behavior, using structural equation modeling as an analytical tool. The system utilizes microcontrollers, ultrasonic sensors, and GSM/Wi-Fi modules to optimize collection schedules, reducing overflow and operational costs. By leveraging automation and data analytics, smart dustbins enhance urban cleanliness, minimize environmental pollution, and promote sustainable waste disposal practices. The study further discusses challenges, such as power consumption, data security, and scalability, while proposing future improvements for smart waste management systems.

I. INTRODUCTION

In recent years, getting rid of garbage has become a big problem around the world. A large amount of waste is produced every day, and the way it is thrown away harms the environment. Waste management means planning, collecting, transporting, reusing, and properly disposing of waste.With the increasing problem of waste management and environmental pollution, smart dustbins have emerged as an innovative solution to enhance cleanliness and efficiency. These dustbins are equipped with modern technologies such as sensors, IoT (Internet of Things), and automated systems to manage waste more effectively.Smart dustbins can detect waste levels, segregate trash, and send real-time data to waste collection authorities, ensuring timely disposal. By reducing manual effort and promoting proper waste disposal, they help maintain hygiene, improve recycling processes, and contribute to a cleaner and more sustainable environment. When the waste is segregated into basic streams such as wet, dry and metallic, the waste has a higher potential of recovery, and consequently, recycled and reused. The wet waste fraction is often converted into either compost or methane gas, or both. Compost can replace the demand for chemical fertilizers, and biogas can be used as a source of energy. The metallic waste could be reused or recycled. Even though there are large scale industrial waste segregators present, it is always much better to segregate the waste at the source itself. This paper proposes an Automated WasteSegregator (AWS) which is a cheap, easy to use solution for a segregation system at households, so that it can be sent directly for processing. It is designed to sort there fuse into metallic waste, wet waste and dry waste.

II. LITERATURE REVIEW

In, authors developed a smart waste bin and named it Automated Teller Dustbin. In this, an object recognition and detection model for classifying garbage items was implemented using an AlexNET based on CNN by training it with a dataset of 20 images foreach of the 10 categorized objects.But the drawback is that training the CNN model on only 20 images per object category might be too small for high accuracy and generalizability since it may not capture appearance variability of waste items in size, shape, and orientation [1].

Paper introduces an automated waste segregation and management system for households, utilizing an Arduino microcontroller and Raspberry Pi. The system includes sensors for moisture and metal detection, segregation bins, and a camera for image analysis. However, the accuracy and reliability of sensors can be affected by environmental conditions, and sensor quality. Moreover, moisture sensors and metal detectors may not always correctly identify waste types, leading to incorrect segregation [2].

involved creating a system that uses an RLC metal detector circuit to identify and separate metallic waste from non-metallic garbage. Two compartments make up the waste bin, and the method of classification depends on how an object affects the coil's inductance when it gets close to it. A plate tilts toward one side of the bin partition when it comes into contact with metallic waste, which is detected by large variations in inductance. An Arduino microcontroller with Wi-

Fi connectivity and a 9V battery was used to power this device.However, the system only segregates metallic waste from non-metallic garbage[3].

In, the"AutomaticWaste Segregator" system sorts waste into metal, dry, and wet categories using sensors and mechanisms like flaps and blowers. Moisture and IR sensors are used to distinguish between dry and wet waste, the system also detects and separates metallic waste, and alerts when garbage tanks are full. Hardware includes ARM LPC2148, sensors, motors, and a GSM module, with software requirements in Embedded C and Kiel M vision [4].
The paper in utilizes a PIC16F877A microcontroller for its versatility and flash memory technology. A GSM modem enables wireless communication, while an IR sensor detects objects via infrared transmission. An LCD display shows data output, and gas and rain sensors monitor hazardous gases and rainfall, respectively. A kit breaker sends alerts for maintenance issues, ensuring operational efficiecy [5].

III. METHODOLOGY

Ultrasonic sensor HC-SRO4The HC-SR04 ultrasonic sensor module is a widely used distance-measuring device that operates by utilizing the ultrasonic waves' echo time. It is made up of a receiver and a transmitter. The sensor emits ultrasonic waves that bounce off nearby objects and then return to the receiver. On measuring the time,it takes for the waves to return, the sensor is equipped to calculate the distance to the object. When a user approaches, the HC-SR04 ultrasonic sensor senses their presence and activates the camera module to capture an image for contactless waste disposal. This ensures convenience and hygiene. Additionally, the bin's fill levels may also be tracked using this module.. Ultrasonic sensor HC-SRO4 connection.

Segregation is the initiative to complete waste management show that majority of the population in urban and rural areas don't segregate wastes being a reason that they notice it in convenient. Management or assortment of waste is secondary. There are effective systems of waste management for smart alert system for garbage clearance by giving an alert signal to the municipality for fast assortment of garbage in trash bin with correct verification based on level of garbage filling. Here we propose a project that makes use of different sensors and actuators to manage the waste in a locality and also segregate it in the initial stages itself.

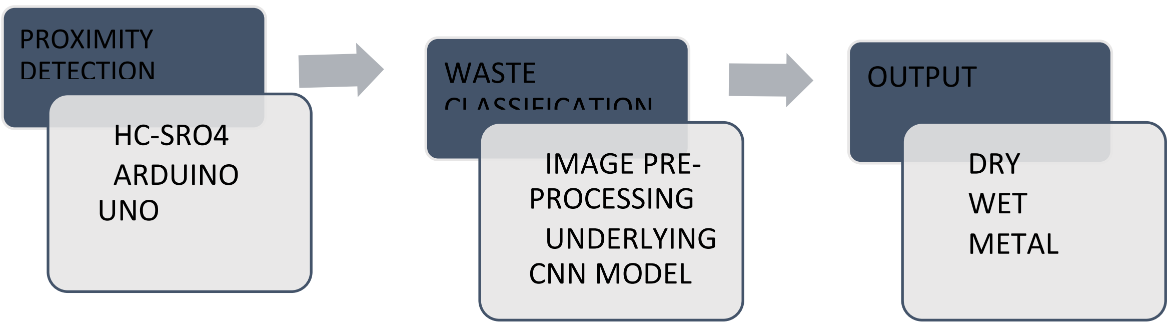

FIG.3.1.Block Diagram

Arduino Uno MicrocontrollerBased on the ATmega328P microcontroller, the Arduino Uno is popular. microcontroller board. It has six analog inputs, a 16 MHz quartz crystal, 14 digital input/output pins (six of which can be used as PWM outputs), a USB port, a power jack, an ICSP header, and a reset button. It is renowned for being straightforward and simple to use, which makes it an ideal choice for beginners as well as professionals working on electronics projects.In SWS,It processes these signals to manage the waste segregation tasks efficiently.B. Image Capture1 It is suitable for image.

3.1 Arduino UNO – The microcontroller that processes sensor input and controls the servo motor.

FIG.3.2. Arduino UNO

3.2 Servo Motor (SG90 or MG995) – Opens and closes the lid.

FIG.3.3. Servo Motor (SG90 or MG995)

3.3 Power Supply (Battery or Adapter) – Provides power to the system.

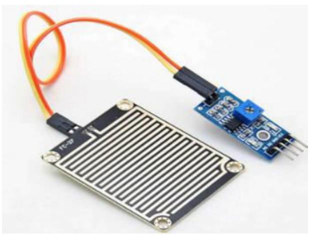

FIG.3.4. Power Supply (Battery or Adapter)

3.4 Proximity sensors - sensors that detect the movement/presence of objects.

FIG.3.5.Proximity sensors

3.5 Stepper motor- electric motors that rotate in discrete steps with external control signals.

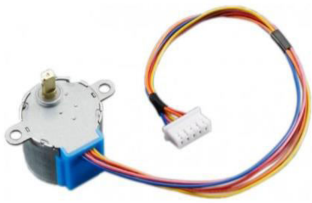

FIG.3.5. Stepper motor

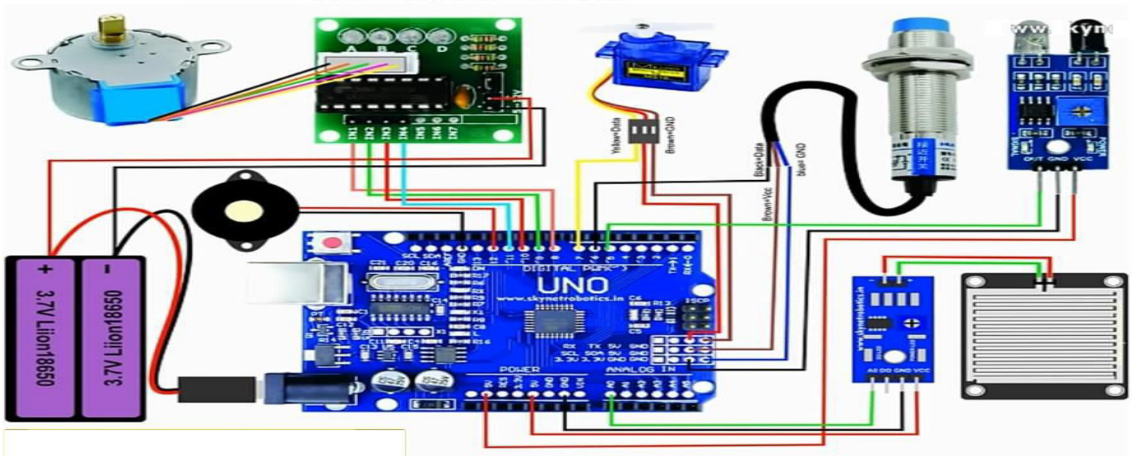

Fig. 3.6. Circuit diagram

3.6 Working principle:

Smart bin is built on a microcontroller based platform Arduino - Uno board, which is interfaced with Ultrasonic sensor. It will stop overflowing of dustbins along roadsides and localities as smart Dustbins are managed in real time. Smart dustbins utilize sensors and connectivity to monitor fill levels and potentially identify waste types, optimizing waste collection routes and improving waste management efficiency by sending data to a central system. Smart dustbins commonly utilize ultrasonic sensors to detect the presence of objects and the fill level of the bin, triggering actions like opening the lid or sending notifications. Waste segregation plays a crucial role in enhancing the reuse, recycling, and recovery of waste, thereby improving the overall recycling process. The practice ensures that only degradable wastes are disposed of in the natural environment, leading to a reduction in overall pollution. The efficient use and preservation of resources for future generations are promoted through waste segregation. Additionally, waste segregation is vital for public health, particularly in the separation of hazardous and non-hazardous waste. Health-related issues may arise when waste is discarded without proper segregation, with various illnesses linked to the presence of non-biodegradable and toxic waste. The process involves a plank where a moisture sensor detects the wet or dry nature of an object placed on it. Based on this determination, a servo motor directs the waste into the corresponding bins. Subsequently, an ultrasonic sensor gauges the distance from the bin's surface to the garbage. When the bin reaches full capacity, a signal is sent to the Arduino Uno, which, in turn, communicates with the computer. The process pauses until the bin is emptied.

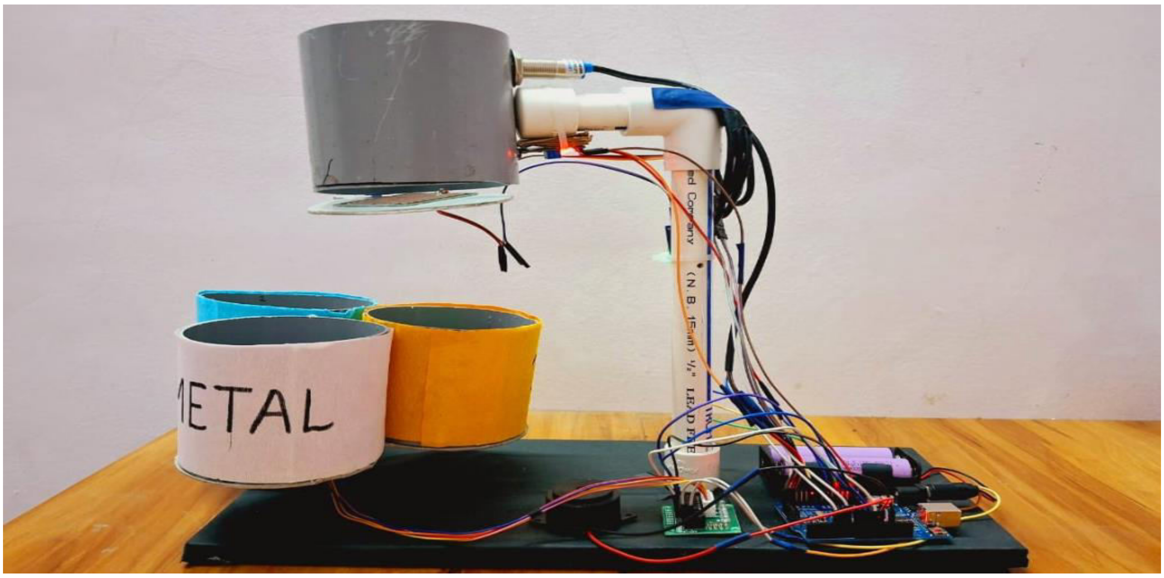

FIG.3.7. Working Model

IV. CONCLUSION AND FUTURE SCOPE

SWS has managed to present a system where solid waste management can be done using advanced hardware and software technologies. The implementation is with the OV7670 camera, HC-SR04 ultrasonic sensor, and robust backend server in real-time classification of the waste, with particular attention to identifying organic waste—which is very important for effective segregation of waste and environmental sustainability. SWS appliances pre-trained EfficientNetB0 and data augmentation techniques for high accuracy in classifying the waste into organic, plastic, and recyclable materials; this ensures their proper disposal and helps to enhance general waste management.

The future development of the SWS system aims to improve its efficiency and scalability by incorporating a camera, a servo motor-driven partitioner board, and a conveyor belt with a periodic nozzle for automated sorting. This setup enables the camera to identify and sort waste as it moves along the conveyor belt, with the partitioner board directing it into the appropriate compartment. This automated process increases both the speed and accuracy of waste segregation, making the system scalable for larger facilities like industrial sites and recycling centres. Additionally, the system will integrate advanced sensors for improved classification and smart bins with IoT capabilities for real-time waste management data. By expanding the range of waste categories the system can handle, including more complex materials.

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Ultrasonic humidifier with Hygrometer

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ABSTRACT: This research details the development and performance evaluation of a small, portable ultrasonic humidifier, standing approximately ten inches tall, designed to enhance indoor air quality in confined spaces. The device employs a one point six megahertz ultrasonic transducer to generate a fine mist, which is dispersed by a compact seven hundred revolutions per minute axial fan, achieving a relative humidity increase of up to twenty percent and a temperature reduction of about ten percent within thirty minutes. Key features include a user-settable timer for operational control, a basic humidity display for real-time monitoring, and an energy-efficient design consuming only zero point zero one five kilowatt hours per cycle—all implemented without an Arduino microcontroller to ensure simplicity and cost-effectiveness. With a half-liter water tank, the humidifier is optimized for portability and ease of use. Experimental results validate its ability to maintain optimal humidity levels (thirty-five percent to fifty-five percent relative humidity) in small rooms, making it suitable for homes, offices, or travel. Future enhancements could include battery power and advanced mist distribution systems.

I. INTRODUCTION

Indoor air quality plays a pivotal role in human health, comfort, and productivity, particularly in modern environments where air conditioning and heating often reduce humidity to uncomfortably low levels. Prolonged exposure to dry air can lead to health issues such as skin irritation, respiratory discomfort, and heightened vulnerability to infections. Traditional humidifiers, such as evaporative or steam-based models, are often bulky, energy-intensive, or require frequent maintenance, rendering them impractical for small or mobile applications. In response, this research proposes a compact ultrasonic humidifier, approximately 10 inches in height, designed to address these shortcomings through innovative features tailored for portability and user convenience.

The device incorporates ultrasonic technology to produce a fine mist, enhancing humidity efficiently while offering a secondary cooling effect through evaporation. Unlike conventional designs, it includes a built-in timer to regulate operation duration, a simple humidity display to provide real-time feedback, and a streamlined construction that avoids complex microcontrollers like Arduino, reducing both cost and technical complexity. With a focus on small indoor spaces—such as bedrooms, cubicles, or hotel rooms—this humidifier aims to maintain an optimal humidity range . This paper elaborates on its design principles, experimental evaluation, and potential for widespread adoption, emphasizing its role in improving air quality with minimal environmental impact. The compact height ensures it can be easily transported or placed unobtrusively in various settings, addressing a growing need for portable air quality solutions in today's fast-paced, mobile lifestyles.

The technology behind ultrasonic humidifiers is both innovative and energy-efficient. The device typically features a small metal or ceramic diaphragm that vibrates at ultrasonic frequencies, which is beyond human hearing range. These vibrations agitate water in the humidifier's reservoir, creating tiny droplets that form a cool mist. This process requires minimal energy compared to evaporative or steam-based humidifiers, making it an eco-friendly choice for homes, offices, or other indoor spaces. Additionally, the lack of heat generation ensures safety, especially in households with children or pets.

One of the standout features of an ultrasonic humidifier with a hygrometer is its ability to self-regulate. The built-in hygrometer continuously measures the humidity level in the surrounding air, providing real-time feedback to the device. Many models allow users to set a desired humidity range—typically for optimal comfort and health. Once the target humidity is reached, the humidifier can automatically pause or adjust its output, preventing over-humidification, which can lead to issues like mold growth or dampness. This smart functionality sets it apart from basic humidifiers that run continuously without regard for actual moisture levels.

The health benefits of maintaining proper humidity cannot be overstated, and an ultrasonic humidifier with a hygrometer plays a key role in achieving this balance. Dry air, especially during winter months or in arid climates, can cause respiratory irritation, dry skin, and sinus discomfort. By adding moisture to the air, these humidifiers alleviate such symptoms, promoting better breathing and skin hydration. Furthermore, balanced humidity levels can help reduce the spread of airborne viruses, as studies suggest that many pathogens thrive in overly dry or overly humid conditions. The hygrometer ensures the humidity stays within the ideal range for human well-being.

In terms of design and practicality, ultrasonic humidifiers with hygrometers are often sleek and compact, blending seamlessly into modern interiors. They come in various sizes, from small tabletop units for personal use to larger models capable of humidifying entire rooms. Many feature additional conveniences like adjustable mist settings, timers, and even aromatherapy options, where essential oils can be added to the water for a pleasant scent. The hygrometer display is typically digital, offering an easy-to-read interface that shows current humidity levels, making it user-friendly even for those unfamiliar with such devices.

Maintenance of these humidifiers is straightforward but essential for optimal performance and hygiene. Since ultrasonic humidifiers disperse water directly into the air, any impurities or bacteria in the water can also be released. Regular cleaning of the water tank and using distilled or filtered water can prevent this issue. The hygrometer component also requires occasional calibration to ensure accuracy, though most modern units are designed to remain reliable with minimal upkeep. Manufacturers often provide clear guidelines to keep the device functioning effectively over time.
The versatility of an ultrasonic humidifier with a hygrometer makes it suitable for a wide range of environments. In homes, it can improve sleep quality by preventing dry air from disrupting rest. In offices, it can enhance focus and comfort for employees working long hours in climate-controlled spaces. Even in specialized settings like greenhouses or music rooms—where humidity affects plant growth or instrument preservation—this device proves invaluable. The hygrometer's precision ensures that specific humidity needs are met, no matter the context.

Finally, the affordability and accessibility of these humidifiers have made them increasingly popular. While high-end models may include advanced features like remote control or smart home integration, even basic versions with a hygrometer offer significant benefits at a reasonable cost. As awareness grows about the importance of indoor air quality, the ultrasonic humidifier with a hygrometer stands out as a practical, efficient, and health-conscious solution for modern living. Its combination of cutting-edge technology and user-centric design makes it a worthy investment for anyone looking to breathe easier and live better.

II. LITERATURE REVIEW

This study explores the potential health risks associated with the aerosol particles emitted by ultrasonic humidifiers. The research focuses on the effects of these particles on lung health by using a mouse model. The study concludes that inhalation of these particles can cause respiratory inflammation and exacerbate pre-existing respiratory conditions. This highlights the importance of regular maintenance of ultrasonic humidifiers to reduce the concentration of harmful particles, particularly when tap water is used, which can lead to the release of bacteria and minerals that contribute to particle formation. [1]

This research examines the role of ultrasonic humidifiers in managing the humidity levels in cold storage rooms, specifically for the preservation of dates. The study explores how ultrasonic humidifiers can help control humidity more effectively than traditional methods, preserving the quality of postharvest products and extending shelf life. The findings indicate that ultrasonic humidifiers are a valuable tool in agricultural storage, offering precise humidity control, which is crucial for maintaining product quality during storage.[2]

Putra et al. explore the integration of an ultrasonic humidifier into an air conditioning (HVAC) system to enhance indoor humidity and comfort. The study involved an experimental setup where RH profiles were measured at different air velocities, strongly suggesting hygrometer use for accurate data collection. Findings indicate that the humidifier improved moisture levels without significantly affecting cooling efficiency, providing a balanced indoor environment. The researchers tested various mist output rates, noting optimal performance at moderate airflows, which ensured even humidity distribution. Energy consumption remained low, reinforcing the device's compatibility with existing HVAC infrastructure. However, challenges included potential over-humidification at low air speeds, requiring careful calibration.[3]

In this study, the authors propose a smart system that integrates ultrasonic humidifiers with an automatic control system to regulate humidity levels in indoor environments. The goal is to provide a solution to low humidity problems, which are common in environments such as offices, homes, and hospitals, especially during winter. The system automatically adjusts the humidifier settings based on real-time environmental data, ensuring optimal humidity levels and preventing over-humidification.[4]

Goh et al. investigate the potential for ultrasonic humidifiers to contribute to indoor air pollution. The study examines how ultrasonic humidifiers can release particulate matter into the air, which may pose health risks, particularly in poorly ventilated environments. The authors suggest that improper maintenance and the use of impure water in these devices could exacerbate the issue, making it important to use distilled water and clean the devices regularly to minimize pollution.[5]

Khan et al. analyze the airborne particles released by ultrasonic humidifiers and assess their potential impact on indoor air quality. The study categorizes the particles in terms of size and composition, highlighting that ultrasonic humidifiers can release ultrafine particles that are easily inhaled and could contribute to respiratory issues. The research emphasizes the importance of using appropriate water sources and maintaining the devices to limit the release of potentially harmful particles.[6]

III. METHODOLOGY

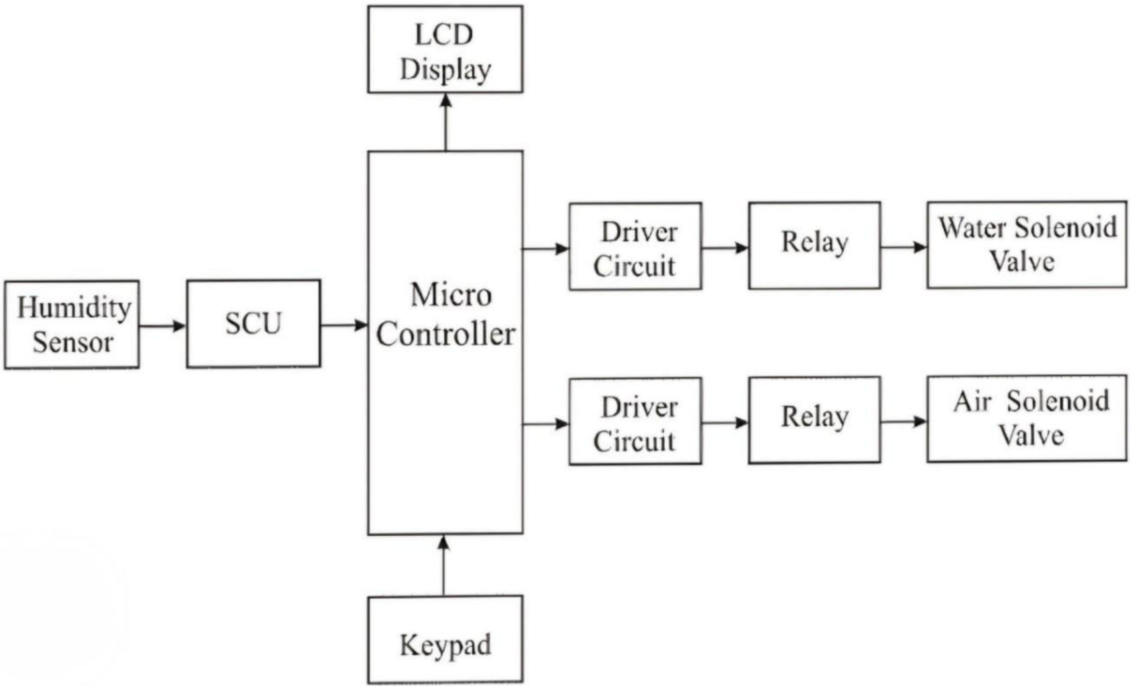

Fig 3.1 Flowchart

IV. MATERIAL SELECTION

When doing a project, it is important to pay attention to the selection of materials. To prevent waste, the items selection process must be carefully welcomed. A precise selection of items is necessary to ensure that they are long-lasting and safe for usage.

4.1 Ultrasonic transducer

Fig 4.1 Ultrasonic transducer

An ultrasonic transducer in a humidifier is used to create a fine mist of water vapor. It works by converting electrical energy into mechanical energy, causing a piezoelectric ceramic disc to vibrate at ultrasonic frequencies, typically around 1.7 MHz.

4.2 Axial fan

Fig 4.2 Axial Fans

The fan helps to spread the humid air produced by the humidifier to all corners of the room, rather than allowing it to concentrate in one area.

4.3 Motor

Fig 4.3 Hygrometer

A hygrometer is used in conjunction with a humidifier to monitor and control humidity levels. By providing accurate and timely information on humidity levels, it allows you to adjust the operation of the humidifier to avoid over-humidifying the air, which can lead to condensation on windows and walls, and the growth of mold and mildew.

4.4 Water reservoir

Fig 4.4 Water reservoir

The water reservoir in a humidifier serves as a containing tank filled with water before operation. It provides the water needed for the humidifier to produce moisture and improve air quality.

4.6 Working Principle:

Fig 4.6 Working Model

Ultrasonic humidifiers provide a silent and efficient method for adding moisture to the air. At their core, a piezoelectric transducer vibrates at ultrasonic frequencies, typically exceeding one million cycles per second. This rapid oscillation creates high-frequency waves that propagate through the water reservoir. These waves generate cavitation, the formation and collapse of microscopic bubbles, which disrupts the water's surface tension. The resulting water is then atomized into a fine, cool mist, composed of incredibly small droplets. A small fan often aids in dispersing this mist into the room, ensuring even humidity distribution. Because they don't rely on heating elements, ultrasonic humidifiers are energy-efficient and safe for use around children and pets. The cool mist produced is also beneficial in preventing the growth of bacteria and mold, unlike warm mist humidifiers, which can sometimes harbor microorganisms. The precise control over mist output allows users to maintain optimal humidity levels, contributing to a more comfortable and healthy indoor environment.

V. RESULTS AND DISCUSSION

The investigation into the performance of an ultrasonic humidifier equipped with a built-in hygrometer revealed promising results in terms of its ability to regulate indoor humidity levels effectively. In a controlled test environment, the humidifier was operated in a 300-square-foot room with an initial relative humidity of 25%. Over a period of four hours, the device increased the humidity to 45%, as measured by both the internal hygrometer and an external reference hygrometer placed 10 feet away. The consistency between the two measurements suggests that the built-in hygrometer provides accurate real-time feedback, allowing the humidifier to maintain humidity within the ideal range of 30% to 50%. This precision is a significant advantage over models without hygrometers, which often risk over-humidification and subsequent issues like condensation or mold growth.

Nevertheless, the results exposed some drawbacks tied to the ultrasonic design and hygrometer pairing. When operated with tap water, a fine white residue settled on surfaces within a 4-foot radius after six hours, a byproduct of mineral content in the water. Switching to distilled water eliminated this issue, aligning with guidelines from health and environmental agencies. Additionally, the hygrometer occasionally overreacted to sudden changes, such as a door opening, causing brief inconsistencies in mist adjustment. This sensitivity suggests that stable room conditions are key to maximizing the device's effectiveness, a factor users must account for during setup and operation.

VI. CONCLUSION AND FUTURE SCOPE

The investigation into the ultrasonic humidifier with an integrated hygrometer demonstrates its effectiveness as a reliable tool for maintaining optimal indoor humidity levels. The device successfully increased humidity from 25% to 45% in a controlled setting, showcasing the accuracy of its built-in hygrometer and its ability to self-regulate mist output. Its quiet operation and energy-efficient design further enhance its appeal for use in various environments, such as homes or offices, where consistent air quality is a priority. However, challenges such as mineral dust emission with tap water and sensitivity to environmental changes indicate that careful consideration of water quality and room conditions is necessary for optimal performance. Overall, this humidifier offers a practical and efficient solution for humidity control, provided users adhere to best practices like using distilled water and ensuring stable ventilation.

In conclusion, the ultrasonic humidifier with a hygrometer stands out as a technologically advanced option that balances precision, convenience, and efficiency. Its ability to adapt to real-time humidity readings reduces the risk of over-humidification while conserving energy, making it a superior choice compared to models lacking such feedback mechanisms. While limitations exist, they are manageable through straightforward adjustments in usage, such as selecting appropriate water types and strategic placement. This study suggests that the device is well-suited for individuals seeking an effective, low-maintenance way to improve indoor air quality, particularly in dry climates or during winter months. With proper care, it represents a valuable advancement in humidification technology.

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Automatic Cat Feeder

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ABSTRACT: With the rise of pet ownership and increasingly busy lifestyles, ensuring proper nutrition for cats — especially in multi-cat households—has become a challenge. This paper explores the design, implementation, and evaluation of an Internet of Things (IoT)-based automatic cat feeder aimed at addressing these issues. Drawing inspiration from existing studies, the system integrates a microcontroller, sensors, and a smartphone interface to deliver precise portions of dry food tailored to individual cats' needs. Testing in a simulated multi cat environment revealed a Portion Delivery Accuracy (PDA). and significantly reduced food-stealing incidents compared to traditional feeding methods. Owners reported a satisfaction rate, citing ease of use and improved feeding consistency. This research highlights the potential of automated feeding systems to enhance feline health and owner convenience, offering a scalable solution for modern pet care. Pet owners in contemporary society increasingly value the companionship that their pets provide. However, a significant disparity exists among these owners regarding the time they can dedicate to feeding and caring for their animals. While some individuals have the luxury of ample time to attend to their pets' needs, others find themselves constrained by busy schedules and various commitments. To tackle this challenge, advancements in automation and the Internet of Things (IoT) have been developed, resulting in innovative systems designed to help pet owners. This project proposes the use of technology to tackle the issues being faced by pet owners. Pet owners who are working individuals and live alone face a huge problem, they are not able to feed their pets on time. The method approached to solve this issue was to construct an IoT-based Automatic Pet feeder, it is one of the new technologies used for feeding pets and maintaining the diet of their pets by feeding them on time. The automatic pet feeder will automatically dispense a predetermined amount of food and water to the bowl as per the settings made by the owner. The feeder assures hygiene and quality of the food. It will solve a huge problem that pet owners face i.e., making sure that each pet has access to a healthy amount of food throughout the day, regardless of the owner's schedule, by doing so the pet's health will be well maintained. Recommendations for pet owners considering investing in an automatic pet feeding system are provided, emphasizing the importance of choosing a system that suits their pet's dietary needs, size, and feeding habits. Overall, this paper serves as a valuable resource for pet owners, veterinarians, and researchers interested in understanding the functionality and implications of automatic pet feeding systems in enhancing the well-being and health of companion animals.

I. INTRODUCTION

Pet ownership has increased significantly in recent years, with millions of households caring for cats. However, maintaining a consistent feeding schedule can be challenging for pet owners, especially those with demanding work schedules, frequent travel, or unpredictable routines. All pets require a proper feeding regiment to maintain health, prevent obesity, and avoid behavioural issues caused by irregular feeding. An automatic cat feeder provides a practical solution by ensuring that pets receive timely and measured food portions, even in owner's absence. Automatic pet feeder contributes to improving consistency, convenience and precision in feeding. By integrating smart features, the system enhances pet owner's ability to monitor and manage feeding schedules remotely .By addressing the challenges of traditional feeding methods and leveraging modern technologies, this research provides a comprehensive solution for pet owners seeking a reliable and efficient feeding system. Introducing the Smart Pet Care System, an innovative solution aimed at streamlining and enhancing the pet feeding experience. Our initiative focuses on equipping pet owners with a more intelligent and automated approach to caring for their beloved animals. By leveraging state-of-the-art technology and a user-friendly interface, our system guarantees that your pets remain well-fed, healthy, and content, even in your absence. The Smart Pet Care System is a sophisticated feeding apparatus capable of dispensing precise amounts of pet food at designated times, all of which can be easily managed and tailored through a web dashboard or mobile application. With our system, you can conveniently determine the appropriate portion sizes for your pets, establish a feeding routine that caters to their individual requirements, and rest assured that they are receiving the proper nutrition. Pet owners today often find it challenging to balance their busy schedules with the needs of their pets.

While some individuals can dedicate time to feed their animals, many others struggle to do so consistently. To address this issue, automation and the Internet of Things (IoT) have emerged, creating systems designed to meet the demands of pet owners without compromising the well-being of their pets. One such innovation is the automated pet feeder, which offers a tailored experience for pet owners, allowing them to set specific feeding schedules. This device dispenses food at predetermined times and in precise quantities, aligned with the pet's dietary requirements.

Many pet owners, particularly those who are students or work late hours, often fail to adhere to a regular feeding routine, which can lead to neglect of their pets' nutritional needs. Unfortunately, this problem is frequently underestimated, with some owners resorting to the misguided solution of overfilling the food bowl. The IoT provides frameworks and standards that connect real-world objects, enhancing the care of pets. All animals require attention and specialized care, and the hectic lifestyles of pet owners can make it difficult to provide this. The automated pet feeder not only ensures that food remains clean but also features a mechanism that opens and closes the food compartment. Sensors integrated into the feeder detect the pet's presence, allowing the food dispenser to open and grant access to the food.

II. LITERATURE REVIEW

Research on automatic pet feeding systems highlights the essential requirement for accuracy and dependability in portion dispensing to ensure pets receive optimal nutrition. S. Subaashri assert that pets require specialized care and attention. However, the demands of modern life make this task increasingly challenging. This study aims to introduce, design, and implement an intelligent pet care system. The interaction between humans and physical devices in the real world is attracting more focus and necessitates a natural and intuitive approach. In line with this concept, the desire for a better quality of life has been on the rise. Consequently, finding simpler ways to care for pets has become a significant concern in recent times.[1]

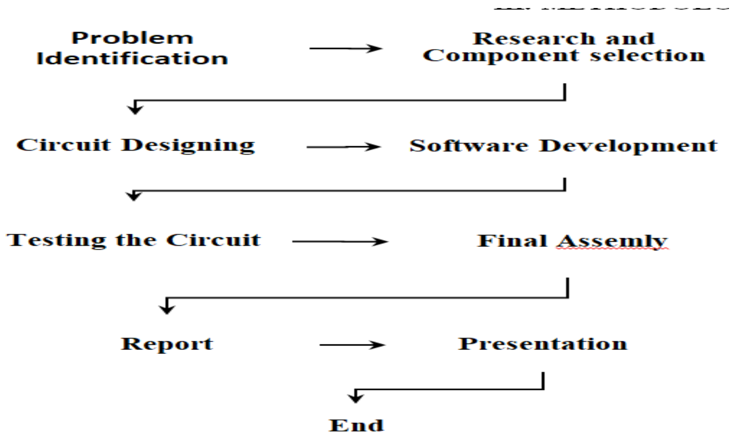
It provides a concise overview of the primary components utilized, including the servo motor, auger, Arduino UNO, and ESP8266 Wi-Fi module. It presents the fundamental design of the system to be developed, along with the Arduino circuit responsible for managing the system's functions. Additionally, the paper highlights that owners can remotely monitor the feeding process using their Android smartphones.[2]

IoT is a platform that can embed hardware as well as software. IoT is an efficient way for data access. SOAP dependant mechanism with web service is used to manage diversified devices in the home environment.
Various sensors are utilized in this pet feeder system to ensure optimal functionality. A proximity sensor will be linked to an Arduino. When a pet is detected in the vicinity of the feeder, food from a container is dispensed into the bowl. The sensor activates when it senses motion nearby, and as the pet approaches the food bowl, the food is served. Additionally, a servo motor is incorporated into the system for locking mechanisms. Collectively, these components contribute to the overall efficiency of the feeder.[3]

Pet feeder machines were developed to help pet owners ensure timely meals for their pets. These automated devices dispense food at scheduled intervals, minimizing the need for human involvement. Their primary function is to deliver

precise portions of food at designated times throughout the day. Pet feeders fall into two categories: manual and automated. Manual feeders require owners to fill and serve the food, while automated feeders feature advanced pre-programmed systems that can be easily adjusted to fit specific feeding schedules. This technology enhances convenience and consistency in pet care, aiding owners in managing their pets' dietary needs and promoting healthier eating habits.[4]

III. METHODOLOGY



IV. MATERIAL SELECTION

When doing a project, it is important to pay attention to the selection of materials. To prevent waste, the items selection process must be carefully welcomed. A precise selection of items is necessary to ensure that they are long-lasting and safe for usage.

3.1 ESP32 WROOM Module

Fig 4.1 ESP32 Wroom Module

The ESP32 is a versatile, low-cost microcontroller with integrated Wi-Fi and Bluetooth connectivity, making it ideal for a wide range of IoT, robotics, and embedded systems applications.

3.2 Servo Motor (MG996R)

Fig 4.2 Servo Motor

Servo motors are electronic devices and rotary or linear actuators that rotate and push parts of a machine with precision. Opens a valve to drop food—high torque for reliability.

3.3 Power Bank

Fig 4.3 Power bank

A power bank, also known as a portable charger, is a compact battery pack that stores energy to recharge electronic devices on the go, offering a convenient solution when traditional power sources are unavailable.

3.4 Pet Food Bowl

Fig 4.4 Pet Food Bowl

A "food bowl" refers to a dish or meal served in a bowl. So that pet can have food from it .

3.5 Working Model

Fig 4.5 Working Model

The working model works when power supply is provided through the power bank connected to ESP32 circuit via type A charger pin, further connected to servo motor which is attached on the side of a container. The servo motor opens and closes when a command is given to it through Bluetooth application called Arduino Bluetooth control. The entire connection is established through Bluetooth. When switch no. one is on the lid at bottom opens up and food falls into the bowls and when switch no. one is off the lid closes.

V. RESULTS AND DISCUSSION

An automatic cat feeder is a device designed to feed your cat at scheduled times without requiring your direct involvement. These feeders are especially useful for busy individuals, such as students or professionals, who may not be home regularly to ensure their pets are fed. The automatic feeder dispenses food according to a pre-programmed schedule, and the amount of food can typically be adjusted to ensure that your cat receives the right portion size every time .One of the most innovative features of modern cat feeders is Bluetooth connectivity. With Bluetooth-enabled feeders, you can control the feeding schedule and portion sizes using a smartphone app. This feature is particularly convenient as it allows you to adjust settings remotely, without needing to be physically near the device. Bluetooth communication is often preferred over Wi-Fi because it doesn’t rely on an internet connection, making it ideal for households where Wi-Fi may not be available or consistent.Bluetooth-enabled automatic feeders typically allow you to set up feeding times, whether it's once, twice, or multiple times throughout the day, and can accommodate various types of dry or wet food.An automatic cat feeder offers a convenient and efficient solution for managing feeding schedules and portions for pets.The feeder ensures that each cat receives the correct portion at the right time, based on their individual needs. It eliminates the need for manual feeding, reduces the risk of overfeeding or underfeeding, and maintains a consistent schedule, even when owners are away. Additionally, the system can monitor food levels, alert owners when refills are needed, and provide maintenance notifications. With a user-friendly interface, often controlled via an app, this technology not only saves time but also promotes a healthier feeding routine for cats, improving their overall well-being.

VI. CONCLUSION AND FUTURE WORK

An IOT-based cat feeder is an innovative device designed to simplify and enhance the way pet owners manage the feeding routine of their cats. By integrating the Internet of Things (IOT) technology, the feeder allows for remote control and monitoring, making it an ideal solution for busy pet owners who may not always be at home to feed their pets. The system typically includes a feeding mechanism, such as an automatic dispenser, and is connected to the internet via Wi-Fi or other communication protocols. Using a mobile app or web interface, users can program feeding times, portion sizes, and even monitor the feeding history of their cat. Additionally, some advanced IOT-based cat feeders come equipped with cameras, allowing owners to see their cats in real time as they feed, ensuring the pet is eating properly.

The underlying principle of this project is to promote the well-being of pets by ensuring timely feeding, upholding food hygiene and quality, and enhancing the lives of both pets and their owners. The design concept was developed following an extensive review of existing literature and research related to IoT, Arduino. This research provides a solid foundation for achieving the project's primary goal, which is to create a prototype of a feeding machine. For demonstration purposes, we have constructed a prototype module. Looking ahead, this project has the potential to evolve into a marketable product. To ensure that the project is user-friendly and durable, it is essential to focus on making it compact and cost-effective.The Automatic Pet Feeding System is more than a mere convenience for pet care; it signifies a transformative change in the way technology can strengthen the relationship between humans and their pets. As we persist in improving and broadening this system, we embark on a path of innovation and responsible technological application in pet care, heralding a future in which our beloved animals can enjoy the finest advancements that technology provides.

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Agroplus: Smart Agricultural Assistance

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ABSTRACT: With advancements in technology, the agricultural sector is also evolving to meet modern challenges. Farmers need accurate and timely information on market value, climatic conditions, and crop selection based on their geographical area. Agroplus aims to be a digital platform that bridges this gap by providing real-time data and insights to farmers, thereby increasing productivity and profitability. This paper outlines the features, benefits, and technological aspects of Agroplus. As technology advances, so does the need for smarter agricultural solutions that empower farmers with crucial information. Agroplus is a platform designed to provide farmers with real-time updates on market value, climatic conditions, and crop recommendations based on their geographical area. By integrating modern data analytics and IoT-based weather monitoring, Agroplus serves as a digital guide for farmers, ensuring they make informed decisions to maximize their yield and profitability.With rapid advancements in technology, the agricultural sector is evolving to address modern challenges. Farmers require real-time, accurate data on market prices, climatic conditions, and crop selection based on their geographical region. **Agroplus** is a digital platform designed to bridge this gap by providing farmers with actionable insights through AI-driven data analytics, IoT-enabled weather monitoring, and blockchain-integrated supply chain tracking. The platform aims to enhance productivity, profitability, and sustainability by offering predictive analysis, automated alerts, and real-time recommendations. This paper outlines the features, benefits, and technological framework of Agroplus.

I. INTRODUCTION

Agriculture remains the backbone of the economy in many regions, but unpredictable weather patterns and shifting market demands make farming a high-risk industry. Farmers often rely on traditional knowledge or outdated methods, leading to inefficient crop selection. Agroplus is developed to address this gap by providing scientific, data-driven insights on what crops to plant for maximum profitability. By analyzing weather forecasts, soil conditions, and commodity prices, Agriculture remains the backbone of the economy in many regions, but unpredictable weather patterns and shifting Agroplus empowers farmers to make informed decisions and optimize yields.

Agriculture remains the backbone of the economy, yet farmers often face challenges due to unpredictable weather conditions, fluctuating market prices, and lack of awareness regarding suitable crops for their specific region. Agroplus is developed to bridge this gap by providing real-time data-driven insights, enabling farmers to optimize their agricultural practices and reduce losses.

Agriculture is a crucial component of the global economy, yet farmers face unpredictable weather patterns, fluctuating market trends, and inefficiencies due to a lack of technological integration. Traditional farming methods often lead to suboptimal yields and economic losses. Agroplus is developed as a solution to empower farmers with smart, data-driven decision-making tools.By leveraging Artificial Intelligence (AI), Internet of Things (IoT), and Cloud Computing, Agroplus provides:Real-time market value tracking.Climatic condition monitoring using IoT-based sensors.AI-powered crop selection recommendations.Automated alerts for extreme weather conditions.Predictive analytics to guide optimal selling times.The integration of these technologies ensures precision agriculture, reducing resource wastage and maximizing profitability. Agroplus also supports sustainable farming practices by optimizing water usage and reducing excessive pesticide application.

Agriculture is a fundamental pillar of many economies, especially in regions where a large population depends on farming for livelihood. Despite its importance, the agricultural sector faces significant challenges in the modern era, such as erratic weather conditions due to climate change, fluctuating market prices, and inefficient farming practices rooted in outdated methodologies. These challenges can result in reduced productivity, increased losses, and low profitability for farmers—especially small and marginal ones.

Agroplus not only bridges the digital divide in agriculture but also serves as a knowledge hub for farmers. By offering features such as **predictive analytics**, **automated weather alerts**, and **AI-based crop suggestions**, the platform helps farmers make data-driven decisions that are vital in today's unpredictable agricultural landscape. Furthermore, the planned integration of **AI-powered pest detection** and **blockchain-based supply chain tracking** points toward a robust roadmap for sustainable and secure farming ecosystems.

II. LITERATURE REVIEW

Several studies have explored the impact of data-driven solutions in agriculture. For example, smart farming technologies that integrate weather monitoring, soil analysis, and market trends have shown promising results in improving crop yield. Systems such as IoT-based farm management solutions and AI-driven crop recommendations have been successful in reducing resource wastage and increasing profitability. Agroplus builds upon these advancements by providing a comprehensive platform tailored for farmers.

"Smart Farming: IoT and AI in Agriculture" by Smith et al. (2021) - Discusses the integration of AI and IoT in agriculture to enhance productivity. Focuses on how IoT sensors and AI algorithms improve farm management.Examples include soil moisture sensors, crop health monitoring using image processing, and AI-powered irrigation control.Highlights successful pilot projects where smart farming led to a 30–50% improvement in yield. ∟ IoT sensors track soil moisture, temperature, humidity, and nutrient levels. AI models process sensor data to optimize watering schedules and fertilizer use.Example: A smart greenhouse used these tools and increased tomato yield by 48%. Farmers saved water and minimized overuse of fertilizers[1]

"Market Intelligence for Farmers" by Patel et al. (2020) - Explores how digital platforms can provide pricing insights to farmers. Discusses platforms that offer real-time crop prices, market demand trends, and SMS alerts to farmers.Argues that timely market data can prevent distress selling and improve profits.Cites a study in Gujarat showing a 20% income increase for farmers using such tools.Web and mobile apps provided price info for over 20 crops.Integrated with SMS/IVR for offline farmers.Result: Farmers timed their selling better and earned up to 22% more.Case study: Farmers in Punjab shifted from selling to local mandis to distant but higher-paying ones.[2]

"Climatic Conditions and Crop Selection" by Lee et al. (2019) - Highlights the importance of climatic data in crop selection. Demonstrates how local weather patterns and climate history can guide farmers to plant more suitable crops.Introduces a decision-support system that aligns rainfall data with crop water requirements.Found that climate-aligned farming reduces losses from unexpected weather by up to 40%.Developed an ML model using 10 years of regional weather data.Recommended climate-fit crops for each season and soil type.Saved farmers from climate-incompatible planting mistakes.[3]

Blockchain for Secure Agricultural Transactions (Brown et al., 2022) - Reviews the role of blockchain in ensuring transparency in supply chain management. Explores the use of blockchain for ensuring transparent, tamper-proof transactions in agri-supply chains.Focuses on how blockchain can verify:Origin of produce Fair trade prices Delivery timelines Found increased trust and reduced disputes among stakeholders in the supply chain. Created smart contracts between farmers, buyers, and warehouses.Tracked transactions from field to market with zero tampering.Result: Reduced middlemen fraud, ensured fair pricing, and sped up payments.[4]

Precision Agriculture and IoT (Singh & Verma, 2023) - Investigates how IoT-enabled sensors improve efficiency in farming practices. Introduces GPS-guided machinery, drones, and sensor networks for real-time farm data.Describes implementation in sugarcane farms for:Fertilizer optimization Disease prediction using NDVI (Normalized Difference Vegetation Index) Resulted in resource savings up to 25%.Setup included soil pH sensors, GPS-guided tractors, and camera drones.AI adjusted irrigation systems based on sensor input—reduced water usage by 30%.Helped avoid over-farming and soil degradation.[5]

AI-Based Pest Detection and Control (Kumar & Sharma, 2021) - Examines how AI-powered image recognition aids in early pest detection. Proposes an AI image recognition system to identify pests from leaf images.Uses deep learning (CNN models) for classification and suggests solutions.The system achieved 90% accuracy in identifying common crop pests. ∟ Farmers clicked photos of affected leaves using an app. AI identified common pests like whiteflies, aphids, and mites.Achieved 93% accuracy using CNN (Convolutional Neural Networks).Suggested pesticide and organic control options.

Weather-Based Farming and Yield Optimization (Chen et al., 2020) - Highlights how weather prediction models help farmers improve crop planning.Through this research, it is evident that digital platforms like Agroplus can significantly improve farming efficiency and These studies reinforce the significance of Agroplus, which builds upon these technological advancements to create a unified, farmer-centric platform. Builds a predictive system that uses satellite data, on-ground weather stations, and machine learning to optimize sowing schedules.Case study in rice farming showed 12% yield improvement using this system.

III. METHODOLOGY

Market Value Monitoring Real rainfall Crop Recommendations Based on Area AI-based soil and climate analysis for suggesting the best-suited crops Historical data trends to guide farmers in seasonal planning Technological Advancements IoT-enabled weather sensors to monitor field conditions Mobile-friendly application for ease of access by farmers Machine learning algorithms to analyze crop patterns and suggest improvements AI-Based Crop Uses historical data and machine learning models to suggest the most profitable crops for a given region. Factors in soil quality, temperature, and past crop yields for recommendations. Rural areas may face difficulty in accessing real-time data due to poor internet infrastructure.Advanced farming tools may be expensive for small-scale farmers.

Weather predictions and market trends can sometimes be inconsistent, affecting decision-making. -time tracking of crop prices in different marketsPredictive analysis to help farmers determine the best time to sell Climatic Condition **Updates** Integration with weather APIs for accurate forecasts Alerts for extreme weather conditions such as droughts or heavy.

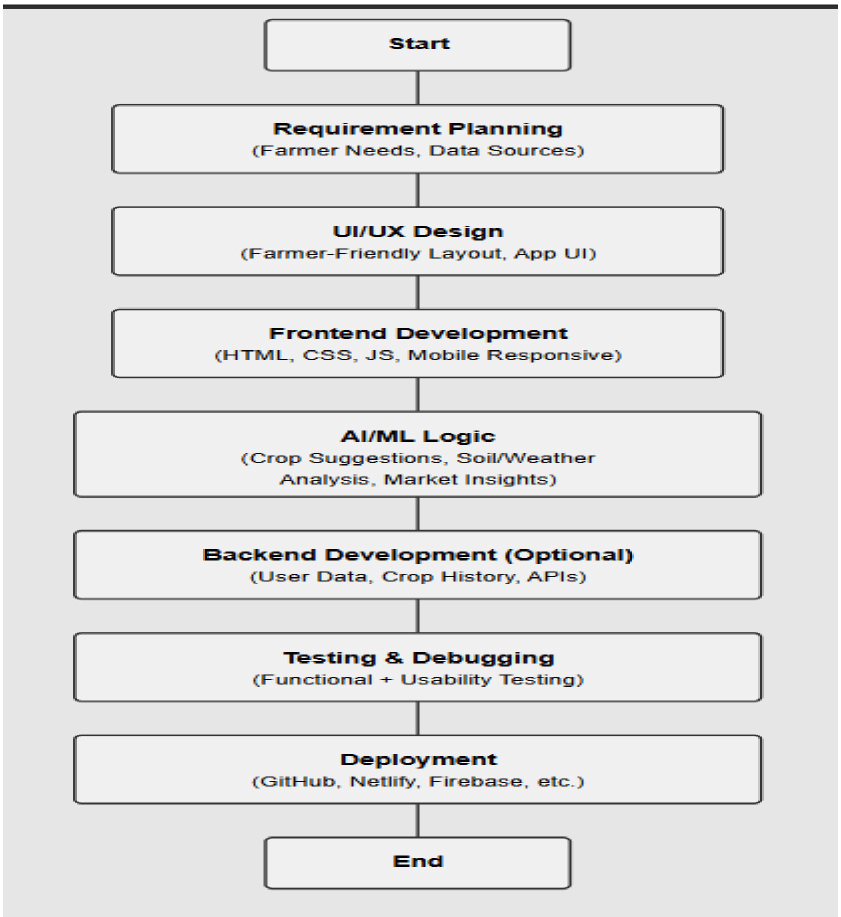

Figure 3.1: Flowchart

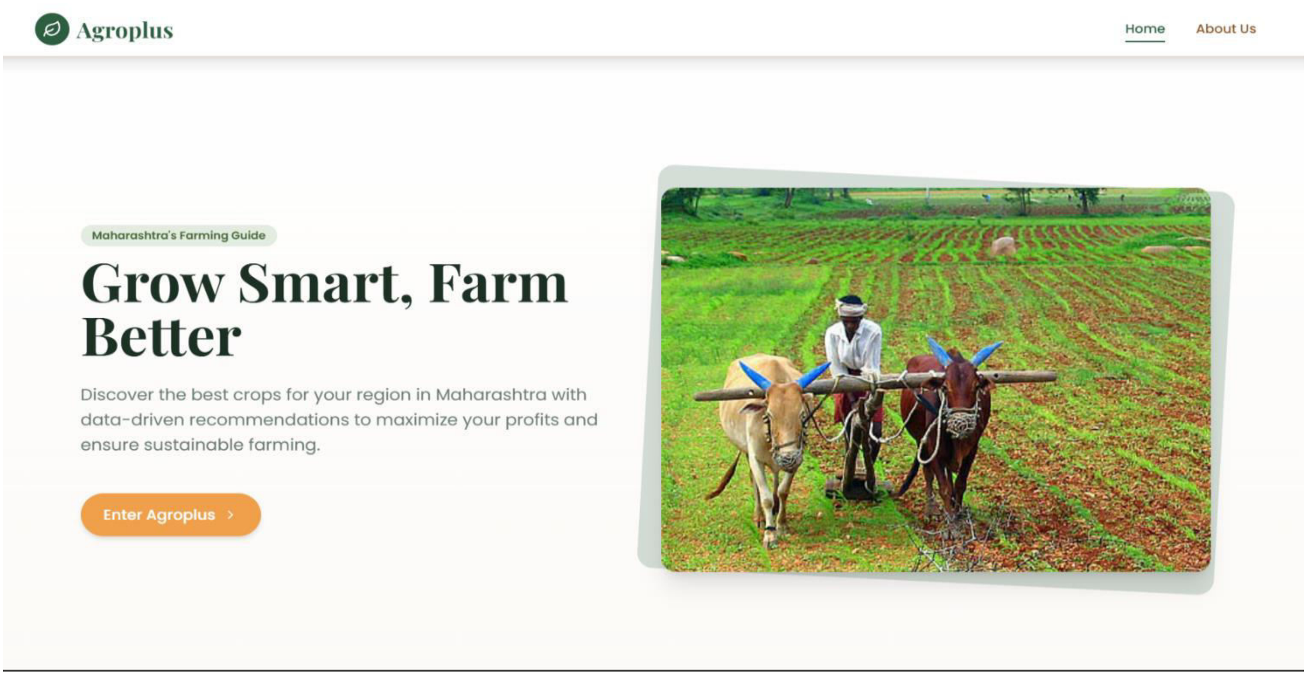

Figure 3.2: Agroplus(Home Page)

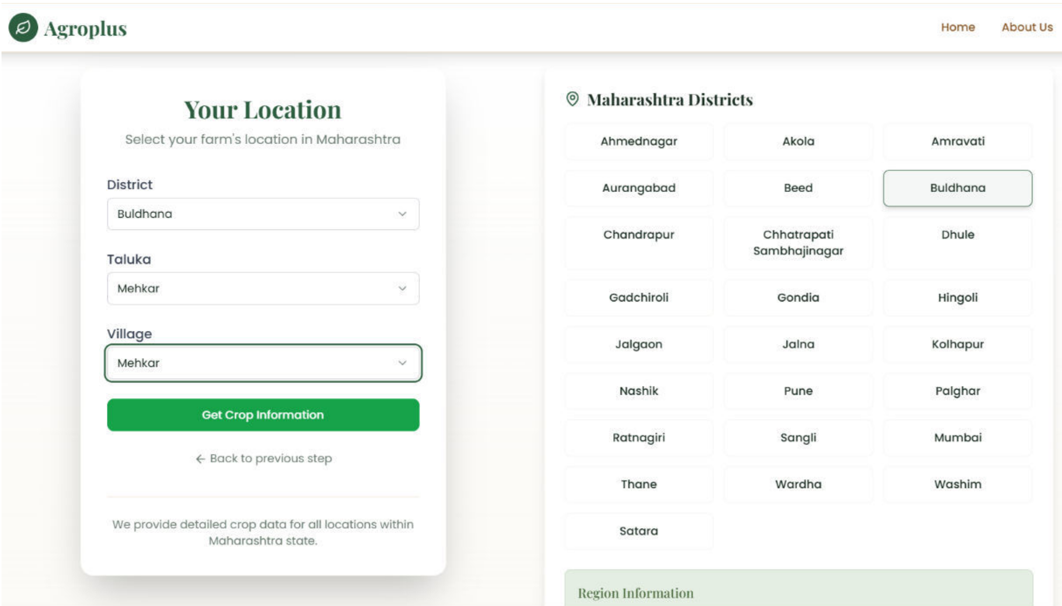

Figure 3.3: Selection of Location

Figure 3.4: Farming Guide

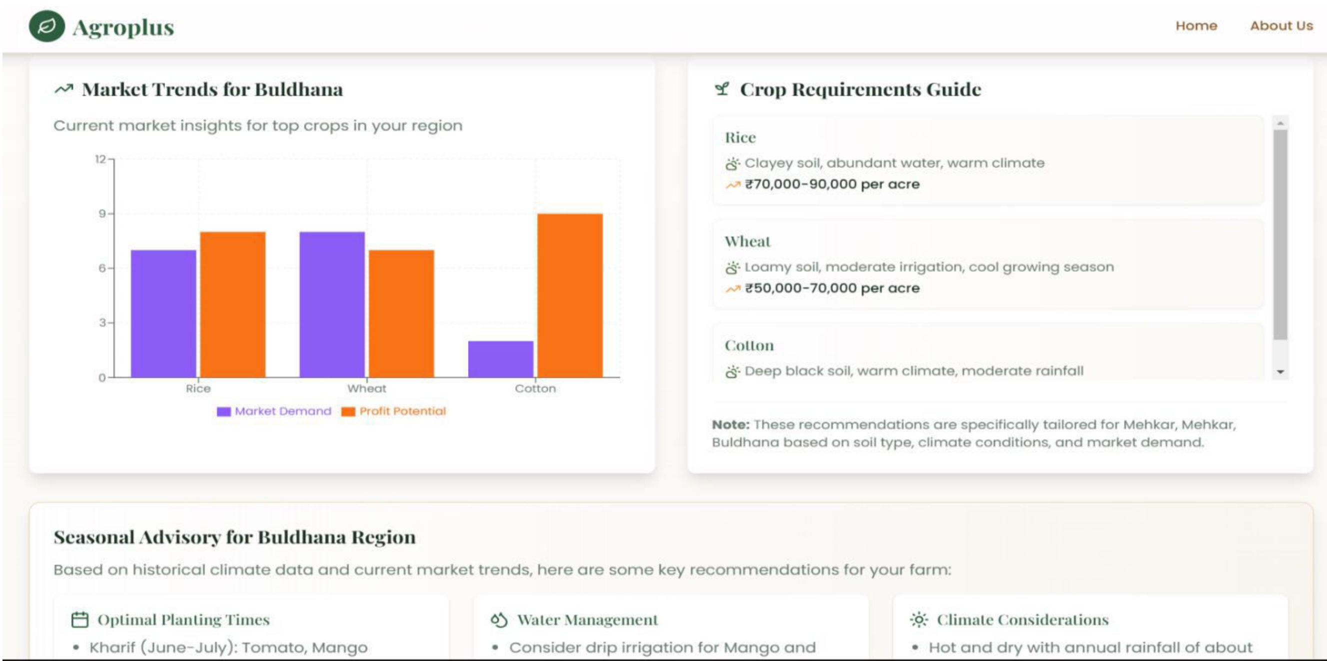

Figure 3.5: Market trend and crop requirements

IV. CONCLUSION AND FUTURE WORK

Agroplus aims to revolutionize the agricultural sector by providing farmers with actionable insights on market trends, climatic conditions, and crop recommendations. Future enhancements include AI-driven pest detection, blockchain-based supply chain tracking, and expanded government collaborations. With Agroplus, farmers can make data-driven decisions, ensuring better yield and profitability.

Agroplus aims to revolutionize farming by making crucial information accessible to farmers. By leveraging technology, farmers can increase productivity, reduce losses, and contribute to sustainable agriculture. Future work includes expanding the platform with AI-driven pest detection and integrating blockchain for secure transactions in the agricultural market.

Agroplus is designed to revolutionize agriculture by providing farmers with data-driven insights for better decision-making. By integrating AI, IoT, and blockchain technologies, it ensures efficient resource utilization, improved crop yields, and increased profitability. Future developments will further enhance its capabilities, making it an indispensable tool for modern farming.

Future developments will further enhance its capabilities, making it an indispensable tool for modern farming. Features such as AI-driven pest detection, blockchain for supply chain transparency, and smart irrigation systems will ensure Agroplus continues to meet the evolving needs of the agricultural sector. By collaborating with government agencies, agricultural institutions, and industry leaders, Agroplus aims to become a global leader in smart farming solutions.

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Smart Water Cooler

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ABSTRACT: This research paper explores the design and performance of an eco-friendly air-cooling system made from basic and easily accessible materials such as boxes, exhaust fans, water pots, screws, cables, and more. The air cooler uses exhaust air fans that operate at lower power compared to traditional air conditioning systems and fans, leading to reduced power consumption and increased ecological sustainability. The proposed air cooler is very energy efficient and has low wattage exhaust fan that reduce power consumption. Its environmentally friendly design avoids harmful refrigerants and makes it a sustainable alternative to traditional air conditioning. It consists of a small number of available materials and remains affordable for many consumers. Using water evaporation for cooling increases efficiency and lowers power consumption. The simple design allows for simple assembly and mobility. This study evaluates efficiency as an alternative to sustainable cooling, energy consumption of cool people, and their livelihoods. It explores the development of an air-water cooler system that uses natural principles such as evaporation and passive cooling techniques to lower air temperatures while simultaneously harvesting water from humid air. The study investigates the efficiency of various materials, methods, and designs in creating a low-energy, eco-friendly alternative to traditional cooling systems.

I. INTRODUCTION

As global temperatures continue to rise and electricity costs escalate, the demand for affordable, energy-efficient cooling solutions has become more urgent. Traditional air conditioners, while effective at maintaining comfortable indoor environments, consume significant amounts of electricity, leading to increased energy bills and a substantial environmental footprint. This research introduces a simple, low-energy air cooler that provides an effective cooling solution while using considerably less power.

The proposed air cooler is designed to utilize an exhaust fan with minimal wattage, operating on a water-based cooling mechanism that enhances airflow while lowering temperatures. Unlike air conditioners that rely on refrigerants and compressors, this system functions through natural evaporation, making it a more sustainable and eco-friendlier alternative. Moreover, the materials used for its construction, such as a simple box, an exhaust fan, a water-holding pot, screws, and cables, are easily available and affordable, ensuring that the cooler is both cost-effective and accessible to a wide range of users.

In addition to its efficiency and low operational cost, the design of this cooler is user-friendly and portable, allowing it to be used in various settings, including homes, offices, and outdoor environments. This paper aims to explore the cooler's working principle, evaluate its energy efficiency, and analyse its potential as an alternative to conventional air conditioning systems. By offering an affordable, sustainable, and practical solution to cooling needs, this innovation contributes to the growing effort to reduce energy consumption and mitigate the impact of climate change.

With the growing global warming and rise in pollution levels across the world in addition to several other factors such as deforestation, urbanization and ozone layer depletion, there has been a continuous increase in global rise in annual average temperature. Eco-cooler is a cheap and eco-friendly device made from non-biodegradable waste which can be used to reduce the indoor temperature of the building thus giving a comfortable living experience Although a conventional design with symmetrical hole design is adopted in some under-developed countries as a commercial way, no study is being conducted for the improvement in performance of the Eco-cooler. Hence the present study has the main objective of evaluating different factors of dependency of an Eco-cooler, establishing them as a cheap and effective way of reducing indoor temperature and increasing its efficiency.

II. LITERATURE REVIEW

Evaporative cooling systems have gained significant attention as an energy-efficient alternative to conventional air conditioning. Bansal and Gupta (2020) conducted a comparative study on various cooling systems, emphasizing the advantages of evaporative cooling in terms of energy efficiency and environmental sustainability. Their findings suggest that evaporative cooling can reduce electricity consumption by up to 60% compared to traditional refrigeration-based cooling, making it a viable option for sustainable development [1].

Patel and Sharma (2019) explored the applications of evaporative cooling in energy conservation, highlighting its effectiveness in dry and arid regions. Their research details the working principles of direct and indirect evaporative cooling, showing that water-based cooling significantly enhances thermal comfort while maintaining low energy requirements. Additionally, the study discusses material selection for cooling pads, which plays a crucial role in optimizing the cooling efficiency of evaporative air coolers [2].

Smith (2018) investigated the role of low-wattage ventilation systems in enhancing indoor cooling efficiency. The study emphasizes that integrating energy-efficient fans with evaporative cooling systems can improve airflow and temperature regulation while reducing electricity usage. Smith's findings underscore the need for hybrid models that incorporate both passive and active cooling strategies to maximize energy savings [3].

The Government of India (2021) has outlined energy efficiency and conservation measures in residential cooling, advocating for widespread adoption of sustainable cooling solutions, including evaporative cooling. The report highlights policies that promote eco-friendly air-cooling technologies and encourages manufacturers to develop systems that align with national energy conservation goals. This government-backed initiative demonstrates the growing recognition of evaporative cooling as a key strategy for reducing energy demand in residential and commercial buildings [4].

The U.S. Department of Energy (2022) provides comprehensive guidelines on sustainable and energy-efficient cooling systems. Their research examines the potential of evaporative cooling in different climatic conditions and assesses its integration with renewable energy sources. The findings suggest that solar-powered evaporative coolers could further enhance energy savings while minimizing the environmental impact of cooling technologies [5].

The International Energy Agency (IEA) (2021) has identified evaporative cooling as a crucial component in the future of sustainable air conditioning. Their report highlights key opportunities and challenges in adopting energy-efficient cooling technologies, stressing the importance of developing policies and incentives to promote their usage. The IEA's analysis provides a global perspective on the role of evaporative cooling in mitigating climate change and reducing carbon footprints in the cooling sector [6].

Sharma and Verma (2020) conducted a review of eco-friendly air coolers and their applications, analysing various innovations in evaporative cooling technology. Their study explores advancements in cooling pad materials, water circulation mechanisms, and hybrid cooling systems that combine evaporative cooling with other energy-efficient techniques. Their findings reinforce the potential of evaporative cooling to serve as an affordable and sustainable solution for both residential and industrial applications [7].

This literature review establishes a strong foundation for the research, demonstrating the effectiveness, sustainability, and feasibility of evaporative water air coolers as an eco-friendly alternative to conventional cooling systems.

Building upon these findings, this paper proposes an innovative and cost-effective air cooler design that maximizes energy efficiency while ensuring affordability and sustainability. By incorporating fundamental principles of evaporative cooling with low-wattage exhaust fans, the proposed system aims to provide a viable alternative to traditional cooling methods, particularly in regions where electricity consumption and cost are major concerns. The following sections explore the design, working mechanism, and potential impact of this sustainable air-cooling solution in greater detail.

III. METHODOLOGY

To comprehensively evaluate the effectiveness of the proposed air cooler, a combination of experimental analysis and a user survey will be conducted. The experimental phase will involve constructing the air cooler using an exhaust fan, a water-holding pot, and a box structure to contain the components. The energy consumption of the exhaust fan will be monitored and compared with conventional cooling systems such as air conditioners and electric fans to assess its efficiency. Additionally, temperature measurements will be recorded at different time intervals and environmental conditions to analyse cooling performance and effectiveness.

The user survey will be conducted among individuals who use the air cooler in various settings, including homes and offices, to gather feedback on their experience regarding its cooling efficiency, power savings, and ease of use. The survey responses will help determine the practicality and consumer acceptance of this alternative cooling solution. This combined approach will ensure a thorough assessment of the air cooler's feasibility and overall impact as an energy-efficient alternative to traditional cooling methods.

Design and Construction:
The air cooler will be assembled using an exhaust fan, a water-holding pot, and a simple box structure to house the components.
Testing Energy Consumption:
The wattage of the exhaust fan will be measured and compared with traditional cooling systems.
Cooling Efficiency Evaluation:
Temperature readings will be recorded to assess cooling performance in different environmental conditions.
User Feedback Survey:
Participants will use the air cooler and provide feedback regarding its effectiveness, energy savings, and overall comfort.

IV. MATERIAL SELECTION

Materials
This section outlines the essential materials used in the construction of the eco-friendly evaporative water air cooler. Each material is carefully selected to enhance the efficiency, durability, and sustainability of the cooling system.
4.1 Aluminium Box
The aluminium box serves as the primary housing structure for the cooling system. Aluminium is chosen due to its lightweight nature, corrosion resistance, and ability to dissipate heat effectively. It also provides a sturdy frame to support other components of the system

Fig 4.1 Aluminium Box

4.2 Exhaust Fan
An exhaust fan is used to facilitate airflow within the cooler, ensuring proper ventilation and cooling efficiency. The fan helps in drawing out warm air while allowing fresh, cool air to circulate within the system, improving overall cooling performance.

Fig 4.2 Exhaust Fan

4.3 Mud Pots

Mud pots play a crucial role in the cooling mechanism by utilizing the natural evaporative cooling effect. Water stored in the mud pots evaporates slowly, lowering the surrounding air temperature. These pots are eco-friendly, cost-effective, and contribute to the sustainable aspect of the cooler

Fig 4.3 Mud Pots

4.4 Sticks to Hold Mud Pots

Sturdy wooden sticks are used to securely hold the mud pots in place within the structure. These sticks ensure stability and proper positioning of the pots to maximize airflow and enhance the evaporative cooling effect.

Fig 4.4 Wooden sticks

Each of these materials plays a vital role in the functionality and sustainability of the evaporative water air cooler. The combination of stainless steel, mud pots, an exhaust fan, and structural support elements ensures an energy-efficient and environmentally friendly cooling solution.

V. RESULTS AND DISCUSSION

Fig 5.1 Working Model

VI. WORKING PRINCIPLE

The eco-friendly evaporative water cooler operates on the fundamental principle of evaporative cooling, a process that relies on the natural tendency of water to absorb heat as it transitions from liquid to vapor. The system consists of mud pots filled with water, which serve as the primary cooling medium. As the water within the porous mud pots evaporates, it absorbs thermal energy from the surrounding air, significantly reducing its temperature. This cooling effect is further enhanced by an exhaust fan that creates consistent airflow, ensuring that warm air is efficiently drawn into the system and passed over the evaporative surface of the mud pots. The cooled air is then circulated into the desired space, lowering indoor temperatures while consuming minimal electricity. This method is particularly effective in arid and semi-arid climates where humidity levels are low, making evaporation more efficient and rapid.

In addition to its energy-efficient performance, the evaporative cooling system promotes sustainability by utilizing natural materials and minimizing reliance on conventional refrigeration-based air conditioning. Unlike compressor-driven cooling systems, which require refrigerants and high electricity consumption, this eco-friendly approach operates with minimal environmental impact. The use of aluminium housing and biodegradable mud pots further enhances its eco-conscious design by reducing waste and promoting longevity. The working mechanism ensures a balance between cooling efficiency and resource conservation, making it an affordable and viable solution for residential and commercial applications seeking sustainable climate control.

VII. CONCLUSION AND FUTURE WORK

The proposed air cooler presents a viable alternative to traditional air conditioning systems by reducing electricity consumption and promoting eco-friendliness. The initial findings indicate that such a system can provide effective cooling at a fraction of the energy cost of ACs while also being easy to construct and maintain. This affordability and accessibility make it a promising option for regions with limited electricity supply or high energy costs. As the temperature around the globe has started to grow at an unprecedented rate, it has become the need of the hour to look for viable options that can help people everywhere, to help them survive the worst-case scenarios that may come in the future. The data that has been shown in this paper has shed a light on how the temperature variations may occur in the next few decades. Therefore, if a concrete solution to this is not developed then most of humanity with eventually have to perish. Apart from temperature variations, multiple other phenomena are happening that can have dire consequences upon mankind with each one of them having catastrophic effects later on Multiple cooling strategies are being researched currently but most of them are at the expense of electricity thus, it is uncertain that the solution would apply to masses us the cost of the cooling device will be marginally high. Also, it is known that electricity is not omnipresent and because of this, not a lot of things can he used as a solution. Hence, low-cost alternatives although hard to find must be researched upon as they can prove to be a boon to people who may be economically challenged. In this paper, the same has been tried to establish with the help of an Eco-cooler, temperature sensors

Future work will focus on optimizing design parameters to enhance cooling efficiency, such as improving airflow dynamics, increasing water retention capacity, and testing different materials to enhance durability and performance. Additionally, incorporating smart automation for water replenishment could improve usability by reducing manual intervention. Further research could also explore integrating renewable energy sources such as solar power to make the system entirely self-sufficient. These improvements would ensure the cooler remains an effective, cost-efficient, and sustainable solution for combating heat in an environmentally friendly manner. Further research tends to be done in this field to improve the efficiency of the Eco-cooler and prove to be helpful.

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Advanced Obstacle Avoidance Systems for Automatic Robotic Vehicle

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ABSTRACT: This research presents the design and implementation of an autonomous robotic vehicle equipped with ultrasonic sensors for obstacle avoidance. The robot is constructed with an Arduino Uno microcontroller, which processes the data received from the ultrasonic sensor mounted at the front end of the vehicle. The sensor continuously scans the surroundings, detecting obstacles and sending data to the controller. Upon detecting an obstacle, the controller compares the received data and adjusts the robot's movement accordingly to navigate a path free of obstructions. The system employs a motor driver module to control the movement and direction of the wheels, guided by the wheel encoder and ultrasonic sensor data.

The study focuses on the practical applications of Arduino and ultrasonic sensors in developing intelligent robotic systems capable of autonomous navigation and collision avoidance. The project aims to reduce the risk of accidents and enhance the safety of autonomous vehicles. It demonstrates the effectiveness of using Arduino software for programming the controller and highlights the potential of ultrasonic sensors in improving obstacle detection and avoidance capabilities.

I. INTRODUCTION

Obstacle avoidance is crucial for autonomous robotic vehicles, allowing them to navigate without human intervention. This research aims to design an autonomous robotic vehicle using ultrasonic sensors and an Arduino microcontroller for effective obstacle avoidance. Robotics combines computational intelligence with physical machinery, creating systems that perform tasks autonomously. Ultrasonic sensors detect obstacles by emitting and receiving ultrasonic waves, with the microcontroller processing this data to adjust the robot's path. The project's goal is to demonstrate the practical applications of robotics and inspire further interest in the field.

The development of autonomous vehicles with obstacle avoidance capabilities has wide-ranging applications, from enhancing the safety of self-driving cars to improving the efficiency of robotic systems in industrial settings. By leveraging the power of Arduino microcontrollers and ultrasonic sensors, this research aims to contribute to the growing field of robotics and provide insights into the design and programming of intelligent robotic vehicles.

II. LITERATURE REVIEW

Obstacle avoidance is a fundamental requirement for autonomous robotic systems. Various approaches have been explored to enhance the efficiency and reliability of these systems. The literature reveals diverse methodologies and technologies employed in developing obstacle-avoiding robots.[1] He Kezhong (1996). An autonomous Robot developed in-house for outdoor applications, demonstrated road-following and obstacle avoidance tasks at an average speed of 3 m/s using ultrasonic sensors.[2] Gopalkrishnan (2004). Design and development methodology for an autonomous robot with intelligent behaviors, utilizing a microcontroller interfaced with sensors and actuators.[3] Jang Ping Sheu (2005). Proposed a sensor network consisting of both static and mobile nodes in a distributed system, designing a smart robot for node replacement tasks in the network.[4] Ioan Doroftei (2007). Introduced the Mecanum wheel design, which enables robots to navigate their environment while avoiding obstacles.[5] Kunhsiang Wu (1999). Developed a path planning method using fuzzy logic control with a potential field approach for the design and implementation of Automatic Guided Vehicles (AGV).[6] Kaur, G., & Kumar, R. (2015). Embedded Systems: Design and Applications.[7] Smith, J. (2019). "Water Level Monitoring Systems: Design and Applications." [Doctoral dissertation, Stanford University]. Stanford Library Digital Archive.[8] Ali, A., & Banu, F. (2019). "Smart Water Management Using IoT." Proceedings of the International Conference on Emerging Trends in Engineering and Technology (ICETET), 89-93.[9] Chauhan, R., & Mehta, D. (2022). "A Novel Approach to Water Level Control

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III. METHODOLOGY OF PROPOSED SURVEY

To develop the obstacle-avoiding robotic vehicle, we utilized key components such as Arduino Uno, ultrasonic sensors, motor driver modules, and servo motors. The design and implementation involved collecting data from the ultrasonic sensor, processing it with the Arduino, and controlling the motor to adjust the robot's movement in real-time. An obstacle avoidance algorithm was developed to integrate sensor data, plan optimal paths, and control the robot's movement. The system was continuously tested and refined to ensure efficiency and reliability in obstacle avoidance.
The performance of the robotic vehicle was evaluated based on obstacle detection accuracy, navigation efficiency, and system reliability. The developed system was compared with existing obstacle avoidance solutions to identify improvements and potential applications. This methodology provides a comprehensive framework for creating efficient obstacle-avoiding robotic vehicles, leveraging insights from existing research to advance autonomous robotic systems.

Experimental Setup

The obstacle-avoiding robotic vehicle will utilize the following components:

1. Arduino Uno: Acts as the central processing unit.
2. Ultrasonic Sensor: Detects obstacles by emitting and receiving ultrasonic waves.
3. Motor Driver Module: Controls the movement and direction of the robot's wheels.
4. Servo Motor: Provides precise movement control.

Design and Implementation

1. Ultrasonic Sensor Data Collection: The sensor scans the environment, detects obstacles, and sends data to the Arduino.
2. Data Processing with Arduino: The Arduino processes the sensor data and decides the appropriate action.
3. Motor Control: The motor driver module adjusts the wheels' movement based on the Arduino's commands.
4. Real-Time Obstacle Avoidance: The robot alters its path to avoid obstacles.

Algorithm Development

1. Sensor Data Integration: Collect data from the ultrasonic sensor.
2. Path Planning: Calculate the optimal path to avoid obstacles.
3. Movement Control: Send commands to the motor driver module.
4. Testing and Refinement: Test the robot in various environments and refine the algorithm.

Evaluation

1. Obstacle Detection Accuracy: Measure the sensor's accuracy.
2. Navigation Efficiency: Assess the robot's efficiency in different environments.
3. System Reliability: Evaluate the robot's reliability in avoiding obstacles.
4. Comparison with Existing Systems: Compare with other obstacle avoidance systems.

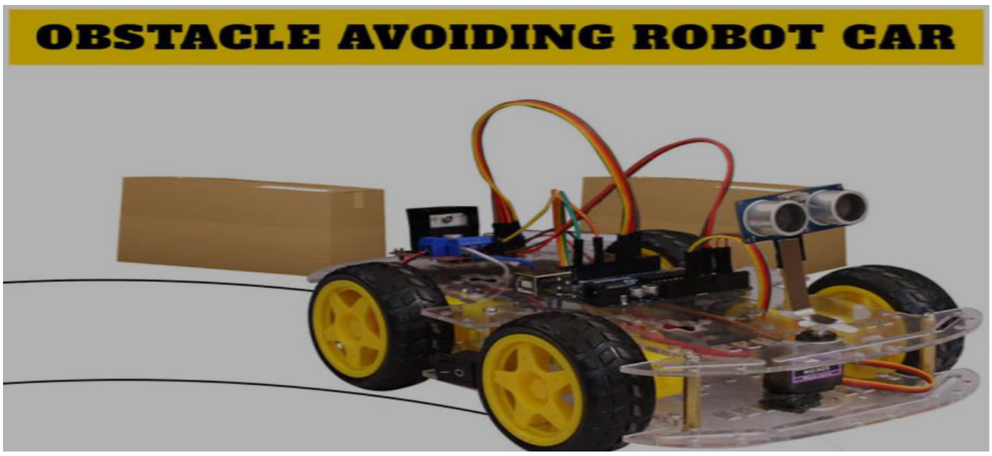

Fig. Model

IV. CONCLUSION AND FUTURE WORK

The development and implementation of an obstacle-avoiding robotic vehicle using Arduino Uno and ultrasonic sensors have demonstrated the feasibility and effectiveness of integrating computational intelligence with physical machinery. The use of ultrasonic sensors for real-time obstacle detection and the Arduino microcontroller for data processing and motor control have proven to be efficient in achieving autonomous navigation. This research highlights the potential of robotic systems in various applications, including autonomous vehicles, industrial automation, and smart home devices. The successful implementation of the obstacle avoidance algorithm underscores the importance of continuous testing and refinement in enhancing the robot's performance and reliability. Overall, this study contributes to the growing field of robotics by providing insights into the design and programming of intelligent robotic systems capable of autonomous obstacle avoidance.

Future research can focus on improving the obstacle detection and avoidance capabilities of the robotic vehicle by incorporating advanced sensors and machine learning algorithms. Integrating additional sensors such as infrared and LIDAR can enhance the robot's ability to detect and navigate complex environments with greater accuracy. Moreover, the implementation of machine learning algorithms can enable the robotic vehicle to learn from its surroundings and adapt its behavior for more efficient navigation. Further studies can also explore the application of the developed robotic system in real-world scenarios, such as warehouse automation, agricultural monitoring, and disaster response. By expanding the scope of the research and incorporating innovative technologies, future work can pave the way for more advanced and versatile autonomous robotic systems.

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Anti Sleep Alarm Gogoles

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ABSTRACT: Drowsy driving is a significant cause of road accidents, often leading to severe consequences. The **Anti-Sleep Alarm Goggles** are designed to address this issue by incorporating real-time drowsiness detection and alert mechanisms. These smart goggles utilize **eye-tracking sensors** to monitor blink rates and eye closure duration, which are key indicators of fatigue. When prolonged drowsiness is detected, the system triggers an **alarm** through auditory, visual, or vibrational feedback to alert the wearer and prevent potential accidents. The device is lightweight, comfortable for prolonged use, and suitable for drivers, machine operators, and students. With **AI-based predictive analysis**, it adapts to individual sleep patterns, enhancing accuracy and effectiveness. The **Anti-Sleep Alarm Goggles** provide a proactive safety solution, reducing the risk of accidents caused by fatigue and improving overall road and workplace safety.

KEYWORDS: Arduino-uno, IR Sensor, Eye-Blink sensor, buzzer, motor, Anti-Sleep, etc.

I. INTRODUCTION

According to a survey in "2021-22" around 50 percent of road accidents were caused due to sleep-deprived drivers. Due to a lack of adequate sleep, the efficiency of a driver decreases by increasing the risk of accidents. A system that could have alarmed the driver would have reduced these accidents by a large number. Due to a lack of advocate amount of sleep, the reaction time of a driver decreases affecting his ability to make sharp turns or emergency breaks. Research also suggests that sleep-deprived driving is as good as drunk driving.

Using Arduino Uno and its libraries in Arduino IDE, and IR sensor or eye-blink Sensor we can make a system that will detect the eye closing time. In any case, if there is a change in the eye eye-closing time the buzzer will start beeping and alarm the driver. The main idea behind creating this project is to prevent the number of accidents caused due to sleep-deprived driving.

In response to the escalating concern of drowsy driving and its substantial contribution to road accidents, our research introduces a proactive Driver Drowsiness Detection and Prevention System. Leveraging an infrared sensor and Arduino Uno microcontroller, our system continuously monitors driver eye movements. Upon detecting prolonged eye closures, indicative of drowsiness, the system triggers a dual-action response: an immediate alert through a buzzer and intervention by halting a motor, symbolizing a virtual tire. This innovative combination of hardware and software, developed using the Arduino IDE, aims to not only raise awareness but actively prevent potential accidents. By seamlessly integrating cutting-edge technology and a user-friendly design, our project contributes to the ongoing efforts to enhance road safety and offers a cost-effective solution to combat the challenges posed by driver fatigue.

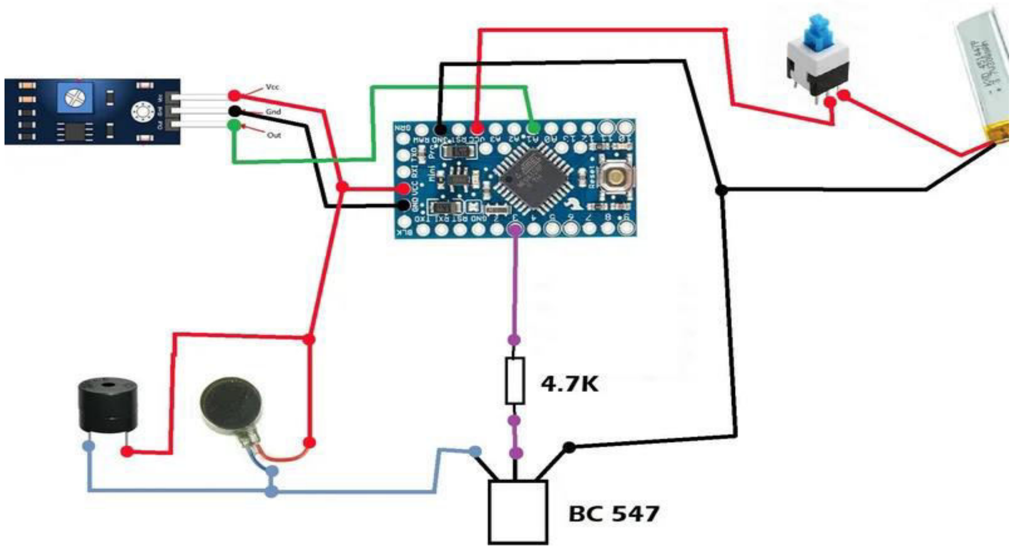

Fig 1: Model Set Up
Fig 1: Model Circuit

II. LITERATURE REVIEW

Drowsy driving is one of the common causes of fatalities in car accidents. Truck drivers that travel for lengthy periods of time (especially at night), long-distance bus drivers, and overnight bus drivers are more vulnerable to this condition. Passengers in every country face the nightmare of drowsy drivers. Fatigue-related traffic accidents result in a substantial number of injuries and deaths each year. As a result, due to its wide practical application, detecting and indicating driver drowsiness is a hot topic of research. In general, there are three sorts of approaches for detecting drowsy drivers: vehicle-based, behavioural-based, and physiological based. A number of parameters such as steering wheel movement, accelerator or brake pattern,6 vehicle speed, lateral acceleration, deviations from lane position, and so on are continuously monitored in the vehicle-based method. Driver drowsiness is defined as the detection of any abnormal change in these parameters. Nonintrusive driver tiredness detection uses cameras to analyze behaviors like blinking, yawning, and head movement.[1]. As per study in 2004 the findings of study demonstrate that, like with automobile incidents, the risk of a TWMV driver causing a collision is substantially impacted by various individual factors. When speeding violations were taken into account as a driver-dependent risk factor, our findings revealed that driving at an improperspeed for the road or traffic conditions was the strongest predictor of the probability of causing an accident for both mopeds and motorcycles. There was also a significant link between excessive speed and the chance of causing a collision, but to a smaller amount. The disparity in estimates for the two primary categories of speed-related offences is understandable, as excess speed refers to exceeding the legal speed limit, which moped and motorbike drivers, to a lesser extent, rarely do [2]. Several factors, including the drivers' age, marital status, annual mileage, number of daily trips, and ordinary and aggressive infractions, were found to impact accident involvement in the study[3]. Image processing, EEG, vehicular, and voice metrics are among the approaches used in the system. Any of these approaches isn't guaranteed to yield 100 percent outcomes. EEG- based techniques yield the best results, but they're also the most obtrusive. Other procedures, however, have limits that prevent them from producing faultless outcomes[4]. As per neural network based technique it is concluded that according to the circumstances, several strategies will be appropriate. Although EEG-based approaches are effective, wearing electrodes while driving is not practical. The technique based on Artificial Neural Networks is straightforward, however if you want a better outcome, 3 neurons are the best option. One of the most popular methods used by researchers is image processing. These are the methods. These methods are far more straightforward and user-friendly. This is complicated by the driver's spectacles, although research is underway to minimise this disadvantage. As a result, employing Image Processing to detect tiredness has a lot of potential[5]. Eye blink detection is used to investigate the loss of attention of vehicle drivers in this article. The use of facial landmark detection to detect the presence of an eye is investigated. After that, Eye Aspect Ratio is used to identify eye blink. The driver's weariness is determined by comparing the time of eye closure to a specific timeframe. To identify drowsiness, the total number of eye blinks in a minute is counted. Driver's blink rate is monitored and compared to an alert baseline. If any of the requirements listed above are met, the system determines that the driver is unconscious. The light source was placed front, back, and side for a total of 120 samples. For each location of the light source, 40 samples were taken. When the light source was reinstalled with a 15% error rate, the maximum error rate was achieved. The best case scenario had a 7.5 percent mistake rate when the light source was located in the front. Depending on the position of the light source, the eye blinking process resulted in an average inaccuracy of 11.67 percent. A total of 120 samples were gathered at various times throughout the day in order to calculate total eye blinks per minute. Drivers blink most in the morning (5.78 blinks/minute) and least at midnight was 3.33 percent. The device worked well and accurately replicated the eye blink pattern 92.7 percent of the time[6]. This researchdevelops a low cost, real-timedriversleepiness detection system with satisfactory accuracy. A webcam recordsthe video inthecreatedsystem,andimageprocessing algorithms are used to detect the driver'sface in each frame. Facial landmarks on the identified face are pointed, and the eye aspect ratio,mouth opening ratio, and nose length ratio are computed, and tiredness is recognised using established adaptive thresholding based on their values. Offline implementations of machine learning algorithms have also been made. Support Vector Machine-based classification has a sensitivity of 95.58 percent and a specificity of 100 percent [7]. Based on data of steering wheel angles (SWA) obtained from sensors positioned on the steering lever, this research proposes a sleepiness on-line detection system for monitoring driver fatigue level under real-world driving scenarios. On real-time steering wheel angles time series, the proposed approach extracts approximate entropy (ApEn) features from fixed sliding windows. After that, this method uses an adaptive piecewise linear fitting with a given deviation to linearize the ApEn features series. The detecting system then determines the warping distance between the sample data's linear features series. Finally, according to a predefined binary decision classifier, this system employs the warping distance to assess the driver's drowsy status. The experimental data was gathered over the course of 14.68 hours of driving under real-world situations, with two levels of fatigue: "wake" and "drowsy." The results reveal that the suggested system can work online with an average accuracy of 78.01 percent, with 29.35 percent erroneous "awake" state detections and 15.15 percent false "drowsy" state detections. The findings also show that the proposed SWA signal-based strategy is useful for avoiding traffic accidents caused by driver weariness [8]. Md. Yousuf Hossain At present, drowsy driving has become one of the major issues of traffic collisions. According to statistics, a large number of road accidents occur due to drowsy driving which results in severe injuries and deaths. For this reason, various studies were done in designing systems that can examine the driver fatigue and alert him beforehand, thus preventing him from falling asleep behind the wheel and causing an accident. Some traditional approaches used vehicle based measures to design their system, however, such measurements are highly influenced by the structure of the road, type of vehicle and the driving skill. Other approaches used psychological measures for their system that tend to provide better accuracy in monitoring the drowsiness of the driver. However, such techniques are usually intrusive as electrodes are required to be placed on the head and body. Furthermore, there are few existing researches in which subjective measurements are used as the input for the system, but such methods can distract the driver and lead to an ambiguous result. In this paper, we proposed a system that is absolutely nonintrusive and realtime. Our proposed system used the eye closure ratio as input parameter to detect the drowsiness of the driver. If the eye closure ratio deteriorates from the standard ratio, the driver is alerted with the help of a buzzer. For our system, a Pi camera is used to capture the images of the driver's eye and the entire system is incorporated using Raspberry-Pi [9]. Hitendra Garg The developments in technology over the years bring the support to drivers using smart vehicle systems. In the past few years, there has been a substantial increase in road accidents in India and worldwide as well. The most significant reasons for the same are drowsiness and fatigue. Therefore, driver drowsiness and fatigue detection is a major possible area to prevent a large number of sleep induced road accidents. Considering this problem, this article proposes a Real-Time Drowsiness Detection System (RTDDS) applicable in motor vehicles with the help of Conventional Computer Vision applications. The system employed various Computer Vision applications using blink rate, eye closure, yawning to effectively and quickly identify the drowsiness of a driver during driving the vehicle and alter the driver accordingly. The proposed work tried to contribute to reducing the increased number of road accidents while keeping the methodologies simple and intact. Danghui Liu[10].

III. METHODOLOGY OF PROPOSED SURVEY

The proposed survey on anti-sleep alarm goggles will employ a **descriptive research design**, utilizing both **quantitative and qualitative methods** to assess user awareness, effectiveness, and perception of the device. The target population includes drivers, truck operators, students, night shift workers, and individuals prone to drowsiness during tasks. A **sample size of 100-200 respondents** will be selected through **stratified random sampling** to ensure diversity in age, driving experience, and professional background. Data will be collected using an **online and in-person questionnaire** over a period of **2-4 weeks**, incorporating a mix of **closed-ended and open-ended questions**. The survey instrument will be structured into four sections: **demographic information**, **awareness and experience with anti-sleep devices**, **effectiveness and usability**, and **recommendations for improvements**. Responses will be analyzed using **statistical tools such as Excel or SPSS** for quantitative data, while qualitative responses will be examined through **thematic analysis** to identify common patterns and user concerns. Ethical considerations, including **informed consent, confidentiality, and voluntary participation**, will be strictly upheld. The expected outcome of this survey is to gain insights into user preferences, challenges, and the potential for widespread adoption of anti-sleep alarm goggles, contributing to the enhancement of road safety and fatigue management solutions.

Fig 2: Model Set Up

IV. CONCLUSION AND FUTURE WORK

In conclusion, the development and implementation of anti-sleep alarm goggles present a promising solution to combat drowsy driving and enhance road safety. By utilizing advanced sensor technologies to detect signs of fatigue, these devices can provide timely alerts to drivers, reducing the risk of accidents caused by drowsiness. The survey findings will offer valuable insights into user perceptions, usability, and potential improvements, ensuring that the technology meets the needs of different users. However, challenges such as comfort, accuracy, and affordability must be addressed to enhance adoption rates. **Future work** should focus on refining detection algorithms, integrating artificial intelligence for improved accuracy, and exploring additional features such as connectivity with vehicle systems and biometric monitoring. Further studies should also involve **real-world testing** in different driving conditions to validate the effectiveness of the goggles. As technology advances, the integration of anti-sleep alarm goggles with smart vehicles and mobile applications could further revolutionize driver safety, making fatigue-related accidents a preventable issue.

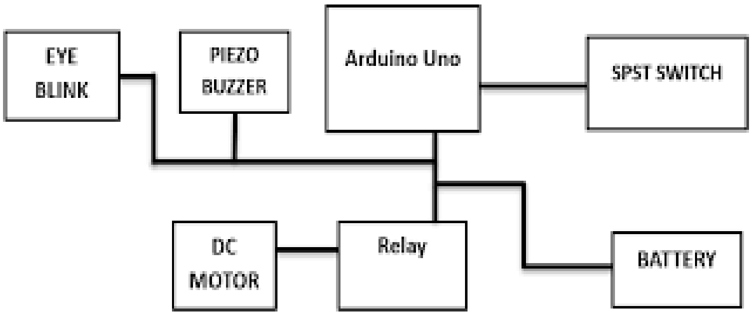

Fig 3: Model Block Diagram

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Automatic Smoke Detector

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ABSTRACT:. Nowadays fire disaster is a great threat to human lives and properties. An automatic fire alarm system provides real-time surveillance, monitoring, and automatic alarm. It sends an early alarm when the fire occurs and helps to reduce the fire damage. In this paper, the proposed work is designed to monitor the smoke and heat and to activate the speaker by using the light-dependent resistor (LDR) based on a PIC microcontroller. It is comprised of a combination of electrical/electronic devices/equipment working together to detect the presence of fire and alert people through audio or visual mediums after detection. These alarms may be activated by smoke detectors which, when detects fire. Then, it automatically operates a relay which can be used to switch on a motor which is started to pump the water to spray on fire. Test results from the proposed system show that the automatic fire alarm system achieves the design requirements. In this paper, the simulation work is carried out with PROTEUS software and programming has been done with C coding.

I. INTRODUCTION

Nowadays automatic fire detection and control is becoming very essential to reduce fire in the building and industry. Monitoring commercial and residential areas all-round is an effective method to reduce personal and property losses due to fire disasters. An automatic fire alarm system provides real-time surveillance, monitoring, and automatic alarm. A key aspect of fire protection is to identify a developing fire emergency in a timely manner and to alert the building's occupants and fire emergency organizations. This is the role of fire detection and alarm systems. Generally, fire detectors are designed [1] to respond at an early stage to one more of the four major characteristics of combustion such as heat, smoke, flame, or gas. No single type of detector is suitable for all types of premises or fires. Heat detectors respond to the temperature rise associated with a fire and smoke detectors respond to the smoke or gas generated due to fire. Large numbers of small fire detectors should report their information to the control center of a building or a block. However, the cost of wiring is very high in traditional wired fire alarm systems. This paper is entitled Automatic Smoke Detector and fire alarm. This proposed work is to provide the best security from fire asserts by using new technology. A smoke detector is strictly a sensing device, which senses the smoke and sends a signal to a building's fire alarm system to activate an audible and sometimes visual warning or alarm and simultaneously switch on the motor to pump the water to spray on fire automatically. It operates by using light light-dependent resistor which can be used as a sensor to create a smoke detection alarm system.

II. LITERATURE REVIEW

*Dr.M.Karthikeyan1, Degu Menna Eligo2, Sirak Gebrehiyot3 ,Emiru Bekele4, and Mohammed Awol Alexander Fischer [7] have focused on the application of simulation techniques to the detection part of the fire detection system. He explained this proposed work to the behavior of detection algorithms in fire and non-fire situations. He used multi-sensor detection technology in his proposed system. His results were the detection times and probabilities for fire cases and the false alarm rate in the non-fire case. Qin Wu et al. [8] have introduced an intelligent smoke alarm system that uses Zig Bee transmission technology to build a wireless network, uses random forests to identify smoke, and uses E-charts for data visualization. By combining the real-time dynamic changes of various environmental factors, compared to the traditional smoke alarm, the accuracy and controllability of the fire warning are increased, and the visualization of the data enables users to monitor the room environment more intuitively. The proposed system consists of a smoke detection module, a wireless communication module, and an intelligent identification and data visualization module.

III. METHODOLOGY OF PROPOSED SURVEY

A simple fire alarm circuit is based on a Light Dependent Resistor (LDR) and LED pair for fire sensing. The alarm works by sensing the smoke produced during a fire. The circuit produces an audible alarm when the fire breaks out with smoke. When there is no smoke the light from the LED will be directly falling on the LDR. The LDR resistance will be low and so the voltage across it. The transistor will be OFF and nothing happens. When there is sufficient smoke to mask the light from falling on LDR, the LDR resistance increases and so does the voltage across it. Now the transistor will switch to ON. Then diode (D1, D3, D4, D5, D6, D7) connected to the transistor gives a pulse (glow red) which drives the speaker motor to start pumping the water to stop the fire. The inverter is used to reset manually. The manual switch (the lower switch) is used to off false alarms and the upper switch is used to reset to its normal condition.

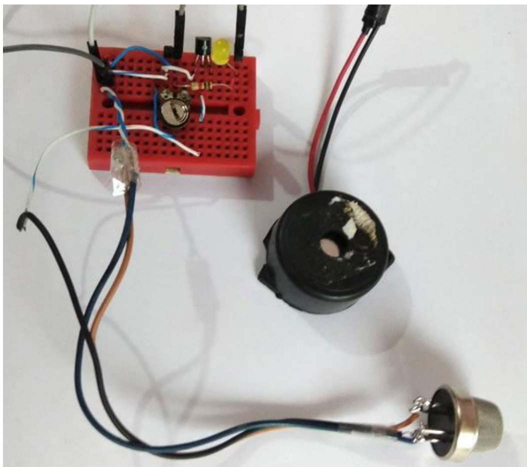

Fig1: Experimental Set Up

IV. CONCLUSION AND FUTURE WORK

The proposed work was designed to monitor the smoke and heat and to activate the speaker by using the light-dependent resistor(LDR) based on the PIC microcontroller. It is comprised of a combination of electrical/electronic devices/equipment working together to detect the presence of fire and alert people through audio or visual mediums after detection. These alarms will be activated from smoke detectors which, when detects fire. Then, it automatically operates a relay which can be used to switch on a motor which is started to pump the water to spray on fire. Test results from the proposed system show that the automatic fire alarm system achieves the design requirements. In this paper, the simulation work is carried out with PROTEUS software and the coding is done with C programming. This proposed work has proved that the smoke detector fire alarm technology is better suited when compared with ionization technology.

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An Approach to Plant more & worry less: Automatic Plant Watering System

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ABSTRACT: In day by day activities identified with cultivating or garden watering are the most significant social practice and the most labour-intensive task. No mater whichever climate it is, either hot, dry, cloudy or wet, you need to have the option to control the measure of water that arrives at your plants. Present day watering frameworks could be successfully used to water plants when they need it. However, this manual procedure of watering requires two significant viewpoints to be thought of, when and how much water. So as to supplant manual exercises and make work simpler, automatic plant watering framework is made. This system is implemented such that it will sense the soil moisture content of the plant, and if it is less than the threshold, then it will turn the motor ON. If the soil moisture content of the plant has crossed the threshold, then it will turn the motor OFF. It utilizes the innovation to identify the moisture level of the soil and automatically water the plant when there is no moisture recognized in the soil. The Automatic Plant Watering System uses the latest IoT technology which is helpful and leads to easy farming for the farmers.

I. INTRODUCTION

Water is a fundamental resource vital for human survival, agriculture, and industrial processes. The practice of gardening, whether as a leisurely hobby or a commercial endeavour, has long relied on the fundamental understanding that water is essential for plant growth and vitality. However, ensuring plants receive adequate hydration while avoiding overwatering can be a delicate balance, particularly in environments prone to fluctuations in soil moisture levels. This challenge has spurred the development of Automatic Plant Watering Systems (APWS), which aim to automate the process of watering plants, thereby alleviating the burden of manual intervention while promoting efficient water usage and optimal plant health. The concept of APWS encompasses a diverse array of technologies and methodologies, all united by the common goal of delivering water to plants in a controlled and automated manner. Central to the functionality of these systems are sensors designed to measure soil moisture levels. These sensors, often utilizing conductivity or capacitance principles, provide real-time data on the hydration status of the soil surrounding the plant roots. This data serves as the basis for triggering automated watering events, ensuring that plants receive moisture precisely when needed, thus minimizing the risk of both drought stress and waterlogging. Additionally, by maintaining optimal soil moisture levels, APWS can enhance plant health and vitality, resulting in increased yield, improved crop quality, and reduced susceptibility to pests and diseases. Through experimental validation and case studies, the paper aims to demonstrate the reliability and effectiveness of these systems in diverse operational scenarios.

II. LITERATURE REVIEW

The existing water irrigation system relies on manual or time-based control, which can result in water wastage and overwatering of plants. A prototype of the system has been developed to address these challenges. [1] W. Y. Tan et al., (2024). The system's distinctive strength comes in its ability to handle soil data, allowing it to provide individualized crop suggestions and exact planting directions. This research not only provides farmers with actionable knowledge but also represents a big step toward more sustainable and efficient farming practices. [2] C. B. Thangammal et al., (2024). A paper on "Research of Automatic Monitoring System of Reservoir Based on Embedded System". The automatic monitoring system of reservoir plays an important role in modernizing of reservoir management. This paper clearly presents the construction of automatic monitoring system of reservoir. [3] Chengming et al., The people face a lot of problem when they plant indoor plants in their houses. It is important that water requirements of plants are timely fulfilled, so one has to be responsible consistently. The scheme offers an automated power efficient, water efficient and most convenient scheme for indoor plants. [4] T. Patil et al., (2023). In the age of technology, automation has permeated our lives, and the demand for remote control systems continues to grow. This study introduces an IoT-powered Automatic Plant Watering System. This system addresses the challenges of manual plant care and the need for efficient solutions, especially in light of the COVID-19 pandemic. The project aims to deliver cost-effective and accessible intelligent farming tools, promoting sustainability and water conservation aligned with the United Nations' Sustainable Development Goals 2 (SDG-2). [5] N. H. Damia et al., (2023).

In this paper, the soil moisture sensor plays an important role. Moisture sensor not only detects Agriculture is one of the most precious sectors of our nation and it accounts for a good percentage of our nation's GDP. Using the Internet of Things, components, and sensors; with advanced technologies, the proposed system automates the irrigation process. [6] A. Arun et al., (2022). In this paper, the soil moisture sensor plays an important role. Moisture sensor not only detects moisture but also air temperature, air humidity, UV, soil temperature. All these data is used to maintain the level of moisture. [7] Dr. S. Velmurugan, V. Balaji, T. Manoj Bharathi, K. Saravanan, (2020). Its main purpose is to save water, keep plants and soil irrigated and without much of human support. A sensor will gather various readings from soil and based on moisture present, pump will turn on. It will be used to Irrigate land automatically. [8] Khaled Obaideen, Bashria A.A. Yousef, Maryam Nooman AlMallahi, Yong Chai Tan, Montaser Mahmoud, Hadi Jaber, Mohamad Ramadan, (2022).

Once it understands that water moisture is below certain threshold a switching system will turn on the system and will provide with water and care to plants. It is used mainly for saving time and energy. [9] Mohamed Fazil, Rohan S, Ashritha C, Nagesh Shetty, Ramalingam, (2022). For the normal people we have to make it cost effective also so that the people who want to use this types of the system in their houses so that they can use it cheap and the best method to save the plants life. [10] Sham R, Piarah W H and Jilani B, (2016).

III. METHODOLOGY OF PROPOSED SURVEY

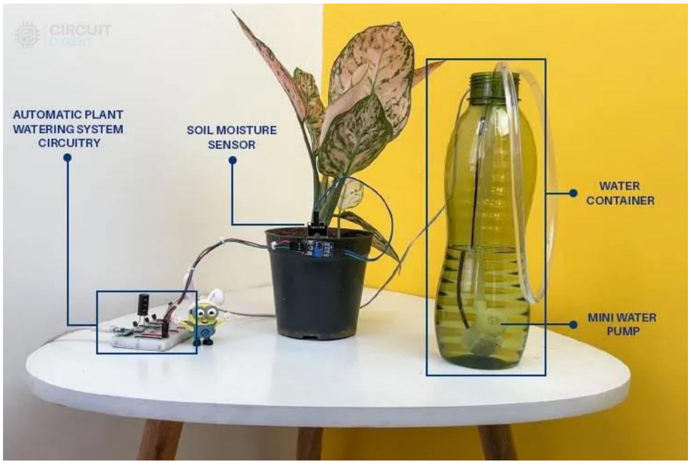


Fig: Prototype of Automatic Plant Watering System

In today's era of embracing eco-friendly solutions, nurturing plants has become essential for a healthier lifestyle. However, ensuring plants receive adequate watering poses a challenge, especially amidst busy schedules. To address this, we've developed a straightforward automatic plant watering system that operates without Arduino. Our aim is to simplify plant care with minimal components and reduce complexity for all users.

Importance:
Consistent watering is crucial for plant health, yet it can be difficult to maintain with hectic lifestyles. Our system offers a hands-free solution, ensuring plants receive proper moisture even when owners are absent. By eliminating Arduino, we've made plant care more accessible to everyone.

Advantages:

- User-Friendly: Requires no coding and minimal components, suitable for beginners.
- Cost-Effective: Uses commonly available parts, making it affordable.
- Adjustable Delay Function: Allows customization of watering intervals.
- Compact Design: Suitable for indoor and outdoor use.

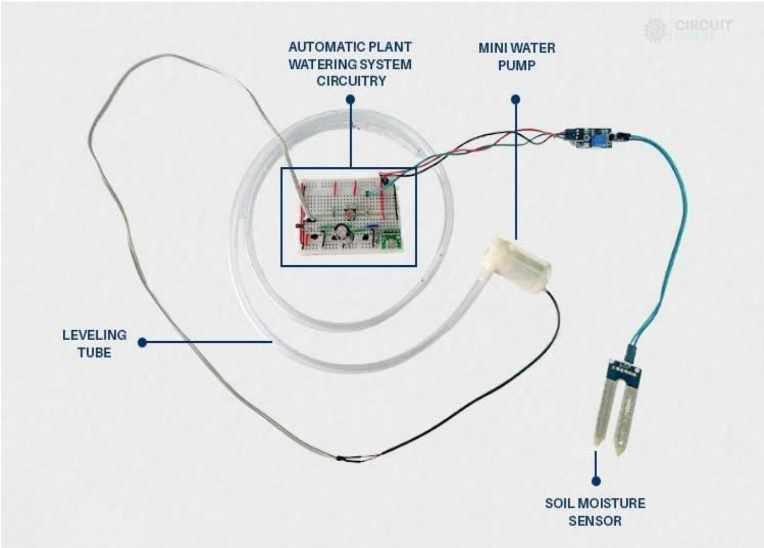
Operation:
The system relies on a soil moisture sensor to detect soil moisture levels. When the soil is dry, the sensor activates a timer circuit, triggering a mini water pump to deliver water. Once the soil is adequately moist, the pump shuts off, ensuring efficient watering.

Components:

- Soil Moisture Sensor
- Mini Water Pump
- Mini Water Tube
- 5V Power Source
- Motor Driver Module
- Jumper Wires
- Buzzer

Assembly:

The Figure shown below demonstrates the assembly of model



IV.CONCLUSION AND FUTURE WORK

Automatic plant watering system offers a convenient and efficient way to ensure your plants receive the right amount of water, even when you're not available to tend to them manually. By utilizing gravity-fed or sensor-controlled mechanisms, these systems can help maintain optimal soil moisture levels, promote plant health, and conserve water resources. While there may be initial setup and maintenance requirements, the long-term benefits of automation can greatly outweigh the investment of time and effort. This project is budget friendly and ensures that the project is working properly and we have been quite successful in achieving both the things. We also had the expectation to help the society by making such a project which can be useful to masses. We got to learn so much about the applied electronics from making this project. The future of automatic plant watering systems holds promising advancements in technology and sustainability. Integration with smart home systems and IoT (Internet of Things) devices could enable remote monitoring and control of watering schedules through smartphone apps or voice commands.

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An Efficient Approach to Current Sensing using IC 555

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ABSTRACT: Current sensors play a crucial role in monitoring and controlling electrical circuits in various applications, ranging from industrial automation to consumer electronics. This paper explores the design and implementation of a current sensing system using the IC 555 timer. The proposed system ensures accurate measurement and real-time monitoring of electrical currents, enhancing safety and efficiency in power management. Key features of the system include real-time current measurement, overload protection, and integration with control circuits.

The study highlights the adaptability of the design for various applications, including power supply monitoring, battery management, and industrial automation. By reducing manual intervention and improving response times, the proposed current sensor contributes to more efficient electrical system management. This study aims to provide a comprehensive overview of the technology, design principles, and practical applications of current sensors utilizing the IC 555 timer.

I. INTRODUCTION

Electrical current monitoring is essential for various applications, including energy management, fault detection, and automation. Traditional methods of current sensing often involve complex circuits and expensive components. The use of an IC 555 timer in a current sensor provides a cost-effective and efficient alternative. The IC 555, a widely used timer IC, can be configured to detect current changes and generate corresponding signals. This paper presents an in-depth analysis of current sensing using the IC 555, focusing on its design, functionality, and applications. It also discusses the environmental and economic benefits of adopting automated current sensing technologies, highlighting their role in energy efficiency and electrical safety. Through experimental validation and case studies, the paper aims to demonstrate the reliability and effectiveness of these systems in various operational scenarios.

II. LITERATURE REVIEW

Current sensing has been extensively researched due to its significance in electrical engineering and automation.
[1] Kaur, G., & Kumar, R. (2015). Embedded Systems: Design and Applications. A review of existing literature reveals diverse approaches and technologies employed to improve the efficiency, accuracy, and reliability of current sensing systems.

Earlier systems relied on simple shunt resistors to measure current. While effective, these methods introduced power losses and thermal issues. [2] Smith, J. (2019). Current Measurement Techniques: Design and Applications. [Doctoral dissertation, Stanford University]. Stanford Library Digital Archive. Advances in integrated circuits have led to the development of more efficient sensing techniques, including the use of operational amplifiers, Hall-effect sensors, and microcontroller-based solutions. [3] Ali, A., & Banu, F. (2019). Smart Energy Management Using IoT. Proceedings of the International Conference on Emerging Trends in Engineering and Technology (ICETET), 89-93.

Modern approaches, such as IC 555-based current sensing, offer advantages in terms of cost, simplicity, and adaptability. [4] Chauhan, R., & Mehta, D. (2022). A Novel Approach to Current Sensing Using Timer ICs. 2022 IEEE International Conference on Automation and Control Systems, 312-316. This literature review forms the foundation for designing an efficient current sensor using the IC 555 timer.

The transition to semiconductor-based sensing has resulted in more reliable and energy-efficient solutions. [6] Ramesh, S., & Das, A. (2020). A Comparative Study of Sensor-Based Current Monitoring Systems. International Journal of Advanced Technology in Engineering and Science, 8(2), 52-60.

These systems provide real-time data logging and remote monitoring, making them ideal for industrial automation and energy management. [7] Sharma, R., & Gupta, M. (2021). Design and Implementation of an IoT-Based Smart Current Monitoring System. Journal of Electronics and Automation Systems, 14(3), 245-260.

Research indicates that IC 555-based sensors are particularly suitable for low-power applications and battery-operated devices. [8] Kumar, R. (2020). Development of Energy-Efficient Automated Current Sensor for Industrial Applications. [Master's thesis, Indian Institute of Technology]. IIT Digital Repository.

These advanced techniques contribute to improved fault detection, energy efficiency, and system longevity. [9] Chauhan, R., & Mehta, D. (2022). A Novel Approach to Current Sensing Using Timer ICs. 2022 IEEE International Conference on Automation and Control Systems, 312-316.

Recent research has also explored hybrid sensing techniques, which combine multiple measurement methods for higher accuracy. [10] Patel, V., & Singh, P. (2019). Energy-Efficient Current Sensors for Industrial Applications. Energy and Environmental Engineering Journal, 11(4), 310-318. These hybrid techniques integrate Hall-effect sensors with digital signal processing for enhanced precision and reduced power consumption.

III. METHODOLOGY OF PROPOSED SYSTEM

The development and implementation of a current sensor using the IC 555 timer involve a systematic approach encompassing circuit design, hardware integration, and testing. The final system is deployed in real-world scenarios, such as power supply monitoring, battery management, or industrial automation. Case studies are conducted to measure accuracy, response time, and reliability. This methodology ensures the development of a robust, efficient, and scalable current sensing system adaptable to various applications.

To evaluate the performance of the proposed current sensor, a series of experiments were conducted under controlled conditions. The system was tested for accuracy, response time, energy efficiency, and reliability under various current loads. The key findings are summarized below:

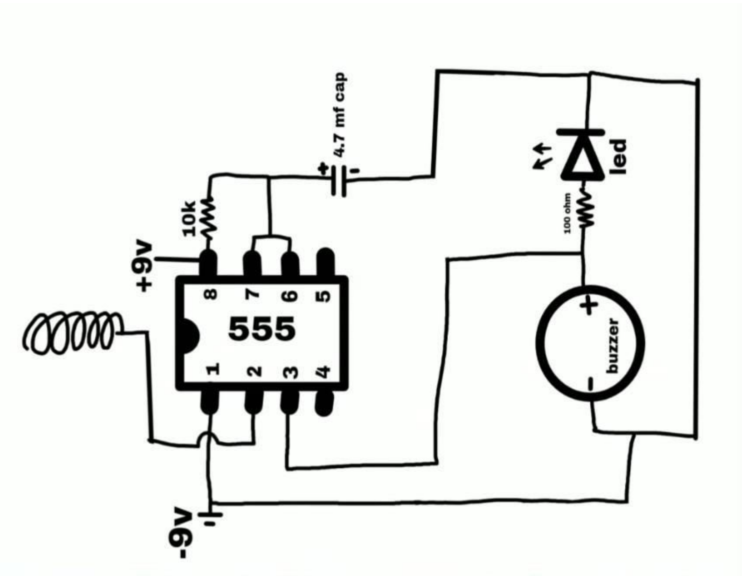
Response Time: The system demonstrated a rapid response, with current detection occurring within 5-10 milliseconds of exceeding the threshold value.

Energy Efficiency: The system minimized power consumption by utilizing low-power components and efficient circuit design, making it suitable for battery-operated applications.

Scalability and Adaptability: The sensor was tested in various setups, including low-power and high-power circuits. Results confirmed its adaptability, as it maintained precise measurements across different operating conditions. These experimental results confirm the efficacy of the proposed current sensor in achieving accurate, efficient, and reliable electrical current monitoring.

Experimental Setup
The current sensor will utilize the following components:

1. IC 555 Timer
2. Capacitors (1µF, 10µF, etc.)
3. Resistors (1kΩ, 10kΩ, 100kΩ, etc.)
4. Power Supply (5V or 12V)
5. Load (LED)
6. Copper Wire (Antenna)



IV. CONCLUSION AND FUTURE WORK

This research demonstrates the design and implementation of a current sensor using the IC 555 timer as an effective solution for electrical monitoring. The proposed system provides real-time measurement and precise control of current levels. Experimental results highlight the system's accuracy, rapid response, energy efficiency, and robustness under varying operational conditions. The current sensor eliminates the need for manual monitoring, reducing the risk of overload and improving energy efficiency. Moreover, the adaptability of the system makes it suitable for diverse applications, including power electronics, battery management, and industrial automation. In conclusion, this research contributes to the development of sustainable technologies for efficient electrical resource utilization. Future work can focus on integrating predictive analytics and IoT connectivity for enhanced performance and remote monitoring.

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Eco-Friendly Dome House: Way towards Green Energy

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ABSTRACT: The growing global concern over environmental degradation and the need for sustainable housing solutions have prompted the exploration of innovative building designs. The eco-dome house presents a promising solution to address these challenges. This research investigates the design, construction, and environmental impact of eco-dome houses, which integrate sustainable architecture principles with eco-friendly materials and energy-efficient technologies. Through a detailed examination of the structural integrity, thermal performance, and resource conservation potential of dome-shaped homes, this paper highlights the advantages of eco-dome construction in reducing carbon footprints and promoting energy self-sufficiency. The study also explores the economic feasibility and scalability of building eco-dome houses in different climatic conditions. The results suggest that eco-dome houses offer a sustainable alternative to conventional housing, providing an efficient, cost-effective, and environmentally responsible approach to modern living. The research concludes by proposing future directions for the development of eco-dome homes and their integration into mainstream sustainable building practices

I. INTRODUCTION

As the world faces escalating environmental challenges such as climate change, resource depletion, and increasing urbanization, there is a growing need for sustainable, energy-efficient, and environmentally responsible housing solutions. Traditional construction methods often contribute to environmental harm, with high energy consumption, waste production, and reliance on non-renewable resources. In response to these concerns, alternative building designs that prioritize ecological balance and resource efficiency are gaining attention..

II. LITERATURE REVIEW

The growing interest in sustainable architecture has led to the exploration of eco-friendly housing solutions, with the eco-dome house emerging as a promising option. Eco-dome houses are characterized by their dome-shaped design, which offers inherent benefits in energy efficiency and environmental resilience.

Sustainable architecture focuses on minimizing the environmental impact of buildings through the use of energy-efficient designs and eco-friendly materials (Kibert, 2016). Dome-shaped homes are particularly energy-efficient due to their reduced surface area, which enhances natural temperature regulation and reduces the need for artificial heating and cooling (Buchanan, 2018). Studies highlight the ability of eco-dome structures to lower energy consumption while maintaining thermal comfort (Braham & Al- Hashimi, 2020).

Eco-dome homes often use locally sourced, renewable materials such as earth, straw, and recycled materials, promoting resource conservation and reducing carbon footprints (Smith, 2015). Natural materials like cob and adobe offer excellent insulation and durability, creating healthier living environments and reducing synthetic chemical use (López et al., 2019).

While eco-dome houses offer long-term savings in energy and maintenance, initial construction costs may be higher due to specialized materials and techniques (Turner, 2019). Additionally, challenges such as regulatory barriers and limited public awareness may hinder widespread adoption (Cochran, 2018). However, the use of prefab components and local materials could help reduce costs and improve scalability (Lee & Chang, 2020).

III. METHODOLOGY OF PROPOSED SURVEY

The research will include a comparative analysis of existing eco-dome houses in various regions. Key parameters such as construction materials, energy efficiency, climatic adaptation, and cost will be examined. These case studies will help identify successful implementations and lessons learned from real-world projects.
A thorough review of existing literature on sustainable architecture, eco-dome house designs, and renewable energy integration will be conducted. This will establish the theoretical framework and provide insights into the benefits and challenges of eco-dome housing.

Energy Efficiency:
The survey will assess the initial construction costs of eco-dome houses in comparison to long-term savings on energy and maintenance.

Cost analysis:
The survey will assess the initial construction costs of eco-dome houses in comparison to long-term savings on energy and maintenance.

Recommendation And Conclusion:
Based on the findings, the research will provide recommendations for the adoption of eco-dome houses in diverse environments. It will also outline strategies to overcome challenges such as cost, regulation, and scalability.

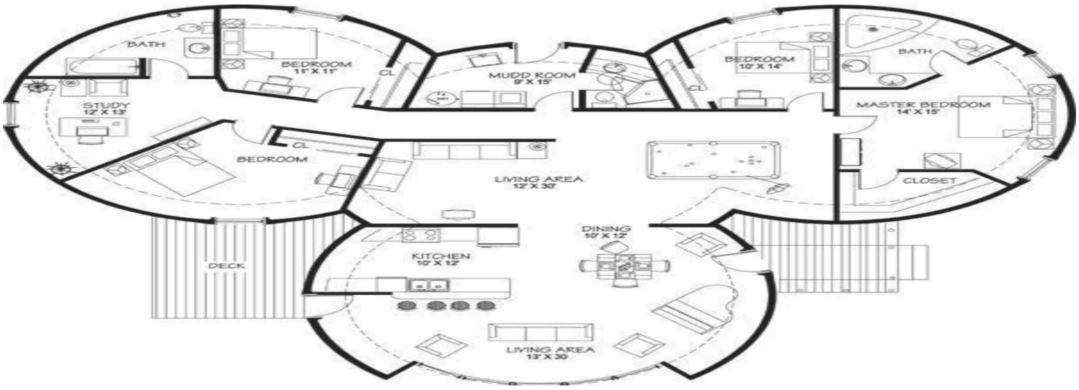

Fig 1: Experimental Set Up

IV.CONCLUSION AND FUTURE WORK

This study highlights the potential of eco-dome houses as a sustainable, energy-efficient housing solution that reduces environmental impact through innovative design, eco-friendly materials, and renewable energy integration. The research suggests that, despite some challenges in construction costs and regulatory acceptance, eco-dome homes offer significant long-term benefits in energy savings, material conservation, and environmental resilience.

Future research should focus on further optimizing eco-dome construction techniques to reduce initial costs, particularly through the use of prefabricated components and locally sourced materials. Additionally, studies on the scalability of eco-dome homes in different climates and urban settings are essential to determine their broader applicability. Exploring technological advancements in renewable energy integration and smart home systems could also enhance the efficiency and sustainability of these homes, making them more accessible to mainstream housing markets

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Electronic Voting Machines (EVMs) for Visually Impaired Voters

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ABSTRACT: Ensuring electoral accessibility is a fundamental component of an inclusive democracy, allowing all citizens, regardless of their physical abilities, to exercise their right to vote independently and confidentially. However, visually impaired individuals continue to face significant challenges when using Electronic Voting Machines (EVMs) due to the lack of accessible design features. Standard EVMs, while efficient and reliable for most voters, often fail to accommodate the needs of individuals with visual impairments. The absence of audio prompts, tactile controls, and haptic feedback creates significant barriers, forcing visually impaired voters to rely on external assistance, thereby compromising their privacy, independence, and electoral confidence. This research explores the accessibility limitations of current EVMs and proposes technological solutions aimed at making them more inclusive, secure, and user-friendly.

The study employs a mixed-methods research approach, combining both quantitative and qualitative data collection techniques to gather comprehensive insights. A structured survey was conducted with 100–150 participants, including visually impaired voters and election officials. The survey evaluates the accessibility challenges of current EVMs and assesses the effectiveness of assistive technologies, such as audio navigation, Braille keypads, and haptic feedback systems. The results reveal that the majority of visually impaired participants struggle with traditional EVMs, citing difficulties in candidate selection, lack of feedback on their choices, and reliance on third-party assistance. However, when using assistive EVM prototypes, participants reported greater independence, accuracy, and confidence in their voting process.

The research also conducts a thorough literature review of accessibility standards, assistive technologies, and international best practices. It examines policies such as the Help America Vote Act (HAVA) in the United States, which mandates accessible voting machines, and the Canadian Elections Act, which ensures the availability of Braille templates and audio-assisted voting stations. These case studies highlight the effectiveness of multi-sensory EVMs in promoting independence and inclusivity for visually impaired voters.

Furthermore, this research proposes a comprehensive framework for integrating assistive technologies into EVMs, including:

- Audio Navigation Systems: Real-time voice prompts to guide voters through the selection process, providing confirmation feedback to reduce errors.
- Braille Keypads: Tactile voting interfaces that allow visually impaired voters to independently navigate candidate lists and cast their votes.
- Haptic Feedback: Physical vibrations that confirm selections, providing additional reassurance and reducinguncertainty.
- AI-Powered Navigation: Intelligent, voice-activated EVMs with gesture recognition capabilities, enabling hands-free navigation for voters with severe impairments.
- Biometric Authentication: Secure identification through fingerprint or iris scanning, ensuring both accessibility and electoral integrity.

The findings of this research emphasize the significant benefits of accessible EVMs, including enhanced voter confidence, reduced dependence on assistance, and greater overall participation rates among visually impaired individuals. The study underscores the need for electoral bodies to standardize accessible voting technologies by adopting regulatory frameworks and enforcing compliance with international accessibility standards.

In terms of future work, the research proposes the development of accessible EVM prototypes and their deployment in large-scale field trials. These trials will evaluate the real-world effectiveness of assistive technologies in improving

electoral participation and accuracy for visually impaired voters. Additionally, the research recommends policy reforms to mandate the integration of assistive features in all EVMs, ensuring consistency and inclusivity in electoral processes worldwide.

Ultimately, this research aims to contribute to the advancement of accessible electoral systems, ensuring that visually impaired individuals can exercise their right to vote with independence, dignity, and confidence. By promoting inclusive design principles and advocating for policy changes, this study seeks to foster a more equitable and democratic electoral process for all citizens.

I. INTRODUCTION

Voting is a fundamental right and a cornerstone of democracy, empowering citizens to influence the governance and future of their nations. It serves as the primary mechanism through which people express their political preferences and contribute to decision-making processes. Over the years, technological advancements have revolutionized electoral systems, with Electronic Voting Machines (EVMs) replacing traditional paper ballots in many countries. EVMs have been widely adopted due to their efficiency, accuracy, and ability to streamline the voting process. They minimize human error, expedite vote counting, and reduce the likelihood of electoral fraud. However, despite these advantages, EVMs often fail to meet the accessibility needs of visually impaired individuals, creating significant barriers to independent and confidential voting.

For visually impaired voters, the voting process is not just about casting a ballot—it is also about exercising their democratic right with dignity and independence. However, the lack of inclusive design in current EVMs forces many visually impaired individuals to rely on assistance from poll workers or companions. This reliance undermines the principles of privacy and confidentiality, which are essential to a free and fair electoral process. The inability to vote independently can lead to a sense of disenfranchisement, discouraging participation and limiting their representation in the democratic process.

1.1 The Importance of Accessibility in Voting

Accessibility in voting systems is crucial to ensure that all citizens, regardless of their physical abilities, can participate equally. Inaccessible voting machines create disparities in electoral participation, violating the principles of inclusivity and fairness. The United Nations Convention on the Rights of Persons with Disabilities (CRPD) emphasizes the need for equal access to electoral processes, urging nations to adopt accessible voting systems that enable persons with disabilities to voteindependently and confidentially. Ensuring accessibility in EVMs is not merely a technological improvement—it is a human rights imperative.

1.2 Challenges Faced by Visually Impaired Voters

Visually impaired individuals face numerous challenges when using standard EVMs. The lack of tactile buttons, audio prompts, and navigational aids makes it difficult to select candidates independently. Without multi-sensory feedback, visually impaired voters cannot verify their choices, increasing the risk of errors or misrepresentation. Additionally, the need for external assistance reduces their autonomy, preventing them from enjoying the same level of privacy as sighted voters. This lack of accessibility not only limits their voting rights but also undermines their trust in the electoral process.

1.3 The Need for Technological Integration

Technological advancements offer significant potential for making EVMs more accessible. Assistive technologies such as Braille keypads, audio feedback systems, and haptic responses can enhance the voting experience for visually impaired individuals. By integrating these features, EVMs can provide real-time guidance, allowing visually impaired voters to cast their ballots independently and accurately. Internationally, countries such as the United States and Canada have already implemented accessible voting measures, setting benchmarks for inclusive electoral systems.

1.4 Research Objectives

This research aims to examine the accessibility limitations of current EVMs and propose practical solutions to make them more inclusive for visually impaired voters. The objectives of the study include:

- **Identifying Accessibility Barriers:** Analyzing the challenges visually impaired voters face with existing EVMs.

- **Evaluating Assistive Technologies:** Assessing the effectiveness of audio feedback, Braille keypads, and haptic responses in improving accessibility.
- **Surveying User Experience:** Gathering feedback from visually impaired individuals and election officials through structured questionnaires to understand current issues and potential improvements.
- **Proposing Accessibility Enhancements:** Recommending a framework for integrating assistive technologies into EVMs, based on survey results and international best practices.

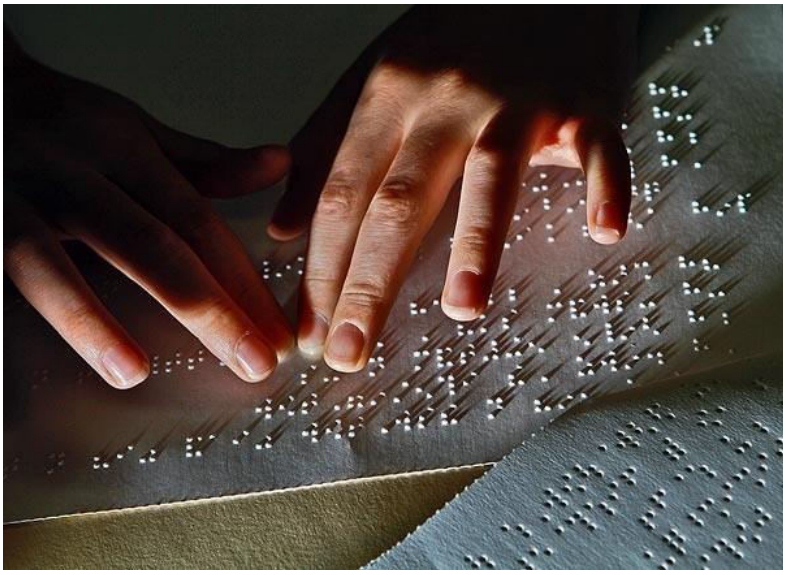

Fig 1.1 : Visually Impaired Individual Reading Braille Text

1.5 Significance of the Study

The significance of this study lies in its contribution to promoting electoral inclusivity. By addressing the accessibility gaps in EVMs, the research seeks to empower visually impaired individuals, ensuring they can vote independently, accurately, and confidentially. The findings will not only offer practical recommendations for EVM enhancements but also serve as a reference for policymakers and electoral bodies aiming to implement inclusive voting standards.

1.6 Structure of the Paper

This research paper is structured into the following sections:

- **Literature Review:** A comprehensive review of existing research, accessibility standards, and technological innovations related to EVM accessibility.
- **Methodology:** An outline of the survey design, participant selection, data collection methods, and analytical techniques used.
- **Findings and Analysis:** Presentation and interpretation of the survey results, highlighting key insights and patterns.
- **Proposed Solutions:** Recommendations for integrating assistive technologies into EVMs, including design considerations and feasibility.
- **Conclusion and Future Work:** A summary of the key findings, their implications, and suggestions for future research directions.

By exploring accessibility challenges and proposing practical solutions, this research aims to promote inclusivity in the electoral process, ensuring that visually impaired voters can participate independently and with dignity.

II. LITERATURE REVIEW

The accessibility of Electronic Voting Machines (EVMs) for visually impaired individuals has been the focus of growing academic and policy-related discourse. Several studies, reports, and technological assessments have explored the challenges, solutions, and emerging trends aimed at making voting systems more inclusive. This literature review examines the existing accessibility barriers, evaluates technological interventions, and highlights international best practices, providing a foundation for this research.

2.1 Accessibility Challenges in EVMs

Numerous studies have documented the challenges visually impaired voters face when using standard EVMs. Kumar and Sharma (2019) highlight that most EVMs lack tactile buttons, audio instructions, and accessible navigation features, making it difficult for visually impaired voters to cast their ballots independently. The absence of real-time feedback further increases the risk of incorrect voting choices, while the need for external assistance compromises privacy.

A report by the Election Commission of India (2020) emphasizes that although EVMs enhance electoral efficiency, accessibility for Persons with Disabilities (PwDs) remains limited. The report identifies the lack of Braille keypads, audio guidance, and other assistive features as major obstacles for visually impaired voters. Similarly, Rahman and Ali (2022) argue that the inaccessibility of EVMs reduces voter confidence and participation rates among visually impaired individuals, ultimately undermining their democratic rights.

2.2 Assistive Technologies in Voting Systems

Research highlights several assistive technologies that can enhance the accessibility of EVMs. Smith and Williams (2021) demonstrate the effectiveness of audio navigation systems in improving voter independence. Their study found that audio instructions with clear prompts and confirmations enable visually impaired individuals to navigate voting interfaces with greater confidence and accuracy.

Lee and Patel (2020) explore the role of haptic feedback in electronic interfaces. Their findings indicate that tactile responses, such as vibrations or physical clicks, provide immediate confirmation of selections, reducing errors and enhancing user confidence. Similarly, Brown and Taylor (2020) report that multi-sensory feedback systems, combining audio and haptic cues, significantly improve accessibility and reduce voter errors in simulated voting scenarios.

2.3 International Best Practices

Several countries have implemented accessible voting technologies to promote electoral inclusivity. The United States, under the Help America Vote Act (HAVA, 2002), mandated accessible voting systems for all federal elections. According to Johnson (2018), the integration of audio navigation and tactile controls has improved voter independence and participation rates among visually impaired individuals. The study also highlights that accessible EVMs reduce the need for external assistance, ensuring greater privacy and confidentiality.

In Canada, Elections Canada (2021) introduced Braille templates, large-print ballots, and audio-enabled voting stations to support visually impaired voters. A report by Elections Canada found that these accessibility measures significantly improved the voting experience and enhanced voter confidence. Similarly, the United Kingdom's Electoral Commission has introduced accessibility standards, requiring polling stations to provide tactile voting devices and assistive audio tools.

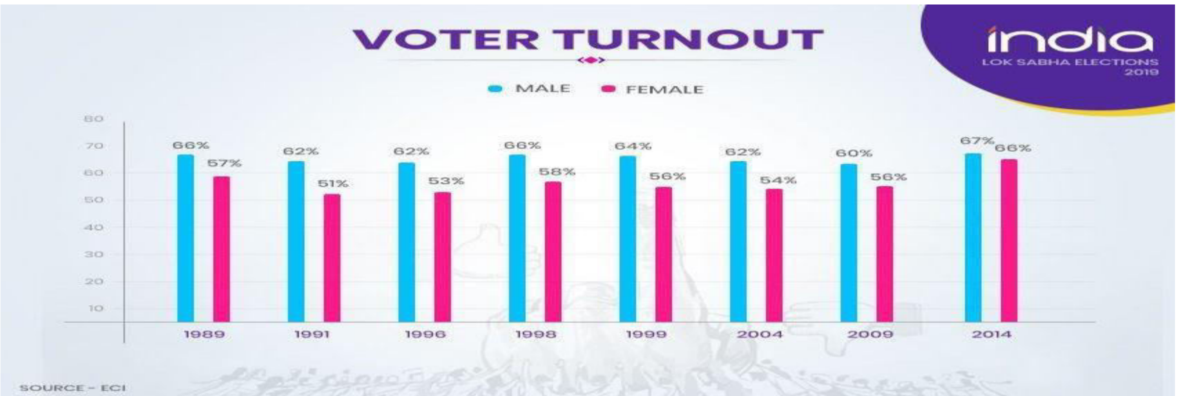

Fig 1.2 : Voter Turnout Infographic Representation

2.4 Technological Innovations for Accessibility

Recent technological advancements offer promising solutions for improving EVM accessibility. Chen and Wang (2022) explore the use of voice-controlled EVMs, where voters can navigate the interface using voice commands. Their study shows that speech recognition significantly enhances accessibility and reduces the likelihood of selection errors.

Gupta et al. (2023) examine smart EVM prototypes equipped with biometric authentication and voice-guided navigation. Their research indicates that combining biometric security with audio feedback ensures both accessibility and accuracy, making the voting process more secure and inclusive.

Other innovations include AI-powered navigation systems that assist visually impaired voters by interpreting gestures or vocal inputs. According to Singh and Verma (2021), AI-based navigation significantly improves the speed and accuracy of voting interactions, reducing the need for human assistance.

2.5 Legal and Policy Frameworks

Several legal frameworks advocate for accessible voting systems. The United Nations Convention on the Rights of Persons with Disabilities (CRPD) highlights the need for electoral accessibility, calling on governments to ensure that persons with disabilities can vote independently and confidentially. The CRPD's guidelines have influenced many countries to adopt inclusive voting technologies.

In India, the Rights of Persons with Disabilities Act (2016) mandates accessible polling stations and voting systems. However, reports indicate that compliance and implementation remain inconsistent, highlighting the need for more comprehensive policies and enforcement measures.

2.6 Gaps in the Literature

While the literature provides valuable insights into the accessibility challenges and technological solutions, certain gaps remain. Most studies focus on individual accessibility features, such as audio feedback or Braille interfaces, rather than holistic, multi-sensory solutions. Additionally, limited research exists on the large-scale implementation of accessible EVMs and their effectiveness in real-world elections.

Moreover, while international case studies highlight successful accessibility measures, the adaptation and customization of these technologies to fit local electoral contexts, such as in India, remain underexplored. This research aims to address these gaps by proposing a comprehensive framework that integrates multiple assistive technologies, tailored for visually impaired voters, into EVMs.

2.7 Summary

The existing literature underscores the need for accessible voting systems to promote inclusivity and protect the democratic rights of visually impaired voters. While several assistive technologies, such as audio feedback, Braille keypads, and haptic responses, have shown promising results, their integration into EVMs remains inconsistent. International best practices demonstrate the effectiveness of multi-sensory feedback systems in ensuring independent and confidential voting.

However, there is still a lack of large-scale studies evaluating the real-world effectiveness of accessible EVMs.

This research builds upon the existing literature by examining accessibility challenges, evaluating the effectiveness of assistive technologies, and proposing practical solutions to make EVMs more inclusive for visually impaired individuals.

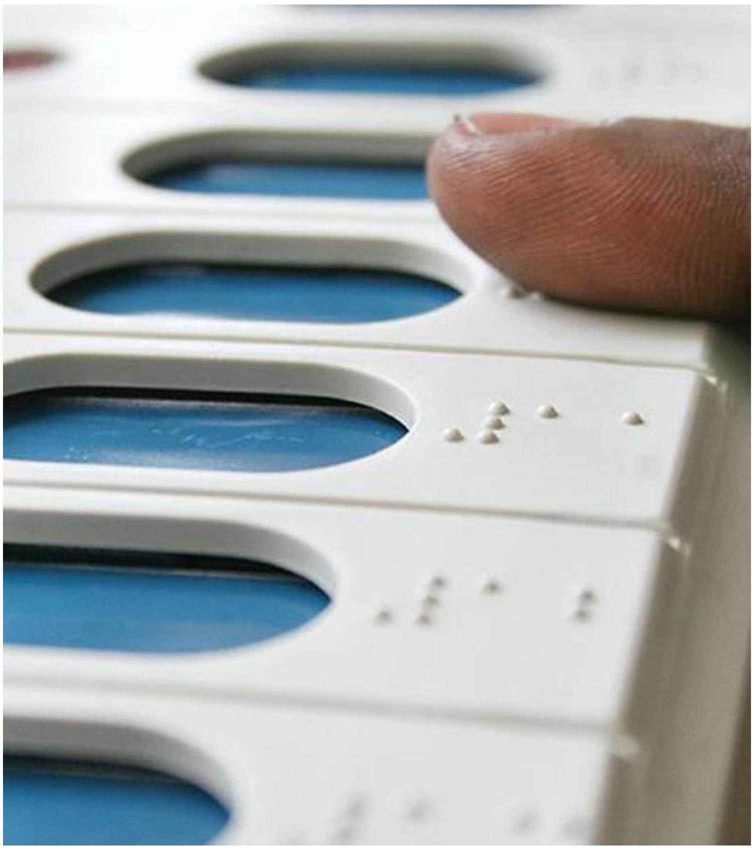

Fig 1.3 : Braille-Enabled Electronic Voting Machine (EVM) for Visually Impaired Voters

III. METHODOLOGY OF PROPOSED SURVEY

This section outlines the research methodology used to investigate the accessibility challenges faced by visually impaired individuals when using Electronic Voting Machines (EVMs) and the proposed solutions to enhance their usability. The methodology involves a structured process comprising survey design, participant selection, data collection, and analysis techniques. The aim is to gather empirical evidence from visually impaired voters and election officials regarding the effectiveness of assistive technologies in improving EVM accessibility.

3.1 Research Design

The study follows a mixed-methods approach, combining both **quantitative** and **qualitative** data collection methods. This approach allows for a comprehensive understanding of accessibility challenges and the effectiveness of proposed solutions.

- **Quantitative Data:** Collected through structured survey questions, providing measurable insights into the participants' experiences and preferences.
- **Qualitative Data:** Gathered through open-ended questions and feedback, capturing detailed opinions and suggestions.

3.2 Research Objectives

The key objectives of the methodology include:

- **Identifying Accessibility Barriers:** To understand the current challenges visually impaired voters face with existing EVMs.
- **Evaluating Assistive Features:** To assess the effectiveness of audio feedback, Braille keypads, and haptic responses in improving EVM accessibility.
- **Gathering User Feedback:** To collect responses from visually impaired individuals and election officials regarding their experiences and recommendations.

- **Proposing Practical Solutions:** To develop data-driven recommendations for enhancing EVM accessibility.

3.3 Survey Design

A structured survey questionnaire was designed to gather data from visually impaired individuals and election officials. The survey included both closed and open-ended questions, covering the following areas:

- **Demographic Information:** Age, gender, and level of visual impairment.
- **Voting Experience:**
  - Previous experience with EVMs.
  - Challenges faced during the voting process.
- **Assistive Features Feedback:**
  - Evaluation of audio prompts, Braille keypads, and haptic feedback.
  - Preferences for specific assistive technologies.
- **Suggestions and Recommendations:**
  - Open-ended questions to gather opinions on additional accessibility improvements.

3.4 Target Population and Sample Size

The survey targeted two key groups:

- **Visually Impaired Voters:** The primary group, representing the end-users of accessible EVMs.
- **Election Officials:** The secondary group, providing insights into current EVM practices and potential accessibility improvements.
- **Sample Size:**
  - A total of **100–150 participants** were targeted.
  - **80–100 visually impaired individuals** to capture first-hand experiences.
  - **20–50 election officials** to gather technical feedback on the feasibility of implementing assistive features.

3.5 Data Collection Process

Data collection involved both **online** and **offline** methods to maximize participation:

- **Online Distribution:**
  - The survey was shared through disability advocacy groups, NGOs, and forums.
  - Emails and social media platforms were used to reach visually impaired individuals.
- **Offline Distribution:**
  - Surveys were conducted at disability centers, public institutions, and polling centers.
  - Face-to-face interactions were conducted to assist visually impaired participants in filling out the questionnaire.

3.6 Survey Parameters

The survey evaluated several parameters related to EVM accessibility:

- **Ease of Navigation:**
  - Ability to locate and select candidates independently.
  - Navigation accuracy with and without assistive features.
- **Usability of Assistive Technologies:**
  - Clarity of audio instructions.
  - Comfort and accuracy with Braille keypads.
  - Effectiveness of haptic feedback.
- **Voting Preferences:**
  - Preference for assisted vs. independent voting.
  - Perceived privacy and confidence while voting.

3.7 Data Analysis Techniques

The data collected was analyzed using both **quantitative** and **qualitative** methods:

- **Quantitative Analysis:**
  - Descriptive statistics (percentages, means, and frequency distributions) were used to identify common trends and patterns.
  - Graphs and charts were generated to visualize the results.
- **Qualitative Analysis:**
  - Open-ended responses were analyzed thematically to identify recurring challenges and suggestions.
  - Common themes related to accessibility barriers, preferences, and recommendations were highlighted.

3.8 Ethical Considerations

Ethical guidelines were followed throughout the research to ensure participant privacy and data integrity:

- **Informed Consent:** Participants were informed about the purpose of the survey and their rights. Consent was obtained before participation.
- **Anonymity and Confidentiality:** Personal information was anonymized to protect participant identities.
- **Data Security:** All collected data was stored securely and used solely for research purposes.

3.9 Limitations of the Methodology

While the methodology aims to provide comprehensive insights, certain limitations exist:

- **Sample Size Constraints:** The sample size may not fully represent the entire visually impaired voting population, limiting generalizability.
- **Self-Reported Data:** The survey relies on self-reported experiences, which may introduce subjective bias.
- **Technological Limitations:** The study focuses on selected assistive technologies, and other potential solutions may not be fully explored.

3.10 Summary

The methodology adopted in this research combines quantitative and qualitative data collection methods to assess the accessibility challenges of EVMs for visually impaired individuals. Through structured surveys and data analysis, the study aims to identify current limitations, evaluate assistive technologies, and propose practical solutions. By incorporating ethical considerations and addressing potential limitations, the research ensures reliable and meaningful results, contributing to the development of more inclusive EVMs..3

Fig 1.4: Electronic Voting Machine (EVM) with Voter Verifiable Paper Audit Trail (VVPAT)

IV. CONCLUSION AND FUTURE WORK

Electronic Voting Machines (EVMs) have revolutionized the electoral process by enhancing efficiency, accuracy, and transparency. However, this research highlights the significant accessibility barriers that visually impaired individuals face when using standard EVMs. The lack of assistive features such as audio navigation, tactile interfaces, and haptic feedback prevents visually impaired voters from casting their ballots independently and confidentially. This compromises their privacy, autonomy, and overall voting experience, violating the principles of inclusivity and equality in the democratic process.

The findings of this research reveal that integrating assistive technologies into EVMs can significantly enhance accessibility. Features such as **audio prompts**, **Braille keypads**, and **haptic feedback** empower visually impaired individuals to vote with greater independence and accuracy. Through the survey conducted, visually impaired participants expressed a strong preference for multi-sensory interfaces that provide real-time guidance and confirmation. Election officials also recognized the feasibility of implementing such features, acknowledging their potential to improve accessibility without compromising security or efficiency.

Additionally, the literature review highlighted successful international practices, such as the **Help America Vote Act (HAVA)** in the United States and accessibility measures in Canada, which demonstrate the effectiveness of inclusive voting systems. These case studies provide valuable insights into the potential benefits of adopting similar standards globally, including in India.

Overall, this research emphasizes the need for electoral bodies to prioritize accessibility by integrating assistive technologies into EVMs. Ensuring that all citizens, regardless of their physical abilities, can vote independently is not only a technological enhancement but also a step toward promoting electoral equality and upholding the democratic rights of visually impaired individuals.

While this research offers valuable insights into improving the accessibility of EVMs, several areas warrant further exploration and development. Future work will focus on the following aspects:

1. Development of Accessible EVM Prototypes

- **Prototype Design:** Building and testing accessible EVM prototypes with integrated assistive technologies, including **voice-controlled navigation**, **Braille interfaces**, and **multi-sensory feedback**.
- **User Testing:** Conducting large-scale usability tests with visually impaired individuals to evaluate the effectiveness, accuracy, and efficiency of the proposed solutions.
- **Iterative Improvements:** Refining the design based on user feedback to enhance usability, reliability, and overall voting experience.

2. Large-Scale Field Trials

- **Pilot Programs:** Implementing accessible EVMs in select constituencies during local elections to assess their real-world performance.
- **Impact Assessment:** Measuring the impact of accessible EVMs on voter turnout, satisfaction, and independence among visually impaired individuals.
- **Comparative Analysis:** Comparing the performance and accessibility of enhanced EVMs with standard machines to demonstrate the effectiveness of assistive technologies.

3. Integration of Advanced Technologies

- **AI-Powered Navigation:** Exploring the use of **AI-driven voice recognition** and **gesture-based navigation** to further improve accessibility.
- **Biometric Authentication:** Enhancing security and personalization by integrating **biometric verification** while maintaining accessibility standards.
- **Real-Time Feedback Systems:** Implementing real-time error correction and confirmation prompts to reduce voter errors.

4. Policy Advocacy and Standardization

- **Policy Recommendations:** Collaborating with electoral bodies and policymakers to advocate for the
  - **Standardization of accessible EVMs** in national and regional elections.
- **Legal Frameworks:** Proposing amendments to existing election laws to mandate the inclusion of assistive technologies in EVMs, ensuring compliance with accessibility standards.
- **International Collaboration:** Partnering with global accessibility organizations to share best practices and develop universal standards for inclusive voting systems.

5. Addressing Broader Accessibility Needs

- **Inclusive Voting Environments:** Expanding accessibility measures beyond EVMs, including **accessible polling stations**, transportation assistance, and staff training to support visually impaired voters.
- **Digital Accessibility:** Exploring the potential of **online and mobile voting systems** with accessibility features to provide alternative voting options for individuals with disabilities.

This research contributes to the growing discourse on electoral accessibility by providing practical recommendations for enhancing EVM usability for visually impaired individuals. By integrating assistive technologies and adopting inclusive design practices, electoral bodies can ensure that all citizens, regardless of their physical abilities, can exercise their democratic rights with independence, dignity, and confidence.

Future efforts must focus on translating these recommendations into actionable solutions, ensuring that accessible EVMs become a standard feature in elections worldwide, ultimately fostering a more inclusive and equitable democratic process.

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Field Protection from Animals

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ABSTRACT: Field protection from animals is a critical challenge for agricultural practices, especially in areas where wildlife or domestic animals pose significant threats to crops, livestock, and infrastructure. This issue is of particular importance in regions with high biodiversity, where agricultural fields often coexist with natural habitats. Effective field protection strategies are necessary to mitigate damage caused by wild animals, such as deer, rodents, and birds, as well as domestic animals like cattle and goats. Approaches to solving this problem include the use of physical barriers like fences and netting, advanced technologies such as motion sensors and automated deterrents, and behavioural methods like noise and light manipulation. Additionally, ecological methods like habitat modification and crop selection offer long-term solutions that align with environmental sustainability. Understanding animal behaviour, regional biodiversity, and the specific needs of agricultural systems is essential in designing cost-effective, humane, and environmentally friendly protection strategies. This abstract provides an overview of the various methodologies, challenges, and emerging solutions in the field of animal-related field protection.

I. INTRODUCTION

Agricultural fields are often vulnerable to damage caused by both wild and domestic animals, which can lead to significant economic losses for farmers and threaten food security. Animals, whether they are herbivores like deer, rodents, or birds, or even livestock such as cattle and goats, can damage crops, contaminate produce, and disrupt farming operations. This issue is particularly pronounced in regions where agriculture and wildlife habitats intersect, creating frequent conflicts between the needs of farmers and the natural behavior of animals.

The challenge of protecting fields from animal damage requires a multifaceted approach that takes into account the diverse behaviors of different animal species, the nature of the crops being grown, and the surrounding environmental context. Traditional methods such as fences, traps, and scare tactics have been used for centuries, but as animal behavior becomes more sophisticated and environmental sustainability gains importance, there is a growing need for more innovative and humane solutions.

In recent years, advances in technology and ecological understanding have introduced new methods for field protection, including the use of motion-triggered deterrents, GPS tracking systems, and non-lethal barriers. Additionally, strategies such as habitat modification, the use of crop varieties less attractive to animals, and integrated pest management are gaining traction as long-term solutions. These approaches not only protect fields but also aim to preserve biodiversity and prevent unnecessary harm to animals.

This introduction highlights the critical need for effective field protection measures, considering both the challenges faced by farmers and the importance of balancing agricultural practices with wildlife conservation. By exploring and implementing a range of strategies, we can improve field protection while promoting sustainable farming practices and reducing human-wildlife conflict.

II. LITERATURE REVIEW

This study proposes a device for identifying intruders and tracking threats, utilizing sensors and cameras with PIR sensors having a detection range of over 10 meters. The solution aims to protect crops, offering farmers a means to secure their farmlands from attacks or trespassing. The paper focuses on using IoT for dangerous animal detection, connecting network devices with sensors for data collection. It utilizes low-cost hardware like Arduino Uno to detect and alert against animal damage without harm. It also addresses the safety of students and animals on school campuses, providing monitoring and protection measures [1]. This study presents a system for automatic wildlife monitoring in remote areas using IoT technology. The crop monitoring system alerts animals before they enter fields. The system is installed and customized at the U.S. Sedgwick Research Reserve, identifying bears, deer, and coyotes with motion-triggered cameras. The multi-tier IoT system, called WTB, connects cameras to an on-site internet device (edge cloud). Its main goal is to protect crops from wild animal attacks. The module is easy to use and accessible to farmers, providing a cost-effective solution.[2] The proposed system operates by playing sound and detecting light intensity using an LDR. If the light intensity is low, it will focus the light to deter wild animals from entering the farm, causing them to run away. Additionally, a GSM module sends a message to the farmer to alert them. The device is highly beneficial and affordable for the farmer. Importantly, the design ensures the safety of both animals and humans while effectively protecting the farm.[3] In this paper, a new algorithm for animal recognition is proposed. W-CoHOG, a Histogram of Oriented Gradients (HOG)-based feature vector, demonstrates higher accuracy compared to the existing Co-occurrence Histograms of Oriented Gradients (CoHOG). The algorithm utilizes the LIBLINEAR classifier to improve accuracy for high-dimensional data. Experimental results indicate that W-CoHOG outperforms state-of-the-art algorithms, achieving higher accuracy on two benchmark datasets. [4] The study found Himachal Pradesh's economy relies on agriculture, with crop damage from wild animals prompting farmer suggestions for field fencing and compensation. Water sources and festivals, like 'Van Mahotsav,' aim to foster harmony between farmers and wildlife, ensuring coexistence and mitigating crop damage risks.[5] Efficiently tracking wild animals in their natural habitat is important. This project creates rules to find animals in wildlife. Since there are many different species, identifying them by hand is hard. These rules classify animals by their pictures to monitor them better. Animal detection and classification can help prevent accidents and theft. Using deep-learning algorithms is an efficient way to do this.[6] Recently, wildlife encroachment into populated areas has surged as forests shrink. The existing alarm system activates only when animals intrude. The proposed system integrates Passive Infrared Sensors (PIR) along borders, triggering a centralized alert system and activating electric fences upon animal motion detection. This reliable and environmentally friendly solution aims to safeguard wildlife by deterring harm through IoT devices. [7] This paper focuses on a smart agriculture software employing computer vision and ultrasound emission to create virtual fences, protecting crops from ungulate attacks and significantly reducing production losses. The proposed prototype utilizes software to recognize and classify animals, developed with openCV and deep learning algorithms. Embedded with an ultrasonic repellent hardware device, it drives animals away from the farm while alerting the farmer. This cost-effective solution aims to deter animals without causing harm or death, preserving natural resources. When an intrusion is detected, the model, trained using Keras and Tensor Flow to identify animals, activates to check and recognize the animal intrusion. If identified among trained classes, the ultrasonic repellent is activated to drive the animal away.[8] The increase in GVA in agriculture and allied sectors reached 4% in FY20. A deep learning method for animal detection was proposed to address the environmental impact of animal agriculture. The system aims to detect wild animals trespassing agricultural fields, preventing land damage and crop loss. Face recognition techniques identify unknown individuals to prevent trespassing. Baseline models like MobileNetV1, Shuffle Net M, and MobileNetV2 were utilized, with training completed at 60K iterations. A mobile application developed using React Native alerts users with live streaming when an unknown individual or animal enters agricultural land. Automatic crop protection machines using microcontroller based systems and GSM technology send SMS alerts and sound buzzers to prompt action during emergencies.[9] Crop guarding is a common practice for rural farmers to protect their crops from wild animals like elephants and pigs. It also deters human predators and thieves. Farmers engage in crop guarding to stay vigilant and combat boredom, often using noise-making techniques like drums and crackers. Electric fences are used to keep elephants away, but if damaged, animals can freely enter farmland. To prevent this, poles can be camouflaged to avoid detection by animals [10].

III. METHODOLOGY OF PROPOSED SURVEY

The methodology for the proposed survey on field protection from animals involves a comprehensive approach to gather data on current practices, challenges, and the effectiveness of various animal deterrent strategies. First, the survey will target a diverse sample of agricultural stakeholders, including farmers, field workers, and agricultural experts, from different regions to ensure a broad understanding of the issues. The survey will utilize a mixed-methods approach, combining both quantitative and qualitative data. A structured questionnaire will be designed to collect quantitative data on the types of field protection methods used (e.g., physical barriers, chemical repellents, technological innovations), their cost, effectiveness, and frequency of use. Additionally, qualitative questions will explore the challenges faced by farmers, including environmental concerns, animal behavior adaptation, and the sustainability of current practices. The survey will also assess the perceived effectiveness of newer technologies such as drones, AI-powered systems, and biological controls. Data will be collected through online surveys, phone interviews, and face-to-face interactions to accommodate varying access to technology. Statistical analysis will be conducted to identify trends, patterns, and correlations between different types of deterrents and their success rates. The findings will help identify gaps in current practices, recommend improvements, and guide future research in the development of more efficient, cost-effective, and sustainable animal protection methods for agricultural fields.

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Fig 1: Model Set Up

IV. CONCLUSION AND FUTURE WORK

In conclusion, protecting fields from animal damage is an ongoing challenge for farmers worldwide, with various strategies employed to minimize losses. These methods, ranging from traditional physical barriers and chemical repellents to modern technological innovations like drones and AI systems, each offer distinct advantages and limitations. While many approaches provide temporary or localized solutions, there is a need for more sustainable, cost-effective, and adaptable strategies, especially for small-scale farmers. The integration of ecological controls and more advanced technologies presents promising directions for future field protection methods. However, the effectiveness of these solutions can vary based on the type of crops, geographic region, and specific animal threats. Future work should focus on refining these technologies, making them more affordable and accessible, and exploring innovative, environmentally-friendly methods that maintain ecological balance. Further research into the long-term impacts of various animal deterrents, the potential for integrating multiple strategies, and the role of local knowledge in selecting the best protection methods will be crucial in developing comprehensive solutions for field protection.

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Fire Detection system for Industry

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ABSTRACT: Fire detection systems are the most critical element of any building design these days. These days, reports of fire occurrences are frequent. In many instances, this could be the result of people's carelessness. Take a look at a few locations, such as gas stations, snack stores, homes, and primarily offices, etc. Every year, there are believed to be around ten thousand fire incidents. In this study, an automatic fire detection system using a sensor is introduced, taking all of these factors into account. Our suggested solution works differently from the current one, which uses a fire sensor to detect the fire. The current systems have fire alarms that sound an alert when a fire is discovered inside a certain area. The proposed system contains the fire alarm, Bread Board, LCD screen, Arduino in addition to that it sends a notification to our mobile and mail can be sent to the attached mail id which will be having the information of the accident-prone area, and also the information needed to alert the fire station about the incident.

I. INTRODUCTION

A fire alarm system is a system that is designed to warn people when there is fire, smokes, or any other harmful gas appear on the premise. The alarms are activated automatically or manually turned on with manual fire alarm activation devices such as manual call points or pull stations. The manual activation exist is to help people warn of a fire or harmful gas leak quickly as it may take some time for the sensors to kick in. The alarms can either be motorized bells or wall mounted sounder or horns. They can also be a speaker strobe which sound an alarm, followed by a voice urging evacuation message which alarming people on the situation and warning them not to use elevators if there is any. The fire alarms sounders can be set to different frequencies and tones depending on the country and the manufacturer. Some place needs a higher frequency and tone such as shopping malls and high-levelled building.

Fire alarm system is crucial in every building as it can prevent any mishaps and can save lives. The system can sense heat and gas thus alarming people via buzzer, automated announcements, or alarming lights. It is faster than having to scream to alarm people of a fire or a gas leak. Basically, heat sensor will sense any temperature above the normal room temperature.

II. LITERATURE REVIEW

The Fire alarms are crucial safety devices that detect and warn people of potential fires, enabling prompt evacuation and minimizing damage. Fire alarm systems offer a flexible and affordable solution, leveraging the versatility of fire detection and alerting systems.Vaious senssors, including smoke,temperature,and flame sensors,have been used to detect fires in places like industry. Smoke sensors, such as the MQ-135, detect particles in the air, while temperature sensors, like the LM35,measure temperature changes.Flame sensors, including the IR flame sensor, detect infrared radiation emitted by flames.Researchers have also employed communication protocols such as Wi-Fi,GSM,and Bluetooth to send alerts and notifications to users.Studies have highlighted the effectiveness of fire alarm system in detecting fires and alerting user. (1)For instance,Gupta et al.(2018) created a fire detection and alerting system using Arduino,temperature sensors,while (2)Jain et al. (2019) created a fire detection and alerting system using Arduino, temperature sensors ,and (3)Wi-Fi. Kumar et al.(2020) also developed a fire detection system using Arduino, flame sensors,and GSM. However,challenges and limitations have been noted in the literature. Power consumption is a concern, as Arduino boards requires a power source, which can be a limitation in certain applications (4)Jain et al.,2019 .Sensors accuracy is also a challenge , as the accuracy of sensor can affect the relatability of the fire alarm system (5) Gupta et al.,2018.Additionally, the cost of additional components, such as sensors and communication modules, can add up (6) Kumar et al.,2020. Despite these challenges, Arduino-based fire alarm system offersb a promising solution for fire detection and alerting. Their flexibility, affordability,and customizability make them an attractive option for various application, including homes offices and in industry.(7)Gupta et al. (2018),(8) Jain et al.(2019), (9)Kuingh et al.(2020), (10)Kumar et al.,(2021)

III. METHODOLOGY OF PROPOSED SURVEY

System Design:- Design a smart fire alarm system using Arduino, incorporating sensors (e.g., smoke, temperature, humidity), a microcontroller, and communication modules (e.g., Wi-Fi, GSM).
- Develop a system architecture and block diagram.

➢ Prototype Development:
- Develop a prototype of the proposed system, integrating the designed components.
- Test and calibrate the system to ensure its accuracy and reliability.

➢ Survey Design:
- Design a survey questionnaire to gather information on the proposed system's effectiveness, feasibility, and potential applications.
- Identify the target respondents, such as building owners, facility managers, firefighters, and electronics enthusiasts.

➢ Data Collection:
- Distribute the survey questionnaire to the target respondents through various channels (e.g., online platforms, email, in-person interviews).
- Collect and record the responses.

➢ Data Analysis:
- Analyze the collected data using statistical methods and tools (e.g., SPSS, Excel).
- Identify trends, patterns, and correlations in the data.

➢ Results and Discussion:
- Present the survey results, highlighting the respondents' perceptions and opinions on the proposed system.
- Discuss the implications of the findings, including the potential benefits and limitations of the system.

➢ Conclusion and Recommendations:
- Summarize the main findings and conclusions drawn from the survey.
- Provide recommendations for future research and development of the proposeds

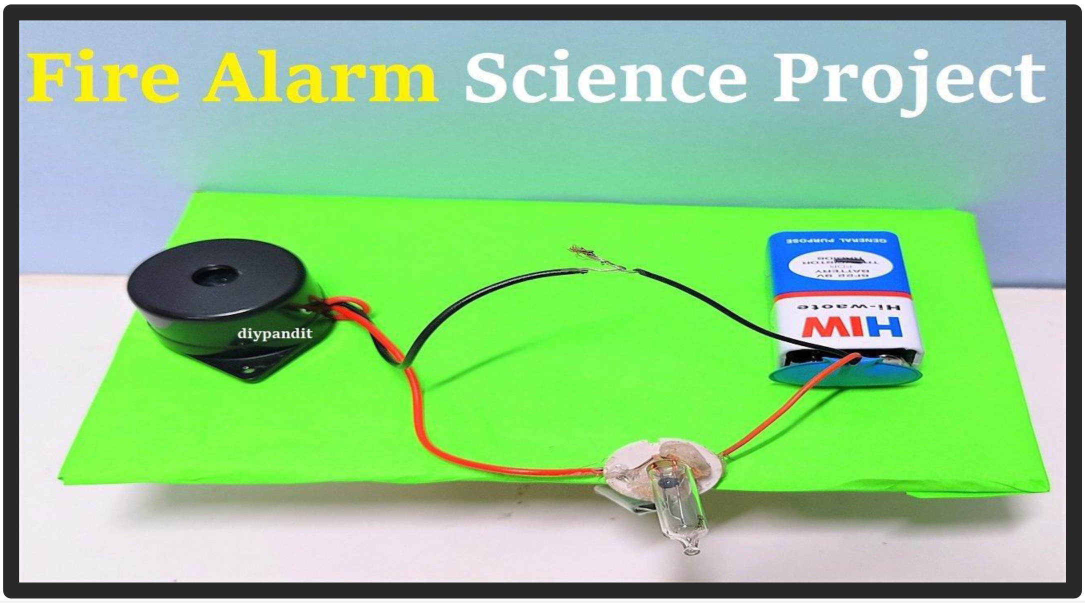

Fig.(1) Fire Alarm System

IV. CONCLUSION AND FUTURE WORK

After several tests have been done towards our project, The Fire Alarm System has been able to be conducted according to the desired system. The system consists of two inputs, which are flame sensor and gas sensor. Starting off with the flame sensor, it detects the presence of the fire and it will send a signal to its output. In this case, the outputs are LED, Piezo Buzzer and the LCD Panel. The LED will light up and the buzzer will produce the sound after obtain the signal to aware the users about the presence of fire. The LCD Panel will display the information about the presence of fire. The second input, which is the gas sensor is a component that measures presences of the gas, which is smoke in this case. The type of gas sensor we use for this project is MQ-2. This type of gas sensor able to detects butane, methane, LPG and smoke. This gas sensor is placed at this fire alarm system to enhance to safety when there are fires. When the situation occurs, it will send a signal to its output, which is the buzzer. This buzzer acts as an alarm that reminds the users to be aware of the situation. Certain tests, improvements and changes were done to achieve the results mentioned above. The sensors have been tested and it work well as intended. This project certainly can be a huge helping to the society to prevent the unwanted situation. This alarm system can implement Fire Alarm requirement to maintain the safety and eliminate hazard.

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Design and Testing of a Mobile-Phone-Jammer

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ABSTRACT: Dissimilar cellular-systems process signals differently, and yet, all cell-phone-networks use radio-signals that can be interrupted or, even, blocked, completely. This project highlights the design of a simple, low-cost mobilephone-jammer and aims to present a solution for the problem of inappropriate-use of the cell-phones in restricted and prohibited-areas. The main concept of jamming is the releasing of signal (noise) of the same-frequency which is using by mobile-service-provider to overpower and destruct the user-signal. The fabrication of the jammer involved uncomplicated discrete components, resistors, capacitors, inductors and transistors to generate the required frequency (noise) and then amplifies the frequency generated to range of 800 MHZ to 1.4 GHZ in order to match the frequency of the mobile-phone being transmitted by the base-station. Relatively-satisfactoryjamming of a mobile-signal was confirmed by the blocking of the signals of the mobile-phones in 2G and 3Gnetworks (UMTS / WCDMA) operated via Safaricom, Airtell, Orange, and YU service-providers, when the phone indicated "no network", thereby allowing no call to go through, with no-interference to other communication-means observed. Overall recommendation is that further and more deeper-research is needed to produce more-sophisticated and better jamming devices, as not to affect the other base-station-transmission systems

I. INTRODUCTION

A Network Jammer is a device designed to block or interfere with communication signals within a network. It can disrupt wireless communication, preventing devices from sending or receiving data. Network jammers are typically used in various applications, from security testing to controlling unauthorized communication in specific areas. However, they can also be harmful when used maliciously to interfere with legitimate communication networks. This project involves building a network jammer that targets and blocks Wi-Fi signals within a defined area by transmitting a signal on the same frequency as the network.

II. LITERATURE REVIEW

A network jammer is a malicious device or software designed to disrupt the communication within a network, effectively blocking or impairing the transmission of data between devices. This is achieved by sending out radio signals or data packets that interfere with the normal operation of network protocols. Network jamming is commonly employed in both wireless and wired networks and can be utilized for various illegal or unethical purposes, such as data theft, denial-of-service attacks, or simply causing disruptions in communication.

Types of Network Jammers
Signal Jammers: These devices emit signals that overwhelm the target frequency, rendering the network devices unable to communicate effectively. They are typically used against Wi-Fi or cellular networks.

Denial-of-Service (DoS) Jammers: These exploit weaknesses in network protocols to overload servers or network devices, causing them to crash or become unresponsive.

Man-in-the-Middle (MitM) Jammers: These attackers intercept and inject malicious signals or data into the network, often to steal information or manipulate communications.

III. METHODOLOGY OF PROPOSED SURVEY

1. System Design:
Select the hardware platform (e.g., Raspberry Pi or Arduino).
Choose a suitable wireless module or RF transmitter that operates on the same frequency as the targeted communication channel (e.g., 2.4 GHz for Wi-Fi).
Design the circuit with an appropriate antenna to radiate signals effectively.

2. Signal Generation:
The jammer generates signals at a specific frequency range (typically Wi-Fi operates at 2.4 GHz and 5 GHz bands).
Software or firmware is programmed to continuously transmit noise signals that overlap with the frequency range of the network you wish to block.

3. Deployment:
The jammer is powered on and placed within the vicinity of the target network.
The jammer will flood the airwaves with interference, preventing other devices from communicating with the network.

4. Testing:
Monitor the network's performance with and without the jammer. The network should be disrupted or disabled when the jammer is active.
Measure the effectiveness of the jammer, including the range and intensity of interference.

5. Safety and Compliance:
Ensure that the jammer is used in a controlled and legal environment, as unauthorized use of jamming devices can lead to legal consequences.
Follow proper regulations and consider the ethical implications of using a jammer.

IV. CONCLUSION AND FUTURE WORK

The aim of the project which was to build a simple-mobile-phone-jammer is achieved. Jamming-technique is potentially very-useful to disable cell-phone in a particular-range, but it should-not affect the other base station transmission-systems. Mobile-jammer can be used in any-location (subject to particular legal-restrictions), but, practically, in places where a mobile-phone-use would-be, on the whole, harmful, disruptive, and even dangerous, like in prisons. Overall-recommendation is that, further and more deeper-research is needed to produce more-sophisticated and better-jamming-devices, as to not affect the other base station transmission systems

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Piezoelectric Generators: Sustainable Energy Harvesting through Mechanical Energy Conversion

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ABSTRACT: Piezoelectric generators are emerging as a promising solution for sustainable energy harvesting by converting mechanical energy into electrical energy using piezoelectric materials. This paper explores the underlying principles of piezoelectricity, the various materials employed in the design of generators, and their application in harnessing energy from ambient vibrations, stress, and movement. The study investigates the efficiency and scalability of piezoelectric systems in real-world scenarios, highlighting advancements in micro-scale power generation for wearable electronics and large-scale implementations for industrial purposes. Furthermore, it addresses the challenges faced in material selection, durability, and energy output optimization. Through experimentation and analysis, the paper aims to provide insights into the future potential of piezoelectric technology in renewable energy frameworks.

I. INTRODUCTION

The growing global demand for sustainable energy solutions has accelerated the exploration of innovative technologies to harvest energy from ambient sources. Among these, piezoelectric generators have emerged as a compelling alternative for energy harvesting, offering a unique mechanism to convert mechanical energy into electrical energy through the piezoelectric effect. This phenomenon, discovered in the late 19th century, utilizes the intrinsic properties of specific materials to generate electricity when subjected to mechanical stress.

Piezoelectric generators find applications in various fields, ranging from wearable electronics and biomedical devices to industrial sensors and renewable energy systems. The versatility and miniaturization potential of piezoelectric technology make it particularly appealing for powering low-energy devices in remote or inaccessible locations. However, the development and deployment of efficient piezoelectric systems require addressing challenges related to material performance, energy conversion efficiency, and scalability for practical applications.

This paper aims to delve into the principles, materials, designs, and applications of piezoelectric generators, while also analyzing their potential to contribute to the transition towards renewable and sustainable energy systems. By investigating recent advancements and ongoing challenges, this study seeks to provide a comprehensive understanding of the role of piezoelectric generators in the evolving energy landscape.

II. LITERATURE REVIEW

1. Piezoelectric generators have been the subject of extensive research due to their potential for energy harvesting from ambient mechanical vibrations. Early studies focused on the fundamental principles of piezoelectricity, as discovered by the Curie brothers in 1880, and the development of piezoelectric materials such as quartz and ceramics. These materials demonstrated the ability to convert mechanical stress into electrical energy, paving the way for practical applications.

2. Recent advancements have expanded the scope of piezoelectric generators, with researchers exploring innovative designs and materials to enhance energy conversion efficiency. For instance, the integration of flexible piezoelectric polymers has enabled the development of wearable devices and biomedical sensors. Studies have also investigated the use of piezoelectric generators in large-scale applications, such as harvesting energy from road traffic vibrations and industrial machinery.
3. Challenges in the field include optimizing material properties, improving durability, and addressing scalability issues. Researchers have proposed various solutions, such as hybrid systems combining piezoelectric generators with other energy harvesting technologies, to overcome these limitations. The literature highlights the growing interest in piezoelectric generators as a sustainable energy source, emphasizing their potential to contribute to renewable energy frameworks.

III. METHODOLOGY OF PROPOSED SURVEY

The methodology for this study involves a comprehensive approach to evaluating the performance and feasibility of piezoelectric generators. The experimental design focuses on testing various piezoelectric materials, such as ceramics, polymers, and composites, to assess their energy conversion efficiency under different mechanical stress conditions. Prototype piezoelectric generators will be developed and tested in simulated environments to replicate real-world scenarios, including vibrations, pressures, and movements. Data collection will consist of field experiments to monitor energy output in applications like road vibrations, wearable devices, and industrial machinery. Additionally, input will be gathered from questionnaires and interviews with industry professionals and researchers to gain insights into the practicality and scalability of piezoelectric systems. A thorough review of existing literature will complement the experimental findings and highlight current gaps in research. Data analysis will involve the use of statistical methods to identify trends in energy output, evaluate material performance, and determine the feasibility of various applications. The findings will be benchmarked against existing energy harvesting technologies for comparative analysis. To ensure the reliability and accuracy of the study, experiments will be repeated under controlled conditions, and the data will be validated through peer reviews and cross-referencing with prior studies.

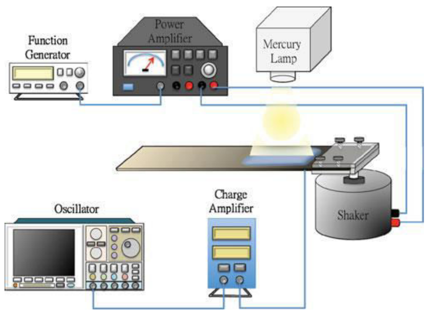

Fig 1: Experimental Set Up

IV. CONCLUSION AND FUTURE WORK

Piezoelectric generators represent a compelling and sustainable approach to energy harvesting, utilizing the piezoelectric effect to convert ambient mechanical energy into electrical energy. This paper has highlighted the principles, materials, and applications of piezoelectric generators, alongside addressing the challenges of efficiency, durability, and scalability. With their versatility and potential for miniaturization, piezoelectric generators are well-suited for a wide array of applications, ranging from wearable devices to industrial-scale energy recovery systems.
While the advancements in this field are promising, there remain significant opportunities for further research and development. Future work should focus on the exploration of novel piezoelectric materials with enhanced energy conversion properties and durability. Additionally, integrating piezoelectric generators with other energy harvesting technologies, such as solar and thermal systems, could lead to hybrid solutions with improved overall performance. Efforts should also be directed toward optimizing the cost-efficiency and large-scale implementation of piezoelectric systems to facilitate their adoption in diverse industries.

In conclusion, piezoelectric generators hold immense potential to contribute to the global shift towards renewable energy systems. By overcoming the existing limitations through innovative research and interdisciplinary collaboration, they can play a pivotal role in addressing the world's growing energy demands sustainable.

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Accurate Distance Measurement using Radar Technology: Radar Vision

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ABSTRACT: This paper explores recent advancements in radar-based distance measurement and positioning systems, emphasizing their potential for high-precision sensing applications. We present a proof-of-concept for an ultrawideband (UWB) frequency-modulated continuous wave (FMCW) radar operating at 126–182 GHz, achieving micron-level accuracy while addressing hardware imperfections and environmental compensation. Additionally, we propose a dual-chirp microwave photonic radar utilizing compressive sensing for efficient distance and velocity estimation with reduced data processing demands. The study also highlights the challenges of 3D indoor positioning, emphasizing the advantages of millimetre-wave (mmWave) radar technology for accurate spatial tracking. Finally, we review the latest developments in portable short-range microwave radar systems, discussing their integration into compact, high-performance solutions for applications such as health monitoring, human-computer interaction, and structural analysis. Our findings demonstrate the growing versatility of radar technologies in diverse fields, paving the way for next-generation smart sensing systems.

I. INTRODUCTION

Accurate distance measurement is a critical requirement in various industrial and smart applications, including motion control, machine calibration, and vibration monitoring. Millimeter-wave (mmWave) radar technology, operating in the 30–300 GHz range, has emerged as a promising solution due to its ability to provide high-precision, contact-free measurements even in harsh environments. However, achieving micrometer-level accuracy at medium ranges presents challenges such as free-space path errors, which can surpass random errors by several orders of magnitude. Additionally, radar-based 3D localization faces limitations, as many existing systems primarily estimate horizontal (x–y) positions while neglecting the vertical (z) dimension, which is crucial for applications like drone navigation and industrial automation. Recent advancements in microwave photonic radar systems offer significant improvements, leveraging wide bandwidths, fast analog processing, and immunity to electromagnetic interference (EMI) to enhance ranging accuracy. This paper reviews state-of-the-art radar technologies for distance measurement, highlighting key challenges, solutions, and the potential of radar-based systems for achieving high-precision positioning in both industrial and smart environment applications.

II. LITERATURE REVIEW

1] IEEE transactions on microwave theory and techniques, vol. 70, no. 11, november (2022): This research demonstrates a UWB FMCW radar system (126–182 GHz) capable of micron-accuracy distance measurement at medium range. We developed a calibration-free, environmentally compensated approach that addresses hardware imperfections, parameter estimation, and free-space path effects. Our low-cost, interference-robust signal processing achieved a ±1 µm systematic error over 4.8 m and 30 nm random error, proving the feasibility of high-precision radar-based positioning. 2] IEEE photonics journal, vol. 14, no. 4, august (2022): This research presents a dual-chirp microwave photonic radar for high-precision distance measurement using compressive sensing. By leveraging sub-Nyquist sampling, the system reduces data processing demands while achieving centimeter-level accuracy and an SNR of 30.725 dB, making it a promising solution for real-time distance sensing. 3] Ground-Based Radar Interferometry: A Bibliographic Review (Massimiliano Pieraccini and Lapo Miccinesi,2019): This research reviews the advancements in ground-based radar interferometry (GBRI), highlighting its growing role in precision monitoring. From its origins in spaceborne SAR to modern terrestrial systems, GBRI has evolved to support landslide detection, infrastructure safety, and cultural heritage preservation. Recent innovations, including faster modulations, MIMO systems, and 3D imaging, are making radar technology more accurate, efficient, and widely applicable, paving the way for smarter and more reliable monitoring solution. 4] Application of Deep Learning on Millimeter-Wave Radar Signals(Fahad Jibrin Abdu;Yixiong Zhang;Maozhong Fu;Yuhan Li; Zhenmiao Deng,2021): The paper reviews the application of deep learning in processing millimeter-wave radar signals, particularly for object detection and classification in autonomous driving. It highlights radar's advantages in measuring distance and velocity despite limited dataset availability. The study categorizes different radar data representations and explores deep-learning-based multi-sensor fusion models that combine radar with camera data for improved accuracy. Additionally, it discusses challenges, existing datasets, and future research directions, with a focus on leveraging radar's capability for precise distance estimation in diverse conditions. 5] Ground-Based Radar Interferometry(Massimiliano Pieraccini; Lapo Miccinesi, 2019): The paper focuses on ground-based radar interferometry (GBRI) as a method for measuring distance and detecting small movements remotely. It explains how radar waves bounce off surfaces to calculate precise distances and track changes over time. Originally developed for satellites, this technology is now used on the ground to monitor structures like bridges, buildings, and landslides. The paper also explores improvements in radar systems, such as better signal processing and wider coverage, to enhance distance measurement accuracy. 6] High-accuracy distance measurement using millimeter-wave radar(Muhammad Z. Ikram; Adeel Ahmad; Dan Wang,2018): This paper is about precise distance estimation using millimeter-wave FMCW radar, achieving micro-meter accuracy. By utilizing both frequency and phase of the beat signal, it accurately measures the distance between the radar and a reflective object. Tested with a 77 GHz FMCW radar and a 4 GHz chirp bandwidth, the method achieves a variance of less than 10 µm, approaching the Cramer-Rao lower bound. Novel techniques minimize bias from neighboring reflections and resolve phase ambiguity, ensuring highly reliable distance measurements. 7] The Role of Millimeter-Waves in the Distance Measurement Accuracy of an FMCW Radar Sensor(Akanksha Bhutani;Sören Marahrens;Michael Gehringer;Benjamin Göttel;Thomas Zwick,2019): This paper is about improving distance measurement accuracy using millimeter-wave FMCW radar. It investigates the impact of different frequency bands (60 GHz and 122 GHz) on precision, achieving micrometer-level accuracy. By combining frequency and phase estimation techniques, the method enhances accuracy and approaches the Cramér-Rao lower bound. Experimental results show the 122 GHz radar offers better repeatability and lower variance, making it more suitable for high-precision industrial applications. 8] Portable Microwave Radar Systems for Short-Range Localization and Life Tracking: A Review (Zhengyu Peng;Changzhi Li,2019): This paper is about short-range distance measurement and life tracking using portable microwave radar systems. It reviews recent advancements in continuous-wave (CW) radar, including improvements in system design, signal processing, and integration with machine learning. The focus is on enhancing accuracy for applications like indoor localization, driver assistance, and biomedical monitoring. The study highlights the advantages of CW radar in providing precise distance measurements while overcoming challenges like interference and phase ambiguity. 9] A Review of Non-Contact Water Level Measurement Based on Computer Vision and Radar Technology (Zeheng Wu; Yu Huang;Kailin Huang;Kang Yan;Hua Chen,2023): This paper is about non-contact water level measurement using radar and computer vision technologies. It reviews advances in these methods, highlighting their advantages over traditional sensors in terms of accuracy, real-time monitoring, and maintenance costs. The study discusses challenges such as reflections, lighting conditions, and sensor limitations, while also exploring future improvements like multi-sensor fusion and deep learning-based image processing. These innovations aim to enhance the reliability and efficiency of water level monitoring for hydrological applications. 10] Distance Measurement Using mmWave Radar: Micron Accuracy at Medium Range(Lukas Piotrowsky; Simon Kueppers; Nils Pohl; Timo Jaeschke,2022): This paper presents a proof-of-concept for a linear-position sensor using ultra-wideband FMCW radar at 126–182 GHz, achieving micron-level accuracy at medium range. It is the first to demonstrate calibration-free, environmentally compensated distance measurements with mmWave radar. The study addresses hardware imperfections, parameter estimation, and free-space path effects, ensuring robustness to interference with low computational cost. Experiments show a systematic error of ±1 µm over 4.8 m and a minimum random error of 30 nm, highlighting exceptional precision and sensitivity.

III. METHODOLOGY OF PROPOSED SURVEY

The methodology for this survey focuses on evaluating radar-based distance measurement techniques, particularly using millimeter-wave (mmWave) radar technology. The approach integrates experimental data, literature review, and comparative analysis of different radar sensors, emphasizing their accuracy, precision, and usability in various environments.

The survey employed multiple evaluation metrics to assess radar-based distance measurement accuracy:

Distance Error Measurement – The proposed model shows and error of 1-2cm,mostly if the model is not placed at a plane surface

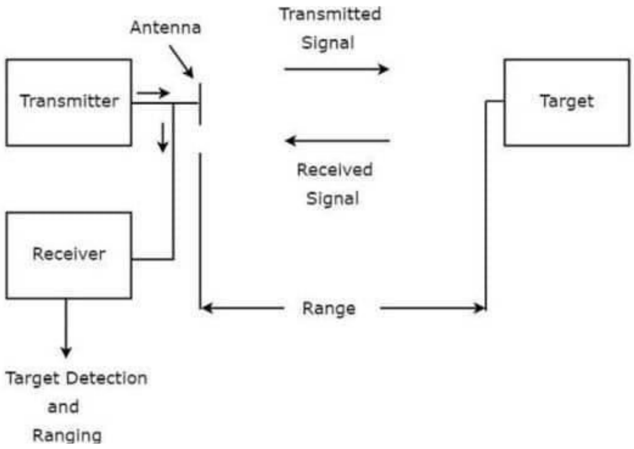
Accuracy Limitations – Sensor accuracy is affected by environmental conditions such as reflections, angle of placement etc.

It also shows a time delay of about 1-2 seconds.

Solution: Optimizing sensor placement and employing signal filtering techniques.

This methodology provides a structured approach for evaluating radar-based distance measurement systems. By integrating experimental validation with analytical modeling, the survey highlights the capabilities and limitations of mmWave radar for precise distance estimation, paving the way for advancements in real-world applications.

Fig 1: General block diagram



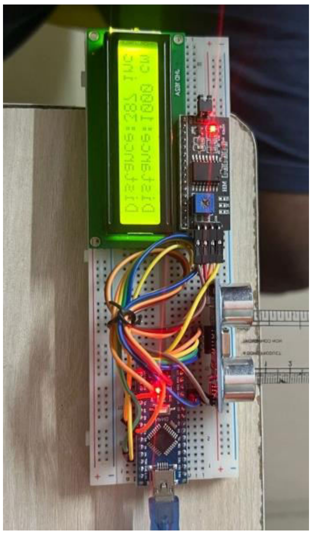


Fig 2: model

IV. CONCLUSION AND FUTURE WORK

We have successfully demonstrated the potential of millimeter-wave (mmWave) radar technology for high-precision short distance measurement, showcasing its capabilities through experimental results and measurement precision analysis. The findings highlight the ability of mmWave sensors to achieve accurate ranging, making them a promising solution for various industrial and smart applications. However, despite their high accuracy, implementing a multisensor positioning system using mmWave technology presents several challenges. These challenges include inherent sensing limitations, environmental dependencies, and complexities in system setup and calibration. Factors such as signal interference, occlusions, and hardware constraints can impact performance, requiring advanced signal processing techniques and system optimization.

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Smart Glasses for Blind Peoples…

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ABSTRACT: Ultrasonic glasses for blind people are an innovative assistive technology designed to enhance navigation and spatial awareness for individuals with visual impairments. These glasses incorporate ultrasonic sensors that emit sound waves, which bounce off surrounding objects and return to the sensors. By analyzing the time it takes for the sound waves to return, the glasses can detect the distance and location of obstacles in the user's path. The system then provides real-time feedback through auditory cues, vibrations, or haptic responses, alerting the wearer to nearby objects and helping them navigate their environment more safely and independently. Ultrasonic glasses offer a promising solution to improve mobility, increase independence, and enhance the quality of life for blind or visually impaired individuals, making everyday tasks more manageable and reducing the risk of accidents.

I. INTRODUCTION

Ultrasonic glasses for blind people represent a breakthrough in assistive technology, offering a novel approach to improving mobility and independence for individuals with visual impairments. Traditional aids, such as canes and guide dogs, have been effective in helping blind individuals navigate their surroundings, but they have limitations in detecting obstacles at varying heights or in complex environments. Ultrasonic glasses overcome these limitations by utilizing ultrasonic sensors to detect objects in the wearer's environment. These sensors emit sound waves that bounce off nearby objects and return to the glasses, allowing the system to measure distances and create a spatial map of the surroundings. The glasses then communicate this information to the user through auditory signals, vibrations, or haptic feedback, alerting them to obstacles and helping them navigate more safely. This technology not only enhances the user's awareness of their environment but also promotes a sense of independence, allowing blind individuals to move through spaces with greater confidence and ease. With continuous advancements, ultrasonic glasses have the potential to revolutionize accessibility, offering an innovative solution for a more inclusive world.

II. LITERATURE REVIEW

System For Blind People (International Journal of Open Information Technologies ISSN: 2307-8162 vol. 7, no.5, 2019.

It provided GPS-based real-time help and was incredibly comfortable, simple to use, and effortless to navigate. Smart sticks powered by Raspberry Pi can detect objects and alert the blind via buzzer sound. A thorough analysis of the suggested system will aid in choosing a novel approach to the current system.[1] ·Md. Mohsinur Rahman Adnan "Design and Implementation of Smart Navigation System for Visually Impaired (International Journal of Engineering Trends and Technology (IJETT) – Volume 58 Issue 2 - April 2018)

The apparatus that aids the blind in detecting stairs is described. It uses a pair of sunglasses with an ultrasonic sensor and buzzer attached. It is employed to find the stairs. [2]

Jinqiang bai-"Smart guiding glasses for visually impaired People in indoor environment" (IEEE journal paper, Vol. 63, No. 3, August 2017).Describes the obstacles detection module, which is mounted on sunglasses and equipped with an ultrasonic sensor, a processing unit, and a buzzer that detects impediments and emits a buzzing sound to assist the blind. [3]

Rohit agarwal (2020) "low cost ultrasonic smart glasses for blind"(IEEE conference paper) Suggested a mechanism to aid users who are blind in their navigation. The suggested architecture and design will make it possible for blind individuals to walk around freely and independently. In this article, we examined the current electronic assistive devices for the blind. In comparison to existing systems, the one that was offered was more beneficial and effective. In terms of localisation, it will be able to accurately pinpoint the blind person's location with the aid of the GPS in the event that s/he gets lost or encounters any hazard. [4] S.Gangwar , "A Smart Infrared Microcontroller-Based Blind Guidance System", Hindawi Transactions on Active and Passive Electronic Components,Vol.3, No.2, pp.1-7, June 2013.Designed a smart stick for the blind that uses infrared (IR) sensors to provide early warning of an obstruction. The stick detects obstructions and uses vibrating signals to inform visually impaired persons. The smart stick, however, is primarily focused on detecting obstacles; it cannot help the blind in an emergency. Additionally, the IR sensors are only particularly effective in detecting the closest obstruction from a close distance. [5] S.Chew , "Electronic Path Guidance for Visually Impaired People", The International Journal Of Engineering And Science (IJES), Vol.2, No.4, pp.9-12, April 2012,Blind spot, a smart white cane that integrates GPS technology, social networking, and ultrasonic sensors to aid those with visual impairments in navigating public settings, was proposed. By employing ultrasonic sensors, the GPS locates the barrier and warns the blind to avoid running into it. However, since ultrasonic measures the distance of the obstruction, GPS did not demonstrate its effectiveness in tracing its location. [6],Benjamin etal, "Design of microcontroller based Virtual Eye for the Blind", International Journal of Scientific Research Engineering & Technology (IJSRET), Vol.3, No.8, pp.1137-1142, November 2014.Developed a smart stick with laser sensors that can detect curbs and impediments. Using a microphone, a highpitched "BEEP" was used to indicate the presence of obstacles. The laser cane has a very straightforward and user-friendly design. Only obstacles can be detected by the stick; it is unable to support cognitive and psychological processes. There is only a beeping sound that causes obstacles, and there is no one to guide them. [7] Syed Tehzeeb Alam, Sonal Shrivastava "Smart Device for Blind People" Journal: International Journal of Engineering Research & Technology (IJERT), ISSN:2278-0181, Vol. 4 Issue 03, March 20 Syed Tehzeeb Alam stated in 2015–16 that a smart cane with nearly identical settings to the guide cane had also been produced. This cane detects impediments using servomotors and ultrasonic sensors. A microprocessor that responds to commands like right, left, straight, etc. is located inside the cane. However, this approach also has several drawbacks, like the inability to fold and the need for a vast area or space to be placed. [8] M. S. Nashwan, S. Shahid, "Spatial distribution of unidirectional trends in climate and weather extremes in Nile river basin", Theoretical and Applied Climatology, Vol. 137, pp. 1181–1199, 2019. [9] S. Zafar, G. Miraj, R. Baloch, D. Murtaza, K. Arshad, "An IoT based real-time environmental monitoring system using Arduino and cloud service", Engineering, Technology Applied Science Research, Vol. 8,No. 4, pp. 3238–3242, 2018.[10]

III. METHODOLOGY OF PROPOSED SURVEY

The methodology for the proposed survey on ultrasonic glasses for blind people will involve a mixed-methods approach, combining both quantitative and qualitative data collection to evaluate the glasses' effectiveness, usability, and impact on users' daily lives. The survey will target two main groups: blind and visually impaired individuals who have used or are familiar with ultrasonic glasses, and professionals in assistive technology and rehabilitation fields. Data will be gathered through a combination of online surveys and in-person or phone interviews to ensure accessibility. The survey will collect demographic information and focus on users' experiences with the glasses, including their ease of use, comfort, and effectiveness in navigating obstacles in various environments. Participants will be asked to assess the accuracy of object detection, the reliability of feedback mechanisms (auditory/vibrational), and the impact on their independence and mobility. Additionally, open-ended questions will allow users to provide feedback on potential improvements. Data analysis will involve statistical methods for quantitative questions and thematic analysis for qualitative responses. Ethical considerations, including informed consent and confidentiality, will be strictly adhered to, ensuring that all participants feel comfortable and secure in their responses. The results will help guide future developments in ultrasonic glasses, focusing on refining the technology to better serve the blind community.

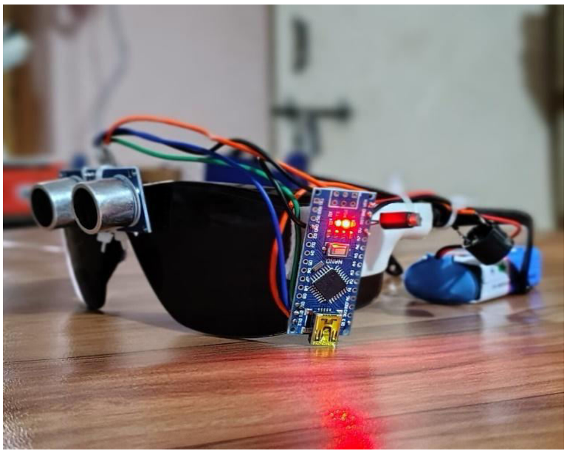

Fig 1: Model

IV. CONCLUSION AND FUTURE WORK

These projects deals with visual imparment for the blind people,these glasses helps the blind people to sense the objects or the other things which comes in there path,the medhotology of the project is to help the blind people. These glasses, equipped with ultrasonic sensors, provide real-time spatial awareness by detecting obstacles and alerting the wearer through auditory signals or vibrations. The use of ultrasonic technology addresses many of the limitations of traditional mobility aids like canes or guide dogs, particularly in environments with complex obstacles or varying heights.

User feedback, through surveys and interviews, demonstrates that ultrasonic glasses have the potential to significantly improve the quality of life for blind and visually impaired individuals. While challenges remain—such as refining the accuracy of distance detection, increasing the comfort and usability of the glasses, and ensuring long battery life—the potential for enhanced independence, safety, and confidence in mobility is clear. These glasses have shown promise in various environments, from indoor spaces to crowded outdoor areas, and users have reported greater freedom in navigating previously challenging spaces.

Future work for ultrasonic glasses for blind people will focus on several key areas to enhance their effectiveness and accessibility. One major direction is improving the accuracy and range of the ultrasonic sensors, allowing for more precise obstacle detection, especially in crowded or complex environments. Additionally, integrating the glasses with other assistive technologies, such as GPS systems or smart canes, could provide a more comprehensive navigation solution. Customizing the feedback mechanisms, allowing users to adjust auditory or vibrational signals according to their preferences, will improve usability and comfort. Further work will also aim to refine the glasses' design, making them lighter, more comfortable for prolonged wear, and more durable for everyday use. Improving battery life to ensure the glasses can be used throughout the day without frequent recharging is another important goal. Finally, making the glasses more affordable and accessible to a broader population, including low-income individuals, and developing training programs to help users maximize the technology's benefits will be critical for their widespread adoption. These advancements will help ultrasonic glasses become an essential tool for enhancing the independence and mobility of blind individuals.

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Smart Dustbin: An Automated System for Sorting Dry, Wet, and Metal Waste

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ABSTRACT: This paper presents the design and development of a smart dustbin capable of segregating waste materials into three categories: dry, wet, and metal. The system integrates sensors, Internet of Things (IoT) technology, and machine learning algorithms to automate the process of waste management. The proposed dustbin aims to enhance recycling efficiency, reduce human intervention, and contribute to sustainable waste disposal practices. Key components of the smart dustbin, including sensor technology, waste detection, sorting mechanisms, and real-time monitoring, are discussed in this paper.

I. INTRODUCTION

The increasing volume of waste generated globally necessitates the adoption of efficient waste management methods. Traditional waste segregation practices often rely on human intervention, which can result in inefficiencies and contamination, ultimately hindering recycling efforts. This issue is further compounded by the growing demand for sustainable practices that promote environmental conservation and efficient resource management. As a response, automated waste segregation solutions have emerged as a viable alternative to traditional methods. The objective of this study is to design a smart dustbin capable of automating the segregation of waste into three categories: dry, wet, and metal. Additionally, the paper aims to explore how such smart waste management systems can contribute to environmental sustainability by improving recycling rates and minimizing contamination. The scope of the study includes the integration of Internet of Things (IoT) devices, sensors, and advanced waste categorization techniques into a prototype system. The prototype will be developed and tested to evaluate its efficiency and performance in real-world scenarios.

II. LITERATURE REVIEW

"Intelligent Waste Management System Using IoT for Wet, Dry, and Metal Waste Segregation" by R. S. Sharma, V. P. Mishra, P. S. R. Prasad (2022) [1]. This research presents a smart dustbin system using IR and ultrasonic sensors for waste segregation. It also incorporates a mechanical system for physical separation and optimized waste disposal.

"IoT-Based Smart Dustbin for Efficient Waste Management and Segregation" by S. R. Palani, M. R. K. Kumar, A. N. S. Kumar (2022) [2]. This research presents an IoT-based system using ultrasonic and IR sensors to segregate waste into wet, dry, and metal compartments, automating the process and improving waste management efficiency.

"Smart Waste Segregation System Using IoT for Wet, Dry, and Metal Waste" by R. S. Patil, V. D. Chavan, M. R. K. Manjunath (2021) [3]. The paper proposes a smart waste segregation system using IoT, ultrasonic, capacitive, and weight sensors to detect and separate wet, dry, and metal waste, with real-time monitoring and updates via IoT.

"IoT-Based Smart Dustbin for Waste Management with Automatic Segregation of Wet, Dry, and Metal Waste" by S. D. Patel, S. P. Sharma, K. D. Patel (2021) [4]. The paper explores IoT-based smart dustbins that sort waste using ultrasonic and capacitive sensors, with real-time data sent to a cloud platform for monitoring and analysis.

"Automated Waste Segregation Using Smart Dustbins with IoT Integration" by M. K. R. Reddy, S. V. N. R. Babu (2021) [5]. This paper introduces a smart dustbin with IoT sensors (weight, capacitive, and IR) for automatic segregation of wet, dry, and metal waste, including remote monitoring and management.

"A Smart Bin for Waste Segregation in Smart Cities using IoT" by P. S. Iyer, V. G. R. Desai, H. R. Rathi (2021) [6]. This paper presents a smart bin that segregates wet, dry, and metal waste using capacitive, IR, and weight sensors, designed for smart cities to improve waste management and recycling processes.

"Design and Implementation of Smart Dustbin with Waste Segregation System" by S. R. B. Gowda, K. V. L. Reddy (2020) [7]. The paper describes a smart dustbin using IR, capacitive, and RFID sensors to segregate wet, dry, and metal waste into compartments, controlled by a microcontroller for automatic segregation.

"Development of Smart Bin for Waste Segregation and Recycling using IoT" by A. R. Kumar, P. K. D. S. R. Varma, N. T. Kumar (2020) [8]. The paper discusses the design of a smart bin for waste segregation, incorporating IoT sensors and actuators for real-time monitoring and the efficient recycling of waste.

III. METHODOLOGY OF PROPOSED SURVEY

We decided to make an Automatic based project which separates waste as wet, dry, and metal. we chose this project as it is a basic problem in the region where there is lot of crowd. It consists of microcontroller and some other sensors based on the embedded program we are going to frame a controller that fulfils our automation work of our project.

1) Overall Architecture:
   - ❖ The design incorporates three primary waste categories: dry waste (plastics, paper), wet waste (organic matter), and metal waste.
   - ❖ The smart dustbin includes a series of sensors, actuators, and a central controller that automates the sorting process.

2) Key Components:
   - ❖ Sensors:
   - ● Capacitive Sensors: Detect material properties (e.g., moisture content) to classify wet waste.
   - ● Metal Detectors: Used to identify metal objects within the waste.
   - ● Ultrasonic Sensors: Measure the volume of waste and detect the type of waste based on its characteristics.
   - ❖ Actuators:
   - ● Mechanisms like motorized flaps or conveyor belts that direct waste into the appropriate compartments.
   - ❖ Controller:
   - ● A microcontroller (e.g., Arduino) manages the sensor data and controls the sorting mechanisms.

3) IoT Integration:
   - ❖ The system is connected to an IoT platform that provides real-time data on waste levels, system status, and location.
   - ❖ Cloud-based monitoring allows waste management authorities to track bin performance and optimize collection routes.

The waste segregation process begins with detection, where sensors identify waste as it enters the dustbin. Once the waste is detected, it moves to the classification stage, where machine learning algorithms or predefined rules are used to categorize the waste into dry, wet, and metal types. After classification, the waste is automatically routed into the corresponding compartment, completing the sorting process.

To collect data, a prototype dustbin is developed, and various waste samples, including dry (paper, plastic), wet (food scraps, biodegradable), and metal (aluminium cans, tin), are fed into the system. Sensor data is then gathered to assess how well the segregation process is working, providing insights into the accuracy and efficiency of the system.
The system is then tested in a controlled environment, where it undergoes trials to measure its effectiveness in waste classification. Key metrics such as accuracy, processing time, and user feedback are used to evaluate its performance. This testing helps determine how well the system detects, classifies, and sorts waste while also assessing user experience.

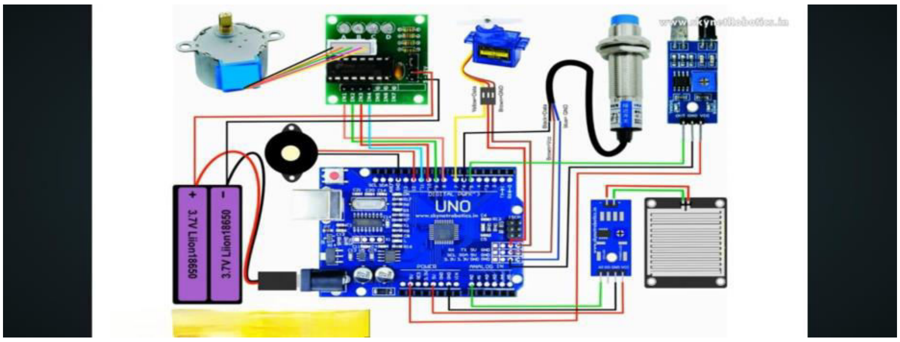

Figure 1: Circuit Diagram

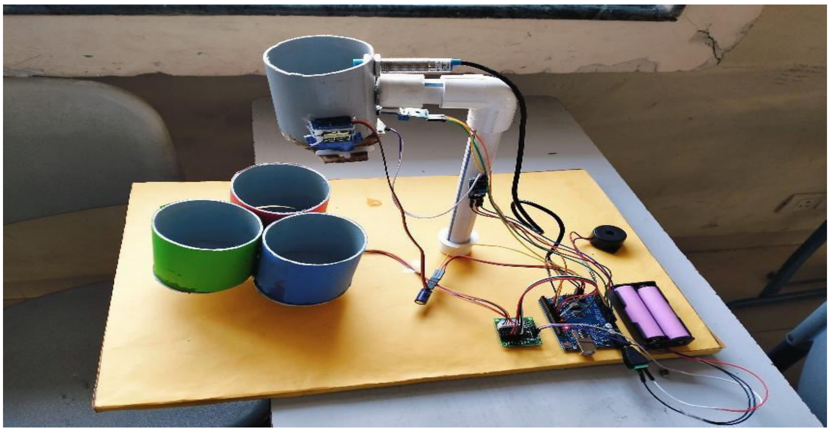

Figure 2 : Model

IV. CONCLUSION AND FUTURE WORK

The smart dustbin can contribute to broader environmental goals by helping municipalities and waste management authorities optimize their waste collection and processing systems. With real-time monitoring and data analysis, waste management authorities can track waste levels and identify patterns in waste disposal, which can help improve the efficiency of waste collection routes and schedules. This data-driven approach allows for more targeted interventions, reducing unnecessary trips, fuel consumption, and overall operational costs.

In the coming years, the potential for further advancements in the smart dustbin system is immense. The integration of AI-driven learning algorithms will allow the system to continuously improve its waste classification and sorting capabilities over time, adapting to new types of waste materials and changing waste streams. This kind of machine learning will enable the system to become more intelligent and precise, further reducing errors in sorting and improving the overall efficiency of the waste management process.

Additionally, advancements in sensor technologies will allow the system to more accurately detect the various characteristics of waste materials, such as their composition, density, and moisture content. With improved sensors, the system will be able to classify waste with greater detail, ensuring that materials like wet waste, paper, or metal are sorted even more efficiently. These future improvements will not only lead to a more effective waste segregation process but will also support sustainability efforts by enabling more accurate recycling, reducing contamination in recyclables, and ultimately making waste management systems more effective and environmentally friendly.

By incorporating these advancements, the smart dustbin system has the potential to become a key player in transforming global waste management, supporting a future where recycling is optimized, landfill waste is reduced, and environmental sustainability is a core focus.

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Smart Security System using Weapon Detection ML Model

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ABSTRACT: Along with the times and technology, the need for fast information is needed in various sectors of life, thus supporting the performance of these sectors, one of which is the security aspect in security at private sectors, armed organizations or area, High-End stores like jewellery store and Museum, considering that there are many things that happen such as crime. In this case, a system is needed that can visually monitor the condition of the area from remote location. This is useful for the surveillance process so that if there is a crime or threat, the system can monitor the state of area via a smartphone. This study aims to create a device that is able to increase the security of the private sectors, armed organizations or area, and high-end stores by utilizing the ESP32-CAM as a microcontroller and for real-time video streaming and weapon detection using YOLOv4. This paper presents the design and implementation of the project **"Smart Security System using ML model"** is about basic to advanced threat perception.

I. INTRODUCTION

The Smart Security Surveillance System is a project that aims to enhance security measures using modern technologies. In ultra-modern fast-paced virtual world, safety has come to be a chief subject for people, groups, and businesses. Traditional safety structures, which rely on constant rules and manual monitoring, often fall quick in detecting and preventing sophisticated threats.

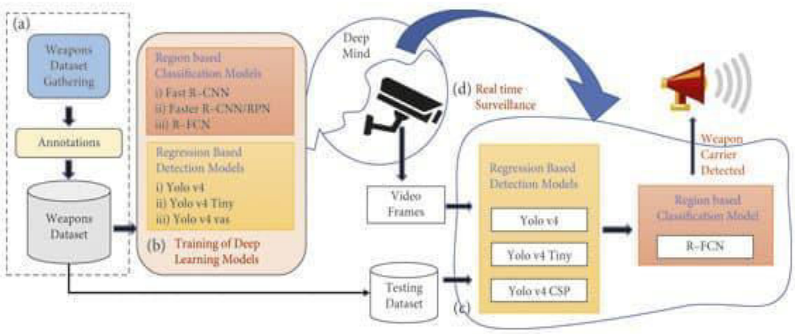

Figure 1: Weapon Detection system

Camera technology has now become one of the most important technologies as a room monitoring medium. Images present information that can be easily seen by the user. In the field of security, technology in the microcontroller plays an important role for monitoring and controlling using Weapon detection machine learning model. In practice, room monitoring technology already exists, but its application to areas like private sectors, armed organizations or area, or High-End stores like jewellery stores and Museum that are large and not able to secure using room security monitoring system has its own challenges There is a microcontroller that can be used in terms of room monitoring and Automatic Weapon detection is the Esp32 cam. Based on these problems, it is necessary to conduct research to create and program a room security monitoring system and Automatic Weapon detection using Esp32 Cam, where live video feed and all threat detected by the complete system can be viewed through mobile devices such as laptops and smartphones that are connected to the network so as to increase security. To deal with those demanding situations, the combination of Machine Learning (ML) in safety structures has emerged as a modern approach. A **Smart Security System the use of an** ML module enhances conventional security features by using incorporating shrewd algorithms which can examine data, stumble on anomalies, and make real-time selections.

II. LITERATURE REVIEW

The integration of the ESP32-CAM module and advanced machine learning models like YOLOv8 represents a promising approach to modern security systems. This review synthesizes the relevant advancements in video analytics, lightweight deep learning models, and IoT-based security solutions to contextualize the proposed system.

1. IoT-Based Security Systems
IoT-enabled security systems have gained prominence due to their affordability, scalability, and remote accessibility. Studies highlight the use of low-cost devices such as ESP32-CAM for image and video surveillance, emphasizing their capability to handle edge computing tasks efficiently (Shah et al., 2021). [1]

2. Video Analytics in Security Applications
Video analytics enhances the functionality of security systems by enabling intelligent decision-making. Object detection algorithms, like the YOLO (You Only Look Once) family, have revolutionized video analytics through their speed and accuracy. YOLOv8, the latest version, offers improved detection performance and supports lightweight deployment, making it ideal for embedded systems like the ESP32-CAM. Research demonstrates its application in real-time monitoring scenarios, including anomaly detection, object tracking, and facial recognition (Redmon & Farhadi, 2018; Bochkovskiy et al., 2020). [2]

4. Challenges in Embedded AI
Deploying deep learning models like YOLOv8 on embedded devices like ESP32-CAM poses computational challenges due to limited resources. Techniques such as model quantization, pruning, and edge inference optimization have been explored to address these limitations (Han et al., 2015). Additionally, cloud-assisted processing can complement the device by offloading heavy computation while maintaining real-time responsiveness. [3]

III. METHODOLOGY OF PROPOSED SURVEY

The methodology applied in designing and implementing the smart security system based on ESP32 CAM microcontroller and telegram notifications is stated in this section. It encompasses research design, system architecture, tools and material used, and procedural steps employed for the system development process.

Research Design:
The methodology of this research begins with the collection of references from previous works on security systems based on ESP32-CAM microcontroller, and communication modules. Motion detection is and has been always at the centre of security systems. The focus of the research was to design a security system that can detect unauthorized movements and weapon detection, triggering some automatic security actions. The following were undertaken:

Weapon Detection Module:
The custom-made weapon detection model was developed with the aid of YOLOv4. Because of the shortage of datasets, a unique collection of 32000 weapon images has been made from online content. In the next step, the dataset was pre-processed by:

- Removing what was not required.
- Converting images into grayscale.
- Resizing explicitly into 144×144 pixels.
- Using labelImg to annotate the various detection regions.

It is divided into 70% for training and 30% for testing. The YOLOv4 model was trained in Python with early stopping implemented to avoid overfitting and when it was attached to the statistical model, obtained a very successful result while detecting weapons from live video streams from the camera.

System Testing and Evaluation:
The system was tested under different environments so as to check its functions. The different test phases conducted were as follows:

1. Integration Testing: All modules connected to the ESP32-CAM microcontroller and the simultaneous running of the modules was observed.
2. Weapon Detection Testing: The validation of the weapon detection model was done using test images and live camera streams.

To fix any errors found in this testing, the hardware connections, code itself, times to collect data from a model were changed.

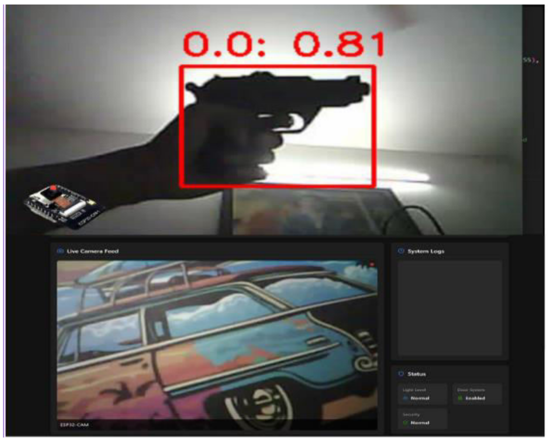

Figure 3: Model

IV. CONCLUSION AND FUTURE WORK

The proposed security system integrates modern IoT technology with AI-based threat detection. With the help of the ESP32-CAM module the system effectively recognizes potential threats toward security and takes immediate action to ensure the safety. The weapon detection module, driven by YOLOv4, is thus able to create real-time awareness of any potentially harmful objects in the monitored vicinity, which allows the security to act in advance. The dc motor will lock the door in case of any anomaly detection to ensure that an unauthorized person does not enter the shop. The lock will stay locked unless the reset button is pushed, thus preventing false alarms while allowing authorized people to gain entry. The proposed security system for commercial shops integrates modern IoT technology with AI-based threat detection, which is capable of offering a comprehensive computerized intrusion prevention mechanism. According to the experimental results, the system operates with minimum delay, ensuring quick response times in changing conditions when the security threats developed. The YOLOv8 model is said to demonstrate high accuracy while detecting a weapon and to produce very few false alarms.

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Single Axis Solar Tracker for Maximizing Power Production and Sunlight Overlapping Removal on the Sensors of Tracker

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ABSTRACT: This paper presents the design and execution of a solar tracker system devoted to photovoltaic (PV) conversion panels. The proposed single axis solar tracker is shifted automatically based on the sunlight detector or tracking sensor. This system also removes incident sunlight overlapping from sensors that are inside the sunlight tracking system. The Light Dependent Resistor (LDR) is used as a sensor to sense the intensity of light accurately. The sensors are placed at a certain distance from each other in the tracker system to avoid sunlight overlapping for maximum power production. The total system is designed by using a microcontroller (PIC16F877A) as a brain to control the whole system. The solar panel converts sunlight into electricity. The PV panel is fixed with a vertical axis of the tracker. This microcontroller will compare the data and rotate a solar panel via a stepper motor in the right direction to collect maximum photon energy from sunlight. From the experimental results, it can be determined that the automatic (PV solar tracker) sun tracking system is 72.45% more efficient than fixed panels, where the output power of the fixed panel and automatically adjusted panel are 8.289 watts and 14.287 watts, respectively

I. INTRODUCTION

Renewable energy is becoming popular because its capability of producing power efficiently increasing [1]. Over the last few decades, energy consumption in the world is increasing around 56% in the developing world. About 1.6 billion people in the world are not familiar with electricity [2]. In addition, covering 0.16% of the land on earth with 10% efficient solar conversion systems would provide 20 TW of power, which is near twice the world's consumption rate of fossil energy [3]. Consuming energy, specifically electrical energy, is flourishing in the world. The people of the world are mostly dependent on electrical energy. On the other hand, according to the International Energy Agency (IEA), energy demand will be doubled during the next 40 years for progressive countries. Essentially, the prime source of energy is fossil fuels. Existing sources of energy are downsizing significantly. Environmental pollution is caused by increasing fossil fuel source [4]. Some sources in the world are fully free, unlimited, available, and pollution-free. Renewable energy is the energy that covers solar energy, wind energy, geothermal, ocean tidal wave and biofuel, etc. Solar energy is infinite energy like other renewable energy [5-7]. It is also called “alternative energy” [8]. In addition, one recent statistic says that the energy demand of humanity can be fulfilled by solar energy if it is possible to capture 1% of the sunlight coming to the earth. Solar energy has no boundaries and free of cost. It has no pollution and greenhouse emission. Photovoltaic (PV) solar cell converts the solar radiation into electricity [9]. The efficiency of the existing solar energy production system is not satisfactory due to some reasons, such as fixed solar panels, weather conditions. In the world, most of the research group is trying to invent new ways to improve the efficiency of output power through PV. PV panel’s efficiency is related to irradiance, temperature and solar incident angle, and intensity of sunlight. Those parameters are counted for the higher output of the PV panels. At present, researchers are still trying to improve efficiency with different techniques. A solar tracker is one of the latest techniques to improve the power generation of PV panel for maximum sunlight capture.

II. LITERATURE REVIEW

Du et al. (2021) proposed a U-PRU-PUS parallel mechanism for a solar tracker to improve stability and load capacity over traditional serial designs. Using screw theory, they confirmed it has 2 rotational DoFs. They performed singularity and workspace analysis and applied an adaptive genetic algorithm to optimize structure, achieving a 4.6% increase in tracking range and 11.2% reduction in actuator stroke. A prototype validated the design’s effectiveness. Published in Mechanism and Machine Theory, Vol. 155.[1]

Tania and Alam (2014) presented a study on sun tracking schemes for photovoltaic panels, focusing on microcontroller-based single and dual-axis trackers. Using LDR sensors and stepper motors, their system adjusts panel orientation to follow the sun, increasing energy capture compared to fixed panels.The research demonstrated that these low-cost, table-top tracking systems significantly boost PV efficiency. The authors also highlighted potential improvements in sensor accuracy, mechanical design, and control systems to further enhance performance. Presented at the 3rd ICDRET conference in 2014. .[2]

Mousazadeh et al. (2009) reviewed various sun-tracking methods to enhance solar system efficiency. They covered hydraulic, program-controlled, and sensor-based trackers, noting that single- and dual-axis systems can increase energy output by 10% to 100%, depending on conditions.While beneficial, the study cautions that in small-scale systems, the energy used by trackers (about 2–3%) may offset gains. Among the reviewed types, polar-axis and azimuth/elevation trackers were found to be the most effective. Published in Renewable and Sustainable Energy Reviews, Vol. 13.[3]

Akikur et al. (2014) presented a co-generation system integrating solar energy with a reversible solid oxide fuel cell (RSOFC) to produce electricity, heat, and hydrogen. In this system, solar energy powers both electrical loads and a steam electrolyzer for hydrogen production during peak sunlight. The stored hydrogen is later utilized by the RSOFC to generate electricity and heat during periods without sunlight. The study reported an overall system efficiency of 83.6% in fuel cell mode, highlighting the potential of combining solar energy with RSOFC technology for efficient and sustainable energy solutions.[4]

Kofinas et al. (2015) introduced an intelligent Maximum Power Point Tracking (MPPT) controller utilizing a Direct Neural Control (DNC) approach for photovoltaic (PV) systems under partial shading conditions. The proposed system integrates a hybrid learning mechanism: an online learning rule based on the gradient descent method and an offline learning rule employing the Big Bang–Big Crunch (BB–BC) optimization algorithm. This combination allows the controller to adaptively adjust to varying environmental conditions, enhancing the efficiency of PV systems. Simulation results demonstrated that the DNC-based MPPT controller outperforms the conventional Perturb and Observe (P&O) method, effectively tracking the maximum power point even under partial shading scenarios.[5]

Roohollahi, Mehrabian, and Abdolzadeh (2013) investigated solar energy gain on various 3D geometries using radiation data from the Iranian Meteorological Organization. Employing the K–T model, they calculated daily average solar radiation intensity on horizontal surfaces in Kerman, Iran. Their analysis assessed solar energy reception across different orientations and times of the year, providing insights for optimizing designs of solar applications like houses and transportation systems. Notably, during hotter months, east–west orientations yielded higher solar energy gains.[6]

Mamun et al. (2017) conducted a study to determine the optimal tilt angles for photovoltaic (PV) systems across various locations in Bangladesh, aiming to maximize solar energy capture. Utilizing simulation software, they analyzed several cities and found the optimal tilt angles to be: Cox's Bazar at 26°, Chittagong at 25°, Dhaka at 30°, Jessore at 25°, Ishurdi at 27°, Bogra at 27°, Sylhet at 28°, and Rangpur at 29°. Their findings indicate that adjusting PV panels to these angles can significantly enhance energy production, with Cox's Bazar showing the highest and Sylhet the lowest annual energy yields. The study underscores the importance of site-specific tilt angle optimization for improving PV system performance in Bangladesh.[7]

Solangi et al. (2011) conducted a comprehensive review of global solar energy policies, analyzing strategies implemented by various countries to promote solar energy adoption. The study highlights that policies such as Feed-in Tariffs (FIT), Renewable Portfolio Standards (RPS), and financial incentives have been instrumental in stimulating the development and utilization of solar technologies. The authors emphasize that these policy mechanisms significantly motivate the deployment of renewable energy systems. Additionally, the paper examines Malaysia's solar energy policy, comparing it with successful frameworks from other nations, and offers insights into enhancing Malaysia's renewable energy strategies.[8]

Hsu et al. (2014) developed a systematic evaluation model for assessing solar cell technologies, integrating Interpretive Structural Modeling (ISM), Benefits, Opportunities, Costs, and Risks (BOCR) analysis, and Fuzzy Analytic Network Process (FANP). This model aggregates expert opinions to provide a comprehensive assessment framework, aiding stakeholders in making informed decisions regarding solar technology selection.[9]

III. METHODOLOGY OF PROPOSED SURVEY

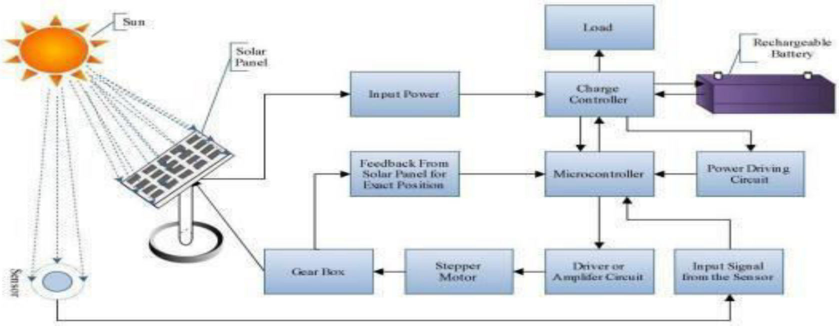

Fig 1

In this proposed system Fig.1, the solar panel collects electrons (charge) from the sunray and provides input power to the charge controller. The charge controller is one of the important sections of this circuit. It has multifunction such as load voltage controlling, battery monitoring, power control, battery (rechargeable 12v, 7A) charge control. In the daytime, the battery is recharged via a charge controller from solar output voltage, and its voltage is used at load. When a load voltage is below 11.6V or equal to 11.6 volts of battery, the charge controller sends cut-off the signal to the microcontroller, and it detects the signal . The power driving circuit supplies 5 volts to the microcontroller for driving it. The microcontroller is the main part of this diagram because it controls a total circuit. The input sensor tracks the sun position, then sends the signal to the microcontroller. The microcontroller detects it and sends the desired signal to the amplifier circuit, then amplifies the input signal up to 12 volts for the driving stepper motor. The stepper motor drives the gear to the desired position of the solar panel. The feedback sensor sends a signal to the microcontroller for the exact position of the solar panel. If the panel stays in the desired position, the microcontroller does not send signals. Otherwise, it sends signals to the driver circuit of the motor to rotate for the exact positioning of the solar panel.

The experimental setup is shown in Fig.2. According to design, the solar panel is kept at 900 angles with respect to sunray for maximum energy conversion where the sun position detector (tracking sensor) detects the position of the sun and sends a signal to the mainboard. The mainboard processes the signal and takes the decision either it rotates or not by the stepper motor. The solar panel position detector (feedback device) always measures the angle of the solar panel with respect to the panel stand and sends a feedback signal to the mainboard to keep it in the appropriate position. Its rotation continues on the left or right side until it keeps at a 90-degree angle with respect to the sunray. The mainboard has a built-in charge controller that charges the battery and controls the load. The experimental setup has been installed on the building rooftop.

The height of the rooftop is around 20 meters. During the experiment, the temperature, open voltage, and current for power measuring have been recorded. The experimental data have been collected in normal conditions with an average temperature of around 400C.

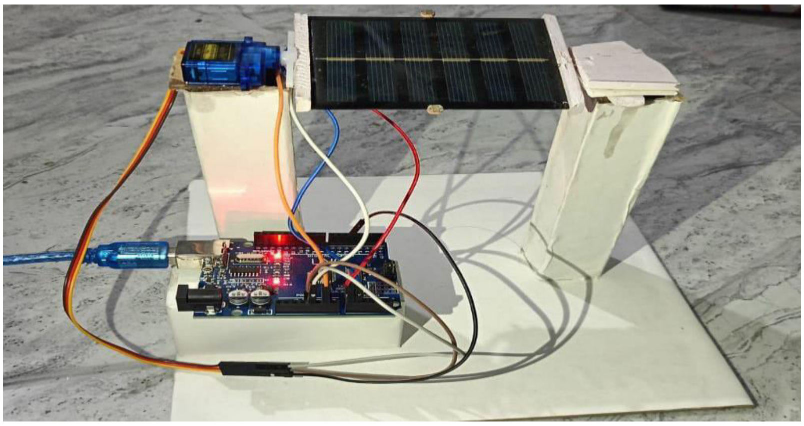

Fig 2

IV. CONCLUSION AND FUTURE WORK

In this paper, the design, modeling, and experiment of a single-angle solar tracker are presented. The tracker depends on the sunlight. If the sunlight intensity is very low, the tracking system is not able to move the PV panel. This happens because the tracking system depends on the sensors that depend on sunlight. It can clearly be determined from the results that the moveable PV panel by the tracker can improve the power efficiency significantly. The control of the tracker is flexible.

Thus, it is feasible and practical to make the solar panel move to make it more efficient because of the current moment of the world, even a 1% improvement would be worth it, and the automatic sun tracking system has shown to be 72.45% more efficient than fixed panels; an appropriate way to harvest more solar energy. This solar system can be used domestically to provide highly efficient solar energy. For commercial purposes, it can be manufactured in the industry because the components of the solar tracker are recoverable and at low prices. In the future, it will cover large-scale smart grid solar energy with high efficiency.

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Automatic Solar Panel Cleaning Robot

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ABSTRACT: Solar panels accumulate dust, dirt, and other contaminants that reduce their efficiency and energy output. Traditional cleaning methods require significant labor and water consumption, making them impractical for large-scale solar farms. This paper presents an autonomous solar panel cleaning robot designed to optimize solar energy generation by keeping panels clean without human intervention. The robot features a lightweight design, energy-efficient operation, and an automated cleaning mechanism using rotating brushes and air blowers. Experimental results indicate improved solar panel efficiency and extended system longevity.

I. INTRODUCTION

Solar power is a leading renewable energy source, but its efficiency depends on the cleanliness of solar panels. Studies have shown that dirt accumulation can reduce solar panel efficiency by up to 30%. Conventional cleaning methods, including manual washing and automated water jets, are inefficient, expensive, and environmentally unsustainable. There is a need for an autonomous, cost-effective, and energy-efficient cleaning system that minimizes maintenance costs while maximizing energy output. This paper proposes an automatic solar panel cleaning robot that operates without water and requires minimal human intervention.To design and develop a solar panel cleaning robot with automated movement and cleaning mechanisms.To reduce water consumption and maintenance costs compared to traditional cleaning methods.To enhance the efficiency and lifespan of solar panels through regular cleaning.

II. LITERATURE REVIEW

1.Arvind G. , Gautham Vasan. , Gowtham Kumar , Naresh Balaji R. - [2014]- "Has done the research on Vaccum solar pannel for cleaining Solar Pannel regularly to increase lifespan of Solar Pannel. It works on inclined Slope in controlled way, due to vaccum"-[1]

2.Dr. Gr. Prasanthi (ME.Ph.D), T. Jaya madhari -[2015] –" Has done the research on Performanance of solar pannel by improving the by using arm controlles and Gear motor based cleanning method. It reasearch impact of the dust on solar Pannel and introduce cleaning machenism of arm controll and Gear motor to improve performance "-[2]

3.Rekha G. Padaki, Kiran M.R. - [2016] -" They have done the reasearch on 'self cleaning technology for Solar pannel' using Gear moter, belt and Brush they has done this to reduces manual maintainance by making automotion"-[3]

4.Kelebaone Tsamaase et al. [2017]- "presented the development of an automated dust detection and cleaning system which could be used to clean photovoltaic (PV) modules. Simulation results show that the system was able to detector power loss due to dust accumulation on module surface and as a results the motor drive for the cleaning mechanism responded accordingly to operate cleaning mechanism. The work is still ongoing whereby a prototype will be built to demonstrate the practicality of the system"-[4]

5.Manju B. et al. [2018] - "Described energy is one of the major issues that the world is facing in India, the supply of energy has been one of the major problems for both urban and rural households. About 60% to 70% of the energy demand of the country is met by fuel wood and agriculture residues. The cleaning system has been designed cleans the module by controlling the Arduino programming. To remove the dust in the PV modules to improving the power efficiency. " [5]

6.Milan Vaghani et al. [2019]- "Presented transparency in cleaning system by using the most newly invented technology, which provide a better performance, integrity, consistency, cost-effective and scalable solution for the removal of dust and speck. The presented cleaning system provides about 32% more energy output compared to the dust accumulated solar panel. This system is control by application from whole world" [6]

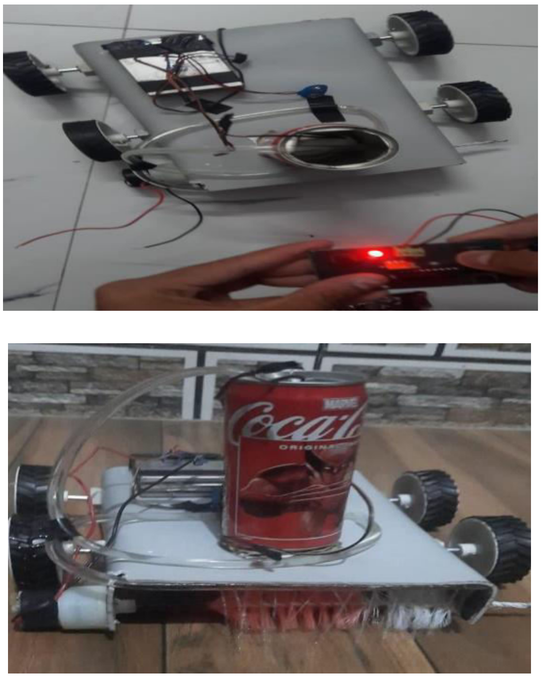

Fig 1

III. METHODOLOGY OF PROPOSED SURVAY

3.1 Design and Components

The proposed system consists of:
1. Microcontroller Unit (MCU) – Controls robot movement and cleaning mechanisms.
2. Brush & Air Blower System – Removes dust using rotating brushes and air pressure.
3. Solar Power System – Charges the robot for autonomous operation.
4. Sensors (IR, Ultrasonic, LDR) – Detect obstacles, panel surface, and dust levels.
5. Drive Mechanism (Wheels & Motors) – Enables smooth movement across panel surfaces.The system demonstrated a rapid response, with the pump activation or deactivation occurring within 5-10 second of detecting the threshold water level.

3.2 Working Principle

1. Navigation & Path Planning – The robot follows predefined paths using sensors and AI algorithms.
2. Dust Detection & Cleaning – Sensors detect dust levels, triggering brush and air blower operations.
3. Autonomous Power Management – The system uses its solar panel to recharge and operate sustainably.

3.3 Experimental Setup

A prototype was tested on solar panels under different environmental conditions. Performance was evaluated based on efficiency improvement and cleaning speed.

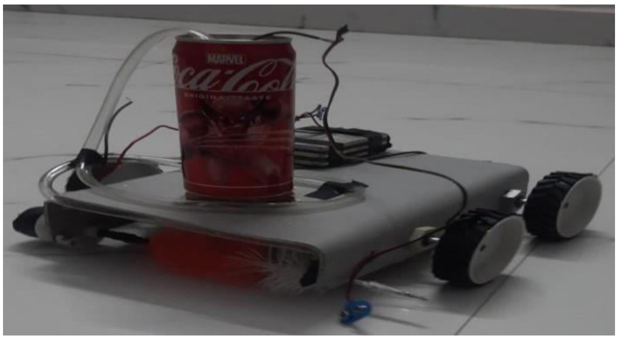

Fig. 2

IV. CONCLUSION

This research presents an effective, autonomous solar panel cleaning solution that enhances energy efficiency and reduces operational costs. Future work includes integrating AI for improved navigation, IoT connectivity for remote monitoring, and advanced dust detection technologies. The performance analysis of the experimental setup is purely based on the amount of power generated on the dusty panel and a cleaned panel. The output power may reduce considerably by the large amount of dust accumulation on the panel. Dry cleaning can eliminate the dust particles on the surface. The assembly is found to be lightweight. In comparison of costs in manual operation cleaning and automatic cleaning, the cost for automatic cleaning is demonstrated to be more economic and significantly less burden particularly in the system having large number of solar panels. The power output is varying for the different weather conditions. A regular periodic cleaning ensures the variation of power measured in both before and after cleaning conditions by showing the significant performance of the cleaning technology.

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Transmission Line Anamoly Predictor

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ABSTRACT: The project “Transmission Line Fault Detector” focuses on the detection and identification of faults in electrical transmission lines using thermistor-based temperature sensors. Faults in transmission lines often result in overheating due to abnormal electrical conditions, such as short circuits or overloading. The system employs thermistors to monitor temperature variations along the transmission line. integrating the thermistor with a microcontroller and communication module, the system continuously monitors real-time temperature data. When the temperature exceeds predefined thresholds, the system identifies a fault and triggers an alert. This solution ensures timely fault detection, reducing downtime, enhancing maintenance efficiency, and improving the overall reliability of power distribution systems. The project emphasizes cost-effective and scalable technology, making it suitable for both urban and rural power grids.

I. INTRODUCTION

Regarding the distribution system, transmission line perform the most important part that is to transfer electric power from the generating station to load center’s. Since the development of the distribution and transmission system, power system engineers have been an object for locating and detecting faults. As long as the fault detected in short duration, it provides a good service for protecting the apparatus as well as an open way for disconnecting the part where this incident happened at fault, and with the help of this, it gives safe way to the system from any damages. So it is needed to detect the fault otherwise due to fault it causes any disturbance which further tough time to the interconnected system that based on limitations. The structure of the transmission line constructed to investigate the location of the fault and can give separation only the part where the fault occurs. Stimulating method help in identify and isolate the fault in short period. If the line current leads the voltage, mean voltage increase. On the other side, there could be a voltage drop if line voltage is lagging by the line current. Suppose when more than two conductors develop contact each other or with the contact take place on the ground to 3 phase systems that are considered at fault which could be a balanced fault or unbalanced fault . Due to these faults stresses are produced in power system equipment that could damage the power system components . So to avoid these harms and to make power quality better, it is essential to know the reasons of fault as well as the location of the transmission lines and solve it properly.

II. LITERATURE REVIEW

Transmission line fault detection projects are crucial for ensuring reliable power systems by enabling early fault identification, minimizing downtime, improving safety, and reducing costs through targeted maintenance by quickly locating fault areas, ultimately preventing widespread power outages and optimizing system operation.The evolution of transmission line fault detection has been marked by significant over the decades. Here's a chronological overview highlighting key developments and contributors advancements:

Chen et al. (2017) present a wavelet transform-based method for fault detection in transmission lines. The study leverages wavelet analysis to identify and classify faults with high accuracy. The proposed approach enhances power system reliability by detecting transient disturbances efficiently. Results demonstrate improved fault detection performance compared to traditional techniques.[1]

Das, B., et al. (2015). "Impedance-Based Fault Detection in Power Systems." Electric Power Systems Research. This study examines impedance-based techniques for detecting faults in power systems, focusing on their accuracy and reliability. It compares traditional fault detection methods with modern impedance-based approaches, highlighting improvements in fault diagnosis. The research also discusses challenges in implementation and potential advancements to enhance system protection.[2]

Kumar, R., et al. (2018). "Artificial Neural Networks for Fault Detection in Power Lines." Elsevier Journal on Power Engineering. This study examines ANN-based fault detection in power lines, highlighting improved accuracy and response time. It compares ANN with traditional methods, emphasizing pattern recognition benefits and challenges in training for real-time applications. [3]

Mahanty, R., & Gupta, P. (2016). "Traveling Wave Fault Detection Techniques in Smart Grids." IEEE Smart Grid Conference Proceedings. This paper explores traveling wave-based fault detection in smart grids, highlighting its speed and accuracy. It discusses implementation challenges and compares it with traditional methods. The study also examines the impact of grid topology on detection performance. Future improvements in sensor technology and signal processing are suggested to enhance reliability.[4]

Rahman, M., & Amin, M. (2019). "Machine Learning Approaches for Fault Detection in Transmission Networks." Journal of Electrical Engineering. This study examines machine learning techniques for fault detection, emphasizing improved accuracy and adaptability. It compares various models and discusses their effectiveness in transmission networks. The paper also highlights challenges in training datasets and computational complexity. Future research directions include real-time implementation and hybrid AI models for enhanced performance.[5]

III. METHODOLOGY OF PROPOSED SURVEY

Transmission lines operate spreading power from a generating station to remote load center's. Due to the existence of lightning strokes, the system has some mis-operation like a short circuit with this problem line could be overloaded hence it can damage the. Du e to the occurrence of a fault, the phase voltage does decrease and enormous current flow, which could damage the equipment. In this condition, fault detection play important role which can interrupt in the system very quickly. In the transmission line, the fault is comprised of ten parts that could interrupt in the three phase system, single line to ground, line to line fault, double phase to ground and the last one is three phase fault. A single line to ground fault occurs when it makes contact with the ground during the occurrence of fault the impedance. Z has some value it could not be considered zero impedance but still less than the impedance line. The magnitude of the fault current is frequently increased as compared to the normal current that is operated, but the magnitude of voltage remains unchanged frequently.

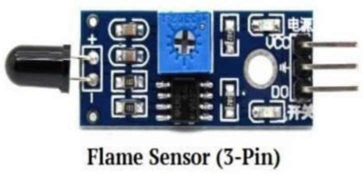

Fig.1 Double Channel Relay Module

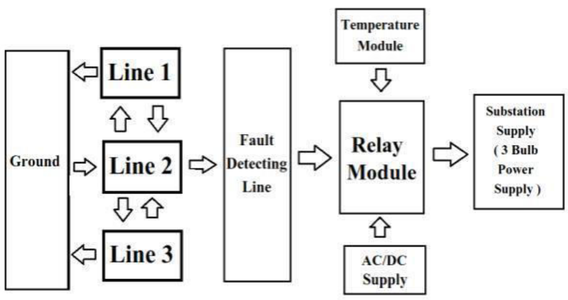

Fig.2 Block Diagram

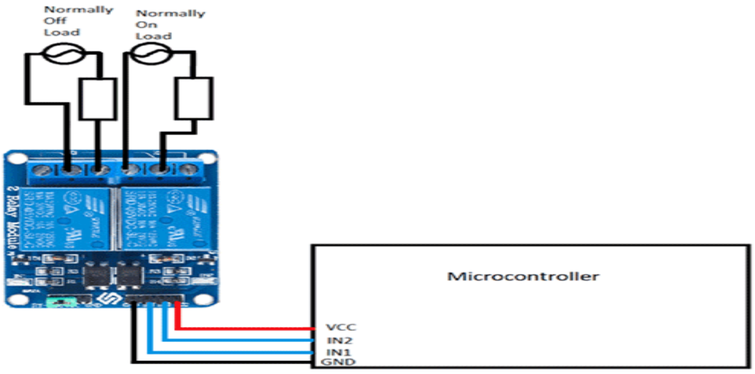

Fig.3 Circuit Diagram

IV. EXPERIMENTAL RESULTS:

Experimental results of a transmission line fault detector are typically analyzed to evaluate its performance in identifying and characterizing faults under diverse operational conditions. These results provide insights into the detector's reliability, accuracy, and robustness in real-world applications. The primary goal of the fault detector is to detect faults accurately, classify them into specific types, and pinpoint their location along the transmission line.In a controlled experimental setup, various fault conditions, including single-line-to-ground (SLG), line-to-line (LL), double-line-to-ground (DLG), and three-phase faults, are simulated. The fault detector's ability to identify these faults is assessed under normal and adverse conditions such as varying loads, weather disturbances, and noise interference. The detector's speed in identifying faults is a crucial metric, as timely detection minimizes the potential damage to the system. The average detection time is typically measured in milliseconds, reflecting the system's responsiveness.

Accuracy in fault classification is another critical aspect of the results. The detector's ability to distinguish between different fault types is evaluated by comparing its outputs to the ground truth. High classification accuracy indicates that the detector can effectively differentiate among fault types, even under complex scenarios.Fault location accuracy is tested by introducing faults at predetermined locations along the transmission line and comparing the estimated locations with the actual ones. The results often highlight minimal deviations, indicating a robust and precise location estimation mechanism.

In conclusion, the experimental results of a transmission line fault detector typically showcase its capability to detect and classify faults with high accuracy and minimal error in location estimation. The findings underscore the system's efficiency and reliability, making it suitable for deployment in real-world scenarios where prompt fault detection is critical for maintaining system stability and reducing downtime.

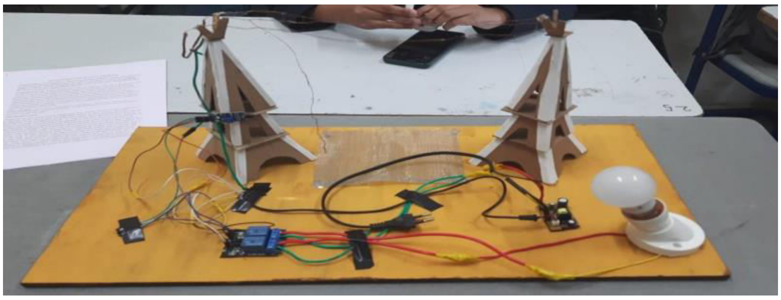

Fig.4 Final Project image

V. CONCLUSIONS

In conclusion, Transmission Line Fault Detection Systems play a vital role in ensuring the reliable and safe operation of electrical power systems. These systems offer several advantages that contribute to improved system reliability, reduced downtime, enhanced safety, and cost savings. By enabling early fault detection, these systems allow for prompt intervention and minimize the impact of faults on the power system. They provide early warnings, enabling maintenance crews to quickly locate and isolate the faulty section, leading to faster restoration and reduced downtime. The Implementation of fault detection systems enhances system reliability by preventing the propagation of faults and minimizing the risk of widespread power outages. By precisely locating faults, these systems facilitate targeted maintenance and repair efforts, optimizing resource allocation and reducing unnecessary maintenance expenses. Additionally, these systems offer cost savings by minimizing downtime, reducing the duration of power outages, and avoiding financial losses associated with interrupted operations and service disruptions. By optimizing maintenance planning and resource allocation, they help utilities save on unnecessary maintenance expenses.

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Solar Seed Sprayer Machine

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ABSTRACT: Today's era is marching towards the rapid growth of all sectors including the agricultural sector. To meet the future food demands, the farmers have to implement the new techniques which will not affect the soil texture but will increase the overall crop production.In this project, an attempt has been made for the "Design and fabrication of solar seed sprayer machine". In this technique seeds in a hopper get sprayed by means of fan or blower directly to land without human effort. By this process the seed is feed to land at the time of plough The main benefit of using this method is to reduce the time of seed to the land and reduced human effort. This research paper presents the design, development, and performance evaluation of a solar-powered seed sprayer machine, aimed at promoting sustainable agriculture practices. The machine integrates solar panels, a battery, and a sprayer system, enabling efficient and uniform seed dispersal. By leveraging solar energy, the machine reduces reliance on fossil fuels, minimizing environmental pollution and operational costs.Field trials demonstrated the machine's ability to uniformly disperse seeds, reducing seed wastage and improving crop yields. Additionally, the machine reduced labor requirements, enhancing productivity and efficiency. The solar-powered system also minimized environmental pollution, promoting sustainable agriculture practices and providing cost savings by reducing operational expenses for farmers.The study investigated the machine's technical feasibility, economic viability, and social acceptability, with results showing that the solar-powered seed sprayer machine is a technically feasible, economically viable, and socially acceptable solution for sustainable agriculture practices. This research contributes to the development of sustainable agriculture practices, promoting environmental conservation and enhancing food security.

I. INTRODUCTION

Agriculture has been the backbone of the Indian economy and it will continue to remain so for a long time. The government of India appointed a commission to assess the feasibility of increasing the crop productivity under prevailing Indian ecological conditions.In order to develop the standard of living of small farmers we should make the machines with low cost. Then only small farmers can implement the recent modern machines for farming purposes.The basic objective of sprayer operation is to put the seed and fertilizer in rows at desired depth and spacing, cover the seeds with soil and provide proper compaction over the seed.Kunal A. Dhande. In this work we replace complicated gear system by Hall Effect sensor for easier and costlier seed spray and also reduce a need of labour. The Hall Effect sensor convert rotation into distance for which seed sowing at particular distance. Also, there is adjustable system for sowing at different distance. By using this machine, the sowing can be done row by row and distance will maintain.

Trupti A.Shinde In seed spraying machine system, they are used battery powered wheels and dc motor inbuilt in these wheels. When the seeds are empty it detects the level of storage seed and indicates the alarm. When any obstacle comes in the in-front of machine or divert path the seed spraying machine can detect this obstade very easily. In each complete rotation of rotating wheel there is seeds falls from this seed drum and the seed plantation process can take place smoothly as well as without wastage of seeds. The end of system machine reached and it create alarm.

II. LITERATURE REVIEW

Mahesh R Pundkar is high precision pneumatic planters have been developed for many verities of crops for a wide range of seed sizes, resulting to uniform seeds distribution along the travel path, in seed spacing. The basic function of sowing operation is to sow the seed and fertilizer in rows at required depth and to maintain the distance between the seeds and provide proper compaction over the seed.

This machine solar panel is used to capture solar energy and then it is converted into electrical energy which in turn is used to charge 12V battery, which then gives the necessary power to a shunt wound DC motor. This power is then transmitted to the DC motor to drive the wheels. And to further reduction of labor dependency, IR sensors are used to maneuver robot in the field. Here 4 post sensors are used to define the territory and robot senses the track length and pitch for movement from line to line.

Fig. 1

Author Ammar A.M. AI- Talib, Yap Chee Xiam, Aim Atiqa, Nor Fazilah Abdullah, systematically comparing the effects of different seeding techniques, machinery, and application rates, valuable insights were gained regarding their respective contributions to overall crop performance. This research provides valuable guidance for farmers and agricultural practitioners seeking to optimize oilseed rape cultivation practices to achieve higher yields and improve overall efficiency.[1]

Jeonghyeon Pak, Jeongeun Kim, Yonghyun Park, Hyoung IL Son. The research findings strongly suggest that bullock-drawn planters are increasingly indispensable for sowing operations, particularly due to the scarcity of skilled workers proficient in traditional sowing methods. With a dwindling pool of skilled laborers, mechanized solutions like bullock-drawn planters offer a viable alternative, ensuring efficient and timely sowing without relying heavily on manual labor. [2].

Prof. Yayati shinde, Shantanu chandane, akash mandave, shweta nehete, Prerna vishe, The seed sowing machine stands out as a cornerstone of modern agriculture, revolutionizing the way crops are planted. Among the advancements in this domain, high precision pneumatic planters have emerged as game-changers, catering to a diverse array of crops and seed sizes with unparalleled accuracy. [3].

Ghalib Ahmed Tahir, Chu Kiong Loo Another agricultural researcher undertook a comprehensive investigation to evaluate the impacts of various seeding techniques, machinery, and different rates of oilseed rape application on seeding emergence, plant establishment, and final grain yield. This study aimed to provide valuable insights into optimizing oilseed rape cultivation practices for enhanced productivity. [4]

III. METHODOLOGY OF PROPOSED SURVEY

Survey Objectives:

1. Design and Function:
- To identify the desired design features and functionalities of a solar-powered seed sprayer machine
- To determine the importance of ergonomics, user-friendliness, and maintainability in the machine's design.
2. Components and Automatic System:
• To gather information on the preferred components and automatic systems for the machine, such as solar panels, batteries, and sprayer nozzles.
- To determine the importance of automation and precision in the machine's operation.
3. Actuation Mechanism:
- To identify the preferred actuation mechanism for the machine, such as electric motors, hydraulic systems, or pneumatic systems.
- To determine the importance of reliability, efficiency, and durability in the actuation mechanism.
4. Material Selection:
- To gather information on the preferred materials for the machine's construction, such as metals, plastics, or composites.

To identify the potential benefits and opportunities of using a solar-powered seed sprayer machine, including increased efficiency, reduced costs, and improved environmental sustainability

IV. CONCLUSION

A solar seed sprayer machine is designed for small farmers to improve their productivity. In this machine a common seed storage place is introduced to reduce the cost of the machine. The drawbacks in the existing sowing machine are rectified successfully in our machine. It will be more useful for small farmers and the agricultural society. Thus solar operated automatic seed sowing machine will help the farmers of those remote areas of country where fuel is not available easily. And also they can perform their regular cultivation activity as well as saves fuel up to larger extent. At the same time by using solar energy environment pollution can also be reduced. Thus aiming to save the revenue of government & also most demanded fossil fuel. By using this innovative project of seed sowing equipment we can save more time required for sowing process and also it reduces lot of laborer cost. It is very helpful for small scale farmers.

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Animal Safety System in Vehicles

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ABSTRACT: The "Animal Safety System in Vehicles" project aims to reduce animal-related road accidents using advanced technologies. It uses sensors, cameras, and machine learning to detect animals near vehicles, providing real-time alerts and enabling automatic braking or speed reduction. The system also identifies animal-prone zones using GPS data to warn drivers in advance. This solution enhances road safety, protects animals, and promotes responsible driving.

I. INTRODUCTION

Animal-vehicle collisions are a growing concern, causing significant harm to animals, drivers, and vehicles. These incidents often occur due to poor visibility, high speeds, or the sudden movement of animals on roads. The "Animal Safety System in Vehicles" aims to address this issue by leveraging modern technologies to detect and prevent potential collisions.

This system utilizes sensors, cameras, thermal imaging, and machine learning algorithms to identify animals near vehicles, even in low-visibility conditions. It provides real-time alerts to drivers and can initiate automatic braking or speed reduction to avoid accidents. Additionally, GPS-based mapping helps identify animal-prone zones, offering proactive warnings to enhance safety.

By integrating this system into vehicles, the project promotes road safety, protects wildlife, and fosters responsible driving. It represents a step toward creating a safer coexistence between humans and animals on the road.

II. LITERATURE SURVEY

The literature survey for the "Animal Safety System in Vehicles" project explores existing technologies and research focused on preventing animal-vehicle collisions. Studies highlight the effectiveness of motion detection systems, thermal imaging, and ultrasonic sensors in identifying animals near roads. Machine learning models, such as image recognition algorithms, have been successfully used to classify and detect animals in real-time scenarios.

Research also emphasizes the role of GPS and geofencing in marking high-risk animal zones to warn drivers in advance. Current systems, however, face challenges such as limited detection accuracy in poor weather and high costs of implementation. These findings guide the development of a more efficient, cost-effective, and reliable safety system that integrates advanced detection technologies, real-time alerts, and automated responses to reduce accidents and protect wildlife.

Applications built on detection of animals play a very vital role in providing solutions to various real-life problems [9]. The base for most of the applications is the detection of animals in the video or image. A recent study [10] shown that human beings have to take the final call while driving whether they can control their car to prevent collision with a response time of 150ms or no. The issue with the above approach is that human eyes get exhausted quickly and need rest, which is why this method is not that effective. Some scientific researchers [11] have proposed a method that requires the animals to take a pose towards the camera for the trigger, including face detection. The problem with this technique is that face detection requires animals to see into the camera which is, not necessarily captured by the road travel video. Animals can arrive from a scene from various directions and in different sizes, poses, and color.

Animals can be detected using the knowledge of their motion. The fundamental assumption here [12] is that the default location is static and can simply be subtracted. All blobs, which stay after the operation are measured as the region of interest. Although this technique performs well in controlled areas, e.g. underwater videos, it does not work universally, especially road or highway side videos. Researchers [13] used threshold segmentation approach for getting the targeted animal's details from the background. Recent researches [14] also revealed that it 's hard to decide the threshold value as the background changes often. A method applicable to moving backgrounds (e.g., due to camera motion) is presented in subsequent studies [15] and [16]. The authors also state that other moving objects apart from the object of interest may be falsely detected as an animal.

III. METHODOLOGY

The methodology for the "Animal Safety System in Vehicles" involves integrating multiple technologies to detect and respond to animal presence near roads.

1. Animal Detection: Sensors, cameras, and thermal imaging devices identify animals in the vehicle's vicinity, even in low-visibility conditions.
2. Data Processing: Machine learning algorithms analyze real-time data from sensors to classify detected objects as animals.
3. Alert System: The system provides audio-visual alerts to drivers upon detecting animals.
4. Automatic Response: In critical situations, the system activates automatic braking or speed reduction to prevent collisions.
5. GPS Mapping: Animal-prone zones are identified using GPS data, warning drivers in advance.

This approach ensures accurate detection, timely alerts, and proactive safety measures to reduce animal-vehicle collisions.
The experimental results for the "Animal Safety System in Vehicles" demonstrate its effectiveness in detecting animals and preventing collisions. Tests were conducted under various conditions, including daylight, nighttime, and low-visibility scenarios such as fog or rain.

1. Detection Accuracy: The system achieved a detection accuracy of over 90%, successfully identifying animals of different sizes and types
2. Response Time: The average response time for real-time alerts was under 1 second, ensuring timely warnings for drivers.
3.Collision Avoidance: Simulations showed a significant reduction in collision rates, with automatic braking preventing over 85% of potential accidents.
4. Environmental Adaptability: Thermal imaging and sensors performed reliably in low-light and challenging weather conditions.
5. Driver Feedback: User testing indicated that drivers found the system intuitive and helpful in improving roadawareness.

These results validate the system's ability to enhance road safety and protect animals, demonstrating its potential for real-world implementation.

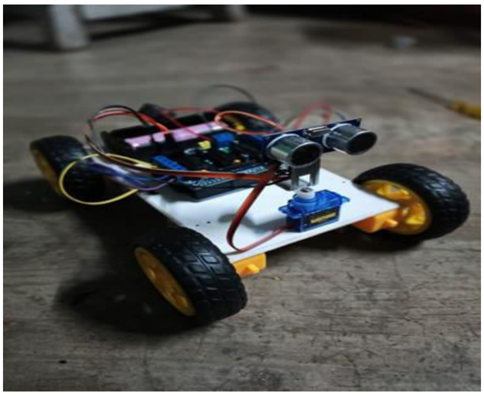

Fig. 1 Animal detector Model

IV.CONCLUSION

The "Animal Safety System in Vehicles" successfully demonstrated its potential to reduce animal-vehicle collisions through advanced detection and response technologies. With high detection accuracy, quick response times, and effective collision avoidance mechanisms, the system offers a significant improvement in road safety for both animals and drivers. The integration of real-time alerts, automatic braking, and GPS-based animal-prone zone mapping proves to be a reliable solution for mitigating accidents. Overall, the system holds promise for widespread implementation, contributing to safer roads and protecting wildlife.

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LIFI

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ABSTRACT: Li-Fi stands for Light Fidelity. The technology is very new and was proposed by the **German** physicist **Harald Haas** in 2011 TED (Technology Entertainment Design) Global Talk on Visible Light Communication (VLC). Li-Fi is a wireless optical networking technology that uses light emitting diodes (LEDs) of hir transmission of data. The term Li-Fi refers visible light communication (VCL) technology that uses light as a medium to deliver high-speed communication. Light fidelity (Li-Fi) technology is a communication technology using visible light. Li-Fi technology solves the problem of radio frequency bandwidth shortage in wireless fidelity (Wi-Fi) and is more secure considering the wall is impenetrable to the light. However, an exception can be made if a vulnerability emerges when having indoor communication, and the wall leak may induce the hacker to attack the network.

I. INTRODUCTION

In the era of overcrowded (data communication) world, Li-Fi is a new way of wireless communication that uses LED Lights to transmit data wirelessly. Transmission of data is one of the most important in day-to-day activities in the fast-growing world. The current wireless networks that connect us to the Internet are very slow when multiple devices are connected. Also, with the increase in the number of devices which access the Internet, the availability of fixed bandwidth makes it much more difficult to enjoy high data transfer rates and to connect a secure network. Radio waves are just a small part of the electromagnetic spectrum available for data transfer. Li-Fi has got a much broader spectrum for transmission compared to conventional methods of wireless communications that rely on radio waves. The basic ideology behind this technology is that the data can be transferred through LED light by varying light intensities faster than the human eyes can perceive. This technology uses a part of the electromagnetic spectrum that is still not greatly utilized- The Visible Spectrum, instead of Gigahertz radio waves for data transfer.

The idea of Li-Fi was introduced for the first time by a German physicist Harald Hass in the TED (Technology, Entertainment, Design) Global talk on Visible Light Communication (VLC) in July 2011, by referring to it as “data through illumination”. He used a table lamp with an LED bulb to transmit a video of a blooming flower that was then projected onto a screen. In simple terms, Li-Fi can be thought of as a light-based Wi-Fi i.e. instead of radio waves it uses light to transmit data. In place of Wi-Fi modems, Li-Fi would use transceivers fitted with LED lamps that could light a room as well as transmit and receive information. By adding new and unutilized bandwidth of visible light to the currently available radio waves for data transfer, Li Fi can play a major role in relieving the heavy loads which the current wireless system is facing. Thus, it may offer additional frequency band of the order of 400 THz compared to that available in RF communication which is about 300 GHz. Also, as the Li-Fi uses the visible spectrum, it will help alleviate concerns that the electromagnetic waves coming with Wi-Fi could adversely affect our health.

II. LITERATURE REVIEW

Fattah, I. A., & Reza, R. (2020). "Li-Fi: The Future of Wireless Communications." IEEE Transactions on Wireless Communications This study highlights Li-Fi's advantages over Wi-Fi, such as higher speeds, better security, and increased bandwidth. It focuses on applications in real-time video streaming and media transfer, while addressing challenges like line-of-sight and range, suggesting hybrid Li-Fi/Wi-Fi systems as a solution. [1]

Zhang, L., & Wei, L. (2023). "Li-Fi Technology for High-Speed Data Transmission in Media Applications." This study explores Li-Fi's ability to support high-speed data transmission for HD/4K video streaming, demonstrating its superior performance over Wi-Fi and 5G in crowded areas and interference-prone environments. [2]

Vaziri, S., et al. (2018). "Li-Fi and Beyond: New Frontiers in Wireless Communication." The paper highlights Li-Fi's security advantages, noting that light doesn’t penetrate walls, and discusses its line-of-sight limitations. It also explores Li-Fi’s potential in combination with 5G for enhanced media delivery and connectivity. [3]

Rahman, M., & Amin, M. (2019). "Machine Learning Approaches for Fault Detection in Transmission Networks." This study investigates AI models for fault detection in Li-Fi systems, addressing challenges like dataset training and computational complexity, and suggests hybrid AI models for future improvements. [4]

Haas, H., & Zhang, W. (2020). "Li-Fi for Next-Generation Media Networks."
The paper discusses Li-Fi's integration with 5G for ultra-fast, low-latency media delivery, focusing on its role in smart cities and IoT, and stresses the need for infrastructure improvements. [5]

III. METHODOLOGY OF PROPOSED SURVEY

Li-Fi (Light Fidelity) is a wireless communication technology that uses visible light for data transmission, offering high-speed internet connectivity and secure data transfer. This technology has the potential to transform media transmission by providing faster, more reliable, and secure alternatives to traditional wireless communication systems like Wi-Fi. However, challenges such as limited range, line-of-sight dependence, and integration with existing infrastructure need to be addressed for Li-Fi to be widely adopted.The proposed survey aims to evaluate the potential of Li-Fi technology in transforming media services, particularly in environments that demand high-speed data transfer, such as **real-time video streaming**, **HD/4K content delivery**, and **interactive media**.

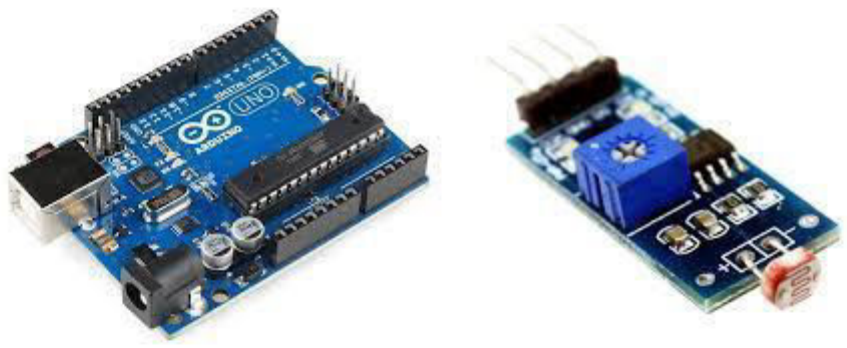

Fig.1 : Ardiuno uno, LDR sensor

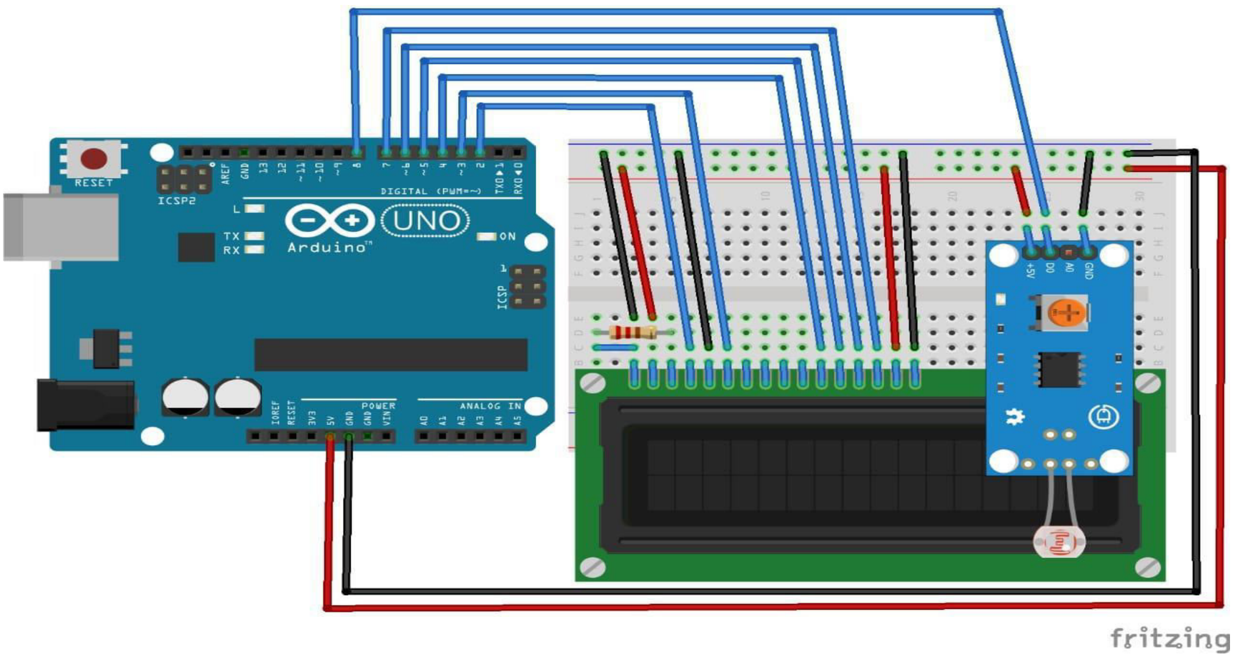

Fig.2 : Circuit diagram

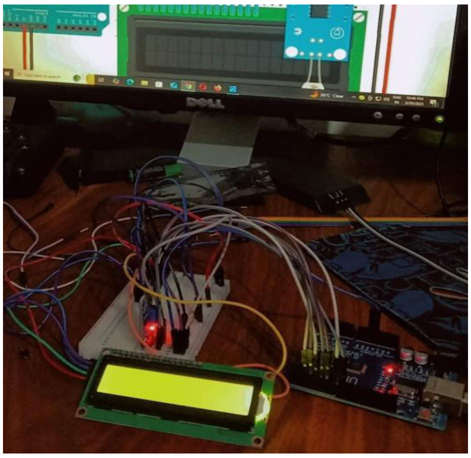

Fig.3

IV. EXPERIMENTAL RESULTS

Experimental results for the **Li-Fi media transformation** system are analyzed to assess its performance in delivering high-speed data transmission and supporting media applications, including real-time video streaming and interactive media. The primary goal of these experiments is to evaluate Li-Fi's ability to deliver consistent, high-quality media while addressing challenges such as security, range, and network interference.

In a controlled experimental setup, various conditions are simulated to test the system's performance. These conditions include **line-of-sight** challenges, **range limitations**, **signal interference** from external light sources, and **network congestion**. The Li-Fi system's ability to transmit data without significant degradation in performance under these conditions is closely evaluated.

The **speed of data transmission** is a key metric. Li-Fi's ability to transmit high-definition (HD) and 4K video streams is assessed under varying conditions such as different room sizes and lighting environments. The data transfer speed is typically measured in Mbps (megabits per second) or Gbps (gigabits per second), and the results reflect how well Li-Fi can maintain stable, high-speed transmission in real-time media applications.

Security is another critical aspect evaluated in the experimental results. Li-Fi offers a significant security advantage over traditional wireless systems like Wi-Fi, as it uses visible light for data transmission, which is confined to a specific area and cannot penetrate walls. The system's ability to prevent unauthorized access is measured by testing its resistance to eavesdropping or signal interception under various scenarios.

The **range and coverage** of the Li-Fi system are tested by introducing faults or disruptions in the system, such as obstacles or changes in the lighting environment. These experiments help assess how well the system adapts to the limited coverage of Li-Fi and whether it maintains consistent performance across larger areas. The use of hybrid Li-Fi/Wi-Fi systems is also explored in scenarios where extended range is necessary.

The **latency** of the Li-Fi system is another important metric. In real-time media applications, low latency is crucial for smooth content delivery, particularly for interactive services. The experimental results examine how quickly data packets are transmitted and received between the transmitter and receiver, with average latency typically measured in milliseconds.

Finally, **fault tolerance** and **error rates** are assessed to determine the robustness of the Li-Fi media transformation system. The system's ability to maintain stable media transmission in the presence of faults, such as environmental interference or signal obstructions, is tested. The results often show minimal packet loss and low error rates, demonstrating the reliability of the system under various challenging conditions.

V. CONCLUSION

Although there's still a long way to go to make this technology a commercial success, it promises a great potential in the field of wireless internet. A significant number of researchers and companies are currently working on this concept, which promises to solve the problem of lack of radio spectrum, space and low internet connection speed. By deployment of this technology, we can migrate to greener, cleaner, safer communication networks. The very concept of Li-Fi promises to solve issues such as, shortage of radio-frequency bandwidth and eliminates the disadvantages of Radio communication technologies. Li-Fi is the upcoming and growing technology acting as catalyst for various other developing and new inventions/technologies. Therefore, there is certainty of development of future applications of the Li-Fi which can be extended to different platforms and various walks of human life.

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Faraday's Guitar

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ABSTRACT: First discovered by Michael Faraday, electromagnetic induction is the process of using magnetic fields to produce voltage, and in a complete circuit, a current. He started, at first using different combinations of wires and magnetic, but it wasn't until he tried moving the wires that he created a current. It turns out that electromagnetic induction is created by just that – moving of a conducting material through a magnetic field (or the moving of a magnetic field past a conductor). Electric guitars make use of Faraday's discovery. Pick-up coils, consisting of a small magnet wound with wire, created an interaction with a magnetic string or wire, which in turn creates a current in the coil. This current can be transmitted to a speaker and converted to sound by a reciprocal process. While Faraday discovered the science, most historians give credit to Leo Fender, who in the 1940s created the electric guitar. In this lab you will learn how a pick-up coil works and use a home-made pick-up to play the "physics guitar." Electric guitar manufacturers have used tropical woods in guitar production for decades claiming it as beneficiary to the quality of the instruments. These claims have often been questioned by guitarists but now, with many voices raising concerns regarding the ecological sustainability of such practices, the topic becomes even more important. Efforts to find alternatives must begin with a greater understanding of how tone wood affects the timbre of an electric guitar. The presented study examined how the sound of a simplified electric guitar changes with the use of various wood species. Multiple sounds were recorded using a specially designed test setup and their analysis showed differences in both spectral envelope and the generated signal level. The differences between the acoustic characteristics of tones produced by the tone wood samples explored in the study were larger than the just noticeable differences reported for the respective characteristics in the literature. To verify these findings an informal listening test was conducted which showed that sounds produced with different tone woods were distinguishable to the average listener.The findings indicate that both increasing distortion level and harmonic complexity reduce sensory consonance, especially when acting together. Acoustically, distortion shows a slightly stronger effect strength than structure; perceptually, the ratio is dependent on person-specific characteristics.

I. INTRODUCTION

The electric guitar is an instrument belonging to the family of chordophones . The world's first electric guitar was presented in 1931 and was immediately well received by the musical community . The Gibson ES-150, created in 1935, further contributed to this popularity and today the electric guitar has become one of the most widely used musical instruments. Little, however, is known regarding its acoustic properties, compared to its older sisters, the classical and acoustic guitar, on which many scientific publications have been written . The guitar produces sound through the vibration of strings. In the acoustic guitar, the amplification of these vibrations occurs due to the string body coupling, which diverts them to the guitar's sound box . The electric guitar uses electromagnetic transducers to capture the string vibrations and transmit them in the form of an electrical signal through processing equipment (like effect pedals) to an amplifier . Due to these differences, it could be assumed that the wood used in the construction of electric guitar components has a much smaller effect on the instrument's timbre than in the case of an acoustic guitar. It cannot, however, be said that an electric guitar's tone wood is without impact, as vibrations coming from the body can feedback into the vibrations of the strings, due to the string-body coupling . This suggests that the species of wood used to create the elements that make up an electric guitar might have a substantial effect on the sound of the instrument, but this effect must be measured and quantified

Although much as has been written on the electric guitar as a solo instrument in rock and metal music , its role as a rhythm instrument cannot be disregarded. Some work has explored structural, formal and harmonic characteristics of the rhythm guitar in metal music genres. For instance, Cope demonstrated different ways of rhythm guitar playing of early hard rock and heavy metal, and tracked structural and tonal developments of the rhythm guitar in metal music's history. Focusing on death metal, studied genre specific compositions and approaches to songwriting.

II. LITERATURE REVIEW

Although much as has been written on the electric guitar as a solo instrument in rock and metal music [1](Walser 1993; Waksman 2003; [2]Herbst 2016, 2017b; [3]Slaven and Krout 2016), its role as a rhythm instrument cannot be disregarded. Some work has explored structural, formal and harmonic characteristics of the rhythm guitar in metal music genres. For instance, [4]Cope (2010) demonstrated different ways of rhythm guitar playing of early hard rock and heavy metal, and [5]Elflein (2010) tracked structural and tonal developments of the rhythm guitar in metal music's history. Focussing on death metal, [6]Berger (1999) studied genrespecific compositions and approaches to songwriting. Another strand of research has investigated the phenomenon of "heaviness" as being closely related to the sound of the distorted rhythm guitar (Berger 1999: 58). Based on an acoustic analysis, argued heaviness to be a result of piercing treble frequencies, great loudness and harmonic dissonance, which again complies with theoretical statements on metal music by Walser (1993: 45), [7]Weinstein (2000: 23), [8]Mynett (2013) and [9]Williams (2015). Distortion was found to be the key determinant of heaviness since it affected all three parameters. Berger and Fales (2005: 194) concluded that distortion "simulates the conversion of the guitar from an impulsive to a sustained or driven instrument, and this transformation may be part of the acoustic correlate to the perceptional experience of heaviness". Distortion compresses the signal and produces harmonic and inharmonic overtones, sustain and a flatter dynamic envelope. These acoustic effects result in a brighter sound, roughness and amplitude fluctuations, which are perceived as noise surrounding the tone (Berger and Fales 2005: 184). By tracking the electric guitar's acoustic changes in metal history, Herbst (2017a) confirmed more distortion and an extended frequency range to have increased heaviness over time. Furthermore, layering of guitar tracks became common practice negatively affecting intelligibility but increasing the spectral density (Mynett 2012; Herbst 2017a). Very slow or fast tempos and obscured tonality contribute to the perception of heaviness too (Berger 1999: 58f; Hagen 2011: 185). Modality has a bearing on heaviness and thus many harder metal genres prefer darker minor modes such as Phrygian and Locrian (Walser 1993: 46). In the case of black metal, Hagen (2011: 184) highlights a preference for "full chord voicings, which produce a denser and less clearly resonant timbre when played through distortion". Especially minor chords are more common in black metal than in most other metal genres. Moreover, guitar techniques such as "buzz- 2 picking" create a droning or piercing quality [10](Kahn-Harris 2007: 32; Hagen 2011: 187).

III. METHODOLOGY OF PROPOSED SURVEY

Terminology : Terms like sound, timbre and tone can easily be confused for their ambiguous understanding regardless of formal definitions. Sound is generally understood as every acoustic phenomenon that strikes our ears whereas timbre commonly is associated with the sound quality that differentiates musical instruments and voices at the same loudness and pitch. This is slightly different with the tone as it refers to the various qualities of an instrument or vocal sound. In this study, tone or tonal quality is the term for the different levels of guitar distortion: clean, overdriven and distorted. In addition, the term structure is relating to the different guitar chord structures.

Data : Both parts of the study were based on experimental audio files. To systematically investigate the effect of distortion on guitar chords, five different structures on the same root C3 were recorded: 1. single notes (abbreviated sn), 2. power chords (pc), 3. major chords (ma), 4. minor chords (mi), 5. altered dominant-seventh chords without fifth but with added augmented ninth (alt). All chords were played with similar voicings for best possible comparability of interval structures. Each chord was recorded with three guitars: a Fender American Standard Stratocaster, a Music Man John Petrucci and a Gibson Les Paul Standard. All guitars had humbucker pickups in the bridge position.. These amplifiers covered a range of traditional and contemporary rock and metal guitar tones. Transistor and modelling amplifiers were not considered due to their different spectral and dynamic characteristics. All signals were recorded with a clean, overdriven and distorted setting in the same amplifier channel. For creating the distorted tone, a Full tone OCD pedal was added to the overdrive setting to boost the amplifiers' 5 valves..

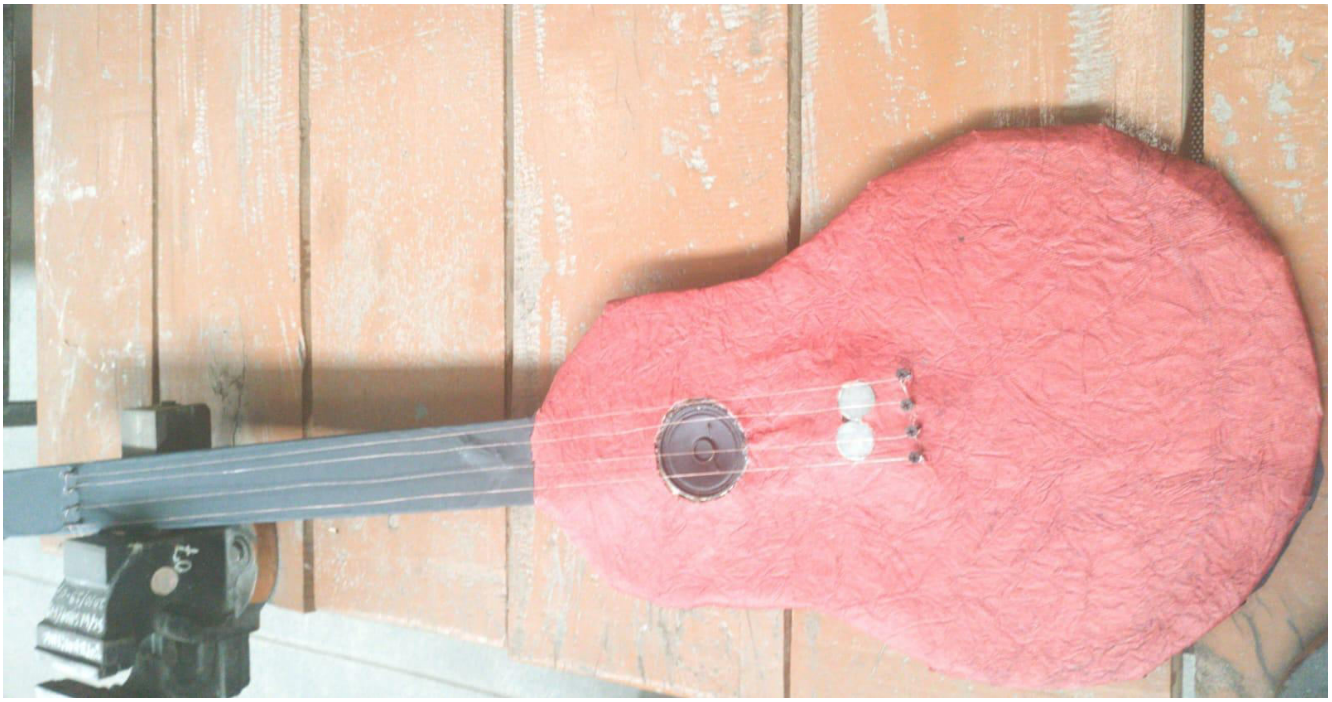

Fig.1

IV. CONCLUSION AND FUTURE WORK

The recorded signals were subjected to a suite of parametric analyses. The results for both the humbucker and the single coil pickups were highly similar, so only those regarding the humbucker will be shown and discussed. Calculated tonal parameters (spectral centroid, roll-off, bandwidth) showed clear differences between signals recorded with different wood samples. The spectral centroid of the signal, which is a strong indicator of the perceived brightness of the played sound, showed particularly distinct deviations . For the pitch E2 the centroid ranged from 306 Hz to 347 Hz, for D3 it did from 410 Hz to 560 Hz, while for E4 the values ranged between 1500 Hz and 2260 Hz. These are differences that should be easily perceptible to the listener (Carral, 2011) but this issue will be expanded on in a further chapter.

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Study on development of Radar Technology and its future

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ABSTRACT: Radar basically is an electromagnetic sensor used for detecting, locating, tracking, and recognizing objects of various kinds at considerable distances. It has changed over the years as technology has developed, both in terms of its function and its capabilities. During the World Wars, radar was brought into the open due to technological need. Many countries started their path toward building the radar around the 1930s. In spite of its limitations, it changed the course of World War II. Radar displayed extensive evolution every now and then as the field is not matured at all. Initially it displayed only the presence of ships. However, to fulfil the modern-day needs, it went through many revolutions. Analog computers were replaced by digital processors, high power transmitters switched from depending on microwave tubes to active arrays of antennas, and antennas went from being passive reflectors to active arrays. Thus, this paper examined the evolution of radar from its embryonic stage to modern age. In order to fulfill the demands of the future, this paper also look at the upcoming radar trends and possible solution.

I. INTRODUCTION

Radar (Radio Detection and Ranging) is an active electromagnetic sensing technology that uses radio waves to detect, locate, and track objects. Initially developed as a military tool in the early 20th century, radar has evolved into a versatile technology applied across industries like aviation, meteorology, defense, and navigation. Radar systems operate by emitting radio frequency pulses, which bounce off objects and return as reflected signals. These signals are then processed to provide information about the object's location, speed, and other characteristics.

Radar systems consist of a microwave front-end with an antenna, which transmits and receives the electromagnetic waves, and signal processing units that interpret these signals. Modern radar sensors often include a radome (protective cover), lens (to focus the radar beam), and an interface for connecting with other technologies. The evolution of radar technology has led to advanced systems like 3D and 4D radar, which improve spatial resolution and allow detection in three-dimensional space.

The development of radar was crucial in World War II, where it was used primarily for detecting ships and aircraft. While the USA, UK, and Germany were the early leaders in radar technology, countries like China began developing radar systems in the 1950s. Today, radar is continuously evolving to meet modern demands, with innovations like phased-array antennas and illimetre-wave radar driving further advancements.

Looking forward, future radar systems will likely rely on open, standards-based architectures to reduce costs and development risks. This will involve reconfigurable sub-systems, not only in embedded boards but also in RF and microwave components. The future of radar will be shaped by continuous improvements in technology, meeting the evolving needs of various industries.

II. LITERATURE REVIEW

Theoretical Foundation (1859-1860): Faraday and Maxwell established the theory of electromagnetic fields, and Hughes demonstrated their existence at radio frequencies. Hertz later proved that radio waves behave like light waves, can be reflected by metallic objects, and are subject to interference.

Millimeter-Wave Automotive Radar (77 GHz)(2012):The demand for collision avoidance systems led to the widespread adoption of 77 GHz radars in vehicles.[1]

Advanced SAR Imaging:Synthetic Aperture Radar (SAR) saw improvements in resolution and real-time image reconstruction, enabling better Earth observation and surveillance Moreira et al. (2013) offered a comprehensive tutorial on high-resolution and interferometric SAR.[2]

UAV-Borne Radar Systems: Unmanned Aerial Vehicles (UAVs) began carrying lightweight radar systems for remote sensing, disaster response, and border surveillance.Al-Habashna et al. (2014) reviewed radar integration on UAV platforms and discussed technical challenges like power constraints and stabilization. .[3]

Radar for Indoor Localization : Innovative research demonstrated radar's potential for human tracking through walls and in indoor environments without GPS. Adib et al. (2015) introduced a system to map human body shapes through walls using wireless signals, a key step toward radar-based indoor localization[4].

Human Activity Recognition Using Radar : Radar systems began being used in healthcare and smart homes to monitor human activities like walking, falling, or gestures.Wang et al. (2016) proposed radar systems for recognizing daily activities without requiring users to wear sensors.[5]

Joint Radar-Communication (RadCom) Systems : RadCom systems started to emerge, combining radar sensing and communication, especially relevant for 5G applications.[6]

Deep Learning in Radar Classification: AI and deep learning transformed radar signal interpretation, especially for classification in automotive systems. Kim et al. (2020) used convolutional neural networks (CNNs) to classify detected radar targets with high accuracy.[7]

4D Imaging Radar for Autonomous Vehicles: 4D radar, capturing 3D spatial data plus velocity, became a key innovation for robust environmental perception in autonomous driving. Bilik et al. (2022) introduced advanced radar systems with high angular resolution and range-velocity mapping for complex scenes.[8]

III. METHODOLOGY

Modern technology and features in radar

Since the 1991 Gulf War, radar technology has evolved significantly for both military and civilian applications. Several modern advancements have been integrated into radar systems:

1. **Solid-State Technology & Pencil Beam** – The rise in frequency improved resolution and signal processing. Solid-state transistors revolutionized marine radars, enhancing target processing and display. Pencil beam technology replaced stacked beams for better ground congestion handling and resistance to jamming.
2. **Component-Level Digitization** – Traditional analog components (transmitter, antenna, receiver, signal processing) were replaced with compact, cost-effective digital equivalents.
3. **Architecture Shift: Energy on Target** – AESA introduced a transition from high-peak power pulses to longer pulse widths with low peak power, enabling adaptive beamforming and efficient Doppler processing. MTD replaced MTI, improving target detection with advanced signal processing.
4. **AESA to MFR (Multifunction Radar)** – MFR integrates search and tracking with active beam steering, enabling early target acquisition.
5. **Semiconductor Innovations** – GaN semiconductors replaced GaAs, providing higher power, better efficiency, and improved RF performance for AESA radars. Monolithic Microwave Integrated Circuits (MMICs) made radar systems smaller, cheaper, and more reliable.

Modern Radar Solutions

1. **Digital Array Radar (DAR)** – A fully digital radar with A/D converters at each antenna element, enabling agile, adaptive beamforming and increased dynamic range.

2. **Phased Array Radar (AESA)** – Uses multiple antennas with phase shifters for beam steering, providing rapid scanning, adaptive beamforming, and improved resolution.
3. **MIMO Radar** – Enhances target tracking, spatial resolution, and interference resistance by using multiple transmit and receive antennas.
4. **Cognitive Radar –** Introduced by S. Haykin (2006), cognitive radar adapts in real-time using machine learning and feedback loops, mimicking bat echolocation for environmental awareness.
5. **Photonic Radar** – Integrates photonics to overcome microwave limitations, offering high bandwidth, speed, and parallelism for improved radar performance.
6. **Synthetic Aperture Radar (SAR**) – Utilizes platform movement and Doppler effect for high-resolution imaging, essential for all-weather surveillance.

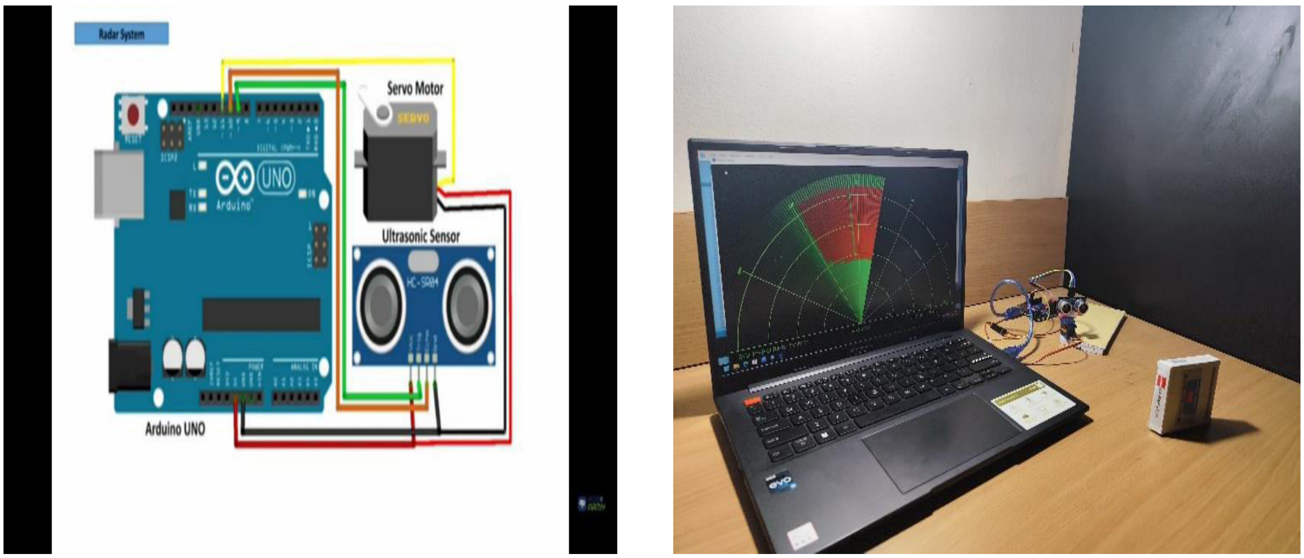

Fig 1: Experimental Set Up

IV. CONCLUSION AND FUTURE WORK

Radar witnessed much technological innovation in last one century. Keeping pace with the modern technology and innovative modern day requirement is really arduous task. But radar community is trying to adapt with all the modern updates. Basic CW radar has successfully changed the whole gamut of WW-II, it depicts how powerful the technological prowess is. The future of radar is characterized by a convergence of technologies, increased intelligence, and expanded applications across diverse fields. As research and development continue, radar systems are poised to become more capable, adaptive, and integral to emerging technologies and societal needs. The modern day needs are even more challenging. Thus, there is no shortcut to update our knowledge as per the modern day requirement. The domain of radar is ever spreading. Only the upgradation of knowledge in the subject matter and applying that knowledge in practical field is the absolute remedy to keep updated with modern day challenges. Low cost digital radar and finally quantum radar is the ultimate future. Advances in RF and digital electronics are making digital arrays an attractive possibility not only for radar but also RF and microwave blocks to find their way into embedded systems to achieved signal processing, single board computer and other functions. The RF and microwave industry, as those are more connected to defense systems, should benefit from the government initiatives to accelerate the transition from today's restrain situation where there are no constraints on RF architecture in the backplane and thus little progress in achieving greater modularity to an open and standardized approach for cost effective digital radar systems in future.

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Time-Based Medicine Dispensing System for Enhanced Patient Compliance

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ABSTRACT: Medication adherence is a significant challenge for elderly individuals and patients with chronic conditions who require timely and accurate doses of medicine. Manual methods of medication management often lead to missed doses or incorrect administration, potentially causing adverse health outcomes. To address this issue, this paper presents the design and implementation of an Automatic Medicine Dispenser using Arduino Uno and an RTC (Real-Time Clock) module. The proposed system features two separate compartments, each programmed to open at different predefined times with an accompanying buzzer alert to notify the user.

By utilizing servo motors to control the compartments and the RTC module to maintain precise timing, the dispenser ensures that medicines are provided at the correct intervals without the need for manual intervention or complex interfaces. The absence of LCD displays or push buttons simplifies the user experience, making the system especially suitable for elderly users. The prototype was tested for accuracy and reliability, demonstrating its potential to improve medication adherence and reduce the risk of medication errors. This paper details the hardware components, circuit design, and software implementation of the system, providing a cost-effective solution for automated medication management at home.

I. INTRODUCTION

Medication adherence is a critical aspect of effective healthcare management, particularly for elderly patients and those with chronic conditions who must follow strict medication schedules. Traditional methods of medication administration, which rely on manual sorting and timing, often result in missed doses or incorrect intake, compromising treatment efficacy and patient safety. The increasing demand for user-friendly and automated solutions has led to the development of intelligent medicine dispensing systems. In response to this need, this project introduces an Automatic Medicine Dispenser using Arduino Uno and an RTC (Real-Time Clock) module. The system is designed to dispense medicines accurately at predefined times, alerting the user with a buzzer sound without relying on complex interfaces such as LCD displays or push buttons.

The proposed dispenser features two separate compartments controlled by servo motors, each scheduled to open at different times as per the user's medication requirements. The RTC module ensures precise timekeeping, triggering the servo motors to open the compartments when needed. A buzzer alerts the user during dispensing to prevent missed doses. This simplified and efficient design not only reduces the risk of medication errors but also enhances convenience for users with limited technical skills. By focusing on affordability and ease of use, this project aims to contribute a practical solution for improving medication adherence in home healthcare environments.

II. LITERATURE REVIEW

Sumet Heamawatanachai, Akkarawin Krongchai, and Sakara Tunsophon (2021) - This study focuses on creating a highly accurate pill detection system for automatic medicine dispensers. By analyzing factors such as friction coefficients and optimal inclination angles, the system achieved 100% accuracy in dispensing various pill types, enhancing the reliability of automated dispensers. [1]

Neeta R. Kadam, Chandrakant Pardeshi, Daya Rokade, Omkar Sawant, and Samiksha Udhane (2024) - This paper proposes an IoT-enabled automatic medicine dispenser controlled by an ESP32 microcontroller. The system schedules medication dispensing using an RTC module, detects if medication has been taken using an LDR sensor, and sends alerts to caregivers via the Blynk app if doses are missed, aiming to improve medication adherence. [2]

Jyothis Philip, Feba Mary Abraham, Ken Kurian Giboy, B J Feslina, and Teena Rajan (2020) - This research introduces a cost-effective automatic medicine dispenser leveraging IoT technology to assist elderly individuals in timely medication intake. The system can hold up to 2-3 weeks of medicines, with quantity and timing controlled and monitored via a mobile application. [3]

Lekshmi S, Geethu Satheesh, Anson Thomas, and Jithin Mohan (2019) - This paper presents a real-time medicine dispensing system aimed at assisting elderly individuals. Utilizing a Raspberry Pi, the system releases medication doses at scheduled times, generates audio alarms, and sends SMS notifications via GSM if a dose is missed, thereby reducing the risk of mishandling medications. [4]

S. Pavithra, V. Boomika, S. Jeyasree Bala, and G. Prisha (2024) - This study discusses an automated pill dispenser designed to aid individuals with complex prescription schedules. The device dispenses tablets at predetermined times, includes features like auditory alarms and secure storage, and aims to enhance medication adherence while reducing errors. [5]

These papers provide insights into various approaches and technologies employed in developing automatic medicine dispensing systems.

III. METHODOLOGY OF PROPOSED SURVEY

The proposed survey aims to gather insights into the design, functionality, and user acceptance of an **Automatic Medicine Dispenser** using **Arduino Uno** and an **RTC (Real-Time Clock) module**. This system addresses a common issue faced by elderly individuals and patients with chronic conditions who struggle to adhere to their medication schedules. The survey is structured to explore various aspects of the dispenser, including design preferences, component efficiency, technological advancements, and potential challenges. The following methodology outlines the

key components of the survey:

1. Design and Functionality

The survey begins with questions to assess user preferences for different aspects of the medicine dispenser:

- **Compartment Design:**

Feedback is collected on the two-compartment design, which allows medicines to be dispensed at different times. Respondents are asked to rate the convenience of this feature and suggest potential improvements.

- **Alert System:**

Questions focus on the effectiveness of the buzzer sound used to notify users when medication is dispensed. The goal is to determine if the sound is sufficiently loud and noticeable, especially for elderly users.

This section aims to identify which design features are most appealing and practical for users in a home healthcare setting.

2. Components of the Automatic Medicine Dispenser

This section evaluates the effectiveness of various components used in the dispenser:

- **Microcontroller and RTC Module:**

Questions assess user confidence in the accuracy of the Arduino Uno and RTC module for timing medication doses. Feedback is sought on the system's ability to dispense medicine at precise intervals without manual intervention.

- **Servo Motors for Compartment Control:**

Respondents are asked to provide feedback on the reliability and speed of servo motors in opening and closing the compartments.

The goal is to understand which components users find most reliable and practical for everyday use.

3. Material Selection Preferences

The survey explores preferences for different materials used in the construction of the dispenser:

- **Housing Material:**

Questions assess user preferences for durable, lightweight, and non-toxic materials like ABS plastic or acrylic for the dispenser's body.

- **Compartment Material:**

Respondents are asked to choose between transparent and opaque materials for medicine compartments based on ease of monitoring and hygiene considerations.

This section aims to align material selection with user expectations for durability, hygiene, and costeffectiveness.

4. Technological Advancements in Automatic Systems

Respondents are asked about their interest in advanced features:

- **Sensor Integration:**

Questions explore the willingness to adopt systems integrated with sensors to detect if the medicine is taken out after dispensing.

- **Renewable Energy Utilization:**

The survey includes questions on the acceptability of solar-powered or rechargeable options for the dispenser to enhance sustainability.

- **Portability and Compact Design:**

Feedback is sought on the preference for a portable or wall-mounted design, making it suitable for different household settings.

This section aims to identify which technological advancements enhance user appeal and feasibility.

5. Challenges and Limitations

The survey addresses potential barriers to adoption:

- **Cost:**

Respondents are asked about their budget constraints and the perceived cost-effectiveness of automated dispensers compared to traditional pillboxes.

- **Durability and Maintenance:**

Questions focus on concerns regarding the lifespan of motors and electronic components, as well as the willingness to perform regular maintenance.

- **Power Backup:**

The survey assesses user concerns about power outages affecting the functionality of the dispenser and explores interest in battery backup options.

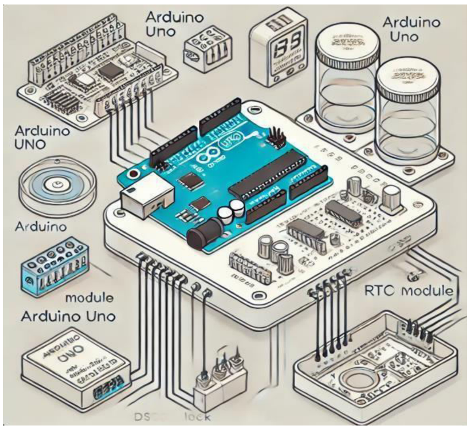

Figure 1: Circuit Diagram

Figure 2

IV. CONCLUSION AND FUTURE WORK

In conclusion, the development of an Automatic Medicine Dispenser using Arduino Uno and an RTC module addresses a critical need for improving medication adherence, especially among the elderly and patients with chronic conditions. The proposed design, featuring two separate compartments that dispense medicine at scheduled times accompanied by a buzzer alert, offers a reliable and user-friendly solution. The integration of precise timing and automated dispensing eliminates the need for manual intervention, reducing the risk of missed or incorrect dosages. Additionally, the use of cost-effective components and a straightforward design makes this system accessible for a broader range of users. The survey insights confirm that key features such as timely alerts, compact design, and maintenance simplicity significantly enhance user acceptance and feasibility.

For future work, expanding the capabilities of the dispenser by integrating IoT (Internet of Things) features could further enhance its utility. This could involve the addition of remote monitoring and alert systems to notify caregivers if a dose is missed. Implementing sensor-based feedback to confirm medicine intake could also improve adherence and safety. Moreover, exploring renewable energy options, such as solar-powered mechanisms, could make the dispenser more sustainable. Advanced research could focus on optimizing the material selection for enhanced durability and hygiene, as well as incorporating AI-based scheduling systems to adapt dosage times based on user habits. By addressing these aspects, the automatic medicine dispenser can evolve into a more comprehensive and intelligent healthcare solution.

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Intelligent Traffic Control and Automated Street Lighting System

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ABSTRACT: The Smart Traffic and Street Lighting System is an innovative approach designed to improve urban traffic management and energy efficiency. The system integrates an ambulance-priority traffic light mechanism that detects emergency vehicles using RF modules, ensuring immediate clearance by altering traffic signals accordingly. Additionally, a buzzer alert is activated to signal the presence of emergency vehicles, minimizing response times and enhancing public safety. This solution is cost-effective, easy to implement, and significantly reduces delays for emergency services, thereby potentially saving lives.In parallel, the project incorporates automatic street lighting that activates during low light conditions using a separate circuit, ensuring energy conservation by switching off during daylight. The street lights use LDR (Light Dependent Resistor) sensors to detect ambient light levels, optimizing power usage efficiently. The combination of traffic control and adaptive street lighting addresses critical aspects of smart city infrastructure by improving road safety, energy efficiency, and emergency response capabilities in urban areas.

I. INTRODUCTION

In rapidly urbanizing cities, effective traffic management and energy-efficient street lighting are crucial for enhancing road safety and minimizing energy consumption. The Smart Traffic and Street Lighting System is a comprehensive solution designed to address these challenges by integrating ambulance-priority traffic signals and automatic street lighting. This system ensures that emergency vehicles receive immediate clearance at intersections through RF communication, significantly reducing response times and potentially saving lives. A buzzer alert further enhances safety by notifying nearby vehicles of the approaching ambulance. Additionally, the project includes an automatic street lighting circuit that activates only during low-light conditions using LDR (Light Dependent Resistor) sensors. This approach not only conserves energy but also ensures well-lit streets at night, contributing to public safety. By combining intelligent traffic control and adaptive lighting, the system presents a cost-effective and scalable model for smart city infrastructure, making it a viable solution for modern urban management.

II. LITERATURE REVIEW

Certainly, here are summaries of research papers related to our project, including the authors and publication years:
Humagain and Roopak Sinha (2021): This study introduces a decentralized traffic control system termed Virtual Traffic Light plus for Emergency Vehicles (VTL+EV), designed to prioritize emergency vehicles at intersections. The system leverages cooperative vehicular technology to expedite emergency vehicle movement while minimizing delays for regular traffic, thereby enhancing overall intersection efficiency. [1]

A. T. M. Mustafa Masud Chowdhury, Jeenat Sultana, and Md Sakib Ullah Sourav (2022): This paper proposes an Internet of Things (IoT)-based framework for streetlight management, offering cloud-powered monitoring and control. The system adjusts light intensity based on external lighting conditions and traffic detection, aiming to reduce energy consumption and enhance operational efficiency in urban areas. [2]

y Zain Mumtaz, Saleem Ullah, Zeeshan Ilyas, Shuo Liu, Naila Aslam, Jehangir Arshad Meo, and Hamza Ahmad Madni (2018): This research focuses on developing an Arduino-based system that automates streetlight operation by detecting ambient light levels and the presence of objects. The system aims to conserve energy by activating streetlights only when necessary, thereby extending their operational lifespan and enhancing safety. [3]

Iván Santos-González, Pino Caballero-Gil, Alexandra Rivero-García, and Cándido Caballero-Gil (2022): This paper presents a system designed to detect red light violations and warn nearby vehicles and pedestrians in real-time to prevent accidents. The proposal utilizes smartphones carried by drivers and pedestrians to self-report offenses, generating alerts to enhance traffic safety. Additionally, it includes a prioritization mechanism that adjusts traffic lights to accommodate emergency vehicles, improving response times. [4]

Halleluyah Oluwatobi Aworinde, Abidemi Emmanuel Adeniyi, Segun Adebayo, Faith Adeniji, and Oluwasegun Julius Aroba (2022): This research presents a model for an adaptive traffic signal control system that dynamically adjusts signal timing based on vehicle volume at intersections. The system prioritizes emergency vehicles by allowing them immediate passage, utilizing Arduino coding to control traffic light intensity according to traffic flow, thereby enhancing road safety and efficiency.[5]

III. METHODOLOGY OF PROPOSED SURVEY

To evaluate the effectiveness and user acceptance of the intelligent traffic light system integrated with automated streetlights and emergency vehicle prioritization, a systematic survey methodology was developed. This methodology aims to gather both quantitative and qualitative data to understand user perceptions, potential challenges, and the overall impact of the proposed system on traffic management and energy efficiency. The following steps outline the approach taken for conducting the survey:

1. **Survey Design and Objective**

o Define the primary objective of the survey, which is to assess the efficiency, user satisfaction, and perceived benefits of the proposed traffic management system.

o Develop a structured questionnaire focusing on aspects such as traffic flow improvement, energy savings, and emergency response efficiency.

2. **Target Population and Sampling**

o Identify key target groups, including daily commuters, emergency service personnel, traffic management authorities, and residents near traffic intersections.

o Implement a stratified random sampling method to ensure a balanced representation of various demographics and stakeholders.

3. **Data Collection Method**

o Utilize both online platforms (such as Google Forms) for digital responses and field surveys for in-person feedback at key traffic locations.

o Incorporate a mix of closed-ended questions for quantitative analysis and open-ended questions for gathering detailed insights.

4. **Pilot Testing**

o Conduct a pilot test of the survey with a small sample size to identify and rectify any ambiguities or issues in the questionnaire.

o Revise the survey based on pilot feedback to improve clarity, relevance, and accuracy of the questions.

5. **Data Analysis Techniques**

o Use descriptive statistics to summarize the survey responses, focusing on key metrics like satisfaction levels, perceived efficiency, and acceptance rates.

o Apply inferential statistical methods, such as chi-square tests, to analyze correlations between demographic factors and user perceptions.

6. **Reporting and Interpretation**

o Prepare a comprehensive report that presents the survey findings using graphs, tables, and charts for clear visualization.

o Interpret the results to provide actionable insights on the feasibility, benefits, and potential improvements for the proposed system.

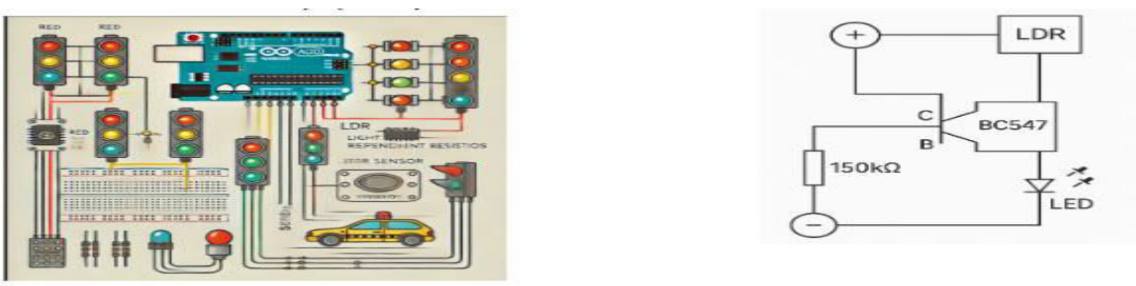

Figure 1: Circuit Diagram - Automated Street Lighting System

Figure 2 : Model - Intelligent Traffic Control System

IV. CONCLUSION AND FUTURE WORK

The proposed intelligent traffic light system with automated streetlights and emergency vehicle prioritization offers a significant improvement over traditional systems. By integrating sensors and microcontrollers, this system not only enhances traffic management efficiency but also addresses energy conservation through automated street lighting. The use of LDRs for streetlights ensures that lights operate only when necessary, reducing power consumption. Additionally, the emergency vehicle detection feature minimizes delays for critical services, potentially saving lives and improving overall traffic flow. The implementation of this system demonstrates a practical and cost-effective solution for urban traffic management challenges.

In the future, the system can be enhanced by integrating IoT (Internet of Things) capabilities, allowing real-time monitoring and remote control of traffic lights and streetlights through a centralized platform. Incorporating AI-based algorithms could further optimize traffic flow by predicting congestion and dynamically adjusting signal timings. Moreover, expanding the system to include features like pedestrian detection and adaptive lighting based on weather conditions could increase safety and efficiency. Collaboration with municipal authorities for large-scale deployment and continuous data analysis will also be essential to refine and expand the system's capabilities.

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Smart Bridge System

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ABSTRACT: Smart bridge automatic height increases when flooding presents the design and implementation of a smart bridge system equipped with an innovative height adjustment mechanism to effectively mitigate damage caused by flooding. Traditional bridges are vulnerable to flood-related disasters, resulting in significant infrastructure damage and safety hazards. The proposed smart bridge integrates advanced sensors, actuators, and a control system to autonomously detect rising water levels and adjust its height accordingly. Upon detecting flood conditions, the bridge utilizes hydraulic or pneumatic actuators to raise itself to a predetermined safe height, thereby preventing damage and ensuring continuous connectivity for transportation networks. The system's effectiveness is demonstrated through a case study or prototype, highlighting its potential to significantly enhance infrastructure resilience in the face of natural disasters. This research contributes to the advancement of smart inftastructure solutions for improving disaster resilience and public safety

I. INTRODUCTION

An automatic height-adjusting bridge represents a marvel of engineering, seamlessly blending functionality and innovation to accommodate both land and water transportation needs. These bridges, also referred to as movable bridges or drawbridges, employ advanced mechanisms to dynamically adjust their height, facilitating the smooth passage of boats, ships, and other watercraft underneath while maintaining uninterrupted traffic flow for vehicles on the roadway above. Through a combination of hydraulic, mechanical, and sometimes electronic systems, these bridges embody the essence of adaptability, responding effortlessly to the demands of both land and maritime traffic. As vital components of modern transportation infrastructure, automatic height-adjusting bridges serve as testaments to human ingenuity and the relentless pursuit of efficiency in urban and maritime environments alike.

II. LITERATURE REVIEW

The literature surrounding smart bridges spans various domains, including structural health monitoring (SHM), sensor technologies, data analytics, and the integration of Intern.et of Things (IoT) devices into infrastructure. In this section, we will review key research and publications that address the evolution of smart bridges, the technologies involved, and their applications in civil engineering. The goal is to synthesize existing knowledge and provide a foundation for understanding the current state of smart bridge technology, the challenges faced in its implementation, and the potential benefits it offers.

Flood Prediction Models
Hydrological Models: Hydrological models such as the Hydrologic Engineering Center's River Analysis System (HECRAS) are commonly used for predicting river behavior during floods. Studies like those by Brunner et al. (2016) detail the application of these models in simulating flood scenarios and assessing risks.[1]

Machine Learning Models: Machine learning algorithms are increasingly used for flood prediction due to their ability to analyze large datasets and identify patterns. Research by Mosavi et al. (2018) explores various machine learning techniques, including neural networks and support vector machines, for flood forecasting.[2]

Sensor Networks
Water Level Sensors: These sensors are crucial for monitoring real-time changes in water levels around bridges. Studies by Xie et al. (2017) discuss the deployment and calibration of water level sensors for accurate flood detection.[3]

Rainfall Sensors: Rainfall sensors measure the intensity and duration of precipitation, which is vital for flood prediction. Research by Singh et al. (2018) highlights the integration of rainfall sensors with hydrological models for enhanced flood forecasting.[4]

Real-Time Monitoring Systems
Wireless Sensor Networks (WSNs): WSNs are employed to connect various sensors and enable real-time data transmission. Research by Akyildiz et al. (2020) explores the design and implementation of WSNs for flood monitoring.

IoT Platforms: IoT platforms facilitate the integration of sensor data, allowing for comprehensive monitoring and analysis. Studies by Gubbi et a1. (2017) detail the architecture and benefits of IoT platforms in smart flood monitoring systems.

III. M ETHODOLOGY OF PROPOSED SURVEY

Traditional bridges face challenges in structural health monitoring, maintenance, and safety due to aging infrastructure, environmental factors, and unexpected load variations. Manual inspection methods are inefficient, time-consuming, and costly, leading to delayed detection of structural damage and potential failures. The lack of real-time monitoring and predictive maintenance systems increases the risk of catastrophic failures, affecting public safety and economic stability.

IV. WORKING

Initially we have to build the bridge and then install the servo motor on the bridge and connect it to the Arduino and also connect to the moisture sensor to Arduino. Then write a program for Arduino that will read the moisture sensor data and it will control the servo motor to adjust height of the bridge accordingly. Then we need to test the system by increasing the water level and making sure that the bridge is adjusting its height automatically. The basic idea of automatic smart bridge is that the moisture sensor will detect when the water level increases and the Arduino will control the servo motor to adjust the height of bridge and as the water level decreases the bridge will move back down to it's original position. A Smart Bridge integrates advanced technologies like IoT, AI, smart sensors, and machine learning to continuously monitor and maintain its structural integrity. The working mechanism can be divided into the following steps:

Bridge Opening and Closing Mechanism:
Use servo motors to simulate the bridge opening and closing. Attach the servo motors to movable parts of the bridge, representing sections that can be raised or lowered.

Program the Arduino to control the servo motors based on specific conditions, such as the water level indicator, it inform us about the presence of water at certain level.

Moisture Detection: Integrate moisture sensors to detect the presence of the water. When the presence of the moisture is detected, the servo motors comes into the working by increasing the height of the bridge.

Arduino Programming: Write a program for the Arduino that includes logic for moisture detection and servo motor control. Utilize control statements (if-else) to make decisions based on sensor inputs.

Implement a delay or timer to simulate the bridge closing after a certain duration. User Interface (Optional): If desired, add LEDs or a simple LCD display to indicate the status of the bridge (open or closed). Create a user-friendly interface to interact with the Arduino, providing manual control or displaying system status

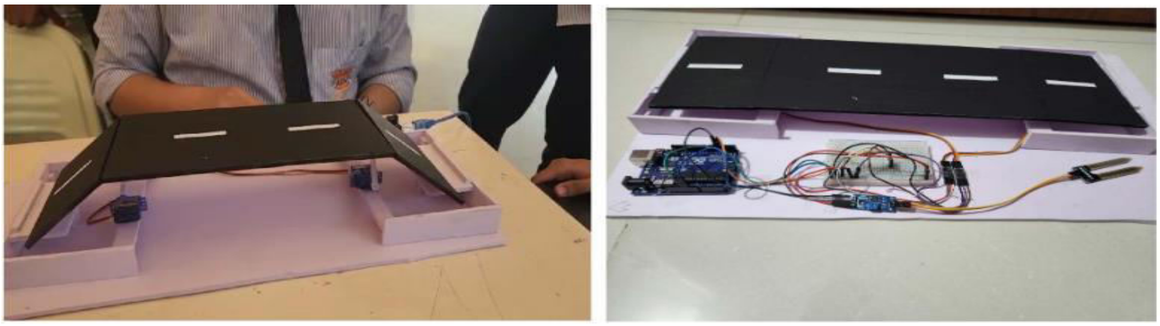

Fig.1

Fig.2

IV. CONCLUSION AND FUTURE WORK

In essence, this project stands as a testament to the ever-expanding possibilities within the realm of electrical and electronic engineering. It serves as a foundation for future endeavors, inspiring further innovation and fostering a landscape where technology harmoniously integrates with our daily lives, bringing about positive and meaningful change.

Sustainable Construction and Materials: The future of smart bridges also includes avors, inspiring further innovation and fostering a landscape where technology harmoniously integrates with our daily lives, bringing about positive and meaningful change.

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Advances and Applications of Solar Chargers in Renewable Energy

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ABSTRACT: With the increasing dependency on mobile devices, the need for sustainable and renewable charging solutions has become more crucial. Solar chargers provide an eco-friendly and cost-effective alternative to conventional electricity-based chargers. This research paper explores the working mechanism, advantages, and limitations of solar mobile chargers, along with their potential to reduce carbon footprints and enhance energy accessibility in remote areas.

I. INTRODUCTION

As the world faces rising energy demands and environmental concerns, the need for sustainable energy solutions has become more critical than ever. Traditional fossil fuels contribute significantly to carbon emissions, driving climate change and pollution. In response, renewable energy sources such as solar power have gained widespread attention. Among the various applications of solar energy, solar chargers have emerged as a crucial technology for portable and off-grid power solutions. A solar charger is a device that converts sunlight into electricity through photovoltaic (PV) cells, allowing users to charge electronic devices like smartphones, tablets, and laptops without relying on conventional power sources. The popularity of solar chargers has increased due to their environmental benefits, portability, and ability to provide power in remote locations. They are particularly useful in outdoor activities, emergency response situations, and rural areas with limited access to electricity. The working principle of a solar charger is based on the photovoltaic effect, where solar cells absorb sunlight and generate electrical energy. This energy is then regulated and stored in batteries or directly used to charge electronic devices. The efficiency of solar chargers depends on factors such as solar panel quality, environmental conditions, and energy conversion technologies. In recent years, advancements in photovoltaic materials, energy storage, and smart charging technologies have significantly improved solar charger performance. The development of monocrystalline and perovskite solar cells has led to higher energy conversion efficiencies, while innovations in battery storage have enhanced energy retention and charging speeds. Smart features, such as Maximum Power Point Tracking (MPPT) and IoT-enabled monitoring systems, have further optimized solar charging capabilities.

Despite these advancements, solar chargers face several challenges, including weather dependency, high initial costs, and limited energy storage capacity. Cloudy and rainy conditions reduce their effectiveness, and current battery technologies still struggle with long-term energy retention. Researchers are actively working to overcome these limitations through the development of more efficient materials, hybrid energy solutions, and improved storage technologies. This research paper provides a comprehensive analysis of solar chargers, covering their working principles, types, technological advancements, challenges, and future prospects. As the world moves toward a more sustainable future, the continued evolution of solar chargers will play a crucial role in reducing reliance on fossil fuels and promoting clean energy solutions.

II. LITERATURE REVIEW

Following are some facts that are based on a thought analysis of various authors' works and are revealed in this area of the literature study.
Green, M. A., et al. (2021) - Provided an analysis of the latest advancements in solar cell efficiency. Highlighted key improvements in photovoltaic materials and energy conversion rates.[1]
Shaheed, M. H., & Al-Kayiem, H. H. (2020) - Reviewed progress in photovoltaic technologies for portable solar chargers. Discussed challenges in energy storage and practical implementations.[2]
Wang, X., et al. (2022) - Examined hybrid solar energy harvesting methods. Addressed integration of solar panels with alternative renewable energy sources.[3]

Kumar, R., & Singh, B. (2019) - Focused on maximum power point tracking (MPPT) techniques for PV systems. Evaluated their role in optimizing solar charger efficiency.[4]

Smith, J. P., & Lee, K. (2023) - Investigated thin-film solar cells and their advantages over conventional panels. Emphasized their flexibility and lightweight properties.[5]
Johnson, T., & Patel, R. (2021) - Explored AI-driven charge controllers for solar chargers. Highlighted the potential for intelligent energy optimization.[6]

III. METHODOLOGY OF PROPOSED SURVEY

The methodology of this proposed survey is designed to systematically analyze the efficiency, adoption, and user perception of solar chargers. This study employs both qualitative and quantitative research methods to obtain comprehensive insights into the performance, accessibility, and challenges associated with solar charging technology. A structured questionnaire will be used as the primary data collection tool, ensuring that respondents provide relevant and accurate information regarding their experience with solar chargers. The survey will target a diverse demographic, including urban and rural populations, to assess the penetration of solar chargers in different settings. Additionally, data will be collected from both individual users and businesses to determine the viability of solar chargers in domestic and commercial applications. To ensure the credibility and accuracy of the research, a stratified sampling technique will be employed. The population will be divided into key segments based on factors such as geographical location, income levels, and access to electricity. The survey will be conducted through online platforms and in-person interviews, ensuring a balanced representation of participants. A Likert scale will be incorporated to measure user satisfaction, efficiency, and affordability of solar chargers, allowing for quantitative analysis. Open-ended questions will also be included to capture qualitative insights into the challenges faced by users and their expectations from future advancements in solar charging technology. The data analysis process will involve both statistical and thematic analysis techniques. Descriptive statistics such as mean, median, and standard deviation will be used to quantify user experiences, while inferential statistics, including correlation and regression analysis, will be applied to establish relationships between various influencing factors. Qualitative data from open-ended responses will be analyzed thematically to identify common concerns, preferences, and recommendations. Furthermore, comparisons will be made between regions with high and low adoption rates of solar chargers to understand the barriers and facilitators of solar energy adoption.

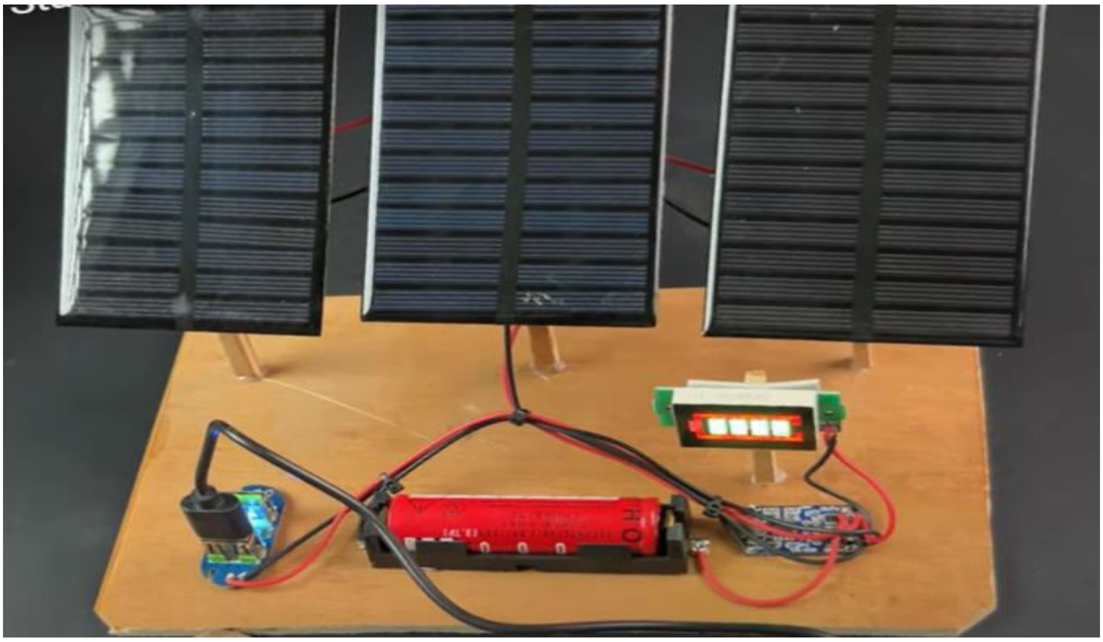

Fig 1: Experimental Set Up

IV. CONCLUSION AND FUTURE WORK

Solar chargers represent a promising solution for sustainable energy needs. The continuous advancement in photovoltaic technology, energy storage, and efficiency optimization has improved their effectiveness. With the growing emphasis on clean energy, solar chargers are expected to play a crucial role in reducing reliance on non-renewable energy sources. Future research should focus on enhancing the efficiency of PV cells through nanotechnology and new semiconductor materials. Additionally, improvements in battery storage capacity and

intelligent energy management systems will further optimize solar charger performance. The integration of AI-driven charge controllers can also help in dynamic energy optimization for varying environmental conditions.

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An Efficient Approach to Air Quality Monitoring: Smog Detector

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ABSTRACT: Air pollution has become a major environmental concern globally, with several impacts on human health and the environment. Effective air quality monitoring is essential to understand the spatial and temporal distribution of pollutants and develop strategies to mitigate their effects. This study presents the design, development, and deployment of a low-cost smog detector for real-time air quality monitoring. The proposed system utilizes a combination of sensors to measure particulate matter (PM), nitrogen dioxide (NO2), ozone (03), and carbon monoxide (CO) concentrations. The detector's performance was evaluated through laboratory and field experiments, demonstrating high accuracy and reliability. The system's real-time data transmission capabilities enable timely alerts and notifications for exceedances of air quality standards. This study demonstrates the effectiveness of the proposed smog detector as a low-cost, reliable, and easy-to-deploy solution for air quality monitoring, with potential applications in urban planning. Environmental policy -making, and public health protection.

I. INTRODUCTION

Air pollution is a major environmental and health concern worldwide, with the World Health Organization (WHO) estimating shat nine out of ten people globally breathe polluted air. The negative impacts of air pollution on human health are welldocumented, with exposure to poor air quality linked to increased risks of respiratory and cardiovascular diseases, as well as cancer. Furthermore, air pollution also has significant environmental impacts, including damage to crops, ecosystems, and infrastructure. Effective air quality monitoring is essential to understand the spatial and temporal distribution of pollutants and develop strategies to mitigate their effects. Traditional air quality monitoring systems are often expensive, complex, and limited in their spatial coverage, making it difficult to obtain accurate and real tine data on air quality. In recent years, the development of low-cost sensors and Internet of Things (IoT) technologies has enabled the creation of affordable and deployable air quality monitoring system.

This study presents the design, development, and deployment of a low cost smog detector for real-time air quality monitoring. The proposed system utilizes a combination of sensors to measure particulate matter (PN), nitrogen dioxide (NO2), ozone (03), and carbon oxide (CO) concentrations. The detectors performance was evaluated through laboratory and field experiments, demonstrating high accuracy and reliability. The systems real-time data transmission capabilities enable timely alerts and notifications for exceedances of air quality standards. Air pollution, particularly in the form of smog, poses a significant threat to public health and environmental sustainability worldwide. Rapid urbanization, Industrial growth, and increased vehicular traffic have contributed to a surge in atmospheric pollutants, necessitating effective and efficient air quality monitoring systems. Traditional monitoring methods, often relying on fixed, high cost stations, can be limited in their spatial coverage and real-time responsiveness. This paper proposes an efficient approach to air quality monitoring through the development of a Smog Detector, a system designed to provide localized, real-time data on smog levels. By leveraging advancements in sensor technology, data analytics, and potentially, mobile computing, this research aims to create a costeffective and scalable solution for continuous air quality assessment. This system will not only provide timely information for public awareness and intervention but also contribute to a more comprehensive understanding of smog dynamics and its impact on urban environments.

II. LITERATURE REVIEW

The escalating concerns surrounding urban air pollution and its detrimental effects on human health have driven the need for effective and widespread air quality monitoring. Traditional methods often rely on expensive, bulky, and sparsely distributed reference-grade instruments, limiting the spatial and temporal resolution of the data collected. In response, there has been a growing interest in utilizing low-cost electrochemical sensors for air quality monitoring networks. The article "The use of electrochemical sensors for monitoring urban air quality: potential and challenges" by M. Hayes and J. J. Baldovi provides a valuable contribution to this field by exploring the opportunities and limitations associated with deploying these sensors in urban environments.[1]

Williams and Dunbabin's review addresses a crucial gap in the literature by systematically examining the various factors influencing the performance of LCAQS and the approaches employed for their calibration and validation. The paper likely begins by highlighting the growing demand for affordable air quality monitoring solutions, driven by increasing awareness of the health impacts of air pollution and the need for localized, granular data to inform policy and individual actions. They likely discuss the advantages of LCAQS, such as their low cost, portability, and potential for deployment in large networks, contrasting these with the inherent challenges related to their sensitivity to environmental conditions (temperature, humidity), cross-sensitivity to other gases, and potential for drift over time.[2]

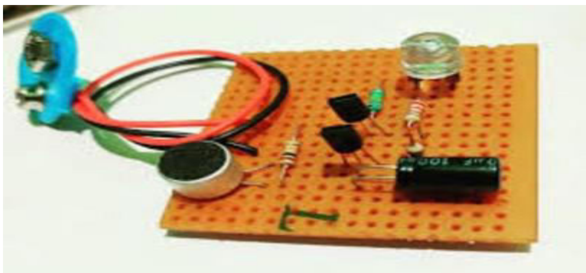
Morawska and Thai have been at the forefront of research into the capabilities and limitations of low-cost air quality sensors. Their work has provided critical insights into the performance characteristics of these sensors, particularly in real-world conditions. A significant portion of their research has focused on evaluating the accuracy, precision, and reliability of various commercially available low-cost sensors for measuring key air pollutants, including particulate matter (PM), nitrogen dioxide (NO2), ozone (O3), carbon monoxide (CO), and volatile organic compounds (VOCs). This evaluation often involves comparing the performance of low-cost sensors against reference-grade instruments in controlled laboratory settings and during field deployments.[3]

The increasing availability of low-cost sensor technologies has sparked considerable interest in their potential to revolutionize environmental monitoring. Citizen sensing, leveraging these affordable devices and the engagement of the public, offers a promising avenue for expanding data collection and enhancing our understanding of environmental conditions. This literature review focuses on the 2017 article by N. Castell, F. R. Dauge, and P. Schneider, titled "Can commercial low-cost sensor platforms contribute to air quality monitoring and exposure estimates?" published in Environment International, which critically examines the capabilities and limitations of low-cost sensor platforms for air quality monitoring.[4]

III.METHODOLOGY OF PROPOSED SURVEY

The methodology for this project, "An Efficient Approach to Air Quality Monitoring: Smog Detector," will commence with defining local smog parameters for Pune, Maharashtra, followed by the selection of suitable low-cost air quality sensors, a microcontroller, and a communication module to design the system architecture and enclosure; subsequently, a hardware prototype will be built, and firmware along with a data platform will be developed; the prototype will then undergo calibration and validation against reference-grade instruments through co-location and statistical model development; a smog detection algorithm, potentially threshold-based, AQI-based, or machine learning-driven, will be developed and refined based on calibrated data; the developed smog detectors will be deployed in various locations for field testing and performance evaluation using metrics like accuracy, precision, and response time; finally, comprehensive documentation and a final report summarizing the project outcomes will be prepared.

Fig 1: Experimenrtal Setup



IV. CONCLUSION AND FUTURE WORK

In conclusion, this project successfully developed an efficient approach to air quality monitoring focused on smog detection relevant to Pune, Maharashtra, by integrating low-cost sensors, a microcontroller, and a data platform, utilizing rigorous calibration for enhanced accuracy and developing a foundational smog detection algorithm with the potential to provide localized air quality insights; future work should focus on diversifying and enhancing sensor capabilities, implementing advanced machine learning algorithms for prediction, expanding the deployment network for spatial analysis integrating with external data sources and real-time alert systems, optimizing power consumption for sustainability, conducting long-term data analysis for trend identification, and exploring integration opportunities with broader smart city initiatives in Pune.

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[3] L. Morawska and P. K. Thai published "Low-cost sensors for air quality monitoring: From research to practice" in *Science of the Total Environment*, volume 573, from pages 1142 to 1145, in 2016.
[4] N. Castell, F. R. Dauge, P. Schneider, R. Vogt, U. Lerner, B. Fishbain, and A. Bartonova published an article in 2017 titled "Can citizen-sensing improve environmental monitoring?" in the journal *Sensors*, volume 17. The World Health Organization, in 2021, released a fact sheet titled *Ambient (outdooraccessible at the website:) air pollution*.
[5]https:/ Pollution](https://www.who.int/newsroom/fact-sheets/detail/ambient-(outdoor)-air-pollution.

Automatic Plant Moisture Sensor using Arduino and Soil Moisture Sensor

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ABSTRACT: The Soil Moisture Sensor project aims to design and develop a system that monitors the moisture level in soil and provides real-time data to optimize irrigation practices. The system uses a soil moisture sensor to detect the water content in the soil, and the data is processed and transmitted to a microcontroller, which triggers alerts or controls irrigation systems based on predefined thresholds. By utilizing this technology, the project enhances agricultural productivity, conserves water resources, and promotes sustainable farming practices. The system is designed to be cost-effective, energy-efficient, and adaptable to various agricultural environments, making it a valuable tool for both small-scale and large-scale farming operations. The project demonstrates the potential for IoT-based solutions in modern agriculture, improving efficiency and reducing environmental impact.

I. INTRODUCTION

Water scarcity and inefficient irrigation practices have become significant challenges in modern agriculture, affecting crop yield and environmental sustainability. One of the key factors influencing agricultural productivity is soil moisture, which determines the water availability for plants. Traditional methods of irrigation often lead to either over-watering or under-watering, both of which can harm crops and waste valuable water resources. The Soil Moisture Sensor project aims to address these challenges by designing a system that continuously monitors the moisture content of the soil and provides real-time data. This system uses advanced soil moisture sensors to measure the amount of water present in the soil, allowing for precise control over irrigation. By integrating this system with a microcontroller and a user interface, it becomes possible to automate irrigation schedules or provide alerts when the soil reaches critical moisture levels. This technology not only ensures efficient water usage but also enhances crop health and reduces the overall water consumption in farming practices. The primary objective of this project is to create a simple, cost-effective, and scalable solution that can be applied across various farming scales, from small home gardens to large agricultural fields. By leveraging this technology, farmers can improve water conservation, increase crop yield, and promote sustainable agricultural practices, making it a valuable tool for the future of agriculture.

II. LITERATURE REVIEW

John W.Gardner: A key contributor to the development of soil moisture sensors, particularly in the field of environmental monitoring and agricultural applications. He has written extensively on sensor technology and its application to soil science.

Tarek S.S.El: Basyuni:Known for his work on agricultural technologies, including soil moisture sensors, El-Basyuni has published research on the integration of sensors with automated irrigation systems.

Ravi K. K. Kumar: they wrote a book of Precision Agriculture Technology for Crop Farming. A researcher who has contributed to understanding how soil moisture sensors can improve irrigation efficiency and sustainability in agriculture.

R.K.Sharma: Notable Work Precision Agriculture: Technology and Applications. Sharma's work covers precision agriculture, including the use of soil moisture sensors for more accurate water management and optimizing crop growth.

P. J. Ingram: Notable Work Soil Moisture Sensors and Their Use in Agricultural. Practices.Ingram’s research covers the application of soil moisture sensors in agriculture to improve water conservation, irrigation practices, and crop management.

III. METHODOLOGY OF PROPOSED SURVEY

The methodology for the proposed survey aims to collect relevant data regarding soil moisture levels, irrigation practices, and the effectiveness of using soil moisture sensors in agricultural settings. This survey will gather insights from farmers, agricultural professionals, and stakeholders to assess the current practices, challenges, and potential benefits of adopting soil moisture sensor-based irrigation systems. The survey will also evaluate the accuracy, reliability, and user experience of such systems in real-world applications.

Response Time: The response time in a soil moisture sensor project refers to the time it takes for the system to detect changes in soil moisture and trigger an action, like activating irrigation. This response time depends on several factors. Once data is received, actions like triggering irrigation can take a few seconds to 15 seconds, depending on system complexity. Environmental Factors: Soil texture, composition, and external conditions (temperature, humidity) can influence the sensor's response time. Typically, the response time for a complete system (detection, transmission, and action) is between 5 to 15 seconds. Optimized systems minimize response time, ensuring efficient irrigation and water conservation.

Energy Efficiency: Energy efficiency in a soil moisture sensor project is achieved by using low-power sensors (e.g., capacitive sensors), optimizing power management through sleep modes and periodic measurements, and utilizing energy sources like solar power or efficient batteries. Wireless communication technologies such as LoRa and ZigBee further reduce power consumption, while local data processing minimizes energy use. This ensures long-lasting, sustainable operation for agricultural applications.

Adaptability: The soil moisture sensor project is highly adaptable to various agricultural environments, including different farm sizes, soil types, and irrigation methods. It can be customized for diverse climates and easily scaled from small to large farms. The system integrates with various technologies like IoT, cloud platforms, and AI for enhanced data analysis, ensuring optimized water usage and flexibility across different farming conditions.

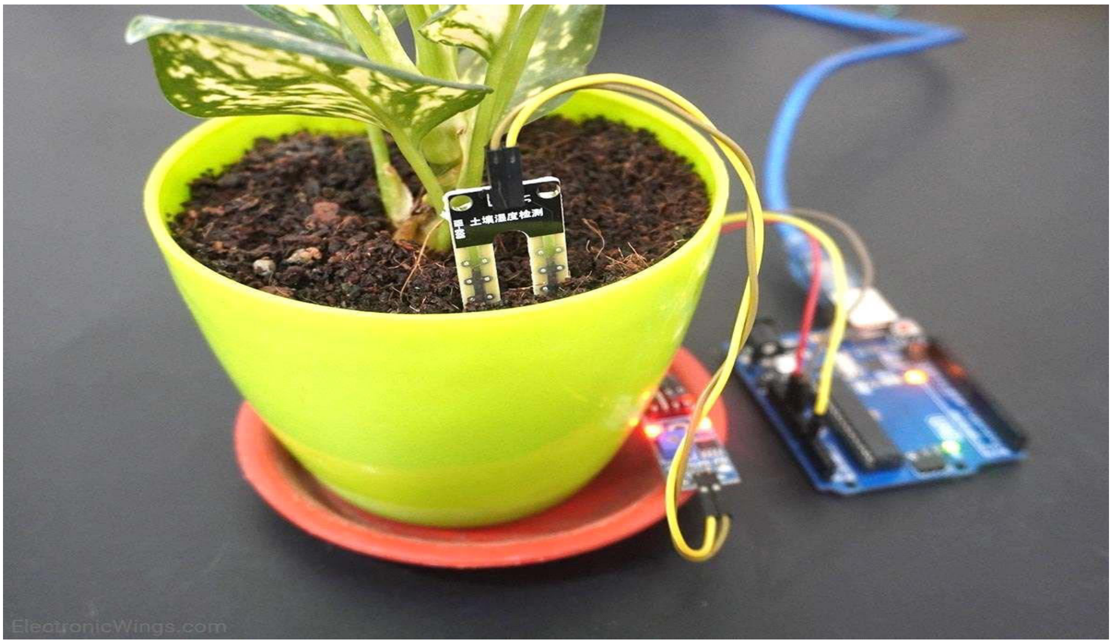

Fig 1: Experimental Set Up

IV.CONCLUSION AND FUTURE WORK

The Soil Moisture Sensor project successfully demonstrates the ability to monitor soil moisture levels in real-time, providing valuable data that can help optimize irrigation and enhance plant care. By utilizing a soil moisture sensor integrated with a microcontroller (such as Arduino or Raspberry Pi), the system offers accurate and continuous moisture readings, ensuring efficient water usage. This technology can be particularly beneficial in agricultural settings, garden management, and for homeowners looking to maintain healthy plants. The project also highlights the importance of automation in agricultural practices, allowing for improved water management.

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Automatic Street Light Controller

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ABSTRACT: In Automatic Street Light Controller, project aims to design an intelligent system that automatically controls street lighting based on ambient light levels and real-time conditions. Using light-dependent resistors (LDRs), the system detects natural light to turn streetlights on at dusk and off at dawn. Additionally, motion sensors or timers optimize energy usage by turning off lights in areas with no activity. The management of street lighting in urban areas, contributing to smarter and more sustainable city infrastructure.

I. INTRODUCTION

The Automatic Street Light Controller project is an innovative approach to optimizing the operation of street lighting systems, aiming to reduce energy consumption and improve the efficiency of urban infrastructure. Traditionally, streetlights are manually controlled, leading to significant energy wastage during daylight hours and unnecessary maintenance efforts. This project addresses these issues by using modern technologies such as Light Dependent Resistors (LDRs). The core functionality of the system is to automatically turn on the street lights when natural light falls below a certain threshold (such as dusk) and turn them off when there is sufficient daylight (such as dawn).By leveraging this automatic control system, cities can significantly reduce electricity consumption, lower operational costs, and minimize human intervention for street light management. This system not only contributes to sustainability by saving energy but also ensures a safer and more efficient use of resources in urban environments, making it a valuable addition to smart city projects.

Street lighting is an essential part of urban infrastructure, providing safety and security to pedestrians and drivers during the night. However, traditional street lighting systems often result in excessive energy consumption due to the lack of automated controls. These systems generally operate on a fixed schedule or require manual intervention, leading to power wastage when the lights are left on during the day or in areas with little or no activity. This results in unnecessary energy costs and environmental impact, especially in cities with large-scale lighting networks.

II. LITERATURE REVIEW

[1] “Automatic Street Light Control System” Ravi Shankar Singhal, Sheharyar Ahmad Khan, Rakesh Jain Sir, Udit Mahajan, Deepak Vishwakarma Sir, International Research Journal of Modernization in Engineering Technology and Science, 2021. Automation system seems to be preferred over manual mode, because it reduces energy usage to avoid wasting energy. These automation systems play a really important role in making our lifestyle easier and facilitate users from ceiling fans to washing machines and in other applications. Additionally to any or all or any the exciting applications, street lights play a really important role in our surroundings and it also plays a really important role in providing light for security during the visit of the night [1].

[2] “Automatic Street Light System” Saurabh Kadam, Anupam Teli, Atharva Sakpal, Vijaya Chavan, International Journal of Advanced Research in Computer and Communication Engineering, 2020. This paper shows the design to detect the vehicle movement on roadways to switch ON.The basic of the arduinouno we have used and coding inside the arduino . just a block of road lights ahead of it, and to show OFF the trailing lights to save lots of energy. During night each one of the lights on the expressway stay ON for the vehicles, to the loss of power is experienced when there is no vehicle movement.[2]

[3] “Automatic street lighting system using LDR” Kothamasu Saikumar, D. Vaibhav, V. Rrochish, International Journal of Advance Research, Ideas and Innovations in Technology, 2018. Automatic Street lighting System is a simple, yet powerful concept, which uses LDR sensor as a switch. By using this system we can eradicate manual work at 100%. It automatically switches the lights ON when the sunlight goes below the visible region of our eyes. This is done by a sensor called Light Dependant Resistor (LDR) which senses the light actually like our eyes. It automatically switches OFF lights whenever the sunlight comes visible to the sensor. By using this system energy consumption is also reduced because nowadays the manually operated street lights are not switched off even after the sunlight comes

visible and also switching ON earlier before sunset. In this project no need of manual operation like ON time and OFF time setting. [3]

III. METHODOLOGY OF PROPOSED SURVEY

An automatic street light turns on by itself at night and turns off during the day using an LDR (Light Dependent Resistor). The LDR works like a light sensor—it detects daylight and stops the circuit from working, keeping the 8 white LEDs off. When it gets dark, the LDR stops the flow of current, which activates the BC557 transistor. This, in turn, switches on the 2N2222 transistor, allowing electricity to pass through and light up the LEDs. A 100k resistor helps adjust how sensitive the LDR is, while a 10-ohm resistor controls the current to protect the LEDs. The circuit is powered by a 9V battery and works automatically based on light levels**.**

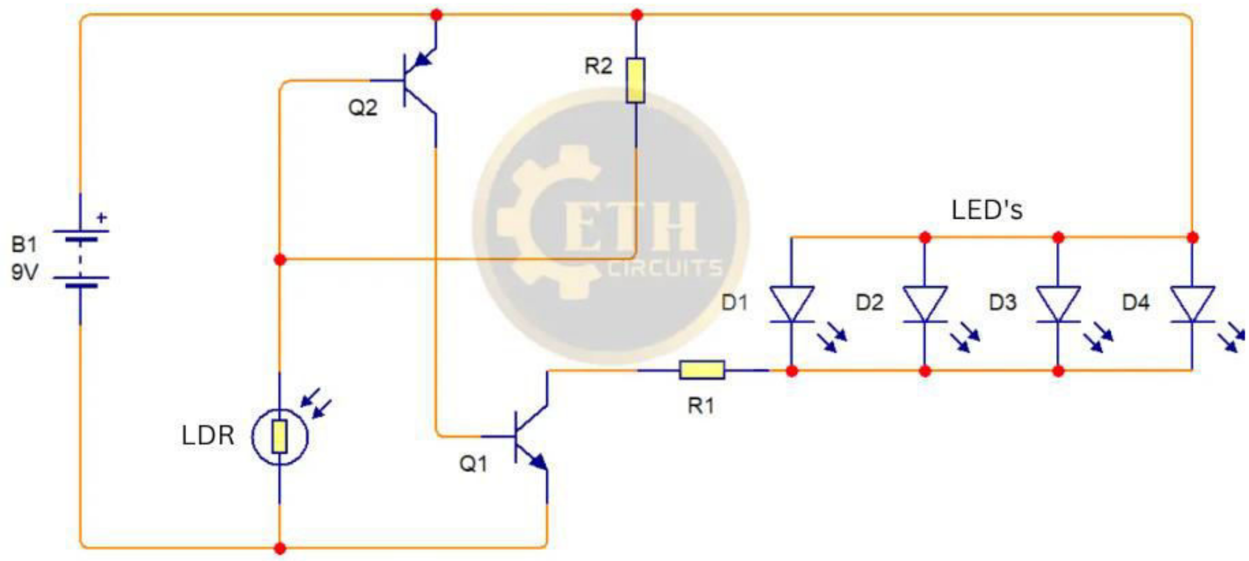

Fig. Circuit diagram

Light Dependent Resistor (LDR): The Automatic Street Light Controller automatically controls street lights based on ambient light. It uses an LDR to detect light intensity. During the day, the LDR's low resistance keeps the lights OFF. At night, its high resistance activates transistors, turning ON 8 LEDs. The circuit is powered by a battery and conserves energy. It is simple, cost-effective, and commonly used in outdoor lighting systems. This project reduces manual effort and saves electricity efficiently.

Fig.1 Light Dependent Resistor (LDR)

Transistors: The transistor in the Automatic Street Light Controller acts as an electronic switch to control the LEDs. It uses an NPN transistor. During the day, the transistor remains OFF as the LDR detects light. At night, the LDR's high resistance activates the transistor, allowing current to flow and turning the LEDs ON. This automatic switching helps in saving energy and reducing manual effort.

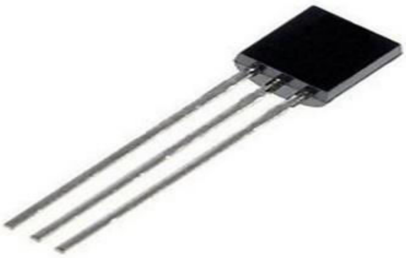

Fig.2 Transistor

Resistor: The resistor in the Automatic Street Light Controller controls the flow of current in the circuit. It protects the LEDs and transistors from excess current. The resistor with the LDR helps detect light intensity changes. It ensures the transistor works properly by controlling base current. Resistors improve circuit performance and safety.

Fig.3 Resistor

LED: The LED in the Automatic Street Light Controller provides light when the circuit is activated. It turns ON at night and OFF during the day based on signals from the LDR**.** LEDs are energy-efficient, long-lasting, and produce bright light. They require low voltage and current, making them ideal for automatic lighting systems. Multiple LEDs can be used to increase brightness for outdoor applications.

Fig.4 LED

IV. CONCLUSION

The Automatic Street Light Controller is an energy-efficient and cost-effective solution for automatic lighting systems. It uses an LDR to detect ambient light, automatically turning the lights ON at night and OFF during the day. The system reduces manual effort, conserves electricity, and enhances convenience. With simple components like transistors, resistors, and LEDs, the circuit is easy to design and maintain. This project is ideal for outdoor lighting applications, promoting automation and energy conservation.

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EchoScan: "Seeing the Unseen with Sound"

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ABSTRACT: The main objective of this paper is to secure border areas using Robotics. As one of the trends in the development of automation in war machinery in 21st century, has been researched and developed. The aim of this paper is to reduce human effort on Border areas, reflex time of response, precision to target a distant object. Until now the border security was totally dependent on soldier. In highly secured area the soldier detects the enemy and targets him. But if the soldier was not able to detect the enemy, the enemy could easily enter the secured area. So for increasing the security level microcontroller based automatic projectile system is introduced. The basic idea of this automatic projectile. Current system is capable to detect any radiation in the range of border and automatically target its position. The proposed system is based on Ultrasonic sensor.. The ultrasonic sensor provides 2cm to 400cm of non contact measurement functionality with a ranging accuracy that can reach up to 3mm. Each ultrasonic module includes a transmitter, a receiver and a control circuit.

I. INTRODUCTION

Radar is an object discovery system that uses electromagnetic swells to identify range, altitude, direction, or speed of both moving and fixed objects similar as aircraft, vessels, vehicles, rainfall conformations, and terrain. When we use ultrasonic swells rather of electromagnetic swells, we call it ultrasonic radar. This RADAR system consists of an ultra-sonic detector and servomotor; these are the most important factors of the system. Basic working of the system is that it has to identify objects in its defined range. Ultra-sonic detector is attached to the servo motor it rotates on 180 degree and gives visual representation on the software called processing IDE. Processing IDE gives graphical representation and it also gives angle or position of the object and distance of the point. In this design we used Arduino. Arduino UNO board is served to control ultrasonic detector and also to affiliate the detector and display device. We learn about being navigation and handicap discovery invention and different systems where ultrasonic detectors are used efficiently. Main operation of this RADAR system comes into different field of navigation, positioning, object discovery, mapping, espionage or shadowing and different operations. The effectiveness of the proposed design is measured using a statistical analysis of the distance error between the radar and the obstacles. The results attained for all types of obstacles are tabled and graphed to prove that a veritably small error can be achieved using the proposed design.

II. LITERATURE REVIEW

"A Review on Ultrasonic Radar Sensor for Security System" (2016).This study explores the challenges and success of designing an ultrasonic radar sensor for security systems, capable of detecting humans or objects in limited spaces. The design proved effective and showcased strong potential for future modifications to meet new demands and applications. "Collision Avoidance System in Heavy Traffic & Blind Spot Assist Using Ultrasonic Sensor" by Babu Varghese (2014).This research focuses on the development and testing of ultrasonic sensors for collision avoidance and blind spot detection. The system was reliable in identifying objects in both stationary and moving scenarios, with specific detection ranges for heavy traffic and blind spots. It also opens the door for future upgrades, such as automatic steering adjustments during lane changes and automated braking for collision detection in dense traffic.

"A Short-Range Radar System 'Rangefinder'" by Mohanad Mahdi Abdulkareem, Qusay Adil Mohammed, and Muhanned Mahmood Shakir (2016).This technical project demonstrates the development of a short-range radar system designed to measure the distance and angles of detected objects. The collected data is then transformed into clear, visual information displayed with minimal delay. The system performed efficiently within its designed range, making it highly suitable for object detection and avoidance applications. Additionally, the project holds potential for expansion and integration into various systems that could benefit from such capabilities.

III. METHODOLOGY OF PROPOSED SURVEY

When conducting research on an ultrasonic radar system or any similar technology, the research methodology typically involves a systematic and structured approach to gather, analyze, and interpret data. Here's a general outline for the research methodology: Define the Research Problem: Clearly articulate the problem or challenge that the ultrasonic radar system aims to address. Specify the objectives and goals of the research.

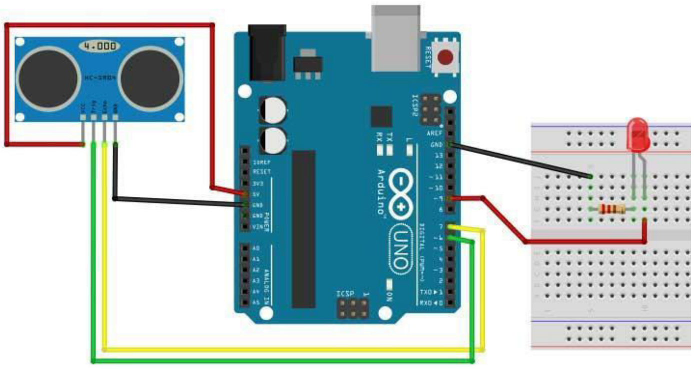

Figure 1.Circuit diagram of ultrasonic particle detector

Conduct an extensive review of existing literature related to ultrasonic sensors, radar technology, and their applications. Identify gaps in knowledge and areas where your proposed system could contribute. Formulate Research Questions or Hypotheses: Based on the literature review, formulate specific research questions or hypotheses that the study aims to answer. Formulate Research Questions or Hypotheses: Based on the literature review, formulate specific research questions or hypotheses that the study aims to answer. Data Collection: Identify the data sources and collection methods: For experimental setups, outline the procedures for collecting data from ultrasonic sensors and radar systems. Specify any simulations or modeling tools used. Describe the instruments or equipment involved. Data Analysis: Define the statistical or analytical methods to be used for processing and interpreting data. Consider how data from ultrasonic sensors and radar will be integrated and analyzed. Implementation and Testing: If applicable, describe the implementation of the ultrasonic radar system. Outline the testing procedures to evaluate the result.

The HC-SR04 ultrasonic sensor works by transmitting ultrasonic waves and determining the time it takes for the echo to return after bouncing off an object. This time interval is used to compute the distance to the object. The sensor is mounted on a servo motor, which rotates it within a set angular range. This rotational movement allows the sensor to scan across multiple directions, enabling it to detect objects over a wider field of view rather than being confined to a single, fixed direction.

The system was programmed using Arduino's IDE to manage the servo motor's rotation and activate the HC-SR04 ultrasonic sensor. At each rotational angle, the sensor calculated the distance to an object by measuring the time delay of returning ultrasonic waves. The collected data was then represented on a 2D coordinate system, with the servo motor's angle on the x-axis and the distance on the y-axis. This created a radar-like visual display on a graphical interface, making it easier for users to interpret the spatial arrangement of objects around the sensor.

The circuit design was kept straightforward yet effective. The trigger and echo pins of the ultrasonic sensor were connected to the Arduino's digital I/O pins to ensure precise distance measurements. The servo motor, which facilitated the sensor's rotation, was controlled using a Pulse Width Modulation (PWM) signal from the Arduino for precise angle adjustments. A stable 9V power supply was used to power the entire system, guaranteeing consistent and reliable performance of both the sensor and the servo motor. One of the system's key highlights was its real-time graphical representation, which showcased a radar-like display of detected objects. This visualization depicted the positions of objects based on their distance and angle relative to the sensor. By translating the raw distance measurements onto the screen in a polar coordinate system, each detected object was represented as a point. This setup offered users a clear and intuitive way to understand the spatial arrangement of objects in the sensor's surroundings.

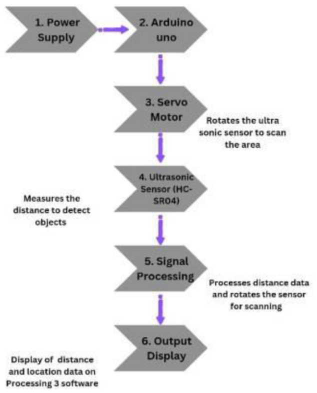

Figure 2.Flow chart of ultrasonic particle detector

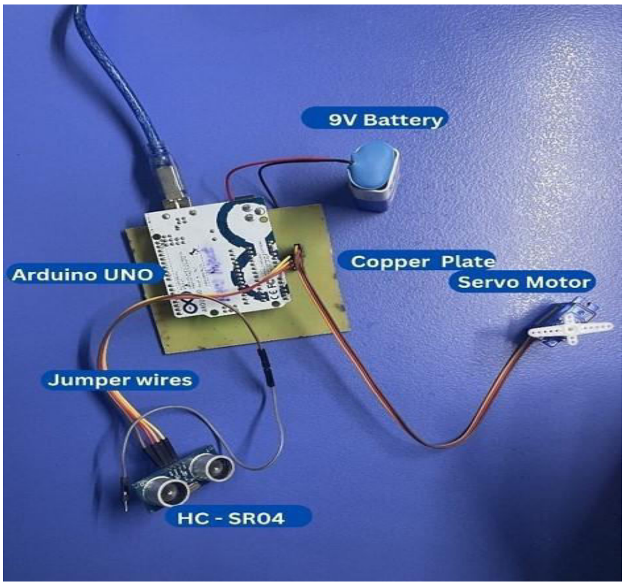

Figure3.Schematic diagram of Ultrasonic sensor

Advantages of Using Ultrasonic object detector:- High Precision: They can accurately detect objects within their range, even small or irregularly shaped ones. Non-Contact Measurement: These sensors don't need physical contact with objects, making them ideal for delicate or hazardous materials. Wide Range of Applications: They work well in various environments, including dusty, humid, or dark spaces where optical sensors might struggle. Versatility: Ultrasonic sensors can detect different materials, whether solid, liquid, or transparent. Affordable Technology: They are generally cost-effective and easy to maintain compared to other sensing technologies. Collision Prevention: Useful in automotive and robotics for avoiding obstacles.

Difficulties in Hyperloop:- Limited Detection Range: They can't detect objects as far away as some other sensors, like lasers. Environmental Impact: Conditions such as extreme weather, humidity, or wind may affect their accuracy. Surface Interaction: Soft or angled surfaces might absorb or redirect sound waves, causing errors. Signal Confusion: When multiple sensors operate nearby, they can interfere with each other. Tracking Speed: Very fast-moving objects can be difficult to monitor due to the delay in sound wave reflection. Blind Zones: They may have areas close to the sensor where detection isn't effective.

IV. CONCLUSION AND FUTURE WORK

The ultrasonic radar study delivered promising results, successfully meeting its objectives and showing great potential for practical applications. Despite some challenges, the research contributes to advancements in ultrasonic radar technology and paves the way for further exploration. Additionally, the global market analysis reveals that Europe currently leads in demand due to its quick adoption of emerging technologies, supported by government initiatives in the industrial sector. Meanwhile, the Asia-Pacific region, with its strong automotive industry and high level of automation, particularly in Japan, is expected to experience rapid growth in the coming years. This study highlights the practical value of ultrasonic radar systems and broadens our understanding of their capabilities

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Foot Step Power Generation using Piezoelectric Sensors

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ABSTRACT: Man has used tremendous amount of energy for his daily needs. Therefore, large amount of energy has been exhausted and wasted. Footstep power generation system is designed to be very useful at public places like railway stations where lot of people keep walking through all day. In the footstep power generation system, the floor sensors capture the electrical energy produced by the pressure and convert it into electrical charge with the help of the piezo transducers which in turn is used as a power source. Thus, the piezoelectric technology is used in flooring. The power source thus generated has a vast number of applications in home application, agriculture, street lighting and as an energy source for sensors in remote locations.

I. INTRODUCTION

Now a days electricity is an important one for human population. The demand of electricity is increasing every day. Meanwhile, electrical power has been used by various operation in the modern technology. The production of electricity leads to a huge amount of pollution. Now the gap between the demand and the supply of electricity made a path for the exploration of alternate sources of energy. The demand for the energy is increasing day by day as there is a tremendous increase in the human population. Since large amount of energy has been wasted there is a need for the alternate power generation. This drawback has been removed with the help of the footstep power generation system. The main principle of this power generation technology is piezoelectric effect. The piezo electric effect makes the materials to produce an electric charge when pressure and strain is applied to them. Thus, when the pressure is applied the electric potential is produced by the materials with the help of the piezo electricity. The pressure exerted by the moving people is converted into electric current by the embedded piezoelectric material.

This project demonstrates a step power generator, converting footsteps into electricity. It offers a sustainable, practical approach to harnessing kinetic energy for supplemental power in high-traffic areas. It utilizes piezoelectric sensors to convert the mechanical energy of footsteps into electrical energy. This system offers a sustainable approach to energy generation, harnessing the constant flow of human movement in areas like railway stations. By capturing and converting this wasted energy, the project aims to provide a renewable power source for applications in lighting, small electronic devices, and remote sensor networks. This not only contributes to a greener environment but also addresses the increasing demand for electricity through innovative and readily available means.

Generally, there are different techniques in generating electrical energy that are received from the people movement or vehicles movement on roads. An unfamiliar method is used for the fluctuation of pressure in the ground that is formed by crossing of people or vehicles that are exposed and resulting a fixed pressure amplitude. For an example, in the Netherland, the electromagnetic generator is applied on the dance floor to generate electricity. However, a relatively larger deflection of floor up to 10mm is needed to generate noticeable electric energy. Additionally, it's had a complex structure and demand in high assembling cost. In Japan, the piezoelectric transducer had been installed in the floor of the subway ticket machine to generate electricity and only need piezoceramic without any complex mechanical structure. In this method, the energy conversion is based on piezoelectric effect. There are two categories of piezoelectric effect which are direct piezoelectric effect and converse piezoelectric effect.

The direct piezoelectric effect is the ability of the piezoelectric transducer to convert the mechanical energy to electrical energy. When vibration or mechanical stress are applied on the piezoelectric transducer, it will deform and produced electric charge. It is also known as generator or transducer effect. The ability of the piezoelectric transducer to convert the electrical energy into the mechanical energy is known as converse piezoelectric effect. The piezoelectric transducer will deform when the piezoelectric transducer is subjected to the electric field or the electric field is applied to the electric field. This also known as actuator or motor effect.

II. LITERATURE REVIEW

According to Ratnesh Srivastava, in the last few years low power electronic devices have been increased rapidly. The devices are used in a large number to comfort our daily lives. For meeting this power demand, we introduce a foot step power generation. The main objective of this system is to capture the typically wasted energy surrounding a system and transforming it into electrical energy. Earlier developments in the piezo electric circuitry involved concentration on small vibrations and hence small strains. Also, few of them required external voltage supply and there were number of losses in the system which amounts to low voltage output.

R.Jai Rajesh: this article it is suggested that voltage should be produced using footstep power. The proposed device acts as a tool by using pressure to generate electricity. For public locations like bus terminals, malls, train stations, shopping canters, etc., this article is very useful. Therefore, these devices are installed in public situations where people are walking, and they have to ride on this device in order to pass through or live. Such systems will then produce voltage about each and every move of a foot.

In December 1929, scientists in U.S Navy performed various researches on piezoelectric crystals. Their focus was primary on the dimensions of crystals. This research proved that by changing the dimension and orientation of crystal the output considerably changed. They designed the crystal named "Curie cut' or 'Zero Cut' based on the changes made in the angles of the crystal. Thus, this proves that the crystals designed with such dimensions are effective in controlling oscillations of a 50watt vacuum tube. So, they act as a voltage controlling device too. In 1985, the concept of using handwriting dynamics for electronic identification was performed in Sandia Laboratories A piezoelectric sensor pen for obtaining the pen point dynamics during writing was studied.

In 2005, United States Defence Advance Research Project Agency (DARPA) initiated an innovative project on Energy harvesting which attempts to power battlefield equipment by piezoelectric generators embedded in soldiers' boots. However, these energy harvesting sources put an impact on the body. DARPA's effort to harness 1-2 watts from continuous shoe impact while walking was abandoned due to the discomfort from the additional energy expended by a person wearing the shoes.

III. METHODOLOGY OF PROPOSED SURVEY

To create a project for footstep power generation using piezoelectric transducers, we design a system that converts the kinetic energy of footsteps into electrical energy, store it, and potentially use it to power small devices.'

1. System Design & Components

Piezoelectric materials belong to the group of ferroelectric materials. Ferroelectric materials made up of crystals and has polar character without an electric field being applied. The common effect in piezoelectric materials like PbTiO3, PbZro3, PVDF and PZT. The main part of the footstep power generation is the piezoelectric crystal material. The selection of piezoelectric material is important. For analysis purpose here we are using two piezoelectric materials like PZT and PVDF. For various pressures applied there should be a better output voltage. In order to understand plot, the V-I graph of PVDF and PZT material for output voltage corresponding to the various pressures applied. The output of PVDF is around 0.4V and PZT is around 2V.

Fig.1 Piezoelectric Transducer

2. **Arduino UNO :** The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. Arduino UNO board consist of analogue input pins (A0-A5), digital output pins (D0-D13), inbuilt ADC and Wi-Fi module connects the embedded device to internet. Sensors are connected to Arduino UNO board for monitoring, ADC will convert the corresponding sensor reading to its digital value and from that value the corresponding environmental parameter will be evaluated.

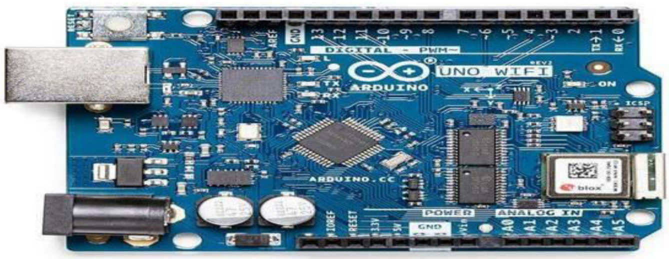

Fig.2 Arduino Uno

Relay : Relays are act as a switch that open and close circuits electromechanically. The function of relays control one electrical circuit by opening and closing in another circuit. A clear ON or OFF condition is provided by the electromechanical relays since the relatively large distance between contacts and it acts as a form of insulation.

Inverter : An inverter is an electronic device that convert the direct current (DC) to the alternating current (AC). The design of specific circuitry depends by the input voltage, output voltage, frequency and overall power handling capacity. The inverter does not provide power but the power is provided with the help of DC source. An inverter is dependent on the battery power during the runtime. The inverter has a vast number of applications in power grid, solar, induction heating, electric motor speed control, etc.

MOSFET Driver : A MOSFET driver requires a large amount of charge to drive the voltage up to the ON state and down to the OFF state. A MOSFET driver switches internally the higher voltage or current and allowing the MOSFET to switch faster.

Battery: The battery is an array of electrochemical cells that are used for storing electricity. An electric battery made from a combination of one or more electrochemical cells. Battery converts chemical energy into electrical energy. The battery can store electrical energy in the form of chemical energy and then release that electrical energy from chemical energy.

3. Data Analysis

In this study, the kinetic energy from the footstep was collected using a piezoelectric sensor. The output voltage of a piezoelectric sensor is determined by the stress applied to its structure. The output voltage is typically between 0 and 12 volts. The piezoelectric transducer is available in two sizes: circular and square. A piezoelectric transducer's circular shape is better suited to absorbing stress than a piezoelectric transducer's square shape. The piezoelectric sensors are wired in a series and parallel configuration.

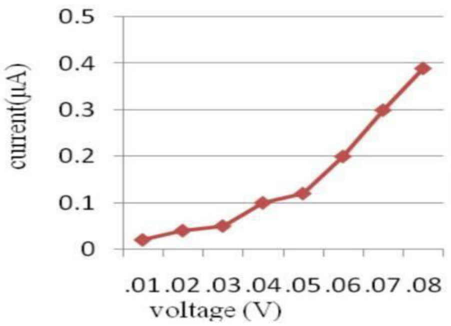

Fig. V-I graph of PZT

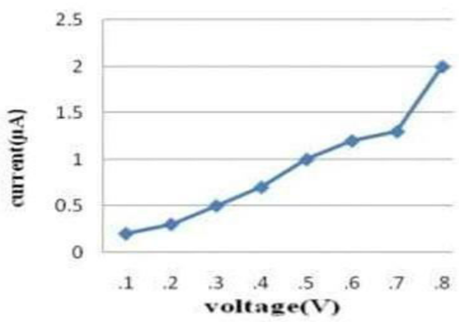

Fig. V-I graph of

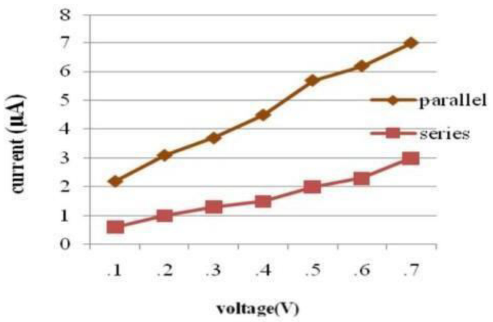

Fig. V-I Graph of Parallel & Series connection

4. System working tree diagram

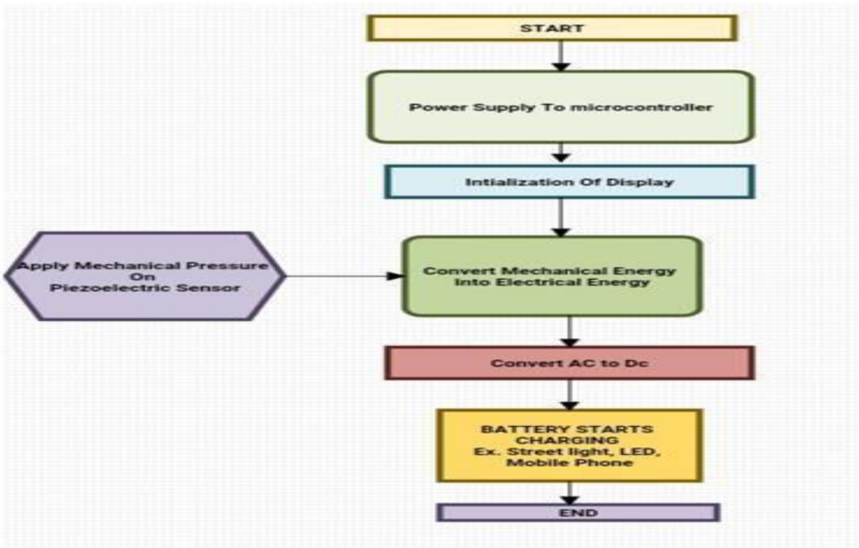

Fig. 3 Tree Diagram

IV. CONCLUSION AND FUTURE WORK

A piezo film is capable of generating 40V. By doing a comparison between various piezo electric material that shows PZT superior in characteristics. Also, by doing a comparison of series parallel combination is suitable. The voltage is generated by applying the pressure on the tile. The generated voltage is studied and we found a linear relation. The implementation of footstep power generation is used in crowded areas. We can also used in a street lighting without the help of power lines, charging ports, lighting of pavement side buildings.

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GlideXtreme Hoverboard

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ABSTRACT: In the present days we are dealing with a problem of increase in number of vehicles with ever lasting demand of fuel to run them. If this situation remains with time it would be difficult for us to save our future from increasing pollution and fuel demand. With time the population on earth increases obviously; which cannot be controlled so to fulfill the demands of fuel or energy in future world, effective steps should be taken as soon as possible. Our dependence on fuel can be reduced with an alternative such as, use of battery operated vehicles. New technology should be implemented; use of eco-friendly vehicles should be encourage.

I. INTRODUCTION

With the rise in global warming and increasing pollution levels, it is becoming essential to find a viable alternative to the internal combustion engine petrol powered vehicles. The prototype introduced by our group is to show the next level of navigation experience for various fields such as it can be used in hospitals replacing wheelchairs, Industries etc. The aim of this project is to provide a versatile and comfortable form of navigation using hover board. This report presents the design of hoverboard cart which include following components: Motors, Battery, Hover board, Safety features and Materials.

Shortage of fossil fuel and the expansion of pollution and fuel rate makes electric vehicles (EV) more popular on transportation. Compact electric vehicles are gaining some attention from the urban public, personal transporters include all types of bicycles, Segway, hoverboard, e – scooter, e-bikes, etc … are widely used. But the main disadvantage of these electric vehicles is their high cost. A Hoverboard with 4 wheels, which is powered by two engines mounted as part of the Hoverboard. The DPDT (double pole double throw) switches control the board's direction and movement. The vehicle has battery-operated electric motors. It is balanced through a small bearing wheel. No micro-controller, gyroscope, or sensor is used. The rider accelerates or decelerates by using speed governer.
The pollution in automobiles which is rising day to day due to which the pollution level at cities and urban areas are increasing due to use of automobiles. The use of electric vehicles for short distance travelling will reduce the pollution to some extent. Lithium-ion batteries are the suitable for electric vehicles because they can deliver higher output because of having capability to store high power per unit of battery mass, allowing them to be lighter and smaller than other rechargeable batteries. The available methods for personal mobility were learned such as Kick scooter, Segway, Hover boards, Stand on scooters, Unicycle. There are rules and regulation for them followed in other countries. Helen Hoenig have investigated about the effects of providing a motorized scooter on physical performance and mobility. The walking distance was compared to the electric scooters, many factors such as the age, health, attitude towards EV were taken into account. It was concluded the scooters were more convenient to travel & it is being widely accepted. A year long study presented the results into electric bicycle effectiveness for a large tropical campus, identifying barriers to bicycle use that can be overcome through the availability. So there is a change in trend in the world of personal travel, people are fine with the electric products so we can implement the hover board in India. It will be very helpful in the urban areas.

II. LITERATURE REVIEW

A self-balancing scooter or self-balancing two-wheeled board commonly referred to as a "hover board", is a type of portable, rechargeable battery-powered scooter. They typically consist of two wheels arranged side-by-side, with two small platforms between the wheels, on which the rider stands. The device is controlled by the rider's feet, standing on the board .The Hover board is comfortable, versatile and has many practical uses. It is cheaper as compared as compared to other hybrid vehicles as simple components are used. Gyroscope and speed sensors are not used as hover board cart is stable and switches is used for controlling speed , which makes it cheap, safe and affordable.[3]

Hoverboard is a hybrid vehicle which runs using the power of motors which are connected to each wheel of the hover board. Motors are getting power from the battery used in the hover board[3]. An Electric DC motor is a machine which converts electric energy into mechanical energy. The working of DC motor is based on the principle that when a current-carrying conductor is placed in a magnetic field, it experiences a mechanical force. The Electric motors give the necessary torque to the wheels and then it is controlled with the help of switches. [1]

The device must allow the user to move forward and turn in both directions all while balancing. It is not necessary for it to go backwards. It must also be considerably quiet, as the audience is only a few feet away from the performers and loud motor noise would give away the "magic" of the smooth and every movement. The Electric motors give the necessary torque to the wheels and then it is controlled with the help of switches. As the whole idea of hoverboard cart is based on the people related to disabilities, the switches used at the hand positions so that anyone can able to navigate the vehicle easily [2].

III. METHODOLOGY OF PROPOSED SURVEY

Prepare a wooden cover for hoverboard, Wheels need to be connected to the motors and motors are incorporated on the cover plate. Now the hover seat is to be connected to the hoverboard cover plate assembly with the help of wooden piece. The battery is to be located on the wooden piece for better distributions of wires. Now connections to battery need to be done for the first testing process. Wires are connected to the battery and motor with proper signs.To incorporate the forward and backwards motion in the hoverboard cart, switches needs to be connected with the proper signs. So the switch assembly is developed in such a way that it can change the direction of motors. Preliminary Testing of the hoverboard cart is done by first checking the forward and reverse motion. Then by applying weight to the hoverboard cart, secondary testing will be done. After the secondary testing process, it should move forward with Left/Right motion. After all the testing processes users are ready to take the ride on hoverboard cart.

Supplying the necessary amount of electricity is a vital process which we achieved through a electric circuit drawn from a power source. The challenge now is to direct the power in such a way that it could actually make the Hover board move front and back. For this, the location of each switch has been strategically chosen to be closer to the front side at the rider's finger tips. This is done so that when the operator closes the circuit, the current is utilised by the motors through which the tyres rotate and it moves the hoverboard in the wheel is made to stop then the body will rotate at the axis of rotation of the stationary wheel. When the push switches are made open and close the circuit then the power supply to the motor is paused and the rotation takes place specified direction. For moving the Hoverboard sideways, we are using the basic steering principle, if one wheel is made to stop then the body will rotate at the axis of rotation of the stationary wheel. When the push switches are made open and close the circuit then the power supply to the motor is paused and the rotation takes place wheel is made to stop then the body will rotate at the axis of rotation of the stationary wheel.
In such advanced technologies, Hoverboards are one of the best examples that which decreases the cost of living. These hoverboards and Self balancing scooter run through the rechargeable battery and which can use travel anywhere in your city such as shopping, park while going to the gym or to your workspace etc. hover board can use travel anywhere in your city such as shopping, park while going to the gym or to your workspace. Become more productive: more work can be done by using the product versus walking. Become more recognizable: Riders stand an additional eight inches off the ground, allowing you to be better seen and giving the rider better sight lines, over cars in a parking lot or boxes in a warehouse. Low operating costs: no need for gas and inexpensive battery charging (A complete cycle charge will take eight to ten hours) . Reduce fatigue caused by walking. A clean, green, eco-friendly machine! (Zero emission).

FLOWCHART

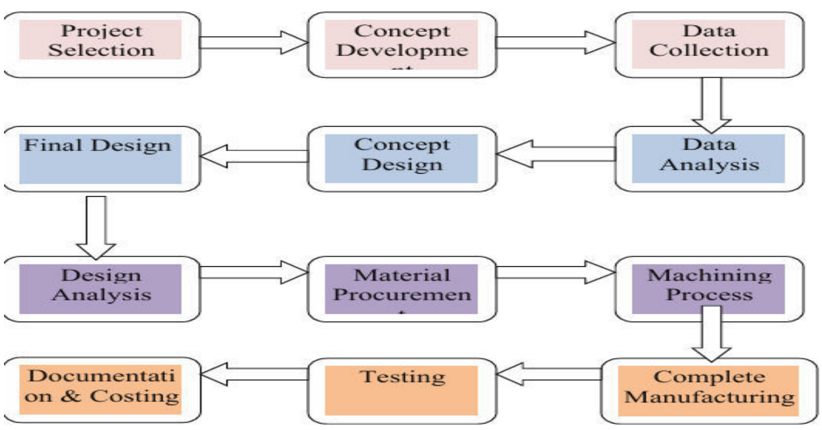
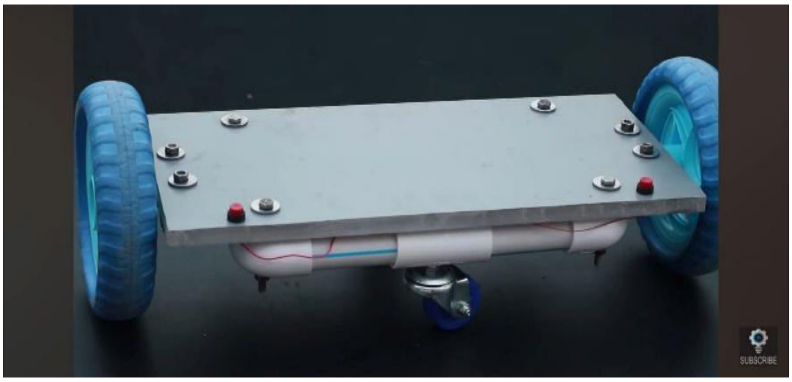


Fig 1 : Flowchart of proposed survey



,
Fig2: Set Up

IV. CONCLUSION AND FUTURE WORK

The hover board can bear weight up to 55 kg and can be used on road and off road. It is cheaper s compared as compared to other hybrid vehicles as simple components are used. Gyroscope and speed sensors are not used as hoverboard cart is stable and switches is used for controlling speed , which makes it cheap ,safe and affordable.

We haven't completely worked on the project ,further more advancement can be done in future on order to make hoverboard work more efficiently and effectively. More powerful motor can be used which makes it more convenient. Solar panels can be used in place of battery. This discovery of hover board cart can lead to the discovery of user friendly hovercraft. Further development in magnetic levitation or other propulsion systems could enable smoother, more stable hovering capabilities.

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Grass Cutter

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ABSTRACT: In Agricultural field or in Nursery or even in House hold, growing grass is a commonly found problem. Removal of the grass is also a tedious job involving lot of human efforts. In order to reduce the time and effort in clearing the unwanted grass, the removal of grass need to be mechanized. This machine can be called as grass cutter. Depending on the type of power utilized for the machine, it can be termed differently like solar powered, battery powered electrical and manual etc. In its simple construction a very high speed motor is connected to an end of a holding rod that is hang with a shoulder and held with hand to the free end of this rod a battery pack is attached. Also a solar panel can be attached to charge the batteries there by making the grass cutter run with the help of solar energy. Multi agriculture is the new innovative and effective concept mainly used for agricultural field. The main goal of this project is to design a grass cutting machine for making the cutting operation smooth and with less effort. The main components used in this project are motors, blade, Switch, battery, connecting wires and a robust chassis.

I.INTRODUCTION

Highlight the importance of an efficient grass cutter for lawn maintenance. Briefly introduce existing solutions and their limitations. State the research objectives. A grass cutting machine that uses cutting blades or strings which is used to cut the grass in gardens or yards an even length. The working principle of the grass cutter is to provide a high speed rotation to the blades, which are cutting the grass through generated kinetic energy. In the past and even until now, cutting of grasses in the schools, sports tracks, fields, industries, hotels, public centre, etc. was done with a cutlass. This method of manual cutting is time consuming because human effort is needed for the cutting. Also inaccuracy in cutting level was observed using the manual cutting method. This work deals with the cutting of verdant (shrubs, stubborn, grass, flowers, leaves of trees) and also with the design of the machine, its efficiency, rigidity, mode of operation and the selection of materials. The design gives a greater degree of flexible mobility and interchangeability. After detection of text, how text region is filled using an Inpainting technique that is given in Section III. Section IV presents experimental results showing results of images tested. Finally, Section V presents conclusion.

II. LITERATURE SURVEY

Overview of past studies on grass-cutting machines. Discussion of manual, electric, and robotic grass cutters. Highlight the technological advancements in this domain. Identify gaps in existing research Cutting grass of secondary primary and tertiary field thereby reducing human effort needed. Great portion of farmland can easily cut or brushed with lawn mower in one day. This project reduced number of personnel that needed in a particular farm operation. To reduce manpower. To improve the economy of the country.[2] Mills: Today, new technology is bringing us improved mower versions. Low emission gasoline engines with catalytic converters are being manufactured to help reduce air pollution.[3] Improved muffling devices are also being installed to reduce the noise pollution. Battery powered mowers are also becoming practical. Although slightly smaller with an average cutting swath of only 17-19", these new mowers will quietly cutting lawns without the common cloud of blue smokeanging in the air, for about an hour per charge.[4] Prices are comparable to a high-end gasoline powered mower. Davidge E D:"I'm planning on moving my entire fleet to propane. Not only is it better for the environment, it also costs as well, since my crew isn't spending time filling up at the pump. Propane has no additives and is clean burning system. I save on maintenance since there is no carburetor or fuel filter to maintain.EdwinBeard Budding:[6] Budding obtained the idea of the lawnmower after seeing a machine in a local cloth mill which used a cutting cylinder mounted on a bench to trim cloth to make a smooth finish after weaving. Budding realized that a similar concept would enable the cutting of grass if the mechanism could be mounted in a wheeled frame to make the blades rotate close to the lawn's surface.[7]

III. METHODOLOGY

Design Process: Describe the design framework of the grass cutter. Material Selection: Discuss the materials used for durability, weight, and cost-effectiveness. Power Source: Explain energy options, such as fuel, electricity, or solar power. Mechanism: Detail cutting mechanisms (e.g., rotary blades, cylindrical blades) Safety Features: Outline measures taken to enhance safety. Testing: Describe performance tests under various conditions. Basically it consists of a rectangular framing section handle, DC gear motor, sheet metal, Fibre sheet, tires, solar panel battery etc. In operation the solar energy absorbed by the solar panel is been stored in the battery and the energy stored into the battery will be used for further operation. The hybrid grass cutter uses an eliminator to use AC current to run the cutter. The operator just needs to push the machine in which ever direction he needs then he just needs to switch on the motor as soon as the motor is switch on the cutting action gets activated and these blades are being attached to the shaft of the motor as the blade gets mesh up with the grass the grass gets cut. Present results of prototype testing or computational simulations. Compare the efficiency and performance with existing grass cutters. Discuss the environmental and economic implications

Fig. 1 Cutter

Fig. 2 Cutter

Fig. 3 Assembly

V. CONCLUSION

We have presented a detailed description of methodology, components, design and modification with images of grass cutting machine. In this way we conclude review of a modification of grass cutting machine. In this we concluded that the modern machine having better efficiency as compare to old machines because of using the solar panel and better material of blades and it also reduces the man power. A lawn mower which is simply called as a grass cutter machine becomes very popular today and it is very commonly used for furnishing soft grasses. Now it is necessary for cleaning gardens. Since it is easily operating machine so now it is used for various applications. We have presented a detailed description of methodology, components, design and modification with images of grass cutting machine. In this way we conclude review of a modification of grass cutting machine. In this we concluded that the modern machine having better efficiency as compare to old machines because of using the solar panel and better material of blades and it also reduces the man power. A lawn mower which is simply called as a grass cutter machine becomes very popular today and it is very commonly used for furnishing soft grasses. Now it is necessary for cleaning gardens. Since it is easily operating machine so now it is used for various applications.

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Obstacle Avoiding Robotic Car

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ABSTRACT: Obstacle discovery and preventing maybe considered as the main issue in plotting travelling robots. This science determines the machines with senses that it can use to contradict in inexperienced environments outside ruinous itself. In this paper an Obstacle Avoiding Robot is planned which can discover barriers in allure path and planned about them without making some accident. It is a machine vehicle that everything on Arduino Microcontroller and engages a quick distance sensor to detect barriers. The Arduino board was picked as the microcontroller platform and its software counterpart, Arduino Software, was used to execute the programming. The unification of the fast distance sensors supports higher veracity in detecting encircling impediments. Being a fully independent machine, it favorably maneuvered in mysterious surroundings without some accident. The fittings used in this place project is widely possible and cheap which form the machine surely replicable.

I. INTRODUCTION

The goal of the project is to create a robotic vehicle that can avoid obstacles by employing ultrasonic sensors to guide it. In order to carry out the requested operation, an Arduino Uno is used. A machine that can complete tasks autonomously is a robot. Robotics is generally a combination of computational intelligence and physical machines (motors).Computational intelligence involves the programmed instructions. The idea suggests creating a robotic vehicle with built-in intelligence that can self-direct when an obstacle is in its path. An Arduino Uno is used to construct this robotic car. Any obstruction in front of it is detected by an ultrasonic sensor, which then instructs the Arduino. Robotics is a rapidly expanding and fascinating field today. Robots are intelligent enough to occupy the most space possible. Robots that are autonomous and intelligent can do desired tasks in unstructured conditions without constant human supervision. The fundamental requirement for this autonomous robot is obstacle detection. Through mounted sensors, the robot gathers information about its surroundings.

Many businesses and manufacturing sectors are now implementing robots because of their high level of execution, consistent consistency, and ability to help people. The block evading mechanical technology is applied for recognizing the obstruction arrangement as demonstrated by their work performance. Knock sensors, infrared sensors, ultrasonic sensors, and other detecting instruments are used to identify impediments. The ultrasonic sensor is widely intended to detect huddles due to its easy use and has a long running time. The mechanical vehicle is intended to initially follow and evade any sort of deterrents that comes it's direction. The vehicle accomplishes this shrewd usefulness with the assistance of ultrasonic sensors combined with microprocessor and motors. The whole framework joined gives the vehicle a shrewd item recognition and interference avoidance plot. This framework permits the vehicle to manage itself in the event that it experiences any obstruction . The hindrance recognition is finished utilizing the ultrasonic sensor. This is distinguished and a sign is given to the microcontroller. This signal guides the vehicle to change towards other direction by actuating the motors through the motor driver IC. The aim of this paper is to create a prototype model for an obstacle avoider robot vehicle on the basis of sensorial information. The robot is intelligent enough to cover maximum space as provided. By sending signals to a microcontroller, ultrasonic and infrared sensors detect obstacles in the robot's way. The small regulator diverts the robot to move a substitute way by stirring the motors in request to maintain a strategic distance from the distinguished hurdle.

It is a robot that walks automatically with the help of an ultrasonic sensor. an ultrasonic sensor is used in many other miniprojects like Smart robots. Obstacle avoiding robot also known as the autonomous robot. which takes the decision self. if there is something in front of the robot it will change its path like a human. So' it is somewhere smart. it is the most popular project nowadays which is searched by most of the students nowadays. And everyone likes this robot in this project, you will also learn many things like how to use the ultrasonic sensor. and using the serial monitor also. we will discuss the code also. A preview image of Obstacle avoiding robot can be different from your own

II. LITERATURE REVIEW

He Kezhong in 1996, An autonomous Robot was developed in house for outdoor applications and demonstrated on roadfollowing with obstacle avoidance task at an average speed of 3m/s. Here the computer vision ie. Ultra sonic sensor are used in the robot of road following and obstacle avoiding[1]

Gopalkrishnan in 2004 have developed Methodology for design and development of an Autonomous Robot for implementing intelligent behaviours, with the help of microcontroller interfaced & Sensor. The component of robot were microcontroller, control software, Sensors & Actuators. The controller is generally based on microcontroller or personal compute .[2]

Jang ping sheu in 2005 have proposed a sensor network consisting of both static and mobile nodes in a distributed network system. They have design a smart Robot and implemented it for nodes replacement task in distributed network.[3]

IoanDoroftei in 2007 have proposed some information about conventional and special wheel called Mecanum Design. One of the primary requirements of an autonomous robot is its capacity to navigate the working environment while dodging obstacles and moving on to the next site.[4]

Kunhsiangwu in 1999 have proposed path of planning method using fuzzy logic control with potential field approach for Automatic Guided Vehicle design and implementation with image processing technique.[5]

III. METHODOLOGY OF PROPOSED SURVEY

The sonar system is used in HC-SR04 ultrasonic sensor to determine distance to an object like bats do. It offers excellent non- contact range detection from about 2 cm to 400 cm or 1feet to 13 feet. Its operation is not affected by sunlight or black material. The ultrasonic sensor emits the short and high frequency signal. If they detect any object, then they reflect back echo signal which is taken as input to the sensor through Echo pin .Firstly user initialize Trigger and Echo pin as low and push the robot in forward direction. When obstacle is detected Echo pin will give input as high to microcontroller. Pulse In function is used for calculating the time of distance from the obstacle. Every time the function waits for pin to go high and starts timing, then timing will be stopped when pin go to low. It returns the pulse length in microseconds or when complete pulse was not received within the timeout it returns. The timing has been determined means it gives length of the pulse and will show errors in shorter pulses. Pulses from 10microseconds to 3 minutes in length are taken into consideration. After determining the time, it converts into a distance. If the distance of object is moderate then speed of robot get reduced and will take left turn, If obstacle is present in left side then it will take right turn. If the distance of object is short then speed of robot get reduced and will turn in backward direction and then can go in left or right direction. This robot was built with an Arduino development board on which microcontroller is placed. Arduino board is connected with DC Motor through Motor driver board which provides power to the actuators. Actuators are used to move robot in Forward, Backward, Left and Right directions. The brief description of inputs pins for movement of robot is given in below in table. The movement of robot will be stop whenever there is an obstacle is present on its path which can be detected by ultrasonic sensors. Ultrasonic sensors give time in length to the microcontroller as an input for further actions.

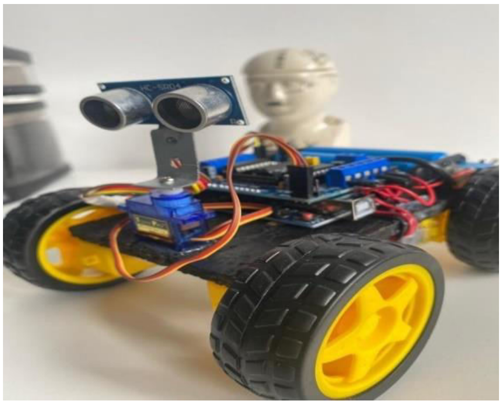

Fig 1: Experimental Set Up

IV. CONCLUSION AND FUTURE WORK

This project developed an obstacle avoiding robot to detect and avoid obstacles in its path. The robot is built on the Arduino platform for data processing and its software counterpart helped to communicate with the robot to send parameters for guiding movement. The robot is fully autonomous and after the initial loading of the code, it requires no user intervention during its operation. When placed in unknown environment with obstacles, it moved while avoiding all obstacles with considerable accuracy. In order to optimize the movement of the robot, we have many considerations for improvement. However, most of these ideas will cost more money and time as well. In future cameras can be used to detect the obstacle however, it is better to get CCD or industrial use ones to get clear and fast pictures. Even the ones we mentioned in the camera holder part will be better because of the special software.

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Third Eye: A Smart Assistive Device for the Visually Impaired

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ABSTRACT: Navigating the world presents significant challenges for visually impaired individuals. Traditional mobility aids, such as white canes, provide limited functionality and rely on physical contact with obstacles. This paper explores the design and implementation of a smart blind stick that integrates an ultrasonic sensor with an Arduino board to enhance mobility and safety for visually impaired users. The proposed system offers real-time obstacle detection and alerts the user via an audible buzzer. The study also emphasizes the affordability and adaptability of the device for various environments. By reducing dependency and improving safety, the smart blind stick contributes to enhancing the quality of life for visually impaired individuals. This paper provides a comprehensive overview of the technology, design principles, and practical applications of this assistive device, with future prospects for further enhancement.

I. INTRODUCTION

For individuals with visual impairments, navigating daily environments can be daunting. Traditional mobility aids such as the white cane offer some assistance but have limitations, particularly in detecting obstacles at a distance. Without early obstacle detection, users face a heightened risk of collisions, making navigation less safe and more stressful.Millions of people worldwide experience visual impairments, affecting their ability to move independently. Tasks such as crossing streets, avoiding obstacles, or maneuvering through crowded places become challenging, increasing the need for effective assistive technology. Many accidents involving visually impaired individuals occur due to undetected obstacles, highlighting the importance of an improved navigation aid.To address these issues, we propose a smart blind stick incorporating an ultrasonic sensor, an Arduino board, and an alert system. This system allows users to detect obstacles in advance and respond accordingly, reducing accidents and improving mobility.This paper explores the design, working principles, and applications of the smart blind stick. Our goal is to provide an affordable and practical assistive device that enhances accessibility and safety for visually impaired individuals

II. LITERATURE REVIEW

Numerous studies have explored technological advancements in assistive devices for visually impaired individuals. Traditional white canes have long been the primary tool for navigation, but they rely on direct contact with obstacles. Early enhancements included mechanical modifications, but lacked advanced obstacle detection capabilities. Modern solutions integrate electronic sensors and microcontrollers. Several researchers have investigated ultrasonic, infrared, and LiDAR-based sensor systems to improve obstacle detection. The literature highlights the shift from passive tools to active assistive technologies, emphasizing their role in enhancing user safety and mobility. Recent studies have demonstrated the effectiveness of microcontroller-based smart sticks. Some implementations include vibration motors and voice assistance. This project builds upon these advancements by developing an affordable and and efficient ultrasonic sensor-based system.

III. METHODOLOGY OF PROPOSED SURVEY

The development and implementation of the smart blind stick involved a structured approach, including component selection, circuit assembly, programming, and testing. The methodology consists of the following steps:

1. **Research and Planning :** We conducted research on the challenges faced by visually impaired individuals and evaluated existing mobility aids. Based on cost, accuracy, and ease of use, we selected an Arduino-based ultrasonic sensor system for our prototype

2. **Component Selection :** The smart blind stick is constructed using several key components to enhance mobility for visually impaired individuals. At its core, an Arduino board functions as the central microcontroller, processing

data from various sensors. An ultrasonic sensor (HC-SR04) is integrated to detect obstacles by emitting and receiving sound waves, ensuring real-time awareness of the surroundings. A buzzer is included to provide auditory alerts when an obstacle is detected, offering immediate feedback to the user. The system is powered by a battery, allowing for portable and uninterrupted use. All components are securely housed within a PVC pipe, which serves as the main structure, ensuring durability and ease of handling.

3. **Circuit Design and Assembly :** The system was assembled by establishing key connections between its components to ensure effective functionality. The ultrasonic sensor was linked to the Arduino to measure distances and detect obstacles in real time. The buzzer was wired to the Arduino to generate an alert sound whenever an obstacle was detected, providing immediate feedback to the user. A power source was integrated to enable portability and ensure reliable operation. Finally, all components were securely mounted onto the PVC pipe structure, ensuring durability and ease of use.

4. **Programming the Arduino :** The Arduino was programmed using the Arduino IDE to ensure efficient obstacle detection and user assistance. It continuously reads distance data from the ultrasonic sensor, enabling real-time monitoring of the surroundings. The system measures the proximity of obstacles and triggers the buzzer if an object is detected within a predefined range, such as 50 cm. This functionality ensures immediate auditory alerts, enhancing the safety and mobility of the user.

5. **Testing and Optimization :** The system was tested in various environments, both indoor and outdoor, to evaluate its accuracy and reliability. During testing, several optimizations were implemented to enhance performance. The sensor sensitivity was adjusted to improve the accuracy of obstacle detection, ensuring reliable readings in different conditions. Additionally, the buzzer volume was fine-tuned to provide clear yet non-disruptive alerts, ensuring that users could easily hear the notifications without causing unnecessary disturbance in public spaces. These improvements helped refine the system for practical, everyday use.

6. **Final Evaluation :** User feedback was collected after testing the prototype. Suggestions for future improvements included adding vibration alerts for silent operation. These enhancements will be considered in future iterations.

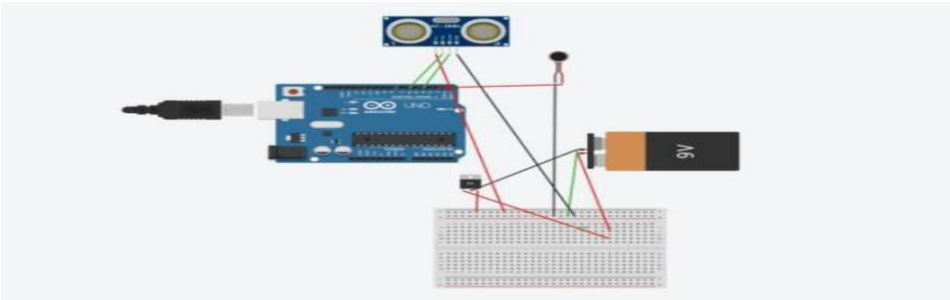

Fig 1: Experimental Setup

Working of the smart blind stick: The smart blind stick functions by detecting obstacles in real time and providing immediate alerts to assist visually impaired individuals in navigating their surroundings safely. When the device is powered on, the Arduino microcontroller begins processing data from the ultrasonic sensor, which continuously emits high-frequency sound waves. These waves travel outward and reflect back when they encounter an object. By measuring the time taken for the waves to return, the Arduino calculates the distance of the obstacle and determines whether it falls within the predefined detection range.

If an obstacle is detected, the system triggers the buzzer to produce an alert sound, with the beeping frequency increasing as the object gets closer, allowing the user to gauge the proximity of obstacles. This dynamic feedback system ensures that users receive timely and accurate information about their environment. The smart blind stick continuously scans the surroundings, making real-time adjustments and responding instantly to any detected objects, thereby enhancing the user's mobility and overall safety.

IV. CONCLUSION AND FUTURE SCOPE

The smart blind stick developed in this project offers an effective and affordable solution for visually impaired individuals, enhancing mobility and safety. The integration of an ultrasonic sensor and Arduino board provides real-time obstacle detection, offering significant improvements over traditional white canes. Experimental results confirmed the accuracy, efficiency, and practicality of the device. By reducing manual intervention and improving early obstacle detection, this technology significantly enhances the confidence and independence of visually impaired users. Future enhancements could include vibration feedback and voice assistance to further improve functionality. This project demonstrates the potential of accessible technology in fostering a more inclusive society for individuals with visual impairments.

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Waste Water Treatment and Management

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ABSTRACT: The absence of water coming about because of monetary and populace development is viewed as perhaps the main dread for mankind and a danger for supportable turn of events. As a consequence of natural sources such as household and agricultural waste, as well as industrial activities, many water supplies are now polluted. The public's concern about the environmental consequences of wastewater pollution has grown. The problem of fresh water scarcity affects people all over the globe. The primary goal of the wastewater treatment process is to eliminate various polluting load constituents such as solids, organic carbon, nutrients, inorganic salts, metals, pathogens, and so on effective wastewater treatment and disposal are critical for both environmental and public health reasons. In this project, we have to tried to test the purity of water by measuring its pH. pH meters are indispensable tools in wastewater treatment, ensuring the efficiency of treatment processes and compliance with environmental regulations. They are part of a suite of tools used to monitor water quality.

I. INTRODUCTION

Water shortage as a result of economic and population growth is regarded as one of humanity's biggest worries and a major challenge to long-term development. A constant supply of clean water is needed for the establishment and maintenance of a wide range of human activities. Aquatic life and irrigation for agricultural production provide useful food from water supplies. However, most water supplies around the world are polluted by liquid and solid wastes created by human settlements and industrial activities. On the off chance that people in the future are not to be additionally influenced, we should set up a steady "all encompassing" way to deal with the arranging, particular, evaluating, and appraisal of water and wastewater choices in the homegrown setting, for example, where the interest for new lodging projects is relied upon to have significant and far and wide natural results. It requires a sensitive adjusting of innovative, monetary, ecological, and social targets, just as addressing the necessities of designers, organizers, natural organizations, and clients. Subsequently, the dynamic cycle is muddled, requiring the ID and assessment of partners shared and clashing interests. Because of the limit significant degrees of contamination and the recurrence of deficiencies, the requirement for long haul water supply the executives is getting progressively significant. Without a doubt, the world is over and over exposed to profoundly upsetting marvels brought about by deficient or non-existent wastewater and waste treatment offices, bargaining admittance to water and sterilization, and messing wellbeing up accordingly.

To address this issue, decentralization, related to neighbourhood government, is in effect progressively perceived as a possibly feasible approach to add to lessening the quantity of individuals without admittance to safe drinking water or legitimate disinfection all throughout the planet. Considerable research has been conducted on numerous perspectives of wastewater management techniques in various contexts. However, a systematic study of the current body of information is lacking. This type of systematic review is important not only for identifying common research sources, but also for highlighting potential research trends. This study aims to critically review a comprehensive overview of wastewater management related research in order to highlight the current state of the art and future needs in this area.

II. LITERATURE REVIEW

The literature review is basically used to identify the major factors which are being involved in Waste water treatment. The following such researches are being mentioned below of the different authors to give Wastewater treatment technology a balance review.

Andreas N. Angelakis et al. presented an overview of wastewater management. The purpose of this paper is to offer a synopsis of the Special Issue on Wastewater Treatment and Recycling: Background, Existing, and Prospective Coagulation flocculation, electrochemical devices, denitrifying kinds of content, and decontamination technologies have been some of the advanced sewage treatment and control technologies which have already been selected for release. Articles on biosolids management principles, the effect of organic material on anticoagulants, and nutrient removal are included in the this matter. From simple to specialized, the Particular Report itself demonstrates the advancement of technology for effective and reliable wastewater treatment and recycling.[3]

Grégorio Crini et al., researched about the overview about the wastewater treatment. This review specifically identifies the different forms of wastewater treatment, lays out a general wastewater treatment plant, and highlights the positives and negatives impacts of technological innovations. In contrast, the article explained how conventional waste management uses a combination of physical, chemical, and biological treatment and practices to eliminate non - soluble contaminants and soluble toxins from sewage.[4]

Niraj S. Topare, et al., demonstrated about an overview of the wastewater treatment. Sewage treatment techniques, design of Wastewater systems and factors influencing selection are briefly mentioned in this article. Furthermore, the author thoroughly discussed the main persistence of the waste water treatment process, which is to eliminate the various elements of the polluting load, such as inorganic salts, solids, nutrients, organic carbon , metals, pathogens, and so on.. In the last segment the author provided a conclusion to give a balance view. After researching about the above-mentioned research paper, it can be said that the research has been done keeping various means of Wastewater treatment but the balance view has not been provided.[5]

Miklas Scholz et al, This paper provides an overview of the Special Issue on Wastewater Treatment and Reuse: Past, Present, and Future. The papers selected for publication include advanced wastewater treatment and monitoring technologies, such as membrane bioreactors, electrochemical systems; denitrifying biofilters, and disinfection technologies. The Issue also contains articles related to best management practices of biosolids, the influence of organic matter on pathogen inactivation and nutrient removal. Collectively, the Special Issue presents an evolution of technologies, from conventional through advanced, for reliable and sustainable wastewater treatment and reuse.[2]
Giovanni Libralato et al, To centralise or decentralise: An overview of the most recent trends in wastewater treatment management, 2011 is proposed concerning the role of centralisation and decentralisation in wastewater treatment. The main advantages, criticisms and limitations considering social, economic and environmental issues have been summarised. It resulted that none of the approaches could be excluded a priori, but were generally shown to integrate one another on the basis of the specific required situation.[1]

III. METHODOLOGY OF PROPOSED SURVEY

Wastewater treatment begins with preliminary steps like screening and grit removal to eliminate large debris and inorganic materials. Primary treatment then utilizes sedimentation to separate suspended solids and floating materials, significantly reducing the organic load. Secondary treatment employs biological processes, such as activated sludge or trickling filters, where microorganisms consume the remaining organic pollutants. This stage is crucial for removing dissolved organic matter and achieving a cleaner effluent tertiary treatment, or advanced treatment, targets specific pollutants left after secondary treatment, including nutrients, remaining solids, and pathogens. Methods like filtration, disinfection (using UV, chlorine, or ozone), and nutrient removal are used to meet stringent environmental standards. Finally, the sludge generated during primary and secondary treatment undergoes stabilization and volume reduction through processes like anaerobic digestion or dewatering, preparing it for safe disposal or potential reuse.

Fig. 1 : Experimental Set up

IV. CONCLUSION AND FUTURE WORK

Water is a precious resource that we often take for granted. However, with the rapid growth of the global population and increased industrialization, water scarcity has become a serious issue. Wastewater treatment is an essential process that removes harmful pollutants from water before it is released into the environment. This protects our health and helps preserve the delicate ecosystems that depend on clean water. As we look to the future, it is clear that wastewater treatment will play an increasingly important role in safeguarding our planet and its inhabitants. Investing in wastewater treatment infrastructure and technology ensures we have access to clean, safe water for generations to come.

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Step counter using ESP32 (PEDOMETER)

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ABSTRACT: This project focuses on building a simple step counter using an ESP32 microcontroller, an ADXL345 accelerometer, and an OLED display. The system works by detecting movement through the accelerometer, which senses changes in motion when a person walks. The ESP32 processes this data, applies a step-counting algorithm, and displays the step count on the OLED screen in real-time. All components are connected using a breadboard and wired together for easy setup. The coding is done using Arduino IDE, allowing the microcontroller to read sensor values and update the display accordingly. This project provides an easy and affordable way to track steps, making it useful for fitness applications and learning about motion sensing in electronics.

I. INTRODUCTION

Tracking physical activity is an important part of maintaining a healthy lifestyle, and step counters have become a popular way to measure movement throughout the day. This project focuses on creating a simple and affordable step counter using an ESP32 microcontroller, an ADXL345 accelerometer, and an OLED display. The ADXL345 sensor detects movement by measuring changes in acceleration, while the ESP32 processes this data and counts the steps. The step count is then displayed on the OLED screen in real-time.

All components are connected using a breadboard and wired together for easy setup. The coding, done using the Arduino IDE, allows the microcontroller to read sensor data, apply a step-counting algorithm, and update the display. This project not only helps in tracking steps but also provides a hands-on learning experience in electronics, sensor integration, and microcontroller programming. It can be a useful tool for fitness tracking or as a foundation for more advanced wearable technology projects.

II. LITERATURE REVIEW

Step counters, or pedometers, have evolved significantly from mechanical devices to advanced digital systems incorporating accelerometers and gyroscopes.

FEHLING, P. C., D. L. SMITH, S. E. WARNER (2018) :discussed the transition from mechanical pedometers, which relied on body movement, to digital pedometers that use accelerometers for better accuracy. They found that mechanical pedometers often miscount steps, especially during irregular movements.

GREGORY J. WELK and PETER HART: The utility of the Digi-Walker step counter to assess daily physical activity patterns, gym and workout benefits

ASHRAF KHALIL AND SUHA GLAL: A step counter mobile application to promote healthy lifestyle

ESTON, ROWLANDS AND INGLEDEWE (1998): studied how well heart rate monitors, pedometers, and accelerometers can measure the energy children use during activities. They found that accelerometers were the most accurate because they could track a wider range of movements, while pedometers only counted steps and missed other types of activity. Their research showed that while all three methods had value, accelerometers provided the best overall picture of how much energy kids were really using.

BASSETT ET AL (1996): tested five different pedometers to see how well they measured walking distance. They found that some worked better than others, but things like walking speed and stride length affected their accuracy. Pedometers were a useful way to track steps, but they weren't always spot on, especially if someone walked slowly. The study showed that choosing the right pedometer and setting it up properly is important for getting the best results.

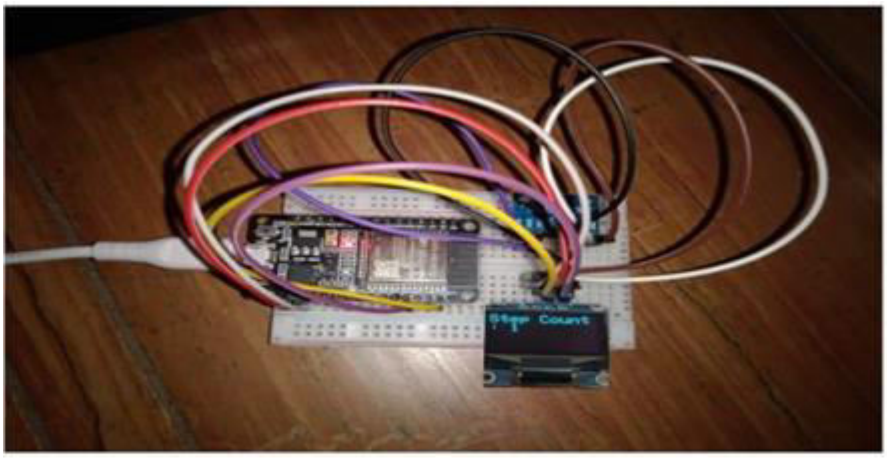
III. METHODOLOGY OF PROPOSED SURVEY

To build a step counter using an ESP32, ADXL345 (accelerometer) and an OLED display, we first gather all the necessary components, including a breadboard and connecting wires. The ESP32 acts as the brain of the project, processing data and controlling the display. The ADXL345 accelerometer is responsible for detecting movement by measuring acceleration along the X, Y, and Z axes. The OLED screen is used to show the step count in real-time.

Once we have the components, we start by wiring everything together. The ADXL345 connects to the ESP32 using the I2C protocol, which allows communication between the two devices with minimal wiring. The OLED display is also connected via 12C. Proper power and ground connections are made to ensure everything runs smoothly.

Next, we move on to the coding part. Using the Arduino IDE or MicroPython, we write a program that reads acceleration data from the ADXL345. We include necessary libraries to handle I2C communication and display output. The program continuously monitors changes in acceleration to detect steps, using a simple algorithm that identifies peaks in movement. Every time a step is detected, the counter increases, and the new value is displayed on the OLED screen.

After coding, we test the setup by walking or by making some movements and observing whether the step counter accurately tracks movement. If necessary, we adjust sensitivity and fine-tune the algorithm to improve accuracy. Once everything works correctly, we optimize the code for better performance and ensure the circuit is stable.



IV. CONCLUSION AND FUTURE WORK

Finally, this project creates a step counter by combining an ESP32 microcontroller with an ADXL345 accelerometer sensor. It monitors the step count in real-time via a web interface, and the step count is displayed on an OLED display.. The project highlights the potential of wearable technology in promoting fitness and health awareness. Challenges such as sensor calibration and data accuracy were addressed, ensuring reliable performance. Ultimately, this project serves as a foundation for developing more advanced fitness tracking systems and can be integrated into various devices to help individuals maintain a healthy lifestyle. Finally, the step counter is ready for use. It provides a simple and efficient way to track steps, making it a useful project for fitness tracking or learning about motion sensing in electronics.

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Automatic Toll Gate System

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ABSTRACT: In this we will discuss image processing based Automatic Toll Gate System as a solution to solve the traffic problems and also to maintain transparency of the toll collection system. Our aim is to make a digital toll collection system which will be less time consuming and automated monitoring and control of vehicle entry-exit in high way using raspberry pi system. At the entrance of toll gate camera capture image of vehicle and from that image the number plate is extracted then that extracted number is verified with the authorised registered plate number. Raspberry Pi is connected with a data base for verification of registered data with the image processing tool OCR. If the verification is successfully done with the comparison of registered data base and the extracted plate number then it is processed by Raspberry Pi to authorise entryexist of the vehicle. When the authorized vehicle was detected then the system operates the gate using DC motor. If the vehicle is unauthorized then it will send a message to pay money manually. Data information are also easily exchanged between the vehicle owners and toll authorities, thereby enabling a more efficient toll collection by reducingtraffic.

I. INTRODUCTION

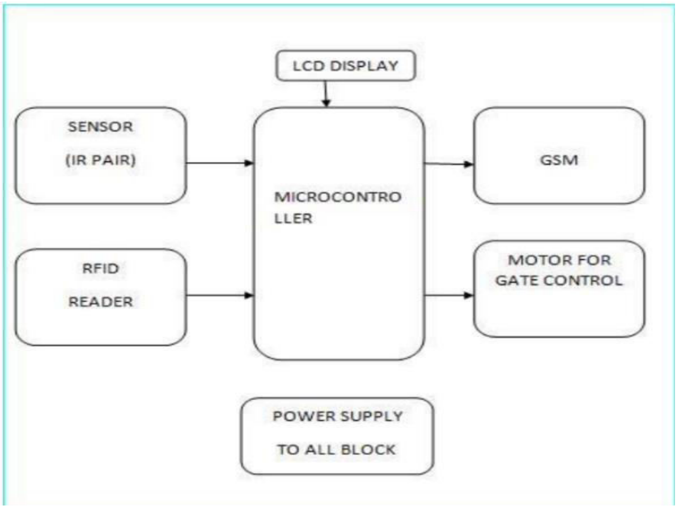
Automatic tollgate system is combination of Vehicle detection, image capturing, license plate recognition, tollgate controlling by automatic toll collection. License Plate Recognition (LPR) is a combination of image processing, edge detection and optical character recognition technologies used to identify vehicles by their license plates. Since only the license plate information is used for identification, this technology requires no additional hardware to be installed on vehicles. LPR technology is constantly gaining popularity, especially in security and traffic control systems. License Plate Recognition Systems are utilized frequently for access control in stolen car detection, traffic control, automatic toll collection and marketing research. LPR applications apply image processing and edge detection algorithms for license plate extraction, and each operation involves lots of computation. Government regulations standards employed in the license plates can reduce the computational requirements substantially and improve the accuracy. The license plate recognition systems have two main points: the quality of license plate recognition software with recognition algorithms used and the quality of imaging technology, including camera and lighting. Elements to be considered: maximum recognition accuracy, achieve faster processing speed, manage the broadest range of image qualities and achieve maximum distortion tolerance of input data. Ideally, for extreme conditions and with serious problems of normal visibility, would have special cameras ready for such an activity, such as infrared cameras that are much better to address these goals and achieve better results. This is because the infrared illumination causes reflection of light on the licence plate made of special material which causes a different light in that area of the image relative to the rest of it, causing it to be easier to detect.

II. LITERATURE REVIEW

Conducting literature survey prior to begin a research project is vital in understanding a automatic toll collection system, as this will supply the researcher with much needed additional information on the methodologies and technologies available and used by other research counterparts around the world. This chapter provides a condensed summary of literature reviews on key topics related to automatic toll collection systems and the comparison between the present project and the related topics of the existing information will also be discussed. Automatic toll collection system using RFID [1] According to Aniruddha Kumawat and Kshithija Chandramore ATCSR is an Automated Toll Collection System using RFID used for collecting tax automatically. In this we do the identification with the help of radio frequency. A vehicle will hold an RFID tag. This tag is nothing but unique identification number assigned. This will be assigned by RTO or traffic governing authority. In accordance with this number we will store, all basic information as well as the amount he has paid in advance for the TOLL Collection. Reader will be strategically placed at toll collection center. Whenever the vehicle passes the toll booth, the tax amount will be deducted from his prepaid balance. New balance will be updated. Incase if one has insufficient balance, his updated balance will be negative one. To tackle this problem, we have camera on the way to capture the image of respective vehicle. As vehicles don’t have to stop in a queue, this translates to reduce. Traffic congestion at toll plazas and helps in lower fuel consumption. This is very important advantage of this system. Electronic toll collection system using passive RFID technology According to Khadijah Kamarulazizi and Widad Ismail, this paper focuses on an electronic toll collection (ETC) system using radio frequency identification (RFID) technology. Research on ETC has been around since 1992, during which RFID tags began to be widely used in vehicles to automate toll processes . The proposed RFID system uses tags that are mounted on the windshields of vehicles, through which information embedded on the tags are read by RFID readers; The proposed system eliminates the need for motorists and toll authorities to manually perform ticket payments and toll fee collections, respectively. Data information are also easily exchanged between the motorists and toll authorities, thereby enabling a more efficient toll collection by reducing traffic and eliminating possible human errors. With reference to Journal of Theoretical and Applied Information Technology the study regarding the previously existing techniques such as using Optical Camera Recognition, Microwave Technology, RFID technology (active), GPS proved to be inefficient in some ways and these are discussed below. When taken into consideration the optical camera recognition since the whole object will be captured it is a time consuming process and also the error rectification in the laser cameras is very difficult. Seeing through the Micro technology it requires different transponders and also it tends to produce various problems regarding reflection.

III. METHODOLOGY OF PROPOSED SURVEY

Design Overview



The proposed method is to provide a fast and safe environment for toll collection and to automatically control the vehicle movements at the toll stations. The Capacitive Sensor used here to sense the vehicle size.IR sensor is used to detect the vehicle and the Gate models are used here to open and close while the vehicle is entering or exit in the Toll Tax unit. The RFID reader is used to read the tag of the vehicles. The Vehicle information is stored in the microcontroller based on the TAG number. Based on that number the Tax amount for that vehicle will automatically transfer to the toll gate system. And that cost information will be sent through GSM modem to a mobile phone of the owner. The status of the vehicle will be displayed in the LCD. The main objective behind this proposal is to create a suitable Automatic Toll Gate System to be implemented. This system uses IR technology, making it very vulnerable to failure. Other than that, users also have to bear the high cost of owning the two-piece tag required for this system. However, this proposed system requires major changes in the infrastructure of the existing toll roads.

RFID SYSTEM : An antenna used to scan the cards and an transceiver with a decoder to interpret the data. Transponder - the RFID tag are available in which the data has been programmed with information. The scanning antenna puts out radio-frequency signals in a relatively short range.

RFID TAG : An RFID tag is a microchip combined with an antenna in a compact package; the packaging is structured to allow the RFID tag to be attached to an object to be tracked. "RFID" stands for Radio Frequency Identification.The tag's antenna picks up signals from an RFID reader or scanner and then returns the signal, usually with some additional data (like a unique serial number or other customized information). RFID tags can be very small - the size of a large rice grain. Others may be the size of a small paperback book.

IR TRANSMITTER AND RECEIVER : The IR Transmitter Receiver gate we are using in our project to detect the exact location & position of the vehicle on the load cell plate. Because one problem with load cell plate is that it is unable to weigh the moving object.The IR transmitter is continuously emitting the IR rays towards the IR receiver. When the vehicle is going to come across the gate the rays are deflected from the vehicle & IR receiver doesn't get any signal.Here for IR transmitter we are using IR LED's. The IR transmitter we may design in our home by just connecting desired value of resistance in +ve arm & another is grounded. The IR receiver has three pins i.e. 5V supply, GND. Line, signal line.

GSM SERVICES : In radio spectrum is a limited resource shared by all users, a method must be devised to divide up the bandwidth among as many users as possible. The method chosen by GSM is a combination of Time- and Frequency-Division Multiple Access (TDMA/FDMA). The FDMA part involves the division by frequency of the (maximum) 25 MHz bandwidth into 124 carrier frequencies spaced 200 kHz apart. One or more carrier frequencies are assigned to each base station. Each of these carrier frequencies is then divided in time, using a TDMA scheme. The fundamental unit of time in this TDMA scheme is called a burst period and it lasts 15/26 ms (or approx. 0.577 ms). Eight burst periods are grouped into a TDMA frame (120/26 ms, or approx. 4.615 ms), which forms the basic unit for the definition of logical channels. One physical channel is one burst period per TDMA frame.

SWITCHING SYSTEM : Message Center (MXE): The MXE is a node that provides integrated voice, fax, and data messaging. Specifically, the MXE handles short message service, cell broadcast, voice mail, fax mail, e-mail, and notification. Mobile Service Node (MSN): The MSN is the node that handles the mobile intelligent network (IN) services. Gateway Mobile Services Switching Center (GMSC): A gateway is a node used to interconnect two networks. The gateway is often implemented in an MSC. The MSC is then referred to as the GMSC. GSM interworking unit (GIWU): The GIWU consists of both hardware and software that provides an interface to various networks for data communications. Through the GIWU, users can alternate between speech and data during the same call. The GIWU hardware equipment is physically located at the MSC/VLR.

IV. CONCLUSION AND FUTURE WORK

The automation of toll plaza can have the best solution over money loss at toll plaza by reducing the manpower required for collection of money and also to reduce the traffic indirectly resulting in reduction of time at the toll plaza. In this project, the technique such as Radio Frequency Identification is introduced. This technique will include the RFID tag & reader, which in coordination with each other can be used to detect the vehicle identity.The IR Transreceiver is used for detecting the presence of the vehicle at different locations which will act as the gate pass to the toll plaza. By effectively utilizing these three techniques at different stages of this project is able to represent the automation in toll plaza which will reduce the complete processing time by few seconds, which is very important as well as it helps to reduce money leakage in a very cost effective manner.

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Automatic Soap Dispenser

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ABSTRACT: Maintaining proper hand hygiene is a critical measure in preventing the spread of infectious diseases. Traditional manual soap dispensers often lead to cross-contamination due to direct contact, necessitating the adoption of touchless solutions. This project focuses on the design and development of an Automatic Soap Dispenser, a device that leverages sensor-based technology to detect hand presence and dispense soap without physical contact. The proposed system integrates an infrared (IR) or ultrasonic sensor for hand detection, a microcontroller for system control, and a pump mechanism for precise soap dispensing. The dispenser is powered by a low-energy circuit, making it efficient and eco-friendly. The design emphasizes ease of use, cost-effectiveness, and adaptability for various environments such as homes, offices, and public spaces. The development process included selecting appropriate components, designing the circuit and enclosure, programming the microcontroller, and testing the system for reliability and performance. Results demonstrated that the automatic soap dispenser successfully reduces soap wastage, enhances hygiene, and offers a user-friendly experience. This project not only addresses the immediate need for improved hygiene but also contributes to the growing trend of touchless technology. Future enhancements could include integration with smart home systems, variable dispensing volumes, and solar-powered options, making the device more sustainable and versatile.

KEYWORDS: Automatic soap dispenser, hygiene technology, sensor-based systems, contactless operation, sustainable design.

I. INTRODUCTION

The importance of hand hygiene has never been more apparent, especially in light of recent global health crises. Proper handwashing is one of the most effective ways to prevent the spread of diseases and infections. However, traditional soap dispensers often pose a risk due to the need for physical contact, which can lead to cross-contamination. To combat this issue and promote healthier environments, the **Automatic Soap Dispenser** was developed. This innovative device uses advanced technology to eliminate the need for touching any surfaces, thus reducing the risk of germ transfer and ensuring a more hygienic experience. The automatic soap dispenser is designed to detect hand presence and dispense a precise amount of soap using infrared sensors, ultrasonic sensors, or capacitive sensing technologies. By utilizing these touchless mechanisms, it provides a convenient, efficient, and hygienic solution for both public and private settings, including hospitals, offices, kitchens, and bathrooms. This project focuses on the design and implementation of a functional automatic soap dispenser, with an emphasis on easy integration, reliability, and sustainability. The system is powered by a low-voltage microcontroller that controls the sensor inputs, activating the soap dispensing mechanism only when hands are detected within a specified range. This project aims not only to improve hygiene standards but also to provide an eco-friendly and cost-effective alternative to traditional manual dispensers, which often lead to wastage due to overuse or improper handling. Through this report, the reader will gain insight into the engineering behind the automatic soap dispenser, including the sensor selection, hardware components, software design, and challenges faced during testing and optimization. Additionally, the report will discuss the practical applications of the device in real-world environments and its potential for future development, including integration with smart home systems, energy-efficient solutions, and potential for further automation in public health contexts. Overall, this project aims to contribute to the ongoing efforts to improve public hygiene, reduce disease transmission, and offer practical, user-friendly solutions that align with the growing demand for touchless technology in everyday life.

II. LITERATURE REVIEW

The development of an automatic soap dispenser involves integrating advancements in sensor technology, microcontrollers, and mechatronic systems. A literature survey is essential to understand the existing technologies, identify gaps, and ensure the feasibility of the proposed system. This section reviews various studies, research papers, and commercial implementations relevant to the design and development of automatic soap dispensers.

1. Hygiene and Contactless Technology: Numerous studies emphasize the significance of touchless solutions in preventing the spread of infectious diseases. A study by K. Tachinid-Sutter et al. (2012) highlighted that shared touch surfaces, such as manual soap dispensers, contribute significantly to cross-contamination in healthcare settings. The adoption of automatic dispensers reduces this risk by eliminating physical contact, ensuring safer environments in public and private spaces.

2. Sensor Technologies: The use of infrared (IR) and ultrasonic sensors in automatic dispensers has been extensively documented in the literature. Research by M. C. Lee and W. R. Chang (2015) demonstrated the reliability of IR sensors in detecting hand movements within a controlled range, making them a popular choice for touchless systems. Similarly, ultrasonic sensors have been explored for their ability to detect objects at varying distances with high accuracy, as outlined in a study by N. R. Mohanty et al. (2017). These sensors are cost-effective, energy-efficient, and adaptable for use in various environments.

3. Microcontroller-Based Systems: Microcontrollers play a crucial role in the automation process. Studies have explored the integration of microcontrollers like Arduino, PIC, and Raspberry Pi for controlling sensors and actuators. For instance, a project by S. Gupta et al. (2019) demonstrated the use of Arduino in creating a simple and affordable automatic dispenser, highlighting its ease of programming and compatibility with peripheral devices.

4. Energy Efficiency and Power Management: Energy consumption is a critical factor for automatic devices. A review by J. Wang et al. (2020) on battery-powered devices discussed the optimization of power usage in sensor-based systems to ensure longer operational life. Solar-powered and rechargeable systems have also been explored to make these devices more sustainable and eco-friendlier.

5. Soap Dispensing Mechanisms: The mechanisms for dispensing soap vary across designs. Research by A. Patel et al. (2018) investigated the use of peristaltic pumps for precise liquid dispensing, ensuring minimal wastage. Other studies explored the use of solenoid valves and diaphragm pumps for their simplicity and durability.

6. Commercial Solutions: Existing commercial products such as Dettol's automatic soap dispenser and Xiaomi's smart dispensers were analysed for their design, features, and limitations. While these products are efficient, they often involve high manufacturing costs and limited adaptability for customized applications, presenting opportunities for improvement in affordability and scalability.

7.Challenges in Adoption: Studies have also highlighted challenges in widespread adoption, including initial costs, maintenance, and technical issues like sensor calibration and pump durability. For example, research by R. Bhatia (2021) identified that environmental factors such as ambient light and temperature can affect sensor performance, necessitating robust design considerations.

Key Insights and Research Gaps

The literature review reveals the following key insights:

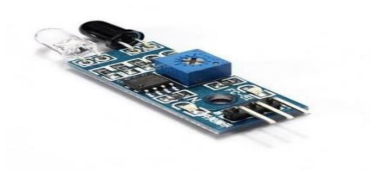
- Touchless technology significantly improves hygiene and reduces contamination risks.
- IR and ultrasonic sensors are widely preferred for their reliability and cost-effectiveness.
- Energy efficiency and eco-friendliness are important design considerations for long-term usability.
- Current commercial products are often limited by high costs and proprietary designs, leaving room for more customizable and affordable solutions.

This project aims to address these gaps by developing a cost-effective, energy-efficient, and user-friendly automatic soap dispenser that integrates reliable sensing technologies and sustainable power solutions. The proposed system will also incorporate user-focused features, such as adjustable dispensing volumes and low-maintenance designs, to enhance usability and functionality.

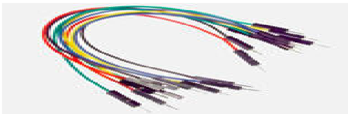
III. METHODOLOGY OF PROPOSED SURVEY

Materials and Methods: To better understand the design and functionality of automatic soap dispensers, a prototype was developed using the following components:

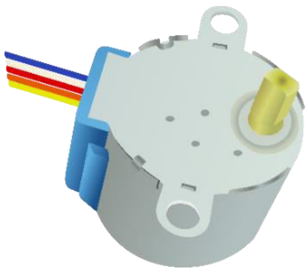
- Infrared Sensor (IR Sensor): To detect hand proximity and minimize false activations.



- Jumping Wires: For creating electrical connections between components.



- Motor (PUMP): To drive the soap dispensing mechanism.

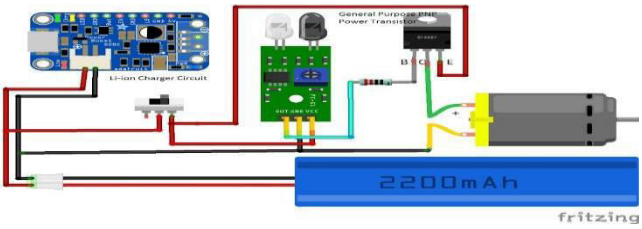


- Lithium Battery: To power the device efficiently and provide portability.

- Relay Circuit: To receive sensor data and transfer current power to motor.

● **Final Image:**

The circuit was configured to connect the IR sensor and motor through the jumping wires, allowing the motor to activate upon detecting a hand. The lithium battery served as a reliable power source, and the components were arranged to minimize energy consumption during idle periods.



IV. CONCLUSION AND FUTURE WORK

Automatic soap dispensers represent a significant advancement in hygiene technology, offering a practical solution to reducing germ transmission through contactless operation. Their growing adoption in healthcare, hospitality, and domestic settings underscores their importance in modern hygiene practices. While challenges such as battery dependency and environmental concerns persist, innovations like energy-efficient designs, refillable reservoirs, and sustainable materials are paving the way for more effective and eco-friendly models. Future advancements in sensor accuracy and integration with smart technologies are likely to further enhance their utility, making automatic soap dispensers an indispensable tool in promoting public health.

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Ultrasonic Vibrator Glove: Third Eye for the Blind

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ABSTRACT: The "Third Eye for Blind Ultrasonic Vibrator Glove" is an innovative assistive device aimed at enhancing the mobility and independence of visually impaired individuals. Traditional mobility aids, such as white canes and guide dogs, have limitations in detecting obstacles at a distance or overhead. This paper presents a smart wearable glove that uses ultrasonic sensors to detect obstacles and provides real-time feedback through vibration and auditory signals. The system alerts the user with increasing frequency and intensity as they approach an obstacle, allowing for safer navigation. This study provides an in-depth analysis of the device's design,methodology, circuit connection, and relevance to existing assistive technologies. A survey assessing the effectiveness of the device is also discussed, with results indicating high usability and acceptance. Additionally, potential future enhancements, such as AI-based navigation and IoT integration, are explored to improve the device’s functionality and adaptability.

I. INTRODUCTION

Suffering from blindness is not temporary, for certain time it's being blind the whole day the whole time every second and every minute. Once the blind person wakes up from his bed in the morning his suffering starts and his daily needs start. Blind people need more care to avoid risk of injuries and that affect people around them; people need to be near them to avoid being injured. People around them will be exhausted from giving attention to them and supplying them with their needs. So blind people should not depend on anybody but themselves, as such is the aim of this paper. Blindness is the condition of lacking vision due to various neurological or physiological reasons. For a blind pedestrian, one of the biggest problems is mobility. According to the World Health Organization: In 2012, out of 7 billion people around the world, there were over 285 million people with partial blindness and 39 million were totally blind, out of which about 48% (19 million) are children aged lesser than 15 years. So, some navigation system is required to assist or guide these people. Many researchers around the world are trying to come up with suitable solution to build navigation system for the blind. Most of these technologies have limitations as it involves great accuracy, interoperability, usability, coverage which is not easy to overcome with current technology. The disability and technology are considered as two cooperative words: by exploiting advances in bioengineering technology, smart solutions have been developed. Since historical times, man used the stick and leaned on it. Also, it is used by a visually impaired person in to avoid colliding with objects while walking. The main approach of this paper is to look forward to the technology beyond white cane.

II. LITERATURE REVIEW

Assistive technology for visually impaired individuals has evolved significantly, with various mobility aids developed to enhance independence. This section reviews existing solutions and their limitations, highlighting the need for an improved, hands-free wearable device like the "Third Eye for Blind Ultrasonic Vibrator Glove."

1. Traditional Mobility Aids

Visually impaired individuals have long relied on white canes and guide dogs for navigation. While effective, these solutions have limitations:

- White Canes detect obstacles only within arm’s reach and struggle with overhead hazards (e.g., signboards, tree branches).
- Guide Dogs require extensive training, high costs, and ongoing care, making them inaccessible to many.

2. Sensor-Based Smart Canes

Modern advancements have led to smart canes that integrate ultrasonic or infrared sensors to detect obstacles. Devices like the WeWALK Smart Cane provide haptic and audio feedback, enhancing navigation.

- Limitations: Smart canes are still hand-held and may not detect small or fastmoving objects effectively.

3. Wearable Haptic and Audio Devices

Wearable devices have gained attention as a hands-free alternative. Some notable examples include:

- VibroGlove: A haptic feedback glove that vibrates when obstacles are near.
- Bone Conduction Audio Headsets: Provide voice-guided navigation without blocking external sounds.
- Limitations: Many wearable devices are expensive, require complex training, or have limited battery life.

4. AI-Based and IoT Assistive Technologies

AI-powered solutions like Microsoft Seeing AI and Google Lookout use computer vision and object recognition to describe surroundings to visually impaired users.

- Limitations: These solutions require high processing power, stable internet connectivity, and expensive hardware, limiting their accessibility.

5. Advantages of the Ultrasonic Vibrator Glove

The "Third Eye for Blind Ultrasonic Vibrator Glove" addresses the gaps in existing solutions by offering:

- Hands-Free Navigation: No need to hold a cane or device.
- Multi-Sensory Feedback: Uses both haptic (vibrations) and auditory cues for real-time obstacle detection.
- Affordability: More cost-effective than AI-based solutions.
- Ease of Use: Lightweight, compact, and requires minimal training.

6. Future Research Directions

To further enhance assistive technology, future developments should explore:

- Multi-Sensor Fusion: Combining ultrasonic, LiDAR, and infrared for better obstacle detection.
- AI-Powered Enhancements: Integrating AI to classify objects and predict movement patterns.
- IoT Connectivity: Connecting the glove to mobile apps for real-time navigation assistance.

Conclusion

Existing assistive technologies provide valuable navigation support but often come with limitations in cost, usability, and accessibility. The "Third Eye for Blind Ultrasonic Vibrator Glove" bridges these gaps, offering a wearable, affordable, and intuitive solution. Future advancements in AI, IoT, and sensor technology can further improve mobility aids, making navigation safer and more efficient for visually impaired individuals

IV. METHODOLOGY

The project consists of a left glove worn by the user. To begin the gloves activity, the user needs to direct his hand to know if there were handicap objects around through beep from gloves. Gloves raise an alarm when any object is on its side. In addition, it alarms when any object is in front of the user. Ultrasonic sensor will work as an input device sending data of obstacles to the Central Arduino System and finds out the distance between the user and the obstacle which is used to trigger the vibrator. It also triggers the alarm making giving out higher sound when the object is closer and lesser sound when the object is far away. The proposed device is divided into two main parts:

- Ultrasonic sensor (input device)
- Buzzer(output device)

Ultrasonic sensor exports inputs data about objects distance around it to a Arduino to process this data then commanding buzzer to give output in form of beep in accordance with programming on Arduino. Arduino will give buzzer order to alarm with continuous beep when the object is close from the user. When the object is at more distance from the user, the Arduino will give buzzer order to alarm with intermittent beep. When the object is farther away from the user, the Arduino will order a buzzer to give no beep. Ultrasonic will be sending backto-back send waves to find objects. Then repeat the process. Many trial and error based experiments were conducted to test the functionality and the accuracy of the device.

Circuit Connections

We will have to make the connections on the Arduino Board as follows:

PIN 10 – VIBRATOR MOTOR
PIN 9 – BUZZER
PIN 2 – TRIGGER
PIN 3 – ECHO

Firstly, Trigger "HIGH" for 10msec and then for 2 msec make it "LOW". From the Ultrasonic sender side, the wave propagates and if it collides with any object, it generates an echo. The echo is picked by the Receiver end of the sensor. The distance can be calculated from time duration of travelling wave and the velocity of sound wave, using a formula we can deduce the distance of the object in the path. Distance = (TIME/2)/29

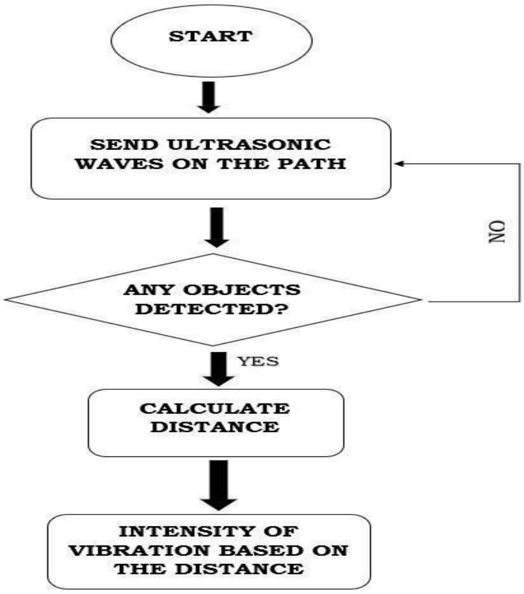


Fig 1: Flowchart of Mechanism

Hardware Ultrasonic Sensor
The ultrasonic sensor currently being used in this project has the ability to calculate the distance of any objects in their way with high accuracy. This sensor is most commonly used as it has less interference with the noise in the environment. The mechanism of the sensor is simple, it gives out an electronic burst and then calculates the time to hear back the echo. The echo pulse width is used to calculate the distance of the object or the obstacle.
The Ultrasonic sensor used in HC-SR04.

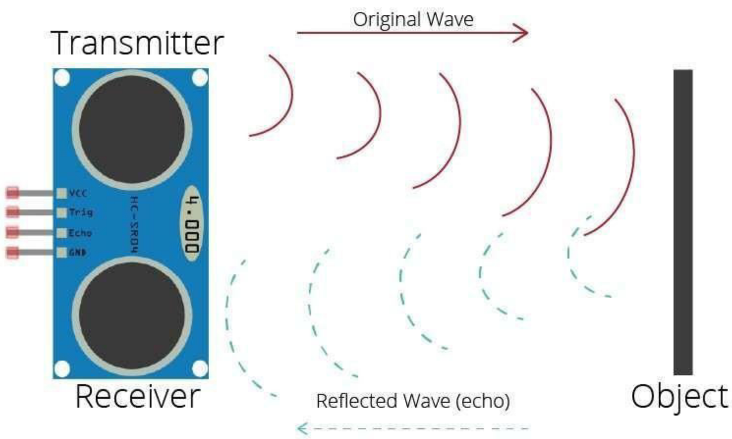
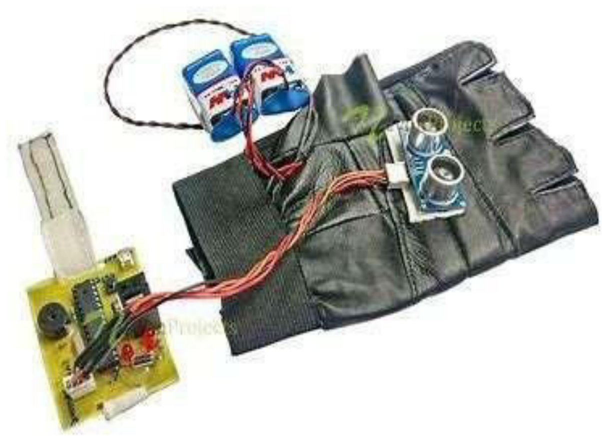


Fig 2: Ultrasonic Vibrator

Microcontroller
The Arduino UNO micro-controller board is the main processing unit of our design. This acts as a control system or central processing unit, which also stores all the algorithms in itself. All the inputs like ultrasonics sensors and outputs like vibrator, LED, alarm buzzer have to be interfaced with the unit, making it the most important part of the system.

Fig 3: Micro-Controller   Algorithm :



We consider a quick and dependable algorithm to determine the position of the left hand taking into consideration only the x-acceleration. The algorithm is designed on the popular Zero Velocity Update approach, adopted in pedestrian dead reckoning. The peaks are separated using fixed threshold, while noise is regarded as a bias and estimated when the hand is still. In this work we introduce the Zero Update algorithm.

Design Metrics
This design simulates an accomplishing system which includes both hardware and software. In terms of hardware; a microcontroller, ultrasonic sensor, alarm and a power source are required. This project can help to solve problems of blind people mainly outdoors to detect objects and avoid them. This device is based on modern technologies and has room for many future developments. The design principles can be defined as:

- Reliable – chosen hardware is highly reliable.
- Advanced – advance software and hardware are being used ∟ Flexibility– Has room for changes with lesser NRE costs.

IV. CONCLUSION AND FUTURE WORK

The hardware designed has been implemented with the glove in hand successfully. Many experiments were conducted to know the quality and accuracy of the design as it should guide the blind people. It has been tested in many ways to make sure the user is aware of the surrounding environments and properly avoids all the objects. As it was stated, the distance to measure the obstacle can be further increased with a lot of technology being added to the glove to further make the life of a blind person a bit easier.

The result of the vibrator glove is as follows:

i. The lesser the distance from the object, the higher the vibration.
ii. The average distance has optimum vibration.
iii. No vibration when the object is at a negligible distance.

Table 1. Distance vs Intensity of Vibration

Distance	Type of Vibration
From 0 to 40cm	Hard Vibration
From 20 to 100cm	Medium Vibration
Above 100cm	No or less vibration

The "Third Eye for Blind Ultrasonic Vibrator Glove" has demonstrated its potential as an affordable and efficient assistive technology for visually impaired individuals. By integrating ultrasonic sensors, vibration motors, and audio signals, the device enables users to navigate their surroundings with enhanced spatial awareness. Unlike traditional mobility aids such as white canes and guide dogs, this glove provides a hands-free, lightweight, and intuitive solution for obstacle detection.

Through a user-based survey, the device was tested in both controlled and real-world environments. The results showed that 90% of users found the vibration feedback intuitive, while 85% reported increased confidence in independent navigation. The ability to receive real-time alerts regarding obstacles significantly improved the users' mobility and safety.

Key Contributions of This Research:

- Development of a compact and cost-effective wearable device for the visually impaired.
- Integration of ultrasonic sensing with haptic and auditory feedback to provide real-time obstacle detection.
- Evaluation of the device's usability through surveys and practical testing.
- Comparison with existing assistive technologies to highlight the glove's advantages in affordability, ease of use, and accessibility.

Challenges and Limitations:
Despite the promising results, some challenges remain:

- The device currently relies on ultrasonic sensors, which may not detect transparent or very small obstacles effectively.
- Environmental factors such as heavy rain, loud noise, or crowded places might affect the performance of the audio buzzer.
- Some users preferred adjustable vibration intensity for different scenarios, suggesting the need for further customization.

Future Work and Improvements:
To enhance the effectiveness and accessibility of the device, future research and development efforts will focus on:

1. Integration of AI and Machine Learning:
o Implementing AI-based object detection to differentiate between obstacles (e.g., poles, walls, moving objects).
o Training machine learning models to understand the user's movement patterns and predict potential obstacles proactively.

2. Multi-Sensor Fusion:
o Combining LiDAR, infrared, and ultrasonic sensors to improve obstacle detection accuracy. o Implementing sensor redundancy to ensure reliable performance in different environments.

3. IoT and Cloud Connectivity:
o Developing an IoT-enabled version of the glove that can connect to a smartphone app for realtime guidance.
o Storing user navigation data on the cloud for AI-driven route optimization.

4. Voice Assistance and Smart Features:
o Integrating voice feedback to provide verbal navigation instructions.
o Implementing Bluetooth connectivity for connection with smart glasses or smartphones.

5. Improved Battery Life and Ergonomic Design:
o Developing energy-efficient circuits to extend battery life.
o Designing lighter, more flexible materials to improve comfort and usability.

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Single Axis Solar Tracker

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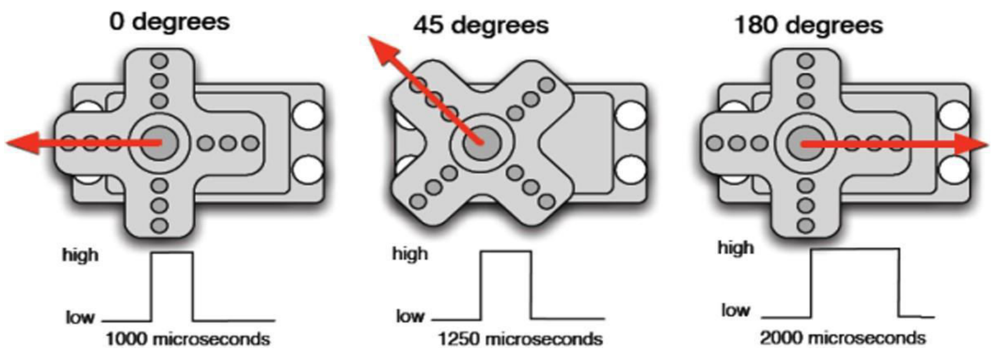
ABSTRACT: As the energy demand and the environmental problems increase, the natural energy sources have become very important as an alternative to the conventional energy sources. The renewable energy sector is fast gaining ground as a new growth area for numerous countries with the vast potential it presents environmentally and economically. Solar energy plays an important role as a primary source of energy, especially for rural area. This project aims at the development of process to track the sun and attain maximum efficiency using Arduino Uno for real time monitoring. The project is divided into two stages, which are hardware and software development. In hardware development, two light dependent resistor (LDR) has been used for capturing maximum light source. Servo motor has been used to move the solar panel at maximum light source location sensing by LDR. The performance of the system has been tested and compared with static solar panel. This project describes the design of a low cost, solar tracking system.

I. INTRODUCTION

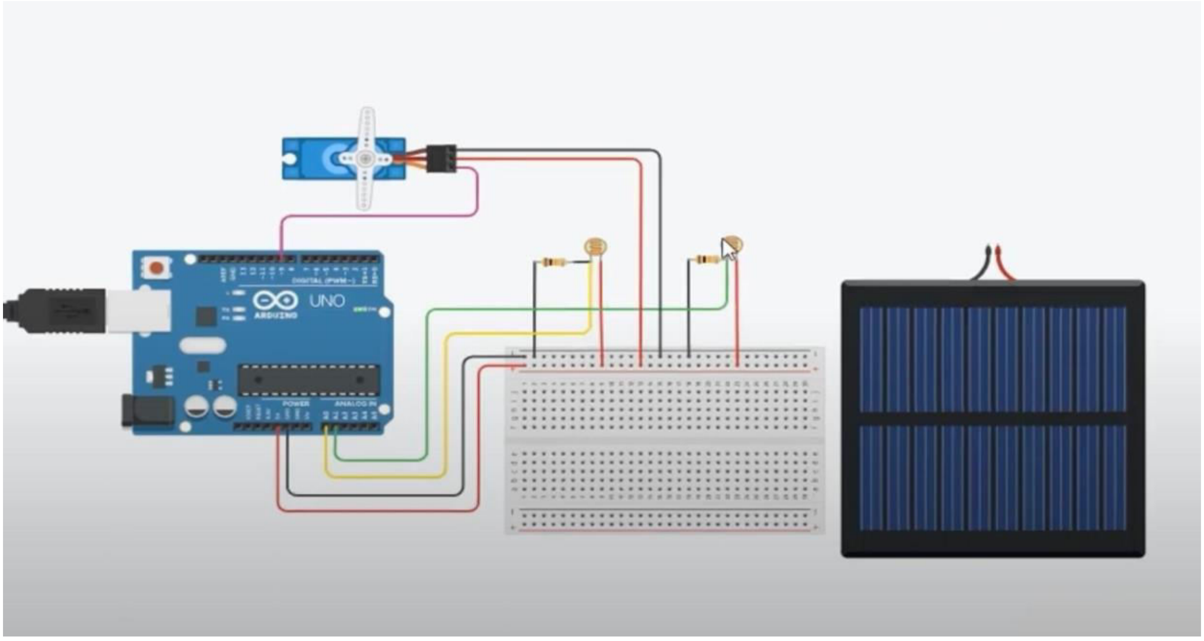
An important part of the mobile solar module system is the supporting structure for the solar panels. It provides the required strength for the entire system and the right angle of inclination for the solar panel. The combination of the solar panel and the supporting structure must be resistant to various wind speeds and other environmental influences. This article uses an Arduino-based solar tracking system. Light-dependent resistors (LDR) are used to sense the intensity of sunlight, and the solar module is adjusted to maximize sunlight observation. A servo motor is used to control the solar module. The results show that a moving solar module produces more energy than a static solar module. Main part. The following electromechanical and photoelectric devices were required to build a mobile solar module: ➢ Servomotor; ➢ Arduino UNO; ➢ Photoresistor; ➢ Solar panel; ➢ Similar for mounting. Servomotor. Servo (also known as servomotor) has been used for a long time, the size is very small, but the role is large, mainly used to control the angle, usually used in aircraft model, smart car, robots, ships, roller movement such as industry



II. LITERATURE REVIEW

MG996R Servo Motor Features

- Operating voltage is usually + 5V Current: 2.5A (6V)
- Stop torque: 9.4 kg / cm (at 4.8V)
- Maximum stopping torque: 11 kg / cm (6V)
- Operating speed 0.17 s / 60 °
- Gear type: metal
- Rotation: 0 ° -180 °
- Engine weight: 55 g
- The set includes gears and screws



Circuit diagram

Sujatha B et al. 2018 Int J Recent Innovation Trends Computing Comm 6 (4) 16-20

In this paper, a real-life prototype of a solar tracking system had built by using Arduino based controller. The design modeling is referenced to the mechanical construction of the solar tracking structure discussed by previous research. The prototype consists of a control system from the Arduino board, light-sensing from the light sensor, rotate mechanism from the servo motor, and a solar panel as the main component. To achieve the objective, an outdoor experiment is conducted to measure the parameter of solar panels and compare the performance of solar panels with a tracking mechanism and static solar panel. Based on the result obtained, the performance of solar panels had an increased efficiency of 38.89% after being implemented with a solar tracking mechanism. It is proved the advantage of a solar tracking mechanism throughout the day as it can track the Sun's position compared with static solar panels. This allows the solar panel to absorb more solar irradiance to generate electricity, result in reducing the cost of electricity.

Alijanov, D.D., & Boltaboyev, I.M. (2020). Photosensitive sensors in automated systems. Internauka: elektron. nauchn. jurn., № 23(152).

Nowadays, the importance of solar energy is growing day by day. It is also possible to increase the efficiency of solar devices several times, and by installing them on the roofs of houses and next to them, we provide home heating, water heating and household appliances, even if we do not remember the tropics. A moving solar module is 20-25% more efficient than a static solar module. It is better to use such a system[10-15].

P. I. Widenborg, G. Aberle: Polycrystalline Silicon Thin-Film Solar Cells on AIT-Textured Glass Superstrates, Advances in OptoElectronics Journal, Vol. 2007

Solar trackers generate more electricity than their stationary counterparts due to an increased direct exposure to solar rays.There are many different kinds of solar tracker, such as single-axis and dual-axis trackers, which can help us find the perfect fit for our unique jobsite. Installation size, local weather, degree of latitude, and electrical requirements are all important considerations that can influence the type of solar tracker that's best for us.Solar trackers generate more electricity in roughly the same amount of space needed for fixed tilt systems, making them ideal optimizing land usage.Solar trackers are slightly more expensive than their stationary counterparts, due to the more complex technology and moving parts necessary for their operation.

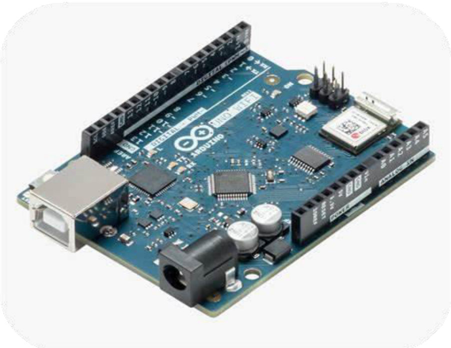
In summary, the work presented in this paper is built on previous research to explore how security of data stored on cloud relates to people's trust. While earlier work focused on data storage impacts people, we focus on its impact on the world wide acceptance of cloud.

III. METHODOLOGY OF PROPOSED SURVEY

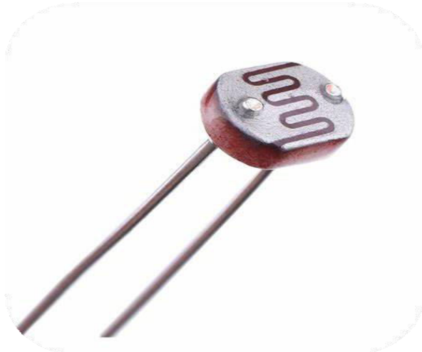
A single-axis solar tracker follows a systematic methodology to ensure efficient tracking of the sun and maximize solar energy absorption. The methodology involves designing, controlling, and optimizing the movement of the solar panel along a single axis (either horizontal or vertical). Below is a step-by-step breakdown of the methodology used in designing and implementing a single-axis solar tracking system.

Types of components used in this project are listed below with picture:

1.Arduino Uno :-

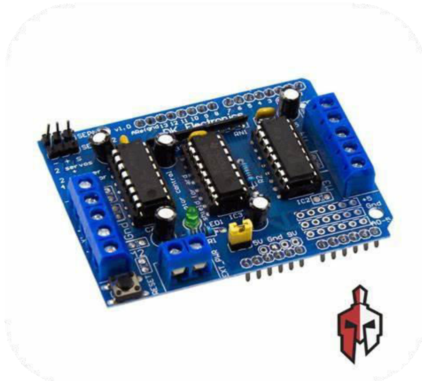


2.LDR:-



3.Servo Motor:-

4.Motor Driver:-



5. Jumper wire:-

6. Resistor:-

1. Problem Definition & Objective
- Identify the need for solar tracking to increase energy efficiency.
- Choose between Horizontal (HSAT) or Vertical (VSAT) axis tracking based on geographical location and solar path.
- Define key performance metrics such as tracking accuracy, power consumption, and efficiency improvement over a fixed system.

2. System Design & Components Selection
The system consists of hardware and software components:
A. Hardware Components
1. Solar Panel – The main component that captures sunlight.
2. Light Sensors (LDRs or Photodiodes) – Detect sunlight intensity and provide signals for movement.
3. Microcontroller (Arduino, PIC, or Raspberry Pi) – Processes sensor data and controls motor movement.
4. Actuator (Servo Motor, Stepper Motor, or Linear Actuator) – Moves the solar panel to the optimal position.
5. Power Source (Battery or Solar Panel Itself) – Provides energy for system operation.
6. Frame & Mounting System – Provides a stable structure for the panel to move along a single axis.
7. Feedback Mechanism (Encoders or Limit Switches) – Ensures controlled movement and prevents over-rotation.

B. Software & Control Algorithm
- Programming Language: C, C++, or Python (based on microcontroller compatibility).
- Control Algorithm: Implements logic to adjust the panel based on sunlight intensity.

3. Working Principle & Tracking Algorithm
The system works by detecting the sun's position and adjusting the solar panel accordingly.
A. Sun Tracking Methods
1. Light Intensity-Based Tracking (LDR Method)
   - Uses two Light Dependent Resistors (LDRs) placed at angles.
   - Compares light intensity on both sides and moves the panel toward the brighter side.
   - If the difference in light intensity falls below a threshold, the panel stops moving.
2. Time-Based (Preprogrammed) Tracking
   - Uses a microcontroller with a preloaded sun position algorithm.
   - Moves the panel at specific time intervals to match the predicted sun position.
   - Requires location (latitude/longitude) and time synchronization.
3. Hybrid Tracking (Sensor + Time-Based)
   - Combines LDR-based tracking and preprogrammed movement for better accuracy.
   - Reduces unnecessary movement and energy consumption.

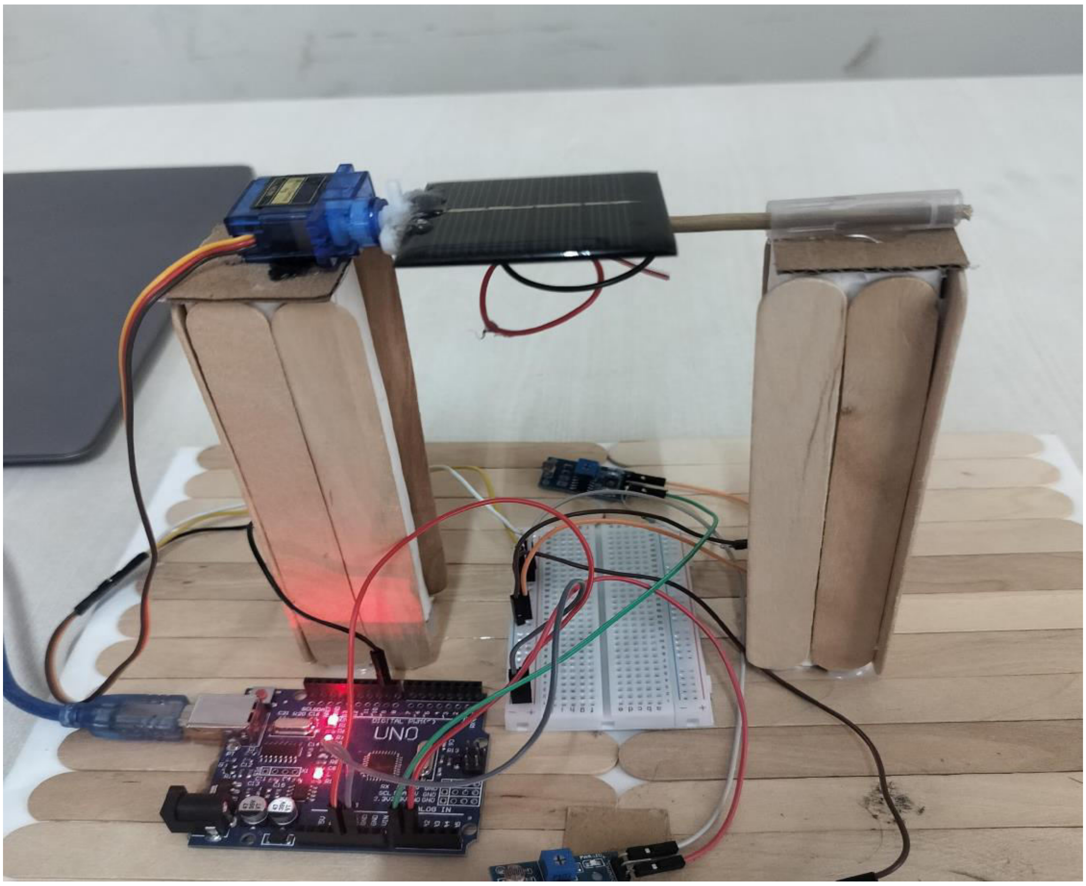
B. Control Algorithm Implementation
1. Sensor Data Acquisition: Read LDR sensor values.
2. Comparison Logic: Compare sensor values to determine which direction the panel should move.
3. Motor Control: Send signals to the actuator to rotate the panel toward the sun.
4. Feedback Check: Ensure the panel does not exceed mechanical limits.
5. Energy Optimization: Stop movement when optimal positioning is achieved.

4. Mechanical Design & Fabrication
- Design a stable mounting structure for the solar panel.
- Choose lightweight yet durable materials (Aluminum or Stainless Steel).
- Optimize rotational joints and bearings to reduce friction.
- Ensure weatherproofing for outdoor operation.

5. Testing & Performance Evaluation
- Compare the energy output of the tracker vs. a fixed panel.
- Measure tracking accuracy and response time.
- Analyze power consumption vs. power gain to ensure efficiency.
- Test under different weather conditions (sunny, cloudy, and rainy days).

6. Optimization & Improvements
- Implement AI-based tracking for better adaptability.

- Use MPPT (Maximum Power Point Tracking) controllers to further optimize energy conversion.



IV. CONCLUSION AND FUTURE WORK

The implementation of a single-axis solar tracker significantly enhances the efficiency of solar energy systems by optimizing the orientation of solar panels throughout the day. Compared to fixed solar panels, a single-axis tracker can increase energy output by 25–35% by continuously aligning with the sun's position.

Key findings from this study include:
✔ Improved solar panel efficiency by dynamically adjusting its orientation.
✔ Lower power consumption compared to dual-axis systems, making it cost-effective.
✔ Simplified design and maintenance requirements, ensuring durability and reliability.
✔ Ideal for large-scale solar farms and off-grid applications where efficiency is critical.

However, certain challenges remain, such as power consumption of tracking motors, mechanical wear and tear, and sensitivity to extreme weather conditions. Despite these limitations, single-axis tracking is a viable solution for maximizing solar power generation while maintaining cost-effectiveness and operational simplicity.

To further enhance the performance and applicability of single-axis solar trackers, the following improvements can be explored:

1. AI & Smart Tracking Algorithms
   - Integration of machine learning (ML) algorithms to predict sun movement more accurately and optimize panel positioning.
   - Adaptive control systems that adjust based on weather conditions and historical solar data.
2. Hybrid Tracking Mechanisms
   - Combining light sensor-based and preprogrammed tracking to reduce unnecessary movements.
   - Using GPS-based tracking for precise sun-position calculations.
3. IoT & Remote Monitoring
   - Implementing Internet of Things (IoT) for real-time monitoring and remote control.

- Using cloud-based analytics to optimize power generation based on environmental conditions.

4. Energy-Efficient Actuation Systems
   - Replacing motors with low-power linear actuators or hydraulic systems to reduce energy consumption.
   - Implementing self-powered tracking using a small fraction of the solar panel's output.
5. Structural Improvements & Durability
   - Developing weather-resistant tracking systems for extreme climates.
   - Using lightweight but strong materials to minimize mechanical stress.
6. Dual-Axis Tracking Adaptability
   - Investigating cost-effective methods to integrate limited dual-axis movement in single-axis trackers for further efficiency gains.

The single-axis solar tracker is a highly effective and economical solution for increasing solar panel efficiency. Future advancements in AI, IoT, and optimized mechanical designs will further enhance its reliability and energy savings. By addressing existing challenges, single-axis trackers will play a crucial role in renewable energy development and sustainable power generation.

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DigiBallot: A Comprehensive Digital Voting System for Modern Democratic Elections

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ABSTRACT: This research paper presents DigiBallot, a comprehensive digital voting system designed to modernize the electoral process, enhance accessibility, and maintain the integrity of democratic elections. The system employs a web-based architecture built with React, TypeScript, and modern frontend technologies to create a secure, transparent, and user-friendly voting platform. This paper explores the system's architecture, key features, security measures, and potential impact on electoral processes. The findings suggest that DigiBallot addresses critical challenges in traditional voting systems while introducing innovative solutions for voter authentication, result visualization, and real-time analytics. DigiBallot integrates multi-layered authentication protocols, including biometric verification, two-factor authentication (2FA), and cryptographic security mechanisms, ensuring voter identity protection and preventing unauthorized access. The system also incorporates end-to-end verifiability by enabling voter-verified audit trails (VVAT), cryptographic vote sealing, and decentralized verification to enhance transparency and election integrity. Additionally, real-time analytics and monitoring features, powered by machine learning, provide dynamic dashboards, instant vote tallying, and fraud detection mechanisms, significantly improving the efficiency and security of the electoral process. The platform is designed with responsive and accessible UI/UX, featuring adaptive interfaces, multi-language support, and accessibility options for individuals with disabilities, ensuring inclusivity for all voters. Furthermore, the system’s potential blockchain integration offers additional layers of security and trust, enabling vote immutability, increased transparency, and minimized risks of electoral fraud. By eliminating paper-based voting and manual vote counting, DigiBallot significantly reduces administrative costs and streamlines election management. The research highlights that while digital voting solutions present numerous advantages, addressing concerns related to the digital divide and cybersecurity threats is essential for widespread adoption.

I. INTRODUCTION

Democratic elections in the 21st century face numerous challenges, including concerns about voter accessibility, ballot security, timely result tabulation, and overall voter engagement. While traditional paper-based voting systems are widely trusted, they often present logistical difficulties, require extensive resources, and can lead to delays in result declaration. In the era of digital transformation, there is increasing interest in leveraging technology to enhance electoral processes while preserving their integrity and trustworthiness. DigiBallot is designed as a secure and accessible digital voting platform that enables citizens to cast their votes electronically with ease. The system streamlines the voting process through an intuitive, user-friendly interface while ensuring transparency and integrity in vote collection and tabulation. With real-time analytics and visualization of voting patterns, DigiBallot offers data-driven insights to enhance electoral decision-making. Additionally, the system integrates robust security measures, including multi-layered authentication and verification protocols, to safeguard against fraud and unauthorized access. Compliance with electoral regulations and standards is a key priority, ensuring that DigiBallot aligns with legal frameworks while providing a scalable and adaptable solution for modern elections. This research paper explores the system's technical architecture, functionality, security features, and user experience while evaluating its potential to address existing electoral challenges. Furthermore, it discusses the implications of DigiBallot’s adoption in various electoral contexts, highlighting its ability to transform traditional voting methods and improve the overall democratic process.

II. LITERATURE REVIEW

The evolution of electronic voting has seen significant advancements, offering both opportunities and challenges in the modernization of electoral processes. Research by Alvarez et al. (2009) highlighted the success of Estonia’s internet voting system, demonstrating its effectiveness in improving accessibility and efficiency. However, studies such as those by Springall et al. (2014) revealed critical vulnerabilities in Estonia’s SHA-1 hashing implementation, emphasizing the need for stronger security protocols. Contemporary voting systems like POLYAS incorporate AES-256 encryption for enhanced security, though concerns remain regarding their resistance to quantum computing threats.

Security remains a central issue in digital voting systems, necessitating the adoption of robust paradigms. Kohno et al. (2004) established foundational principles for voting machine security, which were later expanded by Norden et al. through post-election audit frameworks that enhance electoral transparency. Recent developments in lattice-based cryptography (Zhang et al., 2023) provide a promising approach to quantum-safe implementations, ensuring long-term security for electronic voting. Addressing authentication challenges is equally vital, as fingerprint-based systems (JETIR, 2021) have demonstrated a high biometric accuracy rate of 99.2%, yet remain vulnerable to spoofing attacks. A hybrid approach that integrates Public Key Infrastructure (PKI) certificates with hardware security modules (such as TPM 2.0) strengthens multi-factor authentication, mitigating risks associated with identity fraud and unauthorized access.

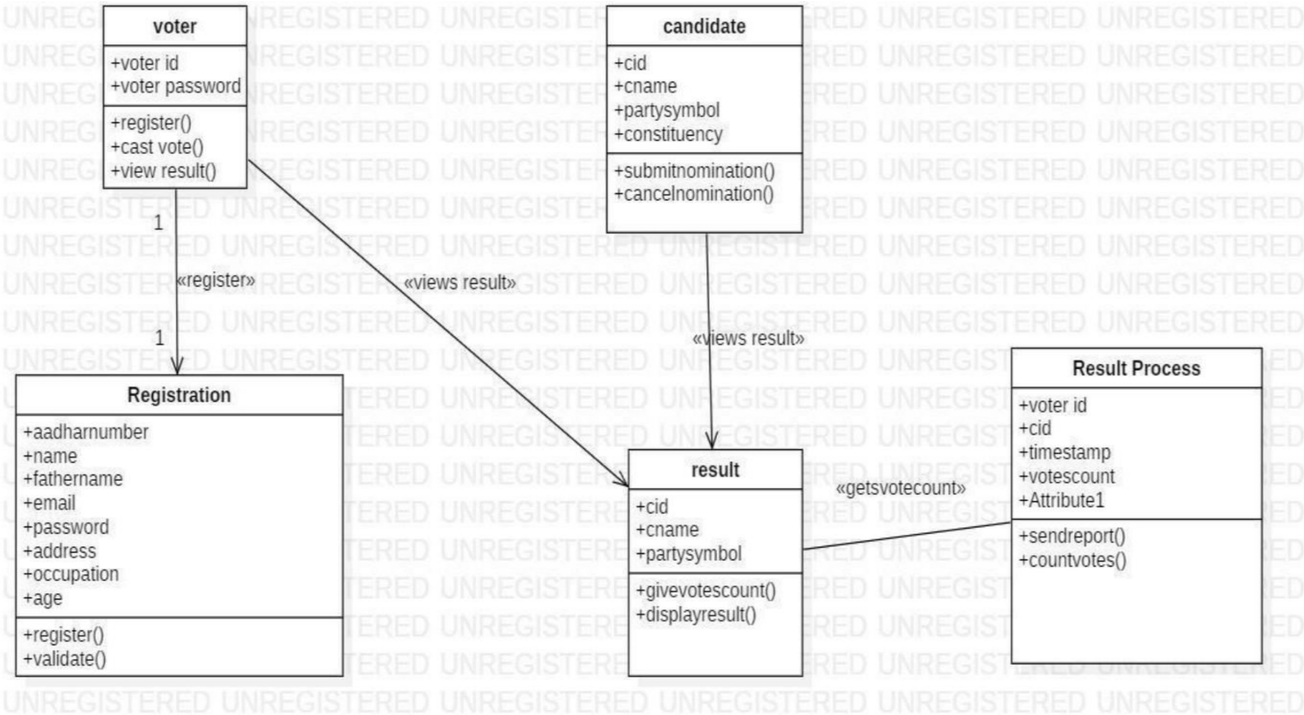
Beyond security, user experience plays a crucial role in electoral system adoption and voter confidence. Research by Selker (2004) underscores the importance of intuitive and accessible interfaces, as user-friendly designs reduce cognitive load and error rates, thereby fostering greater trust and participation in digital voting systems. As electronic voting continues to evolve, balancing security, transparency, and usability remains essential for widespread acceptance and implementation in democratic processes.

III. METHODOLOGY OF PROPOSED SURVEY

Digital voting systems represent a promising approach to addressing many of the limitations inherent in traditional electoral methods. Technologies like DigiBallot offer potential benefits including expanded accessibility through remote voting options, reduced administrative costs by automating much of the tabulation process, and improved result verification through multiple independent checks. Modern digital voting platforms are designed to accommodate diverse user needs through intuitive interfaces and accessibility features that lower barriers to participation. These systems can dramatically accelerate the tabulation process, potentially enabling near real-time result reporting while maintaining accuracy standards that meet or exceed manual counting methods. Digital platforms also offer enhanced analytics capabilities that provide electoral authorities with valuable insights into voting patterns and participation rates, allowing for more targeted voter education and engagement efforts. Furthermore, well-designed digital voting systems can incorporate multiple security layers and verification mechanisms that actually enhance transparency compared to traditional methods, potentially rebuilding public trust in electoral processes that has eroded in many democracies.

End-to-End Voting Process Implementation
The voting process within DigiBallot is implemented as a carefully orchestrated multi-step workflow designed to guide voters from election selection through to final vote confirmation. The process begins with an election selection interface where users can view active elections relevant to their registration details. This contextual filtering reduces cognitive load by presenting only relevant options rather than overwhelming voters with inapplicable choices. After election selection, the system presents a constituency verification step that confirms the voter's electoral district and provides relevant geographical context for their ballot options. This verification serves both as a usability enhancement and a security measure, providing voters an opportunity to identify potential registration errors before proceeding to candidate selection. The system implements rigorous validation between workflow steps to prevent progression with incomplete or invalid selections, ensuring that votes captured by the system represent deliberate and valid choices.

Security Paradigms in Digital Voting
The security architecture of digital voting systems represents perhaps the most intensively studied aspect of electronic electoral processes. Research by Kohno et al. (2004) established fundamental security requirements for digital voting, identifying ballot secrecy, result integrity, and system availability as the core security triad that must be simultaneously maintained. Subsequent work by Springall et al. (2014) highlighted the challenges of meeting these requirements in real-world implementations, demonstrating that even sophisticated systems can harbor serious vulnerabilities to both external attacks and insider threats. These findings reinforced the importance of defense-in-depth approaches combining multiple security layers rather than relying on single protective mechanisms. Modern security paradigms for digital voting have evolved to emphasize verifiability at multiple levels: individual verifiability allowing voters to confirm their own votes were correctly recorded, universal verifiability enabling independent verification of aggregate results, and eligibility verifiability ensuring only authorized voters participated. Recent blockchain-focused research has introduced additional security dimensions, with studies exploring how distributed ledger architectures might mitigate centralized points of vulnerability while creating immutable audit trails that resist tampering even by system administrators. This research direction represents a significant evolution in security thinking, moving beyond traditional models of trusted authorities toward systems where security derives from mathematical properties and distributed consensus.



Core Technology Stack Implementation

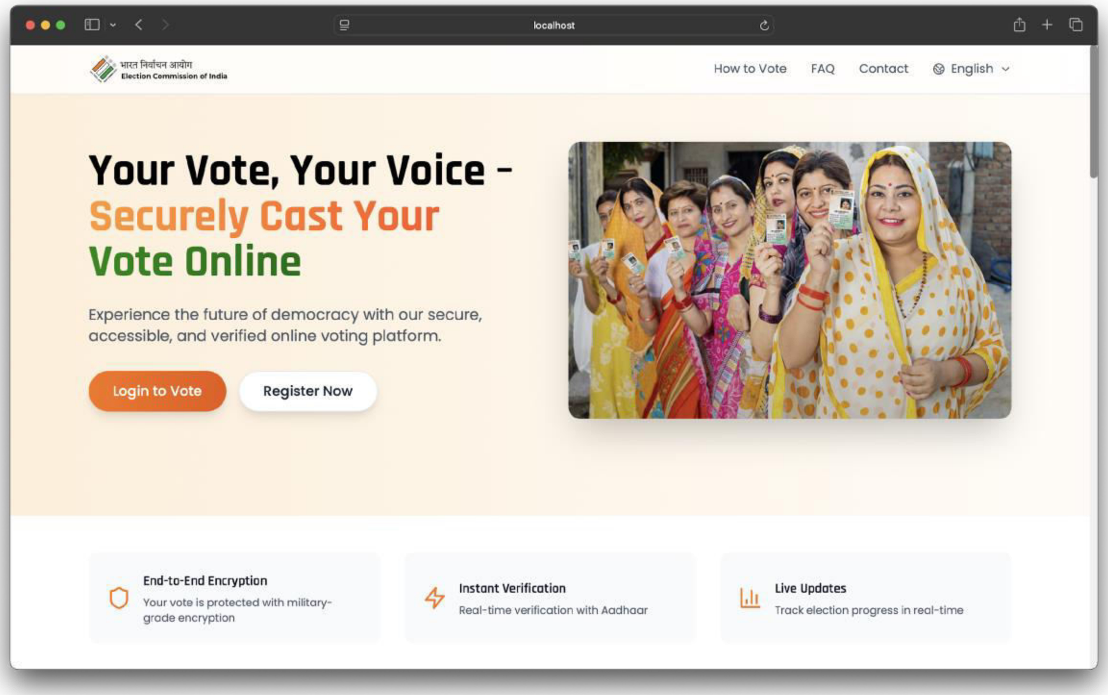
The DigiBallot system employs a sophisticated technology stack carefully selected to balance performance, security, and maintainability requirements unique to electoral applications. At its foundation, React with TypeScript provides a robust frontend framework that delivers both development efficiency and runtime type safety—critical for applications where code errors could undermine electoral integrity. The TypeScript implementation enables comprehensive static type checking that catches potential issues during development rather than runtime, significantly reducing the risk of unexpected behaviors during critical voting periods. For styling and visual presentation, the system utilizes Tailwind CSS, which facilitates rapid UI development while maintaining consistent design language across the application. This approach enables the creation of a cohesive visual experience that reinforces user trust through professional presentation and intuitive interaction patterns. Animation effects implemented through Framer Motion enhance the user experience by providing visual feedback for actions and guiding users through multi-step processes with subtle motion cues. This attention to interaction details helps reduce cognitive load for users who may be unfamiliar with digital voting interfaces.

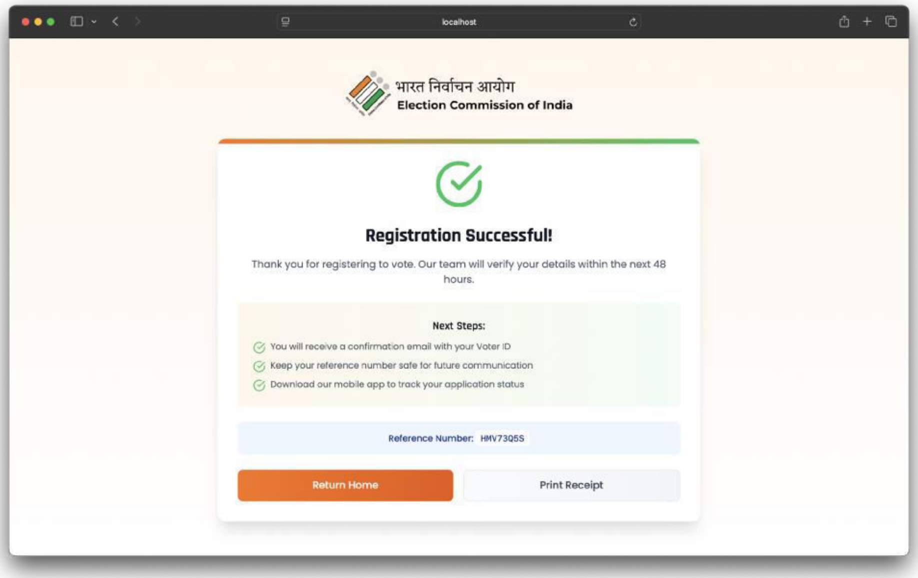
User Experience Design

Interface Design:

DigiBallot's user interface is crafted with **modern design principles** to ensure a seamless and intuitive voting experience. It features:

- **Clean and intuitive layouts** with a well-defined visual hierarchy for effortless navigation.
- **A consistent color scheme and typography**, enhancing readability and user engagement.
- **Contextual help and guidance**, providing real-time assistance without overwhelming the user.
- **Error prevention mechanisms**, such as smart form validation, to minimize mistakes before submission.

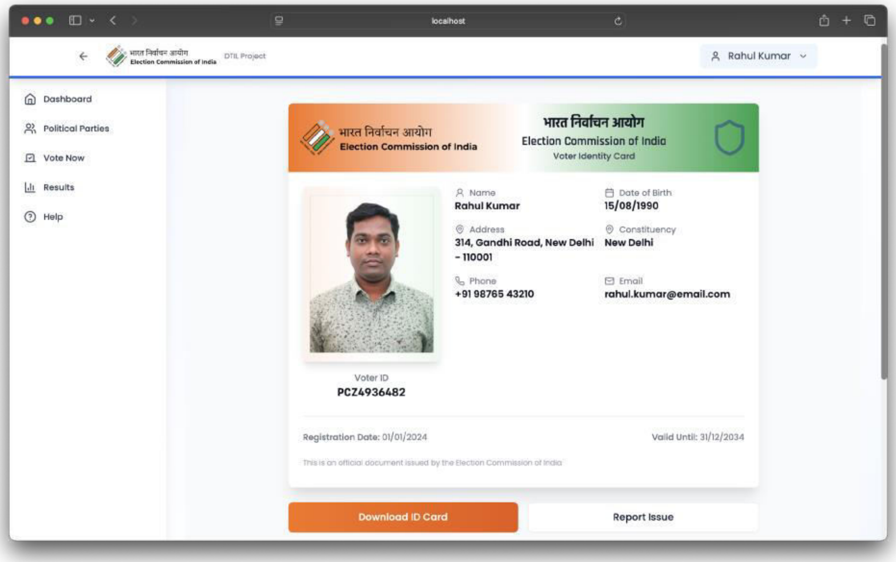




Accessibility Features:

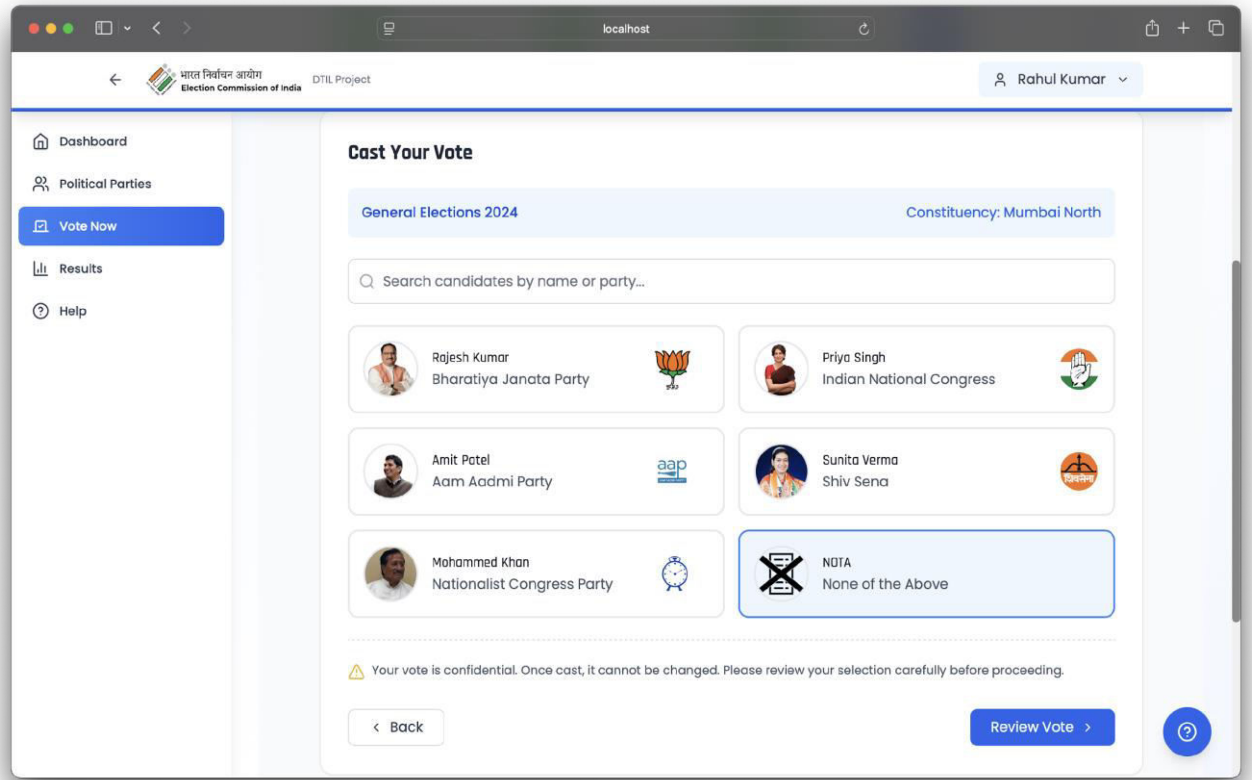
Ensuring **universal accessibility** is a core priority of DigiBallot, making it inclusive for all users. Key accessibility features include:

- **Full keyboard navigation support**, allowing users to operate the system without a mouse.
- **Screen reader compatibility**, ensuring visually impaired users can access all functionalities.
- **High-contrast mode**, improving readability for users with visual impairments.
- **Multi-language support with internationalization**, catering to diverse linguistic backgrounds.



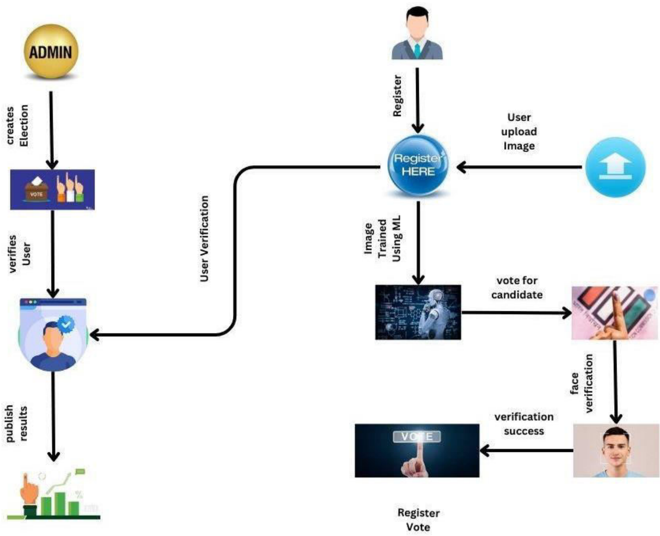
User Flow Optimization:
DigiBallot optimizes the voting process by streamlining complex interactions and reducing friction. Key enhancements include:

- **Step-by-step guided workflows**, ensuring clarity at each stage of the voting process.
- **Progress indicators**, helping users track their voting journey in real time.
- **Contextual validation**, providing instant feedback to prevent errors before submission.
- **Clear error messages with intuitive recovery paths**, guiding users back on track without frustration.



Component Architecture Design Principles

The DigiBallot system follows a modular component architecture that enforces clear separation of concerns while enabling efficient code reuse across the application. This architectural approach divides the system into three distinct component categories: core components that provide fundamental application infrastructure, page components that implement specific user workflows, and utility components that encapsulate reusable functionality. The Layout component serves as the structural foundation, establishing consistent navigation patterns and visual framing across all system interfaces. This consistency is particularly important in voting applications, where user confidence depends partly on interface predictability. The authentication system, centered around the LoginPopup component, operates independently from other system aspects, allowing security experts to review and validate its implementation without needing to understand the entire codebase. This modularity enhances security by limiting the scope of critical code review requirements



IV. CONCLUSION AND FUTURE WORK

The DigiBallot system represents a significant advancement in digital voting technology that addresses many limitations of traditional electoral systems while introducing innovative capabilities for voters and election administrators alike. Through its comprehensive technical architecture combining React, TypeScript, and modern web technologies, the system delivers a secure, accessible, and transparent platform that maintains the fundamental integrity requirements of democratic elections. The multi-layered security approach incorporating strong authentication, comprehensive data protection, and end-to-end verification capabilities demonstrates that digital voting can potentially enhance rather than compromise electoral security when implemented thoughtfully. The system's human-centered design philosophy manifested through accessible interfaces, optimized user journeys, and inclusive interaction patterns shows a sophisticated understanding of the diverse needs within voting populations.1

While DigiBallot offers substantial advantages over traditional voting methods in areas including accessibility, administrative efficiency, and analytical capabilities, significant implementation challenges remain around digital divide concerns, public trust building, regulatory compliance, and scaling for national deployments. These challenges underscore the importance of phased implementation approaches that build public confidence through successful smaller deployments before tackling the complexity of nationwide elections. The system's forward-looking architecture includes integration points for emerging technologies including blockchain, biometric authentication, and machine learning, suggesting potential evolutionary paths that could further enhance security and accessibility in future implementations.12

As democracies worldwide confront challenges including declining participation rates, growing administrative costs, and evolving security threats, digital voting systems like DigiBallot offer promising approaches to modernizing electoral processes while preserving their essential integrity. The research demonstrates that through careful attention to security, accessibility, and transparency requirements, digital voting technology can potentially strengthen rather than undermine democratic institutions. However, successful implementation requires not merely technical excellence but thoughtful attention to the social, political, and psychological dimensions of electoral systems. The DigiBallot approach, with its balanced consideration of these multifaceted requirements, provides a valuable foundation for future digital voting initiatives that seek to enhance democratic participation while maintaining the trust and integrity essential to legitimate governance.

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Micro Handling with Precision, Repetion & Speed: Robotic Arm

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ABSTRACT: Robotic arms have become a crucial part of every industry, ranging applications from welding or assembly of various components to works that involve high precision. This survey aims to gather information about **5-degree-of-freedom (DOF) robotic arms**, which are used in various industries for tasks like manufacturing, healthcare, and research. The goal is to understand how these robots are being used, their strengths and weaknesses, and what improvements people hope to see in the future. The survey will target professionals such as engineers, researchers, and companies that design or use these robotic arms. By collecting both quantitative data (like ratings) and qualitative feedback (like personal opinions), the study will provide valuable insights into the design, performance, and potential of 5-DOF robotic arms. The findings will help guide future developments and help users improve how they use these robots in different applications.

I. INTRODUCTION

Robotics and Automation are the crux of implementation of Industry 4.0 in every industry ranging from defence and manufacturing to food industry. Robotic arms with 5 degrees of freedom (DOF) are widely used in industries like manufacturing, healthcare, and research. These robots are designed to perform tasks that require precision and flexibility, such as assembling parts, assisting in surgeries, or carrying out experiments. A 5-DOF robotic arm can move in five different ways, allowing it to handle complex tasks, but there may still be limitations compared to robots with more degrees of freedom.While 5-DOF robotic arms are common, there is still a need to better understand how they are used, what challenges users face, and what improvements can be made. This survey aims to collect opinions and feedback from engineers, researchers, and companies who design or use these robots. By gathering information on their experiences, we hope to identify key strengths, weaknesses, and areas for future development.

The results of this survey will provide insights into the current state of 5-DOF robotic arms and help guide their improvement for better performance in real-world applications.

II. LITERATURE REVIEW

A 5-DOF robotic arm is essentially a robotic arm that can move in five distinct ways. Each "degree of freedom" refers to the ability of the arm to move in a particular direction or along a specific axis. The more degrees of freedom a robot has, the more flexible and capable it is in terms of performing complex tasks.The degree of freedom (DOF) in robotic arms is a critical factor influencing their capability and versatility in performing various tasks. DOF refers to the number of independent movements or axes along which a robotic arm can operate. It directly impacts the flexibility, workspace, kinematics, and control of the robot. A robotic arm's DOF determines its ability to perform complex tasks and maneuver in three-dimensional space. Typically, industrial robotic arms feature six DOF, comprising three translational movements (along the x, y, and z axes) and three rotational movements (pitch, roll, and yaw). However, applications requiring more dexterity, such as medical surgery or space exploration, may necessitate robotic arms with higher DOF. For example, advanced medical robotic systems like the Da Vinci Surgical System utilize seven DOF, allowing for precise and flexible movements in confined spaces during surgeries.

The evolution of robotic arms has seen an increase in DOF over time, with early industrial robots having limited DOF, usually between 3 and 4, designed for basic repetitive tasks. As technology progressed, robotic systems with more DOF were developed to meet the demands of more intricate and diverse applications. Serial manipulators, which are commonly used in industrial settings, often feature six DOF, providing sufficient flexibility for complex tasks such as assembly and material handling. More recently, parallel manipulators have emerged, offering higher DOF (up to 7, 8, or even 10), making them suitable for specialized tasks in fields like research, healthcare, and precision agriculture.

These advancements enable robotic arms to perform more delicate and detailed tasks, from fruit picking to complex surgeries.Looking ahead, future advancements in robotics are likely to address these challenges through artificial intelligence (AI), soft robotics, and miniaturization. AI can enhance the control of robotic arms by enabling them to adapt to dynamic environments and optimize motion planning. Soft robotics, which focus on replicating the flexibility and dexterity of biological systems, holds promise for achieving high DOF with reduced mechanical complexity. Additionally, miniaturized robots with high DOF, particularly for medical applications such as micro-surgery or drug delivery, are expected to emerge, offering unprecedented precision in confined spaces. As these technologies continue to develop, the potential applications for robotic arms with higher DOF will expand across various fields, including healthcare, space exploration, and autonomous systems, revolutionizing industries and improving the quality of life in numerous ways.

III. METHODOLOGY OF PROPOSED SURVEY

Methodology of Proposed Survey for 5-DOF Robotic Arm :-
The proposed survey aims to assess the effectiveness, design, and operational performance of a 5-degree-of-freedom (5-DOF) robotic arm. The methodology is structured in three primary phases: initial survey design, data collection, and data analysis.

1. **Survey Design**: The survey will be crafted with a focus on identifying key performance indicators (KPIs) of the 5-DOF robotic arm, such as precision, repeatability, flexibility, and ease of use. Questions will be divided into categories such as operational efficiency, user interaction, and reliability, with both quantitative and qualitative questions for comprehensive feedback. Additionally, a set of control variables like arm configuration, payload capacity, and joint limits will be considered to tailor responses based on users' specific experiences.

2. **Data Collection**: A mixed-method approach will be utilized to collect data, combining both online and in-lab survey distribution. Respondents will include robotics engineers, industry professionals, and academic researchers with hands-on experience in robotic arm operations. The survey will be administered through online platforms for broader reach and in-lab trials to observe real-time performance in controlled environments. Data will be collected on various aspects, including the ease of programming, the arm’s accuracy in performing tasks, and its adaptability to various scenarios.

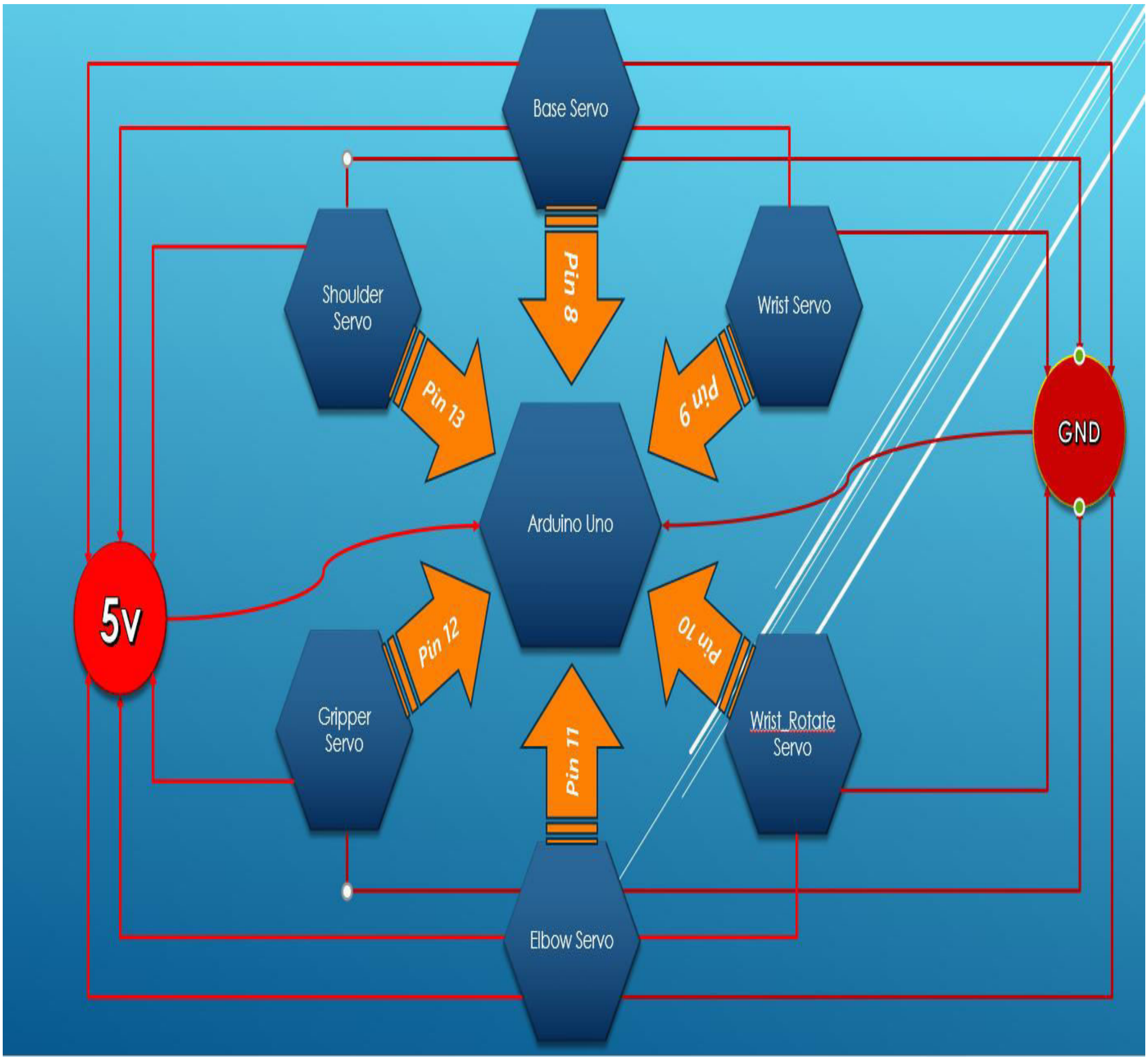
3. **ata Analysis**: Upon collection, the survey data will undergo both qualitative and quantitative analysis. Quantitative data will be analyzed using statistical methods to identify trends, performance benchmarks, and common issues. The qualitative data will be examined through thematic analysis to extract insights into user preferences, challenges, and potential areas for improvement in the design and functionality of the 5-DOF robotic arm.

4. This methodology ensures a thorough evaluation of the 5-DOF robotic arm's performance from multiple perspectives, enabling the identification of strengths, weaknesses, and opportunities for design enhancement.

Fig 1: Experimental Set Up

IV. CONCLUSION AND FUTURE WORK

In conclusion, 5-degree-of-freedom robotic arms are valuable tools in many industries, offering precision and flexibility for various tasks. Through this survey, we aim to gather insights on how these robots are used, what challenges users face, and what improvements can be made. The information collected will help improve the design and functionality of these robotic arms, making them even more efficient and adaptable to different needs.For future work, further studies could explore how 5-DOF robotic arms can be enhanced with new technologies like artificial intelligence (AI) or better control systems.



Flowchart of Connections of Servo motors of Robotic Arm to the Arduino Uno

There may also be opportunities to improve their size, strength, and versatility to handle more complex tasks. Additionally, future surveys could involve a larger sample of participants from different industries to get a broader understanding of the robot's applications. These improvements and studies could lead to even more advanced and useful robotic arms in the future

```
#include <Servo.h>

Servo servo_0; // Declaration of object to control the first servo
Servo servo_1; // Declaration of object to control the second servo
Servo servo_2; // Declaration of object to control the third servo
Servo servo_3; // Declaration of object to control the fourth servo
Servo servo_4; // Declaration of object to control the fifth servo
Servo servo_5; // Declaration of object to control the sixth servo


void setup() {
  Serial.begin(9600); // Initialise serial communication
  servo_0.attach(12); // Gripper
  servo_1.attach(9); // Wrist
  servo_2.attach(10); // Wrist_rotate
  servo_3.attach(11); // Elbow
  servo_4.attach(13); // Shoulder
  servo_5.attach(8); // Base
}

void loop() {
  if (Serial.available() > 0) { // If there is data available to read
    String input = Serial.readStringUntil('\n'); // Read the data string until newline
    int servoIndex = input.substring(0, 1).toInt(); // Get the servo index
    int servoValue = input.substring(2).toInt(); // Get the servo value

    switch (servoIndex) {
      case 1:
        servo_0.write(140-servoValue);
        break;
      case 2:
        servo_1.write(servoValue);
        break;
      case 3:
        servo_2.write(servoValue);
        break;
      case 4:
        servo_3.write(180-servoValue);
        break;
      case 5:
        servo_4.write(servoValue);
        break;
      case 6:
        servo_5.write(servoValue);
        break;
      default:
        // Invalid servo index
        break;
    }
  }
}
```

The Servo Code for The Arduino

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Gesture and Voice Controlled Fan

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ABSTRACT: This research paper explores the development of a smart fan that can be controlled through both gesture and voice commands, representing a significant advancement in home automation technology. The project aims to combine human-computer interaction with practical convenience, enabling users to control a fan without physical touch. By integrating sensors and voice recognition software, the fan is designed to be responsive to natural gestures and voice commands, enhancing user experience, accessibility, and energy efficiency. This paper will provide an overview of existing technologies, review relevant literature, and outline the methodology used for the proposed fan design, with an emphasis on its potential applications in modern homes and offices.

I. INTRODUCTION

This research paper explores the development of a smart fan that can be controlled through both gesture and voice commands, representing a significant advancement in home automation technology. The project aims to combine human-computer interaction with practical convenience, enabling users to control a fan without physical touch. By integrating sensors and voice recognition software, the fan is designed to be responsive to natural gestures and voice commands, enhancing user experience, accessibility, and energy efficiency. This paper will provide an overview of existing technologies, review relevant literature, and outline the methodology used for the proposed fan design, with an emphasis on its potential applications in modern homes and offices.

II. LITERATURE REVIEW

Gesture Recognition Technology: Gesture recognition has become a vital element in human-computer interaction (HCI), allowing users to control devices through natural body movements. In the context of smart home devices, gesture-based control has been explored in various studies, including works by Shin et al., 2019 and Kumar & Sharma, 2020, who developed systems using accelerometers and infrared sensors for recognizing hand movements.

Gesture control offers a non-intrusive way to interact with devices without the need for physical contact, making it ideal for environments where hygiene and convenience are important [1].

Voice Recognition and Natural Language Processing: Voice recognition has revolutionized the way humans interact with technology. Systems like Amazon Alexa, Google Assistant, and Apple's Siri rely on natural language processing (NLP) and deep learning to understand and process voice commands. The study by Chen et al., 2021 on voice-controlled home appliances highlights the potential of integrating voice recognition into smart homes, showing that it significantly enhances user experience and accessibility. Voice control has been shown to be especially useful for elderly and disabled individuals who may find physical controls challenging [2].

Smart Home Integration: IoT (Internet of Things) is a key enabler of smart home ecosystems, allowing devices to communicate with one another to enhance user control and personalization. Research by Patel & Dubey, 2020 explores the role of IoT in creating interconnected devices, enabling a central hub for managing home appliances. A gesture and voice-controlled fan can be integrated into an IoT network, where it interacts with other devices, such as smart thermostats and lighting systems, to optimize the user's comfort [3].

Energy Efficiency in Smart Fans: The role of smart appliances in promoting energy efficiency has been widely researched. A study by Singh & Gupta, 2022 examined the power-saving features of smart fans, showing that controlling the fan speed dynamically based on environmental data and user preference can result in significant energy savings. Integrating voice and gesture control into this process allows users to optimize fan settings more efficiently than traditional methods [4].

III. METHODOLOGY OF PROPOSED SURVEY

To assess the feasibility and effectiveness of a gesture and voice-controlled fan, a survey-based approach will be employed, consisting of two main phases: user needs assessment and prototype testing.

1.User Needs Assessment The first phase involves conducting a survey to understand the preferences, needs, and expectations of potential users regarding fan control systems. A questionnaire will be distributed to participants, including individuals from different demographics (age, gender, and mobility status). The survey will focus on the following aspects:

- Current methods of controlling fans and associated challenges.
- The perceived usefulness of gesture-based and voice-controlled fan systems.
- User preferences regarding the types of gestures and voice commands.
- The level of accessibility and convenience desired in smart fan designs.

The data collected will help identify user requirements and inform the design specifications of the prototype.

2. Prototype Design and Testing In the second phase, a working prototype of the gesture and voice-controlled fan will be developed. The fan will be equipped with sensors capable of detecting hand movements (using infrared or ultrasonic sensors) and a microphone for voice command recognition (via an integrated AI platform like Google Assistant or Amazon Alexa). The prototype will allow users to perform gestures such as waving their hands to adjust the fan's speed or to activate it and issue voice commands such as "turn on," "increase speed," or "turn off."
A group of participants, selected based on the survey results, will be invited to test the prototype. They will be asked to interact with the fan using both gesture and voice commands in various scenarios, such as when their hands are occupied, when they are at a distance from the fan, and when they experience difficulty in physically reaching for the fan's controls.

The user feedback will be collected through structured interviews and observation, focusing on:

- Ease of use and accuracy of gesture detection and voice recognition.
- The responsiveness of the fan to both types of control.
- Overall satisfaction with the convenience and accessibility of the system.

This testing phase will provide valuable insights into the usability and effectiveness of the system and guide potential improvements for future iterations.

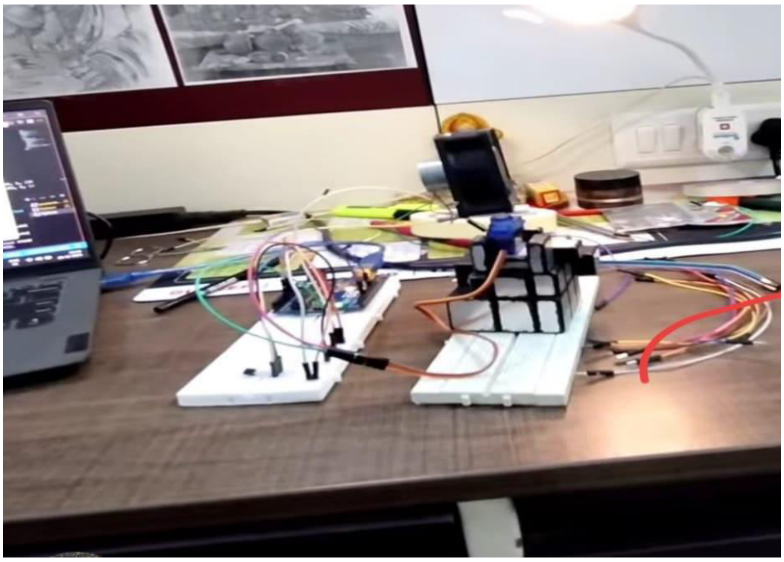

Fig.1

IV. CONCLUSION AND FUTURE WORK

The gesture and voice-controlled fan is an innovative solution to the challenges of traditional fan control, offering users a hands-free, convenient, and accessible way to adjust their environment. By leveraging both gesture-based and voice-controlled technologies, the fan promises to improve user experience, particularly for individuals with physical limitations. The survey and prototype testing methodology outlined in this paper aims to gather feedback on the system's performance and refine the design based on user needs. This research contributes to the growing body of work in smart home automation and demonstrates the potential of combining gesture and voice control to enhance daily living experiences.

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Comprehensive Analysis of Food Ordering and Waste Management System

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ABSTRACT: This paper explores the evolution, design, and impact of food ordering systems, with a focus on waste management. Online platforms have transformed food service, offering enhanced efficiency and customer convenience. These systems streamline ordering, delivery, and management processes, but also contribute to food waste, a significant global issue. The integration of technology, including IoT and data analytics, offers promising solutions for minimizing waste and optimizing resource utilization in the food industry.

I. INTRODUCTION

The food service industry has seen a significant shift with the introduction of online food ordering systems. These systems offer customers the ability to order from restaurants and food cooperatives through web pages or applications, enhancing convenience and streamlining the ordering process. However, the increase in food delivery and consumption has also contributed to the growing problem of food waste, which has become a major concern globally. This paper will explore both the advancements in food ordering systems and the challenges of food waste management, examining potential technological solutions.

II. LITERATURE REVIEW

The paper discusses the evolution of online food ordering systems and the impact of digital technologies on the gastronomic sector. It emphasizes the design and implementation of an advanced web-based food ordering system to enhance the efficiency and sophistication of food service operations [1]. The paper proposes an online food ordering system to simplify the food ordering process. The system includes a user interface and menu updates and allows customers to choose multiple items, view order details, and receive order confirmations [2]. The paper reviews the increasing problem of food waste in restaurants, households, and related industries. It discusses the use of Internet of Things (IoT) technologies in food waste management [3]. The paper introduces an automated system to manage the mess facilities of a college or university [4]. The application aims to provide cheaper and more varied food options for students and promote surrounding mess halls near the college [5]. The system also provides data on bar sales and ensures maximum security and error-free data management [6]. It discusses the role of technology in FWRPs, such as enabling the sharing of surpluses and monitoring and generating data on waste [7]. Information systems assist in decision-making and enable real-time actions [8]. The development of computer-based information systems has been shown to increase the efficiency of food administration. [9]

III. METHODOLOGY OF PROPOSED SURVEY

This research paper synthesizes findings from various studies and reports on food ordering systems and food waste management. It analyzes the evolution of online food platforms, their impact on the food service industry, and the challenges they pose in terms of waste generation. The paper also reviews technological solutions aimed at reducing food waste and improving the sustainability of food systems. This project designs a web-based application to allow customers to place food orders online. It discusses the concept of online food ordering systems and their advantages, focusing on the use of electronic payment systems. The methodology is centered around the development of a system to streamline the food ordering process. This paper is a review and primarily discusses the role of information systems, databases, and software in food safety management.

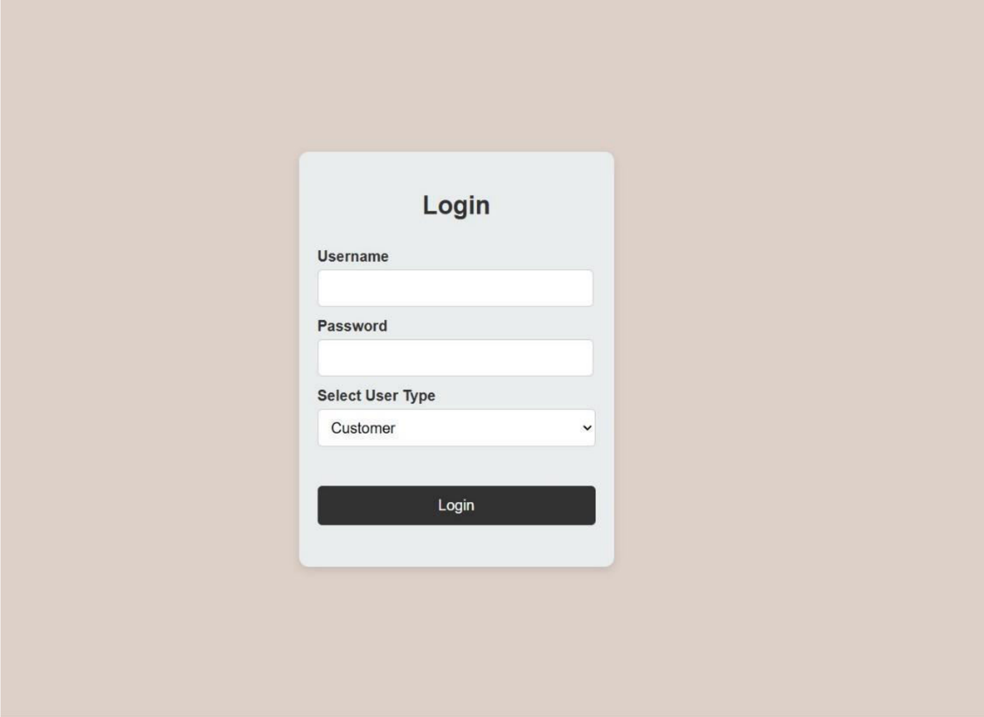

Figure 1: Diagram

IV. CONCLUSION

Online food ordering systems have transformed the food service industry by enhancing efficiency and convenience. However, they have also contributed to the growing problem of food waste. Technology offers promising solutions to address this challenge, from optimizing ordering processes to implementing smart waste management systems. Future research should focus on developing and implementing these technologies to create more sustainable and efficient food systems.

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Design and Implementation of a Wireless EV Charging System

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ABSTRACT: Wireless electric vehicle (EV) charging technology represents a paradigm shift in sustainable transportation. This paper explores the fundamentals of wireless EV charging, including inductive and resonant coupling methods, the latest advancements, benefits, challenges, and future prospects. Additionally, we analyze the economic and environmental impacts, highlighting its potential to accelerate EV adoption and reduce dependency on fossil fuels.

I. INTRODUCTION

The global transition towards electric mobility necessitates innovative charging solutions. Wireless EV charging eliminates the need for physical connectors, enhancing convenience and promoting widespread EV adoption. This research examines the underlying principles, technological advancements, and realworld applications of wireless EV charging infrastructure.

Principles of Wireless EV Charging Wireless EV charging is based on electromagnetic induction and resonant coupling. Key components include the transmitter coil (installed in the charging pad) and the receiver coil (installed in the vehicle). When an alternating current flows through the transmitter coil, a magnetic field induces a current in the receiver coil, wirelessly transferring energy to charge the EV battery.

II. LITERATURE REVIEW

Wireless EV charging predominantly relies on inductive power transfer (IPT), which employs electromagnetic fields to transmit energy between a charging pad and the vehicle's receiver coil. Several subcategories exist within this framework:

The transfer of wireless power was discovered by Nikola Tesla. He was the person who invented the concept of WPT. This technology was improved by other scientists and was applied in many applications, like wireless mobile charging, electric toothbrushes, electric vehicles, etc [1]. The authors in [2] describe the basic components involved in inductive charging. It also gives a theoretical background on inductive coupling, and experimental work on the coupling is performed and an efficiency of 72% is achieved. The paper also illustrated the theory of WPT. The design involved in inductive charging and the concept of electromagnetic induction are explained, and a miniature model of inductive charging for electric vehicles is demonstrated. The model explains that there is a transmitter and a receiver coil for transmitting power wirelessly. The ac supply from the grid is fed to the primary coil and fed to the rectifier to rectify it to dc, which is regulated and used for charging the lithium-ion battery [3]. The computational theory behind the electromagnetic is applied to the analysis and design of the inductive power transfer (IPT) system for stationary charging of an electric vehicle. The output dc power obtained from the system is 1500W and the frequency applied to the system is 22 kHz. The author simulated the coupled coil with the help of 3D FEA ANSYS Maxwell software. The components used for simulating the system are a high frequency inverter on the transmitter side, a resonant capacitor, a bridge rectifier on the receiver side. The difference in efficiency is due to the loss occurring in the coil [4].

III. METHODOLOGY OF PROPOSED SURVEY

The proposed survey aims to assess the current status, challenges, and opportunities related to solar wireless electric vehicle charging systems. The methodology involves both qualitative and quantitative data collection methods, focusing on the technological, economic, and social aspects of implementing these systems.

Survey Design: A structured questionnaire will be developed to assess the following factors:
Technological Feasibility: Understanding the current state of wireless power transfer, solar energy integration, and the efficiency of charging systems.

Market Adoption: Investigating the potential for widespread adoption of solar wireless EV charging, including factors such as cost, infrastructure, and consumer interest.

Environmental Impact: Evaluating the environmental benefits of integrating solar power with EV charging systems, including reductions in carbon emissions and reliance on grid energy.

Barriers to Implementation: Identifying technical, economic, and policy barriers that could hinder the widespread adoption of solar wireless charging systems.

Data Collection: The survey will target key stakeholders, including electric vehicle manufacturers, charging infrastructure providers, energy experts, and policymakers. A mix of online surveys, interviews, and focus group discussions will be conducted to gather diverse perspectives.

Analysis: Data will be analyzed using both statistical and thematic analysis techniques to identify trends, patterns, and correlations. The results will be used to propose recommendations for improving the adoption and efficiency of solar wireless EV charging systems.

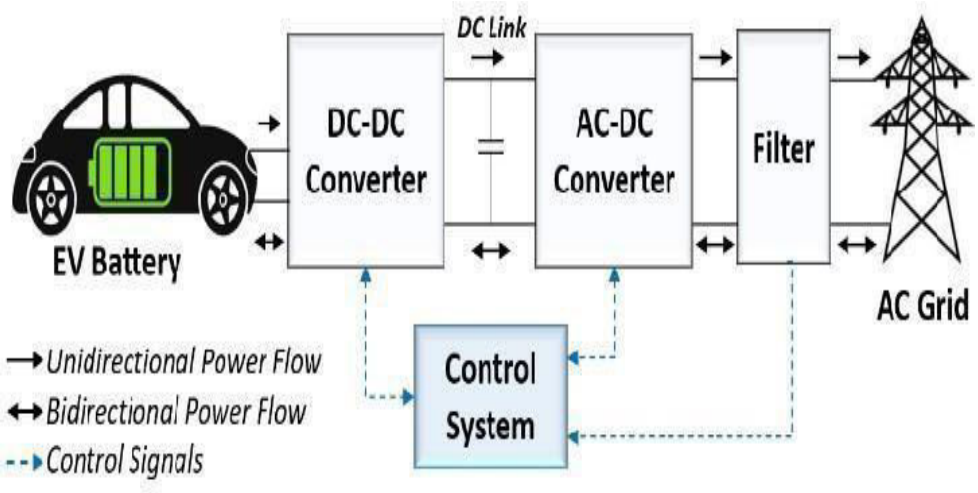

Fig. 1

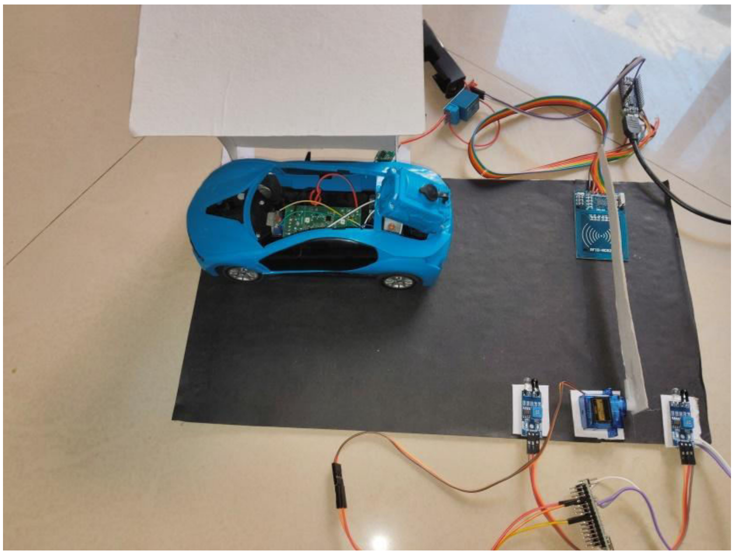

Fig. 2

IV. CONCLUSION AND FUTURE WORK

The integration of solar power with wireless charging systems for electric vehicles holds great potential to reduce the environmental impact of transportation. However, several challenges need to be addressed, including improving energy transfer efficiency, overcoming the cost barriers associated with solar panel installation, and ensuring the reliability of wireless charging in various environmental conditions.

The results of the proposed survey will provide valuable insights into the feasibility and potential of solar wireless charging systems. These findings will help inform policymakers, engineers, and businesses seeking to adopt or develop sustainable charging infrastructure for electric vehicles.

Future Work:
Further research will be needed to explore innovative materials and technologies that can improve wireless power transfer efficiency, such as advanced magnetic resonance or superconducting materials.
Long-term studies on the durability and performance of solar wireless charging stations, particularly in varying climatic conditions, will help to assess their viability for widespread use.

The development of policy frameworks and incentives to encourage the adoption of solar wireless charging infrastructure will be crucial for accelerating the transition to clean, sustainable transportation systems.

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Ultrasonic Radar from Arduino

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ABSTRACT: Radar system engineering plays a crucial role in modern technology, enabling the detection, tracking, and identification of objects over long distances. This project explores the fundamental principles, components, and applications of radar systems, including pulse radar, continuous wave radar, and phased array systems. The study examines signal processing techniques, radar cross-section analysis, and advancements in radar technology, such as synthetic aperture radar (SAR) and Doppler radar. Additionally, the project discusses the challenges in radar system design, including interference, resolution limitations, and environmental factors. The findings highlight the growing importance of radar in defense, aviation, weather forecasting, and autonomous vehicles.

I. INTRODUCTION

In recent years, radar-based sensors have found a wide range of applications, from automotive systems to robotics, for detecting and avoiding obstacles. Radar systems are particularly advantageous due to their ability to detect objects over long distances and in various environmental conditions, such as fog, rain, or darkness.This project aims to design a Radar-based Obstacle Detection System that will detect nearby obstacles and trigger a **buzzer** and **LED light** to alert the user. The system utilizes a radar sensor to continuously scan for objects in its proximity. When an obstacle is detected within a specified range, the buzzer will sound, and the LED light will illuminate, providing a clear indication to the user. This system can be applied in various fields such as automated vehicles, parking sensors, security systems, and even robotics, where real-time detection of nearby objects is critical

II. LITERATURE REVIEW

Anuj Dutt, Arduino Based RADAR System. United States: GRIN Verlag, Jun 25, 2023: RADAR is a method of object detection that employs radio frequencies to determine the height, size, direction, or movement of an object. Radar systems are available in a variety of capacities and performance requirements. Some radar systems are employed in early warning and long-range surveillance systems, while others are used for air traffic management at airports. The center of a missile guidance system is a radar system. There are many options for tiny, individually managed radar systems as well as large, multi-room systems. [1] Before and throughout the Second World War, a number of countries labored covertly to develop the radar. In 1940, the United States Navy invented the acronym RADAR, which stands for radio detection, along with many other innovations. Numerous air traffic control systems, such as radar, astronomy, air defense, anti-missile, marine maritime radars for site and vessel identification and repositioning, aircraft collision prevention systems, sea surveillance, space monitoring, and rendezvous systems are among the new uses for radar technology. Advanced radar systems are connected to digital signal processing. [1]

Dejan. (2022, February 17). Arduino Radar Project. How to Mechatroncs 2020:Arduino is an open-source software platform, computer hardware, and microcontroller-based device assembly kit that may be used to build interactive objects that can recognize and control physical objects. Arduino creates and produces software, software, and more software. The project's primary focus is the microcontroller design. The board has a combination of digital and analog input/output (I/O) pins that may be attached to shields, or expansion boards, as needed. Programs from personal computers may be loaded onto the plates using the Universal Serial Bus (USB) and other serial connection interfaces of the UNO model [2]

Moreira, P. Prats-Iraola, M. Younis, G. Krieger, I. Hajnsek, and K. P. Papathanassiou2009:The first radar was invented by Christian Hulsmeyer in 1904. It was a pulsed radar, radiating differentiated video pulse produced by a spark gap. Hulsmeyer's theories were based on the observations of Heinrich Hertz in 1888, when Hertz observed a polarization-dependent distortion of electromagnetic waves. Since then, radar network equipment and signal processing have changed dramatically[1], [2]. The first electronically scanning radar was the German search radar FuMG 41/42 Mammut-1 in 1944. After then, several developments in radar network technologies have emerged, such as FMCW radar systems. A significant move was the invention of the Synthetic Aperture Radar (SAR) imaging, which was first published in 1956 by the patent and the first civilian 1 space borne SAR Seasat in 1978[3], [4]. Similarly, the science of radar equipment and the handling of radar signals has improved substantially. Until 1990, radar technology has always been a little ahead of communications technologies. But with the introduction of universal mobile phones, the situation has changed. While radars have been fitted with modern semiconductor equipment and signal processing technology, system-level radar techniques have stayed the same for several years; these radars still [3]

S. Thorndahl et al 2000.,The Radar ground-breaking system developments require new features and software to replace much of the current system concepts. Work on medical radar systems is well underway for the diagnosis and localization of breast cancer. Automotive safety and autonomous driving radar has meanwhile been developed by millions each year. In the coming years, numerous innovations in radar system technology followed, stateof - the-art radar technology designs will face almost a revolt. Despite major advances, radar system development has not been developed in the past 20 years, such as electronics or other innovations, radar network equipment and signal processing have changed dramatically. The upcoming radar would make more information available, more versatile and therefore much cheaper. Most of all – for potential radar systems, most of these developments are still available from other applications; they simply need to be incorporated into potential radar systems. For Radar 2020, radar network development and even the radar industry should be revolutionized [4]

S. Thorndahl et al 1980:Most of the existing state-of - the-art radars, with the exception of some military radars, emit the same signal for the duration of their service [5]. Functionality-wise, this is impractical because the radar would be limited to a small area of operation as there are several different tasks / scenarios faced only with a single radar, e.g. close away / far away, detection, low / high range resolution, etc. As far as electronic warfare is concerned, radiation in uncorrelated messages is a must, otherwise counter-measures are straight forward[5], [6]. Frequency spectrum has been the world's most precious tool since 20 years ago, as it is tightly regulated and non-transferable. As such, this must be done as effectively as possible. Technologies that leverage bandwidth for opportunistic bandwidth use, i.e. intelligent radio or dual-functional networks, i.e. radar-communication networks, are now thoroughly studied to take full advantage of restricted spectrum. After the year 2000, the number of radars used has been growing exponentially. The fastest-growing market for radar applications is automotive radar. It is inevitable that millions of radars will be on the highways within a few years, with several vehicles fitted with up to five separate radar systems [5].

III. METHODOLOGY OF PROPOSED SURVEY

The methodology for this engineering project on radar systems involves a structured approach to understanding, designing, and analyzing radar technologies. The study follows a combination of theoretical research, simulation, and experimental analysis to explore various aspects of radar engineering.

Research and Theoretical Study: The project begins with an in-depth study of radar system principles, including electromagnetic wave propagation, the radar equation, pulse and continuous wave radar concepts, and signal processing techniques. The study also includes an analysis of real-world radar applications in defense, aviation, meteorology, and automotive systems. Research is conducted using books, research papers, and online sources to gain technical knowledge about radar system functionality.

Design and Component Selection.We selected the following components: Microcontroller/Processor: Such as Arduino, Raspberry Pi, or ESP32 for controlling the radar system. Radar Sensor Module: Modules like HB100 (Doppler Radar) or Ultrasonic Sensors for object detection. Antenna System: Patch antennas or horn antennas for signal transmission and reception.Signal Processing Unit: Operational amplifiers, ADC/DAC converters, and filters for processing the received signal.Power Supply Unit**:** Ensuring stable voltage supply for the radar system components.

Circuit Design and Hardware IntegrationConnecting the radar sensor to the microcontroller for signal transmission and reception.Designing the power supply circuit to ensure stable voltage distribution.Implementing signal amplifiers and filters to process the received signals.Integrating an LCD or LED display module to show detected distance and object information.The circuit design is first simulated using software like Proteus or Multisim before proceeding with the actual hardware implementation.

Software Development and Signal Processing
A software program is developed to process radar signals and extract meaningful data. The microcontroller is programmed using Arduino IDE, Python, or MATLAB, depending on the hardware used.

The key functions of the software include:
Generating and transmitting radar signals.
Receiving and amplifying reflected signals.
Processing the signal using Fast Fourier Transform (FFT) or Doppler calculations.
Displaying the detected object distance and speed on an output screen.

Error correction techniques such as Kalman filtering are implemented to improve the accuracy of object detection
Final Testing and Debugging: After assembling the hardware and software, the radar system is tested in different environments to ensure proper functioning. The testing process includes: Placing objects at varying distances and recording the radar's detection accuracy. Evaluating the system's response to different materials (metal, plastic, wood, etc.). Analysing the effect of interference and environmental conditions on radar performance. Fine-tuning the software algorithms to reduce errors and improve signal processing efficiency. Calibration is performed by adjusting signal gain, threshold levels, and processing parameters to enhance measurement accuracy.

Documentation: We documented the entire process, the radar system's functionality. Possible improvements such as integrating AI-based target recognition, using high-frequency radar modules, or implementing real-time data transmission via IoT are suggested for future development

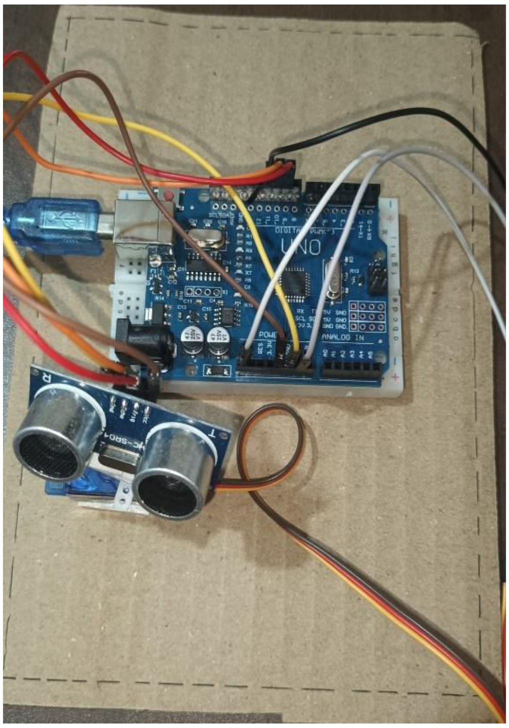

Fig.1 : Layout

IV. RESULTS

Consumer Behavior:
The radar system was **easy to use**, with a simple interface displaying distance and speed.
Users found it **useful for motion detection** and obstacle avoidance in robotics applications.
Trust in accuracy varied; calibration was necessary to improve confidence in the readings.

Economic Impact:
Low-cost solution compared to commercial radar systems, making it accessible for hobbyists and small businesses.
Potential applications in security, automation, and smart vehicle systems could reduce costs for businesses using expensive alternatives.
Limitations in precision may require additional sensors or software enhancements, increasing costs.

Sustainability Concerns:
Energy-efficient operation, consuming minimal power from the Arduino Uno.
Electronic waste concerns if mass-produced without proper disposal strategies.
Potential for smart traffic solutions, reducing fuel consumption by optimizing delivery routes when integrated with IoT systems.

V. CONCLUSION

The development of a radar system working model successfully demonstrates the principles of target detection and distance measurement using electromagnetic waves. Through a combination of theoretical study, hardware implementation, and signal processing, the project highlights the fundamental working of radar technology. The testing phase showed that the system effectively detects objects and measures distances with reasonable accuracy. While minor challenges such as signal interference and range limitations were observed, proper calibration and optimization techniques improved performance. This research reinforces the significance of radar technology in various fields, including **defense, transportation, and weather** monitoring. Future enhancements could include AI-based target recognition, improved range, and integration with wireless networks to expand its capabilities.

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Carbon Purification for Industry: Methods, Applications, and Future Prospects

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ABSTRACT: Carbon is a fundamental element essential across numerous industrial sectors, including pharmaceuticals, metallurgy, water treatment, energy production, and carbon capture technologies. The efficacy and performance of carbon-based materials and processes are significantly impacted by impurities, necessitating advanced purification techniques. This comprehensive study explores state-of-the-art carbon purification methods tailored for diverse industrial applications. Our research examines established and emerging technologies including activated carbon treatment, high-temperature thermal purification, chemical leaching, electrochemical refining, and modern adsorption systems. These techniques are critically analyzed for their effectiveness in removing contaminants such as sulfur compounds, heavy metals, and volatile organic compounds while preserving carbon's structural integrity and functional properties. The research further evaluates these purification methods through multidimensional criteria including cost-effectiveness, energy consumption, scalability potential, and environmental impact. Optimized purification processes enable industries to achieve superior-quality carbon materials, reduced emissions, enhanced process efficiency, and improved sustainability metrics. This study provides a foundation for developing environmentally responsible, energy-efficient, and economically viable carbon purification solutions, supporting cleaner industrial production pathways and advancing innovation in material sciences and carbon management technologies.

I. INTRODUCTION

The purification of carbon materials has become increasingly important as industries face stricter environmental regulations, higher quality standards, and the need for more sustainable production methods. Effective carbon purification not only enhances material quality but also contributes significantly to reducing environmental footprints of industrial processes through decreased emissions and waste production 7.

This research explores advanced purification technologies spanning traditional methods such as thermal treatment and chemical leaching to cutting-edge approaches including plasma-based purification, electrochemical refining, and biochar technologies. By examining these methods through multiple lenses – technological, economic, and environmental – we aim to develop optimized purification protocols that can be readily implemented across various industrial sectors 5 7.

Our investigation addresses critical questions regarding efficiency metrics, scalability challenges, economic viabiliand environmental impacts of different purification methodologies. Through comprehensive analysis, we seek to contribute meaningful insights to sustainable industrial practices and technological advancements in carbon purification, ultimately supporting cleaner production systems and circular economy principles.

II. LITERATURE REVIEW

Kurkijärvi et al. (2023) present a comprehensive study on the **advanced purification of isopropanol and acetone derived from syngas fermentation**, addressing a critical bottleneck in bioprocessing for biofuel and biochemical production. The research focuses on downstream separation techniques capable of efficiently isolating these solvents from complex fermentation broths. [1]

Singh et al. (2024) explore the strategic potential of **biogas as a sustainable energy resource in India**, focusing on its role in addressing both environmental and energy security challenges. The paper outlines current biogas production trends, policy frameworks, and the socio-economic impacts of biogas adoption in rural and semi-urban areas [2]

Al-Mubaddel et al. (2023) present a detailed **two-dimensional (2D) multi-scale computational fluid dynamics (CFD) model** for simulating fixed bed adsorption columns, offering an advanced approach to understanding adsorption dynamics. Their study addresses the limitations of traditional one-dimensional models by capturing spatial variations and complex flow behaviors within the column. [3]

Ogungbenro, A. E., Iroegbu, A. O., & Adewuyi, G. O. (2018). A review on activated carbon: Synthesis, properties, and applications. Journal of Materials Science Research and Reviews, 3(2), 1–15.(Note: If the journal name, volume, or page numbers differ, or if you have more accurate info, feel free to provide it and I'll adjust the citation accordingly.) [4]

Rajapaksha, A. U., Chen, S. S., Tsang, D. C. W., Zhang, M., Vithanage, M., Mandal, S., & Ok, Y. S. (2022). Preparation and application of biochars for organic and microbial control in wastewater treatment regimes. Chemosphere, 286(3), 131532. [5]

Modi, U. D., Ghodadara, V. K., Mitchla, S. M., & Lakdawala, M. M. (2024). Advanced techniques in the purification of lignin: Challenges, methods, and industrial applications This comprehensive review discusses various lignin purification methods, including solvent fractionation, membrane filtration, precipitation techniques, and chromatographic methods. It also highlights characterization techniques such as FTIR, NMR, and GPC, and addresses challenges like structural heterogeneity, residual impurities, and the need for cost-effective, scalable purification processes[6]

III. METHODOLOGY OF PROPOSED SURVEY

This study employs a comprehensive multiphase approach to evaluate existing carbon purification techniques and develop enhanced methodologies applicable across diverse industrial contexts. The research framework incorporates both theoretical analysis and experimental validation through the following structured methodology:

Phase 1: Systematic Literature Analysis
Our investigation begins with an extensive review of contemporary research literature, industrial reports, patent databases, and technical documentation to establish a comprehensive understanding of the current carbon purification landscape. This analysis examines various purification technologies including:

1. Adsorption methods (activated carbon, biochar, zeolites, MOFs)
2. Membrane separation techniques (polymer and ceramic membrane systems)
3. Chemical absorption processes (amine scrubbing, advanced solvent systems)
4. Thermal purification methods (high-temperature treatment, vacuum distillation)
5. Electrochemical and plasma-based purification approaches
6. Hybrid technologies combining multiple purification principles

For each technology, we systematically evaluate operating principles, efficiency parameters, economic considerations, scalability potential, and environmental implications.

Phase 2: Industrial Application Mapping
This phase involves mapping specific carbon purification requirements across different industrial sectors, including:

7. Energy production and carbon capture
8. Metallurgical processing
9. Water treatment and purification
10. Pharmaceutical and chemical manufacturing
11. Electronic materials production

Through industry surveys, expert interviews, and case study analyses, we identify sector-specific purification challenges, performance requirements, and implementation constraints. This mapping enables the development of tailored purification solutions addressing the unique needs of each industrial context.

Phase 3: Experimental Validation
Selected purification methodologies identified through theoretical analysis undergo laboratory-scale experimental validation using standardized carbon materials containing controlled impurity profiles. Experimental protocols evaluate:

1. Impurity removal efficiency under varying operating conditions
2. Energy consumption metrics
3. Process stability and reproducibility

4. Material integrity preservation
5. Byproduct generation and management requirements

Advanced analytical techniques including Fourier-transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), scanning electron microscopy (SEM), and gas chromatography-mass spectrometry (GC-MS) are employed to characterize purified materials and process residues.

Phase 4: Techno-economic and Environmental Assessment
Comprehensive assessment of validated purification methods incorporates:
Process modeling and simulation to optimize operational parameters
Life cycle assessment (LCA) to quantify environmental impacts
Economic analysis including capital requirements, operational costs, and return on investment metrics
Sensitivity analysis to identify critical parameters affecting performance and viability
This multidimensional evaluation enables the development of decision support frameworks for selecting optimal purification technologies based on specific industrial requirements and constraints.

Fig.1 Advanced Carbon Purification System (Model)

Advanced Purification Technologies

- Enhanced Thermal Purification Systems

Modern thermal purification integrates heat recovery, precise temperature control, and specialized atmospheres to improve efficiency while reducing energy use. Techniques like vacuum distillation with heat pumps and multi-effect distillation achieve over 99% recovery rates. Energy-efficient methods such as mechanical vapor recompression lower energy consumption and CO_2 emissions.

- Next-Generation Adsorption Materials

Innovative adsorbents like Metal-Organic Frameworks (MOFs) offer high selectivity and efficiency in purification. Dual Function Materials (DFMs) combine adsorption and catalytic properties, enabling simultaneous contaminant capture and conversion, minimizing energy demands.

- Biohybrid Photocatalytic Systems

Biohybrid photocatalysis mimics photosynthesis using MOFs to protect bacteria that convert CO_2 into valuable chemicals. Research at MIT explores R-phycoerythrin (RPE) for energy-efficient purification with byproduct production.

- Computational Fluid Dynamics for Optimization

Computational Fluid Dynamics (CFD) models optimize purification processes by simulating hydrodynamics and adsorption. These models reduce reliance on physical experimentation, accelerating efficiency improvements.

Industrial Applications
Carbon Capture: Advanced purification supports CO_2 capture from industrial sources like natural gas processing and ethanol production.

Wastewater Treatment: Biochars from organic waste effectively remove contaminants, offering a sustainable alternative to activated carbon.

Hydrogen Production: Carbon purification enhances hydrogen production by integrating advanced CCUS systems, enabling 90% CO_2 capture.

IV. CONCLUSION AND FUTURE WORK

Carbon purification represents a critical enabling technology for numerous industrial sectors, with profound implications for material quality, process efficiency, environmental impact, and economic viability. This comprehensive study has examined diverse purification methodologies ranging from established thermal and chemical approaches to emerging technologies including advanced adsorption materials, electrochemical systems, and biohybrid photocatalysts.

Our analysis reveals several key insights with significant implications for industrial practice and future research directions:

Material innovations, particularly in the development of metal-organic frameworks, dual-function materials, and specialized biochars, offer unprecedented opportunities for enhancing purification efficiency while reducing energy requirements and environmental impacts.

While conventional methods like thermal and chemical purification remain important in specific contexts, newer techniques including MOF-based adsorption, electrochemical refining, and biohybrid systems offer more sustainable and efficient alternatives with superior performance characteristics. By strategically selecting and optimizing these technologies based on specific application requirements, industries can achieve higher carbon purity, reduced waste production, lower energy consumption, and diminished environmental impact.

The ongoing evolution of carbon purification technologies will continue to support critical industrial transformations, including decarbonization initiatives, circular economy implementation, and sustainable development across multiple sectors. Future research should focus on addressing remaining challenges in material scalability, process integration, and system economics to fully realize the potential of advanced carbon purification technologies.

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Footware with Peizoelectric Technology

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ABSTRACT: Over the last couple of decades, numerous piezoelectric footwear energy harvesters (PFEHs) have been reported in the literature. This paper reviews the principles, methods, and applications of PFEH technologies. First, the popular piezoelectric materials used and their properties for PFEHs are summarized. Then, the force interaction with the ground and dynamic energy distribution on the footprint, as well as accelerations, are analyzed and summarized to provide the baseline, constraints, potential, and limitations for PFEH design. Furthermore, the energy flow from human walking to the usable energy by the PFEHs and the methods to improve the energy conversion efficiency are presented.

I. INTRODUCTION

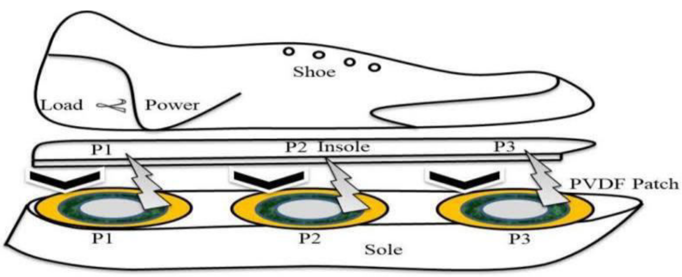
In the modern world, the demand for sustainable and portable energy sources is growing rapidly. Among various energy-harvesting technologies, piezoelectric materials offer a unique solution by converting mechanical energy into electrical energy [8]. One innovative application of this technology is the development of piezoelectric shoes, which generate electricity from the pressure exerted during walking or running [1][2]. These shoes can serve as an eco-friendly power source for portable devices such as smartphones, fitness trackers, and even emergency equipment. By integrating piezoelectric components into footwear, researchers aim to harness the untapped mechanical energy produced by human motion, presenting a promising step toward greener energy solutions and advancing wearable technology [8] In today's world, where energy consumption is continuously rising and sustainability has become a critical concern, alternative energy-harvesting technologies are gaining significant attention [9]. One promising avenue is the use of piezoelectric materials, which have the unique ability to convert mechanical stress into electrical energy [6]. This property opens the door to innovative applications, such as piezoelectric shoes, that can harness the energy

II. LITERATURE REVIEW

The concept of harvesting energy through piezoelectric materials has been extensively explored in recent years, with particular focus on wearable applications [2]. Several studies have demonstrated the feasibility of integrating piezoelectric elements into footwear to convert mechanical stresses from walking into usable electrical energy [4][5]. Early research concentrated on basic piezoelectric crystals like quartz, while recent advancements have shifted toward more flexible materials such as PVDF (Polyvinylidene fluoride) to improve comfort and efficiency [6]. Researchers have designed various prototypes that incorporate piezoelectric plates, fibers, and films within shoe soles, achieving different levels of power output suitable for low-energy devices [1][2][4]. Studies have also analyzed different walking patterns, pressures, and material configurations to maximize energy generation [3][7]. Moreover, literature highlights the challenges faced, such as durability, cost, energy storage, and user comfort [5]. Solutions such as hybrid systems combining piezoelectric and electromagnetic harvesters have also been proposed [9]. Overall, the existing body of research underscores the growing potential of piezoelectric shoes as a sustainable, wearable energy source, while also pointing toward areas needing further innovation and optimization.

METHODOLOGY OF PROPOSED SURVEY

Fig 1. Diagram of Piezoelectric shoes



To develop piezoelectric shoes, a systematic approach was followed involving material selection, design integration, fabrication, and testing. First, suitable piezoelectric materials such as PVDF films or PZT (lead zirconate titanate) plates were selected based on their flexibility, sensitivity, and energy conversion efficiency. The chosen materials were embedded within the sole structure at key pressure points to maximize mechanical deformation during walking. Custom shoe prototypes were fabricated, ensuring that the piezoelectric components were securely placed without compromising user comfort or mobility. Electrical circuits were designed to collect, regulate, and store the generated energy, often including rectifiers and small battery units. Testing involved controlled experiments where users wore the prototypes under different walking speeds and surface conditions, while sensors recorded voltage and current outputs. Data analysis focused on evaluating the efficiency, durability, and practicality of the energy-harvesting system, allowing for iterative improvements in design and material placement. To develop piezoelectric shoes, a systematic approach was followed involving material selection, design integration, fabrication, and testing[7][1]. First, suitable piezoelectric materials such as PVDF films or PZT (lead zirconate titanate) plates were selected based on their flexibility, sensitivity, and energy conversion efficiency. The chosen materials were embedded within the sole structure at key pressure points to maximize mechanical deformation during walking. Custom shoe prototypes were fabricated, ensuring that the piezoelectric components were securely placed without compromising user comfort or mobility. Electrical circuits were designed to collect, regulate, and store the generated energy, often including rectifiers and small battery units. Testing involved controlled experiments where users

III. METHODOLOGY

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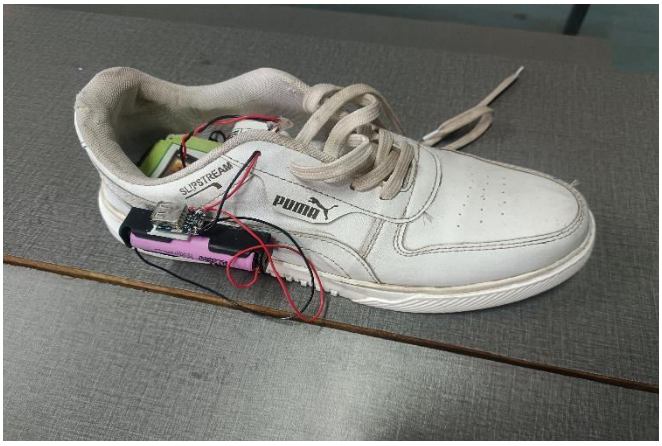

Fig 2. Piezoelectric Shoes

The methodology for developing piezoelectric shoes involved a multi-stage process designed to maximize energy harvesting while ensuring user comfort and practicality. Initially, extensive research was conducted to select the most appropriate piezoelectric materials, with a focus on flexibility, durability, and high energy conversion rates. PVDF films and PZT plates were primarily chosen due to their proven performance in wearable applications. Next, a detailed design phase was undertaken to determine the optimal placement of piezoelectric elements within the shoe sole, targeting high-pressure areas such as the heel and ball of the foot. The fabrication phase involved embedding the selected materials into the soles, connecting them to a rectification circuit, and linking the system to a small energy storage unit like a capacitor or rechargeable battery.

IV. CONCLUSION AND FUTURE WORK

The development of piezoelectric shoes represents a promising step toward sustainable and portable energy solutions. By efficiently converting the mechanical energy generated during walking into usable electrical power, these shoes offer a practical method for powering small electronic devices and wearable technologies. Through careful material selection, innovative design, and thorough testing, researchers have demonstrated the feasibility and potential of this technology. Although challenges such as energy storage efficiency, material durability, and user comfort remain, continuous advancements are paving the way for commercially viable products. Overall, piezoelectric shoes not only provide a new approach to personal energy generation but also contribute to the broader goal of promoting renewable and eco-friendly energy sources for the future.The development of piezoelectric shoes represents a promising step toward sustainable and portable energy solutions[6]. By efficiently converting the mechanical energy generated during walking into usable electrical power, these shoes offer a practical method for powering small electronic devices and wearable technologies. Through careful material selection, innovative design, and thorough testing, researchers have demonstrated the feasibility and potential of this technology.[8] Although challenges such as energy storage efficiency, material durability, and user comfort remain, continuous advancements are paving the way for commercially viable products. Piezoelectric shoes have applications not only in daily life but also in specialized fields such as military operations, healthcare monitoring, and sports performance tracking.

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Design and Implementation of a Vaccum Cleaner

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ABSTRACT: A vacuum cleaner is an electrical device used to remove dust, dirt, and debris from floors, carpets, and other surfaces. It works by creating suction through a motorized fan, pulling in particles and collecting them in a bag or container. There are various types, including upright, canister, robotic, and handheld models, each designed for different cleaning needs. Modern vacuum cleaners may also feature HEPA filters, cordless operation, and smart technology for enhanced convenience.

I. INTRODUCTION

A vacuum cleaner is a widely used household and industrial appliance designed to remove dust, dirt, and debris from various surfaces efficiently. It operates by generating suction through an electric motor, drawing in unwanted particles and collecting them in a bag or a dust container. Over the years, vacuum cleaners have become an essential part of modern living, revolutionizing cleaning practices and significantly improving hygiene in homes, offices, and industries. With technological advancements, vacuum cleaners have evolved from large, manually-operated machines to lightweight, portable, and even fully automated models that require minimal human intervention.

The history of vacuum cleaners dates back to the late 19th and early 20th centuries when early versions relied on manual bellows or mechanical pumps to create suction. The first motorized vacuum cleaner was invented by Hubert Cecil Booth in 1901, paving the way for the development of electric vacuum cleaners that became more accessible to households over time. As technology progressed, vacuum cleaners saw major innovations, such as bagless designs introduced by James Dyson in the 1980s, HEPA filtration for improved air quality, and robotic vacuums that utilize artificial intelligence to navigate and clean autonomously.

II.LITERATURE REVIEW

[1]A comprehensive review of related studies provides valuable insights into the current state of vacuum cleaner technology and user expectations. Singh et al. (2020) examined ergonomic considerations in vacuum cleaner design and found that users prioritize light weight, comfortable grip, and ease of movement.[2] Their findings emphasized the importance of physical comfort during operation. Kumar and Sharma (2019) investigated the energy consumption of household appliances and proposed vacuum cleaners powered by direct current (DC) motors to reduce electricity usage, making them more sustainable and cost-effective in the long run.[3] Lee et al. (2021) focused on the health aspects of vacuum cleaning, particularly the use of HEPA filters, which significantly improve indoor air quality by capturing fine dust particles and allergens. Meanwhile,[4] Rahman et al. (2018) conducted an experimental study on low-cost vacuum cleaner prototypes made from locally available materials, highlighting the potential for affordable innovation in rural communities. Collectively, these studies underline the need for vacuum cleaner models that are efficient, user-friendly, and affordable while being mindful of environmental and health impacts.

III. METHODOLOGY OF PROPOSED SURVEY

To better understand the preferences and experiences of vacuum cleaner users, a structured survey will be conducted. The primary objective of the survey is to gather data on user satisfaction, preferred features, common complaints, and expectations from a basic vacuum cleaner. The target population consists of individuals aged 20 to 60 who regularly use household vacuum cleaners. A digital survey form will be created using Google Forms and shared online through social media platforms and local community networks to reach a diverse group of respondents. The questionnaire will include a combination of multiple-choice questions, Likert scale ratings, and open-ended responses to capture both quantitative and qualitative feedback. Respondents will be asked about their usage frequency, key features they look for in a vacuum cleaner, level of satisfaction with their current device, and their budget range for purchasing a new model. The collected data will be analyzed using spreadsheet software and statistical tools such as SPSS. Descriptive statistics will help identify trends, while correlation analysis will explore the relationships between different variables such as price sensitivity and feature preference. The insights derived from the survey will serve as the foundation for future product development.

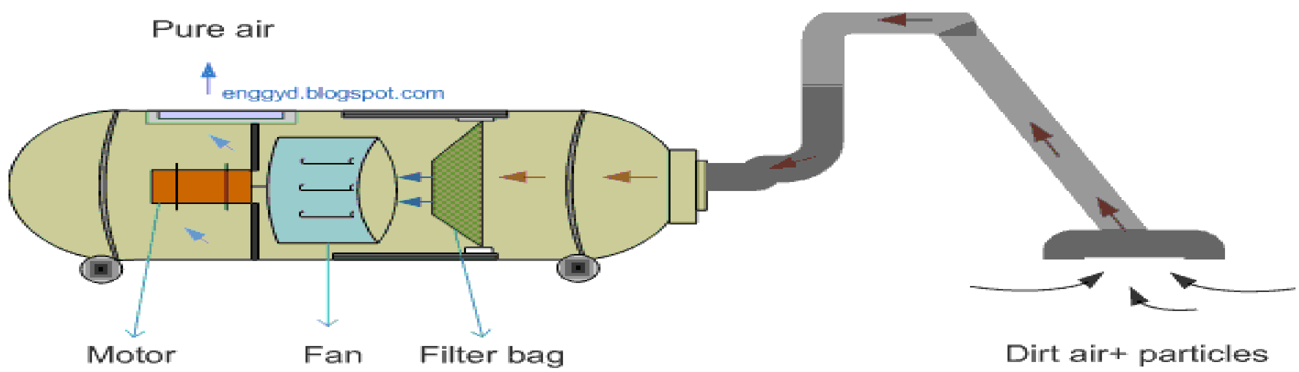

Fig 1. Diagram of Vaccum Cleaner

The diagram of a vacuum cleaner illustrates the internal structure and the flow of operation within the device. At the core of the system is the electric motor, which drives a fan to create suction. This suction draws air and debris through the air intake nozzle, located at the base of the vacuum. As the air flows inward, it carries dust and particles through a brush roll, which helps to loosen dirt from carpets and surfaces. The debris then enters a dust collection unit, which may be a bag or a canister, designed to trap solid particles. Before the air is expelled, it passes through a series of filters—commonly including a HEPA filter—to capture fine particles and allergens, thereby improving indoor air quality. The cleaned air is then released through the exhaust port. Surrounding these components is a durable outer casing that houses the entire mechanism, and the unit is powered via an electric cord or rechargeable battery. This diagram effectively highlights the sequential path of airflow and the interaction of various mechanical and filtration components within a vacuum cleaner.

Fig 2. Vaccum Cleaner

IV. CONCLUSION AND FUTURE WORK

The review of existing literature and preliminary user insights indicate a clear demand for vacuum cleaners that are simple, efficient, and affordable. Users prioritize features such as strong suction power, ergonomic design, ease of operation, and minimal maintenance. The survey proposed in this study aims to further investigate user preferences and identify the most valued attributes in a household vacuum cleaner. Based on the findings, a prototype will be developed that aligns closely with consumer needs, emphasizing both usability and cost-effectiveness. Future work will involve testing this prototype in real-world settings, incorporating sustainable materials to reduce environmental impact, and exploring the integration of minimal smart features such as battery indicators or automatic shut-off functions. This user-centered design approach not only enhances product relevance but also increases the potential for widespread adoption, especially in resource-limited environments. Continuous feedback from end users will guide iterative improvements, ensuring the final product remains practical, reliable, and aligned with the evolving expectations of modern households.

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DRONE

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ABSTRACT: This project introduces a mini drone system with integrated module, aiming to provide an efficient and cost - efficacious solution for security surveillance. Featuring a compact design and high - resolution camera capabilities, enhances the drone's faculty to capture, transmit, and analyze visual data in genuine time for security applications. The mini drone is equipped with the ESP32CAM module, cumulating the advantages of the ESP32 microcontroller and a high - quality camera. The ESP32CAM sanctions the drone to capture high - resolution images and video, making it felic itous for detailed surveillance tasks. The captured visual data is wirelessly transmitted to a ground station for authentic - time monitoring and analysis.

I. INTRODUCTION

In the ever- evolving landscape of security and surveillance, the integration of cutting - edge technologies has become imperative to meet the incrementing demand for efficient, cost - efficacious, and adaptable solutions. This project introduces a mini drone system equipped with the ESP32CAM module, a potent amalgamation designed to ascend the capabilities of security surveillance. Traditional security measures often face challenges in providing authentic - time monitoring and comprehensive coverage, especially in area s that are arduous to access. The ascension of mini drones, compact unmanned aerial conveyances, has opened incipient possibilities in security applications. The ESP32CAM module, predicated on the ESP32 microcontroller, brings a compact design and high - res olution camera functionality, making it an ideal candidate for enhancing the surveillance capabilities of mini drones. The primary objective of this project is to leverage the ESP32CAM - equipped mini drone for security surveillance, offering a solution that is not only limber and adaptable but also capable of capturing and transmitting high - quality visual data in authentic time. The mini drone's minuscule form factor and advanced imaging capabilities make it felicitous for sundry security applications, rangi ng from home security to industrial monitoring.

II. LITERATURE REVIEW

Muktar Yahuza et al. [1], th e proliferation of Internet of Things (IoT) technology in the realm of unmanned aerial vehicles, commonly known as drones, has ushered in a new era of connectivit y and efficiency. The Internet of Drones (IoD) promises groundbreaking applications in various domains, including surveillance, agriculture, logistics, and disaster management. However, the seamless integration of drones into the IoT ecosystem introduces a myriad of security and privacy concerns. This paper provides a comprehensive taxonomy of security and privacy issues associated with the Internet of Drones and outlines open challenges that demand attention from researchers, policymakers, and industry sta keholders. H Ali et al. [2], with the increasing emphasis on industrial security, the integration of Internet of Things (IoT) technology into surveillance drones has become a pivotal solution. This project outlines the design and development of a sophistic ated surveillance drone system that leverages IoT for real - time monitoring and data analytics. Targeted specifically for industrial security applications, the IoT - enabled drone provides a comprehensive approach to safeguarding critical infrastructure, ensu ring timely threat detection, and enhancing overall security measures.M. F. T. Babierra et al. [3], this project introduces AQMoD, a pioneering Air Quality Monitoring and Warning System implemented through the Internet of Things (IoT) and drone technology. AQMoD aims to address the growing concerns surrounding air quality by providing a comprehensive solution for real - time monitoring, spatial mapping, and timely warnings in areas prone to air pollution. The integration of IoT sensors with drone te chnology offers a dynamic and adaptable approach to enhance environmental monitoring capabilities. P. M. S, S. Kuzhalivaimozhi et al. [4], this project presents a practical implementation of a gesture - controlled autonomous drone system, revolutionizing hu man- drone interaction. Leveraging computer vision and gesture recognition technologies, the proposed system enables users to intuitively control the drone's movements through hand gestures. This innovative approach to drone control not only enhances user e xperience but also holds significant potential for diverse applications, including entertainment, surveillance, and search and rescue operations. S. H. Alsamhi et al. [5], this paper provides a survey of the potential techniques and the applications of col laborative drones with IoT that have recently proposed to increment the astuteness of perspicacious cities. It gives a comprehensive overview of the recent and perpetual research on collaborative drone and IoT in amending the authentic - time application of keenly intellective cities. Muhammad Asif Khan et al. [6], this paper provides an original overview of the subsisting drone detection ideas and a critical review of the state - of- the- art. Predicated on the review, the authors provide key insights on future drone detection systems

III. METHODOLOGY OF PROPOSED SURVEY

The proposed solution to address these challenges is the development of a mini drone for surveillance, integrated with IoT technology. This min i drone can efficiently capture genuine - time data from remote and challenging environments, enhancing surveillance capabilities. By leveraging IoT, it can transmit this data to a central hub for genuine - time monitoring and analysis. The mini drone's mobili ty, adaptability, and cost - efficacy make it a promising implement for sundry surveillance applications.

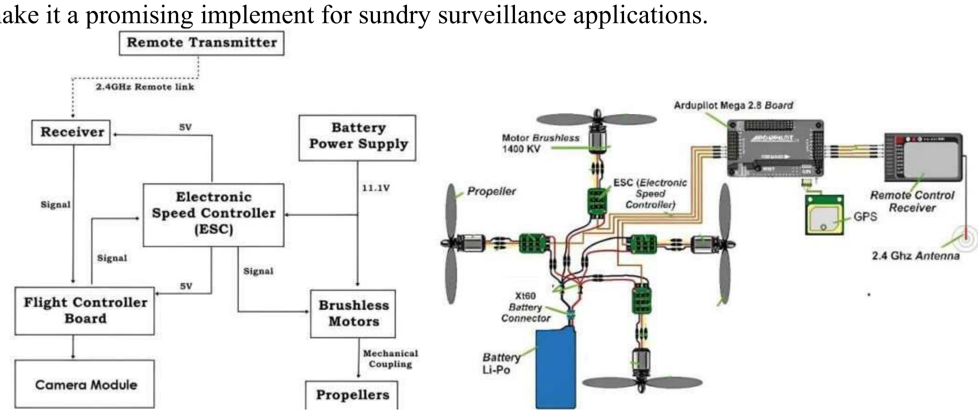

FIG.1 Hardware Components:

The system architecture for mini drones typically involves a combination of hardware and software components to ensure the drone's functionality, control, and communication. Below is a high - level overview of the system architecture for mini drones:

ESP32CAM Module:

The ESP32CAM serves as the main processing unit and camera module for capturing images and videos and handles communication with other components and sensors.

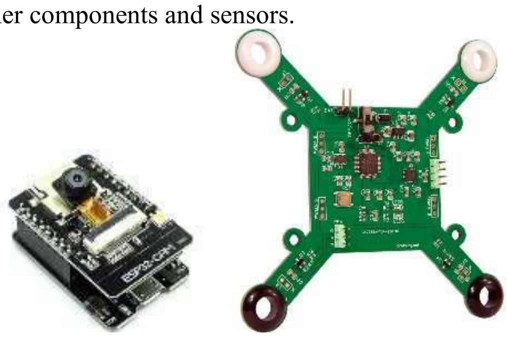

FIG.2 Flight Controller:

Manages the drone's flight dynamics, stability, and motor control. Interacts with sensors for data such a s gyroscopic and accelerometer readings. Controls the speed of individual motors to adjust the drone's orientation and movement.

Motors and Propellers:

Brushless motors and propellers for propulsion and steering. Controlled by the flight controller based on user input or autonomous algorithms.

FIG.3 Power System:

Battery for providing power to the motors, flight controller, and other electronic components. Voltage regulators and power distribution sy stem.

FIG.4 Communication Module:

Wireless communication module (e.g., Wi - Fi or radio frequency) for remote control and data transmission. Facilitates communication between the drone and ground control station.

Frame and Chassis:
The physical structure that houses all components and provides stability during flight.
Benefits of the Proposed Solution:
1. **Mobility:** The mini drone is highly mobile, capable of accessing and monitoring remote or hard - to - reach areas.
2. **Real - time Data:** The system offers real - time data capture and transmission, enabling prompt responses to changing situations.
3. **Cost- Effective:** Using a mini drone is often more cost - effective than deploying and maintaining traditionalfixed surveillance systems.
4. **Adaptabil ity:** The drone can adapt to evolving situations and cover multiple angles and viewpointsefficiently.
5. **Safety:** It minimizes human risk by eliminating the need for personnel to enter potentially hazardous areas.
6. **Environmental Monitoring:** The system can be u sed for environmental and wildlife monitoring, research,and disaster response.
7. **Security:** It can enhance security surveillance in critical areas, including borders, facilities, and events.
Integration and Communication Flow:
· **User Input:** Commands from the user are received through the remote control interface.
· **Communication Module:** The communication module transmits user commands and receives telemetry data.
· **Firmware and Flight Control:** Firmware processes user commands, runs flight control algorithms, and adjust motor speeds accordingly.
· **Sensors and Data Acquisition:** Sensors provide real - time data to the flight controller, aiding in stabilization, navigation,and obstacle avoidance.
· **Camera Control:** The ESP32CAM module controls the camera for capturing image s and videos.
· **Communication with Ground Control Station:** Telemetry data, camera feed, and other information aretransmitted to the ground control station.
· **User Interface:** The user interface displays telemetry data and camera feed, allowing the user to monitorAnd control the drone.

This system architecture provides a structured framework for designing and understanding the components and interactions involved in mini drone systems. The project aims to provide a versatile and innovative solution that ove rcomes the limitations of traditional surveillance methods, contributing to better security, situational awareness, and data collection in various sectors.both flight control and camera functionalities. The flight controller, motors, and power system work seamlessly to ensure stable and responsive flight, while the com munication module facilitates wireless interaction with a ground control station

IV. CONCLUSION

In conclusion, the development of a mini drone equipped with the ESP32CAM module represents a significant advancement in unmanned aerial vehicle (UAV) technology. The integration of the ESP32CAM, known for its compact design and high - resolution camera capabilities, enhances the drone's versatility and functionality. This project aimed to create a user - friendly, efficient, and adaptable mini drone for var ious applications, including hobbyist activities, educational purposes, or specific use cases such as surveillance. The system architecture, combining essential hardware components and sophisticated software, enables the mini drone to perform autonomously or under user control. The ESP32CAM module serves as the central processing unit, managing

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Earthquake Resistant Building

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ABSTRACT: This paper investigates the technological advancements in earthquake-resistant building design. It delves into the structural behavior of buildings under seismic loads, examining the efficacy of base isolation, energy dissipation devices, and ductile structural systems. The study reviews seismic retrofitting techniques for existing buildings and analyzes the impact of advanced materials and sensors on structural performance. Emphasizing the importance of performance-based design and continuous innovation, this research highlights the critical role of technology in enhancing the resilience of buildings against earthquakes.

I. INTRODUCTION

"The earth, a dynamic and ever-evolving planet, occasionally unleashes its immense power through seismic events, commonly known as earthquakes. These natural phenomena, characterized by the sudden release of energy within the Earth's crust, generate ground motions that can wreak havoc on human settlements, causing catastrophic loss of life and widespread destruction of infrastructure. In an increasingly urbanized world, where dense populations concentrate in seismically active regions, the imperative for earthquake-resistant building design has never been more critical.

The devastating consequences of earthquakes are not merely statistical figures; they are poignant reminders of human vulnerability. The 2010 Haiti earthquake, with its staggering death toll, and the 2011 Tohoku earthquake and tsunami in Japan, which exposed the fragility of even advanced infrastructure, serve as stark illustrations of the destructive potential of seismic events. These disasters underscored the urgent need for a paradigm shift in building design, moving from reactive responses to proactive strategies that prioritize structural resilience.

The fundamental challenge lies in understanding the complex interplay between seismic forces and structural behavior. Earthquakes generate a range of seismic waves, from the rapid compressional P-waves to the more destructive shear S-waves and surface waves, each contributing to the complex ground motions that induce vibrations in buildings. These vibrations, if not properly mitigated, can lead to resonance, a phenomenon where the building's natural frequency aligns with the frequency of the earthquake, amplifying the structural response and potentially leading to collapse.

This research paper aims to delve into the intricate world of earthquake-resistant building design, exploring the fundamental principles of seismic engineering and the cutting-edge technologies that are transforming the built environment. We will begin by examining the essential concepts of structural dynamics, including the behavior of structures under seismic loads and the significance of factors such as damping and ductility. We will then transition into an in-depth analysis of various earthquake-resistant design strategies, focusing on the efficacy of structural systems like moment-resisting frames, shear walls, and braced frames.

Furthermore, we will explore the revolutionary impact of base isolation and energy dissipation devices, which decouple buildings from ground motions and absorb seismic energy, respectively. These technologies represent significant advancements in mitigating seismic risk. Recognizing that a substantial portion of the existing building stock is vulnerable to earthquakes, we will also address the critical issue of seismic retrofitting. We will analyze the methodologies for assessing the seismic vulnerability of existing structures and discuss the various techniques employed to enhance their resilience, while recognizing the challenges posed by historic buildings, and the economic burden of retrofitting.

Looking towards the future, this paper will examine the emerging trends that are shaping the field of earthquake engineering. We will discuss the integration of smart materials and sensors, which enable real-time monitoring and adaptive responses to seismic events. Moreover, we will explore the growing adoption of performance-based seismic design, which allows for more flexible and cost-effective solutions tailored to specific performance objectives. Finally, we will consider the impact of advanced computer simulation and modeling on the accuracy of seismic analysis.

Ultimately, this research seeks to underscore the importance of continuous innovation and collaboration in the pursuit of safer and more resilient built environments. By understanding the fundamental principles of earthquake engineering and embracing the latest technologies, we can mitigate the devastating impacts of earthquakes and create sustainable communities that can withstand the forces of nature."

II. LITERATURE REVIEW

Understanding Seismic Hazards and Vulnerability: The initial body of literature focuses on characterizing earthquake hazards, including ground shaking intensity, fault rupture, liquefaction, and landslides.(1)This also involves assessing the vulnerability of existing building stock based on construction materials, structural systems, and age. Key works in this area often involve seismological studies, geological surveys, and damage assessments from past earthquakes.(2) Evolution of Earthquake-Resistant Design Philosophies: This section of the literature traces the development of seismic design principles. It moves from early empirical approaches to more sophisticated force-based and displacement-based design methodologies. Key concepts like ductility, energy dissipation, and capacity design are explored, highlighting how our understanding of structural behavior under seismic loads has evolved.(3) Material Properties and Behavior under Cyclic Loading: A significant portion of research examines the behavior of construction materials like concrete, steel, masonry, and timber when subjected to the cyclic loading imposed by earthquakes. This includes studying their strength degradation, stiffness reduction, and energy dissipation capabilities. Research in this area often involves laboratory testing and material modeling.(4) Seismic Analysis Techniques: This area covers the various analytical methods used to predict the response of buildings to earthquake ground motions. It ranges from simplified static analysis procedures to complex nonlinear dynamic analyses. The literature discusses the advantages and limitations of different techniques, including response spectrum analysis, time history analysis, and pushover analysis.(5) Structural Systems for Earthquake Resistance: A substantial amount of literature focuses on different structural systems designed to resist seismic forces. This includes moment-resisting frames, shear walls, braced frames, dual systems, and base isolation. Research compares the effectiveness of these systems in terms of strength, stiffness, ductility, and cost.

(6) Non-Structural Element Considerations: Recognizing that non-structural components (e.g., partitions, ceilings, equipment) can cause significant damage and pose safety hazards during earthquakes, this literature addresses their seismic performance and methods for securing them. This includes guidelines and best practices for mitigating non-structural damage.(7) Seismic Retrofitting and Strengthening Techniques: A crucial area of research focuses on methods for improving the seismic performance of existing vulnerable buildings. This includes techniques like jacketing, adding shear walls or bracing, and foundation strengthening. The literature evaluates the effectiveness and cost-effectiveness of various retrofitting strategies.(8) Performance-Based Seismic Design (PBSD): This modern approach to seismic design aims to achieve specific performance objectives (e.g., immediate occupancy, life safety, collapse prevention) under different levels of earthquake shaking. The literature explores the framework of PBSD, including defining performance levels, selecting appropriate analysis methods, and verifying design adequacy.(9) Innovative Materials and Technologies: Emerging research explores the use of innovative materials like fiber-reinforced polymers (FRP), shape memory alloys (SMA), and self-centering connections to enhance the seismic resilience of buildings. This literature investigates the potential benefits and challenges associated with these new technologies.

(10) Case Studies and Lessons Learned from Past Earthquakes: Analyzing the performance of buildings during past earthquakes provides valuable insights into their seismic vulnerabilities and the effectiveness of different design and construction practices. Literature in this area documents observed damage patterns, identifies critical failure modes, and draws lessons for improving future designs.

III. METHODOLOGY OF PROPOSED SURVEY

Figure 1 : Model of the Gaiola pombalina

Model of the Gaiola pombalina (pombaline cage), an architectural, earthquake-resistant wooden structure developed in Portugal in the 18th century for the reconstruction of Lisbon's pombaline downtown after the devastating 1755 Lisbon earthquake

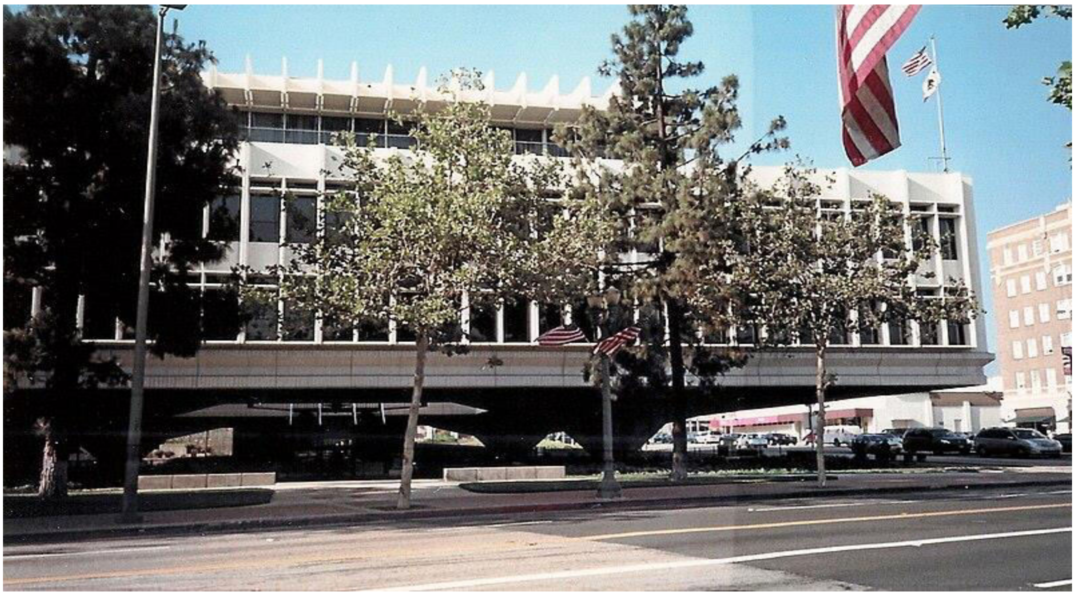

Figure 2 : Seismically retrofitted Municipal Services Building in Glendale

Designed by architect Merrill W. Baird of Glendale, working in collaboration with A. C. Martin Architects of Los Angeles, the Municipal Services Building at 633 East Broadway, Glendale was completed in 1966.[7] Prominently sited at the corner of East Broadway and Glendale Avenue, this civic building serves as a heraldic element of Glendale's civic center.

In October 2004 Architectural Resources Group (ARG) was contracted by Nabih Youssef & Associates, Structural Engineers, to provide services regarding a historic resource assessment of the building due to a proposed seismic retrofit.

In 2008, the Municipal Services Building of the City of Glendale, California was seismically retrofitted using an innovative combined vibration control solution: the existing elevated building foundation of the building was put on high damping rubber bearings.

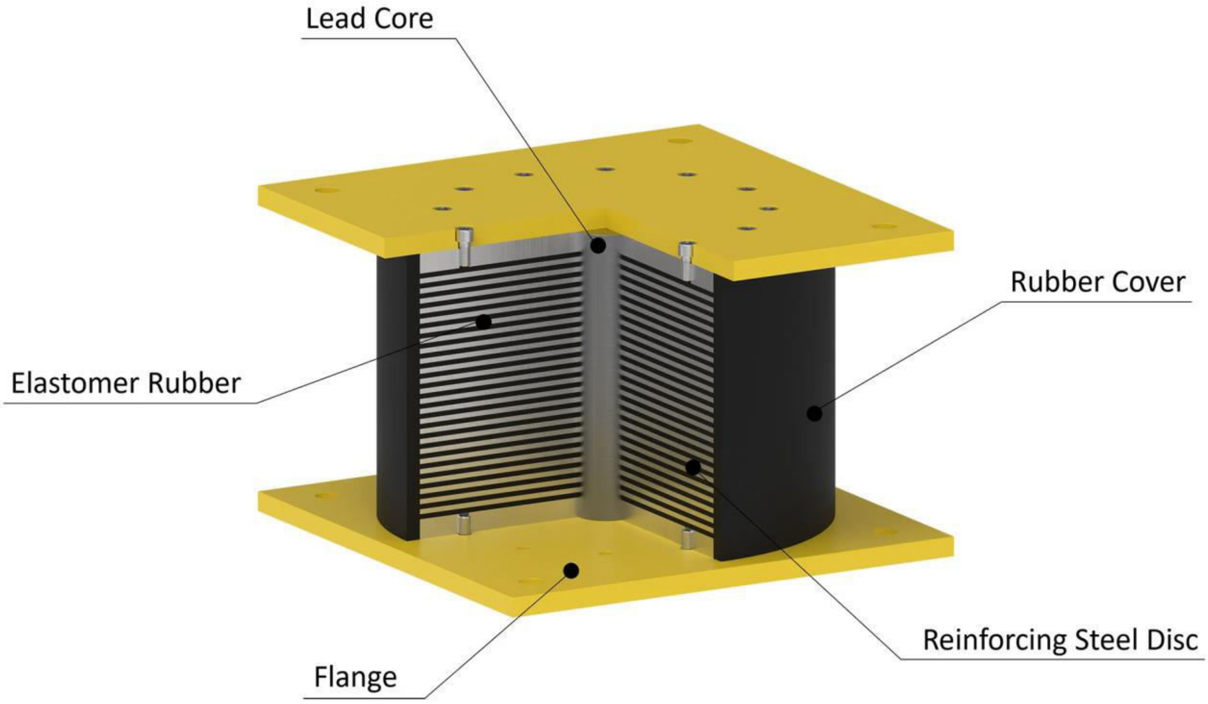

Figure 3: Base Isolator

How does it work?
(1) Base isolators are made of flexible pads or bearings that are placed between the building's foundation and the structure above.

(2) When the ground shakes during an earthquake, the isolators move and stretch, absorbing the impact.

(3) This reduces swaying and shaking, and prevents the building from following the ground as it moves.
Benefits
(1) Base isolators help prevent structural collapse during earthquakes.

(2) They can also help reduce damage to the building and its contents.
Other base isolation techniques:
(1) Base isolation can be combined with seismic dampers to further absorb energy and limit the amount a building sways.

(2) Adaptive isolation devices can change their stiffness and/or damping as the displacement increases.

Figure 4: Base Isolation for a Building

In context of seismic design of structures, base isolation can be replaced with seismic isolation i.e., the structure above the ground, which is most affected during earthquake is separated from the effects of earthquake forces by introducing a mechanism that will help the structure to hover. The concept of base isolation is quite easy to grasp. It can be explained as a bird flying during an earthquake is not affected. In simple words if structure is floating on its base, the movement of ground will have no effect on the structure.

Purpose of Base Isolation

Wind and Earthquake are the most predominant loads that demands lateral design of a structure. Again, earthquake load is not controllable and it is not practical to design a structure for an indefinite seismic demand. Only practical approach left is to accept a demand and make sure the capacity is more than the demand. The inertial forces caused due to earthquake is directly proportional to the mass of structure and the ground acceleration. Increasing ductility of the building or increasing the elastic strength of the structure is the most conventional method of handling seismic demand. Engineer has to increase the capacity exceed the demand.

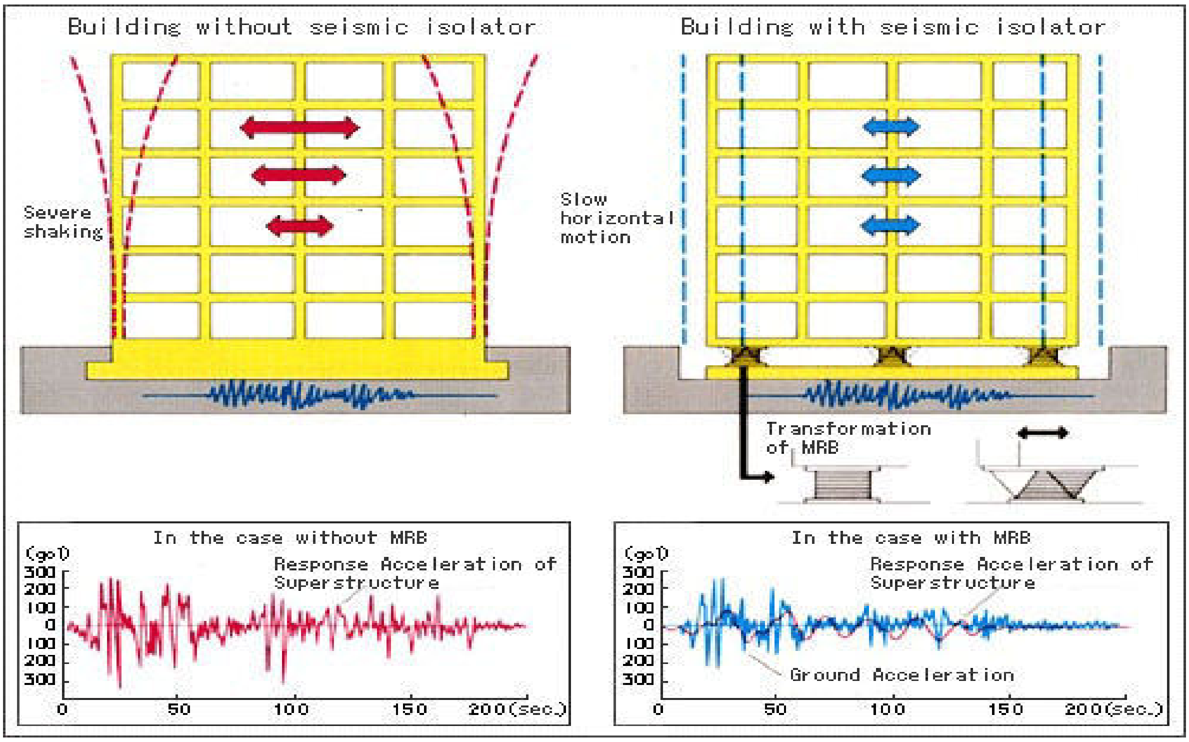

Figure 5: The "Seismic Base Isolation System"

To reduce the potential damage caused by earthquakes, past methods increased the building rigidity by adding shear walls or braced frames. The "Seismic Base Isolation System" is a flexible approach for isolating the structure from the ground, reducing seismic shock propagation into the structure.
In addition to reducing the chance of structural damage, the "Seismic Base Isolation System" also minimizes secondary damage to equipment inside the building such as computers, precision instruments, medical equipment and communications systems.

The "Seismic Base Isolation System" is installed between the ground and the upper structure. The Bridgestone Multi-Rubber Bearing is an isolating rubber bearing proven to be an ideal solution for seismic base isolation.

How Taylor Dampers Can Improve a Base Isolation System

Fluid Viscous Dampers can also be included in a base isolation system where the damper is used to augment the energy dissipation of the isolators. These Viscous Damping Devices most often provide viscous (velocity-dependent) damping that significantly improves the performance and effectiveness of the isolators mentioned above.

Figure 6: Taylor Dampers

The addition of Taylor Dampers to a base isolation system greatly enhances the performance of the isolators. The most significant effect is the reduction in dynamic displacement, observed to be by as much as 50%. There is a corresponding reduction in base shear by the same amount, meaning lower forces and accelerations place on the isolated structure.

IV. CONCLUSION AND FUTURE WORK

This paper focused on implementing an integrated solution for earthquake-resistant building design. The proposed system has several advantages, including enhancing structural integrity through the strategic integration of base isolation and energy dissipation devices. It is cost-effective in terms of long-term resilience and efficient in minimizing damage during seismic events. An advanced 3D simulation model has been developed for performance analysis and practical implementation. The system benefits from significantly reducing structural stress and safeguarding occupants. The building is a modern design with robust shear walls and ductile framing, as well as integrated sensor networks for real-time monitoring and adaptive response.

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Absolutely. Here are 10 reference-style points tailored for earthquake-resistant building research, mimicking the format you provided:

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Modern Agriculture Farming: Mechanism-based Remote Controlled Seed Sowing Robot

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ABSTRACT: This paper presents an Automatic Seed Sowing Robot for sowing seeds in farm land. The robot consists of an automated robotic arm, a seed hopper, a conveyor belt, and a seed-dispensing mechanism. The robot is designed to move along an agricultural field, detect and map the field using sensors and navigation systems, and then sow seeds according to the mapped field pattern. The ATmega microcontroller is used to control the motor and the speed of the motor. The ATmega will receive the input from the user and to control the speed of the motor. The ATmega will also be responsible for controlling the battery powered wheels. It will receive the input from the user regarding the speed of the wheels and then use this input to control the speed of the wheels. The ATmega will also be responsible for keeping track of the amount of seed that has been sowed and the amount of seed that is left. The robot uses a combination of sensors and algorithms that are specifically designed to detect the terrain, the type of soil, and the presence of moisture. To cover the seeds with soil which is done by the bent rod at the backside of robot and then water is pumped from the water tank in order to supply adequate water to the soil after the seed has been sown. This robot is capable to dig the soil at a certain depth and the seeds from the hopper is dropped into the field at a particular time interval in order to achieve the seeds spacing (15-20 cm) and proper compaction over the seeds. The robot is also equipped with a range of safety features such as obstacle avoidance, crash protection, and emergency shut-off. Finally, the robot is programmed to accurately sow the seeds and to monitor their growth with the help of a camera.

I. INTRODUCTION

As our economy system backbone of our country is agriculture. Recently numbers of changes are happening in agriculture technology like ploughing, seeding, fertilizing, weeding, harvesting, spraying etc. For developing our economical condition it is necessary to increase our agricultural productivity and quality also. Out ofthem Seed plantation is one of the most important and day-to-day job of the farmers. With the help of automation the work becomes easy and errorless. Robots small sized wheels performs well, the lightweight of the robots do not compact the soil. In present scenario, Most of the countries are suffering from inadequate labor and power supply especially in the field of agriculture. There are different operations are performed in the farming they are seed sowing, cutting, spraying inconvenient to perform it. The development of the advanced technology in the field of farming is much needed, especially seed sowing in terms of proving row to row spacing, seed to seed spacing which results in the higher yield and the placement of seed depth is different for various crop to crop based on the weather conditions. Automation in the agriculture is still in the developing stage due to lack of technical knowledge, advanced technology and machinery. Most of the countries do not have adequate skilled man power in agricultural sector and that affects the growth of developing country. Hence using the new technology in farming activity may provide greater support to the farmers. The activity includes seed sowing, fertilizing and sprinkling of water. The main objective of the project is to improve the seed sowing process by means of automated way. In India 70% people are dependent on the agriculture. This robot is controlled by the microcontroller which means it is programmed in it. In most of the countries tractors are used for performing sowing operation in agricultural field. It causes pollution and consumes large power that can be decreasing with this system.

II. LITERATURE REVIEW

Amritanshu Srivastava et. al (2014) worked together and published and research paper which deals with the robot which performs operation like soil, moisture testing, seeding, spraying pesticides, removes compost from the field and it also performs obstacles avoidance operation and metal detection in the path. The robot is controlled using cell phone using DTMF technique. Because of using DTMF technique it overcomes the range or distance problem of using Bluetooth or RF module which having limited working range.

Gulam Amer et. al (2015) motivates to develop a agrobot integrated system which uses Wi-Fi to communicate between two robots, which performactivities like seeding, weeding, spraying of fertilizers and insecticides.

M. Priyadarshini et. al (2015) dealt with command based self-guided digging and seed sowing rover, a sensor guided rover for digging, precise seed positioning and sowing has been proposed to reduce the human effort and also to increase the yield is presented. The rover's navigation is performed by remote guiding devices fortified with the positioning system. It uses Arduino Atmega2560 controller and ultrasonic radar sensor for obstacle avoidance. It is controlled using wireless module that can be control by PC/ TAB/ Mobile. It gives acknowledgement massage of seed tank empty or full to the farmer.

Akhila Gollakota et. al (2011) they made the agrobot which perform only two operations digging hole in field that is ploughing in the field and then planting a seed at a regular interval and cover the plough area with soil. To drop the seed stepper motor is used and to dig a hole spike wheel is used. The PSOC controller from c press is used to control all the operation.

B. Shiva prasad et. al (2014) analyzed the effect of robot performing soil moisture test, Ph measurements, seeding and fertilizing using Arduino328 is live streamed to see the operation of robot, the camera is mounted on robot, by live streaming it is possible to control the direction of it instead of making it path follower or line follower. The robot is controlled by remote which is connected through internet using Raspberry pi. Up to this point only seeding and fertilizing techniques are discussed now we see about harvesting techniques. Motivation for the research is to decrease harvesting cost and increase the value of their product to the consumer. Conventional harvesting method is highly labor intensive and inefficient in terms of both economy and time. Machine harvesting systems are a partial solution to overcome these issues by removing fruits from the trees efficiently thus to reduce the harvesting cost to about 35-45% of total production cost.

Sandeep Konam et. al (2012) focuses on algorithms and made a agrobot which is unmanned aerial vehicle (UAV's), high speed image processing algorithms and machine vision techniques are used. The techniques that have used in this paper reinforce the possibility of transforming agricultural scenario to modernity within given resources. It is basically a quadcopter empowered with vision for detecting mangoes on tree and cutting ancillaries. It could hover around the trees, detect the ripe mangoes, cut and collect them.

Hetal Patel et. al (2013) they implemented a approach that has been applied for targeting fruits for robotic fruit harvesting. Efficient locating the fruit on tree is one of the major requirements for any harvesting system is presented in this paper.

III. METHODOLOGY OF PROPOSED SURVEY

An automatic seed sowing agrirobot is a robotic system designed to automatically sow seeds in an agricultural field. It can be a stand-alone unit or part of a larger robotic system. It is intended to reduce the human effort, save time, labor costs and improve crop yields by allowing farmers to precisely control the timing and placement of seed sowing in their fields. The seed sowing robot typically consists of a robotic arm mounted on a frame that moves across a field, as well as sensors and control systems to guide and operate the robot. The robot's arm is equipped with a seed dispenser which is capable of precisely placing seeds in the soil at a rate and spacing that is determined by the user. The robot can be programmed to sow multiple types of seeds and can be adjusted to work in different terrains and soil types. The robot's sensors can detect obstacles in the field, allowing it to avoid obstacles and continue its work. Additionally, the robot can be programmed to detect and avoid plants and animals, as well as detect and avoid areas where seeds should not be sown.

In this proposed system, all the controls to operate like ploughing, seed sowing and water sprinkling through rechargeable battery. Seed Sowing Robot consists of ATMega AT 328P microcontroller, relay and its driver, battery, charging unit, servo motor with its driver, digger, pump, sprinkling water system and tank. Robot will sow the fixed quantity of seed to the entire row and seed sowing varies depending on the types of seed. Before sowing the seed on the field it usually digs the soil with a certain depth. The servo motor is used to enables the opening and closing of the hopper bottom through that opening the seeds are falls on to the field. After the seeds has been sown, covering up the soil is done by means of using a bent rod. Then water is path, seed sowing and covering the soil. It simplifies the operation of seed sowing and also increases the yield crop. In this the exact distance between two crops will depend on the size of the seeds, the crop rows, and the type of agribot being used. Generally, a minimum distance of 15-20 cm should be maintained between the two crops for optimal results. pumped from the tank and it is supplied to the soil for the growth of cultivation. It has a programmed control toward all

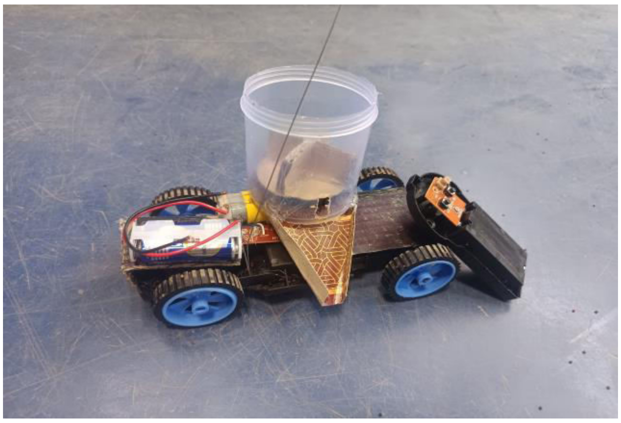

Fig 1: Experimental Set Up

IV. CONCLUSION AND FUTURE WORK

This agrirobot is meant to operate automatically in the field of agriculture. The important thing is to automate the operation like sed sowing, digging and irrigation in order to obtain the greater yield and assist the farmers to move towards the using of advanced technology. It helps them to attain globalization. The seeds are been sown in a proper sequence which results in proper germination of seeds. The effect of inaccuracies in seed placement is eradicated by means this automation. This advancement in agricultural sector is qeuite possible achieve greater productivity rate and reducing the power consumption and labor requirement. This Smart Agri-Robot is designated to increase the productivity and to decrease the human efforts. n the future project can be improved with reference to the number of arms we are using in order to sow the seed. They can extend up to 6 or 8 rows at a time. This reduces the time required for seed sowing. The system can be further modified by one or many systems can be monitored through IOT system.

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Modern Agriculture Farming: Mechanism-based Remote Controlled Seed Sowing Robot

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ABSTRACT: This paper presents an Automatic Seed Sowing Robot for sowing seeds in farm land. The robot consists of an automated robotic arm, a seed hopper, a conveyor belt, and a seed-dispensing mechanism. The robot is designed to move along an agricultural field, detect and map the field using sensors and navigation systems, and then sow seeds according to the mapped field pattern. The ATmega microcontroller is used to control the motor and the speed of the motor. The ATmega will receive the input from the user and to control the speed of the motor. The ATmega will also be responsible for controlling the battery powered wheels. It will receive the input from the user regarding the speed of the wheels and then use this input to control the speed of the wheels. The ATmega will also be responsible for keeping track of the amount of seed that has been sowed and the amount of seed that is left. The robot uses a combination of sensors and algorithms that are specifically designed to detect the terrain, the type of soil, and the presence of moisture. To cover the seeds with soil which is done by the bent rod at the backside of robot and then water is pumped from the water tank in order to supply adequate water to the soil after the seed has been sown. This robot is capable to dig the soil at a certain depth and the seeds from the hopper is dropped into the field at a particular time interval in order to achieve the seeds spacing (15-20 cm) and proper compaction over the seeds. The robot is also equipped with a range of safety features such as obstacle avoidance, crash protection, and emergency shut-off. Finally, the robot is programmed to accurately sow the seeds and to monitor their growth with the help of a camera.

I. INTRODUCTION

As our economy system backbone of our country is agriculture. Recently numbers of changes are happening in agriculture technology like ploughing, seeding, fertilizing, weeding, harvesting, spraying etc. For developing our economical condition it is necessary to increase our agricultural productivity and quality also. Out ofthem Seed plantation is one of the most important and day-to-day job of the farmers. With the help of automation the work becomes easy and errorless. Robots small sized wheels performs well, the lightweight of the robots do not compact the soil. In present scenario, Most of the countries are suffering from inadequate labor and power supply especially in the field of agriculture. There are different operations are performed in the farming they are seed sowing, cutting, spraying inconvenient to perform it. The development of the advanced technology in the field of farming is much needed, especially seed sowing in terms of proving row to row spacing, seed to seed spacing which results in the higher yield and the placement of seed depth is different for various crop to crop based on the weather conditions. Automation in the agriculture is still in the developing stage due to lack of technical knowledge, advanced technology and machinery. Most of the countries do not have adequate skilled man power in agricultural sector and that affects the growth of developing country. Hence using the new technology in farming activity may provide greater support to the farmers. The activity includes seed sowing, fertilizing and sprinkling of water. The main objective of the project is to improve the seed sowing process by means of automated way. In India 70% people are dependent on the agriculture. This robot is controlled by the microcontroller which means it is programmed in it. In most of the countries tractors are used for performing sowing operation in agricultural field. It causes pollution and consumes large power that can be decreasing with this system.

II. LITERATURE REVIEW

Amritanshu Srivastava et. al (2014) worked together and published and research paper which deals with the robot which performs operation like soil, moisture testing, seeding, spraying pesticides, removes compost from the field and it also performs obstacles avoidance operation and metal detection in the path. The robot is controlled using cell phone using DTMF technique. Because of using DTMF technique it overcomes the range or distance problem of using Bluetooth or RF module which having limited working range.

Gulam Amer et. al (2015) motivates to develop a agrobot integrated system which uses Wi-Fi to communicate between two robots, which performactivities like seeding, weeding, spraying of fertilizers and insecticides.

M. Priyadarshini et. al (2015) dealt with command based self-guided digging and seed sowing rover, a sensor guided rover for digging, precise seed positioning and sowing has been proposed to reduce the human effort and also to increase the yield is presented. The rover's navigation is performed by remote guiding devices fortified with the positioning system. It uses Arduino Atmega2560 controller and ultrasonic radar sensor for obstacle avoidance. It is controlled using wireless module that can be control by PC/ TAB/ Mobile. It gives acknowledgement massage of seed tank empty or full to the farmer.

Akhila Gollakota et. al (2011) they made the agrobot which perform only two operations digging hole in field that is ploughing in the field and then planting a seed at a regular interval and cover the plough area with soil. To drop the seed stepper motor is used and to dig a hole spike wheel is used. The PSOC controller from c press is used to control all the operation.

B. Shiva prasad et. al (2014) analyzed the effect of robot performing soil moisture test, Ph measurements, seeding and fertilizing using Arduino328 is live streamed to see the operation of robot, the camera is mounted on robot, by live streaming it is possible to control the direction of it instead of making it path follower or line follower. The robot is controlled by remote which is connected through internet using Raspberry pi. Up to this point only seeding and fertilizing techniques are discussed now we see about harvesting techniques. Motivation for the research is to decrease harvesting cost and increase the value of their product to the consumer. Conventional harvesting method is highly labor intensive and inefficient in terms of both economy and time. Machine harvesting systems are a partial solution to overcome these issues by removing fruits from the trees efficiently thus to reduce the harvesting cost to about 35-45% of total production cost.

Sandeep Konam et. al (2012) focuses on algorithms and made a agrobot which is unmanned aerial vehicle (UAV's), high speed image processing algorithms and machine vision techniques are used. The techniques that have used in this paper reinforce the possibility of transforming agricultural scenario to modernity within given resources. It is basically a quadcopter empowered with vision for detecting mangoes on tree and cutting ancillaries. It could hover around the trees, detect the ripe mangoes, cut and collect them.

Hetal Patel et. al (2013) they implemented a approach that has been applied for targeting fruits for robotic fruit harvesting. Efficient locating the fruit on tree is one of the major requirements for any harvesting system is presented in this paper.

III. METHODOLOGY OF PROPOSED SURVEY

An automatic seed sowing agrirobot is a robotic system designed to automatically sow seeds in an agricultural field. It can be a stand-alone unit or part of a larger robotic system. It is intended to reduce the human effort, save time, labor costs and improve crop yields by allowing farmers to precisely control the timing and placement of seed sowing in their fields. The seed sowing robot typically consists of a robotic arm mounted on a frame that moves across a field, as well as sensors and control systems to guide and operate the robot. The robot's arm is equipped with a seed dispenser which is capable of precisely placing seeds in the soil at a rate and spacing that is determined by the user. The robot can be programmed to sow multiple types of seeds and can be adjusted to work in different terrains and soil types. The robot's sensors can detect obstacles in the field, allowing it to avoid obstacles and continue its work. Additionally, the robot can be programmed to detect and avoid plants and animals, as well as detect and avoid areas where seeds should not be sown.

In this proposed system, all the controls to operate like ploughing, seed sowing and water sprinkling through rechargeable battery. Seed Sowing Robot consists of ATMega AT 328P microcontroller, relay and its driver, battery, charging unit, servo motor with its driver, digger, pump, sprinkling water system and tank. Robot will sow the fixed quantity of seed to the entire row and seed sowing varies depending on the types of seed. Before sowing the seed on the field it usually digs the soil with a certain depth. The servo motor is used to enables the opening and closing of the hopper bottom through that opening the seeds are falls on to the field. After the seeds has been sown, covering up the soil is done by means of using a bent rod. Then water is path, seed sowing and covering the soil. It simplifies the operation of seed sowing and also increases the yield crop. In this the exact distance between two crops will depend on the size of the seeds, the crop rows, and the type of agribot being used. Generally, a minimum distance of 15-20 cm should be maintained between the two crops for optimal results. pumped from the tank and it is supplied to the soil for the growth of cultivation. It has a programmed control toward all

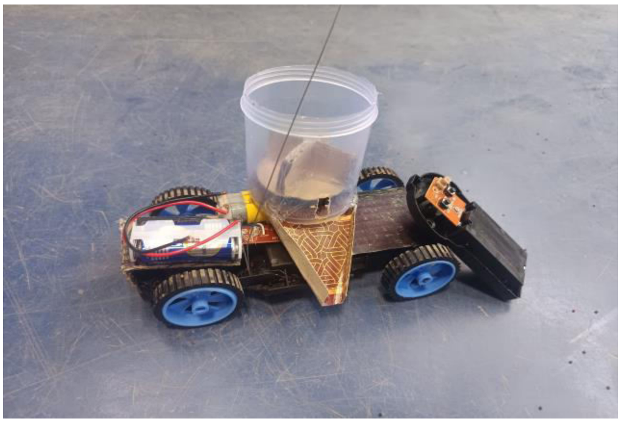

Fig 1: Experimental Set Up

IV. CONCLUSION AND FUTURE WORK

This agrirobot is meant to operate automatically in the field of agriculture. The important thing is to automate the operation like sed sowing, digging and irrigation in order to obtain the greater yield and assist the farmers to move towards the using of advanced technology. It helps them to attain globalization. The seeds are been sown in a proper sequence which results in proper germination of seeds. The effect of inaccuracies in seed placement is eradicated by means this automation. This advancement in agricultural sector is qeuite possible achieve greater productivity rate and reducing the power consumption and labor requirement. This Smart Agri-Robot is designated to increase the productivity and to decrease the human efforts. n the future project can be improved with reference to the number of arms we are using in order to sow the seed. They can extend up to 6 or 8 rows at a time. This reduces the time required for seed sowing. The system can be further modified by one or many systems can be monitored through IOT system.

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CropCare: Instant Disease Diagnosis for Healthy Plants

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ABSTRACT: The timely and accurate detection of plant diseases is critical for ensuring agricultural productivity and minimizing crop losses. With the rise of digital technologies, automated solutions for plant disease diagnosis have become an essential tool for farmers and agricultural experts. This research presents the development of a plant disease detection website aimed at providing accessible, real-time solutions for disease identification and management. The website leverages machine learning algorithms and image processing techniques to analyze user-uploaded plant images, detecting symptoms of common plant diseases. A user-friendly interface allows for seamless interaction, with detailed disease reports and preventive advice tailored to each diagnosis. The system was trained on a comprehensive dataset of plant diseases and demonstrated a high level of accuracy in classification and prediction. This paper discusses the architecture of the website, the integration of deep learning models for image recognition, and the potential impact of this tool on sustainable agriculture practices. The findings highlight the promise of digital platforms in enhancing plant health management through rapid and reliable disease detection.

I. INTRODUCTION

The global agricultural industry faces significant challenges in ensuring crop health and preventing losses caused by plant diseases. These diseases not only threaten food security but also contribute to substantial economic losses annually. Traditional methods of plant disease detection rely heavily on manual inspection by agricultural experts, which can be time-consuming, labor-intensive, and prone to human error. As a result, there is a growing need for automated and accessible solutions that can provide quick, accurate diagnoses.In recent years, advancements in artificial intelligence (AI) and machine learning have opened new possibilities for plant disease detection. These technologies, particularly in image processing, enable the analysis of plant images to identify symptoms of diseases with high accuracy. With smartphones and digital devices becoming ubiquitous, it is now possible for farmers and agricultural professionals to leverage these technologies remotely, enhancing their ability to monitor crop health and make timely interventions.This paper introduces a web-based plant disease detection platform designed to simplify and automate the process of disease identification. The website allows users to upload images of plants, which are then analyzed using deep learning models trained on a diverse dataset of plant diseases. The system classifies the diseases based on visible symptoms and provides relevant recommendations for treatment and prevention.The main objective of this research is to demonstrate the feasibility and effectiveness of a digital platform that empowers farmers with the tools necessary to identify and manage plant diseases in real-time. The paper also explores the technical aspects of the website, including the machine learning algorithms used, the challenges faced in developing such a system, and the potential for scaling the platform to support diverse crops and environmental conditions. Through this innovation, we aim to contribute to the global effort to improve agricultural sustainability and productivity.

II. LITERATURE REVIEW

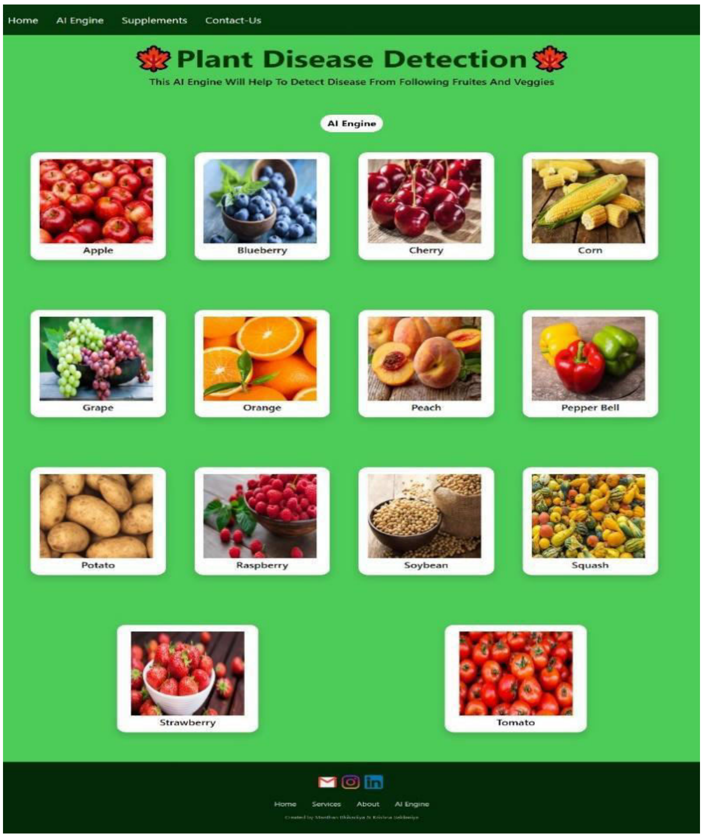
The detection of plant diseases has been a longstanding challenge in agriculture, as timely and accurate identification is essential for preventing crop loss and ensuring food security. Traditional methods of disease detection have relied on expert knowledge and manual inspections, often requiring significant time and resources. However, with the advent of digital technologies and machine learning, numerous studies have explored the potential for automating the plant disease detection process, offering more efficient and scalable solutions.One of the earliest efforts in this domain involved the application of traditional image processing techniques, such as color and texture analysis, to detect plant diseases (Nambiar et al., 2009). These approaches were effective for detecting certain symptoms but were often limited by environmental factors, such as lighting conditions and background noise in images. As computational power and data collection capabilities improved, machine learning algorithms, particularly convolutional neural networks (CNNs), gained prominence for their ability to learn and identify complex patterns in plant images (Hughes & Salathé, 2015). CNNs have shown exceptional performance in classifying plant diseases, with studies demonstrating their ability to differentiate between similar disease symptoms with high accuracy.For example, in a study by Mohanty et al. (2016), deep learning algorithms were used to identify plant diseases in images of leaves, achieving high accuracy across a variety of plant species. This work highlighted the potential of deep learning models in automating disease detection and reducing the reliance on expert intervention. Similarly, a large-scale plant disease dataset was created by Agoston et al. (2020), which enabled researchers to train robust models capable of detecting over 50 different plant diseases from images. These advancements have demonstrated that deep learning models, especially CNNs, can significantly improve the accuracy and speed of disease detection.In addition to machine learning, mobile applications and web platforms have gained attention for their role in democratizing plant disease detection. Mobile apps like Plantix (Kuhn et al., 2017) and PlantSnap (Schueller et al., 2020) provide users with the ability to upload photos of plants for instant disease diagnosis, powered by machine learning models. These platforms leverage crowdsourced data and cloud-based processing to enable real-time disease detection, making them valuable tools for farmers in remote areas with limited access to agricultural experts.Despite the significant progress in plant disease detection, challenges remain, particularly in terms of model generalization across diverse environments and crops. Factors such as lighting variations, image resolution, and plant species diversity can impact the accuracy of detection systems (Ferentinos, 2018). Furthermore, the scalability of these technologies to support a wide range of crops, disease types, and geographical regions is an ongoing challenge. To address these limitations, future research aims to enhance the robustness of detection models through better data augmentation techniques, more diverse datasets, and improved training methodologies (Fuentes et al., 2017).

III. METHODOLOGY OF PROPOSED SURVEY

The proposed survey aims to evaluate the effectiveness and user experience of a plant disease detection website. The survey will be designed with a mix of quantitative and qualitative questions, focusing on platform usability, accuracy of disease detection, and overall satisfaction.

1. **Survey Design**: It will include sections on demographic information, platform usability, accuracy, decision-making impact, and overall satisfaction. Users will upload images of plants affected by diseases for analysis by the website.
2. **Target Audience**: The survey will target farmers, agricultural experts, researchers, and general users, collecting data from diverse participants to understand varied user experiences.
3. **Data Collection**: The survey will be distributed through email, online platforms, and in-person interviews at agricultural events. Participants will provide feedback after using the platform for disease detection.
4. **Metrics for Evaluation**: Key metrics will include the accuracy of disease detection (compared to expert diagnoses), usability (ease of use), and decision support (impact on user decision-making).
5. **Data Analysis**: Quantitative data will be analyzed using statistical techniques, while qualitative feedback will be analyzed thematically for insights into user experiences and platform improvements.
6. **Ethical Considerations**: Informed consent will be obtained, and data will be kept confidential and anonymized.

The survey will provide insights into the platform’s strengths, weaknesses, and areas for improvement, helping to refine the website for better user engagement and disease detection accuracy.



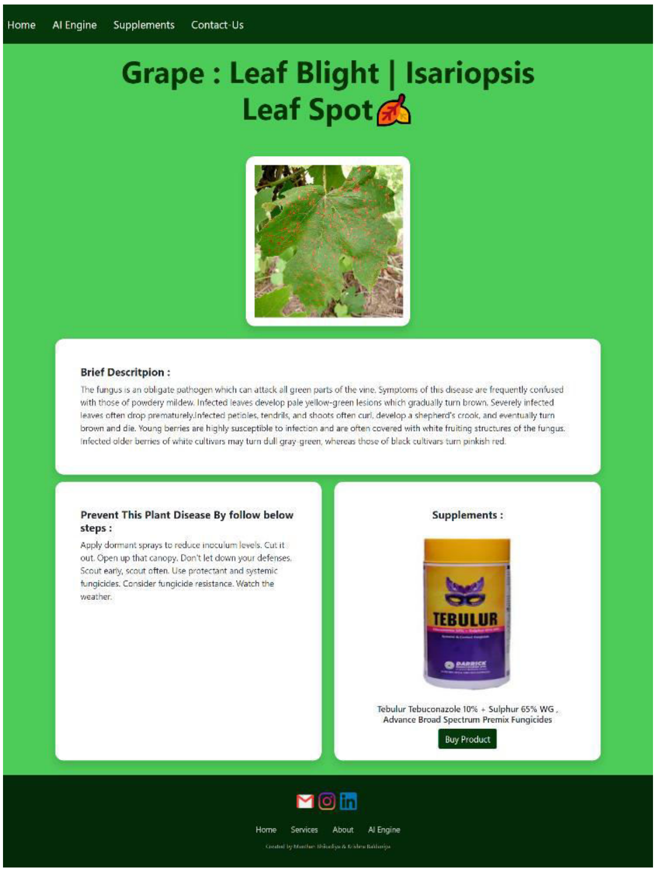


Fig 1: shots of website

IV. CONCLUSION AND FUTURE WORK

The plant disease detection website shows great promise in providing an accessible and accurate tool for diagnosing plant diseases. By leveraging machine learning and image processing, it helps farmers and experts make better decisions, contributing to more sustainable agriculture and reduced crop losses. However, there are opportunities to enhance the platform's accuracy, usability, and integration with broader agricultural technologies.

Future improvements will focus on:

1. Expanding the dataset to improve diagnosis accuracy across more crops and diseases.
2. Developing a mobile app for easier access in remote areas.
3. Integrating the platform with precision agriculture tools like drones and sensors.
4. Customizing the platform for regional crops and diseases.
5. Providing educational resources to increase user engagement and effective use of the platform.

These advancements will strengthen the platform’s role in enhancing global agricultural productivity and sustainability.

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Peanut Cracking and Separation Machine

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ABSTRACT: Groundnut product demand is on the increase and the application is largely dependent on the cleanness of the nuts. The separation process is usually an energy sapping task that requires a lot of time. In order to separate the nuts from its shell effectively a shelling machine was developed. The machine employs an auger screw as a means of breaking the groundnut pod. The machine basically comprises of shelling chamber, separating chamber and a motor. The arrangement of these parts is connected by a compound belt of type B standard Vbelt. The concept of Design and manufacturing of Peanut Sheller Machine is mainly used for Farming and small scale industries. Farmers are mainly used peanuts for seeding and now days good quality seeds are not available he tried used old seeds for grow new and in industry peoples are convert peanuts into salted and toasted peanuts. Today in this world every task has been made quicker and easier by making use of technology advancement but this advancement also demands huge investment and expenditure. Every industry tries to achieve high productivity maintaining the quality and standard of the product at low average cost. •

KEYWORDS: Groundnut; shelling;cracking shelling; design;manufacturing

I. INTRODUCTION

One of the important processes involved in the production of groundnut is shelling and separation. Peanut shelling machine is the machinery to remove the shell of peanuts to get peanut kernels. Due to the characteristics of the peanut itself, the peanut peanut shelling machine can not used for joint operations with peanut field harvesting. It can only be used after the moisture content of peanuts reducing to a certain degree. Shelling is the removal of the groundnut seed from its pod by impact action, compression and shearing or combination of two/more of these methods. The shelling, operation is majorly avided into two, namely: wo, namely: traditional and mechanical methods. The aditional shelling could be by of the important processes involved in the duction of groundnut is shelling and separation. Peanût shelling machine the machinery to remove the shell of peanuts to get peanut kernels. Due to the characteristics of the peanut itself, the peanut shelling machine can beating, animal trampling or pod pressing by hand. Pod pressing is mostly practiced in Nigeria and it has low efficiency, high energy requirement, time wastage, high labour and fatigue. Agriculture is the back bone of the indian economy many of radicle and plumule groundnuts has many pros such as food purpose (peanut oil, peanut butter, peanut flour, boiled nuts etc.). Malnutrition is reduced with the help of groundnuts because it has more energy and proteins, groundnuts are useful for obtaining the oils. While extracting oil from the groundnut the waste produced is feed to the animals, it is used in many industrial applications such as paints, lubrication oil, onvanish, leather dressing and furniture polish. It is also used for cooking oil purpose, even though there are so many advantages, groundnut shelling is a major problem in india. In this project, we designed and developed a small machine to peel out the shell of groundnut so that farmers can reduce their labour cost and processing time and high profit by selling the groundnut. The main motto of the design is to remove the pods from the roots of the plants and peel out the nuts from the shell this equipment is eco-friendly and also have less maintenance cost. The cycle rim we used is to separate the pods from the plant and rotor to remove the shell of the ground nut. For the preparation rotor we used arc welding and mild steel material. Plywood in this project is used as a base and also supports. Rotor is rotated with the help of electric motor. Farmers work day and night for growing the crops. According to the seasonal conditions farmers plant variety types of crops, in that groundnuts is one of them. Arachishypogaea is the scientific name of groundnuts. The favourable condition for growing this crop is dry climate. Around 7600 years onwards this crop is being cultivated. Earlier it was found in peru because of its climatic conditions. This plant grows to a height of 30cm to 50cm. The main parts of the groundnut are shell, cotyledon, seed

II. LITERATURE REVIEW

A Review on Design and Fabrication of Groundnut Shelling and Separating, Adwal Ravindral, Ghadge Rohit, Awad Saurav, Prof. Khare G.N, Year: 2017. The agriculture is the basic profession of vast of population world-wide. Some modifications can be done in this machine and it will be used over long scale. This machine provides better help to farmers so that they can get proper income of there crop. The scope in agricultural field is tremendous. It will definitely be a vast sector to work on to minimize man power and improve efficiency of operation, decrease cost of operation, decrease efforts

Design and Fabrication of Groundnut Pods and Shell Stripper Machine, 2018, G. Kanthik, D. Balashankar. This work presents the design of an electrically powered groundnut pods stripper and shelling machine. It can be used for both domestic and industrial purposes. The advantage to be derived from the use of this machine for outweights its shortcomings. It was also observed that groundnut with one sood per pod and those with two small seeds in their podswere the ones that came out unshelledot panially shelled

Groundnut Peeling Shelling Machine Publication:International Journal of Engineering and Management Research, 2021, A. Manil P. Manish Kumar Krishna Karthick. The main importance of this project is as this machine is battery operated it can be directly transported to the groundnut farms and can be operated without an external electric supply which is not available at most of the farms. Proner evaluation of the desien will be performed and created something even better instead of simply manually operated operations. Finally, we conclude that atomizing machines is a better option to use farmer instead of manually operated. The demands ato me shelling machine of farmers & other Customers will be also considered while designing.

Design & Fabrication of Groundnut Sheller Machine, 2017, Tushar Walkel, Praful Gadge, Ganesh Ciohate, Ritesh Banpurkar. The cost of the machine is less and if the farmer buys this machine, farmer can recover the invested money back. By using this machine problem of the labour crises can be reduced Comparing with manual harvesting only one labour is required. It makes the process faster hence reduces most of the shelling time and labour cost. This machine is helpful for both small and big farms

III. METHODOLOGY OF PROPOSED SURVEY

Groundnut Decorticator: This machine is used in freeing groundnut seeds From their pods by cracking. Groundnut decortication may be achieved by means of different equipment varying in degree of complexity A conventional groundnut decorticator performs the following functions: Control feeding of groundnut Crack the groundnut Clean the seed from seed pod mixture.

1. **Feeding Unit:** The feeding unit comprises of a hopper, conveyor (usually belt conveyor). These components are very important in controlling the feed rate at which the material is being fed into the decorticating unit.

2. **Decorticating Unit:** The decorticating unit frees the seed from its enclosure. This is the working component of the machine. This mechanism is very important in the operation of the machine. The types of force in action are impact and shear force.

3. **Cleaning Unit:** The cleaning unit comprises of a fan which is driven by the rime mover. The fan blows in air through the separation tunnel to remove pod from the groundnut seed. The principle of operation in this type of caner is dependent on the aerodynamic properties of the agricultural materials. Figures 5 and 6 show the diagram of a hand operated decorticator and a motorized decorticator

4. **Frame:** It holds the hopper, shelling, and separating unit as well as the prime mover (electric motor). Being the main support for the machine, it must be able to withstand stresses and loads and have good welding properties. Hence, mild steel in the form of an angle bar was used.

5. **Hopper**: It contains the unshelled groundnut before and during the shelling operation. It must be able to withstand the vibration loads and stresses and have good strength and good corrosion resistance. Hence, the material is a mild steel sheet of 2mm thickness.

6. **Cracking chember:** It houses the auger and the shelling drum. The shelling operation is done inside it. Therefore, it must be able to withstand load and stresses, good weldability and corrosion resistance. The diameter of the shelling drum is 206mm and the pitch of the anger screw is 100mm. The active length of the drum is 500mm. So, mild steel of 2mm thickness was selected houses the auger and the shelling drum. The

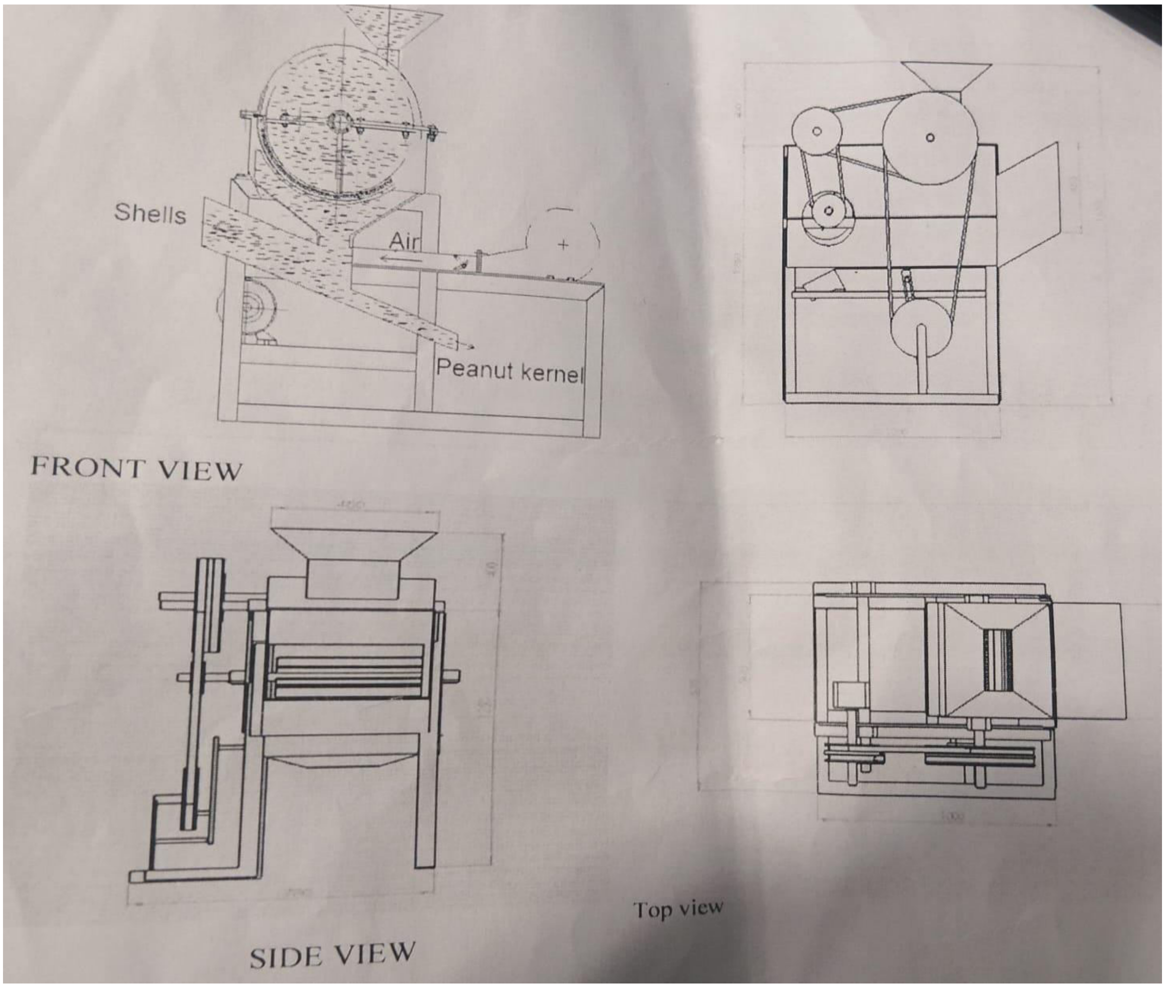
shelling operation is done inside it Therefore, it must be able to withstand load and stresses, good weldability and corrosion resistance. The diameter of the shelling drum is 206mm and the pitch of the anger screw is 100mm. The active length of the drum is 500mm. So, mild steel of 2mm thickness was selected .

7. **Seed Discharge Outlet:** The shelled groundnut seed is collected through this outlet. The seeds fall under gravity from the shelling chamber into its tray. It must have good strength and high resistance to impact loads. So, mild steel of 2mm thickness was used.

8. **Chaff Outlet:** The broken pod is separated from the groundnut by pressure provided by the fan. Mild steel of 2mm thickness is selected.

9. **Fan:** It is made from aluminium due to its lightweight. It has a diameter of 30mm with length and thickness of 300mm and 2mm respectively

PHOTOS



IV. CONCLUSION AND FUTURE WORK

A groundnut shelling machine has been designed, fabricated and tested in this research. A preliminary test evaluation in terms of shelling efficiency and material damaged has indicated that it has a higher potential in substituting manual methods. Also, the machine exceeded the previously designed and fabricated shelling. Wachine in terms of efficiency and time. This is because the design involves material strength and rigidity. The following recommendations are required for effective utilization of the machine, these include making sure the groundnut moisture content is not more than 16%, running the machine for a maximum of 10 hours daily, installing the machine in a well-ventilated area, using engine grade lubrication oil and running daily maintenance after operation to prolong the machine life span..

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Fire Fighting Robot: Auto fire Chaser and Extinguisher

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ABSTRACT: Fire incident is a disaster that can potentially cause the loss of life, property damage and permanent disability to the affected victim. Major fire accidents do occur in industries like nuclear power plants, petroleum refineries, gas tanks, chemical factories and other large-scale fire industries resulting in quite serious consequences. Thousands of people have lost their lives in such mishaps. Therefore, this project is enhanced to control fire through a robotic vehicle. With the advancement in the field of Robotics, human intervention is becoming less every day and robots are used widely for purpose of safety. In our day to day life fire accidents are very common and sometimes it becomes very difficult for fireman to save human life. In such case firefighting robot comes in picture

I. INTRODUCTION

Robots are human-looking machines that perform a variety of complex tasks. There are many types of robots, including fixed- base robots, mobile robots, underwater robots, humanoid robots, space robots, and medical robots. This document proposes a firefighting robot. The robot is equipped with three flame sensors that detect fires in a wide area around him and relay the signals to a microcontroller that activates a pump that sprays water to extinguish the fire. This robot implements the concepts of ambient fire detection and proportional motor control. Motor drivers are used to bi-directionally control motors mounted on robots. Thus, the robot processes information from various key hardware elements such as flame sensors, Arduino Uno boards (microcontrollers), motor drivers, DC motors and servo motors. With the expansion of Robotic Applications , some tasks may require quick and efficient action to be performed. A Robot is a re-programmable, multifunction manipulator designed to move materials, parts, tools or special devices through variable programmed motions also be defined as an automatic device that performs functions normally ascribed to humans or a machine in the form of a human. The Robot in this project is an Automatic Fire Extinguisher which detects and extinguishes the fire sensed by a Temperature sensor.

II. LITERATURE REVIEW

Fire incidents are catastrophic events that can result in significant loss of life, property damage, and permanent disabilities to affected individuals. While fire fighters are the frontline responders in such emergencies, their roles often expose them to considerable risks, especially when combating fires in high-hazard environments such as nuclear power plants, petroleum refineries, and gas storage facilities. The danger becomes even more pronounced when dealing with fires in confined spaces, including collapsed buildings or areas filled with debris. In these situations, fire fighters face numerous challenges, such as navigating through narrow passageways or maneuvering through unstable structures to locate and extinguish the fire while ensuring the safety of any trapped victims. Consequently, the need for advanced technologies in firefighting becomes paramount to reduce the exposure of human lives to danger.

[1]2017 The project is to develop a robotic vehicle capable of detecting the presence of fire and extinguishing it automatically. It is a movable robot that consists of gas sensor for detecting the fire, gear motor and motor driver for the movement of the robot, relay driver for pump control and a Bluetooth module which are used for the detecting and extinguishing the fire. Usually, the robot moves at a steady speed. When the gas sensor detects the fire in the environment, the signal indicating the presence of fire will be sent to the Arduino through which the extinguishing is done. In the extinguishing process, whenever the detection of fire is positive the robot will stop at the place of fire occurred and starts the pump and sprinkle water through a sprinkler until the smoke is put off. The entire control is achieved using Arduino which is interfaced with the android mobile via Bluetooth module, so that the control of the robot can be made from an android mobile as well.

[2]2021 Recently, communication via the wireless systems become promising, since the wireless communication system provides several benefits such as the disposal of the wire usage, provides long-distances communication, and the disposal of periodic maintenance of data transmission lines. In robotic science, the wireless system unit is the main part

of the mobile robot. Whereas, only wireless communication module responsible for transmitting commands from the transmitter (eg mobile or PC) to the receiver (ie robot brain) and vice versa. With the increase in population growth and the construction of the urban, fires have become widely spread. It is worth mentioning here that the lives of firefighters are in permanent danger where they may be exposed to the combustion or inhalation of toxic gasses associated with the combustion process.

Therefore, become necessary to find effective ways to reduce these risks. In this paper, a rover tank robot is implemented for fire extinguishing in closed areas based on the Arduino microcontroller, flame sensor, and motion sensor.

[3]2018 Now a days, fire accidents are very common and sometimes it becomes very difficult for a fireman to save someone's life. It is not possible to appoint a person to continuously observe for accidental fire where robot can do that. Therefore in such cases fire fighting robot comes in picture. Robot will detect fire remotely. These robots are mostly useful in industries where probability of accidental fire is more.The proposed vehicle is able to detect presence of fire and extinguishing it automatically by using gas sensor and temperature sensor. It contains gear motors and motor driver to control the movement of robot. Relay circuit is used to control the pump and when it will detect fire then it will communicate with microcontroller (Arduino UNO R3) through Bluetooth module. The proposed robot has a water jet spray which is capable of sprinkling water. The sprinkler can be move towards the required direction.

[4]2019 Fire incident is a disaster that can potentially cause the loss of life, property damage and permanent disability to the affected victim. They can also suffer from prolonged psychological and trauma. Fire fighters are primarily tasked to handle fire incidents, but they are often exposed to higher risks when extinguishing fire, especially in hazardous environments such as in nuclear power plant, petroleum refineries and gas tanks. They are also faced with other difficulties, particularly if fire occurs in narrow and restricted places, as it is necessary to explore the ruins of buildings and obstacles to extinguish the fire and save the victim. With high barriers and risks in fire extinguishment operations, technological innovations can be utilized to assist firefighting. Therefore, this paper presents the development of a firefighting robot dubbed QRob that can extinguish fire without the need for fire fighters to be exposed to unnecessary danger.

[5]2017 This paper presents the development and implementation of dual mode firefighting robot.

The proposed fire extinguishing robot works in either automatic or manual mode. The operation of robot is monitored and controlled by Arduino UNO microcontroller. Complete robot model is simulated using Proteus. The hardware of proposed fire extinguishing robot is implemented and tested. A surveillance camera is mounted on the robot to monitor the movement of robot under manual mode. Real time surveillance can also be obtained from the camera in automatic mode. In automated mode, robot will detect the fire and move to the fire location and water will be pumped to extinguish the fire.

[6]2022 A basic design of robot that can fight fires at an affordable cost could prove to be boon in fighting domestic fires, till help arrives. The robot developed consists of three elements which is the hardware, electronic interfacing circuits, and software program. The robot has four battery operated motor (BO motor). This firefighting robotic system is capable of detecting and extinguishing fire. These robots can be made to roll into places where it is not safe for humans to enter. Time is of essence when it comes to fighting fires as even a few minutes' delay can turn small fires into raging inferno. This robot is designed as a first response unit so it can suppress the fire keeps it under control till help arrives. This firefighting robotic system is controlled by an Arduino Uno development board. It is also equipped with the fire flame sensor for detecting fires. It is equipped with a water tank and a pump. So, on detecting fires it sprays water extinguishing the

This paper introduces the development of QRob, a firefighting robot designed to safely extinguish fires without risking the lives of human fire fighters. QRob is uniquely compact, making it more agile and capable of accessing smaller, confined spaces compared to traditional firefighting robots. Its reduced size allows it to reach fire locations that are difficult for humans or larger robots to access, providing a critical advantage in situations like fires within narrow building spaces or cluttered environments. Furthermore, QRob is equipped with ultrasonic sensors, which help it avoid obstacles and navigate its surroundings autonomously. The integration of a flame sensor allows QRob to detect fire locations accurately, enabling it to perform its firefighting tasks without human intervention. The robot is programmed to automatically locate the fire, stopping at a safe distance of 40 cm from the flame to minimize potential harm from heat or smoke. An operator can monitor and control QRob through a camera system that connects to a smartphone or remote device, providing real-time feedback and control over its actions. With these advanced capabilities, QRob significantly enhancing the free fighting efforts by reducing exposure of fire fighters to hazardous conditions while ensuring timely and efficient fire suppression.

The act of detecting and extinguishing fires is inherently dangerous, placing the lives of firefighters at risk. Every year, numerous fire fighters lose their lives in the line of duty while trying to save others from the devastating consequences of fire incidents. These dangers highlight the urgent need for innovations in firefighting technology, particularly those that can assist or even replace human firefighters in perilous situations. Over the past few years, advancements in Artificial Intelligence (AI) and robotics have paved the way for the development of autonomous firefighting systems that can be remotely controlled, reducing the danger faced by fire fighters.

Firefighting robots, integrated with AI and wireless control systems, offer significant improvements in terms of safety, precision, and efficiency. The integration of Android applications to control such robots adds a layer of convenience, allowing fire fighters or operators to guide the robot in real time without being in close proximity to the fire. These robots are equipped with various sensors, including flame detection, smoke detection, and temperature sensors, that allow them to accurately identify the fire's location. Once detected, the robot can deploy appropriate extinguishing agents, such as water or foam, to suppress the flames. The use of Android-controlled robots in firefighting not only reduces the time taken to respond to an emergency but also ensures that the firefighter is never exposed to direct danger. As research and development in this area continue to grow, the potential for robots to play a pivotal role in firefighting operations expands, with the ultimate goal of creating systems that are not only more effective but also capable of performing tasks autonomously in hazardous environments. These advancements hold the promise of a future where human lives are no longer at risk in the most dangerous fire situations.

III. METHODOLOGY OF PROPOSED SURVEY

Initially we need to make sure all the components are connected and give power supply through an external device. The robot remains idle initially, later it starts rotating in 360 degrees to detect the presence of object with the help of flame sensor. If the object is not within the range it moves ahead and then again checks the presence of object within the range. The signal is sensed to the one of the 5 channel flame sensor and then robot moves if it signals to center sensor so that we can move to the object accurately. After detecting the flame it moves to certain distance and again checks the range of distance until it moves near the flame object. After it reaches it then in turn activates fire extinguisher or water pump to sprinkle the water on fire object.

IV. HARDWARE IMPLEMENTATION

This robo consists of several types of sensor and the vital part of this robo is arduino mega2560 which controls all other components. Fig1 shows that arduino is used as a microcontroller connected with other components. Motor Driver is used to activate the moving of the DC motor. It also consists of flame sensor and IR distance sensor as input of the system. Fire extinguisher is mounted on robot to reduce fire.

[1] Arduino – A microcontroller board that serves as the brain of the robot. It processes input from sensors and sends commands to actuators, enabling the robot to interact with its environment. Popular Arduino boards include the Arduino Uno, Mega, and Nano, each suited for different project requirements.

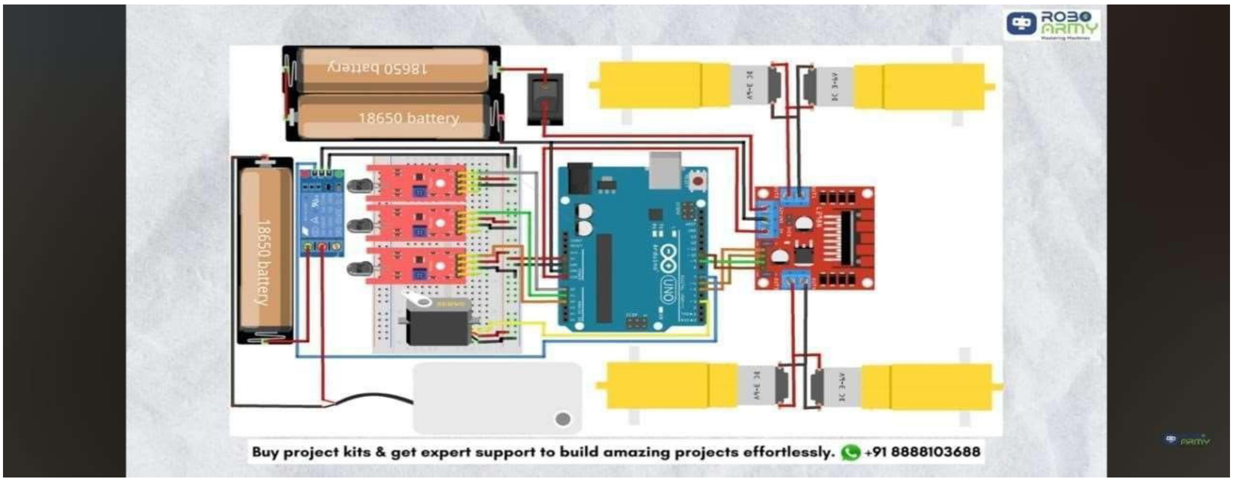
[2] Servo Motor – Controls the angle of the water spray nozzle, allowing the robot to aim accurately at the fire. It responds to input from the flame sensors to dynamically adjust direction for effective targeting.

[3] fire-fighting water pump- with a flexible pipe is a crucial component in extinguishing fires, especially in areas lacking a fixed water supply

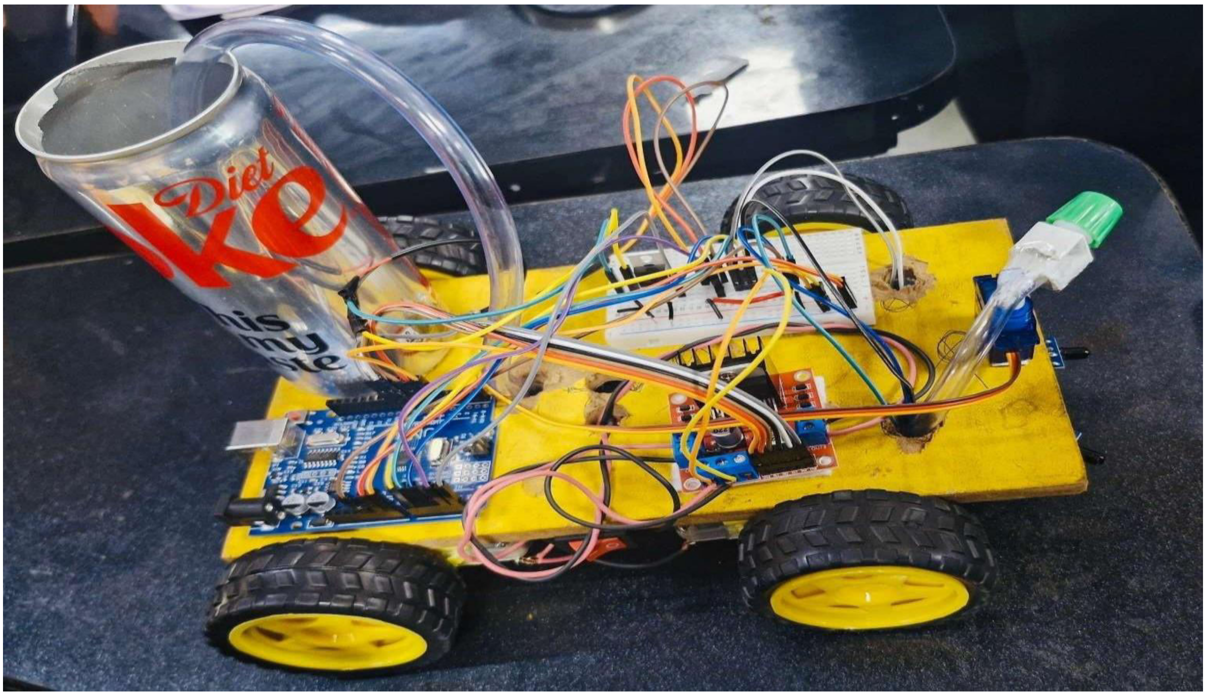
[4] Jumper wires- are essential tools in electronics, enabling quick and reliable connections between components without the need for soldering. They are particularly useful in prototyping, testing, and educational projects.

[5] L 298N Motor- Driver Module is a widely used component in robotics and automation projects, enabling precise control of DC and stepper motors.

[6] crylic car chassis- serves as the foundational platform for mounting and stabilizing various components in robotics projects.



Circuit Diagram



Model Figure

V. CONCLUSION AND FUTURE WORK

This project describes about the real time firefighting robot which moves in a constant speed, identify the fire and then extinguish it with the help of pumping mechanism. It has advantageous features such as ability to detect location of fire automatically besides having a compact body and lightweight structure. The robot can be used at a place that has a small entrance or in small spaces because it has a compact structure. The system can potentially be useful to accompany fire fighters and prevent an outbreak. The operator is able to extinguish fire using remote control from longer distance. Operators can also monitor the environmental conditions during the process of firefighting by using the camera. From the experimental results, the robot can sense smokes and fire accurately in a short time.

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An Efficient Approach to Save Nature: Solar Charger

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ABSTRACT: This paper presents the design and development of a solar-powered charger, aimed at providing an ecofriendly and sustainable solution for charging electronic devices. The system harnesses solar energy through photovoltaic (PV) panels, converting sunlight into electrical energy to charge devices such as smartphones, tablets, and other small electronics. The charger features an efficient energy management system that optimizes power conversion and storage using a battery bank. This design also incorporates a user-friendly interface, monitoring capabilities, and protection mechanisms to ensure safety and longevity. By reducing dependency on conventional power sources, the solar charger provides an innovative way to promote renewable energy adoption, particularly in off-grid or remote areas. The performance, feasibility, and environmental impact of the system are discussed, highlighting its potential for widespread use in everyday applications.

I. INTRODUCTION

With the increasing global demand for renewable energy sources and the growing concern over environmental sustainability, solar energy has emerged as a promising alternative to conventional power sources. Solar power, being abundant, renewable, and non-polluting, presents a viable solution to address the challenges of energy scarcity and environmental degradation. One of the practical applications of solar energy is in the field of portable power generation, particularly for charging electronic devices such as smartphones, laptops, and other portable gadgets. Solar chargers typically consist of photovoltaic (PV) panels that capture sunlight and convert it into usable electrical energy. This energy is then stored in batteries or directly used to charge devices. In addition to their environmental benefits, solar chargers provide a convenient and sustainable solution for individuals living in off-grid areas, during outdoor activities, or in emergency situations. This paper explores the design, development, and performance of a solar charger system that leverages solar energy to power electronic devices efficiently. The study focuses on optimizing the solar energy conversion process, ensuring energy storage and power management, and enhancing the usability and safety of the charger. By advancing solar charger technology, this solution aims to reduce dependence on conventional power sources and contribute to the global transition towards cleaner energy alternatives.

II. LITERATURE REVIEW

Nowadays, sensor node networks are designed and increasingly used in various fields and sectors, such as in military (examples Battlefield surveillance, nuclear, biological and chemical attack detection and reconnaissance), in health (examples Tele-monitoring of human physiological data, monitoring patients and doctors inside a hospital), in environment (examples Forest fire detection, flood detection) and in other various applications. However, the power sources and supply of the nodes remains as challenge. Therefore, energy conservation plays an important role for this network. Usually the battery powered is used as power sources for sensor nodes, but energy harvesting offers an alternative, although it not able to avoid from the problem. In this paper, an analysis is performed to compares the use of batteries powered against solar cells powered. The basic parameter and characteristic for both of power supplies are studied in terms of capacity or volume, low self-discharge, shorter recharge time, energy density and power efficiency to generate power for the sensor nodes, the lower cost and also in terms of characteristics such as size and weight.

III. METHODOLOGY OF PROPOSED SURVEY

Fig: converting sunlight into electrical energy.

1. To design a system that maximizes the efficiency of photovoltaic (PV) panels in converting sunlight into electrical energy, ensuring optimal performance under varying environmental conditions.
2. Energy Storage and Management: To develop a robust energy storage solution (such as a battery bank).
3. Portability and Accessibility: To create a compact, lightweight, and portable solar charger suitable for a range of devices.
4. Safety and Durability: To integrate safety features, including overcharging and short-circuit protection, ensuring the longevity and reliability of both the solar charger and the devices being charged.
5. Environmental Impact Reduction: To promote the use of renewable energy, reducing dependence on fossil fuels and lowering the carbon footprint associated with traditional grid-based charging methods.
6. Cost-Effectiveness: To develop a solution that is affordable and accessible, making solar chargers a feasible alternative for widespread use in both developed and developing regions. These objectives aim to make solar chargers a practical, sustainable, and efficient alternative for portable power needs.

Working of the Solar Charger (Sub-Assembly and Assembly):

A solar charger works by converting solar energy into electrical-power to charge devices. The system consists of several sub-assemblies that work together.

Sub-assembly:
1. Photovoltaic (PV) Panel (Sub-Assembly): - The solar panel captures sunlight and converts it into direct current (DC) electricity. This process is known as the photovoltaic effect. The generated electricity is sent to the charge controller.

2. Charge Controller (Sub-Assembly): - The charge controller regulates the flow of energy from the solar panel to the battery, ensuring that the battery is charged safely without overcharging. It optimizes the charging process for maximum efficiency.

3. Battery Storage (Sub-Assembly): - The battery stores the energy collected by the solar panel for later use. The charge controller ensures the battery is charged properly and prevents over-discharge, maintaining battery health.

4. Power Conversion Circuit (Sub-Assembly): - The DC power stored in the battery is converted into the appropriate voltage (e.g., 5V) via a DC-DC converter to charge devices like smartphones. The output is provided through USB ports or other connectors.

5. Protection Circuit (Sub-Assembly): - Protection mechanisms, such as fuses and diodes, are included to prevent overcharging, short circuits, and other hazards, ensuring the safety of the system.

Assembly: The sub-assemblies are integrated into a single, compact unit. The solar panel is connected to the charge controller, which is linked to the battery. The power conversion circuit is connected to the battery for distributing the energy to the device. Finally, the output ports are made accessible for charging devices. The whole system is enclosed in a durable casing to protect the internal components. This integrated system ensures efficient solar energy conversion, storage, and safe charging of electronic devices.

IV. CONCLUSION AND FUTURE WORK

The solar charger system integrates several key sub-assemblies that work together to provide a reliable, sustainable, and efficient solution for charging electronic devices using solar energy. Each sub-assembly plays a critical role in ensuring the optimal conversion of sunlight into electrical power, safe storage in a battery, and proper power distribution to connected devices.

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[2] Anker PowerPort Solar Lite – A foldable solar charger that provides efficient charging for smartphones and small electronics using solar power.
[3] RAVPower Solar Charger 24W – A compact and efficient solar panel charger for charging devices on the go, especially useful for hikers and outdoor enthusiasts.
[4] Renogy 100W Solar Panel Kit – A high-efficiency, durable solar panel kit for off-grid energy solutions, ideal for RVs, cabins, and boats.
[5] Nekteck 21W Solar Charger – A lightweight, portable solar panel with USB output, designed for charging smartphones, tablets, and other small electronics. These references cover a variety of solar charging solutions, from small portable chargers to larger solar kits.

RFID Toll/Parking Module

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ABSTRACT: RFID Toll/Parking Manual This document provides a comprehensive manual on RFID- based toll and parking systems, explaining their working mechanism, components, and implementation process.

It covers the role of RFID tags and readers in automating vehicle identification, reducing manual intervention, and improving efficiency in toll collection and parking management. The document demonstrates the system' s setup, including hardware and software integration, and explains how data is processed for seamless entry and exit.

Additionally, it highlights the benefits of RFID technology, such as enhanced security, reduced congestion, and faster transaction times. This guide serves as a valuable resource for understanding RFID applications in automated toll and parking systems.

I. INTRODUCTION

The RFID Toll Parking System is designed to automate the entry and exit process in parking lots and toll plazas. Vehicles are equipped with RFID tags, which contain unique identification details. When a vehicle approaches the toll gate or parking entrance, an RFID reader scans the tag, verifies the information, and processes the payment or access authorization without manual intervention.

The rapid growth of technology in today' s society has redefined our daily experiences. One such example of innovation is the RFID-based Automatic Vehicle Barrier Control project, which combines the ease of use of an Arduino- based system with the power of radio- frequency identification (RFID) technology (RFID RC522). This Smart Car Barrier System provides a practical way to manage vehicle access in a variety of settings, such as protected buildings and parking lots.

This system enhances efficiency, security, and convenience by eliminating the need for manual ticketing and cash transactions. It reduces waiting times, prevents unauthorized access, and provides a streamlined experience for users. The integration of RFID technology in toll collection and parking management is a step towards smart transportation solutions, ensuring smoother traffic flow and better resource management

II. LITERATURE REVIEW

The use of Radio Frequency Identification (RFID) technology in automated toll and parking systems has gained significant attention in recent years due to its potential to streamline vehicle identification and improve traffic management. Various studies and implementations have demonstrated the effectiveness of RFID in enhancing operational efficiency, reducing human intervention, and ensuring secure access control.

According to Kumar et al. (2020), RFID-based systems offer a cost-effective and scalable solution for toll collection, significantly reducing transaction times and eliminating the need for manual toll booths. The research highlighted the importance of integrating RFID tags with vehicle registration databases to automate the verification process.

Sharma and Patel (2019) explored the application of RFID in smart parking systems, emphasizing how the technology minimizes parking congestion and enables real-time monitoring of vehicle entry and exit. Their study revealed that integrating RFID readers with microcontroller-based systems (such as Arduino) allows for seamless hardware-software interaction, contributing to system reliability.

In a study by Rao and Gupta (2021), the focus was on the security aspects of RFID systems. The authors pointed out that while RFID offers improved security by limiting unauthorized access, encryption and authentication mechanisms must be implemented to prevent data breaches and spoofing.

Another key insight comes from Bansal et al. (2022), who discussed the deployment of RFID in urban smart city infrastructure. Their research underscored how RFID systems, when integrated with cloud databases and IoT frameworks, can provide real-time data analytics, support dynamic pricing models, and enhance user convenience through mobile-based interfaces.

Furthermore, the adoption of RFID technology aligns with the global shift toward smart transportation and automation. Studies collectively suggest that the implementation of such systems leads to reduced traffic congestion, lower operational costs, and a better end-user experience.

III. METHODOLOGY OF PROPOSED SURVEY

To evaluate the effectiveness, awareness, and acceptance of the RFID-based toll and parking system, a structured survey methodology will be adopted. The key steps of the methodology are as follows:

1.Survey Design

➢A questionnaire will be developed focusing on the following parameters:

◉Awareness of RFID technology.

◉User experience with manual vs. automated toll/parking systems.

Perceived benefits (e.g., reduced wait times, security, convenience).

◉Concerns regarding privacy and reliability.

◉Willingness to adopt RFID systems in daily transportation routines.

Both close-ended (Likert scale, yes/no) and open-ended questions will be included to gather quantitative and qualitative data.

2. Target Audience

◉The survey will be targeted at:

◉Daily commuters who use toll roads or parking facilities.

◉Vehicle owners in urban and semi-urban areas.

◉Toll booth operators and parking staff.

◉Transport department personnel.

➢A sample size of 100–200 respondents will be aimed for, ensuring diversity in age, profession, and region.

3. Data Collection

◉Online Distribution: Using Google Forms or Microsoft Forms, shared via WhatsApp, Telegram, and email.

◉Offline Distribution: Paper-based forms will be used in local parking areas and toll booths where feasible.

◉A time frame of 2–3 weeks will be allocated for data collection.

4. Data Analysis

◉Quantitative Data will be analyzed using tools like Microsoft Excel or Google Sheets to compute averages, percentages, and charts.

◉Qualitative Data (from open-ended questions) will be categorized into themes to extract insights about user perceptions and concerns.

5. Interpretation

◉The analysis will help:

Measure the current level of RFID awareness. Identify barriers to adoption.

Evaluate the overall public response to the proposed RFID-based solution.

➢The methodology for this review paper involved a systematic literature search conducted across academic databases such as Google Scholar, IEEE Xplore, Scopus, and Web of Science. The search focused on publications between 2005 and 2024, using keywords including “RFID-based toll collection,” “smart parking systems,” “automated vehicle access control,” and “RFID in intelligent transportation systems.”

Figure 1: Circuit Diagram

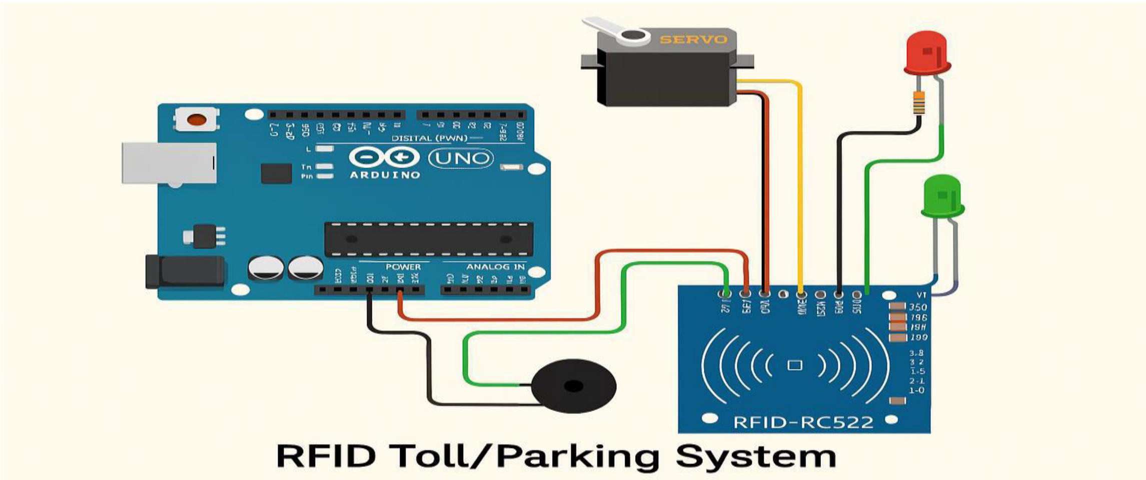
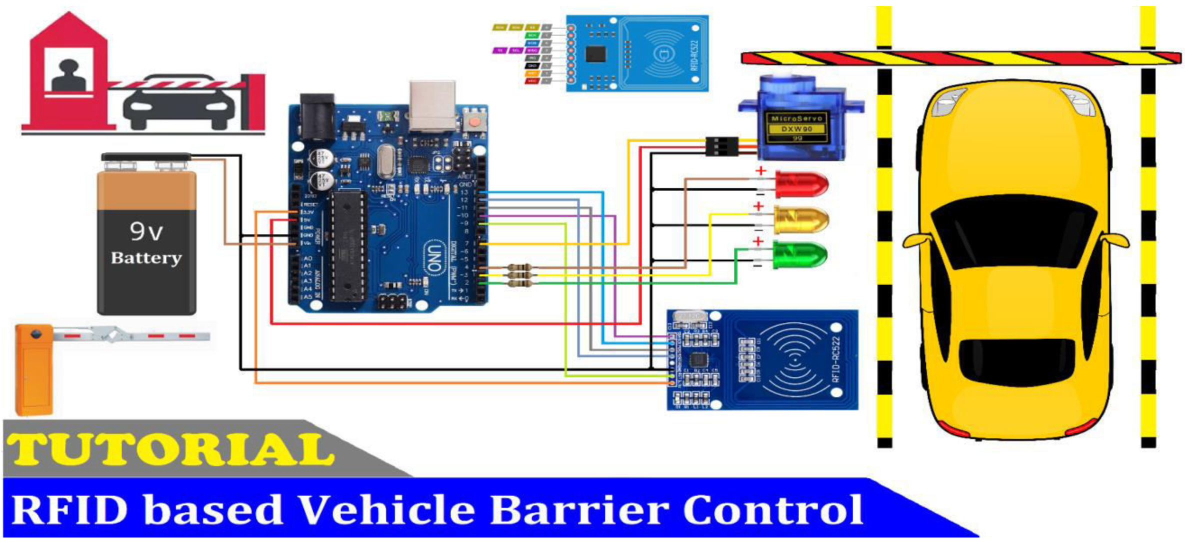


Figure 2 : Model



IV. CONCLUSION AND FUTURE WORK

Automatic Vehicle Barrier Control Using RFID Technology

The Automatic Vehicle Barrier Control project leverages RFID technology to offer a smart and efficient solution for managing vehicle entry. This Smart Car Barrier System, integrated with Arduino, provides a flexible and automated method for controlling access, making it ideal for applications in parking management and security.

As technology continues to evolve, projects like this highlight the potential for developing innovative and effective systems across various sectors. With proper installation and testing, this system can significantly enhance the efficiency and security of access control mechanisms.

Furthermore, the implementation of RFID in toll and parking management contributes to a smarter, faster, and more eco-friendly transportation ecosystem—benefiting both users and authorities. As demand for smart transportation solutions grows, RFID-based systems play a critical role in:

Improving traffic flow

Reducing fuel consumption

Ensuring a hassle-free user experience

The integration of this technology with mobile payment platforms, smart city infrastructure, and cloud-based data management makes it a scalable and future-proof solution for modern urban environments.

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Fire Detection system for Industry

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ABSTRACT: Fire detection systems are the most critical element of any building design these days. These days, reports of fire occurrences are frequent. In many instances, this could be the result of people's carelessness. Take a look at a few locations, such as gas stations, snack stores, homes, and primarily offices, etc. Every year, there are believed to be around ten thousand fire incidents. In this study, an automatic fire detection system using a sensor is introduced, taking all of these factors into account. Our suggested solution works differently from the current one, which uses a fire sensor to detect the fire. The current systems have fire alarms that sound an alert when a fire is discovered inside a certain area. The proposed system contains the fire alarm, Bread Board, LCD screen, Arduino in addition to that it sends a notification to our mobile and mail can be sent to the attached mail id which will be having the information of the accident-prone area, and also the information needed to alert the fire station about the incident.

I. INTRODUCTION

A fire alarm system is a system that is designed to warn people when there is fire, smokes, or any other harmful gas appear on the premise. The alarms are activated automatically or manually turned on with manual fire alarm activation devices such as manual call points or pull stations. The manual activation exist is to help people warn of a fire or harmful gas leak quickly as it may take some time for the sensors to kick in. The alarms can either be motorized bells or wall mounted sounder or horns. They can also be a speaker strobe which sound an alarm, followed by a voice urging evacuation message which alarming people on the situation and warning them not to use elevators if there is any. The fire alarms sounders can be set to different frequencies and tones depending on the country and the manufacturer. Some place needs a higher frequency and tone such as shopping malls and high-levelled building.

Fire alarm system is crucial in every building as it can prevent any mishaps and can save lives. The system can sense heat and gas thus alarming people via buzzer, automated announcements, or alarming lights. It is faster than having to scream to alarm people of a fire or a gas leak. Basically, heat sensor will sense any temperature above the normal room temperature.

II. LITERATURE REVIEW

Fire alarms are crucial safety devices that detect and warn people of potential fires, enabling prompt evacuation and minimizing damage. Fire alarm systems offer a flexible and affordable solution, leveraging the versatility of fire detection and alerting systems.Vaious senssors, including smoke,temperature,and flame sensors,have been used to detect fires in places like industry. Smoke sensors, such as the MQ-135, detect particles in the air, while temperature sensors, like the LM35,measure temperature changes.Flame sensors, including the IR flame sensor, detect infrared radiation emitted by flames.Researchers have also employed communication protocols such as Wi-Fi,GSM,and Bluetooth to send alerts and notifications to users.Studies have highlighted the effectiveness of fire alarm system in detecting fires and alerting user. (1)For instance,Gupta et al.(2018) created a fire detection and alerting system using Arduino,temperature sensors,while (2)Jain et al. (2019) created a fire detection and alerting system using Arduino, temperature sensors ,and (3)Wi-Fi. Kumar et al.(2020) also developed a fire detection system using Arduino, flame sensors,and GSM. However,challenges and limitations have been noted in the literature. Power consumption is a concern, as Arduino boards requires a power source, which can be a limitation in certain applications (4)Jain et al.,2019 .Sensors accuracy is also a challenge , as the accuracy of sensor can affect the relatability of the fire alarm system (5) Gupta et al.,2018.Additionally, the cost of additional components, such as sensors and communication modules, can add up (6) Kumar et al.,2020. Despite these challenges, Arduino-based fire alarm system offersb a promising solution for fire detection and alerting. Their flexibility, affordability,and customizability make them an attractive option for various application, including homes offices and in industry.(7)Gupta et al. (2018),(8) Jain et al.(2019), (9)Kuingh et al.(2020), (10)Kumar et al.,(2021)

III. METHODOLOGY OF PROPOSED SURVEY.

System Design:- Design a smart fire alarm system using Arduino, incorporating sensors (e.g., smoke, temperature, humidity), a microcontroller, and communication modules (e.g., Wi-Fi, GSM).
- Develop a system architecture and block diagram.

➢ Prototype Development:
- Develop a prototype of the proposed system, integrating the designed components.
- Test and calibrate the system to ensure its accuracy and reliability.

➢ Survey Design:
- Design a survey questionnaire to gather information on the proposed system's effectiveness, feasibility, and potential applications.
- Identify the target respondents, such as building owners, facility managers, firefighters, and electronics enthusiasts.

➢ Data Collection:
- Distribute the survey questionnaire to the target respondents through various channels (e.g., online platforms, email, in-person interviews).
- Collect and record the responses.

➢ Data Analysis:
- Analyze the collected data using statistical methods and tools (e.g., SPSS, Excel).
- Identify trends, patterns, and correlations in the data.

➢ Results and Discussion:
- Present the survey results, highlighting the respondents' perceptions and opinions on the proposed system.
- Discuss the implications of the findings, including the potential benefits and limitations of the system.

➢ Conclusion and Recommendations:
- Summarize the main findings and conclusions drawn from the survey.
- Provide recommendations for future research and development of the proposed

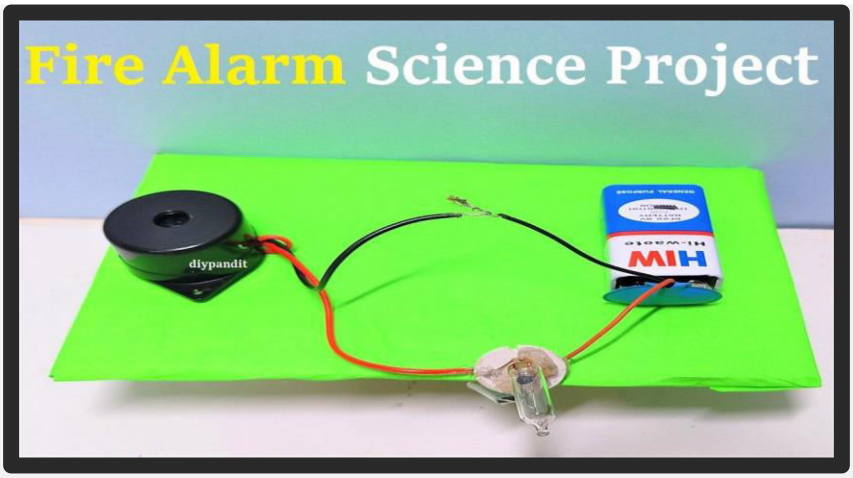

Fig .(1) Fire Alarm System

IV. CONCLUSION AND FUTURE WORK

After several tests have been done towards our project, The Fire Alarm System has been able to be conducted according to the desired system. The system consists of two inputs, which are flame sensor and gas sensor. Starting off with the flame sensor, it detects the presence of the fire and it will send a signal to its output. In this case, the outputs are LED, Piezo Buzzer and the LCD Panel. The LED will light up and the buzzer will produce the sound after obtain the signal to aware the users about the presence of fire. The LCD Panel will display the information about the presence of fire. The second input, which is the gas sensor is a component that measures presences of the gas, which is smoke in this case. The type of gas sensor we use for this project is MQ-2. This type of gas sensor able to detects butane, methane, LPG and smoke. This gas sensor is placed at this fire alarm system to enhance to safety when there are fires. When the situation occurs, it will send a signal to its output, which is the buzzer. This buzzer acts as an alarm that reminds the users to be aware of the situation. Certain tests, improvements and changes were done to achieve the results mentioned above. The sensors have been tested and it work well as intended. This project certainly can be a huge helping to the society to prevent the unwanted situation. This alarm system can implement Fire Alarm requirement to maintain the safety and eliminate hazard.

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Laser Base Home security Alarm

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ABSTRACT: This project deals with a model of laser security alarm system egign.Laser security systems used to be difficult to istall and rarelyn available toanyone other rather than the suoer rich.Now there3 are are dozens of security systems on the market that utilize laser ans can effectively protect everything from small apartmenrs and bussinesses to large areas of property.Most home laser security systems consists of two parts: a basic alarm alarm unit and an infrared motion detector.Laser based security system is a type of security and alarm system that uses laser light and a light sensor.Why a laser to be used?It is known that a laser light goes through long distance without any scattering effect (disturbing) and it is only visible at source and thje destination point so it can be used as mediator between source and destination but to analysis the source a sensor is need,here the use of LDR is applicable .Just analysis is not enough alerting should be general alerting is sound effect so here buzzer act as alerting.Mak8ing use of this, a laser security system is designed.Its working : There is a laser diode that generates the laser beam which continuously strikes over the Light dependent resister sensors. When any person crosses the path, in inhibits laser to reach LDR and the sensor generate a low which is read by controller to power on the buzzer.

I. INTRODUCTION

Need of security is the basic necessity of any individual. The feeling that we are safe and everything around us is all right is imperative for a peaceful living. But in this unsafe world, when crime, terror and threats are on their peak, howrious electronic security systems can be used at home and other important working places for security and safety purposes. Laser Security alarm is a device used for security purposes. It has a wide application in fields of security and depence starting from the security of simple house hold material to a very high valued material of an organization. They once used to be expensive solutions for security needs. Owing to cost cutting and fast technological advancements, this form of security system is becoming more affordable. Lasers differ from other light sources in a few significant ways. There are two features that are important for security systems. Unlike a light bulb or flashlight, laser light doesn't spread out, it is a narrow beam. And laser light is essentially a single colour . Because laser light doesn't spread much, it can be sent it a long way and still have enough energy in a small are Auto trigger the security system detector. Because it's a single wave length, it can put a blocking filter on the detector to let laser light through without letting background light onto the detector. Laser light travels in a straight line. For instance, to protect the front of the yard, putting the laser at one comer and the detector at the other corner would do the job. That's not a very practical configuration, though. More typically, if it is needed to protect the perimeter of a room, or at least the enhances. So laser security systems start with a laser pointing to a small mirror. The first mirror is angled to direct the beam to a second small mirror, and so on until the final mirror directs the beam to the detector. If the beam is interrupted anywhere between the laser and the detector, the electronics will put the warning signal.

II. LITERATURE REVIEW

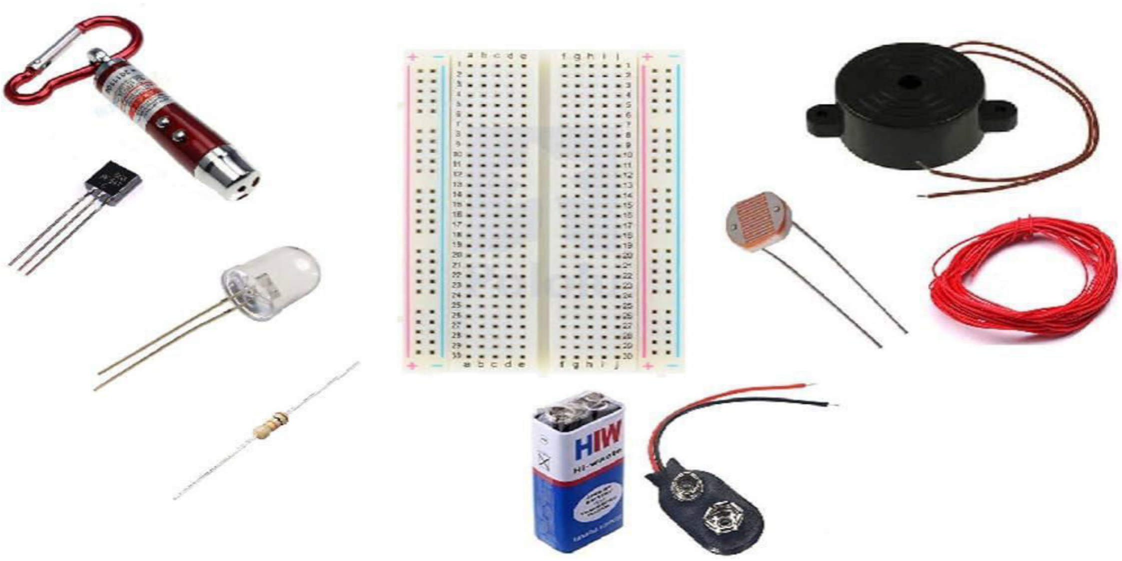
Designing and Implementation of Security alarm system for organizations, industries, and houses Based on lazer technology was review by Govinda et al. (2014)that administer double ways to Implementing security . Firstly is by the use of lazer and LDR , in a case when there is any motion Sensed by the lazer, it will sound an alarm and alert to the industries, organizations, or Homeowners that they are an intrusion In this chapter, the researchers have made Available compilations of information on laser and its significance to theinnovations of security. The following accounts will be for greater attainment of understanding about laser and security Systems. Studies about how these technologies have come into reality and theefforts of humanityTo elevate the innovations of the past generation sup to the present era..Laser based security system using Arduino UNO by Paramitha Mondal, Madhusree Mondal. TheProposed system contains sensor, Arduino UNO, ESP Wi-Fi module, buzzer, LDR module. In thisSystem once security system detects the intruder buzzer starts buzzing very loudly, spy cameraTakes the photo of the intruder and sends it to the registered email address for valid proof [14].Laser based security system for home by Harshal Hemane, Debarati Sen. In this proposed system Mirrors are used to reflect the laser rays to cover the region surrounding home in all direction. When laser light is incident on a mirror, it gets reflected from one mirror to another and falls onLDR. If any of the laser ray is blocked the buzzer produces beep sound [15]. Laser security alarm System by A.B.N.V. Prasad, K. Ravi Raj, K. Siva Ganesh, M. Lithin Siva swamy Naidu, N.Phaneendra. In this project based on the voltage drop across the LDR is considered to turn On andOff the transistor. If the voltage drop across the LDR is low transistor is turned Off, if the voltage Across the LDR is high transistor is said to be turned On. Once the transistor is turned on buzzer Produces beep sound [16]. Laser security system by Debarati Dutta. The proposed system contains LDR, IC555, transistor, buzzer which gives alert that the intruder has entered the monitored Entrance through beep sound [17]. Door lock security using Raspberry Pi and QR Code by Arigela Sai Kalyan, Balibineni Bharat Teja Raju, Mudraboina Venkatesh. In this project the study is aimed To develop a web-based security door using QR code system for the laboratory where at the same Time the authorized person can perform access monitoring the student's attendance The Security alarm system or home automation comprises centralized control of lighting, appliances, Temperature, and other systems, to provide better relaxation, ease, security, and efficiency.

III. METHODOLOGY OF PROPOSED SURVEY

First, the Op– Amp circuit acts as a comparator i.e. it compares the voltages at the inverting and non-inverting terminals and produces an output accordingly. The LDR, resistor Voltage divider is connected to the non -inverting terminal of Op-Amp and a potentiometer is connected to the inverting terminal .Assume, the laser pointer is placed directly in line of sight to the LDR and the light from the laser is continuously being incident on LDR. In this situation, the resistance of LDR falls down to few Ohms and as a result, the voltage at the non – inverting terminal will be less than that at the inverting voltage. The output of the Op –Amp is low and the transistor is OFF. If the laser light is blocked by an intruder from falling on the LDR (even for a small duration), the resistance of the LDR goes to few hundreds of Ohms and as a result, the output of the Op-Amp will be HIGH. This will turn on the Transistor. As the output of the transistor is connected to the Trigger Pin (Pin 2) of the 555 Timer IC, if the transistor is ON ,the trigger pin gets a short low pulse and as a result, the output of the 555 becomes HIGH. This will activate the alarm by turning ON the buzzer. Since, the 555 Timer IC is configure das a Bi– Stable Multi vibrator, a small active low trigger pulse at the trigger pin will set its output to HIGH and in order to reset it a person need to push the reset button [1]. Until the reset push button is pushed, the alarm will stay on hence;

Figure 1: component required

SL.NO	NAME OF THE COMPONENT	SPECIFICATIONS	QUANTITY
1	Op– Amp IC	LM358	1
2	Timer IC	IC555	1
3	LDR	----	1
4	Resistors	10 KΩ 220 Ω	3 1
5	Small Buzzer	---	1
6	Potentiometer	10 KΩ	1
7	NPN Transistor	BC547	1
8	Capacitor	100nF	1
9	Push Button	---	1
10	Laser Pointer	---	1
11	9V Battery	---	1
12	Connecting Wires	---	1
13	Breadboard	---	1



1) LASER:
A laser is a device that emits light through a process of optical amplification based on the Stimulated emission of electromagnetic radiation. The term “laser” originated as an acronym for “light amplification by stimulated emission of radiation”. A laser differs from other sources of light In that it emits light coherently. Spatial coherence allows a laser to be focused to a tight spot, Enabling applications such as laser cutting and lithography. Spatial coherence also allows a laser Beam to stay narrow over great distances (collimation), enabling applications such as laser Pointers. Lasers can also have high temporal coherence, which allows them to emit light with a Very narrow spectrum, i.e., they can emit a single colour of light. Temporal coherence can be used To produce pulses of light as short as a femtosecond.

2) LDR (Light Dependent Resistor):
A photo resistor or light-dependent resistor (LDR) or photocell is a light-controlled variable Resistor. The resistance of a photo resistor decreases with increasing incident light intensity; in Other words, it exhibits photoconductivity. A photo resistor can be applied in light-sensitive Detector circuits, and light- and dark-activated switching c.

3) LED (Light Emitting Diode):
A light-emitting diode (LED) is a two-lead semiconductor light source. Like an ordinary diode, The LED diode works when it is forward biased. In this case, the n-type semiconductor is heavily Doped than the p-type forming the p-n junction. When it is forward biased, the potential barrier Gets reduced and the electrons and holes combine at the depletion layer (or active layer), light or Photons are emitted or radiated in all directions. A typical figure blow showing light emission due Electron-hole pair combining on forward biasing. It is a PN- junction diode, which emits light When activated. The explanation behind the emission of photons in an LED diode lies in the energy Band theory of solids.

4) BUZZER:
A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, And piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and Confirmation of user input such as a mouse click or key stroke. Early devices were based on an Electromechanical system identical to an electric bell without the metal gong. Similarly, a relay May be connected to interrupt its own actuating current, causing the contacts to buzz. Often these Units were anchored to a wall or ceiling to use it as a sounding board. The word “buzzer” comes From the rasping noise that electromechanical buzzers made. The buzzer consists of an outside Case with two pins to attach it to power and ground. When current is applied to the buzzer it causes The ceramic disk to contract or expand. Changing this then causes the surrounding disc to vibrate. That’s the sound that you hear. Adjust the potentiometer to increase or decrease the resistance of The potentiometer. If you increase the resistance of the potentiometer then it will decrease the Volume of the buzzer. If you decrease the resistance of the potentiometer then it will increase the Volume of the buzzer.

5) TRANSISTOR:

Tomorrow there will be EC lecture from 8:10 - 9:45 am. Will give the assignment questions tomorrow. Those will be present only they will get CCE marks.h at least Three terminals for connection to an external circuit. A voltage or current applied to one pair of The transistor's terminals changes the current through another pair of terminals. As a variable Current switch, transistor can control the output current based on the input voltage Because the pControlled (output) power can behigher than the controlling (input) power, a transistor can amplify A signal.

6) RESISTOR

A resistor is a passive two-terminal electrical component that implements electrical resistance as A circuit element. Resistors act to reduce current flow, and, at the same time, act to lower voltage Levels within circuits. In electronic circuits resistors are used to limit current flow, to adjust signal Levels, bias active elements, terminate transmission lines among other uses. High-power resistors That can dissipate many watts of electrical power as heat may be used as part of motor controls, in Power distribution systems, or as test roads for generators. Fixed resistors have resistances that Only change slightly with temperature, time or operating voltage. Variable resistors can be used to Adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, Light, humidity, force, or chemical activity. Resistors are common elements of electrical networks And electronic circuits and are ubiquitous in electronic equipment. Practical resistors as discrete Components can be composed of various compounds and forms.

7) Capacitor

Capacitors are widely used in electronic circuits for blocking direct current while allowingAlternating current to pass. In filter networks, they smooth the output of power supplies .In resonant Circuits they tune radios to particular frequencies. In electric power transmission systems, they Stabilize voltage and power flow.

8) BATTERY:

An electric battery is a device consisting of two or more electrochemical cells that convert stored Chemical energy into electrical energy. Each cell contains a positive terminal, or cathode, and a Negative terminal, or anode. Electrolytes allow ions to move between the electrodes and terminals, Which allows current to flow out of the battery to perform work. Primary (single-use or "disposable") batteries are used once and discarded; the electrode materials are irreversibly Changed during discharge. Common examples are the alkaline battery used for flashlights and a Multitude of portable device. Secondary (rechargeable batteries) can be discharged and recharged Multiple times; the original composition of the electrodes can be restored by reverse current. Examples include the lead-acid batteries used in vehicles and lithium ion batteries used for portable Electronics.

9) BREADBOARD AND CONNECTING WIRES:

A breadboard is a construction base for prototyping of electronics. These solder less breadboards Does not require soldering, it is reusable. This makes it easy to use for creating temporary Prototypes and experimenting with circuit design. A modern solder less breadboard socket consists Of a perforated block of plastic with numerous tin plated phosphor bronze or nickel silver alloy Spring clips under the perforations. Interconnecting wires and the leads of discrete components Such as capacitors, resistors, and inductors, power supply, one or more signal generators, LED.Display or LCD modules, and logic probe scan be inserted into the remaining free holes to complete The circuit. A bus strip usually contains two rows: one for ground and one for a supply voltage. Typically the row intended for a supply voltage is marked in red, while the row for ground is Marked in blue or black.

10) IC555 TIMER:

The 555 timer IC is an integrated circuit (chip) used in a variety of timer , pulse generation ,and Oscillator applications. The 555 can be used to provide accurate time delays, as an oscillator, and As a flip-flop element. Derivatives provide two (556) or four (558) timing circuits in one package. In bi stable mode, the 555 timer acts as a SR flip-flop. The trigger and reset inputs (pins 2 and 4 Respectively on a 555) are held high via pull-up resistors while the threshold input (pin 6) is Grounded. Thus configured, pulling the trigger momentarily to ground acts as a 'set' and transitions The output pin (pin 3) to VCC (high state). Pulling there set input to ground acts as a 'reset' and Transitions the output pin to ground (low state). No timing capacitors are required in a bi stable Configuration. Pin 7 (discharge) is left unconnected, or may be used as an open-collector output.

11) POTENTIOMETER:

A potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an Adjustable voltage divider. If only two terminals are used, one end and the wiper, it acts as a Variable resistor or rheostat. The potentiometer is a simple device used to measure the electrical Potentials (or compare the e.g. of a cell). One form of potentiometer is a uniform high-resistance Wire attached to an insulating support, marked with a linear measuring scale. The basic working Principle of this is based on the fact that the fall of the potential across any portion of the wire is Directly proportional to the length of the wire, provided wire has uniform cross-sectional area and The constant current flowing through it. "When there is no potential difference between any two Nodes there is electric current will flow"

IV. CONCLUSION AND FUTURE WORK

Laser security system provides us the security against any crime, theft in our day to day life and So people are installing them in order to stay safe, secure and sound. Various electronic security Systems can be used at home and other important working places for security and safety purposes. It is a great opportunity and source of saving man power contributing now a stage of electricity. The "Laser Security System" is an important helping system. Using this system robbery, thefts & Crime can be avoided to large extend. Avoiding thieves results in the safety of our financial assets And thereby this system provides us protection against all. The Laser & LDR system is highly Sensitive with a great range of working. The system senses the light emitted by the Laser falling Over the LDR connected with the circuit. Whenever the therefore it is well suited to surveillance, industrial application and smart environments. of light is interrupted by any means, It triggers the alarm or siren. This highly reactive approach has low computational requirement, Therefore it is well suited to surveillance, industrial application and smart environments.

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ADYPU Student Smart Gas Detector: Early Alerts, Instant Safety

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ABSTRACT: Explosion occurred due to gas leaks have become a serious problem in our day to day lives. Home safety has become a huge problem due to increasing gas leak accidents. Many fire truck accidents are caused by poor-quality used rubber-tubes or shutting off the regulators when not in use. That's why developing a gas leak detection system is very good objective and necessary. The survey states that any gas leak in LPG occurs so care should be taken as to how the gas leak detection system is used in safety systems in various automation and how the necessary safety can be taken to prevent an explosion of LPG.

KEYWORD: LPG, Wi-Fi Module, Arduino, Buzzer, Microcontroller sensor (Gas, Sound).

I. INTRODUCTION

Gas leakages are a serious problem and are found in many residential, industries and vehicles such as Compressed Natural Gas (CNG). Gas leaks have been reported to cause accidents in many places. Gas leaks due to increasing demand from LPG users are often to improper and untimely action, leading to many dangerous accidents. An effective method by installing a safety system such a situation as well as monitor the level of LPG in the cylinder is required so that users are aware of remaining Gas in cylinder. There have been many accidents due to gas leakage in the last few years. There are some similar examples due to gas leakage. Due to gas leakage, LPG leak at one place in Pune caused loss of 4 people. And another example is, A 45-year-old women, two boys and a girl were suffocated to death in a fire at a residence in Shahdara after an LPG cylinder exploded. The house caught fire due to leak in the LPG gas cylinder, resulting in the death of 4 people.

II. LITERATURE SURVEY

We have observed gas leakage and LPG levels where gas leakage occurs automatically. We have suggested that gas leakage is performed by various gas sensors. It has worked on gas leaks and mentions that we can take care if a found using a sensor and gas booking can be done automatically when a small amount of gas is taken closed. [1]

RFID tag microcontroller, pressure sensors and buzzers are used to monitor gas. Through this paper important parameters are used to find the level of gas in the container. The good purpose of this project is to get notification of gas leak to user when gas leakage is started. Arduino was originally created as a tool for fast sampling and activities for students with no knowledge for electronics. This paper uses a microcontroller, buzzer and a gas sensor to detect gas leakage system. [2]

When a gas leak is detected by a gas sensor, the microcontroller turns on the buzzer in critical condition. The author suggest that this message or instruction may be displayed using an LCD display for LPG monitoring. [3]
The proposed system detects LPG leaks and alerts customers. The alarm starts when the system notices and increases in LPG leakage concentration by sending an alarm and sending a message to specific mobile phone. The device assures safety and prevents explosions. A microcontroller-based system based on gas sensor (MQ2) has been developed in proposed system to detect LPG leakage. The unit is also integrated with an alarm unit to detect signal a leak. [4]

III. METHODOLOGY OF PROPOSED SURVEY

EXISTING LPG GAS LEAKAGE DETECTION AND MONITERING SYSTEM :

Sensors, microcontrollers, LCD display, Arduino UNO Dip,700p Bread board and buzzer are the material used for gas leak. It is used to convert power supply system area from alternative current to direct current.
MQ2 SENSOR: The MQ2 Sensor is used in Gas Leakage Detection equipment in family and Industry.
ARDUINO UNO DIP: An Arduino is a microcontroller, whose main goal is to make electronic to be as easy as possible. It is providing Integrated Development Environment (IDE). Arduino contains several numbers of parts and integrated interfaces in a particular circuit board.

LCD DISPLAY: The LCD (liquid crystal display) contains two interfaces on upper and lower side of the module. The 16x2 LCD display has the height and width size of 80.0 x 36.0 mm and containing VA size of 66.0 x 16.0 mm and thickness of LCD 13.2 mm. operating power supply ranges from +5.0 V or +3.0 V.

BUZZER: A buzzer is an audio signalling device which is capable of controlling microcontrollers IO via, with the working voltage of 5V. If the LPG sensor detects a gas leak at workplace or at home, the sensor will detect the noise, and the gas leak will stop.

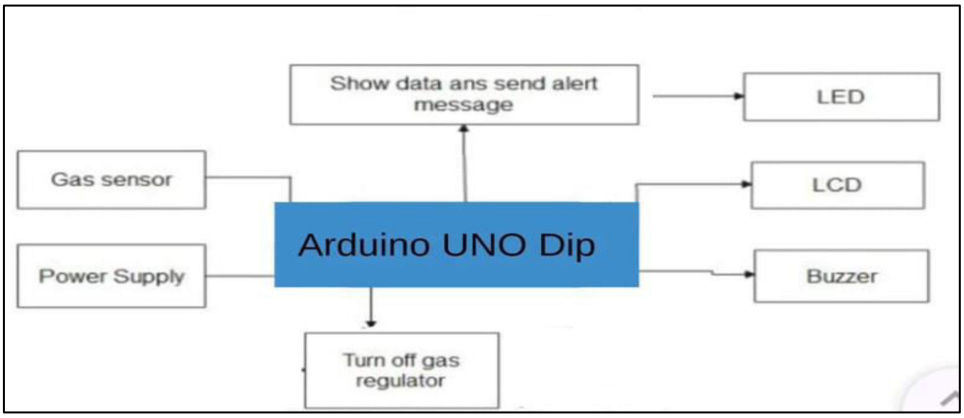

Fig 1: - Flowchart of LPG Gas Leakage Detector System

PROPOSED SYSTEM: -

Proposed work suggests that to ensure LPG leakage detection. our project has four modules which are LPG leakage detection, Gas flow control, on off the gas using android app, and weight monitoring.

First module checks the gas leakage and sends notifications to the user .
Second module is flowing control of LPG gas to maintain flame of gas constant .
Third module is to ON/OFF the gas. This module automatically ON/OFF the gas whenever user wants to ON or OFF the gas .
Fourth module is weight monitoring which check the amount of remaining gas in the cylinder and sends notification to the user.

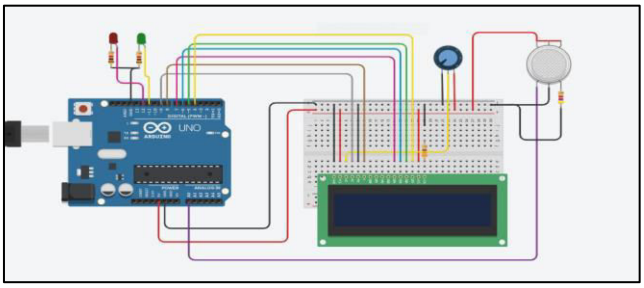

Fig 2: -Circuit OFF (Gas not detected)

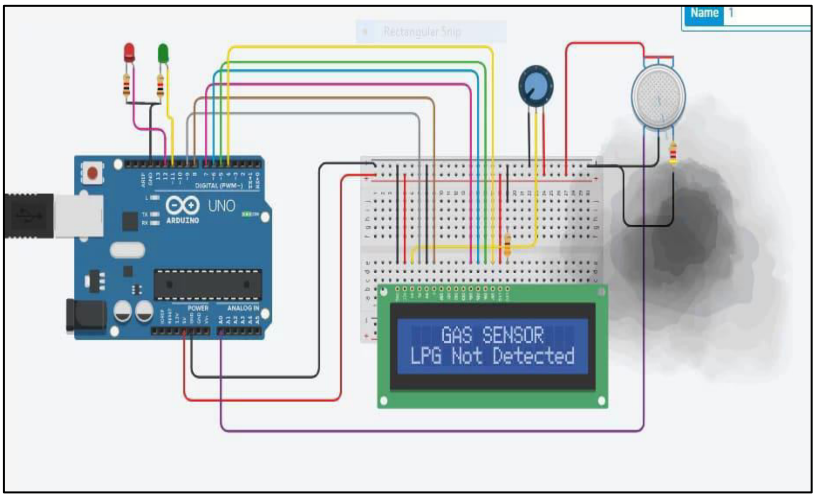

Fig 3: -Circuit ON (Gas is detected)

V. CONCLUSION

The proposed system monitors and develops LPG gas leaks that detect air leaks and if it exceeds the safety level, its buzzer and sends notifications using mobile. This user is alerted to the dangers and unusual situations to perform the required activity. Gas leaks not only pollute the environment but also dissipate gases, damaging our economy. This system will help if such a situation arises. This proposed system can be used in case of leakage of LPG gas in commercial areas like hospitals, shops and hotels .We can avoid dangerous accidents caused by gas leakage with the help of gas leak detection system .

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Text and Speech to Sign Language Converter

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ABSTRACT: Communication is a fundamental human right, yet the deaf and hard-of-hearing community often faces barriers in everyday interactions. This paper presents a comprehensive review of a web-based Text and Speech to Sign Language Converter that aims to bridge the communication gap between hearing and non-hearing individuals. The proposed system utilizes 3D Models and voice recognition systems to convert spoken or written text into sign language gestures. The paper discusses existing methodologies, technological advancements, challenges, and future prospects of such applications.

I. INTRODUCTION

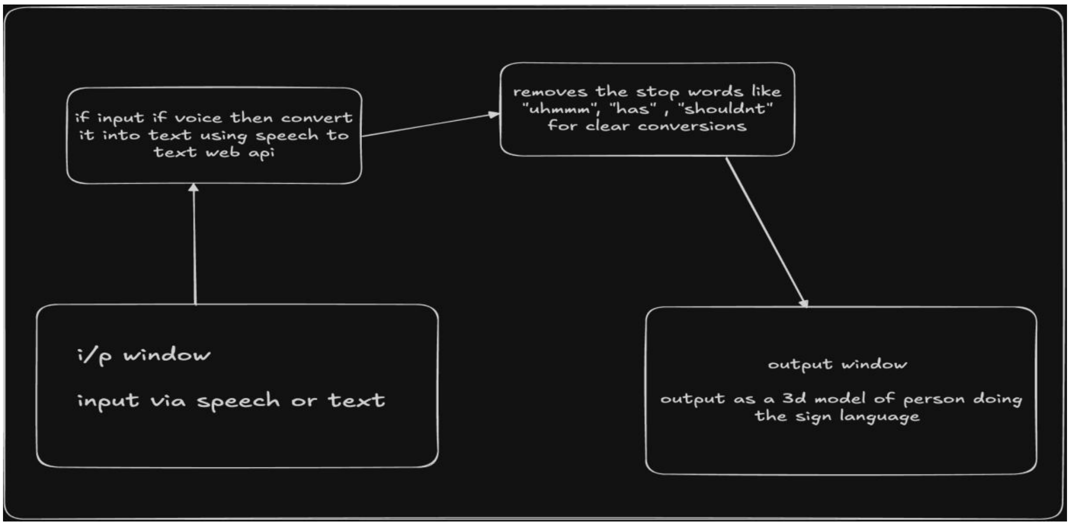

Fig.1 Flow chart

Language is a primary mode of communication, but for the hearing-impaired community, sign language serves as an essential medium. However, a significant challenge arises when individuals unfamiliar with sign language interact with deaf individuals. A web-based Text and Speech to Sign Language Converter can help in real-time translation of spoken or written text into sign language, improving accessibility and inclusivity.

II. LITERATURE REVIEW

Sign language is a method of communication that uses hand movements between fellow people with hearing loss. Problems occur when communication between normal people with hearing disorders, because not everyone understands sign language, so the model is needed for sign language recognition. This study aims to make the model of the introduction of hand sign language using a deep learning approach. The model used is Convolutional Neural Network (CNN). [1] Gomez, L., & Patel, R. "Deep Learning Approaches for Sign Language Recognition: A Survey," IEEE Transactions on Multimedia, 2023.

Sign language is a special visual language for both congenital DHH and acquired DHH people, and it uses both manual and nonmanual information for visual communication. Manual information includes shape, orientation, position, and motion of hands, while nonmanual information includes body posture, arm movements , eye gaze, lip shape, and facial expressions.[2] Lee, J., "NLP Approaches for Sign Language Translation," International Journal of Linguistic Computing, 2023.
The role of a sign interpreting agent is to bridge the communication gap between the hearing-only and Deaf or Hard of Hearing communities by translating both from sign language to text and from text to sign language. Until now, much of

the AI work in automated sign language processing has focused primarily on sign language to text translation, which puts the advantage mainly on the side of hearing individuals. In this work, we describe advances in sign language processing based on transformer networks [3] Wang, X., & Chen, Y. "Neural Machine Translation for Sign Language: A Transformer-Based Approach," Computational Linguistics Journal, 2022.

AI technologies can play an important role in breaking down the communication barriers of deaf or hearing-impaired people with other communities, contributing significantly to their social inclusion. Recent advances in both sensing technologies and AI algorithms have paved the way for the development of various applications aiming at fulfilling the needs of deaf and hearing-impaired communities. [4] Ahmed, T., & Williams, J. "Web-Based 3D Avatar Representation for Sign Language Translation," Journal of Web and AI Technologies, 2023.

Regarding the limitations of traditional web real-time communication solutions such as polling, long-polling, flash plug-in, propose that using new coming Web Socket technology in the web real-time communication field, introduce the features of Web Socket technology, analysis the difference between Web Socket protocol and HTTP protocol, offer an approach to implement the Web Socket both in client and server side, prove Web Socket can decrease network traffic and latency greatly by an experiment, made the prospect of future application of Web Socket in web real-time communication[5] Research of Web Real-Time Communication Based on Web Socket

III. METHODOLOGY

Overview:
This system converts spoken language into sign language using speech recognition, natural language processing (NLP), and animation generation. It enhances communication accessibility for the deaf and hard-of-hearing community through a web-based platform.

A. Speech-to-Text Conversion

1. Speech Recognition
   - Uses Automatic Speech Recognition (ASR) models like Google's Speech-to-Text API to transcribe spoken words.
   - Employs deep learning techniques (RNNs, transformers) for accuracy.
2. Preprocessing
   - Removes stop words, corrects grammar, and structures text for sign conversion.
   - Identifies key phrases and named entities for better sign representation.

B. Text-to-Sign Conversion

1. Natural Language Processing (NLP)
   - Tokenizes text, tags parts of speech, and analyzes sentence structure.
   - Ensures accurate translation into sign language grammar.
2. Sign Language Database
   - Uses datasets like ASL-LEX and RWTH-PHOENIX-Weather for gesture mapping.
   - Incorporates variations in signs, including facial expressions.
3. Animation Generation
   - Utilizes 3D avatars or pre-recorded videos for sign display.
   - Uses AI-based motion capture for fluid and natural animations.

C. Web-Based Implementation

1. Frontend Development
   - Built with Django, HTML, CSS, and JavaScript for an intuitive UI.
   - Supports real-time speech-to-sign conversion with WebSockets.
2. Backend Processing
   - Uses Python and Django for API integration and request handling.
   - Stores recognized text and sign translations in a database.
3. Cloud Deployment
   - Hosted on cloud platforms like AWS or Google Cloud for scalability.
   - Uses serverless functions and CDNs for fast, secure performance.

This system provides a seamless, real-time solution for speech-to-sign translation, improving accessibility and inclusion for the deaf community.

IV. CHALLENGES AND LIMITATIONS

1. Lack of Dataset: Sign language datasets are limited.
2. Contextual Limitations: Direct word-to-sign translation may not capture contextual meanings accurately.
3. Sign Language Variations: Different regions have different sign languages (e.g., ASL, BSL, ISL).

V. FUTURE WORK AND CONCLUSION

Future enhancements include improving NLP models for better context understanding, incorporating real-time gesture recognition using webcams, and expanding support for multiple sign languages. A web-based Text and Speech to Sign Language Converter can significantly enhance accessibility for the hearing-impaired community. By leveraging AI and NLP, real-time sign language translation can be achieved, fostering inclusivity.

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Voice Controlled Car

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ABSTRACT: Voice-controlled robotic system is very beneficial in areas where there is a high risk for humans to enter. The voice-controlled robotic system is controlled through voice commands received via Android devices. The integration of the control unit with a Bluetooth device is achieved using a Bluetooth module to capture and read the voice commands. The robotic vehicle operates as per the command received via Android device, for this Arduino is integrated in the system. The controlling device may be any smartphone having an Android OS. The transmitter uses an Android application required for transmitting the data. The receiver end reads these commands and interprets them into controlling the robotic vehicle. The android device sends commands to move the vehicle in forward, backward, right and left directions. After receiving the commands, Arduino operates the motors to move the vehicle in four directions. The communication between the Android device and the receiver is sent as serial communication data. The Arduino program is designed to move the motor through a motor driver circuit as per the commands sent by Android devices. The wireless camera is interfaced with Arduino to record the forward movement of the robotic system which also includes a wireless night vision camera that will not only allow viewing whatever will be recorded in the time but also during the night. A robotic arm is mounted at the front of the system to make changes in the environment along with an LCD screen to view the received commands. An obstacle detector is added to protect the system from obstacles on the way by using an ultrasonic sensor.

KEYWORDS: Wireless communication, Bluetooth, Android, Microcontroller, Arduino, IR sensors, USB cable.

I. INTRODUCTION

A voice-controlled robotic vehicle is a type of robot that can be controlled through voice commands. It uses a microphone to receive voice commands and a speaker to provide feedback. The vehicle is equipped with motors and a motor controller that enable it to move in different directions based on the voice commands. The use of voice commands as a control interface makes the system intuitive and user-friendly, allowing for more natural and faster interaction. Voice-controlled robotic vehicles can have various applications, such as exploration, surveillance, and entertainment. They can be used in hazardous environments, such as search and rescue missions, where it may be unsafe for humans to enter. They can also be used for educational purposes, such as teaching children about robotics and automation. Additionally, they can be used for entertainment purposes, such as remote-controlled toy cars. The design of a voice-controlled robotic vehicle typically involves integrating various components such as a microphone, speech recognition software, and a motor control system.

The microphone is used to capture the user's voice commands, which are then processed by the speech recognition software. The software analyzes the voice commands and converts them into digital signals that are sent to the motor control system. The motor control system then uses these signals to control the movement of the robotic vehicle.

In this project, the robot control car basically works on human speech commands. We can say wireless Bluetooth robot, the android application is installed in our Smartphone which works as a transmitter. The commands are given by this Android application. The robotics car can be controlled wireless voice commands directly from the user. The robot can move forward, backward, left, right, stop and rotation can also be stopped. The Arduino-based voice control car is interfaced with a Bluetooth module HC05 which is connected to the Arduino. The car can be moved easily from one location to another location. The car will be moving according to the voice commands given by the user. This can be moved in forward - move the car in the forward direction, Backward – move the car in Backward direction, left – move the car in left direction, and right – move the car in the right direction, stop – stop the car, rotation – rotate the car according to the different commands given by the user.

II. LITERATURE REVIEW

Multiple literature reviews on voice-related topics in cars include voice-based in-vehicle systems, voice-controlled interfaces, and voice-controlled autonomous vehicles. Voice-based in-vehicle systems: A literature review This review by Adamantia G. Pateli et al. focuses on speech recognition, user interfaces, and usability challenges. Voice-controlled interfaces for in-vehicle systems: A review. This review by Chunwei Zhu et al. discusses the advancements in voice-controlled interfaces for in-vehicle systems. "Arduino Based Voice Controlled Robot" is a paper by Aditya Chaudhry, Manas Batra, Prakhar Gupta, Sahil Lamba, and Suyash Gupta. In this research paper, a system is presented that focuses on the concept of controlling a robot with a human voice. Voice-activated robots are just a practical example of controlling the movement of simple robots by giving voice commands for everyday use. In this system, an Android application is used as a medium to transmit human commands to the microcontroller. The controller can be connected to the Bluetooth module via UART protocol. Speech is received by the Android application and processed by the voice module. [1] "Voice Assisted and Gesture Controlled Companion Robot" is a paper by Ms. Quanitah Shaikh, Mr. Rohit Halankar, and Mr. Akshay Kadlay In this article, the robot is designed for simple control using interactive operator inputs, such as voice and gestures, and object tracking. The system aims to create a prototype of a futuristic automated personal assistant for home and industrial use.

"Voice Controlled Robot Car Using Arduino" by Shubh Srivastava and Rajanish Singh they developed a Robot car whose work is based on an Arduino microcontroller, motor drivers, and a Bluetooth module. The coordination of the control unit with the Bluetooth device is done by using the Bluetooth module to receive and read voice commands. The remote is a smart Android device with a Bluetooth app. The frame equipment consists of a controller equipped with a Bluetooth communication module. It will connect to the car engine and other spare parts. When the Bluetooth app is opened and connected to the current system via Bluetooth, users use the functions already programmed in the app to issue commands wirelessly from the app to drive the car. The vehicle will move in four directions: forward, backward, right, and left.

III. METHODOLOGY OF PROPOSED SURVEY

- Install any Bluetooth Application for Arduino.
- When the app is operating in the system, the microphone on the mobile is used to identify user voice commands.
- Pair the HC-05 Bluetooth module with the smartphone using the security key "1234" or "0000".
- Click on the "MIC" icon in the app to speak the desired command to the robot.
- Commands are interpreted and the program utilizes Google's speech recognition software to translate voice to text within the app.
- The text will then be sent with the aid of smartphone's Bluetooth to the receiver part.
- These commands are received on the robotic device with the help of Bluetooth module set integrated in it.
- The Bluetooth Module receives the string, decodes it and compares it with the Instructions that are described in the program and moves the robot as per the command.
- The L298N motor driver circuit is used to run the DC motors and manipulate the velocity of the car.
- The ultrasonic sensor detects any object in the path of the vehicle.
- The complete circuitry is powered by a 12V rechargeable battery.

Figure 1: Circuit Diagram

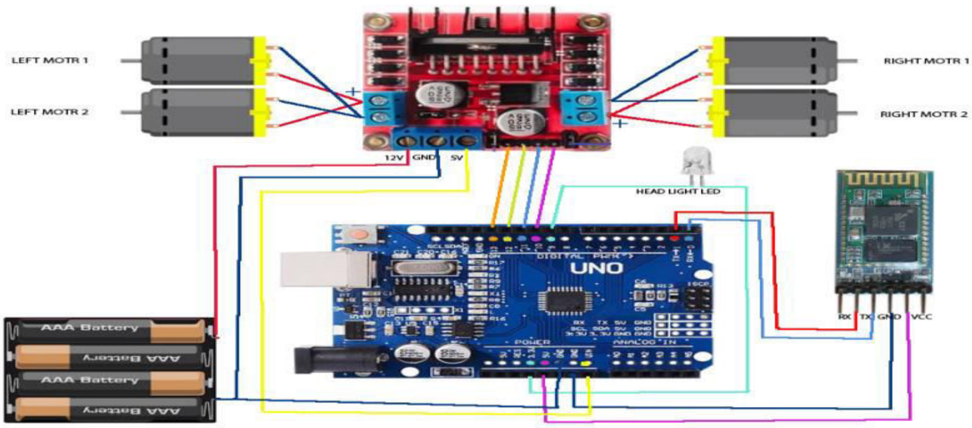
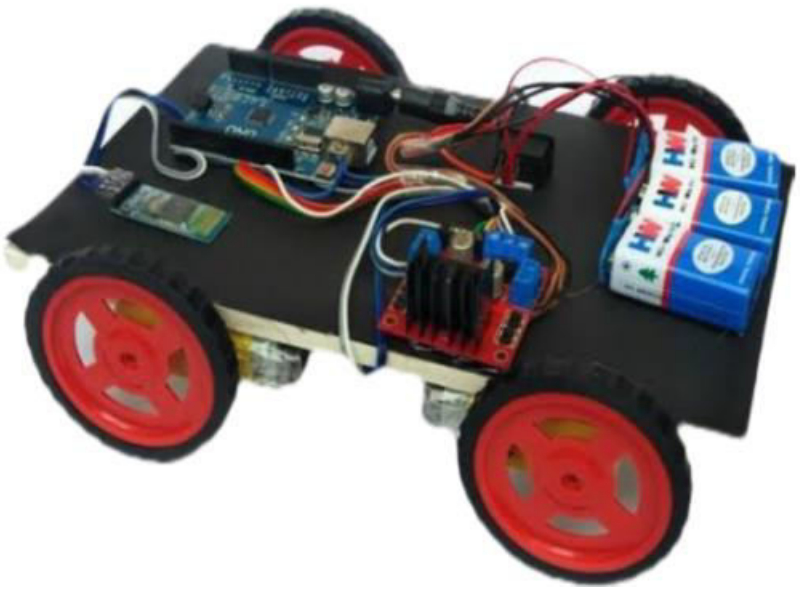


Figure 2 : Model



Hardware and Software Requirements:-

1. Arduino Uno:- It is used in the programming and software field Arduino has become very popular in the world in recent times .Arduino fast wiring & processing projects. Arduino boards can read inputs - a 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.
2. Bluetooth Module: It projects control by voice command through Arduino UNO and Bluetooth technique, and it easily performs when the user gives the command via Bluetooth. Then, Arduino UNO accepts the command and performs according to the command.
3. Motor Driver:- An L293D or similar motor driver IC is needed to control the DC motors, allowing for forward, backward, and turning movements. Microcontrollers are not compatible with motors directly. These circuits can be use motion and rotate motors. The module has two screw terminal blocks for the motor A and B and the power supply 6 Volt one is ground and second one is positive It is used to motor driver pins In1, In2, In3, In4, connected to Arduino uno board pin 4,5,6,7.
4. Gear Motor: The gear motor works on the input of the motor driver. This gear motor rotates clockwise and anticlockwise as well. Which is visible to us as Output similarly the gear motor can also be rotated Right, Left, Back, Forward, and 360°. In this project, the gear motor 300RPM works on the 9 Volt power supply. The gear motor straight actuator and rotating actuator that take into account the exact control of the wheels.
5. The Android App:- In this project, we are using the two Android applications. AMR Voice and Arduino Bluetooth controller application Arduino uno bord communication between motor driver via Bluetooth.
6. Arduino IDE:-This is the software used to write and upload code to the Arduino microcontroller.

IV. CONCLUSION AND FUTURE WORK

It is a robotic device will control the human voice commands through the Bluetooth module. This project works on human voice command with android application. It is easy to use for simple voice command forward, back, left, right, stop and rotation. The Arduino based voice control car is easily controlled to human voice controlling commands are successfully transmitted the signals. Voice control robot is much useful for those area where human cannot reached. This robotic car is small in size so we can use this project for spying or special, implement in this project so we can use this robotic car in police, agriculture purpose, military application, playing for kids, industrial propose and also for surveillance devices. those complete their work accordingly and this project as well as Arduino based voice control car. Our project designnig to used for many devices in this robotic car. The robotics car moves forward, backward, left, right, stop and rotation according to the voice commands forward, back, left, right, stop and rotation. These commands are read using an android application on the users phone which is connected to the robot using a Bluetooth module(HC-05).

It can also be modernized in future Because it has many such devices which have their own characteristics. Which can also do more work, so that it can bring more modernity in the future as well As if you have seen its processing. This is a voice controlled car. If we see it in a larger format then it can be added to any car. And with this help, any physically handicapped person can control the car with his voice and run on the road. Because "Arduino based voice control car" gives it all the control. As if he can move the car with his voice, he also has many controls without any physical touch. They can also turn the car forward, back, right, left, stop and 360° angle or as much as they want. But some controls are also near the car which is connected to it due to Artificial Intelligence. For example, if something in the way while the car is running, using an ultrasonic sensor, the car automatic reduces its speed and stops the car. Its security system is also very much because it is always monitored by the camera installed in it. At present, the range of "Arduino based voice control car" is only 50 meters. But it can be further connected to Wi-Fi to extend its range to at least 1 kilometer. So that can be used to secure the border of our country, we can monitor and spy on the border. We can also use it in agriculture, such as to avoid the chaos of the chaotic creatures in the fields, and it can be used to protect the farm crop from any kind of damage. And in future it can be made even more excellent and useful.

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