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PILLAI COLLEGE OF ENGINEERING

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FROM THE PRINCIPAL'S DESK

The need for ongoing exploration and innovation is critical in today's engineering world and it demands the highest level of creativity. So it has become essential for today's generation to find ways to embrace new experimental learning processes to succeed and move towards more concrete goals. As Principal, I stand with the thought of providing students with the right platform for opportunities in an environment that fosters academic and co-curricular learning.

I am happy that the faculty members and students of electronics and telecommunication department with their teamwork succeeded in bringing out such an innovative journal which portrays various technological advances in the field of electronics and telecommunication. The encouragement and support provided a framework for students to showcase their talent. It gives great pleasure to see the creative expression of students who had contributed to this journal. I am extremely delighted with this journal and I wish to the department staff and students success in their future endeavours.

WITH BEST WISHES,

DR SANDEEP JOSHI

PRINCIPAL

PILLAI COLLEGE OF ENGINEERING

FROM THE HEAD OF DEPARTMENT'S DESK

It has been an absolute pleasure seeing the final year students of the EXTC department work on their projects. The innovative ideas thought and implemented by them is quite impressive. Not only have they made sure their projects are efficient, but they also made sure that it is cost-effective, a factor one needs to keep in mind while making a project with actual use. The papers submitted by them to the journal showcase their work to the rest of the college. By the means of the project, it has been made sure that the work done by these students does not go unnoticed. The efforts taken by the journal committee to make sure the whole college sees the talent of our department is much appreciated and applauded. I wish the students good luck for their future and hope the continue taking such innovative approaches in life.

WITH BEST WISHES,

DR AVINASH R. VAIDYA

HEAD OF DEPARTMENT

ELECTRONICS AND TELECOMMUNICATION ENGINEERING

FROM THE TEACHER'S DESK

The annual journal of the EXTC department is a place where the projects formed by the student of the department are showcased in front of the whole college. The papers submitted by the students act as an excellent source of information that can be referred by the other students. The hard work done by the Journal committee has been immense. The committee members not only designed the journal but also lend a hand to the students writing the papers. The punctuality with which the work has been done by them is really commendable. The technical papers submitted this year showcase how innovative the thinking of the students has become and indicates towards a promising future. I wish good luck to the committee and look forward to more wonderful issues of this journal.

PROF. JAYASHRI D. BHOSALE

ASSISTANT PROFESSOR

ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Project Work is a learning experience which aims to provide students with the opportunity to synthesize knowledge from various areas of learning, and critically and creatively apply it to real-life situations. This year's projects have all been very much fascinating and at the same time productive in their own way. We came across various networking projects, energy management based projects which are the need of present-day scenario and many more such amazing works. All of which was cost-effective as well as creatively executed, showing the capability of the students to think outside the box. The members of the journal committee have worked immensely well in showcasing the potential of our department students. The journal team was swift enough to get things done before the deadlines and made sure that the papers submitted did not have a shred of error. I appreciate the cooperative spirit and the attention to detail that enabled us to streamline the entire process to achieve success and meet our goals.

PROF. SUCHITRA PATIL

ASSISTANT PROFESSOR

ELECTRONICS AND TELECOMMUNICATION ENGINEERING

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FOREWORD

SOLARIO - UNMANNED SOLAR AERIAL VEHICLE

The charge generated by solar panel is received and stored energy is divulged to a DC motor that runs the brushless motors.

IOT BASED PRECISION FARMING SYSTEM

An irrigation solution using IoT is provided to farmers.

BRAILLE LANGUAGE PRINTER

Implementation of a printer for the visually impaired. Digital text is converted Into Braille and embossed on paper.

LAND MINE DETECTION SHOES

The shoes provided to the military soldiers will have the ability to detect metallic landmines by using pulse induction.

TRAFFIC DENSITY CONTROLLER

Convolutional neural networks (CNN) are used for counting the car on road for traffic management.

LI-FI BASED VOICE CONTROLLED ROBOT

Li-Fi communication based voice operated robot.

COIN BASED WATER DISPENSER SYSTEM

Water /cola dispenser that uses motors and sensors.

CRACK DETECTION USING IMAGE PROCESSING USING CNN

Crack detection is necessary for maintenance of concrete structures. UAV's play a big role in this.

ZIGBEE BASED WIRELESS COMMUNICATION USING ADVANCED ENCRYPTION STANDARD

A half duplex wireless encrypted communication module using zigbee.

WIRELESS HUMANOID BIONIC ARM ON ROBOTIC VEHICLE

A system is designed to create a wireless humanoid bionic arm which will be used in robotic vehicles.

SOLDIER HEALTH AND POSITION TRACKING SYSTEM WITH SPY ROBOT

Army personnel health parameters are monitored like heart beat, body temperature, etc. using body sensor networks.

SOLARIO - UNMANNED SOLAR AERIAL VEHICLE

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Abstract— **Drone or a Quadcopter is an aerial vehicle which can be driven independently or by pilots on the ground. They are called rotorcrafts because unlike helicopters or planes they do not contain fixed wings, instead here lift is created with the help of circling narrow-chord airfoils. Drones (unnamed aerial vehicle UAV) are of different types and they have different uses depending upon the configurations. To have the power over the motion of the vehicle it is necessary to vary the revolution rate of one of the motor discs, thereby altering its lift and torque weight characteristics. To complete a required job, quadcopters have different structures according to it. Motors, batteries, electronic speed controllers are the elements that change depending on the power needed and work to be done by the quadcopter. Besides applications like a GPS or cameras or infrared cameras are used in aid to missions like disaster assistance, cultivation, search and rescue, and 3D mapping of the natural features of an area. One of the front runners in the area of renewable energy resources today is solar power. Solar panels are used to capture solar energy and convert into useful electrical energy. The paper illustrates how the charge generated by an array of solar panels is received and its battery pack is to be controlled using a microcontroller-based charge controller to ensure efficient storage of charge in a battery pack. The stored energy would be divulged to a DC motor which would run the brushless motors**

I. Introduction

Nowadays, there is an increased demand for natural resources such as fuel, coal, etc. As our world is getting closer, the need for transportation has increased, thus increasing the number of motor vehicles. This leads to increased use of fuels. This is the reason for the depletion for our most important resources like fuel and minerals. This project is designed to build a solar drone that is completely eco-friendly. The applications of the alternate energy and resources, as well as to build a practical solar drone to generate the power that could have real-world application upon future technological advances. This project is a strongly innovative design using local technologies and resources. In this new technology, there is no use of electric power. Quadcopter are devices that are operated using a remote have four arms which are made up of propellers in the X formation. According to the criterion form, two propellers will rotate in a clockwise way and the other two will rotate in an anti-clockwise way, permitting the vehicle to ascend perpendicularly, glide above the air in a selected manner. By adding up four motors and propellers each to a lightweight border constructed with a fiberglass substance or carbon fiber which is linked to a remote-control transmitter through a small control board fixed with a gyroscopic stabilization network and attached to a lithium polymer battery. These crafts are comparatively easy to build.

The fast progress in calculating the power, the productiveness of the components like small microprocessors, brushless dc motor and gyroscopic

II. System Model And Problem Definition

Frame: In designing a quadcopter's frame we have to take into consideration the weight that has to be borne by the quadcopter along with the weight of all the components itself. To further reduce the weight of the quadcopter perforations can be made to the body of the frame. The quadcopter frame can be made up of several materials including plastic, aluminum, carbon fiber, etc.

ESC: Electronic Speed Control is mainly an electronic circuit whose principle is to change the electric motor's swiftness, path and to also to operate as an energetic break.

The ESC circuitry can be a standalone unit that can be plugged into the receivers throttle control channel. Regardless of the type of ESC used it construes the control information in a way that changes the switching rate of networks of FET. The quick switching of the transistors is the cause that the motors emit its typical extreme loud whine. From a partial voltage from an on-board DC power input, the brushless ESC creates a three-phase AC power output.

In general, ESC is rated according to utmost current, e.g. 25 amperes. The ESC's tends to be heavier if the rating is larger, which is a feature used in balancing the quadcopter.

Esc's are an essential component of the modern quadcopter that provides features like high power, high frequency, high-resolution three-phase AC power to the motors in a tremendously small package. These crafts rely on the changeable speed of the motors driving the propellers. This large difference and fine RPM control motor speed is necessary for a quadcopter to take off.

In a general quadcopter, ESC's can rapidly fill in rate compared to the standard 50 Hz signal used in most other RC applications. PWM signals up to 400 Hz can be used in many cases and the rate can be amplified even higher by other control options. Low pass filter is software delays that are removed to perk up the control latency.

Solar panel: There are different types of solar panels available, namely, monocrystalline silicon, polycrystalline silicon, and Amorphous Silicon thin-film modules.

Monocrystalline silicon solar panels are one of the most efficient types of solar panels and they have square-shaped cells. These devices have the most silicon content out of all the different panel types, which makes them more expensive to make but conversely they take up quite less relative space. These solar panels are typically used in high-reliability applications like telecommunications. Polycrystalline silicon solar panels use less silicon, which makes them somewhat less efficient. However, the unique design, which features strips of silicon wrapped around rectangular conduit wires, allows them to function more efficiently. Certain circumstantial use of polycrystalline silicon solar panels such as when used on rooftops can yield efficiency as close to as those of monocrystalline silicon solar panels.

Components	Specifications
Microcontroller	STM32
Brushless Motor	1400 KV
Li-po Battery	2200mAh
Solar Panels	Polycrystalline 250-400watts
Electronic Speed Controller	Input Voltage: 11.1 ~ 11.7 V; Constant Current: 30A

PROBLEM DEFINITION

The main problem that arises in the flight of the quadcopter is the self-levelling of the quadcopter. Due to those problems that arise during self-levelling the quadcopter flips on its self and cannot lift in the air.

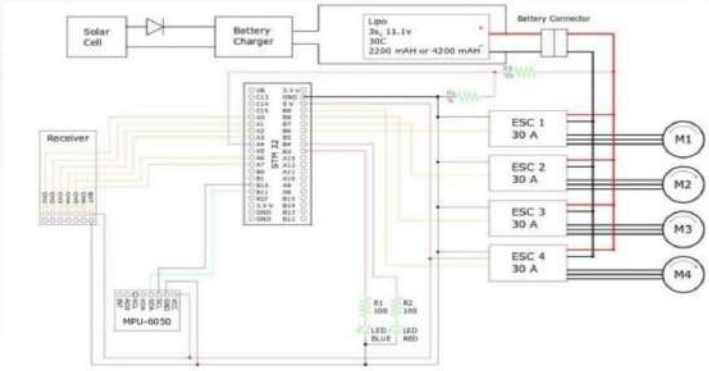
Another problem that arises ifs the difficulty in the ESC calibration wherein the four rotors of the copter does not rotate in synchronization.

III. Flight Control

At the center of rotation, each rotor has its force and torque that pulls the force in reverse to the vehicle's path of flight. If all the rotors are turning at the same angular velocity, with rotor one and three rotating clockwise and rotor two and four anticlockwise, the total aerodynamic torque and the angular acceleration about the yaw axis is exactly zero. This is why the tail rotor is not necessary on conventional helicopters. By mismatching, the balance in aerodynamic torque yaw is induced.

IV. Methodology

UAVs needs a set of basic instructions for it to balance and move swiftly. So, there are components such a PID, IMU, Gyro, Radio controller which needs to be set to maintain a drone. First, PI (Proportional, Integral, Derivative) is an instrument used in industrial control applications to regulate temperature, flow, pressure, speed and other process variables. It is initialized with values in roll, yaw, pitch. The setup of IMU and gyro is manually done. Calibration of Drone is done for Gyro and IMU. The receiver is connected to the transmitter which is in a radio controller. Throttle, yaw, roll, the pitch is set for a controller. The battery is connected and the motor is controlled by the electronic speed controller.



V. Application

Surveying of objects and ground-based on orthographic photos. UAVs are used for Civil uses like aerial crop surveys, aerial photography, search and rescue, an inspection of power lines and pipelines, counting wildlife, delivering medical supplies to otherwise inaccessible regions, and detection of illegal hunting, reconnaissance operations, cooperative environment monitoring, border patrol missions, convoy protection, forest fire detection and monitoring, surveillance, coordinating humanitarian aid, plume tracking, land surveying, fire and large-accident investigation, landslide measurement, illegal landfill detection, the construction industry, smuggling and crowd monitoring. UAVs are especially useful in accessing areas that are too dangerous for manned aircraft.

VI. Acknowledgement

The upcoming success and outcome of this project require a lot of guidance and assistance from many people and we are extremely privileged to have got this all along the journey of completing our project. All that we have been doing is only due to such supervision and assistance and we would not forget to thank them. We owe our deep gratitude to our project guide Prof. Rubina Shaikh, who took keen interest on our project work and guided us all along, till the completion of our project work by providing all the necessary information for developing a good system. We are thankful for and fortunate enough to get constant encouragement, support and guidance from our HOD Dr Avinash Vaidya and all Teaching staffs of EXTC Department who are helping us in completion of our project work, Also, we would like to extend our sincere esteem to all staff the laboratory for their timely support.

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IoT BASED PRECISION FARMING SYSTEM

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***Abstract*—The intent of the present study is to provide a full proof irrigation solution to the farmers with the assistance of Internet of Things (IoT). The major motive behind this project is to create a cost-effective automated irrigation system to reduce water wastage and this is quite a challenge. The measurement of different parameters is essential to calculate the efficient quantity of water for crops or plants. Since the motive was to make this project cost effective, the system consists of different types of low cost and low power consumption sensors. For example- soil moisture sensor. Setup of ARM 7 LPC 2148 with sensors is used to control the opening of the irrigation valve. Precision Agriculture is growing day by day with the help of technologies provided for communication and control in agriculture. The Internet of things, cloud computing and edge computing are the most important technologies to enhance the connectivity of precision agriculture. The crop fields are monitored with the help of certain IoT devices and sensors, which later on through communication modules deliver a means through which users can get desired information.**

***Keywords*— Crop Analysis, Sensors, LPC2148, Poly-House.**

I. INTRODUCTION

Farmers in India still practice traditional farming. Natural factors heavily affect farming and along with this a massive manpower is required to carry out farming. Since this profession is largely dependent on physical hard work, most farmer's children prefer to select other career options. A study shows that farmers prefer selling their cultivable land to builders to earn quick money. This has made it necessary to increase productivity from the shrinking farmlands which in turn feed the billion plus population of India in the future. Precision agriculture will provide a solution to it. It is known that IoT is the collaboration of electronics engineering and computer sciences to solve traditional problems of farming [1]. Thus making use of specialized equipment, software and IT services. This approach accesses real time data about the conditions of the water content in soil, environment temperature, along with other relevant information. The software uses the data to provide guidance to farmers about irrigation, harvesting times, soil management and crop market rate. [2]

Scope

Farming in recent years has faced several drawbacks due to migration of people from rural to urban areas. Due to this the farmers are switching to a new way of farming called precision farming. The main scope of precision farming is to increase the yields and production of crops without the losses of resources and manpower. In our project we maintain a database which increases all the necessary data for farmers. Precision farming is mainly used in poly house, greenhouse farming for the production of particular types of crops.

The Challenges that we are going to face are complex coding of ARM7 and installing LPC2148 in circuits and combining many circuits. The budget of our project including costs of all the components, controller and other resources is estimated nearly ₹9000. This project is going to help farmers to modernize and to get familiar with new technologies. It will also help farmers in producing a nice quality yield.

1.1. Objectives

The objective of this work is as follows:

- ➔ This project helps provide time efficiency to the farmers and has also reduced the extravagant use of resources such as fertilizers, pesticides, water and electricity.
- ➔ It keeps various factors like humidity, temperature, soil etc. under check and gives a crystal clear real- time observation.
- ➔ To understand the method of feature extraction for content-based recommendation systems and collaborative filtering that may help users for decision making.
- ➔ To identify evaluation metrics used for performance analysis of different recommendation systems.
- ➔ To increase the accuracy and efficiency of agricultural input applications.
- ➔ To deliver this technology to a wide segment of local researchers, environmentalists, farmers and agro-economists.

Table 1 Summary of literature survey

II. LITERATURE SURVEY

Agriculture being a major occupation in India for a long time has faced a setback due to the migration of residents from rural to urban areas. To overcome this trouble farmers should adapt precision farming techniques, one of the oldest ways in agriculture is the manual method of checking the parameters. The cloud computing devices can create a computing system from sensors to tools that observe data from agricultural field images and from human actors on the ground and accurately feed the data into the repositories. This idea proposes a noble methodology for smart farming by linking a smart sensing system and smart irrigation system wirelessly. It proposes a low cost and efficient wireless sensor network technique to acquire the soil moisture and temperature from various locations of the farm and as per the needs of the crop, controllers take the decision whether the irrigation has to be enabled or not.

2.1. Automated Irrigation System Using a WSN and GPRS Module

Joaquin Gutierrez, Juan Francisco villa- medina in 2013 Proposed an automated irrigation system using a wireless sensor network and GPRS module. The system was developed for optimized usage of water for agriculture crops. It consists of a wireless network of soil moisture and temperature sensors placed in the root zone of the plant [4].

2.2 Real- Time Automation and Monitoring System for Modernized Agriculture

G. Meena Kumari et al.2017 proposed a technological development in Wireless Sensor Networks made it possible to use in monitoring and control of greenhouse parameters in precision agriculture. In the Field bus concept, the data transfer is mainly controlled by a hybrid system to automate the system performance and throughput. The atmospheric conditions are monitored and controlled online by using Ethernet IEEE 802.3. [5].

2.3 Internet of Things and Cloud Computing for Agriculture in India

IOT and cloud computing technology can be effectively used to increase the crop production to meet the growing needs of increasing population in India. M2M being the integral part of IOT is helpful to sense the geographical requirements by tracking the land where we want to implement IOT. Cloud computing along with IOT is helpful to charge pay per usage and thus reducing the cost in agriculture.[6]

This report provides a summary of a comprehensive review and synthesis of published research on the various projects which are based on farming. Which gives an idea about Growth in the agricultural sector is necessary for the development of the economic condition of the country. Also, various techniques to provide farms to increase the production and field cultivations, also better crop conditions.

SR No	Author	Paper	Advantages	Disadvantage
1	Joaquin Gutierrez, Juan Francisco villa-medina in 2006	Automated Irrigation System Using a Wireless Sensor Network and GPRS Module	The system was powered by photovoltaic panels and had a duplex communication link based on a cellular-Internet interface that allowed for data inspection and irrigation scheduling to be programmed through a web page.	The investment in electric power supply is expensive.
2	G.Meena Kumari et al.2008	An Effective Method for Crop Monitoring Using Wireless Sensor Network	The atmospheric conditions are monitored and controlled online by using Ethernet IEEE 802.3.	Provides only precision values that is not accurate and is not cost efficient
3	Kiran R. Biduaa, Dr. Chhaya N. Patela et al.2015	Internet of Things and Cloud Computing for Agriculture in India.	It is helpful to sense the geographical requirements by tracking the land where we want to implement IOT.	Smart agriculture needs availability on the internet continuously. Rural part of the India did not fulfill this requirements

III. PROPOSED SYSTEM & METHODOLOGY

Precision Farming is a smart system that would help farmers to reduce their manual work and productively grow crops so as to get a better yield. It collects real time data from sensors placed on the farm. Sensors sense the soil moisture of surrounding soil, and this information is sent to Farmer's mobile. This system keeps the farmer updated by timely notifications. This reduces human effort and also makes sure that the required amount of water is given to the crops thus, reduces water wastage and also helps to improve crop quality and economic output of the farm.

3.1 Materials and Methods

In this project firstly the Soil moisture sensor will check the water level of the soil and the DHT 11 Sensor will check the weather. After this, if the water level of the soil is not sufficient then to increase the water level, a water tank will produce the water which will mix with an accurate percentage of fertilizers and pesticides that will be given to a particular crop. This overall data will be saved on the ThinkSpeak cloud database, and this data will be shared to the farmer. It will also monitor the atmosphere i.e. heat and moisture which will help in predicting which crop should be planted and which crop will be suitable for this atmosphere. Also, while using it as a polyhouse if these conditions don't match with the desired

crop requirements then this scenario will be managed using exhaust fans.

3.2 Basic Working

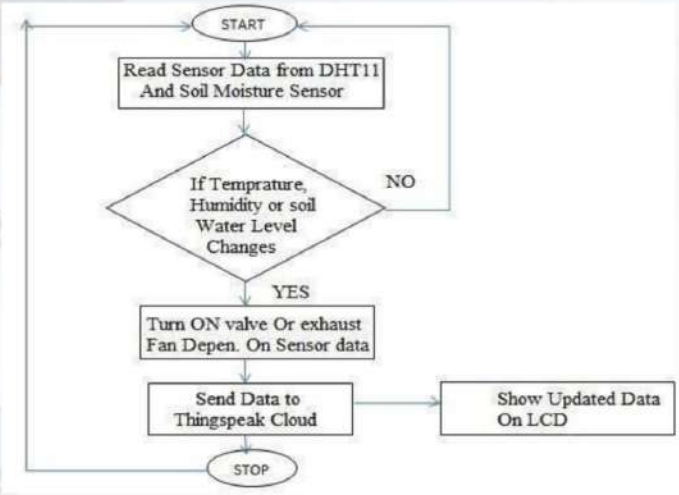

Fig.1 Flowchart

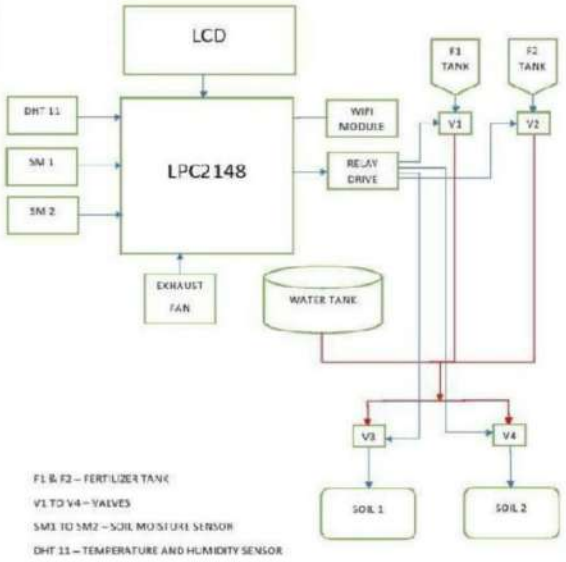

Fig.2 Block Diagram

This project works according to the above flowchart. When the system starts the moisture of soil is measured using Soil Moisture sensor, also the temperature and humidity of the environment is observed using DHT11 Sensor. If the soil water level changes, the system automatically turns ON valves of water tanks and fertiliser tanks which produce the required amount of water and fertiliser to the crops. Also, if the temperature and humidity change, the exhaust fan automatically turns ON. Then the Overall obtained data is sent to thingspeak cloud and shows updated data on LCD.

3.3 Microcontroller Used

ARM 7 LPC 2148 - The full form of an ARM is an advanced reduced instruction set computer (RISC)machine and it is a 32-bit processor architecture expanded by ARM holdings. The applications of an ARM processor include several microcontrollers as well as processors. The architecture of an ARM processor was licensed by many corporations for designing ARM processor-based systems on chip products and CPUs. This allows the corporations to manufacture their products using ARM architecture. Likewise, all main semiconductor companies will make ARM-based systems on chips such as Samsung, Atmel, TI etc.

The LPC2148 is a 16 bit or 32-bit ARM7 family-based microcontroller and available in a small LQFP64 package. On-chip static RAM is 8 kB-40 kB, on-chip flash memory is 32 kB-512 kB, the wide interface is 128 bits, or the accelerator allows 60 MHz high-speed operation. It has 2 kB of endpoint RAM and USB 2.0 full speed device controller. Furthermore, this microcontroller offers 8kB on-chip RAM nearby to USB with DMA. One or two 10-bit ADCs offer 6 or 14 analog i/ps with low conversion time as 2.44 µs/ channel. Only 10-bit DAC offers changeable analog o/p. External event counter/32-bit timers-2, PWM unit, & watchdog.

IV. APPLICATIONS

There are various applications of this project. The applications are followed by the list here.

4.1 Crop Analysis

Another traditional method that can be implemented now is the blanket use of fertiliser and herbicide. Farmers can now use technology to analyse the overall health in minute detail, even down to the individual plants. Meaning fertiliser and herbicide is only administered when required and costs are greatly reduced [8].

4.2 Variable Rate Application

Variable rate application (VRA) in precision agriculture is an area of technology that focuses on the automated application of materials to a given landscape. The way in which the materials are applied is based on data that is collected by sensors. These materials include things like fertilizers and chemicals, and they all help optimize one's crop production [9].

4.3 Polyhouse

Polyhouse farming is a way of protected cultivation in agriculture. The polyethylene plastic is used to cover the structure. It enables the cultivation of high value crops (horticulture) in the structure.

Some are naturally ventilated polyhouses and some are under the total climate control system having motorised screens and ventilators. It proves to be beneficial to the farmers since it enables.

i. Off Season cultivation of vegetables/fruits which enables the farmer to have a better price realisation
ii. Extended life cycle of the crops.
iii. Controlled environment for the crops.
iv. Cucumbers,tomatoes,strawberries, bottle gourd, cabbage, capsicum, flowers etc can be cultivated in polyhouse.

5. Mainly Drip irrigation is employed in polyhouse farming.

4.4 Yield maps

Yield maps are one of the most valuable sources of spatial data for precision agriculture. In developing these maps, it is essential to remove the data points that do not accurately represent the yield at a corresponding location. Map averaging or smoothing is usually done to aid data interpretation. A long yield history is essential to avoid drawing conclusions that are affected by the weather or other unpredictable factors during a particular year. Typically, at least five years of yield maps are desired. Processed yield maps can be used to investigate factors affecting the yield or to prescribe variable rate applications of agricultural inputs according to spatially variable yield goals (yield potential) [10]. Producers interested in precision farming should, however, always evaluate different management approaches to identify those that provide the greatest benefit at a particular site.

4.5 Data Management

IIoT enables easy collection and management of tons of data collected from sensors and with integration of cloud computing services like Agriculture fields maps, cloud storage etc., data can be accessed live from anywhere and everywhere enabling live monitoring and end to end connectivity among all the parties concerned [11].

V. RESULTS AND EVALUATION

IoT's importance is increasing day by day in our lives. There are a variety of applications in this respect. Because these methods are inspired by precision farming techniques, they can also be used to differentiate between different algorithms and software methods. They can be more usable in various applications so one of them is an agriculture area. In today's world, people are beginning to make use of intelligent devices and systems thus; they have a smart assistant thanks to these systems. In this paper, an architecture has been proposed so it helps farmers to manage the irrigation time of their agriculture correctly. The result of it is shown it is efficient in resource consumption. The results of the system that is an application can be of great benefit to the farmer. The user can have direct access to the cloud database where all the data is been collected and stored, also the user can only access the data with id and password. The user can directly divide his own land into as many regions as desired in this application. Therefore, the users will provide saving in their time, water and fertilizer. The ability of the proposed cloud-based IoT system to efficiently collect, store, and process the data needed for different precision agriculture applications. In addition, this application is reliable because the user can check the data even if he is not present there, also he can control the amount of water and fertilizer to the crops.

VI. CONCLUSIONS

Precision Farming is a truly comprehensive approach to agriculture. Precision Farming includes plantation, chemical application, harvesting of crops. Basically, here we use an advanced technology in cultivation with existing agriculture equipment to maximize yield while minimizing losses. Thus, losses come in many terms. These losses can be minimized by clearly getting the idea of the crop which is going to grow in that particular area of soil and the type of the soil which is present in that region. There are various other factors that will be considered like temperature of the soil and the surroundings, humidity of soil, fertilizers and pesticides needed for the crop. This form of agriculture practices to apply nutrients, water, seeds, and other agricultural inputs to grow more crops in a wide range of soil environments. Precision agriculture can help farmers know how much and when to apply these inputs. Farmers also conserve soil for sustainable food production. Precision agriculture also provides farmers with a wide range of information to build up a record of their own farm, improve decision making for better yield, foster greater trace-ability, enhance marketing of farm products, improve lease arrangements/agreements and relationships with landlords, enhance the inherent quality of farm products (e.g. protein level in bread-flour wheat).

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Braille Language Printer

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Abstract **– Many visually impaired people are restricted from gaining any readable content and as we are migrating towards digital format. It has become even more difficult for them to access those content. Braille language is used by visually impaired people to read and write. Braille printer assists those people by converting digital texts into Braille language and embossing it onto the paper. Braille printer takes input from user in the form of text file and converts it and embosses it on the paper in the Braille language.**

I. INTRODUCTION

In the digital era, it has become convenient to access plethora of knowledge, but such access is only beneficial for normal users. To provide such access to visually impaired people tactile writing system also called Braille language is the solution.

Braille printer is the system which helps the visually impaired people, by converting texts in digital format to Braille language and embossing that onto the paper. The user enters the text as the input, the text is converted into Braille language and that is embossed on the paper. Due to this system visually impaired people can be on par with normal people in terms of intellectual progress.

But Braille printers are expensive hence, large number of visually impaired people are left out from accessing such system. Our printer is designed to fulfill the following objectives, cheap, easy to use, and having quality on-par with existing printers hence, large number of people will be able to purchase and use it. Thus, helping the visually impaired people to have the intellectual progress on par with normal people.

II. LITERATURE SURVEY

We have referred to a paper written by Lita, Mazare [9]. In which they have created a Braille printer based on PIC16F877 micro-controller. The system was meant for educational purpose and was fast and efficient but, the design of the printer was complex as it contained 6 stepper motor and solenoids which in turn increased the cost of printer.

The other paper referred by us was written by Kociolek, Wiecek [8]. Their proposal was to use thermoplastic sheets instead of normal pulp-based paper. The printing system is thermal based, and dots are imprinted or erased by local application of heat, which causes embossments or depressions respectively. However, the obvious disadvantage here is the availability of such print media, as well as the fact that the plastic film used has a low heat deflection temperature (40°C). Therefore, the technology is not viable for developing markets or areas where the temperature regularly exceeds the threshold.

The next paper referred by us was written by Padmavati S and Nivedta V [10] focus on the process of printing Braille documents using a dot matrix printer. Since, dot matrix performs functions which are suitable for Braille language, just by increasing the tactile motion of pins in the header. It is possible to print Braille language as per the standard format. But it is difficult to procure dot matrix printer since, most of them are phased out by manufacturing companies and probability of finding a working dot matrix printer is low.

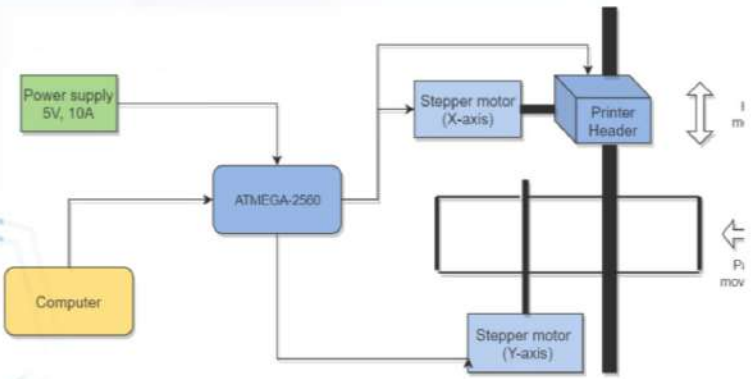
III. PROPOSED SYSTEM

Thus, after reviewing the above systems and analyzing their advantages and disadvantages. We decided to design the system with optimal use of the stepper motors and solenoid, which are the most expensive parts in a printer, while also designing the outer structure of the printer using 3D printing

The proposed system will comprise of micro-controller, a solenoid and a pair of stepper motors, one of which will help to roll the paper in and out of the printer and the other will guide the header to which the solenoid is attached.

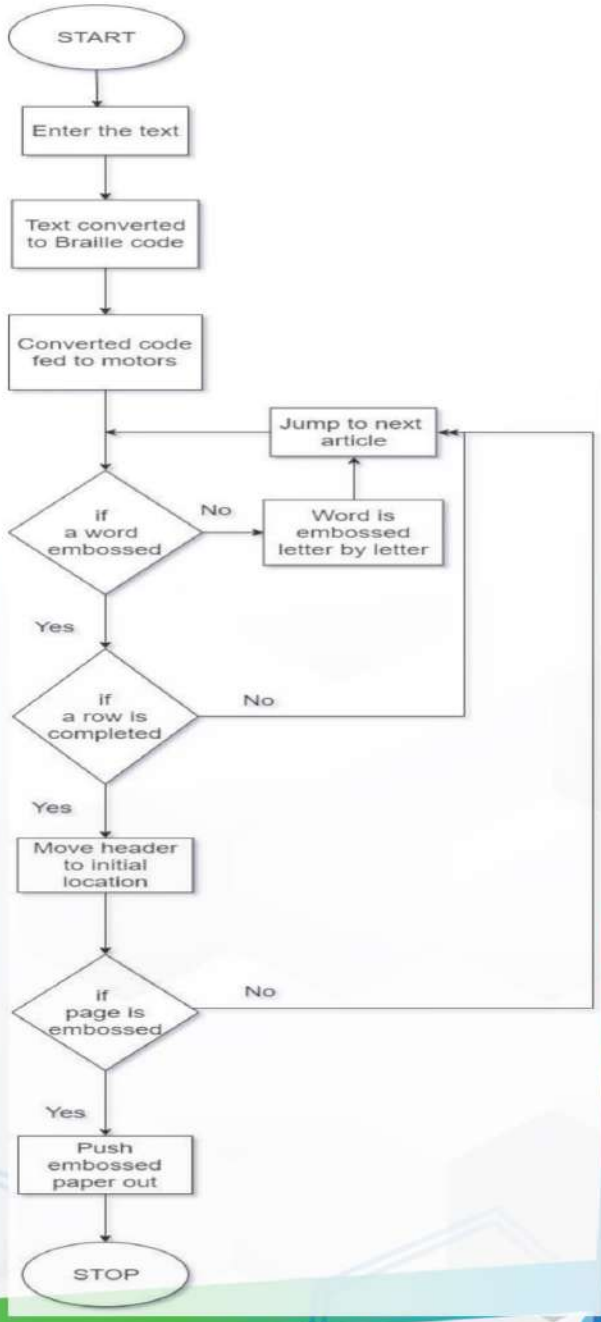
The proposed algorithm is as follows; the user will give text file as the input. The input file is converted into Braille language in which each character is represented by a 3X2 matrix. The micro-controller will acquire those instructions step by step and guide the stepper motors, The header will emboss each character in a top to bottom fashion.

IV. SYSTEM ARCHITECTURE



- **Input File:** The input file is a text file which is generated, when the user enters the input in the provided dialog box. The input file cannot be of any other format like .pdf since, pdf format is equivalent to an image format and it is logically not possible.
- **GUI & Firmware:** The user enters the input un the dialog box provided by the GUI in the user's computer. GUI converts the input into the text document and that text document is converted in G-codes by the firmware. The firmware sends those G-codes to the micro-controller.
- **Micro-controller:** The micro-controller controls the movement of the stepper motors, which in turn aligns printer header (embosser) to the desired position and controls the movement of the paper.
- **Stepper motors:** It controls the alignment of the header and positions it to the required embossing position. After each word, it leaves one Braille character worth of space. When a line is completed it moves the header to it's initial location. And other motor controls the movement of the paper.
- **Printer header:** It consists of a Push/Pull Solenoid which embosses on the paper as per the G-codes. It will embose, only if the input is high"1" and will remain stationary if input is low"0".

V. SYSTEM ALGORITHM



1. The input file is a text file.
2. The characters are processed and converted into G-code format.
3. The header embosses the Braille character as per the format.
4. The word is embossed letter by letter until the whole word is completed. After completion it leaves a character worth of space and the whole process continues
5. The words are embossed until the whole line is utilized. When the line is completely utilized paper is pushed forward and the whole process continues.
6. The lines of words are embossed until the whole page is embossed. When the page is utilized completely, it is pushed outside of the printer and the next page is processed. The process continues until whole file is completed.

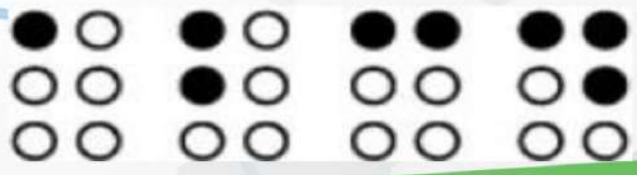
VI. OUTPUT

Input:

Processing the input data, converting it from .txt format to G-code and sent to micro-controller

```
Done
Send gcode? (y/n)
y
Sending data to COM6
A[100000]
B[101000]
C[110010]
D[110100]
Printing the data.....
```

Output:



VII. RESULT

The proposed braille printer can generate printed material using the braille writing system for blind or visually impaired users. It is user friendly and handy. The design is tested for embossing different alphabets. It prints alphabets in Braille language. The printing cost of the proposed machine is reasonable.

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Land Mine Detection Shoes

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***Abstract* — The primary goal of this project is to help the military personnel to detect landmines with an extremely portable and an essential part of military clothing, the shoes. It's been a known fact that the soldier has to carry 60 to 100 pounds (i.e. 27 to 45 Kg) backpack. Along with this, the soldier also has to carry a mine detecting equipment, which adds more to the already immense load they have to carry. To lessen the woes of the soldiers, a mine detecting shoe will ameliorate the situation. This shoe will have an ability to detect metallic landmines . The landmine detecting shoe will be able to detect mines, in the range of nearly 2-3 meters of soldier's proximity. The information or location of that landmine can be determined by using a wearable smart watch. The smart watch will be tailored to display the relevant information i.e. the depth of landmine and information about its proximity, with visuals. Pulse induction method is used for detecting the landmines.**

***Index Terms*— Landmines, Military personnel, proximity, metallic landmine, smart watch.**

I. INTRODUCTION

One of the most insidious remnants of war-torn terrain can be left over landmines. Nearly undetectable and almost always forgotten landmines can cripple and kill innocents well after a conflict has been settled. To help remedy this problem we are developing a landmine detector concept that's easy to use and extremely portable. It is a miniature mine detector that fits inside the sole of a shoe. Built using a conductive metal coil that radiates an electromagnetic frequency the device can spot large pieces of metal that are nearby, including landmines. "The device is with the goal of saving a life, hence the name, first by the families of the victims and second for the cost effects of military forces by the loss of his men in combat. To notify wearers if they're about to stumble into an area where a landmine might be hidden the system also comes with a watch-like interface that alerts the wearer to the position of any nearby trouble with an easy to read locator map.

II. TYPES OF DETECTION TECHNIQUES

A. Ground Penetrating Radar

Ground-penetrating radar (GPR) is a geophysical method that uses radar pulses to image the subsurface. This non-destructive method uses electromagnetic radiation in the microwave band (UHF/VHF frequencies) of the radio spectrum, and detects the reflected signals from subsurface structures.

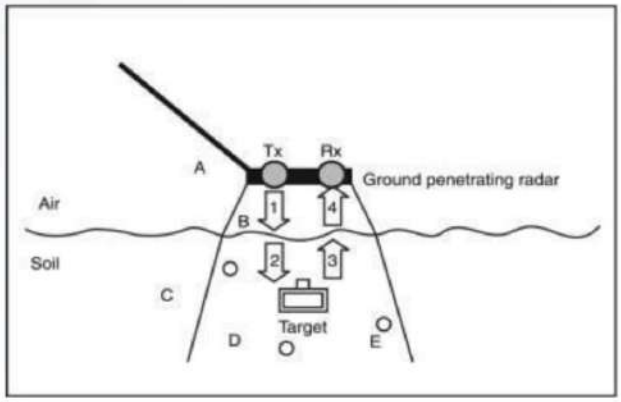

Fig. 1— Simplified description of the basic principles of a ground penetrating radar

B. Detection using Metal Detector

Ggooneratne, C. P., Mukhopahyay, S. C., & Sen Gupta, G. (2004) [2] composed the metal detector (MD) technique which has a primary coil (transmitter) and one or more secondary coils (receiver).A time-varying current in the transmitter coil generates an electromagnetic field, which induces electric (eddy)currents in nearby metallic objects [1]. These eddy currents, in turn, induce a time varying current in the receiver coil, which is amplified and processed to provide an indication for the presence of landmines. The main advantage of this technique is its ability to detect metal objects of dimensions less than 1 cm at a depth of 50 cm. It has low cost, and it is reliable in all weather and soil moisture conditions.

III. PROPOSED SYSTEM

A. Introduction

The landmine detection shoe works in cooperation with smartwatch. The smartwatch performs all the tiny computations whilst the heavy lifting, such as data processing, is done by the microcontroller installed in the shoes. The user wears the smartwatch and shoes in their respective places. When the user commands the smartwatch to begin the detection process the smartwatch sends signals to the microcontroller in the shoe, to begin the detection process. The shoe then initiates the detection using the combination of Ground Penetrating Radar and Metal Detector. The receiving circuitry sends the signals for processing. STM32 processes the data and computes the proximity information of the landmine i.e. the angle and the distance from the shoe. This information is then sent back to the smartwatch.

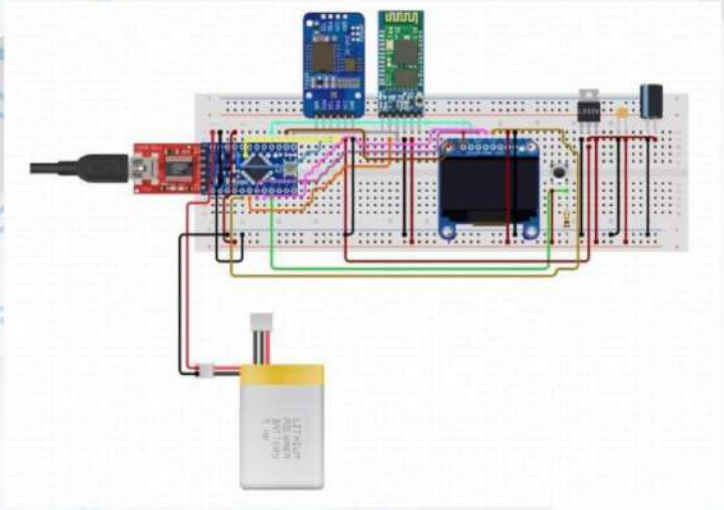

Fig.2 - Circuit connections of smartwatch made using circuito.io

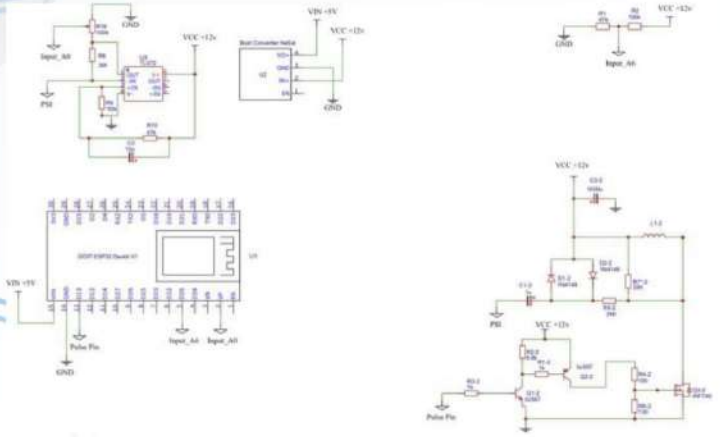

Fig. 3 - Schematic of circuit for shoe's ESP32 microcontroller

B. Pulse Induction for landmine detection

Landmine detection using electromagnetic radiation is based on the difference between the electromagnetic properties of the target and the ground. Several versions of the electromagnetic techniques are currently employed or envisioned to detect buried landmines. These versions typically differ in the operating frequency, the employed bandwidth of the electromagnetic spectrum, the type of the transmitted signals, the interpretation of the reflected signals, or the type of transmitter and receiver. Metal detector (MD), ground penetrating radar (GPR), microwave radar (MWR), millimeter wave radar (MMWR), electrical impedance tomography (EIT) and infrared (IR) techniques are common electromagnetic detection techniques.

- *Metal Detector:* The MD technique is based on electromagnetic induction (EMI). It is composed of a primary coil (transmitter) and one or more secondary coils (receiver). A time-varying current in the transmitter coil generates an electromagnetic field, which induces electric (eddy)currents in nearby metallic objects. These eddy currents, in turn, induce a time varying current in the receiver coil, which is amplified and processed to provide an indication for the presence of landmines.
- *Ground Penetrating Radar:* GPR operates by transmitting an electromagnetic signal into the soil and detecting the reflected signal at the receiver [2]. The transmitter emits a pulsed wave or a continuous wave with a given frequency. The receiver collects the waves backscattered by the discontinuities in permittivity. Discontinuities can be caused by both the buried objects like landmines (useful signal) and the natural discontinuities in the soil (clutter).
- *Microwave Radar:* This technique is based on the transmission of short radio and microwaves (102to3 9 103MHz) radiation pulses from an antenna into the ground and measuring the time for reflections to return to the same antenna. Reflections occur at the boundaries between materials of different dielectric constants that are normal to the incident radiation. Transmitting high frequencies provides high resolution images, but it is subject to high attenuation in the soil. Thus, high frequencies are suitable for the detection of small shallow objects. Conversely, low frequencies achieve lower resolutions but are less attenuated in the soil.
- Millimeter Wave Radar: It is a hyperspectral system that collects images at differentMMW frequencies (from 90 to 140 GHz) using a vector network analyzer that collects backscattering MMW radiation from the buried sample.

C. Implementation Details

The velocity and reflectivity of the electromagnetic wave in soil are characterized by the dielectric constant (relative permittivity) of the soil. When the dielectric constant of the soil is εr, the propagation velocity of electromagnetic waves in this medium is given by

$$v = c/\sqrt{\square\square}.$$

where c = 3×10^8 m/s. Note then that in air (εr = 1), the propagation velocity is then v = c.

When GPR transmits electromagnetic waves from a transmitting antenna located off-the-ground, signals travel in the air layer and when the electromagnetic wave encounters any di-electrical discontinuity, a reflection occurs. The latter is received by a receiving antenna, located off-the-ground, and it is referred to as an A-scan, e.g., a single waveform recorded by GPR, with the antennas at a given position (x, y). In this data set, the time t is the only variable, related to the depth z by the propagation velocity of the EM waves in the medium.

When moving the GPR antennas on a line along the x-axis, a set of A-scans can be gathered, which form a two-dimensional (2D) data set called a B-scan . When the amplitude of the received signal is represented by a colour scale (e.g., gray-scale), a 2D image is obtained and is shown in Figure 6. The

2D image represents a vertical slice in the ground. Reflections on a point scatter located below the surface appear, due to the beamwidth of the transmitting and the receiving antenna, as hyperbolic structures in a B-scan. Finally, when moving the antenna over a (regular) grid in the xy-plane, a three-dimensional (3D) data set can be recorded, called a C-scan.

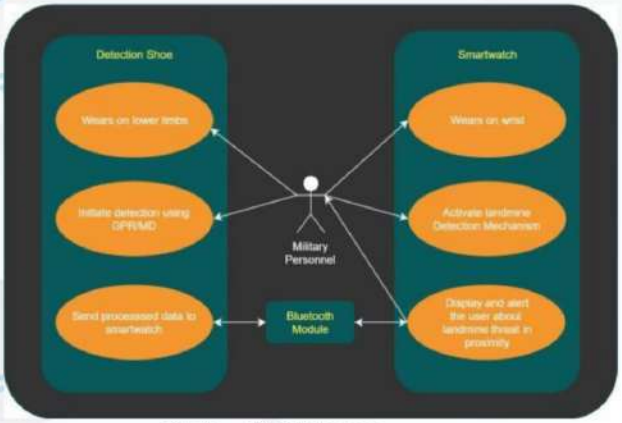

Fig.4 — Final Diagram

C. Data Communication

Data communication between the smartwatch's STM32 microcontroller and shoe's ESP32 microcontroller is established via bluetooth 4.0 technology. The STM32 microcontroller is interfaced with HC-05 bluetooth module via serial port while ESP32 microcontroller has built-in bluetooth antenna. The purpose of using bluetooth as a primary data communication channel was to keep the overall power demand of the system minimum without compromising on the bandwidth and latency.

D. Portability

The landmine detection equipment weighs around 450g with battery and coils while the smartwatch weighs about 50g with battery. The average weight of mine detection equipment that soldiers carry is around 3.8kg. Our solution has obtained remarkable reduction in weight i.e. around 3.3kg have been reduced.

E. Durability and Battery Life Estimate

Landmine detection shoes have battery backup of 24 hr, and smart watch battery life goes up to 48 hr. Durability of shoes and smart is very good, since it can survive in war fields and in kind of weather conditions.

IV. CONCLUSION

The landmine detection wearable equipment caters to the military personnel's woes of heavy weight equipment. We have been able to accomplish the target of making the landmine detection equipment as lightweight as possible.

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Traffic Density Controller

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***Abstract*— The methodologies existed previously to count vehicles from a road image have depended upon both hand-crafted feature engineering and rule-based algorithms. To detect and track vehicles in an image, the above mentioned methodologies require many predefined thresholds. The present study provides a supervised learning methodology that does not require above mentioned traditional approaches. A deep convolutional neural network (CNN) was devised to count the number of vehicles on a road segment based solely on video images. The present methodology does not refer an individual vehicle as an object to be detected separately; rather, it collectively counts the number of vehicles as a human would. The test results show that the proposed methodology outperforms existing schemes.**

***Keywords*—Deep convolutional neural network (CNN), Machine learning, Traffic density, Vehicle counting**

I. Introduction

The traffic state is represented by three customary parameters: traffic volume, speed, and density whereas existing surveillance systems such as loop detectors can easily measure the former two parameters in the field, measuring the density is difficult; although the density is a decisive parameter, service level is determined by it [1]. As computer vision technology has evolved, many researchers have shifted their focus on detecting, tracking, and classifying vehicles from video images, which has reaped very promising results [2-6].

According to the taxonomy [7], existing computer vision technologies to detect and track moving objects can be broken down into three branches: temporal difference, optical flow, and background subtraction.

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Keemin Sohn is the corresponding author and with the laboratory of Big-data applications in public sectors, Chung-Ang University, Seoul, Korea (e-mail: kmsohn@cau.ac.kr). utilizes the differences in two consecutive images to detect objects [8,9]. This method is very vulnerable where unexpected noise occurs. The optical-flow method depends on obtaining an effective background image as a baseline to detect objects [10]. Background subtraction is the most prevalent method in this particular field [11, 12]. This method utilizes a static background image that is prepared in advance, and then regards the image as a foundation against which to compare other images that include objects. Namely, silhouettes are drawn by black pixels with an intensity that surpasses that of the background.

The aforementioned description is only for establishing a difference of objects from the background. Even though localizing pixels of objects is successful, counting the number of objects is often difficult. In order to count objects, another segmentation process is necessary. There have been many different methods used to recognize a blob, ranging from drawing a bounding box based on the convex hull theory [13] to utilizing an edge detector [14]. Of course, machine learning technologies can be applied [13, 15]. Consequently, all existing approaches, at least in part, are dependent on several arbitrarily chosen rules and hand-crafted engineering to extract features.

The present study provides a simple approach to count vehicles on a road segment based solely on video images with no hand-crafted feature engineering. Regression approaches have been used many a times to deal with crowd counting [16-18]. However, studies have rarely utilized a regression approach to collectively count vehicles for the purpose of measuring the traffic density on a road segment, even though this is much simpler than detecting, tracking, and classifying vehicles on an individual basis. The counting of vehicles becomes easy once an individual vehicle has been identified successfully. However, such elaborate technology is redundant where the measured traffic density is utilized simply to evaluate the traffic state (e.g., the level of service) based on the highway capacity manual (HCM) along with traffic volumes and speeds collected from the existing spot detectors. In the study field of traffic-flow theory, measuring traffic density has long been regarded as impossible. Traditionally, the density had to be approximated by the occupancy rate measured from spot detectors. Thus, the success in counting vehicles simply by road images would be a significant breakthrough in advancing existing traffic control and management.

Unlike previous studies wherein a conventional

feed-forward neural network was employed for crowd counting [16-18], the present study adopted a deep convolutional neural network (CNN) to estimate the number of vehicles from a video shoot. CNNs have recently recorded great success when recognizing medical CT images and human faces in a field of computer vision [19-21]. The intent of present study began with the expectation that a CNN must perform well in counting vehicles, which is far more simpler than recognizing medical CT images or human faces.

The next section describes the entire framework of the present vehicle-counting scheme and elaborates on the principle of CNN. Collection of data, training and testing the CNN model is described in third section. The innumerate results and comparisons with those from the most prevalent methodologies, as well as with those from other previous studies adopting various methodologies, are shown in the fourth section. The fifth section draws conclusions and provides possible extensions for the present study.

II. MODELING FRAMEWORK

Preparing data to feed a CNN is the starting point of the present study. The input features of a CNN are the RGBvalues of an image at each pixel level. Whereas a CNN requires no preprocess to extract input features, each input image should have a label, since a CNN belongs to the category of supervised machine learning. In the present study, vehicles within each input image were counted manually in order to tag a label to the image. This labeling task is easier than that performed by existing CNNs to detect objects, which requires drawing a bounding box for each target object. Nonetheless, it may take great effort to manually count vehicles in all input images. An efficient way to circumvent this difficulty will be suggested in the fourth section.

Input images to train and test a CNN model were obtained from video shoots taken at the approach of an actual intersection. Video shoots for every single second were chosen to prepare the input images. Most machine learning models are over-fitted to training data. To avoid over-fitting, the model after training should be validated against a new dataset that has never been used in the training stage. Thus, it is important to divide available input images into a training set and a test set. After dividing the input data, the training set was augmented using various filters, so that a CNN model could accommodate different situations that the original training data did not account for.

Unfortunately, at the present time, there is no systematic way to determine the best model structure for a CNN within a practical computing time. A plausible model structure must be selected by trial-and-error. While finding the best model structure, hyper-parameters should be determined upon a third dataset other than the training and test datasets. To establish a model structure, 5% of the training images were selected. After training, the model performance was evaluated and compared based on the test data that had been separated from the training data. The background subtraction method was chosen as a baseline to verify the utility of the present model. Finally, the comparison was conducted based on three performance indices: the mean absolute error (MAE); the correlation coefficient with observed numbers; and, the percent root mean squared error (%RMSE).

A CNN model within the entire modeling framework played a key role in counting vehicles using a video image. However, it is difficult to explain what mechanism makes it possible to count vehicles. The most plausible way to guess the mechanics is to investigate high-level features that the CNN extracts via filters. The features that the present model extracted from the traffic images are shown and discussed in the fourth section.

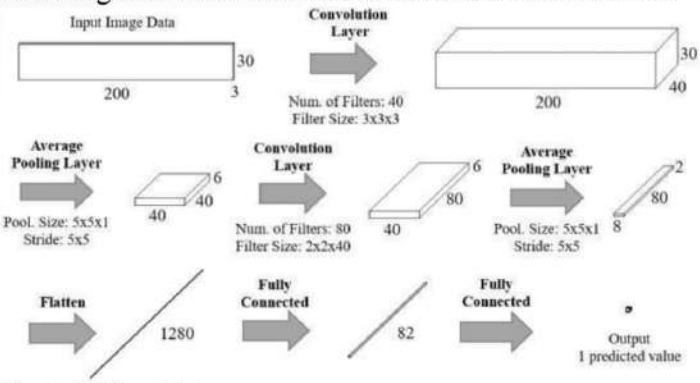

Fig. 1. CNN model structure.

Fig. 1 shows the structure of the CNN model that was adopted in the present study. The original high-resolution (90×600) input images were downsized into a tractable dimension (30×200). Since each input image was in color with RGB values, the dimensions of the input image were $3 \times 30 \times 200$. The first convolution layer was created using 40 $3 \times 3 \times 3$ filters each of which slid through an input image with a stride value of 1. Each cell value of the convolutional hidden layer was computed by the linear combination of all weights of a filter and the values of the portion of a target image that the filter covered, and then was activated by a rectified linear unit (ReLU). The ReLU outperformed the conventional sigmoid function, which is one of the recent breakthroughs for deep learning [22]. At this stage, each filter captured its own basic feature regardless of the feature location within an image. In addition, using filters had the advantage of reducing the number of weight parameters to be estimated, since each filter shared weight parameters wherever it resided within an image. To avoid a layer-by-layer dimensionality reduction, prior to convoluting the filters, target images were padded with null columns and rows that consisted of 0s. After convolution, a new layer was created by pooling each of the 5×5 cells of the convoluted layer with average values, which had a smoothing effect on the images.

At the next stage, a second convolution layer was created by allowing 80 $2 \times 2 \times 40$ filters to slide through the previous pooled layer. The second-level convolution filters extracted more complex features than those elicited from the first-level filters. After average pooling again, the second convolutional hidden layer was flattened to facilitate connection to a generic hidden layer. The connection between the flattened layer and the next fully connected layer was the same as that between two consecutive hidden layers of a feed-forward neural network. The fully connected layer linearly fed the final output layer of a single node that represented the observed number of vehicles.

III. LITERATURE SURVEY

A CNN is known to recognize objects irrespective of scale, location, or orientation. In particular, one of the main motivations of the present study was to confirm whether a CNN can count partially occluded vehicles. Also, real-world traffic images may contain either a few instances of vehicles or a very large number of them. Whether a CNN can count vehicles regardless of congestion level was another issue that the present study tried to resolve. Answers to these questions will be clearly presented in the fourth section.

The training method of a CNN is not different from that of a feed-forward neural network. The basic theory is to derive weight parameters that minimize the sum of squared errors between observed and estimated output values, which is formulated as a loss function. A back-propagation algorithm is used to derive the gradient of the loss function with respect to each weight parameter. The algorithm, however, has a fatal drawback. The derivative of errors is likely to be lessened, as they are propagated from the top to the bottom layers, which is a phenomenon that is referred to as the vanishing gradient problem. Owing to adopting a ReLU for activating the node values instead of the conventional sigmoid function, the back-propagation algorithm successfully trained the proposed CNN model. A ReLU activates node values greater than 0 into themselves and values less than 0 into 0's, which prevents the gradient vanishing problem. Readers who are interested in the details of CNN can refer to this framework.

Another advantage of a CNN is that the number of weight parameters to be estimated can be reduced considerably compared with adopting a conventional feed-forward neural network. A feed-forward neural network has a large number of weight parameters because each cell of an input image should connect to all hidden nodes of the second hidden layer. A CNN, however, takes only filter parameters into account, which makes it possible to recognize a large-dimension image.

IV. CONCLUSIONS

The present study was a demonstration of a unique approach to counting vehicles on a road segment in order to accurately quantify traffic density at an aggregate level for traffic control and management. As compared to existing methodologies, the present approach showed appreciable way to count vehicles at an acceptable accuracy rate. It was concluded that the proposed CNN model is applicable for measuring the traffic density at the HCM level.

However, further studies will be necessary to tackle several difficulties regarding the proposed approach. Even though the proposed model did not require hand-crafted feature engineering and rule-based algorithms, how to determine the hyper-parameters of a CNN was not addressed in this particular study. A CNN model contains several hyper-parameters such as the number of hidden layers, the number of hidden nodes within each hidden layer, the filter size for each convolutional hidden layer, and the number of filters used for each hidden layer, etc. The performance of the model is driven the optimal values of hyper-parameters. The values need to be evaluated systematically.

In addition, the current CNN model ignored the vehicle details while counting the number of vehicles in an image. Namely, the CNN model counted vehicles regardless of size, model, and type. Of course, the purpose of counting vehicles was confined to evaluating traffic flows at the aggregate level in the present study. However, in the future, advanced counting technology should recognize the details of each vehicle. In particular, distinguishing between moving and stopped vehicles is very important for traffic control and management. A CNN model based on consecutive images is now under construction to count vehicles while discerning whether each vehicle is moving or not. If this succeeds, the next version of the present study will measure the space mean speed as well as the traffic density. The space mean speed is another important parameter in traffic engineering, and it cannot be measured directly with the existing surveillance systems.

V. RESULT/OUTPUT

A novel system for detecting and tracking vehicles in traffic surveillance systems is presented in this study. This system involves locating moving objects present in complex road scenes by implementing an advanced background subtraction methodology. The innovation concerns a histogram-based filtering procedure, which collects scatter background information carried in a series of frames, at pixel level, generating reliable instances of the actual background. The proposed algorithm reconstructs a background instance on demand under any traffic conditions.The rationale in the approach is that of detecting the moving
objects from the difference between the current frame and a reference frame, often called "background image", or "background model". Background subtraction is mostly done if the image in question is a part of a video stream.
Background subtraction provides important cues for numerous applications in computer vision, for example surveillance tracking or human poses estimation.

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LI-FI BASED VOICE CONTROLLED ROBOT

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Abstract— Li-Fi is ideal or high-density wireless data coverage inside confined area. Li-Fi technology is based on LEDs for the transfer of data via the use of LEDs. The transfer of the data can be achieved with the help of all kinds of light, no matter the part of the spectrum that they belong.

In this paper, the idea of this currently developing technology of Li- Fi is culminated into a voice controlled RC Car wherein the mode of communication involved for car control is done via Li-Fi transmission using existing technologies such as LED bulb and mini solar panel at a project level. The voice commands are given through user's phone via android app to the bulb terminal and the processed signal in the form of light is received by RC Car to function.

Keywords— Li-Fi, LEDs, light, spectrum, voice controlled RC Car, Li- Fi transmission, existing technologies, LED Bulb, mini solar panel, android app.

I. INTRODUCTION

Li-Fi is termed as Light Fidelity. This is a technique used for transmission of data at very high speed through light, which transfers data by varying its intensity. This variation in light provides us binary 1 and binary 0 of data which transmits information wirelessly through Visible Light Communication (VLC).

Light-Fidelity (Li-Fi) is a technology which is very similar to the fibre optics communication where the data is transmitted through a LED that varies at a higher intensity that which cannot be recognized by human eye. This technology uses LED for transmission and optocoupler for reception. LED's can toggle on and off very quickly where binary "1" is sent when LED is ON and "0" is when the LED is OFF. Data can be encoded by varying the flicker rate of the LED. Human eye cannot recognize the rate at which LED changes the state from ON to OFF therefore the output appears constant. Light frequency can be altered by encoding different data channels by using red, green and blue LED"s which gives maximum speed of 10 Gbps [1][4].

Due to use of light, Li-Fi can be employed successfully undersea where Wi-Fi cannot reach. It can also be used in applications which are likely to be interfered with by the radio waves. Aircrafts, hospitals and military operations are the main applications where Li-Fi can be helpful. Li-Fi offers better security, availability and efficiency than Wi-Fi. Li-Fi can offer public internet access by leveraging the low cost of LED's [2].

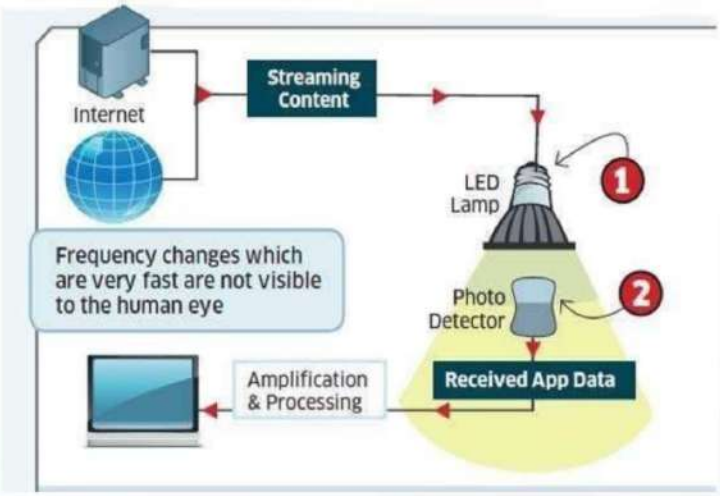


Fig 1.1: Typical Li-Fi System

The Figure 1.1 shows the function of a typical Li-Fi system, which explain the information flow through the VLC (visible light communication) media rather than wireless RF path.

II. OBJECTIVES

The purpose of this synopsis is to implement "Li-Fi based Voice Controlled Robot" where Li-Fi technology is employed as wireless medium to achieve machine movements according to the operator's voice commands via android app.

In electromagnetic spectrum, UV rays are dangerous for human body, radio waves have insufficient spectrum for increasing data and infrared rays are used for low power applications. To overcome these problems Li-Fi technologies is used as it is the optical adaptation of Wi-Fi using visible light spectrum for data transfer [3].

Table 1: Li-Fi vs. Wi-Fi

Parameters	Wireless Technology	
	Light Fidelity	Wireless Fidelity
Speed for data transfer	Faster transfer speed (>1 Gbps)	Data Transfer speed (150 Mbps)
Medium through which data transfer occurs	Light as a carrier	uses radio spectrum
Spectrum Range	Visible light spectrum has 10000 times broader spectrum in comparison to radio frequency	Radio frequency spectrum range less than visible light spectrum
Cost	Cheaper than Wi-Fi because free band doesn't need license and uses visible light	Expensive in comparison to Li- Fi as it uses radio spectrum
Operating frequency	Hundreds of THz	2.4GHz

The Table 1.1 shows the performance of Li-Fi against the existing Wi-Fi. As VLC uses light unlike RF which is also harmful for health for higher frequency operations.

The objective of this project is as follows:

1. To study the communication through Li-Fi: an application of VLC and implement it by controlling a robot via voice commands send through LED bulb.
2. To understand the communication range of LED bulb for Li-Fi applications and estimation of light radiation coverage through the bulb.
3. To improve the range of the communication signals using different approaches
4. To study android app development for voice input via mobile handset and voice processing.

III. SYSTEM SPECIFICATIONS AND ANALYSIS

The proposed system aims to make use of existing technologies which prevents extra costs and replacing the ongoing technology. Hence being adaptive in nature it can be realized into three main parts for convenience:

A. User End Terminal

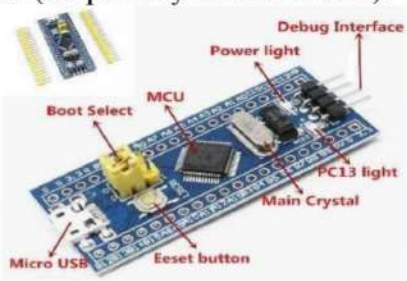
The control commands to be given to robot here are voice commands. The cheapest and reliable technique involves the use of in-built microphone of the user's handheld smart phone via a custom-made android application as developed in [6]. This application records User's voice commands in real time and sends this data to Li-Fi transmitter module for signal processing.

B. Li-Fi Transmitter

This module receives the data from the User Terminal (in this case smart phone) via Bluetooth and is sent to microcontroller for data processing and signal generation. The components used in this module are listed as follows:

1. HC-05 Serial Bluetooth

2. STM32 F103C8T6 ARM Microcontroller board (As primary controller unit).



3. Solid State Relay Module (1 Channel)

4. 5-Watt LED Bulb (de-assembled).

C. Li-Fi Receiver

This module receives signals in the form of light flickering done by the transmitter part via 6V mini solar panel and is processed by another microcontroller and hence the voice command is decoded into a triggering function.

The components in this section are used as follows:

1. 6V mini solar panel.

2. Arduino Uno Microcontroller board (As secondary controller unit)

3. L298N Motor Driver Module.

4. BO DC Gear Motors (Dual Shaft)

5. Motor Wheels

IV. CIRCUIT DIAGRAMS AND DESIGN

The circuit design consists of several phases as a result of the domain being under research, the system design is made such that it makes use of existing system in this case a generic LED bulb as a transmitting source. This results in decreased costs of the proposed system to be developed.

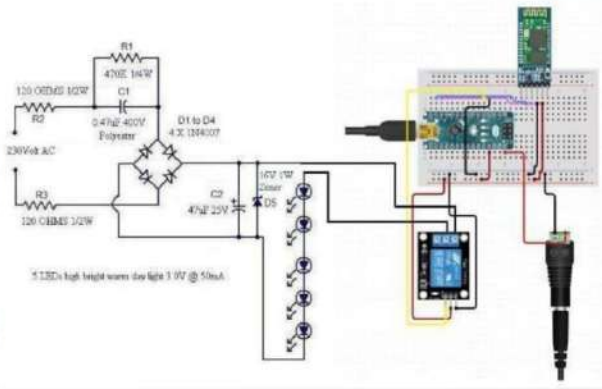
The design phases include:

A. MODIFICATION OF AC BULB:

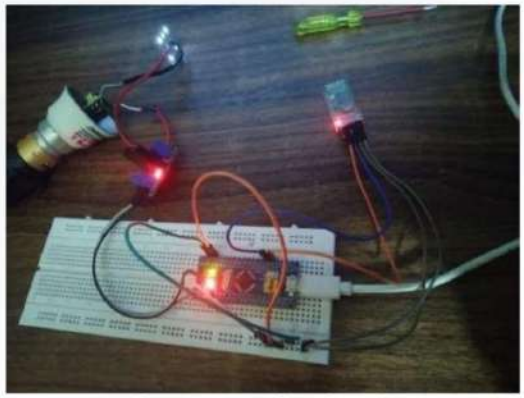
To achieve light flickering at a higher rate, a custom made off- the-shelf relay is required which is very expensive and requires a considerable resource. Hence to proceed with, a solid state relay is used as a switch to switch between '1' and '0' at high rate. Electronic relay is recommended as a mechanical relay is not suitable for fast switching and may produce errors in real time run. Therefore, modification in the LED bulb is essential as the DC output of the filter is bypassed with the SSR relay module as shown

In this configuration the relay has to switch the DC power rather than the AC power with respect to the message signal generated by the ARM microcontroller.

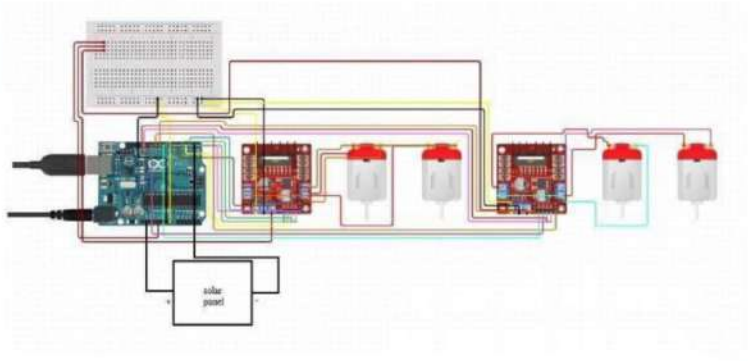
B. TRANSMITTER CIRCUIT DIAGRAM



The Microcontroller STM32F103C8T6 is an ARM CORTEX M3 Board which is programmable using Arduino IDE software. The board takes in the data from Bluetooth module serially and generates a binary code of the message command. The Light bulb is made to flicker at the coded rate as per the relay module used and the light flickers as per the binary '1' and '0'.

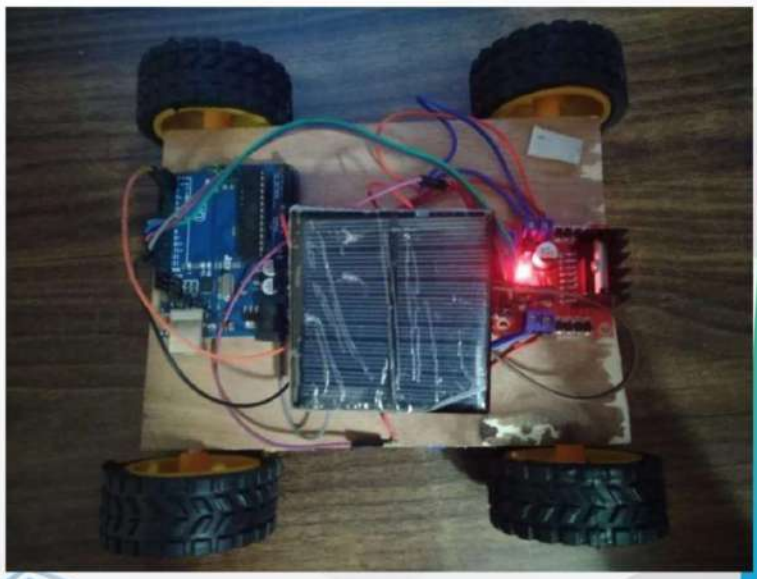


C. RECEIVER BOT CIRCUIT DIAGRAM



On receiving the light, the solar panel continuously indicates the light with the bit '1' and the flicker with bit '0'. With suitable coding the received bits can be used as a trigger under a specific code retrieved by the sensor as a command function and hence triggers the motor to run.

This circuit is realised in design as shown:



V. SYSTEM WORKING

Step1: User enters voice command through android application through smart phone device.

Step2: The application converts speech to text and sends the text message via Bluetooth to the Bluetooth module.

Step3: The microcontroller receives this data from Bluetooth module serially and generates a binary code as per the commands in the written code.

Step4: This Binary sequence is given as input to the solid-state relay acting as a switch which switches the bulb as per the calculated Bit rate to match the baud rate of receiver module

Step5: The LED bulb flickers as per the switching and gives the output of luminous intensity of ranging from 500 lumens to 900 lumens which is sufficient enough to light up a general 100 square meters.

Step6: This flickering is captured by the mini solar panel in the robot functioning at the calculated baud rate and diverts this code to Arduino board.

Step7: As per the program code, the received binary code is decoded and as per the assigned trigger, the function is executed by motors. Hence the robot function as per the voice command transmitted through light and the phenomenon of Li-Fi communication is established.

VI. SCOPE

The scope of such technology has vast applications in future technologies:

- Security:

The communication signal is limited by the range of light. Hence the communication is confined into the room and limits unauthorized access to anyone.

- Cellular Communications:

In external urban environments, the use of Li-Fi enabled street lamps would provide a network of internet access points. In cellular communication, the distance between radio base stations has come down to about 200-500 meters. So, instead of deploying new radio base stations in our cities, street lamps could provide both, illumination during night, and high-speed data communication 24/7.

- EMI sensitive environments:

On aircraft, Li-Fi enabled lighting will allow high data rate connectivity for each passenger. It will allow connectivity at all times, without creating electromagnetic interference (EMI) with sensitive radio equipment on the flight deck. The reduction in cabling requirement also means a lighter aircraft.

- Intelligent transportation systems:

Car headlights and tail lights are steadily being replaced with LED versions. This offers the prospect of car-to-car communication over Li-Fi, allowing development of anti-collision systems and exchange of information on driving conditions between vehicles.

VII. CONCLUSION

The aim of the paper was to make use of Li-Fi communication to control a robot via voice commands. The range of the communication is increased up to few meters sufficient enough to use in a 100- 300 square meter room using a single bulb. However, an arrangement of multiple bulbs can be used to make it usable for office floors.

The voice recognition is executed smoothly via smart phone android application cutting down the extra cost of hardware. This project aims to develop this system with minimum cost and hardware. The data transmission via light functions smoothly but the transmission rate can be enormously increased using state-of-the-art advance electronic switching circuit or by an advance amplifier.

The reception can be improved using expensive sensors and the efficiency of receiver can be increased to a high extent. This project still marks a number of future improvements to be done and further research and investments can ignite the efficiency of this prototype.

ACKNOWLEDGEMENT

We are really grateful as we managed to embark ourselves for the Project "Li-Fi based Voice Controlled Robot" within the given time. We sincerely thank our Project Guide Prof Sonali Kathare, Project Coordinator Prof. Ajit Saraf and HOD Dr. Avinash Vaidya Sir for the guidance and encouragement in taking up this project.

We also show our deepest gratitude to our project guide Prof Sonali Kathare for guiding us in every stages of this work and special gratitude to Prof Ruchira Patole for guiding us in several stages and in research and development in the context.

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COIN BASED WATER DISPENSER SYSTEM

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***Abstract*-Now a day's water vending machines are available and operated on only one coin but our aim is to design water vending machine which is operated on different coins. In India there is problem of safe drinking water therefore we are going to provide mineral water. Water has become the most commercial products of the century. This may sound bizarre, but true. The stress on the multiple water resources is a result of a multitude of factors. On the one hand, the rapidly rising population and changing lifestyles have increased the need for fresh water. If opportunity costs were taken into account, it would be clear that in most rural areas, households are paying far more for water supply than the often-normal rates charged in urban areas. Also, if this cost of fetching water which is almost equivalent. To 150 million women days each year, is covered into a loss for the national exchequer, it translates into a whopping 10 Billion rupees per year.**

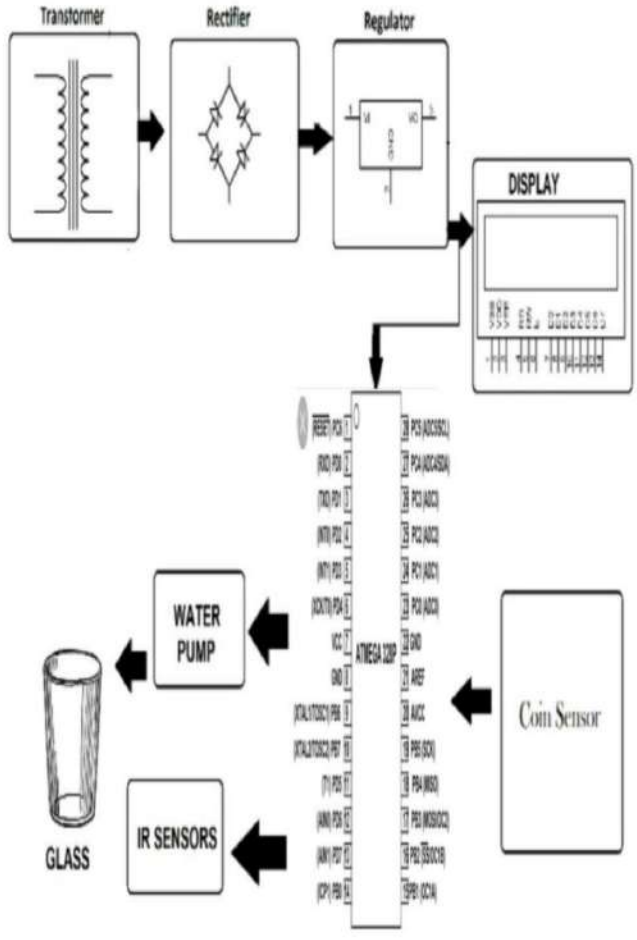
I. INTRODUCTION

With the advancement of technology the 'Coin Based Water Dispenser' provides comfort and it fits well for its users in the era of modernization . Here we put forward a fully automated coin based water dispenser system using microcontroller and sensor. The system is capable of fully automated water/cola dispensing using motors and sensors. The system also senses if

glass is placed at the counter to avoid water spoilage if there is no glass placed at the counter panel. The system uses IR sensors to detect presence of glass and then the sensors send a signal to the microcontroller. The microcontroller now processes the information sent by the sensors to determine if glass is present.

On detecting a valid coin the system now sends a signal to the controller who checks if glass is present and then it starts the motor to pour water in glass using motor as long the glass is present. If glass is removed during the process, system stops the water supply until glass is encountered. Thus we here put forward a smart water dispenser system with water saving feature.

Block Diagram



Block diagram description-

In this proposed system, fully automated system that enables the user to get water automatically without wasting any time by just inserting the coin in an automated machine. Normally in remote areas such as mountains or desert land forms, the supply of water is a very difficult task because lake of human life or electricity. Beside this, in shopping malls, supper stores, universities or community centers where when any one wants to just drink water or cola then he wastes so much time due to long row of customer. In these places, if any automated machine or automated water or cola dispenser system would be installed then everyone can save their precious time. So many systems are available in market like this but that systems are so much costly as well as not so much reliable and efficient. Here we have been presenting a system that is called a coin based water dispenser system. This system has designed with the help of coin sensor, water pump, IR sensor, LCD display, single phase step down ac transformer, bridge rectifier, voltage regulator and water pump. This system also has coin detect facility means when a valid coin is inserted in machine. Regulated power supply is designed to provide system with constant supply of 5 volts. The dispenser will dispense water only when the correct coin is inserted as well as with the placement of glass below the nozzle. The correctness of coin is detected by the coin sensor and the object detection is done by an IR sensor. If both the conditions are satisfied then a signal is given to the microcontroller and accordingly water pump gets activated and water will be dispensed.

II. HARDWARE DETAILS

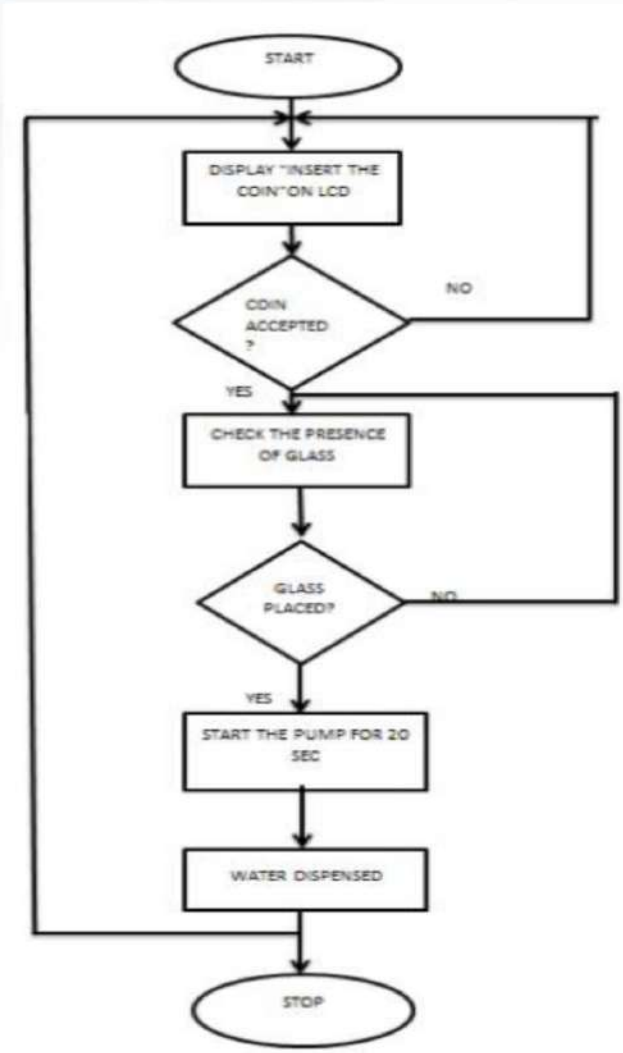
The experiment setup is carried out on a computer system which has the different hardware

Specifications

SR. No.	Requirement	Specification
1.	Power supply	5 volts
2.	Coin sensor	12 volts
3.	IR sensor	5 volts
4.	Water pump	5 volts
5.	Dispensing duration	Less than 25 seconds
6.	Software	Arduino IDE

Table -1: Hardware Specifications

A. FLOW CHART



B. LCD DISPLAY

The system uses 2-line, 16 character LCD display as shown in figure 4. It has 4 bit interface. It is relatively easy to use once you have it mapped into your processor's memory mapped I/O. Then Characters need to send to display; they show it up on the screen.

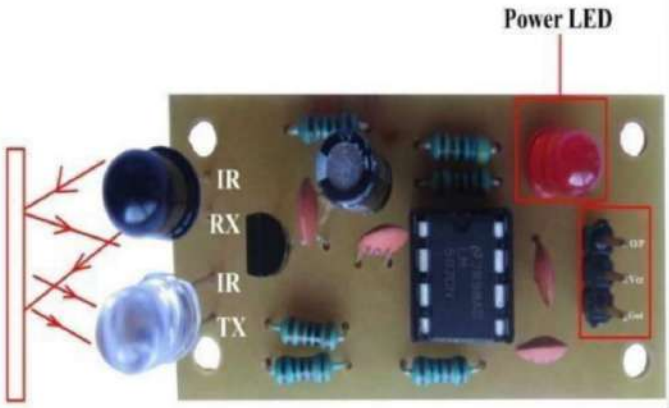
C. RELAY

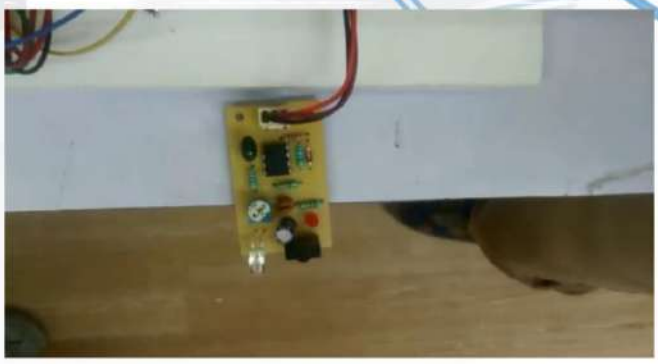
A relay as shown in figure 5 is an electrically operated switch. An electromagnet is used in relays to operate a switch mechanically, but also other operating principles such as solid state relays are used. Relays are used where it is necessary to control a circuit by a low-power signal. The first relays were used in long distance telegraph circuits as amplifiers; they repeated the signal coming from one circuit and re-transmitted on other circuit. Relays were used extensively in telephone exchanges and in early computers to perform logical operations.

D. IR SENSOR

An Infrared sensor as shown in figure 6 is a sensor which is able to detect the presence of nearby objects without any physical contact.

An Infrared sensor emits an infrared signal or an electromagnetic radiation (infrared) and looks for a change in the field. The object being sensed is often referred to as the Infrared sensors target that demands different sensors. For example, a capacitive or photoelectric sensor are suitable for a plastic target; an inductive proximity sensor always requires a metal target. The maximum distance the sensor can detect is called as "nominal range". Some sensors have adjustments of the nominal range or means to report a graduated detection distance. With the absence of mechanical parts and lack of physical contact between sensor and the sensed object, infrared sensors may have high reliability and long functional1 life.





III. RESULT

The objective of this project is to construct a machine that will automatically dispense water on the detection of the right coin (correct denomination). Coin sensor module is separately programed for Rs.5 and Rs.10 coin. Coin sensor is a double coin acceptor, so it is programmed for a two coin, that is, 10 rupees for one litre and 5 rupees for half litre. Also one can get water easily through wate dispenser available at public places such as Railway Stations, Bus Stands, Airports, etc.

IV. CONCLUSION

Thus we have worked on the project coin based water dispenser as per above algorithm and block diagram shown.

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CRACK DETECTION USING IMAGE PROCESSING & CONVOLUTIONAL NEURAL NETWORK

CLEMENT FERNANDES, RACHNA BHILARE, SWATI DUTTA, ROHIT KAPADI

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Abstract **– Crack assessment is a necessary method within the maintenance of concrete structures. In general, concrete cracks area unit inspected by manual visual observation of the surface, that is in and of itself subjective because it depends on the expertise of the inspectors. Further, it's long, pricy and sometimes unsafe once inaccessible structural members area unit to be assessed. unmanned aerial vehicle (UAV) technologies combined with digital image process have recently been applied to crack assessment to beat the drawbacks of manual visual scrutiny. However, identification of crack info in terms of dimension and length has not been totally explored in UAV-based applications, as a result of the absence of distance measurements and tailored image process. This paper presents a price effective UAV primarily based approach for structure analysis. The images captured by the UAV are analyzed using Image Processing & Convolutional Neural Network. The results obtained are then compared.**

Index Terms- **Unmanned Aeril Vehicle (UAV), Image Processing(IP), Convolutional Neursl Network(CNN).**

INTRODUCTION

Massive disasters and safety-accidents have frequently occurred all over the world due to improper maintenance of structures and poor structural analytics. There has been a great interest in finding proper and cost effective measures for safety inspection of infrastructures. The techniques used for the same till present are time-consuming and expensive with results being highly subjective as they merely depend on the judgement of the inspector. Huge and tall structures such as cable bridges, high- rising towers, dams and industrial power plants are known to have its inaccessible area and limitation in field inspection due to its geometry. In some cases, inspection of critical structural members is not possible due to its spatial constraints. Here the use of Unmanned Ariel Vehicle (UAV) with digital image processing techniques can provide us with a efficient system that can be used for crack detection. UAV technology has been developed for military applications but in recent years it has been used in public sector as well. It is being used to develop a unmanned courier system. With plenty of availability of these drones in the market, it is suitable for our application.

This study aims at developing a structural analysis system in which a basic UAV is used to get images of inaccessible parts of a structure. These images are then analyzed using Image processing (IP) and Convolutional Neural Network (CNN). The results obtained will be compared with actual results in order to know the reliability of the system.

IMAGE ANALYSIS TECHNIQUE FOR CRACK DETECTION

It is an inevitable phenomenon to avoid cracks in concrete structures. The real estate sector in India has seen rapid growth in the past few years especially at a time when India is competing in the international market. A lot of parameters such as relaxation in FDI etc have promoted this development. In spite of the tremendous growth seen in this sector, a large part of existing infrastructure still is very old. Hence, it is important now more than ever to develop well de_ned Structural Health Monitoring (SHM) system. Also, there is the risk of human loss when these structures start to fail. Hence, our project aims to _nd a solution that will help make these structures safe . In this study of the proposed system, the image analysis technique is capable to inspect the exterior of structures, detect cracks and calculate the crack width and also a program with the required technique are developed.

1. Development of crack detecting technique

In the study of various image analysis techniques, it has been varied and concluded that the morphological operation is effective for crack detection. The morphology techniques being translated into morphology or morphological processing in a dictionary defines the process of manipulating the image shape that is used as the concept of mathematical morphology with a tool for extracting useful elements in expressing territory shape such as boundary, frame and block. In this study, we have attempted to clearly detect the crack structure in the captured images with using the morphology techniques. The crack detection technique is accomplished through a major process of segmentation, decision making and feature extraction process. If the captured images have poor quality or image correction is required for extracting the specific element, pre-processing must be performed to improve the quality of image before image analysis for the actual crack detection is done

THE PROPOSED SYSTEM

A. SOFTWARE DESCRIPTION

Convolutional Neural Network (CNN)

A) Flaw Detection Algorithm

This section describes the classifier we created for the purpose of detecting cracks and spalling in an image.

a) Data preparation and Labelling

We searched for several preprocessed Crack and Spalling dataset online and selected the CSSC dataset since that was the only dataset suitable for our application. The dataset consists of 278 spalling images and 954 crack images. We have used data augmentation and image processing techniques to generate more images for each class. Our dataset comprises of 1345 crack images, 1345 spalling images and the third class (neither crack nor spalling) consists of 2000 images. For labelling the images, we first created three folders (one for each class) and then manually segregated the dataset into the folders. The code simply uses the folder name (i.e. Crack, Spalling , not crack not spalling) to extract the label name and assigns that label to all the images belonging to that folder.

b) CNN Model Trainig

Our model is inspired by the very popular VGG classi_er and is a smaller version of the same. VGG has proven its ability to deeply understand high level features of an image and provide appropriate representation. The _gure presents the CNN architecture, which is the original configuration for concrete crack detection. The _rst layer is the input layer of 96 96 3 pixel resolutions, where each dimension indicates height, width, and channel (e.g., red, green, and blue), respectively. Input data pass through the architecture and are generalized with spatial size reduction to 1 1 1024 at first dense fully connected layer. The vector, including the 1024 elements, is fed into the rectifed linear unit (ReLU) layer. Finally, the softmax layer predicts whether each input data is a cracked ,spalled or intact concrete surface. BN layers are located after every convolution and activation layer. Dropout and Max- pooling layers are located after the 1st , 3rd and 5th convolution layers.

c) Activation

1.ReLU

The ReLU is half recti_ed (from bottom). f(z) is zero when z is less than zero and f(z) is equal to z when z is above or equal to zero. But the issue is that all the negative values become zero immediately which decreases the ability of the model to fit or train from the data properly. That means any negative input given to the ReLU activation function turns the value into zero immediately in the graph, which in turns a_ects the resulting graph by not mapping the negative values appropriately

2. Sigmoid

It is especially used for models where we have to predict the probability as an output. Since probability of anything exists only between the range of 0 and 1,sigmoid is the right choice.

3. Softmax

Softmax function calculates the probabilities distribution of the event over n difierent events. In general way of saying, this function will calculate the probabilities of each target class over all possible target classes. Later the calculated probabilities will be helpful for determining the target class for the given inputs. The main advantage of using Softmax is the output probabilities range. The range will 0 to 1, and the sum of all the probabilities will be equal to one. If the softmax function used for multi- classification model it returns the probabilities of each class and the target class will have the high probability. This is why softmax activation, at the final fully connected layer, is the right choice for our application.

d) Auxiliary nodes

1. Batch Normalization (BN)

Batch normalization reduces the amount by what the hidden unit values shift around (covariance shift). Covariance shift means that if an algorithm learned some X to Y mapping, and if the distribution of X changes, then we might need to retrain the learning algorithm by trying to align the distribution of X with the distribution of Y. We can use higher learning rates because batch normalization makes sure that there's no activation that's gone really high or really low. It reduces overfitting because it has a slight regularization e_ects. Similar to dropout, it adds some noise to each hidden layers activations.

2. Dropout

Dropout is a technique where randomly selected neurons are ignored during training. They are dropped-out randomly. This means that their contribution to the activation of downstream neurons is temporally removed on the forward pass and any weight updates are not applied to the neuron on the backward pass. As a neural network learns, neuron weights settle into their context within the network. Weights of neurons are tuned for speci_c features providing some specialization. Neighboring neurons become to rely on this specialization, which if taken too far can result in a fragile model too specialized to the training data. This reliant on context for a neuron during training is referred to complex co-adaptations.

Image Processing(IP)

a) Contrast Stretching

Contrast stretching is a simple image enhancement technique that attempts to improve the contrast in an image by `stretching' the range of intensity values it contains to span a desired range of values, e.g. the full range of pixel values that the image type concerned allows. It differs from the more sophisticated histogram equalization in that it can only apply a linear scaling function to the image pixel values. As a result the enhancement' is less harsh. The simplest form of processing is to adjust the brightness of an image by adding a bias value, b, to all the pixel values of an image; where $b > 0$ would increase the brightness of an image and $b < 0$ would darken the image.

b)Image Segmentation

Image segmentation is the process of partitioning an image into parts or regions. This division into parts is often based on the characteristics of the pixels in the image. For example, one way to find regions in an image is to look for abrupt discontinuities in pixel values, which typically indicate edges. These edges can define regions. Other methods divide the image into regions based on color values or texture.

c) Image Morphology

Segmentation results may cause some pixels to be removed producing holes to some parts of the images; this could be seen from characters having some holes in them where some of the pixels were removed during thresholding. Larger holes can cause characters to break into two or more parts/objects. On the other hand, the opposite can also be true, as segmentation can join separate objects making it more difficult to separate characters; these solid objects resemble blobs and are hard to interpret. The solution to these problems is Morphological Filtering. Useful techniques include erosion and dilation, opening and closing, outlining, and thinning and skeletonization . These techniques work on binary images only.

d)Image Thinning

Thinning is a morphological operation that is used to remove selected foreground pixels from binary images, somewhat like erosion or opening. It can be used for several applications, but is particularly useful for skeletonization. In this mode it is commonly used to tidy up the output of edge detectors by reducing all lines to single pixel thickness. Thinning is normally only applied to binary images, and produces another binary image as output. The thinning operation is related to the hit-and-miss transform. The thinning operation is related to the hit-and-miss transform and can be expressed quite simply in terms of it. The thinning of an image *I* by a structuring element *J* is:

$$Thin(I,J) = I\text{-}hit\text{-}and\text{-}miss(I,J)$$

where the subtraction is a logical subtraction defined by:

$$X\text{-}Y = X \; n \; NOT \; Y$$

e)Global image thresholding

Image thresholding is the process of separating the information of an image from its background, hence, thresholding is usually applied to grey-level or color document scanned images. Thresholding can be categorized into two main categories: global and local. Global thresholding methods choose one threshold value for the entire document image, which is often based on the estimation of the background level from the intensity histogram of the image; hence, it is considered a point processing operation. On the other hand, local adaptive thresholding uses different values for each pixel according to the local area information Global thresholding methods are used to automatically reduce a grey-level image to a binary image. The images applied to such methods are assumed to have two classes of pixels (foreground and background)

f)Image size normalization

The result from the character segmentation stage provides isolated characters which are ready to be passed into the feature extraction stage; therefore, the isolated characters are normalized into a specific size, decided empirically or experimentally depending on the application and the feature extraction or classification techniques used, then features are extractclemeed from all characters with the same size in order to provide data uniformity.

A. HARDWAREDESCRIPTION

a)DRONE

1.Flight Controller-KK2.1.5

KK2.1.5multi-rotor controller manages the flight of multirotor aircraft. Its purpose is to stabilize the aircraft during flight and to do this, it takes signals from on- board gyroscopes and passes these signals to the atmega324pa processor, which in-turn processes signals according the users selected firmware and passes the control signals to the installed Electronic Speed Controllers (ESCs) and the combination of these signals instructs the ESCs to make fine adjustments to the motors rotational speeds which in-turn stabilizes the craft. The KK2.1 has an auto-disarm function and will disarm itself after 20 sec if throttle is at idle. For extra safety. Can be turned on/off in "Mode Settings" menu.

2. Brushless Motors (A2212/13T-1000kv)

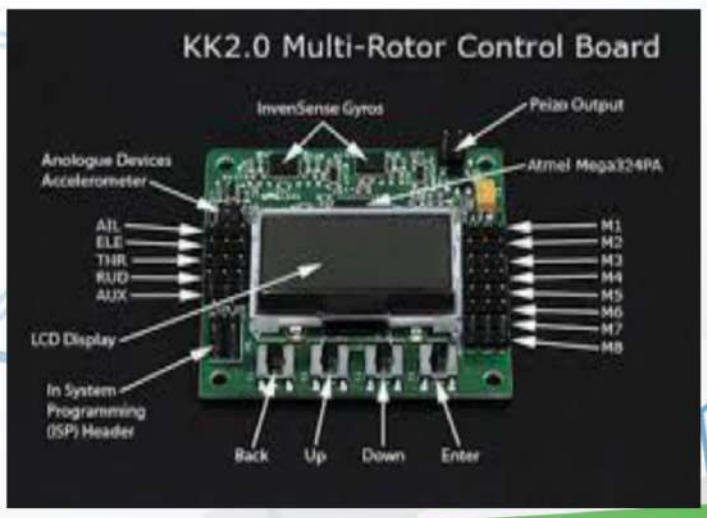
A2212 is a brushless outrunner DC motor specifically made to power quadcopters and multirotors. It is a 1000kV motor. It provides high performance, super power and brilliant efficiency. These motors are perfect for medium size quadcopters with 8 inch to 10-inch propellers. Since it's 13T so number turns are high and provide less speed but more torque. Because of three phase connections we can control the speed of motor more accurately and also more smoothly.

3. Propellers

The purpose of your quadcopter propellers is to generate thrust and torque to keep your drone flying. Torque is generated when the propellers accelerate up or down. As the propeller rotates, and pushes through the air, the air pushes back and causes a counter rotation on the body of the drone. This is why all of the propellers on a multirotor drone do NOT rotate in the same direction. Once you mounted a propeller on the motor, the rpm won't be that high because of the props resistance. Higher KV motors would turn the propeller quicker with less torque, and lower KV motors create higher torque with less rotation.

4. Electronic Speed Controller

An electronic speed control or ESC is an electronic circuit that controls and regulates the speed of an electric motor. It may also provide reversing of the motor and dynamic braking. A brushed motor can have its speed controlled by varying the voltage on its armature. A brushless motor requires a different operating principle. The speed of the motor is varied by adjusting the timing of pulses of current delivered to the several windings of the motor.



APPLICATION

1. UAV inspection and monitoring system.
2. UAV surveying and mapping system.
3. UAV solarpark and PV inspection.
4. UAV condition survey and civil engineering.
5. UAV precision agriculture.
6. UAV aerial imaging - HR photos and stills.
7. UAV aerial imaging - HD im and videos.
8. UAV computer vision.
9. UAV inspired military systems.
10. UAV based health care systems.

CONCLUSION

This project proposed an automated UAV based approach towards Structural Health Monitoring, being capable of accurately classifying Cracks and Spalling defects in structures. The hardware utilized in this approach was a quadcopter equipped with a camera and the obtained images were proccessed with a software classifier based on CNN and Image Processing using MATLAB. The end results show that our trained model has a 90 percentage validation accuracy on an average, better than that of Image Processing .

FUTURE SCOPE

More experimental and theoretical studies are required to calculate quantitative and accurate crack width by the image analysis techniques and additional equipment for safety improvement which is considered necessary to apply UAV to the structural inspecting system. However a standard for selecting optimal equipment is made pre and post processing calibration techniques related to the crack detection with improvement of the equipment performance must be studied further as there are many fine defects on the concrete surface, no cracks can be mistaken for the crack in case of simply improving the equipment performance. Also, by integrating remote localization techniques with Neural Computing we can realize much more advanced systems and with the increasing affordability of embedded Neural Compute Units achieving true autonomous applications is becoming an achievable feat.

RESULT

A. Convolutional Neural Network (CNN)

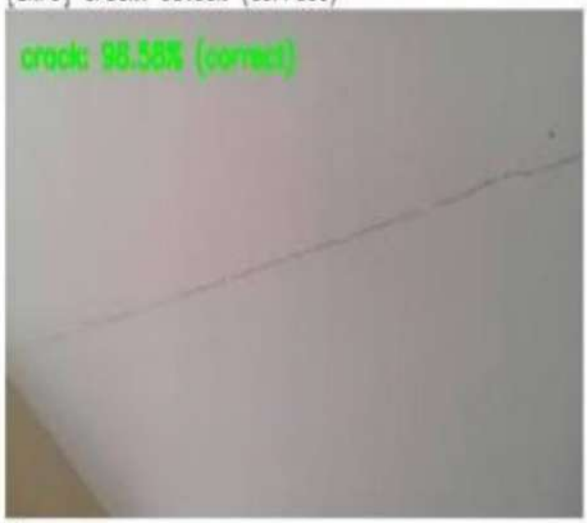
```
[INFO] loading network...
[INFO] classifying image...
crack: 0.09%
not_crack & not_spalling: 0.00%
spalling: 99.96%
[INFO] spalling: 99.96% (correct)
```


```
[INFO] loading network...
[INFO] classifying image...
crack: 0.00%
not_crack & not_spalling: 0.01%
spalling: 99.97%
[INFO] spalling: 99.97% (correct)
```


```
[INFO] loading network...
[INFO] classifying image...
crack: 68.29%
not_crack & not_spalling: 69.72%
spalling: 0.01%
[INFO] not_crack & not_spalling: 69.72% (incorrect)
```

-1

```
[INFO] loading network...
[INFO] classifying image...
crack: 98.58%
not_crack & not_spalling: 61.12%
spalling: 0.00%
[INFO] crack: 98.58% (correct)
```



-1

[38]

```
[INFO] loading network...
[INFO] classifying image...
crack: 98.67%
not_crack & not_spalling: 14.67%
spalling: 0.00%
[INFO] crack: 98.67% (correct)
```

-1

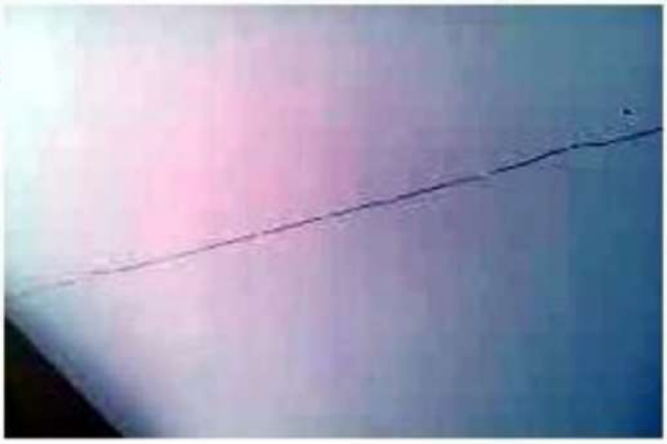
[40]

```
[INFO] loading network...
[INFO] classifying image...
crack: 0.01%
not_crack & not_spalling: 0.01%
spalling: 100.00%
[INFO] spalling: 100.00% (correct)
```

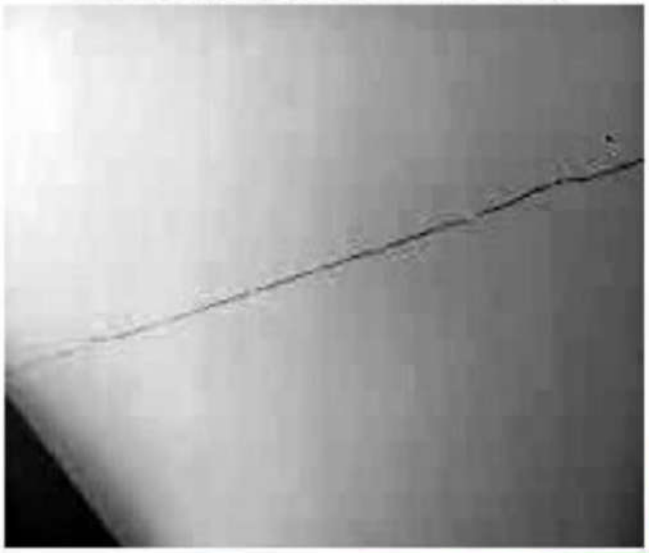
A. Image Processing(IP)

Original image

Contrast stretched image

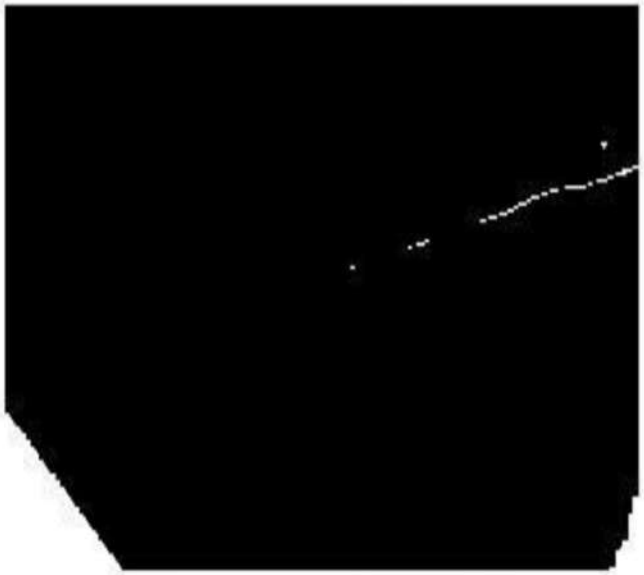


RGB to gray (contrast stretched)



Thinned image

Cleaned image



final output

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ZigBee Based Wireless Communication Using Advanced Encryption Standard

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Abstract **-In this paper, we demonstrate half duplex wireless communication using two modules, encrypted using Advanced Encryption System (AES) which is a 128 bit encryption system. Each module consists of an ATMEGA Microcontroller, a Zigbee module which acts as a transmitter/receiver and a LCD display. This system works at 2.4 GHz. A USB keyboard is used to give input to the module. Once the data is sent from one module, it can only be decrypted using the correct key on the other module, else it returns a garbage value.**

Keywords—**Advanced Encryption System(AES), Zigbee, ATMEGA Microcontroller, Half-Duplex wireless communication.**

I. INTRODUCTION

Our paper is based on half duplex wireless communication in close proximity between two fabricated modules. This wireless communication is achieved using a Zigbee module.
Zigbee is a device that facilitates wireless communication between two devices at very low consumption of power and zero latency. Further this wireless communication is secured using AES encryption. AES stands for advanced encryption system. It is a state of art encryption method which is used in securing online transactions.

There are two identical modules, each consisting of USB port, microcontroller, Zigbee module and a LCD soldered on a PCB. A keyboard is used to give text input (0-9 and A-Z) upto 32 characters and is encrypted using a key. (Max 16 characters).
On pressing enter, the encrypted text is wirelessly transmitted to the other module using Zigbee.
A red blink on LED of the other module indicates the message has been received. A prompt on the LCD asks user to enter the key. If the correct key is entered, the message is displayed, else a garbage value is shown.

II. LITERATURE SURVEY

Nevon circuits in their work "Secured Wireless Communication" dated 14 August, 2012, stress on the need to encrypt the transmitted data in a duplex communication system. The data to be transferred is encrypted using AES. AES is an acronym for Advanced Encryption System which is one of the most secure symmetric encryption algorithm. A key is assigned which, if entered correctly in the receiver module, displays the actual message, else a garbage value is displayed.

The wireless transmission of data is achieved using a Bluetooth module. Although the system is capable of transmitting encrypted data wirelessly in close range, the power consumption is a factor that is overlooked. 1W of power is used by the Bluetooth module to transmit and receive data in a radius of up to 10m at the frequency range of 2.4 GHz. This is on the higher side.
A proposed design change of using a ZigBee module instead of the originally used Bluetooth module would help in this department.

Since Zigbee and its underlying standard IEEE 802.15.4 are recent, there has been little research investigating the power consumption of the different network architectures and comparison between the possible operating modes of the two networks. Most studies focus on beacon enabled network mode because most applications require bi-directional data flow and in star networks it gives the best energy savings. However in a real time monitoring application, data flow is mostly one way and is sent from the sensor node to a central storage device for processing and recording and therefore beacon enabled mode might not give the best energy savings.

Zheng and Lee developed a computer simulation model of the media access control (MAC) and physical (PHY) layers of IEEE 802.15.4 for the Network Simulator-2 (NS-2) to quantify its operation. They then studied its operation in star and peer-to-peer network topologies in beacon mode with focus on association efficiency, orphaning, collisions and duty cycle. Beacon mode is a mode of operation of IEEE 802.15.4 where network nodes are synchronised by periodic packet broadcasts or 'beacons' which are sent out by the coordinator. Their research shows that IEEE 802.15.4 is an excellent low power low data rate wireless standard upon which applications can be built. The simulation model created by Zheng and Lee has been the subject of a large number of research projects, several of which are detailed in the following paragraphs.

Huang and Pang recently investigated the effect of two system parameters in the MAC layer of a Zigbee network, beacon order and superframe order, on the power consumption of a small star architecture beacon enabled Zigbee network. The beacon order and superframe order

are two parameters which set the duty cycle of the network nodes. Their work showed that these parameters can considerably increase the power consumption if the parameters are set incorrectly. A beacon enabled star network was also researched by Ling-xi et al. They created a state diagram detailing the different states the transceiver can be in along with time intervals and current measurements for a Freescale MC13192 transceiver. Their research shows that 14 adjusting the transmission power does not have a large effect on overall power consumption because the duration spent in transmit mode is small.

III. PROPOSED SYSTEM AND METHODOLOGY

a. Wireless Communication

Wireless communications is a type of data communication that is performed and delivered wirelessly. This is a broad term that incorporates all procedures and forms of connecting and communicating between two or more devices using a wireless signal through wireless communication technologies and devices.

Wireless communication generally works through electromagnetic signals that are broadcast by an enabled device within the air, physical environment or atmosphere. The sending device can be a sender or an intermediate device with the ability to propagate wireless signals. The communication between two devices occurs when the destination or receiving intermediate device captures these signals, creating a wireless communication bridge between the sender and receiver device.

Although all of these communication technologies have different underlying architecture, they all lack a physical or wired connection between their respective devices to initiate and execute communication.

b. Data Encryption

Data encryption translates data into another form, or code, so that only people with access to a secret key (formally called a decryption key) or password can read it. Encrypted data is commonly referred to as ciphertext, while unencrypted data is called plaintext. Currently, encryption is one of the most popular and effective data security methods used by organizations. Two main types of data encryption exist - asymmetric encryption, also known as public-key encryption, and symmetric encryption.

The purpose of data encryption is to protect digital data confidentiality as it is stored on computer systems and transmitted using the internet or other computer networks. The outdated data encryption standard (DES) has been replaced by modern encryption algorithms that play a critical role in the security of IT systems and communications.

These algorithms provide confidentiality and drive key security initiatives including authentication, integrity, and non-repudiation. Authentication allows for the verification of a message's origin, and integrity provides proof that a message's contents have not changed since it was sent. Additionally, non-repudiation ensures that a message sender cannot deny sending the message.

Data, or plaintext, is encrypted with an encryption algorithm and an encryption key. The process results in ciphertext, which only can be viewed in its original form if it is decrypted with the correct key.

Symmetric-key ciphers use the same secret key for encrypting and decrypting a message or file. While symmetric-key encryption is much faster than asymmetric encryption, the sender must exchange the encryption key with the recipient before he can decrypt it. As companies find themselves needing to securely distribute and manage huge quantities of keys, most data encryption services have adapted and use an asymmetric algorithm to exchange the secret key after using a symmetric algorithm to encrypt data.

On the other hand, asymmetric cryptography, sometimes referred to as public-key cryptography, uses two different keys, one public and one private. The public key, as it is named, may be shared with everyone, but the private key must be protected. The Rivest-Sharmir-Adleman (RSA) algorithm is a cryptosystem for public key encryption that is widely used to secure sensitive data, especially when it is sent over an insecure network like the internet. The RSA algorithm's popularity comes from the fact that both the public and private keys can encrypt a message to assure the confidentiality, integrity, authenticity, and non-repudiability of electronic communications and data through the use of digital signatures.

c. Embedded Systems

An Embedded System is a combination of computer hardware and software, and perhaps additional mechanical or other parts, designed to perform a specific function. An embedded system is a microcontroller-based, software driven, reliable, real-time control system, autonomous, or human or network interactive, operating on diverse physical variables and in diverse environments and sold into a competitive and cost conscious market. An embedded system is not a computer system that is used primarily for processing, not a software system on PC or UNIX, not a traditional business or scientific application. High-end embedded & lower end embedded systems. High-end embedded system - Generally 32, 64 Bit Controllers used with OS. Examples Personal Digital Assistant and Mobile phones etc .Lower end embedded systems - Generally 8,16 Bit Controllers used with an

minimal operating systems and hardware layout designed for the specific purpose.

d. Advanced Encryption Standard

The Advanced Encryption Standard, or AES, is a symmetric block cipher chosen by the U.S. government to protect classified information and is implemented in software and hardware throughout the world to encrypt sensitive data.

The selection process for this new symmetric key algorithm was fully open to public scrutiny and comment; this ensured a thorough, transparent analysis of the designs submitted.
NIST specified the new advanced encryption standard algorithm must be a block cipher capable of handling 128 bit blocks, using keys sized at 128, 192, and 256 bits; other criteria for being chosen as the next advanced encryption standard algorithm included:

.

AES comprises three block ciphers: AES-128, AES-192 and AES-256. Each cipher encrypts and decrypts data in blocks of 128 bits using cryptographic keys of 128-, 192- and 256-bits, respectively. The Rijndael cipher was designed to accept additional block sizes and key lengths, but for AES, those functions were not adopted.

The AES encryption algorithm defines a number of transformations that are to be performed on data stored in an array. The first step of the cipher is to put the data into an array; after which the cipher transformations are repeated over a number of encryption rounds. The number of rounds is determined by the key length, with 10 rounds for 128-bit keys, 12 rounds for 192-bit keys and 14 rounds for 256-bit keys.
The first transformation in the AES encryption cipher is substitution of data using a substitution table; the second transformation shifts data rows, the third mixes columns. The last transformation is a simple exclusive or (XOR) operation performed on each column using a different part of the encryption key -- longer keys need more rounds to complete.

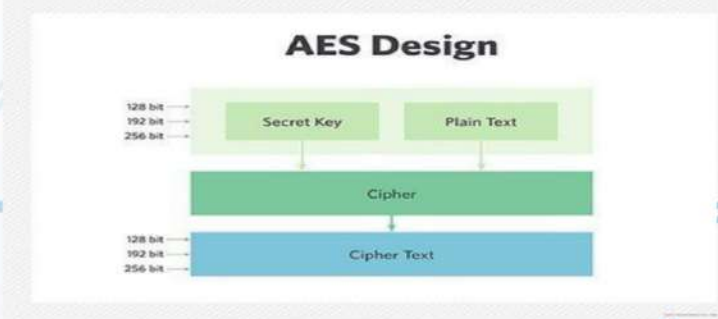

Fig. 1 Advanced Encryption Design

IV. APPLICATIONS

a. Real-Time, Reliable & Accessible.

Low latency describes a network that is optimized to process a very high volume of data messages with minimal delay (latency). These networks are designed to support operations that require near real-time access to rapidly changing data.
Packet Error Rate (PER) is used to test the performance of an access terminal's receiver. Tests conducted by the ZigBee Alliance had a 0% packet error rate, hence high data reliability.
Owing to low latency and zero packet error rate, this system is both Real-Time and Data-Reliable.
Accessibility is the ability to deliver packets reliably even in harsh network environments. Since latency and PER are both very low, accessibility is high.

b. Secure.

The system uses 128 bit AES encryption:
As it is implemented in both hardware and software, it is one of the most robust security protocol.
About 2^{128} attempts are needed to break in. This makes it a very safe protocol.
It uses higher length key sizes such as 128, 192 and 256 bits for encryption. Hence it makes AES algorithm more robust against hacking.

c. Convenient, cost-effective and eco-friendly.

The system is based on wireless communication and thus cuts out on the use of wires that makes it portable while also cutting out the cost of wires and their installation.

The system also uses minimal power which makes it eco-friendly.

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WIRELESS HUMANOID BIONIC ARM ON ROBOTIC VEHICLE

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Abstract- The demand for artificial arms have increased exponentially. They are commonly demanded in areas where human interference is not possible or extremely difficult. The use can vary widely, from taking readings from a hostile environment to diffusing explosives. Here, we aim to build a robotic arm that will mimic natural human movements. The data will be acquired through accelerometers. The output of the accelerometer is smoothened using proper averaging algorithm. It also reduces the noise coming from the sensors. The development of this arm is based on ATmega32. The ATmega640 platform along with a personal computer for signal processing, which will all be interfaced with each other using serial communication. Finally, this prototype of the arm is expected to overcome challenges like picking and placing objects. They will be used mostly in hostile environments.

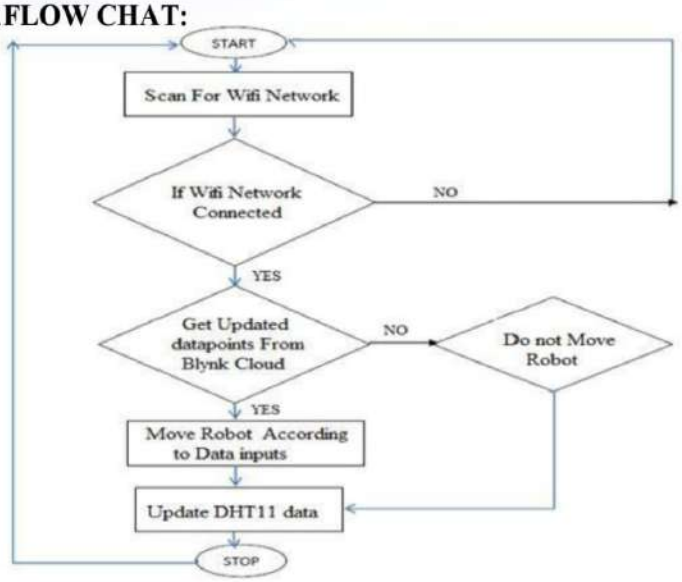
I. INTRODUCTION

Automation is one of the increasing need with in industries as well as for domestic applications.Automation reduces the human efforts by replacing.the human efforts by system which are self-operated, The Internet is one way of the growing platform for automation, through which new advancement are made through which on easily monitor as well control the system using internet.As we are making use of Internet the system becomes secured and live data monitoring is also possible using IOT system.In this project we are making a bot in which a robotic arm is placed and temperature sensor is on bot which shows us the room temperature live on blynk app. The Bot & robotic arm will be control by the blynk app. These will help the employee those working with these industries as they can control this automation from any corner of the world using a concept of IOT.

Automation is one of the increasing need with in industries as well as for domestic applications. Automation reduces the human efforts by replacing the human efforts by replacing the human efforts by system which are self operated,the internet is one way of growing platform for automation, through which new advancement are made through which on easily monitor as well control the system using internet. As we are making use of Internet the system becomes secured and live data monitoring is also possible using IOT system.

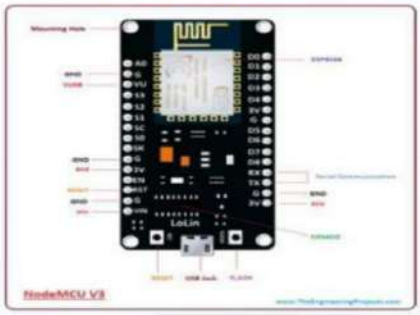
II.BLOCK DIAGRAM:

V.FLOW CHAT:



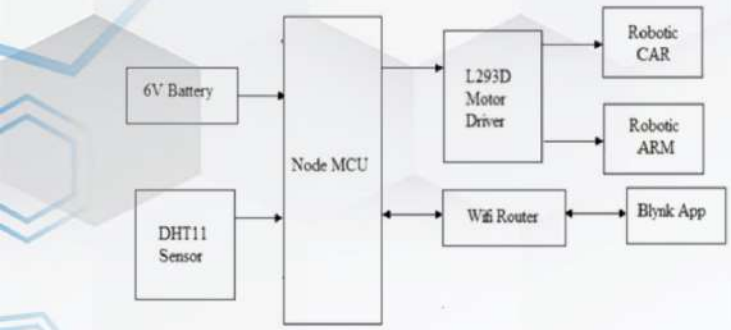
A.Node MCU:

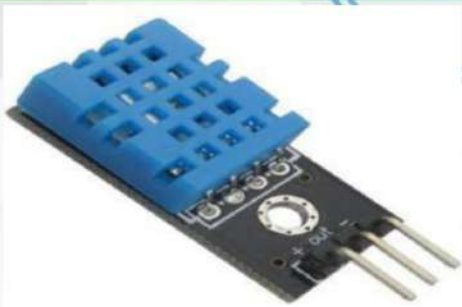
NodeMCU is an open source IoT platform.It includes firmware which runs on the ESP8266 Wi-Fi SoCfrom Espressif Systems, and hardware which is based on the ESP-12 module.



B.DHT11 TEMPERATURE AND HUMIDITY SENSOR:

This DHT11 Temperature and Humidity Sensor features a calibrated digital signal output with the temperature and humidity sensor capability. It is integrated with a high-performance 8-bit microcontroller. Its technology ensures the high reliability and excellent long-term stability. This sensor includes a resistive element and a sensor for wet NTC temperature measuring devices. It has excellent quality, fast response, anti-interference ability and high performance .





III.Block diagram description :

The system is consist of Node MCU which use controller. To access the internet network We require the internet connectivity which provided by Node MCU itself.To sense temperature and humidity with in industries we used the DHT11 sensor.To monitor the live data we used the application called Blynk. To monitor the data the values of sensor are uploaded over the Blynk server through which the controlling of various devices.

IV.HARDWARE DETAIL -

Hardware specification:

Microcontroller – Atmega328

Operating voltage – 5V Input

voltage(rec) – 7-12V Input

voltage(limits) – 6-20V

O Pins 14 (of which 6 provide PWM output)

Analog input pins – 6

DC current per I/O pin – 40 mA

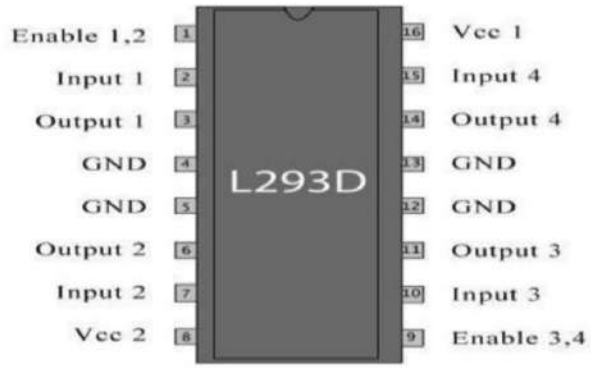
DC current for 3.3V pin – 50 Ma

Flash memory – 32 KB of which 0.5KB used by bootloader

SRAM – 2KB

C. L293D MOTOR DRIVER:

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC Motor with a single L293D IC.



VI.ACKNOWLEDGMENT:

As we know electronics and telecommunication engineering is the art of combining the knowledge of science, engineering and physics to acquire the ability to design a system, components, or processor to meet desired needs. We would like to thank and express our sincere gratitude to our project guide Prof. Ujwal Harode for her valuable guidance, patience , constant encouragement, her valuable ideas and support. We would also like to thank Dr.Avinash Vaidya, Head of thedepartment of Electronics and Telecommunication Engineering and Dr. Sandeep M. Joshi, Principal of PCE, New Panvel for their valuable support and outstanding academic environment which helped us to develop such an idea and encourage us to develop this project. We would also thank all the staff members of the Department of Electronics and Telecommunication Engineering for their critical guidance. .

V.RESULT AND DISCUSSION:

Overall, the objectives of this project have been achieved which are developing the hardware and software for wireless mobile robotic arm, implementing the pick and place system operation and also testing the robot that meets the criteria of purpose project. From the analysis that has been made, it is clearly shows that its movement is precise, accurate, and easy to control and user friendly. The mobile robot has been developed successfully as the movement of the robot including mobile and arm robot can be controlled wirelessly. This robot is expected to overcome the problem such as placing or picking object that away from the user, pick and place hazardous object in the fastest and easiest way.

VII.SCOPE

Automation through IOT can help to get rid of the short distance communication.Thus, introducing internet in industries can help to have control over the application from anywhere in the world

VIII.CONCLUSION:

In this report, We proposed and implement the IOT based system. Using this System we can control bot over wifi using Node Mcu. The system comprises, very low cost component such as DHT11 sensor, Dc and servo motors which are used to move the bot. The presence of every module has been reasoned out and placed carefully thus contribution to the best working of system, the different Standard datasets and research paper are referred while designing of system. The application of this system is identified and presented.

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SOLDIER HEALTH AND POSITION TRACKING SYSTEM WITH SPY ROBOT

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Department of Electronics and Telecommunication Engineering, PCE, New Panvel.

***Abstract*— Nowadays, security of the world is totally dependent upon soldiers and so the safety and precaution of the soldier plays an important role. for the soldier's health and security we can implement certain devices and systems which show the current position, health status and obstacles ahead of the soldier. On the battlefield the soldier has to face many difficulties, like scarcity of water or any natural disaster (like flood) or may face different obstacles in his path like mines, and this can risk the soldier's life. To reduce this risk, we can implement and send a spy robot instead of the soldier which can detect the factors like metal, obstacles and water detection and alert the soldier about the dangers ahead of them. For tracking the location and determining the health status of the soldiers and to transmit the message through SMS to the base station we use the Global System for Mobile Communication (GSM). The GSM technology helps to receive an update of the health status and position of the soldier. The robot consists of sensors like water, metal and obstacles which will be embedded on an RC car which will collect the information and show it on an LCD display.**

***Keywords*— Sensor, GSM, RC car.**

I. INTRODUCTION

Indian armed forces are the third largest standing army in the world with 1,200,255 active troops and 990,960 reserve troops. The army suffers a lot due to the unavailability of information and supplies which may increase the death toll. The casualties can be minimized, if the real-time information is available at the control room about the health and location of the soldier. Unawareness of current location of soldiers, inability of continuous communication with the control room during the operations, lack of immediate medical attention and operations under different conditions are the few prominent safety issues faced by the soldiers. In this rapidly growing technology, the main aim of the 21st century smart spy robots is to reduce the human losses in the field and also to provide information regarding the health of the soldier via regular monitoring. In the last decades, technologies such as cable based systems and walkie-talkies are the most commonly used technologies in the army. However, these technologies suffered from many problems like loss of signals, high noise as well as the bulky nature. Hence, we require some technologies which can monitor the health parameters of the soldier, as well as, be used for the surveillance purposes. The proposed system is based on GSM based transmission and RF communication based robot which will be helpful in the continuous monitoring of soldiers health parameters and for identifying the problems which are being faced by the soldier.

II. LITERATURE SURVEY

Many efforts were reported by different academicians and researchers to track the location of the soldiers' along with their health condition on the battlefield. Pavan Kumar et.al. Reported GPS based technology to monitor the soldier health parameters and location tracking using GPS. AT89C51 microcontroller was used to collect health parameters and then these parameters are transferred through GSM to the base unit [1]. A ZigBee based approach movements and heartbeat of the patient. The collected information were then added to the cloud-based websites with the help of IOT [2]. A Raspberry-Pi based approach to monitor the body temperature, respiration, movements and heartbeat of the patient. The collected information was then added to the cloud-based websites with the help of IoT[3]. A real-time, ARM processor based approach for the monitoring and collection of temperature, heartbeat, ECG parameters of patients by R. Shaikh et. al. [4]. ZigBee and GSM wireless technology were used to send current updates of patients to the doctor and then doctors can take immediate action against that patient. A wireless body area sensor networks (WBASNs) technology using ZigBee was reported in [5] to continuously monitor the health and location of humans. RF based modules were used to gather the live information of soldiers on the battlefield, proposed by G. Raj et. al. in [6]. Further, a one-time password (OTP) based system was proposed in [7] to secure and authenticate the data processing. Jassaset. al. proposed an idea of integration of wireless sensor network and cloud computing for the information processing in real- time and speedy manner [8]. A google map based approach was proposed in [9] to track the location of the soldiers. Metal detectors are used which made the system[10] However, all these systems are stuck-up by one or more reasons like costly implementation, delay in response and bulky nature.

Hence, a portable wireless real-time system based on GSM and wireless communication concept is developed and proposed in this paper which will be an effective alternative to the existing technologies in the area of soldiers' health and location tracking on the battlefields with help of a robot.

Communicating with the base(control room) station become the fundamental challenges in military operations. Also the proper navigation between soldiers' organizations plays important role for careful planning and co-ordination. So this paper focus on the soldiers need and with the help of the robot which will help the soldier in the battlefields. The information of the soldier will be shared with the control room through SMS in case of any emergence the soldier can press the distress button which will send the distress signal to the control room which will alert the control room with what kind of emergence the solider is in.

The most significance in this is implementation of M-Health and the robot. Implementation of this system improves the security of our country and also help to improve the safety of the soldier. This system also helps to provide/ detecting the information like water, bomb etc, in the surrounding which will help the soldier to movie with caution from one place to another. The casualties of war are reduced with the help of this system. It also helps to giving information of the surrounding and warning to the soldiers. This strengthens the defense system.

III. THE PROPOSED SYSTEM

A. BLOCK DIAGRAM

a) Soldier's Unit

The proposed system performs the task of health monitoring, these information will be transmitted via GSM Module to the control room(i.e registered mobile number). Based on the information received, the authorities can initiate immediate action by deploying a medical emergency, rescue team or any backup force for their help.

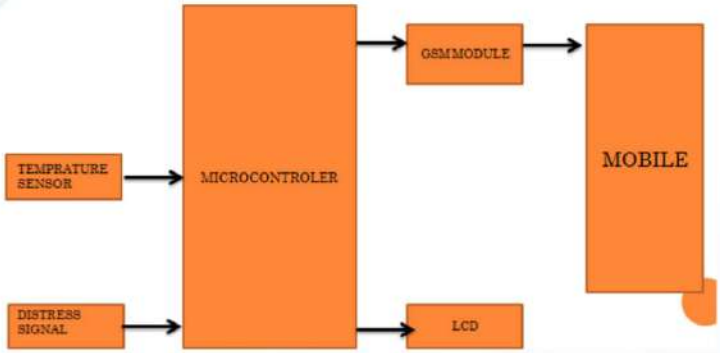

Fig 1. Block Diagram of soldier health and positioning tracking system (soldier unit)

The microcontroller will act as the brain of the unit. Soldier unit consists of LM35 temperature sensor, Panic Button, buzzer, 16*2 LCD display, GSM Module. The threshold values are priorly set and pre-programed in the microcontroller as per the surrounding environment and the person under the test. In the proposed experiment we have considered body temperature for the verification purpose to determine the health status of the soldier. Whenever the temperature deviates from the set threshold value, the system gets alert and sends the data to the control room with a buzzer beep. The received health information is processed by the microcontroller and relevant details are updated on the LCD screen. The soldier can even send distress signals incase of any medical emergency or manpower requirement which is passed on to the registered mobile user at the basecamps via GSM. The soldier can even convey his location details in the form of a text message via GSM.

b) Spy Robot

The aim of the project is to design, manufacture and operate a spy robot, the movement of the robot is controlled by the remote controller. In order to achieve the on-set goals, we have used sensors that can precisely identify the obstacles in the robot's path. The wireless remote is used to drive the robot in any required direction. Magnet sensor uses the electromagnetic property to detect bombs, PIR sensor is used to detect any obstacle ahead of the soldier like trees, Water level sensor uses the conductivity property to detect the presence of water. The information is encoded and wirelessly transmitted and received via the RF systems and original signal is retrieved after decoding. The microcontroller processes this information and accordingly controls the movement of the robot. LCD display is used to display the detected parameter via respective sensors and alert the soldier.

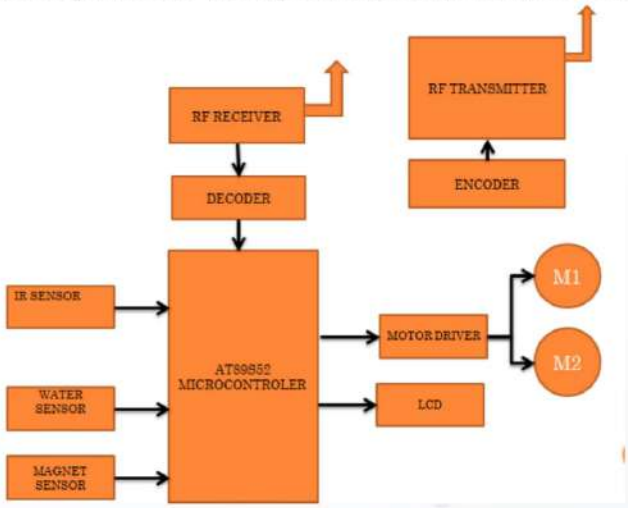

Fig 2. Block Diagram of spy robot

B. HARDWARE DESCRIPTION

- Temperature Sensor : LM35

LM35 is a temperature sensor which is widely used to measure body temperature. This device is rated to operate over a -55°C Temperature range. The normal human temperature is around 37°C. Hence, a threshold value in the range of 30° to 40°C is considered.

- Panic Button and Buzzer

Panic button is one kind of switch which is provided to soldiers to help in panic situations. If the soldier presses the panic button then the buzzer will turn on and the system will

generate an alert by which the base camp will come to know soldiers are facing some difficulties.

- GSM Modem

GSM, which stands for Global System for mobile communication, reigns as the world's most widely used cell phone technology. Cell phone towers in the nearby area, GSM module is a breakout board and minimum system of SIM900 Quad-band/SIM900A Dual-band GSM module. It can communicate with controllers via AT commands. This module supports software power on and reset. It has a quad-band 850/900/1800/1900 MHz. It has control via AT commands, a very low power consumption of 1.5 mA (sleep mode).

- Power Supply circuit

The power supply circuit is the important part of any electronics system. Power supply circuit is used to provide power to the microcontroller, LCD, sensors and DC Motor. Regulated output of +5V and of +12V is provided by the power supply circuit. The voltage from the transformer is rectified and filtered by the capacitor. DC voltage that is obtained from the capacitor is given to the input pin of the regulated microcontroller.

- PIR sensor

The PIR (Passive Infra-Red) sensor is used to detect the change made in the surrounding object by measuring the infrared levels made by the movement of the object. The high signal due to the motion of objects is detected on the I/O pin. PIR sensor is a pyroelectric device. The PIR sensor is a device which generates electric charge when exposed to infrared radiation and is made of a crystalline material. An on-board amplifier is used to measure the changes in voltage generated that is obtained by the infrared on striking the object. Fresnel Lens is a special kind of filter used in this sensor which is used to focus the infrared signal onto the object. The motion of the object is indicated by an on board amplifier on rapid change of the ambient infrared signal. This PIR sensor has a single bit output which has a small size that makes it compatible to all microcontrollers of 3V and 5V operation with <100uA current draw.

- DC Motor

DC motor is used to provide locomotion to the robot. It is driven by the power supply circuit with a supply of 12V. DC motor used is compatible with the microcontroller.

IV. APPLICATION

1) Tracks location

The position of the soldier on the war field is sent to the base station with the help of GSM module through SMS.

2) Determination of health status

The health status of the soldier can be monitored without going on the field as this information reaches the base camps via GSM module.

3) Alerts about any risks formerly

The spy robot can be sent into places where there is a high probability of enemy threats. This way the soldier would get prior information about the obstacles ahead. This in turn would be beneficial in minimizing human loss during wars.

4) Backup

This system consists of a buzzer which can be used by the soldier for sending distress signals in the times of need and conveys to the military that they need help.

V. RESULT

LM35 body temperature sensor senses body temperature continuously. Here, we have set 33.600c as the threshold level. Whenever the body temperature of the soldier goes above the assigned threshold value, the system will send relevant data to the control room. The LCD displays the obstacles detected by the robot, if any. The panic button is used in case of any emergency and sends the message i.e. "There is an emergency, please attend urgently" and will alert the militants at the basecamp. Accordingly, the control room will take necessary actions. The LCD displays the obstacles detected by the robot and priorly alerts the soldier about any dangers ahead of him.

VI. CONCLUSION

Our project overcomes most of the difficulties faced by the soldiers in the war zone and a complete aid is provided to the soldiers. The project as a whole can be subdivided into two different projects, one is the soldier health and position tracking system and the other is the spy robot. These two projects are different but they are interconnected via their applications. This is a cost effective, reliable and efficient approach to facilitate the soldiers and reduce human losses. It makes use of various locations and health status tracking and related information transmitting devices which works on a variety of principles. The spy robot is implemented to detect/sense obstacles (water, mine etc.) in their path. This is a prototype which could be implemented on a larger scale with necessary modifications. Thus, in defence application it is possible to provide 24 hour security.

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- **Pillai HOC Institute Of Management Studies & Research** - ***Rasayani*** (MMS: 2-year Post-Graduate Course)

ENGINEERING COURSE

Bachelor, Master & PhD

(Approved by AICTE) (Affiliated to the University of Mumbai & Recognised by Govt. of Maharashtra.)

NBA Accredited

- **Pillai College of Engineering- New Panvel**
  - *B. E. in Information Technology*
  - *B. E. in Computer Engineering*
  - *B. E. in Electronics Engineering*
  - *B. E. in Mechanical Engineering*
  - *B. E. in Electronics & Tele- communication Engineering*
  - *B. E. in Automobile Engineering*
  - *M. E. in Information Technology*
  - *M. E. in Computer Engineering*
  - *M. E. in Electronics Engineering*
  - *M. E. in Mechanical Engineering (CAD/CAM, Robotics)*
  - *M. E. in Mechanical Engineering (Thermal)*

PhD (Technology)

Computer Engineering

Mechanical Engineering

- **Pillai HOC College of Engineering & Technology, *Rasayani***
  - *B.E. in Mechanical Engineering*
  - *B.E. in Electronics & Telecommunication Engineering*
  - *B.E. in Automobile Engineering*
  - *B.E. in Information Technology*
  - *B.E. in Computer Engineering*
  - *B.E. in Civil Engineering*
  - *B.E. in Electrical Engineering*
  - *B.E. in Computer Engineering (Direct second year)*
  - *M.E. in Mechanical Engineering (Machine Design)*
  - *M.E. in Electronics & Telecommunication Engineering*
  - *M.E. in Computer Engineering*
  - *M.E. in IT(Information & Cyber Warfare)*
  - *M.E. in Civil Engineering (Construction & Management)*
  - *M.E. in Computer Engineering (Computer Network & Information Security)*

PhD (Technology)

Civil Engineering

Computer Engineering

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