A Project report

on

TACTILE NAVIGATION SUPPORT FOR BLIND INDIVIDUALS

Submitted in partial fulfillment of the requirements

for the award of the degree of

BACHELOR OF TECHNOLOGY

in

COMPUTER SCIENCE & ENGINEERING

By

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SRINIVASA RAMANUJAN INSTITUTE OF TECHNOLOGY

(AUTONOMOUS)

(Affiliated to JNTUA, Accredited by NAAC with 'A' Grade, Approved by AICTE, New Delhi & Accredited by NBA (EEE, ECE & CSE)

Rotarypuram Village, BK Samudram Mandal, Ananthapuramu-515701

2023-2024

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Certificate

This is to certify that the Project report entitled TACTILE NAVIGATION SUPPORT FOR BLIND INDIVIDUALS is the bonafide work carried out by **M. Joshika, H. Arshia Parveen, K. Hemanth Reddy, G. Akshaya** bearing Roll Number **204G1A0545, 204G1A0515, 214G5A0506, 214G5A0501** in partial fulfilment of the requirements for the award of the degree of **Bachelor of Technology** in **Computer Science & Engineering** during the academic year 2022 - 2023.

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Date: **EXTERNAL EXAMINER**

Place: Rotarypuram

DECLARATION

We, Ms M. Joshika with reg no: 204G1A0545, Ms H. Arshia Parveen with reg no: 204G1A0515, Mr K. Hemanth Reddy with reg no: 214G5A0506, Ms G. Akshaya with reg no: 214G5A0501 students of SRINIVASA RAMANUJAN INSTITUTE OF TECHNOLOGY , Rotarypuram , hereby declare that the dissertation entitled **"TACTILE NAVIGATION SPPORT FOR BLIND INDIVIDUALS"** embodies the report of our project work carried out by us during IV year Bachelor of Technology under the guidance of **Dr. B. Harichandana, M.Tech,Ph.D**, Associate Professor Department of CSE, **SRINIVASA RAMANUJAN INSTITUTE OF TECHNOLOGY**, and this work has beensubmitted for the partial fulfillment of the requirements for the award of the Bachelor of Technology degree.

The results embodied in this project have not been submitted to any other University of Institute for the award of any Degree or Diploma.

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ACKNOWLEDGEMENT

The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without the mention of people who made it possible, whose constant guidance and encouragement crowned our efforts with success. It is a pleasant aspect that we have now the opportunity to express our gratitude for all of them.

It is with immense pleasure that we would like to express our indebted gratitude to our Guide **Dr. B. Harichandana, M.Tech, Ph.D, Associate Professor, Computer Science & Engineering**, who has guided us a lot and encouraged us in every step of the project work. We thank her for the stimulating guidance, constant encouragement and constructive criticism which have made possible to bring out this project work.

We express our deep felt gratitude to **Mr. C. Lakshminatha Reddy, Associate Professor and Mr. M. Narasimhulu, Assistant Professor, Project Coordinators** for their valuable guidance and unstinting encouragement enabled us to accomplish our project successfully in time.

We are very much thankful to **Mr. P. Veera Prakash, M.Tech., (Ph.D.), Assistant Professor & Head of the Department, Computer Science & Engineering,** for his kind support and for providing necessary facilities to carry out the work.

We wish to convey our special thanks to **Dr. G. Bala Krishna, Ph.D., Principal** of **Srinivasa Ramanujan Institute of Technology** for giving the required information in doing our project work. Not to forget, We thank all other faculty and non- teaching staff, and our friends who had directly or indirectly helped and supported us in completing our project in time.

We also express our sincere thanks to the Management for providing excellent facilities**.**

Finally, we wish to convey our gratitude to our families who fostered all the requirements and facilities that we need.

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ABSTRACT

Sighted individuals possess the ability to navigate their surroundings with ease and utilize their visual facility to promptly identify potential hazards. Conversely, individuals who are visually impaired are unable to perceive the external environment, traverse independently, or discern danger. Moreover, they may occasionally feel distressed and wish to notify their family or friends of their location via text. So, the primary challenge faced by visually impaired individuals is their reliance on others, as even their closest relatives may not always be able to provide adequate care. To address this issue, "Smart Stick" would be developed utilizing the "Internet of Things". Using a variety of sensors, including ultrasonic, soil moisture, RF, GPS, and GSM modules and using Arduino UNO, the Smart Stick empowers blind people to be self-adequate and gives them sense of normalcy.

Keywords:

Smart Stick, Ultrasonic Sensor, Soil Moisture, Solar Panel, Infrared Sensor, GPS-GMS Module, Relay Module, RF Module, User setup Notification.

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LIST OF ABBREVIATIONS

IoT	Internet of Things
WHO	World Health Organization
IR	Infrared
GPS	Global Positioning System
GSM	Global System for Mobile Communications
RF	Radio Frequency
SMS	Short Messaage Service
CPU	Central Processing Unit
Li	Lithium
SPI	Serial Peripheral Interface
LED	Light Emitting Diode
AT	Attention
THD	Total harmonic distortion
DC	Direct Current
AC	Alternating Current
IDE	Integrated Development Environment
SDLC	Software Development Life Cycle

CHAPTER 1
INTRODUCTION

Individuals who are visually impaired have several challenges in their daily lives, including those related to social interaction, movement, and information retrieval. Their freedom and quality of life may be impacted by these challenges. Our main aim to work on this project is to focus the blind population of the world and to assist them in every walk of life through the aid of technology. According to the procured data from World Health Organization (WHO) and National Federation of the Blind, there are around 253 million people, who are visually impaired out of which 36 million people are blind worldwide. According to the report by Times of India, India is now home to the world’s largest number of blind people. Of the 36 million people across the globe who are blind, over 15 million are from India. On the other hand, while India needs 2.5 lakh donated eye every year, the country’s 109 eye banks (five in Delhi) manage to collect a maximum of just 25,000 eyes, 30% of which cannot be used.

According to a survey conducted by an NGO, 98% blind people have met with accidents while traveling. In addition, there are no special facilities provided to blind people in local transports resulting in the high number of accidents involving blind people.

The main aids that blind people use are trained dogs, but such dogs are very expensive and not very reliable. Some other products available in the market are the smart belt, smart ring, smart cane etc. But these devices have very limited usability and lack approach due to more cost. So blind people are not interested in buying such products. Some innovators also tried to assist the blind people using IR sensor, but our research found that IR sensor could not work in sunlight because it also contains some amount of infrared rays, which can be detected by photodiode present in IR sensor; our device overcomes this limitation as well.

To a person who is visually impaired, a mobile phone does not effectively serve the purpose to send a panic message whenever the person ends up at a location unknown to him. A simple button on the stick will do the job of sending a message to the acquaintances of the blind person. A software application is designed to let the acquaintances change, add or delete the phone numbers. The user can also set up the phone numbers with the help of the supplier, who has admin access to change the phone numbers. To assist the user if a stick is misplaced, a remote with button is provided, which when pressed, makes a buzzer sound on the stick.

In order to address all above-defined problems and to empower 36 million blind people worldwide, the proposed system provides efficient navigation and low-cost aid for the blind, which gives a sense of artificial vision, by providing them information about the environmental scenario of objects around them. The stick is integrated with various sensors like ultrasonic sensor, water sensor with GPS-GSM module and RF module and with microcontroller etc. Sensors serve as its eyes and the microcontroller as its brain, which will retrieve data from the surroundings and pass on commands to the user notification setup. GPS keeps on monitoring the location of the blind person. RF module will help the blind person to locate the stick easily. The system can easily charge
by solar panel.

1.1 Problem Statement

The system aims to address the challenge of enhancing the navigation safety for visually impaired individuals. Using ultrasonic sensors, it detects obstacles and signals the user through auditory alerts. Additionally, it employs sensors to identify damp surfaces, triggering vibratory alerts. In emergency situations or when the user faces difficulties, the system is designed to send SMS notifications with the user's location. Moreover, a misplaced stick can be located using an RF remote control. This multifunctional approach aims to provide comprehensive assistance to individuals with visual impairments during navigation.

- Blind people cannot easily recognize obstacles or stairs while using normal blind stick.
- No safety features on the normal blind stick.
- Cannot locate the location of the normal blind stick user when they are having an emergency problem or lost in a public area.

1.2 Objectives

The main objective is to develop a comprehensive model geared towards enabling autonomous navigation for individuals with visual impairment in diverse environments, encompassing both familiar and unfamiliar locales. The implementation includes an alert system utilizing a buzzer to effectively signal the presence of obstacles, facilitating obstacle detection and avoidance. Additionally, the work focuses on the creation of a user-friendly interface featuring tactile feedback and discernible sensations specifically tailored for blind users. The intent is to provide a nuanced and accessible interface, allowing blind individuals to interpret environmental cues and navigate with enhanced self-sufficiency.

- To develop a prototype hardware for modern blind stick.
- To help the blind people navigate the route at their best.
- To reduce the risk of injuries and lost for the visually impaired person.

1.3 Scope of the Project

The scope of the project encompasses the development and implementation of a multifunctional Smart Stick for visually impaired individuals. The key functionalities include obstacle detection using ultrasonic sensors, identification of damp surfaces, provision of auditory and vibratory alerts, SMS notifications in emergency scenarios, and remote location retrieval through an RF remote control. The project aims to enhance the safety and independence of visually impaired individuals during navigation. Future enhancements may involve the integration of machine learning for adaptive obstacle detection, smart navigation systems, voice recognition, and exploration of wearable technology options. The project's scope extends to aligning with global accessibility standards, fostering community integration, and focusing on miniaturization and aesthetic improvements for widespread adoption.

CHAPTER 2
LITERATURE SURVEY

The literature review section provides an overview of prior research and findings related to wet/damp surfaces, object detection, upstairs detection, and the Internet of Things (IoT). This survey seeks to contextualize the state of the field as it is today to close knowledge gaps and establish the foundation for the recommended technique.

Development of a walking assistance using Ultrasonic sensor

This paper describes the creation of an ultrasonic walking stick obstacle detection for those with vision impairments. The central processing unit (CPU) of the system is a PIC microcontroller, which sounds a buzzer to warn the visually impaired user to impediments that are identified within a 5 to 35 cm range [1]. Although the technology makes it easier to navigate safely in a variety of locations, it has trouble recognizing some barriers, such stairs and wet surfaces [5]. The study emphasizes the usefulness of the suggested walking stick while pointing out areas that might be improved in subsequent iterations to solve its present shortcomings. Programmable wheels to steer the stick away from the obstacles and also lead the blind person towards his/her destination. Employing IoT to give the benefits of inter-communication between smart sticks (or mobile, PCs) nearby to utilize the functionality of the other stick when one stick's functionality breaks down. Also, running this integrated set of hardware requires an alternative to the battery. The use of solar panels for instance, will be more advantageous in order to get recharged. Obstacles within the distance of about 3m can be detected with the help of these sensors.

Exploring Visionary Walking Aids: Focus on Water Surface Detection

A unique walking assistance system for the visually handicapped is presented in this study. It combines a voice module, an ultrasonic sensor, soil moisture sensor, object, and water sensors, and a blind stick framework [2]. The Arduino UNO receives input from the ultrasonic sensor about obstacles and processes it. The Arduino UNO calculates the obstacle's proximity after analyzing the data. Nothing is done if there is not a barrier to the circuit closing [6]. Most notably, when obstacles are detected within 50 cm of the device, a single voice alert is generated by the system. The study focuses on the technology design and operation of the developed walking aid device for visually impaired individuals [7]. Their proposed system can also detect obstructions that are hidden such as downward stairs, holes etc. The drawback of this proposed stick is that it can be difficult to keep because it was not designed to be foldable. Modification to the proposed system would be: A Braille input device to give the blind person an uncomplicated method to provide the destination address for navigation.

GPS-Based Stick Localization: Challenges and Constraints

To pinpoint an object's accurate ground position smart stick, to be exact, this paper describes the use of the GPS as a satellite navigation system [3]. The stick's location data is updated to a central main board through this system. It is crucial to remember, nevertheless, that this system's effectiveness is limited indoors because GPS signals are unavailable there [4]. Additionally, signals are only precise within 5-meter range, indicating limits in the technology. Under some operational scenarios, the study emphasizes the intrinsic limitations of GPS-based positioning systems [8]. It also used GPS and GSM module. GPS to give positioning and navigation to the stick. GSM module helps to give notifications when the blind person is faced with threats. The system is powered by a rechargeable battery. The hardware implemented on their proposed system consists of the Pair of ultrasonic sensors, Infrared sensor, Water sensor, GPS module, GSM/GPRS module, and Arduino Uno microcontroller board (ATmega328P). The smart stick facilitates the blind person to make calls at times of emergency via the GSM/GPRS module. The GPS module also helps to trace the blind person through the data collected by it. It warns the blind person through beep sound whose intensity increases as the person nears the obstacle which aid him to move aside of the obstacle. Also, when obstacles are detected, it invokes the right speech warning message through a Bluetooth earphone. The use of a rechargeable battery in the system also ensures longer time usage.

RF-Based Stick Localization for Visually Impaired Autonomy

If the stick is misplaced from its intended location, visually challenged people can be informed of its whereabouts by activating RF remote control device. The remote control may send signals to the stick thanks to the RF modules, which enable wireless communication [10]. By providing a concrete method of directing visually impaired individuals back to the proper location of the stick, this communication increases their independence and reduces the possibility of misplacing [9]. To create a dependable and effective localization system for assistive sticks intended for people with vision impairments, RF technology must be integrated. It [8] designed and implemented a Smart Stick for Obstacle Detection and Navigation. Their proposed system utilized infrared, ultrasonic and water sensors.

CHAPTER 3

METHODOLOGY

Existing technologies, like as canes, can assist blind persons in navigating their environment by allowing them to detect obstacles in their route by touching or poking them. Smart belts, smart rings, smart canes, and other aids, in addition to the previous way, can assist users by detecting obstructions using ultrasonic or laser sensors. To warn them, these technologies emit an audio or vibration in response to the detected obstructions.

A solar charging unit is incorporated into the power supply module in addition to regular power supply charging unit. So that the blind stick will charge even in the absence of regular electrical power supply with the help of solar panel unit. The internal block diagram of power supply module of existing and proposed models of blind stick are shown in fig 3.1 and fig 3.2 respectively.

3.1 Existing System

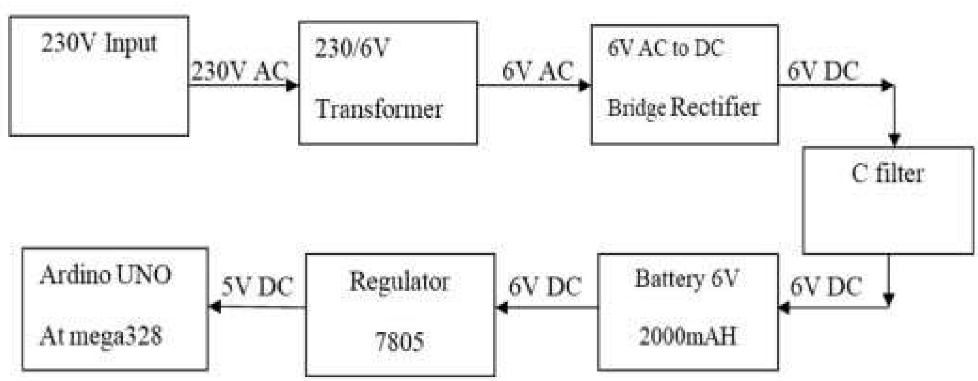

Fig 3.1 Power Supply Module of Existing Model of Blind Stick

The power supply block shown in Fig 3.1 mainly consists a charging unit for charging 2000 mAh Li-ion batteries. The charging of Li-ion batteries is done using regular electric power supply. It will give a power backup of about 5 hrs on full charge. The blind stick with 5 hrs power backup may not be sufficient if the blind people travel for long distances. This issue is addressed in the proposed model of blind stick.

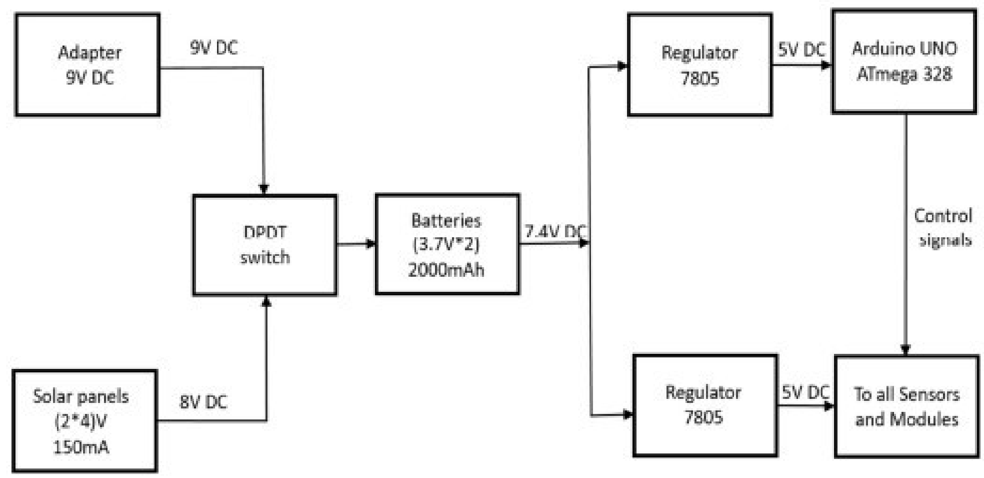

Fig 3.2 Power Supply Module of Proposed Model of Blind Stick

3.2 Proposed system

Developing a Smart stick comprising three modules: one for Object Detection & Wet surface Detection alerts the user by sending buzzer & vibration sounds, second for GMS and GPS Modules for sending location to mobile devices via Push button and another is for the remote control, which is utilized to locate a misplaced stick by sounding an alert.

Module 1: Object and Wet Surface Detection

The first module utilizes ultrasonic for object detection and soil moisture for wet surface. Alerts the user through a dual-alert mechanism, comprising a buzzer for auditory signals and a vibration mechanism for tactile feedback.

Module 2: GSM and GPS Location Notification System

The second module incorporates GPS and GSM modules for accurate communication and position tracking. Actual-time location notifications are transmitted via push notifications to pre-specified mobile devices when user-initiated push button is pressed. Combines location-based communication with sophisticated environmental awareness to create absolute Smart Stick solution.

Module 3: Remote Control

The third module designed with an RF module and a dedicated remotecontrol unit, this module introduces remote control capabilities for locating the stick. Users can remotely activate location alerts, adding a layer of convenience to the Smart Stick. Auditory feedback through a buzzer enhances the user experience during remote control interactions, making the system more user-friendly and accessible.

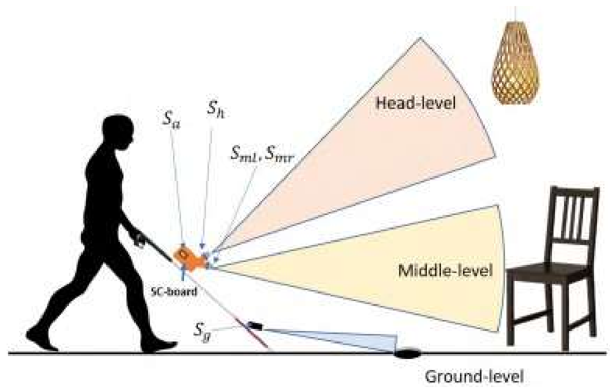

Fig-3.3 Sketch of obstacles

In the proposed system, we use some hardware components. By using these required hardware components, we are able to design a prototype model. Different connections are made to the Arduino board. Among these hardware components, the main component is Arduino Uno microcontroller and solar panels, sensors, modules etc. So, the hardware components used to build the prototype design are mentioned below.

3.3 Hardware:

- Arduino Uno microcontroller
- Solar Panels
- Ultrasonic Sensor
- Moisture Sensor
- Infrared Sensor
- GSM Module
- GPS Module
- RF Module
- Batteries
- Relay Module

- Speaker
- Buzzer
- Vibration Motor
- Push Button
- Adapter

3.3.1 Arduino UNO

The ATmega328P microprocessor is included on the Arduino UNO microcontroller board. This encompasses 14 digital i/o pins, with six configurable as PWM pins, and 6 analog pins. The board is equipped with 16 MHz resonator made of ceramic, an USB link for computer interfacing, ICSP header for a reset button and on-board programming. This provides comprehensive support for the microcontroller, facilitating ease of use by utilizing an AC-to-DC adapter to supply power to it or a USB connection to a computer.

In this project, we can use Arduino UNO board on ATmega328 microcontroller is shown in fig 4.1. It is a 8-bit microcontroller based on AVR RISC architecture. Arduino UNO board have 14 digital input pins out of which it contains 6 PWM output pins and the analog input pins are having 6. i.e., from A0 to A5. ATmega328 is one kind of single-chip microcontroller and it is based on 8-bit RISC (Reduced Instruction Set Computing) processor. It has operating voltage of 5v. It will generate the PWM signals.

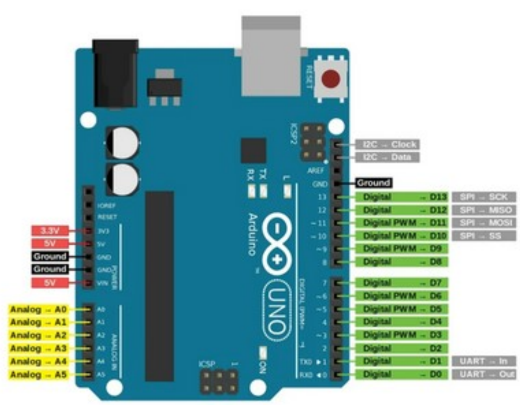

Fig-3.4 Arduino Uno

Usage of Arduino board:

Each of the 54 digital pins on the mega can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor(disconnected by default) of 20-50 Kohms. In addition, some pins have specialized functions:

Reset Button:

There is a reset button given which is used to restart the program running in the Arduino UNO. There are two ways to restart the whole program.

- You can use the default reset button.
- You can connect your own reset button at the pin labelled as reset.

Analog I/O Pins:

The Arduino Uno board has 6 analog pins from A0 to A5. The pins are best used in case of the analog sensors. The analog pins can read the analog signals from them like temperature, proximity, humidity etc., and converts them into digital values that can be read and processed by the microcontroller SPI ports. The SPI (Serial Peripheral Interface) is considered for an expansion of the output. In most pf the cases, ICSP pin act as a small programming header in Arduino Uno consist of RESET, SCK, MOSI, MISO, VCC and GDN.

Digital I/O pins:

Arduino UNO board does have 14 digital i/o pins (input/output pins) out of which contains 6 PWM output (Pulse Width Modulation). The digital pins can be configured to read logic values such as 0 and 1 or can give logic(0 and 1) output for different modules such as LED’s, Relays etc. There is a symbol “~” corresponding to the PWM pins. Additionally, there is AREF which is used to set an external reference voltage usually in between 0 to 5 volts.

3.3.2 Ultrasonic Sensor

Target distance is measured by the electrical transducer in the ultrasonic sensor. by emitting ultrasonic waves. Utilizing piezoelectric crystals, the transmitter releases sound waves, which, upon reflecting off the target, are captured by the receiver. The received signals are then converted into electrical signals, enabling precise distance measurement. Notably, ultrasonic waves operate beyond the audible range of humans, with the sensor's core components are being the transmitter and receiver.

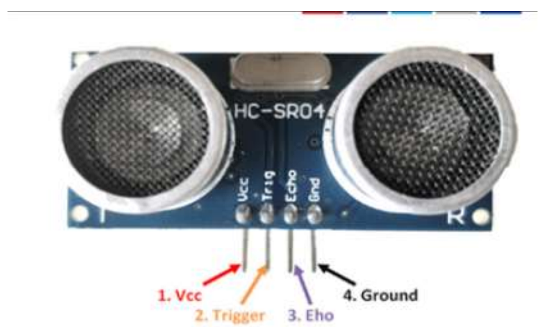

Fig-3.5 Ultrasonic Sensor

There are mainly two essential elements which are the transmitter and receiver. Using the piezoelectric crystals, the transmitter generates sound, and from there it travels to the target and gets back to the receiver component. Specifications:

- The sensing range lies between 40 cm to 300 cm.
- The response time is between 50 milliseconds to 200 milliseconds.
- The Beam angle is around 50.
- It operates within the voltage range of 20 VDC to 30 VDC.
- The voltage of sensor output is between 0 VDC – 10 VDC.
- Ambient temperature is -250C to +700C.

Vcc	Power supply 5V
GND	Common ground
Trigger pin	To start the sensor
Echo pin	Receive the signal

Table 3.1. Pin Description of Ultrasonic Sensor

3.3.3 Soil Moisture

A soil moisture sensor is used to detect the presence of water in the path of blind people. The two probes on the sensor act as variable resistors. When they are placed on a surface, electricity conducts more easily on a wet surface, thus offering a low resistance. While on dry surfaces, more resistance is offered, since electricity conducts poorly. To get the moisture level, the sensor uses these two probes to read the resistance between them.

Soil moisture sensor measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighing of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity. Soil moisture sensors typically refer to sensors that estimate volumetric water content.

- The FC-28 soil moisture sensor includes 4-pins
- VCC pin is used for power
- A0 pin is an analog output
- D0 pin is a digital output
- GND pin is a Ground

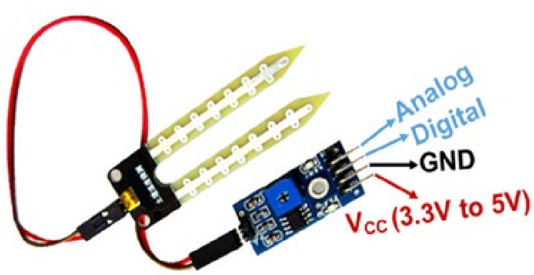

Fig-3.6 Soil Moisture Sensor

3.3.4 Infrared Sensor

An electronic gadget that recognizes infrared radiation is called an infrared sensor, including movement and object heat. Operating as a sensitive photodiode in the non-visible spectrum, it undergoes resistance and voltage changes proportional to received infrared light intensity. Widely used for object presence detection, it is effective in identifying objects within a specified area.

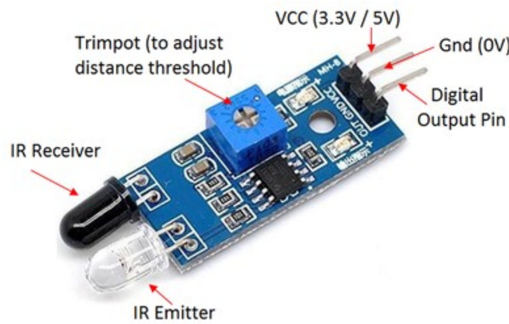

Fig-3.7 Infrared Sensor

3.3.5 RF module

An RF module is a small technological gadget that makes wireless communication between two devices through the transmission and reception of radio signals. This wireless exchange of information can be achieved via use of optical transmission. Widely used in embedded systems, RF modules play a crucial role in establishing efficient wireless connectivity, utilizing either optical or radio-frequency communication methods.

RF communications incorporate a transmitter and a receiver. This module can be used to locate a misplaced stick. The RF transmitter can transmit serial data. Similarly this transmitted data can be received by an RF receiver. In this project the transmitter is mounted on a simple remote control. The receiver is mounted on the stick.

Fig-3.8 RF Module

3.3.6 GSM Module

The GSM module is integral for device communication with the GSM network, managing the establishment and upkeep of communication links. It plays a key role in emergency notifications, alerting designated recipients via SMS. Operational prerequisites include integration with a cellular network and SIM card. A

GSM (Global System for Mobile Communications) module is a small electronic device that allows mobile communication with cellular networks. They communicate with cellular networks using standard AT (Attention) commands through a serial interface, and can provide services such as voice, SMS messaging, and data connectivity.

- NET is a pin where you can solder the helical antenna provided with the module.
- VCC supplies power to the module. It can be anywhere from 3.4V to 4.4 volts.
- RST (RESET) is a hard reset pin. If you got the module in an absolutely bad space, pull this pin LOW for 100ms to perform a hard reset.

Fig-3.9 GSM Module

3.3.7 GPS Module

GPS is a satellite-based navigation system delivering time and location data to GPS receivers. It operates in all weather conditions and is utilized to provide accurate location information, including latitude, longitude, altitude, and time, to devices like Arduino Uno via serial communication. It is instrumental in assisting visually impaired individuals by sharing precise location details with distressed parties.

The battery is automatically charged when power is applied and maintains data for up to two weeks without power. Next, we have our LDO, because of the on-board LDO, the module can be powered from a 5V supply. Finally, we have our UFL connector where we need to connect an external antenna for the GPS to properly work.

- High sensitivity for tracking
- Low supply current (~45mA)
- Is able to track 5 locations per second with an accuracy of 2.5m (horizontal).

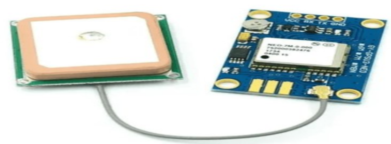

Fig-3.10 GPS Module

3.3.8 Relay Module

Relay modules are electromagnet-operated electrical switches that are triggered by low-power signals from microcontrollers. It controls electrical circuits by opening or closing, comprising a coil, solenoid, iron yoke, movable armature, and contacts. Relay is an electromechanical device that uses an electric current to open or close the contacts of a switch. The single-channel relay module is much more than just a plain relay, it comprises of components that make switching and connection easier and act as indicators to show if the module is powered and if the relay is active or not.

- Supply voltage – 3.75V to 6V
- Quiescent current: 2mA
- Current when the relay is active: ~70mA
- Relay maximum contact voltage – 250VAC or 30VDC
- Relay maximum current – 10A

Fig-3.11 Relay Module

3.3.9 Battery

An energy-storage device that transforms chemical energy into electrical energy is a battery. through electrochemical reactions. It consists of cells with three primary components: an anode ('-'), a cathode ('+'), and an electrolyte facilitating chemical reactions. Batteries serve as essential power sources in diverse applications, functioning by harnessing chemical potential energy and transforming it into electrical energy for utilization in electronic systems. The controller receives its power from a 12 V Li-ion battery that is reusable, which supplies necessary power to all of the sensors and modules that are linked to it.

Fig-3.12 Battery

3.3.10 Speaker

A speaker is employed as an auditory signaling component to deliver audio alerts to the user. The relay associated with the infrared sensor is configured to trigger upon detecting an obstruction, subsequently activating the speaker to emit alerting sound. This relay-driven mechanism ensures that the speaker is engaged in response to the infrared sensor's detection of an obstacle, providing effective means of alerting the user to the presence of obstructions in the monitored environment.

Fig-3.13 Speaker

- Rating a speaker: Speakers are rated in distortion, watts, frequency response, and total harmonic.
- Frequency response: It is produced by speakers, which is the rate of the lows and highs of the sound.
- Watts: For the speakers, it is the amount of amplification.
- Total harmonic distortion (THD): It is the amount of distortion created with the help of amplifying the signal.

3.3.11 Vibration motor

A vibratory motor, is deliberately unbalanced three-phase motor used for vibrating sieves and providing haptic feedback. Controlled by a relay triggered by a moisture sensor detecting water, the motor is activated to induce vibration in response to the detected moisture presence. The relay linked to the moisture sensor is then activated, facilitating the seamless integration of the vibratory motor into the system.

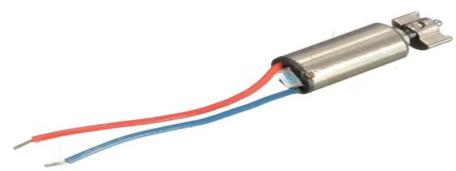

Fig-3.14 Vibration Motor

The main feature of this motor is, it has magnetic properties, lightweight, and motor size is small. Based on these features, the motor performance is highly consistent. The configuration of these motors can be done in two varieties one is coin model and another one is a cylinder model. The vibrator motor specifications mainly include type, max operating torque, max. centrifugal force, weight range, rated current and output. The construction of these motors can be done in two varieties one is coin model and another one is the cylinder/ bar model. These motors are used in numerous material handling devices like conveyors, feeder, and vibrating screens.

3.3.12 Solar Panels

A solar panel, utilizing photovoltaic cells, converts sunlight into electricity by exciting electrons. These electrons generate direct current (DC) electricity, suitable for powering devices or storing in batteries. The setup incorporates two 4V solar panels for a battery charging alongside a conventional power source. Solar technologies, employing mirrors or PV panels, harness solar energy for electricity production or storage in thermal storage or batteries.

Fig-3.15 Solar Panel

3.3.13 Push Button

A push-button is a simple switch mechanism to control some aspect of a machine or a process. Buttons are typically made out of hard material, usually plastic or metal. The surface is usually flat or shaped to accommodate the human finger or hand, so as to be easily depressed or pushed. Buttons are most often biased switches, although many un-biased buttons (due to their physical nature) still require a spring to return to their un-pushed state.

Fig-3.16 Push Button

3.3.14 Switch

In an electrical circuit, a switch is used to connect or detach the conducting channel, stopping the flow of current. In order to preserve battery life, it is utilized to switch the stick on or off while not in use.

Fig-3.17 Switch

3.3.15 Adapter

An adapter is a device that changes the characteristics of one electrical system or device to another that would not otherwise work together. Power adapters change the voltage from AC to a single DC by plugging them into a wall outlet.

Fig-3.18 Adapter

3.3.16 Buzzer

An Arduino buzzer basically a beeper. The Arduino buzzer is a device that produces sound when an electric current is passed through it. The Arduino buzzer can be directly connected to the Arduino and produce different tones by giving different frequency electric pulses to the buzzer. These buzzers are most commonly used as beepers in any system, alarm devices, timers, security systems and to produce sound on confirmation of user input in many systems. The buzzers are of different types such as mechanical buzzers, electro mechanical and piezoelectric buzzers.

Fig 3.19 Buzzer

3.4 Software

In this chapter, we will discuss about software development. In this we will use a microcontroller, USB cable and a PC. Here, first we can test the microcontroller by using a USB cable connecting to the PC. When we attach a USB cable to the microcontroller the LED will blink. Through this we can decide that the microcontroller works properly. By using PC we can dump the code into the microcontroller. By dumping the code only, the working of microcontroller depends. So, we can use the Arduino microcontroller for various purpose.

3.4.1 Installation of Software

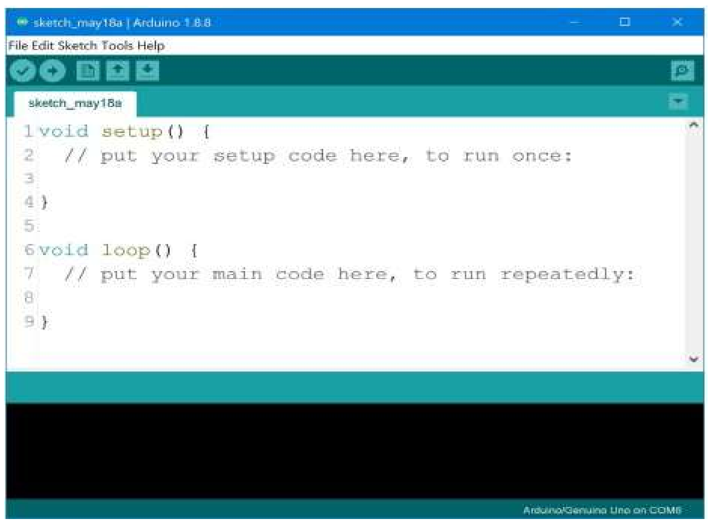

Fig 3.20 Arduino IDE

Arduino is an open-source platform which is easy to use and a lot of library is provided. Compared to other microcontroller, it has a variety of different microcontroller build for specific purposes. Arduino itself also has its own Arduino development environment which is free and easily available online. Arduino is a development board whereas microcontroller like 8051 is just a microcontroller. Arduino simplifies the amount of hardware and software development needed to do in order to get the system running.

The driver for the Arduino needs to be installed by just plugging in the board. The port number needs to be set correctly before transferring the code from computer to the microcontroller. Once the code is done, we can transfer the code by just pressing the upload button and the code will be directly transferred to the microcontroller. For debugging purpose, the Arduino is equipped with a serial monitor for user to check. This is to ensure the data transfer is correct and is successfully received at both ends.

OPERATION DEMO

Step 1: Install the Arduino Software (IDE)

Download the most recent variant from this page: https://arduino.cc/en/Main/Software. Next, continue with the establishment and please permit the driver establishment process.

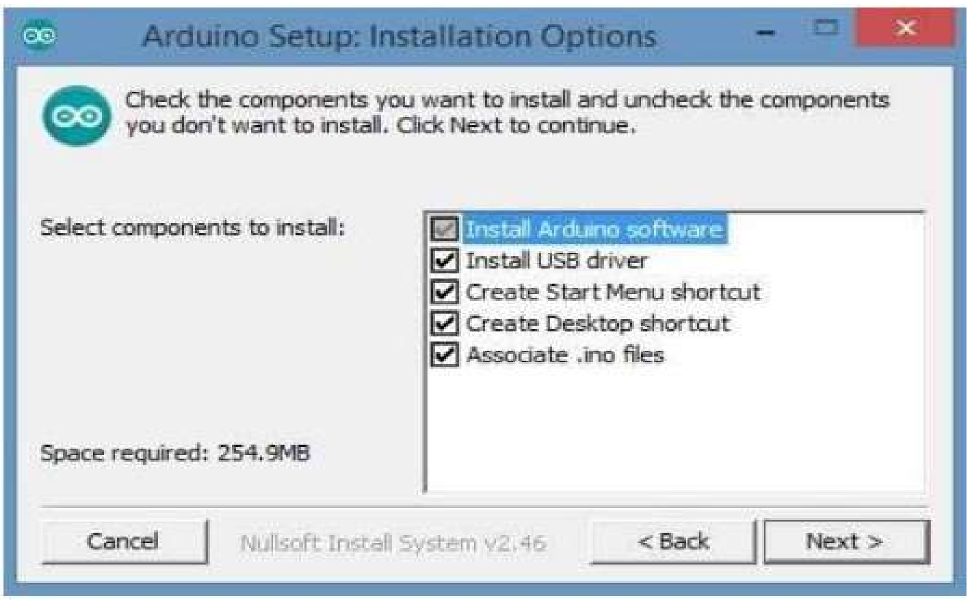

Fig 3.21 Arduino Setup Installation Options

Pick the parts to introduce and click “next” catch.

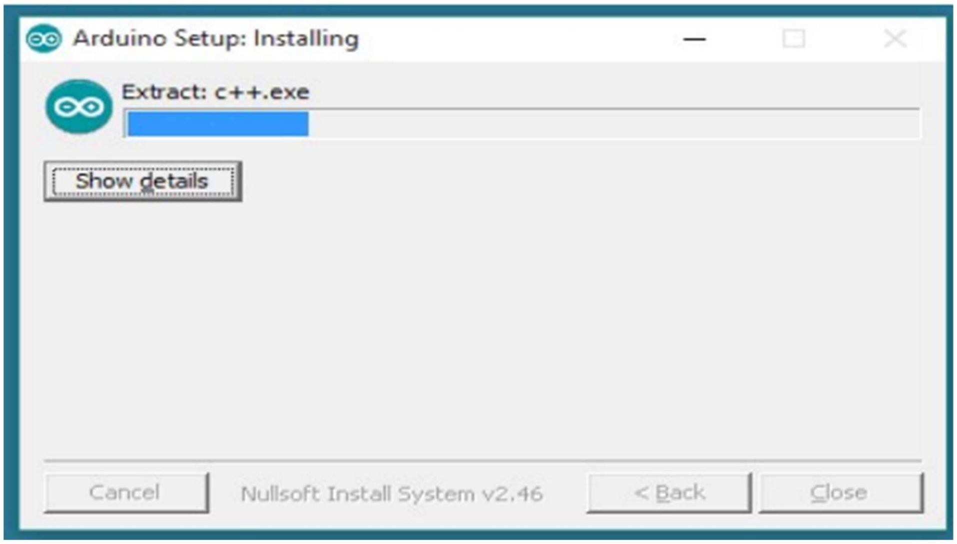

Fig 3.22 Arduino Setup Installation Folder

Pick the establishment index.

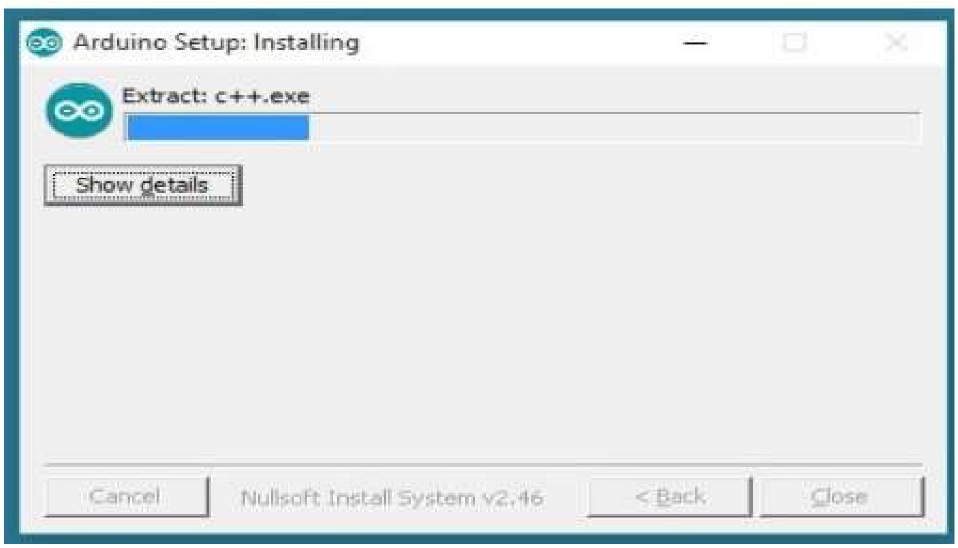

Fig 3.23 Arduino Setup Installing

The procedure will separate and introduce all the expected documents to execute legitimately the Arduino software (IDE).

Step 2: Get An Uno and USB Cable

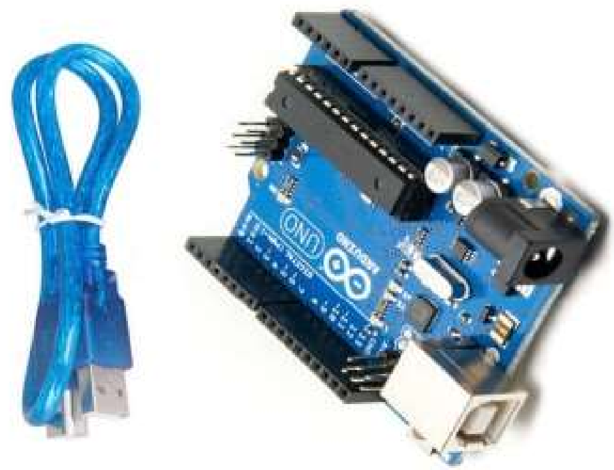

Fig 3.24 USB cable UNO board

Step 3: Connect the Board

The USB association with the PC is important to program. The UNO will consequently draw control from either the USB or an outside power supply. Associate the board to your PC utilizing the USB link.

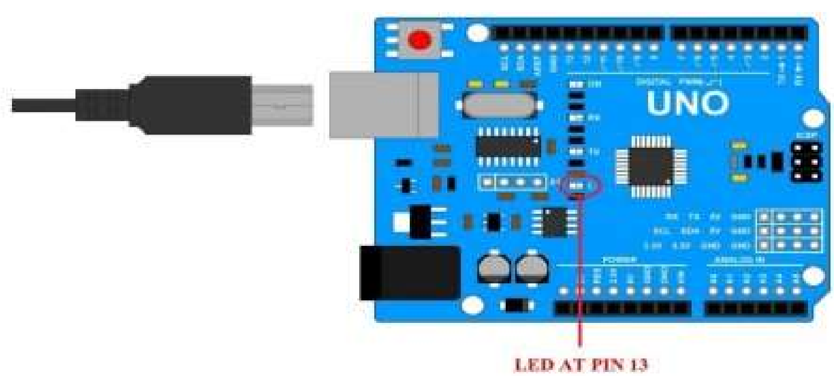

Fig 3.25 Connection of USB cable with UNO board

Step 4: Open Lesson 1 (LED Blink)

Open the LED blink example sketch:

CD>For Arduino>Demo code>Lesson LED_blink>ledblink.

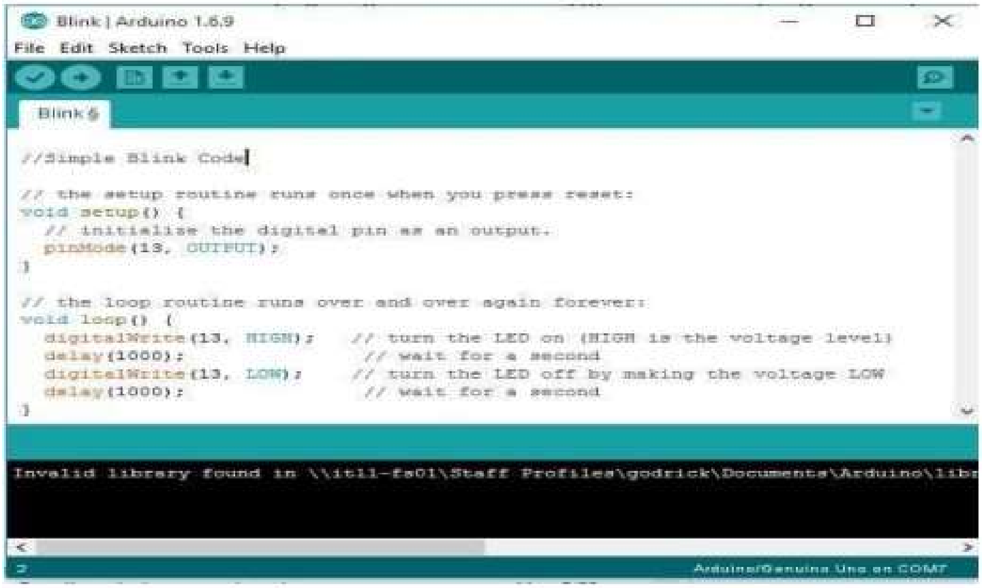

Fig 3.26 LED Blink

Step 5: Select Tour Board

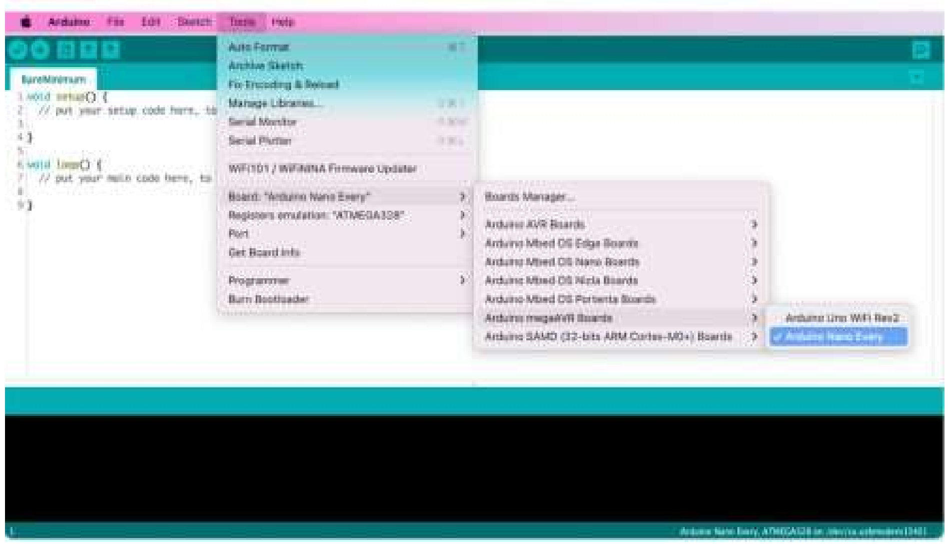

Fig 3.27 Path to Select Board

You will need to select the entry in the Tools > Board menu that corresponds to your Arduino board.

Step 6: Select your Serial

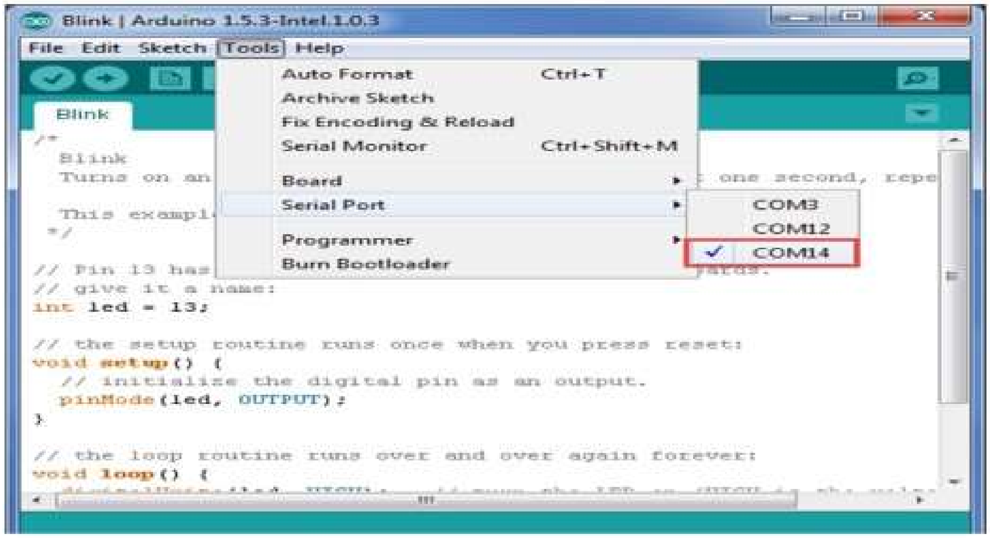

Fig 3.28 Path to Select Serial Port

Select the serial gadget of the board from the Tools | Serial port menu. This is probably going to be COM3 or higher (COM1 and COM2 are generally held for equipment serial ports). To discover, you can detatch your board and reopen the menu; the passage that vanishes ought to be the arduino board. Reconnect the board and select that serial port.

Step 7: Upload the program

Fig 3.29 Path to Upload

Presently, essentially tap the "Transfer" catch in the earth. Hold up a couple of moments – you should see the Rx and Tx leds on the board blazing. On the off chance if transfer is fruitful, the message "Done transferring" will show up in the status bar.

Step 8: Output

A few second later , upload finishes. You should see the pin 13 (L) LED on the board start to blink (in orange).

3.5 Functional Requirements:

- To develop a prototype hardware for modern blind stick.
- To help the blind people navigate the route at their best.
- To reduce the risk of injuries and lost for the visually impaired person.

3.6 Non-Functional Requirements:

Reliability:

- The smart blind stick should be ensuring that it operates consistently and accurately in various environments and conditions.

Portability:

- The device should be lightweight, compact, and easy to carry, ensuring that it is practical for daily use and travel.

Usability:

- The smart blind stick should be user-friendly, with an intuitive interface and easy-to-understand controls.

3.7 Planning

To implement this project Iterative Model is used. It involves continuous cycle of Planning, Analysis, Implementation and Evaluation. The Iterative Model allows the accessing earlier phases, in which the variations made respectively. The final output of the project renewed at the end of the Software Development Life Cycle (SDLC) process.

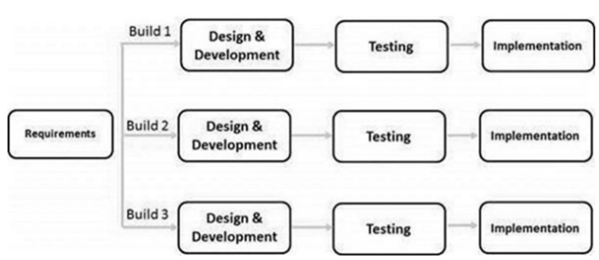

Fig 3.30 Iterative Model

3.8 Cost Estimation

S. No.	Item Head	Estimated Cost (Rs.)	Fund to be arranged by students / other sources (Rs.)	Fund required from the Institute in INR Total (Rs.)
A	**Non-recurring (Capital Items)**			
1	*Permanent Equipment*			
	*Subtotal (*Non-recurring*)*			
B	**Recurring Items (General)**			
1.	*Manpower*	*4*		
2.	*Consumables*	Arduino Uno 1100 Solar Panels (2) 500 Ultrasonic Sensor (2) 300 Moisture Sensor 150 Infrared Sensor 250 GSM Module 550 GPS Module 650 RF Module 350 Batteries (2) 500 Relay Module (2) 200 Regulators (2) 250 Speaker 200 Amplifier 300 Buzzer (2) 100 Vibration Motor 250 Push Button 150 Adapter 400		6200
3.	*Contingencies*	Male to Male Jumper Wires 120 Soldering Iron, soldering stand and wire 800		920
4.	*Travel*	400		400
5.	*Overhead*			
	*Subtotal (*Recurring Items)			7520
	Total amount (A+B)			7520

Table 3.2 Estimated cost of the equipment

3.9Time Estimation

S. No.	***Activity / Milestone***	**No. of Months**
1.	Domain Selection	0.25
2.	Abstract	0.25
3.	Literature Survey	0.5
4.	Planning	1
5.	Design	1
6.	Hardware Testing	1
7.	Software Implementation	1
8.	Hardware Implementation	1.5
9.	Testing	0.5
10.	Execution	1

Table 3.3 Activity performed

CHAPTER 4
DESIGN

4.1 Block Diagram

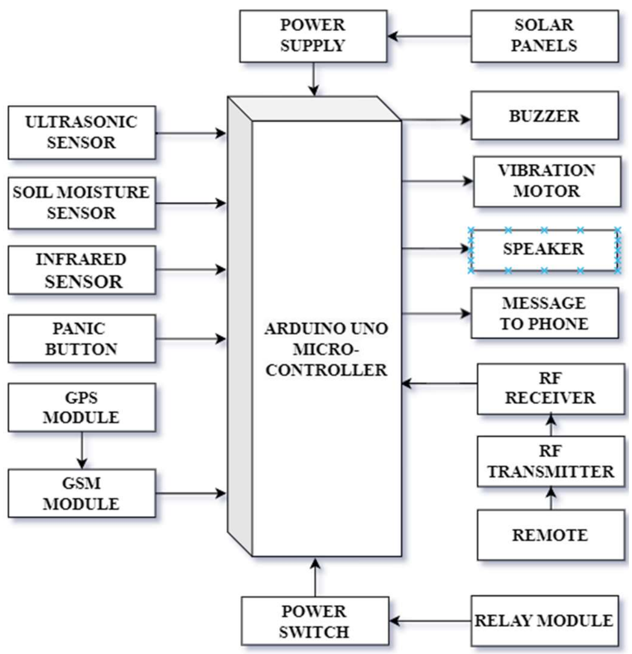

Fig 4.1 Block Diagram

Here is a brief overview of the working principle of a multifunctional blind stick:

1. **Ultrasonic sensor:** The ultrasonic sensor is used to detect obstacles in the path of the user. It emits high-frequency sound waves and measures the time taken for the waves to bounce back from objects in the vicinity. Based on this information, the device alerts the user about the presence of obstacles.
2. **Moisture sensor:** The moisture sensor is used to detect wet surfaces such as puddles or wet floors. This helps the user to avoid slippery surfaces that can pose a safety hazard.
3. **IR sensor:** The IR sensor is used to detect the proximity of objects. It emits infrared rays and detects their reflection to determine the distance of the object from the user.
4. **GPS module:** The GPS module is used to track the location of the blind person.

5. **GSM module:** The GSM module is used to send SMS alerts to a pre-configured emergency contact in case of an emergency. For example, if the blind person presses the panic button, the device can automatically send an alert message to a family member or caregiver.
6. **RF module:** The RF module is used to provide the user with audio feedback about the surrounding environment. For example, it can inform the user about the presence of traffic or other potential hazards.
7. **Solar panel**s: The solar panels are used to provide power to the device. They can be used to recharge the battery during the day, ensuring that the device remains operational even in areas without access to a power source.

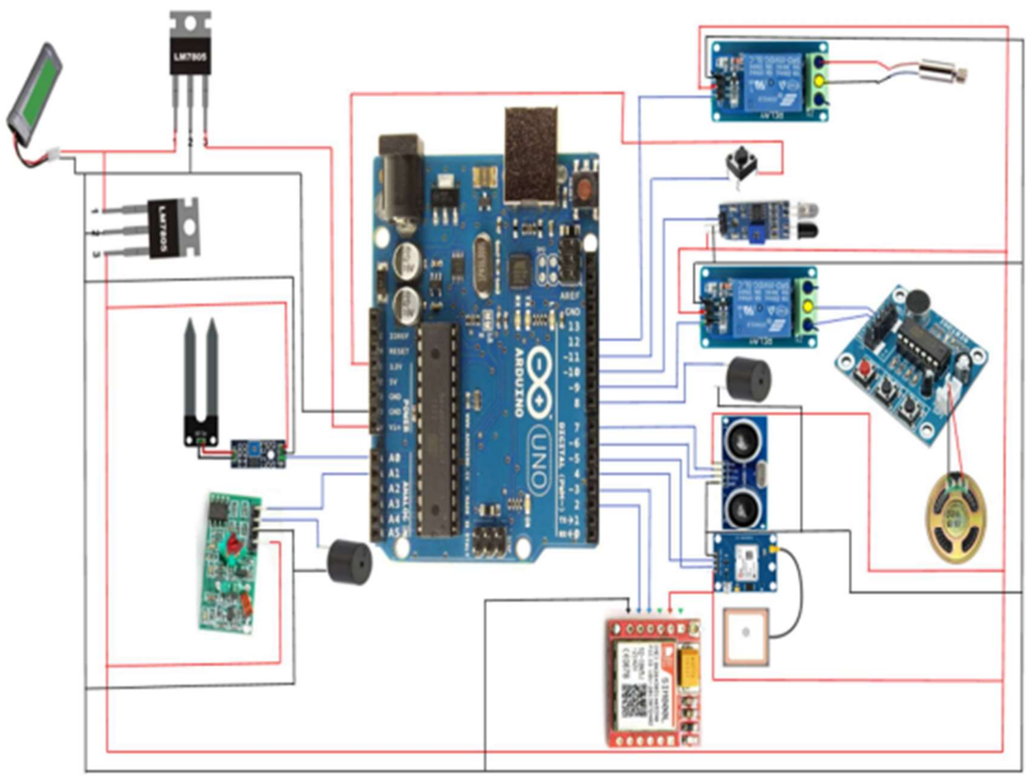

Fig 4.2 Experimental Setup

4.2 Flow chart for detecting obstacles and water surfaces

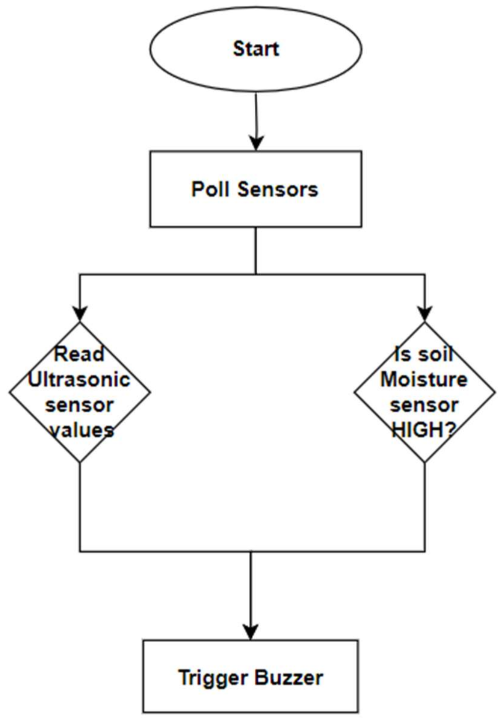

Fig 4.3 Flow chart for detecting obstacles and water surfaces

The first module of the system integrates ultrasonic technology for object detection and soil moisture sensing to detect wet surfaces. This combination enables the system to effectively identify obstacles and assess soil moisture levels. Ultrasonic sensors emit high-frequency sound waves and measure the time it takes for them to bounce back, thus determining the distance to objects in their path. This feature aids in obstacle avoidance, enhancing the safety and efficiency of the device.

To ensure timely alerts and user awareness, the module employs a dual-alert mechanism. This mechanism consists of a buzzer for auditory signals and a vibration mechanism for tactile feedback. The buzzer emits audible alerts, notifying users of any detected obstacles or wet surfaces. Meanwhile, the vibration mechanism provides tactile feedback, ensuring that users are alerted even in noisy or crowded environments where auditory signals may be less effective.

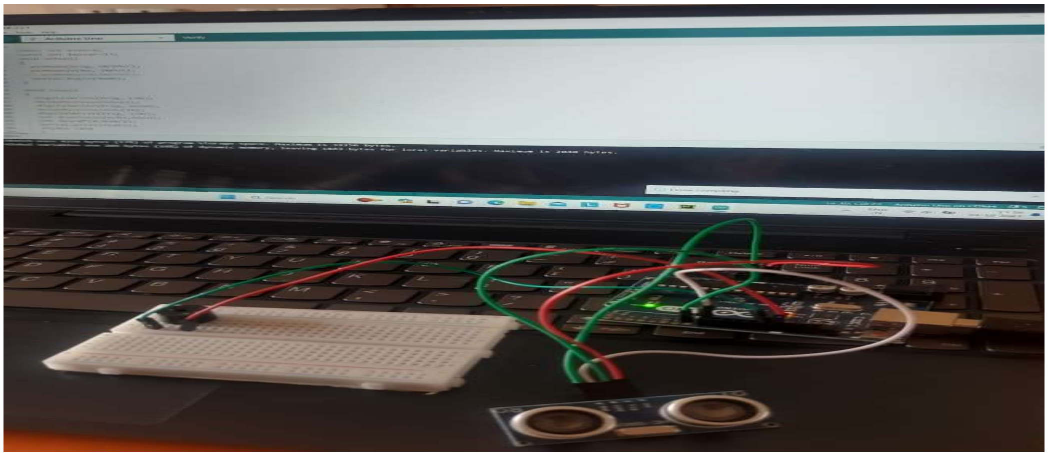

Fig 4.4 Obstacle Detection by Ultrasonic Sensor

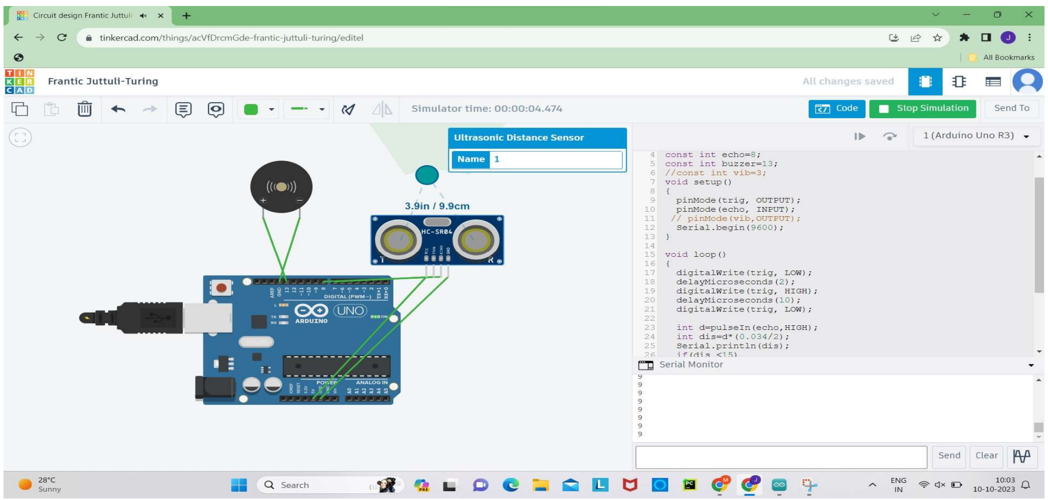

Fig 4.5 Object Detected and Triggered Buzzer

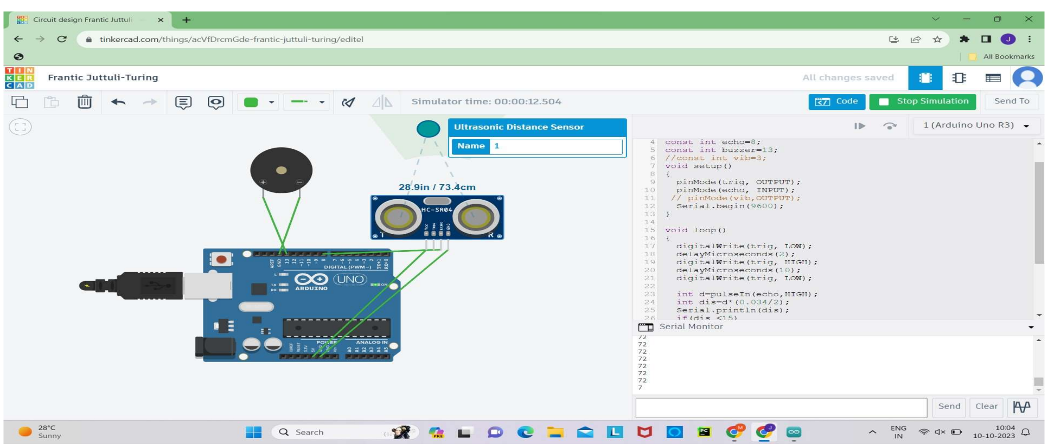

Fig 4.6 No Object Detected and Buzzer not triggered

The inclusion of soil moisture sensors allows the system to discern the moisture content of the ground. This capability is particularly useful for applications such as gardening or agriculture, where knowledge of soil moisture levels is crucial for plant health and growth. By incorporating these sensors, the system can accurately detect wet surfaces, enabling users to make informed decisions about watering or drainage.

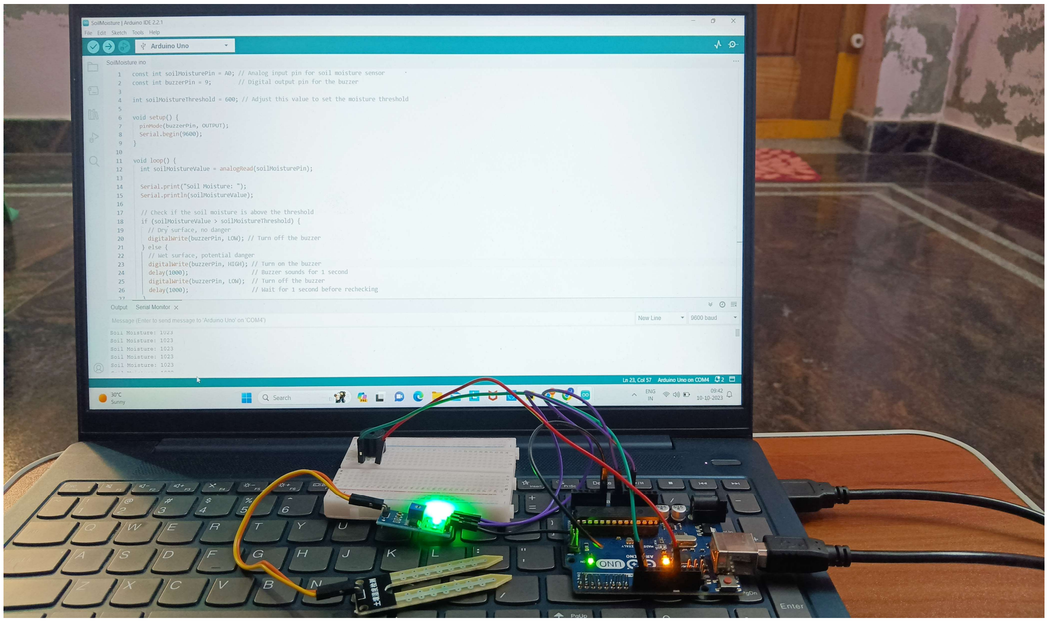

Fig 4.7 Water Detection by Soil Moisture Sensor

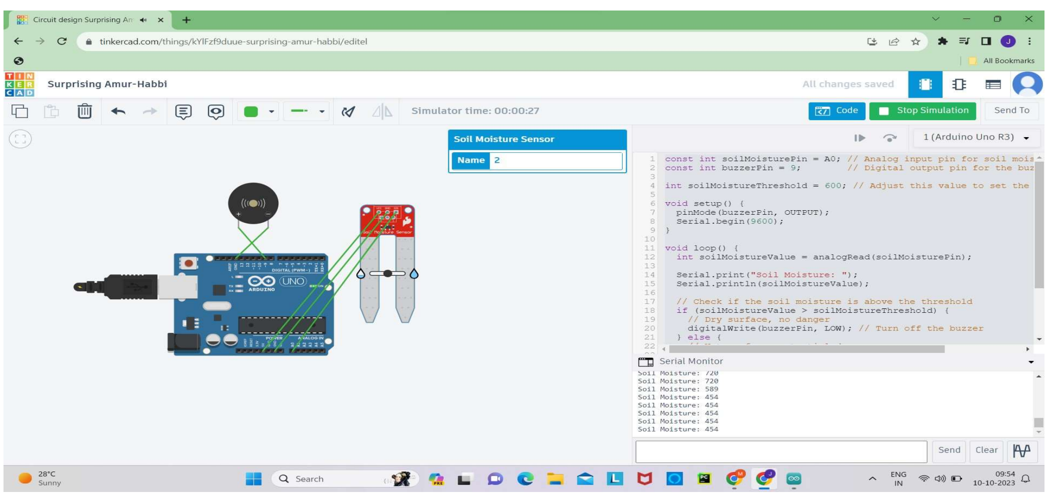

Fig 4.8 Water Detected and Triggered Buzzer

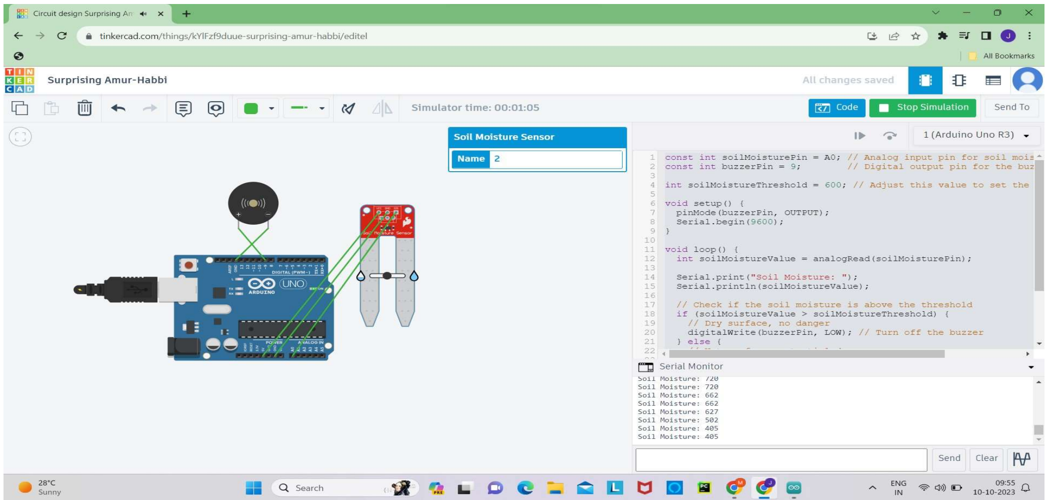

Fig 4.9 No Water Detected and Buzzer not triggered

By combining ultrasonic technology with soil moisture sensing and a dual-alert mechanism, the first module offers a comprehensive solution for object detection and wet surface detection. This integration enhances the functionality and usability of the system, making it suitable for a wide range of applications, from navigation aids for the visually impaired to smart irrigation systems for agricultural use.

4.3 Flow chart for SMS Notification

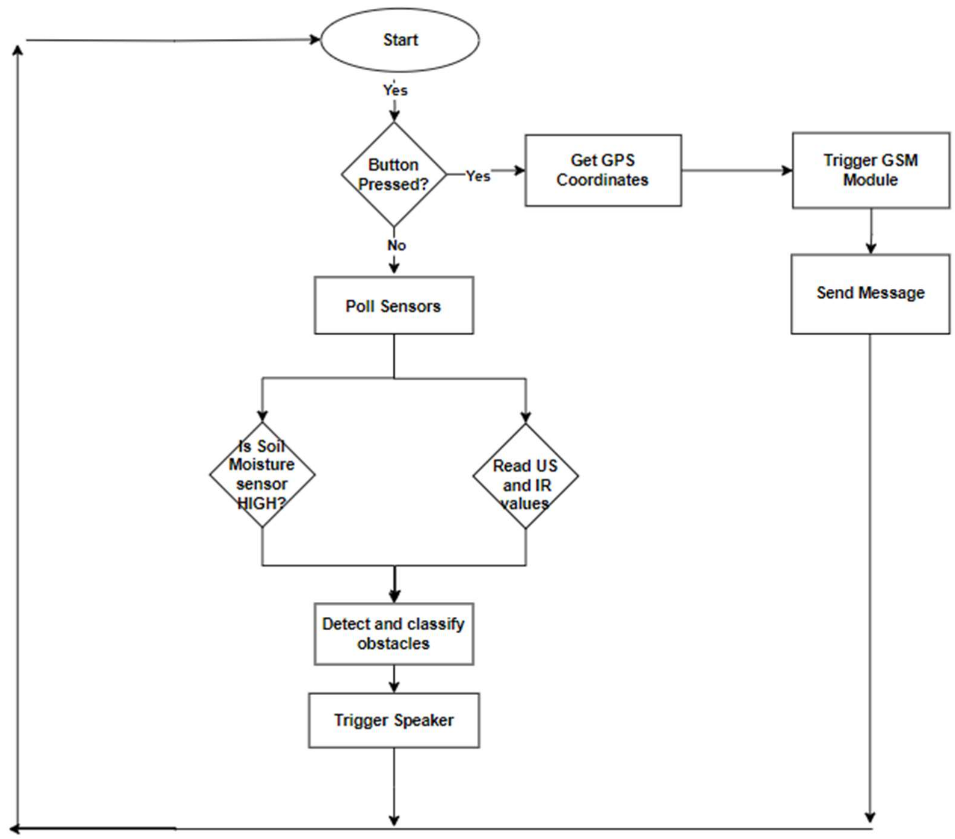

Fig 4.10 Flow chart for detecting obstacles, water surfaces and SMS Notification

The second module of the Smart Stick system integrates GPS and GSM technologies to enable precise position tracking and communication. By leveraging GPS signals and cellular networks, the device can determine its exact location and transmit real-time updates to pre-specified mobile devices. This feature is activated when the user presses a designated push button, ensuring quick and efficient communication in emergency situations or when assistance is needed.

Combining location-based communication with sophisticated environmental awareness, this module provides a comprehensive solution for users. It offers not only the ability to track the user's position accurately but also ensures seamless connectivity with caregivers or emergency responders. With its reliable push notification system and integration of GPS and GSM modules, the second module enhances the overall functionality and safety of the Smart Stick, making it an invaluable tool for individuals requiring assistance with navigation and communication.

4.4 Flow chart for Remote Control

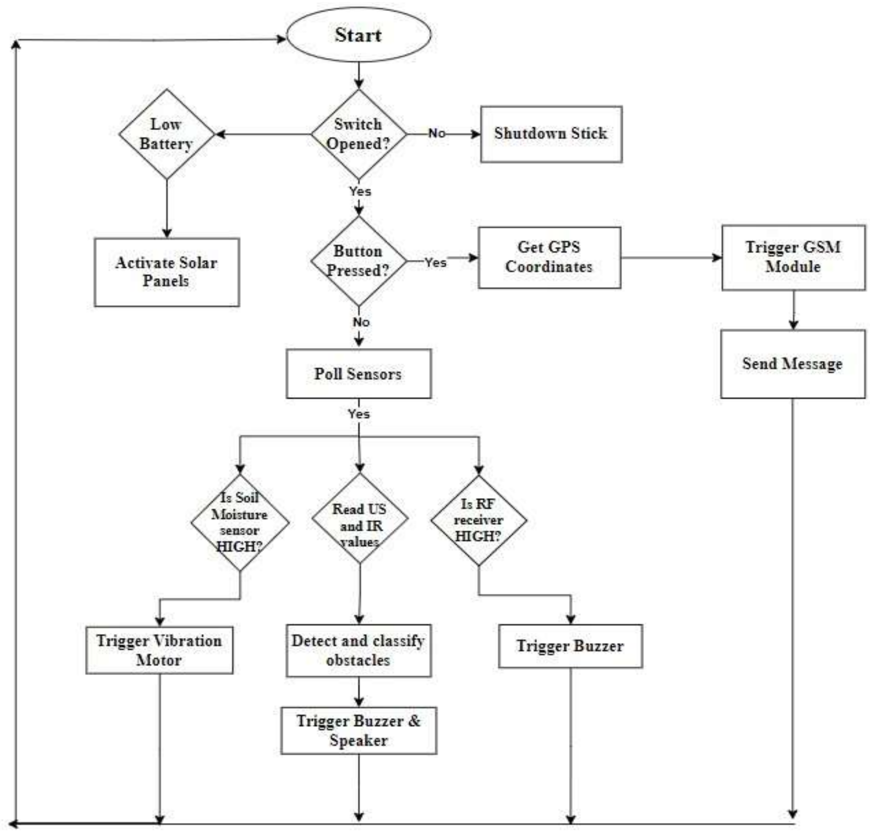

Fig 4.11 Flow chart for detecting obstacles, water surfaces and SMS Notification, RemoteControl

The third module of the Smart Stick system is engineered with an RF (Radio Frequency) module and a dedicated remotecontrol unit, expanding its capabilities with remote control functionalities. With this module, users gain the ability to remotely activate location alerts, providing an added layer of convenience to the Smart Stick's functionality. This feature enables users to locate the stick even if it's out of reach or misplaced, enhancing the overall user experience and ensuring peace of mind.

In addition to its remotecontrol capabilities, the third module incorporates auditory feedback through a buzzer, further enhancing the user experience during interactions with the remote control unit. This auditory feedback makes the system more user-friendly and accessible, allowing users to easily understand and respond to remote control commands. By combining remote control capabilities with auditory feedback, the third module adds versatility and usability to the Smart Stick system, catering to the needs of users seeking enhanced control and convenience.

CHAPTER 5
IMPLEMENTATION

5.1 Hardware Implementation

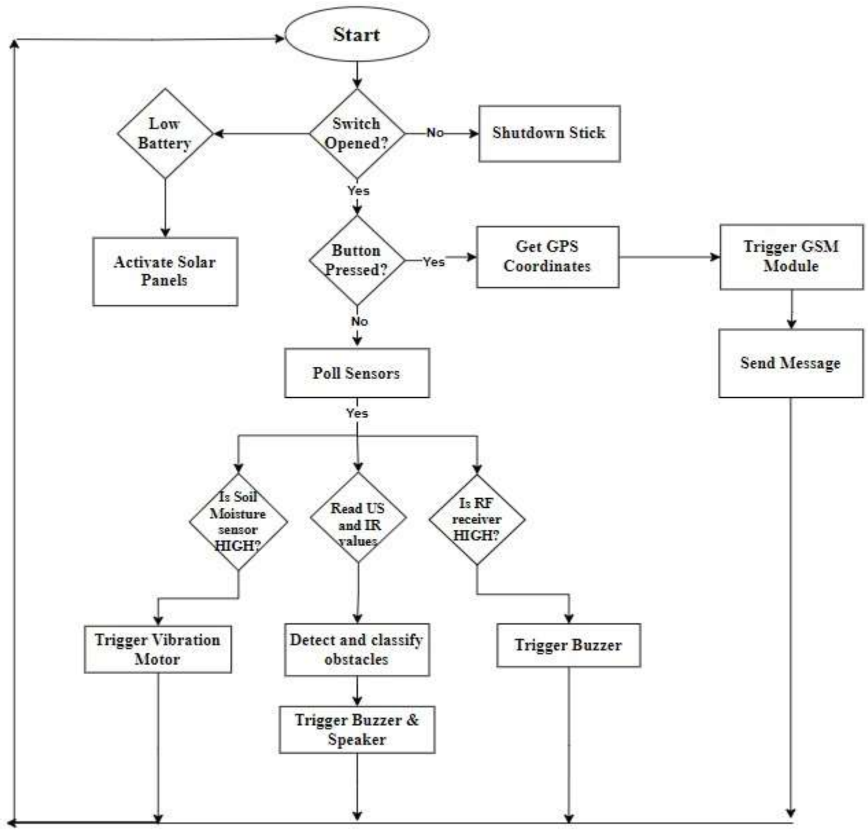

Fig 5.1 Implementation of Proposed system

Switch

The smart blind stick activates and becomes operational when the switch is turned on. It does not begin to operate if it is not turned on.

If switch == 1 -- Smart Blind Stick On (1)

Else -- Smart Blind Stick Off

Objects Detection

It is positioned two thirds of the way up the stick's length away from the bottom end in order to detect impediments. This configuration can identify barriers of different sizes and shapes. Following the analysis of the data from these sensors, the logic in the "Table 1" below determines the type of obstacle, and the buzzer is used to play the appropriate answer to the user.

Fig 5.2 Sensing the objects using Ultrasonic sensor

a = pulseIn(echoPin, HIGH); (2)

d=(a/2)/29.1; (3)

If d < 20

If (d > 50 && d < 100)

Alerts voice1

If d < 35

If d < 150

If (d > 150 && d < 200)

Alerts voice2

Else

No Alert

Where voice1 - Speaker

Voice2 – Buzzer

TABLE 5.1 Classification of obstacles based on sensor readings

Type of Obstacle	Type of alert	Sensors (Proximity & Distance readings)	
		IR sensor	Ultrasonic sensor
Stairs	**Voice 1**	< 20 cm	> 50 cm & < 100 cm
Near Obstacles	**Voice 2**	< 35 cm	< 150 cm
Far Obstacles	**Voice 2**	< 35 cm	> 150 cm & < 200 cm

An ultrasonic sensor positioned at a about 40° angle on the stick was used to detect the objects. In order to demonstrate that there are no objects in the road, the distance of the sensor shouldn't be greater than 74 cm if it is positioned at a height of 56 cm.

One of these methods is sound, where a buzzer is utilized that stands out from the others by making a sound that blind people can identify—beeps.

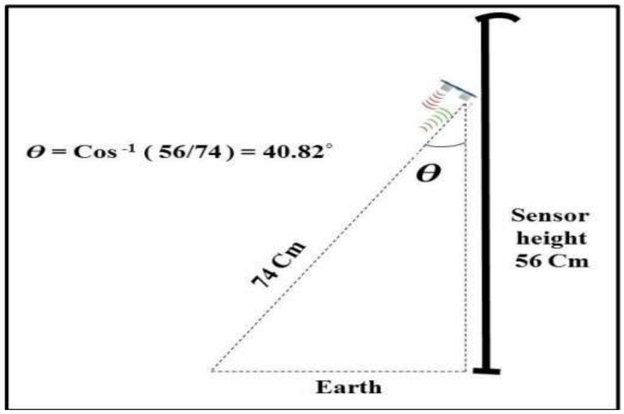

Fig 5.3 Inclination of Ultrasonic sensor

Moisture Level

When the moisture sensor reaches the threshold value, it operates by scanning the surface and providing a boolean output. The vibration motor, which is affixed to the top end of the stick, alerts the user by vibrating.

If value > 50 -- Vibration Motor On (4)

Else -- Vibration Motor Off

IR sensor

In order to facilitate the recognition of stairs and other tiny impediments on the ground, an The stick has infrared fitted at the bottom. Using a voice kit, we are able to verify that the speaker is issuing the proper speech warning and to examine the entire operation.

If motion == 1 -- Speaker On (5)

Else -- Speaker Off

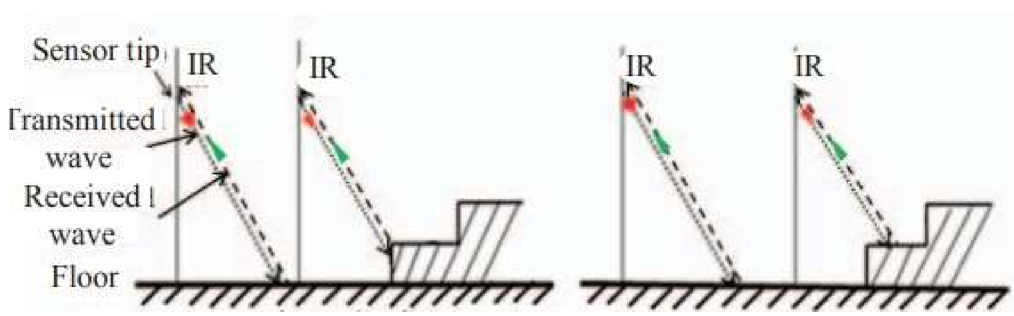

Fig 5.4 IR sensor for Upstairs

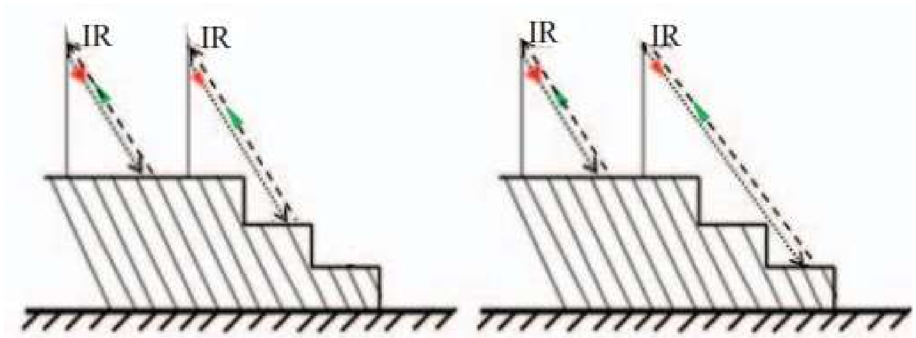

Fig 5.5 IR sensor for Downstairs

RF Receiver

An RF transmitter positioned on a basic remote controller sends an RF signal to an RF receiver mounted on a stick. Together with the RF transmitter, this remote controller also features a straightforward push button that, when depressed, sends out an RF signal that the blind stick's RF receiver picks up and helps the user find it by raising a buzzer alarm for a short while after getting the signal.

If remote == 1 -- Find the position of stick (6)

Else Can't find the position of stick

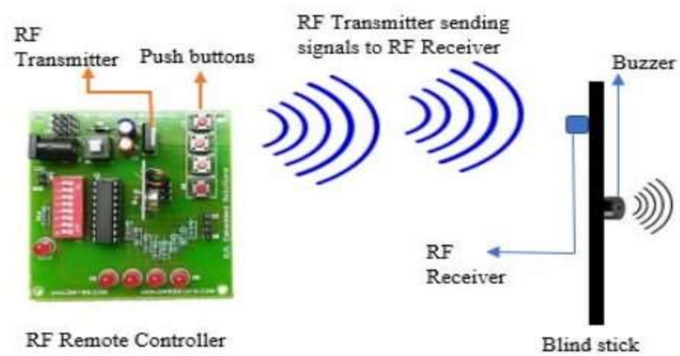

Fig 5.6 RF Mechanism

GPS & GSM

The GPS module polls the user for their coordinates when it detects a button press. The syntax for these coordinates is "http://maps.google.com/maps?q=loc:<latitude>,<longitude>," which is the URL for a Google Maps location. The link is then prefaced with a suitable phrase, like "Alert please help me," and this processed message is sent via the GSM module. to the user's caregivers.

If pushbutton ==1 -- Activate the GPS Module (7)

If GPS == 1 -- Activate the GSM Module (8)

If GSM ==1 -- Send Location to coordinates (9)

Else – No Location sent

Else – No Activation of GSM Module

Else – No Activation of GPS Module

5.2 Software Implementation

Source code:

```
#include <SoftwareSerial.h>
#include <RH_ASK.h>
#include <SPI.h> // Not actualy used but needed to compile
#include <TinyGPSPlus.h>
SoftwareSerial ss(4, 5);//gps tx rx
SoftwareSerial mySerial(3,2);//gsm tx rx
RH_ASK driver;
TinyGPSPlus gps;
#define echoPin A1
#define trigPin A2
#define Relay1  9
#define Relay2  13
#define Buzzer  8
#define SoilMoisture A0
#define PushButton 12
#define IR 10
long duration;
int distance;
int ButtonState = 0;
byte gpsData = 0;
String Lat, Long;
int timer;
void displayInfo()
{
  //Serial.print(F("Location: "));
  if (gps.location.isValid())
  {
    Lat = String(gps.location.lat());
```

```
    Long = String(gps.location.lng());
    Serial.print(gps.location.lat(), 6);
    Serial.print(F(","));
    Serial.println(gps.location.lng(), 6);
  }
  else
  {
    Serial.print(F("INVALID"));
  }
}
void GSM_setup()
  {
    Serial.begin(9600);
    mySerial.begin(9600);
    Serial.println("Initializing...");
    delay(1000);
    mySerial.println("AT"); //Once the handshake test is successful, it will back to OK
    updateSerial();
    mySerial.println("AT+CMGF=1"); // Configuring TEXT mode
    updateSerial();
    mySerial.println("AT+CMGS=\"+916301083854\"");
    updateSerial();
    String textSMS1="Alert please help me: GPS
LOCATION\nhttp://maps.google.com/?q=";
      textSMS1 += Lat;
      textSMS1 += ",";
      textSMS1 += Long;
    mySerial.print(textSMS1); //text content
    updateSerial();
    mySerial.write(26);
}
void updateSerial()
{
  delay(500);
```

```
  while (Serial.available())
    {
      mySerial.write(Serial.read()); //Forward what Serial received to Software Serial Port
    }
   while(mySerial.available())
    {
      Serial.write(mySerial.read()); //Forward what Software Serial received to Serial Port
    }
}
void Distance()
{
  long duration, distance;    // Trigger ultrasonic pulse
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);   // Measure the pulse duration on echo pin
  duration = pulseIn(echoPin, HIGH);    // Calculate distance in centimeters
  distance = (duration / 2) / 29.1;    // Print distance to Serial Monitor
  Serial.print("Distance: ");
  Serial.print(distance);
  Serial.println(" cm");
  if(distance >10 && distance < 30)    {
      digitalWrite(Buzzer, HIGH);
      delay(50);
      digitalWrite(Buzzer, LOW);
      timer = distance * 10;
      delay(timer);
    }
}
void RF433_Receive()
{
```

```
  uint8_t buf[12];
  uint8_t buflen = sizeof(buf);
  if (driver.recv(buf, &buflen)) // Non-blocking
    {
      Serial.print("Message: ");
      Serial.println((char*)buf);
      if((char*)buf ==1)
        {
         digitalWrite(Buzzer,HIGH);
        }
    }
}
void SoilMoisutre()
{
 int Moisture = analogRead(A0);
 int value = map(Moisture,1023,0,0,100);
 Serial.print("Moisture Level :");
 Serial.println(value);
 if(value > 50)
   {
    digitalWrite(Relay1,HIGH);
   }
 else
   {
    digitalWrite(Relay1,LOW);
   }
}
void IRsensor()
{
 int Motion = digitalRead(IR);
 Serial.print("Motion :");
 Serial.println(Motion);
 if(Motion == 0){
    digitalWrite(Relay2,HIGH);
```

```
    }
  else{
      digitalWrite(Relay2,LOW);
    }
}
void setup() {
  pinMode(trigPin,OUTPUT);
  pinMode(echoPin, INPUT);
  pinMode(Relay1, OUTPUT);
  pinMode(Relay2, OUTPUT);
  pinMode(Buzzer, OUTPUT);
  pinMode(SoilMoisture, INPUT);
  pinMode(IR,INPUT);
  pinMode(PushButton,INPUT);
  Serial.begin(9600);
  ss.begin(9600);
  if (!driver.init())
      Serial.println("init failed");
  //GSM_setup();
}
void loop() {
  while (ss.available() > 0)
    if (gps.encode(ss.read()))
      displayInfo();
  ButtonState = digitalRead(12);
  if (ButtonState == HIGH) {
    GSM_setup();
  }
  RF433_Receive();
  SoilMoisutre();
  Distance();
  IRsensor();
  delay(500);
}
```

CHAPTER 6
TESTING

6.1 Testing approach

We will test the project in two stages: software and hardware. The software part is to be tested via the Arduino UNO IDE, whereas the hardware part has to be tested physically. It is necessary to check whether the system is working properly or not.

6.2 Features to be tested

After building the whole circuit we test it, This project should satisfy some features. Features to be tested as follows:

- ➢ The IR sensor should give proper output when it detects the object.
- ➢ It should display the alert message whenever the blind person is in danger.
- ➢ Check the working of Ultrasonic Sensor & Moisture Sensor.

6.3 Testing tools and environment

For testing of the project we require some tools, like to test Arduino program we require software called Thonny IDE. Using this we can check the program that program is working properly or not. For hardware checking we require power supply and threshold values are fixed manually.

6.4 Test cases

In this section we discuss about the inputs, expected output, testing procedure.

6.4.1 Inputs

This project requires only one inputs:
Power supply: Power supply is the basic need of any electronic circuit. Here
we use 7.4v power directly from the battery.

6.4.2 Expected Output

The expected output of this project should be an alert message to the coordinates of the blind person and obstacle & moisture is detected then it will alert a buzzer sound. The output should also be seen on the serial monitor of the Arduino UNO IDE.

6.4.3 Testing Procedure

For testing, first connect the circuit to the power supply is given to the Arduino UNO NANO using computer and it can also be done by using battery. In this way the whole testing circuit is built. Summary of the testing procedure:-

- ➢ Connect the circuit according to the diagram
- ➢ Give power to the system.
- ➢ Vary moisture level and Ultrasonic values to fix the threshold values.
- ➢ Get the output from the IR sensor.
- ➢ Display the alert message on mobile phone with a buzzer sound.

CHAPTER 7

RESULTS

The Circuit diagram for the while setup of the Smart Stick. It is capable of detecting the surroundings for various barriers of different sizes and producing the required auditory using the ultrasonic sensor in the presence of buzzer. When damp surfaces are detected using sensors, it might alert the user by vibratory sounds and also enable to send SMS based on the user's location in an emergency or when they are having trouble. When the stick is misplaced, the user can find the stick by using RF remote control.

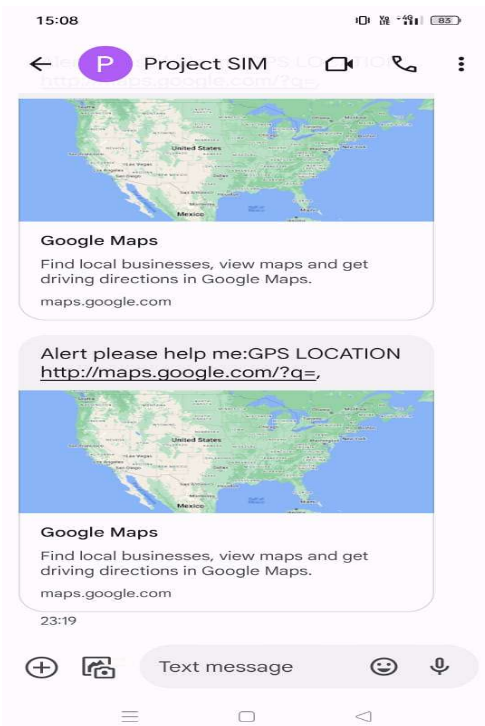

Fig 7.1 Alert Messages to the Coordinates of blind people

Fig 7.2 Smart Blind Stick

Devices	Number of tests	Measured	Number of Succeeded tests	Percentage of succeed tests
Obstacles	20	65.5 cm	20	100%
Stairs	20	75.5 cm	18	90%
Heat	15	25.5 cm	13	86.6%
Water	15	45 cm	14	93.3%
Average percentage of succeed of the tested device				92.5%

TABLE 7.1 Tests of Smart Blind Stick

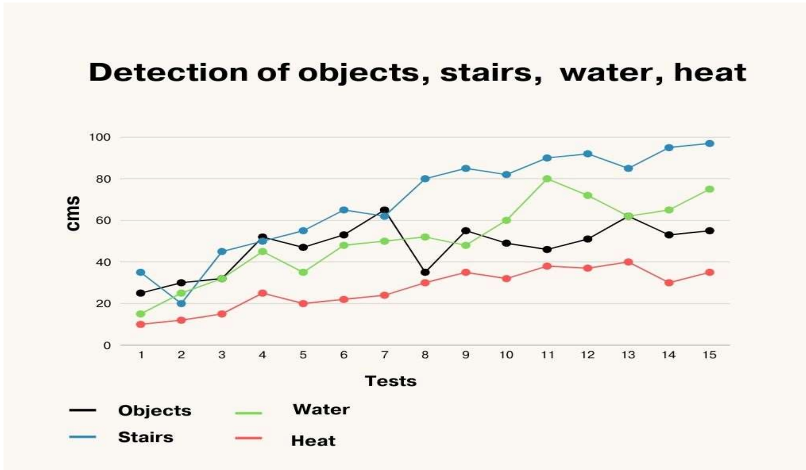

Fig 7.3 Detection of Objects, stairs, water, heat

Obstacle Position	Accuracy
0 - 20 cm	95%
20 - 40 cm	92%
40 - 60 cm	94%
60 - 80 cm	93%
80 - 100 cm	95%
100 - 120 cm	92%
120 - 140 cm	91%

TABLE 7.2 Reliability for obstacle position

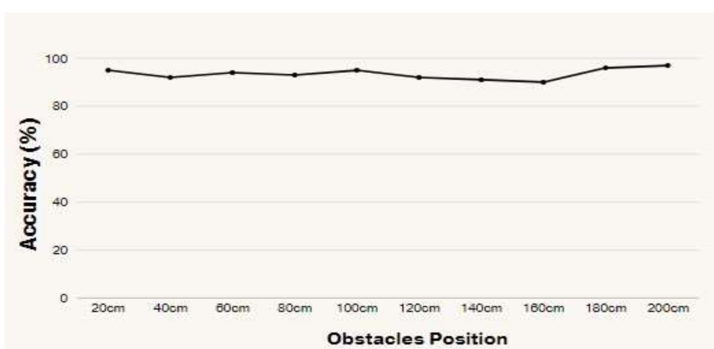

Fig 7.4 Reliability for obstacle position

Moisture Content	Accuracy
40 - 60 cm	95%
60 - 80 cm	92%
80 - 100 cm	97%
100 - 120 cm	94%
120 - 140 cm	96%

TABLE 7.3 Reliability for moisture content

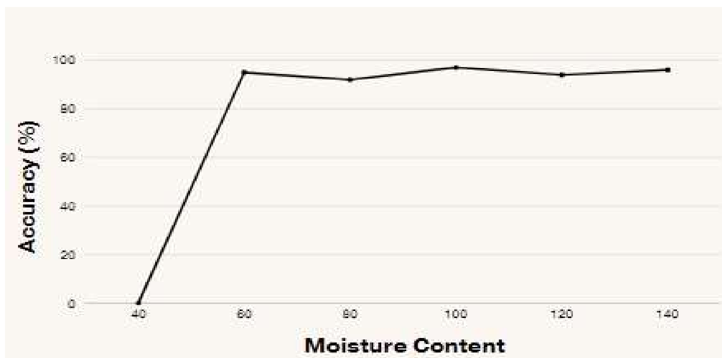

Fig 7.5 Reliability for moisture content

CONCLUSION

Finally, the proposed system effectively detects barriers using the ultrasonic sensor with auditory alerts and provides safety features such as vibratory alerts for damp surfaces and emergency SMS based on user location. The inclusion of an RF remote control for stick retrieval enhances user autonomy. The system offers a comprehensive solution for obstacle detection, emergency response, and stick location retrieval, making it valuable tool for individuals with visual impairment.

The multifunctional blind stick is a device that has been designed to assist visually impaired people in their mobility and navigation. It combines various technologies such as ultrasonic sensor, Moisture sensor, GPS, voice assistance, and to provide enhanced functionality and convenience to the user. By providing real-time feedback about the user's surroundings, obstacles, and destinations, the multifunctional blind stick enables visually impaired individuals to navigate their surroundings with greater ease and confidence. Furthermore, the addition of solar panels in the design provides a sustainable energy source, making it more eco-friendly for the user. This is particularly important for visually impaired individuals who may not have easy access to a reliable power source.

Overall, the multifunctional blind stick with ultrasonic, moisture, and infrared sensors, GPS, GSM, radio frequency modules, and solar panels can greatly improve the mobility and safety of visually impaired individuals, allowing them to navigate their environment with greater ease and confidence. This technology has the potential to make a significant positive impact on the lives of visually impaired individuals, increasing their independence and improving their quality of life.

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