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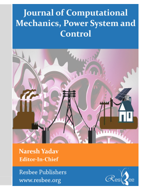

IoT Based Alert System for Visually Impaired Person

M.Nirmala

Department of Computer Applications
Hindusthan College of Engineering and Technology,
Coimbatore, India.

Mathan Kumar A

Department of Computer Applications
Hindusthan College of Engineering and Technology,
Coimbatore, India.

Abstract: The design, development, and testing of an Internet of Things (IoT)- enabledsmart stick allowing blind people to traverse the outdoors with the capability to distinguish and warn about impediments are presented in this work. The suggested design uses water sensors to identify puddles and other wet surfaces in the user's route, ultrasonic sensors to detect obstacles and a high-definition camera with object identification built in. Additionally, after properly recognizing and identifying items, the person is informed about various obstacles and objects utilizing voice feedback through earphones. The suggested smart stick has two operating modes: the first mode uses ultrasonic sensors to detect obstacles and provide feedback via vibration motors regarding their direction. The second mode employs voice feedback while still detecting and identifying obstacles. Under the situation and a person's preferences, it enables switching between the two modes. Additionally, the user's latitude and longitude values are recorded and uploaded to the IoT platform for efficient tracking via global positioning system (GPS) and global system for mobile communication (GSM) modules, which allow the user's or stick's live location to be watched on the IoT dashboard. Additionally, a panic button is offered for emergency assistance by creating a request signal in the form of an SMS that includes a Google Maps link created using latitude and longitude coordinates and transmitted through an IoT-enabled environment. The lightweight, waterproof, size-adjustable, and battery-efficient smart stick has been designed. Energy efficiency, portability, stability, ease of use, and sturdy features are all guaranteed by the entire design. This system's major goal is to assist visually impaired people in an outside setting while maintaining their safety and freedom.

Keywords: Arduino UNO, Water sensor, Ultrasonic sensors, Node MCU, GPSModule.

Nomenclature

Abbreviation	Expansion
Arduino UNO	UNO Refers to One in Italy
IoT	Internet of Things
NESII	National Eyes Survey
MCU	Micro Controller Unit
GPS	Global Positioning System
GUI	Graphical User Interface
TDS	Total Dissolved Solids
SMS	Short Message Service
USB	Universal Serial Bus
IDE	Integrated Development Environment
DC	Direct Current
SRAM	Static Random Access Memory
EEPROM	Electrically Erasable Programmable Read-only Memory
LED	Light-Emitting Diode
VIN	Voltage In
GND	Ground
IOREF	Input-Output voltage REFerence.
UART	Universal Asynchronous Receiver-Transmitter
RX	Receiver
TX	Transmitter
SDA	Secure Device Access
SCL	Service Capability Layer
SPDT	Single Pole Double Throw
HC	Headphone Coupling
PIR	Passive Infrared Sensor
SDK	Software Development Kit
GSM	Global System for Mobile Communication
NAV	Navigation
SoC	System-on-a-Chip
CMDS	Cooperative Medical Diagnosis multi-agent System

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1. Introduction

Aristotle believed that sight is one of the five senses that contribute to our understanding of the outer world. Visual impairments can have a long-term negative impact on children's verbal, emotional, and other skills. Worldwide, there are 2.2 billion people with vision impairment who struggle with their near- or farsightedness. Adults with vision impairment often have reduced levels of productivity and participation in the workforce, as well as increased levels of concern or dissatisfaction.

Motivation and Background: Visually impaired individuals face numerous challenges in their daily lives, including navigating their surroundings and accessing important information. These challenges can significantly impact their independence and quality of life. One particular area of concern is the need for an effective alert system that can help visually impaired individuals detect and avoid obstacles in their path. Despite previous efforts to address this issue, there is still a need for a more robust and reliable solution.

Prior Efforts to Solve the Problem: Several attempts have been made to develop alert systems for visually impaired individuals. Existing solutions include wearable devices that use ultrasonic sensors or cameras to detect obstacles and provide haptic or auditory feedback. While these solutions have shown promise, they often suffer from limitations such as limited range, accuracy issues, and high cost. Therefore, there is a need to explore alternative approaches that can overcome these limitations.

Importance of Solving the Problem: Developing an effective alert system for visually impaired individuals is of significant importance. It can enhance their mobility, safety, and independence, enabling them to navigate their environment with greater confidence. By addressing the limitations of existing solutions and providing a more reliable and affordable system, we can significantly improve the daily lives of visually impaired individuals.

Contribution in the Context of Prior Work: Our research contributes to the existing body of work in the domain of alert systems for blind individuals in the following ways:

Development of an IoT-based alert system: We present a novel approach that leverages IoT technologies to create a more affordable, scalable, and reliable alert system for visually impaired individuals.

Integration of real-time obstacle detection and localization: Our system combines real-time obstacle detection algorithms with accurate localization techniques, enabling visually impaired individuals to navigate their surroundings with greater awareness.

Personalized feedback and adaptability: We emphasize the importance of personalized feedback and the ability to adapt the system to individual needs and preferences.

This paper is organized as follows: Section 2, we provide an overview of related work in the field of alert systems for visually impaired individuals. Section 3 presents the problem definition. Section 4 explains the methodology employed to evaluate the system's performance and effectiveness. Section 5 discusses the components used in the process. Section 6 explains the circuit diagram. Section 7 discusses the advantage and disadvantages. Section 8 explains the results and discussion. Section 8 concludes the paper.

2. Literature Survey

In 2016, R. Kumar *et al.*[1] have described IoT as a technological revolution that makes objects interconnected and allows real-time monitoring of patient health. This paper discussed the use of Raspberry Pi boards to monitor a patient's body temperature, respiration rate, heartbeat, and body movement. It provides better medical facilities to patients and facilitates doctors and hospitals.

In 2010, Pratap Misra *et al.*[2] book offers a comprehensive introduction to GPS: the system, signals, receivers, measurements, and algorithms for the estimation of position, velocity, and time. It was divided into four parts: the basic framework for a global navigation satellite system, estimation of position, velocity, and time, the structure of the GPS signals, signal processing steps, and the challenges posed by signal blockage and RFID.

In 2017, Vanishree M L *et al.,* [3] have described IoT as a revolution of the Internet, allowing networked objects to be sensed and controlled remotely. It offered assistance and support to visually impaired people to achieve independence and improve participation. As of 2014, 285 million people were visually impaired worldwide, and can be prevented or treated with cost-effective measures.

In 2019, A V Nandini *et al.,* [4] have created a prototype called "Smart cane for assisting visually impaired people" to overcome the problems they face in their daily life. The device was a low-cost and lightweight system that processes signals and alerts the visually impaired over any obstacle, potholes, or water puddles. The estimated number of visually impaired people in the world was 285 million, of which 39 million were blind and 246 million had low vision.

In 2018, Santosh R. *et al.* [5] have developed a research work to revolutionize micro-irrigation and intelligent farming. A GUI was developed to provide information such as soil pH, conductivity and TDS, temperature and humidity, and moisture. A priority-driven algorithm was used to find the lowest one to start irrigation and soil moisture sensors are placed at each node. Smart and micro-irrigation was the new trend due to factors such as irregularity of monsoon and less availability of groundwater.

In 2015, Lee *et al.*[6] have described IoT as a global network of machines and devices capable of interacting with each other. This article presented five IoT technologies, three IoT categories for enterprise applications, the net present value method and real options approach, and five technical and managerial challenges. It also provided guidelines, strategies, and best practices for IT staff and managers to integrate IoT devices into enterprise information systems successfully.

In 2016, Mari Carmen Domingo [7] have explained IoT can offer assistance to disabled people and support them to achieve a good quality of life and participate in social and economic life. It depicts a world of networked smart devices, where everything was interconnected. This technological evolution enables new ways of communication between people and things.

In 2013, Cristina Elena Turcua *et al.* [8] have aimed to show radio frequency identification, multi-agent, and IoT technologies can be used to improve people's access to quality and affordable healthcare services, Reduce medical errors, Improve patient safety, and Optimize healthcare processes. Many of the errors occurring in healthcare were related to the lack of availability of important medical information about the patient. Healthcare systems across EU countries were largely organized in the form of separate medical facilities.

In 2014, Nuno Vasco Lopes *et al.* [9] have executed an IoT architecture for disabled people to identify and describe the most relevant IoT technologies and International Standards for the stack of the architecture. It discussed the enabling IoT technologies and their feasibility for people with disabilities and presents two use cases that are currently being deployed for this population. Connected devices offered the potential to transform a person's quality of life, particularly for persons with disabilities.

In 2012, Melanie Swan [10] have explained that the IoT ecosystem was emerging to support the process of connecting real-world objects to the Internet via sensors and microprocessor chips. It had four critical functional steps: Data creation, Information generation, Meaning-making, and action-taking. The U.S. National Intelligence Council defined the IoT as things that were readable, Recognizable, Locatable, Addressable, and Controllable via the Internet.

2.1 Review

Table 1 portrays the methodology, advantages, and disadvantages of the existing method. We considered ten papers that used a different methodology to alert visually impaired persons. Each method has certain benefits and shortcomings, that were explained in detail.

Authors	Methodology	Advantages	Disadvantages
R. Kumar *et al.* [1]	Raspberry Pi boards	• Real-time monitoring of patient health. • More efficient and cost effective. • Easy to interface for Doctors and caregivers.	• Limited focus on specific health parameters. • May lead to issues related to data privacy and security. • Need Internet connectivity. • Not suitable for all patients.
Pratap Misra *et al.* [2]	GPS	• Provided accuracy in various levels. • Can be applicable to many devices.	• Signals may affect through external factors. • Required specific equipment's and expertise. • Expensive.
Vanishree M L *et al.* [3]	IoT	• Improved independence and participation in local activities. • Powerful tool • Easy navigation	• May face privacy and security concerns, lack of standardization, and high cost.
A V Nandini *et al.* [4]	Smart cane prototype	• Low-cost and lightweight system for visually impaired individuals. • Used multiple sensor for perfect guidance. • Used to travel in low light condition. • Distress message helped during emergencies.	• Prototype is in developing stage and further need testing and improvement to make it more efficient and user-friendly.

Santosh R. et al. [5]	micro-irrigation system	• Revolutionized micro-irrigation and intelligent farming.	• Limited relevance to the visually impaired alert system.
Lee *et al.* [6]	Net present value approach and real option approach.	• Provide flexibility in investment decision and decision making. • Understand the benefits of IoT Investment.	• Focuses on enterprise applications rather than the visually impaired alert system. • Method are not foolproof and may not always accurate.
Mari Carmen Domingo [7]	IoT architecture	• Improved the quality of life for people with disabilities.	• May face privacy and security concerns, lack of standardization, and high cost.
Cristina Elena Turcua, *et al.* [8]	CMDS, RFID, Multi-agent systems, and IoT	• Improves access to healthcare services and patient safety. • Provide informative decisions and improve patient outcome. • Improved patient tracking facility. • Easy integration with the existing system	• Limited relevance to the visually impaired alert system. • Issues in security and privacy concerns, standardization, and scalability.
Nuno Vasco Lopes *et al.* [9]	IoT Architecture	• Improved accessibility. • Personalised solution. • Easy to integrate with the existing method. • Practical and Effective.	• Faced challenges in cost and compatibility.
Melanie Swan [10]	IoT ecosystem	• Provides a conceptual understanding of the IoT ecosystem.	• No specific methodology mentioned.

3. Problem Definition

In the past, visually impaired individuals walked with a wooden stick, but over time, the aluminum cane supplanted it. Nonetheless, as technology advances and we enter the modern era of automation, this walking staff for the blind will no longer be able to grant them independence. In addition to the smart stick itself, numerous assistive technologies such as the Mowat sensor, SensCap, Laser Cane, Embedded Glove, and NAV Belt have been developed over time. The smart stick was the most prevalent form of assistive technology in the early 20thcentury. As much as possible, Assistive technology aims to reduce accidents involving visually impaired individuals. The Sens Cap should be worn around the midsection on top of the NAV Belt.

The proposed architecture for the smart stick is based on the IoT, which enables and leverages a variety of existing sensors, including the ultrasonic sensor, the water sensor, and the GPS/GSM sensor. It features two modes in which an ultrasonic sensor detects the barrier and vibrating motors notify the user of its location, while the second module is responsible for obstacle detection and recognition and provides verbal feedback. A water sensor is utilized to detect puddles of water or wet surfaces, and GPS/GSM determines the precise location of the user. Additionally, a specific water sensor has been designed with intelligent positioning for accurate detection of puddles, vibration motors to assist the user in navigating the obstacle, and headphones to play the pertinent audio message for warning about the obstacle's location. The sensors have been positioned so as not to modify the standard cane grip.

4. Methodologies

The proposed system is designed to alert blind individuals when something moves in front of them while they are walking. It consists of two parts: one that notices nearby items and warns the user, and a second that receives the location and informs the user once more. This concept is intended to reduce the risk of accidents for visually impaired people in unplanned cities and careless driving.

The proposed method is simple to use. An intelligent stick that is connected to the IoT and can identify impediments as shown in Fig.1.Block Diagram. The system has two modes for recognizing barriers, locating obstacles in the way of humans, and locating wet regions that should be avoided for safety. It provides the user with input through the use of headphones and vibration motors coupled to the controller. Additionally, the system offers live location sharing that is cloud- and IoT-based. Each concerned person's credentials are unique, and only they can share them with those they feel comfortable doing so to protect the privacy of the visually impaired user.

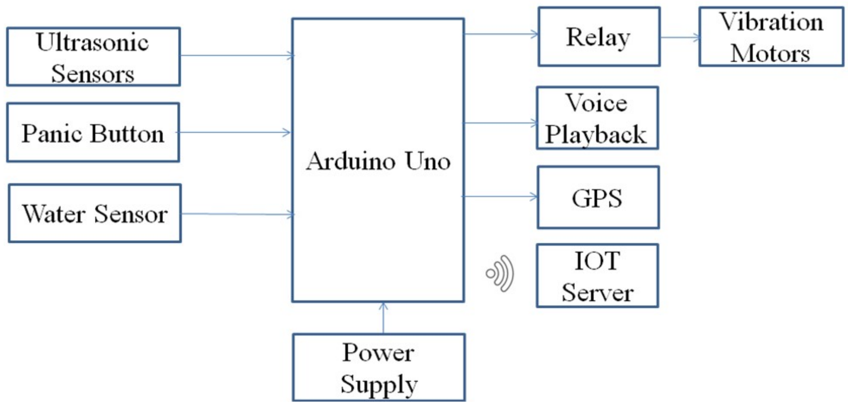

Fig.1.*Block Diagram*

4.1 Modules

It consists of four modules. They are

- Sensor Placement
- Obstacle Detection Module
- Water Detection Module
- GPS/SMS Gateway Module

4.1.1 Sensor Placement

Each sensor has been placed at different angles for maximum coverage of the area in front and allowing for different obstacle detection. The maximum detecting range is 3.5m.However, the maximum allowable range by the ultrasonic sensor is 4.5 m. Overhead obstacles are detected up to 1.2m.Since only these obstacles need to be avoided by the user.

4.1.2 Obstacle Detection Module

Three ultrasonic sensors are used for obstacle detection. Any obstacle detected by the left sensor only plays the audio message for the left obstacle and turns on the right vibration motor to guide the visually impaired person to the right and vice versa for the right obstacle. When both the sensors detect an obstacle, the obstacle is in front, and the front audio message is played, the vibration motor is turned on, indicating that the user can move in any direction.

4.1.3 Water Detection Module

For water detection, the copper shorting technique has been used. For this purpose, a custom water sensor was designed using two copper terminals that were made from copper sheets. When water comes across the path, copper terminals get in contact with it, and water causes the short-circuiting resulting output pin of the sensor to go HIGH. Then send a signal to the controller, which then generates an audio alert for water detection.

4.1.4 GPS/SMS Gateway Module

When the user misplaces the smart stick and needs any assistance in finding it, a trigger button on the stick has been implemented to send their location to their specified caretakers via SMS. For this purpose, ne06m is used, which is a low-cost and small-size GPS module that can be integrated into different IoT projects. This module was selected due to its low operating voltage, which ranges from 3.4 V to 4.4 V. It makes it a perfect candidate for our application, achieving a longer battery life.

5. Component

The various components that are used in the process are

- Ultrasonic Sensor
- Panic Button
- Water Sensor
- Arduino Uno
- Power Supply
- Relay
- Voice Playback
- GPS
- IoT Server
- Vibration Motors

5.1 Component Description

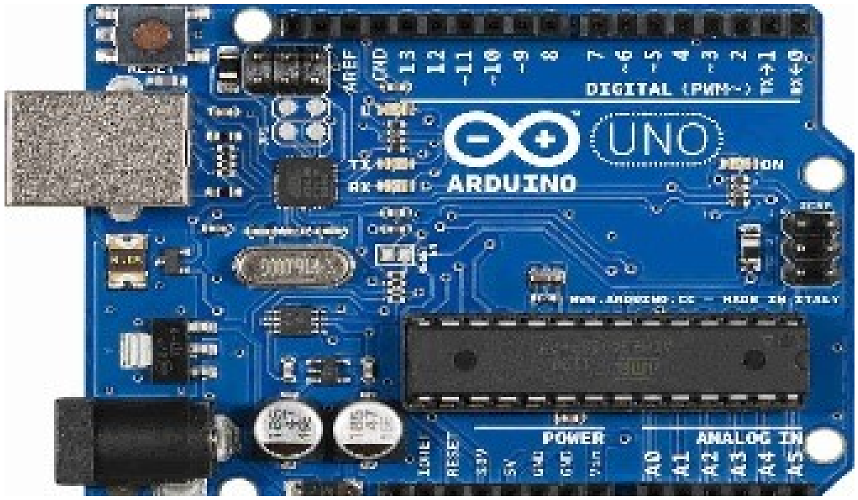

Fig.2.*Arduino UNO*

Arduino.cc developed the open-source Arduino UNO microcontroller board ***Fig.2.Arduino*** based on the Microchip ATmega328P microprocessor. The board's sets of digital and analog input/output (I/O) pins can be used to interface with a variety of expansion boards and other circuits. Through a type B USB port, the Arduino IDE can be used to program the board's 14 digital pins and 6 analogue pins. It can run on voltages between 7 and 20 volts and can also be powered by a USB connection or an external 9-volt battery. The 1.0 release of the Arduino Software (IDE) was designated as "1.0," and the Italian word "UNO" was chosen to represent it. Future iterations of Arduino were built on the UNO board and the Arduino Software (IDE) version 1.0.

5.1.1 Specifications

- Microcontroller: Microchip ATmega328P
- Operating Voltage: 5 Volts
- Input Voltage: 7 to 20 Volts
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB is used by the bootloader
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock Speed: 16 MHz
- Length: 68.6 mm
- Width: 53.4 mm
- Weight: 25 g

5.1.2 Pin Functions

5.1.2.1 General Pin Functions

The Arduino/Genuino board has four pins: LED, VIN, 5V, 3V3, GND, IOREF, and Reset. The LED is powered by digital pin 13 and is on when the pin has a HIGH value; it is off when the pin has a LOW value. The VIN pin can be used to access voltage that has been supplied via the power jack or to feed voltage to it. The 5V pin outputs a regulated 5V from the regulator on the board, while the 3V3 pin creates a 3.3-volt supply. Ground pins, IOREF, GND, and IOREF can be read by a properly constructed shield, which can then choose the proper power supply or enable voltage translators on the outputs to operate with 5V or 3.3V. The reset can be added to shields that already have one but block the board-mounted one.

5.1.2.2 Special Pin Functions

The UNO has 14 digital and 6 analogue pins that can be used as inputs or outputs. Each pin includes a 20-50k ohm internal pull-up resistor that may provide or receive 20 mA under ideal working conditions. The maximum current draw of any I/O pin must not be exceeded to protect the microcontroller from long-term damage. Some pins have specialized functions, such as pins 0 (RX) and 1 (TX) for serial / UART, pins 2 and 3 for external interruptions, and the following PWM numbers are available: 3, 5, 6, 9, 10, and 11. SPI devices are supported, A4 or the SDA pin and A5 or the SCL pin for TWI/I2C, and AREF (Analogue Reference) is the analogue inputs' reference voltage.

5.1.3 Relay

The major components of the circuit are as follows

- ULN 2803
- 12V SPDT relay

5.1.3.1 ULN 2803

The control circuit receives input from the microcontroller's output ports, and the breaker is activated when the ULN generates a high signal. The software that is burned into the microcontroller allows it to provide high or low output at the appropriate output ports. When voltage is applied to the coil, current travels through the wire, creating a magnetic field that pulls the contacts together until the current flow has stopped.

5.1.3.2 SPDT Relay

This is a SPDT as shown in Fig.3.SPDT Relay and Current will flow between the movable contact and one fixed contact when the coil is de-energized and between the movable contact and the alternate fixed contact when the relay coil is energized.

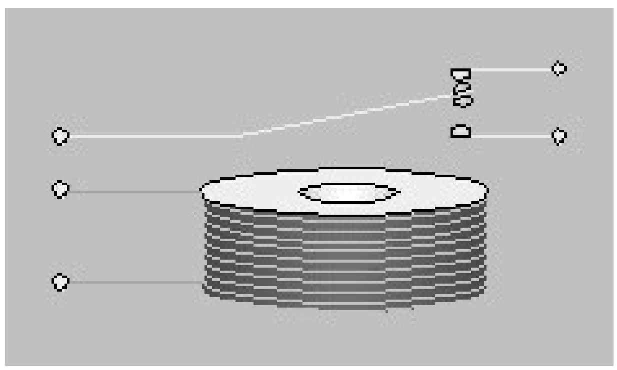

Fig.3.*SPDT Relay*

5.1.4 HC-SR04 Ultrasonic Sensor

The HC-SR04 ultrasonic sensor Fig.4.Ultrasonic Sensor works on the same principles as a radar system, converting electrical energy into acoustic waves at a frequency above 18 kHz. It reads from 2 cm to 400 cm (0.8 inches to 157 inches) with an accuracy of 0.3 cm (0.1 inches). It also comes with ultrasonic transmitter and receiver modules.

Fig.4.*Ultrasonic Sensor*

5.1.5 Water Sensor

The moisture of the soil is essential for plants to grow, as nutrients provide food and water changes the temperature. Transpiration can be used to change the temperature and root systems are better developed in moist soil. Extreme soil moisture levels can lead to anaerobic situations and soil pathogens.

This sensor Fig.5.Water Sensor uses capacitance to measure the water content of the soil (dielectric permittivity). It can be inserted into the earth and the status of the water content can be reported in percent. It is perfect for science courses such as environmental, agricultural, biology, soil science, botany, and horticulture.

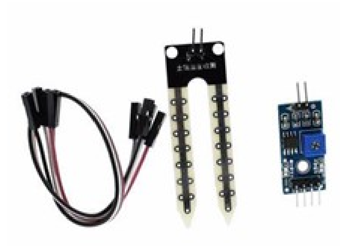

Fig.5.*Water Sensor*

5.1.6 GPS

GPS (Figure 6) includes both satellites and ground-based control installations. A GPS sensor interprets signals from satellites using a surface-mount chip, while a module is a tiny board on which the sensor and other components are placed. A GPS receiver is a device with a data display and other parts, such as memory for data storage. The space segment, control segment, and user segment are the three segments that make up a GPS, with 31 satellites in the space section orbiting 12,500 miles above the planet. Command, control, and monitoring stations are found in the control section while receiving devices make up the user segment.

Fig.6. *GPS Sensor*

5.1.7 Server Connection

The four satellites are needed to determine a position on the earth in 3dimensional space as shown in Fig.7.Server Connection. Each of these satellites carries multiple atomic clocks which maintain precise time and a pseudo-random number generator in the form of the linear feedback shift register.

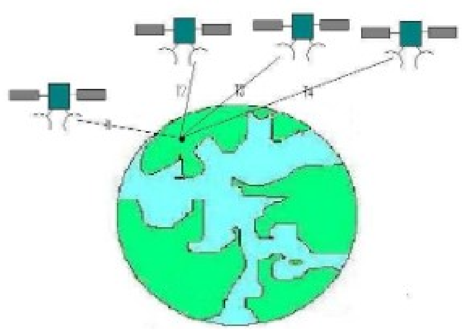

Fig.7.*Server Connection*

The GPS receiver can identify signals from at least four satellites by comparing the pseudo-random bit sequences it receives, and it can determine its distance from each satellite by comparing the times of the signals' arrival.

5.1.8 Voice Playback Board APR33A3

The APR33A3 is an 8-channel voice record and audio playback board that incorporates the APR33A series IC, a potent audio processor, together with high-performance audio ADCs and DACs and it is depicted in Fig.8.Voice Playback Sensor. It can be utilized in a variety of applications, such as an accident detection system's audio notifier or a PIR sensor application's Namaste Greeting Robot. Additionally, it can be applied to voice-controlled robots, automatic telephone answerers, train announcement systems, and doorbells. The APR33A series was created specifically for the straightforward key trigger, allowing the user to record and playback audio messages for an average of 1, 2, 4, or 8 times. The sampling rate may also be changed by changing the value of the resistors. It is appropriate for a simple user interface or when the length of a single message needs to be limited.

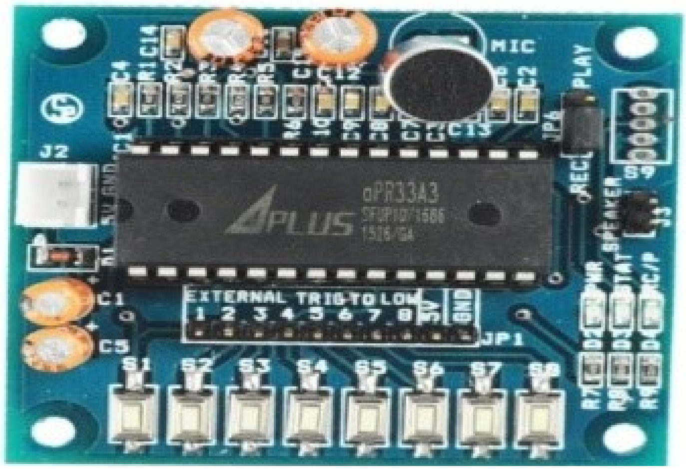

Fig.8.*Voice Playback Sensor*

5.1.9 Node MCU

The ESP8266 is a low-cost SoC that serves as the foundation of the open-source NodeMCU depicted in Fig.9.NodeMCU Sensor. It has all of the essential components of a computer, including CPU, RAM, networking (WiFi), and even a contemporary operating system and SDK. However, it is difficult to access and use as a chip, as it requires soldering wires with the necessary analogue voltage to its pins and programming it in low-level machine instructions. The Arduino project developed an open-source software development kit (SDK) and hardware architecture for their adaptable IoT controller. The Arduino hardware is a microcontroller board with standard data ports, LED lights, and a USB connector, similar to Node MCU. However, Arduino's adaptability also results in substantial variances between producers. For example, few Arduino boards offer Wi-Fi features, but some do have a serial communication interface instead of a USB port.

Fig.9.*NodeMCU Sensor*

5.1.9.1 Node MCU Specifications

The Node MCU is offered in a variety of packaging designs, with the ESP8266 core shared by all. The Amica and LoLin are the two most popular Node MCU types, with the ESP8266's open-source design allowing for new iterations.

5.1.10 Vibration Motor

The vibration motor (Figure 10) is a coreless DC motor with a small size and the primary function of vibrating or making a sound to warn the user when they receive a call. Its magnetic qualities, lightweight, and compact size contribute to its high degree of consistency. There are two ways to configure these motors: coin model or cylinder model. The major characteristics are type, maximum operational torque, maximum centrifugal force, weight range, rated current, and output.

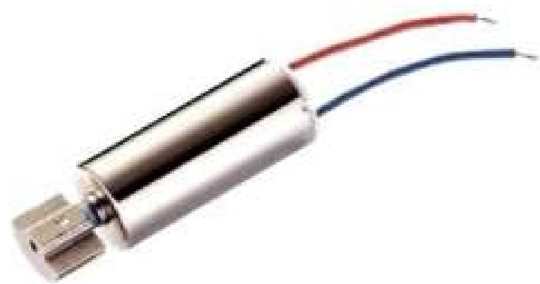

Fig.10.*Vibration Motor*

6. Circuit Diagram

Figure 11 represents the circuit diagram of the proposed method.

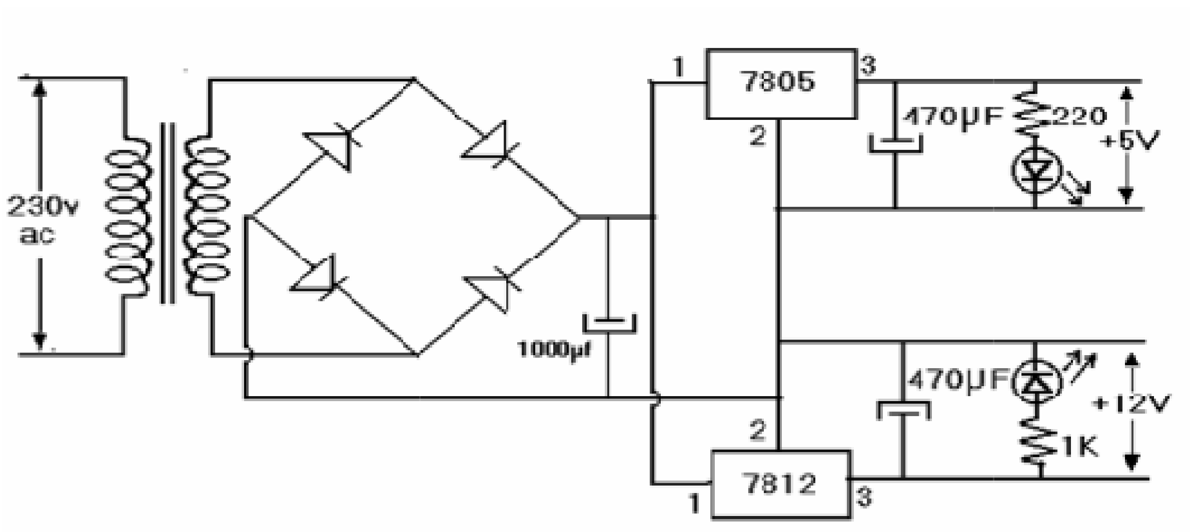

Fig.11.*Circuit Diagram*

6.1 Power Supply

The effective functioning of any device or instrument relies on the availability of an uninterrupted and specific range of supply voltage. Hence, this necessitates the design of a suitable power supply unit that acts as the basic driving force for the components used.

6.2 Transformer

Depending on the required value of the D.C., the A.C. applied to the power transformer's primary winding can either be stepped up or down as shown in Figure 11-Circuit Diagram. The transformer in our circuit conducts a step-down operation, converting the 230 V AC to 12 V AC across the secondary winding. Relatively speaking, 15V A.C. The transformer's top will be positive and its bottom will be negative after one change in the input voltage. The polarity will shift in the following alternation.

6.3 Bridge Rectifier

The bridge rectifier is a widely used circuit for delivering huge volumes of DC electricity. Four diodes have been utilized in this rectifier design, two of which will conduct during the negative alternation and two of which will conduct during the positive alternation.

6.4 Voltage Regulator

We require a regulator to supply a consistent voltage of 5V due to the volatility in the supply. For an input range from 17.5V to 7.5V, the IC regulators 7805 and 7812 generate a constant voltage of 5V and 12V, respectively. The DC output generated will have a ripple frequency of 120 Hz and will be a unidirectional pulsating current. A variety of fixed output voltages are available for the three terminal LM7805 series regulators, making them suitable for a variety of applications. Local card regulation, which does away with the distribution issues associated with single-point control, is one of these. The voltages enable the application of this regulation in solid-state electronic logic systems, instrumentation, Hi-Fi, and other devices. Despite being primarily intended to function as fixed voltage regulators, these devices can be used in conjunction with external components to provide adjustable voltages and currents. If sufficient heat sinking is given, the LM 7805 series is available in aluminum. To-3 package that permits over 1.0Amps of load current. To keep the peak current at a safe level, current limiting is used. To reduce internal power dissipation, the output transistor has safe area protection. if the amount of internal power loss exceeds the capacity of the heat sinking. It switches to the thermal shutdown current to stop the IC from overheating. For output voltage other than 5V, 12V, and 15V the LM117 series provides the output range from 1.2V to 5.7V.

7. Advantages and Disadvantages

Advantages

- **Enhanced Safety:** The system helps improve the safety and well-being of visually impaired individuals by providing real-time alerts about obstacles, potholes, water puddles, or other potential hazards in their surroundings.
- **Increased Independence:** By receiving timely alerts, visually impaired persons can navigate their environment more confidently and independently, reducing their reliance on assistance from others.
- **Cost-effective Solution:** The proposed system utilizes Raspberry Pi boards and IoT technology, which can be relatively affordable compared to some traditional assistive devices or technologies.
- **Real-time Monitoring:** The system enables real-time monitoring of vital signs such as body temperature, respiration rate, heart rate, and body movement, allowing for early detection of any abnormalities and timely medical interventions.
- **Remote Access:** The IoT aspect of the system allows remote access to the collected data, enabling doctors or healthcare professionals to monitor patients' health status and provide necessary support or interventions when needed.
- **Easy Deployment:** The use of Raspberry Pi boards and IoT technology simplifies the deployment of the system, making it accessible to a wider range of visually impaired individuals.

Disadvantages:

- **Technical Complexity:** The implementation and maintenance of an IoT-based system can be technically challenging, requiring expertise in IoT devices, sensor integration, and data communication.
- **Connectivity and Reliability:** The system heavily relies on stable internet connectivity and communication networks. Any disruptions or network issues may affect the system's reliability and real-time alert delivery.
- **Sensor Accuracy:** The accuracy and reliability of the sensors used in the system can vary, which may impact the precision of the collected data and subsequent alerts.
- **Privacy and Security Risks:** IoT systems collect and transmit sensitive personal data, raising concerns about privacy and data security. Adequate measures must be implemented to protect the privacy and security of the users' information.
- **User Adoption and Training:** The successful adoption of the system may require users to learn new technologies and adapt to the system's interface, which could pose challenges for some visually impaired individuals who are not familiar with IoT devices.

8. Results & Discussions

A module for obstacle discovery, water recognition, front obstacle detection, pit and flight of stairs placement, and pit and obstacle detection utilizing multiple sensors is included in the IoT-based "smart stick" for blind people. GPS and GSM modules are used to simplify daily tasks. The GPS module can identify disabled people when they leave the house. A carer can use a smartphone app to find him as shown in Table 1:Location Detection Data. He can move freely after his stress is released. The GSM module sends emergency texts to the family if the disabled person experiences any problems. Figure 13 shows the emergency message sample. The obstruction detection module uses sonar and water level sensors to identify and recognize the kind, location, and distance of barriers from the blind person. The system outputs include a buzzing sound and an audio signal from a speaker. All specializations could fail if the stick is positioned incorrectly. The recommended solution is a remote-controlled alarm system. The controller's emergency button can be used to locate a misplaced stick and notify family members of an emergency. The blind guy can find his stick by pressing the emergency controller button. A stick-mounted Arduino UNO is connected to each sensor, GPS, and GSM module. Figure 12 shows the model of the walking stick.

Table 1:*Location Detection Data*

S.No.	Longitude	Latitude	Location
1	9.4218	77.8367	Virudhunagar
2	10.8915	76.9908	Hindusthan College of Engineering and Technology, Coimbatore.
3	11.0129	76.9934	Hindusthan College of Arts and Science, Coimbatore.

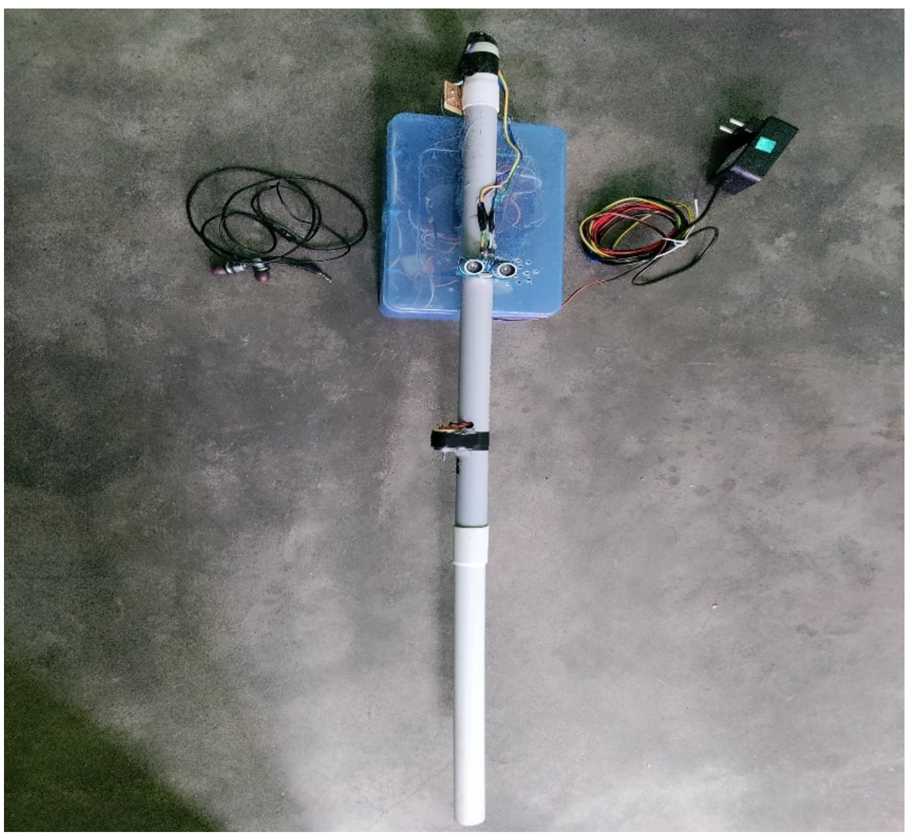

Fig.12.*Walking Stick Model*

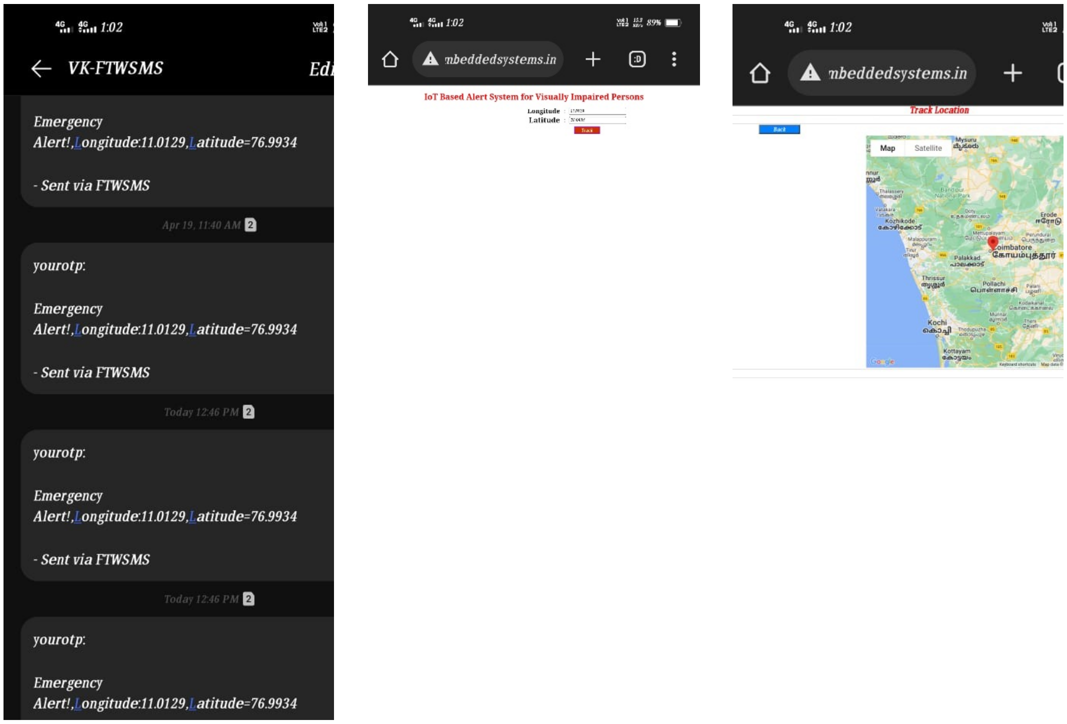

Fig.13.*Emergency Message Report*

10. Conclusions

Our proposed framework targets observing the indispensable indications of the child, for example, pulses and internal heat levels utilizing remote innovation and sound sensors used to quantify infant cry. Our suggested framework focuses on monitoring the child's vital signs, such as pulses and body temperature, using remote technology and a sound sensor that measures infant cries. People who are blind or visually impaired frequently use a dog or a stick to help them walk safely while performing daily duties. Modern sticks now come equipped with assistive sensors to help users identify objects and navigate outside due to advancements in technology. This idea offers a smart stick that can help blind people by sensing and recognizing obstacles. Thanks to the proposed IoT-enabled intelligent stick with obstacle recognition's numerous features, which include obstacle detection and recognition, water puddle detection, audio messages, haptic feedback, live location sharing, and a panic button for SMS emergency contact, the blind population could travel independently. The recommended smart stick additionally includes video and ultrasonic sensors that can identify obstacles in the user's environment and alert them via vibration motors and headphones connected to the controller. As a result, the system is entirely automated and doesn't need the user's input. Obstacle detection and identification are both useful in and of themselves, but the former offers additional accessibility features and the latter has a longer battery life. The technology runs continually so that the blind person can always receive updates on the roadblocks in their path. The visually handicapped can so easily complete their daily tasks with the aid of this intelligent stick and move around freely without having to worry about getting lost or bumping into anything or anyone.

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