SMART STICK FOR BLIND PEOPLE

A COMMUNITY SERVICE PROJECT REPORT

Submitted by

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In partial fulfillment for the award of the degree

of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND ENGINEERING

SCHOOL OF COMPUTING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

KALASALINGAM ACADEMY OF RESEARCH AND EDUCATION

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Project Title	:	Smart Stick For Blind People
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Subject(s) as Pre-requisite	:	Arduino Programming, Integrated Circuits
Constraints	:	Schools, Colleges, Universities
Project Related to	:	Vision Disabilities
Standard	:	This amendment specifies modifications to the IEEE Std 802.11. There has been a substantial increase in the development of assistive technology for people with vision impairments in recent years. This research paper describes the design and development of a "smart stick" prototype incorporating ultrasonic sensors and Global Positioning System (GPS)/GSM modules for obstacle and location detection.

DECLARATION

I hereby certify that the work which is being presented in the B.Tech. Community Service Project Report entitled **"SMART STICK FOR BLIND PEOPLE",** in partial fulfillment of the requirements for the award of the **Bachelor of Technology in Computer Science And Engineering** and submitted to the Department of Computer Science And Engineering of Kalasalingam Academy of Research and Education (Deemed to be University) – Tamil Nadu., is an authentic record of my own work carried out during a period from December 2022 to April 2023 under the supervision of **Ms. G. KOTHAI**. The matter presented in this thesis has not been submitted by me for the award of any other degree elsewhere.

Signature of Candidate

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This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

Signature of supervisor

Date: **Ms. G. Kothai / Assistant Professor**

KALASALINGAM ACADEMY OF RESEARCH AND EDUCATION

SCHOOL OF COMPUTING

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BONAFIDE CERTIFICATE

Certified that this project report "**SMART STICK FOR BLIND PEOPLE"** is the bonafide work of **"JAYAKUMAR S (9920004053), KAMALAKANNAN P (9920004060), MOHAMED SULTHAN ISHAQ A (9920004087), PADMANABAN S (9920004095)"** who carried out the project work under my supervision.

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ABSTRACT

There has been a substantial increase in the development of assistive technology for people with vision impairments in recent years. This research paper describes the design and development of a "smart stick" prototype incorporating ultrasonic sensors and Global Positioning System (GPS)/GSM modules for obstacle and location detection. A buzzer on the smart stick alerts the user of barriers within a specific distance and conveys location information to the visually impaired person's authorized guardian. The GPS/GSM modules assist users with position detection and navigation, allowing them to more efficiently explore their surroundings. The prototype was subjected to user research, which revealed its potential to increase the mobility and autonomy of visually impaired persons. According to the findings of the study, the smart stick has the potential to be a useful assistive technology for the visually impaired community.

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LIST OF ABBREVIATIONS

GPS	Global Positioning System
GSM	Global System for Modules

CHAPTER 1

INTRODUCTION

According to the World Health Organization (WHO), approximately 285 million people worldwide are visually impaired, with 39 million completely blind. The visually impaired community has a number of challenges in daily life, notably in terms of mobility and independence. Assistive gadgets have been developed to assist the visually impaired in overcoming these challenges. One such technology is the "smart stick," which may help the visually impaired identify objects and positions. The smart stick is a portable device that contains a number of sensors and technologies to help visually impaired persons increase their mobility and independence. By identifying boundaries and providing location information, the smart stick can help users traverse their surroundings more successfully and securely. Sensor technology, microcontrollers, and wireless communication improvements have resulted in the development of increasingly complex smart stick prototypes in recent years. The smart stick for blind people is one such prototype, which recognizes objects and locations using ultrasonic sensors and GPS/GSM modules, respectively. The goal is to design, build, and test a smart stick prototype for blind people. The smart stick will use ultrasonic sensors to identify objects within a specified distance and GPS/GSM modules to deliver position information. Furthermore, the smart stick will use a buzzer to alert the user of potential obstacles as well as relay location information to a designated guardian of the visually impaired individual. To do this, a smart stick prototype is built using the Arduino Uno microcontroller board. The Arduino Uno is a popular open-source microcontroller board that is used for prototyping and DIY applications. The Arduino Uno Microcontroller is used to conduct numerous operations, such as object and position detection, on the smart stick.

1.1 EMBEDDED SYSTEMS

1.1.1 Introduction

An embedded system is a computer system that is built to accomplish specific tasks, sometimes with restricted resources and real-time limitations. It is often a mix of hardware and software that is incorporated into a larger system to execute a specific job, such as a machine or appliance. Unlike general-purpose computers, embedded systems are intended to do a single task very effectively, frequently with little or no human input or involvement. They are used in a variety of applications, including consumer electronics, automotive systems, medical equipment, and industrial control systems.

Embedded systems are frequently used in conditions with restricted resources, such as minimal memory or computing power, and must be power-efficient, durable, and dependable. They may also feature specialized input and output interfaces adapted to their unique purpose, such as sensors, actuators, or display displays. Embedded system design and development need specialized expertise in hardware, software, and system integration. Understanding the system's limits and needs, selecting appropriate components, building software to operate the hardware, and testing and debugging the system to assure its stability and performance are all part of the process.

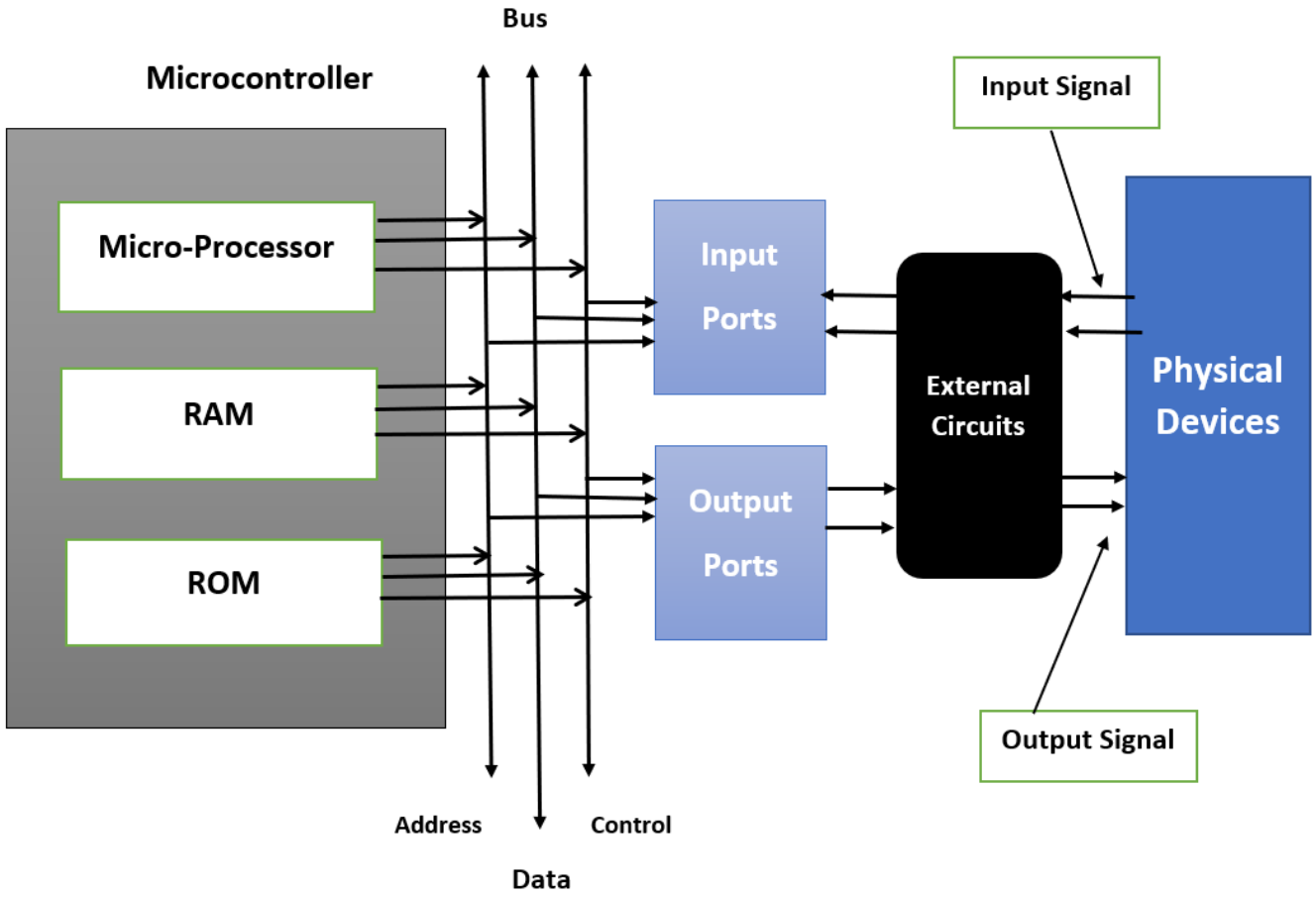


Fig 1.1.1 Overview of Embedded System

1.1.2 Types of Embedded Systems

➔ **Stand-alone embedded systems:** These are self-contained systems that perform a specific function, such as a digital camera or a washing machine.

➔ **Real-time embedded systems:** These systems have to respond to external events or stimuli within a specific time frame, often in milliseconds or microseconds. Examples include automotive systems, aircraft controls, and medical devices.

➔ **Networked embedded systems:** These are systems that are connected to a network, such as the internet or a local area network (LAN). Examples include smart home devices, industrial automation systems, and security systems.

➔ **Mobile embedded systems:** These are systems that are designed to be portable and may be powered by batteries or other portable power sources. Examples include smartphones, tablets, and wearable devices.

➔ **Hybrid embedded systems:** These are systems that combine multiple types of embedded systems to perform a specific function. For example, a modern car might have a real-time embedded system for controlling the engine, a networked embedded system for entertainment and communication, and a mobile embedded system for navigation and tracking.

The Arduino UNO can be classified as a general-purpose embedded system, as it is not designed for a specific application but can be programmed and adapted to perform a wide range of tasks.

1.1.3 Embedded Systems Hardware

Embedded system hardware typically consists of one or more microprocessors or microcontrollers, memory, input/output (I/O) devices, and various sensors and actuators.

- **Microprocessors and Microcontrollers:** These are the central processing units (CPUs) of embedded systems. They are small, low-power processors designed for specific tasks and often come with integrated memory and other peripherals. Microcontrollers are a type of microprocessor that includes on-chip memory, I/O ports, and other peripherals, making them ideal for many embedded applications.

- **Memory:** Embedded systems require memory to store instructions, data, and other information. Memory can be volatile or non-volatile, and the type and amount of memory used depends on the requirements of the application.

- **Input/Output Devices:** Embedded systems need to interact with the external environment, and input/output (I/O) devices enable this interaction. I/O devices can include sensors, such as temperature, pressure, and motion sensors, as well as actuators, such as motors, LEDs, and displays.

- **Communication Interfaces:** Embedded systems often require communication interfaces to connect with other systems, such as Ethernet, Wi-Fi, Bluetooth, and serial communication ports.

- **Power Management:** Embedded systems typically run on batteries or external power sources, and power management hardware is used to regulate and optimize power consumption, extending battery life and reducing power consumption.

Designing and selecting the appropriate hardware for an embedded system requires careful consideration of the requirements of the application, including performance, power consumption, size, and cost.

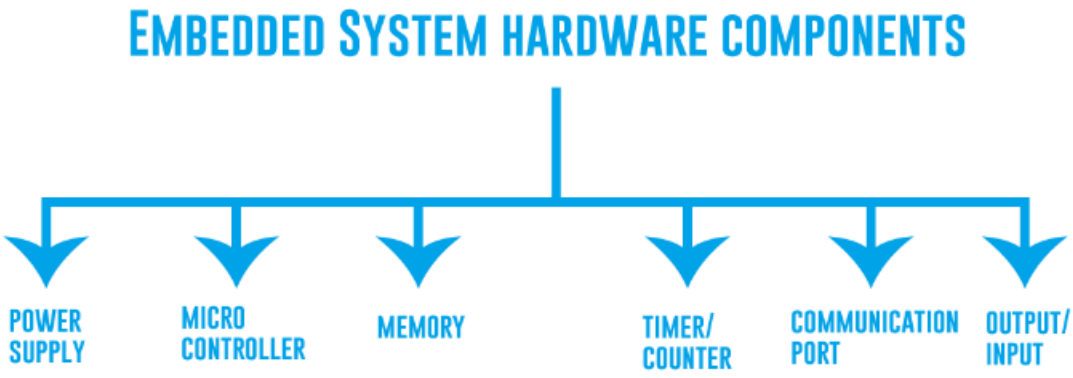


Fig 1.1.3 Components of Embedded Systems Hardware

1.1.4 Embedded Systems Software

Embedded system software is a set of instructions or code that runs on the embedded system hardware to perform a specific function. The software for embedded systems can be broadly classified into two categories: system software and application software.

- **System Software:** System software includes the software that manages the hardware resources of the embedded system, such as the microcontroller or microprocessor, memory, and I/O devices. This software typically includes device drivers, operating systems, and middleware, which provide a higher level of abstraction for the application software.

- **Application Software:** Application software includes the software that performs the specific task or function for which the embedded system is designed. The application software is typically written in a high-level programming language and compiled into machine code that can be executed by the microcontroller or microprocessor.

Embedded system software development requires specialized knowledge and skills in low-level programming, real-time programming, and hardware interfaces. Embedded system software developers use various programming languages such as C, C++, assembly language, and Python to develop the software for embedded systems.An embedded system software is designed to maintain in view of the 3 limits:

- Availability of system memories
- Availability of processor's speed
- Once the system runs continuously, there is a need to control power dissipation for activities like stop, run and wake up

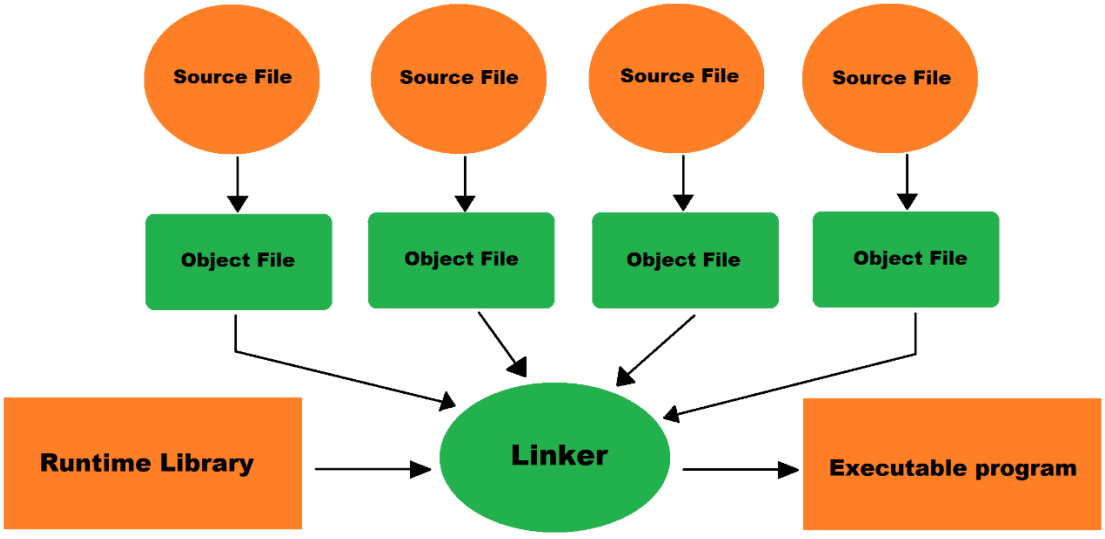


Fig 1.1.4 Components of Embedded Systems Software

1.1.5 Applications of Embedded Systems

Embedded systems have numerous applications in various fields due to their ability to perform specific functions with real-time constraints and minimal intervention. Some of the applications of embedded systems include:

- **Consumer electronics:** Embedded systems are widely used in consumer electronics such as televisions, smartphones, and smart home devices.
- **Automotive:** Embedded systems are used in vehicles for various functions, including engine control, safety features, entertainment systems, and navigation.
- **Medical devices:** Embedded systems are used in medical devices such as pacemakers, insulin pumps, and patient monitors.
- **Industrial automation:** Embedded systems are used in industrial control systems for process control, monitoring, and automation.
- **Aerospace:** Embedded systems are used in aerospace applications such as spacecraft, aircraft, and missiles for navigation, control, and communication.
- **Defense and security:** Embedded systems are used in defense and security applications for communication, control, and surveillance.
- **Robotics:** Embedded systems are used in robotics for control, sensing, and communication.
- **Internet of Things (IoT):** Embedded systems are used in IoT devices for collecting and processing data from sensors and actuators.
- **Agriculture:** Embedded systems are used in agriculture for monitoring and control of irrigation systems, climate control, and crop monitoring.
- **Energy management:** Embedded systems are used in energy management systems for monitoring and control of energy consumption and production.

CHAPTER 2

LITERATURE SURVEY

- Bhavani R et.al [1] suggests to overcome these challenges by using the technology and creates an electronic stick that allows visually impaired people to be more self-sufficient. The proposed model includes an ultrasonic transducer, a water circuit, and an RF transmitter and receiver module. The ultrasonic sensor detects impediments and produces a buzzer to warn the user. Whenever the water circuits come into contact with water, it activates the buzzer. The stick also incorporates indoor location tracking, allowing the user to find a misplaced stick by pushing a button on the control panel. The prototype model controls the complete arrangement with an Arduino ATMEGA 328-PU microcontroller, and the gadget is simple, inexpensive, and lightweight.

- Latif G et.al [2] focuses on an Internet of Things (IoT)-based system that can assist handicapped persons in real time. It presents a stand-alone system that monitors the vocal activity of impaired persons and alerts care takers or hospitals if any unusual occurs. The system extracts voice features using DCT and classifies the features using SVM. The prototype is made up of a Raspberry Pi, the voice recording modules, a Wi-Fi module, and an LCD screen. For real-time storage and audio analysis, the system makes advantage of cloud web services. The accuracy attained for the MAV dataset is 81.74%, while it is 67.90% for real-time voice input. This technique may be useful for patients suffering from life-threatening diseases such as cardiac arrest, bipolar disorder, and hysteria.

- Dhanalakshmi et.al [3] claims that blind people might become fully dependent on others and have difficulty for performing basic chores. This reliance can be eliminated with the assistance of contemporary technology, such as the ‘smart cane,' which employs sensors to identify obstructions and communicates this information to the user via vibrations. The gadget is environmentally friendly and can be of great assistance to the blind.

- The Smart Blind Stick [4] is a gadget that detects things and relays information through voice to the visually impaired, minimising the need for human assistance. This device can also help the elderly who have poor vision. This study focuses on applying artificial intelligence to implement object recognition and categorization in order to increase the device's capabilities. The gadget, which is put on a stick, takes photos, which are subsequently translated into sound or voice to educate the user about their surroundings.

- The smart stick is a suggested device to assist visually impaired persons in detecting and avoiding hazards while walking. Nada A et.al system [5] detects stairs and other impediments within four meters using infrared and ultrasonic sensors, as well as a sensor at the bottom to avoid puddles. When impediments are recognised, the microprocessor 18F46K80, vibration motor, and ISD1932 flash memory are utilised to trigger voice warnings and vibration alerts. The smart stick is inexpensive, quick, lightweight, and foldable, allowing the user to travel twice as fast as usual while being secure.

- A Smart Blind Stick was created to assist visually impaired people with daily activities. However, it is difficult for them to detect obstacles while walking, which makes it dangerous. The smart stick [6] detects steps with infrared sensors and barriers up to four metres away using ultrasonic sensors. In addition, a water sensor detects water in the user's route, and a buzzer notifies them of any impediments encountered.

- The convergence of machine learning and IoT has transformed the digital world. Individuals with visual impairments can benefit greatly from object detection using deep learning and virtual assistants. This study suggests an intelligent headwear built using a camera module and a Raspberry Pi running deep learning software. A smart blind stick with a microprocessor and various sensors is also being developed. The model [7] makes use of IoT and Bluetooth connectivity for real-time data monitoring, as well as a cloud server for authorised staff, to monitor the vision impairment. Object detection, sensor data calculation, and system usability all are examined and evaluated with a SUS score of 86%. This proposed method is practical and advantageous for the daily chores of vision-impaired persons.

- To aid persons with a motor deficit, a novel mechatronic system [8] for a robotic unicycle staff has been designed. The device is intended to be used as a walking stick and can support persons weighing up to 93 kg. Load cells are used to determine the user's weight, and an Android app enables real-time interaction between the user and the gadget. To reduce displacement errors, future implementations may include multi-axis load cells and neural networks.

- Although navigation assistance technology assists the blind, accurate solutions remain few. 14 blind volunteers virtually learnt routes at home for three days before physically navigating them using NavCog to gain a better understanding of route knowledge acquisition via smartphone-based virtual navigation. The findings [9] showed that participants could soon realize direct routes and gradually enhance their

understanding of both shorter and longer trips. However, virtual navigation did not improve user performance significantly.

- The smart stick [10] is a proposed method to assist visually impaired persons in detecting impediments without the assistance of others. To detect obstacles, it employs an ultrasonic sensor, an infrared instrument, a radio frequency transmitter and receiver, and a vibration motor. It is user-friendly, has a rapid reaction, consumes less power, is less in weight, and is simple to handle and fold.

- Kumar M et.al [11] suggest an innovative technique to overcoming the primary obstacles that blind and partly impaired persons confront when crossing the street and reading. It reads written information with a voice stick using an Android phone, which really is low-cost that generates an alarm if any obstacles are identified.

- The technological advancement demands the development of a device that can act as a navigation guide for the visually impaired. To detect obstructions and monitor the user's status, the device [12] includes an ultrasonic sensor, a water sensor, and a pulse heart sensor. To offer direction and position information, electronic components such as the MP3 module and GPS module are employed.

- A visually challenged smart stick [13] equipped with infrared, ultrasonic, and water sensors identifies obstacles within 3 metres. It also has a GPS module for locating and navigating the stick. The GPS module assists the blind person in navigating to their destination, while the GPS receiver updates the person's location, and the coordinates of that place can be used to track the blind person for safety purposes. The GSM module can also be used to alert the blind individual to potential threats.

- The research article [14] presents an appropriate solution for visually impaired people to walk independently and confidently using a Raspberry Pi microcontroller, obstacle-detecting sensors, a GPS module, speakers, and other linked components.

- Sharma et.al [15] offer a novel low-cost yet long-lasting and accurate smart stick for supporting visually impaired people while walking in unstructured indoor/outdoor environments. Using vibrations in the hand and voice in the ear, it identifies obstructions of any height in front of or slightly sides of the user. Real-time experiments have been conducted in various circumstances by various people to test the accuracy of the stick, with positive results.

- Blind persons with impairments employ innovative technology such as vibration sensors, ultrasonic sensors, and voice instructions to detect obstacles and indicate directions on their walking sticks. An interfacing GPS [16] is used to determine the precise location of the item in front of them, allowing them to request assistance if it is a human in their path.

- Saaid M. F et.al [17] aim is to create a smart cane equipped with an ultrasonic sensor and an earphone for measuring the distance from obstacles. Data is transferred to the National Instruments myRIO-1900 controller for processing, which results in a beeping sound. Verification tests have been used to validate performance.

- The suggested technology [18] is a smart cane with a facial recognition algorithm to assist the blind distinguish human faces. It has a camera attached to the spectacles, a vibration motor linked to the cane, and a mobile computer. The camera delivers a picture to the mobile computer, which collects characteristics from the image and then uses Ada boost to recognise the face. Following face detection, information about the discovered face picture is obtained. The cane transmits vibration signals that are different from one person to another to inform the blind person about the identification of the recognised individual.

- The smart cane [19] has infrared and ultrasonic sensors for detecting impediments, a water sensor for detecting puddles, and a sound system and vibration motor that activates when an obstacle is identified. In the event of an emergency, a GPS system offers information about the present position.

- A cane [20] is a device that can act as the third leg for the elderly and crippled. It can identify obstacles such as walls and holes, as well as remind blind individuals to walk on the blind sidewalk. It emits warning noises based on the distance between obstacles and the depth of the holes. Using a speech cue module, the system can also lead blind persons to go along the blind sidewalk.

CHAPTER 3

SURVEY QUESTIONS AND NEED ANALYSIS REPORT

3.1 SURVEY QUESTIONS

1. Have you ever used a smart stick designed for blind people before?

☐ Yes ☐ No

2. What features do you think would be most useful in a smart stick for blind people?

Answer: _____

_____

3. How often do you encounter obstacles while using your current cane or guide dog?

☐ More Often ☐ Less Often

4. How important is mobility and independence to you as a blind person?

☐ Very Much important

☐ Little important

☐ Not important

5. Would you prefer a smart stick that can be controlled by voice commands or physical buttons?

☐ Voice Commands ☐ Physical Buttons

6. How important is the weight and size of the smart stick to you?

☐ Very Much important

☐ Little important

☐ Not important

7. What range of price would you be willing to pay for a smart stick?

Answer: _____

8. How important is the accuracy of obstacle detection to you?

☐ Very Much important

☐ Little important

☐ Not important

9. Would you prefer a smart stick that has GPS tracking capabilities?

☐ Yes ☐ No

10. Do you think a smart stick for blind people would be more effective than a cane or a guide dog in navigating public spaces?

☐ Yes ☐ No

11. Are there any specific features or capabilities that you would like to see in a smart stick or navigation aid for blind people?

☐ Yes ☐ No

If Yes: _____

Signature:

Contact Number:

Photo of the person to be surveyed:

SMART STICK FOR BLIND PEOPLE

Community Service Project (CSP) – Field Survey Report

Name: Sivabalan **Gender:** ☑ Male ☐ Female

Age: 10 **Location:** Madurai

Occupation: Student **Date:** _____

Indian Association for the Blind, Madurai

Questions:

1. Have you ever used a smart stick designed for blind people before?

   ☐ Yes ☑ No

2. What features do you think would be most useful in a smart stick for blind people?

   Answer: water resistant, easy to handle.

3. How often do you encounter obstacles while using your current cane or guide dog?

   ☑ More Often ☐ Less Often

4. How important is mobility and independence to you as a blind person?

   ☐ Very Much important

   ☐ Little important

   ☑ Not important

5. Would you prefer a smart stick that can be controlled by voice commands or physical buttons?

☐ Voice Commands ☑ Physical Buttons

6. How important is the weight and size of the smart stick to you?

☐ Very Much important

☐ Little important

☑ Not important

7. What range of price would you be willing to pay for a smart stick?

Answer: 1500

8. How important is the accuracy of obstacle detection to you?

☑ Very Much important

☐ Little important

☐ Not important

9. Would you prefer a smart stick that has GPS tracking capabilities?

☑ Yes ☐ No

10. Do you think a smart stick for blind people would be more effective than a cane or a guide dog in navigating public spaces?

☑ Yes ☐ No

11. Are there any specific features or capabilities that you would like to see in a smart stick or navigation aid for blind people?

☐ Yes ☑ No

If Yes: _____

Signature:

Contact Number:

Sivabalan, 6th

SMART STICK FOR BLIND PEOPLE

Community Service Project (CSP) – Field Survey Report

Name: Ammu **Gender:** ☐ Male ☑ Female

Age: 12 **Location:** Madurai

Occupation: Student **Date:** _____

Indian Association for the Blind, Madurai

Questions:

1. Have you ever used a smart stick designed for blind people before?

   ☐ Yes ☑ No

2. What features do you think would be most useful in a smart stick for blind people?

   Answer: Flexible.

3. How often do you encounter obstacles while using your current cane or guide dog?

   ☑ More Often ☐ Less Often

4. How important is mobility and independence to you as a blind person?

   ☐ Very Much important

   ☑ Little important

   ☐ Not important

5. Would you prefer a smart stick that can be controlled by voice commands or physical buttons?

☑ Voice Commands ☐ Physical Buttons

6. How important is the weight and size of the smart stick to you?

☑ Very Much important

☐ Little important

☐ Not important

7. What range of price would you be willing to pay for a smart stick?

Answer: 2000

8. How important is the accuracy of obstacle detection to you?

☑ Very Much important

☐ Little important

☐ Not important

9. Would you prefer a smart stick that has GPS tracking capabilities?

☑ Yes ☐ No

10. Do you think a smart stick for blind people would be more effective than a cane or a guide dog in navigating public spaces?

☑ Yes ☐ No

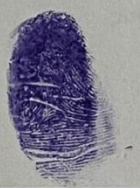
11. Are there any specific features or capabilities that you would like to see in a smart stick or navigation aid for blind people?

☐ Yes ☑ No

If Yes: _____

Signature:

Contact Number:



Ammu, 7th

SMART STICK FOR BLIND PEOPLE

Community Service Project (CSP) – Field Survey Report

Name: Manimaran G **Gender:** ☑ Male ☐ Female

Age: 38 **Location:** Madurai

Occupation: Head Master **Date:** _____

Indian Association For the Blind, Madurai.

Questions:

1. Have you ever used a smart stick designed for blind people before?

   ☑ Yes ☐ No used vibrating stick

2. What features do you think would be most useful in a smart stick for blind people?

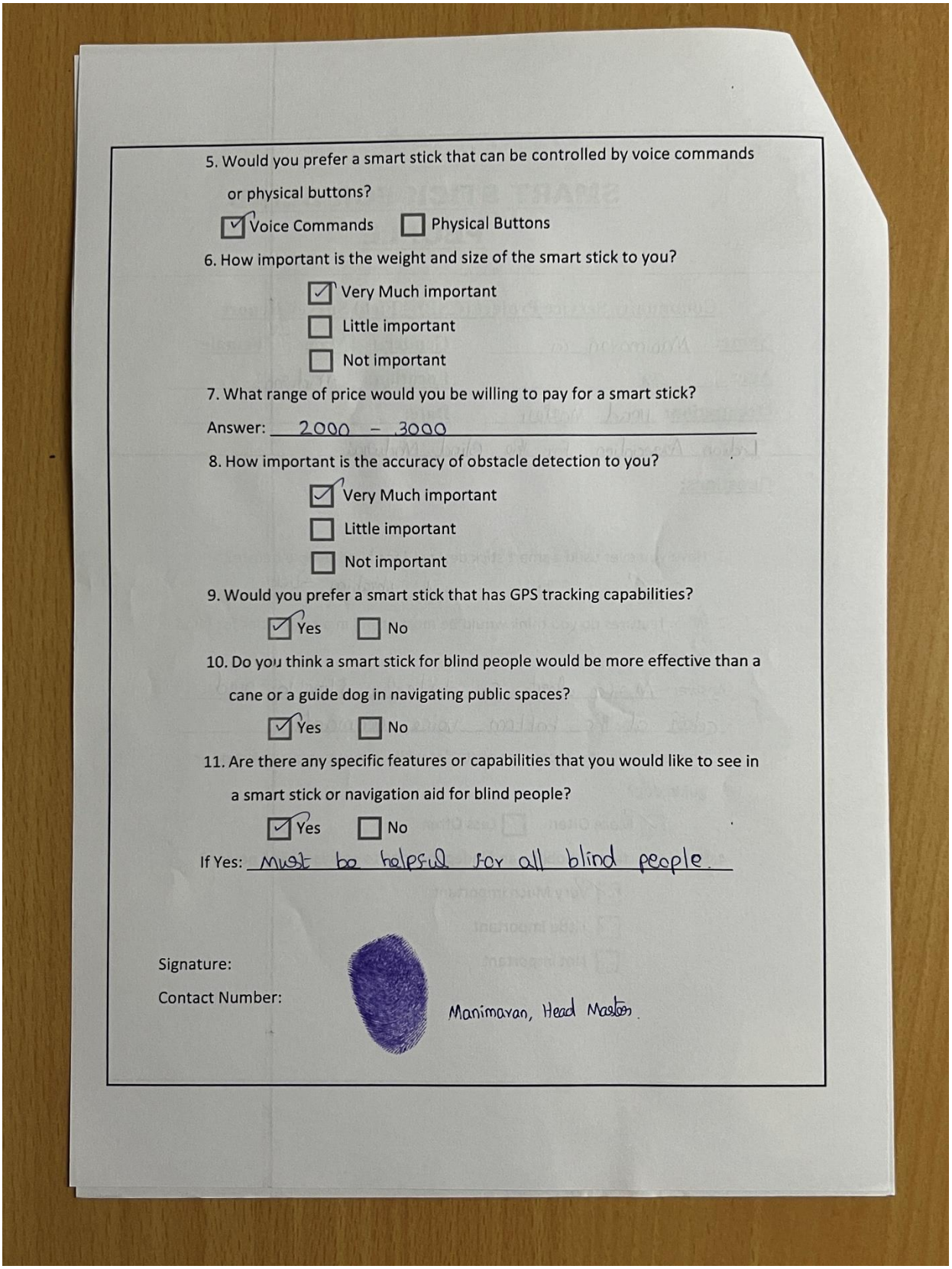
   Answer: Music alerts for obstacles, flexible, red color at the bottom, voice commands.

3. How often do you encounter obstacles while using your current cane or guide dog?

   ☑ More Often ☐ Less Often

4. How important is mobility and independence to you as a blind person?

   ☑ Very Much important
   ☐ Little important
   ☐ Not important



5. Would you prefer a smart stick that can be controlled by voice commands or physical buttons?

☑ Voice Commands ☐ Physical Buttons

6. How important is the weight and size of the smart stick to you?

☑ Very Much important
☐ Little important
☐ Not important

7. What range of price would you be willing to pay for a smart stick?

Answer: 2000 - 3000

8. How important is the accuracy of obstacle detection to you?

☑ Very Much important
☐ Little important
☐ Not important

9. Would you prefer a smart stick that has GPS tracking capabilities?

☑ Yes ☐ No

10. Do you think a smart stick for blind people would be more effective than a cane or a guide dog in navigating public spaces?

☑ Yes ☐ No

11. Are there any specific features or capabilities that you would like to see in a smart stick or navigation aid for blind people?

☑ Yes ☐ No

If Yes: must be helpful for all blind people.

Signature:

Contact Number:

Manimaran, Head Master.

Fig 3.1 SURVEY FORM FIGURES


Shot on realme U1


Shot on realme U1


Shot on realme U1


Shot on realme U1


Shot on realme U1


Shot on realme U1

Fig 3.2 FIELD SURVEY FIGURES

CHAPTER 4

OBJECTIVES

4.1 Objectives for smart stick for blind people:

- To improve the safety of blind people by providing real-time feedback about obstacles in their path.
- To enhance the mobility and independence of blind people by helping them navigate unfamiliar environments.
- To provide a cost-effective solution for blind people to access real-time obstacle detection and location detection technology.
- To reduce the risk of accidents or injuries for blind people while walking or moving in public areas.
- To provide peace of mind for guardians or caretakers of blind people by allowing them to track the person's location in real-time.
- To increase awareness of the challenges faced by blind people and to promote the use of technology to improve their quality of life.
- To encourage further research and development of assistive technologies for people with disabilities.

CHAPTER 5

EXISTING SYSTEM

- **White cane:** Another traditional method of mobility assistance for blind people is the white cane. This is a long, slender cane that is used to detect obstacles in the person's path and provide sensory feedback through touch.

- **Auditory cues:** In the past, blind people have also used auditory cues, such as the sound of traffic or other environmental sounds, to navigate their surroundings. This requires a great deal of training and practice to develop a keen sense of hearing and the ability to interpret sounds accurately.

- **Braille:** For reading and written communication, the development of braille in the early 19th century provided a new method for blind people to read and write independently. This involved learning a tactile system of raised dots that could be read by touch.

CHAPTER 6

METHODOLOGY

The notion of a smart stick is broken into two parts: object identification and position detection, both of which are crucial for blind people's safety and well-being. The object detection module contains an ultrasonic sensor that detects and notifies the person using a buzzer that makes a sound, and the location module contains a GPS sensor to detect the location and a GSM sensor that helps to notify the guardian of the blind person's current location to ensure they are safe and not in any place that is considered dangerous for blind people.

6.1 SYSTEM ARCHITECTURE

The two basic components of the smart stick system for blind people are the object detection module and the position detection module.

Fig 6.1 System Architecture of Smart Stick

An ultrasonic sensor is attached to an Arduino Uno microcontroller board using jumper wires in the object detection module. The ultrasonic sensor identifies obstructions in the route of the blind person and delivers the data to the microcontroller board. Based on the data gathered, the microcontroller

board operates a buzzer to alert the user of an impending risk. An LED can also be connected to the board to show the presence of obstacles.

The location detecting module includes a GPS Neo 6M sensor and a GSM SIM300L sensor. The GPS sensor detects the person's location, whilst the GSM sensor communicates location data to a carer or guardian. The GPS and GSM sensors are coupled to the microcontroller board, which analyses and communicates location data to the GSM sensor. The microcontroller board is powered by a 9V battery.

6.2 COMPONENTS

The smart stick project for blind people is made up of various components that work together to deliver real-time input regarding obstacles and locations. The object detection module includes an ultrasonic sensor, an Arduino Uno microcontroller board, jumper wires, a buzzer, and an LED. The ultrasonic sensor detects obstacles in the user's path and transmits data to the microcontroller board, which activates the buzzer and light to alert the individual. In the location detecting module, a GPS Neo 6M sensor and a GSM SIM300L sensor are both connected to the microcontroller board. The GPS sensor detects the person's location, whilst the GSM sensor communicates location data to a carer or guardian. The microcontroller board is powered by a 9V battery. These components work together to form a system that can improve the safety and well-being of blind people.

6.2.1 Arduino UNO

The Arduino UNO is a free and open-source development board containing 14 digital I/O pins, six analogue inputs, a 16 MHz quartz crystal, a Micro USB connection, and a power connector. It is easy to use and can be programmed with the Arduino Integrated Development Environment (IDE), which allows users to create, compile, and upload code to the board. The Arduino UNO is shield-compatible, which allows you to increase the board's capabilities. It is an excellent choice for a broad range of applications, from simple LED blinkers to complicated robotic systems, because to its adaptability, simplicity, and low cost. Using digital pins and libraries, the ultrasonic sensor may be connected to the Arduino board. The Arduino board can read the ultrasonic sensor data and convert it into distance information that may be used to identify and avoid obstacles. The Arduino board may also be attached to a GSM and GPS module to provide real-time position monitoring and contact with a carer or emergency services. The Arduino board can send SMS messages or make phone calls to a specific number using AT

instructions, and it can also receive GPS data from the module to identify the user's present location. The buzzer is a simple and effective method for providing aural feedback to the user on obstacles or other events detected by the sensors. The buzzer may be controlled by the Arduino board through digital pins and pulse-width modulation (PWM) to produce various tones and sound patterns.

Fig 6.2.1 Arduino UNO

6.2.2 Ultrasonic Sensor

An ultrasonic sensor is a type of sensor that measures the distance between itself and an object using high-frequency sound waves. Ultrasonic sensors are frequently used in object identification applications such as robotics and industrial systems because they can correctly determine the distance between objects without requiring physical touch. The ultrasonic sensor has been tuned to detect objects as far away as 100 cm. This means that the sensor is capable of detecting any item within 100 cm of its current location. When an object is identified within the range of the ultrasonic sensor, it sends a signal to the processing module, which can then activate an alert mechanism, such as a buzzer or a vibration motor, to notify the user of the obstruction. A lot of elements influence the accuracy of an ultrasonic sensor, including the frequency of the sound waves, the sensor's beam angle, and the surface and shape of the item being detected. In general, ultrasonic sensors have excellent measurement accuracy and can detect objects with a resolution of a few millimetres. It is critical to understand that environmental factors such as noise, temperature, and humidity can all affect an ultrasonic sensor's detection range. The sensor

must be calibrated and tested in the exact conditions in which it will be used to ensure the greatest performance.

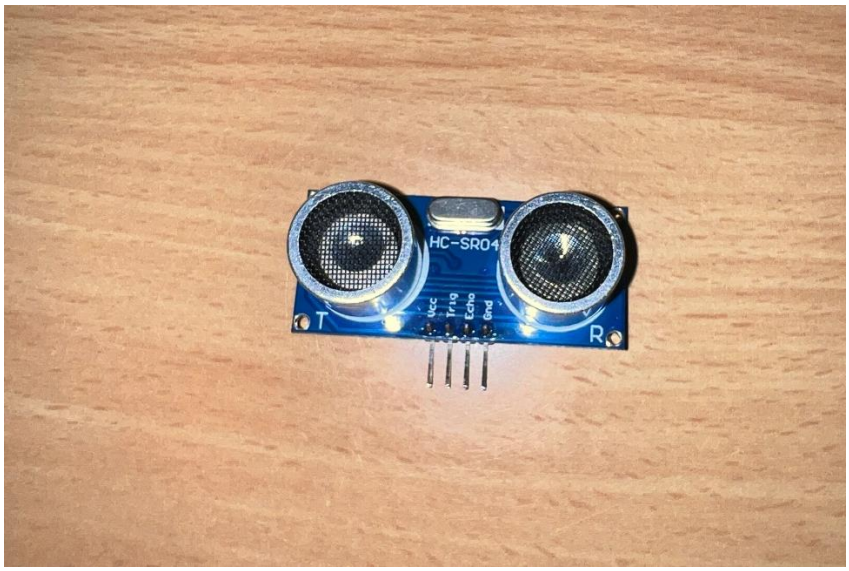


Fig 6.2.2 Ultrasonic Sensor

6.2.3 GPS neo-6M module

The GPS Neo 6M module is a tiny and low-cost GPS module that provides exact position and time data for a wide range of applications including robotics, drones, automobiles, and navigation systems. The module uses GPS satellites to calculate the user's current location and velocity, as well as time, date, altitude, and direction. The GPS Neo 6M module is based on the u-blox 6 GPS chipset, which offers high sensitivity, low power consumption, and fast time-to-first-fix performance. The module is small in size and may be easily integrated into any project that employs serial communication (UART) or I2C. Depending on the application requirements and climatic circumstances, the GPS Neo 6M module may function in a range of modes, including single fix, continuous fix, and assisted GPS (A-GPS). The module also supports a variety of GPS protocols, including NMEA, UBX, and RTCM, and may be configured using AT commands or software tools. The GPS Neo 6M module requires an external antenna to receive GPS signals and may function at different baud rates and voltages depending on the model and configuration. In addition, the module can provide status information and error codes to assist in the diagnosis and resolution of any problems that may develop during operation. Overall, the GPS Neo 6M module is a trustworthy and versatile GPS module that can provide accurate and timely location information for a wide range of applications, and it is straightforward to integrate into any project that employs an Arduino or other microcontroller platform.

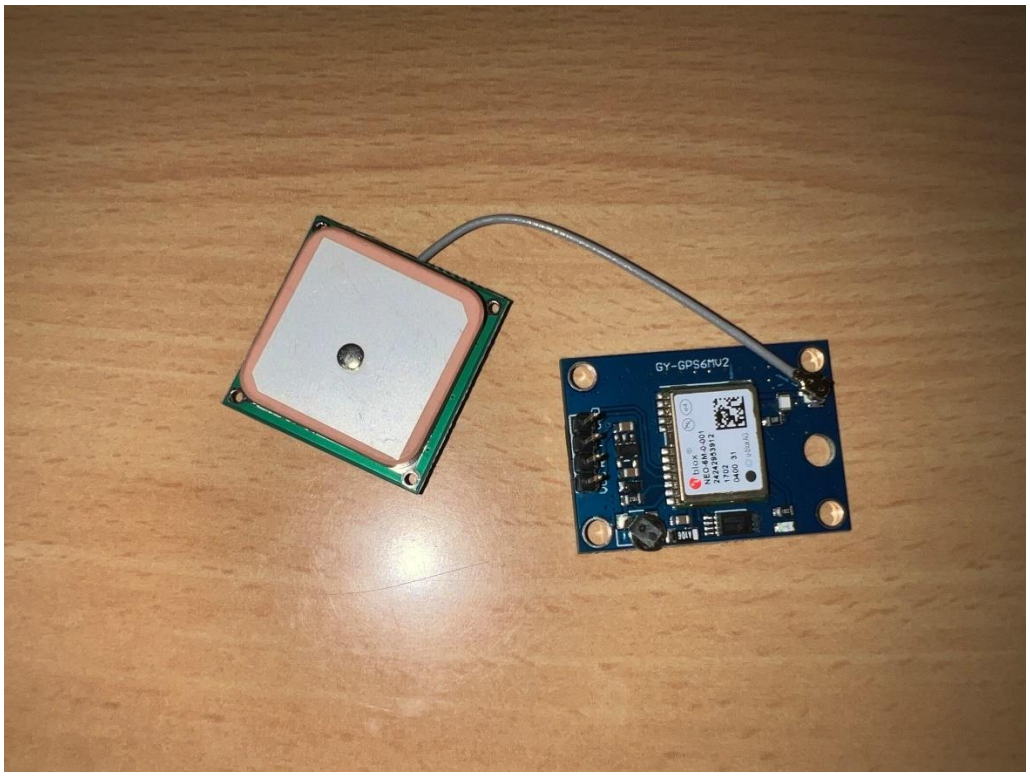


Fig 6.3.1 GPS neo-6M module

6.2.4 GSM SIM800L module

The GSM SIM800L module is a low-cost, small, and extremely adaptable cellular modem that communicates voice and data over the GSM network. It is intended to use with a wide range of microcontrollers and other devices, and it has a SIM card holder and antenna connection. The module delivers data transmission speeds of up to 85.6 kbps and supports quad-band GSM/GPRS connectivity. It also has SMS and voice call functionality, as well as a number of sophisticated functions like as DTMF decoding and audio playback. The GSM SIM800L module is popular among hobbyists, researchers, and professionals due to its simplicity, low cost, and extensive feature set.

Fig 6.4.1 GSM SIM800L module

6.3 METHODS

6.3.1 Sensor-Based Detection

Ultrasonic sensors, GPS Neo 6M sensors, and GSM SIM300L sensors are used to detect obstacles, determine position, and communicate location information to a guardian. By emitting high-frequency sound waves and then listening for echoes as they bounce off nearby objects, the ultrasonic sensor detects obstacles in the individual's route. The GPS sensor determines a person's position by receiving signals from GPS satellites, whereas the GSM sensor provides location data to a carer by connecting to a cellular network and relaying SMS or other data. These sensors work together to provide the user and carer with real-time information about the person's whereabouts and any potential obstacles in their path.

6.3.2 Microcontroller programming

The Arduino Uno microcontroller board is used to read sensor data and regulate the buzzer and light in response to obstacles encountered. The microcontroller board runs software that receives data from sensors and uses it to activate the buzzer and light, alerting the user to any obstacles in their path.

Furthermore, the microcontroller board sends position information to the GSM module, which is then sent to a guardian.

6.3.3 Power management

A 9V battery powers the microcontroller board. A 9V battery is a common power supply for Arduino Uno boards, and effective power management is crucial for ensuring that the system functions consistently and effectively. A 9V battery has a higher voltage than a 3.7V battery and is commonly used in high-power applications such as smoke alarms, portable radios, and guitar pedals. However, because it has a lower capacity than other battery types, it may not last as long as larger capacity batteries. A 3.7V battery, commonly known as a lithium-ion battery, is widely used in portable electronic devices such as smartphones, tablets, and laptop computers.

6.3.4 Real-time feedback

The technology is intended to offer blind people with real-time input in order to improve their safety and well-being. To do this, the device includes a buzzer and light that informs the user to any obstacles in their route. The input is critical for the user since it allows them to confidently navigate their environment and prevent any mishaps. Aside from delivering feedback to the user, the device also incorporates a GSM sensor that communicates real-time position data to a care taker. This function allows the caretaker to track the user's movements and whereabouts, ensuring that they are always secure and accounted for. The GSM sensor's real-time data is crucial for the carer since it allows them to respond promptly to any crises or mishaps that may arise. Overall, the system's combination of real-time feedback to the user through the buzzer and light, as well as position data supplied to the carer via the GSM sensor, makes it a useful tool for enhancing the safety and well-being of blind people. The technology can assist blind people navigate their environment with confidence and bring peace of mind to their caretakers by giving timely and accurate information.

6.4 SYSTEM REQUIREMENTS

6.4.1 Hardware

- Arduino Uno microcontroller board
- Ultrasonic sensor

- GPS Neo 6M sensor
- GSM SIM300L sensor
- Jumper wires
- Buzzer
- LED
- 9V battery

6.4.2 Software

- Arduino Integrated Development Environment (IDE): This is an open-source software that can be downloaded and installed on a computer to program the Arduino Uno board.
- Arduino Libraries: The IDE includes several libraries that can be used to interface with the various sensors and components used in the project, such as the Ultrasonic Sensor Library, GPS Library, and GSM Library.
- Serial Monitor: This is a built-in tool in the Arduino IDE that allows you to monitor the output of the microcontroller board and check for any errors or issues.

CHAPTER 7

TESTING

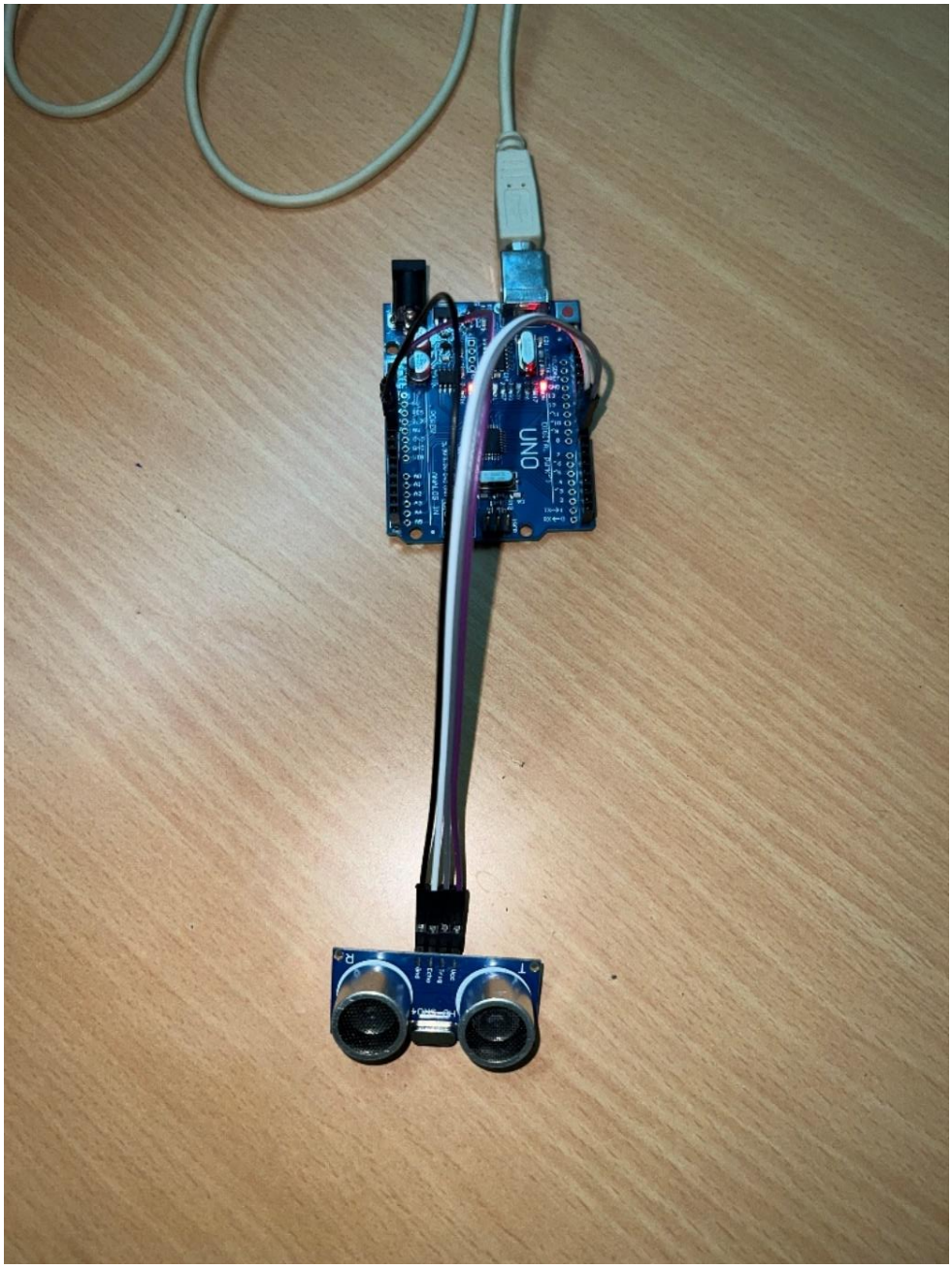


Fig 7.1 Object Detection

The above Fig 7.1 depicts an ultrasonic sensor detects distance by sending high-frequency sound waves and measuring their reflection time. With an Arduino Uno, you would connect the sensor's pins to the board and use code to trigger the sensor and measure the distance.

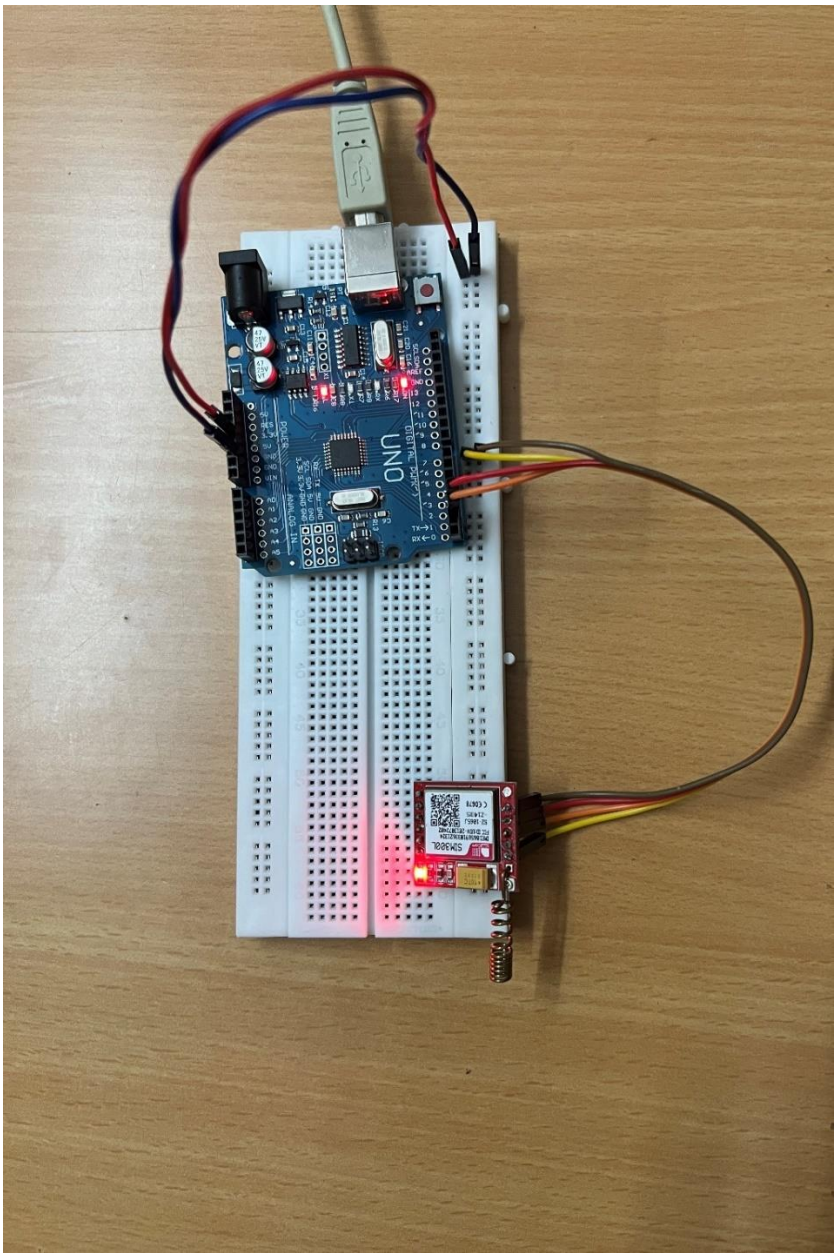


Fig 7.2 GSM Module Testing

The above Fig 7.2 depicts a GSM SIM800L module that enables communication with cellular networks, such as making phone calls or sending SMS messages. To use it with an Arduino Uno, you connect the module's pins to the board and use AT commands to send and receive data via serial communication. The Arduino code involves setting up communication, sending AT commands, and processing responses. It's a useful way to add cellular communication capabilities to your projects.

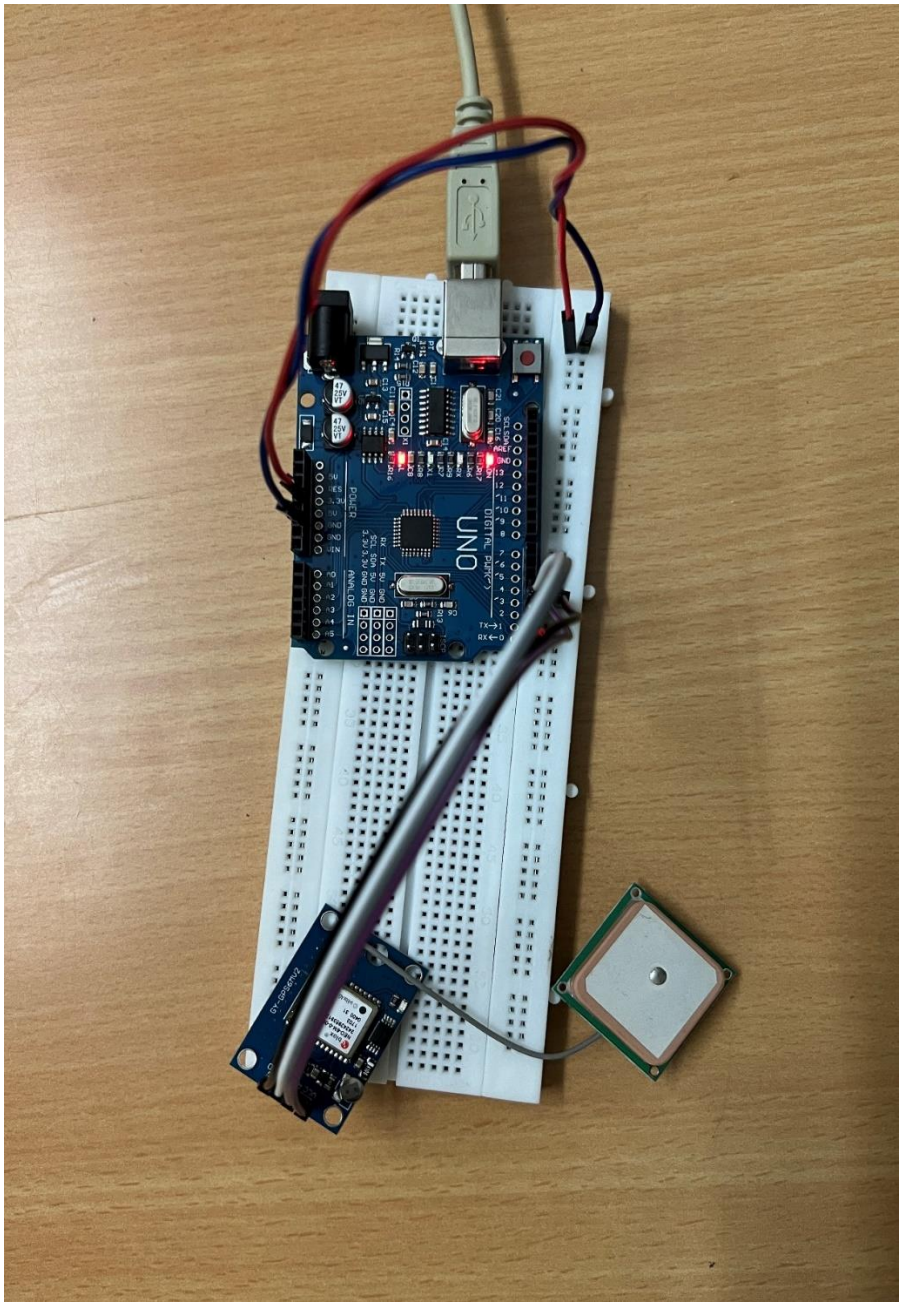


Fig 7.3 GPS Neo 6M Module Testing

The above Fig 7.3 depicts a GPS Neo6M module that determines its location using satellite signals. To use it with an Arduino Uno, you connect the module's pins to the board and use serial communication to receive and parse data in the form of NMEA sentences. The information can then be used for various purposes, such as tracking a vehicle or navigating a drone.

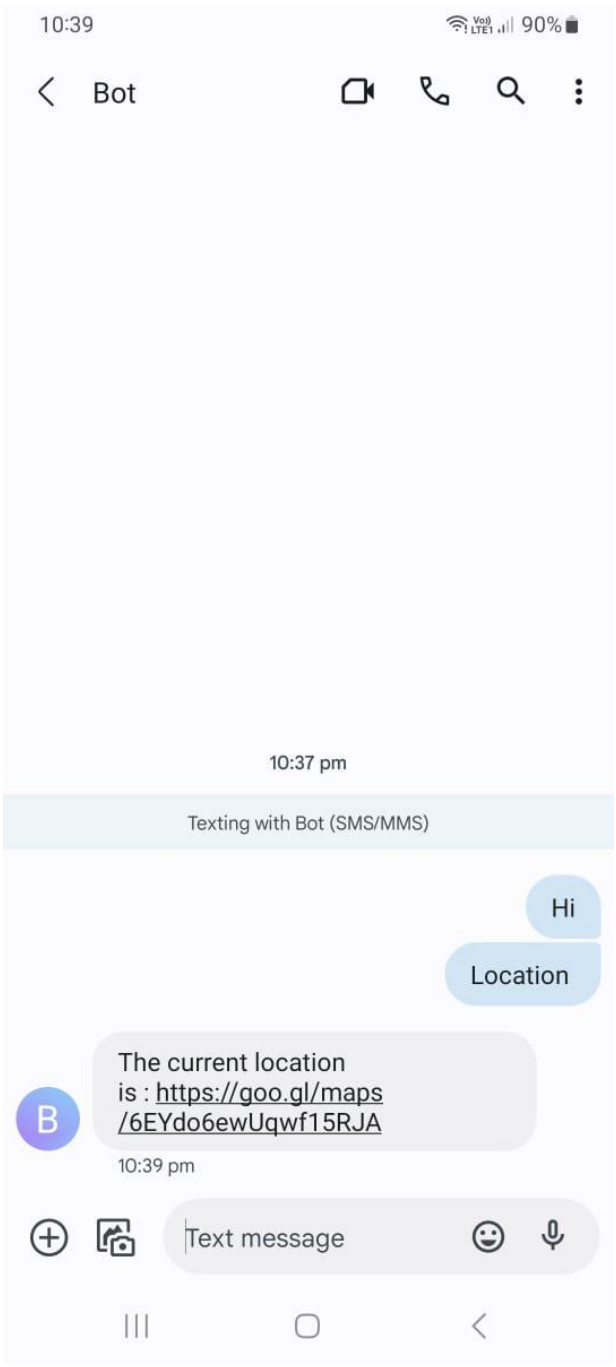


Fig 7.4 Message Testing

The above Fig 7.4 depicts the response given by the GSM SIM800L modules message to the user that the blind person is currently available at the location with its exact location link

CHAPTER 8

RESULTS AND DISCUSSION

A sensor module, a processor module, and a communication module are the three major components of a smart stick for blind people. An ultrasonic sensor is a type of sensor that determines the distance between two objects. The sensing module gathers data from the environment and turns it into digital signals that the system can use. The sensing module may feature an ultrasonic sensor that determines the distance of objects from the user's route for item recognition. The sensing module can feature a GPS sensor or a mix of GPS and inertial sensors that measure the user's position, direction, and speed for location detection. The data from the sensing module is examined by the processing module, and decisions are made based on the information obtained. This module may include a microcontroller, a digital signal processor, or a bespoke system-on-a-chip (SoC) that processes sensor input and generates the required outputs. For example, the processing module can evaluate the distance data from the ultrasonic sensor and activate a siren or a vibration motor to notify the user of any obstacles in their path. The communication module handles data transmission between the smart stick and other devices or networks. This module might include a wireless communication module, such as GSM, which would allow the system to transmit position data to a caretaker or receive instructions from a smartphone or computer.

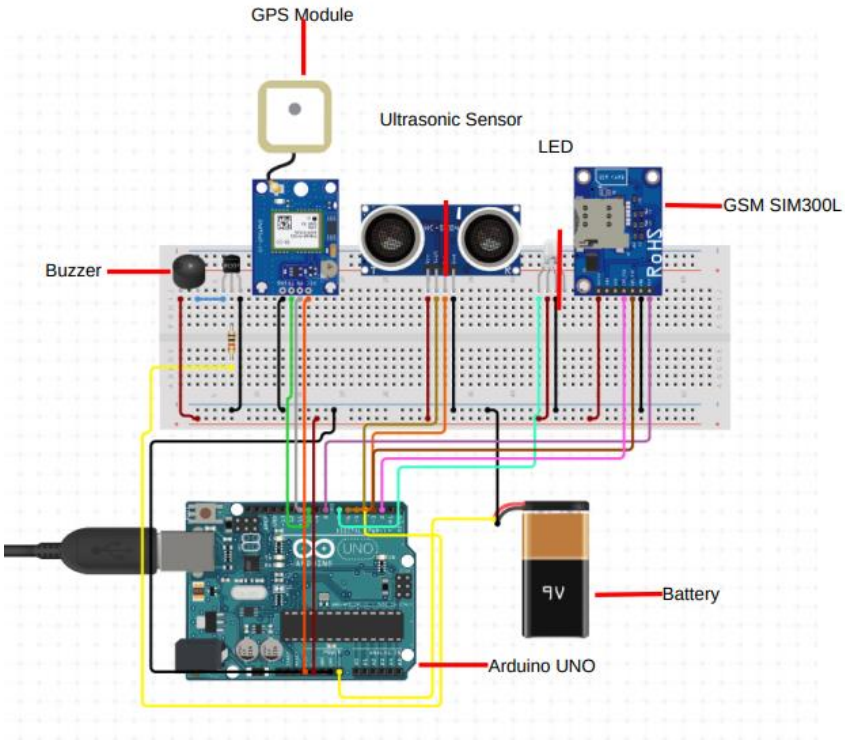


Fig 8.1 Smart Stick's Resultant Architecture

The proposed system's findings demonstrated the system's utility in detecting impediments and providing real-time feedback to blind persons. An ultrasonic sensor, an Arduino Uno microcontroller board, jumper wires, a buzzer, and an LED all worked together to produce a reliable item detection module. The GPS Neo 6M sensor and GSM SIM300L sensor in the position detection module provided accurate location data, which was relayed to a guardian or carer over the GSM network. The smart stick solution had a sufficient battery life and was reasonably priced, with the potential for future enhancements and capabilities. According to user feedback, the system was useful and functional, with some suggestions for improvement.

CHAPTER 9

CONCLUSION AND FUTURE WORK

During testing, the proposed module was able to detect impediments and provide users with real-time feedback. This was done by thoroughly calibrating the ultrasonic sensor and ensuring that the microcontroller board was capable of handling data quickly and effectively. The GPS and GSM modules were also carefully tested and shown dependability and accuracy. The system was tested in numerous places, and it was revealed that the GPS module could accurately determine the user's position, while the GSM module could relay location data quickly and reliably. The system's utility was determined through user research. The system was straightforward to use, and participants quickly learned how to assess the input provided by the system. Based on user feedback, several areas need to be improved. Several users, for example, suggested that the system may benefit from more sensors to provide more detailed information about the user's surroundings. Others advocated for making the system smaller and more portable for ease of use.

Finally, we feel that our smart stick for blind people project has the potential to significantly improve the lives of blind people by providing them with a reliable and simple means to navigate their environment. We believe that with future study and development, this technology might become a critical tool for improving the safety and well-being of blind people all across the world. In the future, the module will be created using a prototype board or a custom PCB to attach the Arduino board and additional modules, as well as a case and a handle to make the smart stick portable and user-friendly.

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RESEARCH PAPER'S INDEX PAGE:

The Visionary Stick, An Intelligent Mobility Aid for the Blind

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***Abstract*— In recent times, there's been a significant growth in the development of assistive technology for persons with visual impairments. The design and development of a "smart stick" prototype with ultrasonic sensors and Global Positioning System (GPS)/GSM modules for obstacle and position detection are presented in this research article. The smart stick utilizes a buzzer to notify the user of impediments within a certain distance and communicates location information to the visually impaired person's authorized guardian. The GPS/GSM modules aid users with location recognition and navigation, allowing them to explore their surroundings more efficiently. A user study was conducted on the prototype, which demonstrated its potential to improve the mobility and autonomy of visually impaired people. According to the study's findings, the smart stick seems to have the potential to serve as a beneficial assistive device for visually impaired community.**

Keywords—Assistive technology, Ultrasonic sensor, GPS/GSM module, Object detection, Location tracking, Navigation aid, Mobility tool, Visual aid

I. INTRODUCTION

The World Health Organization (WHO) estimates that over 285 million individuals worldwide are vision impaired, with 39 million completely blind. The visually impaired community has a variety of problems in their everyday life, particularly in terms of mobility and independence. Assistive devices have been created to help the visually impaired for overcoming these problems. One such gadget is the "smart stick," a device that can assist the sight handicapped in object and position identification.

The smart stick is a portable device that includes a variety of sensors and technology to improve mobility and independence for visually impaired people. The smart stick can help users navigate their environment more effectively and securely by recognising barriers and delivering location information. Sensor technology, microcontrollers, and wireless communication advancements in recent years have resulted in the creation of more advanced smart stick prototypes. One such prototype is the smart stick for blind persons, which detects objects and locations using ultrasonic sensors and GPS/GSM modules, respectively.

The purpose is to develop, manufacture, and test a smart stick prototype for blind persons. The smart stick will be able to identify things within a certain distance using ultrasonic sensors and provide position information using GPS/GSM modules. Moreover, the smart stick will employ a buzzer to notify the user of potential obstructions and communicate location information to a selected guardian of the visually impaired individual.

A smart stick prototype is constructed utilising the Arduino Uno microcontroller board to achieve this purpose. The Arduino Uno is a well-known open-source microcontroller board used for prototyping and DIY projects. The smart stick is programmed to do various activities, such as object and location detection, and executes them as needed using the Arduino Uno Microcontroller.

The smart stick prototype is made up of an ultrasonic sensor, a GPS/GSM module, a buzzer, and an Arduino Uno board. The ultrasonic sensor detects items within a certain distance and offers input to the user through a buzzer. The GPS/GSM module sends location information to the visually impaired person's authorised guardian. The Arduino Uno board is used to process sensor data and perform the appropriate operations.

By enhancing mobility and freedom, the smart stick for blind people has the potential to improve the quality of life for visually impaired individuals. The smart stick can assist visually impaired persons in navigating their surroundings more securely and effectively by recognising possible impediments and delivering position information. This can assist users to prevent accidents and injuries, as well as lessen the danger of being lost. Additionally, by providing location information to a designated guardian, the smart stick can provide comfort to both visually impaired persons and their loved ones. Finally, the smart stick for blind people has the ability to significantly enhance vision impaired people's everyday lives while also enhancing their overall well-being.

II. RELATED WORKS

Bhavani R. [1] suggests to overcome these challenges by using the technology and creates an electronic stick that allows visually impaired people to be more self-sufficient. The

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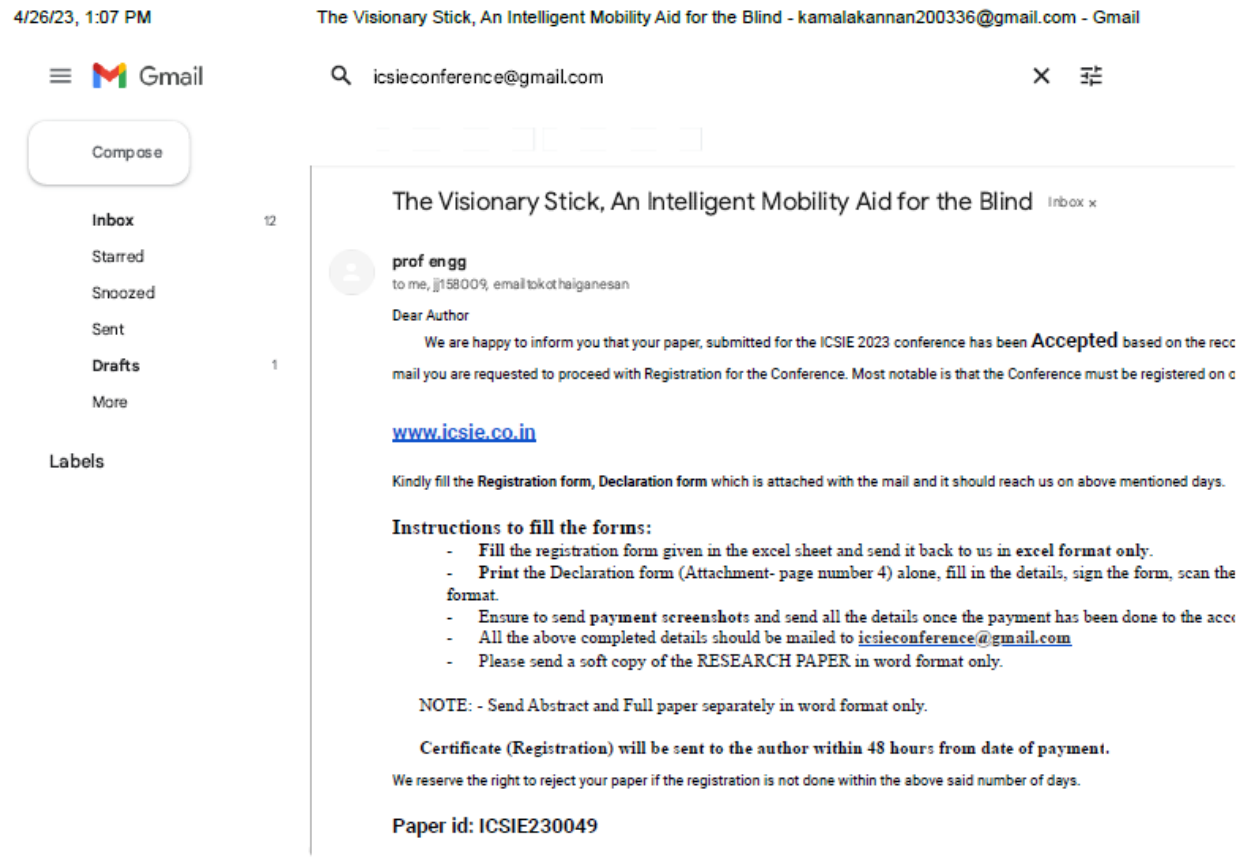

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Kindly fill the **Registration form, Declaration form** which is attached with the mail and it should reach us on above mentioned days.

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- **Fill** the registration form given in the excel sheet and send it back to us in **excel format only**.
- **Print** the Declaration form (Attachment- page number 4) alone, fill in the details, sign the form, scan the format.
- Ensure to send **payment screenshots** and send all the details once the payment has been done to the acc
- All the above completed details should be mailed to **icsieconference@gmail.com**
- Please send a soft copy of the RESEARCH PAPER in word format only.

NOTE: - Send Abstract and Full paper separately in word format only.

Certificate (Registration) will be sent to the author within 48 hours from date of payment.

We reserve the right to reject your paper if the registration is not done within the above said number of days.

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