

## SMART BLIND STICK WITH OBSTACLE DETECTION AND NAVIGATION ASSISTANCE

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### ABSTRACT

This project present the smart blind stick designed to enhance the mobility ,And independence of visually impaired individuals .The device integrates ultrasonic sensor ,GPS, And machine learning algorithms to detects obstacles , Provide navigation assistce, The smart blind sticks it's Helps to blind people, The stick is properly detected the direction, And offer a real time feedback ,The smart blind stick uses a microcontroller to process sensor data ,Detect obstacles ,And trigger audio or vibration alert ,The GPS module provides location information , enabling users to navigate familiar and unfamiliar environments with confidence .The machine learning model improves obstacles detection and navigation assistance through user data and feedback .This technology aims to reduce accident

**Keywords:** Smart Blind Stick ,Obstacle Detection , Navigation, Assistance, Machine Learning, GPS, Ultrasonic Sensor.

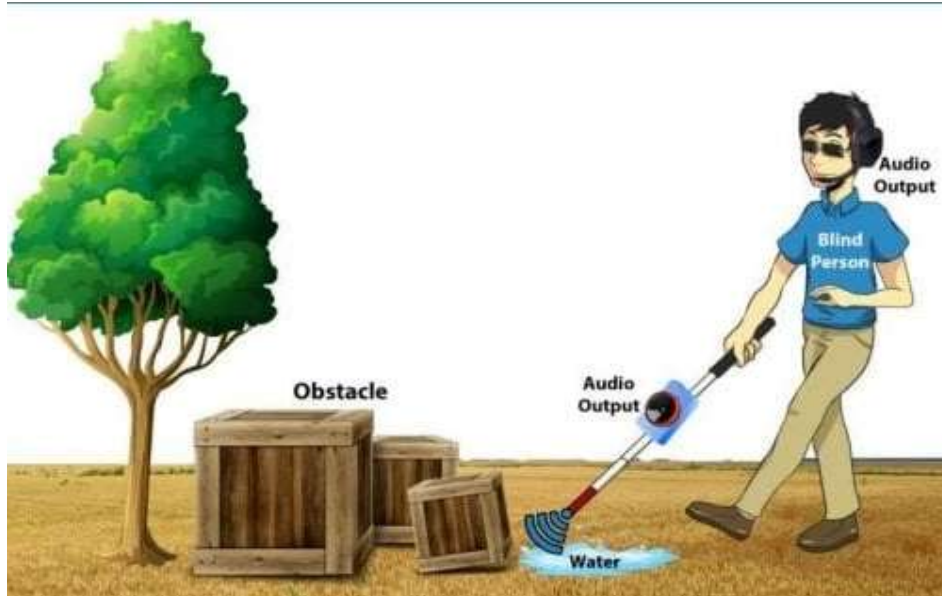
### I. INTRODUCTION

This innovative asstivive device integrates advance sensors ,GPS ,And machine learning algorithms to detect Obstacles, Provide real time feedback ,And offer navigation assistance .By doing so ,It enables user to move confidently and safely through various environments, Reducing the risk of accident and injuries The smart blind stick is designed to be user- friendly and adaptable to different user needs .It's development has the potential to significantly impact the lives of visually impaired individuals ,Promoting greater autonomy , confidence ,And overall well-being Navigating the World can be challenging for visually impaired individuals. Traditional white canes provide limited feedback about the environment , Mainly detecting obstacle in the immediate path ,To enhance mobility and safety , Innovative solution like smart blind sticks are being developed .This device integrates advance technologies to assist users in detecting Obstacles and navigating more effectively.

Numerous people all over the world have visual impairments or are completely blind. It is very distressing that loss, and total blindness are the four categories of visual impairment. A person is considered legally blind if they have less than 20/200 vision in either eye or a severely restricted field of vision. People who are legally blind or nearly blind often rely on guide dogs or walking canes to get around. The majority of the time, this crew aims to sneak through their work without anyone noticing [3, 9]. A guide dog's duty is to prevent its human master from colliding with obstacles in the environment. If you're visually impaired, you can use a walking stick to feel out the terrain ahead of you and locate potential hazards. The need for aid devices has never gone away, and it never will.

Individuals with visual impairments have access to a number of navigation aids and devices [21]. A person who is blind must be able to navigate independently and identify objects. The Smart Stick is a ground. Could drastically enhance the quality of life for the visually impaired. The device's many features make it easier for users to move around in their surroundings, gain access to needed information, and complete otherwise difficult tasks. The Smart Stick's ability to detect obstacles and steer around them is a major plus [12]. The system employs sensors to identify potential hazards and then alerts the user with both auditory and tactile cues. As a result, people who are visually impaired may be safer and more self-reliant on their daily adventures. The GPS navigation system built into the Smart Stick is another crucial component that can facilitate travel in uncharted territories. The device has audio instructions to help the user get where they need to go, making it simpler to get around in crowded places like subways, malls, and other public places. The Smart Stick can

greatly improve visually impaired people's lives [18]. The device's many features help users navigate safely, access information, and complete difficult task as shown in



**Figure 1:** Visually person walking through the surrounding.

There are currently 1.4 billion people residing in India. Around the globe, 8.90 million people experience vision impairment. Ninety percent of the population requires assistance to walk as shown in fig 2. on those who, due to visual impairments, are unable to independently navigate unfamiliar environments. Researchers hope that their work will lead to improved methods for the visually impaired to navigate the blind person.



**Figure 2:** Commercially Available walking stick for Blind person.

## II. METHODOLOGY

1. The working of the system begins when the power supply is given. The ultrasonic sensor is then used to detect obstacle and provides distance between obstacle and the device. GPS Module provides navigation. When obstacle is detected, the distance and the navigation will be processed using Raspberry Pi device. The processing happens in such a way that if the obstacle is on to the right side, a voice command will be given to take left and vice versa.
2. The mobility and safety of visually impaired individuals by integrating advanced technologies into a smart blind stick. The system will feature obstacle detection, navigation assistance, user feedback, and environmental awareness, all while ensuring ease of use and accessibility.

• ER Diagram:

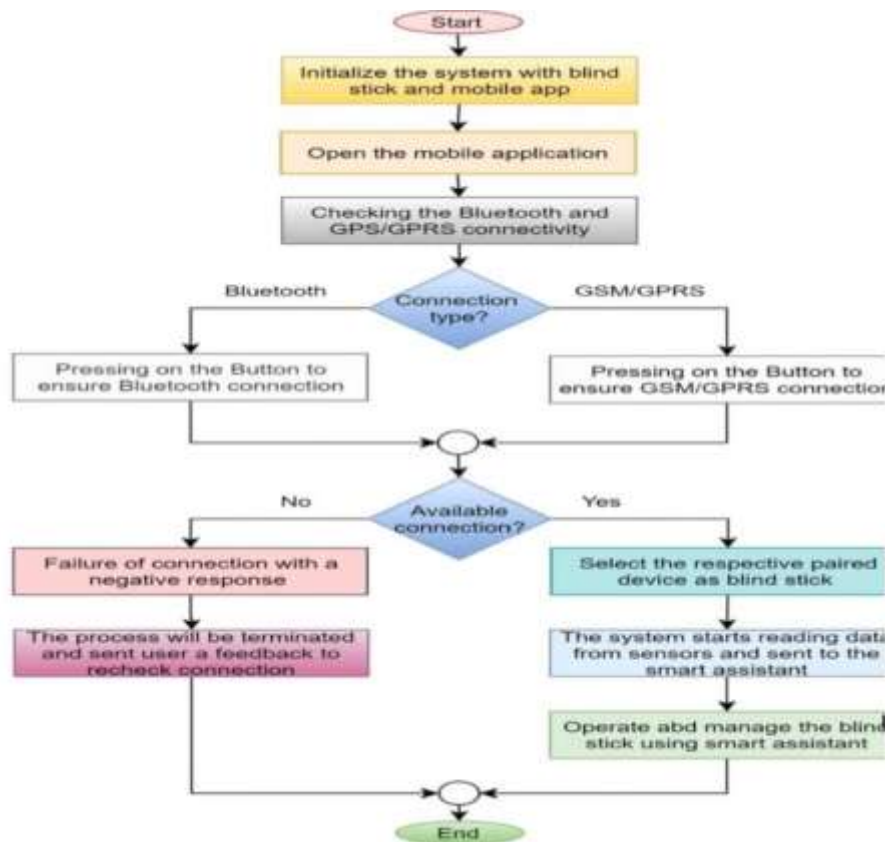


Figure 3:

• How it works :-

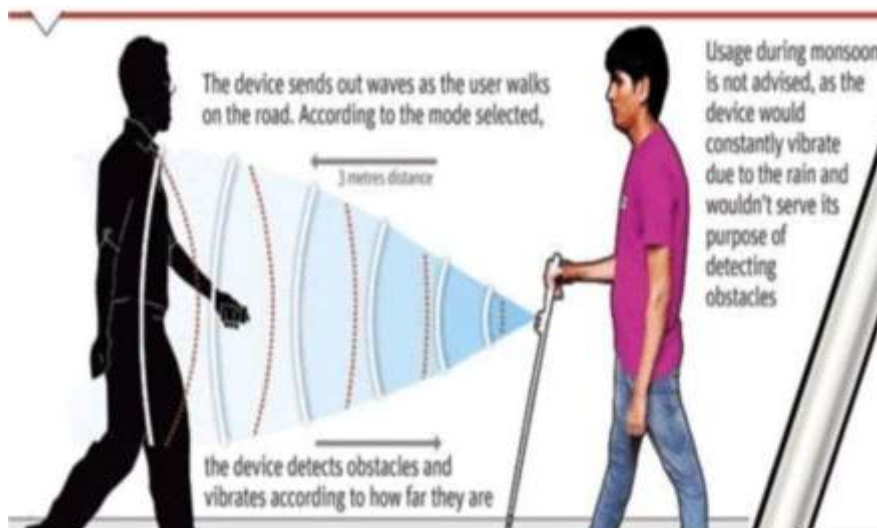


Figure 4:

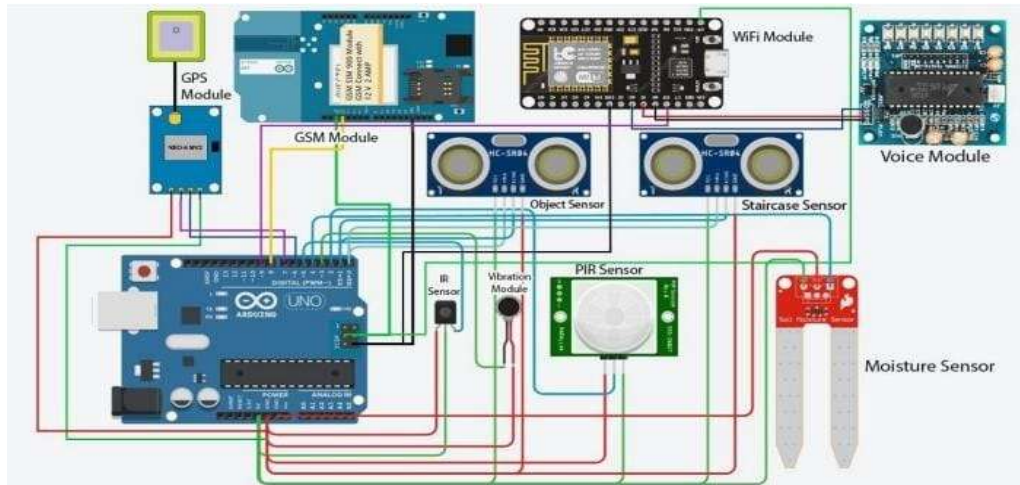
System configuration

Hardware & Software Requirement:

- Ultrasonic sensor: An ultrasonic sensor is a device that uses ultrasonic waves to measure distance, detect objects, or gauge levels of fluids. Here's a breakdown of its main features  
Obstacle Detection: Used in vehicles and robotics to avoid collisions.
- Level Sensing Monitors fluid levels in tanks.
- Distance Measurement: Employed in various industrial and consumer applications.

- Raspberry-pi: Raspberry Pi is a small, affordable single-board computer developed by the Raspberry Pi Foundation. It's designed to promote computer science education and enable DIY projects. With various models offering different specifications, Raspberry Pi can be used for tasks such as programming, robotics, home automation, media centers, and more. It runs various operating systems, primarily Linux, and supports a wide range.
- SD Card: An SD (Secure Digital) card is a type of removable storage device used to store data in various electronic devices, such as cameras, smartphones, and computers. They come in different sizes (standard, mini, and micro) and capacities, ranging from a few megabytes to several terabytes. SD cards are commonly used for expanding storage and transferring files due to their portability and ease of use.
- RF Transmitter: A Radio Frequency (RF) transmitter is an electronic device that converts information (voice, data, or video) into radio waves and transmits them through an antenna to a receiver. The receiver then decodes the radio waves back into the original information
- Frequency Range:
  - RF transmitters operate within specific frequency bands, including:
    1. VLF (Very Low Frequency): 1-10 kHz
    2. LF (Low Frequency): 10-100 kHz
    3. MF (Medium Frequency): 100-500 kHz
    4. HF (High Frequency): 1-30 MHz
    5. VHF (Very High Frequency): 30-300 MHz
- Lidar sensor:-Lidar (Light Detection and Ranging) sensor uses laser light to measure distances and create 3D images.
- RF Receiver: [RF Receiver (Radio Frequency Receiver):
  - A device that captures and decodes radio frequency (RF) signals transmitted from a sender, converting them back into their original form (voice, data, video, etc)
- Button Switches: Electrical or mechanical devices controlling electrical flow or signals. Types include push-button, toggle, rocker, slide, touch, membrane, and keypad switches. They provide on/off control, mode selection, setting adjustments, navigation, alarm activation, and signal transmission in various applications
- Battery: battery is a device that stores chemical energy and converts it into electrical energy through electrochemical reactions. It typically consists of one or more electrochemical cells, each containing an anode (negative electrode), a cathode (positive electrode), and an electrolyte. Batteries are used in a wide range of applications, from powering small electronics like remote controls to providing energy for electric vehicles and renewable energy storage systems.
- Wi-Fi module: A wi-fi module is a hardware component that enables devices to connect to a wireless network, allowing them to communicate over the internet or with other devices. It typically includes a radio transmitter and receiver, along with a microcontroller to manage data processing. Wi-Fi modules are commonly used in IoT devices, smart home applications, and embedded systems.
- Microcontroller unit: microcontroller unit (MCU) is a compact integrated circuit designed to govern a specific operation in an embedded system. It typically includes a processor core, memory (both RAM and flash), and input/output peripherals on a single chip. MCUs are used in a wide range of applications, from simple devices like home appliances to complex systems
- GSM module: In our blind navigation stick, the GSM module serves as a means of communication with external devices or individuals. For example:
  - Emergency Alerts: If the navigation stick detects a hazardous condition, such as heavy rain, it can use the GSM module to send an emergency alert to a predefined contact (e.g., a caretaker or emergency services).
  - Location Sharing: The GSM module can periodically send the user's location coordinates to a designated contact, allowing the user's whereabouts to be tracked remotely.

- Voice Calls: In case of emergencies or when the navigation stick detects critical conditions, it can use the GSM module to make voice calls to a caretaker or emergency contact for immediate assistance.
- Text Messages: The GSM module can send text messages containing important information or



**Figure 5:**

- Machine learning:-Machine learning is a subset of artificial intelligence that focuses on developing algorithms that enable computers to learn from and make predictions or decisions based on data. Instead of being explicitly programmed for specific tasks, machine learning models improve their performance as they are exposed to more data.
- Aurdinio uno code:-
- // Pin where the LED is connected
- const int ledPin = 13;
- void setup() {
- // Initialize the digital pin as an output
- pinMode(ledPin, OUTPUT);
- }
- void loop() {
- // Turn the LED on
- digitalWrite(ledPin, HIGH);
- // Wait for one second
- delay(1000);
- // Turn the LED off
- digitalWrite(ledPin, LOW);
- // Wait for one second
- delay(1000);
- Embedded-C:-Embedded C is a popular programming language for the development of embedded systems, such as Microcontrollers like the Arduino Uno used in blind navigation researchs. Creating a research for blind navigation is useful for several reasons:
- Efficiency: Embedded C is designed to be lightweight and efficient, making it suitable for use in Microcontroller-based systems. This is crucial for blind navigation researchs where processing power, Memory, and battery life are frequently constrained. 2. Real-time control: Real-time applications, such as blind navigation, can make use of Embedded C.

### III. RESULTS AND DISCUSSION

The Walking Smart Stick for blind people is a great innovation in the field of assistive technology. It is a smart stick that can be used by visually impaired individuals navigate their surroundings independently, when they are in unfamiliar places. The smart stick is designed to use multiple sensors and is integrated with the person's caretaker's phone for active updates of the blind person. With the help of an Arduino board, a piece of electronics capable of detecting obstructions is constructed. During testing, we put the gadget through its paces by positioning a number of objects in front of, and at varying distances from, its sensors. The technology effectively alerts the user and caretakers. of the primary benefits of this smart stick is that it enables visually impaired individuals to be more independent. For many blind people, the fear of getting lost or injured in unfamiliar surroundings can be a significant barrier to traveling independently. With the walking smart stick, they can now navigate safely and confidently. The smart stick can detect obstacles in the user's path and alert them to potential hazards, such as trees, poles, or other obstructions. This feature allows users to move around without needing assistance, making them feel more in control of their environment. Another benefit of the walking smart stick is its real-time updates.

- The smart stick is integrated with the user's caretaker's phone, which provides active updates to the blind person.
- This feature ensures that the caretaker is informed about the user's location and well-being. In case of any emergency, the caretaker can quickly come to the user's aid. This makes the smart stick a safer and more reliable tool for visually impaired individuals to use.



**Figure 6:**

**Table 1:** Comparison of displacement of all 4 cases

SN.	System Parameter Under Test	No. of Trails	Performance Rate
1	GPS Coordinates	20	100%
2	SMS Waring	15	100%
3	Ultrasonic Object Detection	15	95%
4	Ultrasonic Staircase Detection	15	95%
5	RF Transmitter/Reciever	15	100%
6	Emergency Button	15	100%
7	Vibration Output	15	100%
8	Sound Alert	15	100%

### IV. CONCLUSION

Primary purpose of this system is to serve as a protective barrier and provide assistance to those who are blind in becoming more aware of their surroundings. The work that will be done in the future involves the installation of a GPS system, the construction of an application, and facial recognition so that they can identify the individuals who came before them. The addition of a GPS system makes it possible to pinpoint the precise location of a blind person, which not only enables their caretakers to locate them but also serves as an excellent

guide. In order for visually impaired persons to be able to live their lives in a pleasant manner, it is essential for them to have access to an item that is both effective and comfortable. In a growing nation like India, there is a pressing need for a solution that is both cost-effective and efficient, so that the greatest number of people may benefit from the effective product that is the subject of this study. The goal of the research titled "Smart Stick for Blind using arduino.

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