



# Smart Cane for Visually Impaired Based on IoT

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## ABSTRACT

*Portability of the blind people will not gate access correctly so thereis so much amount of minimum memory space available Visual impairment can be termed as blindness or vision loss. This impairment causes many difficulties in their day-to-day activities such as in reading, walking, socializing, and driving. The white cane is considered to be the symbol of freedom, independence, and confidence. The proposed smart cane is designed with obstacle detection module, heat detection, water detection, light detection, pit and staircase detection using InfraRed (IR) sensor, GPS (Global Positioning System), and GSM(Global System for Mobile) which helps them to accomplish his/her daily tasks with ease. The obstacle detection module uses ultrasonic range along with camera to detect the obstacles which intimates that the obstacle is detected and also about what the obstacle is? We use Raspberry Pi to inform the impaired user about what the object is and it is sent as a voice message through headset. The GPS is used to identify the current location of the person which is sent as a text message and also as a voice message through headset. Traffic signals are identified by using Raspberry Pi and intimate the user through headset whether to wait for the signal or move.*

**Keywords - Assistive technology, visually- impaired, functional test**

## 1. INTRODUCTION

Blind people or say visually impaired people find difficulty in mobility in unknown environments. Mobility means the feasibility of on the road unfamiliar environments with none supplementary assistance. Visually impaired people face many hardships in mobility. Guiding visually impaired people by use of some sound technology that helps them to search out their way with the assistance of some mobile systems is referred as Navigation Assistance for Visually Impaired (NAVI). There are many researches that are being conducted to assist people full of vision loss and partially sighted. Mostly these technologies have enormous limitations and have a good impact on the performance and efficiency of the system developed to guide them[1]. People who suffer from vision loss usually use dogs or walking persist with help them to detect obstacles. The stick cannot scan the platform in and of itself and it just function a tool to assist people from danger just in case of situation like traffic and in road crossing. Secured feeling and confidence might be enormously increased using such devices that provides a signal and warning to search out the direction of an object less or obstacle less way in changing environments. Electronic Travel Aids (ETAs) could be a device that warns the user with help of some signals either the sound waves or by physical interaction with people like vibratory patterns. this method provides a crucial measure to cut back accidents among blind people in common traffic areas and provides away warning to them by creating an excellent tendency to detect objects and obstacles as blind death has become common thanks to their inability to work out and manage situations in heavy traffic. The proposed system helps the visually impaired people to achieve their destination by commanding them through voice recognition system via Bluetooth. The headset and walking stick are connected by Bluetooth. As soon because the data is serviced from the receiver within the Bluetooth headset, it's converted to text using voice recognizer. Then, sent to the walking stick where GPS device is found. The GPS identifies the present location and find the thanks to their destination [2]. A cushty system is that the one which may guide people with low vision or Smart cane for visually impaired supported IoT visually impaired, through audio commands are remarked as Navigation System for Visually Impaired. Navigation can be made easier for them by providing smart cane in order that they are doing not face difficulties while walking. A traditional walking stick is employed by impaired people for his or her movements in day-to-day activities. But they're going to be unaware of the object's presence. There are many new and massive sorts of research are done to develop and build a navigation assistance system for visually impaired. There are a number of the constraints like which isn't accurate, not easily usable without the assistance of others, coverage and these issues aren't easy to beat in current technology Designing a sensible cane are going to be more reliable and self-reliant for his or her navigation purpose. This cane is intended in such some way that which is affordable for all impaired people because most of the people are from the underdeveloped side and it becomes impossible for them to urge a high cost navigation system. This is often conveyed to them through voice recognition system available in navigator. Additionally there to, suggest the mode of transportation, and measures the gap and time taken to succeed in their



destination.

## **2. RELATED WORK**

In an uttering computing world, information about location and position is necessary to find blind people because they may get lost. This states that for every five second someone in the world goes blind. Ninety percentages of school children did not pursue their secondary education because of this suffering from vision loss. Current statics enforce that India ranks one among the blind people population India's human crowd has measured up to 120 Cr. an Numerous applications Organization, in the year of among 7 billion human populations 285 million people are blind and which 19 million are children who are below 15 years. Among those t 8.90 Cr. Humans suffer from vision loss. Most of them need human assistance to travel. Death of blind pedestrians ranks four among all means of causes of death. Moreover 30,000 blind people die every year due to trouble with navigation. Roughly 400 legally blind pedestrians are hospitalized as the result of a motor vehicle accident. There are totally 39 million blind people in this technical world. There are many mobile based and web struggle. Predominantly IOT (Internet of Things) products serve as a major backbone for them. There are IOT products that help them to find objects ahead them. It also helps them to navigate around without hurdle, without clashing with world. To develop a user-friendly low costgadget for safe movement of visually impaired people[2]. The smart Cane is an important tool for the visually impaired people to make their move in this world. It helps the user to move in their surroundings but, it is difficult for them to memorize the locations of the object or obstacles when they move to the new locations which are unknown to them. The blind cane cannot detect any obstacle which is present in front of them. There have been many developed mobile based and web based applications to help the visually challenged people. But there are fewer devices which is affordable to help them to meet their daily needs. Recognition system which is available in this navigation gadget. These voice commands are transmitted to them through a headset. The Smart Cane is an important tool for the visually impaired people to make their move in this world. It helps the user to move in their surroundings but, it is difficult for them to memorize the locations of the object or obstacles when they move to the new locations which are unknown to them. The blind cane cannot detect any obstacle which is present in front of them. There have been many developed mobile based and web based applications to help the visually challenged people. But there are fewer devices which is affordable to help them to meet their daily needs.

### **2.1 Navigation Gadget for Visually Impaired [1]:**

This paper relies on developing a navigation gadget with the headset which helps them to find their way in this world. It also helps the people to move and reach their destination path through a voice commands. The detection of obstacles is processed using ultrasonic sensors which have been controlled by the microcontroller. In this gadget, the headset and the stick are paired using Bluetooth. The GPS is used in this gadget to identify the location and also the destination way that person has to move are received via headset. Their destination path will be sent to them in form of voice recognition system which is available in this navigation gadget. These Voice commands are transmitted to them through a headset.

### **2.1 Cost Efficient Autonomous Navigation System (E-Cane) [2]:**

This device is designed based on the robotics in which they used an algorithm for detecting the objects with the help of an ultrasonic sensor. This sensor is to detect objects which are placed in front of the user and also on the floor more accurately. In this system, a high-frequency sound wave gets produced and its reflected sound wave is then received by the sensor for detecting the objects. A Micro Electro Mechanical System (MEMS) based gyroscope is used in their navigation system so that the position of the sensor while detecting the objects which are placed down will be remain fixed even when the person moves his/her hand holding this cane. When an object comes in front of a person, a piezoelectric beeper is been used here where it produces an alarm to be aware of his/her movement.

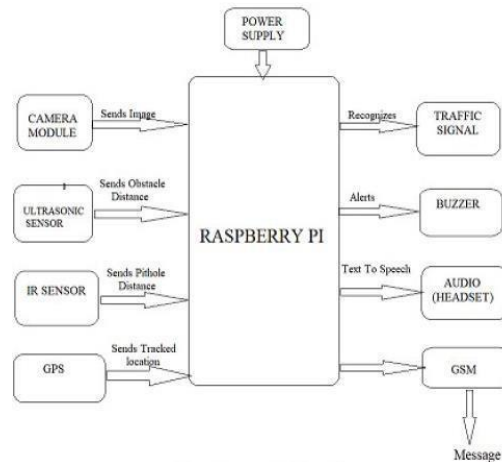
### **3.3. Sound and touch based smart cane [3]:**

The design of this smart cane is enabled with Obstacle detection module, heat detection and also has haptic modules. The ultrasonic range is identified which helps in detecting the obstacles while using the cane. The distance between the obstacles from the user will be measured and this measurement is sent back to the Bluetooth. The alert regarding the obstacle distance will be intimated to the user through the headset. In haptics module, moving obstacles are indicated with the help of vibratory motors to the users. This also sends a warning message to the user of respective dangers as a voice command through a headset. If obstacle approaches, a tactile feedback will be given to the user. The vibratory motor is also placed so that it makes the vibration depending upon the speed of the obstacle which is approaching near to the user.



### 3. PROPOSED SYSTEM

A white cane is used by the people who are visually impaired to scan their surroundings for obstacles and also helpful for other traffic participants in identifying the user visually impaired and taking appropriate care. There are various kinds of wearable and new portable technologies have been developed to guide them for the navigation purpose.



**Fig -1** System Architecture.

This proposed smart cane system will reduce their day-to-day complexity and helps them to move in this world freely without any guidance. The smart cane is developed in such a way that it will be more reliable, can be used independently and it is also easy to implement. The system is embedded with the headset through which the identified object will be sent as a voice to the impaired people. The cane is also attached with the GPS to detect the location and a person has to wear the headset so that information about the obstacle will be intimated. The main characteristics of the system include minimizing the workload among the user, comfortable with mobility, easy movement with the world. The obstacle is detected with the help of reflections from ultrasonic waves emitted by them. If the detected object range is found to be nearer to the cane then the strength of the object will be larger and also if the detected object range is in the longer distance then the strength of the vibration in the cane produced will be smaller[3]. The smart cane is designed in such a way that it will be user detached. The obstacle is detected using ultrasonic sensor and this sensor is controlled by the controller called Raspberry Pi. The main advantage of this proposed system is object detection. The camera module is attached with the Raspberry Pi so that it captures the image of the object and sends the detected object to the controller. The detected object name will be intimated to the user through the headset as a voice command. This project is based on developing a smart cane that is a walking stick and in order to inform about the obstacle, a headset is used.

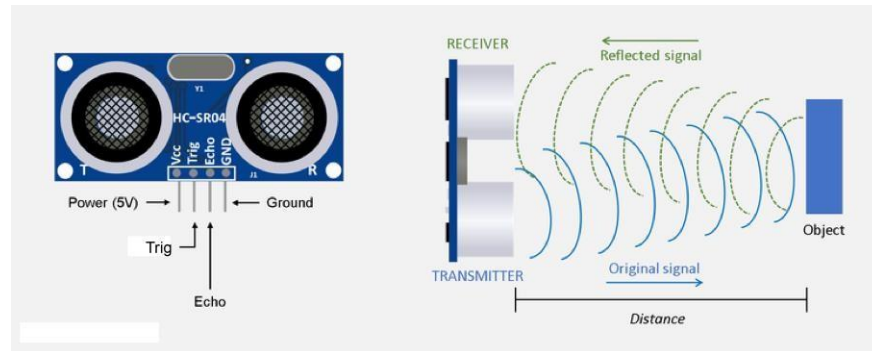
This cane system gets the location regarding destination through the voice command which is given by the speech synthesizer. The current location of the visually impaired is identified using the GPS component which is placed in the smart cane. The wearable headset and their walking stick are paired using Bluetooth. The GPS is used in the cane to identify the location of the impaired people and it also guides them to their destination address[5].

### 4. IMPLEMENTATION

This smart cane is designed to detect the obstacles, light, pit hole and also to make their movement to a destination. Detecting the obstacle and the name of the object will be intimated to the user through headset.

#### 4.1 Object detection by the Sound wave:

An ultrasonic sensor is used to detect an obstacle by emitting frequency sound waves towards an object. It produces an echo or reflected signal to the receiver part of the sensor while hitting the object. The time taken for emitting the signal and receiving back the echo is calculated from which distance of the object from the sensor is calculated. The equation for calculating the distance is given as:  $V = dx/t$  or,  $d = v \cdot t$ . Where  $t$  is considered as the sound time taken to travel the  $d$  meter distance with the velocity of  $v$  meter/second.



**Fig - 2** Ultrasonic Sensor Module.

#### 4.1.1 Sensor Module

Smart cane is an innovative stick designed for visually challenged people to navigate easily without the help of an assistant. The proposed system not only helps the people to detect the obstacle but also intimate the user what the obstacle is and how far it is through a voice command using headset. The detected obstacle is passed as input to the raspberry pi.

#### 4.1.2 Camera Module

The camera module along with the ultrasonic sensor is used to detect the obstacle in front of the user. The camera module uses raspberry pi camera and open cv for obstacle detection. Raspberry pi camera captures the object along with open CV for detection. The captured object is detected, identified and intimated to the user about what the object is. The detected object is intimated as a voice message through headset.

#### 4.1.3 Navigation System Module

This navigation system module helps the visually challenged people to navigate easily without the guidance. The user needs to tell their destination through voice message. The directions to reach their destination are sent through the headset as voice note with the help of GPS.

#### 4.1.4 Speech Synthesizer / Voice Synthesizer System

The output detected from the ultrasonic sensor, IR sensor, camera module and GPS is given to the raspberry pi. After the detection, it is sent to raspberry pi in a text format. Then the output which is in text format is given to GTTS (Google Text To Speech) as input. This converts the text message to the voice command which is informed to the user through headset. The voice command is given as an output for all the detection in order to make their movement easily.

#### 4.1.5 GPS

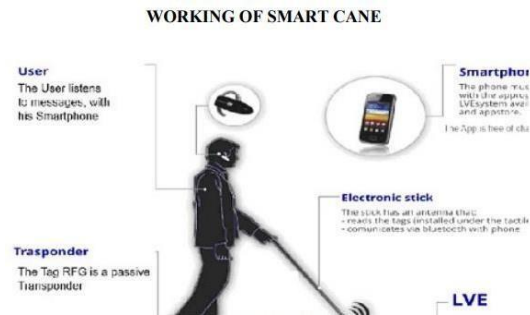
Receiver the person and the destination location are calculated which is combined with the GPS system. GPS contains ceramic embedded antenna which is connected to the module through the LOW NOISE AMPLIFIER (LNA). It is used to track the routes of the destination address. The location of the start point and the location of the destination along with the in between locations are given as input. The latitude and the longitude of these locations are mapped.

#### 4.1.6 Playback Unit

The playback unit is used as a talking clock, queue number announcements, voice warning alerts and so on. It is maintained and controlled by the controller unit. The message's address is sent to the playback by the controller, once received the address message is played back to the user.

#### 4.1.7 Raspberry Pi

The Raspberry Pi is a series of a small single-board computer that can be used to learn programming and practical projects. It is a great hardware for electronics projects. It used to send the data with details like GPS location and climate condition. Raspberry Pi is a controller, which is more powerful as an Arduino microcontroller. This controller is used to detect the obstacles, light, pit hole and also the traffic signals. This controller is preferred since it uses the camera module. This camera module detects the object and sends the data to the controller[4].



**Fig - 3** Working of Smart Cane

## 5. CONCLUSION

The proposed project is the design architecture of a Guiding stick for visually challenged people. This helps in detecting the object in front of the user and intimate about what the object is. Rather than only detecting the object, this system also recognizes the object and sends information about the object to the user through headset. This cane can also be further improved to have more decision-making capabilities by using other types of sensors. So, that it helps to solve the problems faced by them in their daily life. The system also takes measures to ensure their safety such as obstacle detection, pit hole detection, traffic signal detection and also has an buzzer in order to recognize the cane if it is misplaced.

## 6. REFERENCES

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