# NAVIGATION AID FOR BLIND PEOPLE - LITERATURE REVIEW

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## ABSTRACT

*There are about 2.2 billion people with vision impairment or blindness. Visually impaired people face a lot of challenges in their day-to-day life. Physical movement is, in fact, one of the greatest challenges. Blind people find it very difficult to merely walk around high traffic areas or any unfamiliar places and therefore have to take help from other sighted individuals. To move around in familiar places, visually impaired people usually memorize the area and where the things are kept. However, those things if moved to some other place might cause issues for blind people. The most widely used way blind people use to travel from one place to other is the white cane. With all the technological developments, certain devices have been developed to help visually impaired people to move freely around in the environment. This paper presents a systematic literature review for some of the devices developed for navigation purpose of blind people.*

**Keywords:** -*Blind people, Visually impaired people, Obstacle detection, GPS tracking, Navigation aid for blind.*

## 1. INTRODUCTION

According to a survey conducted by WHO (World Health Organization) estimates that in the world, about 1% of the human population is visually impaired and amongst them, about 10% are fully blind and 90% with low vision, the main problem with blind people is how to navigate their way. Many people with serious visual impairments cannot travel independently due to the heavy traffic on the road and in unfamiliar places. Blind people rely on lot of means on their mobility. Different approaches exist to help the visually impaired, the most widely used means for the mobility of the visual impaired people is the white cane with a red tip. It also enables to let people around them to know that the person is blind and help them to overcome obstacles. A long cane can also be used to extend the user's range of touch sensation. The cane is usually swung in a low sweeping motion, across the intended path of travel to detect the obstacles. Or they may use guide dogs which are characterized by a many imperfections. Even after so much technological advancements there have not been many inventions for the help of visual impaired people. There are fewer types of equipment which fulfill their needs or provides them with the guidance.

### 1.1 Obstacle detection

A large number of the existing studies shows that many electronic aids use ultrasonic sensors to detect the obstacle. The ultrasonic sensor HC-SR04 has a range of 2cm to 4m of contactless measurement and it consists of an ultrasonic transmitter and receiver. The sensor is first triggered by a pulse when an object is detected. It then transmits a signal and checks for its return. The distance is measured as follows:

Distance = (time taken by the signal to go and return/2) * (velocity of sound in air)

Most of the papers suggest mounting the ultrasonic sensors on the stick. One of the author suggests mounting the ultrasonic sensor on the wrist thereby calling it a wearable device. The ultrasonic sensors, water sensor, buzzer, and

RF transmitter/Receiver are used to record information about the presence of obstacles on the road. Most of the blind guidance systems use ultrasound because of its immunity to the environmental noise.
It is possible that the visually impaired person may slip over water spilt either in the house or on roads. Thus, an author suggested the use of water sensor for sensing water as obstacle. One paper suggest the use of accelerometer ADXL345 to detect when the blind person stumbles over. Some of the devices also make use of IR sensors for detecting obstacles. An IR sensor can detect the heat emitted by an object in the surrounding and also detect its motion. Cameras can also be used for detecting objects. This is not widely used because it involves complex image processing algorithms.

Then once the object is detected then the visually impaired person must be alerted about it. This is mostly done with the help of a buzzer or a vibrator. The author made use of a buzzer for alerting the person and let the intensity of the buzzer go on increasing as the person approaches near the object. In case the environment is noisy or the bind person is facing hearing loss then a vibrator alarm can be used. Another paper suggested to establish a connection between the obstacle detection circuit and a mobile phone carried by the user using a Bluetooth controller. And when an obstacle is detected the blind person is let known through the vibrations on the mobile phone and voice message. Portable speakers or earphones interfaced with the hardware circuit can also be used to alert the visually impaired about the obstacles. With the rapid advances of modern technology both in hardware and software it has become easier to provide intelligent navigation system to the visually impaired.

### 1.2 Safety Solutions

Different types of sensors can be used to track the situation of the visually impaired people. Few studies indicates the method of using a simple walking stick equipped with sensors to give information about the environment. A paper has suggested the use of GPS technology which will be integrated with pre-programmed locations which allows the user to choose the optimal route. The author suggested the use of ultrasonic sensor, pit sensor, water sensor, GPS receiver, level converter, driver, vibrator, voice synthesizer, keypad, speaker or headphone, a microcontroller and a battery. Where GPS antenna is a device that helps to boost the reception signal of a GPS unit. A GPS unit can detect not just latitude and longitude, but also altitude and even speed. The GPS unit can be used in the smart stick to obtain the latitude and longitude of the location of the blind person. The data obtained from this is used to find the address of the blind person's location. These data are helpful to keep track of the blind person.
Another author suggested the use of RFID reader, and the Google's Android operating system, which allows the user to connect to an Android phone through Bluetooth. In addition, it consists of a printed circuit board containing a microcontroller, an analog-to-digital converter, an infrared sensor, and a Bluetooth module. This helps the guardian to keep a constant track of the visually impaired.

Another theory suggested the use of GSM module and a panic button. After pressing the button the location of the blind person and a text message is directly send to the guardian. It helps in letting know the guardian that the blind person is in trouble. The author suggested the use of GPS module, GSM module and Arduino Uno microcontroller board. Whereas the GSM (Global System for Mobile communications) module is a hardware which can be integrated with any equipment to fully utilize the module's functionalities. The GSM module requires a registered SIM card to be inserted into it to operate. It provides facilities of making and receiving voice calls and sending SMS messages wirelessly. These features of GSM module can be used in the smart stick which imparts great advantage for the blind person in emergency situations. The blind person can also make an emergency call or receive any calls to his number. In GSM module every command line starts with "AT" which informs the module about the start of a command line.

Another paper suggested the use of navigation device for the visually impaired which focuses on providing voice output for obstacle. Navigation using infrared sensors, RFID technology, and android devices. RFID tags are installed into public building and are also integrated into blind person's walking stick. The device is connected to an android phone through Bluetooth. And an android application is designed which gives voice directions based on RFID tag read and also updates person's location information on the server.

## 2. CONCLUSIONS

Although several authors have suggested their theories on the issues face by visually impairedpeople, this problem has not been given much attention. After going through a lot of paper, we found that obstacles can be easily detected using ultrasonic sensors rather than image processing using camera. The best possible placement of ultrasonic sensors gives the best obstacle detection. Therefore, we would like to propose a system consisting of ultrasonic sensors for obstacle detection and a panic button interfaced with a GPS and GSM module incorporated for the utmost safety of the blind person.

## 3. ACKNOWLEDGMENT

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