

# An Arduino Based Safety Stick for Blind People

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**Annotation:** The mobility and independence of visually impaired individuals remain significant challenges due to environmental obstacles and the absence of reliable assistive devices. Current mobility aids lack integrated technological features to enhance safety and navigation. This study introduces an Arduino-based smart stick designed for blind people, incorporating ultrasonic sensors for obstacle detection, water sensors for hazard identification, and heart pulse sensors for user health monitoring. The system employs an MP3 module for audio feedback and a GPS module for location tracking. Findings indicate that the device provides accurate obstacle detection, real-time alerts, and improved navigation assistance, enhancing the safety and autonomy of visually impaired users. The results suggest that the proposed system offers a cost-effective and portable solution for blind mobility, with implications for future developments integrating GSM communication and solar-powered functionalities.

**Keywords:** smart stick, blind navigation, Arduino, ultrasonic sensors, assistive technology.

## 1- INTRODUCTION

The development of technology requires the innovation of a device that can be used to help the blind as a road guide. This device is kind of the white cane to help blind people to scan their surroundings for obstacles or orientation marks. This device is equipped with an ultrasonic sensor, a water sensor, and a pulse heart sensor that will be mounted on a white cane to determine changes in the environment's. Ultrasonic sensors are used to detect obstacles in front of it by utilizing ultrasonic wave reflection, water detection sensors to find out if there is a puddle or flooded ahead, and pulse heart sensors to monitor the condition of the user. It works, If there are obstacles and inundation conditions then the use of electronic modules such as the MP3 module is a component that plays an important role for the user, the use of the MP3 module is used to provide direction with sound output, while the GPS module to provide location information from the user. [1]

Eyes are organs of the visual system that can detect all the changes around environment. Visually impaired persons have difficulty to interact and feel their environment. They have little contact with surrounding[2]. Physical movement is a challenge for visually impaired persons, because it can become tricky to distinguish where he is, and how to get where he wants to go from one place to another[3]. they usually use their hearing senses for navigation assistance in their daily activities, but if they are only use the sense of hearing it will be dangerous for their safety, so it needed to develop an intelligent and smart stick to assist and alert visually impaired persons from obstacles and give information about their location. This blind stick is designed using a heart pulse sensor and various electronic modules that can be connected to the Android device of the closest relative. The use of pulse heart sensors will function as sensing the value of the pulse per minute, this aims to determine the condition of a person's body. Basically when humans are in a panic condition, the heart or pulse will beat more than the normal frequency, there are several things that will happen if someone experiences anxiety, as follows:

- Psychological symptoms: feelings of anxiety, bad premonitions, fear of their own thoughts, irritability, tension, anxiety, and shock.
- Disorders of sleep frequency and tense dreams.
- Impaired concentration and memory.
- Somatic symptoms: pain in muscles and bones, heart palpitations, spasms, shortness of breath, indigestion, urinary disorders, humid cold hands.

The design of the device resembles as a general white cane. it is divided into 2 types, a long cane and folding cane. Long cane, designed primarily as a mobility tool used to detect objects in the path of a user. Cane length depends upon the height of a user, and traditionally extends from the floor to the user's sternum. It is the most well-known variant, though some organizations favor the use of much longer canes. Folding cane are a convenient way to take the cane anywhere to go. But, this stick type is not good, because the conductivity is less sensitive and less strong when used [4].

Vision is the most important part of human physiology as 83% of information human being gets from the environment is via sight. The 2011 statistics by the World Health Organization (WHO) estimates that there are 70 million people in the world living with visual impairment, 7 million of which are blind and 63 million with low vision.

The conventional and oldest mobility aids for persons with visual impairments are characterized with many limitations.

Some inventions also require a separate power supply or navigator which makes the user carry it in a bag every time they travel outdoor.

These bulky designs will definitely make the user to be exhausted. The objectives of this research work include: to design an assistive technology for visually impaired people that can

detect obstacles and provides alternative routes for the blind; to alarm the user through vibration to determine the obstacles direction sources; and to help the user find his stick when he cannot remember where is was kept.

### 2. Accidents Statistics faced by Blind people

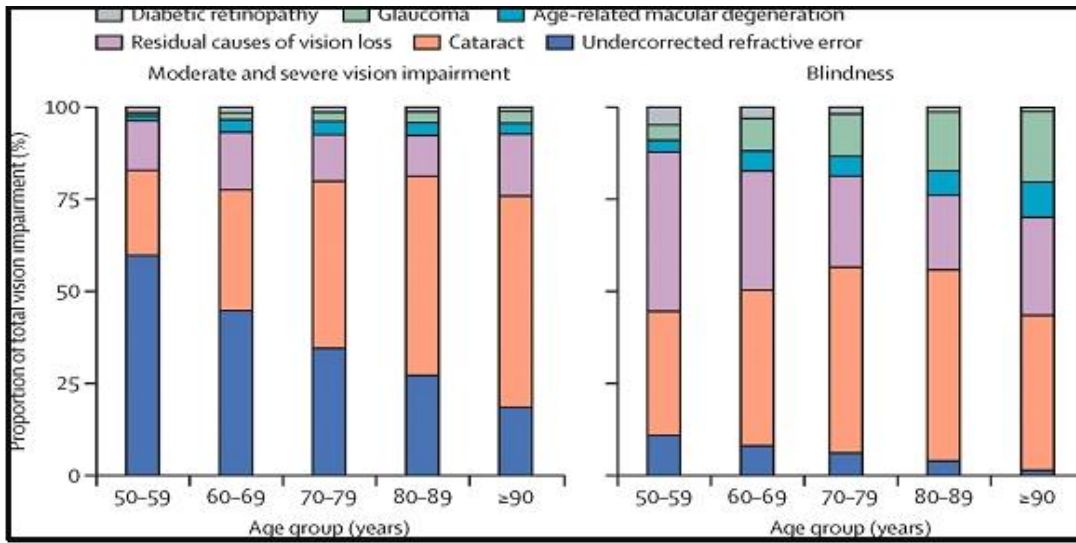


Fig. 1 Blind person according to age [5]

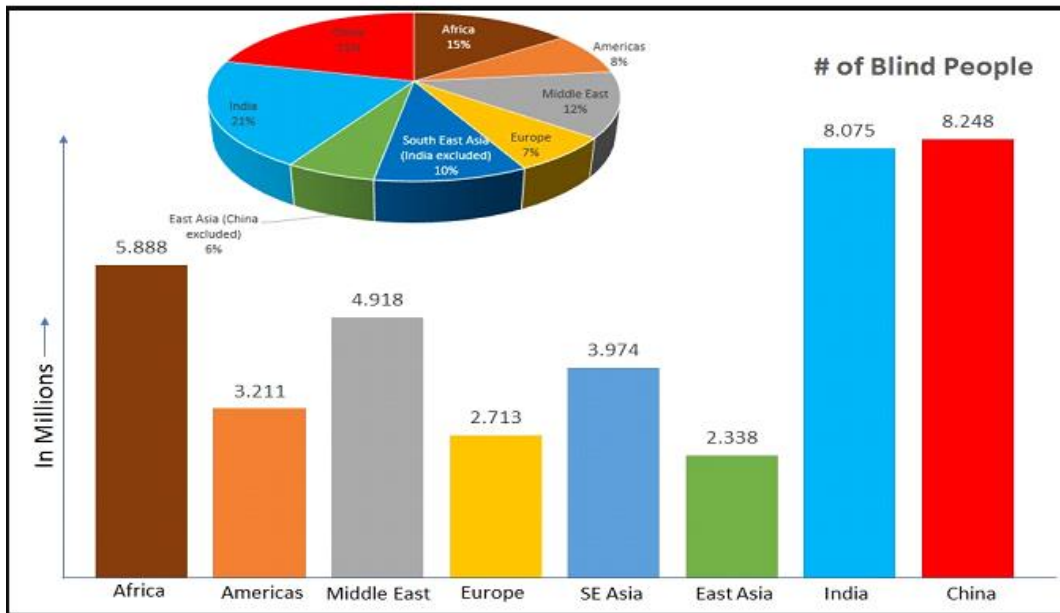
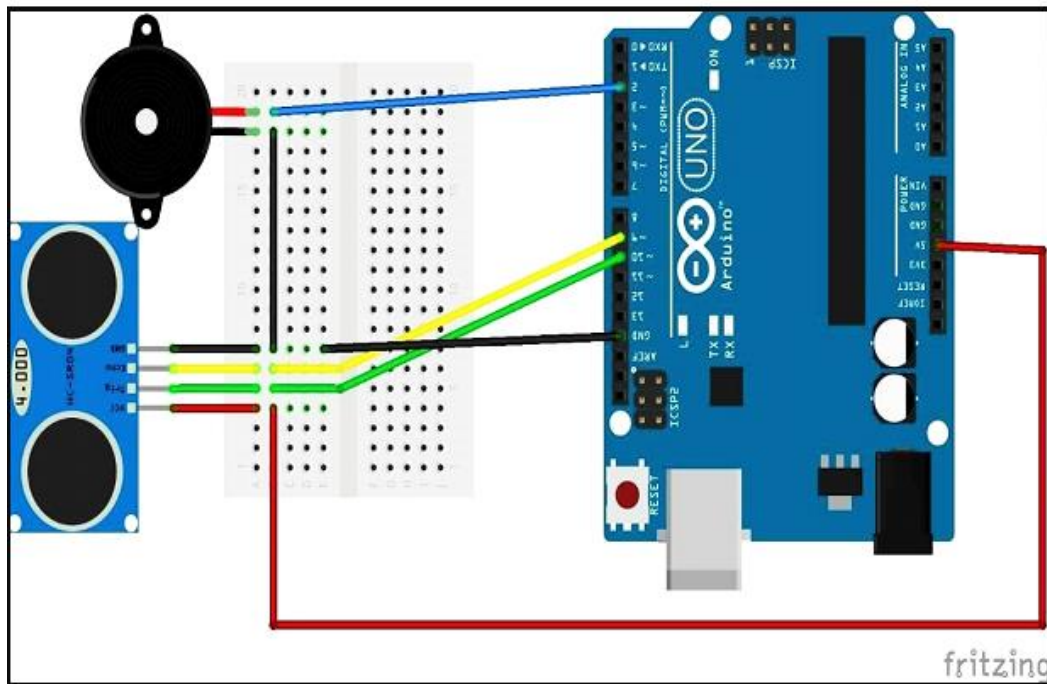


Fig. 2 Blind people in the world [5]

### ➤ System Description

The smart blind stick deals with the obstacle detection of fire and water incidents and this the alarm does alert to the user. The stick is handy and detect the following incidents with good accuracy. In this section, circuit diagram and execution of major portions of this project describes elaborately. The ultrasonic sensor is used here for obstacle detection as well as rain sensor and fire sensor are used here for any type of fire incidents or water clotting detection.[6]



**Fig. 3 Circuit representation of obstacle detector**

### 3- RESULTS AND DISCUSSION

In this section, the proposed model of the smart stick is shown in fig 13. From the analysis of data it can be said that it is accurate and easy to handle and no precaution would be taken for the user. This stick operates on 4V rechargeable battery and is not long time consuming for charging. It is based on electronics components, so they should be take care from any type of hazardous zone. This project is only for testing or research purpose, so that it may not be same as per real data.[10]

#### ➤ Model of Propose System



**Fig. 11**The real shape of the stick

### ➤ Applications

It works as a navigation device for the blind people by alerting them about dangers. The system is applied in automotive parking sensors and obstacles warning system. It is applied during the measurement of object distance. Robotics barriers. Auto detection. With little software and sensor up gradation, can be extensible to any other application and specification.

### ➤ Source code

```
//Define pins for ultrasonic and buzzer
int const trigPin = 10;
int const echoPin = 9;
int const buzzPin = 2;
void setup()
```

```
{
  pinMode(trigPin, OUTPUT); // trig pin will have pulses output
  pinMode(echoPin, INPUT); // echo pin should be input to get pulse width
  pinMode(buzzPin, OUTPUT); // buzz pin is output to control buzzing
}
```

```
void loop()
```

```
{
  // Duration will be the input pulse width and distance will be the distance to the obstacle in centimeters
  int duration, distance;
```

```
// Output pulse with 1ms width on trigPin
digitalWrite(trigPin,
```

### ➤ Conclusion

This paper is proposed a smart blind stick based on obstacle detection which overcome the problems faced by blind people. This system is light weight, cost efficient, simple circuitry and low maintenance cost. The circuit of this project was incorporated with arduino uno, which is very reliable and stable with open software. It was found to be very reliable and stable. This proposed system helps to quick detection of incidents such as obstacle, fire and water and takes a suitable action by the user. According to our observation and research the smart stick is advantageous to orthopedic sectors. As discussed earlier this device is low cost and less power consuming which is affordable for poor persons. According to proposed model here three arduino uno are used but it can be replaced with one arduino uno which makes this sticks less bulkier and compact in size. [11]

### ➤ Future Scope [12]

Ensuring safety for the blind person there are some future aspects of this project:

1. A future development of this project can be enlarged with GSM and GPS module, so that providing more safety about their movement.
2. Instead of the stick we can also use blind shoe by using same technology for their easy and comfortable movement.
3. Battery is the power house of this project but instead of battery in future we also use solar panel and it is freely available in nature.

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