Contents:

a. Abstract

Visually impaired people find difficulties detecting obstacles in front of them, during walking in the street, which makes it dangerous. The smart stick comes as a proposed solution to enable them to identify the world around. In this report we propose a solution, represented in a smart stick with a pair of ultrasonic sensor to detect any other obstacles in front of the user, within a range of 50 centimeters. This proposed system uses the Arduino R3 UNO microcontroller.

The smart stick is of low cost, has a fast response, low power consumption and light weight.

b. Introduction:

"***Humans are not disabled. A person can never be broken. Our built environment, our technologies, is broken and disabled. We the people need not accept our limitations, but can transfer disability through technological Innovation***"

-Hugh Herr

Vision is a very special gift provided by the god to humans. It is due to vision only that the persons are able to see and interact with the environment. But this vision may get lost due to some accident or due to the chronic eye diseases which are not cured on time leading to permanent blindness. According to the WHO report about 236 million people are visually impaired out of which 37 million are blind and are having severe or moderate vision impairment. The stick which is presented in this paper is very cost effective and can be taken into use by the blind persons to guide them through the obstacles which further enhances their mobility so that they can move independently with a greater accuracy.

c. Literature Review:

Moving ahead from the simple white cane, the first electronic blind stick which got a wide popularity is the ‘Benjamin C5 Laser cane’ .Thereafter comes the use of the Mowat sensor which uses the ultrasonic for detection of any obstacle. Thereafter taking inspiration from these works the electronic stick which is presented in this paper is not only efficient but also very cost effective.

PROPOSED STICK –The stick which is presented in this paper consists of integration of an ultrasonic sensor with a microcontroller. With the help of this ultrasonic sensor the stick would be detecting the obstacle which will indicate to the blind person with the help of the buzzer mounted on to the stick.

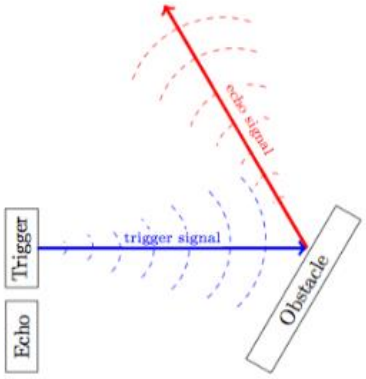
d. Components and their Implementation:

- ARDUINO UNO R3:

Arduino Uno: Arduino UNO is a microcontroller board based on ATmega328p. It has 20pins out of which 16 digital input and output pins and 6 analog input pins, 16MHZ Quartz crystal, power jack, ICSP header and reset button. It is very easy to perform with Arduino since it is user friendly, we can directly connect it to computer with USB cable, power it with AC-DC adapter or battery.

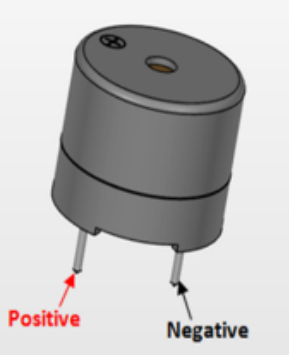
- ULTRASONIC SENSOR Hc-SR04:

Ultrasonic Sensor: HC-SRC04 ultrasonic sensor has 4 pins-ground, Vcc, trigger and Echo. It ranging from 2cm to 400cm (4m). Mainly it has two opening –one is transmitter which is used to transmit the signal and another one is receiver which is used to receive the signal. It sends ultrasound waves at high frequency and receive back the signal.



Distance = (time taken * speed of sound)/2

- 3V DC BUZZER:



A buzzer is a small yet efficient component to add sound features to our project/system. It is very small and compact 2-pin structure hence can be easily used on breadboard, Perf Board and even on PCBs which makes this a widely used component in most electronic applications.

- 9V BATTERY :

Used as a Power supply for the stick.

- JUMPER WIRES:

Used to make connections between each of the components used in the project.

- BATTERY CLIP:

Used to connect the power supply to the microcontroller, here 9V battery and the Arduino UNO R3.

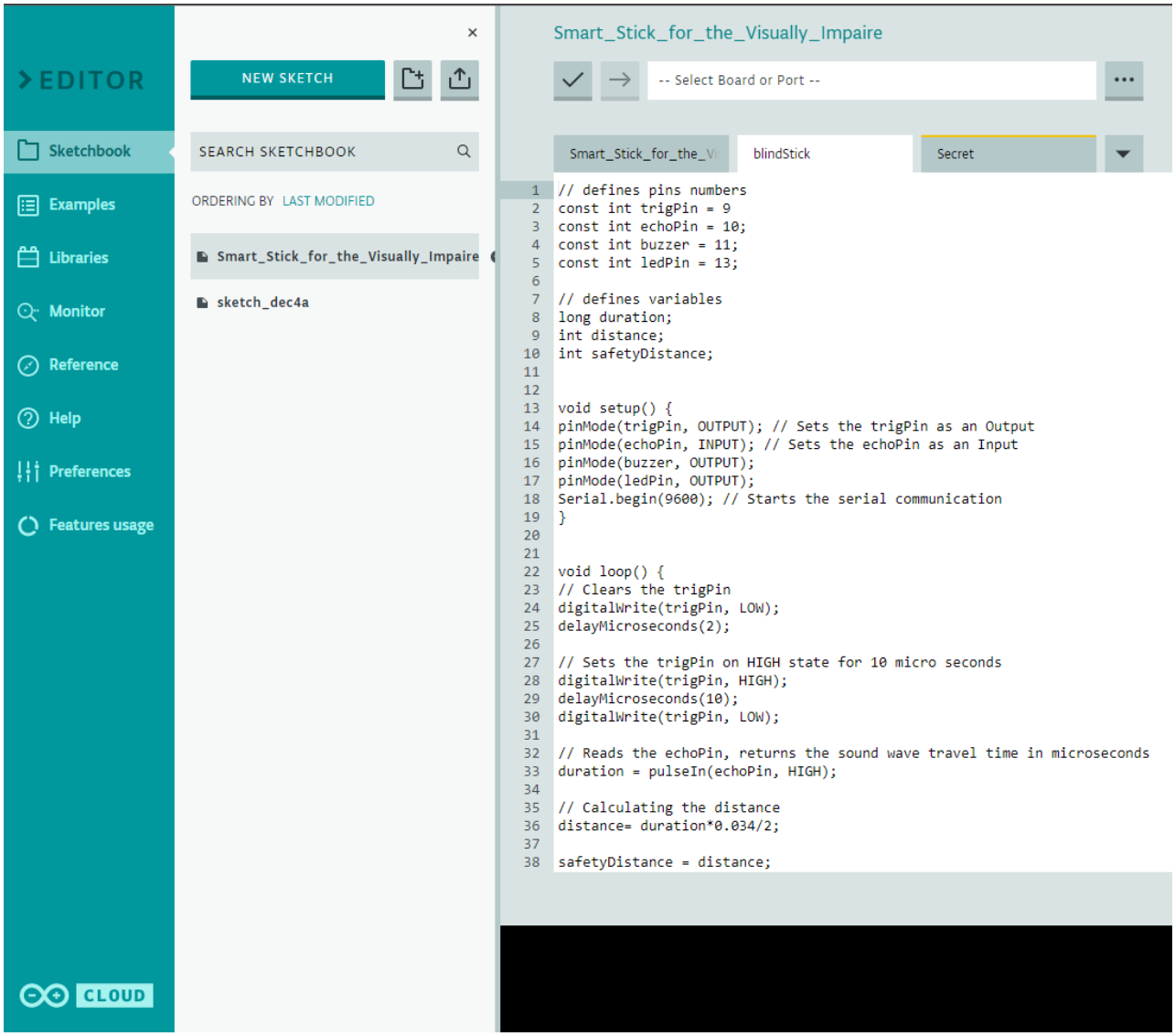
e. Software Development:

The Arduino code is fed to the Arduino R3 board using the ARDUINO IDE

The code used is as follows:

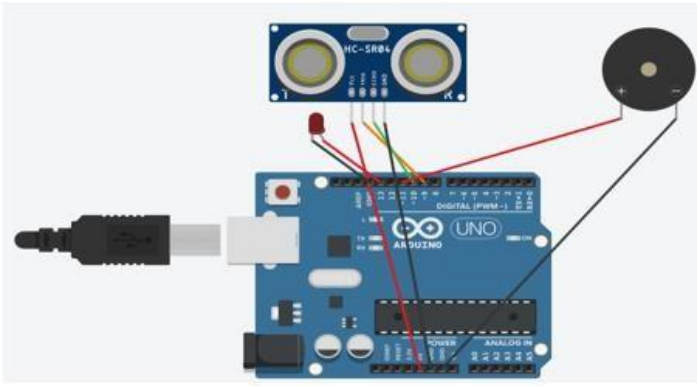
```
// defines pins numbers
const int trigPin = 9
const int echoPin = 10;
const int buzzer = 11;
const int ledPin = 13;

// defines variables
long duration;
int distance;
int safetyDistance;


void setup() {
pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
pinMode(echoPin, INPUT); // Sets the echoPin as an Input
pinMode(buzzer, OUTPUT);
pinMode(ledPin, OUTPUT);
Serial.begin(9600); // Starts the serial communication
}


void loop() {
// Clears the trigPin
digitalWrite(trigPin, LOW);
delayMicroseconds(2);

// Sets the trigPin on HIGH state for 10 micro seconds
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);

// Reads the echoPin, returns the sound wave travel time in microseconds
duration = pulseIn(echoPin, HIGH);
```

```
// Calculating the distance
distance= duration*0.034/2;

safetyDistance = distance;
if (safetyDistance <= 5){
  digitalWrite(buzzer, HIGH);
  digitalWrite(ledPin, HIGH);
}
else{
  digitalWrite(buzzer, LOW);
  digitalWrite(ledPin, LOW);
}

// Prints the distance on the Serial Monitor
Serial.print("Distance: ");
Serial.println(distance);
```

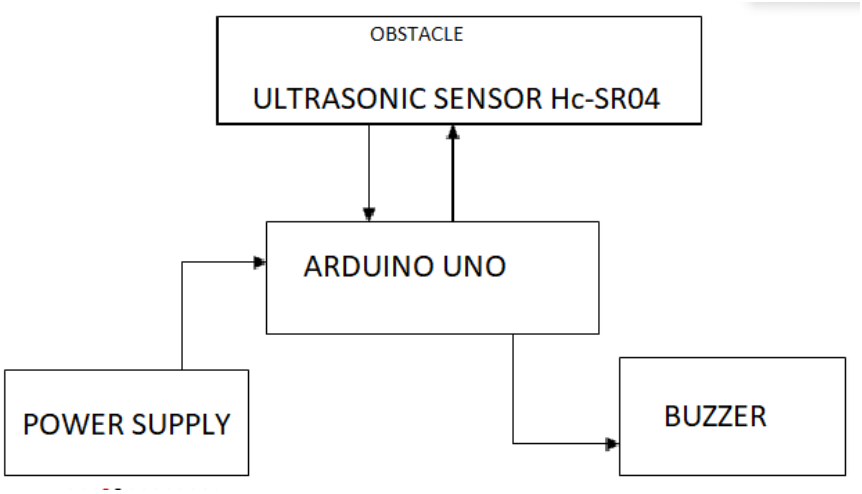


f. Circuit & Block Diagram:

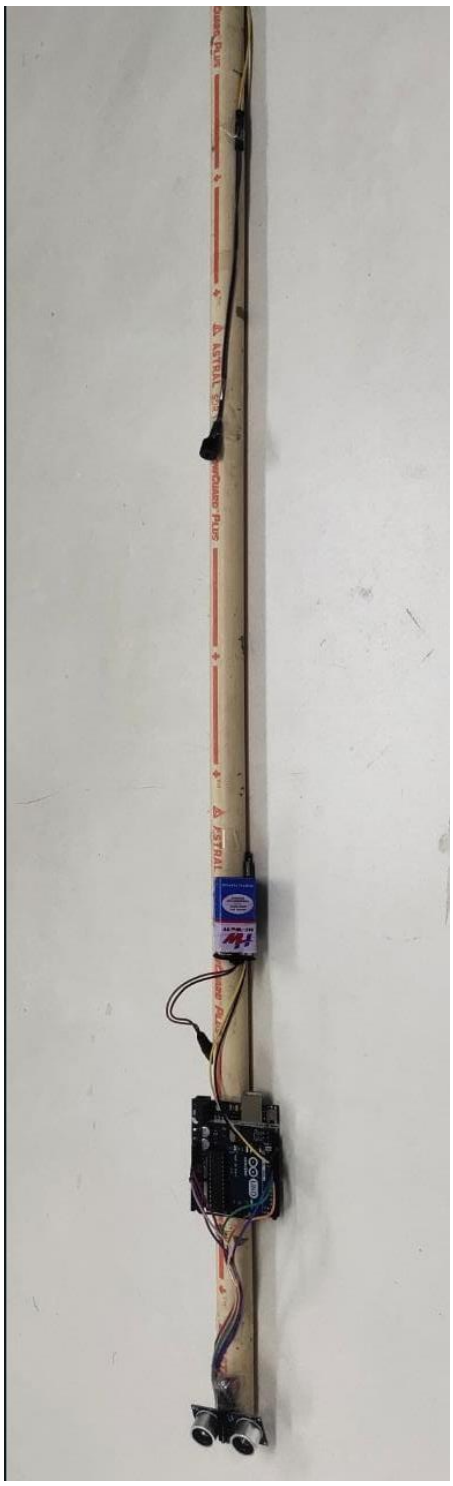
- CIRCUIT DIAGRAM:



- BLOCK DIAGRAM:



- THE MODEL DEVELOPED IN REAL LIFE:



g. Working:

The smart stick works on the basic principle of a sonar. This is achieved with the help of ultrasonic sensors.

Connect the ultrasonic sensors to the Arduino UNO. The input pins of trigger and echo of front ultrasonic sensor is connected to the Arduino board. The buzzers are connected to pins given on the microcontroller. The buzzers are of different frequency and generate different sounds. First, we should calculate the distance of the obstacle with the help of ultrasonic sensor, which is

Distance = (time taken * 0.034)/2

The connections are made as shown in the above circuit diagram as well as the block diagram.

h. Applications & Advantages:

1) Help blind people to easily walk to their destination.
2) Auto detection.
3) Obstacle detection with indication support.
4) Simple to use.
5) Low cost.
6) Light weight.

i. Future Scope:

1) This can be manufactured on a large scale and make it available to general public at very low costs.

2) GPS can help to find shortest and best path as accordingly to google map based on real time coordinates.

3) Infrared sensors can also be used along with ultrasonic sensors to make the device more efficient and detect water puddles and during night.

4) A transmitter and receiver can also be used wirelessly to detect the exact location of the stick in case it is lost.

5) It can also have the facility for the GSM such that it can send and receive messages whenever there is an emergency.

j. Conclusion:

This system offers a low-cost, reliable, portable, low-power consumption and robust solution for navigation with obvious short response time.

It is worth mentioning at this point that the aim of this study which is the design and implementation of a smart walking stick for the blind has been fully achieved. The Smart Stick acts as a basic platform for the coming generation of more aiding devices to help the visually impaired to navigate safely both indoor and outdoor.

In a developing country like India, there is a need for a cost-effective solution so that most of the people can have an effective product as mentioned in this report.

k. Acknowledgement:

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Finally, we would also like to thank my parents and friends who helped us a lot in finalizing this project within the limited time frame.

I. References:

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4) https://circuitdigest.com/microcontroller-projects/arduino-smart-blind-stick

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