A Smart OCR Based Voice-Enabled Blind Stick For Visually Impaired People

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Abstract- *Visually impaired people face a challenge when it comes to navigating safely from place to place. It becomes increasingly difficult for them to perform trivial tasks without heavily depending on others. Our proposed system aims to provide an efficient way to remedy this issue. The smart stick is a technique to help sightless people to recognize their way. To accomplish this, the system involves many sensors to screen fundamental signs that can be interfaced to the relative mobile or the web. It has the capacity of reading and transmitting emergency signs to relatives. In this webcam take pictures of the scene and afterwards pre-process these pictures with the help of Viola Jones and TensorFlow Object Detection algorithm. It uses the Optical character recognition technology for the identification of the printed characters using image sensing devices and computer programming. It converts images of typed or printed text into machine encoded text. In this research these images are converted into the audio output (Speech) through the use of OCR and Text-to-speech synthesis. The conversion of printed document into text files is done using PC which again uses PyTesseract library and Python programming. The text files are processed & convert into the audio output (Speech) using GOOGLE Text-to-speech (gTTS) & python programming language and audio output is achieved. The said techniques are used to detect objects. IoT acts as an assistant in healthcare and plays an extremely important role in wide scopes of medicinal services observing applications.*

I. INTRODUCTION

Blind people are having difficulty moving or surviving without support. Using Voice Controlled Blind Stick is therefore a gift for people with blindness. Using Arduino UNO, Ultrasonic Sensor, Voice playback module are used, we have built a Smart Voice Controlled blind button. Arduino is a microcontroller that can very easily do all the calculations with great precision. The new blind stick allowing visually challenged people to navigate using advanced technology with ease.In addition to voice module, the blind stick is combined with ultrasonic sensor. The ultrasonic sensor senses the barrier, and the user is warned by the voice module. Persons with visual impairments have difficulty communicating and sensing their surroundings. They have little contact with the surrounding countryside. Physical movement is a problem for visually impaired people, because determining where he is and how to get where he needs to go from one location to another can become difficult. He will carry a sighted family member or his companion to assist him in exploring unknown locations. More than half the world's legally blind are unemployed. Because the types of jobs that they can do are minimal. We have less of a job rate. They rely on mobility and financial support for their families. They're opposed to their freedom from interacting with people and social activities. In the past, different systems have restricted functionality without a solid understanding of non-visual perception. Many devices are for indoor navigation only, and do not have any obstacle identification and position determination functionality in outdoor environments. Scientists have spent decades creating an interactive and responsive stick to support and warn visually impaired people from obstacles and provide knowledge about where they are. Work has been carried out over the last decades on new devices to develop a good and reliable system for visually impaired people to identify obstacles and alert them in areas of risk. There are certain devices that have certain shortcomings.

II. LITERATURE REVIEW

2.1 S. Rajeswari, S. Niraja P Rayen, "Smart Blind Stick Using LDR and Ultrasonic Sensor" 2018

The objective of this paper is used to help the blind people and they are able to easily interact with the physical world by using this smart blind stick. About 285 million people are visually impaired worldwide: 39 million are blind and 246 million have low vision. If you notice them, you can very well know about it they can't walk without the help of other. One has to ask guidance to reach their destination. Using this blind stick , a person can walk more confidently. This stick with ultrasonic sensor detects the object in front of the person and give response to the user by alarm from the buzzer. So, the person can walk without any fear. The another LDR sensor are used in the stick to identify the day and night for the blind people. The microcontroller to receive the sensor

signals and process them to short pulses to the Arduino pins where buzzers are connected. This device will be best solution to overcome their difficulties and help them to live the better life.

2.2 N.Loganathan, K.Lakshmi, "Smart Stick for Blind people", 2020

Blind person finds it difficult to detect the presence of any obstacles in their way while moving from one place to another and it is very difficult to find the exact location of the stick if it have been misplaced. Thus, the smart stick comes as a proposed solution to help the visually impaired people in their day to day living without the help of others. In this paper we proposed a solution for the blind people by using an ultrasonic sensor in the blind stick. The instrument stands used to perceive the obstacles at the range of four meters and infrared instrument is castoff to perceive the nearer complications in front of the blind people. Thus the radio frequency transmitter and receiver help the user to find the exact location of the smart stick with the help of buzzer. The vibration motor which is placed in the smart stick gets activated and produces a vibration when any obstacle is detected. This proposed method uses the Arduino UNO as controller. The branch is accomplished of sensing all difficulties in front of the user. The smart stick is of user friendly, quick response, very low power consumption, lighter weight and it is easy to hold and fold by the user.

2.3 Shashank Chaurasia and K.V.N. Kavitha, "An Electronic Walking Stick For Blinds" 2014

Independence is the building methodology in achieving dreams, goals and objectives in life. Visually impaired persons find themselves challenging to go out independently. There are millions of visually impaired or blind people in this world who are always in need of helping hands. For many years the white cane became a well-known attribute to blind person's navigation and later efforts have been made to improve the cane by adding remote sensor. Blind people have big problem when they walk on the street or stairs using white cane, but they have sharp haptic sensitivity. The electronic walking stick will help the blind person by providing more convenient means of life. The main aim of this paper is to contribute our knowledge and services to the people of blind and disable society.

2.4 M. Hemalatha, T. Porselvi, R Deepashri, R Jeyashri, L. Kurinjimalar, J. ShaliniPriya "An Intelligent Reading Aid for Stone blind Individuals" 2022

In this digital and modernized era, people acquire and enhance their knowledge by going through printed books and digital documents. But it is restricted only to people with clear vision. On the other side, it is still cumbersome for stone blind and visually impaired people to read and understand the books and documents they wish to read. Though Braille system is one of the procedure present, but many a times, published documents do not have braille or audio versions for the sake of those blind people. Even though different electronic equipment was available nowadays, but they were expensive for every blind people to afford. To overcome these limitations for those people, we have proposed an intelligent device that helps and assists the stone-blind people to read the printed text in the document. This paper focuses on the implementation of photo to speech application for those people. This is a smart integrated system which incorporates a camera through which we provide the document which is further processed by Optical Character Recognition (OCR) software using Raspberry Pi. In this project, we have added an additional new feature that consists a motor controlled by an IC that enables the equipment to turn to the next page when it reaches to the end of a particular page in a book. So, this project enables the stone-blind people to read the books and documents by hearing through audio generated by the proposed equipment.

III. PROPOSED SYSTEM

3.1 OVERVIEW

The main aim is to done to find ways to improve life for visually challenged people. The smart walking stick, the Assistor, helps visually challenged people to identify obstacles and provide assistance to reach their destination. The Assistor works based on the technology of object detection. This kind of system helps visually impaired people to interact with computers effectively through vocal interface. Text Extraction from color images is a challenging task in computer vision. Text-to-Speech is a device that scans and reads English alphabets and numbers that are in the image using OCR technique and changing it to voices. The design of the Autonomous Walking Stick for the Blind Using Ultrasonic sensor detection and mailing system involves the incorporation of the following steps-

Ultrasonic sensors are incorporated- to sense objects on the right, left and in front respectively. This project has been built around PC. It is controlling the peripherals like Camera and speaker which act as an interface between the system and the user. Object detection is used to detect the object and Optical Character Recognition or OCR is implemented in this project to recognize characters which are

then read out by the system through a speaker. The camera is mounted on a stand in such a position that if a paper is placed in front of camera, it captures a full view of the paper into the system. Also, when the camera takes the snapshot of the paper, it is ensured that there are good lighting conditions. The content on the paper should be written in English and be of good font size. When all these conditions are met the system takes the photo, processes it and if it recognizes the content written on the paper. After this it speaks out the content that was converted in to text format in the system from processing the image of the paper. In this way Reading Device for Blind People helps a blind person to read a paper without the help of any human reader.

3.1.1 Advantages of Proposed System

- It can detect any obstacle with the help of ultrasonic sensors and it can provide correct location of obstacle by using the GPS system.
- 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.
- Running this integrated set of hardware requires an alternative to the battery.
- The proposed stick is not bendable therefore keeping it might be challenging.
- This cost effective and light weight device can be designed to take the pattern of a plastic and portable device which can be completely fixed on the familiar white cane or blind stick.
- The advent of modern accessibility features like text to speech allows blind people and people with low vision to be more independent.
- People who can't read from a screen can still interact with the content by having the text read aloud to them. Even people with no diagnosed visual impairments who experience occasional eye fatigue can benefit from text to speech, also known as TTS.

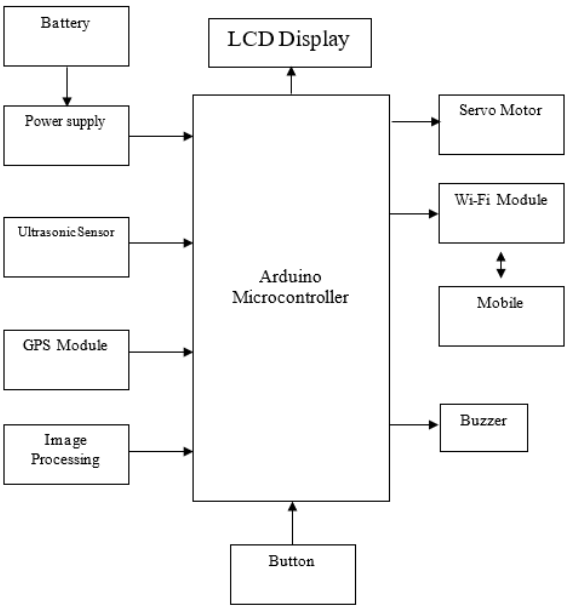


Fig. 3.1 Block Diagram

3.2 ARDUINO MICROCONTROLLER

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino senses the environment by receiving inputs from many sensors, and affects its surroundings by controlling lights, motors, and other actuators. Writing codes in the Arduino programming language and using the Arduino development environment. Arduino consists of both a physical programmable circuit board and a piece of software, or IDE (Integrated Development Environment) that runs on computer, used to write and upload computer code to the physical board.

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. Simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. A typical ARDUINO UNO board can be used for many applications based on the coded program.

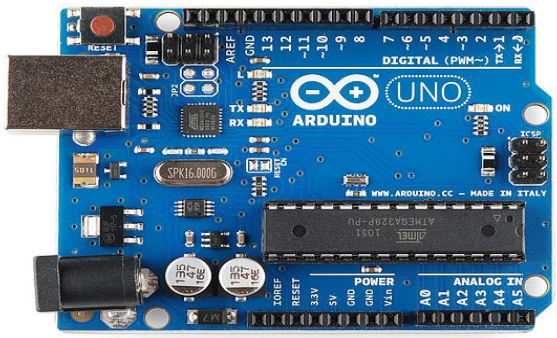


Fig. 3.2 Arduino UNO

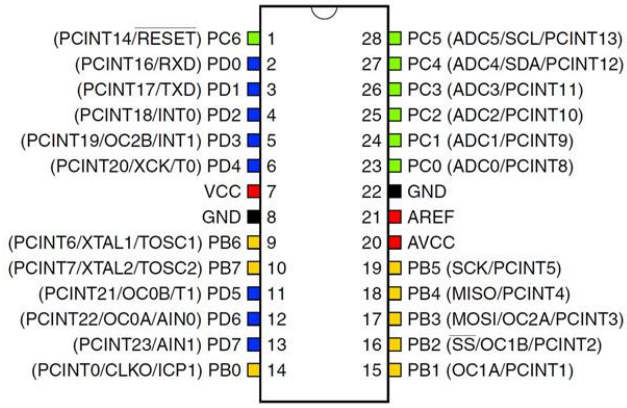
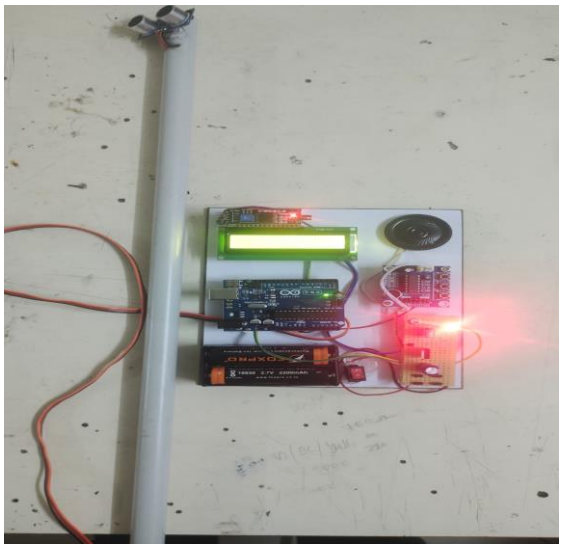


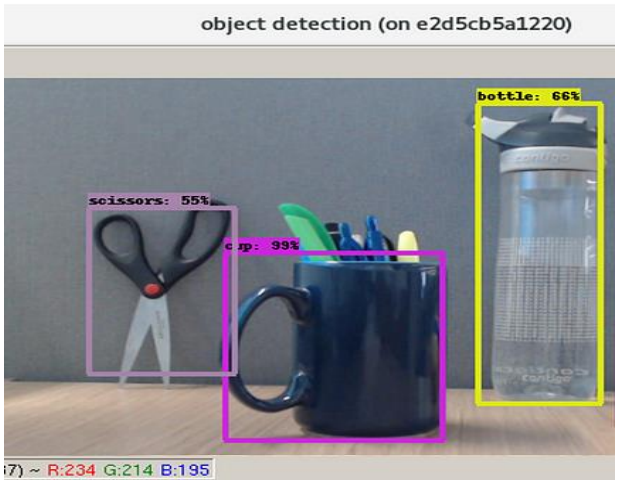
Fig. 3.3 Atmega 328

IV. RESULTS AND DISCUSSION

4.1 SNAPSHOT



4.2 Object Detection



V. CONCLUSION AND FUTHURE ENHANCEMENT

5.1 CONCLUSION

Thus, the smart walking stick, the Assistor, helps visually challenged people to identify obstacles and provide assistance to reach their destination. The Assistor works based on the technology of echolocation, image processing and a navigation system. The Assistor may serve as a potential aid for people with visual disabilities and hence improves their quality of life. There is a lot of work and research being done to find ways to improve life for visually challenged people. There are multiple walking sticks and systems which help the user to move around, indoor and outdoor locations but none of them provide runtime autonomous navigation along with object detection and identification alerts. The Assistor uses ultrasonic sensors to echo sound waves and detect objects. Text-to-Speech device can change the text image input into sound with a performance that is high enough and a readability tolerance of less than 2%, with the average time processing less than three minutes for A4 paper size. OCR is employed to perform word recognition on the localized text regions and rework into audio output for blind users. The Blind Walking Stick has been finally made into prototype which can be used to guide the blind . Its aims to solve the problems faced by the blind people in their daily life. The system also takes the measure to ensure their safety . This project will operate to help all the blind people in the world to make them easier to walk everywhere they want. It was done to help the blind to move infront very well. It is used to help the people with disabilities that are blind to facilitate the movement and increase safety.

5.2 FUTURE ENHANCEMENT

The smart blind stick can be trained for more number of objects which in turn would help the blind person to move around in various neighborhoods with increased level of safety. In the future, the stick can be used for face detection. This increases the safety of the blind person in knowing the identity of the person in front of him.

VI. SOURCE CODE

```
#define USE_ARDUINO_INTERRUPTS true
#include <PulseSensorPlayground.h>
#define BLYNK_PRINT Serial
#include <ESP8266_Lib.h>
#include <BlynkSimpleShieldEsp8266.h>
#include <LiquidCrystal_I2C.h>
#define I2C_ADDR     0x27
```

```
LiquidCrystal_I2C
lcd(I2C_ADDR,2,1,0,4,5,6,7,3,POSITIVE);
#include <TinyGPS.h>
TinyGPS gps;
char auth[] = "fKah8LGTgnU52MjXcCNr349y6rdg03L9";
char ssid[] = "xxxx";
char pass[] = "yyyy";
#define EspSerial Serial2
#define ESP8266_BAUD 115200
ESP8266 wifi(&EspSerial);
const int PulseWire = A7;
const int LED13 = 13;
const int buzzer = 2;
int Threshold = 550;
float lat = 0.0;
float lon = 0.0;
long startMillis;
long secondsToFirstLocation = 0;
const int analogInPin1 = A3;
const int analogInPin2 = A2;
const int water = A5;
int sensorValue1 = 0;
int sensorValue2 = 0;
int waterValue;
PulseSensorPlayground pulseSensor;
const int lm35_pin = A4;
int trigPin1 = A1;
int echoPin1 = A0;
long duration1, cm1, inches1;
int trigPin2 = 7;
int echoPin2 = 6;
long duration2, cm2, inches2;
const int voice1 =8;
const int voice2 =9;
const int voice3 =10;
const int voice4 =11;
void setup() {
Serial1.begin(9600);
Serial2.begin(9600);
Serial.begin(9600);
lcd.begin(16, 2);
pulseSensor.analogInput(PulseWire);
pulseSensor.blinkOnPulse(LED13);
pulseSensor.setThreshold(Threshold);
lcd.setCursor(0,0);
lcd.print(" SMART BLIND");
lcd.setCursor(0,1);
lcd.print("   PEOPLE");
delay(2000);
lcd.clear();
lcd.setCursor(0,0);
lcd.print(" MONITORING");
lcd.setCursor(0,1);
lcd.print("   SYSTEM  ");
delay(2000);
Serial1.print("Simple TinyGPS library v. ");
Serial.println(TinyGPS::library_version());
Serial1.println("by Mikal Hart");
Serial1.println();
startMillis = millis();
Serial1.println("Starting");
EspSerial.begin(ESP8266_BAUD);
delay(10);
Blynk.begin(auth, wifi, ssid, pass);
Blynk.virtualWrite(V0, " SMART BLIND  ");
Blynk.virtualWrite(V1, "  PEOPLE ");
delay(100);
Blynk.virtualWrite(V0, " MONITORING ");
Blynk.virtualWrite(V1, "  SYSTEM   ");
pinMode(buzzer, OUTPUT);
pinMode(trigPin1, OUTPUT);
pinMode(echoPin1, INPUT);
pinMode(trigPin2, OUTPUT);
pinMode(echoPin2, INPUT);
pinMode(voice1, OUTPUT);
pinMode(voice2, OUTPUT);
pinMode(voice3, OUTPUT);
pinMode(voice4, OUTPUT);
digitalWrite(voice1, HIGH);
digitalWrite(voice2, HIGH);
digitalWrite(voice3, HIGH);
digitalWrite(voice4, HIGH);
lcd.clear();
if (pulseSensor.begin()) {
Serial.println("We created a pulseSensor Object !");
lcd.clear();
lcd.print("BPM:");
}
}
void loop() {
Blynk.run();
waterValue = analogRead(water);
sensorValue1 = analogRead(analogInPin1);
sensorValue2 = analogRead(analogInPin2);
int myBPM = pulseSensor.getBeatsPerMinute();
int temp_adc_val;
float temp_val;
temp_adc_val = analogRead(lm35_pin);
temp_val = (temp_adc_val * 4.88);
temp_val = (temp_val/10);
Serial.print("Temperature = ");
Serial.print(temp_val);
Serial.print(" Degree Celsius\n");
delay(1000);
```

```
lcd.setCursor(0,0);
lcd.print(" BODY TEMP: ");
lcd.setCursor(0,1);
lcd.print(temp_val);
lcd.setCursor(6,1);
lcd.print(" *C");
Blynk.virtualWrite(V5, temp_val);
delay(2000);
lcd.clear();
delay(500);
if (pulseSensor.sawStartOfBeat()) {
Serial.println("♥  A HeartBeat Happened ! ");
Serial.print("BPM: ");
Serial.println(myBPM);
lcd.clear();
lcd.print("BPM:");
lcd.setCursor(0,1);
lcd.print(myBPM);
Blynk.virtualWrite(V6, myBPM);
}
digitalWrite(trigPin1, LOW);
delayMicroseconds(5);
digitalWrite(trigPin1, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin1, LOW);
pinMode(echoPin1, INPUT);
duration1 = pulseIn(echoPin1, HIGH);
cm1 = (duration1/2) / 29.1;
Serial.println(cm1);
if(cm1<6 )
{
digitalWrite(buzzer, HIGH);
delay(500);
lcd.setCursor(0,0);
lcd.print(" OBSTACLE ");
lcd.setCursor(0,1);
lcd.print(" DETECTED");
Blynk.virtualWrite(V0, "  OBSTACLE  ");
Blynk.virtualWrite(V1, "  DETECTED  ");
delay(2000);
lcd.clear();
Blynk.virtualWrite(V0, "            ");
Blynk.virtualWrite(V1, "            ");
digitalWrite(voice1, LOW);
digitalWrite(buzzer, LOW);
}
else{
digitalWrite(voice1, HIGH);
}
digitalWrite(trigPin2, LOW);
delayMicroseconds(5);
digitalWrite(trigPin2, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin2, LOW);
pinMode(echoPin2, INPUT);
duration2 = pulseIn(echoPin2, HIGH);
cm2 = (duration2/2) / 29.1;
Serial.println(cm2);
if(cm2<6 )
{
digitalWrite(buzzer, HIGH);
delay(500);
lcd.setCursor(0,0);
lcd.print(" POTHOLE ");
lcd.setCursor(0,1);
lcd.print(" DETECTED");
Blynk.virtualWrite(V0, "  POTHOLE  ");
Blynk.virtualWrite(V1, "  DETECTED  ");
delay(2000);
lcd.clear();
Blynk.virtualWrite(V0, "            ");
Blynk.virtualWrite(V1, "            ");
digitalWrite(voice2, LOW);
digitalWrite(buzzer, LOW);
}
else
{
digitalWrite(voice2, HIGH);
}
delay(20);
if(sensorValue1<310){
digitalWrite(buzzer, HIGH);
lcd.setCursor(0,0);
lcd.print("  PEOPLE ");
lcd.setCursor(0,1);
lcd.print("  FALLING");
Blynk.virtualWrite(V0, "   PEOPLE  ");
Blynk.virtualWrite(V1, "   FALLING  ");
delay(2000);
lcd.clear();
place();
delay(2000);
lcd.clear();
digitalWrite(buzzer, LOW);
Blynk.virtualWrite(V0, "            ");
Blynk.virtualWrite(V1, "            ");
}
if(waterValue>150)
{
lcd.setCursor(0,0);
digitalWrite(buzzer, HIGH);
lcd.print("  WATER ");
lcd.setCursor(0,1);
lcd.print(" DETECTED");
```

```
Blynk.virtualWrite(V0, "   WATER  ");
Blynk.virtualWrite(V1, "  DETECTED  ");
delay(2000);
lcd.clear();
Blynk.virtualWrite(V0, "              ");
Blynk.virtualWrite(V1, "              ");
digitalWrite(voice3, LOW);
digitalWrite(buzzer, LOW);
delay(500);
}
else
{
digitalWrite(voice3, HIGH);
}
}
void place()
{
bool newData = false;
unsigned long chars = 0;
unsigned short sentences, failed;
for (unsigned long start = millis(); millis() - start < 1000;)
{
while (Serial1.available())
{
int c = Serial1.read();
++chars;
if (gps.encode(c))
newData = true;
}
}
if (newData)
{
if(secondsToFirstLocation == 0){
secondsToFirstLocation = (millis() - startMillis) / 1000;
Serial.print("Acquired in:");
Serial.print(secondsToFirstLocation);
Serial.println("s");
}
unsigned long age;
gps.f_get_position(&lat, &lon, &age);
lat == TinyGPS::GPS_INVALID_F_ANGLE ? 0.0 : lat;
lon == TinyGPS::GPS_INVALID_F_ANGLE ? 0.0 : lon;
Blynk.virtualWrite(V2, 1, lat, lon, "patient");
//Serial.print("Location: ");
// Serial.print(lat, 6);
// Serial.print(" , ");
//Serial.print(lon, 6);
//Serial.println("");
lcd.print(lat);
lcd.setCursor(0,1);
lcd.print(lon);
Blynk.virtualWrite(V3, lat);
Blynk.virtualWrite(V4, lon);
delay(500);
delay(2000);
lcd.clear();
}
if (chars == 0){
//Serial.println("Check wiring");
}
else if(secondsToFirstLocation == 0){
}
}
```

REFERENCES

[1] Adarsh S, Mohamed Kaleemuddin S, Dinesh Bose and K I Ramachandran, (2016)“Performance comparison of Infrared and Ultrasonic sensors for obstacles of different materials in vehicle/ robot navigation applications”, IOP Conf. Ser.: Mater. Sci. Eng. 149 012141.

[2] Balakrishnan, G. Sainarayanan, G. Nagarajan, R. and Yaacob, S.(2007) Wearable RealTime Stereo Vision for the VisuallyImpaired, Engineering Letters, vol. 14, no. 2.

[3] Chaurasia, Shashank Kavitha, K.V.N.. (2015), ”An electronic walking stick for blinds”. 2014 International Conference on Information Communication and Embedded Systems, ICICES 2014. 10.1109/ICI-CES.2014.7033988.

[4] Dey, N. Paul, A. Ghosh, P. Mukherjee, C. R. De and S. Dey,(2018) ”Ultrasonic Sensor Based Smart Blind Stick,” 2018 International Conference on Current Trends towards Converging Technologies (ICCTCT), Coimbatore, pp. 1-4, doi: 10.1109/ICCTCT.2018.8551067.

[5] Diana Earshia, S.M.Kalaivanan and K.Bala Subramanian. “A Wearable Ultrasonic Obstacle Sensor for Aiding Visually Impaired and Blind Individuals”, International Journal of Computer Applications® (IJCA) (0975 – 8887) National Conference on Growth of Technologies in Electronics, Telecom and Computers - India’s Perception, GOTETC-IP’13.

[6] Docbelle W. (2000) Artificial Vision for the blind by Connecting a Television Camera to the Brain, ASAIO Journal, Vol:46, page 3-9.

[7] Dodds, A. Clark-Carter, D. and Howarth, C. (1984)The sonic PathFinder: an evaluation, Journal of Visual Impairment and Blindness, vol. 78, no. 5, pp. 206–207.

[8] Duraisamy Sathya & Pugalendhi Ganesh Kumar,(2017) ‘Secured Remote Health Monitoring System, IET Healthcare Technology Letters’, vol. 4, issue. 6, pp. 228-232.

[9] Kuranov, R. L. A. and Pisarevsky, V.(2002) An empirical analysis of boosting algorithms for rapid objects

with an extended set of Haarlike features, Intel Technical Report MRLTR-July 02-01.

[10] Lienhart, R. and Maydt, J.(2002) An extended set of Haar-like features for rapid object detection, presented at the IEEE International Conference on Image Processing.