
# Third Eye For The Blind

**Designed and Developed by**

| | |
|---|---|
| 1. E. Akshay | 2011CS010085 |
| 2. B. Sai Sankeerth | 2011CS010049 |
| 3. Siddhanth Bang | 2011CS010089 |
| 4. E. Sumanth Reddy | 2011CS010088 |

**Guided by**
**Mr. Narasimha Reddy**

**Department of Computer Science & Engineering**

**MALLA REDDY UNIVERSITY, HYDERABAD**

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MALLA REDDY UNIVERSITY

(Telangana State Private Universities Act No.13 of 2020 and G.O.Ms.No.14, Higher Education (UE) Department)

# CERTIFICATE

This is to certify that this is the Application development lab record entitled "**Third Eye for The Blind**", submitted by **E. AKSHAY (2011CS010085), B. SAI SANKEERTH (2011CS010049), SIDDHANTH BANG (2011CS010089), E. SUMANTH REDDY (2011CS010088)** B. Tech **IV** year **I** semester, Department of CSE during the year 2023-2024 The results embodied in this report have not been submitted to any other university or institute for the award of any degree or diploma.

**Internal Guide:**
**Mr. Narasimha Reddy**

**HOD-CSE**
**Dr. Shaik Meeravali**

**External Examiner**

MALLA REDDY UNIVERSITY
(Telangana State Private Universities Act No.13 of 2020 and G.O.Ms.No.14, Higher Education (UE) Department)

# DECLARATION

I declare that this project report titled **THIRD EYE FOR THE BLIND** submitted in partial fulfillment of the degree of B. Tech in CSE is a record of original work carried out by me under the supervision of Mr. Narasimha Reddy and has not formed the basis for the award of any other degree or diploma, in this or any other Institution or University. In keeping with the ethical practice in reporting scientific information, due acknowledgements have been made wherever the findings of others have been cited.

| | |
|---|---|
| E. Akshay | 2011CS010085 |
| B. Sai Sankeerth | 2011CS010049 |
| Siddhanth Bang | 2011CS010089 |
| E. Sumanth Reddy | 2011CS010088 |

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# ABSTRACT

Third eye for the blind is an innovation with the help of the multidiscipline subjects like computer science, electronics engineering and health science which helps the blind people to navigate with speed and confidence by detecting the nearby obstacles using the help of ultrasonic waves and notify them with a buzzer sound or vibration. According to WHO 39 million people are estimated as blinds worldwide. They are suffering a lot of hardships in their daily life. The affected ones have been using the tradition white cane for many years which although being effective, still has a lot of disadvantages. This will be a wearable technology for the blinds. One of the main peculiarities of this device is that it will be affordable. The main controlling device of the project is Arduino nano. This will be equipped with ultrasonic sensors, consisting of module. Using the sensor, visually impaired can detect the objects around them and can travel easily. When the sensor detects any object, it will notify the user by beep or vibration. Thus, this is an automated device. Thus, this device will be of a great use for the blinds and help them travel different places.

# LIST OF FIGURES

# CHAPTER – 1

# INTRODUCTION

## 1.1 Introduction

With the improvement of the living standards of the people, we have become so materialistic that we have forgotten how the physically disabled people live a tough life. They undergo rigorous, apathetic and indifferent behavior towards them for being physically disabled. They become dependent on other people in a way for their day-to-day routine chores. Blind and impaired persons always depend on other people for their locomotion. Eye is prime sense of organ in perceiving the outside environment; dysfunction of such prime sense organ severely affects the knowledge perceiving capability of the outside environment. Therefore, going around to places in such environment is a very big challenge because the blind people cannot depend on their own eyes and thus face many difficulties. The objective of this project The Third Eye for the Blind is to design a product which is very much useful to those people who are visually impaired and those who often have to rely on others. Third eye for Blind project is an innovation which helps the visually impaired people to move around and go from one place to another with speed and confidence by knowing the nearby obstacles using the help of the wearable band which produces the ultrasonic waves which notify them with buzz sound or vibrations. It allows the user those who are visually impaired to walk freely by detecting the obstacles. They only need to wear this device as a band or cloth on their body. According to WHO or the World Health Organization, 39 million people are estimated as blinds worldwide. They are suffering a lot of hardship in their daily life. The physically disabled ones have been using the traditional way that is the white cane for many years which although being effective, still has a lot of disadvantages and limitations. Another way is, having a pet animal such as a dog, but it is really expensive. Thus, the aim of the project Third eye for the Blind is to develop a cheap, affordable and more efficient way to help the blind people to navigate with greater comfort, speed and confidence. This is the wearable technology for the blinds which helps resolve all the problems of the existing technologies.

Now a days there are so many technologies, things and smart devices for the visually impaired people for the navigation, but most of them have certain problems for the blind people and the major drawbacks are that those things need a lot of training and efforts to use. One of

the main peculiarities of this innovation is, it is affordable for everyone, the total cost being less than $25 or ~1500 INR. There are no such devices available in the market that can be worn like a cloth and having such a low cost and simplicity. With the use of this improvised device in a large scale, with improvements in the prototype, it will drastically benefit the community of the visually impaired or the blind people. The walking cane is a simple and purely mechanical device dedicated to detect the static or the constant obstacles on the ground, uneven surfaces, holes and steps via simple tactile-force feedback. This device is light, portable but limited to its size and it is not used for dynamic obstacle detection. These devices operate like the radar and the system of the device uses the ultrasonic wave's fascicle to identify the height, direction and the speed of the objects. The distance between the person and the obstacle is measured by the time of the wave travel. However, all the existing systems inform the blind the presence of the object at a specific distance in front of or near to him.

These details help the user or the blind people in detecting the obstacles and thus change the way and walk accordingly. Information about the objects and their place in the way of the walking like an obstacle and their characteristics can create additional knowledge to enhance the space manifestation and memory of the blind or the visually impaired people. To overcome, the above mentioned limitations this work offers a simple, efficient, configurable virtual for the blind.

## 1.2 Problem Statement

Individuals with visual impairments face significant challenges in navigating their surroundings independently, often relying on traditional aids like canes and guide dogs. While these tools are helpful, there is a need for a more advanced and versatile solution to empower the blind in understanding their environment, avoiding obstacles, and navigating unfamiliar spaces confidently. This project aims to design a **'third eye'** for the blind, a technologically advanced system that combines sensor technologies, artificial intelligence, and user-friendly interfaces to provide real-time environmental information and enhance spatial awareness for individuals with visual impairments.

## 1.3 Objective

The primary objective of the **"Third Eye for the Blind"** project is to develop an affordable and wearable assistive technology solution that combines expertise from computer science, electronics engineering, and health science to empower visually impaired individuals in navigating their surroundings with speed and confidence. By leveraging the capabilities of Arduino Nano and ultrasonic sensors, the project aims to create an automated device capable of detecting nearby obstacles using ultrasonic waves and notifying users through user-friendly cues such as buzzer sounds or vibrations. With a focus on affordability, the objective is to provide a viable alternative to traditional white canes, addressing the challenges faced by the estimated 39 million blind individuals worldwide. This multidisciplinary innovation seeks to enhance the daily lives of the visually impaired, promoting independence and improved mobility in diverse environments.

## 1.4 Goal of Project

The overarching goal of the **"Third Eye for the Blind"** project is to develop and deploy an accessible, affordable, and wearable assistive technology that significantly enhances the mobility and independence of visually impaired individuals. By integrating multidisciplinary knowledge from computer science, electronics engineering, and health science, the project aims to create a reliable and user-friendly device using Arduino Nano and ultrasonic sensors. The specific objectives include providing real-time obstacle detection, automated notification through audible or tactile cues, and a seamless navigation experience for the visually impaired. Ultimately, the goal is to positively impact the lives of the estimated 39 million blind individuals worldwide by offering a practical and affordable alternative to traditional aids, fostering greater autonomy and confidence in daily travel and activities.

## 1.5 Literature Survey

Over the last few years or we can say over the last decades, research has been conducted for new devices and technologies to design a good and reliable and efficient system for blind or visually impaired people to detect the obstacles and warn or alert them at danger places or the obstacles. There are some systems which has some limitations and clampdown. Shoval et al. in [1] developed a Navbelt, an obstacle avoidance wearable portable computer which is only for indoor navigation. Navbelt was equipped with two modes, in the first one the system information was translated to audio in different sounds. One sound for free for travel direction and other for blocked, it was difficult for the person to differentiate the sounds. Other problem was the system would not know the user momentary position. D. Yuan et al. in [2] have discussed about the virtual white cane sensing device based on active triangulation that can measure distances at a rate of 15 measurements/second. A blind person can use this device for sensing the environment, pointing it as if it was a flash light. Beside measuring distances, this device can detect surface discontinuities, such as the foot of a wall, a step, or a drop-off. This is obtained by analyzing the range data collected as the user swings the device around, tracking planar patches and finding discontinuities. Benjamin et al. in [3] introduce a laser cane with three photo diodes and three laser diodes function as receiver making an optical triangulation. The laser cane generally detects the obstacle in three specified directions. One is 45º to the ground for overhanging obstacles, the second one is parallel to the ground and third one is for sharp deepness. The laser cane has no data or technology or we can say system for determining the location and the position of the obstacle, rather it is just like a hit and trial method. J. Na proposed an interactive guide system for indoor positioning of this, which can't detect the obstacles and hurdles. The system is not suitable for the outdoor activities. Sabarish. S in [4] have described the development of a navigation aid in order to assist blind and visually impaired people to navigate easily, safely and to detect any obstacles. The system is based on a microcontroller with synthetic speech output. In addition to this, the device consists of two vibrators, two ultrasonic sensors which is mounted on the user's shoulders or any other body part and another one integrated into the cane. M.A Ungar S [5]. has proposed methods for the visually impaired people for the urban cities. But they didn't consider about the people who cannot afford costly equipment and devices. This limitation is overcome by the device third eye for the blind. Ms. Pooja Sharma [6] has discussed that the obstacles can be detected, but it has many limitations on the angles and the distance. On contrary, this project will have a wide angle for the detection where the sensors range will be wide. In today's world of innovations, there are many innovations for the visually impaired people like the white cane with the cane with a red tip for helping the movements

of the blind people. There are many different types of canes used in today's world with growing technologies such as the white cane, the smart cane [7], and the laser cane [8]. The cost of the trained dogs is also very high and is not affordable option [9]. A survey found [10] that the remote guidance system is very difficult to carry and thus the wearable band will be more optimized version. Likewise Guide Cane, this invention also has a control button on the handle, and the button has four different directions. This invention of the Third eye for blind has the same shortcomings or limitations as the Guide Cane where there will be a difficulty to save space for the cane or to place the smart cane like the other. Other than that, cost is also a problem in this project as it uses ultrasonic sensors and many servo motors. If the cost is high, users may not be able to afford for it\ because the average income of the visually impaired people is usually less. Smart Cane has been designed by students from Central Michigan University where this invention uses Radio Frequency Identification (RFID). RFID is used to detect objects or obstacles in front of the user and detects the RFID tag that has been placed in several locations to navigate the users. This invention is just like a normal stick but is provided with a bag, which the user to wear. The bag provides electrical power to the invention and informs the user through speakers inside the bag. For users who cannot hear, there are special gloves that will vibrate at every finger, in which different vibrations in each finger have different meanings. However, this invention has several shortcomings and is only suitable for small areas. This is because it only detects the area with RFID tag otherwise this invention only works as a regular blind cane.

# CHAPTER – 2

# PROBLEM IDENTIFICATION

## 2.1 Existing System

The existing system for assisting visually impaired individuals predominantly relies on traditional aids, with the primary tool being the white cane. Here's a description of the existing system:

**1. White Canes:**

- **Overview:** Visually impaired individuals commonly use white canes for mobility and obstacle detection.
- **Functionality:** The white cane is manually swept across the user's path to detect obstacles and changes in terrain.
- **Limitations:** While effective, the white cane has limitations in providing real-time information and requires constant physical interaction from the user.

**2. Guide Dogs:**

- **Overview:** Some visually impaired individuals use guide dogs trained to navigate obstacles and provide assistance.
- **Functionality:** Guide dogs are trained to guide their owners, avoid obstacles, and navigate through various environments.
- **Limitations:** Availability, cost, and extensive training periods limit the widespread use of guide dogs. They may not be suitable for all individuals or environments.

**3. Braille Navigation Systems:**

- **Overview:** Some navigation systems use Braille to provide information about the environment.
- **Functionality:** Users can receive information about their surroundings through Braille maps or signs.

- **Limitations:** Limited to specific locations with Braille infrastructure, and not practical for dynamic environments.

**4. Human Assistance:**

- **Overview:** Visually impaired individuals often rely on assistance from sighted individuals.
- **Functionality:** A sighted guide verbally communicates information and assists with navigation.
- **Limitations:** Dependence on others, limited privacy, and may not be available at all times.

**5. Smartphone Apps:**

- **Overview:** Some apps leverage GPS and sensors in smartphones to assist with navigation.
- **Functionality:** Apps provide auditory or haptic feedback based on GPS data and sensors.
- **Limitations:** Reliance on smartphone capabilities, potential accuracy issues, and the need for a smartphone.

**Challenges with the Existing System:**

- Limited real-time information about the immediate environment.
- Reliance on physical contact or external assistance.
- Affordability and accessibility issues for advanced assistive technologies.

The "Third Eye for the Blind" project aims to address these limitations by introducing a wearable and affordable IoT-based solution that enhances real-time obstacle detection and provides automated notifications for improved mobility and independence.

**Fig 2.1.1: Existing system**

## 2.2 Proposed System

The proposed system aims to revolutionize the way visually impaired individuals navigate their surroundings by introducing a wearable and affordable assistive technology solution. Leveraging the multidisciplinary fields of computer science, electronics engineering, and health science, the system integrates cutting-edge technology to address the limitations of the existing systems. Here's an overview of the proposed system:

**1. Wearable Device:**

- **Description:** A compact, lightweight wearable device equipped with an Arduino Nano as the main control unit.
- **Functionality:** The device will be designed to be comfortably worn by the user, providing a hands-free and unobtrusive navigation experience.

**2. Ultrasonic Sensors:**

- **Description:** Integrated ultrasonic sensors will be positioned strategically on the wearable device.
- **Functionality:** These sensors will emit ultrasonic waves and detect their reflections to identify obstacles and measure distances in real-time.

**3. Automated Notification System:**

- **Description:** The device will feature an automated notification system.
- **Functionality:** Upon detecting an obstacle, the system will trigger audible cues (such as a buzzer sound) or tactile cues (such as vibrations) to notify the user promptly.

**4. Arduino Nano Control Unit:**

- **Description:** The Arduino Nano serves as the central control unit of the system.
- **Functionality:** It processes data from the ultrasonic sensors, triggers notifications, and ensures the seamless operation of the entire system.

**5. Affordability:**

- **Description:** The project emphasizes affordability to make the technology accessible to a wider user base.
- **Functionality:** Cost-effective components and open-source platforms like Arduino contribute to the affordability of the device.

**6. User-Friendly Design:**

- **Description:** The system will be designed with user-friendliness in mind.
- **Functionality:** Intuitive controls, easy setup, and minimal maintenance requirements will contribute to a positive user experience.

**7. Real-Time Obstacle Detection:**

- **Description:** The primary focus is on real-time obstacle detection to enhance user safety and mobility.
- **Functionality:** The system will continuously scan the environment, providing immediate feedback to the user about nearby obstacles.

**8. Navigation Assistance:**

- **Description:** The proposed system will assist users in navigating through various environments.

- **Functionality:** Beyond obstacle detection, the system may incorporate features like directional guidance to help users reach their destinations.

**Expected Benefits:**

- Increased independence and confidence in daily mobility.
- Real-time awareness of the surrounding environment.
- Affordability, making the technology accessible to a larger user base.
- User-friendly design for ease of adoption and operation.

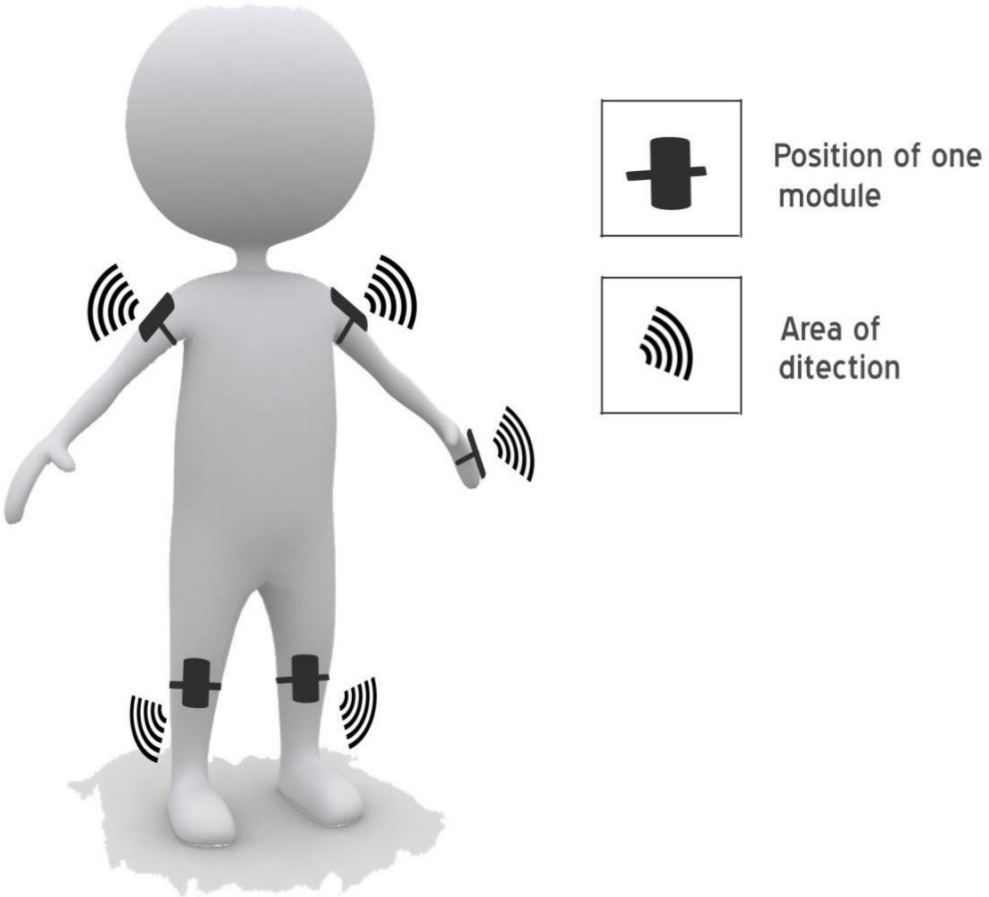


**FIG 2.2.1: Proposed System**

# CHAPTER – 3

# REQUIREMENTS

## 3.1 Software Requirements

- Arduino IDE studio compiler for dumping code into Microcontroller.
- Express SCH for Circuit design.
- Embedded C language.

## 3.2 Hardware Requirements

- **3.3v Battery:**3.7V 300mAH (Lithium Polymer) Lipo Rechargeable Battery Model KP-402030


**Fig 3.2.1: Battery**

- **Arduino nano**: Arduino Nano is a small size board and also flexible with a wide variety of applications. This is good product for fast and small prototyping. Arduino is an open-source hardware and software company, project and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices. Arduino Nano is based on the ATmega328 SMD chip. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 8 analog inputs, 1 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, and a reset button.

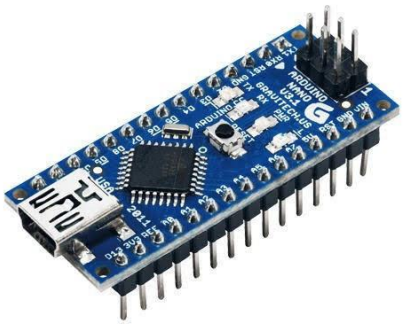

**Fig 3.2.2: Arduino nano**

- **Ultrasonic sensor**: Ultrasonic sensors (also known as transceivers when they both send and receive, but more generally called transducers) work on a principle similar to radar or sonar which evaluates attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object. This technology can be used for measuring: wind speed and direction (anemometer), tank or channel level, and speed through air or water. For measuring speed or direction a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water.


**Fig 3.2.3: Ultrasonic sensor**

- **Vibration motor**: A **vibrating alert** is a feature of communications devices to notify the user of an incoming connection. It is particularly common on mobile phones and pagers and usually supplements the ring tone. Vibrating alerts are primarily used when a user cannot hear the ring tone (a noisy environment or through hearing loss) or wants a more discreet notification. However, when the device is placed on a

hard surface it can often be as loud as a ringtone. Most 21st-century mobile phones are fitted with a vibrating alert, one of the exceptions being the Nokia 9500: due to the large size of this phone a larger motor would be required to make the phone vibrate.

**Fig 3.2.4: Vibration motor**

- **Buzzer:** Basically, the sound source of a piezoelectric sound component is a piezoelectric diaphragm. A piezoelectric diaphragm consists of a piezoelectric ceramic plate which has electrodes on both sides and a metal plate (brass or stainless steel, etc.). A piezoelectric ceramic plate is attached to a metal plate with adhesives. Applying D.C. voltage between electrodes of a piezoelectric diaphragm causes mechanical distortion due to the piezoelectric effect. For a misshaped piezoelectric element, the distortion of the piezoelectric element expands in a radial direction. And the piezoelectric diaphragm bends toward the direction. The metal plate bonded to the piezoelectric element does not expand. Conversely, when the piezoelectric element shrinks, the piezoelectric diaphragm bends in the direction Thus, when AC voltage is applied across electrodes, the bending is repeated, producing sound waves in the air.


**Fig 3.2.5: Buzzer**

- **LED light:** A light-emitting diode (LED) is a semiconductor light source. LEDs are used as indicator lamps in many devices, and are increasingly used for lighting. Introduced as a practical electronic component in 1962, early LEDs emitted low-intensity red light, but modern versions are available across the visible, ultraviolet and infrared wavelengths, with very high brightness.

**Fig 3.2.6: LED**

- **Jumper wires:** A **jump wire** (also known as **jumper**, **jumper wire**, **DuPont wire**) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

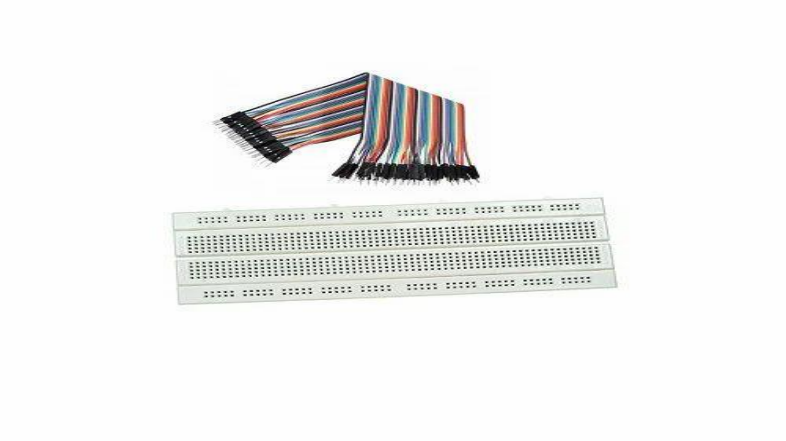

**Fig 3.2.7: Jumper wires**

- **Switches**: **switch** is an electrical component that can disconnect or connect the conducting path in an electrical circuit, interrupting the electric current or diverting it from one conductor to another.[1][2] The most common type of switch is an electromechanical device consisting of one or more sets of movable electrical contacts connected to external circuits. When a pair of contacts is touching current can pass between them, while when the contacts are separated no current can flow.

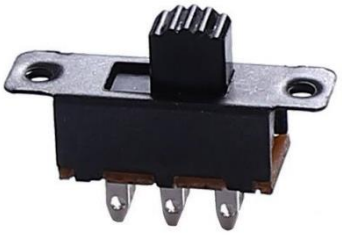

**Fig 3.2.8: Toggle Switch**

# CHAPTER – 4

# DESIGN AND IMPLEMENTATION

## 4.1 Design

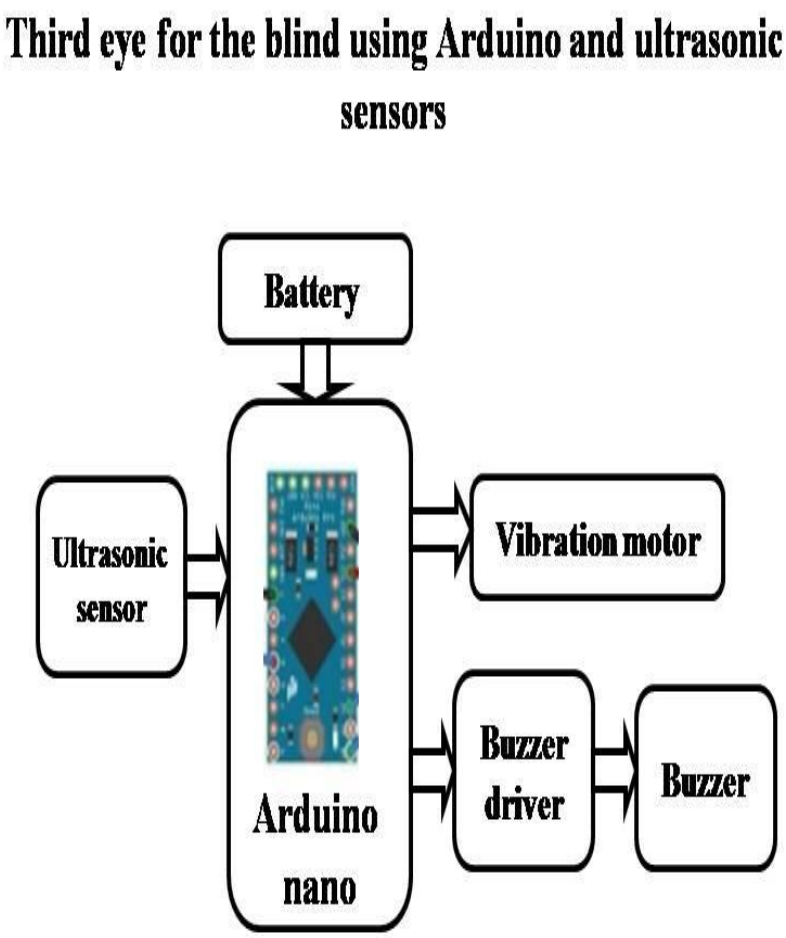


**FIG 4.1.1: Design**

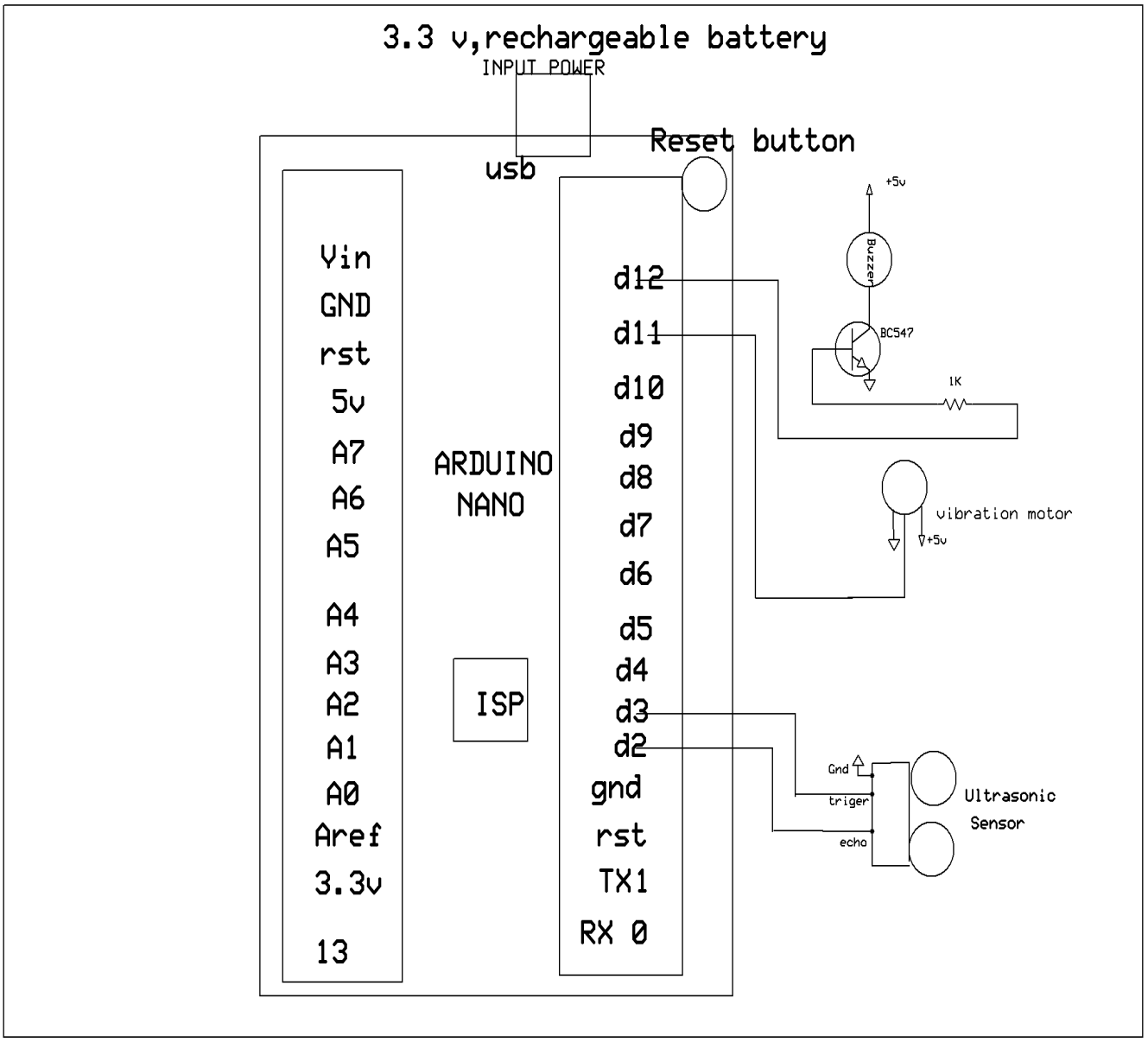


**FIG 4.1.2 Connections**

## FLOW CHART

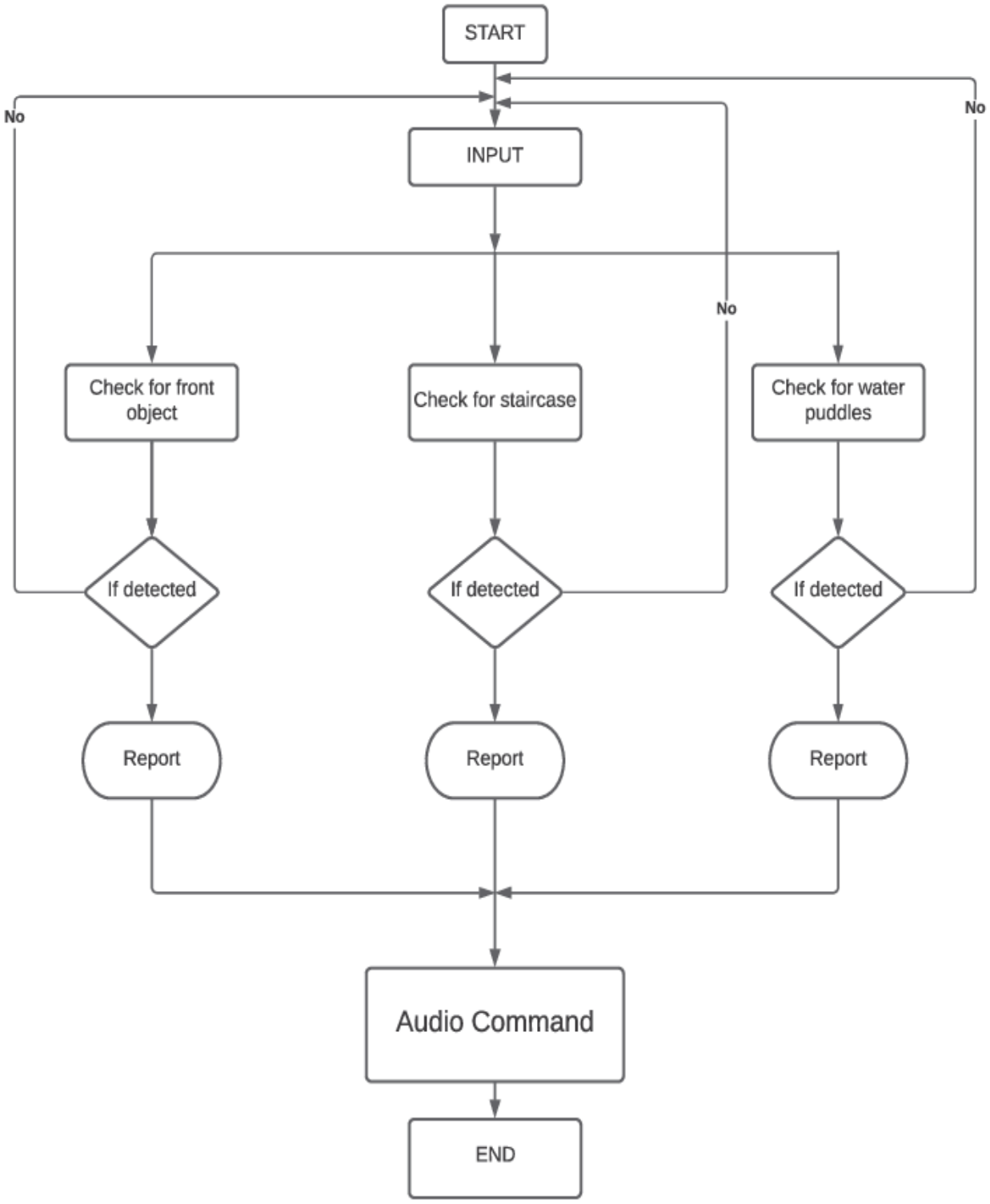


**FIG 4.1.3: Flow Chart**

## 4.2 IMPLEMENTATION

We first cut the board in 5 X 3 cm dimension and solder the female headers for the arduino to the board. Then soldering of the buzzer is carried out. This proposed system consists the equipment like Arduino mini pro, ultrasonic sensor, vibrating motor, buzzers for detecting the obstacles and, Red LEDs, Switches, Jumper cable, power bank, Male and female header pins, 3.3 volt old mobile battery, some elastic and stickers to make the device wearable as a band for wearing for the users. The Ultrasonic sensor is wired accordingly. The Ultrasonic sensor pin VCC is connected to the Arduino pin VCC, Ultrasonic sensor pin GND is connected to the Arduino pin.

The equation for the distance calculation between the sensor and the object is as follows
D = (HPTW * SV)/2
Where, D = Distance in cm. HPTW = High time of pulse
width. SV = Sound velocity in cm/s.

The Ultrasonic sensor here used as a transceiver. The ultrasonic waves are emitted by the transmitter when the objects are detected. Both the transmitter and receiver resent inside the ultrasonic sensor. We calculate the time interval between the transmitted and received signal. In this way, along these lines our project will be intended for the outwardly weakened individuals and will make it simple and advantageous as it will be a wearable gadget and therefore will help the client in voyaging and identifying the impediments while strolling effortless.

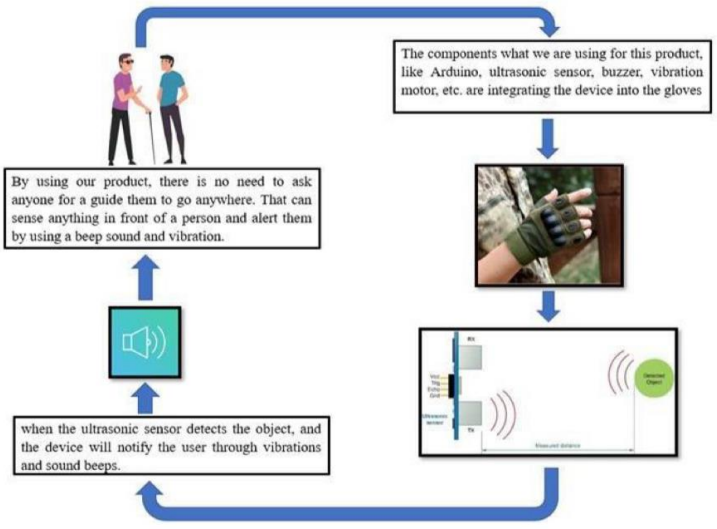


**FIG 4.2.1 Implementation**

# CHAPTER – 5

# CODE

## 5.1 Source Code

```
#include <stdio.h>
#include <string.h>
#include <ctype.h>
#include <sr04.h>

const int trigPin1 = 8;
const int echoPin1 = 9;
int buz = 12;


void setup()
{

  Serial.begin(9600);
  pinMode(trigPin1, OUTPUT);    //SR04 trig
  pinMode(echoPin1, INPUT);     //SR04 echo

  pinMode(buz,OUTPUT);
  pinMode(13,OUTPUT);

  digitalWrite(13, HIGH);   // turn the LED on (HIGH is the voltage level)
  digitalWrite(buz, LOW);   // turn the LED on (HIGH is the voltage level)
  delay(700);               // wait for a second
  digitalWrite(13, LOW);    // turn the LED off by making the voltage LOW
  digitalWrite(buz, HIGH);   // turn the LED on (HIGH is the voltage level)
  delay(700);
  digitalWrite(13, HIGH);   // turn the LED on (HIGH is the voltage level)
  digitalWrite(buz, LOW);   // turn the LED on (HIGH is the voltage level)
  delay(700);               // wait for a second
  digitalWrite(13, LOW);    // turn the LED off by making the voltage LOW
  digitalWrite(buz, HIGH);   // turn the LED on (HIGH is the voltage level)
  // wait for a second

}
```

```
long duration, r;
int distance;
int flag = 0;
int count = 1;
int limit = 45;

void loop()
{


  digitalWrite(13, LOW);    // turn the LED off by making the voltage LOW
  digitalWrite(buz, LOW);   // turn the LED on (HIGH is the voltage level)
  get_dist1();

  Serial.println(targetDistance1);

  if (targetDistance1 < limit)
  {

      digitalWrite(13, HIGH);    // turn the LED off by making the voltage LOW
      digitalWrite(buz, HIGH);   // turn the LED on (HIGH is the voltage
level)

  }
delay(450);
}
```

## 5.2 Screenshot of Application

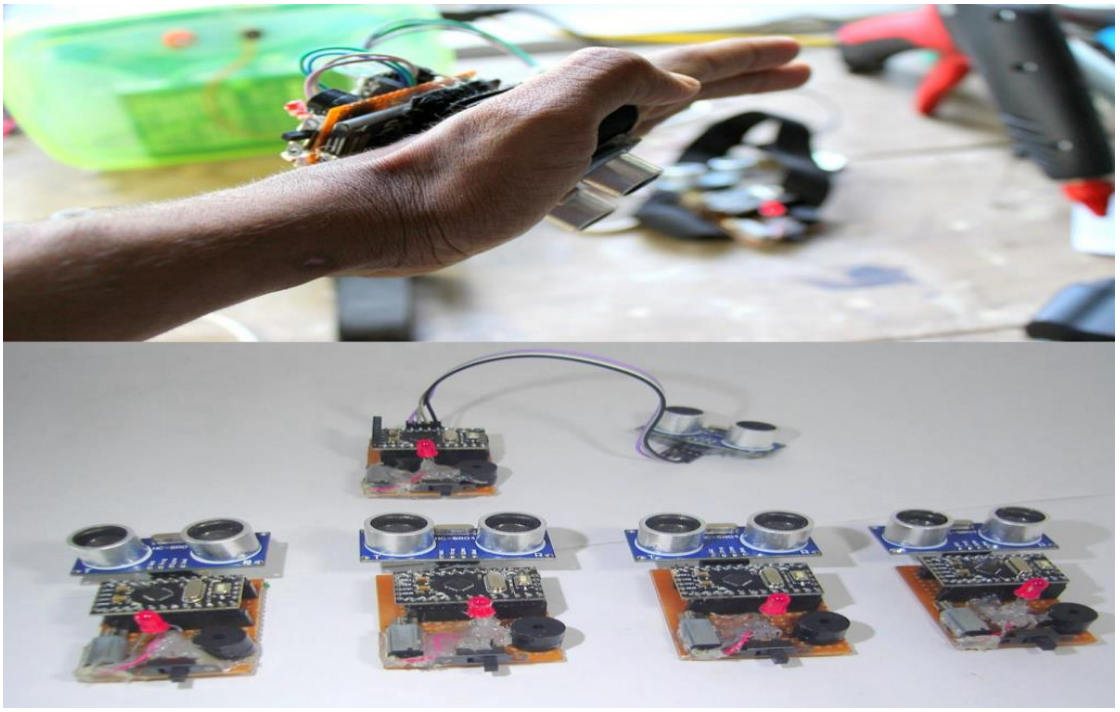

**Fig 5.2.1: Screenshot1**

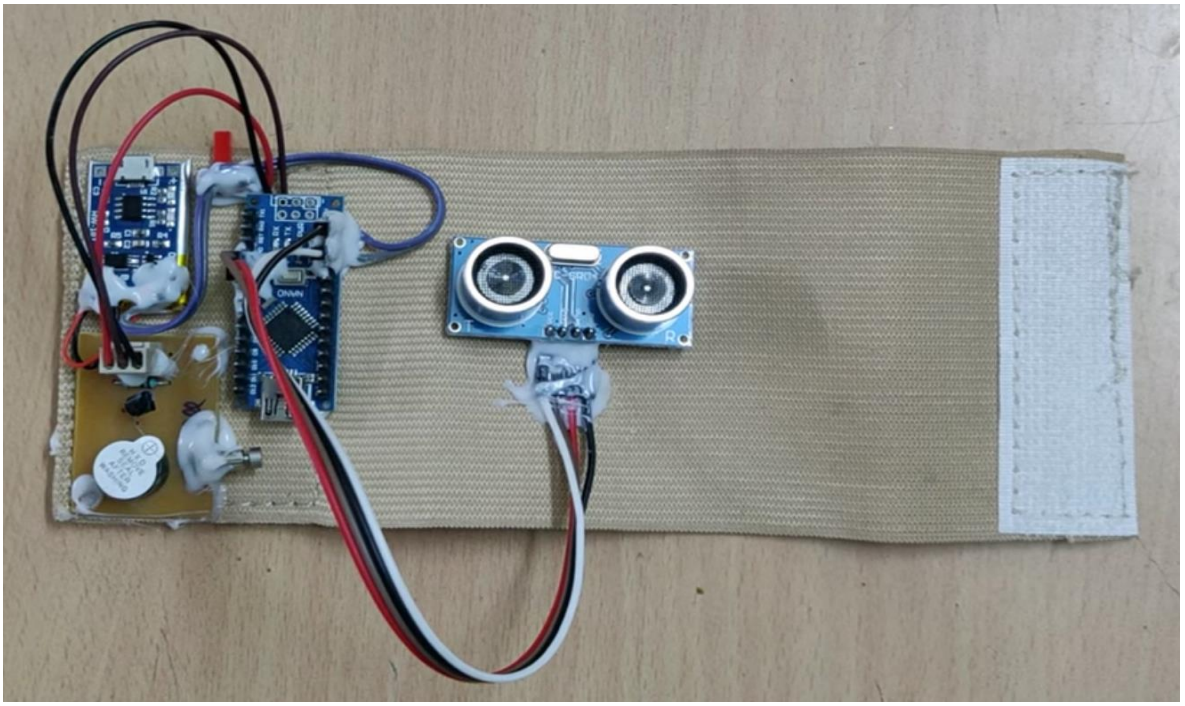

**Fig 5.2.2: Screenshot2**

# CHAPTER – 6

# RESULTS AND CONCLUSION

## 6.1 Results

The project "**Third eye for the blind using Arduino and ultrasonic sensor**" was designed a wearable device that is used to provide security and alerts the blind people with the help of ultrasonic sensor, buzzer and vibration. Whenever ultrasonic sensor detects any obstacle, this will be fed as input to the micro controller and the microcontroller active the buzzer and vibration motor which is used to indicate the blind presence about obstacle nearer to it.The system is created and designed for visually impaired people. This device helps the visually impaired people to handle several states and responds to the user in every environment. All the conditions can be easily met by the blind individual using ultrasonic sensor and the Arduino board. This device will help the visually impaired people to know about the obstacles in every direction.

**Fig 6.1.1: Result 1**

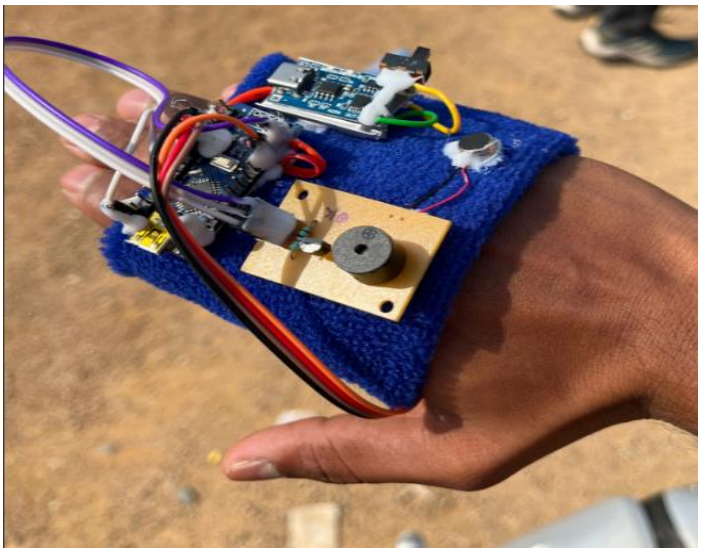

**Fig 6.1.2: Result 2**

## 6.2 Conclusion

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced ICs with the help of growing technology, the project has been successfully implemented. Thus, the project has been successfully designed and tested.Thus, the project, Third Eye for blind people is made sightless individuals to live independently, so as to perform their daily activities easily and more confidently with high level of safety. This Arduino based concept for the blind people is simple, cheap and can be easily carried and maintained. This system is able to scan and detect the hindrances in all directions irrespective of the height or depth the object lies at. With this project, if construction is done properly, the blind can enjoy the taste of sight and can move freely from one place another without assistance of the other individual.

## 6.3 Future Scope

- We can add GSM module to send the alert voice message.
- We can add GPS module to track the location of the blind person.

In future with the advancement of quicker response of sensors, like the usage of top notch sensors it can be made highly useful and also the modules that one needs to wear as a bracelet or on any other part of the body can be transformed into a wearable clothing like a coat, so that it can be made fit for working and there can be more advancement in this device for instance we can use piezeo electric plates in the shoes of the user which can generate sufficient electricity that the modules can run on

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