THIRD EYE FOR BLIND WITH ULTRASONIC SENSOR

A PROJECT REPORT

SUBMITTED IN PARTIAL FULFILLMENT OF

THE REQUIREMENT FOR THE AWARD OF

THE DEGREE OF M.SC – COMPUTER SCIENCE

BY

FARVEZ MUSHRAF

RA2232017010005

RUBAN KUMAR R

RA2232017010006

SURI P

RA2232017010034

Under the guidance of

Dr.E.Aarthi

(Assistant Professor, Department of Computer Science)

DEPARTMENT OF COMPUTER SCIENCE

FACULTY OF SCIENCE AND HUMANITIES

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

S.R.M. Nagar, Kattankulathur, Kancheepuram District

OCTOBER 202

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Under Section 3 of UGC Act, 1956)

BONAFIDE CERTIFICATE

Certified that this project report **" THIRD EYE FOR BLIND WITH ULTRASONIC SENSOR"** is the bonafide work of "**Farvez Mushraf (RA2232017010005), Ruban Kumar R (RA2232017010006), Suri P (RA2232017010034)"** who carried out the mini project work under my supervision towards partial fulfillment of II-year M.Sc. – Computer Science course requirement.

SIGNATURE

Dr.G.Kalpana,
Head and Professor,
Department of Computer Science,
Faculty of Science and Humanities,
SRMIST, Kattankulathur.

SIGNATURE

Dr.E.Aarthi
Assistant Professor,
Department of Computer Science,
Faculty of Science and Humanities
SRMIST, Kattankulathur

CERTIFICATE OF VIVA-VOCE-EXAMINATION

This is to certify that Mr. **Farvez Mushraf** Register No **RA2232017010005,** Mr. **Ruban Kumar R** Register No **RA2232017010006,** Mr. **Suri P** Register No **RA2232017010034** submitted for the Viva-voce Examination of the Mini Project – PCS21E31L of III Semester, II year - Computer Science, held on……, during the academic year 2023-2024 at the Department of Computer Science, Faculty of Science and Humanities, SRM Institute of Science and Technology, Kattankulathur.

Internal Examiner
Name :

Designation :

External Examiner
Name :

Designation :

DECLARATION OF ASSOCIATION OF RESEARCH PROJECT WITH SDG GOALS

This is to certify that the research project entitled **THIRD EYE FOR BLIND WITH ULTRASONIC SENSOR** carried out by Mr. **Farvez Mushraf (RA2232017010005),** Mr. **Ruban Kumar R (RA2232017010006),** Mr. **Suri P (RA2232017010034)** under the supervision of Dr. **E.Aarthi Assistant Professor**, of **Computer Science** in partial fulfillment of the requirement for the award of Under Graduation/Post Graduation/ Diploma/ Ph.D. program has been significantly or potentially associated with SDG Goal No ------- titled -------- ----------.

This study has clearly shown the extent to which its goals and objectives have been met in terms of filling the research gaps, identifying needs, resolving problems, and developing innovative solutions locally for achieving the above-mentioned SDG on a National and/or on an International level.

Signature of the Student Guide and Supervisor

Head of the Department.

Abstract

The “Third Eye for Blind with Ultrasonic SENSOR”, is designed to help the blind to overcome the lack of visual sense, by using other senses like sound and touch. It uses audio and vibration signals to notify the user about upcoming hurdles. As the distance between the glove and obstacle decreases, the frequency of both audio and vibration signals increases. Thus, the system helps to ease the navigation process for the needy.

The system uses an Atmega-328 microcontroller, which is a high-performance 8-bit AVR RISC-based microcontroller. It has 32KB of ISP flash memory with read-while-write capabilities, as well as 1KB EEPROM, and 2KB SRAM. It also has features like 23 general-purpose I/O lines, 32 general-purpose working registers, and three adjustable timer/counters with compare modes. For sensing the distance of the system use an HC-SR04, an Ultrasonic Range Finder Distance Sensor Module. The sensor module is designed to measure the distance using the principle of SONAR or RADAR, using ultrasonic waves to determine the distance of an object. The system also consists of a buzzer to generate an alarm sound and a motor to generate vibration signals.

The "Third Eye for the Blind" offers several key advantages over existing assistive technologies. Its discreet and unobtrusive design ensures that users do not attract unnecessary attention, promoting social integration. The real-time feedback allows for immediate adjustments in navigation, ensuring safety and security in unpredictable environments. The system is customizable, enabling users to fine-tune the vibration patterns to suit their individual preferences and needs.

Keywords: blind people, RF remote, security, sensors, stair detection, obstacle recognition, microcontroller, daily life, ultrasonic sensor.

ACKNOWLEDGEMENT

At the outset, I would like to express my thanks to the Lord almighty for helping me to complete this project work successfully.

I express my gratitude towards management of SRMIST, for rendering support in every possible way to complete this project work

I am extremely grateful to Dr. A. Duraisamy, Dean, College of Science and Humanities, SRM Institute of Science and Technology for his support.

I am extremely thankful to Dr.Albert Antony Raj, Deputy Dean I/c, College of Science and Humanitites, SRM Institute of Science and Technology for his encouragement.

I express my sincere gratitude to Dr.G.Kalpana , Head and Associate Professor, Department of Computer science for the encouragement and support provided during the project work.

I would like to express my gratitude towards my guide, Dr.E.Aarthi, Assistant Professor, Department of Computer Science for the kind encouragement and co-operation which helped me in completing this project.

However, it would not have been possible without the kind and constructive support of my department faculty members and lab programmers of the Department of Computer Science.

Name of the Students,
Farvez Mushraf
RA2232017010005
Ruban Kumar R
RA2232017010006
Suri P
RA2232017010034

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CHAPTER 01

1.1 INTRODUCTION TO THE THIRD EYE FOR THE BLIND

As per the definition of blindness, we mean the person without sense of sight. A blind person has no ability to see anything. While struggling for the different levels of comforts of the general population, we have reached to a point where we have started to completely ignore the people who are living a miserable life due to lack of vision. They face enormous challenges in their daily lives and hence end up living a dependent life. They experience a completely different life from the normal people and experience detached and uninterested conduct towards them for being physically disabled. They need other individuals for their movement from one place to another. Sight is the basic sense of life and therefore a person's movement from place to place in this condition is a major challenge for the visually impaired . The target of this task , This project for the blind or visually impaired person will provide a gadget that is helpful to them as well as the persons who depend on any individual due to lack of sight. Third eye for blind task can be an innovation for the sightless individuals, it will help them to move from here and there and among different places with confidence by knowing the nearest obstructions while wearing the band which leaves the ultrasonic waves which inform the person with beep-sound or vibration. It can let the person who is not able to move and distinguish even snags due to lack of vision. They just have to put on the gadget as a band/bracelet or it can be adjusted on the dress on their body. As per WHO(world health organisation) 2.2 billion people suffer from vision impairment. They experience a lot of troubles in the daily lives. This device can be an innovation for the physically disabled or blind individuals. The people with physical disability used the common way that is white cane previously that was also efficient, but it had lot of limitations. Second approach is, having a pet ,like a dog ,though it is costly but is helpful .Therefore this task ,Third eye for blind will be developed as a moderate, very productive approach to help the blind person traverse with confidence and more interest. The device acts as an innovation for blinds which helps to solve all issues . At Present, enormous techniques and brilliant innovations are available for the physically disabled people, almost all of these devices have solved some of the issues for the sightless people but there exist many demirits like they require considerable measures of preparing and and high maintenance. The uniqueness of the proposed advancement is, it is fair for everyone, the total cost being under $20 or 1500 INR. In the market, no such devices are available that look like an item that can be worn with so much less effort, clarity. By increasing the usage of the gadget and the upgrading the changes in the model, it would definitely be profitable to the people with less or no vision at all. The basic mechanical gadget that is the strolling stick is manufactured so that it can be used in

identifying stationary objects on floors, unbalanced surfaces, holes, steps using the basic mechanical matter. The gadget is fine, convenient but because of compact area it cannot be used for vast snag identification The device works like radar, orientation of the device uses the ultrasonic waves and collect them to note the altitude, direction or also velocity of that object. The separation among the object and person is assessed on the travelling of the wave. Nevertheless, all present systems advise the person about the closeness of the protest at a certain space in forefront or nearby the individual. The interesting aspects enable the unsighted person in distinguishing snags and grants him access to choose his path properly with no issue. This device can help the person in identifying any type of hindrance like a snag. For surviving the earlier stated restrictions this project work provides primary, productive, customizable and effective solution to the visually impaired.

SCOPE OF THE PROJECT

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.

1.4 PROBLEM STATEMENT:

Despite the advancements in assistive technology, blind and visually impaired individuals still face significant challenges in navigating their surroundings safely and independently. While traditional aids such as white canes and guide dogs provide valuable assistance, they have limitations. White canes can only detect obstacles that are directly in front of the user, and guide dogs require extensive training and maintenance.

As a result, blind and visually impaired individuals often rely on others for assistance with tasks such as crossing streets, avoiding obstacles, and finding their way around unfamiliar environments. This can be both time-consuming and frustrating, and can limit their independence and participation in society.

CHAPTER 02

2.1 SYSTEM ANALYSIS

2.1.1 EXISTING SYSTEM

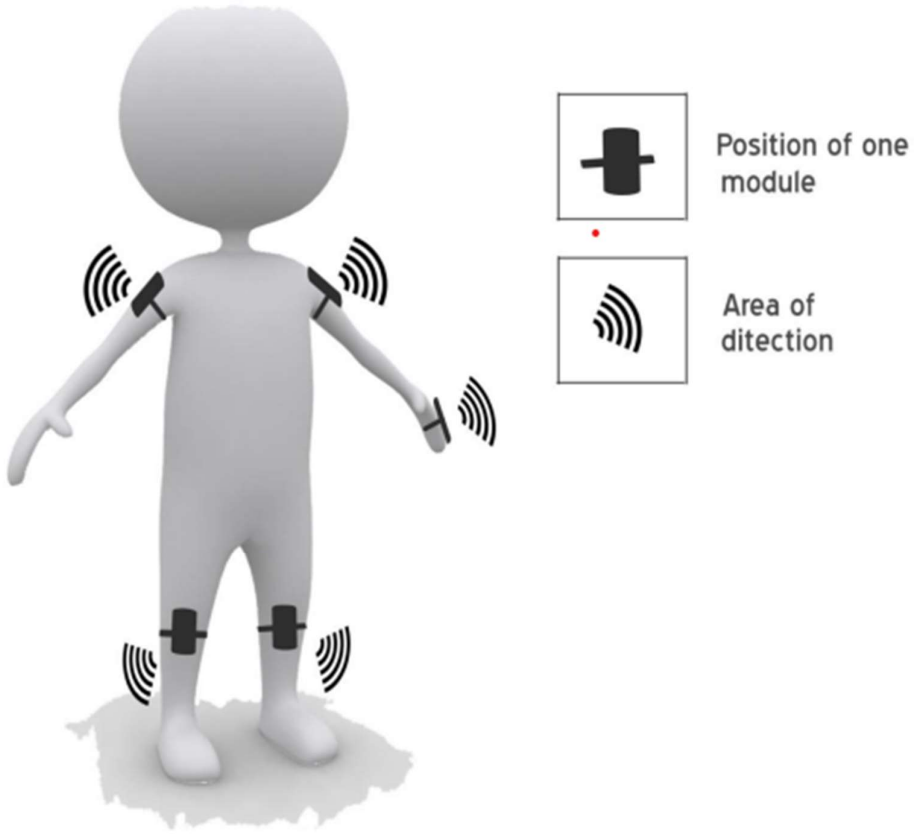
- White cane
- Pet dog
- Smart devices (eg: Vision a torch for blinds)

2.1.2 PROBLEM OF THE EXISTING SYSTEMS

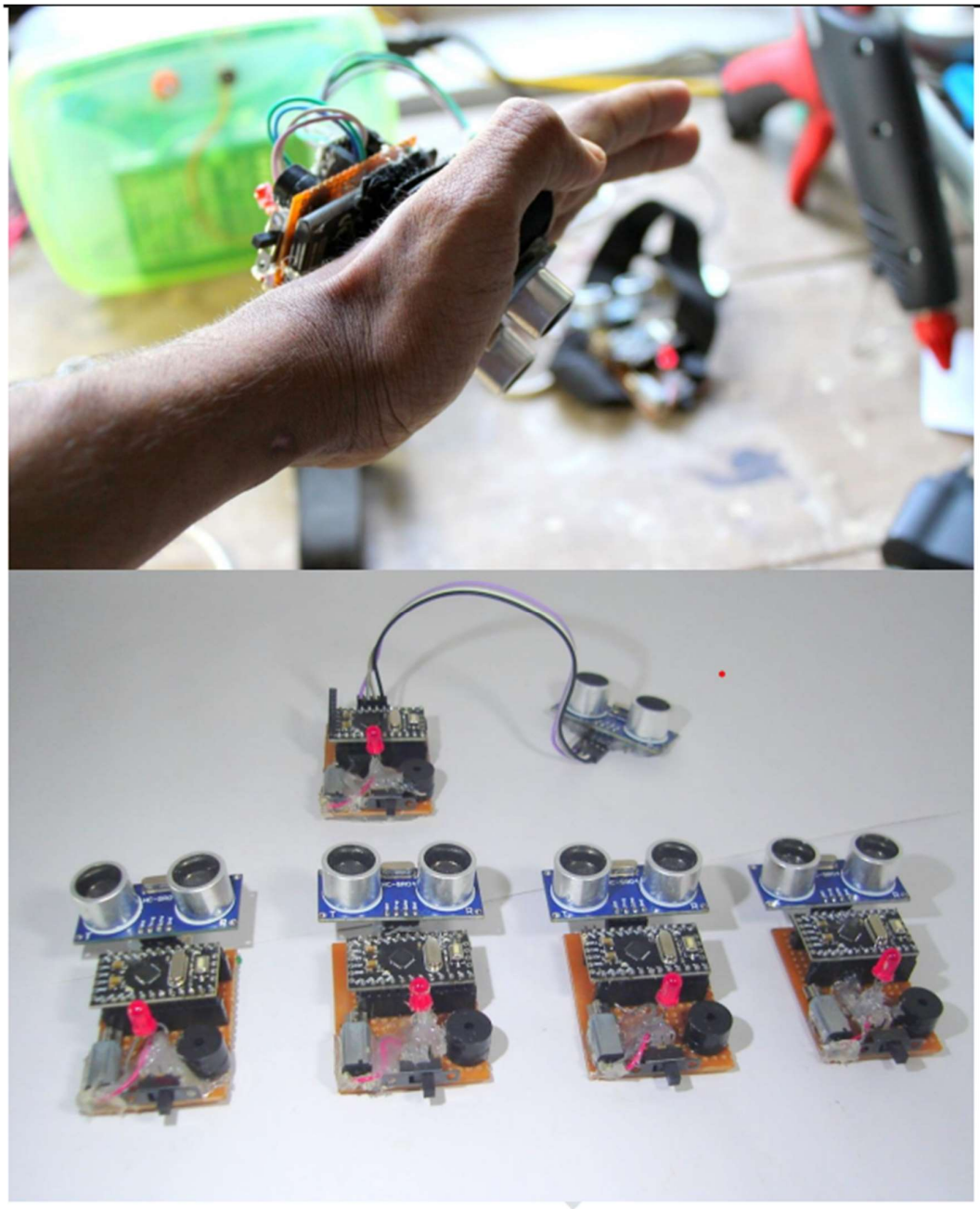
1. White cane - May easily crack/ break, the stick may get stuck at pavement cracks of different objects.
2. Pet dog - Not everyone can afford its daily needs.
3. Common Disadvantages (Including the smart devices) Cannot be carried easily, needs a lot of training to use…

2.1.2 THIRD EYE FOR BLINDS AS A SOLUTION

By wearing this device they can fully avoid the use of white cane and such other devices. This device will help the blind to navigate without holding a stick which is a bit annoying for them. They can simply wear it as a band or cloth and it can function very accurately and they only need a very little training to use it.



We have designed a special wearable device based on the arduino board which can be worn like a cloth for blinds. This device is equipped with five ultrasonic sensors, consisting of five modules which are connected to the different parts of the body. Among them, two for both shoulder, another two for both knees and one for the hand. Using the five ultrasonic sensors, blind can detect the objects in a five dimensional view around them and can easily travel anywhere. When the ultrasonic sensor detects obstacle the device will notify the user through vibrations and sound beeps. The intensity of vibration and rate of beeping increases with decrease in distance and this is a fully automated device.



2.2 PROPOSED SYSTEM

HARDWARE:

To construct the Third Eye device, connect the Arduino Nano's female pins to the male headers on the ultrasonic sensor HC-SR04, buzzer, and battery cap using female and male wires. The Arduino Nano's USB port can then be used to power the device using a USB cable and battery.

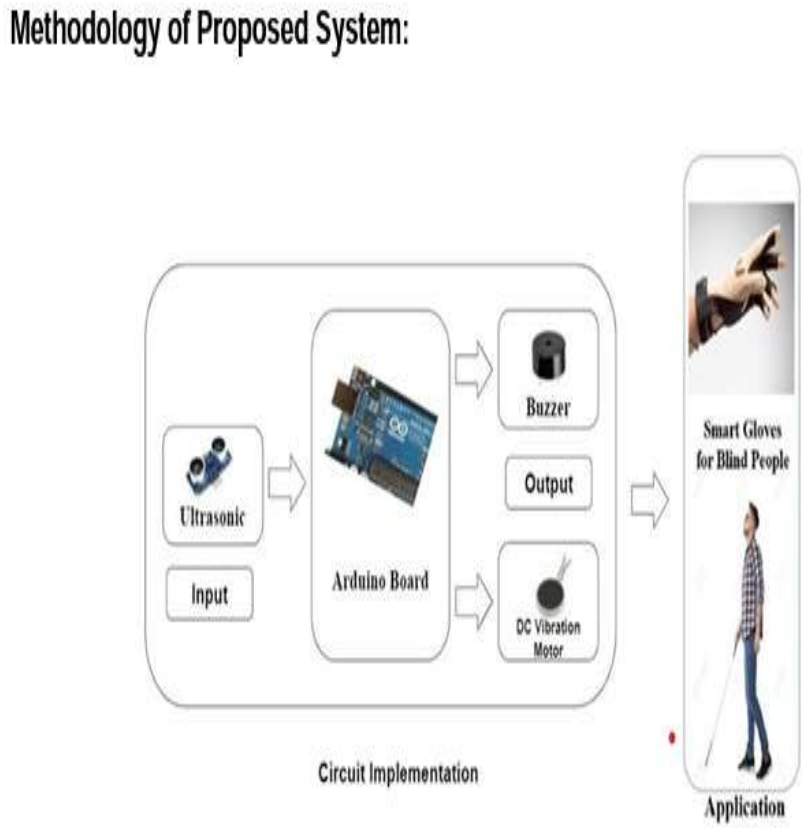


Fig. 1 Block Diagram Image of the proposed system

SOFTWARE: The Third Eye Ultrasensor, coded in C and compiled with the Arduino IDE, utilizes the capabilities of the Arduino platform to provide a comprehensive and intuitive solution for obstacle detection and navigation assistance.

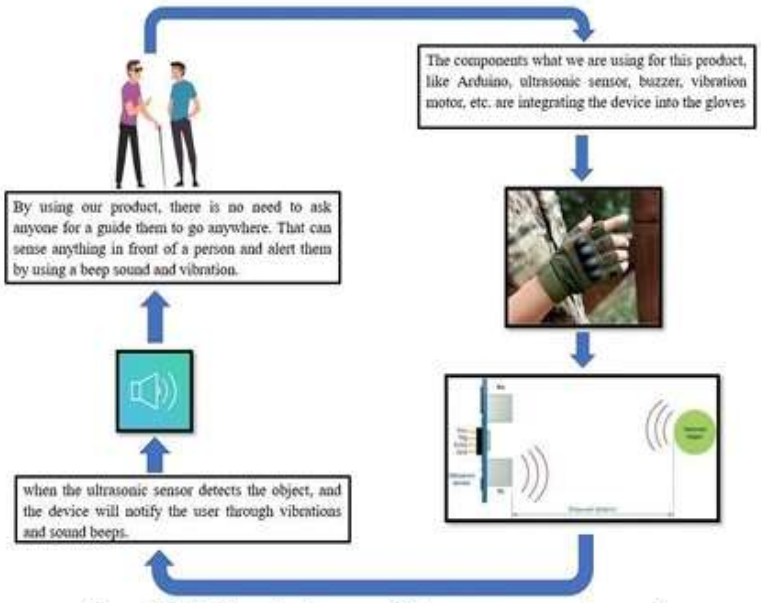


Fig. 2 Methodology of the proposed system

2.3 FEASIBILITY STUDY

Technical Feasibility

The Third Eye for Blind with Ultrasonic Glove is technically feasible. Ultrasonic sensors are widely available and inexpensive, and they can be used to accurately detect nearby obstacles. Microcontrollers are also widely available and inexpensive, and they can be used to process sensor data and generate vibration patterns. The development of a haptic feedback system is also feasible, as there are a variety of haptic actuators available.

Commercial Feasibility

The Third Eye for Blind with Ultrasonic Glove has the potential to be a commercially viable product. There is a large and growing market for assistive technology, and the Third Eye for Blind with Ultrasonic Glove has the potential to meet the needs of a significant portion of this market. The device is also relatively inexpensive to produce, which would make it affordable to a wide range of consumers.

Operational Feasibility

The Third Eye for Blind with Ultrasonic Glove is operationally feasible. The device is easy to use and does not require any special training. The device is also portable and can be used in a variety of environments.

Schedule Feasibility

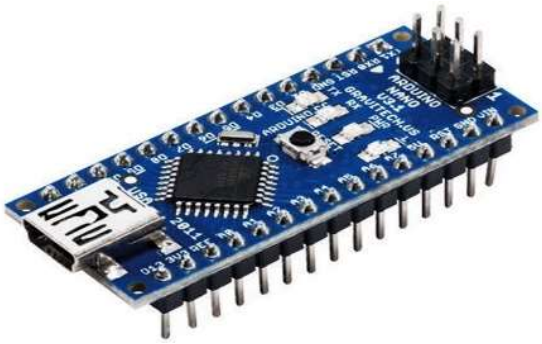
The Third Eye for Blind with Ultrasonic Glove can be developed within a reasonable timeframe. The device is based on well-established technologies, and the development process is straightforward.

CHAPTER 03

3.1 REQUIREMENTS ANALYSIS

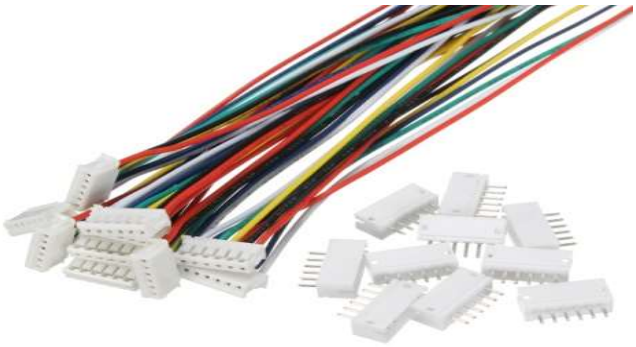
3.1.1 HARDWARE SPECIFICATION

1: Arduino Nano



The Arduino Nano is a microcontroller-based device with 16 digital pins that can be used for various purposes. It can be used for almost every task, from minor to massive industrial-scale projects. It can also be used for prototyping and developing new applications.

2: Female and Male wires

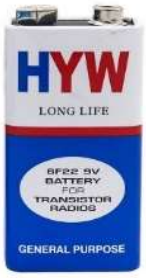


A male connector is commonly referred to as a plug and has a solid pin for a center conductor. A female connector is commonly referred to as a jack and has a center conductor with a hole in it to accept the male pin.

3: USB cable

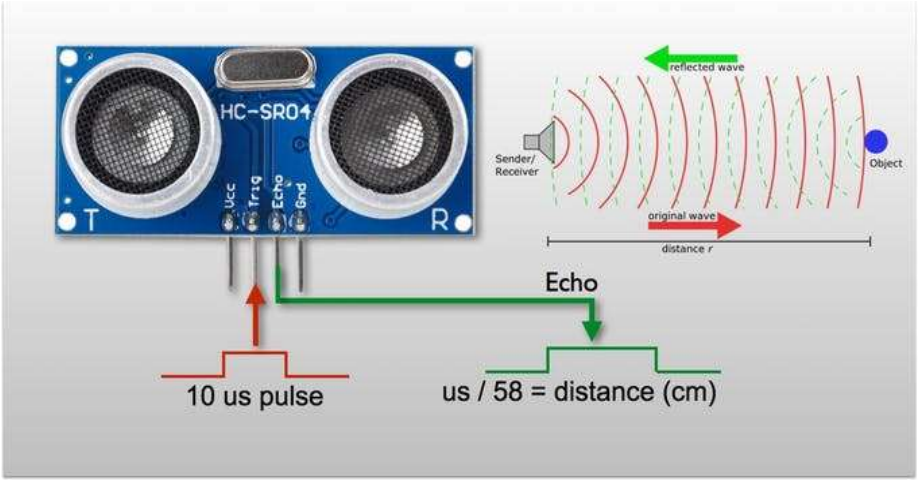
A USB cable is a common interface cable used to connect various electronic devices to a computer or power source. It's widely used for data transfer, charging, and communication between devices.

4: Battery



A battery is a device that converts chemical energy contained within its active materials directly into electric energy by means of an electrochemical oxidation-reduction (redox) reaction. This type of reaction involves the transfer of electrons from one material to another via an electric circuit.

5: Ultrasonic sensor HC-SR04



The HC-SR04 Ultrasonic Distance Sensor is a sensor used for detecting the distance to an object using sonar. It's ideal for any robotics projects you have that require you to avoid objects, by detecting how close they are you can steer away from them.

6: Buzzer

The third eye for blinds is an innovation that helps blind people to navigate with speed and confidence by detecting nearby obstacles using the help of ultrasonic waves and notifying them with a buzzer sound or vibration.

7: BATTERY CAP

These caps serve two purposes: they permit the checking and maintenance of water and acid levels and provide a vent for the escape of gases formed when the battery is charging.

3.1.2 SOFTWARE SPECIFICATION

3.1.2.1 ARDUINO COMPILER

- The Arduino compiler is a free and open-source software development platform for creating programs for Arduino microcontrollers.
- The Arduino compiler is based on the Processing programming language, which is a dialect of Java.
- The Arduino compiler is easy to learn and use, even for beginners.

3.1.2.2 LANGUAGE C

- The C language is a general-purpose programming language that is widely used for embedded systems development.
- The C language is a powerful and versatile language that can be used to create a wide variety of software applications.
- The C language is well-suited for the development of real-time systems, such as the Third Eye Ultrasonic Sensor.

3.1.2.3 SPECIFIC REQUIREMENTS

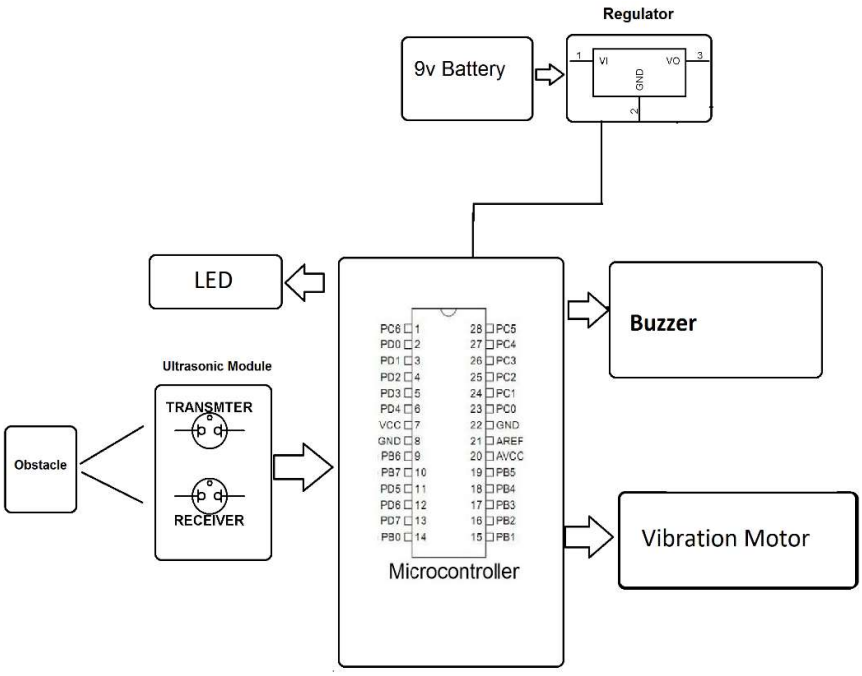
- The software must be able to read data from the ultrasonic sensor.
- The software must be able to calculate the distance to nearby objects.
- The software must be able to generate haptic feedback patterns that correspond to the distance to nearby objects.
- The software must be able to run on an Arduino microcontroller.

CHAPTER 04

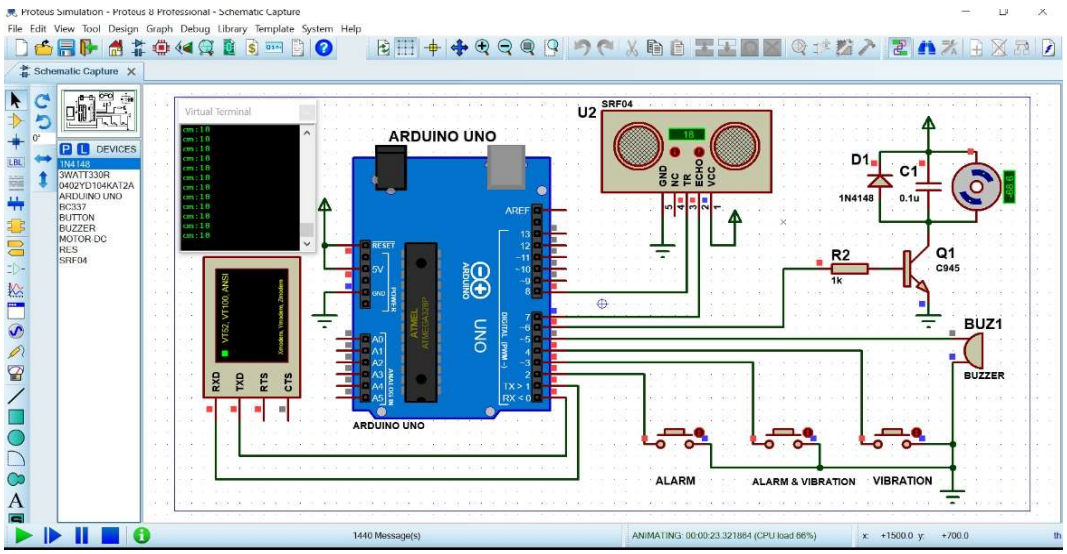
4.1 SYSTEM DESIGN

.1.1 ARCHITECTURE DIAGRAM

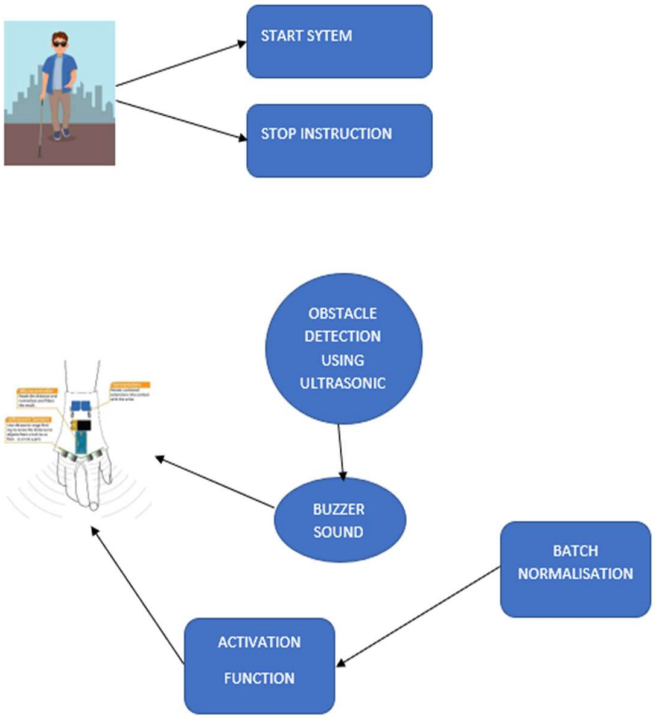
.1.2



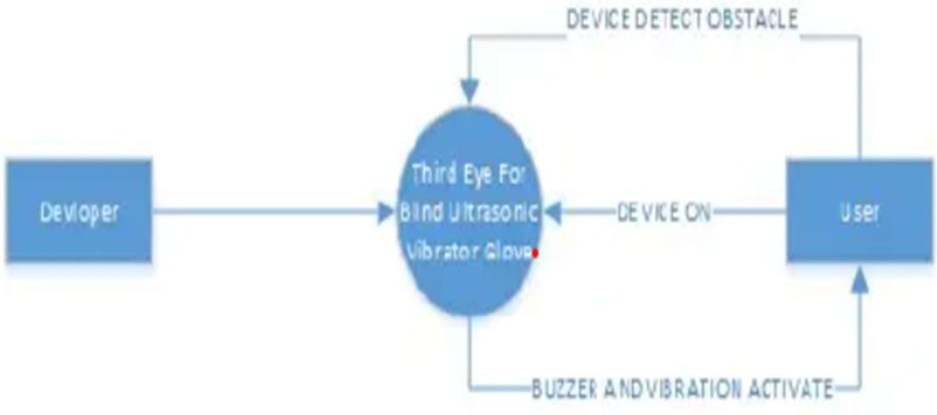
4.1.2 CONTEXT DIAGRAM



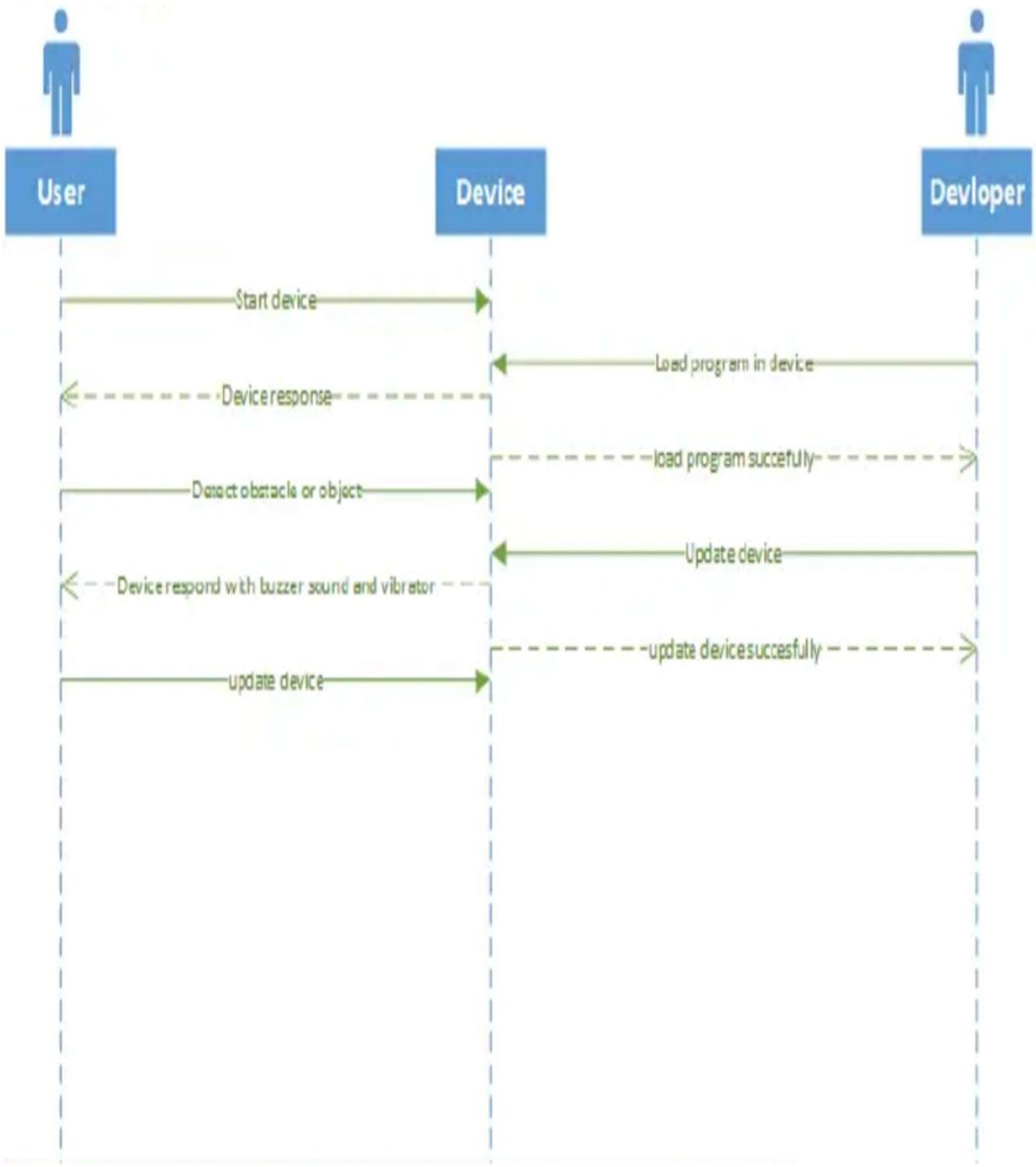
4.1.3 USE CASE DIAGRAM



4.1.4 DATA FLOW DIAGRAM



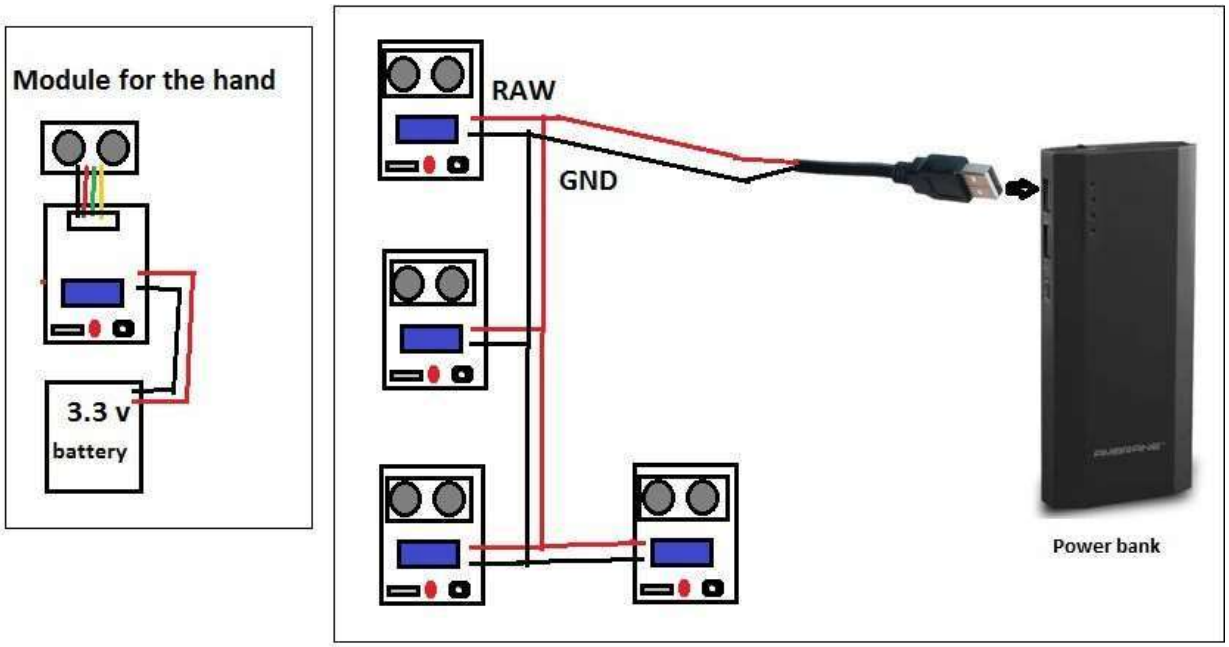
4.1.5 SEQUENCE DIAGRAM



CHAPTER 05

5.1 MODULE DESCRIPTION

Step:01 Circuit Diagram - Descriptions.



Wiring instruction.

Ground of LED, buzzer, and vibration motor to GND of Arduino

+ve of LED and middle leg of switch to Arduino pin 5

+ve of Buzzer to the first leg of the switch

+ve of Vibration motor to the third leg of the switch

Ultrasonic sensor

Ultrasonic sensor pin VCC - Arduino pin VCC

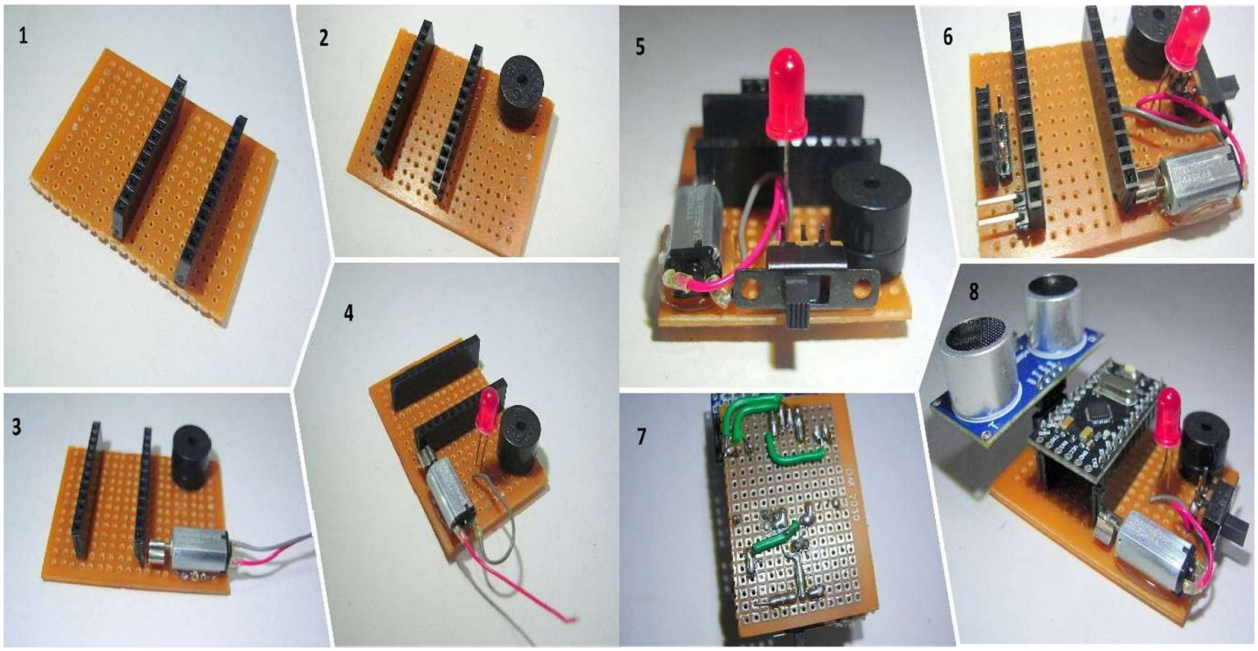
Ultrasonic sensor pin GND - Arduino pin GND

Ultrasonic sensor pin Trig - Arduino pin 12 Ultrasonic

sensor pin Echo - Arduino PIN 12

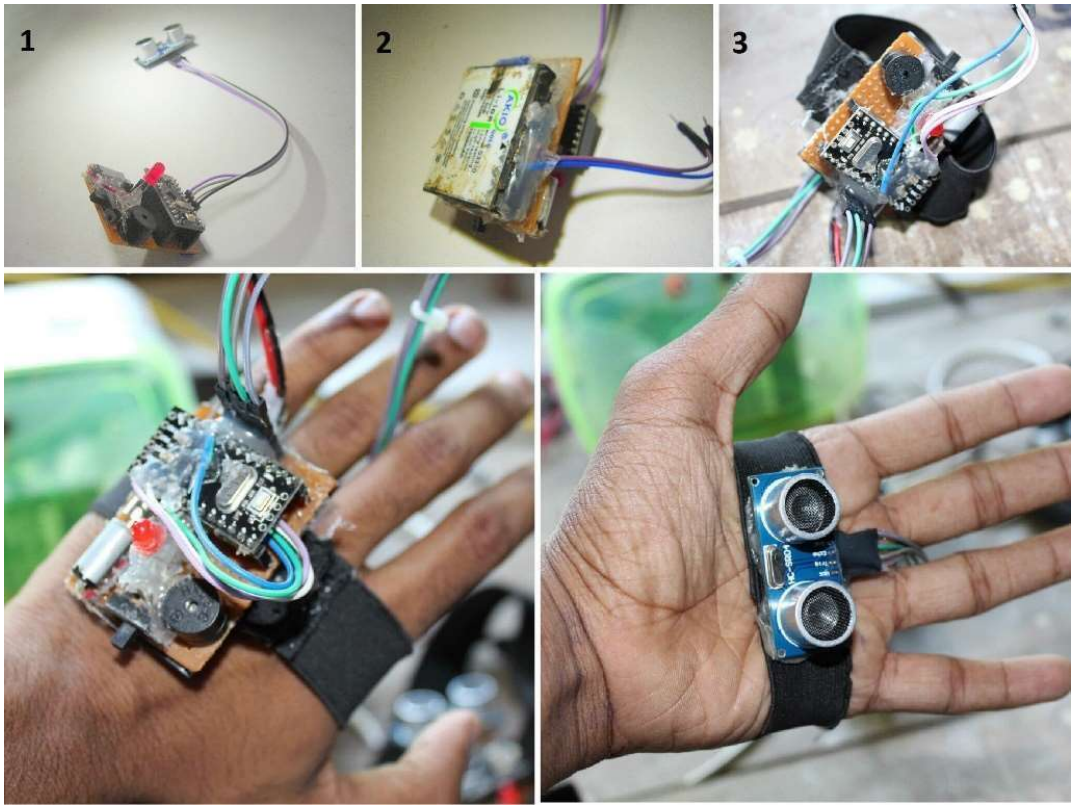
The switch used here is for selecting the mode. (buzzer or vibration mode.)

Step:02 Making the Modules



1. First cut the pref board in 5 X 3 cm dimensions and solder the female headers for the Arduino to the board.
2. Then solder the buzzer.
3. Then connect the vibrating motor using the glue gun and solder wires to it.
4. Then connect the LED.
5. Then connect the switch.
6. Then connect header pins for ultrasonic sensors and for battery input.
7. Then solder everything as shown in the circuit diagram.
8. Now connect the Arduino and ultrasonic sensor to the board.

Step:03 Code + Making the Module for the Hand



1. Connect the ultrasonic sensor to the board by using 4 jumper cables.
2. Then connect a 3.7-volt mobile battery to this module.
3. Then connect the elastic band as shown in the figure.

5.2 IMPLEMENTATION DETAILS

This proposed system consists the equipment like Arduino mini pro, ultrasonic sensor, pref board, vibrating motor, buzzers for detecting obstacles and letting the user know about the obstacle, Red LEDs, Switches, Jumper cable, power bank, Male and female header pins, 3.3-volt old mobile battery which is unused or discarded, some elastic and stickers to make the device wearable as a band for wearing for the users. The wiring of the device is done in the following manner. 27 The Ground of the LED, buzzer, and vibration motor are connected to the GND of the Arduino. The +ve of the LED and the middle leg of a switch are connected to the Arduino pin 5. The +ve of the Buzzer is wired to the first leg of the switch and the +ve of the Vibration motor is wired to the third leg of the switch. The Ultrasonic sensors are wired accordingly.

The Ultrasonic sensor pin VCC is connected to the Arduino pin VCC, the Ultrasonic sensor pin GND is connected to the Arduino pin GND, the Ultrasonic sensor pin Trig is attached to the Arduino pin 12, the Ultrasonic sensor pin Echo is connected to the Arduino PIN 12. The switch used here is for selecting the mode. (Buzzer or vibration mode.) We first cut the pref board in 5 X 3 cm dimensions and soldered the female headers for the Arduino to the board. Then soldering of the buzzer is carried out. Then using the glue connect the vibrating motor and solder the wires to it. Then connection of the LED is done. Then connect the switch. Connect the header pins for ultrasonic sensors and for the battery input. Then solder all the things and connect the Arduino and ultrasonic sensor to the board. Also, connect the elastic band to all the modules. For making the module for the hand, connect the ultrasonic sensor to the board by using 4 jumper cables. Then connect a 3.7 volt mobile battery to this module. Then connect the elastic band. In the end, after all the connections are done to the Arduino board, upload the code to each Arduino board and power the 4 other modules using a power bank. The US sensor is a transducer and is used in pairs as a transceiver.

The transmitter emits the US waves and if obstacles are present in the path, the US waves hit the obstacles and get reflected back, and the reflected wave is received by the receiver. The US sensor is a combination of one transmitter and receiver. The time interval between the sending and receiving of the US signal is calculated, this time interval is used to calculate the distance between the sensor and the obstacle. The sensors that are placed in the waist belt are in such a manner that the Ultrasonic pulses of sensors must not overlap one over the other.

Sensors have a field of view (coverage) of about 60 degrees for 4 feet distance, as the distance from the sensor increases, the coverage angle 28 decreases. Thus, the objective is to cover a wide angle to detect the obstacles with the help of the ultrasonic sensors to help the blind and make it easy for them to move around easily without any hassle. Hence, the distance calculation is calculated the sensor detects and the further procedure of the buzz sound to the user is carried out.

Thus, this way Third Eye for Blind will be designed for visually impaired people and will make it very easy and convenient as it will be a wearable device and thus will help the user in traveling and detecting the obstacles while walking very easily.

CHAPTER 06

6.1 SYSTEM TESTING

6.1.1 TEST CASES

6.1.1.1 Test Case

- Objective: Verify that the sensor can accurately measure the distance to a nearby object.
- Steps:
    1. Place the sensor at a known distance from a nearby object.
    2. Take a measurement of the distance to the object.
    3. Compare the measured distance to the known distance.

Expected Result: The measured distance should be within a reasonable margin of error of the known distance.

6.1.1.2 Test Case

- Objective: Verify that the sensor can detect objects at different distances.
- Steps:
    1. Place the sensor at a variety of distances from a nearby object.
    2. Take measurements of the distance to the object at each distance.
    3. Compare the measured distances to each other.

Expected Result: The measured distances should decrease as the distance between the sensor and the object decreases.

6.1.1.3 Test Case

- Objective: Verify that the sensor can detect objects in different environments.
- Steps:
    1. Place the sensor in a variety of environments, such as indoors, outdoors, and in noisy environments.

2. Take measurements of the distance to a nearby object in each environment.
3. Compare the measured distances to each other.

Expected Result: The measured distances should be similar in each environment.

6.1.1.4 Test Case

- Objective: Verify that the sensor can detect objects of different shapes and sizes.
- Steps:
    1. Place the sensor in front of a variety of objects of different shapes and sizes.
    2. Take measurements of the distance to each object.
    3. Compare the measured distances to each other.

Expected Result: The measured distances should be different for objects of different shapes and sizes.

6.1.1.5 Test Case

- Objective: Verify that the sensor can be used to create a haptic feedback system.
- Steps:
    1. Connect the sensor to a haptic feedback device.
    2. Place the sensor in front of a nearby object.
    3. Observe the haptic feedback provided by the device.

Expected Result: The haptic feedback should increase in intensity as the distance between the sensor and the object decreases.

6.1.2 UNIT TESTING

In the context of this code, unit testing would involve creating individual tests for each of the conditional statements in the loop() function. For example, one test could be created to ensure that the buzzer is turned on when the distance to the object is between 100 and 70 centimeters. Another test could be created to ensure that the buzzer is turned on with a shorter delay when the distance to the object is between 10 and 5 centimeters.

To create a unit test, a developer would typically use a unit testing framework such as JUnit or pytest. These frameworks provide a number of features that make it easier to write and execute unit tests.

Once a unit test has been created, it can be executed to verify that the code is working correctly. If the unit test fails, the developer will need to investigate the cause of the failure and fix the code.

By writing unit tests, developers can ensure that their code is working correctly. Unit tests can also be used to identify and fix bugs before they are released to production.

In the case of the code snippet you provided, the following unit tests could be created:

- Test that the buzzer is turned on when the distance to the object is between 100 and 70 centimeters.
- Test that the buzzer is turned on with a shorter delay when the distance to the object is between 80 and 50 centimeters.
- Test that the buzzer is turned on with an even shorter delay when the distance to the object is between 50 and 30 centimeters.
- Test that the buzzer is turned on with an even shorter delay when the distance to the object is between 30 and 20 centimeters.
- Test that the buzzer is turned on with an even shorter delay when the distance to the object is between 20 and 10 centimeters.
- Test that the buzzer is turned on with an even shorter delay when the distance to the object is between 10 and 5 centimeters.
- Test that the buzzer is turned on with the shortest delay when the distance to the object is between 5 and 1 centimeters.
- Test that the buzzer is turned off when the distance to the object is greater than 100 centimeters.

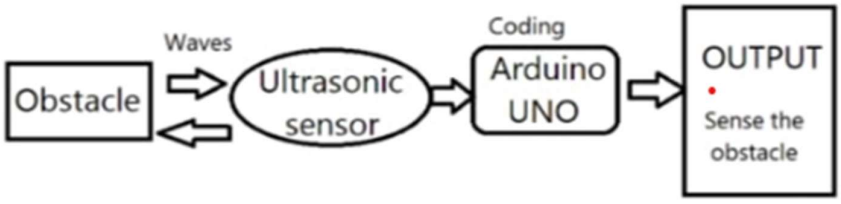
6.1.3 VALIDATION

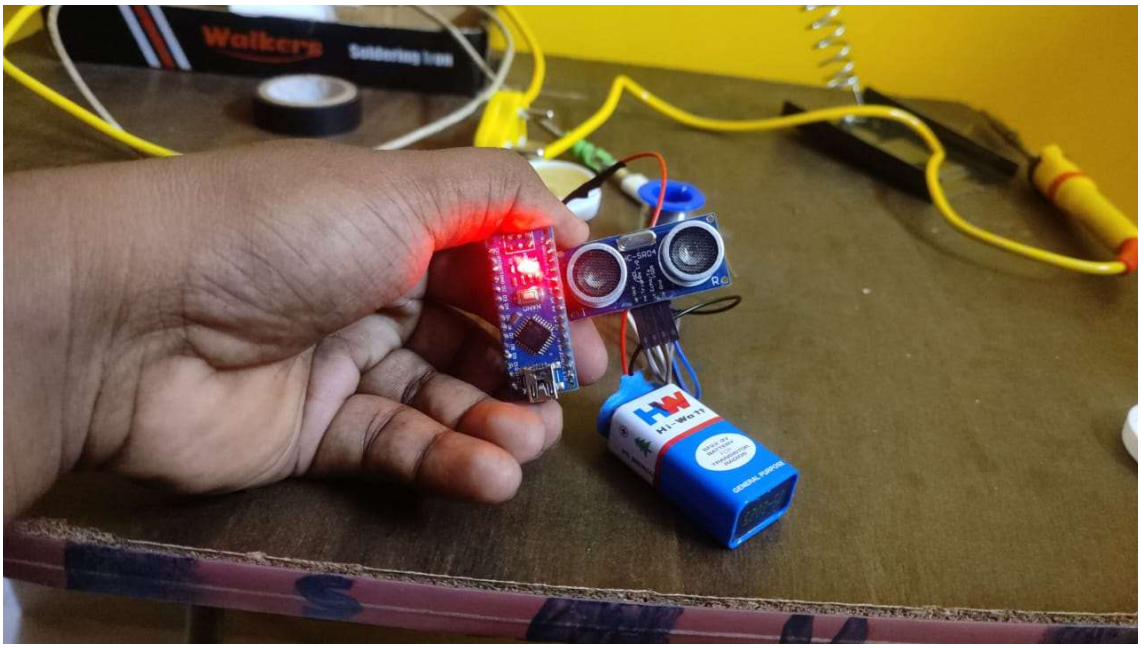
Validation is the process of ensuring that a product, service, or system meets its intended requirements. In the context of the Third Eye Ultrasonic Sensor, validation would involve testing the sensor to ensure that it meets the following requirements:

- Accuracy: The sensor must be able to accurately measure the distance to nearby objects.
- Reliability: The sensor must be able to operate reliably in a variety of environments.
- Usability: The sensor must be easy to use and understand for blind and visually impaired individuals.

To validate the Third Eye Ultrasonic Sensor, the following tests could be conducted:

- Accuracy tests: The sensor could be tested against a known distance to ensure that it is able to accurately measure the distance to objects.
- Reliability tests: The sensor could be tested in a variety of environments, such as indoors, outdoors, and in noisy conditions, to ensure that it is able to operate reliably.
- Usability tests: The sensor could be tested with blind and visually impaired individuals to ensure that it is easy to use and understand.




Walkers
Soldering Iron

CHAPTER 7

7.1 CODING

```
#define trigPin 12
#define echoPin 11
int Buzzer = 8;
int duration, distance;

void setup() {
        Serial.begin (9600);

        pinMode(trigPin, OUTPUT);
        pinMode(echoPin, INPUT);
        pinMode(Buzzer, OUTPUT);

}

void loop() {

    digitalWrite(trigPin, HIGH);
    delayMicroseconds(1000);
    digitalWrite(trigPin, LOW);
    duration = pulseIn(echoPin, HIGH);
    distance = (duration/2) / 29.1;

  if (distance <= 100 && distance >= 70)
        {
         Serial.println("object detected \n");
        Serial.print("distance= ");
        analogWrite(Buzzer,0);
        delay (500) ;
```

```
analogWrite(Buzzer,255);
delay (5000) ;
}

 else if (distance <= 80 && distance >= 50)
{
 Serial.println("object detected \n");
Serial.print("distance= ");
analogWrite(Buzzer,0);
delay (450) ;
analogWrite(Buzzer,255);
delay (450) ;
}

 else if (distance <= 50 && distance >= 30)
{
 Serial.println("object detected \n");
Serial.print("distance= ");
analogWrite(Buzzer,0);
delay (250) ;
analogWrite(Buzzer,255);
delay (250) ;

}
   else if (distance <= 30 && distance >= 20)
{
 Serial.println("object detected \n");
Serial.print("distance= ");
analogWrite(Buzzer,0);
delay (150) ;
analogWrite(Buzzer,255);
delay (150) ;
```

```
}

   else if (distance <= 20 && distance >= 10)
{
 Serial.println("object detected \n");
Serial.print("distance= ");
analogWrite(Buzzer,0);
delay (100) ;
analogWrite(Buzzer,255);
delay (100) ;



}

else if (distance <= 10 && distance > 5)
{
 Serial.println("object detected \n");
Serial.print("distance= ");
analogWrite(Buzzer,0);
delay (50) ;
analogWrite(Buzzer,255);
delay (50) ;



}

else if (distance <= 5 && distance >= 1)
{
 Serial.println("object detected \n");
```

```
        Serial.print("distance= ");
        analogWrite(Buzzer,0);
        delay (10) ;
        analogWrite(Buzzer,255);
        delay (10) ;
        }
  else
     Serial.println("object detected \n");
        Serial.print("distance= ");
        Serial.print(distance);
        analogWrite(Buzzer,255);
  {
}
}
```

CHAPTER 08

8.1 CONCLUSION

The primary purpose of this study is to produce a prototype for blind people that can detect objects or obstacles even in motion in front of users and feed warning back, in the form of buzz and vibration, to users. A combination of ultrasonic sensors and Arduino UNO functions are used to detect obstacles. The proposed prototype was designed and verified. Now it is used for blind people to facilitate movement and increase safety.

8.2 FUTURE ENHANCEMENT

The wearable technology for blinds resolves the existing technical problems. Nowadays, there are many instruments and intelligent devices for visually impaired people for navigation. Still, most of them have specific issues with carrying, and the major drawbacks are those that need a lot of training to use. One of the main peculiarities of this innovation is that it is affordable for everyone. There are no such devices available in the market that can be worn like cloth and have such a low cost and simplicity. When used on a large scale, with improvements in the prototype, it will drastically benefit the community.

The prototype device has the following features:

- ➢ It is a wearable technology for blinds.
- ➢ It uses ultrasonic waves to detect obstacles.
- ➢ It notifies the blocks/ obstacle by vibrations and a buzzer sound.

CHAPTER 09

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