INDIAN INSTITUTE OF INFORMATION TECHNOLOGY BHOPAL

MAJOR PROJECT

ON

THIRD EYE FOR THE BLIND

SUBMITTED IN PARTIAL FULFILLMENT FOR THE DEGREE OF BACHELOR OF TECHNOLOGY

SUBMITTED BY:-	**SUBMITTED TO:-**	**UNDER THE GUIDANCE OF:-**
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SESSION 2020-2021

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY BHOPAL

DEPARTMENT OF ELECTRONICS AND COMMUNICATIONS ENGINEERING

CERTIFICATE

This is to certify that **Anubhav Singh (17U01011), Ashutosh Pathak (17U01018) & Jai Mehta (17U01031)** students of B.Tech 4th year **(ELECTRONICS AND COMMUNICATIONS ENGINEERING)**, have successfully completed their project "**THIRD EYE FOR THE BLIND**" in partial fulfilment of their major project in Electronics And Communications Engineering.

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(Project Coordinator)

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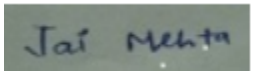
DECLARATION

We, hereby, declare that the following report which is being presented in the Major Project **"THIRD EYE FOR THE BLIND"** is the partial fulfilment of the requirements of the fourth year (seventh semester) Major Project in the field of **ELECTRONICS AND COMMUNICATIONS ENGINEERING**. It is an authentic documentation of our original work carried out under the guidance of **Dr. Bhupendra Singh Kirar** and the dedicated co-ordination of **Dr. Afreen Khursheed**. The work has been carried out entirely at **Indian Institute of Information Technology Bhopal**. The following project and its report, in part or whole, has not been presented or submitted by us for any purpose in any other institute or organization.

We, hereby, declare that the facts mentioned above are true to best of our knowledge. In case of any unlikely discrepancy that may possibly occur, we will be the ones to take responsibility.

Anubhav Singh (17U01011) **Ashutosh Pathak (17U01018)** **Jai Mehta(17U01031)**





AREA OF WORK

Third eye for blind is a wearable device that can help the visually impaired people to move by themselves in a indoor environment. This reduces the work on people who are assisting the blind. Furthermore it also provides an opportunity for visually impaired persons to move from one place to another independently. Technology has been developing a lot these days and people are showing interest in them. This device is helpful especially when the person wants to move around a house or some indoor places by themselves. In this device, the distance of the obstacle is determined by using a Ultrasonic module and a Microcontroller. The obstacle distance is measured and informed to the visually impaired person in the form of a buzzer and vibrations. The person can move in other directions and avoid collisions using this. This project used only the microcontroller instead of using a whole Arduino board, so the size of the device is reduced to a large extent and the cost is also minimized. End results of the work would be a gloves with a wearable band attached to the gloves to which all the components are connected on a PCB, which works with high degree of accuracy and reliability.

ACKNOWLEDGEMENT

With due respect, we express our deep sense of gratitude to our respected guide **Dr. Bhupendra Singh Kirar** for his invaluable support and guidance. We are thankful for the encouragement that he has given us in completing this project successfully. His rigorous evaluation and constructive criticism was of great assistance.

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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 peculiarity of this device is that it will be affordable. The Arduino Pro Mini 328-15/16 MHz board is worn like a device. 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.

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INTRODUCTION

1.1 Existing System

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. Navbelt,an obstacle avoidance wearable portable computer which is only for indoor navigation was developed. 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. Time and again there have been innovations in the wearable technologies for the blind. The field of Biomedical Robotics has been around for a really long time now. Out of the many gloves developed for the blind, one of the most convincing designs is that of an electronic glove for both, the blind and the deaf. The design here makes use of LCD screens and gestures for conveying ideas to the deaf. The cost associated with this design is definitely low. However, this cost can be significantly reduced further by designing a separate glove altogether exclusively for the blind which would plummet the cost by a large extent by getting rid of the concept of displaying gestures on screens. Another design, makes use of only the vibrational motor sans the buzzer mechanism that is used in the design presented in this paper. The effect of a combination of a beeping sound and a vibration is more impactful than only vibrations. Another Visual Impairment Aid, makes use of a similar concept. We have tried to build on this existing glove by making it less complex and easily constructible so as to be marketed on a large scale. The glove presented in this also happens to be much cheaper than the Visual Impairment Aid with little to no depreciation in its performance.

1.1.1 Introduction

Third eye for blind is a wearable device that can help the visually impaired people to move by themselves in a indoor environment. This reduces the work on people who are assisting the blind. Furthermore it also provides an opportunity for visually impaired persons to move from one place to another independently. Technology has been developing a lot these days and people are showing interest in them. This device is helpful especially when the person wants to move around a house or some indoor places by themselves. In this device, the distance of the obstacle is determined by using a Ultrasonic module and a Microcontroller. The obstacle distance is measured and informed to the visually impaired person in the form of a buzzer and vibrations. The person can move in other directions and avoid collisions using this. This project used only the microcontroller instead of using a whole Arduino board, so the size of the device is reduced to a large extent and the cost is also minimized. End results of the work would be a gloves with a wearable band attached to the gloves to which all the components are connected on a PCB, which works with high degree of accuracy and reliability.

1.1.2 Proposed System

The objective of this project 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. This project is an innovative one 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. Thus the aim of the project 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 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 project 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 waves fascicle to identify the 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 person 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. The existing system consists of the devices or the supports like white cane for helping them to detect the obstacles and travel to places, pet dogs, smart devices like vision a torch for blinds. But, there were many limitations and problems in this existing systems like in the white cane, it may easily break or crack. The white cane may get stuck at the pavement cracks of the different objects. Whereas the pet dogs cost is huge and need a lot of training. In the proposed system, the design is based on a special wearable device based on the Arduino board which can be worn like a cloth for blinds or a band. This device is equipped with ultrasonic sensor. By wearing this

device, they can fully avoid the use of the 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 wear the device as a band or like a cloth and it can function very accurately and they only need a very little training to use it as it is quite simple, efficient and easy to operate and wear.

Chapter 2

LITERATURE REVIEW

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 analysing 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.

Chapter 3

METHODOLOGY AND WORK

DESCRIPTION

3.1 BLOCK DIAGRAM:

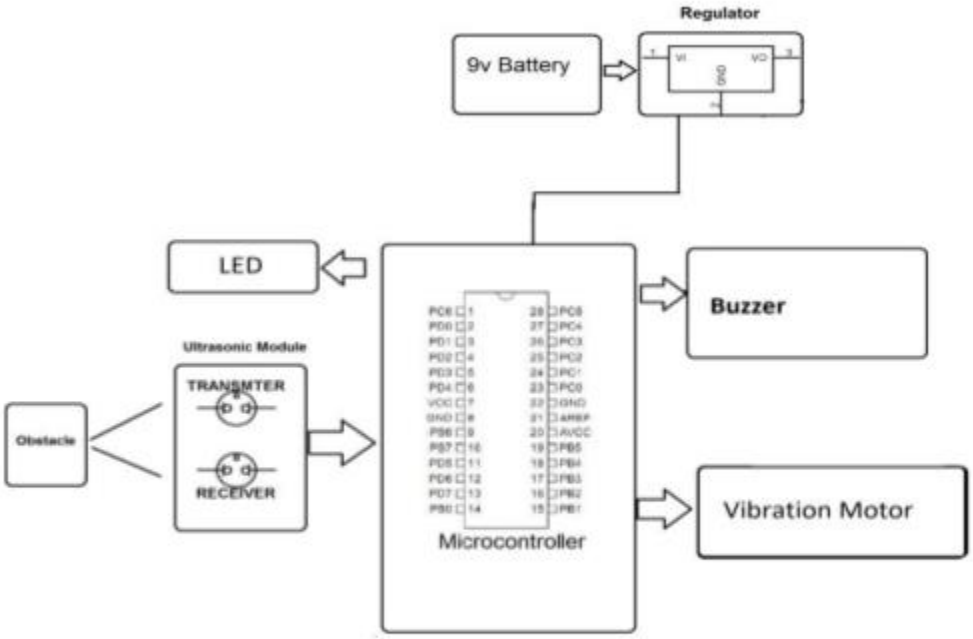

Figure 1: Block diagram

As the blind person needs to know that there is an obstacle infront of him, an Ultrasonic sensor module is used to detect the obstacles. It is a transceiver which works on the principle of sonar. It transmits a high frequency sound wave signal for every 10µs. This sound signal hits the obstacle and gets reflected which is called as an echo. The duration for which this echo signal goes high is known through the echo pin of Ultrasonic module which in turn is connected to the microcontroller. The microcontroller used here is ATmega328P which is used to calculate the distance by the duration obtained from the echo pulse. The duration which is known through the echo signal covers the duration from the ultrasonic module to the obstacle and from obstacle to the ultrasonic module. So, it is divided by 2 and multiplied by the speed of the sound waves (340m/s) to get the original distance. Based on the distance, we could see the output. This entire processing is done by the microcontroller used here. 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.

There are 3 output indicators here which are LED, Buzzer and Vibration Motor. These are programmed such that their output depends upon the calculated distance. For example, the buzzer buzzes rapidly when the person moves more closer towards the obstacle and it buzzes less frequently when the person is a bit far from the obstacle. Similar is the case of LED and Vibration motor. LED blinks with more delay when the person is nearer to obstacle and it blinks with less delay when he is moving away from the obstacle in the backwards direction. Distance could be set as per the choice of the user. A limit to the distance is managed after which there won't be any of the 3 outputs seen. But one should remember that the ultrasonic sensor module used here is 3 cm to 300 cm. A regulator is being used so as to meet the specifications of the components provided in the datasheet. The regulator used is the 7805 regulator to provide 5v constant voltage.

Chapter 4
TOOLS AND TECHNOLOGY USED

1. **Arduino nano:**
   Arduino Nano is one type of microcontroller board, and it is designed by Arduino.cc. It can be built with a microcontroller like Atmega328. This microcontroller is also used in Arduino UNO. It is a small size board and also flexible with a wide variety of applications. This board has many functions and features like an Arduino Duemilanove board. However, this Nano board is different in packaging. It doesn't have any DC jack so that the power supply can be given using a small USB port otherwise straightly connected to the pins like VCC & GND. This board can be supplied with 6 to 20volts using a mini USB port on the board.

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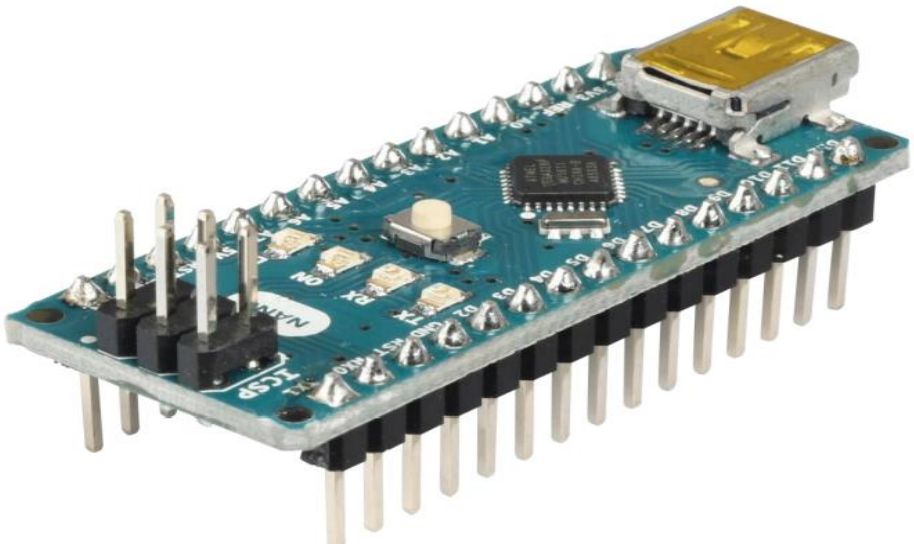


1 Atmega328P :

The Atmel Atmega328P is a 32K 8-bit microcontroller based on the AVR architecture. Many instructions are executed in a single clock cycle providing a throughput of almost 20 MIPS at 20MHz. The ATMEGA328-PU comes in an PDIP 28 pin package and is suitable for use on our 28 pin AVR Development Board. The computer on one hand is designed to perform all the general purpose tasks on a single machine like you can use a computer to run a software to perform calculations or you can use a computer to store some multimedia file or to access internet through the browser, whereas the microcontrollers are meant to perform only the specific tasks, for e.g., switching the AC off automatically when room temperature drops to a certain defined limit and again turning it ON when temperature rises above the defined limit. There are number of popular families of microcontrollers which are used in different applications as per their capability and feasibility to perform the desired task, most common of these are 8051, AVR and PIC microcontrollers. In this we will introduce you with AVR family of microcontrollers.

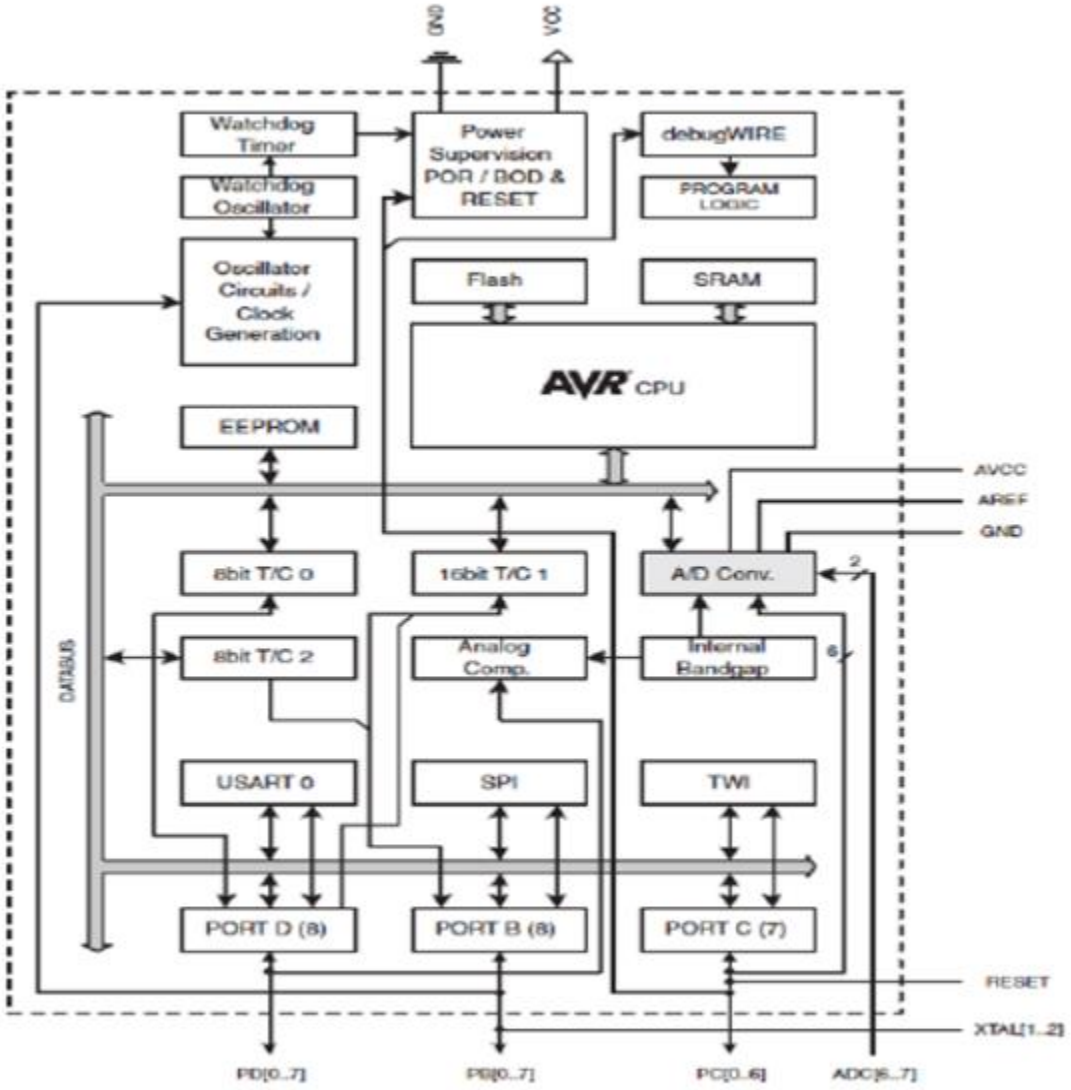


Figure 3: Atmega 328P architecture

1 Ultrasonic Sensor HC-SR04 :

Ultrasonic sensor provides a very low-cost and easy method of distance measurement. This sensor is perfect for any number of applications that require you to perform measurements between moving or stationary objects. Naturally, robotics applications are very popular but you'll also find this product to be useful in security systems or as an infrared replacement if so desired. You will definitely appreciate the activity status LED and the economic use of just one I/O pin. The ultrasonic sensor measures distance using sonar; an ultrasonic (well above human hearing) pulse is transmitted from the unit and distance-to-target is determined by measuring the time required for the echo return. Output from the ultrasonic sensor is a variable-width pulse that corresponds to the distance to the target.

Figure 4: Ultrasonic sensor

2 Vibration Motor:

The Eccentric Rotating Mass vibration motor, or ERM, also known as a pager motor is a DC motor with an offset (non-symmetric) mass attached to the shaft. As the ERM rotates, the centripetal force of the offset mass is asymmetric, resulting in a net centrifugal force, and this causes a displacement of the motor. With a high number of revolutions per minute, the motor is constantly being displaced and moved by these asymmetric forces. It is this repeated displacement that is perceived as a vibration. The vibration produced by ERMs is an example of "Driven Harmonic Vibration". This means there is an external driving force causing the system to vibrate, and this is also sometimes called forced vibration. The term 'harmonic' means that the system is forced to vibrate at the frequency of the excitation. It is important to remember that in the case of the ERM model, the excitation input is not the DC voltage applied to the motor. Instead, it is the rotation of the mass around the central motor shaft.

Figure 5: ERM motor

3 Buzzer:

Buzzer consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound.

Figure 6: Buzzer

4 Voltage Regulator 7805 :

The LM78XX/LM78XXA series of three-terminal positive regulators are available in the TO220/D-PAK package and with several fixed output voltages, making them useful in a Wide range of applications. Each type employs internal current limiting, thermal shutdown and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output Current. Although

designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

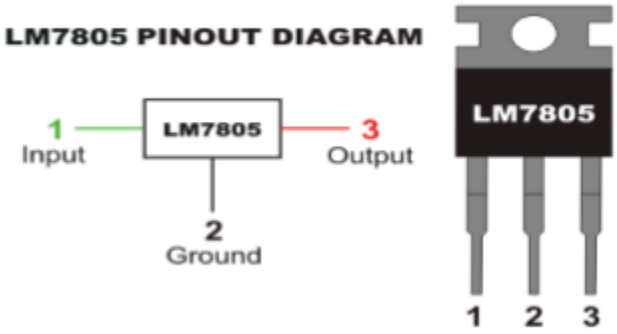


Figure 7: Voltage regulator 7805

5 Push Button:

A push-button (also spelled pushbutton) or simply button is a simple switch mechanism for controlling some aspect of a machine or a process. Buttons are typically made out of hard material, usually plastic or metal. The surface is usually flat or shaped to accommodate the human finger or hand, so as to be easily depressed or pushed. Buttons are most often biased switches, though even many un-biased buttons (due to their physical nature) require a spring to return to their un-pushed state. Different people use different terms for the "pushing" of the button, such as press, depress, mash, and punch.

Figure 8: Push Button

Chapter 5

CONCLUSION

RESULT:

THE presented system is designed and configured for the use of the blind and visually disabled people. This device is able to handle several states that the visually impaired people face. This device responds to the user in all the circumstances which is faced by the blind people with the help of the use of the Ultrasonic sensors and the Arduino Board.

Case 1: When the obstacle or the object is in the left it will tell the user that: The obstacle is in left

Case 2: When the obstacle is in right it will say: The obstacle in right.

Case 3: When the obstacle is in front, the device will say: the obstacle is in front. Similarly for all the directions like left, right, back etc it will notify the user wearing it..

Thus, this project proposed the design and architecture of a new concept of Arduino based Virtual Eye for the blind people. A simple, cheap, efficient, easy to carry, configurable, easy to handle electronic guidance system with many more amazing properties and advantages is proposed to provide constructive assistant and support for the blind and visually impaired persons. The system will be efficient and unique in its capability in specifying the source and distance of the objects that may encounter the blind. It is able to scan and detect the obstacles in the areas like left, right, and in front of the blind person regardless of its height or depth. With the proposed architecture, if constructed with at most accuracy, the blind will be able to move from one place to another without others help. The project as a whole was successful in developing a more durable navigation technique apart from the existing ones. This was just a prototype of the original idea that had to be presented here. The project, if used on a wider scale and distributed to blind people, really has the ability to make an impact to the community.

Chapter 6

FUTURE SCOPE

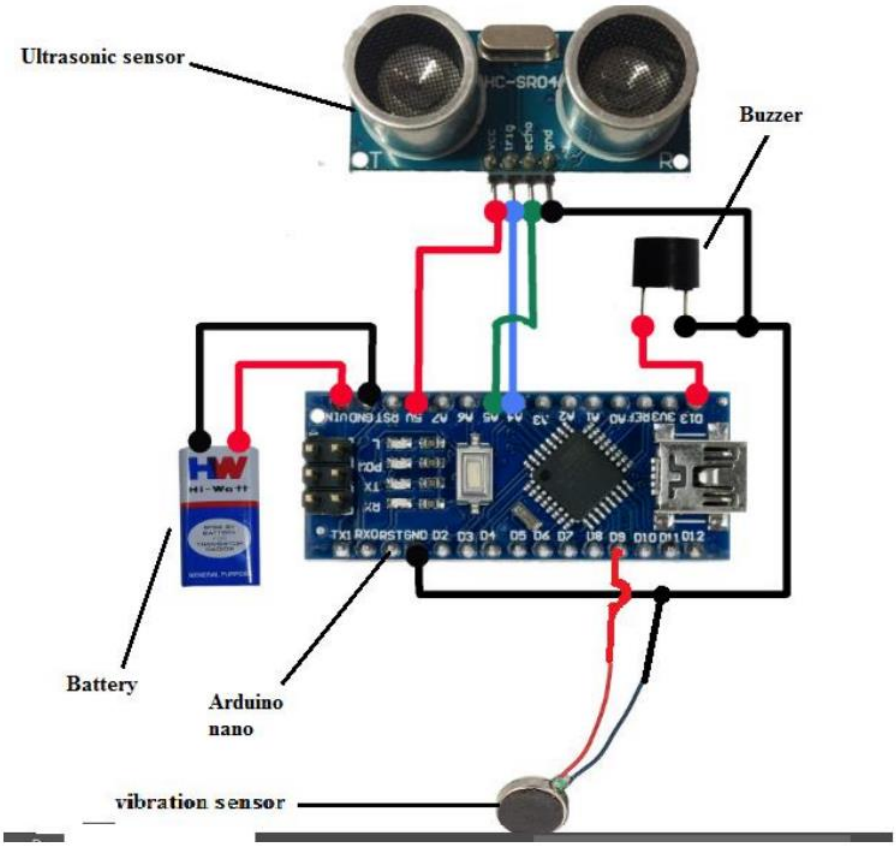
Blind people need constant assistance to do their daily chores. The Third Eye for Blind is a device helpful for the blind to do their work independently in an indoor environment. It is developed to help the blind to overcome the lack of visual sense by using other senses like sound and touch. A combination of a microcontroller Atmega 328P and an Ultrasonic sensor HC-SR04 are used as inputs to calculate the distance of the obstacle from the blind person and another combination of vibrator motor and buzzer are used to indicate the person about the obstacle. Thus, an Ultrasonic Sensor is used to detect the obstacle which is very efficient and accurate. The removable microcontroller ATmega328p from an Arduino Uno is used for processing the duration obtained from the Ultrasonic sensor and finally, output is received through three devices LED, Buzzer and Vibrator motor in the form of sound and touch. Thus, a simple, cheap, efficient, easy to carry, configurable, easy to handle electronic guidance system is developed to provide constructive assistance for the blind. With this system, if constructed with at-most accuracy, the blind people will be able to move without others help.

The entire project can be made in the form of jacket, so that the device doesn't need to be wear one by one. By specifically suing the specialized boards that are designed, using them instead of Arduino and also by using high quality ultrasonic sensors makes and gives faster response which make the device capable of working in crowded places and thus this will be implemented in the future enhancement of this device.

APPENDIX

Code in Arduino :

```
const int pingTrigPin = A4; //Trigger connected to PIN 7
const int pingEchoPin = A5; //Echo connected yo PIN 8
 int buz=13; //Buzzer to PIN 4
 int buz1=9;
void setup()
 {
Serial.begin(9600); pinMode(buz, OUTPUT);
 pinMode(buz1, OUTPUT);
 }
void loop()
 {
 long duration, cm;
pinMode(pingTrigPin, OUTPUT);
 digitalWrite(pingTrigPin, LOW);
 delayMicroseconds(2);
digitalWrite(pingTrigPin, HIGH);
 delayMicroseconds(5);
digitalWrite(pingTrigPin, LOW);
 pinMode(pingEchoPin, INPUT);
 duration = pulseIn(pingEchoPin, HIGH);
 cm = microsecondsToCentimeters(duration);
if(cm<=100 && cm>0)
 {
 int d= map(cm, 1, 100, 20, 2000); digitalWrite(buz, HIGH);
 digitalWrite(buz1, HIGH);
delay(50);
 digitalWrite(buz, LOW);
 digitalWrite(buz1, LOW);
 delay(d);
 }
 Serial.print(cm);
Serial.print("cm");
 Serial.println();
 delay(40);
 }
 long microsecondsToCentimeters(long microseconds)
 { return microseconds / 29 / 2; }
```


Ultrasonic sensor
Buzzer
Battery
Arduino
nano
vibration sensor

REFERENCES

1. Shraga Shovel, Iwan Ulrich, Johann Borenstien. Nav Belt and the Guide Cane, IEEE Transactions on Robotics & Automation. 2003; 10(1):9-20.
2. Yuan D, Manduchi R. Dynamic Environment Exploration Using a Virtual White Cane, Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR), University of California, Santa Cruz, 2005, 1-7.
3. Benjamin JM, Ali NA, Schepis AF. A laser cane for the blind", Proceedings of San Diego Medical Symposium, 1973, 443-450.
4. Sabarish S. Navigation Tool for Visually Challenged using Microcontroller, International Journal of Engineering and Advanced Technology (IJEAT), 2013; 2(4):139-143.
5. Espinosa MA, Ungar S, Ochaíta E. Blades comparing methods for Introducing Blind and Visually Impaired People to unfamiliar urban environments., Journal of Environmental psychology. 1998; 18:277-287.
6. Pooja Sharma, Shimi SL, Chatterji S. A Review on Obstacle Detection and Vision, International Journal of Science and Research Technology. 2015; 4(1):1-11.