Smart Walking Stick for Blind People Using Ultrasonic Sensor



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Letter of Transmittal

17th January, 2020

To

The Supervisor

Department of EEE

Sonargaon University,

147/I, Panthapath, Dhaka.

Subject: Submission of Project report.

Dear Sir,

Please find enclosed the project report entitled "**Smart Walking Stick for Blind People Using Ultrasonic Sensor ".** The study has been carried out in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical & Electronic Engineering.

In carrying out the study, we have followed supervisor's advice and collected required information from several text books, reference books, web sites and other sources. We think you will find it useful and informative. We would be glad to furnish you further explanations or clarifications if required.

Sincerely yours,

Md. Sanzid Gazi
Md. Rubel Rana
Md. Anisur Rahman
Md. Mahmudul Hasan
Md. Parvez Hossain

Declaration

It is declared hereby that this thesis paper or any part of it has not been submitted to anywhere else for the award of any degree.

.....	….....
Md. Sanzid Gazi	**Md. Rubel Rana**
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Certification

This is to certify that this project entitled "**Smart Walking Stick for Blind People Using Ultrasonic Sensor**" is done by the following students under my direct supervision. This project work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering, Sonargaon University (SU) in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering.

Supervisor

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Dipayan Saha

Lecturer

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ACKNOWLEDGEMENT

The report titled as on **Smart Walking Stick for Blind People Using Ultrasonic Sensor**"has been prepared to fulfill the requirement of our practicum program. In the process of doing and preparing our practicum report, we would like to pay our gratitude to some persons for their enormous help and vast co-operation.

At first, we would like to show our gratitude to the University authority to permit us to do our practicum.Specially, we would like to thank to our honorable teacher **Dipayan Saha,** Lecturer, Department of Electrical & Electronics Engineering, SU–Sonargaon University, Dhaka, for his valuable and patient advice, sympathetic assistance, co-operation, contribution of new idea.Deep theoretical and hardware knowledge & keen interest of our supervisor in this field influenced us to carry out this project. His endless patience, scholarly guidance,continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior draft and correcting them at all stage have made it possible to complete this project.

Finally, we would like to thanks again to the respected **Vice- Chancellor of SU, Professor Dr. Md. Abul Bashar** also thanks to **Head of Department of SU , Electrical & Electronics Engineering, Professor Dr. M. Bashir Uddin** because they are designated such an environment for learning through which we got the opportunity to acquire knowledge under Bsc in EEE program, and that will be very helpful for our prospective career.

We are, indeed, grateful to all those from whom we got sincere cooperation and help for the preparation of this report

ABSTRACT

Blind stick is an innovative stick designed for visually disabled people for improved navigation. We here propose an advanced blind stick that allows visually challenged people to navigate with ease using advanced technology. The blind stick is integrated with ultrasonic sensor along with light and water sensing. Our proposed project first uses ultrasonic sensors to detect obstacles ahead using ultrasonic waves. On sensing obstacles the sensor passes this data to the microcontroller. The microcontroller then processes this data and calculates if the obstacle is close enough. If the obstacle is not that close the circuit does nothing. If the obstacle is close the microcontroller sends a signal to sound a buzzer. It also detects and sounds a different buzzer if it where detects water and alerts the blind. One more feature is that it allows the blind to detect if there is light or darkness in the room. The system has one more advanced feature integrated to help the blind find their stick if they forget they kept it. A wireless RF based remote is used for this purpose. Pressing the remote button sounds a buzzer on the stick which helps the blind person to find their stick. Thus this system allows for obstacle detection as well as finding stick if misplaced by visually disabled people.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Visually impaired people are the people who finds it difficult to recognize the smallest detail with healthy eyes. Those who have the visual acuteness of 6/60 or the horizontal range of the visual field with both eyes open have less than or equal to 20 degrees. These people are regarded as blind. A survey by WHO (World Health Organization) carried out in 2011 estimates that in the world, about 1% of the human population is visually impaired (about 70 million people) and amongst them, about 10% are fully blind (about 7 million people) and 90% (about 63 million people) with low vision. The main problem with blind people is how to navigate their way to wherever they want to go. Such people need assistance from others with good eyesight. As described by WHO, 10% of the visually impaired have no functional eyesight at all to help them move around without assistance and safely. This study proposes a new technique for designing a smart stick to help visually impaired people that will provide them navigation. The conventional and archaic navigation aids for persons with visual impairments are the walking cane (also called white cane or stick) and guide dogs which are characterized by a many imperfections.

The most critical shortcomings of these aids include: essential skills and training phase, range of motion, and very insignificant information communicated been communicated. Our approach modified this cane with some electronics components and sensors, the electronic aiding devices are designed to solve such issues. The ultrasonic sensors, water sensor, buzzer, and RF transmitter/Receiver are used to record information about the presence of obstacles on the road. Ultrasonic sensor have the capacity to detect any obstacle within the distance range of 2cm-450cm. Therefore whenever there is an obstacle in this range it will alert the user. Water sensor is used to detect if there is water in path of the user. Most blind guidance systems use ultrasound because of its immunity to the environmental noise. With the rapid advances of modern technology both in hardware and software it has become easier to

provide intelligent navigation system to the visually impaired. Recently, much research effort have been focused on the design of Electronic Travel Aids (ETA) to aid the successful and free navigation of the blind. Also, high-end technological solutions have been introduced recently to help blind persons navigate independently. Another reason why ultrasonic is prevalent is that the technology is reasonably cheap. Moreover, ultrasound emitters and detectors are portable components that can be carried without the need for complex circuit. RF module will help the person to find the stick wherever it is placed. Whenever the user wants to locate it, such a person will press a button on remote control and buzzer will ring, then the person can get the idea of where the stick is placed.

Vision is the most important part of human physiology as 83% of information human being gets from the environment is via sight. The 2011 statistics by the World Health Organization (WHO) estimates that there are 70 million people in the world living with visual impairment, 7 million of which are blind and 63 million with low vision. The conventional and oldest mobility aids for persons with visual impairments are characterized with many limitations. Some inventions also require a separate power supply or navigator which makes the user carry it in a bag every time they travel outdoor. These bulky designs will definitely make the user to be exhausted. The objectives of this research work include: to design an assistive technology for visually impaired people that can detect obstacles and provides alternative routes for the blind; to alarm the user through vibration to determine the obstacles direction sources; and to help the user find his stick when he Research Article Volume 8 Issue No.8 International Journal of Engineering Science and Computing, cannot remember where is was kept. Several attempts have been made to design guard or obstacle avoidance devices for the blind using components with limited number of applications. This section will discuss some of these attempts and their shortcomings. For instance; proposed a Smart Walking Stick for Visually Impaired. The proposed method is a simple walking stick equipped with sensors to give information about the environment. pre-programmed locations allows the user to choose the optimal route to be taken. In the system, ultrasonic sensor, vibrator and battery were used.

The proposed system intended to provide low cost and efficient navigation aid for the blind which gives a sense of artificial vision by providing information about the environmental scenario of objects around them whilst providing real-time assistance via. The performance of

the prototype developed was evaluated with four obstaclescenario which are: Concrete wall, Human body, Cardboard box, and Plastic. The proposed solution is a moderate budget navigational aid for the visually impaired. The cost effectiveness of the proposed solution leads to compromises in performance. One of the drawbacks of their proposed method is that the capability of the prototype is limited as a visually impaired person can travel only to four locations using the stick. Also, the navigation system will need to convey information other than that needed for guidance, and it is not feasible to provide guidance information at high intermittencies. It did not provide the functionality for voice control using speech recognition. Other improvements that could have improved the proposed system include: Increasing the range of the ultrasonic sensor and implementing a technology for determining the speed of approaching obstacles. Synchronization with external memory to increase the number of routes stored. Synchronization with various navigation software applications available on the internet so that new, un-programmed destinations can also be chosen.



Figure 1.1: Ultrasonic working

1.2 Objective

The main objective is to help visually challenged people to navigate with ease using advance technology. In this technology controlled world, where people strive to live independently, this project proposes an ultrasonic stick for blind people to help them gain personal independence. Since this is economical and not bulky, one can make use of it easily

1.3 LITERATURE SURVEY

Voice operated outdoor navigation system for visually impaired persons done by Somnath and Ravi (2012). Uses a stick equipped with ultra-sonic sensors. The stick contains which will have SD memory card which used to store different locations. The user can set the location by will guide the person to his/her destination. This system will also provide the speed and the remaining distance to reach the destination. When the ultra-sonic sensors detect any obstacle directly the buzzer will activate the vibration motor. This system can be classified as a low cost system affordable by the user. The system uses the ARM processor which has more memory space, so that the operating speed is high. However, this system cannot operate indoors because there will be no signal . The accuracy to be improved because it only can be controlled within 5 meters radios. Finally, the blind person need to be trained on the system so that he or she can use it effectively. Shruit and Prof. A system done for using smart stick for blind people: obstacles detections, artificial vision and real time assistance via. This system operate , artificial vision system, obstacle detection.. This system also contains ultrasonic sensors to detect the obstacles. Furthermore, system is to reach the required destination. Once any obstacle is detected or the destination is reached the voice circuit will activate providing certain type of voice. All these sub systems are connected to microcontroller which control the entire operation of the system. This system can be classified as a low cost system. The accuracy of the artificial vision unit provides a high accuracy output for the user.

In addition to that, the detection distance of the system is 15 meters. However, the designing complexity of the system make it difficult to design and understand. Another study in the same field to help blind people uses the pulse echo technique in order to provide a warning sound when detecting the obstacles. This technique is used by the United States military for locating the submarines. They used pulse of ultrasound range from 21 KHz to 50 KHz which hit the hard surface to generate echo pulses. By calculating the difference between signals

transmit time and signal receiving time we can predict the distance between the user and the obstacles. This system is very sensitive interms of detecting the obstacles. It has a detection range up to 3 meters and a detection angle between 0 degree to 45 degree. However, this system require more power to operate because of the transmitter and receiver circuits. So, this system need to be redesigned to operate with less power consumption. another study done by for developing an intelligent guide stick for blind people used an intelligent CPU called MELDOG which uses artificial intelligence. It can identify the accurate position of obstacles using ultrasonic sensors and laser sensors. In order to identify the position the “map matching technique” was used by using the ultrasonic sensors. This system includes a DC motor controller which connected to the encoder. When the wheels rotate 18 degree the infrared sensors attached to both wheels will transmit the signal to the CPU in order to provide a location update. This system is an accurate detecting system can provide the user continuous update for detecting the obstacles with detection angle between 0 degree to 18 degree.

However, this system is expensive and is complex in designing. It is heavy compared to other similar system. The weight of the system is around 5.5 Kg. The detection distance for the system is very low which is around 87.5 cm to 105 cm. a study done by (Jayant, Pratik and Mita, 2012) proposed a smart cane assisted mobility for the visually impaired. The system is based on normal ultrasonic sensors and ATMEL microcontroller. It operates with two rechargeable battery(7.4v) it can be recharged using USB cable or AC adaptor. The control unit is programmed using ATMEL AVR microcontroller ATMEGA328P microcontroller. Once any obstacles are detected vibration and buzzer will start in order to warn the user. This system is a non-complex system to use. It has the ability to cover a distance up to 3 meters and has the rechargeable feature of the buttery. Also, this system can be International Journal of Engineering Science and Computing, folded in small piece so that the user can carry it easily. However, this system has only one direction detection coverage and it is inaccurate in detecting the obstacles. All the studies which had been reviewed shows that, there are many types of smart sticks for blind people and all of them uses different techniques to give the required assistance for the blind person. However, the studies shows that, using the ultrasonic sensors is an efficient solution to detect the obstacles with maximum range of 7 meters and 45 degree coverage. In addition to that, using a noncomplex microcontroller will help the blind person to use the devise (stick) easily and without any problems. Finally, the device should work for a long time with minimum power and it could be recharged. This system propose a

stick which uses ultrasonic sensors for detection and a microcontroller that controls the system without complexity. The detection angle is 180 degree. It is use a 12 volt lithium rechargeable battery. It is low cost and light weight system.

CHAPTER 2

PROJECT OVERVIEW

2.1 Block diagram

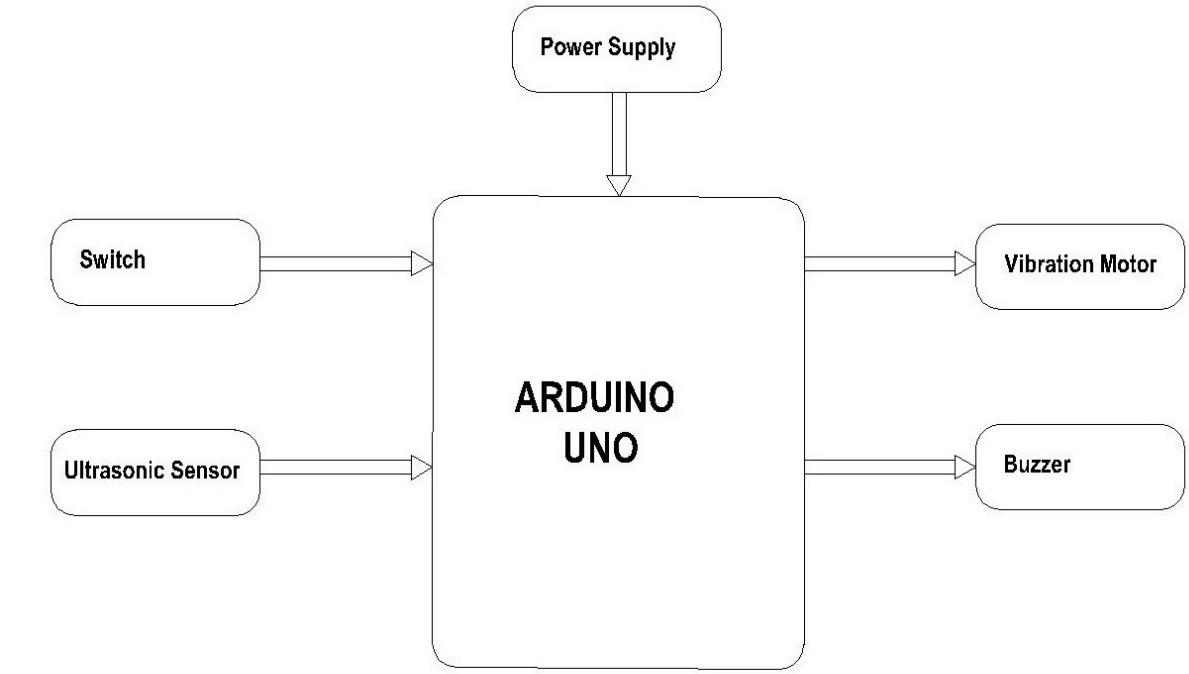


FIG – 2.1 BLOCK DIAGRAM OF THE PROJECT

The microcontroller then processes this data and calculates if the obstacle is close enough. If the obstacle is not that close the circuit does nothing. If the obstacle is close the microcontroller sensor a signal to sound a buzzer. It also detects and sounds a different buzzer if it where detects water and alerts the blind. He block diagram of safety stick for blind people contains Power Supply,Crystal Oscillator, Reset Circuit, and Ultrasonic Sensor & Buzzer as shown in *t*he AT89S52 is a low-power, high-performance CMOS 8-bit microcontrollerwith 8K bytes of in-system programmable Flash memory. The device ismanufactured Mistreatment Atmel's high-density nonvolatile memorytechnology and is compatible with the industry-standard 80C51 instruction setand pin out. The on -chip Flash allows the program memory to bereprogrammed in-system or by a Typical nonvolatile memory pro-grammar.

Bycombining a versatile 8-bit CPU with in-system programmable Flash on amonolithic chip, the Atmel AT89S52 isa

Powerful microcontroller which provides a highly-flexible andefficient resolution to several embedded management applications.

When signals from the sensors of sound circuit, playback circuit or vibrator circuit have been detected, it will be transmitted to an extra circuit connected thereto, in order to activate the specified output.

2.2 Working Principle

The main part in the system is the microcontroller that controls the other components in the system. When the ultrasonic sensors detect any objects or obstacle in 180 degree path it will activate the buzzer and the vibration motor. In addition to that, messages it will be sent to the microcontroller which will get the stick from transmit the location in response to the sender. In the areas with low signals cameras can be use, this system works by fitting a camera on the persons head, it will use certain algorithm to identify the highs and obstacles in front the blind person. In case of an emergency, the user of the stick will press the emergency button and the signal from the button will go to the microcontroller which will get the location from the and transmit the location to which will send a SMS messages to the all saved numbers in the system.

2.3 Advantage

• The system enables the blind people to move with the same ease and confidence as sighted people.

• Since the system is linked Ultrasonic sensor it provides the direction information.

• Avoid the obstacle based on ultrasonic sensor

• Facilitates the easier communication in case of emergency

2.4 Limitation

In the construction field, the usage of electronic measuring device is still not widely used yet. Due to the high cost of these equipments at market, an economic way needs to think of in order to create an accurate measuring device with low cost. Nowadays, measuring distance is considered as problem in construction field or indoor measuring activities because this task is

made by using measuring tape. The problem will occur when using measuring tape where we need at least 2 persons to measure between two distances. Besides, it is not have a perfect accuracy due to parallax and obstacle in their way.

Improvement had been done where some products have infrared light emitters and receivers to determine an object's distance. Other devices have laser-based systems which have improved accuracy and precision. Presently, the detection techniques of laser, radar, and infrared ray have been widely applied at the aspect of obstruction detection and distance measurement. Because of the expensive price, the distance measurement system of laser and radar is only set on the minority of instruments. For infrared sensor, the range of the distance that can be measured is very short with only a range of 4-30 cm.

Therefore, this project is necessary to do the process of measurement quickly and accurate without doing measurement manually, it also has the advantages to store measurement as many as 32 memories at one time.

2.5 Application

- Used to measure the obstacle distance.
- This system used in automotive parking sensors and obstacle warning systems.
- Used in terrain monitoring robots.
-

2.6 WORKING OF SYSTEM

Blind stick is an innovative stick designed for visually disabled people for improvednavigation. We here propose an advanced blind stick that allows visually challenged people tonavigate with ease using advanced technology. The blind stick is integrated with ultrasonic sensoralong with water sensing. Our proposed project first uses ultrasonic sensors to detect obstaclesahead using ultrasonic waves. On sensing obstacles the sensor passes this data to themicrocontroller. The microcontroller then processes this data and calculates if the obstacle is closeenough. If the obstacle is not that close the circuit does nothing. If the obstacle is close themicrocontroller sends a signal to sound a speaker. It also detects and sounds a different buzzer if itdetects water and alerts the blind. The system has one more advanced feature integrated to help.



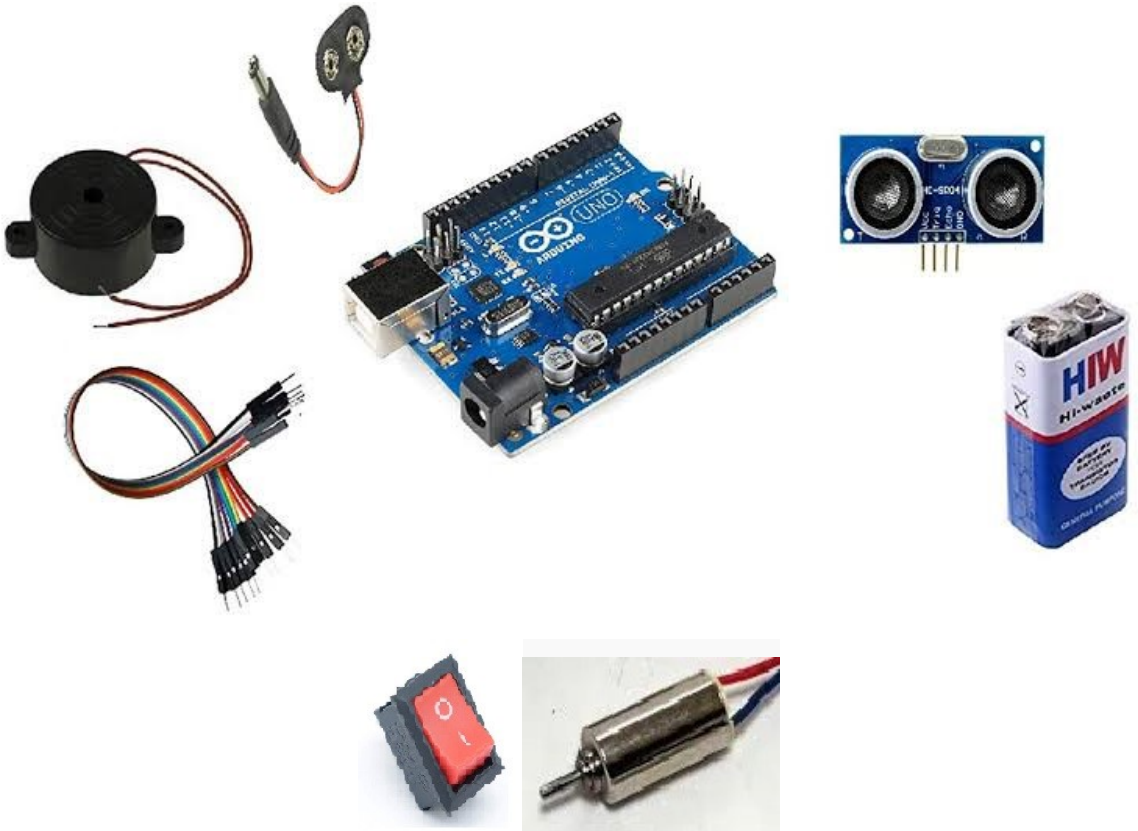
FIG – 2.2 THE SCREEN SHOT OF RESULT

CHAPTER 3

DESCRIPTIONS OF COMPONENTS

3.1 A list of components used in the project is given below:

1. Aluminum Stick
2. Plastic Box
3. Arduino Uno
4. Ultrasonic Sensor HC-04
5. Jumper wire
6. Buzzer
7. Vibrate Motor
8. Switch
9. Battery 9v



Figere :3.1 project Equipment

3.2 Arduino Uno

Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language and the Arduino Software (IDE), based on Processing.

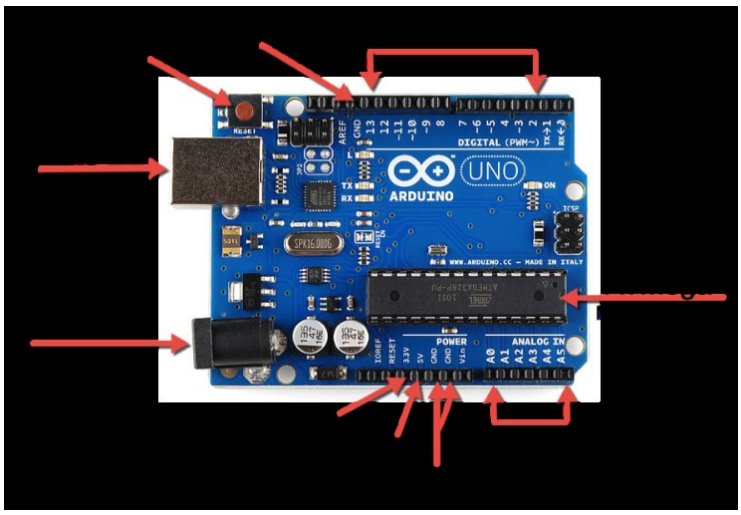


Fig: 3.2 Arduino UNO Pin Diagram

3.2.1 PIC16F72 MICROCONTROLLER

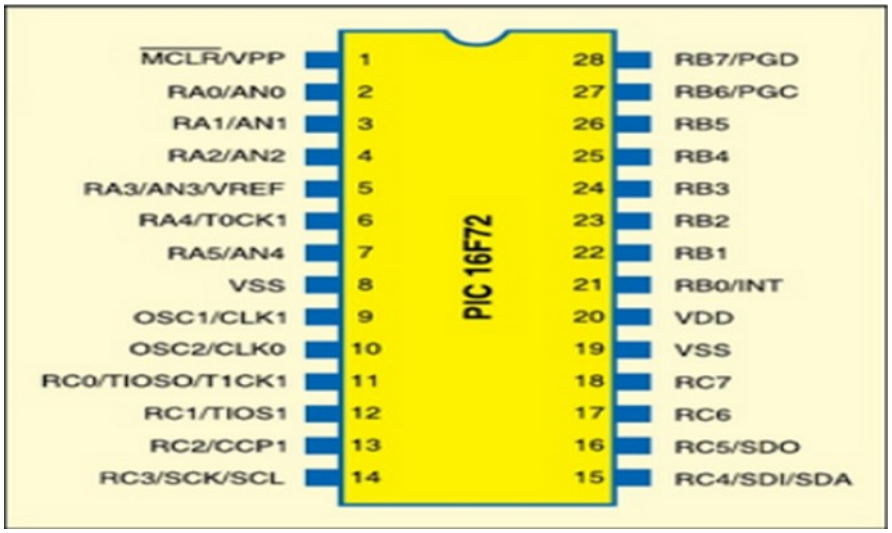


Fig 3.3 Pin Name



Fig 3.4 PIC16F72 IC

3.2.2 Features:

- Standard Flash Memory
- 1 µs Instruction Execution
- 35 Instructions
- 25 mA Source and Sink Per I/O
- ICSP™ (In-Circuit Serial Programming™)
- 1-8-Bit, 1-16-Bit and 1 WD Timer (PIC16F72 1-16 Bit, 2- 8-Bit and 1 WDT)
- 0-5.5 V Operating Range

PIN CONFIGURATION AND DESCRIPTION Of PIC16F72MICROCONTROLLER

Pin Name	PDIP, SOIC, SSOP Pin#	MLF Pin#	I/O/P Type	Buffer Type	Description
OSC1/CLKI	10	6	I	ST/CMOS	Oscillator crystal input/external clock source input.
OSC2/CLKO	10	7	O	—	Oscillator crystal output. Connects to crystal or resonator in Crystal Oscillator mode. In RC mode, the OSC2 pin outputs CLKO, which has 1/4 the frequency of OSC1, and denotes the instruction cycle rate.
MCLR/VPP	1	26	I/P	ST	Master Clear (Reset) input or programming voltage input. This pin is an active low RESET to the device.
RA0/AN0 RA1/AN1 RA2/AN2 RA3/AN3/VREF RA4/T0CKI RA5/AN4/SS	2 **3** 4 5 6 7	27 28 1 2 3 4	I/O I/O I/O I/O I/O I/O	TTL TTL TTL TTL ST TTL	PORTA is a bi-directional I/O port. RA0 can also be analog input0. RA1 can also be analog input1. RA2 can also be analog input2. RA3 can also be analog input3 or analog reference voltage. RA4 can also be the clock input to the Timer0 module. Output is

					open drain type. RA5 can also be analog input4 or the slave select for the Synchronous serial port.
RB0/INT RB1 RB2 RB3 RB4 RB5 RB8/PGC RB7/PGD	21 22 23 24 25 26 27 28	18 19 20 21 22 23 24 25	I/O I/O I/O I/O I/O I/O I/O I/O	TTL/ST TTL TTL TTL TTL TTL TTL/ST TTL/ST	PORTB is a bi-directional I/O port. PORTB can be software Programmed for internal weak pull-up on all inputs. RB0 can also be the external interrupt pin. Interrupt-on-change pin. Interrupt-on-change pin. Interrupt-on-change pin. Serial programming clock. Interrupt-on-change pin. Serial programming data.
RC0/T1OSO/ T1CKI RC1/T1OSI RC2/CCP1 RC3/SCK/SCL RC4/SDI/SDA RC5/SDO	11 12 13 14 15 16 17 18	8 9 10 11 12 13 14 15	I/O I/O I/O I/O I/O I/O I/O I/O	ST ST ST ST ST ST ST ST	PORTC is a bi-directional I/O port. RC0 can also be the Timer1 oscillator output or Timer1 clock input. RC1 can also be the Timer1 oscillator input. RC2 can also be the Capture1 input/Compare1 output/ PWM1 output. RC3 can also be the

RC6 RC7					synchronous serial clock input/output for both SPI and I2C modes. RC4 can also be the SPI Data In (SPI mode) or Data I/O (I2C mode). RC5 can also be the SPI Data Out (SPI mode).
VSS	8, 19	5, 16	P	—	Ground reference for logic and I/O pins.
VDD	20	17	P	—	Positive supply for logic and I/O pins.

Table 3.1 PIN Description

3.2.3;Technical specifications:

Table 3.2 Technical specifications of Arduino UNO

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P)of which 0.5 KB used by boot loader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz

3.3 Ultrasonic Sensor

(1) **Ultrasonic transducers**: Generating, detecting & processing ultrasonic signals Ultrasonic is the production of sound waves above the frequency of human hearing and can be used in a variety of applications such as, sonic rulers, proximity detectors, movement detectors, liquid level measurement. Ultrasonic Ranging Module HC - SR04

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:

 Using IO trigger for at least 10us high level signal,

 The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.

 IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning.

Test distance = (high level time × velocity of sound (340M/S) / 2,

The Flow chart of obstacle detector using ultrasonic sensor in which is having two parts, first part deals with the obstacle detection while the second part deals with distance measurement, and alerting the users depending on distance of the obstacle to avoid collusion. Depending on the distance of the obstacle from the person four zones are formed: far zone, near zone, close zone and danger zone. If the detected object is at 4 meter or more then it comes under far (safe) zone. If the object is found at 2 meter or more then it comes under near zone, if the object is found at 1 meter or more then it comes under close zone, and if the object is detected at less than 1 meter then it comes under danger zone. A voice instruction along with vibrating alert and a buzzer voice will be send to user at every zone to alarm him and let people around that blind person to help him.

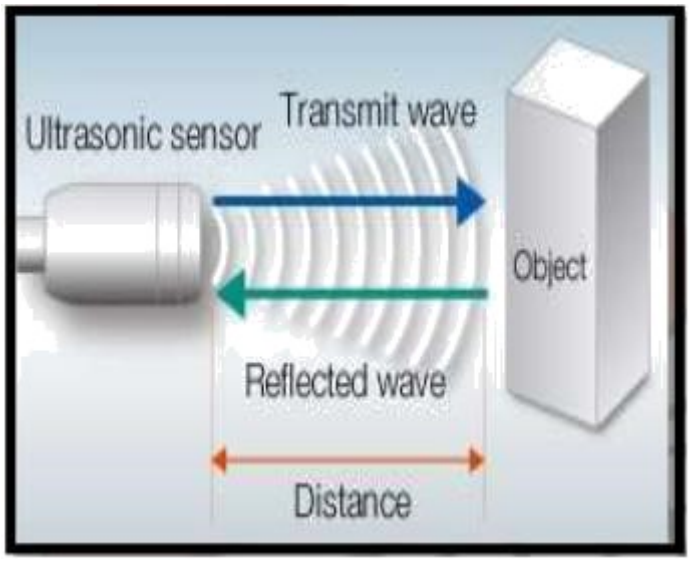


Figure 3.5 Ultrasound Distance Measurements

The main part within the system is that the microcontroller that controls the opposite Components of the system. When the supersonic sensors discover any objects or obstacles in180 degree horizontal, it will activate the buzzer mechanically.

Buzzer is an audio signaling device which may be mechanical, Electromechanical or piezoelectric. Typical uses of buzzers include alarm device, timers.



Fig: 3.6 Ultrasonic Sensar HC-04

3.3.1 Features:

*Power Supply: +5V DC

*Quiescent Current :< 2mA

*Working Current: 15mA

*Effectual Angle: <15°

*Ranging Distance: 2cm – 400 cm/1" - 13ft

*Resolution: 0.3 cm

*Measuring Angle: 30 degree

*Trigger Input Pulse width: 10uS

*Dimension: 45mm x 20mm x 15mm

3.3.2 Pin Configuration:

1. **Vcc**: This pin is connected to the positive 5V DC
2. **Trigg**: The trigger signal is applied to this pin for starting the transmission. This signal must be HIGH for 10us. When a valid trigger signal is applied, it generates 8 pulses of 40 KHz.
3. **Echo**: At this pin, module generates the signal whose time period is proportional to distance.
4. **GND**: This pin is connected to the ground.

3.3.3 Background of smart sensor

History has shown that advancements in materials science and engineering have been important drivers in the development of sensor technologies. For instance, the temperature sensitivity of electrical resistance in a variety of materials was noted in the early 1800s and was applied by Wilhelm von Siemens in 1860 to develop a temperature sensor based on a copper resistor. The high resonance stability of single-crystal quartz, as well as its piezoelectric properties, has made possible an extraordinarily wide range of high performance, affordable sensors that have played an important role in everyday life and national defense. More recently, a new era in sensor technology was ushered in by the

development of large-scale silicon processing, permitting the exploitation of silicon to create new methods for transuding physical phenomena into electrical output that can be readily processed by a computer. Ongoing developments in materials technology will permit better control of material properties and behavior, thereby offering possibilities for new sensors with advanced features, such as, lower cost, and increased reliability.

As noted in the preface, the Committee on New Sensor Technologies: Materials and Applications were asked to identify novel sensor materials that could benefit the manufacture and operation of advanced systems. Therefore the committee identified a conceptual framework that could relate sensor materials to application needs within which the importance of particular sensor materials could be determined.

Given the extensive body of published work relating to the broad, multidisciplinary subject of sensor technologies, the committee prepared a summary bibliography drawn from the recent literature. The bibliography includes review articles, books, relating to the wide range of Sensor technologies. These references can form a basis from which a more detailed study of any particular sensing technology, principle, or application can be initiated. Several key journals dealing with sensing have been included in the bibliography; they are suggested as starting points for investigating the most recent developments and trends in sensor technologies.

Despite the extensive published literature that treat the fundamentals of sensor technology, considerable ambiguity exists in sensor definition and classification, as illustrated by a recent buyers guide for sensors in which two lists of sensor suppliers are provided, one based on properties sensed and the other on technologies used. The latter list includes both physical phenomena (for example, acoustic, electrochemical, Hall Effect and infrared sensors), and material types (such as bimetallic, fiber optic, thick-and thin-film, and zirconium oxide sensors).

Understanding the physical or chemical effects that yield useful transduction is important in selecting and designing sensors. However, these effects by themselves are usually not sufficient to establish an unambiguous sensor classification, since typical sensors may use more than one effect. A simple example is a diaphragm pressure gauge. The diaphragm uses one form of mechanical energy to create another (pressure generates displacement and strain); however, the creation of an electrical signal from the displacement or strain can be accomplished using many approaches. The diaphragm could be made of a piezoelectric

material, in which the air would induce an electrical charge; an inductive or capacitive effect could be employed to measure the charge related to the strain and the deflection and thereby infer the pressure. Thus understanding all of the possible field effects and features of transducer materials behavior provides the most complete set of sensor design options.

3.4 VIBRATE MOTOR

The smart walking stick scheme has an additional vibratory feedback mechanism which is crucial for multiple disable peoples i.e. sensory disability associated with a motor disability or intellectual disability. This enhances the overall feedback received by the user who receives the output in different formats of vibration; distinctive as per sensors.

3.5 BUZZER

A transducer (converts electrical energy into mechanical energy) that typically operates A buzzer is in the lower portion of the audible frequency range of 20 Hz to 20 kHz. This is accomplished by converting an electric, oscillating signal in the audible range, into mechanical energy, in the form of

CHAPTER 4

Design and Implementation

4.1 Project Construction

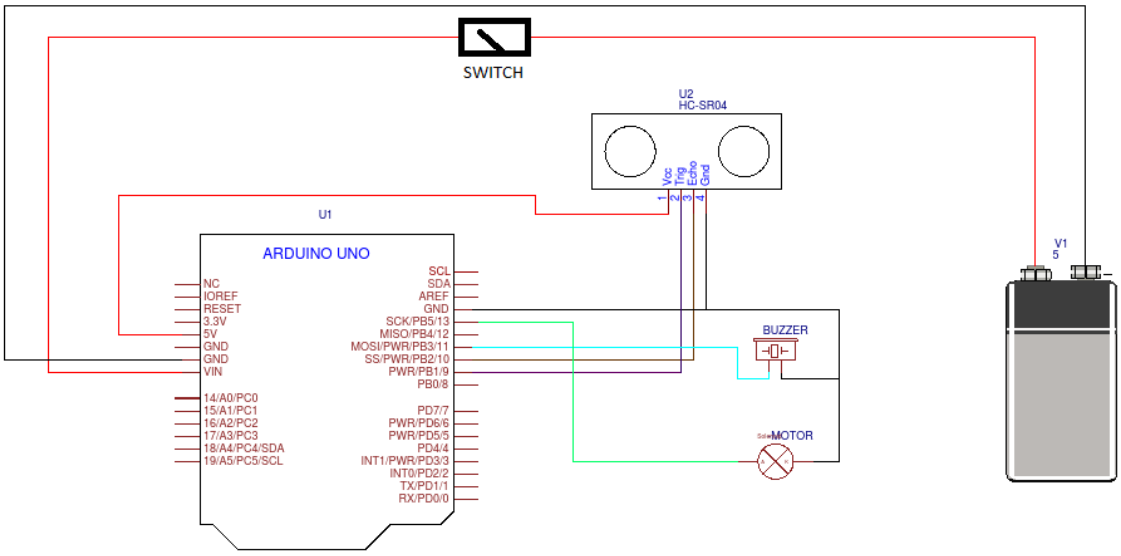


Figure: 4.1 Circuit Diagram of the System

In the circuit an Arduino UNO is used as the platform. Ultrasonic sensor is connected to Arduino. The ultrasonic sensor has 4 pins:

Figure 4.1: Arduino connections

- Ultrasonic VCC to Arduino 5v.
- Ultrasonic GND to Arduino GND.
- Ultrasonic TRIG to Arduino D 9.
- Ultrasonic ECHO to Arduino D10.
- Buzzer RED to Arduino D11
- Buzzer BLACK to Arduino GND.
- Vibrator motor pin 1 to Arduino D13.
- Vibrator motor pin 2 to Arduino GND

Positive terminal of 9-volt battery is connected to Vin pin of Arduino through a DPDT switch and the negative terminal is connected to GND pin of Arduino. A buzzer is connected between D11 pin of Arduino and GND pin.

The whole project has been designed on Eagle. The same circuit prototype can be made using a breadboard or zero. The circuit diagram and design are given below.

As shown in diagrams there are two openings in Ultrasonic sensor first is transmitter (or Trigger) and second is receiver (or Echo).

Ultrasonic sensor sends high frequency pulses, these pulses reflects from object and takes as Echo, time between echo and Trig is measured by the microcontroller or Arduino which is directly proportional to distance.

The speed of sound is 340 meter per second in the air, and the distance between sensor and object is equal to time multiplied by speed of sound divided by two.

Distance = (Time * Speed Of Sound) ÷ 2

After the distance measurement, Arduino makes a beep format using buzzer, when distance is high, frequency of beep is decreased and beep frequency is increased when distance is low

The range of HC-04 Ultrasonic sensor is not high, it can only measure 50cm in open space, for more distance many other powerful sensors are available in the market.

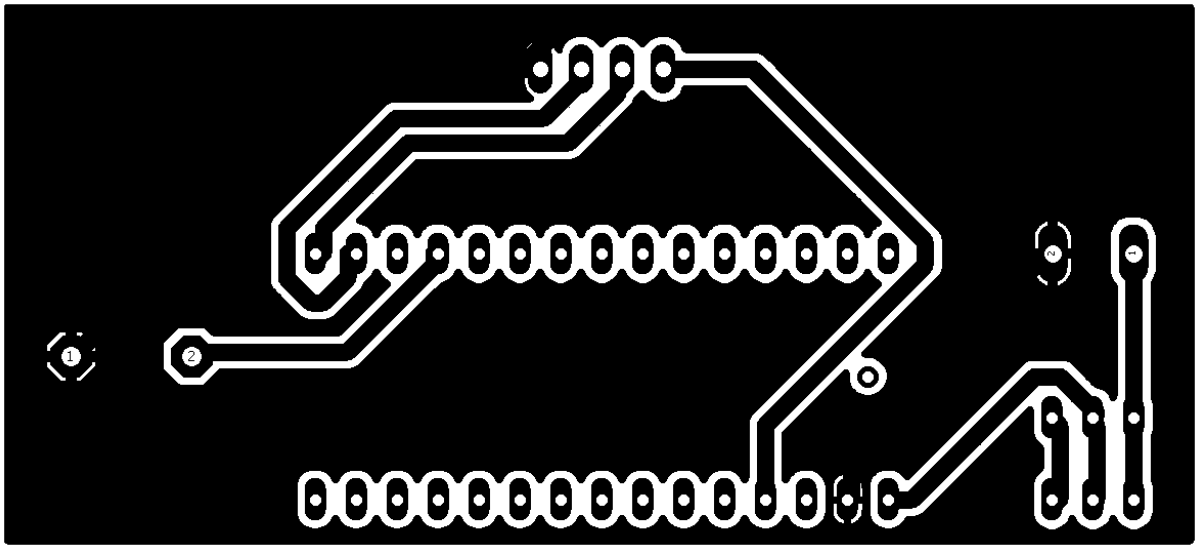


Figure: 4.2 **Ultrasonic Blind Walking Stick – PCB Design**



FIG – 4.3 THE SCREEN SHOT OF PROJECT

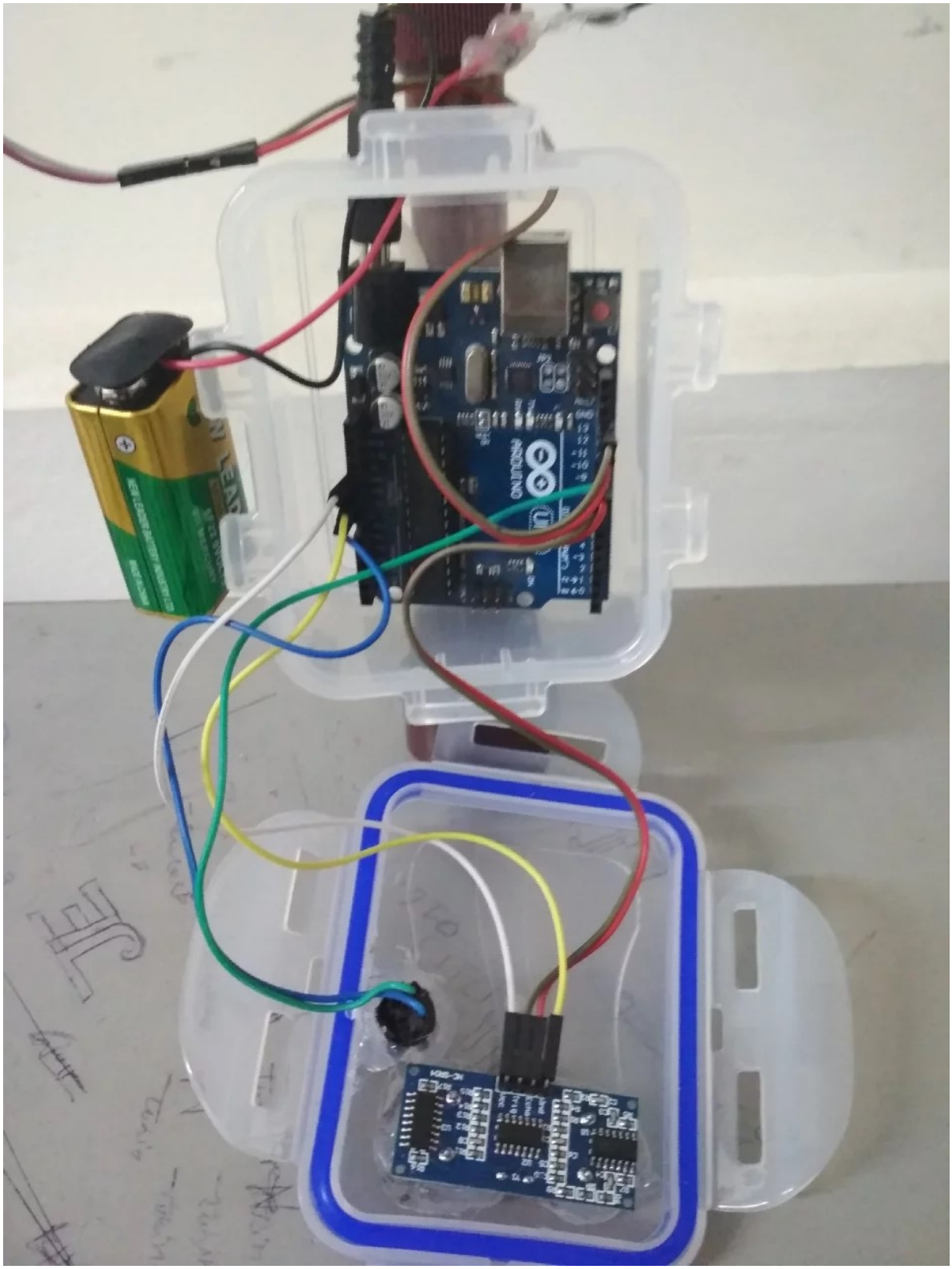


FIG – 4.4 THE SCREEN SHOT OF PROJECT

4.2 Cost Estimation

Table:4.1 Cost Estimation

SI	Particulars	Qty.	Unit Price	Total Price
1	Aluminum stick	1	200	200
2	Plastic Box	1	50	50
3	Ultrasonic Sensor HC-04	1	150	150
4	Arduino Uno	1	550	550
5	Buzzer	1	40	40
6	Vibrator Motor	1	50	50
7	Switch	1	10	10
8	battery 9v	1	70	70
9	Jumper wire	As Per Need	50	50
Total				**1170.00**

Chapter 5
Conclusions

5.1 Discussion



FIG –5.1 THE SCREEN SHOT OF THE RESULT

It is worth mentioning at this point that the aim of this study which is the design and implementation of a smart walking stick for the blind has been fully achieved. The Smart Stick acts as a basic platform for the coming generation of more aiding devices to help the visually impaired to navigate safely both indoor and outdoor. It is effective and affordable. It leads to good results in detecting the obstacles on the path of the user in a range of three meters. This system offers a low-cost, reliable, portable, low power consumption and robust solution for navigation with obvious short response time. Though the system is hard-wired with sensors and other components, it's light in weight. Further aspects of this system can be improved via wireless connectivity between the system components, thus, increasing the range of the ultrasonic sensor and implementing a technology for determining the speed of approaching obstacles. While developing such an empowering solution, visually impaired and blind people in all developing countries were on top of our priorities. The device constructed in this work is only capable of detecting obstacles and moisture. Holes cannot be detected using this device nor the nature of obstacle. Therefore, a better device can be constructed using ultrasonic sensors, arduino Uno and other devices that employ audio commands to alert the user of what is in his path of movement. A vibrator may also be added for ease of use and convenience. In the future, further modifications to enhance the performance of the system will be added. These include: A global positioning method to find the position of' the user using the GPS, and GSM modules to communicate the location to a relative or care giver. It should also accommodate wide varying grips for flexible handling.

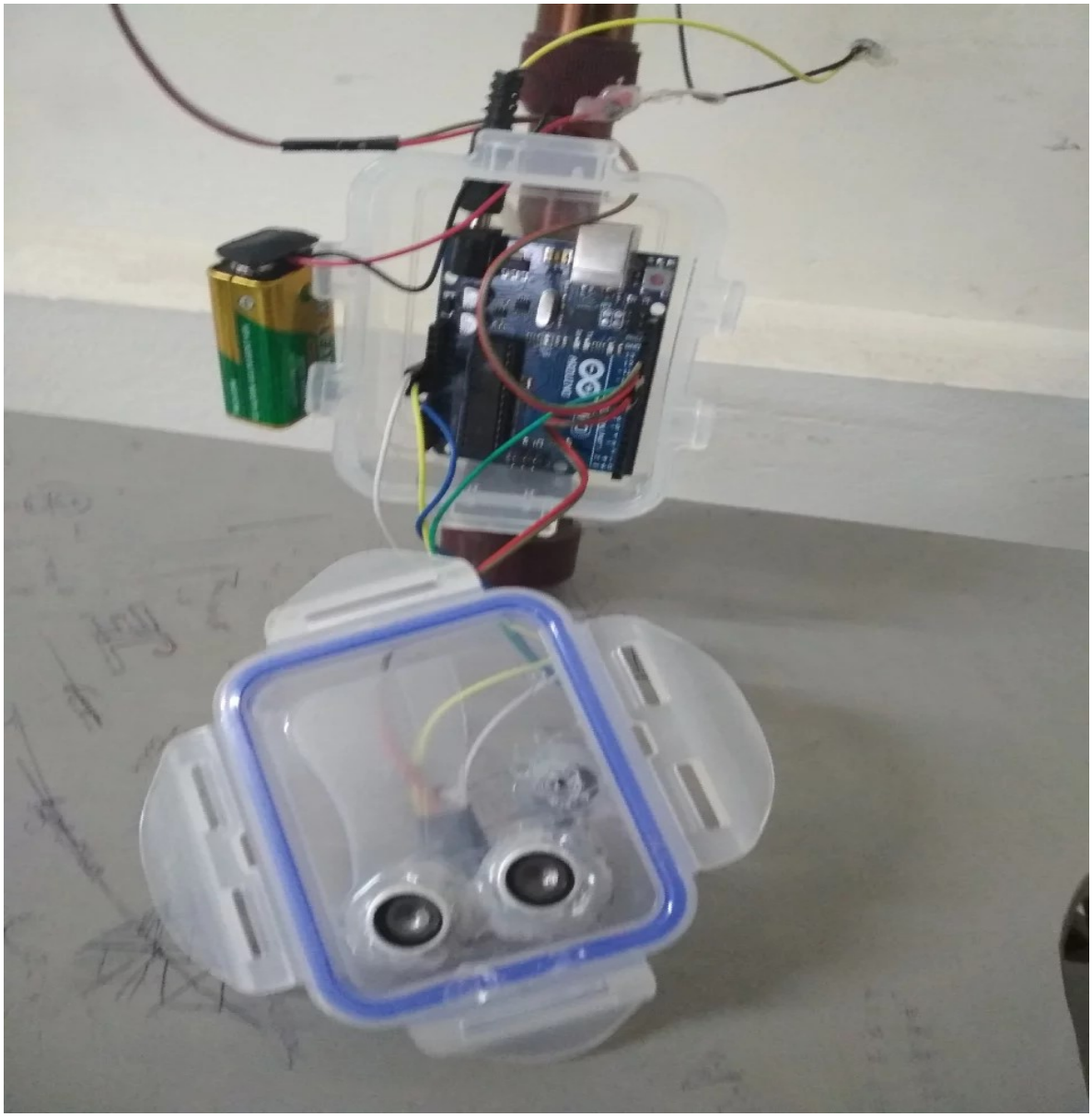


FIG –5.2 THE SCREEN SHOT OF THE RESULT

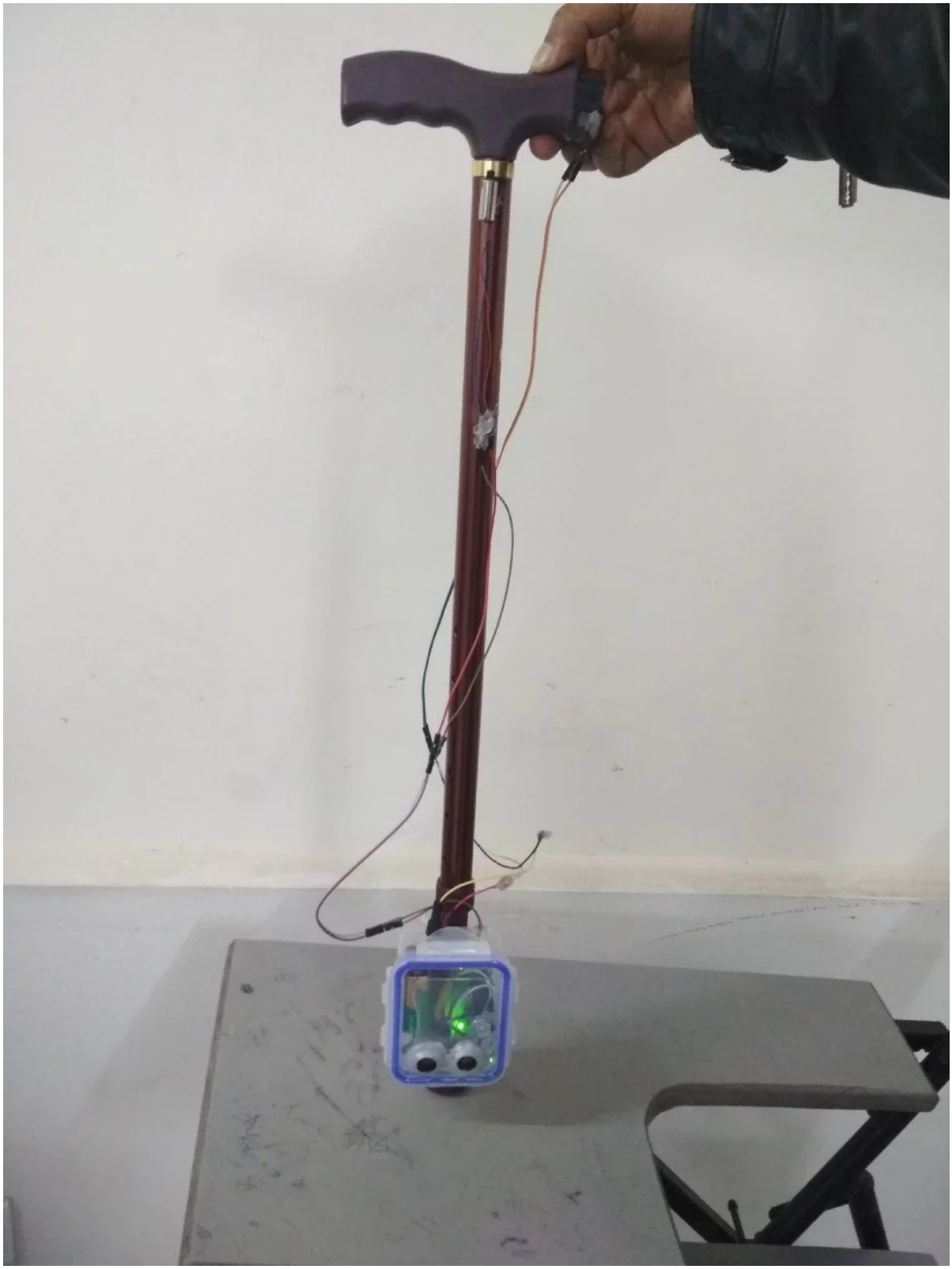


FIG –5.3 THE SCREEN SHOT OF THE RESULT



FIG –5.4 THE SCREEN SHOT OF THE RESULT

5.2 Future Works

Blind stick is an innovative stick designed for visually disabled people for improved navigation. We here propose an advanced blind stick that allows visually challenged people to navigate with ease using advanced technology. The blind stick is integrated with ultrasonic sensor along with light and water sensing. Our proposed project first uses ultrasonic sensors to detect obstacles ahead using ultrasonic waves. On sensing obstacles the sensor passes this data to the microcontroller. The microcontroller then processes this data and calculates if the obstacle is close enough. If the obstacle is not that close the circuit does nothing. If the obstacle is close the microcontroller sends a signal to sound a buzzer. It also detects and sounds a different buzzer if it detects water and alerts the blind. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today.98 percent of all microprocessors are manufactured as components of embedded systems. with general-purpose counterparts are low power consumption, small size, rugged operating ranges, and low per-unit cost. This comes at the price of limited processing resources, which make them significantly more difficult to program and to interface with. However, by building intelligence mechanisms on the top of the hardware, taking advantage of possible existing sensors and the existence of a network of embedded units, one can both optimally manage available resources at the unit and network levels as well as provide augmented functionalities, well beyond those available.

For example, intelligent techniques can be designed to manage power consumption of embedded systems. Modern embedded systems are often based on microcontrollers (i.e. CPUs with integrated memory or peripheral interfaces) but ordinary microprocessors (using external chips for memory and peripheral interface circuits) are also common, especially in more-complex systems. In either case, the processor(s) used may be types ranging from general purpose to those specialized in certain class of computations or even custom designed for the application at hand. A common standard class of dedicated processors is the digital signal processor (DSP).Since the embedded system is dedicated to specific tasks, design engineers can optimize it to reduce the size and cost of the product and increase the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale.

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Appendix

Code:

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

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

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

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

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

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

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

safetyDistance = distance;
if (safetyDistance <= 50){
  digitalWrite(buzzer, HIGH);
  digitalWrite(motor, HIGH);
}
else{
  digitalWrite(buzzer, LOW);
  digitalWrite(motor, LOW);
}

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