

SMART SHOES FOR VISUALLY IMPAIRED PEOPLE

Submitted in partial fulfillment of the requirements for the
award of Bachelor of Technology degree in
Biomedical Engineering

By

DARREN AKASH.J (39240013)

KEERTHIVSAN.V (39240020)

KISHORE.R (39240021)



DEPARTMENT OF BIOMEDICAL ENGINEERING

SCHOOL OF BIO AND CHEMICAL ENGINEERING

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

MAY 2022



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

Accredited with Grade "A" by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

www.sathyabama.ac.in

DEPARTMENT OF BIOMEDICAL ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Interdisciplinary Project Report is the bonafide work of **DARREN AKASH.J (Reg. No.39240013)**, **KISHORE.R (Reg. No. 39240021)** and **KEERTHIVASAN.V (Reg. No.39240020)** who carried out the project entitled "**SMART SHOES FOR VISUALLY IMPAIRED PEOPLE**" under our supervision from **December 2021 to May 2022**.

Dr. Bethanne Janney, M.E., Ph.D.,
Guide and supervisor

Dr. T.SUDHAKAR, M.Sc., Ph.D.,
Head of the Department

Submitted for Viva voce Examination held on 30th April 2022.

Internal Examiner

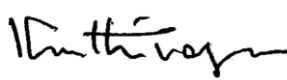
External Examiner

DECLARATION

We, **DARREN AKASH.J** (Reg. No. 39240013), **KISHORE.R** (Reg. No. 39240021), and **KEERTHIVASAN.V** (39240020) hereby declare that the Interdisciplinary Project Report entitled “**SMART SHOES FOR VISUALLY IMPAIRED PEOPLE**” done by us under the guidance of **Dr. Bethanny Janney, Department of Biomedical Engineering** is submitted in partial fulfillment of the requirements for the award of **Bachelor of Technology** degree in **Biomedical Engineering**.

DATE:

PLACE:

1. 
2. 
3. 

SIGNATURE OF THE CANDIDATE

ACKNOWLEDGEMENT

We are pleased to acknowledge our sincere thanks to Board of Management of **SATHYABAMA** for their kind encouragement in doing this Interdisciplinary project and for completing it successfully. We are grateful to them.

We convey our thanks to **Dr. Anima Nandha , Ph.D.**, Dean, School of Bio and Chemical Engineering and **Dr. T. Sudhakar, M.Sc., Ph.D.**, Head of the Department, **Department of Biomedical Engineering** for providing us necessary support and details at the right time during the progressive reviews.

We would like to express our sincere and deep sense of gratitude to our Interdisciplinary Project Guide **Dr. Bathannee Janney, M.E., Ph.D., Department of Biomedical Engineering** for her valuable guidance, suggestions and constant encouragement paved way for the successful completion of our project work.

We wish to express our thanks to all **Teaching and Non-teaching** staff members of the **Department of Biomedical Engineering** who were helpful in many ways for the completion of the project.

ABSTRACT:

Eyes play important role in our day to day lives and are perhaps the most valuable gift we have. This world is visible to us because we are blessed with eyesight. But there are some people who lag this ability of visualizing these things. Due to this, they will undergo a lot of troubles to move comfortably in public places. Hence, wearable device should design for such visual impaired people. IoT based Smart shoe system for the blind is a system made with the help of ultrasonic sensors paired to ESP 32 Microcontroller. Internet of things is all about making physical objects communicate with other objects or even with humans. It is an enabling technology which has a rapid development and growth in the market. In our India there are almost 40 million blind people among which 1.6 million are children. Blind people face great difficulty to travel independently. They have to depend on others in many aspects of their life. The Major problem is when they walk on the road. With a stick in hand they cannot detect every obstacle that comes in their way. The Smart shoe design provides a long term solution for the blind to walk on roads independently. The smart shoe will help the Blind person to reach his destination independently. It is built using IoT Technology in which the shoe will be embedded with various sensors, Microcontroller and buzzers. The shoe warns the user by making noise with the buzzer when he/she walks in front of an obstacle. 285 million people are estimated to be visually impaired worldwide out of which 39 million people are blind and 246 million have low vision. This paper presents various features of smart shoes for visually impaired using Internet of Things.

TABLE OF CONTENTS

CHAPTER NO	TITLE	PAGE NO
	ABSTRACT	v
	LIST OF ABBREVIATION	viii
	LIST OF FIGURES	ix
1	INTRODUCTION	1
	1.1 SMART SHOE FOR VISUALLY IMPARED	2
	1.1.1 OBSTACLE DETECTION FOR BLIND	2
	1.1.2 FOOT STEP POWER GENERATION	3
	1.1.3 HEALTH TRACKER AND GPS	3
2	LITERATURE SURVEY	4
3	AIM AND SCOPE	12
	3.1 AIM	12
	3.2 SCOPE	12
4	MATERIALS AND METHODS	13
	4.1 METHODOLOGY	13
	4.1.1 BLOCK DIAGRAM WITH EXPLANATION	13
	4.2 HARDWARE USED	14
	4.2.1 ESP 32 MICROCONTROLLER	14
	4.2.2 ULTRASONIC SENSOR	16

	4.2.3 BUZZER	17
	4.2.4 VIBRATOR	18
	4.2.5 LITHIUM BATTERY	19
	4.2.6 DIODES	20
	4.2.7 PIEZOELECTRIC SENSORS	20
	4.3 SOFTWARE USED	22
	4.3.1 ARDUINO IDE	22
5	RESULTS AND DISCUSSION	25
	5.1 RESULTS	25
	5.2 DISCUSSION	28
6	SUMMARY AND CONCLUSION	29
	6.1 SUMMARY	29
	6.2 CONCLUTION	29
	REFERENCES	30
	APPENDIXES	32

LIST OF ABBREVIATION

ABBREVIATION	EXPANSION
IOT	INTERNET OF THINGS
IR	INFRARED
LED	LIGHT EMITTING DIODE
ETA	ELECTRONIC TRAVELLING AID
ERM	ECCENTRIC ROTATING MASS
IDE	INTEGRATED DEVELOPMENT ENVIRONMENT
GPS	GLOBAL POSITIONING SYSTEM
AC	ALTERNATIVE CURRENT
DC	DIRECT CURRENT

LIST OF FIGURES

FIGURE NO	NAME OF THE FIGURE	PAGE NO
4.1.1	Block Diagram with Explanation	13
4.2.1	ESP 32 Microcontroller Function Block Diagram	15
4.2.2	Ultrasonic Sensor	16
4.2.3	Buzzer	17
4.2.4	Vibrator Motor	18
4.2.5	Lithium Battery	19
4.2.6	Diode	20
4.2.7	Piezoelectric Sensor	21
4.3.1	Arduino IDE Interface	22
5.1.1	Prototype	25
5.1.2	Programming in Arduino IDE	26
5.1.3	Ultrasonic Sensor attached to the microcontroller	26
5.1.4	Buzzer attached to the setup	27
5.1.5	Piezoelectric sensors attached to the sole of the shoes	27
5.1.6	Final prototype	28

CHAPTER-1

INTRODUCTION

IOT is all about making physical stuffs communicating with each other and, hence our project is based on this application. Smart shoes for blind person. This shoe will be enriched with various sensors with their numerous features which would help blind persons to make their way to destination. People with visually impaired faced most of the challenges in the environment. The long Hoover Cane used by them is not advantages while walking and travelling. Smart shoes is a smart footwear technology. It adopts smartphone applications to support tasks cannot be done with standard footwear. The uses shows vibrating of the smart phone to tell users when and where to turn to reach their destination via Google Maps or self-lacing. Using smart shoes for visually impaired people need not to be depending on others for mobility. The systems we have designed consist of sensors and vibrator for sensing the surrounding environment and giving feedback to the blind person. It is used as a safety device as well as navigation device. The electronic hardware will be fixed in shoes for users. User will wear the shoe and travel anywhere, and attached sensor will be sense obstacles near to the shoes alerts with the help of visually impaired people.

India contributes about 21% of the blind people over total population. In a million population, there are around 53 thousand persons that are visually impaired, 46 thousand are having low vision and around 7000 have completely lose the vision. 285 million people are estimated to be visually impaired worldwide out of which 39 million people are blind and 246 million have low vision. Smart shoes will help the visually impaired person to move on independently with help of ultrasonic sensor to detect obstacles.

1.1 SMART SHOE FOR VISUALLY IMPAIRED

The smart shoe warns visually impaired people of obstacles in their way while they are walking in public. Moving around independently in public places is a challenge for many disabled people, especially people who are visually impaired. Fire hydrants, potholes, steps, etc. are some of the obstacles people who are blind and low vision need to be careful about. Now, an innovative smart shoe aims to help them negotiate such obstacles and move around in a safe and independent. This smart shoe has sensors that warn blind and low vision people about various obstacles in their way with acoustic and visual warning signals, as well as vibration feedback. It has a built-in battery, ultrasonic sensors, a processing unit, and a wireless connection to the smartphone. All of this is mounted in a water and dust resistant casing at the front of the shoes. This makes it tough and durable for any kind of weather.

1.1.1 OBSTACLE DETECTION

The smart shoes detect obstacles and give warnings through pre-selected feedback. The first option is through haptic or vibration feedback. The vibration is provided directly on the shoe so the user gets a sense of any obstacle in front. The second option is acoustic feedback, which is received through a Bluetooth-linked smartphone or bone conduction headphones. Then, there's visual feedback where the impulses are passed on through LED lights on the shoe. This also provides light in the dark. You can make adjustments in real-time with the button on the back of the device. The range can be adjusted up to four meters by briefly

pressing the button. The makers advise the continued use of a guide dog while walking in public.

1.1.2 FOOT STEP POWER GENERATION

The power generated by the piezoelectric sensors replaces the standby power that is constantly used in sensors and LED's used in the shoes; the piezoelectric energy thus reduces battery consumption. The piezoelectric sensor which is inserted under the insoles of shoes, converts mechanical energy generated by motion of user into electrical energy. The piezoelectric material is a smart material which generates electrical charges under strain changes when subjected to pressure, and electrodes can collect electrical charges to produce electrical current.

1.1.3 HEALTH TRACKER AND GPS

This Wearable technology allows user to calculate all the daily activity like step count, calorie count, and exercise count of the user using that wearable physical device. Accelerometer is responsible to count the total number of step and on the basis of total step count the Shoe application will count the distance, and total calorie burned. The smart shoes contain a GPS tracking device that's embedded in the base of the heel. The device constantly transmits location coordinates to the smartphone device. The GPS shoes allow real-time tracking of the wearer

CHAPTER-2

LITERATURE SURVEY

1) Smarts Assistive shoes for blind: Ariba Khanam, Anuradha Dubey, Bhabya Mishra (2019) International Journal of Advance Research in Science and Engineering (IJASE) introduced the smart assistive shoes for blind people which will help them in their needed activities. The shoes will detect the nearby obstacles and simultaneously send a message to the receiver in audio and vibration form. The ultrasonic sensor detect the obstacles for blind people. The arduino microcontroller keeps the pulling the ultrasonic sensor and provide the feedback via vibrator. This paper presents an idea dealing the problems faced by visually impaired individual through assistive device in form of shoes. The shoes will be detect the nearby obstacles and continuously send a message to the receiver in audio and vibration form. The ultrasonic sensor has been fully utilized on order to advance the mobility of the blind. Future work will be focused image acquired by using web camera and NI camera helps in identification of object as well as scans the entire instances for the presence of number objects in the path of the blind person.

2) Design and Developement of a Prototype Rehabilitative Shoes for the Blind: Ziad O.AbuFaraj, Elie Jabbaur, Paul Ibrahim, Anthony Ghaoui (2018) Institute of Electrical and Electronics Engineers, Each shoes is mounted with three pairs of ultrasonic transducers placed on aspect of the toe cap so as to detect ground level obstacles of different heights as well as ground pits and holes. Additionally, design considerations mitigated the effects of ipsilateral and contralateral foot swing, ground level detection, stair climbing and

descent as well as others impediment that might be perceived as obstacles. The corresponding tactile outputs are provided by three miniature sized vibrating motors embedded within the collar of the shoes. Each shoes is mounted with three pairs of ultrasonic transducers placed on aspect of the toe cap so as to detect g ground level obstacles of different heights as well as ground pits and holes. Instrumented with the smart shoes, underwent an extensive training session, whereby each sensor was independently triggered and the corresponding tactile output was acivated.

- 3) Smart Shoes a Safe Future for the Blind:** Shlesha Khursade, Malavika Karunan, Ibtisam Sayyad, Saloni Mohanty (2016) International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE), one such wearable system designed to provide directional information to the visually impaired. Now a day, android mobile is commonly used by everyone. With help of android application, wearable device is to be made to help in navigation path. Sensors attached with the hardware will sense obstacles and vibrators will vibrate for left and right turn through path. A buzzer will be used for alerting the user that obstacle is nearing blind. Android mobile is commonly used by everyone. With help of android application, wearable device is to be made to help in navigation path. Obstacles comes in contact with the sensors, the distance is calculated, from the sensor and the obstacles. If obstacles is in the predefined range of 15- 20 cm, it is detected and the buzzer starts beeping.

4) Li-Fi Based Smart Shoes for Blind: Shanthi M, Madhu Meena M.K, Kadiravan R, Kowsalya R.J (2019) International Journal of Engineering Science and Computing, Smart shoes that helps the visually impaired in navigation through voice commands which are conveyed light source in their path. The RFID reader detects all information stored on the tag, it is then analyzed and the data retrieved is transmitted to a control unit that translates the information into Braille code. The ultrasonic sensor is used for obstacle detection The IR sensor is used for detection of water in the path. The receiver receives this flicking light and converts it into electrical signal. The signal is then converted to binary data which recognized as audio signals. Thus navigation done using LiFi. This paper proposes a smart shoe that helps the visually impaired in navigation through voice commands which are conveyed through light sourced (Li-Fi) in their path. The Li-Fi module produces LED which transmit data to the shoe module. The Li-Fi receiver at the shoe detects this signal and the controller plays this data through the speaker.

5) Smart Navigational Shoes for the Blind Person: Saylee Begampure, Renuka Deshmukh, Sheetal Chotaliya, Shubham Sirsat (2017) International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering, Android is a working system created google for portable system. It depends on the linux bit and intended for touch screen, for example, cell phone and tablets. The system is implemented in shoes we used a battery for power supply. Bluetooth is used to get the location coordinate form mobile phone by using GPS setting from mobile. The shoes sync up with a Smartphone app that uses maps and vibrate to tell users when and where to turn to reach their destination. The control

unit gives vibration according to the route coordinates in shoes to indicate the blind person. With help of android application, wearable device is to be made to help in navigation path. The IR sensor is utilized for obstacle detection in the project that the obstacle is distinguished out and about then buzzer will turn ON. The shoes sync up with a Smartphone app that uses maps and vibrate to tell users when and where to turn to reach their destination. In future scope we will focus Bluetooth speaker, it's used to get the location coordinate from mobile phone by using GPS.

- 6)** Smart Assistive Shoes and Cane, Soul mate for the blind people: Shubham Rastogi, Pankaj Sharma, Parth dhal, Rishav Agarwal, Shristhi Thakur (2020) International Journal of Advanced Research in Electronics and Communication Engineering, The technology proposed in the paper serves as a solution for visually impaired people. The smart shoes that alerts visually impaired people over obstacles coming between their ways and could help them in walking with less collision. IR sensor connected to the module and the voltage level depending upon the status of the IR sensor are transmitted to the microcontroller and as per the data collected an appropriate alerting the blind person about the surroundings. The arduino controller receives the input from the above sensors, executes and decode it and again select the appropriate saved voice messages and command to the speaker. The smart shoes that alerts visually impaired people over obstacles coming between their ways and could help them in walking with less collision. A shoes that could communicate with the user through voice alert and pre-recorded message. The system has been used to receive data from the sensing devices, two connected to the shoe to detect objects at the

ground. Then, as per the information received by the micro controller, it provides an acoustic feedback to the user. In future, longitudinal research would be required to judge if the smart shoes would be able to augment their conventional way of mobility, thereby make them independent after prolonged used.

- 7) Designing Smart Shoes for Obstacle Detection: Empowering Visually Challenged Users Through ICT, Vikram Singh, Parmar Krishna, Sai Inkoolu (2017) International Federation for Information Processing**
- The smart shoes presented in this paper explores the potential of tap in alerting users about the obstacles in front through a novel method of providing feedback mechanism. It detect obstacles in a customizable range of up to 2m by making use of an ultrasonic sensor and providing the feedback to user through a tapping mechanism at the foot-arch. There are two buttons are available for this smart shoes. Power button: This button is used powering the system on and off. Mode Button: The footwear can be used in any of the two mode using the mode button when it is pressed the buzzer present in the system indicates current mode. The smart shoes by evaluating it from (a) ratio of obstacles identified total obstacles encountered, (b) distance of obstacles apprehension and (c) response time. The result showed that the users were able to detect 89.5% obstacles out of all encountered obstacles with mean response time of 3.08s. User's average distance of obstacle apprehension was 108 cm in regular mode and 50cm in the crowd mode. Future work will be focused enhancing the performance of the system and reducing the load on the user by adding the camera to guide. Image acquired by the web camera and NI cameras helps in

identification of objects as well as scans the entire instances for the presence of number of objects in the path of the blind.

- 8) Smart Assistive Shoes and Cane-Solemates for the Blind People:**
S.D. Asha Mahesh, K. Raj Supriya, M.V.S.S., N.K. Pushpa Latha, P.Gowri, T.Sonia, B,Nani, (2019) International Journal of Engineering Science and Computing This system is intended to provide overall measures object detection and send information related to blind people. This project aims at the development of an Electronic Travelling Aid (ETA) to help the blind people to find obstacle free path. This ETA is fixed to the shoe. When the object is detected near to the shoe alerts them with the help of vibratory circuit and also in advancement with help of speakers or headphone that is voice command with help of android application. IR sensor which detects the presence of the obstacles in the direction and sends the command to the controller the detection of object in the direction. Smart shoes that alerts visually impaired people over obstacles coming between their ways and could help them in walking with less collision. When the object is detected near to the shoe alerts them with the help of vibratory circuit and also in advancement with help of speakers or headphone that is voice command with help of android application. After receiving the input from the shoe module via Bluetooth module, the arduinolily receives the input, decodes it and select the appropriate saved voice message and commands to the speaker which give indication to the user of the obstacles in the respective direction. In future, longitudinal research would be required to judge if the smart shoes would be able to augment their conventional way of mobility, thereby make them independent after prolonged used.

9) Smart Shoe for Visually Impaired: Saloni Mohanty, Malavika Karunan, Ibtisam Sayyad, Shlesha Khursade, (2018) International Journal of Advanced Research in Computer and Communication Engineering Electronic component is fixed in shoes of user. User will wear shoes for easy, mobility. Sensors will sense obstacles, vibrators will vibrate for left and right turn through path. When sensors will detect any obstacles, user will be informed through android system being used by the user. Bluetooth connection is provided through which mobile and electronic part can be connected. The system propose detects the nearest obstacle via an ultrasonic sensor system and sends back feedback to inform blind person about its location. The system propose detects the nearest obstacle via an ultrasonic sensor system and sends back feedback to inform blind person about its location. When sensors will detect any obstacles, user will be informed through android system being used by the user Sensor will detect obstacles and vibrator will vibrate according direction. The Bluetooth connection is provided through which mobile and electronic part can be connected. Future work will be focused enhancing the performance of the system and reducing the load on the user by adding the camera to guide. Image acquired by the web camera and NI cameras helps in identification of objects as well as scans the entire instances for the presence of number of objects in the path of the blind.

10) Design of Arduino based Shoe for Blind with Wireless charging : Mohamma d Hassan, M.D. Atqur Rahman, Shakeb Alam, (2020) International journal of electrical, electronics and data communication There are broadly three stages involved in the design of the proposed blind shoe: Input stage: Ultrasonic sensor, the

sensor is used to detect obstacles in the path of blind person. Control stage: The micro controller is programmed in such a way that it will send a required trigger signal to the two vibrating motor and a buzzer whenever error is found to be beyond the tolerance range. Output stage: The vibrating motor which will act according to signal received by microcontroller. The buzzer is also there that sounds when water sensor detects the presence of water. The GPS tracker has been used to send a SOS message on mobile, whenever the blind person breaches the restricted area. The shoe enables both partially and totally blind person to self-navigate in an unknown environment. The proposed shoe comes with features such as obstacle detector sensor, water sensor, wireless charging, GPS tracking. The shoe can be used for nearly 3-4 hours once the rechargeable battery gets fully charged. The obstacles detection range can be set just by making a small change in the program. In future work we will focus on GPS. It's also added for monitoring visually impaired movement and to track the position.

CHAPTER-3

AIM AND SCOPE

3.1 AIM:

- This project aims at the development of an Electronic Travelling Aid (ETA) kit to help the blind people to find obstacle free path. This ETA is fixed to the shoe.
- This system is intended to provide overall measures object detection, human detection, and real-time Assistance system consist of microcontroller, ultrasonic sensor and a buzzer.
- Here ultrasonic sensor has been used to detect the distance between the user and the obstacle and alerts the user.
- This smart shoes also has GPS to help the visually impaired to navigate.
- Therefore we introduce ESP32 microcontroller based smart shoes with the goal that aims to reducing the problems and issues faced by visually impaired people.

3.2 SCOPE:

- Mobility is one of the main problems encountered by the blind in their life, this smart shoes helps to overcome the issues faced by them.

CHAPTER-4

MATERIALS AND METHODS

4.1 METHODOLOGY

- We have interfaced esp32 microcontroller with ultrasonic sensor to detect the obstacles using ultrasonic waves.
- The buzzer (sounds) alerts visually impaired people over objects which are coming between their ways and could help them in walking with less accident.
- And, we used piezoelectric sensors (foot step power generation) it converts mechanical energy into electrical energy and it will be used as backup for battery.

4.1.1 BLOCK DIAGRAM WITH EXPLANATION

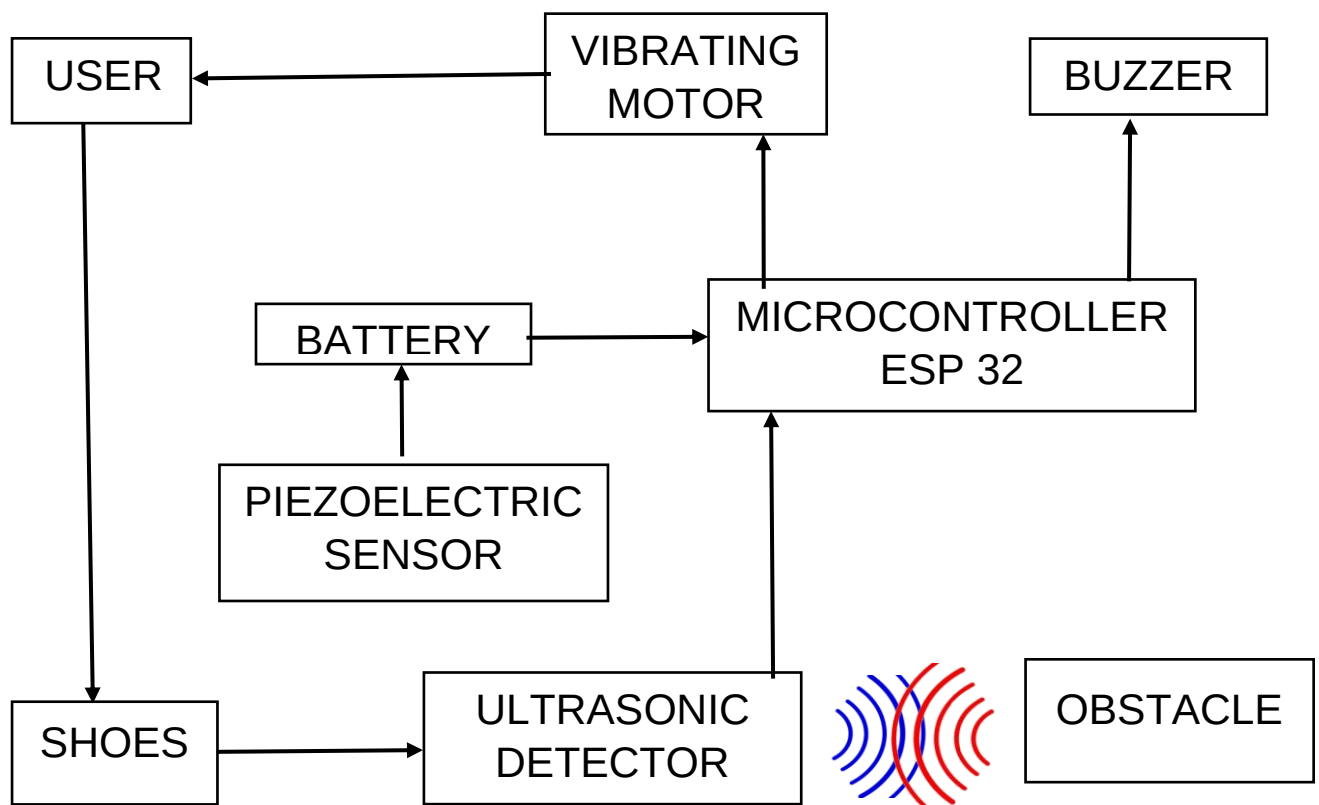


FIG 4.1.1 BLOCK DIAGRAM WITH EXPLANATION

In this smart shoe, ESP 32 carries a main role. We have interfaced all the sensors and other components into the microcontroller. At first the ultrasonic sensor detects the obstacles and pass the information to the microcontroller, microcontroller gives instruction to the buzzer to give (sound) and vibrator to alert the person and help them from the risk. Secondly, we have used piezoelectric sensors to generate electricity while walking, this energy is used as a backup for the battery which is used in the device Through the microcontroller, contains WIFI module which is helpful for the IOT things (steps count, GPS, distance etc..)

4.2 HARDWARES USED:

4.2.1 ESP 32 MICROCONTROLLER

ESP32 is a series of low-cost, low-power system on a chip microcontrollers with integrated Wi-Fi and dual-mode Bluetooth. The ESP32 series employs either a Tensilica Xtensa LX6 microprocessor in both dual-core and single-core variations, Xtensa LX7 dual-core microprocessor and a single-core RISC-V microprocessor and includes built-in antenna switches, RF balun, power amplifier, and low-noise receive amplifier, filters, and power-management modules. ESP32 is created and developed by Espressif Systems, a Shanghai-based Chinese company, and is manufactured by TSMC using their 40 nm process. It is a successor to the ESP8266 microcontroller.

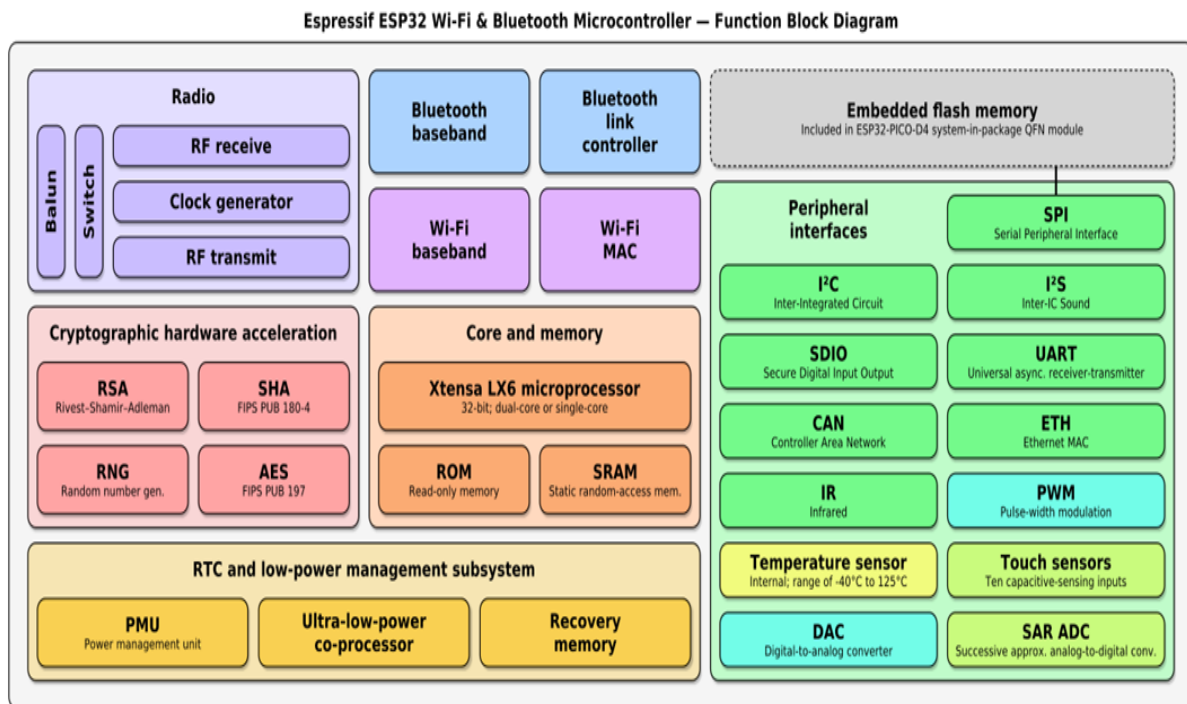
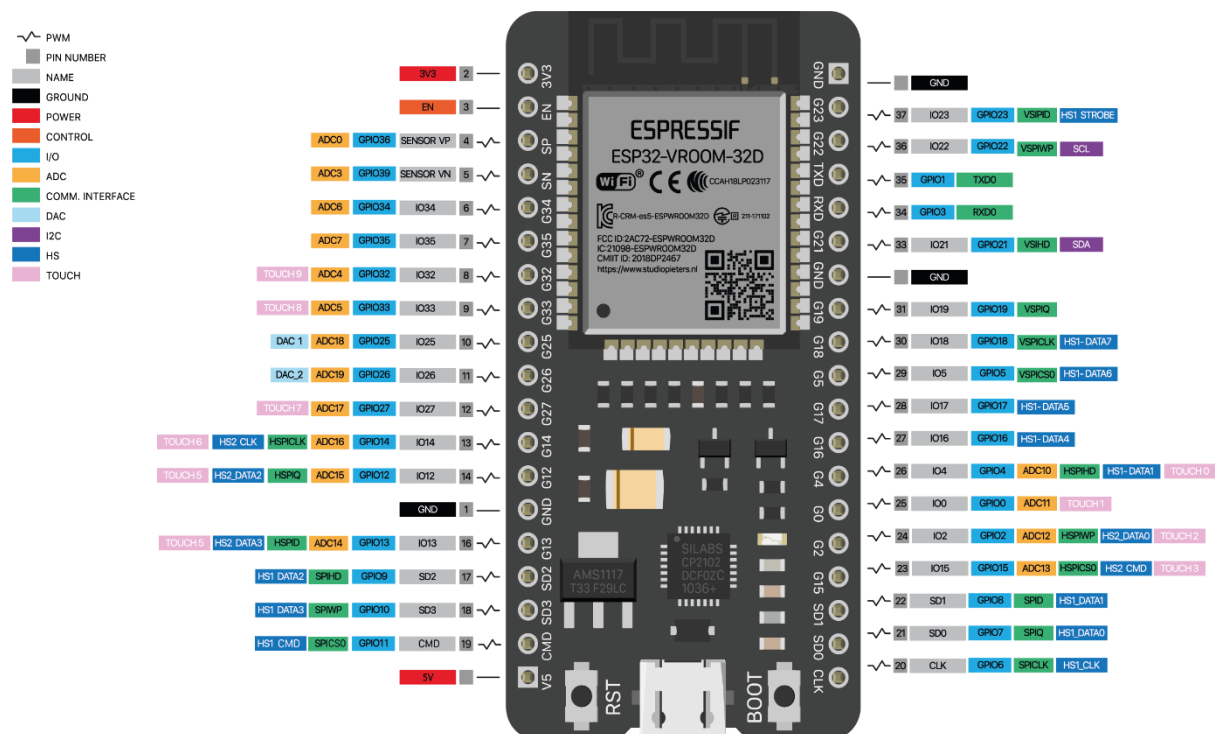


FIG 4.2.1 ESP 32 MICROCONTROLLER FUNCTION BLOCKDIAGRAM



4.2.2 ULTRASONIC SENSOR

An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity. High-frequency sound waves reflect from boundaries to produce distinct echo patterns. Ultrasonic sensors work by sending out a sound wave at a frequency above the range of human hearing. The transducer of the sensor acts as a microphone to receive and send the ultrasonic sound. Ultrasonic sensor uses a single transducer to send a pulse and to receive the echo. The sensor determines the distance to a target by measuring time lapses between the sending and receiving of the ultrasonic pulse. IoT ultrasonic sensors are designed for non-contact detection of solid and liquid objects. These sensors are used for a wide variety of functions from monitoring the level of water in a tank to fluid identification/concentration, to detecting object proximity.

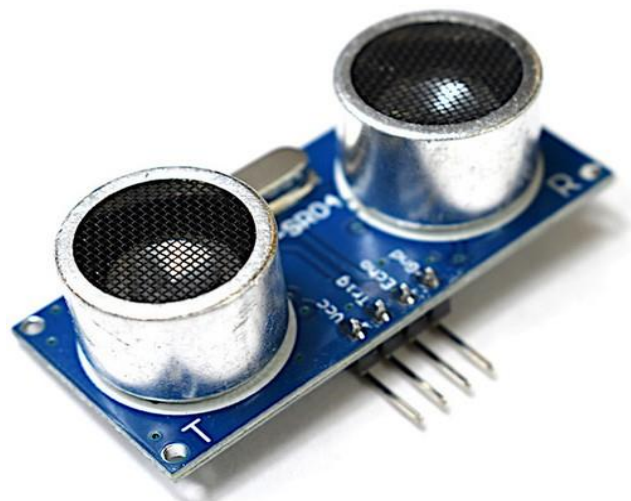
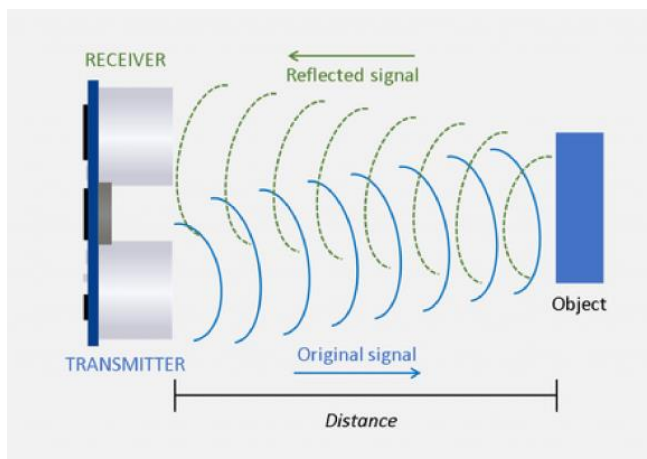


FIG 4.2.2 ULTRASONIC SENSOR

4.2.3 BUZZER

A Buzzer is an audio signalling device. There are many types of buzzer and here 5V passive Buzzer is used, which is used to create the sound and it may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke. The passive buzzer is an electromagnetic squeaker used to generate sound signals of different frequencies. It requires an AC signal to make a sound, where a changing input signal produces the sound, rather than producing a tone automatically. To use this 5v buzzer, connect one pin to ground and the other to a microcontroller programmed to output a square wave or a timer IC.



FIG 4.2.3 5V PASSIVE BUZZER

4.2.4 VIBRATOR

Vibration motor is a compact size coreless DC motor used to inform the users of receiving the signal by vibrating, no sound. Vibration motors are widely used in a variety of applications including cell phones, handsets, pagers, and so on. A vibratory motor is a three-phase motor that is intentionally unbalanced, and is also known as an eccentric rotating mass (ERM) or vibrating motor. This tiny motor produces vibrations by spinning an eccentric shaft at over 900 RPM when powered at 1.5V. It is intended for operation around 1.5V, and polarity is not important that is, the motor can run CW or CCW. The main purpose of this vibrator motor is to alert the user from receiving the call by without sound and vibrating. These motors are applicable for different categories like pager, handsets, cell phones, bluetooth etc. Vibration motor is a coreless DC motor and the size of this motor is compact. The main purpose of this motor is to alert the user from receiving the call by without sound/vibrating. The main feature of this motor is, it has magnetic properties, lightweight, and motor size is small. Based on these features, the motor performance is highly consistent. The configuration of these motors can be done in two varieties one is coin model and another one is a cylinder model.



FIG 4.2.4 VIBRATOR MOTOR

4.2.5 LITHIUM BATTERY

Batteries that have lithium as their anode is called lithium batteries. The charge moves from anode to cathode during discharge and cathode to anode during charging. Lithium batteries were introduced way back in the 1980-the 1990s. These batteries have completely revolutionized the portable electronics market such as cellular telephones and laptop computers. Lithium Battery is a latest technology battery which has 5 features - 2x life with 100% charging efficiency, light weight and no maintenance. Lithium-Ion, or Li-Ion batteries are a type of rechargeable battery that's used in many applications, but most commonly in the electronics industry. Li-Ion batteries provide portable electricity, powering electronic gadgets such as mobile phones, laptops and tablets.



FIG 4.2.5 9V BATTERY

4.2.6 DIODES

A diode is a two-terminal electronic component that conducts current primarily in one direction (asymmetric conductance); it has low (ideally zero) resistance in one direction, and high (ideally infinite) resistance in the other. Diodes can be used as rectifiers, signal limiters, voltage regulators, switches, signal modulators, signal mixers, signal demodulators, and oscillators. The fundamental property of a diodes is its tendency to conduct electric current in only one direction.



FIG 4.2.6 DIODE

4.2.7 PIEZOELECTRIC SENSOR

A piezoelectric sensor is a device that uses the piezoelectric effect to measure changes in pressure, acceleration, temperature, strain, or force by converting them to an electrical charge. A piezoelectric sensor converts physical parameters - for example, acceleration, strain or pressure into an electrical charge which can then be measured. They are highly sensitive and very small in size making them well suited to everyday objects. Piezoelectricity is the charge created across certain materials when a mechanical stress is applied. Piezoelectric pressure sensors exploit this effect by measuring the voltage across a piezoelectric element generated by the applied pressure. They are very robust and are used in a wide range of industrial applications. The sensors convert a physical,

acceleration, pressure, or other input to an electrical signal that serves as an input to a data processing system. This sensor signal often results in a response from the system. One example of such a piezo sensor is an accelerometer. A piezoelectric transducer consists of quartz crystal which is made from silicon and oxygen arranged in crystalline structure (SiO_2). Piezoelectric transducer/sensor is an active transducer and it does not need external power supply as it is self-generating.

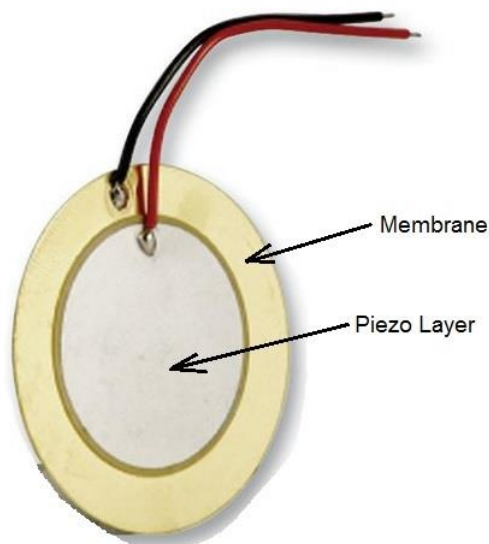


FIG 4.2.7 PIEZOELECTRIC SENSOR

4.3 SOFTWARE USED

4.3.1 ARDUINO IDE

The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino boards. The IDE application is suitable for different operating systems such as Windows, Mac OS X, and Linux. It supports the programming languages C and C++. Here, IDE stands for Integrated Development Environment.

The program or code written in the Arduino IDE is often called as sketching. We need to connect the Genuino and Arduino board with the IDE to upload the sketch written in the Arduino IDE software. The sketch is saved with the extension '.ino.'

The Arduino IDE will appear as:

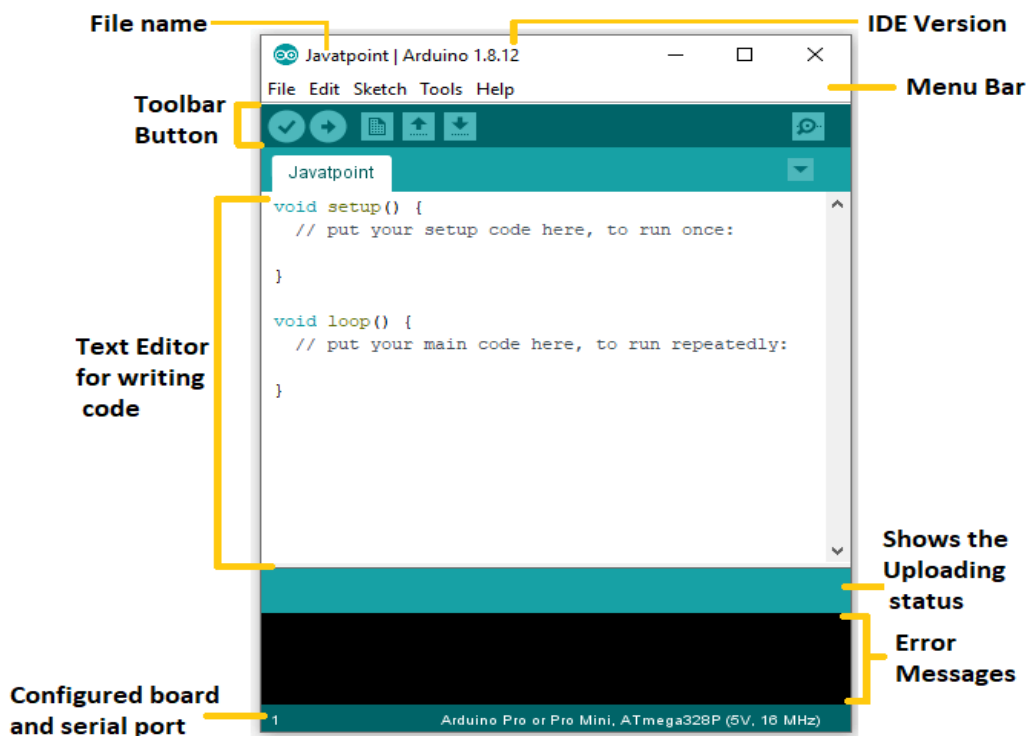


FIG 4.3.1 ARDUINO IDE INTERFACE

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them. The Arduino software is easy-to-use for beginners, yet flexible enough for advanced users. It runs on Mac, Windows, and Linux. Teachers and students use it to build low cost scientific instruments, to prove chemistry and physics principles, or to get started with programming and robotics. Designers and architects build interactive prototypes, musicians and artists use it for installations and to experiment with new musical instruments. Makers, of course, use it to build many of the projects exhibited at the Maker Faire, for example. Arduino is a key tool to learn new things. Anyone - children, hobbyists, artists, programmers - can start tinkering just following the step by step instructions of a kit, or sharing ideas online with other members of the Arduino community. There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Netmedia's BX-24, Phidgets, MIT's Handyboard, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package. Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems.

- Inexpensive - Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than \$50
- Cross-platform - The Arduino Software (IDE) runs on Windows, Macintosh

OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.

- Simple, clear programming environment - The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with how the Arduino IDE works.
- Open source and extensible software - The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to.

Writing Sketches

Programs written using Arduino Software (IDE) are called **sketches**. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

CHAPTER – 5

RESULT AND DISCUSSION

5.1 RESULT

- In this project, we used arduino IDE software to implement the commands to the ESP 32 microcontroller.
- When the ultrasonic detects the obstacle it transfers the signal to the ESP 32 microcontroller and the microcontroller transfers the signal to the vibrator and buzzer to warn the user.
- The Piezoelectric sensor produces electricity while walking and acts as a back-up power source.
- The lithium battery gets charged by the piezoelectric sensors.
- The ESP 32 has an inbuilt Wi-Fi and Bluetooth module, it can be connected to the smartphone



FIG 5.1.1 PROTOTYPE

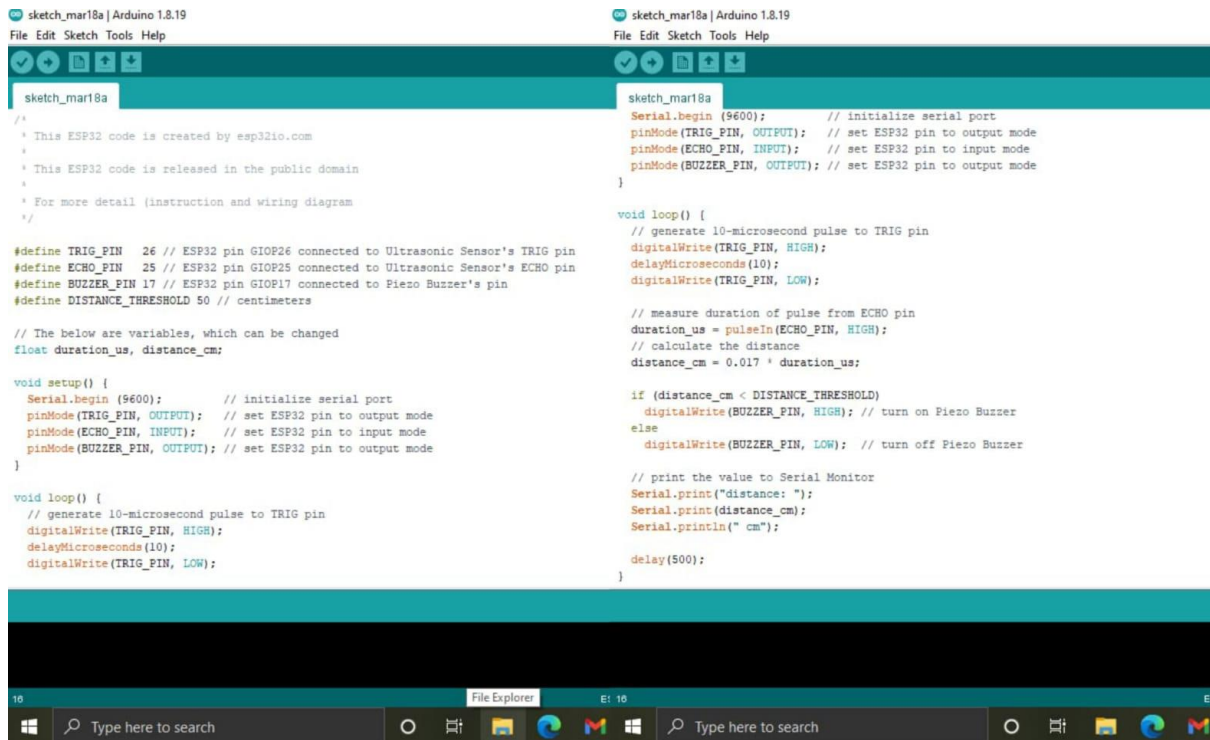


FIG 5.1.2 PROGRAMMING IN ARDUINO IDE

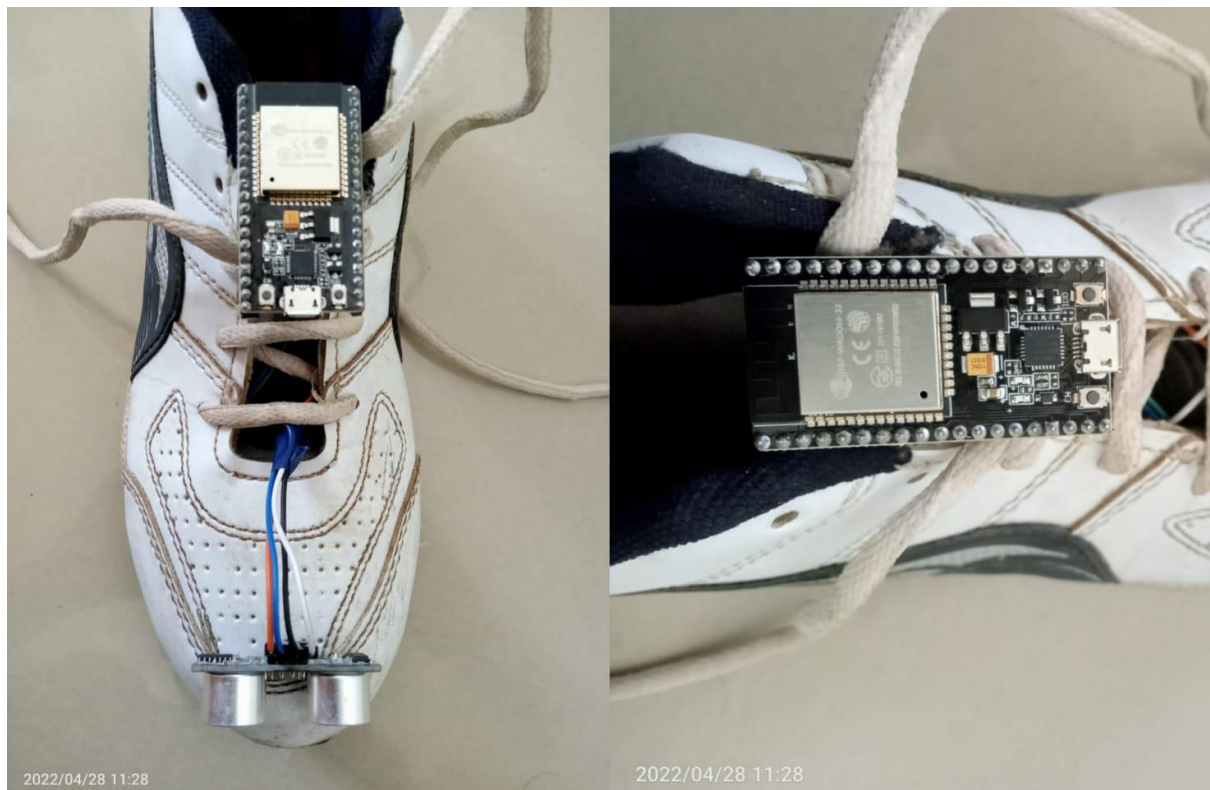


FIG 5.1.3 ULTRASONIC SENSOR ATTACHED TO THE MICROCONTROLLER



FIG 5.1.4 BUZZER ATTACHED TO THE SETUP

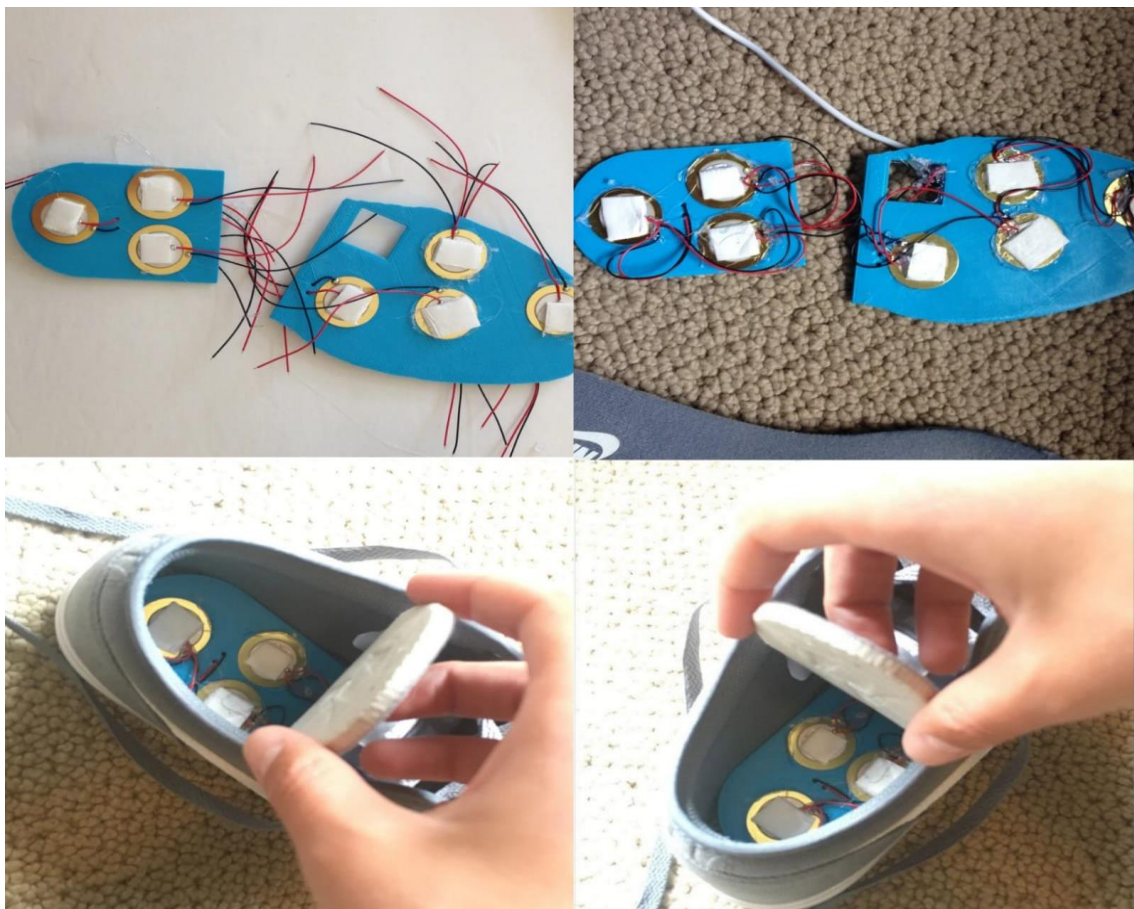


FIG 5.1.5 PIEZOELECTRIC SENSOR ATTACHED TO THE SOLE



FIG 5.1.6 FINAL PROTOTYPE

5.2 DISCUSSION

This section provides about a review of applications of ambient sensors and systems used in this project. After the successful implementation and testing of coding the following output was achieved. The screenshots of the setup have been displayed above the figure.

- Commanding ESP 32 Microcontroller.
- Connecting the ultrasonic sensor, vibrator motor and buzzer to the microcontroller.
- Piezoelectric sensors are attached to the sole of the shoe and connected to the battery.

CHAPTER – 6

SUMMARY AND CONCLUSION

6.1 SUMMARY

- We are using Ultrasonic sensor to detect the obstacle in the pathway of the visually impaired people.
- The Ultrasonic sensor detects the obstacle and transmits the signal to the ESP 32 Microcontroller.
- The ESP 32 Microcontroller transmits the signal to the buzzer and the vibrator to warn the user.
- The overall process is done by automatically.

6.2 CONCLUSION

The main focus of this paper is to implement various technology in the smart shoes for visually impaired people. The smart shoes uses the most reliable source, light, to communicate data to the visually impaired. In future work we will be focused on the enhancing the better performance of the system and to reducing the load on the users.

REFERENCES

- [1]. Ariba khanam, Anuradha Dubey, Bhabya Mishara, " A Smart Assistive Shoes for Blind People", International Journal of Advance Research in Science and Engineering, Volume No.07, special issue No .01, April 2018.
- [2]. S.D. Asha Mahesh, K.Raj Supriya, M.V.S.S.N.K. Pushpa Latha, P. Gowri, T.Sonia, B. Nani, " Smart Assistive Shoes and Cane: Solemates for the Blind People", International Journal of Engineering Science and Computing, Volume 8 Issue No.4, April 2018.
- [3]. M. Madhu Meena, M.K. kadiravan, R. Kowsalya, R.J. Lokharaj, "Li-Fi Based Smart Shoe for Blind", International Journal of Engineering Science and Computing, Volume 9 Issue No.3, March 2019.
- [4]. Saloni Mahanty, Malavika Karunan, Ibtisam Sayyad, Shlesha Khursade, "Smart Shoes for Visually Impaired", International Journal of Advanced Research in Computer and Communication Engineering, Volume 6, Issue 11, November 2017.
- [5]. Shubham Rastogi, Pankaj Dhall, Rishav Agarwal, Shristhi Thakur, "Smart Assistive Shoes and Cane: Solemates for the Blind People", International Journal of Advanced Research in Electronics and Communication Engineering, Volume 6, Issue 4, April 2017.

[6]. Saylee Begampure, Renuka Deshmukh, Sheetal Chotaliya, Shubham Sirsat, “ Smart Navigational Shoes for the Blind Person”, International Journal of Innovative Research in Electrical, Electronics, Instrumentation and control Engineering, Volume 6, Issue 4, April 2018.

[7]. Ziad O. Abu-faraj, Paul Ibrahim, Eile Jabbour, Anthony Ghaoul, “Design and Development of a Prototype Rehabilitative Shoes and Spectacles for the Blind”, 5th International Conference on BioMedical Engineering and informatics, 978-1- 4673-1184-7/12/\$31.00, 2012.

[8]. Vikram Singh Parmar, Krishna Sai Inkoolu, “Designing Smart Shoes for Obstacle Detection”, Empowering Visually Challenged Users Through ICT”, International Federation for Information Processing, 97-68-3-319-6768, August 2017.

[9]. Shlesha Khursade, Malavika Karunan, Ibtisam Sayyad, Saloni Mohanty, “Smart Shoes: “A Safe Future for the Blind”, International Journal of Innovative Research in Computer and Communication Engineering”, Volume No.6, Issue 5, May 2018.

APPENDIXES

Code for ESP32 microcontroller

```
/*  
  
 * This ESP32 code is created by esp32io.com  
  
 *  
  
 * This ESP32 code is released in the public domain  
  
 */  
  
  
#define TRIG_PIN 26 // ESP32 pin GIOP26 connected to Ultrasonic  
Sensor's TRIG pin  
  
#define ECHO_PIN 25 // ESP32 pin GIOP25 connected to Ultrasonic  
Sensor's ECHO pin  
  
#define BUZZER_PIN 17 // ESP32 pin GIOP17 connected to Piezo  
Buzzer's pin  
  
#define DISTANCE_THRESHOLD 50 // centimeters  
  
  
// The below are variables, which can be changed  
  
float duration_us, distance_cm;  
  
  
void setup() {  
  
    Serial.begin (9600);      // initialize serial port  
  
    pinMode(TRIG_PIN, OUTPUT); // set ESP32 pin to output mode
```

```
pinMode(ECHO_PIN, INPUT); // set ESP32 pin to input mode

pinMode(BUZZER_PIN, OUTPUT); // set ESP32 pin to output mode

}
```

```
void loop() {

    // generate 10-microsecond pulse to TRIG pin
    digitalWrite(TRIG_PIN, HIGH);
    delayMicroseconds(10);
    digitalWrite(TRIG_PIN, LOW);

    // measure duration of pulse from ECHO pin
    duration_us = pulseIn(ECHO_PIN, HIGH);

    // calculate the distance
    distance_cm = 0.017 * duration_us;

    if (distance_cm < DISTANCE_THRESHOLD)
        digitalWrite(BUZZER_PIN, HIGH); // turn on Piezo Buzzer
    else
        digitalWrite(BUZZER_PIN, LOW); // turn off Piezo Buzzer

    // print the value to Serial Monitor
    Serial.print("distance: ");
```

```
Serial.print(distance_cm);  
Serial.println(" cm");  
  
delay(500);  
}
```