A

Project Report

On

ULTRASONIC VISION FOR BLIND

Submitted In Partial Fulfilment For the Diploma In

Computer Engineering

Submitted by

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ACADEMIC YEAR (2023-2024).

CERTIFICATE

This is to certify that Mr./Ms **Gangotri Datta Kompalwar** has Successfully Completed the Project Report on the topic **"ULTRASONIC VISION FOR BLIND"** satisfactorily in partial fulfilment of the requirement for the award of the diploma in Computer Engineering under the guidance of **Mr. Syed Ateeq** during the year 2023-2024.

Course In-Charge	HOD	PRINCIPAL
(Mr. Syed Ateeq)	**(Ms. Choudhary N. G.)**	**(Dr. Agrawal E. S.)**

PROJECT APPROVAL SHEET

The project entitled **"ULTRASONIC VISION FOR BLIND"** by Gangotri Datta Kompalwar has been approved for the diploma in Computer Engineering for the Academic Year 2023-2024.

External Examiner:

Guide	HOD	Principal
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Date: --------------------

Place:--------------------

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Sincerely

Gangotri Datta Kompalwar

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ABSTRACT

A distance measurement and depth measurement system with a buzzer sound alert is designed to detect any obstruction and depths in front of blind person to make him/her aware before collision or falling down. In this project one ultrasound device is used to detect distance of object in front of person and Another ultrasonic sensor is programmed to detect depth in front of person . A Buzzer is used to give two different sound for two ultrasonic sensor. This whole system is programmed and co-ordinated through an Arduino which reads distance and depth from ultrasonic sensors and sets up an output in the form of voice massage when it crosses certain limits.

A blind person faces a lot of problems while walking or travelling from one place to another, many times they get injured after colliding with an object or wall which they can't see, presently there are many proposed models working on this, but the big problem with them is no one is focusing on potholes or depths on land at which a blind person can easily fall down. so this system can detect obstructions in front of person and it also focuses on detecting any type of depth or potholes on land and aware the blind person with a sound output alert.

- A dedicated object detection ,depth detection system with a buzzer alert for blind person.
- It gives a sound alert to blind person before collision to a wall or object or before falling down a depth.
- It includes various components which works together for accuracy and safety.
- The aim is to prevent a blind person from accidently bumping an object or obstruction or falling down a pothole or depth.

CHAPTER 1: INTRODUCTION

Visually challenged people are one among the dependant population in the society who need an extended help from the general public for every normal activity for others such as crossing the roads, boarding the buses and in general realization of the obstacle which is in front of them. This project mainly focuses on providing light for the blind people and relieving them from the dark world by providing them vision using high frequency ultrasonic sound waves. Ultrasonic sound waves which are basically high frequency waves and are beyond the range of hearing capability of human beings. These sound waves are used by mammals such as bats and whales to detect the presence of obstacles in front of them. The sound waves which are being sent by these mammals are being reflected back from the obstacle thereby ensuring its presence. This process is known as echolocation. The natural phenomenon of echolocation used by the mammals is being practically implemented here for providing vision for the visually impaired.

Blindness is the lack Smart of vision caused due to physiological or neurological factors resulting in visual disability. Blindness can be temporary or permanent, and partial or complete blindness causing a person to become dependent on others for help. Even disabled people want to be independent in today's world and do not want to seek help from others. Smart Blind Stick is an innovative device, which is an initiative to help blind people to resolve the problems faced by them in their daily life. Smart Blind Stick is a system device that incorporates several features, namely- obstacle detection, depth detection. The main objective of the device is to help blind people to walk with complete relief and self-dependency. The blind stick is integrated with two ultrasonic sensors, buzzer and Arduino UNO.

In this project one ultrasound device is used to detect distance of object in front of person and Another ultrasonic sensor is programmed to detect depth in front of person . An ISD and a sound output device is used to record and play personalized voice alert or voice notes. This whole system is programmed and co-ordinated through an Arduino which reads distance and depth from ultrasonic sensors and sets up an output in the form of voice massage when it crosses certain limits.

The Smart Blind Stick automatically detects the obstacle in front of the person by use of sensors present in the systems; it also incorporates moisture detection at its bottom in order to detect the moisture of the soil or ground so that the person will be aware if it is feasible to walk on that particular ground.

Ultrasonic vision for the blind is a technology that utilizes ultrasonic sensors to detect obstacles and provide feedback to blind or visually impaired individuals, aiding them in navigation. These sensors emit high-frequency sound waves that bounce off objects in the environment. By analysing the time it takes for these sound waves to return, the device can determine the distance to obstacles and convey this information to the user

An ultrasonic sensor is used in many industries for different purpose , the main aim is to detect distance of objects.in this project this capability of ultrasonic sensor is used to make both distance and depth detection and made to work with sound alert system.

For those with visual impairments, the simple act of navigating through the world can pose significant challenges. However, with advancements in technology, innovative solutions emerge to empower independence and enhance mobility. Among these solutions stands the Smart Blind Stick, a groundbreaking device harnessing the power of ultrasonic vision and Arduino Uno microcontroller technology.

At its core, the Smart Blind Stick is a beacon of ingenuity, designed to provide real-time feedback and obstacle detection to users, enabling safe and confident navigation through diverse environments. Equipped with ultrasonic sensors, akin to the biological echolocation abilities of certain animals, this device emits high-frequency sound waves that bounce off obstacles in its vicinity. By precisely measuring the time taken for these waves to return, the Smart Blind Stick swiftly detects obstacles, opening up a clearer path forward.

Driven by the Arduino Uno microcontroller, this intelligent device orchestrates a symphony of data processing and feedback mechanisms. Through meticulously crafted algorithms, the Arduino interprets sensor data, calculating distances and identifying potential hazards. The culmination of this processing manifests in intuitive auditory feedback, delivered via integrated buzzers or piezo speakers. Users receive immediate alerts, with varying tones or frequencies signifying proximity to obstacles, thereby facilitating informed decision-making and effortless navigation.

Yet, the Smart Blind Stick is more than just a tool; it's a testament to inclusivity and technological empowerment. With its open-source Arduino platform, this device invites collaboration and innovation from a global community, fostering continuous improvement and customization. Its modular design accommodates future enhancements, from tactile interfaces to wireless connectivity, ensuring adaptability to evolving needs and preferences.

As we embark on this journey towards accessibility and inclusion, the Smart Blind Stick stands as a beacon of hope, illuminating pathways and breaking down barriers. With each step forward, it reaffirms our commitment to a world where everyone, regardless of vision, can navigate with dignity and independence.

In a world where the rhythm of life pulses through bustling streets and dynamic environments, the journey of those with visual impairments is marked by unique challenges. Navigating through these spaces demands not just physical agility, but also a reliance on innovative solutions that transcend the limitations of traditional aids. Enter the Ultrasonic Vision Smart Blind Stick, a beacon of technological ingenuity poised to revolutionize mobility for the blind and visually impaired.

At its core, this remarkable device embodies the marriage of cutting-edge ultrasonic technology with the versatility of the Arduino Uno microcontroller. Through a symphony of sensors and algorithms, the Smart Blind Stick transforms the surrounding environment into a canvas of awareness. Ultrasonic sensors emit high-frequency sound waves, echoing off nearby obstacles, while the Arduino Uno orchestrates the intricate dance of data processing. The result? A real-time map of the user's surroundings, enabling swift detection of obstacles and providing crucial auditory feedback.

However, the brilliance of the Smart Blind Stick lies not only in its functionality but also in its unwavering commitment to inclusivity and empowerment. Its open-source Arduino platform invites collaboration and innovation, fostering a global community dedicated to enhancing accessibility. From customizable feedback mechanisms to seamless integration with auxiliary technologies, the Smart Blind Stick adapts and evolves with the diverse needs of its users. Yet, beyond its technological prowess, the Smart Blind Stick embodies a profound ethos of independence and dignity. It is a symbol of liberation, empowering users to navigate the world on their own terms, free from the constraints of visual impairment.

With each step guided by the gentle hum of ultrasonic waves, users reclaim control over their journey, forging paths where barriers once stood. As we embark on this transformative journey, let us embrace the promise of the Ultrasonic Vision Smart Blind Stick—a beacon of hope illuminating the path towards a more inclusive future. Together, let us redefine the boundaries of possibility and usher in an era where innovation serves as a gateway to independence for all.

In a world where every step holds the promise of adventure, the journey of those with visual impairments has often been marked by uncertainty and dependency. Yet, in the corridors of innovation, a beacon of hope emerges—a technological marvel poised to redefine mobility and independence. Enter the Smart Blind Stick, a revolutionary fusion of ultrasonic vision and Arduino Uno ingenuity, designed to empower users with a newfound sense of autonomy.

Picture a world where obstacles dissolve into mere whispers, where every corner is explored with confidence and grace. This vision becomes reality through the intricate dance of ultrasonic sensors and intelligent microcontrollers. The Smart Blind Stick serves as a vigilant companion, its sensors emitting high-frequency sound waves that navigate the surrounding terrain with unparalleled precision. As these waves bounce back, the Arduino Uno transforms echoes into a symphony of data, painting a vivid picture of the user's environment in real-time.

But the brilliance of the Smart Blind Stick extends far beyond its technical prowess. It embodies a philosophy of inclusivity and empowerment, inviting users to take centre stage in their own narrative. Through customizable feedback mechanisms and an open-source ethos, this device becomes a canvas for creativity and collaboration. Whether it's the gentle hum of a buzzer or the pulsating rhythm of haptic feedback, users shape their experience to suit their unique preferences and needs.

Yet, amidst the marvel of technology lies a deeper truth—a truth rooted in the transformative power of independence. With each tap of the Smart Blind Stick, users carve out pathways to newfound freedom, transcending the limitations of their condition. No longer bound by the confines of uncertainty, they navigate the world with purpose and poise, emboldened by the knowledge that obstacles are merely stepping stones on the journey of life.

Living with visual impairment poses significant challenges in navigating the world independently. While traditional white canes provide assistance, they have limitations in detecting obstacles at a distance.. One such solution is the development of a Smart Blind Stick equipped with Ultrasonic Vision, powered by Arduino Uno.

Fig.1.1 Blind Person Walking with blind stick equipped with object detection system.

The Smart Blind Stick utilizes ultrasonic sensors to detect obstacles in the user's path and provides real-time feedback through auditory or haptic signals. Arduino Uno, a popular microcontroller platform known for its versatility and ease of use, serves as the brains of this assistive device. By combining ultrasonic technology with Arduino's programmability, the Smart Blind Stick offers an intelligent and reliable tool for individuals with visual impairments to navigate their surroundings safely.

The Smart Blind Stick utilizing Ultrasonic Vision and Arduino Uno represents a significant advancement in assistive technology for the visually impaired. By harnessing the power of ultrasonic sensors and Arduino's programmability, this innovative device offers a practical and affordable solution to enhance the mobility and independence of individuals with visual impairments. With further development and refinement, the Smart Blind Stick has the potential to positively impact the lives of millions worldwide, empowering them to navigate the world with greater freedom and confidence.

1.1 Objectives

The objective of this project is to build and test a working model on object and depth detection system for blind person using ultrasonic sensors Arduino and other components.

1.2 System Specifications

- **Hardware Requirements:**
  1. Ultrasonic Sensor
  2. Arduino UNO
  3. Buzzer

- **Software Requirements:**
  1. Arduino IDE : arduino-ide_2.2.1_Windows_64bit

CHAPTER 2: LITERATURE SURVEY

2.1 Ultrasonic Sensor :

The history OF ULTRASONIC SENSORS dates back to 1790, when Lazzaro Spallanzani first discovered that bats maneuverer in flight using their hearing rather than sight. Jean-Daniel Colladon in 1826 discovered sonography using an underwater bell, successfully and accurately determining the speed of sound in water.

The era of modern ultrasonics started about 1917, with Langerin's use of high-frequency acoustic waves and quartz resonators for submarine detection. Since that time, the field has grown enormously, with applications found in science, industry, medicine and other areas.

2.1.1 Working Of Ultrasonic Sensor :

Ultrasonic sensors work by emitting sound waves at a frequency too high for humans to hear. They then wait for the sound to be reflected back, calculating distance based on the time required. This is similar to how radar measures the time it takes a radio wave to return after hitting an object.

While some sensors use a separate sound emitter and receiver, it's also possible to combine these into one package device, having an ultrasonic element alternate between emitting and receiving signals. This type of sensor can be manufactured in a smaller package than with separate elements, which is convenient for applications where size is at a premium.

While radar and ultrasonic sensors can be used for some of the same purposes, sound-based sensors are readily available—they can be had for just a couple dollars in some cases—and in certain situations, they may detect objects more effectively than radar.

For instance, while radar, or even light-based sensors, have a difficult time correctly processing clear plastic, ultrasonic sensors have no problem with this. In fact, they're unaffected by the colour of the material they are sensing.

It is designed to measure the distance of any object by using an ultrasonic transducer. Ultrasonic means of distance measurement is a convenient method compared to traditional one using measurement scales.

This kind of measurement is particularly applicable to inaccessible areas where traditional means cannot be implemented such as high temperature, pressure zones etc.

It emits an ultrasound at 40 000 Hz which travels through the air and if there is an object or obstacle on its path It will bounce back to the module. Considering the travel time and the speed of the sound you can calculate the distance.

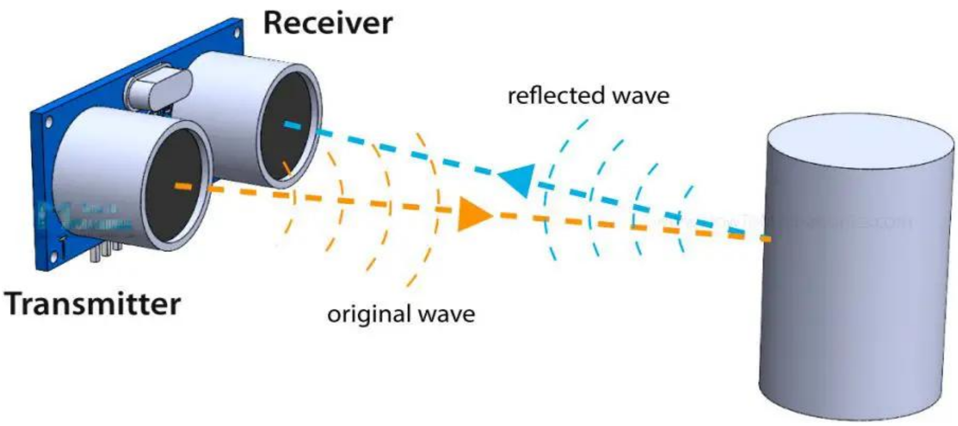

Fig.2.1.1.1 Directions of Ultrasonic Waves.

On the other hand, if an object is made out of a material that absorbs sound or is shaped in such a way that it reflects the sound waves away from the receiver, readings will be unreliable.

An ultrasonic sensor measures distance by emitting ultrasonic waves (sound waves with a frequency higher than the human audible range) and then listening for the echo. The time it takes for the sound waves to travel to an object and bounce back to the sensor is used to calculate the distance.

1. Triggering the Sensor:

The Arduino sends a short pulse to the sensor's trigger pin. This pulse tells the sensor to send out a burst of ultrasonic waves.

2. Emitting Ultrasonic Waves:

Once triggered, the sensor emits a burst of ultrasonic waves. These waves travel through the air until they encounter an object.

3. Object Detection:

When the ultrasonic waves hit an object, they bounce back, creating an echo. The sensor's receiver (connected to the echo pin) detects this echo.

4. Measuring Time:

The Arduino measures the time it takes for the ultrasonic waves to travel to the object and back. It does this by timing how long it takes for the echo pulse to return. This time is measured in microseconds.

5. Calculating Distance:

Since sound travels at a known speed through the air (approximately 343 meters per second or 0.0343 cm/µs at room temperature), the Arduino can use the time measured in step 4 to calculate the distance to the object.

Distance = (Time * Speed of Sound) / 2

The division by 2 is because the time measured represents the total travel time, which includes both the "to" and "from" distances.

6. Output:

The Arduino can then use this calculated distance for various purposes, such as displaying it on an LCD, triggering an alarm, or controlling a robot's movement.

7. Looping:

This process typically repeats in a loop so that the Arduino can continuously monitor the distance to the object.

8. Adjustment and Calibration:

Depending on the specific requirements and environmental conditions, adjustments may be necessary. This could involve calibrating the sensor or adjusting the code to account for factors like temperature, humidity, or the speed of sound.

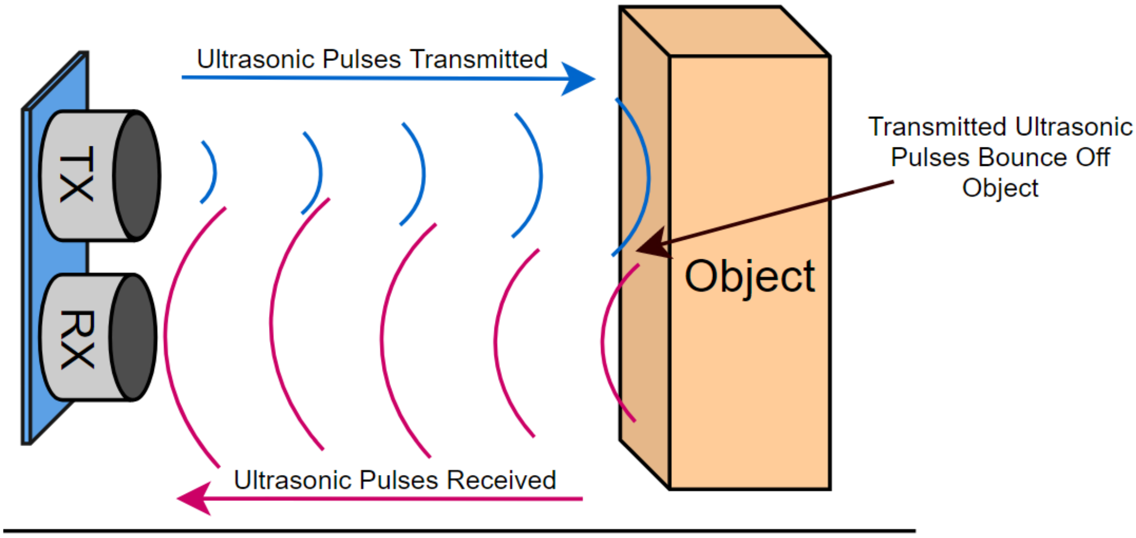

Fig.2.1.1.2 Working of Ultrasonic Sensor.

An ultrasonic transducer comprising of a transmitter and receiver are used. The total time taken from sending the waves to receiving it is calculated by taking into consideration the velocity of sound. In this way distance is calculated.

Ultrasonic sensors work by emitting sound waves at a frequency too high for humans to hear. They then wait for the sound to be reflected back, calculating distance based on the time required. This is similar to how radar measures the time it takes a radio wave to return after hitting an object.

While some sensors use a separate sound emitter and receiver, it’s also possible to combine these into one package device, having an ultrasonic element alternate between emitting and receiving signals. This type of sensor can be manufactured in a smaller package than with separate elements, which is convenient for applications where size is at a premium.

While radar and ultrasonic sensors can be used for some of the same purposes, sound-based sensors are readily available—they can be had for just a couple dollars in some cases—and in certain situations, they may detect objects more effectively than radar.

On the other hand, if an object is made out of a material that absorbs sound or is shaped in such a way that it reflects the sound waves away from the receiver, readings will be unreliable.

2.1.2 Features Of Ultrasonic Sensor :

The features of the HC-SR04 sensor include the following :

1. The power supply used for this sensor is +5V DC
2. Dimension is 45mm x 20mm x 15mm
3. Quiescent current used for this sensor is <2mA
4. The input pulse width of trigger is10uS
5. Operating current is 15mA
6. Measuring angle is 30 degrees
7. The distance range is 2cm to 800 cm
8. Resolution is 0.3 cm
9. Effectual Angle is <15°
10. Operating frequency range is 40Hz
11. Accuracy is 3mm

2.1.3 Applications Of Ultrasonic Sensor :

The applications of HC-SR04 sensor include the following :

1. This sensor is used to measure speed as well as the direction between two objects
2. It is used in wireless charging
3. Medical ultrasonography
4. This is used to detect objects & avoid obstacles using robots such as biped, pathfinding, obstacle avoidance, etc.
5. Depth measurement
6. Humidifiers
7. This sensor is used to plot the objects nearby the sensor by revolving it
8. Non-destructive testing
9. By using this sensor depth of pits, wells can be measured by transmitting the waves through water.
10. Embedded system
11. Burglar alarms

2.2 Arduino:

Arduino was created in 2005 by Massimo Banzi and David Cuartielles at the Interaction Design Institute Ivrea in Ivrea, Italy, building upon the work of Hernando Barragán (creator of Wiring). Arduino has an extensive community of makers, hobbyists, programmers, and professionals that has helped in the development worldwide.

Arduino is an open-source prototyping platform in electronics based on easy-to-use hardware and software. Subtly speaking, Arduino is a microcontroller based prototyping board which can be used in developing digital devices that can read inputs like finger on a button, touch on a screen, light on a sensor etc. and turning it in to output like switching on an LED, rotating a motor, playing songs through a speaker etc.

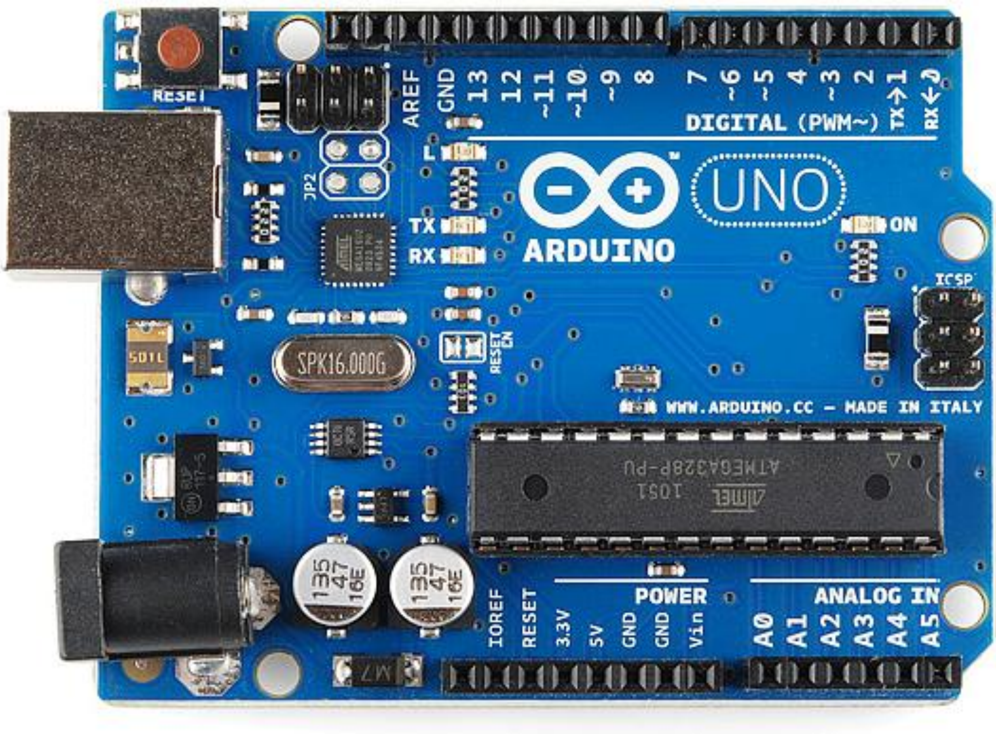

Fig.2.2.1 Arduino

Arduino boards consist of a circuit board that can be programmed and a software called Arduino IDE (Integrated Development Environment). The IDE is used to write and upload computer code to the board.

Over time, the Arduino board has gained popularity among people who just started developing electronics. This is because Arduino is different from other programmable circuit boards developed in the past. Unlike those boards, Arduino requires no programmer to load a new code. All you just need is a USB cable and you are good to go. Asides this, Arduino offers several features and benefits.

Arduino boards can read inputs from sensors and turn them into outputs, such as activating a motor, turning on an LED, or publishing something online. For example, we can connect an Arduino to a button, switch, temperature sensor, GPS sensor, magnetometer, PIR sensor, ultrasonic range finder, and more. The Arduino can process the inputs from any input device and output a result to an output device based on certain conditions defined in the Arduino program.

The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board -- you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.

- **Types of Arduino:**
  1. Arduino Uno
  2. Arduino Nano
  3. Arduino Uno Mini
  4. Arduino Micro
  5. Arduino Mini

2.2.2 Features of Arduino:

1. **Open source:**

   Arduino is open source, and the IDE is also open source.

2. **Easy microcontroller board:**

   Arduino is easy to use for projects.

3. **Simple programming:**

   Programming Arduino is simple.

4. **Easy interfacing sensor:**

   Interfacing sensor is easy due to digital input/output and analog input pins.

5. **Arduino IDE:**

   Arduino IDE is a hassle-free, simple, and straightforward programming environment.

6. **Beginner-friendly software:**

   The program makes it easier to code websites and applications.

7. **Pre-assembled circuit board:**

   Arduino shield is a pre-assembled circuit board that provides additional functionality to your barebones Arduino board.

8. **Flash memory:**

   Arduino UNO has 30kb Flash memory.

9. **Light Emitting Diodes (LEDs):**

   LEDs are versatile components that can be used to create various lighting effects and displays.

10. **Tiny footprint:**

    Arduino Nano is 45 mm long, 18 mm wide, and weighs 7 grams.

11. **Serial Monitor:**

    Serial monitor plays a very important role in debugging of Arduino Sketches.

2.2.3 Applications of Arduino:

1. Home Automation:

One of the most prevalent applications of Arduino is in home automation systems. Arduino boards, combined with sensors, actuators, and wireless connectivity, allow homeowners to control various aspects of their living spaces with ease.

2. Robotics:

Arduino plays a vital role in the realm of robotics, enabling enthusiasts and professionals to build their own robots. With Arduino, you can integrate sensors, motors, and controllers to create autonomous machines capable of performing specific tasks. From simple line-following robots to complex humanoid models, Arduino provides a robust foundation for learning and experimenting with robotics concepts.

3. Wearable Technology:

By leveraging Arduino’s compact size, low power consumption, and compatibility with various sensors and displays, inventors have created wearable devices. These devices include smartwatches, fitness trackers, and garments embedded with interactive elements. Arduino’s versatility enables developers to design personalized wearable solutions that cater to specific needs and preferences.

4. Educational Teaching:

Arduino’s accessibility and affordability make it an excellent educational tool for teaching electronics, programming, and problem-solving skills. Arduino-based projects provide hands-on learning experiences, encouraging students to explore technology, unleash their creativity, and develop a deep understanding of concepts. It fosters a practical and engaging learning environment for students of all ages.

5. IoT:

Among the various uses of Arduino, it also plays a pivotal role in the field of the Internet of Things (IoT). Its compatibility with various sensors, connectivity modules, and cloud services makes it an ideal platform for building IoT solutions. Arduino boards can collect data from sensors, process it, and transmit it to the cloud for analysis and action. Its flexibility, affordability, and extensive community support have made it a popular choice for IoT prototyping and development.

7. 3D Mapping & Printing:

3D printing has become widely popular thanks to its ability to turn ideas into tangible objects quickly at a low cost. This makes it easier to prototype products or bring new creations to life without having expensive machinery that runs only a few items at a time. By pairing an Arduino board with one printer motor driver, users have full control over their 3D printer's movements while still maintaining accuracy when producing parts within the tight tolerances required for certain applications.

8. Automated Gardening:

Automated gardening is an increasingly popular way to grow plants with Arduino. This can be done by using digital sensors and actuators that interact with a user's environment, such as temperature or water levels.

9. Smart City Projects:

Arduino is a powerful tool for enabling the development of smart city projects, such as automated parking systems, traffic control solutions, or even energy-efficient lighting networks. Smart city projects are designed to improve urban infrastructure by using technology to optimize services and reduce costs. With its advanced capabilities, Arduino can be used to create sophisticated sensors that collect data from various sources within cities and process it to detect patterns, trends, and insights.

10. Drones:

Drones have become increasingly popular in recent years thanks to their ability to provide aerial imaging services with minimal effort. Arduino's ease of use allows users to customize each component according to their exact needs while also providing support for wireless communication protocols like Wi-Fi or Bluetooth. This provides users with the ability to build custom drones tailored to specific applications, such as agriculture monitoring, search and rescue operations, and more.

CHAPTER 3: SCOPE OF THE PROJECT

3.1 Scope Of Project In Various Fields:

1. Medical:

Now a days medical field has become so advance due to use of engineering and technology in the medical field yet there is need of developing instruments in some fields specially for handicapped person. These project covers a huge group of population as blind person these device will play its role in improving quality of lifestyle in blind person

2. Engineering and Technology:

There is constantly massive study and inventions are going on in this field yet many of this new ideas uses microprocessors as their base components. There is immense possibilities of new inventions this project uses microprocessor as a helping hand for blind person with ultrasonic sensor and sound output it helps blind person to detect front objects and depth. This technology can be further improved and used for mankind purpose.

3. Industrial Purpose:

There are more than 4.6 million blind person alone in India there is huge need of providing them with right technology to improve their life or protect them from accidents. Many of this population can offer a small amount from their pocket at industrial level there is need of creating such a useful device at affordable rate which this project can useful.

3.2 System Module:

- Distance Measurement System
- Depth Measurement System
- Different Buzzer Sounds For Three Possible Situations. I.E. Front, Depth, Both At Once.

1. **Distance Measurement System:**

   A distance measurement system consists of a ultrasonic sensor and Arduino UNO. An Ultrasonic sensor consist of a transmitter and a receiver. An ultrasonic sensor emits a sound pulse in the ultrasonic range. This sound pulse propagates at the speed of sound through air (about 344 meters per second) until the sound pulse encounters an object.

   The sound pulse bounces off the object and is returned in reverse to the sensor where this "echo" is received. By measuring the time it takes for the sound pulse to travel from sensor to object and back to the sensor. The distance to the object can be calculated very accurately. This measuring principle is also called "Time of Flight", or transit time measurement

2. **Depth Measurement System:**

   Depth measurement system is based on same device and principle of working as distance measurement system ,the main difference is seen in Arduino programming , as the threshold or trigger values are set up in such a way that as the distance from ground cross certain limit it triggers a sound output through Arduino to play specific sound.

3. **Different Buzzer Sounds For Three Possible Situations. i.e. Front, Depth, Both at once:**

   There are three different sound outputs for three possible situations,

   - **For front :** The Arduino is programmed using buzzer which gives discontinued sound or beep i.e. every beep at a time interval 1 second.
   - **For depth :** The Arduino I programmed with buzzer which gives continued sound or beep.
   - **For both :** It gives two beeps at a time interval of 1 second.

3.3 Advantages Over Present Models :

1] This model not only focuses of front obstacles but also this model helps blind people from any type of accidental collision and falling to a depth, stairs, potholes etc.

2] All present models are focused only on front obstacles on the other hand this model also focuses on front obstacles and any type of depths.

3] The ISD used in this model helps to record and play personal voice commands so one can get aware before any obstacle or fall.

4] As this model is integrated in stick used by a blind person no extra load needed to carry it separately.

5] The model is cost effective as compared to its usability and utility.

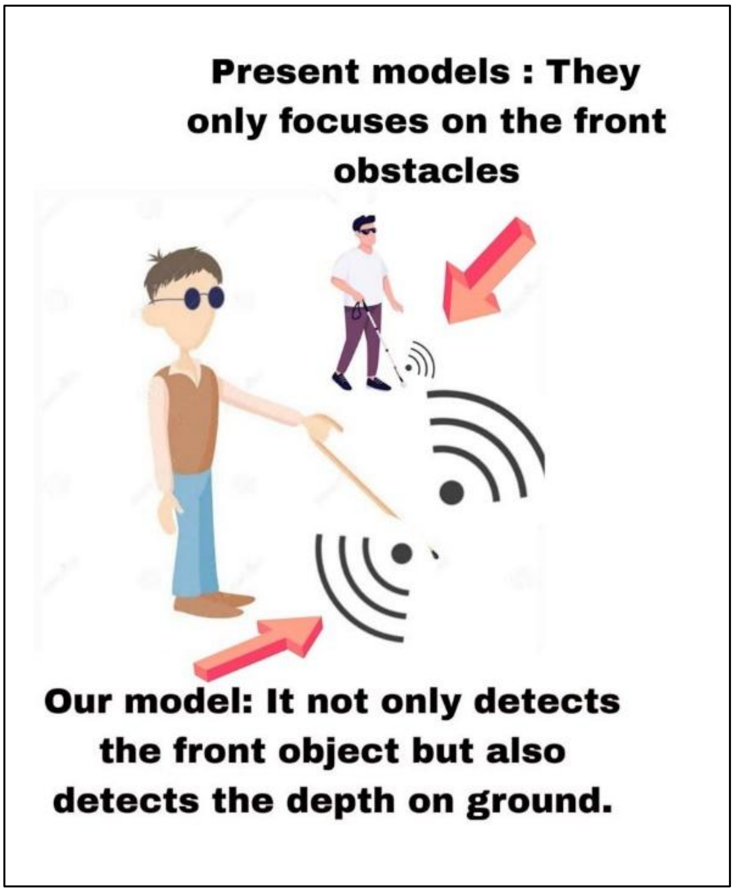

Fig.3.3.1 Advantages Over Present Models.

CHAPTER 4: DESIGN

The project is based on SDLC and Experimentation model as this project is based on both software development and hardware manufacture. For this project Analysis of problem is done to select the topic then detailed planning has been done to systematically roll out the project all requirements and needs are listed up.

A final design has been decided all the equipment's are constructed according design and planning software has been coded according to the need of design and working of instruments the final testing of hardware and software has been done and efficacy of the project has been tested and project is finalized.

4.1 Design Aspects:

While designing the project we considered following points to:

1. **Auditory Feedback:**

As visually blind person can't see front objects the auditory signals plays an important role, in helping the person while walking. Here, we used an ISD to record and play personalized message and a sound output device, it will surely act as second eye for the blind person and alert him before any accident.

2. **Ultrasonic Sensor:**

It is used to detect obstacles Infront while walking and standing which integrates with ISD and Arduino to create sound output as warning.

3. **Compact Design:**

This system is naturally integrated with a stick used by blind person, which makes it very comfortable for users. Simple controls: the operation of whole system has been kept so simple with one press tactile button which makes it very user friendly.

4. **Robust Material:**

The whole project is integrated with the stick used by blind which is very light weight and also durable and anti-rust proof which makes it long lasting. User training and accessibility standard: as this project is made in such way that anyone can operate it with a small onetime training, also we designed the project as per the unique needs and preferences of blind persons with their valuable feedback wherever needed.

CHAPTER 5: IMPLEMENTATION DETAILS

5.1 Components Of Project :

1. Arduino Uno
2. Hc-Sr04 Ultrasonic Sensor
3. Buzzer
4. 9v Battery
5. Blind Stick
6. Connecting Wires

Fig.5.1.1 Components Of Project.

5.2 Technical Specifications of Arduino UNO:

As Arduino UNO is based on ATmega328P Microcontroller, the technical specifications of Arduino UNO are mostly related to the ATmega328P MCU. But none the less, let me give you a brief overview about some important specifications of Arduino UNO.

MCU	ATmega328P
Architecture	AVR
Operating Voltage	5V
Input Voltage	6V – 20V (limit) 7V – 12V (recommended)
Clock Speed	16 MHz
Flash Memory	32 KB (2 KB of this used by bootloader)
SRAM	2 KB
EEPROM	1 KB
Digital IO Pins	24 (of which 6 can produce PWM)
Analog Input Pins	6

5.3 Arduino UNO Board Layout

The following image shows the layout of a typical Arduino UNO board. All the components are placed on the top side of the PCB.

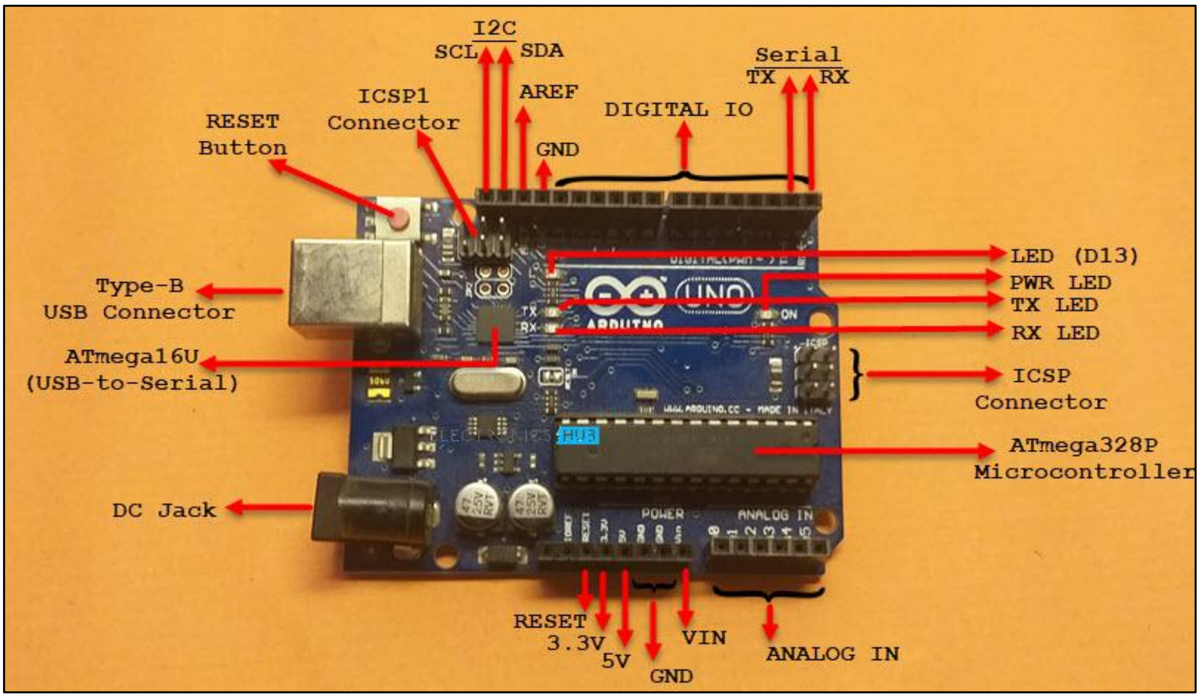

Fig.5.3.1 Arduino UNO Layout.

As you can notice, there is a Type-B USB connector on the left short edge of the board, which is used for powering on the board as well as programming the Microcontroller. There is also a 2.1 mm DC jack to provide external power supply.

Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button.

It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

5.4 Pins and Configuration :

- **What are the Input and Output Pins of Arduino UNO?**

1. Of the 32 pins available on the UNO board, 22 pins are associated with input and output. In that 14 pins (D0 to D13) are true digital IO pins, which can be configured as per you application using pinMode(), digitalWrite() and digitalRead() functions.
2. All these Digital IO pins are capable of sourcing or sinking 20mA of current (maximum 40mA is allowed). An additional feature of the Digital IO pins is the availability of internal pull-up resistor (which is not connected by default).
3. The value of the internal pull-up resistor will be in the range of 20KΩ to 50KΩ.
4. There are also 6 Analog Input Pins (A0 to A5). All the analog input pins provide a 10-bit resolution ADC feature, which can be read using analogRead() function.
5. An important point about Analog Input pins is that they can be configured as Digital IO pins, if required.
6. Digital IO pins 3, 5, 6, 9, 10 and 11 are capable of producing 8-bit PWM Signals. You can use analogWrite() function for this.

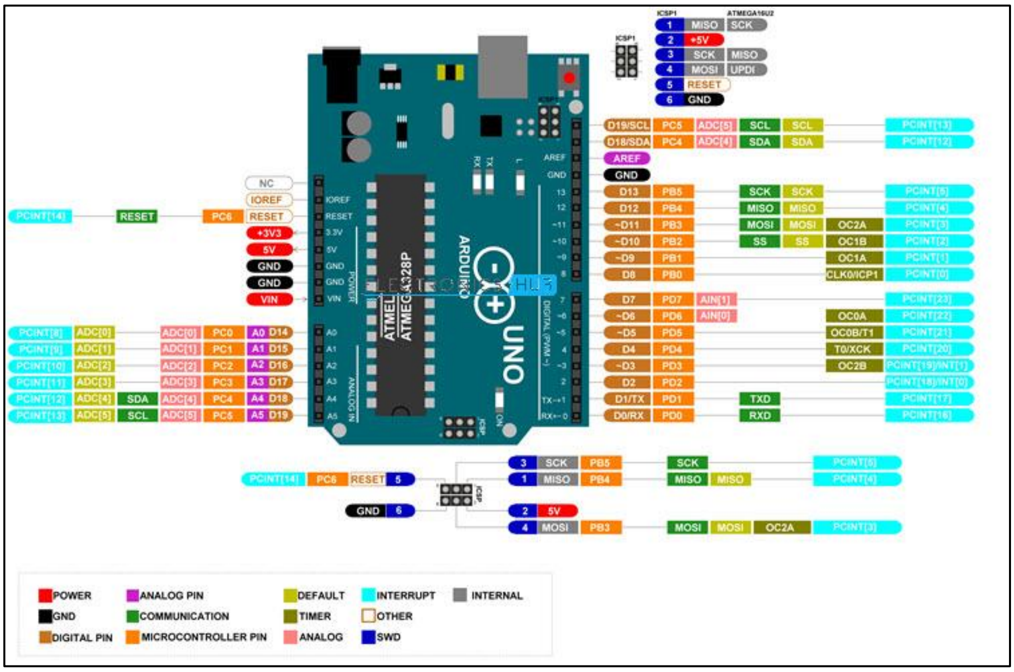

Fig.5.4.1 Pin Diagram Of Arduino UNO.

5.5 HC-SR04 Ultrasonic Sensor Pin Configuration:

This sensor includes four pins and the pin configuration of this sensor is discussed below.

Pin Configuration Of Ultrasonic Sensor :

1. Pin1 (Vcc): This pin provides a +5V power supply to the sensor.
2. Pin2 (Trigger): This is an input pin, used to initialize measurement by transmitting ultrasonic waves by keeping this pin high for 10us.
3. Pin3 (Echo): This is an output pin, which goes high for a specific time period and it will be equivalent to the duration of the time for the wave to return back to the sensor.
4. Pin4 (Ground): This is a GND pin used to connect to the GND of the system.

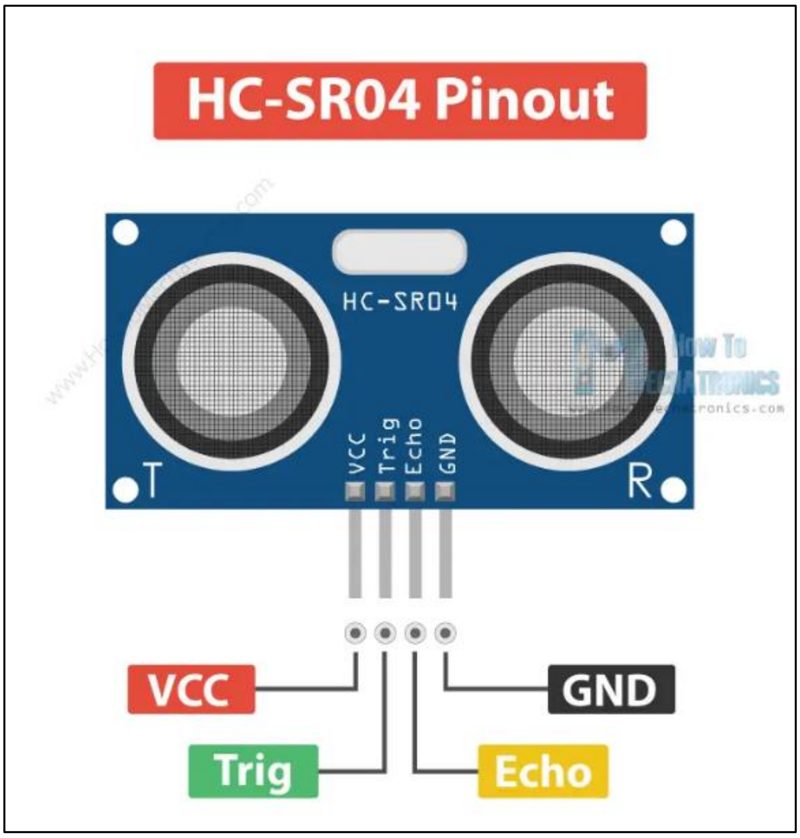

Fig.5.5.1 HC-SR04 Ultrasonic Sensor.

5.6 Buzzer:

The buzzer, also known as the piezo buzzer, is a small speaker that can be connected directly to an Arduino to produce a tone at a set frequency. It is the most commonly used buzzer with the Arduino.

Buzzer is the most easy and cost-effective way to add sound to your Arduino projects. Using a buzzer we can create projects like timer, stopwatch, fire alarm, siren, etc.

Buzzers come in different types, including mechanical, electromechanical, and piezoelectric. Piezoelectric buzzers are lightweight, easy to construct, and can generate different tones of different frequencies. They also don't require a separate oscillating circuit.

To use an active buzzer, you can connect it to a DC power supply, such as the 5 volts of your Arduino. The buzzer has two pins, one positive and one negative. You can connect one jumper wire to 5 volts and one to ground.

The buzzer will produce a loud tone at a constant frequency. We don't need any code to use an active buzzer, but you can wire a button in series between the power supply and the buzzer to control it.

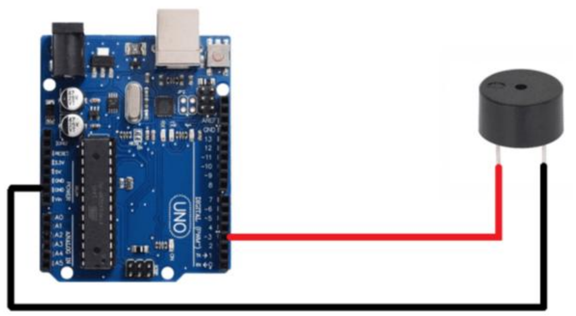

Fig.5.6.1 Buzzer.

Here are some code examples for using a buzzer with Arduino:

- tone(buzzer, 1000): Sends a 1KHz sound signal to pin 9
- delay(1000): Pauses the program for one second
- noTone(buzzer): Stops the signal sound
- loop(): Makes the program run again and again, creating a short beeping sound

5.7 Instructions For Connecting System:

To connect two HC-SR04 ultrasonic sensors to an Arduino Uno, you'll need to use multiple digital pins for triggering and receiving the ultrasonic signals. Here's how you can connect them:

1. **VCC and GND Connections:**

- Connect the VCC pin of both HC-SR04 sensors to the 5V pin on the Arduino Uno.
- Connect the GND pin of both HC-SR04 sensors to the GND pin on the Arduino Uno.

2. **Trigger and Echo Pins:**

- Each HC-SR04 sensor requires two pins: one for trigger and one for echo.
- Choose digital pins on the Arduino Uno to connect to the trigger and echo pins of each sensor.
- Connect the trigger pin of the first HC-SR04 sensor to a digital pin (e.g., Pin 2) on the Arduino Uno.
- Connect the echo pin of the first HC-SR04 sensor to another digital pin (e.g., Pin 3) on the Arduino Uno.
- Connect the trigger pin of the second HC-SR04 sensor to a different digital pin (e.g., Pin 4) on the Arduino Uno.
- Connect the echo pin of the second HC-SR04 sensor to another different digital pin (e.g., Pin 5) on the Arduino Uno.

3. **Buzzer Connections:**

- Connect the positive end of the buzzer to another digital pin(e.g., Pin 6) on the Arduino Uno.
- Connect the negative end of the buzzer to GND pin on the Arduino Uno.

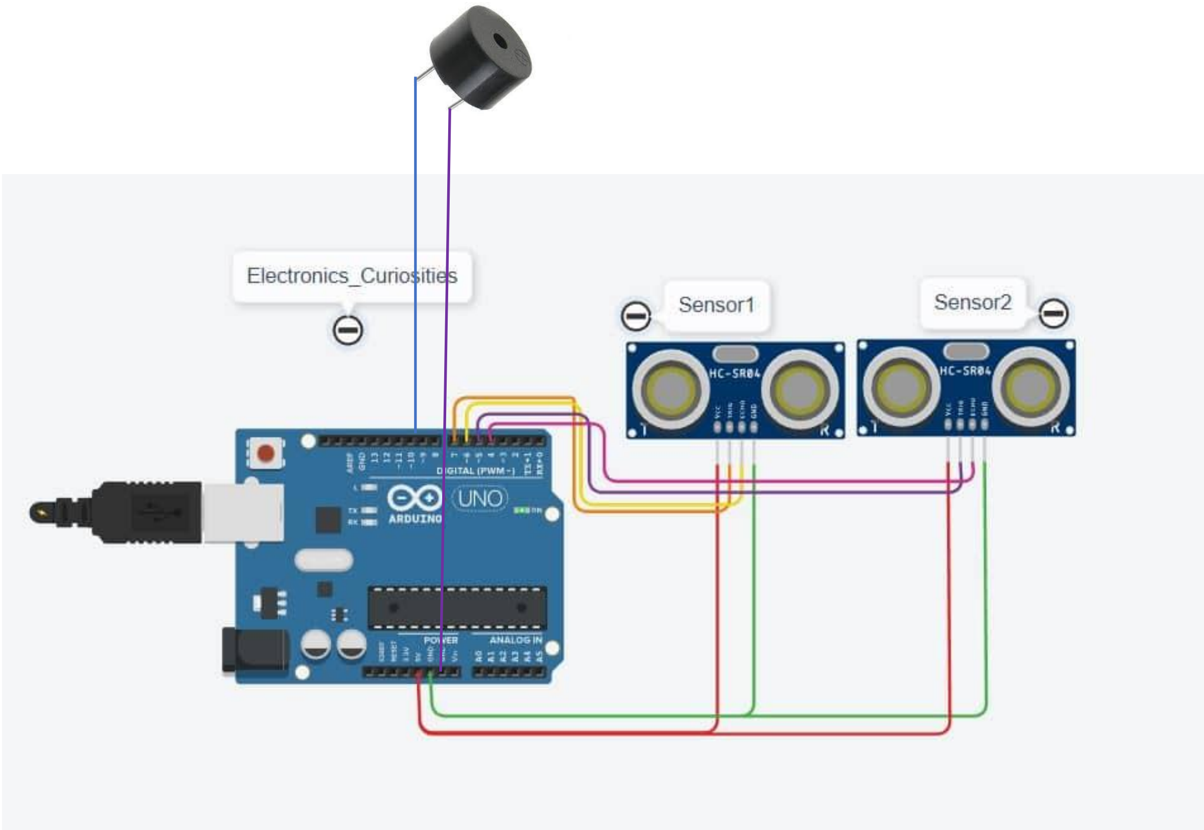

Fig.5.7.1 Total Circuit Diagram.

CHAPTER 6: SYSTEM TESTING

Every new project requires proper testing with different conditions parameters and environment for this we have tested our model through following tests:

- **Software Testing:**
  1. Range Testing
  2. Obstacle Testing
  3. Buzzer Activation And Sound Rhythm Testing
- **Hardware Testing:**
  1. Environment Test
  2. Durability Test
  3. Battery Life Test
  4. Mobility Test
- **Software Testing**
  1. **Range Testing:**
     - **Programmed range For Front object :** < 50cm
     - **Testing Instruments:** Measurement Scale

     Testing was done in a manual environment for this the object is placed in front of ultrasonic sensor and measuring scale is placed behind to measure the distance between sensor and object. An object is brought closer to the sensor while continuously monitoring the distance.

     - **Result :** The distance at which the buzzer is activated is noted the accuracy rate was 95%.

     - **Programmed range For Depth object :** > 60cm
     - **Testing Instruments:** Measurement Scale

     For depth testing the object is places initially just infront of sensor and taken away from the sensor while continuously monitoring the distance on measurement scale the point at which the buzzer activated is noted down this gave us the accuracy for depth measurement it is set out to be 96% accurate.

2. **Obstacle Testing:**

   In this test various objects of different materials sizes and shapes brought in front of sensor and tested whether the sensor detects different objects accurately or not the accuracy is come about 96%.

3. **Buzzer Activation And Sound Rhythm Testing:**

   In this test the buzzer sound is tested for three different conditions for front and depth and both types of obstacles. The sound output and its rhythm is noted as per programmed in Arduino above three conditions are concluded at 100% accuracy.

- ## Hardware Testing:

1. **Environment Testing:**

   The present model is tested in three different environment like controlled lab, open space, public space. The test is set out to be a good rate of accuracy about 95% for normal objects in a lab environment with minor variations in public space.

2. **Durability Testing:**

   For durability testing we used drop test, water test and temperature test. All three test are performed in a lab conditions the model has passed over 300 drop test, survived for more than two hours under one meter of water test and it survived temperature up to 50 degree Celsius and 5 degree Celsius very well.

3. **Battery Life Testing:**

   A normal 9v NiMh battery for 2 weeks which can be further include with lithium ion rechargeable batteries of more power.

4. **Mobility Testing:**

   The device weighs 500gm along with stick and it is foldable at three sides which makes it very comfortable and handy to carry at different places.

CHAPTER 7: OUTPUT

Fig.7.1 Ultrasonic Vision For Blind.

Fig.7.2 Front Obstacle Detection With Ultrasonic Vision.

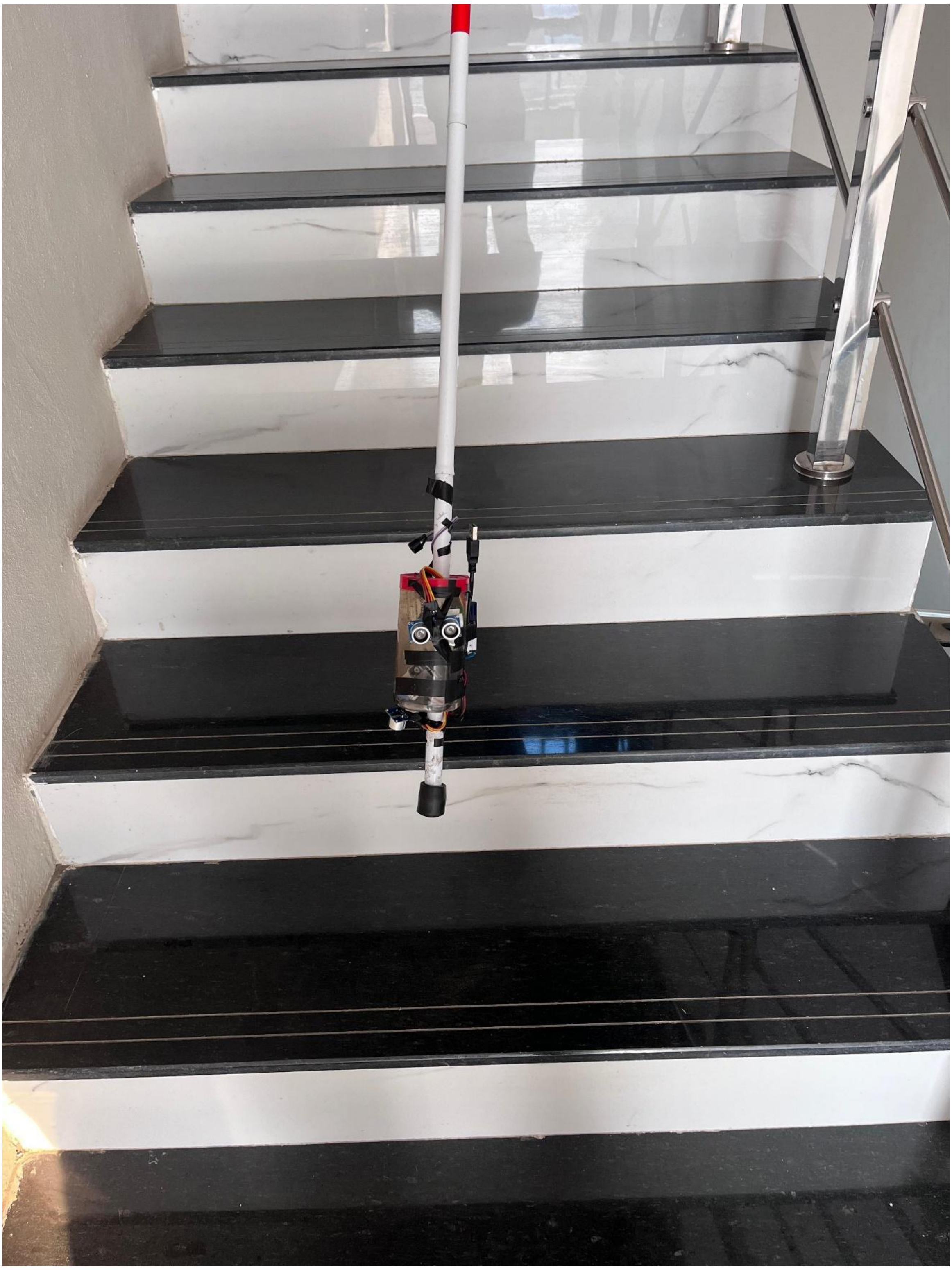

Fig.7.3 Depth Detection With Ultrasonic Vision.

CHAPTER 8: CONCLUSION

India has over 5 million people with visual impairments. They face numerous small and large accidents while walking. Identifying this problem, this project has been selected. A study of various literature revealed that at present, there were several working models and proposed theories on ultrasonic sensor object detection systems for blind individuals. However, they all focus solely on detecting objects in the forward direction. Collected data reveals that many accidents involving blind individuals occur due to potholes, stairs, or changes in terrain.

To address these issues, we've employed two ultrasonic sensors: one for forward object detection and the other for depth detection. This design tackles both problems. To make this system more relevant, we've incorporated an ISD1860 for recording voice notes and an alert sound output device. All of these components are connected to an Arduino UNO, which is programmed to coordinate them seamlessly. The system serves as both an object and depth detection system with a sound alert feature for blind individuals, reducing the likelihood of accidents and aiding them in navigating obstacles and changes in terrain.

As there are very few industries which are practically implanting the idea of ultrasonic object detection system for blind specially in developing and highly populated country like India where more than 4.6 million people are blind it is very needful to have an affordable as well as well-developed model of present project.

In future as technology is progressing in every field of medical science this project will serve a purpose of quality life for blind person with some changes and modifications. This technology will serve many blind person and make their life simpler. Though the angle of profit this project have a huge scope in market as presently there is very less competitor's for this idea.

CHAPTER 9: REFERENCES

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