SMART BLIND STICK

Minor Project Report

Submitted by:

NAYAN SHIVHARE(0103IT161067)

PRATIK MAHAJAN (0103IT161083)

SWATI KUMARI (0103IT161116)

Group No.- 19

in partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

IN

INFORMATION TECHNOLOGY

at

LAKSHMI NARAIN COLLEGE OF TECHNOLOGY

KALCHURI NAGAR, RAISEN ROAD, BHOPAL (INDIA) - 462021

SESSION JAN JUNE 2019

LAKSHMI NARAIN COLLEGE OF TECHNOLOGY BHOPAL (M.P.)

Department of Information Technology

DECLARATION

We hereby declare that the minor project entitled "**SMART BLIND STICK**" submitted for the B.E.(Information Technology) degree is **our** original work and the project has not formed the basis for the award of any other degree, diploma, fellowship or any other similar titles.

Name & Signature of the students with date

Place : Bhopal

Date : 09/04/2019

(1) Nayan Shivhare

(2) Pratik Mahajan

(3) Swati Kumari

LAKSHMI NARAIN COLLEGE OF TECHNOLOGY BHOPAL (M.P.)

Department of Information Technology

CERTIFICATE

This is to certify that the minor project titled "**SMART BLIND STICK**" is the bona fide work carried out by **Nayan Shivhare (0103IT161067), Pratik Mahajan (0103IT161083)** and **Swati Kumari (0103IT161116)** students of **B.E.(Information Technology)** of Lakshmi Narain College of Technology, Bhopal affiliated to Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal, Madhya Pradesh (India) during the academic year 2018-19, in partial fulfillment of the requirements for the award of the degree of **Bachelor of Engineering (Information Technology**) and that the project has not formed the basis for the award previously of any other degree, diploma, fellowship or any other similar title.

Signature & Seal of HOD, Information Technology **Signature of the Guide with Date**

Lakshmi Narain College of Technology, Bhopal

ACKNOWLEDGEMENT

I am grateful, to **Prof. Pragati Ambekar**, Project Coordinator, Department of **Information Technology**, for her kind cooperation throughout the planning & preparation of this project.

Nothing can be taken away from my project guide P**rof. Akshay Jadhav** Department of **Information Technology**, who has been instrumental in guiding us through the various aspects of designing of our project & implementing the idea of the project "**SMART BLIND STICK**".

ABSTRACT

God gifted sense of vision to the human being is an important aspect of our life. But there are some unfortunate people who lack the ability of visualizing things. The visually impaired have to face many challenges in their daily life. The problem gets worse when they travel to an unfamiliar location. Only few of the systems available for visually impaired people can provide through beep output. None of these systems work perfectly for both indoor and outdoor applications.

In this, we propose a device for the visually impaired which is focused on providing beep output for obstacle prevention. The proposed device is used for guiding individuals who are partially sighted or blind. This device is used to help blind people to travel with the same ease and confidence as sighted people. The device has proximity sensor. The whole device is designed to be small and is used in conjunction with the stick. This device is being very helpful for those visually impaired people , which are supposed to face many day to day problems based on there regularity towards there life.

The problem gets worse when there is an obstacle in front of them. Blind stick is an innovative stick designed for visually disabled people for improved survival. The paper presents a theoretical system concept to provide a smart ultrasonic aid for blind people. The system is intended to provide overall measures – Artificial vision and detection. The aim of the overall system is to provide a low cost and efficient aid for a visually impaired person who gets a sense of artificial vision by providing information about the environmental scenario of static and dynamic objects around them.

Table Of Contents

`

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

1.1 Problem Definition :

According to the WHO, about 30 million people are estimated to be permanently blind worldwide. Independence is the important methodology in achieving objectives, dreams and goals in life. Visually impaired/blind persons find themselves challenging the dangerous paths to go out independently. Their life is full of risk. These people are totally dependent on others. They even cannot walk on their own. Visually impaired people are the people who can't identify smallest detail with healthy eyes. Those who have the visual acuity of 6/60 or the horizontal extent of the visual field with both eyes open less than or equal to 20 degrees, these people are considered blind. Such people are in need of aiding devices for blindness related disabilities. As described in 10% of blind have no usable eyesight at all to help them move around independently and safely. The electronic aiding devices are designed to solve such issue.

1.2 Project Overview :

“Humans are not disabled. A person can never be broken. Our built environment, our technologies, is broken and disabled. We the people need not accept our limitations, but can transfer disability through technological Innovation”.
Blind stick is an innovative stick designed for visually disabled people for improved navigation. The paper presents a theoretical system concept to provide a smart ultrasonic aid for blind people. The system is intended to provide overall measures – Artificial vision and object detection.

To record information about the obstacles presence in a road, active or passive sensors can be used. In case of a passive sensor, the sensor just receives a signal. It detects the reflected, emitted or transmitted electromagnetic radiation provided by natural energy sources. In case of using an active sensor, the sensor emits a signal and receives a distorted version of the reflected signal. It detects reflected responses from objects irradiated with artificially generated energy sources. These kind of active sensors are capable of sensing and detecting far and near obstacles. In addition, it determines an accurate measurement of the distance between the blind and the obstacle. Overall, in the obstacle detection domain,four different types of active sensors may be used: infrared, laser, ultrasonic, in addition to radar sensors.

The smart stick is basically an embedded system integrating the ultrasonic sensor to detect obstacles in front of the blind from ground level height to head level height in the range of 2cm - 400cm a head. Ultrasonic sensors sensor collect real time data and send it to Arduino Uno micro-controller. After processing this data, the micro-controller actives the buzzer which beeps continuously until the position of the stick is not changed

1.3 Hardware Specification :

The project **Smart Blind Stick** is based on the **Internet of Things (IoT)**. We are developing a project by using simple available technologies. This Smart Stick for blind people has sensor, with the help of which it has been possible to enhance more features to the walking stick.

- We used **Arduino Uno** , it is micro-controller which control all the calculations and give instruction to other components.
- In this **Ultrasonic Sensors** are used to calculate distance of the obstacles around the blind person to guide the user towards the available path.
- We used the **Buzze**r which gives us output in the form of sequence of beep sound which the blind person can hear.
- We used a **9v Battery** for the power supply.

1.4 Software Specification :

In this Smart Blind Stick Arduino Uno plays a key role. It is micro-controller which manage all the calculations such as distance calculation, send message to buzzer etc. Arduino come up with a package having hardware and to control hardware they have their own software called **Arduino Software (IDE**). All the code/instruction are placed in Arduino memory, which are followed by the other components.

CHAPTER 2

LITERATURE SURVEY

2.1 Existing System :

Over the last decades, research has been conducted for new devices to design a good and reliable system for visually impaired persons to detect obstacles and warn them at danger places. There are some systems which has some deficiencies.

A Navbelt was developed by Shovalet, an obstacle avoidance wearable portable computer which is only for indoor navigation. Navbelt was equipped with two modes, in the first one the system information was translated to audio in different sounds. One sound for free for travel direction and other for blocked, it was difficult for the person to differentiate the sounds. Other problem was the system would not know the user momentary position.

A stick for distance measurement using infrared sensors, have introduced by S. Innet and N. Ritnoom which is a complex and time wasting process. The stick has different vibration modes for different range which is difficult for a blind to differentiate, it needs time for training.

2.2 Proposed System :

We have many reasons to design smart stick for blind; firstly, the blind to feel free, isn't surrounded by wires as in belt and its content. Secondly, is easy to use because it is familiar and affordable. Thirdly, to be able to detect obstacles that exist on the ground (this is not available in glasses), which he walks indoor and outdoor is faced by obstacles such as stairs, puddles and sidewalks.

The smart stick is basically an embedded system integrating the ultrasonic sensor to detect obstacles in front of the blind from ground level height to head level height in the range of 2cm - 400cm a head. Ultrasonic sensors sensor collect real time data and send it to Arduino Uno microcontroller. After processing this data, the microcontroller actives the buzzer which beeps continuously until the position of the stick is not changed.

2.3 Feasibility Study :

Feasibility Study is a high level capsule version of the entire process intended to answer a number of questions like: What is the problem? Is there any feasible solution to the given problem? Is the problem even worth solving? Feasibility study is conducted once the problem clearly understood. Feasibility study is necessary to determine that the proposed system is Feasible by considering the technical, Operational, and

Economical factors. By having a detailed feasibility study the management will have a clear-cut view of the proposed system.

The following feasibilities are considered for the project in order to ensure that the project is variable and it does not have any major obstructions. Feasibility study encompasses the following things:

- Technical Feasibility
- Economic Feasibility
- Operational Feasibility

In this phase, we study the feasibility of all proposed systems, and pick the best feasible solution for the problem. The feasibility is studied based on three main factors as follows.

- **Technical Feasibility**:

In this step, we verify whether the proposed systems are technically feasible or not. i.e., all the technologies required to develop the system are available readily or not. Technical Feasibility determines whether the organization has the technology and skills necessary to carry out the project and how this should be obtained. The system can be feasible because of the following grounds:

- All necessary technology exists to develop the system.
- This system is too flexible and it can be expanded further.
- This system can give guarantees of accuracy, ease of use, reliability.
- This system can give instant response to inquire.

Our project is technically feasible because, all the technology needed for our project is readily available.

- **Economic Feasibility:**

Economically, this project is completely feasible because it requires no extra financial investment and with respect to time, it's completely possible to complete this project in 1 months. In this step, we verify which proposal is more economical. We compare the financial benefits of the new system with the investment. The new system is economically feasible only when the financial benefits are more than the investments and expenditure. Economic Feasibility determines whether the project goal can be within the resource limits allocated to it or not. It must determine whether it is worthwhile to process with the entire project or whether the benefits obtained from the new system are not worth the costs. Financial benefits must be equal or exceed the costs. In this issue, we should consider:

- The cost to conduct a full system investigation.

- The cost of h/w and s/w for the class of application being considered.
- The development tools.
- The cost of maintenance etc...

Our project is economically feasible because the cost of development is very minimal when compared to financial benefits of the application.

- **Operational Feasibility:**

In this step, we verify different operational factors of the proposed systems like man-power, time etc., whichever solution uses less operational resources, is the best operationally feasible solution. The solution should also be operationally possible to implement. Operational Feasibility determines if the proposed system satisfied user objectives could be fitted into the current system operation.

- The methods of processing and presentation are completely accepted by the clients since they can meet all user requirements.
- The clients have been involved in the planning and development of the system.
- The proposed system will not cause any problem under any circumstances.

Our project is operationally feasible because the time requirements and personnel requirements are satisfied. We are a team of two members and we worked on this project for two working months.

CHAPTER 3

SYSTEM ANALYSIS & DESIGN

3.1 Requirement Specification:-

List of Components :

Sr. No	Components	Specifications	Quantity
01	Ultrasonic sensor	HC-SR04	01
02	Arduino	UNO	01
03	Buzzer	5V	01
04	Switch	DPDT	01
05	Battery	9 Volt	01
06	PCB	--------	01
07	Jumping wires		5

➢ Components description :

(1) Ultrasonic Sensor (HC-SR04)

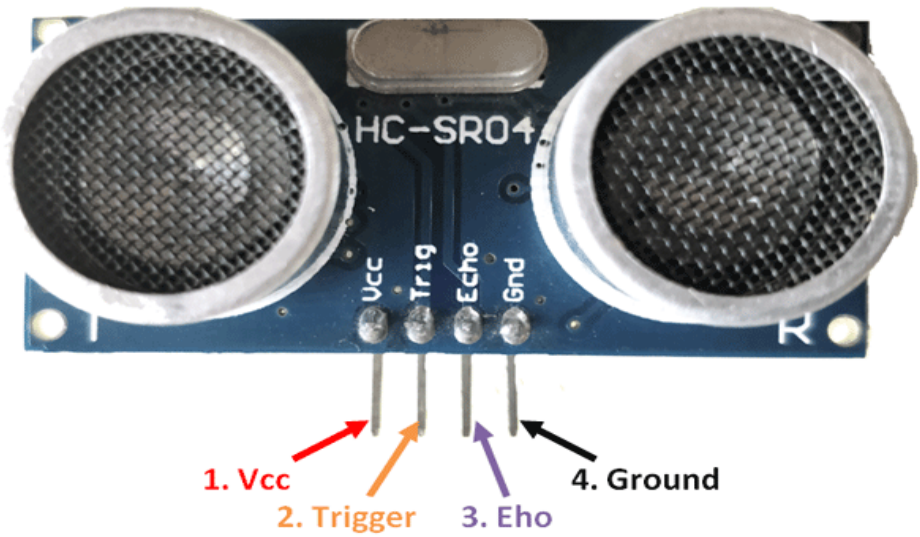


Fig. 3.1.1 Ultrasonic Sensor HC SR04 Pin Diagram

Ultrasonic sensors (also known as transceivers when they both send and receive) work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object.

This technology can be used for measuring: wind speed and direction (anemometer), fullness of a tank and speed through air or water. For measuring speed or direction a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water. To measure the amount of liquid in a tank, the sensor measures the distance to the surface of the fluid. Further applications include: humidifiers, sonar, medical ultra sonography, burglar alarms and non-destructive testing. Systems typically use a transducer which generates sound waves in the ultrasonic range, above 18,000 hertz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed. The technology is limited by the shapes of surfaces and the density or consistency of the material.

- **Ultrasonic Sensor Pin Configuration:**

Pin Number	Pin Name	Description
1	Vcc	The Vcc pin powers the sensor, typically with +5V
2	Trigger	Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.
3	Echo	Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.
4	Ground	This pin is connected to the Ground of the system.

- **HC-SR04 Sensor Features:**

  - Operating voltage: +5V
  - Theoretical Measuring Distance: 2cm to 450cm

- Practical Measuring Distance: 2cm to 80cm
- Accuracy: 3mm
- Measuring angle covered: <15°
- Operating Current: <15mA
- Operating Frequency: 40Hz

➢ **HC-SR04 Ultrasonic Sensor - Working:**

As shown above the **HC-SR04 Ultrasonic (US) sensor** is a 4 pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver.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.

If you need to measure the specific distance from your sensor, this can be calculated based on this formula:

$$\text{Distance} = \tfrac{1}{2}\ T \times C$$

(T = Time and C = the speed of sound)

At 20°C (68°F), the speed of sound is 343 meters/second (1125 feet/second), but this varies depending on temperature and humidity. Specially adapted ultrasonic sensors can also be used underwater. The speed of sound, however, is 4.3 times as fast in water as in air, so this calculation must be adjusted significantly.

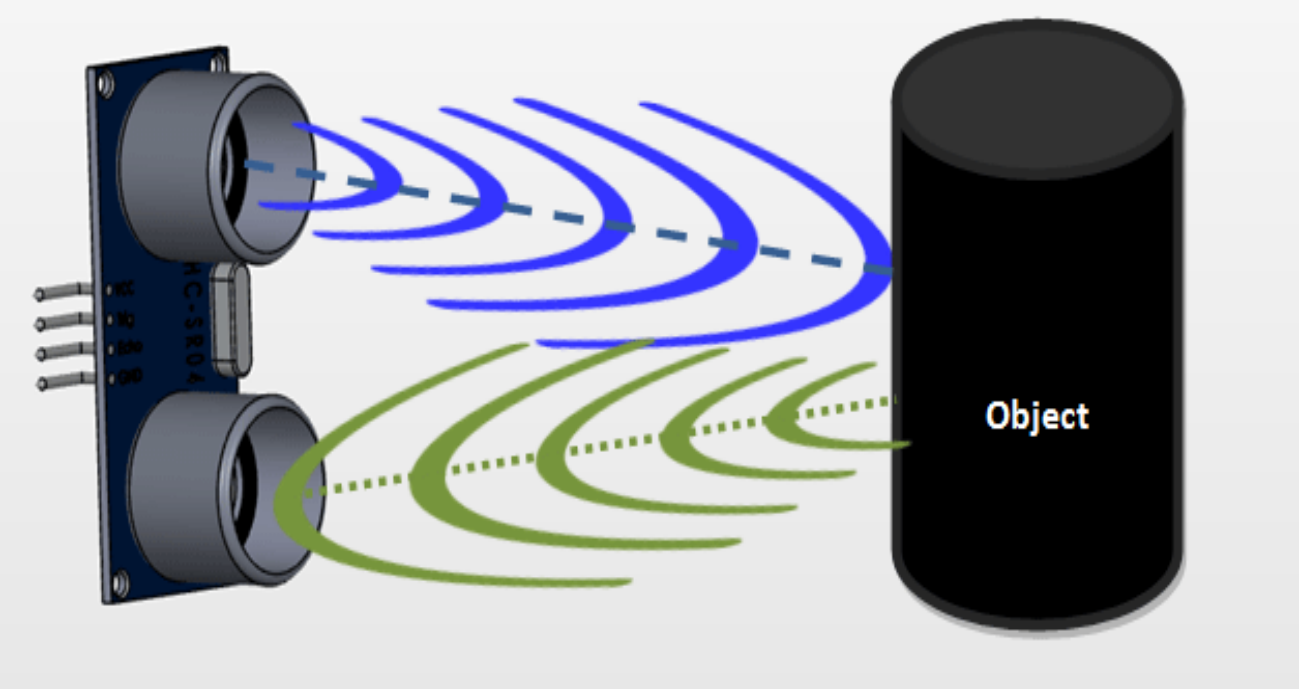


Fig.3.1.2 Ultrasonic Sensor Working

(2) Arduino Uno

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

A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike. Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments.

All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

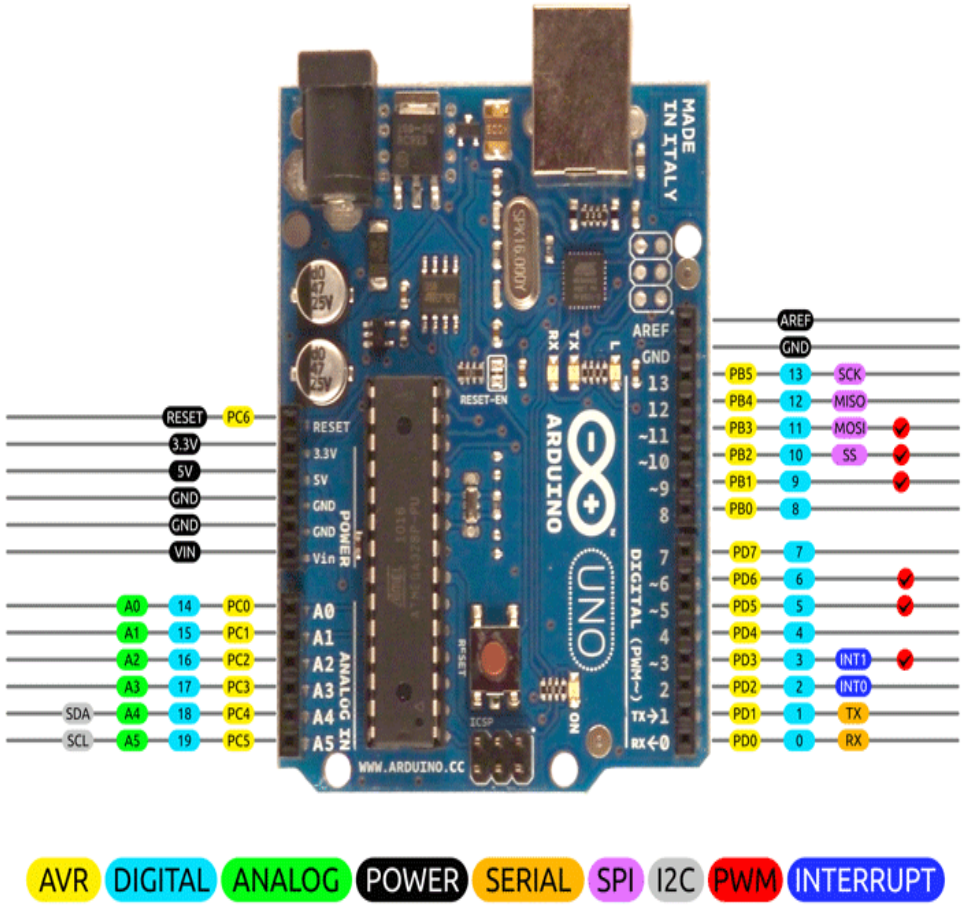


Fig.3.1.3 Arduino Uno

(3) BUZZER

A **buzzer** or beeper is an audio signalling device, which may be mechanical, electro-mechanical, or piezoelectric (piezo for short). Typical uses of **buzzer s**and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke. A buzzer is a device which makes a buzzing or beeping noise. There are several kinds; the most basic is a piezoelectric buzzer, which is just a flat piece of piezoelectric material with two electrodes. This type of buzzer requires some kind of oscillator (or something more complicated like a microcontroller) to drive it—if you apply a DC voltage you will just get a click. They are used in places where you need something that emits an audible tone, but don't care about high-fidelity sound reproduction, like microwave ovens, smoke alarms, and electronic toys.

They are cheap and can be very loud without using very much power. They are also very thin, so they can be used in flat objects like "singing" greeting cards. A piezoelectric element also produces a voltage in response to pressure, so piezoelectric buzzers can also be used as crude pressure sensors or microphones.

Fig.3.1.4 BUZZER

(4) Switch

A switch is a generic term used to refer to an electric switch that is actuated by very little physical force, through the use of a tipping-point mechanism. They are very common due to their low cost and durability, greater than 1 million cycles and up to 10 million cycles for heavy duty models. This durability is a natural consequence of the design. Internally a stiff metal strip must be bent to activate the switch. This produces a very distinctive clicking sound and a very crisp feel.

When pressure is removed the metal strip springs back to its original state. Common applications of micro switches include the door inter lock on a microwave oven, leveling and safety switches in elevators, vending machines, and to detect paper jams or other faults in photocopiers. Micro switches are commonly used in tamper switches on gate valves on fire sprinkler systems and other water pipe systems, where it is necessary to know if a valve has been opened or shut. The defining feature of micro switches is that a relatively small movement at the actuator button produces a relative large movement at the electrical contacts, which occurs at high speed (regardless of the speed of actuation).

Fig.3.1.5 ON and OFF Switch

(5) BATTERY

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smartphones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that when connected to an external circuit will flow and deliver energy to an external device. When a battery is connected to an external circuit, electrolytes are able to move as ions within, allowing the chemical reactions to be completed at the separate terminals and so deliver energy to the external circuit. It is the movement of those ions within the battery which allows current to flow out of the battery to perform work. Historically the term "battery" specifically referred to a device composed of multiple cells, however the usage has evolved additionally to include devices composed of a single cell.

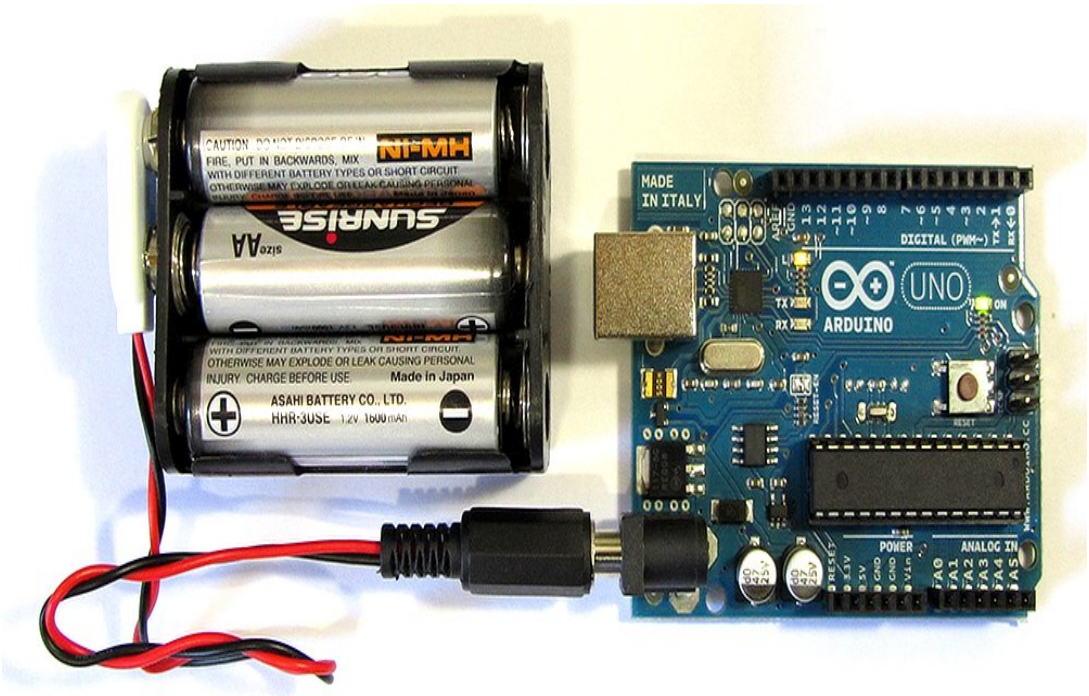


Fig.3.1.6 Battery used for Arduino Uno

(6) JUMPER WIRES

Jumper wires are simply wire that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed. Fairly simple. In fact, it doesn't get much more basic than jumper wires.

- **What Do the Colors Mean?**

Fig.3.1.7 Jumper wires

Though jumper wires come in a variety of colors, the colors don't actually mean anything. This means that a red jumper wire is technically the same as a black one. But the colors can be used to your advantage in order to differentiate between types of connections, such as ground or power.

- **Types of Jumper Wires:**

Fig.3.1.8 Male to Female

Fig. 3.1.9 Male to Male jumper wires

Jumper wires typically come in three versions: male-to-male, male-to-female and female-to-female. The difference between each is in the end point of the wire. Male ends have a pin protruding and can plug into things, while female ends do not and are used to plug things into. Male-to-male jumper wires are the most common and what you likely will use most often.

3.2 Flow Chart :

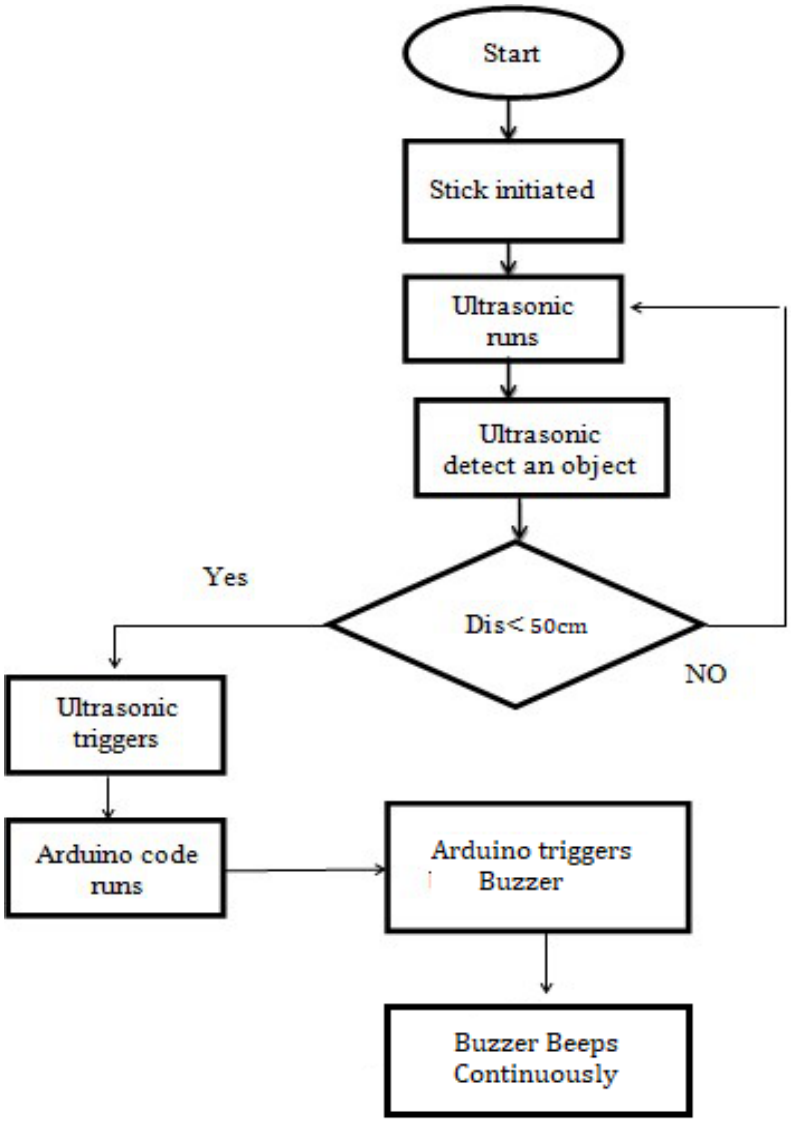


Fig. 3.2.1 Flow Chart

3.3 Connectivity :

The Arduino integrated system keeps the person informed about the obstacles lying ahead. Such aid gives user more knowledge about the environment and enables them to make decisions much more quickly, thus allowing them to move around more confidently and effectively. The smart stick may be used in the nearby environment may be in a park, at work, at home, and while a long journey. The designed assisted device helps a visionless person to anticipate the surrounding using the sensor and buzzer.

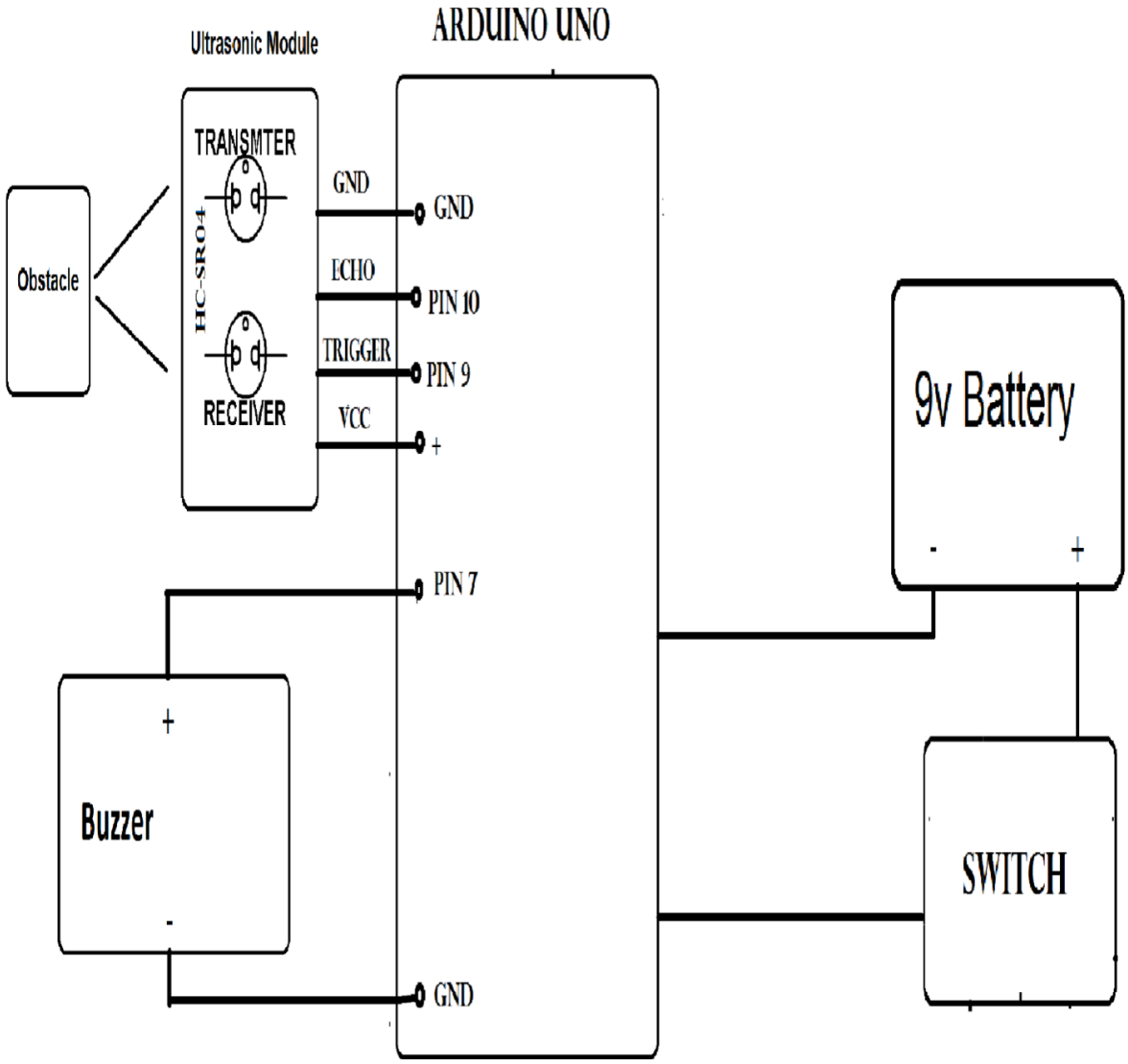


Fig. 3.3.1 Circuit Diagram of Smart Blind Stick

➢ Circuit Connection:

In the circuit an Arduino Uno is used as a platform. Ultrasonic sensor is connected to Arduino. The ultrasonic sensor has 4 pins-

- Vcc or 5 volt which is connected to 5 volt pin of Arduino.
- Trigger which is connected to D9 pin of Arduino.
- Echo pin connected to D10 pin of Arduino.
- Ground which is connected to GND pin of Arduino.
- Positive terminal of 9 volt battery is connected to Vin pin of Arduino through a switch and the negative terminal is connected to GND pin of Arduino.
- A buzzer is connected between D7 pin of Arduino and GND pin. Ultrasonic sensors are used for obstacle avoidance. Buzzer is used for or as an output device.

3.4 Arduino Code :

```
int const TriggerPin = 10;
int const EchoPin = 9;
int const BuzzerPin = 2;

void setup() {
  // put your setup code here, to run once:
  pinMode(TriggerPin, OUTPUT);
  pinMode(EchoPin, INPUT);
  Serial.begin(9600);
  pinMode(BuzzerPin, OUTPUT);
}

void loop() {
  // put your main code here, to run repeatedly:
  int distance,duration;
  digitalWrite(TriggerPin, HIGH);
  delayMicroseconds(2);
  digitalWrite(TriggerPin, LOW);
  delayMicroseconds(5);
  digitalWrite(TriggerPin, HIGH);
  pinMode(EchoPin, INPUT);
  duration = pulseIn(EchoPin, HIGH);
  distance = (duration/2)/29.1;
  if(distance <= 50 && distance >= 0)
  {
   digitalWrite(BuzzerPin, HIGH);
  }
  else
  {
   digitalWrite(BuzzerPin, LOW);
  }
  delay(60);
  }
```

3.5 Testing Process :

Testing itself may be defined at various levels of SDLC. The testing process runs parallel to software development. Before jumping on the next stage, a stage is tested, validated and verified.

Testing separately is done just to make sure that there are no hidden bugs or issues left in the software. Software is tested on various levels -

- **Unit Testing**

While coding, the programmer performs some tests on that unit of program to know if it is error free. Testing is performed under white-box testing approach. Unit testing helps developers decide that individual units of the program are working as per requirement and are error free.

- **Integration Testing**

Even if the units of software are working fine individually, there is a need to find out if the units if integrated together would also work without errors. For example, argument passing and data updation etc.

- **System Testing**

The software is compiled as product and then it is tested as a whole. This can be accomplished using one or more of the following tests:

  - **Functionality Testing** - Tests all functionalities of the software against the requirement.
  - **Performance Testing** - This test proves how efficient the software is. It tests the effectiveness and average time taken by the software to do desired task. Performance testing is done by means of load testing and stress testing where the software is put under high user and data load under various environment conditions.
  - **Security & Portability** - These tests are done when the software is meant to work on various platforms and accessed by number of persons.

- **Acceptance Testing**

When the software is ready to hand over to the customer it has to go through last phase of testing where it is tested for user-interaction and response. This is important because even if the software matches all user requirements and if user does not like the way it appears or works, it may be rejected.

  - **Alpha testing** - The team of developer themselves perform alpha testing by using the system as if it is being used in work environment. They try to find out how user would react to some action in software and how the system should respond to inputs.
  - **Beta testing** - After the software is tested internally, it is handed over to the users to use it under their production environment only for testing purpose. This is not as yet the delivered product.

Developers expect that users at this stage will bring minute problems, which were skipped to attend.

- **Regression Testing**

Whenever a software product is updated with new code, feature or functionality, it is tested thoroughly to detect if there is any negative impact of the added code. This is known as regression testing.

- **Black-box testing**

It is carried out to test functionality of the program. It is also called 'Behavioral' testing. The tester in this case, has a set of input values and respective desired results. On providing input, if the output matches with the desired results, the program is tested 'ok', and problematic otherwise.

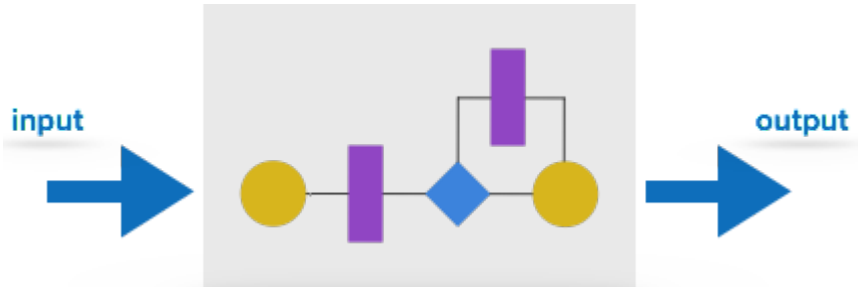
In this testing method, the design and structure of the code are not known to the tester, and testing engineers and end users conduct this test on the software.

Black-box testing techniques:

- **Equivalence class -** The input is divided into similar classes. If one element of a class passes the test, it is assumed that all the class is passed.
- **Boundary values** - The input is divided into higher and lower end values. If these values pass the test, it is assumed that all values in between may pass too.
- **Cause-effect graphing** - In both previous methods, only one input value at a time is tested. Cause (input) – Effect (output) is a testing technique where combinations of input values are tested in a systematic way.
- **Pair-wise Testing** - The behavior of software depends on multiple parameters. In pairwise testing, the multiple parameters are tested pair-wise for their different values.
- **State-based testing** - The system changes state on provision of input. These systems are tested based on their states and input.

- **White-box testing**

It is conducted to test program and its implementation, in order to improve code efficiency or structure. It is also known as 'Structural' testing.



In this testing method, the design and structure of the code are known to the tester. Programmers of the code conduct this test on the code.

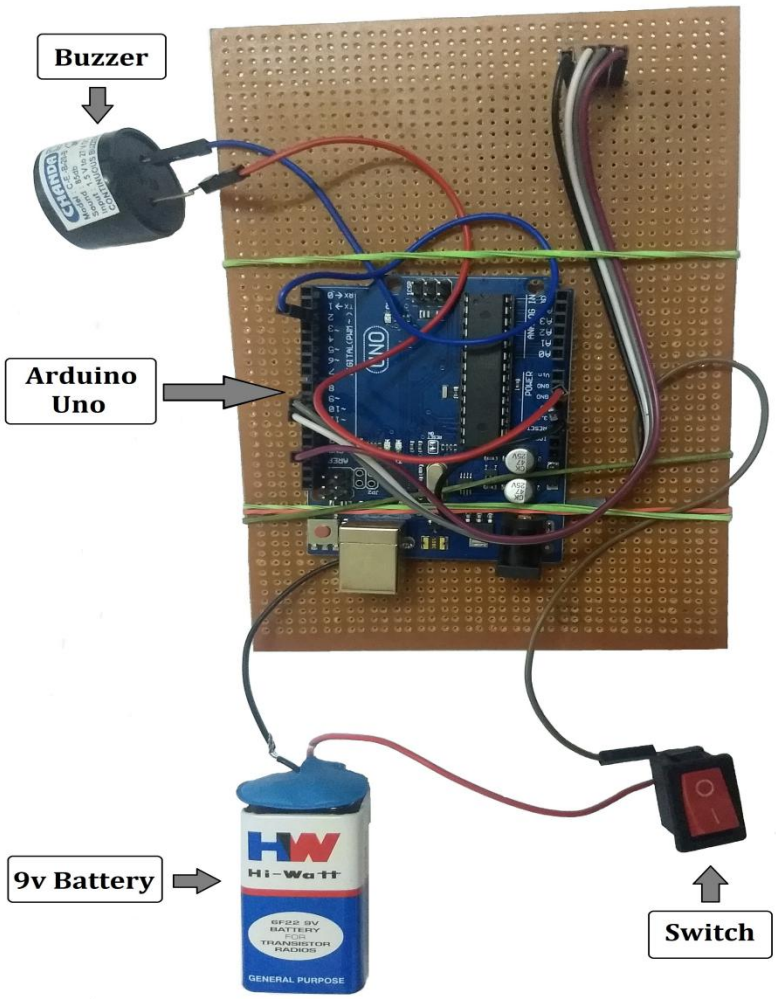
The below are some White-box testing techniques:

- **Control-flow testing** - The purpose of the control-flow testing to set up test cases which covers all statements and branch conditions. The branch conditions are tested for both being true and false, so that all statements can be covered.
- **Data-flow testing** - This testing technique emphasis to cover all the data variables included in the program. It tests where the variables were declared and defined and where they were used or changed.

CHAPTER 4

RESULTS / OUTPUT

As we know blind stick is an alternate to traditional walking stick;it outclass the problem of visually effected people. It helps blind people to navigate through the path with ease. User friendly with that its also affordable by a common person because of their cost efficient design. We have many reasons to design smart stick for blind. It is able to detect obstacles that exist on the ground. When he walks indoor or outdoor and face any obstacles such as stairs, puddles and sidewalks the blind stick will warn the user about it through beeps buzzer continuously.



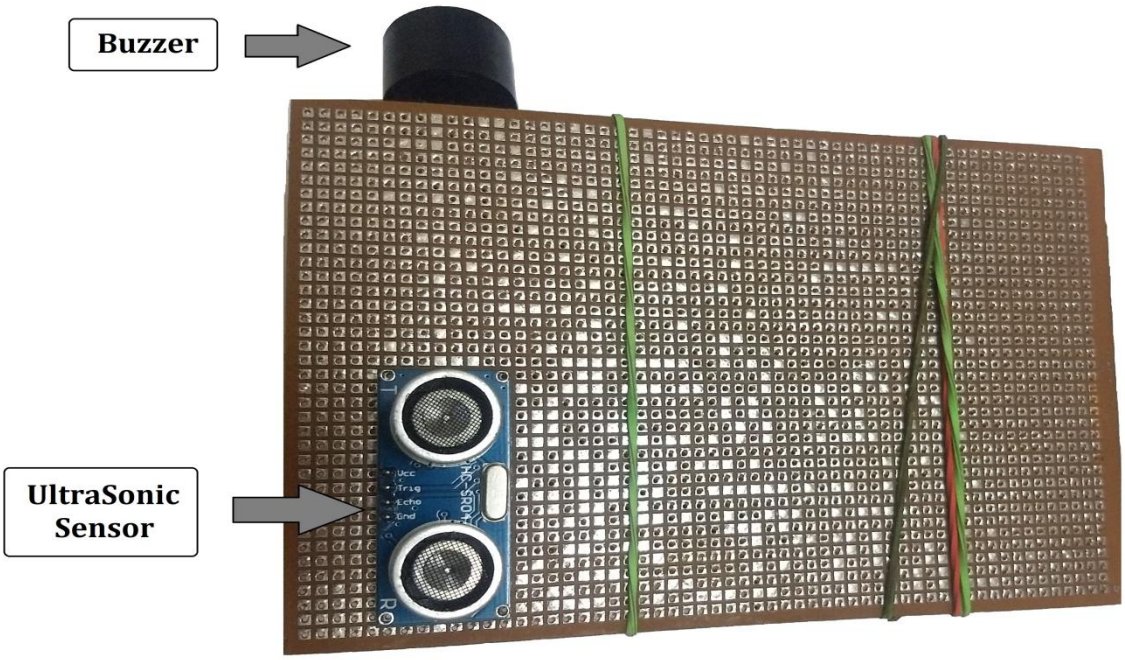


fig. 4.1 Smart Blind Stick

CHAPTER 5

CONCLUSIONS / RECOMMENDATIONS

All the studies which had been reviewed show that, there are a number of techniques for making a ultrasonic blind walking stick for blind people. The goal of the Smart Blind Stick is to bring the blind tick up to technological modernity while maintaining its affordable price. The Smart Blind Stick is geared towards an elderly, less affluent demographic group that would demand comfort, accessibility, and affordability solution to millions of blind person worldwide. The Smart Blind Stick is a practically feasible product and convenient to carry around like any other walking stick. Using the ultrasonic sensor, Arduino board, and vibration motor, the Smart Blind Stick greatly increases the object detection range of the white cane, thereby improving the lives of the visually impaired users. This could also be considered a crude way of giving the blind a sense of vision.

● FUTURE SCOPE

The system can be supplemented with actual GPS MODULE used in cars and we can provide a vibrator for the partially deaf person.

➢ GPS Module :

New improved GPS Module with built-in antenna and memory back-up for OEM and hobbyists projects. This unit features low power consumption, high sensitivity. The unit is ideal for navigation systems, distance measurements, vehicle monitoring and recording, boating direction and location, together with hiking and cross country exploring.

➢ GSM Modem :

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. When a GSM modem is connected to a computer, this allows the computer to use the GSM modem to communicate over the mobile network. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS and MMS messages.

REFERENCES

[1] www.wikipedia.com

[2] www.who.int/mediacentre/factsheets/fs282/en/

[3] http://www.irdindia.in/journal_ijaeee/pdf/vol5_iss6/6.pdf

[4]https://www.arrow.com/en/research-and-events/articles/ultrasonic-sensors-how-they-work-and-how-to-use-them-with-arduino

[5]http://www.ijritcc.org/download/conferences/ICRTCEE_16/ICRTCEE_Track/1454314937_01-02-2016.pdf

APPENDICES

7.1 Details of Hardware :

(1) Ultrasonic Sensor (HC-SR04)

Ultrasonic sensors (also known as transceivers when they both send and receive) work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object.

This technology can be used for measuring: wind speed and direction (anemometer), fullness of a tank and speed through air or water. For measuring speed or direction a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water. To measure the amount of liquid in a tank, the sensor measures the distance to the surface of the fluid. Further applications include: humidifiers, sonar, medical ultra sonography, burglar alarms and non-destructive testing. Systems typically use a transducer which generates sound waves in the ultrasonic range, above 18,000 hertz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed. The technology is limited by the shapes of surfaces and the density or consistency of the material.

- **Ultrasonic Sensor Pin Configuration:**

Pin Number	Pin Name	Description
1	Vcc	The Vcc pin powers the sensor, typically with +5V
2	Trigger	Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.
3	Echo	Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.
4	Ground	This pin is connected to the Ground of the system.

- **HC-SR04 Sensor Features:**

  - Operating voltage: +5V

- Theoretical Measuring Distance: 2cm to 450cm
- Practical Measuring Distance: 2cm to 80cm
- Accuracy: 3mm
- Measuring angle covered: <15°
- Operating Current: <15mA
- Operating Frequency: 40Hz

➢ **HC-SR04 Ultrasonic Sensor - Working:**

As shown above the **HC-SR04 Ultrasonic (US) sensor** is a 4 pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver.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.

If you need to measure the specific distance from your sensor, this can be calculated based on this formula:

Distance = ½ T x C

(T = Time and C = the speed of sound)

At 20°C (68°F), the speed of sound is 343 meters/second (1125 feet/second), but this varies depending on temperature and humidity. Specially adapted ultrasonic sensors can also be used underwater. The speed of sound, however, is 4.3 times as fast in water as in air, so this calculation must be adjusted significantly.

(3) Arduino Uno

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

years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments.

A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike. Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments.

All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

(4) Buzzer

A **buzzer** or beeper is an audio signalling device, which may be mechanical, electro-mechanical, or piezoelectric (piezo for short). Typical uses of **buzzer s**and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke. A buzzer is a device which makes a buzzing or beeping noise. There are several kinds; the most basic is a piezoelectric buzzer, which is just a flat piece of piezoelectric material with two electrodes. This type of buzzer requires some kind of oscillator (or something more complicated like a microcontroller) to drive it—if you apply a DC voltage you will just get a click. They are used in places where you need something that emits an audible tone, but don't care about high-fidelity sound reproduction, like microwave ovens, smoke alarms, and electronic toys.

They are cheap and can be very loud without using very much power. They are also very thin, so they can be used in flat objects like "singing" greeting cards. A piezoelectric element also produces a voltage in response to pressure, so piezoelectric buzzers can also be used as crude pressure sensors or microphones.

(5) Switch

A switch is a generic term used to refer to an electric switch that is actuated by very little physical force, through the use of a tipping-point mechanism. They are very common due to their low cost and durability, greater than 1 million cycles and up to 10 million cycles for heavy duty models. This durability is a natural consequence of the design. Internally a stiff metal strip must be bent to activate the switch. This produces a very distinctive clicking sound and a very crisp feel.

When pressure is removed the metal strip springs back to its original state. Common applications of micro switches include the door inter lock on a microwave oven, leveling and safety switches in elevators, vending machines, and to detect paper jams or other faults in photocopiers. Micro switches are commonly used in tamper switches on gate valves on fire sprinkler systems and other water pipe systems, where it is necessary to know if a valve has been opened or shut. The defining feature of micro switches is that a relatively small movement at the actuator button produces a relative large movement at the electrical contacts, which occurs at high speed (regardless of the speed of actuation).

(6) Battery

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smartphones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that when connected to an external circuit will flow and deliver energy to an external device. When a battery is connected to an external circuit, electrolytes are able to move as ions within, allowing the chemical reactions to be completed at the separate terminals and so deliver energy to the external circuit. It is the movement of those ions within the battery which allows current to flow out of the battery to perform work. Historically the term "battery" specifically referred to a device composed of multiple cells, however the usage has evolved additionally to include devices composed of a single cell.

(7) Jumper Wires

Jumper wires are simply wire that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed. Fairly simple. In fact, it doesn't get much more basic than jumper wires.

Though jumper wires come in a variety of colors, the colors don't actually mean anything. This means that a red jumper wire is technically the same as a black one. But the colors can be used to your advantage in order to differentiate between types of connections, such as ground or power.

7.2 Steps to Execute :

If you use the Smart Blind Stick for the first time , here are some simple steps to follow -

1. Firstly, make sure that the position of Ultrasonic Sensor attached in Blind stick is in front direction.

2. Now, switch ON the Power Supply.
3. Start walking.
4. Keep walking.
5. Stop when you hear a beep sound.
6. And change the direction.