PROFORMA FOR THE APPROVAL PROJECT PROPOSAL

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PNR No.: …… Roll no: _____

1. Name of the Student
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2. Title of the Project
_____

3. Name of the Guide

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4. Teaching experience of the Guide
_____

5. Is this your first submission? Yes No

Signature of the Student Signature of the Guide

Date: …… Date: …….

Signature of the Coordinator Date: ……

DISTANCE MEASUREMENT USING ULTRA SONIC SENSOR WITH ARDUINO

A Project Report

Submitted in partial fulfilment of the requirements for the award of the Degree of

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

By

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MUMBAI, 400 001

MAHARASHTRA

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ABSTRACT

The project is designed to develop a distance measurement system using ultrasonic waves and interfaced with Arduino Nano with the LCD. We can utilize these frequency range 20hz to 20khz waves through ultrasonic sensor HC-SR04.

The advantages of this sensor when interfaced with Arduino which is a control and sensing system, a proper distance measurement can be made with new techniques. As large amounts are spent for hundreds of inflexible circuit boards, the Arduino will allow business to bring many more unique devices.

This distance measurement system can be widely used as range meters and as proximity detectors in industries and also in Car Parking.

The hardware part of the ultrasonic sensor is interfaced with Arduino. This method of measurement is an efficient way to measure small distances precisely.

The distance of an obstacle from the sensor is measured through the ultrasonic sensor. After knowing the speed of sound the distance can be calculated.

Manual distance measuring is always done at the expense of human error. Precise and fix measurement of low range distance, is the main objective for this project.

In Earlier Days Humans were Measuring distance with an measuring Material from which they don't get an proper or accurate reading this make the main problem for human for an proper solution. So for Solution this Project is been made for Reading Accurate Reading in Digital form with an compact device.

In this project the hardware are Arduino Nano, Ultra Sonic Sensor HC-SR04 , LCD Module etc. this will be the compact device which people can use easily.

The software is being Used is Arduino Software (IDE) contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

In this project the main role is of Ultra Sonic Sensor. The Ultrasonic Sensor HC-SR04 sends out a high-frequency sound pulse and then times how long it takes for the echo of the sound to reflect back. The sensor has 2 openings on its front.

The speed of sound is approximately 341 meters (1100 feet) per second in air.

The Advantage of this project people will be able to measure any distance in easy method and with accurate reading it will be also in budget.

ACKNOWLEDGEMENT

This acknowledgment is nothing but a small token of gratitude towards the people who have helped along the way. We take the opportunity of submitting this dissertation report to express our deep regards towards the ones who offered their invaluable guidance in an hour of need. Prominent among them our project guide **Mrs. Chhaya Pawaskar** who helped us as well as guided us right from the selection of this project to successful completion of this project report.

We also like to thank other staff members of **INFORMATION TECHNOLOGY** department for their guidance and help during our project development. We are deeply thankful to our principal **Dr.U.M.Maske** for her support and the interest she showed behind our project.

This work would not have been possible without active contribution from Teacher's, Laboratory staff and others who was helpful to us at each stage.

DECLARATION

I hereby declare that the project entitled," **Distance Measurement Using Ultra Sonic Sensor with Arduino**" done at **Mumbai,** has not been in any case duplicated to submit to any other university for the award any degree. To the best of my knowledge other than me, no one has submitted to any other university.

The project is done in partially fulfilment of the requirements for the award of degree of **BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY**) to be submitted as final semester project as part of our curriculum.

BHAVIN MANSHUKLAL DEDHIA

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Chapter 1:

Introduction

1.1 Background:

In earlier days the measurements are generally occurring through measuring devices. Therefore we use a proper display unit for measurement of distance for Proper Results.

In This Project We can use sources such as sound waves which are known as ultrasonic waves using ultrasonic sensors and convert this sound wave for the measurement of various units such as distance, speed.

This technique of distance measurement using ultrasonic in air includes continuous pulse-echo method, a burst of pulse is sent for transmission medium and is reflected by an object kept at specific distance. The time taken for the sound wave to propagate from transmitter to receiver is proportional to the distance of the object.

1.2 Objective:

- In this distance measurement system, we had ultrasonic sensor HC-SR04 interfaced with Arduino Uno. Programming and hardware part of ultrasonic sensor interfacing with Arduino Uno.
- An ultrasonic sensor houses a transducer that emits high-frequency, inaudible acoustic waves in one direction when the transducer element vibrates. If the waves strike and bounce off an object, the transducer receives the echoed signal and gives Output in the LCD Display.

- The sensor then determines its distance from the object based on the length of time between the initial sound burst and the echo's return.
- On a specific distance reaches then it produces sound.
- It also have Bluetooth module from which it can transfer data to Android app.
- Precise and fix measurement of low range distance
- To measure a distance at any obstacle.
- Operating range of 0.5m up to 4 m with an accuracy of 1 cm.
- Design a simple circuit and find a suitable hardware for this project.

Purpose, Scope and Applicability

1.3.1 Purpose:

This project is been done Because of it consumes lots of time while measuring the Distance for normal people as well as for main workers. This project has an Arduino which will be connected through an ultrasonic sensor which will give you accurate Distance from the object placed between through ultrasonic sound waves.

The ultrasonic sensor uses this information along with the time difference between sending and receiving the sound pulse to determine the distance to an object. It is also has been design for blind people when the sound waves reflect with object then it will produced sound these will help blind person to walk properly with no stress.

1.3.2 Scope:

- Can be used as parking assistance systems in vehicles with high power ultrasonic transmitter to Park Car.
- Can be used as burglar alarm with suitable additional software for homes and offices.
- Can be a used in the liquid level measurement.
- Can be used to find breakdowns in wires or threads.
- Using temperature Compensation, it can be used over wide temp range.
- Height measurements.

1.3.3 Applicability:

Distance Measurement System Is Used in Our day to day life which is the Example of Car. At a Time of Car Parking the Driver Watch's in LCD Panel the Measurement System Devices is Fixed on Back Side of the car if the Object Comes near to the device then it transfers the sound to Understand the driver to stop the car.

Also for Blind person when the slash with person these project will help.

Chapter 2:

2.1 Survey of Technologies:

A technology I will be using is IOT (Internet Of Things). The Internet of things (IoT) is the network of physical devices, vehicles, home appliances, and other items embedded with electronics, software, sensors, actuators, and connectivity which enables these things to connect, collect and exchange data, creating opportunities for more direct integration of the physical world In these days. The technology I will be many Hardware Components Like Arduino, Ultrasonic sensor etc.

Arduino is an open-source platform used for building electronics projects with its own Software. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

The HC-SR04 ultrasonic sensor uses sonar to determine the distance to an object like bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package.

From 2cm to 400 cm or 1” to 13 feet

The Above Components will help me to Execute Reading of Projects.

I have selected these technologies because Mostly it is Recent Use in Many foreign areas, therefore, it can use in India too with more Upgrades

Chapter 3

Requirements and Analysis

3.1 Problem Definition:

The problem on which I am are working on the project is about Making a Compact digital Measurement Gadget.

This is the Major Problem Of this Project Because Many people don't have or don't Cary Measuring materials.

By this Compact Devices, People will like to Cary this Amazing Device and It is Easy to use.

3.2 Requirements Specification:

User Requirement-

a. The Device should give accurate reading to the User's

b. The Device is easy to use and learn.

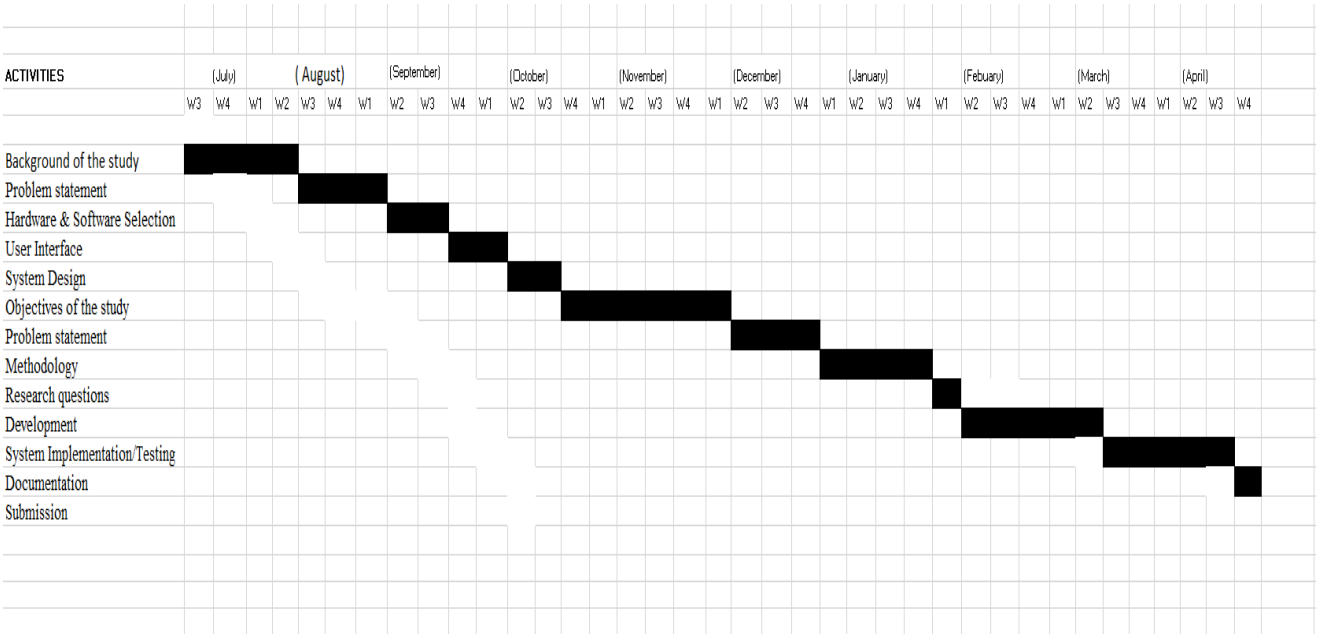
c. The Device allows to gives a reading in meter's and in centimetres.

The Problem is been solved by a Compact devices which is been made which gives an proper output in the Digital form.

3.3 Planning and Scheduling:

Planning can be thought of as determining all the small tasks that must be carried out in order to accomplish the goal.

A project schedule is a document collecting all the work needed to be deliver the project on time.



3.4 Software and Hardware Requirements:

- The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328P (Arduino Nano 3.x). It has more or less the same functionality of the Arduino, but in a different package. It lacks only a DC power jack and works with a Mini-B USB cable instead of a standard one.
- As the name indicates, ultrasonic sensors measure distance by using ultrasonic waves.
- The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Ultrasonic Sensors HC-SR04 measure the distance to the target by measuring the time between the emission and reception.
- LCD (liquid crystal display) is the technology used for displays in notebook and other smaller computers.
- Battery for giving power
- Button for On/Off
- Buzzer

Hardware Requirements:

Hardware	**Minimum Requirement**	**Reason**
Arduino Nano	1	Main Module
Ultra Sonic Sensor	1	Sound Waves
LCD Display	1	For Display Measurements
Battery	1	For Power
Button	1	On/Off
Jumper Wires	1 set	Connections
Buzzer	1	Sound
Bluetooth Module	1	Data Transfer
Android Phone	1	Receiving data

Software Requirements:

Software	Minimum requirement
Operating System for computer	Windows 7/10 32/64 bit
Ram	4/8 GB

Preliminary Product Description:

Functional Requirement-

a. The LCD Should Display Proper Readings.

b. The Sensor Should Work Properly.

c. The Buzzer should properly work when distance reaches to a particular distances.

d. Sound should properly works when it reaches particular distances.

e. Bluetooth module should be giving accurate data transfer.

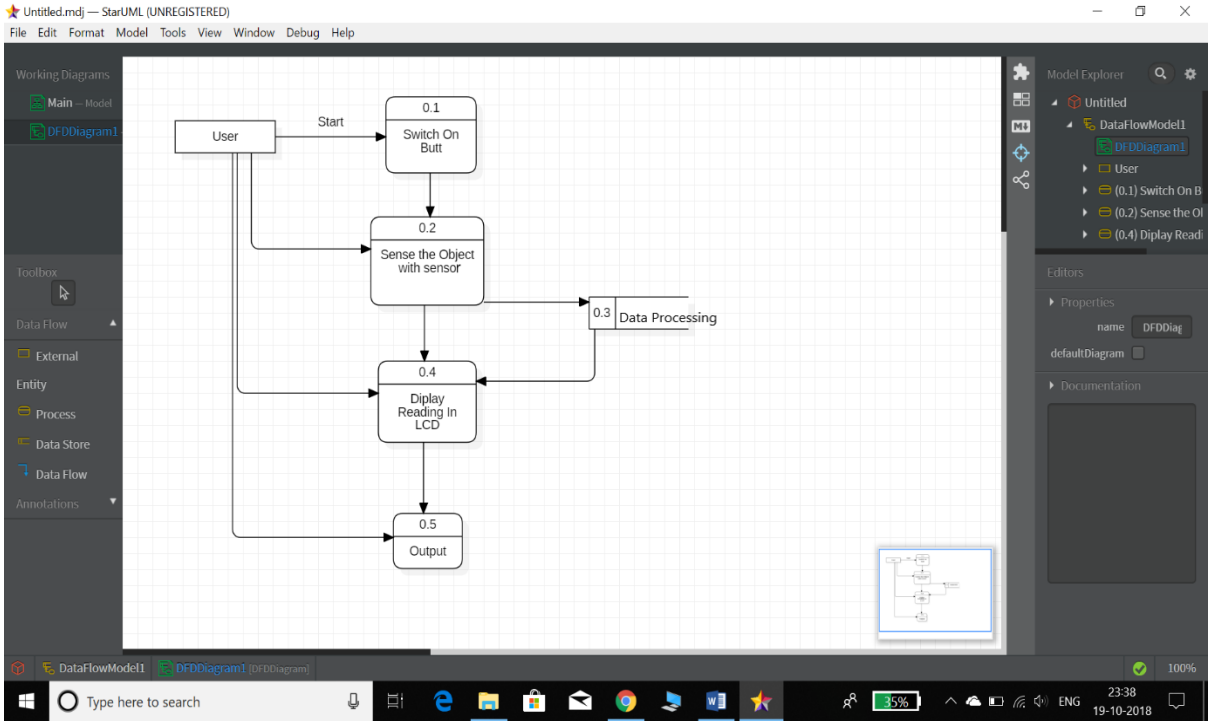
Non Functional Requirement-

a. The device should have a fast response time.

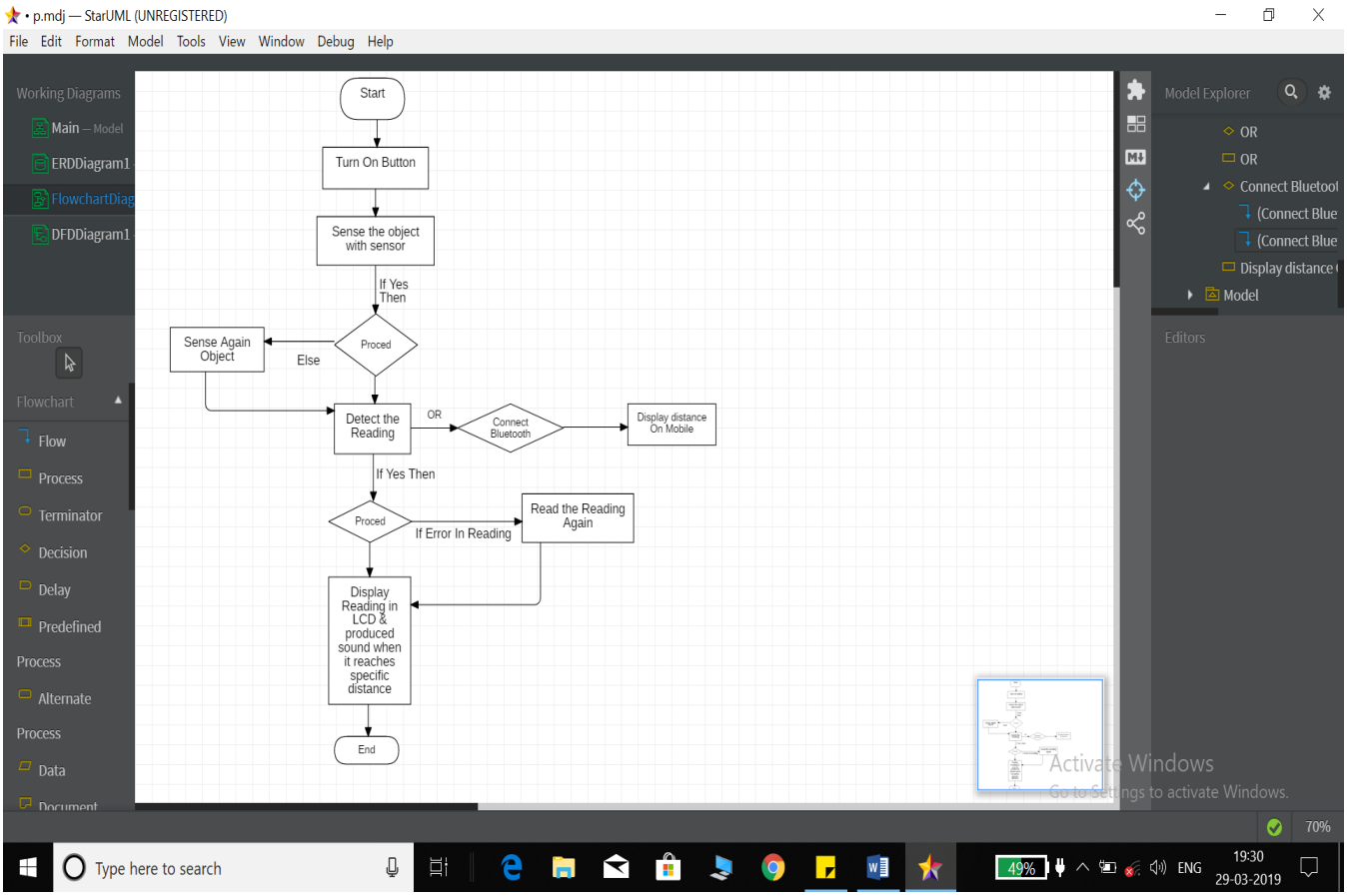
b. The Device Should Give Accurate Reading If it is Far away from Object.

c. The system should be reliable. In the case of system failure, the system should be able to recover quickly and continue working normally.

3.5 Conceptual Models:

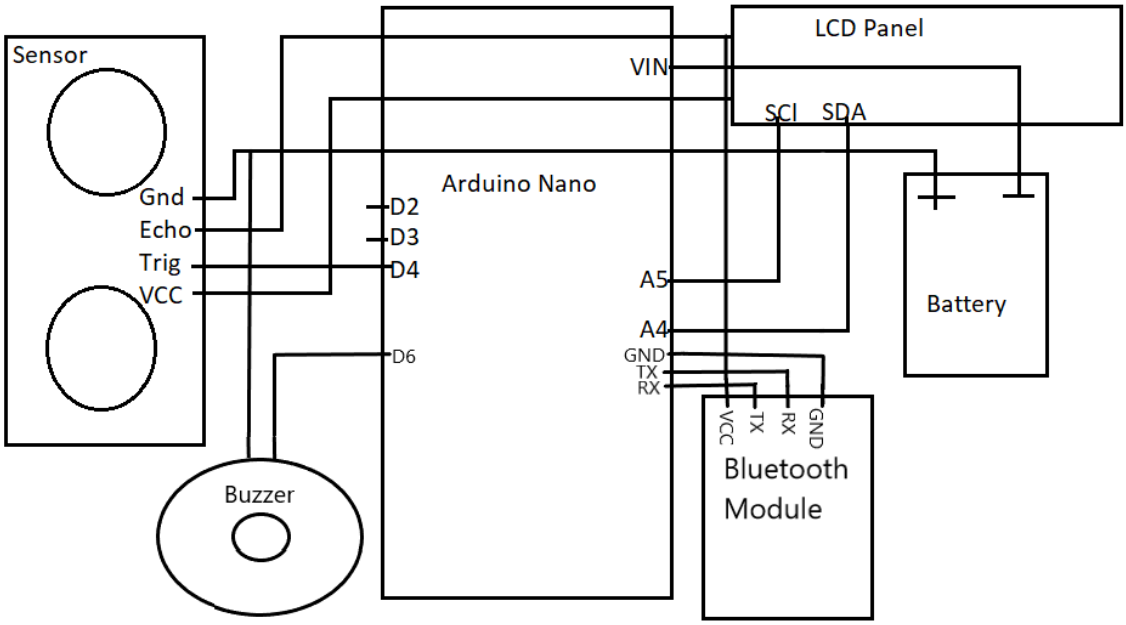


Flow Chart Diagram:-



This is Data flow diagram of an Distance measurement System which will have an Entity User's and the other side the process will flow Step by Step at least the User will get Output In LCD Panel.

3.6 ER diagram:



- In this Project the Connection is been used between an Arduino Nano , Ultra Sonic Sensor , LCD Panel , Battery.
- The Arduino Pin Number A4 is been Connected to an LCD Module SDA.
- The Arduino Pin Number A5 is been Connected to an LCD Module SCl.
- The Ultra Sonic Sensor VCC will be connected to an LCD Module.
- The Ultra Sonic Sensor Trig (Trigger) will be connected to a Pin Number D4.
- The Ultra Sonic Sensor Echo will be connected to a Pin Number D3.
- The Ultra Sonic Sensor GND (ground) will be connected to an Battery.
- The Second Phase of Battery Will be connected to VIN.
- The Buzzer will be connected to D6 and Ground Pin
- All Connection will be done by An Jumper Wires.
- The Bluetooth module of GND to GND & VCC to VCC , TX to RX , RX to TX.

Chapter 4

System Design

4.1 Basic Modules:

In these project there are 3 basic module which will be using are as follows

1) Arduino Nano: - This is smaller version of Arduino it is used to store code and its been connected to other device to perform some action according to the code is been stored.

2) Ultra Sonic Sensor :- This is the Sensor which is used for calculating distance from starting point to the object placed it calculates distance through an Ultrasonic sound waves and Display the Reading in the LCD Panel.

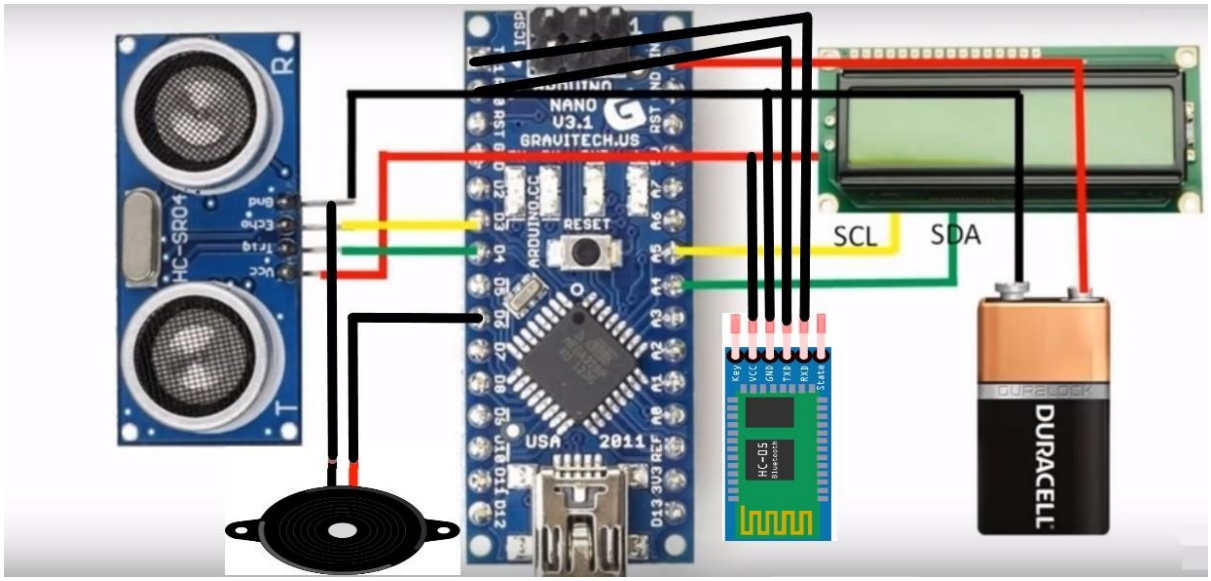
3) LCD Module: - This LCD Panel is been used to display reading which is been Calculated by an Ultra sonic sensor.

4) Buzzer: - The buzzer will produced sound when the specific distance has been detected.

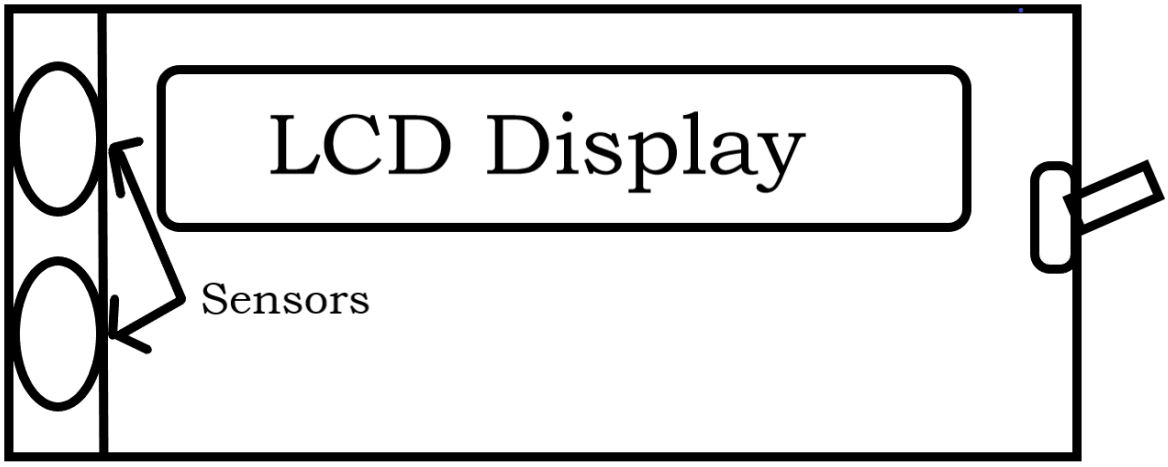
5) Bluetooth module:- It Transfer data from Bluetooth to Android Phone.

4.2 Data Design:

This is the Data design of Distance Measurement the ultra-sonic sensor will be get connected to Arduino Nano and with LCD to display the reading and also connected to battery for a power supply.

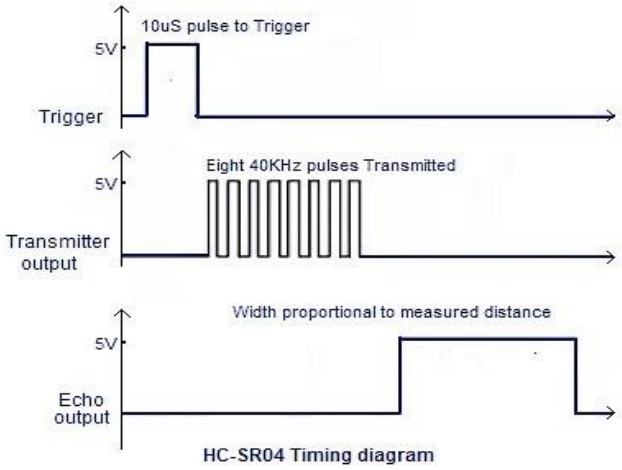


4.3 User Interface:



User interface of Distance measurement using ultra sonic sensor which people can interact easily.

4.4 Logic Diagram:



HC-SR04 Timing diagram

HC-SR04 Pinout

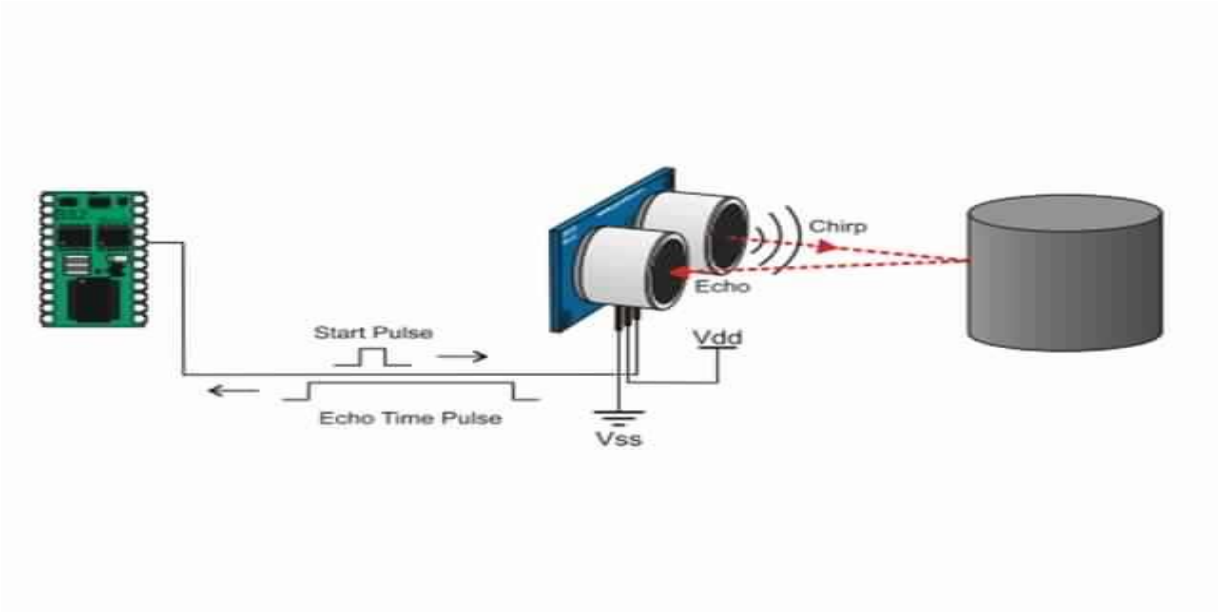
Ultrasonic sensor “HC-SR04” provides an output signal proportional to distance based on the echo. The sensor here generates a sound vibration in ultrasonic range upon giving a trigger, after that it waits for the sound vibration to return. Now based on the parameters, sound speed (220m/s) and time taken for the echo to reach the source, it provides output pulse proportional to distance.

4.5 Test Case Design:

In this test case design the Ultrasonic sound vibrates at a frequency above the range of human hearing.

Transducers are the microphones used to receive and send the ultrasonic sound.

Our ultrasonic sensors, like many others, use a single transducer to send a pulse and to receive the echo. The sensor determines the distance to a target by measuring time lapses between the sending and receiving of the ultrasonic pulse.



Chapter 5

Implementation and Testing

Implementation Approaches:-

The Basic Plan for Implementation is firstly perform all the steps on the Software with all hardware components with all connections properly.

After all Steps and Connections secondly check is it working same as we have decided and check if any error or bugs has occurred or not.

If all Steps, connections are proper and giving the proper output then we can implement in Real World. Bring all the basic Hardware and Software for the Project and for first time Implement on the bread board if it goes all well then you go for Main Implementation.

Coding Details and code Efficiency:-

```
#define trigPin 2            /////// Define Trigger pin

#define echoPin 4         ////////// Define Echo pin

#include <LiquidCrystal_I2C.h>          /////LCD Library

int safetyDistance;                    ////// Declare safety Distance

LiquidCrystal_I2C lcd(0x27, 16, 2);       ///0x27--lcd address

#define buzzer 6                       /////Define Buzzer pin

void setup()

{

pinMode(trigger,OUTPUT);       ///Trigger sends signal
```

```
 pinMode(echo,INPUT);            ///Echo Receives signal
 lcd.print("    WELLCOME    ");      ///printing message
 lcd.print(" Distance Meter ");
lcd.print("By Bhavin Dedhia");
lcd.print("Distance:");
 lcd.print("Distance:");
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
}


void loop()
{
  digitalWrite(trigPin, LOW);      /// printing distance on lcd
    digitalWrite(trigPin, HIGH);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH);   ////receiving distance data into duration variable
  distance = (duration/2) / 29.1;    //// formula for distance
 lcd.print(distance);
 lcd.print("Cm ");
 //lcd.print("Distance:");
```

```
 lcd.print(distance/100);

 lcd.print(" Mt");

 Serial.print(distance);

  Serial.println(" cm");

safetyDistance = distance;

if (safetyDistance <= 40){ //Enter the Distance according to detect object

  digitalWrite(buzzer, HIGH);  /// Sound goes on the distance reaches to equal to 40

}

else {

  digitalWrite(buzzer, LOW);/// Sound goes of the distance reaches greater than  40

}
```

Testing Approaches: -

Testing will be step by step firstly will start from Hardware part.

Unit Testing:-

1) Ultrasonic Sensor testing checks all the waves are working properly or not. The Trigger is sending the Sound waves and echo is receiving the data Sound waves. Is it giving proper distance when it reflect from object?
2) LCD testing checks all print stages where all type of statement has been printed properly. Is the print statement visible or it is low light printing?
3) Arduino Nano testing checks the all the pins are working properly. Does the new code is overlapping from previous one or not?
4) Buzzer testing checks the sound is properly audible or not?

Integration Testing:-

In Integration Testing Combine all the components together and checks is it working properly. When Arduino Nano is connected to all components like Ultrasonic sensors, lcd, buzzer checking the working process. Is the ultrasonic sensor giving all data properly, Is lcd Printing all data with meters and centimetre, is the buzzer is audible when it reaches the objects.

Modification and Improvements:-

- After the Testing all the components properly some errors has been faced. So too Improve that errors I have made some changes in coding as well as in connection.
- In coding while defining the trigger and echo it was only printing LCD so I have define another trigger with different name to print on Android App.
- I have given sufficient delay time for printing proper output.
- While on Connection I have made one wire Ground from which many ground pin can be connected.
- I have also set the Cursor so that the print doesn’t mismatch.

Chapter 6

Results and Testing

Test Reports: -

The Arduino which stores minimum amount of data of coding to run has also been a biggest challenge to me to proceed. Where as to ultrasonic sensor it also a finite thing to take care always while testing some time I got different reading after changing some formula I got accurate reading.

Also with LCD at first time as a new product it wasn't starting but after some changes it got in working state when I display some text it was displaying in random manner after giving some cursor value it got place where I was wanting to display.

User Documentation:-

Firstly I had assemble all the hardware components all to together because all can be in compact device to look good for user.

Secondly when we on the switch the LCD display starts and it Display first Print statement (WELLCOME) with proper adjusting cursor.

After First Print statement while putting the some delay it prints Second Print statement of (Distance Meter) cursor on first line and printing (By Bhavin Dedhia) on second line.

At last it prints the distance with Centimetre and Meter with proper and accurate distance.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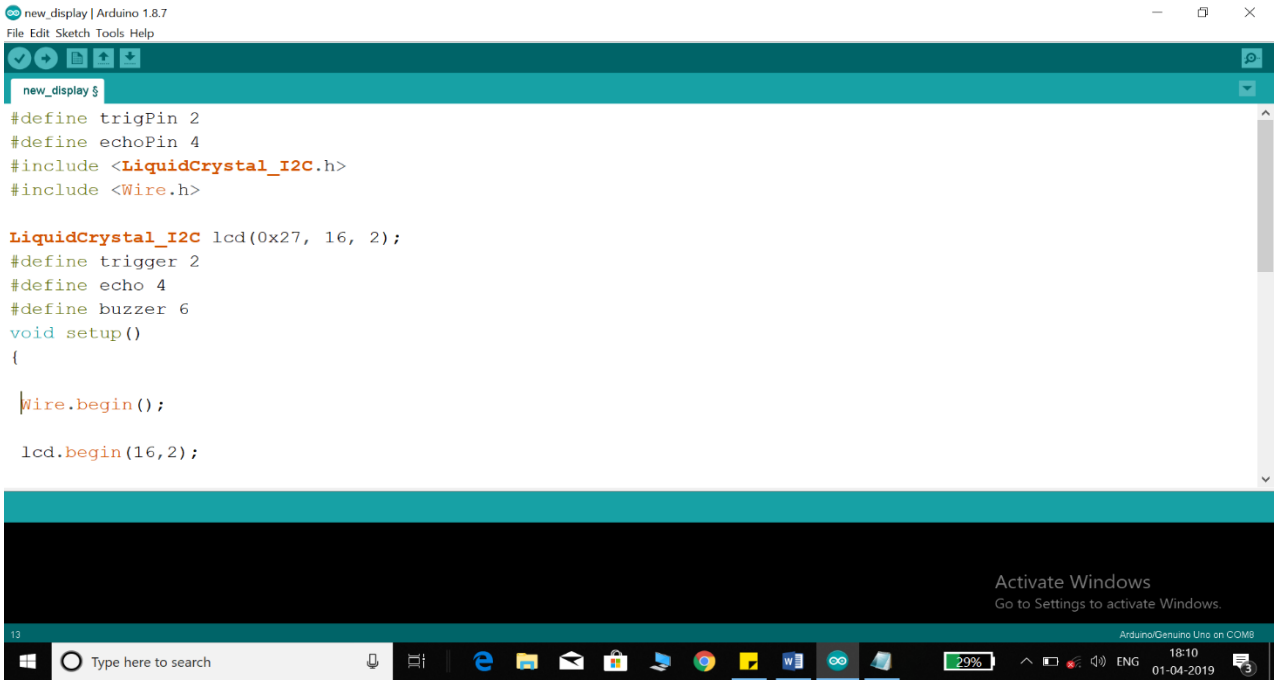

Software I had used in this project is Arduino Software in which the python language is been used for programming and the software has features of compiling and uploading features as well.

Conclusion

Conclusion:-

The main purpose of this study is to produce a prototype that can detect objects or obstacles in front of users and feeds warning back, in the forms of voice, to users. Combination of ultrasonic sensors and an Arduino function for detection and distance gloves and obstacles in front. This project is for people with disabilities that are blind to facilitate the movement and increase safety.

The smart blind gloves is successfully designed consistent with all the objectives achieved. The first objective is achieved by applied the programmable distance and barrier detection system ultrasonic sensor. Develop a product or hardware that can determine distance and detect barriers in front barriers. The second objective is achieved by complete the design to investigate the design smart blind gloves using ultrasonic sensor and buzzer.

One of the most important difficulties faced by the visually challenged persons is constraints in independent mobility and also in Bluetooth module. They primarily use the hand gloves as a mobility aid allowing them to detect close by obstacles. Developments in Arduino systems have opened up a vast area of research and development for affordable and portable assistive devices for the physically challenged.

It can also have another variant with Arduino UNO which can support vibration too. This unit consists of an ultrasonic ranger and a vibrator controlled by a Arduino uno to offer an increased detection range of three meters. The distance information is conveyed to the user through non-interfering multi-frequency vibratory stimuli, the frequency of vibration indicating the proximity of obstacles. This unit is also capable of detecting fast moving obstacles.

Future Scope:-

The device can have a GPS navigation system if person want to give location of his/her by pressing button it can be track the person Location.

In Future we can add a voice command by indicating the left and right directions from which the user’s can use very comfortless.

It can also be converted in blind stick from which we can a add water detection sensor at the bottom from which it can detect the water.

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3) YouTube

4) Ultrasonic Distance Measurement Prakhar Shrivastava, Praveen Kumar, Ankit Tiwari – 2014

5) http://circuitdigest.com

6) IOT (Internet of Things) BSCIT SEM 5

Distance Measurements Using Arduino

Hardware Components	Costs
1. Arduino Nano(1)	280/-
2. Ultrasonic Sensor(1)	85/-
3. LCD 16 x 2 with I2C address(1)	350/-
4. Jumper Wires (set)	50/-
5. Bluetooth Module(1)	250/-
6. On / Off Button(1)	20/-
7. Buzzer(1)	25/-

Total Cost----Rs:1060/-