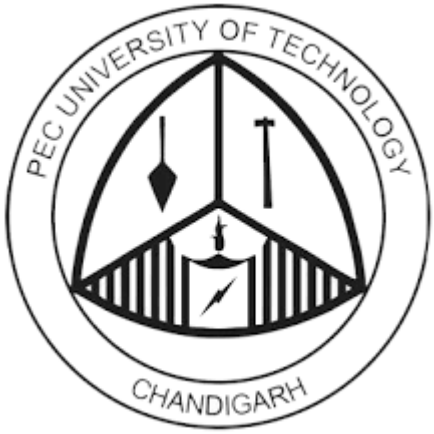
Obstacle Sensing Walking Stick

ESD project Semester1



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Submitted by:

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Semester –1st , M.E
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CERTIFICATE

It is hereby certified that the work which is being presented in the M.E. Project Report entitled 'OBSTACLE SENSING STICK FOR VISUALLY IMPAIRED', in partial fulfillment of the requirements for the award of the Master of Engineering in Electronics Engineering under the course of 'Electronic System Design' and submitted to the Department of Electronics & Communication Engineering of PEC University of Technology Chandigarh is an authentic record of our own work carried out. The report is submitted by the following students of M.E(Electronics) , 1st semester:

Divya Khandelwal (ME16207022), Sonali Shukla (ME16207024)

This is to certify that the above statement made by the candidates are correct to the best of our knowledge.

Date: 7/10/2016

Dr. Neelam Rup Prakash
Professor,
ECE Department

ACKNOWLEDGEMENT

This is to express our gratitude for all those people who have been a source of guidance during the complete course of this project.

Our deepest gratitude is to Dr. Neelam Rup Prakash, Professor, Electronics and communication department. We have been fortunate to have received constant support and guidance during the period of the development of the project.

Also we would like to express heartfelt gratitude to fellow mates which helped us constantly to focus on the project and sort out various technical and non technical problems related to the project.

Thanking all.

Divya Khandelwal ME16207022
Sonali Shukla ME16207024

CONTENTS

Bill Of Material

S.No.	Component	Amount	Value
1.	Resistor	1	100 ohm
3.	Ceramic Disc Capacitor	2	10pF
4.	Ceramic Disc Capacitor	2	0.1uF
5.	Arduino Uno Board with ATMEGA controller	1	-
6.	Jumper wires	-	-
7.	Voltage Regulator	1	9V to 5V
8.	Buzzer 10mm Diameter	1	-
9.	HC-SR04 Ultrasonic Rangefinder Module	3	Range: 2 to 400 cm
10.	Battery	1	9V

PREFACE

The project is aimed at creating a cost-effective obstacle-sensing walking stick that can be used for specifically by visually impaired people both during the day and the night.

This project is designed to guide a blind person to walk and avoid bumping into obstacles. Low cost ultrasonic rangefinders along with a microcontroller is used to measure the distance to obstacles and if they are close enough provide a feedback to the user in form of beeps or vibrations.

This ultrasonic sensors used transmit ultrasonic waves and receive the echo. This concept is the same as used by a 'BAT' to fly and catch preys. Herein, the received echo helps in calculating the distance of the obstacle, thereby getting a idea about the path to follow.

The microcontroller used in the project is Arduino which gets the output of the sensors at its input pin and then after performing computations according to its programming it gives the output to the buzzer which then beeps for the specified number of times according to the sensor from which microcontroller receives output.

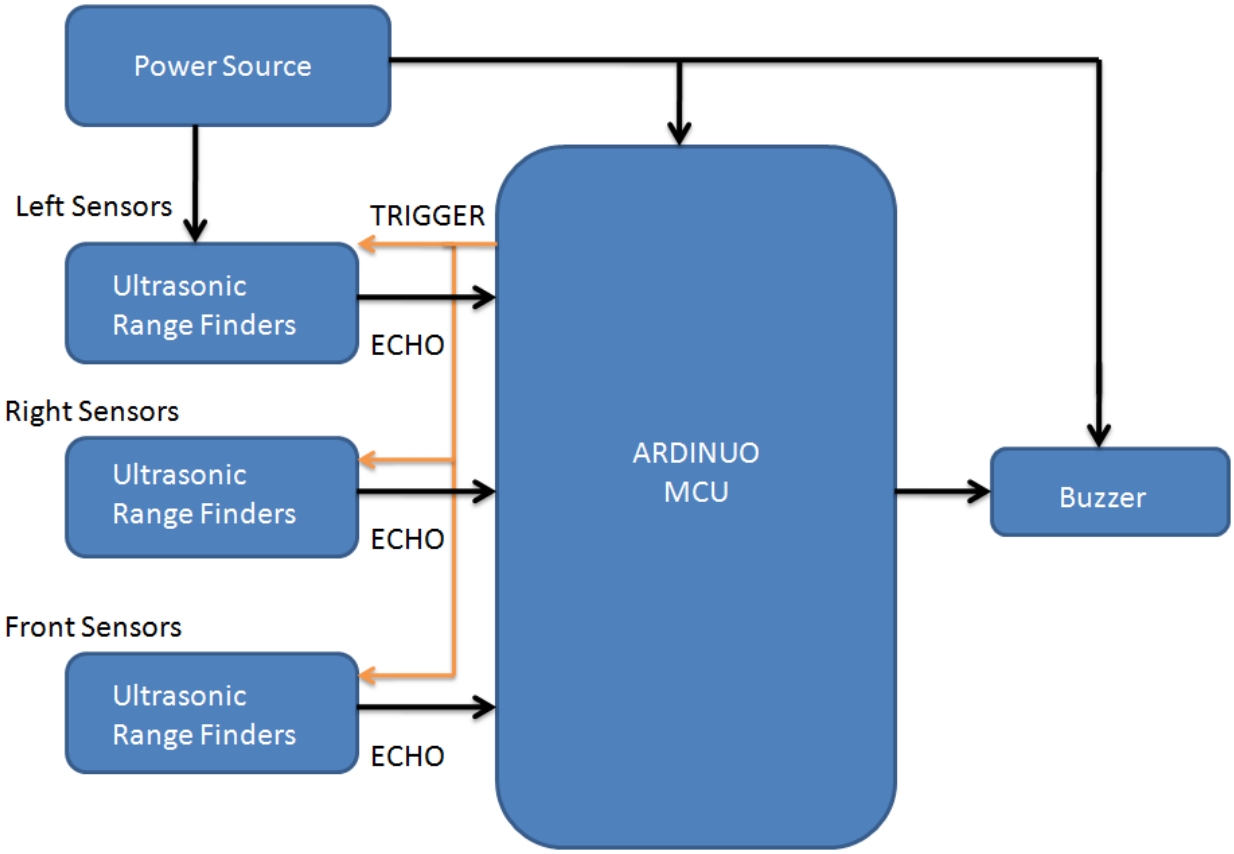
After the simulation of circuit on a simulation platform 'PROTEUS 8', the project will be implemented on hardware.

INTRODUCTION

TITLE OF THE PROJECT	**OBSTACLE SENSING WALKING STICK FOR VISUALLY IMPAIRED**
KEY OBJECTIVE	To build a cost-effective obstacle-sensing walking stick that can be used both during the day and the night.
ABSTRACT	This project is designed to guide a visually impaired person to walk and avoid bumping into obstacles. Low cost ultrasonic rangefinders along with a microcontroller is used to measure the distance to obstacles and if they are close enough provide a feedback to the user in form of beeps or vibrations.
IMPACTS	This would provide a less costly system to the blind, catering to the needs of a lot of blind people. This project aims to give a blind person a sense of independence, since he/she would not depend on someone else while performing daily activities.

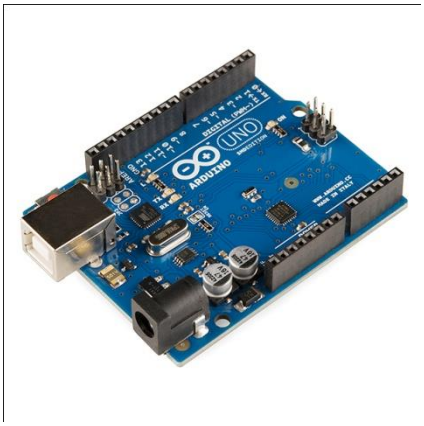
DESCRIPTION

This project is designed to guide a visually impaired person to walk and avoid bumping into obstacles. Low cost ultrasonic rangefinders along with a microcontroller is used to measure the distance to obstacles and if they are close enough provide a feedback to the user in form of beeps.



COMPONENTS

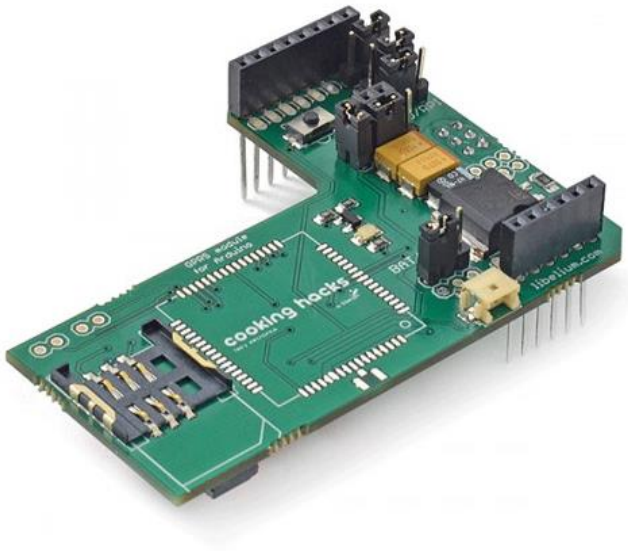
These are used to measure the distance to the obstacle. They emit sound waves with their frequency lying in the ultrasonic spectrum (more than 20KHz) and thus inaudible to human ears. These sound waves goes to the obstacle and bounces back to the detectors. We use a common HC-SR04 rangefinder module for this purpose



This is the heart of the project. It reads distance to obstacle using the sensor and also commands the buzzer. We here use the microcontroller- ARDINUO.

This microcontroller is the most user friendly and easy to program

A small 10mm diameter 5 volt buzzer is used to alert the user about the obstacles. It beeps once for a obstacle in Right, thrice for a obstacle in front and twice for an obstacle in left. You can also connect a vibrator motor in parallel with the buzzer. This will provide a vibrational feedback along with audio beeps.



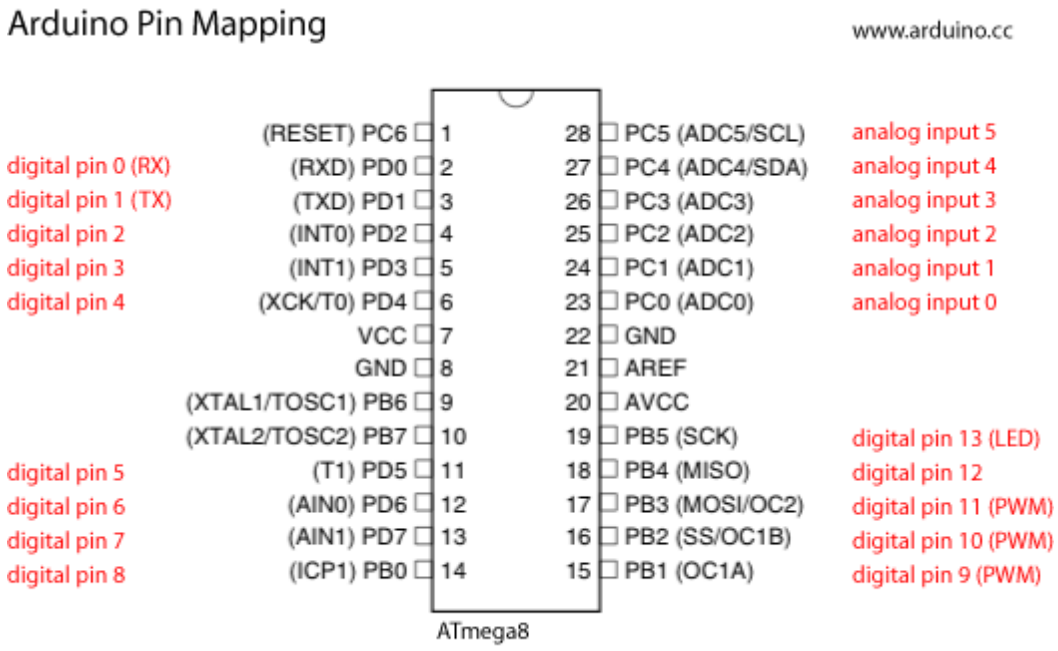
SIM908 : GPRS+GPS Quadband Module for Arduino.

This shield integrates the **SIM 908 module**, and counts with GPRS and GPS technologies that enables you to perform real time tracking applications.

The idea is simple: read the GPS coordinates (longitude and latitude) and send them by using a HTTP request to a web server. Then use a browser to load the PHP webpage which uses Googlemaps to show the location in realtime.

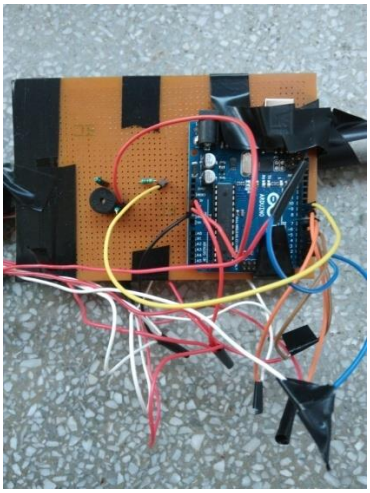
ARDUINO PIN CONFIGURATION

Digital Pin 1	-
Digital Pin 2	Trigger pin of Left Sensor
Digital Pin 3	Echo pin of Left Sensor
Digital Pin 4	Trigger pin of Front Sensor
Digital Pin 5	Echo pin of Front Sensor
Digital Pin 6	-
Digital Pin 7	Trigger pin of Right Sensor
Digital Pin 8	Echo pin of Right Sensor
Digital Pin 9	Positive terminal of buzzer

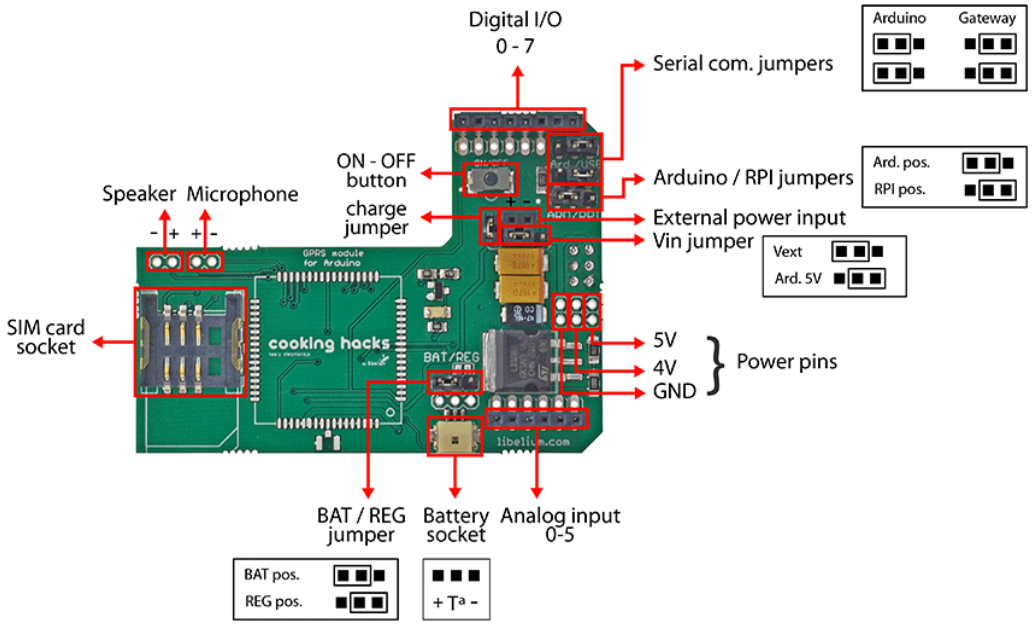


PCB LAYOUT

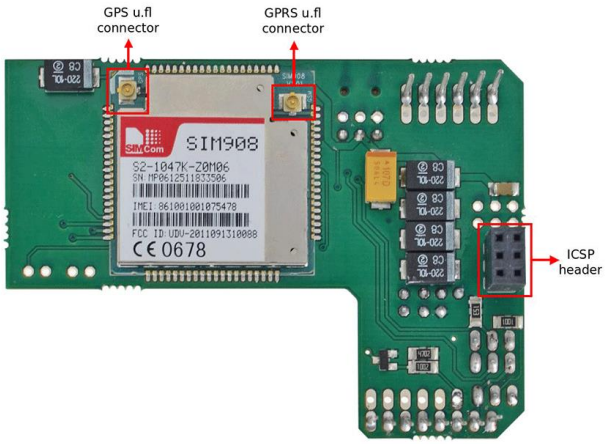
We have made a small single side PCB for this project. The PCB holds all the parts of this project the microcontroller and the power supply circuit of the circuitry. The sensors are placed at special angle towards the bottom side of the stick to sense the objects better. They are connected to rest of the circuit through jumper wires. The connections of the components are done accordingly. The second figure shows the fully assembled circuit.



DETAILS OF THE GPRS/GSM MODULE (modification suggested in project)



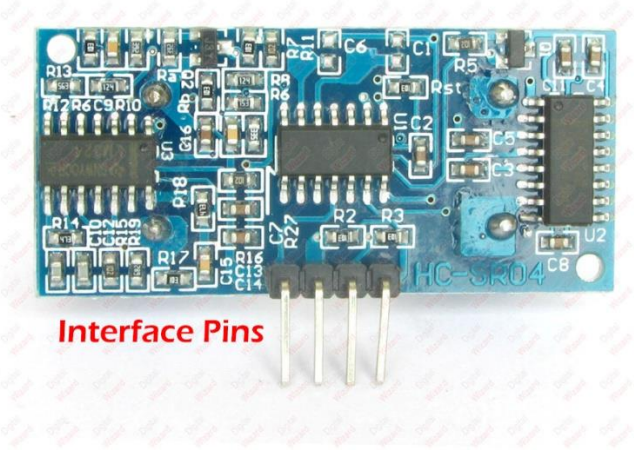
TOP VIEW OF MOCULE



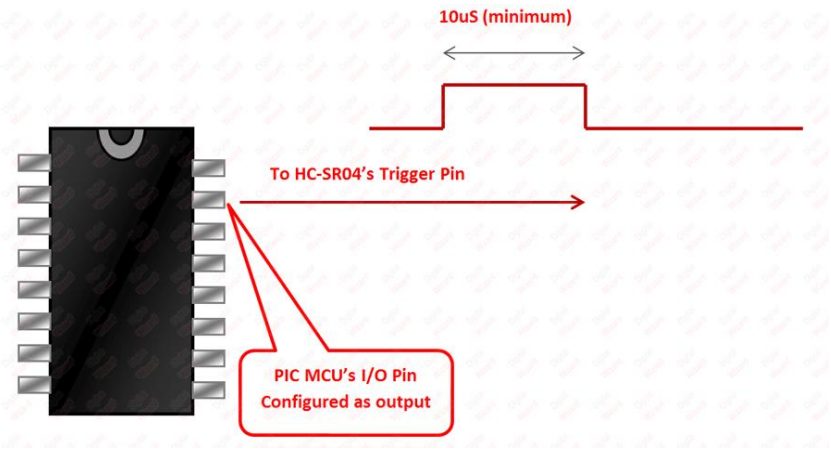
BOTTOM VIEW OF MOCULE

DETAILS OF THE SENSOR

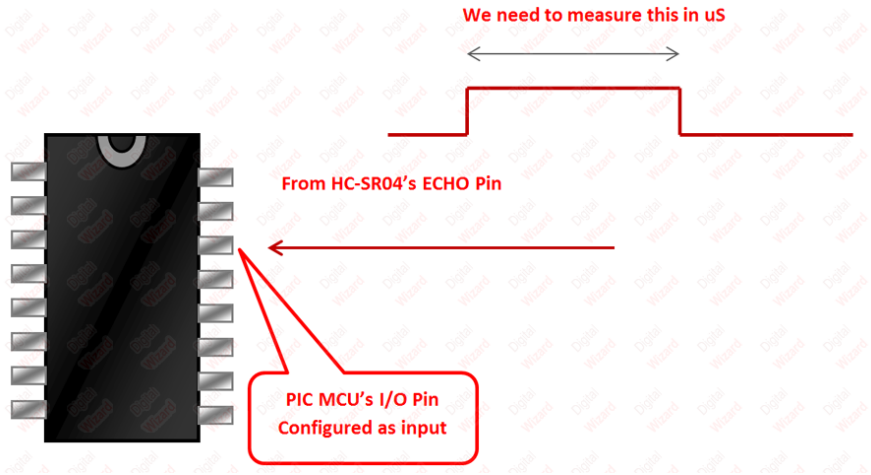
For sensing distance to obstacles, an HC-SR04 sensor module has been used. It has an ultrasonic transducer which generates the ultra sonic waves, an ultra sonic receiver and control circuitry built on a small PCB.



For interfacing with microcontroller it provides two lines namely TRIGGER and ECHO. The trigger pin is an input pin, the MCU sends a 10uS high pulse on this line to tell the HC-SR04 to start a taking a measurement.



As soon as the HC-SR04 receives this pulse it sends out ultrasonic waves and waits for it to goto the obstacle and come back to the sensor. The sensor then emits a pulse on the ECHO line whose width is equal to this time. By simple calculation we can find the distance to obstacle.



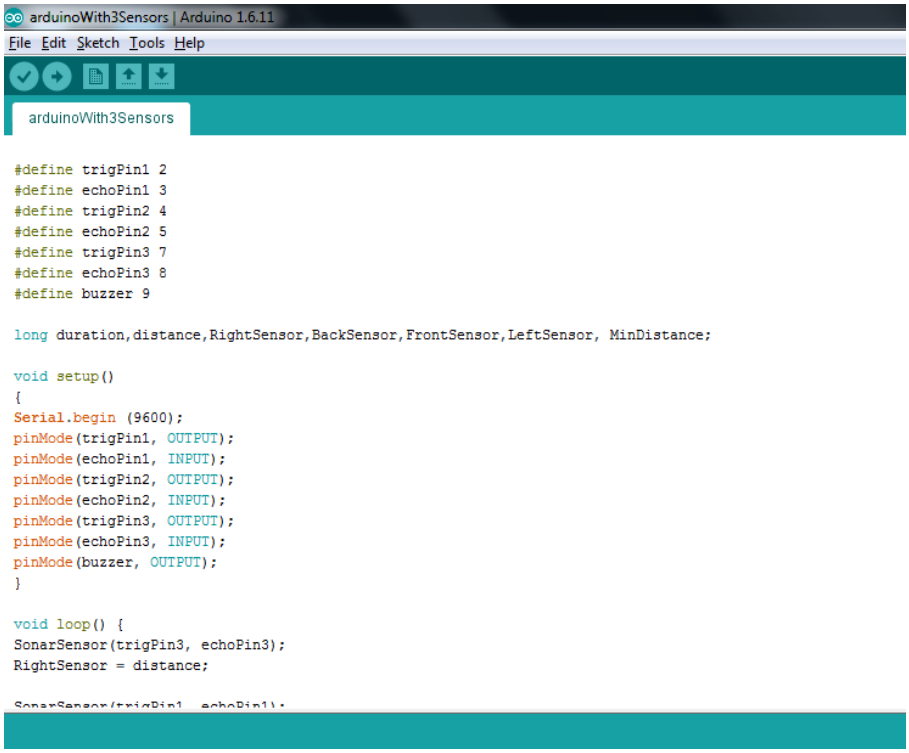
Three such such sensors are used in this project to find obstacle in front, left and right of the user.

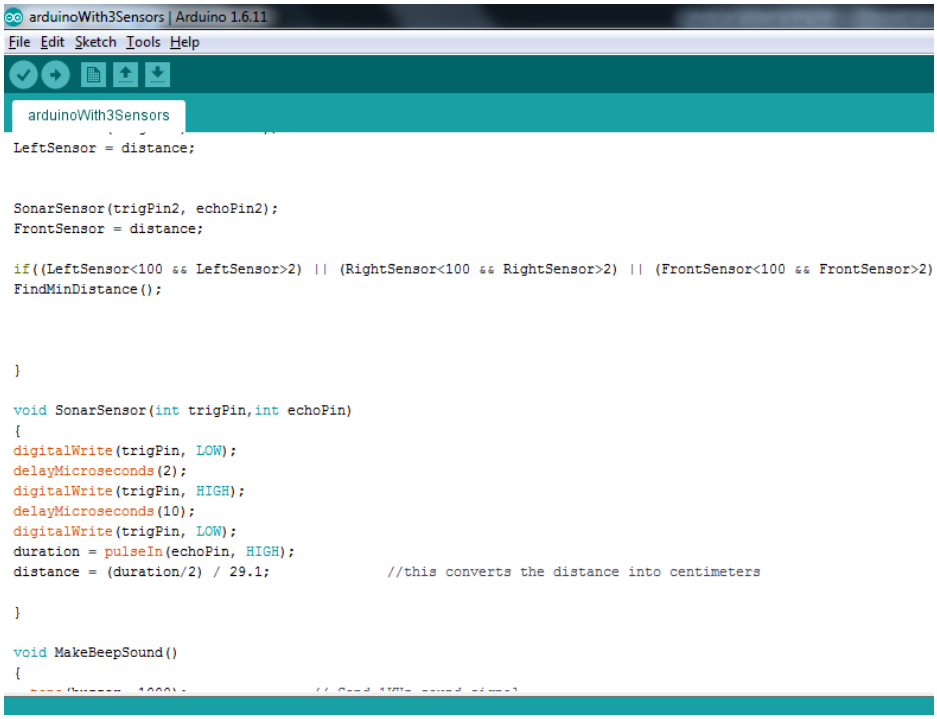
CODE

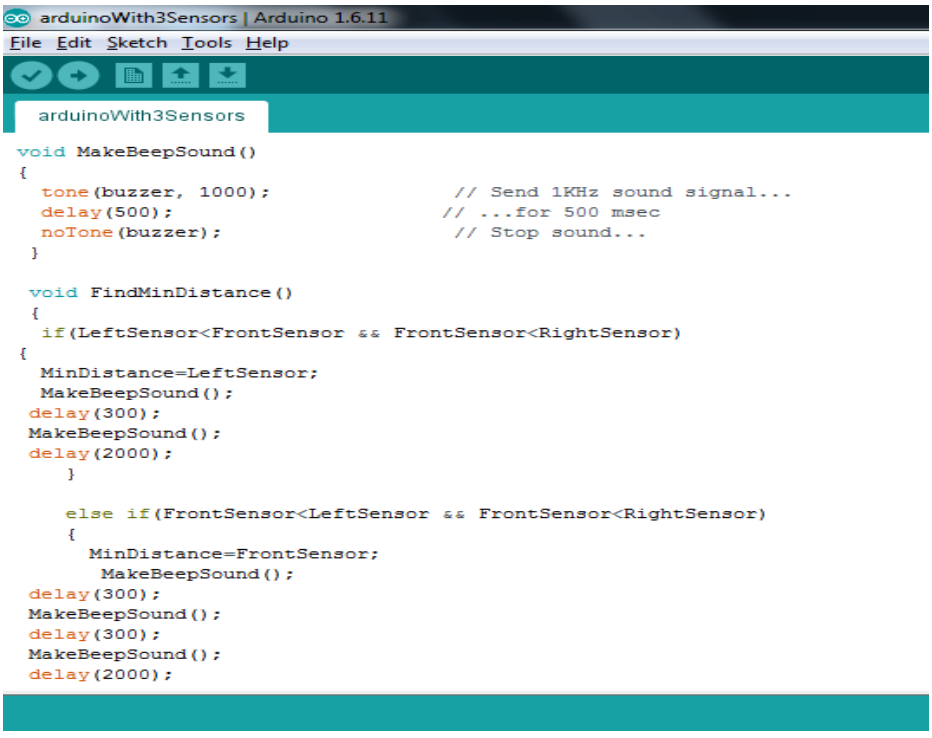
The most important and complex part of this program is the part which measures the distance using the HC-SR04 sensor. Reading the sensor involves two important steps.

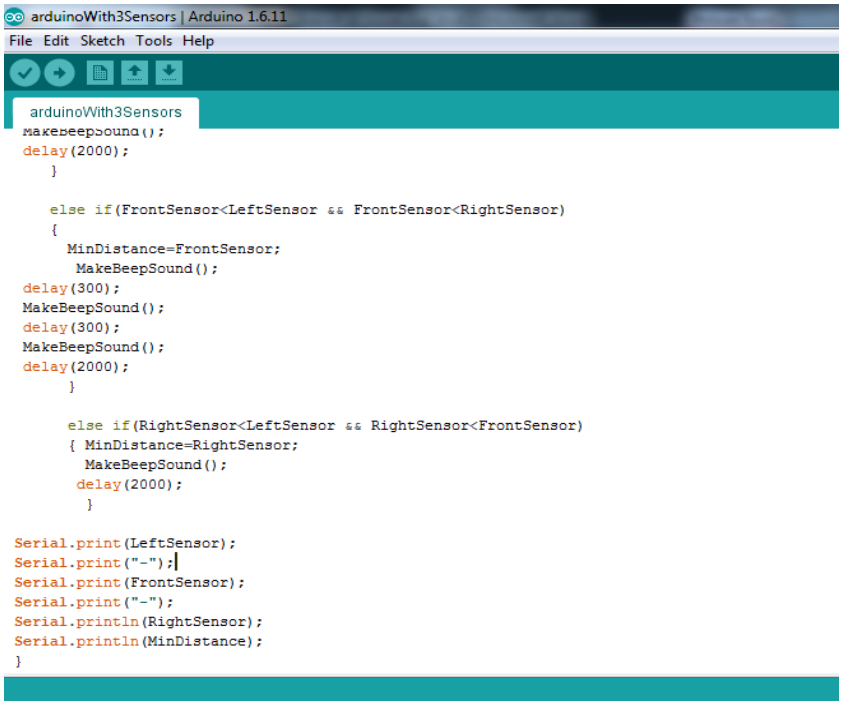
- Triggering the sensor.
- Measuring the width of pulse on the ECHO line.

ARDUINO CODE SNIPPETS:




arduinoWith3Sensors | Arduino 1.6.11
File Edit Sketch Tools Help
arduinoWith3Sensors
LeftSensor = distance;
SonarSensor(trigPin2, echoPin2);
FrontSensor = distance;
if((LeftSensor<100 && LeftSensor>2) || (RightSensor<100 && RightSensor>2) || (FrontSensor<100 && FrontSensor>2)
FindMinDistance();
}
void SonarSensor(int trigPin,int echoPin)
{
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
duration = pulseIn(echoPin, HIGH);
distance = (duration/2) / 29.1;
//this converts the distance into centimeters
}
void MakeBeepSound()
{


arduinoWith3Sensors | Arduino 1.6.11
File Edit Sketch Tools Help
arduinoWith3Sensors
void MakeBeepSound()
{
tone(buzzer, 1000);
// Send 1KHz sound signal...
delay(500);
// ...for 500 msec
noTone(buzzer);
// Stop sound...
}
void FindMinDistance()
{
if(LeftSensor<FrontSensor && FrontSensor<RightSensor)
{
MinDistance=LeftSensor;
MakeBeepSound();
delay(300);
MakeBeepSound();
delay(2000);
}
else if(FrontSensor<LeftSensor && FrontSensor<RightSensor)
{
MinDistance=FrontSensor;
MakeBeepSound();
delay(300);
MakeBeepSound();
delay(300);
MakeBeepSound();
delay(2000);


arduinoWith3Sensors | Arduino 1.6.11
File Edit Sketch Tools Help
arduinoWith3Sensors
MakeBeepSound();
delay(2000);
}
else if(FrontSensor<LeftSensor && FrontSensor<RightSensor)
{
MinDistance=FrontSensor;
MakeBeepSound();
delay(300);
MakeBeepSound();
delay(300);
MakeBeepSound();
delay(2000);
}
else if(RightSensor<LeftSensor && RightSensor<FrontSensor)
{ MinDistance=RightSensor;
MakeBeepSound();
delay(2000);
}
Serial.print(LeftSensor);
Serial.print("-");
Serial.print(FrontSensor);
Serial.print("-");
Serial.println(RightSensor);
Serial.println(MinDistance);
}

CHALLENGES FACED

This project came with its own limitations and challenges.

Following are the challenges that the team faced while working on this project:

i. Calibration of the sensors:
It was quite a challenge to obtain the optimum distance at which the combination of sensors used would give the correct output. Using three sensors simultaneously increased the complexity of the system due to interference between the three.

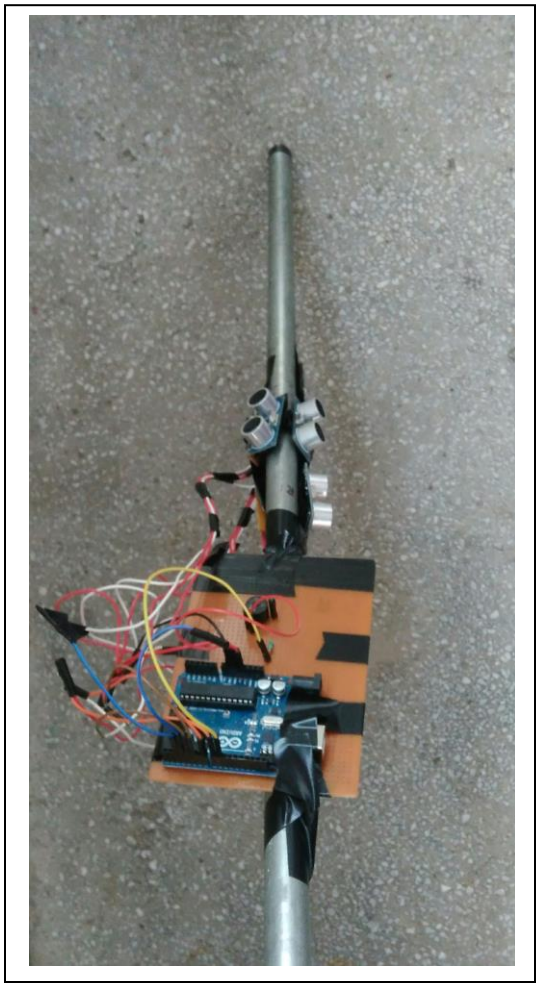
ii. Directivity of the sensors:
The sensors used can detect obstacles in their line of sight. Hence, any object that lies out of it, can go undetected. This can be taken care of by increasing the number of sensors used.

iii. Location Finder Module:
Integration of Gpm/Gprs modules poses challenge as it makes the stick bulky and heavy to carry. Thus making the stick light in weight becomes a challenge. Also sending exact location of the person carrying stick is also a task to be carried out accurately.

RESULT AND CONCLUSION

The above design is sufficiently able to perform its function of helping a visually impaired person to be able to walk independently as the stick helps him to sense the obstacles.
Low cost ultrasonic rangefinders along with a microcontroller is used to measure the distance to obstacles and if they are close enough provide a feedback to the user in form of beeps or vibrations.

The project can be modified by installing more sensors and vibrators so that stick vibrates on sensing and obstacle. Vibrations can be much easily sensed as compared to number of beeps which would require the user to be always alert.



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