Object Detection With Ultrasonic Sensor Using Arduino

Mini Project submitted to SASTRA deemed university
in the partial fulfillment of the requirement
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Electronic and Communication Engineering

ECE300: Mini Project

submitted by

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JUNE 2022

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BONAFIDE CERTIFICATE

This is to certify that the project work entitled "**Object Detection With Ultrasonic Sensor Using Arduino**" is a bonafide record of the work carried out by

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DECLARATION

We declare that the thesis titled "**Object Detection With Ultrasonic Sensor Using Aurduino**" submitted by us is an original work done by us under the guidance of **Dr. Jayabharathy.R** (SAP/ECE/SEEE),., School of Electrical and Electronics Engineering, SASTRA Deemed to be University during the final semester of the academic year 2021-22, in the School of Electrical and Electronics Engineering. The work is original and wherever we have used materials from other sources, we have given due credit and cited them in the text of the thesis. This thesis has not formed the basis for the award of any degree, diploma, associate-ship, fellowship or other similar title to any candidate of any University.

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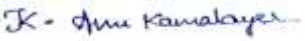
Signature of the candidate: 

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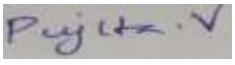
Signature of the candidate: 

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ABSTRACT

The project is about object detection with ultrasonic sensor using Arduino .Here we are using ultrasonic sensor to produce signals to find the distance at which the object is located. Arduino IDE software is used to dump the code into Arduino UNO board. Arduino controller is connected with laptop using USB cable and give visual representation of distance on lcd. Object is detected using ultrasonic sensor distance is calculated and it is indicated using red and green led. Buzzer is also used to produce sound on detection of object placed at a distance below 20cm. Our project is one solution to overcome the problem of limitation of surveillance. Control in observing object as a negligence of the limitation of view. Our project is about implementation of Radar.Radar stands for radio detection and ranging. It is a device whose function is to determine distance of moving and fixed object. Radar system is controlled via Arduino. Basic working of the project is to detect the object in its defined range. Main application of this Radar comes into different field of navigation, positioning, object identification. our project is suitable for indoor applications.

Keywords: Ultrasonic sensor, Buzzer, LCD, Arduino

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ABBREVATION

IDE - integrated development environment

CHAPTER 1

INTRODUCTION

In the present developing world, there are various innovations in every field of work. There are a number of fields where this is important including Robotics, Monitoring, Security etc. There are some instances where you just need small devices to solve large problems. Innovation of small devices are very essential to save our precious time. There are various resources which are used to develop these devices and help to solve our problems. In olden days, for measuring the distance between the objects, measuring devices like scales were used. But now a days digitalization is on peak. So measuring distance between the objects can also be digitalized. With the use of ultrasonic sensors, objects(placed in the line of sight of ultrasonic sensor) can be detected and the distance can be measured from the sensors and it can also be displayed using the LCD screen, further two LEDs are used to indicate shorter and longer distance. Red LED glows on distance lesser than 20cm and sound is produced by buzzer. For distance greater than 20cm green LED glows.

Ultrasonic sensor gives a simple route in distance estimation. Ultrasonic Sensor measure the distance of the items in air through non-contact method. They measure distance without harm and are very easy to utilize and are reliable. These distance measurement sensors associate with all regular kinds of mechanization and telemetry components. Ultrasonic sensors are very effective in detecting the exact location and angle at which the objects are placed .The echo time reaction of ultrasonic sensor locator depends on schedule of movement after trigger. Ultrasonic sensors are broadly utilized for distance estimation purpose. Ultrasonic sensors – relatively low power and easy to configure and control, but also has distinct advantages and disadvantage.

Software used is Arduino IDE.

This framework depends on Arduino and ultrasonic sensors. Here the ultrasonic sensor detects the inputs and the LED and buzzer gives the output. As Arduino is switched on by running the program in arduino software, the power is given through data cable. The ultrasonic sensor produces ultrasonic waves through the trigger pin. At the point when these waves recognize or hit any object then it will reflect back to the receiver as an echo. At that point it identifies there is an obstruction present in front of this sensor. Firstly the Arduino is programmed using the Arduino IDE software.

Give the connections as per the block diagram. Now switch on the power supply by connecting aurdino to laptop through data cable. Firstly the ultrasonic sensor will produce ultrasonic signal . Place an object in front. While the sensor sends a beam of light out of the trigger pin and waits for it to return. Piezo – electric buzzer acts an alarm when an object is detected by the ultrasonic sensors. These buzzers are very much useful when the person cannot see the obstacles and if the buzzer sounds, then he gets cautious as some obstacles is present in front of him. Buzzer is placed so that it sounds when an object is detected by the sensors. The output for the distance can be seen on the laptop screen by clicking the serial monitor option. The working of the prototype is simple and it contains less components which makes this project less costly.

Here the distance of stationary or moving objects can be found out by using only one ultrasonic sensor and one Arduino uno board with suitable algorithms makes this project unique.

CHAPTER 2

LITERATURE SURVEY

"Arduino based radar system". Authors are S. Hameed, N.J.D. Rashid and F. Shobia . The paper was presented at March 14 2019 IEEE International Conference. The researchers implemented a model to detect the object in define range (0 to 180 degree).

"Embedded system based RADAR system using ardiuno & ultra-sonic sensor ". Authors are A.E. Onoja, L. Ajao andA.M. Oluwadamilola. The paper was presented at January 1, 2017 IEEE International Conference. The researchers implemented a model to read the distance of object and the angle of incident.

"Detecting Long Range Objects Under RADAR system using Ardiuno" by S. Nandhini, J. Harry William and M.Gokulakrishnan. The paper was presented at April 6, 2020 IEEE International Conference April 6, 2020. Researchers have found the distance and angle and represented in graphical form.

"A Short Range System Rangefinder". Authors are M.M. Abdulkareem Qusay Adil Mohammed and Muhammed Mahmood Shakir. The paper was presented at 2016.The researchers have found the distance and angles of detected objects and also converted these data into visual form using processor 3 software.

"Review of techniques and methods for object detection". Author is Ali Khan. The paper was presented at February 2019 IEEE International Conference. The researchers have used PIR sensor, ultrasonic sensor, laser sensor, dampness sensor, PIR sensor, heat or temperature detection sensor to detect almost any kind of objects.

CHAPTER 3

METHODOLOGY

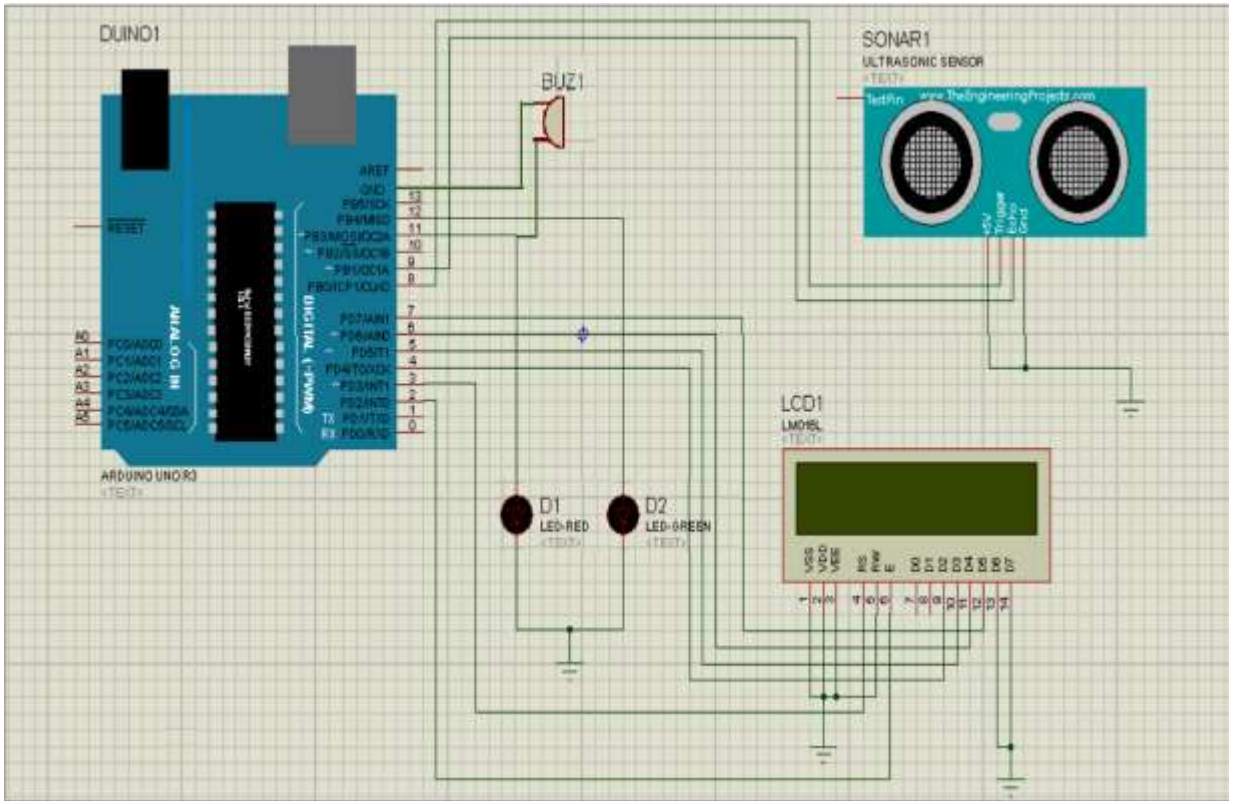


Fig -1

Ultrasonic sensor has four pins

1. Vcc – 5v positive supply must be given to Vcc.
2. Trig – In Arduino digital pin 9, trig is to be connected.
3. Echo – In Arduino at digital pin 10, echo is connected.
4. Gnd – Gnd is connected to the common ground of the arduino to close the circuit.

Buzzer connection

Positive end is connected to pin 11.

Negative end is connected to ground.

LCD connection

LCD RS pin to digital pin 7

LCD Enable pin to digital pin 6

LCD D0 pin no connection

LCD D1 pin no connection

LCD D2 pin no connection

LCD D3 pin no connection

LCD D4 pin to digital pin 5

LCD D5 pin to digital pin 4

LCD D6 pin to digital pin 3

LCD D7 pin to digital pin 2

LCD R/W pin to ground

LCD VSS pin to ground

LCD VDD pin to 5v

LCD Vo pin to ground

LCD A pin to ground

LCD K pin to ground

LED connection

Red LED connection

Positive end connected to 11

Negative end connected to the ground

Green LED connection

Positive end connected to 12

Negative end connected to the ground

COMPONENTS USED

1) ultrasonic sensor: is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target). In order to produce the ultrasonic sound, trig pin must be high for 10*10^(-6)s which will produce ultrasonic sound with 8 cycle sonic burst. In order to calculate the distance between the sensor and the object, the sensor measures the time it takes between the emission of the sound by the transmitter to its contact with the receiver. The formula for this calculation is T=S/V, where S is the distance, T is the time, and V is the speed of sound 340meters/second. For example, if an object is kept at 10 cm distance from ultrasonic sensor. The time for the sound to bounce back is 294*10^(-6)s. To calculate distance S=T*0.034/2(divided by 2 as the echo pin has to travel forward and backward).

Ultrasonic sensor has four pins

1. Vcc
2. Trig
3. Echo
4. Gnd

2)Arduino: Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino board is an open-source platform used to make electronics projects. It consists of both a microcontroller and a part of the software or Integrated Development Environment (IDE) that runs on your PC, used to write & upload computer code to the physical board. We can tell the board what to do by sending a set of instructions to the microcontroller on the board. To do so we use the Arduino programming language (based on Wiring), and the Arduino Software (IDE). Aurduino is powered by data cable in our project.

3)Buzzer: An arduino buzzer is also called a piezo buzzer. It is basically a tiny speaker that you can connect directly to an Arduino. You can make it sound a tone at a frequency you set. The buzzer produces sound based on reverse of the piezoelectric effect. Piezo electricity is an effect where certain crystals will change shape when you apply electricity to them. By applying an electric signal at the right frequency, the crystal can make sound. The buzzer produces the same noisy sound irrespective of the voltage variation applied to it. It consists of piezo crystals between two conductors. When a potential is applied across these crystals, they push on one conductor and pull on the other. This, push and pull action, results in a sound wave. Most buzzers produce sound in the range of 2 to 4 kHz.

4)Breadboard: breadboard, or protoboard, is a construction base for prototyping of electronics. In the 1970s the solderless breadboard (also known as plugboard, a terminal array board) became available and nowadays the term "breadboard" is commonly used to refer to these. Because the solderless breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design. A variety of electronic systems may be prototyped by using breadboards, from small analog and digital circuits to complete central processing units (CPUs). In this project we are using breadboard to connect LCD and LED components to arduino board.

5)LCD Display: The LiquidCrystal library allows you to control LCD displays through arduino IDE software. Here we are using 16-pin interface. Output for the distance is seen on a 16x2 LCD. The LCDs have a parallel interface, meaning that the microcontroller has to manipulate several interface pins at once to control the display.

The interface consists of the following pins:

A register select (RS) pin that controls where in the LCD's memory we are writing data to. We can select either the data register, which holds what goes on the screen, or an instruction register, which is where the LCD's controller looks for instructions on what to do next.

A Read/Write(R/W) pin that selects reading mode or writing mode.

An Enable pin that enables writing to the registers.

8 data pins (D0 -D7)**.** The states of these pins are high or low. These 8 data pins are the bits that we

are writing to a register when you write or the values you're reading when you read. There is also a display contrast pin (Vo)**,** power supply pins (+5V and GND) and LED Backlight (Bklt+ and BKlt-) pins that you can use to power the LCD, control the display contrast, and turn on and off the LED backlight, respectively.

The process of controlling the display involves putting the data that form the image of what you want to display into the data registers, then putting instructions in the instruction register.

The LiquidCrystal Library simplifies this for us so we don't need to know the low-level instructions.

In LCD display the cursor is set by instruction lcd.setcursor( ). LiquidCrystal lcd(7,6,5,4,3,2) used to indicate the arguments for the LCD initialization. It represent the Arduino pins connected to RS, EN, D4, D5, D6, and D7, in that order. In the setup, the library's begin() function is called to set up the LCD display with the character size.

6)LED : A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor. In our project we are using red and green LED. Red LED indicates shorter distance. Green LED indicates longer distance.

7)Connecting wires: used to connect LED pins and LCD display to arduino control board.

CHAPTER 4
WORK FLOW

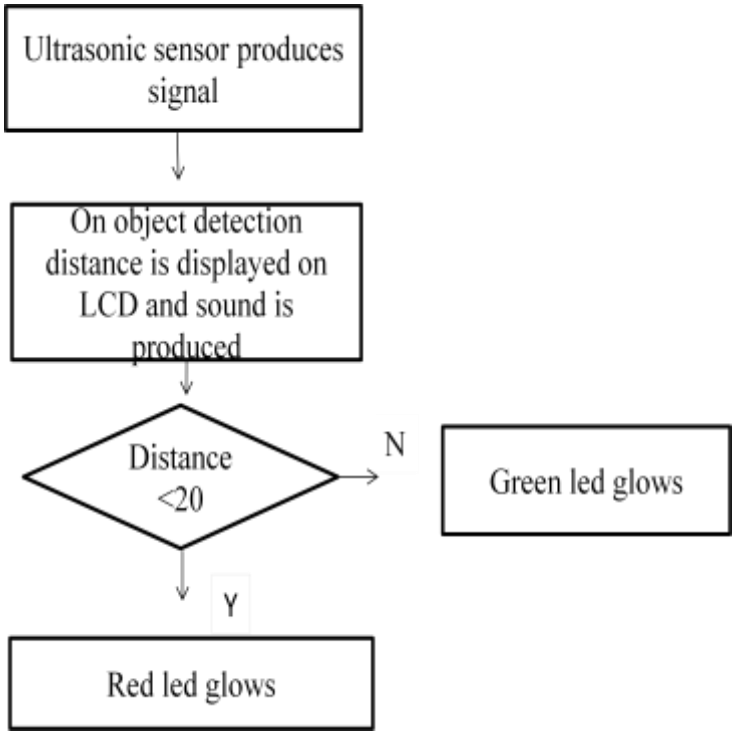


Fig 2

To detect object using Arduino, we connect electronic components in circuit on bread board. Ultrasonic sensor is connected ,which is used for both transmitting and receiving signal. We are using two LEDs in our project to indicate the distance. Red LED glows when the distance is 1 to 19cm. Green LED glows when the distance is more than 20cm.Aurdino controller is connected to laptop using USB cable and the distance of the object from ultrasonic sensor is seen on the screen and LCD .Using buzzer sound is produced on detection of object placed at less than 20cm(0 to 19).

CHAPTER 5
ARDUINO CODE

```
#include<LiquidCrystal.h>
LiquidCrystal lcd(7,6,5,4,3,2);
const int trigPin = 9;
const int echoPin = 10;
const int buzzer =11;
int ledPin1=12;
int ledPin2=11;
long duration;
int distance;

void setup()
{
  lcd.begin(16,2);
  pinMode(buzzer,OUTPUT);
  pinMode(ledPin1,OUTPUT);
  pinMode(ledPin2,OUTPUT);
  pinMode(trigPin,OUTPUT);
  pinMode(echoPin,INPUT);
  Serial.begin(9600);
}
void loop( )
{
  digitalWrite(trigPin,LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin,HIGH);
  delayMicroseconds(10);
   digitalWrite(trigPin,LOW);
```

```
  duration=pulseIn(echoPin,HIGH);
  distance=duration*0.034/2
  if(distance>=1 and distance<20)
  {
   digitalWrite(ledPin1,HIGH);
   digitalWrite(ledPin2,LOW);
   digitalWrite(buzzer,HIGH);
   lcd.setCursor(1,1);
   lcd.print("Distance ");
   lcd.print(distance);
   lcd.setCursor(12,1);
   lcd.print("    ");
   delay(10);
   }
  else if(distance>=20)
  {
   digitalWrite(ledPin1,LOW);
   digitalWrite(buzzer,LOW);
   digitalWrite(ledPin2,HIGH);
   lcd.setCursor(1,1);
   lcd.print("Distance ");
   lcd.print(distance);
   lcd.setCursor(12,1);
   lcd.print("    ");
   delay(10);
  }

Serial.print("Distance");
Serial.println(distance);
}
```

CHAPTER 6
APPLICATIONS

- Our proposed model can be attached at the back of car during car reverse taking it produces sound on encountering object placed at less than 20cm or it may also indicate the driver that that a vehicle coming back is not maintaining the minimum distance.

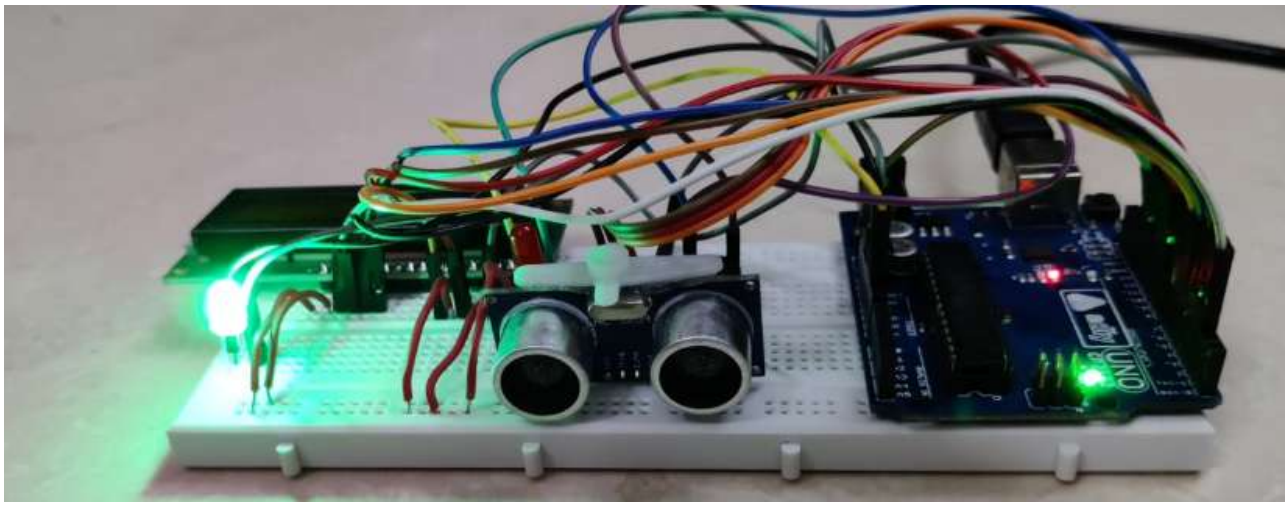
- It can be used by blind people to indicate a object is present closer by.

- It can also be used to ensure that nobody enters restricted area. Our model can be used to prevent unauthorized human/creatures entering restricted area. This system can observe a zone of restricted area and cautions authorities with a buzzer as an alert

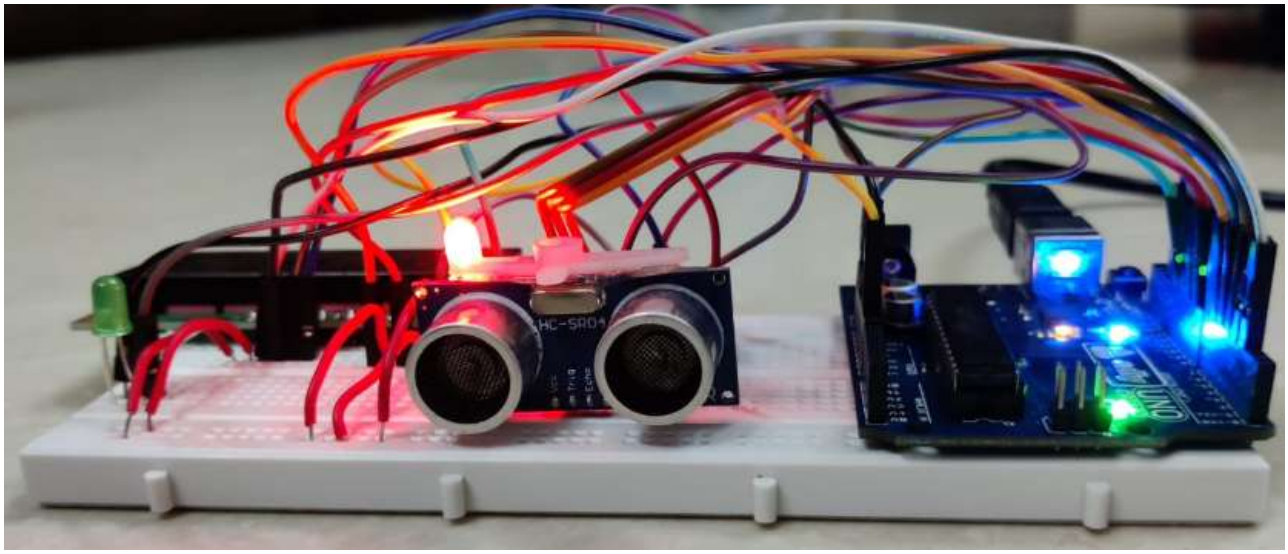
- It can also be used in security system .It can placed around a valuable object say in museum ,the model produces sound on encountering any object nearby valuable object.

- It can be used in object detection in dangerous area like railway tracks.

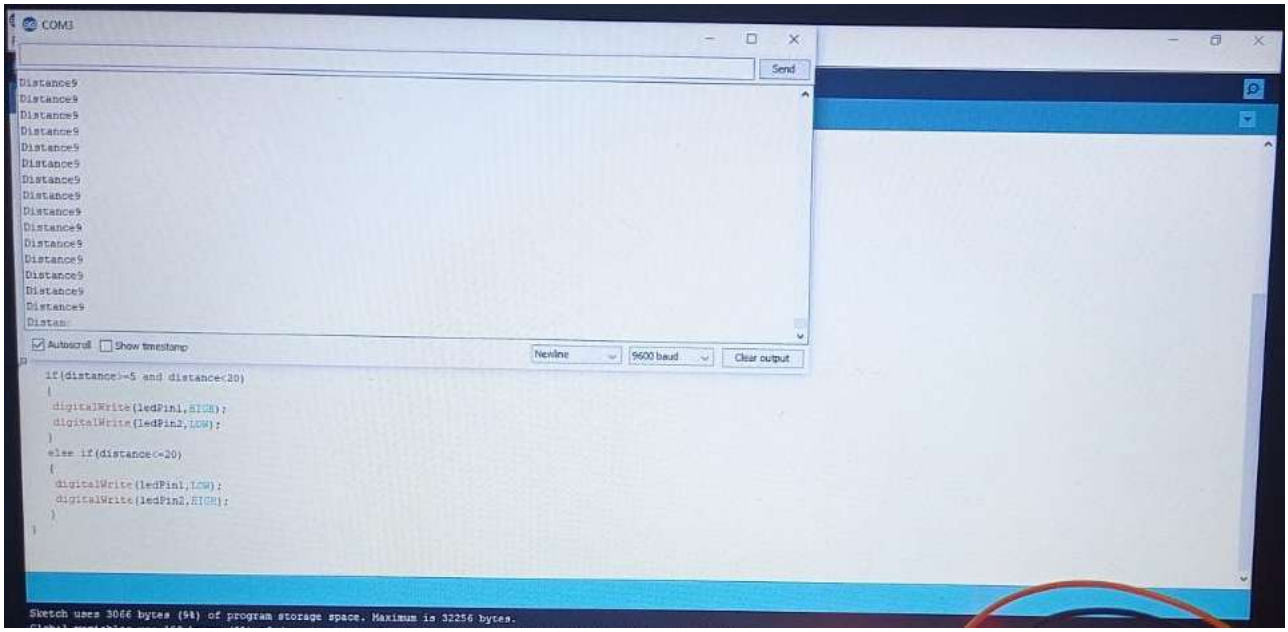
CHAPTER 7
OUTPUTS



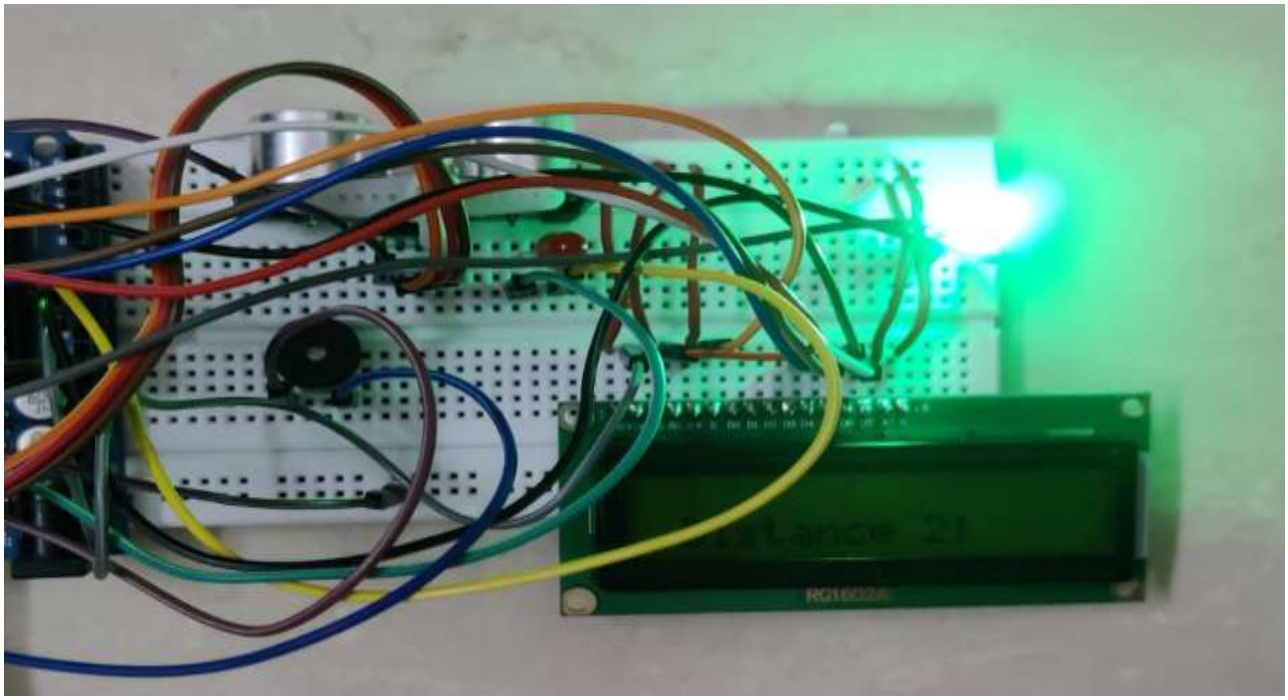
Green light is produced on detection of object placed greater than 20cm.



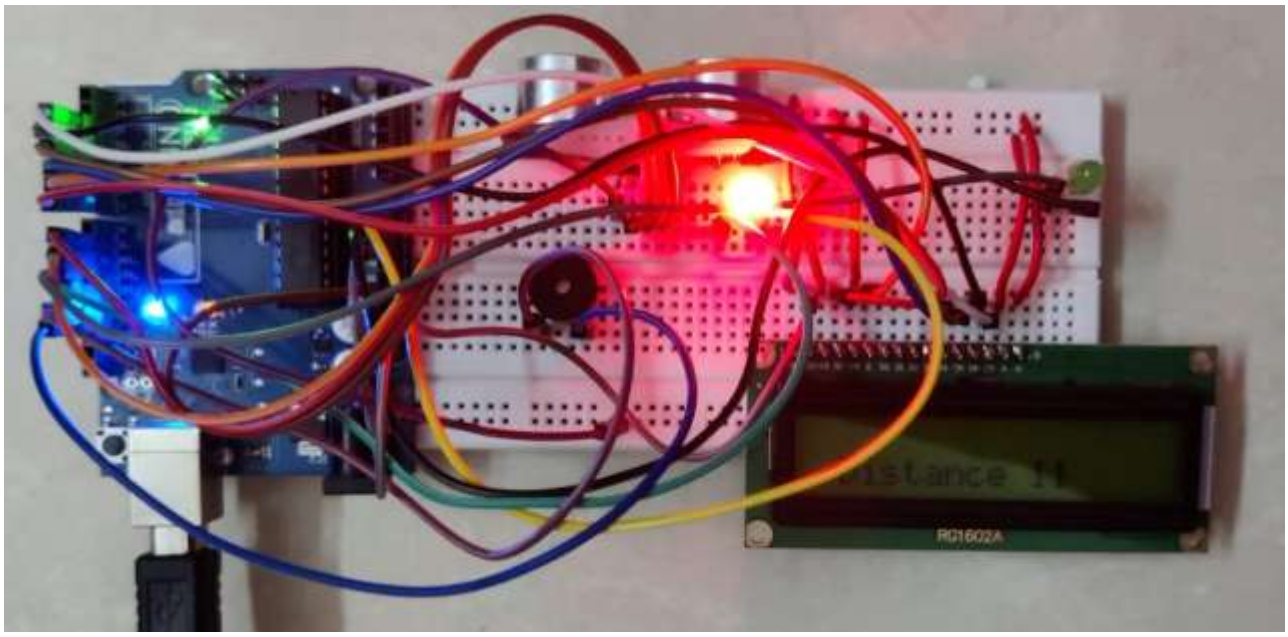
Red light is produced on detection object placed at a distance less than 20cm and sound is produced by buzzer.



Serial monitor output



LCD output for distance greater than 20cm



LCD output for distance less than 20cm

CHAPTER 8
CONCLUSION

We proposed a improved method for identifying objects in efficient way using arduino controller, ultrasonic sensor and servo motor. We can also conclude that ultrasonic sensor is best for object detection .It can be easily used in any projects like robotics and assistance system. Ultrasonic sensor cannot be affected by any environmental factor like dark or light. Arduino provides a additional improvement in finding larger distance. In our project we have designed a system for short range of object detection .This system can detect objects kept at the line of sight emitted by ultrasonic sensor .The project can be improved by using 360 degree servo motor to detect objects kept about 360 degree around ultrasonic sensor. The model was successful in detecting the exact distance object from the ulltrasonic sensor. The proposed system has only small error while calculating the objects which are near to the sensor but is accurate in calculating the objects which are kept within a distance of 60cm. Overall, this model can provide 100% efficiency unless the distance of the objects is less than 1 cm or the size of the object is very small. The above model is efficient for object placed at distance between 4 to 60 cm.

CHAPTER 9
REFERENCE

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