A Project Report on
OBJECT DETECTION WARNING SYSTEM

Submitted in partial fulfillment of the requirement of
the degree of
Bachelor of Engineering
Under
(Assam Science and Technology University)

By

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APPROVAL SHEET

This project report entitled **"Object detection warning system"** is approved for

the degree of BACHELOR OF ENGINEERING, DEPARTMENT OF INSTRUMENTATION ENGINEERING under ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY.

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ACKNOWLEDGEMENT

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We also extend our heartfelt gratitude to Dr. Neelanjana Baruah, Head of the Department of Instrumentation Engineering, Jorhat Engineering College.

We thank all the faculty members of the Department of Instrumentation Engineering who helped us directly or indirectly in preparing this project.

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CERTIFICATE OF GUIDANCE

This is to certify that the project entitled **"Object Detection Warning System"** submitted by Biswajeet Roy, Isha Rani Das, Bitupan Gogoi and Madhurjya Bora in partial fulfillment of the requirements for the award of degree in Bachelor of Engineering of the Department of Instrumentation Engineering under Assam Science and Technology University has been carried out under my guidance.

The contents of this report have not been submitted in part or full to any other university for the award of any other degree or diploma.

Date:

Place: Jorhat.

Signature of guide

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CANDIDATE DECLARATION

We hereby certify that the work which is presented in this reported entitled **"Object Detection Warning System"** in partial fulfillment of the requirement for the award of the degree of Bachelor of Engineering submitted in the Department of Instrumentation Engineering of Jorhat Engineering College under Assam Science and Technology University is an authentic record of our own work carried out during August 2020 to March 2021 under the supervision of Dr. Ujjwal Manikya Nath of the Department of Instrumentation Engineering of Jorhat Engineering College, Jorhat, Assam.

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This is to certify that Biswajeet Roy, Isha Rani Das, Bitupan Gogoi and Madhurjya Bora, B.E 7Th semester students of the Department of Jorhat Engineering College, has successfully completed their project on **Warning System",** under the guidance of Dr. Ujjwal Manikya Nath of the Department of Instrumentation Engineering of Jorhat Engineering College, Jorhat, Assam. We have examined this report and hereby accord an approval of its as a successful project work.

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ABSTRACT

Motion detection has become one of the great areas of research in the world. Many activities are carried out in the presence of motion. One of the focus has been the use of ARDUINO UNO microcontroller, Ultrasonic sensor, passive infrared sensor and many others to sense and measure distance. This study aimed at designing a sensor that can easily measure how far the object is, monitor change of distances as the object approach and display the results in the Liquid Crystal Display (LCD), give a sound alarm. The hardware utilized included the ARDUINO UNO on a Printed Circuit Board (PCB) interfaced with LCD, Buzzer and Ultrasonic sensor. The program to run the circuit was developed using ARDUINO IDE and stored at the memory of the ARDUINO microcontroller. The study demonstrated that the designed sensor could be used to accurately determine the position of an approaching object and display the distance readings on the LCD. Simultaneously the sensor display visual LED signal set and colour coded as for instance, distance greater than 10cm and distances less than 50cm then Red LED light will blink, while at the same time producing sound signals a sound

buzzer. Thus, this method of distance sensing and measurement is efficient and assures measurements of small distances precisely.

CONTENTS

CHAPTER 1

INTRODUCTION

Now a day's automation is a part of today's communication and communication is a part of advancement of technology [4], so we decided to work on this field, and design something which will make human life today's aspect.

Automation or automatic control is the use of various control system for operating equipment such as machinery, processes in factories, boilers and heat treating ovens, switching on telephone networks, steering and stabilization of ships, aircraft and other applications and vehicles with minimal or reduced human intervention [2], [5]. Some processes have been completed automated. The biggest benefit of automation is that it saves labour, however, it is also used to save energy and materials and to improve quality, accuracy and precision.

The project is designed to build an obstacle avoidance vehicle using three ultrasonic sensors [1]. This vehicle is generally a combination of electronic devices, microcontroller involves the programmed instructions. The project proposes the vehicle that has an intelligence built in it such that it guides itself whenever an obstacle comes ahead of it. This vehicle is built using an ARDUINO UNO, Three ultrasonic sensors and LCD to detect any obstacles ahead of it and measures the distance between the object and ultrasonic sensor.

This technology has sufficient intelligence to cover the maximum area of provided space. This obstacle detection is primary requirement of this technology. This technology gets the information from surrounding areas through the mounted sensors on the vehicle. In the very fast growing world of technologies the transportation plays a very important role, and the incredible growth of transportation in today's world causes in increasing numbers of accident [6], [7]. So, the main motto of this project is to avoid these accident generally happens in the Metro Politian areas due to driving errors. Thus using this technology, life of people inside a vehicle will be safer, and the world will be a better place to live in.

CHAPTER 2

MOTIVATION OF THE WORK

Accidents have been a serious problem in our busy lives. With the increase in human population the number of vehicles on the road has tremendously increased. This has resulted in the more frequent occurrence of accidents. Whether it be a minor or serious accident, it causes injuries

to human, and even cause. Accidents are mostly caused due to the crashing of cars. Some research shows that 90% of crashes are caused due to human errors.

Most of the car crashes also occur due to bad weather conditions. To drive a car in rainy days is much difficult than driving in normal weather. Moreover a foggy road can also cause difficulty in driving a car. The drivers may not be able to see the vehicles ahead of him. In such situations if the vehicles have an inbuilt obstacle avoiding facility.

Now-a-days many people, generally the young drivers habit of using their mobile phones while diving. This diverts their minds from road which eventually cause the crashing of car with other cars or any other objects. The obstacle avoiding facility is boon for such drivers.

This is an ARDUINO-based collision detection warning system. This kind of system is the fastest growing safety feature in automotive industries. Such a system enables the vehicles to identify the chances of collision and give audio and continuously visual warning to driver, so that the driver can take immediate action to avoid collision from the approaching obstacle. This project idea is based on an ARDUINO UNO microcontroller and the whole project will give you a very good understanding of how this system actually works. In the coming sections the step-by-step method is explained.

CHAPTER 3

COMPONENTS USED IN THE CIRCUIT

3.1 MICROCONTROLLER (ARDUINO UNO)

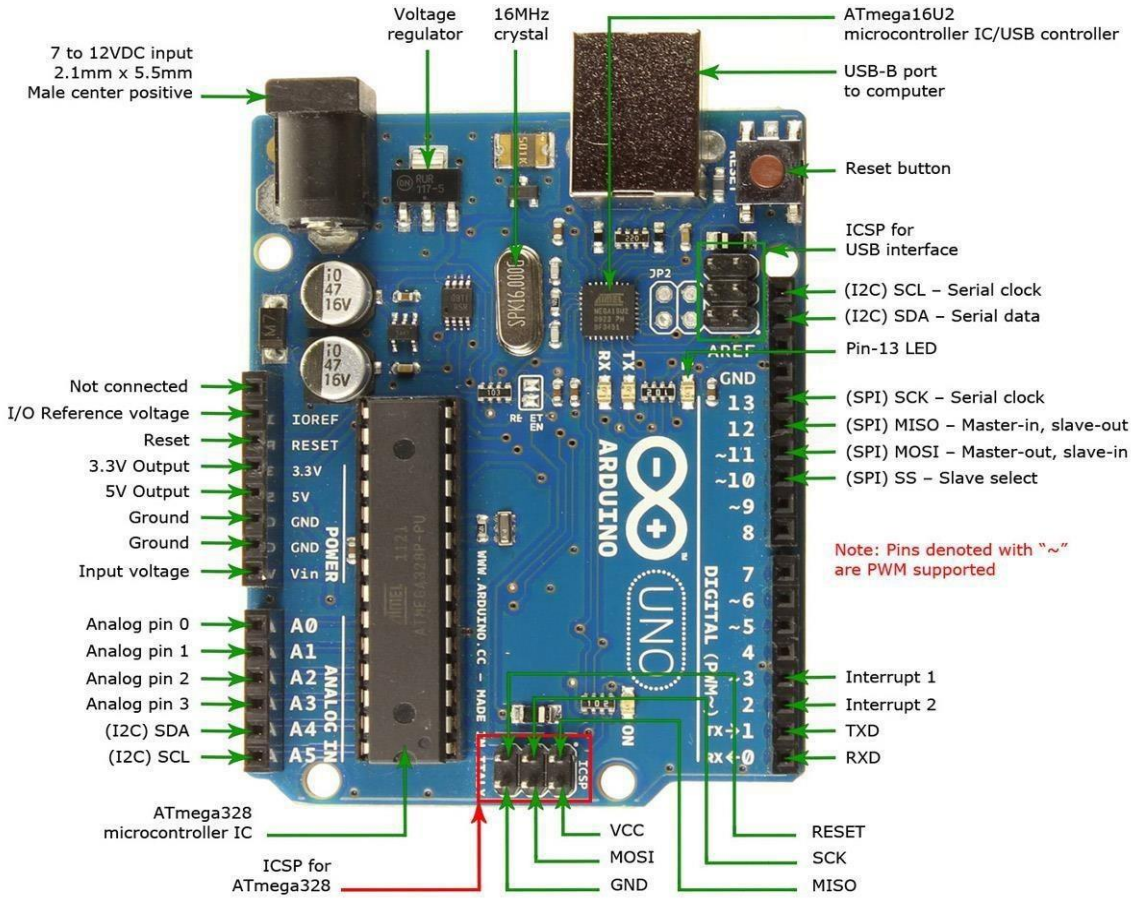

Fig 3.1: ARDUINO microcontroller

A microprocessor is basically a specialized form of microprocessor that is designed to be selfsufficient and cost sufficient. It is a part of the whole circuit board and is designed to perform a few dedicated functions. ARDUINO UNO is a small microcontroller board. It has 14 pin digital input/output pins, 6 analog pins, a crystal oscillator, a USB connector and a reset button. It contains everything needed to support the microcontroller; we simply need to connect it to a computer or laptop with a USB cable.

Some power pins of the boards are as follows:-

a) 5V _ It is used to power the microcontroller and other components of the circuit in the board.

b) 3V – A 3.3 V supply is generated by the on board regulator.

c) VinThis pin is used to supply voltage using an external power source.

d) GND – All the negative terminals of the components are fed to the ground pin.

The UNO has 14 digital pins which can be used as input or output pin.

- a) RXIt is used to receive data.
- b) TXIt is used to transmit data.

3.2 ULTRASONIC SENSOR

Fig 3.2: Ultrasonic sensor

Ultrasonic sensors are used as distance measurement and obstacle detectors. And as our project needs to measure the distance so as to detect the obstacle so it is the perfect component for us. The Ultrasonic sensor has two transducer, one is used as transmitter and the other is used as a receiver. It has four pins and they are- V_{cc}, trig (trigger), Echo and GND (ground).

The ARDUINO board sends a short pulse to the trig pin to trigger the detection. The sensor then sends a burst of ultrasound and raises its Echo line high. As soon as it detects an echo, it lowers the echo line again. The duration of the pulse is equal to the time taken by the ultrasound to travel to the object and back to the sensor. This time is then converted into distance for measurement.

Here we are using three Ultrasonic Sensor, First sensor is in front of the car, Second sensor is in the Left side of the car, and the Third sensor is in the Right side of the car.

3.3 PIEZO-BUZZER

Piezo buzzers, an example in below figure, is a simple device that can generate basic beeps and tones. They work by using a piezo crystal, a special material that changes shape when voltage is applied to it. If the crystal pushes against a diaphragm, like a tiny speaker cone, it can generate a pressure wave which the human ear picks up as sound. Simple change the frequency of the voltage sent to the piezo and it will start generating sounds by changing shape very quickly.

Piezo-Buzzer is also readily available in the market in the most of the electronics dealers. It is a low and cost-effective device which has capability of converting mechanical energy into sound energy. When the ultrasonic sensor detects motion of the object, it activates the piezo buzzer which produces the alarmed sound depend on the frequency of the approaching object. It has been used in various motions detectors in producing the sound signals.

Fig 3.3: Piezo-Buzzer

3.4 LCD (Liquid Crystal Display)

Here we are using 16×2 LCD display.

Liquid-Crystal Display (LCD) is a rectangular shape type display. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images or fixed images with low information content, which can be displayed or hidden, such as words, digits, and seven-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made from a matrix of small pixels, while other displays have larger elements. LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement. For example, a character positive LCD with a backlight will have black lettering on a background that is the colour of the backlight, and a character negative LCD will have a black background with the

letters being of the same colour as the backlight. Optical filters are added to white on blue LCDs to give them their characteristic appearance.

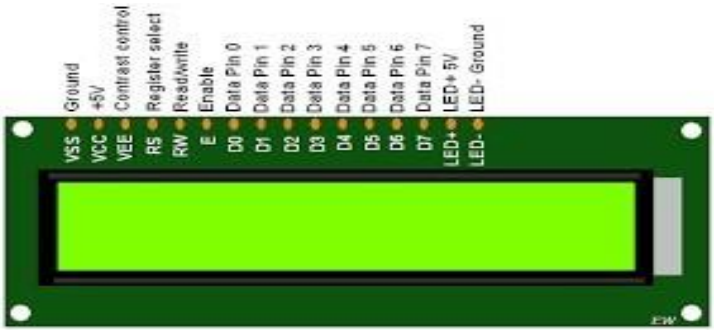

Fig 3.4: LCD display

3.5 JUMPER WIRES

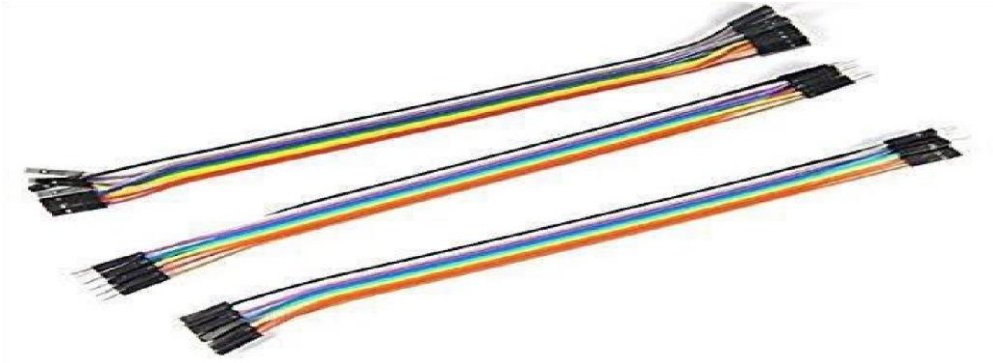

Fig 3.5: Jumper wires

A jumper wire is a short electrical wire with a slid tip at both ends. Since both the ends of the wire have connectors, interconnection between various components becomes easy. Jumper wires are of three types-

i) Male to male ii) Female to female
iii) Male to female

Jumper wires are fitted by inserting their end connectors into the slots provided in ARDUINO UNO board, relay etc. The main advantage of using jumper wire over ordinary wire is that it does not requires the effort, time and cost of soldering which also makes it easier to connect as well as disconnect the components.

3.6 LED's & REGISTER

Fig 3.6: LEDs

A **light-emitting diode** (**LED**) is a semiconductor light source that can 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 is determined by the energy required for electrons to cross the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.

Here in this project we are using one LED of red colour.

- It is two terminal device, referred as Light emitting diode.
- It is used to emit light.
- It converts electrical signal into light signal.
- It is used in forward bias and reversed bias it works similar to normal PN junction diode.

CHAPTER 4

BLOCK DIAGRAM

The ARDUINO based collision detection warning system designed in this project consists of hardware as well as software part also. The hardware consists of the circuit while the software part deals with the programming of the microcontroller using ARDUINO UNO.

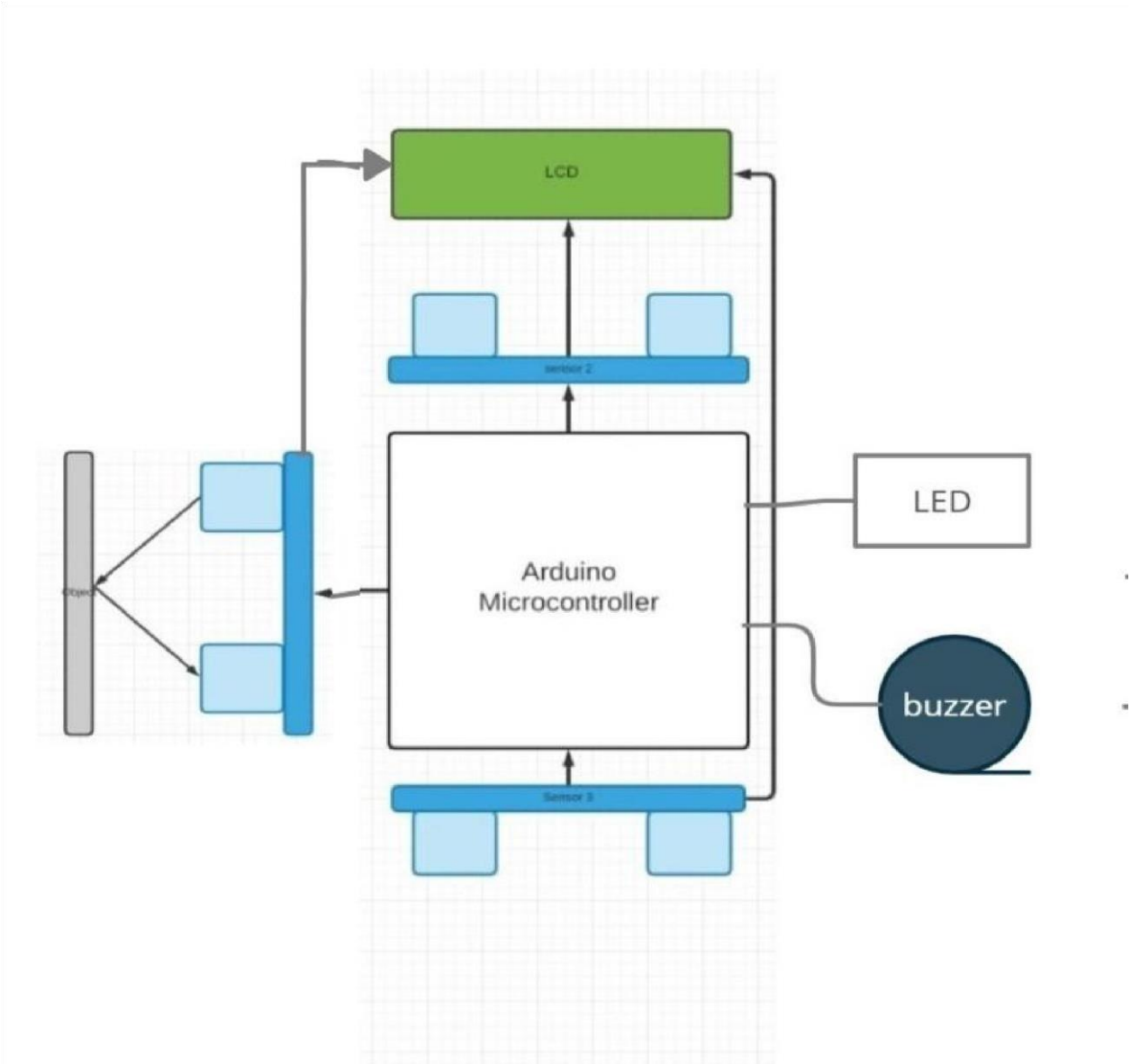

Fig 4.1: Block diagram of the system

Warning System - This subsystem of the system provides reliable warning to driver about a possible collision prior to their reaching an unsafe position or location. The composition of the warning system comprises of the buzzer, LED and continuously distance monitoring LCD. The warning subsystem has three operation modes. Firstly, the system detects the

object and then in LCD display it shows the distance that is how far the object from the sensor and the LCD is continuously monitor the distance between the sensor and the object.

Secondly, when the object is moves forward to the sensor and the distance between the object and the sensor becomes 50cm then the Piezo-Buzzer will rung and red LED will be on which gives the signal to the driver so that driver can take necessary action.

CHAPTER 5

CIRCUIT DIAGRAM

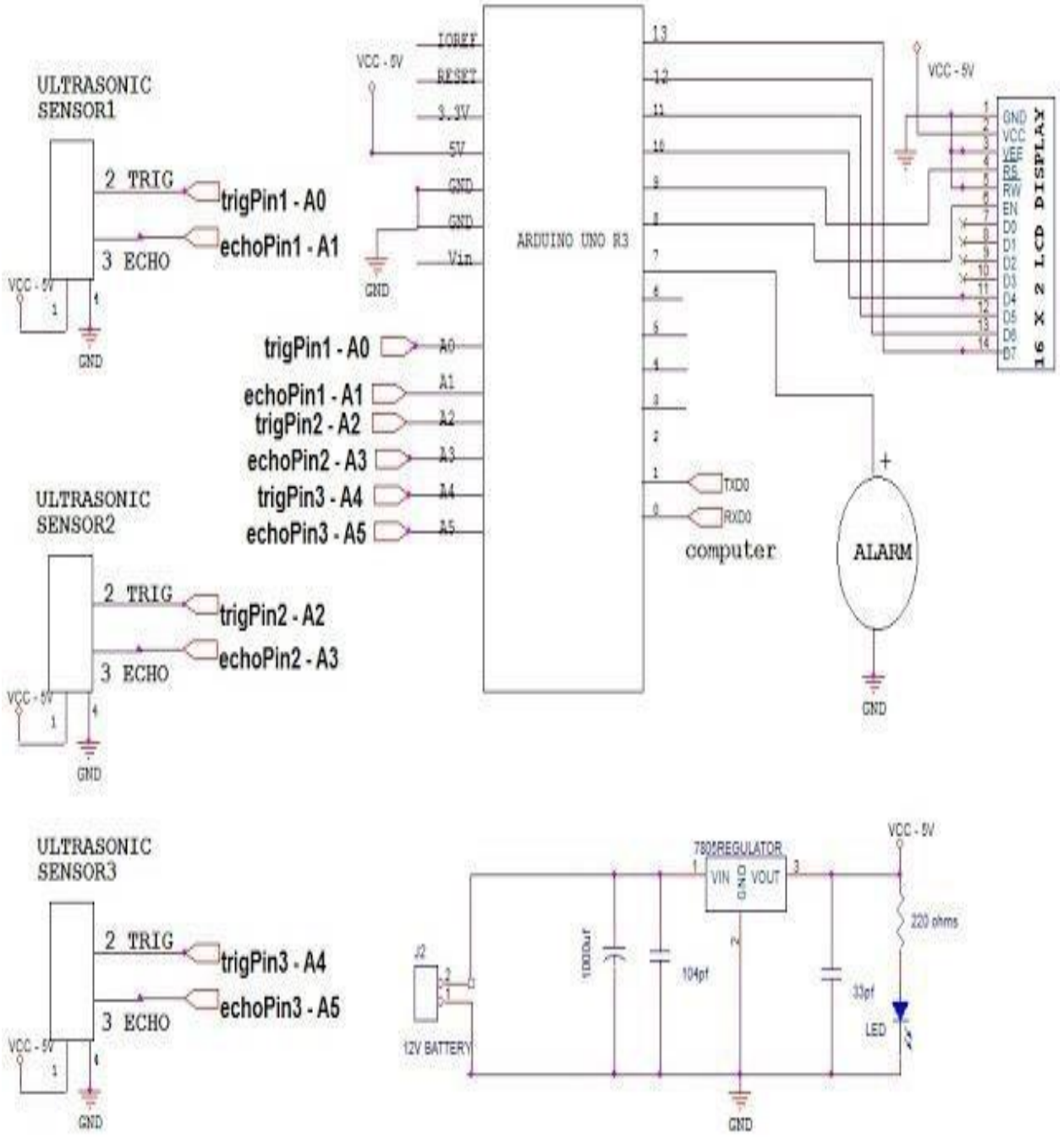

Fig 5.1: Circuit diagram of the system

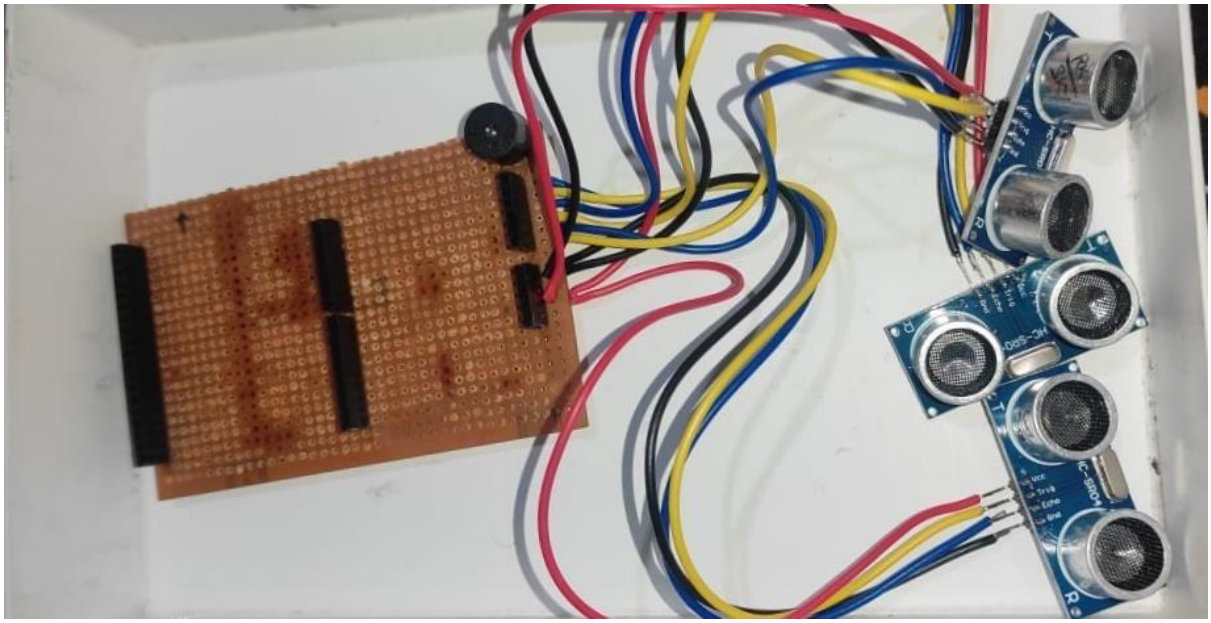

Fig 5.2: Connection of three ultrasonic sensor

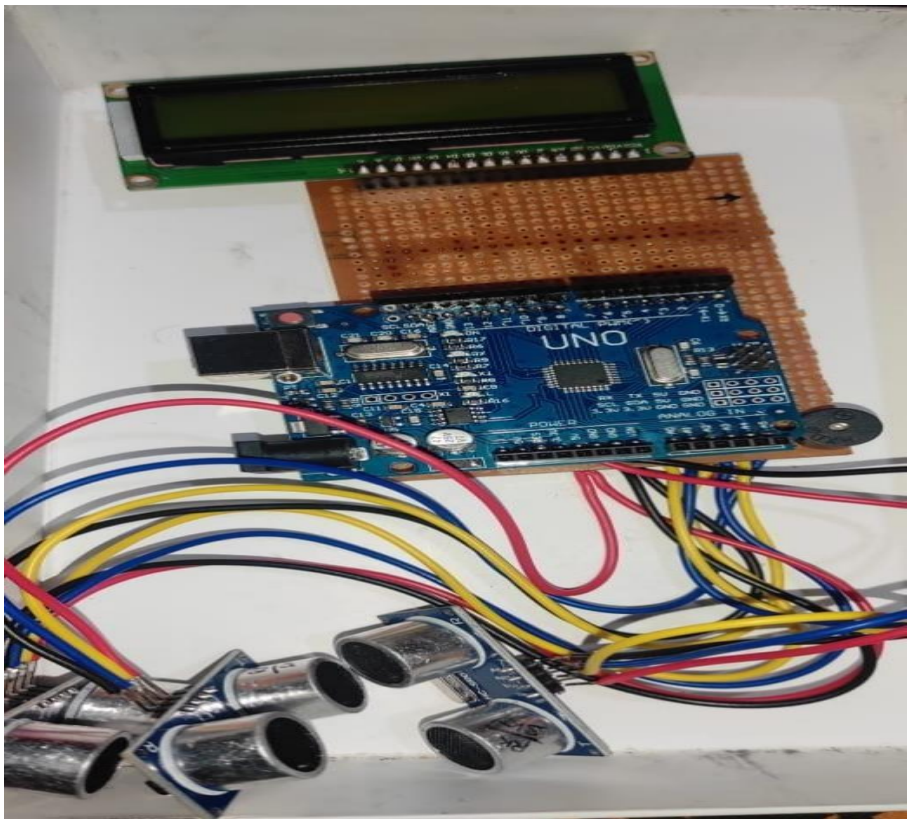

Fig 5.3: Connection of LCD display along with sensors CHAPTER 6

WORKING

6.1 DIFFERENT WORKING ZONES

The aim of the project is to avoid an obstacle and continuously monitoring the distance between the object and the sensors. For this purpose three ultrasonic sensors are fitted in front, left, right of the vehicle which will detect an obstacle by calculating the distance between the obstacle and the vehicle. The basic principle of ultrasonic distance measurement is based on echo when the object is found near to the sensor and the object detected by the ultrasonic sensor.

Here, in this project we are using three Ultrasonic sensors

- Ultrasonic sensor 1 (Front sensor)
- Ultrasonic sensor 2 (Left sensor)
- Ultrasonic sensor 3 (Right sensor)

Our project works on the three working zones

- Zone 1: No warning.
- Zone 2: Distance monitoring.
- Zone 3: Necessary action.

6.1.1 ZONE 1

When the object is not in the range of the three ultrasonic sensor then the system does not give any signal and does not shows any distraction. If the object is not in the range of the ultrasonic sensor then the LCD does not show any distance in screen.

6.1.2 ZONE 2

In the second zone, when the object is in the ultrasonic range then transmitter part of the sensor transmit a ultrasound waves which collide with the object and returns the ultrasound wave to the receiver part of the sensor, and when ultrasound waves transmit after that it

receives at that time period of transmitting and receiving the sound waves ultrasonic sensor calculate the distance between the object and the sensor and signal is sent to the LCD display and it displays the obtained distance.

Here we are using three ultrasonic sensor and we gave the particular sensor name as example, Front Sensor, Left Sensor, Right Sensor. When the object is detected and it shows distance in to the LCD display and also it shows the sensor name from which sensor the system detects the object, and in this zone the system continuously measure and shows the distance in the LCD display.

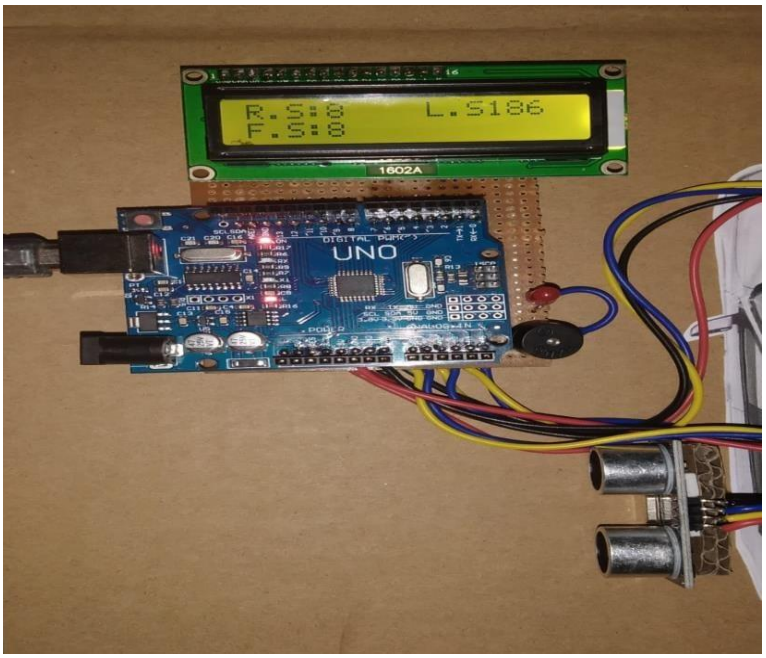

Fig 6.1: Distance from the three sensor

- Front Sensor (F.S)
- Left Sensor (L.S)
- Right Sensor (R.S)

6.1.3 ZONE 3

As discussed in zone 2, continuously measure and shows the distance in the LCD. In this zone when the ultrasonic sensor senses the distance between the object and the sensor less than 50cm then the signal goes into the piezo-buzzer and the buzzer will rung along with the Red LED will be on, in this condition driver has to pay attention so, that driver can take necessary action to avoid collision.

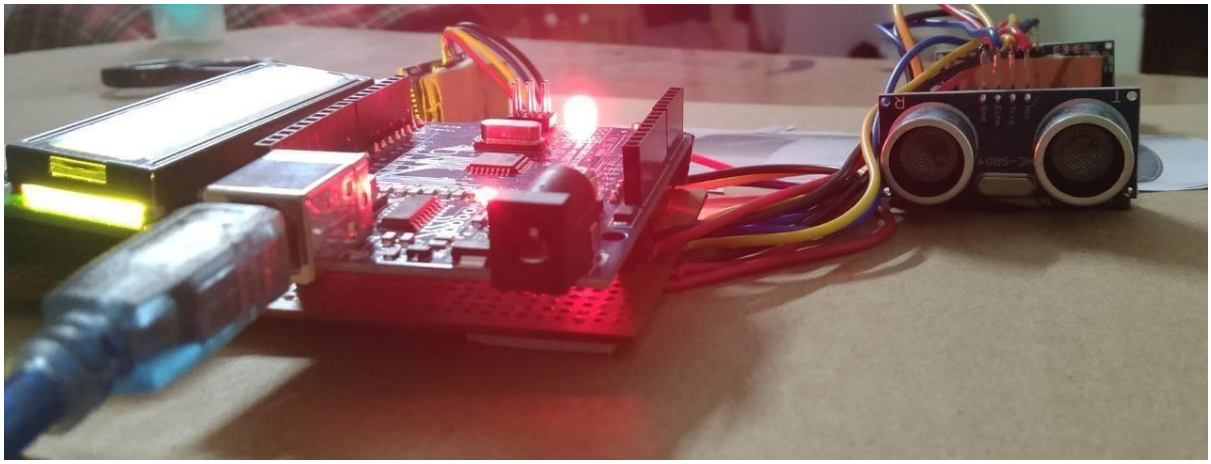

Fig 6.2: Picture of LED blink

6.2 PROGRAMMING CODE

```
#include <LiquidCrystal.h>


LiquidCrystal lcd(7, 6, 5, 4, 3, 2);


#define trigPin1 A0

#define echoPin1 A1

#define trigPin2 A2

#define echoPin2 A3

#define trigPin3 A4

#define echoPin3 A5
```

```
int ALARM = 9;
long duration, distance, FIRSTSensor, SECONDSensor, THIRDSensor;

void setup() {
  lcd.begin(16, 2);
  Serial.begin(9600);
  lcd.clear();

  pinMode(trigPin1, OUTPUT);
  pinMode(echoPin1, INPUT);
  pinMode(trigPin2, OUTPUT);
  pinMode(echoPin2, INPUT);
  pinMode(trigPin3, OUTPUT);
  pinMode(echoPin3, INPUT);
  pinMode(ALARM, OUTPUT);

  digitalWrite(ALARM, LOW);
  lcd.setCursor(0, 0); lcd.print("Object Detection");
  lcd.setCursor(0, 1); lcd.print("Warning system");
  delay(3000); lcd.clear();
```

```
  lcd.setCursor(0, 0); lcd.print("3 HC-SR04");
  lcd.setCursor(0, 1); lcd.print("Ultrasonic");
  delay(3000); lcd.clear();
  lcd.setCursor(0, 0); lcd.print("Sensors With");
  lcd.setCursor(0, 1); lcd.print("Arduino");
  delay(3000); lcd.clear();
}

void loop() {
  // Read sensor data
  SonarSensor(trigPin1, echoPin1);
  FIRSTSensor = distance;
  SonarSensor(trigPin2, echoPin2);
  SECONDSensor = distance;
  SonarSensor(trigPin3, echoPin3);
  THIRDSensor = distance;

  digitalWrite(ALARM, LOW);

  // Print sensor data to serial monitor
  Serial.print("S1: "); Serial.println(FIRSTSensor); delayMicroseconds(10);
```

```
  Serial.print("S2: "); Serial.println(SECONDSensor); delayMicroseconds(10);
  Serial.print("S3: "); Serial.println(THIRDSensor); delayMicroseconds(10);

  // Display sensor data on LCD
  lcd.setCursor(0, 0); lcd.print("R.S: "); lcd.print(FIRSTSensor);
  lcd.setCursor(9, 0); lcd.print("L.S: "); lcd.print(SECONDSensor);
  lcd.setCursor(0, 1); lcd.print("F.S: "); lcd.print(THIRDSensor);
  delay(1000); lcd.clear();

  // Check distances and trigger alarm if needed
  if ((FIRSTSensor >= 10) && (FIRSTSensor <= 50)) {
    digitalWrite(ALARM, HIGH); delay(500);
  }
  if ((SECONDSensor >= 10) && (SECONDSensor <= 50)) {
    digitalWrite(ALARM, HIGH); delay(500);
  }
  if ((THIRDSensor >= 10) && (THIRDSensor <= 50)) {
    digitalWrite(ALARM, HIGH); delay(500);
  }
}
```

```
// SonarSensor function to calculate distance
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;
}
```

CHAPTER 7

RESULT AND DISCUSSION

7.1 DISCUSSION

This study sought to first design of a motion detector to detect approaching objects and record the distance in LCD and raise a light (from an LED) and a sound alarm (from a Piezo-buzzer). To achieve this, the components that include the ARDUINO UNO, resistors, LEDs, buzzer, LCD and three ultrasonic sensor were fixed to the PCB and connected as described in chapter six. Figure 8, shows the connections in progress. A jumper wire was connected from the 5 volts port from the ARDUINO UNO to Vcc port in the three ultrasonic sensor to the positive channel of the breadboard. Another GND terminal of the ARDUINO is grounded and also three GND terminal of the sensors grounded. A piezo buzzer having two terminals, positive terminal was connected to the digital pin 7 at the Arduino while the negative part was grounded. The limit set for the Piezo Buzzer was to produce the sound alarm at the distance greater than 0cm and less than 50cm.

The ultrasonic sensor having four pins. Here we are using three ultrasonic sensor. First sensor Echopin1 was connected to pin number A1 while Trigpin1 being connected to pin number A0 in the ARDUINO UNO. Second sensor Echopin2 was connected to pin number A3 while Trigpin2 being connected to pin number A2 in the ARDUINO UNO. Third sensor Echopin3 was connected to pin number A5 while Trigpin3 being connected to pin number A4 in the ARDUINO UNO, and one LED is connected with the Piezo-buzzer so that when the buzzer is on then the LED is also have to be blink.

LCD has 14 terminals which were connected to the ARDUINO as: Pin 11 to Pin 10, Pin 12 to pin 11, Pin 13 to pin 12, Pin 14 to pin 13, Pin 4 to pin 9, Pin 6 to pin 8 as shown in figure 5. LCD pin 2 that is Vcc is connected to 5v and LCD pin 3 and 5 is connected to GND pin 1 of the LCD.

When the power was connected to the circuit, LCD produced a green light and it displayed distances. The program to run the circuit shown in figure 8 above was compiled in ARDUINO IDE and upload to the ARDUINO microcontroller chip. The study also tested the display of the LCD, its brightness that could be adjusted, and the accuracy of the

displaced distance versus the actual object distance. Once confirmed that everything was working as expected, the connections were assembled into a single unit.

An object was moved along the scale and measure. The values from the scale were compared to the corresponding data from the LCD and the readings in the LCD were tabulated in the table 1.

Table 1 comprise of the Actual values recorded from the scale measure, values displayed on the LCD, Absolute errors, relative errors and the percentage errors tabulated. Absolute errors were obtained from the difference between the values from the scale measure-actual values and the values recorded from the LCD-approximated values. Relative errors were obtained from dividing the |measured-actual| =absolute errors by the actual values. Percentage errors were obtained from the product of relative errors by 100%.

Fig 7.1: LCD display

7.2 TABLE I

Distance values measured VS displayed in the sensor

Sl. No.	Actual Distance (cm)	Measured Distance (cm)	Absolute Error	Relative Error	% Error
1	113.5	113	0.5	0.00440528	0.440528
2	104	103	1	0.00961538	0.961538
3	94.6	93	1.6	0.01691331	1.691331

4	82.8	82	0.8	0.00966183	0.966183
5	74.4	74	0.4	0.00537634	0.537634
6	70.2	70	0.2	0.00284900	0.2849
7	62.8	62	0.8	0.01273885	1.273885
8	49.8	50	0.2	0.00401606	0.401606
9	40.5	40	0.5	0.01234567	1.234567
10	20	20	0	0	0
11	16	15.8	0.2	0.0125	1.25
12	8	8.4	0.4	0.05	5

CHAPTER 8

OBSERVATIONS

We have connected the required apparatus as shown in the connection diagram. Our technology comprises of three ultrasonic sensor to sense the obstacle to prevent from accident. The program in the ARDUINO UNO is set in such a way that it continuously monitor the distance from the object and shows in to the LCD whenever an obstacle is occurred the buzzer will rung as well as the LED will be ON.

After power is on we have seen that our technology starts moving, and continuously moves until an obstacle is placed in front of it. It verifies that the ultrasonic sensor is working properly.

Since the ultrasonic sensor is placed in the front, left and right, therefore the technology only give warning when an obstacle is placed in front of the sensor, which can detect the object and shows the distance in the LCD, and to overcome the accident we can use this system in the car.

CHAPTER 9

CONCLUSIONS

We propose an intelligent warning system for accident prevention and making the environment as much as better and safe place to live.

Ultrasonic sensor is a reliable solution for detecting human and animal and this technique certainly can save lots of life. Any kind of obstacle detection system must be equipped with combination of different sensors. Detecting humans and animals including any kind of obstacles will certainly give us a better solution to reduce the death of humans and animals in road accident.

Here in this project we are used three ultrasonic sensor for detecting obstacles and tested successfully. Our project has been developed by integrating features of all the hardware components used. In coming future when the idea will be implemented, surely the rate of road accidents by car due to collision can be drastically reduced. Arduino based collision detection and warning system is designed and mounted on a car to demonstrate the system and it was found functional. The ultrasonic sensor was able to read distances of shorter range accurately and alert the driver if the car is in danger of collision.

9.1 OUTCOME OF THE PROJECT

In this study, a tool to detect motion of objects, display the recorded distances on the LCD screen, produce a recorded sound alarm by Piezo-Buzzer and also red light by LEDs was assembled. The obstacle detection system was successfully connected and the ARDUINO program used in this project was sent to the ARDUINO microcontroller to run the circuit. The three ultrasonic sensor was able to send the ultrasonic sound waves to the approaching object in front of our system and the alarm sound from the Piezo-buzzer was produced. Piezo-buzzer was set to produce sound at different levels. The limit set for the Piezo-buzzer was to produce the sound alarm at the distance less than 50cm. The results were correct since for the distance equal or greater than 50cm produced no tone from the Piezo-buzzer. LEDs were also set to produce light when the Piezo-buzzer will rung. On the outcome, LEDs produced light as they were expected. The LCD was also displayed the variation of distances as the object approaches near to the ultrasonic sensors. When the power was

connected to the system set-up, the values were recorded in the LCD screen indicating that the connection was right and the program runs successfully.

9.2 ADVANTAGES

- If the driver is drunk and feeling sleepy and the distance between the object and the sensor is less than 50cm then the buzzer will ring.
- Used to detect an object in Extreme conditions like fog and misty areas.

9.3 DRAWBACK

- If the ultrasonic sensor get damaged, then system does not detect the object and the accident will occur.

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