American International University- Bangladesh

Department of Computer Science

Lab Report Cover Sheet

Course Name	MICROPROCESSOR AND EMBEDDED SYSTEMS
Lab Report No.	06
Lecturer Name	**MD. ALI NOOR**
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Section	O
Group No.	03

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Title: Interfacing the Arduino with an external sensor to establish communication using the RS-232 protocol with implementing an obstacle detection system.

Abstract

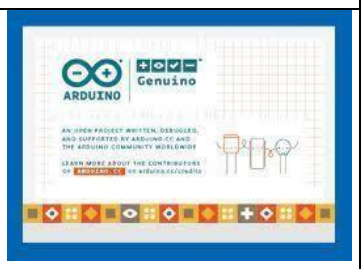
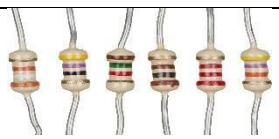
The main objective of this project is to utilize the RS-232 interface to link the Arduino to an external sensor and construct an obstacle detection system. This experiment made use of the Tinkercad and Arduino IDE programs. The hardware and software for the Arduino IDE were first used in this experiment in the lab setting. To better understand the simulation program, this experiment was conducted at home using Tinkercad.

Objectives

The main goal of this exercise is to

1. Use the Arduino IDE to code a basic obstacle detection system.
2. Integrate a basic hardware obstacle detection system.

Equipment List

No	Equipment Name	Figure
1	Arduino IDE (any version) Software	
2	Arduino Uno (R3) board	
3	Resistors	

4	Sonar Sensor (HCSR04)	
5	LED (Red, Green, Yellow)	
6	Tinkercad	

Overview of Sonar Sensor:

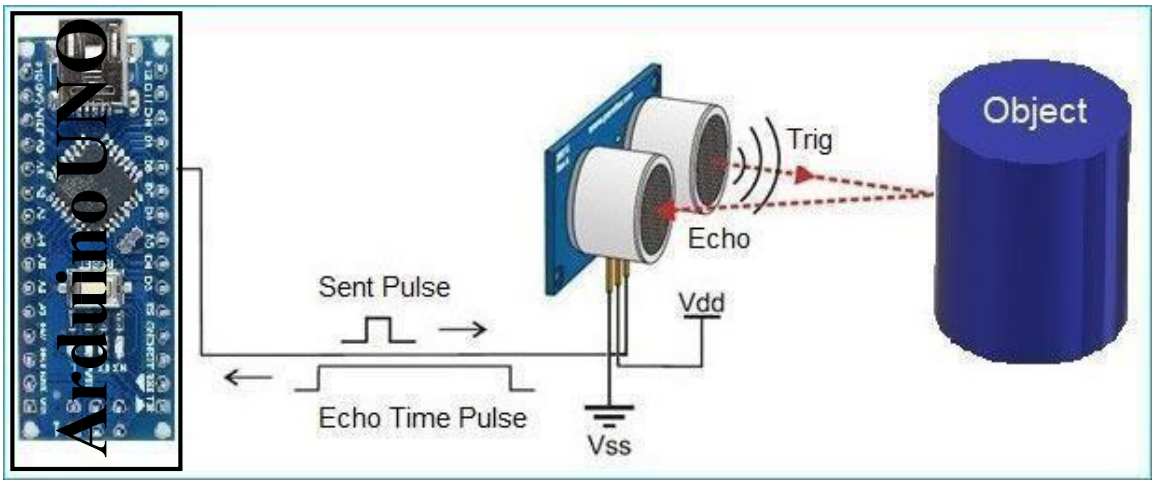


Figure 1: Aurdino Sensor

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

Setting up the Circuit

The main task of our lab is to use a sonar sensor to detect the distance of an obstacle.

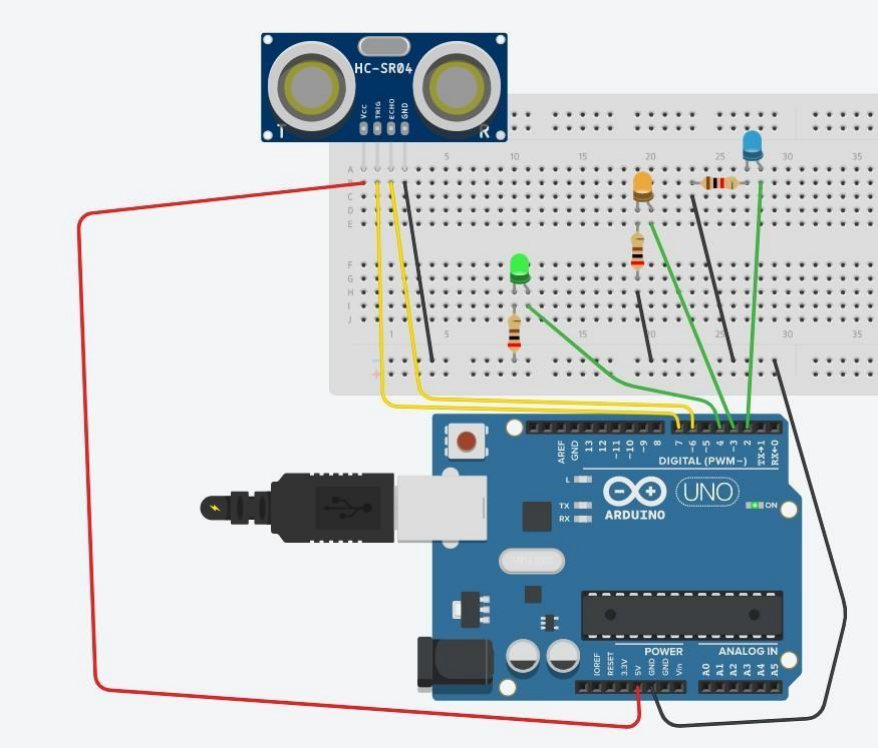


Figure 2: Aurdino simulation circuit

Hardware Set-Up

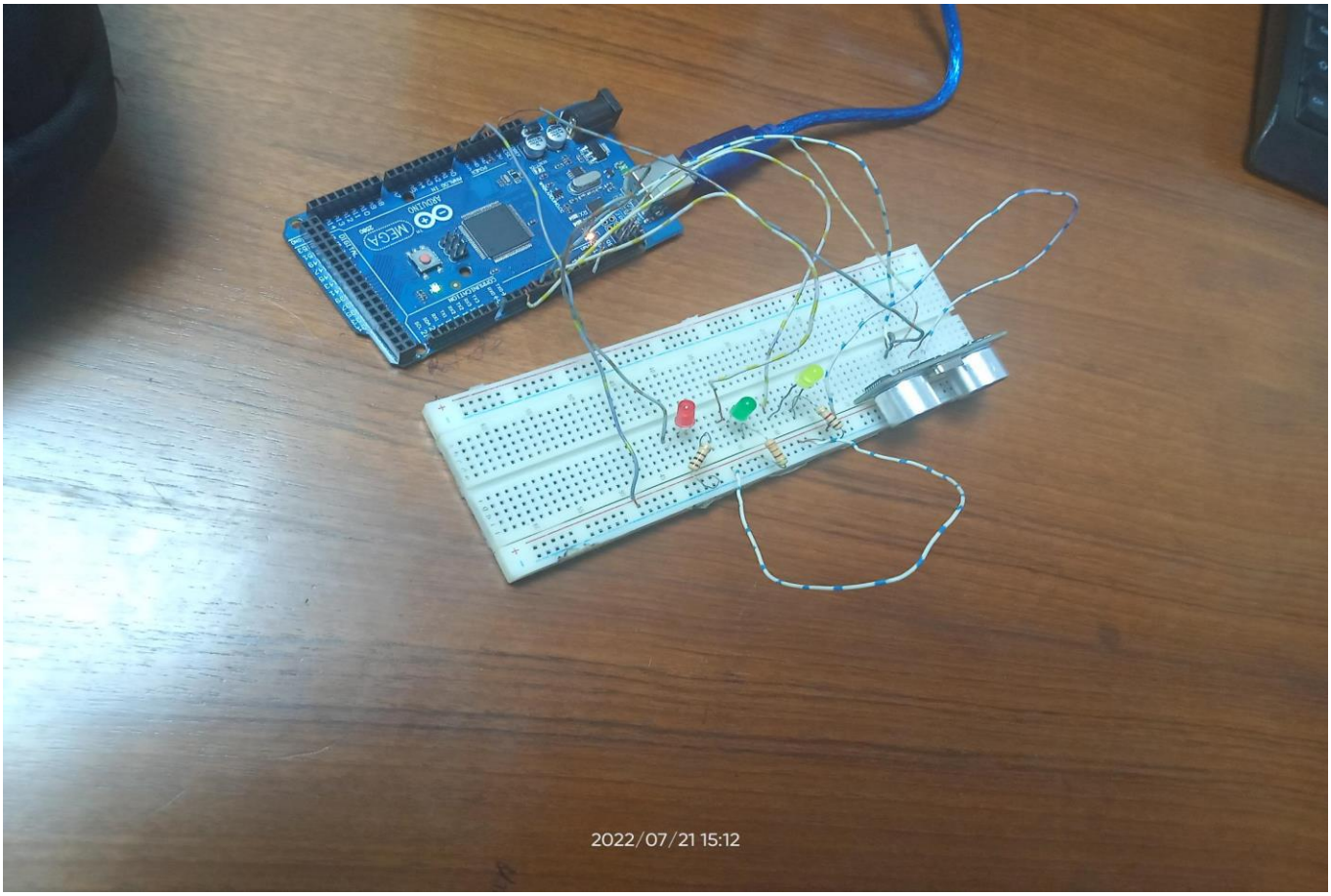


Figure 3: Arduino hardware setup

Hardware Results

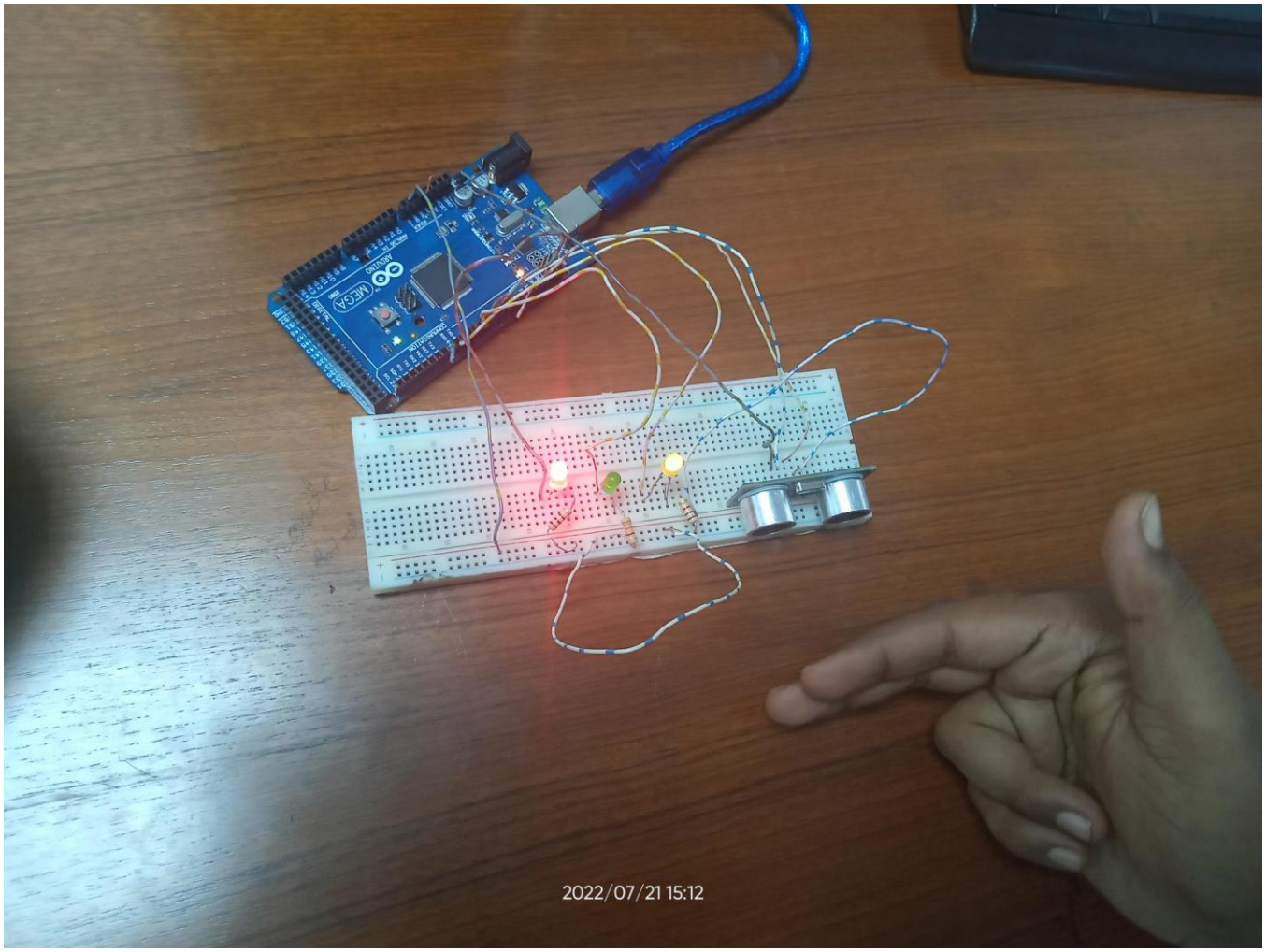


Figure 4: Arduino hardware results

Lab code :

```
int distanceThreshold = 0;
 int cm = 0;
 int inches = 0;
long readUltrasonicDistance (int triggerPin, int echoPin)
{
pinMode (triggerPin, OUTPUT); // Clear the trigger
digitalWrite (triggerPin, LOW);
 delayMicroseconds(2);

// Sets the trigger pin to HIGH state for 10 microseconds
digitalWrite (triggerPin, HIGH);
delayMicroseconds(10);
digitalWrite (triggerPin, LOW);
pinMode (echoPin, INPUT);

// Reads the echo pin, and returns the sound wave travel time in microseconds

return pulseIn (echoPin, HIGH);
}
void setup()
{
Serial.begin(9600);
pinMode(2, OUTPUT);
pinMode(3, OUTPUT);
pinMode(4, OUTPUT);
}
void loop()
{
// set a threshold distance to activate LEDs
//considering the features of ultrasonic sensor


distanceThreshold = 80;
```

```
// measure the ping time in cm, 340m/s=0.034cm/µs, therefore 0.034/2=0.017 mainly as the signal is working as echo
cm = 0.017 * readUltrasonicDistance(7, 6);

 // convert to inches by dividing by 2.54

inches = (cm / 2.54); Serial.print(cm);
Serial.print("cm, ");
Serial.print(inches);
Serial.println("in");

if (cm > distanceThreshold)
{
digitalWrite(2, LOW);
digitalWrite(3, LOW);
digitalWrite(4, LOW);
}
if (cm < distanceThreshold && cm > distanceThreshold-20 )
{
digitalWrite(2, HIGH); digitalWrite(3, LOW); digitalWrite(4,
LOW);
}
if (cm < distanceThreshold-20 && cm > distanceThreshold-40 )
{
digitalWrite(2, HIGH);
 digitalWrite(3, HIGH);
 digitalWrite(4, LOW);
}
if (cm < distanceThreshold-40 && cm > distanceThreshold-70 )
 {
digitalWrite(2, HIGH);
digitalWrite(3, HIGH);
 digitalWrite(4, HIGH);
}
delay(100); // Wait for 100 millisecond(s)
}
```

Simulation Set-Up

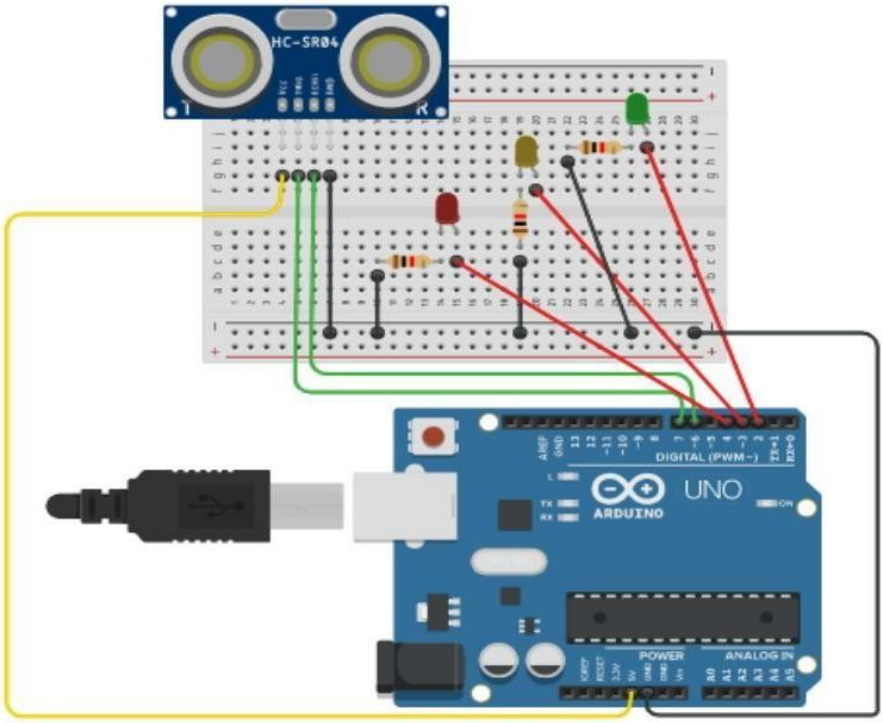


Figure 5: Implementing an obstacle detection system circuit design using Tinkercad

Simulation Results

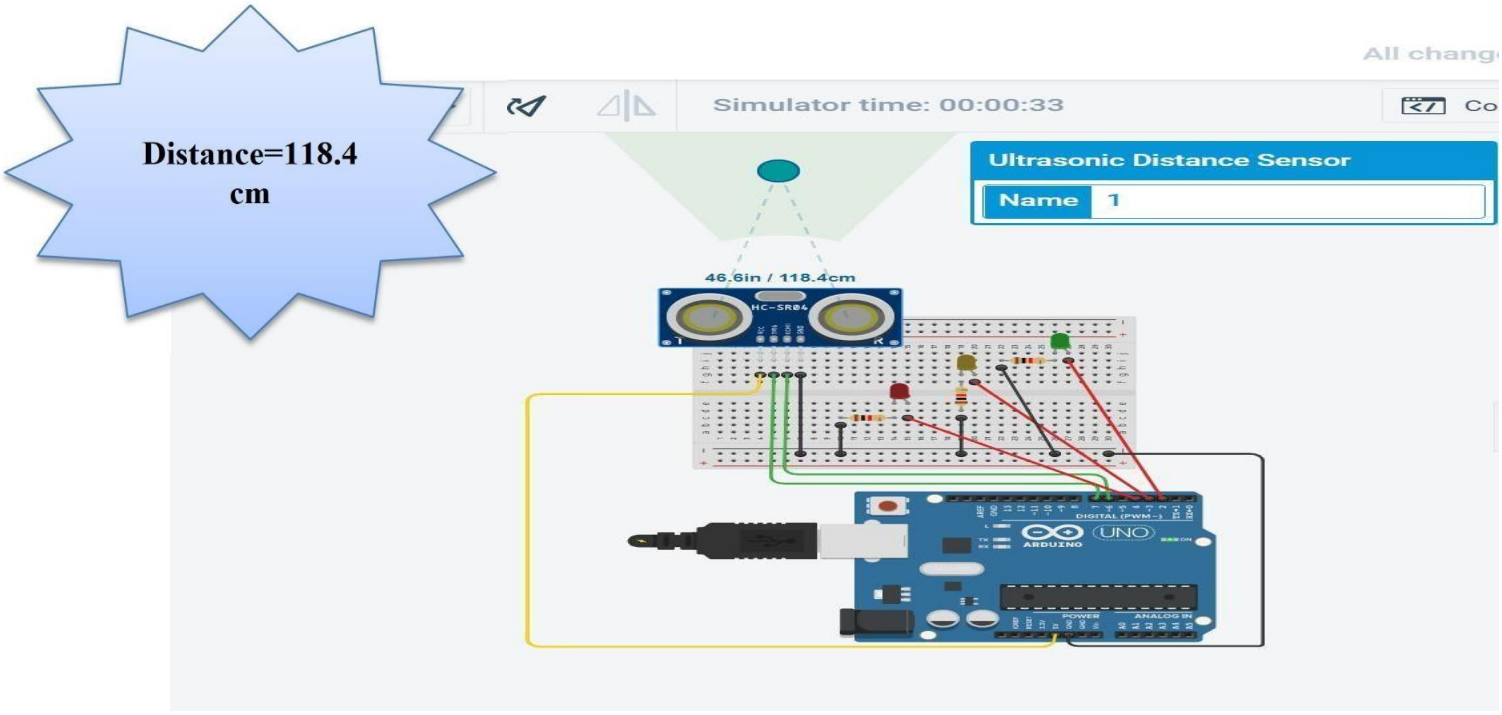


Figure 6: When Distance>50cm(No light is on)

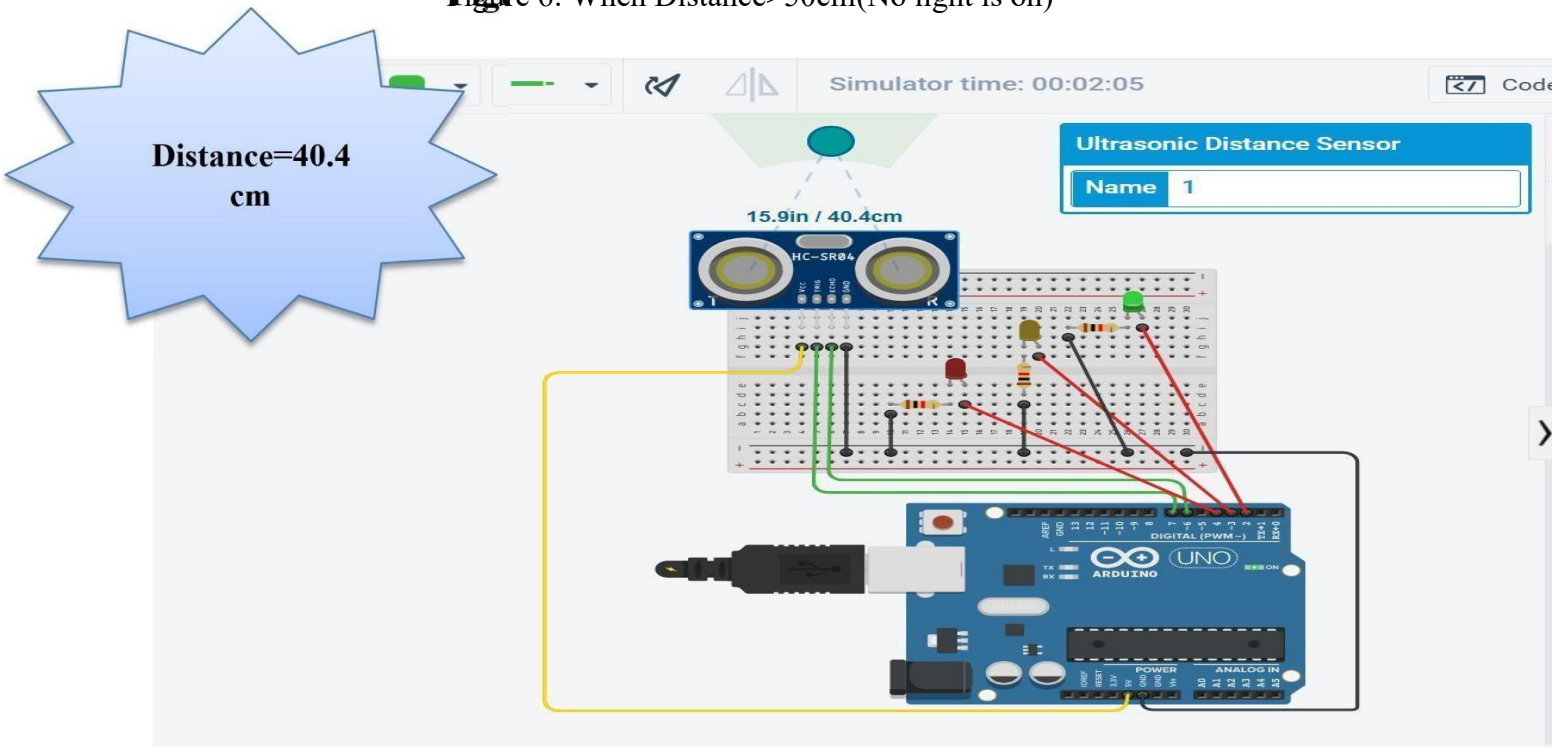


Figure 7: When Distance between 35 cm to 50cm(Green light is on)

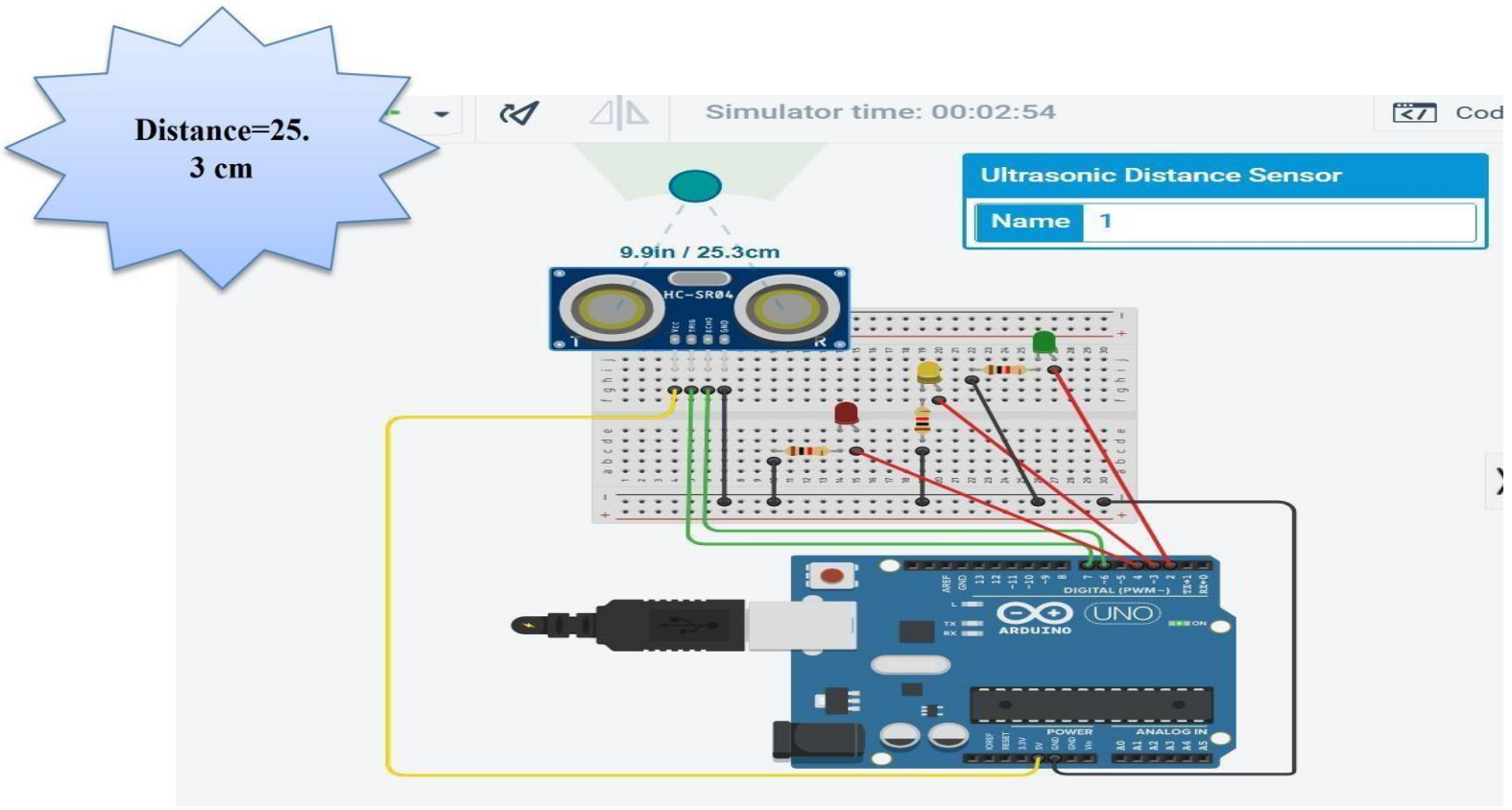


Figure 8: When Distance between 20 cm to 35cm (Yellow light is on)

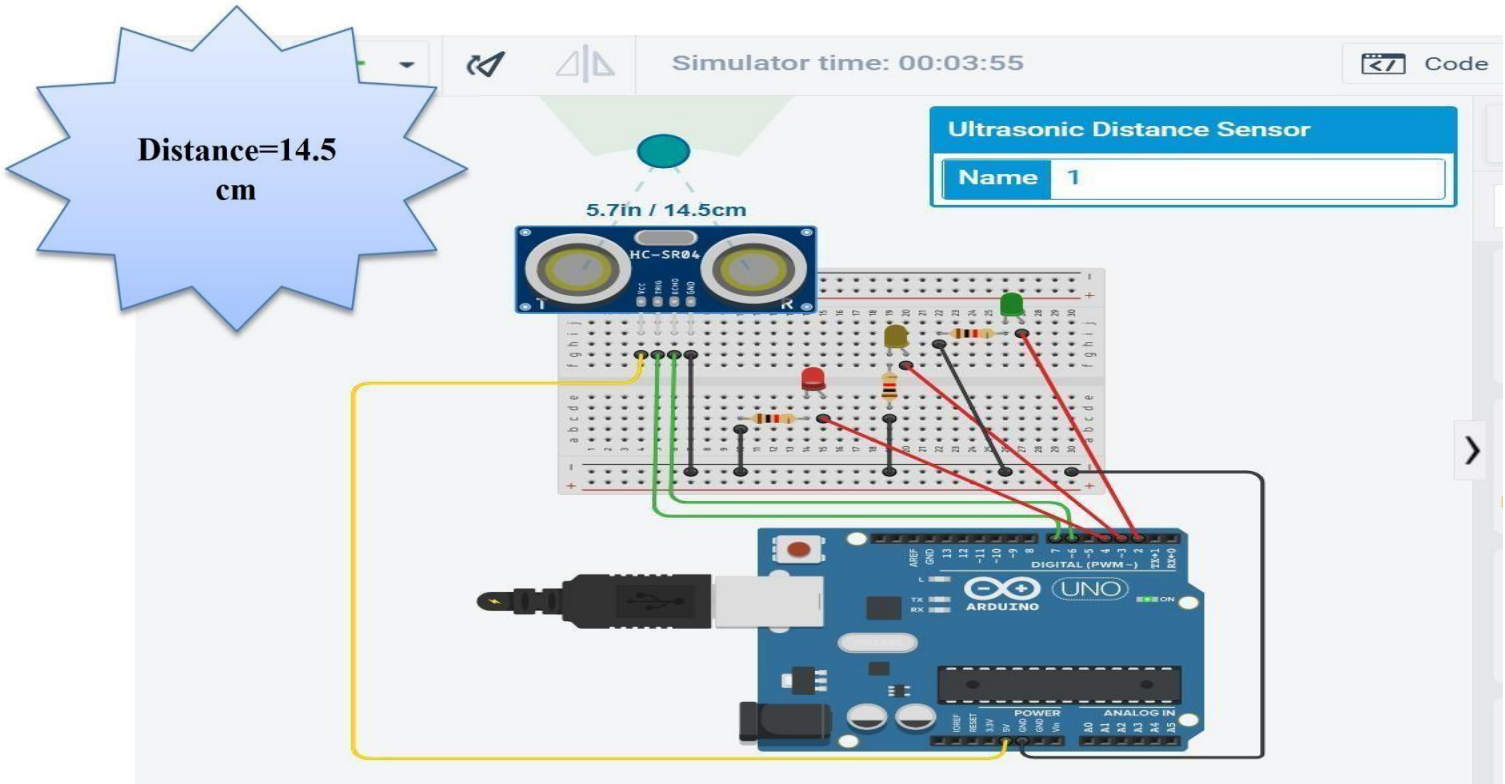


Figure 9: When Distance between 0 cm to 20cm(Red light is on)

Discussion

Two methods were used to conduct this experiment. First, an HC-SR04 sensor breadboard, an Arduino board, three red, yellow, and green animated LED lights, three resistors, and connecting wires were used to build the obstacle detection design. Ports 2, 3, and 4 were each linked to three LED lights. The Arduino IDE program was then used to write the code for the obstacle detecting system. After that, I linked the Arduino board to my computer and executed the code to get the intended outcome. As seen in the graphic in the Hardware Settings section, we employed the mouse as an impediment in this experiment. The chord distance is configured to be between 0 cm and 50 cm whether the LED light is on or off. The LED light did not turn on when the distance was more than 50 cm. When the mouse was between 35 and 50 cm away, the green light turned on. When the mouse was between 20 and 35 cm from the wall, the yellow light turned on. When the mice were within 0 to 20 cm of one another, a red light would turn on. Tinkercad software was used for this experiment in order to have a better understanding. At the time of doing this experiment, I had some problems. Both the pin arrangement and the coding included various mistakes. However, these issues were resolved with the use of online resources and experimental guides. Lighting for the runway produced great effects.

Conclusion

The intended outcomes were accomplished and the obstacle detection system was effectively put into use. As a result, it may be concluded that the experiment was successful.

References

[1] American International University Bangladesh-(AIUB) Lab Manual.

[2] Hardware Implementation of Obstacle Detection for Autonomous Vehicle https://www.researchgate.net/publication/351993147

[3] Arduino IDE, https://www.arduino.cc/en/Main/Software

[4] Ultrasonic Distance Sensor in Arduino With Tinkercad,

https://www.tinkercad.com/things/kKLhDC67ui1-exp-06ftgroup-06/editel

[4] Hardware Implementation of Obstacle Detection for Autonomous Vehicle https://www.ijariit.com/manuscripts/v7i3/V7I3-1473.pdf

[5] Object Detection System using Arduino and Android Application for Visually Impaired People https://www.ijcaonline.org/archives/volume181/number15/karmakar-2018-ijca-917797.pdf