University of Asia Pacific

Department of Computer Science and Engineering

CSE 316: Microprocessors and Microcontrollers Lab

LAB REPORT

Experiment Number: **02**

Experiment Title: **Mini Project 2: Distance Measurement using Ultrasonic Sensor and Servo Motor**

Date of Submission: **27.08.2025**

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1. Experiment Name

Mini Project 2: Distance Measurement using Ultrasonic Sensor and Servo Motor

2. Objective

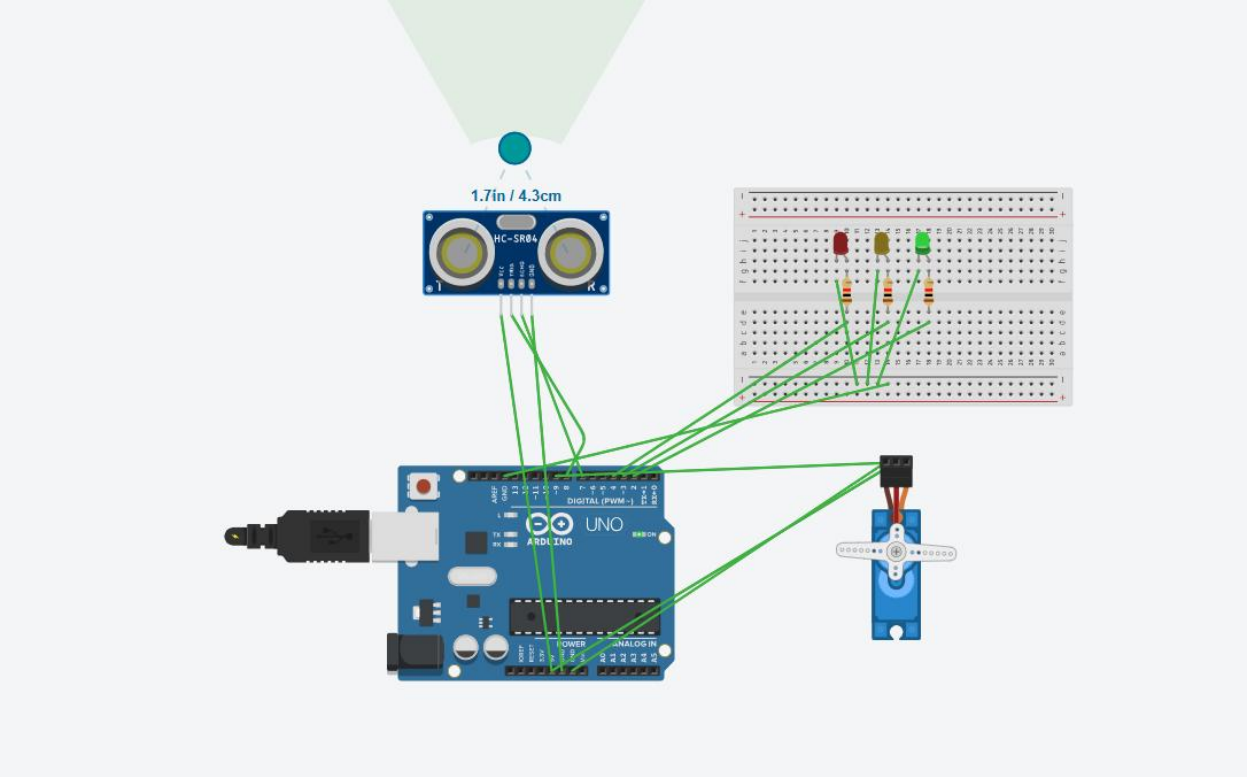
The objective of this experiment is to measure the distance of an object using an ultrasonic sensor and to control a servo motor and LEDs based on the measured distance. The project demonstrates the integration of sensors, actuators, and microcontroller programming for real-time distance monitoring and response.

3. Apparatus / Hardware & Software Requirements

All required tools and components:

- Microcontroller (Arduino Uno, ESP8266 etc.)
- Ultrasonic Sensor
- USB port
- Software (e.g., Arduino IDE)
- Servo Motor
- LED light- 3 piece
- Resistors- 3 piece
- Breadboard, Connecting Wires, Power Source etc

4. Circuit Diagram / Schematic



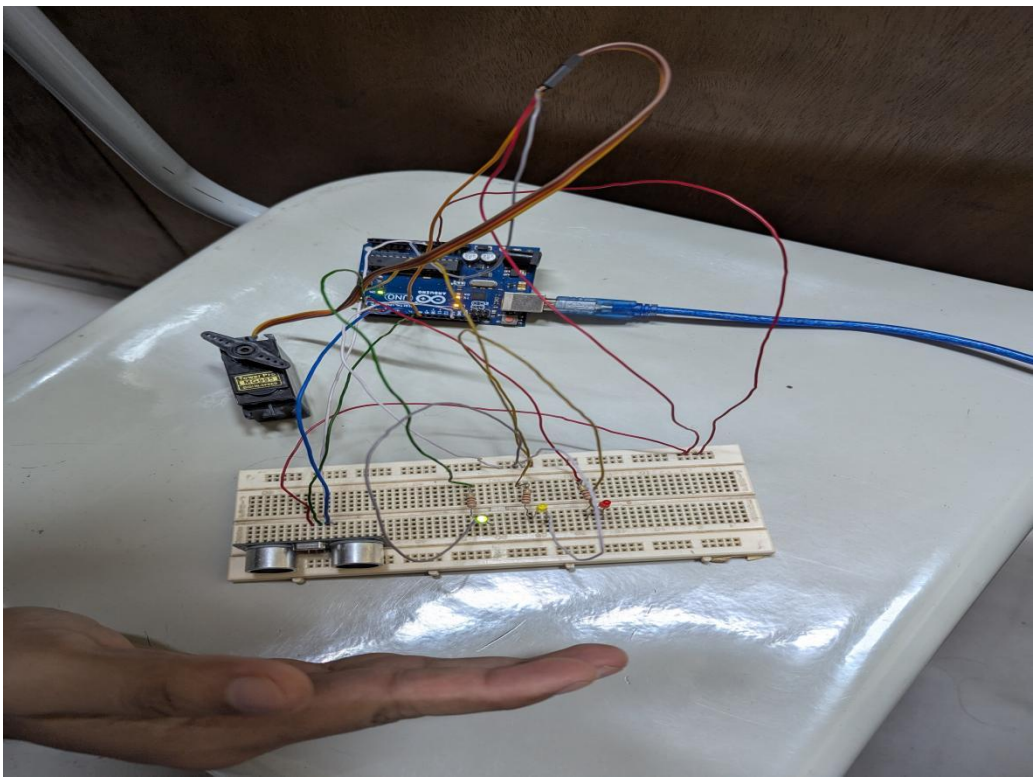
5. Code / Assembly Program

```
#include <Servo.h>
Servo myServo;

// Pin assignments
const int trigPin = 8;
const int echoPin = 7;
const int greenLED = 2;
const int yellowLED = 3;
const int redLED = 4;

long duration;
int distance;

void setup() {
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
```

```
  pinMode(greenLED, OUTPUT);
  pinMode(yellowLED, OUTPUT);
  pinMode(redLED, OUTPUT);

  myServo.attach(9);

  Serial.begin(9600);
}

void loop() {
  // Send ultrasonic pulse
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);

  // Measure echo time
  duration = pulseIn(echoPin, HIGH);

  // Calculate distance in cm
  distance = duration * 0.034 / 2;

  Serial.print("Distance: ");
  Serial.print(distance);
  Serial.println(" cm");

  // Control LEDs and Servo based on distance
  if (distance <= 10) {                  // Close range
    digitalWrite(greenLED, HIGH);
    digitalWrite(yellowLED, LOW);
    digitalWrite(redLED, LOW);
    myServo.write(90);
  }
  else if (distance <= 20) {          // Medium range
    digitalWrite(greenLED, LOW);
```

```
    digitalWrite(yellowLED, HIGH);
    digitalWrite(redLED, LOW);
    myServo.write(45);
  }
  else {                                  // Far range
    digitalWrite(greenLED, LOW);
    digitalWrite(yellowLED, LOW);
    digitalWrite(redLED, HIGH);
    myServo.write(0);
  }

  delay(200); // Short delay for stability
}
```

6. Output / Observations



When an object is placed ≤ 10 cm from the sensor:

- Green LED glows.
- Servo motor rotates to 90°.

When an object is between 11 cm and 20 cm:

- Yellow LED glows.
- Servo motor rotates to 45°.

When an object is > 20 cm away:

- Red LED glows.
- Servo motor rotates to 0°.

Serial Monitor displays the measured distance continuously.

7. Result

The ultrasonic sensor successfully measured the distance of an object, and the Arduino controlled the LEDs and servo motor accordingly. The system responded correctly to changes in distance, verifying the code and circuit functionality.

8. Conclusion

This experiment demonstrates the effective use of an ultrasonic sensor for distance measurement and the control of output devices (LEDs and servo motor) based on sensor input. It shows how microcontrollers can interface with sensors and actuators to build simple automation and object detection systems. This principle can be applied in robotics, parking sensors, obstacle-avoiding systems, and smart automation.