University of Asia Pacific

Department of Computer Science and Engineering

CSE 316: Microprocessors and Microcontrollers Lab

LAB REPORT

Experiment Number: **01**

Experiment Title: **Traffic Light Control using Servo Motor and LEDs.**

Submitted by:

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1. Experiment Name

Distance Measurement using Ultrasonic Sensor and Servo Motor

2. Objective

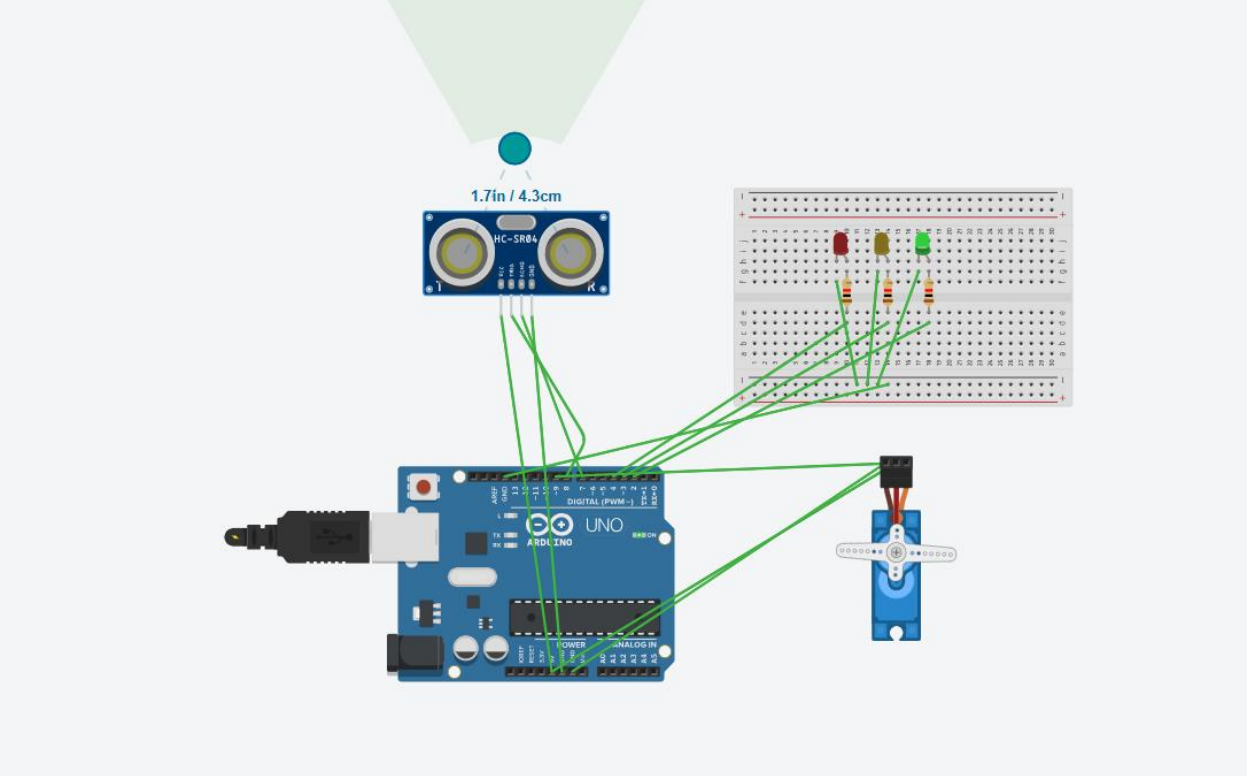
The objective of this experiment is to design and implement a system that measures the distance of an object using an ultrasonic sensor and adjusts the position of a servo motor based on the measured distance.

3. Apparatus / Hardware & Software Requirements

- List all required tools and components:

- Arduino Uno (or similar microcontroller)
- Ultrasonic Sensor (HC-SR04)
- Servo Motor
- Breadboard, Jumper Wires, Resistors
- Arduino IDE Software
- USB Cable for power and programming.

4. Circuit Diagram / Schematic

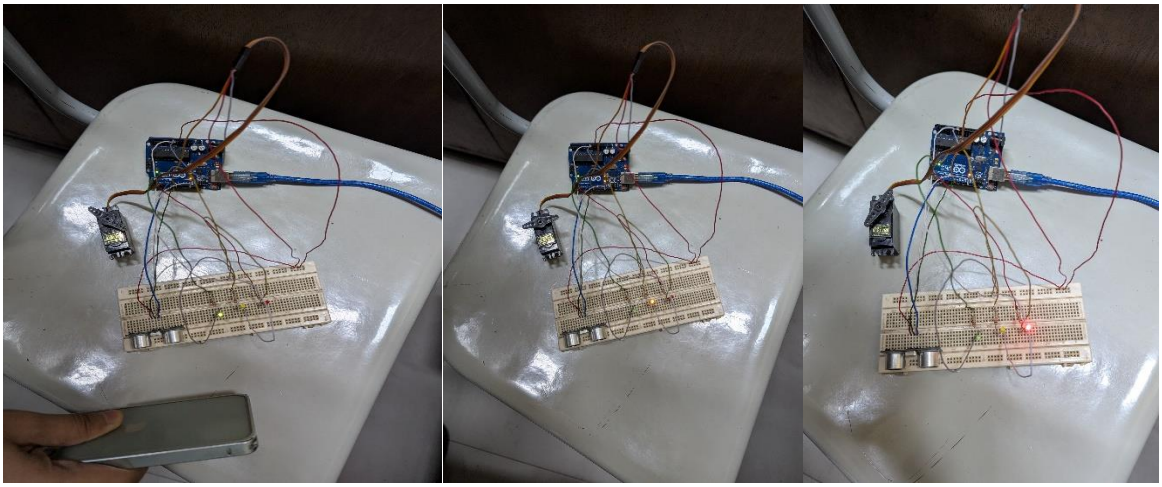


5. Code / Assembly Program

```
#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



The following sequence was observed from the system:

Distance Range (cm)	LED Status	Servo Angle (°)	Observation
0 – 10	Green ON, Yellow OFF, Red OFF	90°	Object is very close → Servo moves fully open
11 – 20	Green OFF, Yellow ON, Red OFF	45°	Object at medium distance → Servo moves halfway
> 20	Green OFF, Yellow OFF, Red ON	0°	Object is far → Servo remains closed

7. Result

The system was able to measure distances accurately and map them to corresponding servo motor positions. The servo responded smoothly to changes in distance. This shows that the integration between the ultrasonic sensor and servo motor was correctly implemented and functioned reliably.

8. Conclusion

In this experiment, we built a distance measurement system using an ultrasonic sensor, a servo motor, and LEDs with an Arduino Uno. The ultrasonic sensor measured the distance of an object, and the system responded by lighting up different LEDs and adjusting the servo position. At close range, the green LED turned on with the servo fully open, at medium range the yellow LED lit with the servo half open, and at far range the red LED was activated while the servo stayed closed. This experiment successfully showed how sensor data can be used to control both visual indicators and mechanical movement, giving us practical experience in combining sensing, feedback, and actuation in a microcontroller-based system.