CS 5331: Special Problems in CS: Cyber Physical Systems Spring 2023

Assignment 6:
Gesture Controlled Servo Motor

Amir Faiyaz
R11772642

a. The objective of the work was to control the direction of a servo motor by moving the hand closer or further from the light sensor. The procedure involved setting up the hardware with an Arduino board, a servo motor, a light sensor, and a breadboard. The key results were achieved by scaling the data from the light sensor to fit the range of servo motor angle (0º to 180º) for smooth transitions, using a linear expression equation. The Arduino code written for this purpose was able to control the servo motor angle in response to the distance of the hand from the light sensor.

b.

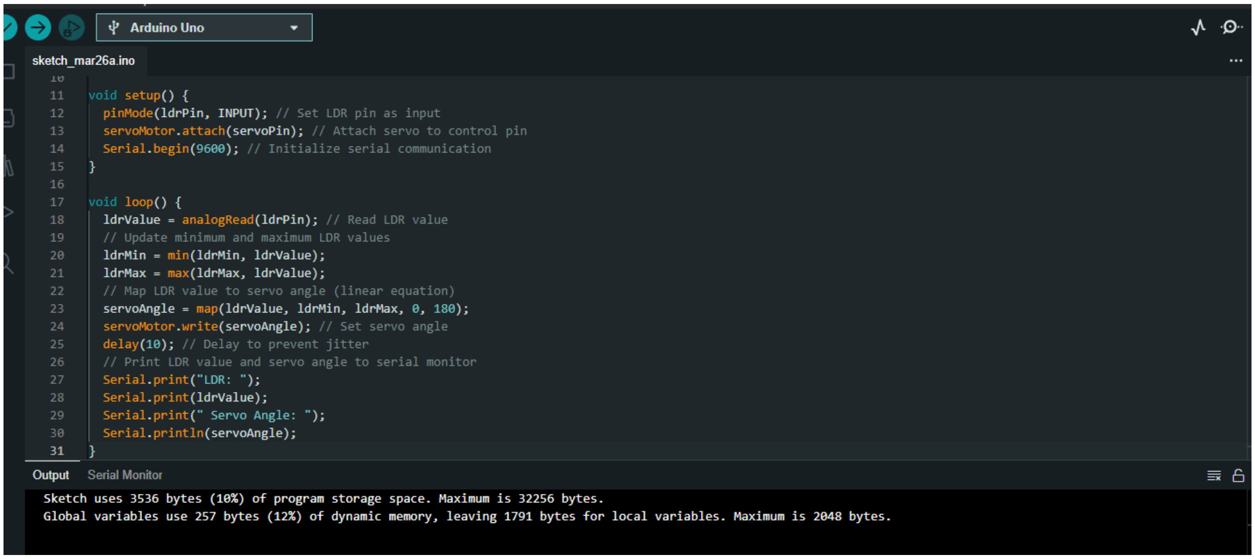
```
include <Servo.h>

int ldrPin = A0; // LDR analog input pin
int ldrValue = 0; // LDR value
int servoPin = 9; // Servo control pin
Servo servoMotor; // Servo object
int servoAngle = 0; // Servo angle
int ldrMin = 1023; // Minimum LDR value
int ldrMax = 0; // Maximum LDR value

void setup() {
  pinMode(ldrPin, INPUT); // Set LDR pin as input
  servoMotor.attach(servoPin); // Attach servo to control pin
  Serial.begin(9600); // Initialize serial communication
}

void loop() {
  ldrValue = analogRead(ldrPin); // Read LDR value
  // Update minimum and maximum LDR values
  ldrMin = min(ldrMin, ldrValue);
  ldrMax = max(ldrMax, ldrValue);
  // Map LDR value to servo angle (linear equation)
  servoAngle = map(ldrValue, ldrMin, ldrMax, 0, 180);
  servoMotor.write(servoAngle); // Set servo angle
  delay(10); // Delay to prevent jitter
  // Print LDR value and servo angle to serial monitor
  Serial.print("LDR: ");
  Serial.print(ldrValue);
  Serial.print(" Servo Angle: ");
  Serial.println(servoAngle);
}
```

c.

We used a light sensor to detect the proximity of the hand to implement the servo motor movement to correlate with the hand gesture. The servo motor moved towards an angle of 0o as the hand moved closer to the sensor, while it moved away from the sensor at an angle of 180o. We accomplished this by scaling the light sensor data with a linear expression equation to fit the range of servo motor angle for smooth transitions.

Other types of sensors, such as accelerometers or gyroscopes, which can detect movement along different axes, could be used to detect other types of hand motion, such as side to side.

d.



```
void setup() {
  pinMode(ldrPin, INPUT); // Set LDR pin as input
  servoMotor.attach(servoPin); // Attach servo to control pin
  Serial.begin(9600); // Initialize serial communication
}

void loop() {
  ldrValue = analogRead(ldrPin); // Read LDR value
  // Update minimum and maximum LDR values
  ldrMin = min(ldrMin, ldrValue);
  ldrMax = max(ldrMax, ldrValue);
  // Map LDR value to servo angle (linear equation)
  servoAngle = map(ldrValue, ldrMin, ldrMax, 0, 180);
  servoMotor.write(servoAngle); // Set servo angle
  delay(10); // Delay to prevent jitter
  // Print LDR value and servo angle to serial monitor
  Serial.print("LDR: ");
  Serial.print(ldrValue);
  Serial.print(" Servo Angle: ");
  Serial.println(servoAngle);
}
```

```
Sketch uses 3536 bytes (10%) of program storage space. Maximum is 32256 bytes.
Global variables use 257 bytes (12%) of dynamic memory, leaving 1791 bytes for local variables. Maximum is 2048 bytes.
```

e.