

# Experiment 5

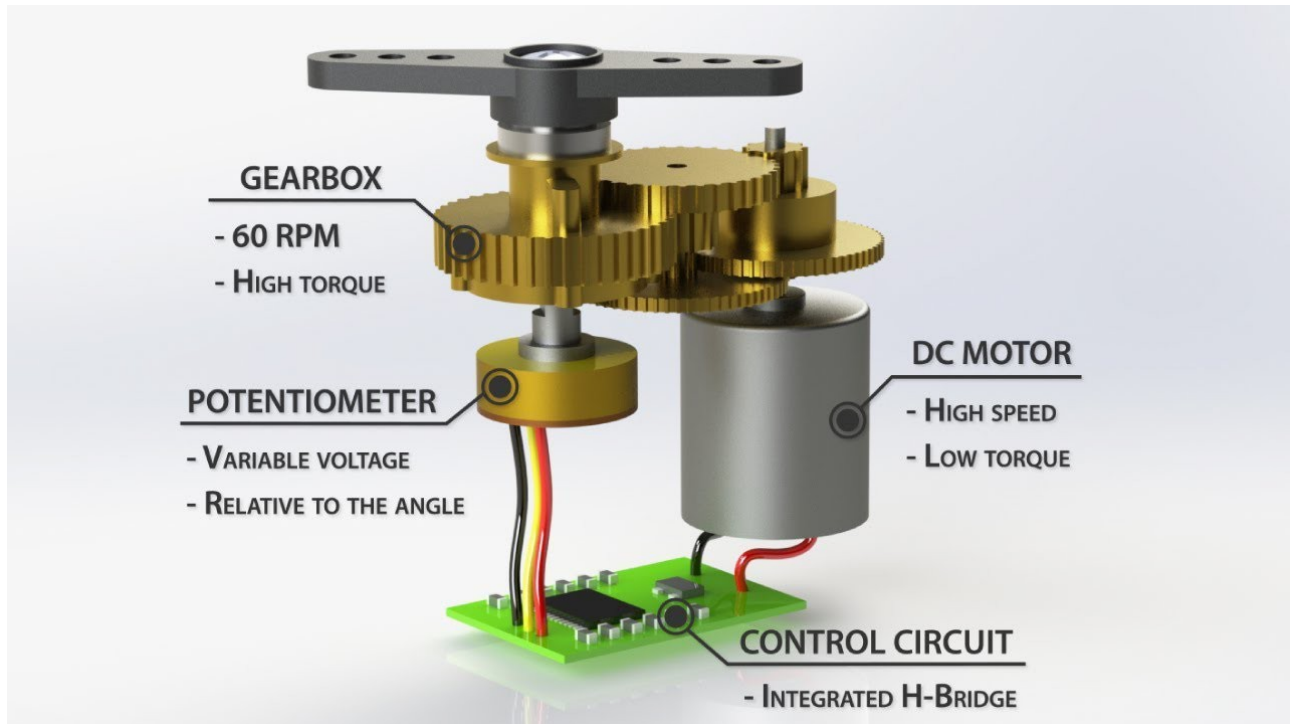
## Servo Motor / Flex Sensor

### Outline

In this experiment, it is expected from you to,

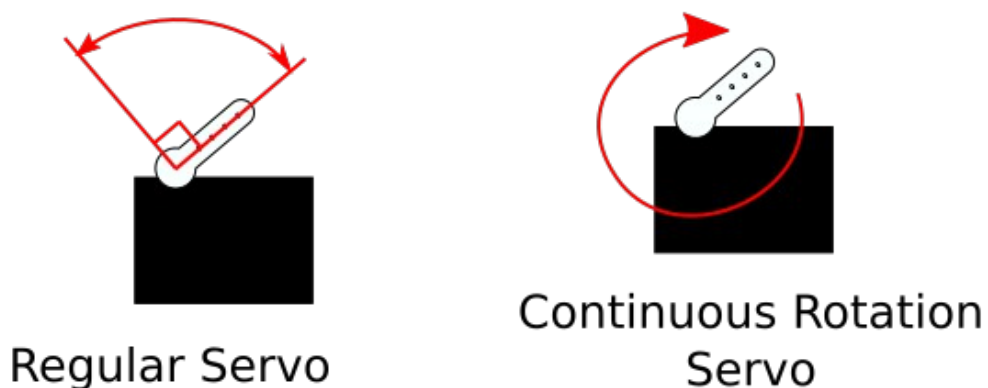
1. Learn the servo motor structure and usage
2. Assemble and test the servo motor circuit
3. Learn the flex sensor structure and usage
4. Assemble and test the flex sensor circuit
5. Modification

## 1. Servo Motor



**Structure of Servo Motor**

Servo motors are specialized motor complexes with feedback circuitry (controller) that let the user to set the speed and position of the motor precisely. Servo motors divided into 2 category, as regular (limited arc) and continuous, according to their operational range. Servo motors are very power efficient and can maintain their torque values at high speeds unlike step motors.



**Types of Servo Motors**

Servo motors controlled by continuously pulsing signal. Many hobby servo motors use 50Hz (20ms) pulsing signal and duration of the pulse determines the position of the motor. Generally 1ms length of pulse represents the lower limit of possible angles while 2ms represents the upper limit but you need to check the datasheet of your servo motor to be sure.

→ || ← 1 ms



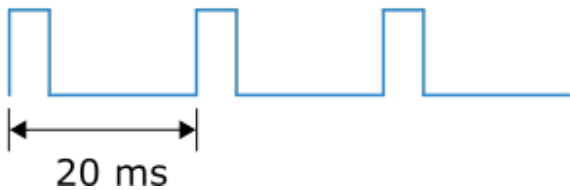
0 degrees

→ || ← 1.5 ms



90 degrees

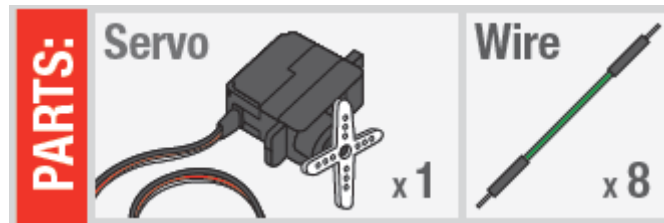
→ || ← 2 ms



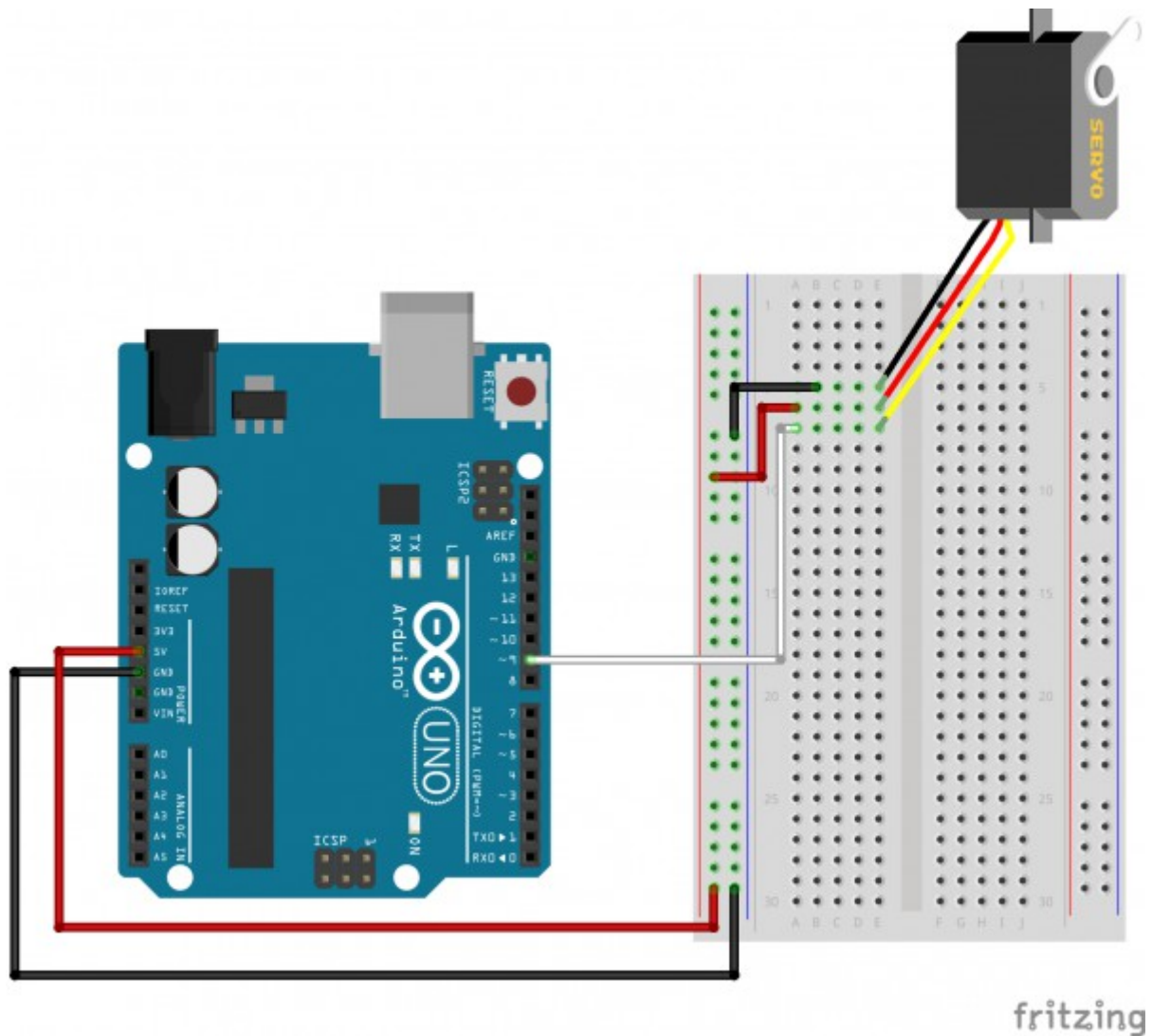
180 degrees

**Servo Motor Signal-Degree Relation**

## 2. Assembling the Servo Motor Circuit



Required Parts



Fritzing Diagram of the Circuit

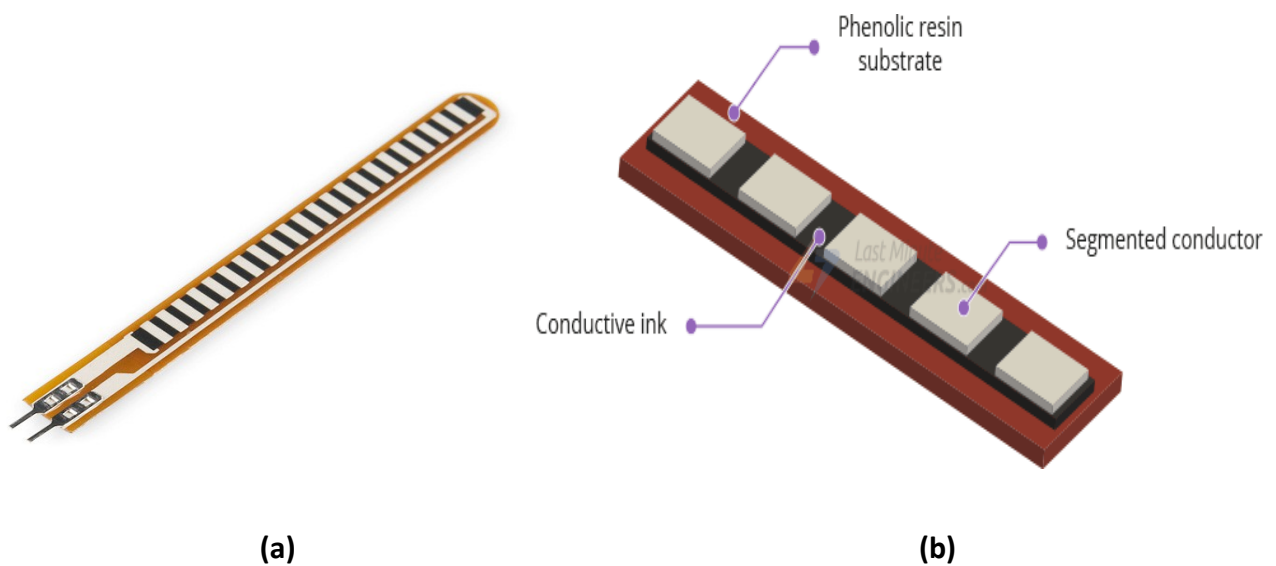
1. Connect your servo motor as shown in the diagram
2. Verify and upload your code to the arduino board
3. Observe the result and compare it with the expected outcome

**Expected Outcome:** First the servo motor should cycle between predefined angles then should rotate from the lowest angle to the highest and again to the lowest.

### **3. Testing The Servo Motor Circuit**

1. Try to find the lowest and highest achievable degrees of your servo motor.

## 4. Flex Sensor



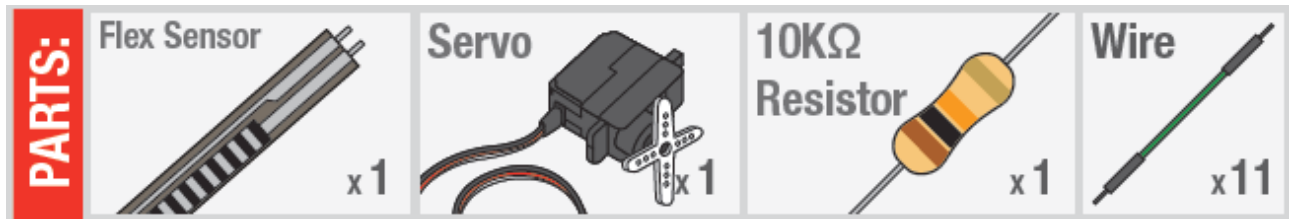
**(a) Flex Sensor, (b) Structure of Flex Sensor**

A flex sensor is a plastic strip with a conductive coating. When the strip is straight, the coating will be a certain resistance. When the strip is bent, the particles in the coating get further apart, increasing the resistance.

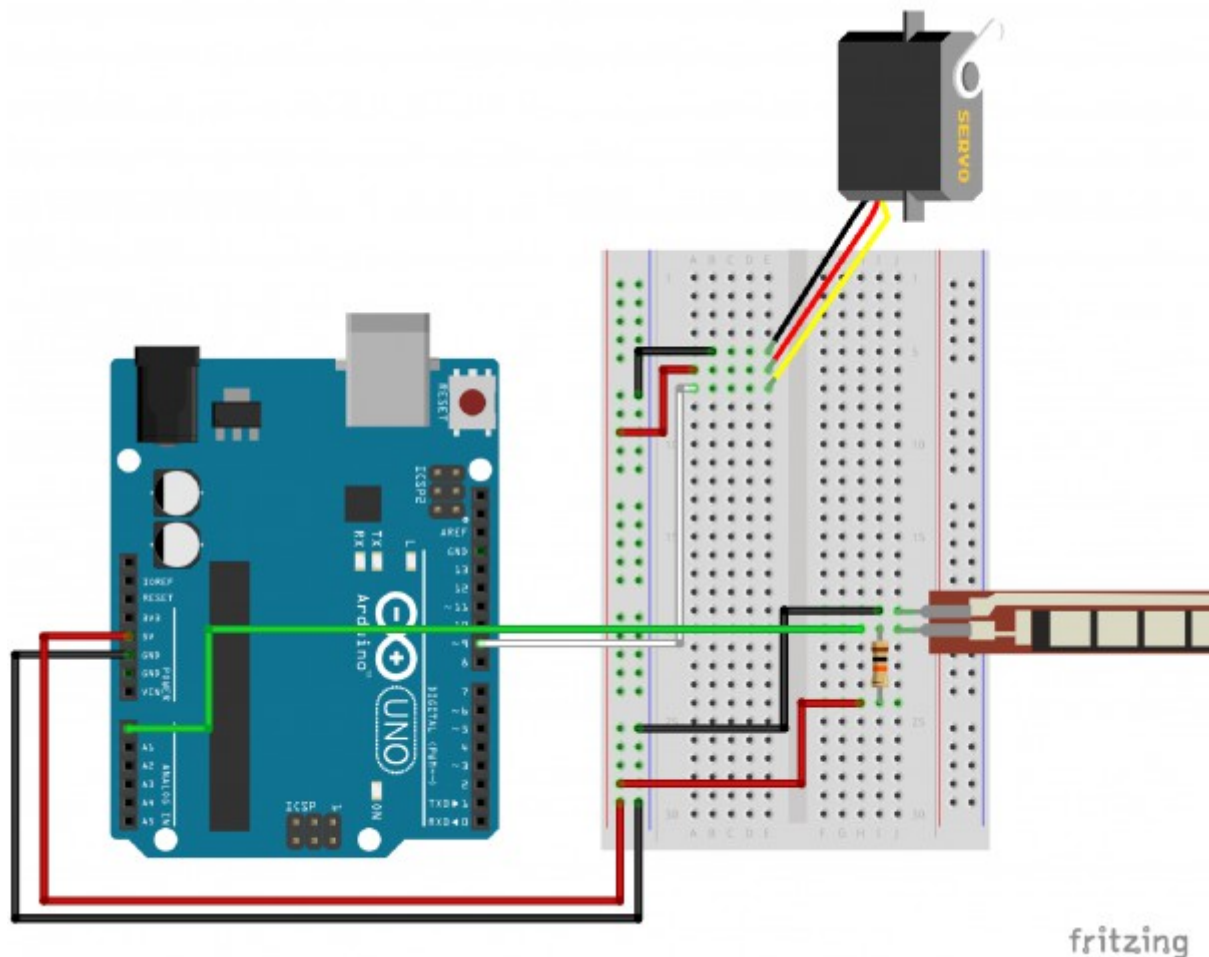


**Working Principle of the Flex Sensor**

## 5. Assembling the Flex Sensor Circuit



Required Parts



Fritzing Diagram of the Circuit

1. Select your resistors (10k  $\Omega$ ) by using the color code table
2. Connect your flex sensor and the servo motor as shown in the diagram
3. Verify and upload your code to the arduino board
4. Observe the result and compare it with the expected outcome

**Expected Outcome:** You should see the servo motor's angle changes according to the resistance applied from flex sensor.

## 6. Testing The Flex Sensor Circuit

1. Since we are using analog input, determine the maximum and minimum input values of your flex sensor.
  - While determining the input value does not bend the flex sensor too much to deter any chance to damaging it
  - You can also check the maximum and minimum resistance values of the flex sensor by using multimeter



# Modification

Use a servo motor, a flex sensor, 3 leds and 2 buttons and other necessary parts, to utilize the mentioned ones (like using correct resistors), as follows

1. Flex sensor will be used to determine the speed of the servo motor
  - There will be 3 levels of speed
2. Leds will be used to visualize the current speed level of the servo motor
3. First button will be used to increase the angle of the servo motor
4. Second button will be used to decrease the angle of the servo motor