

NIELIT, Gorakhpur

Course Name: A-level (1st Sem.)

Subject: IoT

Topic: Servo interfacing with Arduino

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Introduction



Servo Motor

A servo motor is an electric device used for precise control of angular rotation. It is used in applications that demand precise control over motion, like in case of control of a robotic arm.

A Servo Motor is a small device that has an output shaft. This shaft can be positioned to specific angular positions by sending the servo a coded signal. As long as the coded signal exists on the input line, the servo will maintain the angular position of the shaft. If the coded signal changes, the angular position of the shaft changes. In practice, servos are used in radio-controlled airplanes to position control surfaces like the elevators and rudders. They are also used in radio-controlled cars, puppets, and of course, robots.

The rotation angle of the servo motor is controlled by applying a PWM signal to it.

By varying the width of the PWM signal, we can change the rotation angle and direction of the motor.



Servos are extremely useful in robotics. The motors are small, have built-in control circuitry, and are extremely powerful for their size. A standard servo such as the Futaba S-148 has 42 oz/inches of torque, which is strong for its size. It also draws power proportional to the mechanical load. A lightly loaded servo, therefore, does not consume much energy.

The guts of a servo motor is shown in the following picture. You can see the control circuitry, the motor, a set of gears, and the case. You can also see the 3 wires that connect to the outside world. One is for power (+5volts), ground, and the white wire is the control wire.



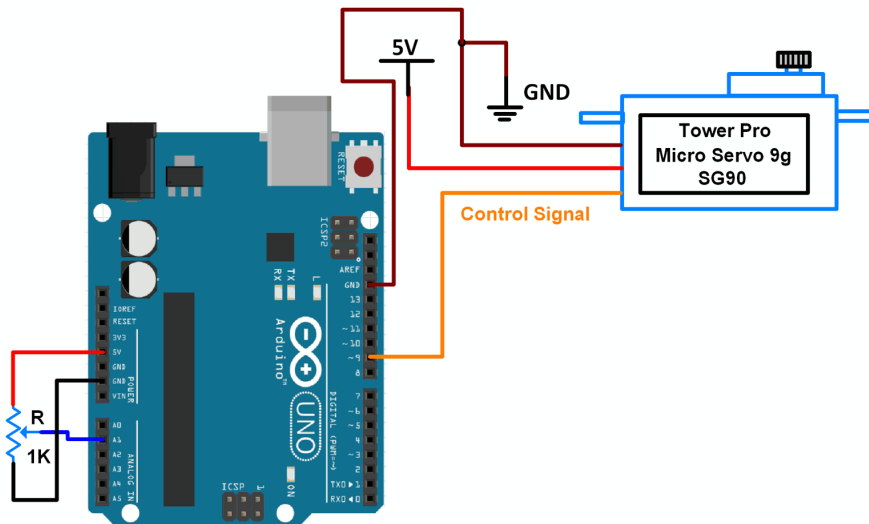
Working of a Servo Motor

The servo motor has some control circuits and a potentiometer (a variable resistor, aka pot) connected to the output shaft. In the picture above, the pot can be seen on the right side of the circuit board. This pot allows the control circuitry to monitor the current angle of the servo motor.

If the shaft is at the correct angle, then the motor shuts off. If the circuit finds that the angle is not correct, it will turn the motor until it is at a desired angle. The output shaft of the servo is capable of traveling somewhere around 180 degrees. Usually, it is somewhere in the 210-degree range, however, it varies depending on the manufacturer. A normal servo is used to control an angular motion of 0 to 180 degrees. It is mechanically not capable of turning any farther due to a mechanical stop built on to the main output gear.

The power applied to the motor is proportional to the distance it needs to travel. So, if the shaft needs to turn a large distance, the motor will run at full speed. If it needs to turn only a small amount, the motor will run at a slower speed. This is called proportional control.

Interfacing Diagram



Interfacing Servo Motor With Arduino UNO

Example

Sketch For Servo Position Control Using PWM

```
#include <Servo.h>

// Declare the Servo pin
int servoPin = 3;

// Create a servo object
Servo Servo1;

void setup() {
    // We need to attach the servo to the used pin number
    Servo1.attach(servoPin);
}

void loop(){
    // Make servo go to 0 degrees
    Servo1.write(0);
}
```

```
delay(1000);  
// Make servo go to 90 degrees  
Servo1.write(90);  
delay(1000);  
// Make servo go to 180 degrees  
Servo1.write(180);  
delay(1000);  
}
```