Servo Motors

We strongly recommend you go through the PWM tutorial before delving into this.

Suppose you need to set something to a precise angle. This could be the rudder of an aircraft, or maybe an arm of a humanoid robot. These applications do not require continuous rotation. Normal motors can rotate at a set RPM, but they can't be set to remain stationary at a certain precise angle. This is where you would use a servo.

Getting a bit more technical, mose servos have a 180 degree freedom of rotation. It means they can be set to any angle between 0 and 180 degrees, and it will not just rotate to that angle, but hold its position against external forces. Servos are rated on this ability, termed 'Holding Torque'.
Higher the holding torque, more it is able to fight large external forces and hold its set position.

Interfacing a Servo Motor

So you know that PWM can be used to regulate the power delivered to a device. But it has another use. The mark time, i.e., the time that the pulse is high, may be treated as a data attribute, that may be transmitted through a PWM. This is precisely what drives servo motors.

Servo motors have three pins:

- Red: Power supply, 5V DC
- Black: Ground
- White: Data input

The data input is supposed to be a PWM signal of time period 20ms, i.e., a 50Hz refresh rate. The mark time varies between 1ms and 2ms.

1ms mark time would set the servo to 0 degree angle, and 2ms would set it to the 180 degree position. A mark time of 1.5ms would set it to the 90 degree position, and this is generally referred to as the neutral position.

Servos are typically controlled using microcontrollers. On the Arduino, there is a library that is shipped by default, called, unsurprisingly, the servo library. The whole documentation can be found on the Arduino library reference page at https://www.arduino.cc/en/Reference/Servo

The important methods are described here:

- First and foremost, the servo library has to be included. This is done using

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

- The next thing to do is declare a Servo object

  ```
  Servo myservo;
  ```

- Then, the object is told the pin number to which the servo is connected to

  ```
  myservo.attach(9);
  ```

  Here, the pin is assumed to be 9.

- Now, you can set the servo to any required angle like so:

  ```
  myservo.write(val);
  ```

  Here, val is the angle in degrees, varying in the range 0 to 180