Servo Motors

Servo Motors:

What is the Servo Motor?:

- A servo motor is a rotary actuator or a motor that allows for precise control in terms of angular position, acceleration, and velocity. It has certain capabilities that a regular motor does not have. Consequently, it makes use of a regular motor and pairs it with a sensor for position feedback.

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Servo Motors:

Why the Servo Motor:

- The servo motor is most used for high technology devices in industrial applications like automation technology. It is a self-contained electrical device, that rotates parts of the machine with high efficiency and great precision. Moreover, the output shaft of this motor can be moved to a particular angle. Servo motors are mainly used in home electronics, toys, cars, airplanes, and many more devices.
- Thus, this blog discusses the definition, types, mechanism, principle, working, controlling, and lastly the applications of a servo machine.

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Servo Motors:

Types of Servo Motors:

- Servo motors can be of different types based on their applications. The most important amongst them are AC servo motor, DC servo motor, brushless DC servo motor, positional rotation servo motor, continuous rotation servo motor, and linear servo motor.
- A typical servo motor comprises of three wires namely- power, control, and ground. The shape and size of these motors depend on their applications.

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Servo Motors:

Types of Servo Motors:

- Series motors.
- Split series motor.
- Shunt control motor.
- Permanent magnet shunt motor.
- Linear servo motor.
- Continuous rotation servo motor.
- Positional rotation servo motor.
- Brushless DC servomotor.

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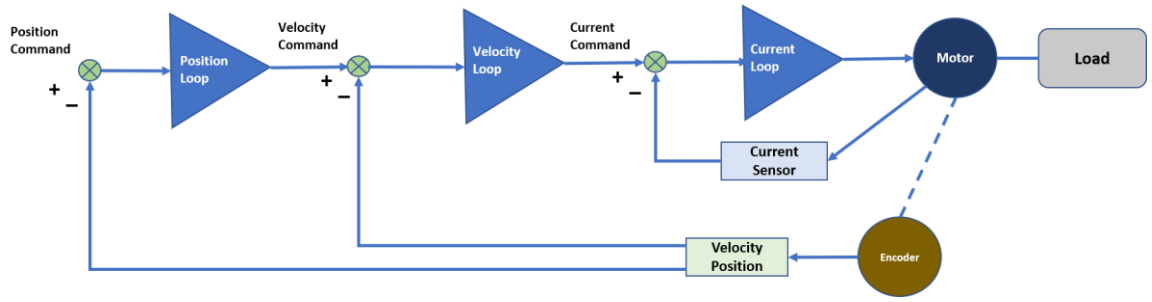
How Servo Motor Works:

How Servo Motor works:

- A servo motor works as part of a closed-loop system providing torque and velocity as commanded from a servo controller utilizing a feedback device to close the loop. The feedback device supplies information such as current, velocity, or position to the servo controller, which adjusts the motor action depending on the commanded parameters.



How Servo Motor Works:

How Servo Motor works:

- A simple industrial servo motor consists of a permanent magnet DC motor with an integral tachometer that provides an output voltage proportional to speed. The drive electronics deliver the necessary voltage and current to the motor based on the voltage fed back from the tachometer. In this example, a commanded speed (represented as a command reference voltage) is set in the driver, then the circuitry in the driver compares the tachometer feedback voltage and determines if the desired speed has been accomplished - known as a closed velocity loop.
- The velocity loop is monitoring the commanded velocity and tachometer feedback, while the driver adjusts the power to the motor to maintain the desired commanded velocity.

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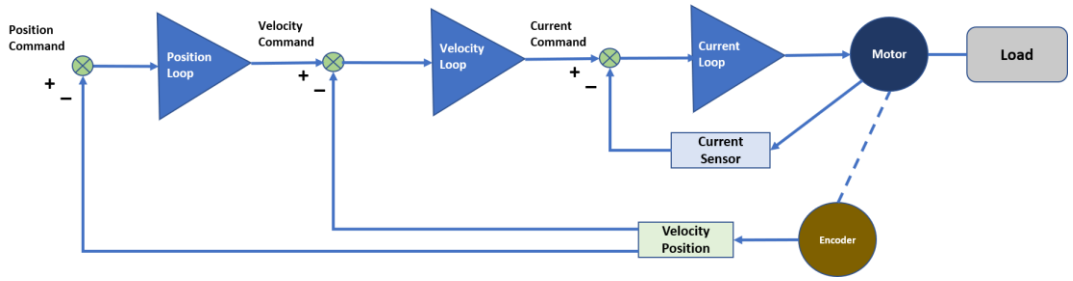
How Servo Motor Works:

We can shorten the previous into four steps:

- Pulse width to voltage converter sends a voltage to the error Amp.
- position sensor senses the motor shaft angle position and sends it to the error amplifier.
- error amp compares between these two signals and drive a voltage to the dc motor to correct its position.
- Control pulse(PWM) sent to the servo.



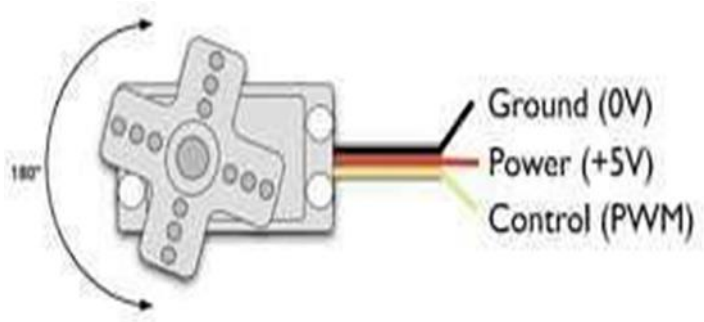
Connection of Servo Motor:

Hardware Connection:

- Black Wire:
  - It is the Ground polar of the motor.
- Red Wire:
  - It is the Vcc polar of the motor.
- Orange Wire:
  - It is the Control Signal of the motor.

The most common servos works at 50 Hz frequency.

This means that the period is 20ms



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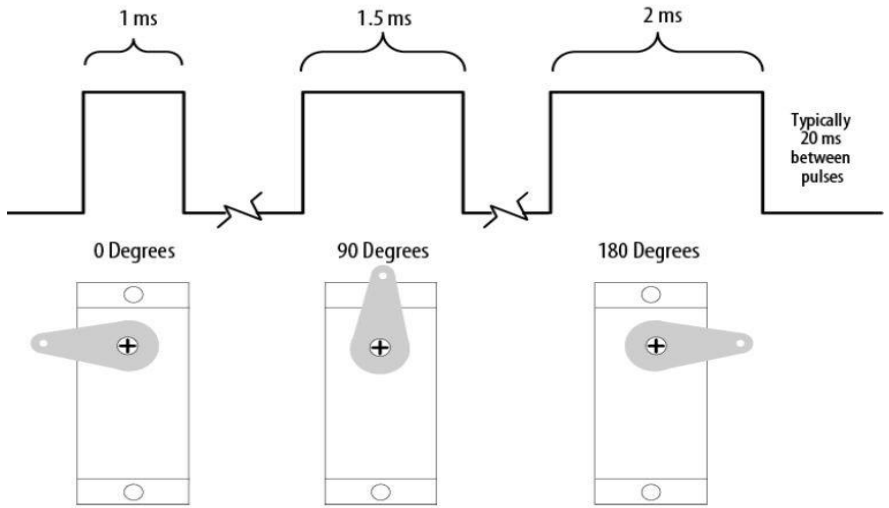
Connection of Servo Motor:

The pulse width sent to servo ranges is as follows:

- Minimum: 1 millisecond ---> Corresponds to 0 rotation angle.
- Maximum: 2 millisecond ---> Corresponds to 180 rotation angle.



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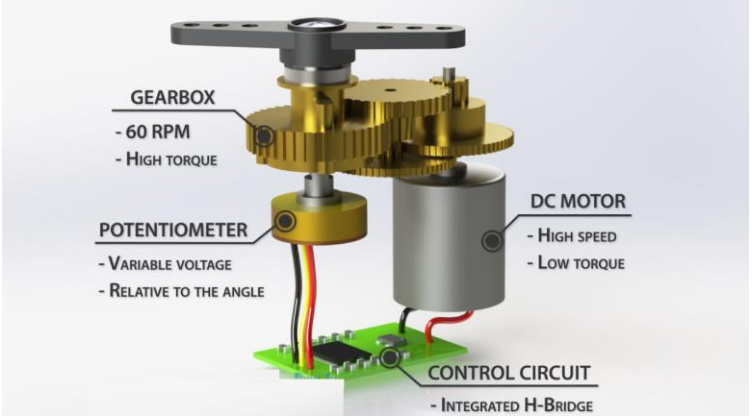
How to Control the Servo Motor:

There are three ways to control the servo motor:

- Software Delay:
  - In this way you can generate a pulse on the servo-signal pin to move it to the 0-degree position by software delay as the following Sodo code:Signal pin High;
    - delay 1 ms;
    - Signal pin Low;
    - delay 19 ms;
    - angle.



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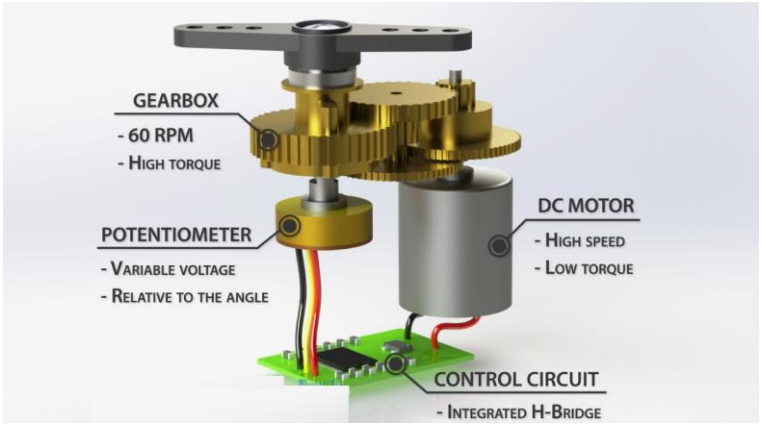
How to Control the Servo Motor:

There are three ways to control the servo motor:

- Timer Interrupt:
  - In this way you can generate a pulse on the servo-signal pin to move it to the 0-degree position by Timer interrupt as the following Sodo code:
    - Set timer interrupt after 1 ms;
    - Signal pin High at the 1st ISR;
    - At the next ISR Set Signal pin to LOW
    - Count another 18 ISR;
    - Repeat the cycle again



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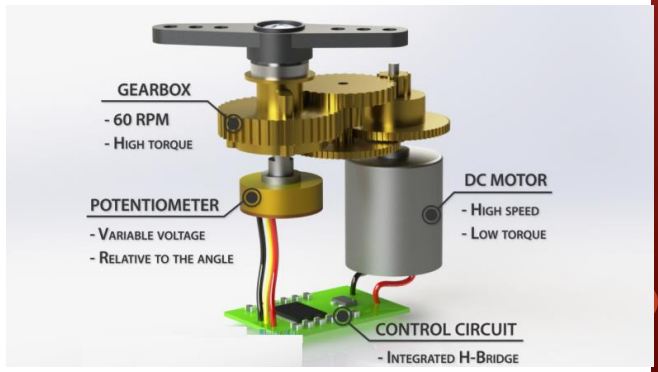
How to Control the Servo Motor:

There are three ways to control the servo motor:

- PWM:
  - In this way you can generate a pulse on the servo-signal pin to move it to the 0-degree position by PWM Mode on Timer 1 as the following Sodo code:
    - Set timer 1 at any PWM mode which its top is ICR or OCR1A;
    - Set your prescaler and calculate the time period to generate 50 Hz PWM;
    - Set your duty cycle 5% ;
    - Connect the Signal pin to the PWM channel you ran it.



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THANK YOU!