Servo Experiment

Module Introduction

In the mechanical and electrical control system of robot, the control effect of steering gear is an important factor affecting the performance. The steering gear can be used in micro electro mechanical system and aircraft model. Its simple control and output make it very easy for the single chip microcomputer system system to interface with it.

The steering gear is a kind of position (angle) servo driver, which is suitable for those control systems which need constant angle change and can be maintained. At present, it has been widely used in high-end remote control toys, such as aircraft model, submarine model, and remote control robot. It can be rotated to any angle between 0 and 180 degrees, and then stop precisely according to your command, so it is suitable for control systems requiring angle change and holding. Steering gear is an unprofessional name. In fact, it is a kind of servo motor, a set of automatic control device, composed of DC motor, reduction gear set, sensor and control circuit. What is automatic control? The so-called automatic control - by using a closed-loop feedback control circuit to constantly adjust the output deviation - makes the system output constant.

Working Principle

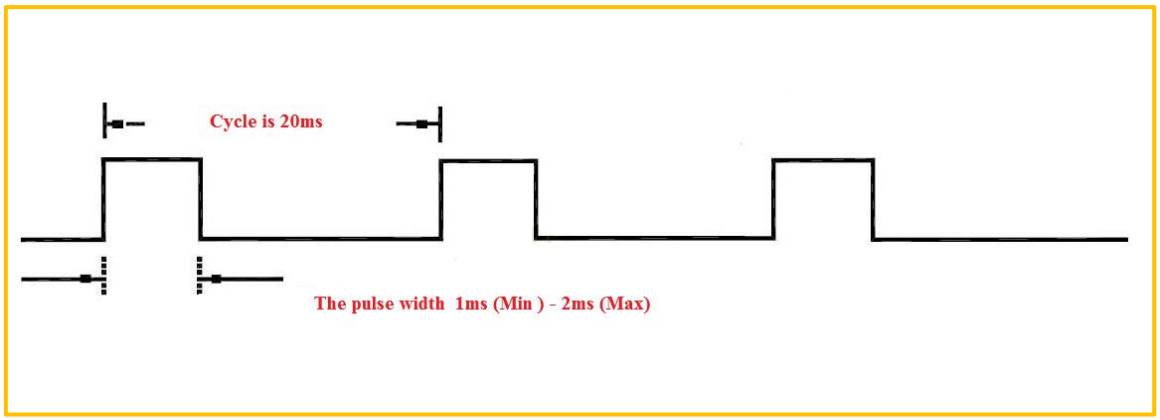
The servo control signal enters the signal modulation chip through the channel of the receiver to obtain the DC bias voltage. It has a reference circuit inside, which generates a reference signal with a period of 20ms and a width of 1.5ms. The DC bias voltage obtained is compared with the voltage of the potentiometer to obtain the voltage difference output. Finally, the positive and negative output of the voltage difference to the motor driver chip determines the positive and negative rotation of the motor. When the motor speed is fixed, the potentiometer is driven to rotate by cascaded reduction gear, so that the voltage difference is 0, and the motor stops rotating. The steering gear has the maximum rotation angle, and the middle position refers to the volume from this position to the minimum angle, and the maximum angle is exactly the same.

In the most important part, the maximum rotation angle varies with different steering gears, but the bandwidth in the middle position is determined, i.e. 1.5 ms.

Control of Steering Gear

The control of the steering gear generally needs a time base pulse of about 20ms, and the high-level part of the pulse is the angle control pulse part in the range of 0.5ms ~ 2.5ms. Taking 180 degree angle servo as an example, the corresponding control relationship is like this.

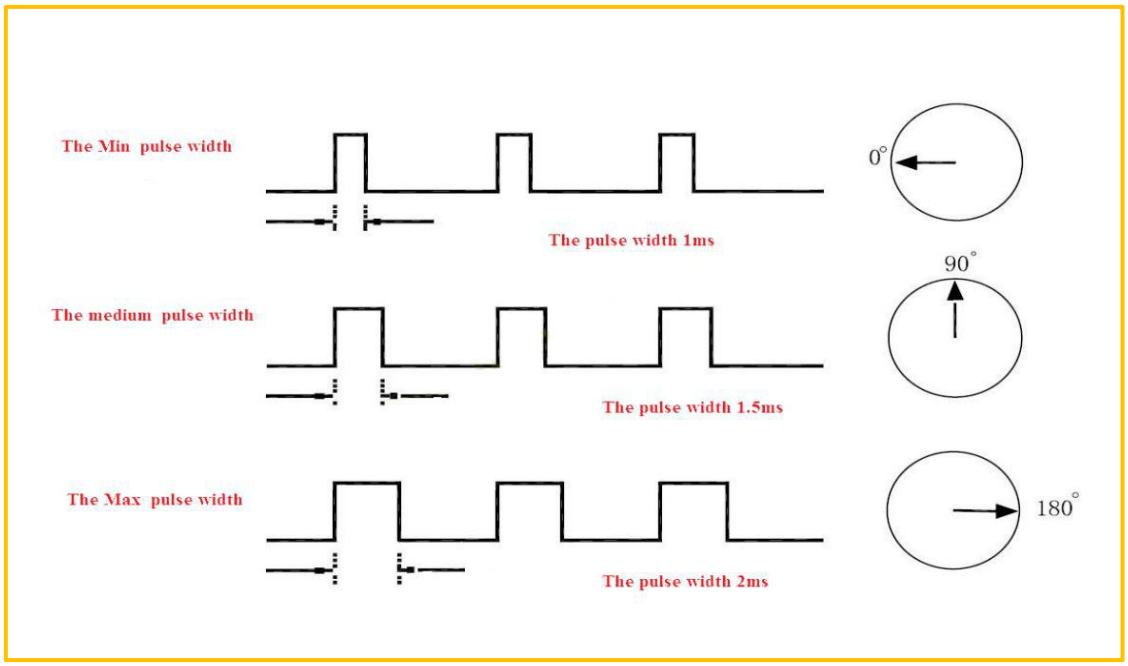
- 0.5ms----------0° ;
- 1.0ms----------45° ;
- 1.5ms----------90° ;
- 2.0ms----------135° ;
- 2.5ms----------180° ;



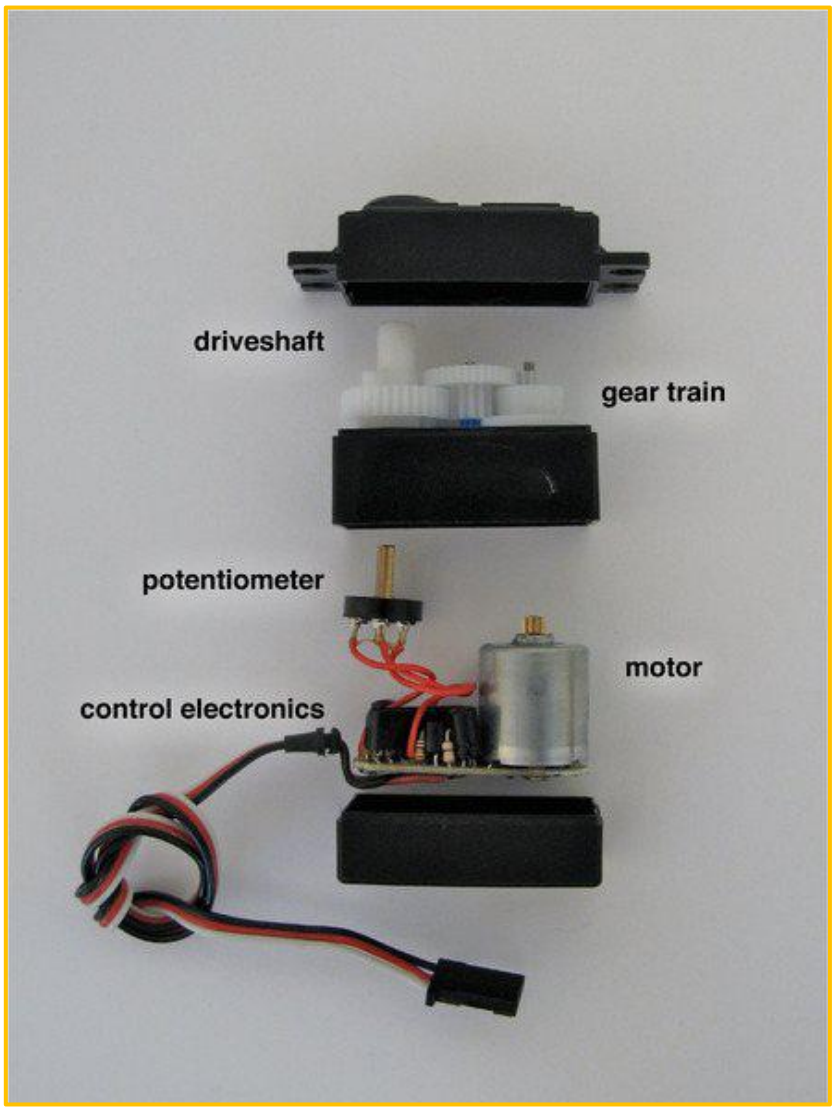
The rotation angle is generated by a continuous pulse from the control line. This method is called pulse modulation. The pulse length determines the steering gear rotation angle. For example, the steering gear rotates to the middle position for 1.5 ms pulse (the middle position 90° for 180° steering gear). When the control system sends a command to move the steering gear to a certain position and keep it at a certain angle, the influence of external force will not change the angle. The angle will not remain constant unless the control system continuously pulses to stabilize the steering angle.

When the steering gear receives a pulse less than 1.5ms, the output shaft will be taken as the standard intermediate position and rotate counterclockwise for a certain angle. When the received pulse is greater

than 1.5ms, the output shaft rotates clockwise. The maximum and minimum values may be different for different brands of steering gears, or even for different steering gears of the same brand.



Internal Structure of Steering Gear



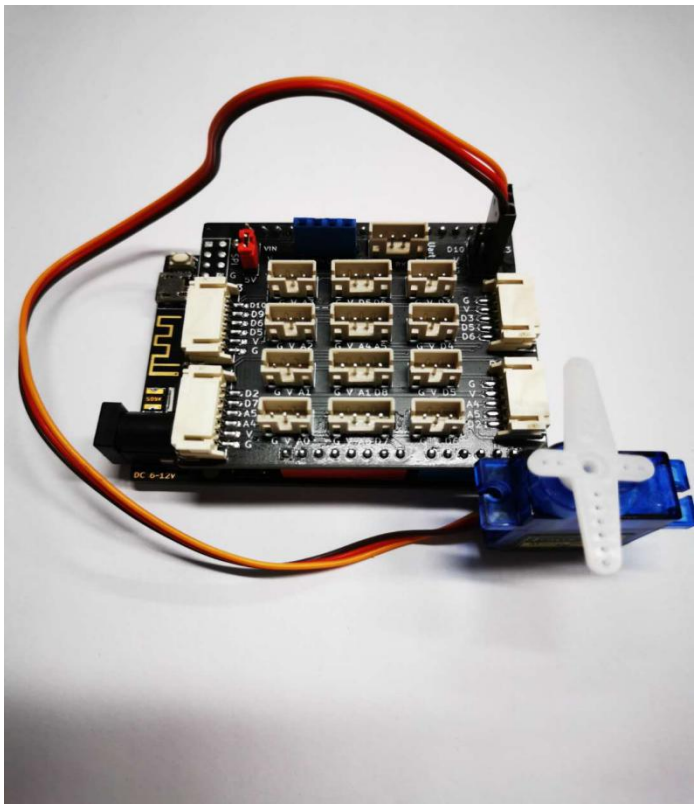
Purpose of the Experiment

Be familiar with the working principle of the steering gear; control the rotation of the steering gear through Arduino.

Device List

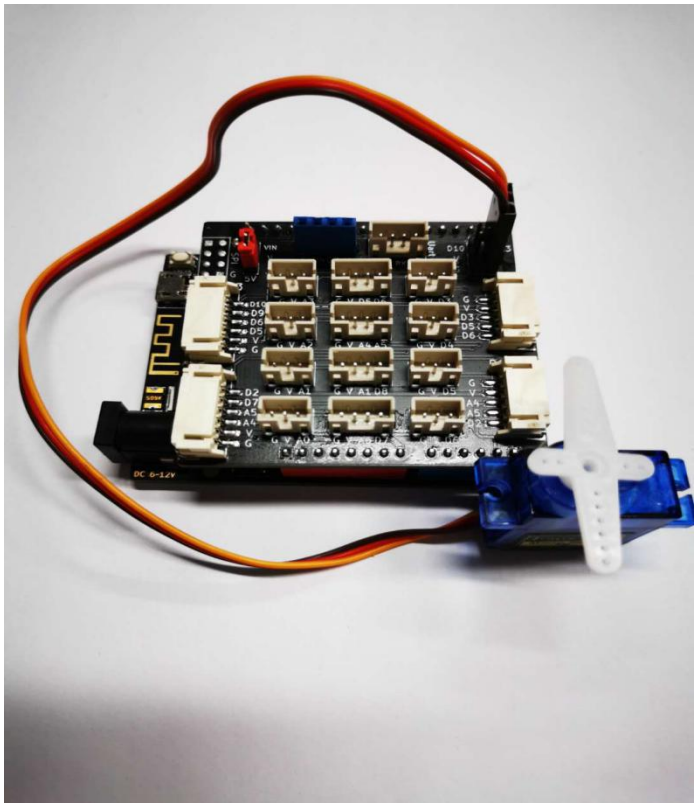
- BLE-UNO Main Board: 1
- Expansion Board: 1
- USB Data Wire: 1
- Steering Engine : 1

Physical Wiring Diagram

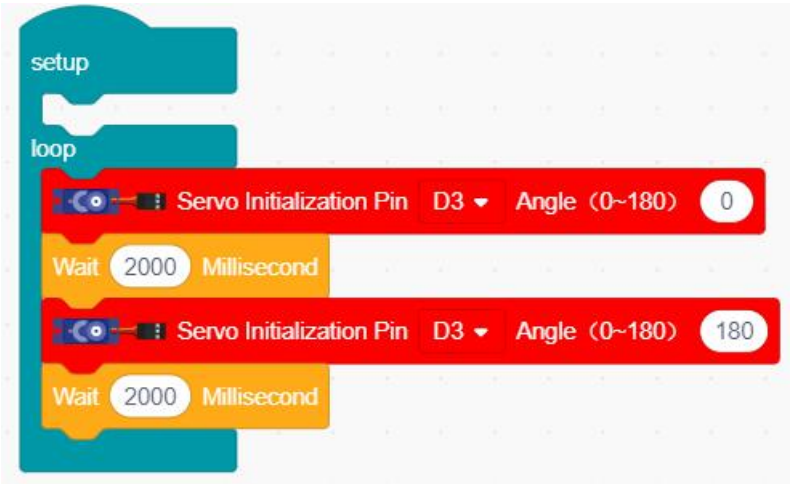


Program Code

```
#include <Servo.h>

Servo servo;

void setup()
{
    servo.attach(3); //set servo pin
}

void loop()
{
    servo.write(0); //set servo angle
    delay(2000);
    servo.write(180);
    delay(2000);
}
```



MagicBlock Program



Mixly Program

The steering gear program compiled by Mixly is shown in the following figure: