

## Automatic rotation experiment of steering gear from 0 to 180 degrees

### The steering gear introduction

In the robot electromechanical control system, the steering gear control effect is an important factor influencing the performance. The steering gear can be used as the basic output actuator in mems and model aircraft. Its simple control and output make the single-chip microcomputer system very easy to interface with it.

A steering gear is a position (Angle) servo driver for control systems that require constant change in Angle and can be maintained. Currently in high grade remote control toys, such as aircraft models, including aircraft models, submarine models; Remote-controlled robots are already widely used. Steering gear is a common name, is actually a servo motor. It can be rotated to any Angle between 0 and 180 degrees and then stopped exactly as you command, thus suitable for control systems that require Angle change and retention. Steering gear is an unprofessional name. It is actually a servomotor, a set of automatic controls, made up of dc motors, reduction gear sets, sensors and control circuits. What is automatic control? So-called automatic control - by using a closed-loop feedback control circuit to constantly adjust the output deviation - keeps the system output constant.

### Operating principle of steering gear

The steering gear control signal enters the signal modulation chip from the channel of the receiver to obtain the dc bias voltage. It has an internal reference circuit that generates a reference signal with a period of 20ms and a width of 1.5ms. The obtained dc offset voltage 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 drive chip determines the positive and negative rotation of the motor. When the motor speed is constant, the potentiometer is rotated by the cascade 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 that position to the minimum Angle, and the maximum Angle is exactly the same. The most important part, the maximum rotation Angle varies with the steering gear, but the bandwidth in the middle position is fixed, i.e. 1.5 ms.

### Steering gear control

The control of the steering gear generally requires a time base pulse of about 20ms, and the high level part of the pulse is generally the Angle control pulse part within the range of 0.5ms~2.5ms. Take 180-degree servo as an example, then the corresponding control relationship is as follows:

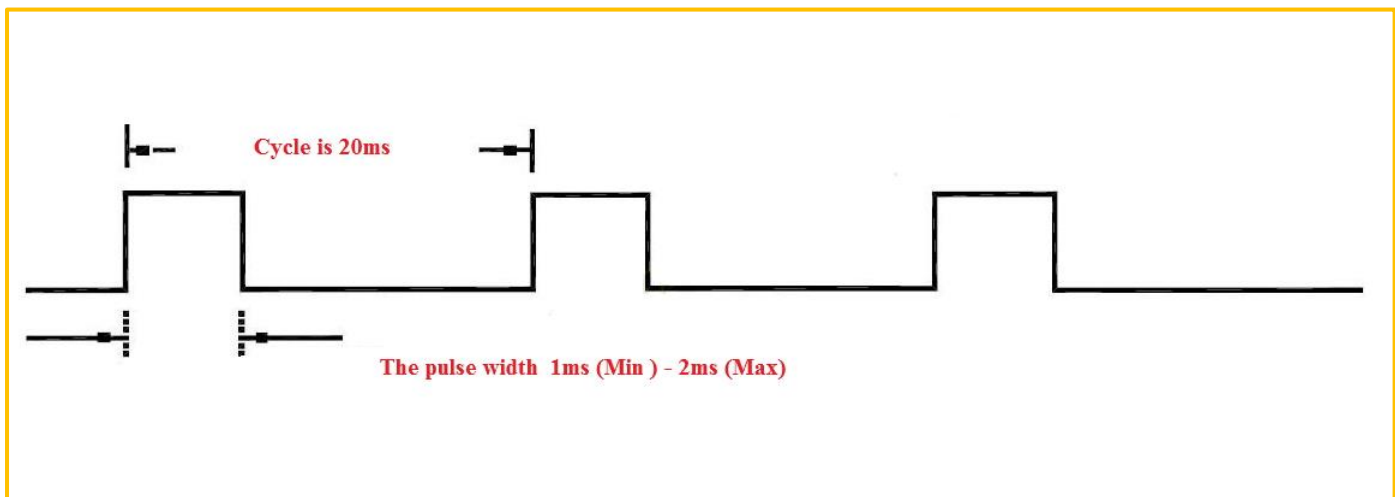
0.5ms-----0degree;

1.0ms-----45degree;

1.5ms-----90degree;

2.0ms-----135degree;

2.5ms-----180degree;



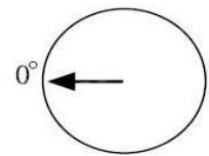
The rotation Angle is generated by a continuous pulse from the control line. This method is called pulse modulation. The length of the pulse determines the rotation Angle of the steering gear. For example, the steering gear rotates to a 1.5 millisecond pulse in the middle position (for a 180° steering gear, the middle position is 90° ). When the control system issues a command to move the steering gear to a specific position and hold it at an Angle, the effect of external forces does not change the Angle. The Angle will not remain constant until the control system sends out pulses continuously 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 middle position and rotated anticlockwise at a certain Angle. When the received pulse is greater than 1.5ms, the output axis rotates clockwise. The maximum and minimum values may be different for different brands of steering gear, or even for different steering gear of the same brand.

The Min pulse width



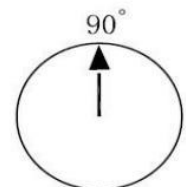
The pulse width 1ms



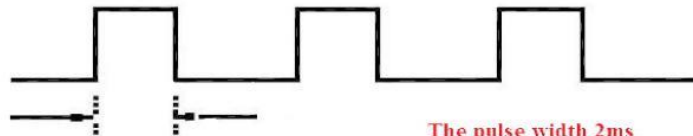
The medium pulse width



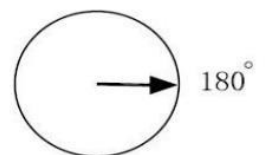
The pulse width 1.5ms



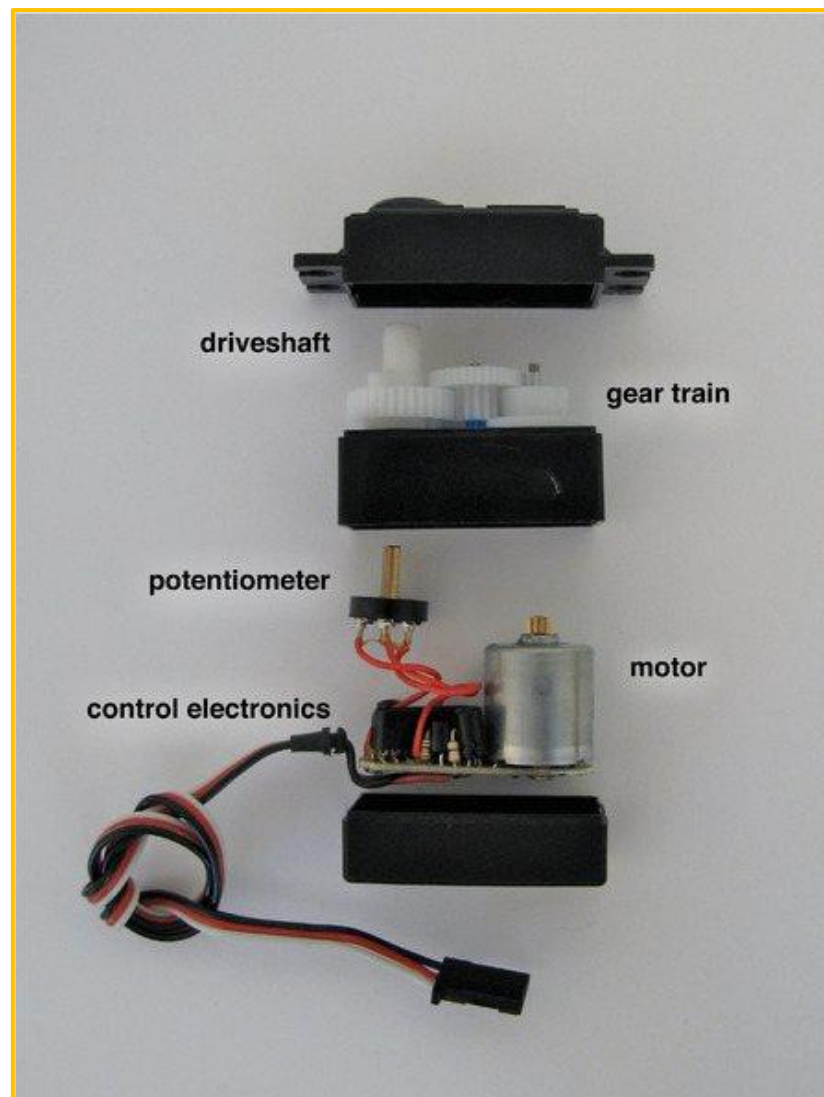
The Max pulse width



The pulse width 2ms



## Internal Structure of Steering Gear



## Experiment Purpose

- Understand the operating principle of steering gear
- Use The Keywish Arduino Uno R3 motherboard to control the automatic rotation of the steering engine from 0 ° to 180 °.

## Experimental principle

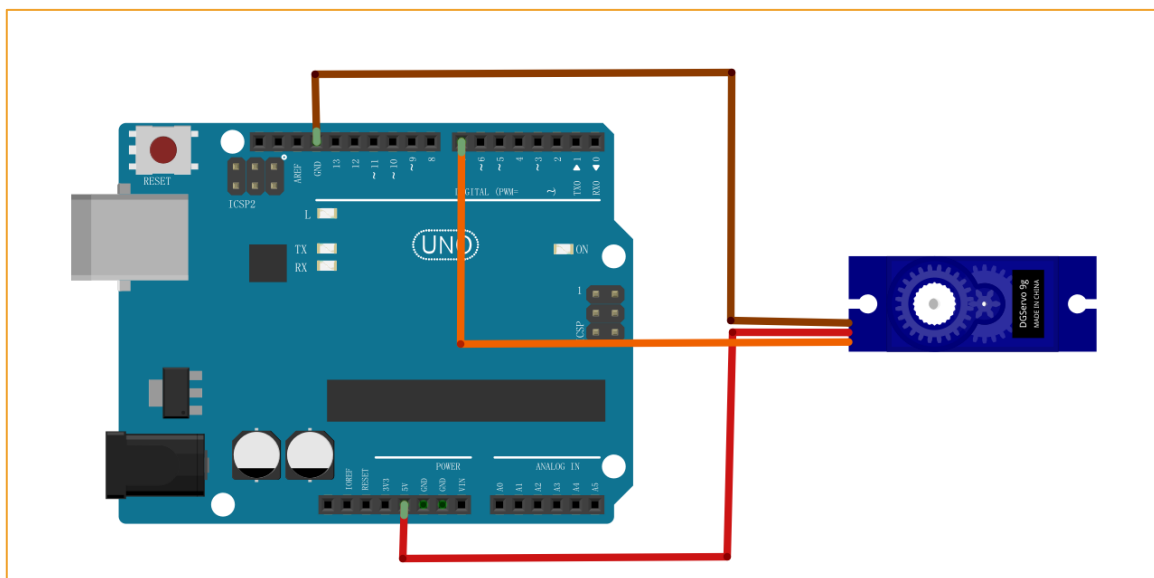
The signal wire of the steering gear is connected to the 7 feet of Keywish Arduino Uno R3 motherboard. After burning the program, input the Angle to adjust the steering gear in the serial port monitor to make the steering gear turn to the corresponding Angle

## The component list

- ◆ Arduinos Uno motherboard
- ◆ Breadboard
- ◆ USB cable
- ◆ SG90 steering gear
- ◆ Jumper wires

## Wiring the circuit

Arduino UNO R3 board	Servo motor
5V	VCC(reed)
GND	GND (brown)
7	S (orange)



## Arduino IDE programming program (not use the steering engine library file)

```
int servopin = 7;
void servopulse(int angle)
{
```

```
int pulsewidth = (angle * 11) + 500;
digitalWrite(servopin, HIGH);
delayMicroseconds(pulsewidth);
digitalWrite(servopin, LOW);
delayMicroseconds(20000 - pulsewidth);
}
void setup()
{
  pinMode(servopin, OUTPUT);
}
void loop()
{
  for ( int angle = 0; angle < 180; angle += 2)
  {
    for (int i = 0; i < 10; i++)
    {
      servopulse(angle);
    }
  }
  for ( int angle = 180; angle>0; angle -= 2)
  {
    for (int i = 0; i < 10; i++)
    {
      servopulse(angle);
    }
  }
}
```

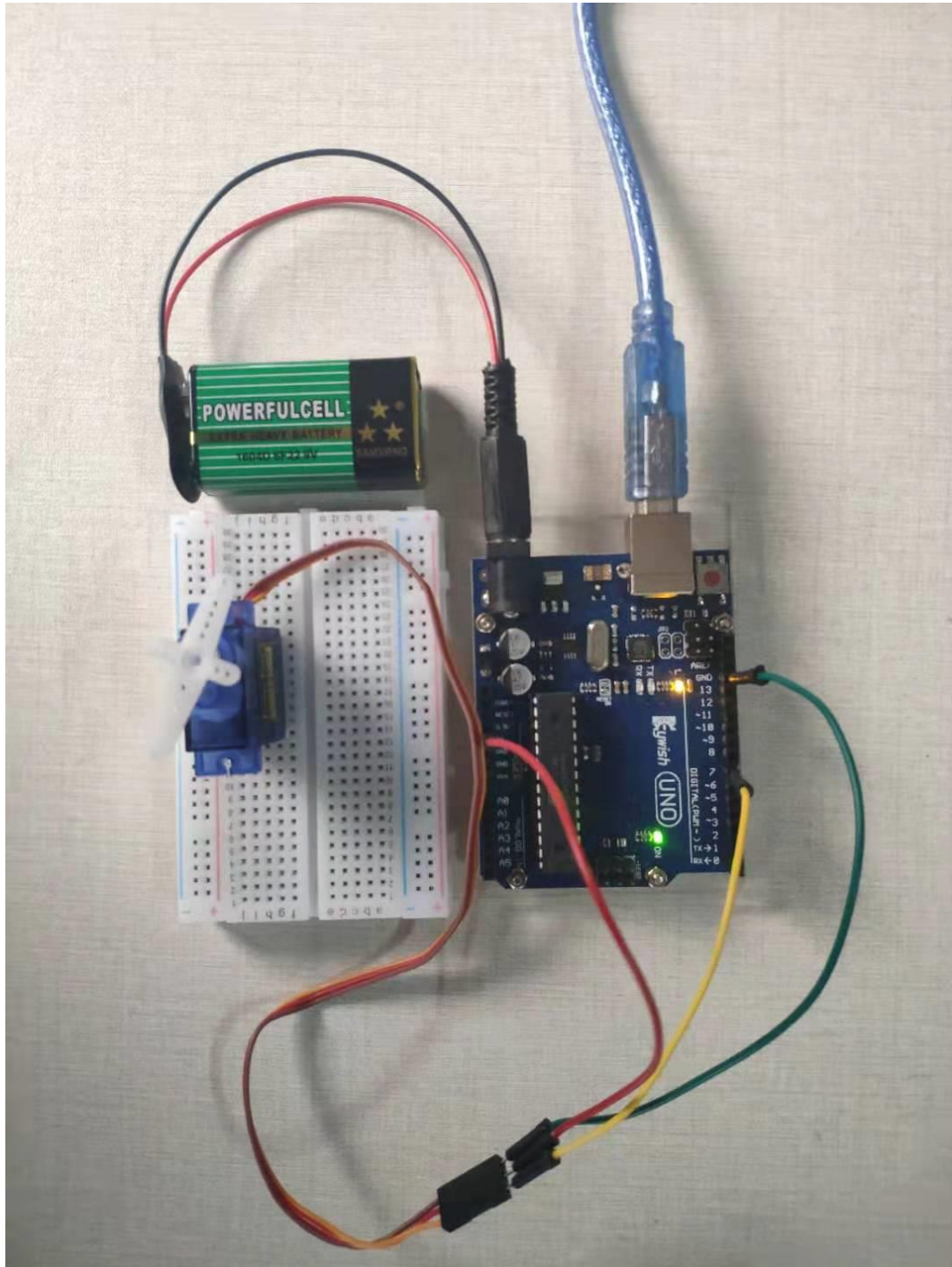
## Arduino IDE programming program ( use the steering engine library file)

```
#include <Servo.h>

Servo myservo; // 定义舵机对象，最多八个
int pos = 0;    // 定义舵机转动位置
void setup()
{
  myservo.attach(7); // 设置舵机控制针脚
}
void loop()
{
  // 0 到 180 旋转舵机，每次延时 15 毫秒
  for(pos = 0; pos < 180; pos += 1)
  {
```

```
myservo.write(pos);  
delay(15);  
}  
// 180 到 0 旋转舵机，每次延时 15 毫秒  
for(pos = 180; pos>=1; pos-=1)  
{  
    myservo.write(pos);  
    delay(15);  
}  
}
```

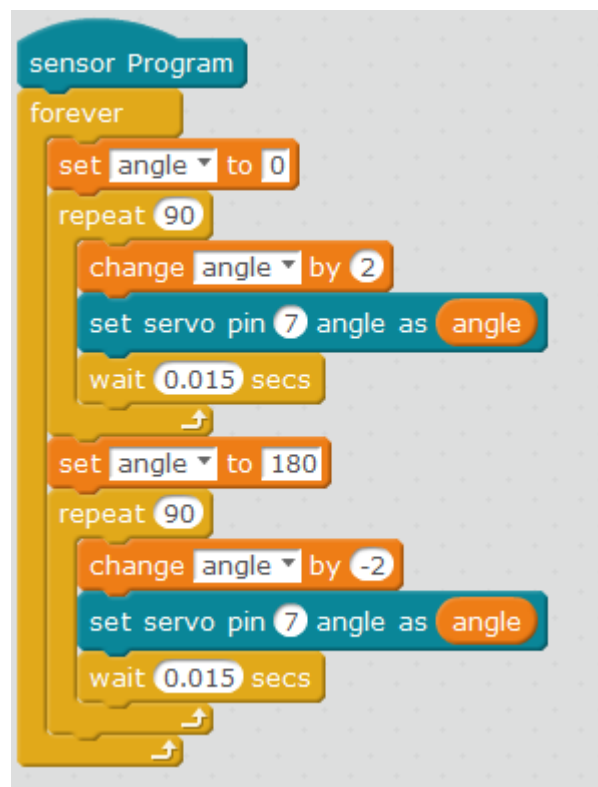
## Experiment Result



### Mblock graphical programming program

MBlock writes the program as shown in the figure below:





## Mixly graphical programming program

The program written by Mixly is shown as follows:

