

# LK Cokoino Arm Kit Tutorial



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## I About Us

LK Cokoino is mainly engaged in maker education. Its product series include Arduino, Raspberry, Microbit, ESP WiFi, etc. Our R & D and production team has been engaged in this industry for 7 years, with very strong R & D and production capacity, and the products developed and produced have been consistently praised by customers.

Email : [cokoino@outlook.com](mailto:cokoino@outlook.com)

Github : <https://github.com/Cokoino/CKK0006> (Tutorial)

Facebook: <https://www.facebook.com/cokino.lk>

Company website address: <http://cokino.com/>

Amazon:[https://www.amazon.com/stores/COKOINO/page/D21BC7AE-4404-4508-89AA-BEDE7718902C?ref\\_=ast\\_bln](https://www.amazon.com/stores/COKOINO/page/D21BC7AE-4404-4508-89AA-BEDE7718902C?ref_=ast_bln)

## II Arm Kit System

### 1. Overview

The Mechanical arm is the most widely used automated mechanical device in the mechanical field. It can be seen in the fields of industrial manufacturing, medical treatment, entertainment services, military, semiconductor manufacturing, and space exploration. Although their shapes are different, they all have a common feature, that is, they can accept instructions and accurately locate a point in the three-dimensional (or two-dimensional) space for operations.

The mechanical arm can imitate certain actions of human hands and arms, and realize grasping, assembling, and handling actions according to a fixed program. It is the earliest industrial robot that can replace human labor to achieve mechanization and automation of production, and can replace humans to complete dangerous operations. Therefore, mechanical arm are widely used in the assembly, handling, disassembly, inspection of flammable and explosive materials, as well as high-risk environments such as fire fighting, anti-terrorism and riot prevention.

### 2. Structure

The mechanical arm is mainly composed of three parts: the actuator, the drive mechanism and the control system. In order to grasp objects at any position and orientation in space, 6 degrees of freedom are required; degrees of freedom are the key parameter of manipulator design. The more degrees of freedom, the greater the flexibility of the manipulator, the wider the versatility, and the more complex the structure. Generally, the robot has 2 to 3 degrees of freedom.

#### 2.1 Operation Structure

The operation structure of the mechanical arm is composed of hands, arms, and torso.

##### <1> Hands

The hand is mounted on the front end of the arm. The inner hole of the arm is equipped with a transmission shaft, which can transmit the application to the wrist to rotate, stretch the wrist, and open and close the fingers.

The structure of the hand of mechanical arm is imitating a human finger, and it is divided into three types: no joints, fixed joints and free joints. The number of fingers can be divided into two fingers, three fingers, and four fingers, among which two fingers are the most used. According to the shape, size, weight, material and operation requirements of the object to be grasped, there are a variety of structural forms, such as clamping type, holding type and adsorption type, etc.

##### <2> Arms

The function of the arm is to guide the fingers to grasp the work pieces accurately and transport it to the desired position. In order for the mechanical arm to work correctly, the 3 degrees of freedom of the arm must be accurately positioned.

##### <3> Torso

The torso is a bracket for installing arms, power sources and various actuators.

### 2.2 Drive mechanism

There are four main types of drive mechanisms used by mechanical arm: hydraulic drive, pneumatic drive, electrical drive and mechanical drive.

#### **<1> Hydraulic Drive**

The hydraulic drive mechanical arm usually consists of a hydraulic motor (various oil cylinders, oil motors), servo valves, oil pumps, oil tanks, etc. The drive system is composed of a drive mechanical arm to work. Usually it has a great snatch ability (up to several hundred kilograms), and it is characterized by compact structure, smooth movement, impact resistance, vibration resistance, and good anti-explosion. However, hydraulic components require high manufacturing accuracy and sealing performance. Otherwise, oil leakage will pollute the environment.

#### **<2> Pneumatic Drive**

The drive system is usually composed of air cylinders, air valves, air tanks and air compressors. It is characterized by convenient air source, rapid action, simple structure, low cost and convenient maintenance. But it is difficult to control the speed, and the air pressure cannot be too high, so the snatch ability is low.

#### **<3> Electrical Drive**

Electrical drive is the most commonly used drive method for mechanical arm. It is characterized by convenient power supply, fast response, large driving force, convenient signal detection, transmission, and processing, and a variety of flexible control schemes can be adopted. The driving motor generally adopts a stepping motor, and a DC servo motor is the main driving method.

#### **<4> Mechanical Drive**

The mechanical drive is only used for fixed movements. Generally, a cam link mechanism is used to achieve the prescribed action. It is characterized by reliable action, high working speed and low cost, but it is not easy to adjust. Others also use hybrid drive, that is, liquid-gas or electric-hydraulic hybrid drive.

### **2.3 Control System**

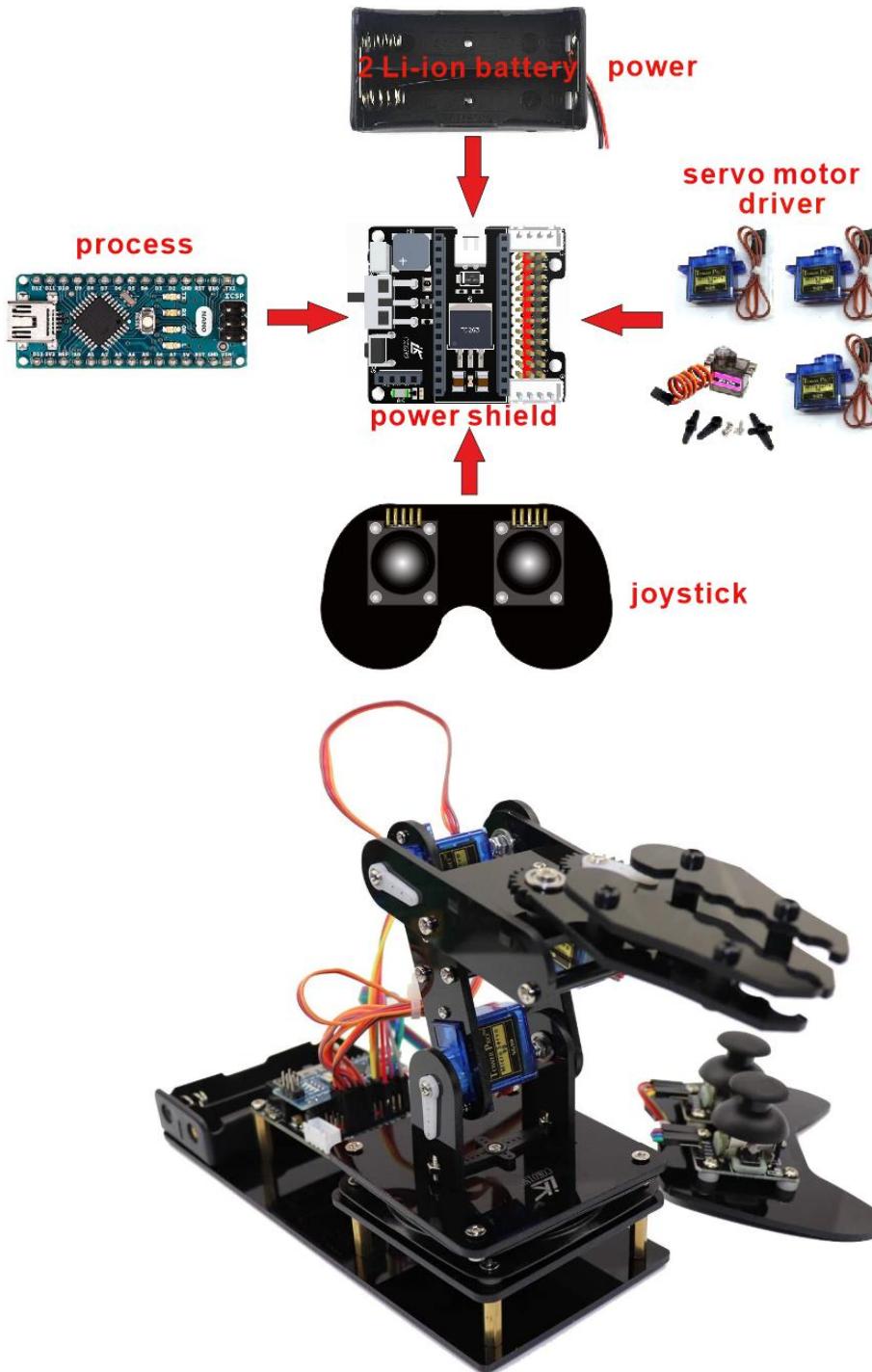
The control system completes specific actions by controlling the motors of each degree of freedom of the mechanical arm. At the same time, the feedback information from the sensor is received to form a stable closed-loop control.

The elements of mechanical arm control include work sequence, arrival position, action time, movement speed, acceleration and deceleration, etc. The control of the mechanical arm is divided into two types: point position control and continuous trajectory control.

The control system can be designed to adopt digital sequence control according to the requirements of the action. It must first compile a program to store it, and then control the mechanical arm to work according to the prescribed program.

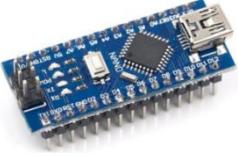
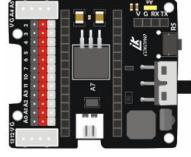
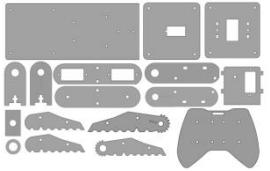
### III Cokino Arm Kit

The above-mentioned are all demanding mechanical arm. It has high precision, large volume, heavy weight, and expensive price. It is very complicated and unnecessary for our beginners and maker hobbies. Next, we will introduce the DIY-based cokino mechanical arm. Below, we will use pictures to express the control system, control method, power supply, power conversion, and actuator of the mechanical arm.



## IV Components List

### 1. List

	NANO board*1		NANO shield*1
	USB Cable*1		Joystick module*2
	A pair of Acrylic sheet		SG90 Servo*3
	18650 battery case*1		MG90S Servo*1
	turntable*1		DuPont line*8
	P1.2*4mm self-tapping screw*17		M2*8mm round head screw *8
	M2 nut*8		M3*6mm round head screw*20
	M3*10mm round head screw*10		M3*10mm countersunk head screw*2
	M3*8mm countersunk head screw*6		M3*12mm countersunk head screw*4
	M3*18mm countersunk head screw*1		M3 mm nut*12
	M3 mm self-locking screw*7		M3*20mm copper column*4
	M3*30MMAluminum column*2		M3*37MMAluminum column*2

	Φ 3*3mm nylon column*12		M3*6 black nylon stud*4
	M3*5 black nylon screw*8		Φ 3*8*4 flange bearing F693ZZ*4
	M2 Phillips screwdriver		M3 Phillips screwdriver
	5.5-4 spanner		M3 Flat pad*3

## 2.Parts documentation

We provide a wealth of documents to help you learn and understand the working principle of the main components of the robotic arm, such as: arduino nano main control board, cokino nano expansion board, servo, remote sensing module specifications and usage, etc., please refer to us for specific instructions "Documents" folder.

## 3.Notes Before Use

- \* This product contains small parts, please prevent children from swallowing it by mistake.
- \* Children must install and use our product in the company of an adult.
- \* This product contains sharp parts, please prevent punctures.
- \* Customers need to purchase formal and qualified 18650 lithium batteries.
- \* It is forbidden to use this product in a watery or humid environment.
- \* It is forbidden to forcibly move the mechanical arm by hand during operation, otherwise it will cause permanent damage.

# V Set up a programming environment

## 1.Install Arduino IDE

### 1.1 Install in Windows System

See: <https://www.arduino.cc/en/Guide/Windows>

### 1.2 Install in macOS System

See: <https://www.arduino.cc/en/Guide/macOS>

### 1.3 Install in Linux System

See: <https://www.arduino.cc/en/Guide/Linux>

### 1.4 Portable IDE (Windows and Linux)

See: <https://www.arduino.cc/en/Guide/PortableIDE>

## 1.5 ChromeOS (Arduino Create App) in the Chrome Web Store

See: <https://chrome.google.com/webstore/detail/arduino-create/dcgicpihgkmccijgalccpmjlnjopdfe>

Noted of downloading the software package for free:



## 2. Use Arduino IED

Please refer to the Arduino IDE operation interface and tutorial:

<https://www.arduino.cc/en/Guide/Environment>

## 3. PC install CH340 USB to serial port driver

Our nano motherboard uses a USB-to-serial chip made in China. You can select the installation package you need according to this link and install it:

[http://www.wch-ic.com/downloads/CH341SER\\_EXE.html](http://www.wch-ic.com/downloads/CH341SER_EXE.html)

relation files	
file name	file content
CH341SER.ZIP	CH340/CH341 USB to serial port Windows driver, includes DLL dynamic library and non-standard baud rate settings and other instructions. Supports 32/64-bit Windows 10/8.1/8/7/VISTA/XP, Server 2016/2012/2008/2003, 2000/ME/98, Microsoft WHQL Certified, supports USB to 3 and 9 wire serial ports.
CH341SER_LINUX.ZIP	CH340/CH341 USB to serial port LINUX driver, supports 32/64-bit operation system.
CH341SER_MAC.ZIP	CH340/CH341 USB to serial port MAC OS driver, supports 32/64-bit operation system, contains instructions for use.
CH341SER_ANDROID.ZIP	CH340/CH341 USB to serial port Android free drive application library, for Android OS 3.1 and above version which supports USB Host mode already, no need to load Android kernel driver, no root privileges. Contains apk, lib library file (Java Driver), App Demo Example (USB to UART Demo SDK).

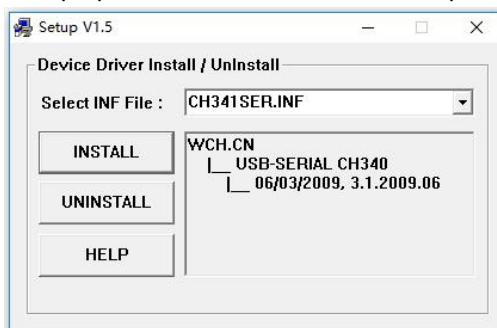
Note: The "drivers" folder we provide also provides the above drivers.

### Windows Installation Example:

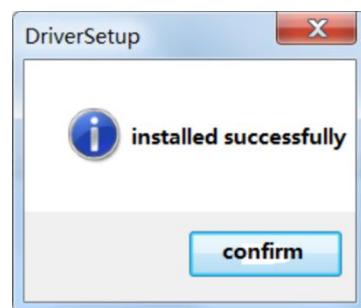
3.1 After unzipping, double-click to open the installer. As shown below:



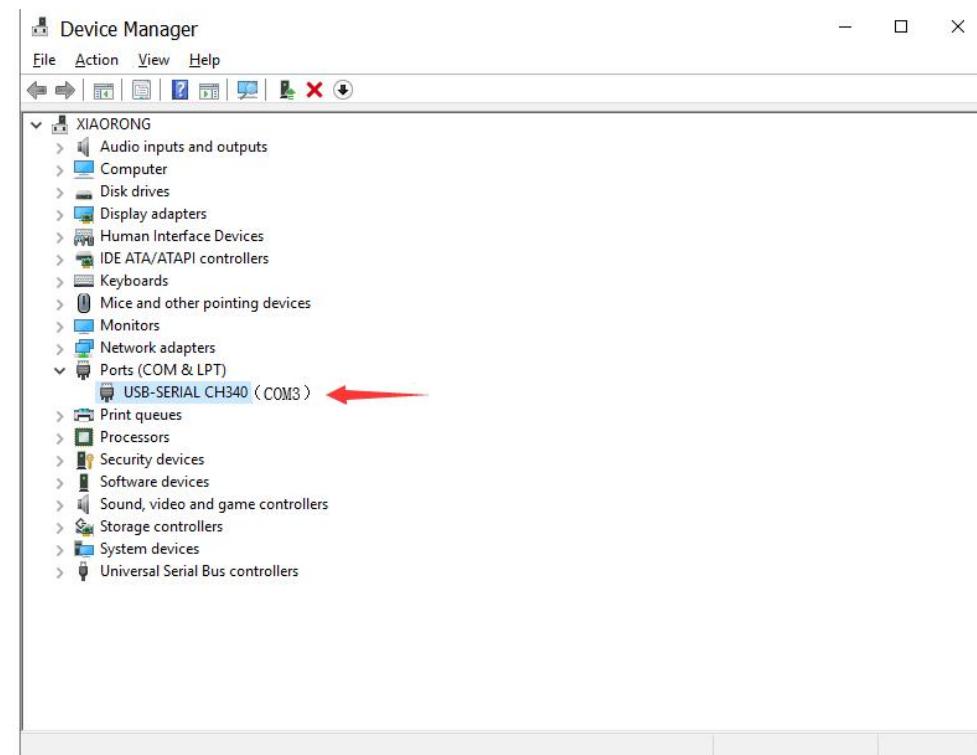
3.2 Pop up a install interface, click the top button to install the driver



3.3 Successful installation



3.4 If the driver is successfully installed, when the nano motherboard is connected to the computer through the USB cable, under the path "Computer" -> "Properties" -> "Device manager", you can find CH340 COM3, as shown below.



## 4. More information for Using Arduino IDE

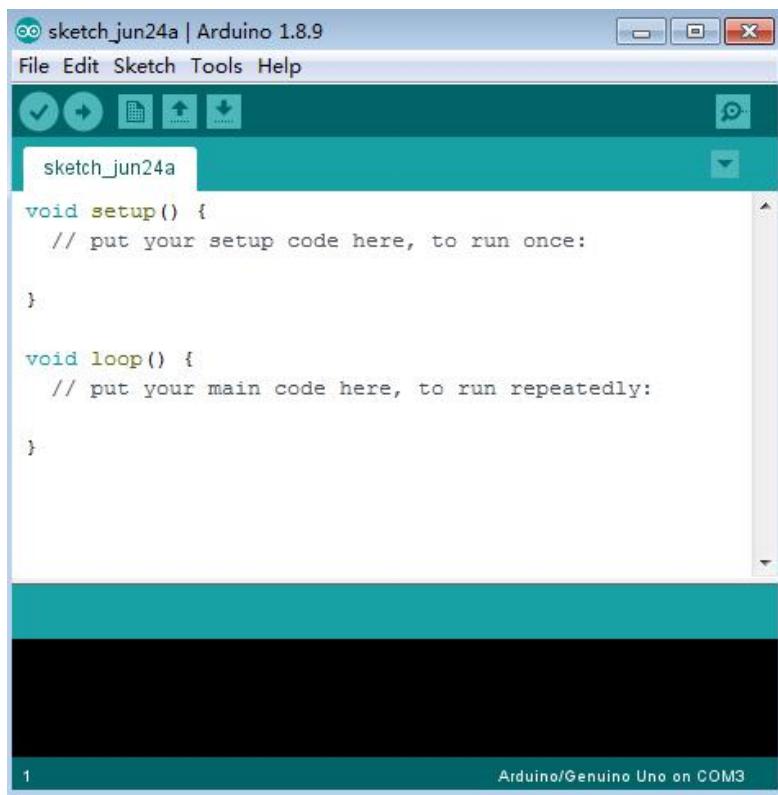
Official tutorials: <https://www.arduino.cc/en/Tutorial/HomePage>

Language Reference: <https://www.arduino.cc/reference/en/>

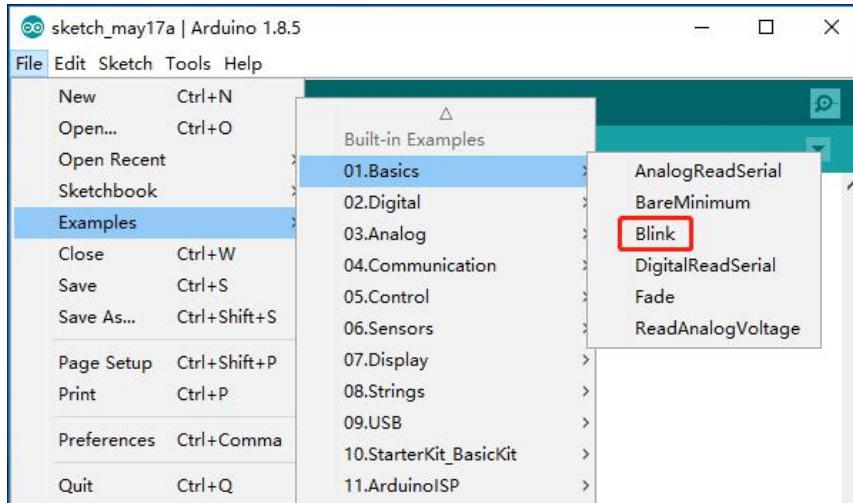
## 5. The first sample program



5.1 Double-click the computer desktop icon to open the arduino IDE, as shown below:



5.2 Open the LED blink example sketch: File > Examples >01.Basics > Blink.



```

@@ Blink | Arduino 1.8.9
File Edit Sketch Tools Help
Blink
by Arturo Guadalupi
modified 8 Sep 2016
by Colby Newman

This example code is in the public domain.

http://www.arduino.cc/en/Tutorial/Blink
 */

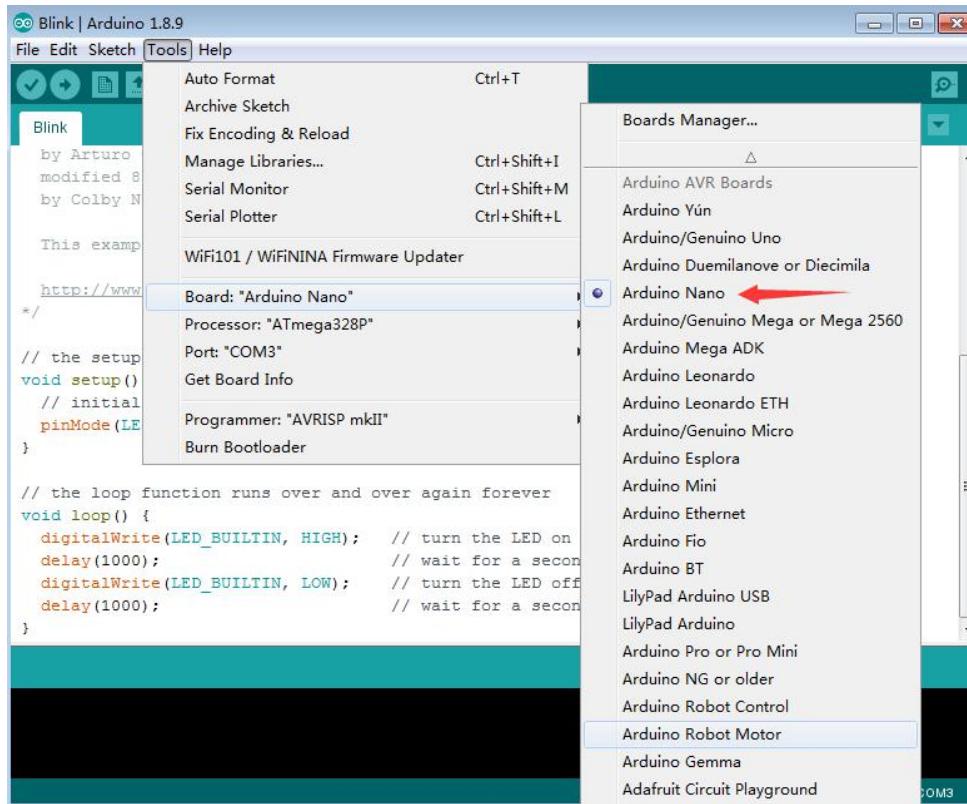
// the setup function runs once when you press reset or power the board
void setup() {
    // initialize digital pin LED_BUILTIN as an output.
    pinMode(LED_BUILTIN, OUTPUT);
}

// the loop function runs over and over again forever
void loop() {
    digitalWrite(LED_BUILTIN, HIGH);      // turn the LED on (HIGH is the voltage level)
    delay(1000);                         // wait for a second
    digitalWrite(LED_BUILTIN, LOW);       // turn the LED off by making the voltage LOW
    delay(1000);                         // wait for a second
}

```

Arduino/Genuino Uno on COM3

5.3 Select the board type, click "tools"--->"Board"--->"Arduino Nano", as shown below:



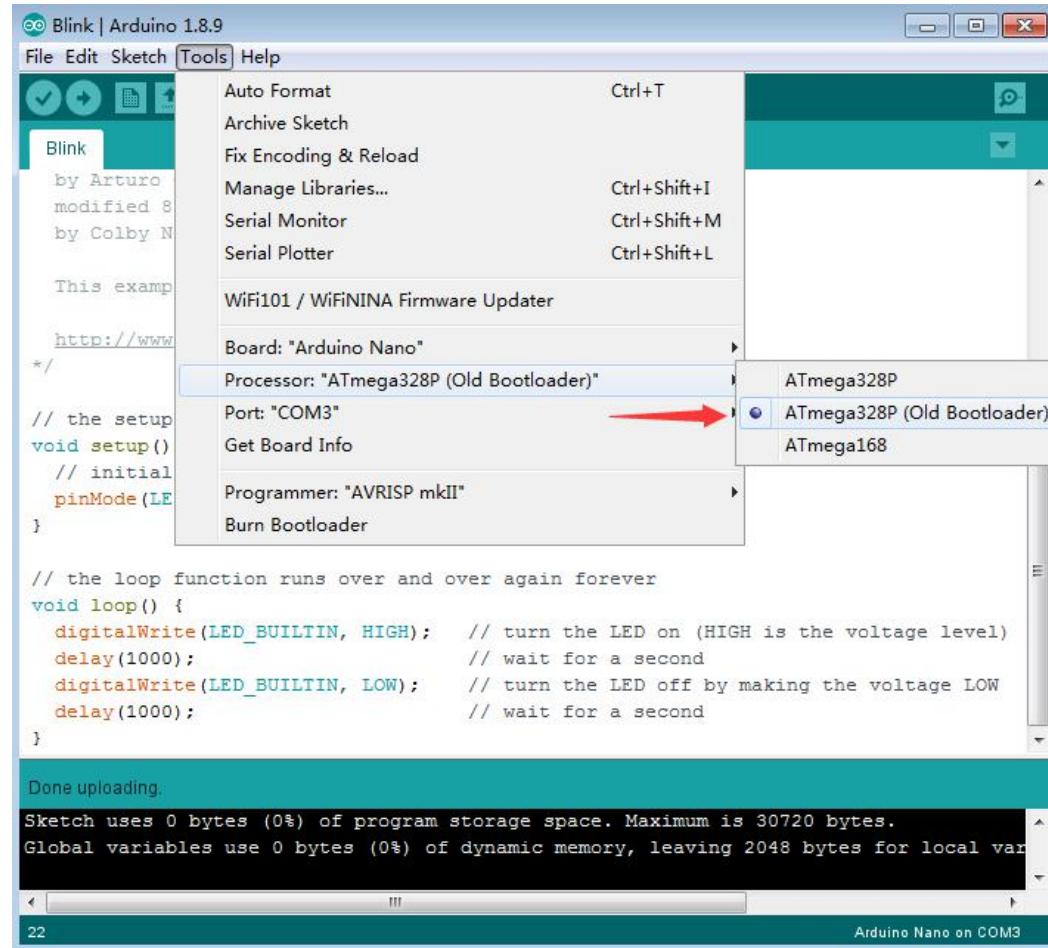
#### 5.4 Nano processor selection:

You will find this option in the Arduino IDE above version 1.8.5.

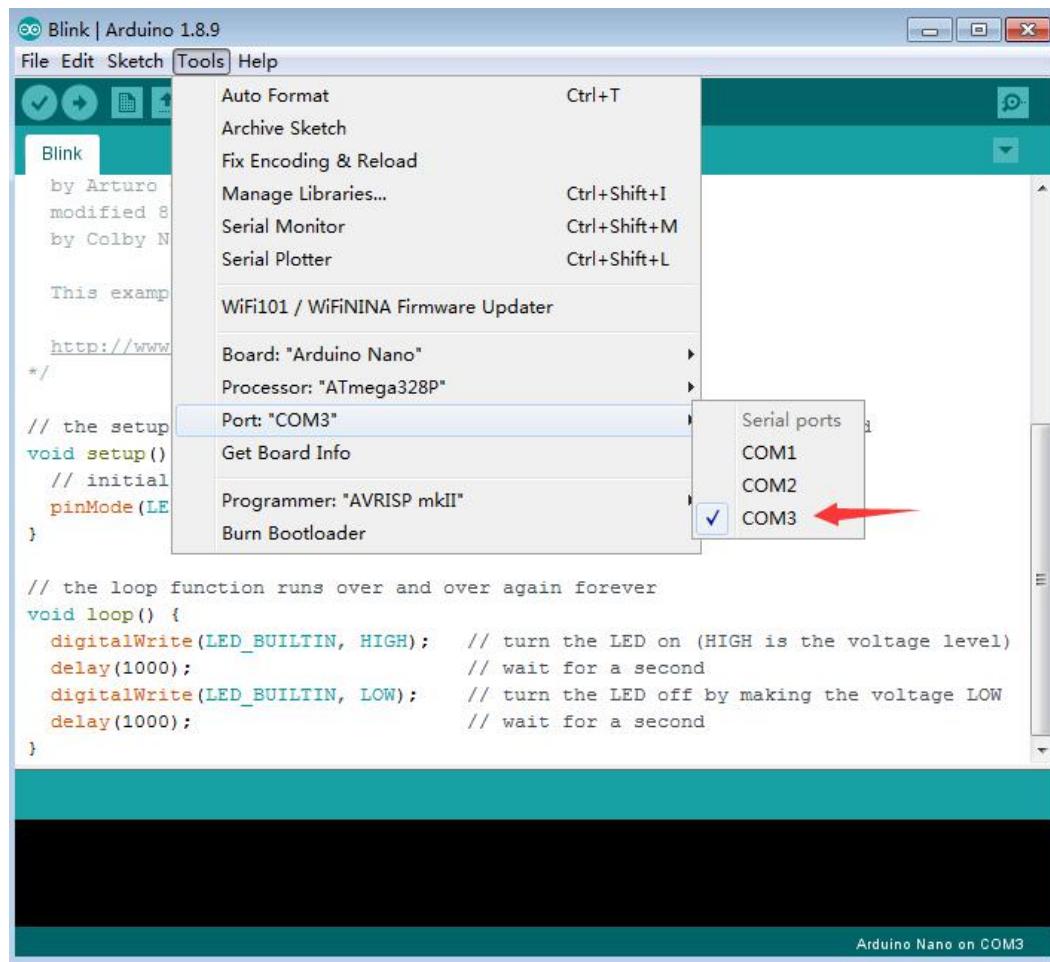
If the nano manufacturer burns the old version of the bootloader to the nano motherboard, you must select "ATmega328P (Old Bootloader)";

If the nano board is burned with a new version of the bootloader, you must select "ATmega328P".

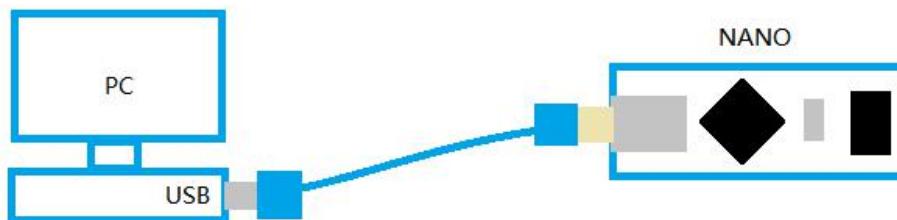
Here we choose the old bootloader, as shown below:



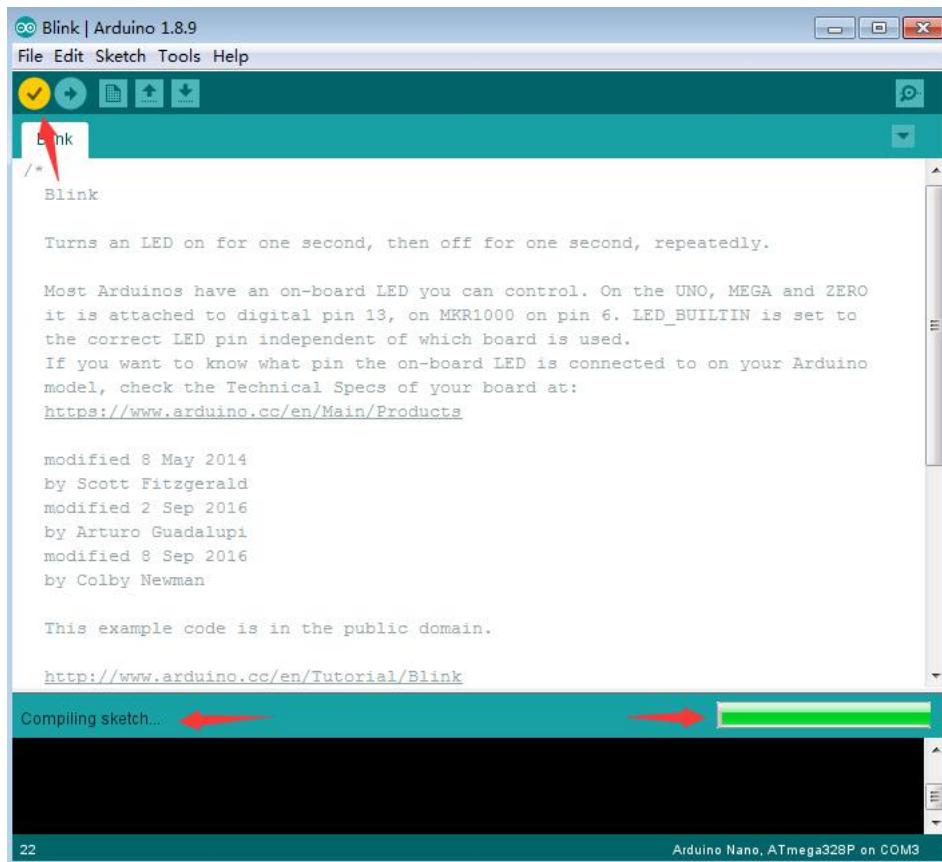
5.5 Select the port, "tools"---> "Port"---> "COM port of nano motherboard", as shown below:



5.6 Connect the PC to the nano motherboard via the USB cable



5.7 Compile the code and verify the correctness of the code, as shown below:



The screenshot shows the Arduino IDE interface with the 'Blink' sketch open. The status bar at the bottom right indicates 'Arduino Nano, ATmega328P on COM3'. In the center, a progress bar shows the compilation process. A red arrow points to the status bar message 'Compiling sketch...', and another red arrow points to the progress bar.

```
/* Blink | Arduino 1.8.9
File Edit Sketch Tools Help
Blink
/*
Blink

Turns an LED on for one second, then off for one second, repeatedly.

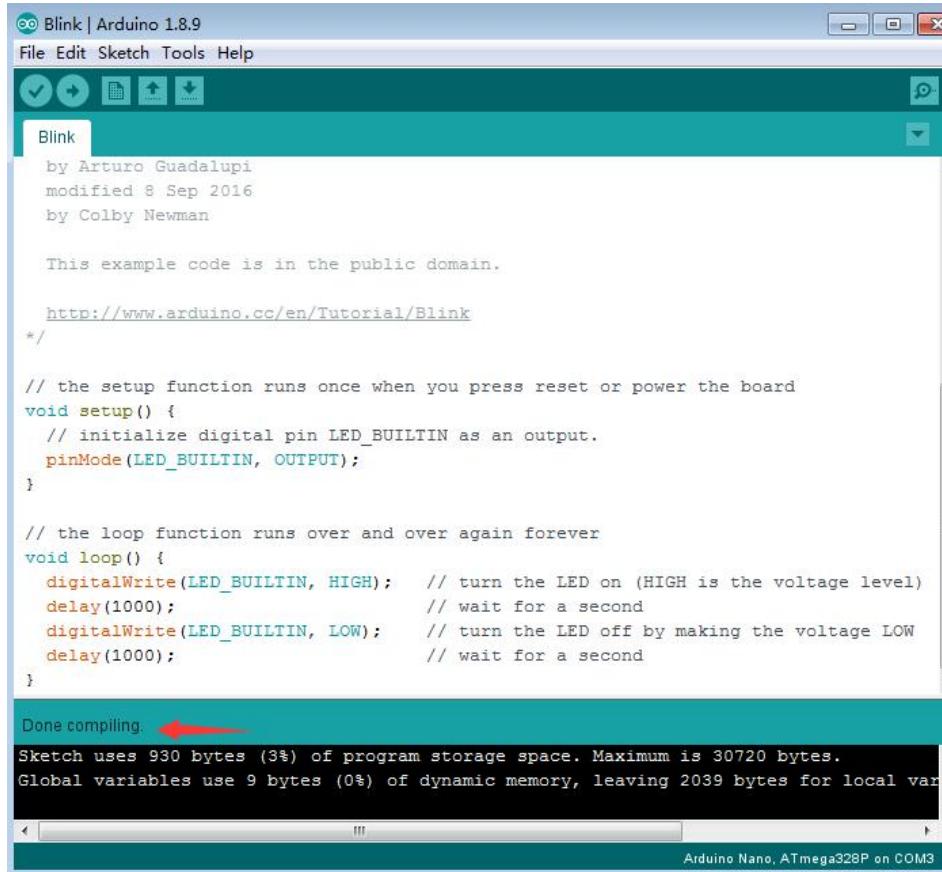
Most Arduinos have an on-board LED you can control. On the UNO, MEGA and ZERO it is attached to digital pin 13, on MKR1000 on pin 6. LED_BUILTIN is set to the correct LED pin independent of which board is used.
If you want to know what pin the on-board LED is connected to on your Arduino model, check the Technical Specs of your board at:
https://www.arduino.cc/en/Main/Products

modified 8 May 2014
by Scott Fitzgerald
modified 2 Sep 2016
by Arturo Guadalupi
modified 8 Sep 2016
by Colby Newman

This example code is in the public domain.

http://www.arduino.cc/en/Tutorial/Blink
Compiling sketch... →
22 Arduino Nano, ATmega328P on COM3
```

## 5.8 Upload the code



The screenshot shows the Arduino IDE interface with the 'Blink' sketch open. The status bar at the bottom right indicates 'Arduino Nano, ATmega328P on COM3'. The code editor displays the 'Blink' sketch. A red arrow points to the status bar message 'Done compiling.', and another red arrow points to the message 'Sketch uses 930 bytes (3%) of program storage space. Maximum is 30720 bytes.' in the terminal window.

```
/* Blink | Arduino 1.8.9
File Edit Sketch Tools Help
Blink
by Arturo Guadalupi
modified 8 Sep 2016
by Colby Newman

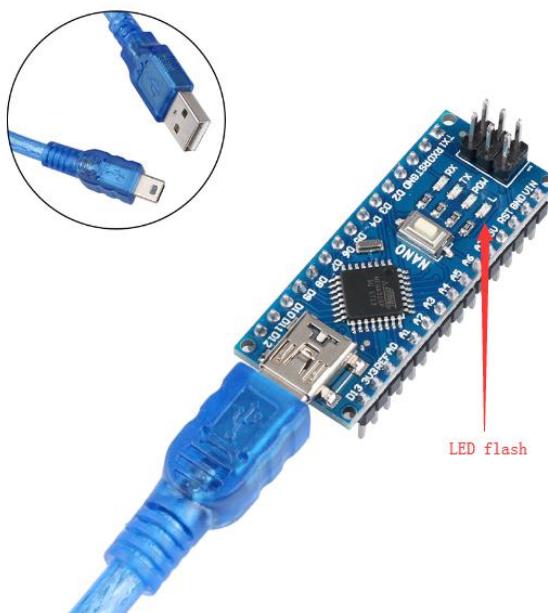
This example code is in the public domain.

http://www.arduino.cc/en/Tutorial/Blink
*/
// the setup function runs once when you press reset or power the board
void setup() {
    // initialize digital pin LED_BUILTIN as an output.
    pinMode(LED_BUILTIN, OUTPUT);
}

// the loop function runs over and over again forever
void loop() {
    digitalWrite(LED_BUILTIN, HIGH);      // turn the LED on (HIGH is the voltage level)
    delay(1000);                         // wait for a second
    digitalWrite(LED_BUILTIN, LOW);       // turn the LED off by making the voltage LOW
    delay(1000);                         // wait for a second
}

Done compiling. →
Sketch uses 930 bytes (3%) of program storage space. Maximum is 30720 bytes.
Global variables use 9 bytes (0%) of dynamic memory, leaving 2039 bytes for local var
Arduino Nano, ATmega328P on COM3
```

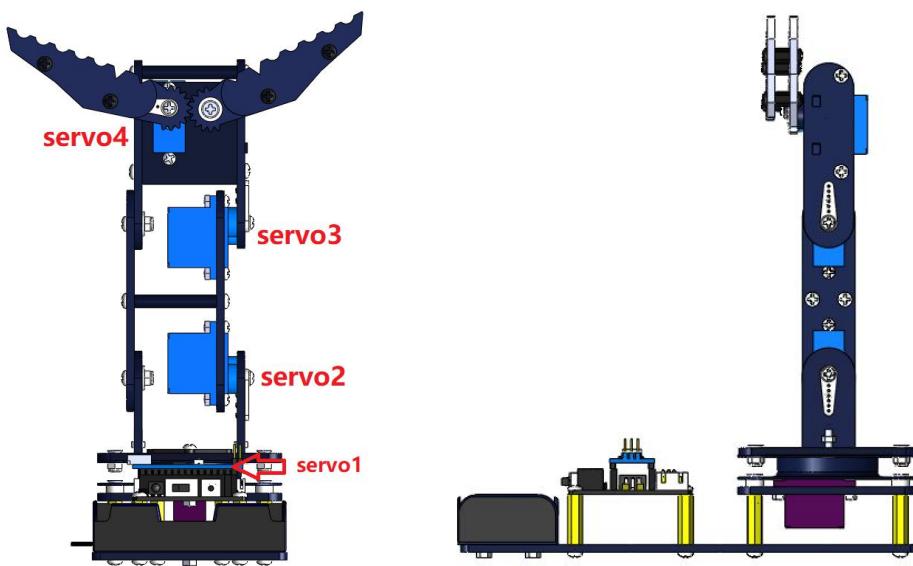
5.9 As a result, the L-label LED of the nano motherboard flashes once every 1 second, as shown below:



## VI Initialize the servo before installation

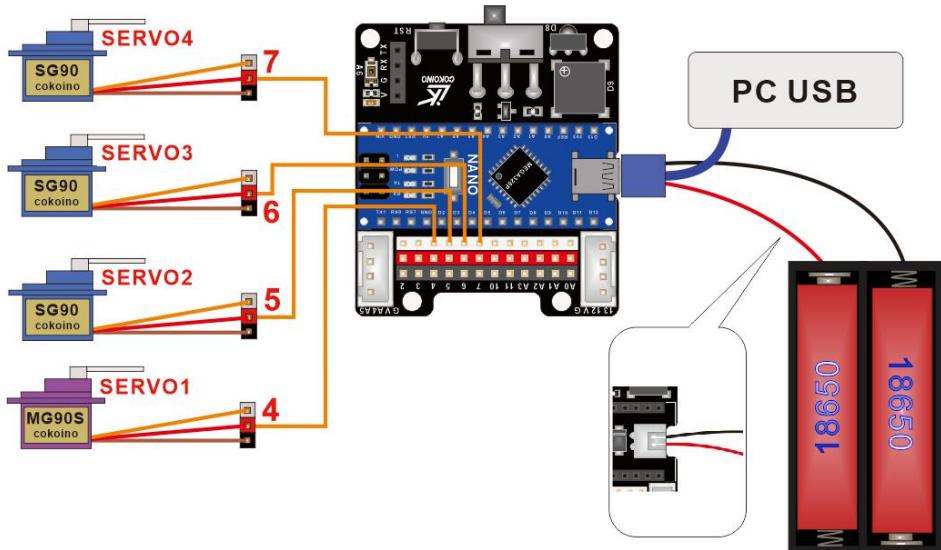
### 1. Why initialize servo?

Because we cannot know the angle of the servo when it comes out from the factory, and we need to know the angle of the servo when we install the robotic arm to assemble it correctly. All the servo motors of our robotic arm must be initialized to 90 degrees before they can be installed normally. The figure below is an example of the initial posture of the robot after it is installed. Only when the servo of the robotic arm is installed correctly according to this posture can the robot run perfectly.

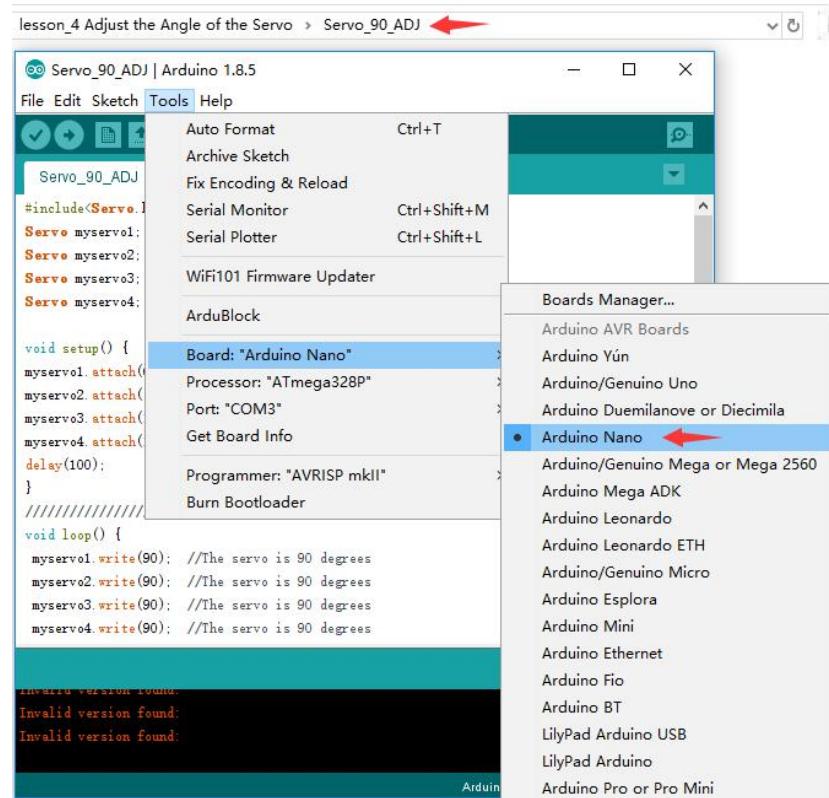


### 2. How to initialize the 4 servo angles of the robot?

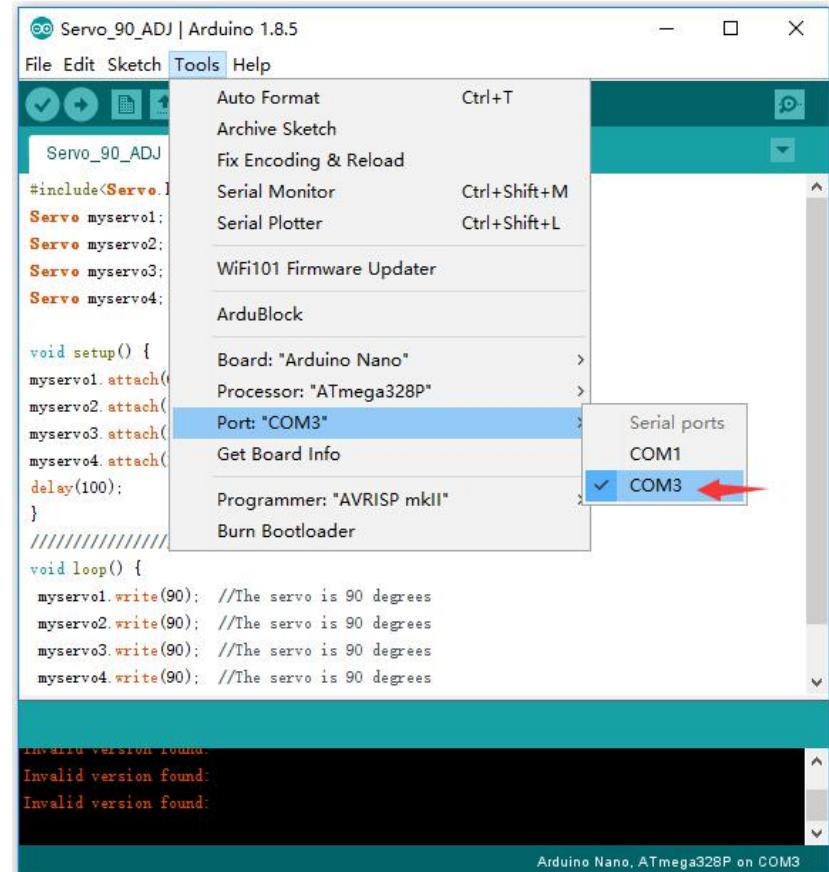
2.1 Please connect the 4 servos, naono motherboards, nano expansion boards, and battery boxes as shown in the figure below, and then connect them to the PC via a mini USB cable.



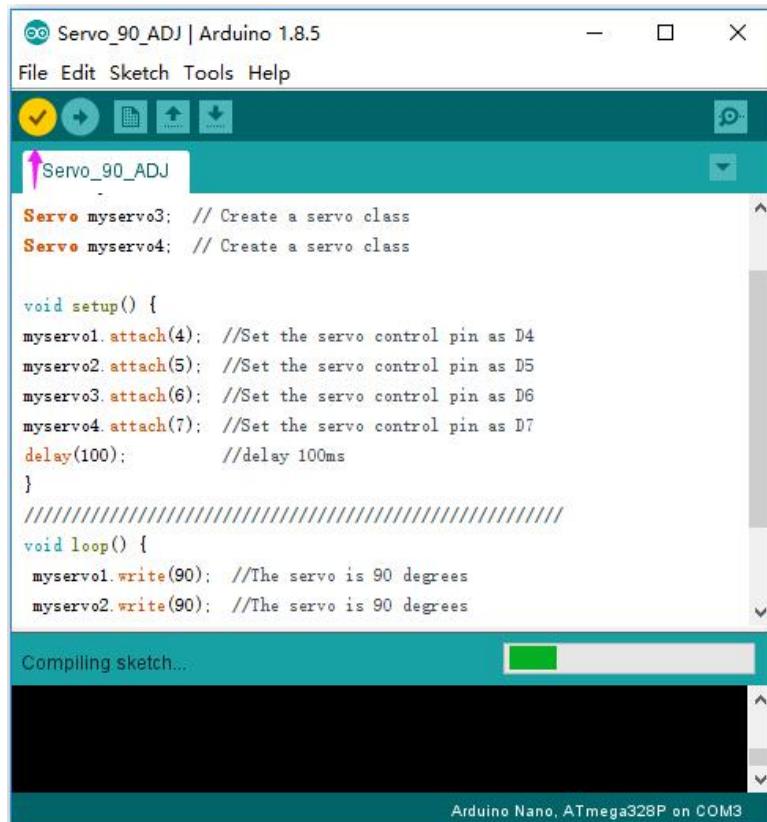
2.2 Then use the arduino IDE to open the source code program in the "Code"-->"Servo\_90\_Adj" folder, and select the motherboard model, as shown in the figure below:



### 2.3 Choose a USB port



## 2.4 Verification Program



The screenshot shows the Arduino IDE interface with the title bar "Servo\_90\_Adjust | Arduino 1.8.5". The menu bar includes File, Edit, Sketch, Tools, and Help. Below the menu is a toolbar with icons for upload, refresh, and other functions. The code editor window contains the following sketch:

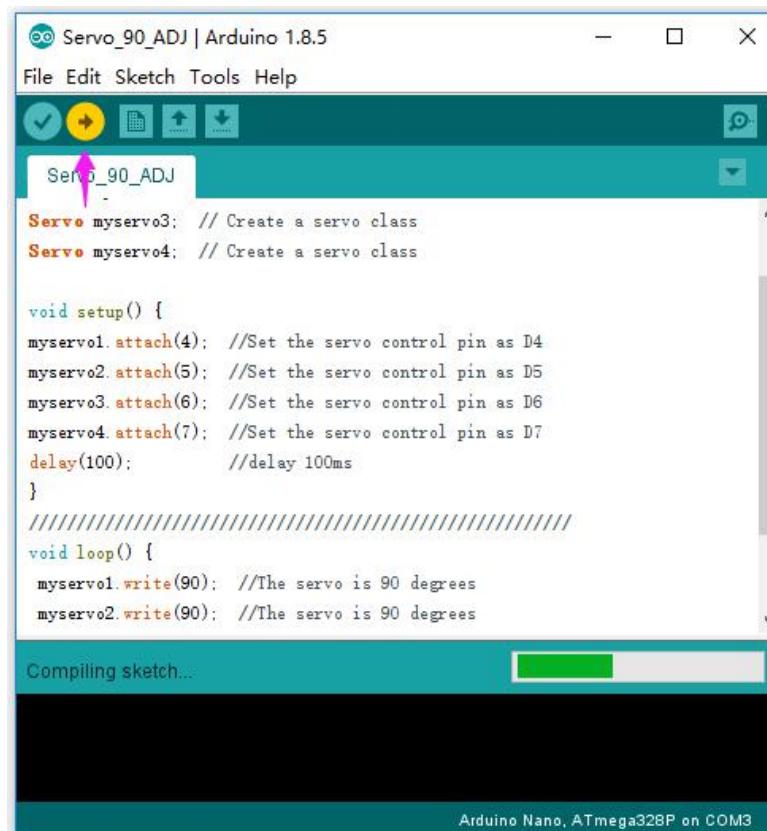
```
Servo myservo3; // Create a servo class
Servo myservo4; // Create a servo class

void setup() {
  myservo1.attach(4); //Set the servo control pin as D4
  myservo2.attach(5); //Set the servo control pin as D5
  myservo3.attach(6); //Set the servo control pin as D6
  myservo4.attach(7); //Set the servo control pin as D7
  delay(100); //delay 100ms
}

void loop() {
  myservo1.write(90); //The servo is 90 degrees
  myservo2.write(90); //The servo is 90 degrees
```

The status bar at the bottom indicates "Compiling sketch..." and "Arduino Nano, ATmega328P on COM3".

2.5 Upload the program to the NANO motherboard, then turn on the power switch on the expansion board, the program will automatically initialize the servo servo to 90 degrees. (Note: The Bluetooth module cannot be plugged into the expansion board when uploading the program)



The screenshot shows the Arduino IDE interface with the title bar "Servo\_90\_Adjust | Arduino 1.8.5". The menu bar includes File, Edit, Sketch, Tools, and Help. Below the menu is a toolbar with icons for upload, refresh, and other functions. The code editor window contains the same sketch as the previous screenshot:

```
Servo myservo3; // Create a servo class
Servo myservo4; // Create a servo class

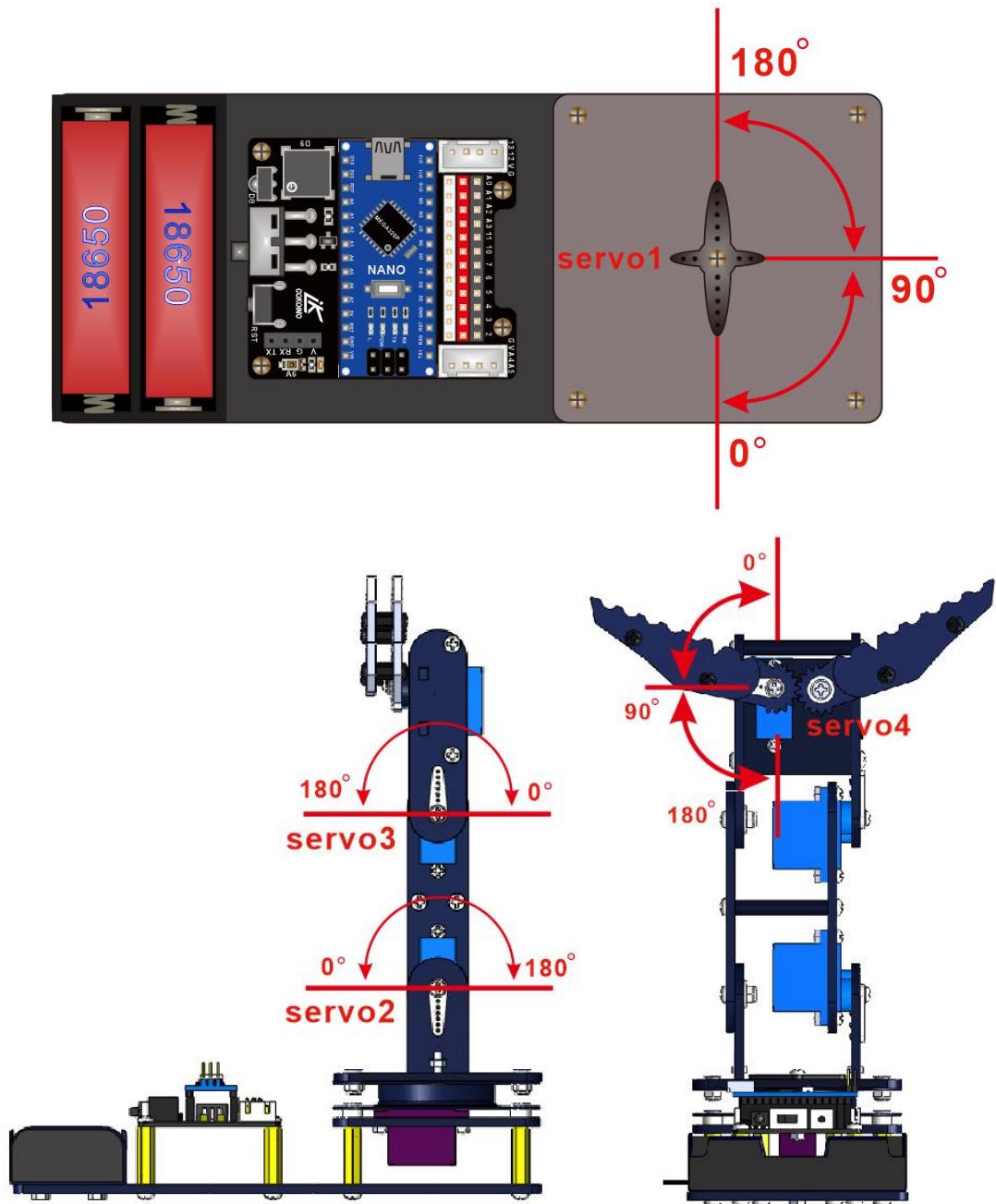
void setup() {
  myservo1.attach(4); //Set the servo control pin as D4
  myservo2.attach(5); //Set the servo control pin as D5
  myservo3.attach(6); //Set the servo control pin as D6
  myservo4.attach(7); //Set the servo control pin as D7
  delay(100); //delay 100ms
}

void loop() {
  myservo1.write(90); //The servo is 90 degrees
  myservo2.write(90); //The servo is 90 degrees
```

The status bar at the bottom indicates "Compiling sketch..." and "Arduino Nano, ATmega328P on COM3".

### 3.Servo installation and precautions after initial angle

It is forbidden to rotate the servo motor again after the servo servo is initialized at 90 degrees. The following figure shows the initial installation of servo1, servo2, servo3, and servo4 and the trajectory during subsequent movement.

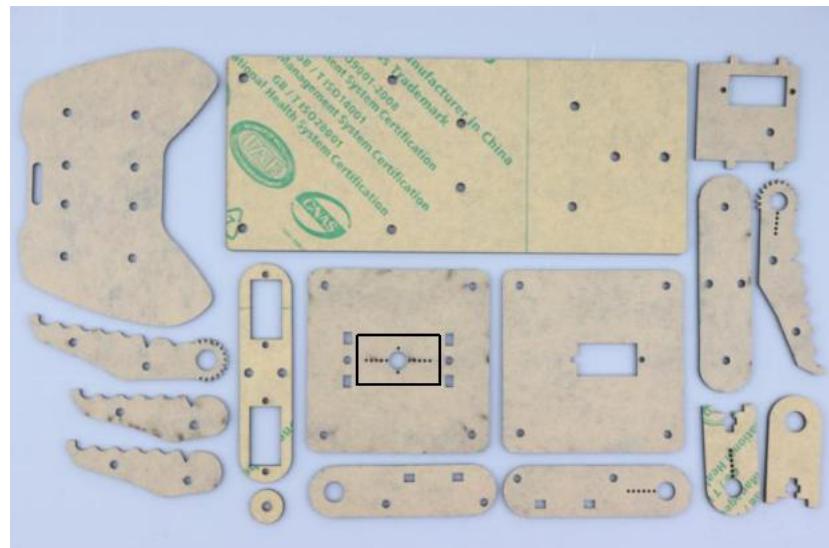


## VII Robotic arm installation and wiring

### 1. Robotic arm installation

## Start assembly

**1. Before assembly, we need to use a screwdriver to peel off the acrylic sheet**



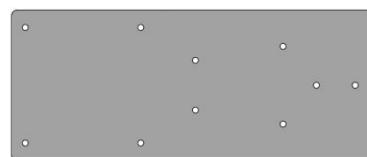
#### Step 1: Assembling the Battery Box

Tool: 

Need to prepare:

acrylic plate A

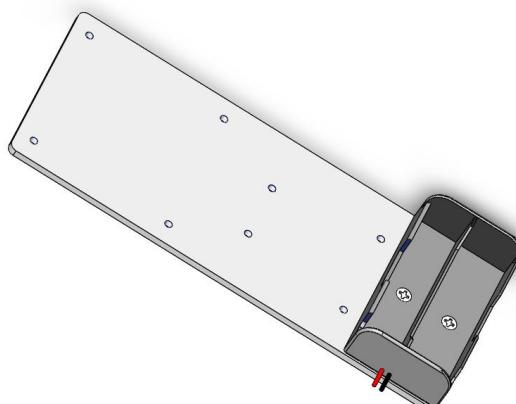
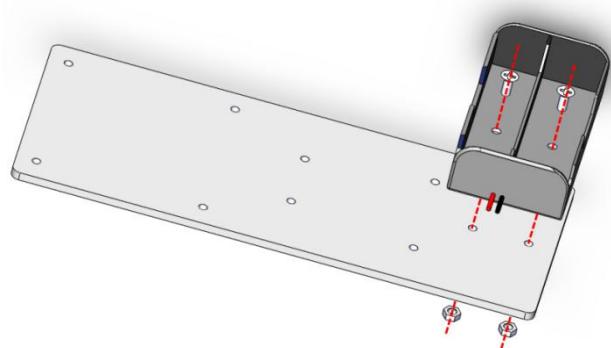
1



the Battery Box	1	
M3 * 8 countersunk head screw	2	
M3 nut	2	

**Demo:**

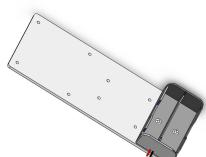
Use M3 \* 8 countersunk head screws and M3 nuts to install the battery box on the structure A;  
**Pay attention to the installation direction of the battery box;**



**Step 2: Assembling the M3 \* 20MM hexagon copper pillar**

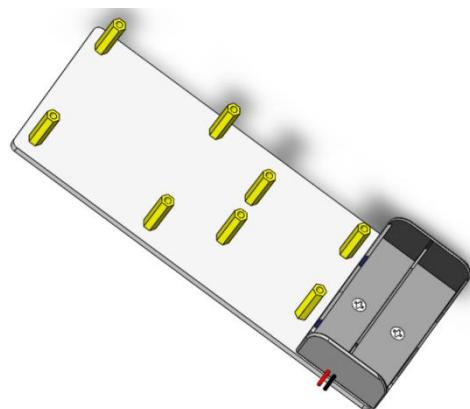
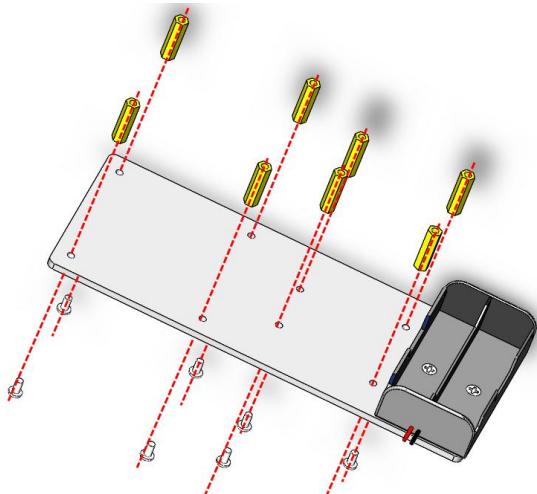
Tool: 

**Need to prepare:**

M3 * 20MM hexagon copper pillar	8	
M3*6 mm nut	8	
Step 1 structure	1	

**Demo:**

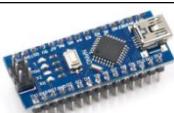
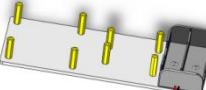
Use M3 \* 6MM round head screws to install M3 \* 20MM hexagonal copper pillars on structural member A;



### Step 3: Assembling nano board and nano shield

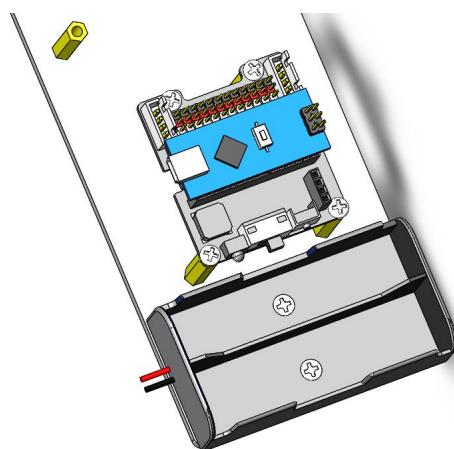
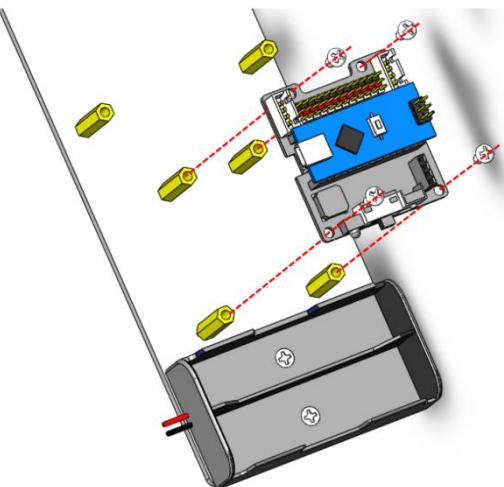
Tool: 

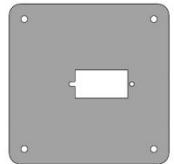
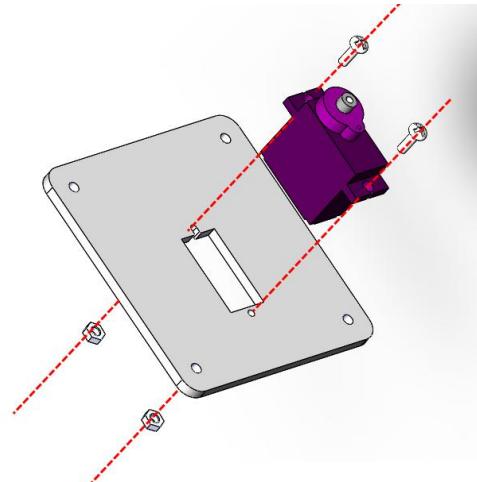
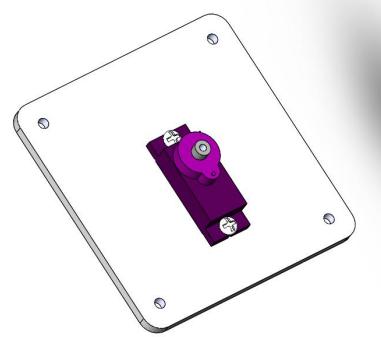
#### Need to prepare:

M3*6mm round head screw	4	
Nano board	1	
Nano shield	1	
Step 2 structure	1	

#### Demo:

Use M3 \* 6MM round head screws to fix NANO and NANO expansion board on structure A;

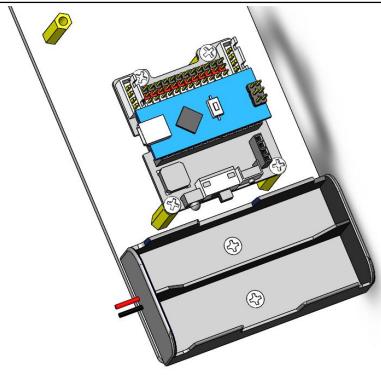
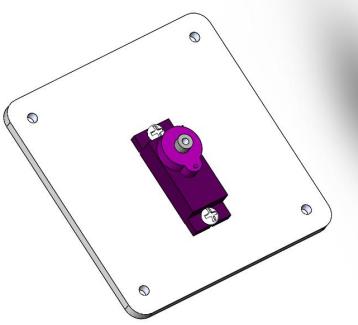


<b>Step 4: Assembling the MG90 servo</b>	Tool: 
<b><u>Need to prepare:</u></b>	
Structure B	1 
MG90 servo	1 
M2 mm nut	2 
M2*8 round head screw	2 
<b><u>Demo:</u></b>	
Use M2 * 8MM round head screws and M2 nuts to install the MG90 servo on the structural member B;	 

**Step 5: Assembling the turntable,  
structure B, structure A**

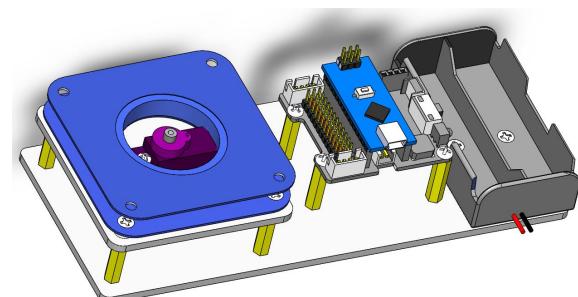
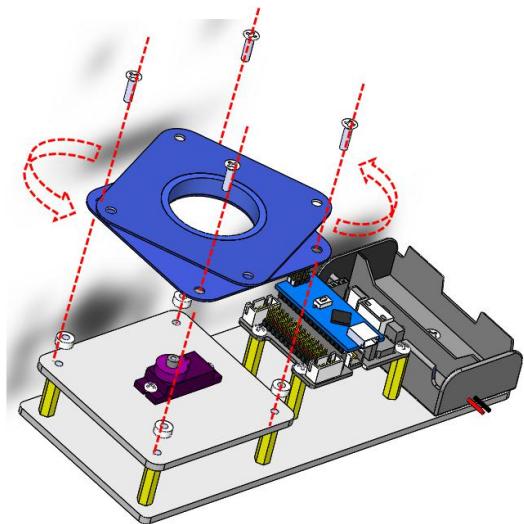
Tool: 

**Need to prepare:**

Step 3 structure	1	
Step 4 structure	1	
turntable	1	
$\phi 3*3\text{mm}$ nylon column	4	
M3*12mm countersunk head screw	4	

**Demo:**

Use M3 \* 12 countersunk head screws to fix the turntable, structure B, and nylon post on structure A;



**Step 6: Assembling the MG90 servo**

**cross**

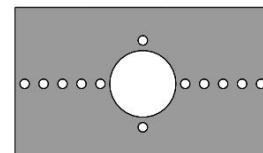
Tool:



**Need to prepare:**

Structure S

1

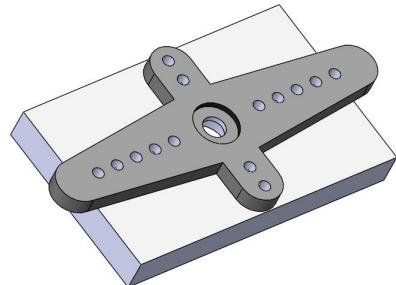
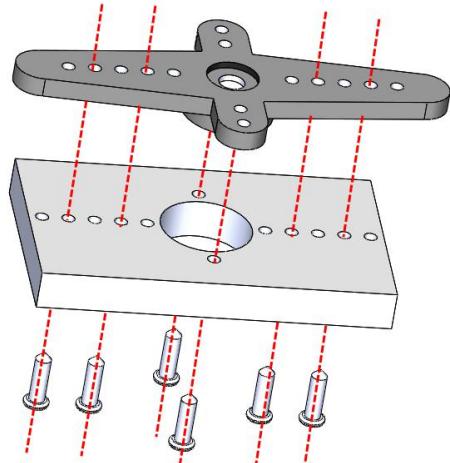


MG90 servo cross	1	
P1.2*4mm self-tapping screw	6	

**Demo:**

Use M1.2 \* 4 self-tapping screws to fix MG90 servo cross on structural member S;

**Pay attention to the installation direction of MG90 servo cross**



**Step 7: Assembling Structure D,**

**Structure E and Structure C**

**Tool:**



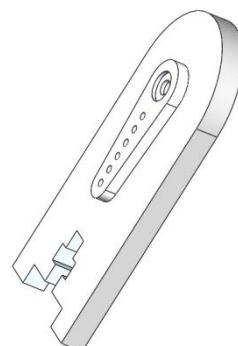
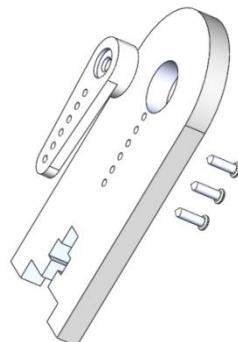
**Need to prepare:**

Structure D	1	
Structure E	1	
Structure C	1	
M3*10mm countersunk head screw	2	
P1.2*4mm self-tapping screw	3	
M3 nut	2	
Servo arm	1	

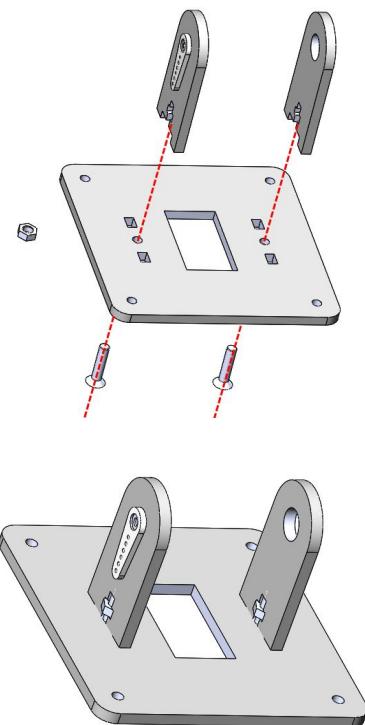
**Demo:**

Use M1.2 \* 4MM self-tapping screws to fix the servo arm on the structure D;

Pay attention to the direction of servo arm



Use M3 \* 10MM countersunk head screws and M3 nuts to fix structure D and structure E to structure C;  
**Pay attention to the installation direction of structure D and E;**



### Step 8: Assembling Step 7 Structure and Step 5 Structure

Tool:

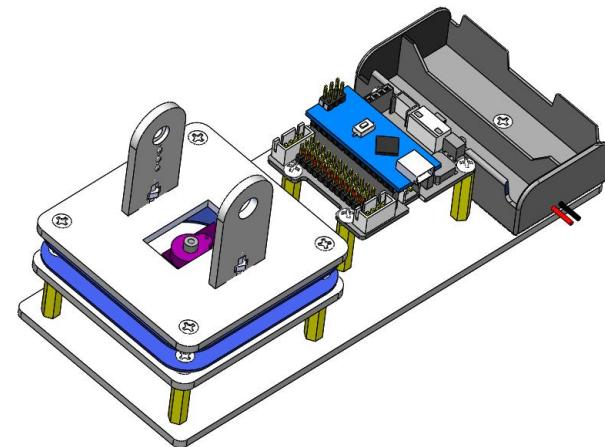
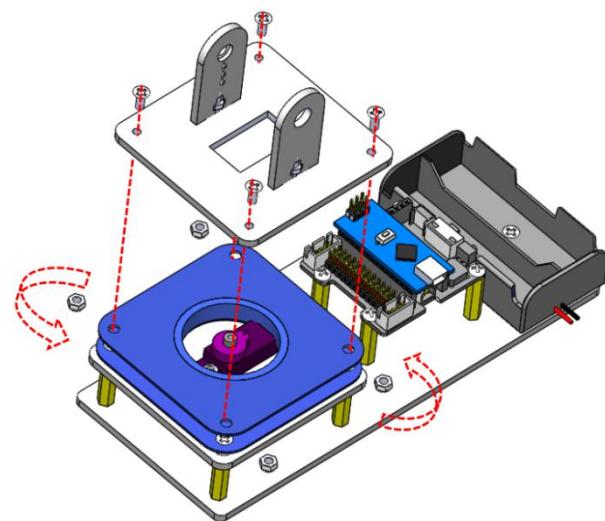
#### Need to prepare:

Step 5 Structure	1	
Step 7 Structure	1	
M3 * 8 countersunk head screws	4	
M3 self-locking nut	4	

**Demo:**

Use M3\*8 countersunk screws and M3 self-locking nuts to install the step 7 structural parts on the step 5 structural parts;

Note: When installing the self-locking nut, you can rotate the shaft on the structure of step 5 to facilitate installation;



**Step 9: Assembling Structure C and  
turntable**

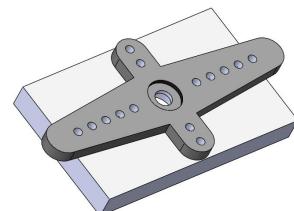
Tool:

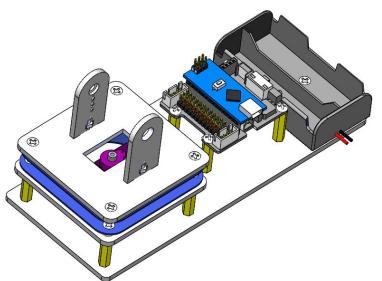
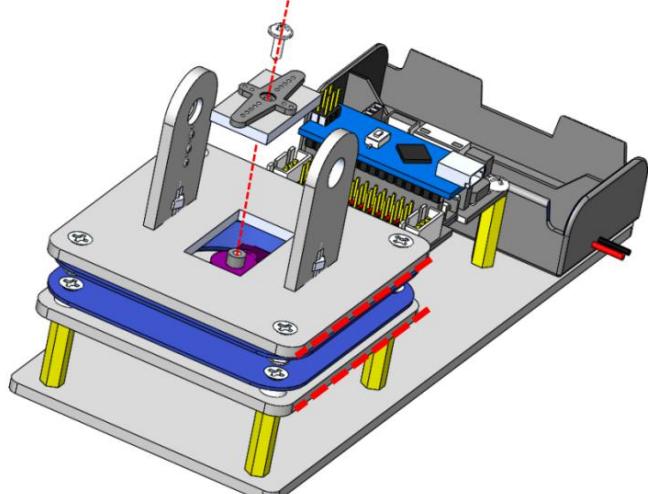
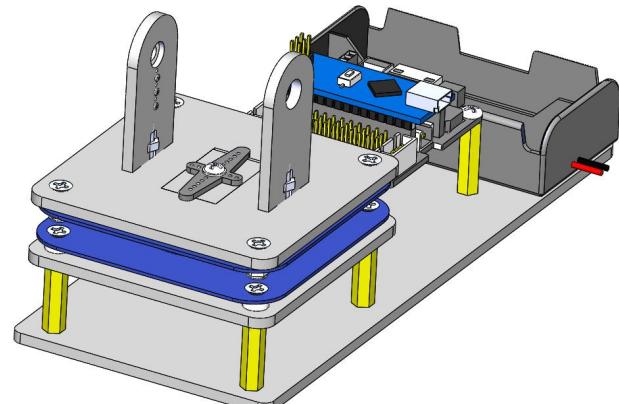


**Need to prepare:**

Step 6 Structure

1



Step 8 Structure	1	
MG90 Servo Screw	1	
<b><u>Demo:</u></b>		
<p>1. First, ensure that the MG90 servo angle is reset to zero;      2. Ensure that the side of structural member B is parallel to the side of structural member C; (the thick dotted line in the figure)      3. Use the M2.5 self-tapping screw that comes with the MG90 steering gear to fix the structure of step 6 to the steering gear on the structure of step 8;</p>  		

## Step 10: Assembling Structure F and SG92 Servo

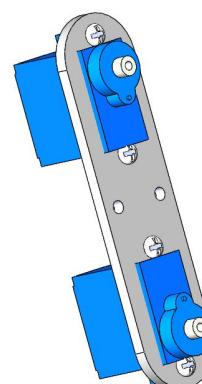
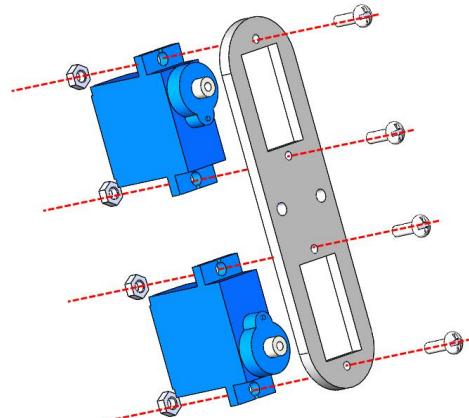
Tool: 

### Need to prepare:

Structure F	1	
M2*8mm round head screw	4	
M2 nut	4	
servo	2	

### Demo:

Use M2 \* 8MM round head screws and M2 nuts to install the servo on the structural part F;  
**Note the install direction of the servo;**



**Step 11: Assembling Structure G  
and Structure H**

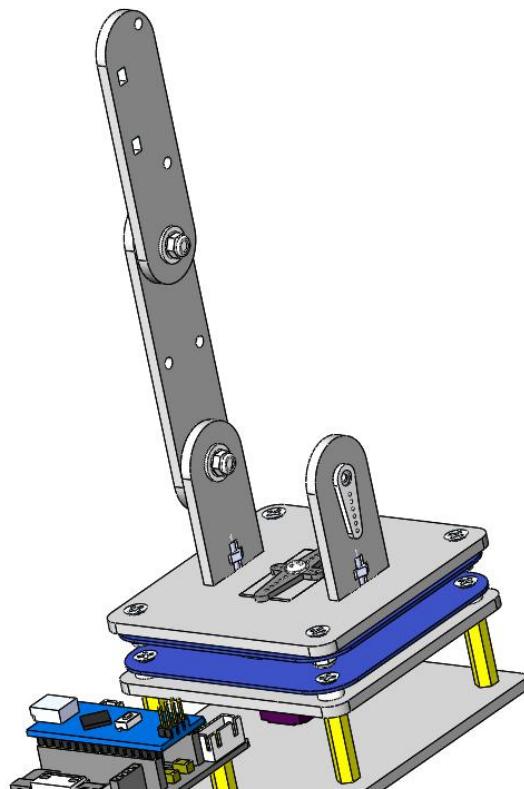
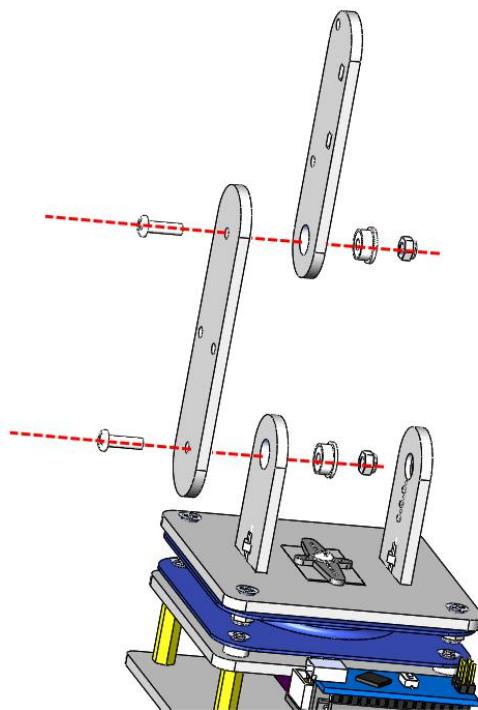
Tool:



**Need to prepare:**

Structure G	1	
Structure H	1	
Step 9 Structure	1	
$\phi 3*8*4$ flange bearing F693ZZ	2	
M3 mm self-locking screw	2	
M3*10mm round head screw	2	
<b><u>Demo:</u></b>		

Use M3 \* 10MM round head screws and M3 self-locking nuts to fix structure G, structure H and bearing;  
Pay attention to the installation order of structure G, structure H, and bearings;



## Step 12: Assembling Step 11

Structure and Step 10 Structure

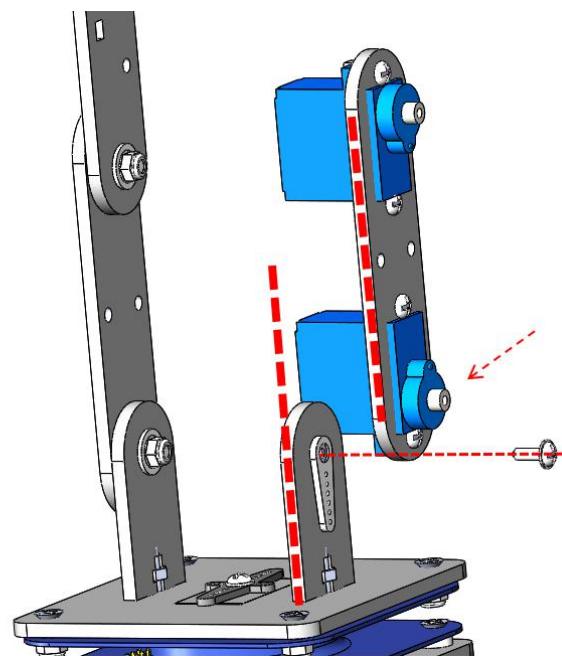
Tool:



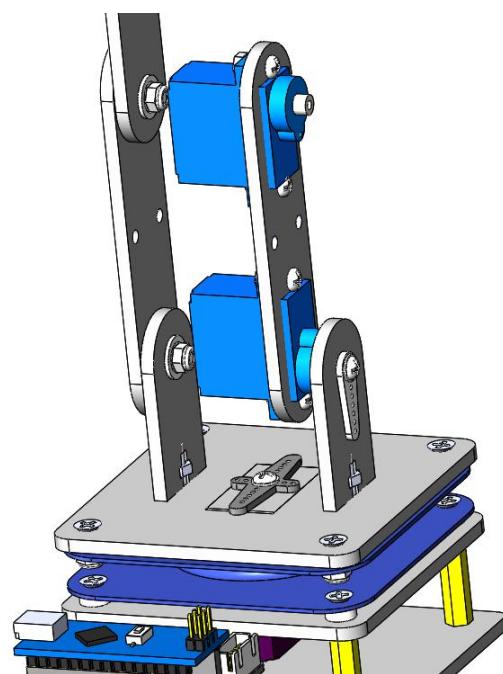
### Need to prepare:

Step 11 Structure	1	A 3D rendering of the assembled Step 11 structure. It features a vertical grey metal frame with two horizontal blue base plates. A blue servo motor is mounted on the left base plate, and a blue microcontroller board is mounted on the right base plate. A yellow servo horn is attached to the bottom of the frame.
Step 10 Structure	1	A 3D rendering of the base plate for the Step 10 structure. It is a grey metal plate with four circular holes and two blue rectangular base blocks attached to its underside.
SG90 servo screw	1	A 3D rendering of a single SG90 servo screw, showing its threaded shank and hexagonal head.

**Demo:**



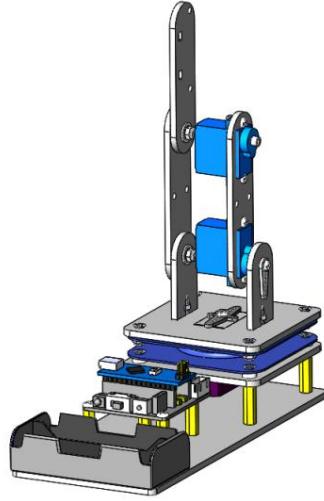
Keep structure D and structure F parallel, shown by the red dotted line;

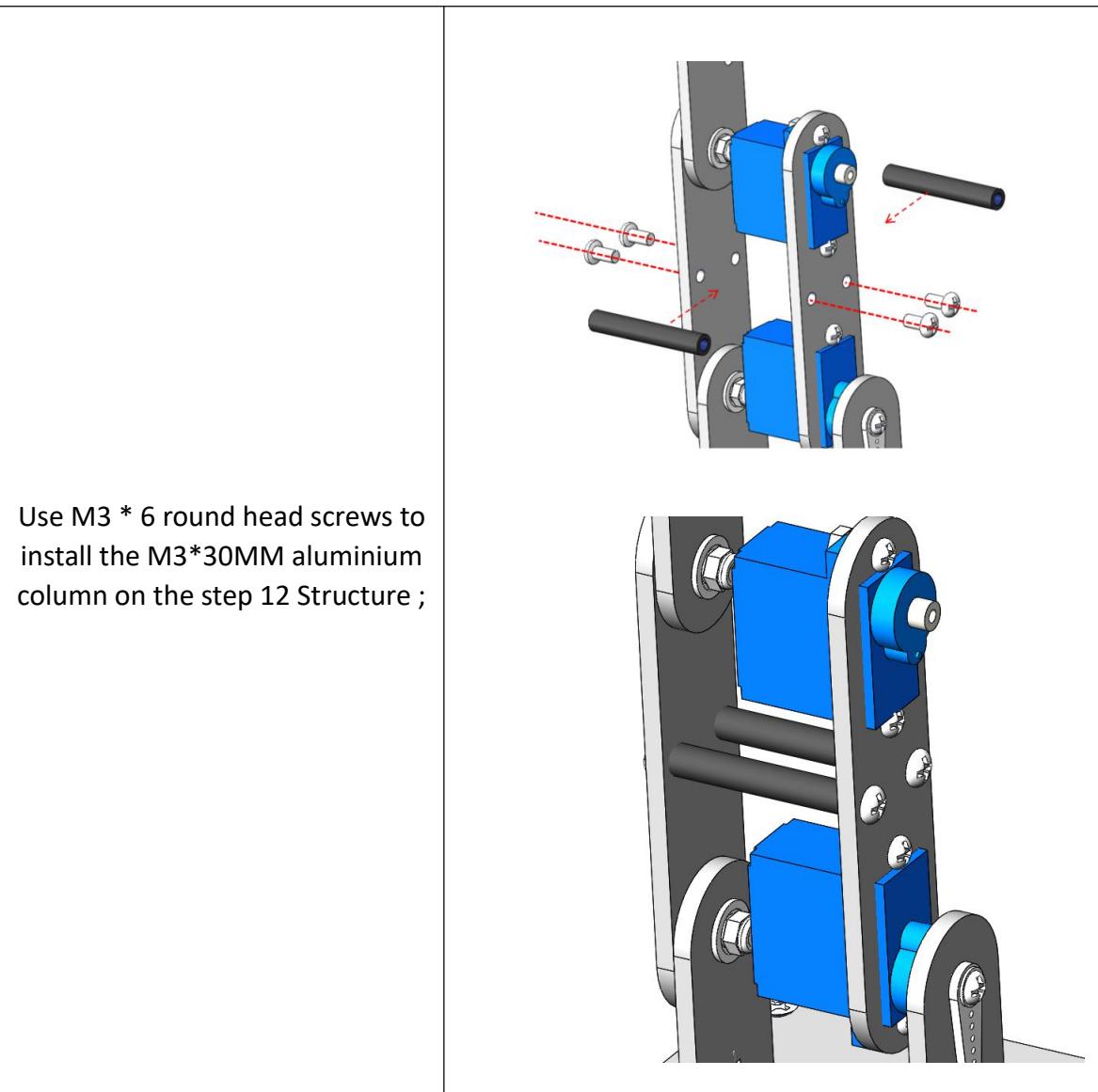


**Step 13: Assembling M3\*30MM  
aluminium column**

Tool: 

**Need to prepare :**

Step 12 Structure	1	
M3*30MM aluminium column	2	
M3*6mm round head screw	4	
<b><u>Demo:</u></b>		



Use M3 \* 6 round head screws to install the M3\*30MM aluminium column on the step 12 Structure ;

#### Step 14: Assembling Structure I and servo arm

Tool:

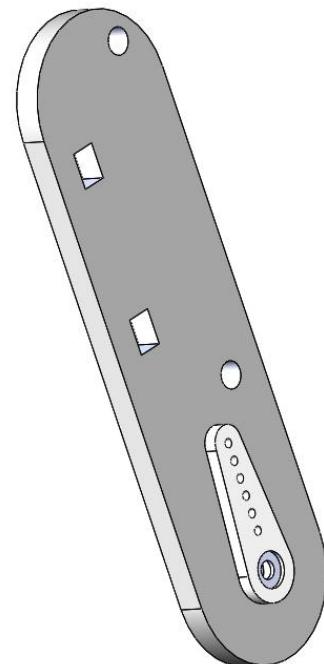
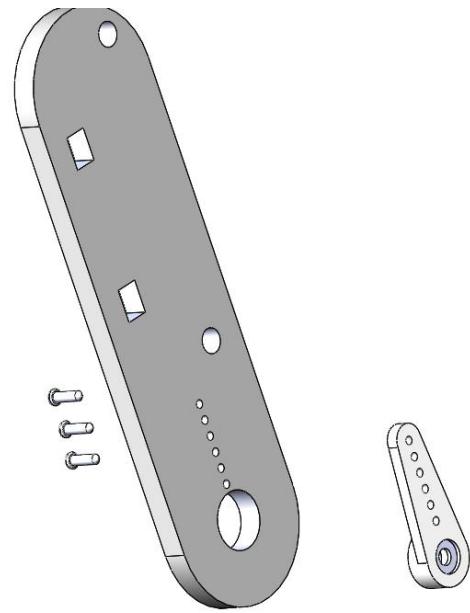


#### Need to prepare:

Structure K	1	
P1.2*4mm self-tapping screw	3	
servo arm	1	

**Demo:**

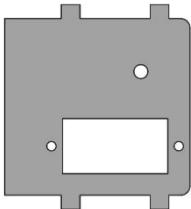
Use M1.2 \* 4 self-tapping screws  
to fix the servo arm on the  
structure K;  
**Pay attention to the mounting  
direction of the servo arm**



**Step 15: Assembling Structure J  
and servo**

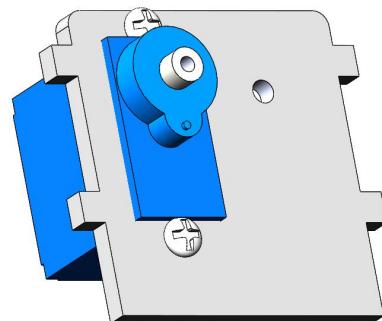
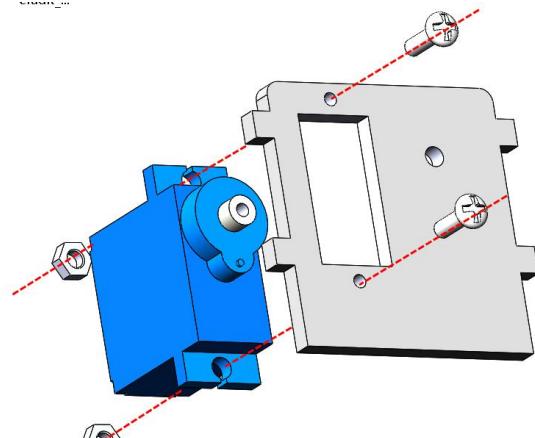
Tool: 

**Need to prepare:**

Structure M	1	
SG90 Servo	1	
M2*8mm round head screw	2	
M2 nut	2	

**Demo:**

Use M2 \* 8MM round head screws and M2 nuts to install the servo on the structure M;  
Pay attention to the installation direction of the servo;

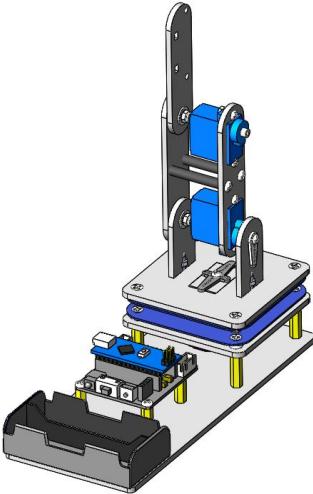
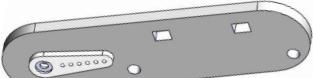
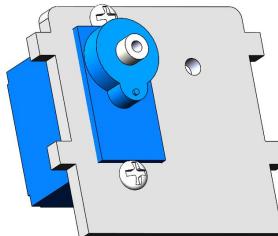


## Step 16: Assembling Step 13

Structure, Step 14 Structure and  
Step 15 Structure

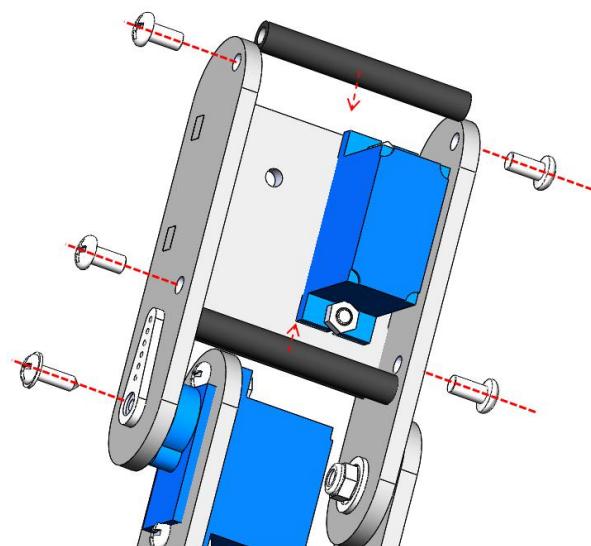
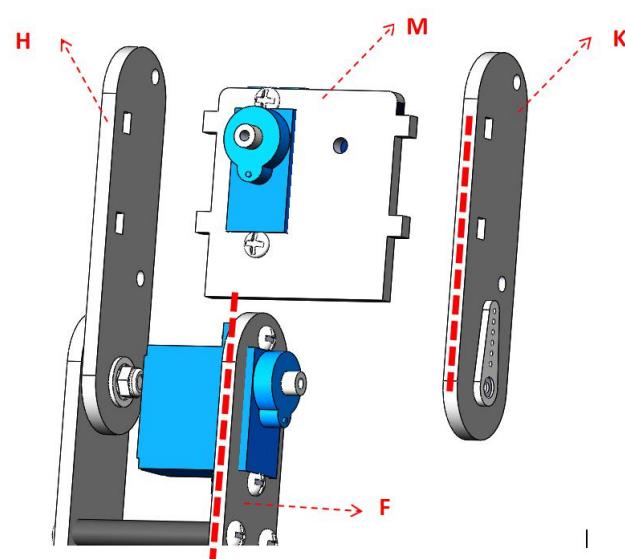
Tool: 

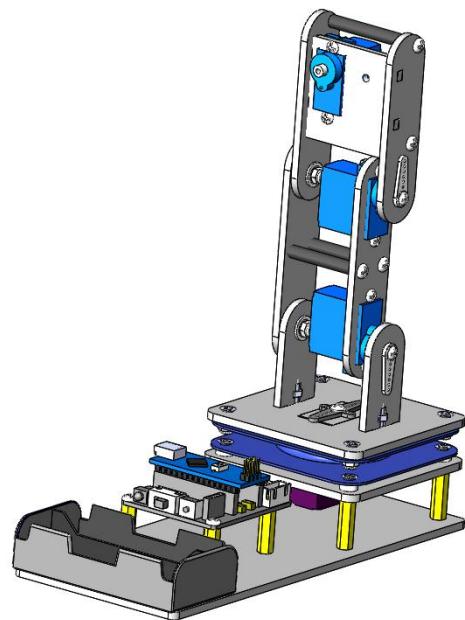
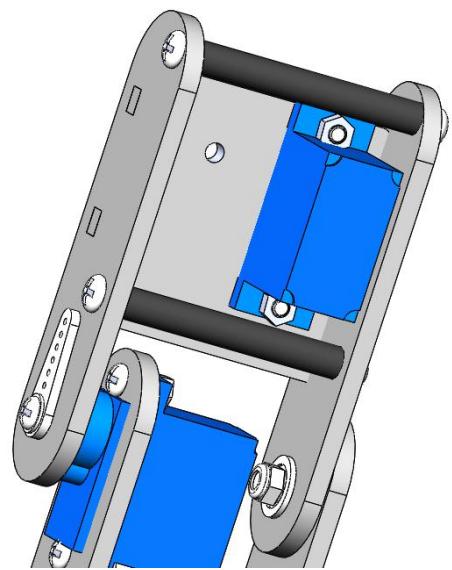
### Need to prepare:

Step 13 Structure	1	
Step 14 Structure	1	
Step 15 Structure	1	
M3*37MM Aluminium column	2	
M3*6mm round head screw	4	
Servo screw	1	

**Demo:**

1. 1. Install structural part M and structural part H;
2. 2. The side of structural member K and the side of structural member F are kept parallel (the red thick dashed line is shown in the figure);
3. 3. Install the single arm of the steering gear on the structure K with the steering gear shaft on the structure F, and install the structure M and the structure K at the same time;
4. 4. Use M3\*6 screws to install the aluminum column between the structural part H and the structural part K;
5. Use the self-tapping screws of the steering gear to fix the single arm of the steering gear and the steering gear shaft (the screw fixing force needs to be moderate)





**Step 17: Assembling the left  
finger of the hand**

Tool:

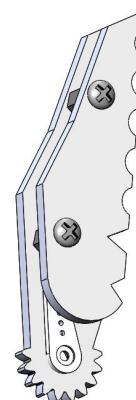
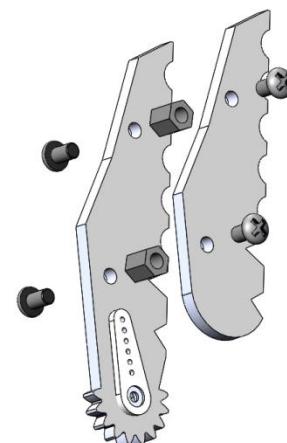
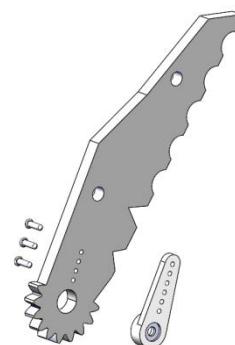


**Need to prepare:**

Structure N	1	
Structure L	1	
Servo arm	1	
P1.2*4mm self-tapping screw	3	
M3*6 black nylon stud	2	
M3*5 black nylon screw	4	

**Demo:**

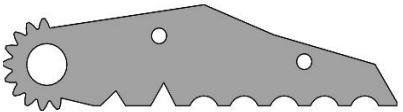
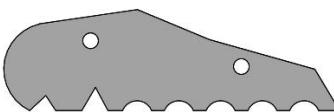
1. 1. Use M1.2\*4 self-tapping screws to fix the single arm of the steering gear on the structure N; (pay attention to the direction)
2. Use M3\*5 nylon screws to fix the nylon column, structural part N, and structural part L; (note the direction)



**Step 18: Assembling right finger  
of the hand**

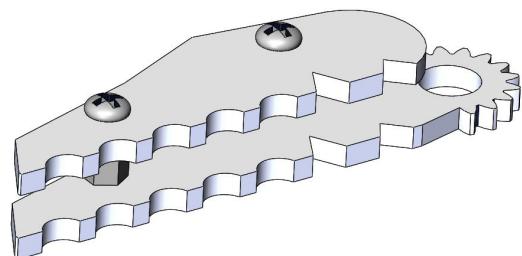
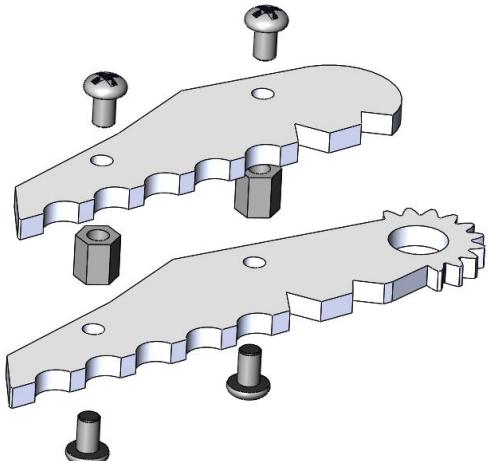
Tool: 

**Need to prepare:**

Structure X	1	
Structure L	1	
M3*6 black nylon stud	2	
M3*5 black nylon screw	4	

**Demo:**

Use nylon screws and nylon studs  
to fix the structure L on the  
structure X;



## Step 19: Assembling Step 16

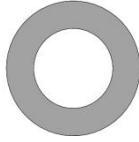
Structure and robot finger

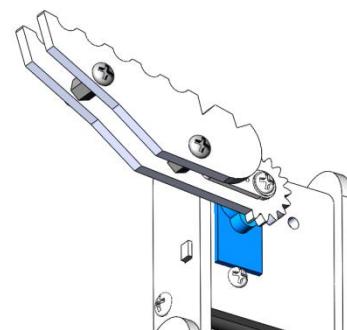
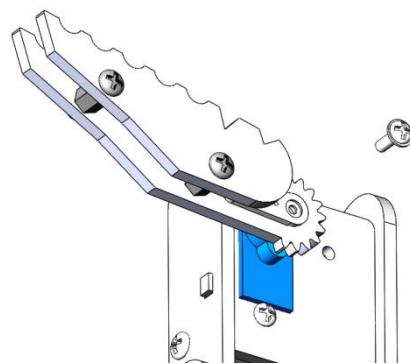
Tool:



### Need to prepare:

Step 16 Structure	1	A 3D CAD rendering of the Step 16 robotic structure. It shows a vertical metal frame with blue components inside, mounted on a base plate with yellow feet. A grey foot pedal is at the bottom left.
Left finger	1	A 3D CAD rendering of the left robotic finger. It features a grey base plate with two black screws, a central metal frame, and a blue gear-like component at the top.
Right finger	1	A 3D CAD rendering of the right robotic finger. It features a grey base plate with two black screws, a central metal frame, and a blue gear-like component at the top, similar to the left finger but oriented differently.

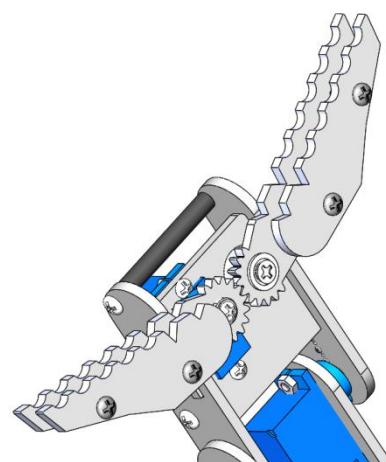
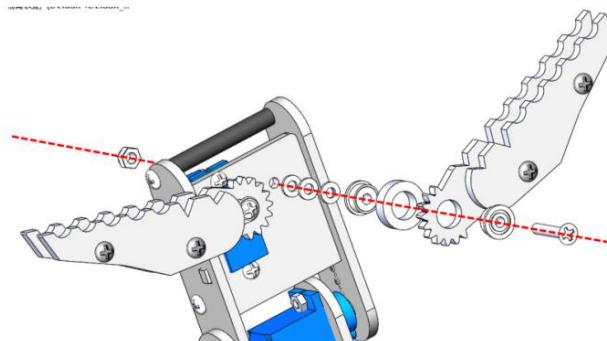
Structure P	1	
$\phi 3*8*4$ flange bearing F693ZZ	2	
M3 Flat pad	3	
M3*18mm countersunk head screw	1	
M3 mm self-locking screw	1	
<b><u>Demo:</u></b>		
1. The left part of the claw and the steering gear shaft on the structural member M are installed at 90 degrees; (as shown in the figure) 2. Use the screws provided with the steering gear to fix the single arm of the steering gear and the steering gear shaft;		



Use M3 \* 18 countersunk head screws and M3 self-locking nuts to fix the bearing, right finger, structure N, and Flat pad on structural part J

Note:

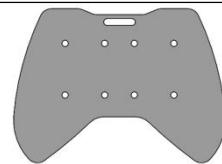
1. Install in order;
2. Be careful not to damage the gear;



## Step 20: Assembling the joystick controller

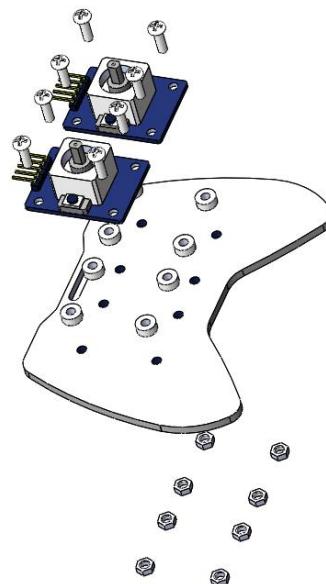
Tool: 

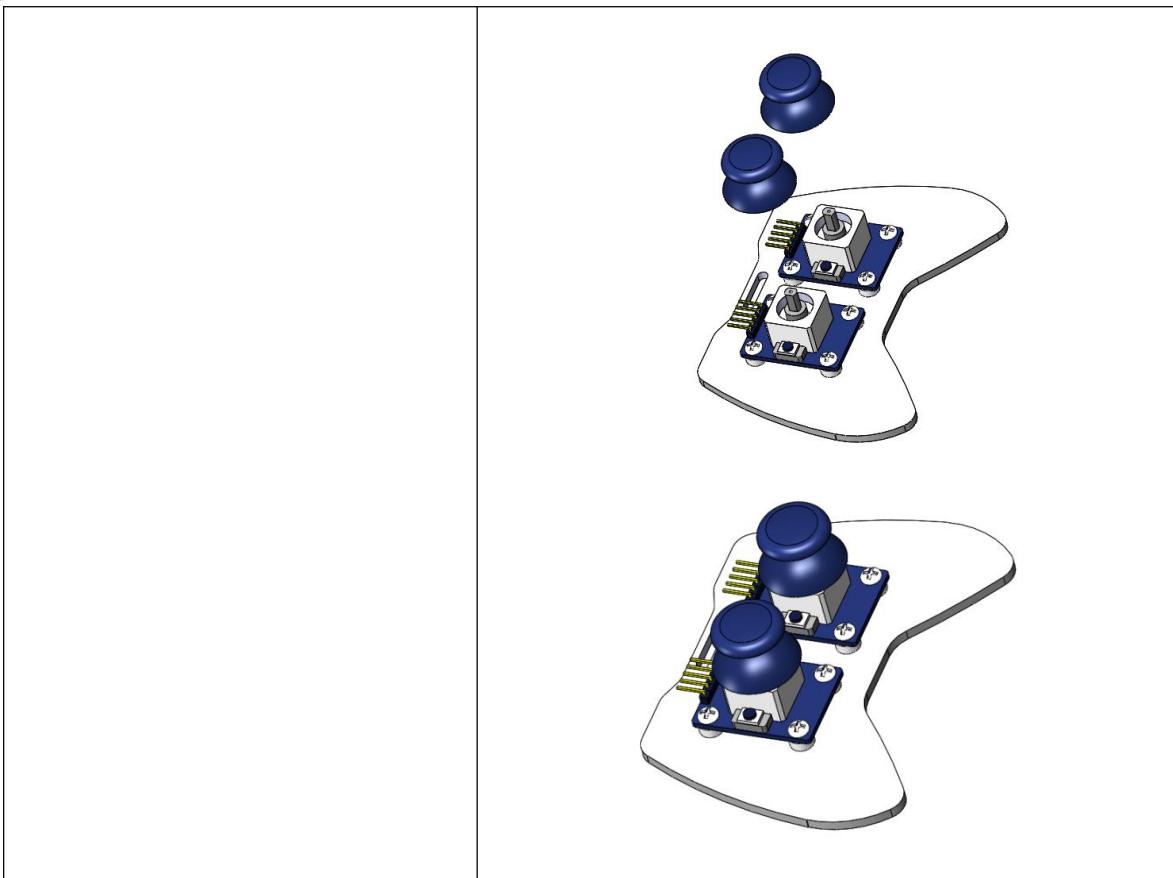
### Need to prepare:

Structure K	1	
Structure L	2	
M3*10mm round head screw	8	
N3 nut	8	
Φ 3*3mm nylon column	8	

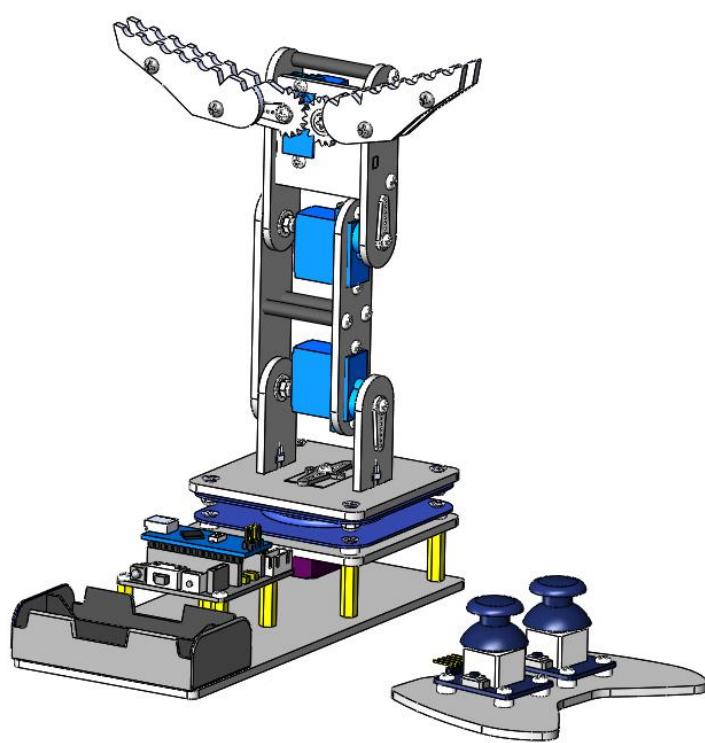
### Demo:

Pay attention to the mounting direction of the servo arm;

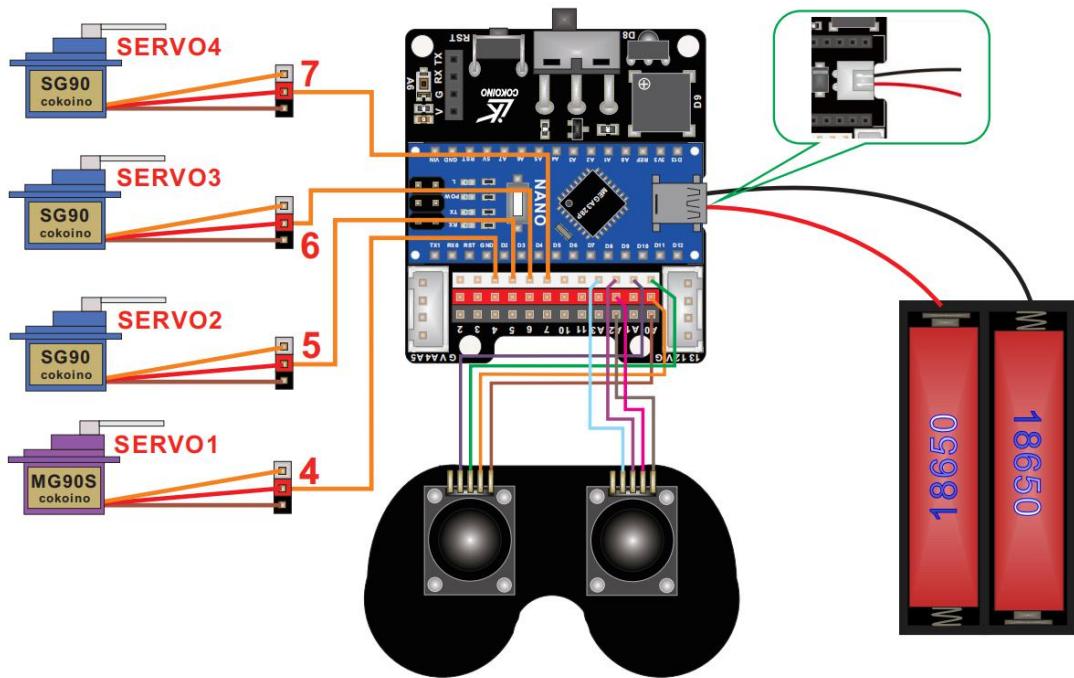




Congratulations, a cool robot is done



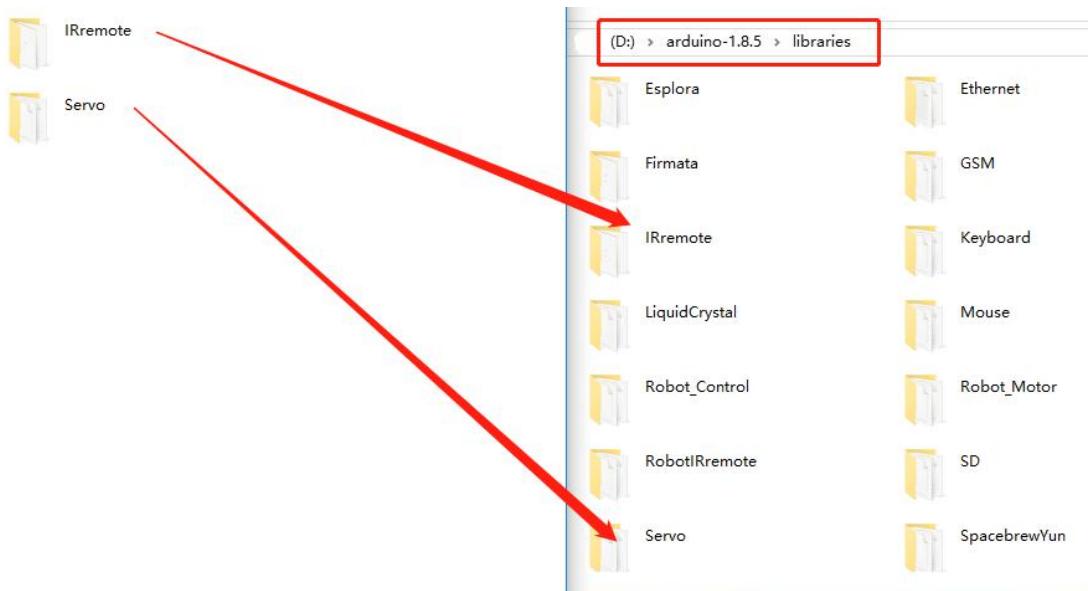
## 2. Wiring diagram



## VIII Run the robotic arm

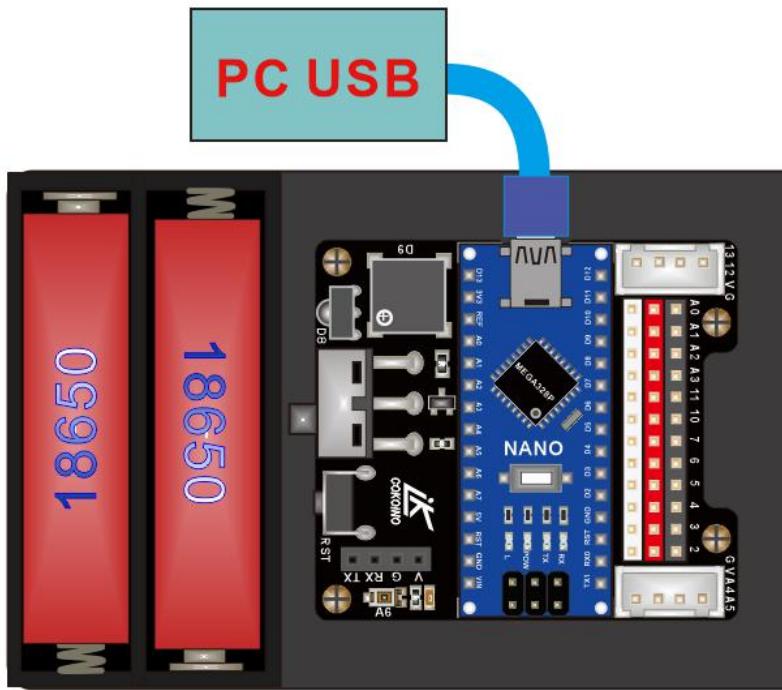
### 1. Install the library file

Our code uses the two arduino library files "Servo" and "IRremote". Before running the code, the "Servo" and "IRremote" folders under the Libraries folder provided by us must be copied to the arduino installation directory. In the "libraries" file, as shown below:

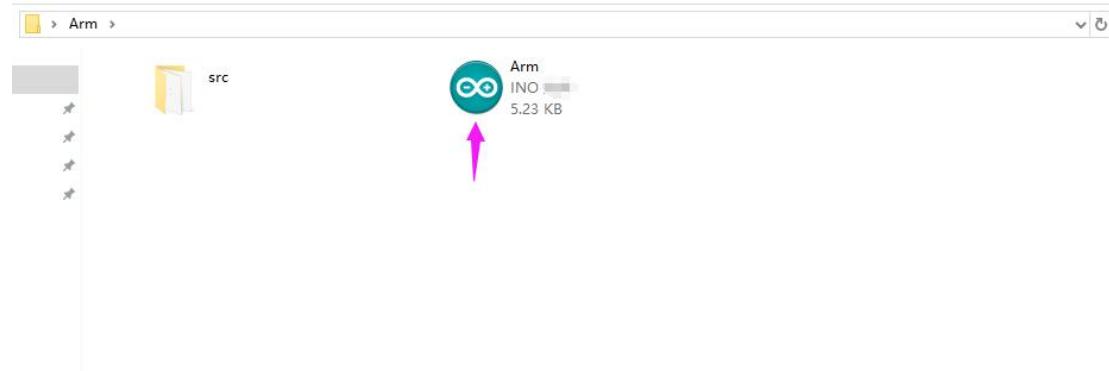


## 1. Burning program

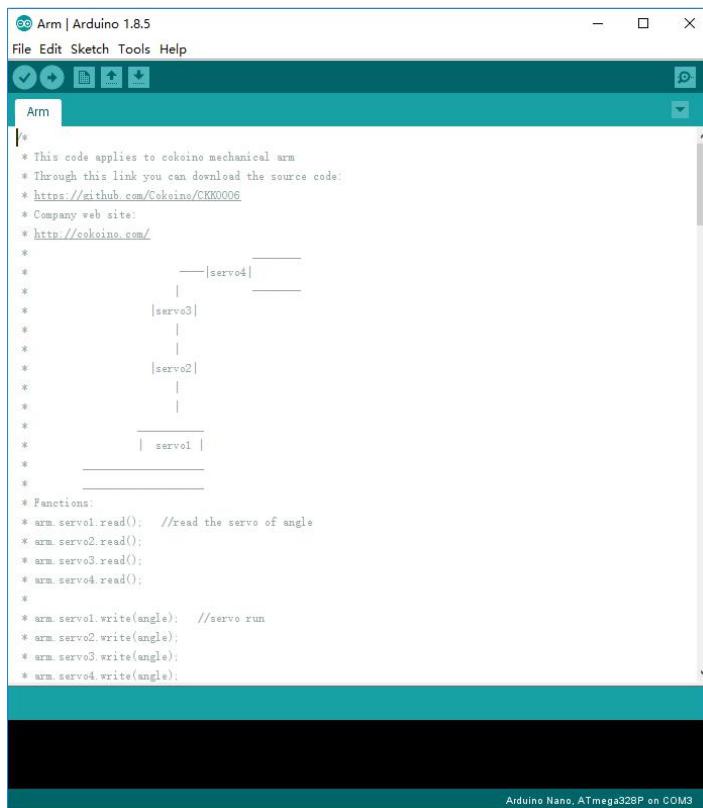
2.1 Turn the power switch on the nano motherboard to the "ON" state, and connect the USB port to the USB port of the PC via a USB cable



2.2 Double-click to open the source code of the "Code"-->"Arm" folder, as shown in the figure below:



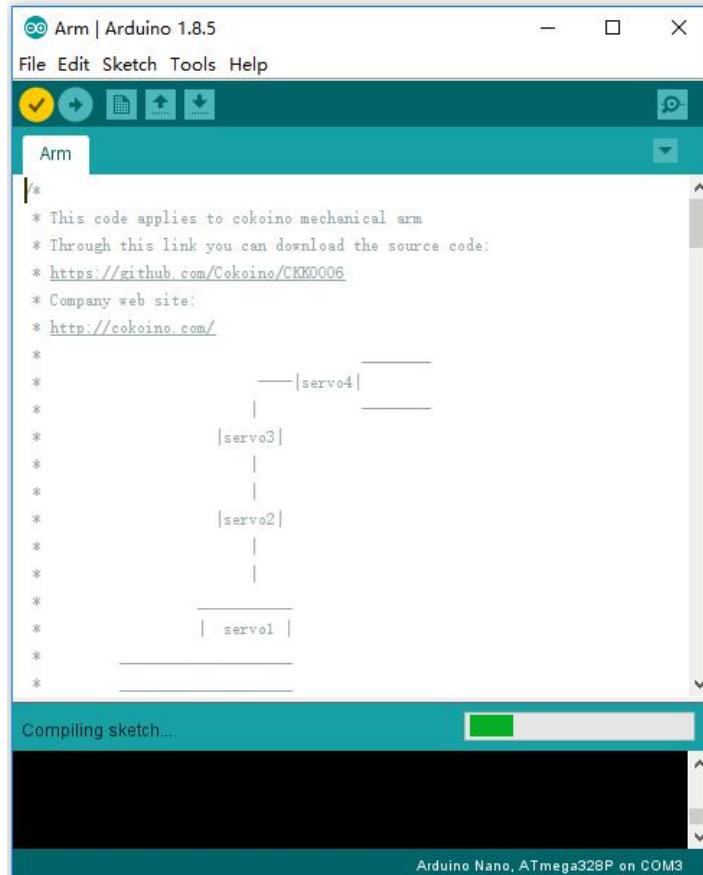
## 2.3 Arduino IDE opens the initial picture of the code:



The screenshot shows the Arduino IDE interface with the title bar "Arm | Arduino 1.8.5". The menu bar includes File, Edit, Sketch, Tools, and Help. Below the menu is a toolbar with icons for Save, Run, Upload, and others. A dropdown menu labeled "Arm" is open. The main code editor window contains C++ code for a mechanical arm. The code includes comments explaining the code applies to a cokoino mechanical arm, provides a link to the source code on GitHub, and lists company web sites. It defines four servos (servo1 to servo4) and includes functions for reading and writing their angles. The code ends with a copyright notice. At the bottom of the IDE, it says "Arduino Nano, ATmega328P on COM3".

```
/*
 * This code applies to cokoino mechanical arm
 * Through this link you can download the source code:
 * https://github.com/Cokoino/CKK0006
 * Company web site:
 * http://cokoino.com/
 *
 *          ---|servo4|_____
 *          |           |
 *          |servo3|_____
 *          |           |
 *          |           |
 *          |servo2|_____
 *          |           |
 *          |           |
 *          |           |
 *          |servo1|_____
 *          |
 *          |
 */
* Functions:
* arm.servo1.read(); //read the servo of angle
* arm.servo2.read();
* arm.servo3.read();
* arm.servo4.read();
*
* arm.servo1.write(angle); //servo run
* arm.servo2.write(angle);
* arm.servo3.write(angle);
* arm.servo4.write(angle);
*/
Copyright (C) 2013 Cokoino
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it under the terms of the GNU General Public License as published by
the Free Software Foundation, either version 3 of the License, or
(at your option) any later version.
This program is distributed in the hope that it will be useful,
but WITHOUT ANY WARRANTY; without even the implied warranty of
MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the
GNU General Public License for more details.
You should have received a copy of the GNU General Public License
along with this program. If not, see <http://www.gnu.org/licenses/>.
```

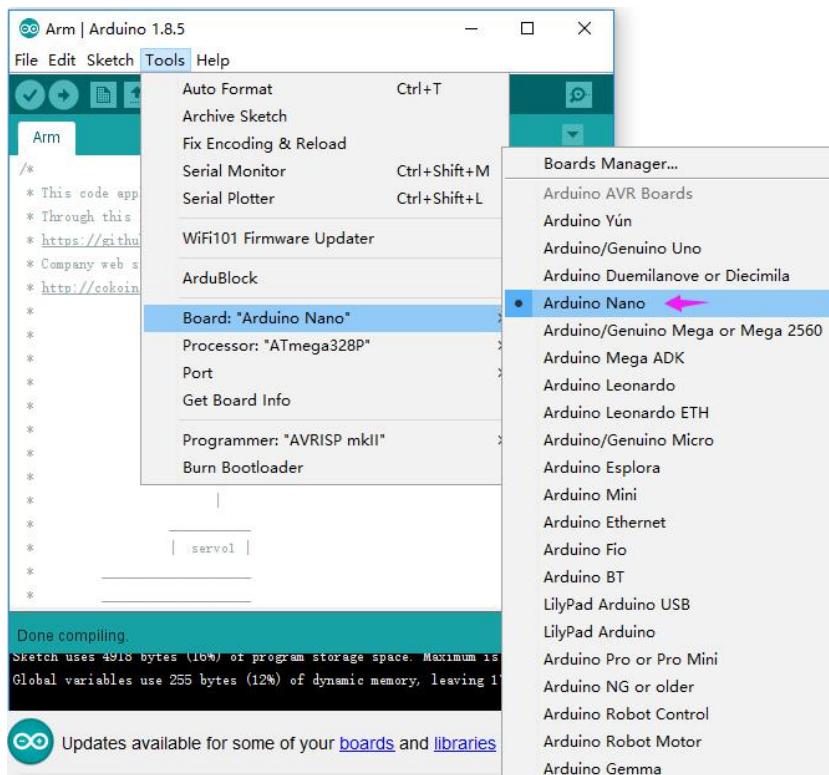
## 2.4 Check code:



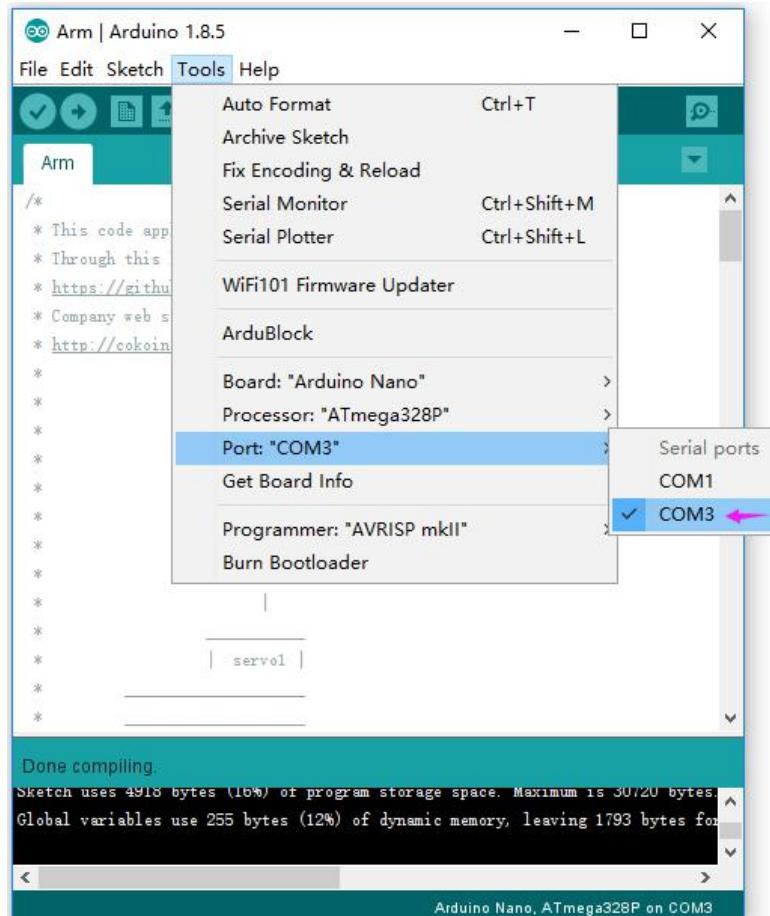
The screenshot shows the Arduino IDE interface with the title bar "Arm | Arduino 1.8.5". The menu bar includes File, Edit, Sketch, Tools, and Help. Below the menu is a toolbar with icons for Save, Run, Upload, and others. A dropdown menu labeled "Arm" is open. The main code editor window contains the same C++ code for a mechanical arm as in the previous screenshot. At the bottom of the code editor, it says "Compiling sketch...". A progress bar is visible at the bottom of the screen. At the very bottom, it says "Arduino Nano, ATmega328P on COM3".

```
/*
 * This code applies to cokoino mechanical arm
 * Through this link you can download the source code:
 * https://github.com/Cokoino/CKK0006
 * Company web site:
 * http://cokoino.com/
 *
 *          ---|servo4|_____
 *          |           |
 *          |servo3|_____
 *          |           |
 *          |           |
 *          |servo2|_____
 *          |           |
 *          |           |
 *          |           |
 *          |servo1|_____
 *          |
 *          |
 */
* Functions:
* arm.servo1.read(); //read the servo of angle
* arm.servo2.read();
* arm.servo3.read();
* arm.servo4.read();
*
* arm.servo1.write(angle); //servo run
* arm.servo2.write(angle);
* arm.servo3.write(angle);
* arm.servo4.write(angle);
*/
Copyright (C) 2013 Cokoino
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it under the terms of the GNU General Public License as published by
the Free Software Foundation, either version 3 of the License, or
(at your option) any later version.
This program is distributed in the hope that it will be useful,
but WITHOUT ANY WARRANTY; without even the implied warranty of
MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the
GNU General Public License for more details.
You should have received a copy of the GNU General Public License
along with this program. If not, see <http://www.gnu.org/licenses/>.
```

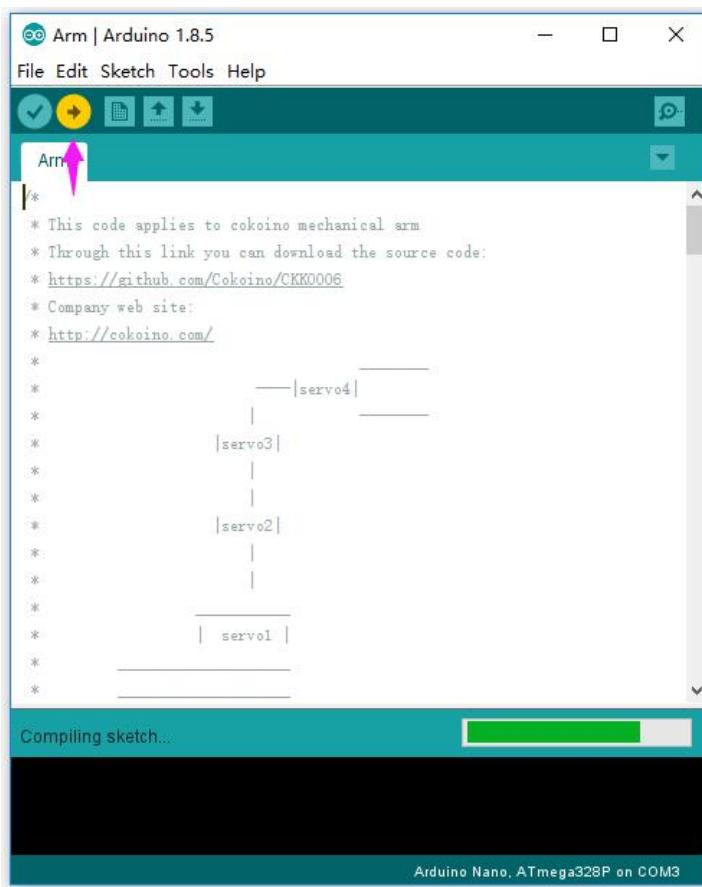
## 2.5 Select the development board:



## 2.6 Select the burning port:



## 2.7 Burning code:

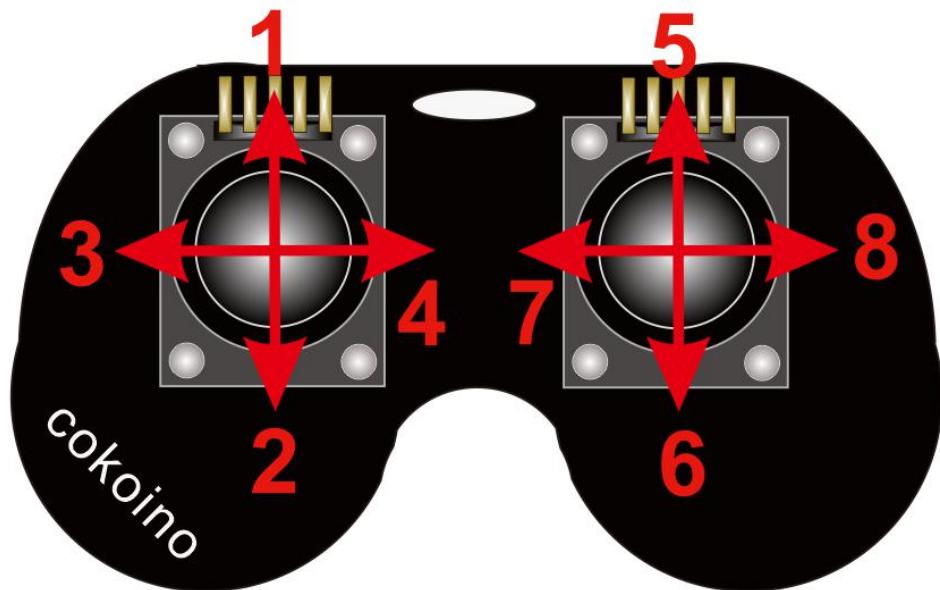


The screenshot shows the Arduino IDE interface with the title bar "Arm | Arduino 1.8.5". The menu bar includes File, Edit, Sketch, Tools, and Help. Below the menu is a toolbar with icons for upload, refresh, and save. The main window displays the "Arm" sketch code. The code is a comment block describing the application to a mechanical arm with four servos. It includes links to GitHub and the company website. The code structure shows a vertical hierarchy of servos: servo4 at the top, followed by servo3, servo2, and finally servo1 at the bottom. A pink arrow points to the "Upload" button icon in the toolbar. At the bottom of the IDE, a progress bar indicates "Compiling sketch..." and the status "Arduino Nano, ATmega328P on COM3".

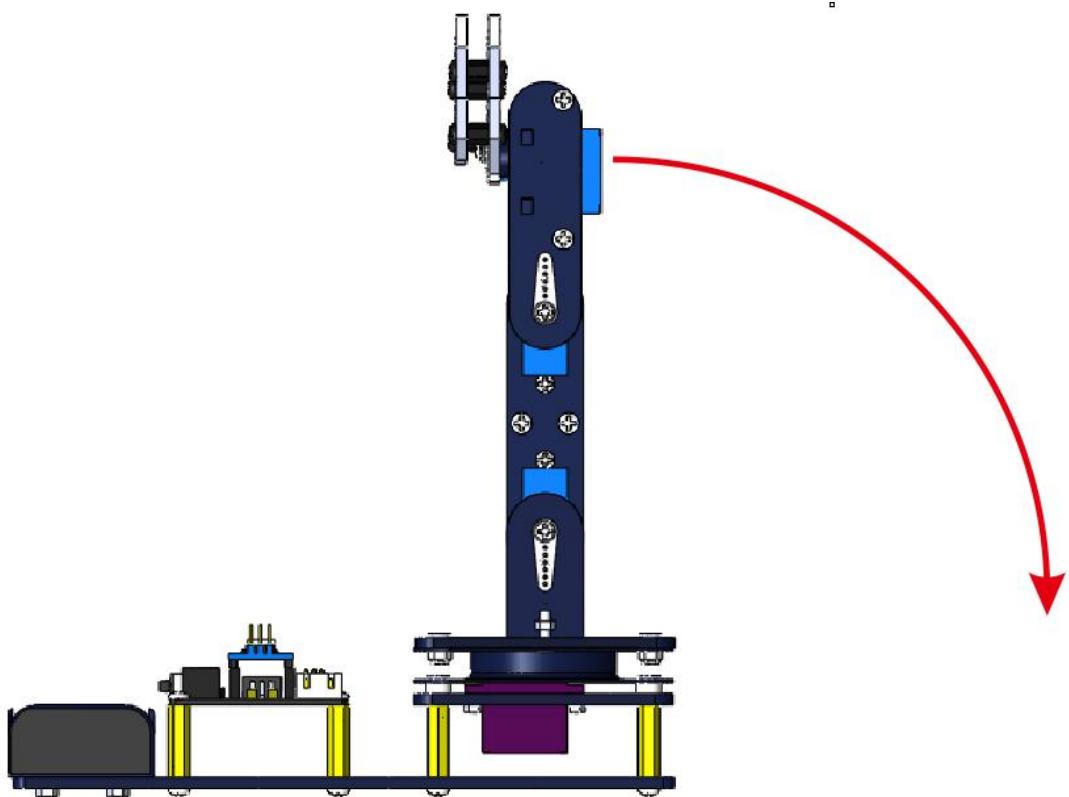
At this step, the code burning has been completed. Let's learn how to operate the robot arm and feel the joy of success!

## 2. Manipulate the robotic arm

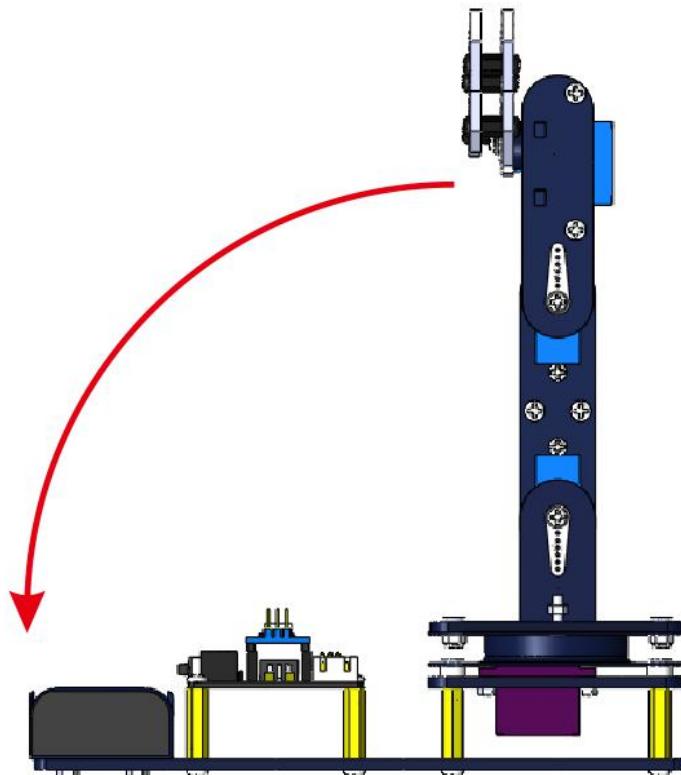
Description of the joystick handle:



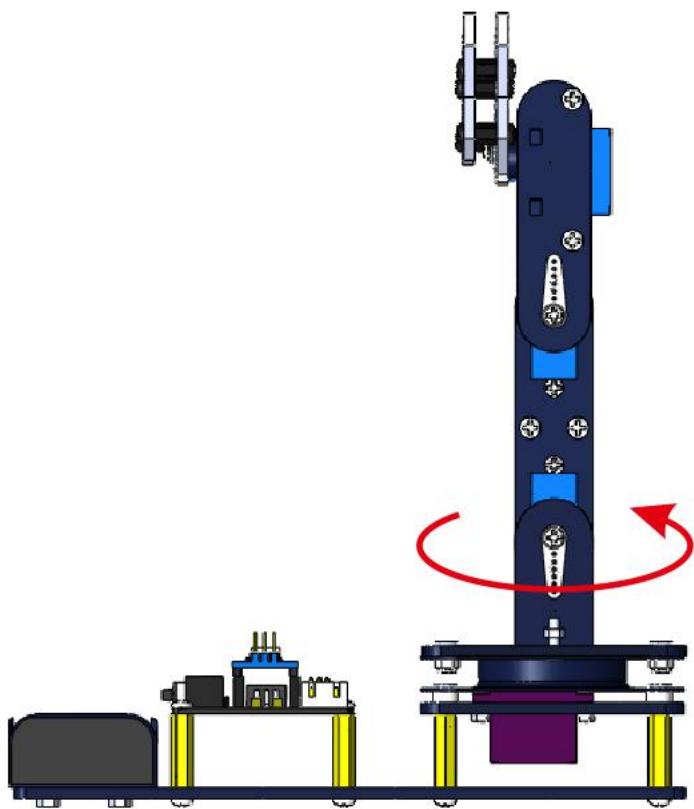
**1:** Robot arm swings forward



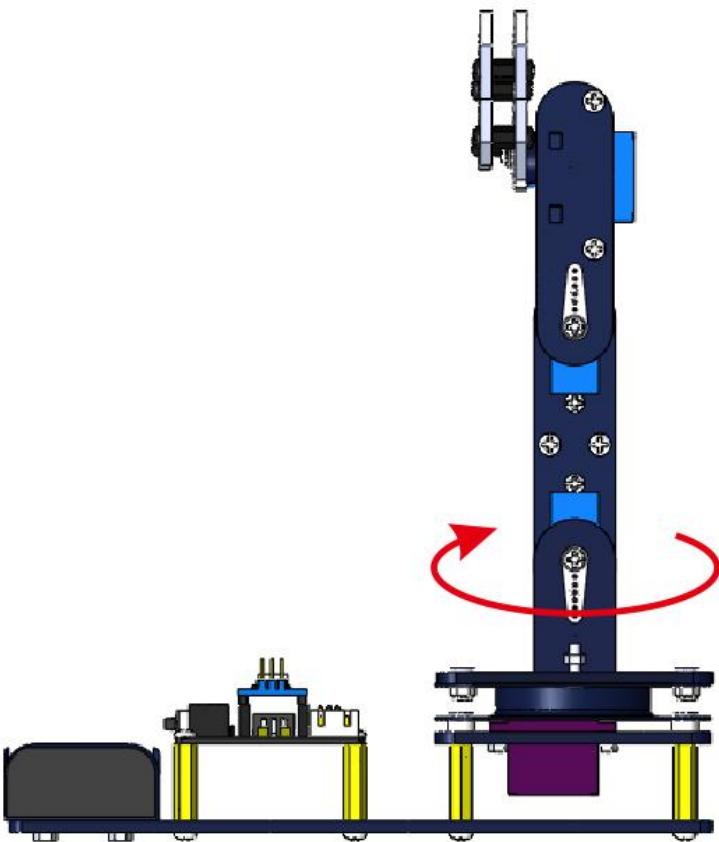
**2:** Robot arm swings backward



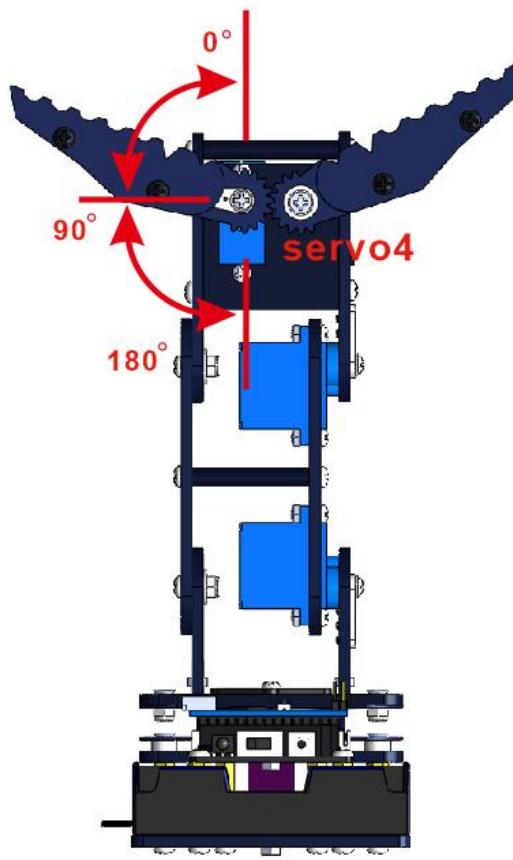
**3:** Robot arm swings left



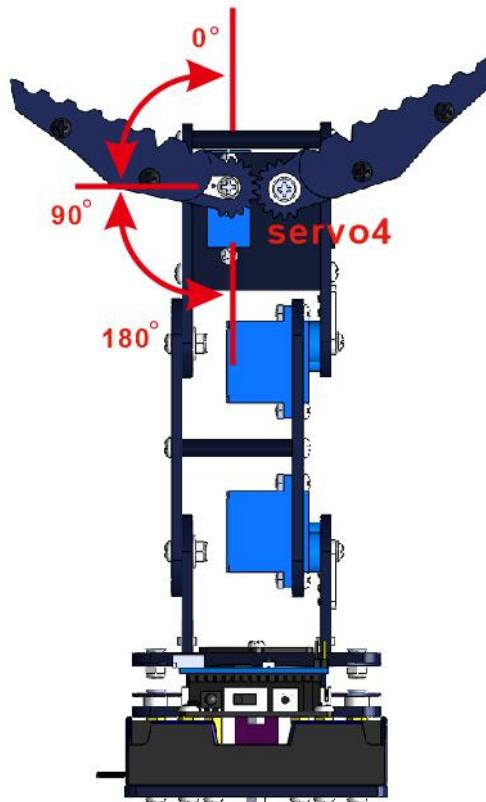
**4:** Robot arm swings right



5: The claws of the robot arm are closed (servo4 turns to 0 degrees)

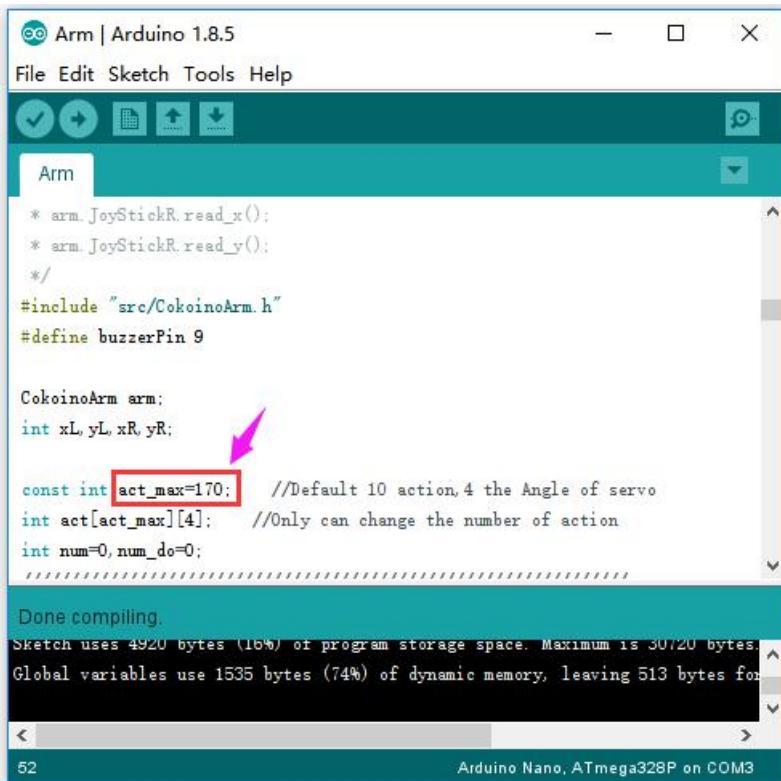


6: The claws of the robot arm are open (servo4 turns to 180 degrees)



**7:** Record the actions of the mechanical arm

The default design in the program can record 10 robot arm actions continuously, and the buzzer will sound once when the recorded action is greater than 10 actions. By modifying the numbers in the basic code, a maximum of 170 actions can be recorded, as shown in the figure below:



```
Arm | Arduino 1.8.5
File Edit Sketch Tools Help
Arm
* arm.JoyStickR.read_x();
* arm.JoyStickR.read_y();
*/
#include "src/CokoinoArm.h"
#define buzzerPin 9

CokoinoArm arm;
int xL, yL, xR, yR;

const int act_max=170; //Default 10 action, 4 the Angle of servo
int act[act_max][4]; //Only can change the number of action
int num=0, num_do=0;

Done compiling.
Sketch uses 4920 bytes (16%) of program storage space. Maximum is 30720 bytes.
Global variables use 1535 bytes (74%) of dynamic memory, leaving 513 bytes for
Arduino Nano, ATmega328P on COM3
52
```

**8:** Perform recorded actions

The buzzer first buzzes, and then executes the recorded robot arm actions in sequence. The machine cannot be controlled during the recording action of the manipulator, until the recorded action is completed, the buzzer will beep again to prompt the completion of the recording action.

## **IX Trouble shooting**

### **1.Robot arm does not work**

- <1>Please ensure that the total voltage of the two lithium batteries is between 7-8.4V.
- <2>Whether the two lithium batteries are installed correctly.
- <3>Please confirm whether the wiring is correct.

### **2.The robotic arm does not rotate**

- <1>Please ensure that the total voltage of the two lithium batteries is between 7-8.4V.
- <2>Please confirm whether to install the robotic arm after initial servo according to chapter VI.
- <3>Please confirm whether the wiring is correct.

### **3.The operation of the robotic arm is different from the description of the data**

- <1>Please confirm whether to install the robotic arm after initial servo according to chapter VI.
- <2>Please confirm whether the wiring is correct.

### **4.Contact us for support**

Email : [cokoino@outlook.com](mailto:cokoino@outlook.com)

Facebook: <https://www.facebook.com/cokino.lk>