



Adept Robotic Arm

Warning

Please pay attention to the following issues when purchasing or using the product:

- ★ There are small components included in this kit. Swallowing mistakenly or misoperation can cause serious infection and be even fatal. When an accident occurs, please seek medical assistance immediately.
- ★ Please place the product in a safe place where an under-6-year-old cannot touch, who should not use or approach the product.
- ★ Juveniles should use the product with their parents.
- ★ Do not place the product or the components near any AC socket or other circuits to avoid electric shock.
- ★ Do not use the product near any liquid or flame.
- ★ Do not use or store the product in an extreme environment such as in extremely low or high temperature and heavy humidness.
- ★ Please remember to power off when the product is not in use.
- ★ Do not touch the moving or rotating part of the product.
- ★ The product may get heat at some part, which is just normal. But misoperation may cause overheat.
- ★ Misoperation may cause damage to the product. Please take care.
- ★ Do not connect the positive and negative poles of the power inversely, or the devices in the circuit may be damaged.
- ★ Please place and put the product gently. Do not smash or shock it.

About

Adept is a technical service team of open source software and hardware. Dedicated to applying the Internet and the latest industrial technology in open source area, we strive to provide the best hardware support and software service for general makers and electronic enthusiasts around the world. We aim to create infinite possibilities with sharing. No matter what field you are in, we can lead you into the electronic world and bring your ideas into reality.

The code and manual of our product are open source. You can check on our website:

<http://www.adeept.com/>

If you have any problems, feel free to send an email for technical support and assistance:

support@adeept.com

On weekdays, we usually will reply within 24 hours. Also welcome to post in our official forum:

<http://www.adeept.com/forum/>

Copyright

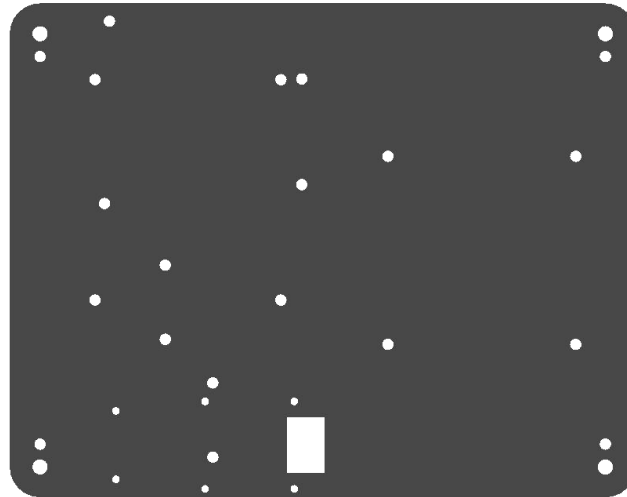
This user manual and code can be used for learning, DIY, refitting, etc., except for commercial purpose. The Adept Company owns all rights of contents in the manual, including but not limited to texts, images, data, etc. Any distribution or printing should be implemented with the permission of the Company, or it will be deemed illegal.

contents

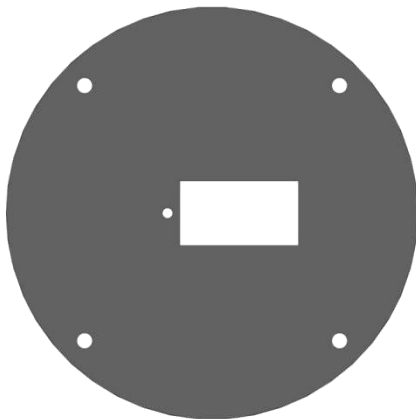
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1. Components List

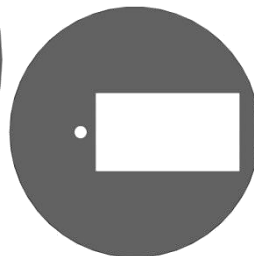
1.1. Acrylic Plates



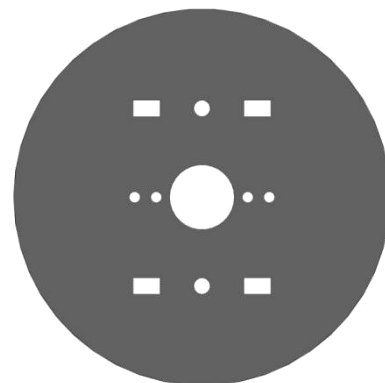
A01
1pcs



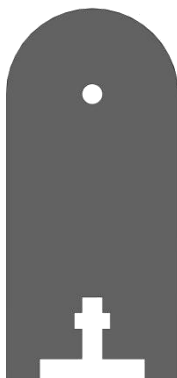
A02
1pcs



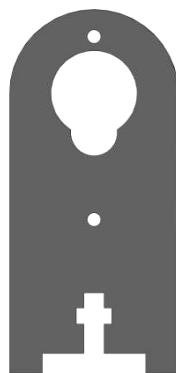
A03
1pcs



A04
1pcs



A05
1pcs



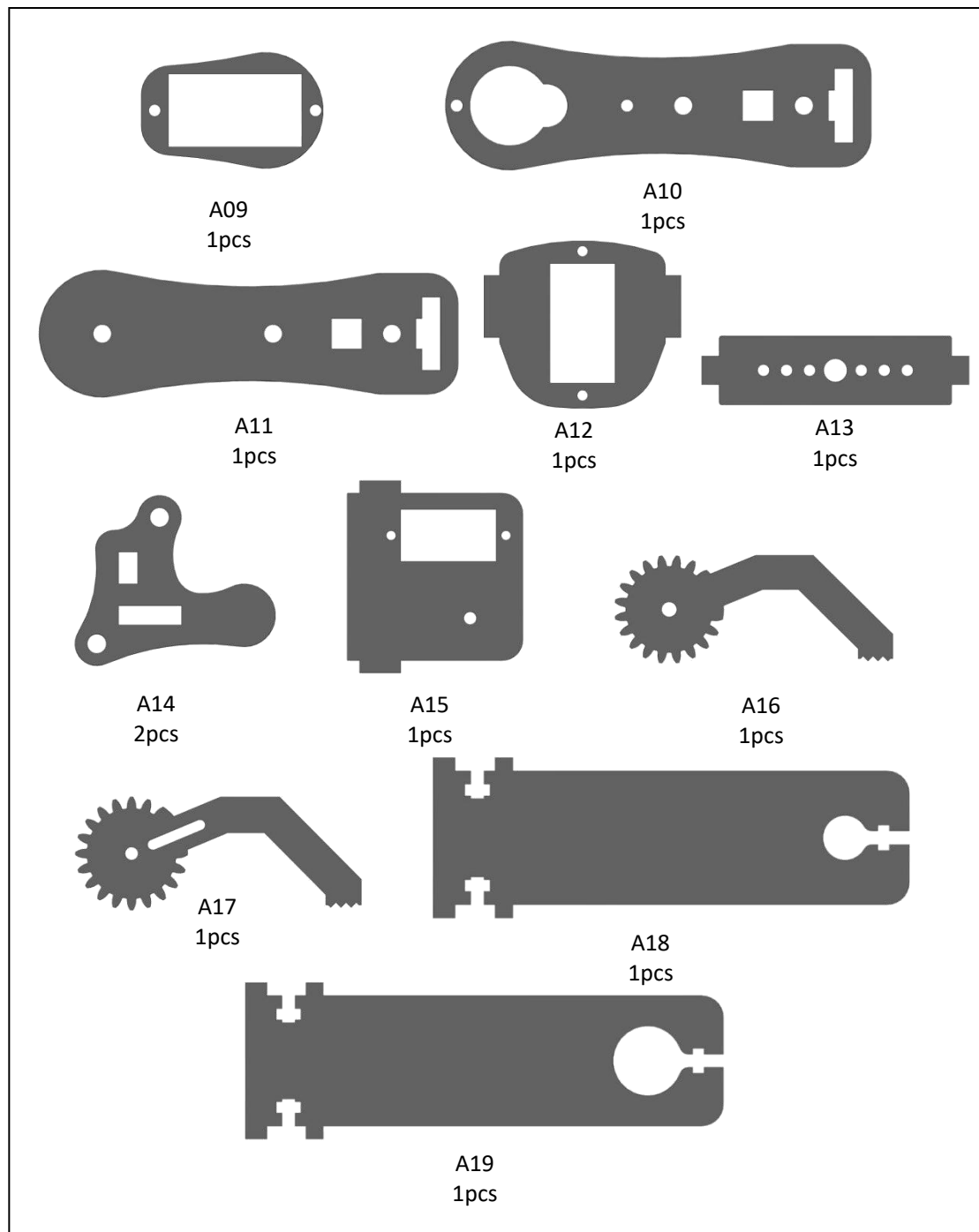
A06
1pcs



A07
1pcs



A08
1pcs



The acrylic plates are fragile, so please be careful when assembling them in case of breaking.
 The acrylic plate is covered with a layer of protective film. You need to remove it first.
 Some holes in the acrylic may have residues, so you need to clean them before the use.

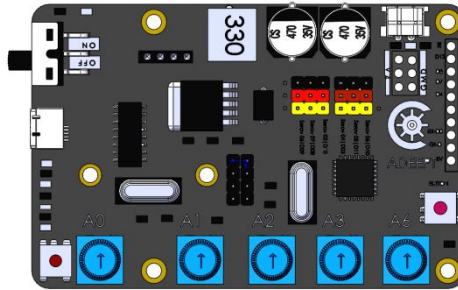
1.2. Machinery Parts

<p>M2 Nut</p>  <p>X11 www.adeept.com</p>	<p>M3 Nut</p>  <p>X7 www.adeept.com</p>	<p>M3 Lock Nut</p>  <p>X3 www.adeept.com</p>	<p>M2.5*11 Copper Standoff</p>  <p>X2 www.adeept.com</p>	<p>M2*10 Screw</p>  <p>X9 www.adeept.com</p>
<p>M2.5*7 Screw</p>  <p>X5 www.adeept.com</p>	<p>M3*5 Screw</p>  <p>X4 www.adeept.com</p>	<p>M3*8 Screw</p>  <p>X18 www.adeept.com</p>	<p>M3*12 Screw</p>  <p>X5 www.adeept.com</p>	<p>M3*18 Screw</p>  <p>X1 www.adeept.com</p>
<p>M3*10 Countersunk Head Screw</p>  <p>X2 www.adeept.com</p>	<p>M3*8 Copper Standoff</p>  <p>X1 www.adeept.com</p>	<p>M3*15 Nylon Standoff</p>  <p>X4 www.adeept.com</p>	<p>M2*18 Screw</p>  <p>X2 www.adeept.com</p>	<p>M3*30 Nylon Standoff</p>  <p>X5 www.adeept.com</p>
<p>M3*40 Nylon Standoff</p>  <p>X2 www.adeept.com</p>				

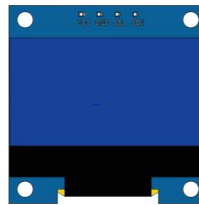
<p>Sucking disc component</p>  <p>Cap Nut X4</p>  <p>Sucking Disc X4</p>	<p>51108 Bearing</p> 
--	--

1.3. Electronic Parts

Adept Arm Drive Board X1



OLED X1



1

18650x2 Battery Holder X1



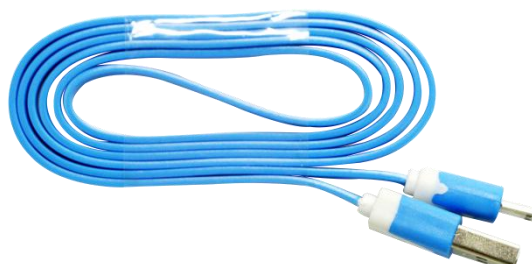
Servo X6



Servo Extension Cable X1



USB Cable X1



1.4. Tools

Cross Socket Wrench X1



Large Cross-head Screwdriver X1



Ribbon X1

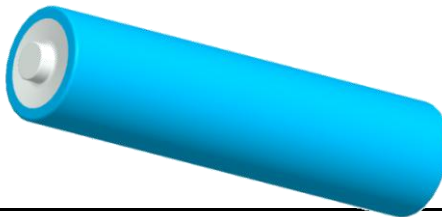


Winding Pipe X1



1.5. Self-prepared Parts

18650 Battery X2



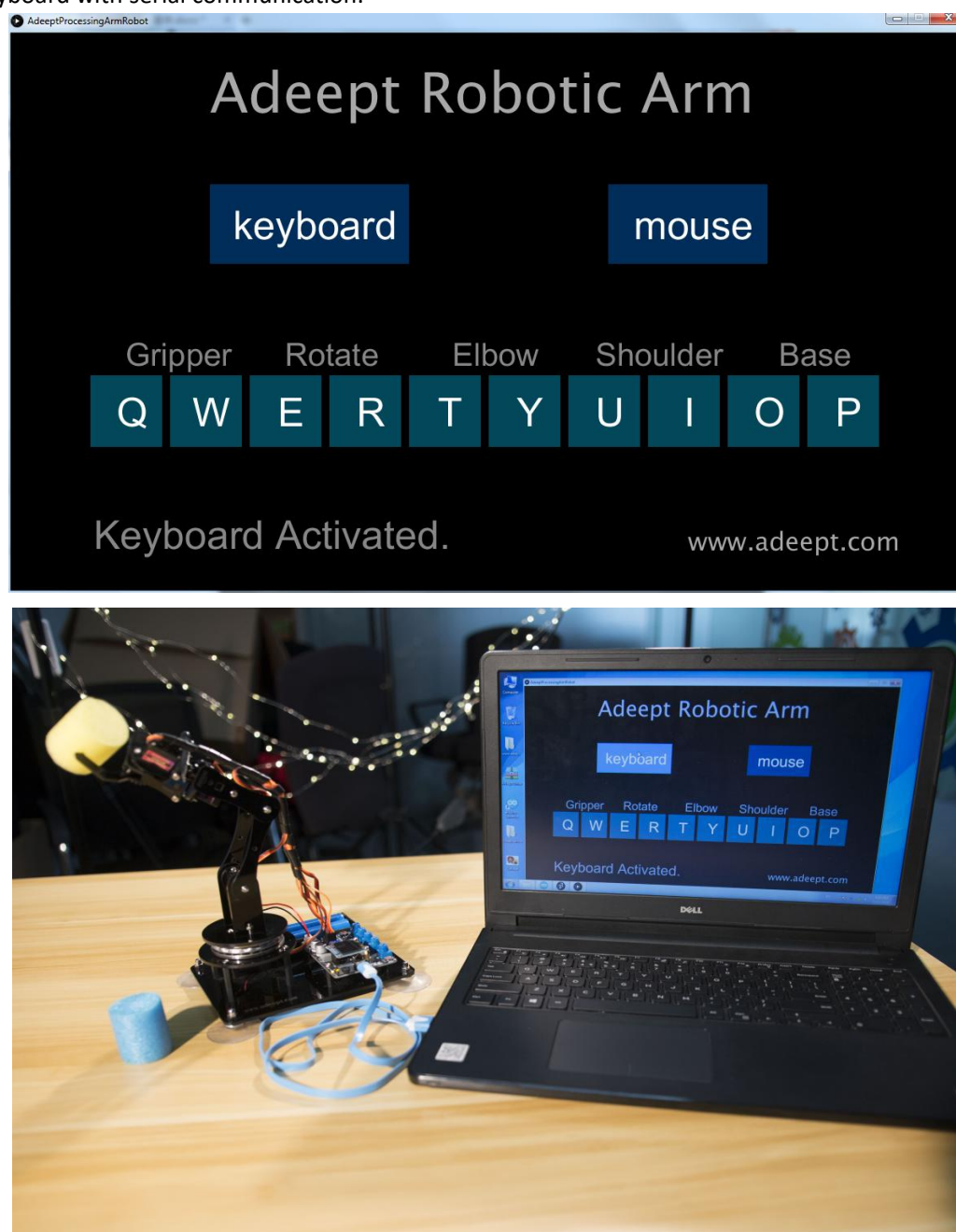
Pencil X1



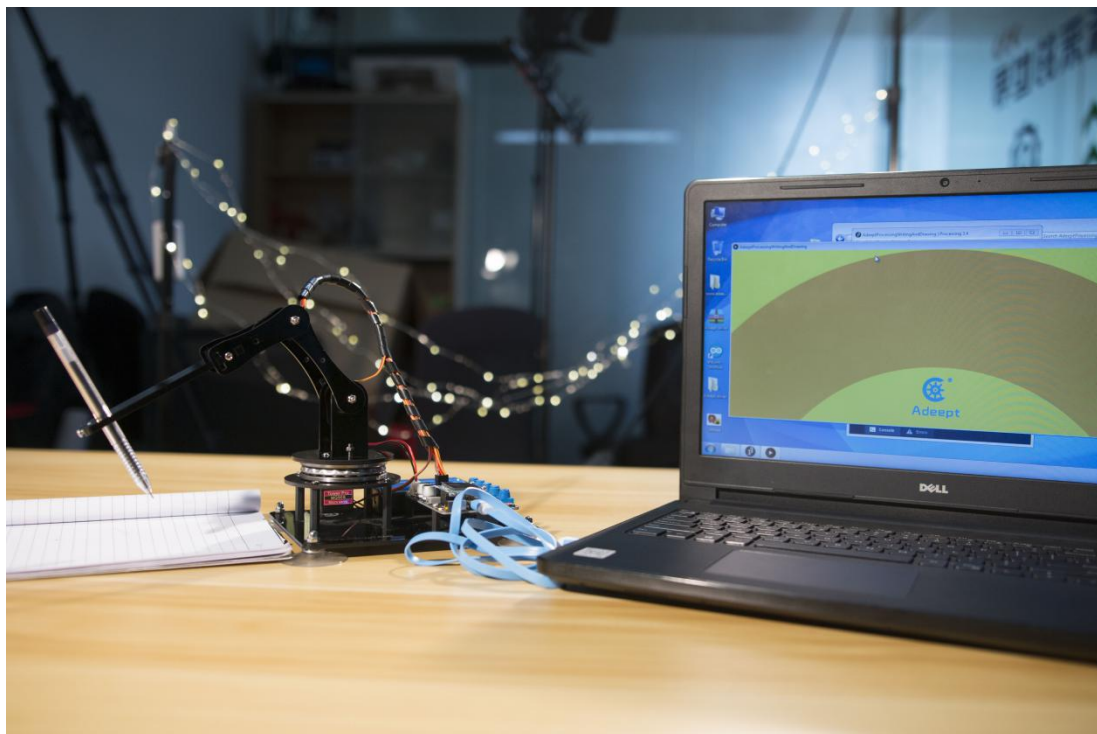
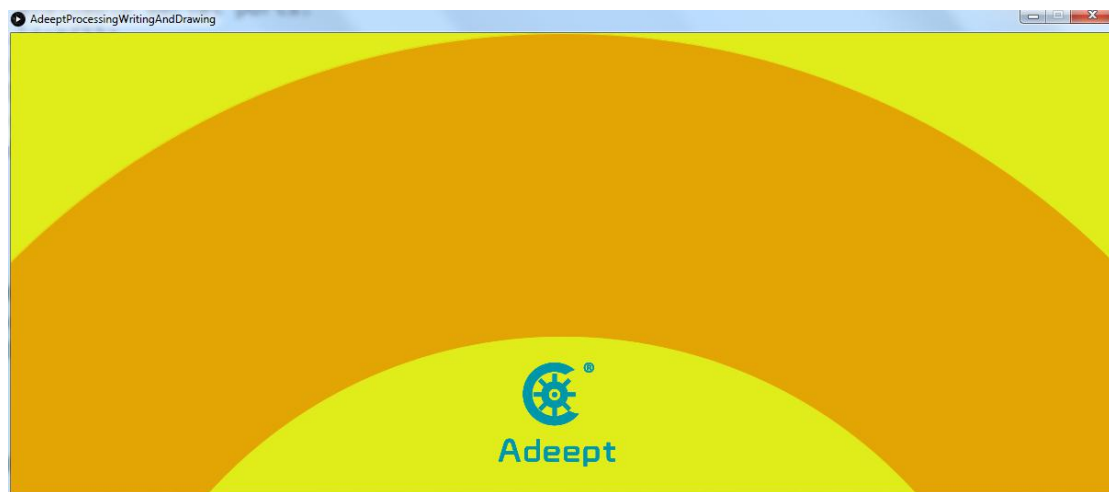
2.Introduction of Robotic Arm

Nowadays, under the progress of science and technology, the biggest difference between a robotic arm and a human arm lies in flexibility and strength. That is, the biggest advantage of the robotic arm is that normally it can repeat the same motion without feeling tired. Today Adept recommends a robotic learning kit to learn how to assemble a robotic arm and learn how to write the code to control the robotic arm to perform the specific motions. We provide a completed using method for learning Arduino and Processing-- write PC software and send motion commands to the robotic arm with Processing; write the motion of the servo of the robotic arm with Arduino.

The following figure shows that we control the robotic arm to pick up the object through the keyboard with serial communication.



The following figure shows that we control the robotic arm to write and draw through the mouse with serial communication.



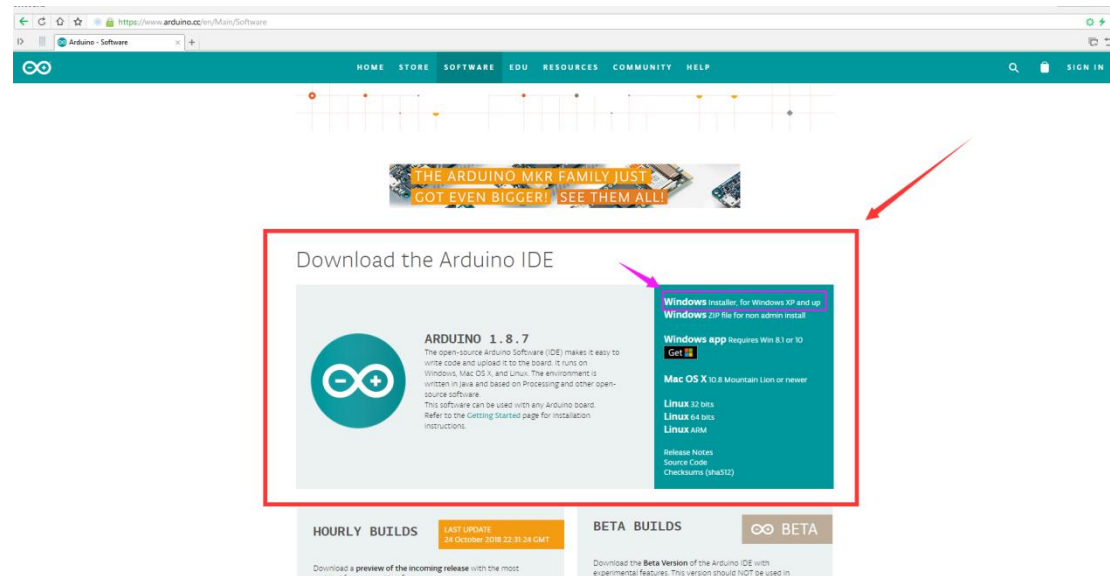
We have added the learning and memory function to the robotic arm. We let the robotic arm to record the manually controlled mechanical movements we made, and the robotic arm can learn repeatedly, such as repeat moving the object, repeat drawing the same graphic, repeat keyboard input and repeat turning book pages.

3.Arduino and Processing Environment Installation

More about building up Arduino development environment please check this video

More learning videos please click on <http://www.adept.com/video/>

Let's take the Windows 64-bit system as an example (the Arduino IDE also supports MAC and Linux). First open the browser and enter the URL <https://www.arduino.cc/en/Main/Software> and you will see the following interface.



Click "JUST DOWNLOAD".



Contribute to the Arduino Software

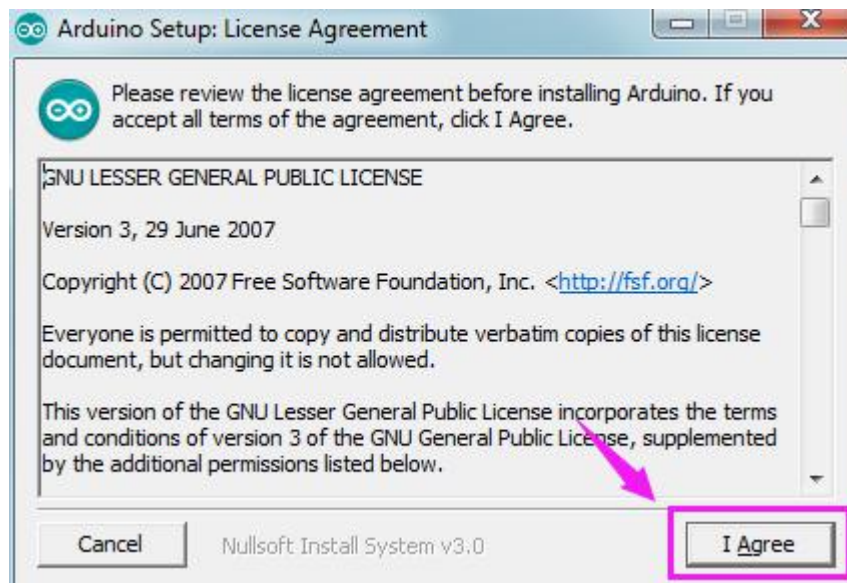
Consider supporting the Arduino Software by contributing to its development. (US tax payers, please note this contribution is not tax deductible). [Learn more on how your contribution will be used.](#)



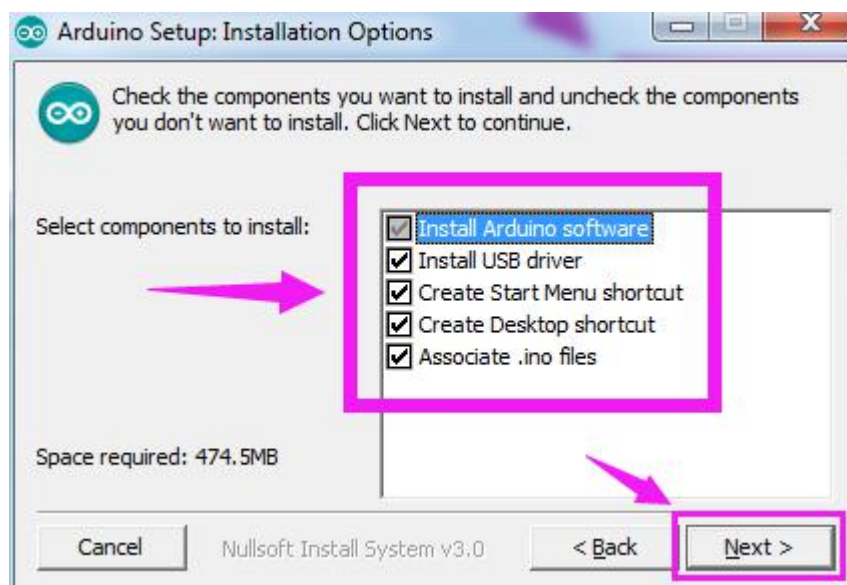
Run the downloaded file.

 arduino-1.8.7-windows	10/26/2018 1:43 PM	Application	105,762 KB
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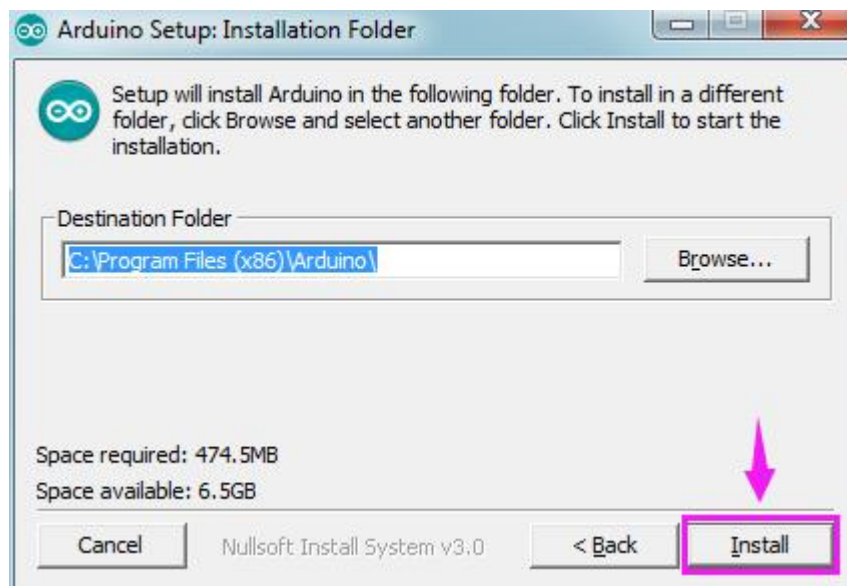
Click "I Agree".



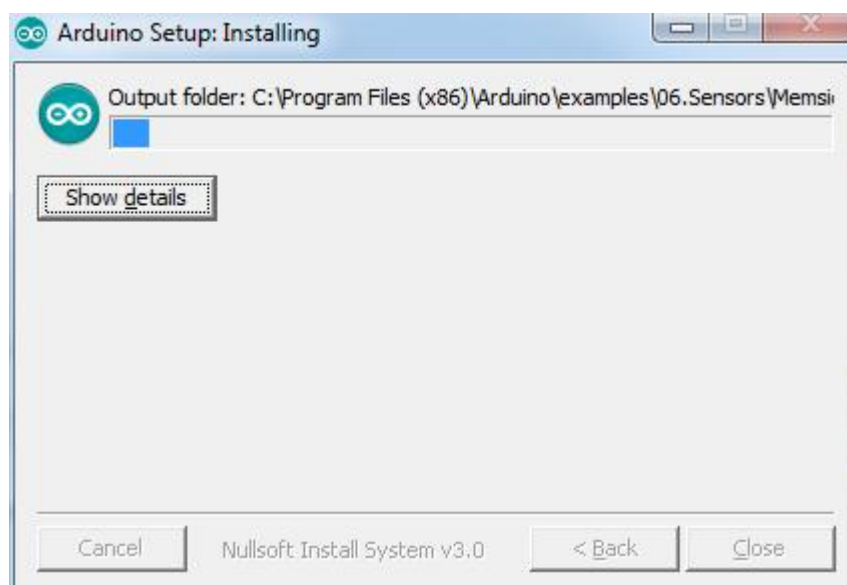
Click "Next".



Leave the installation path as default, click "Install".



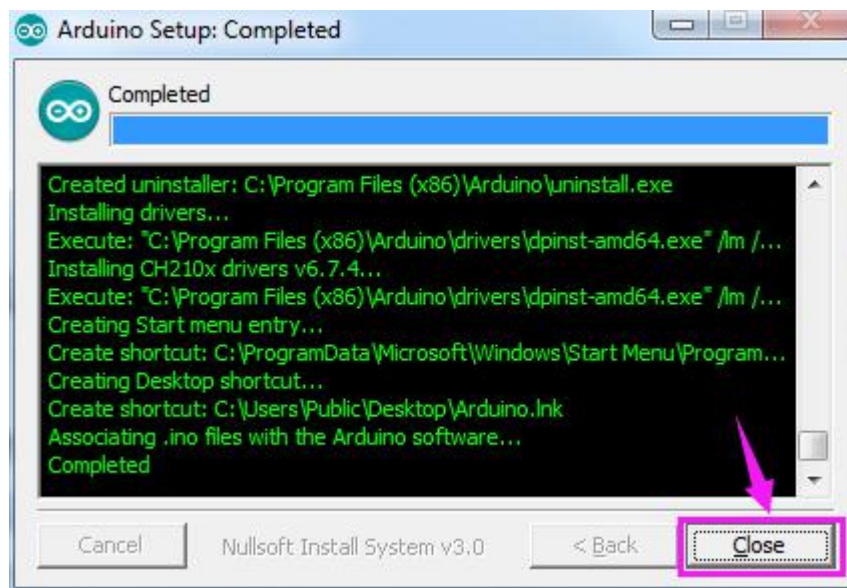
Then enter the installation process, please wait.



If the option pops up during the installation process, please select "Install".



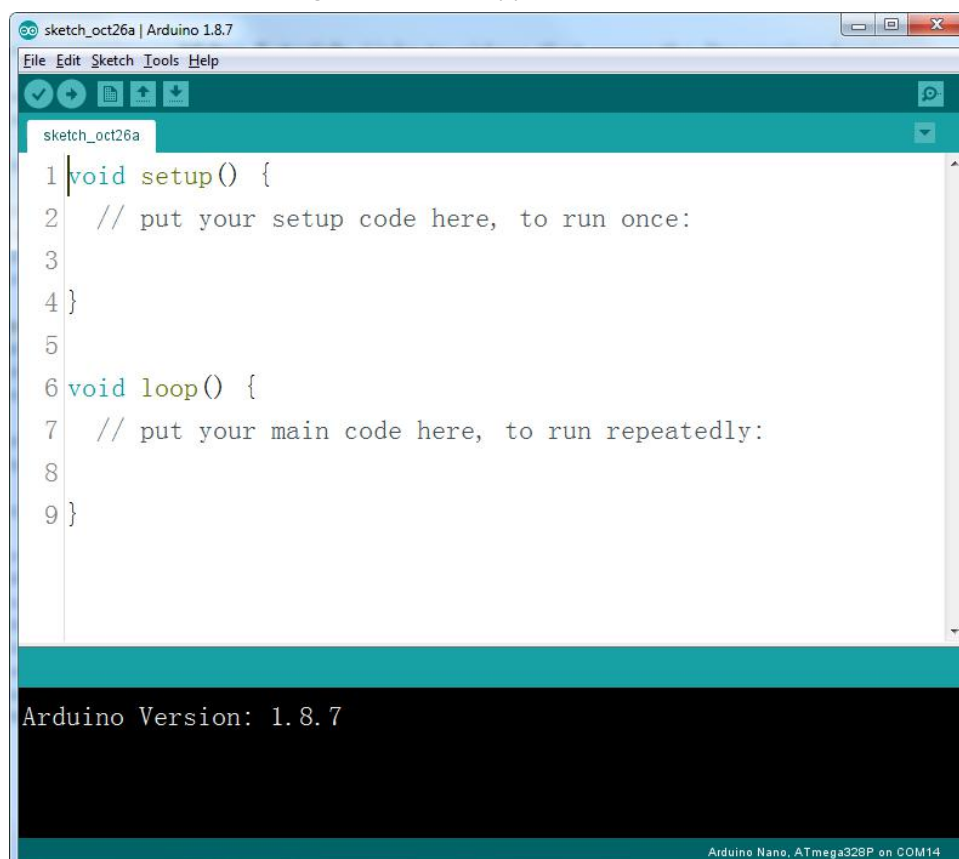
When the installation is complete, click "Close".



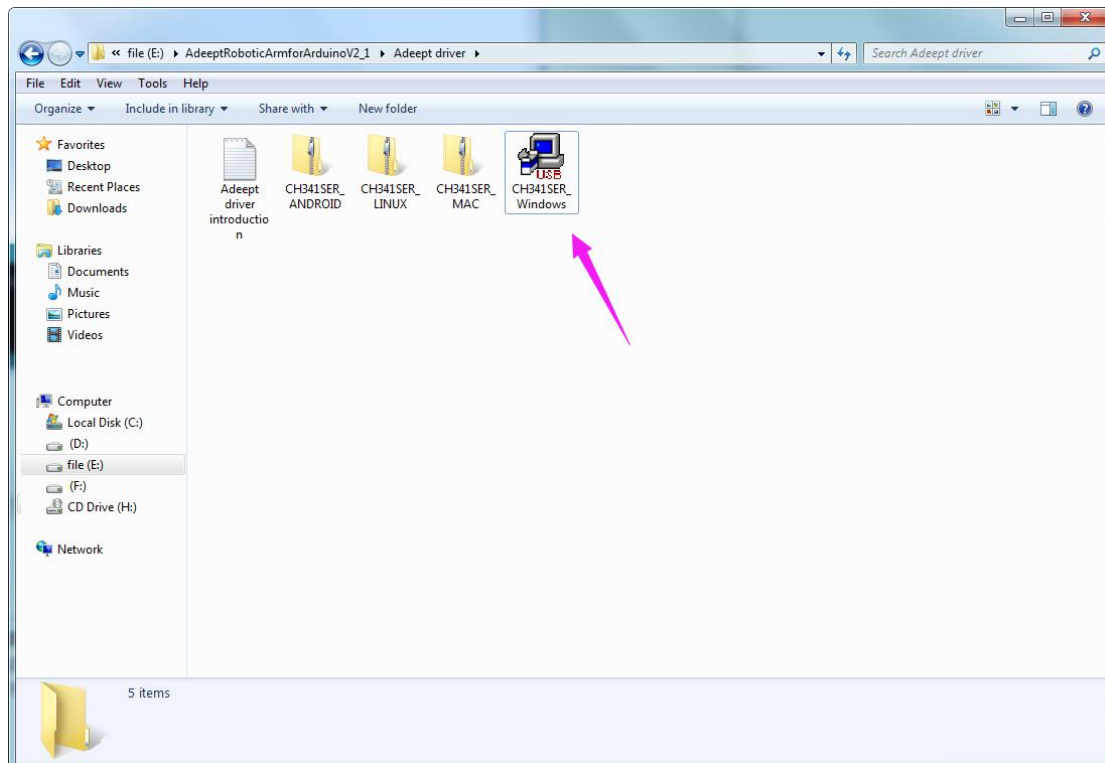
After the installation is complete, you can see the icon of the Arduino IDE on your computer desktop.



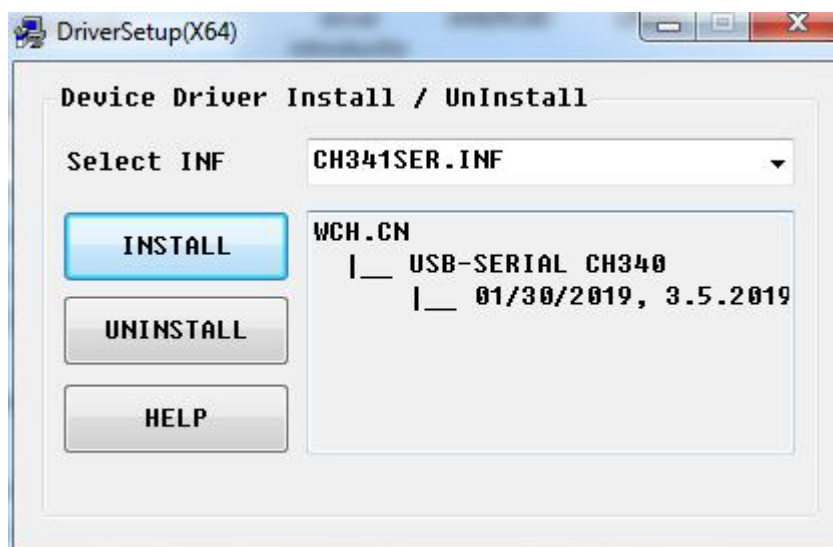
Click to run Arduino, the following interface will appear.



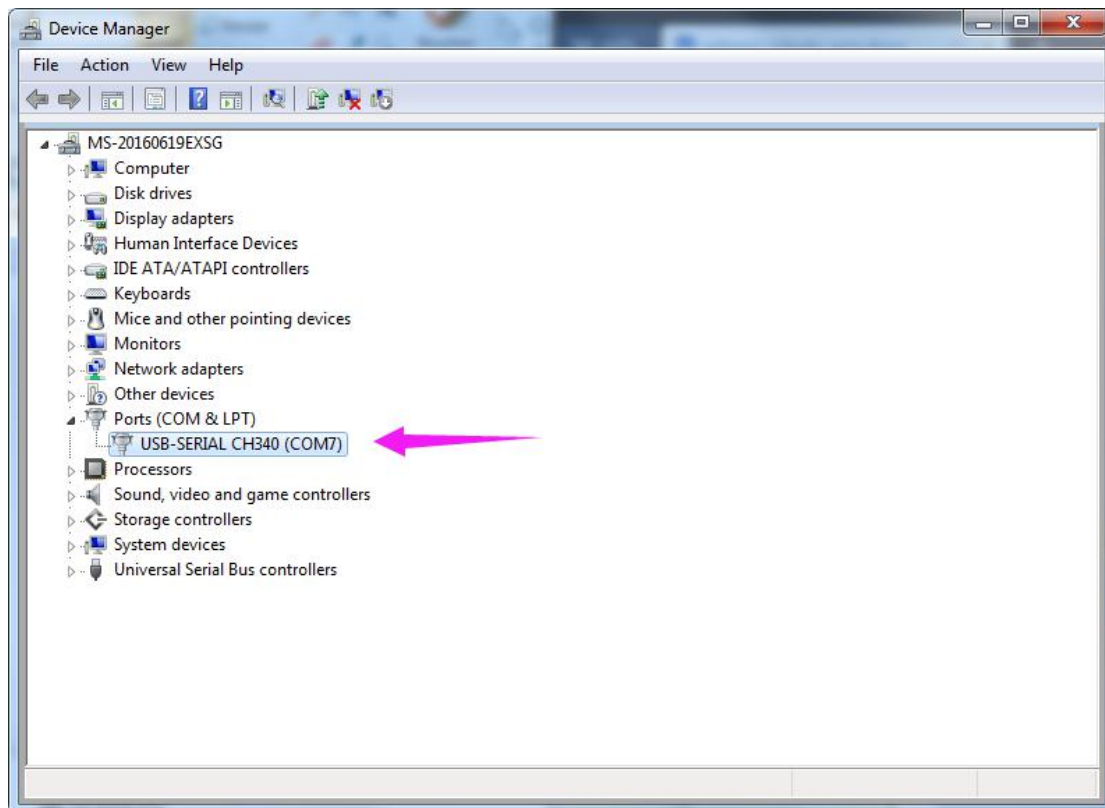
Next we need to install the driver program of the Adept Robotic Arm Drive Board. We provide driver programs for 4 systems, Windows, Android, Linux and Mac in the package. We need to select the corresponding driver installation according to the system. Let's take the Windows system as an example. Firstly connect Adept Robotic Arm Drive Board to the computer with a USB cable. Then open the package, find out the CH341SER_Windows.exe application, and run the program.



The following interface appears, click "INSTALL"

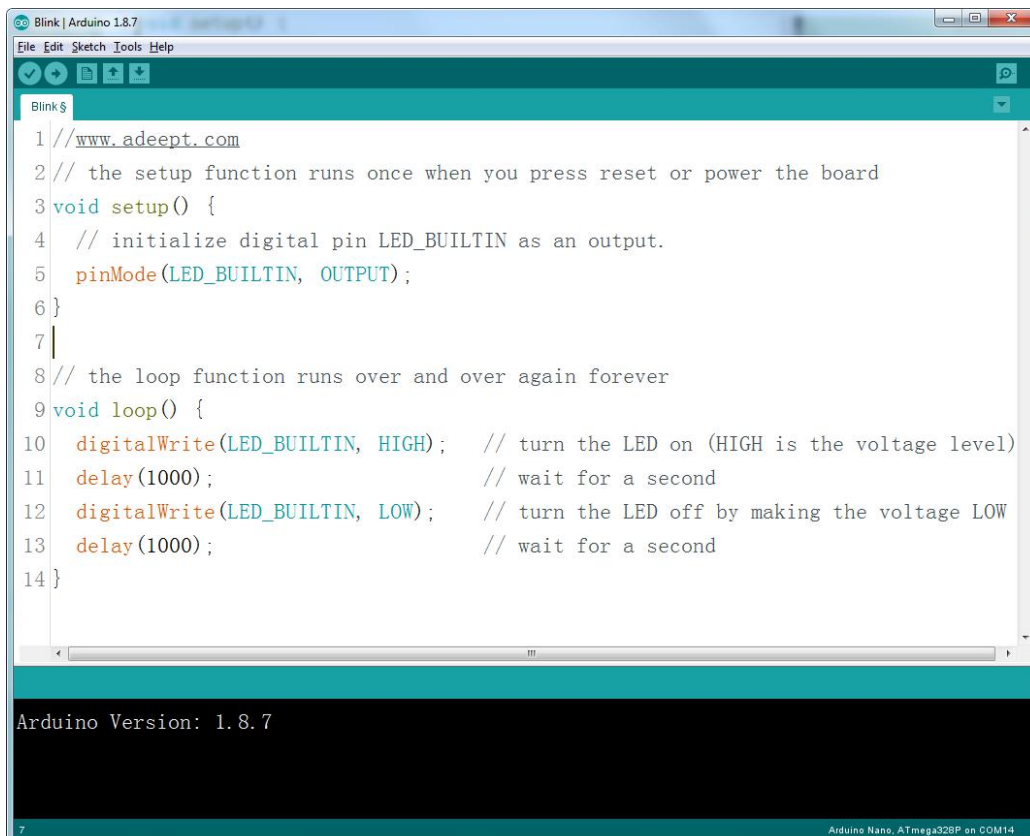


Wait a few minutes for the driver to be installed, and then open the Device Manager of the computer and you will see that the computer has recognized the Adept Robotic Arm Drive Board, and the Adept Robotic Arm Drive Board port number is COM7. It may be recognized differently on different computers for example COM1, COM2, COM3 and so on.



Let's write a simple program that lights up the LEDs on the Adept Robotic Arm Drive board and lets them flash.

Code:



```

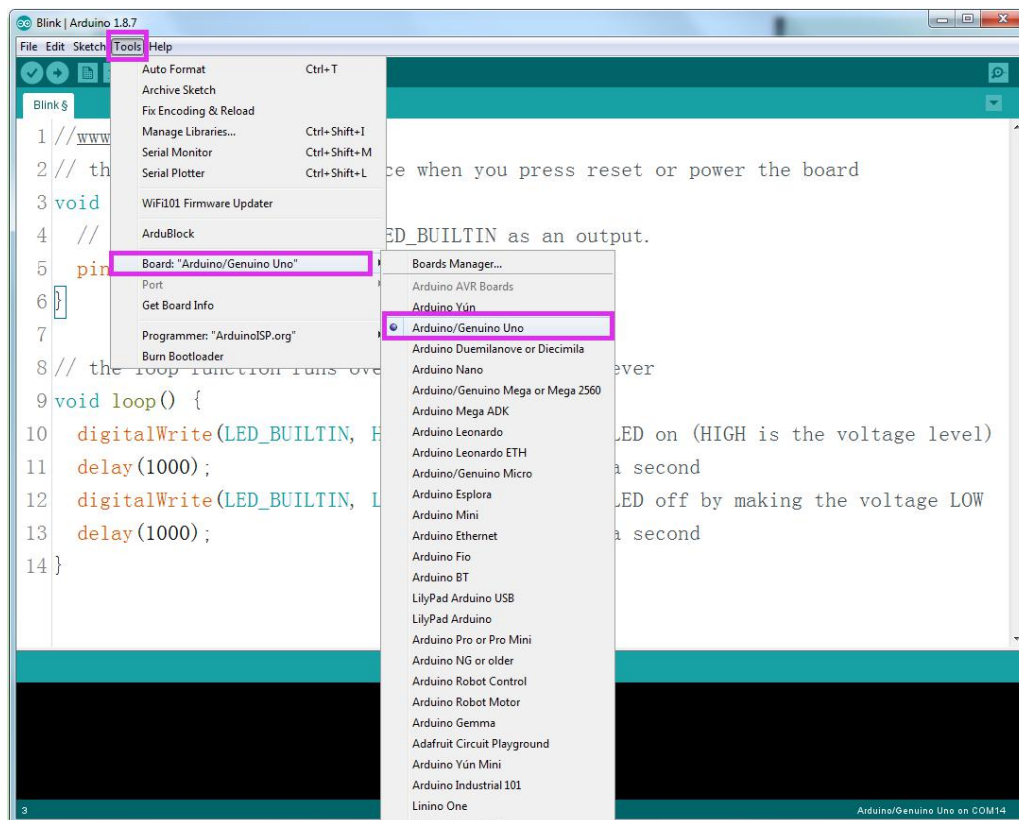
1 //www.adept.com
2 // the setup function runs once when you press reset or power the board
3 void setup() {
4   // initialize digital pin LED_BUILTIN as an output.
5   pinMode(LED_BUILTIN, OUTPUT);
6 }
7 |
8 // the loop function runs over and over again forever
9 void loop() {
10  digitalWrite(LED_BUILTIN, HIGH); // turn the LED on (HIGH is the voltage level)
11  delay(1000); // wait for a second
12  digitalWrite(LED_BUILTIN, LOW); // turn the LED off by making the voltage LOW
13  delay(1000); // wait for a second
14 }
    
```

Arduino Version: 1.8.7

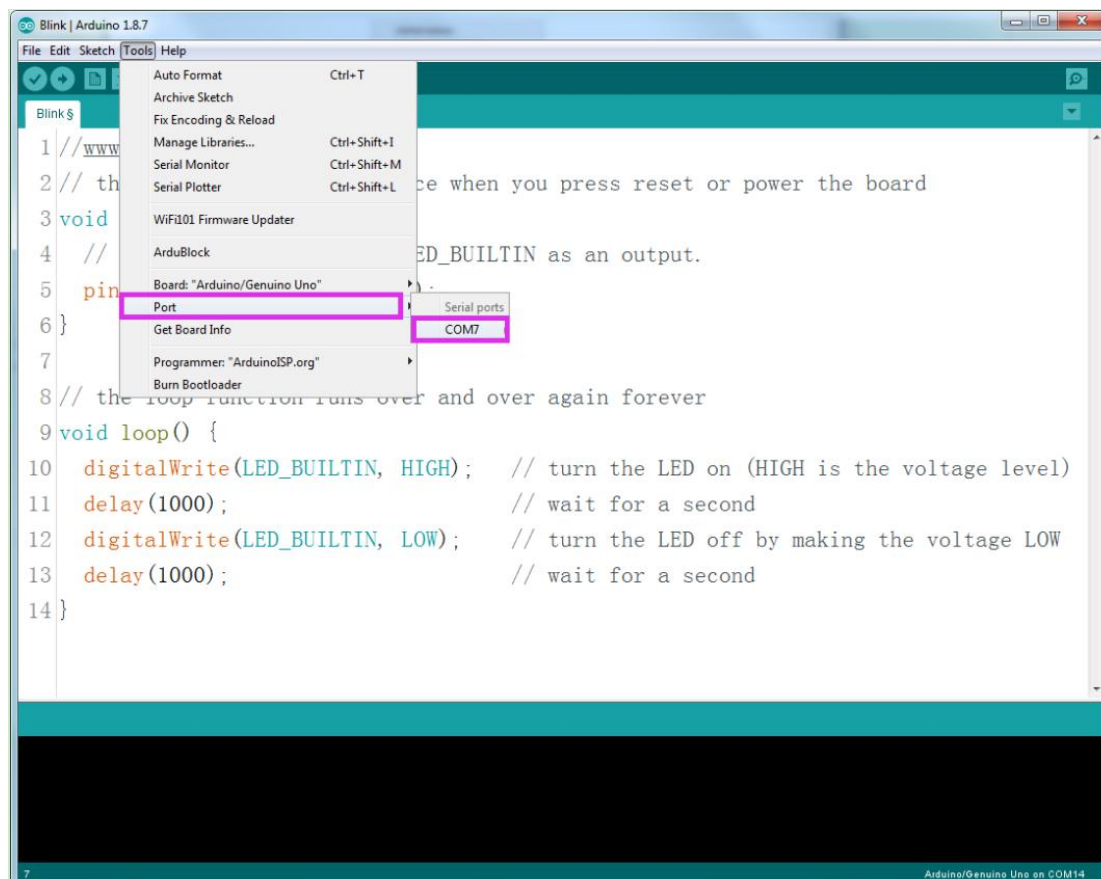
Arduino Nano, ATmega328P on COM14

Next we connect the Adept Robotic Arm Drive Board to the computer with a USB cable.

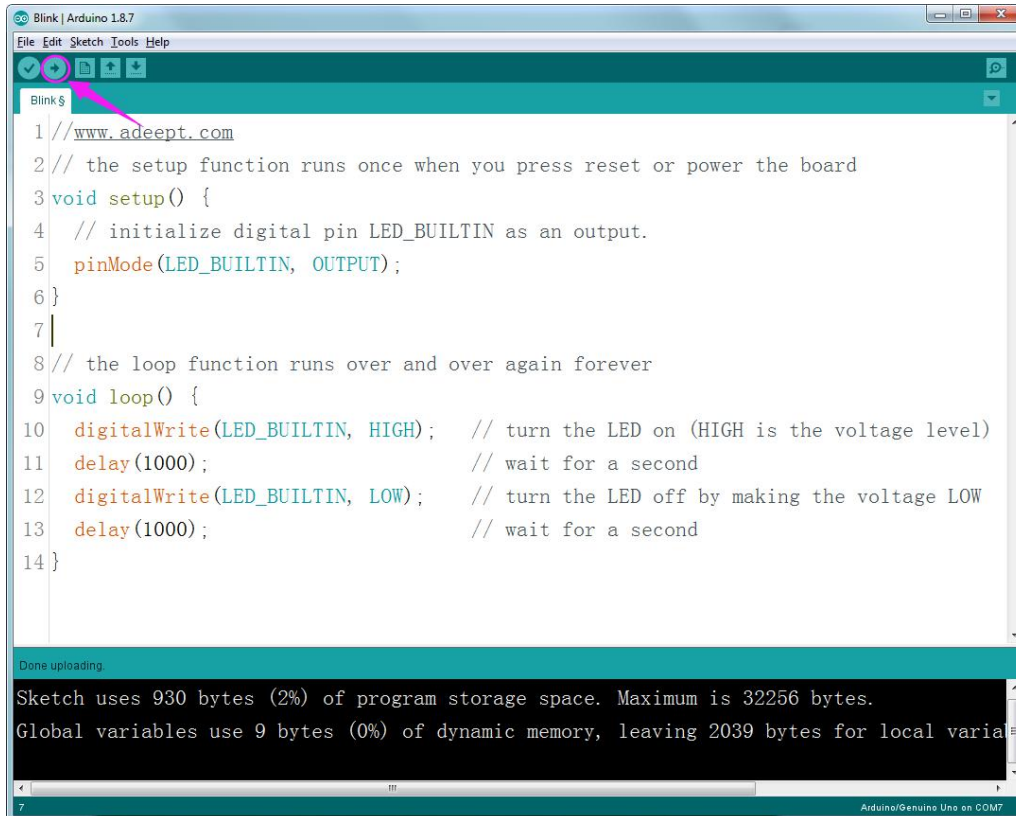
Next, go back to the Arduino IDE interface and select the model of the control board. Click on "Tools" -> "Board" -> "Arduino/Genuino Uno", as shown below



Next click "Tools"->"COM7(Arduino/Genuino Uno)"



When finish selecting, upload the code to Adept Robotic Arm Drive Board by clicking "Upload".



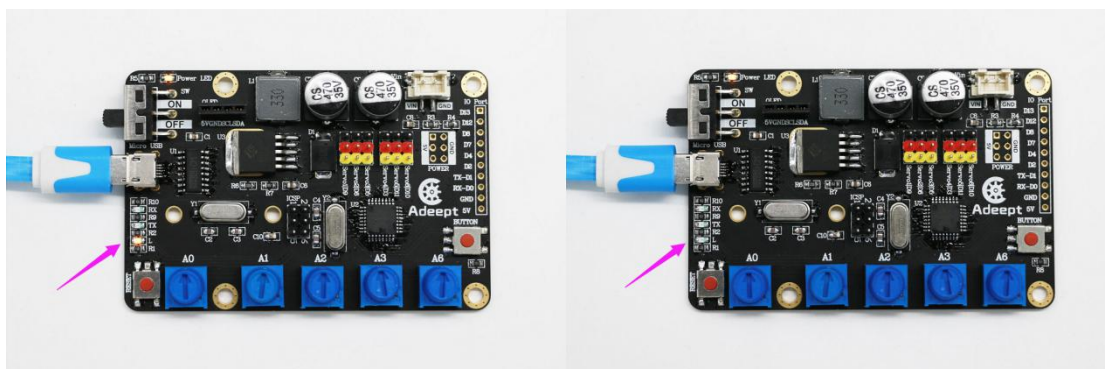
```

Blink | Arduino 1.8.7
File Edit Sketch Tools Help
Blink $
1 //www.adept.com
2 // the setup function runs once when you press reset or power the board
3 void setup() {
4   // initialize digital pin LED_BUILTIN as an output.
5   pinMode(LED_BUILTIN, OUTPUT);
6 }
7
8 // the loop function runs over and over again forever
9 void loop() {
10  digitalWrite(LED_BUILTIN, HIGH); // turn the LED on (HIGH is the voltage level)
11  delay(1000); // wait for a second
12  digitalWrite(LED_BUILTIN, LOW); // turn the LED off by making the voltage LOW
13  delay(1000); // wait for a second
14 }

Done uploading.
Sketch uses 930 bytes (2%) of program storage space. Maximum is 32256 bytes.
Global variables use 9 bytes (0%) of dynamic memory, leaving 2039 bytes for local variables.

7 Arduino/Genuino Uno on COM7
  
```

When the code is successfully downloaded to Adept Robotic Arm Drive Board, you can see the LED flashes.



More details about the download and usage of Processing, please click on this video

More learning videos please click on <http://www.adept.com/video>

Open your browser and enter the URL www.processing.org

Click on "Download Processing"

Processing p5.js Processing.py Processing for Android Processing for Pi Processing Foundation

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» Medium



Welcome to Processing 3! Dan explains the new features and changes; the links Dan mentions are on the Vimeo page.

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» Browse Tutorials

» Visit the Reference

Processing is a flexible software sketchbook and a language for learning how to code within the context of the visual arts. Since 2001, Processing has promoted software literacy within the visual arts and visual literacy within technology. There are tens of thousands of students, artists, designers, researchers, and hobbyists who use Processing for learning and prototyping.

- » Free to download and open source
- » Interactive programs with 2D, 3D, PDF, or SVG output
- » OpenGL integration for accelerated 2D and 3D
- » For GNU/Linux, Mac OS X, Windows, Android, and ARM
- » Over 100 libraries extend the core software
- » Well documented, with many books available

» Donate

Please join us as a member of the Processing Foundation. We need your help!

» Exhibition

komorebi
by Leslie Nooteboom

Particle Flow
by NEOANALOG

Objectifier
by Bjørn Karmann

The operating system we choose to use here is windows 64-bit, select "Windows 64-bit"

Processing
p5.js
Processing.py
Processing for Android
Processing for Pi
Processing Foundation

< Processing

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Download Processing. Processing is available for Linux, Mac OS X, and Windows. Select your choice to download the software below.



3.4 (26 July 2018)

Windows 64-bit

Linux 64-bit

Mac OS X

Linux 32-bit

Linux ARM
(running on Pi?)

» [Github](#)

» [Report Bugs](#)

» [Wiki](#)

» [Supported Platforms](#)

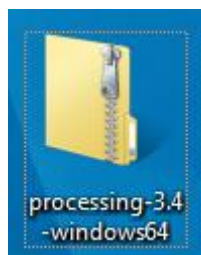
Read about the [changes in 3.0](#). The [list of revisions](#) covers the differences between releases in detail.

Stable Releases

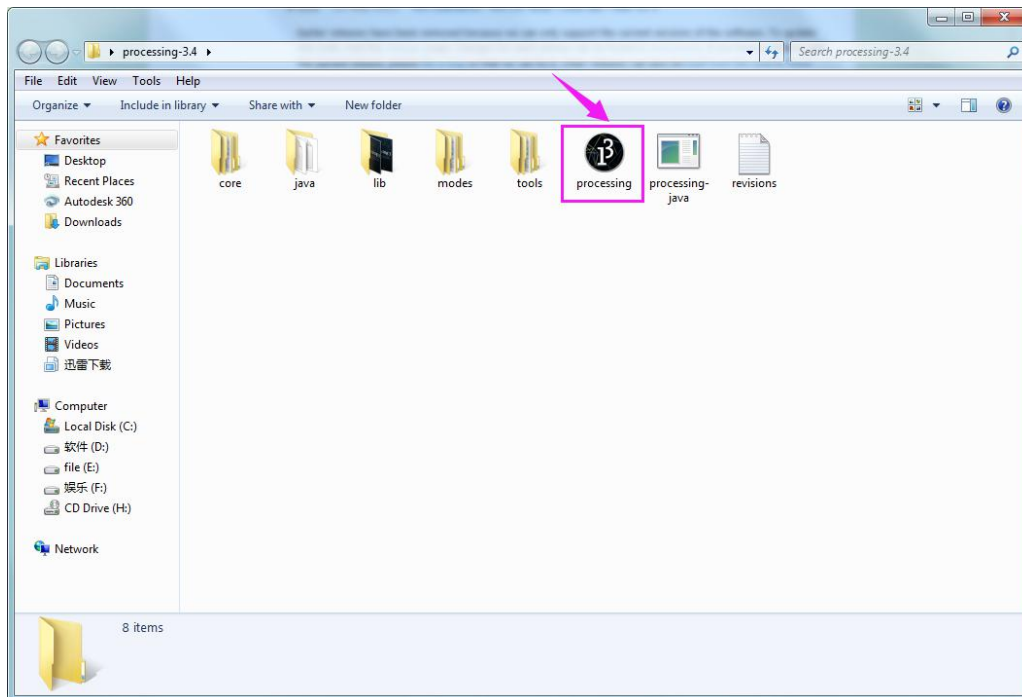
- **3.4** (26 July 2018) [Win 32](#) / [Win 64](#) / [Linux 32](#) / [Linux 64](#) / [Linux ARMv6hf](#) / [Mac OS X](#)
- **3.3.7** (13 March 2018) [Win 32](#) / [Win 64](#) / [Linux 32](#) / [Linux 64](#) / [Linux ARMv6hf](#) / [Mac OS X](#)
- **2.2.1** (19 May 2014) [Win 32](#) / [Win 64](#) / [Linux 32](#) / [Linux 64](#) / [Mac OS X](#)
- **1.5.1** (15 May 2011) [Win \(standard\)](#) / [Win \(no Java\)](#) / [Linux x86](#) / [Mac OS X](#)

Earlier releases have been removed because we can only support the current versions of the software. To update old code, read the [changes](#) page. Changes for each release can be found in [revisions.txt](#). If you have problems with the current release, please [file a bug](#) so that we can fix it. Older releases can also be [built from the source](#). Read [More](#) about the releases and their numbering. To use [Android Mode](#), Processing 3 or later is required.

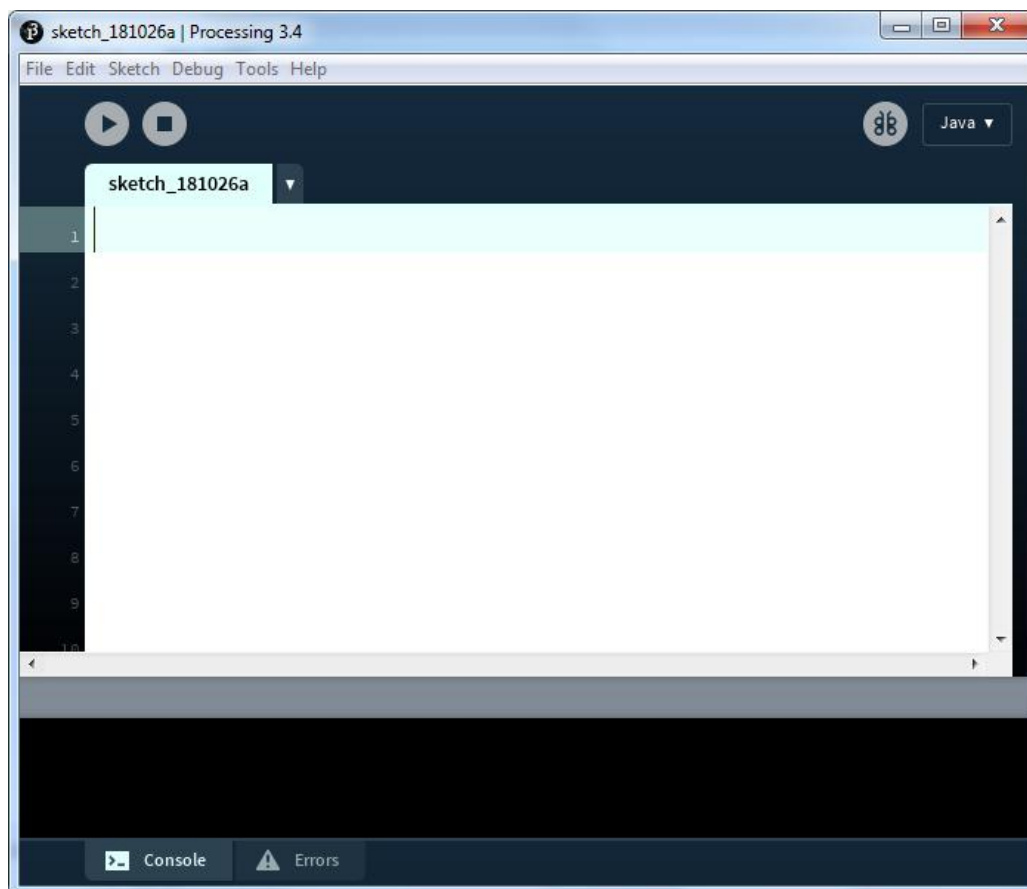
When finish downloading, you will get a compressed file "processing-3.4-windows64.zip".



After extracting this file, you can get the following file, just click to run processing, it can be run directly without installation.

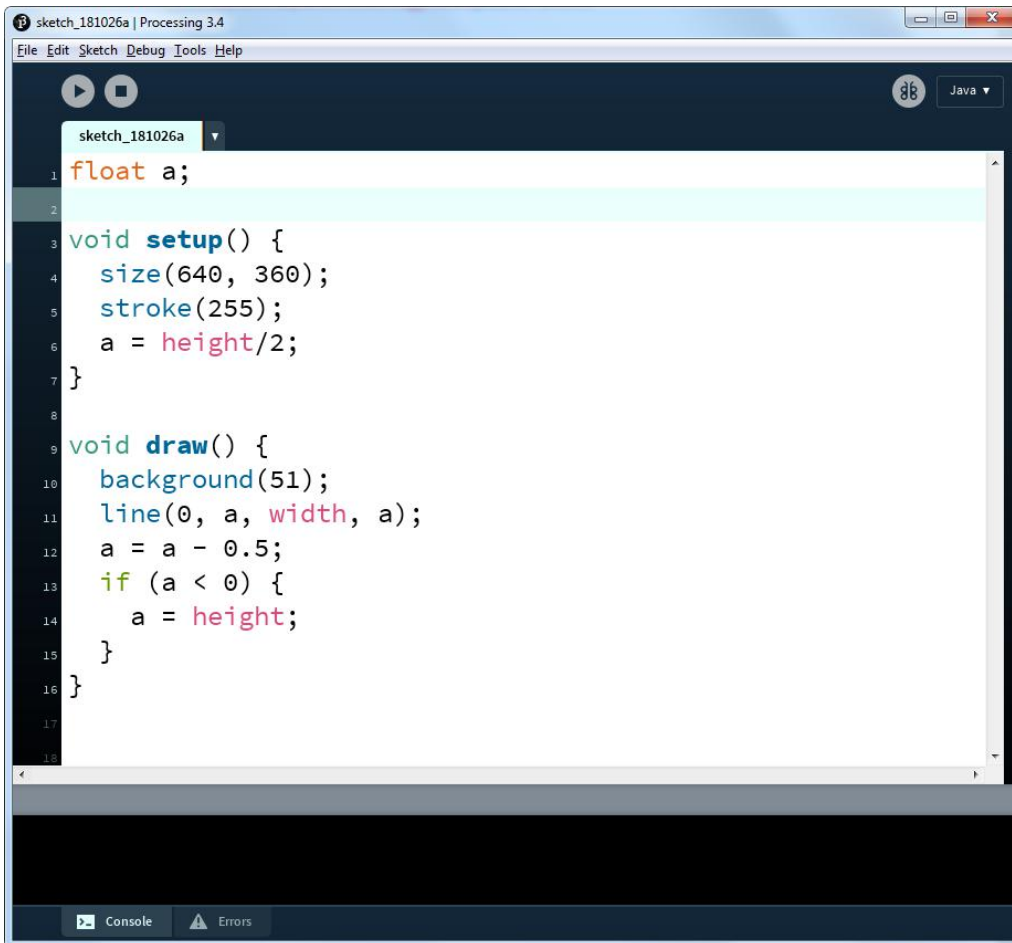


The interface is as follows after the Processing runs



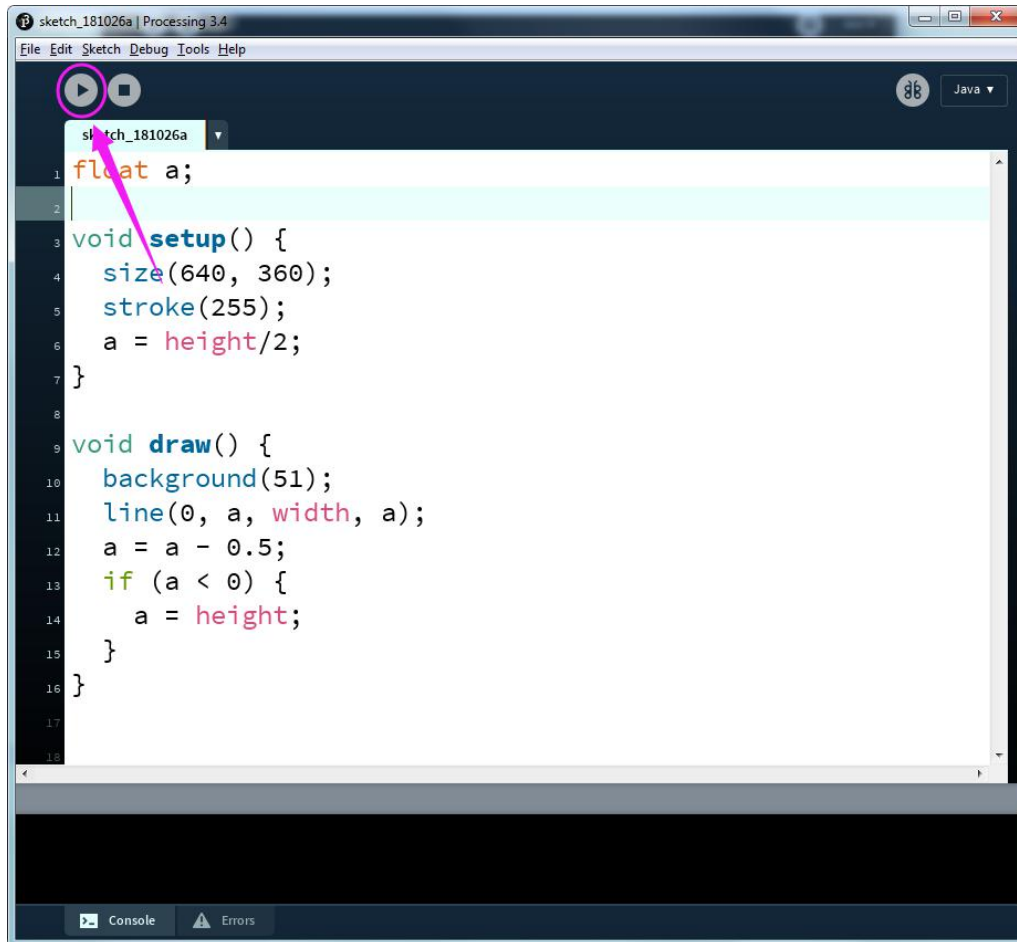
Let's write a simple code that implements the following functions

"Change the variable to create a moving line. When the line moves out of the window edge, the variable becomes 0 and the line goes back to the bottom of the screen."

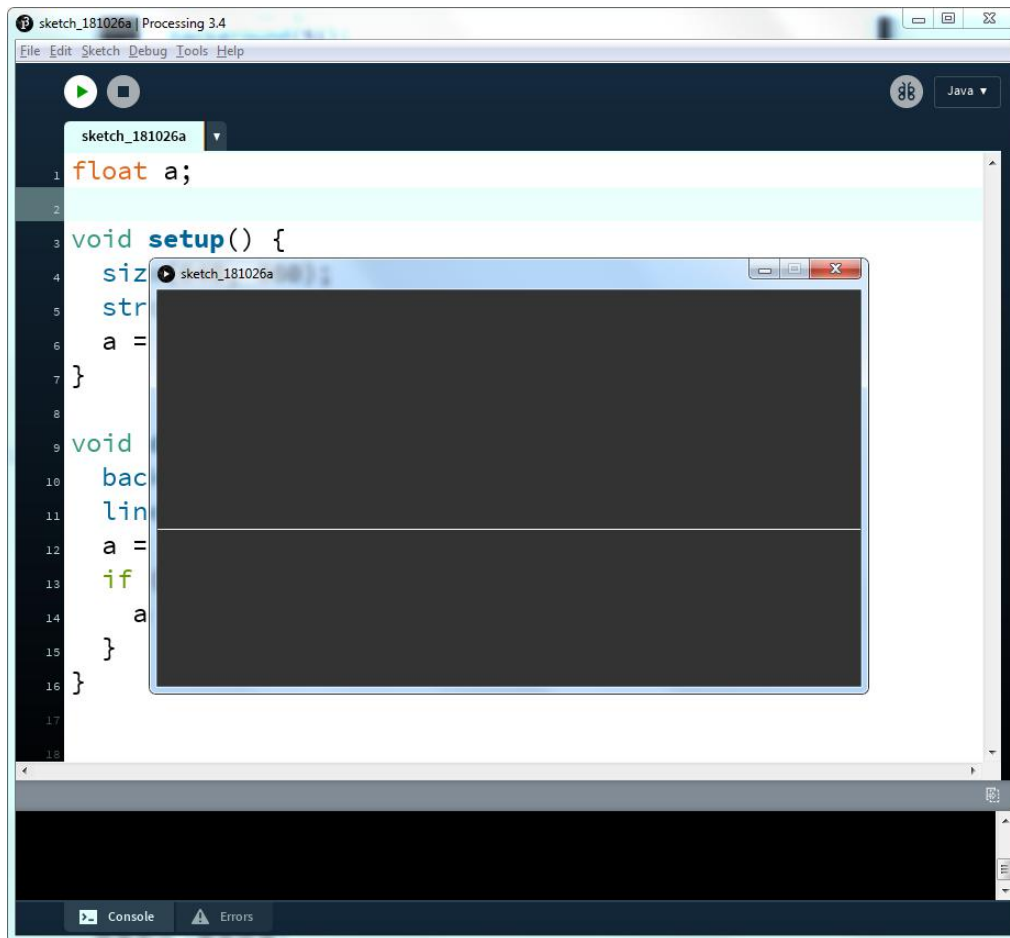


```
sketch_181026a
1 float a;
2
3 void setup() {
4   size(640, 360);
5   stroke(255);
6   a = height/2;
7 }
8
9 void draw() {
10  background(51);
11  line(0, a, width, a);
12  a = a - 0.5;
13  if (a < 0) {
14    a = height;
15  }
16 }
17
18
```

Click "Run".



Running effect is as follow.



We need to upload a piece of code to the Adept Robotic Arm Drive Board before starting to assemble the robotic arm. Find out "00 The servo initialization code of robotic arm assembly" in the documentation we provided and upload the code from the file to

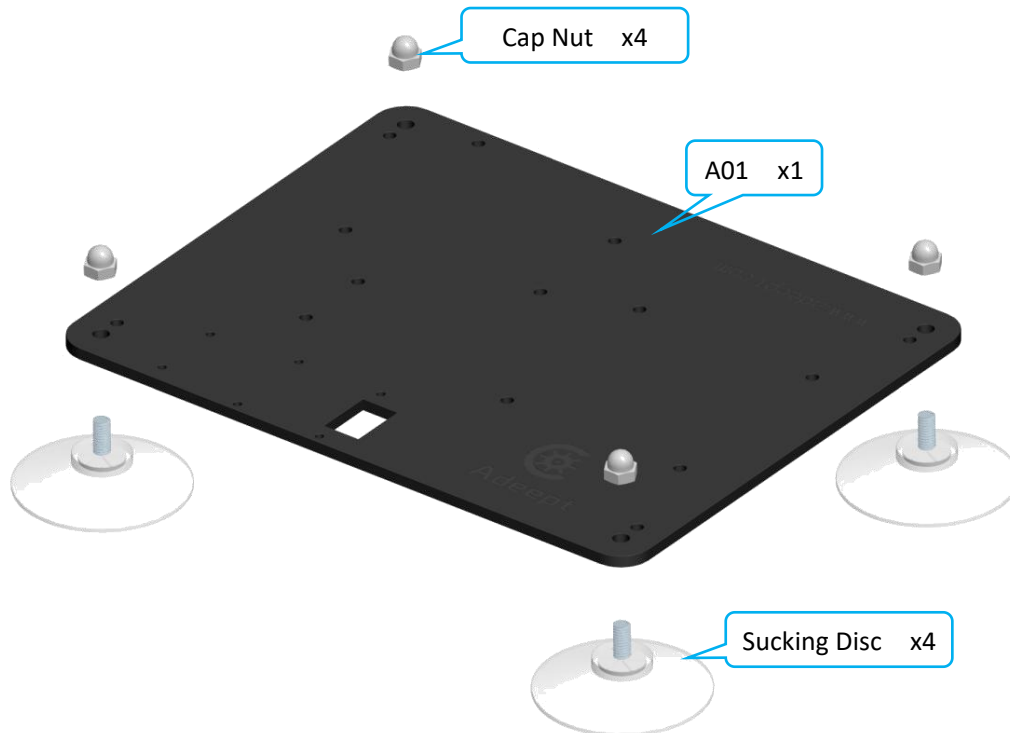
Adept Robotic Arm Drive Board.

4 Assembly

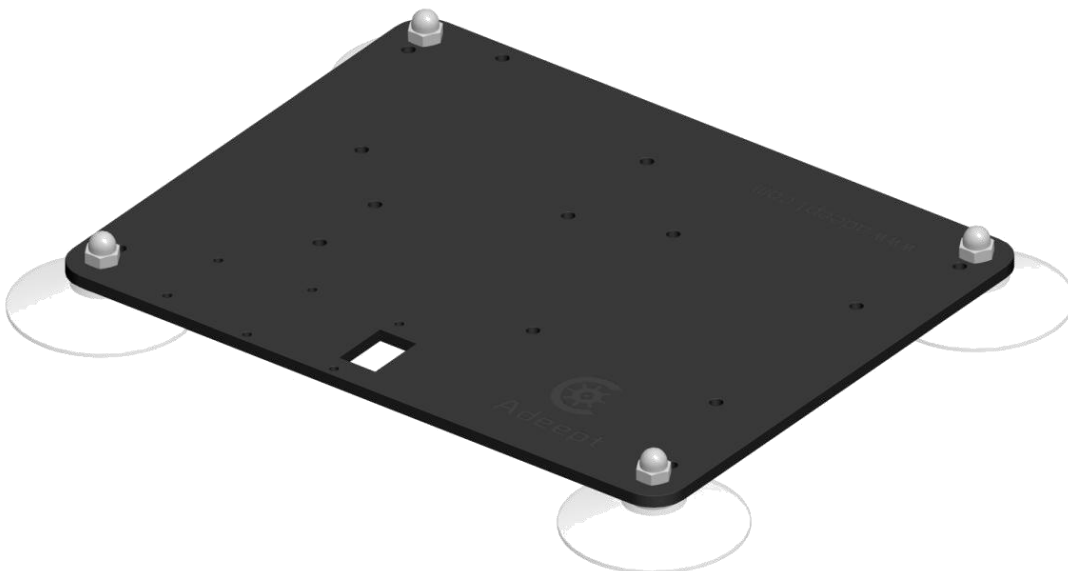
4.1. Pedestal Assembly.

1. Fix four Sucking Discs on the four corners of A01.

Assemble the following components

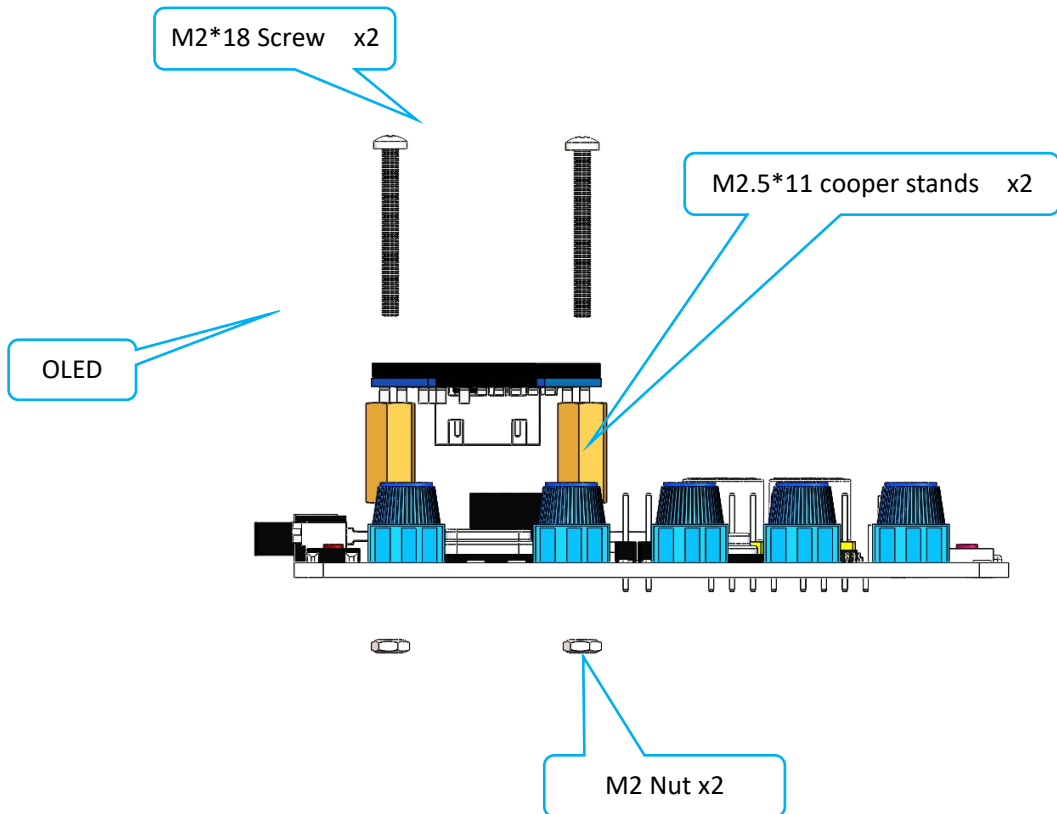


Effect diagram after assembling

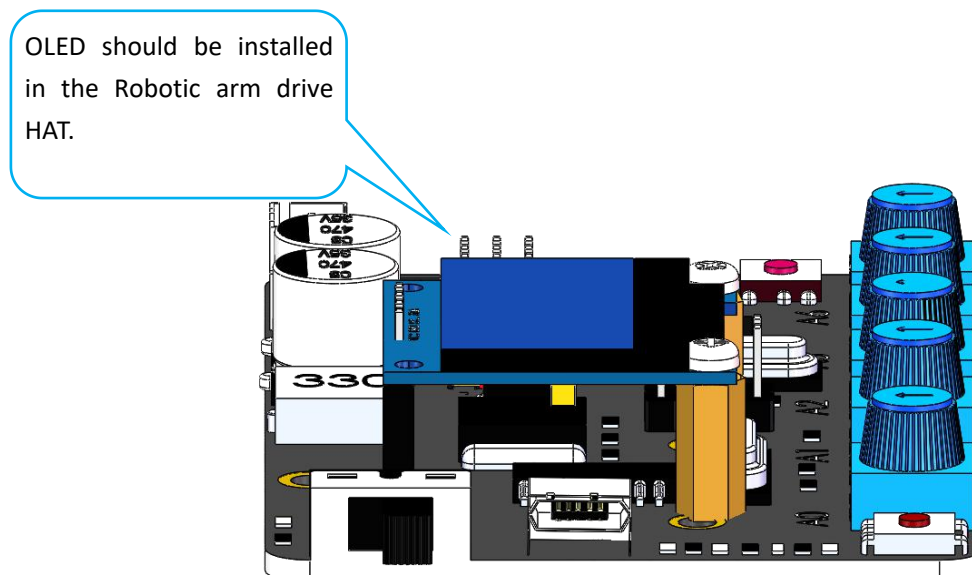


2. Fix OLED to drive

Assemble the following components

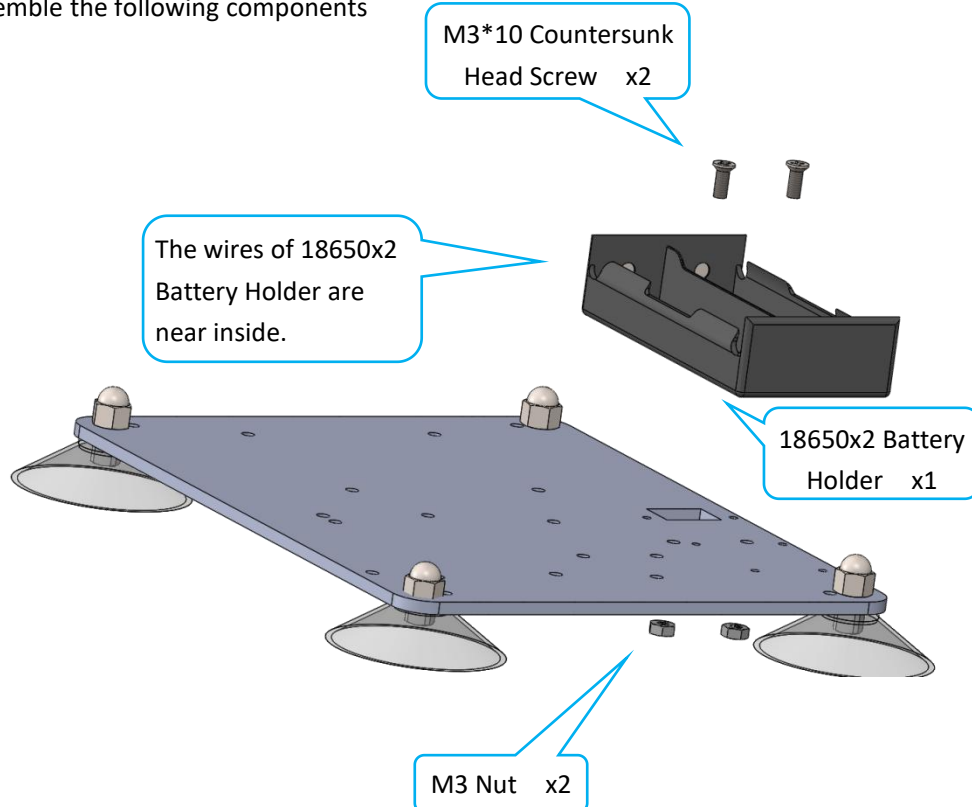


Effect diagram after assembling

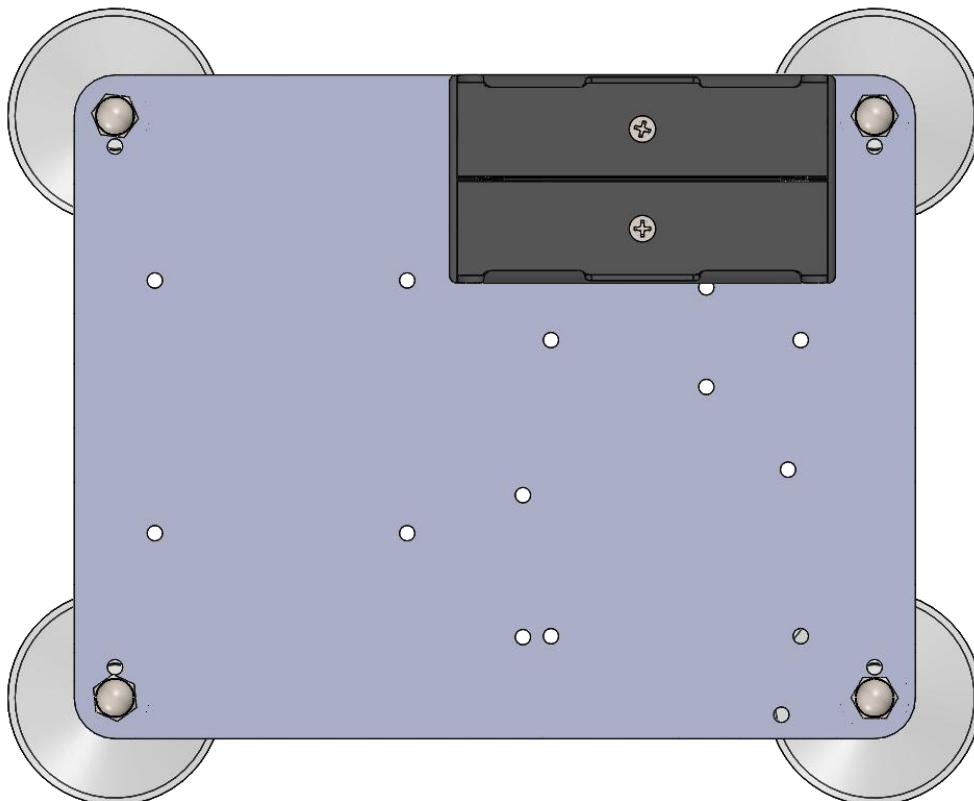


3. Fix 18650x2 Battery Holder to A01.

Assemble the following components

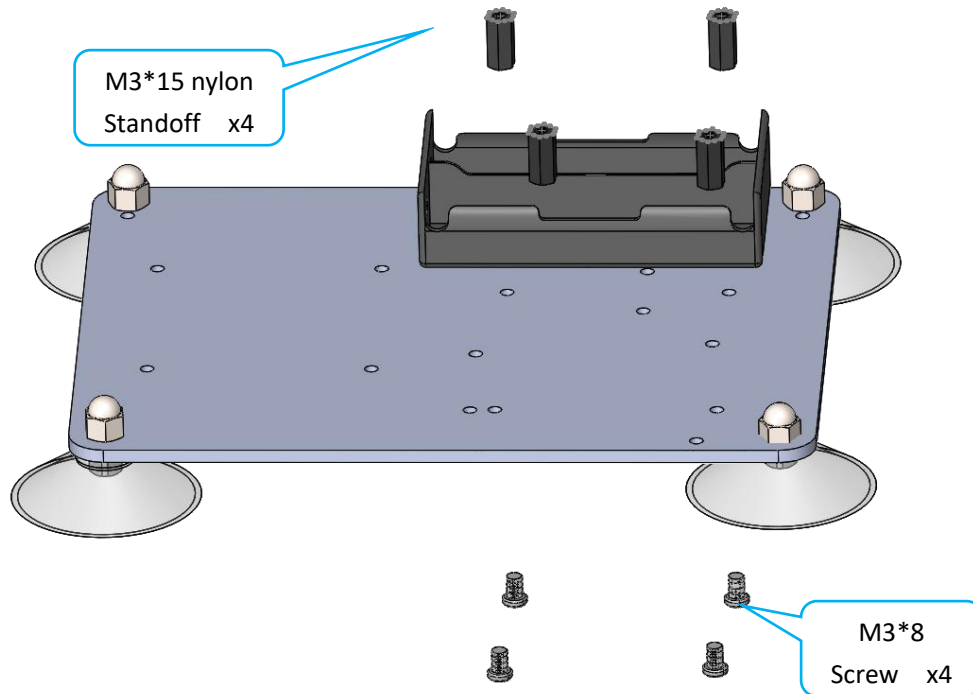


Effect diagram after assembling

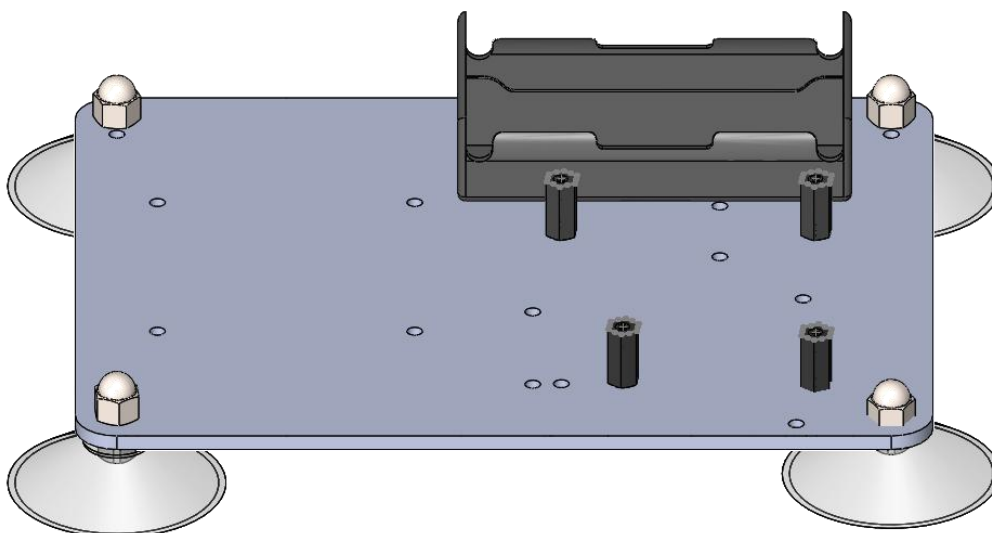


4. Fix four M3*6 Copper Standoffs to A01.

Assemble the following components

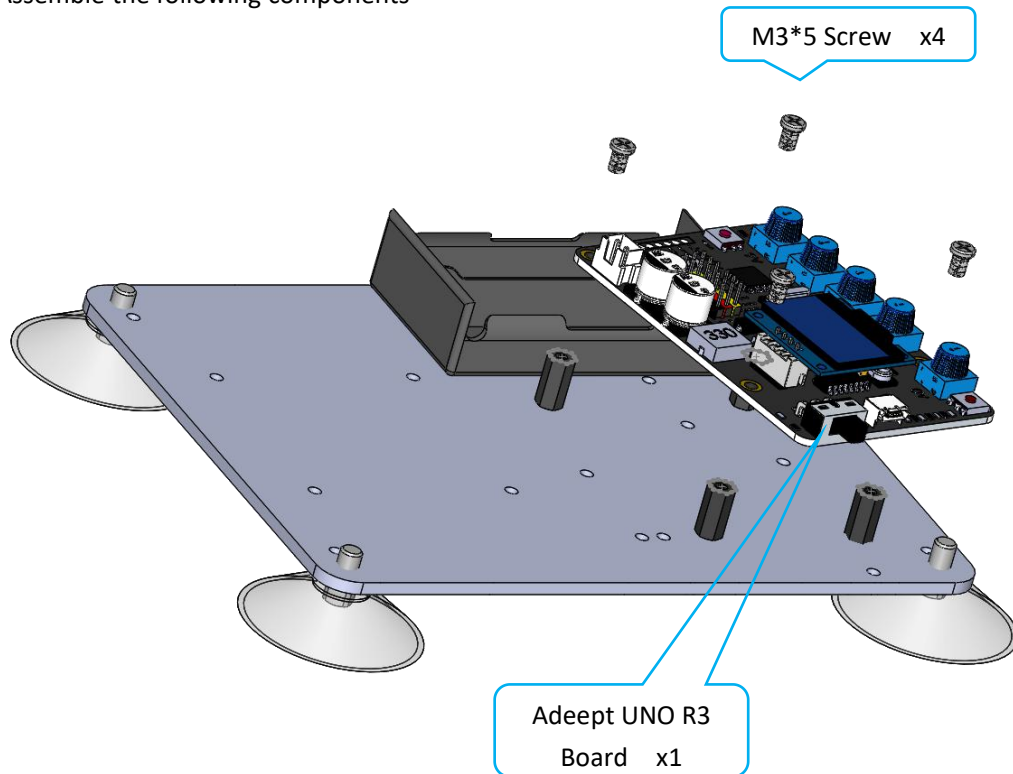


Effect diagram after assembling

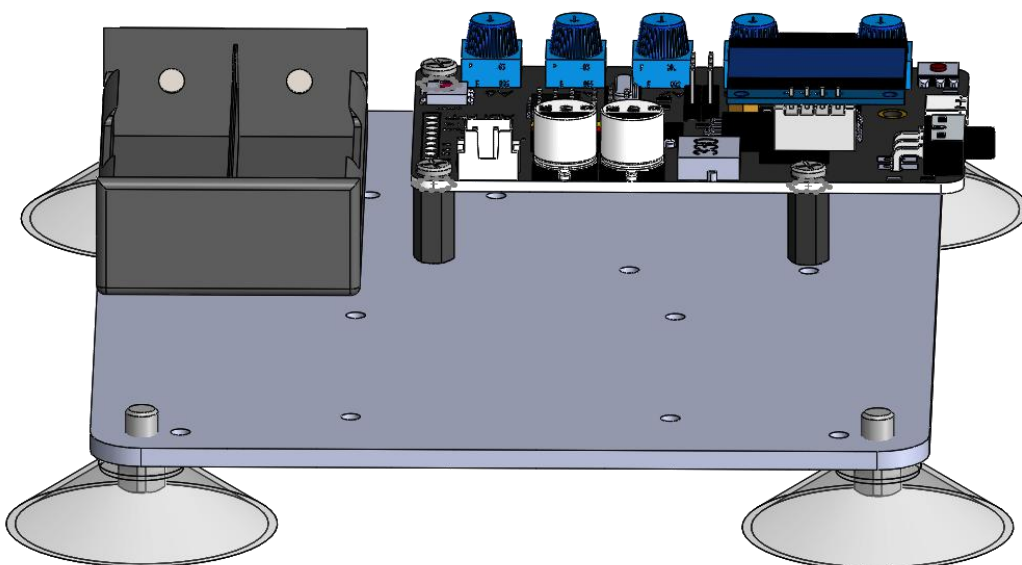


5. Fix Adept UNO R3 Board to M3*6 Copper Standoff.

Assemble the following components

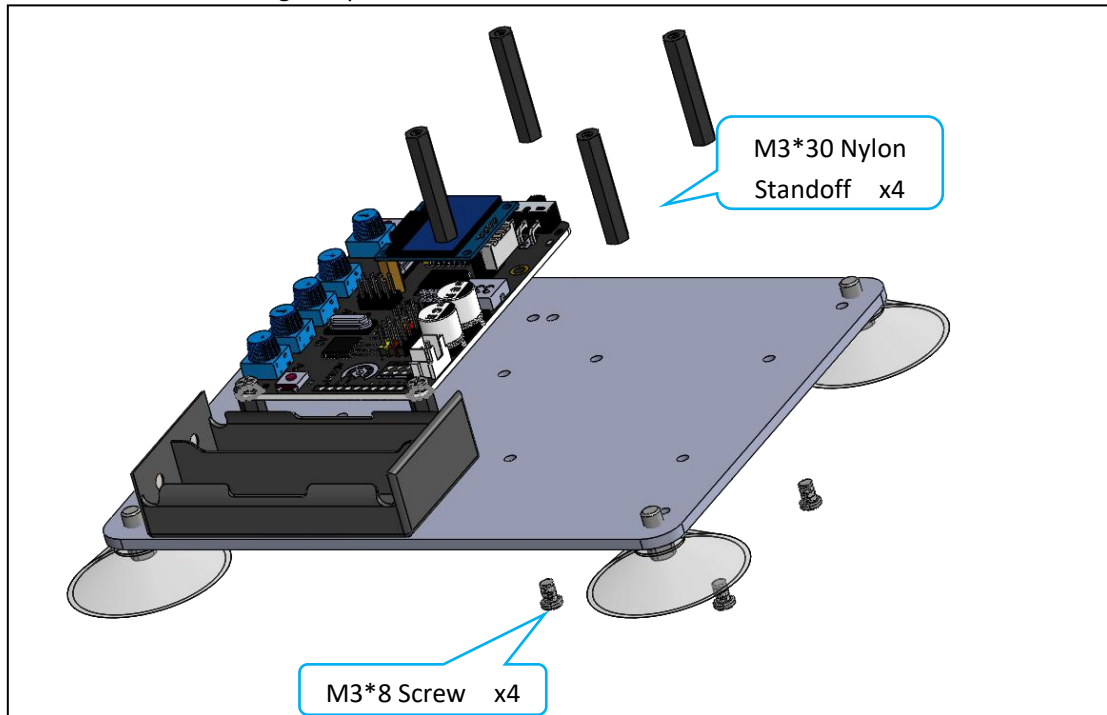


Effect diagram after assembling

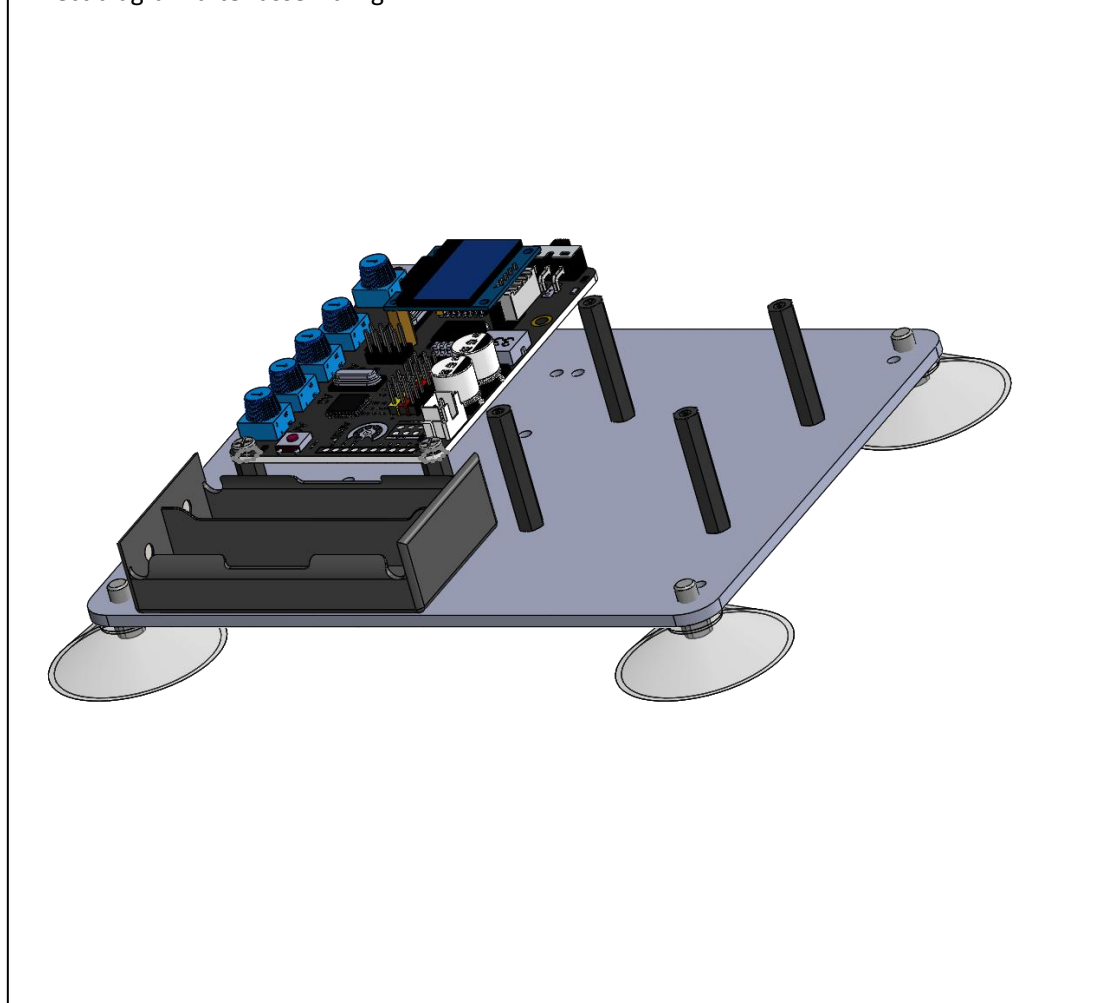


6. Fix four M3*30 Nylon Standoffs to A01.

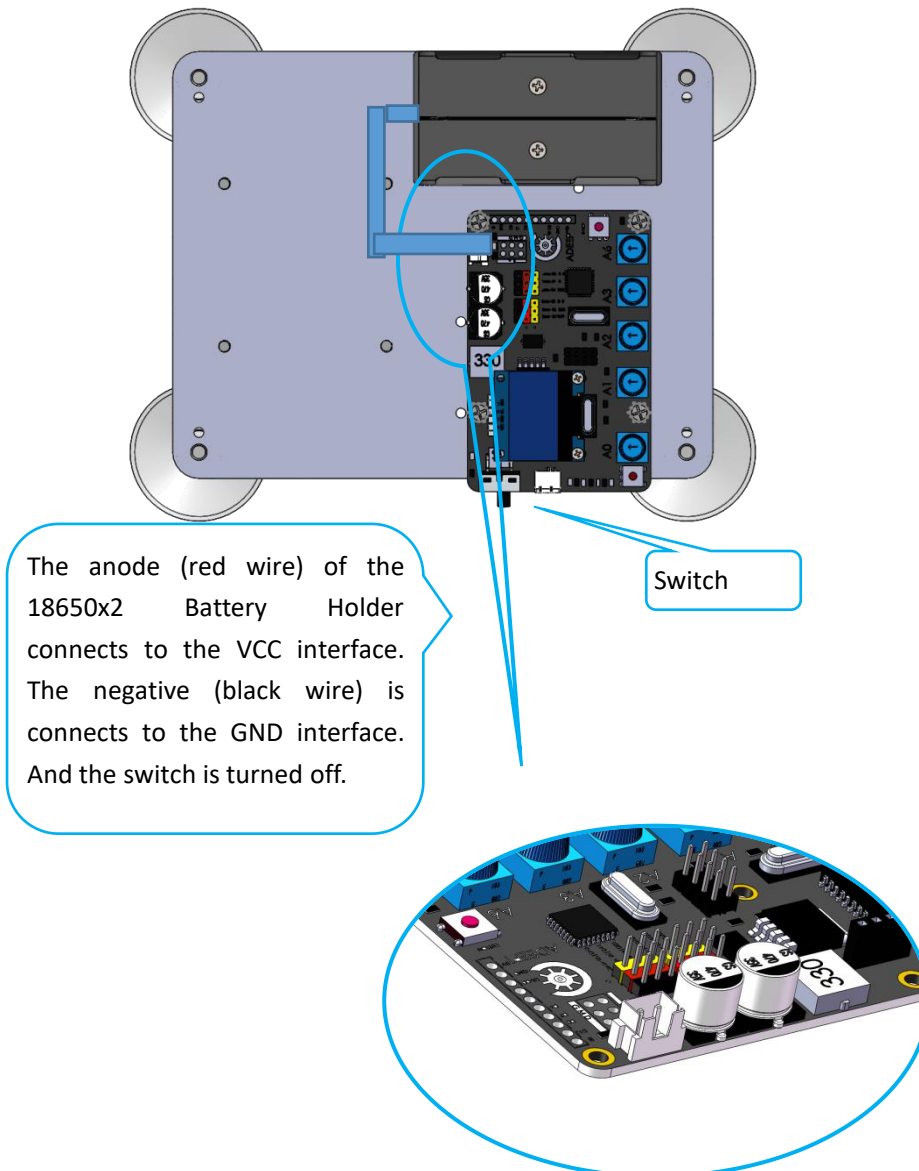
Assemble the following components



Effect diagram after assembling



Connect the 18650x2 Battery Holder to Adept Arm Drive Board.

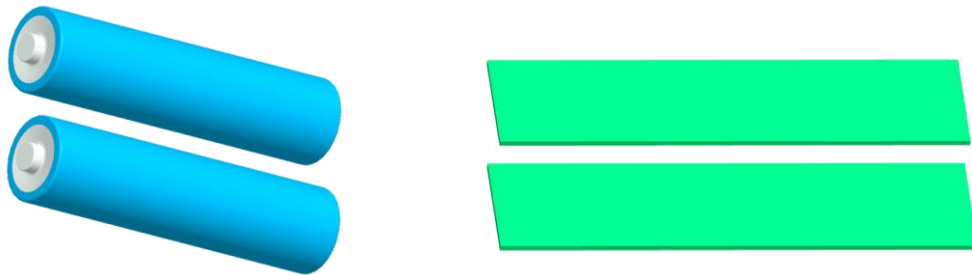


Once the circuit is connected, load your 18650 battery into 18650x2 Battery Holder and turn on the switch on the Adept Arm Drive Board. At this point, the servo will automatically rotate to the initial state, then turn off the power and remove each servo.

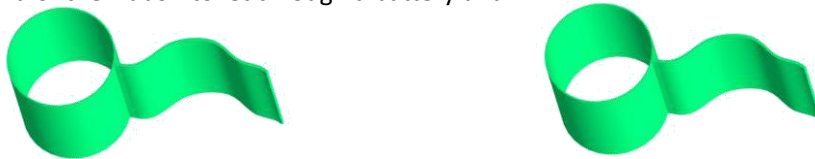
In the subsequent installation processes, before fixing the servo to the rocker arm with screws, do not rotate the rotary shaft of the servo. Otherwise, you need to follow this step again to debug the servo.

4.2. Install and Remove Batteries

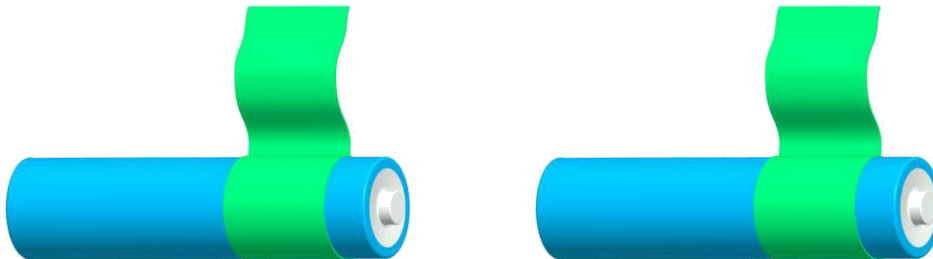
Take out 2 ribbons and 2 batteries.



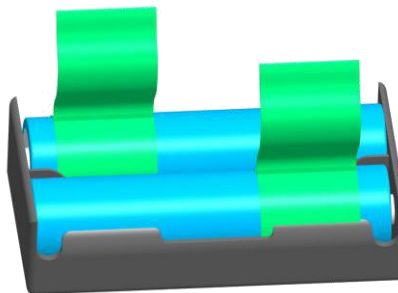
Roll one end of the ribbon to let through a battery and fix.



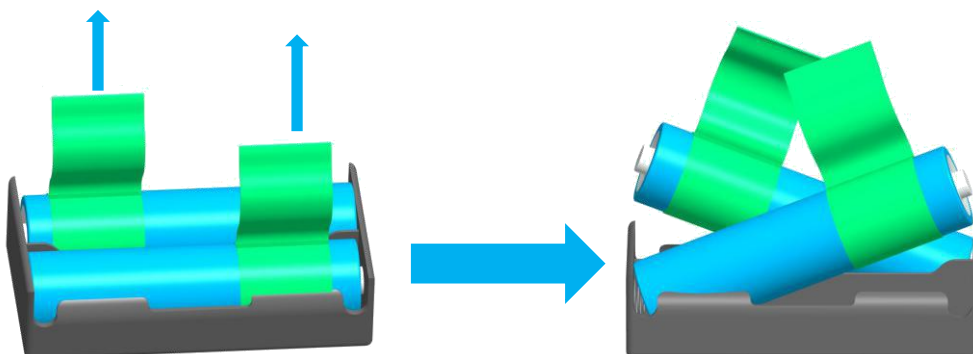
Insert the batteries into the rings-ribbon closer to the anode.



Install the batteries into the holder based on the pole.



To remove the batteries, just pull the ribbon and take them out.

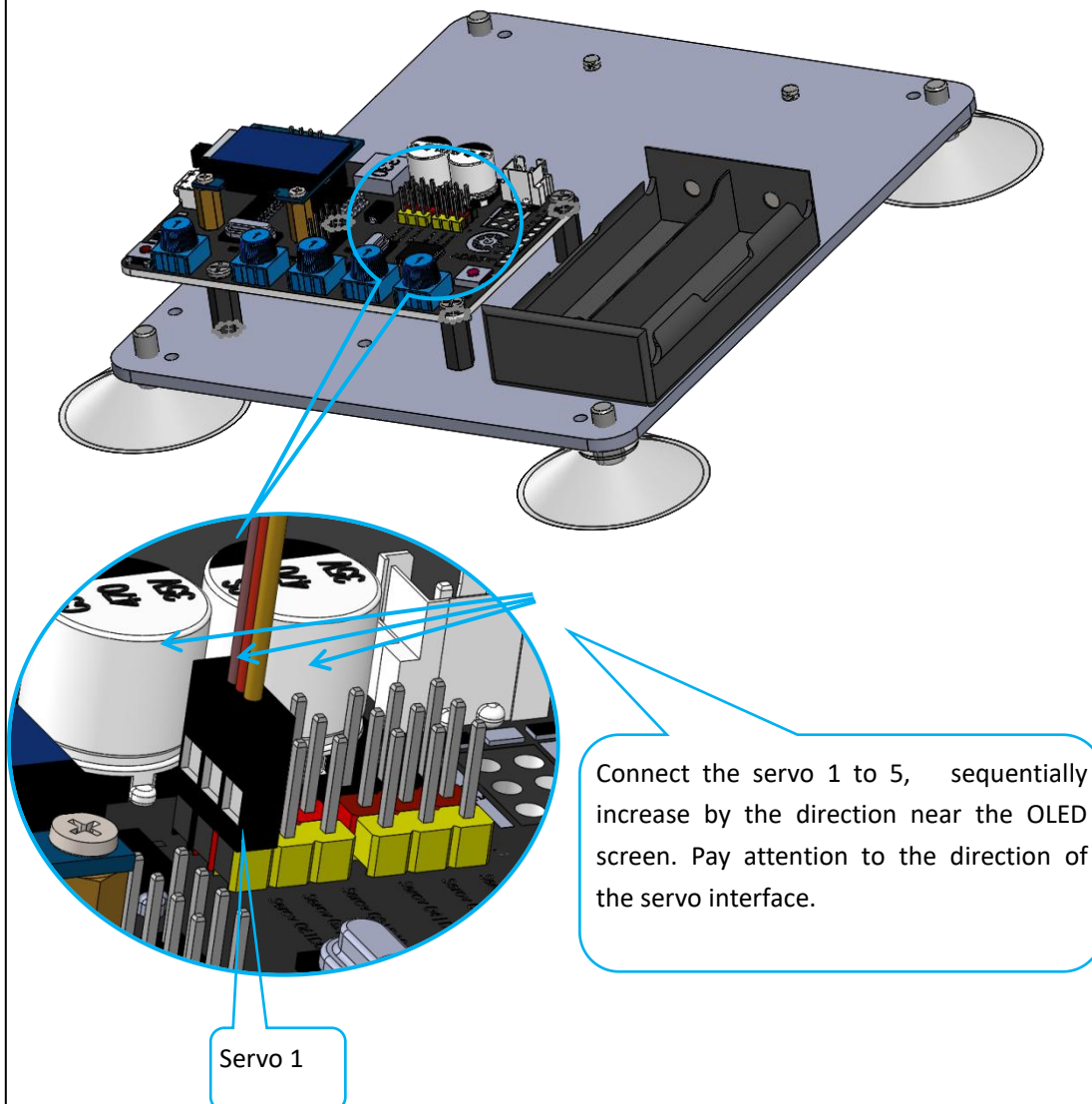


4.3. Turnplate and Rocker Arm Assembly

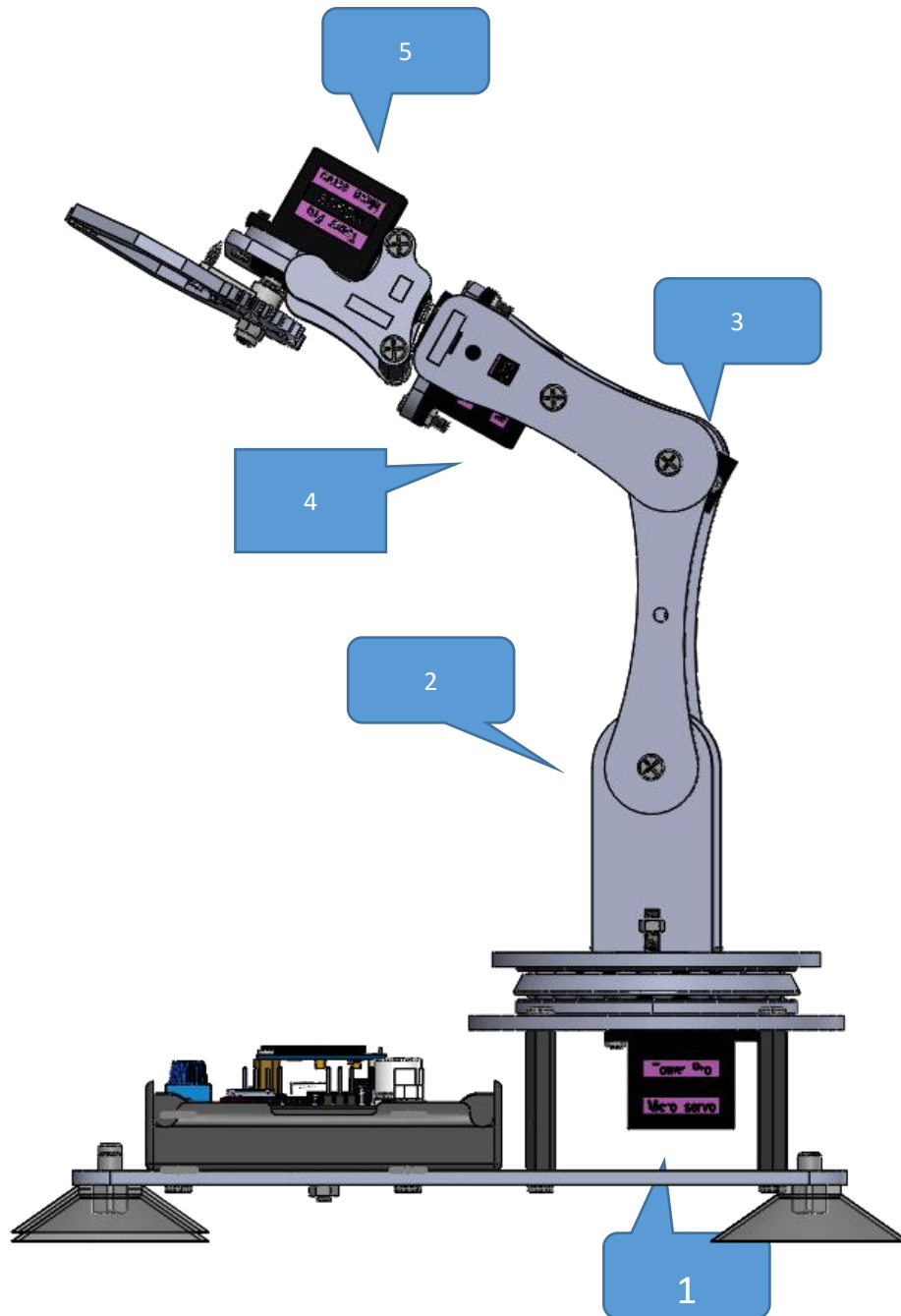
.Servo debugging.

Connect five servos to the Adept Arm Drive Board.

For convenience to read, only one end of the servo power cable is shown here.

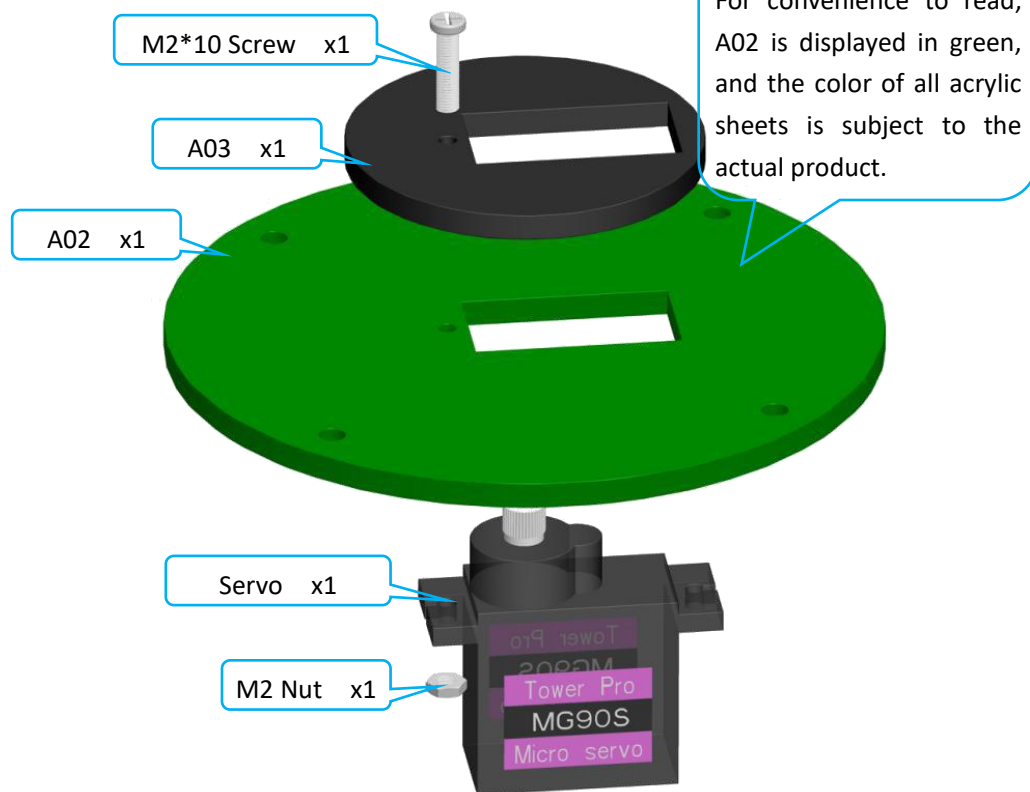


SERVO of number

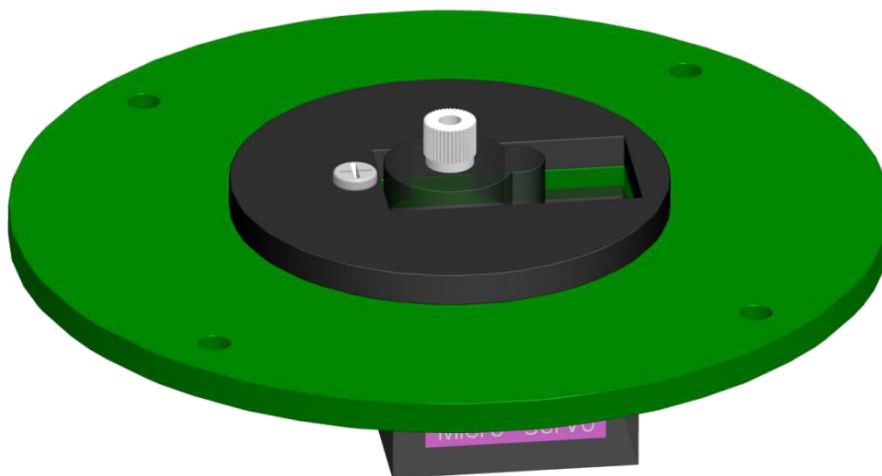


2. Fix a debugged servo to A02 and A03.

Assemble the following components

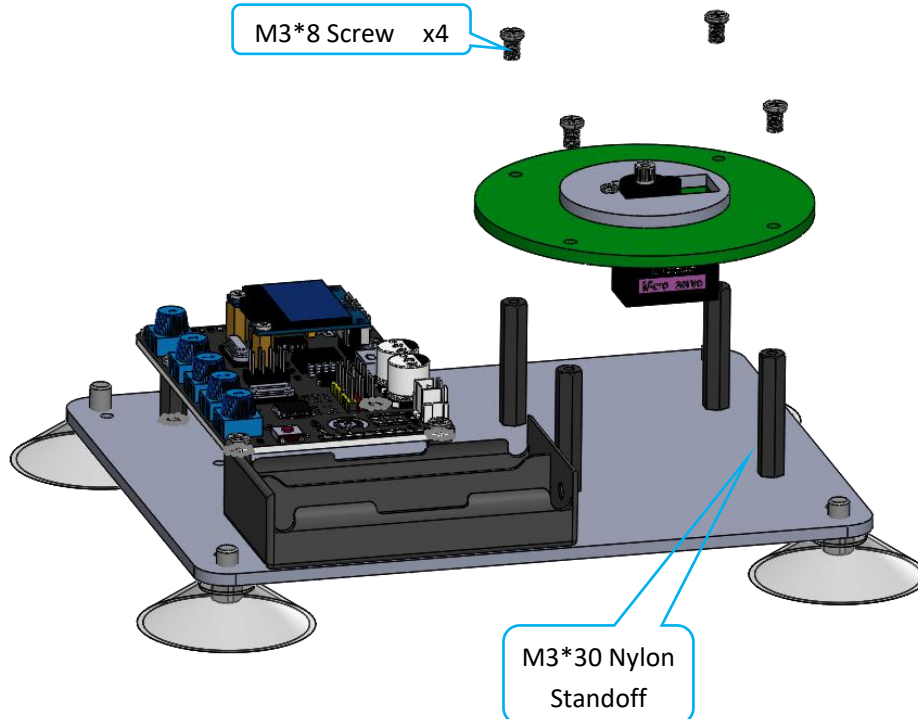


Effect diagram after assembling

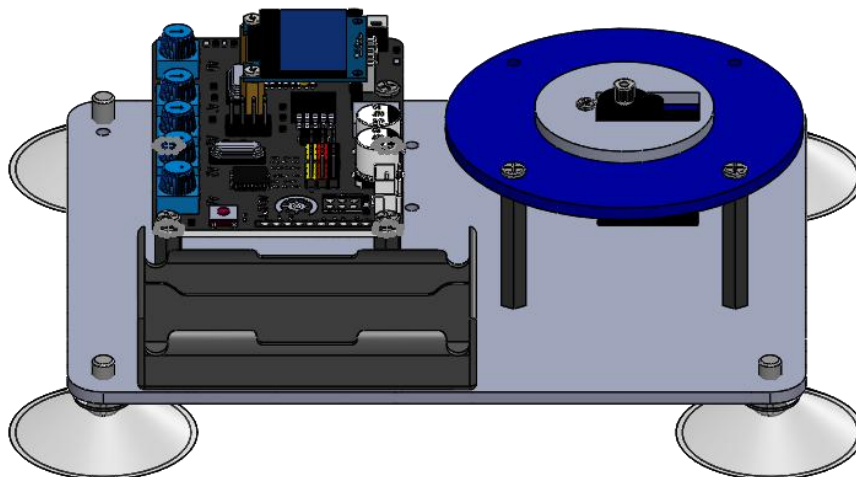


3. Then fix A02 to M3*30 Nylon Standoff.

Assemble the following components



Effect diagram after assembling



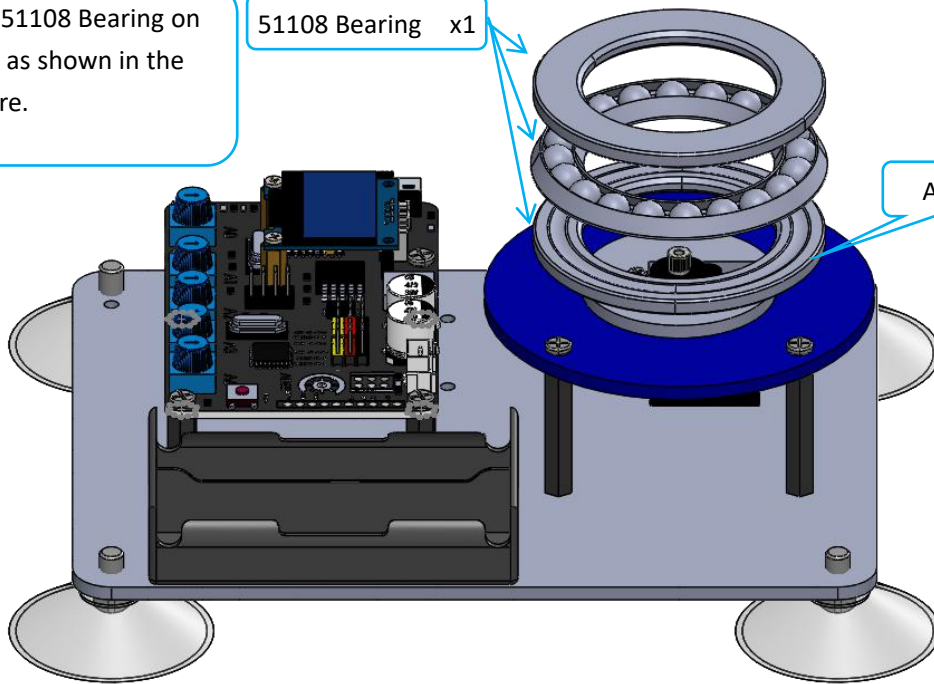
4. Assemble 51108 Bearing.

Assemble the following components

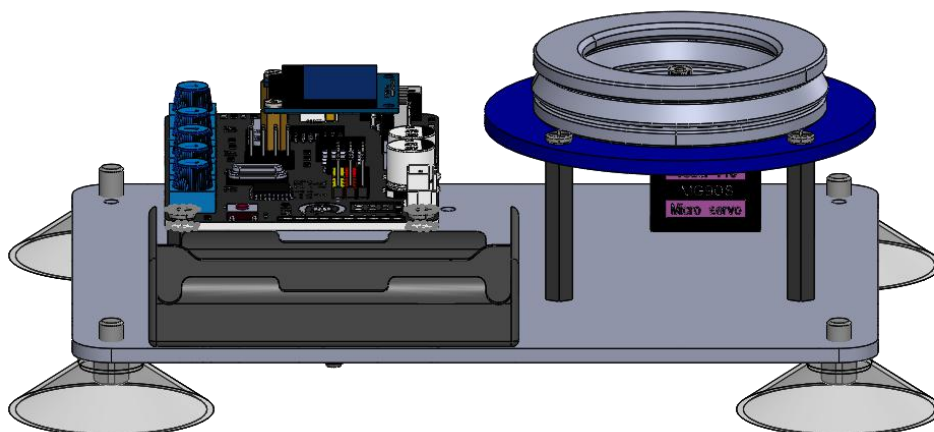
Put 51108 Bearing on A03 as shown in the figure.

51108 Bearing x1

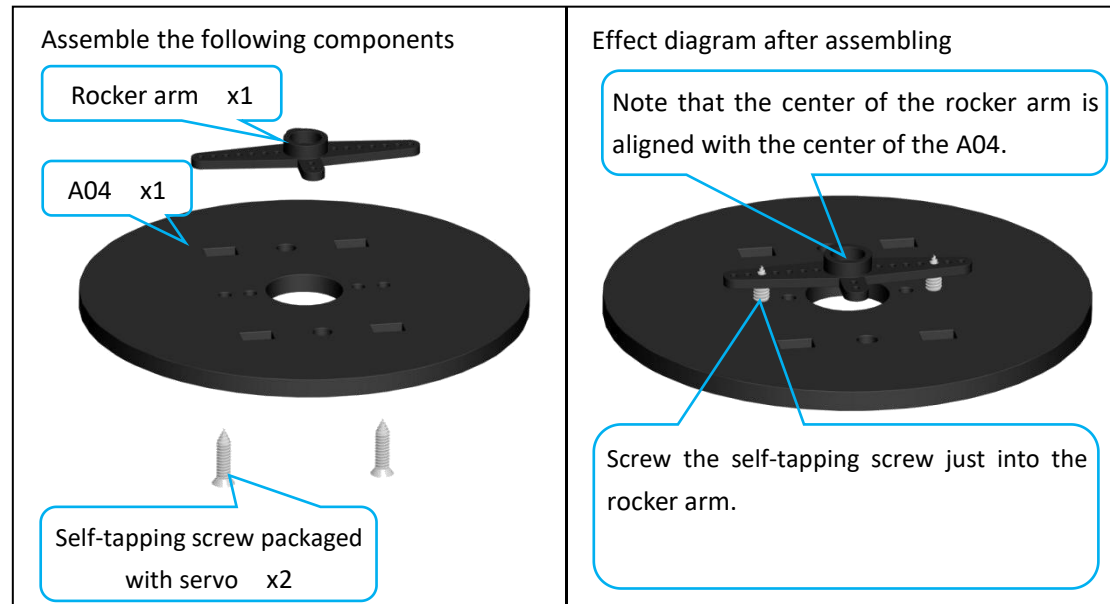
A03



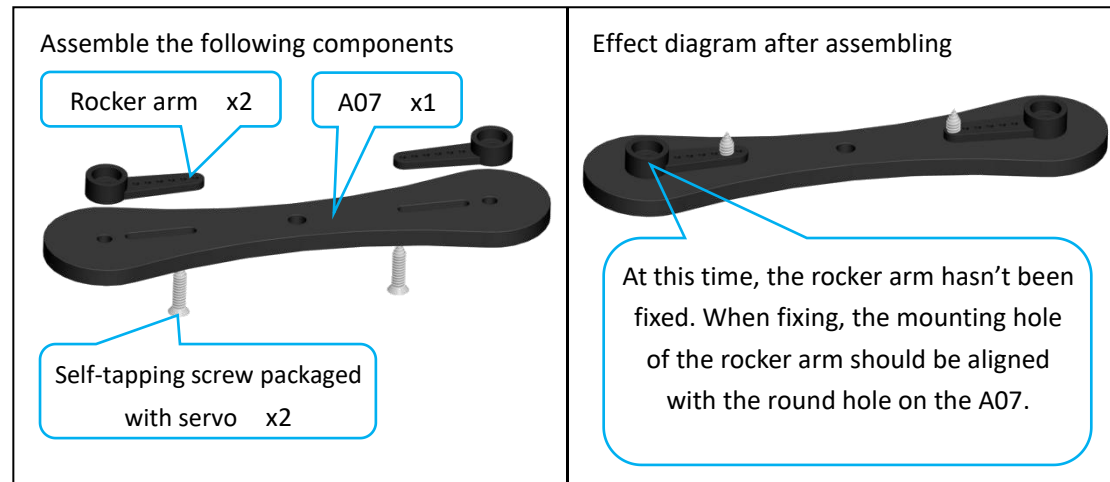
Effect diagram after assembling



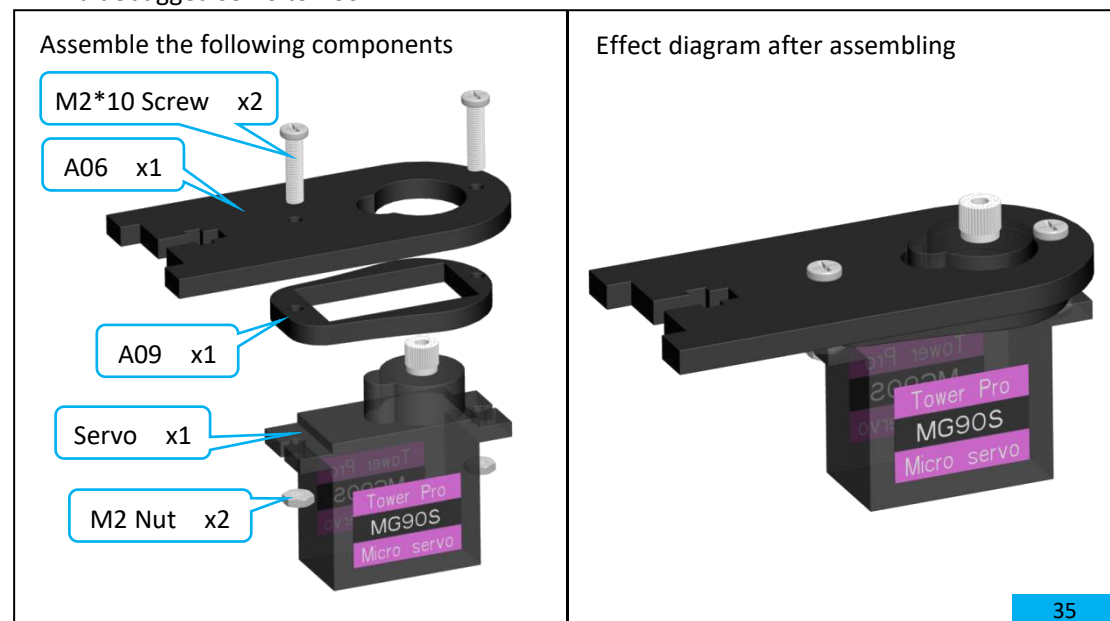
5. Take a rocker arm as in the illustration and connect it to A04.



6. Take two rocker arm as in the illustration and connect them to A07.

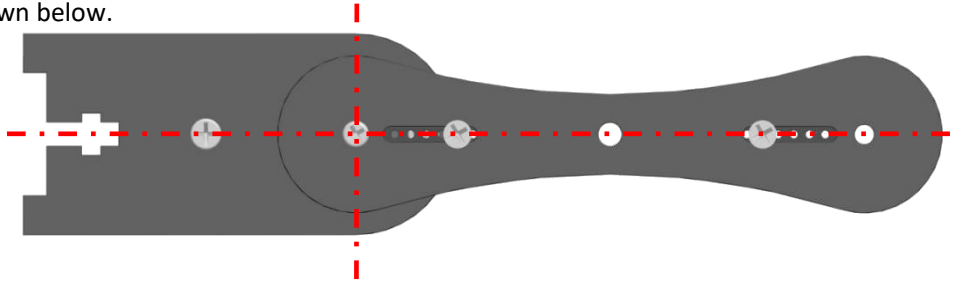


7. Fix a debugged servo to A06.

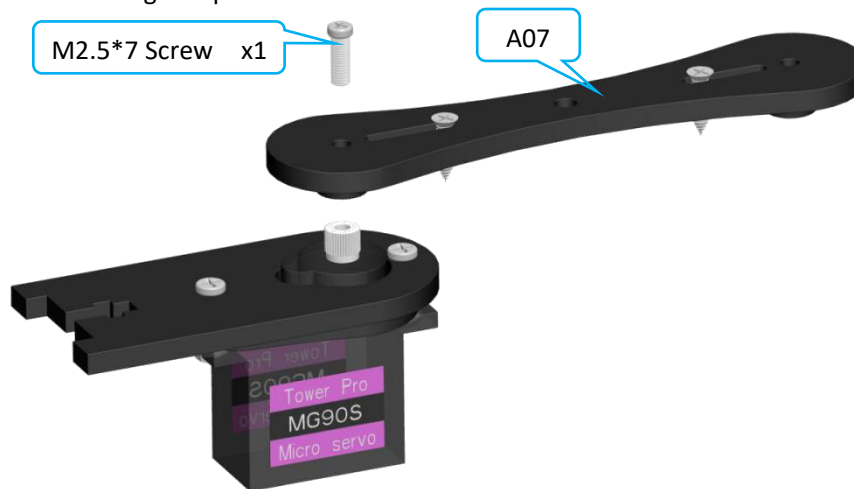


8. Then fix one end of A07 to the servo on A06.

First install the rocker arm on the A07 into the servo. When installing, the mounting hole of the rocker arm should be aligned with the round hole on the A07. Install it at the angle shown below.



Assemble the following components

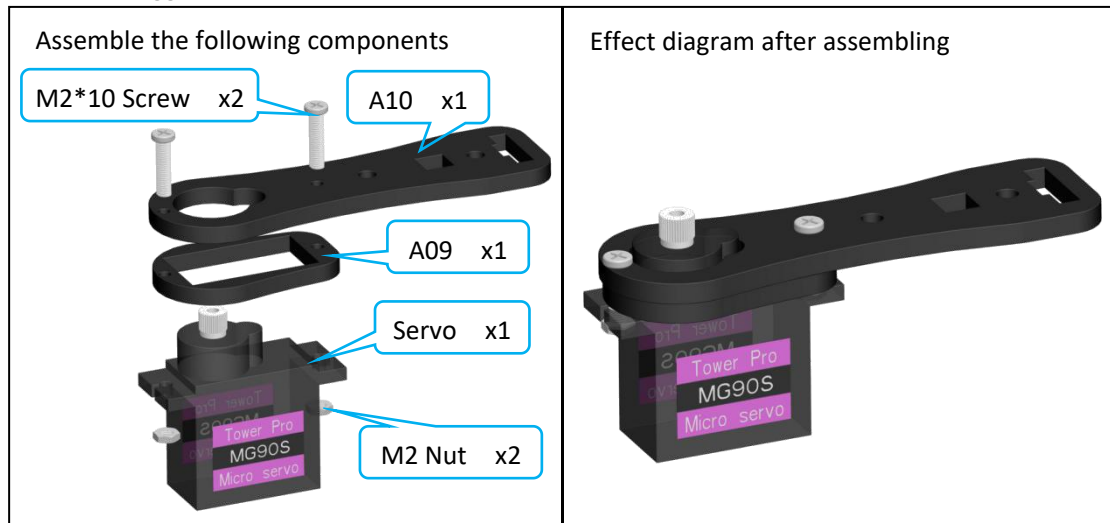


Effect diagram after assembling

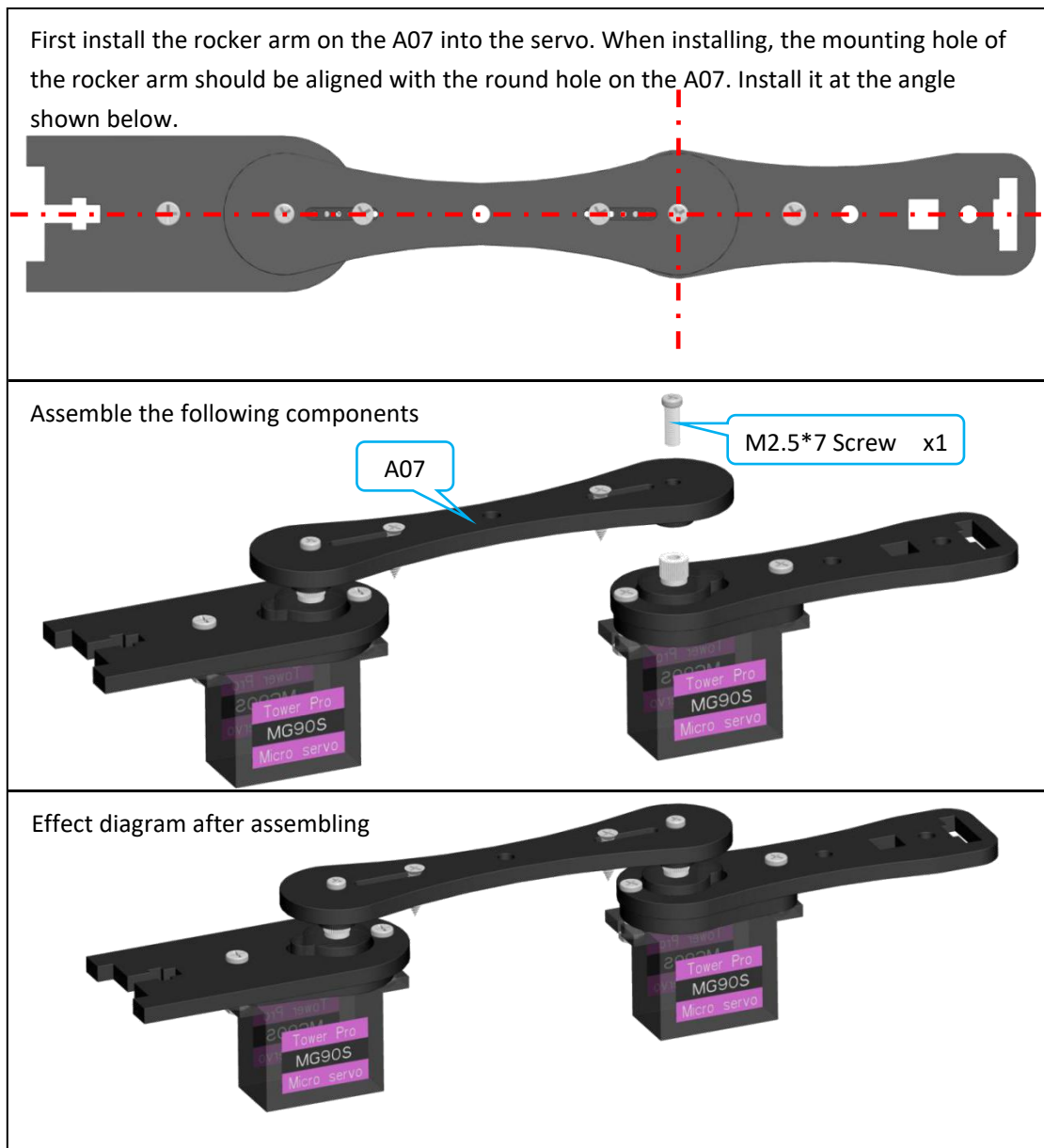
Please note that when installing the rocker arm, connect the servo to the robot drive Hat. The robot drive Hat will automatically check the servo angle.



9. Fix a debugged servo to A10.

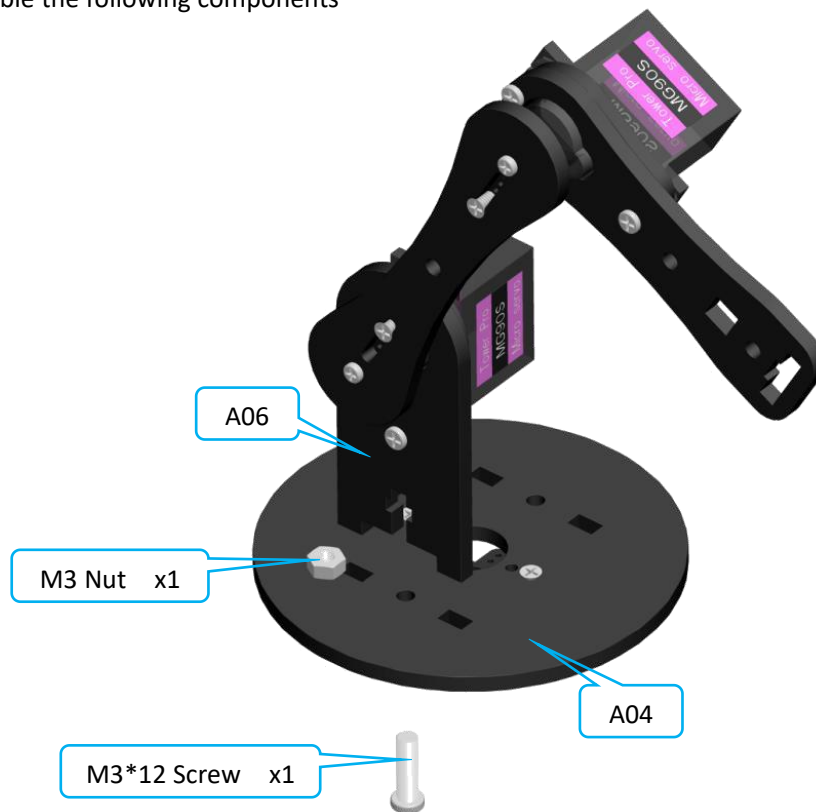


10. Then fix the other end of the A07 to the servo on the A10.



11. Then fix A06 to A04.

Assemble the following components

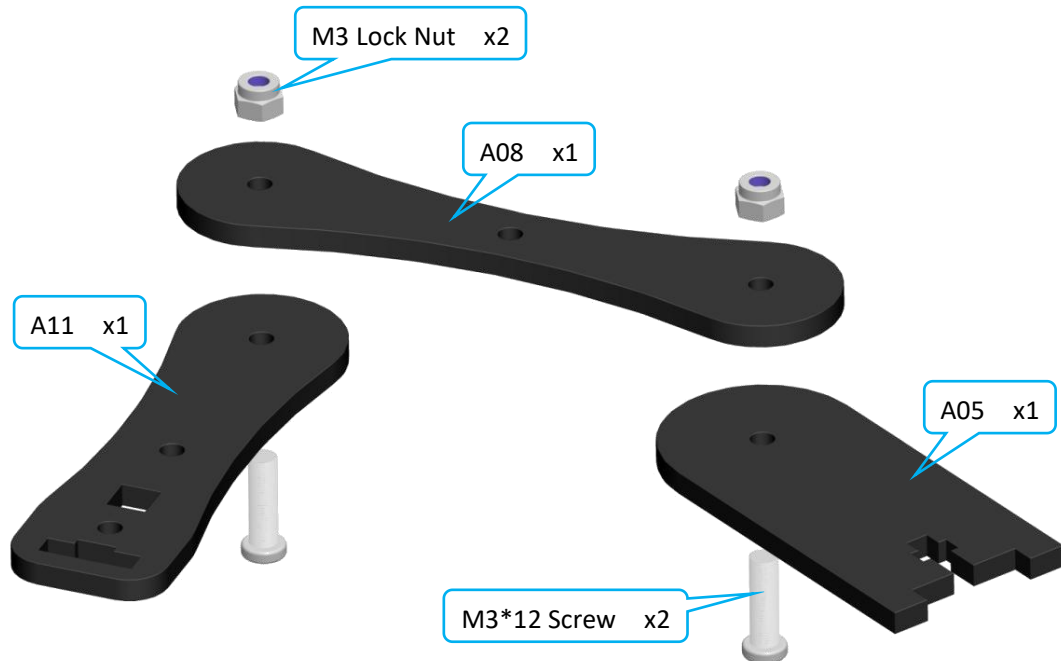


Effect diagram after assembling



12.Connect A05 with A08 and A11.

Assemble the following components



Do not tighten between M3 Lock Nut and M3*12 Screw. Allow rotation between A05 and A08, also A08 and A11.

Effect diagram after assembling



13. Fix A05 to A04.

Assemble the following components

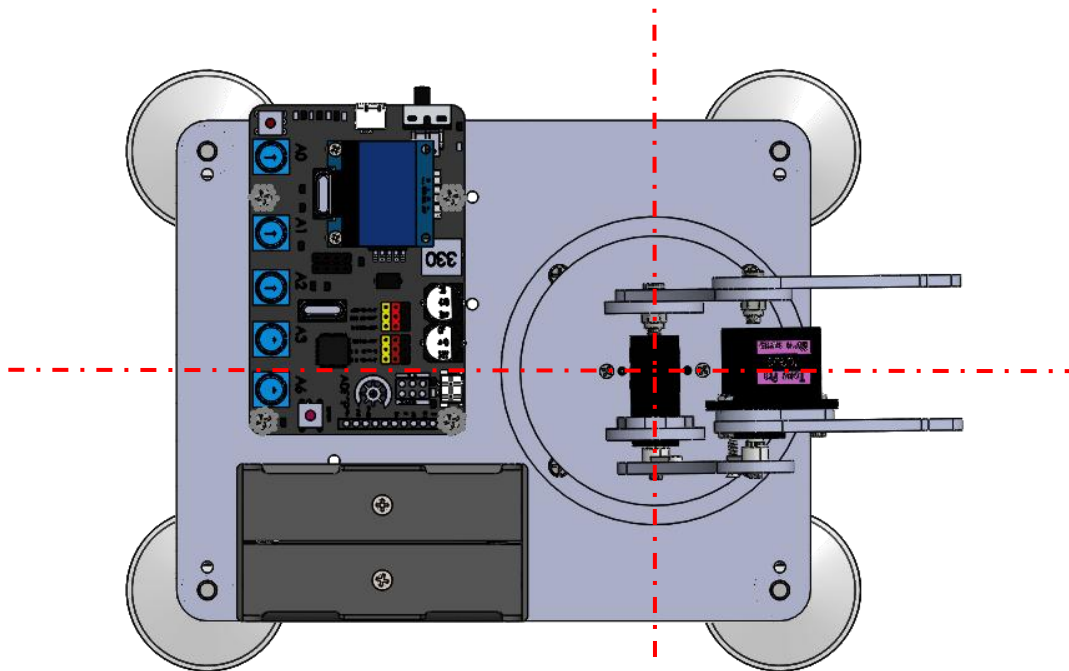


Effect diagram after assembling

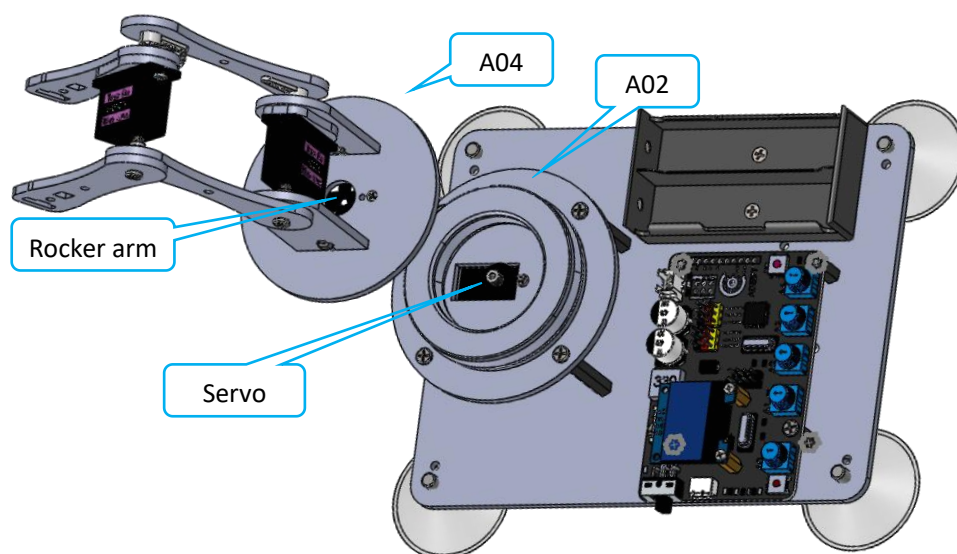


14. Fix the rocker arm under A04 with the servo on A02.

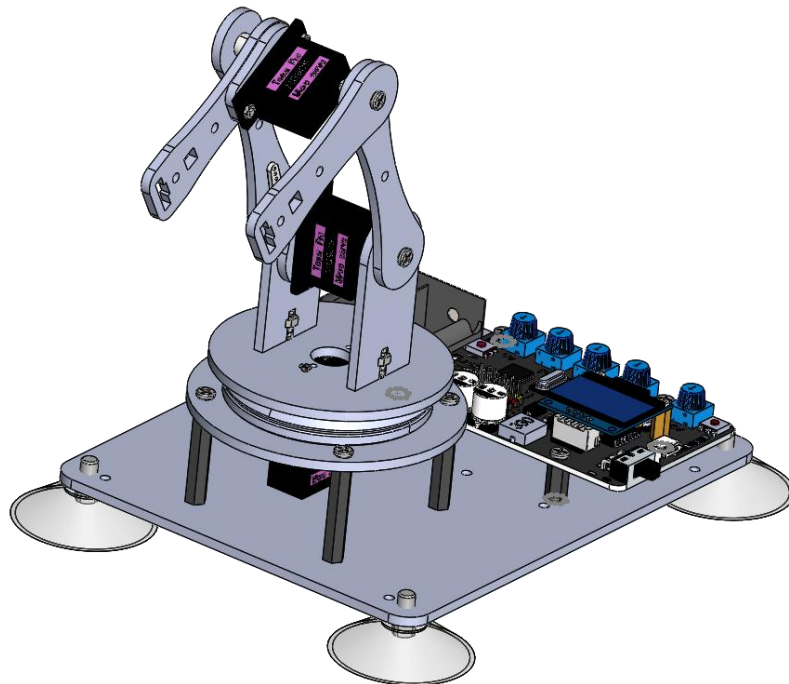
The angle when the rocker arm is installed into the servo is as shown below.



Assemble the following components

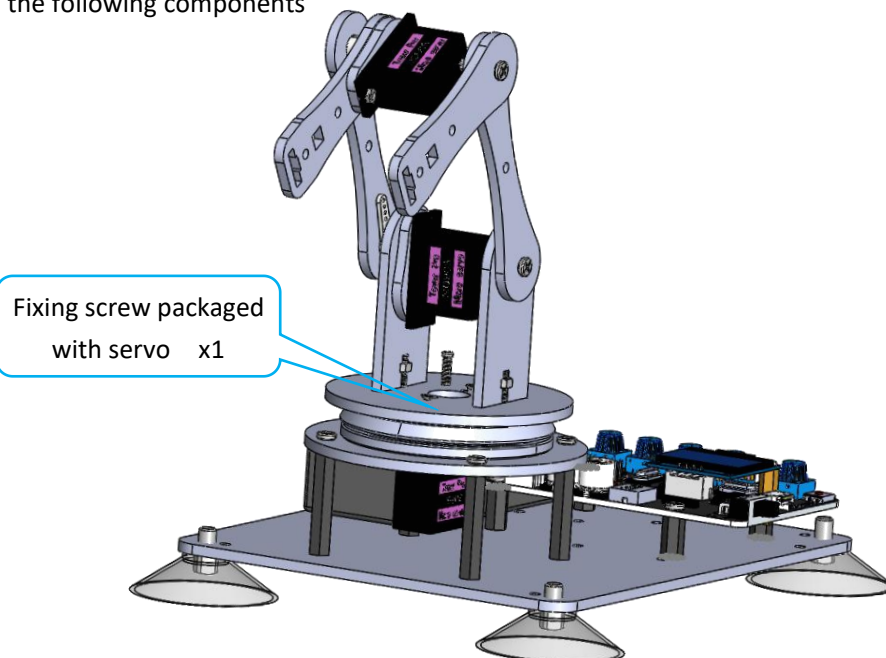


Effect diagram after assembling

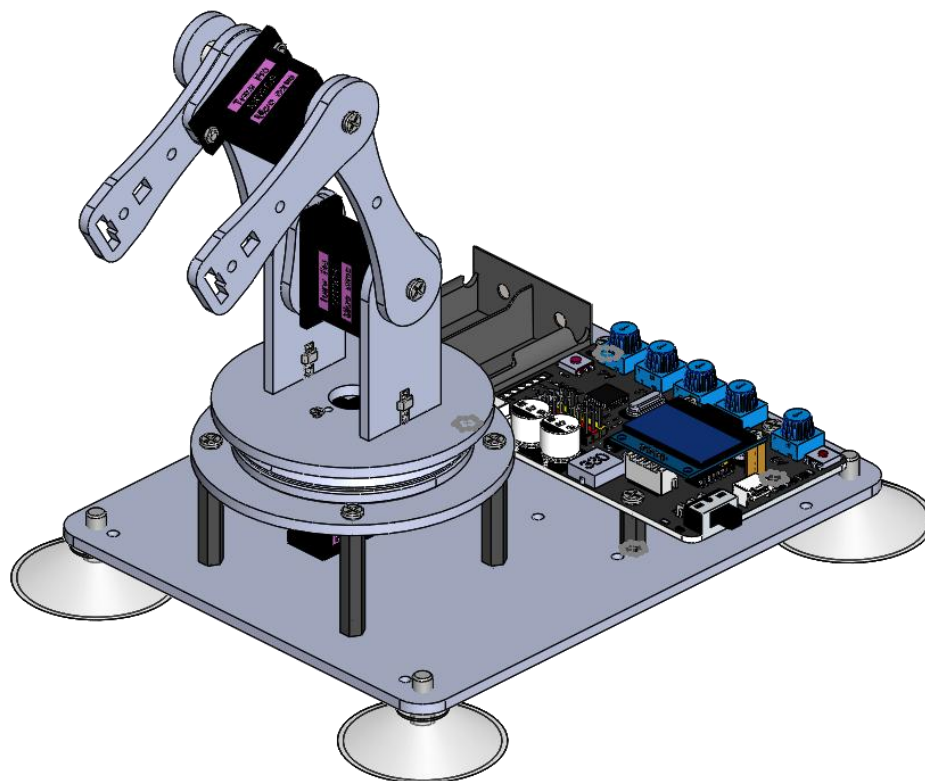


Then fix the rocker arm to the servo with the fixing screw packaged with servo.

Assemble the following components



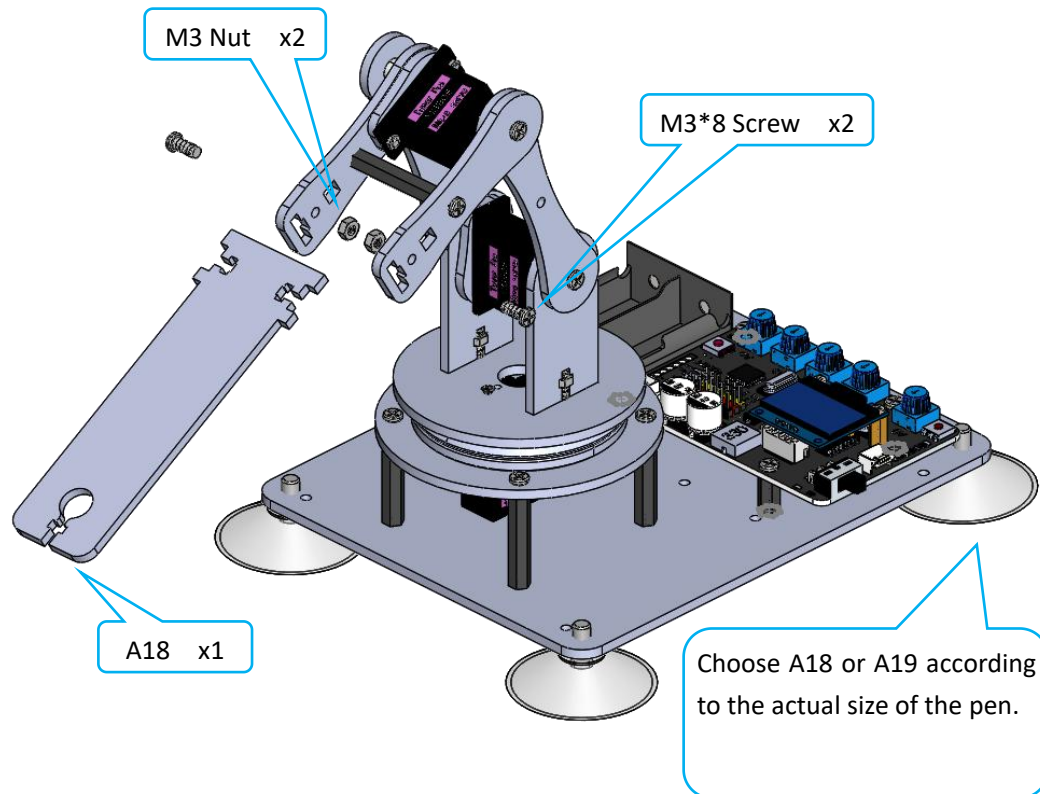
Effect diagram after assembling



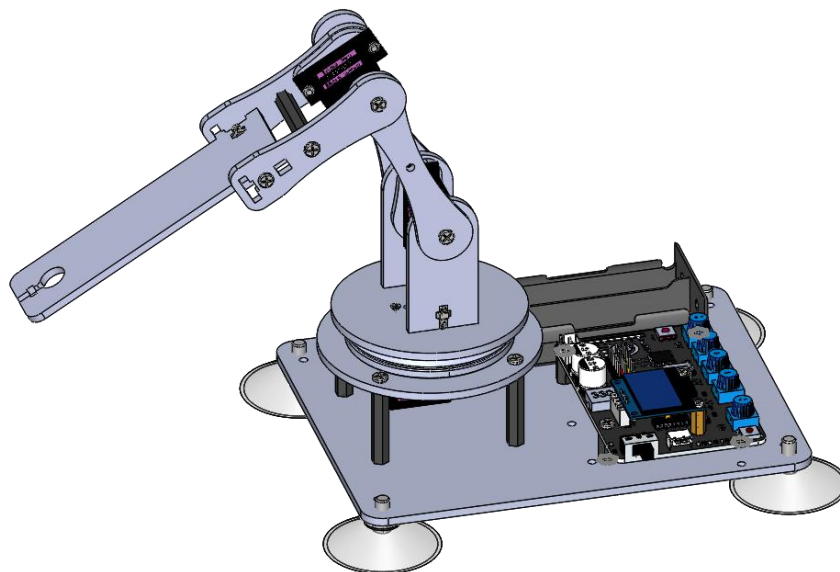
4.4.Play 1

Fix A18 between A10 and A11.

Assemble the following components

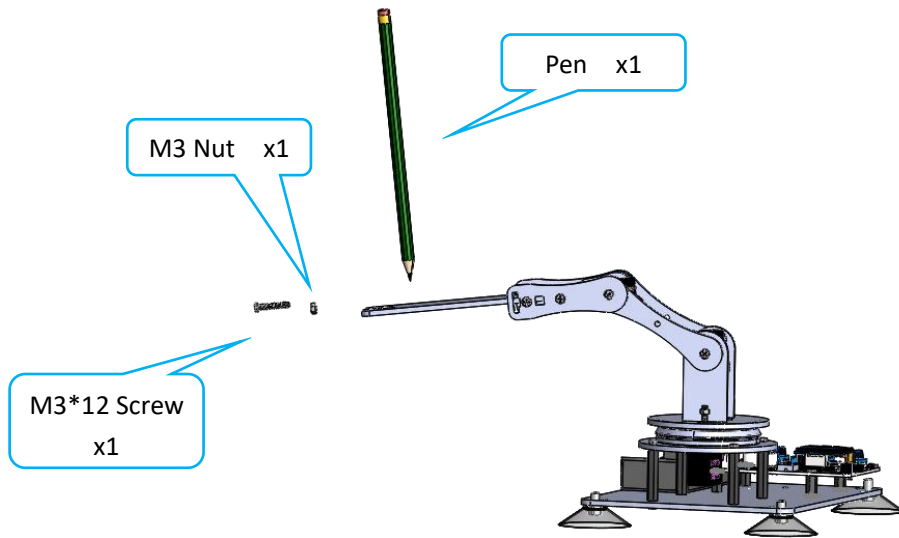


Effect diagram after assembling

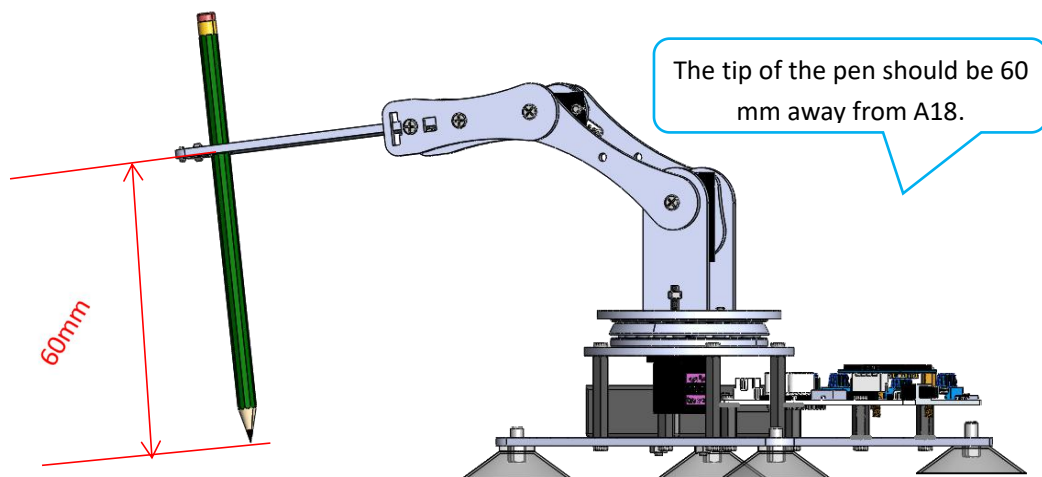
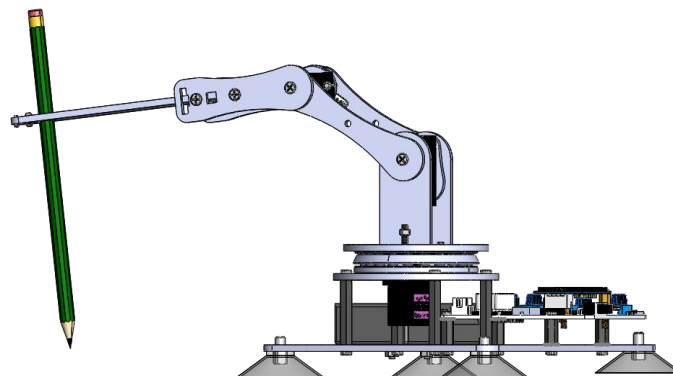


Fix the pen with A18.

Assemble the following components



Effect diagram after assembling



4.5.Play 2

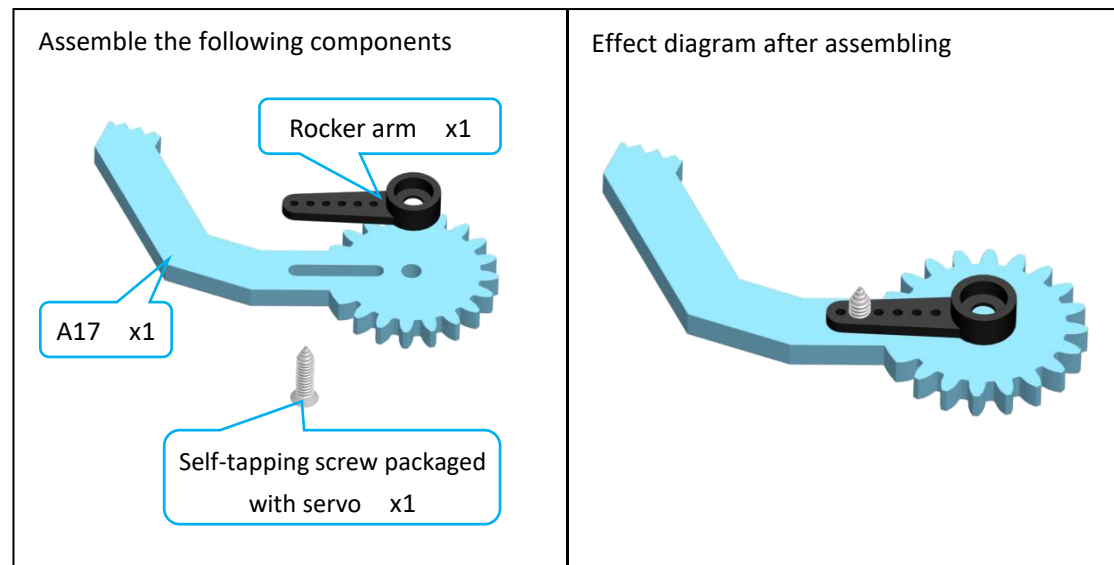
1. Fix one M3*8 Copper Standoff to A15.

<p>Assemble the following components</p> <p>M3*8 Copper Standoff</p> <p>M3*18 Screw x1</p> <p>A15</p>	<p>Effect diagram after assembling</p> <p>Install it in strict accordance with the position shown in the figure. Do not mount the M3*8 Copper Standoff on the other side of the A15.</p>
---	--

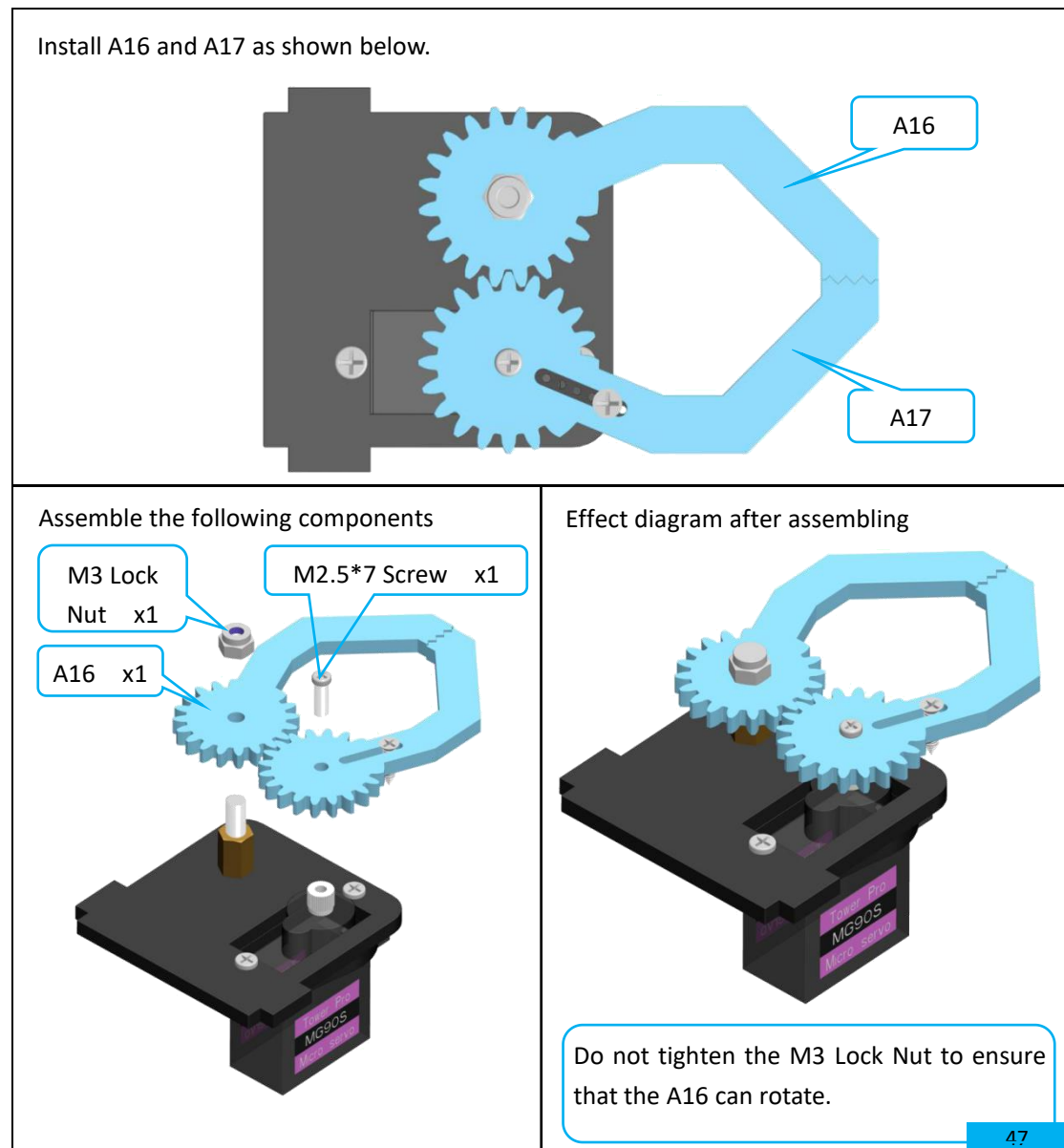
2. Fix a debugged servo to A15.

<p>Assemble the following components</p> <p>M2*10 Screw x2</p> <p>A09 x1</p> <p>Servo x1</p> <p>M2 Nut x2</p>	<p>Effect diagram after assembling</p>
---	--

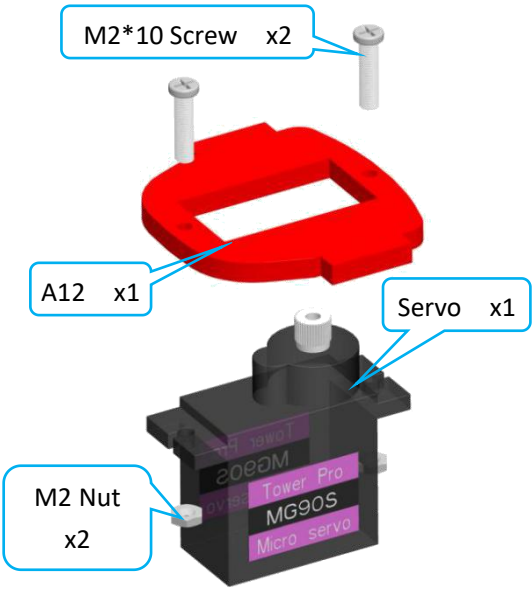

3. Fix one rocker arm of the servo to A17.



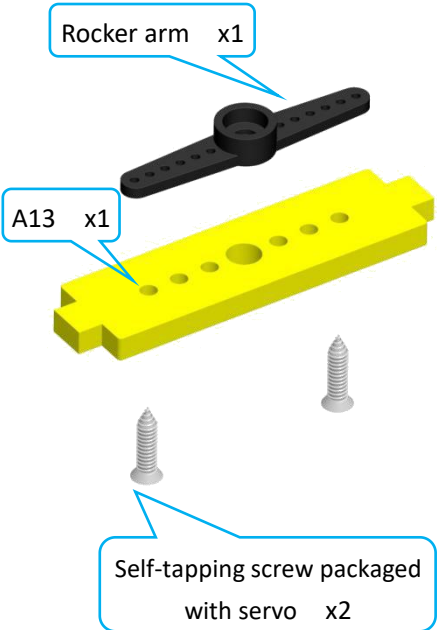
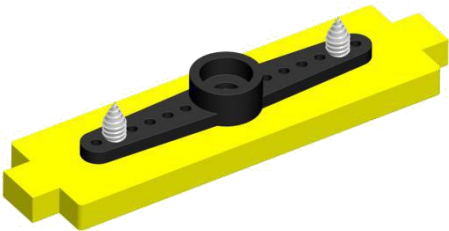
4. Assemble A16 and A17.



5. Fix a debugged servo to A12.

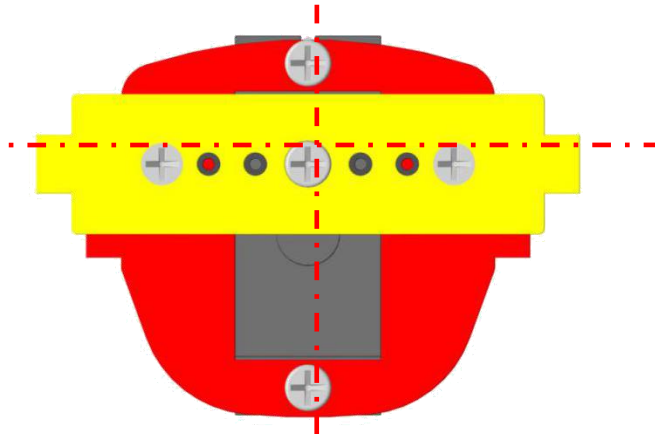
<p>Assemble the following components</p> 	<p>Effect diagram after assembling</p> 
--	---

6. Fix a rocker arm to A13.

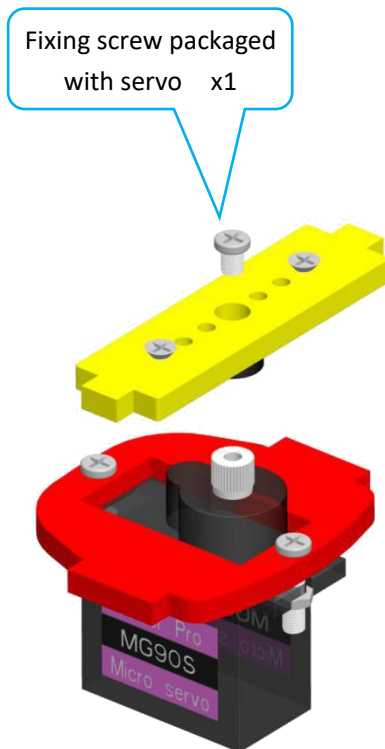
<p>Assemble the following components</p> 	<p>Effect diagram after assembling</p> 
--	---

7. Fix the rocker arm on the A13 to the servo on the A12.

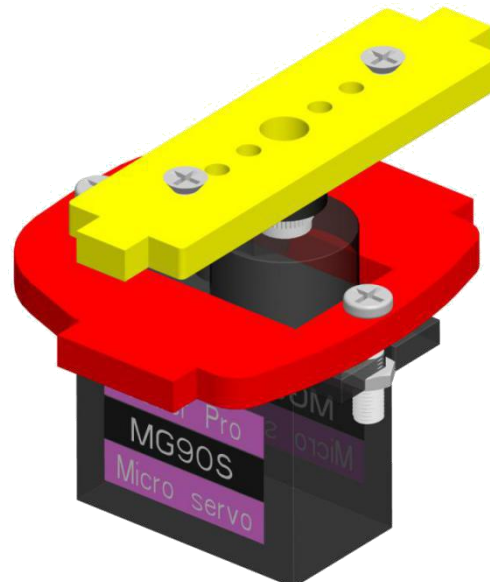
Install as shown below.



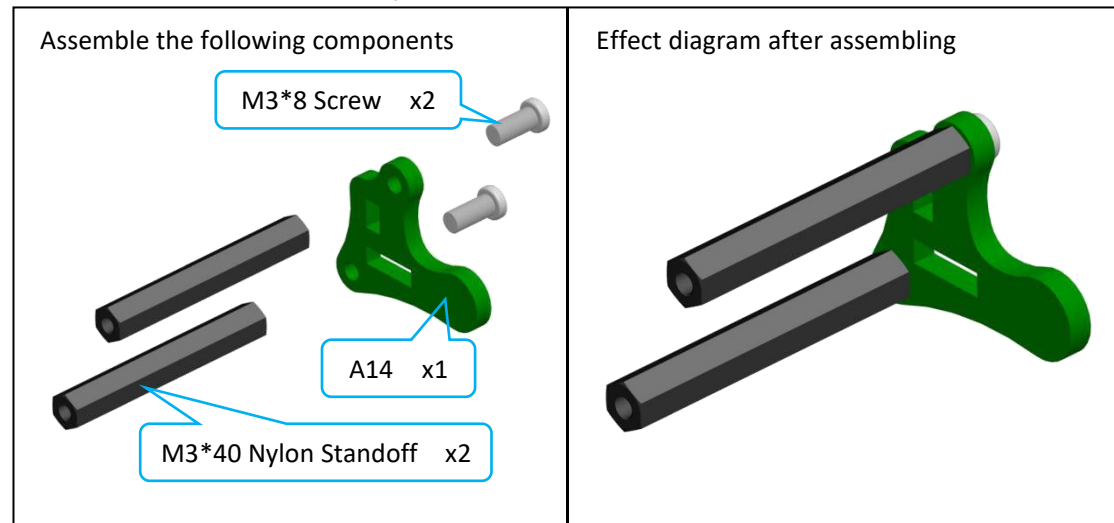
Assemble the following components



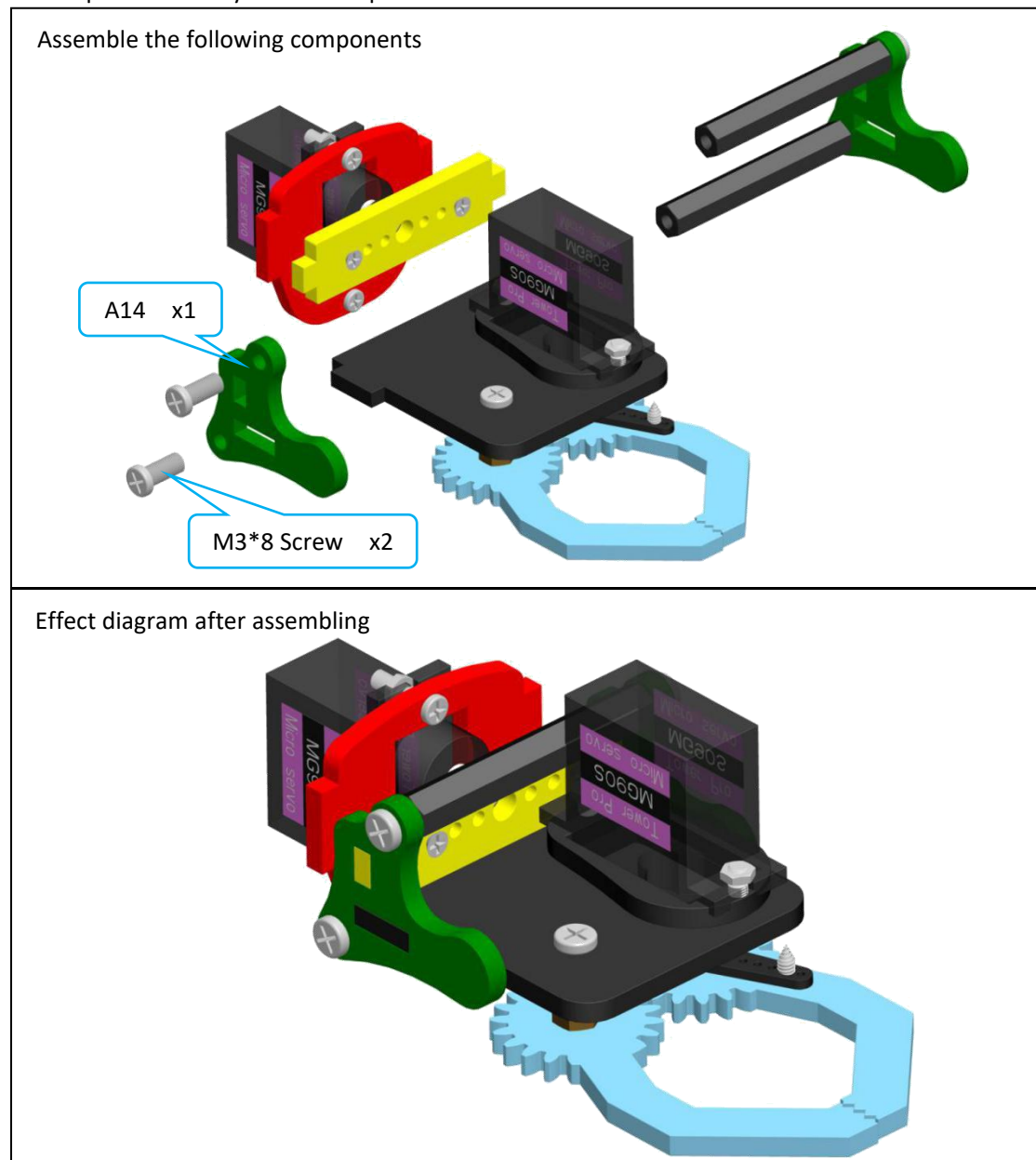
Effect diagram after assembling



8. Fix one A14 with two M3*40 Nylon Standoffs.

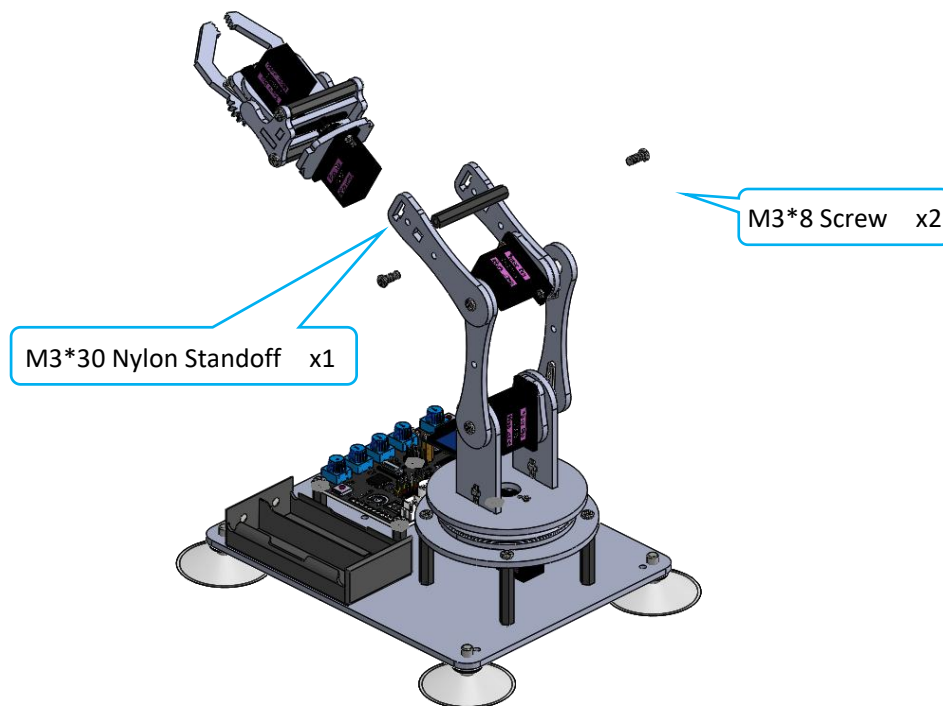


9. Complete assembly of the clamp section.

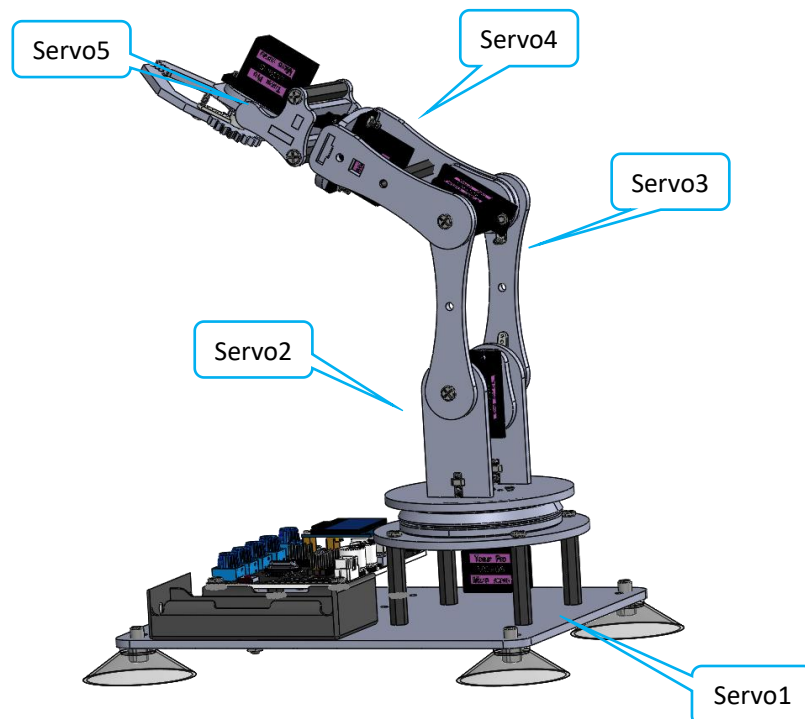


Install the clamp section on the robotic arm.

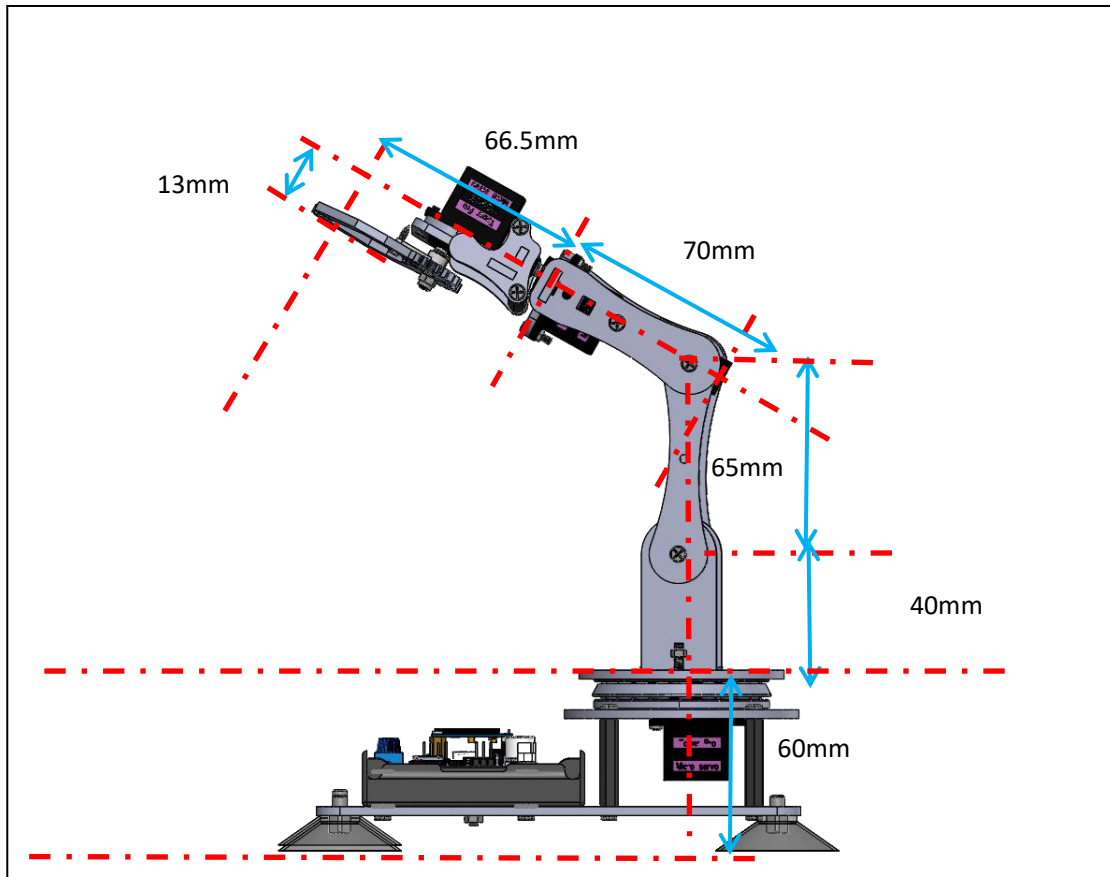
Assemble the following components



Effect diagram after assembling

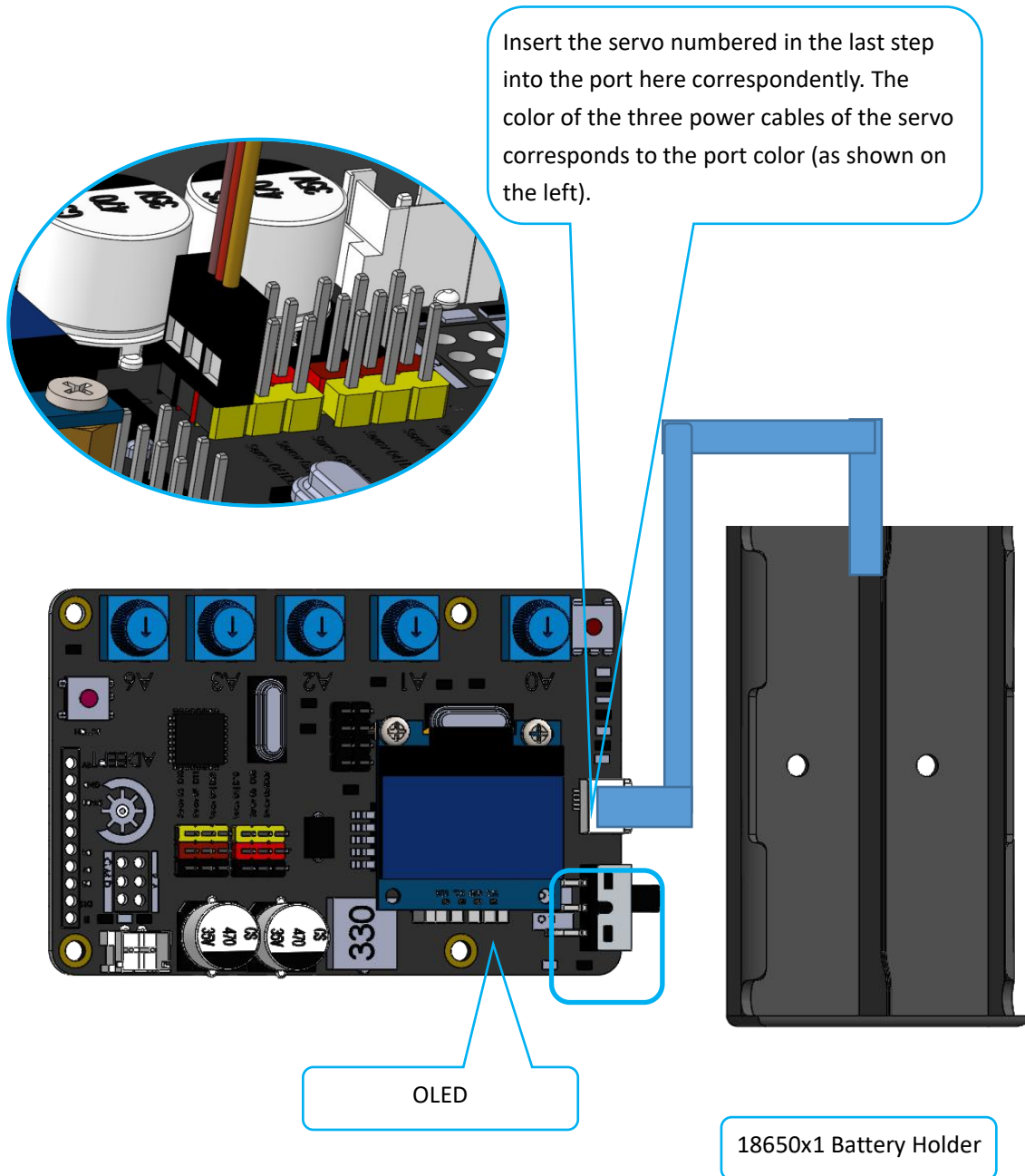


Number each servo to prepare for the circuit connection.



4.6 Circuit Connection

Connection of each devices for the robotic arm:



5. Combinations of the robotic arm.

Assemble method (except the front part of the robotic arm).

In 90 degrees when powered on



Before starting to exert the function, we need to test whether there are problems with the assembly of the robotic arm. In the matching code, `AdeptArmInitializationCode.ino` is the code for testing the robotic arm to adjust to 90 degrees when powered on. You can open the code and download it to the Arduino for testing (it may not be able to achieve the effect shown in the picture when powered on, a little error is allowed to exist)

6.Functions of the robotic arm

We provide three examples to complete the function of carrying objects. You can give full play to your creativity to develop new functions. Click on <http://www.adeept.com/forum> to explore and learn with us.

6.1. Potentiometer control mode

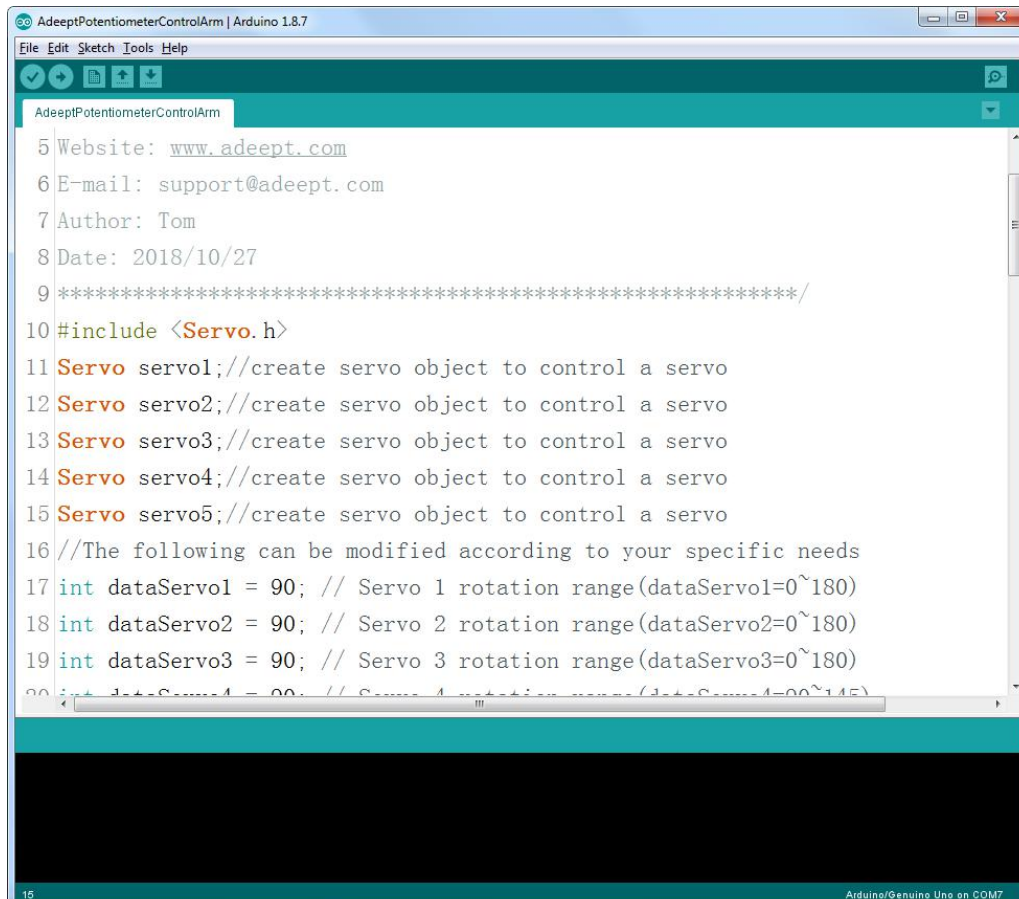
Rotate the potentiometer on the driver board to control the robotic arm to clamp objects. Code AdeptPotentiometerControlArm.ino

Specific function descriptions.

- The potentiometer A0 on the driver board controls the movement of servo 1, range from 0 to 180 degrees.
- The potentiometer A1 on the driver board controls the movement of servo 2, range from 0 to 180 degrees.
- The potentiometer A2 on the driver board controls the movement of servo 3, range from 0 to 180 degrees.
- The potentiometer A3 on the driver board controls the movement of servo 4, range from 0 to 180 degrees.
- The potentiometer A6 on the driver board controls the movement of servo 5, range from 35 to 90 degrees.

Operating steps

Firstly open the code AdeptPotentiometerControlArm.ino we provide.

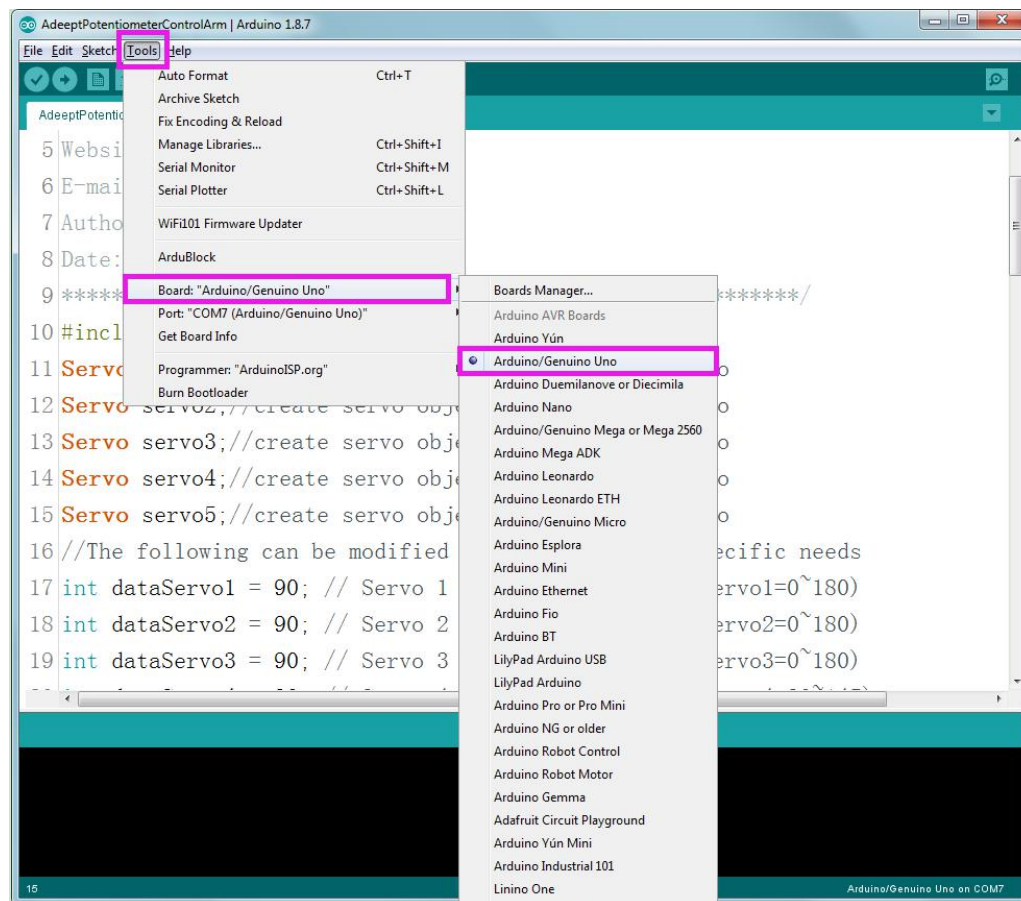


```

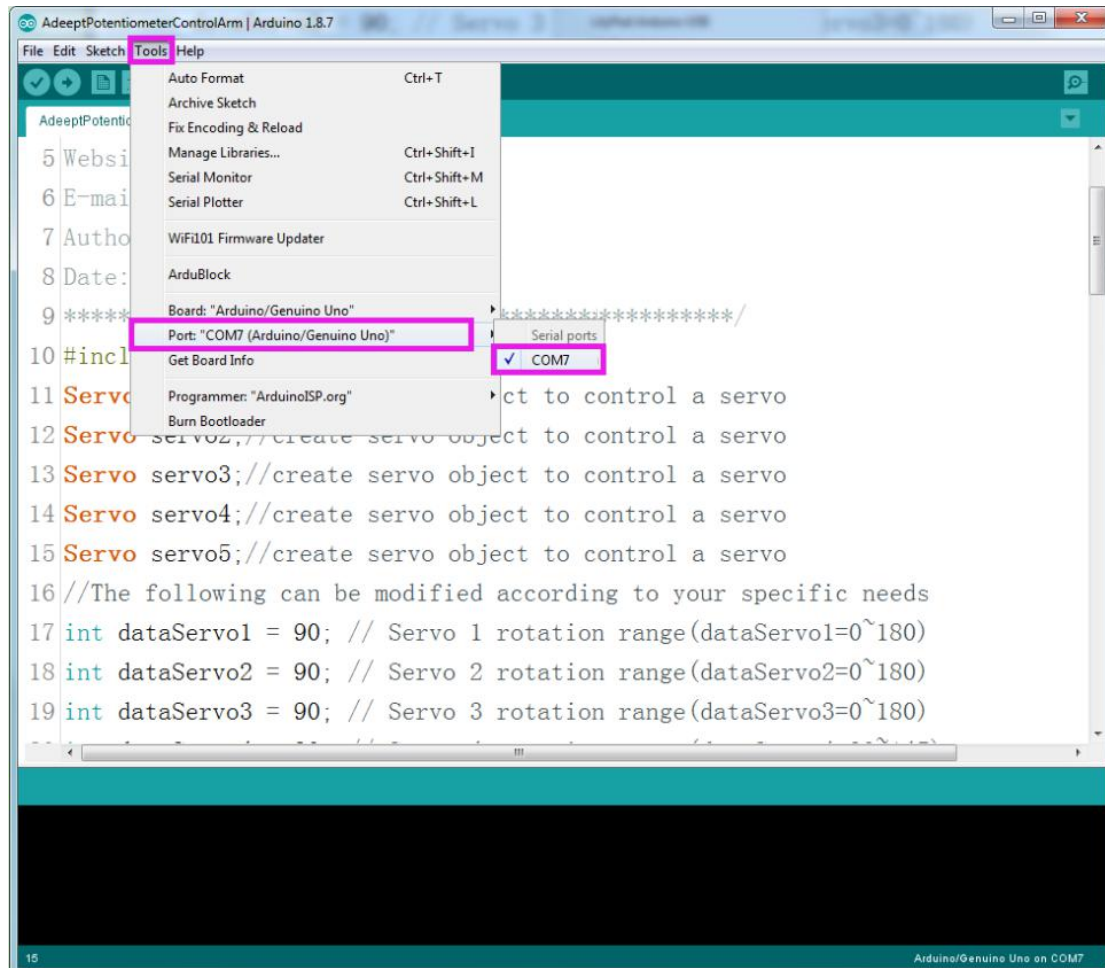
AdeptPotentiometerControlArm | Arduino 1.8.7
File Edit Sketch Tools Help
AdeptPotentiometerControlArm
5 Website: www.adeept.com
6 E-mail: support@adeept.com
7 Author: Tom
8 Date: 2018/10/27
9 *****/
10 #include <Servo.h>
11 Servo servo1;//create servo object to control a servo
12 Servo servo2;//create servo object to control a servo
13 Servo servo3;//create servo object to control a servo
14 Servo servo4;//create servo object to control a servo
15 Servo servo5;//create servo object to control a servo
16 //The following can be modified according to your specific needs
17 int dataServo1 = 90; // Servo 1 rotation range(dataServo1=0~180)
18 int dataServo2 = 90; // Servo 2 rotation range(dataServo2=0~180)
19 int dataServo3 = 90; // Servo 3 rotation range(dataServo3=0~180)
20 int dataServo4 = 90; // Servo 4 rotation range(dataServo4=0~180)
21 int dataServo5 = 90; // Servo 5 rotation range(dataServo5=35~90)
22
23 void setup() {
24   // Initialize the servos
25   servo1.attach(9);
26   servo2.attach(10);
27   servo3.attach(11);
28   servo4.attach(12);
29   servo5.attach(13);
30 }
31
32 void loop() {
33   // Move the servos to their target positions
34   servo1.write(dataServo1);
35   servo2.write(dataServo2);
36   servo3.write(dataServo3);
37   servo4.write(dataServo4);
38   servo5.write(dataServo5);
39   delay(1000);
40 }
15 Arduino/Genuino Uno on COM7
  
```

Then connect the robotic arm to the computer with the USB cable. (Note: Do not turn on the power supply to prevent damages of swinging arm. Also pay attention to this in the subsequent operation).

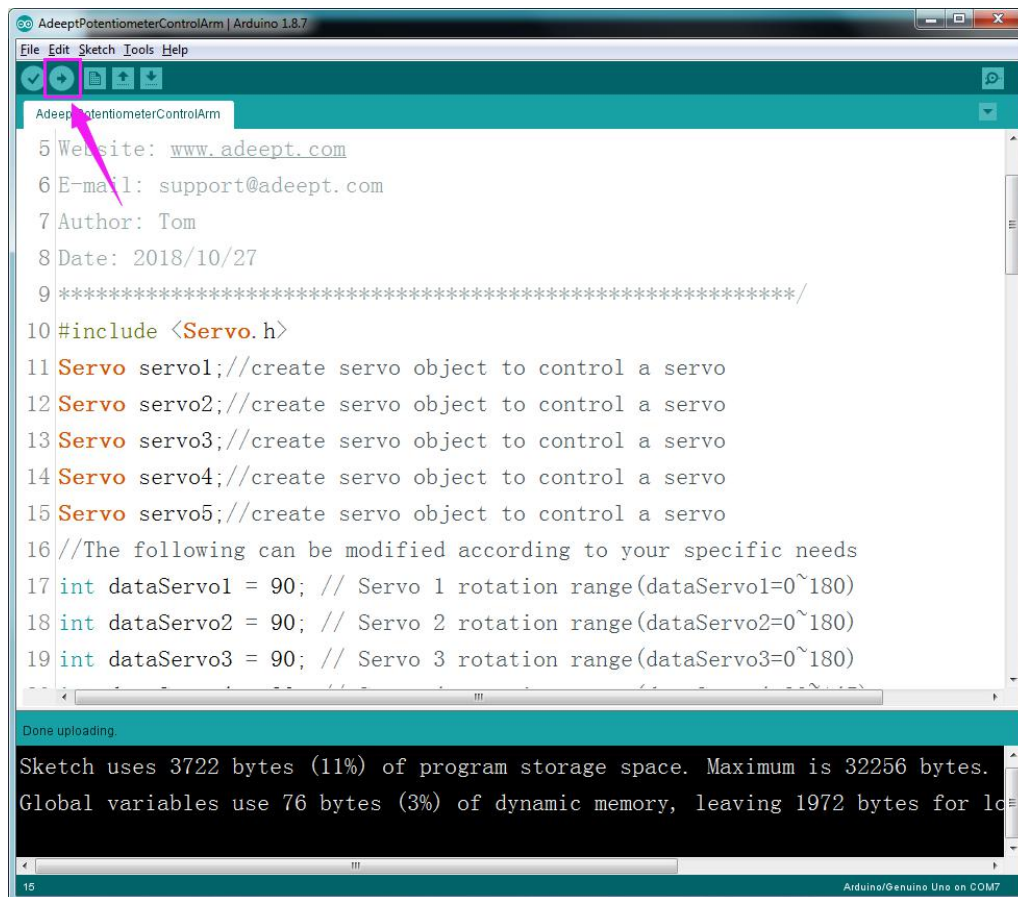
Motor software "Tools"-"Board"-"Arduino/Genuino Uno"



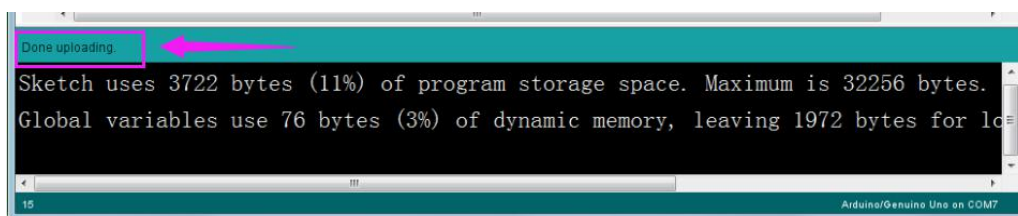
Next, click on "Tools" -> "Port:" -> "COM7" (note that the COM7 here may be recognized differently on different computers, it can be COM1, COM2 or COM3 and so on.)



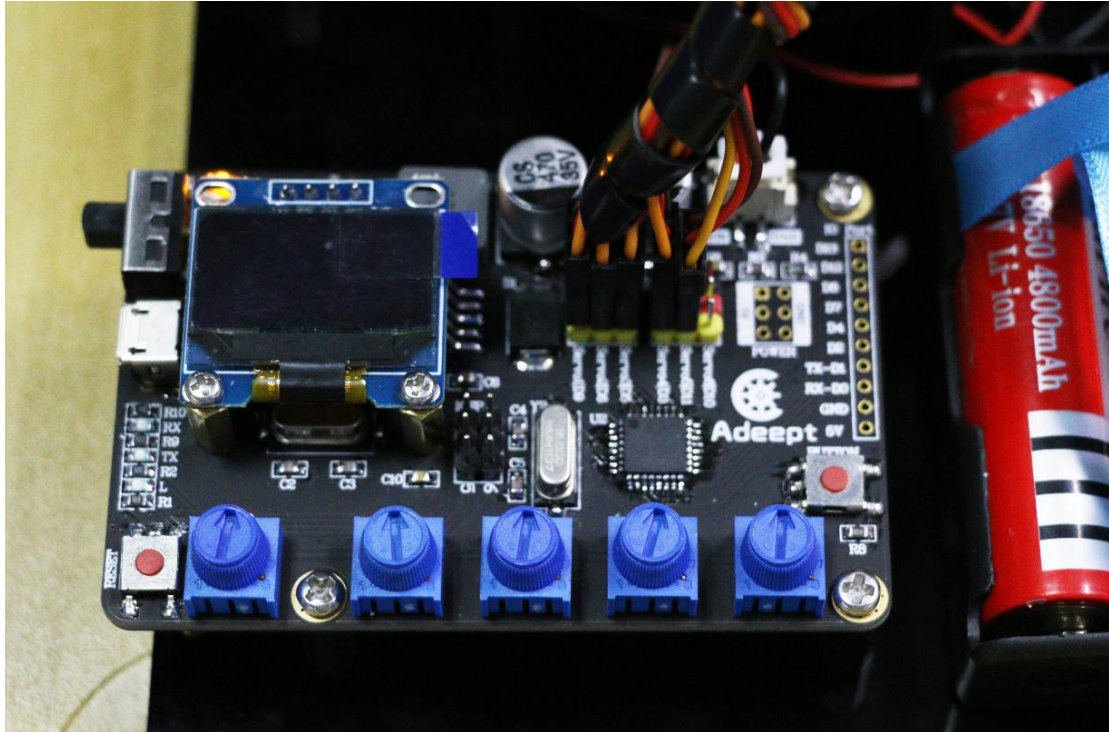
Then click "Upload" to upload the program to the Adept Robotic Arm Drive board.



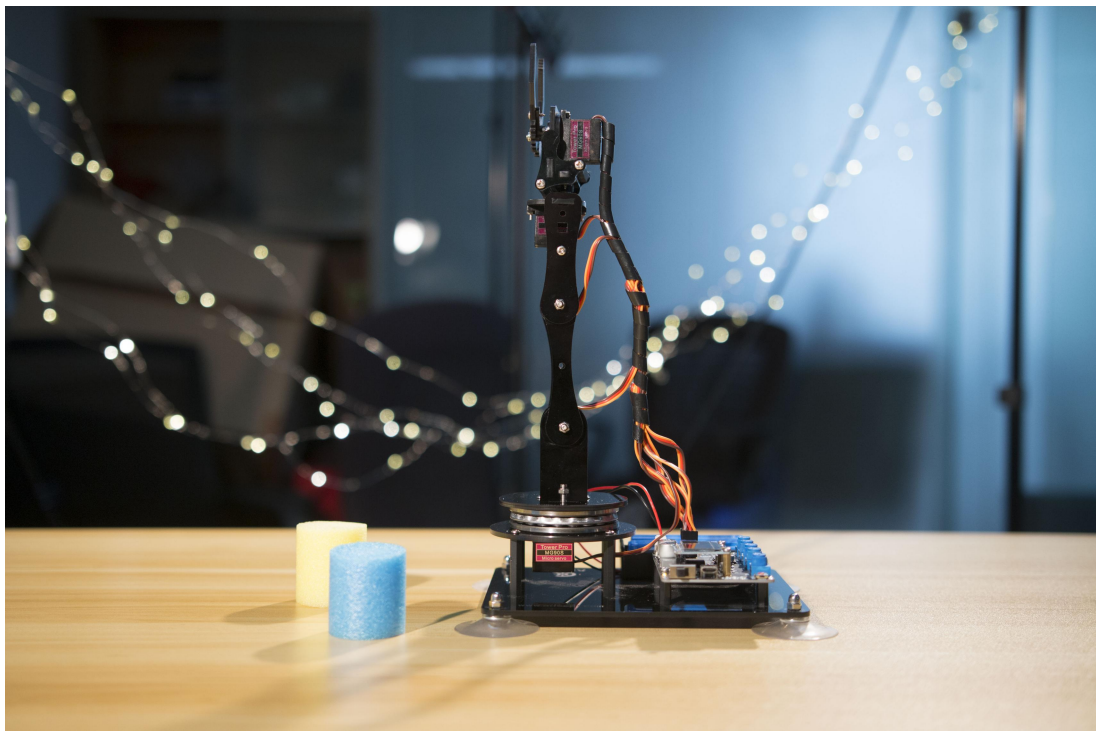
When the software prompts the following information, the code upload is complete.



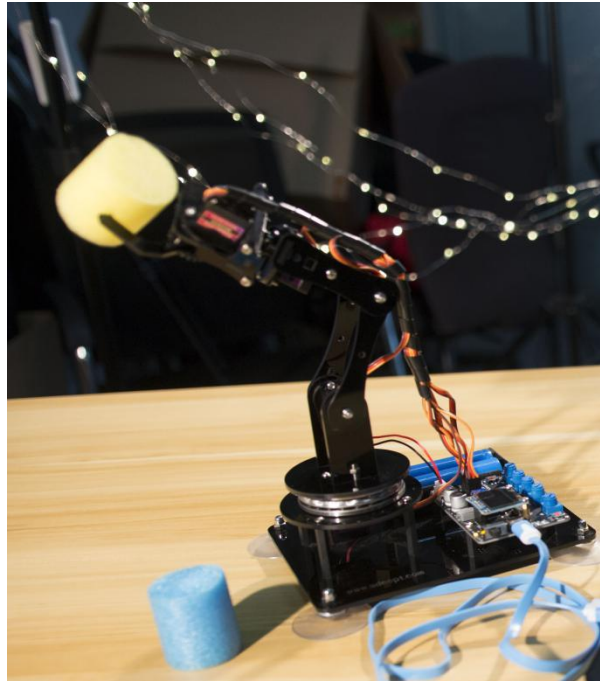
Next, unplug the USB cable connected to the robotic arm. Note: Do not turn on the power of the arm after downloading the program. Adjust the four potentiometers on the driver board to the center first, as shown below:



Then manually adjust the robotic arm to the position shown below:



Gently support the robotic arm with your hand to prevent swinging arm. Turn on the power, and then rotate the four potentiometers on the driver board to control the arm to clamp and carry objects. The rotation angle of Servo5 is set in the code.



6.2.Learning mode

Function introduction

Rotate the potentiometer on the driver board to adjust the movement of the robotic arm. Use the touch button to record the movement of the arm. It can record 200 motions in maximum and write the recorded motions to EEPROM. After re-powering, press and hold the touch button for more than 3 seconds, the robotic arm will automatically perform the previously recorded motions.

Specific function descriptions.

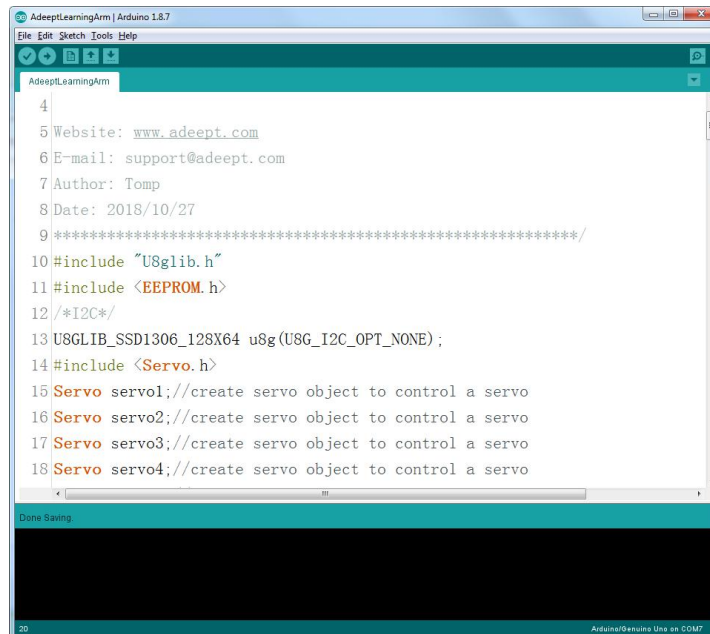
- The potentiometer A0 on the driver board controls the movement of servo 1, range from 0 to 180 degrees.
- The potentiometer A1 on the driver board controls the movement of servo 2, range from 0 to 180 degrees.
- The potentiometer A2 on the driver board controls the movement of servo 3, range from 0 to 180 degrees.
- The potentiometer A3 on the driver board controls the movement of servo 4, range from 0 to 180 degrees.
- The potentiometer A6 on the driver board controls the movement of servo 5, range from 35 to 90 degrees.

The robotic arm can be adjusted by rotating the potentiometer. Press the touch button, UNO will automatically record the position at the current moment, and then adjust the potentiometer to change the position of the arm and press the touch button again, UNO will record the position of

at the current moment, and so on, you can gradually make it record the track you need. It can record 200 motions in maximum at a time. You can change the number of motions to be recorded in the program. When the data recorded by UNO reaches the motion data set by the program, the robotic arm will automatically repeat the recorded motions. At this time, when the system is restarted, the robotic arm will still in learning mode. If you want the arm to repeat the last motion, you only need to press and hold the touch button for more than 3 seconds.

Operating steps

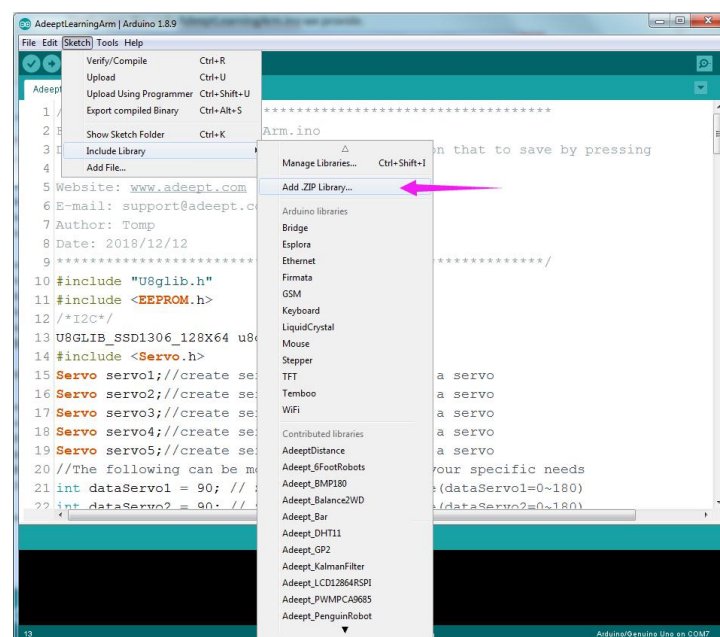
Firstly open the code AdeptLearningArm.ino we provide.

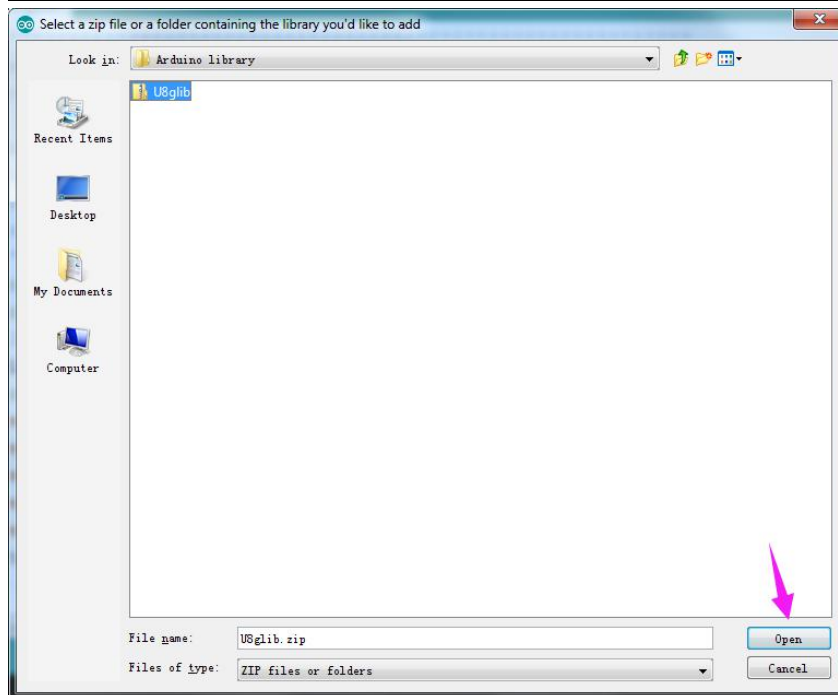


```

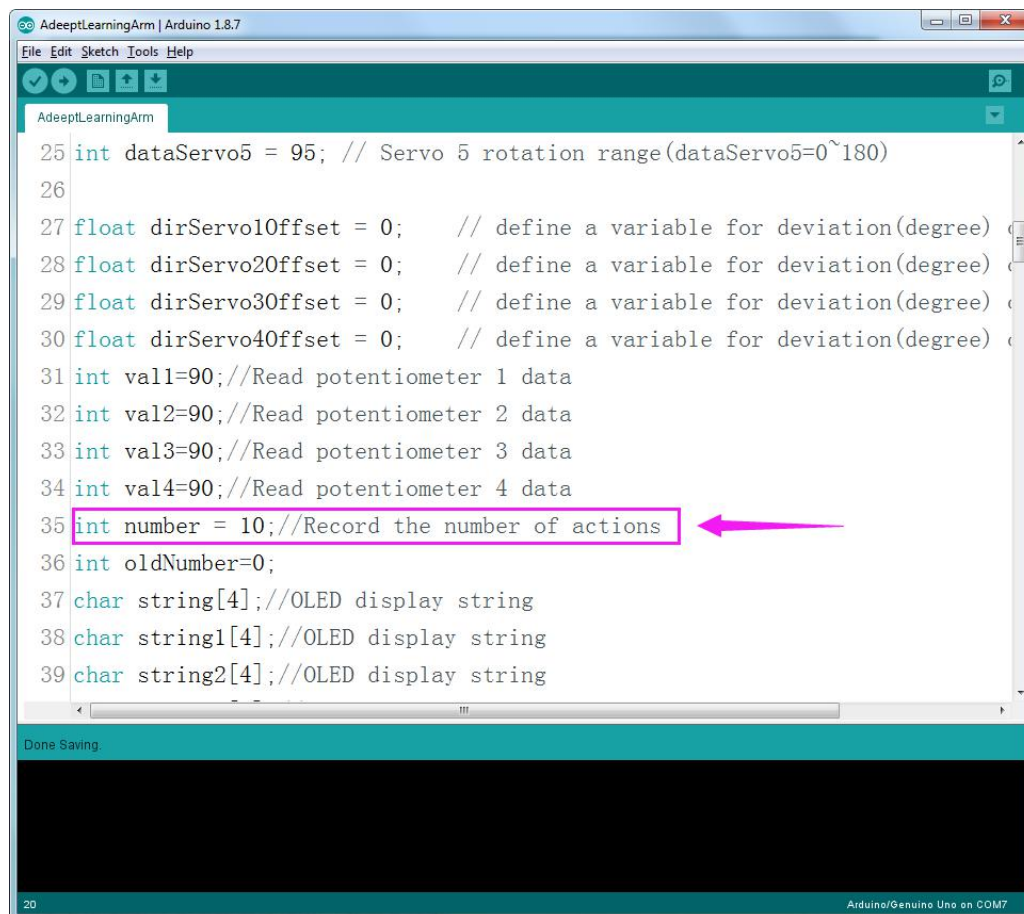
AdeptLearningArm | Arduino 1.8.7
File Edit Sketch Tools Help
AdeptLearningArm
4
5 Website: www.adept.com
6 E-mail: support@adept.com
7 Author: Tomp
8 Date: 2018/10/27
9 *****/
10 #include "U8glib.h"
11 #include <EEPROM.h>
12 /*I2C*/
13 U8GLIB_SSD1306_128X64 u8g (U8G_I2C_OPT_NONE);
14 #include <Servo.h>
15 Servo servol;//create servo object to control a servo
16 Servo servo2;//create servo object to control a servo
17 Servo servo3;//create servo object to control a servo
18 Servo servo4;//create servo object to control a servo
    
```

在运行该程序前，我们需要先添加 OLED 显示屏的驱动函数库 U8glib.zip（该函数库在我们提供的资料包中）。

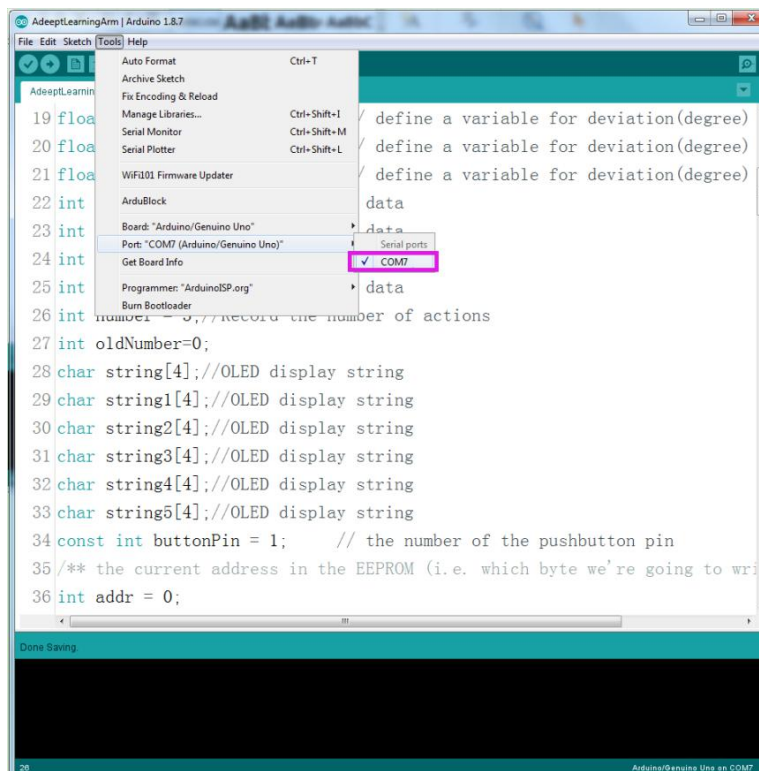
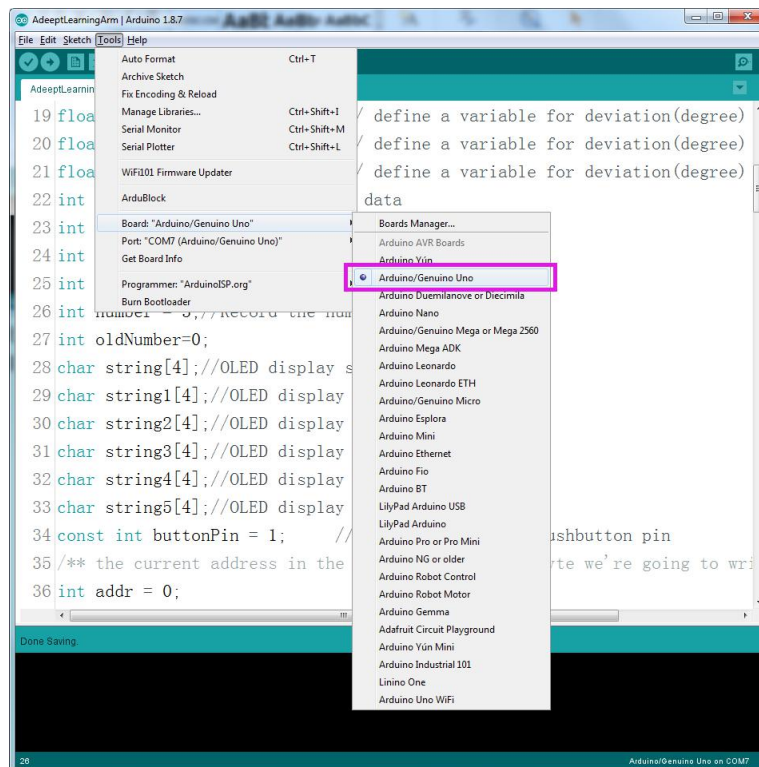


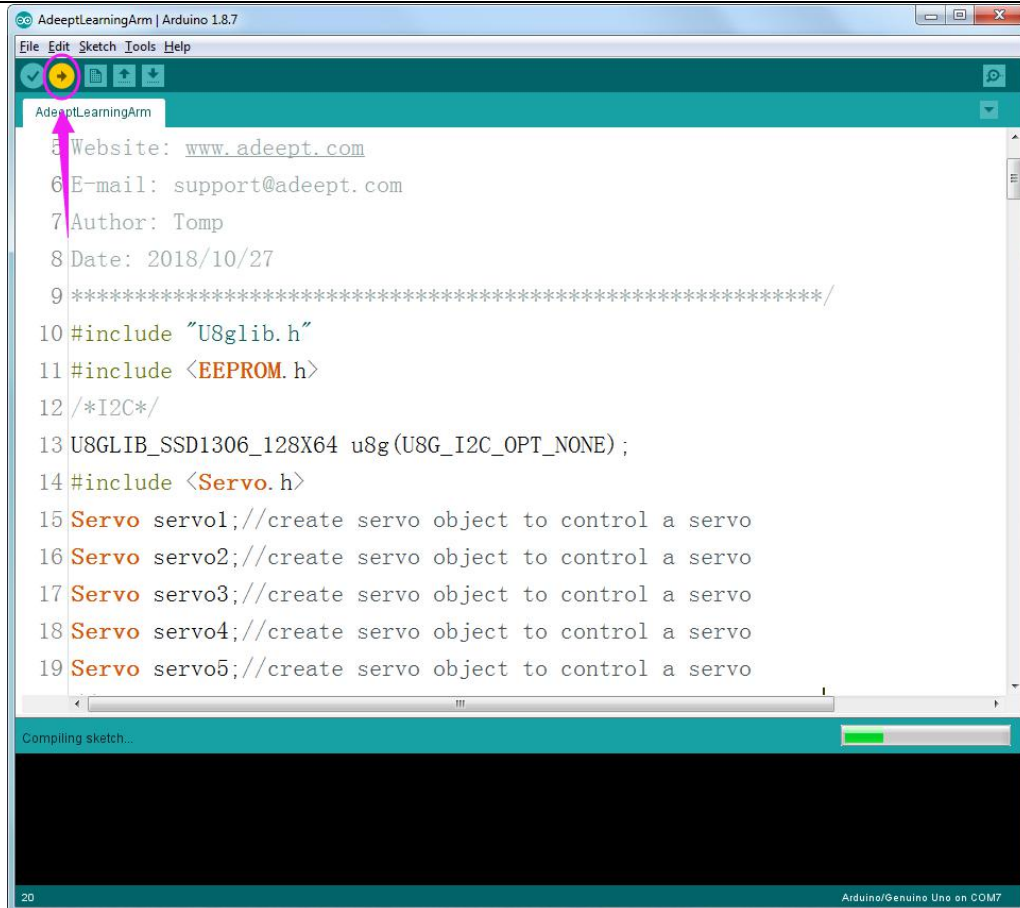


Before downloading the program, you have to plan how many motions to record this time.

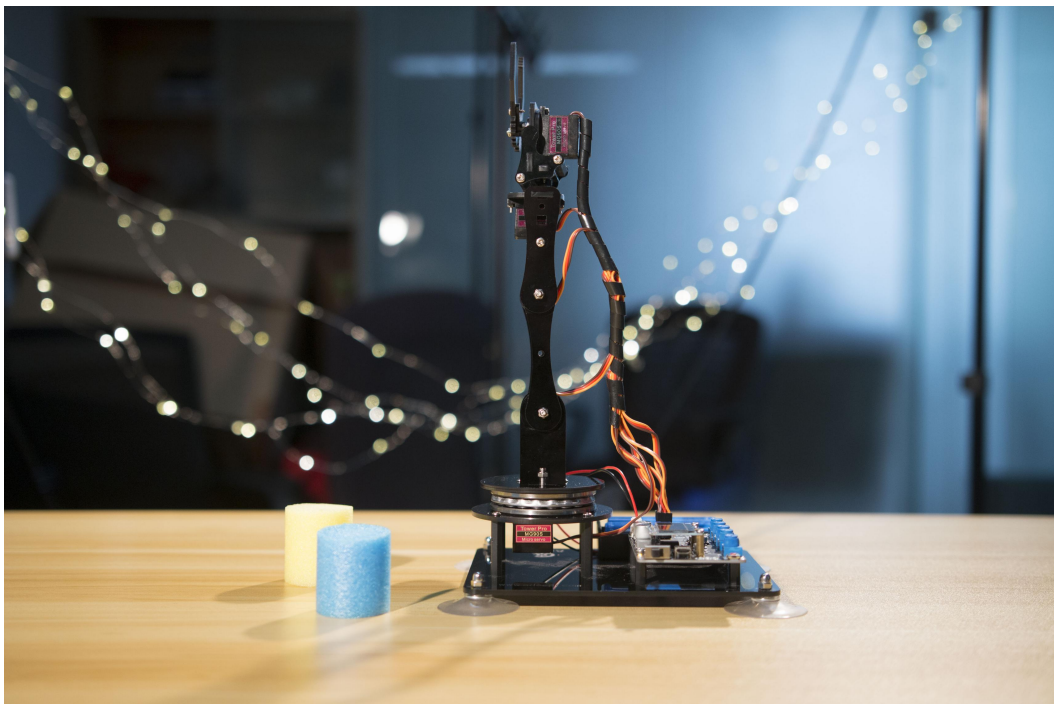


Take the recording of 10 times of motion data as an example, download the code to the UNO board, firstly connect the robotic arm to the computer with the USB cable, and then select the development board model and port.

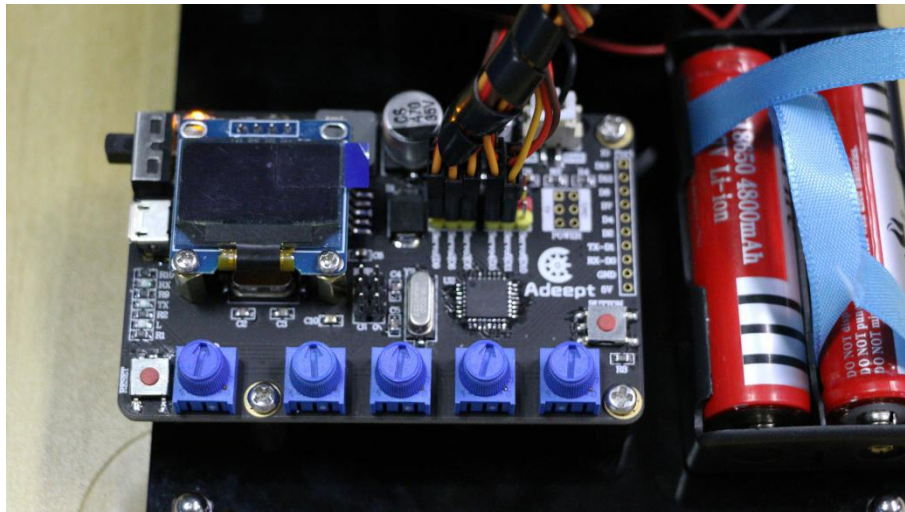




After the program is successfully uploaded, unplug the USB cable connected to the robotic arm. Adjust the potentiometer, rotate the Servo1, and straighten the arm as follow:



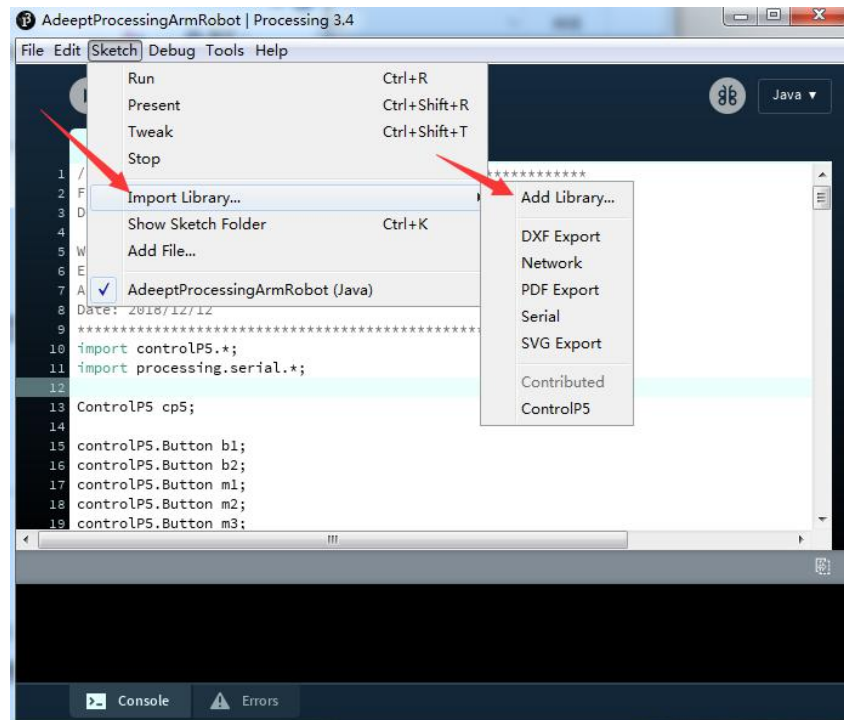
Next, rotate the potentiometer on the driver board to the center as shown below:



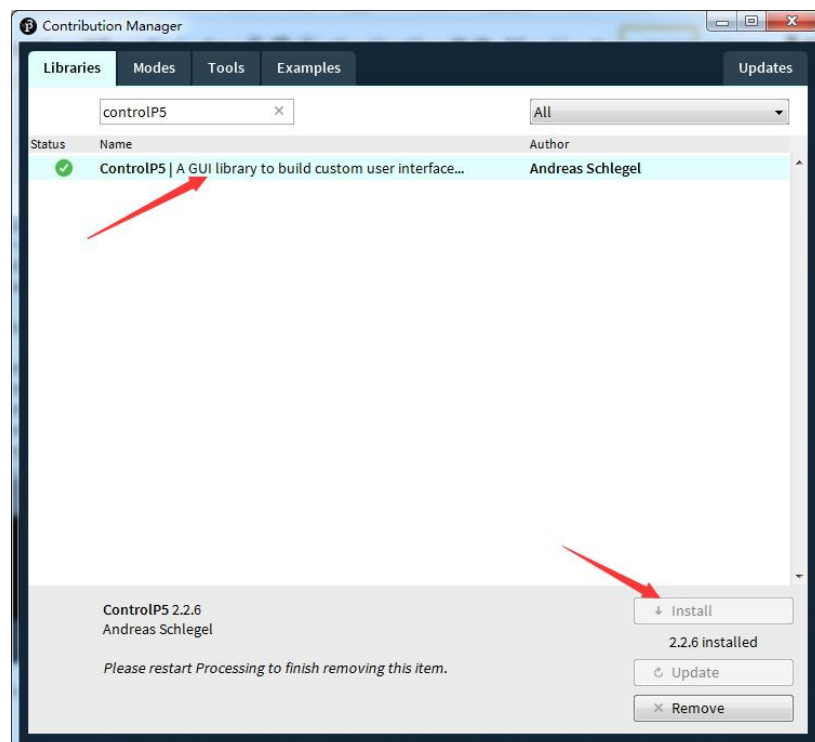
After completing the above preparations, gently support the robotic arm and then turn on the power. You will see the working status of the current situation and the number of the remaining motions the robotic arm needs to be record display on the OLED. Adjust the potentiometer to move the robotic arm. When the arm moves to the position you need, press the button (note that the time for pressing the button cannot exceed 3 seconds), UNO will record the position information of the arm at the current moment and the number of remaining motions displayed on OLED will lose one. When the displayed number is 0, the robotic arm completes recording and will run automatically. If the arm is powered off, the previously recorded motion information is still stored in EEPROM. After turning on the power again, if you don't need to modify the motion of the arm, you can press and hold the button for more than 5 seconds, the arm will automatically perform the previously recorded motions.

6.3. Processing controls servo

If the code hasn't been used in processing before, the library file controlP5 needs to be added.



Then search controlP5.

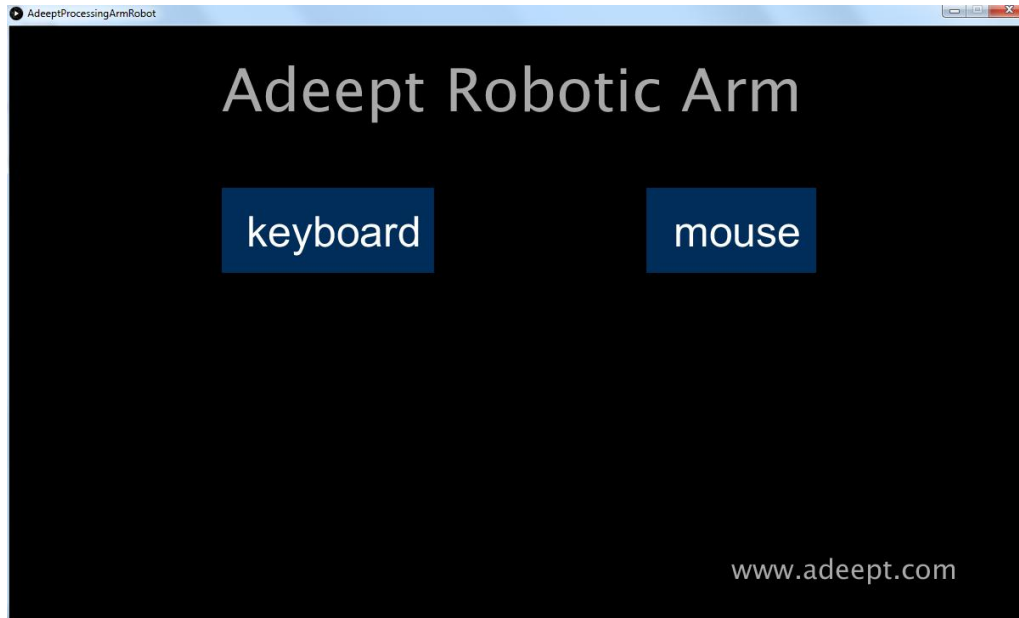


Finally click Install.

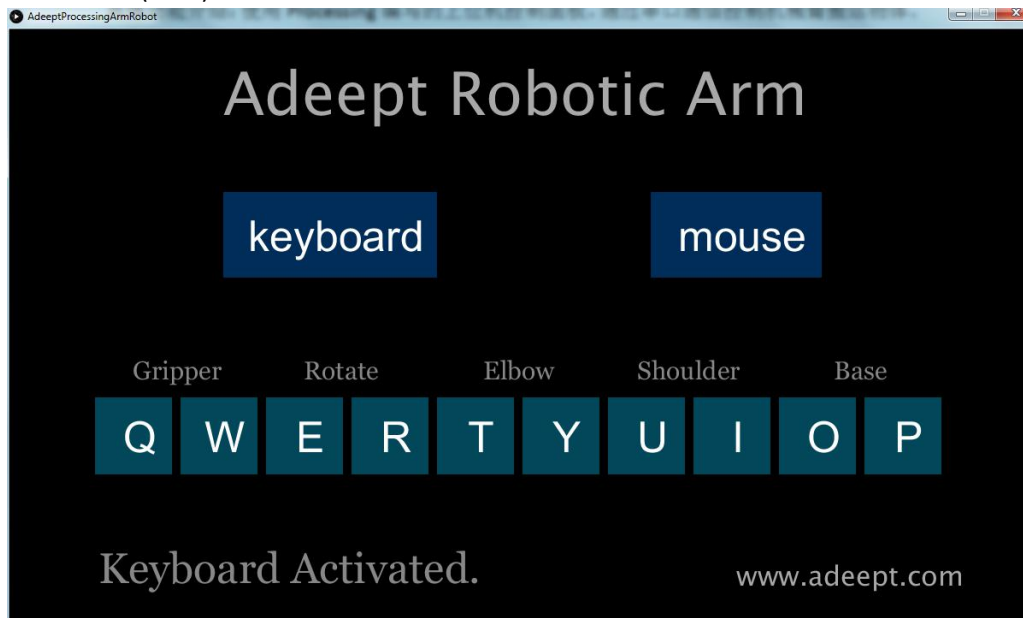
Specific function introduction:

Control the robotic arm to carry objects through Processing with serial communication.

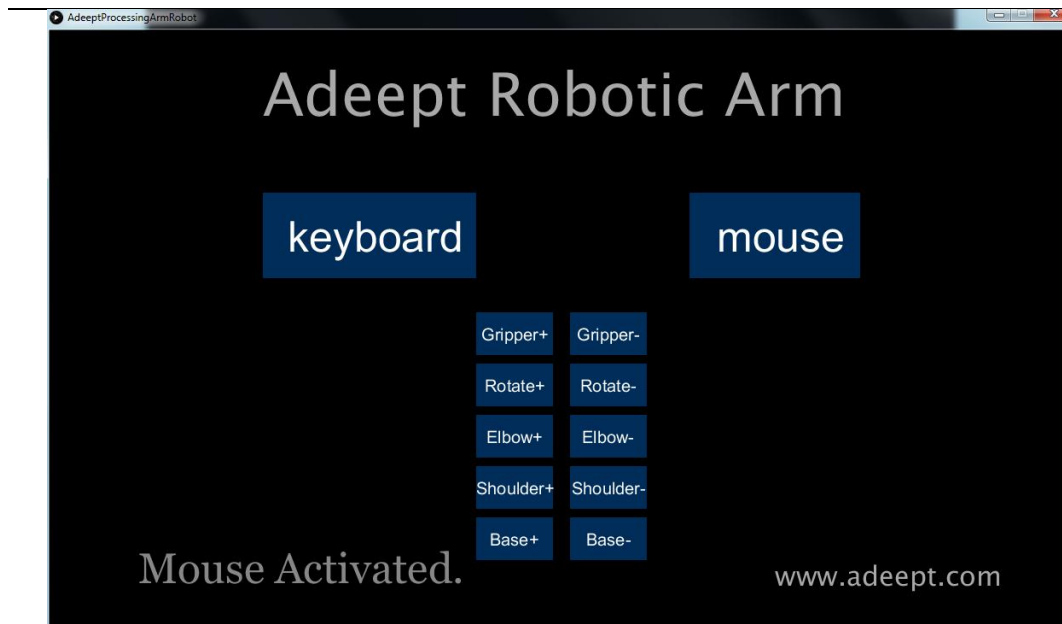
Processing interfaces are as follows.



Click "keyboard" the following interface will appear. Next, press the corresponding button on the keyboard to control the arm. "Q" and "W" control servo4 (Gripper), "E" and "R" control servo5 (Rotate), "T" and "Y" control servo3 (Elbow), "U" and "I" control servo2 (Shoulder), "O" and "P" control servo1 (Base).



Click "mouse" and the following interface will appear.



At this point, click the corresponding button, the robotic arm will make the corresponding movement. "Gripper+" and "Gripper-" control the servo5, "Rotate+" and "Rotate-" control the servo4, "Elbow+" and "Elbow-" control the servo3, "Shoulder+" and "Shoulder-" control the servo2, "Base+" and "Base-" control the servo1.

Operating steps:

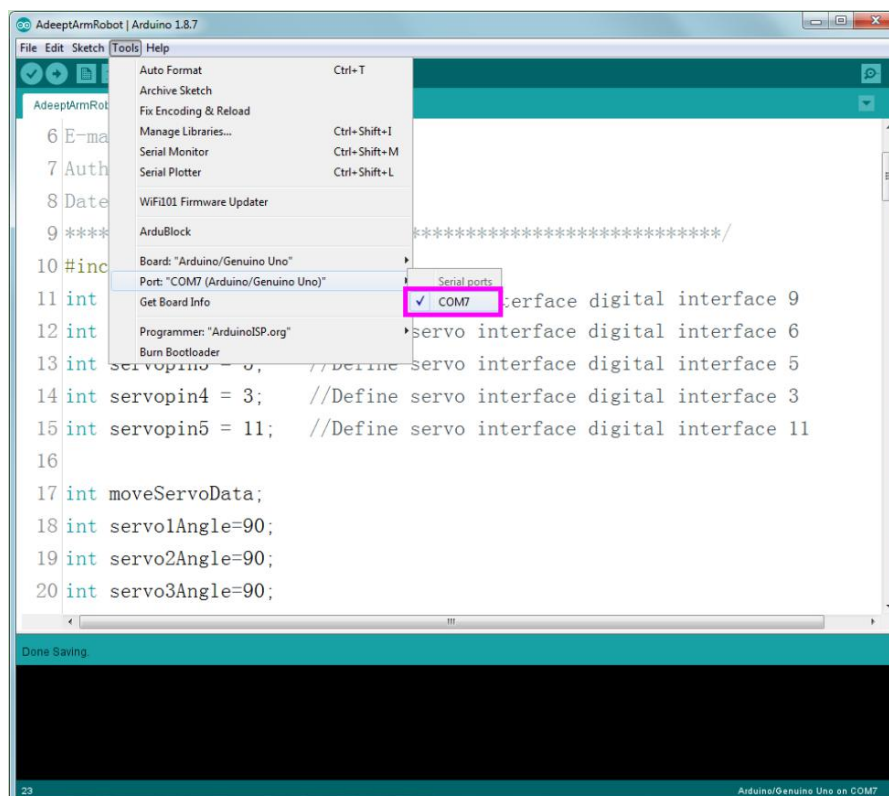
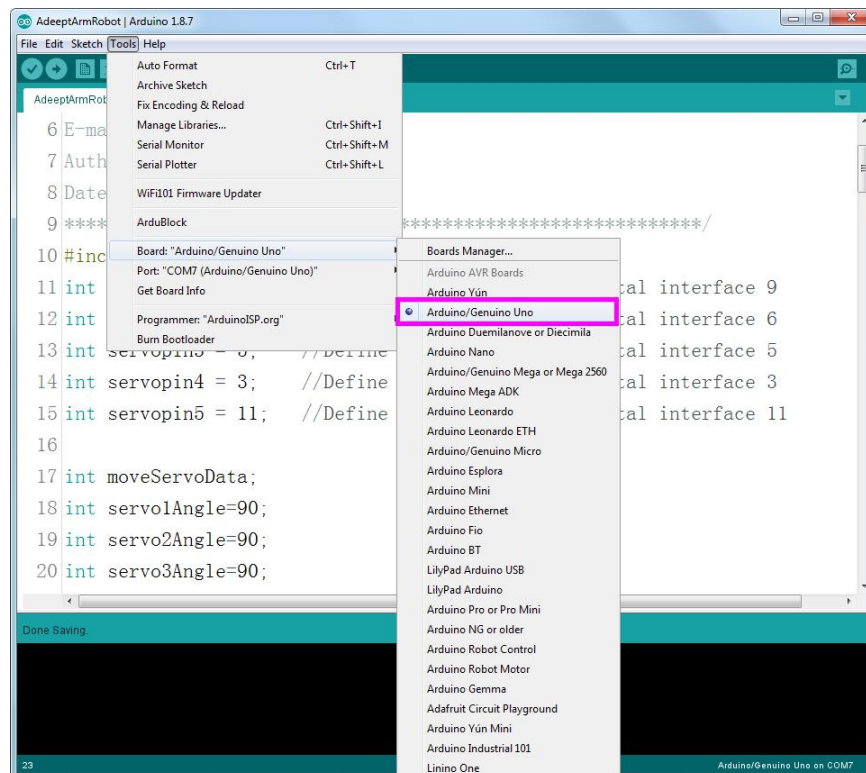
Open the file AdeptArmRobot.ino, as shown below:

```

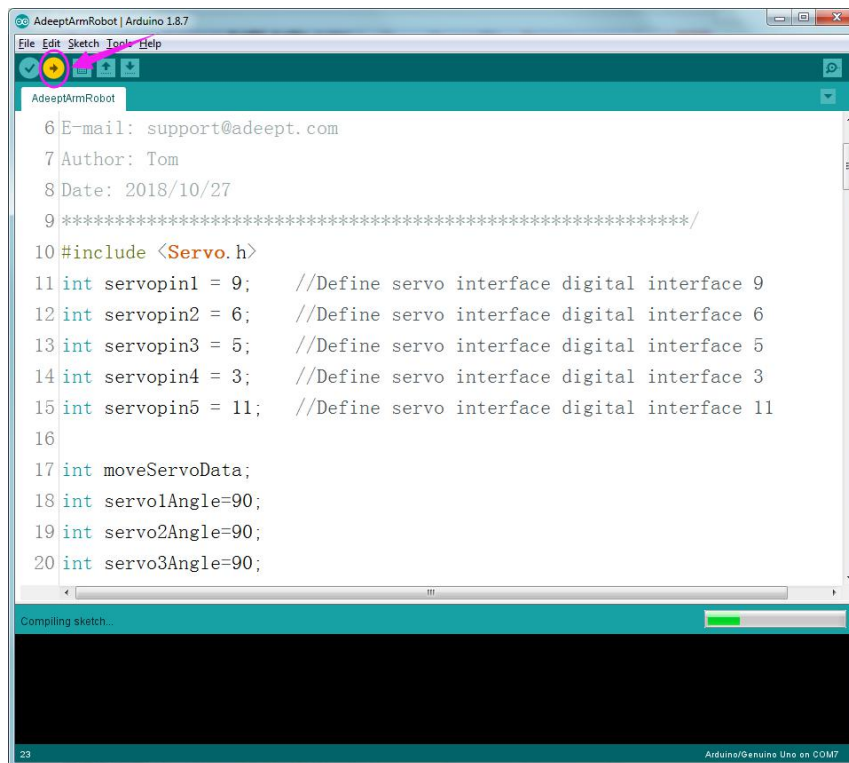
AdeptArmRobot | Arduino 1.8.7
File Edit Sketch Tools Help
AdeptArmRobot
6 E-mail: support@adept.com
7 Author: Tom
8 Date: 2018/10/27
9 *****/
10 #include <Servo.h>
11 int servopin1 = 9; //Define servo interface digital interface 9
12 int servopin2 = 6; //Define servo interface digital interface 6
13 int servopin3 = 5; //Define servo interface digital interface 5
14 int servopin4 = 3; //Define servo interface digital interface 3
15 int servopin5 = 11; //Define servo interface digital interface 11
16
17 int moveServoData;
18 int servo1Angle=90;
19 int servo2Angle=90;
20 int servo3Angle=90;
21
22
23
Done Saving
Arduino/Genuino Uno on COM7

```


Next, connect the robotic arm to the computer with the USB cable. Select the development board model and port, as shown below:

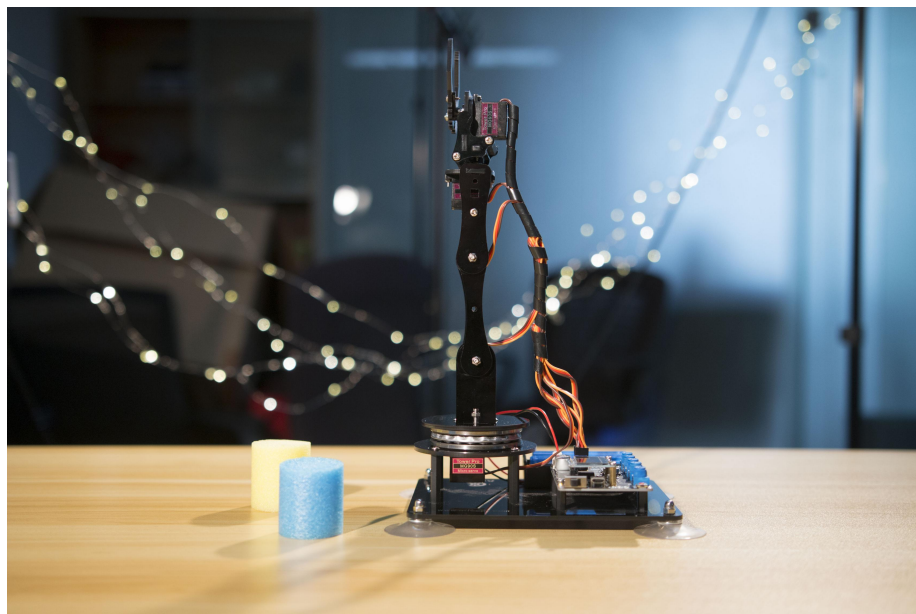


Click "Upload" to upload the code to UNO, as shown below:

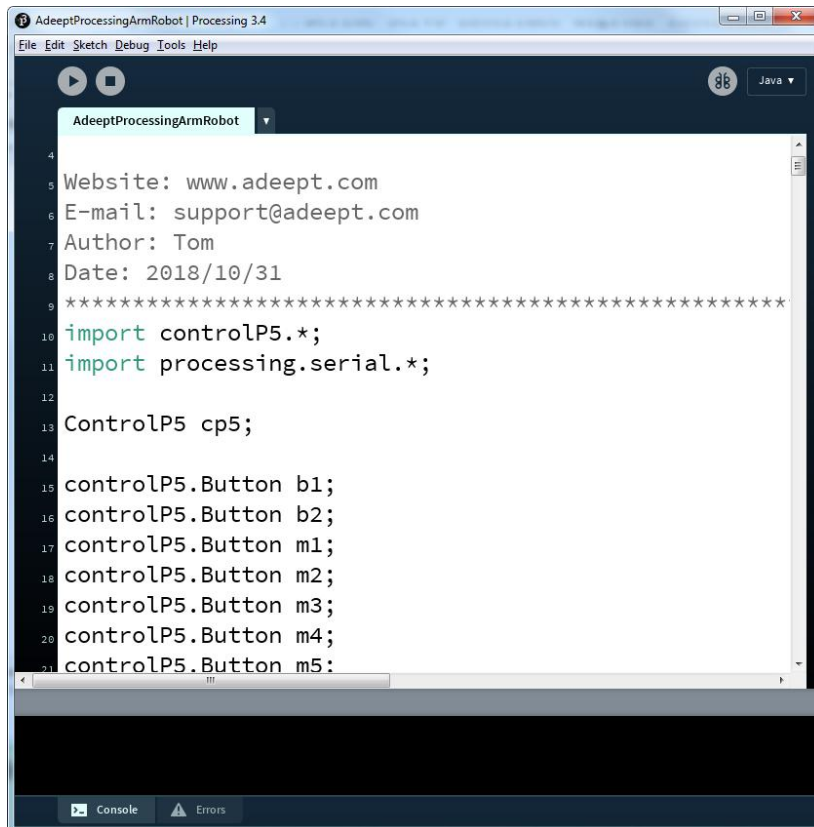


After downloading, close AdeptArmRobot.ino.

Note that the arm is still connected to the computer with the USB cable. Rotate the arm to the position as shown in the figure below (the initialization value is set in the program. If the arm is not in the position as shown below before powered on, it will swing and may cause damages when is energized), and then turn on the power.



Next open AdeptProcessingArmRobot.pde

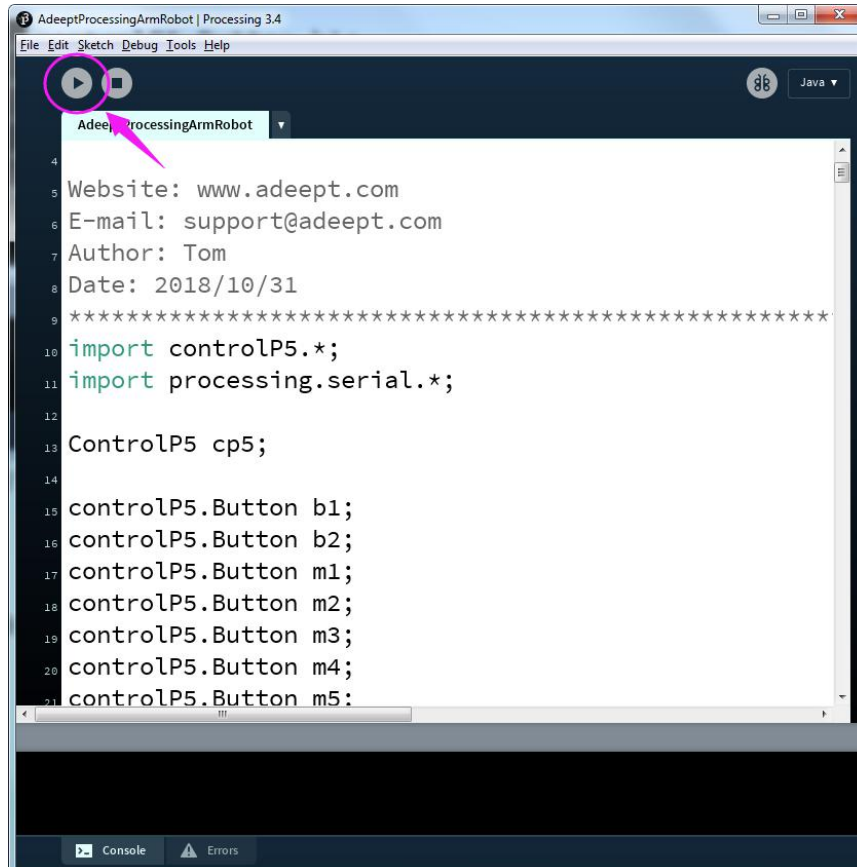


```
AdeptProcessingArmRobot | Processing 3.4
File Edit Sketch Debug Tools Help

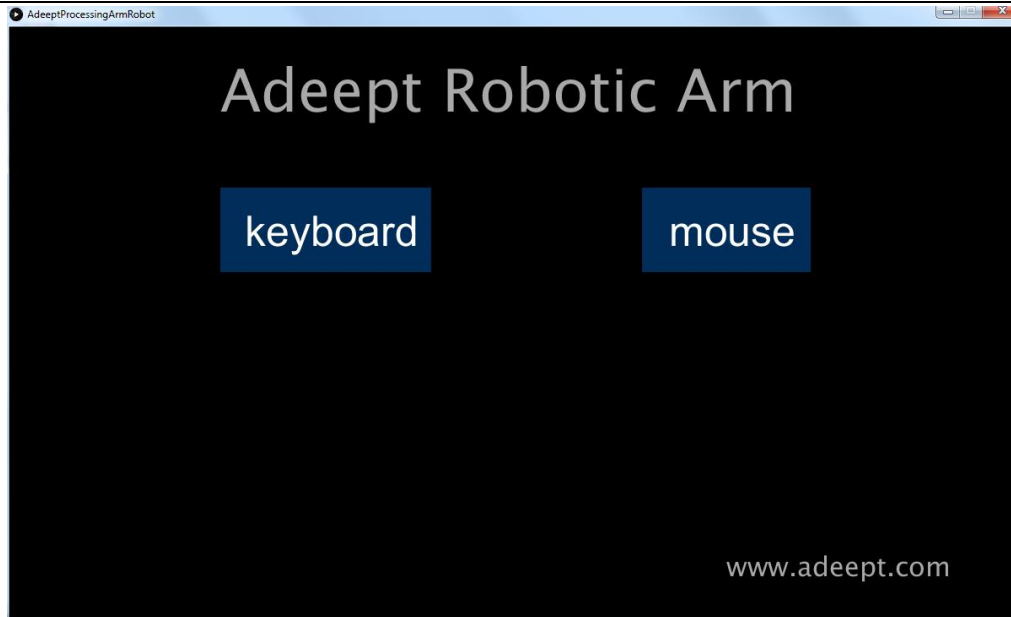
AdeptProcessingArmRobot

4
5 Website: www.adept.com
6 E-mail: support@adept.com
7 Author: Tom
8 Date: 2018/10/31
9 *****
10 import controlP5.*;
11 import processing.serial.*;
12
13 ControlP5 cp5;
14
15 controlP5.Button b1;
16 controlP5.Button b2;
17 controlP5.Button m1;
18 controlP5.Button m2;
19 controlP5.Button m3;
20 controlP5.Button m4;
21 controlP5.Button m5;
```

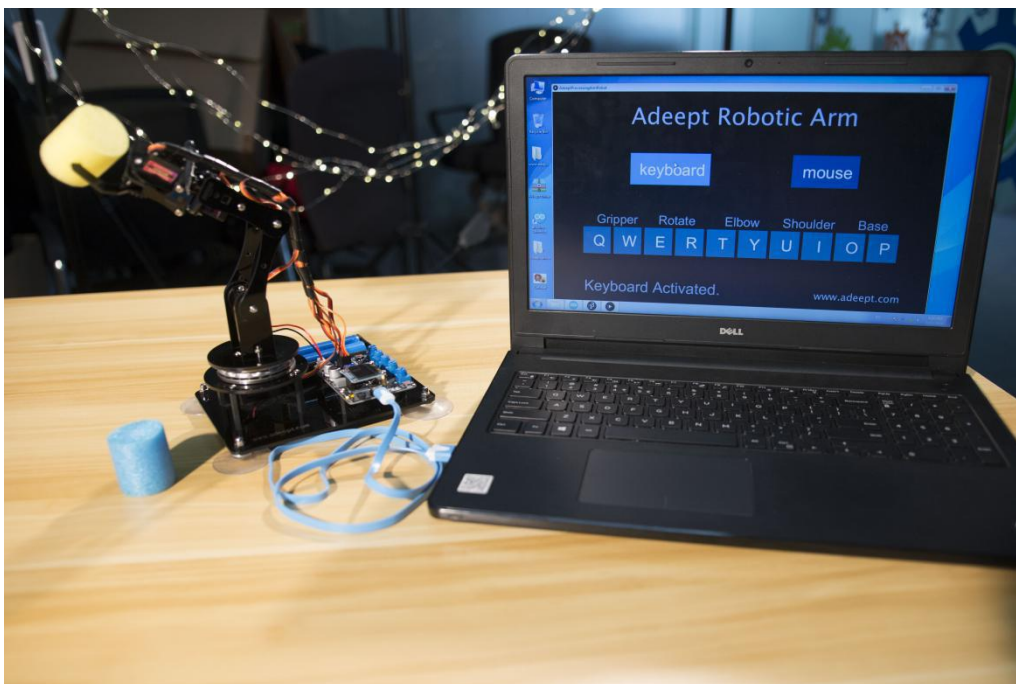
Click "Run" to run the code, as shown below:



The interface of successful running is as below:



The control interface can then be used to control the robotic arm.



6.4. Imitation function

Function introduction:

The motion track can be divided specifically if rotate the potentiometer A0, A1 and A2 to adjust the robotic arm. Press the touch button every time the arm moves (how much distance to move here can be determined by you. The shorter the moving distance, the more data the robotic arm records, and the more it imitates the movement similarly). When the number displayed on OLED is decremented by 1, it indicates that the previous data were successfully recorded in the EEPROM. Rotate three potentiometers A0, A1 and A2 to adjust the motion track of the robotic arm, and then press the touch button to record the next set of data again. Once repeated, the robotic arm can record the motion track that needs to be imitated. Note that how many sets of data we need to record are set in the program.

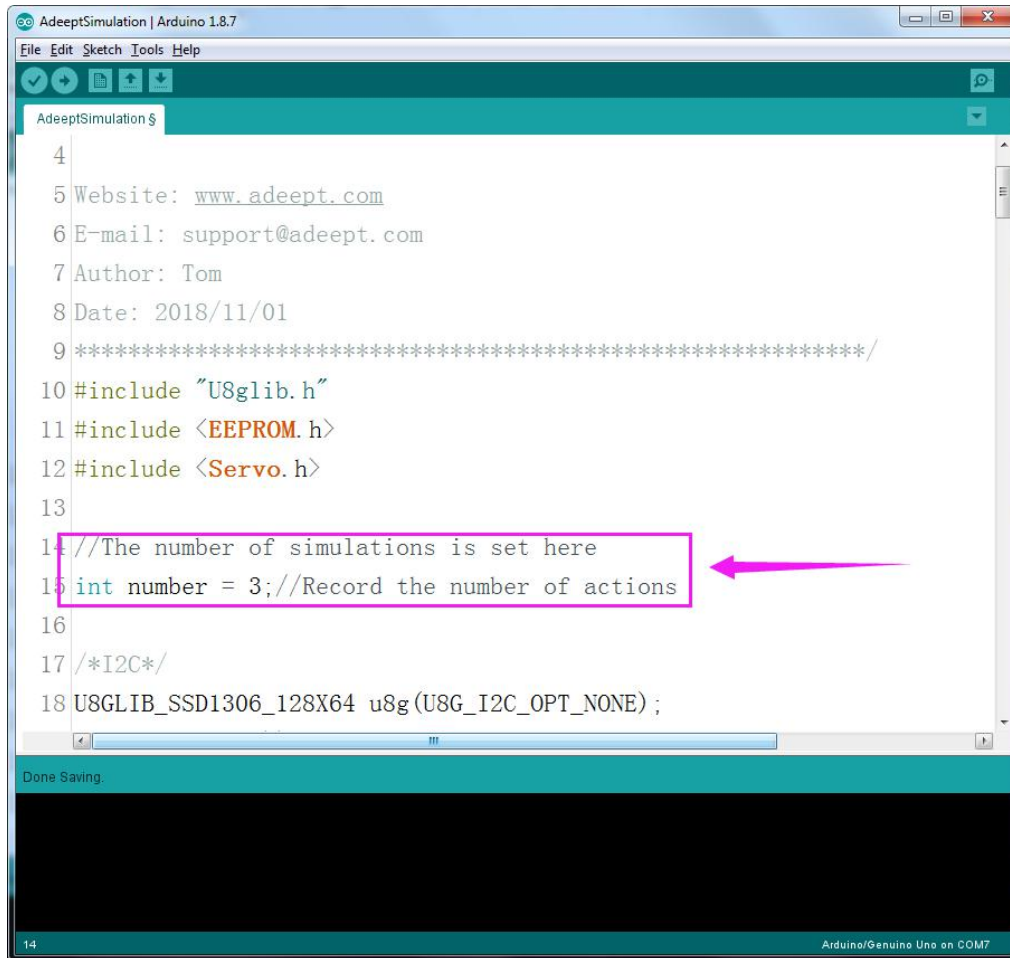
```
//The number of simulations is set here  
int number = 3;//Record the number of actions
```

After the program is downloaded for the first time, the imitation step can be run only when the setting record in the program is full. Otherwise, the robotic arm will read the recorded motion track data that is not set by us in the EEPROM. Consequently it will run as the setting movement at first but will not later.

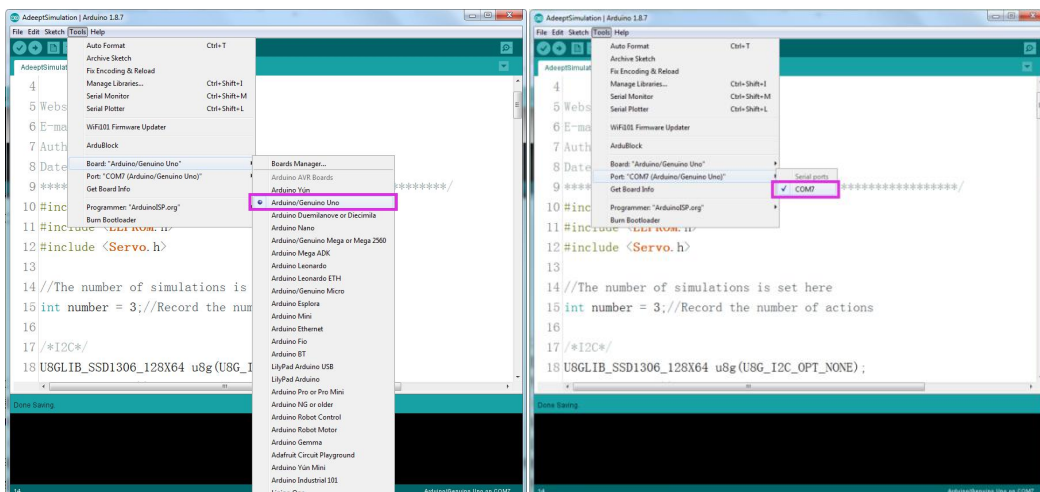
In this function, the robotic arm records the data of three servos, which is more than the data of five servos. The robotic arm can record up to 333 sets of motion when in imitation function and write the recorded data to the EEPROM. After the robotic arm is re-powered, the previously recorded data is still saved. Press and hold the touch button for more than 3 seconds, the arm will start to imitate the motion. (Note: before using the arm, make sure that the motion track of the arm has been recorded before.)

Operating steps:

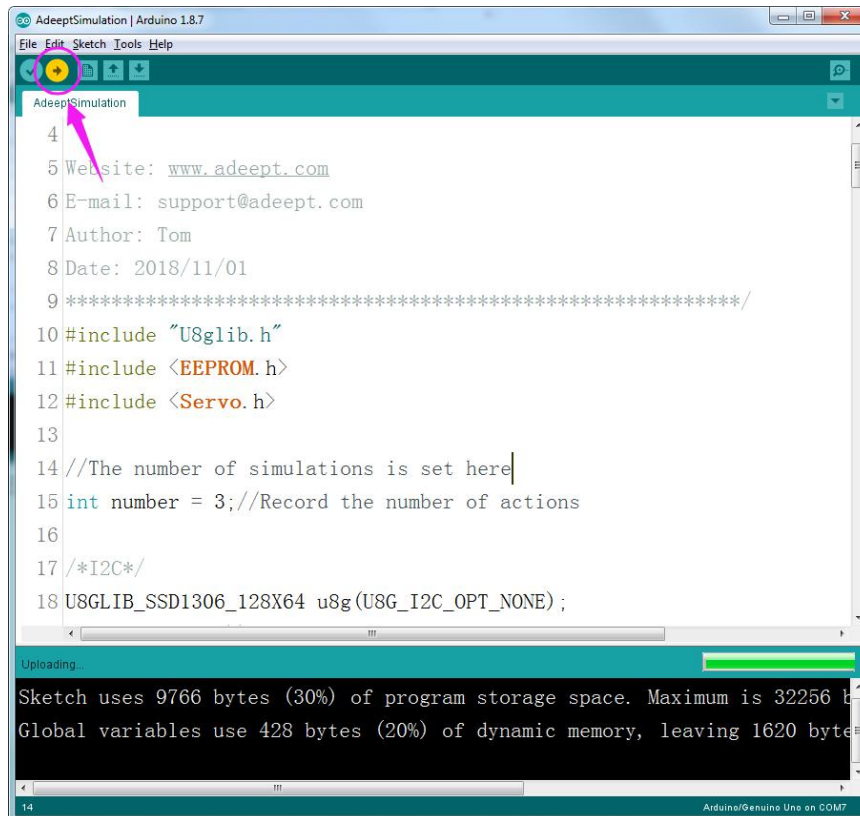
Step 1: Open the Arduino program AdeptSimulation.ino. First, estimate how many steps the robotic arm need to complete. For example, 3 steps, 15 steps, 200 steps, etc., 333 is the maximum.



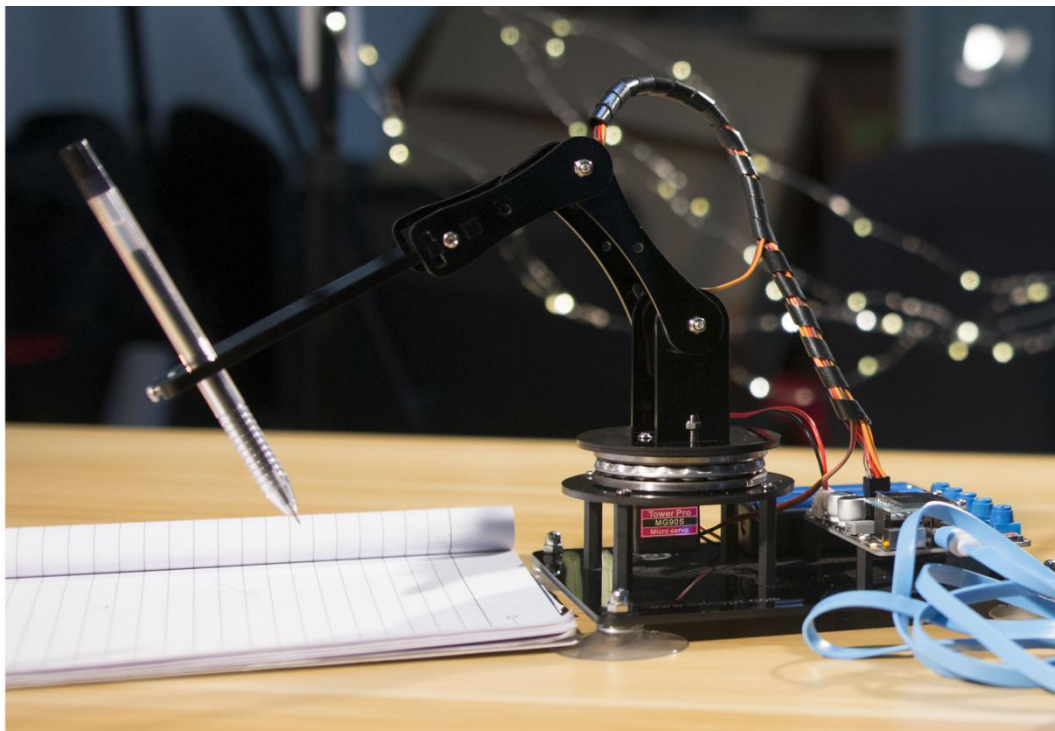
Step 2: Connect the robotic arm to the computer with the USB cable. (Note: Do not turn on the power supply when downloading the program to prevent damages of swinging arm.) Select the board model and port in Arduino IDE.



Step 3: Click "Upload" to upload the code to UNO of the robotic arm.



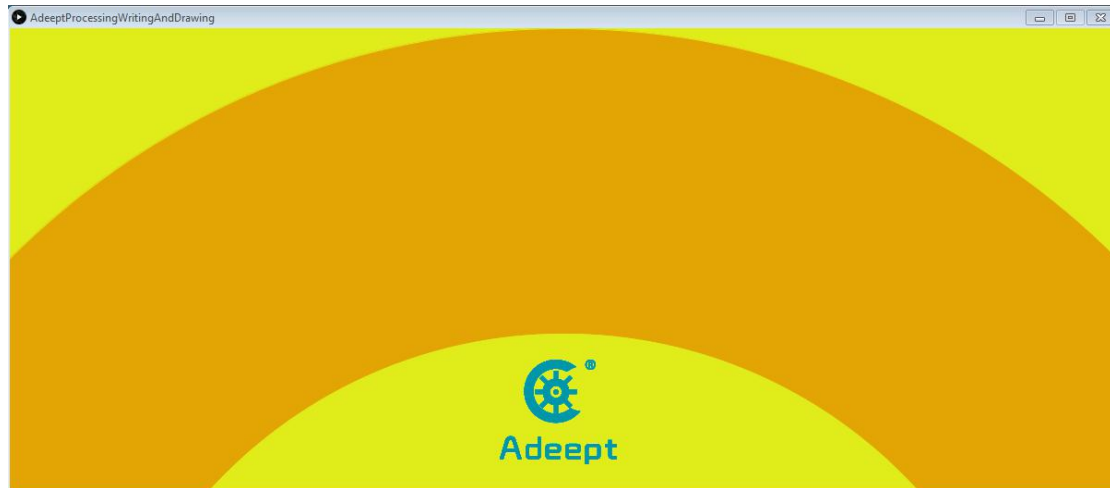
Step 4: Unplug the USB cable connected to the robotic arm and turn on the power. You can implement the imitation function to make keyboard input and turn e-book pages.



6.5. Processing controls robotic arm to write and draw

Function introduction:

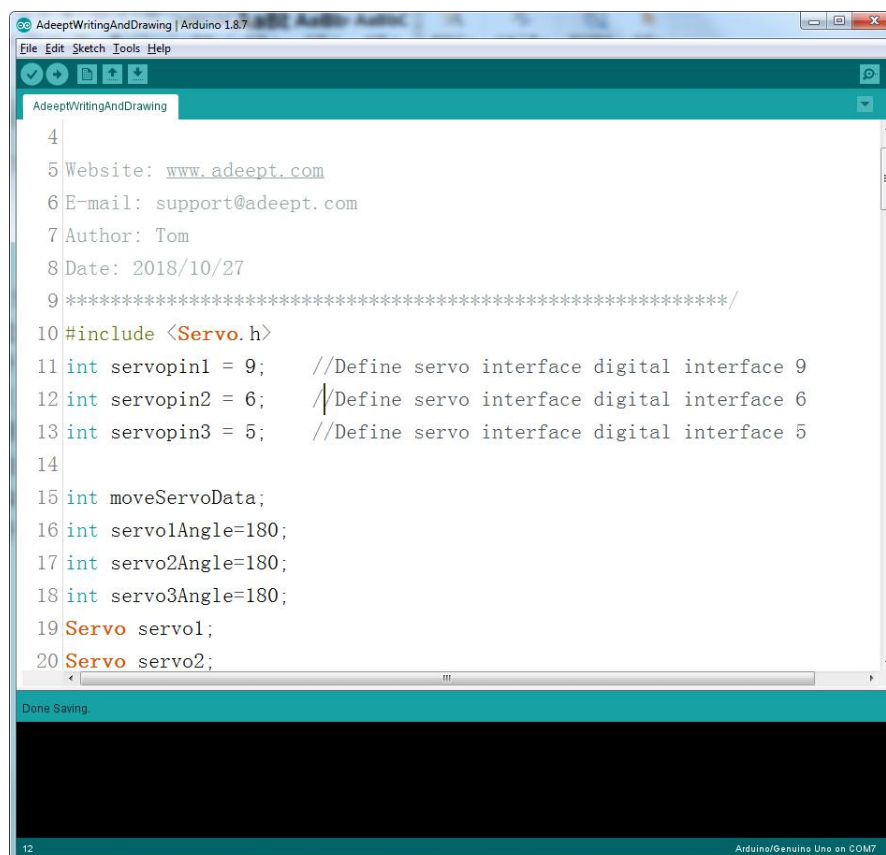
The control interface of Processing is as shown below:



Draw or write in the yellow area with the mouse, you will see that the robotic arm paints what we depict on the control panel on the paper. Note that due to errors in the servo, etc., the content depicted by the arm will be slightly biased.

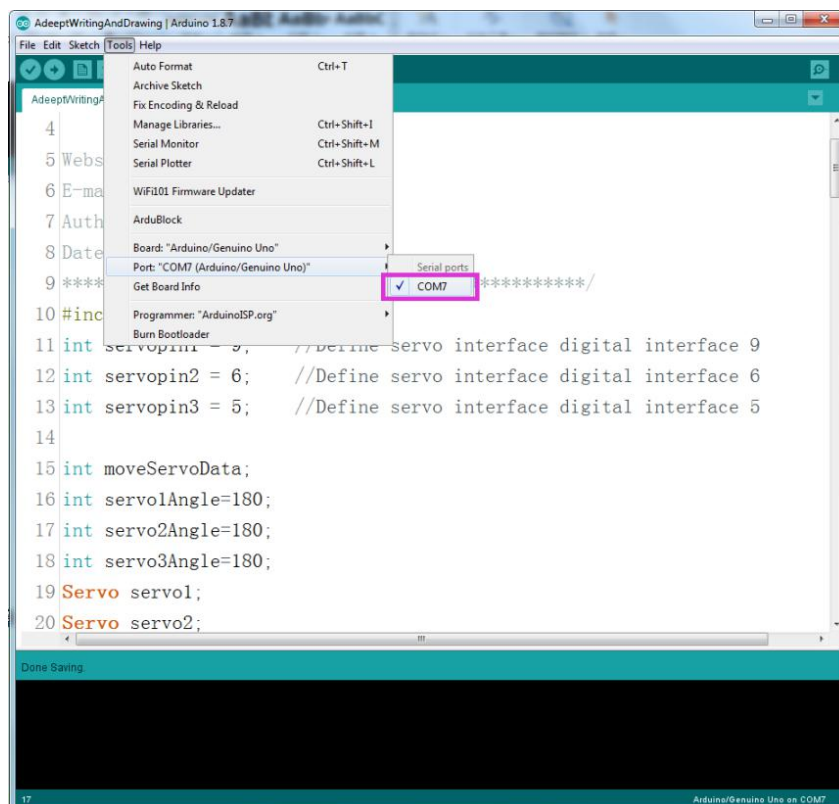
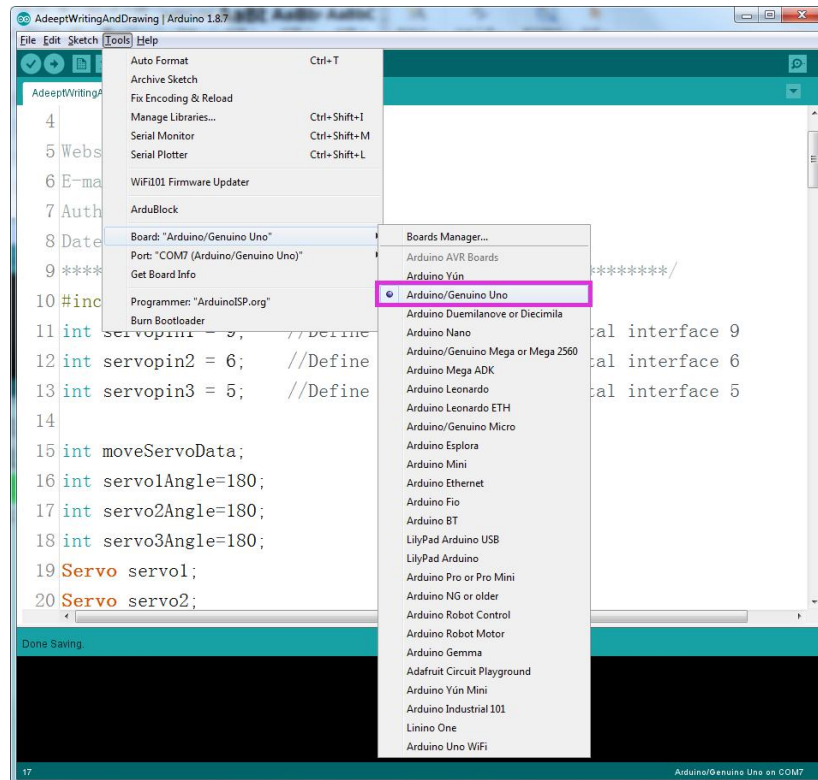
Operating steps:

Open AdeptWritingAndDrawing.ino, the following interface will appear.

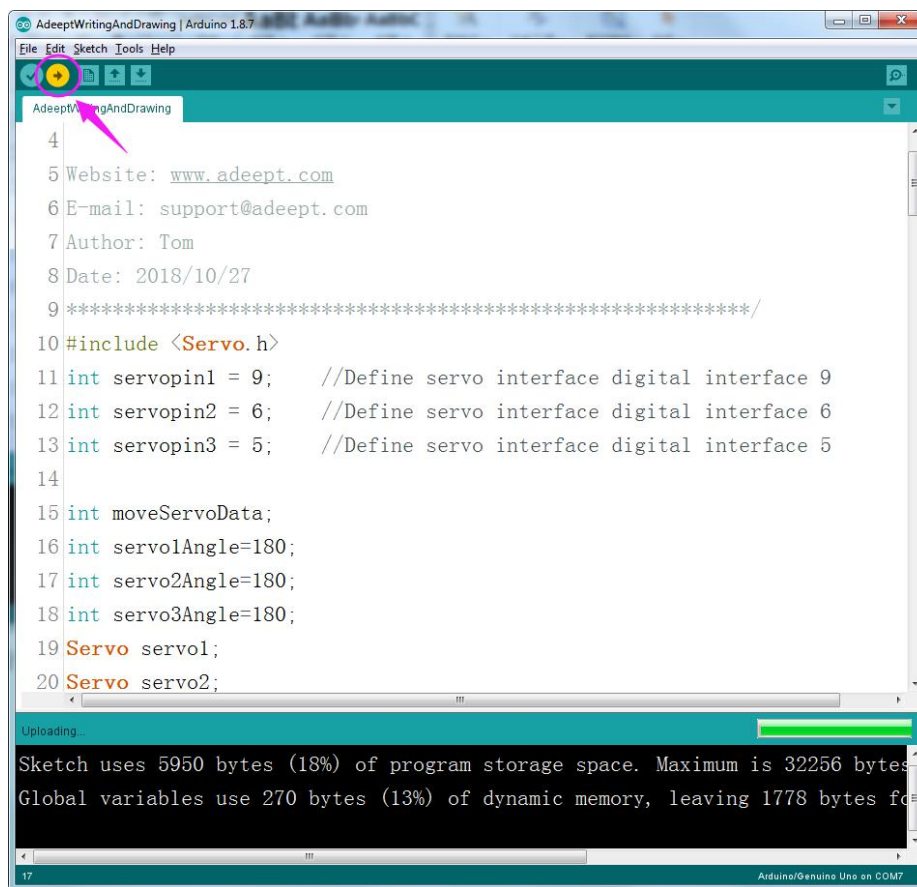


Connect the robotic arm to the computer.

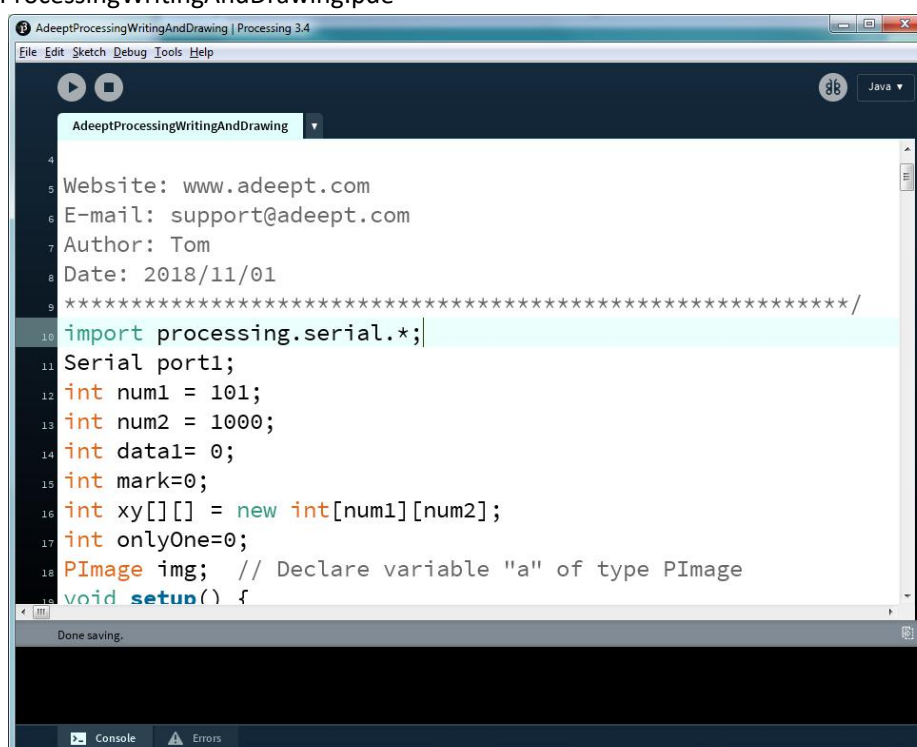
Next select the development board model and port, as shown below:



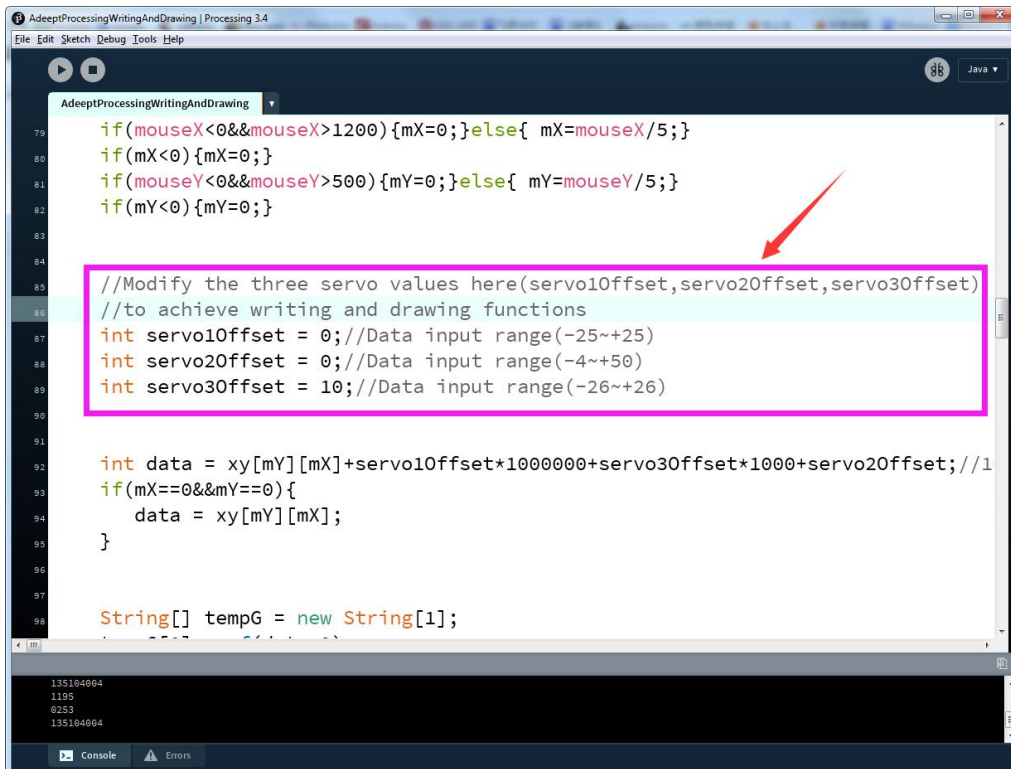
Click "Upload" to upload the code to the UNO board.



Close the Arduino IDE after completed download. Do not unplug the USB cable connected to the robotic arm. Turn on the power supply and open the program AdeptProcessingWritingAndDrawing.pde



Next, fine-tune the offset of the servo. In this experiment, the initial adjustment of the three servos is required. Otherwise, the pen may not be able to write and draw or it may generate bad typeface.

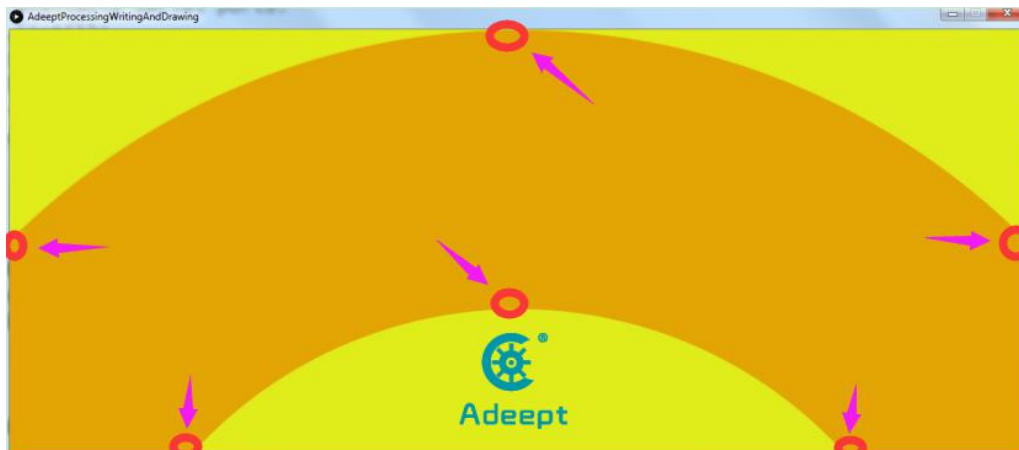


```

AdeptProcessingWritingAndDrawing | Processing 3.4
File Edit Sketch Debug Tools Help

79  if(mouseX<0&&mouseX>1200){mX=0;}else{ mX=mouseX/5;}
80  if(mX<0){mX=0;}
81  if(mouseY<0&&mouseY>500){mY=0;}else{ mY=mouseY/5;}
82  if(mY<0){mY=0;}
83
84
85  //Modify the three servo values here(servo10ffset,servo20ffset,servo30ffset)
86  //to achieve writing and drawing functions
87  int servo10ffset = 0;//Data input range(-25~+25)
88  int servo20ffset = 0;//Data input range(-4~+50)
89  int servo30ffset = 10;//Data input range(-26~+26)
90
91
92  int data = xy[mY][mX]+servo10ffset*1000000+servo30ffset*1000+servo20ffset;//1
93  if(mX==0&&mY==0){
94      data = xy[mY][mX];
95  }
96
97
98  String[] tempG = new String[1];
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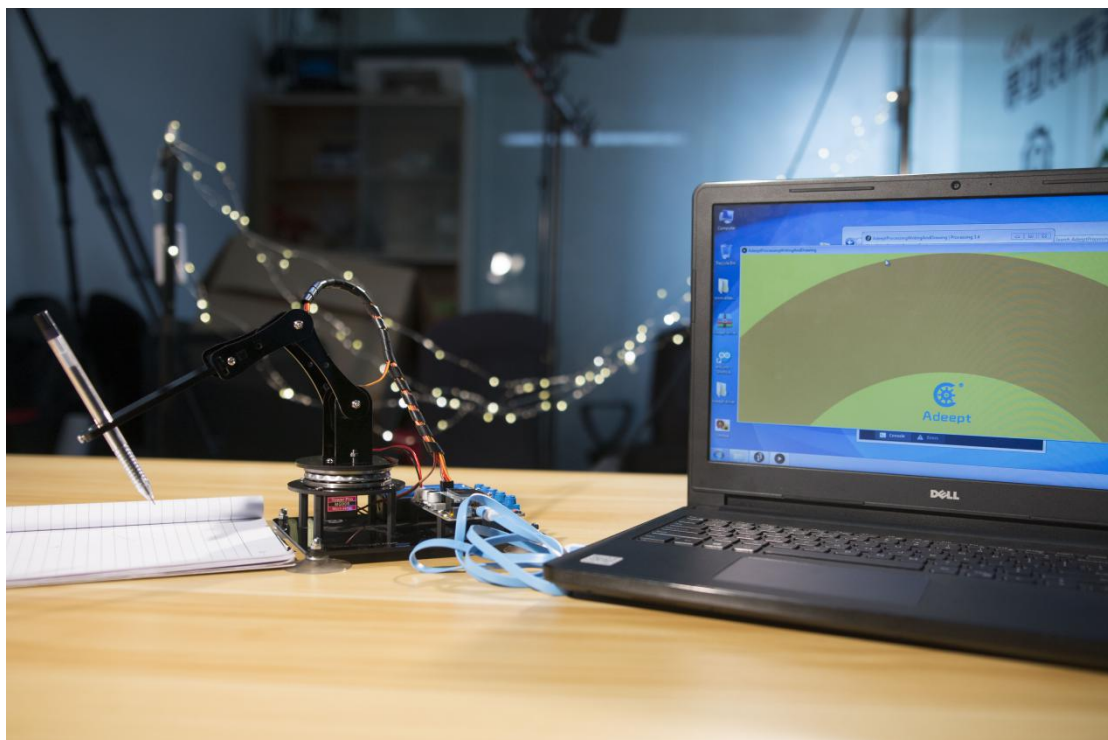
Click the dots as shown below:



click each dot to see if the tip of the pen falls on the paper. If it's not or suspend in the air, you need to modify the three parameters. (Note that there's certain error existing, the three parameters are not required to be precise. During the debugging, you will find that several sets of data can make the robotic arm work normally.)

```
//Modify the three servo values here(servo1offset,servo2offset,servo3offset)
//to achieve writing and drawing functions
int servo1offset = 0;//Data input range(-25~+25)
int servo2offset = 0;//Data input range(-4~+50)
int servo3offset = 10;//Data input range(-26~+26)
```

After modifying the three parameters to make the tip of the pen reach to the paper (do not make the tip press against the paper), click "Run" to run the control panel program. The robotic arm will paint as you write or draw in the dark yellow area with the mouse.



7.Afterword

Thanks for purchasing our product and reading the manual! If you spot any errors or have any ideas or questions for the product and this guide, welcome to contact us! We will correct them if any as quickly as possible.

For more information about Arduino, Raspberry Pi, smart car robot, or robotics, etc., please follow our website www.adept.com. We will introduce more cost-effective, innovative and intriguing products!

Thanks again for choose Adept product!



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