Free your innovation

Freenove is an open-source electronics platform.
www.freenove.com

Warning

When you purchase or use this product, please note the following:

- This product contains small parts. Swallowing or improper operation them can cause serious infections and death. Seek immediate medical attention when the accident happened.
- Do not allow children under 3 years old to play with or near this product. Please place this product in where children under 3 years of age cannot reach.
- Do not allow children lack of ability of safe to use this product alone without parental care.
- Never use this product and its parts near any AC electrical outlet or other circuits to avoid the potential risk of electric shock.
- Never use this product near any liquid and fire.
- Keep conductive materials away from this product.
- Never store or use this product in any extreme environments such as extreme hot or cold, high humidity and etc.
- Remember to turn off circuits when not in use this product or when left.
- Do not touch any moving and rotating parts of this product while they are operating.
- Some parts of this product may become warm to touch when used in certain circuit designs. This is normal. Improper operation may cause excessively overheating.
- Using this product not in accordance with the specification may cause damage to the product.

About

Freenove is an open-source electronics platform. Freenove is committed to helping customer quickly realize the creative idea and product prototypes, making it easy to get started for those enthusiasts of programing and electronics and launching innovative open source products. Our services include:

- Electronic components and modules
- Learning kits for Arduino
- Learning kits for Raspberry Pi
- Learning kits for Technology
- Robot kits
- Auxiliary tools for creations

Our code and circuit are open source. You can obtain the details and the latest information through visiting the following web sites:
http://www.freenove.com
https://github.com/freenove

Your comments and suggestions are warmly welcomed, please send them to the following email address:
support@freenove.com

References

You can download the sketches and references used in this product in the following websites:
http://www.freenove.com
https://github.com/freenove
If you have any difficulties, you can send email to technical support for help.

The references for this product is named Freenove Hexapod Robot Kit, which includes the following folders and files:

- Arduino Sketches and libraries for Arduino
- Processing Sketches and libraries for Processing
- AboutBattery.pdf Notes about battery
- CalibrationGraph.pdf Calibration graph
- Readme.txt Instructions
- Tutorial.pdf Tutorial

Support

Freenove provides free and quick technical support, including but not limited to:

- Quality problems of products
- Problems in using products
- Questions for learning and technology
- Opinions and suggestions
- Ideas and thoughts

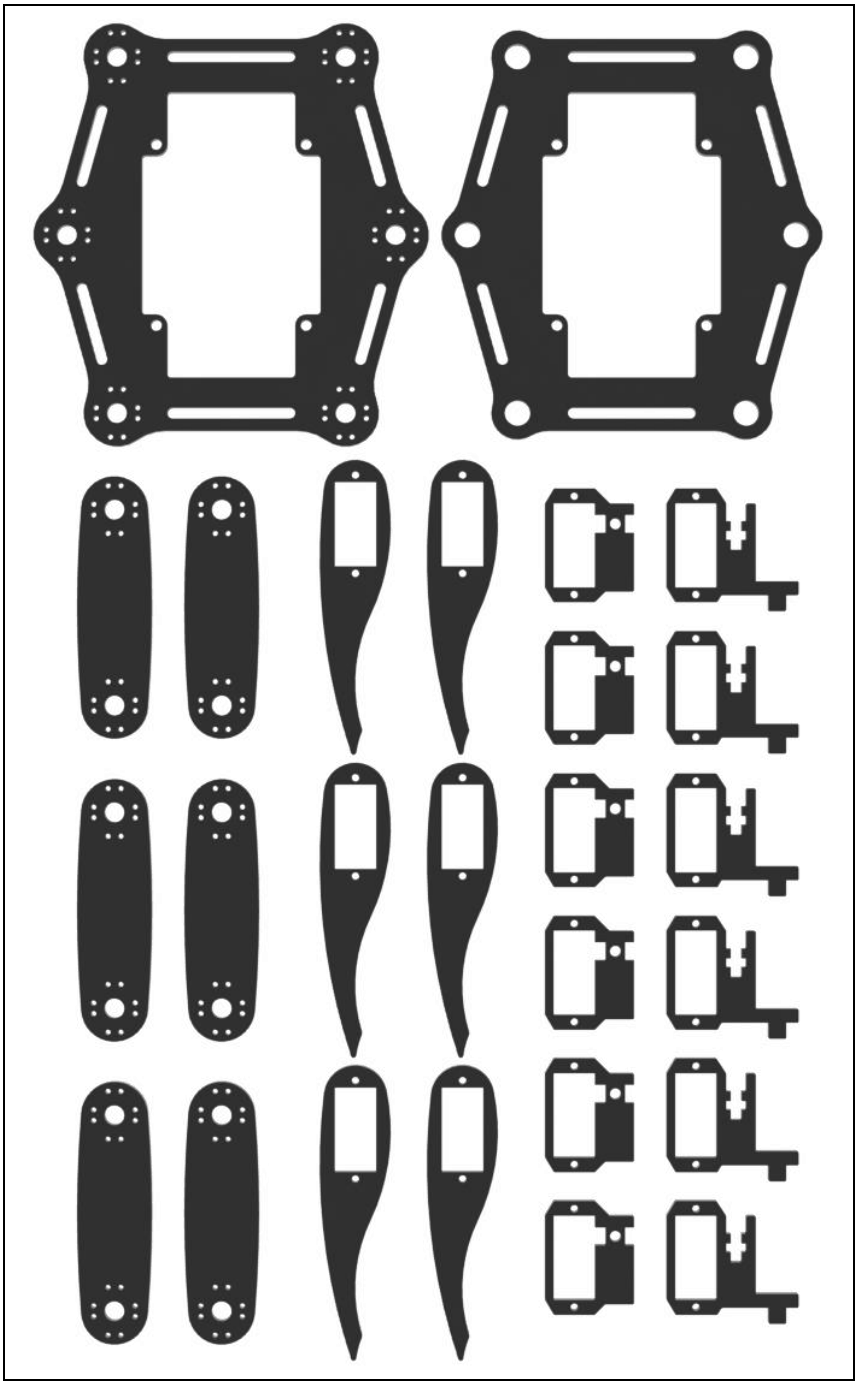
Please send email to:
support@freenove.com
On working day, we usually reply to you within 24 hours.

Copyright

Contents

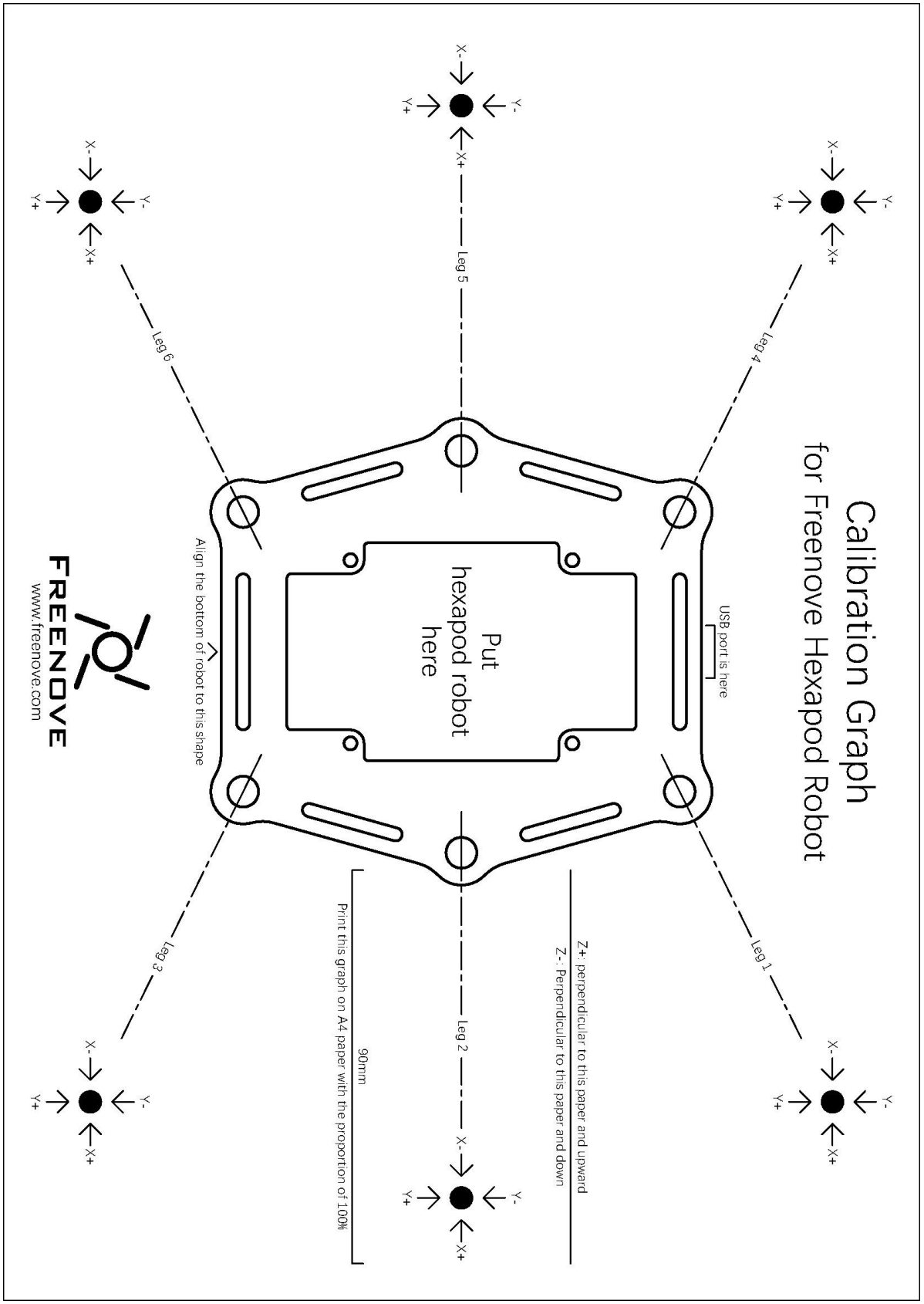
List

Acrylic Parts



The surface of the acrylic parts is covered with a layer of protective film, you need to remove it first.
Some holes in the acrylic parts may have residues, you also need to clean them before using.

Calibration Graph

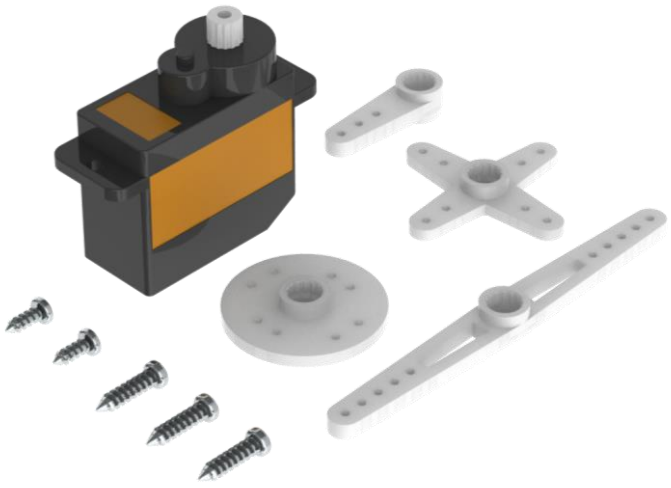


Mechanical Parts

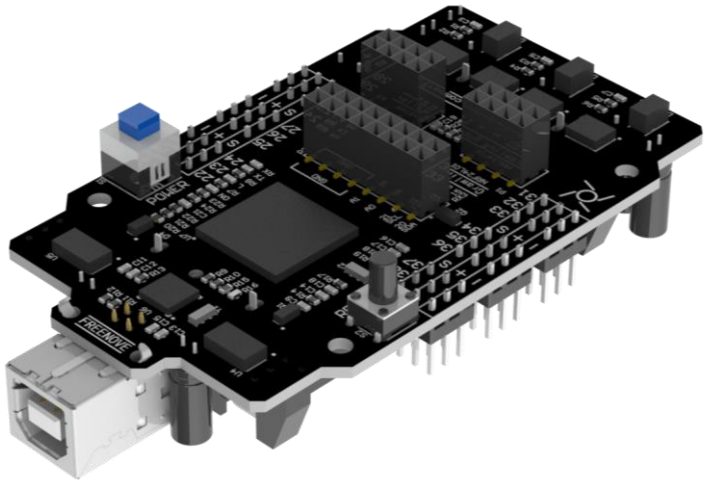
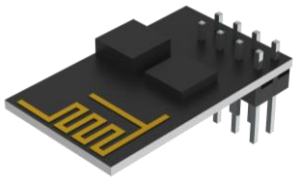
M3*27 Copper Standoff  x6 Freenove	M3*5 Copper Standoff  x6 Freenove	M3*12 Screw  x8 Freenove	M3*8 Screw  x10 Freenove
M2 Nut  x40 Freenove	M3 Nut  x8 Freenove	M2*10 Screw  x40 Freenove	M1.2*7 Self-tapping Screw  x160 Freenove

Dynamic Parts

Servo x18



Electronic Parts

Freenove Crawling Robot Controller x1 	ESP8266 Wi-Fi Module x1 
USB Cable x1 	
Cable Tidy x75cm 	

Tools

Cross Screwdriver x1

Self-prepared Parts

14500 3.7V rechargeable lithium battery x2
(Refer to “AboutBattery.pdf” for detailed information)

Preface

This is a hexapod robot kit based on Arduino and Processing. Arduino and Processing, which are free and open source, can be runned on Mac, Windows, and GNU/Linux platforms.

You can use this kit to assemble a cool hexapod robot, and make it move and act through wireless control. You can also directly control the IO ports on control board. In details, you can use the following devices to control this robot:

- Laptop or Desktop computer with wireless network adapter. (Run Mac, Windows, or GNU/Linux)
- Android phone or tablet. (Run Android 4.2 or later)
- Remote control. (Freenove Remote Control Kit, FNK0028)

We provide complete code, but also you can easily write code for this robot. By using the Arduino library file we provided, you only need write a few lines of code to control action and movement of the robot. You can also connect sensors and modules to the IO ports and power ports on control board.

The assembled robot is shown below (the wires are not shown).

Arduino

Arduino is an open-source electronics platform based on easy-to-use hardware and software. It's intended for anyone making interactive projects.

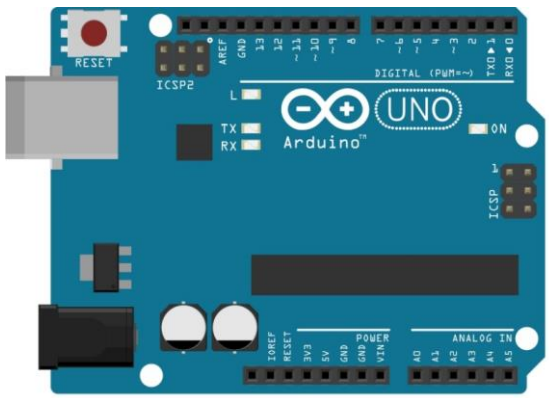
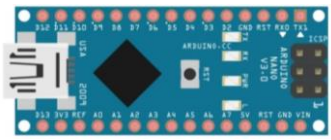
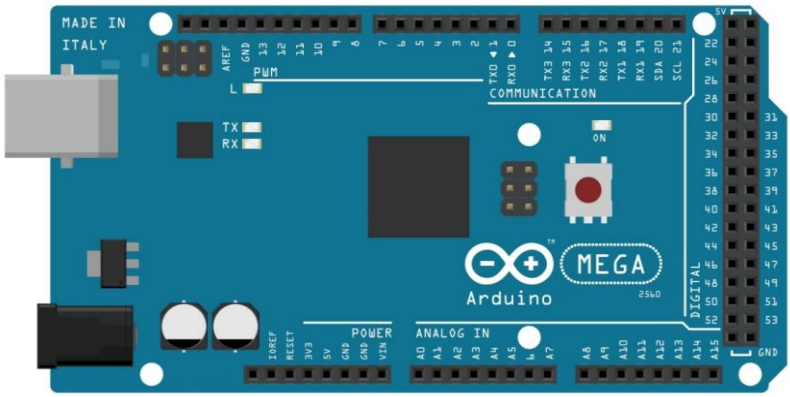
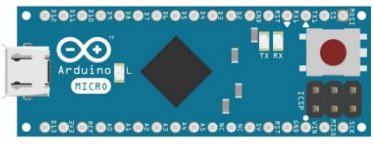
Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on C/C++), and the Arduino software (IDE).

The Arduino software is free and open source, and runs on the Mac, Windows, and GNU/Linux platforms.

Arduino Board

Arduino Board is a circuit board, with integrates micro controller, input, output interface and etc.

Arduino Board has several models. Popular boards include:

Uno 	Nano 
Mega 2560 	Micro 

Arduino Programming Language

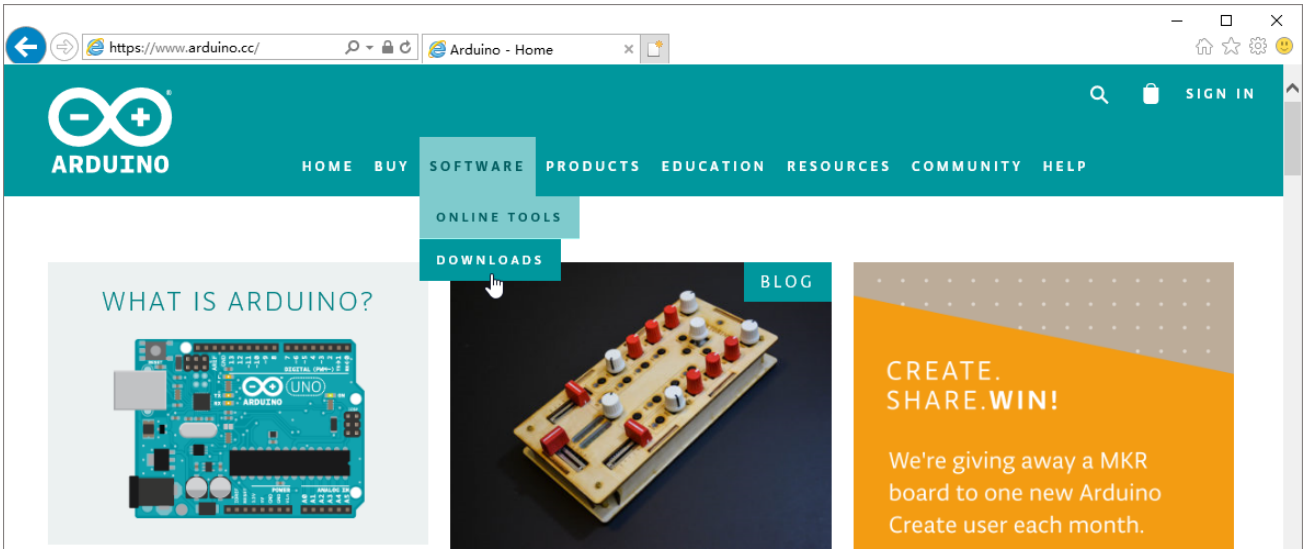
The Arduino programming language is based on C/C++.
Please visit https://www.arduino.cc, click "Learning" > "Reference" for details.

If you want to learn it easily, please visit http://www.freenove.com for Arduino kits designed for beginners.

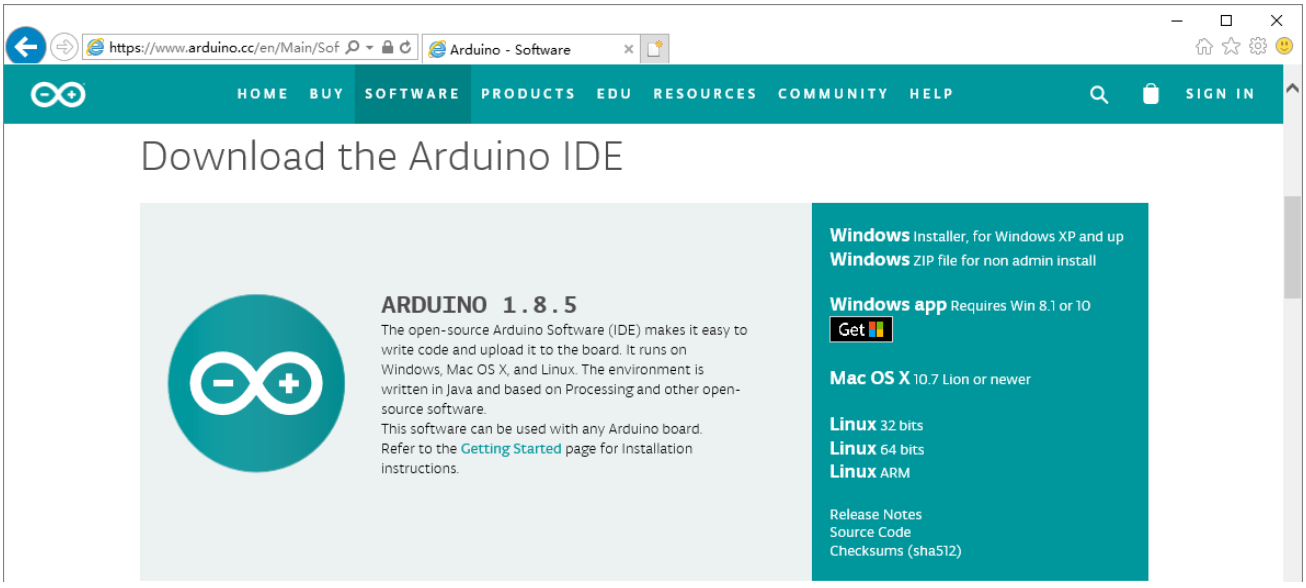
Arduino Software

The Arduino Software (IDE) allows you to write code in the Arduino programming language and upload them to your board.

Please visit https://www.arduino.cc, then click "SOFTWARE" – "DOWNLOADS" to enter the downloads page.

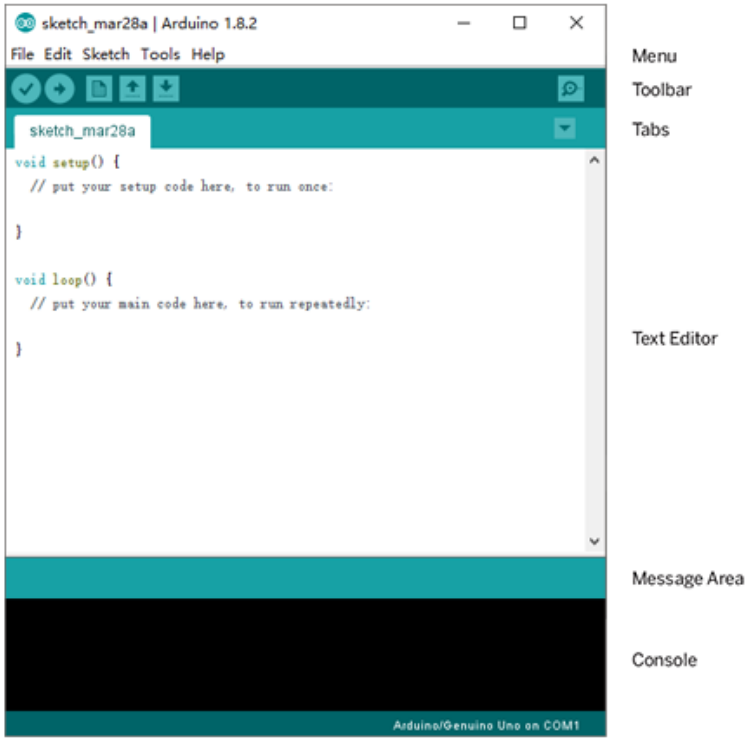


Find "Download the Arduino IDE". Microsoft Windows users please click the "Windows Installer".



After the download is complete, run the installer and complete the installation.

Open the Arduino Software, the interface of Arduino Software is as follows:



Programs written using Arduino Software (IDE) are called **sketches**. These sketches are written in the text editor and are saved with the file extension **.ino**. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

Verify
Checks your code for errors compiling it.

Upload
Compiles your code and uploads it to the configured board.

New
Creates a new sketch.

Open
Presents a menu of all the sketches in your sketchbook. Clicking one will open it within the current window overwriting its content.

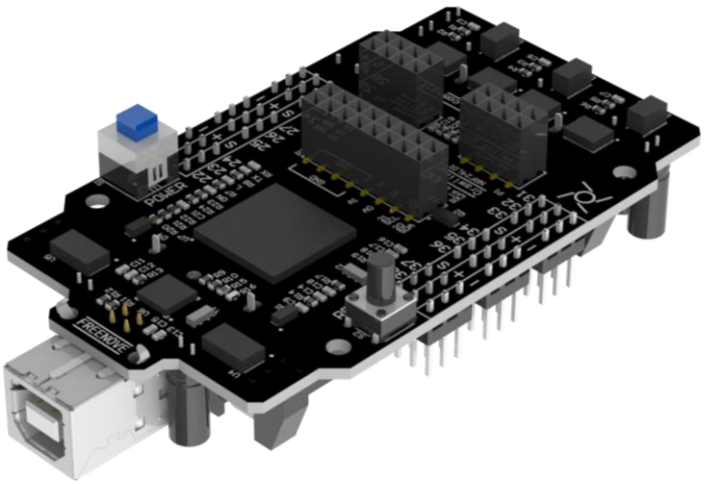
Save
Saves your sketch.

Serial Monitor
Opens the serial monitor.

Additional commands are found within the five menus: File, Edit, Sketch, Tools, Help. The menus are context sensitive, which means only those items relevant to the work currently being carried out are available.

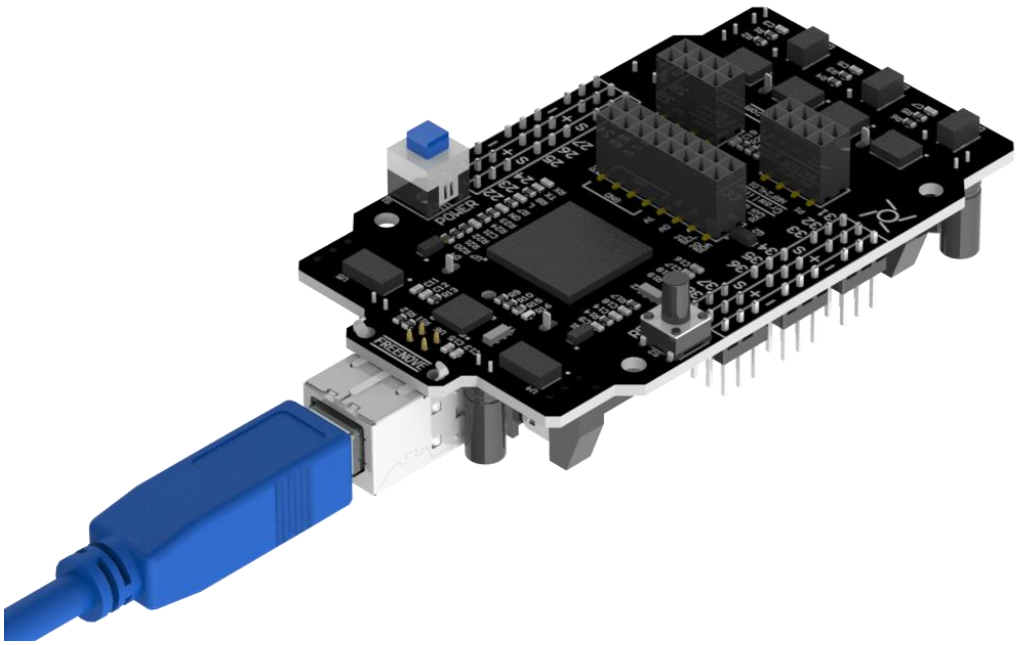
Freenove Crawling Robot Controller

Freenove Crawling Robot Controller is used to control this robot. It is based on Arduino Mega 2560. We changed the circuit, so that it can drive 18 servos and install ESP8266 Wi-Fi module and NRF24L01 wireless module. It also has some IO ports and power ports for your use.

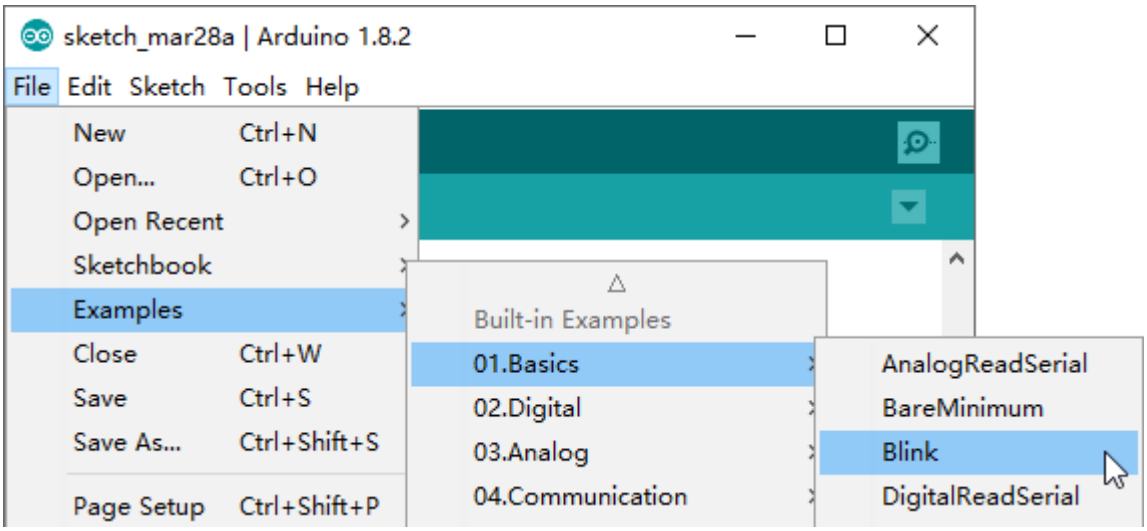


First Use

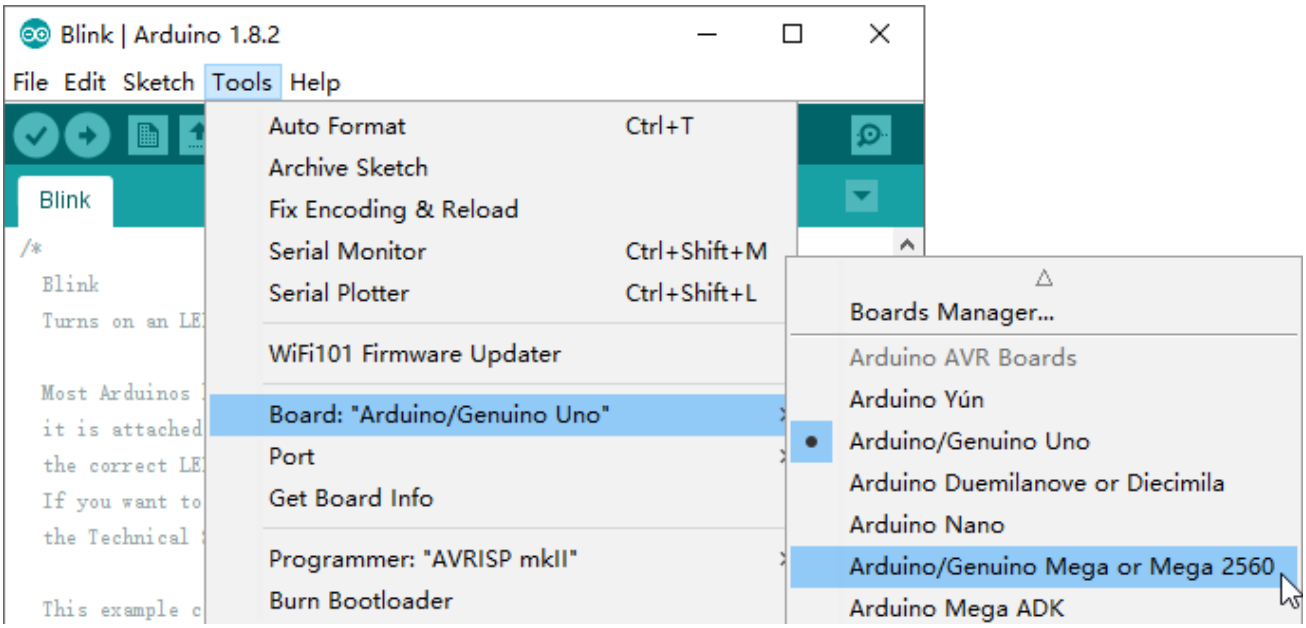
Connect Freenove Crawling Robot Controller to computer with USB cable.



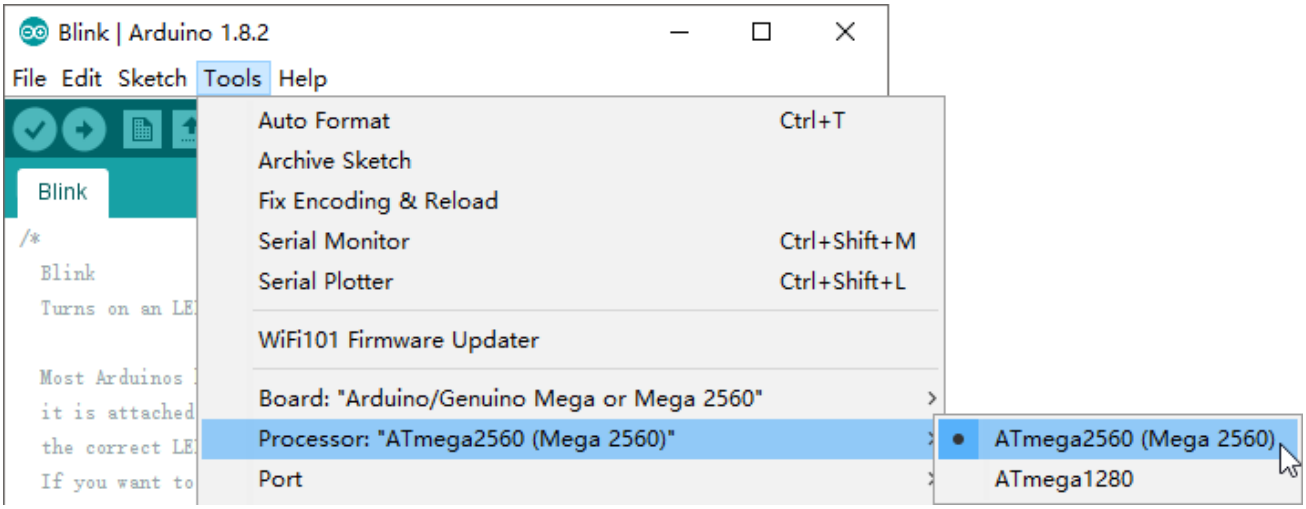
Open the exmple sketch "Blink".



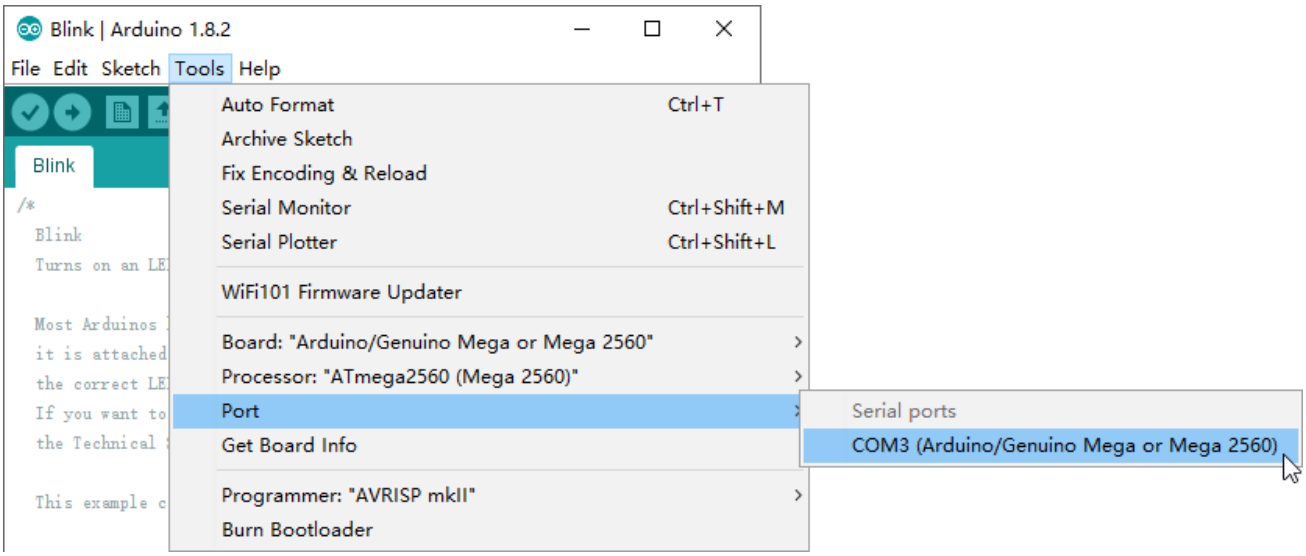
Select "Board" > "Arduino/Genuino Mega or Mega 2560".



Select "Processor" > "ATmega2560 (Mega 2560)".



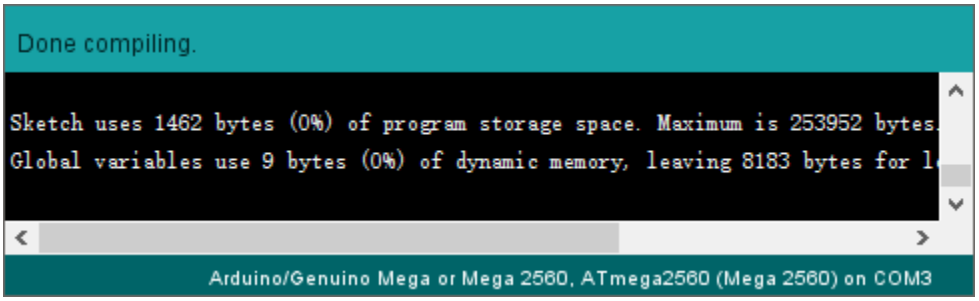
Select "Port". Your port may be different from the following figure. If the board is not detected, please wait for a while, then click "Tools" to check again.



Click "Verify" button.

Figure below shows code are compiling.

Wait a moment for the compiling to be completed. Figure below shows the code size and percentage of space occupation.



Usually, when we write code, if it has a syntax error, the interface will prompt the error message. Then the compiling can't be completed.

Click "Upload" button.

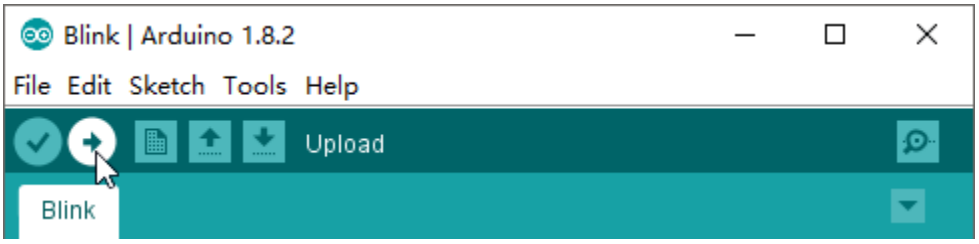
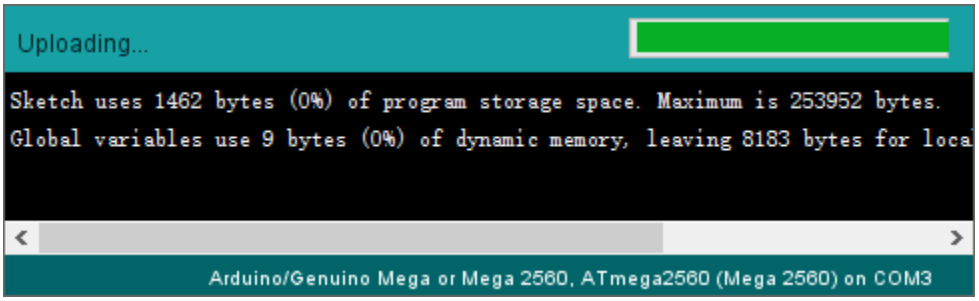
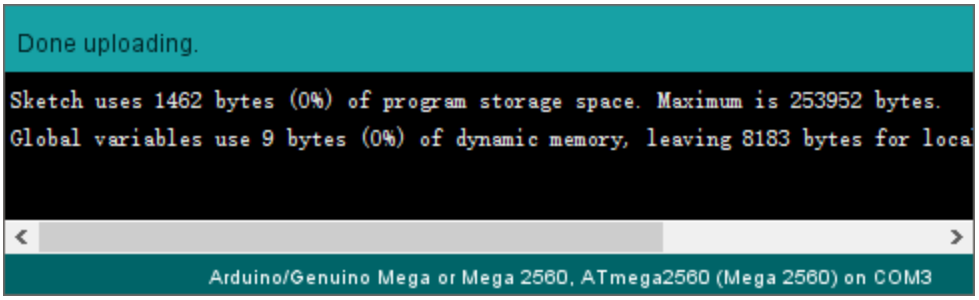


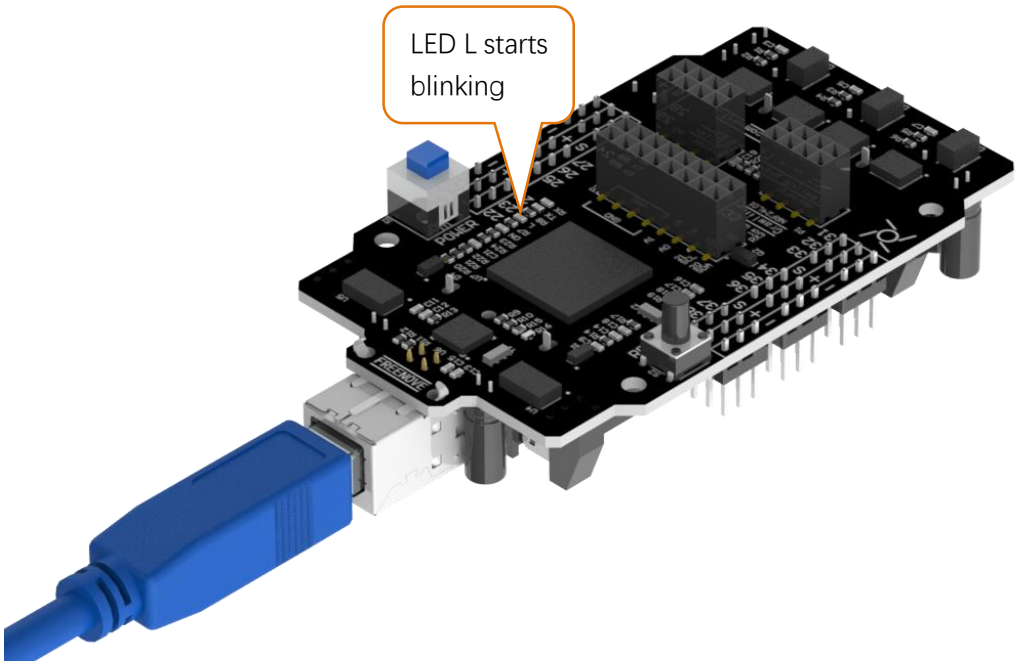
Figure below shows code are uploading.



Wait a moment for the uploading to be completed.



After that, we will see the LED marked with "L" on Freenove Crawling Robot Controller starts blinking.



So far, we have completed the first use. I believe you have felt the joy of Arduino.

Processing

Processing is a flexible software sketchbook and a language for learning how to code within the context of the visual arts.

The Processing software is free and open source, and runs on the Mac, Windows, and GNU/Linux platforms, which is the same as Arduino software. In fact, Arduino software is based on Processing software. At present, they still have similar interface.

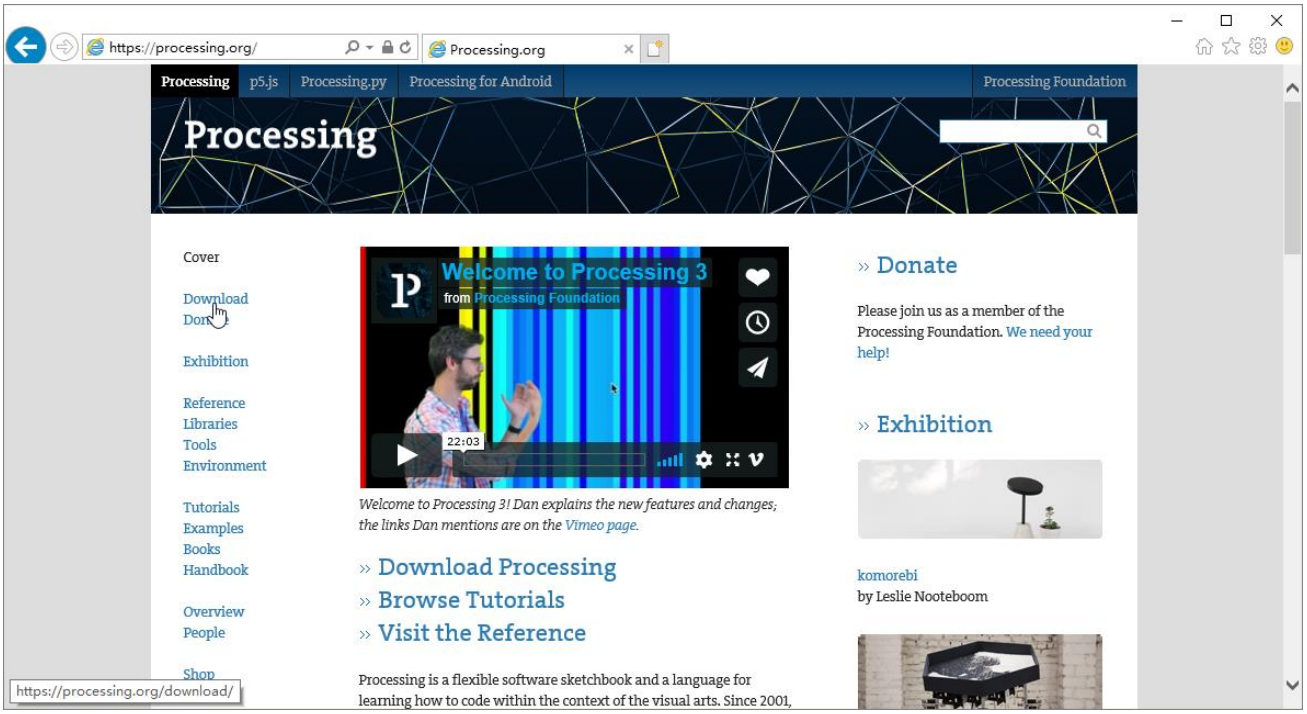
Processing Programming Language

The Processing programming language is based on Java in default.
Please visit https://processing.org/, click "Reference" for details.

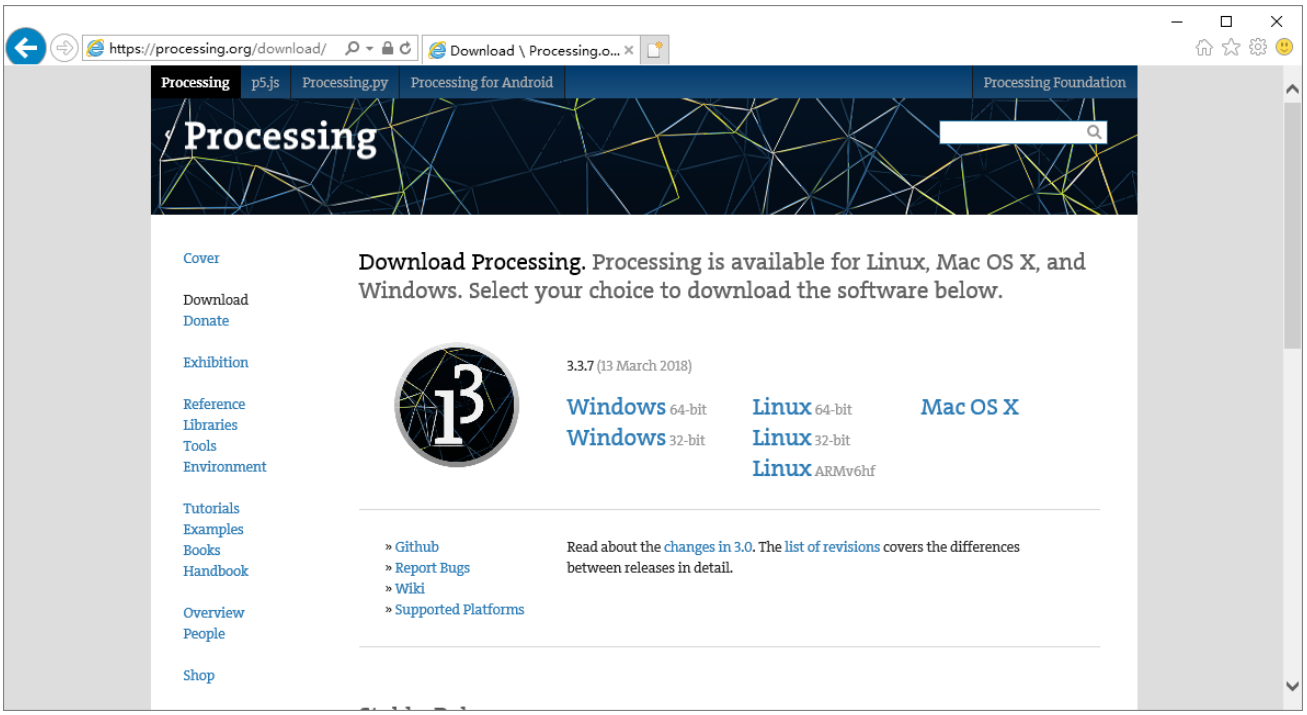
Processing Software

Processing software / Processing Development Environment (PDE) makes it easy to write Processing programs.

Please visit https://processing.org/, click "Download" to enter the download page.



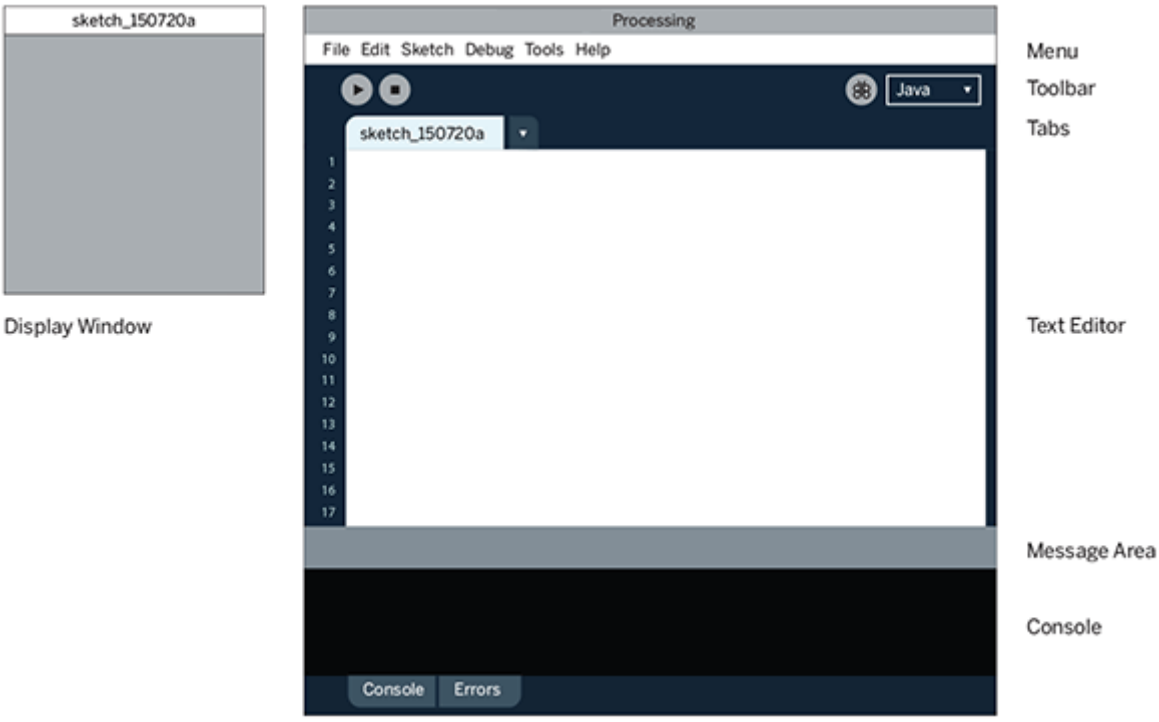
Download Processing for your computer.



Installation on each machine is straightforward:

- On Windows, you'll have a .zip file. Double-click it, and drag the folder inside to a location on your hard disk. It could be Program Files or simply the desktop, but the important thing is for the processing folder to be pulled out of that .zip file. Then double-click processing.exe to start.
- The Mac OS X version is also a .zip file. Double-click it and drag the Processing icon to the Applications folder. If you're using someone else's machine and can't modify the Applications folder, just drag the application to the desktop. Then double-click the Processing icon to start.
- The Linux version is a .tar.gz file, which should be familiar to most Linux users. Download the file to your home directory, then open a terminal window, and type:
  tar xvfz processing-xxxx.tgz
  (Replace xxxx with the rest of the file's name, which is the version number.) This will create a folder named processing-2.0 or something similar. Then change to that directory:
  cd processing-xxxx
  and run it:
  ./processing

With any luck, the main Processing window will now be visible. Everyone's setup is different, so if the program didn't start, or you're otherwise stuck, visit the troubleshooting page for possible solutions.



Programs written using Processing Software (PDE) are called **sketches**. These sketches are written in the text editor and are saved with the file extension **.pde**. It has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by Processing sketches including complete error messages and text output from sketches with the print() and println() functions. (Note that the console works well for occasional messages, but is not intended for high-speed, real-time output.)

The buttons on the toolbar can run and stop programs:

Run
Runs the sketch. In Java mode, it compiles the code and opens a new display window.

Stop
Terminates a running sketch.

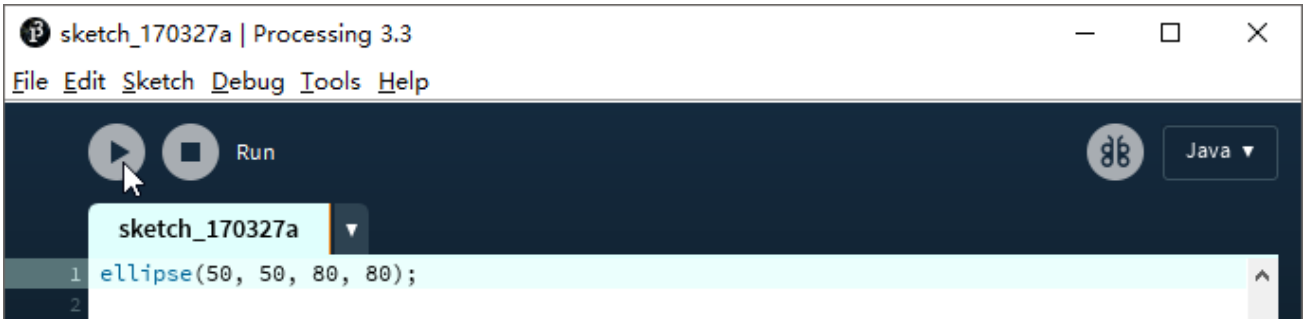
Additional commands are found within the six menus: File, Edit, Sketch, Debug, Tools, Help. The menus are context sensitive which means only those items relevant to the work currently being carried out are available.

First Use

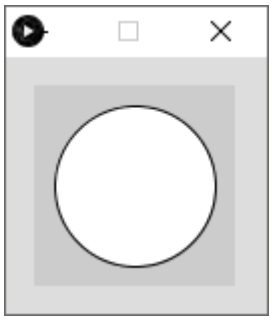
In the editor, type the following:

```
1  ellipse(50, 50, 80, 80);
```

This line of code means "draw an ellipse, with the center 50 pixels over from the left and 50 pixels down from the top, with a width and height of 80 pixels." Click the Run button (the triangle button in the Toolbar).

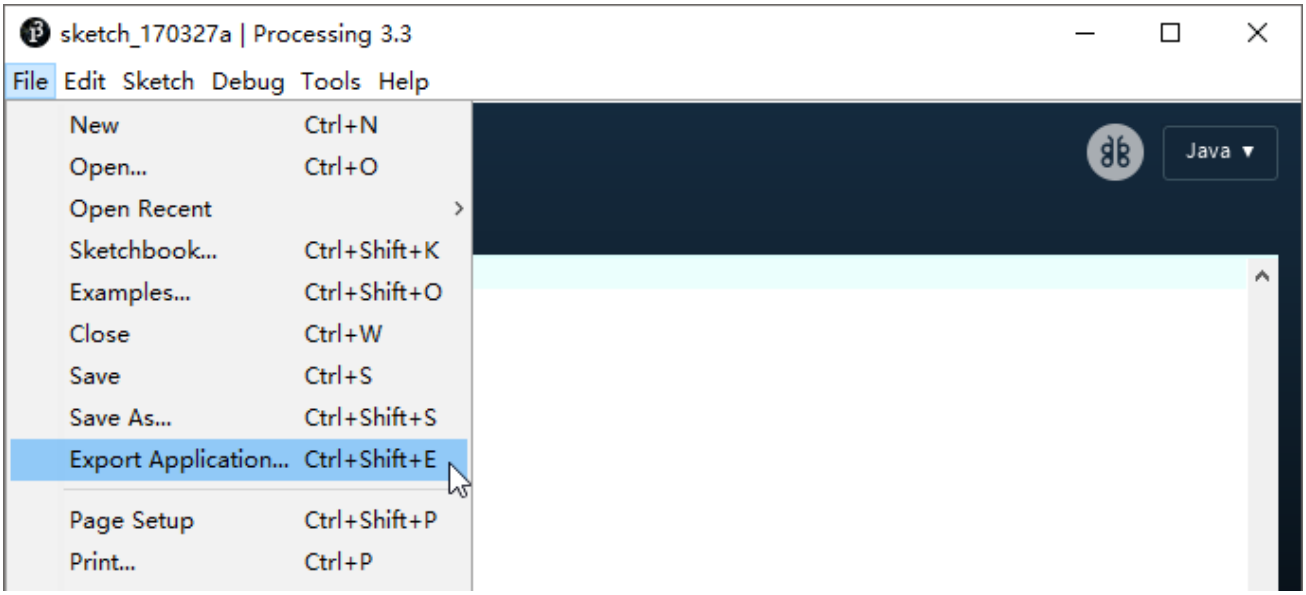


If you've typed everything correctly, you'll see a circle on your screen.



If you didn't type it correctly, the Message Area will turn red and complain about an error. If this happens, make sure that you've copied the example code exactly: the numbers should be contained within parentheses and have commas between each of them, and the line should end with a semicolon.

You can export Processing sketch to an application to run it directly without opening the Processing.
To export the sketch to the application, you must save it first.



So far, we have completed the first use. I believe you have felt the joy of Processing.

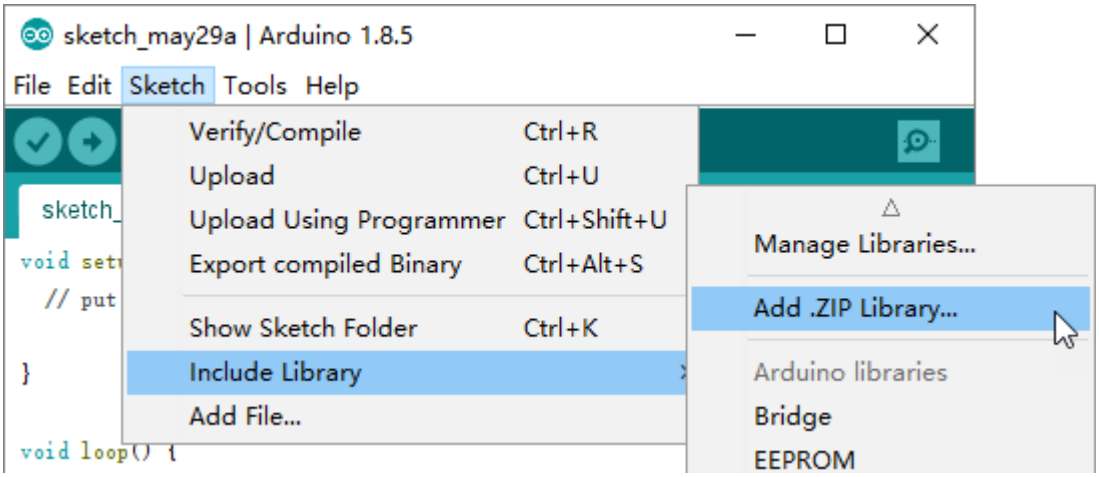
Default Sketches

We have written code for this robot and it must be uploaded to the control board before assembling.

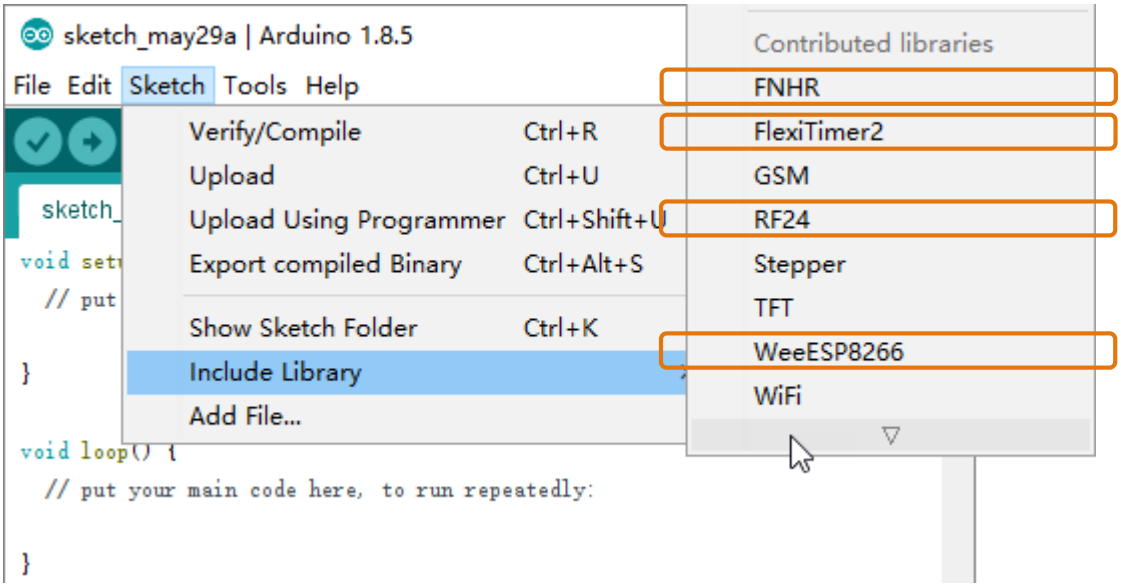
Arduino Sketch

Libraries are a collection of code that makes it easy for programming.
The "FNHR" (Freenove Hexapod Robot) library is used to control this robot, we need to add it and other needed libraries to Arduino software.

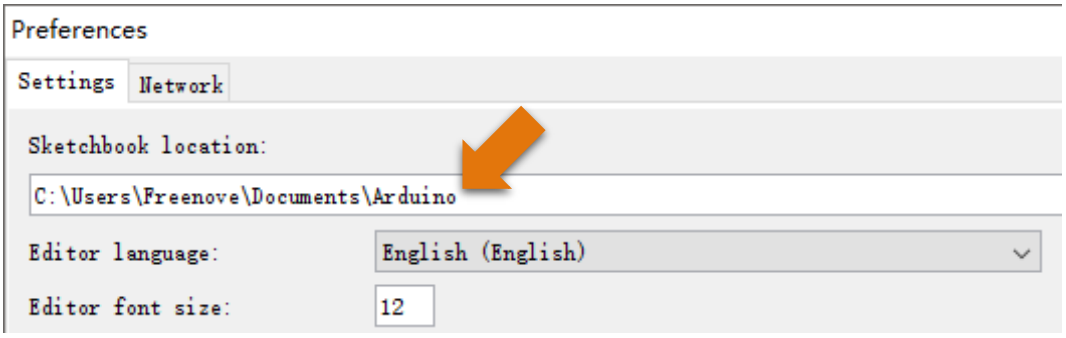
Click "Add .ZIP Library..." to add library. You need to add all files under “Arduino\Libraries” folder.



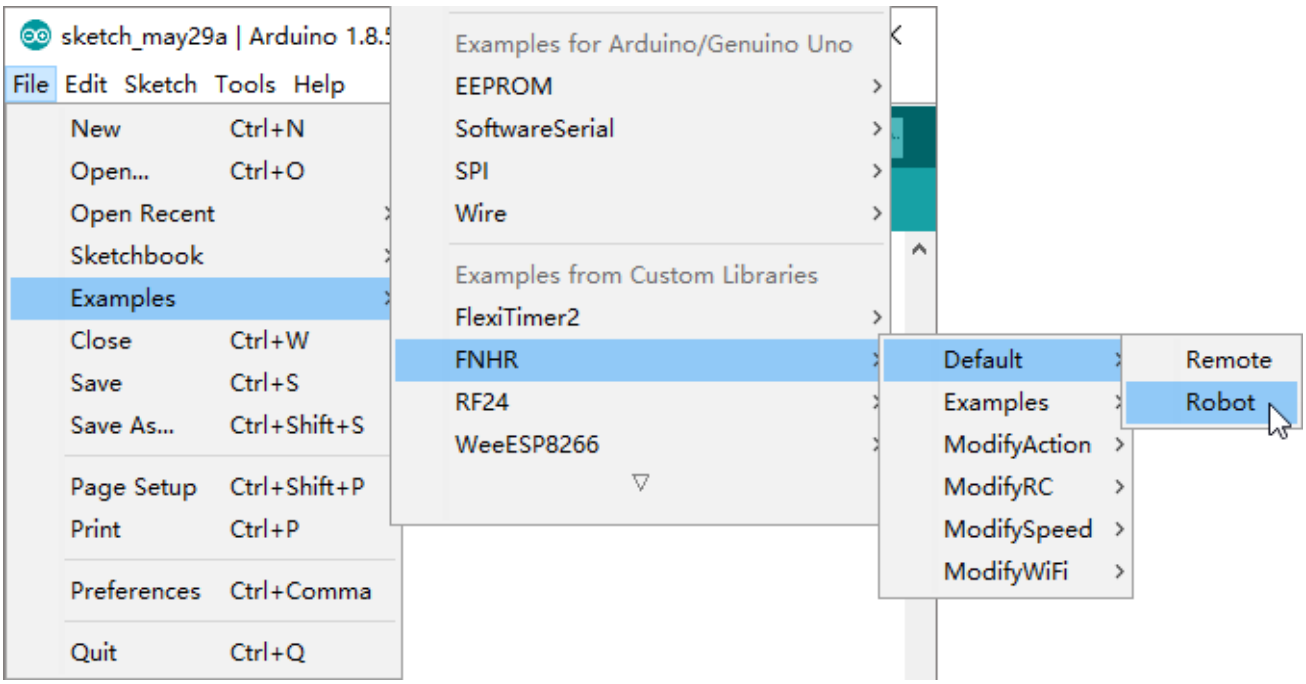
You can find the added libraries in "Sketch" > "Include Library", make sure that all the following libraries are added.



You can find the library files in the "libraries" folder under "Sketchbook location" in the "File">"Preferences" window. You can view the source code to understand their specific usage.



Now open "File" > "Examples" > "FNHR" > "Default" > "Robot".

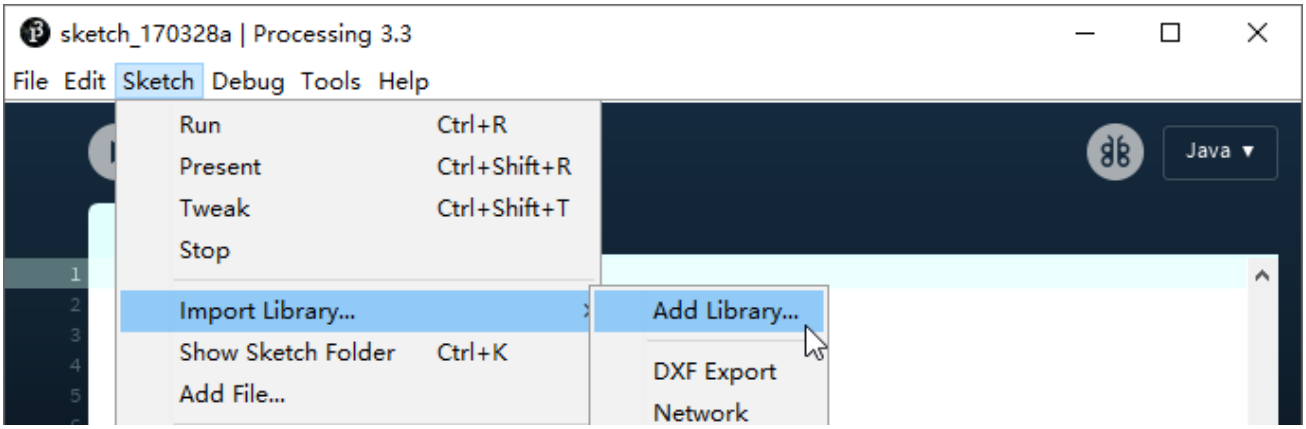


Then upload it to Freenove Crawling Robot Controller.

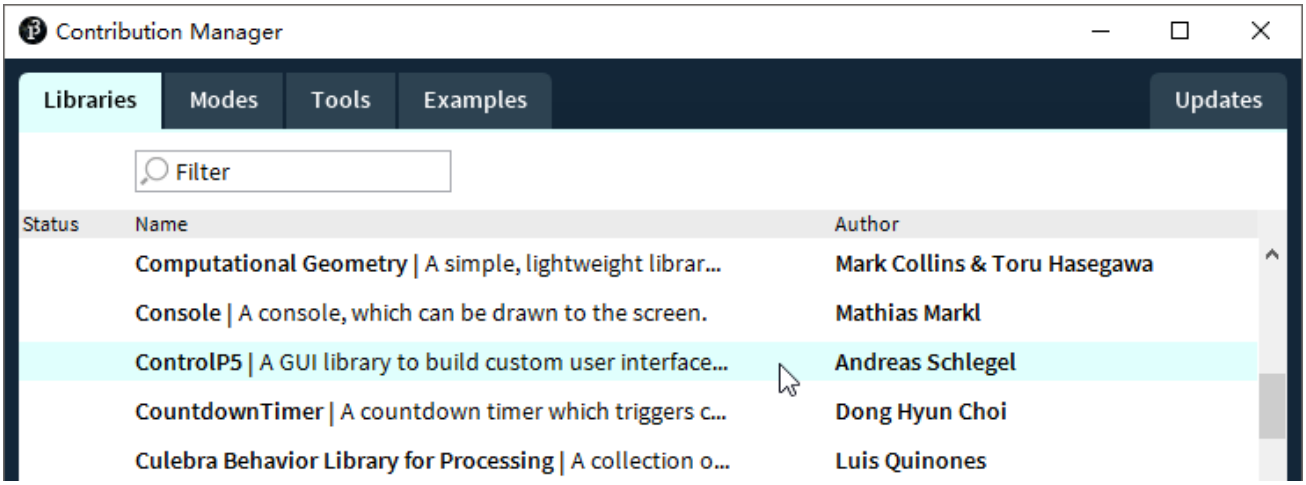
Processing Sketch

We also need to add library to Processing software.

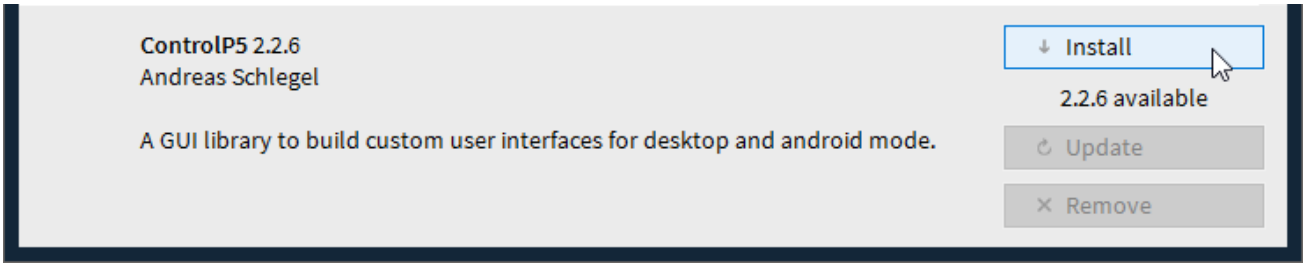
We can add library online. Click "Add Library... " to open "Contribution Manager".



Find "ControlP5" in the "Libraries" tab, and click to select it.



Then click “Install”.

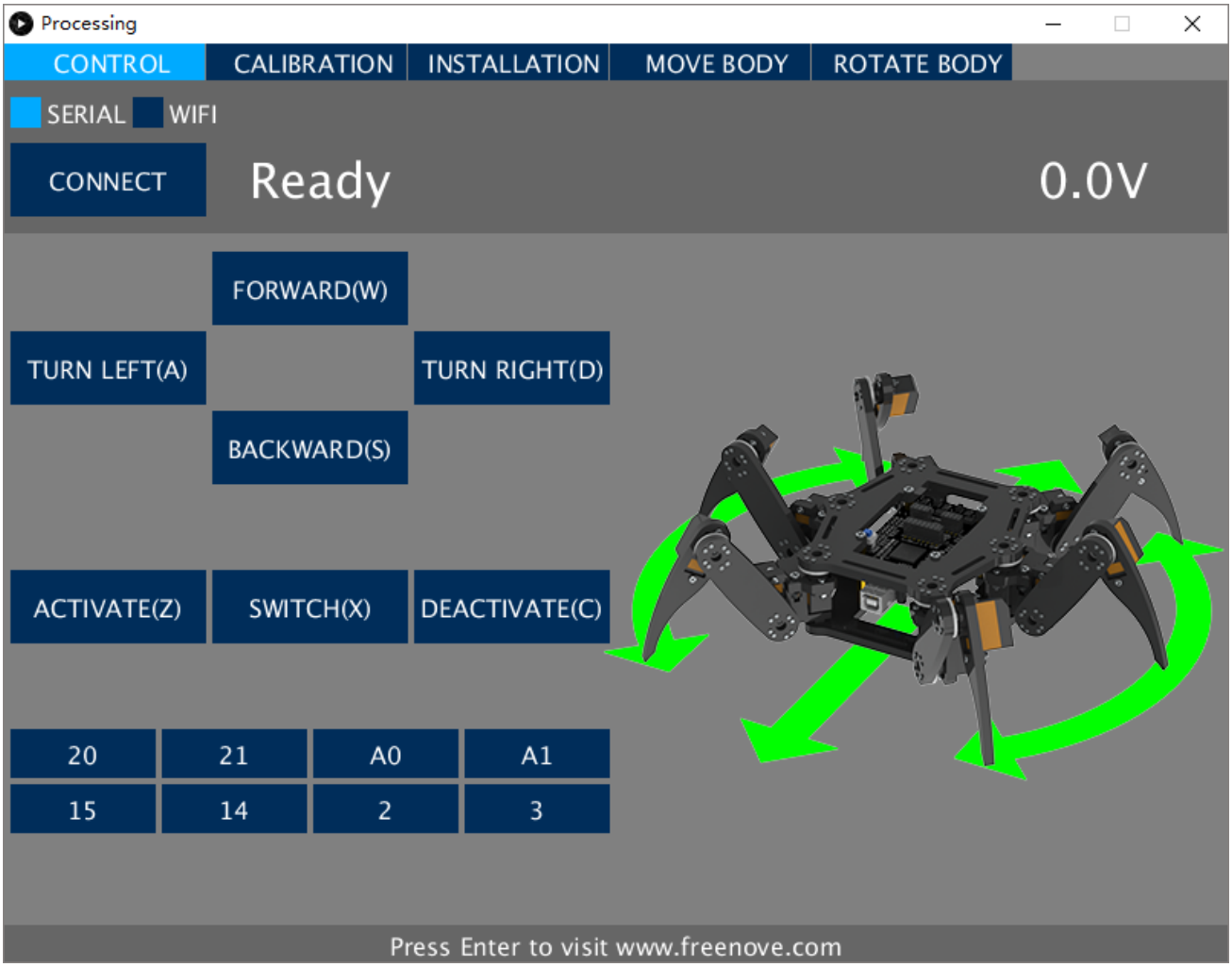


After the installation succeeds, close “Contribution Manager” window.

We can also install library offline. Unzip “Processing\Libraries\controlP5.zip” to "libraries" folder under "Sketchbook location" in the "File">"Preferences" window. You will need to create the "libraries" folder if this is your first contributed library. After that, restart Processing software.

After library files are installed, open "Processing\Sketches\Processing\Processing.pde" with Processing software.

Click “Run”, then the following window appears. We will call it "Processing Application" in later chapter.



Processing Application can be used to control the robot.

Now let us try it. Connect the Freenove Crawling Robot Controller to computer.

Select "SERIAL" in Processing Application, then click "CONNECT".

Wait for processing. It may take a few seconds.

When the "CONNECT" button changs to "DISCONNECT", the connection is successful.

Click this button again to disconnect.

Assembly

Now let us assemble the robot.

Please assemble and use the robot on smooth and insulated surface such as desktop, otherwise the robot may be damaged.

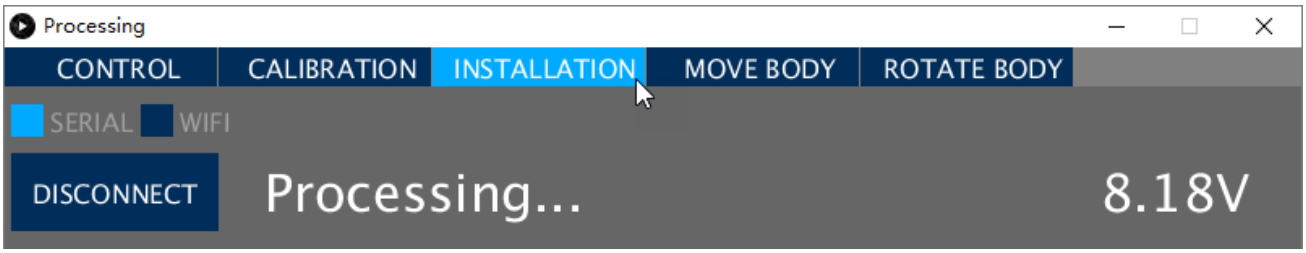
Step 01

First set control board to installation mode.

Load two 14500 batteries for the control board. Connect it to computer and turn on the power. Then open Processing Application and click “CONNECT” button.

After the connection succeeds, click "INSTALLATION" on the top.

Wait for processing.



After the processing, click “DISCONNECT”to disconnect.

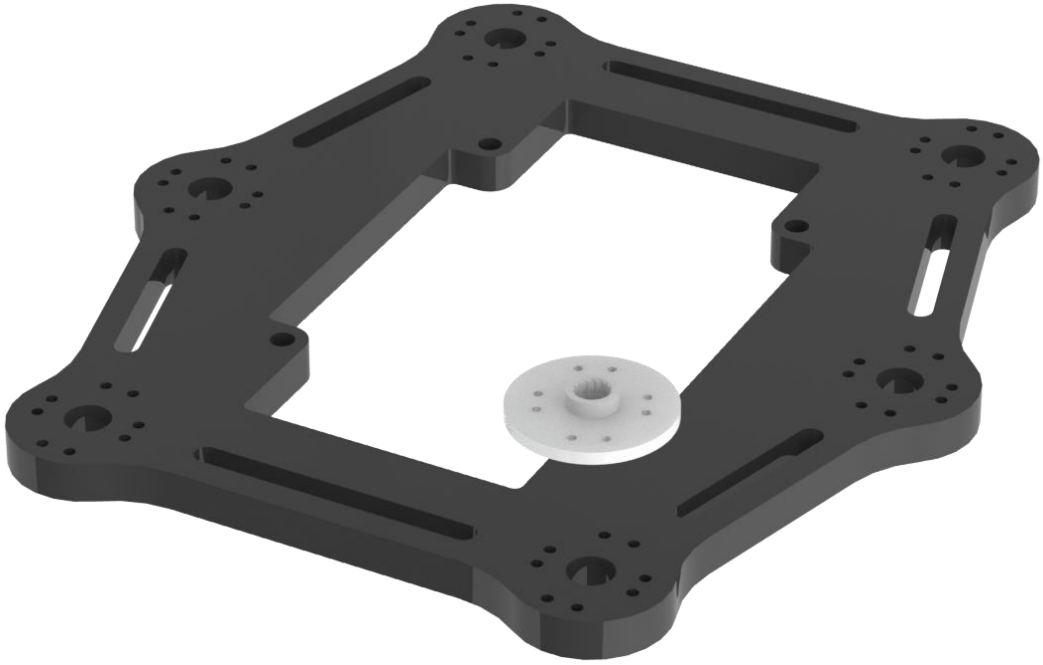
The control board may restart when disconnected. Then you should see that the "L" LED on the control board flashes three times every short time, indicating that it is under installation mode.

Turn off the power and disconnect the USB cable. Then remove the batteries.

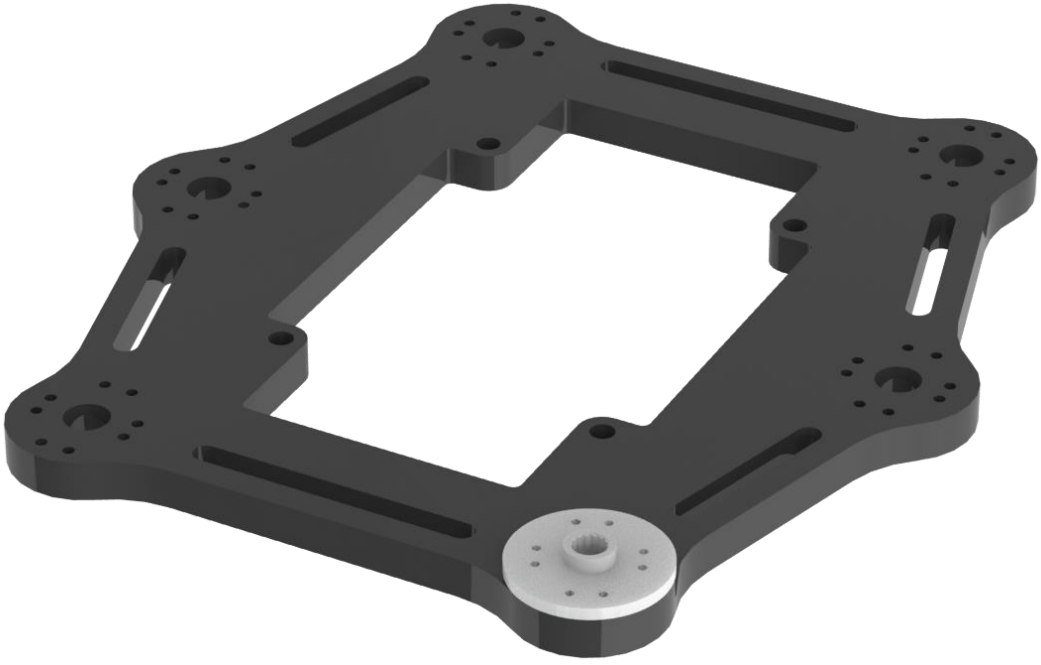
Make sure this step has been executed correctly before the start of the next step.

Step 02

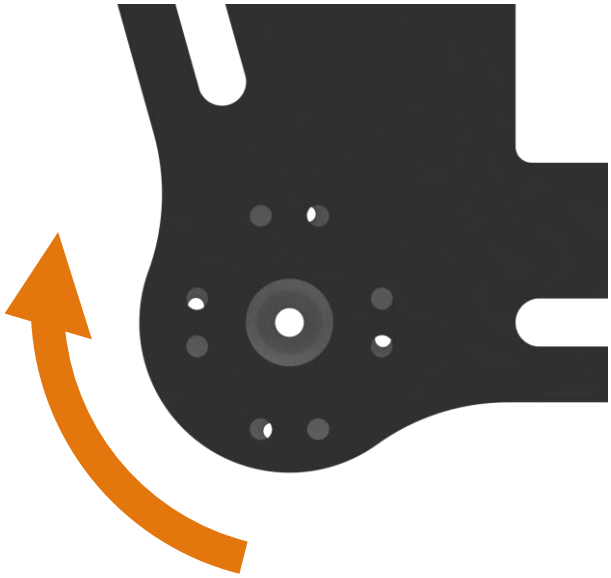
Place disc servo arm on acrylic plate.
(Disk servo arm and servo are packed together.)



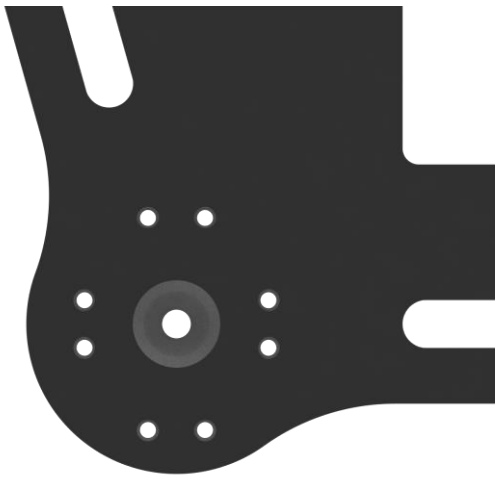
Right location is as below.



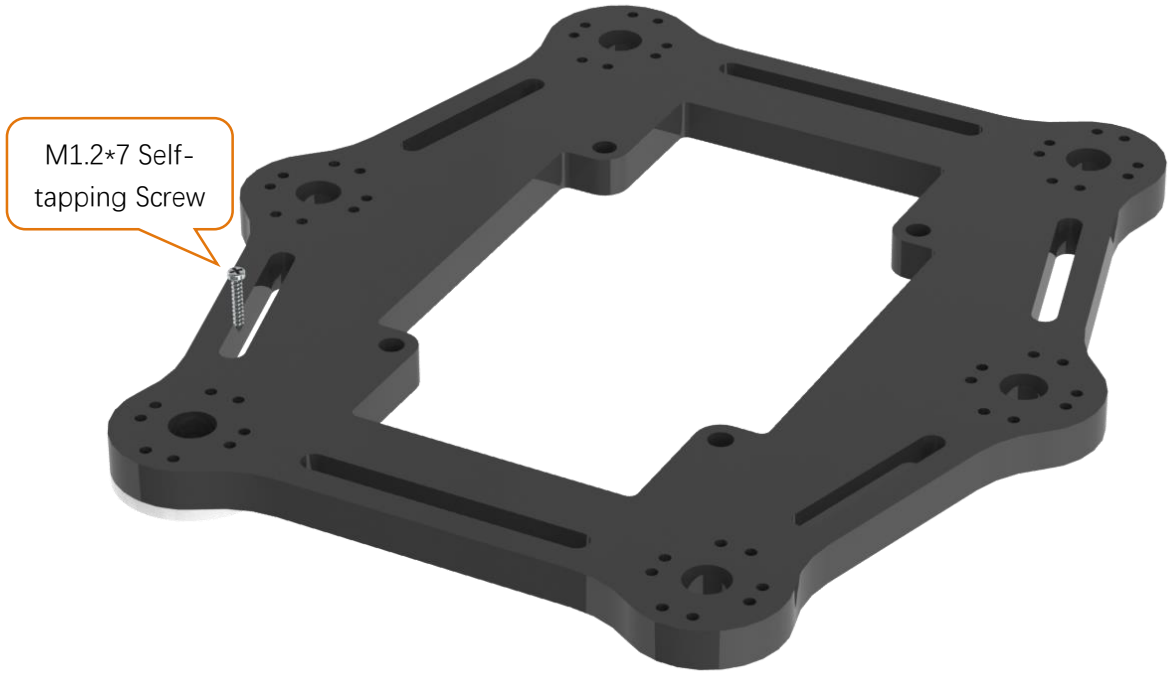
Rotate disc servo arm so that its holes can aligned with the holes in the acrylic plate.



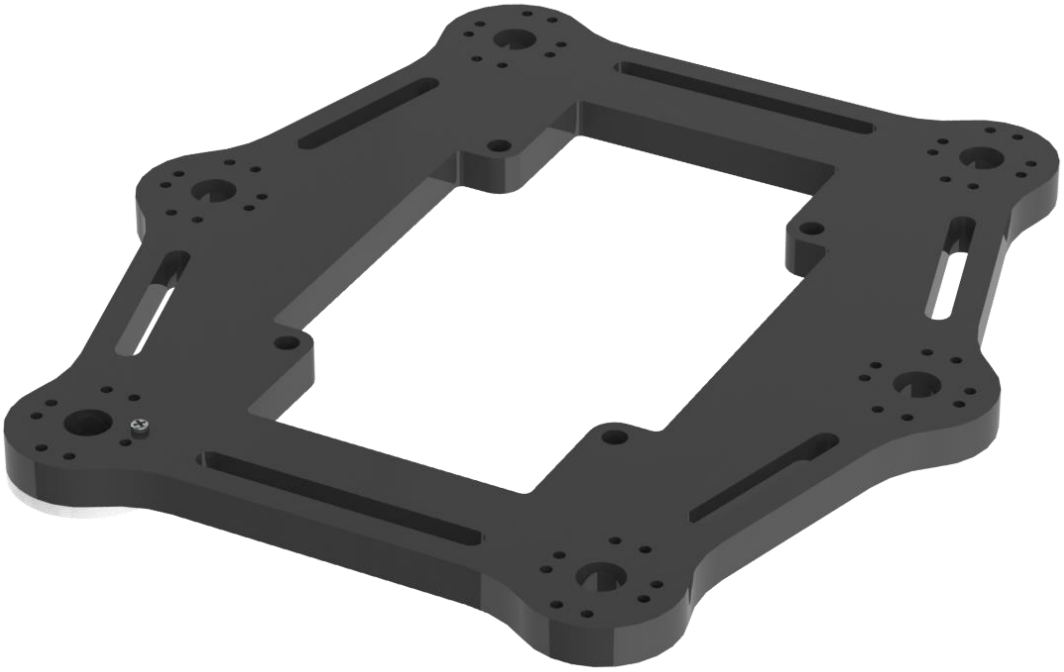
When all holes align:



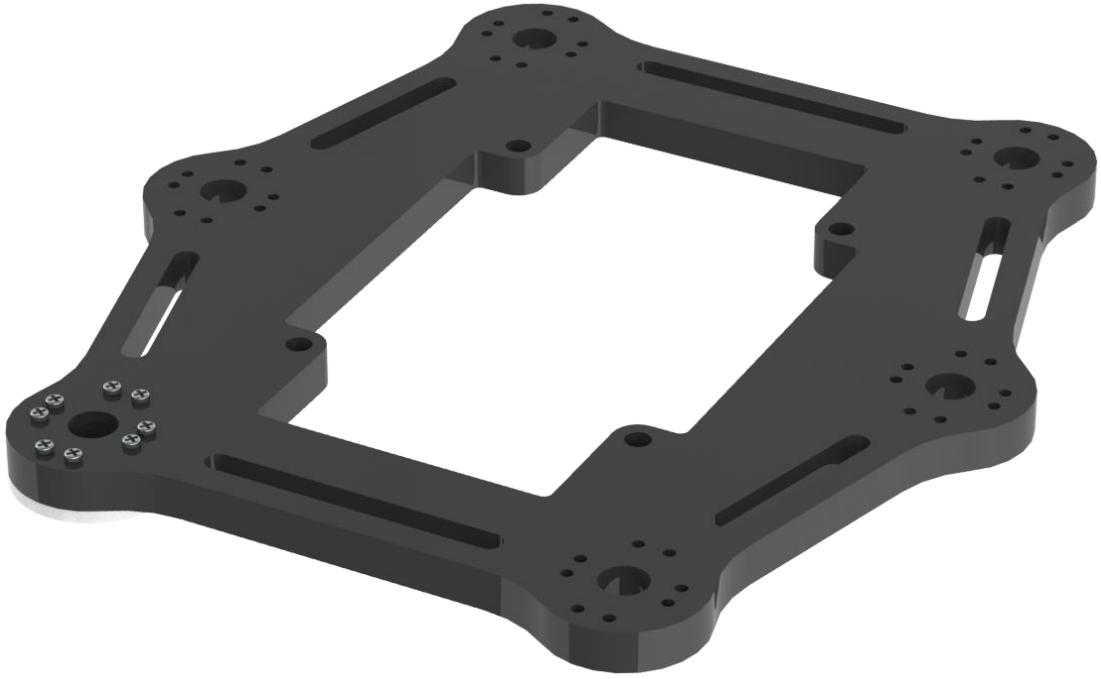
Use the screw to fix disc servo arm to acrylic plate.



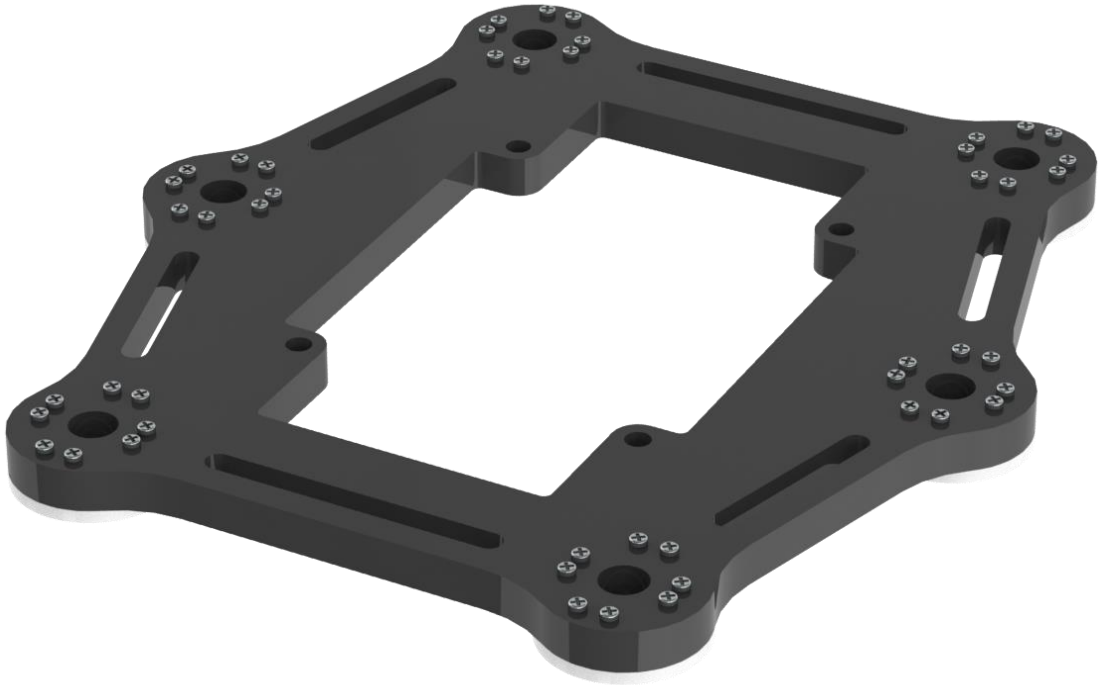
Tighten the screws as below.



Use the same screws to fix other holes of disc servo arm.

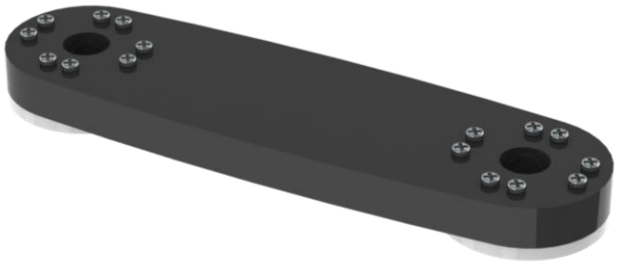


Use the same screws to fix 5 other disc servo arms to acrylic plate.



Step 03

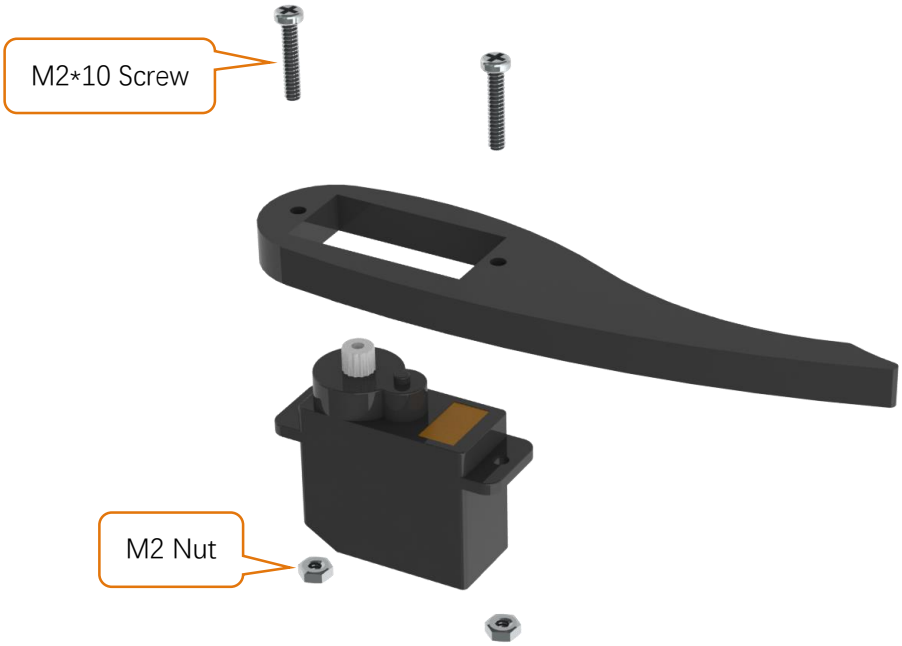
Use the same screws to fix 2 disc servo arms to following acrylic plate.



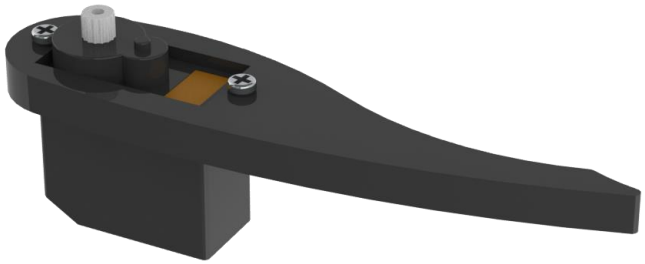
Assemble 5 other acrylic plates as below.

Step 04

Use screws and nuts to fix servo to following acrylic plate.



Fix them as below. Note the position of the servo shaft.

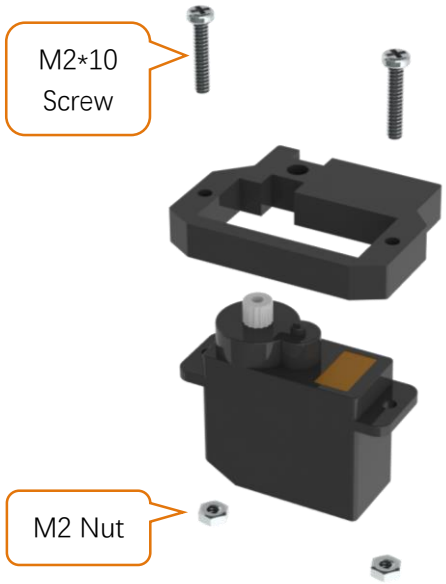


Assemble 5 other acrylic plates.

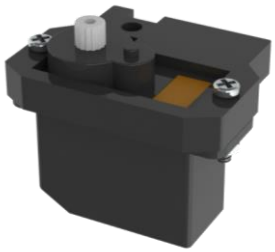
Note the direction of acrylic plates. Three of them are opposite to the other three.

Step 05

Use screws and nuts to fix servo to following acrylic plate.

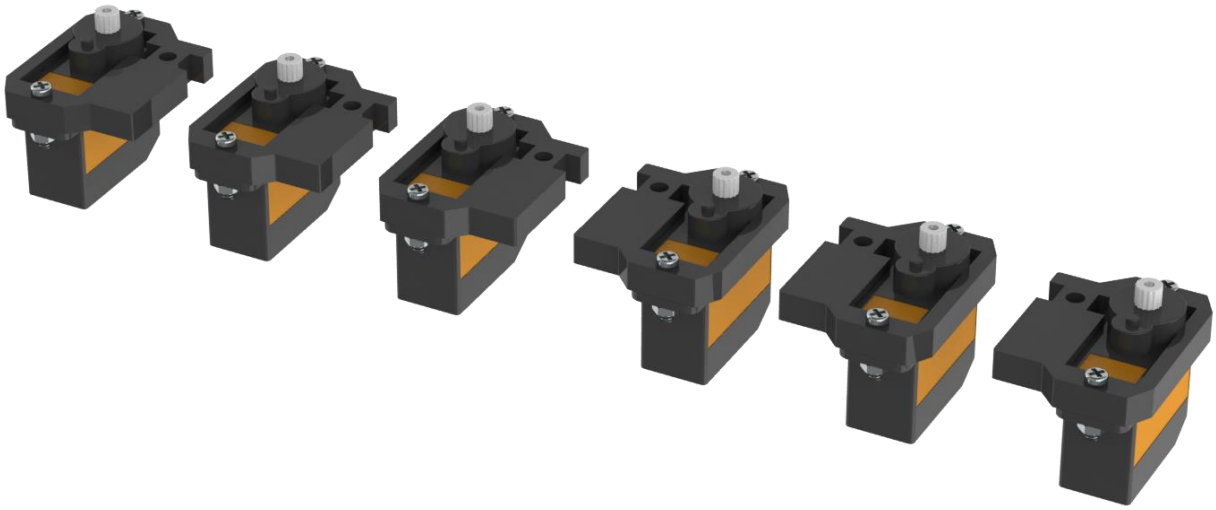


Fix them as below. Note the position of the servo shaft.



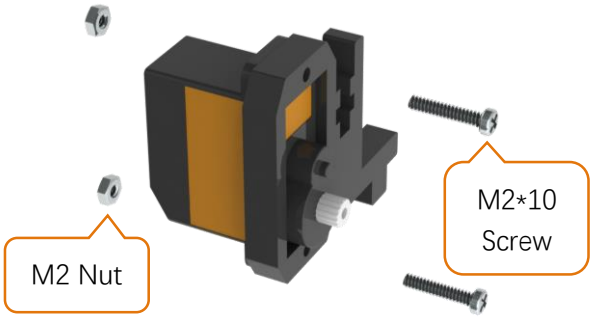
Assemble 5 other acrylic plates.

Note the direction of acrylic plates. Three of them are opposite to the other three.

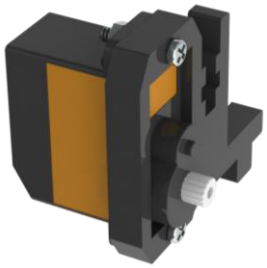


Step 06

Use screws and nuts to fix servo to following acrylic plate.



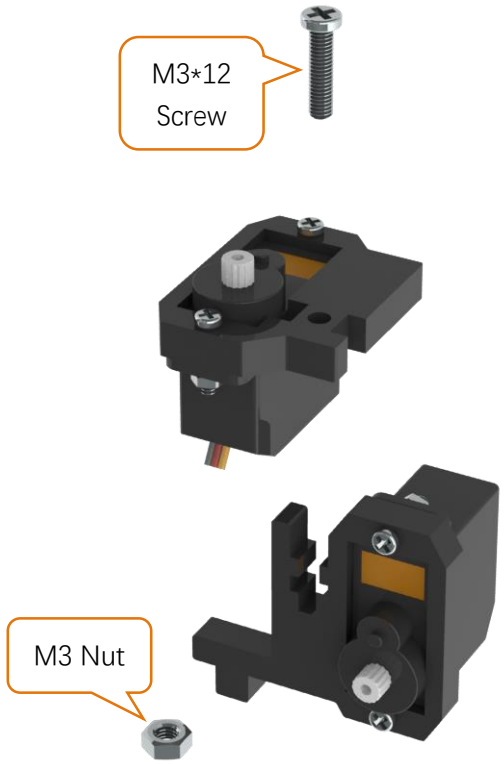
Fix them as below. Note the position of the servo shaft.



Assemble 5 other acrylic plates.

Note the direction of acrylic plates. Three of them are opposite to the other three.

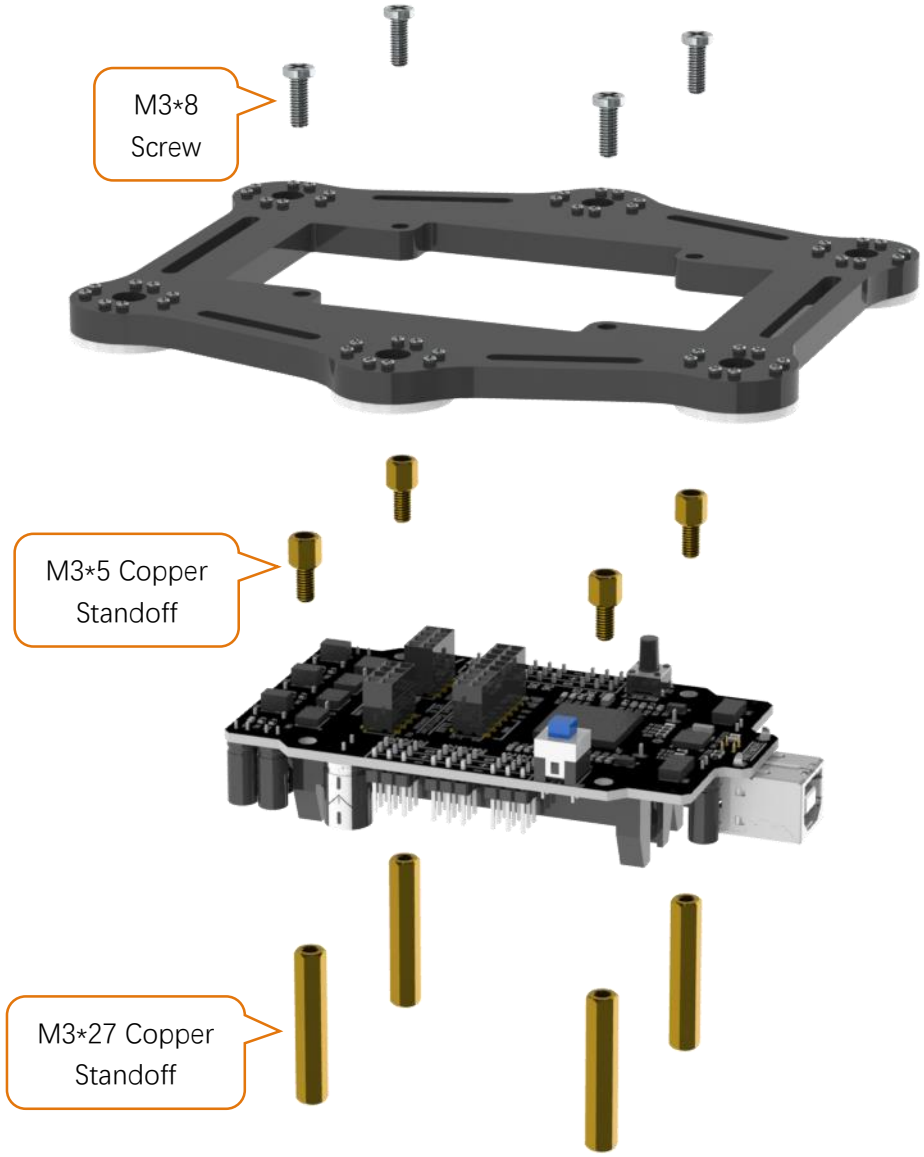
Step 07

Use screws and nuts to fix two parts assembled before. 	Fix them as below. Three set of them need to be assembled. 
Use screws and nuts to fix two parts assembled before. 	Fix them as below. Three set of them need to be assembled. 

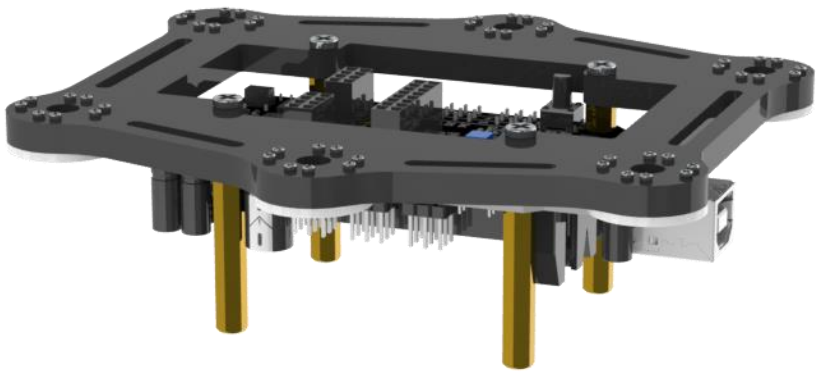
After the assembly is completed, 6 following components are obtained.
Note that three of them are different from the other three.

Step 08

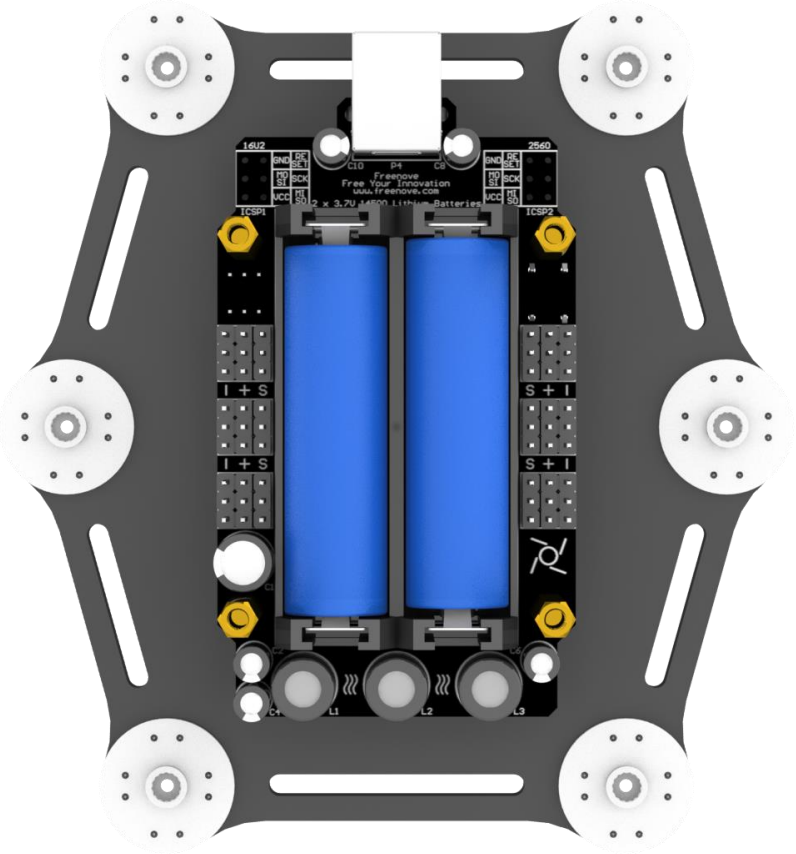
Use screws and copper standoffs to fix control board to following part assembled before.



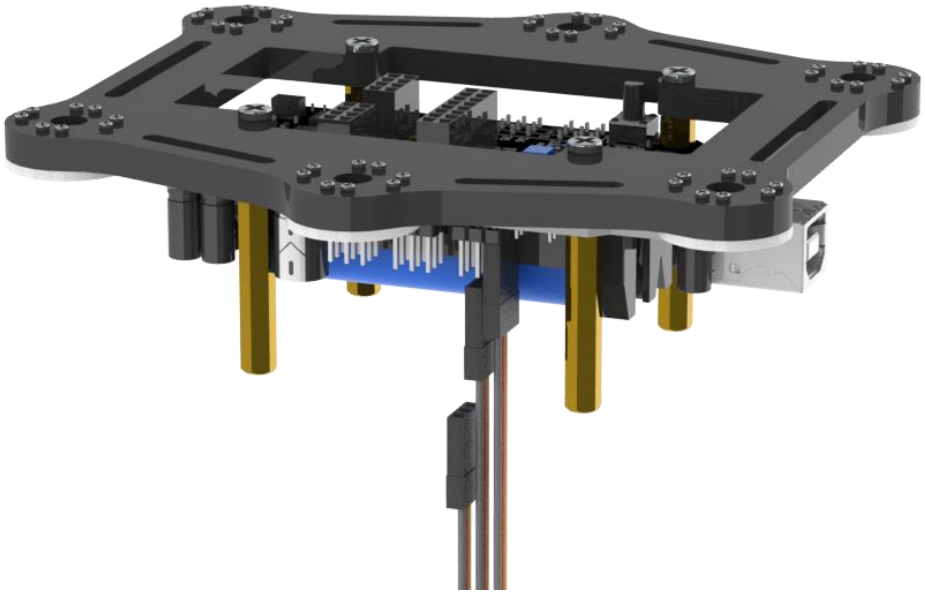
Fix them as below.



Load two 14500 batteries for the control board.



Make sure the power is turned off, and then connect all servos to control board.
(yellow wire of servo to S, red to +, black to -)
(servos can be connected randomly to ports)

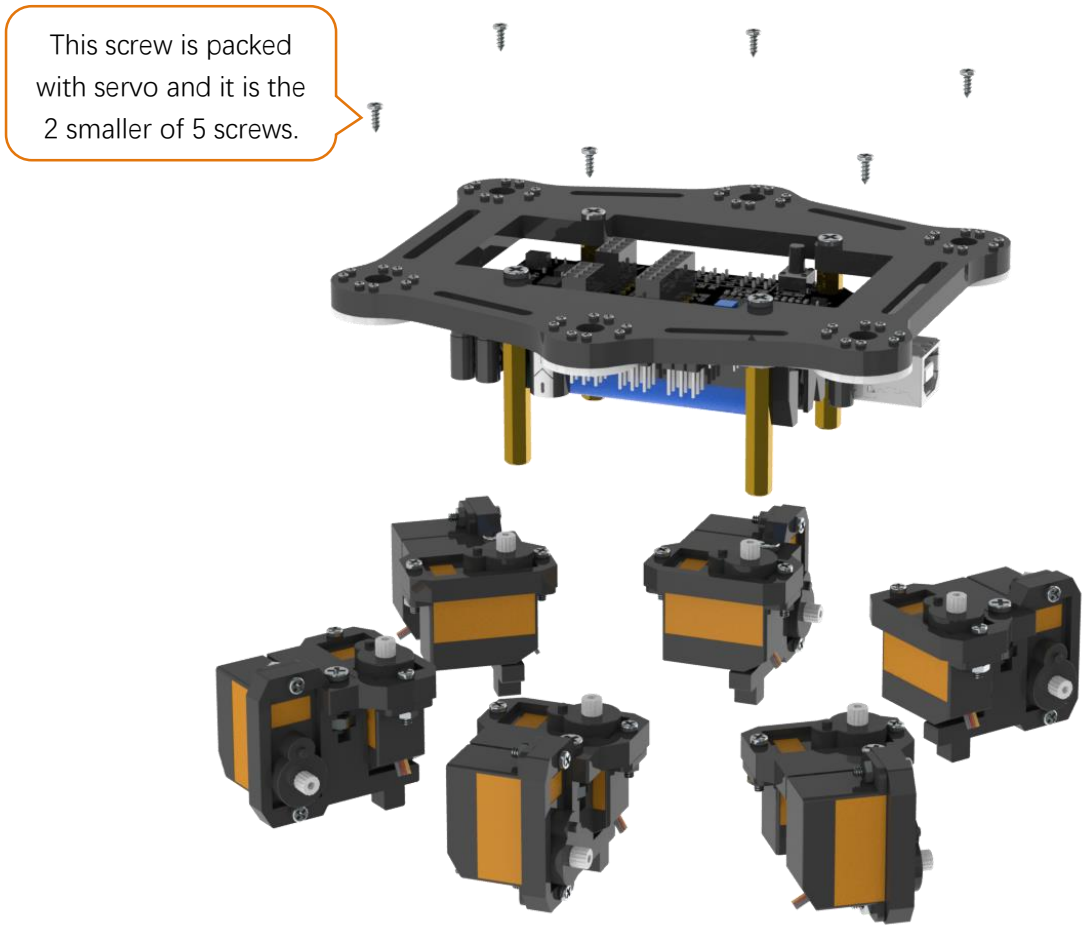


Step 09

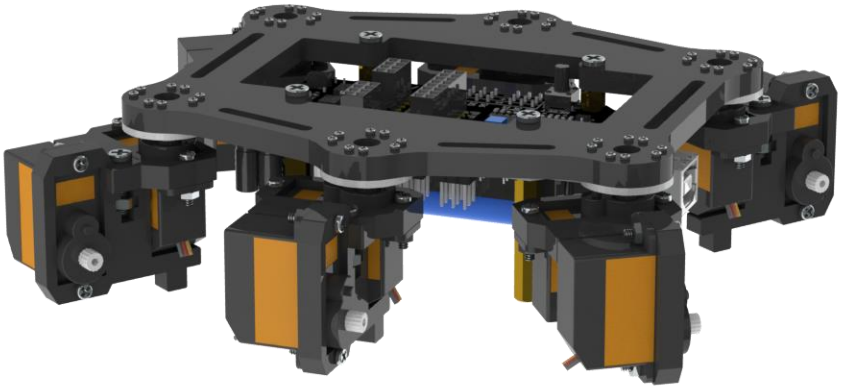
Turn on the power of control board and remain the state, unless requested to close. Start the following steps after the servos stop.

Keep all servos connect to control board, unless requested to disconnect. The wires of servos are not shown in the diagram.

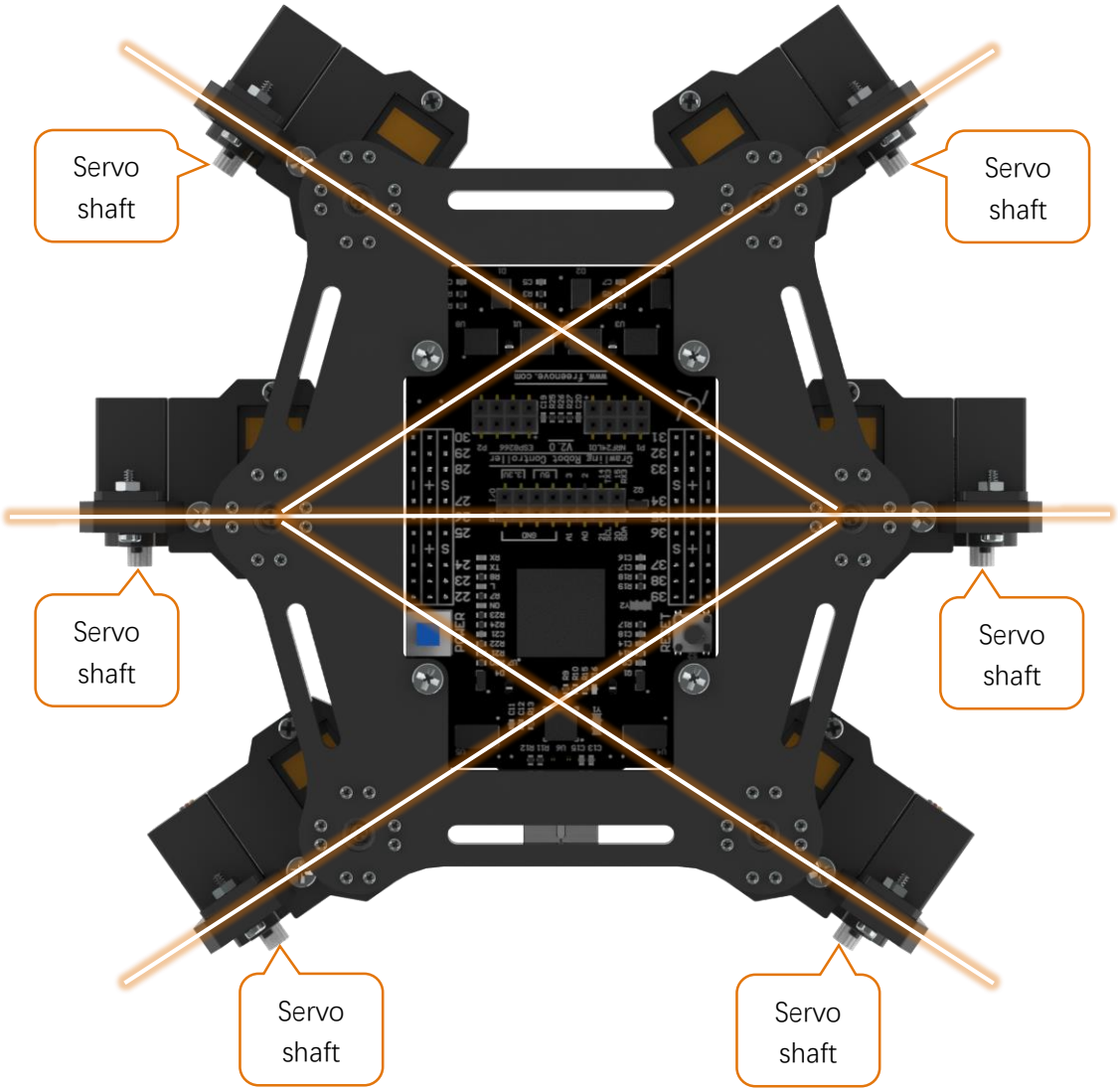
Use screws to fix 6 parts assembled before. Please note the installation angle of 6 parts. (Refer to assembly result later)



Fix them as below.

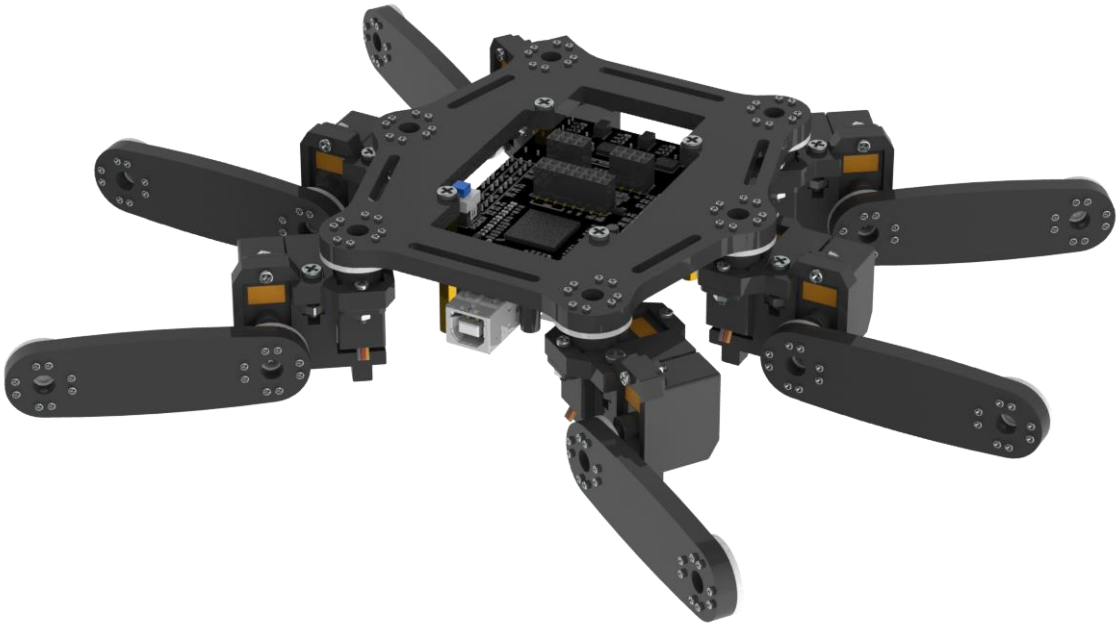


After the installation is completed, the angle of 6 parts should be shown as below. Please try to approach the angle. A small deviation is acceptable. We will correct the deviation in later calibration step.

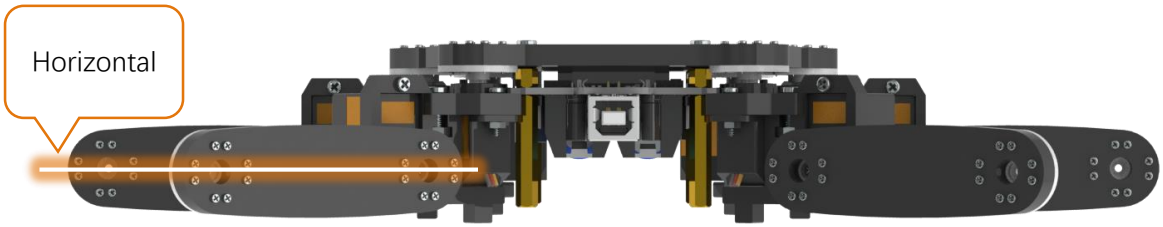


Step 10

Use the same screws to fix 6 parts assembled before. Please note the installation angle of 6 parts. (Refer to assembly result later)



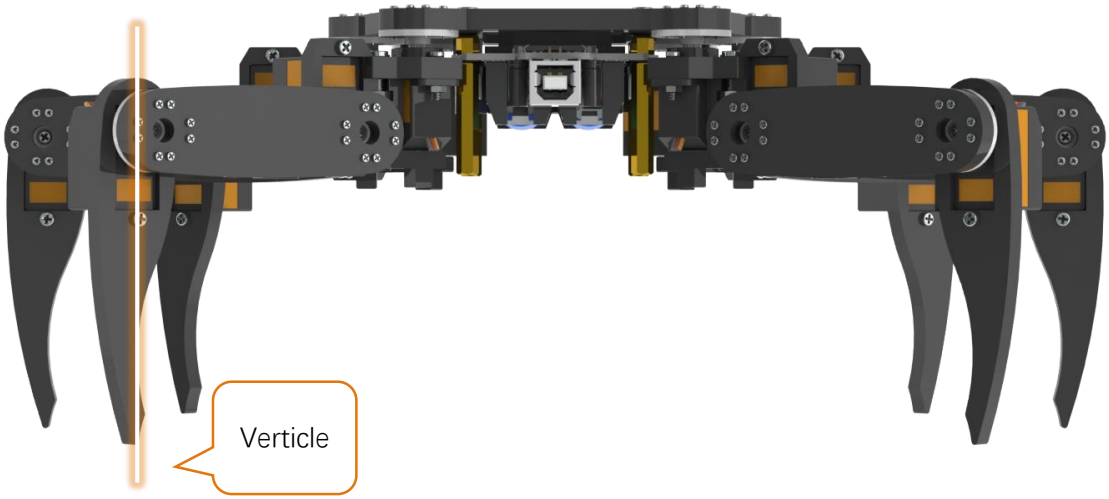
After the installation is completed, the angle of 6 parts should be shown as below. Please try to approach the angle. A small deviation is acceptable. We will correct the deviation in later calibration step.



Step 11

Use the same screws to fix 6 parts assembled before. Please note the installation angle of 6 parts. (Refer to assembly result later).

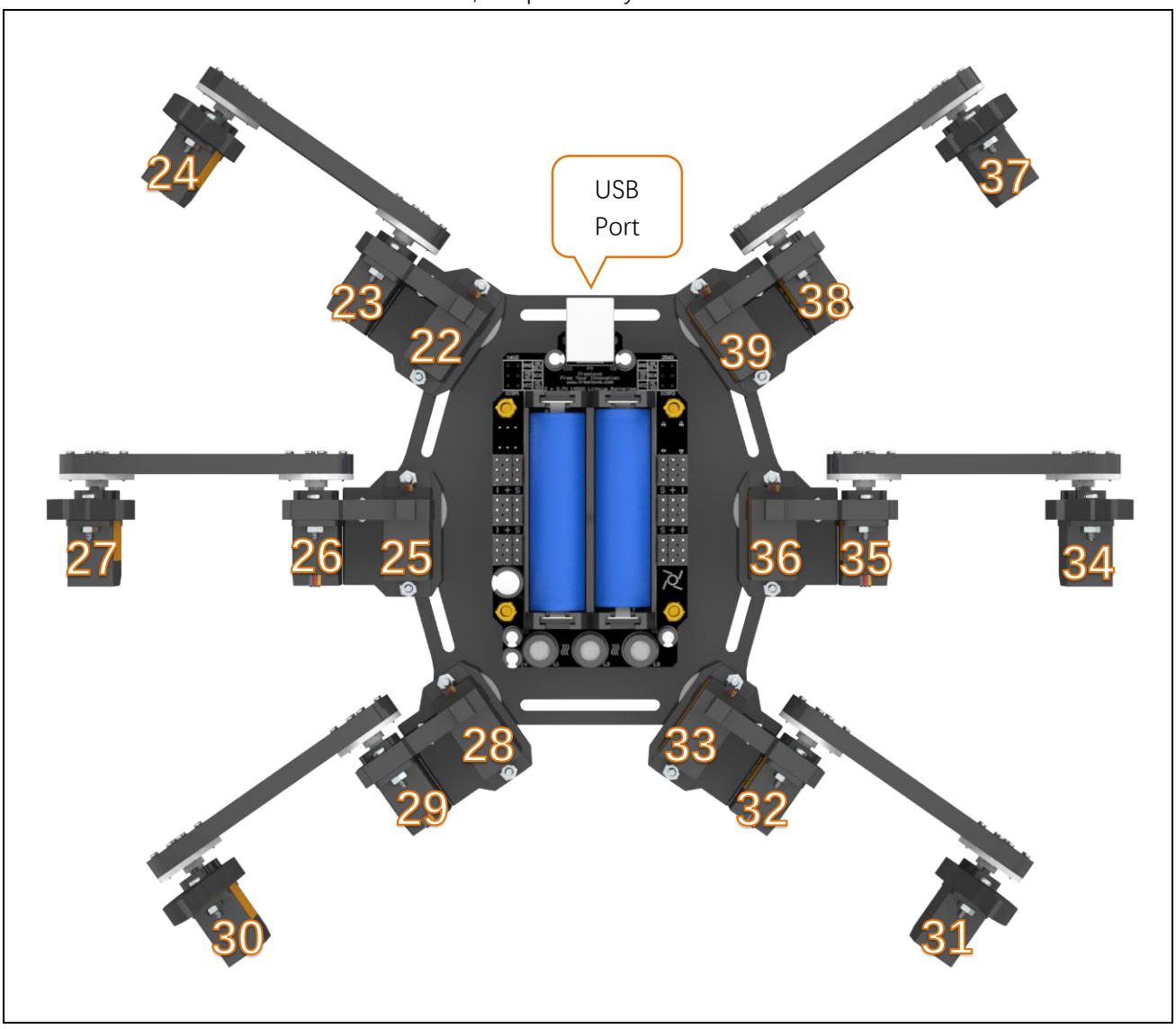
After the installation is completed, the angle of 6 parts should be shown as below. Please try to approach the angle. A small deviation is acceptable. We will correct the deviation in later calibration step.



Step 12

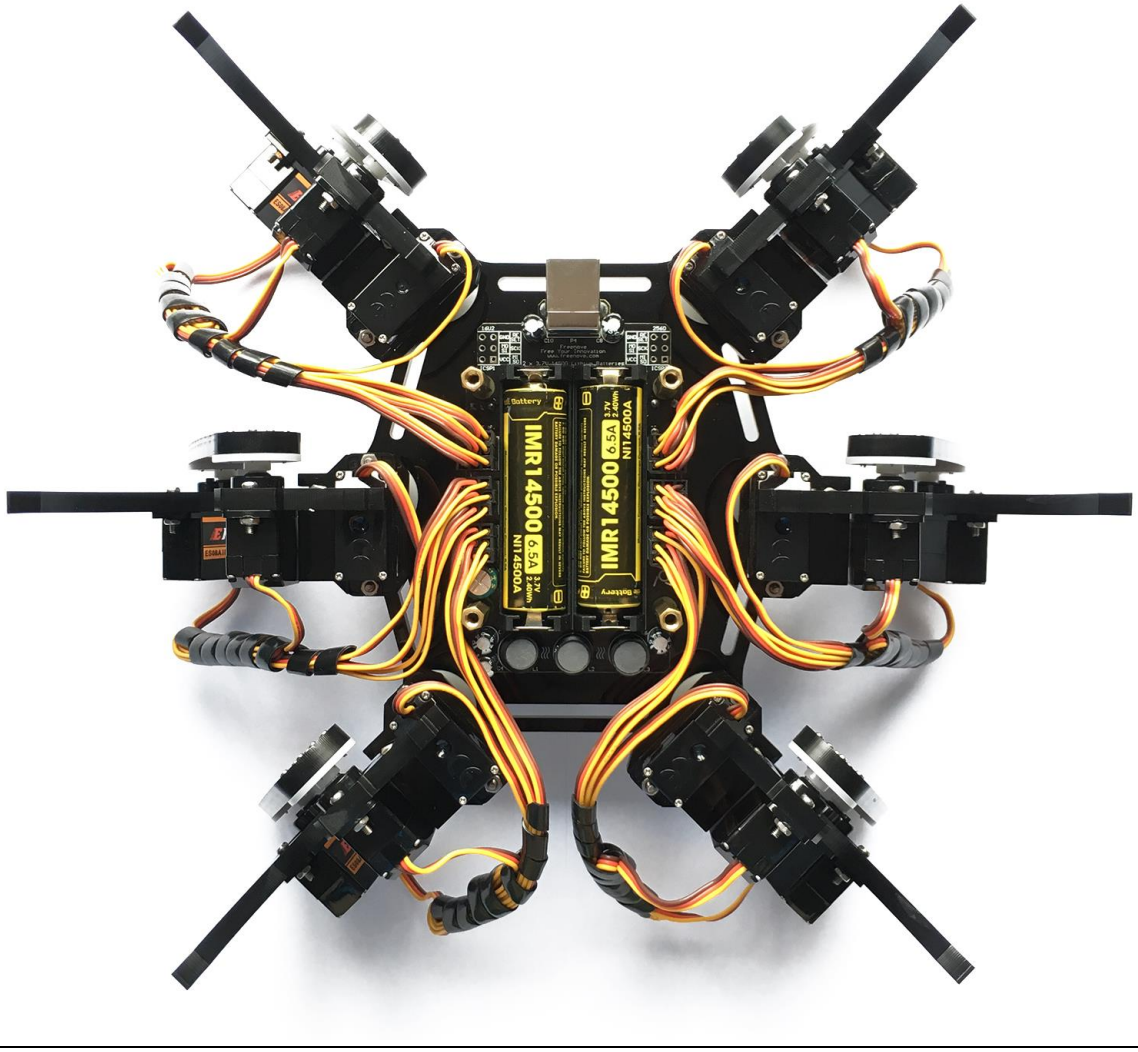
Turn off the power and pull off all the wires of servos.

Then reconnect the servos to control board, the ports they should connect to are shown below.



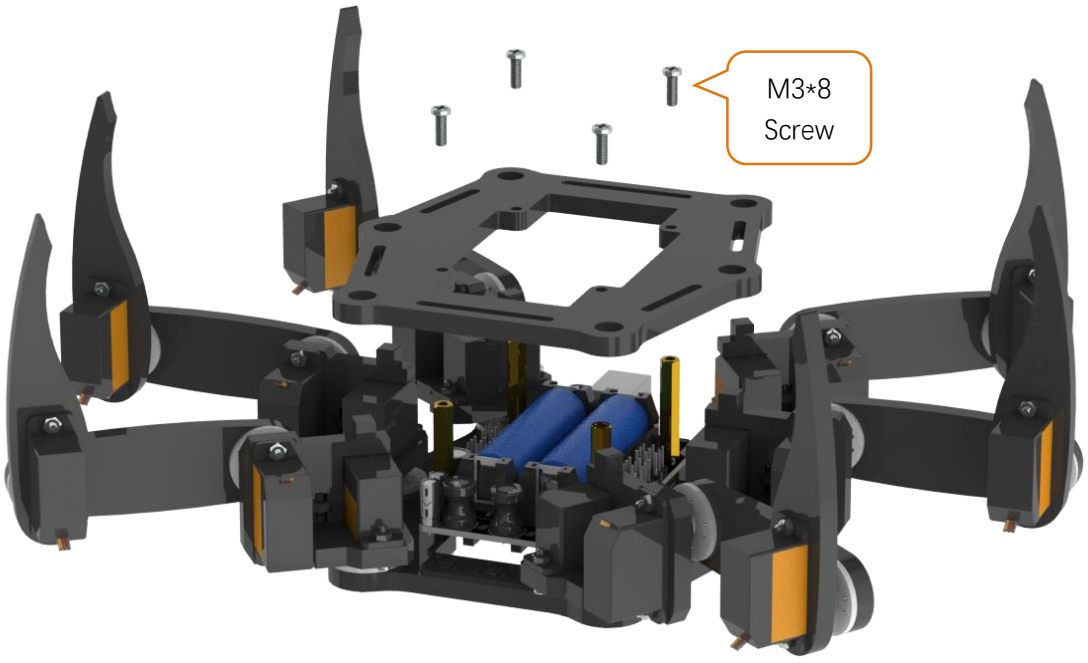
Use cable tidy to arrange the wires of servos.

Do not wrap the wires too tight, so that the servos are free to move.



Step 13

Use screws to fix the folowing acrylic plate.



Fix it as below.

Step 14

Fix ESP8266 module to control board.

Fix it as below.

Now all the assembly is completed.

Calibration

Now start calibration to correct installation errors of servos.

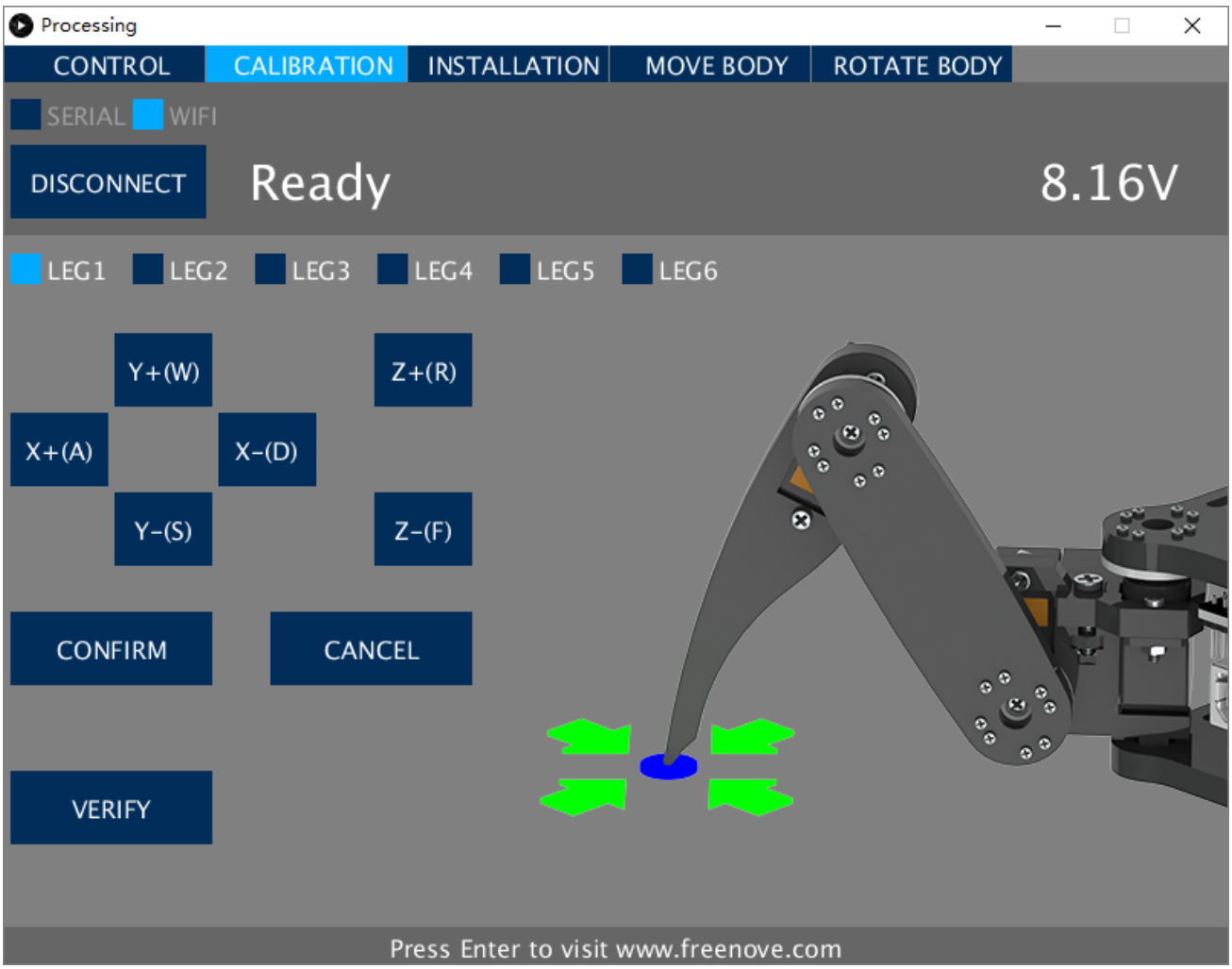
Step 01

First, set the robot to calibration mode.

Now we can use Wi-Fi to connect the control board. Turn on the switch, the robot will create a Wi-Fi hotspot named "Freenove Hexapod Robot" with password "Freenove" (case sensitive). Connect the computer to this hotspot, select "WIFI" in Processing Application, and then click "CONNECT" button.

If your computer can't connect to a Wi-Fi hotspot, you can still use the "SERIAL" way to connect to the robot.

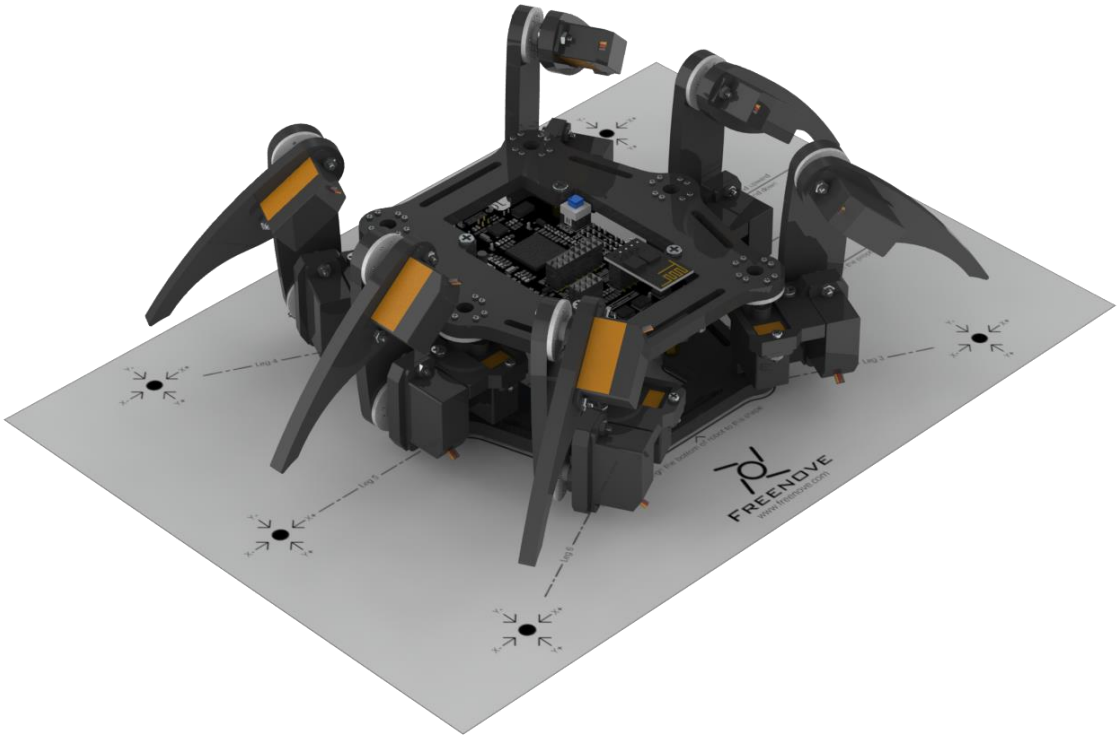
After the connection succeeds, click "CALIBRATION" on the top.



The robot will move to following posture, indicating it is already in calibration mode.

Step 02

Now, start calibration. Put the robot on the calibration graph. The bottom of the robot should coincide with the specific outline in the graph. USB interface should also coincide with the mark in the graph.



If the calibration graph is missing or damaged, you can print a copy. Print the "CalibrationGraph.pdf" by 1:1 (100%) on A4 paper.

Then start calibrate. Select "LEG1", and then click "X+", "X-", "Y+", "Y-" and "Z+", "Z-", so that the end of Leg1 is aligned with the black dots in the graph.

Then select the "LEG2", "LEG3", "LEG4", "LEG5"and “LEG6" to calibrate. After the front steps are completed, the ends of all legs will be aligned with corresponding dots, as shown below.

Click "CONFIRM" and the calibration data will be stored in the robot.

Click "VERIFY", and then the robot will restore to the state before calibration. Then converted to the state after calibration, which indicates that the calibration is completed.

The calibration needs to be excuted only once. Its data is stored in EEPROM. It won't be changed if you upload the default sketch again. If you disassemble the robot, replace the servo or control board, you need to calibrate the robot again. If you are not satisfied with the results of last calibration, you can also choose to calibrate again.

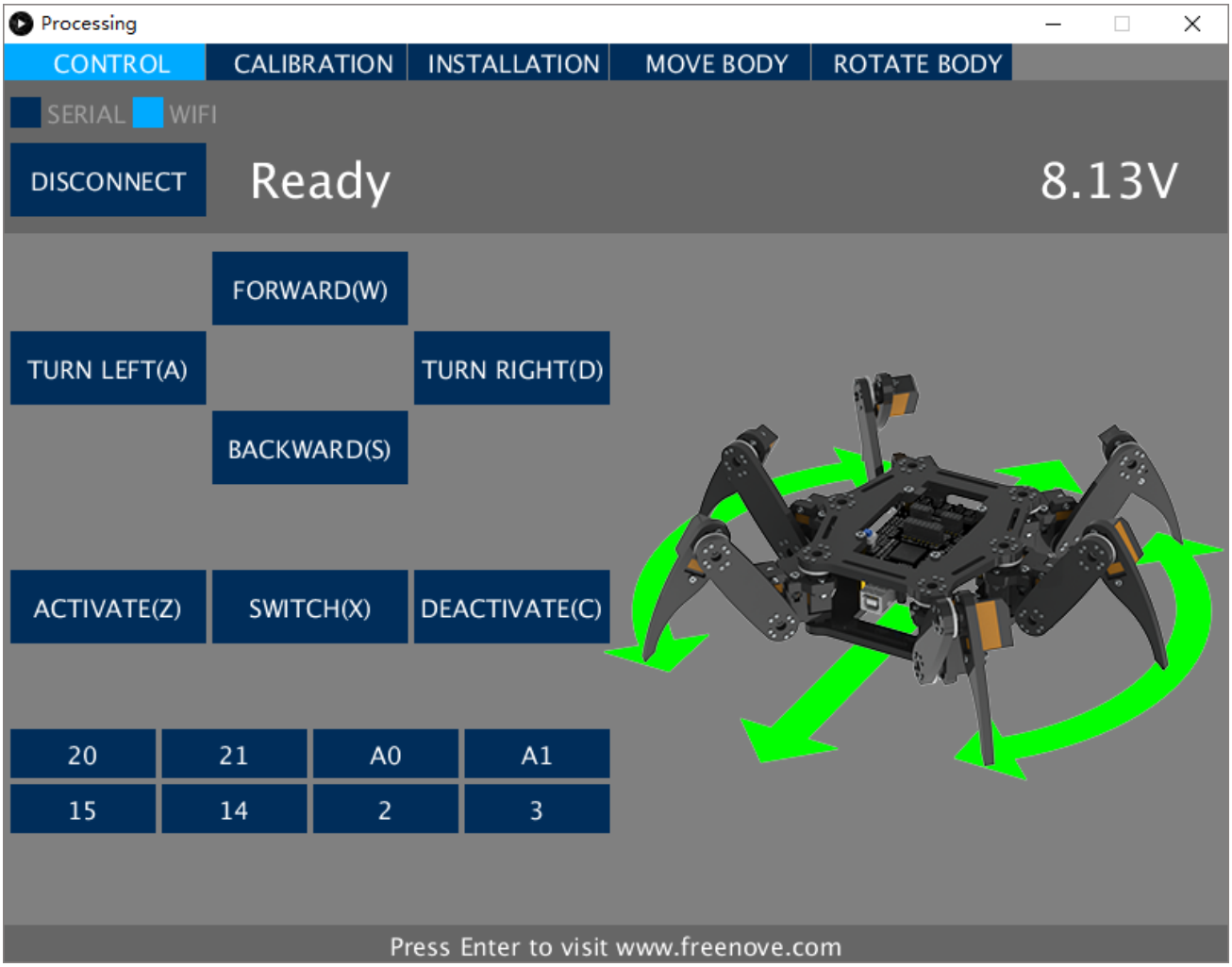
Default Functions

Now we can control the robot.

Use Computer

Open Processing Application and use Wi-Fi to connect the robot. Processing Application can control the robot to show all the default functions.

In the "CONTROL" page, you can control the basic functions of the robot.



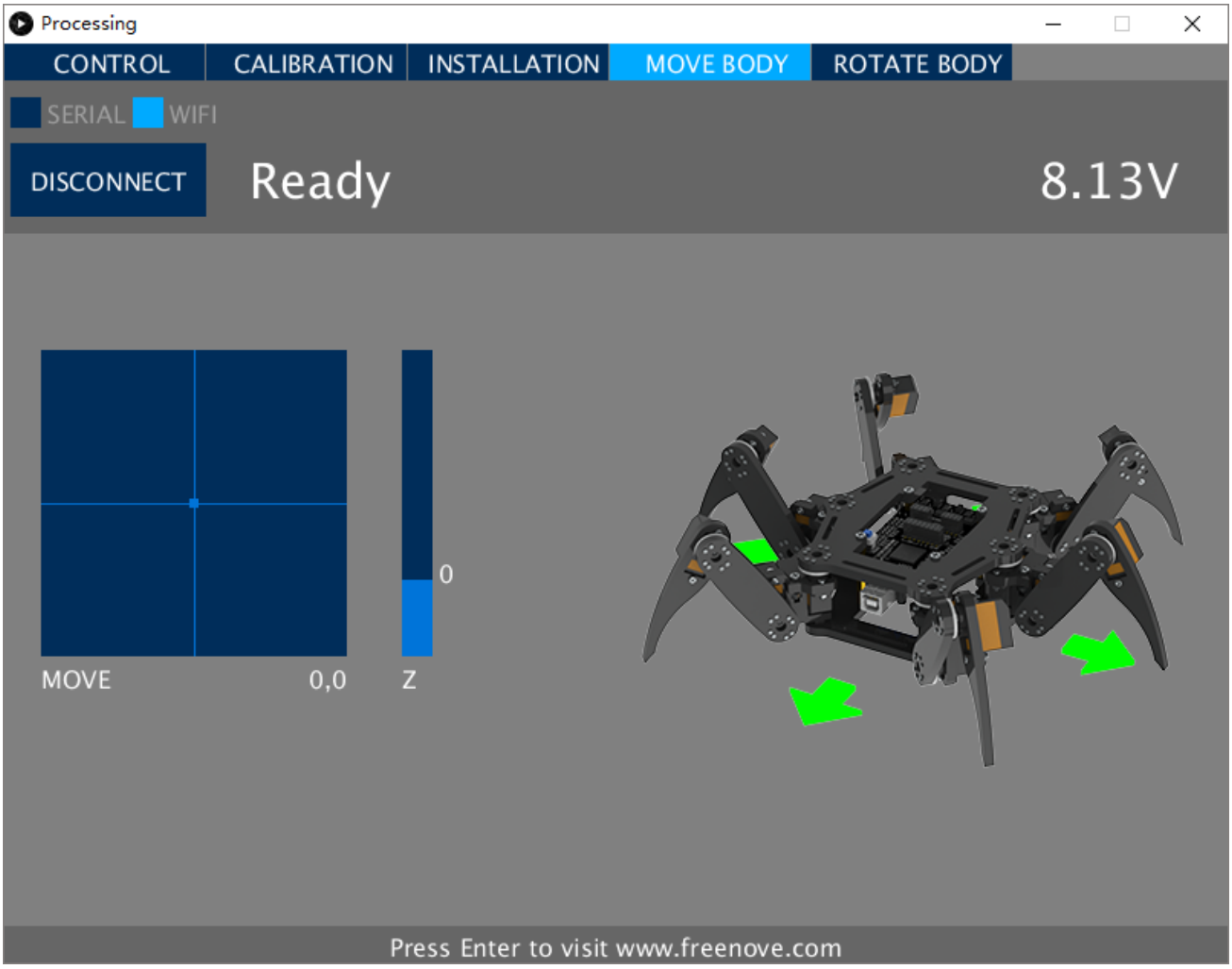
You can execute the following operation:

- Forward, backward, turn left, turn right.
- Switch active mode and sleep mode. Sleep mode can help to save the power of batteries.
- Switch output state of IO ports. You can connect and control some output modules.

You can also use keyboard to control the robot. The key is marked in later bracket of the button.

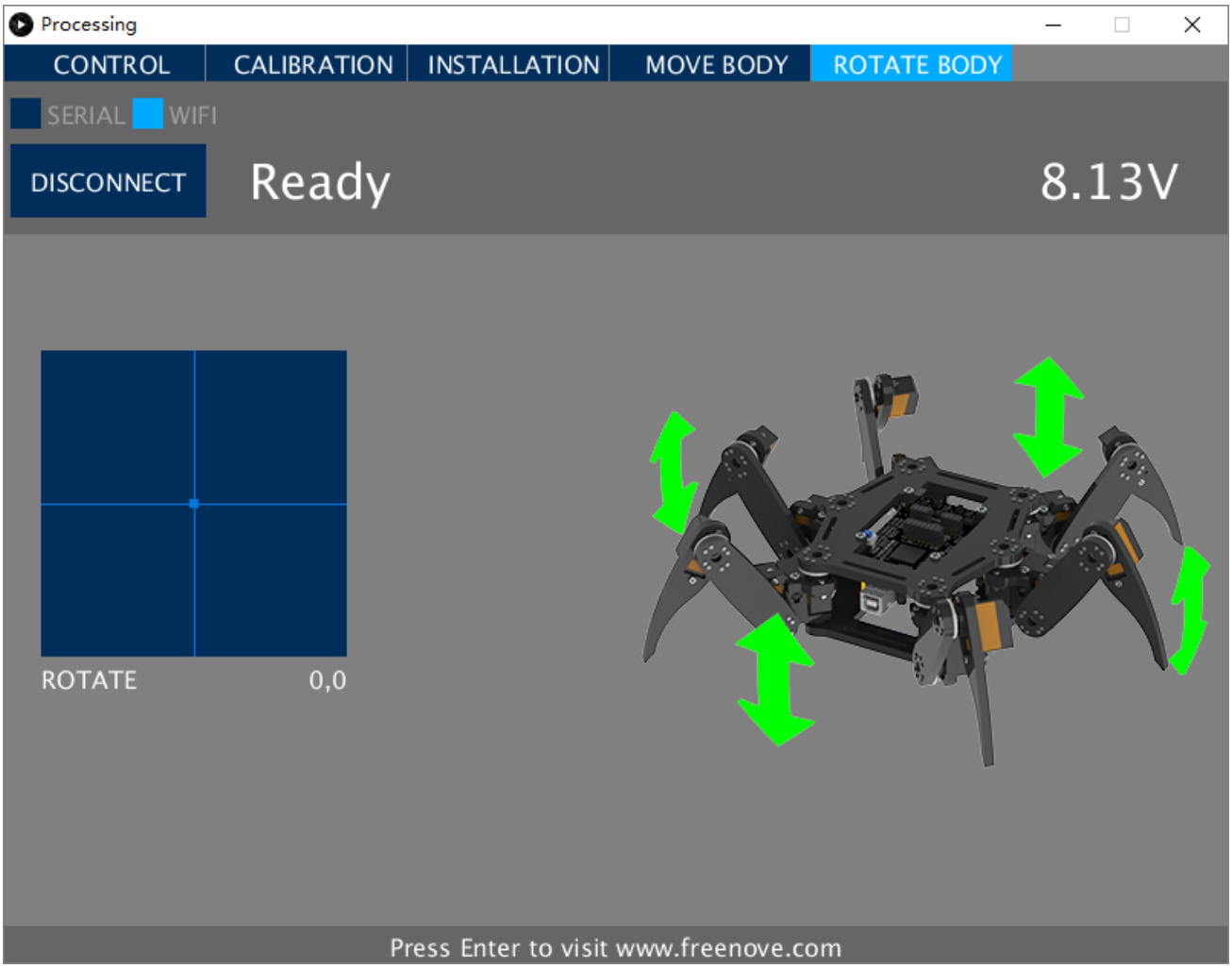
If there is no action for a long time, the robot will switch into sleep mode automatically. And any command will activate the robot automatically.

In the "MOVE BODY" page, you can control the robot to move body in the place where it stays.



Use mouse to click on the "MOVE" box, the robot body will move to the corresponding location.
You can also use mouse to click on the "Z" box to control the height of the robot body.

In the "ROTATE BODY" page, you can control the robot to twist body in the place where it stays.



Use mouse to click on the “ROTATE " box, the robot body will twist to the corresponding posture.

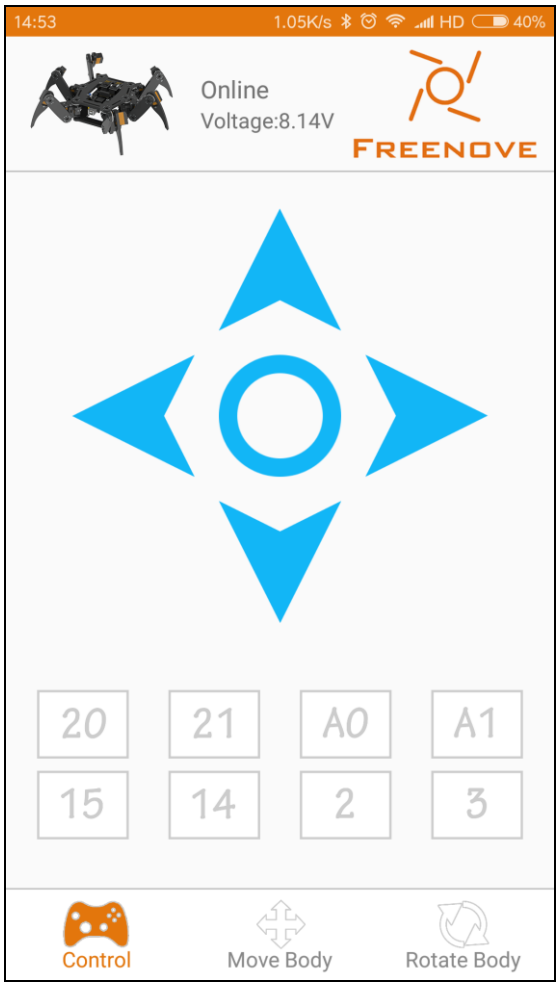
Use Android Device

You can use Android phone or tablet to control the robot.

First, please install Freenove APP for your Android device:

- View or download on Google Play:
  https://play.google.com/store/apps/details?id=com.freenove.suhayl.Freenove
- Download APK file directly:
  https://raw.githubusercontent.com/Freenove/Freenove_App_for_Android/master/freenove.apk

After the installation is completed, connect the Android device to Wi-Fi hotspot of the robot. Then open the Freenove APP and select “Freenove Hexapod Robot Kit”. As shown below:



The APP will connect the robot automatically. The online state will appear on the top. If the offline state appears, you can touch the robot logo on the top left corner to reconnect.

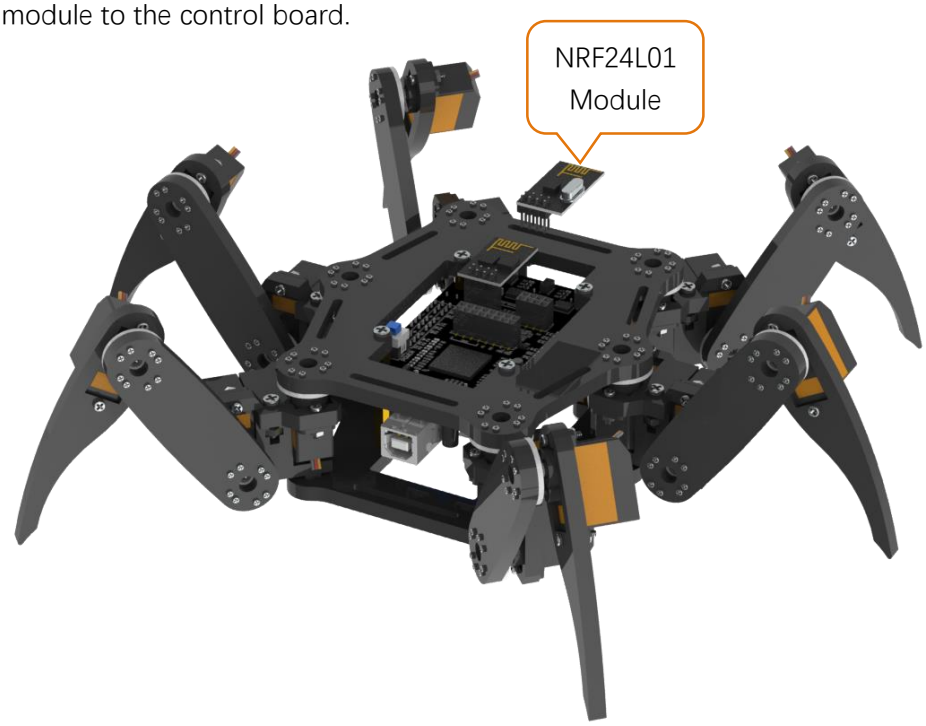
This APP is similar to the Processing Application, and you can explore it by yourself.

Use Remote Control

You can also use the remote control (Freenove Remote Control Kit, FNK0028) to control the robot.

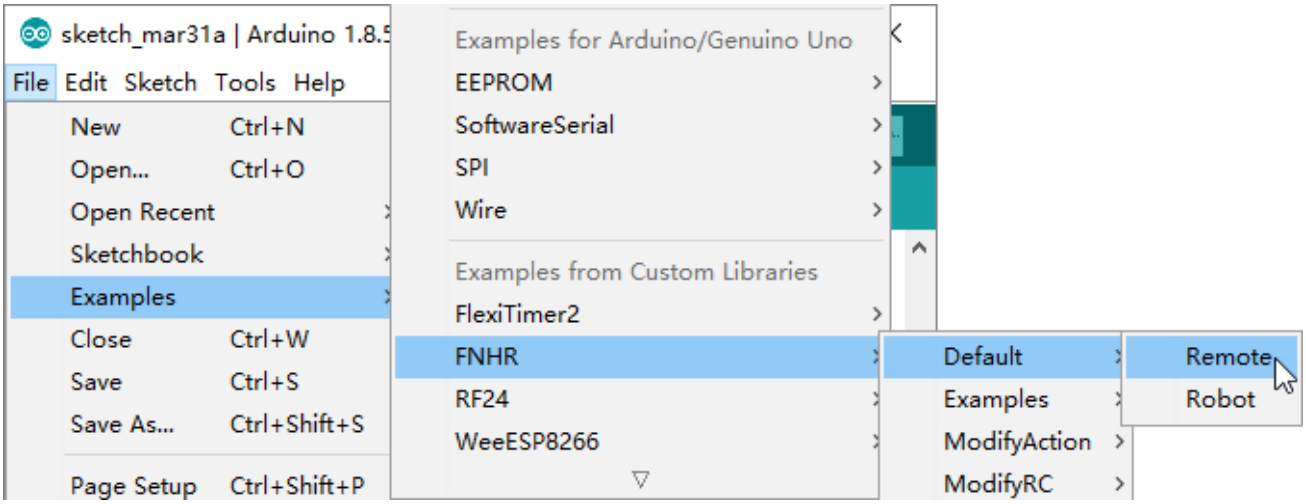
Please refer to tutorial(https://github.com/Freenove/Freenove_Remote_Control_Kit/raw/master/Tutorial.pdf) to assemble the remote control first. The Freenove Remote Control Kit contains two NRF24L01 modules, fix one of them to the robot. Please turn off the power when assembling.

Fix NRF24L01 module to the control board.

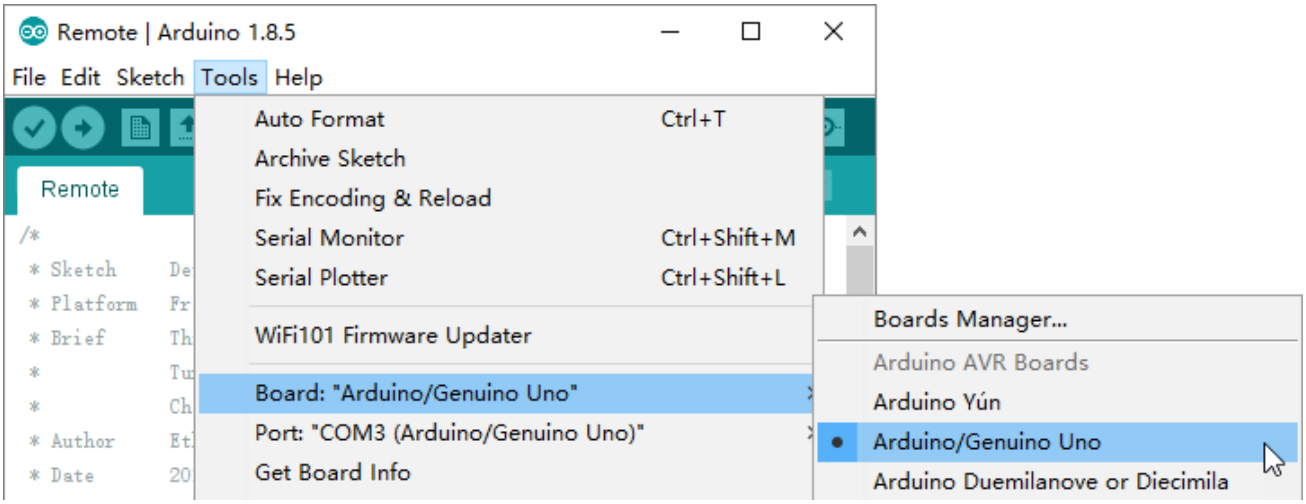


Fix it as below.

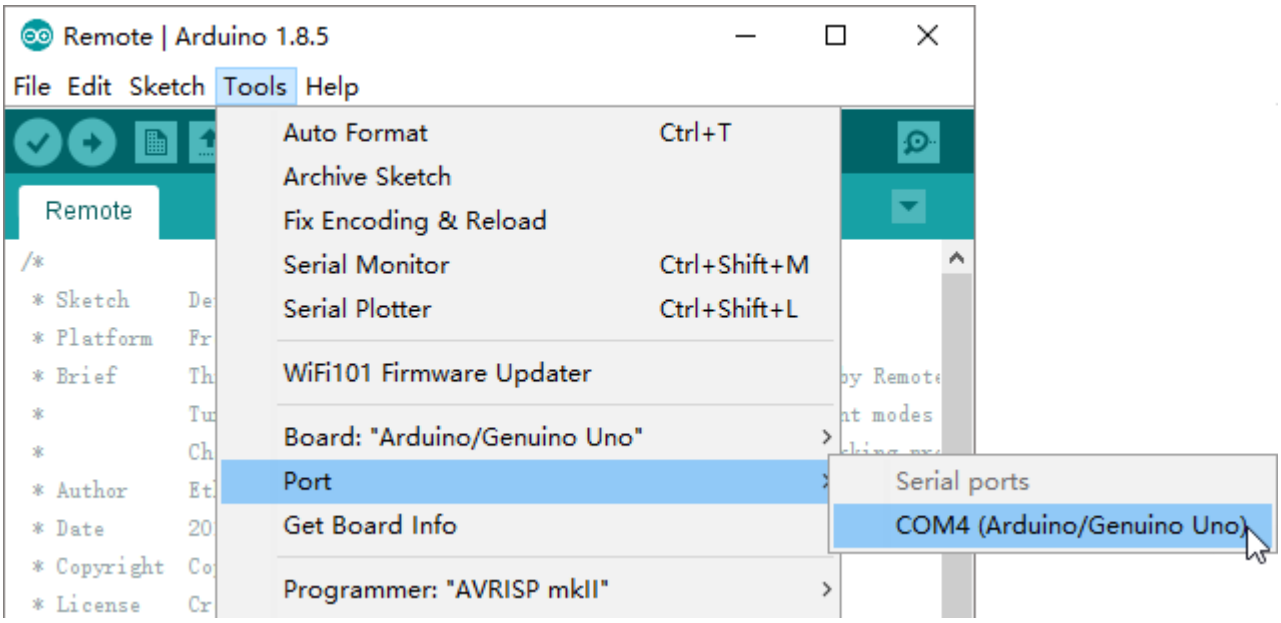
Now, upload sketch for remote control. Connect the remote control to computer.
Open "File" > "Examples" > "FNHR" > "Default" > "Remote".



Select "Board" > "Arduino/Genuino Uno".



Select "Port". Your port may be different from the following figure.



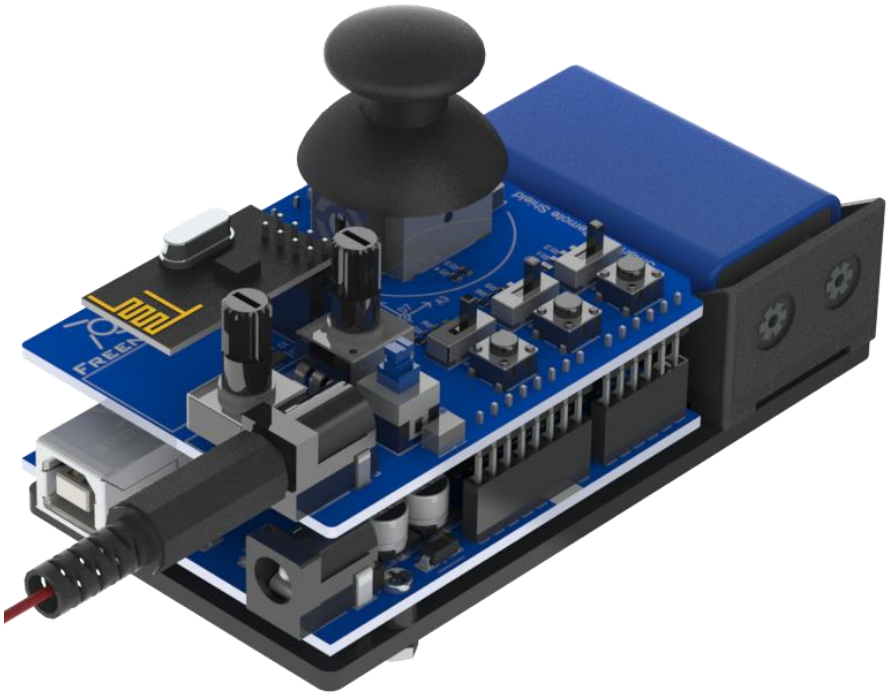
Then upload it to the remote control.

Load the batteries for the remote control or connect it to computer with an USB cable, and switch it on. Turn on the robot, and then you can use the remote control to control the robot.

At normal operation state, the "LED3-D8" on remote control will be bright or flashing.

The remote controller has three toggle switches, and one toggle switch is corresponding to one operation mode. When you want to switch mode, you need to swich on only one toggle switch, and keep others off.

- Only switch on the "S1-D4" for "CONTROL" mode. In this mode, you can use the joystick to control the robot to move. In addition, press the toggle to swich between active mode and sleep mode.
- Only switch on the "S2-D3" for "MOVE BODY" mode. In this mode, you can use the joystick to control the robot to move body in the place where it stays. In addition, “POT2-A1”is used to adjust the height of robot body.
- Only switch on the “S3-D2” for "ROTATE BODY" mode. In this mode, you can use the joystick to control the robot to twist body in the place where it stays.



Programming

It is easy to reprogram for this robot.

Modify Default Sketches

You can modify the Wi-Fi hotspot name and password when using default sketches by calling the following function.

```
1  void FNHR::SetWiFi(String name, String password)
```

Please open "File" > "Examples" > "FNHR" > "ModifyWiFi" > "Robot" to see how to use.

You can modify the wireless communication channel between robot and remote.
To modify the robot, call the following function.

```
1  void FNHR::SetRC(byte byte0, byte byte1, byte byte2, byte byte3, byte byte4)
```

To modify the remote, call the following function.

```
1  void FNHRRemote::SetRC(byte byte0, byte byte1, byte byte2, byte byte3, byte byte4)
```

You must set same channel to be able to control robot by romote.
Please open "File" > "Examples" > "FNHR" > "ModifyRC" to see how to use.

You can modify the action speed when using default sketches by calling the following function.

```
1  void FNHR::SetActionSpeed(float speed)
```

Please open "File" > "Examples" > "FNHR" > "ModifySpeed" > "Robot" to see how to use.

You can modify the action group when using default sketches by calling the following function.

```
1  void FNHR::SetActionGroup(int group)
```

There are three different action groups, which determine the way robot moves and turns.
Please open "File" > "Examples" > "FNHR" > "ModifyAction" > "Robot" to see how to use.

Custom Programming

You can also use the library (FNHR) we provide to program the robot.

First, include FNHR library in Arduino sketch.

```
1  #include <FNHR.h>
```

Then define a robot object.

```
2  FNHR robot;
```

In function setup(), start the robot.

```
3  void setup() {
4    robot.Start();
5  }
```

Now, you can directly use the following code in function loop() to control the robot.

```
6    robot.CrawlForward();
7    robot.CrawlBackward();
8    robot.TurnLeft();
9    robot.TurnRight();
10   robot.SleepMode();
11   robot.ActiveMode();
12   robot.SwitchMode();
13   robot.MoveBody(float x, float y, float z);
14   robot.RotateBody(float x, float y, float z, float angle);
15   robot.LegMoveToRelatively(int leg, float x, float y, float z);
16   robot.SetActionSpeed(float speed);
17   robot.SetActionGroup(int group);
```

There are some examples in"File" > "Examples" > "FNHR" > "Examples ". You can open and upload them to learn how to use FNHR library to control the robot.

You can also open the FNHR.h file of FNHR library to view the specific usage, this file has detailed comments.

If you upload the code written by yourself, the robot will be controlled only by your code, and you will not be able to use the computer, Android device and remote control to control it. You can reupload the default sketch to restore.

What's next?

Thanks for your reading.

This tutorial is all over here. If you find any mistakes, missions or you have other ideas and questions about contents of this tutorial or the kit and ect, please feel free to contact us, and we will check and correct it as soon as possible.

After completing the projects of this tutorial, you can try to remodify this robot, including purchasing and installing other electronic modules of Freenove, or improving the code to achieve different functions you want.

If you want to learn more about Arduino, Raspberry Pi, smart cars, robots and orther interesting products in science and technology, please continue to focus on our website. We will continue to launch cost-effective, innovative and exciting products.

Thank you again for choosing Freenove products.