



Adept



RaspClaws

Adept Smart Robot Kit
for Raspberry Pi

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 humidity.
- ★ 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

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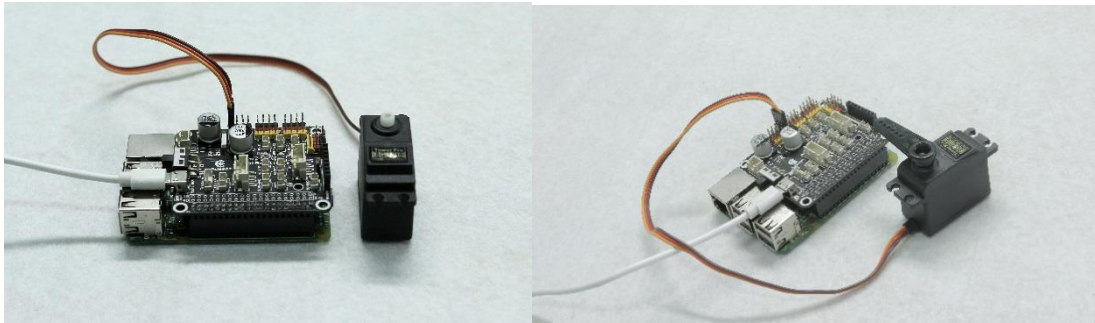
Before assembling

Before installing the robot, **you need to install the software (refer to second half of the document) to control the robot on the Raspberry Pi**. Because the servo needs to be returned to the original position during the robot assembly process, which requires the assistance of a Raspberry Pi with software that runs normally.

How to make a servo return to original position

Connect the servo to the Raspberry Pi that is **turned on**. When the connection is completed, the servo will immediately run, and it will automatically return to the original position in a very short time. Then you can install the rocker arm on the servo at a specified angle.

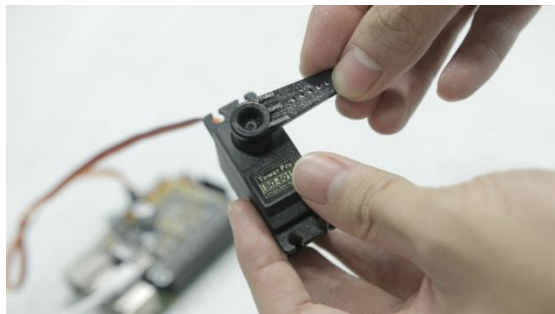
automatically return → install rocker arm



(The type of servo and the installation angle of the rocker arm is for reference only. Please refer to the actual product and assembly part.)

Whether the servo has returned to original position

You can test whether the servo has returned to original position by pulling the rocker arm (don't try too hard to prevent damage to the servo). The servo that has automatically returned cannot be pulled.


















If your servo does not return to the original position automatically, you can manually run the server.py file and then try to connect the servo.

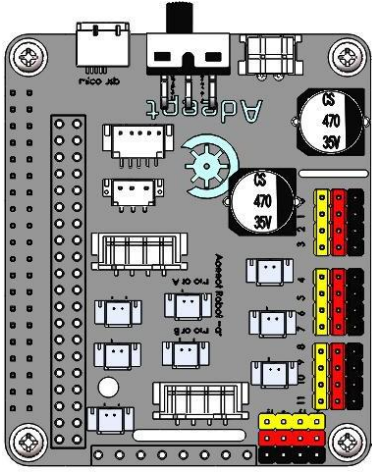
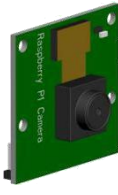

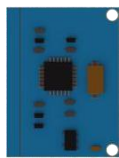
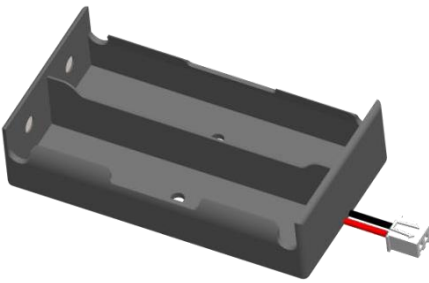

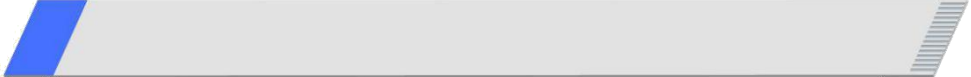
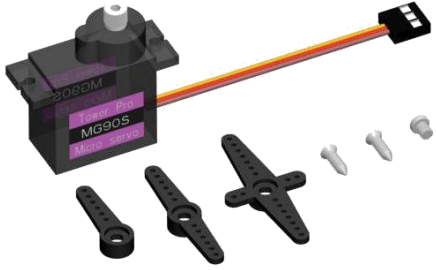
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1.2. Machinery Parts

 <p>M2 Nut</p> <p>X27</p> <p>www.adeept.com</p>	 <p>M3 Nut</p> <p>X30</p> <p>www.adeept.com</p>	 <p>M2*8 Screw</p> <p>X27</p> <p>www.adeept.com</p>	 <p>M2.5*4 Screw</p> <p>X6</p> <p>www.adeept.com</p>	 <p>M2.5*8 Screw</p> <p>X18</p> <p>www.adeept.com</p>
 <p>M3*8 Screw</p> <p>X28</p> <p>www.adeept.com</p>	 <p>M1.4*6 Self-tapping Screw</p> <p>X12</p> <p>www.adeept.com</p>	 <p>M1.7*6*6 Self-tapping Screw</p> <p>X15</p> <p>www.adeept.com</p>	 <p>M3*8 Countersunk Head Screw</p> <p>X2</p> <p>www.adeept.com</p>	 <p>M2.5*14 Copper Stand off</p> <p>X4</p> <p>www.adeept.com</p>
 <p>M2.5*11 Copper Stand off</p> <p>X1</p> <p>www.adeept.com</p>	 <p>M2.5*10+6 Copper Stand off</p> <p>X4</p> <p>www.adeept.com</p>	 <p>M3*40 Nylon Standoff</p> <p>X8</p> <p>www.adeept.com</p>	 <p>M3*15 Nylon Standoff</p> <p>X6</p> <p>www.adeept.com</p>	 <p>M3*10 Screw</p> <p>X24</p> <p>www.adeept.com</p>

1.3. Electronic Parts

<p>Adept robot HAT X1</p> 	<p>Raspberry Pi Camera X1</p> 
<p>Car Light X4</p> 	<p>mpu—6050</p> 
<p>18650 Battery Holder Set X1</p> 	<p>3-Pin Wire X4</p> 
<p>Raspberry P1 Camera Ribbon X1</p> 	<p>Servo x15</p> 

1.4. Tools

Cross-head Screwdriver X1



Winding Pipe X1



Large Cross-head Screwdriver X1

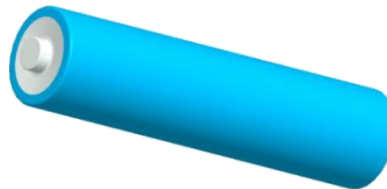


Ribbon X1

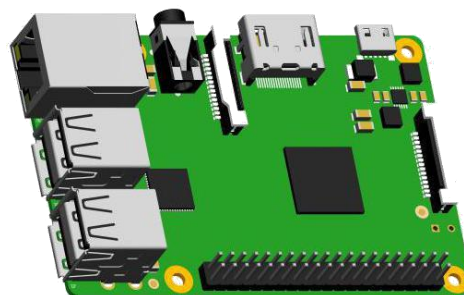


1.5 Self-prepared Parts

18650 Battery X2



Raspberry Pi



18650 battery specification: It is recommended to use lithium battery above 3000mAh and without overcurrent protection. The power supply current requirement is above 3A. Using 18650 lithium battery with overcurrent protection function, 18650 battery whose capacity is less than 1700mAh, 18650 battery specially for strong-light flashlight, 18650 battery with power shortage or counterfeit lithium battery produced by informal manufacturers will cause the unstable work of the robot, power cut and even damage to the Raspberry Pi and robot.

The robot can be turned on normally, but the Raspberry Pi will automatically restart or shut down after, also because of the problem caused by the 18650 battery.

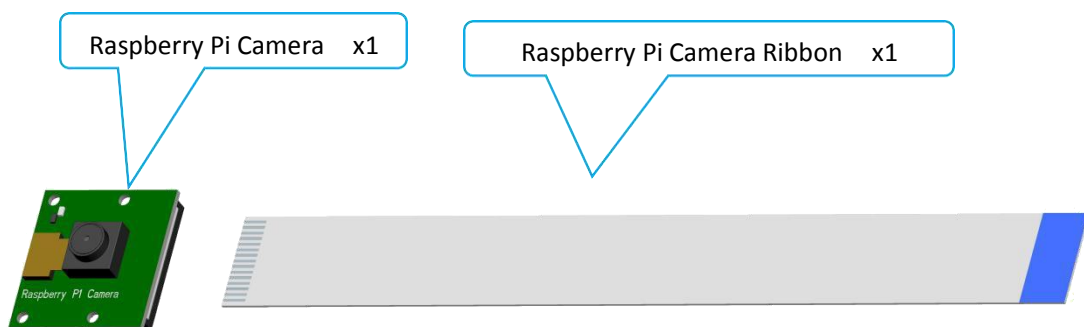
2. Assembly

2.1. Preparations before Assembly

1. Connect the Raspberry Pi Camera and the ribbon.

Assemble the following components

Note: That in the next operation, the Pi Camera of the Raspberry Pi should always be connected to the Raspberry Pi, and do not reverse the wires of the Raspberry Pi.

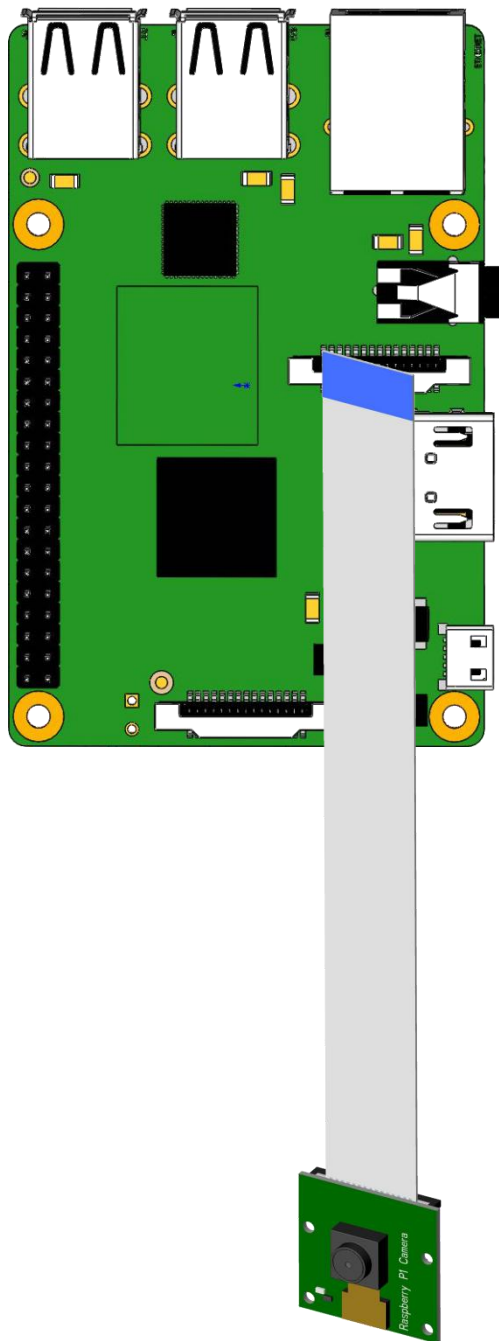


Effect diagram after assembling



2. Connect the Raspberry Pi Camera and the Raspberry Pi.

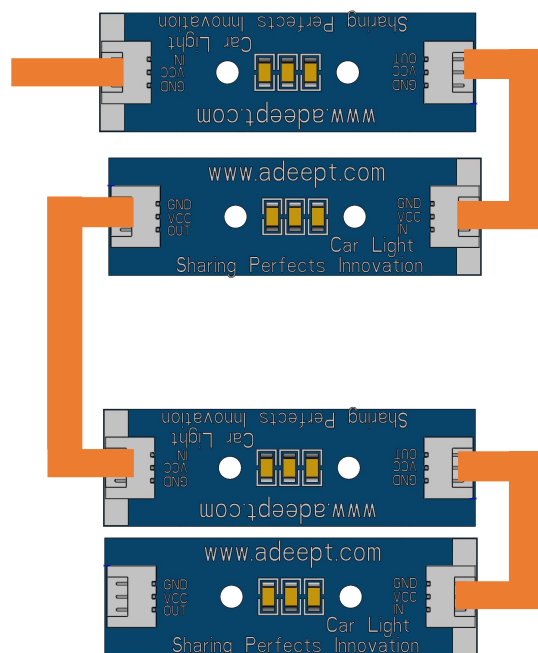
Assemble the following components



The two plugs of 3-Pin Wire are small plugs



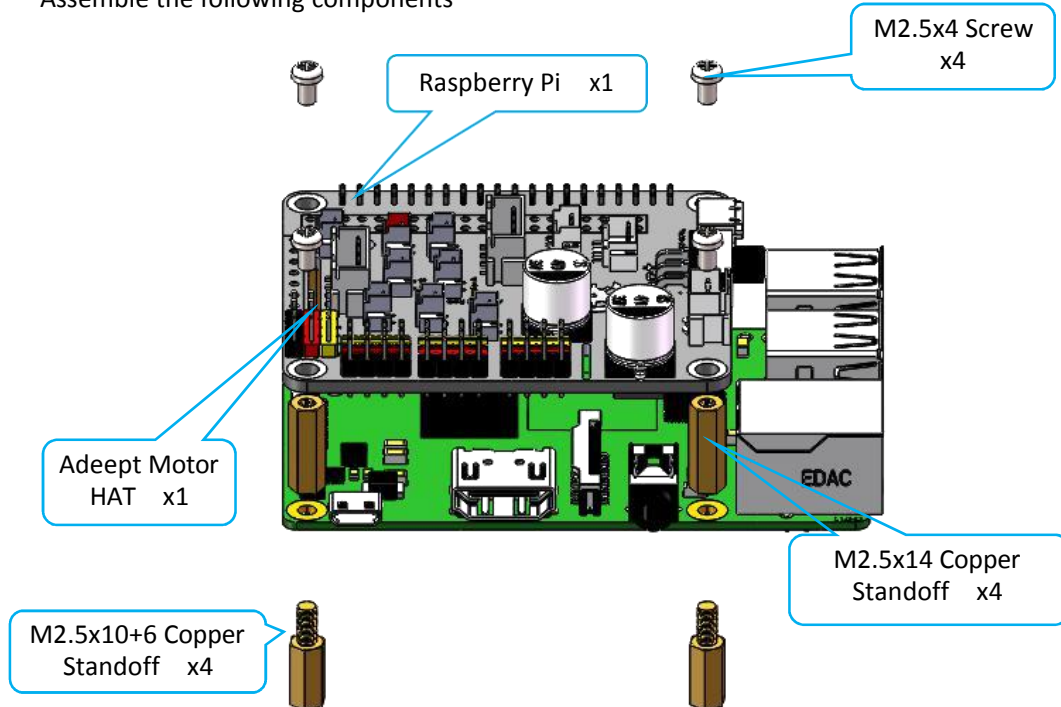
Wires are connected to the input of Car Light (the end marked with a white strip pattern)



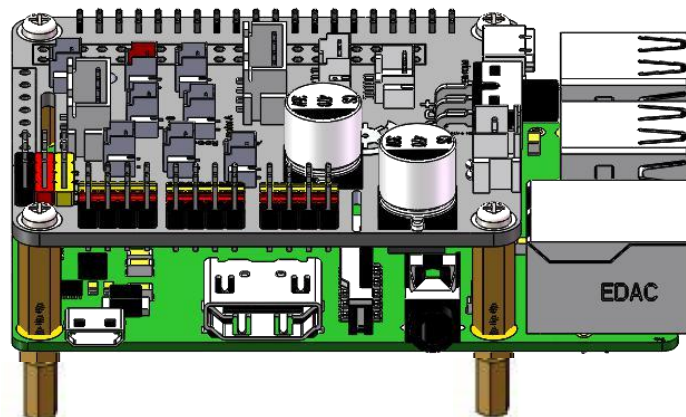
2.2. Servo debugging.

1. Fix four M2.5x10+6 Copper Standoffs on Raspberry Pi.

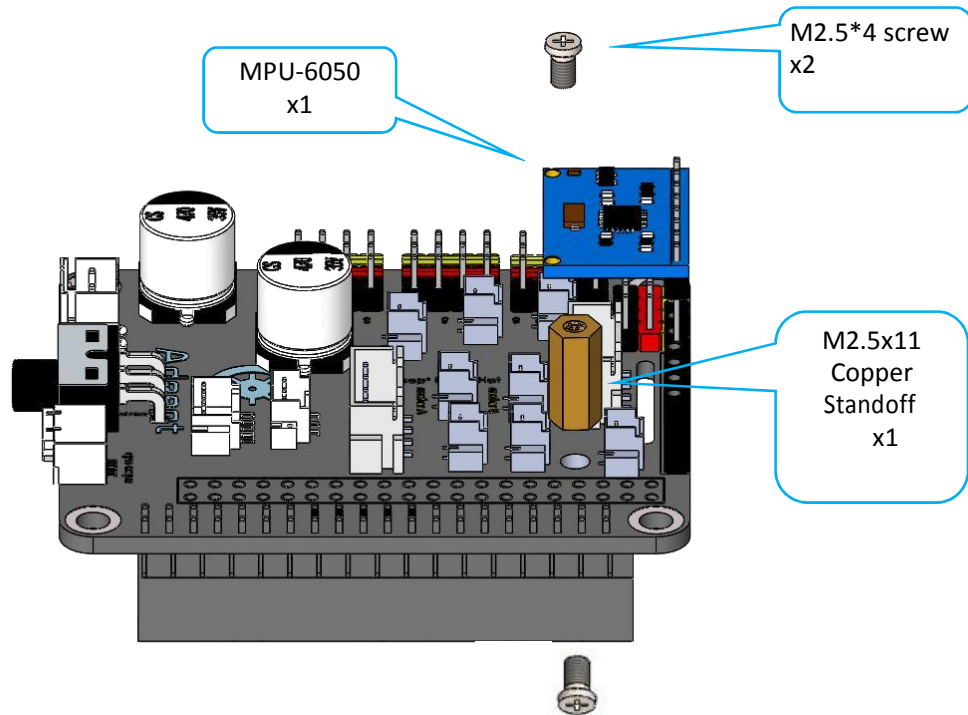
insert the Adept Motor HAT into Raspberry Pi.
Assemble the following components



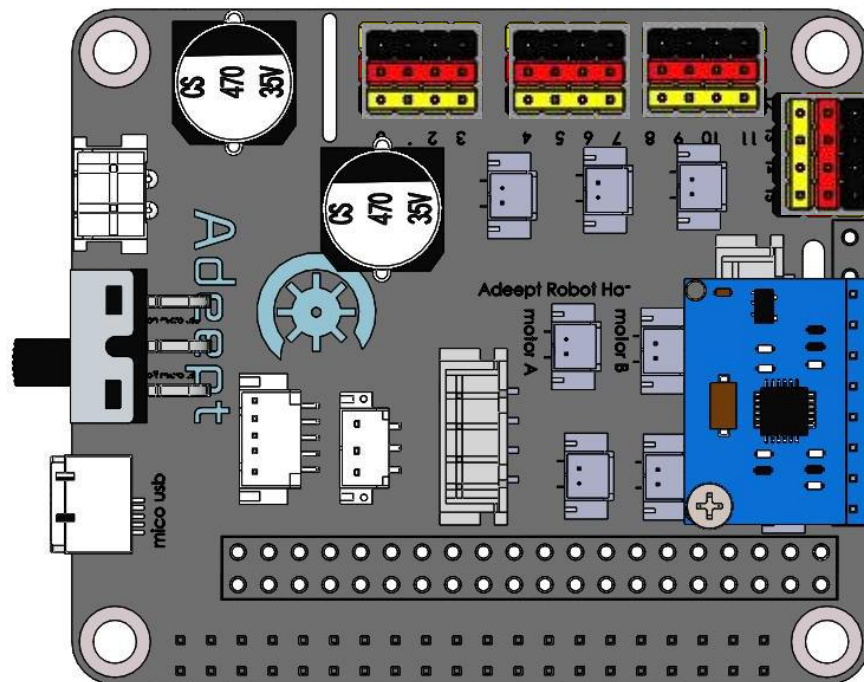
Effect diagram after assembling



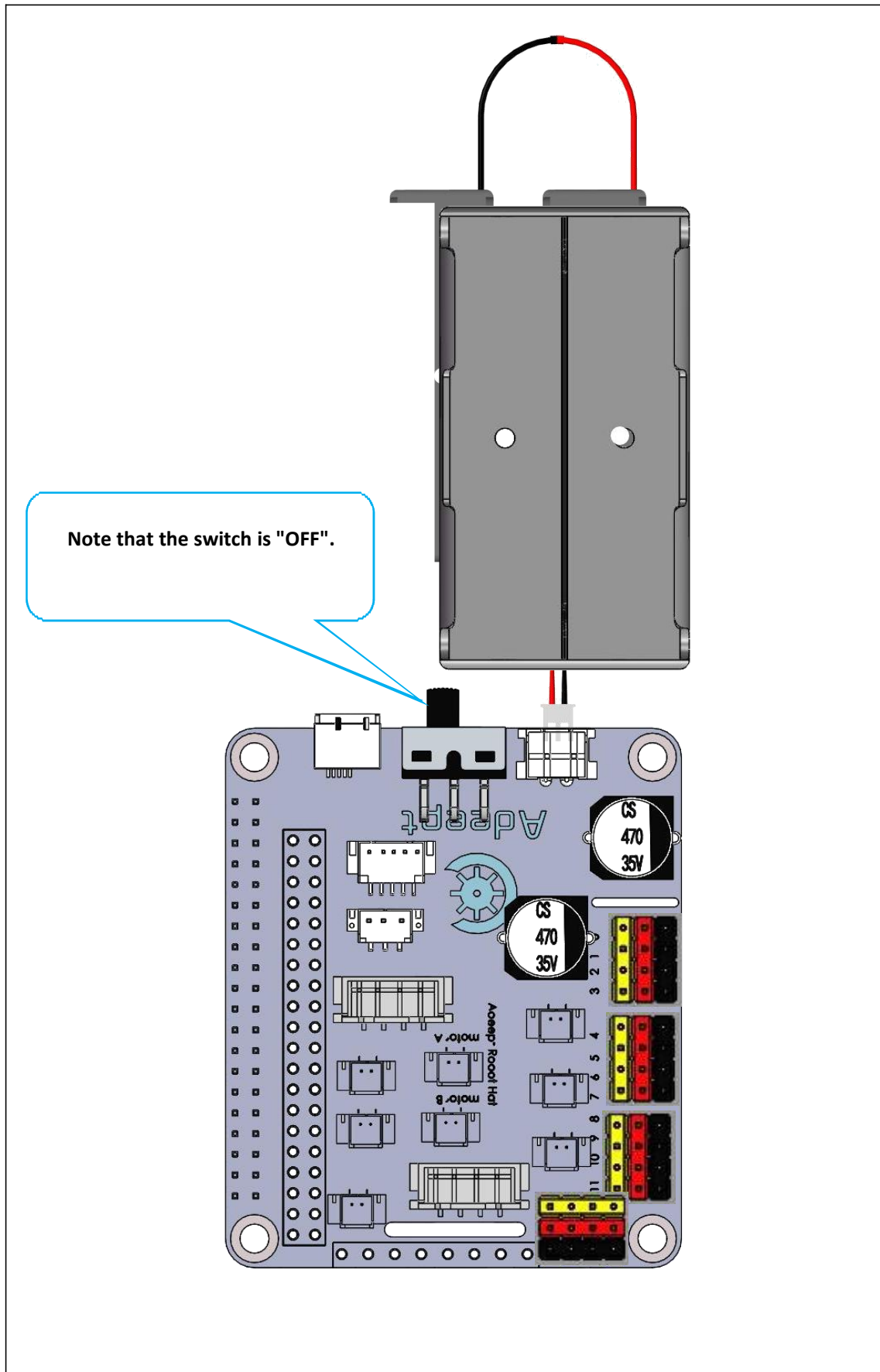
Connect the driver board to mpu-6050.



Effect diagram after assembling

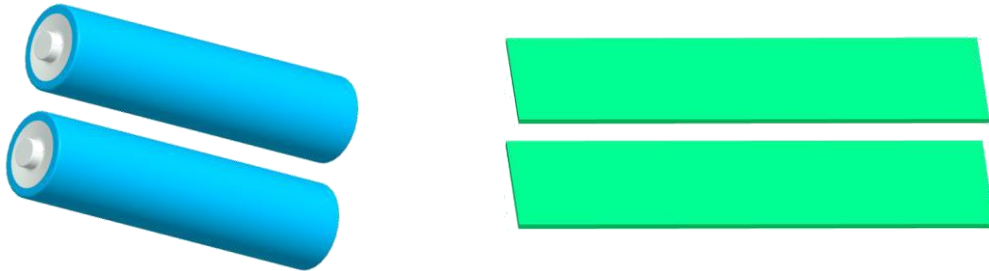


3. Connect the 18650 Battery Holder Set to the Adept Motor HAT.

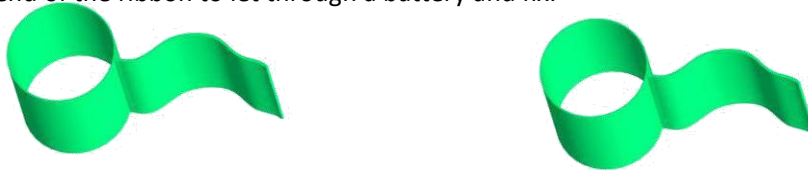


2.3. Install and Remove Batteries

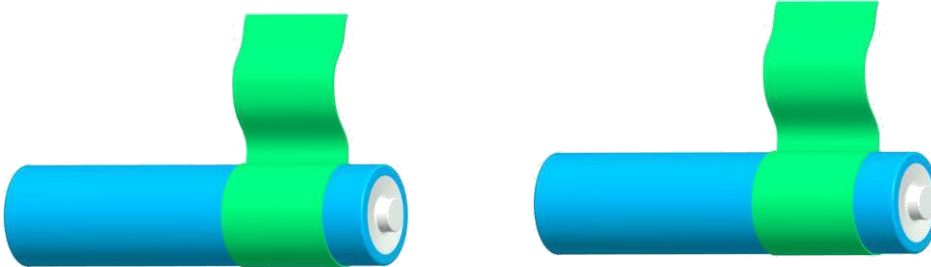
Take out 2 ribbons and 2 batteries.



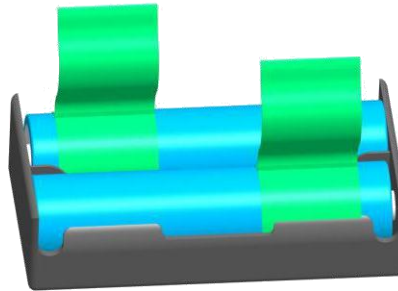
Roll one end of the ribbon to let through a battery and fix.



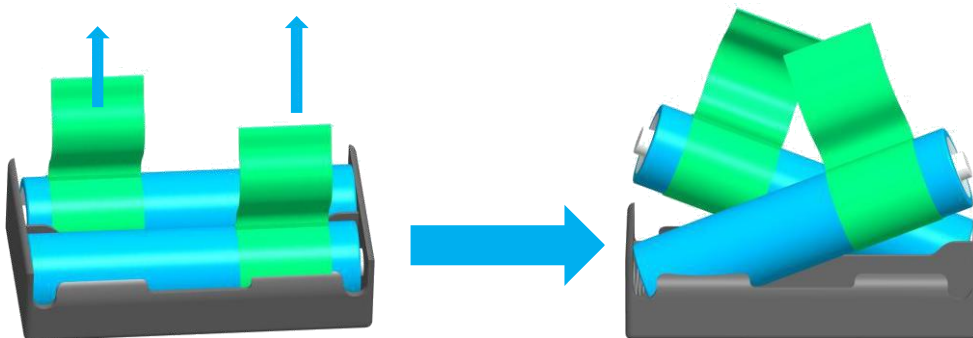
Insert the batteries into the rings-ribbon closer to the anode.



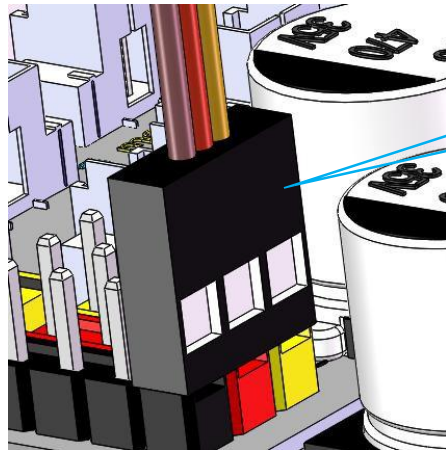
Install the batteries into the holder based on the pole.



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

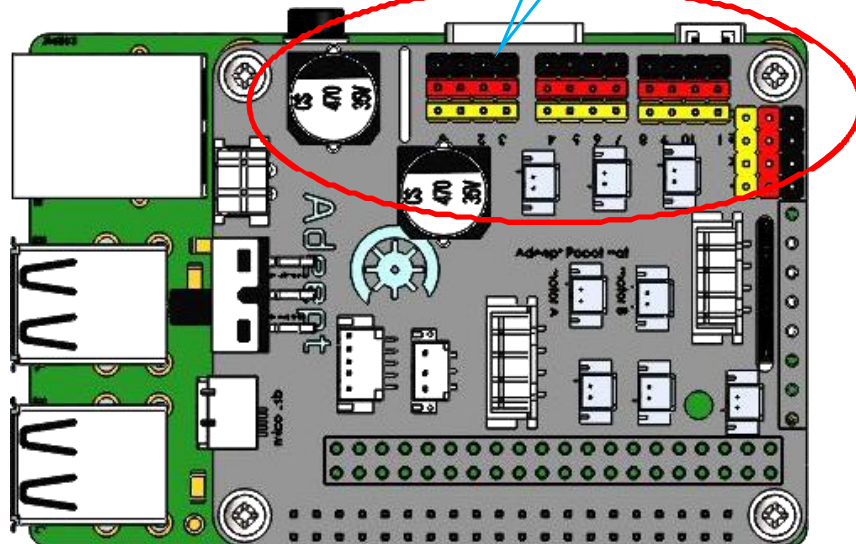


4. Connect servos to Adept Motor HAT.

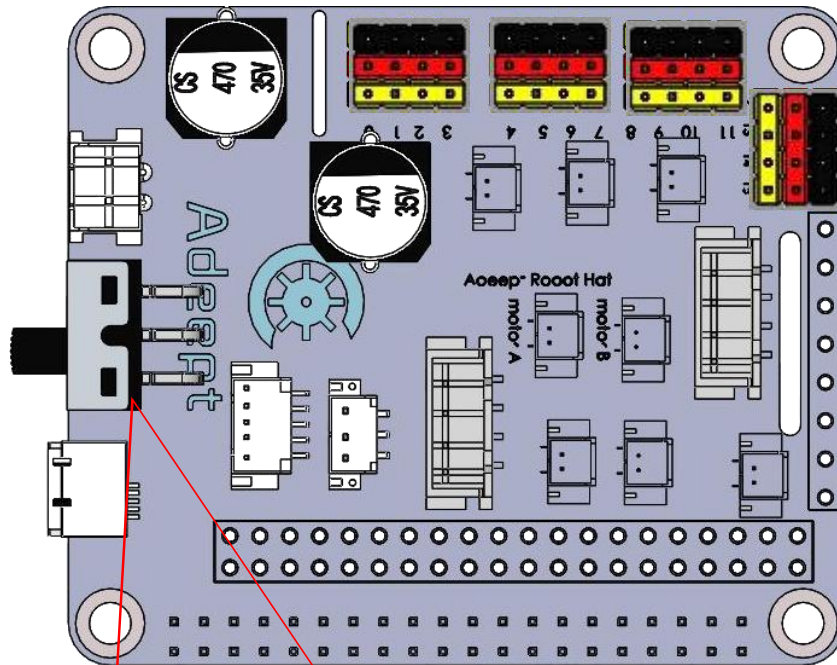


The color of the servo wire corresponds to the color of the port.

Connect the servo to pwm0-13 on the Motor HAT.



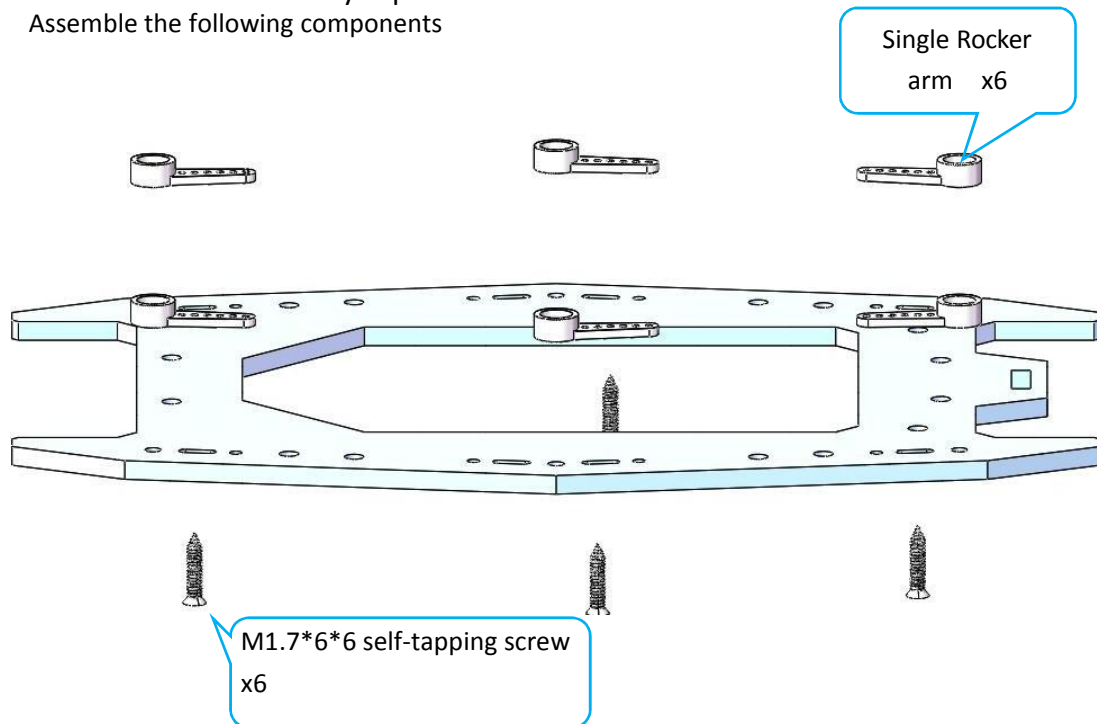
4. Before switching on, you need to insert the configured SD card into the Raspberry Pi. For details, please refer to the third chapter of the document. Otherwise, the servo will not rotate to the middle position after booting. In the next installation, the servos need to be connected to the robot HAT. And the Raspberry Pi will automatically adjust the servo to the correct angle.



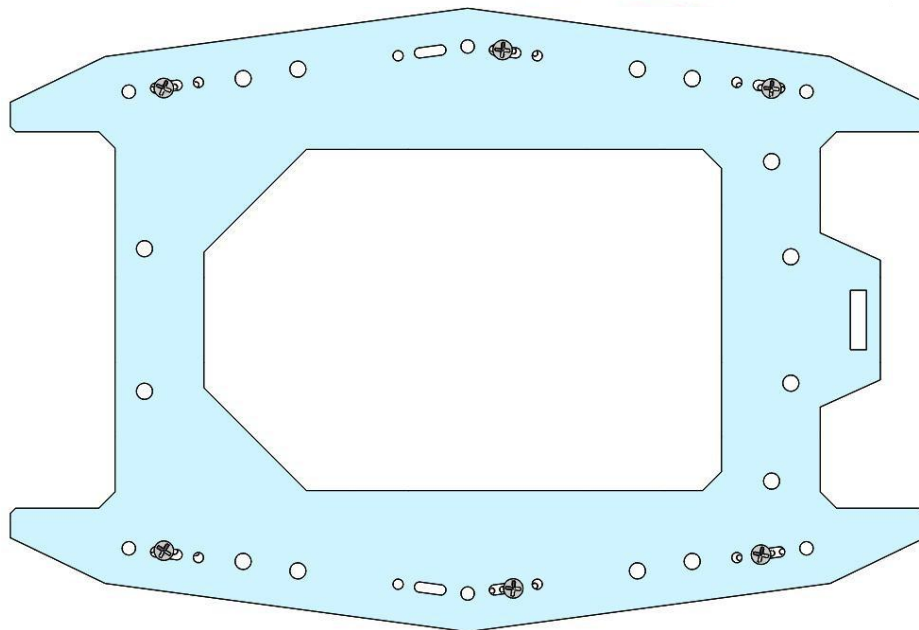
Turn the switch here to "ON" (power on), the servo will automatically rotate to the initial position. Wait about one minute for the servo to automatically rotate to the position of 90° and stay at 90° .Then you can proceed to the next step of assembly. If there is a power outage during the assembly process, turn on the power supply again and wait about one minute to continue.

2.4 install the arm

Fix a rocker arm to the acrylic plate.
Assemble the following components

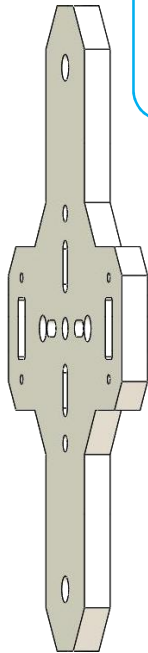


Effect diagram after assembling



Assemble the following components

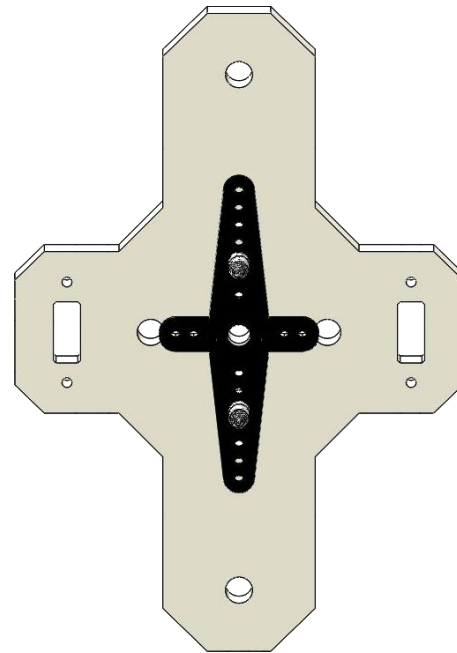
M1.7*6*6
Self-tapping
screw x2



4 foot
Rocker
arm x6

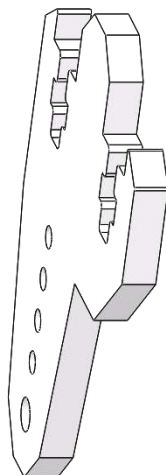
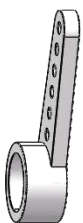


Effect diagram after assembling



Assemble the following components

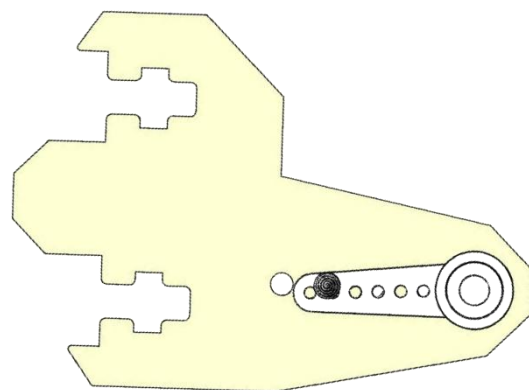
Single Rocker
arm x1



M1.7*6*6
Self-tapping
screw
x1



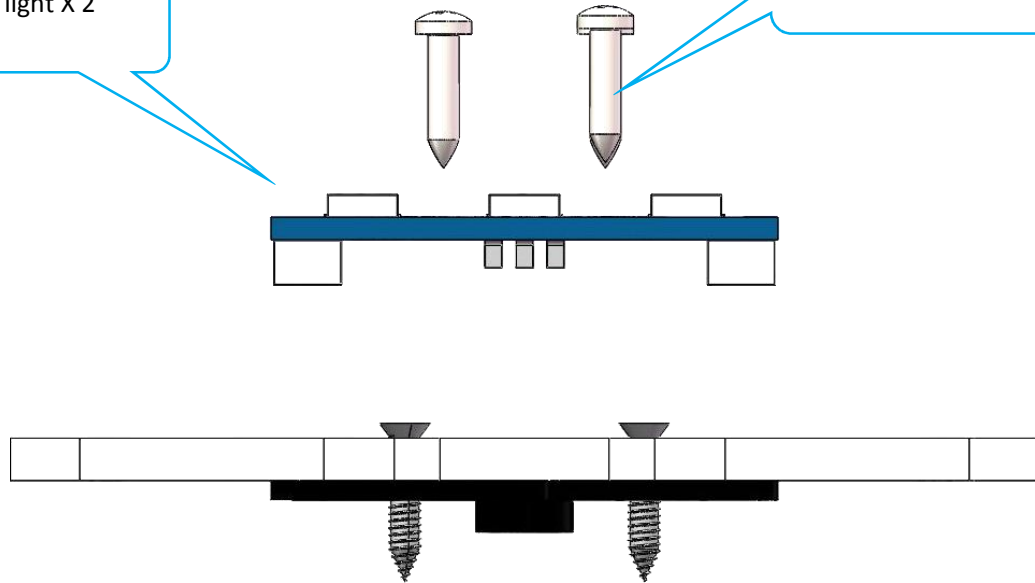
Effect diagram after assembling



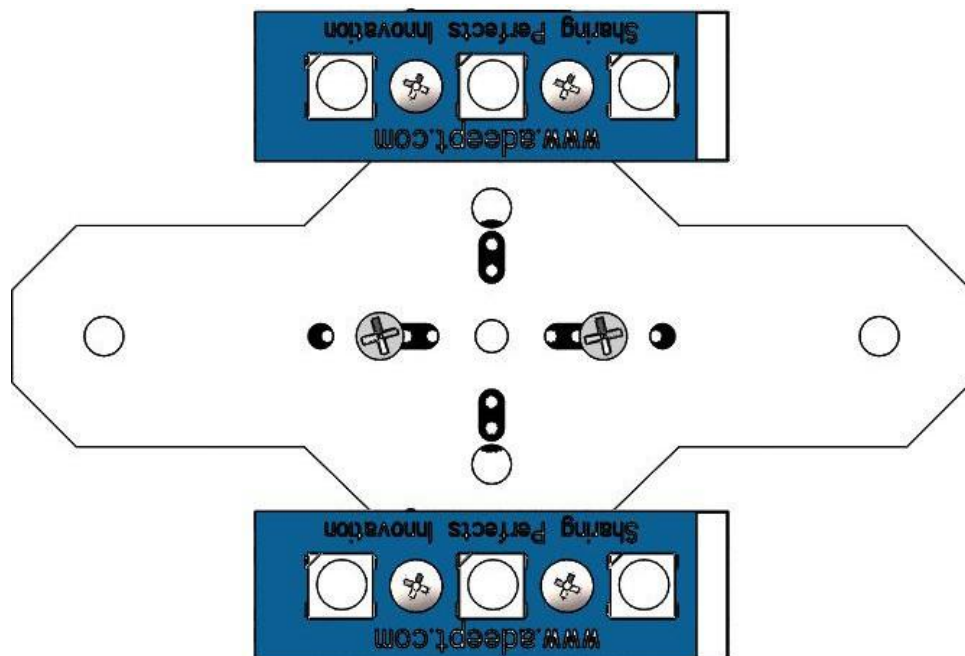
Assemble the following components

Car light X 2

M1.4*6 Self-tapping screws X4



Effect diagram after assembling



2.5 install the feet

Fix a debugged servo to the acrylic plate.

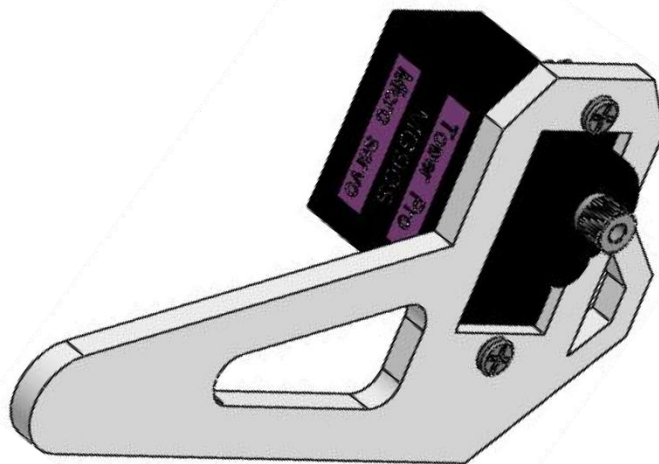
Assemble the following components

M2 Nut
X2

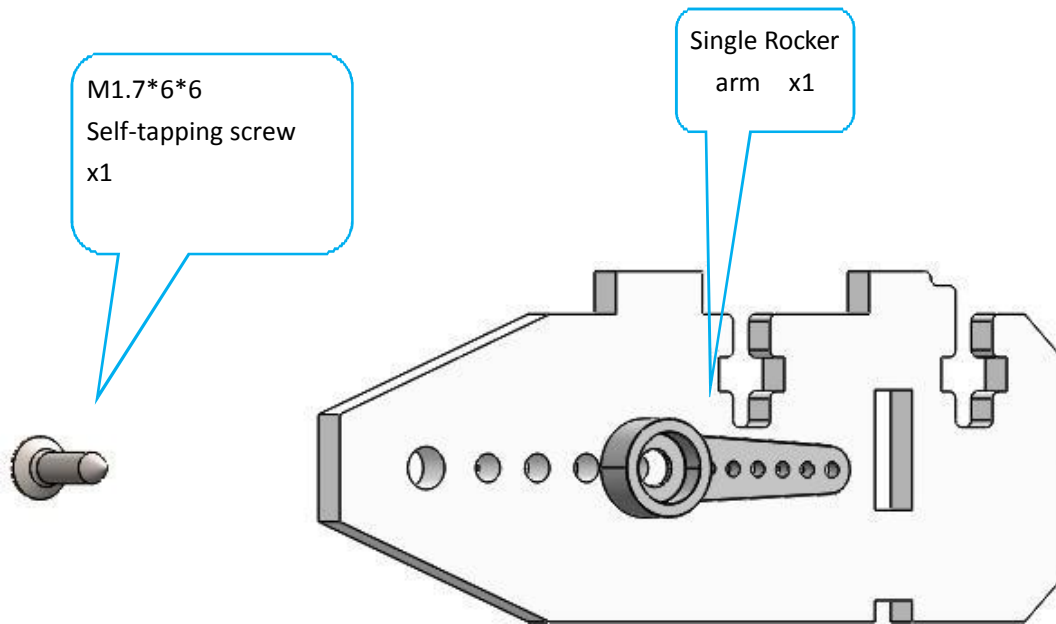
M2*8 Screw
X2

Servo x1

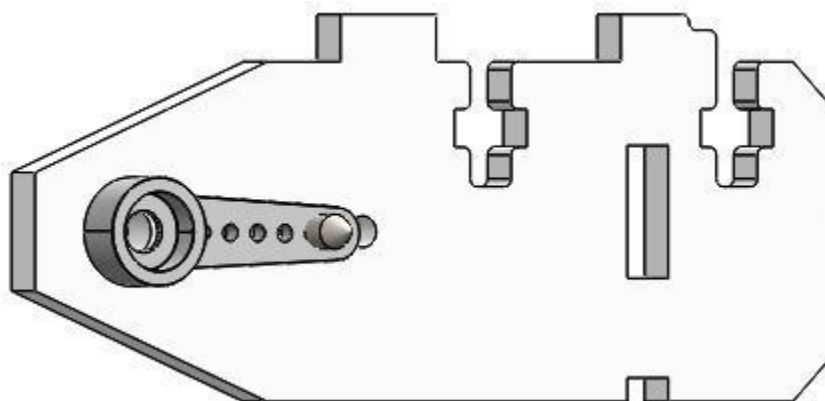
Effect diagram after assembling



Assemble the following components

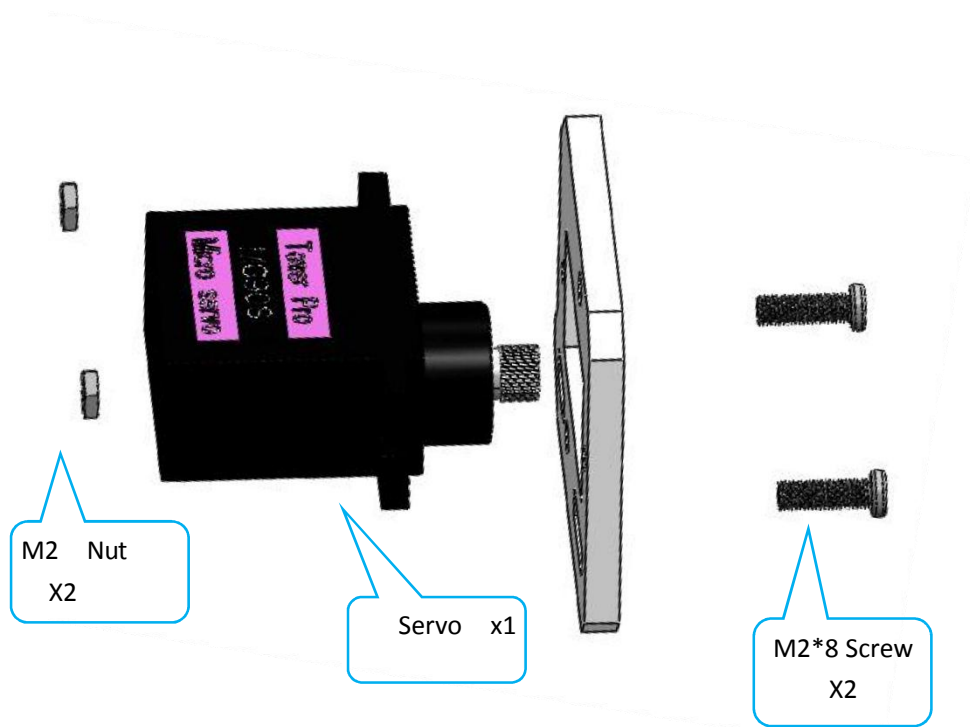


Effect diagram after assembling

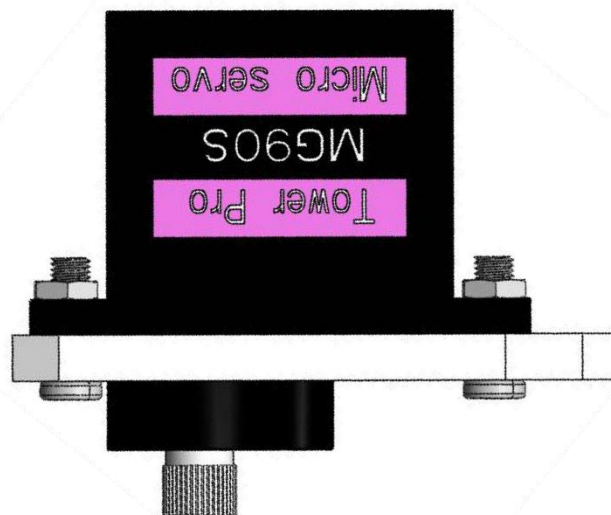


Fix a debugged servo to the acrylic plate.

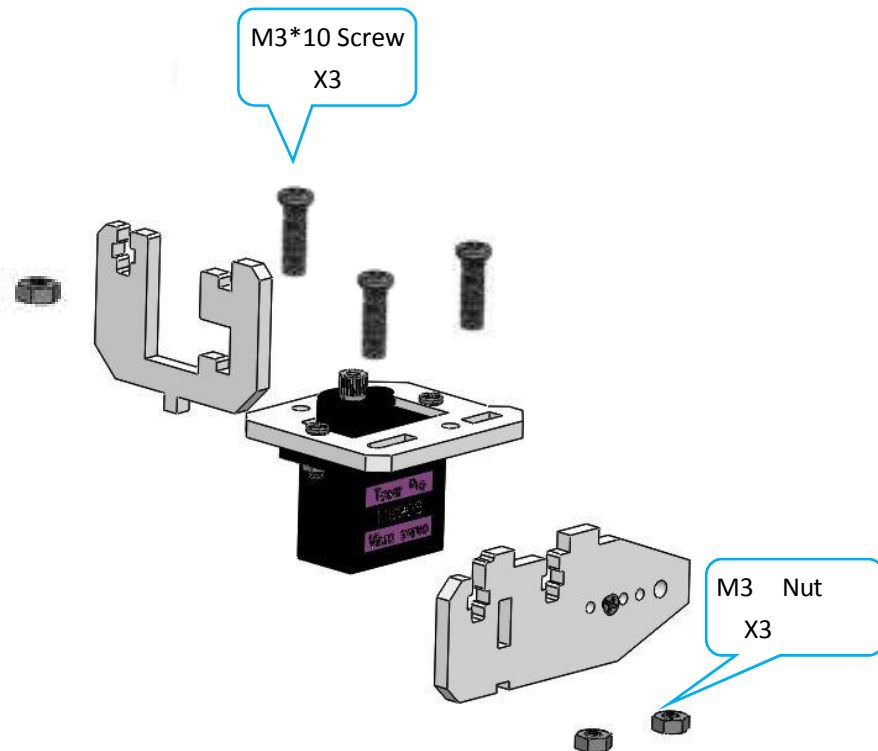
Assemble the following components



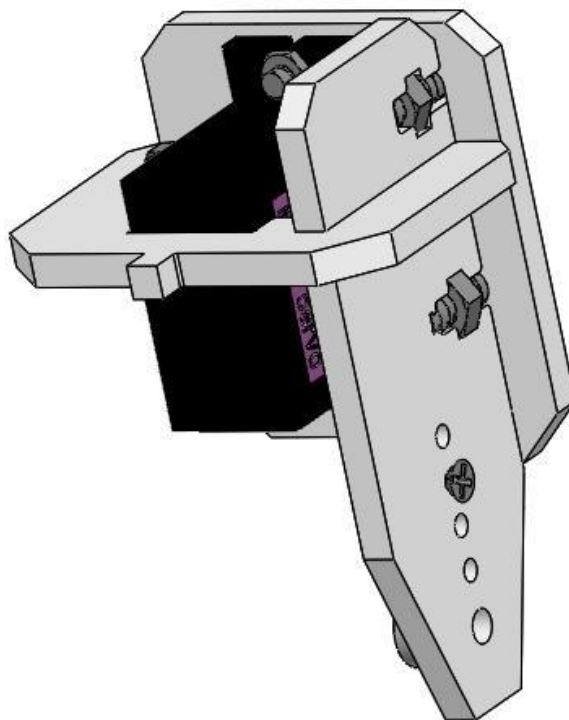
Effect diagram after assembling



Assemble the following components

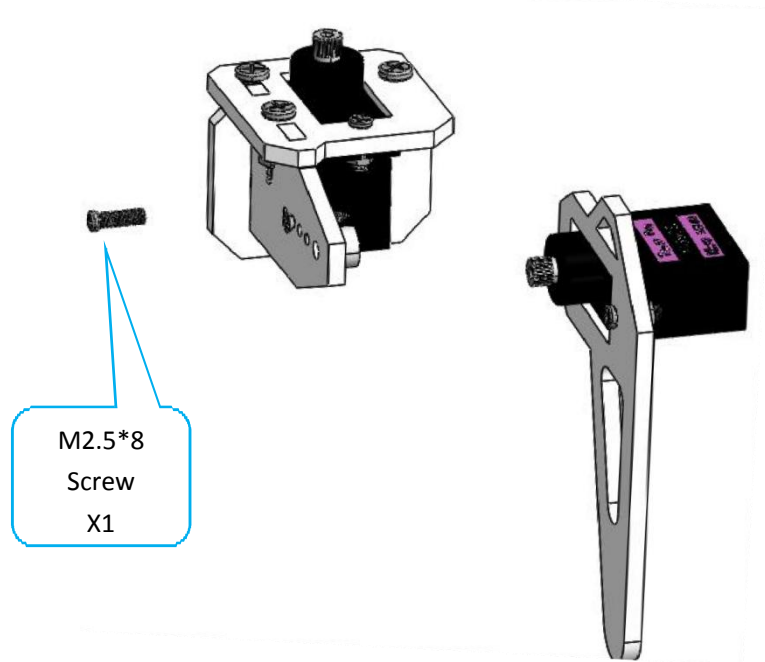


Effect diagram after assembling



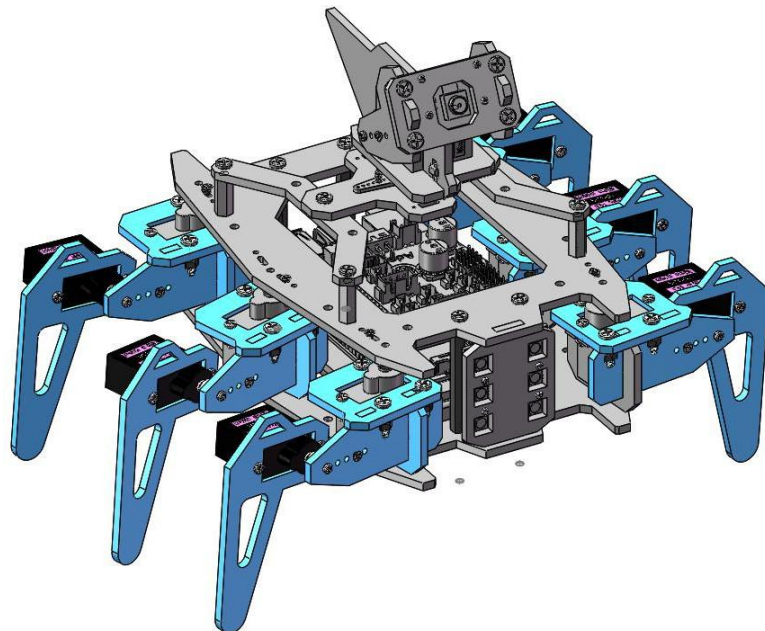
Fix Robot feet

Assemble the following components



The foot of the robot

Effect diagram after assembling

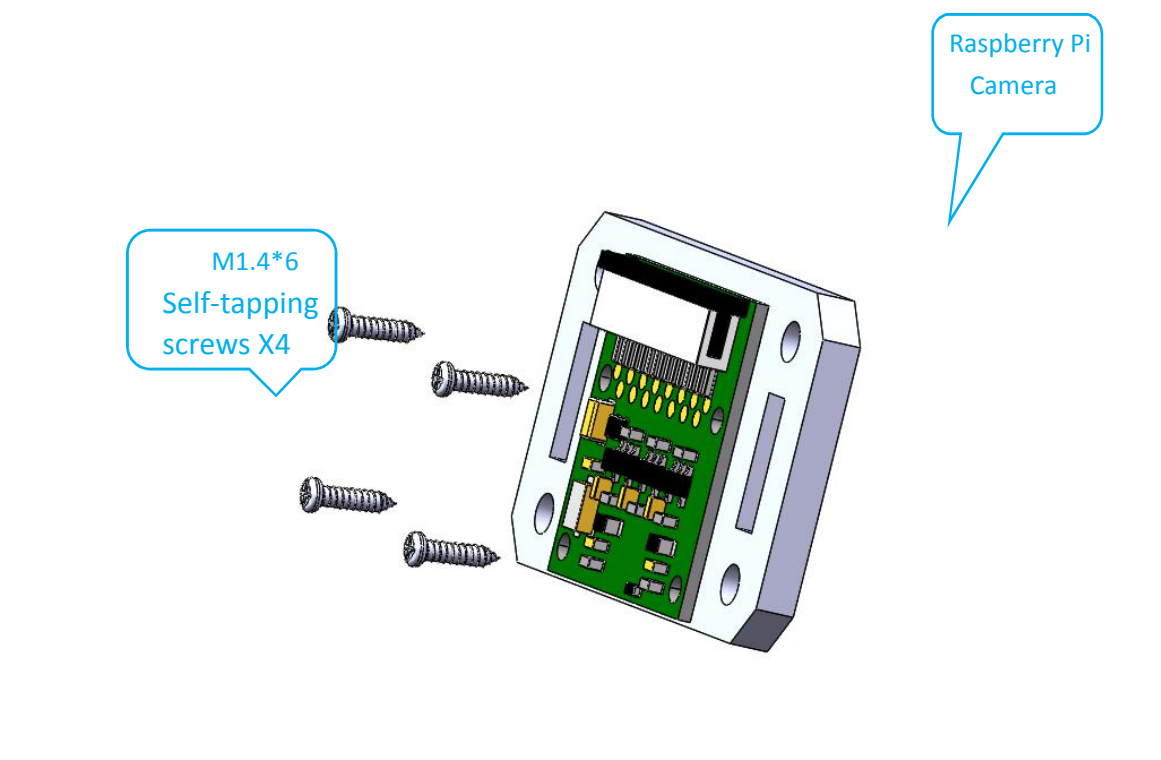


Install the servo and the acrylic plate on the right foot opposite from the ones on the left foot.

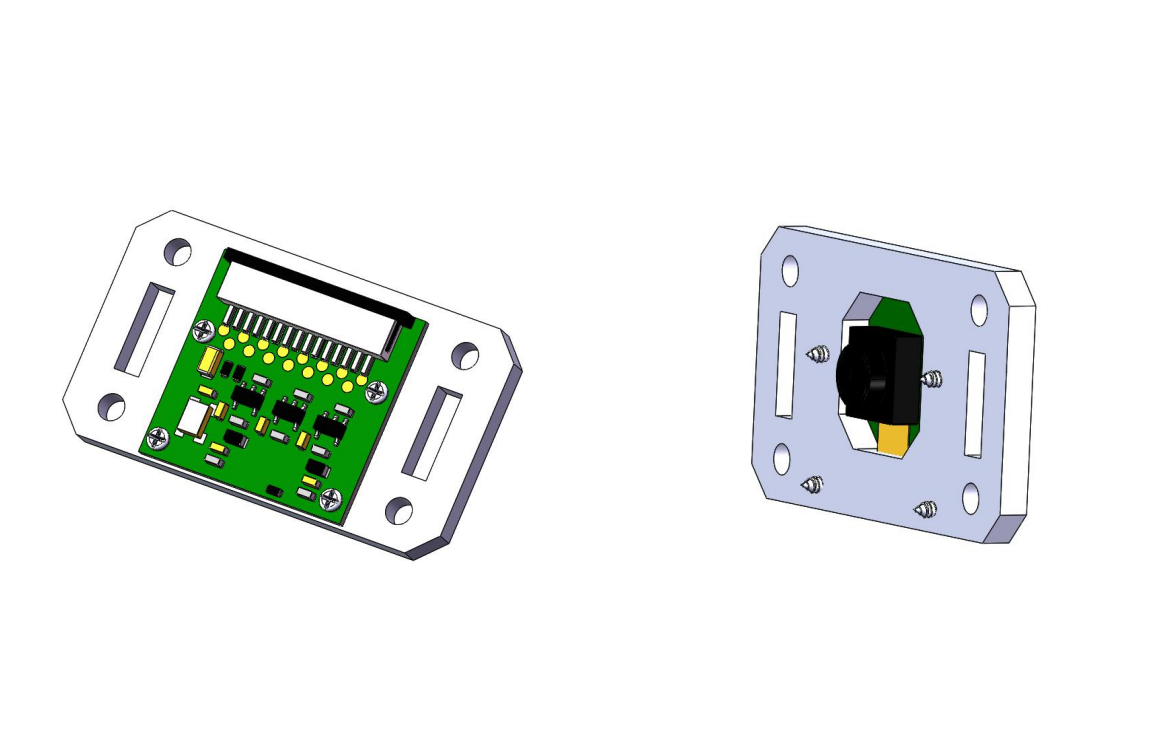
2.3 install the Camera

Fix Raspberry Pi Camera on Acrylic Plates

Assemble the following components

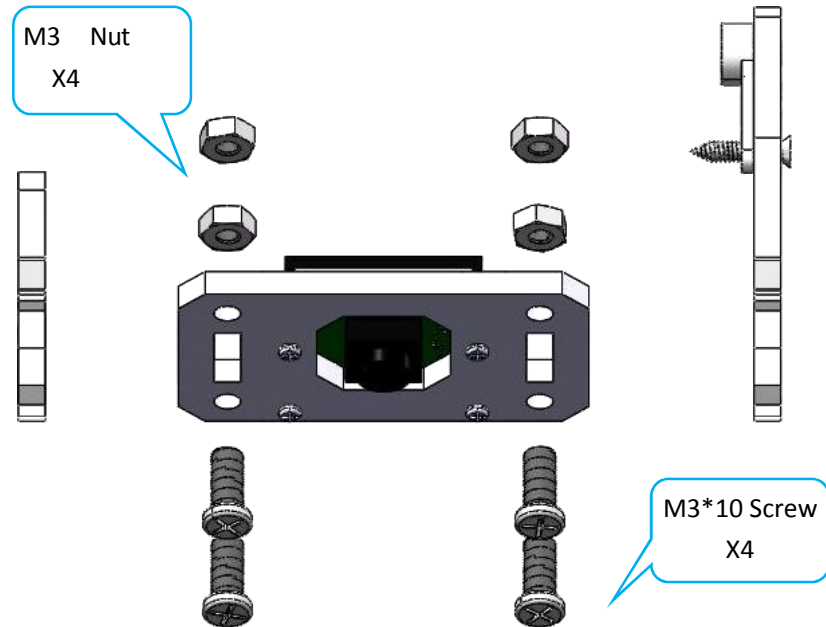


Effect diagram after assembling

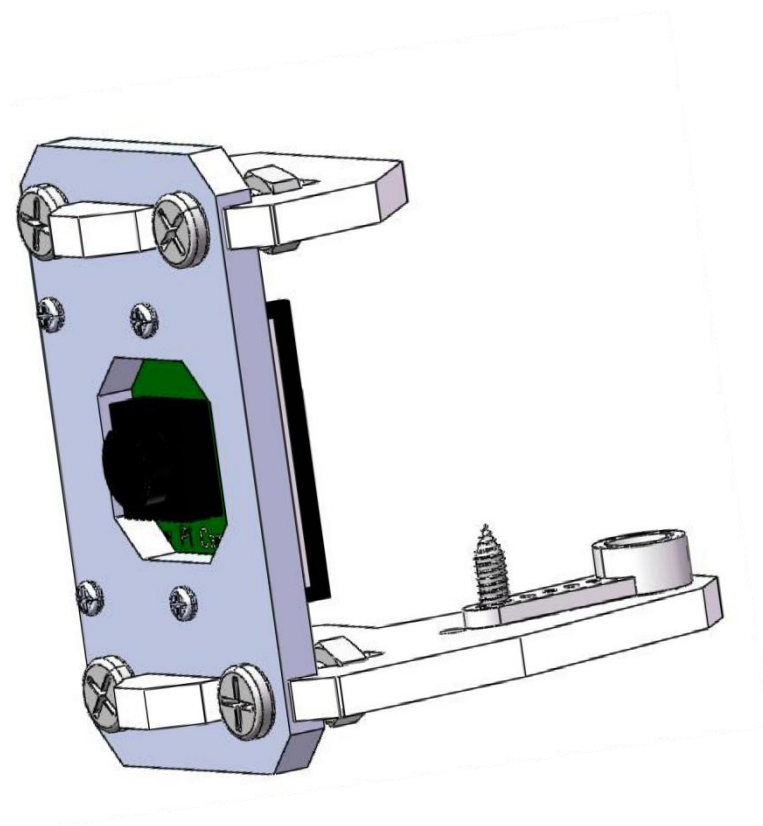


Assemble Pi Camera

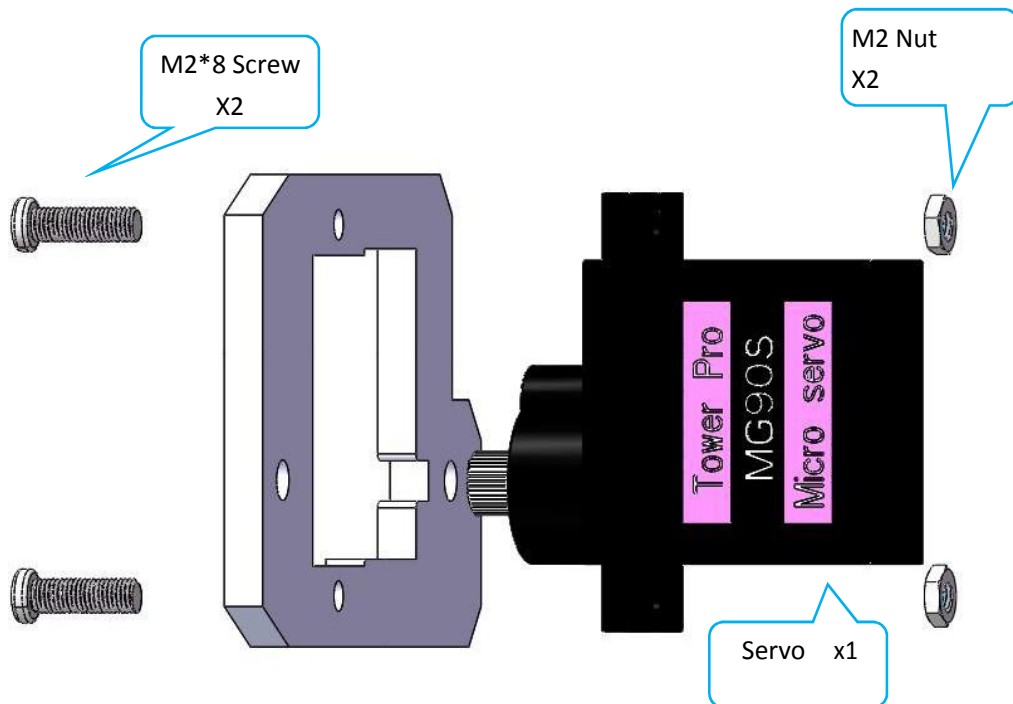
Assemble the following components



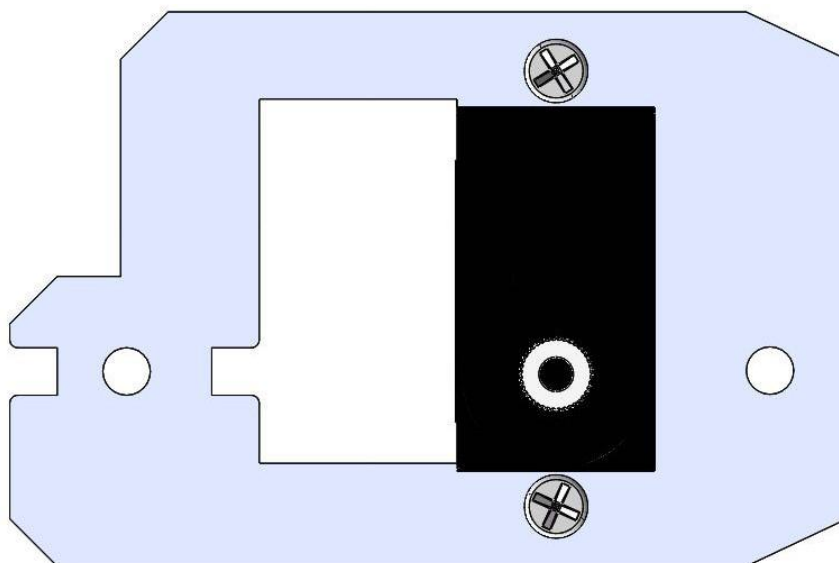
Effect diagram after assembling



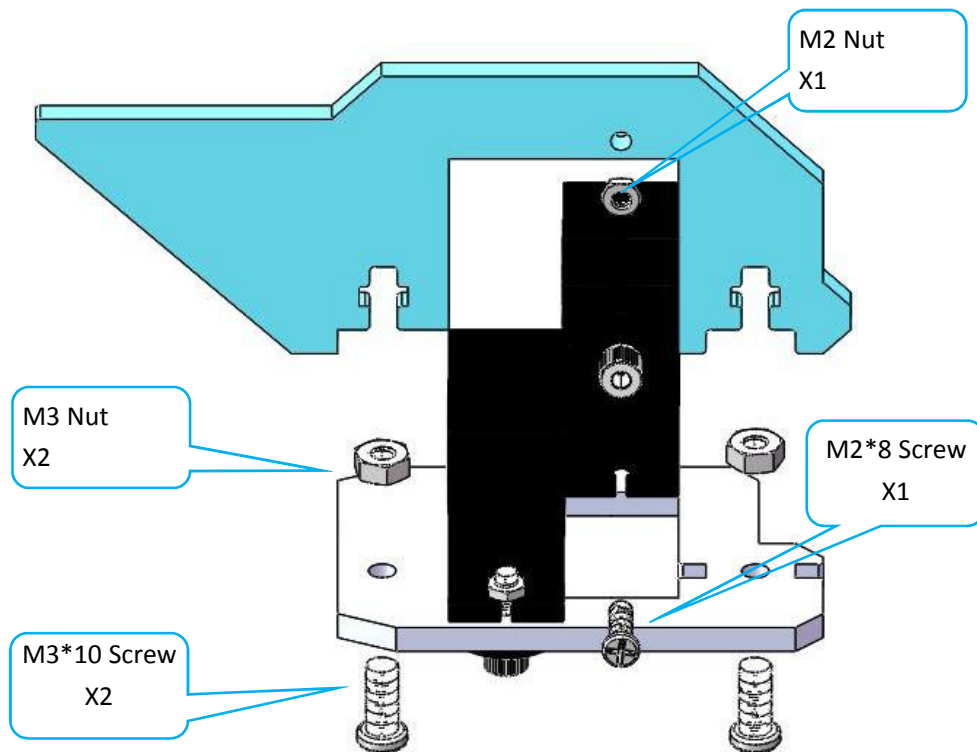
Assemble the following components



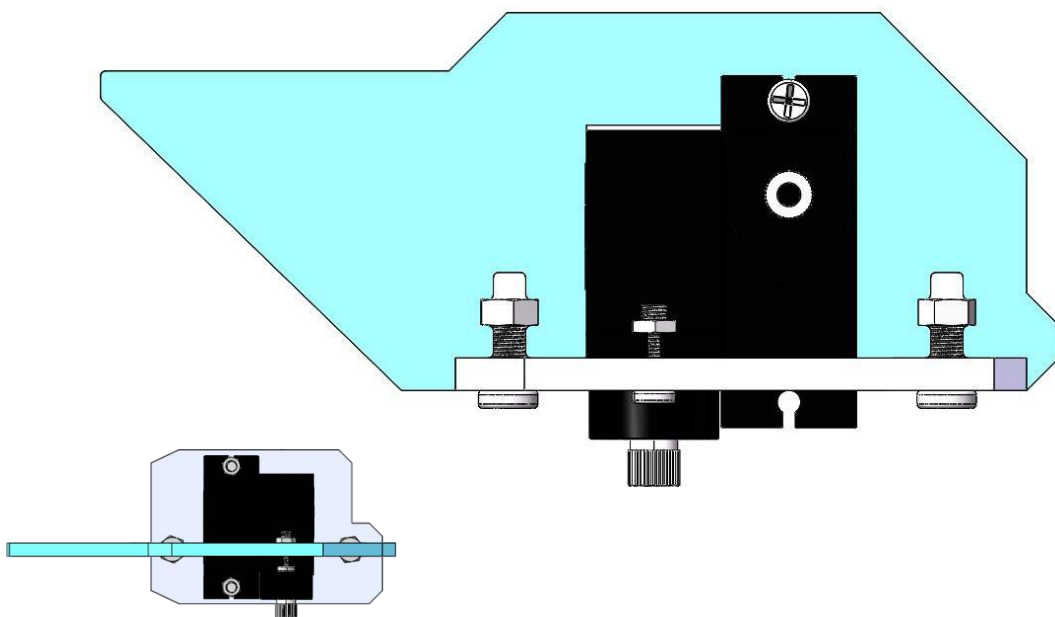
Effect diagram after assembling



Assemble the following components

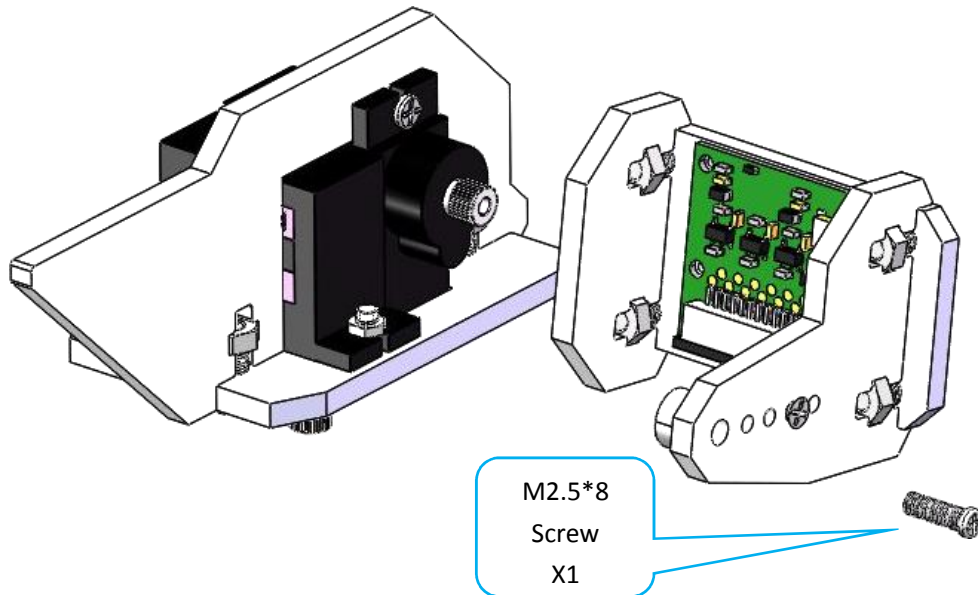


Effect diagram after assembling

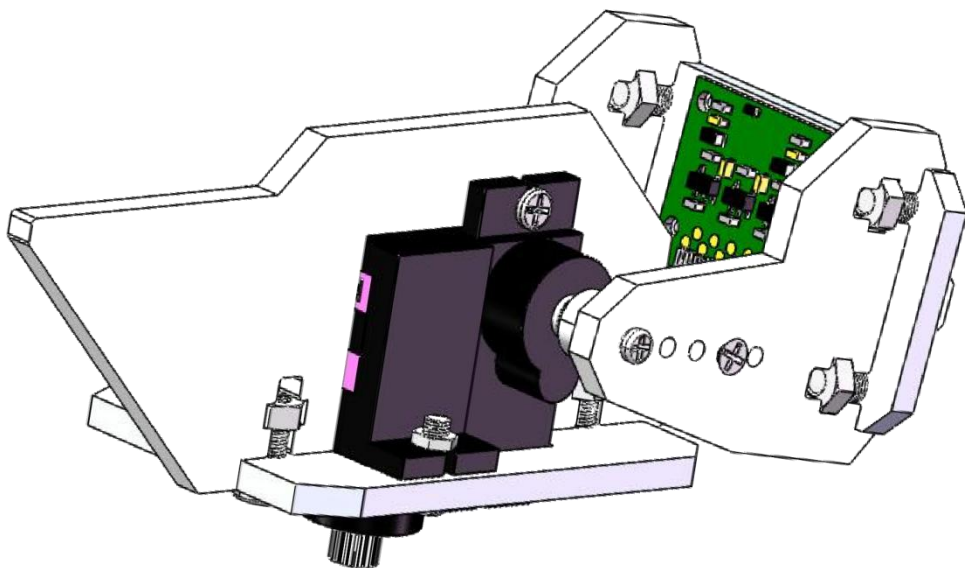


Connect Assemble Pi Camera

Assemble the following components



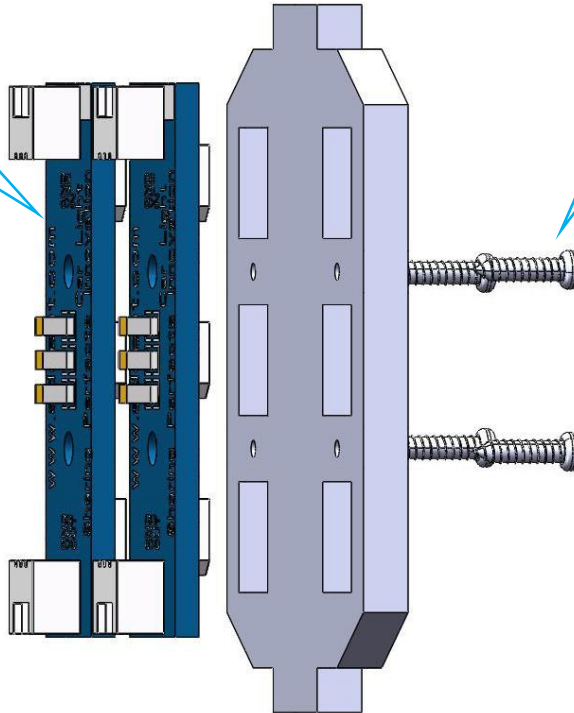
Effect diagram after assembling



Fix car light on Acrylic Plates

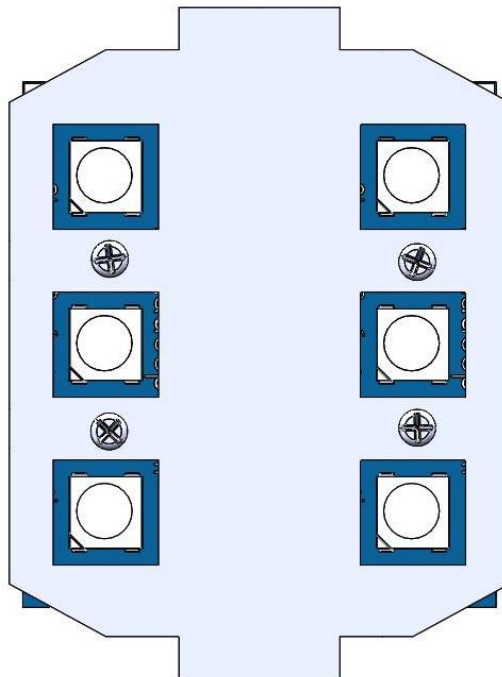
Assemble the following components

Car light
X 2

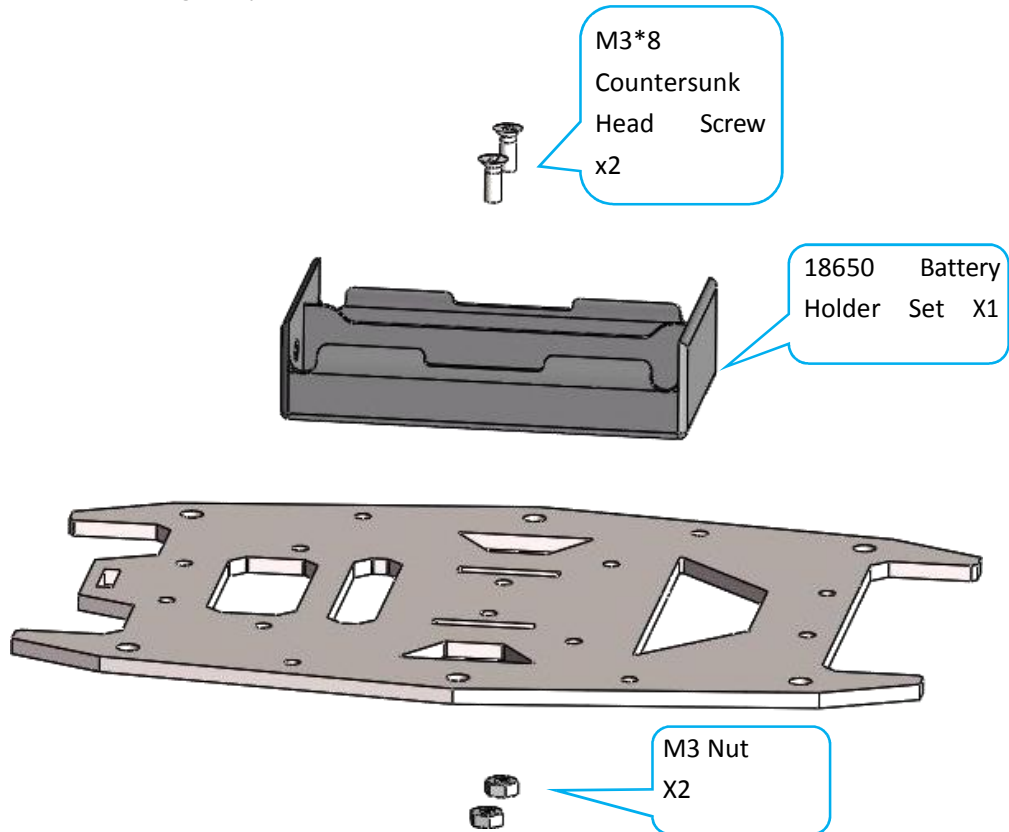


M1.4*6
Self-tappin
g screws X4

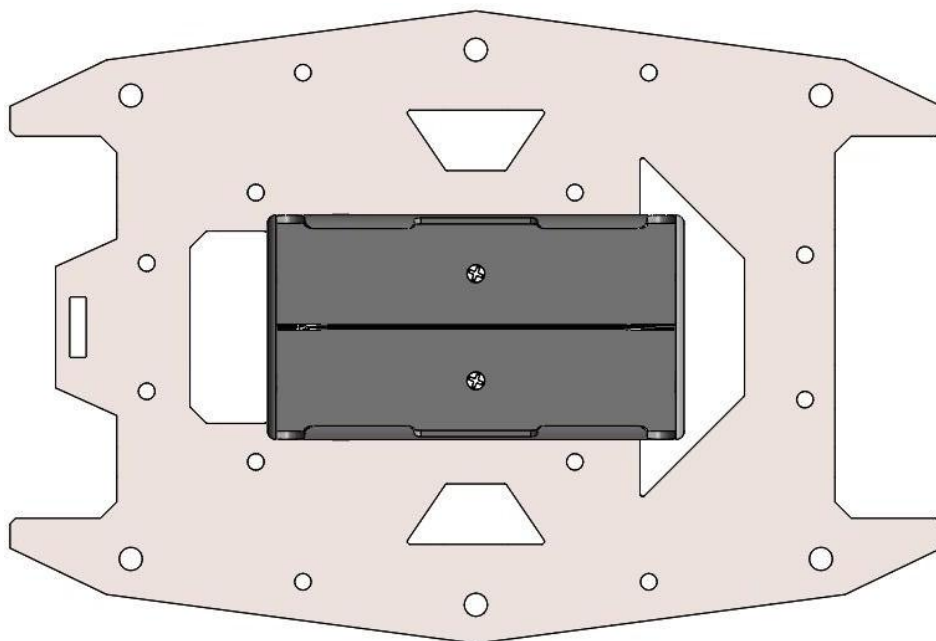
Effect diagram after assembling



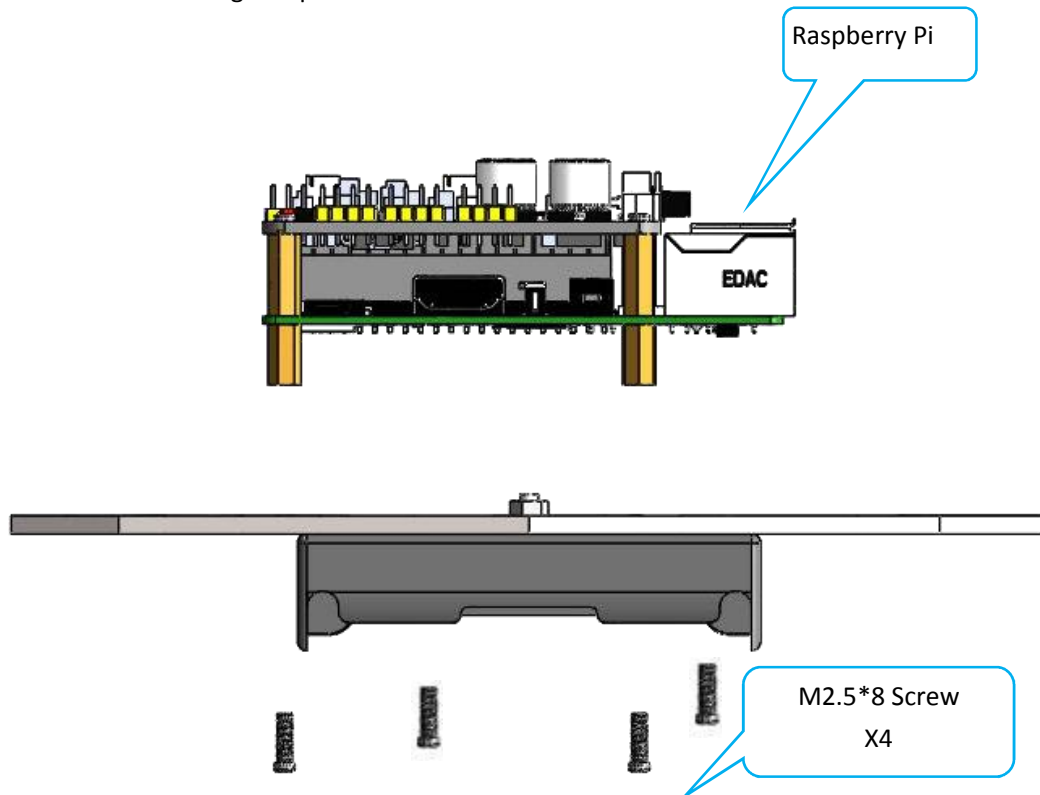
Assemble the following components



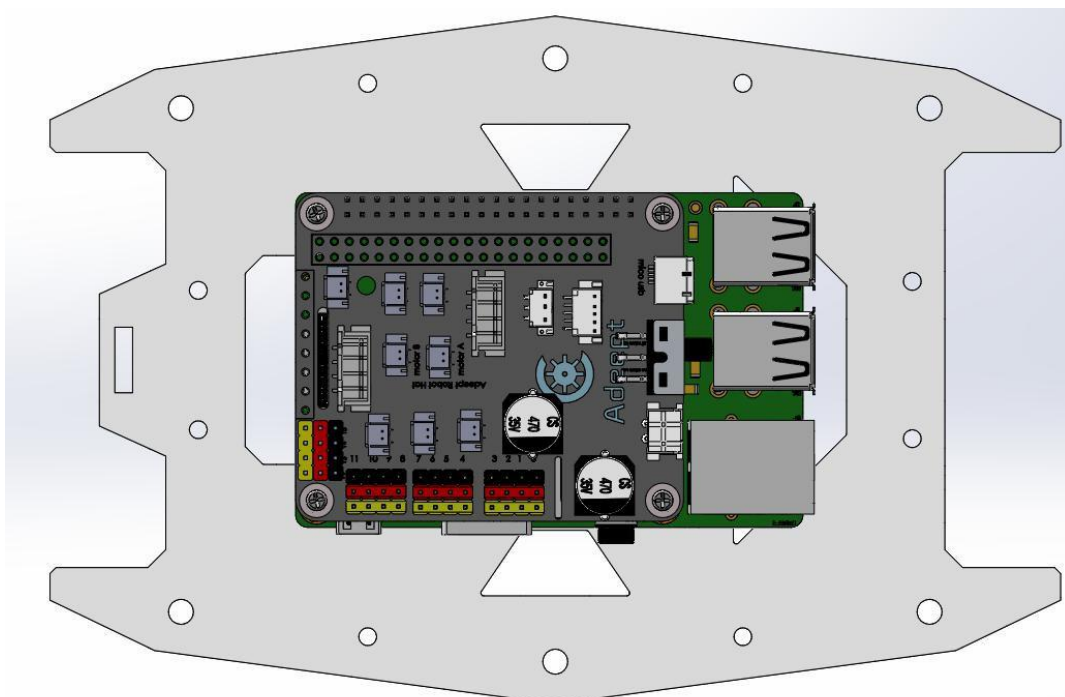
Effect diagram after assembling



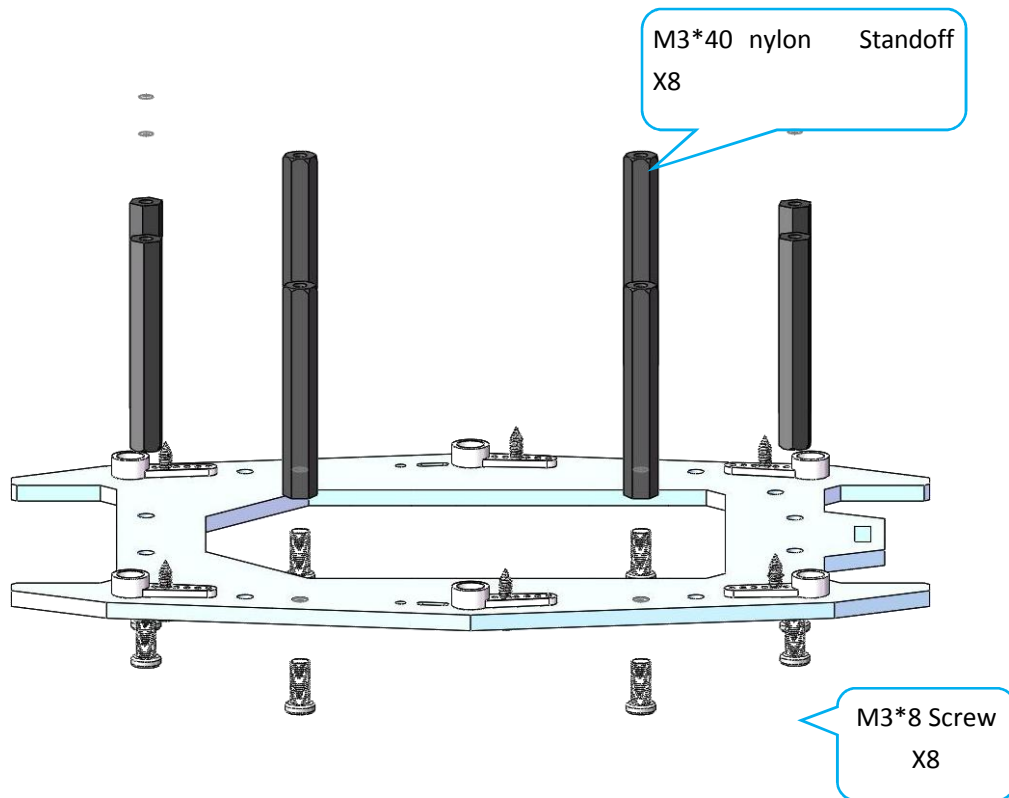
Assemble the following components



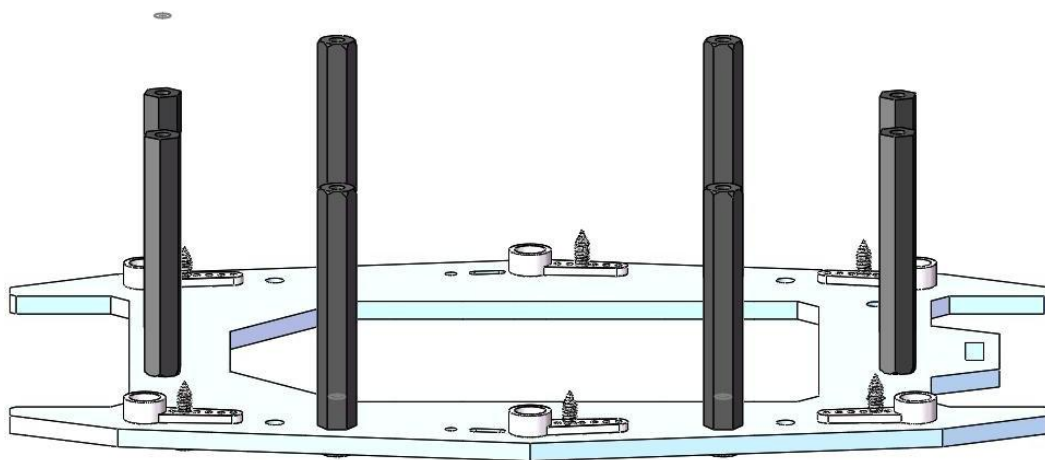
Effect diagram after assembling



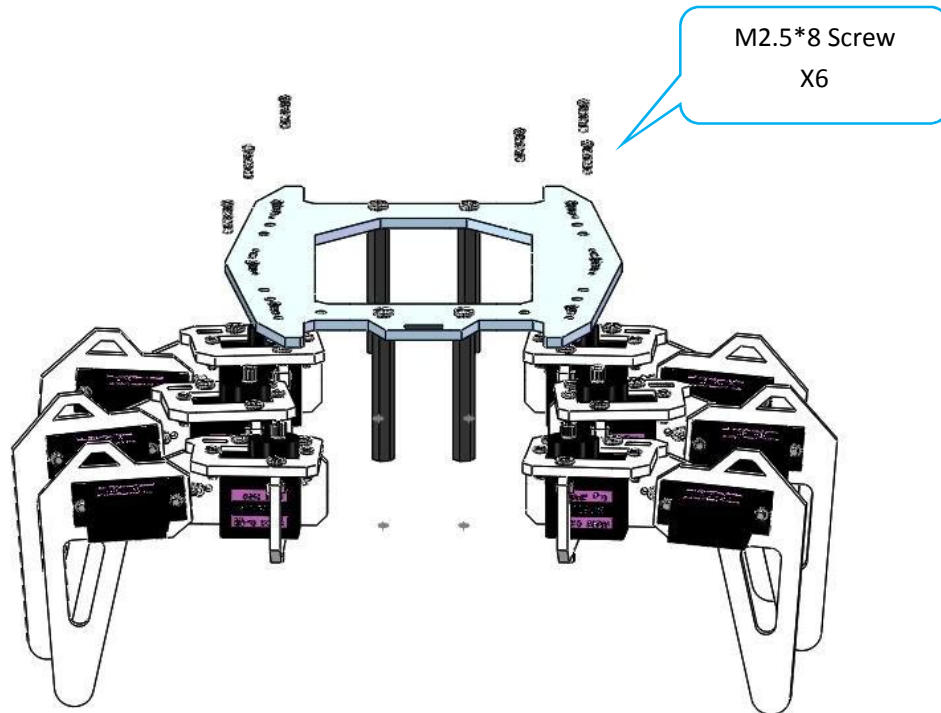
Assemble the following components



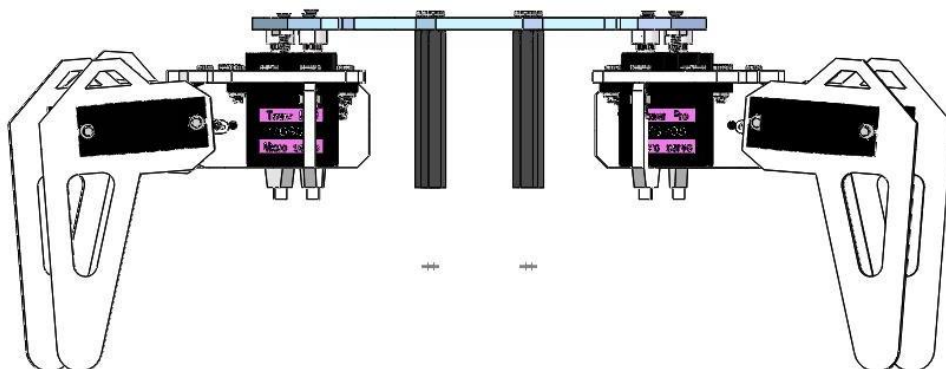
Effect diagram after assembling



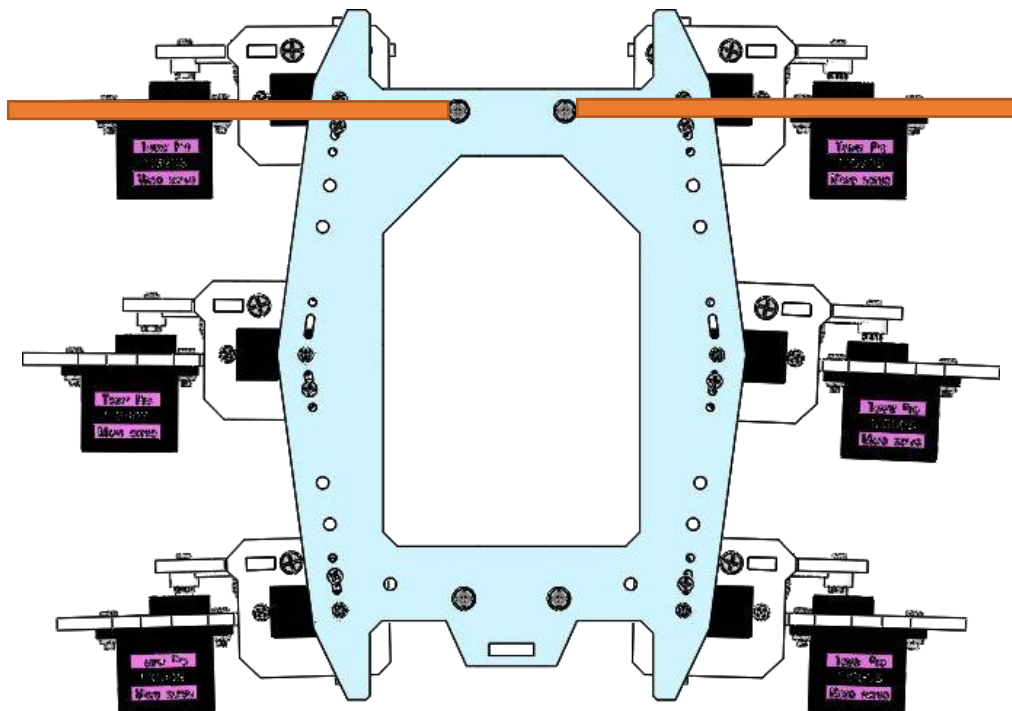
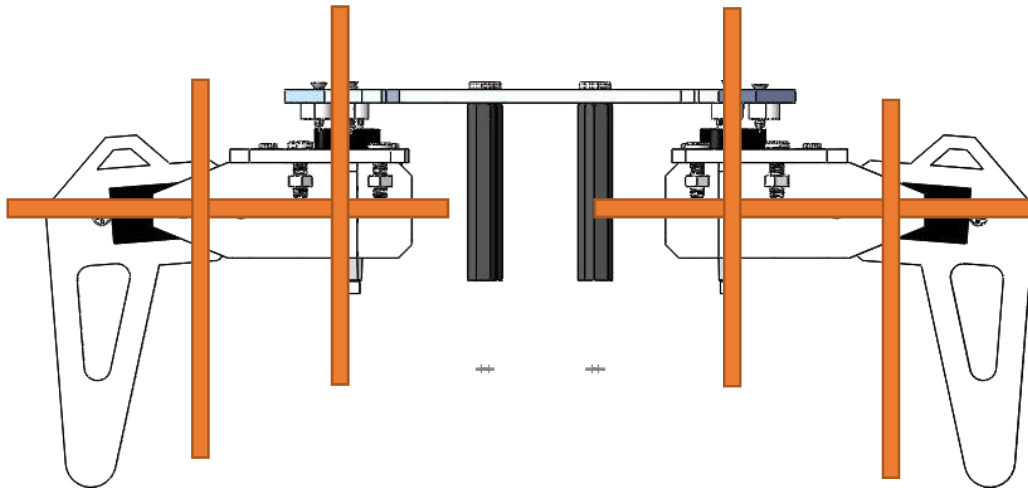
Assemble the following components



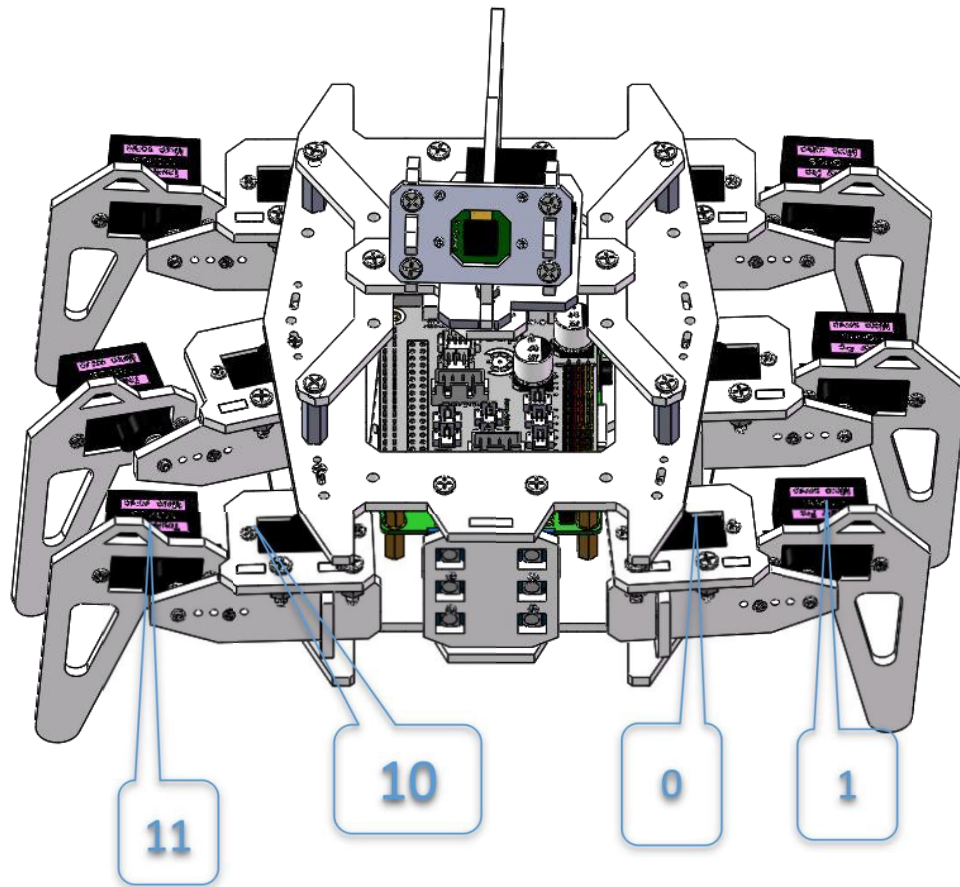
Effect diagram after assembling



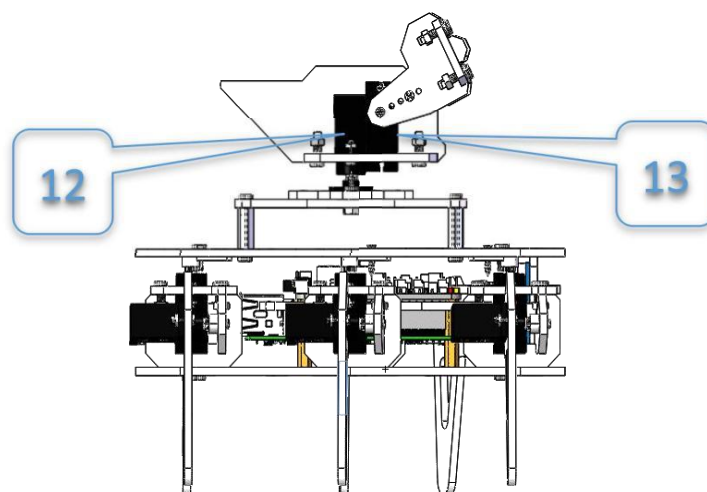
When connecting the servo to the acrylic plate, connect the wiring to PWM interface, the driver board will automatically check the position of the servo. Pay attention to the installation angle when installing the servo.

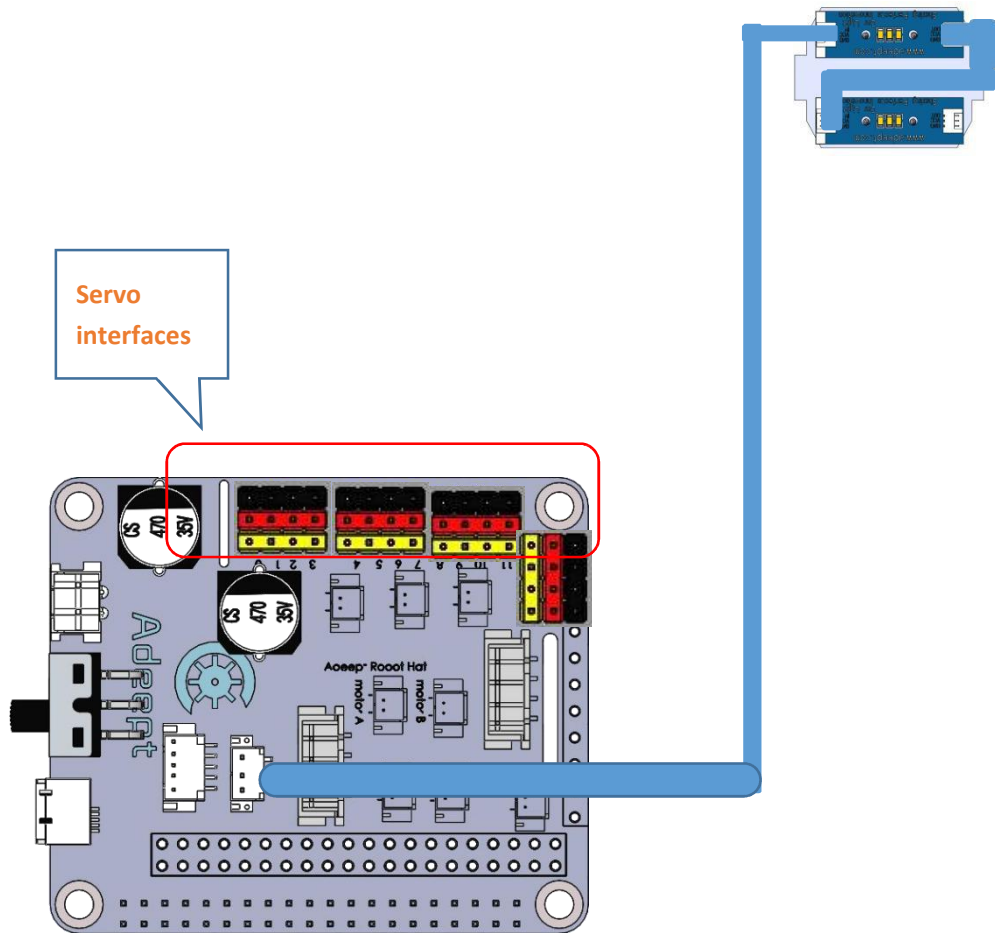


The corresponding PWM numbers of the driver board to the servos.

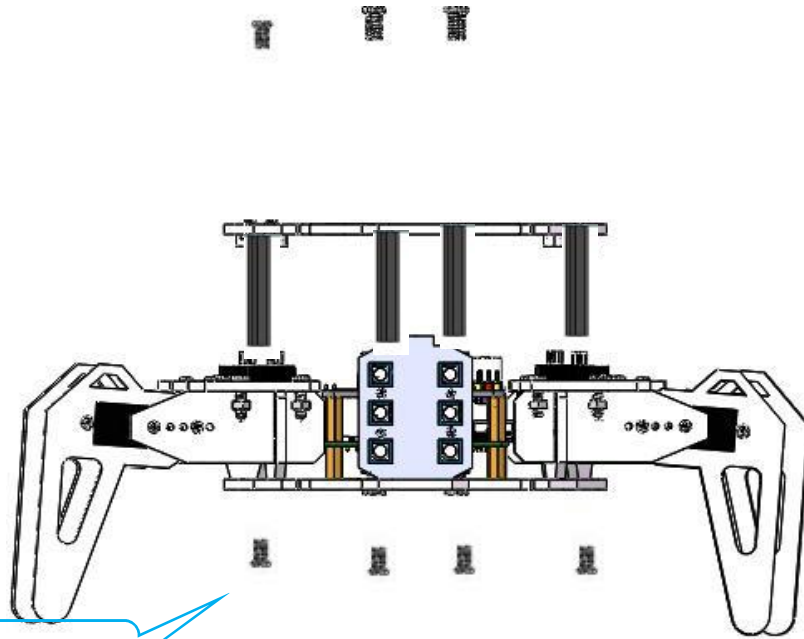


7	6	The body	4	5
9	8		2	3
11	10		0	1



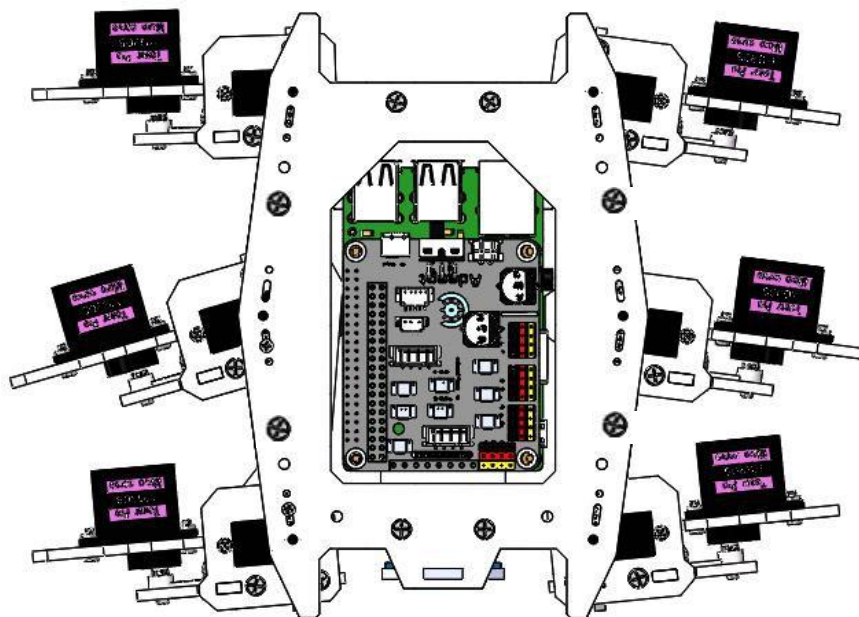


Assemble the following components

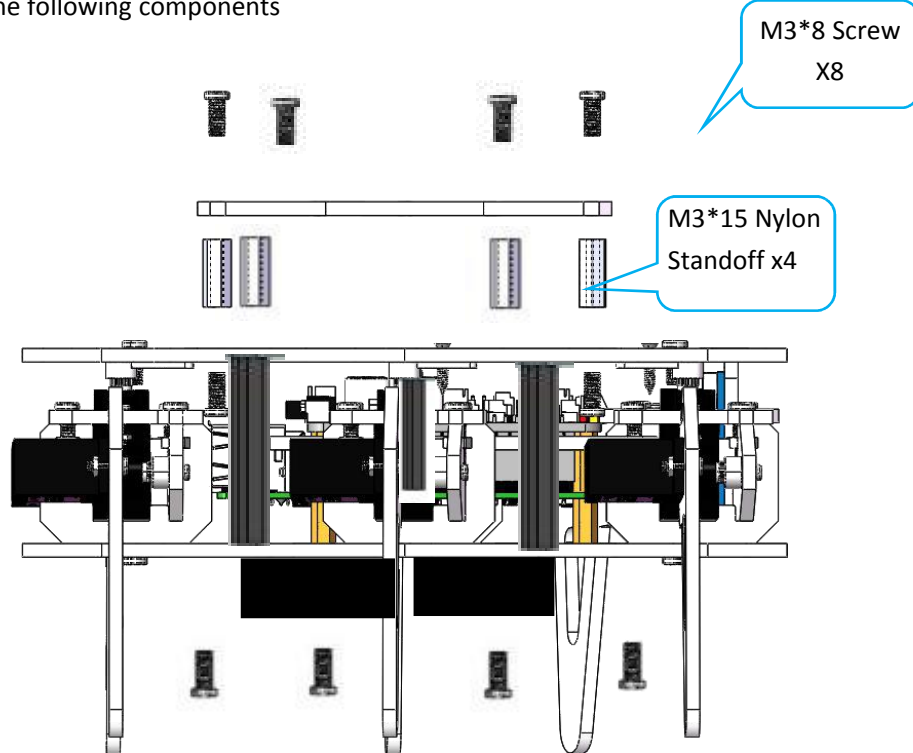


M3*8 Screw
X 8

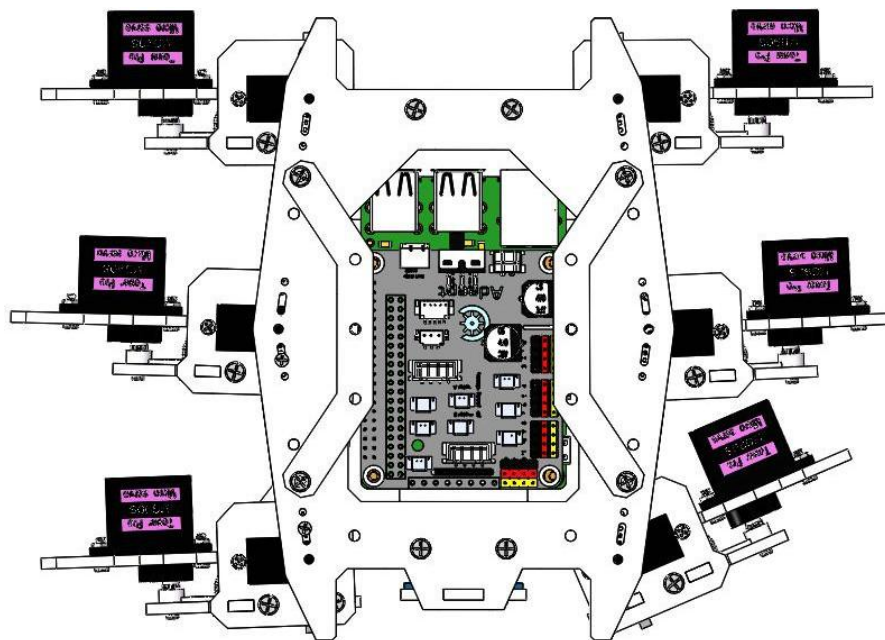
Effect diagram after assembling



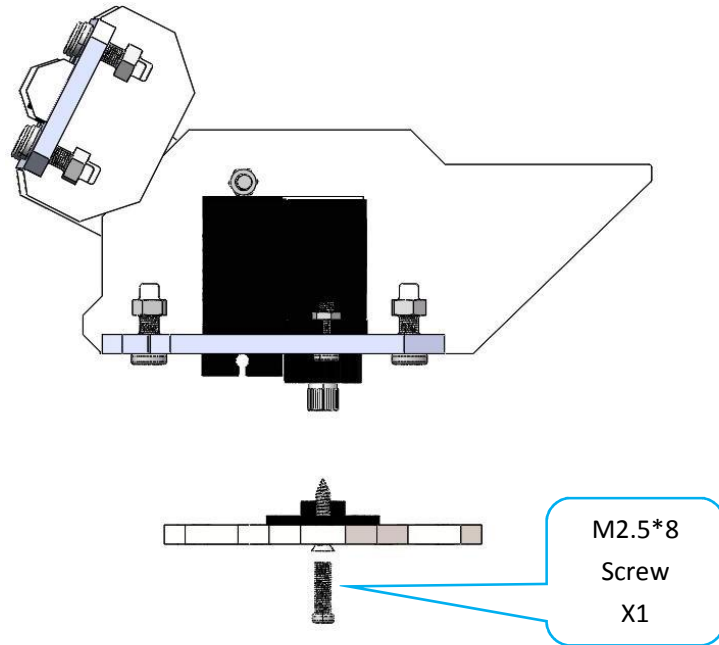
Assemble the following components



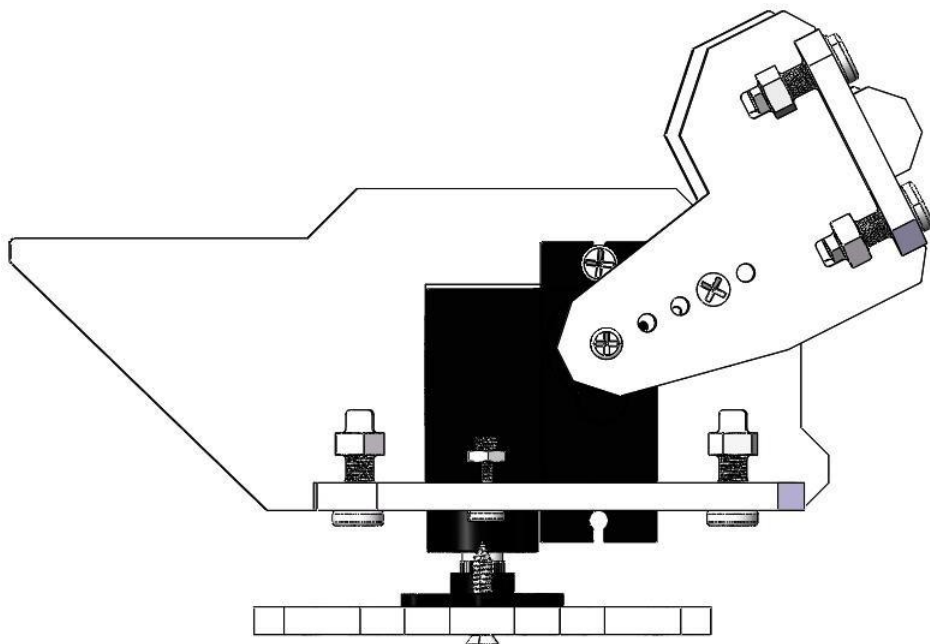
Effect diagram after assembling



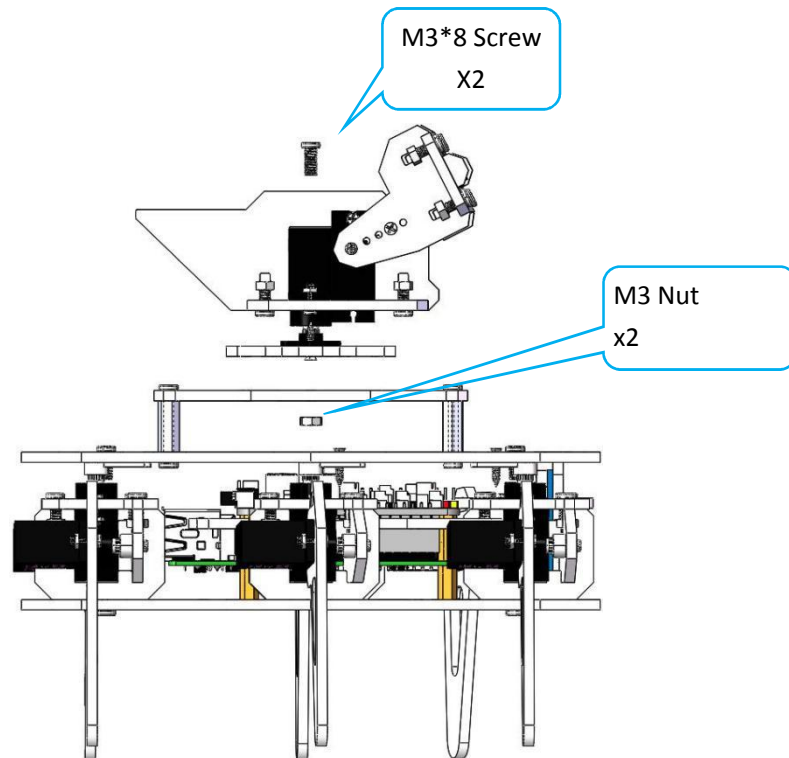
Assemble the following components



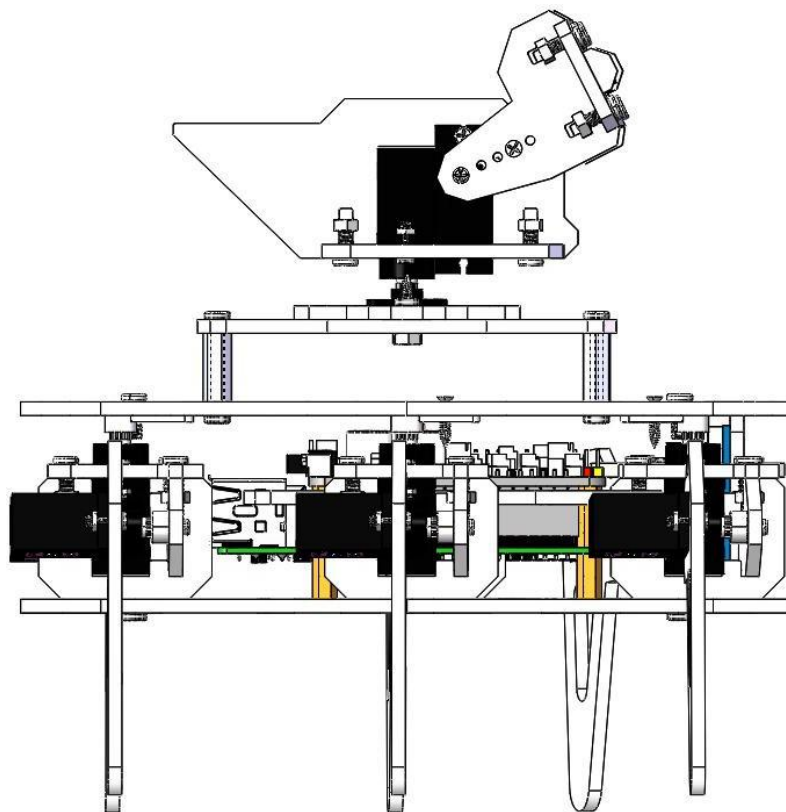
Effect diagram after assembling



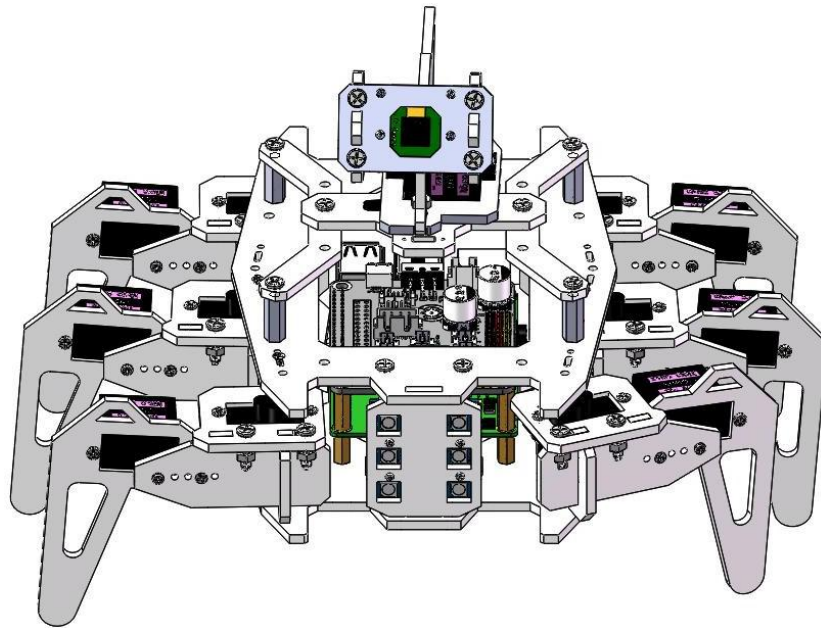
Assemble the following components



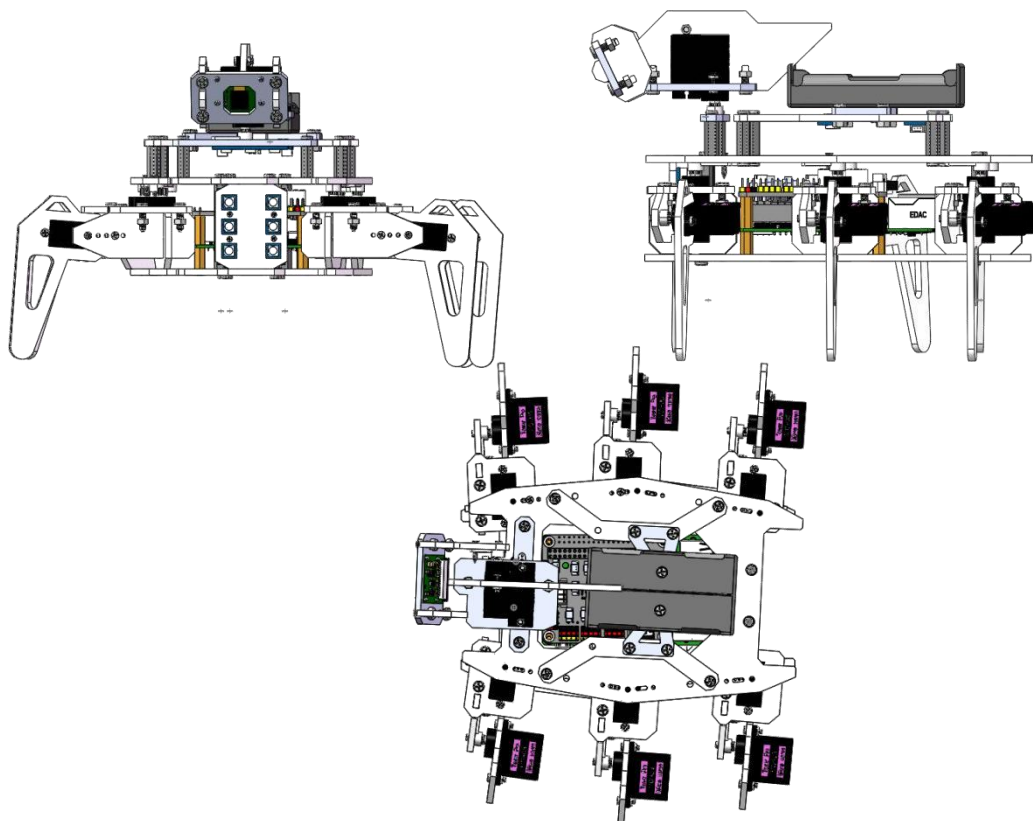
Effect diagram after assembling



Installation method one (suitable for flat road surface).



Installation method two suitable for uneven road surface .



Software Installation

You can Find general video tutorials for the software installation section in :

<https://www.adeept.com/video/detail-30.html>

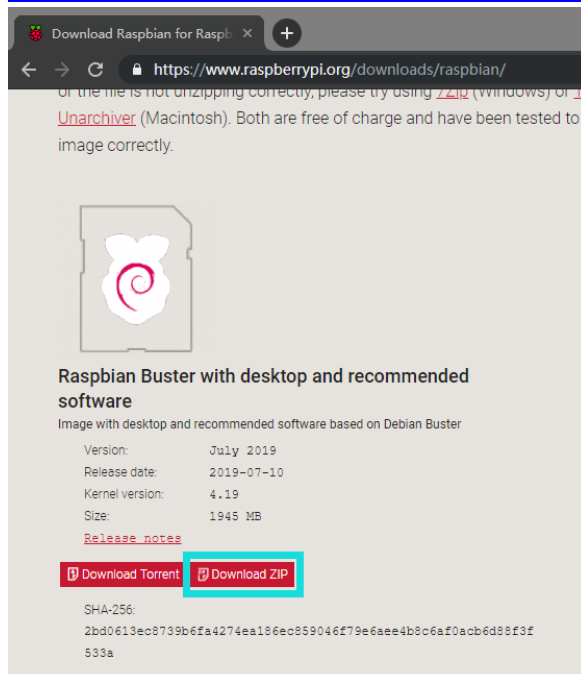
Raspberry Pi system installation & setup

Download image file of Raspberry Pi system (Raspbian)

First we need to log in to the Raspberry Pi official website to download the image file of the Raspberry Pi system

Raspberry Pi official website:

<https://www.raspberrypi.org/downloads/raspbian/>



Download the complete version of Raspbian (Buster with desktop and recommended software) ,download the ZIP file of this image to the local and unzip it.

Download and install Win32 Disk Imager

Win32 Disk Imager is an image burning tool. Use it to burn the Raspberry Pi system just unzipped into the SD card.

Download address:

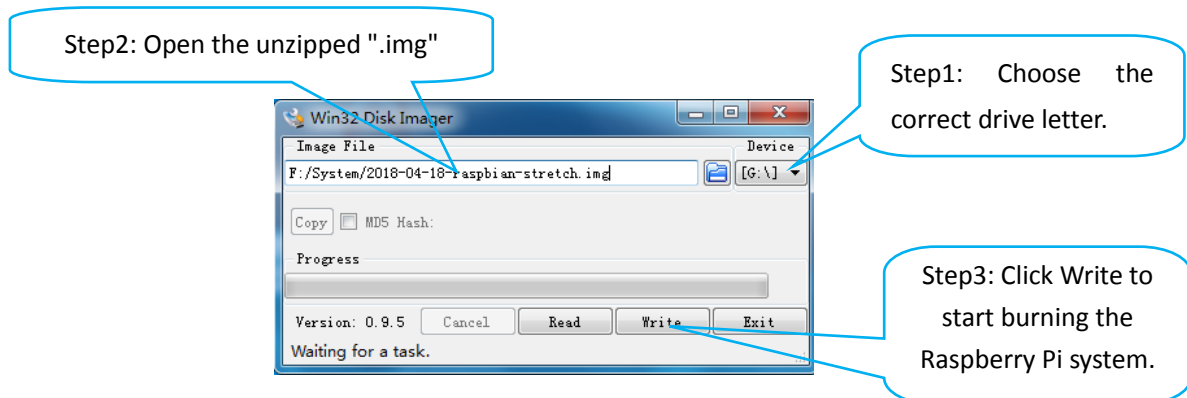
<https://sourceforge.net/projects/win32diskimager/>



Burn the Raspberry Pi system (Raspbian) into SD card

First, insert the SD card into the card reader, then connect the card reader to the computer, run Win32 Disk Imager, select the drive letter of the SD card in the Device on the right. Do not choose the wrong, because the next operation will burn the Raspberry Pi system in the selected drive letter, and delete all the files in that drive letter.

After selecting the SD card drive letter in Device, click the folder icon to the left of the SD card drive letter to find the previously unzipped Raspberry Pi image file. The image file name here will be updated with the official website of the Raspberry Pi. No need to be exactly the same as the name in the picture below, as shown in the figure:



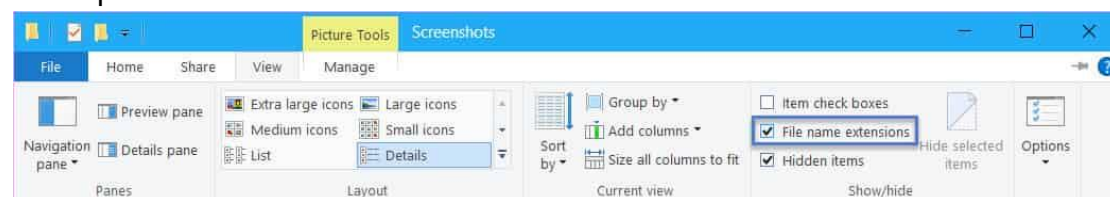
Make sure the selected drive letter is correct again, and then click Write to start burning the Raspberry Pi system. This process may take more than ten minutes. You can make use of the time to continue to prepare the following content.

Enable the SSH service of Raspberry Pi and set WIFI for Raspberry Pi

The way we use does not need to set up the Raspberry Pi with peripherals such as display and keyboard. While waiting for the Raspberry Pi system to write to the SD card, you can proceed to prepare two files and copy the two files to the SD card to be burned with the Raspberry Pi system. And then insert the SD card into the Raspberry Pi to boot. The Raspberry Pi will automatically start the SSH service and connect to WIFI. You can remotely control the Raspberry Pi to perform the installation of the robot software.

Since some operations involve changing the file extension, first you need to display the file extension:

File Explorer-View-Tick file name extensions



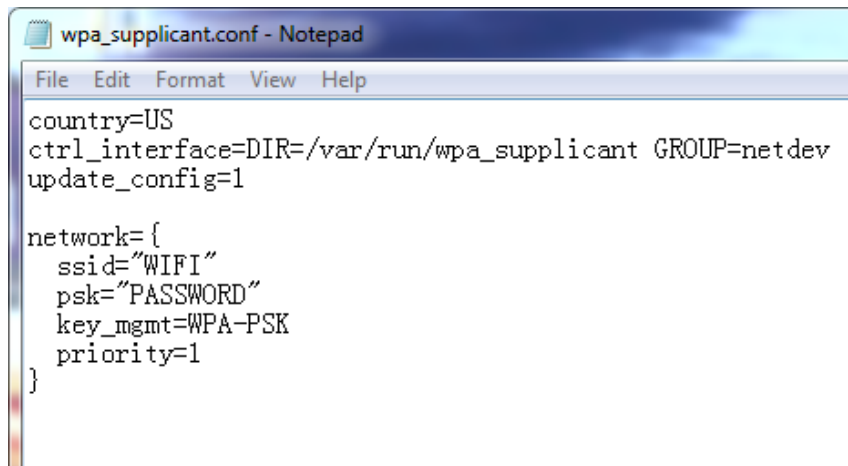
Create a new file named **ssh** anywhere on your computer without any extension.

You can create a new ssh.txt first and then delete the .txt.

Create a new file named **wpa_supplicant.txt**, and write in the following content

```
country=US
ctrl_interface=DIR=/var/run/wpa_supplicant GROUP=netdev
update_config=1

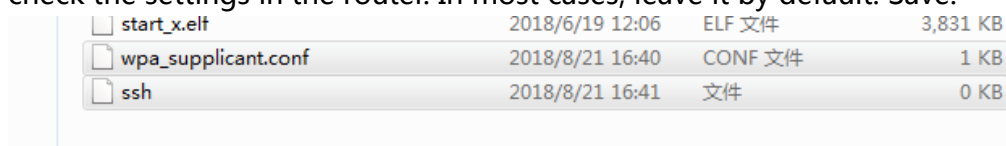
network={
    ssid="WIFI"
    psk="PASSWORD"
    key_mgmt=WPA-PSK
    priority=1
}
```



```
wpa_supplicant.conf - Notepad
File Edit Format View Help
country=US
ctrl_interface=DIR=/var/run/wpa_supplicant GROUP=netdev
update_config=1

network={
  ssid="WIFI"
  psk="PASSWORD"
  key_mgmt=WPA-PSK
  priority=1
}
```

Where country = US is area setting , you can leave it unchanged; Change WIFI of ssid = "WIFI" to the name of your own WIFI (the name of the WIFI that the Raspberry Pi needs to connect automatically when booting); Change PASSWORD of psk= "PASSWORD" to WIFI password; key_mgmt is the encryption method. You can check the settings in the router. In most cases, leave it by default. Save.



<input type="checkbox"/> start_x.elf	2018/6/19 12:06	ELF 文件	3,831 KB
<input type="checkbox"/> wpa_supplicant.conf	2018/8/21 16:40	CONF 文件	1 KB
<input type="checkbox"/> ssh	2018/8/21 16:41	文件	0 KB

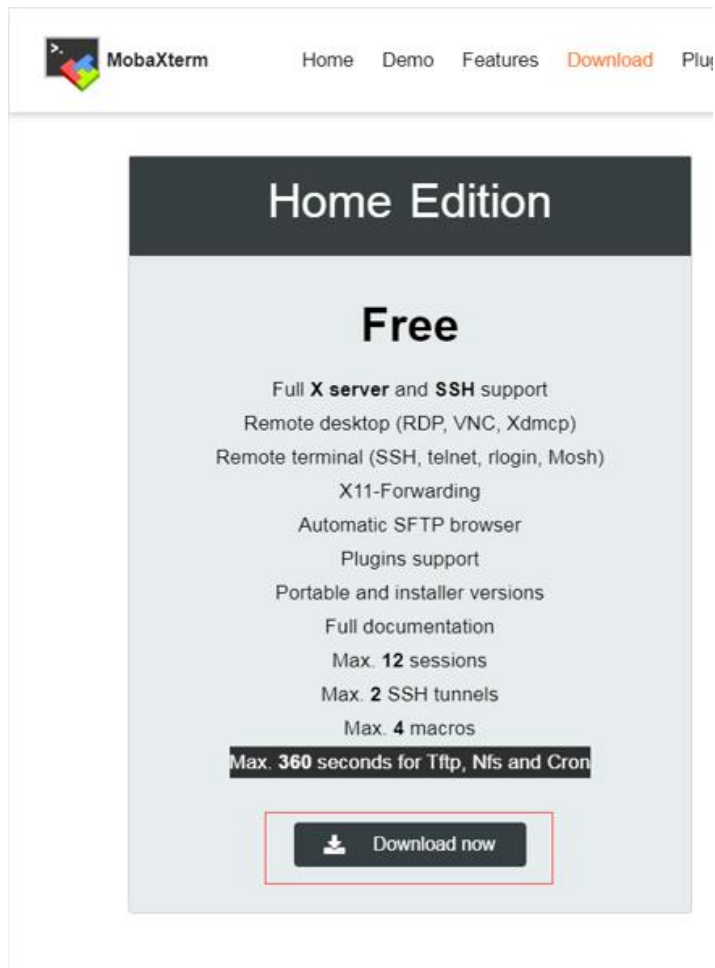
Change the extension of the **wpa_supplicant.txt** file to .conf, wait for the SD card to be burned, copy the prepared **ssh** file and **wpa_supplicant.conf** to the SD card, eject the SD card, and insert the SD card into the Raspberry Pi.

Download and install MobaXterm

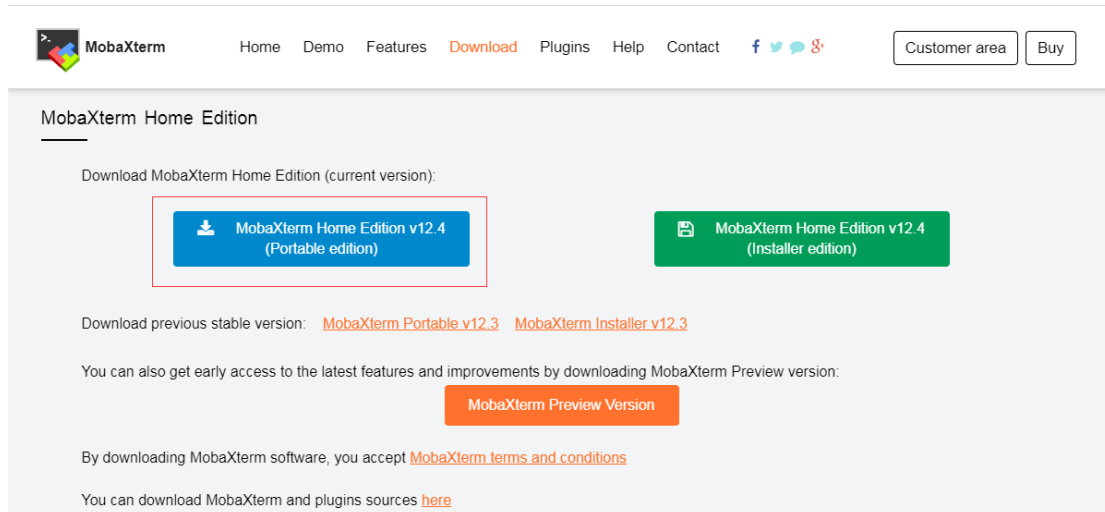
MobaXterm is a terminal tool software that can be used to remotely control the Raspberry Pi. You need to enable SSH on the Raspberry Pi to remotely control it. For how to enable SSH on Raspberry Pi and connect to WIFI automatically, please refer to the above steps.

MobaXterm download address:

<https://mobaxterm.mobatek.net/download.html>



Choose the free version.



Download portable edition, so that to directly unzip and use after downloading.

Install robot programs in Raspberry Pi

Insert the SD card that was previously burned into the Raspberry Pi system and copied with the ssh and wpa_supplicant.conf files into the Raspberry Pi, and then power the Raspberry Pi. If your Raspberry Pi is connected with the Raspberry Pi

driver board (Robot HAT), you can power the Raspberry Pi driver board and the Raspberry Pi through the micro USB interface on the driver board, or power the Raspberry Pi through connecting the power interface on the driver board to the battery holder with lithium batteries. We recommend to power with micro USB, since the installation process may take a long time.

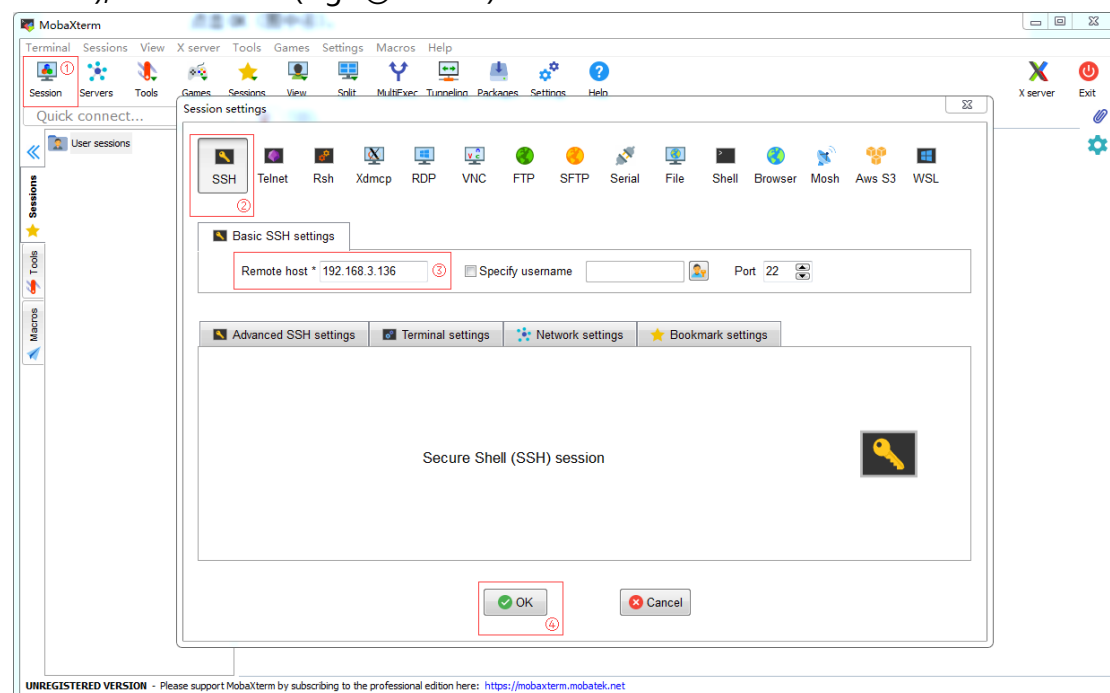
You can also directly power the Raspberry Pi without installing a driver board.
Turn on the Raspberry Pi.

Obtain the IP address of Raspberry Pi

Wait tens of seconds, the Raspberry Pi will automatically connect to WIFI. You need to obtain the IP address of the Raspberry Pi. You can download a Network Scanner on your mobile phone, or obtain the IP address using other methods (can be queried in the router).

Connect to Raspberry Pi

After running MobaXterm, the first thing to do is to create a new session. Click Session in the upper left corner (Fig. ① below), click SSH in the pop-up window (Fig. ② below), fill in the IP address of the Raspberry Pi in the remote host (Fig. ③ below), and click OK (Fig. ④ below).



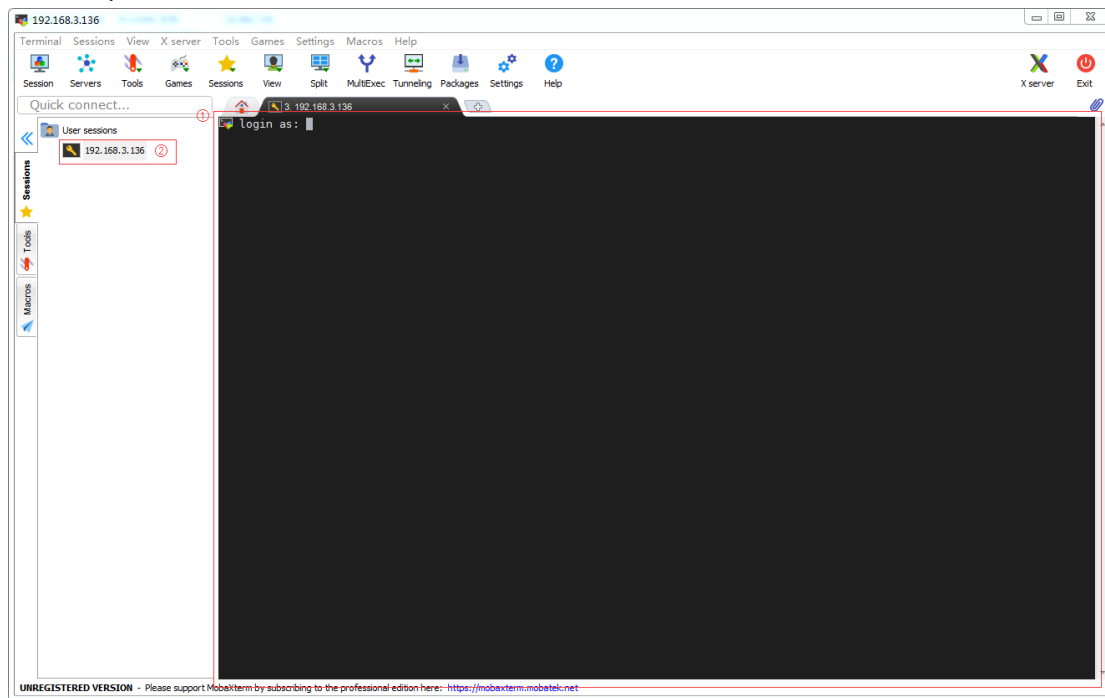
Then enter the account and password for logging in to the Raspberry Pi in the Raspberry Pi terminal (see Fig. ① below):

Default account is pi

Default password is raspberry

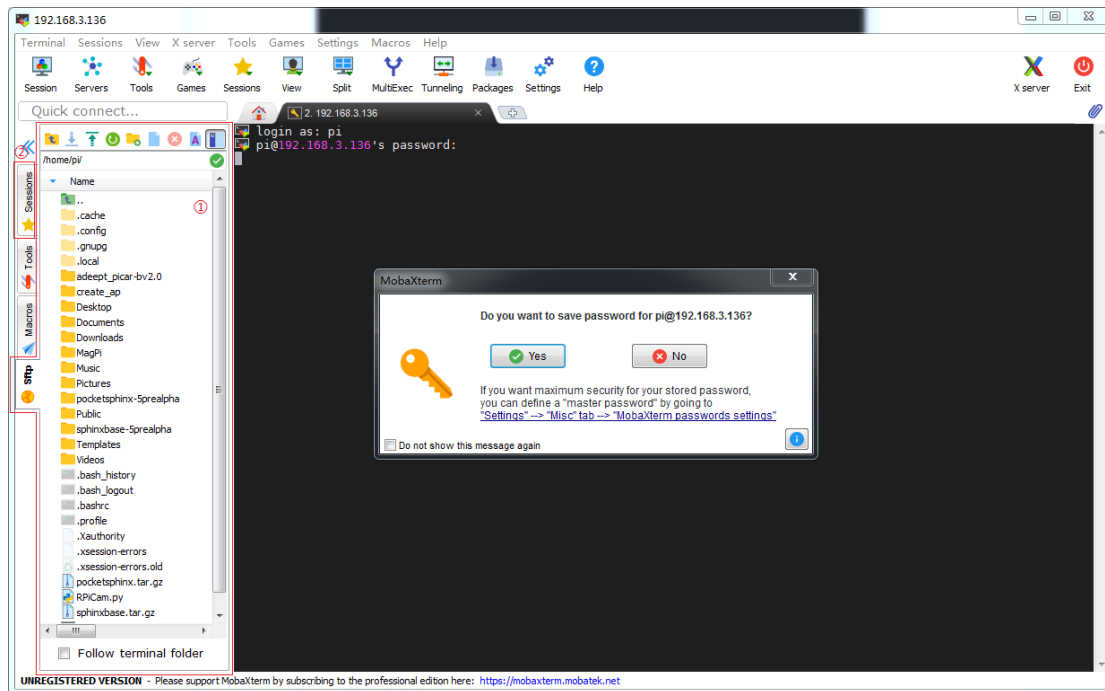
When entering the password, the password or * will not displayed on the screen, but it does not mean that the password was not entered successfully. After entering, press Enter to log in to the Raspberry Pi.

This session is saved in the left column (Fig. ② below). The next time you connect the Raspberry Pi, just double-click here to connect the Raspberry Pi again. (Note: If the IP address of Raspberry Pi changes, you need to start a new session from scratch.)



After the account and password are entered correctly, a window will pop up asking if you want to save the account and password. In order to facilitate the next login you can choose Yes.

At the same time, the left column will be replaced with a file transfer system (see Fig. ① below). This window can be used to conveniently interact with files in the Raspberry Pi system. If you want to return to the session selection, just click Sessions on the tab on the left column (Fig. ② below).



That's it, the connection to the Raspberry Pi is complete.

Download the robot program

Setting up the robot program step by step and installing it will take a lot of time and effort. In the software package, we provide an installation package to install and automatically perform related settings.

First, download the product project (software package) in the Raspberry Pi terminal. Enter the following command (Note that all lowercase input must be used):

```
sudo git clone https://github.com/adeept/adeept_raspclaws.git
```

Then install (note that python3 command must be used, the same below):

```
sudo python3 adeept_raspclaws/setup.py
```

This process may take several hours, please wait patiently for the installation to finish, the Raspberry Pi will automatically restart, and MobaXterm will be disconnected. If the program is installed correctly, server.py under the package will run automatically. Most problems after installation are caused by server.py not being run automatically. If server.py does not run automatically for some reasons, you can run it manually by typing:

```
sudo python3 adeept_raspclaws/server/server.py
```

Note: Do not run multiple server.py, if you do (or run a new one without noticing that there is already an automatically running server.py), use the following

command to clear them :

```
sudo killall python3
```

An error message may appear during the installation process, but don't worry. It is normal for an error to occur during the installation process. **Whether the installation is successful depends on the successful operation of server.py.**

Wait patiently for the installer to run. When the line *restart* appears, the installer has completed execution. If the connection to the Raspberry Pi is disconnected before the *restart* occurs, please run setup.py again after troubleshooting the problem (mostly a restart caused by low battery). Don't worry that running the installer again will take a lot of time, the dependent libraries that have been installed before will be automatically skipped.

Sometimes the installation of the software or dependent libraries required by the product fails due to network reasons, causing server.py to run incorrectly. When this happens, running setup.py again is most useful.

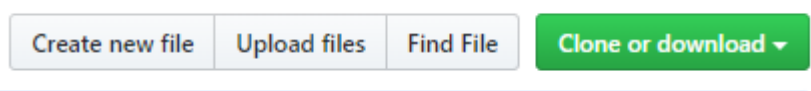
Install the robot program on PC

Download address:

https://github.com/adeept/adeept_raspclaws

Click Clone or download - Download ZIP

Download and unzip.



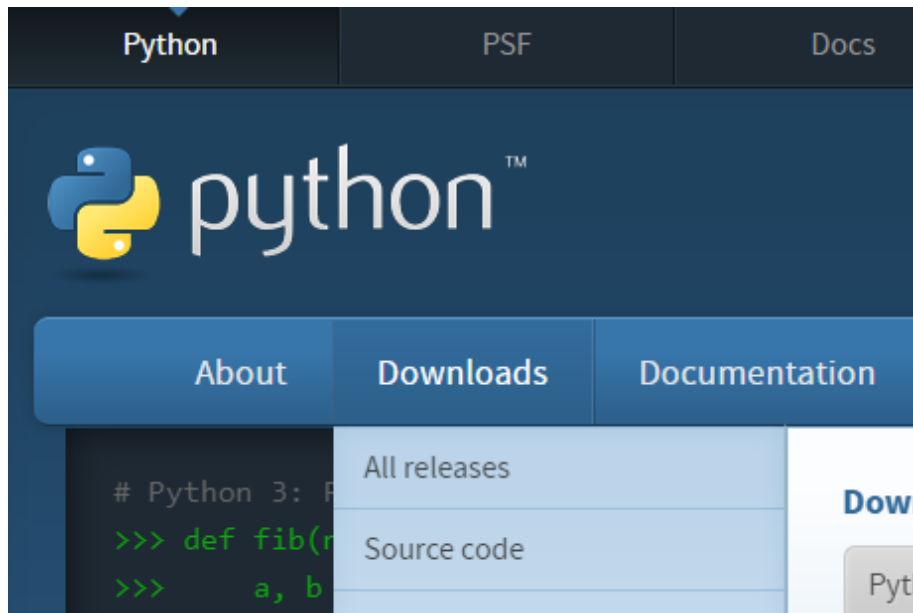
There is a client folder in the unzipped folder. This folder contains the program of the robot product on the PC. After we install Python3, we can run it (GUI.py).

Install Python3

We need to install Python in the computer to run our PC program. The code for this product is compiled using Python 3.7, so it is best to download Python version 3.7 to prevent possible compatibility errors.

Download address:

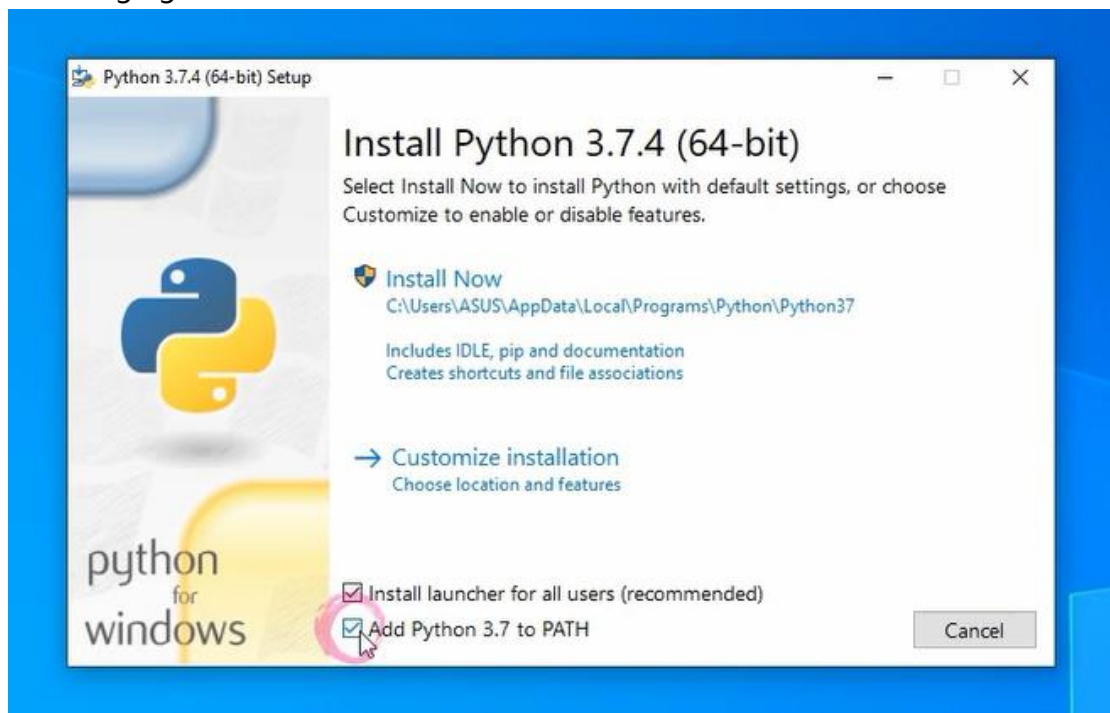
<https://www.python.org/>



Click **Downloads**->**Download Python 3.7.0**.


After downloading Python, double-click the installation package to install it.

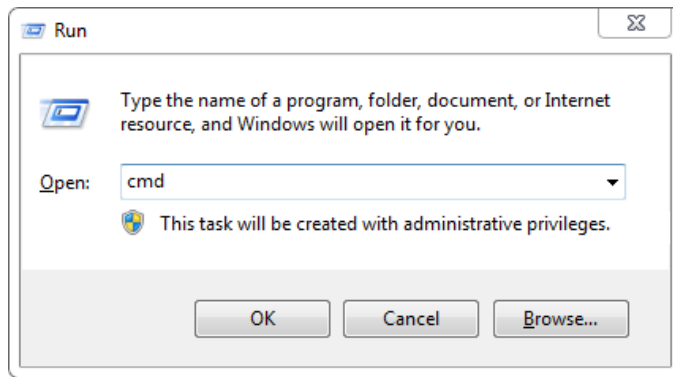
When installing Python, be sure to select Add python to PATH, as shown in the following figure:



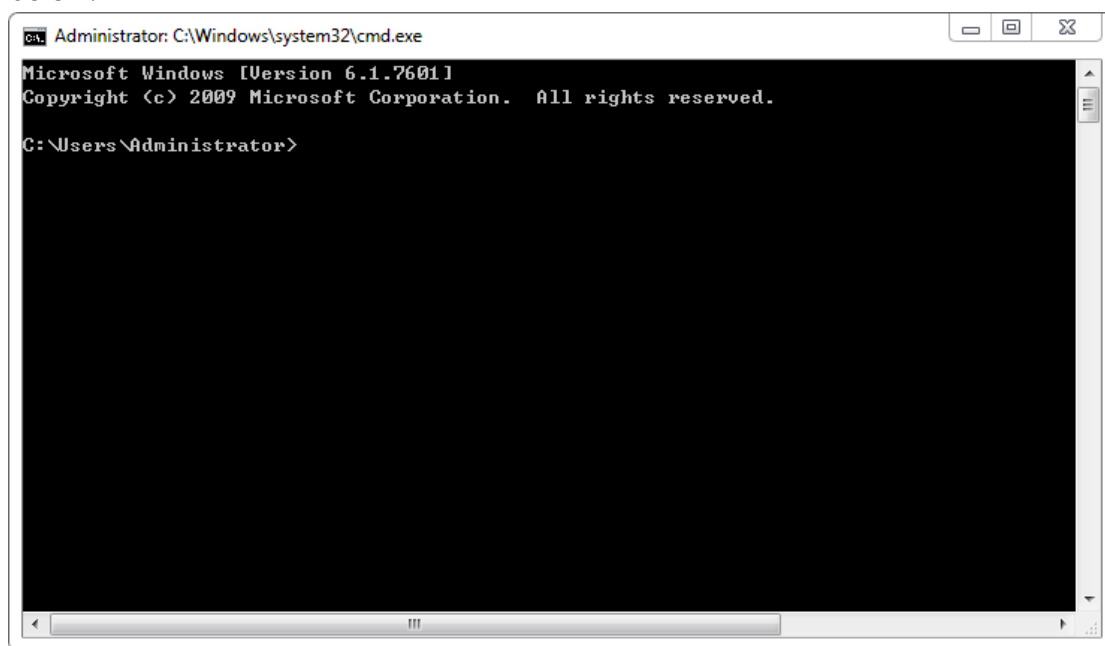
Install Numpy

NumPy is a basic software package for scientific computing with Python. OpenCV needs its related functions.

Press  + **R** and enter cmd, click "OK" to open CMD.



After clicking "OK", the CMD interface will pop up, as shown below:



Enter:

```
pip3 install numpy
```

Then press Enter to start downloading and installing Numpy.

Download opencv_python.whl and install OpenCV

Download address:

<https://www.lfd.uci.edu/~gohlke/pythonlibs/#opencv>

After getting to this page, you may need to manually enter "#opencv" after the URL to redirect to the location where opencv is located.

OpenCV, a real time computer vision library.

[opencv_python-4.2.0-cp38-cp38-win_amd64.whl](#)
[opencv_python-4.2.0-cp38-cp38-win32.whl](#)
[opencv_python-4.2.0-cp37-cp37m-win_amd64.whl](#)
[opencv_python-4.2.0-cp37-cp37m-win32.whl](#)
[opencv_python-4.2.0-cp36-cp36m-win_amd64.whl](#)
[opencv_python-4.2.0-cp36-cp36m-win32.whl](#)
[opencv_python-4.1.2-cp38-cp38-win_amd64.whl](#)
[opencv_python-4.1.2-cp38-cp38-win32.whl](#)
[opencv_python-4.1.2-cp37-cp37m-win_amd64.whl](#)
[opencv_python-4.1.2-cp37-cp37m-win32.whl](#)
[opencv_python-4.1.2-cp36-cp36m-win_amd64.whl](#)
[opencv_python-4.1.2-cp36-cp36m-win32.whl](#)
[opencv_python-4.1.2-cp35-cp35m-win_amd64.whl](#)
[opencv_python-4.1.2-cp35-cp35m-win32.whl](#)
[opencv_python-4.1.2+contrib-cp38-cp38-win_amd64.whl](#)
[opencv_python-4.1.2+contrib-cp38-cp38-win32.whl](#)
[opencv_python-4.1.2+contrib-cp37-cp37m-win_amd64.whl](#)
[opencv_python-4.1.2+contrib-cp37-cp37m-win32.whl](#)
[opencv_python-4.1.2+contrib-cp36-cp36m-win_amd64.whl](#)
[opencv_python-4.1.2+contrib-cp36-cp36m-win32.whl](#)
[opencv_python-4.1.2+contrib-cp35-cp35m-win_amd64.whl](#)
[opencv_python-4.1.2+contrib-cp35-cp35m-win32.whl](#)
[opencv_python-3.10-cp34-cp34m-win_amd64.whl](#)
[opencv_python-3.10-cp34-cp34m-win32.whl](#)
[opencv_python-2.4.13.7-cp27-cp27m-win_amd64.whl](#)
[opencv_python-2.4.13.7-cp27-cp27m-win32.whl](#)

OpenCV, a real time computer vision library.

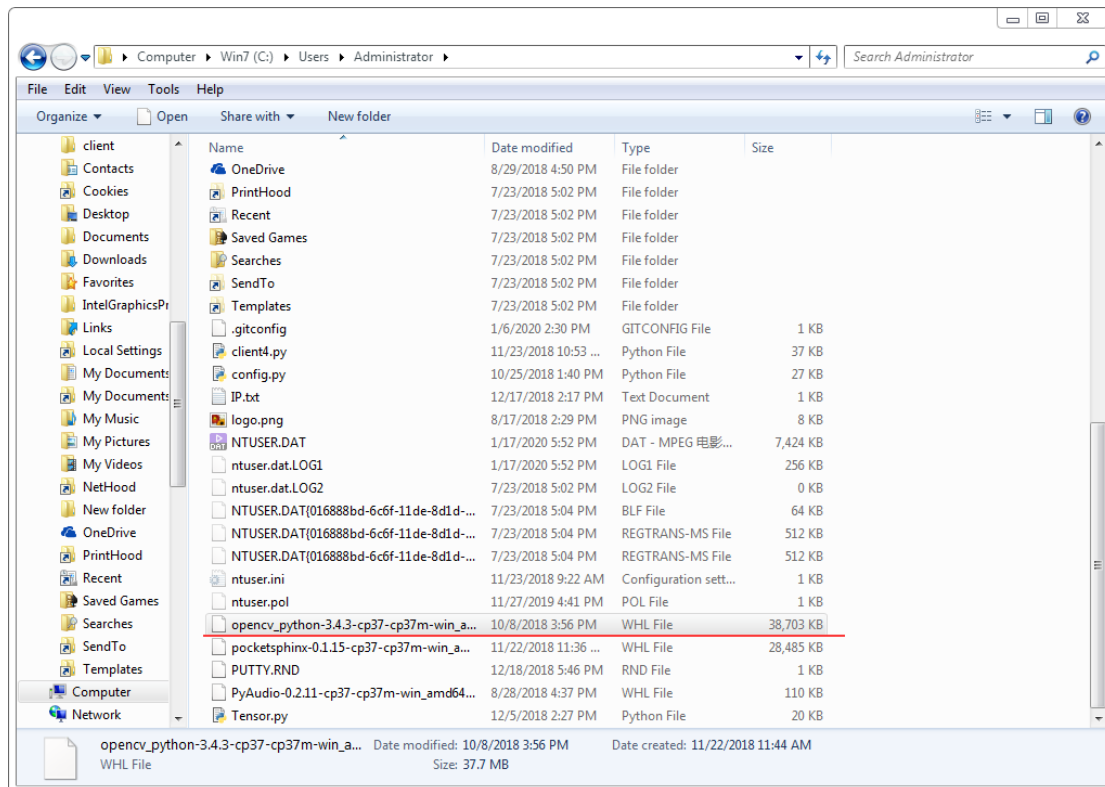
[opencv_python-4.2.0-cp38-cp38-win_amd64.whl](#)
[opencv_python-4.2.0-cp38-cp38-win32.whl](#)
[opencv_python-4.2.0-cp37-cp37m-win_amd64.whl](#)
[opencv_python-4.2.0-cp37-cp37m-win32.whl](#)
[opencv_python-4.2.0-cp36-cp36m-win_amd64.whl](#)
[opencv_python-4.2.0-cp36-cp36m-win32.whl](#)
[opencv_python-4.1.2-cp38-cp38-win_amd64.whl](#)
[opencv_python-4.1.2-cp38-cp38-win32.whl](#)
[opencv_python-4.1.2-cp37-cp37m-win_amd64.whl](#)
[opencv_python-4.1.2-cp37-cp37m-win32.whl](#)

Choose the version to download here. 4.2.0 is the latest version of opencv when this document was made; cp37 corresponds to python3.7 installed on the computer; amd64 corresponds to 64-bit python.

Depending on the version of python you download, you may need to choose a different version of opencv. The way to check the python version and digits is to enter the command in cmd: python, and then enter the python shell. The corresponding information will be displayed:

```
C:\Users\Administrator>python
Python 3.7.1 (v3.7.1:260ec2c36a, Oct 20 2018, 14:57:15) [MSC v.1915 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
```

After the download is complete, go to the Users directory (ie, the "Users" folder) on your computer and copy the .whl file you just downloaded to this location.



The Users directory of each computer may not be the same. You can find the location of your Users directory in the command line window that opened by pressing **Win + R** and typing cmd.

```
C:\Users\Administrator>
```

Install OpenCV

Enter the following command in cmd:

```
pip3 install opencv_python
```

Then press TAB, the computer will automatically complete the remaining file names, as shown below:

```
C:\Users\Administrator>pip3 install opencv_python-4.2.0-cp37-cp37m-win_amd64.whl
```

Then press Enter to install openCV.

Install zmq and pybase64

zmq and pybase64 are libraries for real-time video. Enter the following command:

```
pip3 install zmq pybase64
```

```
C:\Users\Administrator>pip3 install zmq pybase64
```

Press Enter to begin installation. After installation, you can run the GUI.py file in the client folder (some GUI.py is named after the product).

After the server.py in the Raspberry Pi runs successfully (by default, it will run

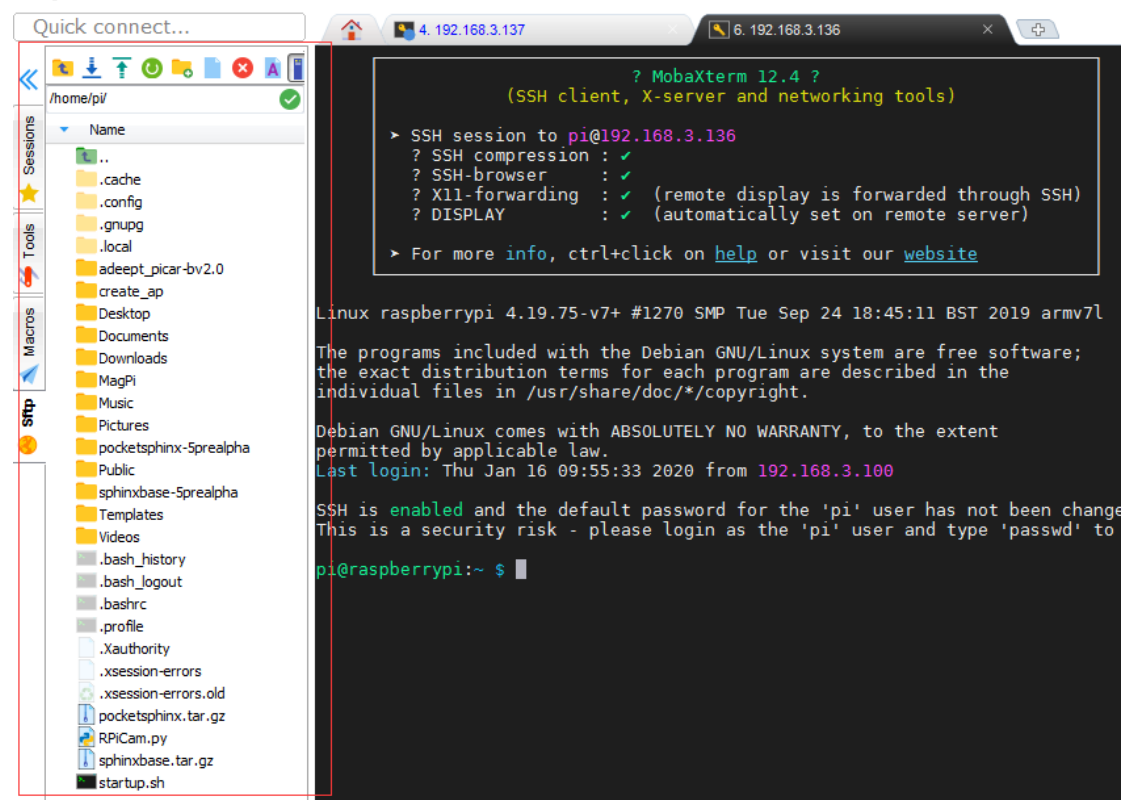
automatically every time you turn it on), enter the IP address of the Raspberry Pi in the GUI control terminal on the PC, and then click Connect to control the robot. The specific control method of the GUI can be found on the latter part of the manual.

MobaXterm file transfer tutorial

When there are some problems with the software installation, or when you want to modify or customize the robot control script, you will need to modify the files in the Raspberry Pi. Although connecting the Raspberry Pi to the display and the mouse and keyboard set can easily operate the Raspberry Pi's file system, the file transfer tool provided by MobaXterm gives us a more convenient choice.

Enable file transfer system

After connecting with Raspberry Pi using MobaXterm, the file transfer system will be automatically turned on. If it is not displayed automatically, you can click **the sftp on the left tab bar** to call it out.



Operate file system

The operation of the file transfer system is similar to the way we usually operate a computer. You can double-click to enter the folder, or double-click to open the file using the default program.

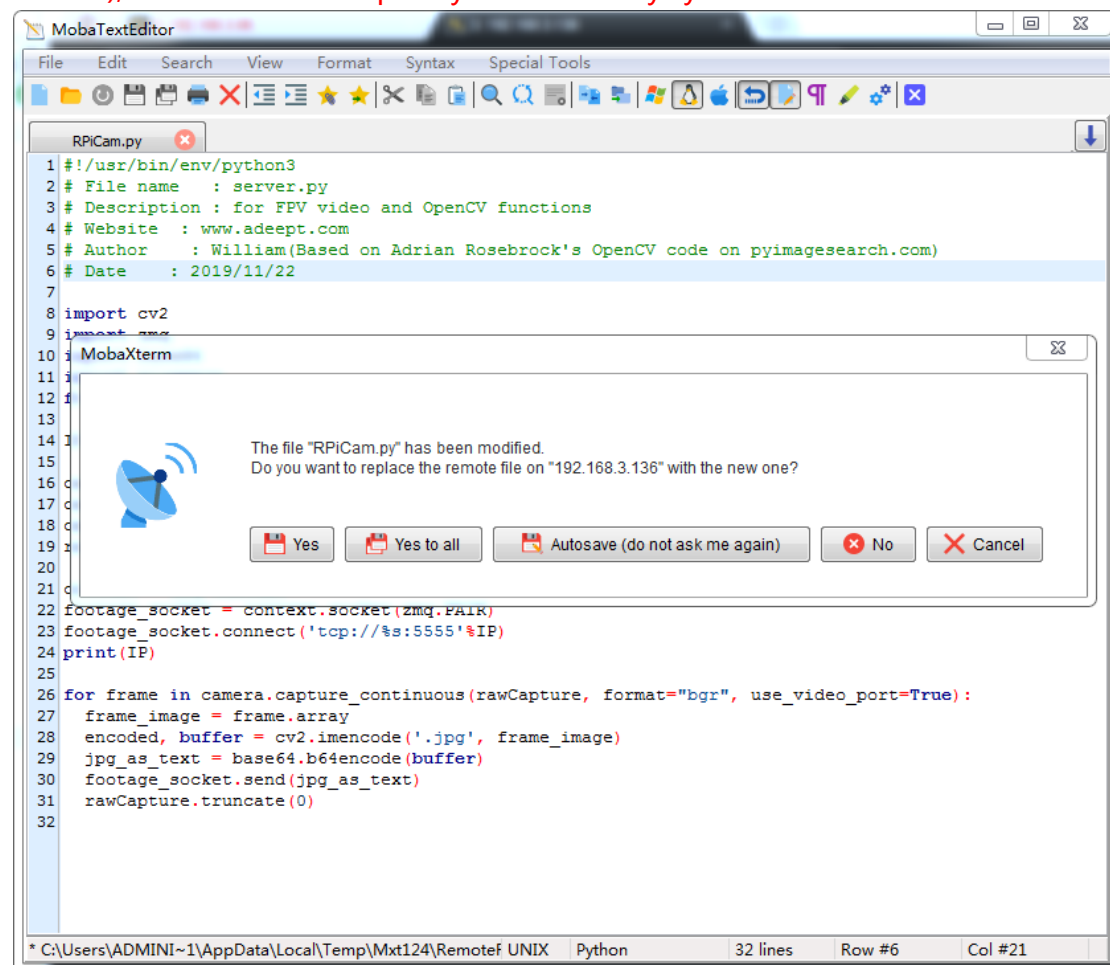
You can also right-click a file and select the *Open with ...* to choose the software to

open the file.

File modifying and saving

The editing method after opening the file is the same as usual (it uses the editor that comes with MobaXterm by default). The only thing to note is that when you save the file, MobaXterm will prompt you if you want to synchronize the files in the Raspberry Pi.

Note: Only after you click Yes or Yes to all (or click Autosave, which will automatically synchronize the files in the Raspberry Pi after you save the files by default), the files in the Raspberry Pi will be truly synchronized.



GUI tutorial

The GUI is a graphical interface that runs on the PC for robot control. It is contained in the client directory of the package, and is usually called GUI.py. If you installed python according to the manual, just double-click GUI.py to open it.

Depending on the product, the GUI is also composed of different modules and windows. Below is a list of most of the GUI modules and windows. You can compare the modules and windows of your GUI to understand their functions and usage.

Common GUI modules

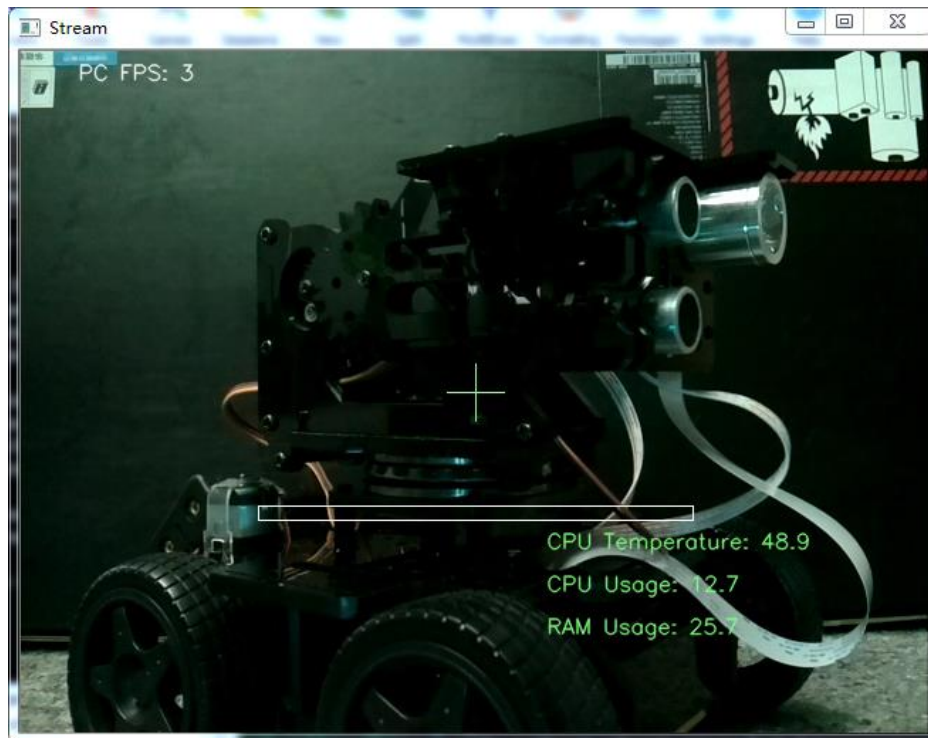
Common GUI modules are those modules or windows that can be found on almost all robots.

Python running window



This window will accompany each GUI when it is opened. Any runtime exception will be displayed on here. If this window is closed, the GUI will be exited.

Camera video streaming window



The picture captured by the camera will be displayed. Depending on the product type, the window rendering method may be different, and some products can also interact with this window.

IP address input box

IP Address:

Connect

Enter the IP address of Raspberry Pi here and click Connect to connect the GUI to the Raspberry Pi.

Raspberry Pi status and connection status display bar

Before connecting:

CPU Temp:

CPU Usage:

RAM Usage:

Disconnected

Use default IP

After connecting:

CPU Temp: 50.5°C

CPU Usage: 10.8

RAM Usage: 24.4

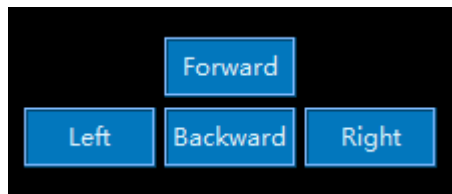
Connected

IP:192.168.3.136

Some hardware information of Raspberry Pi and current connection status are

displayed.

Movement control

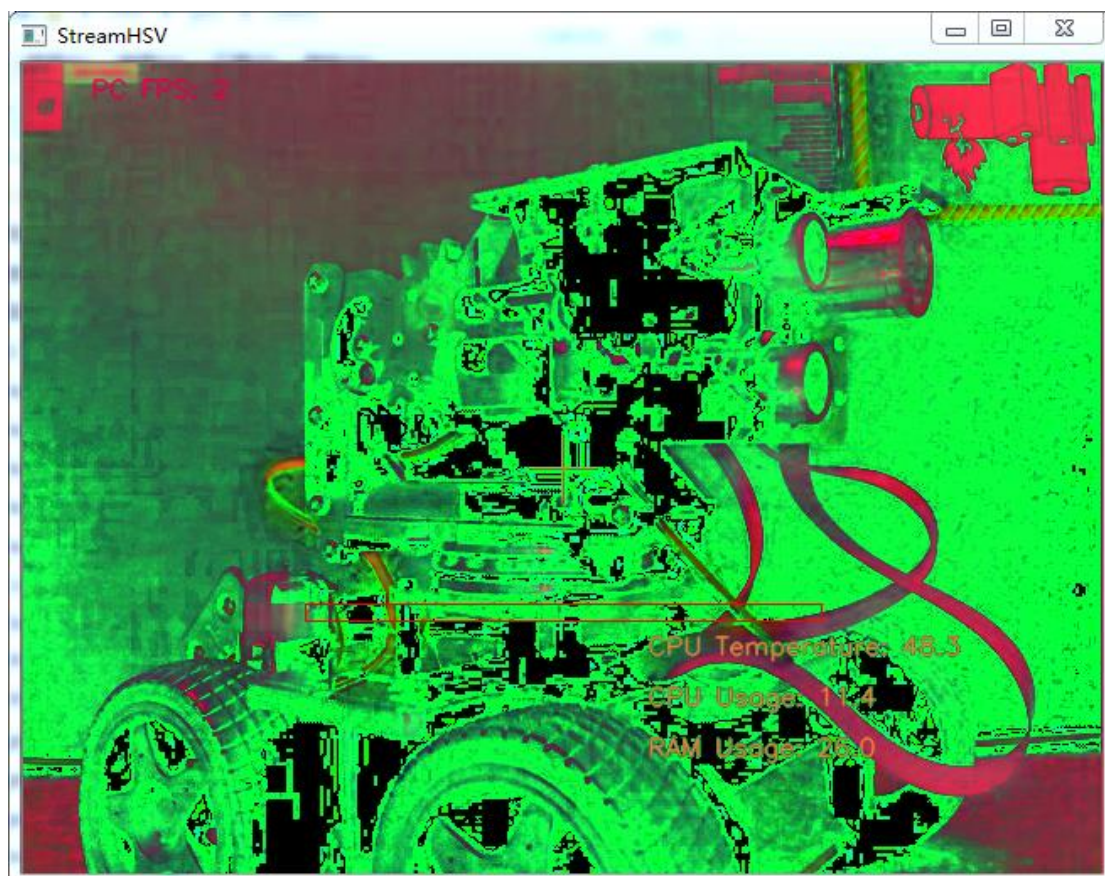


Back and forth, left and right movement control.

Other GUI modules

Most GUI modules and windows will only appear on products with certain features.

Color space video streaming window



The picture captured by the camera is converted to the HSV color space mode. The difference between colors in this mode is shown in red and green, which makes it easy to observe the performance under the color tracking function.

Potentiometer port switch



Control the on and off of port1, port2 and port 3 on the development board. If you turn on an interface, the Raspberry Pi will provide 3.7V power for this interface.

Note: In order to avoid damaging the development board or the Raspberry Pi, do not connect overloaded components to these three interfaces.

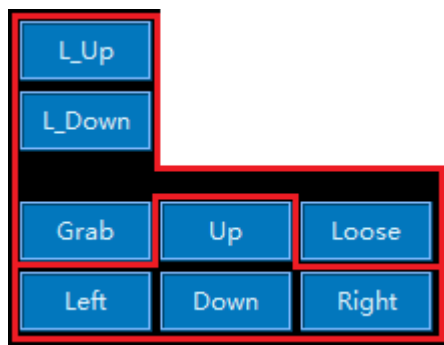
Speed control slider



Controls the speed at which the robot car moves.

If the value is set too small, the robot car will not be moved or difficult to move.

PTZ-Robotic arm control module



Divided into two parts (outlined by a red line). The upper part is dedicated to the robotic arm mode. L_Up and L_Down control the up and down movement in mechanical mode, Grab and Loose are grasping and loosening respectively of the robotic arm. The lower part is universal for PTZ and robotic arm. Left and Right are the left and right rotation of the PTZ or robotic arm, Up and Down are the up and down movement of the PTZ or robotic arm.

Spider robot attitude control module



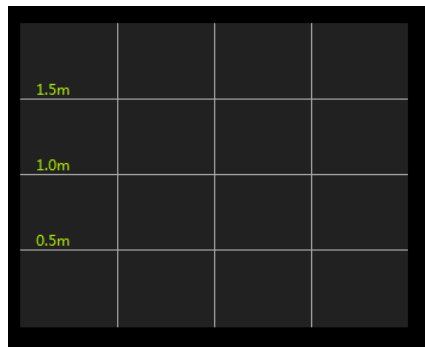
StandUp and StayLow: Control the spider robot to stand and lie down.

Lean-L and Lean-R: roll left and right

Left and Right: Tilt left and right

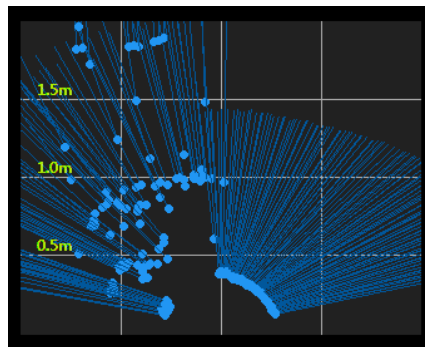
Up and Down: control the standing height

Ultrasonic radar



Before scanning:

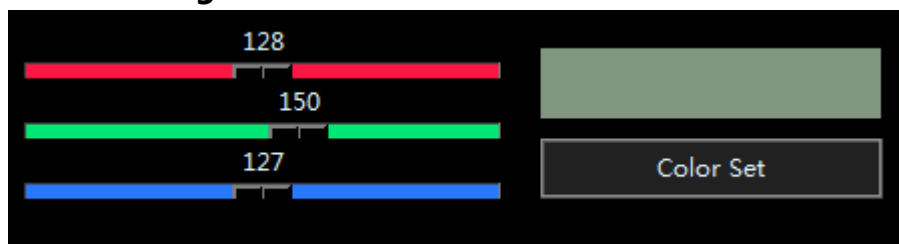
Showing the results of an ultrasound scan.



扫描后：

After
scanning:

Color setting module

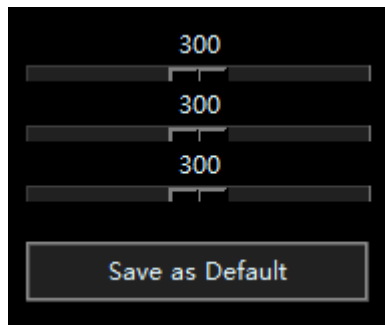


Used to set the color to look for in color tracking and the line color to be tracked in video tracking mode.

Clicking on Color Set will change the color of color checking. The color of the line to be tracked in the video tracking mode needs to be confirmed in the video tracking module.

You can also click the camera video stream or color space video stream window to set the color.

Servo fine-tuning module




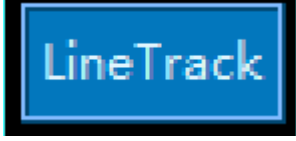





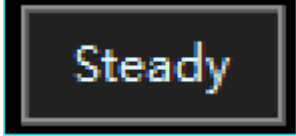
Used to correct the deviation angle of the servo. Drag the slider to fine-tune the servo angle, and click Save as Default to save the current servo position as the default position.

Function button group

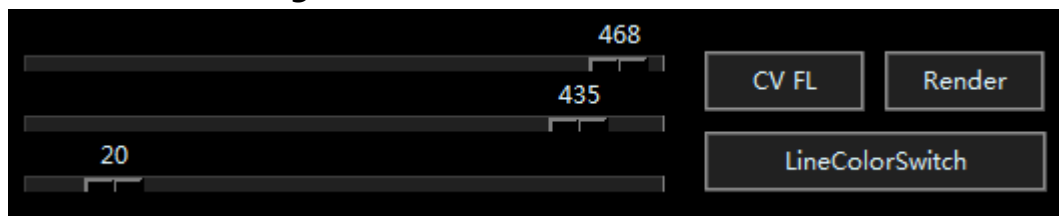
A considerable part of the functions of the robot are controlled by a single button. For the aesthetic of the GUI, these function buttons are grouped together to form a function button group. Depending on the models of the robots, the function buttons on their corresponding GUI are also different.

The following is a description of the functions of each function button:

Button	Function	Description
	Ultrasound scanning	The robot uses an ultrasonic module to scan the semicircle range in front of it, and displays the obtained obstacle information on an ultrasonic radar.
	Color tracking	After enabling, the robot will not move and look for the set color in the camera screen and try to aim at this color.
	Motion detecting	After enabling, the robot will not move and give feedback after detecting the camera is shooting a moving object
	Sensor line tracking mode	Specific function for robot cars. The car tracks the black lines on the white ground through the sensor at the bottom (can also track the white lines on the black ground by adjusting the parameters on the findline.py in the package).
	Automatic obstacle avoiding	The robot goes straight ahead, uses the ultrasonic module to detect obstacles, and automatically avoids them.

	Camera stabilizing	After enabling, the robot will automatically adjust the attitude of the camera to keep it in the horizontal position when turned on.
	Gait switching	Specific function for quadruped spider robots. After enabling, it is switched to diagonal gait (the default is triangle gait).
	Self-stabilizing mode	Specific function for spider robots. After enabling, the robot will keep horizontal by adjusting the legs.

Video line tracking module



This section controls the visual line tracking function.

CV FL : enable visual line tracking function.

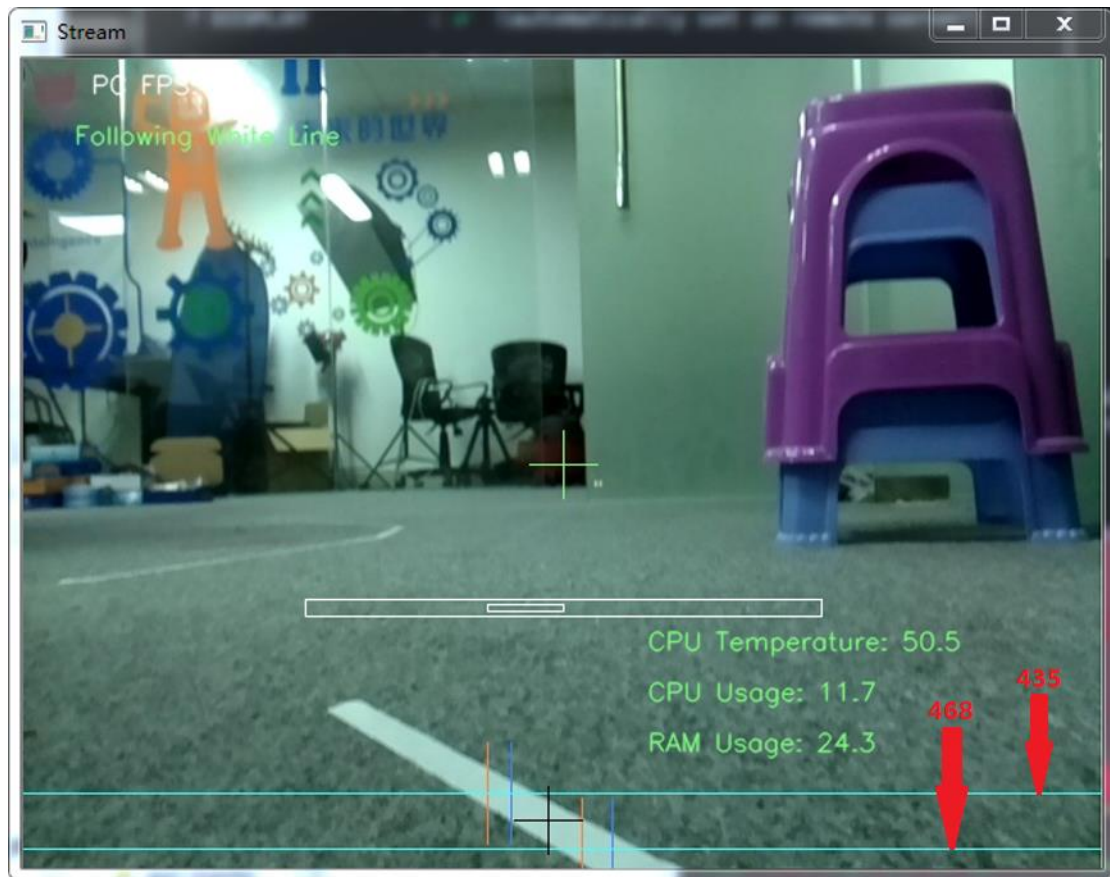
Render : Switch video rendering.

LineColorSwitch : Set the color of the line to be tracked (based on the color on the color setting module).

Three sliders:

The upper and lower sliders respectively control the position of the two auxiliary lines as shown in the figure below (the values indicate the vertical pixel points where the auxiliary lines are located). Only the content between the two auxiliary lines will be used by the robot to determine whether it is the line to be tracked. Therefore, try to ensure that there is nothing between the two auxiliary lines except the line to be tracked and the floor.

The last slider is used to control steering sensitivity. The smaller the value, the more the robot tends to turn left and right when following the line.



Exposure adjustment module



Used to adjust the exposure of the camera. It is mainly used in conjunction with the visual line tracking mode. You can adjust the exposure value to make the robot better recognize the line to be tracked. You can turn on video rendering to see the effect of setting exposure values on robot tracking.

Common issues

Q: Setup.py disconnects during runtime?

A: setup.py will restart automatically after execution. Check to if there is a line *restart* on the console. If so, the installation program has been executed.

Q: Errors prompt up when running setup.py?

A: An error may occur during the installation process, which is not necessarily a problem during the installation process. There is also a server.py file in the package. Whether the installation is completely successful depends on whether this script can run normally.

Q: After the setup is finished: When installing the servo, the servo does not return to the original position after it is connected to the Raspberry Pi . / When using the GUI to connect the Raspberry Pi, there' s an error "target computer actively refuses" / and other similar problems?

A: There is a server.py file in the server directory of the package. As mentioned in the installation tutorial, most of the problems are caused by it not running automatically. Use MobaXterm to connect to the Raspberry Pi, and try to use the command `sudo python3 adeept_raspclaws/server/server.py` to run it manually.

Q:The server.py does not run automatically. It is inconvenient to run it manually every time, how can I make it run automatically?

A: Ensure that the package installation path is all lowercase. Use the full lowercase command when cloning a package can make the installation path of the package all lowercase.

Q: Can't search the IP address of the Raspberry Pi?

A: If using a network scanner, search a few more times. The most reliable way is to log in to the gateway to find out if a Raspberry Pi is connected to wifi. In addition, after the SD card has been run in the Raspberry Pi,

do not move the ssh or wpa_supplicant.conf files to the SD card. This will prevent the Raspberry Pi connecting to wifi.

Q: without permission to modify or delete files?

A: Use the command '`sudo chmod 777 [file name]`' to open the permissions of the files. Note that this command needs to be executed using an administrator account. In general, the default account pi is an administrator account

Q: I want to check the error message of server.py, what should I do?

A: You can use MobaXterm to connect to the Raspberry Pi, use `sudo killall python3` to clean up any remaining processes, and then run server.py manually. All the error messages will be displayed on MobaXterm.

Q: When I open the GUI, it crashes / Nothing happens when I open the GUI / I want to see the error message of the GUI, what should I do?

A: The GUI crashes or doesn't respond because error occurs. To see the GUI error messages, you can use command `python GUI.py` in cmd to run the GUI, and the error message will be displayed in the command line window.

Q: Can I use Raspberry Pi 4 to install a robot

A: absolutely can. All our products are compatible with Raspberry Pi 4

Q: Appears Remote I / O error ?

A: It may be caused by running the script of robot control (including server.py) without the expansion board plugged in. Sometimes this exception may occur (for example, an interface is in loose contact). At this time, you can ignore and re-run the script. It usually does not occur often.

3.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.

After completing all projects in the guide, you should have some knowledge of the Raspberry Pi and Robot, thus you can try to change the robot into other projects by adding more Adept modules or changing the code for extended functions.

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 and service!



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