Adeept®

RaspClaws

Adeept 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 humidness.
- ★ Please remember to power off when the product is not in use.
- ★ Do not touch the moving or rotating part of the product.
- ★ The product may get heat at some part, which is just normal. But misoperation may cause overheat.
- ★ Misoperation may cause damage to the product. Please take care.
- ★ Do not connect the positive and negative poles of the power inversely, or the devices in the circuit may be damaged.
- ★ Please place and put the product gently. Do not smash or shock it.

About

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

The code and manual of our product are open source. You can check on our website:
http://www.adeept.com/

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

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

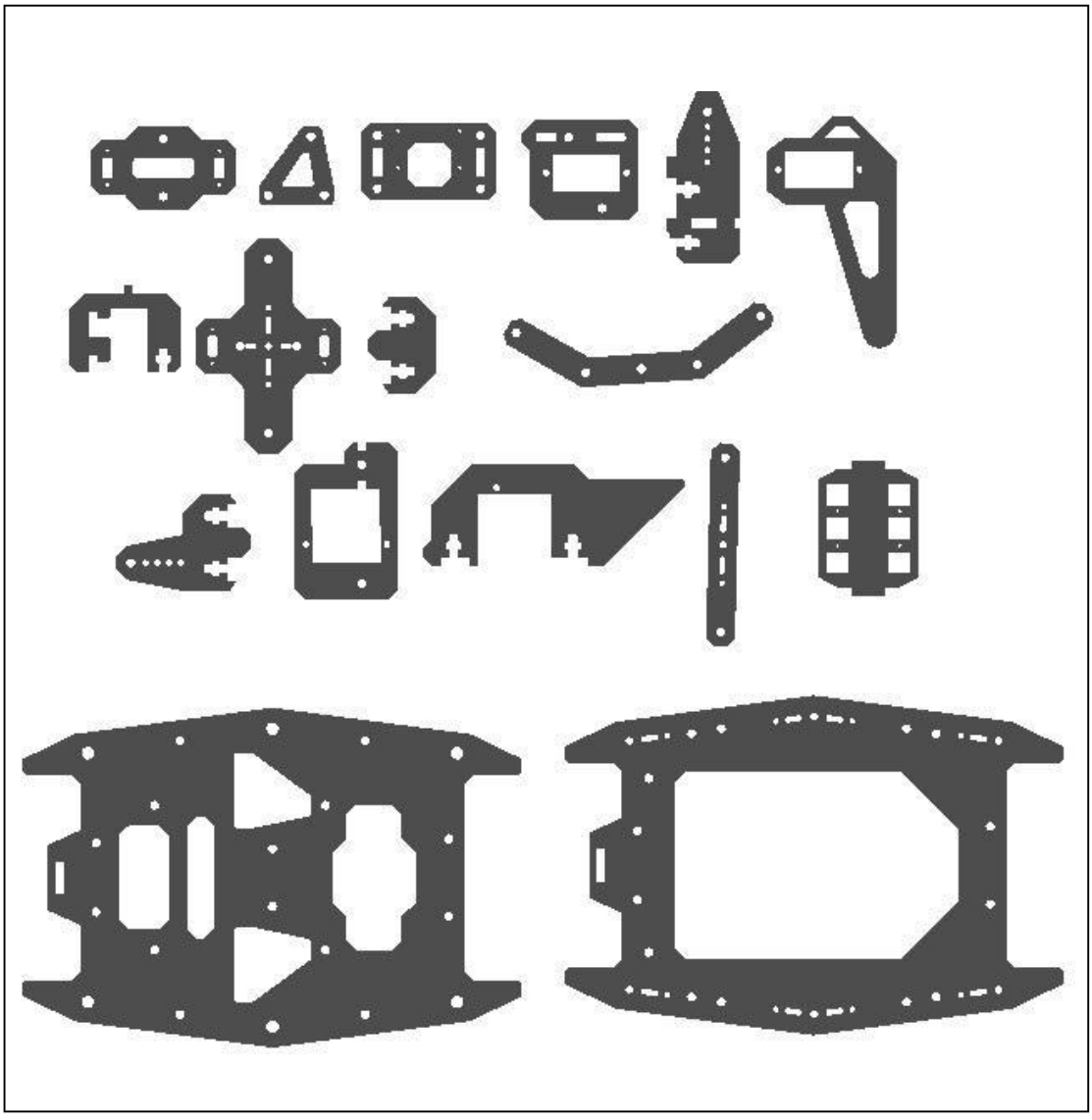
Copyright

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

contents

1. Components List

1.1. Acrylic Plates



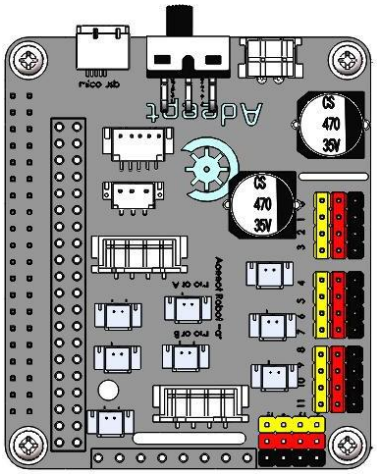
The acrylic plates are fragile, so please be careful when assembling them in case of breaking.
The acrylic plate is covered with a layer of protective film. You need to remove it first.
Some holes in the acrylic may have residues, so you need to clean them before the use.

1.2. Machinery Parts

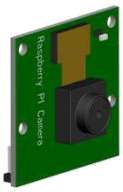
M2 Nut  X27 www.adeept.com	M3 Nut  X30 www.adeept.com	M2*8 Screw  X27 www.adeept.com	M2.5*4 Screw  X6 www.adeept.com	M2.5*8 Screw  X18 www.adeept.com
M3*8 Screw  X28 www.adeept.com	M1.4*6 Self-tapping Screw  X12 www.adeept.com	M1.7*6*6 Self-tapping Screw  X15 www.adeept.com	M3*8 Countersunk Head Screw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

1.3. Electronic Parts

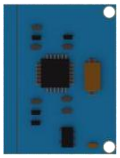
Adeept robot HAT X1



Raspberry Pi Camera X1



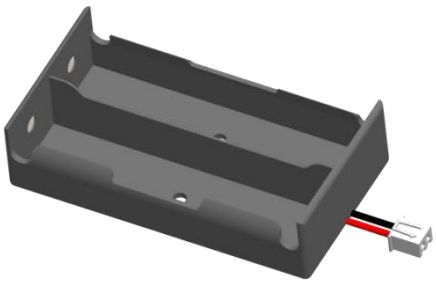
mpu—6050



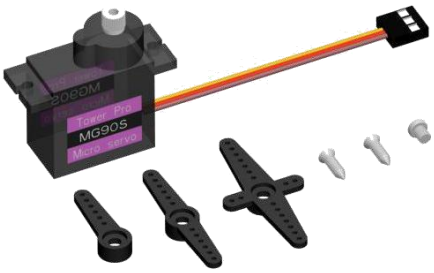
Car Light X4

3-Pin Wire X4

18650 Battery Holder Set X1



Servo x15



Raspberry P1 Camera Ribbon X1

1.4. Tools

Cross-head Screwdriver X1

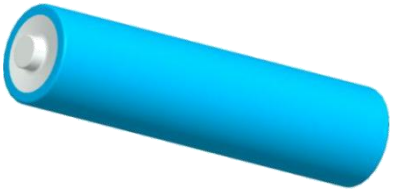
Winding Pipe X1

Large Cross-head Screwdriver X1

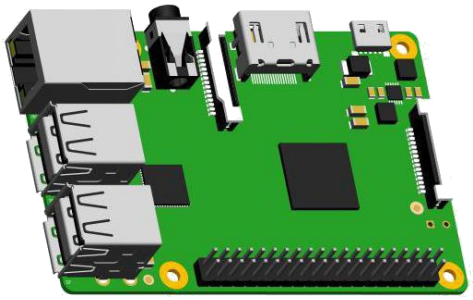
Ribbon X1

1.5 Self-prepared Parts

18650 Battery X2



Raspberry Pi

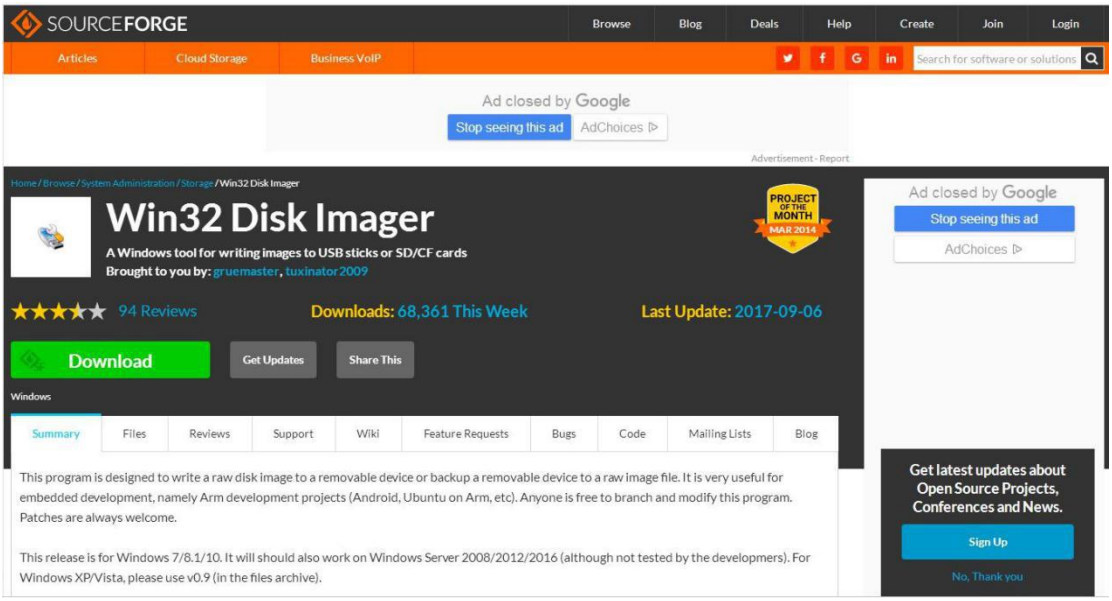


18650 battery specification: It is recommended to use lithium battery above 3000mAh and without overcurrent protection. The power supply current requirement is above 3A. Using 18650 lithium battery with overcurrent protection function, 18650 battery whose capacity is less than 1700mAh, 18650 battery 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.

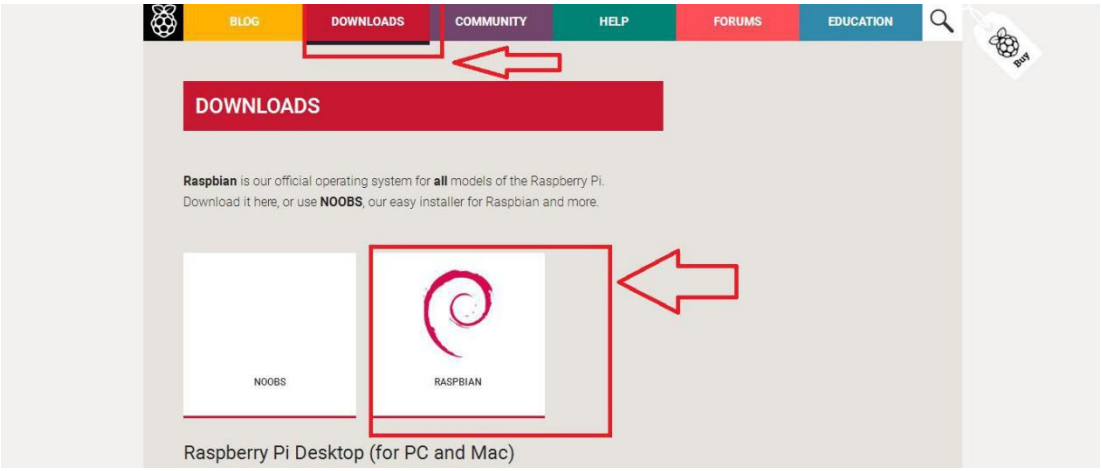
2. Software & Hardware

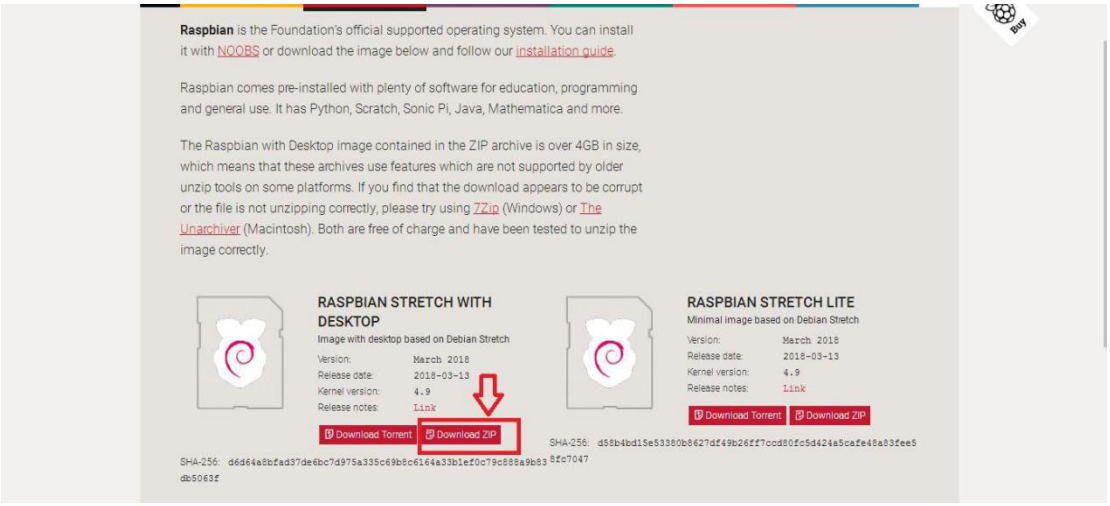
2.1. Software Installation

The software installation video is as follows
https://www.adeept.com/video/detail-70.html
Install the Raspbian Operating System
First, install the operating system for the Raspberry Pi. The official system, Raspbian, is recommended. If you've finished the installation and the system works well, you may skip this step.
You need to download the Win32 Disk Imager and burn the operating system to the SD card.
Download the Win32 Disk Imager at:
https://sourceforge.net/projects/win32diskimager/



Download the Image for Raspbian
Go to Raspberry Pi official website:
https://www.raspberrypi.org/
click though **Download**->**Raspbian**. Raspbian is suitable for novice since it's supported by Raspberry Pi and based on Linux.





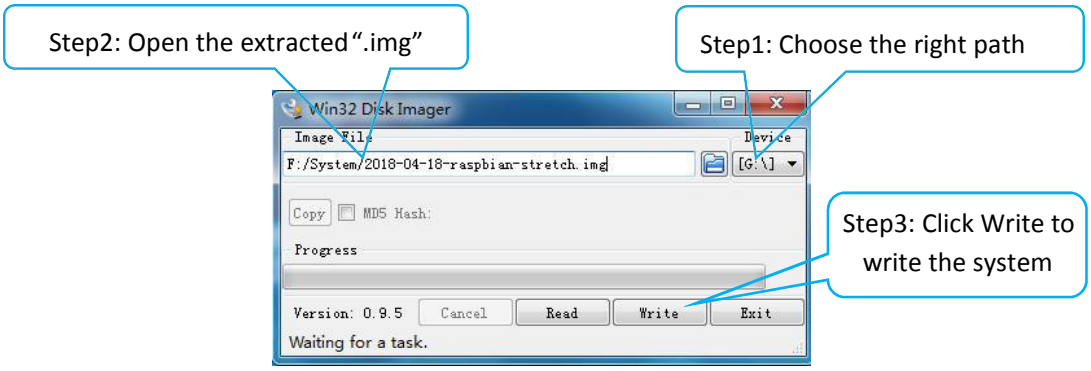
After it's downloaded, unzip it for later SD card system creation.

Write Raspberry Pi Operating System to SD Card

First, insert the SD card into the card reader and connect it to the USB port of the computer.

Click open the **Win32 Disk Imager** and choose the path of the SD card (here it's Disk G).

Click open the ***.img*** file extracted previously, and click **Write**.



Display the Filename Extension

For some operations, you may need to change the filename extension (suffix). In some Windows systems, they are hidden by default and you need to make the setting. You may

search on the Internet by yourself for how to display the filename extension (suffix) in your own system.

For example, in Windows 7, you may go to **My Computer** ->**Organization** ->**Folder and Search**->**View**, and uncheck the **Hide extensions for known file types**.

Enable SHH and Setup WiFi

Keep the SD card connected with the computer. Open the root directory of the card and create a file named *ssh* without any suffixes.

Under the root directory of the SD card, create a file *wpa_supplicant.txt* and write the following contents into the file:

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

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

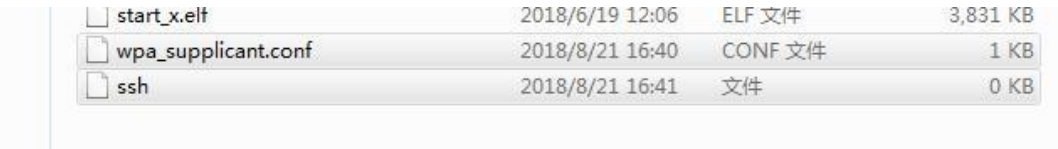
```
country=US
ctrl_interface=DIR=/var/run/wpa_supplicant GROUP=netdev
update_config=1

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

In the code above, replace **WIFI** with your own WiFi SSID name and **PASSWORD** with your password for the WiFi network. Save the file and change the name of the file *wpa_supplicant.txt* into *wpa_supplicant.conf*.

* Make sure MAC filtering has been turned off for the router.
* The *WPA-PSK* behind *key_mgmt=* is the common encryption method for most routers. If the network connection fails, you may log in and check on the router management page.
* For more about the network connection for Raspberry Pi, please visit the related page via this link:

https://www.raspberrypi.org/forums/viewtopic.php?t=203716

The two files newly created are as shown below:



Download and Install PuTTy

PuTTy is a software that connects with the Raspberry Pi via ssh. With the tool, you may control the Raspberry Pi by the computer.
Download:
https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html


The installer packages above will provide all of these (except PuTTYtel), but you can download them one b

(Not sure whether you want the 32-bit or the 64-bit version? Read the FAQ entry.)

putty.exe (the SSH and Telnet client itself)			
32-bit:	putty.exe	(or by FTP)	(signature)
64-bit:	putty.exe	(or by FTP)	(signature)
pscp.exe (an SCP client, i.e. command-line secure file copy)			
32-bit:	pscp.exe	(or by FTP)	(signature)
64-bit:	pscp.exe	(or by FTP)	(signature)
psftp.exe (an SFTP client, i.e. general file transfer sessions much like FTP)			
32-bit:	psftp.exe	(or by FTP)	(signature)
64-bit:	psftp.exe	(or by FTP)	(signature)
puttytel.exe (a Telnet-only client)			
32-bit:	puttytel.exe	(or by FTP)	(signature)
64-bit:	puttytel.exe	(or by FTP)	(signature)
plink.exe (a command-line interface to the PuTTY back ends)			
32-bit:	plink.exe	(or by FTP)	(signature)
64-bit:	plink.exe	(or by FTP)	(signature)
pageant.exe (an SSH authentication agent for PuTTY, PSCP, PSFTP, and Plink)			
32-bit:	pageant.exe	(or by FTP)	(signature)
64-bit:	pageant.exe	(or by FTP)	(signature)

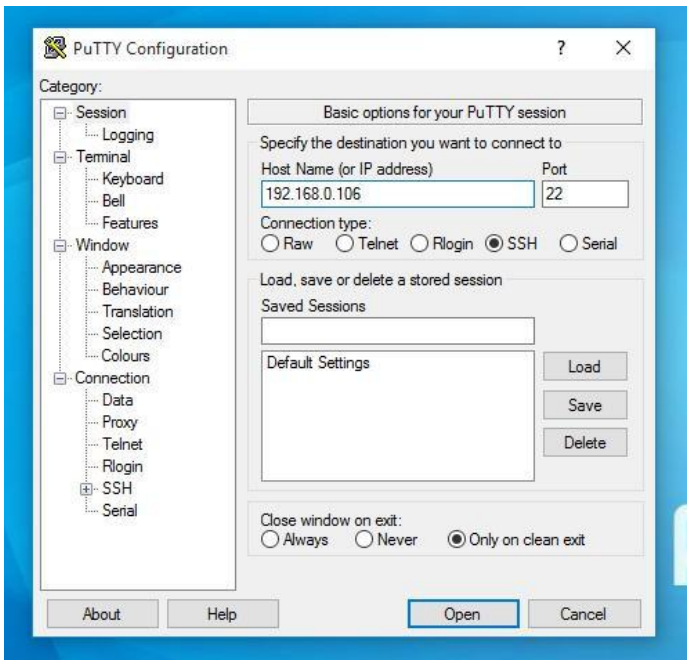
http://blog.csdn.net/github_38111866

Acquire Raspberry Pi's IP Address

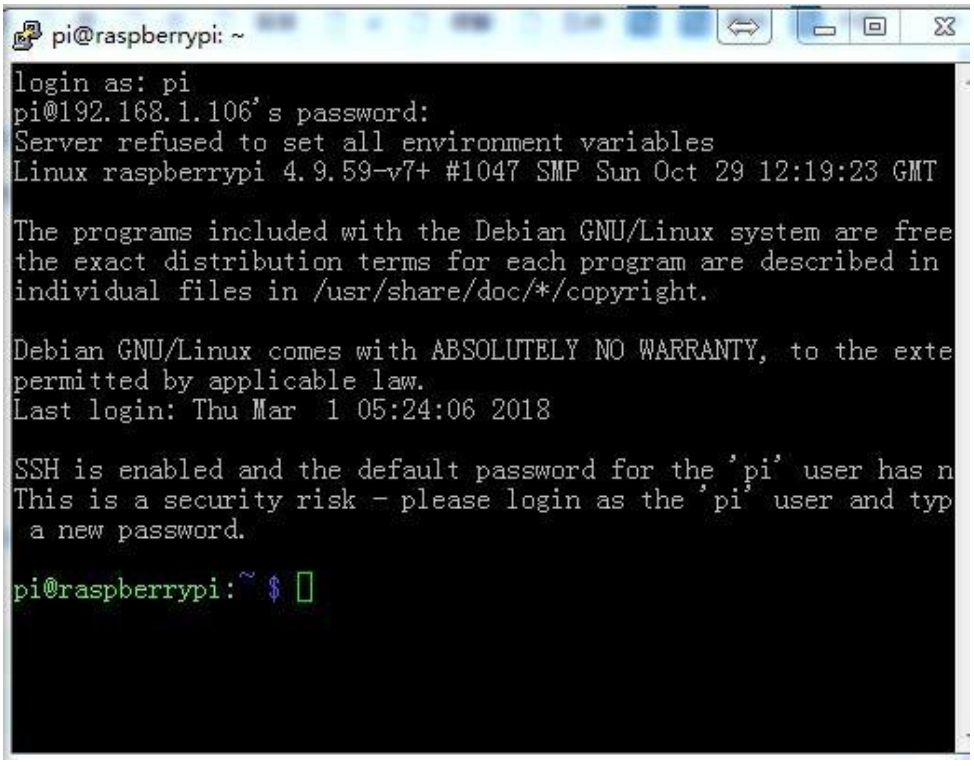
Install the 18650 batteries and switch on the car.
Method A: Log in to the router management page on the computer to check the address of the Raspberry Pi.
Method B: Download the **Network Scanner App** to check the address.
The address of the Raspberry Pi is the one with "*Raspberry*".
* The name of the router that the computer or mobile connects should be consistent with the one of the WiFi in the file *wpa_supplicant.conf* written to the root directory of the SD card in the Raspberry Pi.

Connect the Raspberry Pi and Computer

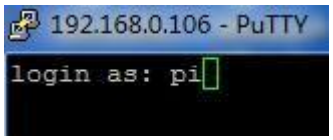
Open PuTTy, enter the IP address of the Raspberry Pi in **Host Name (or IP address)** and click **Open**.



If a warning window prompts, click **Yes**.



Then a terminal will pop up. The default account is pi.



The password for login is *raspberry* by default.
* When you typing in the password, nothing will appear on the screen but it does not mean no input. Type in the password carefully and press **Enter** after it's done.
Log in successfully.

2.2 Download Program

Setting up in a Raspberry Pi may take you a lot of time, and there are too many libraries needed, so we write a python program to do the most of works for you.

Download the program of the raspclaws.
Input the code below to download:

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

Then setup：

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

It may take some time to finish.It may take 2-3 hours to install, and we need to wait patiently.Also do not turn off or disconnect the Raspberry Pi. If the installation fails in this step, please contact us at support@adeept.com in time.

When the Raspberry Pi software is installed, the Raspberry Pi will automatically restart. And the program runs automatically after booting.At this time PuTTy will automatically disconnect.
The Raspberry Pi program has been installed when it comes to this step.Next we need to assemble the robot, please shut down the Raspberry Pi and remove the power supply.

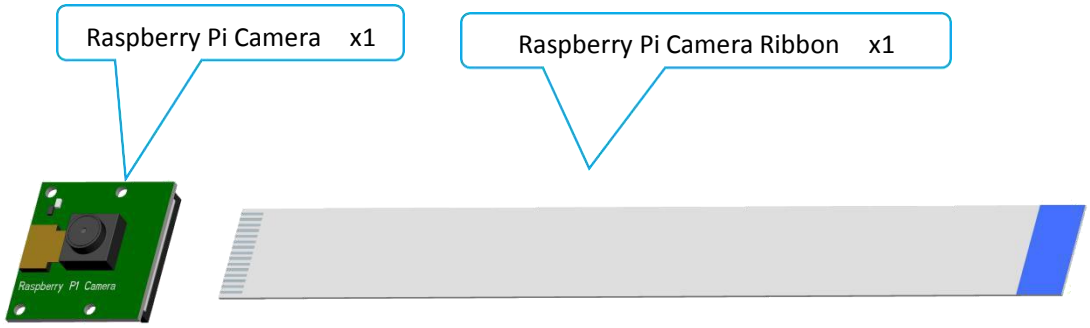
3. Assembly

3.1. Preparations before Assembly

1.Connect the Raspberry Pi Camera and the ribbon.

Assemble the following components

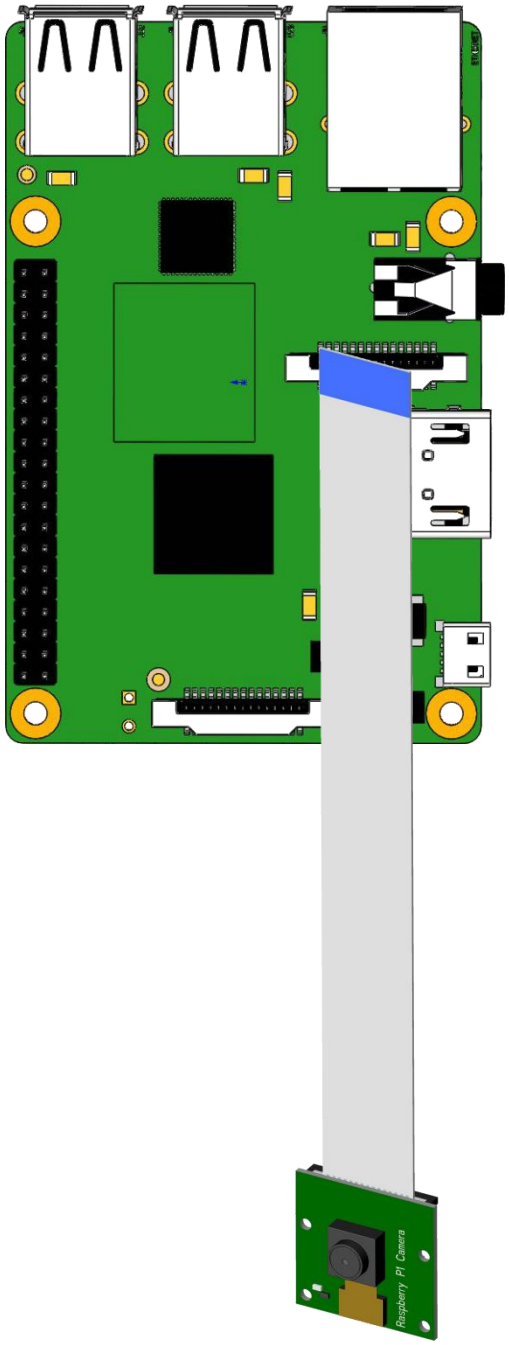
Note: That in the next operation, the Pi Camera of the Raspberry Pi should always be connected to the Raspberry Pi, and do not reverse the wires of the Raspberry Pi.



Effect diagram after assembling

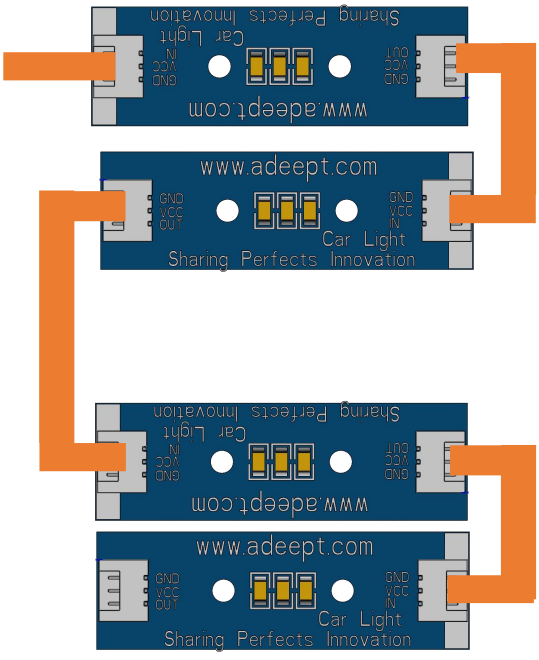
2. Connect the Raspberry Pi Camera and the Raspberry Pi.

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)

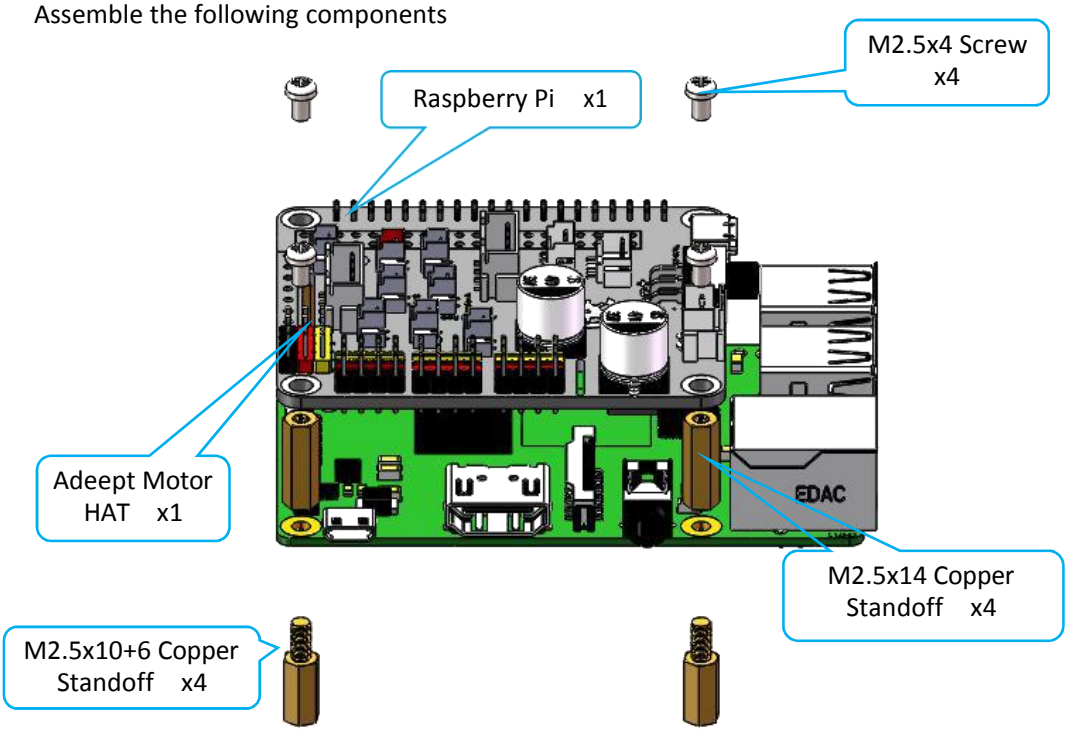


3.2. Servo debugging.

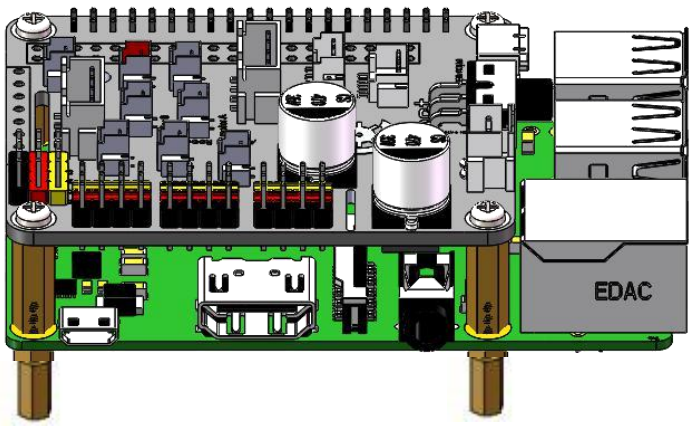
1. Fix four M2.5x10+6 Copper Standoffs on Raspberry Pi.

insert the Adeept Motor HAT into Raspberry Pi.

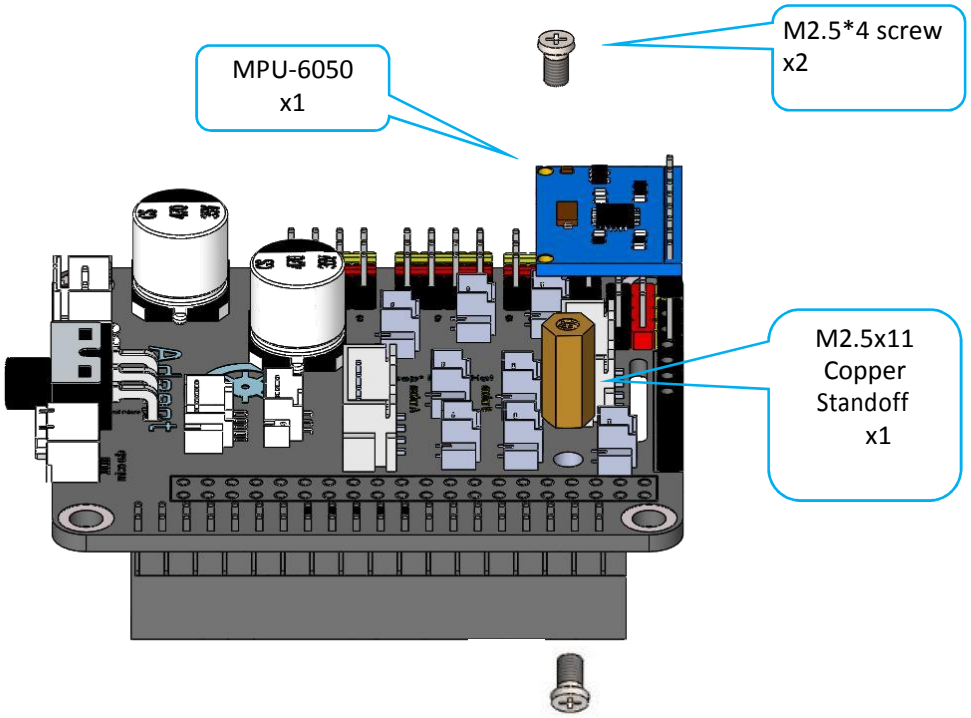
Assemble the following components



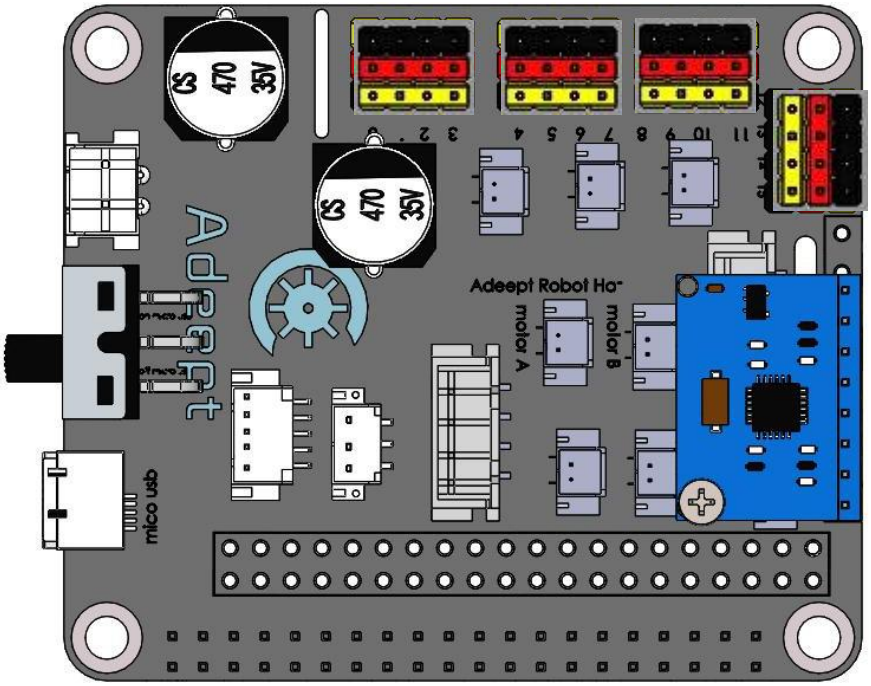
Effect diagram after assembling



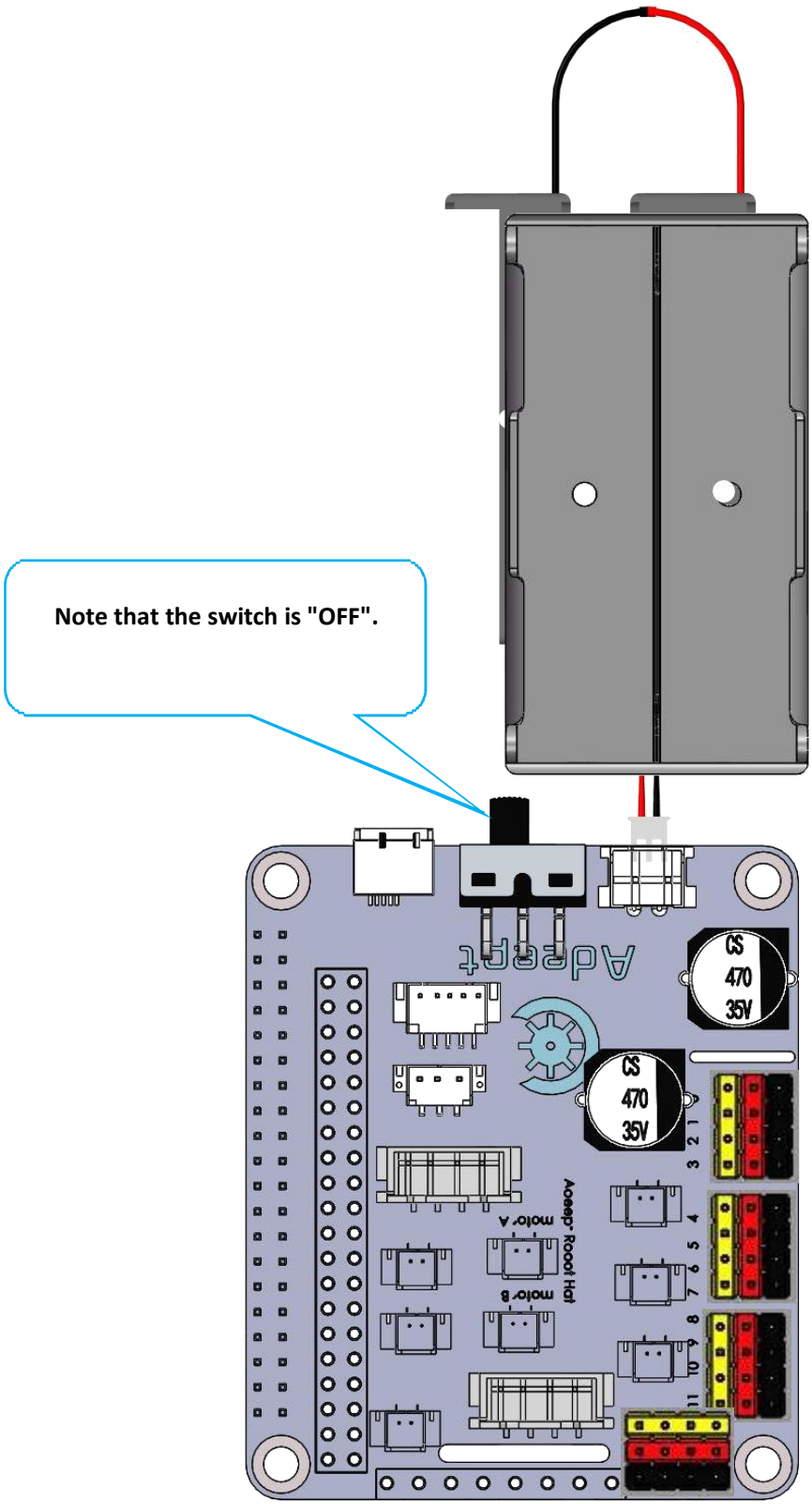
Connect the driver board to mpu-6050.



Effect diagram after assembling

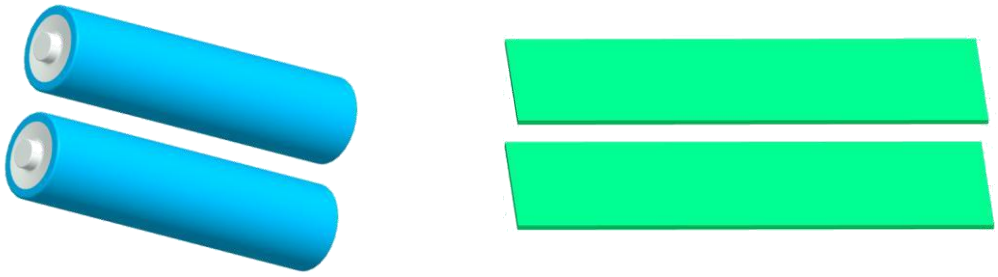


3. Connect the 18650 Battery Holder Set to the Adeept Motor HAT.

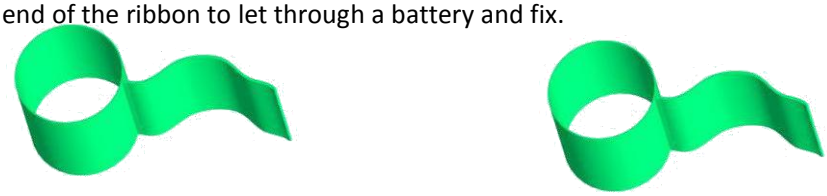


3.3.Install and Remove Batteries

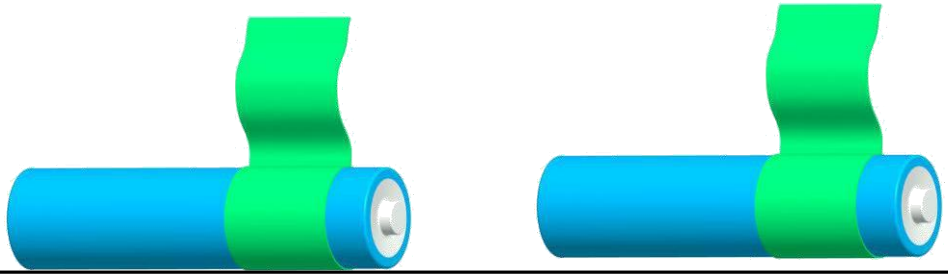
Take out 2 ribbons and 2 batteries.



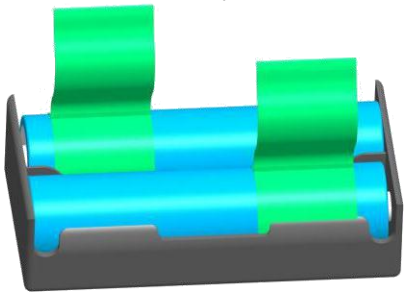
Roll one end of the ribbon to let through a battery and fix.



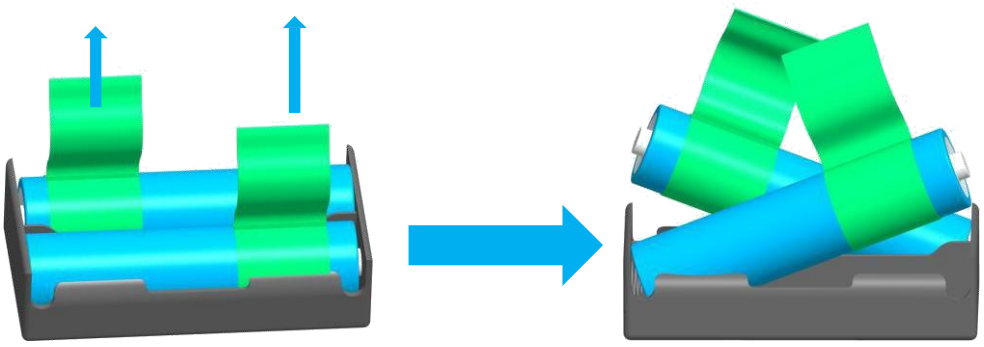
Insert the batteries into the rings-ribbon closer to the anode.



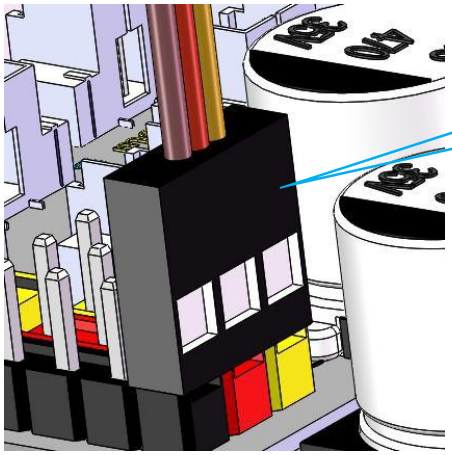
Install the batteries into the holder based on the pole.



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

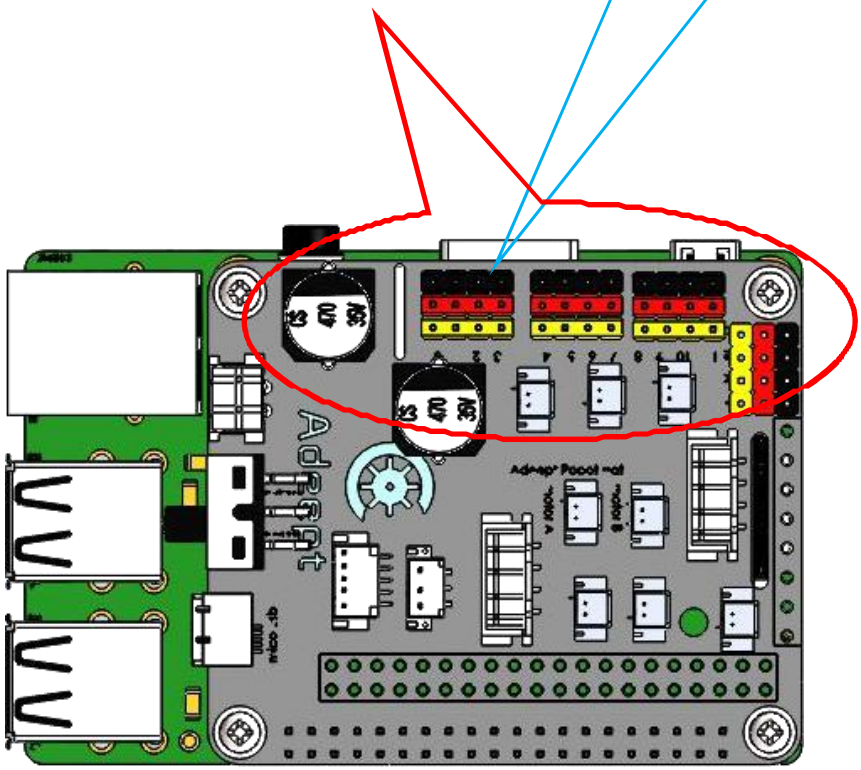


4. Connect servos to Adeept Motor HAT.

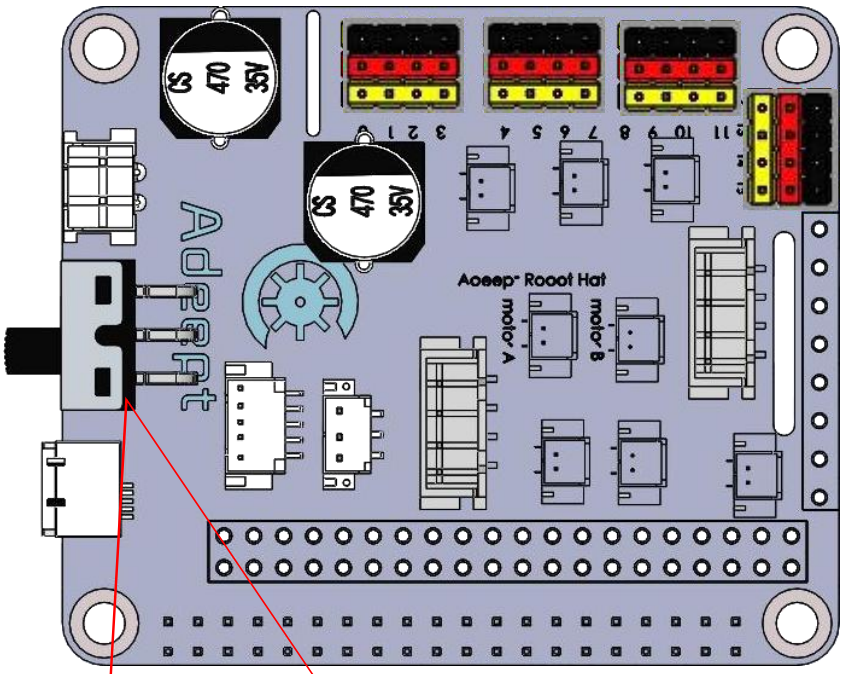


The color of the servo wire corresponds to the color of the port.

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.

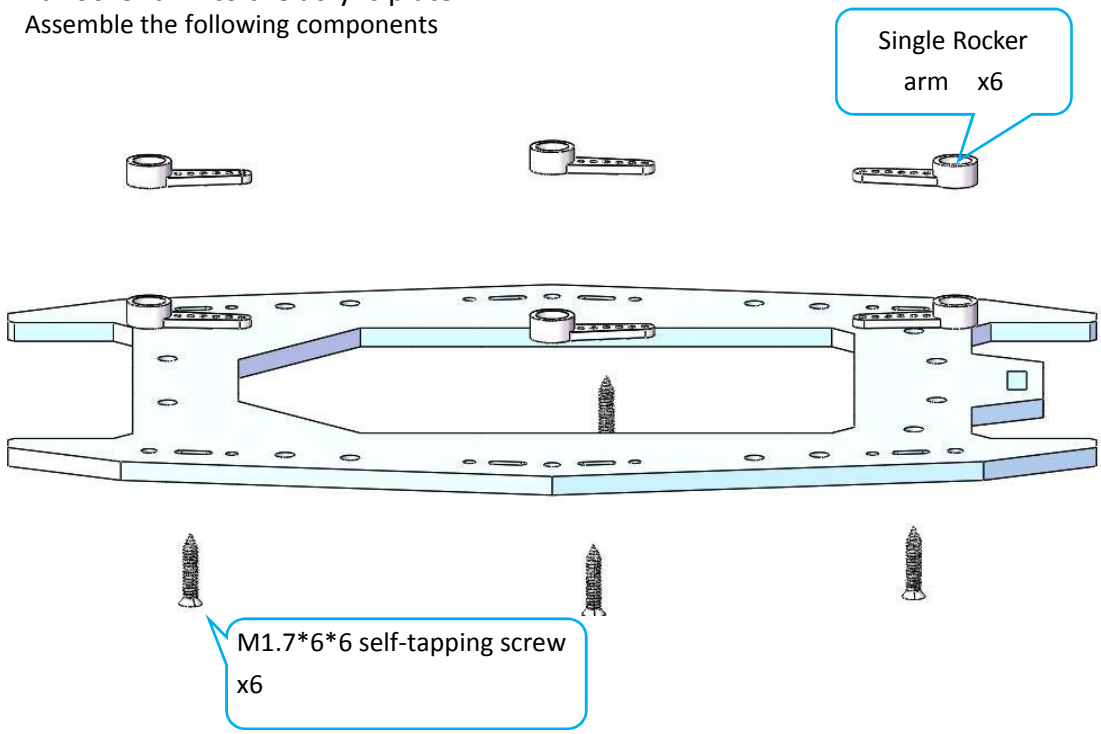


Turn the switch here to "ON" (power on), the servo will automatically rotate to the initial position. Wait about one minute for the servo to automatically rotate to the position of 90° and stay at 90° .Then you can proceed to the next step of assembly. If there is a power outage during the assembly process,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

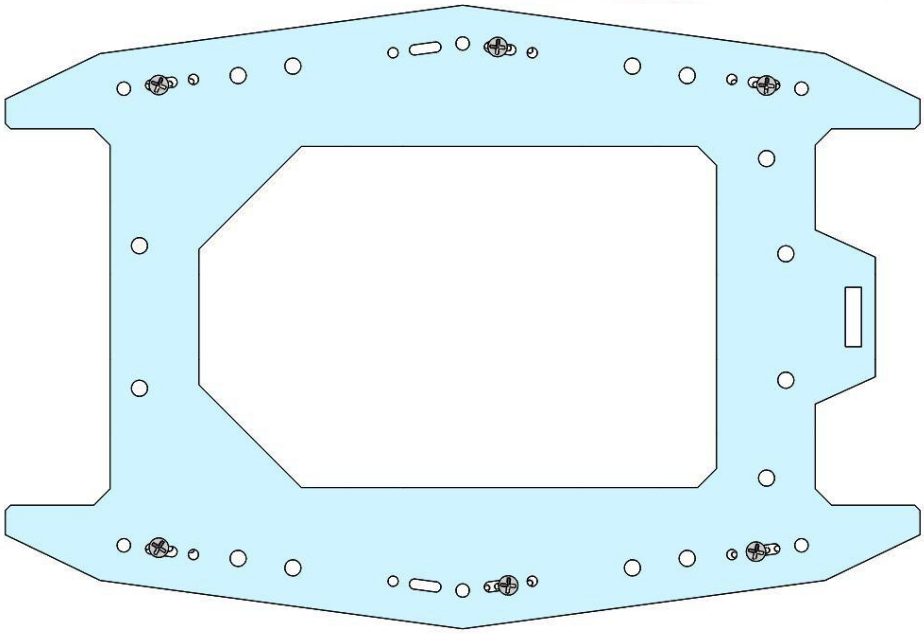
3.4 install the arm

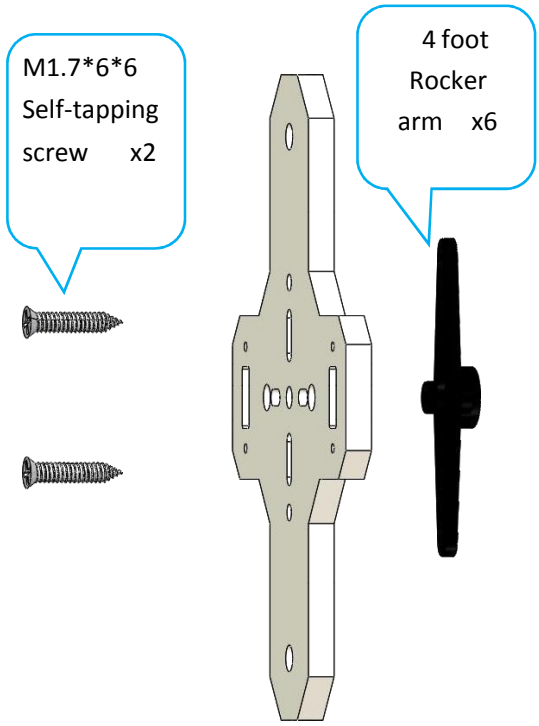
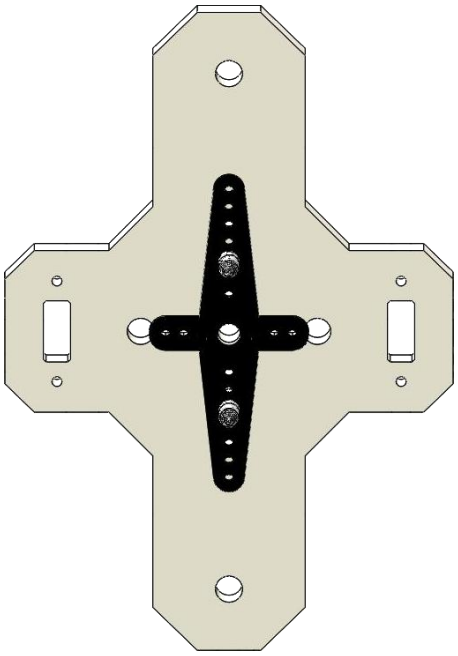
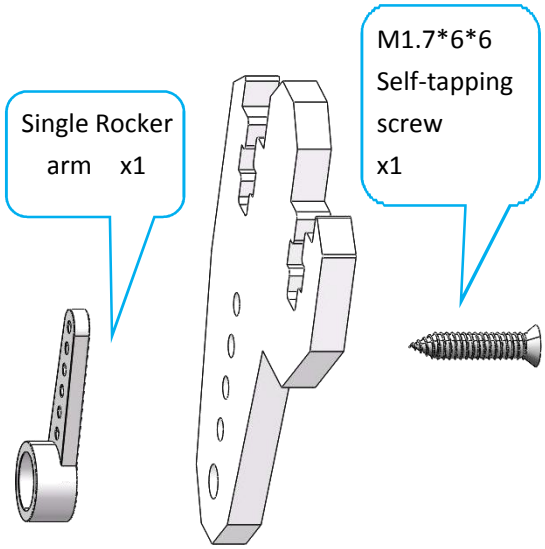
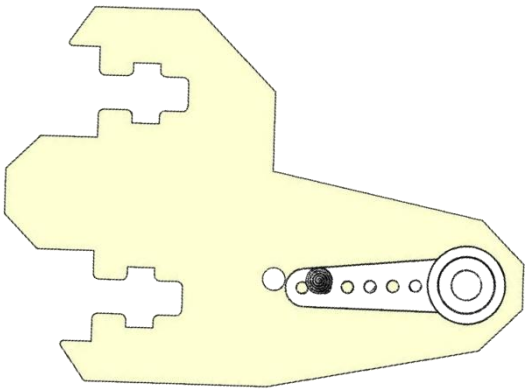
Fix a rocker arm to the acrylic plate.

Assemble the following components

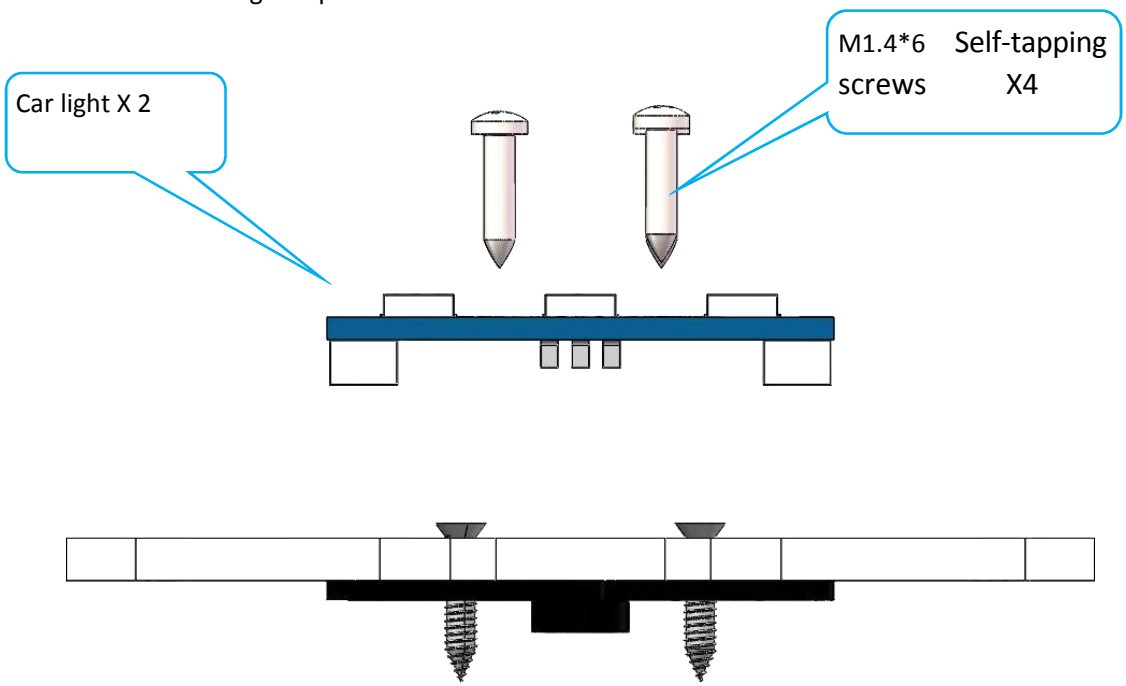


Effect diagram after assembling

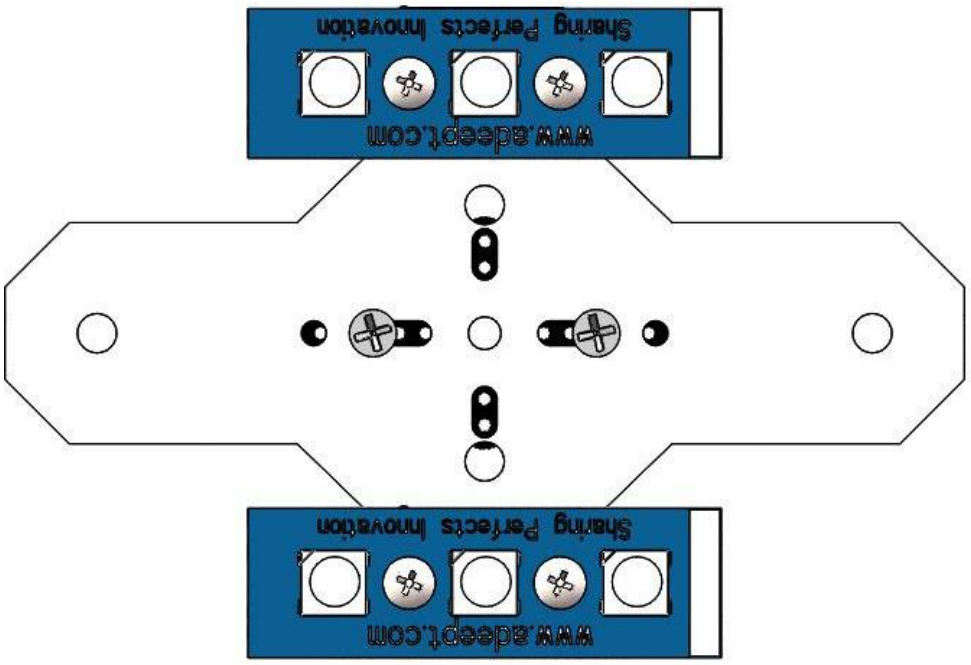


Assemble the following components 	Effect diagram after assembling 
Assemble the following components 	Effect diagram after assembling 

Assemble the following components



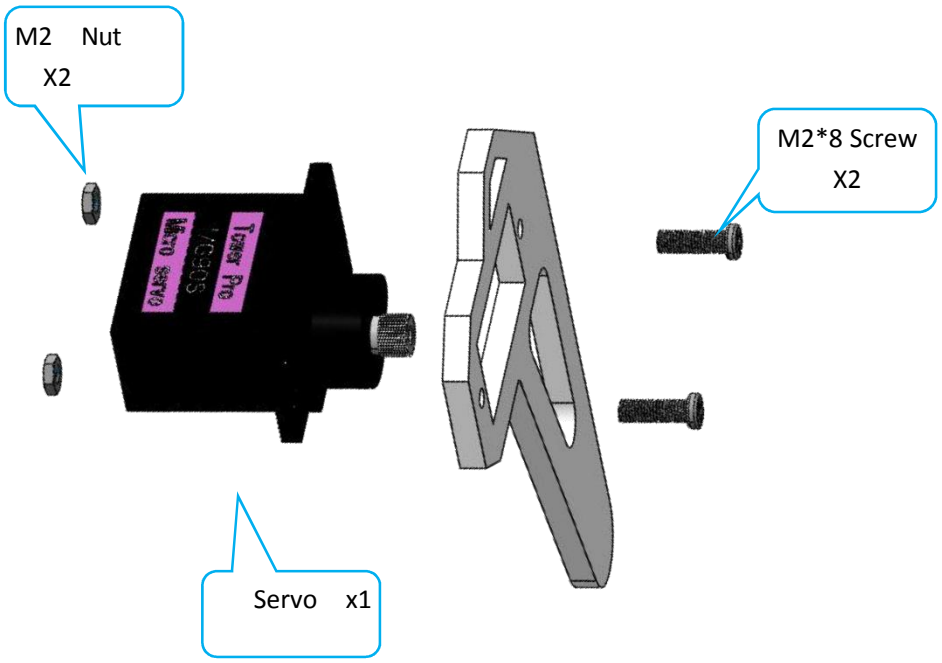
Effect diagram after assembling



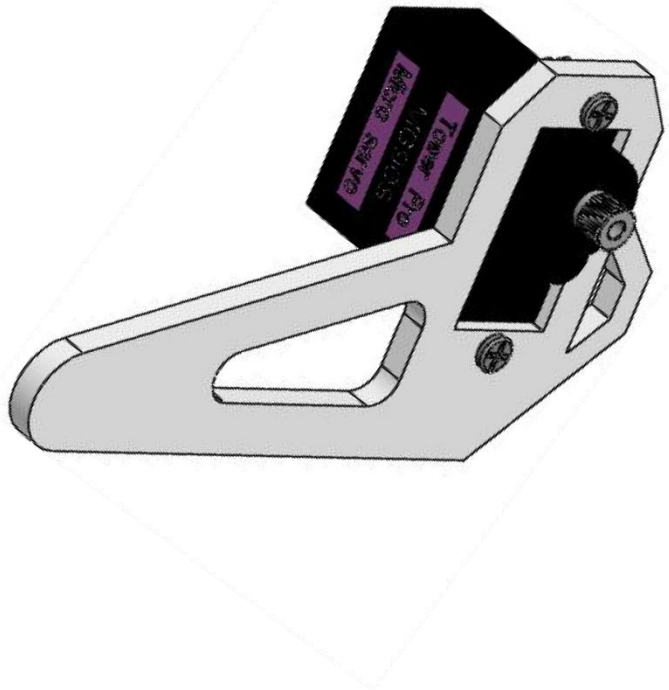
3.5 install the feet

Fix a debugged servo to the acrylic plate.

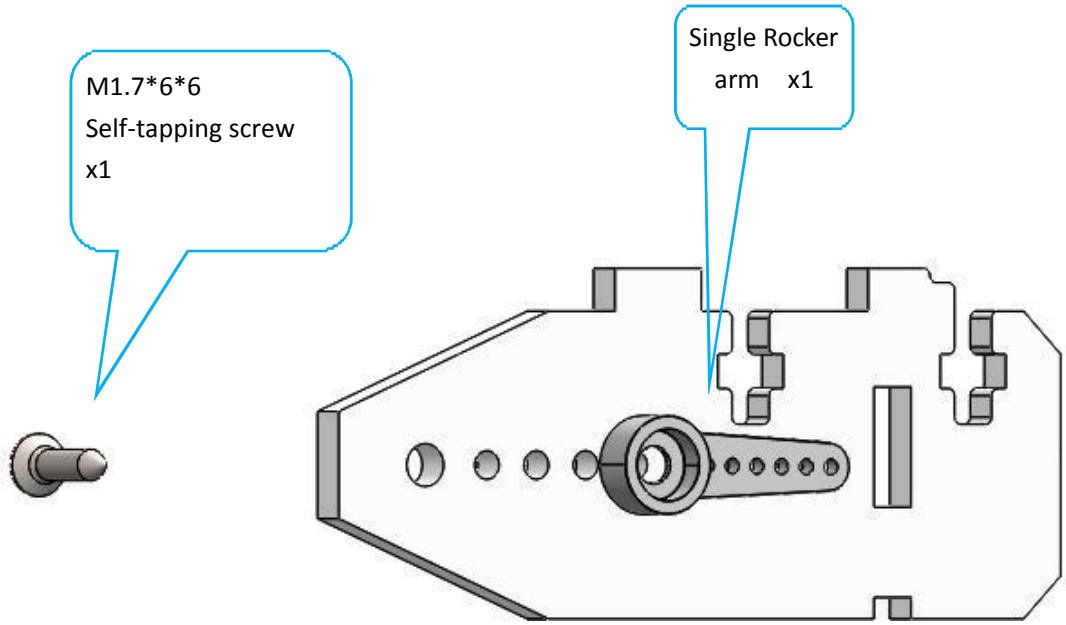
Assemble the following components



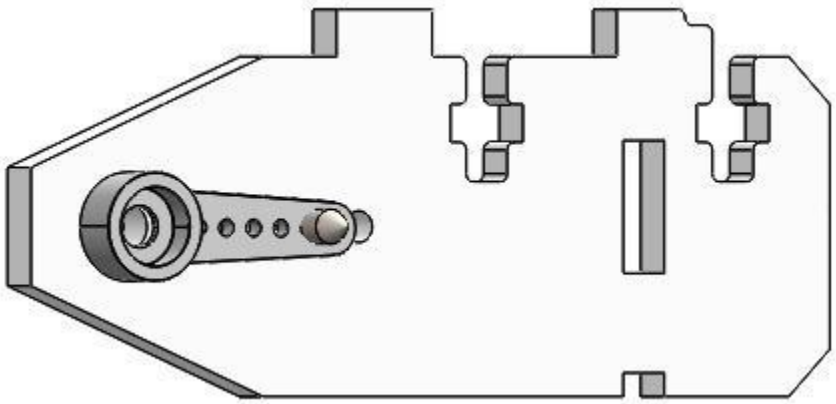
Effect diagram after assembling



Assemble the following components

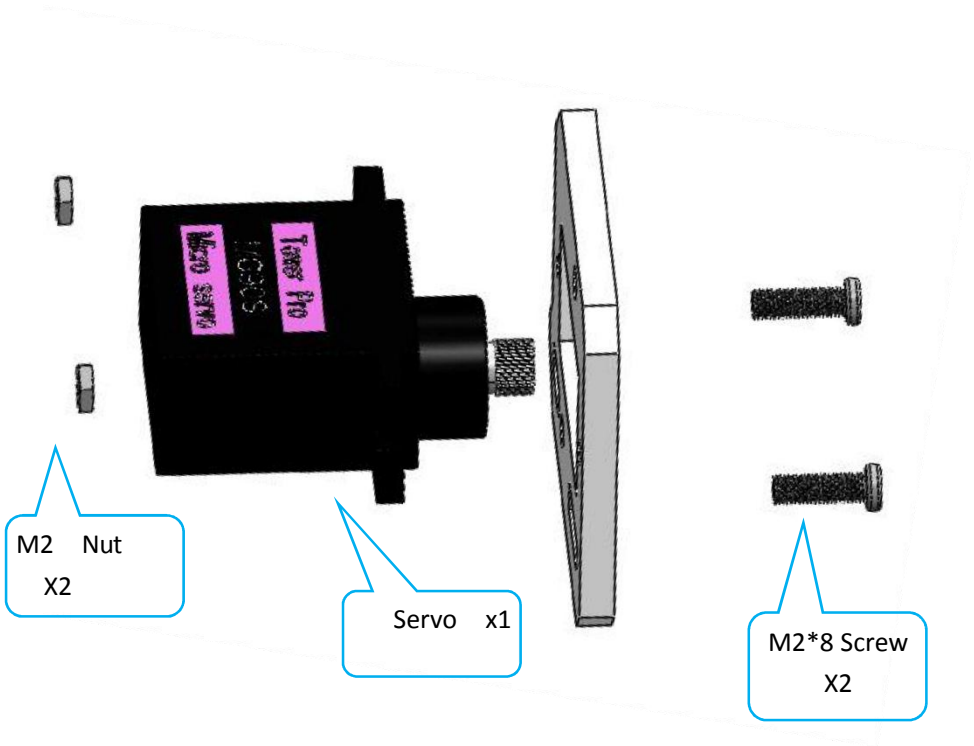


Effect diagram after assembling

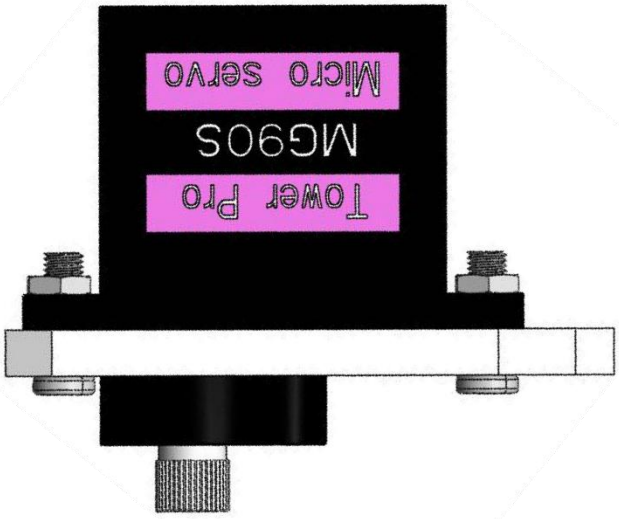


Fix a debugged servo to the acrylic plate.

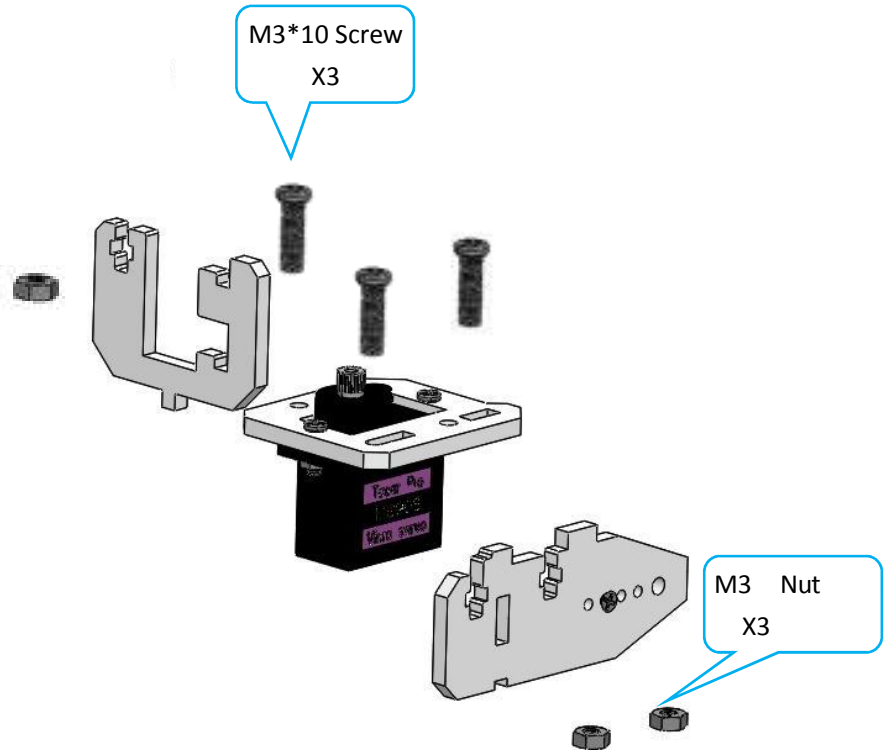
Assemble the following components



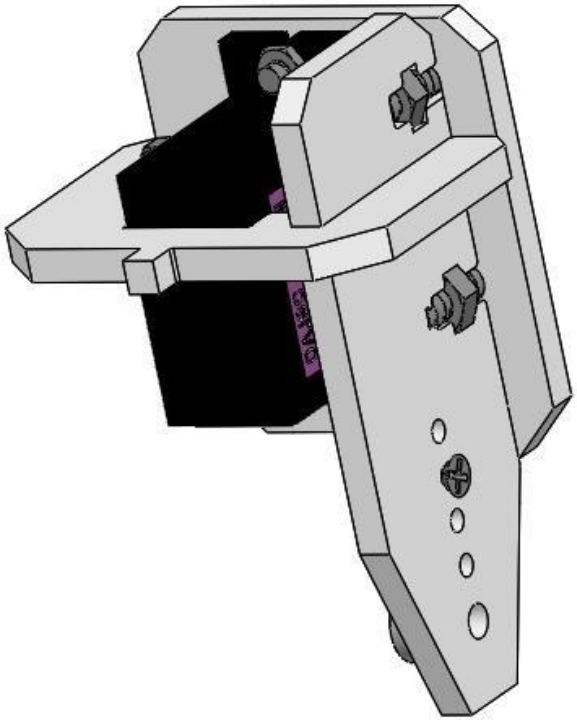
Effect diagram after assembling



Assemble the following components

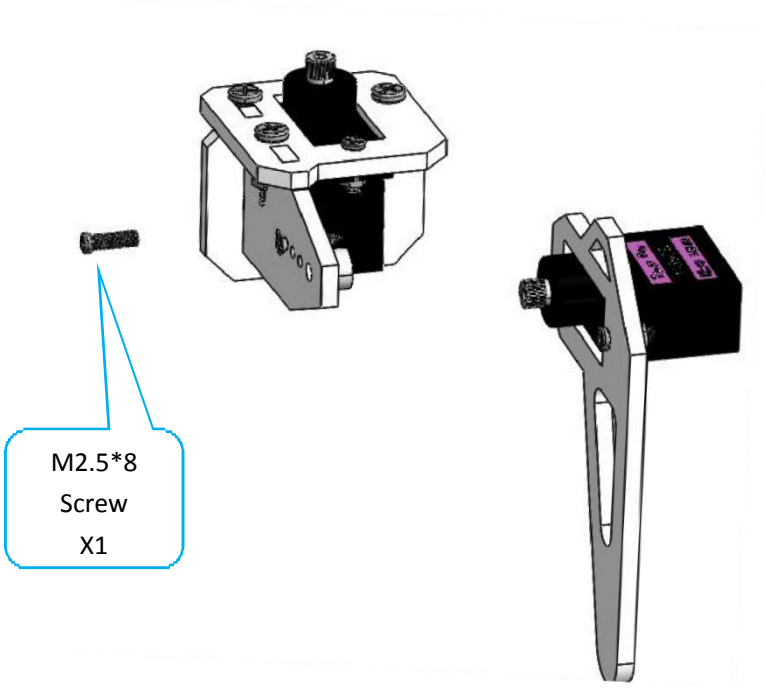


Effect diagram after assembling



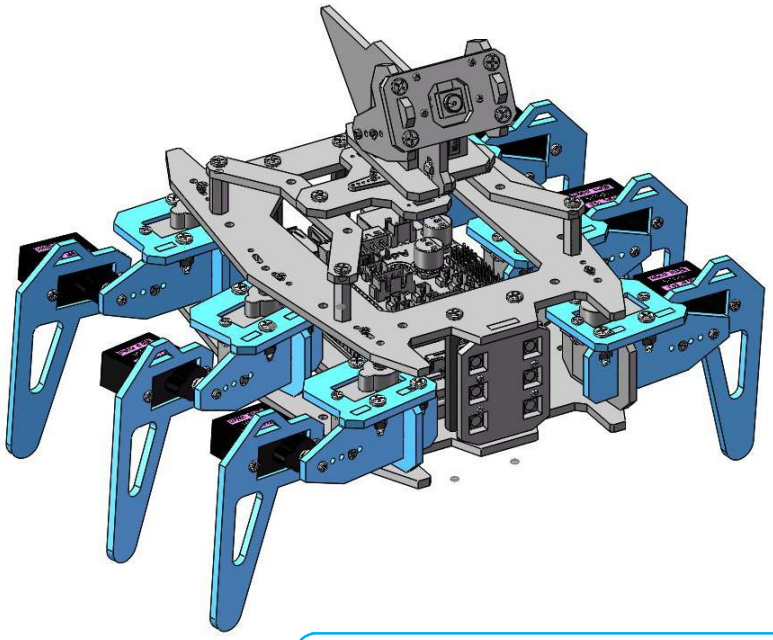
Fix Robot feet

Assemble the following components



The foot of the robot

Effect diagram after assembling

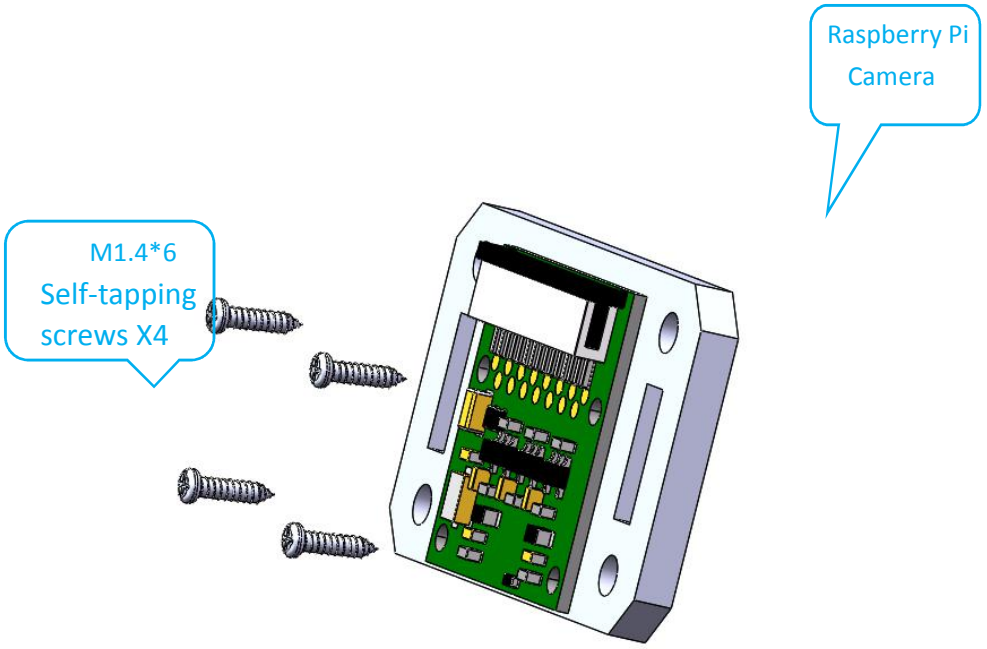


Install the servo and the acrylic plate on the right foot opposite from the ones on the left foot.

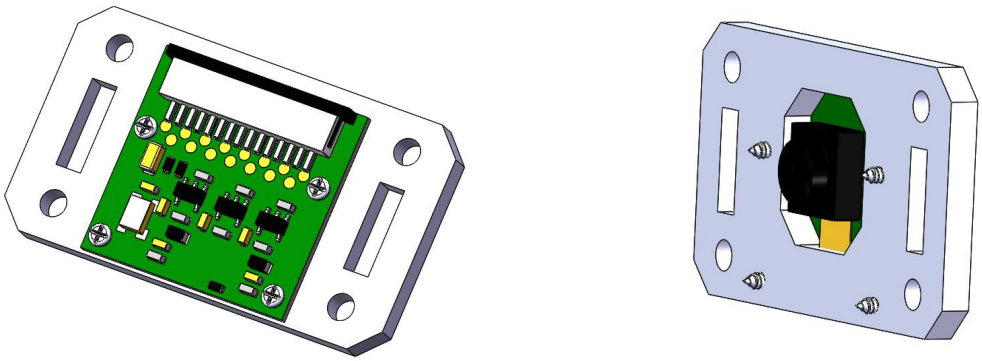
3.3 install the Camera

Fix Raspberry Pi Camera on Acrylic Plates

Assemble the following components

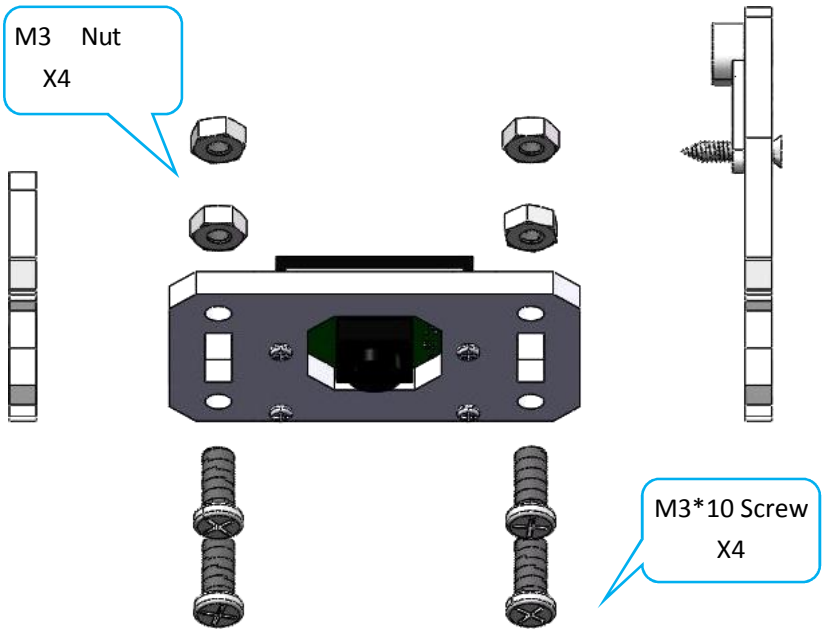


Effect diagram after assembling

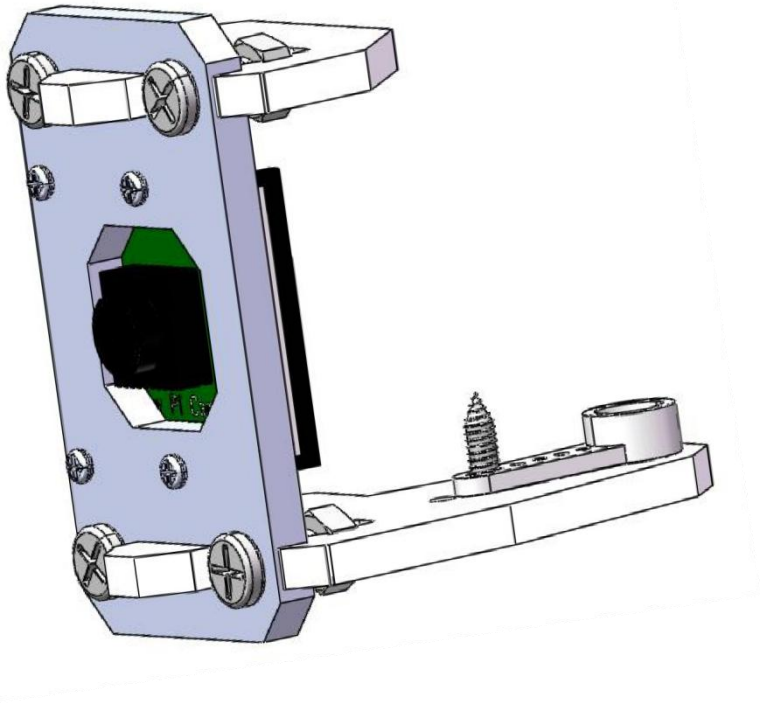


Assemble Pi Camera

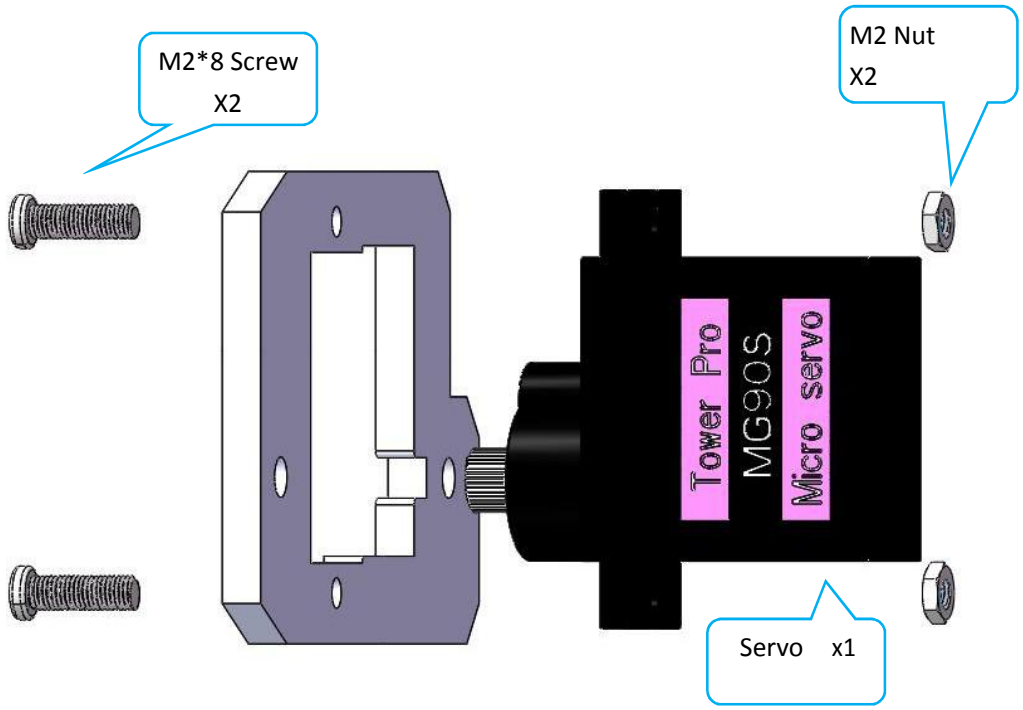
Assemble the following components



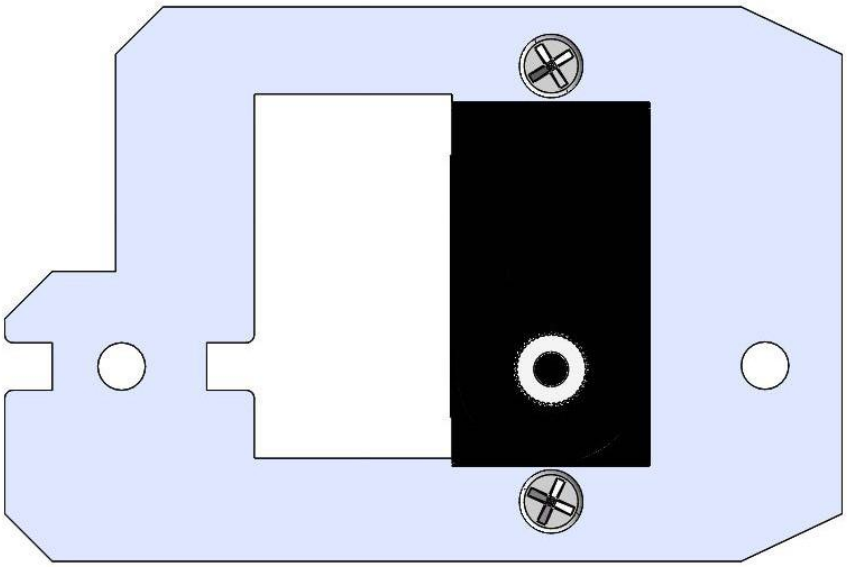
Effect diagram after assembling



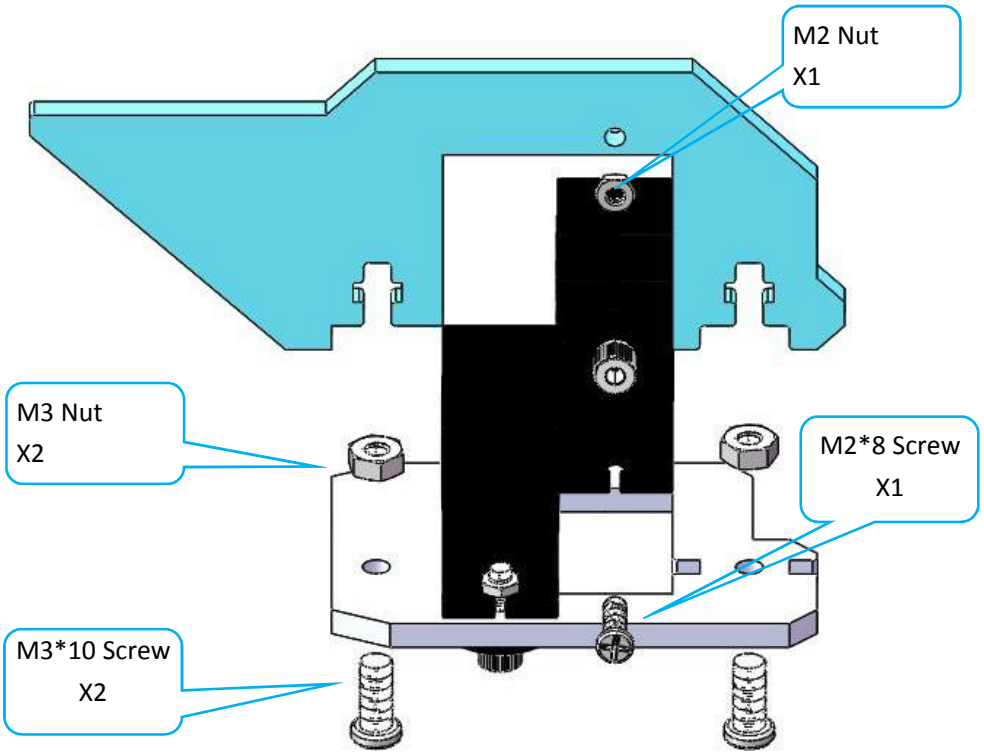
Assemble the following components



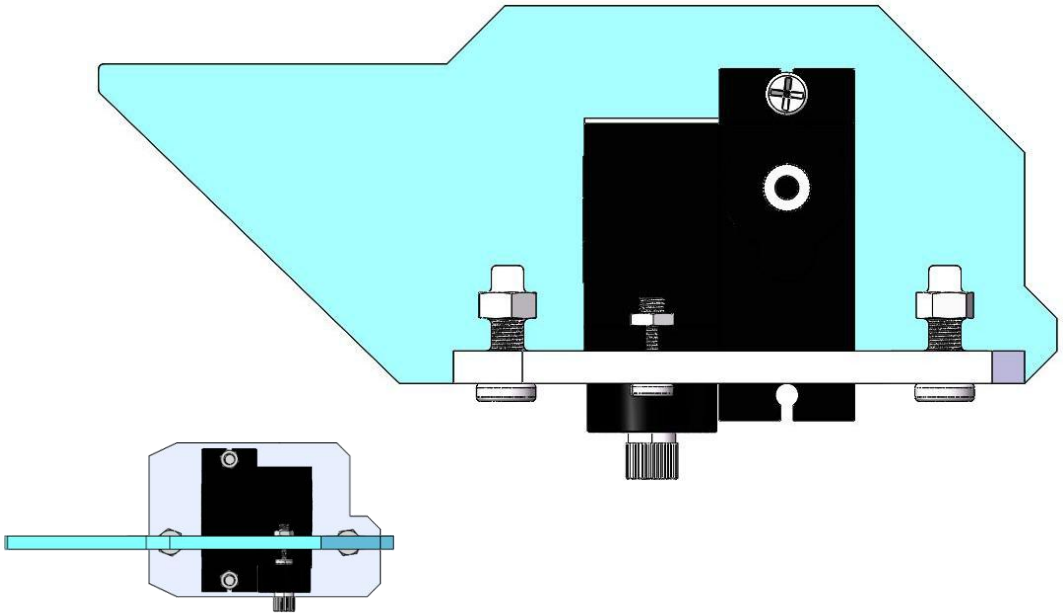
Effect diagram after assembling



Assemble the following components

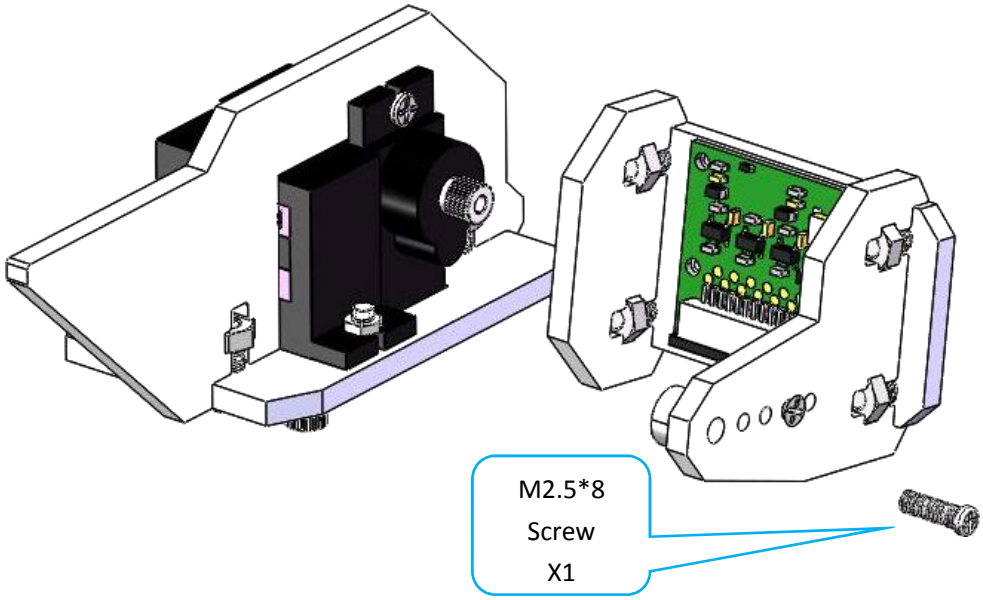


Effect diagram after assembling

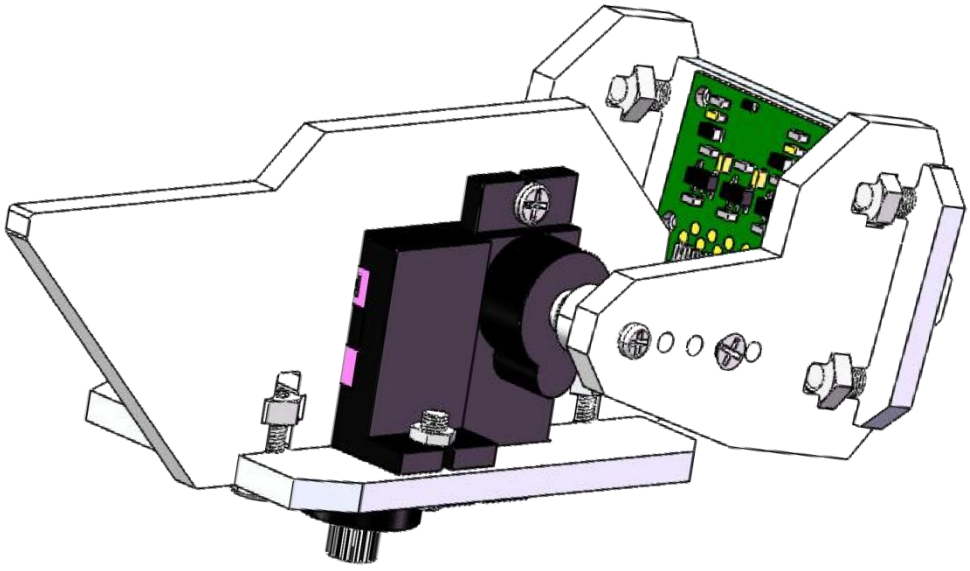


Connect Assemble Pi Camera

Assemble the following components

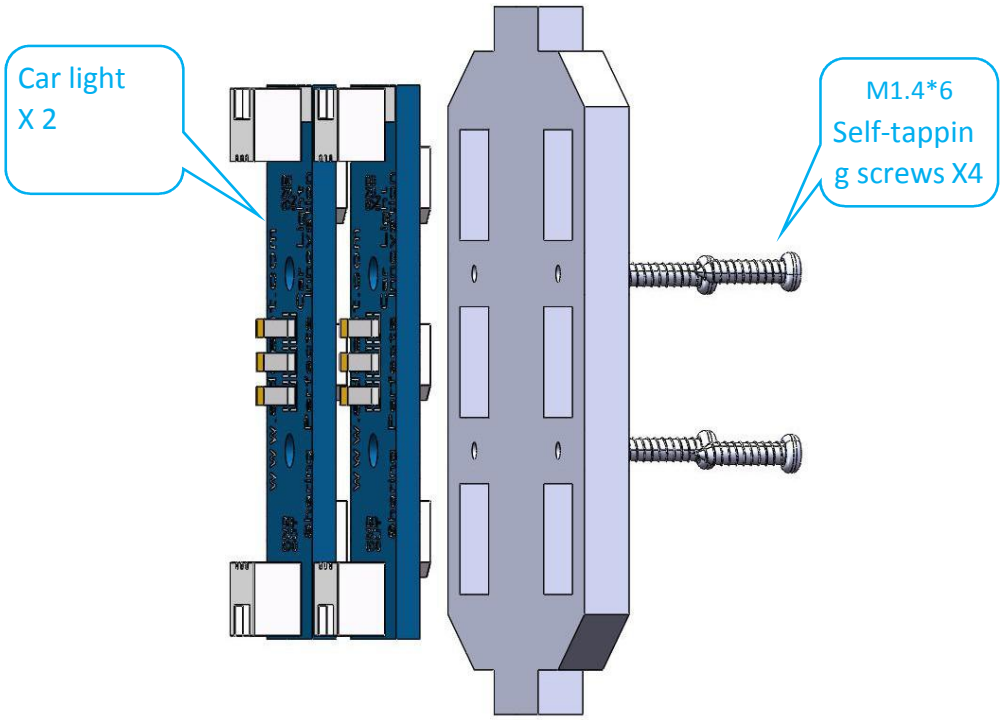


Effect diagram after assembling

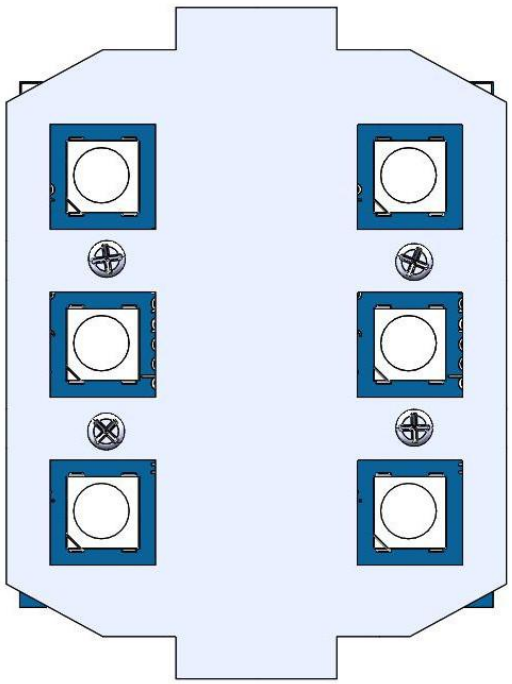


Fix car light on Acrylic Plates

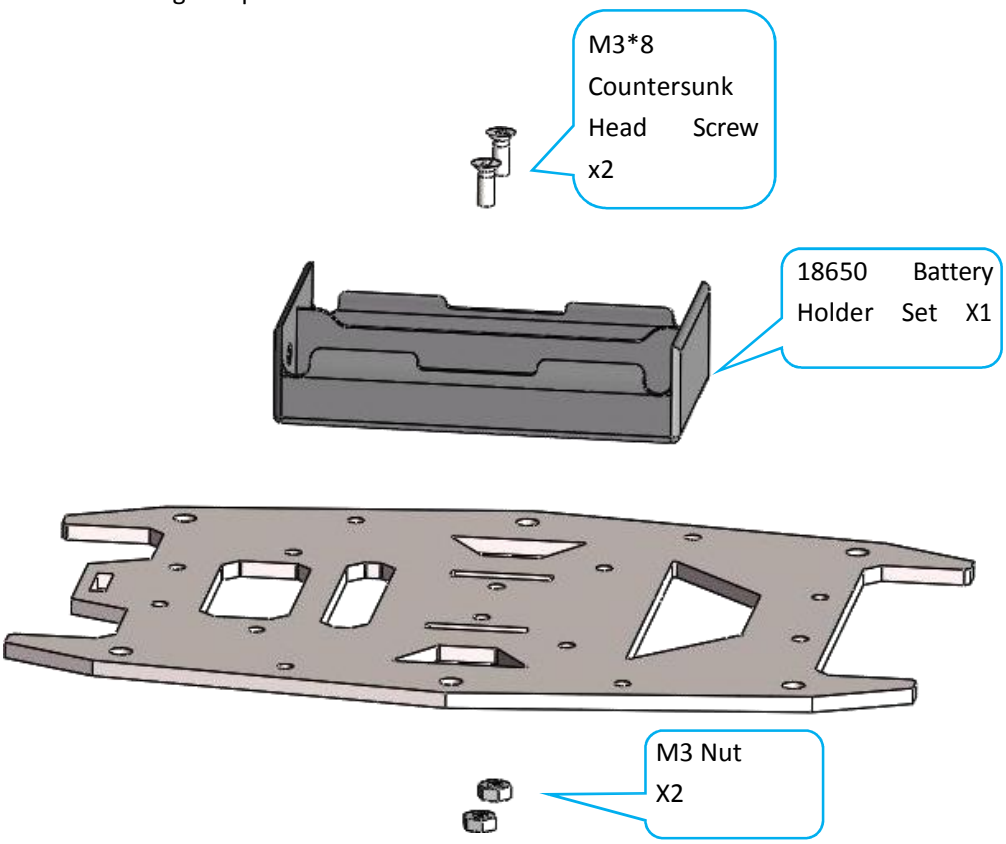
Assemble the following components



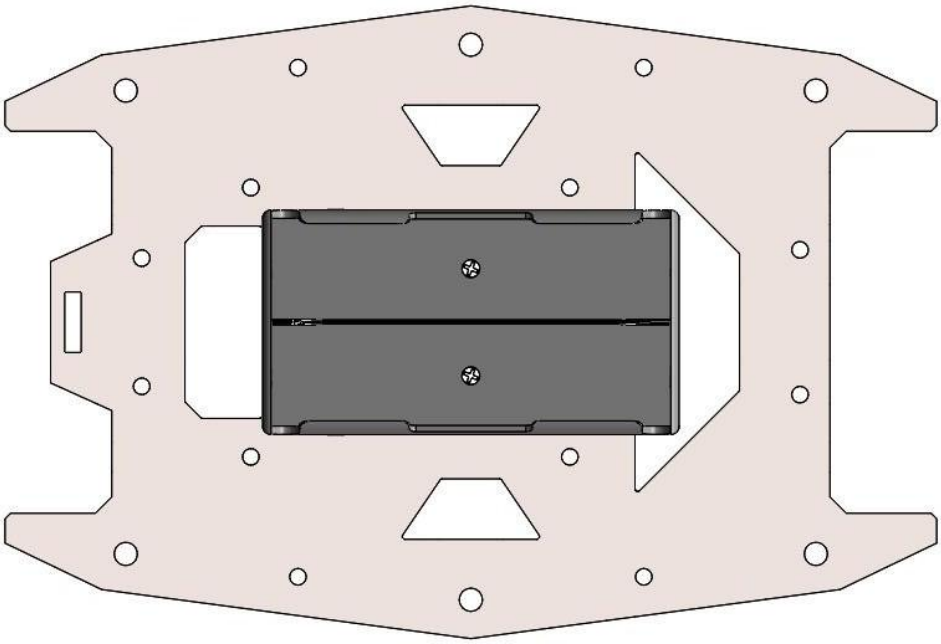
Effect diagram after assembling



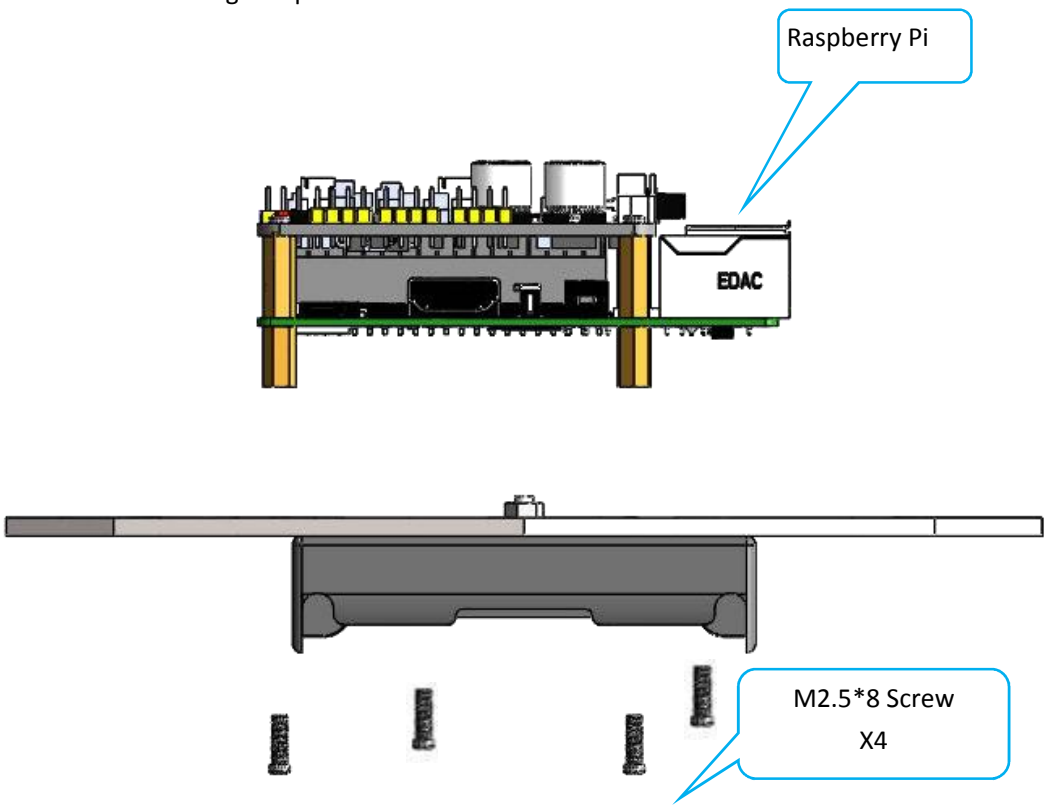
Assemble the following components



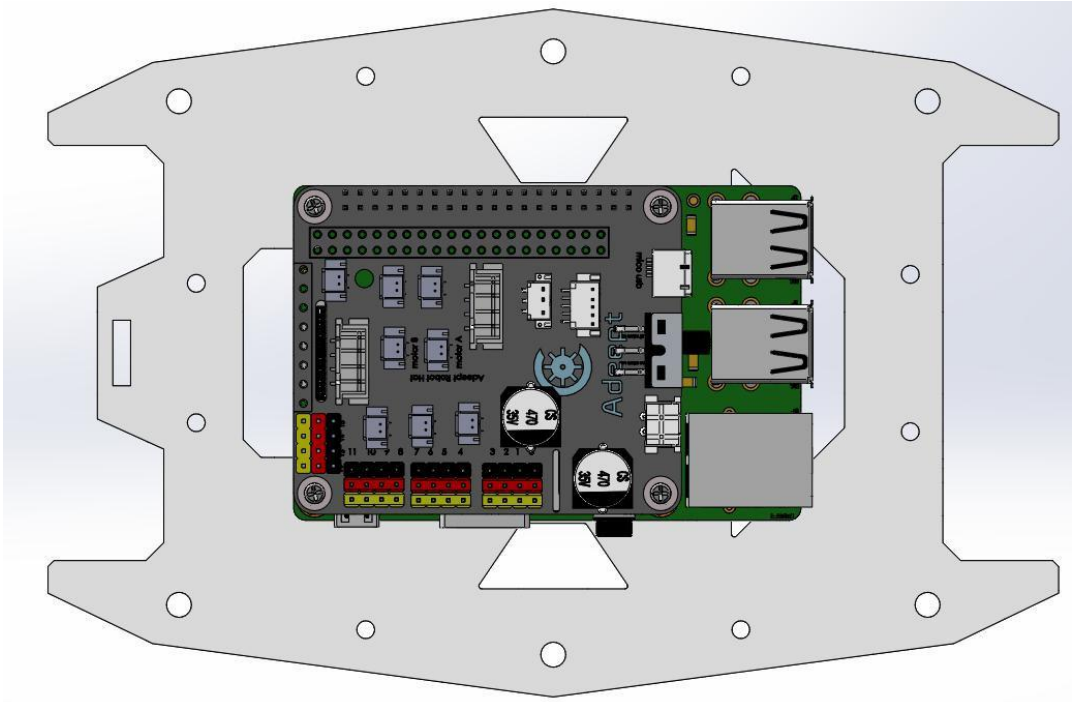
Effect diagram after assembling



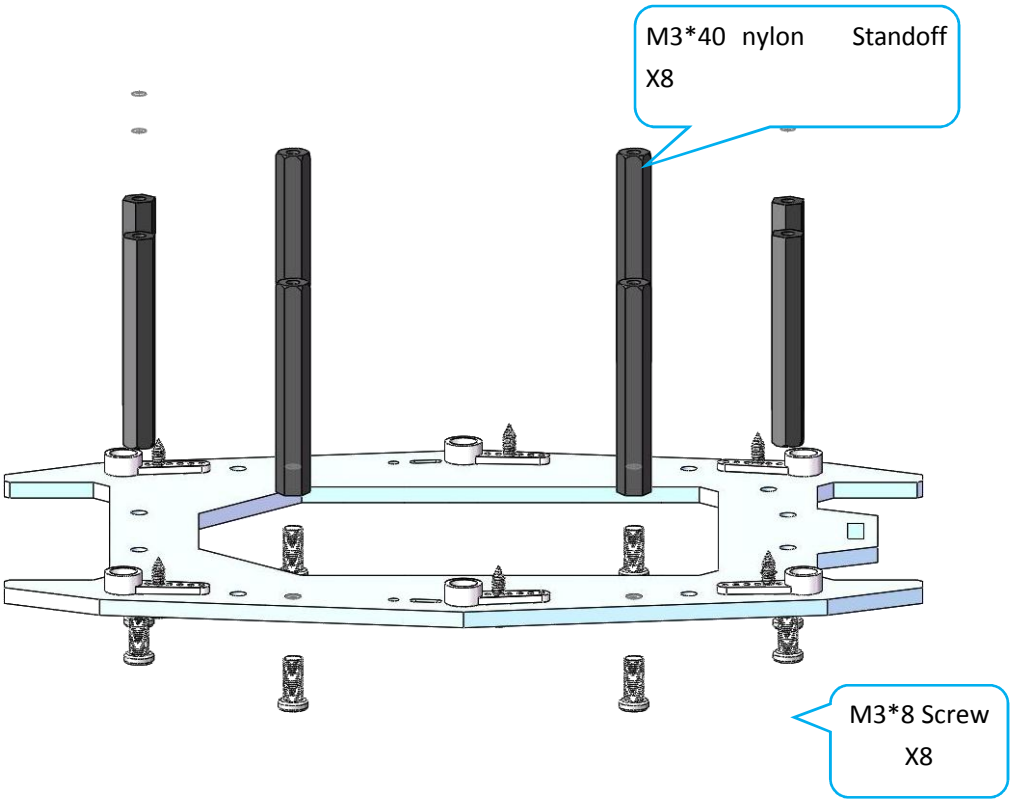
Assemble the following components



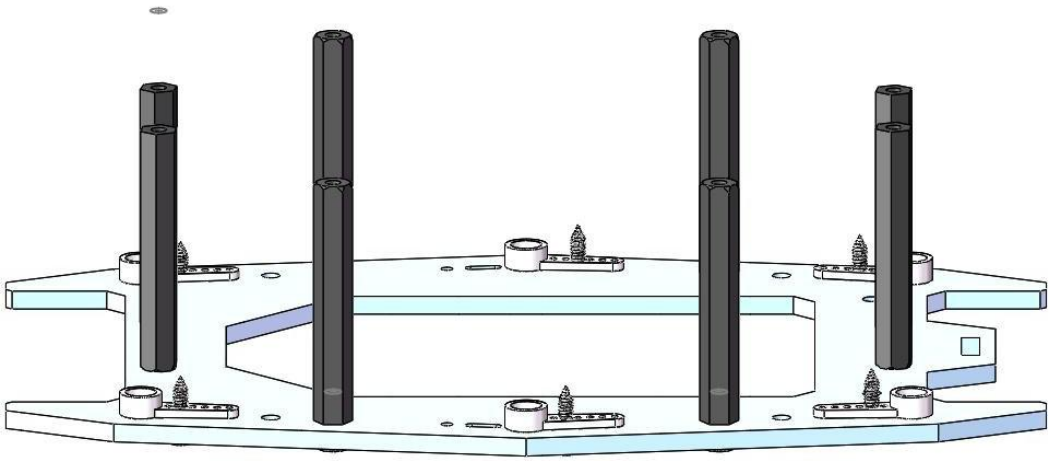
Effect diagram after assembling



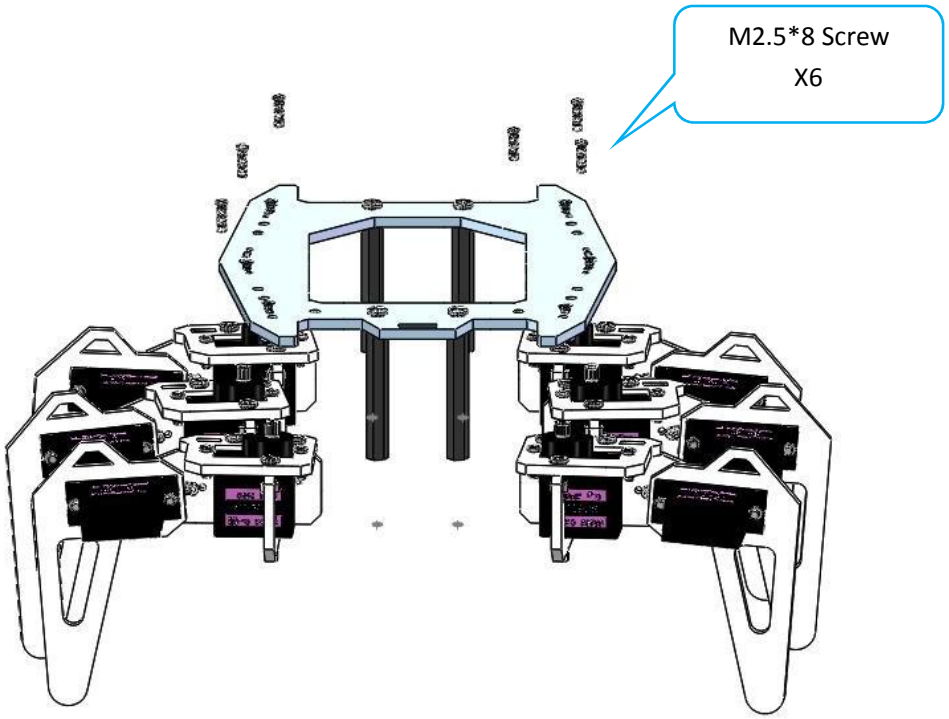
Assemble the following components



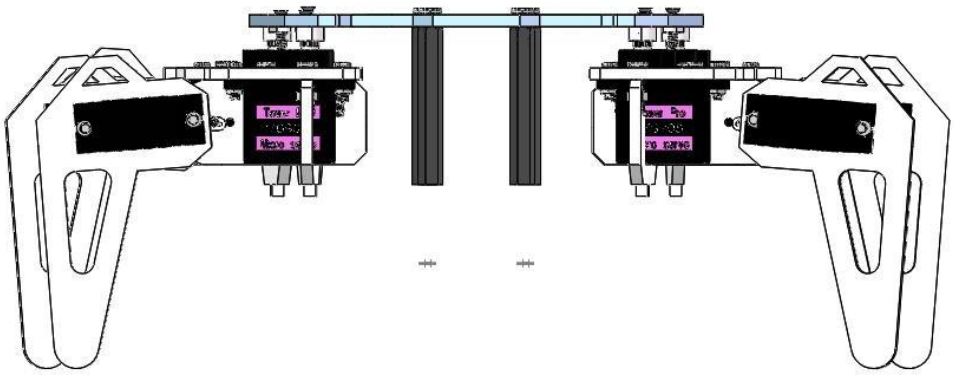
Effect diagram after assembling



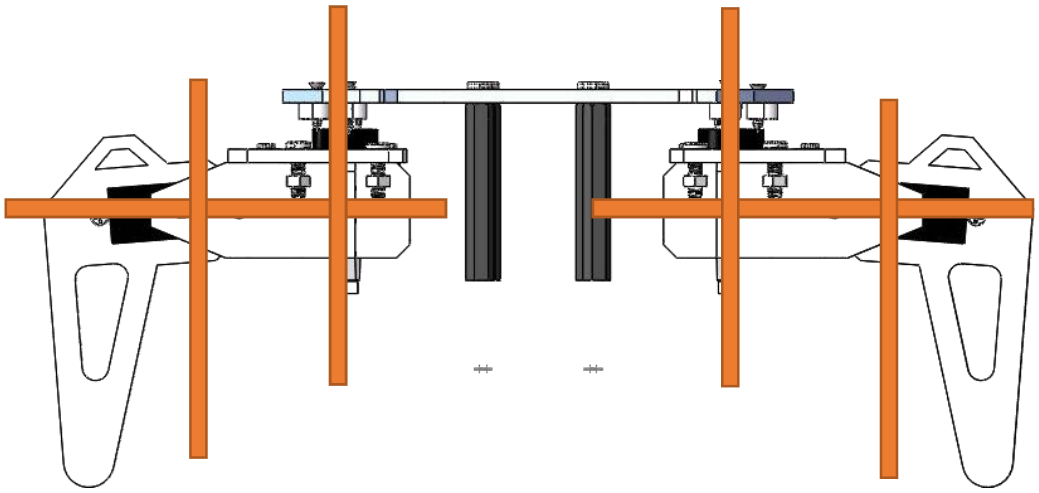
Assemble the following components

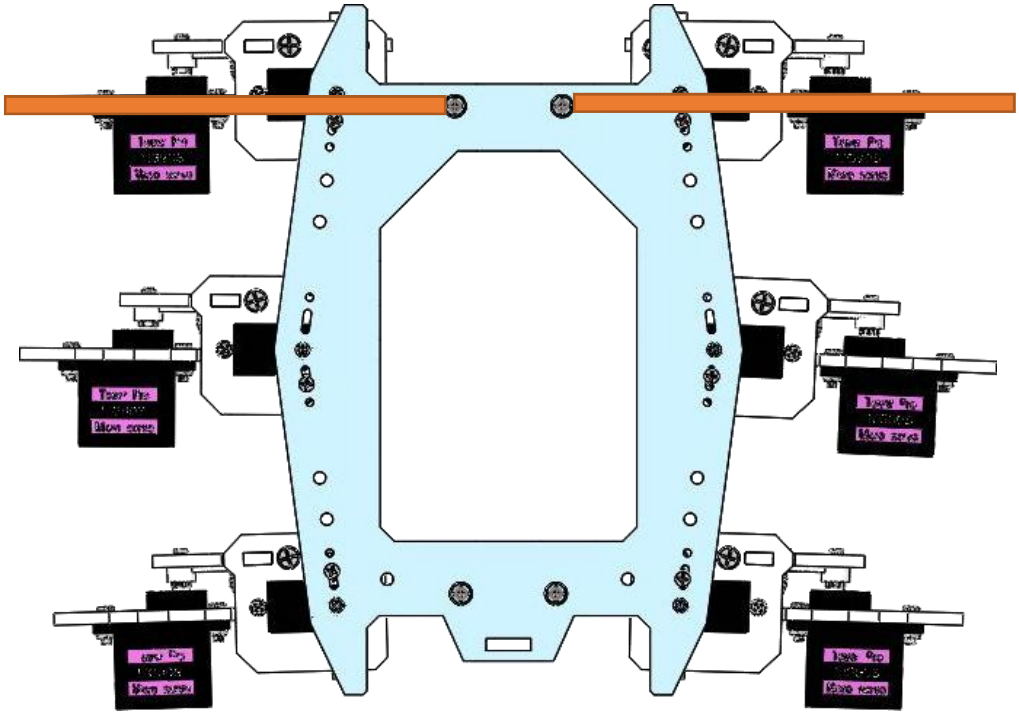


Effect diagram after assembling

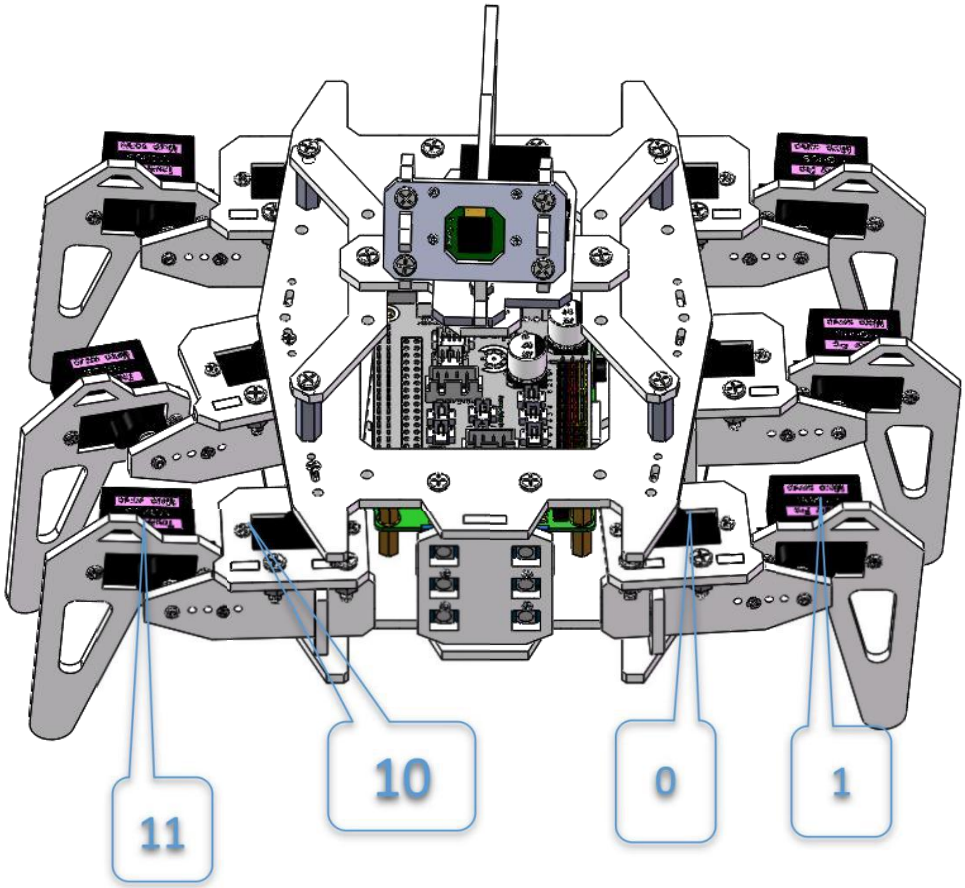


When connecting the servo to the acrylic plate, connect the wiring to PWM interface, the driver board will automatically check the position of the servo. Pay attention to the installation angle when installing the servo.

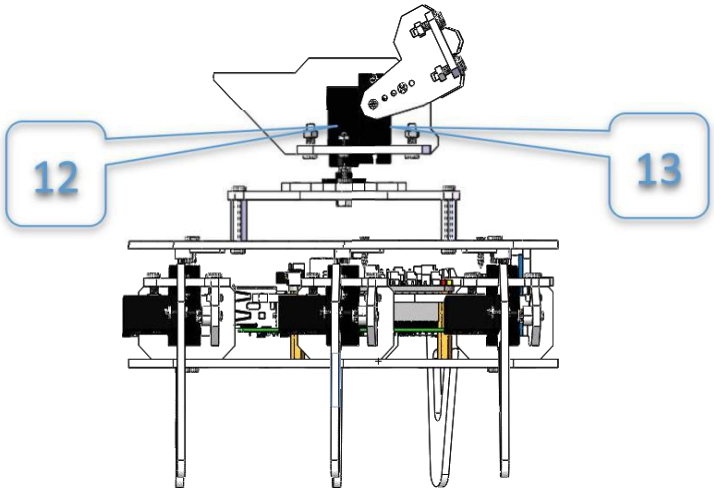


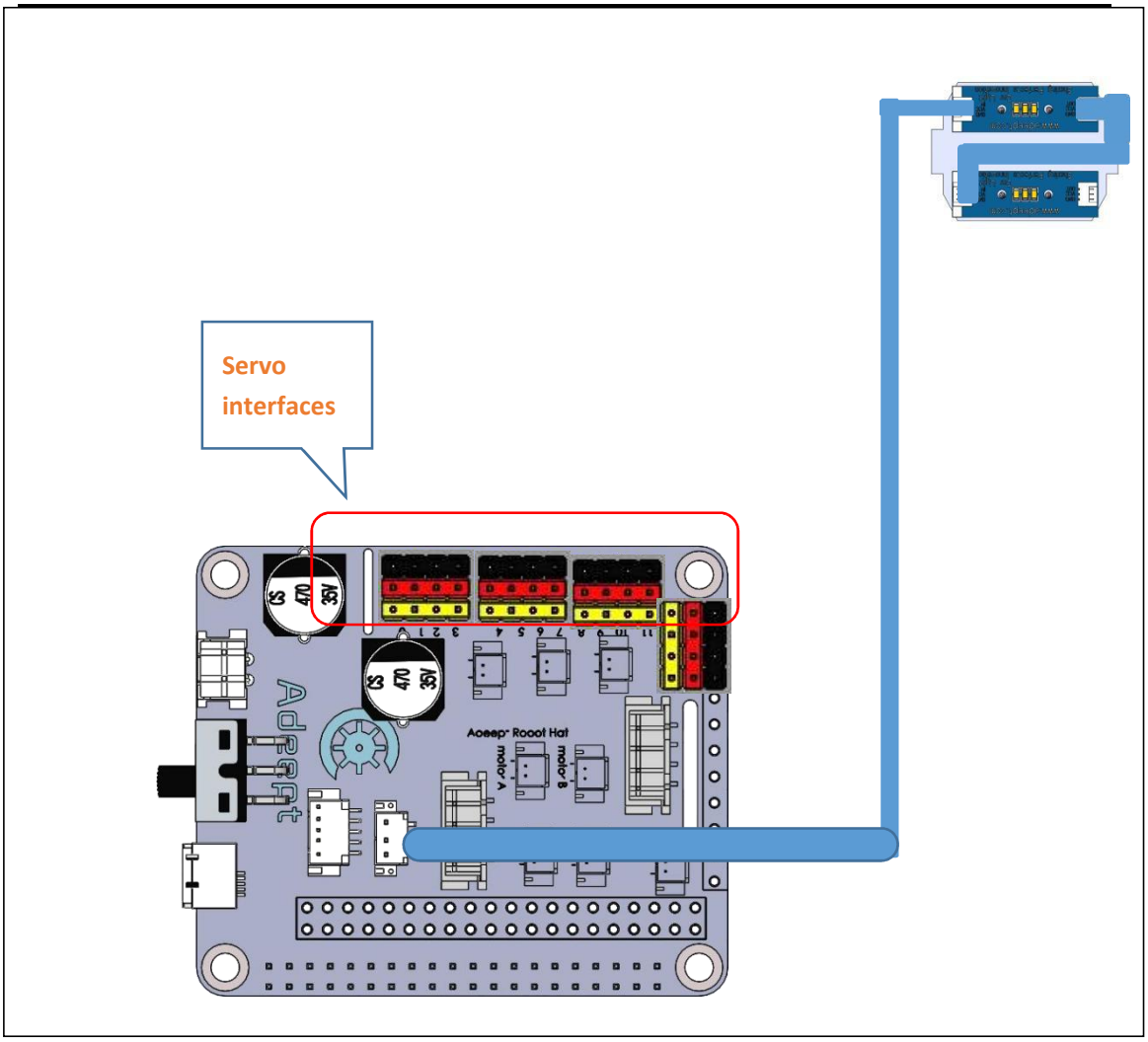


The corresponding PWM numbers of the driver board to the servos.

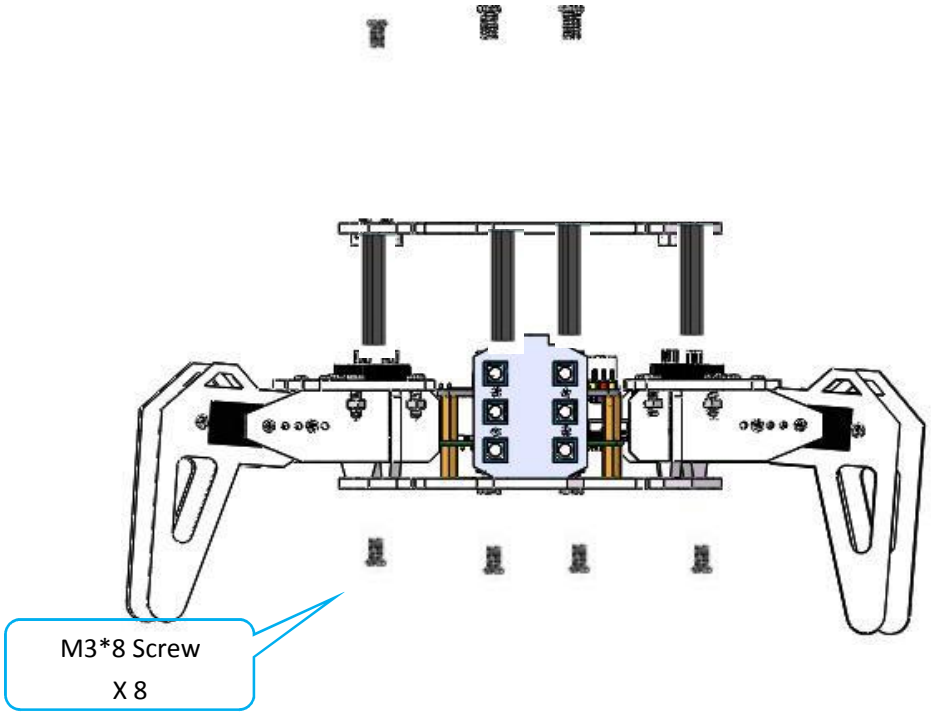


7	6	The body	4	5
9	8		2	3
11	10		0	1

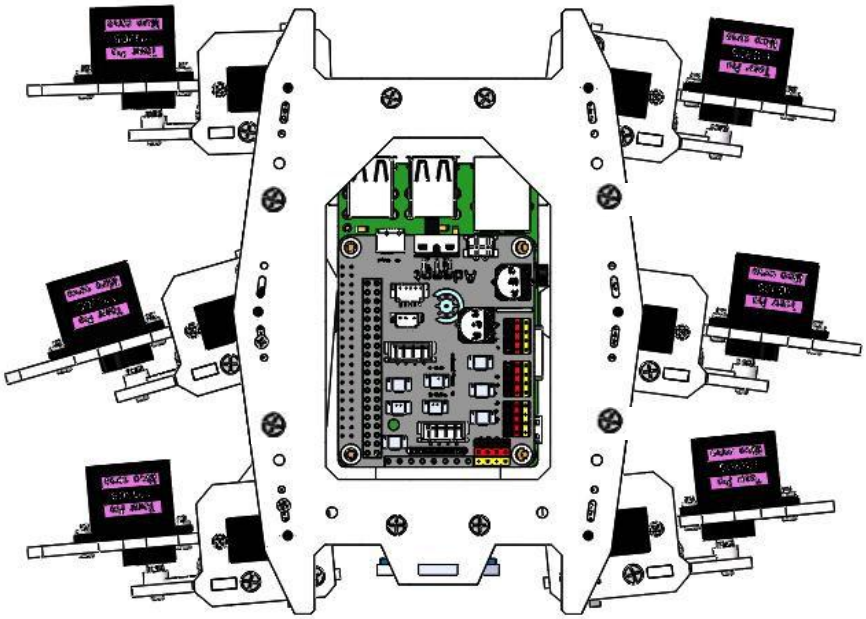



Servo
interfaces
Adeept
Adeept Raspberry Pi Robot Hat
motor A
motor B

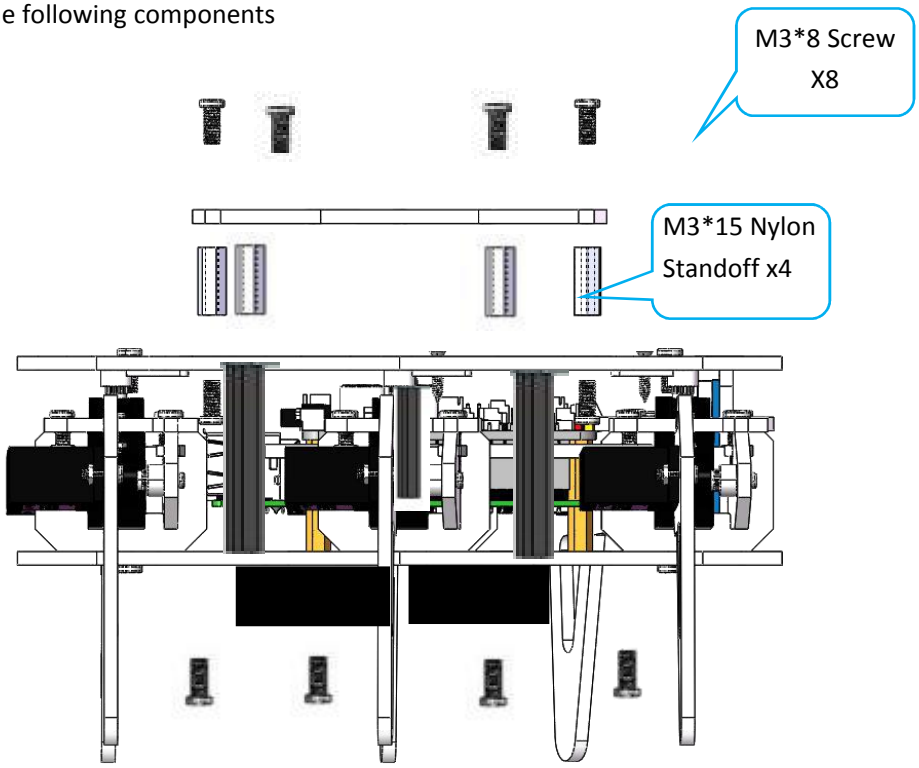
Assemble the following components



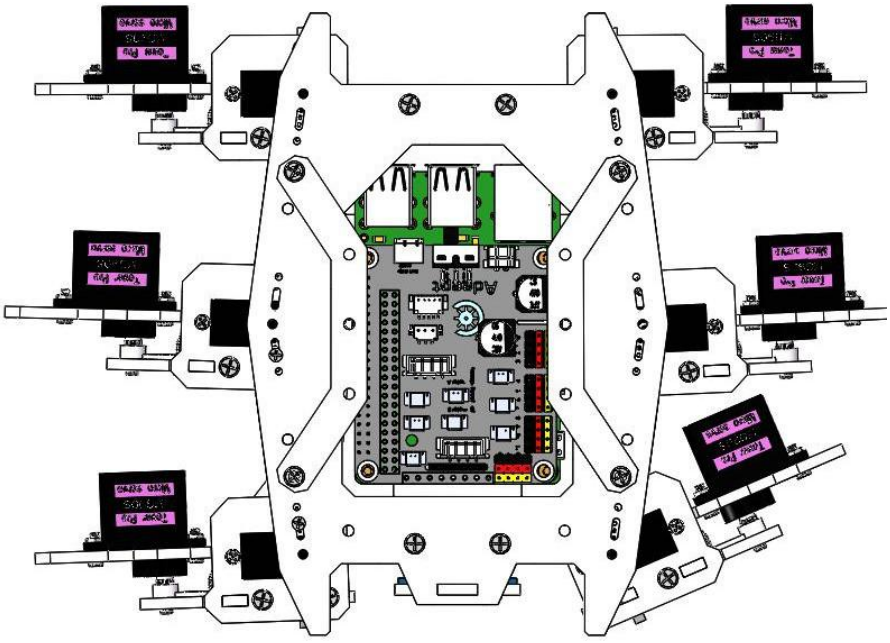
Effect diagram after assembling



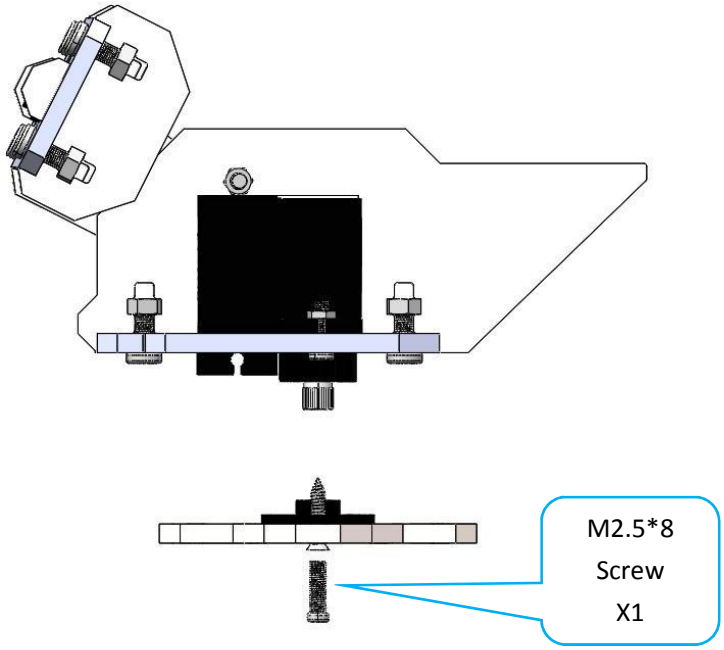
Assemble the following components



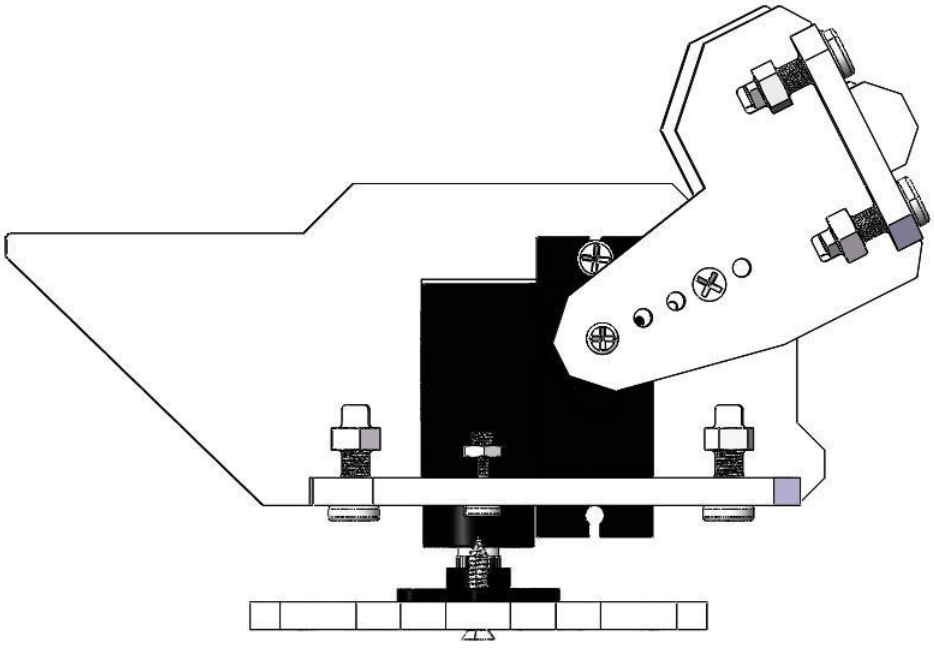
Effect diagram after assembling



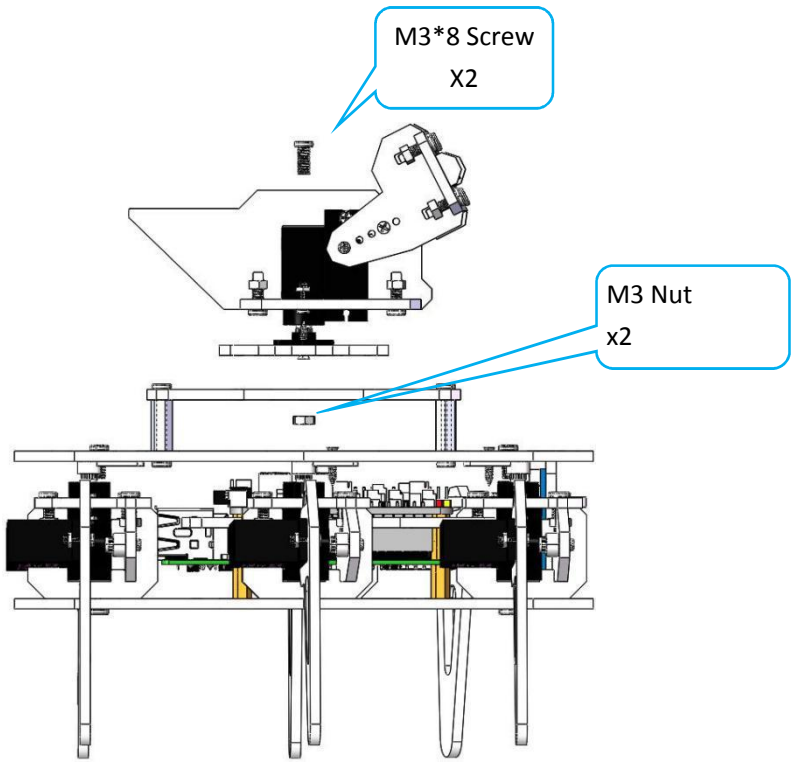
Assemble the following components



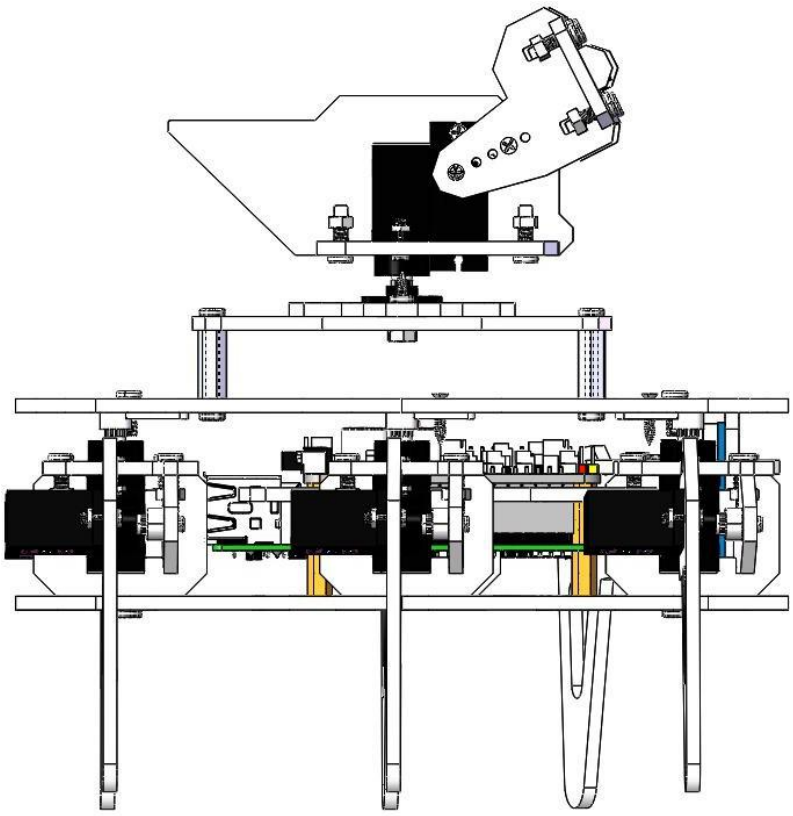
Effect diagram after assembling



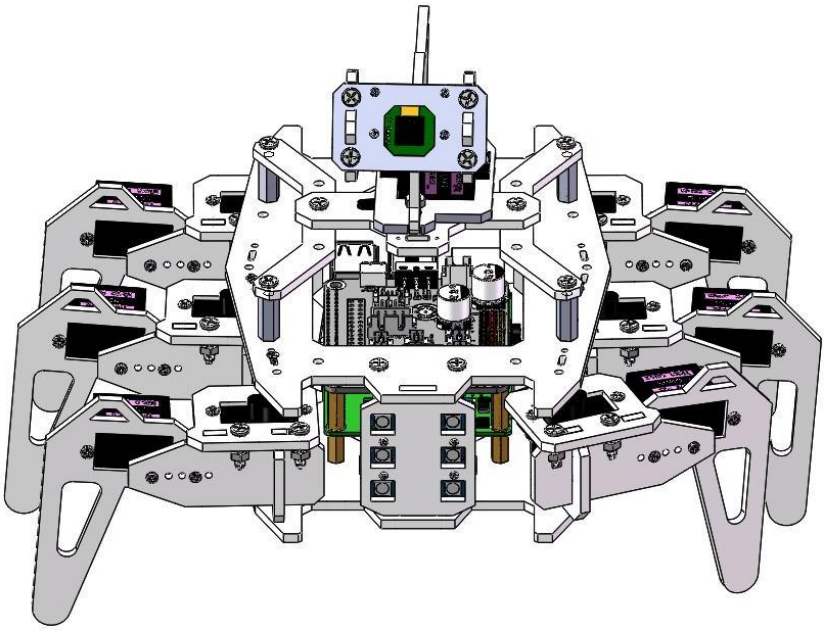
Assemble the following components



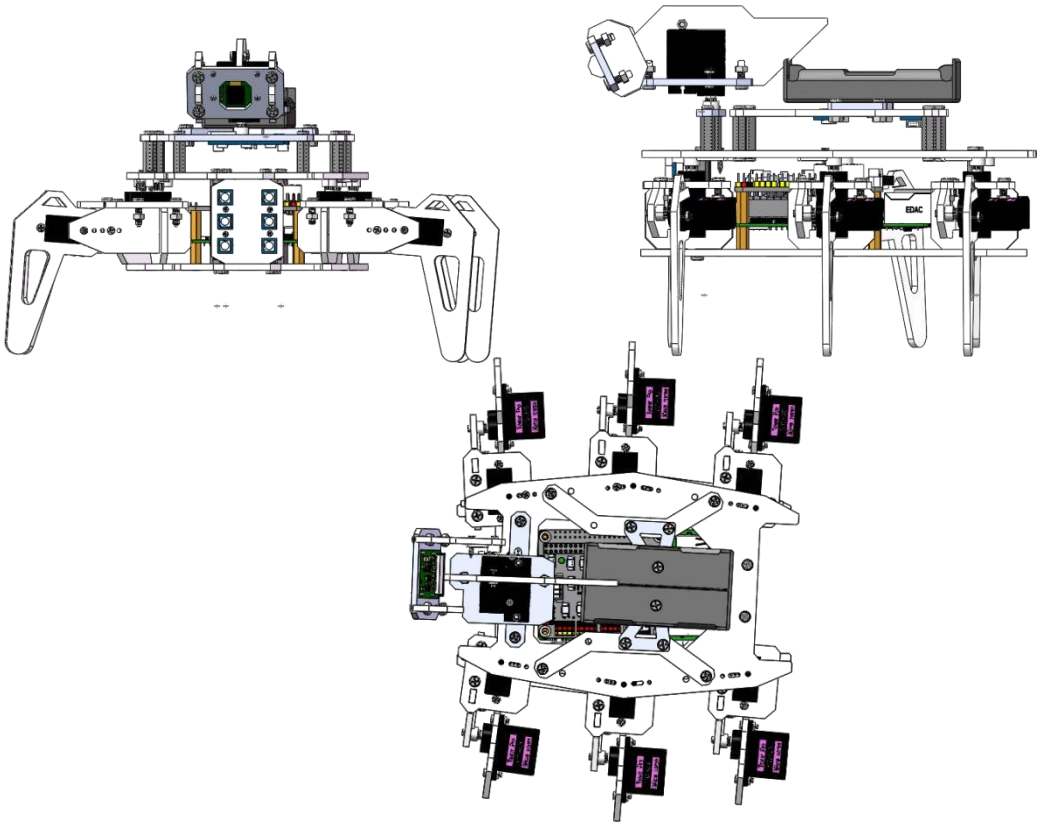
Effect diagram after assembling



Installation method one (suitable for flat road surface).



Installation method two suitable for uneven road surface .



4.Install Python3.7 in the PC

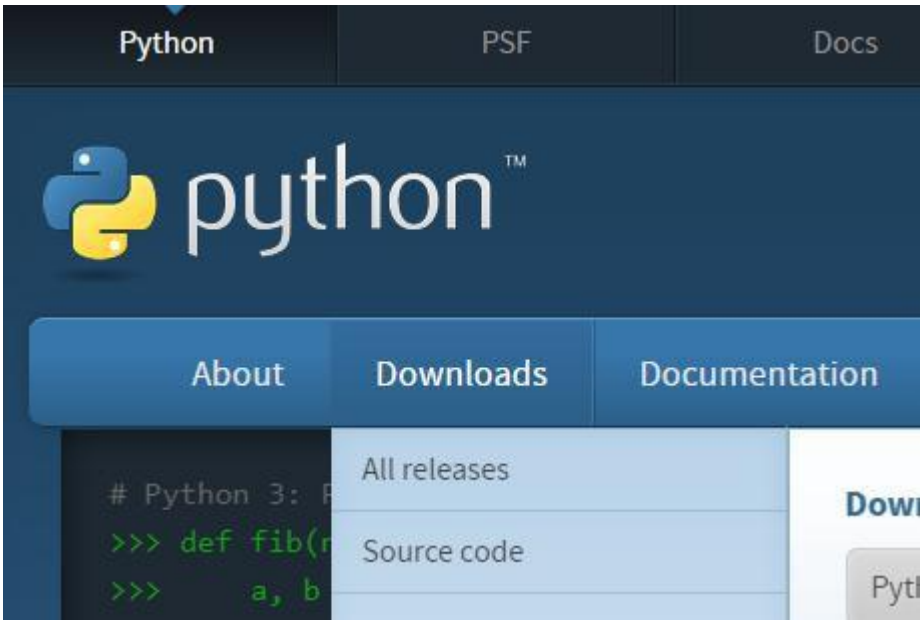
4.1. Install Python3.7

The software installation video is as follows

https://www.adeept.com/video/detail-70.html

So far there are two versions of Python: 2.X and 3.X. The graphical UI of the terminal control is written in Python 3.7 and it supports multiple platforms. Here we'll focus on the installation of Python 3.7 under Windows.

Download Python 3.7: https://www.python.org/



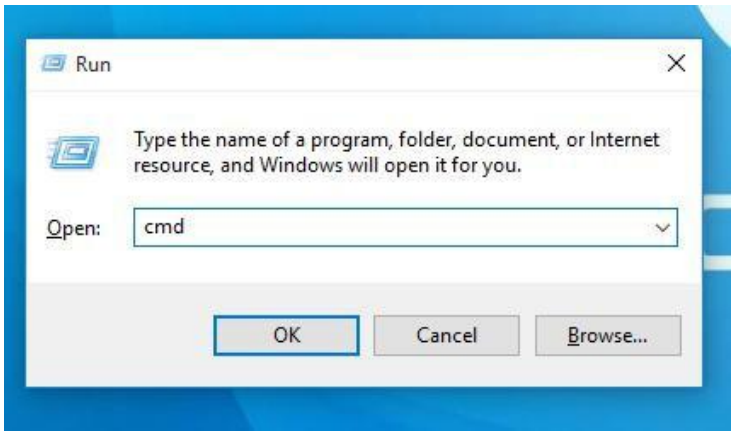
Click through **Downloads**->**Download Python 3.7.0**.

Install it after download is done. Python will configure the environment variables during the installation.

*Pay attention to the 32-bit or 64-bit of your system when downloading Python - choose the corresponding Python version based on your own system.

Install OpenCV:

Press + **R** in Window and enter CMD in the textbox



Click **OK**

Type in:
pip3 install numpy
to Install numpy.

NOTE: If Python3.7 is the only version in your PC, you can use both pip and pip3 to install software, but when you also have Python2.x installed, you must use pip3 to install it in your Python3.7 library.

NumPy is a general-purpose array-processing package designed to efficiently manipulate large multi-dimensional arrays of arbitrary records without sacrificing too much speed for small multi-dimensional arrays.

Download OpenCV_python.whl:

opencv_python-4.1.0+contrib-cp35-cp35m-win32.whl
opencv_python-4.1.0+contrib-cp35-cp35m-win_amd64.whl
opencv_python-4.1.0+contrib-cp36-cp36m-win32.whl
opencv_python-4.1.0+contrib-cp36-cp36m-win_amd64.whl
opencv_python-4.1.0+contrib-cp37-cp37m-win32.whl
opencv_python-4.1.0+contrib-cp37-cp37m-win_amd64.whl
opencv_python-4.1.0-cp35-cp35m-win32.whl
opencv_python-4.1.0-cp35-cp35m-win_amd64.whl
opencv_python-4.1.0-cp36-cp36m-win32.whl
opencv_python-4.1.0-cp36-cp36m-win_amd64.whl

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

In our case, we download opencv_python-4.1.0-cp37-cp37m-win_amd64.whl for Python3.7 on x64 OS.(3.4.3 is the version of openCV, which may update lately, so just download whatever is the latest.)
Download it and save it in default user path (in my case is C:\Users\effec\) so you don't have to input the path when installing.
Now you can install OpenCV_python:
pip3 install opencv_python-4.1.0-cp37-cp37m-win_amd64.whl

And then you need to install zmq and pybase64 for FPV function (same reason in RPi):
pip3 install zmq pybase64

4.2 Run the RaspClaws

Start

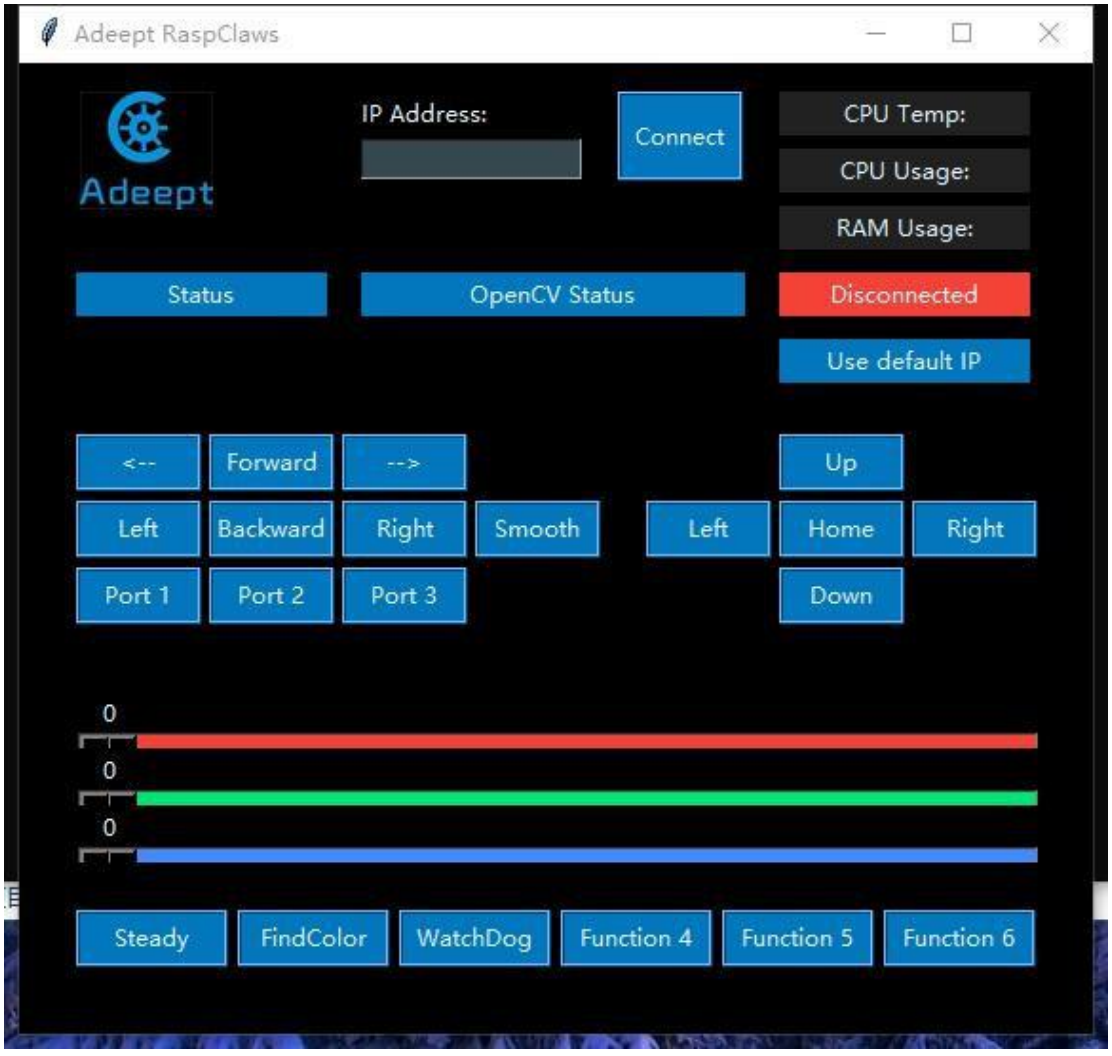
Switch on the car.

After a while, if the LEDs turn red, it means the car's server is connected to a Wi-Fi waiting for the PC client to join.

If there is no Wi-Fi for the car to connect with, the LEDs turn blue, it means the car has set up an AP-Hotspot, you can use your PC to search it, the RPi Car's AP-Hotspot's SSID name is AdeeptCar and password is 12345678.

Then implement operations in Windows.

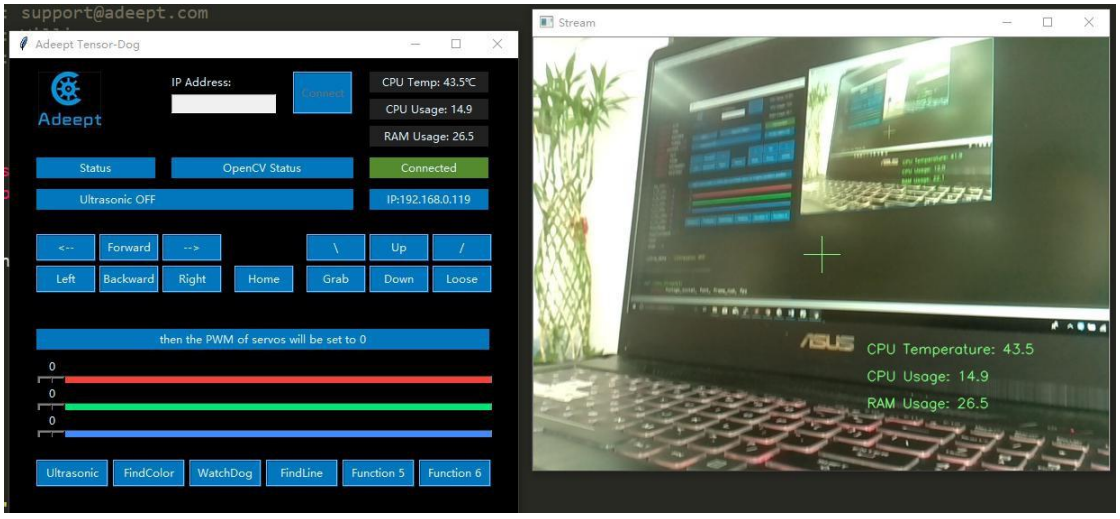
Double click to run the file *Raspclaws.py* in the folder *client*.



For initial running, you need to enter the IP address of the Raspberry Pi car **IP Address**, then click **Connect**, and the program will connect to the Raspberry Pi.

After connection, the program will save the IP address. For the next use, if the IP address of the Raspberry Pi has not changed, you may press **Enter** directly next time to connect.

After the connection is made successfully, the Video window shows up.



OpenCV Color Recognition

By default, the Robot finds the biggest yellow object in its view and follows it. When it gets close enough, it would stop, and if it gets too close to the yellow object, it would go back.

Steady Function

After the Steady Function is turned on, the robot will maintain the balance of the body by adjusting the height of each leg, but in this state, the robot cannot be able to move. This function needs to continuously read data from the mpu6050 chip to ensure that the mpu6050 and the Robot HAT remain connection.

OpenCV Watch Dog Function

If the camera on the robot detects an object moving or changing, the LEDs on the robot will turn red. This feature is developed based on Adrian Rosebrock's OpenCV code on pyimagesearch.com. You can also learn more about the OpenCV to gain more fun to play with, such as syncing the captured image to the dropbox after detecting the motion of the object. The example program we provide just makes the LEDs display red however. For other functions, you can install the corresponding packages according to your needs, just by changing the code in FPV.py.

Add More Functions

Function 5 and Function 6 buttons are placeholders for other functions you want to add. This robot is based on raspberry pi so there are a lot more functions you can play with, but some other libraries are required.
We intend to simplify the installation steps as much as possible to lower the barriers for more people. Hence, for example, voice recognition, which requires a large number of lib raries to be installed, will not be provided in the standard program. If you are interested in this, you can try to expand more. We will offer the installation and application methods of other functions in the follow-up tutorials. Please subscribe our Youtube channel for more.

Change LED Color

You can control the colors of the LEDs on the robot in real time by dragging these three sliders. These three sliders correspond to the brightness of the three channels of RGB. In theory, you can create 16,777,216 (256^ 3) kinds of colors through these three sliders.

Safe Shutdown

You may notice there's no such thing as a power button for the Raspberry Pi as for PC. Most people would directly unplug the power cable for the Raspberry Pi, which may cause damage to the Raspberry Pi and SD card, data loss, etc. To avoid such issues, you need a safe shutdown for the Raspberry Pi.
If you just use the Raspberry Pi independently, you may shut it down with the following command:

```
sudo shutdown –h now
```

When the green light stops blinking on the Raspberry Pi, you may unplug the power cable. If you're applying the Raspberry Pi smart car, you may tab the Exit button in the app of this product. When the green light stops blinking on the Raspberry Pi, switch to OFF for the Power switch on Shield and you can shut down the Raspberry Pi then.

5.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 Adeept 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.adeept.com. We will introduce more cost-effective, innovative and intriguing products!

Thanks again for choose Adeept product and service!

Adeept

Sharing Perfect Innovatins

support@adeept.com