

PiCar-V Robot



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Introduction

The PiCar-V is an open source robot learning kit based on Raspberry Pi. Equipped with a wide-angle USB webcam, it is powerful together with three whole new circuit boards and less but simpler wiring.

Some construction plates in a well-designed structure, solid, durable and shatterproof. Complete code suitable for almost all platforms to control the car. Python code is provided for the car, and you can also program and debug it with Dragit, a Snap-based graphical interface, by just simple dragging and dropping the code blocks for complex functions

There are many ways to control the robot remotely: with the app on PC (works on any OS), you can control the car and the cam's direction on the UI and view the image it takes in real time; or, with the related code, realize the same functions on a web browser, which means it can work with any mobile phones, tablets, etc.

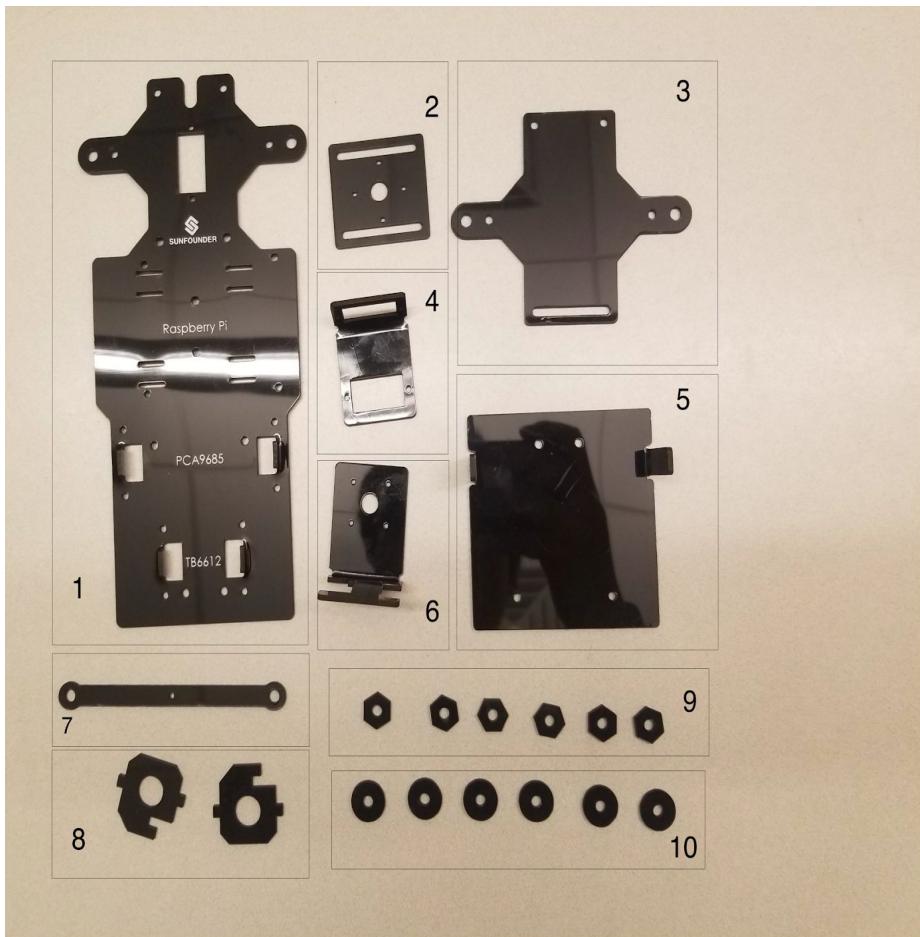
Component List

1. Component List



1. Constructure plates
2. SunFounder Servo
3. 18650 Battery holder
4. USB Camera
5. Wires
6. Tools
7. Wheel
8. Motor Driver
9. Robot HATS
10. PCA9685 PWM Driver
11. DC Gear Motor
12. Cable wrapper
13. Mechanical Fasteners / Wifi Adapter

2. Construction Plates

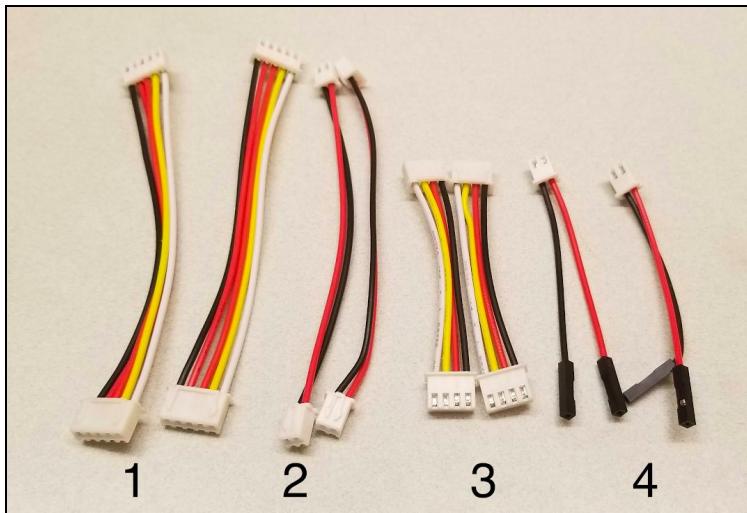


1. Upper plate
2. Servo mount
3. Front Half Chassis
4. Servo-Camera base
5. Back Half Chassis
6. Camera mount
7. Steering Linkage
8. Steering Connector
9. Hex Front Wheel Fixing Plate
10. Bearing Shield

3. Mechanical Fasteners



4. Wires



1. 5-Pin Jumper Wire (100mm HX2.54)
2. 2-Pin Jumper Wire (100mm HX-2.54)
3. 4-Pin Jumper Wire (50mm HX-2.54)
4. 2-Pin Jumper Wire (50mm HX-2.54)



1. SunFounder SF006C Servo
2. Servo Accessories



1. 1-arm Rocker Arm
2. 2-arm Rocker Arm
3. 4-arm Rocker Arm
4. Rocker Arm Screw
5. Rocker Arm Fixing Screw × 2

5. Other components

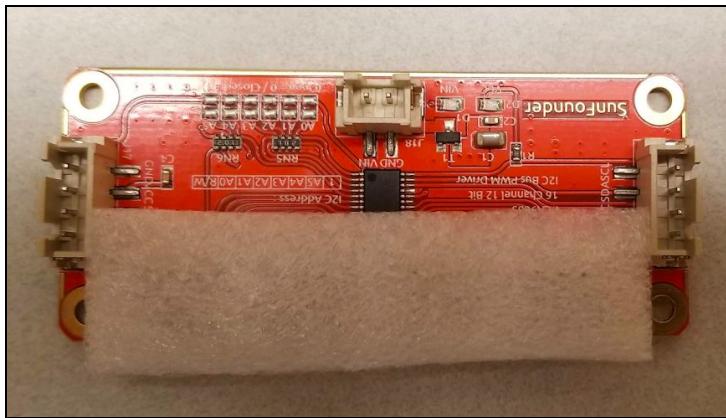
Wheels



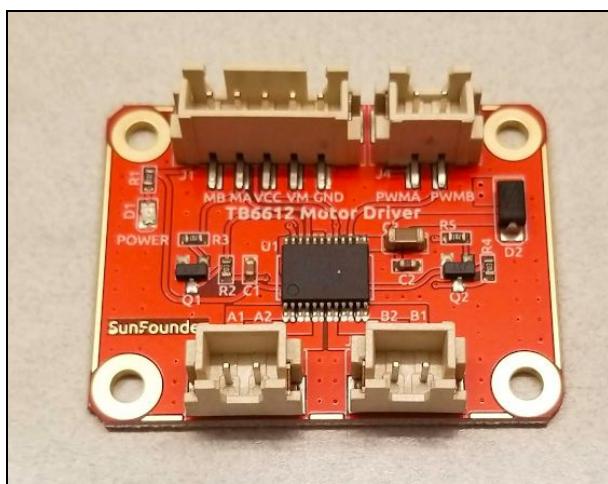
Robot HATS



PCA9685 PWM Driver



Motor Driver

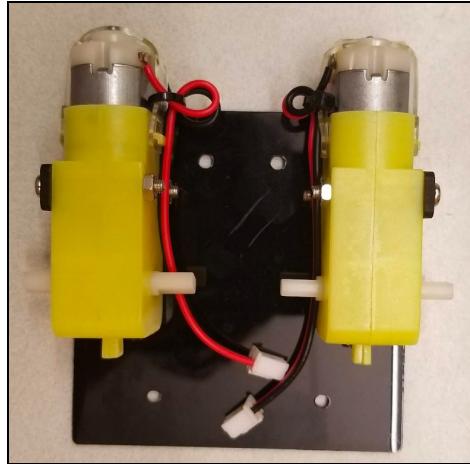


Building the Car

- Fixing Rear Wheels
 - You will need:
 - Back Half Chassis
 - DC Gear Motor x 2
 - Screws:

MT 3*25+5	
M LM3	

- Assemble the two motors with four of the screws and nuts. Pay attention to the place the motors with the wires inward. You can put this part aside for now.



- Battery Holder
 - You will need:
 - Upper Plate
 - Ribbon
 - 18650 Battery holder
 - Screws:

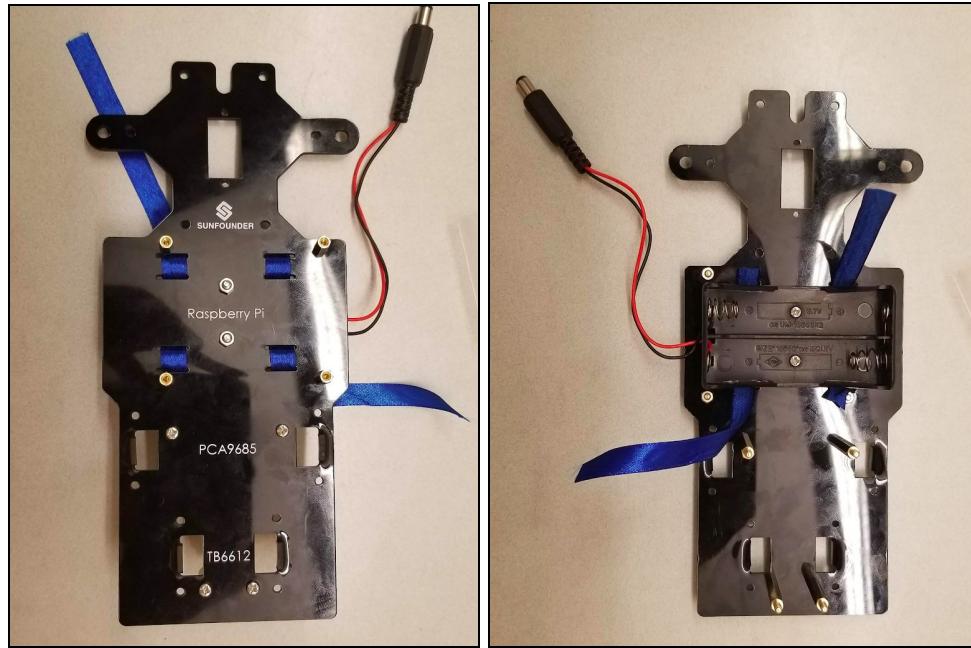
M2.5*8+5+ copper standoff	
M LM2.5 (M2.5 nuts)	
MSC 3*8 (M3*8 Countersunk screws)	

M LM3 (M3 nuts)	
------------------------------------	---

- Mount the m2.5x8 and m2.5 nuts into the upper plate first. Pay attention to the holes that you need to use and that the side the protruding prop should face up.
- Turn the upper plate upside down, cut the ribbon in half and thread them through the holes plate. Leave one end longer out of the plate for each to remove the battery easily later.



- Mount the battery holders with two M3x8 and M3 nuts. Pay attention to the direction of the battery holder's wire.



- Rear Wheels
 - You will need:
 - Screws:

MT 3*25+5	
KA 3*8 (M3X8)	

- Insert four M3x8 screws with four M3x25 copper standoffs

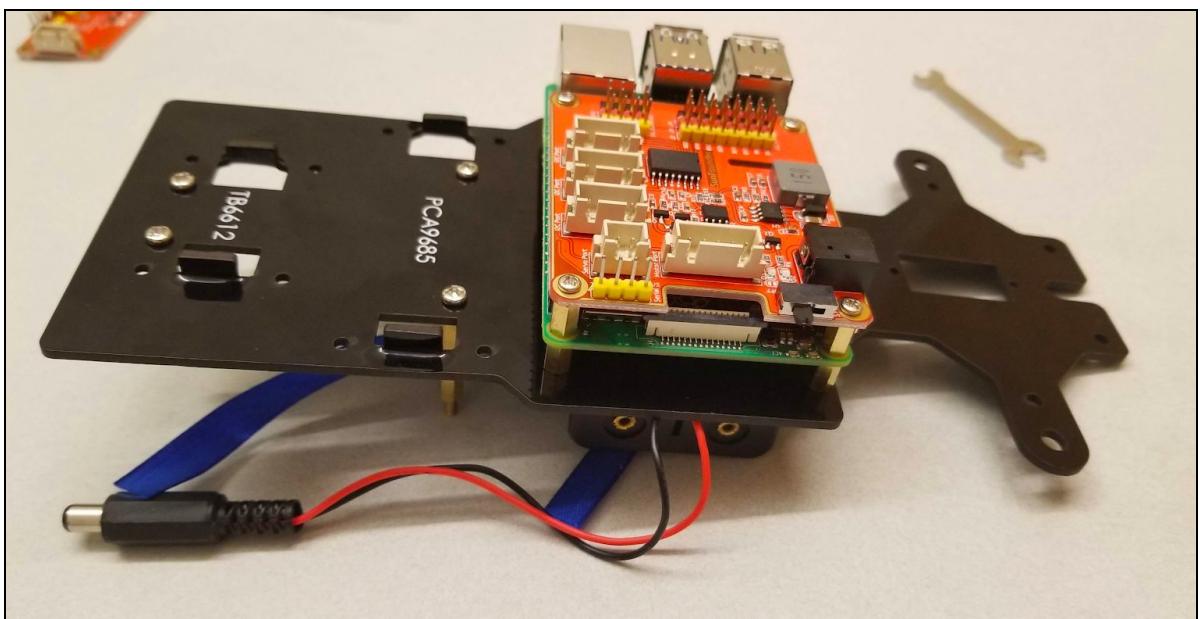


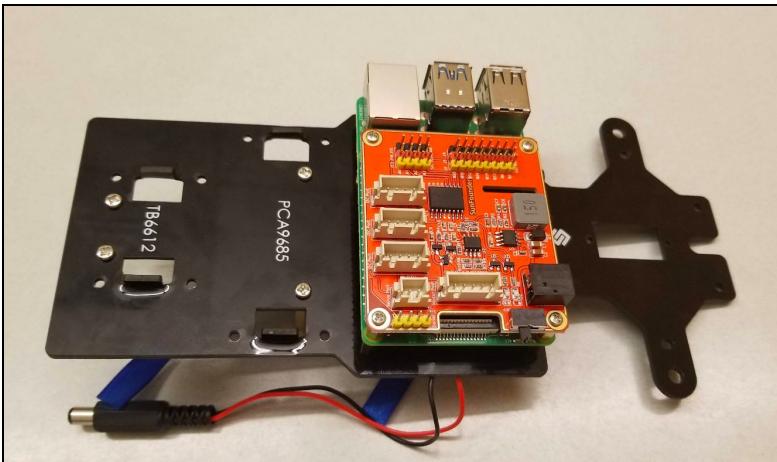
PCB Assembly

- You will need
 - Raspberry Pi (TF Card Inserted)
 - Motor Driver
 - Robot HATS
 - PCA9685 PWM Driver
 - Screws:

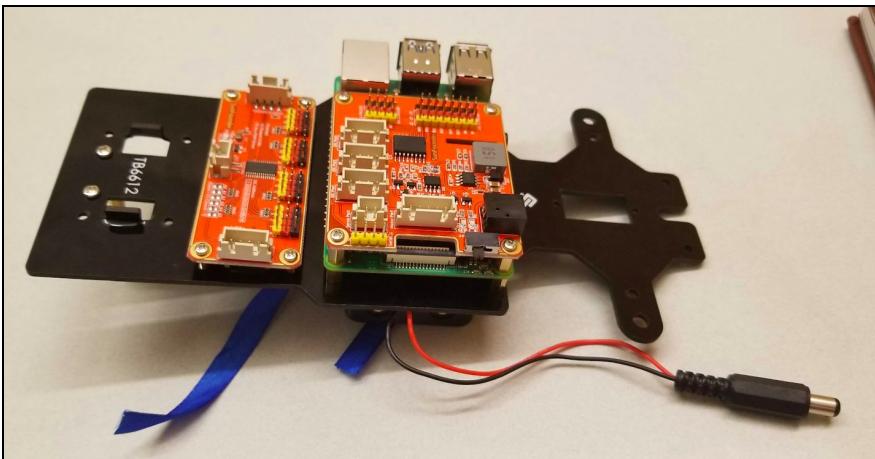
M2.5*8+5+ copper standoff	
M LM2.5 (M2.5 nuts)	
M2.5X6	
MS 2.5X12	

- Assemble the Raspberry Pi (TF Card inserted) with eight M2.5x8 copper standoffs, then plug the Robot HATS onto it, and fix the Robot HATS with four M2.5X6

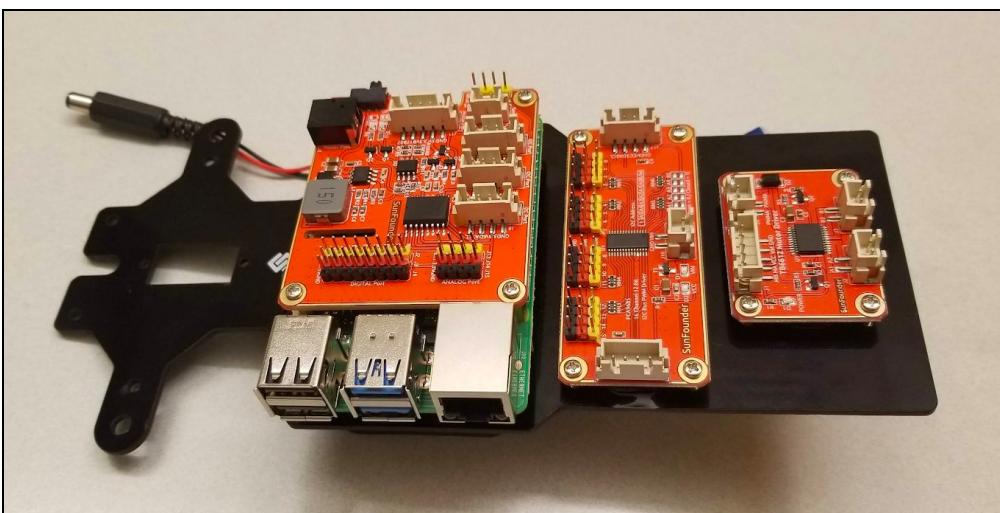




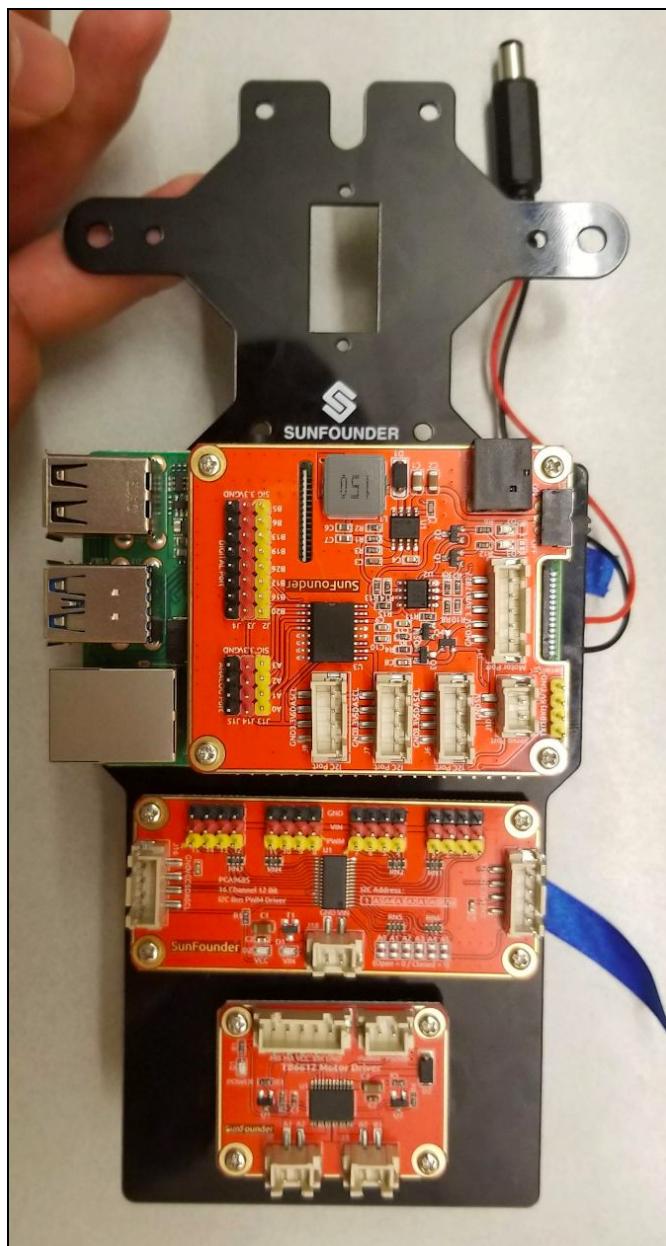
- Fix the PWM Driver with four MS 2.5X12 and M2.5 nuts



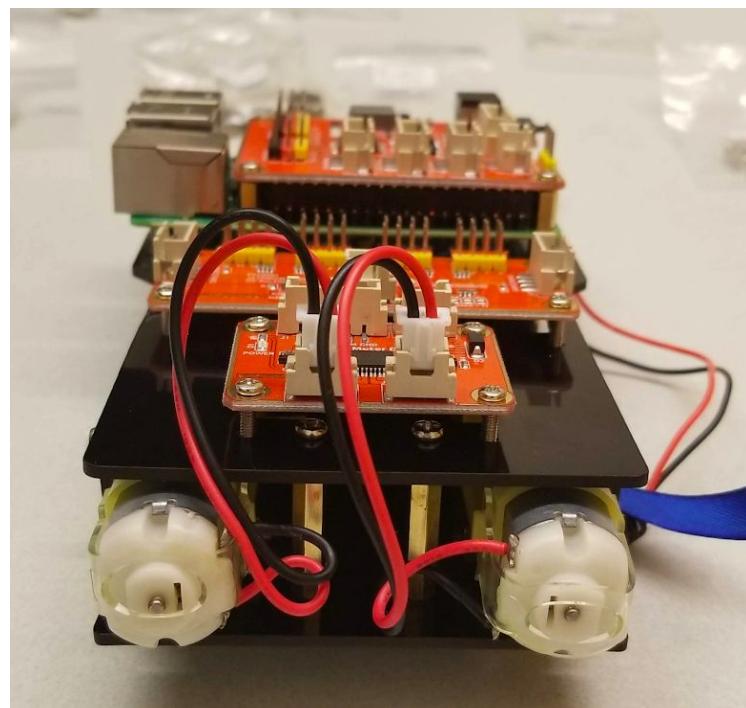
- Fix the Motor Driver with four MS 2.5X12 and M2.5 nuts



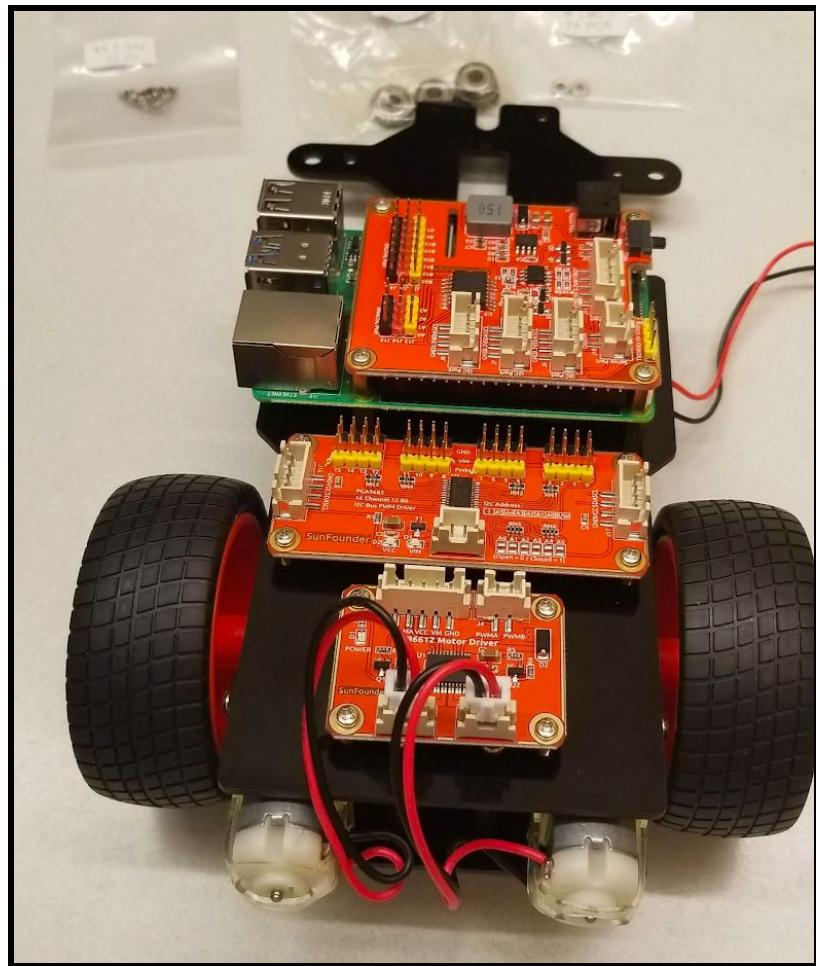
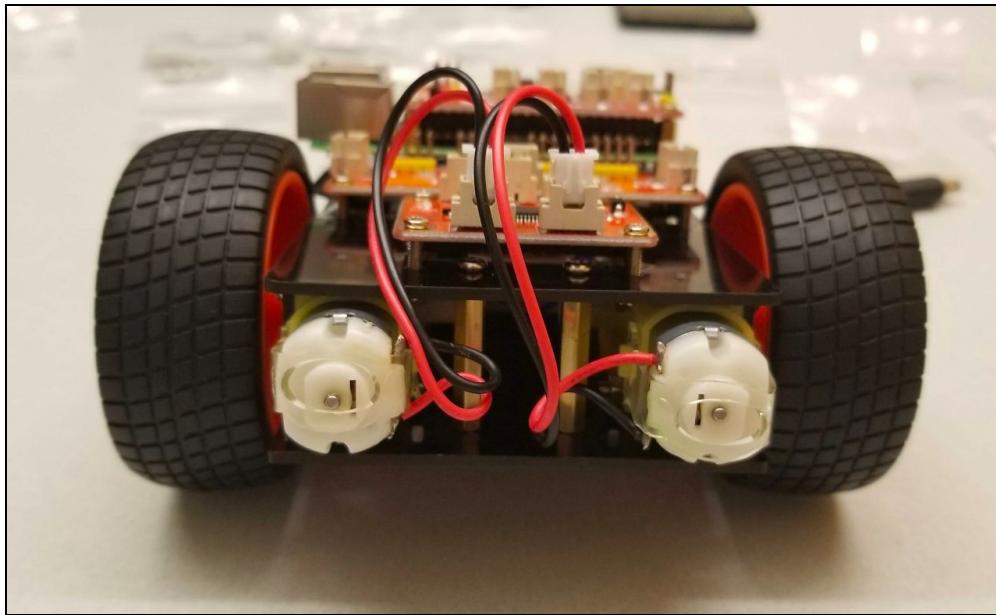
Before continuing, make sure your down plate look like below:



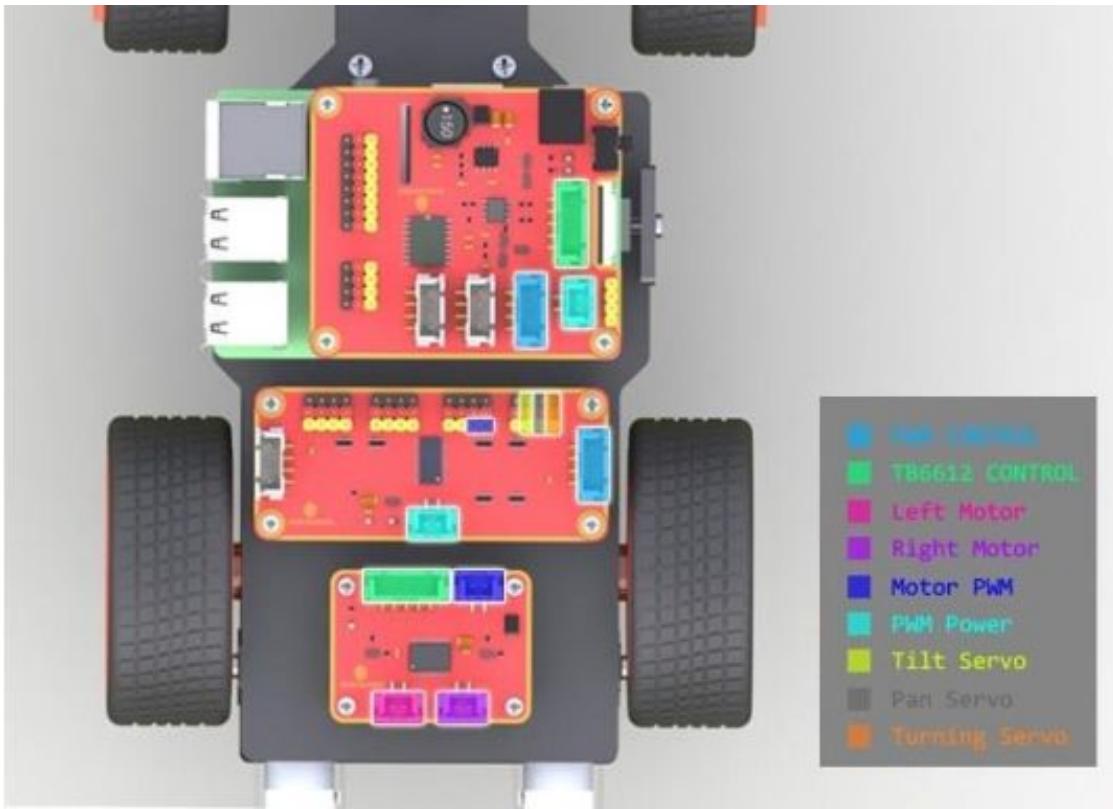
- Rear Wheels Driving
 - Assemble the rear wheels



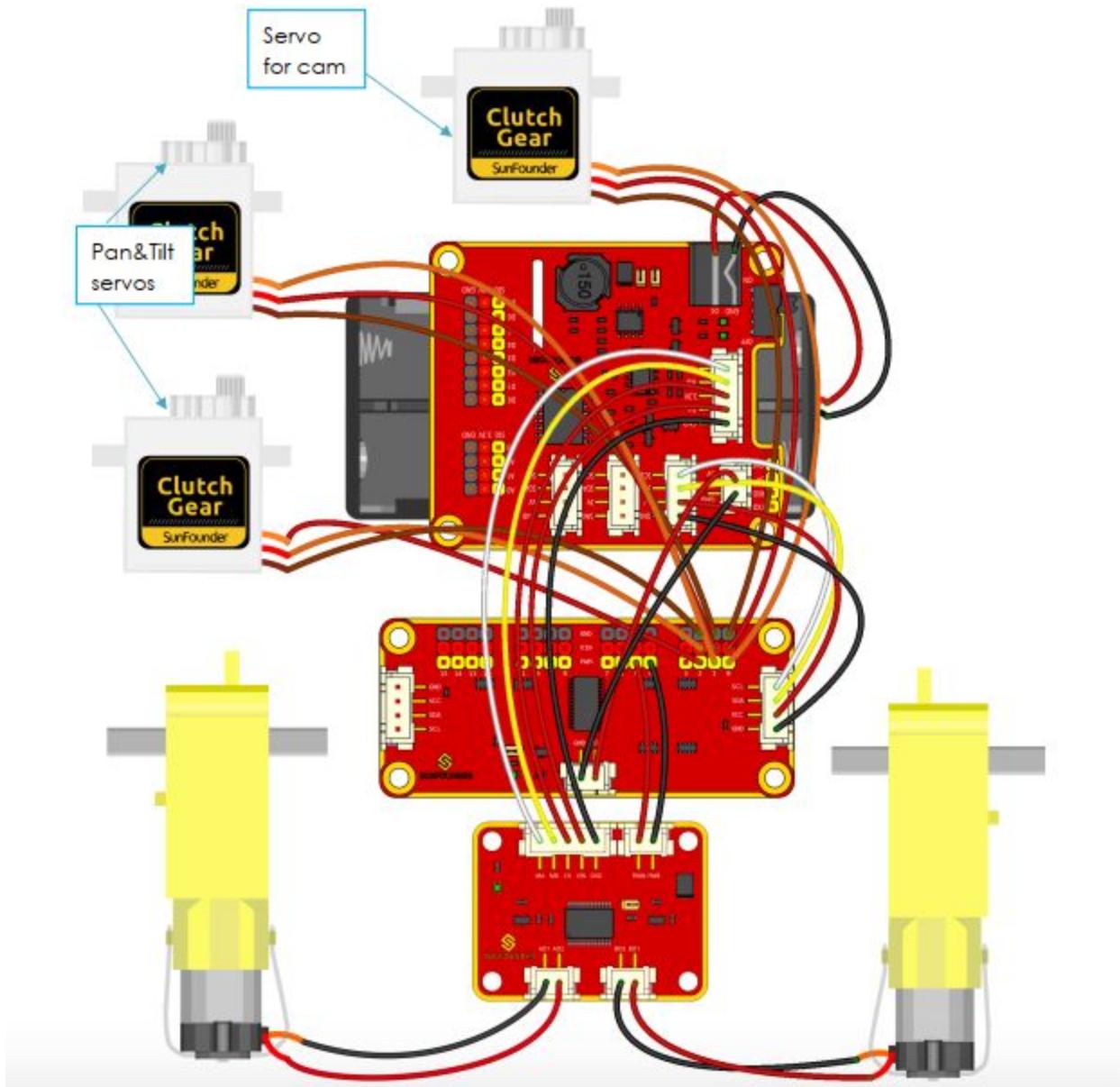
- Align the rear wheel with the motor shaft, and rotate to insert gently



Circuits Building



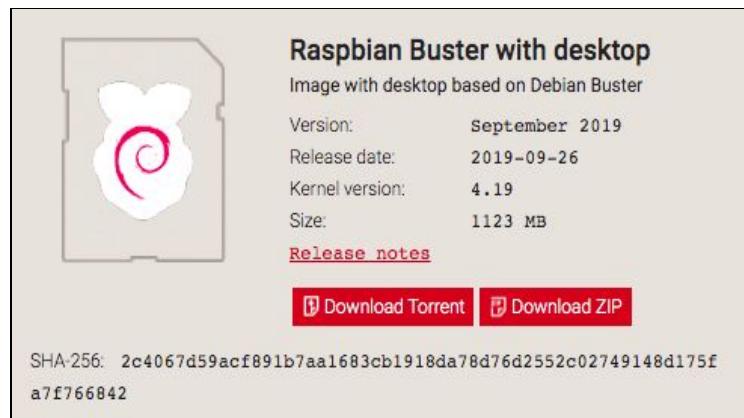
- You will need
 - Wires
 - Sunfounder servo
- Connect the **PWM CONTROL** of the Robot HATS with the PCA9685 PWM Driver, and the **TB6612 CONTROL** with the TB6612 Motor Driver.
- Then the **Left Motor** and the **Right Motor** of the TB6612 to two motors, and the **Motor PWM** with the No. 4 and 5 PWM channel of the PCA9685.
- Connect the **PWM Power** of the PCA9685 with the Robot HATS, and its channel 0, 1, and 2 of with the **Turning Servo**, the **Pan Servo** and the **Tilt Servo** respectively.



Servo Configuration

We need to make the servo to rotate 90 degrees when is mounted, so the rotation can match with the application in the car.

1. Burn the image
 - a. Follow the below steps to configure the TF card before inserting into the Raspberry Pi.
 - b. Download the image from: <https://www.raspberrypi.org/downloads/raspbian/>
 - c. Use the RASPBIAN STRETCH DESKTOP would be a better choice.



- d. Unzip the download package
- e. Open the tool image burning:
 - i. For Windows: win32DiskImager
 - ii. For Mac: BalenaEtcher
 1. Select the image
 2. Select the target
 3. Click on Flash! (Wait until the system is written to the card)

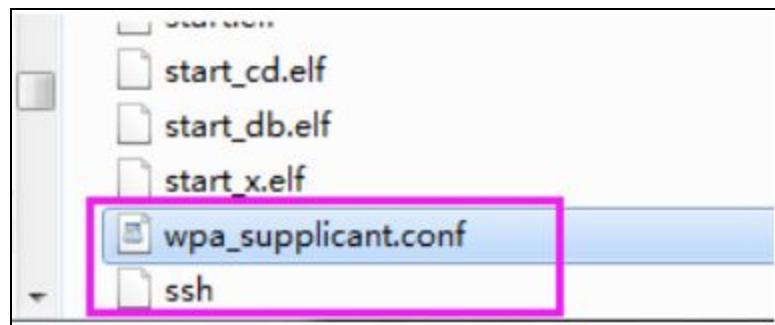


4. When the process is completed, click ok and eject the SD card safely.
5. Files configuration:
 - a. Insert the SD card back to your computer
 - b. Create a blank file **ssh** under the **/boot** directory to enable remote login and make sure the file does not have any suffix
 - c. Create a wifi configuration file **wpa_supplicant.conf** under **/boot** and add the following to the file

```
country=US
update_config=1
ctrl_interface=DIR=/var/run/wpa_supplicant
GROUP=netdev
network = {
    scan_ssid=1
    ssid= "MyNetworkSSID"
    psk= "MyNetworkPassword"
    key_mgmt=WPA-PSK
}
```

ssid = "Name of your wifi"

psk = "your Wi-Fi password "



6. Eject, Insert and Boot

- Safely remove the SD card from your PC and insert into the Raspberry Pi. Power up the Pi and once it has booted you should be connected to your WiFi network.
- You may be able to use your Router admin interface to list connected devices. Your Pi should appear in the list with an assigned IP address.

7. Troubleshooting [Connectivity issues](#)

Before continuing make sure to insert the batteries, the software installation and calibration needs a long time and the battery won't be able to support

2. Login into Raspberry Pi

- You will need to identify the IP of your Raspberry PI, you can use any of the network scanners available.
 - For Windows: You can use **Advanced IP scanner**
 - For Mac:
 - Download IP Scanner software
 - Make sure you are in the same Network as your Raspberry Pi
 - Open the app to start scanning, you will see a computer list of your network segment



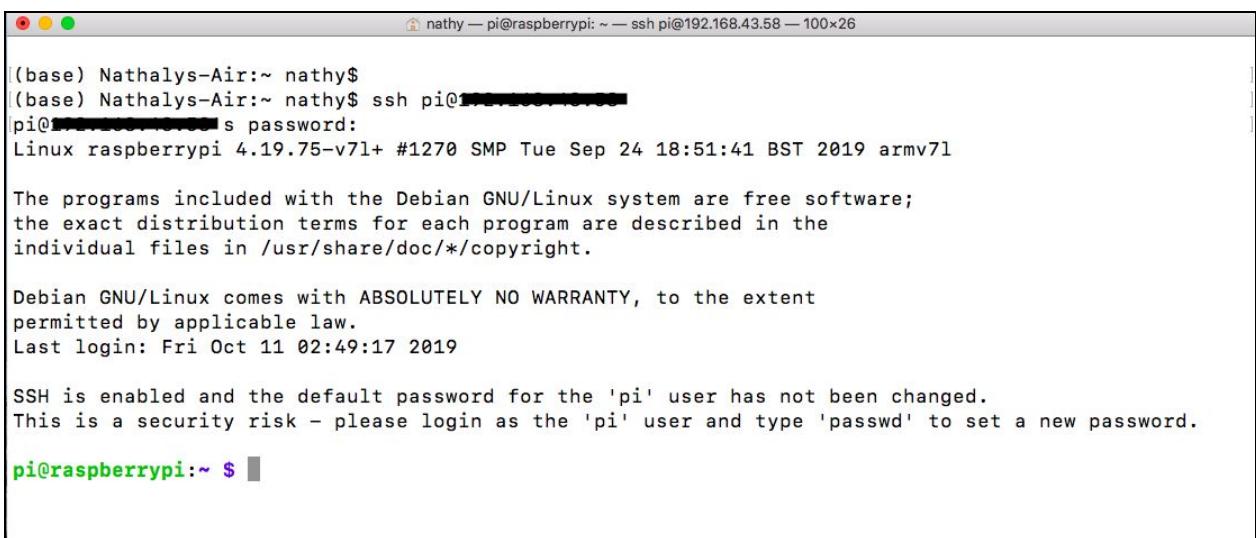
b. SSH

i. For Windows:

1. Download Putty
2. Open Putty and click Session add the IP address and make sure to use port 22
3. Click Open and YES in the security prompt window

ii. For Mac:

1. Open your Terminal application
2. Type: ssh pi@ip_address
3. Click yes and type the password
4. Username: pi - Password: raspberry



The screenshot shows a macOS terminal window titled "nathy — pi@raspberrypi: ~ — ssh pi@192.168.43.58 — 100x26". The session is established with the command "ssh pi@192.168.43.58". The user is prompted for a password, which is entered. The terminal then displays the standard Debian/GNU-Linux welcome message, including the kernel version (Linux raspberrypi 4.19.75-v7l+ #1270 SMP Tue Sep 24 18:51:41 BST 2019 armv7l), the copyright notice, and a warning about the lack of warranty. It also shows the last login information (Fri Oct 11 02:49:17 2019) and a note about the default password being unchanged. Finally, the prompt "pi@raspberrypi:~ \$ █" is shown.

3. Get the Source code

a. Git clone the source code from Github [SunFounder_PiCar-V](https://github.com/sunfounder/SunFounder_PiCar-V)

```
cd ~/  
git clone  
https://github.com/sunfounder/SunFounder_PiCar-V.git  
ls  
cd ~/SunFounder_PiCar-V  
sudo ./install_dependencies
```

```
natty — pi@raspberrypi: ~/MagPi — ssh pi@192.168.43.58 — 100x26
pi@raspberrypi:~ $ git clone https://github.com/sunfounder/SunFounder_PiCar-V.git
Cloning into 'SunFounder_PiCar-V'...
remote: Enumerating objects: 3, done.
remote: Counting objects: 100% (3/3), done.
remote: Compressing objects: 100% (3/3), done.
remote: Total 987 (delta 0), reused 1 (delta 0), pack-reused 984
Receiving objects: 100% (987/987), 9.47 MiB | 4.98 MiB/s, done.
Resolving deltas: 100% (442/442), done.
pi@raspberrypi:~ $
pi@raspberrypi:~ $ ls
MagPi  SunFounder_PiCar-V
pi@raspberrypi:~ $
```

```
natty — pi@raspberrypi: ~/SunFounder_PiCar-V — ssh pi@192.168.43.58 — 100x26
pi@raspberrypi:~ $
pi@raspberrypi:~ $ ls
MagPi  SunFounder_PiCar-V
pi@raspberrypi:~ $
pi@raspberrypi:~ $ cd SunFounder_PiCar-V/
pi@raspberrypi:~/SunFounder_PiCar-V $
pi@raspberrypi:~/SunFounder_PiCar-V $ ls
ball_track  datasheet  __init__.py      LICENSE      README.md      show
client      i2cHelper.py  install_dependencies  mjpg-streamer  remote_control
pi@raspberrypi:~/SunFounder_PiCar-V $ sudo ./install_dependencies
Get:1 http://archive.raspberrypi.org/debian buster InRelease [25.1 kB]
Get:2 http://raspbian.raspberrypi.org/raspbian buster InRelease [15.0 kB]
Get:3 http://archive.raspberrypi.org/debian buster/main armhf Packages [259 kB]
Get:4 http://raspbian.raspberrypi.org/raspbian buster/main armhf Packages [13.0 MB]
99% [4 Packages store 0 B]                                1,090 kB/s 0s
```

The installation will install the required components and configure for the running environment. Make sure the raspberry is connected to the internet.

The Raspberry Pi will prompt you to reboot after the installation, type yes to continue.

4. Configure the Servo Code

- After the reboot is completed, SSH into the Raspberry Pi

```
cd ~/ SunFounder_PiCar-V
sudo ./install_dependencies
picar servo-install
```

Assemble Part Two

1. Front Wheels

Pay attention to the direction of the Steering connector before assembly

Keep servo-install running in the whole process

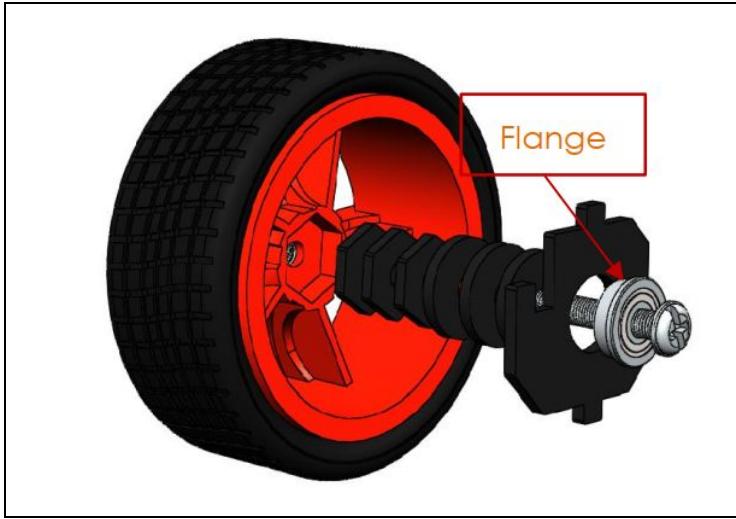
You will need

- i. Front Wheels x2
- ii. Constructor tools
 1. Steering connector
 2. Bearing Shields x3
 3. Hex Front Wheel Fixing x3
- iii. Screws:

MS4x25	
(M LM4) M4 Self-locking nut	
Flange Bearing	



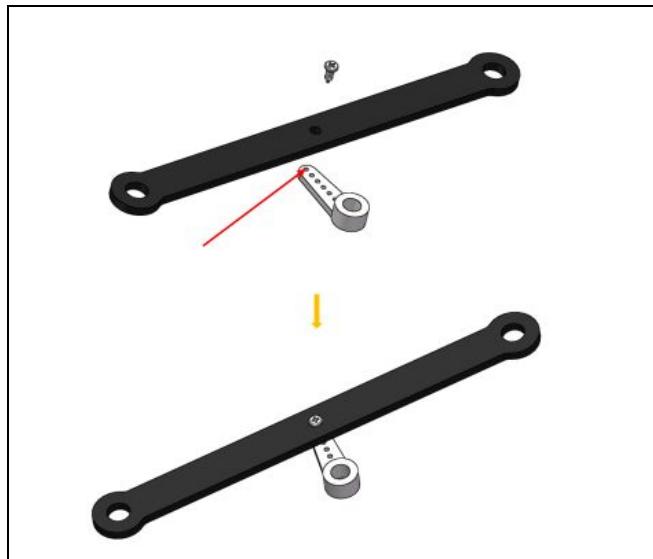
- Assemble the two motors with four of the screws and nuts. Pay attention to the place the motors with the wires inward. You can put this part aside for now.



2. Steering Part

You will need:

- i. 1-arm Rocker arm
 - ii. Rocker Arm Screw (The longer in the servo pack)
 - iii. Steering Linkage
- Connect the steering linkage and the rocker arm with the screw.
 - Insert it into the FIRST hole of the arm. You should try to screw it hardly so as tight to the arm.
 - Dont worry of the arm which is soft and also fasten as tightly as possible.
 - Loosen the screw a little so the Steering can move flexibly.



3. Steering Part

You will need:

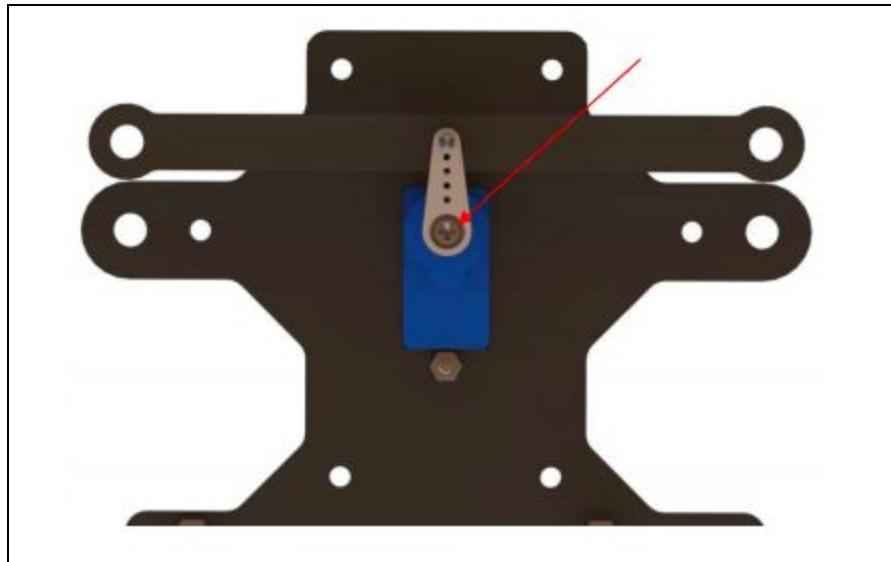
- SunFounder Servo PWM Channel 0
- Upper Plate
- Screws:

M2X8	
M2 nuts	



- Mount the servo that connects to PWM Channel 0 to the upper plate using the screws described above. Pay attention to the direction of the servo wires
- Connect the steering linkage and the rocker arm, make sure is in 90 degree angle. If everything is ok, take out the Rocker arm fixing screw (the shortest) to

connect them as:



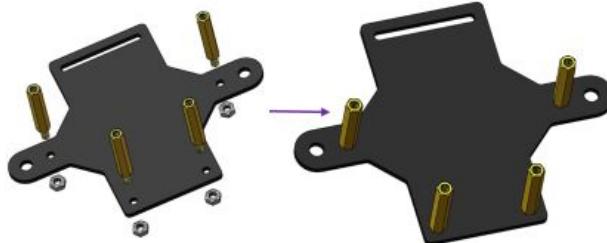
4. Front Half Chassis

You will need:

- Front half chassis
- Screws:

MT 3*25+5	
M LM3	

- Assemble the Front chassis with the screws and the nuts



- Take out the wheels and mount them in the upper plate

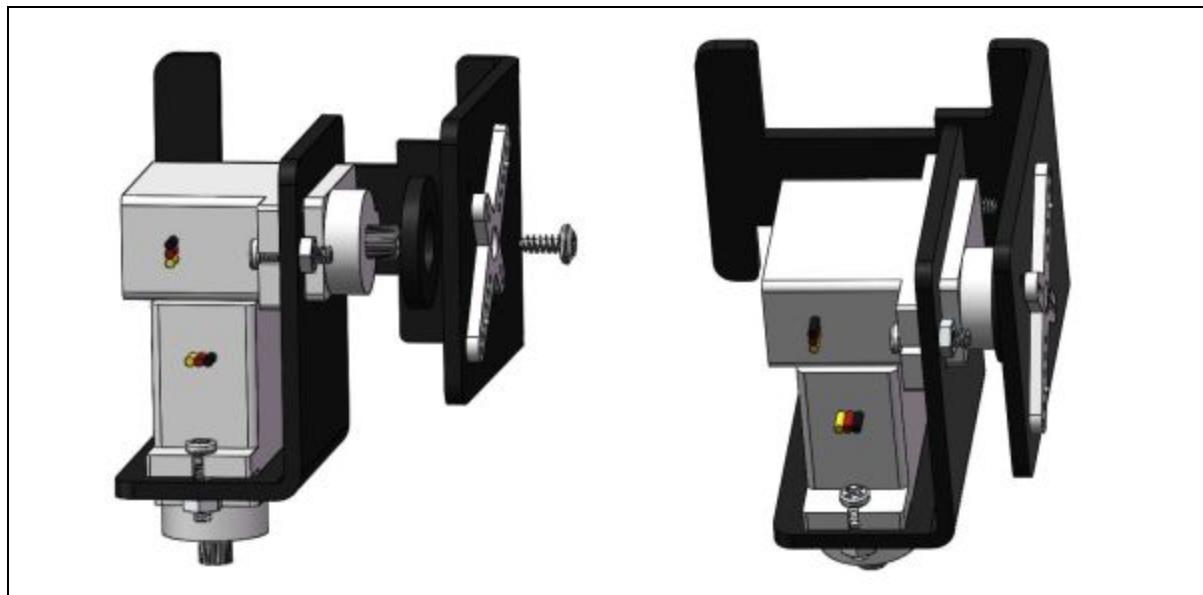
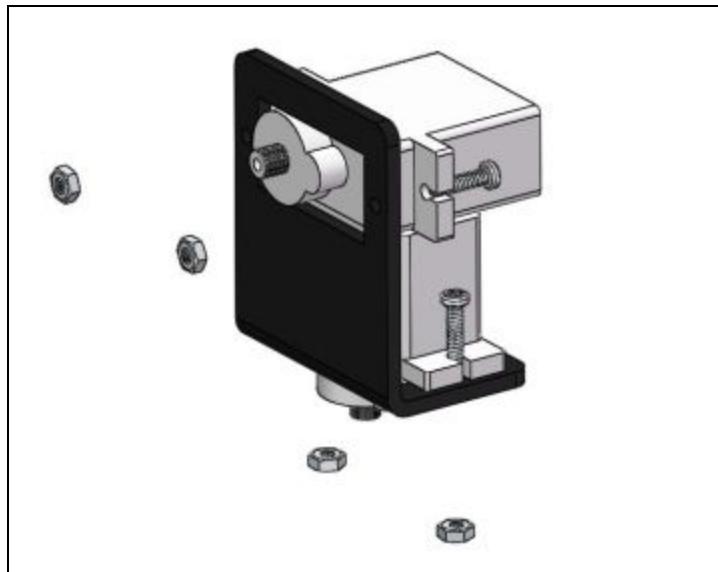
- Pan and Tilt
 - You will need:
 - Cross Rocker arm
 - Pan-Tilt- Base
 - Screws:

M1.6x4	
M2X8	
M2 nuts	
M LM3	
M 3x10	

- Take out the Cross rocker arm and mount it onto the Pan-Tilt Base with the screws. Pay attention it to the wholes. Do the same with the tilt arm

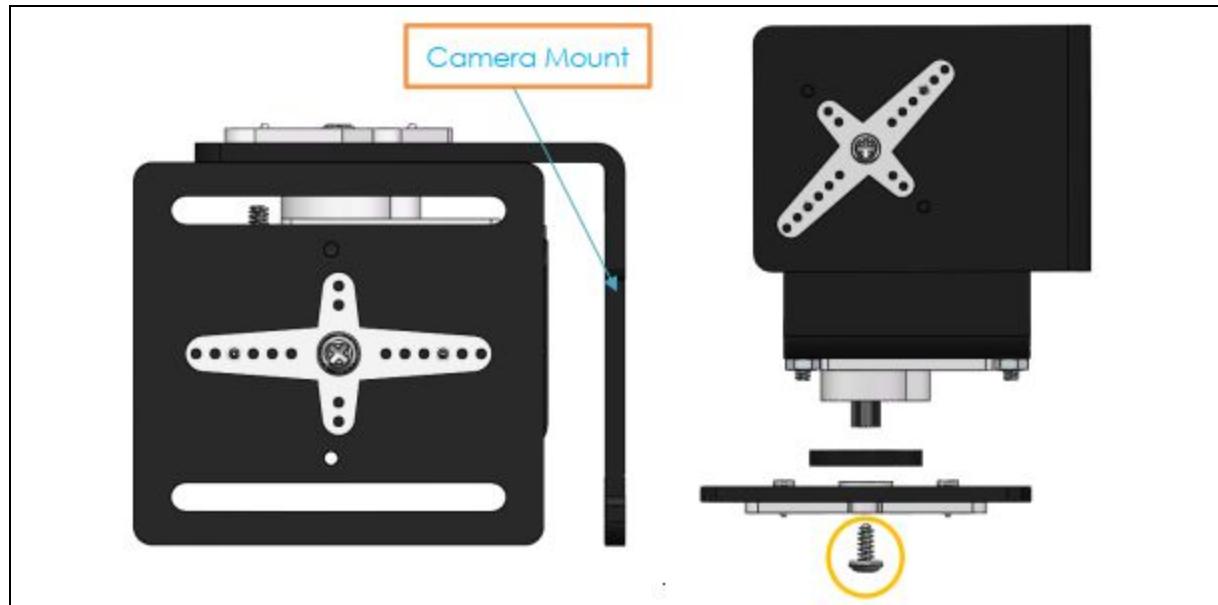


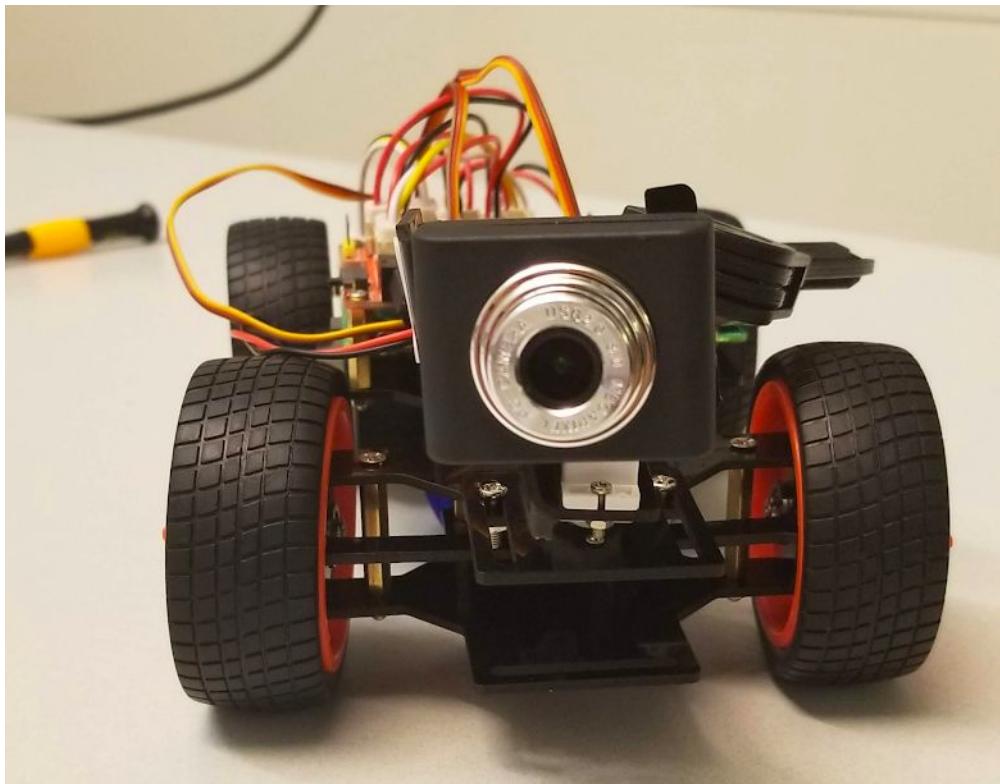
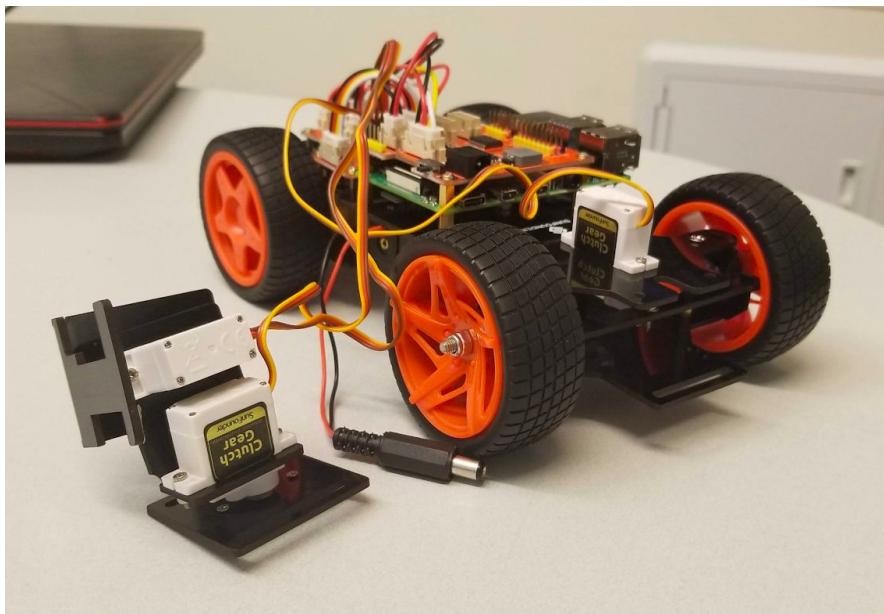
- Assemble the two servos connected to PWM Channel i.e. the Pan Servo, to the Pan Servo. Mount with four M2x8 screws and the M2 nuts (pay attention to the relative position of the servo shaft to the slot on the plate)
- Make sure the arm is 90 degrees





Assemble the camera with M3x10 screws and M3 nuts.





Installing the Client

1. Set up the environment in your computer
 - a. Get the Source code
 - b. Git clone the source code from Github [SunFounder_PiCar-V](https://github.com/sunfounder/SunFounder_PiCar-V)

```
pip install pyqt5
git clone
https://github.com/sunfounder/SunFounder_PiCar-V.git
ls
cd ~/SunFounder_PiCar-V/remote_control
```

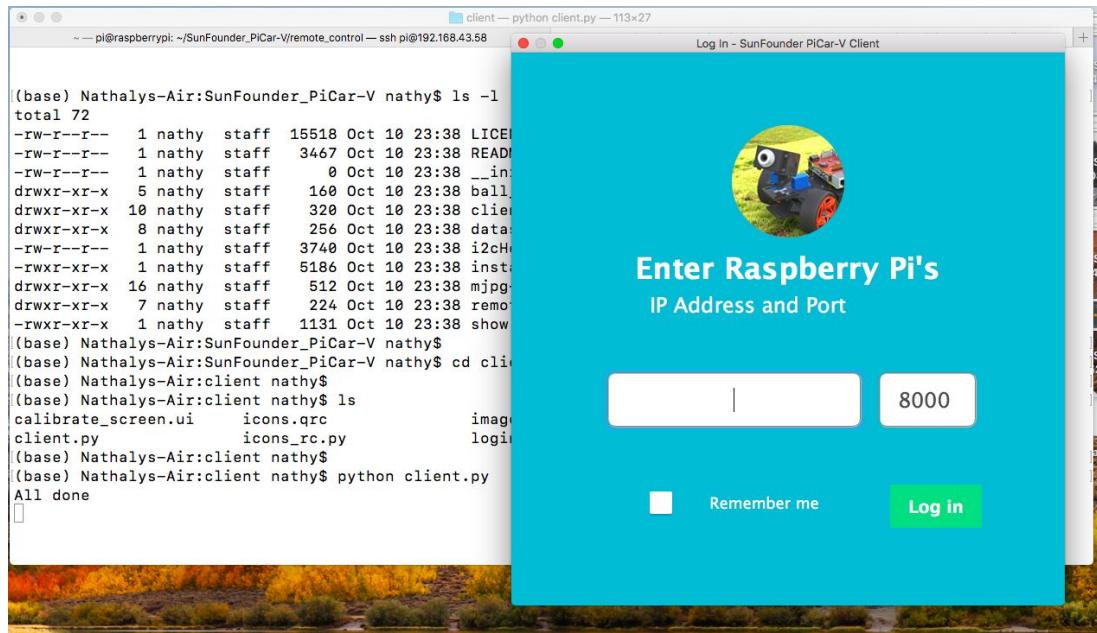
Getting on the Road

1. Server
 - a. SSH into the Raspberry Pi
 - b. Startup the web service

```
cd ~/SunFounder_PiCar-V/remote_control
sudo ./start
```

2. Client
 - a. Startup the web service

```
cd ~/SunFounder_PiCar-V/client
python client.py
```



You can login using the Raspberry IP

References

1. [Manual](#)
2. [Sundfounder Video](#)