OSOYOO Mecanum Wheel Robotic Car Kit for Raspberry Pi

INTRODUCTION

Model : 2021006600 SKU: AMC25RPI00

Mecanum wheels, also known as omni wheels, consist of a hub with rollers oriented 45° to the axis of rotation. The Mecanum wheels are wheel hubs fitted with integrated rollers that move passively and independently.

Depending on which wheels rotate in which direction, the platform will move forward, backward, sideways, diagonally, or spin in place. This range of maneuverability enables the Omni Platform to efficiently navigate any space, particularly around tight corners, narrow lanes, and complex pathways.

This omnidirectional robot car learning kit, designed for both Arduino and Raspberry Pi. With the powerful Mecanum wheels, the car can perform more advanced movements, such as sideways shifting and diagonal motion, controlled via a mobile phone or tablet app.

When using an Arduino Mega2560, it includes all the essential features of a traditional Arduino robot car, such as Bluetooth remote control, IoT functionality via Wi-Fi, line tracking, and obstacle avoidance autonomous driving.

When using a Raspberry Pi, it offers many of the same features as an Arduino-based robot car, including line tracking, obstacle avoidance autonomous driving, and follow mode, while also supporting network video-based control.

Besides, we have designed 6 step by step lessons which help students to learn raspberry pi robot programming. If you are an experience DIY player or raspberry programmer, you can also get a lot of knowledge from this.

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CONTENTS

Lesson 1A Basic Hardware Assembly

INTRODUCTION

Model 2021006600

Mecanum Omni direction wheel is a very interesting wheel which allows robot car make omni-directional movement (e.g. parallel shift to left and right).

In this project, we will show how to use raspberry pi to control an OSOYOO mecanum wheel robot car to make some basic movement including go forward, backward, left turn, right turn, parallel left shift, parallel right shift etc.

This lesson also guides you through assembling the car chassis and connecting the Raspberry Pi and OSOYOO PWM HAT to the OSOYOO Model Y board. This setup serves as the foundation for the following
lessons.

PARTS & DEVICES

OSOYOO Mecanum wheels robot car chassis x1

OSOYOO Wheels and motors x4 (left-wheels x2/right-wheels x2)

OSOYOO Rapberry pi 4B x1 (Not included in this kit)

OSOYOO OSOYOO PWM HAT shield x1

OSOYOO Model Y Motor driver board

OSOYOO Voltage meter x1

OSOYOO Battery box x1

OSOYOO 6pin male to male jumper wire x2

OSOYOO 3pin female to female jumper wire x1

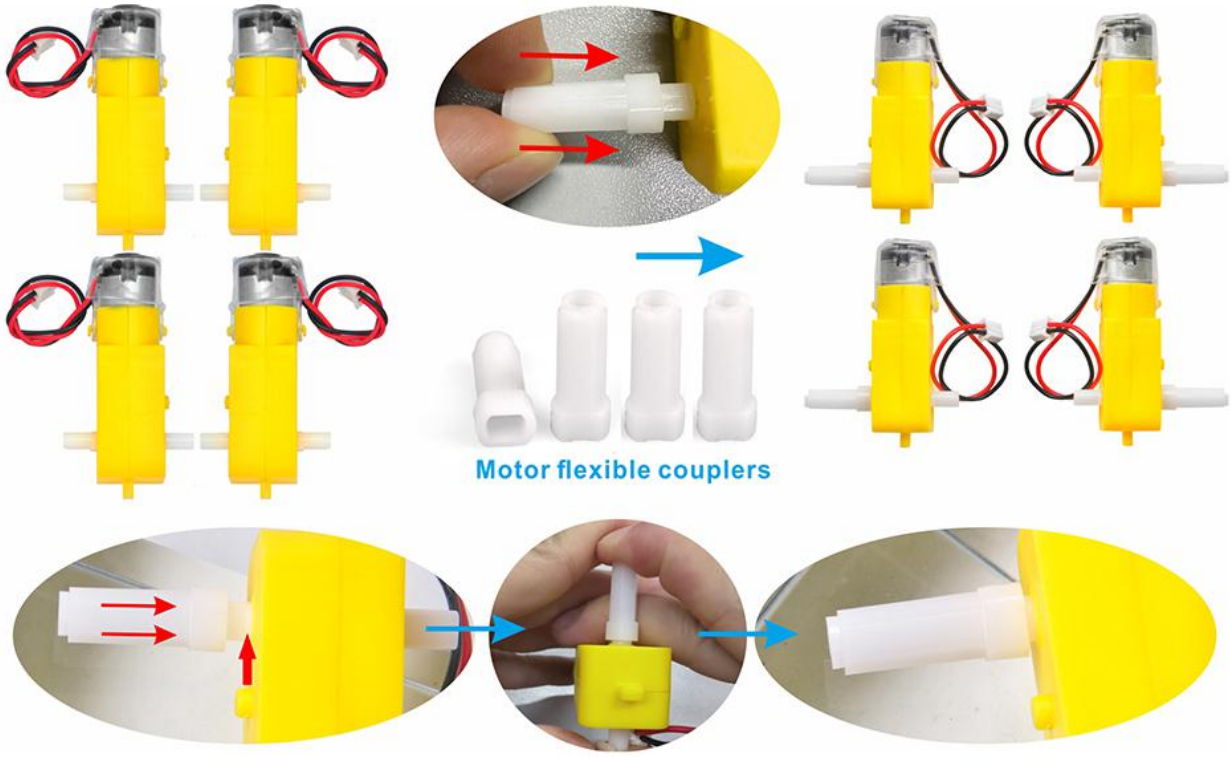
OSOYOO 2 pin PnP female to female x1

18650 Batteries(3.7V) x2

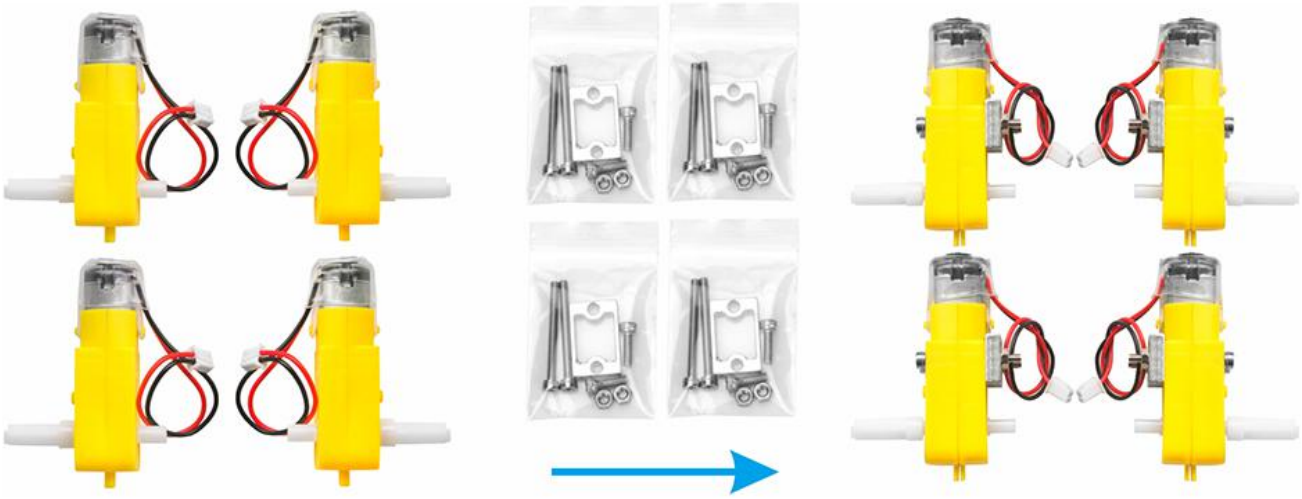
Battery charger x1

HARDWARE INSTALLATION

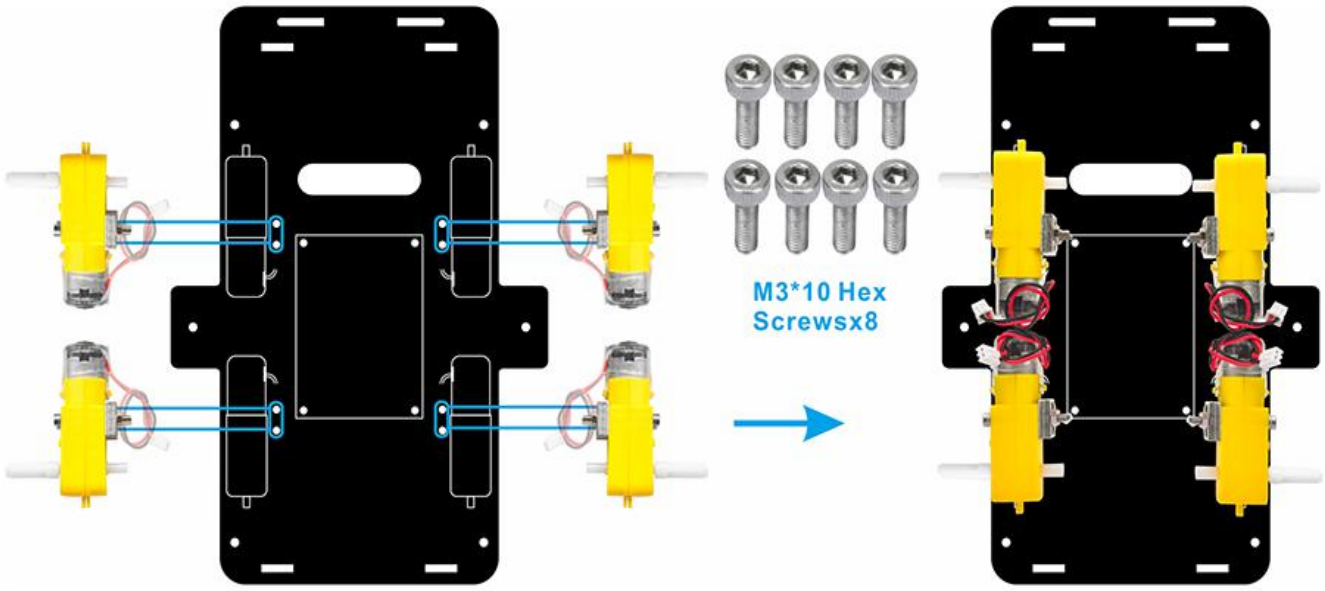
0) Please install the white coupling onto the yellow motor according to the steps shown in the image, **ensuring that the coupling is inserted all the way to the base**.



1) Attach the 4 motors using the metal motor holders as shown. (Please ensure the motor orientation is correct before installing the metal motor holders.)



2) Secure the 4 motors to the lower car chassis using M3*10 hex screws and a hex screwdriver, as shown in the image. (The screws required for this step are included in the metal motor holder package.)



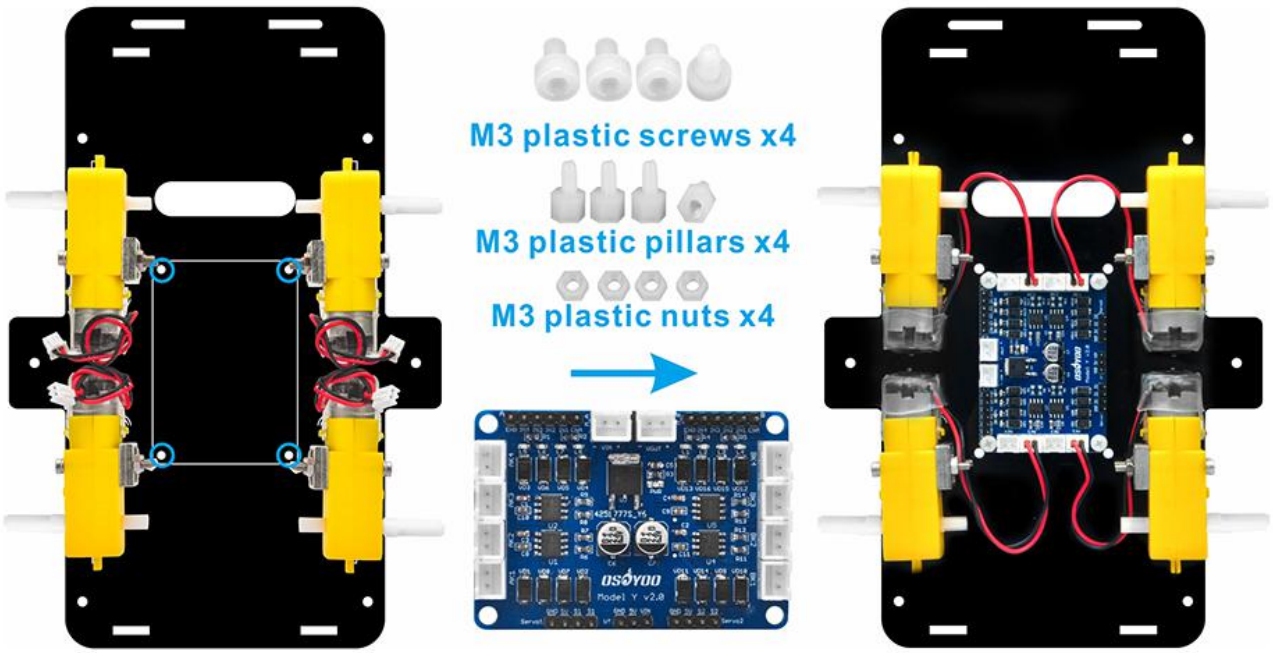
3) Mount the OSOYOO Model Y driver board onto the lower car chassis using 4 M2.5 plastic screws, plastic pillars, and plastic nuts (It is recommended to install the plastic pillar with the male end facing downward) .

(Ensure the OSOYOO Model Y driver board is installed in the correct orientation.)

There are two installation modes for plastic pillars:

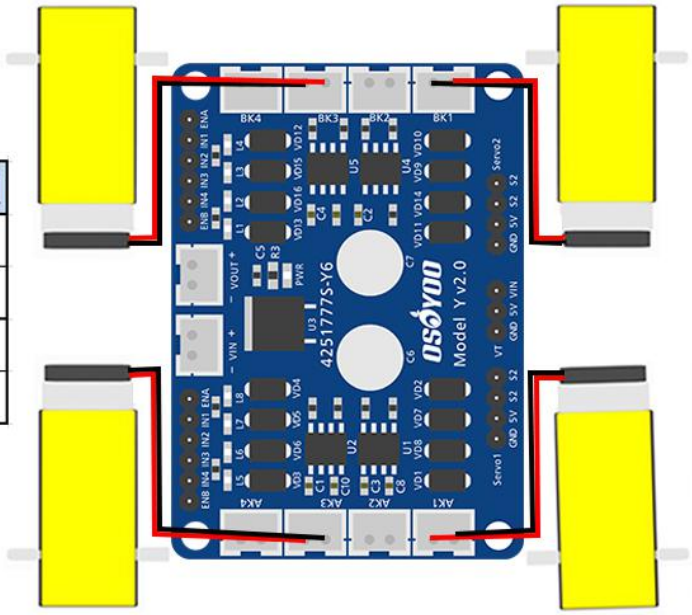
A. The male end of the plastic pillar faces downward.

B. The male end of the plastic pillar faces upward.

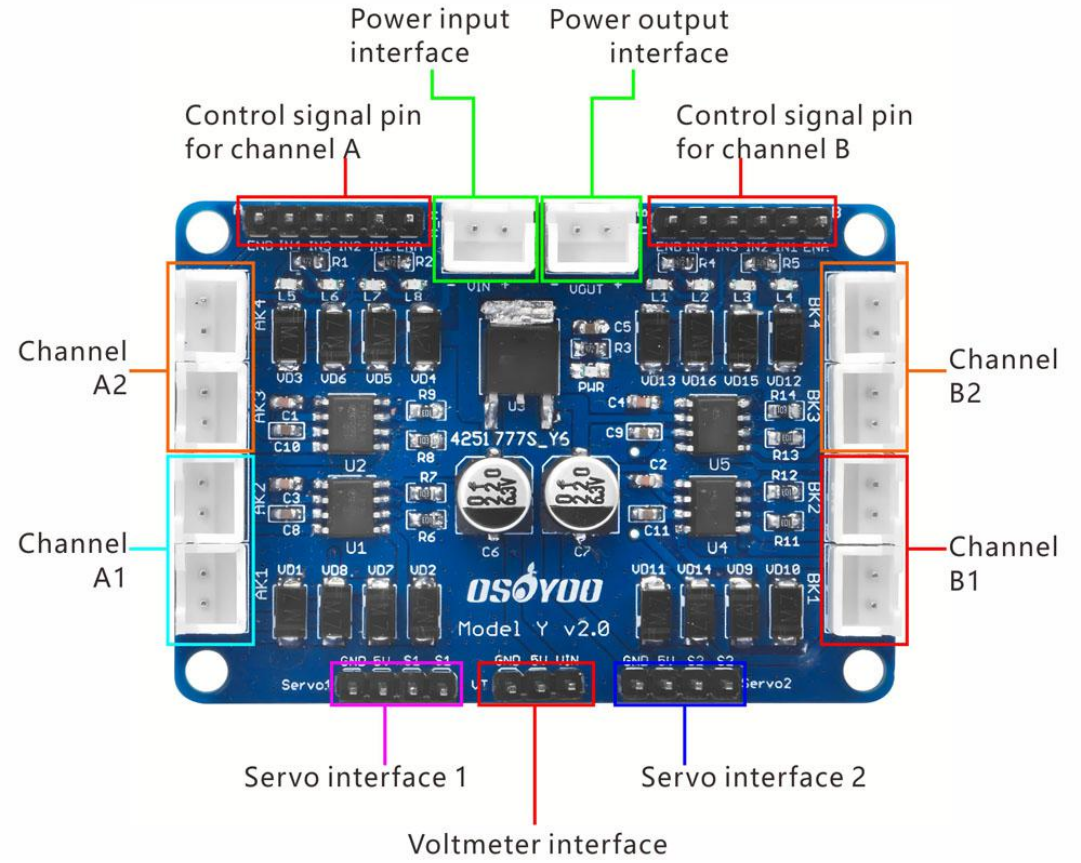


4)Connect the 4 motors to the K1 and K3 sockets on the Model Y motor driver board, as shown in the diagram.

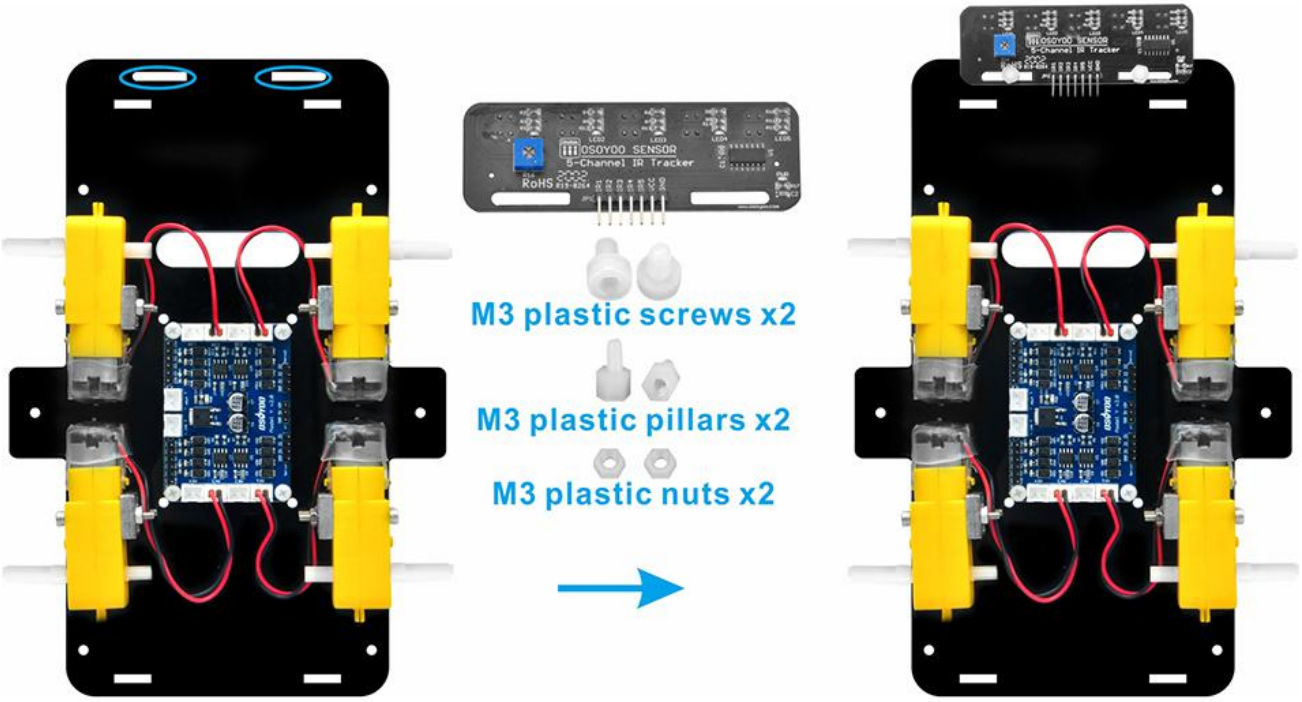
Wheel Motor	Model Y board
Front-right wheel motor	BK1/BK2
Front-left wheel motor	BK3/BK4
Rear-right wheel motor	AK1/AK2
Rear-left wheel motor	AK3/AK4



About Model Y V2.0 H-Bridge 4-Channel Motor Driver :
https://osoyoo.com/?p=46344

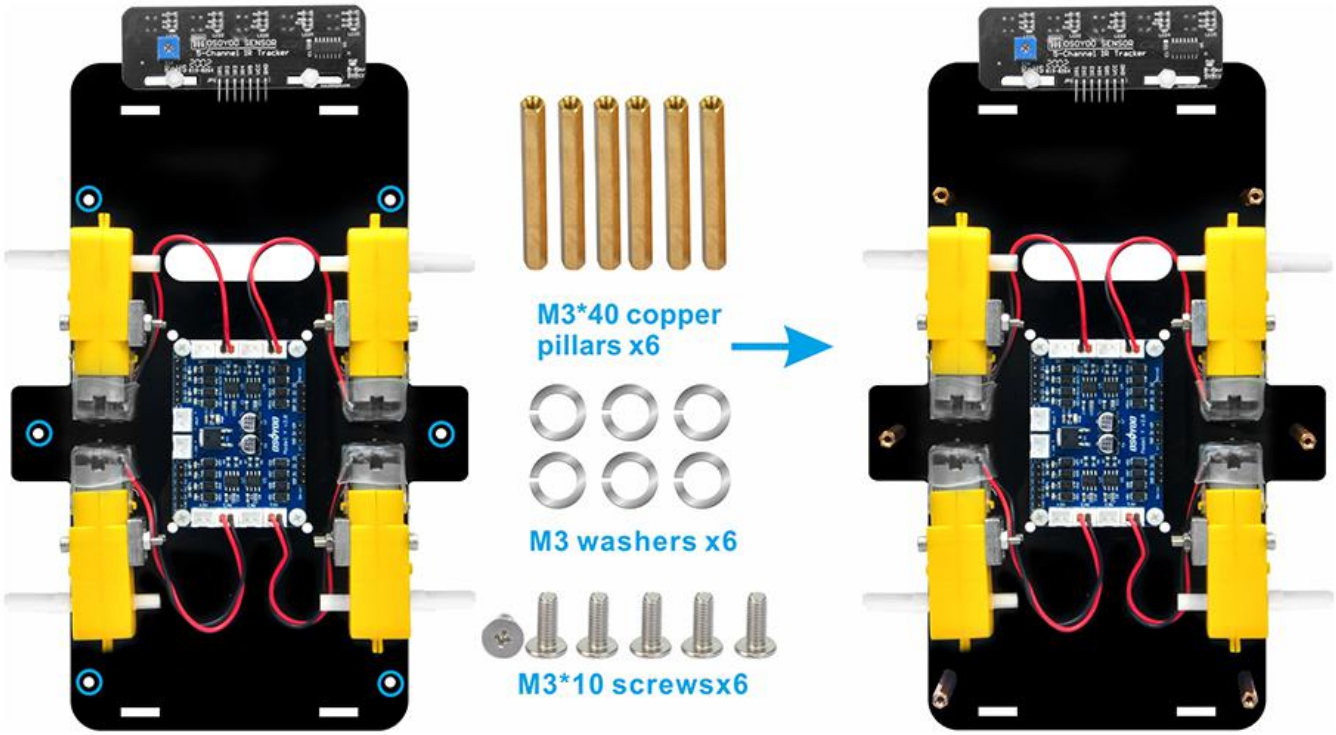


5) Attach the tracking sensor module to the lower chassis using two M2.5 plastic screws, two M2.5 plastic pillars, and two M2.5 plastic nuts(*It is recommended to install the plastic pillar with the male end facing upward*). Ensure the sensor is securely fixed and properly aligned for accurate functionality.

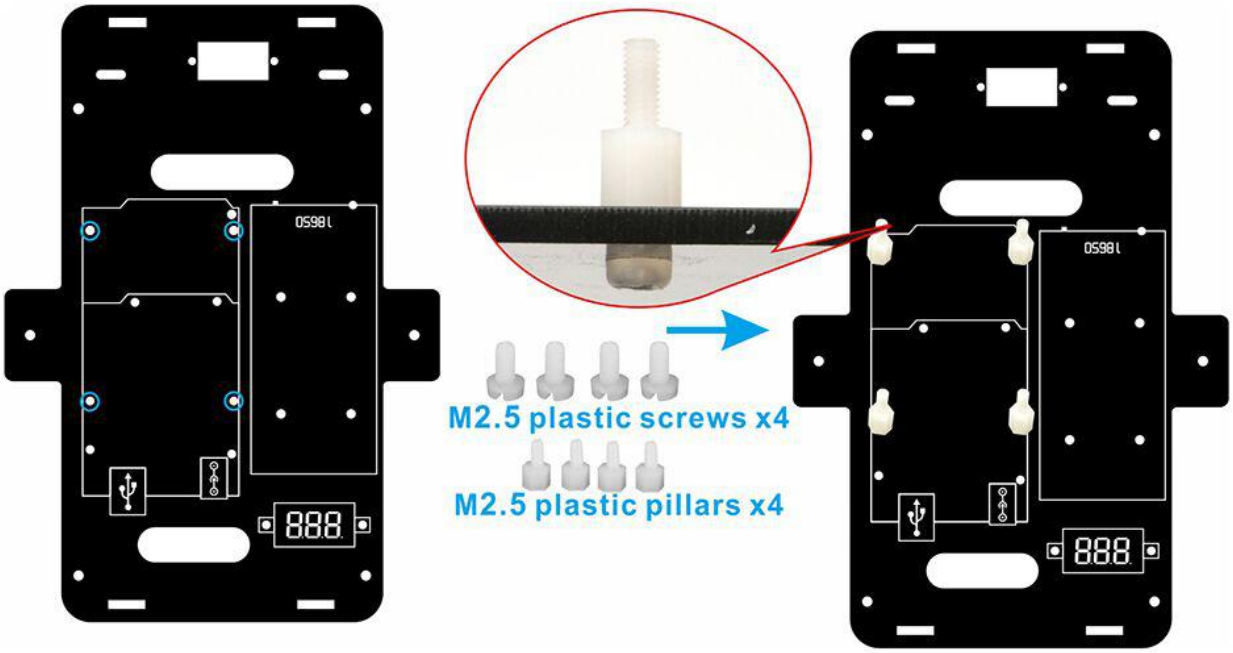


6) Attach six M3*40 copper pillars to the lower chassis using six M3*10 screws and six M3 washers. Ensure the pillars are firmly fixed to provide stable support for the upper chassis.

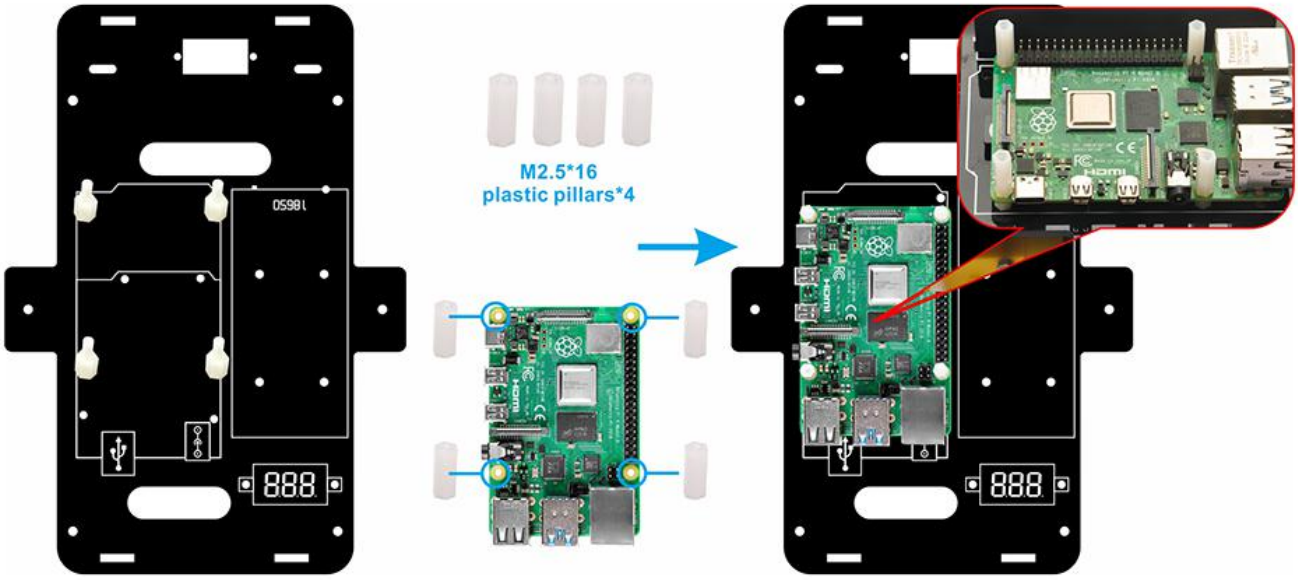
Slide the washer onto the screw, a washer distributes screw pressure and improves stability when securing screws into metal pillars.



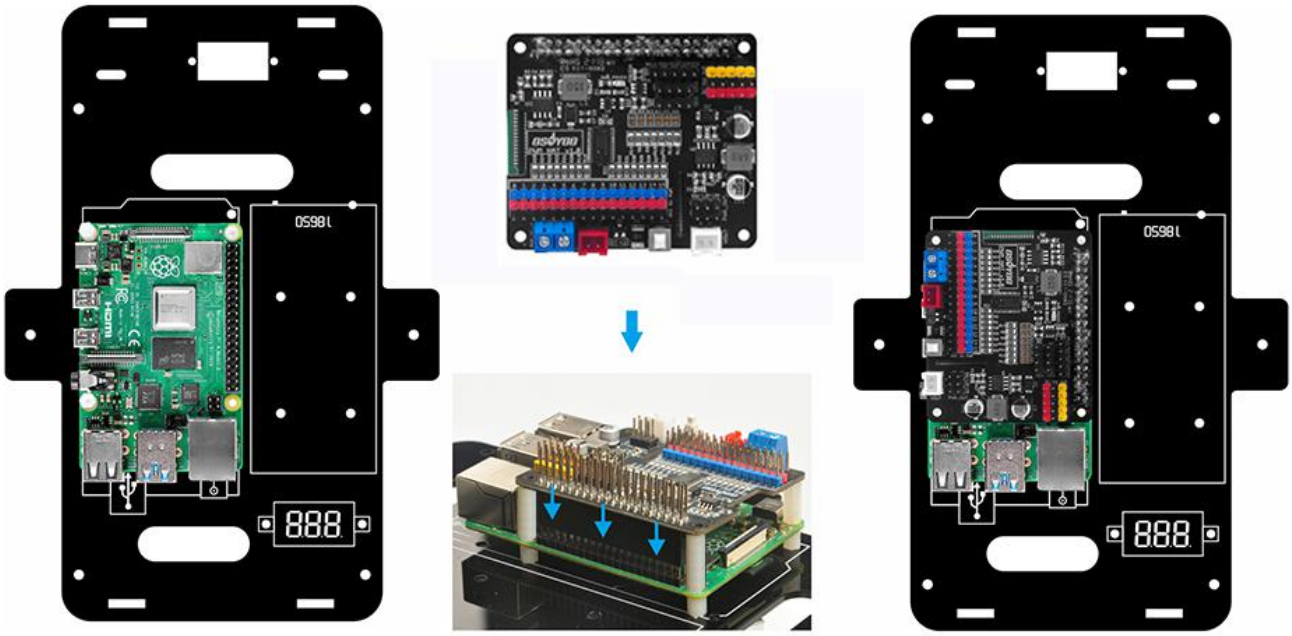
7) The acrylic chassis has dedicated mounting holes for installing the Raspberry Pi board. Please install white plastic M2.5*5+6 standoffs and M2.5*5 screws on these 4 holes as shown in the figure below.



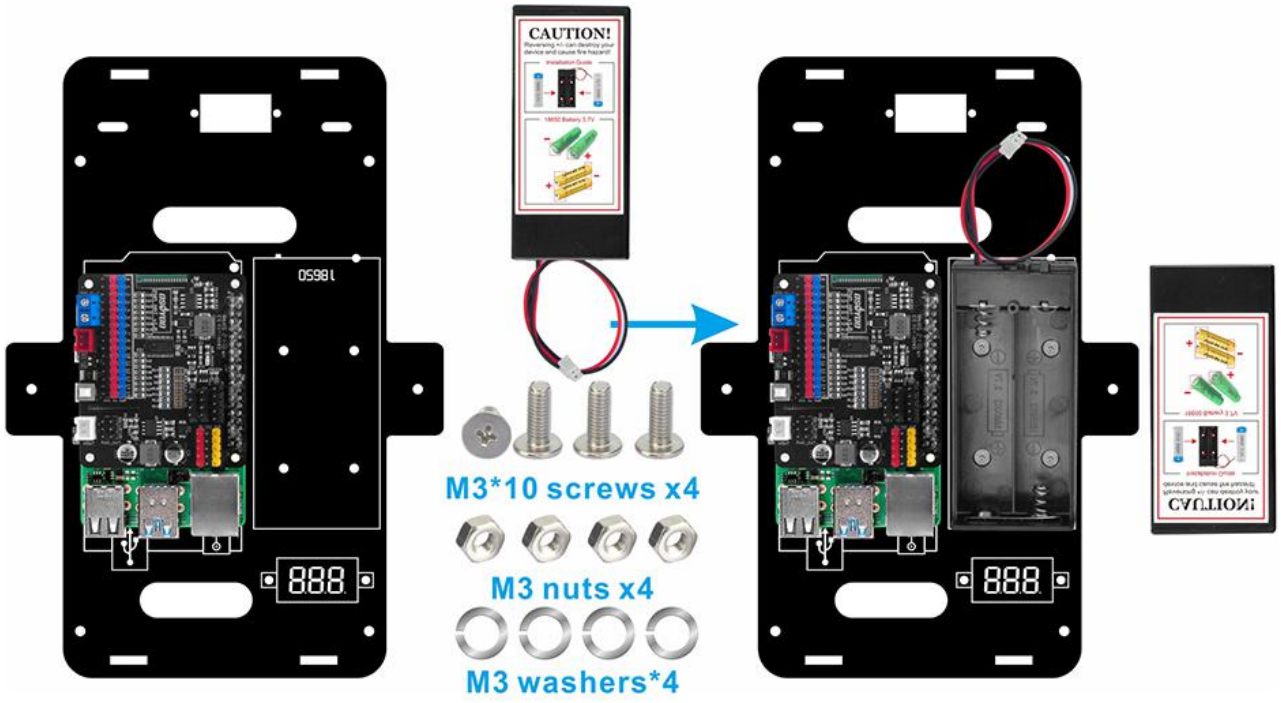
8） Secure the raspberry pi 4 board(**Not included in this kit.**) to the upper chassis using four M2.5x16 plastic pillars.



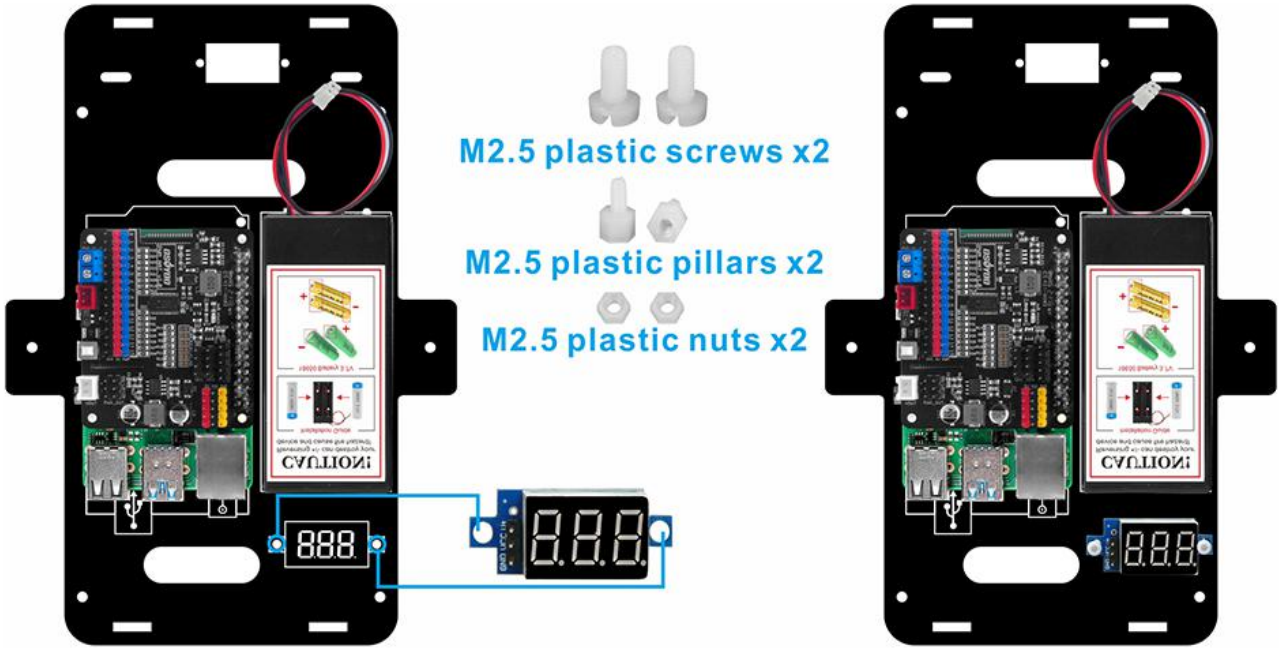
9) Insert OSOYOO PWM HAT shield onto your raspberry pi board.



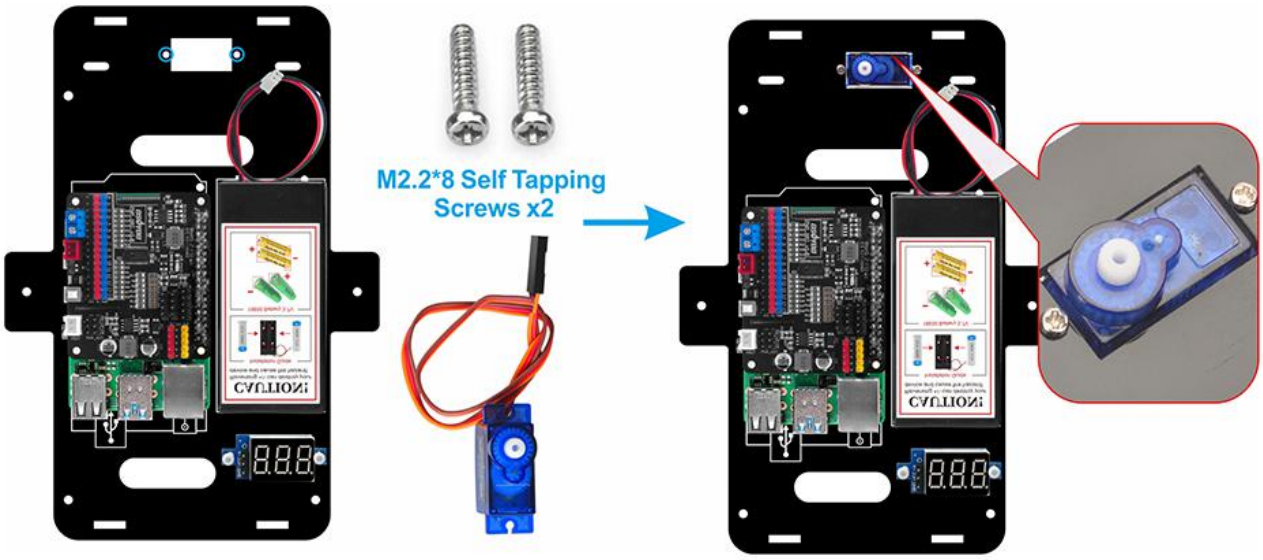
10) Use four M3*10 screws , four M3 nuts and four M3 washers to attach the battery box to the designated markings on the upper chassis.



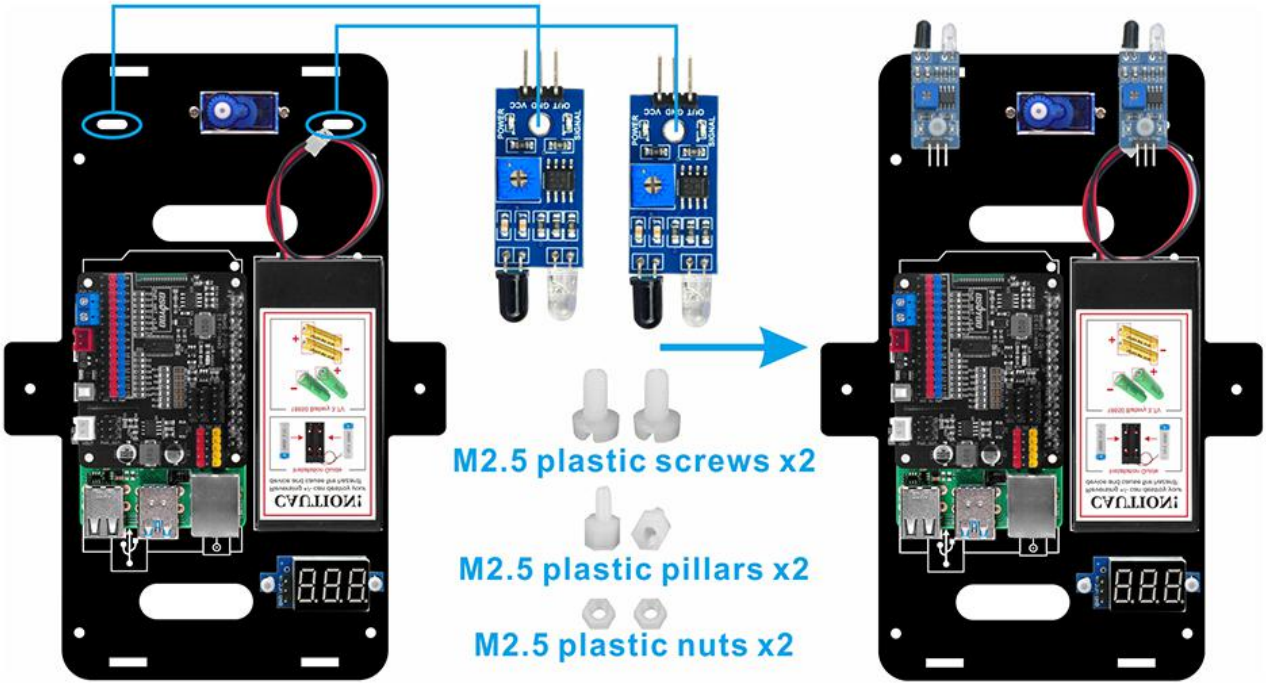
11) Attach the voltage meter to the designated markings on the lower chassis using two M2.5 plastic screws, two M2.5 plastic pillars, and two M2.5 plastic nuts. *(It is recommended to install the plastic pillar with the male end facing upward.)*



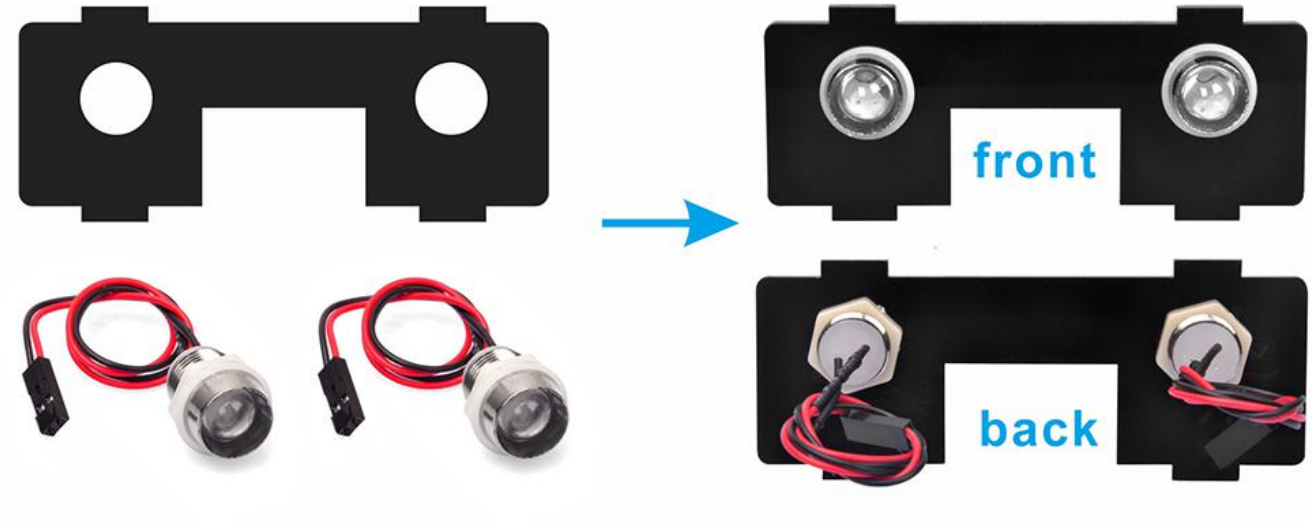
12) Using two M2.2*8 self-tapping screws, mount the SG90 servo motor at the front of the upper chassis.



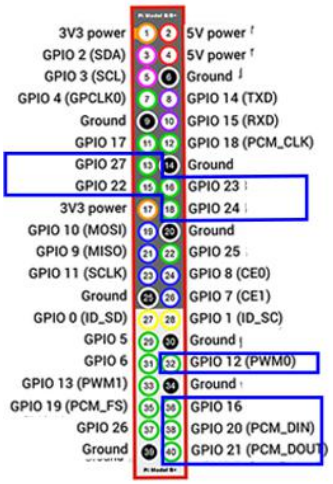
13) Attach two IR distance sensors to the front of the upper chassis using two M2.5 plastic screws, M2.5 plastic pillars, and M2.5 plastic nuts. To secure the sensors tightly, It is recommended to install the plastic pillar with the male end facing upward.



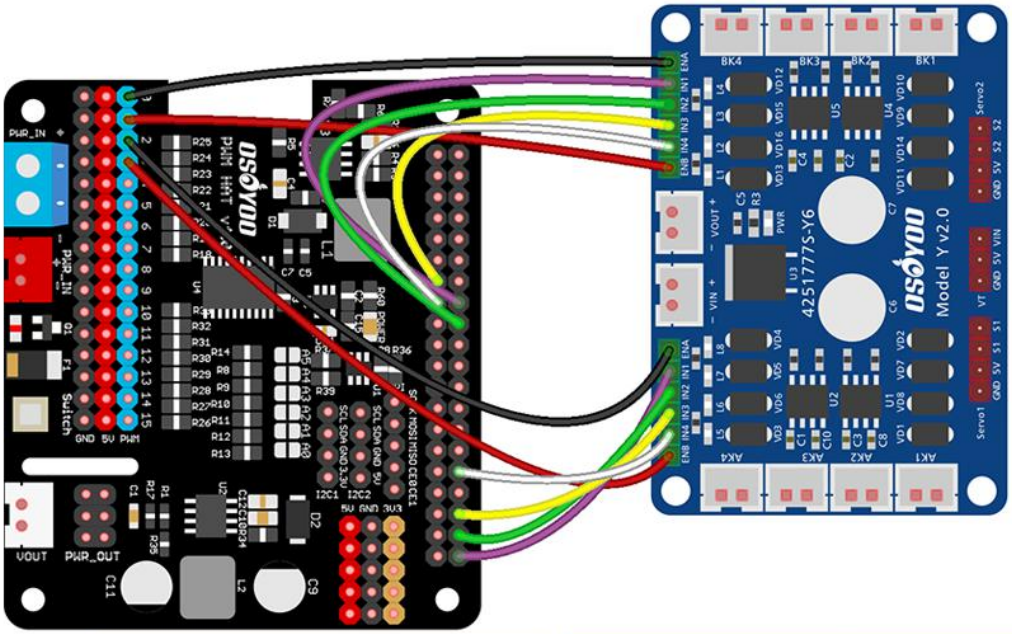
14) Mount two LED lights onto the front barrier plate as shown in the diagram.



15) Connect OSOYOO model Y board to OSOYOO PWM hat shield with 2pcs 6pin female to female jumper wires as follows. The 6-pin wires in Area B need to go through the hole near SG90 servo, the other 6-pin wires in Area A need to go through the hole near voltage meter.



2pcs 6pin male to female wires

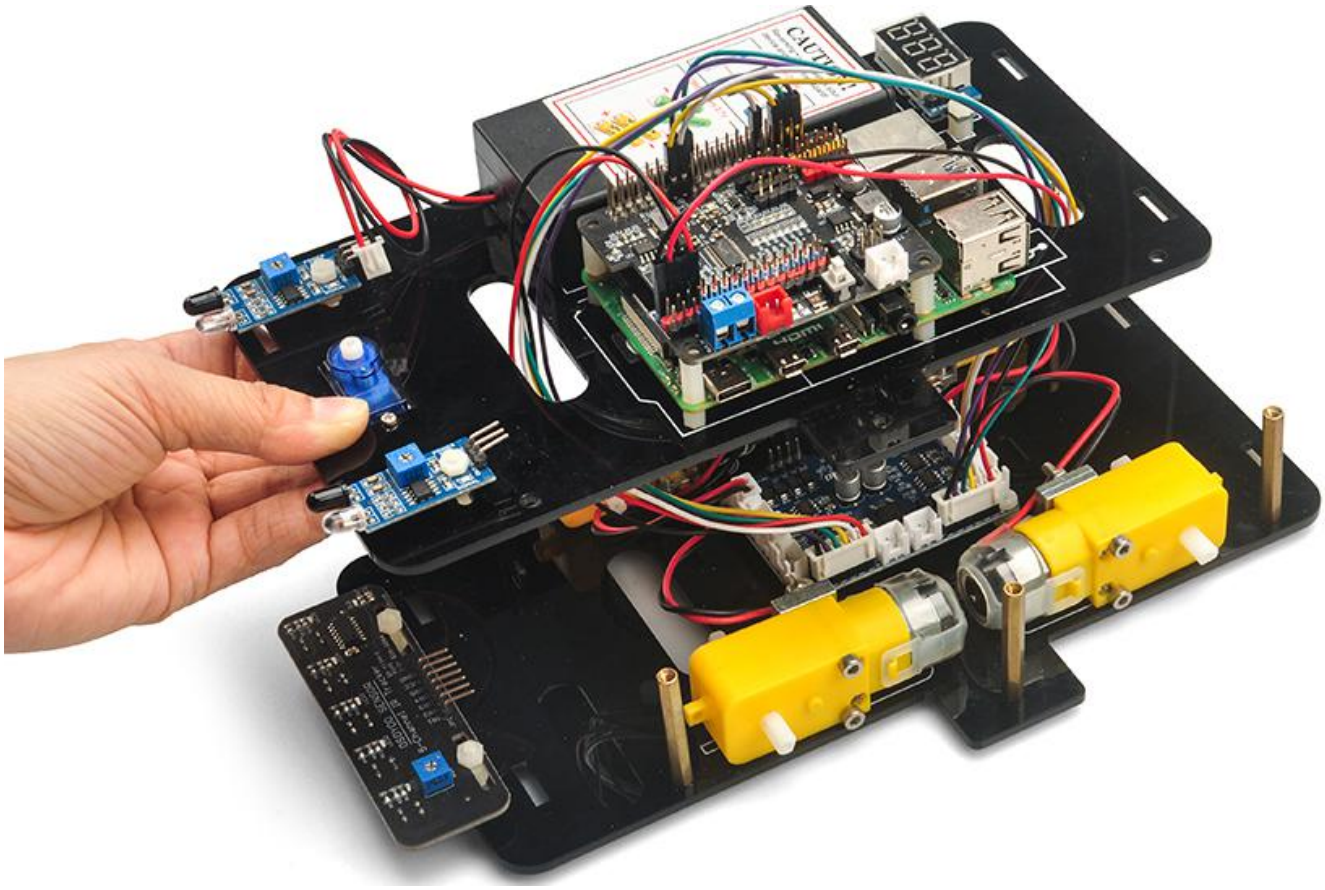


Model Y Motor Shield V2.0	PWM HAT V1.0
Channel B ENA	PWM 0
Channel B IN1	GPIO 23
Channel B IN2	GPIO 24
Channel B IN3	GPIO 27
Channel B IN4	GPIO 22
Channel B ENB	PWM 1

Model Y Motor Shield V2.0	PWM HAT V1.0
Channel A ENA	PWM 2
Channel A IN1	GPIO 21
Channel A IN2	GPIO 20
Channel A IN3	GPIO 16
Channel A IN4	GPIO 12
Channel A ENB	PWM 3

Caution:

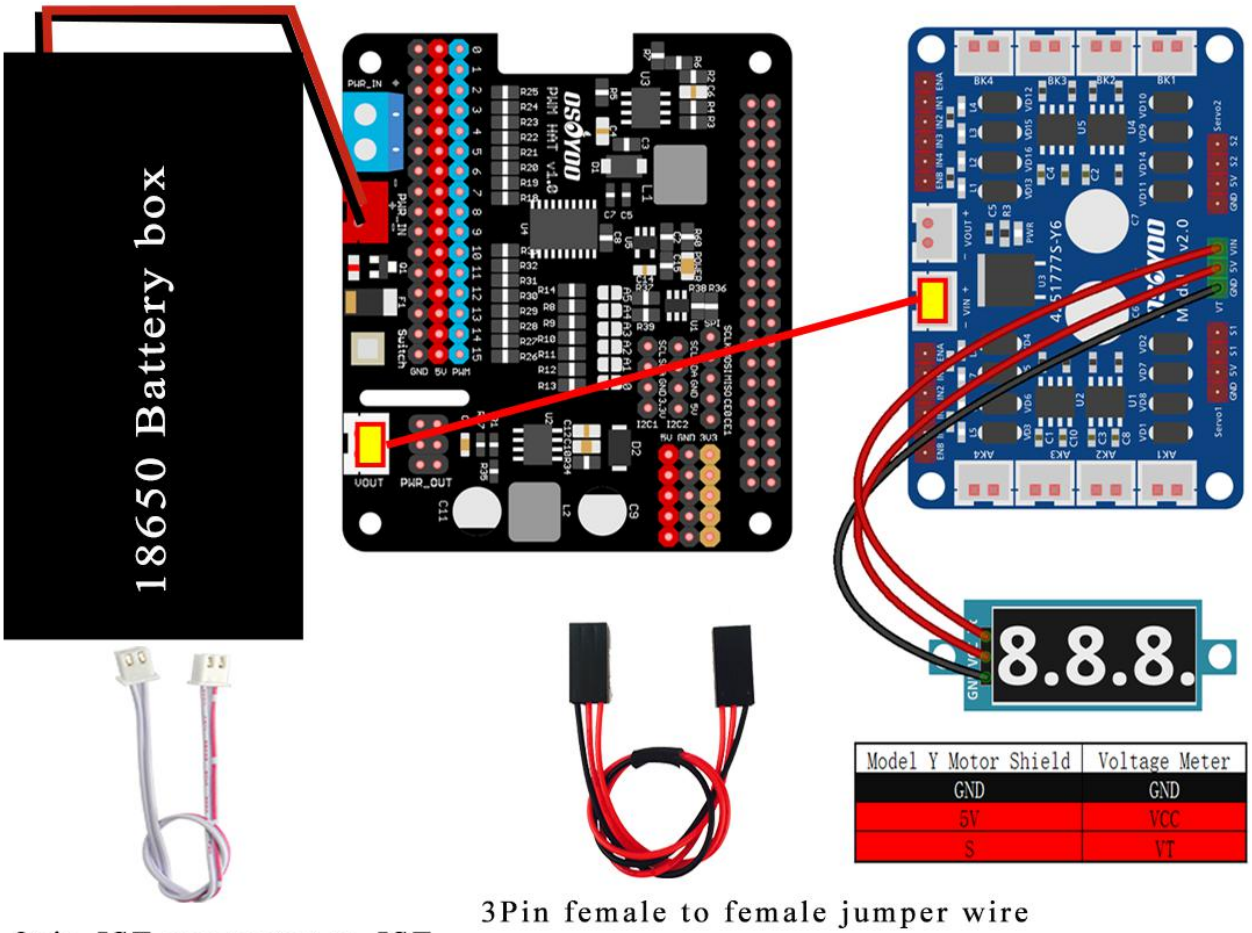
When insert/remove this 6-pin plug into Model Y 6-pin male socket, please hold the plastic pin-holder to do operation. Never drag the wires to pull the plug out of the socket, otherwise it will damage the wires.



16) Connect voltage meter to OSOYOO model Y board with 3pin female to female jumper wire as below connection diagram.

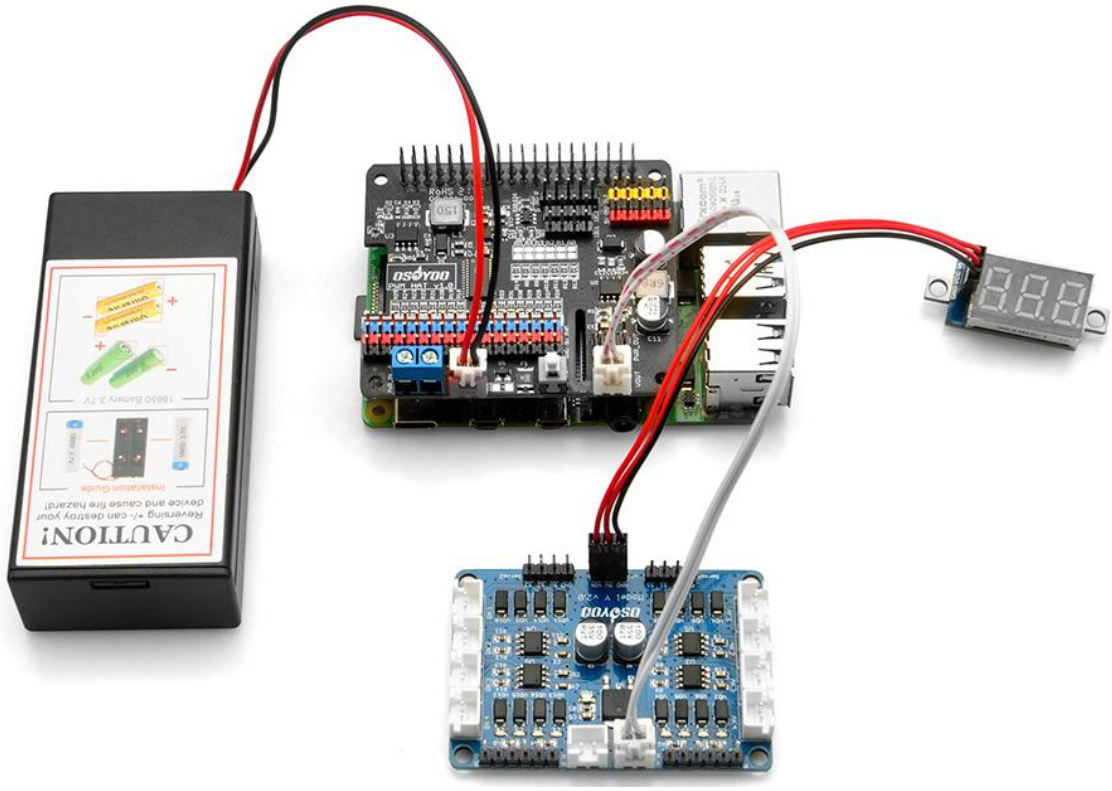
Connect OSOYOO model Y board 12V-GND socket to VIN-GND socket with OSOYOO 2pin PnP cable 20cm as per following graph.

Connect battery box to VIN-GND socket of OSOYOO Uart WiFi shield according below connection diagram.

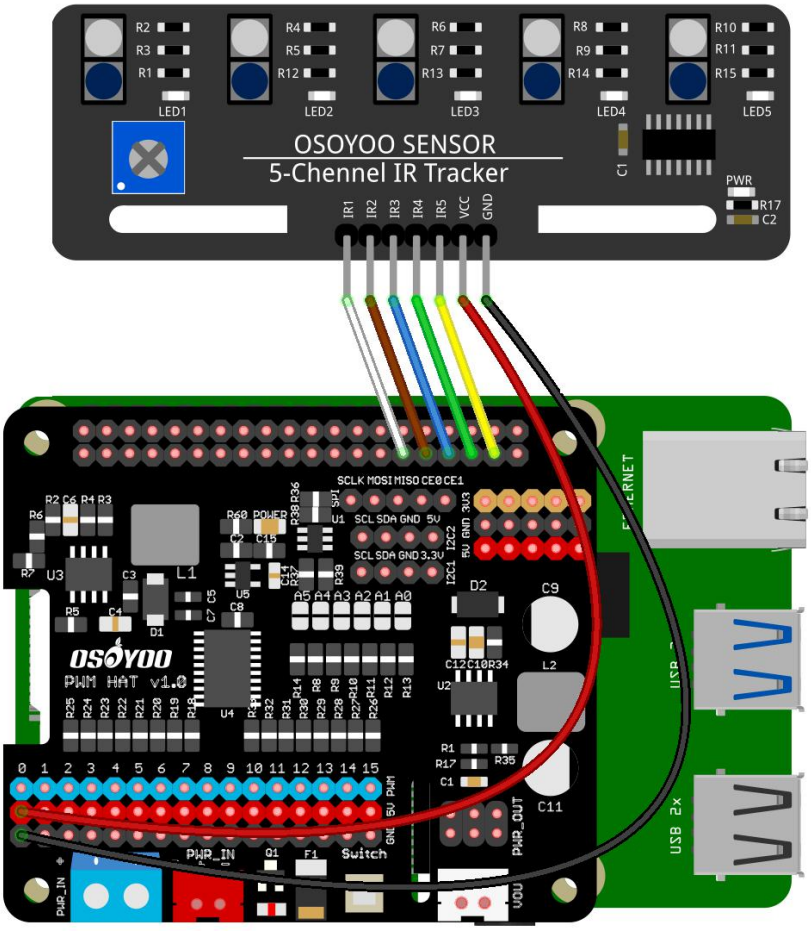


2pin JST connector to JST female to female connector

3Pin female to female jumper wire

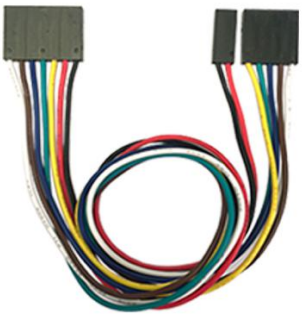


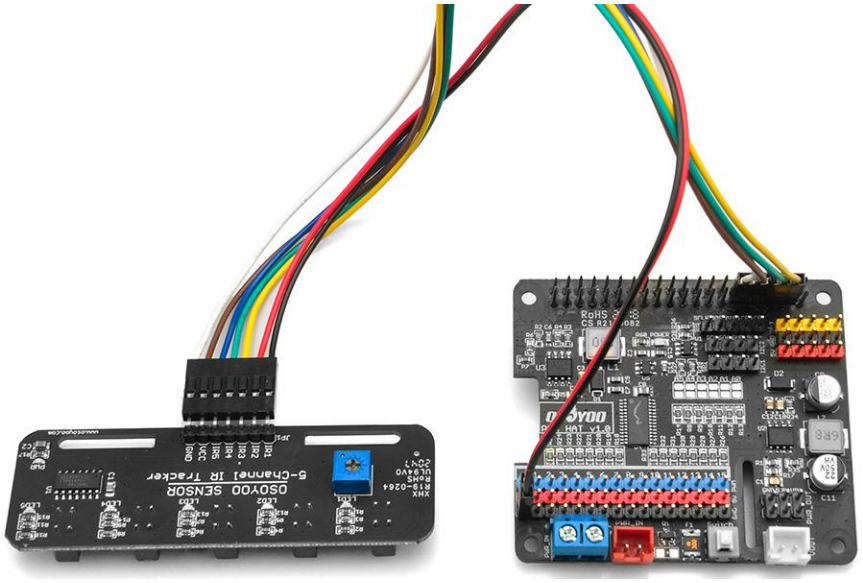
18) Connect GND-VCC pin of tracking sensor module to GND-5V of OSOYOO PWM hat shield ; connect IR1, IR2, IR3, IR4, IR5 pins to GPIO5, GPIO6, GPIO13, GPIO19, GPIO26 with 7pin 25cm female to female cable as the following photo shows..



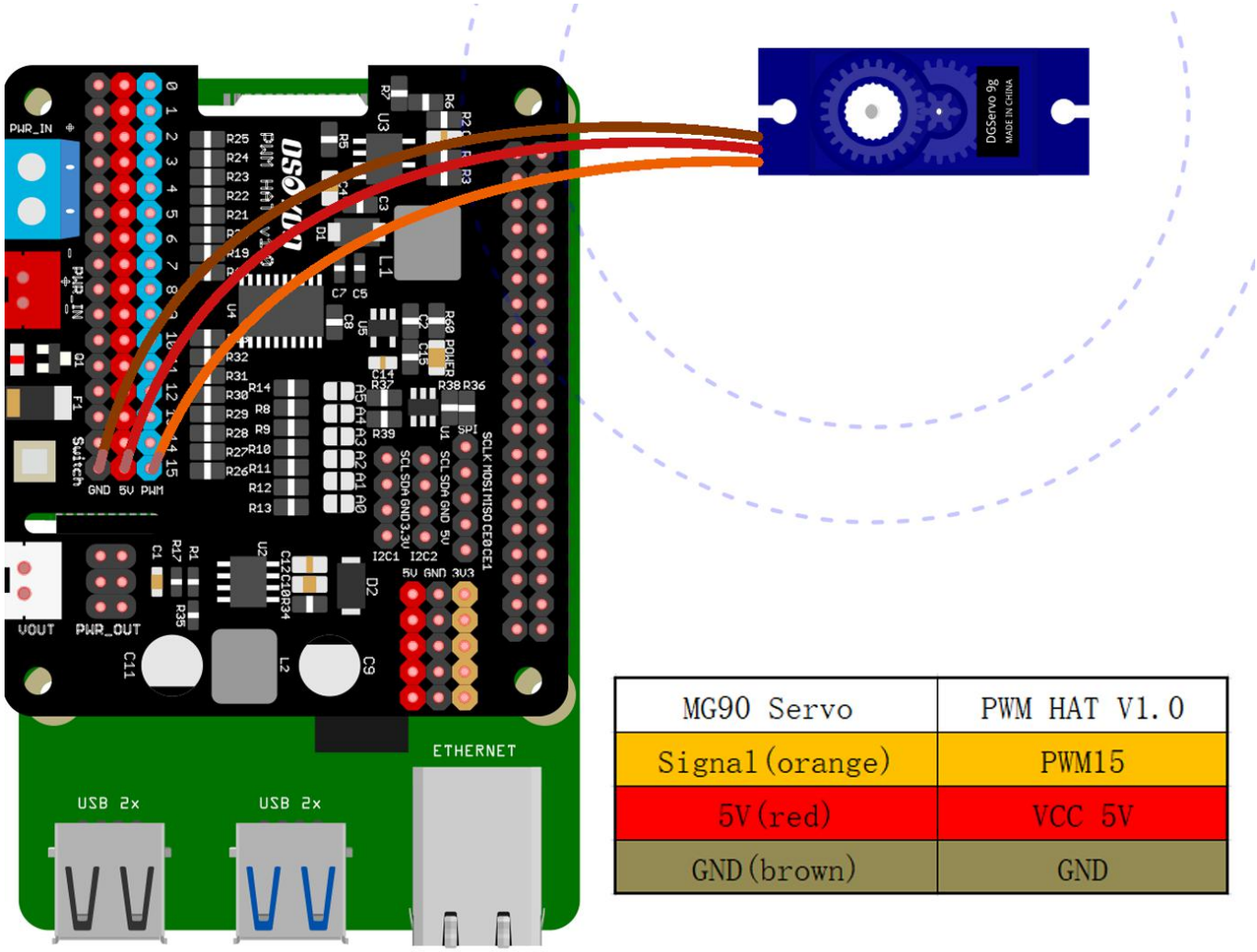
5-Point Tracking Sensor	PWM HAT V1.0
GND	GND
VCC	VCC
IR1	GPIO 5
IR2	GPIO 6
IR3	GPIO 13
IR4	GPIO 19
IR5	GPIO 26

7Pin female to female jumper wire





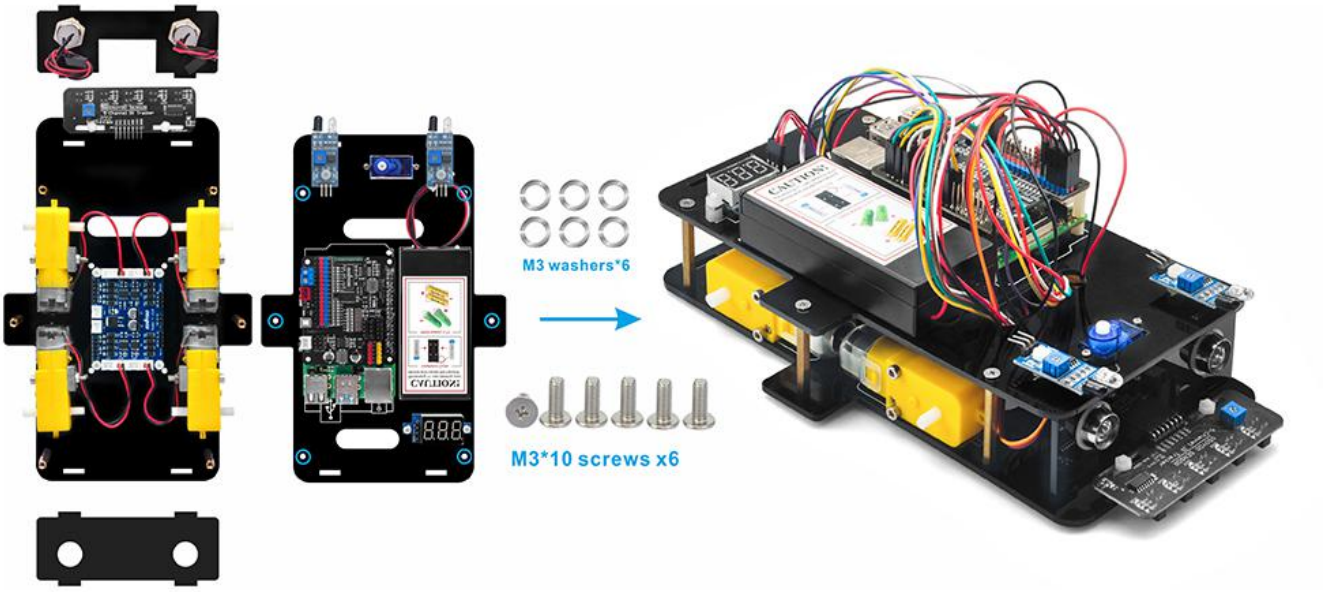
19) Connect SG90 servo motor, OSOYOO model Y board and OSOYOO PWM hat as following diagram.



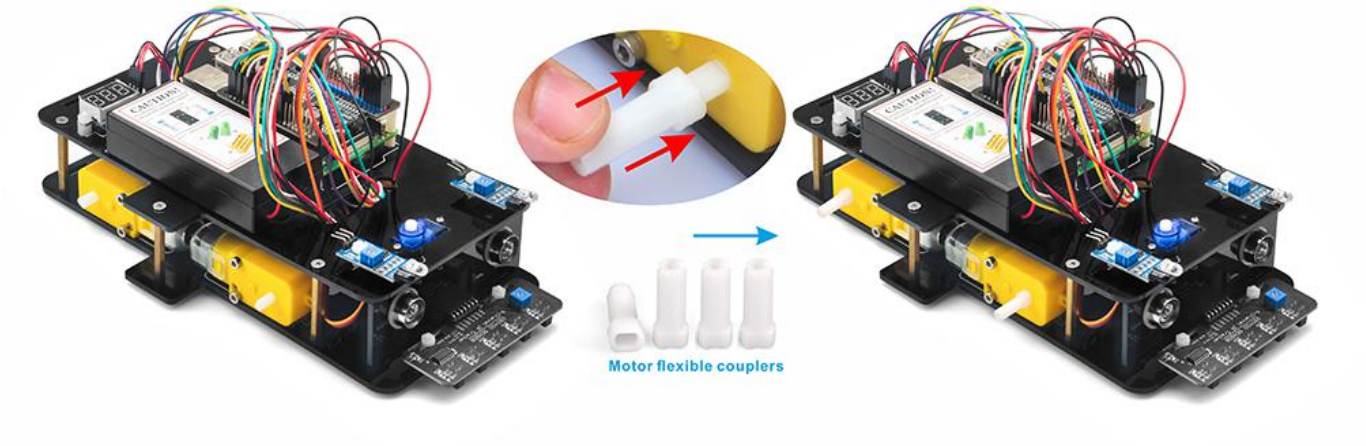
MG90 Servo	PWM HAT V1.0
Signal(orange)	PWM15
5V(red)	VCC 5V
GND(brown)	GND

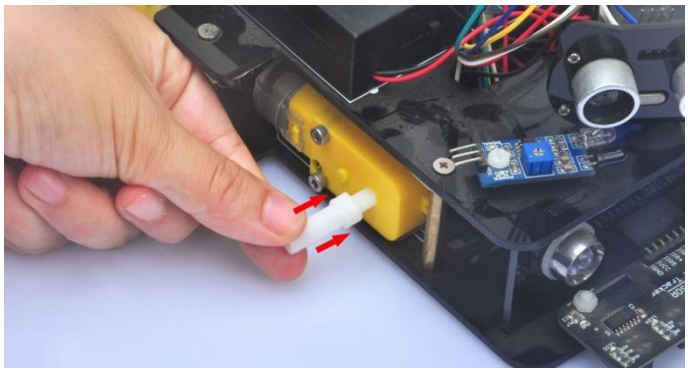
20）Ensure all necessary circuit connections are completed before assembling the upper and lower chassis. Fix upper chassis to lower chassis with 6pcs M3*10 hex

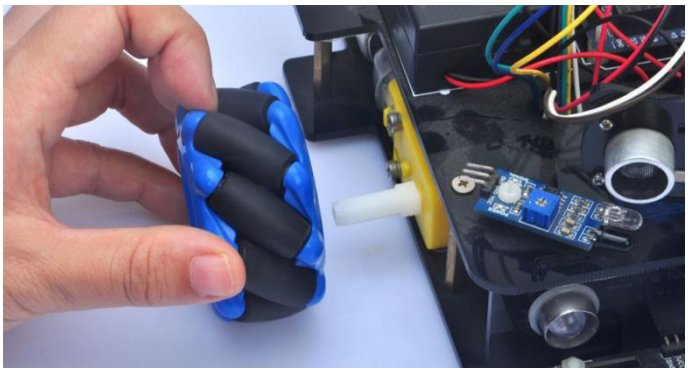
screws.



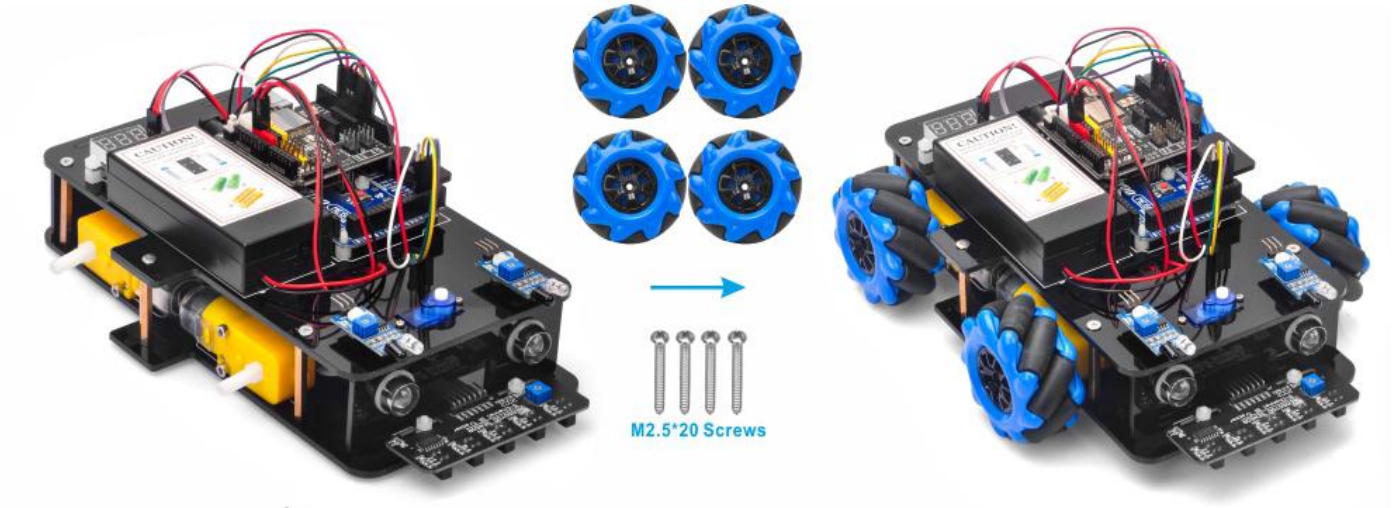
21) Install 4 flexible coupling and wheels onto the motors with 4pcs M2.5X20 or M2.6X20 Self-tapping screw. Please ensure the white coupling is fully inserted into the bottom of the yellow motor.







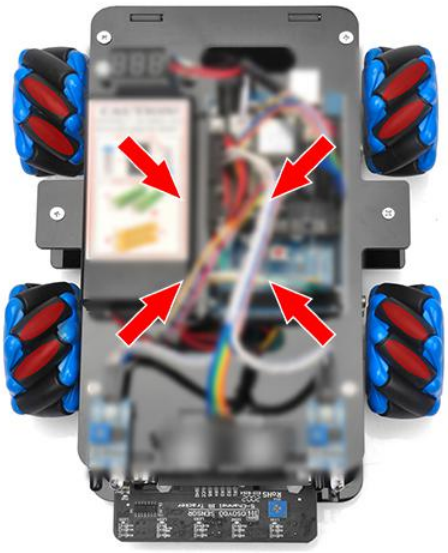
22) Install 4 wheels onto the motors with 4pcs M2.5X20 screws.



Note: There are two types of wheels. Arrange them with the rollers angled toward the car's center when viewed from above.

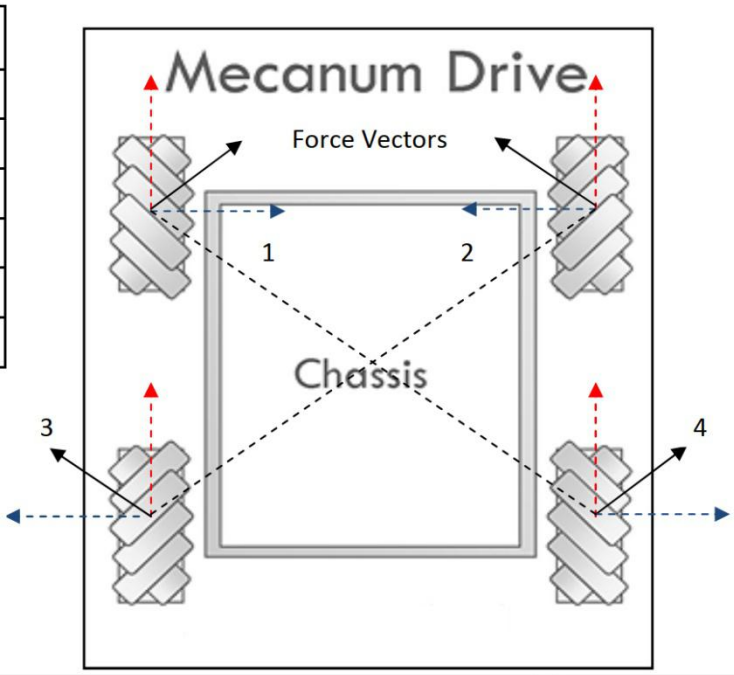
There are two types of Mecanum wheels, left and right Mecanum wheel; the difference between them is the orientation of rollers. For A Mecanum wheel, as shown below, rollers are orientated from lower right to upper left. Rollers for B wheels are installed in the opposite way.

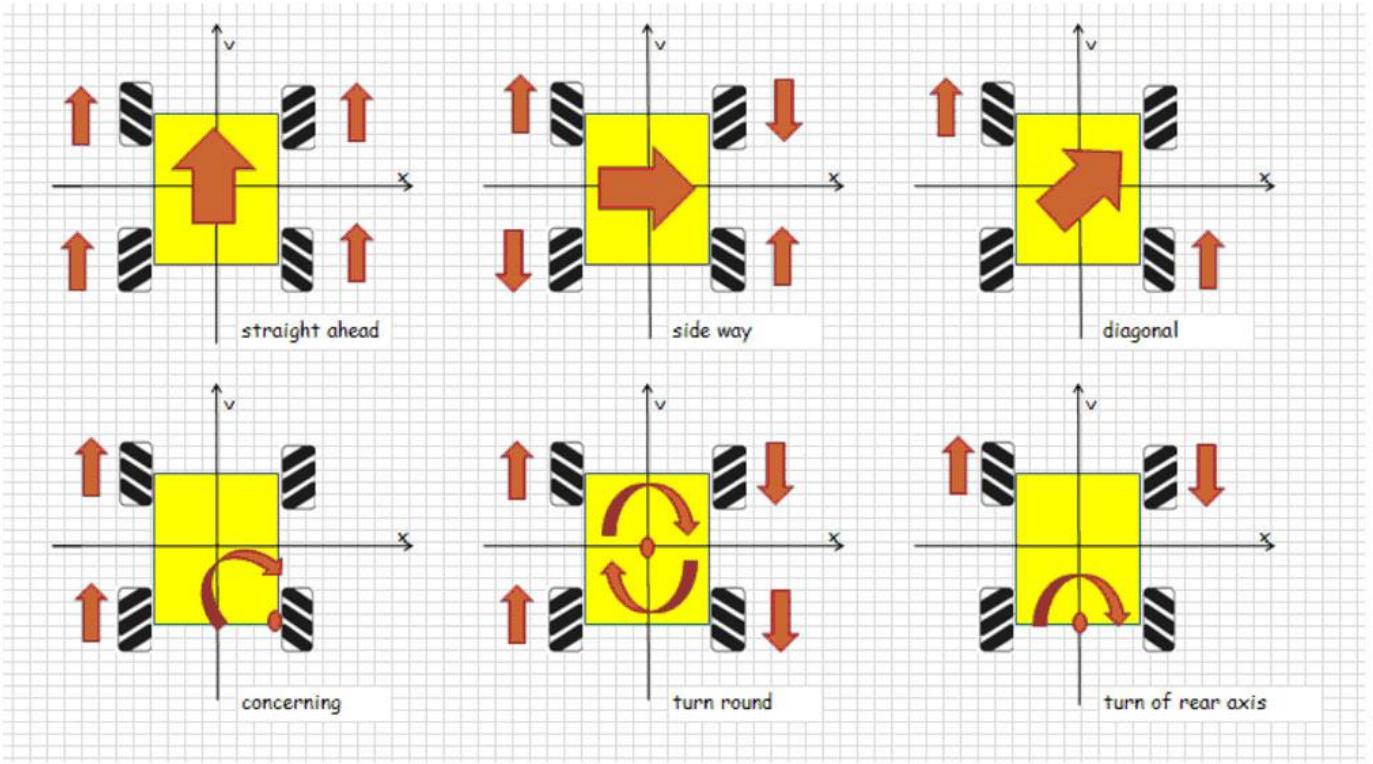
A correct configuration requires each of four wheels is set in the way as shown below, where the rotation axis of each wheel's top roller points to the center of the platform. Please notice that all the dynamic analysis and pre-written codes are based on this configuration.



Direction of Movement	Wheel Actuation
Forward	All wheels forward same speed
Reverse	All wheels backward same speed
Right Shift	Wheels 1, 4 forward; 2, 3 backward
Left Shift	Wheels 2, 3 forward; 1, 4 backward
CW Turn	Wheels 1, 3 forward; 2, 4 backward
CCW Turn	Wheels 2, 4 forward; 1, 3 backward

To the right: This is a top view looking down on the drive platform. Wheels in Positions 1, 4 should make X- pattern with Wheels 2, 3. If not set up like shown, wheels will not operate correctly.





Now the hardware installation is almost complete. Before installing the 18650 batteries into the box, we need to upload and run the sample code on the Raspberry Pi first. We will cover in detail how to upload and run the sample code on the Raspberry Pi in the next lesson.

Lesson 1B Software Installation

INTRODUCTION

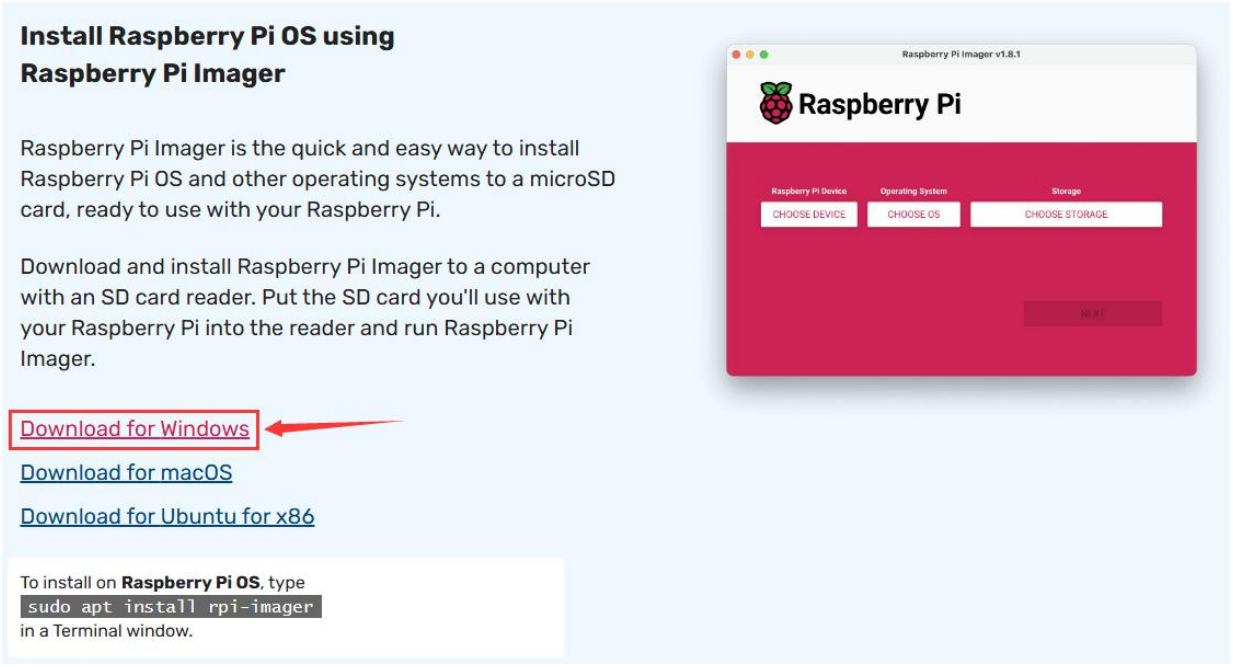
In this lesson, we will guide you through the installation and setup of the Raspberry Pi operating system, along with the necessary software and libraries to control your OSOYOO Mecanum Wheel Robot Car.

SOFTWARE INSTALLATION

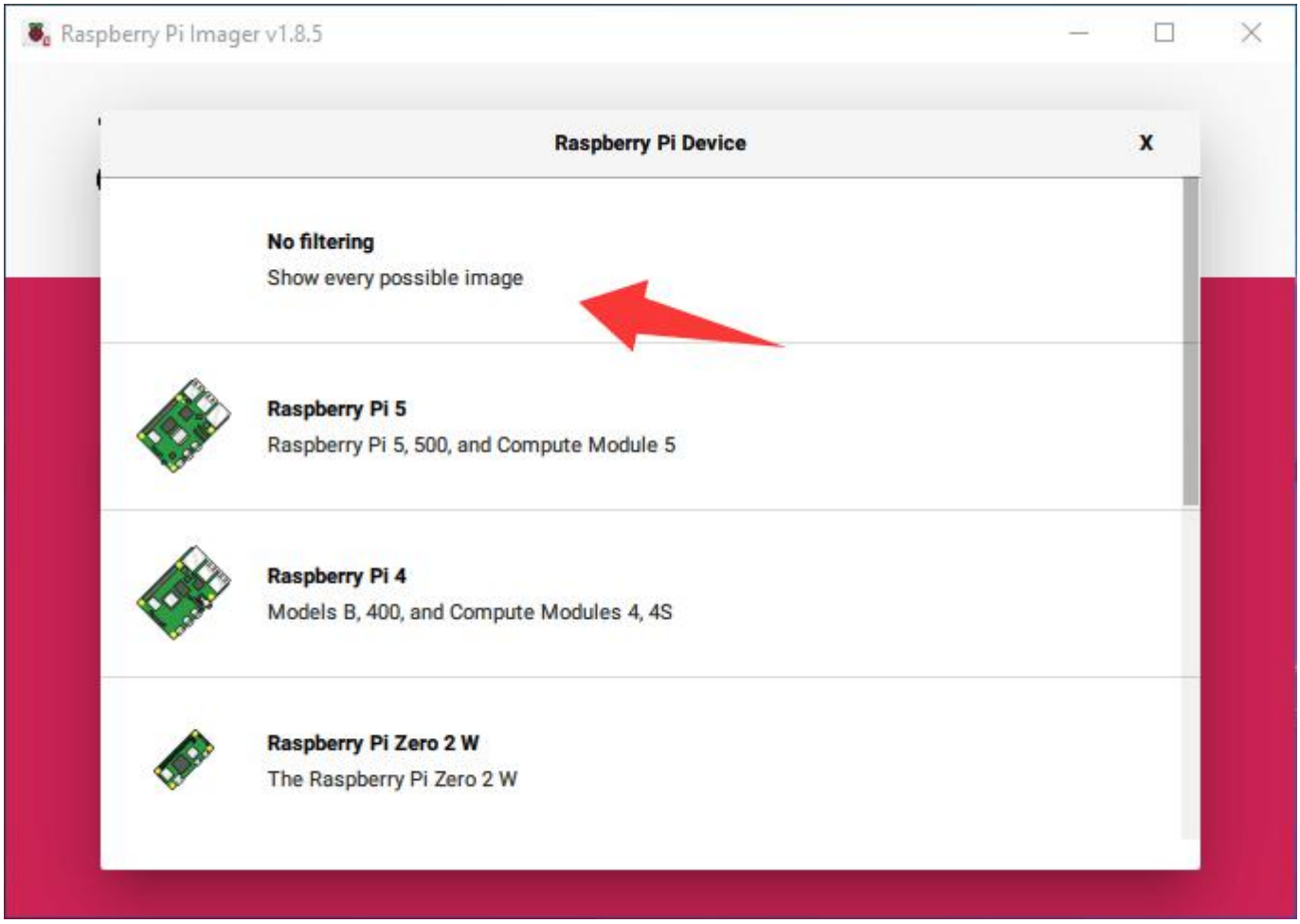
Note: here we take Raspberry Pi imager v1.8.5 as example to install OS, and other version may have some differences. （Device: Raspberry Pi 4B）

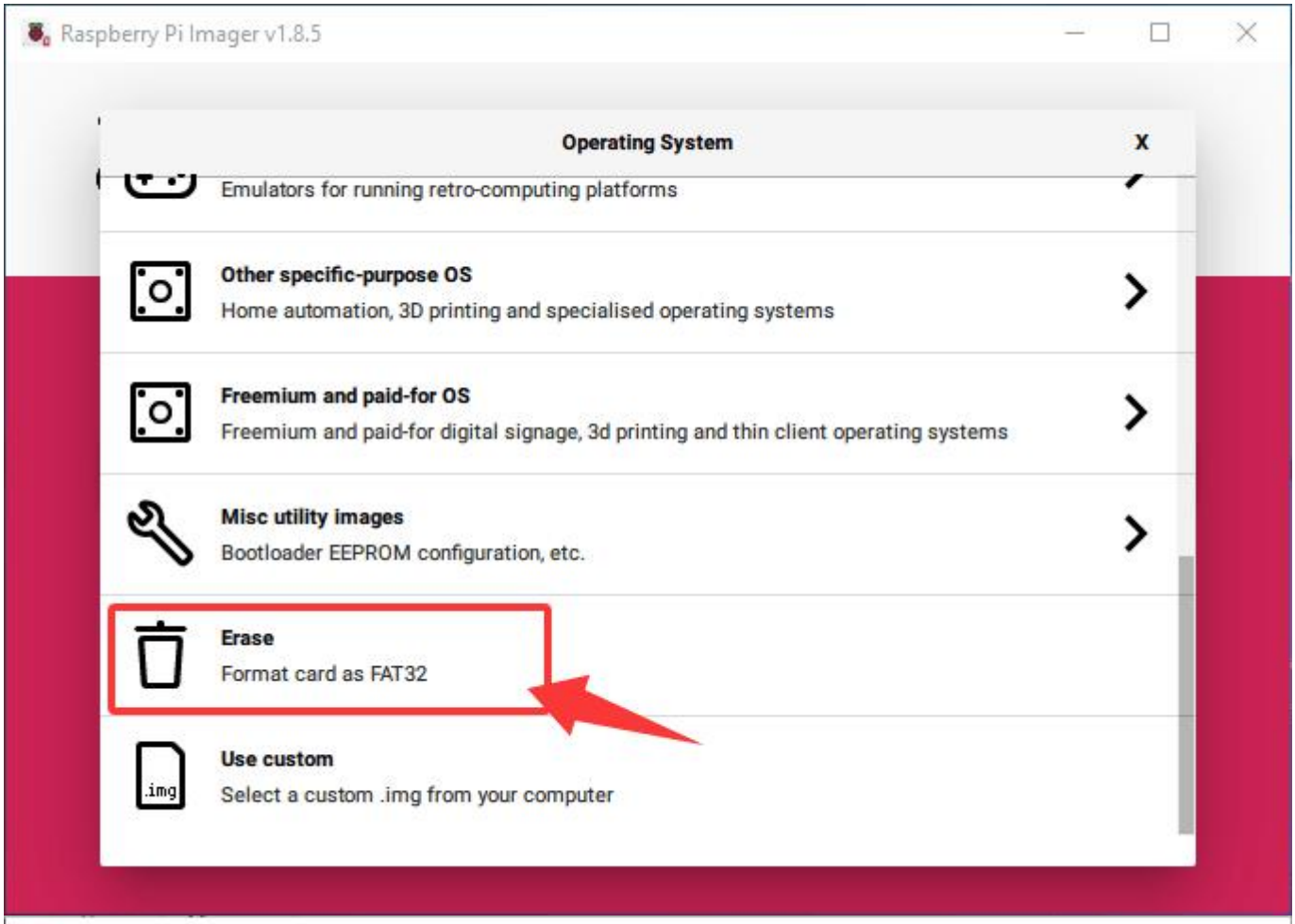
Step 1: Prepare a newly formatted micro SD memory card (TF card) with USB micro SD card reader, recommend sizes are 16G, 32G. (skip this step if your SD card has pre-installed Rasbian OS Image)

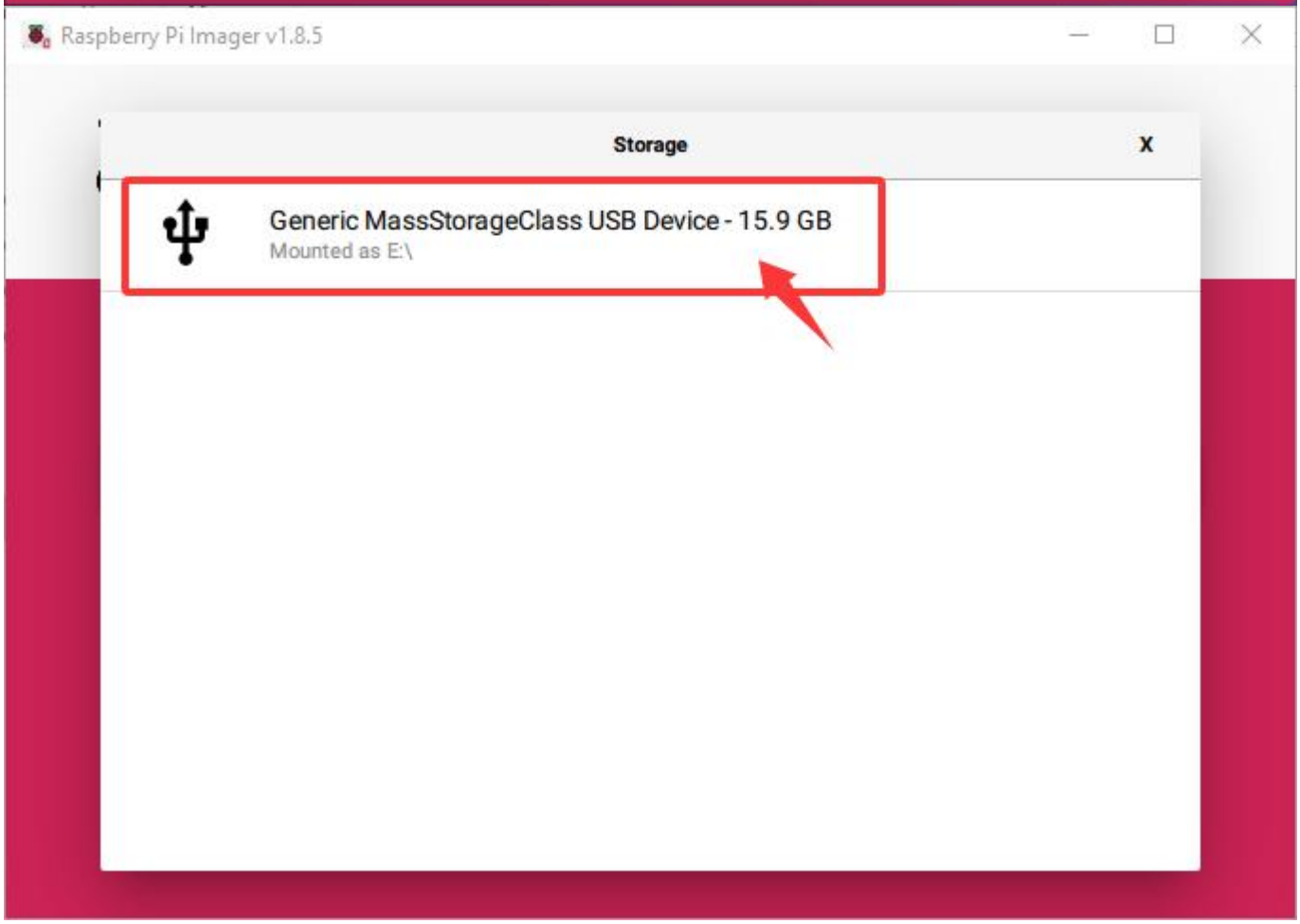
Step 2: Download the Raspberry Pi Imager from Raspberry Pi official website: https://www.raspberrypi.com/software/.

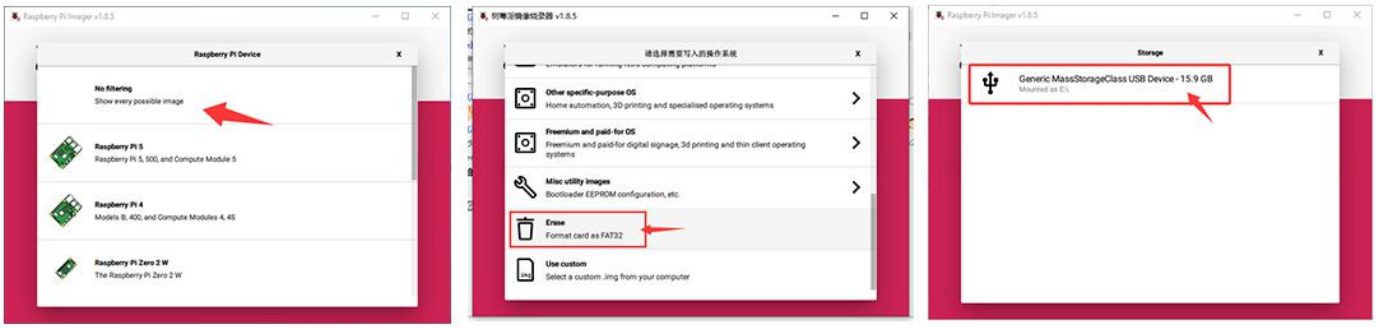


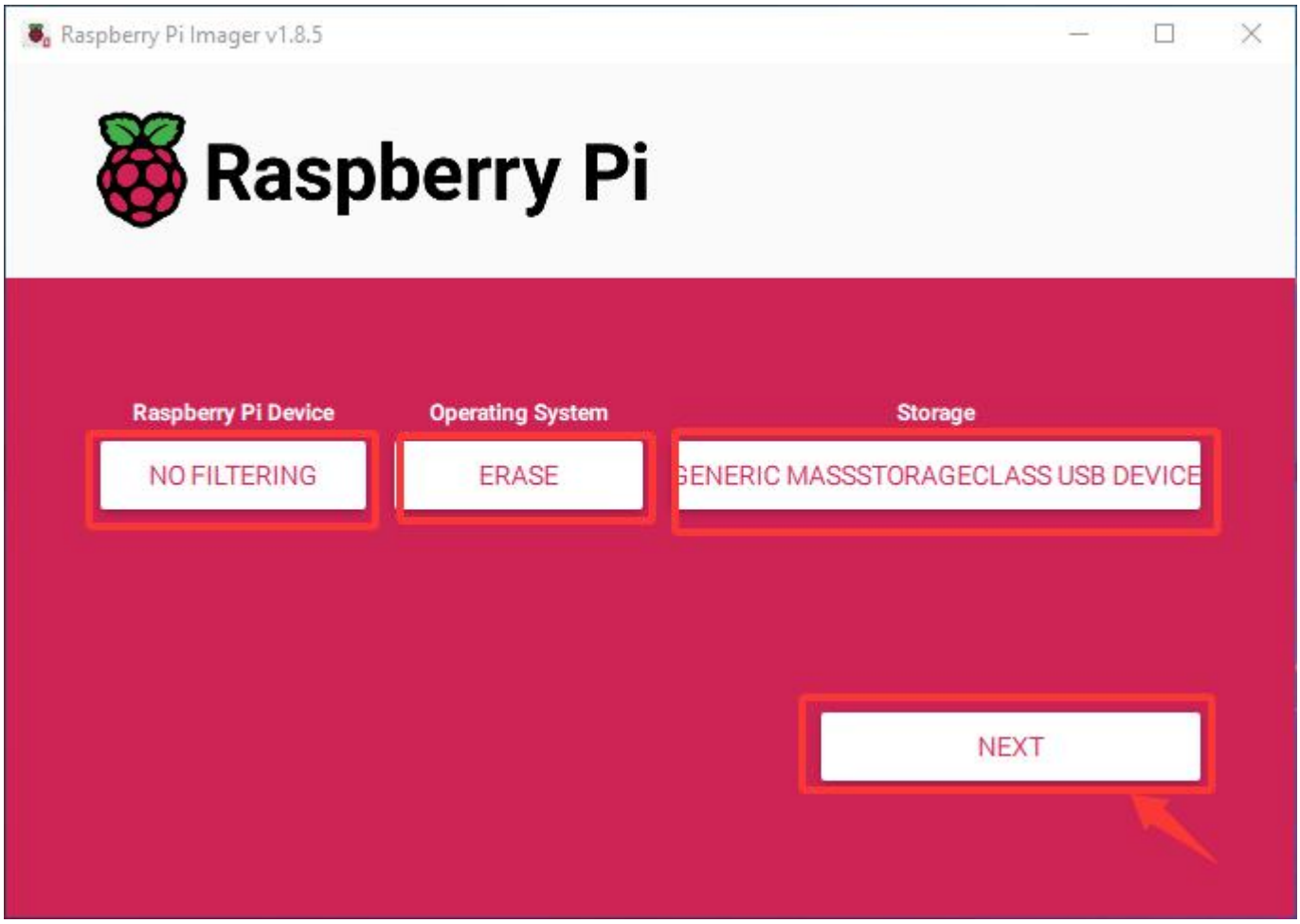
Step 3: Format your micro SD card: Run Raspberry Pi Imager and select “Erase” in Operating System field, and “your micro SD card” in Storage field.



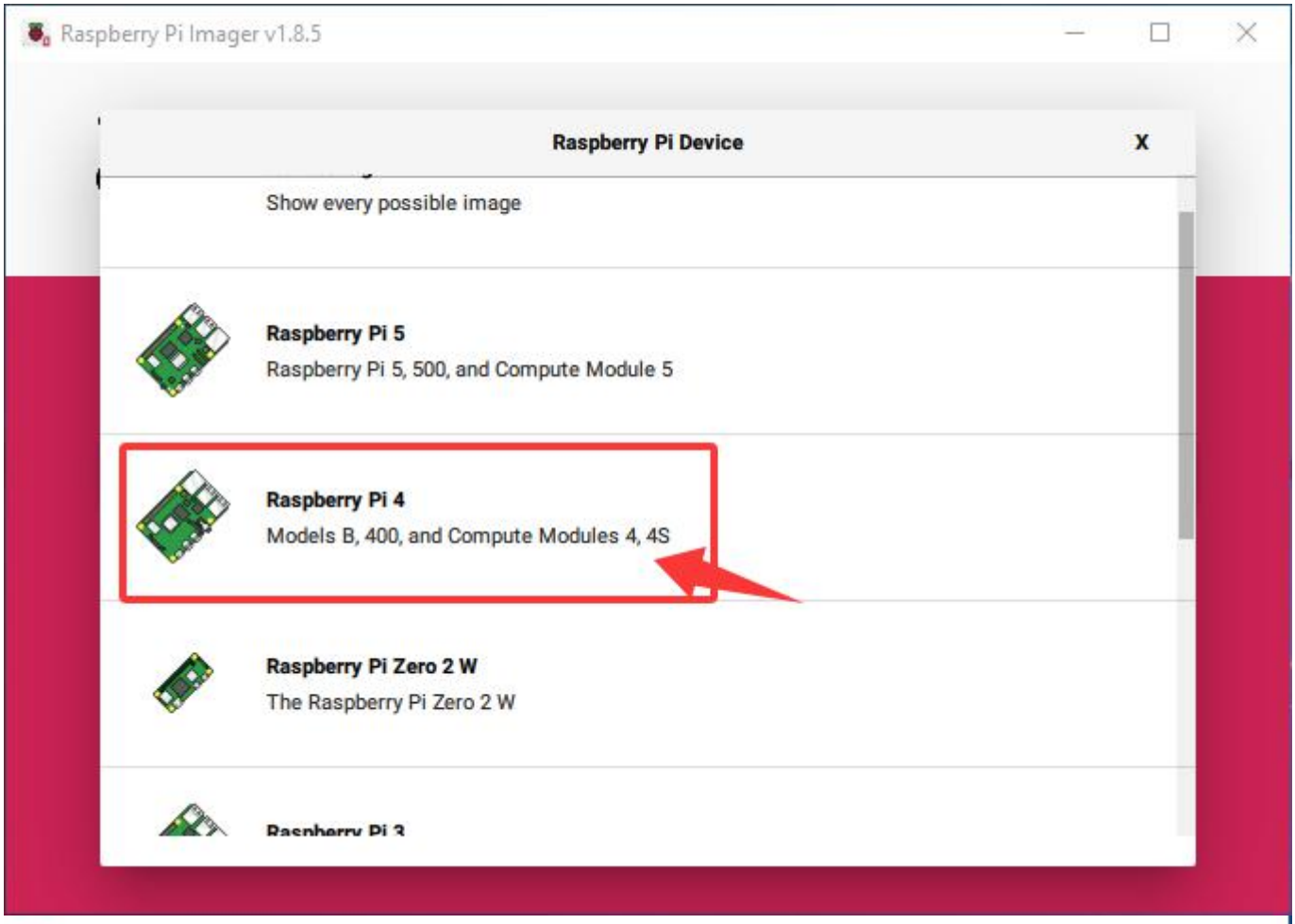

Raspberry Pi Imager v1.8.5
Operating System
Emulators for running retro-computing platforms
Other specific-purpose OS
Home automation, 3D printing and specialised operating systems
Freemium and paid-for OS
Freemium and paid-for digital signage, 3d printing and thin client operating systems
Misc utility images
Bootloader EEPROM configuration, etc.
Erase
Format card as FAT32
Use custom
Select a custom .img from your computer
.img

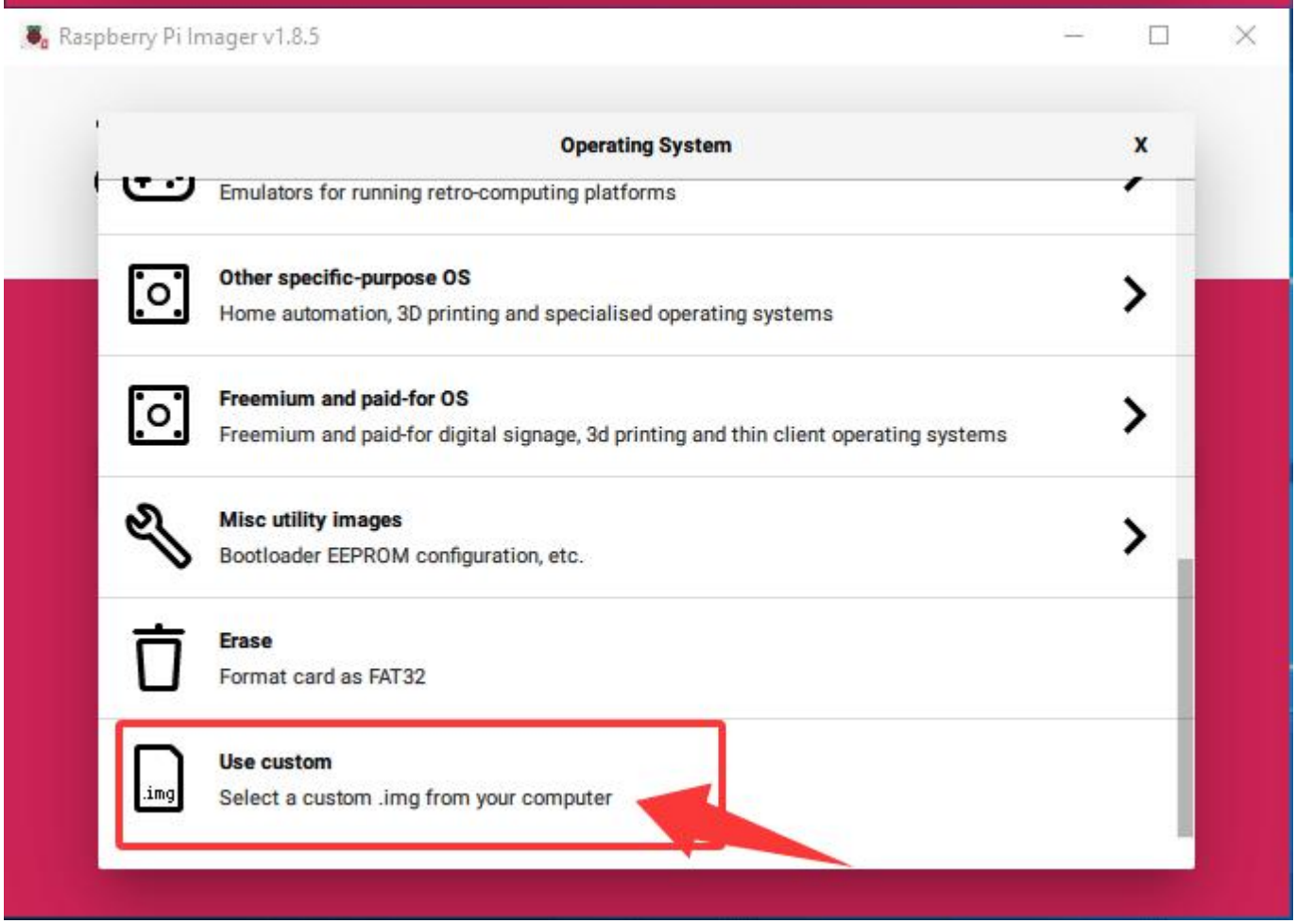

Raspberry Pi Imager v1.8.5
Storage
Generic MassStorageClass USB Device - 15.9 GB
Mounted as E:\

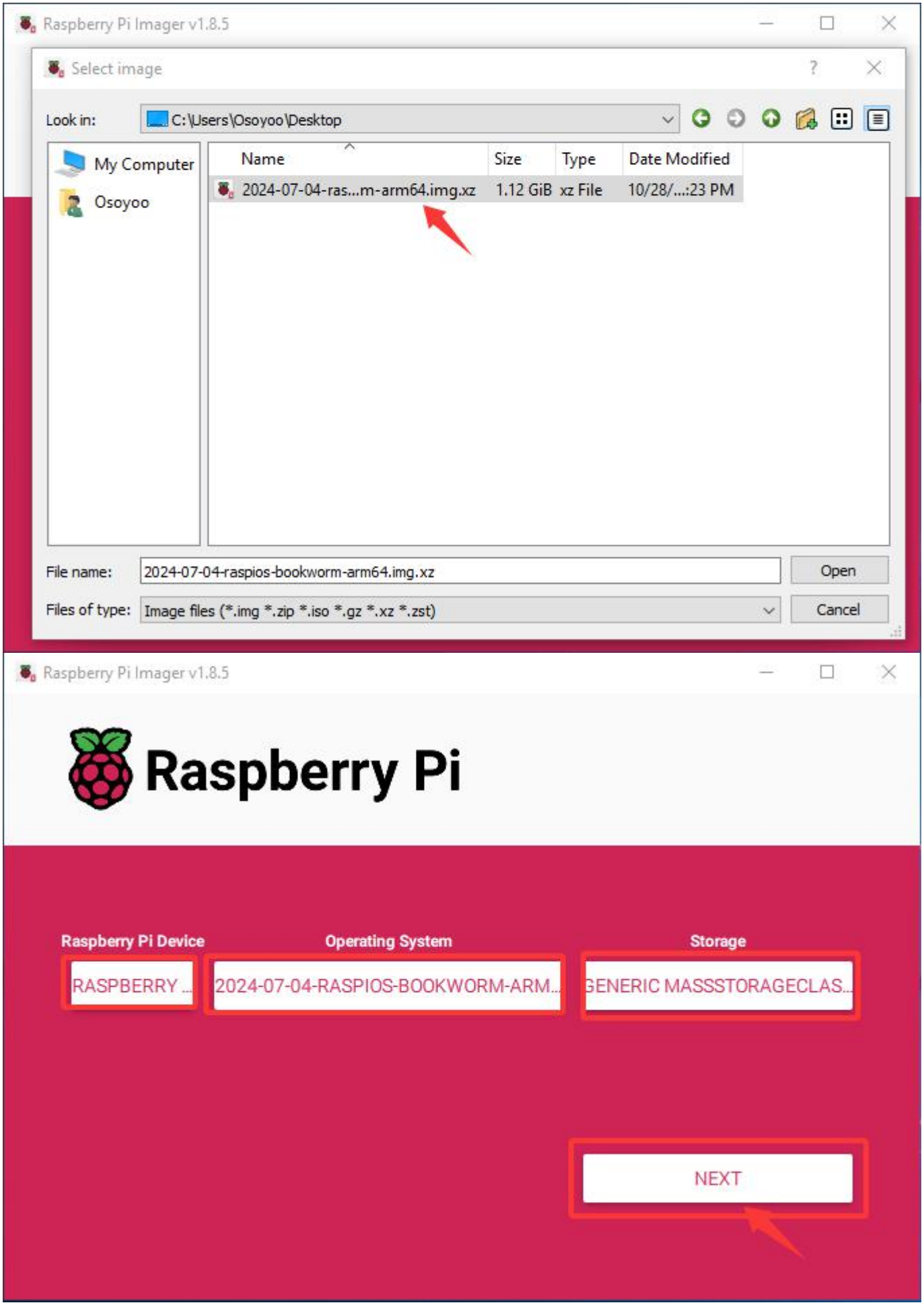




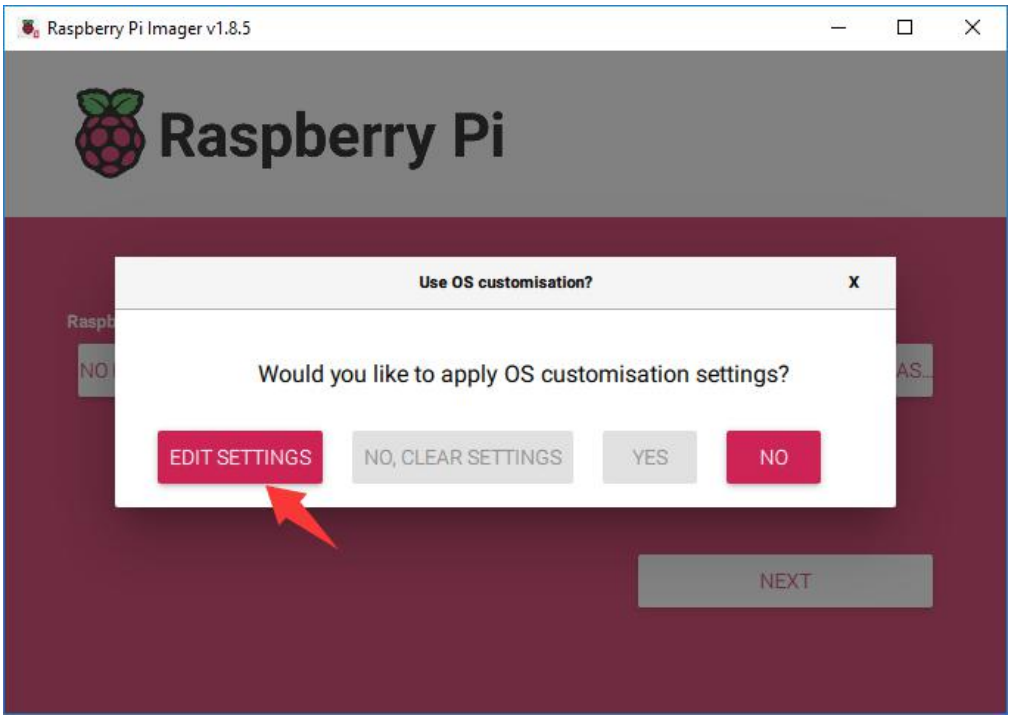
Step 4: Run Raspberry Pi Imager, select your Raspberry pi 4 in device, then select “Use custom” in Operating System field then browse “Raspberry Pi OS” you have downloaded, then select “your SD card” in Storage field. (If you have burnt Raspberry Pi OS in your SD card, please skip step 2 to step 5).

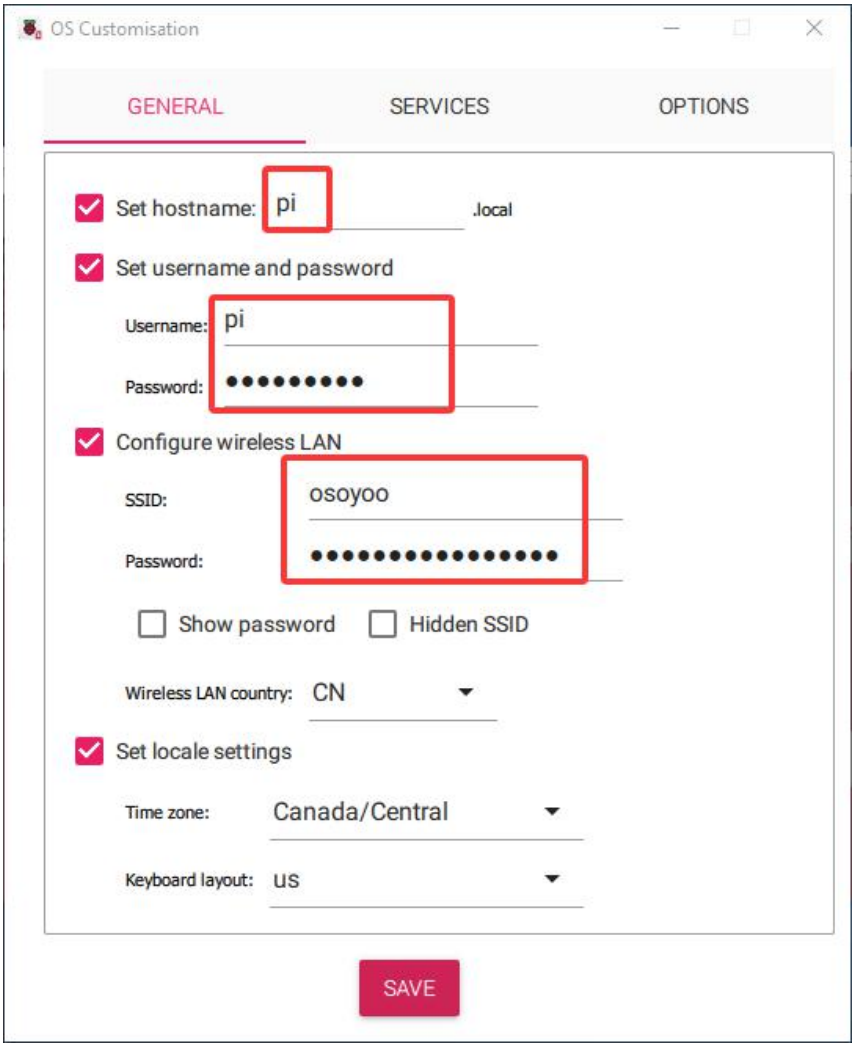

Raspberry Pi Imager v1.8.5
Raspberry Pi Device
X
Show every possible image
Raspberry Pi 5
Raspberry Pi 5, 500, and Compute Module 5
Raspberry Pi 4
Models B, 400, and Compute Modules 4, 4S
Raspberry Pi Zero 2 W
The Raspberry Pi Zero 2 W

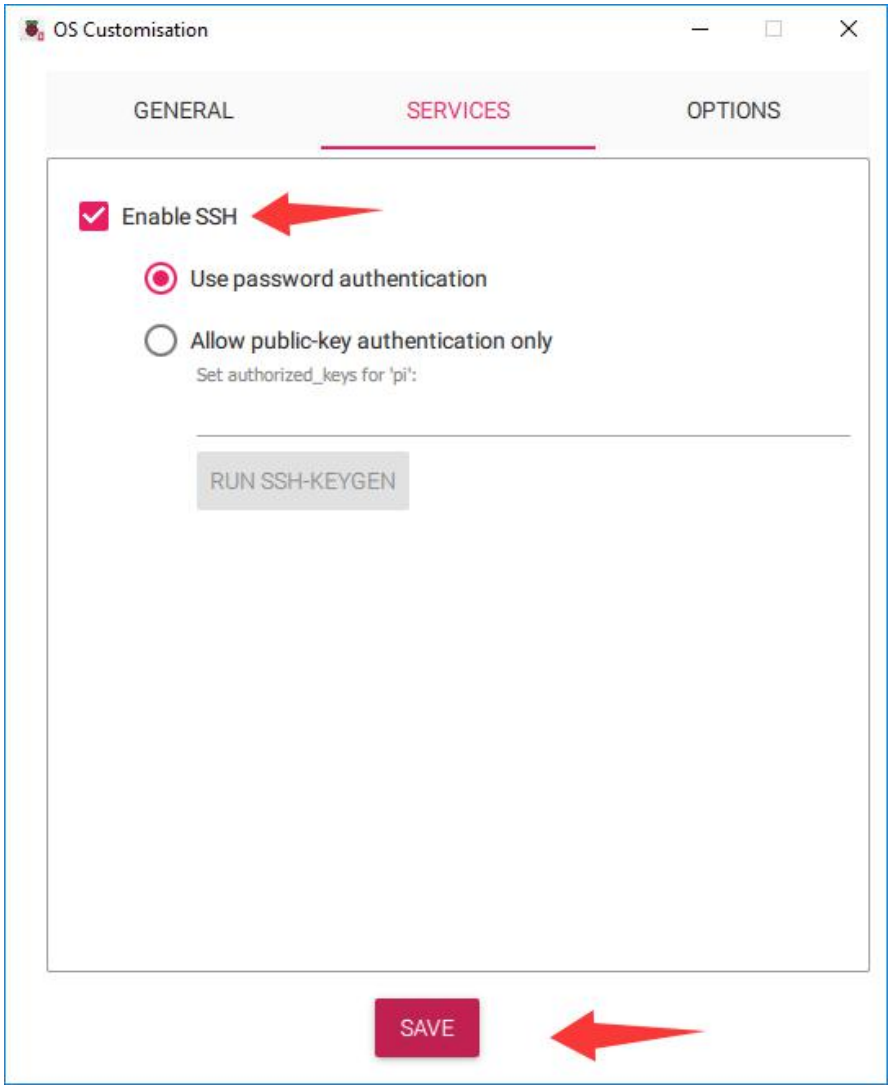

Raspberry Pi Imager v1.8.5
Operating System
X
Emulators for running retro-computing platforms
Other specific-purpose OS
Home automation, 3D printing and specialised operating systems
Freemium and paid-for OS
Freemium and paid-for digital signage, 3d printing and thin client operating systems
Misc utility images
Bootloader EEPROM configuration, etc.
Erase
Format card as FAT32
Use custom
Select a custom .img from your computer
.img

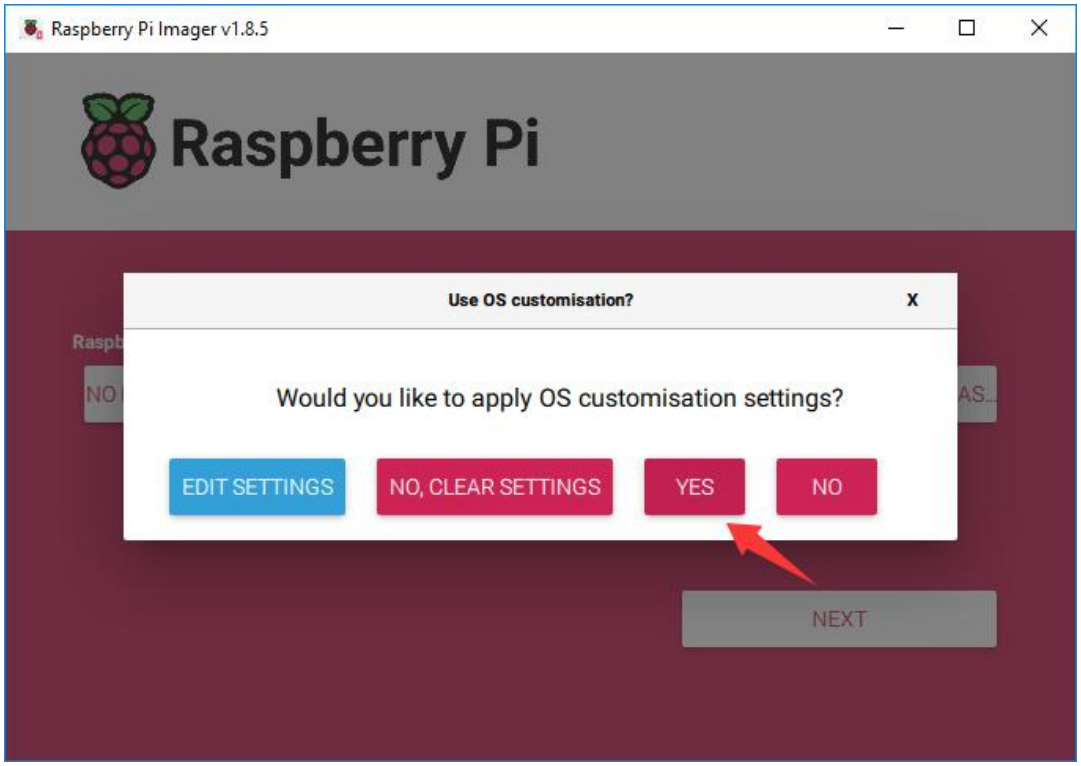

Raspberry Pi Imager v1.8.5
Select image
Look in:
C:\Users\Osoyoo\Desktop
My Computer
Osoyoo
Name
Size
Type
Date Modified
2024-07-04-ras...m-arm64.img.xz
1.12 GiB
xz File
10/28/...:23 PM
File name:
2024-07-04-raspios-bookworm-arm64.img.xz
Open
Files of type:
Image files (*.img *.zip *.iso *.gz *.xz *.zst)
Cancel
Raspberry Pi Imager v1.8.5
Raspberry Pi
Raspberry Pi Device
Operating System
Storage
RASPBERRY ...
2024-07-04-RASPIOS-BOOKWORM-ARM...
GENERIC MASSSTORAGECLAS...
NEXT

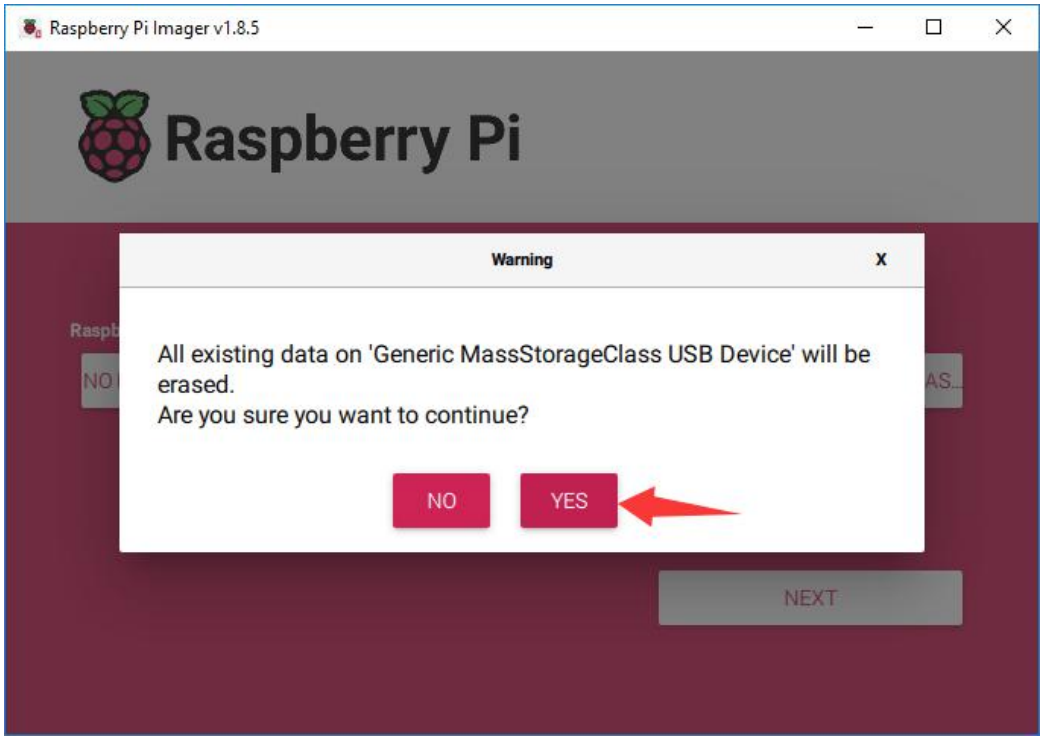
Step 5: Click ‘EDIT SETTINGS’ to configure the username and password (we use ‘pi’ as the username and ‘raspberry’ as the password in this example) and configure wireless LAN, then click SERVICES to enable SSH, finally click “SAVE”.

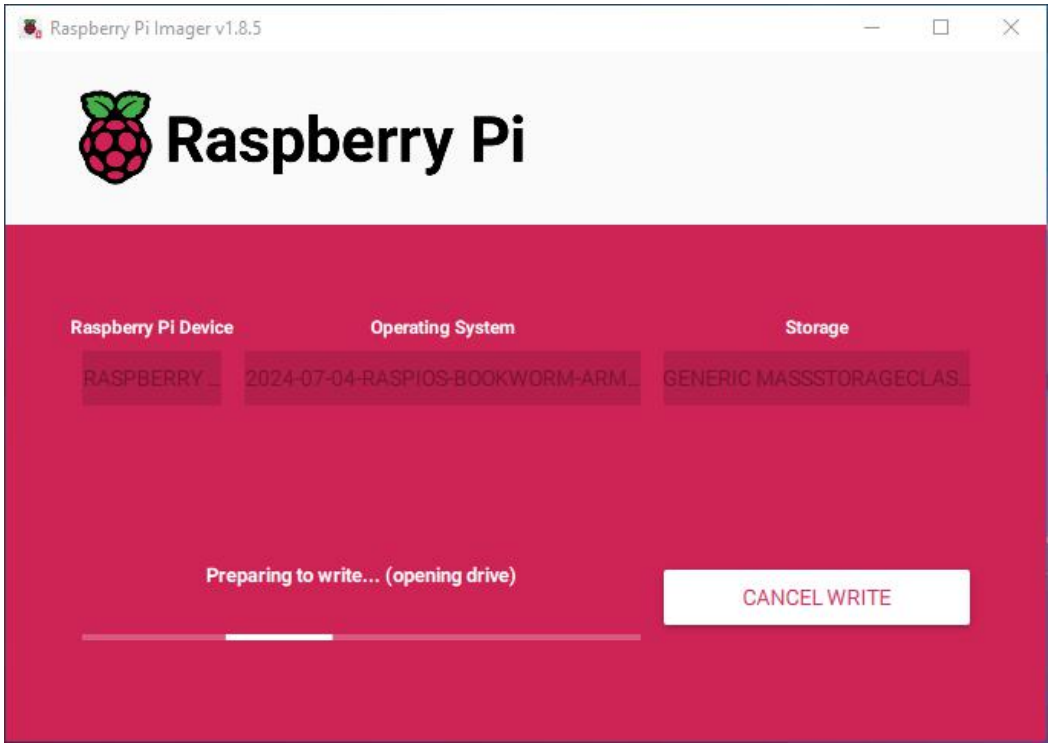





OS Customisation
GENERAL
SERVICES
OPTIONS
Enable SSH
Use password authentication
Allow public-key authentication only
Set authorized_keys for 'pi':
RUN SSH-KEYGEN
SAVE


Raspberry Pi Imager v1.8.5
Raspberry Pi
Use OS customisation?
X
Would you like to apply OS customisation settings?
EDIT SETTINGS
NO, CLEAR SETTINGS
YES
NO
NEXT

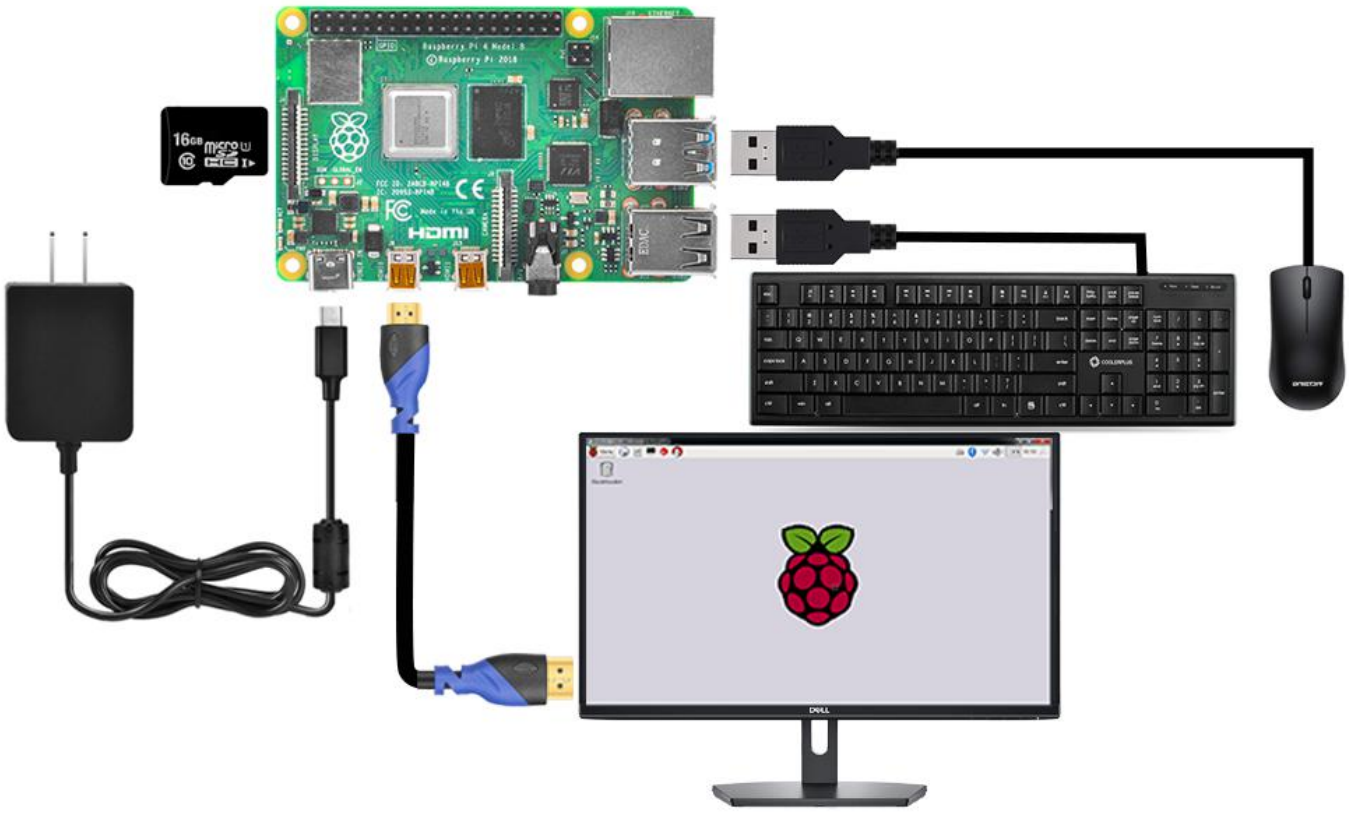




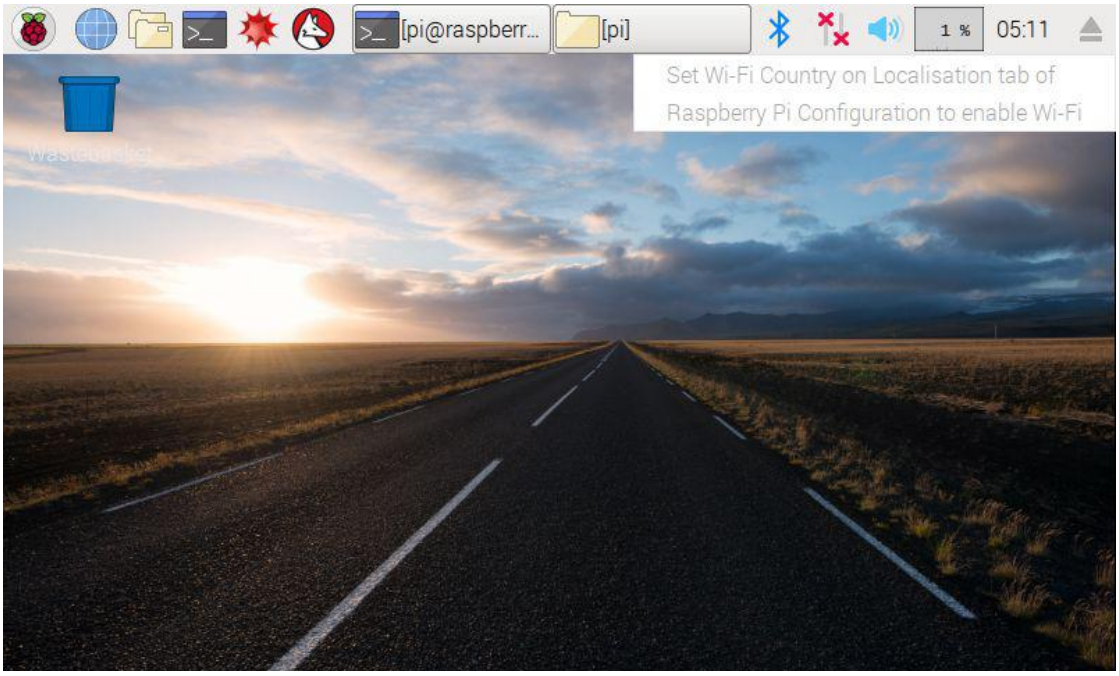
Control Raspberry Pi remotely

Step 1: Know the IP address

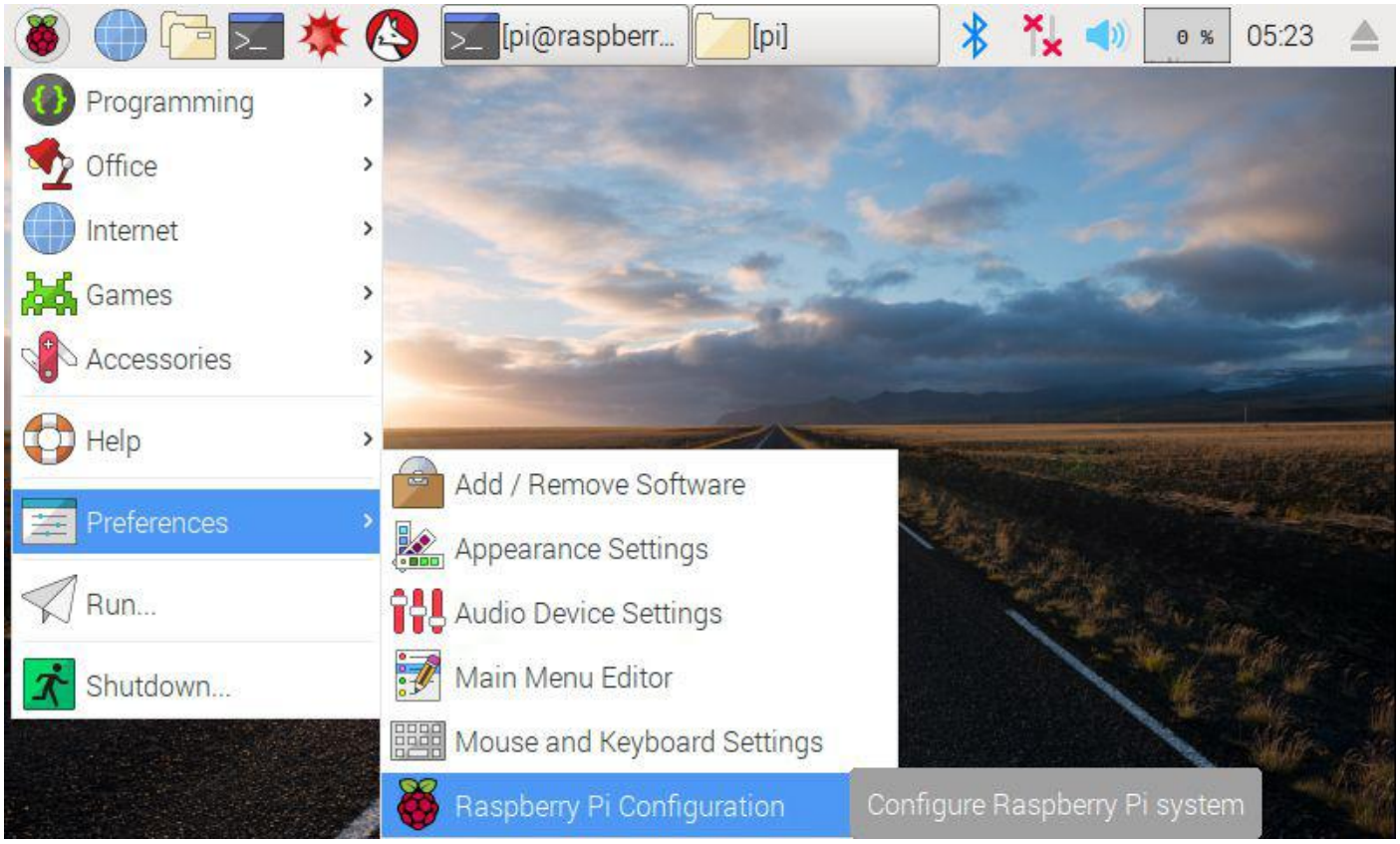
1. Connect Raspberry Pi to your HDMI monitor or TV. Put a keyboard and mouse into Raspberry Pi USB ports. Insert SD card which has installed OS into the slot on your Raspberry Pi (If you have already installed your Raspberry Pi robot car, please connect it to a screen to find out the IP address).

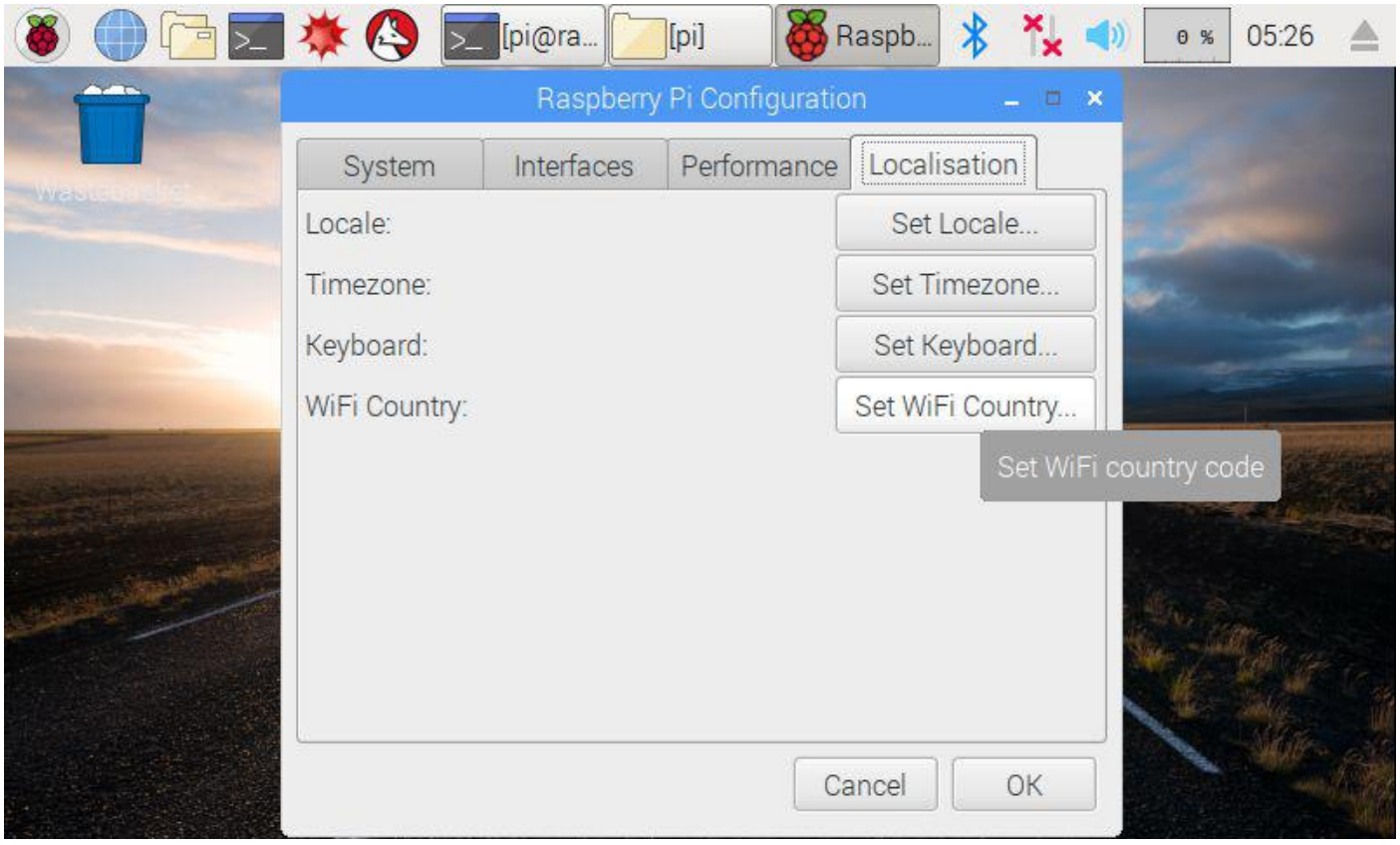


2. If you move over the Lan icon, and get the notice as following:



3. Please click configure the WIFI setting as following:



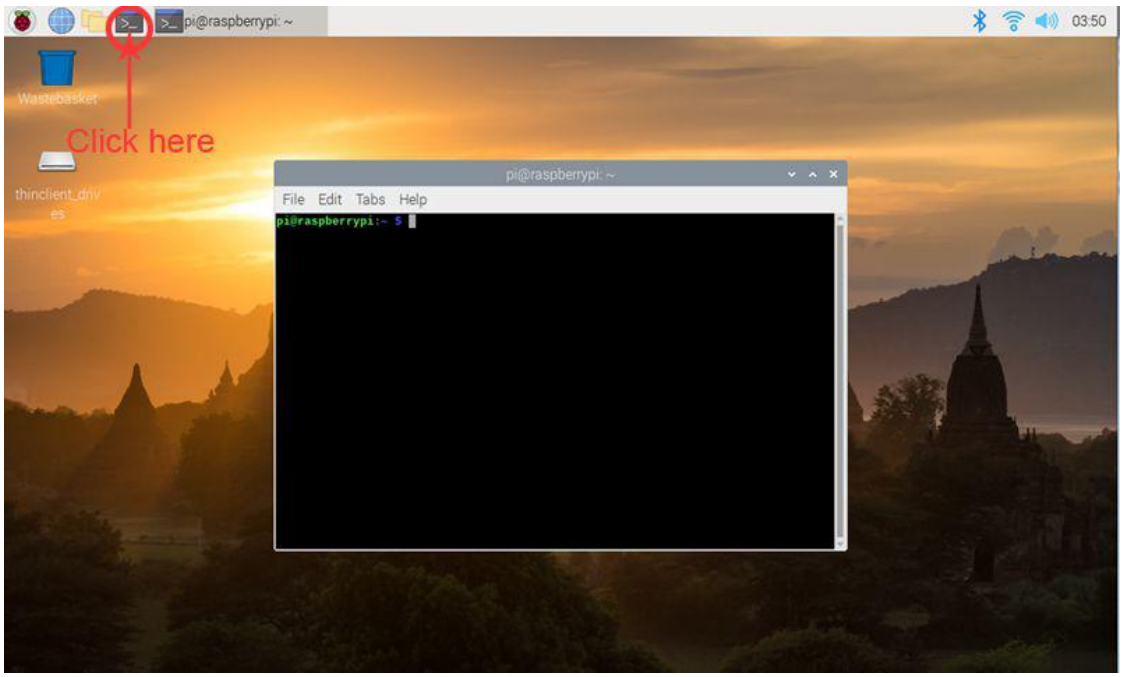


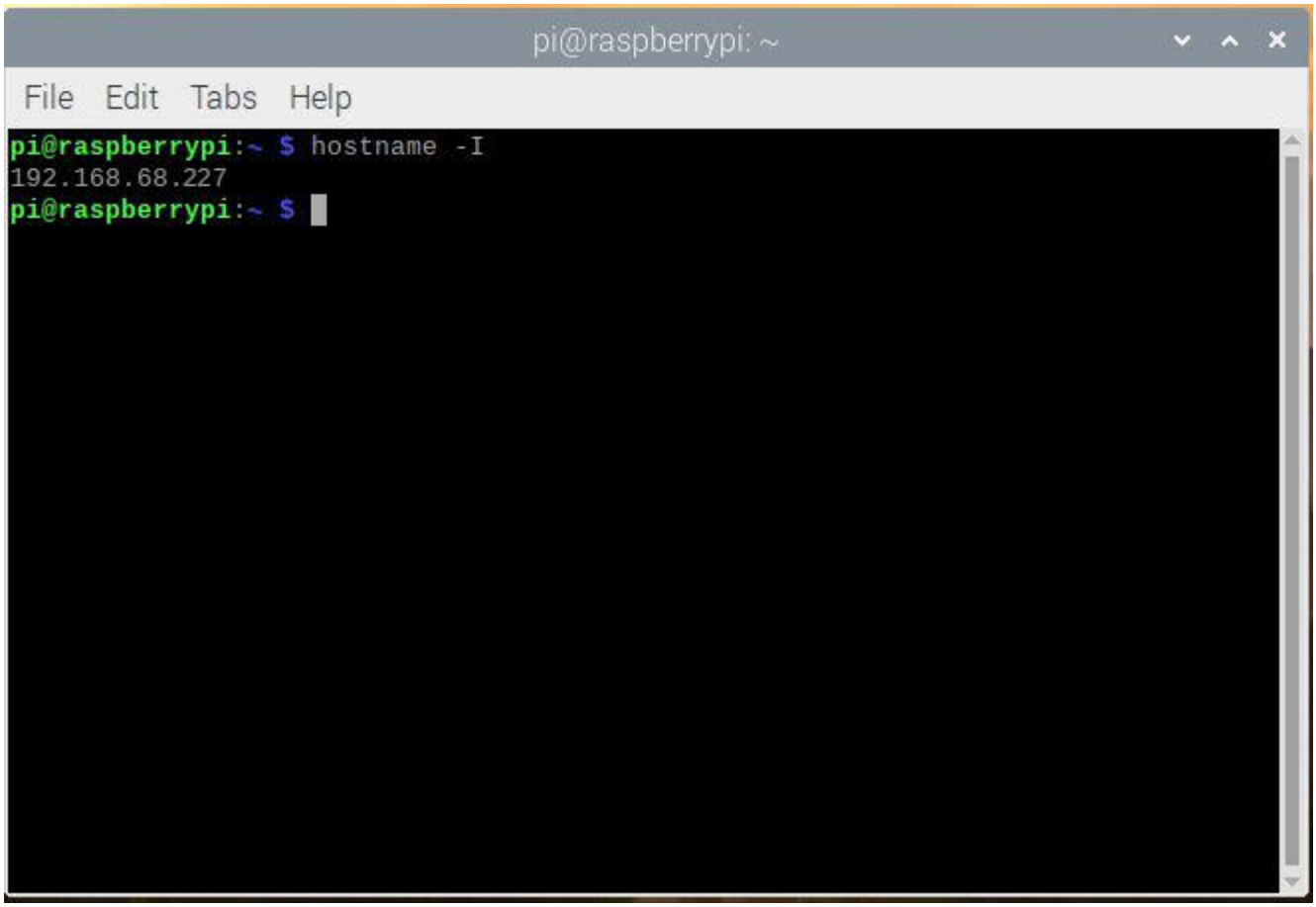
4. Find out the IP address of the RPi.

Method A: Connect your Pi to monitor and mouse, click LAN or WIFI icon to get the IP address as following photo.

Method B: Open the Terminal on the screen, enter the following command in terminal window to get your IP address :

hostname -I





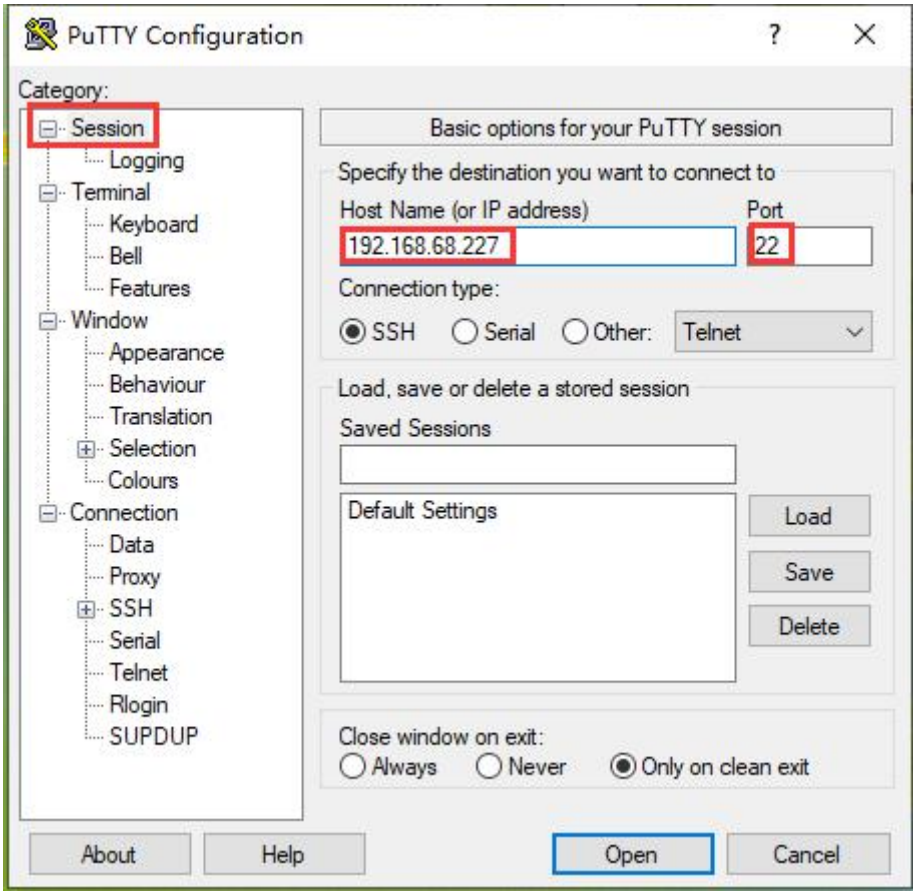
Step 2: Use an SSH client to control the Raspberry Pi remotely.

Note:
1) To learn more about how to use ssh tool to control Raspberry Pi remotely, Please visit the link: https://osoyoo.com/2017/06/20/raspberry-pi-3-basic-tutorial/#7
2) In our sample lessons, we use Windows PC as the remote console device and PuTTY as the ssh tool.

1. Please insert SD card which have installed OS into Raspberry Pi board (Before inserting the SD card, power off the Raspberry Pi first), and then power on robot car.

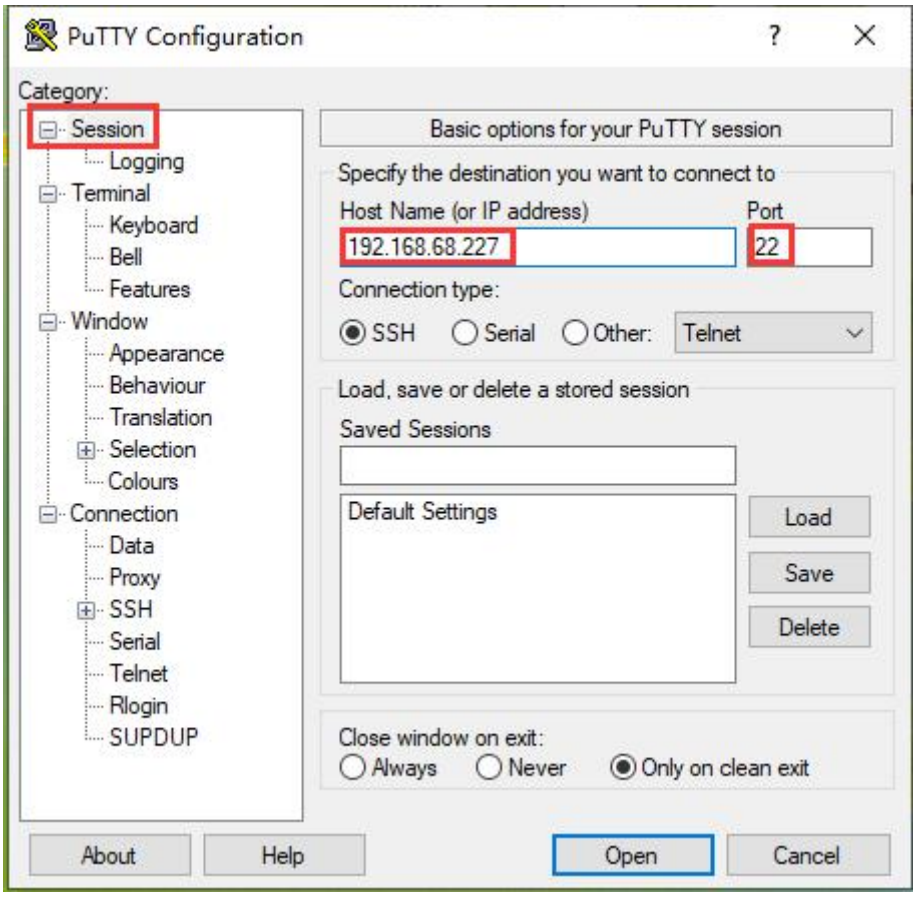
2. Download PuTTY from: https://www.chiark.greenend.org.uk/~sgtatham/putty/ and install this exe. in your Windows PC.

3. Open PuTTY and click Session on the left tree-alike structure (generally it's collapsed upon PuTTY startup),enter the IP address you got into the textbox under Host Name pi (or IP address 192.168.68.227) and 22 under Port (by default it is 22) ,then click open.



4. Note that when you first log in to the Raspberry Pi with the IP address, you'll be prompted with a security reminder. Just click Yes. When the PuTTY window prompts login as: type in the user name: pi, and password: raspberry (the default one, if you haven't changed it).

Note: when you're typing the password in, the window shows nothing just null, but you're in fact is typing things in. So just focus on typing it right and press Enter. After you log in the RPi successfully, the window will display as follows:



Use ssh tool to control Raspberry Pi remotely on other OS PC, Please visit the link:
https://osoyoo.com/2017/06/20/raspberry-pi-3-basic-tutorial/#7

**********Sample Project**********

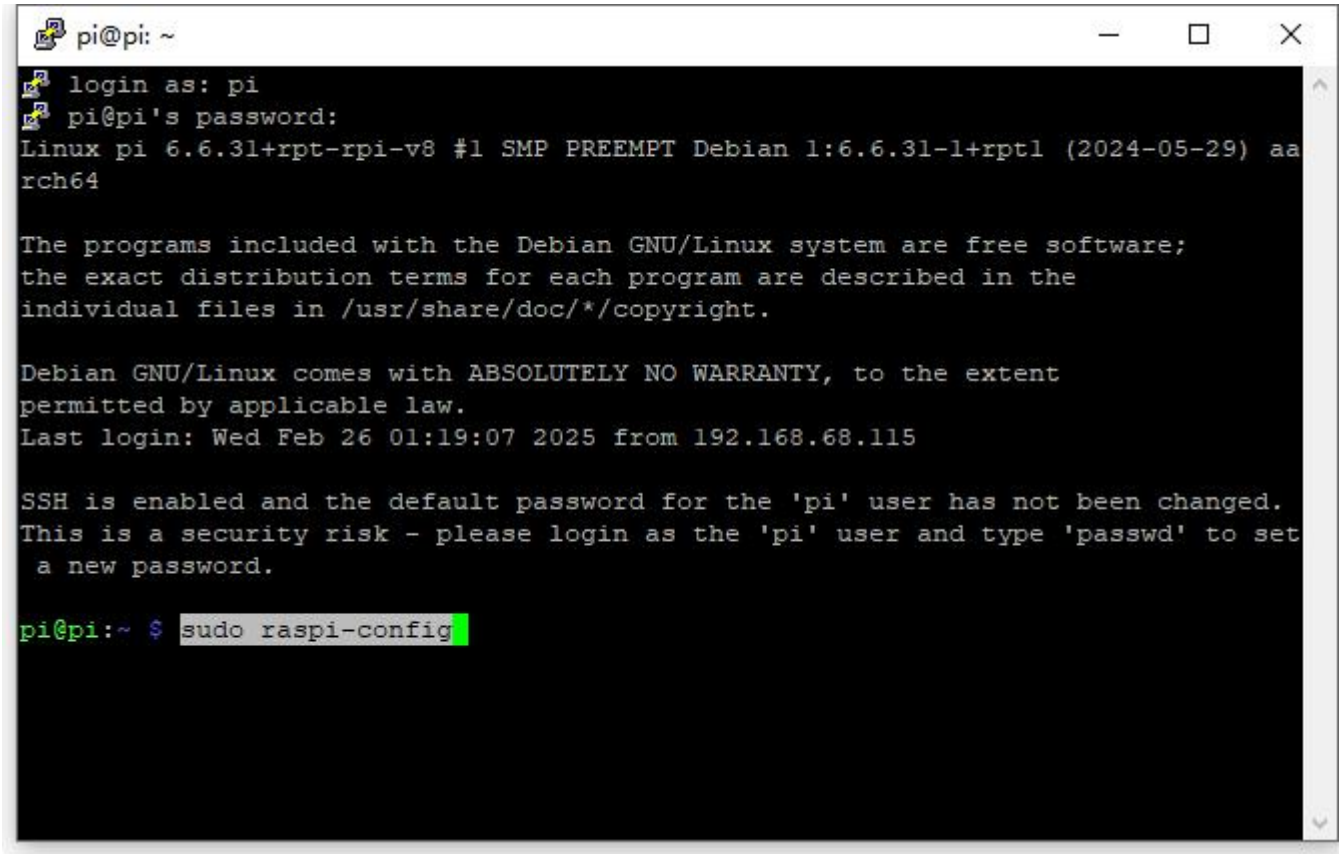
Step 0: Please insert the SD card which has installed OS into Raspberry pi board and turn on your robot car firstly.

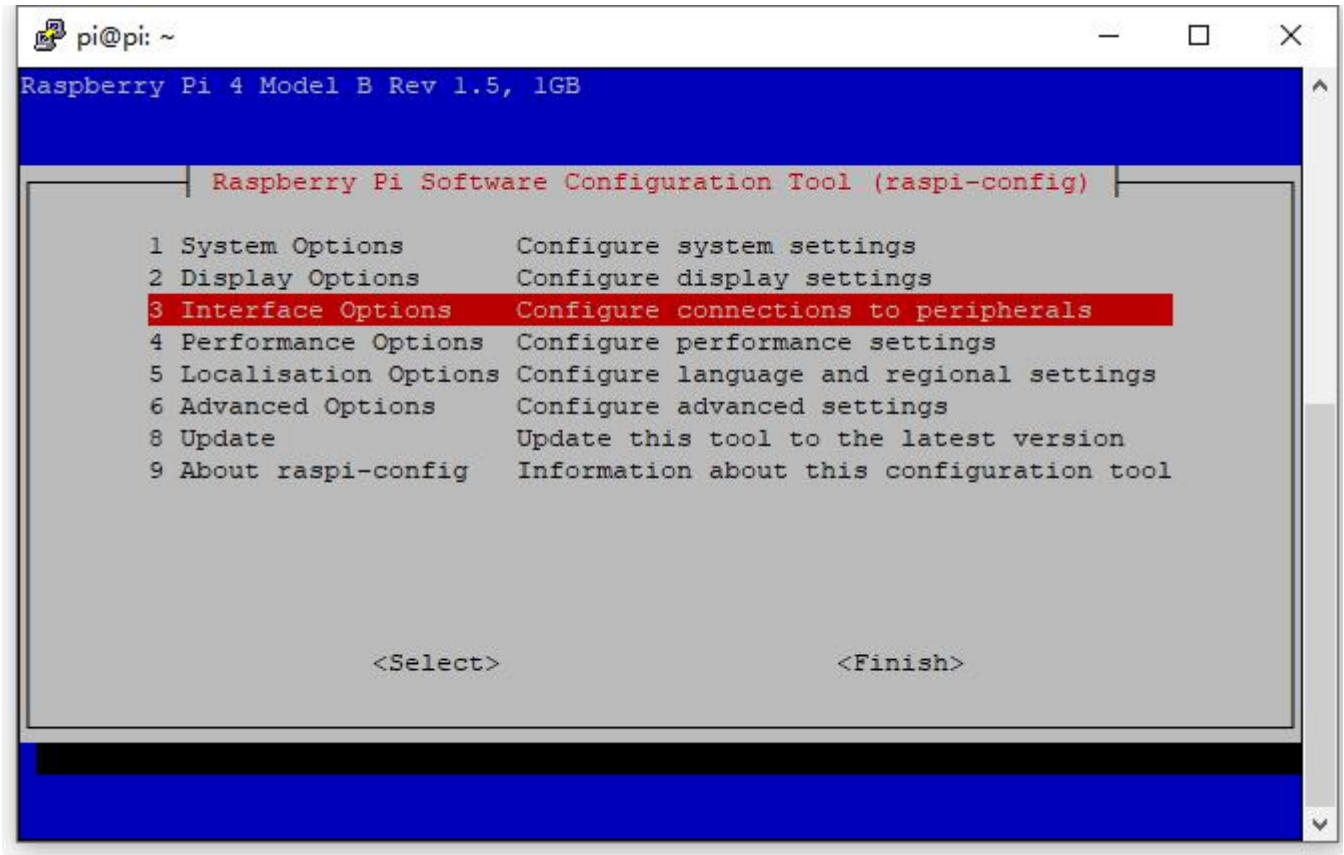
If you don't know how to install OS, please visit install OS with Raspberry Pi imager.
If you don't know how to control Raspberry Pi board remotely, please visit control Raspberry Pi remotely.
Step 1: Enable I2C

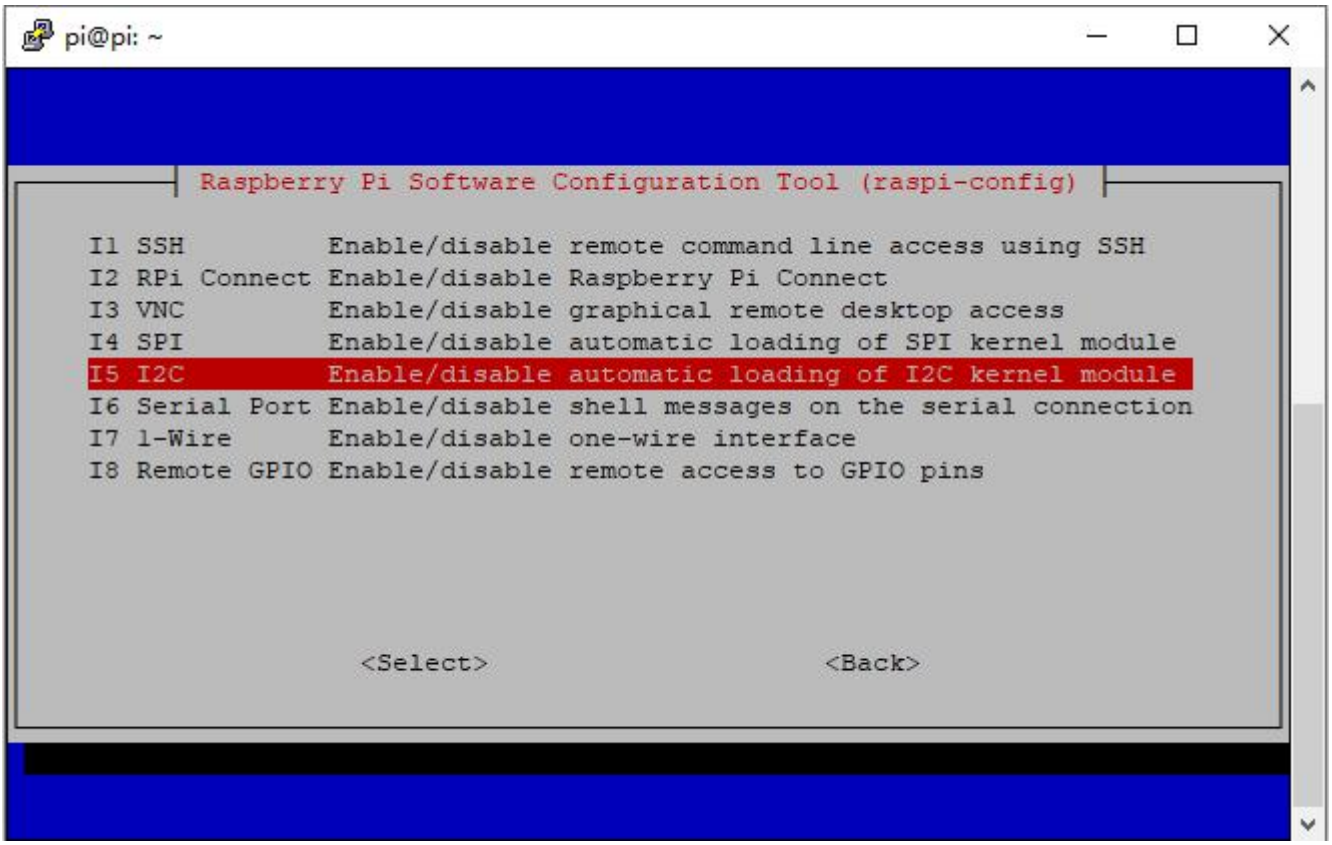
If you have not enable I2C, please run following command to enable I2C.

sudo raspi-config

Then select Interfacing Options->I2C->Yes->Ok->Finish


pi@pi: ~
login as: pi
pi@pi's password:
Linux pi 6.6.31+rpt-rpi-v8 #1 SMP PREEMPT Debian 1:6.6.31-1+rpt1 (2024-05-29) aarch64
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Wed Feb 26 01:19:07 2025 from 192.168.68.115
SSH is enabled and the default password for the 'pi' user has not been changed.
This is a security risk - please login as the 'pi' user and type 'passwd' to set a new password.
pi@pi:~ $ sudo raspi-config


pi@pi: ~
Raspberry Pi 4 Model B Rev 1.5, 1GB
Raspberry Pi Software Configuration Tool (raspi-config)
1 System Options Configure system settings
2 Display Options Configure display settings
3 Interface Options Configure connections to peripherals
4 Performance Options Configure performance settings
5 Localisation Options Configure language and regional settings
6 Advanced Options Configure advanced settings
8 Update Update this tool to the latest version
9 About raspi-config Information about this configuration tool
<Select>
<Finish>



Step 2: If you don’t have rpi.gpio and adafruit-pca9685 library, use the following command to install the library.

sudo apt-get update

sudo apt-get upgrade

```
pi@raspberrypi:~ $ sudo apt-get update
Get:1 http://archive.raspberrypi.org/debian buster InRelease [32.6 kB]
Get:2 http://archive.raspberrypi.org/debian buster/main armhf Packages [400 kB]
Get:3 http://raspbian.raspberrypi.org/raspbian buster InRelease [15.0 kB]
Get:4 http://raspbian.raspberrypi.org/raspbian buster/main armhf Packages [13.0
MB]
Get:5 http://raspbian.raspberrypi.org/raspbian buster/non-free armhf Packages [1
10 kB]
Fetched 13.6 MB in 21s (657 kB/s)
Reading package lists... Done
pi@raspberrypi:~ $ sudo apt-get upgrade
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
The following packages will be upgraded:
  curl firmware-atheros firmware-brcm80211 firmware-libertas
  firmware-misc-nonfree firmware-realtek ghostscript git git-man
  libcurl3-gnutls libcurl4 libde265-0 libgs9 libgs9-common libmariadb3
  libopenexr23 libpam-systemd libpcre2-16-0 libpcre2-8-0 libpcre2-posix0
  libsystemd0 libtiff5 libudev1 libudisks2-0 mariadb-common
  python-cryptography python-werkzeug python3-cryptography python3-werkzeug
  systemd systemd-sysv tzdata udev udisks2 wireless-regdb xserver-common
  xserver-xorg-core
37 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
Need to get 89.2 MB of archives.
After this operation, 100 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://archive.raspberrypi.org/debian buster/main armhf xserver-common all
 2:1.20.4-1+rpt4+deb10u9 [2,236 kB]
```

Step 3: Install pca9685 and servokit library :

1) If you are using Bulleye OS, please run following commands:

sudo pip install adafruit-circuitpython-pca9685

sudo pip install adafruit-circuitpython-servokit

```
pi@raspberrypi:~ $ sudo pip3 install adafruit-circuitpython-pca9685
Looking in indexes: https://pypi.org/simple, https://www.piwheels.org/simple
Collecting adafruit-circuitpython-pca9685
  Downloading https://files.pythonhosted.org/packages/7a/de/c6af4bba7b2a331fa8c5
6a47f7e6c47dd7dd0703d5e414f29a795fda7f9d/adafruit_circuitpython_pca9685-3.4.10-p
y3-none-any.whl
Collecting adafruit-circuitpython-busdevice (from adafruit-circuitpython-pca9685
)
  Downloading https://files.pythonhosted.org/packages/46/59/1a187155643f491b6bea
2e66d455c8f34751353042e5113a609009c6d257/adafruit_circuitpython_busdevice-5.2.6-
py3-none-any.whl
Collecting adafruit-circuitpython-register (from adafruit-circuitpython-pca9685)
  Downloading https://files.pythonhosted.org/packages/19/82/d2aa20911129f0c57ff5
a02ae64659d563e6dee27f9a4a2e3592ebe44fe3/adafruit_circuitpython_register-1.9.16-
py3-none-any.whl
Collecting Adafruit-Blinka (from adafruit-circuitpython-pca9685)
  Downloading https://files.pythonhosted.org/packages/f3/fd/0331cfff7649c58caac5
afb528b5757cd94edc35744f19430f32b1c1416a/Adafruit_Blinka-8.20.1-py3-none-any.whl
 (303kB)
    3% |                                | 10kB 14kB/s eta 0:00:20
```

```
pi@raspberrypi:~ $ sudo pip3 install adafruit-circuitpython-servokit
Looking in indexes: https://pypi.org/simple, https://www.piwheels.org/simple
Collecting adafruit-circuitpython-servokit
  Downloading https://files.pythonhosted.org/packages/14/34/1a22ee0ea37bcce532d8
372e2303cbbdfa1be01678212a8379ec23ace029/adafruit_circuitpython_servokit-1.3.15-
py3-none-any.whl
Collecting adafruit-circuitpython-busdevice (from adafruit-circuitpython-servoki
t)
  Using cached https://files.pythonhosted.org/packages/46/59/1a187155643f491b6be
a2e66d455c8f34751353042e5113a609009c6d257/adafruit_circuitpython_busdevice-5.2.6
-py3-none-any.whl
Collecting adafruit-circuitpython-register (from adafruit-circuitpython-servokit
)
```

2) If you are using Bookworm system in Raspberry Pi 5, please run following commands:

sudo pip install --break-system-packages adafruit-circuitpython-pca9685
sudo pip install --break-system-packages adafruit-circuitpython-servokit

```
pi@raspberrypi:~ $ sudo pip install  --break-system-packages adafruit-
hon-pca9685
Looking in indexes: https://pypi.org/simple, https://www.piwheels.org/
Collecting adafruit-circuitpython-pca9685
  Downloading https://www.piwheels.org/simple/adafruit-circuitpython-p
fruit_circuitpython_pca9685-3.4.16-py3-none-any.whl (6.0 kB)
Collecting Adafruit-Blinka
  Downloading https://www.piwheels.org/simple/adafruit-blinka/Adafruit
50.0-py3-none-any.whl (364 kB)
     ---------------------------------------- 364.7/364.7 kB 572.2 kB/s e
Collecting adafruit-circuitpython-register
  Downloading https://www.piwheels.org/simple/adafruit-circuitpython-r
afruit_circuitpython_register-1.10.1-py3-none-any.whl (14 kB)
Collecting adafruit-circuitpython-busdevice
  Downloading https://www.piwheels.org/simple/adafruit-circuitpython-b
dafruit_circuitpython_busdevice-5.2.10-py3-none-any.whl (7.5 kB)
Collecting Adafruit-PlatformDetect>=3.70.1
  Downloading https://www.piwheels.org/simple/adafruit-platformdetect/
latformDetect-3.75.0-py3-none-any.whl (25 kB)
Collecting Adafruit-PureIO>=1.1.7
  Downloading https://www.piwheels.org/simple/adafruit-pureio/Adafruit
1.11-py3-none-any.whl (10 kB)
```

```
pi@raspberrypi:~ $ sudo pip install  --break-system-packages adafruit-
hon-servokit
Looking in indexes: https://pypi.org/simple, https://www.piwheels.org/
Collecting adafruit-circuitpython-servokit
  Downloading https://www.piwheels.org/simple/adafruit-circuitpython-s
afruit_circuitpython_servokit-1.3.18-py3-none-any.whl (5.7 kB)
Requirement already satisfied: Adafruit-Blinka>=7.0.0 in /usr/local/li
11/dist-packages (from adafruit-circuitpython-servokit) (8.50.0)
Requirement already satisfied: adafruit-circuitpython-busdevice in /us
b/python3.11/dist-packages (from adafruit-circuitpython-servokit) (5.2
Requirement already satisfied: adafruit-circuitpython-pca9685 in /usr/
python3.11/dist-packages (from adafruit-circuitpython-servokit) (3.4.1
Collecting adafruit-circuitpython-motor
  Downloading https://www.piwheels.org/simple/adafruit-circuitpython-m
uit_circuitpython_motor-3.4.14-py3-none-any.whl (10 kB)
Requirement already satisfied: adafruit-circuitpython-register in /usr
/python3.11/dist-packages (from adafruit-circuitpython-servokit) (1.10
Requirement already satisfied: Adafruit-PlatformDetect>=3.70.1 in /usr
/python3.11/dist-packages (from Adafruit-Blinka>=7.0.0->adafruit-circu
ervokit) (3.75.0)
Requirement already satisfied: Adafruit-PureIO>=1.1.7 in /usr/local/li
11/dist-packages (from Adafruit-Blinka>=7.0.0->adafruit-circuitpython-
(1.1.11)
Requirement already satisfied: binho-host-adapter>=0.1.6 in /usr/local
n3.11/dist-packages (from Adafruit-Blinka>=7.0.0->adafruit-circuitpyth
```

Step 4: Type following command to download the sample code.

wget https://osoyoo.com/driver/mecanum/mecanum5.py

```
pi@pi:~ $ wget https://osoyoo.com/driver/mecanum/mecanum.py
--2025-03-03 22:01:30--  https://osoyoo.com/driver/mecanum/mecanum.py
Resolving osoyoo.com (osoyoo.com)... 104.21.42.94, 172.67.160.120, 2606:4700:3036::ac43:a078, ...
Connecting to osoyoo.com (osoyoo.com)|104.21.42.94|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 5449 (5.3K) [text/x-python]
Saving to: 'mecanum.py'

mecanum.py                          100%[=============================================================================>]

2025-03-03 22:01:32 (18.8 MB/s) - 'mecanum.py' saved [5449/5449]
```

Step 5: Put the robot car on the ground and run following command:

python mecanum5.py

After the above python is running, your motors will move forward for 0.75 seconds and then move backward for 0.75 seconds, turn left for 0.75 seconds and turn right for 0.75 seconds then shift to right , then shift to left , then do some omni direction move and stop.

By the end of this lesson, your Raspberry Pi will be fully configured, and you will be able to remotely control the robot car and execute movement commands (python mecanum.py).

The car will move in the following sequence: forward → backward → right parallel shift → left parallel shift → diagonal left-forward→back to original point→diagonal right-forward→back to original point →left turn → right turn → , and finally stop.

Troubleshooting

If, after running the Lesson 1 code, you notice that one side wheels are not turning, or one side wheels can only move forward but not backward, or only backward but not forward, the issue is likely a loose or broken wire in the 6-pin cable connecting to the Model X board.
Here is the solution:
Step 1: Disconnect the 6-pin cable that connects the Model Y board and the Arduino board.
Step 2: Locate six (6) single spare Female-to-Male jumper wires from your kit (any color is fine).
Step 3: Use these six single jumper wires to manually reconnect the Model Y pins (ENA, IN1, IN2, IN3, IN4, ENB) to the corresponding pins on the Arduino as per previous model Y wire map
Step 4: Retest the Lesson 1 code to see if the issue is resolved. If the problem still exists, you can send your problem detail to support@osoyoo.info and our tech support team will help you.

Lesson 2 Tracking Line Robot Car

INTRODUCTION

In this lesson, we will do a line-tracking auto-driving project. We will add a 5-Point tracking sensor module to the robotic car built in Lesson 1. The software in this lesson will read data from the 5-Point Tracking sensor module and automatically guide the smart car to move along the black track line in the white ground.

Lesson 1 must be completed before doing this line-tracking project.

PARTS & DEVICES

OSOYOO Mecanum wheels robotic car chassis x1

OSOYOO Wheels and motors x4 (left-wheels x2/right-wheels x2)

Raspberry pi 4/5 board (Not included in this kit)

OSOYOO PWM HAT shield x1

OSOYOO Model Y driver board x1

OSOYOO Voltage meter x1

OSOYOO 5-point tracking sensor module x1

OSOYOO Battery box x1

OSOYOO 3pin female to female jumper wire x1

OSOYOO 6pin female to female jumper wire x2

OSOYOO 7pin female to female jumper wire x1

OSOYOO 2 pin XH.25 female to female x1

18650 Batteries(3.7V) x2

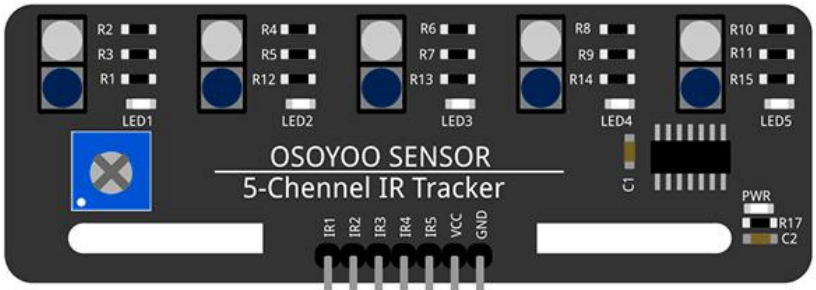
Battery charger

x1

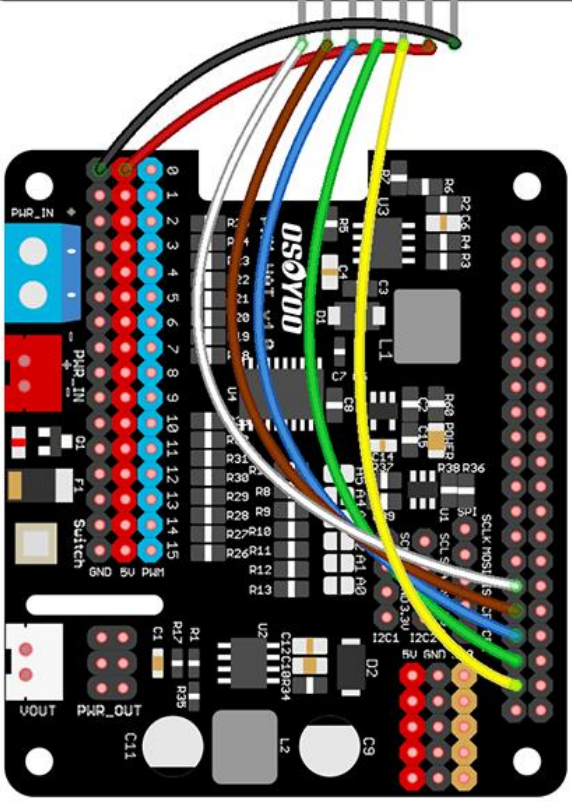
HARDWARE INSTALLATION

Step1. Keep all Lesson 1 connections intact. (Warning: Do not remove any pre-installed wires from Lesson1).

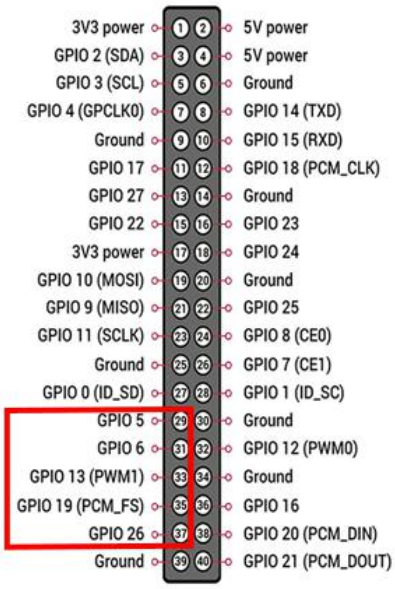
Step2. Connect the GND and VCC pins of the tracking sensor module to the GND and 5V pins on the OSOYOO PWM HAT shield respectively. Then link the IR1-IR5 pins to GPIO5, GPIO6, GPIO13, GPIO16, and A1 using a 7-pin 25cm F/F cable, as shown in the photo below.

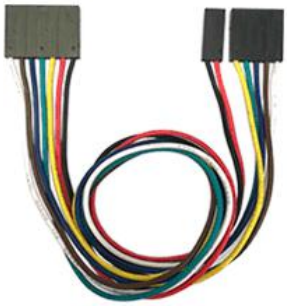


5-Point Tracking Sensor	PWM HAT V1.0
GND	GND
VCC	VCC
IR1	GPIO 5
IR2	GPIO 6
IR3	GPIO 13
IR4	GPIO 19
IR5	GPIO 26



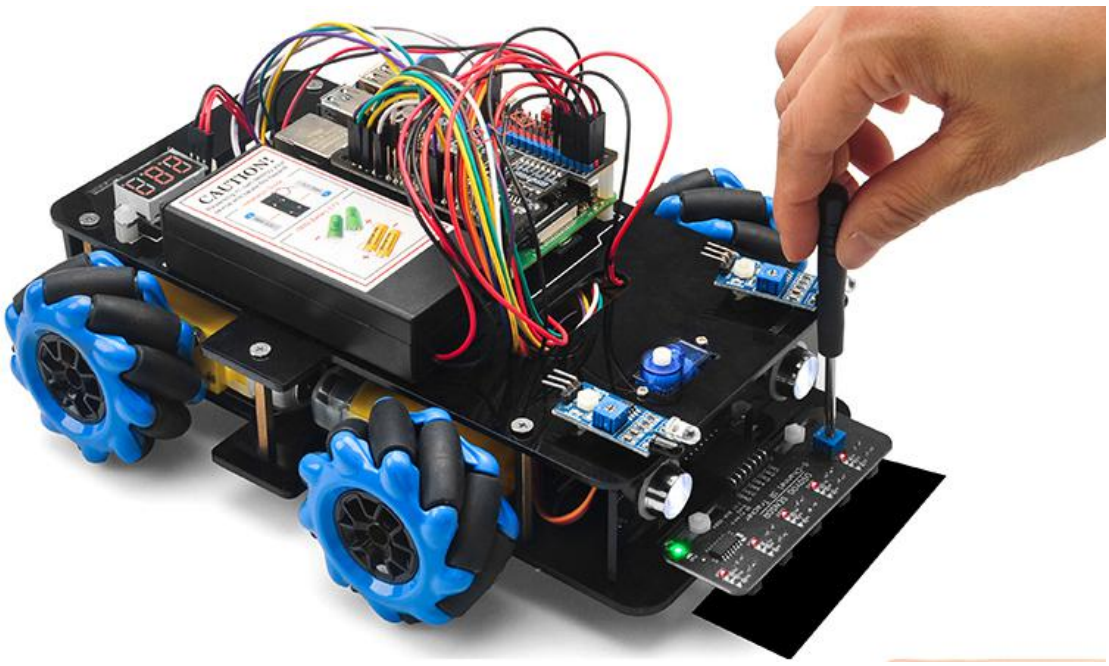
7Pin female to female jumper wire

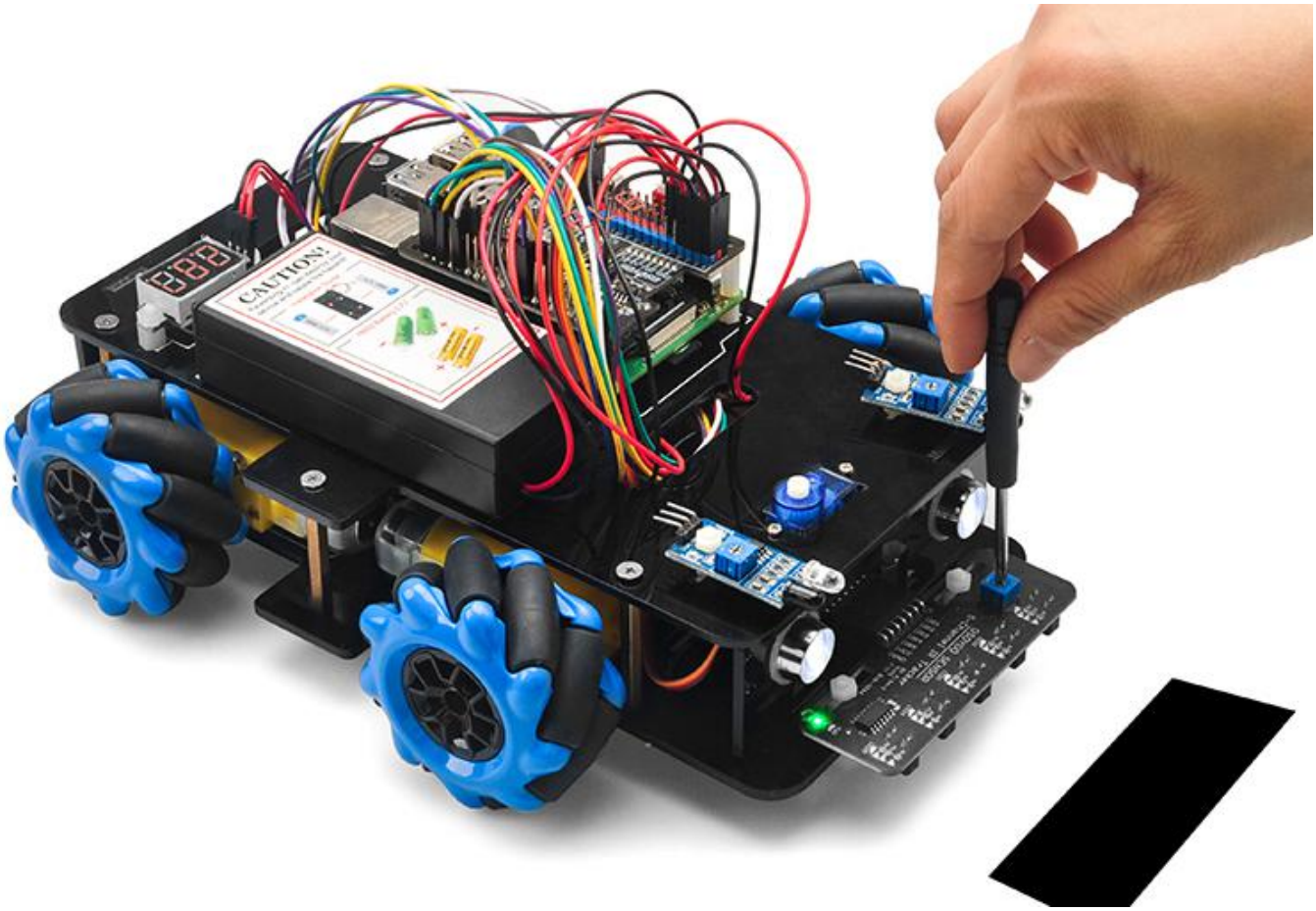




Step3. To adjust the tracking sensor sensitivity:

Power on the battery box while holding the car stationary . Use a Phillips screwdriver to tune the potentiometer on each tracking sensor until optimal response is achieved: Signal LED ON when detecting black tracks; Signal LED OFF when over white surfaces.





HOW TO PLAY

Run following command:

wget https://osoyoo.com/driver/mecanum/linetracking5.py
python linetracking5.py

Final Testing:
Prepare a black track (20-30 mm width) on a light-colored surface. Avoid sharp turns (minimum recommended radius: 15 cm) to prevent the car from losing tracking.

Power on the car and center the tracking sensor module over the black track. The car will then follow the track autonomously.

Lesson 3 Obstacle Avoidance Robot Car

INTRODUCTION

In this lesson, we will do an obstacle avoidance auto-driving project. We use an ultrasonic module to “see” the obstacle, and the car will turn around from the obstacle automatically.

You must complete lesson 1 before you continue on with this lesson.

PARTS & DEVICES

OSOYOO Mecanum wheels robotic car chassis x1

OSOYOO Wheels and motors x4 (left-wheels x2/right-wheels x2)

Raspberry pi 4/5 board (Not included in this kit)

OSOYOO PWM HAT shield x1

OSOYOO Model Y driver board x1

OSOYOO Voltage meter x1

OSOYOO MG90 servo motor x 1

OSOYOO Ultrasonic sensor module x1

OSOYOO Mount holder x1

OSOYOO Battery box x1

OSOYOO 3pin female to female jumper wire x1

OSOYOO 6pin female to female jumper wire x2

OSOYOO 10pin female to female jumper wire x1

OSOYOO 2 pin XH.25 female to female x1

18650 Batteries(3.7V) x2

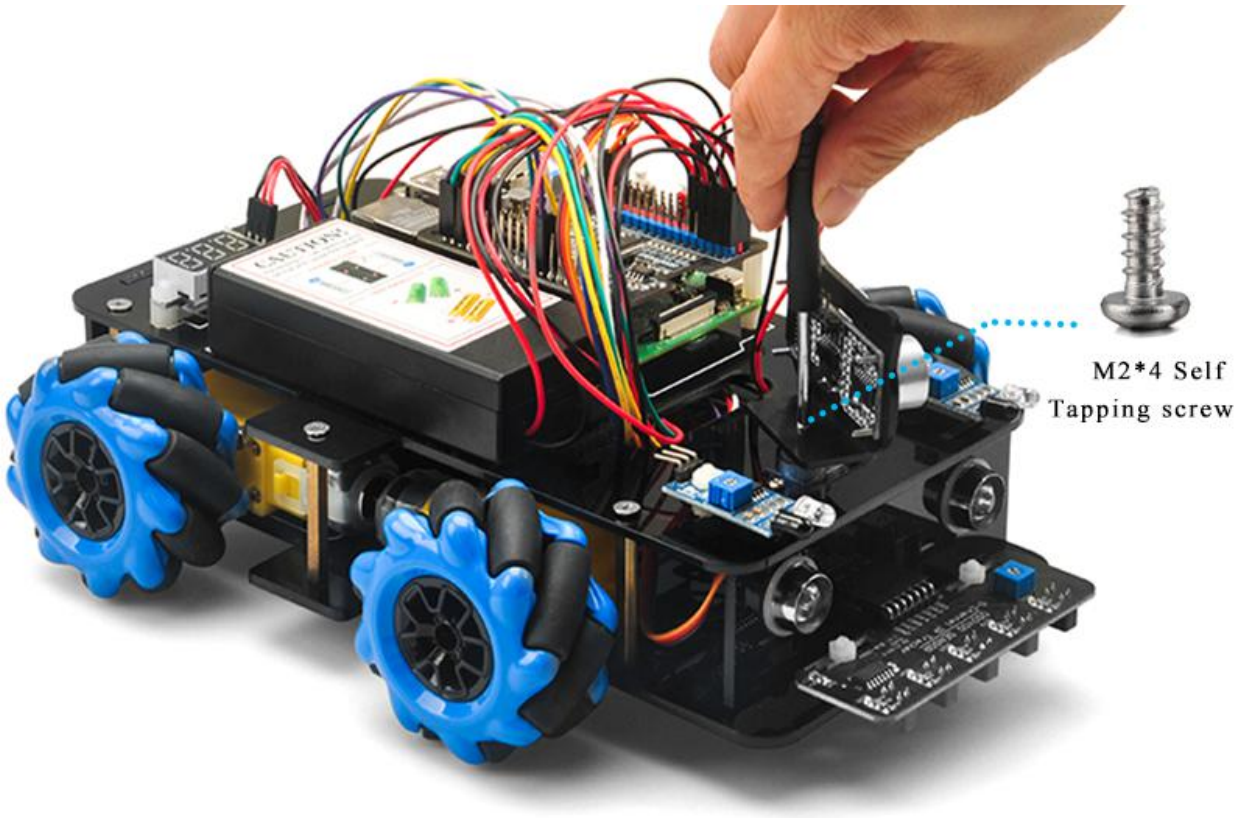
Battery charger x1

HARDWARE INSTALLATION

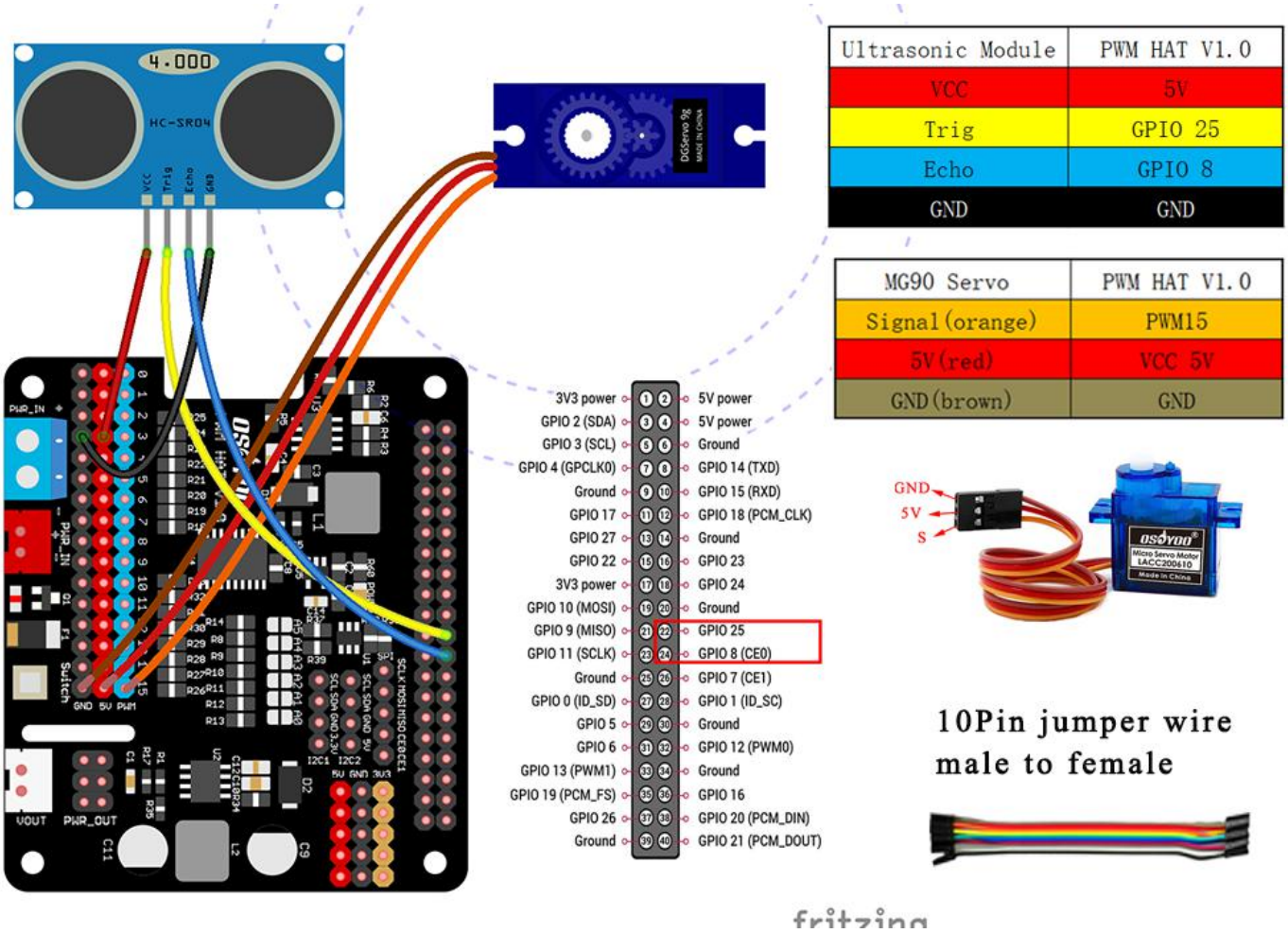
Ensure all connections from Lesson 1 remain unchanged. **Do not remove any existing wires** installed during Lesson 1.

Step 1: Mount the ultrasonic module to the holder using four M1.5×8mm screws and four M1.5 nuts.

Step 2: Install mount holder for Ultrasonic Module on SG90 servo motor with the M2*4 Self tapping screwm or the screws inside the SG90 servo motor.



Step 3: Please keep all lesson 1 connections same as it is.
Connect SG90 servo motor and ultrasonic module to OSOYOO PWM HAT shield as follows.



Note: You need to split 4 pcs of female-to-female jumper wires from our 10-pc jumper wire bundle. Any color from the bundle will be ok. The rest wires are as spare parts for potential broken or damaged wires.

SOFTWARE INSTALLATION

Connect raspberry pi 4 via USB-C cable from PC, Open PuTTY and enter the IP address (or Host Name pi) and 22 under Port (by default it is 22) ,then click open.

Use ssh tool to control Raspberry Pi remotely on other OS PC, run Sample Code by following command:

wget https://osoyoo.com/driver/mecanum/mecanum_oa5.py
python mecanum_oa5.py

Ultrasonic sensor servo initial direction alignment

The servo will make some movement and finally stops at front direction for 3 seconds.

If the ultrasonic sensor does not face the front during this first 3 seconds, you should turn off battery immediately and remove the sensor from the servo, reinstall it and make it

facing straight forward direction as following picture. Otherwise, the obstacle avoidance program will not work properly.

After adjusting sensor direction, turn on battery again, the sensor should face front same as following picture. If its direction is not straight forward, turn off battery and do direction alignment again.

Final Testing :

After turning on the battery switch on the battery box, if the ultrasonic module turn to front view position, that means you don't need to adjust sensor position anymore. Just wait 3 seconds. If no obstacle is detected, the car will go forward. If any obstacles are detected, the car will stop, the ultrasonic module will turn from right to left to detect surrounding obstacles. The robot car will decide to make left turn, right turn or backward according to obstacle sensor data and our obstacle avoidance algorithm.

Sometimes your car might have collision and make your Ultrasonic sensor position change, you must remember to do sensor direction alignment again as per link Ultrasonic sensor servo initial direction alignment.

HOW TO PLAY

Use ssh tool to control Raspberry Pi remotely on other OS PC, run Sample Code by following command:

python mecanum_oa5.py

Lesson 4 Target Tracking Robot car

INTRODUCTION

In this lesson, we will install 2pcs IR distance sensors on a robot car and program the car to follow object movements. The car receives the signal from the IR distance sensors, and then the program will drive the car to take actions.

PARTS & DEVICES

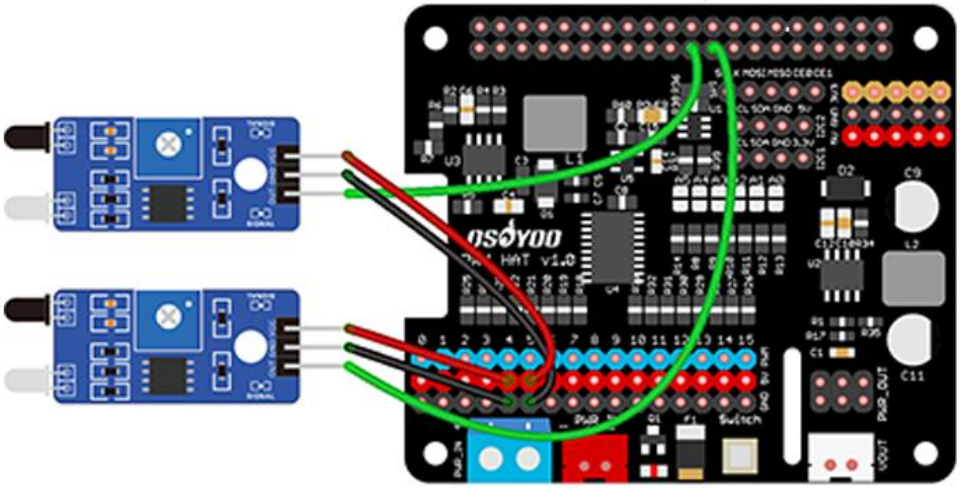
OSOYOO Mecanum wheels robotic car chassis x1
OSOYOO Wheels and motors x4 (left-wheels x2/right-wheels x2)
Raspberry pi 4B/5B board (Not included in this kit))
OSOYOO PWM HAT shield x1
OSOYOO Model Y driver board x1
OSOYOO Voltage meter x1
OSOYOO IR distance sensors x2
OSOYOO Battery box x1
OSOYOO 3pin female to female jumper wire x1
OSOYOO 6pin female to female jumper wire x2
OSOYOO 10pin female to female jumper wire x1
OSOYOO 2 pin XH2.54 female to female x1
18650 Batteries(3.7V) x2
Battery charger x1

HARDWARE INSTALLATION

Step 1: Install the smart car basic framework as per Smart Car Lesson 1. If you have already completed installation in Lesson 1, just keep it as is.

Step 2: Connect 2pcs IR distance sensors modules as below connection diagram.
(Remember : DO NOT remove any existing wires installed in Lesson 1).

IR Obstacle Sensor	PWM HAT V1.0
VCC(Left)	5V
GND(Left)	GND
OUT(Left)	GPIO 9
VCC(Right)	5V
GND(Right)	GND
OUT(Right)	GPIO 10



10Pin jumper wire
female to female

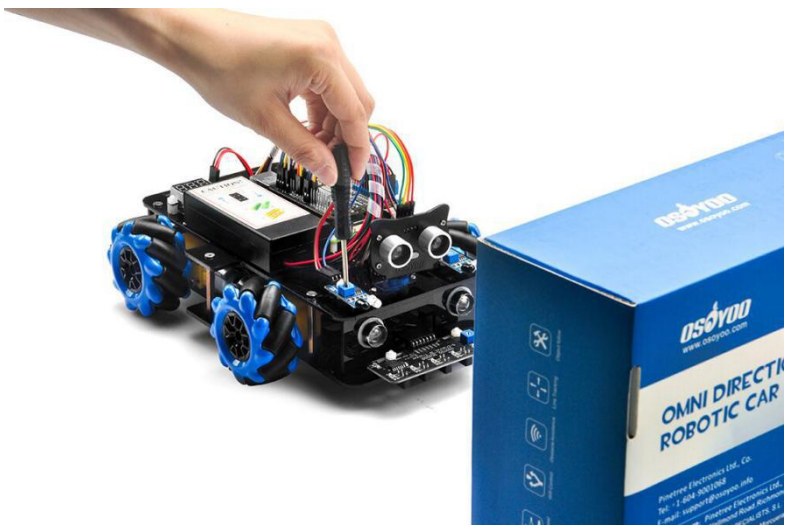
SOFTWARE INSTALLATION

Step 1: Make sure you have installed rpi.gpio, PCA9685 library and enable I2C in lesson 1.

Step 2: Turn on the robot car , using SSH tools to download the python code by typing the following command in your Raspberry Pi terminal.

wget https://osoyoo.com/driver/mecanum/follower5.py
python follower5.py

Step 3: Put object about 10 cm ahead of each IR distance sensors and adjust potentiometer on IR distance sensors to detect object or your hand.



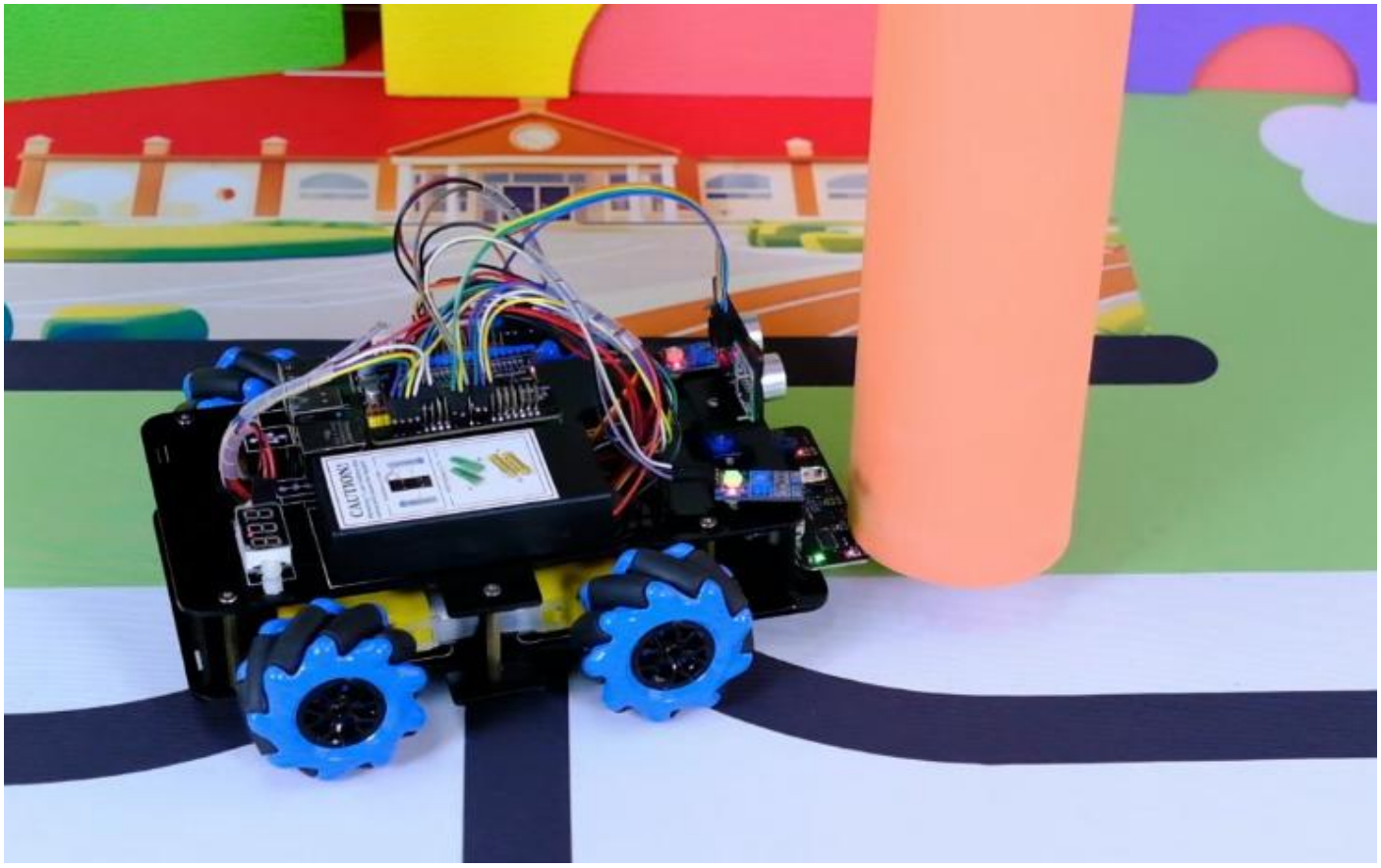
Move object or your hand ahead of car, and then the car will move accordingly: looks like you pull it. It goes forward when both IR Obstacle Avoidance modules detect object or your hand; it turns right when the right IR Obstacle Avoidance modules detect object; it turns left when the left IR distance sensors detect object.

When object or your hand is over 10cm ahead, it will stop.

Note: When these IR modules detect objects, both the power indicator and signal indicator are on. When No object is detected, only power indicator is on, signal indicator is off. If the signal indicator is always on even though there is no obstacle in front of the sensor, you need to adjust the potentiometer.

HOW TO PLAY

Run following command in your ssh terminal:
python follower5.py



Lesson 5 Web-Camera Robot Car

INTRODUCTION

In this lesson, we will show you how to use Python3 Flask and Camera Stream software to control a Raspberry Pi Robot Car through the Internet. You will monitor the car's real-time movement through its eye (front camera).

PARTS & DEVICES

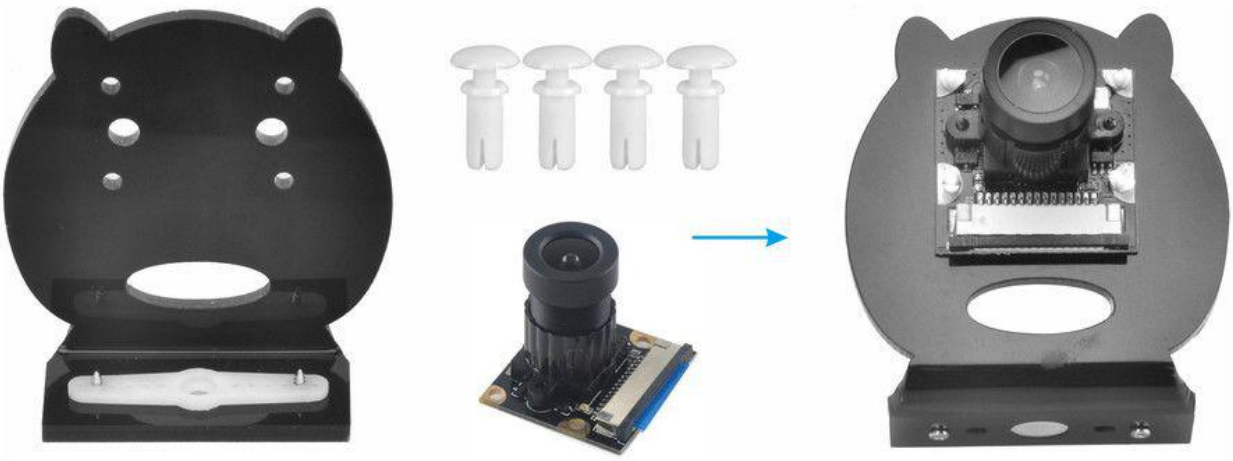
OSOYOO Mecanum wheels robotic car chassis x1
OSOYOO Wheels and motors x4 (left-wheels x2/right-wheels x2)
Raspberry pi 4B/5B board (Not included in this kit)
OSOYOO PWM HAT shield x1
OSOYOO Model Y driver board x1
OSOYOO Voltage meter x1
OSOYOO CSI camera with cable x1
OSOYOO Camera holder x1
OSOYOO Battery box x1
OSOYOO 3pin female to female jumper wire x1
OSOYOO 6pin female to female jumper wire x2
OSOYOO 2 pin XH2.54 female to female x1
18650 Batteries(3.7V) x2
Battery charger x1

HARDWARE INSTALLATION

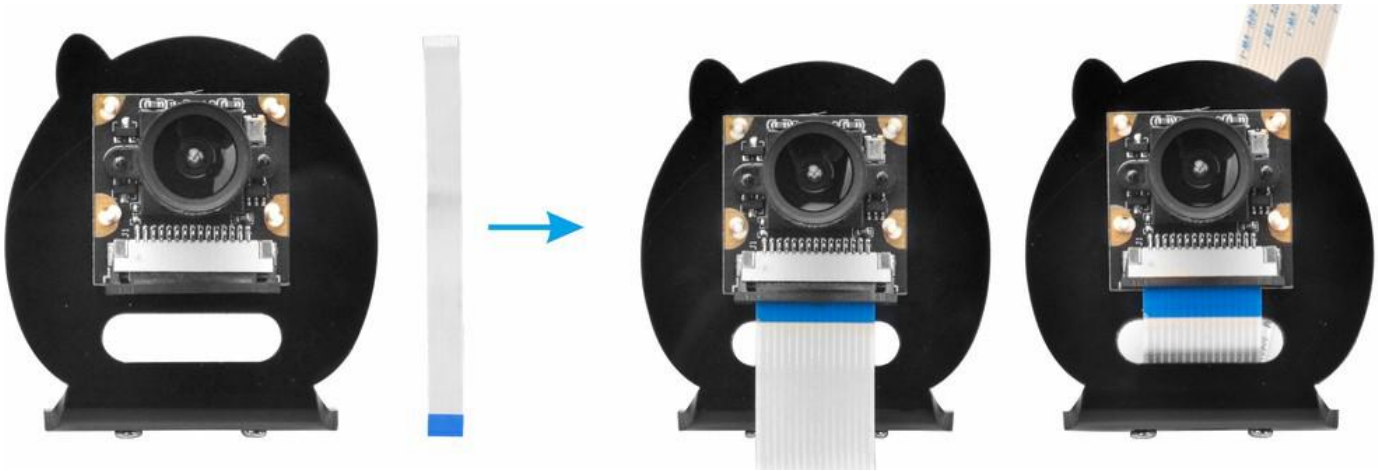
Step 1: You must complete Lesson 1 basic framework, Servo Must be installed and connected PWM 15 port.(Ignore if already installed)

Step 2: Choose slotted bracket in servo motor to cross Camera holder from top to bottom and fix blade with M1.5*6 Self Tapping Screws.

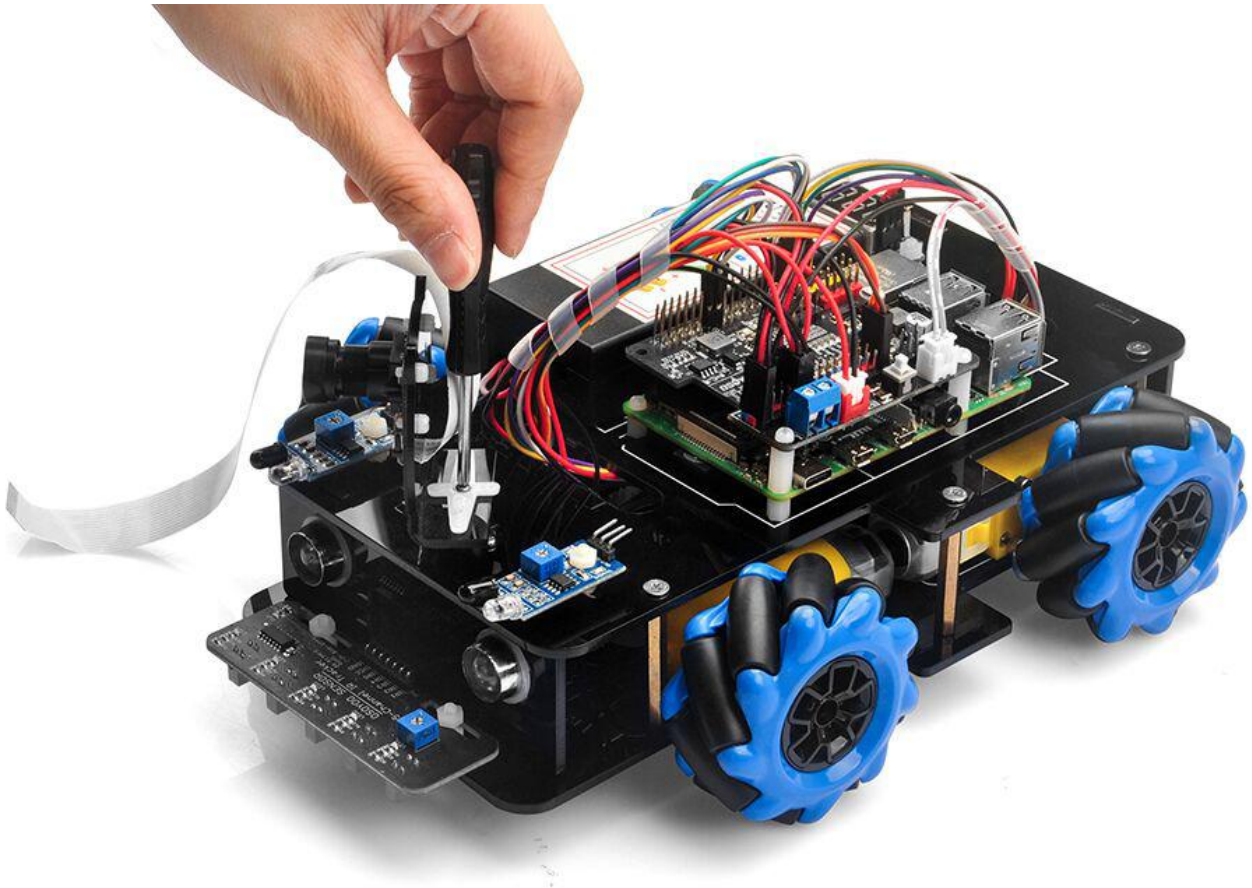
Step 3: Install CSI camera to camera holder with 4pcs M2 push pin rivets.



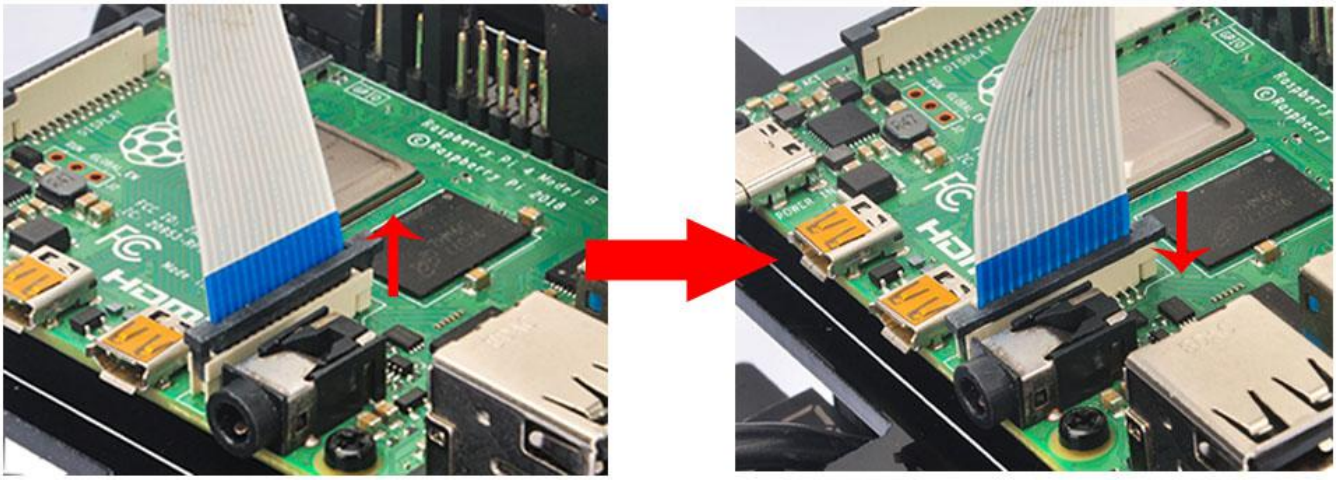
Step 4: Connect the CSI ribbon cable to the CSI camera.



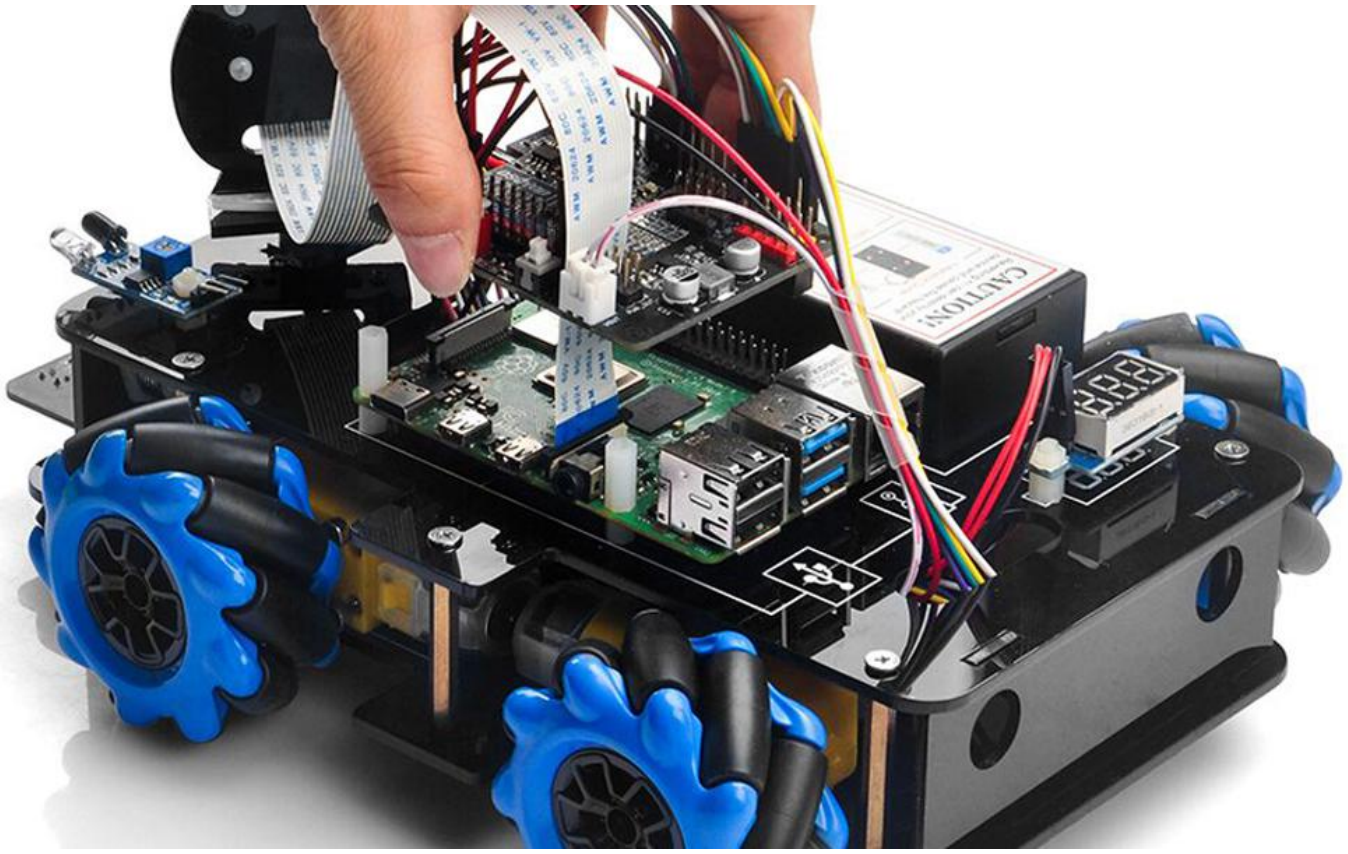
Step 5: Install camera holder on servo motor with M2*4 Self Tapping screw.

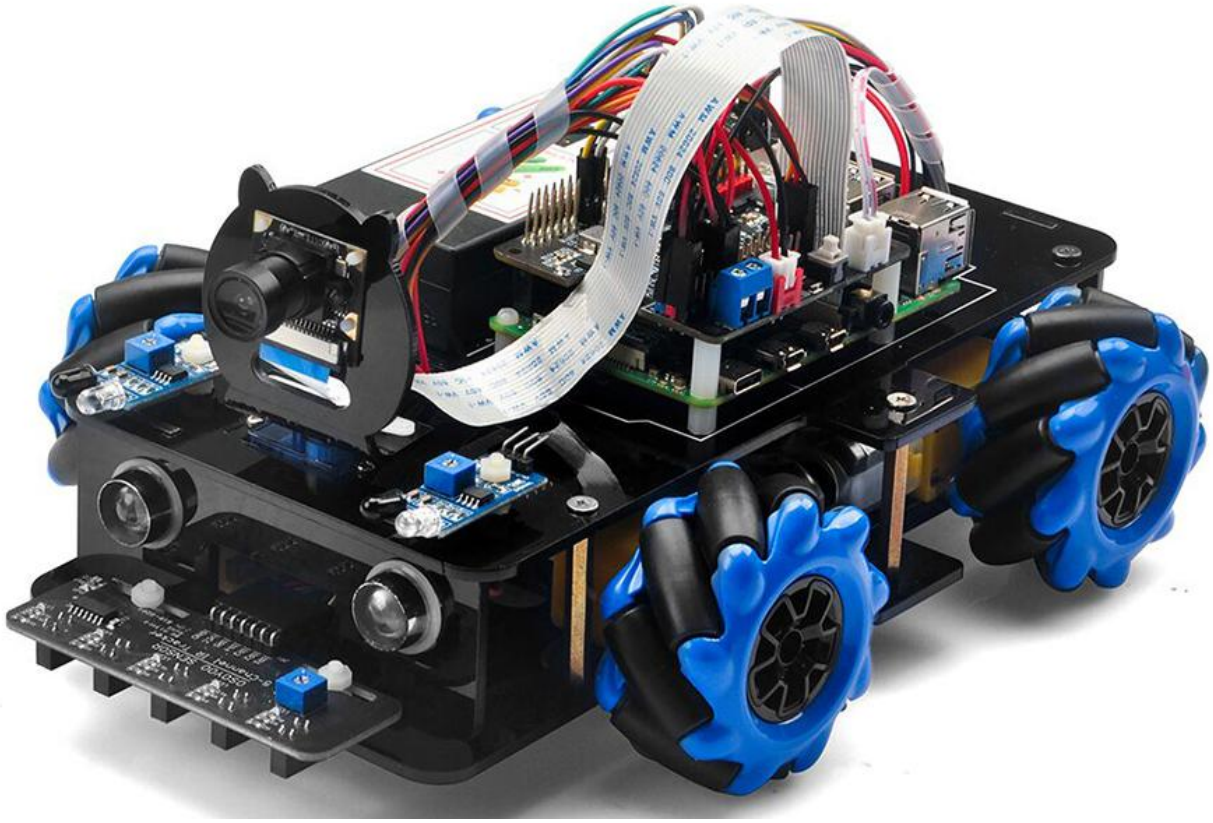


Step 6: Connect the CSI camera to CSI Slot of Raspberry Pi with CSI ribbon cable (Please pay attention to the connections of the cable before you install
it.)



Step 7: Install OSOYOO PWM HAT on raspberry pi board.





SOFTWARE INSTALLATION

Make sure you have installed rpi.gpio, adafruit-pca9685 library and enable I2C in lesson 1, and power on the robot car.

Please use following command to start picamera streamer server in your Raspberry Pi.

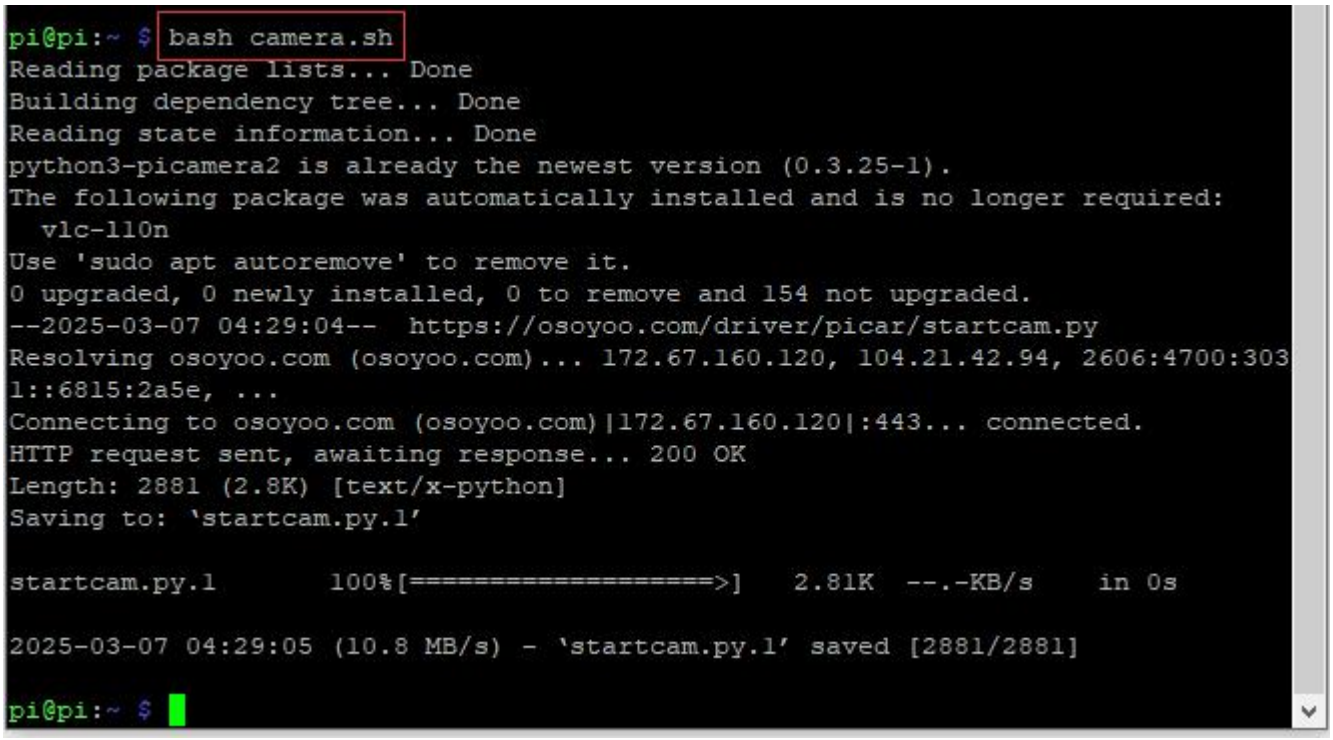
Step 1: Please enable Camera in Raspberry Pi by typing following command (Note: If you burn BOOKWORM OS, you needn't enable Camera)

sudo raspi-config

Then select → Interfacing Options→ Camera→ No→ Ok→ Finish (Please reboot the Raspberry Pi according to the notice.)

Step 2: Type following command to download Osoyoo Camera Stream Software software :
wget https://osoyoo.com/driver/picar/camera.sh

Step 3: Install Osoyoo Camera Stream Software, this is an one-time installation task, you only need to install the software once by typing the following command:
bash camera.sh



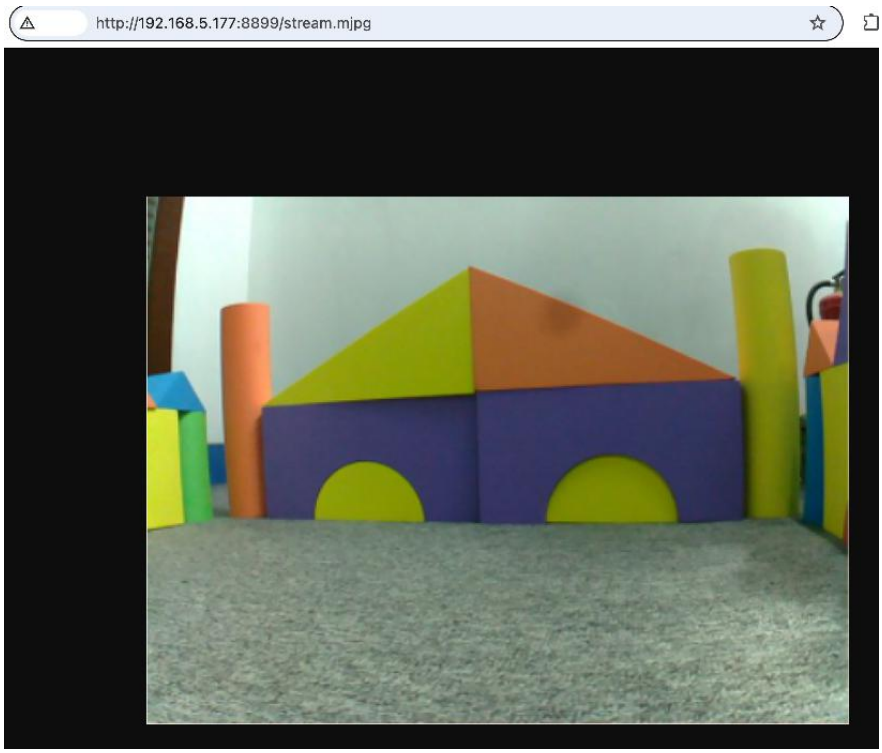
After running above commands, Osoyoo Camera Stream software is installed in your Raspberry Pi. So Simple!

NOTE: Camera Stream Software only need install ONCE! So if you want to run camera stream in future, you just follow next step (STEP 4) and execute python startcam.py file.

Step 4: Start after you have installed camera server, you can start the Camera Server by running following command in your Pi terminal:
python startcam.py

```
pi@pi:~ $ python startcam.py
Traceback (most recent call last):
  File "/home/pi/startcam.py", line 11, in <module>
    from picamera2 import Picamera2
  File "/usr/lib/python3/dist-packages/picamera2/__init__.py", line 4, in <modul
e>
    import libcamera
  File "/usr/lib/python3/dist-packages/libcamera/__init__.py", line 4, in <modul
e>
    from ._libcamera import *
ImportError: /lib/aarch64-linux-gnu/libcamera.so.0.3: undefined symbol: _ZN7libp
isp22compute_optimal_strideER24pisp_image_format_config
pi@pi:~ $
```

Step 5: Now you can use your browser to test the surveillance video. Now please visit http://your raspberry pi ip:8899/stream.mjpg
(in my case http://192.168.68.227:8899/stream.mjpg) , you will see the video surveillance.



Method 1: Use browser to control a Raspberry Pi Robot Car through the Internet

Step 1: Open a new terminal window and run the following code to install the OSOYOO web

camera controlled robot car software

wget https://osoyoo.com/driver/mecanum/osoyoowebcar.sh -O osoyoowebcar.sh

Step 2: type the following command:

bash osoyoowebcar.sh

After running above commands, you will automatically create a directory called osoyoowebcar, the structure is as follows:

Step 3: type the following command to enter the folder osoyoowebcar

cd osoyoowebcar

Step 4: Then type the following command to edit the file templates/index.html

nano templates/index.html

Step 5: Please replace 192.168.0.89 in line 34 with your pi's IP address, and click "Ctrl"+"X" then "Y" to save the file and then click "enter" to exit the file.

Step 6: put the car on the ground and run the code by typing the following command

sudo python ~/osoyoowebcar/webcar.py

Step 7: In your PC or cell phone which is the same Wi-Fi network of your Raspberry Pi, open the browser and visit http://your_RaspberryPi_ip_address.

The arrows buttons are direction control keys, the red circle button in the middle is the STOP key. There are four speed control buttons in the bottom:

0 key means the slowest speed
— key means the 2nd slow speed
== key means regular speed
++ key means fastest speed
In the top of the page, there is a Camera Direction Slider, you can move the slider to make

shift movement.

Method 2: Use APP to control a Raspberry Pi Robot Car through the Internet

Step 1: Open a new terminal window and run the following code to download the sample code for APP control

wget https://osoyoo.com/driver/mecanum/udpmecan5.py -O udpmecan5.py

Step 2: Type the following command to run the sample code (ATTENTION: please select a correct command according to your Pi board):

python udpmecan5.py

Step 3: Download OSOYOO Wi-Fi UDP Robot Car control APP
In Google Play or Apple Store, please search keywords “OSOYOO IoT UDP Robot APP”, you will find a red icon APP as following (Note: If you can not find this APP in Google Play, you can directly download the APP from following link:
https://osoyoo.com/driver/udp-app.apk):

Step 4: Connect your phone with the same router Wi-Fi SSID of Raspberry Pi use. Open the APP, click “setting icon(1)” to enter “setting UI”, enter IP address to your Raspberry Pi IP address and Port to 8888, enter http://your_raspberry_pi_ip:8899/stream.mjpg to video Target, then turn Video Target switch to green, then click save, then click “back icon(7)” to back control UI as following:

Step 5: Now, put the car on the ground, and you can click the ◄ ► ▲ ▼ direction keys and top slider to make the car move. Use [] pause key to stop the car movement.

The Slider at the top of direction keys can rotate the car, if slider goes to left, car makes left turn, if slider goes to right, car turns to right.

▲key makes car move forward, ▼key makes car move backward.

◄ key make car shift to left side, ►key makes car shift to right side.