OSOYOO

Omni-wheel

Easy Assembly **Omni-wheel** **Wifi Control** **Obstacle Avoidance** **Line Tracking**

More information: http://osoyoo.com/?p=49235

INTRODUCTION

Mecanum wheels, also known as omni wheels or Ilon 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 Arduino Omini Direction Robot Car learning kit is developed our Japan and Canada engineer team. It has all features a traditional Arduino Robot car should have, including remote control by Bluetooth, IoT through Wifi, Line tracking and Obstacle Avoidance auto driving. With the help of powerful Mecanum wheels, the car can make much more complicated movement such as sideway shifting and digaonally movement controlled by Cell phone APP.

The kit comes with OSOYOO mega2560 board (fully compatiable with Arduino Mega2560) and OSOYOO Esp8266 Wifi Shield. Besides, we have designed five step by step lessons which help students to learn Arduino robot programming from scratch. If you are an experience DIY player or Arduino programmer, you can also get a lot of knowledge from this kit's open source code and hardware to make interesting DIY project of your own.

AUTHORIZED ONLINE RETAILERS

Mecanum Wheel Robot Car Full Package

Buy from US	Buy from UK	Buy from DE	Buy from IT	Buy from FR	Buy from ES	Buy from JP
ⓐ BUY NOW	ⓐ BUY NOW	ⓐ BUY NOW	ⓐ BUY NOW	ⓐ BUY NOW	ⓐ BUY NOW	ⓐ BUY NOW

CONTENT

Lesson 1 Basic Robot Car Assembling

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

In this project, we will show how to use Arduino to control an OSOYOO Brand mecanum wheel robot car.

OSOYOO Mecanum Wheels Robotic Car Chassis x 1 (2x left-wheels/2x right-wheels and 4x Motor)
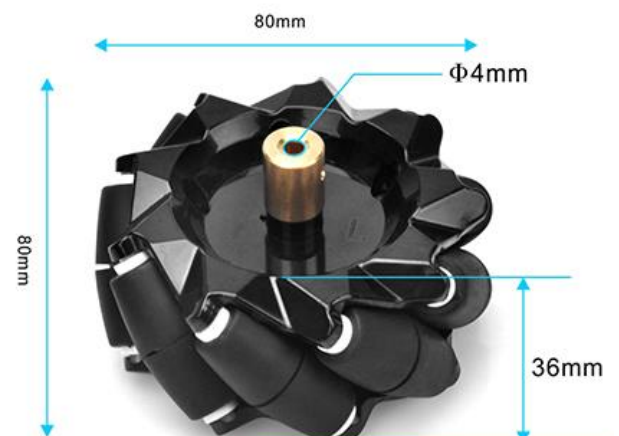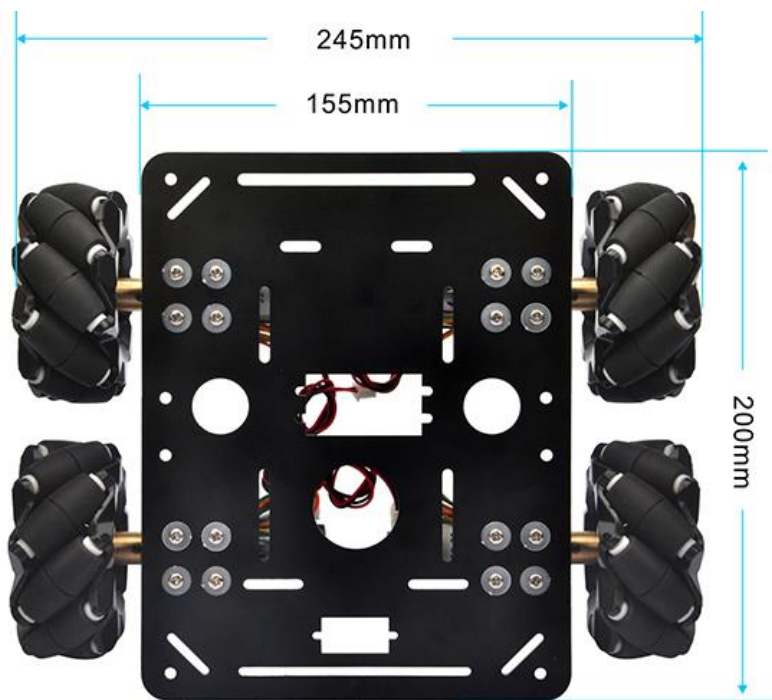OSOYOO MEGA2560 board fully compatible with Arduino
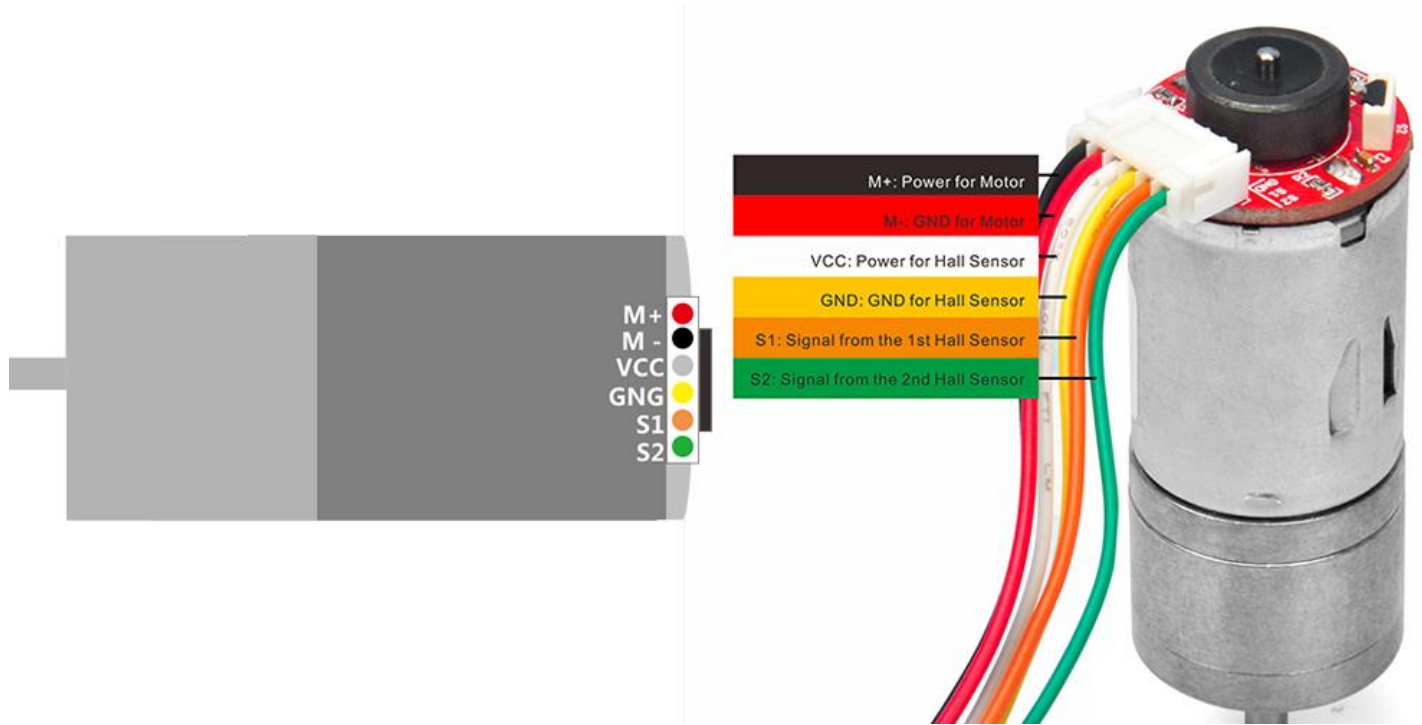OSOYOO Wifi Shield x 1
OSOYOO Model Y motor driver x 1
OSOYOO battery box x 1
18650 Batteries x2

Specifications:

|	
M+: Power for Motor	M+
M-: GND for Motor	M -
VCC: Power for Hall Sensor	VCC
GND: GND for Hall Sensor	GNG
S1: Signal from the 1st Hall Sensor	S1
S2: Signal from the 2nd Hall Sensor	S2

HARDWARE INSTALLATION

STEP1. Install the metal holder on metal chassis with 16pcs M3.5*12 screws, M3.5 rubber rings and M3.5 nuts

M3.5 nuts 16pcs
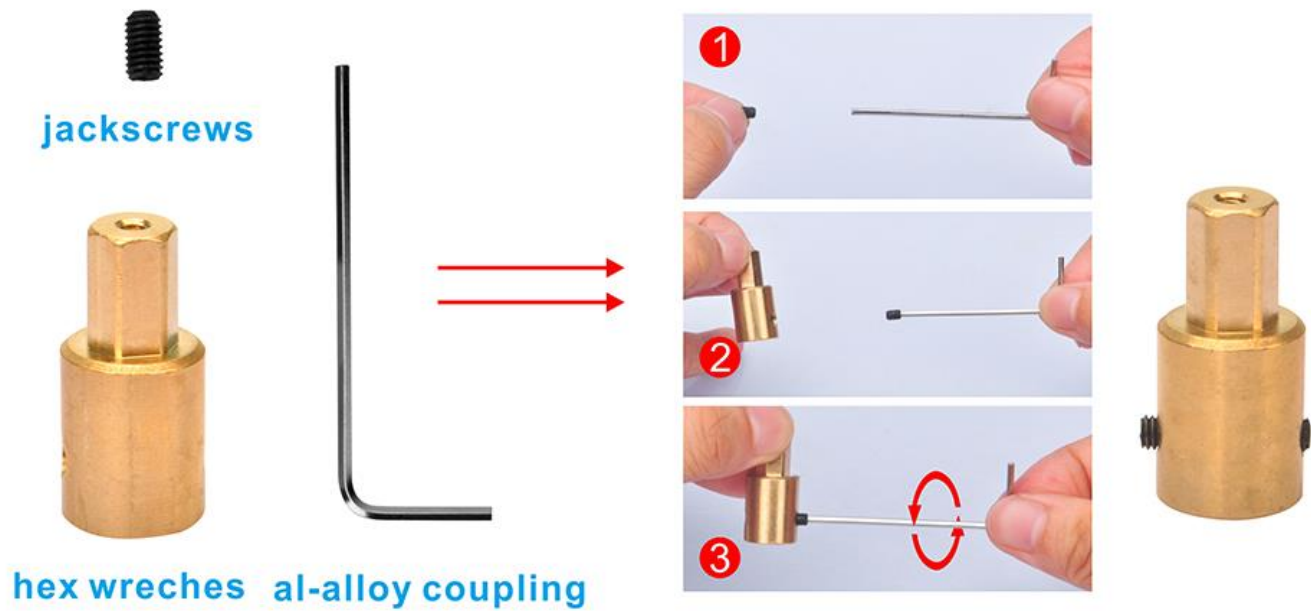
M3.5 rubber rings 16pcs

M3.5x12 screws 16pcs
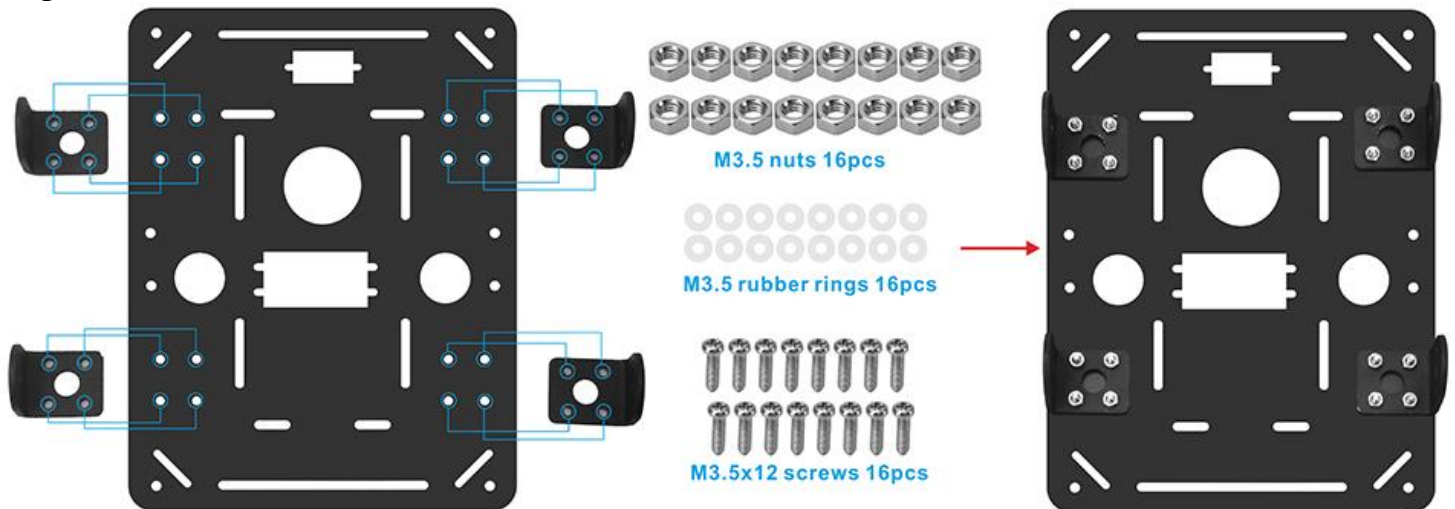
STEP2. Installing 8pcs M3*6 screws as per the following red box.

M3*6 screws x8
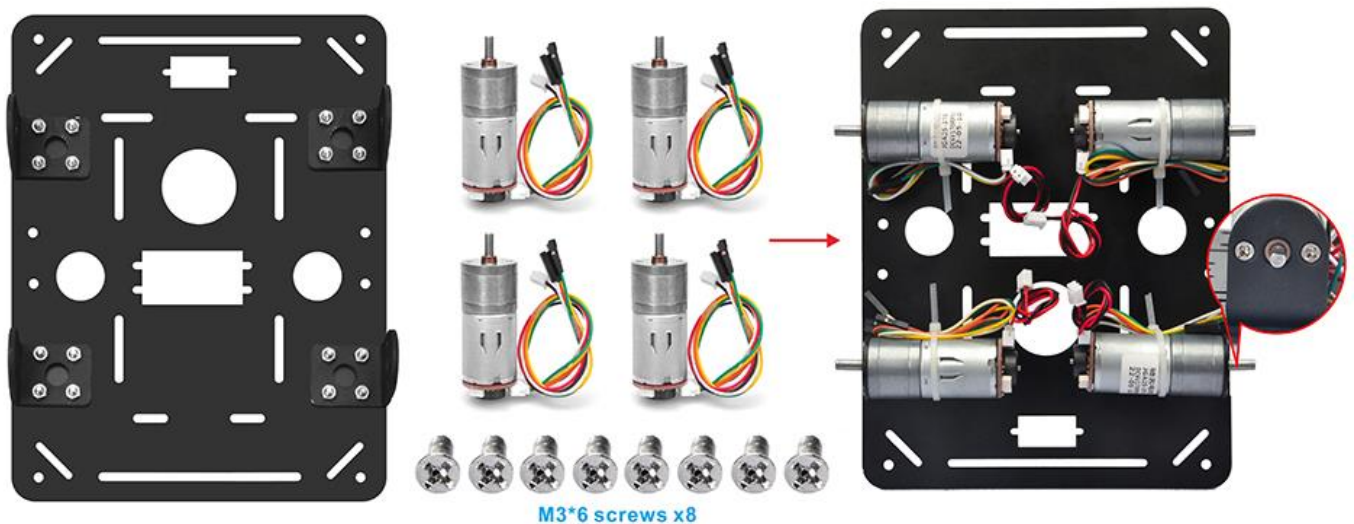
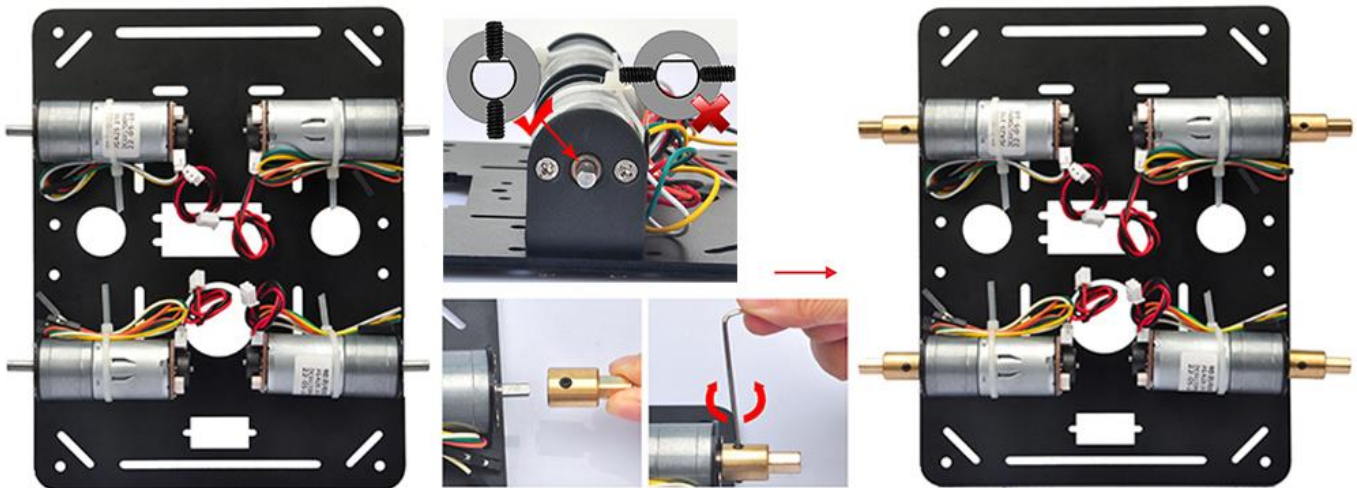STEP3. Install the jackscrews on al-alloy coupling, please tighten jackscrews to fix the al-alloy

coupling on motor.

jackscrews

hex wreches   al-alloy coupling

The shaft from the motor has a flat area on it. Make sure that the jackscrew was positioned on this flat, and tightened both screws on the shaft.

STEP4. Install the 4 mecanum wheels on al-alloy coupling with 4pcs M2.5*10.

Wheels x4

M2.5x10 screw

The Mecanum wheel has some sub-wheels on the main wheel. The four Mecanum wheels have

two types by the sub-wheel directions. Check the type left wheel and right wheel by following **picture left side**. You must 100% sure that correct type of wheel is installed into correct position as per **picture right side**, the rolling direction of each wheel will determine the whole car moving directions showed in the picture.

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 prewritten codes are based on this configuration.

Two types of mecanum wheel and their installation position in the car.

Left wheel   Right wheel

Different rotation combination of 4 wheels will result in different car movement directions. Following pictures shows how they works.

straight ahead   side way   diagonal

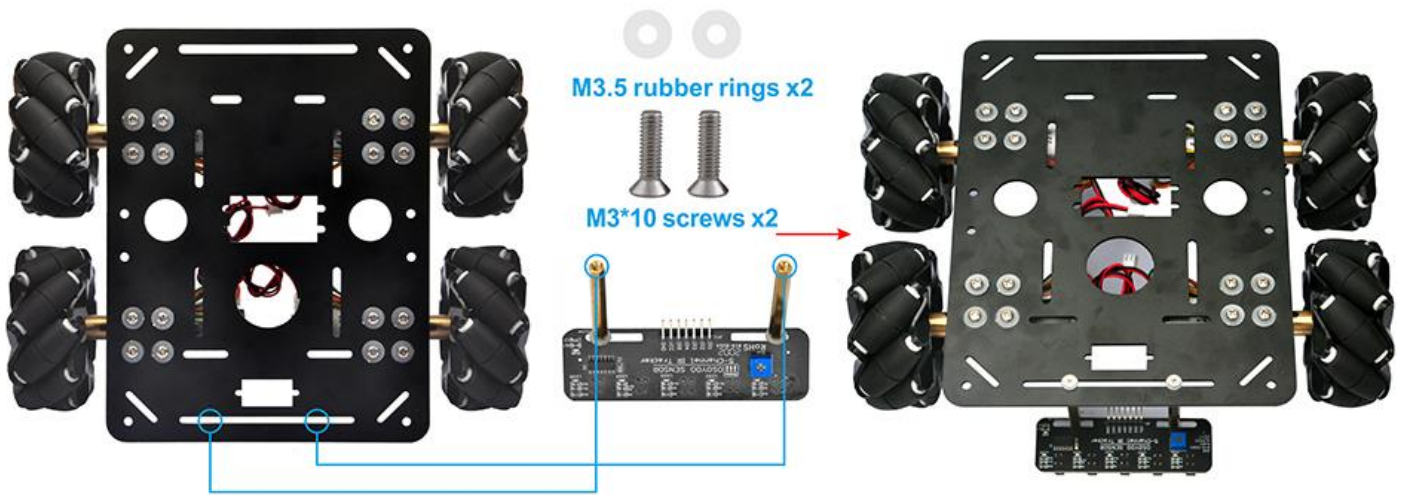concerning   turn round   turn of rear axis
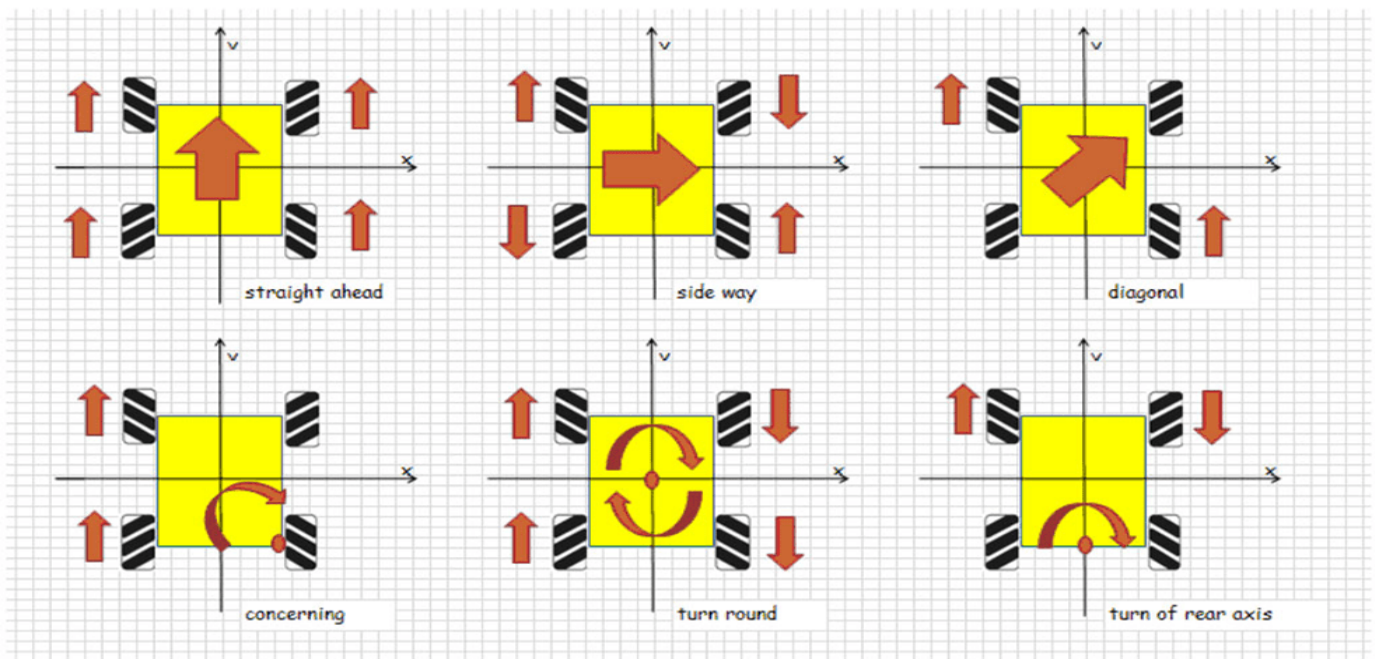
STEP5.Install 2pcs M3x40 copper pillars with 2pcs M3 screws and 2pcs M3.5 rubber rings
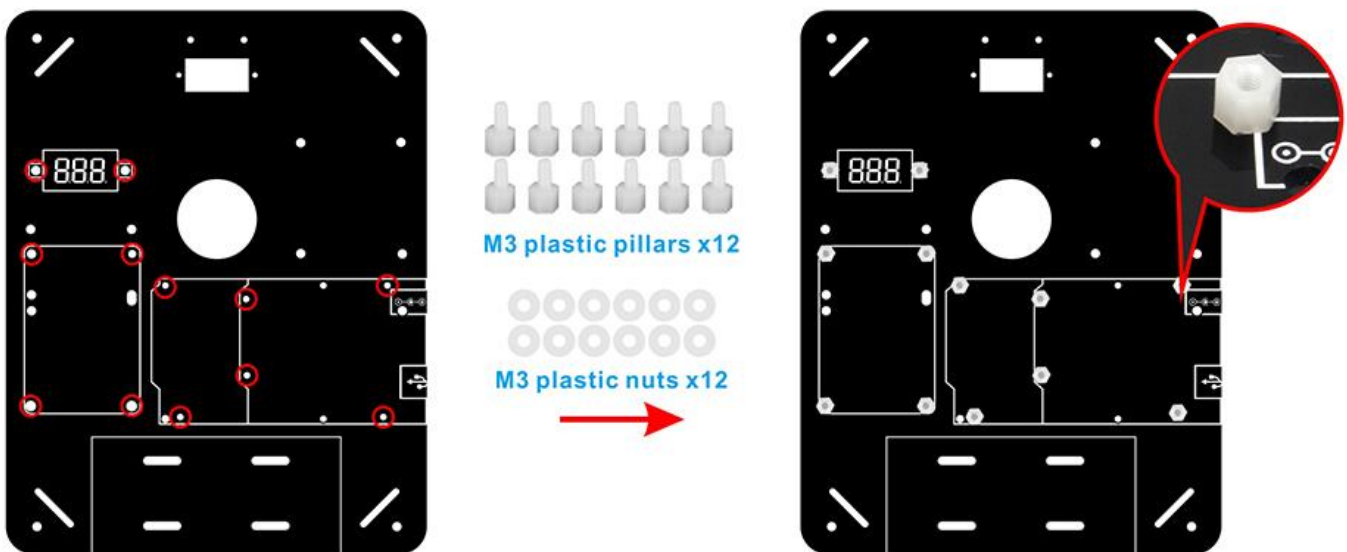
on tracking sensor as following pictures.

STEP6. We will add a 5-Point tracking sensor module to the car chassis with M3 nuts as following pictures.

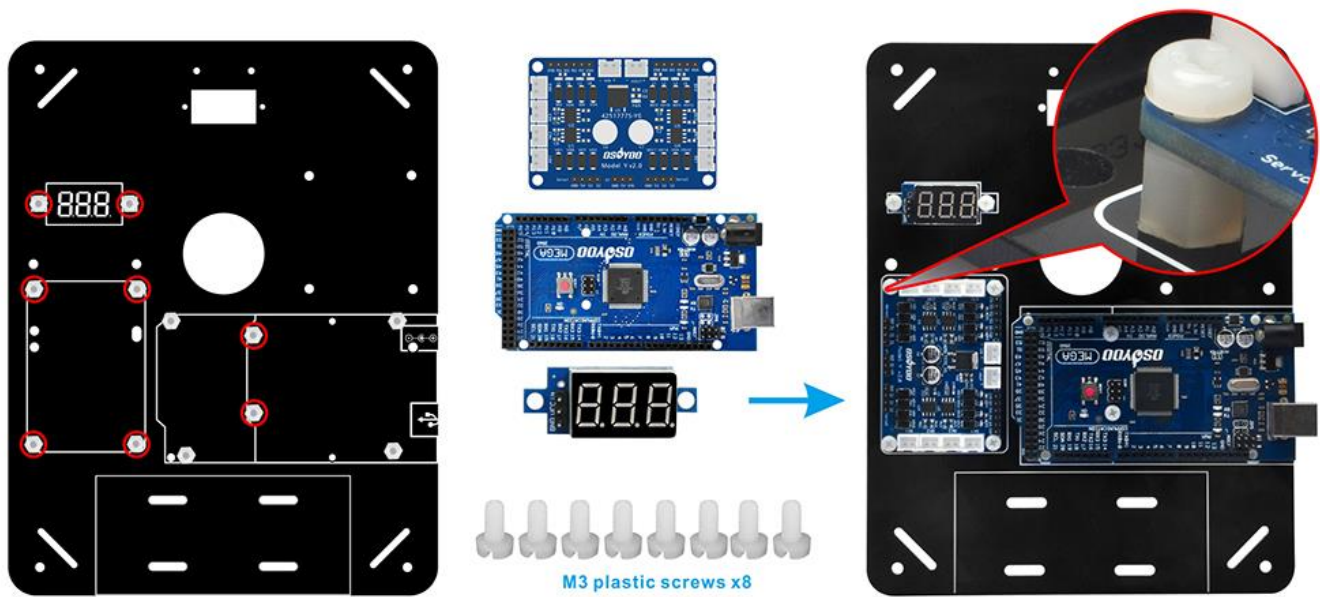

STEP7. Install 12pcs M3 plastic pillars and nuts on acrylic board as following pictures.
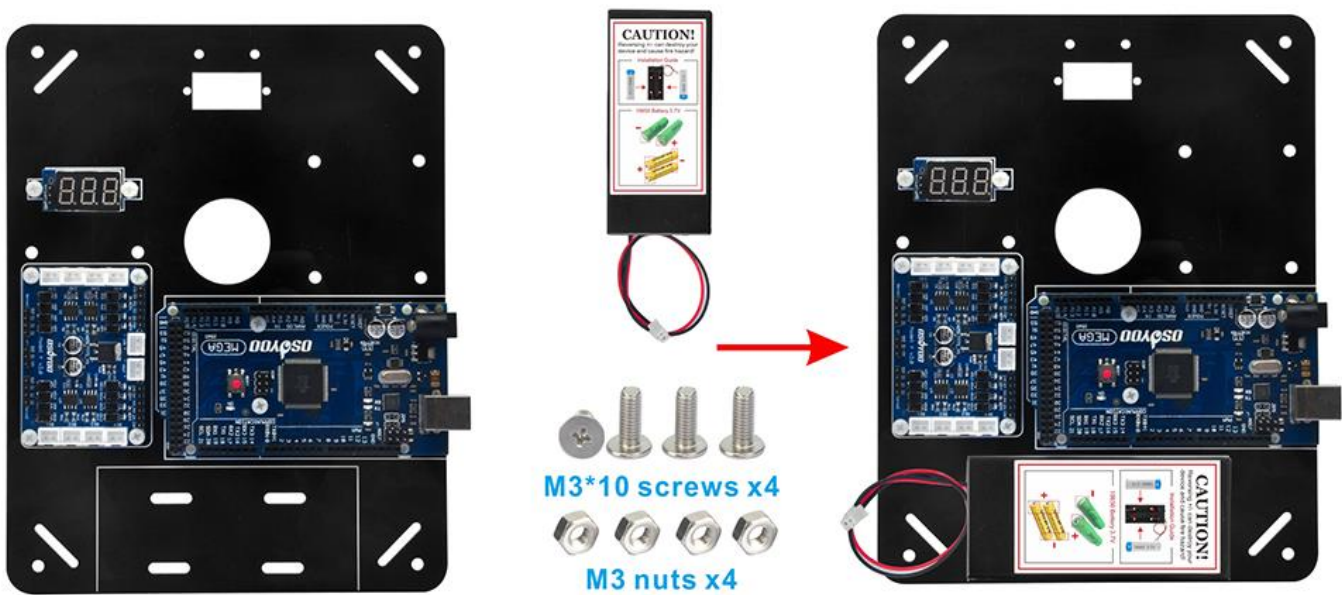
STEP8. Install 1pcs osoyoo Mega2560 board, 1pcs model Y motor driver board and 1pcs voltage meter on acrylic chassis with 8pcs M3 plastic screws as following pictures.

M3 plastic screws x8

STEP7. Install battery box with 4pcs M3x10 screws and nuts as following pictures.

M3*10 screws x4

M3 nuts x4

STEP8.Install SG90 servo on the acrylic chassis with 2pcs M2.2*8 self tapping screws as following pictures.

M2.2*8 self tapping screws x2
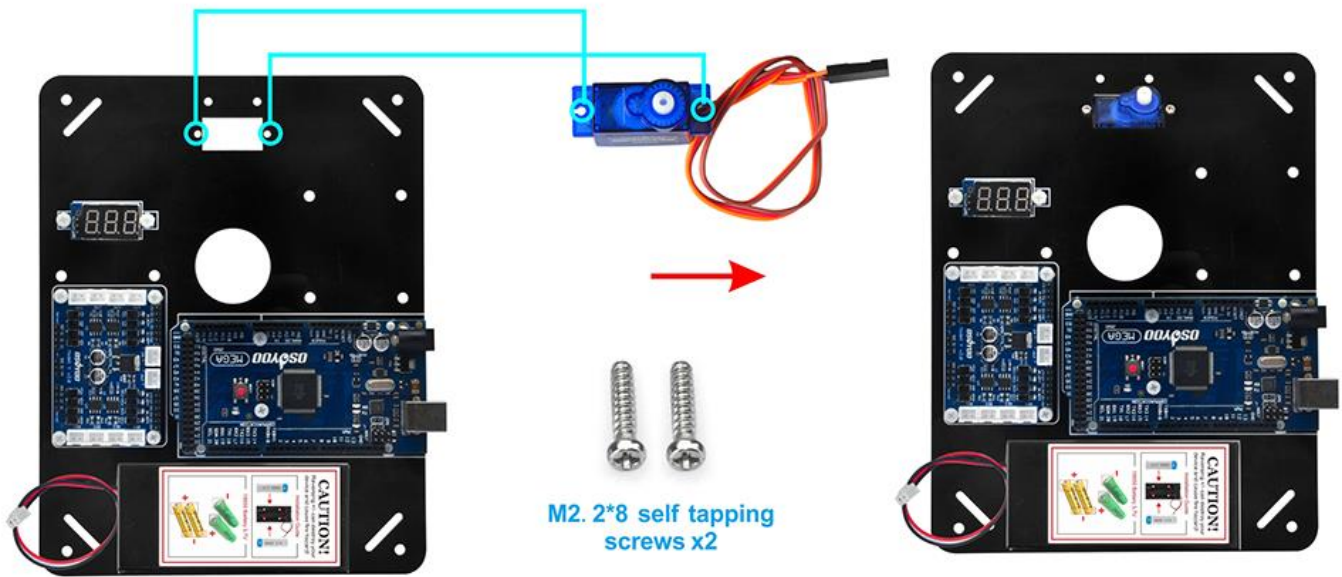
STEP9. Remove the red jumper cap from wifi shield and insert OSOYOO wifi shield into Arduino Mega2560 board as following pictures.
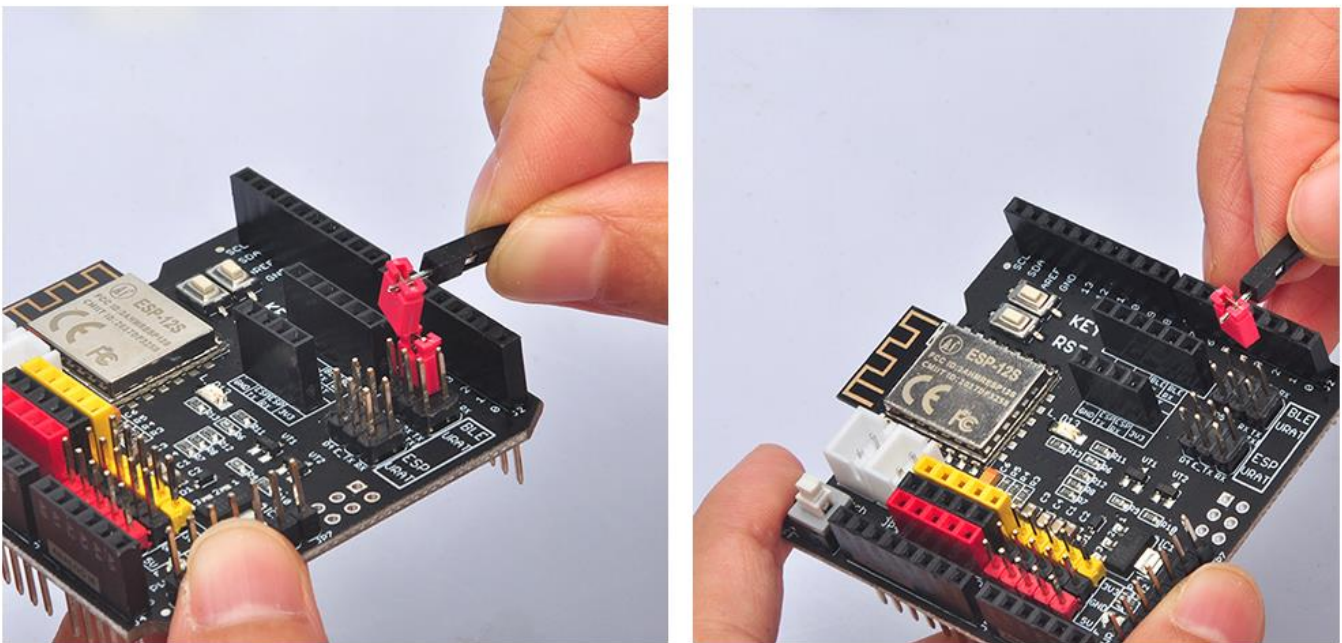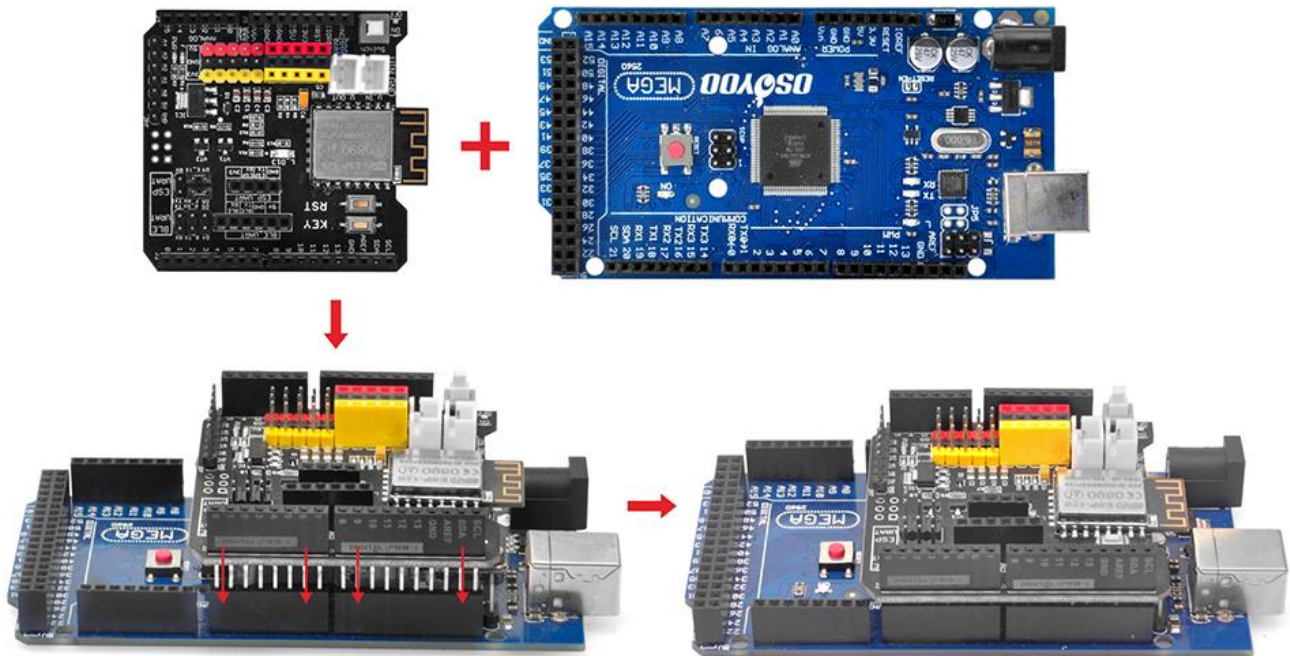
STEP10.Install the acrylic chassis on metal chassis. Please note the front and back of acrylic chassis and metal chassis.
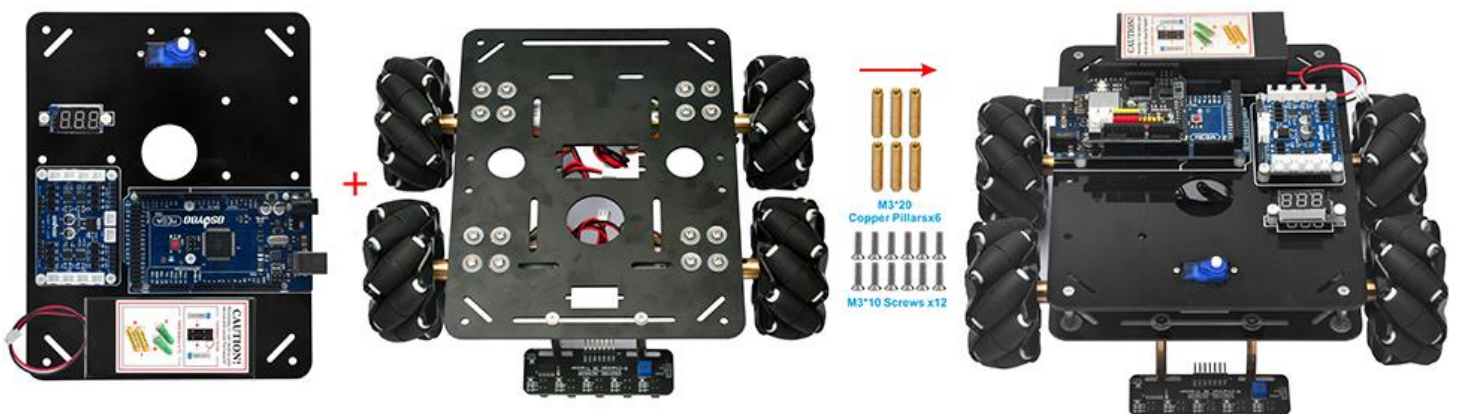
Before connect wires, make sure you have inserted OSOYOO WIFI Shield onto MEGA2560 board already.

Front-left wheel motor

Front-right wheel motor

Rear-left wheel motor

Rear-right wheel motor

Front

Front

Front-left wheel motor

Front-right wheel motor

Rear-left wheel motor

Rear-right wheel motor

18650 battery box

Back

Back
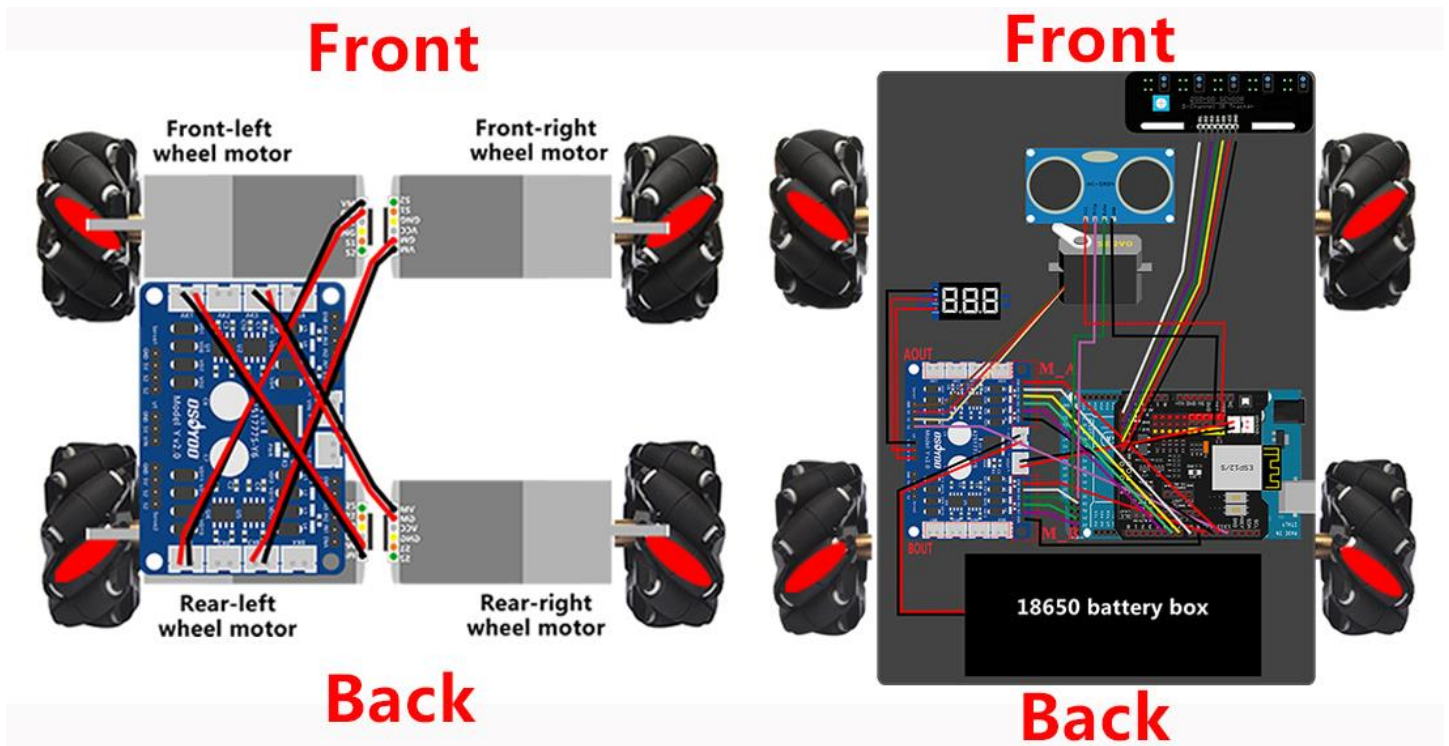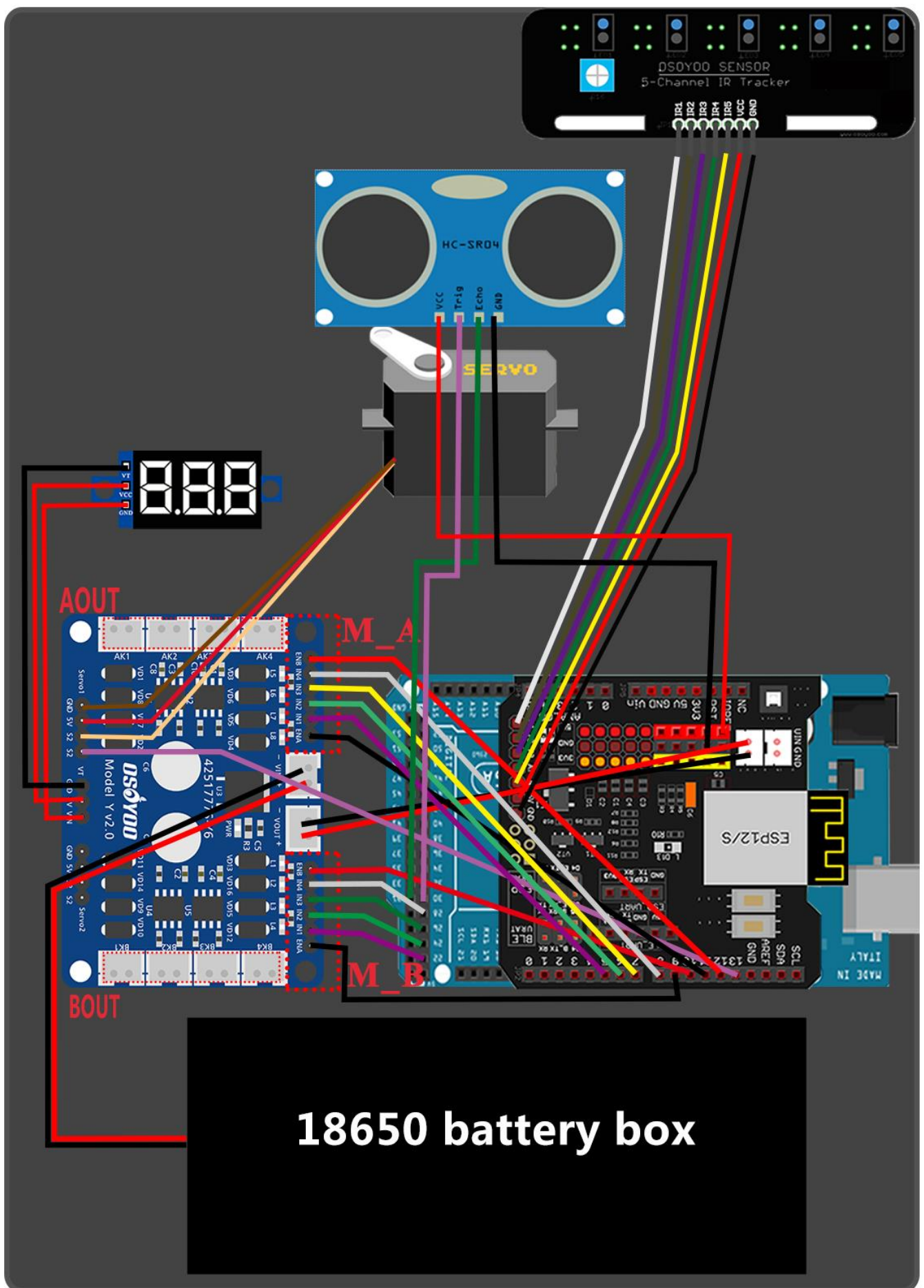
STEP11. Connect 4 motors to model Y driver board as per the following pictures.

Wheel Motor	Model Y board
Front-right wheel motor	BK1 or BK2
Front-left wheel motor	BK3 or BK4
Rear-right wheel motor	AK1 or AK2
Rear-left wheel motor	AK3 or AK4
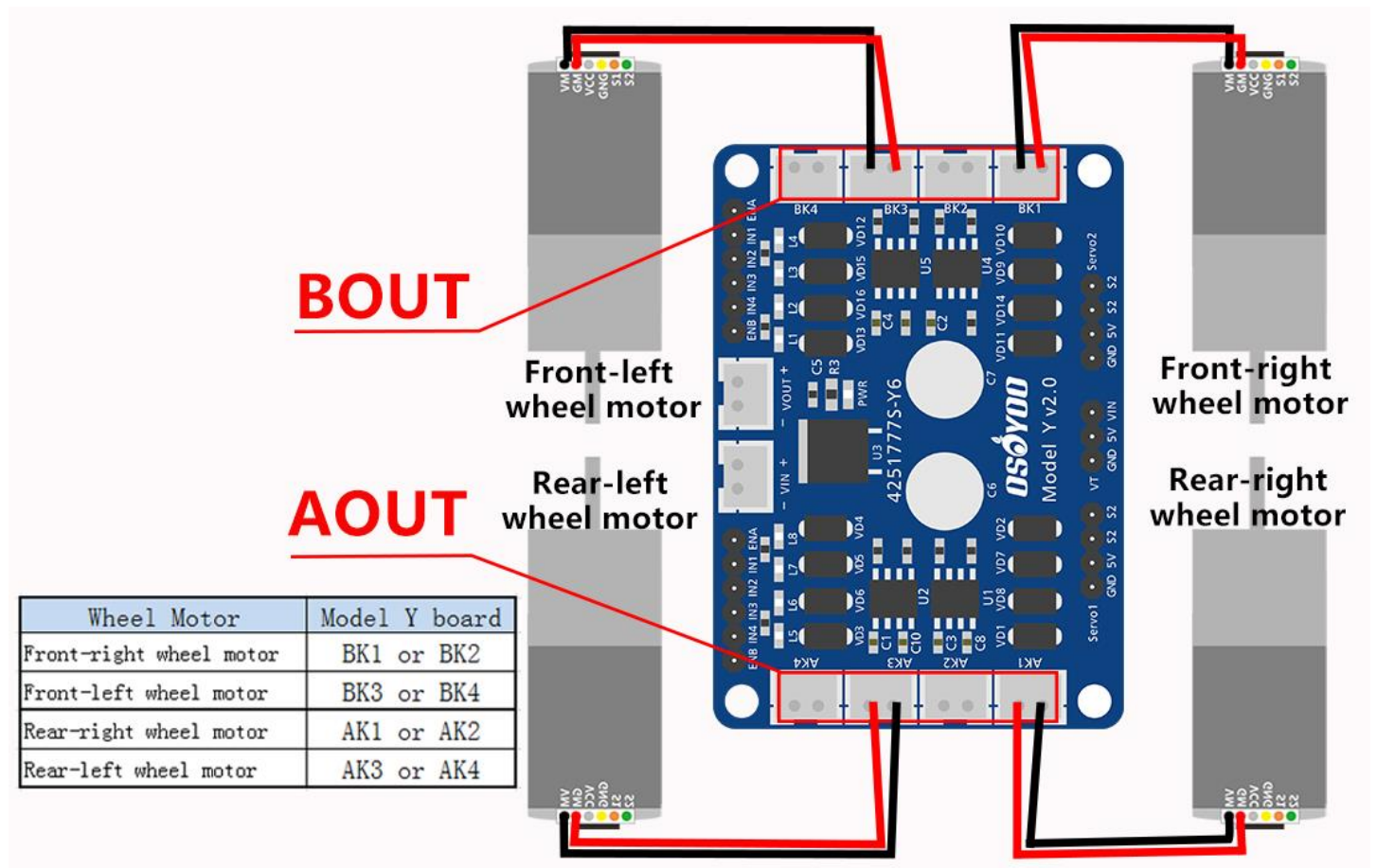
STEP12.

Model Y board M_A IN1,IN2,IN3,IN4 pin connect to D5,D6,D7,D8.

Model Y board M_B IN1,IN2,IN3,IN4 pin connect to D22,D24,D26,D28.

M_A ENA ,ENB pin connect to D11,D12.

M_B ENA ,ENB pin connect to D9, D10.
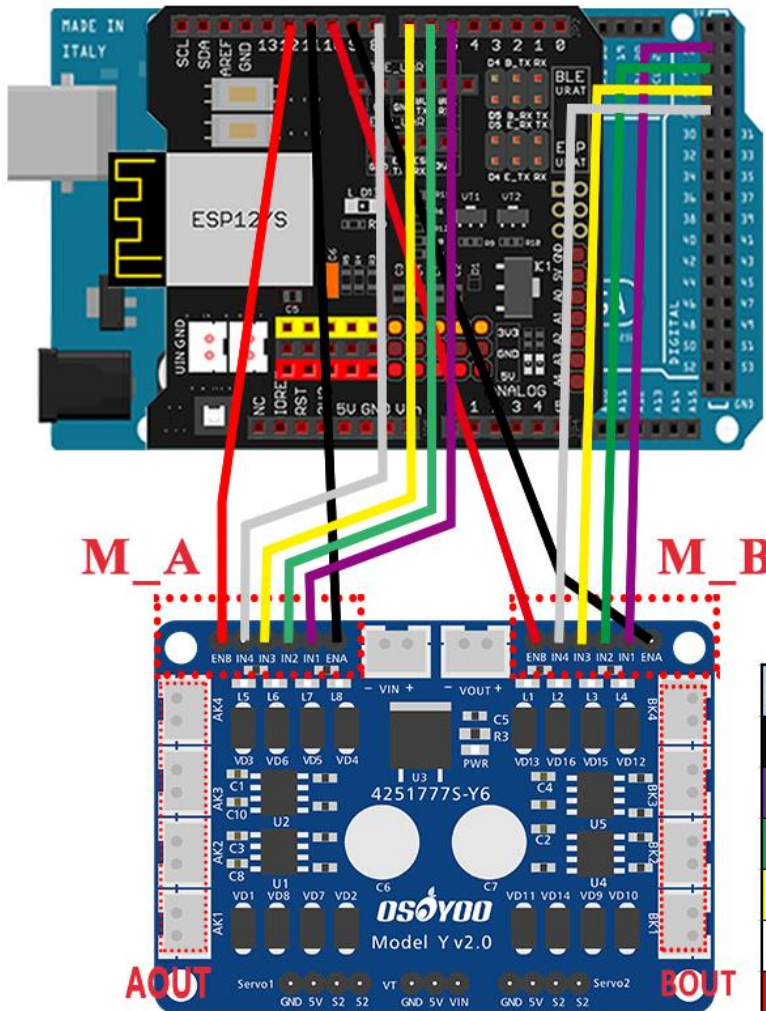
2pcs 6pin male to female wires

Model Y board	Uart Wifi Shield
M_A ENA	D11
M_A IN1	D5
M_A IN2	D6
M_A IN3	D7
M_A IN4	D8
M_A ENB	D12

Model Y board	Uart Wifi Shield	Mega2560 board
M_B ENA	D9	/
M_B IN1	/	D22
M_B IN2	/	D24
M_B IN3	/	D26
M_B IN4	/	D28
M_B ENB	D10	/
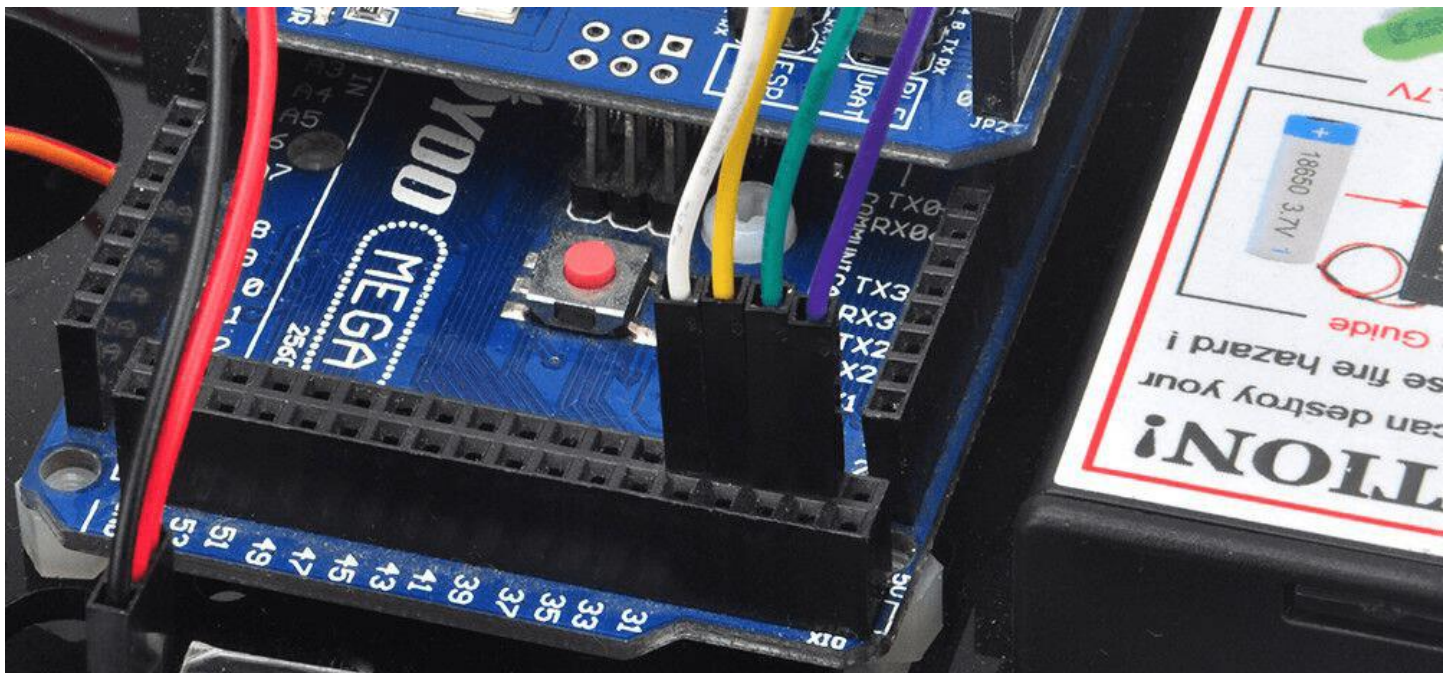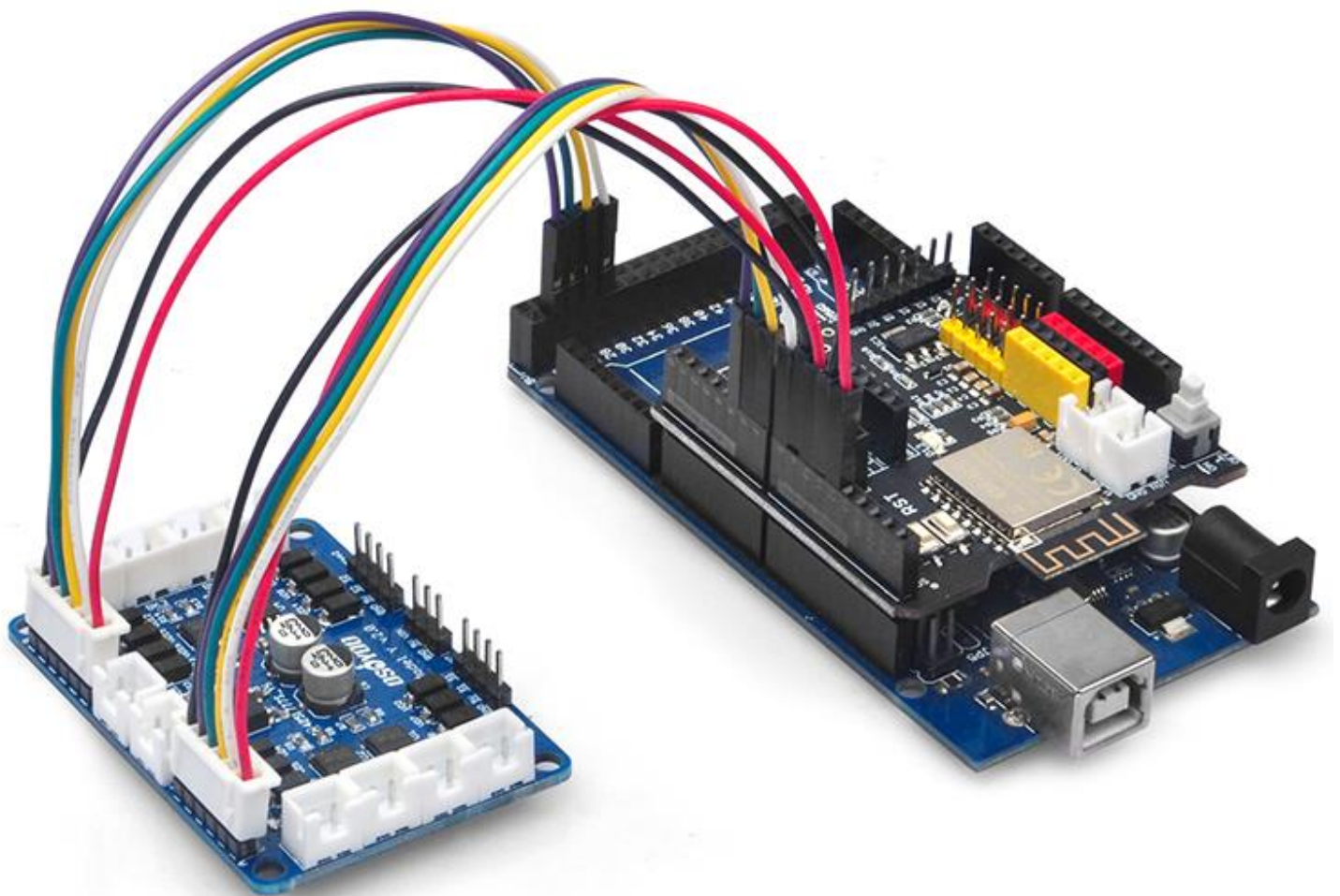
Caution:
When insert/remove the 6-pin parallel cable plug into Model Y 6-pin male socket,   please hold the white plastic pin-holder to do operation. Never drag the wires to pull the plug out of the socket, otherwise it will damage the wires.

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STEP12.

Connect the voltage meter to model Y motor driver board with 3pin female to female cable as following picture.

Connect model Y motor driver board to wifi shield with 2pin XH2.54 female cable.

Connect 18650 battery box to model Y motor driver board as following picture.

Motor Y Board	Voltage Meter
GND	GND
5V	VCC
VT	VT

Front-left wheel motor

Front-right wheel motor

Rear-left wheel motor

Rear-right wheel motor

Front

Front-left
wheel motor

Front-right
wheel motor

Rear-left
wheel motor

Rear-right
wheel motor

Back

Front

18650 battery box

Back

- 16 -

18650 battery box

Open-source Arduino Software(IDE)		Download Arduino IDE here: https://www.arduino.cc/en/Main/Software?setlang=en
7 zip is a free zip utility that un-zips zip files		Download 7zip here for free https://www.7-zip.org/

Step 1: Install latest Arduino IDE (If you have Arduino IDE version after 1.1.16, please skip this step). Download Arduino IDE from https://www.arduino.cc/en/Main/Software?setlang=en , then install the software.

Step 2: Download https://osoyoo.com/driver/mecanum_metal_chassis_m2/m2-lesson1.zip, unzip the download zip file called m2-lesson1.zip , you will see a folder called m2-lesson1.

Step 3: Connect Mega2560 board to PC with USB cable, Open Arduino IDE -> click file -> click Open -> choose code "m2-lesson1.ino" in m2-lesson1 folder, load the code into arduino.

Step 4: Choose corresponding board/port for your project, upload the sketch to the board.

```
1  /*
2  * / _ \ /___)/ _\| | | |/ _ \ / _ \ / ___) _\|     \
3  *| |_| |___ | |_| |_| | |_| | |_| ( (___ |_| | | | |
4  * \___/(___/ \___/ \__  |\___/ \___(_)___)___/|_|_|_|
5  *                  (___/
6  * Arduino Mecanum Omni Direction Wheel Robot Car
7  * Tutorial URL https://osoyoo.com/?p=49235
8  * CopyRight www.osoyoo.com
9
10 * After running the code, smart car will
11 * go forward and go backward for 2 seconds,
12 * left turn and right turn for 2 seconds,
13 * right shift and left shift for 2 seconds,
14 * left diagonal back and right diagonal forward for 2 seconds,
15 * left diagonal forward and right diagonal back for 2 seconds,
16 * then stop.
17 *
18 */
19 #define SPEED 100
```

Done uploading.

```
Sketch uses 2848 bytes (1%) of program storage space. Maximum is 253952 bytes.
Global variables use 9 bytes (0%) of dynamic memory, leaving 8183 bytes for local v
```

218   Arduino Mega or Mega 2560 on COM260

HOW TO PLAY

Disconnect Arduino from PC, put battery into battery box. When you put the car on the ground and turn on the switch on OSOYOO Uart WIFI shield and the switch on battery box if you install battery box for 18650.

After running Lesson 1 code, the car will move

Forward→Backward→Left turn→Right turn→
Right Parallel Shift→Left Parallel Shift→
Up Right Diagonal→Down Left Diagonal→
Up Left Diagonal → Down Right Diagonal

NOTICE

In next lessons, if you want to change the speed performance of the robot car, you need to change the constants in lesson.ino sketch file:

#define MIN_SPEED
#define TURN_SPEED

```
#define SLOW_TURN_SPEED
#define BACK_SPEED
#define SHIFT_SPEED
#define SPEED
#define FAST_SPEED
```

MIN_SPEED is the minimum power required to start the car. If when APP engine toggle is switched to RED, but your car does not move, you need increase this value , if the car runs too fast at engine start moment, you need reduce this value.

TURN_SPEED and SLOW_TURN_SPEED value determines the turning speed of your car. If your car turning too fast, you need reduce these two values, if turning too slow or not turning,increase these two values.

SLOW_TURN_SPEED about 20 to 30 lower than TURN_SPEED value.

BACK_SPEED value determines the reverse back running speed.

SHIFT_SPEED value determines parallel shifting speed.

SPEED value determines forward moving speed

FAST_SPEED: The difference between FAST_SPEED and SPEED determines the slight turning sharpness. The max value of FAST_SPEED is 255.

To get better running performance result, motor power(speed) value should be adjusted properly as per battery level. If motor power(speed) value is too high, your car might run too fast and easy to out of control. If motor power(speed) is too low, the car might not even move.

Lesson 2 Obstacle Avoidance Robot Car

In this lesson, you must complete lesson 1 before you continue on with this lesson. we use the ultrasonic module to "see" obstacle and measure the distance. If the distance is less than predefined threshold value, the buzzer will beep and the car will turn around from the obstacle automatically.

PARTS & DEVICES

OSOYOO Mecanum Wheels Robotic Car Chassis x 1 (2xleft-wheels/2xright-wheels and Motor x 4)
OSOYOO Mega2560 board fully compatible with Arduino x 1
OSOYOO WiFi shield x 1
OSOYOO Model Y motor driver x 1
OSOYOO MG90 servo motor x 1
OSOYOO Ultrasonic sensor module x1
OSOYOO Ultrasonic mount holder
OSOYOO Battery box x 1
OSOYOO 3pin female to female jumper wire x1
OSOYOO 6pin male to female jumper wire x2
OSOYOO 2 pin XH.25 female to female x1
OSOYOO 10 pin jumper wire male to female x1
18650 Batteries (3.7V) x 2

HARDWARE INSTALLATION

You must complete lesson 1 (assembling the car) before you continue on with this lesson. In this lesson3, we will add a servo motor and to the robotic car built in Lesson 1.

STEP1: Install Ultrasonic Module to mount holder with 4pcs M1.4*8 screw and M1.4 nuts.
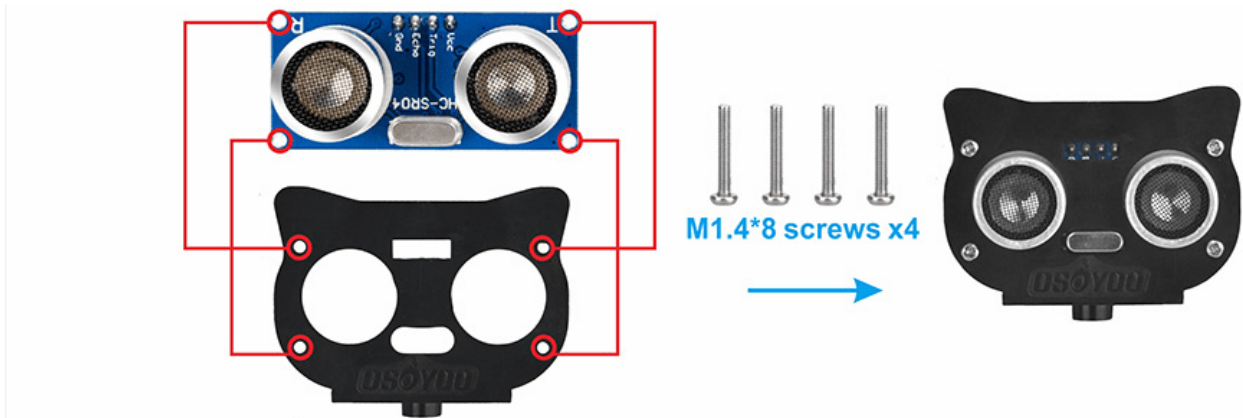
STEP2: Install mount holder for ultrasonic module on servo motor with M2*4 Self Tapping screw.

When placing the ultrasonic underneath,as the self tapping screws screws easily strip.
A.Support the motor from underneath,as the self tapping screws easily strip.
B.Do not insert the screw until after the alignment process.
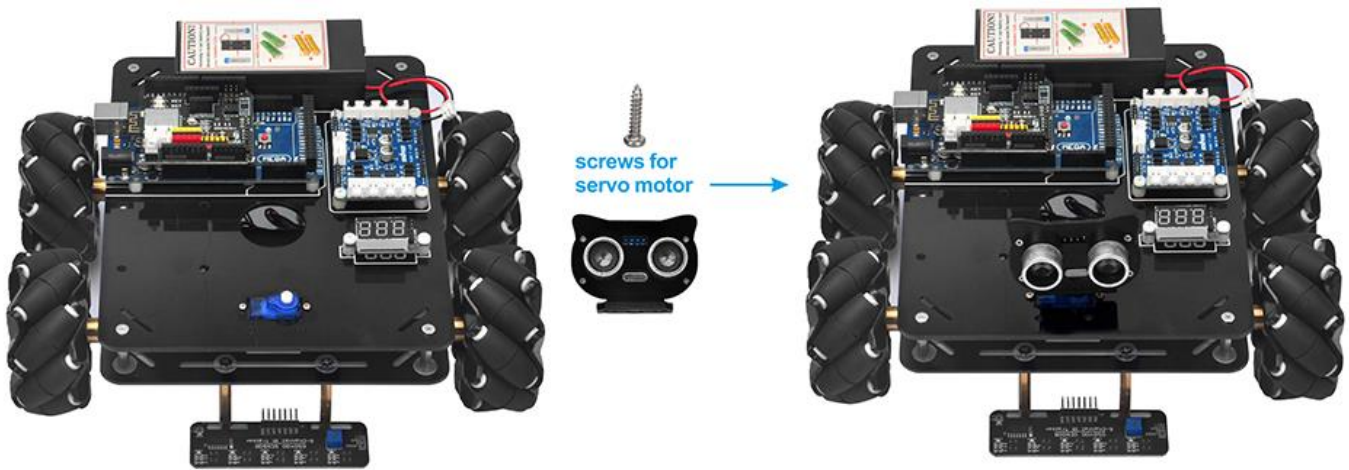
CIRCUIT CONNECTION

You must complete lesson 1 (assembling the car) circuit connection. No need change anything, just keep the hardware wire connection as it is.

STEP3: Please keep all lesson 1 connections same as it is. Before connecting wires, make sure that you have connect SG90 servo motor to model Y board and OSOYOO uart wifi shield as follows.

(Note: You need split 1 pcs of male-to-female jumper wires from our 10-pc jumper wire bundle. Any color from the bundle will be ok. The rest of wires are as spare parts for potential broken or damaged wires.)

Model Y Board	Wifi Board
S	D13

Model Y board	MG90 Servo
S	S (orange)
5V	5V (red)
GND	GND (brown)
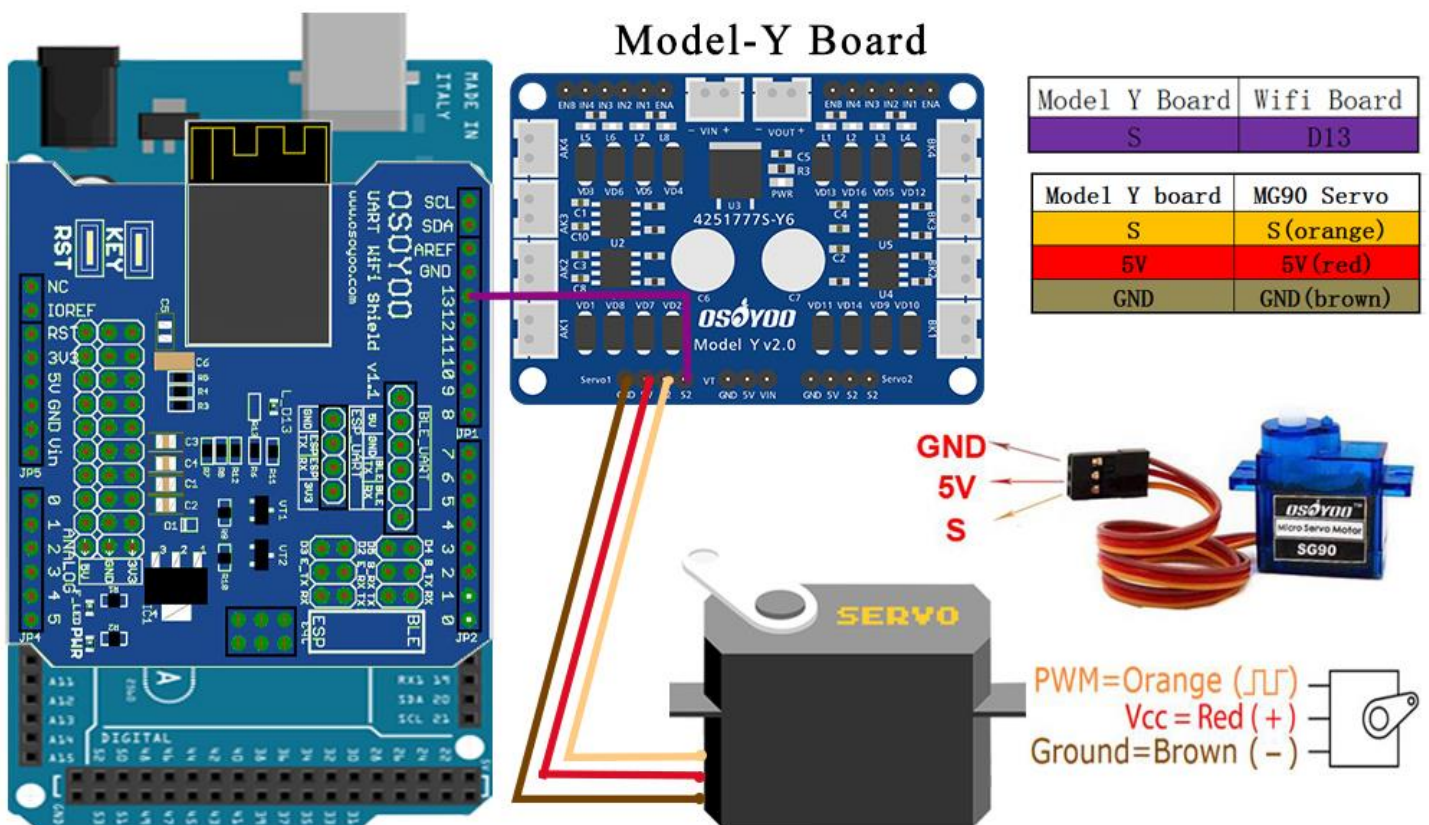
STEP4: Connect VCC,Trig,Echo,GND of ultrasonic module to 5V,D30,D31,GND of wifi shield with 4 pcs of male-to-female jumper wires.
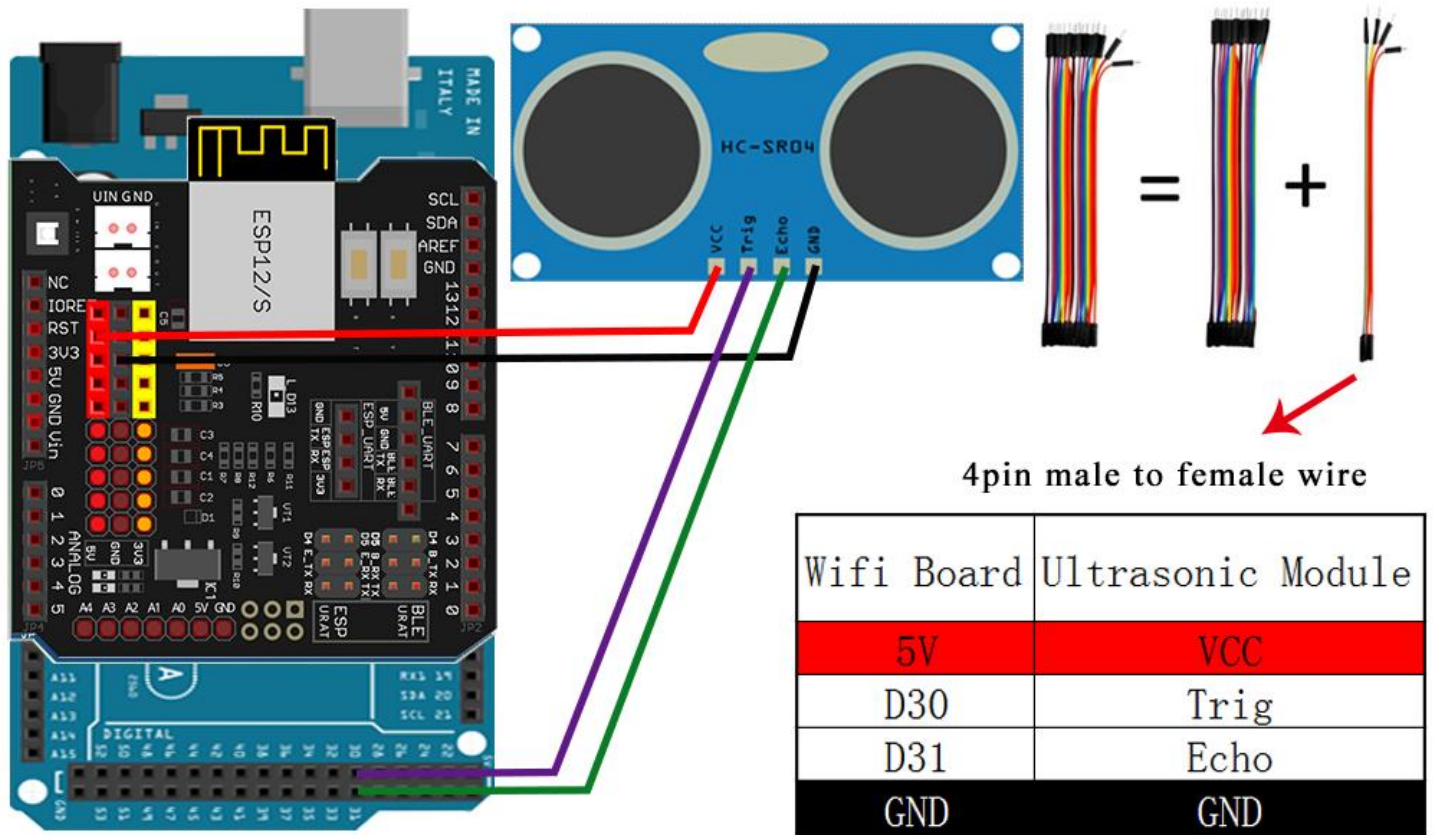
(Note: You need split 4 pcs of male-to-female jumper wires from our 10-pc jumper wire bundle. Any color from the bundle will be ok. The rest of wires are as spare parts for potential broken or damaged wires.)


4pin male to female wire

Wifi Board	Ultrasonic Module
5V	VCC
D30	Trig
D31	Echo
GND	GND

SOFTWARE INSTALLATION

| Open-source Arduino Software(IDE)		Download Arduino IDE here: https://www.arduino.cc/en/Main/Software?setlang=en
7 zip is a free zip utility that un-zips zip files		Download 7zip here for free https://www.7-zip.org/

Step 1: Install latest Arduino IDE (If you have Arduino IDE version after 1.1.16, please skip this step). Download Arduino IDE from https://www.arduino.cc/en/Main/Software?setlang=en , then install the software.

Step2: Download **https://osoyoo.com/driver/mecanum_metal_chassis_m2/m2-lesson2.zip** , unzip the download zip file m2-lesson2.zip, you will see a folder called m2-lesson2 .）

Step3: Connect Mega2560 board to PC with USB cable, Open Arduino IDE -> click file -> click Open -> choose code "m2-lesson2" in lesson folder, load the code into Arduino as following.
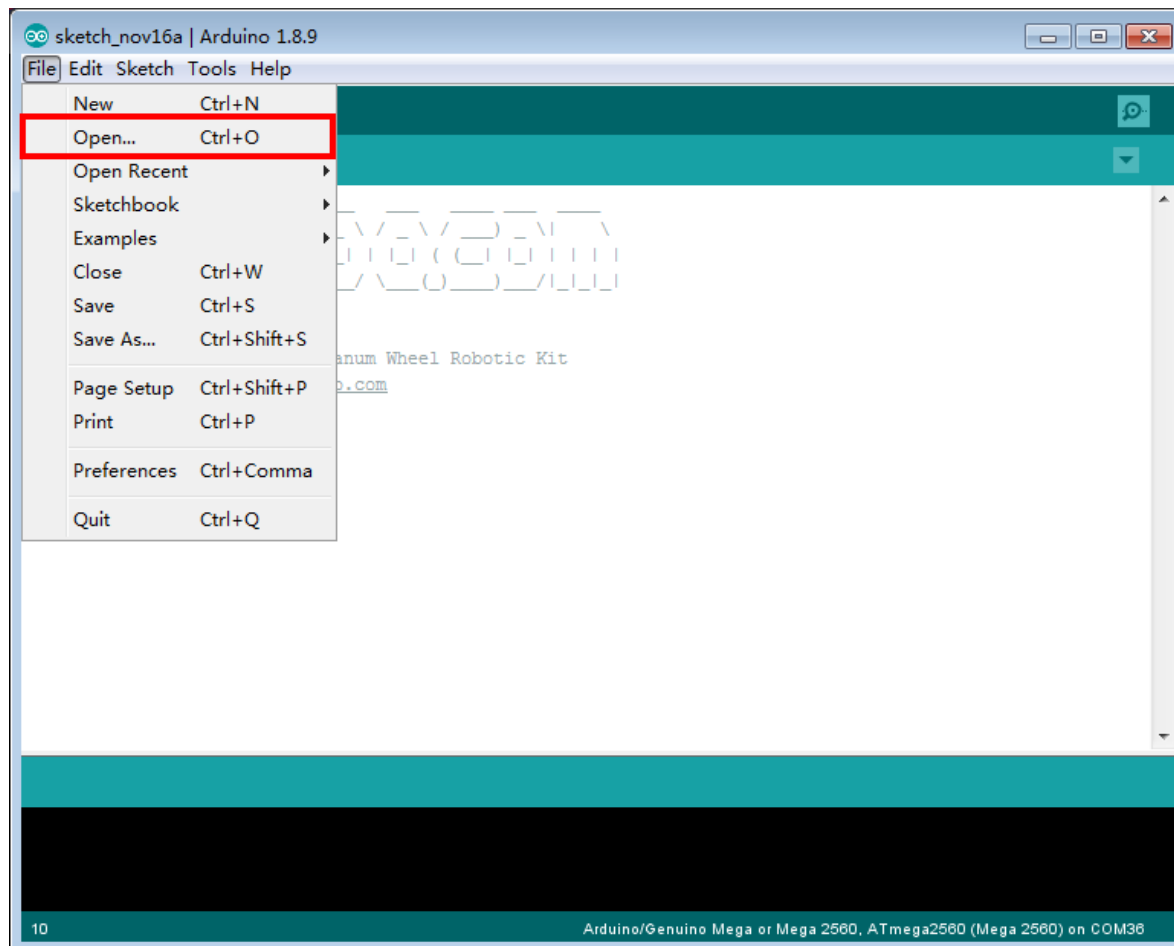
Step4: Choose corresponding board/port for your project, upload the sketch to the board.
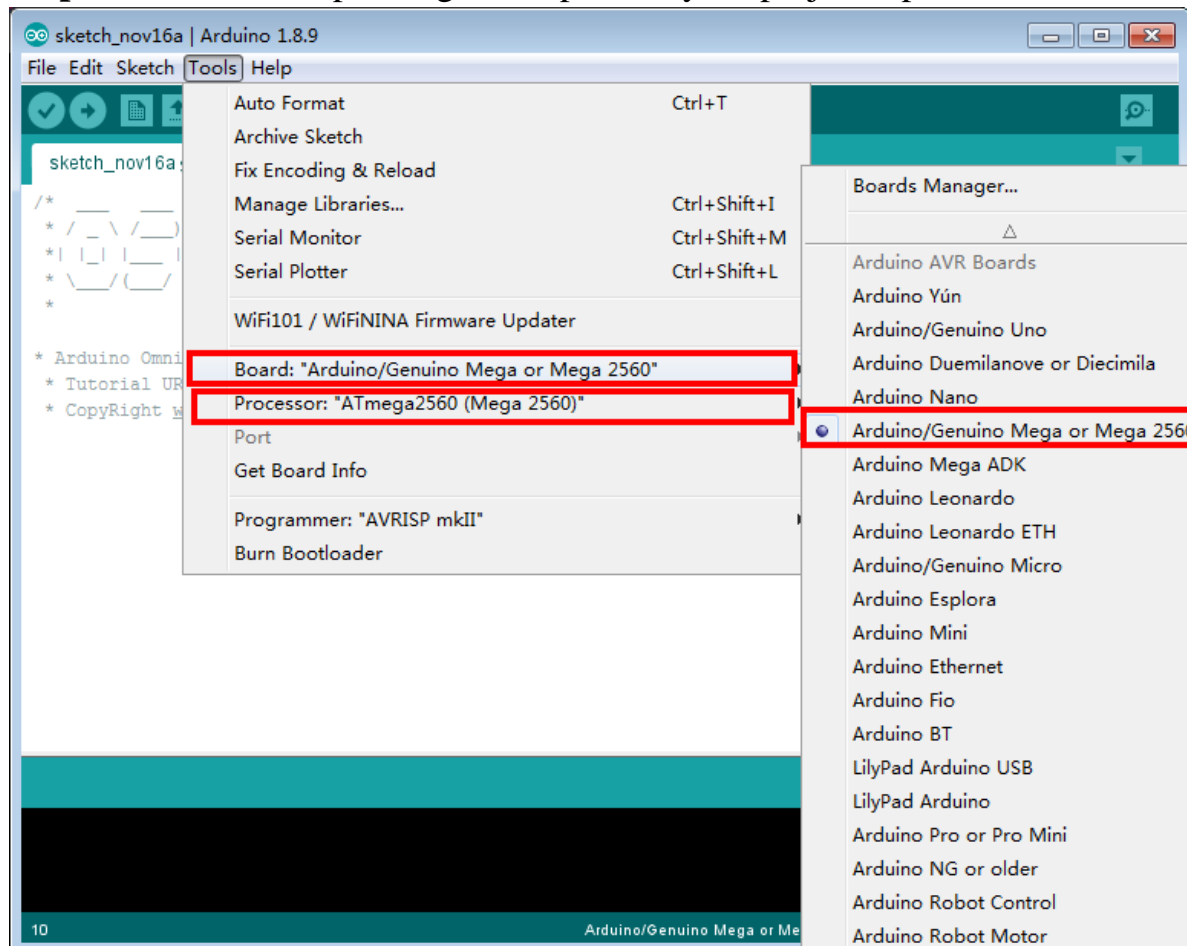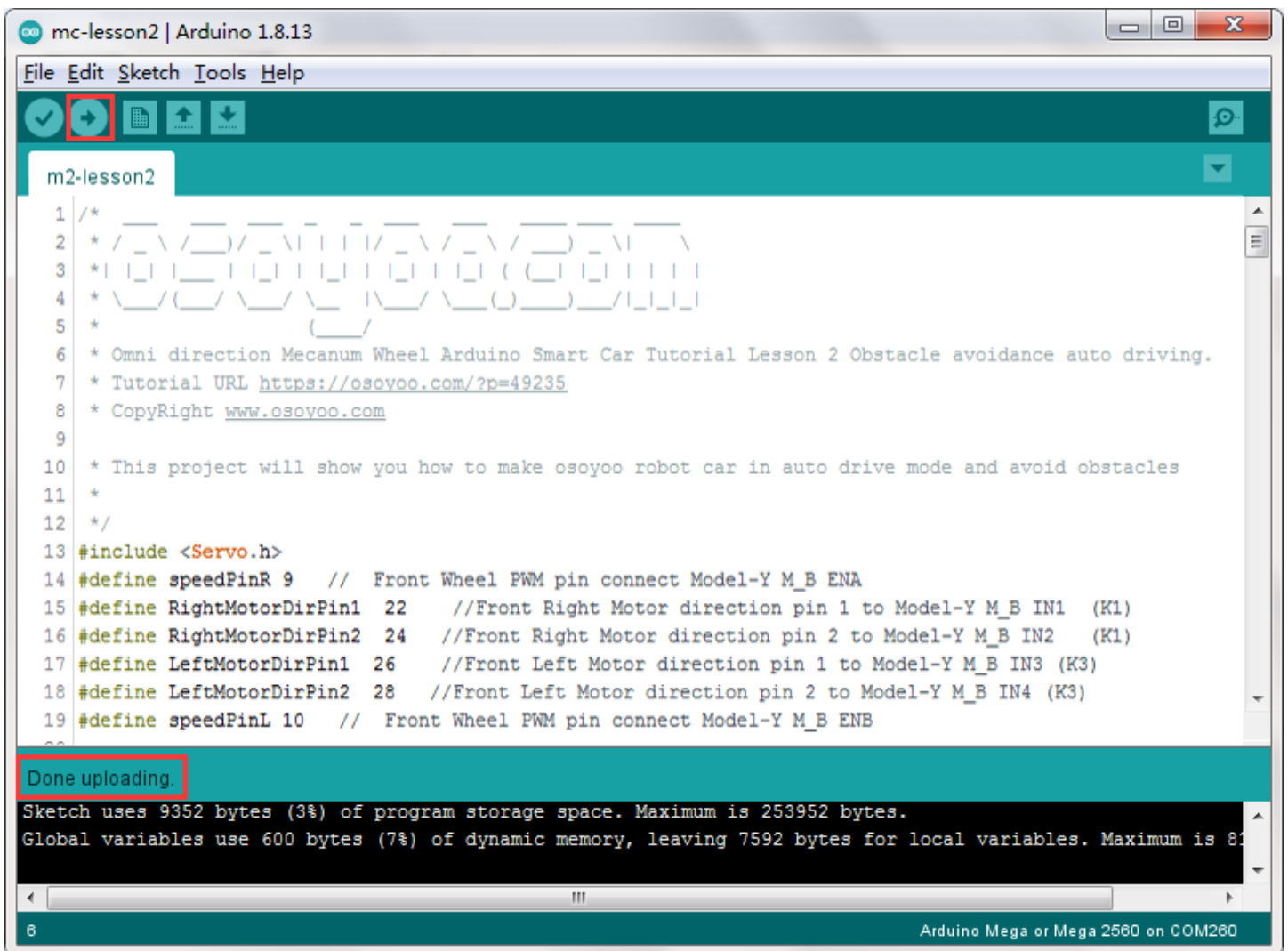
Step5: Ultrasonic sensor servo initial direction alignment

After turning on the battery, the servo will make some movement and finally stops at a direction for 5 seconds.During this first 5 seconds, you must make sure the Ultrasonic sensor(two eyes) is facing straight forward.

If it is not straight forward, you should turn off battery immediately and remove the sensor from 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. If its direction is not straight forward, turn off battery and do direction alignment again.
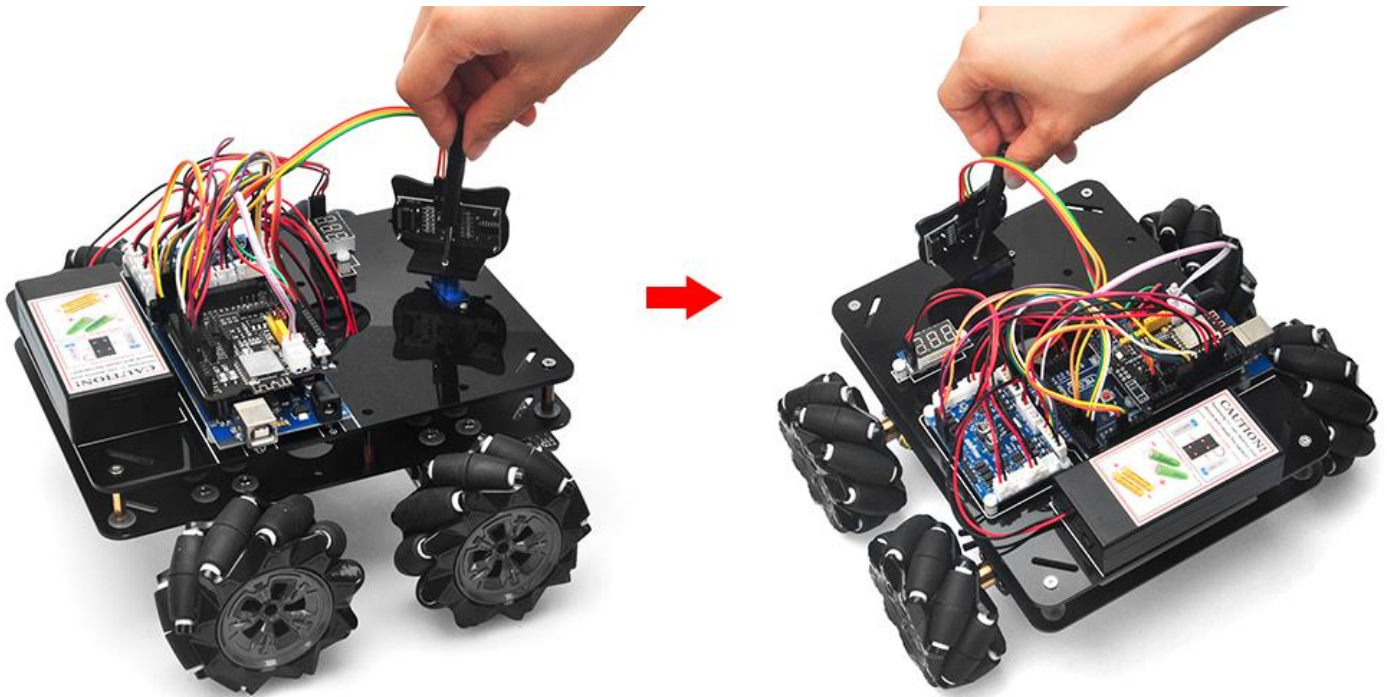
If the ultrasonic module turn to front view position, that means you no need adjust sensor position anymore. Just wait 5 seconds.

If no obstacle is detected, the car will go forward. If any obstacles is detected, the car will stop, the ultrasonic module will turn from right to left to detect surrounding obstacle.

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.

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.

Important parameters in the sketch file

Following parameters in Line 35 to 39 of m2-lesson2.ino are very important to make performance tuning. See the comments in the #define statements:

#define FAST_SPEED 170 //both sides of the motor speed

#define SPEED 100 //both sides of the motor speed

```
#define TURN_SPEED 150 //both sides of the motor speed

#define BACK_SPEED1 150 //back speed

#define BACK_SPEED2 100 //back speed
```

```
#define TURN_SPEED 150 //both sides of the motor speed

#define BACK_SPEED1 150 //back speed

#define BACK_SPEED2 100 //back speed
```

Lesson 3 Line Following Robot Car

In this lesson3, we will add a 5-Point tracking sensor module to the robotic car built in Lesson1.

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.

PARTS & DEVICES

OSOYOO Mecanum wheels robotic car chassis x 1 (2x left-wheels/2x right-wheels and Motor x 4)

OSOYOO Mega2560 board fully compatible with Arduino   x 1

OSOYOO WiFi shield x 1

OSOYOO Model Y motor driver x 1

OSOYOO 5-Point Tracking sensor module

OSOYOO 3pin female to female jumper wire x1

OSOYOO 6pin male to female jumper wire x2

OSOYOO 7pin female to female jumper wire x1

OSOYOO 2 pin XH.25 female to female x1

OSOYOO Battery box x 1

18650 Batteries(3.7V) x 2
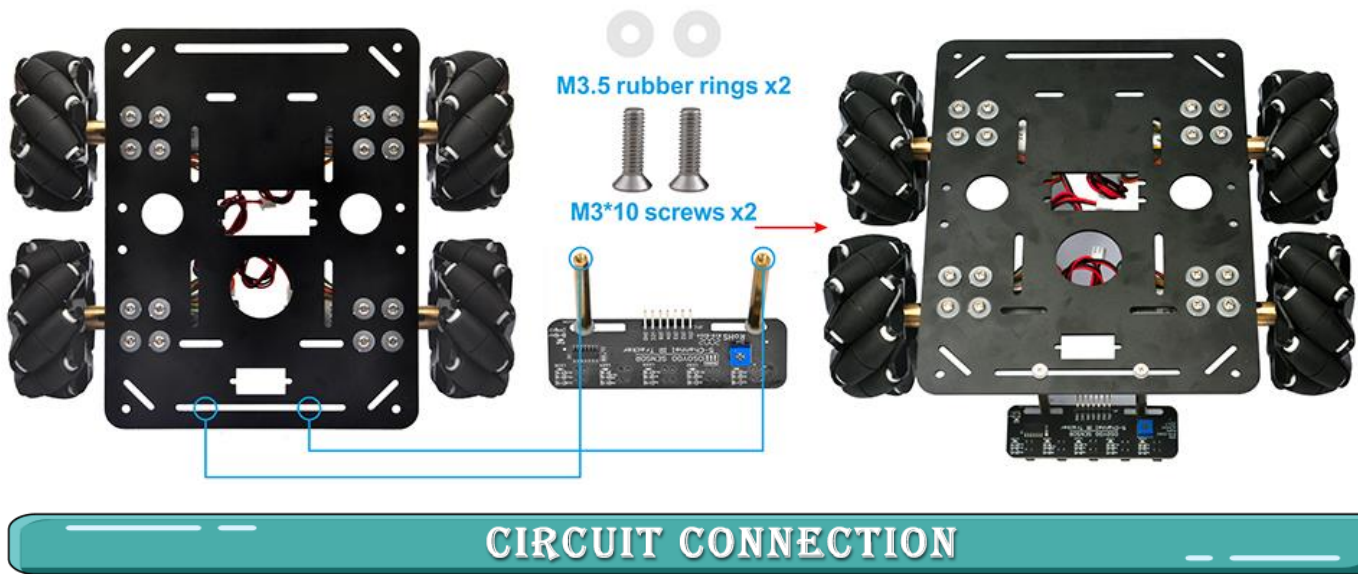
HARDWARE INSTALLATION

You must complete lesson 1 (assembling the car) before you continue on with this lesson.

STEP1: We have install 2pcs M3x40 copper pillars with 2pcs M3 screws and 2pcs M3.5 rubber rings on tracking sensor in lesson1 as following pictures.
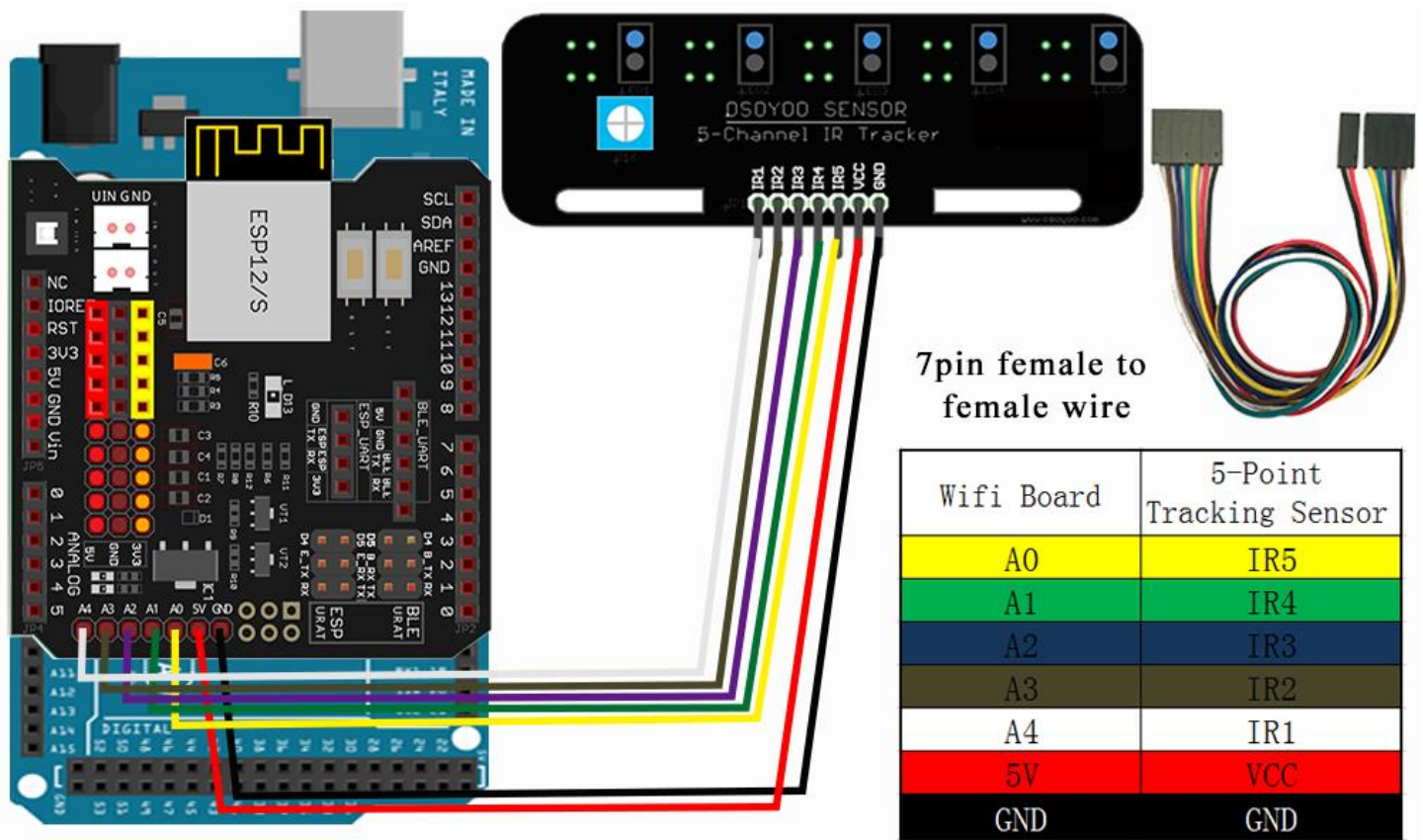
STEP2. We have added a 5-Point tracking sensor module to the car chassis with M3 nuts in lesson1 as following pictures.

Start the installation from previous status of <u>Lesson 1</u>. If you have installed Lesson 1, no need change anything, just keep the hardware wire connection as it is.

STEP3 : Connect 5-point tracking sensor board to WIFI Shield as per following picture.

Connect GND pin of tracking sensor module to GND of wifi shield;
Connect VCC pin of tracking sensor module to 5V of wifi shield;
Connect IR1,IR2,IR3,IR4,IR5 pins to A4, A3, A2,A1,A0 with 7pin female to female cable as the following photo shows (Remember: DO NOT remove any existing wires installed in Lesson 1).

Wifi Board	5-Point Tracking Sensor
A0	IR5
A1	IR4
A2	IR3
A3	IR2
A4	IR1
5V	VCC
GND	GND

SOFTWARE INSTALLATION

| Open-source Arduino Software(IDE)		Download Arduino IDE here: https://www.arduino.cc/en/Main/Software?setlang=en
7 zip is a free zip utility that un-zips zip files		Download 7zip here for free https://www.7-zip.org/

Adjust the sensitivity of tracking sensor modules.

Turn on and hold the car and adjust the potentiometer on the tracking sensor with cross screwdriver until you get the best sensitivity status: the signal indicate LED light will turn off when sensor is above white ground, and the signal LED will turn on when the sensor is above black track.

Step 1: Install latest Arduino IDE (If you have Arduino IDE version after 1.1.16, please skip this step). Download Arduino IDE from https://www.arduino.cc/en/Main/Software?setlang=en , then install the software.

Step 2: Download https://osoyoo.com/driver/mecanum_metal_chassis_m2/m2-lesson3.zip , unzip the download zip file m2-lesson3.zip, you will see a folder called m2-lesson3 .

Step 3: Connect Mega2560 board to PC with USB cable, Open Arduino IDE -> click file -> click Open -> choose code "m2-lesson3.ino" in lesson folder, load the code into Arduino as following.
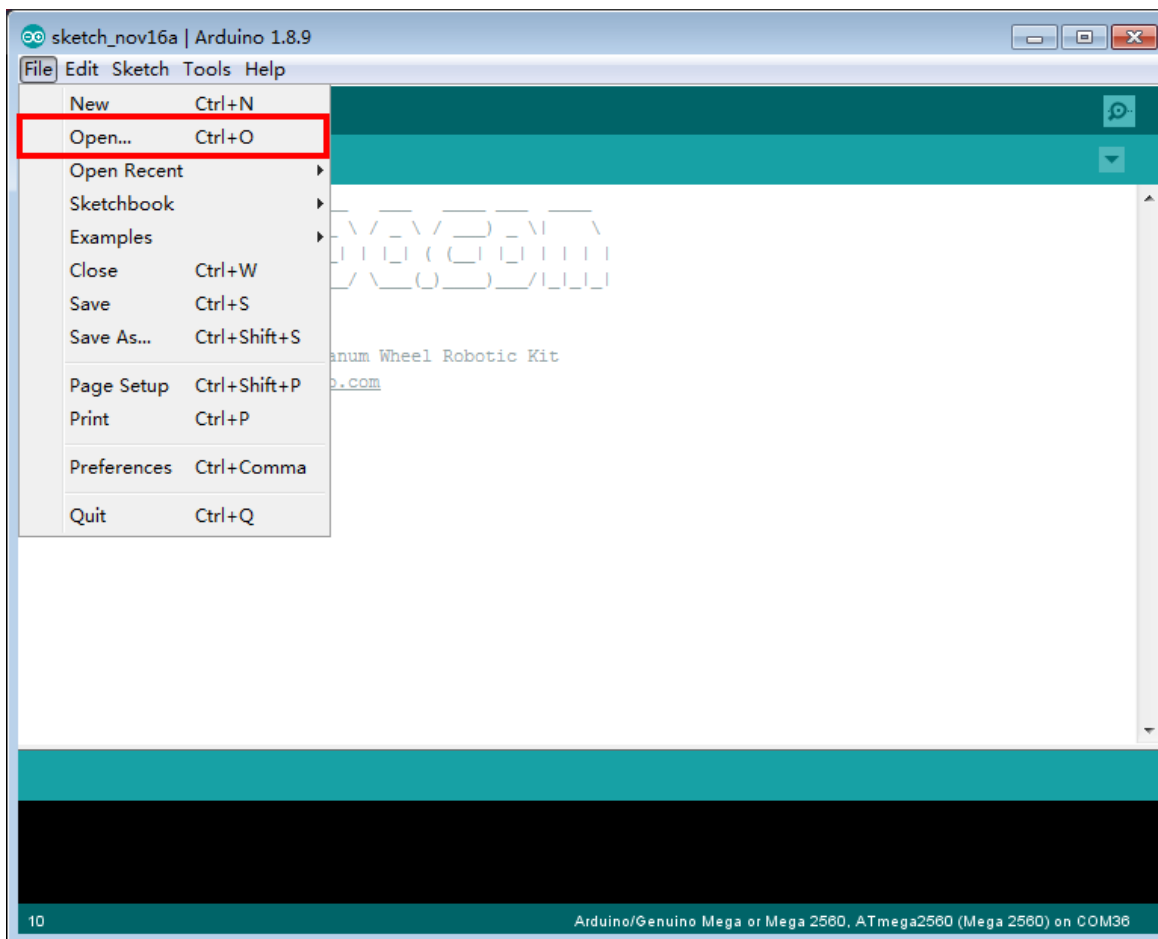
Step 4: Choose corresponding board/port for your project, upload the sketch to the board.

Step 5: Adjust the sensitivity of tracking sensor modules.

Turn on and hold the car and adjust the potentiometer on the tracking sensor with cross screwdriver until you get the best sensitivity status: the signal indicate LED light will turn off when sensor is above white ground, and the signal LED will turn on when the sensor is above black track.
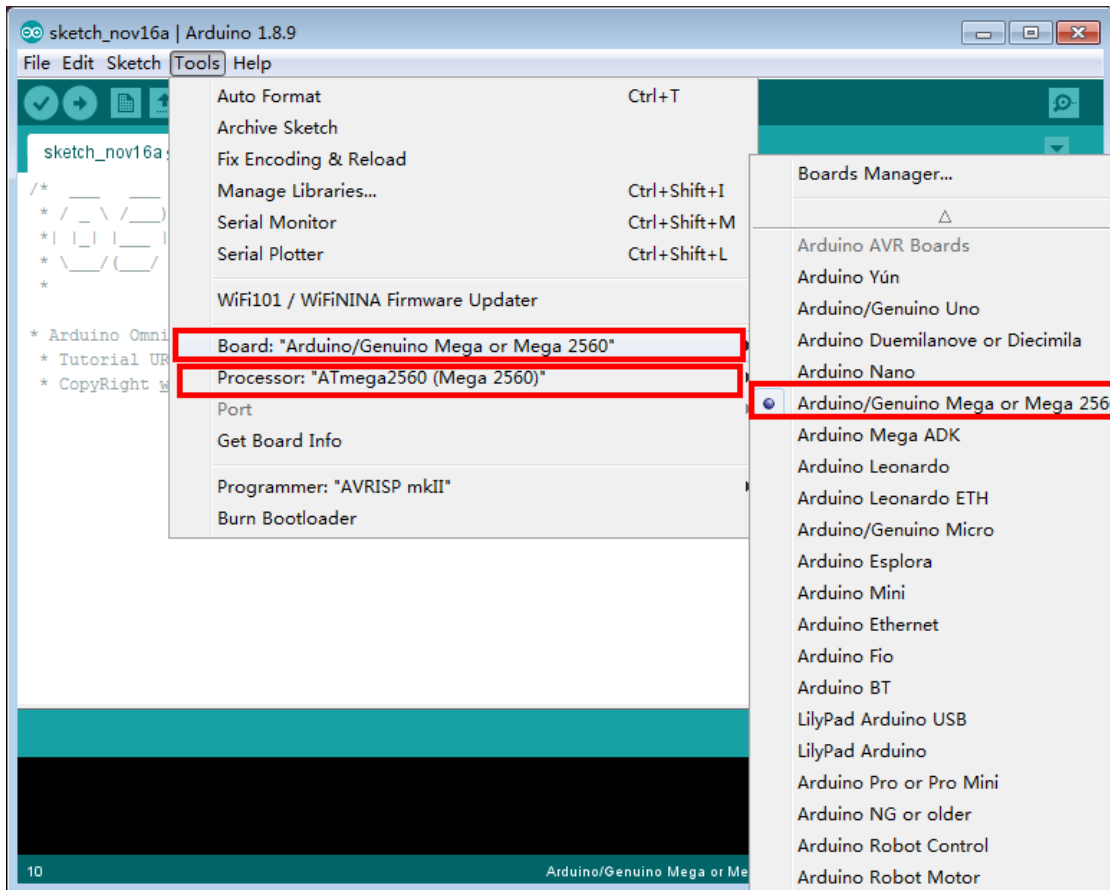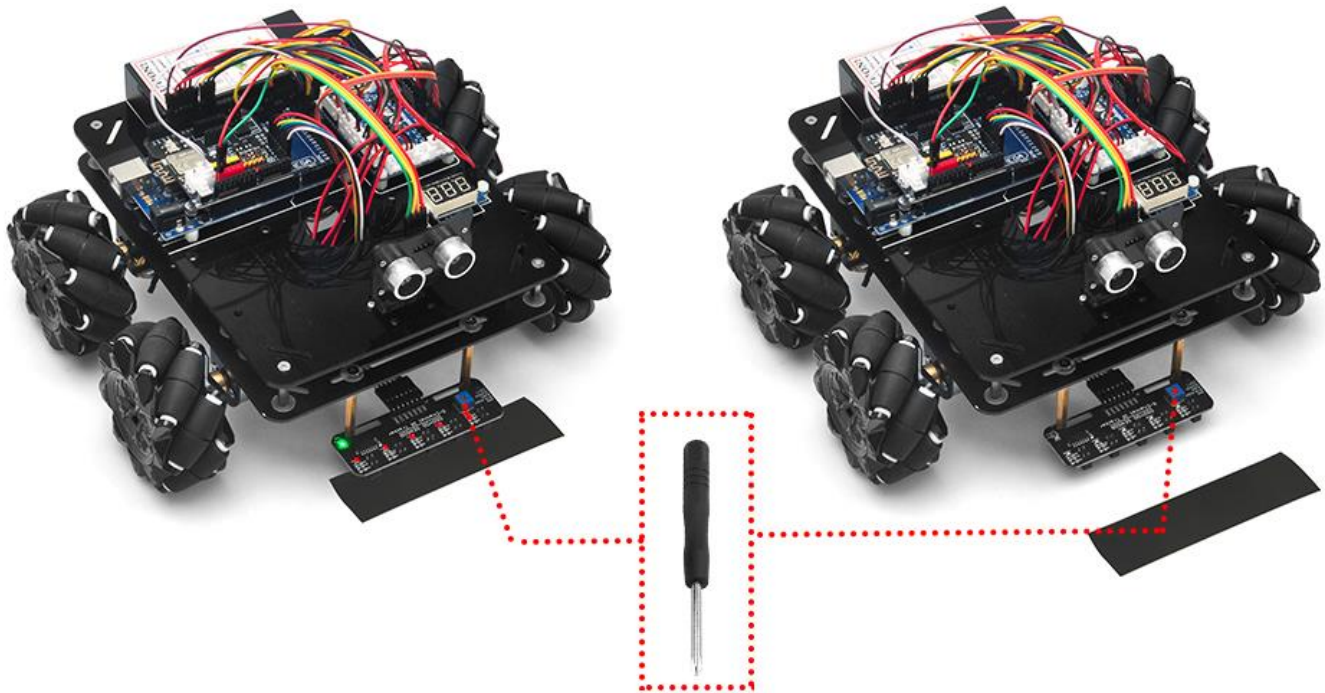

HOW TO PLAY

Prepare a black track (the width of the black track must be between 20mm and 30mm) in white ground. Please be noted that the bend angle of track can't be too sharp otherwise the car will move out of the track.

Turn on the car and put the middle of tracking sensor module facing over black track, and then the car will move along the black track automatically.

Motor Speed Tuning for better tracking performance

To get better tracking performance result, motor power(speed) value should be adjusted properly as per battery level. If motor power(speed) value is too high, your car might run too fast and easy to get out of track. If motor power(speed) is too low, the car might not even move.
To adjust the motor power value, you need change the 3 constants : MID_SPEED, HIGH_SPEED,LOW_SPEED in line 14,15,16 in m2-lesson3.ino sketch file. Their default values are 100,120,80 which are good when batteries are fully charged.

After batteries are running low, you might need to increase the value of these 3 constants. You can gradually add or reduce 10 each time on these values and compare which values have best tracking performance.

Lesson 4 Bluetooth Controlled Imitation Driving

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

In this project, we will show how to use Arduino to control an Osoyoo Brand mecanum wheel robot car.

PARTS & DEVICES

OSOYOO Mecanum Wheels Robotic Car Chassis x 1 (2xleft-wheels/2xright-wheels and Motor x 4)

OSOYOO Mega2560 board fully compatible with Arduino x 1

OSOYOO WiFi shield x 1

OSOYOO Model Y motor driver x 1

OSOYOO MG90 servo motor x 1

OSOYOO Ultrasonic sensor module x1

OSOYOO Ultrasonic mount holder

OSOYOO Battery box x 1

OSOYOO 3pin female to female jumper wire x1

OSOYOO 6pin male to female jumper wire x2

OSOYOO 2 pin XH.25 female to female x1

OSOYOO 10 pin jumper wire male to female x1

18650 Batteries (3.7V) x 2

HARDWARE INSTALLATION

You must complete [lesson 1 (assembling the car)](#) before you continue on with this lesson. No need change anything, just keep the hardware wire connection as it is.
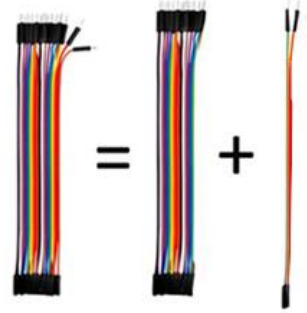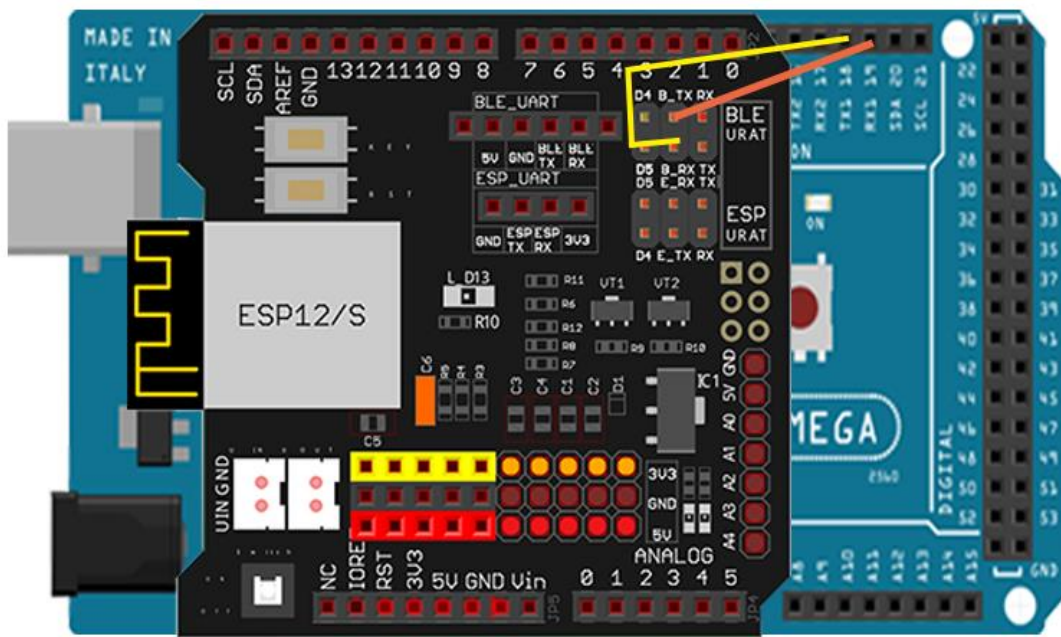
CIRCUIT CONNECTION

**STEP1:** Connect B_TX and B_RX to D19 and D18.

(Note: You need split 2 pcs of male-to-female jumper wires from our 10-pc jumper wire bundle. Any color from the bundle will be ok. The rest of wires are as spare parts for potential broken or damaged wires.)

Wifi Board	Arduino mega2560
B_TX	D19
B_RX	D18

2pin male to female wire

STEP2: Bluetooth Module should be inserted into bluetooth 6-pin slot in OSOYOO Wifi Board
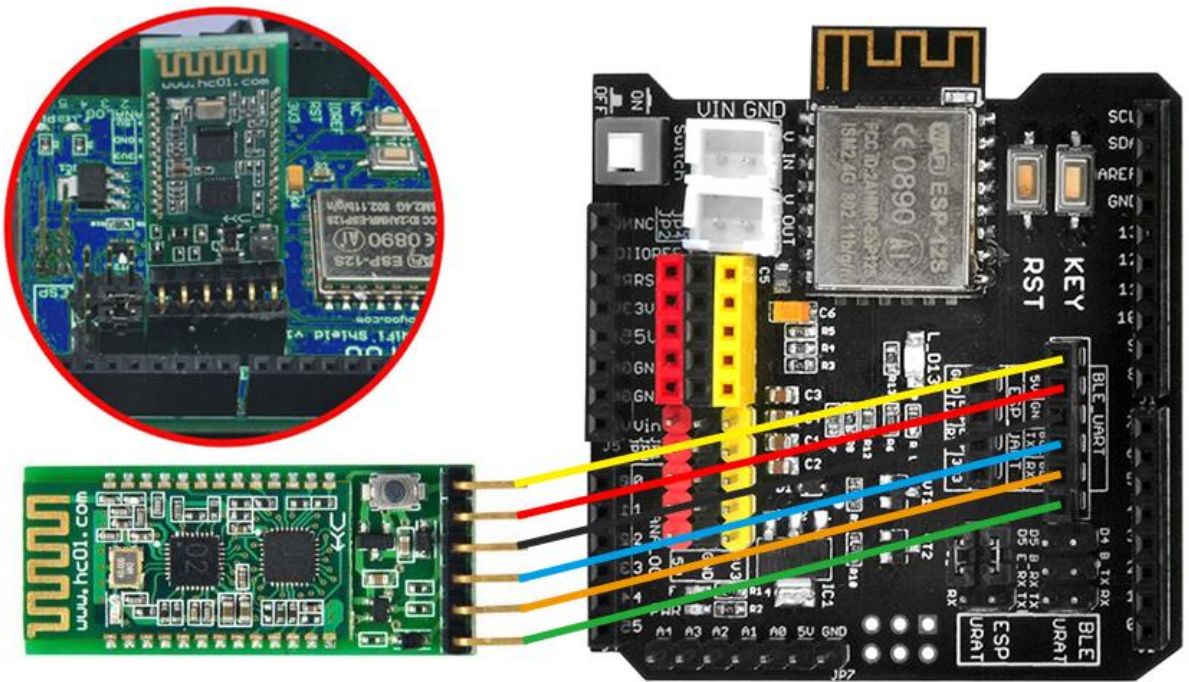
SOFTWARE INSTALLATION

Open-source Arduino Software(IDE)		Download Arduino IDE here: https://www.arduino.cc/en/Main/Software?setlang=en

|		
7 zip is a free zip utility that un-zips zip files		Download 7zip here for free https://www.7-zip.org/

Step 1: Install latest Arduino IDE (If you have Arduino IDE version after 1.1.16, please skip this step). Download Arduino IDE from https://www.arduino.cc/en/Main/Software?setlang=en , then install the software.

Step 2: Download https://osoyoo.com/driver/mecanum_metal_chassis_m2/m2-lesson4.zip, unzip the download zip file m2-lesson4.zip, you will see a folder called m2-lesson4 .

Step 3: Connect mega2560 board to PC with USB cable, Open Arduino IDE -> click file -> click Open -> choose code "lesson4.ino" in lesson4 folder, load the code into arduino.
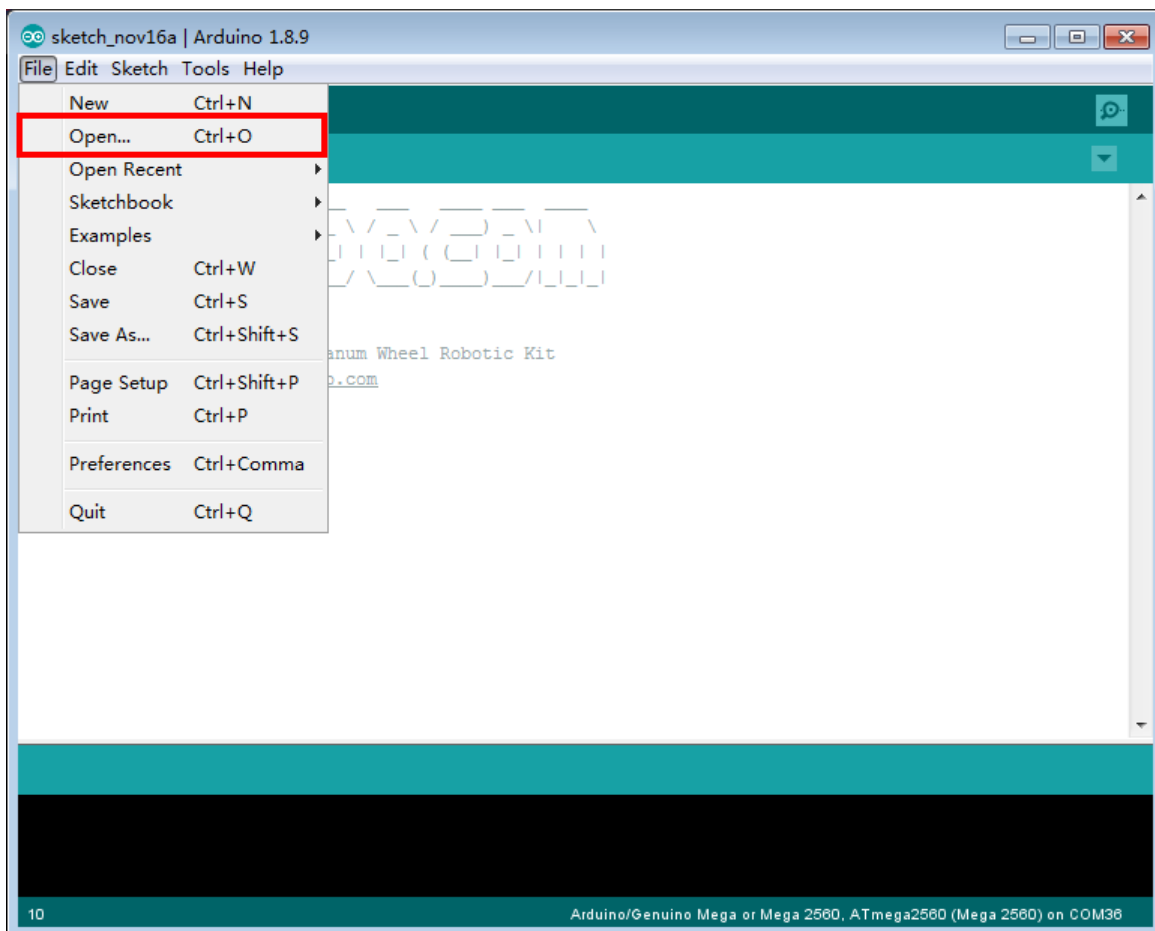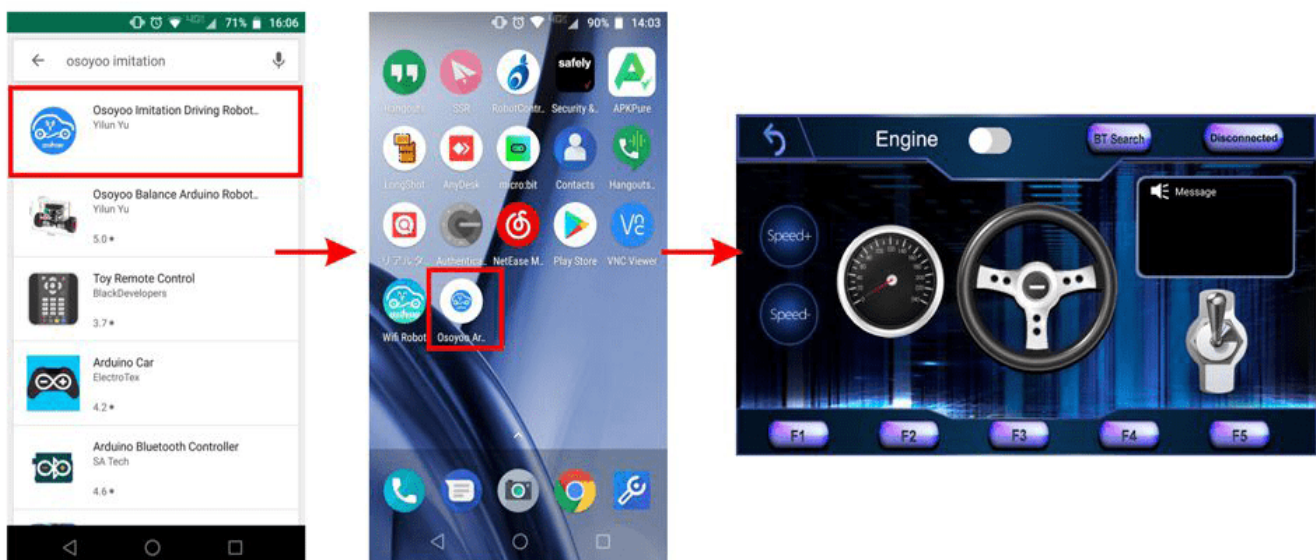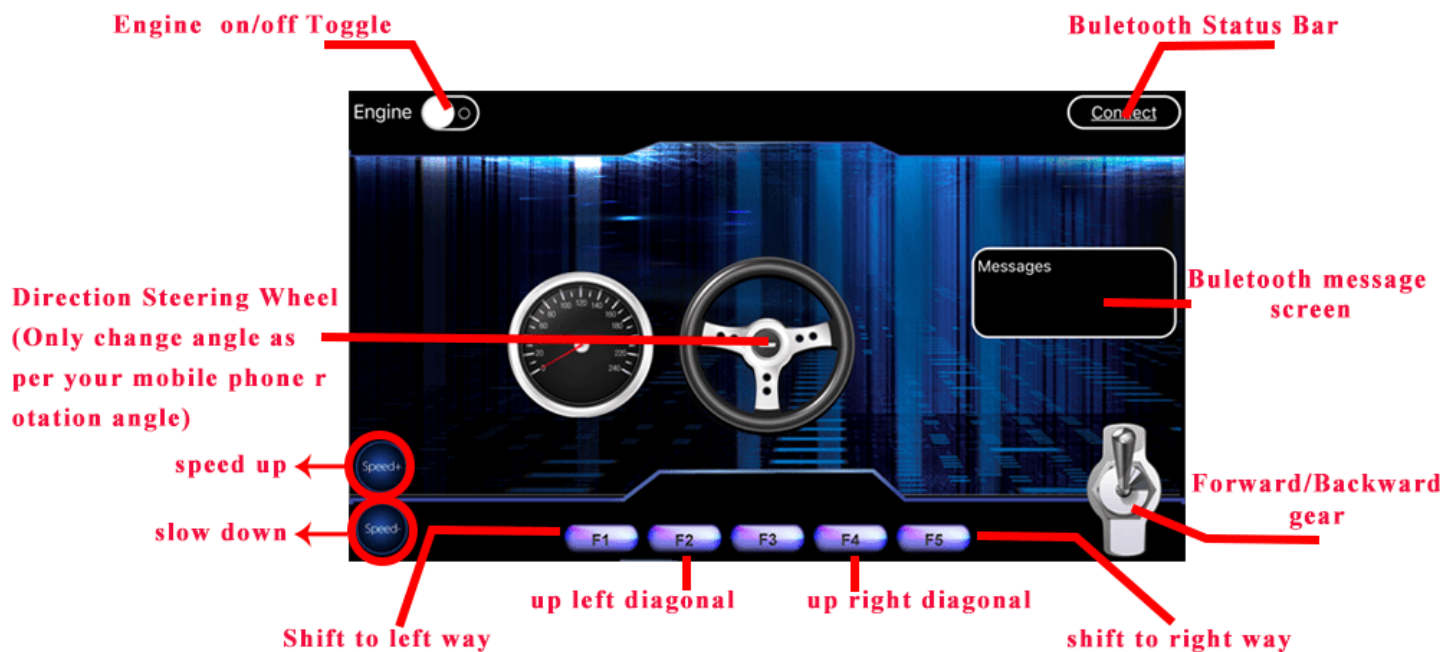
Step 4: Choose corresponding board/port for your project,upload the sketch to the board.
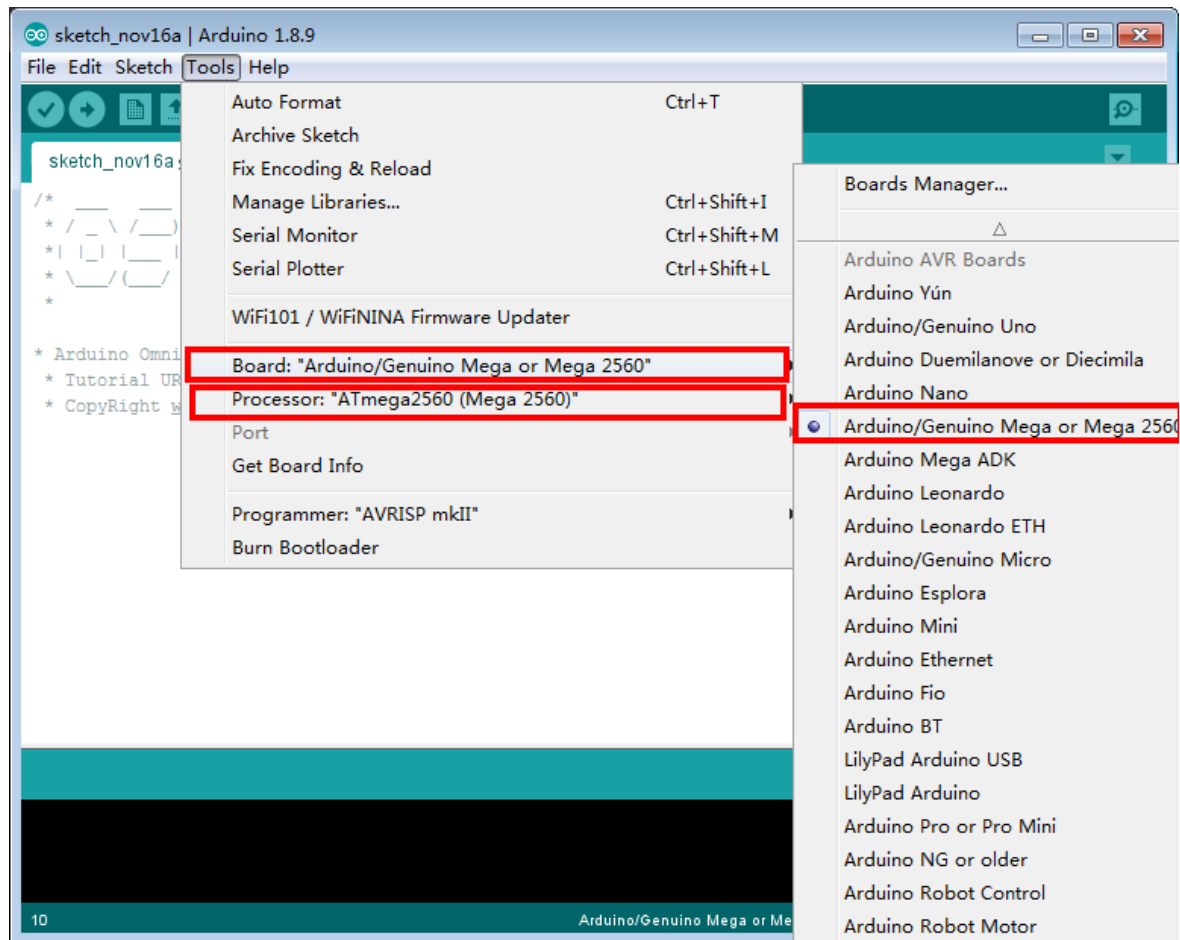
Mobile APP:

Go to your Google Play or Apple APP store and search APP name "OSOYOO imitation driving", Download the APP as following and install it in your smart phone.

Engine on/off Toggle

Buletooth Status Bar

Direction Steering Wheel
(Only change angle as
per your mobile phone r
otation angle)

Buletooth message
screen

speed up

slow down

Forward/Backward
gear

Shift to left way

up left diagonal

up right diagonal

shift to right way

HOW TO PLAY

Power on the robot, and open APP.

1) If you have not paired Bluetooth module with your cell phone, please pair the bluetooth module first before open the APP. In your cell phone Setting-> Bluetooth ,find a Bluetooth device called **HC02**, pair it with password 1234

2) After bluetooth HC02 device is paired, open the APP. If you are using Android APP, Click **BT Search** Button to connect APP to HC02 device, if it is iOS APP, just click **connect**

3) Click Engine Switch to start/stop the car

4) Click Speed +/- button to accelerate or reduce speed

5) Rotate the mobile phone to change direction (steering wheel will rotate while you are turning the phone).

6) Click Gear button to change gear to Forward or Backward direction.

7) Press F1 to Shift to left way, F5 to shift to right way, F3 to up left diagonal, F4 to up right diagonal.

NOTICE

Motor Speed Tuning for better performance

To get better running performance result, motor power(speed) value should be adjusted properly as per battery level. If motor power(speed) value is too high, your car might run too fast and easy to out of control. If motor power(speed) is too low, the car might not even move.

To adjust the motor power value, you need change the 3 constants line 27,28,29 in mecanum-2560-lesson4.ino sketch file:

```
#define MIN_SPEED   50
#define TURN_SPEED   70
#define SLOW_TURN_SPEED   50
#define BACK_SPEED 60
```

MIN_SPEED is the minimum power required to start the car. If when APP engine toggle is switched to RED, but your car does not move, you need increase this value , if the car runs too fast at engine start moment, you need reduce this value.

TURN_SPEED AND, SLOW_TURN_SPEED value determines the turning speed of your car. If your car turning too fast, you need reduce these two values, if turning too slow or not turning, increase these two values. Always make

SLOW_TURN_SPEED about 20 to 30 lower than TURN_SPEED value.

BACK_SPEED value determines the reverse back running speed.

After batteries are running low, you might need to increase the value of these 3 constants. You can gradually add or reduce 10 each time on these values and compare which values have best tracking performance.

Lesson 5 Wifi Controlled Robot Car

In this project we will connect Robot Car to Wifi and Use an APP to control the car through Internet. This is a typical Internet of Things (IoT) Application.

PARTS & DEVICES

OSOYOO Mecanum wheels robotic car chassis x 1 (2x left-wheels/2x right-wheels and Motor x 4)

OSOYOO Mega2560 board fully compatible with Arduino   x 1

OSOYOO WiFi shield x 1

OSOYOO Model Y motor driver x 1

OSOYOO MG90 servo motor x 1

OSOYOO Ultrasonic sensor module x1

OSOYOO Ultrasonic mount holder

OSOYOO 5-Point Tracking sensor module

OSOYOO 3pin female to female jumper wire x1

OSOYOO 6pin male to female jumper wire x2

OSOYOO 7pin female to female jumper wire x1

OSOYOO 2 pin XH.25 female to female x1

OSOYOO Battery box x 1

18650 Batteries(3.7V) x 2

HARDWARE INSTALLATION

If you just finishes all lesson 1 (assembling the car) and lesson 4(bluetooth imitation driver), please keep all lesson connections same as it is. Then plug out bluetooth from Wifi Shield.

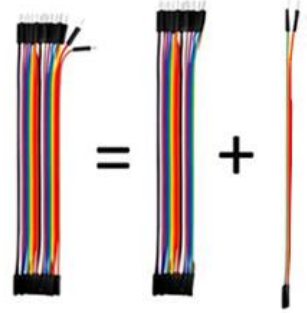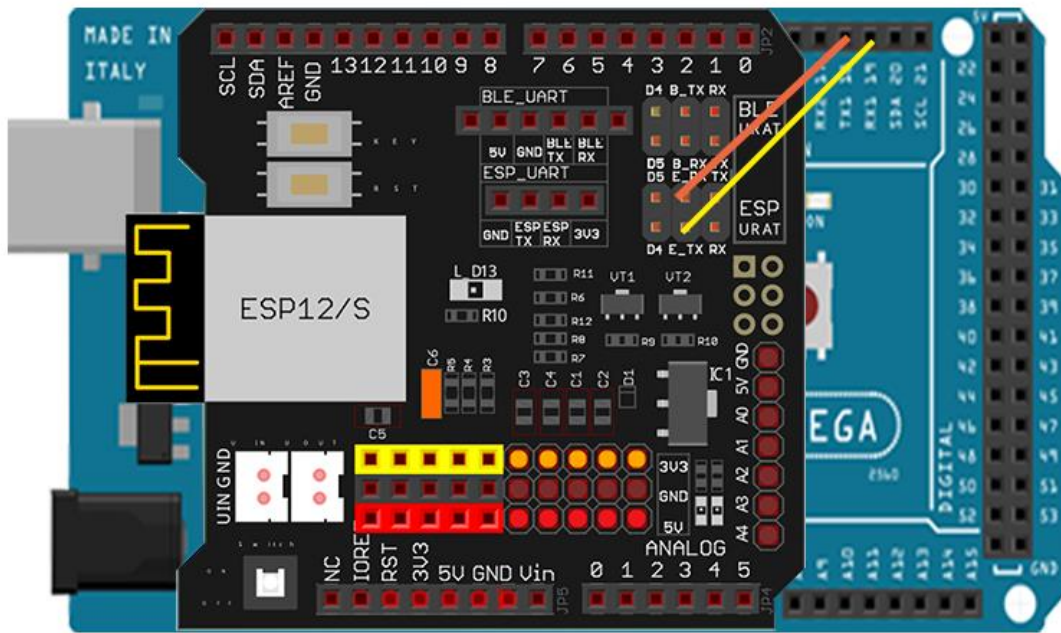## CIRCUIT CONNECTION

Remove the connection B_TX to D18 and B_RX to D19.
Connect E_RX to D18(TX1) and E_TX to D19(RX1).

(Note: You need split 2 pcs of male-to-female jumper wires from our 10-pc jumper wire bundle. Any color from the bundle will be ok. The rest of 8 pcs wires are as spare parts for potential broken or damaged wires.)

Wifi Board	Arduino mega2560
E_TX	D19
E_RX	D18

2pin male to female wire

Open-source Arduino Software(IDE)		Download Arduino IDE here: https://www.arduino.cc/en/Main/Software?setlang=en
7 zip is a free zip utility that un-zips zip files		Download 7zip here for free https://www.7-zip.org/

Step 1: Install latest Arduino IDE (If you have Arduino IDE version after 1.1.16, please skip this step). Download Arduino IDE from https://www.arduino.cc/en/Main/Software?setlang=en , then install the software.

Step 2: Please download the library zip file from WiFiEsp-master.zip .Open Arduino IDE ->click Sketch ->Include Library ->Add .ZIP library , then load above zip file into Arduino.
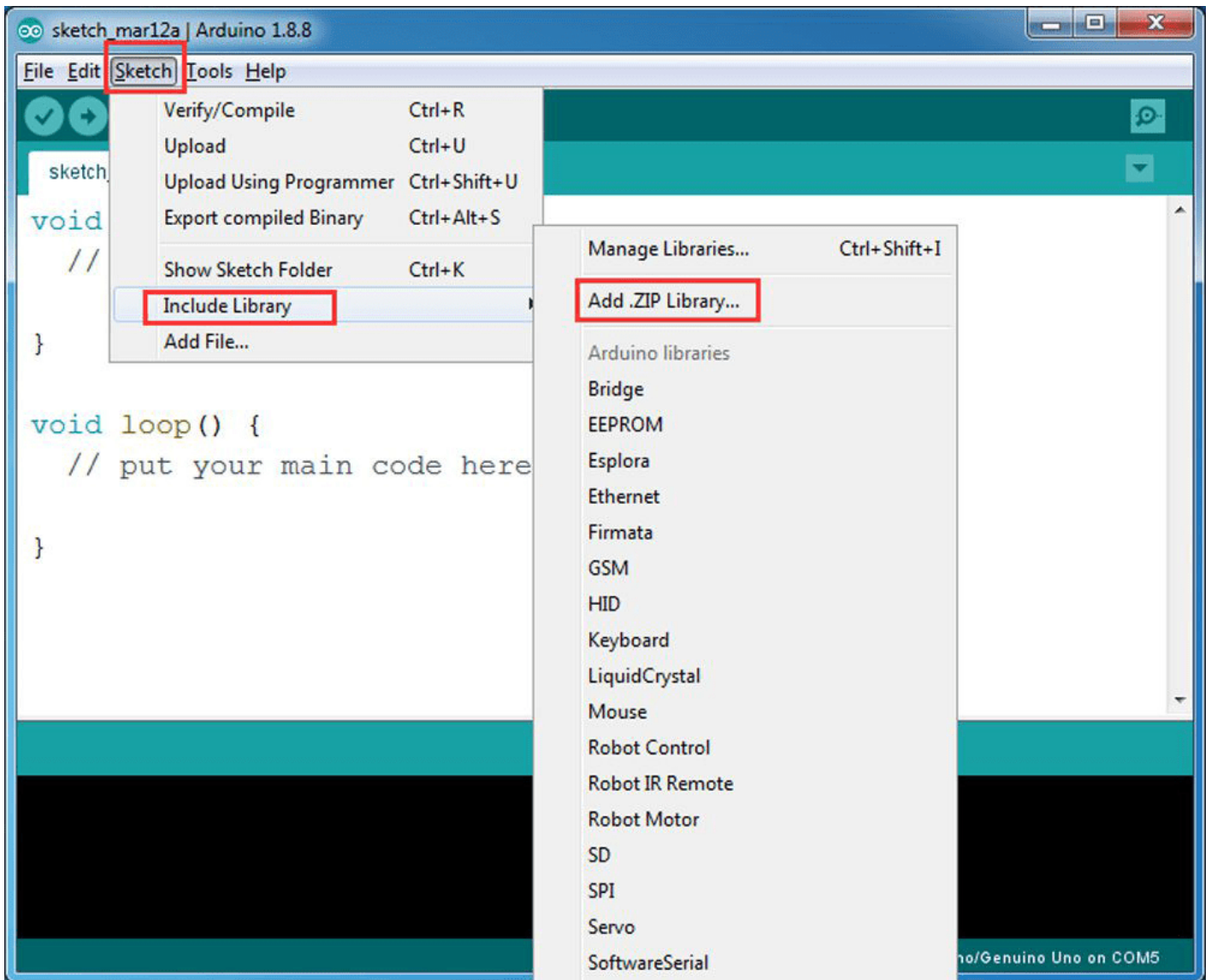
Step 3: APP installation-you need search "OSOYOO Wifi UDP Robot Car Controller " in Google Play or Apple Store, and then install this APP. **DOWNLOAD APP FROM https://osoyoo.com/driver/arduino-udp/udp-robot.apk**
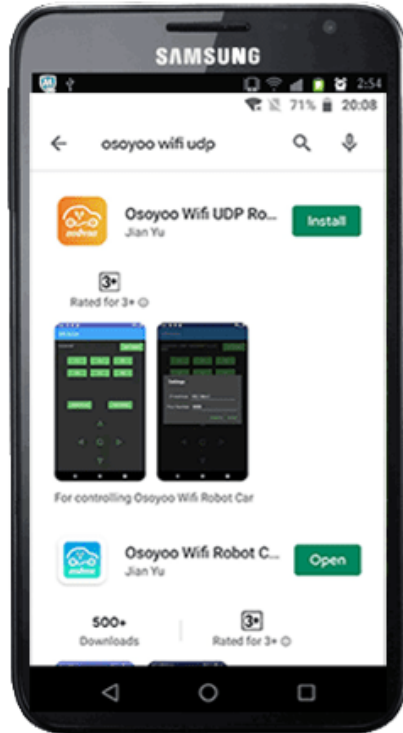
Android Phone   Apple iOS

YOU CAN ALSO DOWNLOAD APP DIRECTLY FROM
https://osoyoo.com/driver/arduino-udp/udp-robot.apk

Step 4: Arduino Sketch code Installation:

Downloadhttps://osoyoo.com/driver/mecanum_metal_chassis_m2/m2-lesson5.zip

Unzip the downloaded file, enter the m2-lesson5 folder, you will see two sub-folder : m2-lesson5A and m2-lesson5B.These two folders have program for two Wifi modes: AP mode and STA mode. The Arduino sketches for these two modes are different. Let's explain these two modes one by one.

When working in AP mode, our robot car itself will become a Wifi Hot Spot. Our cell phone can connect to Robot Car as its wifi client. The IP address of Robot is fixed as 192.168.4.1 and It is not connected to WAN.

(1) Unzip the **m2-lesson5** file and you will see a folder named m2-lesson5a, upload the code into Arduino.

```
m2-lesson5a | Arduino 1.8.13

File Edit Sketch Tools Help

m2-lesson5a

 1  /*      ___   ___  ___  ___  ___   ___   ___  ___  ___
 2   * / _ \ /___)/ _ \| | | |/ _ \ / _ \ / ___) _ \|    \
 3   *|  |_| |___ | | |_| | |_| | |_| | |_| ( (___| |_| | | | |
 4   * \___/(___/ \___/ \___ |\___/ \___(_)____)___/|_|_|_|
 5   *                      (___/
 6   * Arduino Mecanum Omni Direction Wheel Robot Car
 7   * Tutorial URL http://osoyoo.com/?p=49235
 8   * CopyRight www.osoyoo.com
 9   *
10   * In this project we will connect Robot Car to Wifi and Use
11   * an APP to control the car through Internet.
12   *
13   */
14  #define SPEED 150
15  #define TURN_SPEED 150
16  #define SHIFT_SPEED 140
17
18  #define TURN_TIME 500
19  #define MOVE_TIME 500
```

```
1           Arduino Mega or Mega 2560, ATmega2560 (Mega 2560) on COM260
```

(2) Open your Arduino Serial monitor, and you will see a similar result as AP mode. A new Wifi SSID "osoyoo_robot" with IP address 192.168.4.1 will show up in the window.

This means your Robot car has a Wifi Hot Spot name "osoyoo_robot" , its IP address is 192.168.4.1
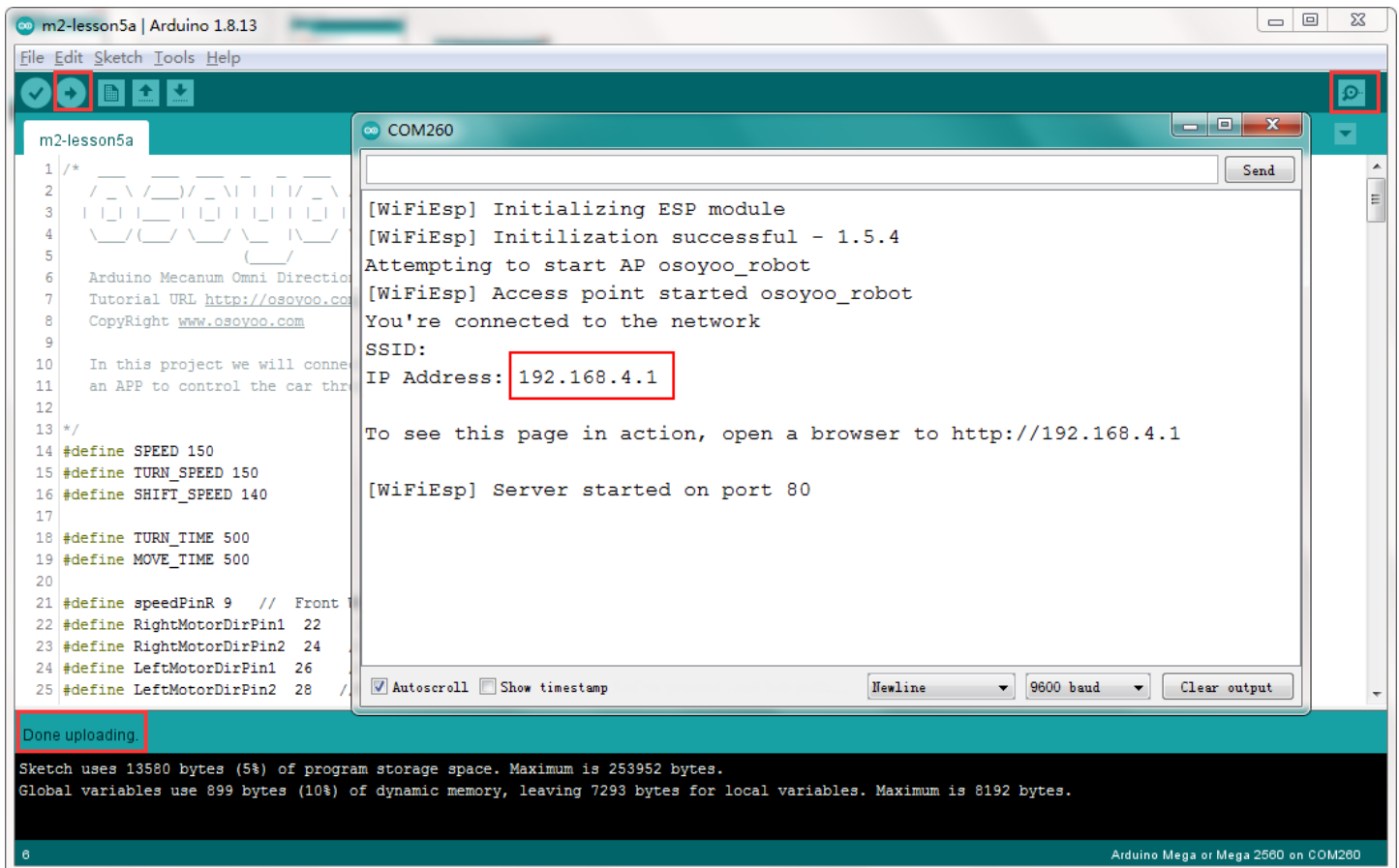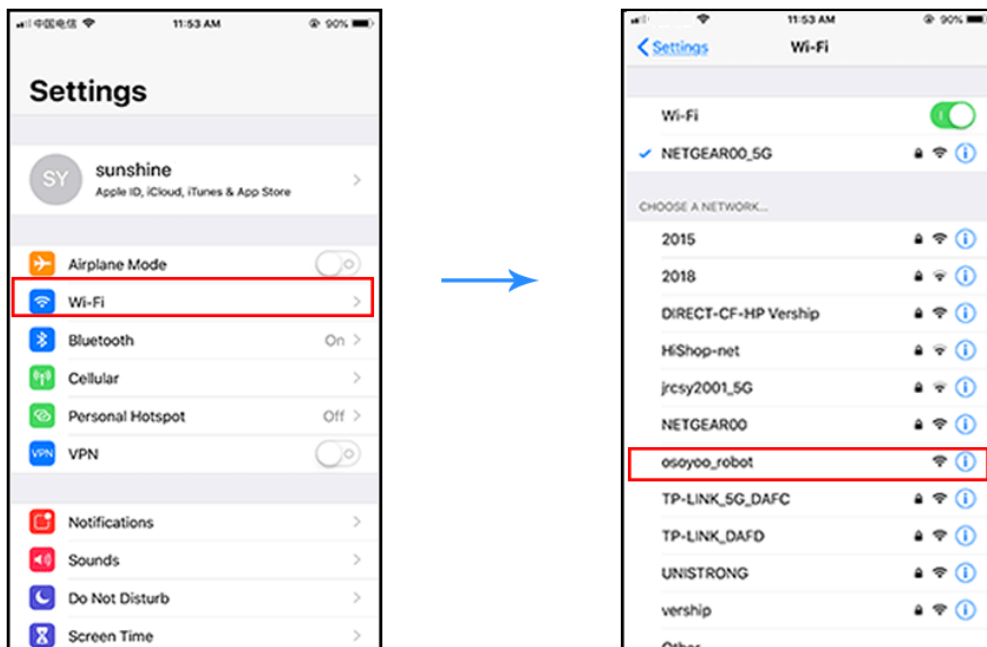
(3) Now your Robot car become a Wifi Hot Spot and set IP address as "192.168.4.1" to your APP Setting section. Port number keep default value **8888**.
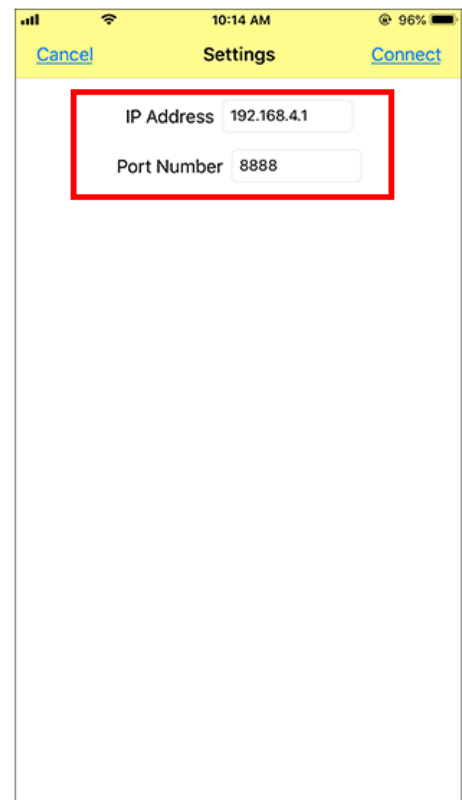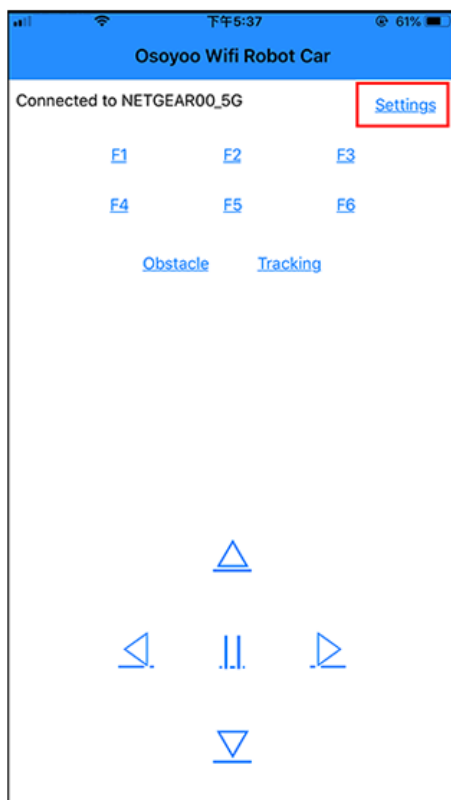
(4) Connect your cell phone to "osoyoo robot" Wifi hotspot, you can use Mobile phone control the robot car.

(5)You can click the ◄ ► ▲ ▼ direction keys to make the car move. Use "‖" pause key to stop the car movement.

Click Obstacle to shift left side, Click Tracking to shift right side.

Click F1 to make upper-left diagonal movement, Click F3 to make upper-right diagonal movement.

Click F4 to make back-left diagonal movement, Click F6 to make back-right diagonal movement.
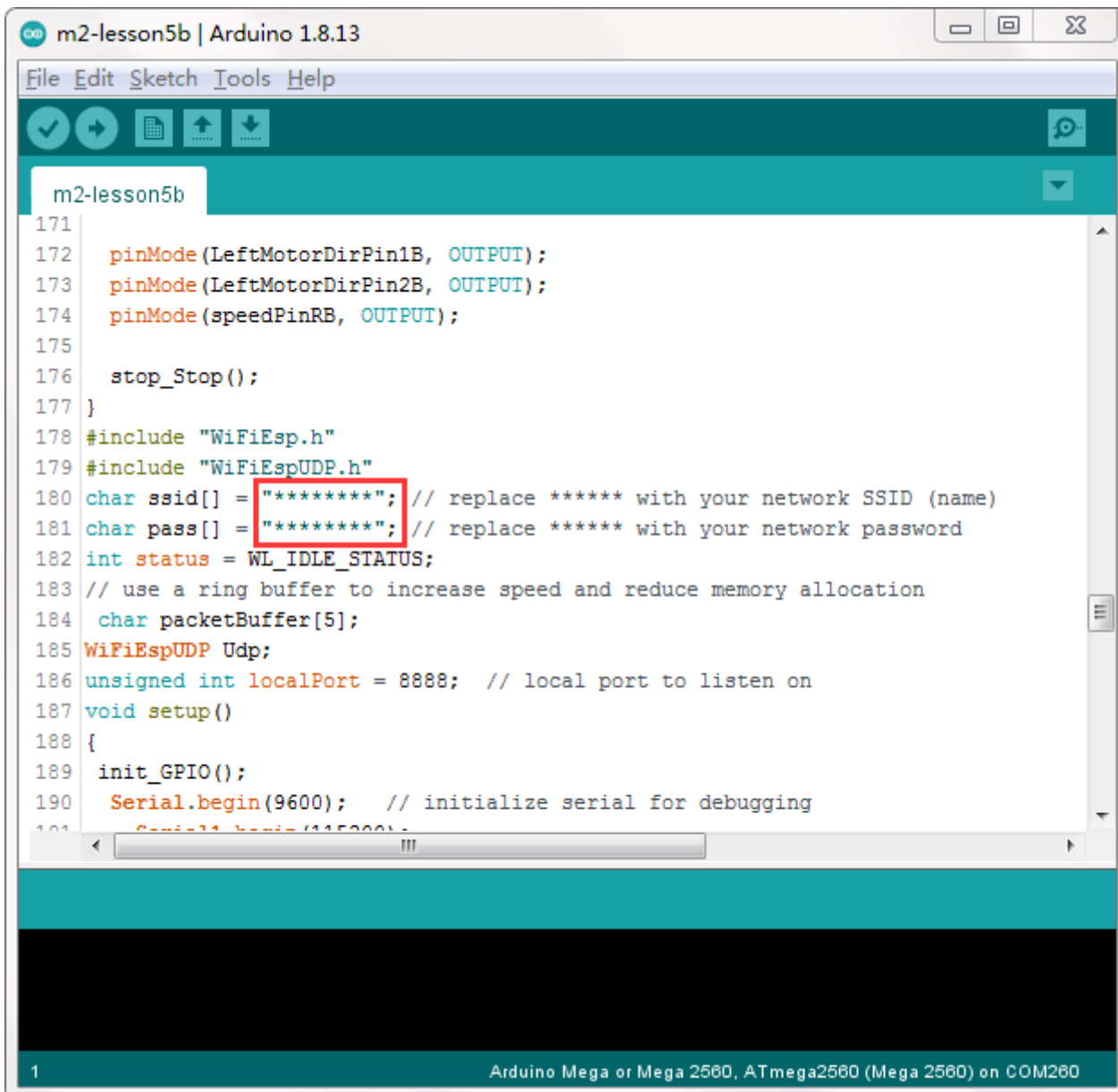
STA MODE

In STA mode, robot car does not work as a wifi hotspot. Instead, it will become an internet node in your LAN. You need tell Arduino sketch what is your local router's Wifi SSID and password, then Arduino talks to router and get its own LAN IP address from DHCP server. You can use Mobile APP to access the robot car's IP address and control its movement.

(1) Unzip the **m2-lesson5** file and you will see a folder named m2-lesson5b, then load the m2-lesson5b.ino code into Arduino.
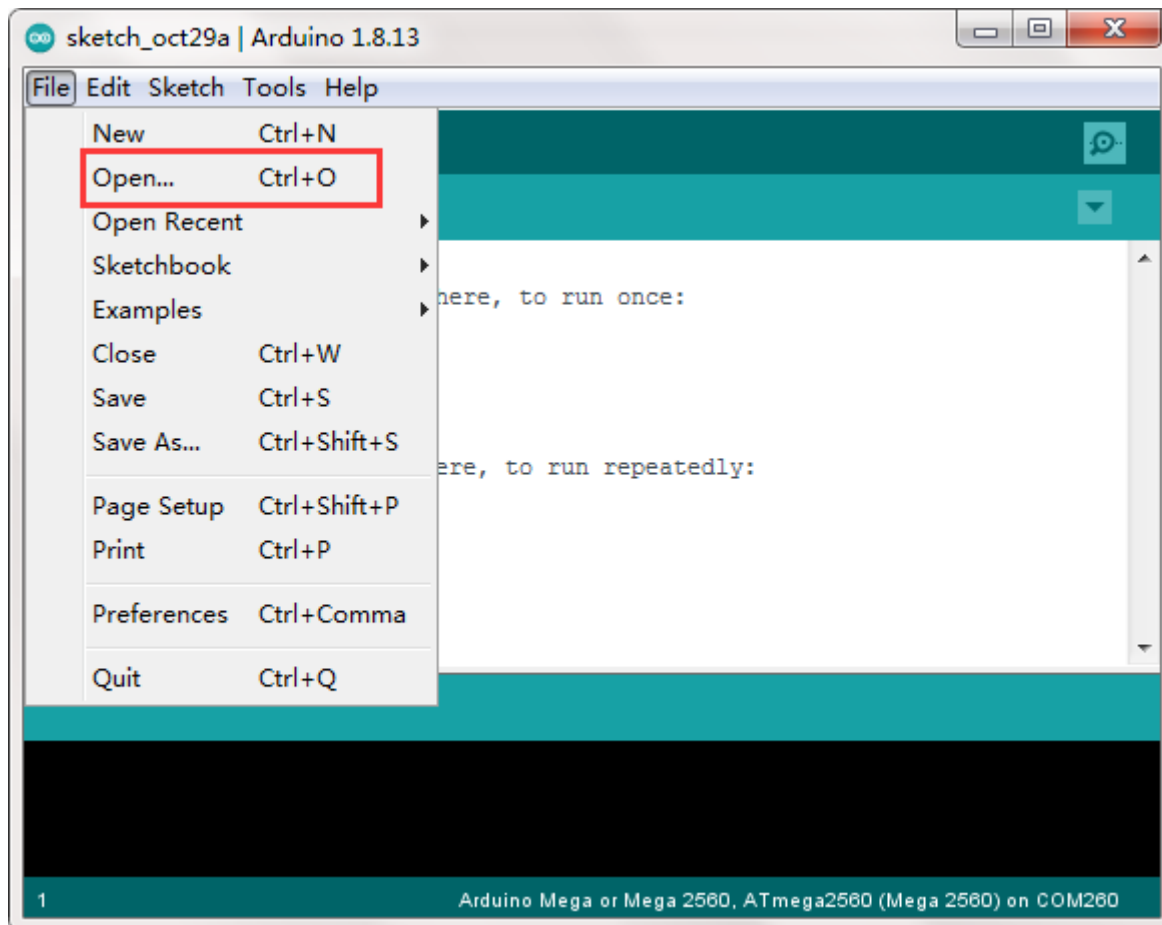
(2) You need change the code Line 180 and Line 181 :

char ssid[] = "YOUR_ROUTER_SSID"; // replace this with your router wifi SSID
char pass[] = "YOUR_ROUTER_WIFI_PASSWORD"; // replace with your wifi *password*

```
171
172   pinMode(LeftMotorDirPin1B, OUTPUT);
173   pinMode(LeftMotorDirPin2B, OUTPUT);
174   pinMode(speedPinRB, OUTPUT);
175
176   stop_Stop();
177 }
178 #include "WiFiEsp.h"
179 #include "WiFiEspUDP.h"
180 char ssid[] = "********"; // replace ****** with your network SSID (name)
181 char pass[] = "********"; // replace ****** with your network password
182 int status = WL_IDLE_STATUS;
183 // use a ring buffer to increase speed and reduce memory allocation
184   char packetBuffer[5];
185 WiFiEspUDP Udp;
186 unsigned int localPort = 8888;  // local port to listen on
187 void setup()
188 {
189  init_GPIO();
190   Serial.begin(9600);   // initialize serial for debugging
```

(3) Upload the sketch to Arduino. click the Serial monitor window in upper right corner of Arduino IDE, you will see following result:
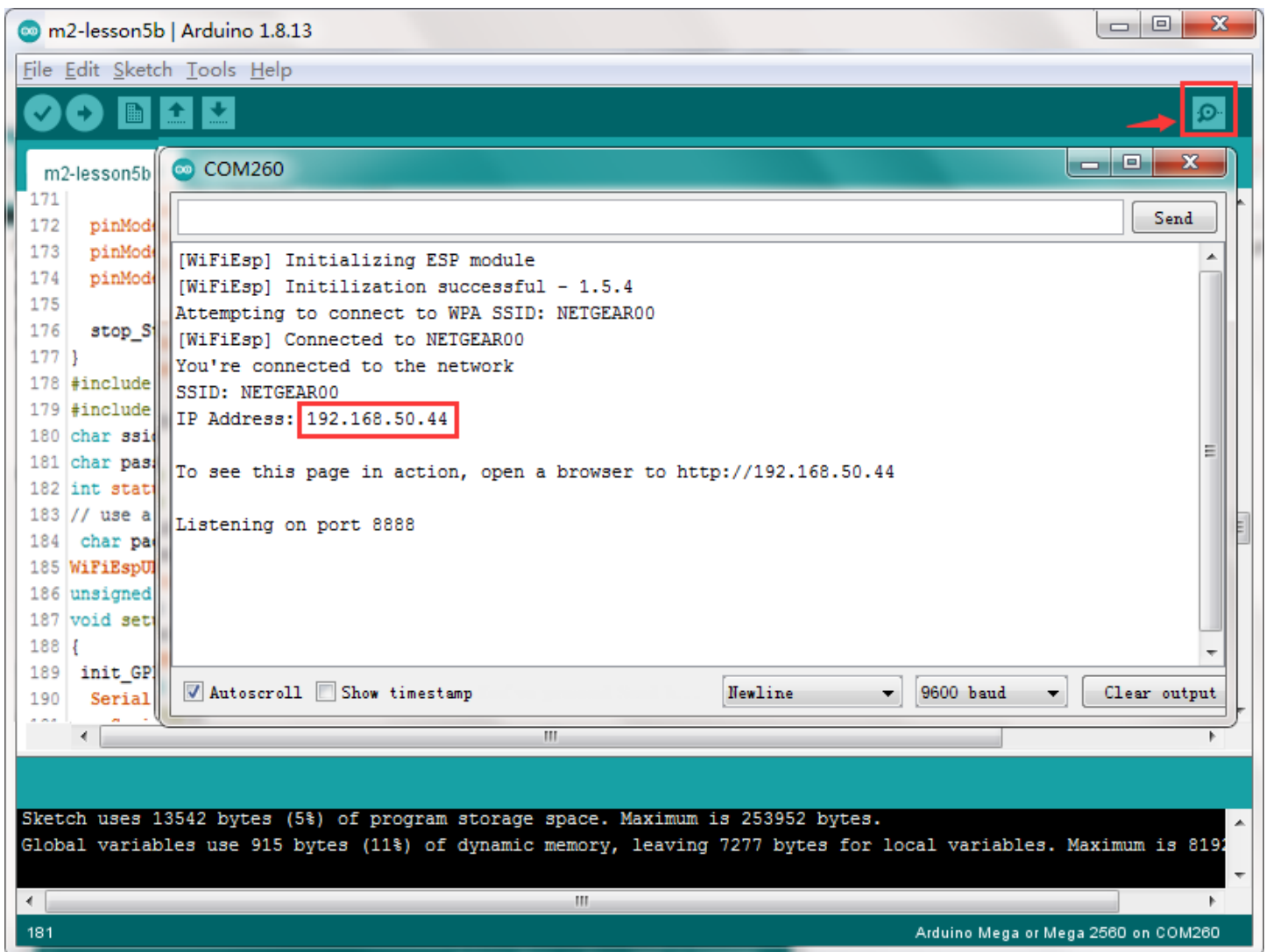
(4) In this mode, your will see an IP address which is our LAN IP address assigned by my router.

Please write down this IP address and click Setting to set up robot IP address and set this IP address to your APP Setting section (no need change default port 80 in APP).

(5)Now your Robot car is connected to your LAN, you can use Mobile phone under same LAN to control the robot car.

   If your APP is in WAN, you need to go to your Router Control Panel, forward Port 80 to Robot car LAN IP address, then you can use Router IP to control the car. This feature makes our robot car A REAL INTERNET OF THING device

(6)You can click the ◄ ► ▲ ▼ direction keys to make the car move. Use "‖" pause key to stop the car movement.

 Click Obstacle to shift left side, Click Tracking to shift right side.

  Click F1 to make upper-left diagonal movement, Click F3 to make upper-right diagonal movement.

  Click F4 to make back-left diagonal movement, Click F6 to make back-right diagonal movement.

FAQ about the Wifi UDP APP and sketch Code:

Q1) How to tune the robot car speed?

A: If you want change the speed performance of the robot car, please following parameters in line 11 to 13:

```
#define SPEED 85
#define TURN_SPEED 90
#define SHIFT_SPEED 130
```

SPEED value determines forward moving speed
TURN_SPEED value determines turning speed
SHIFT_SPEED value determines parallel shifting speed

Q2) What happened when you press   buttons in OSOYOO WiFi UDP Robot Car APP ?

A: When you press a button of the APP, APP will send a single-letter message through UDP protocol to target device (in this example, our Arduino Wifi Shield)

Button	UDP message
F1	F
F2	G
F3	H
F4	I
F5	J
F6	K
▲	A
▼	B
▶	R
◀	L
square	E
obstacle	O
tracking	T

Q3) How does Arduino handle the UDP command?

A: Line 230 to line 245 in m2-lesson5a.ino file are the codes which react to Cell phone command. For example, when ▲ is pressed, according to Q1 table, a letter "A" command was sent from Cell phone to Arduino.   Line 233 case 'A' …. statement will make the car make car moving forward.

```
 char c=packetBuffer[0];
switch (c)      //serial control instructions
{
   case 'A':go_advance(SPEED);;break;
   case 'L':left_turn(TURN_SPEED);break;
   case 'R':right_turn(TURN_SPEED);break;
   case 'B':go_back(SPEED);break;
   case 'E':stop_Stop();break;
   case 'F':left_shift(0,150,0,150);break; //left ahead
   case 'H':right_shift(180,0,150,0);break; //right ahead
   case 'T':left_shift(150,0,150,0); break;//left back
   case 'K':right_shift(0,130,0,130); break;//right back
   case 'O':left_shift(200,150,150,200); break;//left shift
   case 'T':right_shift(200,200,200,200); break;//left shift
   default:break;
```

}