Table of Contents

Introduction....2
Authorized Online Retailers....2
Description....2
Praperation....3
Lesson 1 Build the Robot Car....4
Objective....4
How to Make....5
Lesson 2: Basic Movement....7
Objective....7
Circuit Connection....8
How to Code....10
How to Play....16
Lesson 3: Line Tracking....17
Objective....17
Circuit Connection....18
How to Code....18
How to Play....22
Lesson 4: Bluetooth Control....24
Objective....24
Circuit Connection....25
How to Code....26
How to Play....32
Lesson 5: Wifi Control....35
Objective....35
Circuit Connection....35
How to Code....37
How to Play....41

Introduction

Authorized Online Retailers

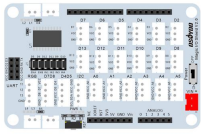
Buy from US	Buy from UK	Buy from DE	Buy from IT	Buy from FR	Buy from ES	Buy from JP
BUY NOW	BUY NOW	BUY NOW	BUY NOW	BUY NOW	BUY NOW	BUY NOW

Description

- 600+ parts includes bricks, gears, axis and 1 piece Controller board, expansion board, ultrasonic sensor, wifi module, servo motor, humidity and temperature, battery, 2pcs tracking sensor modules, Photoresistor, motors, and wheels
- The OSOYOO Model-T Robot Car designed to provide kids through DIY different Robot car to interesting and challenging building experience, robotic movement and mechanical structure
- The OSOYOO Model-T Robot Car helps to enhance kids' imagination and creativity, hand-eye coordination, self-confidence and promotes the importance of teamwork & collaboration
- This kit is based on OSOYOO basic board compatible with UNO. This is a an open source electronics archetype platform for electronics engineers, hobbyist, designers or anyone interested in creating interactive electronics projects
- This building Robot car kit has provide graphical programming (for basic projects) and IDE (for IOT projects). It's really suitable for teenage or adults to learn basic program language
- This learning kit provides 7 sample lessons including basic movement, following light, line tracking, obstacle avoidance, robot gripper, wifi remote control and IOT project. These tutorials teach how to build, code, and run the robot car.
- OSOYOO Expansion board and Sensor modules are designed with XH2. 54 ports to avoid the many potential errors novice users encounter with

similar products

Praperation

	Preparation before Class 1: Download and Install Arduino IDE		Preparation before Class 2: OSOYOO basic board for Arduino UNO
	Preparation before Class 3: OSOYOO Magic I/O Shield for Arduino		

Lesson 1 Build the Robot Car

Objective

In this lesson, we will show how to assemble a moving robot car with OSOYOO Building Blocks.



Parts & Device

Please prepare the following parts to complete this project

NOTE:

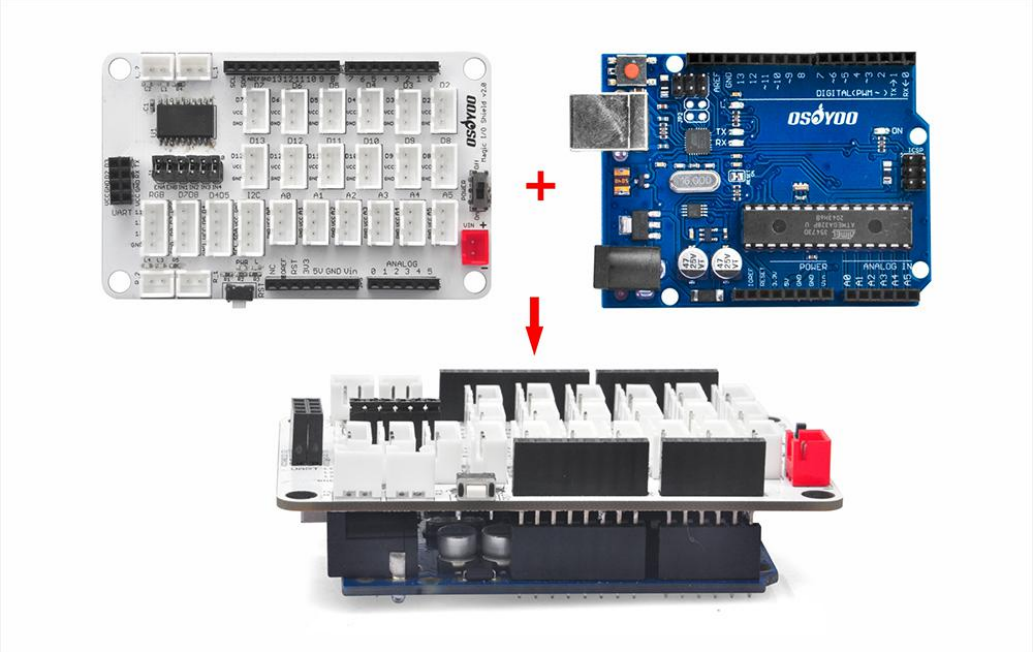
1.the color of the building block is subject to the actual product, which does not affect the use.

2. ALL OSOYOO PRODUCTS FOR ARDUINO ARE THIRD PARTY BOARD WHICH IS FULLY COMPATITABLE WITH ARDUINO



How to Make

Before you build the robot with blocks, please install OSOYOO basic board for Arduino under OSOYOO Magic I/O shield as following *(Attention please : the pins of I/O shield is* aligned with the port of basic the board firstly, then press the shield tightly on the board).



Please follow the clear PDF building steps from

https://osoyoo.com/picture/2022008400/lesson1/lesson1.pdf

Lesson 2: Basic Movement

Objective

In this tutorial, we will use the car to do some simple movements. Once the car installation is completed, it is very important to test the installation and sample code. If you have passed the test movement of this lesson, it means OSOYOO Basic Board for Arduino, motor control module, motors, batteries, chassis and wire connections between these parts are all functioning well.

If you don't complete the frame of car, please review lesson 1



Circuit Connection

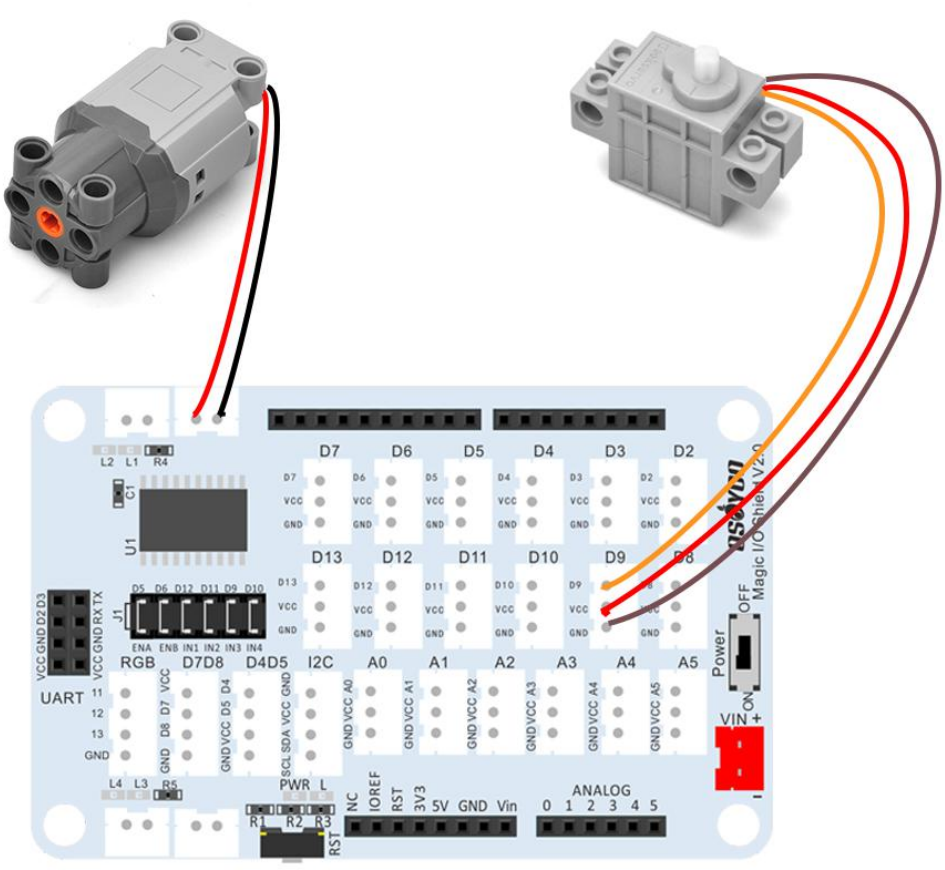
Connection: (*Attention please: there are six jumper caps on ENA/ENB/IN1/IN2/IN3/IN4***)**

IN1 to D12 (*jumper cap)*

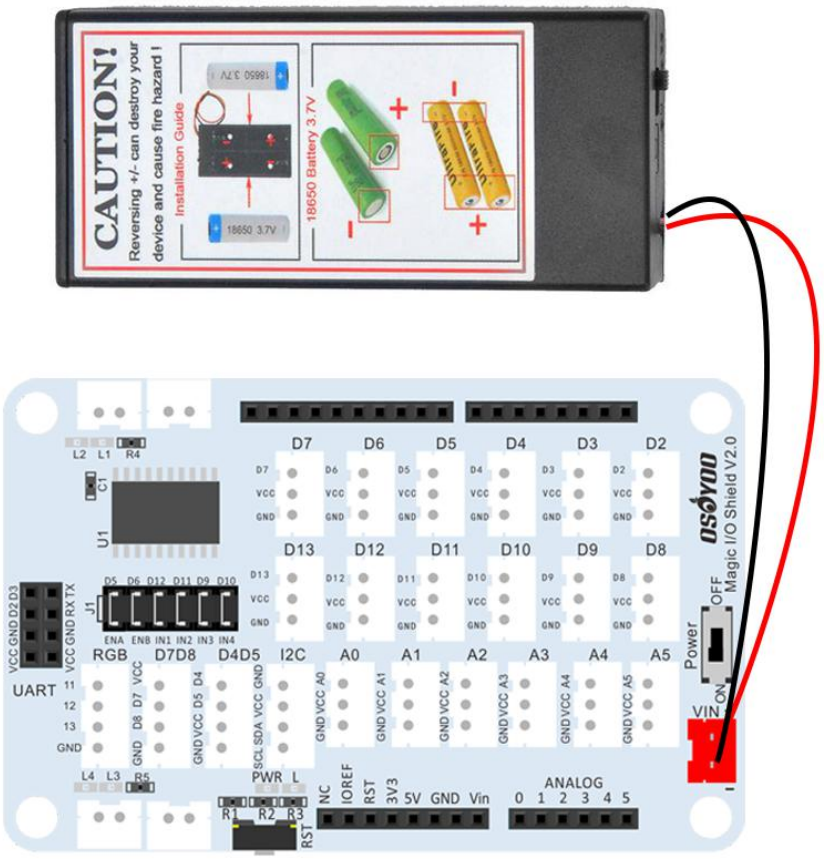
IN2 to D11 (*jumper cap)*

Motor to L1

Servo to D9



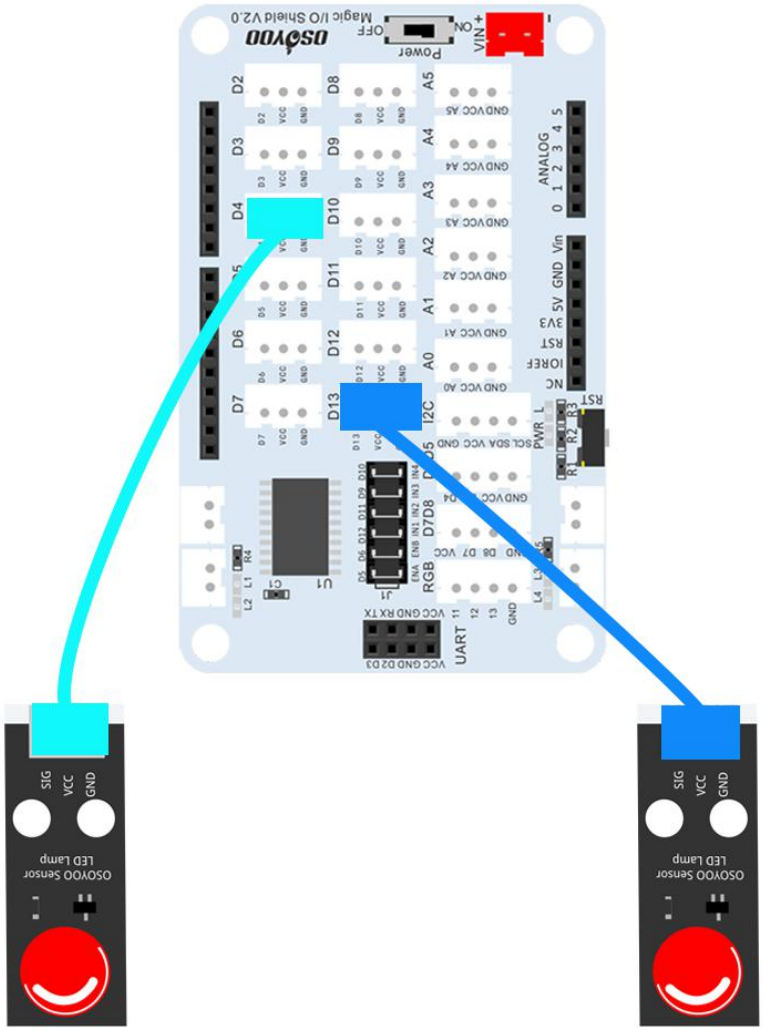
Connect the battery case to power port of Magic I/O shield as following:



Connect the OSOYOO Red LED Module to power port of Magic I/O shield as following:

Left LED - D4

Right LED - D13



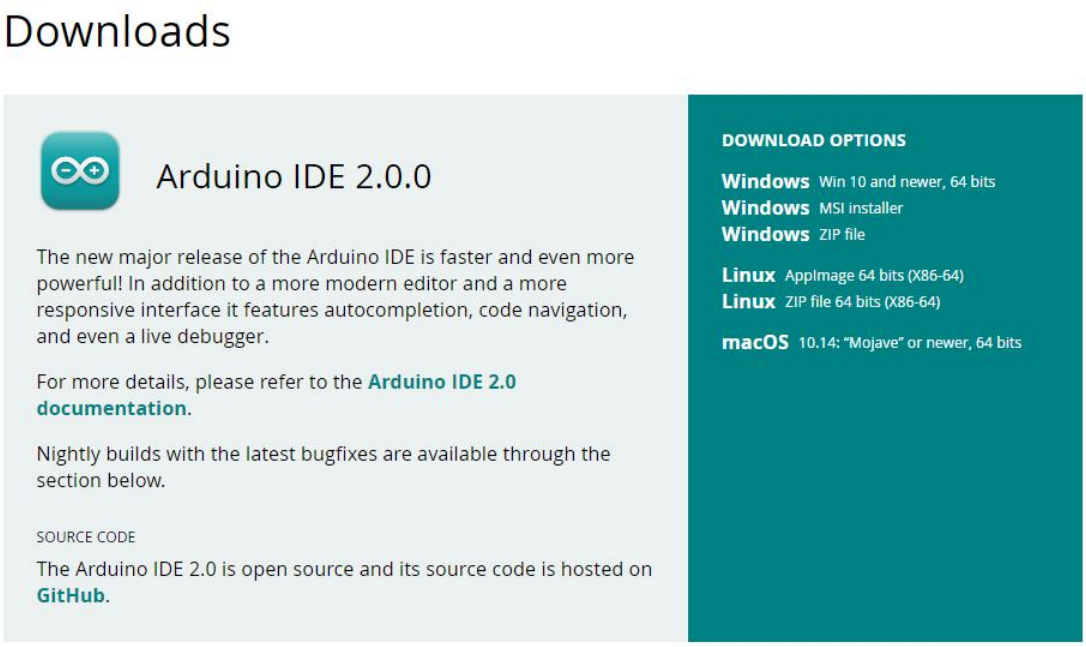
How to Code

Open-sourceSoftware(IDE)	IDE	Download IDE here: https://www.arduino.cc/en/software
7 zip is a free zip utility that un-zips zip files	7ZIP	Download 7zip here for free https://www.7-zip.org/

STEP 1:

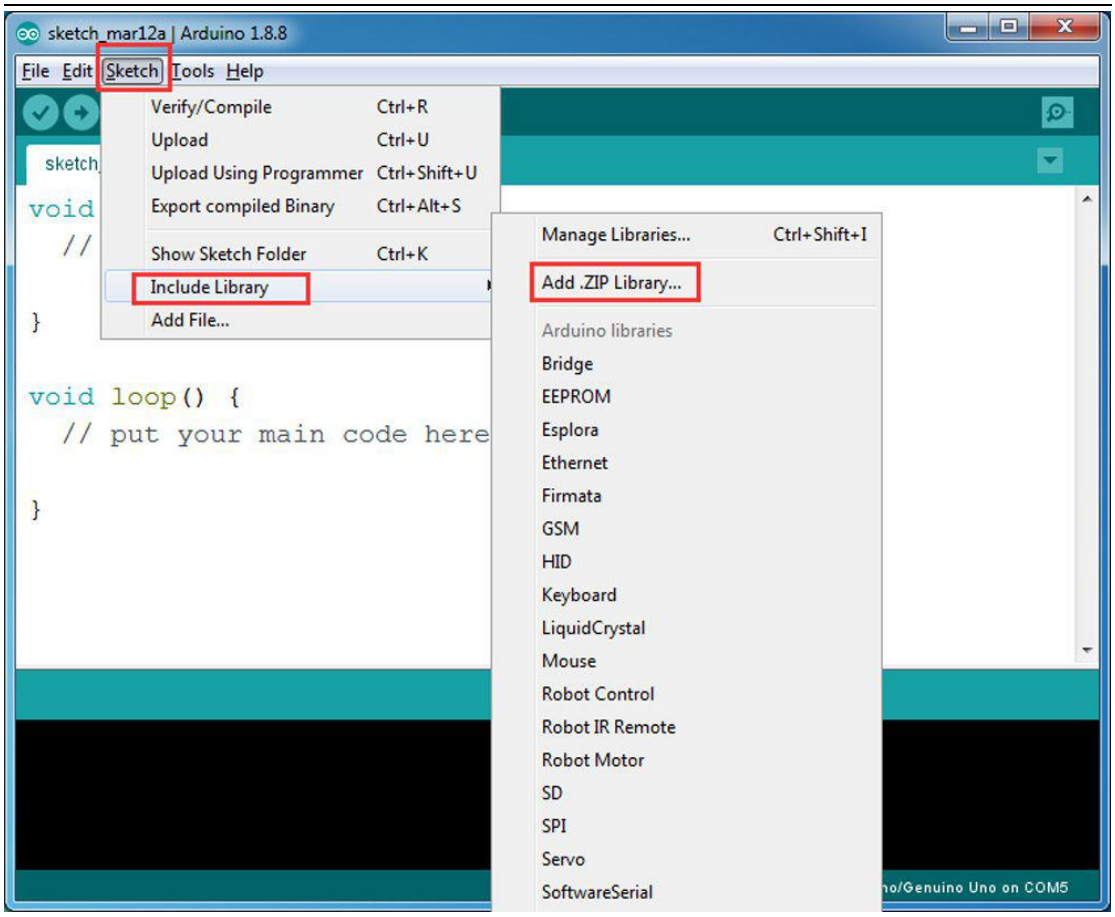
Install latest IDE (If you have IDE version after 1.1.16, please skip this step).

Download IDE from https://www.arduino.cc/en/software, then install the software.



STEP 2:

Download PWMServo library zip file
from https://osoyoo.com/driver/sg90car/PWMServo.zip ,
then import the library into Arduino IDE(Open Arduino IDE-> click Sketch->Include Library->Add .Zip Library)



You will see a pop-up windows , now you can go to your download folder and select PWMServo.zip file and upload this file to Arduino library.

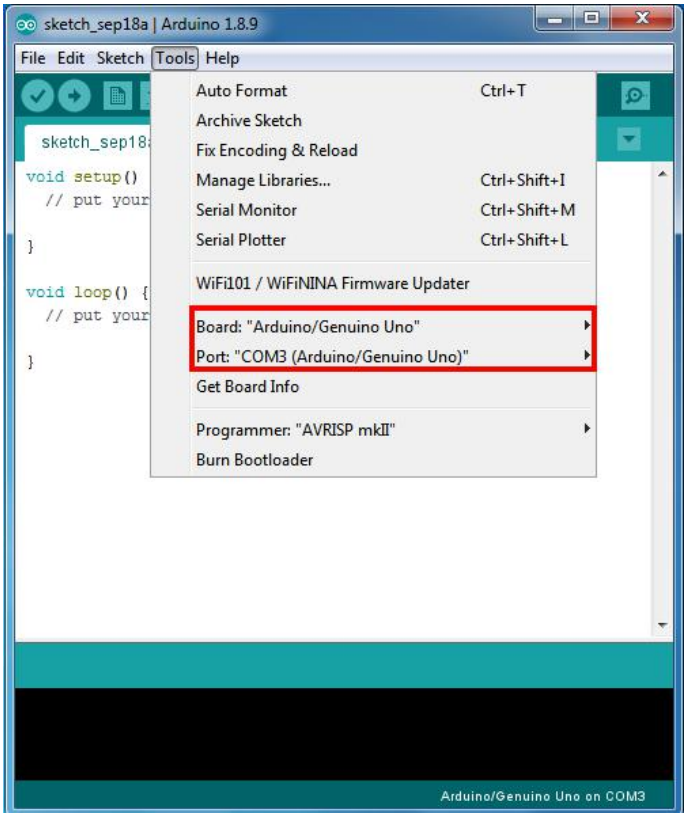
STEP 3:

Download https://osoyoo.com/driver/2022008400/lesson2.zip , unzip it, you will see a folder called ***lesson2***

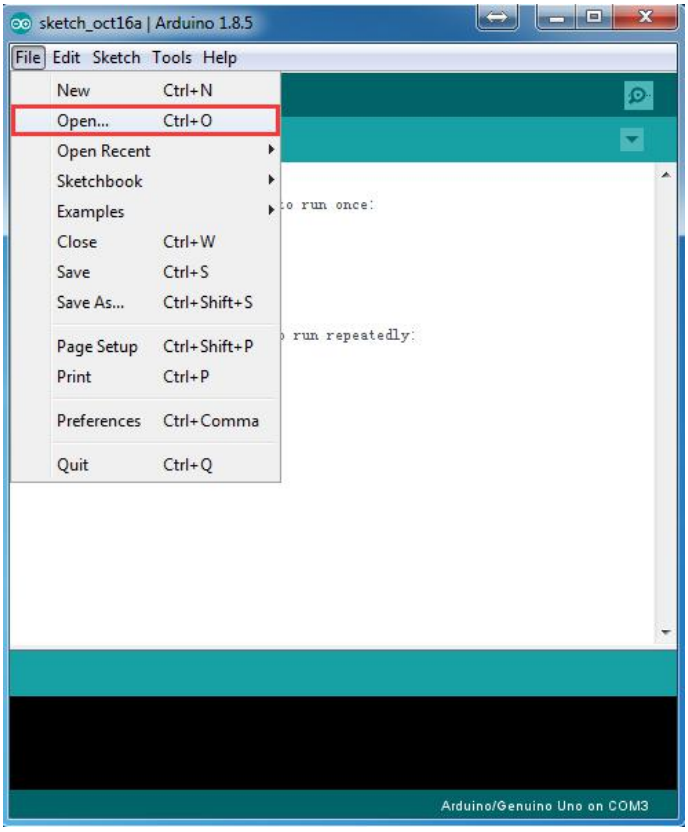
STEP 4:

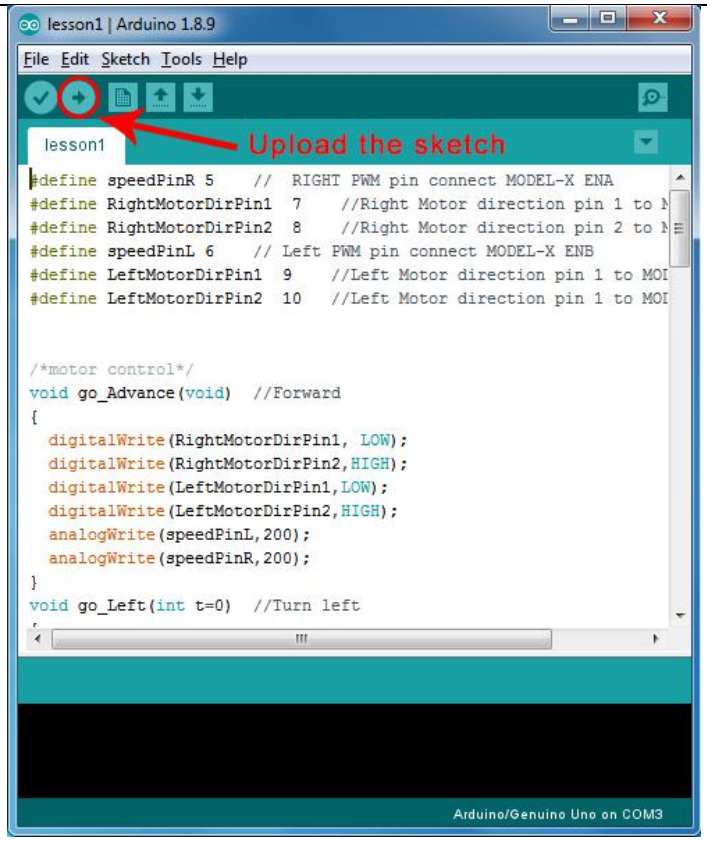
Connect UNO R3 board to PC with USB cable, open IDE, choose corresponding board/port for your project.

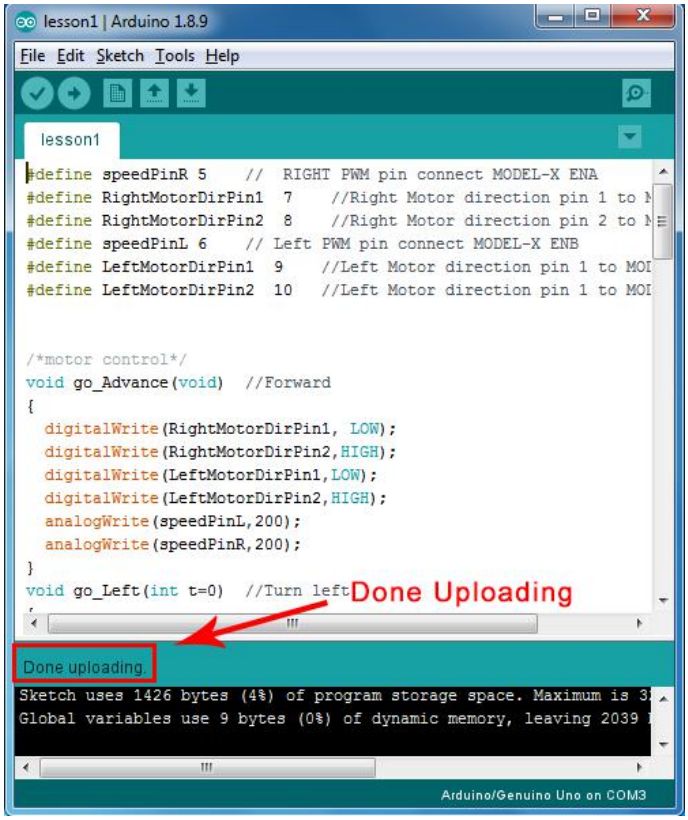
Notice: Shut off your battery or Unplug your power adapter when upload sketch code to OSOYOO Basic Board for Arduino.



Click file -> click Open -> choose code "***lesson2.ino***", load the code into OSOYOO Basic Board for Arduino, and then upload the sketch to the board.



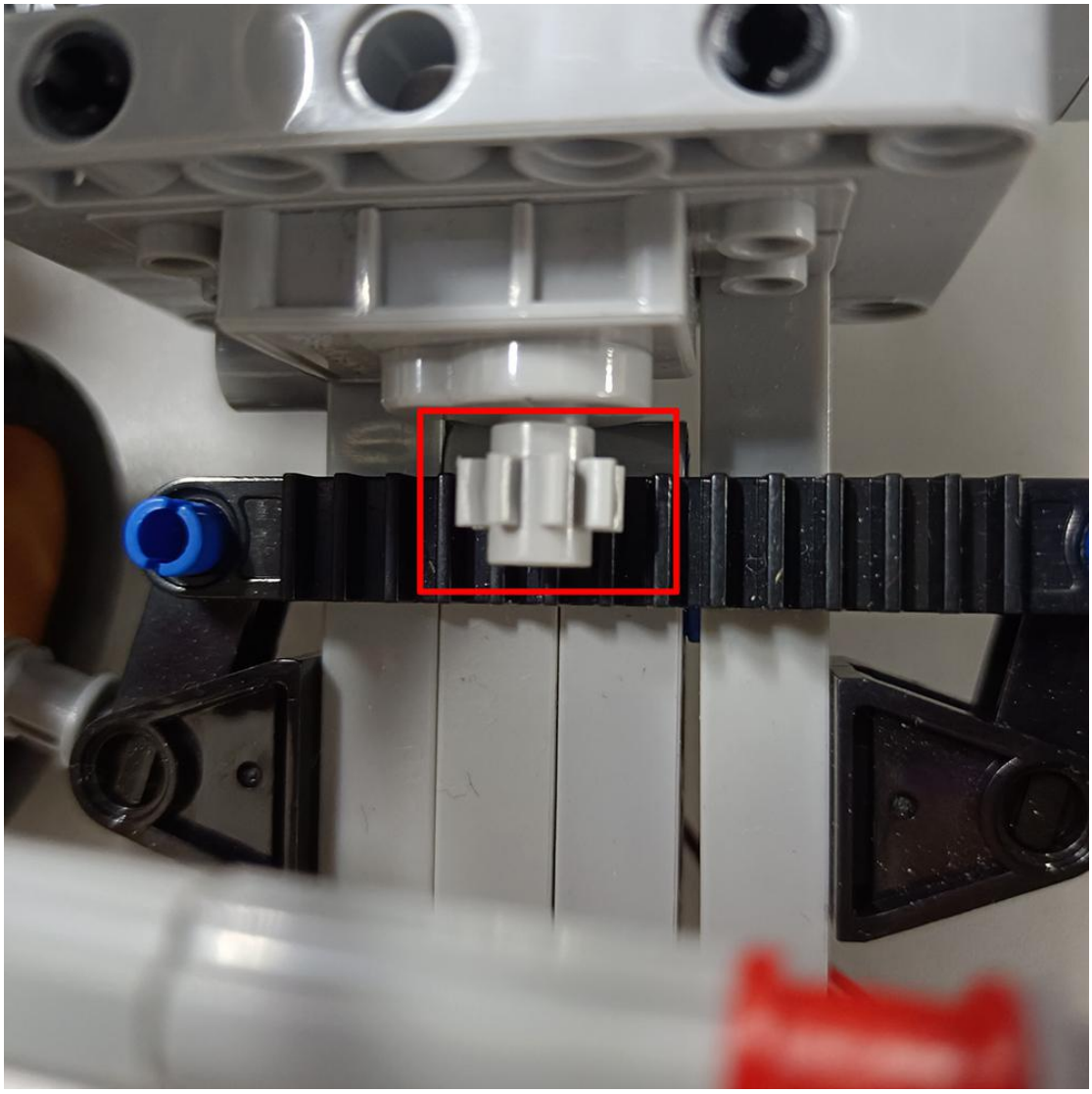

lesson1 | Arduino 1.8.9
File Edit Sketch Tools Help
lesson1
Upload the sketch
#define speedPinR 5 // RIGHT PWM pin connect MODEL-X ENA
#define RightMotorDirPin1 7 //Right Motor direction pin 1 to
#define RightMotorDirPin2 8 //Right Motor direction pin 2 to
#define speedPinL 6 // Left PWM pin connect MODEL-X ENB
#define LeftMotorDirPin1 9 //Left Motor direction pin 1 to MOI
#define LeftMotorDirPin2 10 //Left Motor direction pin 1 to MOI
/*motor control*/
void go_Advance(void) //Forward
{
digitalWrite(RightMotorDirPin1, LOW);
digitalWrite(RightMotorDirPin2,HIGH);
digitalWrite(LeftMotorDirPin1,LOW);
digitalWrite(LeftMotorDirPin2,HIGH);
analogWrite(speedPinL,200);
analogWrite(speedPinR,200);
}
void go_Left(int t=0) //Turn left
Arduino/Genuino Uno on COM3


lesson1 | Arduino 1.8.9
File Edit Sketch Tools Help
lesson1
#define speedPinR 5 // RIGHT PWM pin connect MODEL-X ENA
#define RightMotorDirPin1 7 //Right Motor direction pin 1 to
#define RightMotorDirPin2 8 //Right Motor direction pin 2 to
#define speedPinL 6 // Left PWM pin connect MODEL-X ENB
#define LeftMotorDirPin1 9 //Left Motor direction pin 1 to MOI
#define LeftMotorDirPin2 10 //Left Motor direction pin 1 to MOI
/*motor control*/
void go_Advance(void) //Forward
{
digitalWrite(RightMotorDirPin1, LOW);
digitalWrite(RightMotorDirPin2,HIGH);
digitalWrite(LeftMotorDirPin1,LOW);
digitalWrite(LeftMotorDirPin2,HIGH);
analogWrite(speedPinL,200);
analogWrite(speedPinR,200);
}
void go_Left(int t=0) //Turn left
Done Uploading
Done uploading.
Sketch uses 1426 bytes (4%) of program storage space. Maximum is 3
Global variables use 9 bytes (0%) of dynamic memory, leaving 2039
Arduino/Genuino Uno on COM3

STEP 5:

Servo Alignment: If your steering servo does not facing face to center front direction, then you have two options:

Option 1) You can remove the small gear from servo, re-align the front wheel direction manually and then install the small gear onto servo again.



Option 2) You can change the default value of following line:

#define FRONT 90 // 90 degree means steering to front

If your steering wheels tends to left, increase the value from 90 to 95,100,105 …

if your steering wheels tends to right, decrease the value from 90 to 85,80,75 …
Run the sketch again until your steering wheels finally faces to front.

Then write down the FRONT value, we will use this value to change the lesson3,4,5 sketch code and make steering servo always facing front at default FRONT value.

How to Play

1.Disconnect OSOYOO Basic Board for Arduino from PC and confirm that the power switch of the OSOYOO Motor Shield is off, then assure the battery is in the battery box.
(Note: make sure polar direction is correct, otherwise it can destroy your device and cause fire hazard).

2. Put the car on the ground, turn on the switch of the battery box and the OSOYOO Motor Shield, the car should go forward, backward, left turn, right turn, go backward, back to right, back to left, then stop.
Note: If the car does not move as per above mentioned result, you should check your wire connection, jumper caps on OSOYOO Motor Shield, battery voltage (must over 7.2v).

3. If you want to change the angel of the right or left, please edit the following line of the code and upload the sketch again:

```
int RIGHT=FRONT+80;
int LEFT=FRONT-38;
```

4. If you want to change the speed of the car, please revise the following code of the sketch (**Note: the max value is 255**)

```
#define SPEED 190
#define HI_SPEED 220
```

Lesson 3: Line Tracking

Objective

In this tutorial, we will use two OSOYOO tracking sensors to guide the car to move along the black track line in the white ground automatically. The software in this lesson will read data from the tracking sensors and automatically guide the car to move along the black track line in the white ground.

A Line Follower Robot, as the name suggests, is an auto-driving vehicle which follows a black track line printed in white ground. Tracking sensors in the robot keeps checking if the current car location is out of the track. If yes, then car will make a negative movement to draw the robot car back to track.

If you don't complete the frame of car, please review lesson 1



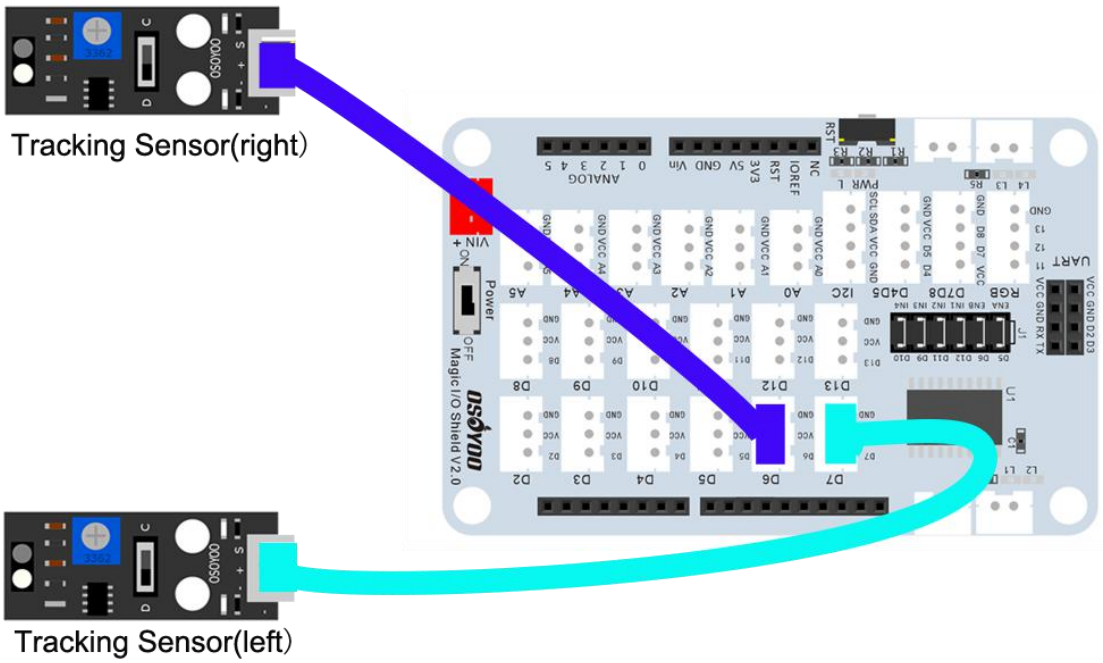
Circuit Connection

If you don't complete the basic wire connection, please review lesson 2

Connection:

Left Tracking Sensor to D7

Right Tracking Sensor to D6



How to Code

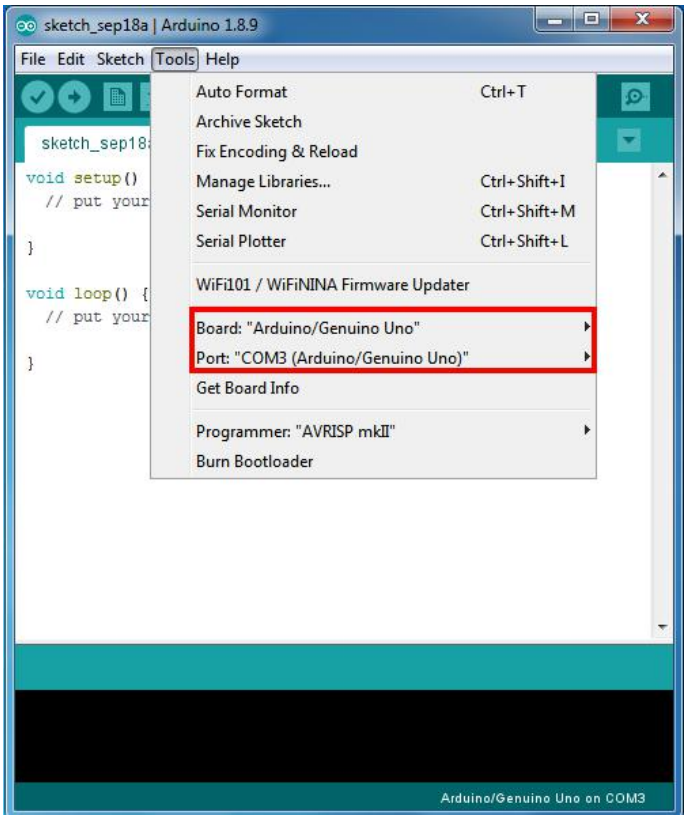
STEP 1:

Download https://osoyoo.com/driver/2022008400/lesson3.zip , unzip it, you will see a folder called ***lesson3***

STEP 2:

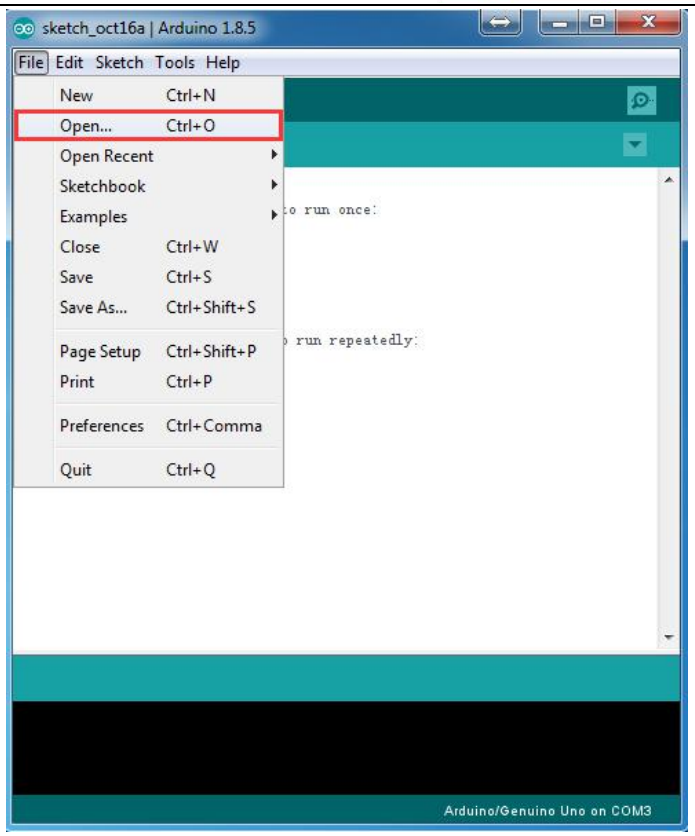
Connect UNO R3 board to PC with USB cable, open IDE, choose corresponding board/port for your project.

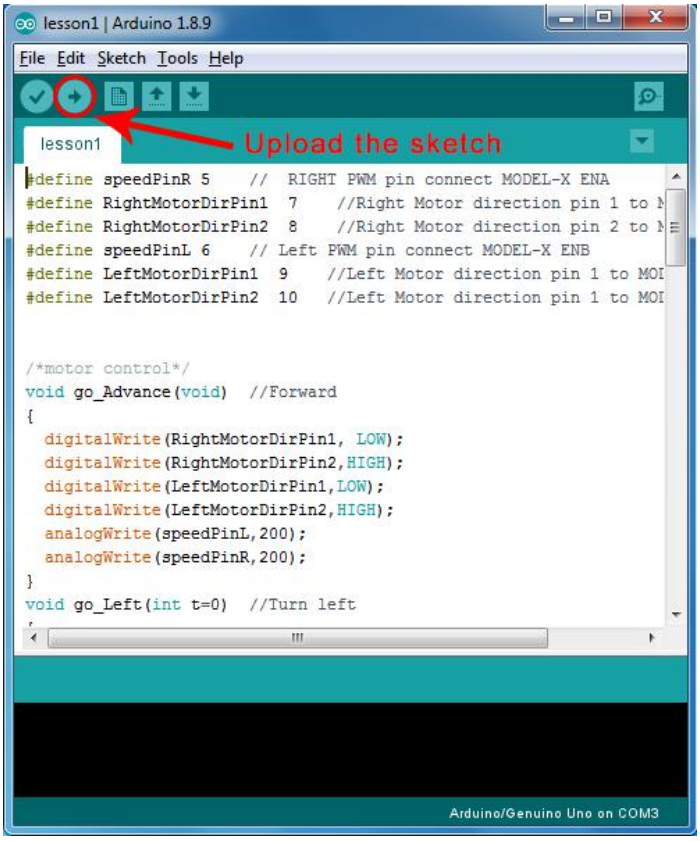
Notice: Shut off your battery or Unplug your power adapter when upload sketch code to OSOYOO Basic Board for Arduino.

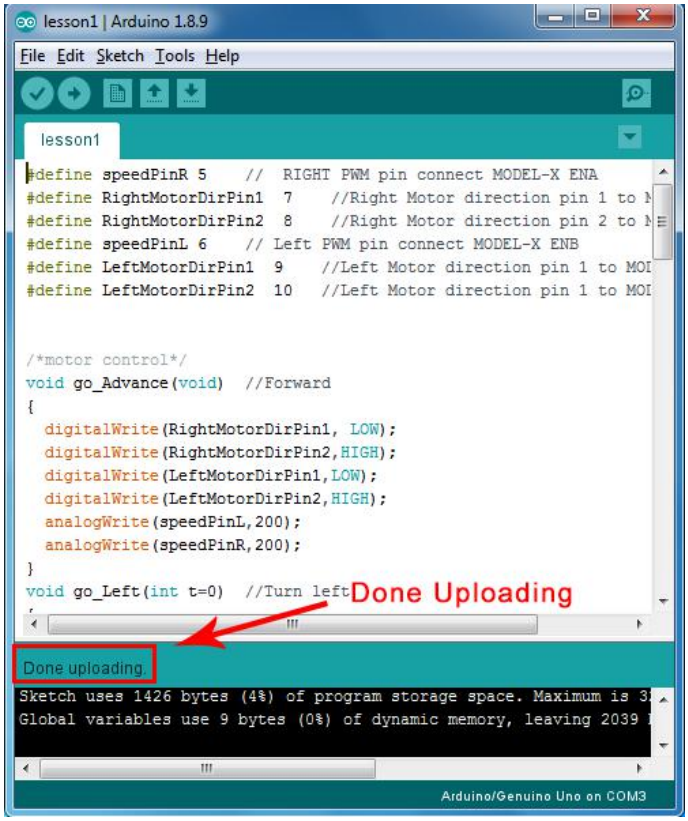


STEP 3:

Click file -> click Open -> choose code "***lesson3.ino***", load the code into OSOYOO Basic Board for Arduino, and then upload the sketch to the board.


sketch_oct16a | Arduino 1.8.5
File Edit Sketch Tools Help
New Ctrl+N
Open... Ctrl+O
Open Recent
Sketchbook
Examples
Close Ctrl+W
Save Ctrl+S
Save As... Ctrl+Shift+S
Page Setup Ctrl+Shift+P
Print Ctrl+P
Preferences Ctrl+Comma
Quit Ctrl+Q
to run once:
run repeatedly:
Arduino/Genuino Uno on COM3


lesson1 | Arduino 1.8.9
File Edit Sketch Tools Help
lesson1
Upload the sketch
#define speedPinR 5 // RIGHT PWM pin connect MODEL-X ENA
#define RightMotorDirPin1 7 //Right Motor direction pin 1 to
#define RightMotorDirPin2 8 //Right Motor direction pin 2 to
#define speedPinL 6 // Left PWM pin connect MODEL-X ENB
#define LeftMotorDirPin1 9 //Left Motor direction pin 1 to MOI
#define LeftMotorDirPin2 10 //Left Motor direction pin 1 to MOI
/*motor control*/
void go_Advance(void) //Forward
{
digitalWrite(RightMotorDirPin1, LOW);
digitalWrite(RightMotorDirPin2,HIGH);
digitalWrite(LeftMotorDirPin1,LOW);
digitalWrite(LeftMotorDirPin2,HIGH);
analogWrite(speedPinL,200);
analogWrite(speedPinR,200);
}
void go_Left(int t=0) //Turn left
Arduino/Genuino Uno on COM3



Notice: Servo Alignment

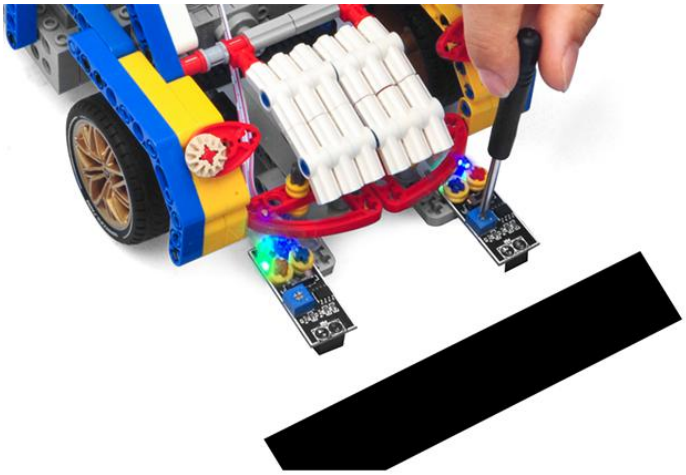
Please change the default value 90 in the following line as the FRONT value in the option 2 in Step 5 of lesson2. If you align the wheel direction manually as the option 1 in Step 5 of lesson2, please skip this step.

```
#define FRONT 90          // steering to front
```

STEP 4:

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.

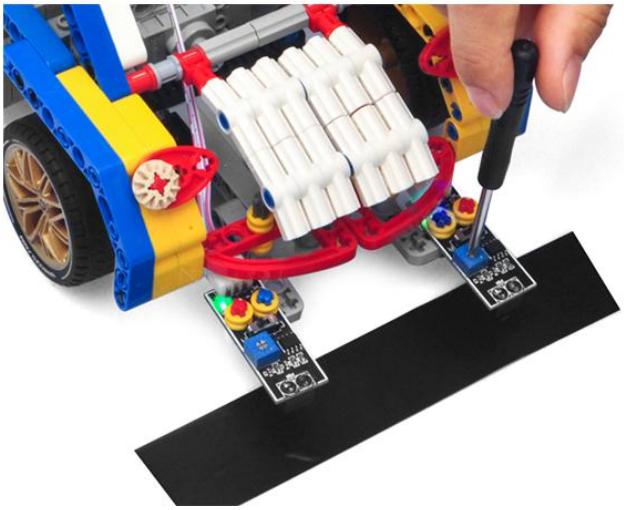


White:

LED ON

Black:

LED OFF



How to Play

1.Prepare a black track (the width of the black track is more than 20mm and less than 30mm) in white ground. Please note, the bend angle of track can't be larger than 30 degree. If the angle is too large, the car will move out of the track.

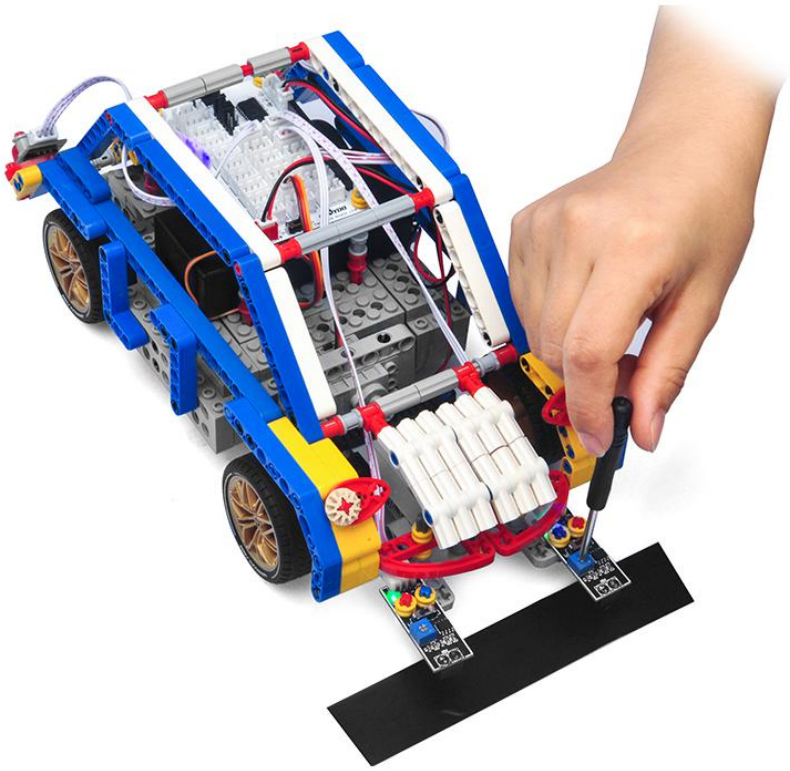
2. Put the car on the track, turn on the switch of OSOYOO Motor Shield and the switch of the batter box, the car will move along the black track.
Note: If the car does not move as per above mentioned result, you should check your wire connection of tracking sensor, battery voltage (must over 7.2v).

3. If you want to change the angel of the right or left, please edit the following line of the code and upload the sketch again:

int RIGHT=FRONT-70;int LEFT=FRONT+70;

5. If you want to change the speed of the car, please revise the following code of the sketch **(Note: the max value is 255)**

#define SPEED 190#define HI_SPEED 220



Lesson 4: Bluetooth Control

Objective

In this lesson, we will use Mobile to control our robot car and make an imitation driving. Since is a mock driving, we will use a virtual steering wheel and gear in our APP to imitate their counterparts in real car.

You must complete lesson 2 Basic Movement before you continue on with this lesson.

If you don't complete the frame of car, please review lesson 1

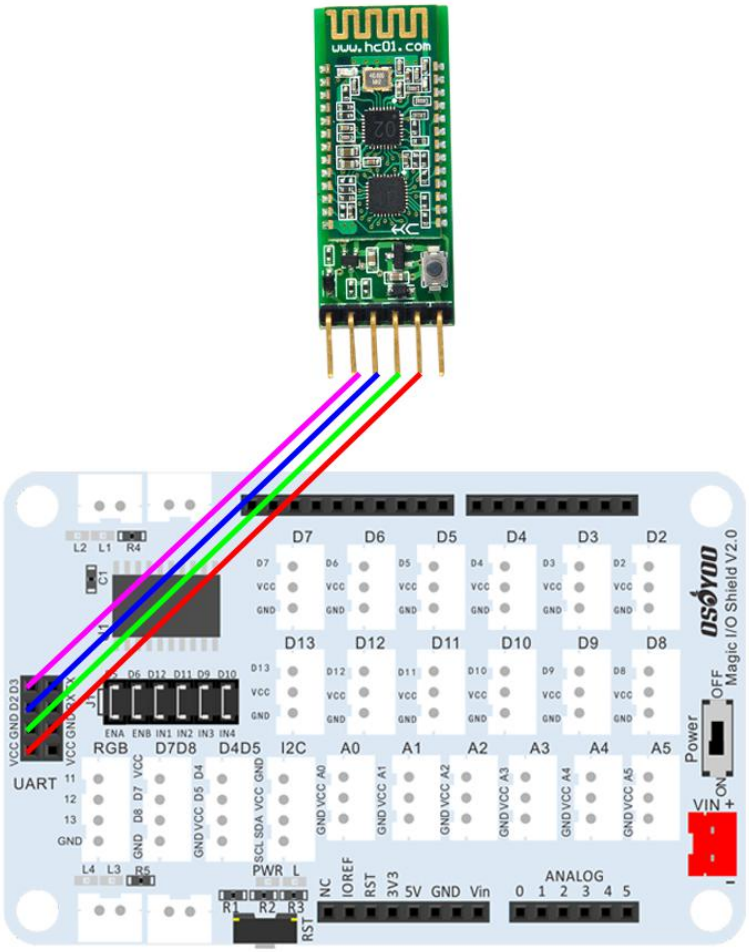


Circuit Connection

If you don't complete the basic wire connection, please review lesson 2

Connection:

Insert Bluetooth Module (VCC,GND,D2,D3) into OSOYOO motor shield as following graph (Remember: DO NOT remove any existing wires installed in Lesson2):



How to Code

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/
OSOYOO imitation driving Robot APP		Search "**OSOYOO imitation driving**" in Google Play or Apple APP store

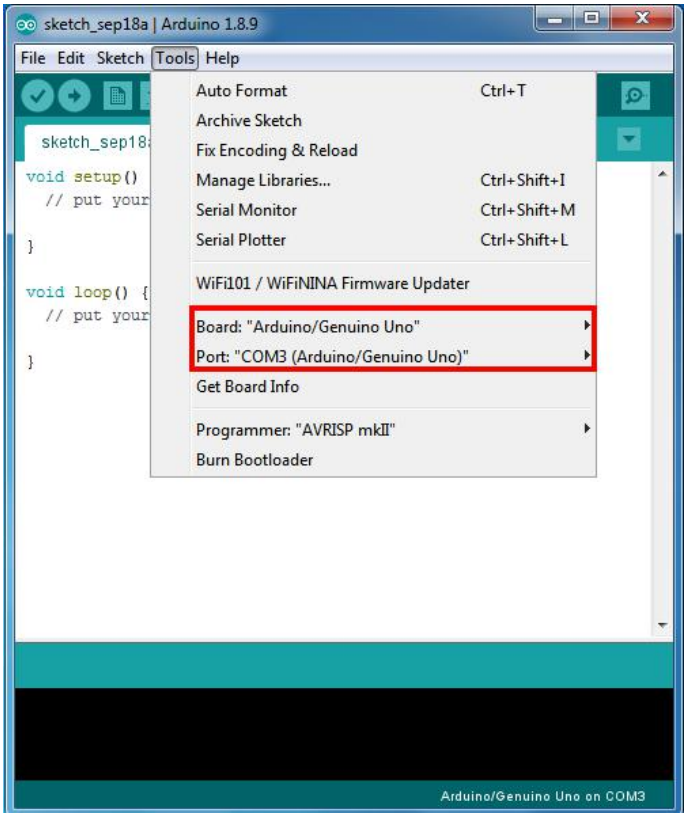
STEP 1:

Download https://osoyoo.com/driver/2022008400/lesson4.zip , unzip it, you will see a folder called ***lesson4***

STEP 2:

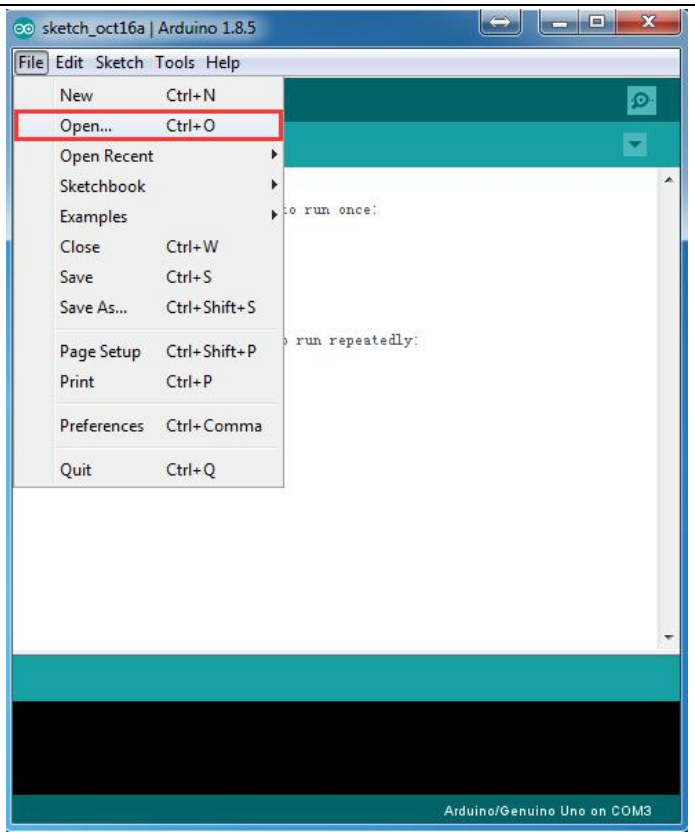
Connect UNO R3 board to PC with USB cable, open IDE, choose corresponding board/port for your project.

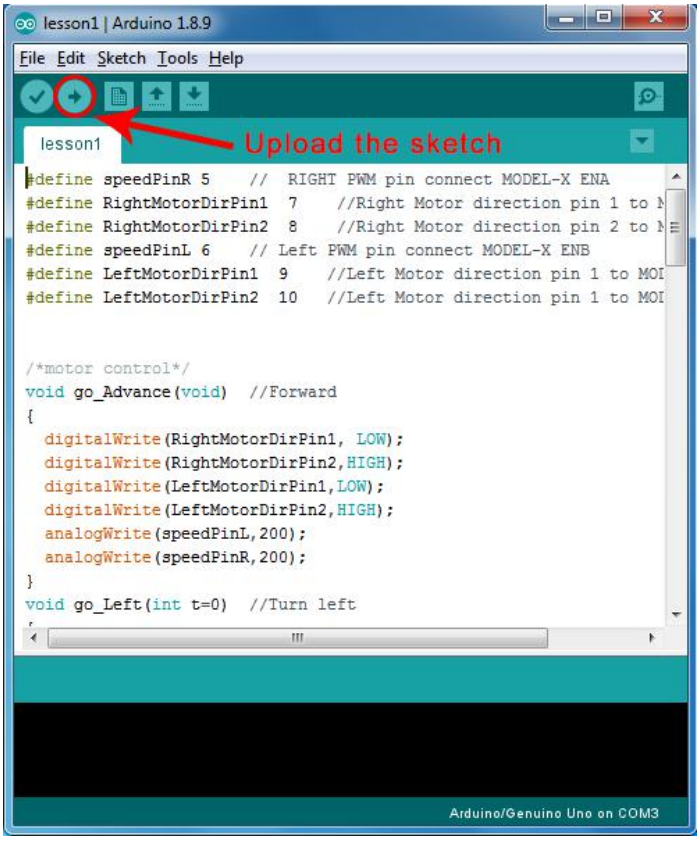
Notice: Shut off your battery or Unplug your power adapter when upload sketch code to OSOYOO Basic Board for Arduino.

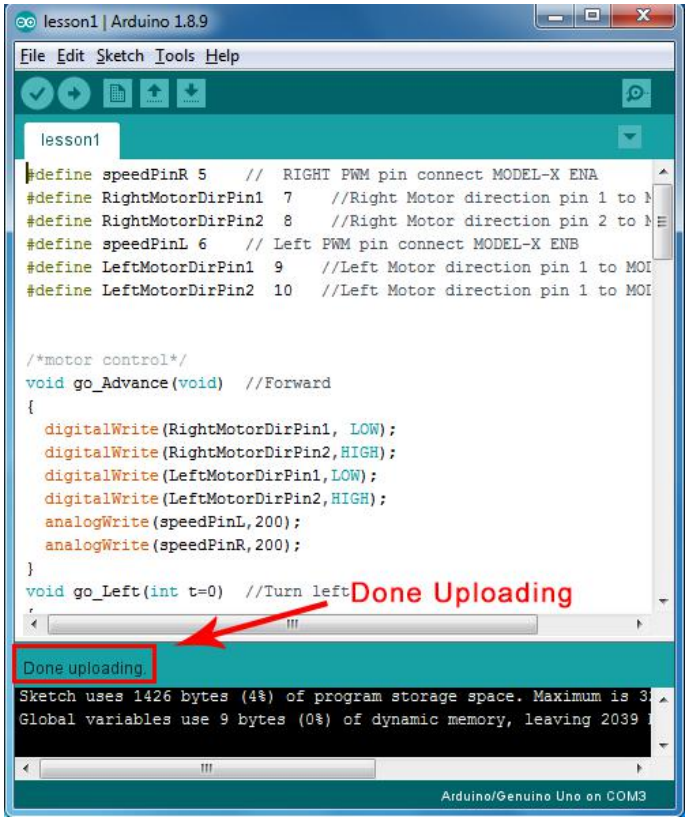


STEP 3:

Click file -> click Open -> choose code "***lesson4.ino***", load the code into OSOYOO Basic Board for Arduino, and then upload the sketch to the board.


sketch_oct16a | Arduino 1.8.5
File Edit Sketch Tools Help
New Ctrl+N
Open... Ctrl+O
Open Recent
Sketchbook
Examples
Close Ctrl+W
Save Ctrl+S
Save As... Ctrl+Shift+S
Page Setup Ctrl+Shift+P
Print Ctrl+P
Preferences Ctrl+Comma
Quit Ctrl+Q
to run once:
run repeatedly:
Arduino/Genuino Uno on COM3


lesson1 | Arduino 1.8.9
File Edit Sketch Tools Help
lesson1
Upload the sketch
#define speedPinR 5 // RIGHT PWM pin connect MODEL-X ENA
#define RightMotorDirPin1 7 //Right Motor direction pin 1 to
#define RightMotorDirPin2 8 //Right Motor direction pin 2 to
#define speedPinL 6 // Left PWM pin connect MODEL-X ENB
#define LeftMotorDirPin1 9 //Left Motor direction pin 1 to MOI
#define LeftMotorDirPin2 10 //Left Motor direction pin 1 to MOI
/*motor control*/
void go_Advance(void) //Forward
{
digitalWrite(RightMotorDirPin1, LOW);
digitalWrite(RightMotorDirPin2,HIGH);
digitalWrite(LeftMotorDirPin1,LOW);
digitalWrite(LeftMotorDirPin2,HIGH);
analogWrite(speedPinL,200);
analogWrite(speedPinR,200);
}
void go_Left(int t=0) //Turn left
Arduino/Genuino Uno on COM3



Notice: Servo Alignment

Please change the default value 90 in the following line as the FRONT value in the option 2 in Step 5 of lesson2. If you align the wheel direction manually as the option 1 in Step 5 of lesson2, please skip this step.

```
#define FRONT 90          // steering to front
```

STEP 4:

Install APP into your mobile phone

1) Install APP on Android device as following

In Google Play store search APP name “OSOYOO imitation driving”, download the APP as following and install it in your smart phone

If you can not use Google Play to find the APP, please Download the APP from following link :https://osoyoo.com/driver/v1car.apk.

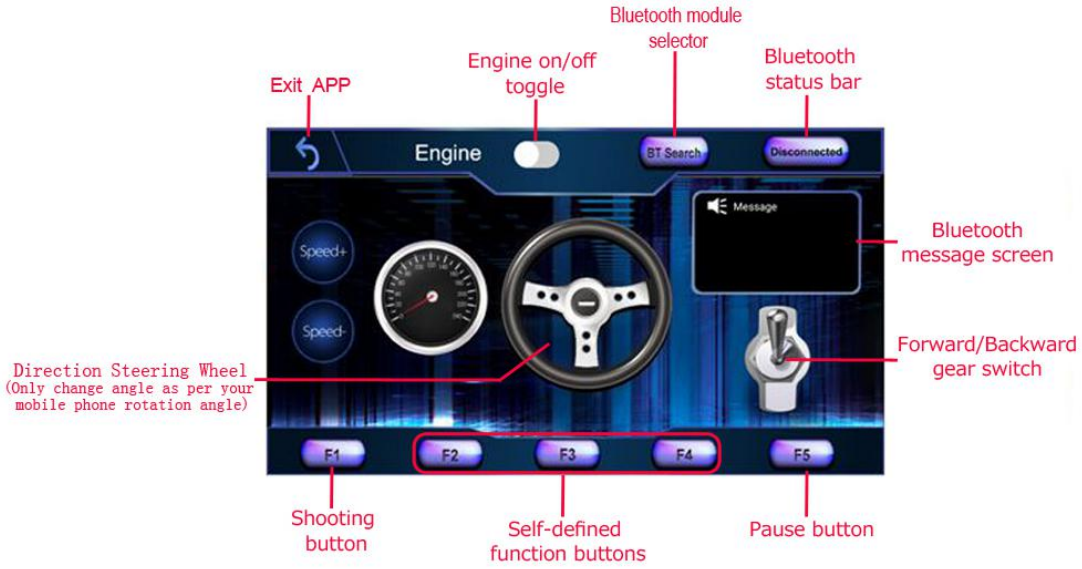


2) Install APP on Apple IOS device as following

In Apple APP store search APP name “OSOYOO imitation driving”, download the APP as following and install it in your smart phone



Explanation of APP UI (UI is different between Android and IOS)



-
  - **Connect HC-02 bluetooth in Android phone.** There is a **BT Search** button in Android APP: When click this button, you will see a Bluetooth device list which has been paired with your APP. Select HC-02 device to connect the car. Once HC-02 is connected, Bluetooth Status will change from Disconnected to Connected. You can only control your car when Bluetooth is connected.
  - **Connect HC-02 bluetooth in iPhone/iPad** , simply click Connect button, a HC-02 device will show up in a pop-up list. Click that HC-02 device will connect Bluetooth module to your iPhone. Then the Connect button will change name to Disconnect.
  - **Engine toggle** : When Engine toggle is set to OFF(white), car will stop and all buttons in the APP will be disabled. When Engine toggle is set to ON(red), car will start to move. All other movement control buttons will active.
  - **Forward/Backward gear switch:** This gear switch can control the car is moving ahead or reverse like real car gear.
  - **F1,F2,F3,F4,F5 customized button.** In this lesson, we only use F5 which pause the the car movement. The difference between F5 and Engine OFF button is that Engine OFF button when touched, all other buttons will be disabled. You should toggle Engine button again to enable other button. On the other hand, when F5 is clicked, the car will stop but all other buttons is still active. Even you do not touch any button just change your cell phone angle position(like you move the steering wheel), the car will move again.

- **Direction Steering Wheel** : When you rotate your mobile phone angle, the steering wheel will change angle as per your mobile phone rotation angle. This will make your car change direction. For example, when steering wheel make clockwise rotation, car will move to left. Remember, the steering and Forward/Backward gear should work together same as you are driving a real car. For example, when you want back your car to a right side packing lot, you need set Gear to R position and rotate your steer to count-clockwise direction.

-
  - **Speed+**: Make the robot car speed up
  - **Speed-**: Make the robot car slow down

Connect APP to HC-02 Bluetooth Module

- **Connect with Android device:**
  If you use **Android** device and 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.After bluetooth HC02 device is paired, open the APP. Click **BT Search** Button to connect APP to HC02 device.
- **Connect with iOS device:**
  If you use iOS device, simply open the APP, click Connect button, you will see a Bluetooth list, select the HC02 device .

How to Play

Now you have installed your hardware and software for this lesson, let's drive our car!

Step 1) Put your robot car onto the ground and turn on the battery switch.

Step 2)Go to your mobile phone ->Setting ->Bluetooth setting and search a Bluetooth device called HC-02, pair it with code 1234

Step 3) Open OSOYOO imitation driving Robot APP, Click BT Search button and find the bluetooth you have paired

Step 4) Turn on Engine toggle, click **Speed+** to make the robot speed up as the robot car is very slow at first. When you rotate your mobile phone angle, your car will change direction.

Enjoy your driving!

On Android device

1. Open OSOYOO imitation driving Robot APP



2. Click BT Search and scan Bluetooth device



3. Choose HC-02 device till device is connected



4. Turn on engine toggle



5. Click Speed+ to make the car move,
click gear switch to control car move forward or backward
rotate mobile phone angle to change car direction,



On IOS device

1. Open OSOYOO imitation driving Robot APP



2. Click Connect and scan Bluetooth device



3. Choose HC-02 device till APP shows Disconnect



4. Turn on engine toggle



5. Click Speed+ to make the car move,
click gear switch to control car move forward or backward
rotate mobile phone angle to change car direction,




Bluetooth

Lesson 5: Wifi Control

Objective

In this lesson, we will use Mobile to control our robot car and make an imitation driving. Since is a mock driving, we will use a virtual steering wheel and gear in our APP to imitate their counterparts in real car.

You must complete **lesson 2 Basic Movement** before you continue on with this lesson.

If you don't complete the frame of car, please review lesson 1



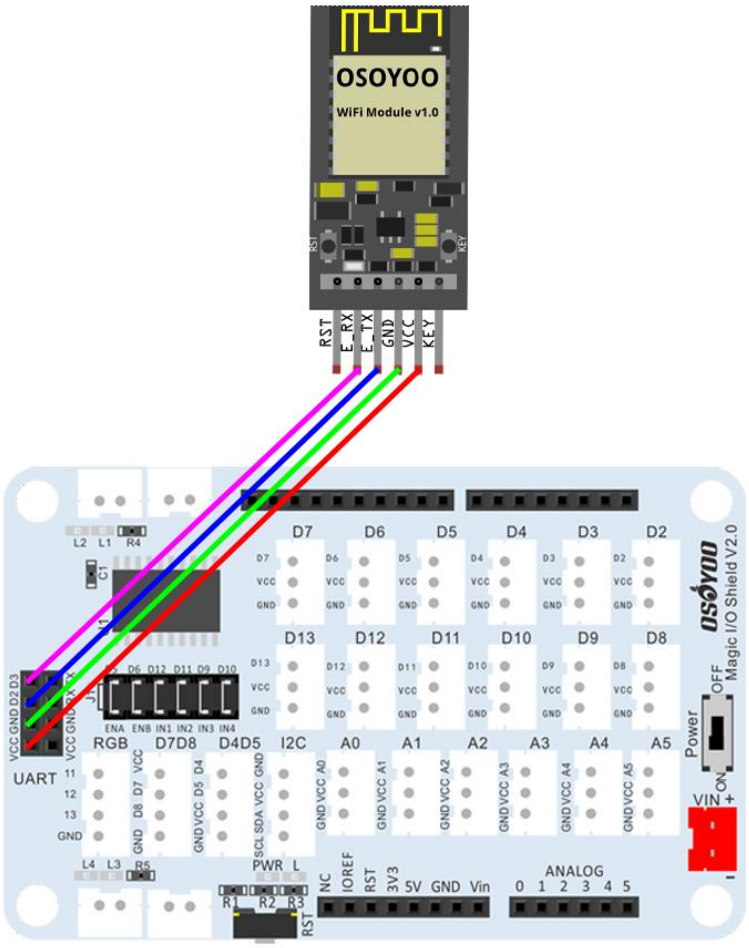
Circuit Connection

If you don't complete the basic wire connection, please review lesson 2

Connection:

Remove Jumper caps on ENB,IN3,IN4

Insert WiFi Module (VCC,GND,D2,D3) into OSOYOO motor shield as following graph (Remember: DO NOT remove any existing wires installed in Lesson2):



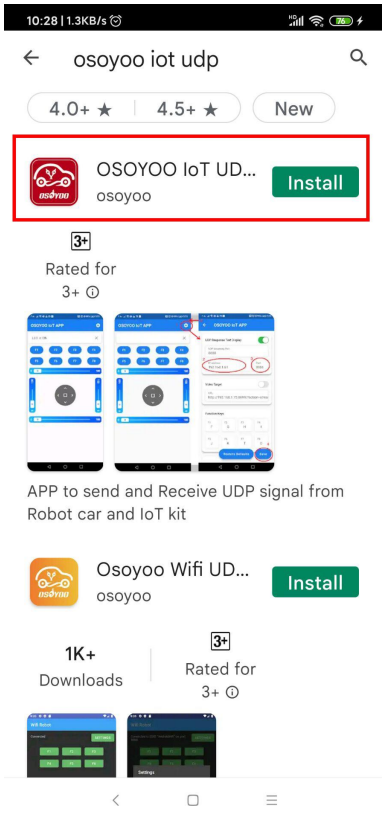
PART	Motor Shield
IN1 jumper	D12
IN2 jumper	D11
ENA jumper	D5
Steer Servo	D9
Back Motor Cable	K1 or K2
Left Tracking Sensor	D6
Right Tracking Sensor	D7
E_TX jumper	D4

E_RX jumper D11

How to Code

Step 1)

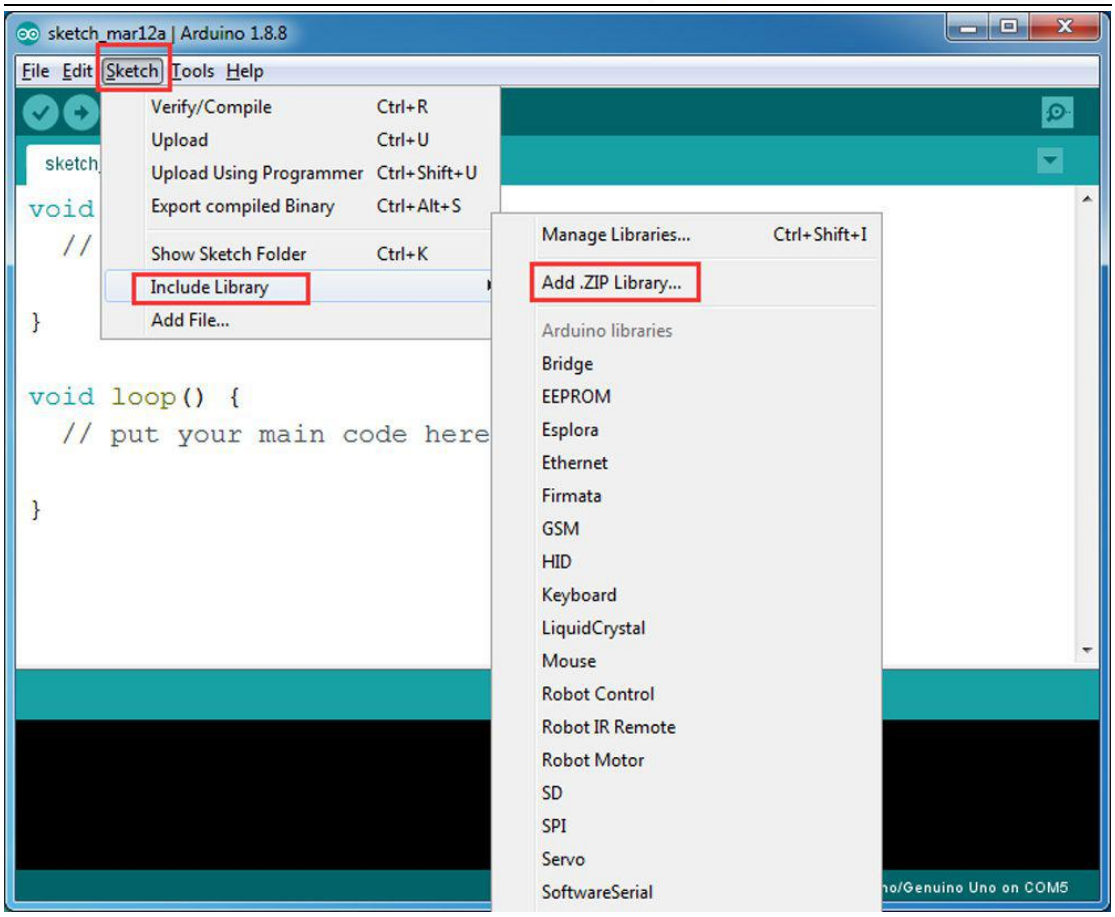
Download OSOYOO WIFI UDP Robot Car control APP
In Google Play or Apple Store, please search key words “OSOYOO iot UDP Robot Car”, you will find a red icon APP as following:



Step 2) Please download PWMServo library from https://osoyoo.com/driver/sg90car/PWMServo.zip if you haven't installed the library in lesson 2.

Also Please download the WifiESP-Master library zip file from https://osoyoo.com/driver/WiFiEsp-master.zip

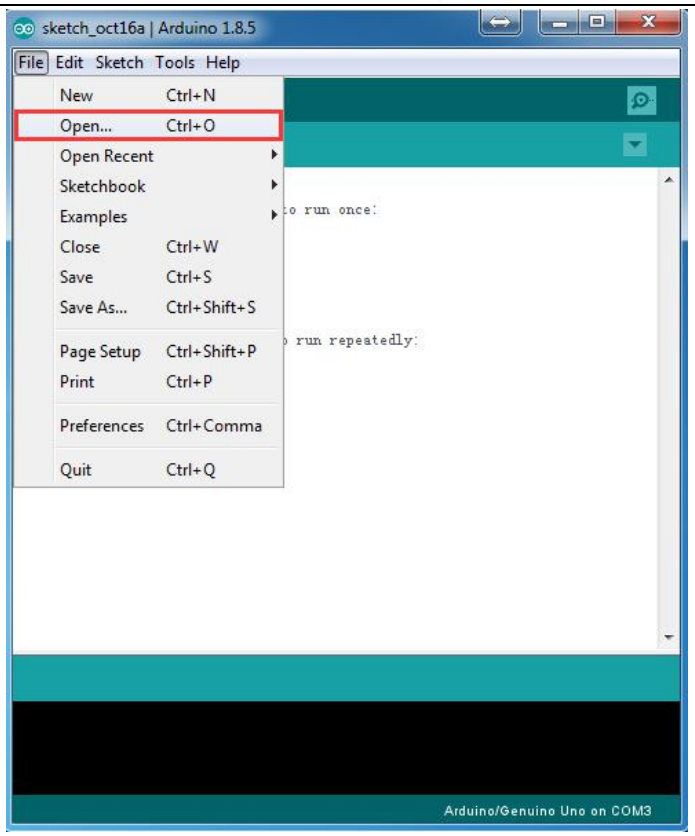
Now Open Arduino IDE ->click Sketch ->Include Library ->Add .ZIP library , then load above two zip files into OSOYOO Basic Board for Arduino.



Step 3) Sketch code Installation:

1) Please download sketch code from https://osoyoo.com/driver/2022008400/lesson5.zip.

Unzip the file, you will see a folder **lesson5.ino** . Open Arduino IDE -> click file -> click Open -> choose code file **blesson5.ino** in above folder, load the code into OSOYOO Basic Board for Arduino



2) You need change the wifi SSID and passsword in line 52,53

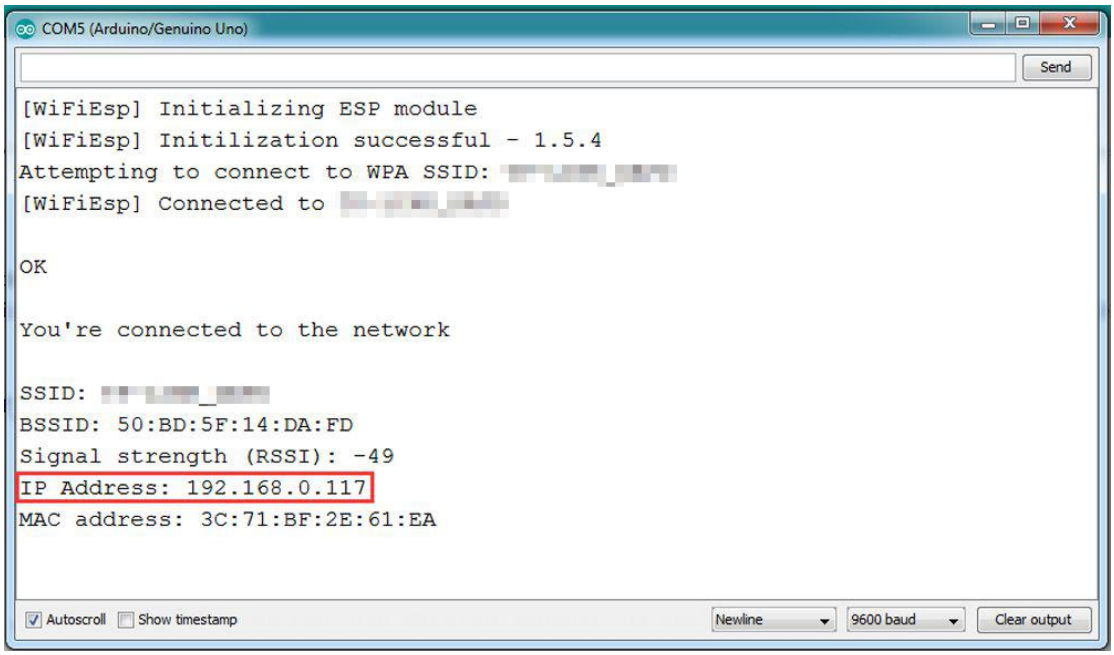
*char ssid[] = "***"; //* replace *** with your router wifi SSID

*char pass[] = "***"; //* replace *** your wifi *password*

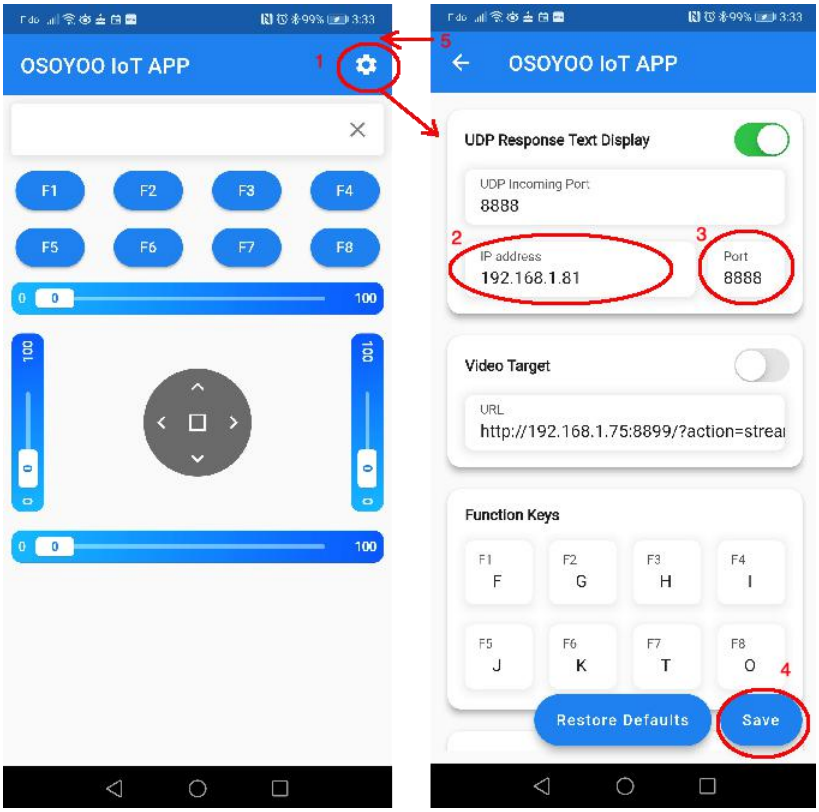
3) Please change the default value 90 in line 19 as the FRONT value in lesson 1. If you align the wheel direction via the option 1 in Step 5, please skip this step.

```
#define FRONT 90          //degree when steering facing straight forward
```

4) Upload the sketch to OSOYOO Basic Board for Arduino. Finally, click the Serial monitor window in upper right corner of Arduino IDE, you will see following result:



5) 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 and **Port** to **8888** in settings.



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 8888 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

How to Play

Turn on the car. Now click Setting to set up robot IP address.
A) you need connect cell phone to the same LAN ssid of your robot car and set IP address same as the Robot IP showed in Arduino Serial Monitor.
You can click the ◄ button to make left turn(rotate steering wheel counterclockwise) , click ►button to make right turn (rotate steering wheel clockwise)
▲ button will make car move forward and ▼ key will make car move backward.
If you press F7 key, the car will do line tracking.



