Robot Tank Car Kit V2.0

Content

More details	https://osoyoo.com/?p=33608
Support Email	support@osoyoo.info

Robot Tank Car Chassis or Electronic Parts Kit V2.0 Buy Link

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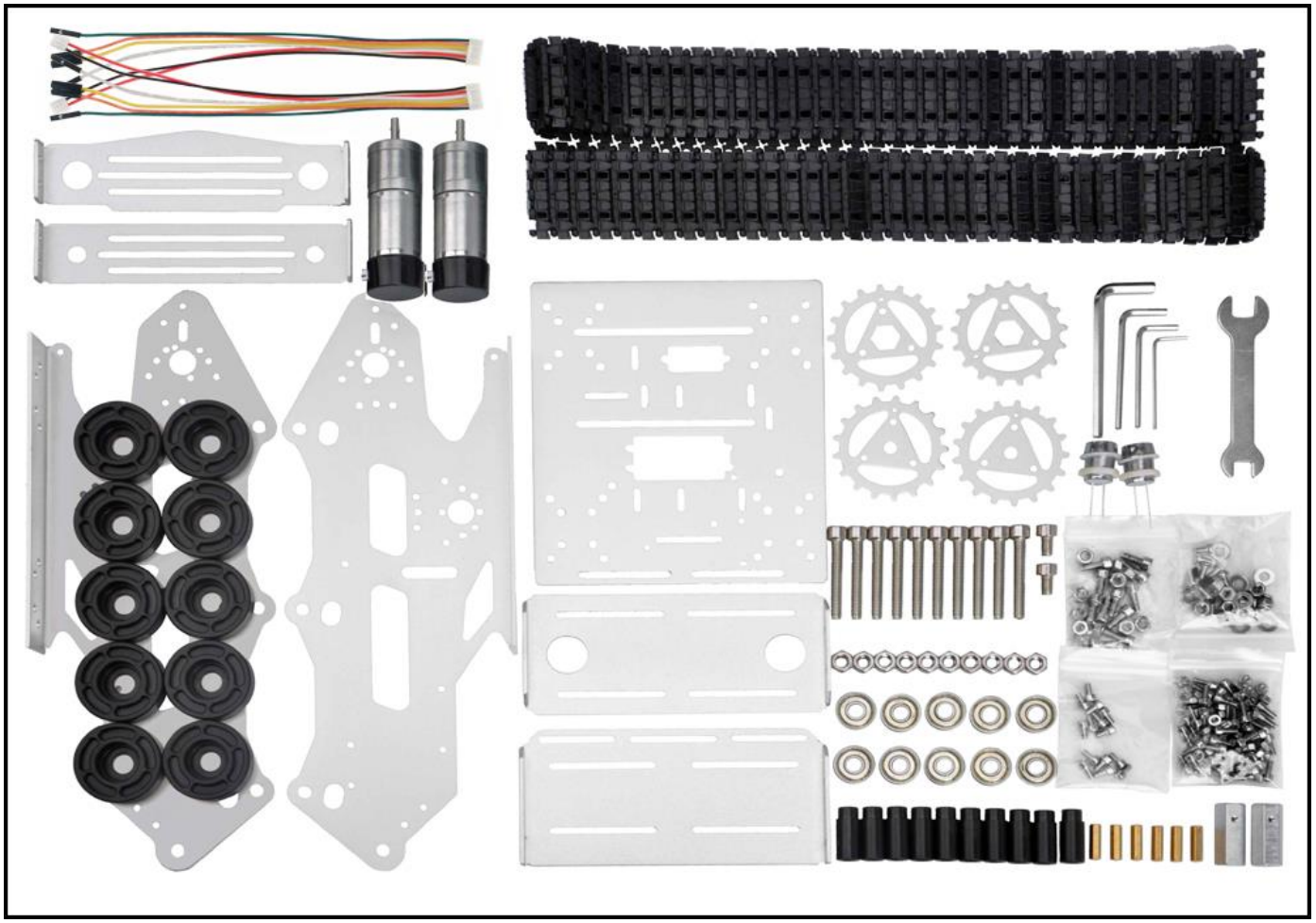
Lesson1(1):Tank chassis assembly

OBJECTIVE

In this lesson, we will install tank car chassis as basic framework.

PARTS & DEVICES



HARDWARE INSTALLATION

Step1: Assemble the carrying wheels (x10)

Main components:

1x black wheel

1x bearing

1x circle shaft

1x M6 nuts

1x M6*40 inner hexagon screws

Step2: Assemble the driving wheels(x2)

Main components:

2x wheel pieces

3x copper pillar

1x Al-alloy coupling

1x jackscrews

1x M6*10 inner hexagon screws

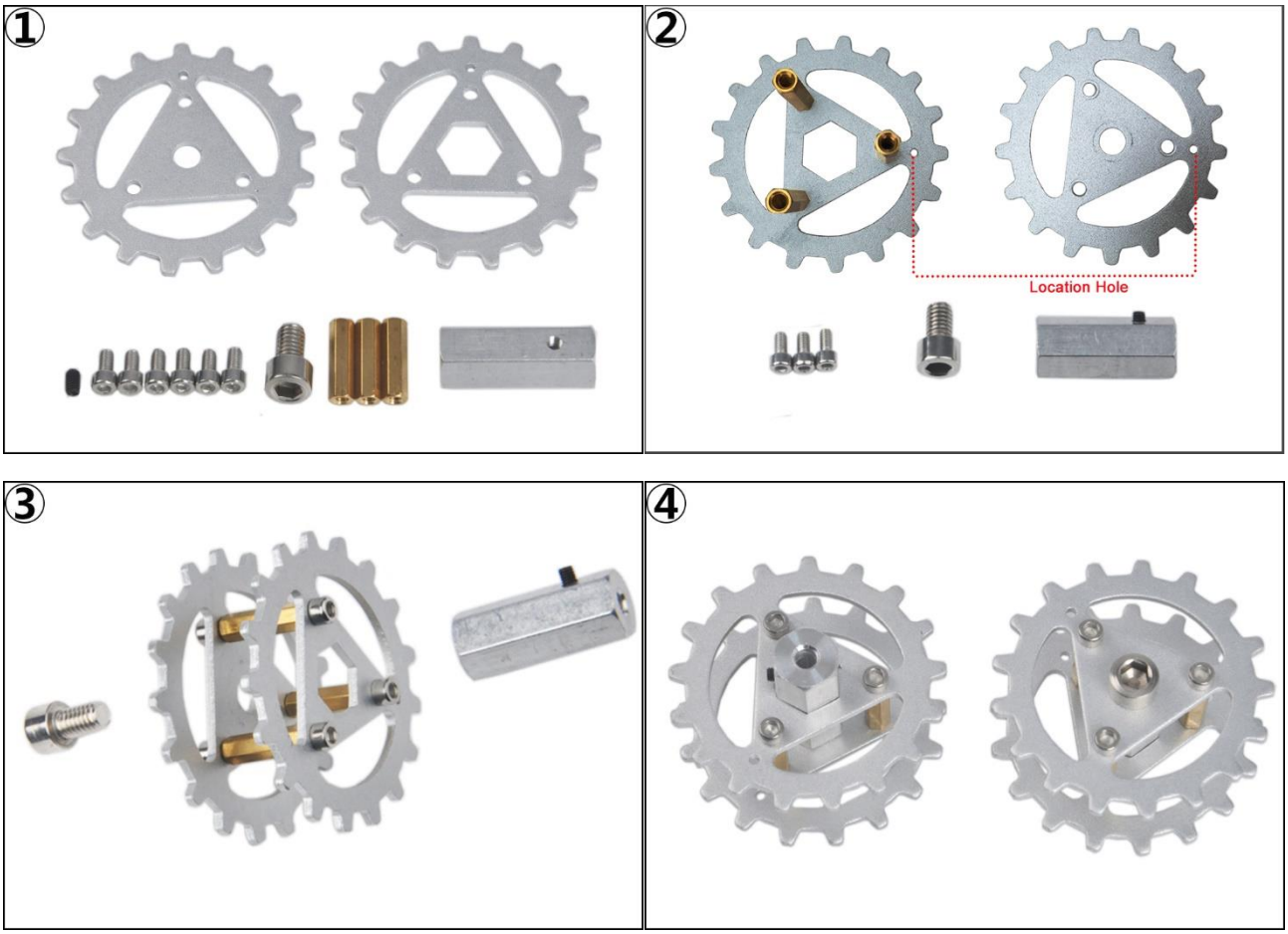
6x M3*10 inner hexagon screws

Note:

1)Please align the two location holes in the wheel pieces.

2)Install the jackscrews into the al-alloy coupling, then insert the al-alloy coupling into the big hole of driving wheel, fix the al-alloy coupling with M6 hex screws.

3)To fix the driving wheels on motors easily,do not tighten the jackscrews.



Step3: Install the main plate

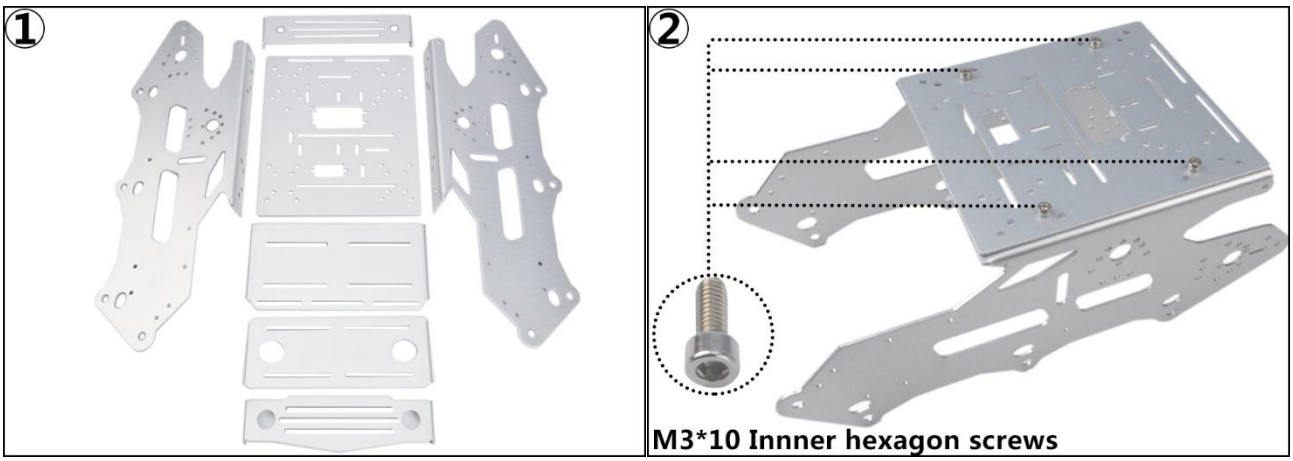
Main components:

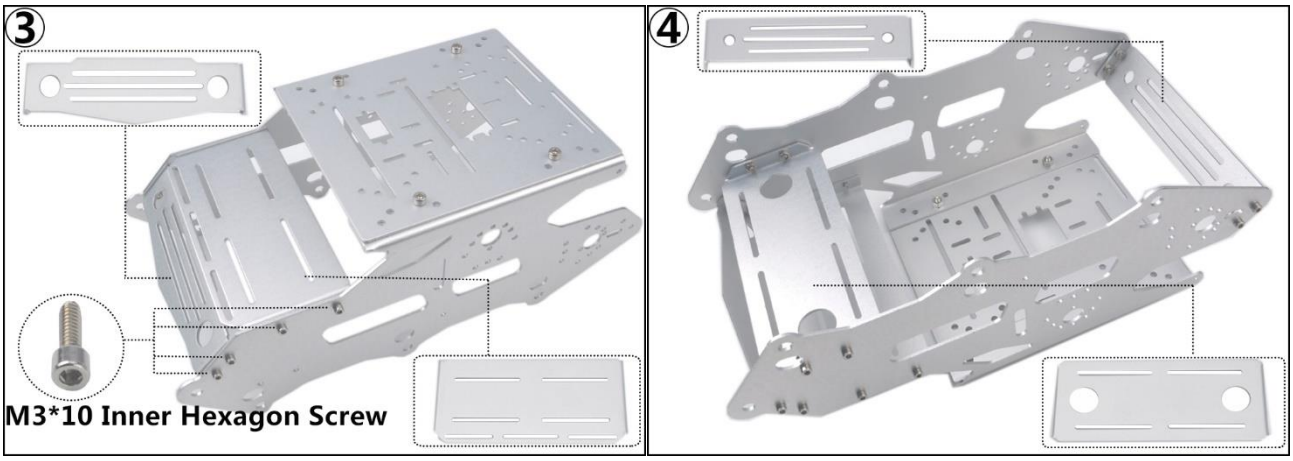
5x plates (include the base plate and subplates as following pictures)

20x M3*10 inner hexagon screws

Note:

Fix the biggest base plate with 4 pieces M3*10 screws for the first time, then fix the other subplates in turn as the following pictures.





Step 4: Install motor

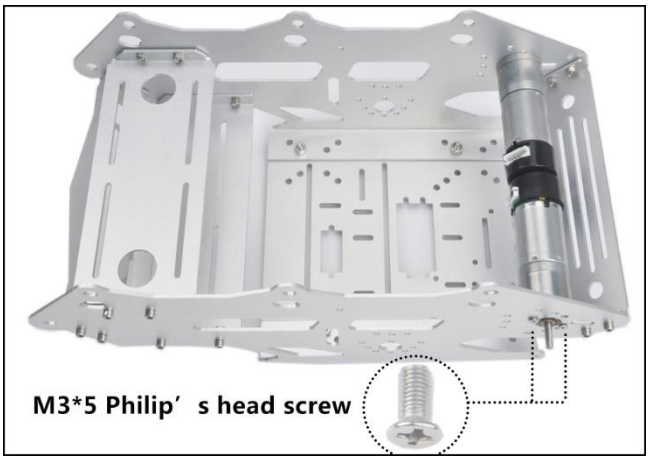
Main components:

2x side plates (include left side plate and right side plate)

2x motors

4x M3*5 screws (phillips head)

Note: When you fix the motor with phillips head screw, please do not use too long screw to avoid getting stuck.



Step5: Install all wheels and tracks on car

Main components:

1x tank car chassis

10x carrying wheels

10x driving wheels

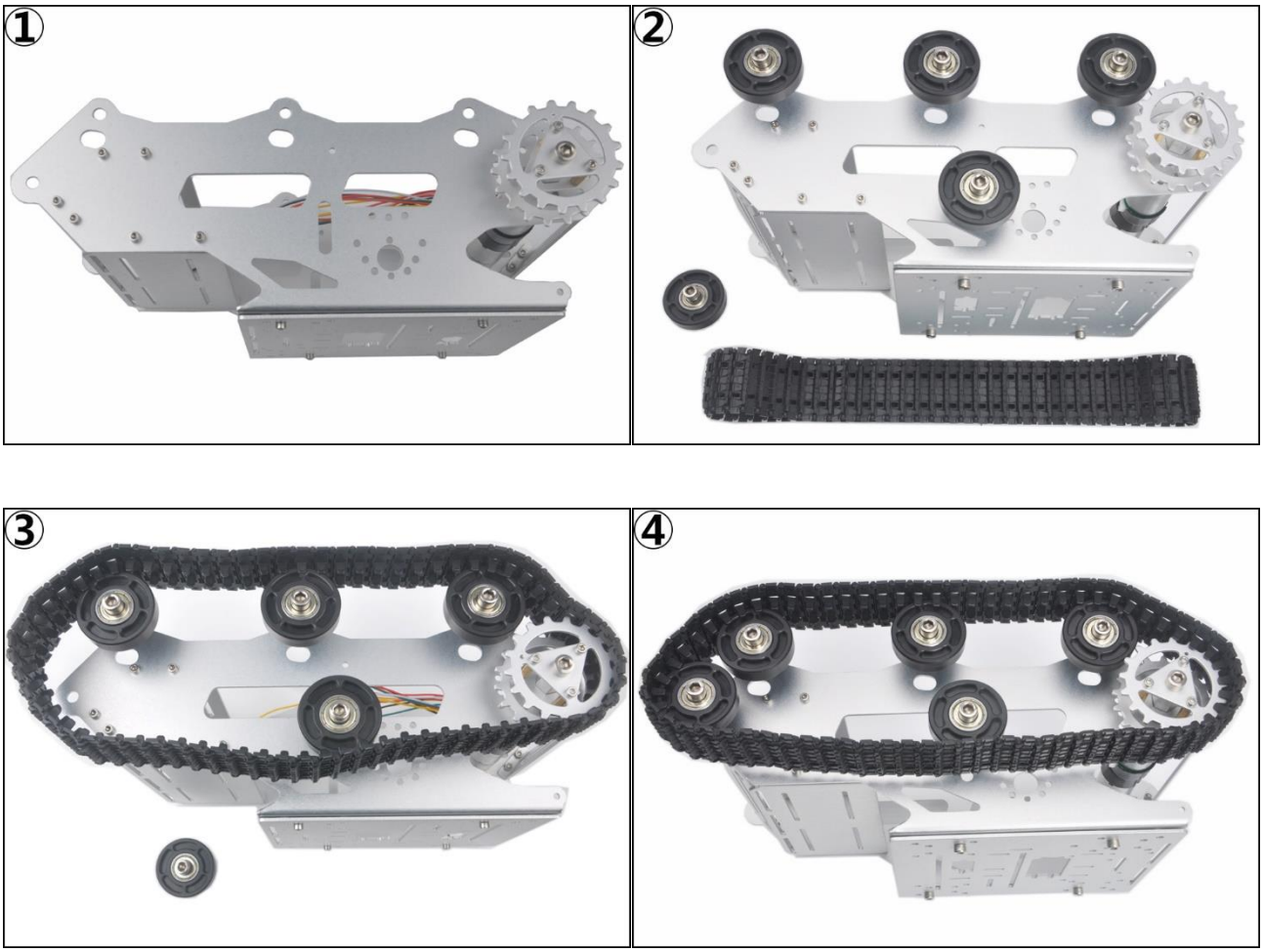
2x Tracks

Note:

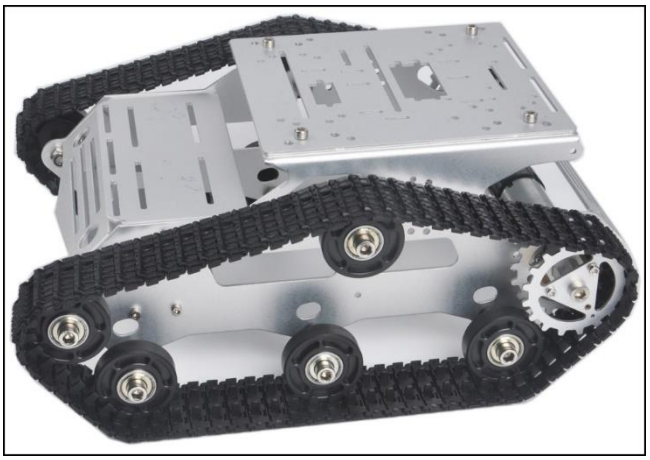
1)To make the tracks install more easily, we recommend not to tighten the fifth carrying wheel and adjust the proper width between the driving wheel and side plate.

2)Please tighten the jackscrews with hex wrenches to connect the driving wheels to the motor. If the driving wheel is blocked by its jackscrew and cannot insert into motor axis, please slightly loosen the jack screw driving wheel.

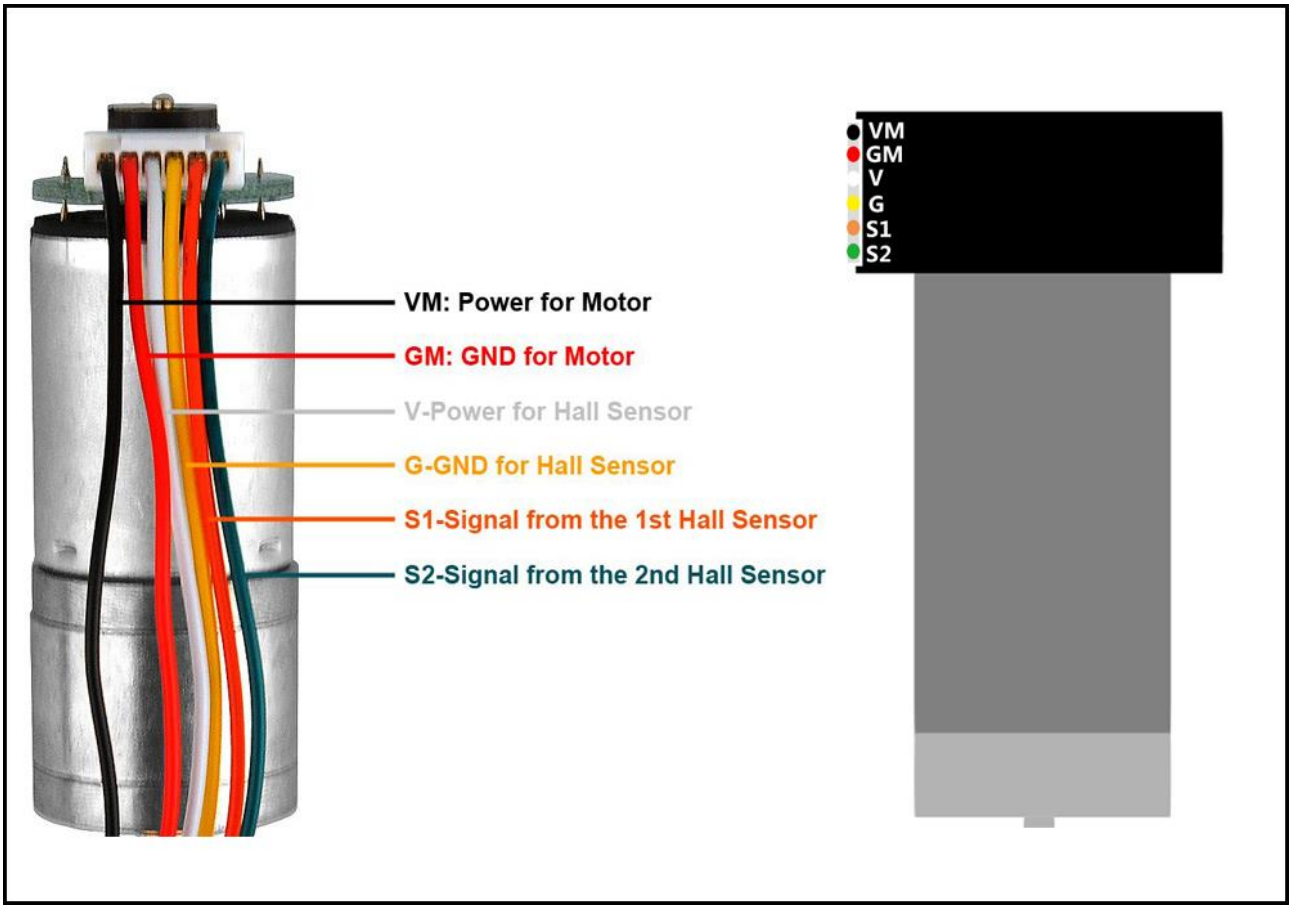
3)Please choose the proper length tracks as per your need before install the tracks.



VI.The Finished Presentation



VII. Encoder Motor Pinout


VM: Power for Motor
GM: GND for Motor
V-Power for Hall Sensor
G-GND for Hall Sensor
S1-Signal from the 1st Hall Sensor
S2-Signal from the 2nd Hall Sensor
VM
GM
V
G
S1
S2

产品型号：GM25-370-24140-75-14.5D10

1. 标准使用条件 (Standard Operating Conditions)

NO.	項 目(Item)	規 格(Specification)	检验方法 (Test Method)
1.1	额定电压 (Rated Voltage)	DC 9.0V	电压表 (Multimeter)
1.2	速比 (Gear Ratio)	1/75	
1.3	马达转向 (Rotation)	CW	手感 (Handle)
1.4	姿 势(Motor Position)	检查时水平 (All position in horizontal)	手感 (Handle)
1.5	检测时时温度范围 Temperature	0 Degree - 30 Degree Celsius	温度计 (Thermometer)
1.6	检测时时湿度范围 Humidity	30% ~ 95%	湿度计 (Hygroscope)

2. 电机性能 (Performance Of Motors)

NO.	項 目(Item)	規 格(Specification)	检验方法 (Test Method)
2.1	空载转速 (No-load Speed)	11500±10%rpm	转速表 (Flash Speed Indicator)
2.2	空载电流 (No-load Current)	180mA(Max)	电流表 (DC Power Supply)
2.3	堵转电流 (Stall Current)	4500mA(Max)	电流表 (DC Power Supply)
2.4	堵转力矩 (Stall Torque)	160g.cm	扭力计 (Torque Measure)

3. 整机性能 (Performance of Gear motors)

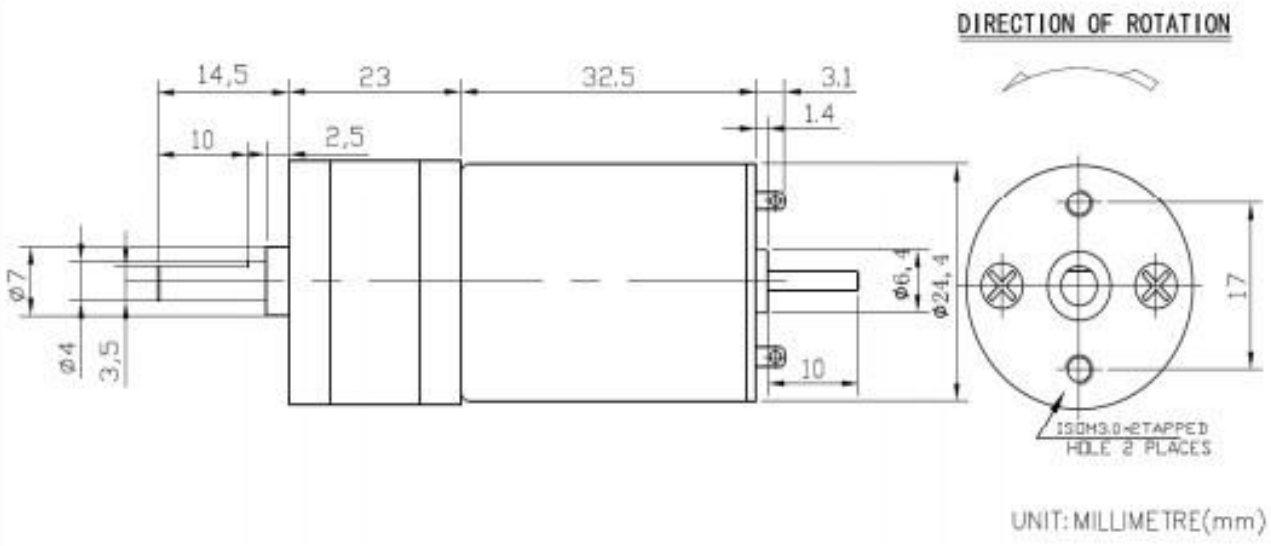
NO.	項 目(Item)	規 格(Specification)	检验方法 (Test Method)
3.1	输出转速 (Output Speed)	150±10%rpm	转速表 (Flash Speed Indicator)
3.2	空载电流 (No-load Current)	200mA(Max)	电流表 (DC Power Supply)
3.3	堵转电流 (Stall Current)	4500mA(Max)	电流表 (DC Power Supply)
3.4	堵转力矩 (Stall Torque)	9.5kg.cm	扭力计 (Torque Measure)
3.5	负载力矩 (Rated Torque)	3000g.cm	扭力计 (Torque Measure)
3.6	负载电流 (Rated Current)	1200mA(Max)	电流表 (DC Power Supply)
3.7	负载转速 (Rated Speed)	100±10%rpm	转速表 (Flash Speed Indicator)
3.8	噪音 30CM (Noise)	56dB	分贝仪 (Digital Sound Levd Meter)

4. 基本尺寸 (The Dimension)

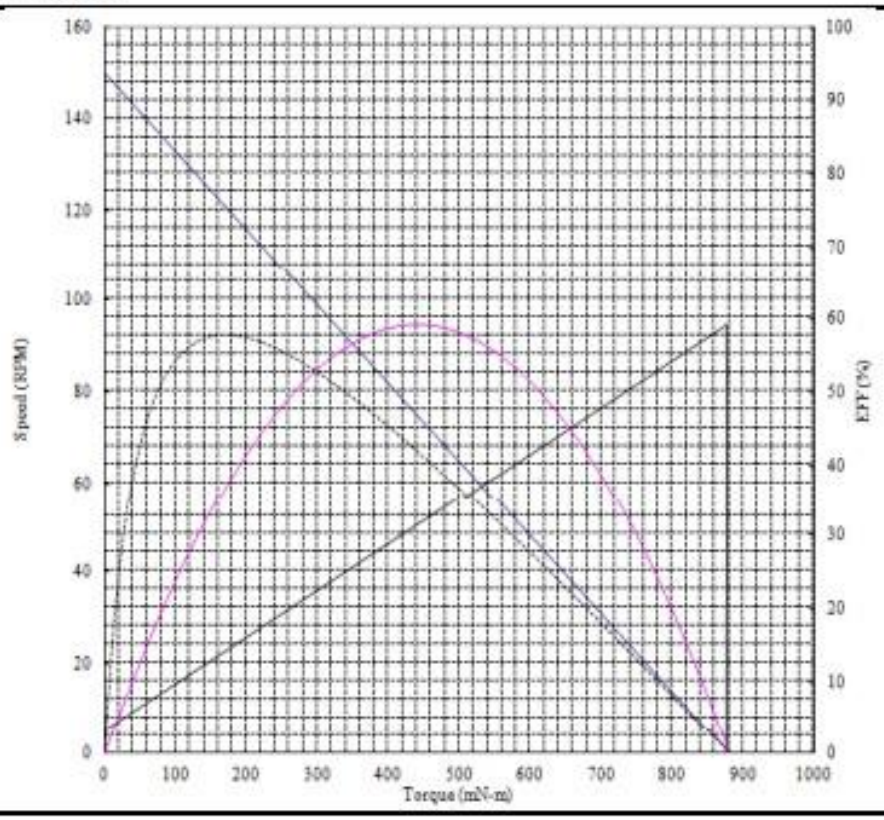
NO.	項 目(Item)	規 格 (Specification)	检验方法 (Test Method)
4.1	轴伸尺寸 (The Outside Shaft Length)	14.5mm	卡尺 (Vernier Calipers)
4.2	轴向间隙 (Shaft End Play)	0.05-0.50mm	治具 (Frock)
4.3	螺孔 (Screw Size)	M3.0	治具 (Frock)
4.4	出轴直径 (Dia.of shaft)	Φ4mm D3.5	卡尺 (Vernier Calipers)
4.5	外形安装尺寸 (Outline Mounting Dimension)	Refer to the Outline Drawing	治具和卡尺 Calipe

5. 产品照片 (The product photos)

6. 产品外形图 (Product drawings)



7. 曲线图 (Curve drawings)



Lesson1(2): Tank car control board basic assembly

OBJECTIVE

In this lesson, we will install the most important framework in the tank car and program the car to do some simple movements. If you have passed the test movement in this lesson, it means Arduino UNO board, voltage meter,motor control driver module, motors, batteries,chassis and wire connections between these parts are all functioning well.

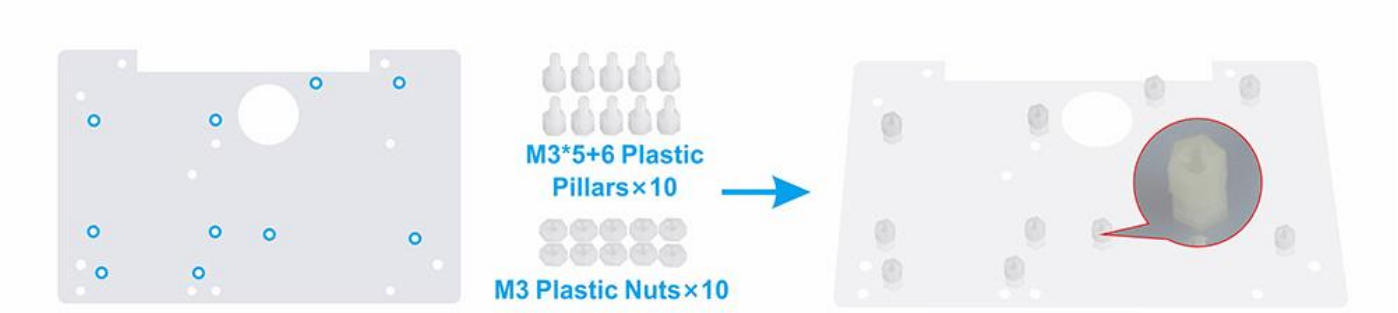
As your experiments in future lessons are all based on frame work of Lesson 1, it is very important to test the installation and sample code in this Lesson properly.

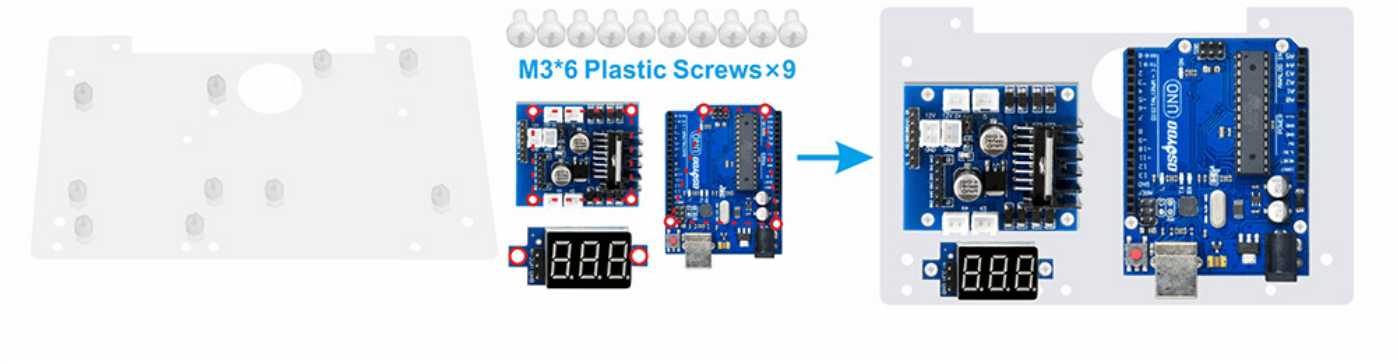
PARTS & DEVICES

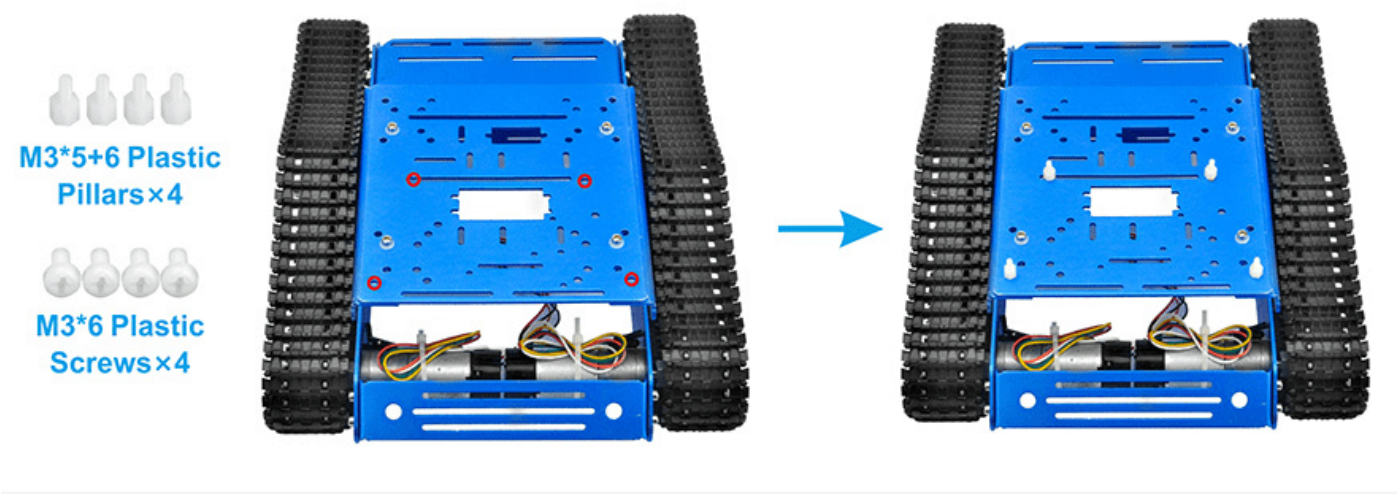
TR300 tank car chassis x1 +Acrylic board chassis x1
OSOYOO UNO R3 board fully compatible with Arduino x1
OSOYOO V1.3 Wifi shield x1
OSOYOO Model X motor driver x1
OSOYOO Battery box x 1
OSOYOO Voltage meter x1
18650 batteries(3.7V) x 2
some screws and jumper wires

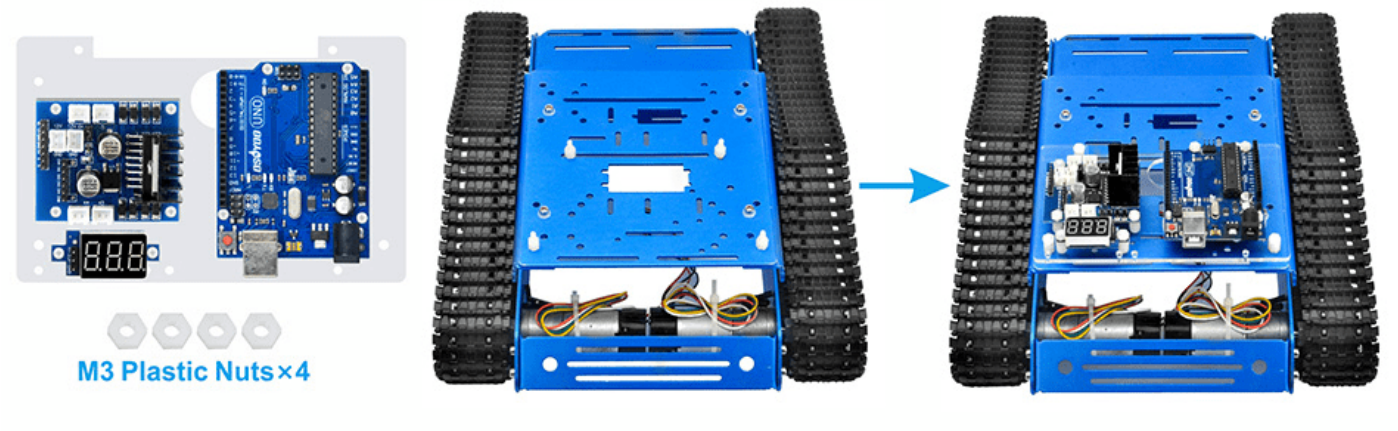
HARDWARE INSTALLATION

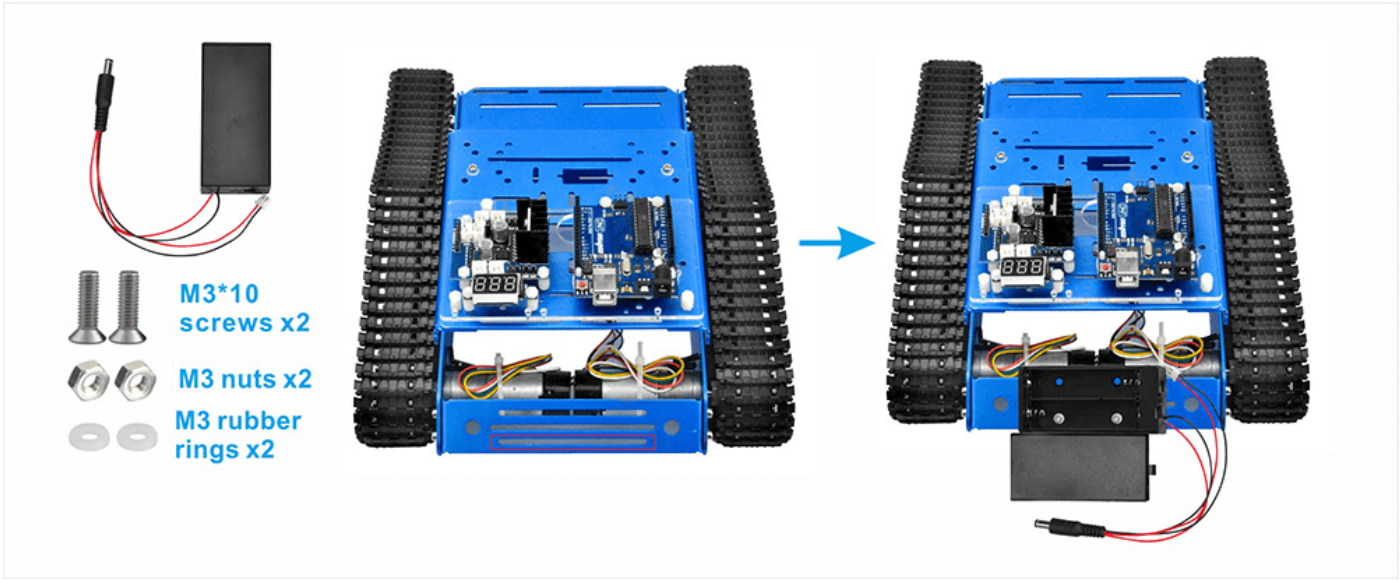
Install Arduino UNO,wifi expansion board,L298N motor driver board and voltage meter on upper acrylic chassis with M3*6 screw, M3*6 Plastic Pillars and M3 nuts.




M3*6 Plastic Screws×9

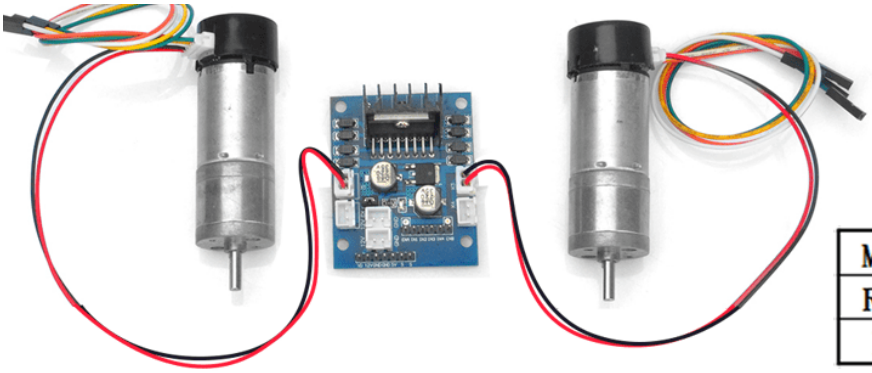

M3*5+6 Plastic Pillars×4
M3*6 Plastic Screws×4


M3 Plastic Nuts×4

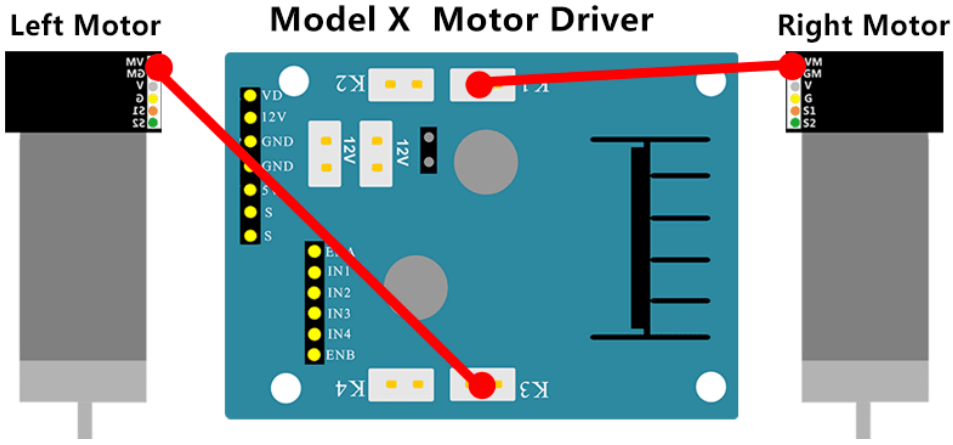


CIRCUIT CONNECTION

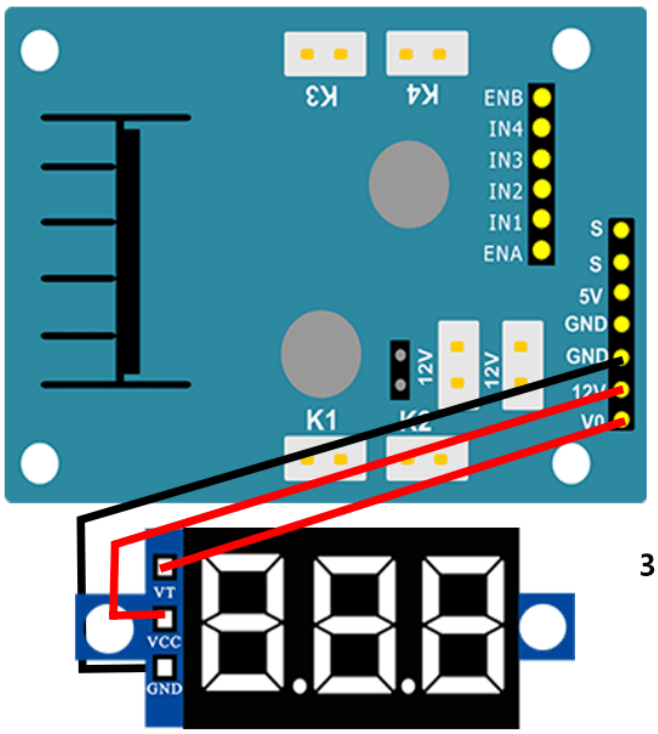
Step 1: Connect Driver board K1 (or K2) and K3 (or K4) sockets to 2 motors as per the following graph.

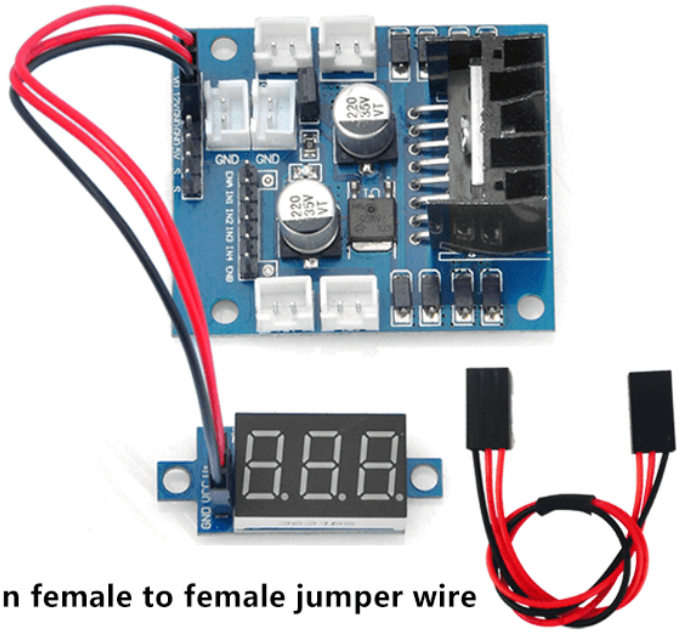


Motor	Motor X Driver Board
Right	K1 or K2
Left	K3 or K4



Step2: Connect the Uno board, battery box, Voltage Meter and driver board according below connection diagram.

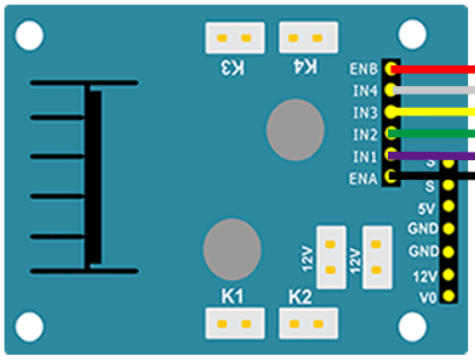




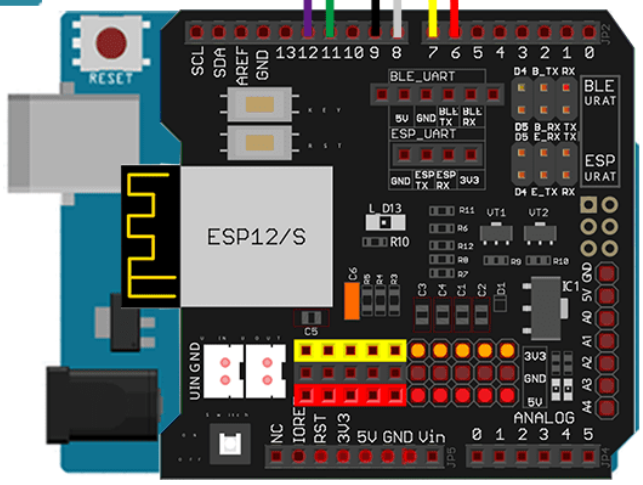
3pin female to female jumper wire

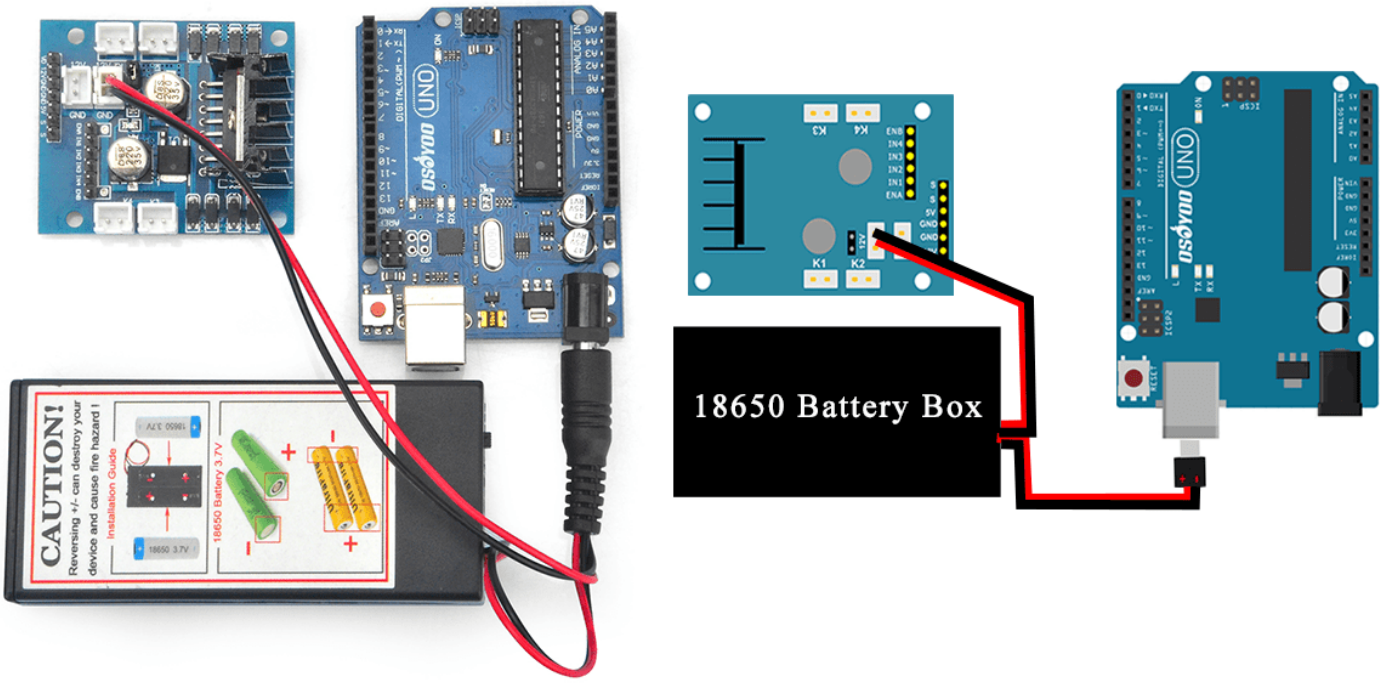
Voltage Meter	Motor X Driver Board
GND	GND
VCC	12V
VT	VO

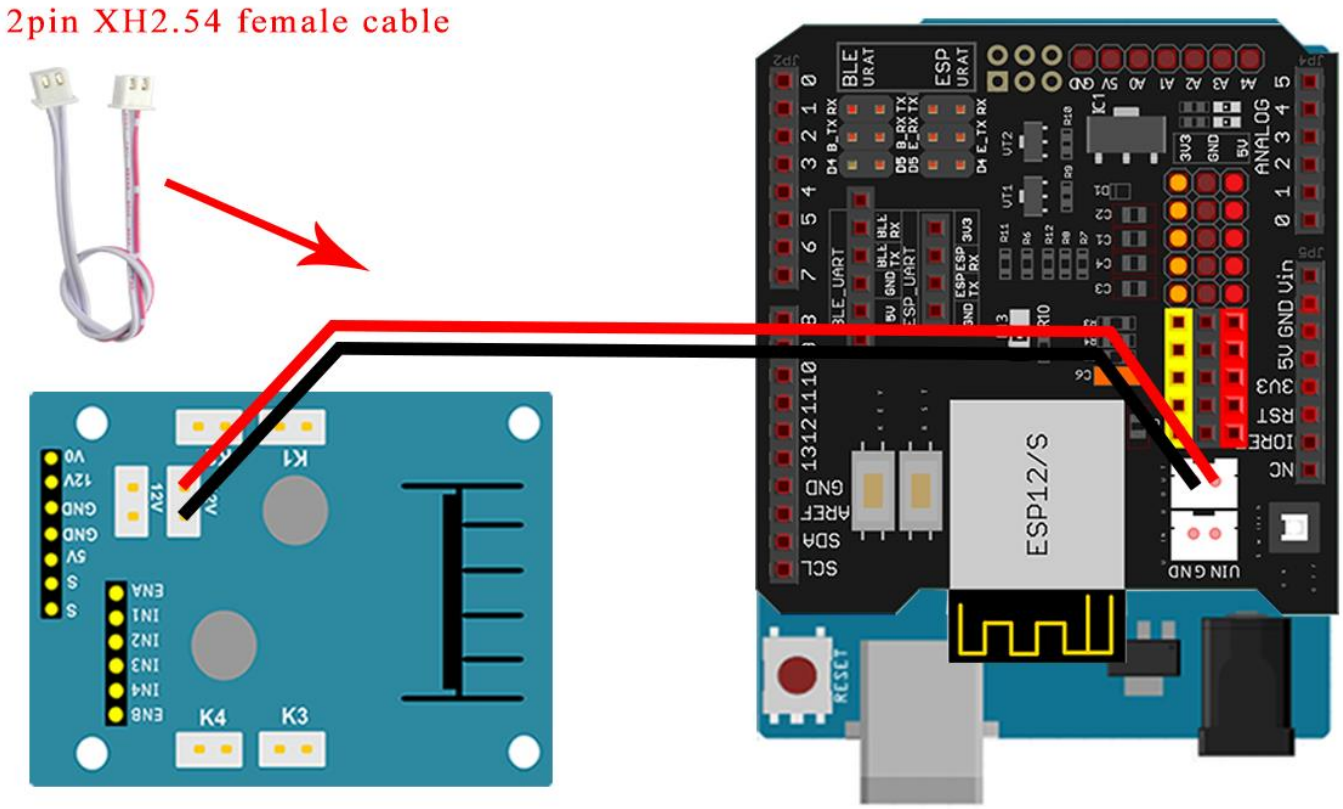
6pin female to male jumper wire



Motor X Driver	Wifi Shield
ENA	D9
N1	D12
N2	D11
N3	D7
N4	D8
ENB	D6







Now hardware installation is almost down, you need to put the 18650 batteries inside the holder.Both flat top and button top 18650 battery can be put inside the holder. The button top battery is recommend because it is easier to figure out positive pole of the battery.If you buy flat top battery, you must make sure the positive pole of the battery is put on the + side of the holder.if you make put battery on wrong

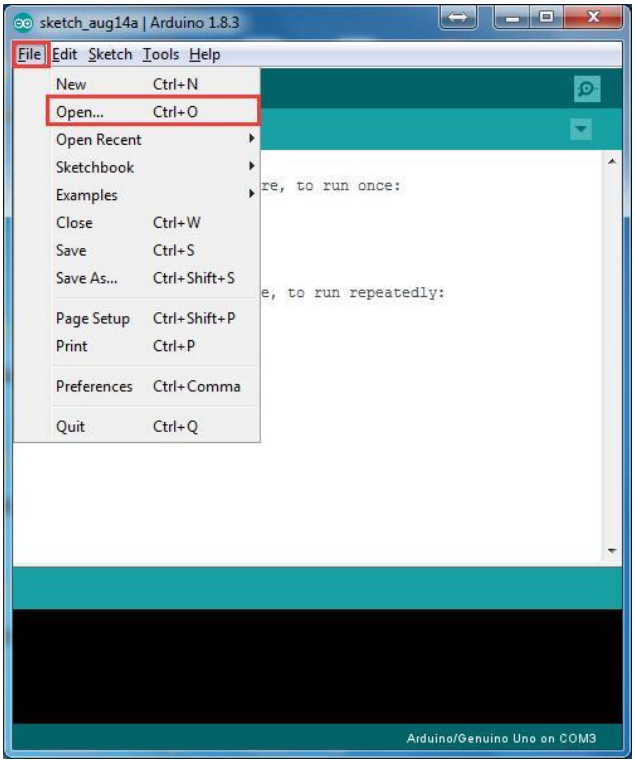
direction, it will damage the car.Before we install 18650 batteries into the box, we need burn the sample code into Arduino First.

SOFTWARE INSTALLATION

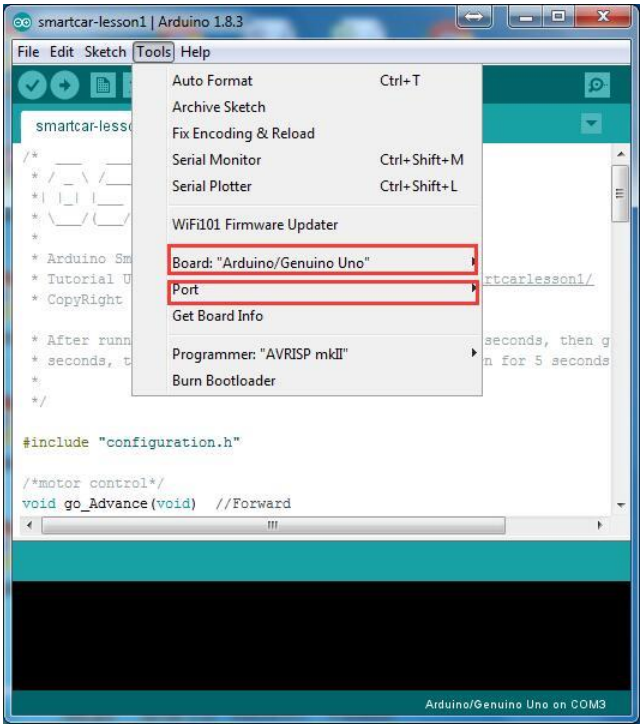
Step 1: Install latest Arduino IDE (If you have Arduino IDE version after 1.1.16, please skip this step)Download Arduino IDe from https://www.arduino.cc/en/Main/Software?setlang=en , then install the software.

Step2 : Download Lesson One sample code from https://osoyoo.com/driver/TR300_tank/arduino_tank_carV2.0/tankcarV2.0-lesson1.zip , unzip the download zip file tankcar-lesson1.zip, you will see a folder called tankcar-lesson1.

Step 3: Connect Arduino UNO to PC with USB cable, Open Arduino IDE -> click file -> click Open -> choose code "tank_robot_lesson2.ino" in tank_robot_lesson2 folder, load the code into arduino.**(Notice: Shut off your battery or Unplug your power adapter when upload sketch code to Arduino.)**



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



HOW TO PLAY

Please install your 18650 batteries in battery box for 18650 as per following instruction.

Disconnect Arduino from PC, put battery into battery box. When you put the car on the ground and turn on the switch on battery box if you install battery box for 18650, the car should go forward 2 seconds, then go backward 2 seconds, then left turn for 2 seconds, then right turn for 2 seconds, then stop. If the car does not move as per above mentioned result, you should check your wire connection, battery voltage (must over 7.2v).

Lesson2: IR Remote controlled

OBJECTIVE

In this tutorial, we will use tank car kit V2.1 to make a simple remote controlled smart car. Once the car installation is completed, we will use a Infrared Remote to control the car movements including go forward, go back, left turn and right turn.

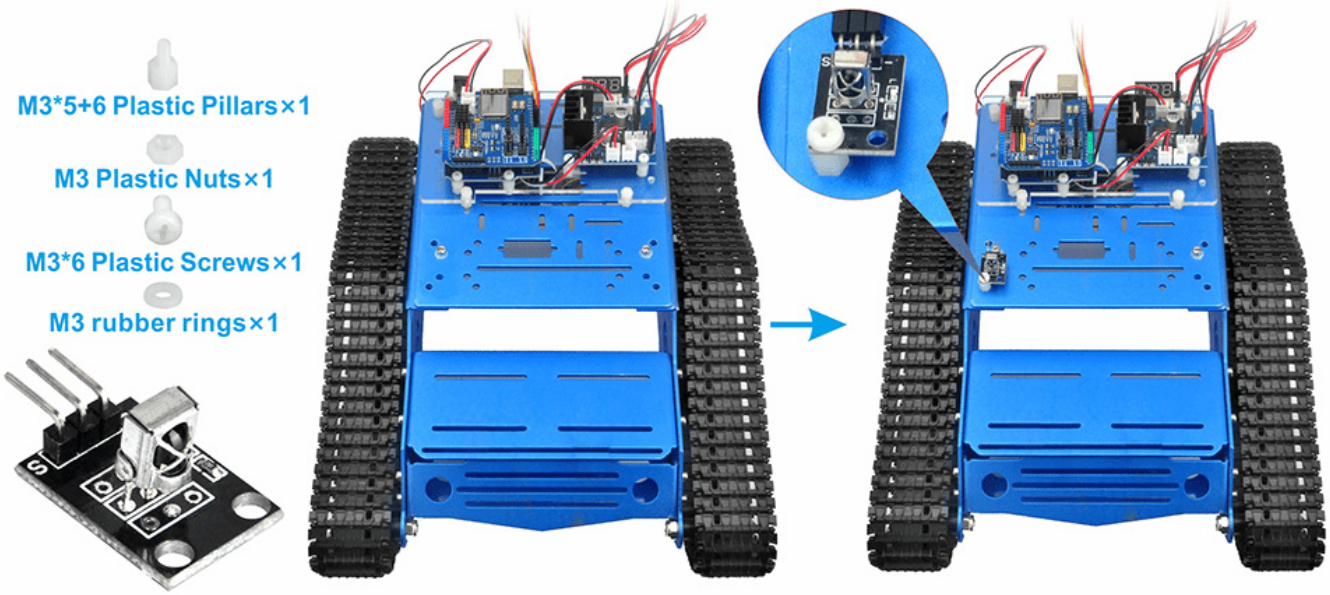
PARTS & DEVICES

TR300 tank car chassis x1 +Acrylic board chassis x1
OSOYOO UNO R3 board fully compatible with Arduino x1
OSOYOO V1.3 Wifi shield x1
OSOYOO Model X motor driver x1
OSOYOO Battery box x 1
OSOYOO Voltage meter x1
IR remote controller and receiver x1
18650 batteries(3.7V) x 2
some screws and jumper wires

HARDWARE INSTALLATION

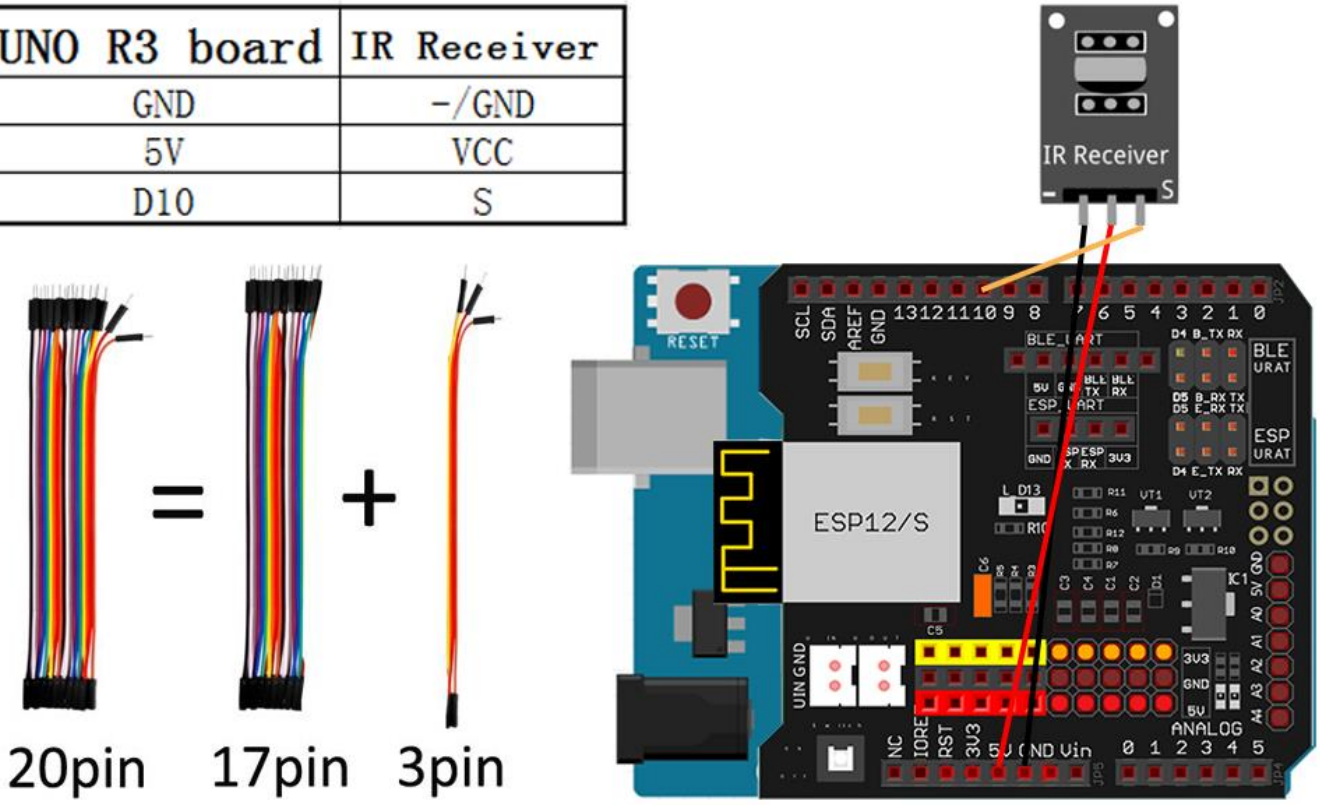
Step 1: Install the smart car basic frame work as per Tank car Lesson 1(2) . If you have already completed installation in Lesson 1, just keep it as is.

Step 2: Add an IR receiver module onto the car. Install the IR receiver module with 1pcs M3*5+6 plastic pillars, M3 plastic nuts, M3*6 plastic and M3 rubber rings at the front of chassis.



Step 3: Connect the S pin in IR receiver to D10 pin in UNO board, GND to GND, VCC to 5V, as the following photo (Remember: DO NOT remove any existing wires installed in Lesson 1)

UNO R3 board	IR Receiver
GND	-/GND
5V	VCC
D10	S

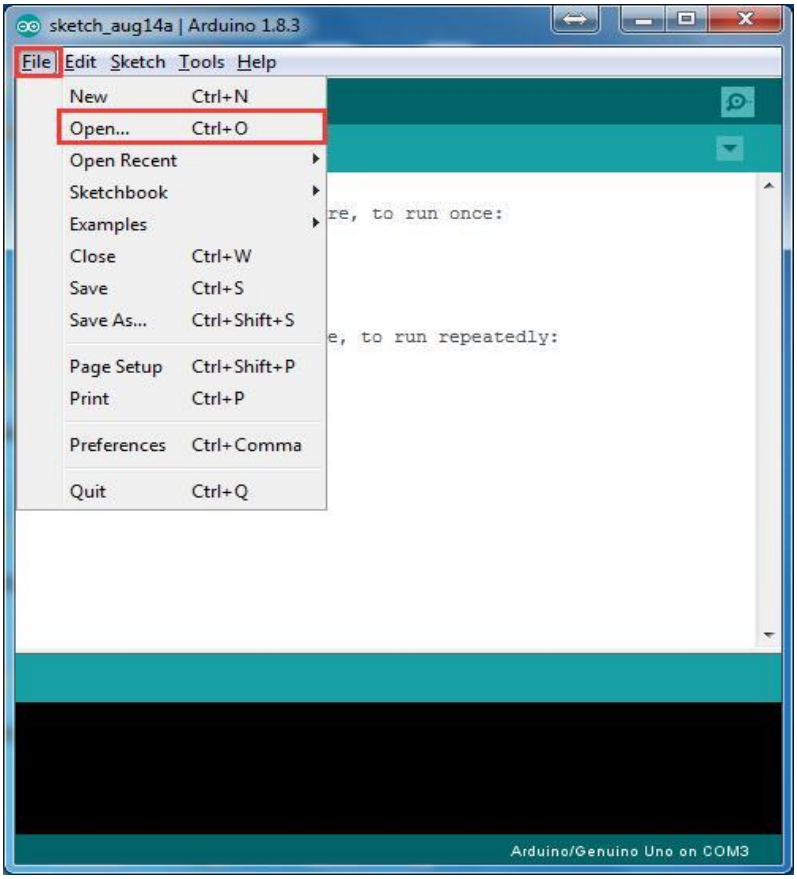


SOFTWARE INSTALLATION

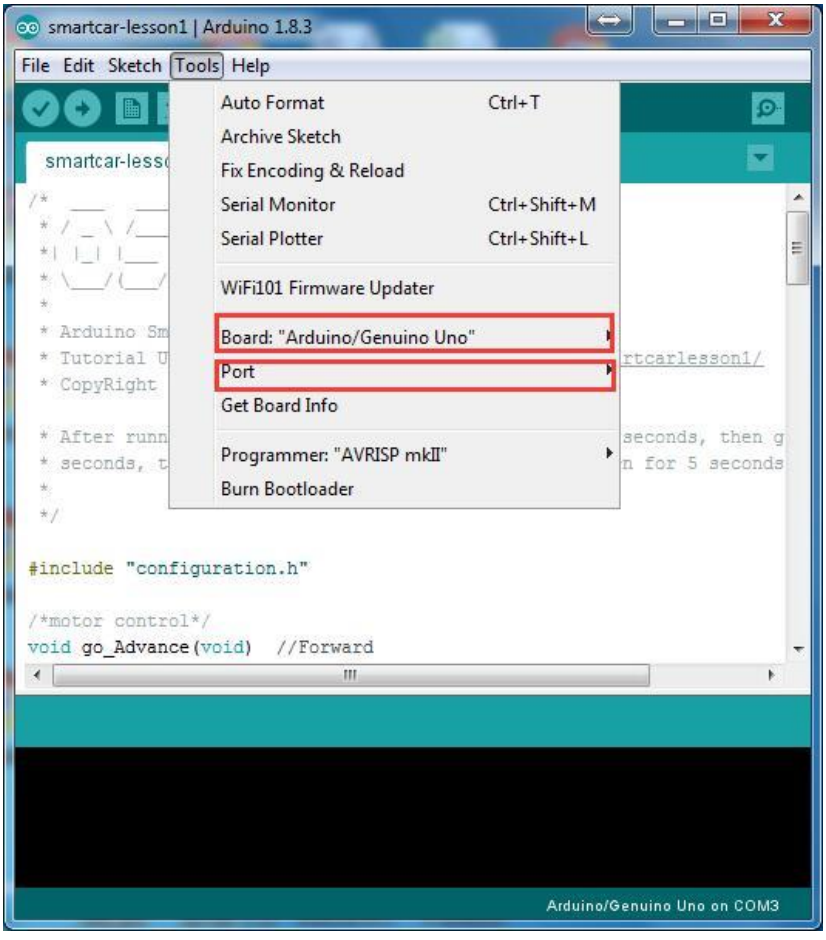
Step 1: Install latest Arduino IDE (If you have Arduino IDE version after 1.1.16, please skip this step)Download Arduino IDe from https://www.arduino.cc/en/Main/Software?setlang=en , then install the software.

Step2 :Download Lesson One sample code from https://osoyoo.com/driver/TR300_tank/arduino_tank_carV2.0/tankcarV2.0-lesson2.zip , unzip the download zip file tankcar-lesson1.zip, you will see a folder called tankcar-lesson1.

Step 3: Connect Arduino UNO to PC with USB cable, Open Arduino IDE -> click file -> click Open -> choose code "tank_robot_lesson2.ino" in tank_robot_lesson2 folder, load the code into arduino. (Notice: Shut off your battery or Unplug your power adapter when upload sketch code to Arduino.)

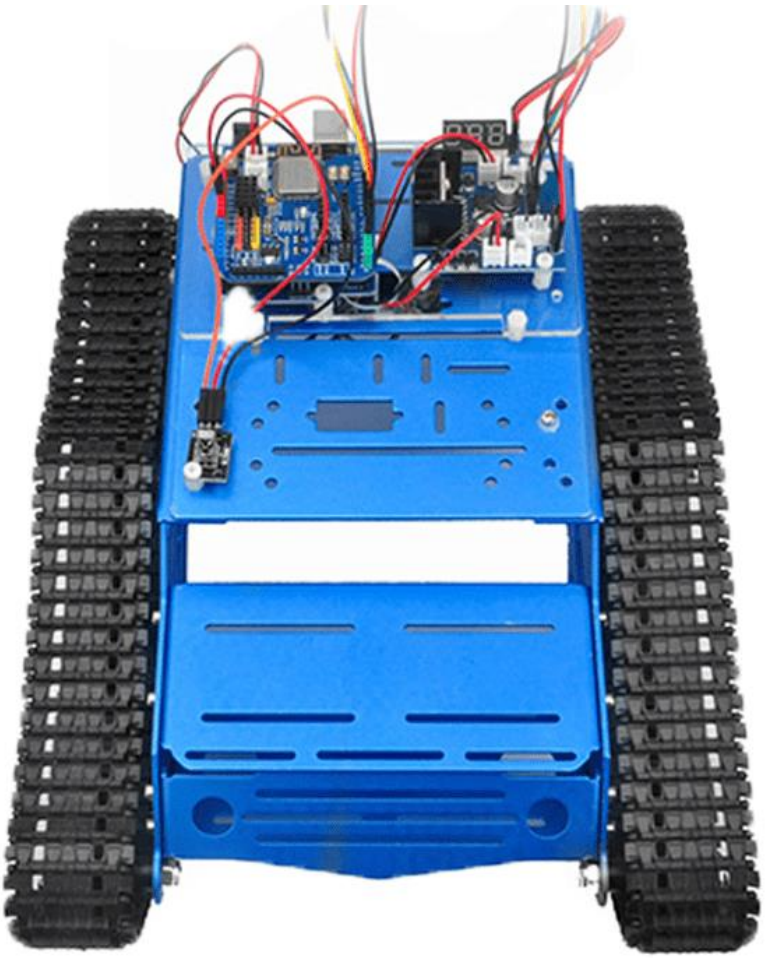


Step 4: Choose corresponding board/port for your project, upload the sketch to the board.



HOW TO PLAY

Press IR controller keys to control the car movements as per following instruction table:



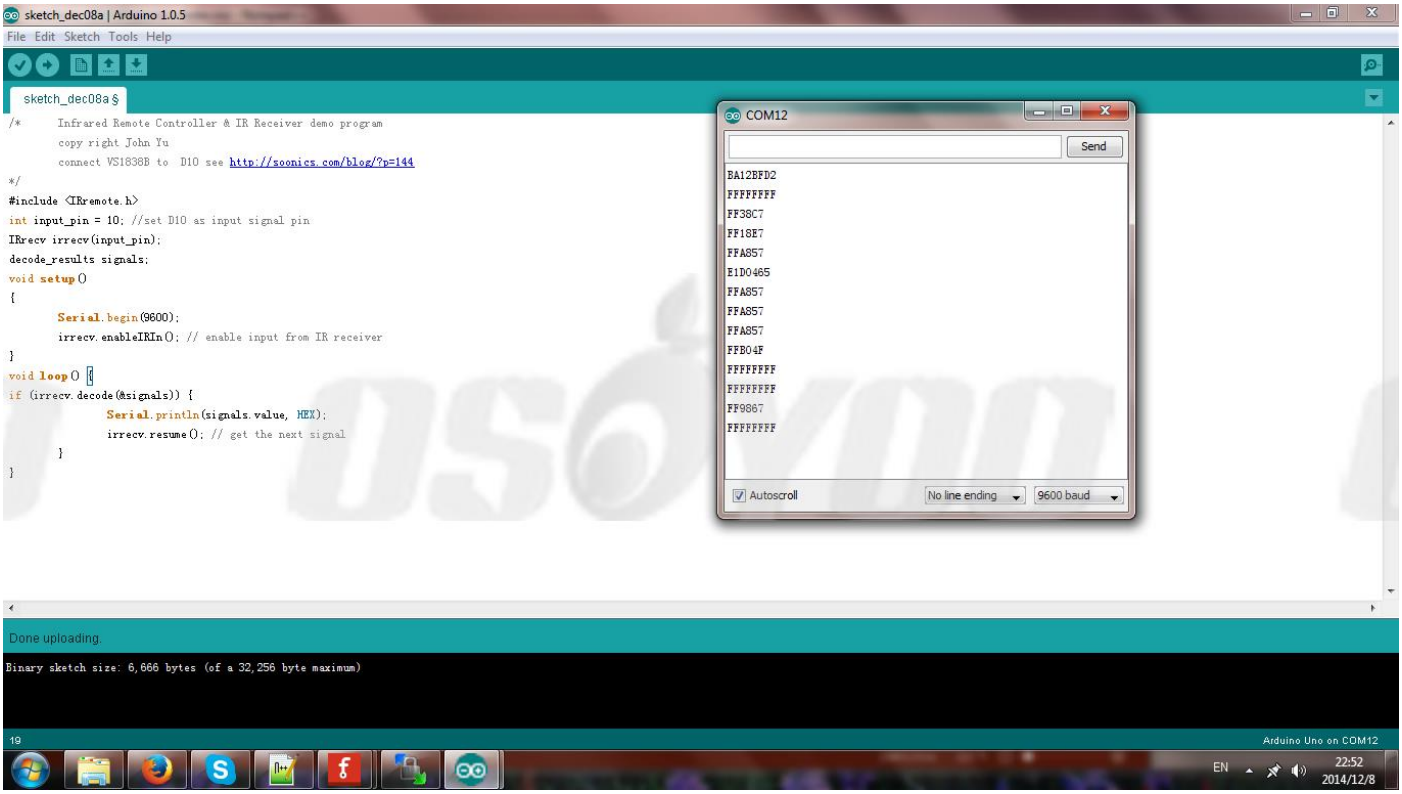
IR Remote Key	Car movement
▲	Go forward
▼	Go backward
◀	Turn left
▶	Turn right

Trouble shooting:

Some user found that this IR remote does not work. The reason might be the IR remote sends different button code which does not match our sample code. In order to solve this problem. Please take following steps:
Step A) Get the IR code of each button in your IR remote.
Copy code from following link:https://osoyoo.com/wp-content/uploads/samplecode/irdemo.zip

upload above sketch into your Arduino and open the serial monitor in your upper-right corner.
press the “▲” “▼” “>” “<” ”OK” button in your remote, you will see their IR code as following picture:

Write down the IR code of your control buttons “▲” “▼” “>” “<” “OK” button.



STEP B)replace the IR code in lesson 2 sketch file:

Open your Lesson 2 code again, then you will see following lines define the IR CODE of each button:

```
#define IR_ADVANCE      0x00FF18E7      //code from IR controller “▲” button
#define IR_BACK         0x00FF4AB5      //code from IR controller “▼” button
#define IR_RIGHT        0x00FF5AA5      //code from IR controller “>” button
#define IR_LEFT         0x00FF10EF      //code from IR controller “<” button
#define IR_STOP         0x00FF38C7      //code from IR controller “OK” button
#define IR_turnsmallleft 0x00FFB04F     //code from IR controller “#” button
```

Please change the value of each button in above lines to match the code from **Step A).** If you don’t know how to change, just Send Email to us and give us the code of each button from **Step A)**, I can help you to change the code and email new sketch file to you.

Above method can also allow you to use other IR sending device (i.e TV remote, DVD remote, air conditioner remote etc) to control the car. Just use Step A) to get the key code of your remote and change the sketch file in Step B), it will work.

Lesson3: Object follow

OBJECTIVE

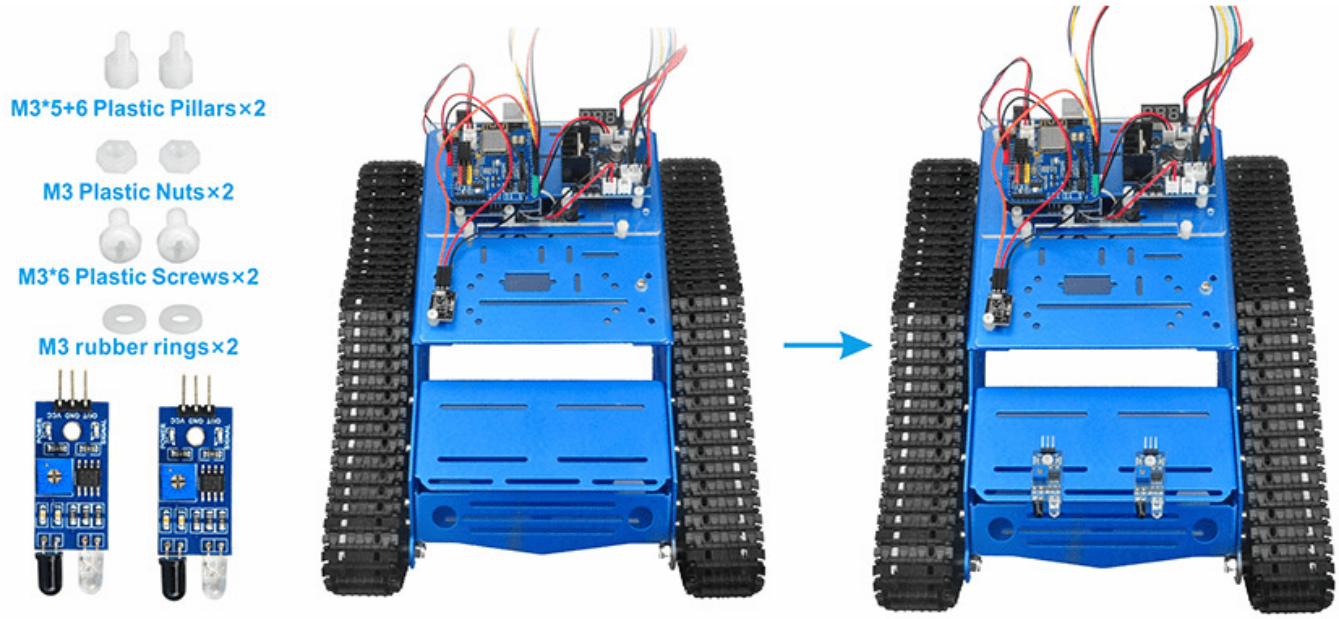
In this lesson, we will install 2pcs IR Obstacle Avoidance modules on robot car and program the car to follow object movements. The principle of this experiment is based on IR detection object. The car receives the signal from the IR Obstacle Avoidance module, and then the program will drive the car to take actions. You must complete lesson 1 (assembling the car) before you continue on with this lesson.

PARTS & DEVICES

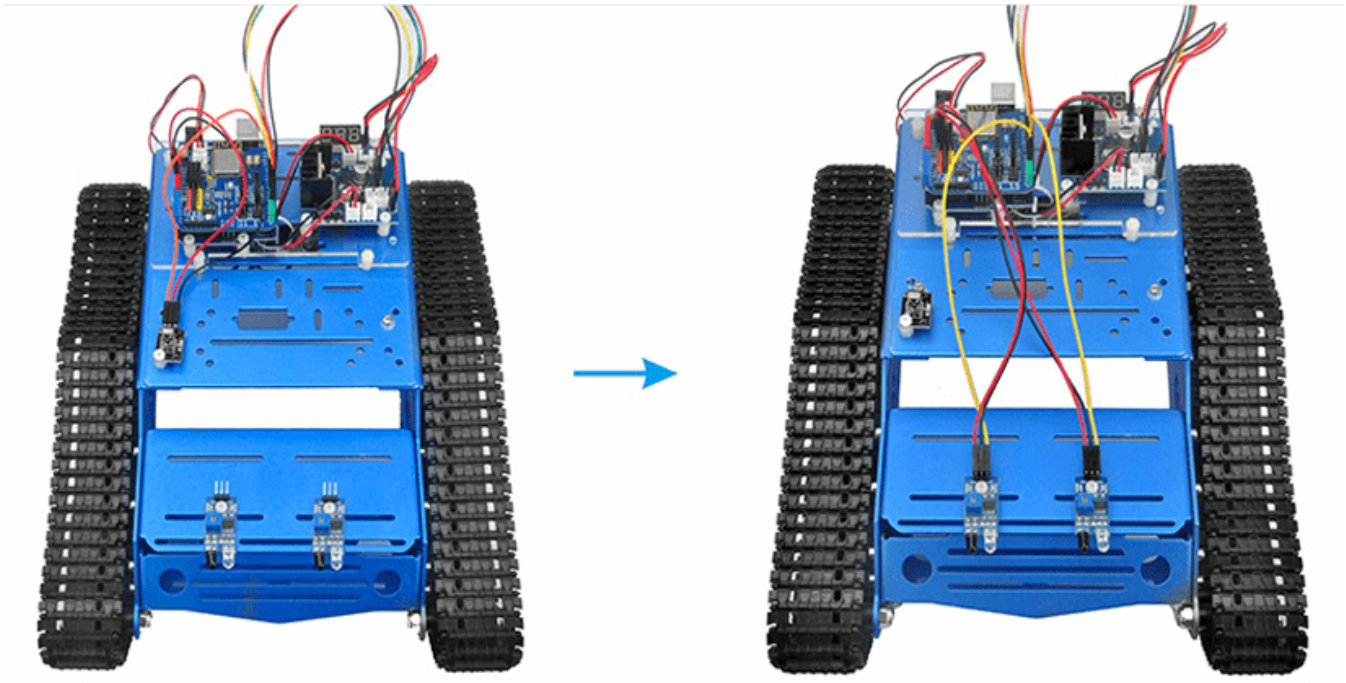
TR300 tank car chassis x1 +Acrylic board chassis x1
OSOYOO UNO R3 board fully compatible with Arduino x1
OSOYOO V1.3 Wifi shield x1
OSOYOO Model X motor driver x1
OSOYOO Battery box x 1
OSOYOO Voltage meter x1
OSOYOO IR obstacle avoidance module x1
18650 batteries(3.7V) x 2
some screws and jumper wires

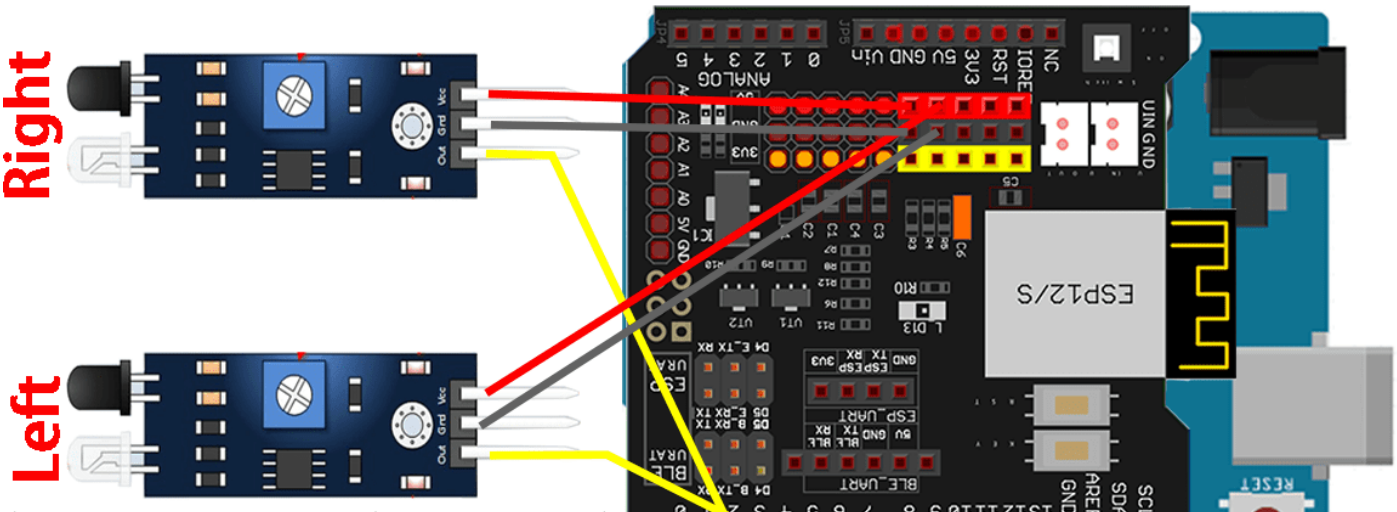
HARDWARE INSTALLATION

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

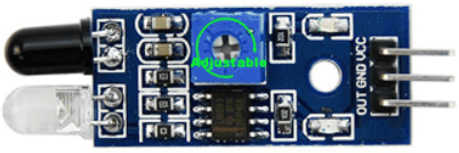


Step 2: Add 2pcs IR Obstacle Avoidance modules onto the car. Install the IR Obstacle Avoidance modules with 2pcs M3*5+6 plastic pillars, M3 plastic nuts, M3*6 plastic and M3 rubber rings at the front of chassis.





IR Obstacle Sensor	Wifi Shield
VCC(Left)	5V
GND(Left)	GND
OUT(Left)	D3
VCC(Right)	5V
GND(Right)	
OUT(Right)	D2



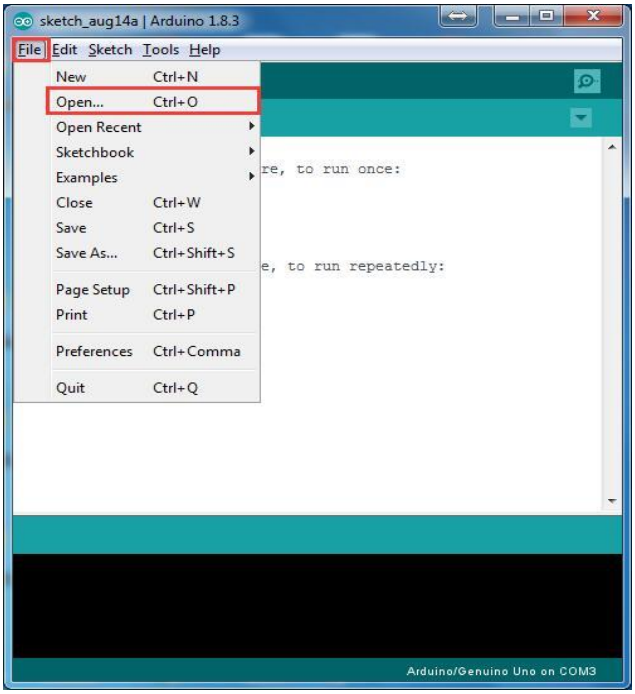
IR Obstacle Sensor

SOFTWARE INSTALLATION

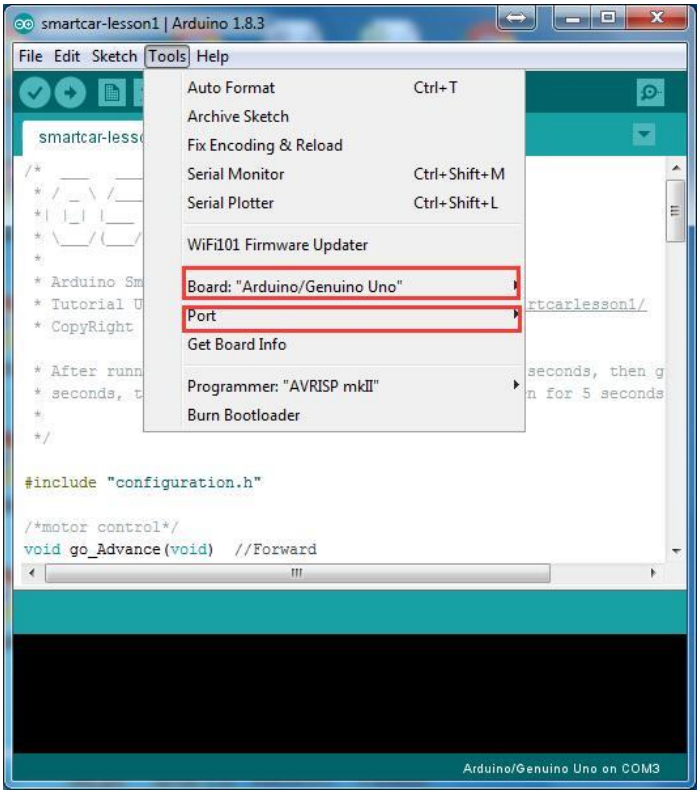
Step 1: Install latest Arduino IDE (If you have Arduino IDE version after 1.1.16, please skip this step)Download Arduino IDe from https://www.arduino.cc/en/Main/Software?setlang=en , then install the software.

Step2 : Download Lesson sample code from https://osoyoo.com/driver/TR300_tank/arduino_tank_carV2.0/tankcarV2.0-lesson3.zip , unzip the download zip file tankcar-lesson3.zip, you will see a folder called tankcar-lesson3.

Step 3: Connect Arduino UNO to PC with USB cable, Open Arduino IDE -> click file -> click Open -> choose code "tank_robot_lesson3.ino" in tank_robot_lesson folder, load the code into arduino. **(Notice: Shut off your battery or Unplug your power adapter when upload sketch code to Arduino.)**



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



Step 5: Turn on the car, put object about 10cm ahead of each IR Obstacle Avoidance modules and adjust potentiometer on IR Obstacle Avoidance modules to detect object or your hand.

Note: When these module detect objects, the power indicator and signal indictor are on. when you move object over detection distance, the power indicator is on. If the signal indictor is always on even though the object is over detection distance, you also need to adjust the potentiometer

HOW TO PLAY

Turn on the car, 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 Obstacle Avoidance modules detect object.
when object or your hand is over 10cm ahead, it will stop.

Note:
1) As IR Obstacle Avoidance modules are installed at the back of the car, all movement directions are contrary to other courses.
2) The car can only move forward, turn right and turn left, but cannot move backward.

Lesson4: Line tracking

OBJECTIVE

In this lesson, we will add 5-point tracking sensors to the framework built in Lesson 1. If you have not completed installation in Lesson 1, please review Lesson 1

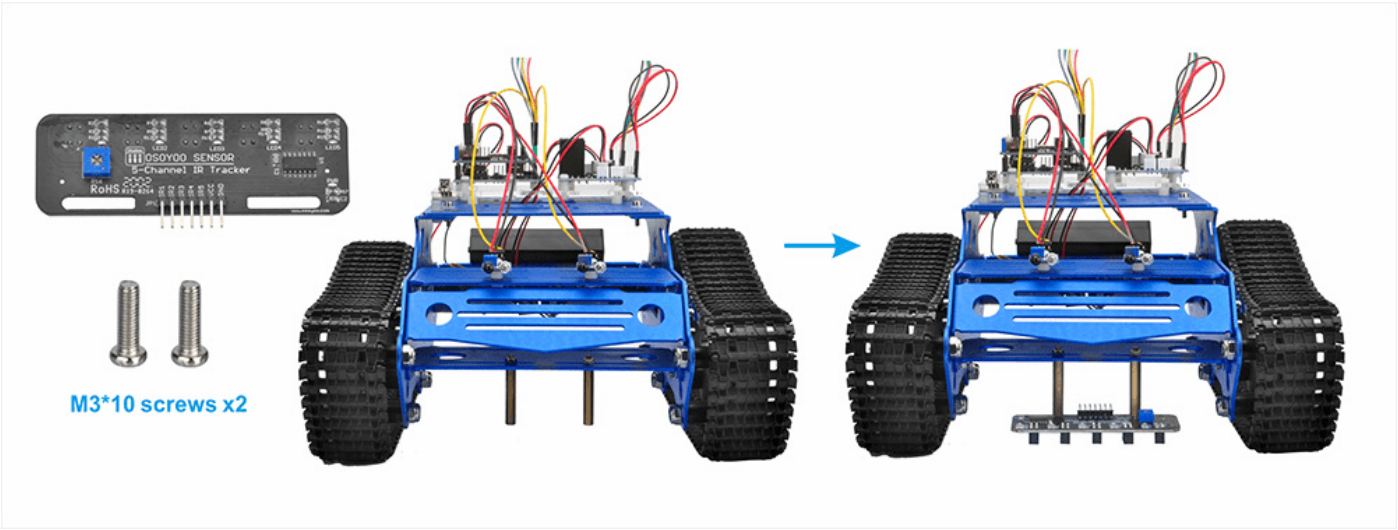
The software in this lesson will read data from these 5-point tracking sensors and automatically guide the smart car to move along the black track line in the white ground.

PARTS & DEVICES

TR300 tank car chassis x1 +Acrylic board chassis x1
OSOYOO UNO R3 board fully compatible with Arduino x1
OSOYOO V1.3 Wifi shield x1
OSOYOO Model X motor driver x1
OSOYOO Battery box x 1
OSOYOO Voltage meter x1
OSOYOO 5-Point tracking sensor module x1
18650 batteries(3.7V) x 2
some screws and jumper wires

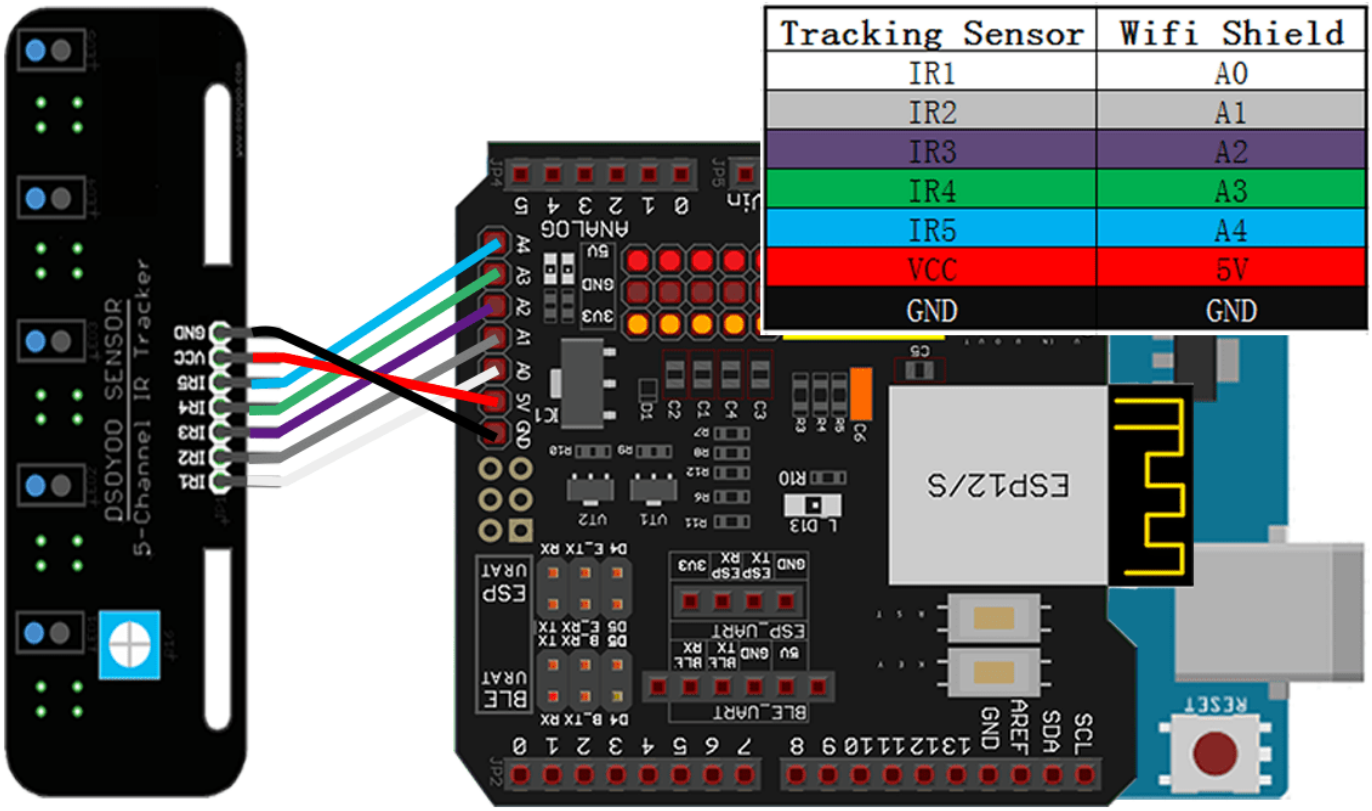
HARDWARE INSTALLATION

Step1: Install 2 pcs M3*30+6 copper pillars and 2 pcs nuts at the front of lower car chassis,then install 5-point tracking sensor module with 2pcs M3 screws as per the following pictures.



CIRCUIT CONNECTION

Use 7pin female to female jumper wires to connect 5-point tracking sensor modules. Connect GND to GND, VCC of tracking sensor module to 5V in UNO board,IR1,IR2,IR3,IR4,IR5 to A1,A2,A3,A4,A5 in UNO board. As the following photo shows (Remember : DO NOT remove any existing wires installed in Lesson1):



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

SOFTWARE INSTALLATION

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 Lesson One sample code from https://osoyoo.com/driver/TR300_tank/arduino_tank_carV2.0/tankcarV2.0-lesson4.zip , unzip the download zip file , you will see a folder called tankcar-lesson4.

Step 3: Connect Arduino UNO to PC with USB cable, Open Arduino IDE -> click file -> click Open -> choose code "tankcarV2.0-lesson4.ino" in lesson4 folder, load the code into arduino. (Notice: Shut off your battery or Unplug your power adapter when upload sketch code to Arduino.)

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

Testing: 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 90 degree. If the angle is too large, 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.

Lesson5: Obstacle avoidance

OBJECTIVE

In this lesson, we will add a servo motor, an ultrasonic module and a buzzer onto Lesson 1 framework. With these new devices, the car can “see” obstacle through ultrasonic sensor 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.

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

PARTS & DEVICES

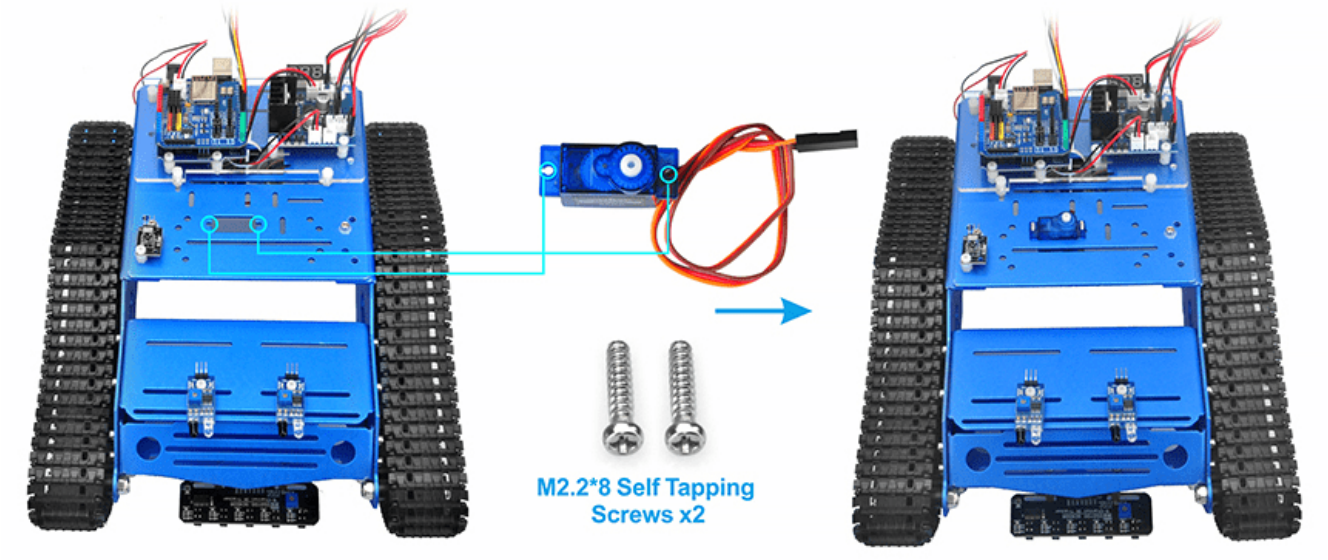
TR300 tank car chassis x1 +Acrylic board chassis x1
OSOYOO UNO R3 board fully compatible with Arduino x1
OSOYOO V1.3 Wifi shield x1
OSOYOO Model X motor driver x1
OSOYOO Battery box x 1
OSOYOO Voltage meter x1
OSOYOO SG90 servo motor x1
OSOYOO Ultrosonic avoidance module x1
18650 batteries(3.7V) x 2
some screws and jumper wires

HARDWARE INSTALLATION

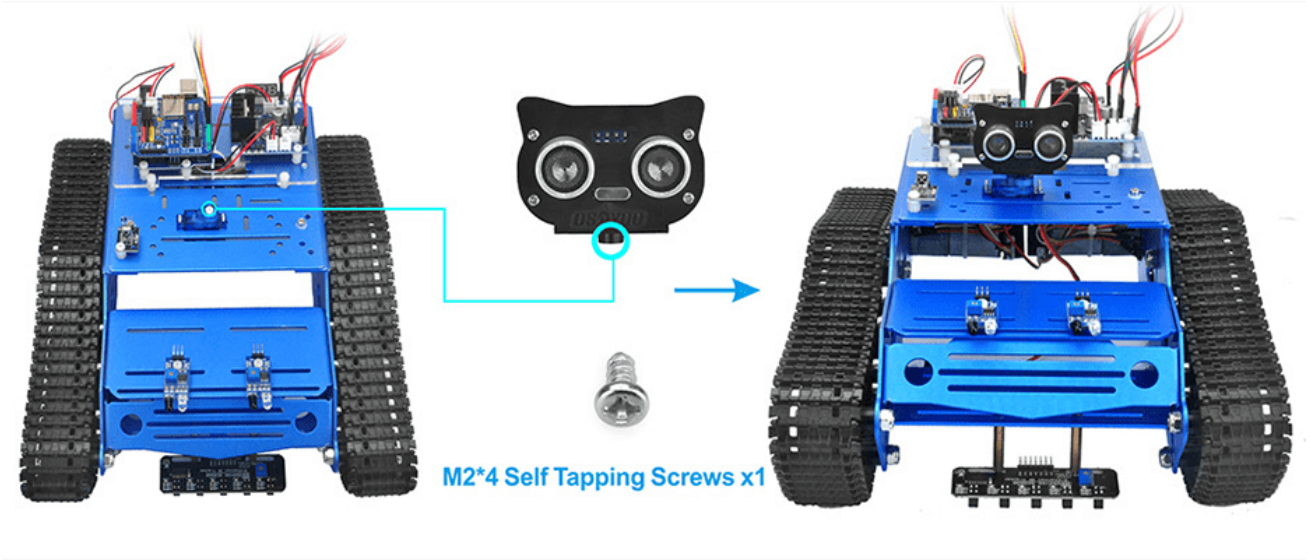
Step 1: Install the smart car basic frame work as per Lesson 1 .If you have already completed installation in Lesson 1 , Everything keep it as is except move ENA from D9 to D3(we need D9 for Servo control).

Step 2: Install Ultrasonic Module to mount holder with 4pcs M1.4*8 screw and M1.4 nuts.

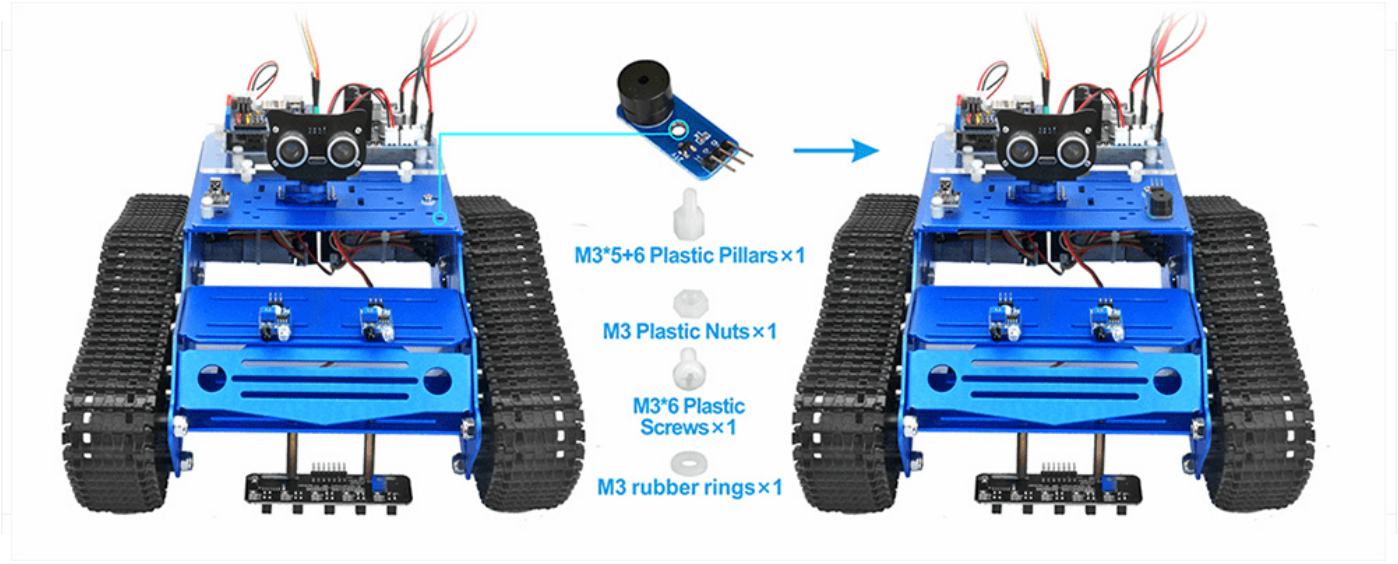
Step 3: Remove screws on copper pillars and install servo motor at the front of car chassis with 2pcs M2.2*8 Self Tapping Screws.



Step 4: Install mount holder for Ultrasonic Module on servo motor with M2*4 Self Tapping screw (Please note: please upload code to adjust servo motor direction before fixing this screw).



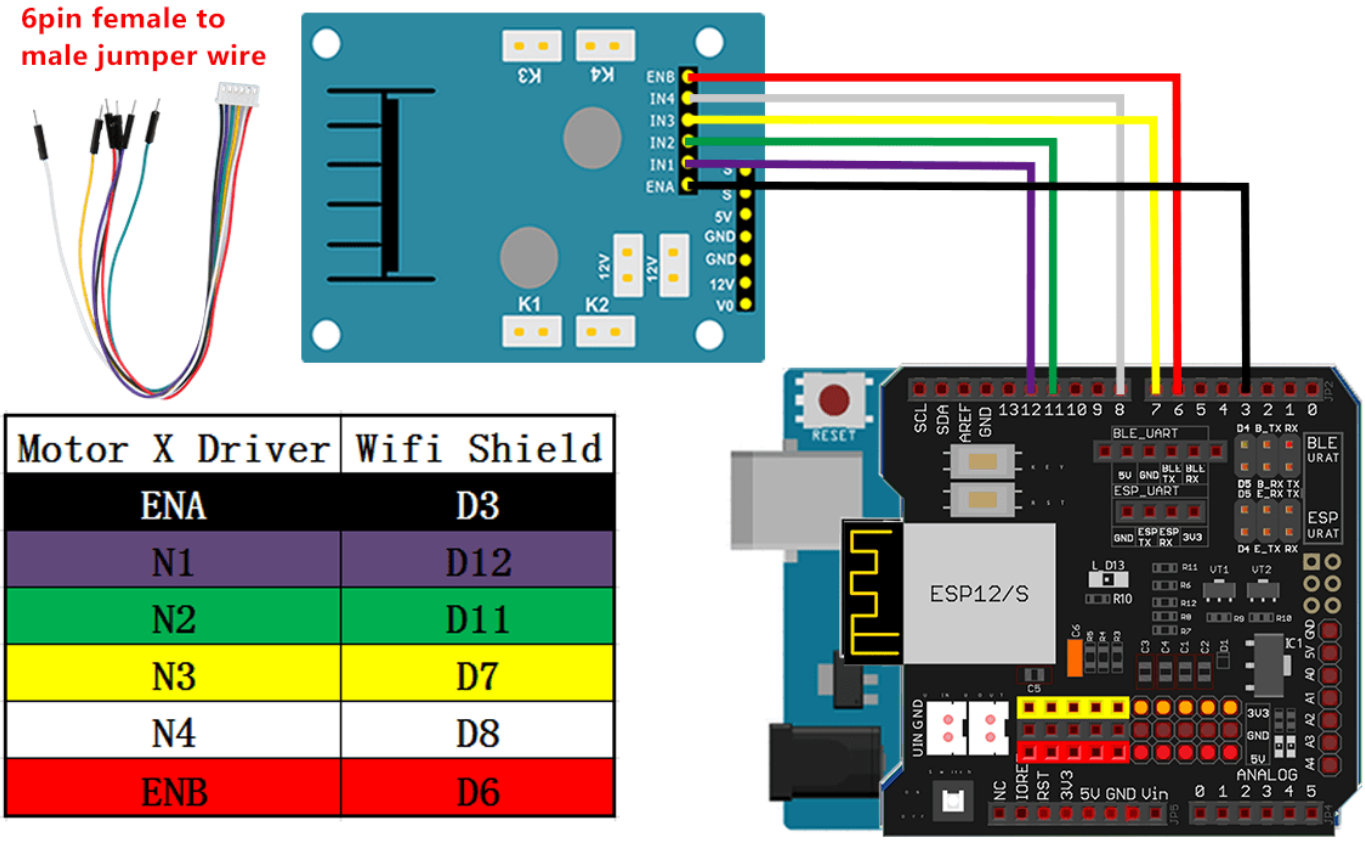
Step 5: Install Buzzer module at the back of upper chassis with 1pc M2.5 plastic screw, M2.5 plastic pillar and M2.5 plastic nut.



CIRCUIT CONNECTION

Step 6: Install the smart car basic frame work as per Lesson1(2). If you have already completed installation in Lesson 1, **Everything keep it as is except move ENA from D9 to D3 .**

Connect OSOYOO wifi shield and OSOYOO MODEL X motor driver module as following graph.

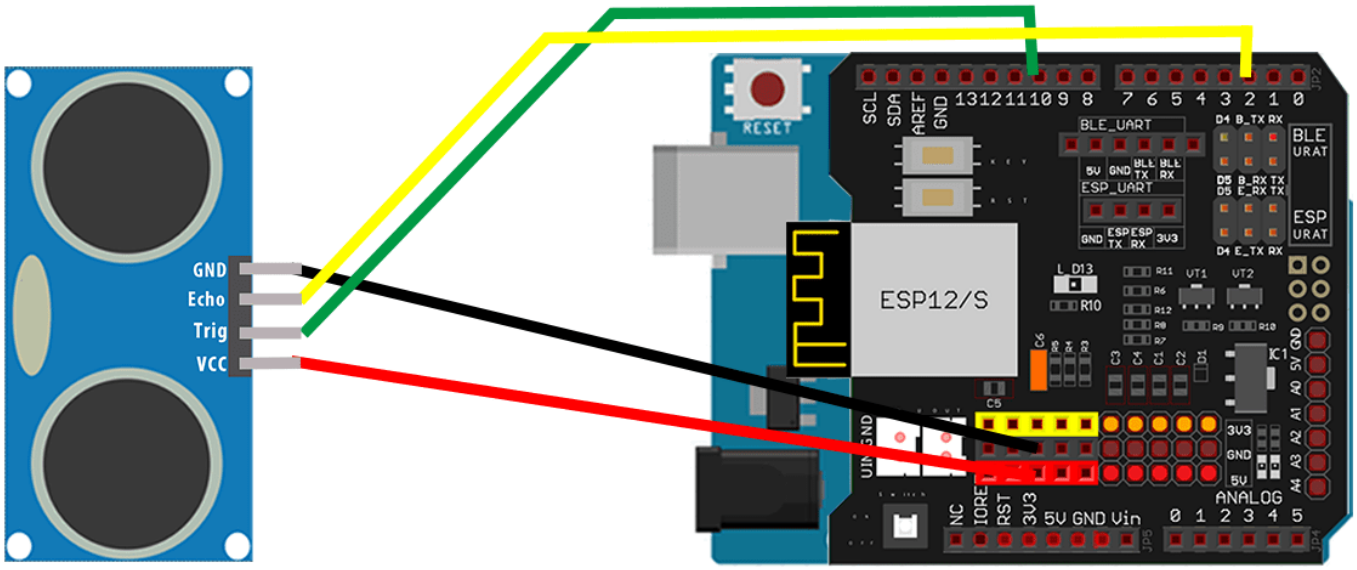


Motor X Driver	Wifi Shield
ENA	D3
N1	D12
N2	D11
N3	D7
N4	D8
ENB	D6

Step 7: Connect Ultrosonic sensor GND to GND, Echo to D2, Trig to D10 and VCC to 5v in UNO board.

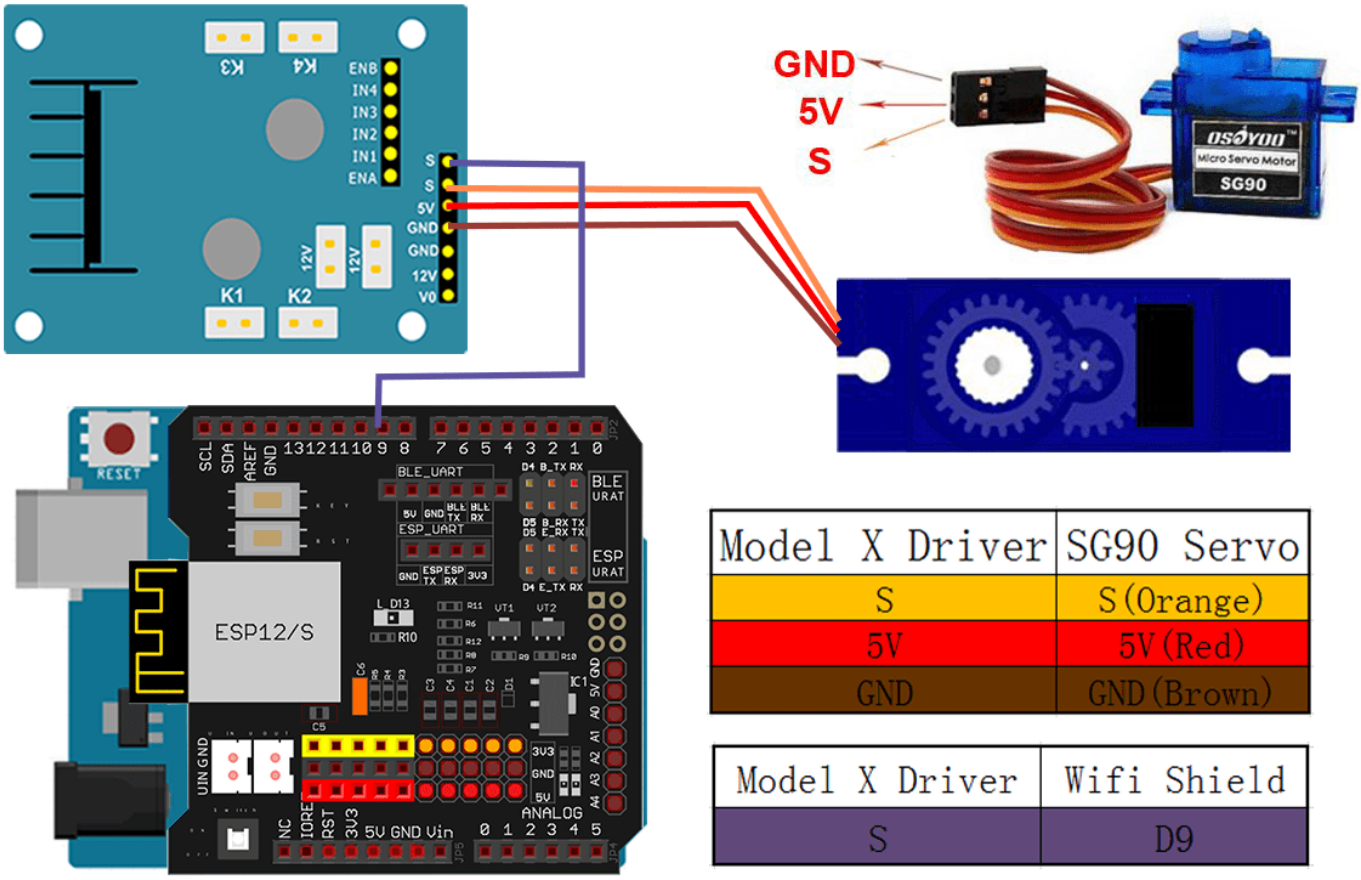
Connect OSOYOO wifi shield and ultrsonic sensor module as following graph.

Ultrosonic Sensor	Wifi Shield
GND	GND
Echo	D2
Trig	D10
VCC	5V



Step 8: Connect SG90 servo GND to GND, 5v to 5v and S to S in model X. Then use 1 pin jumper wire to connect S in model X to PIN 9 in UNO Board.

Connect OSOYOO model X board and SG90 servo as following graph.



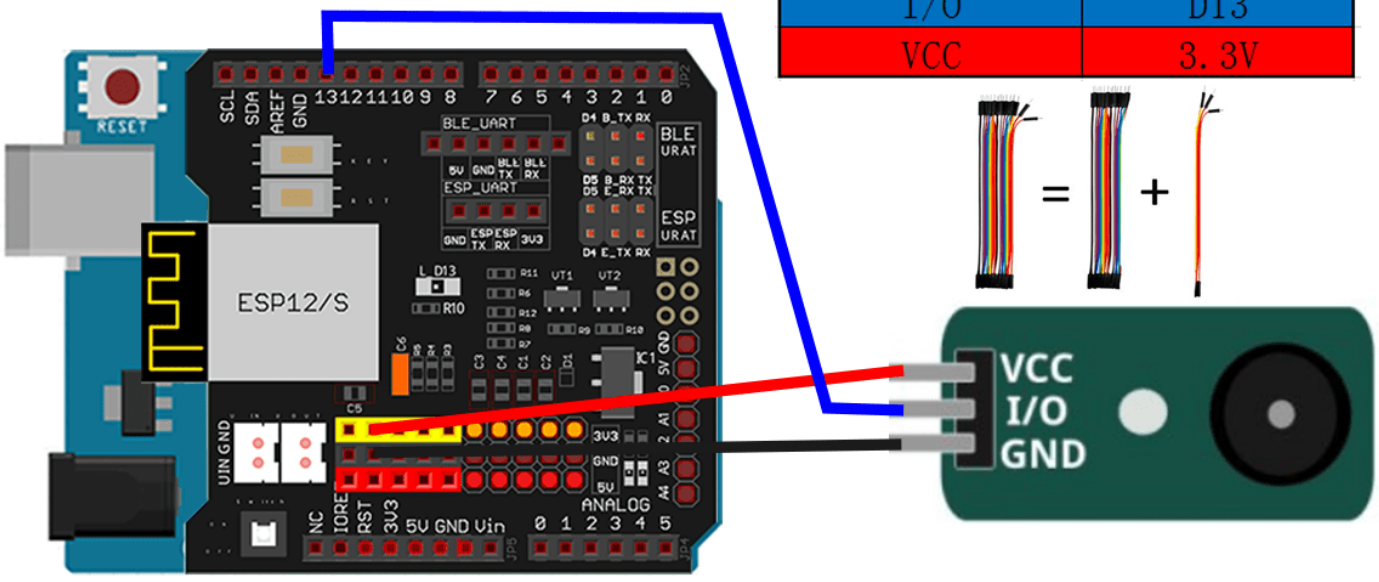
Model X Driver	SG90 Servo
S	S(Orange)
5V	5V(Red)
GND	GND(Brown)

Model X Driver	Wifi Shield
S	D9

Step 9: Connect buzzer sensor GND to GND, I/O to D13,VCC to 3.3V in UNO board.

Connect OSOYOO wifi shield and buzzer sensor module as following graph.

Buzzer Module	Wifi Shield
GND	GND
I/O	D13
VCC	3.3V



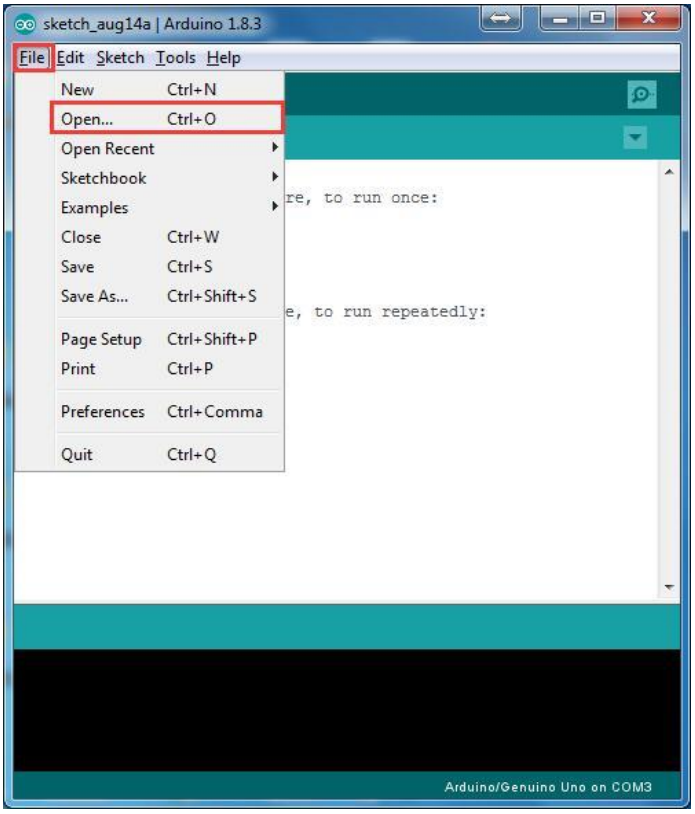
SOFTWARE INSTALLATION

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.

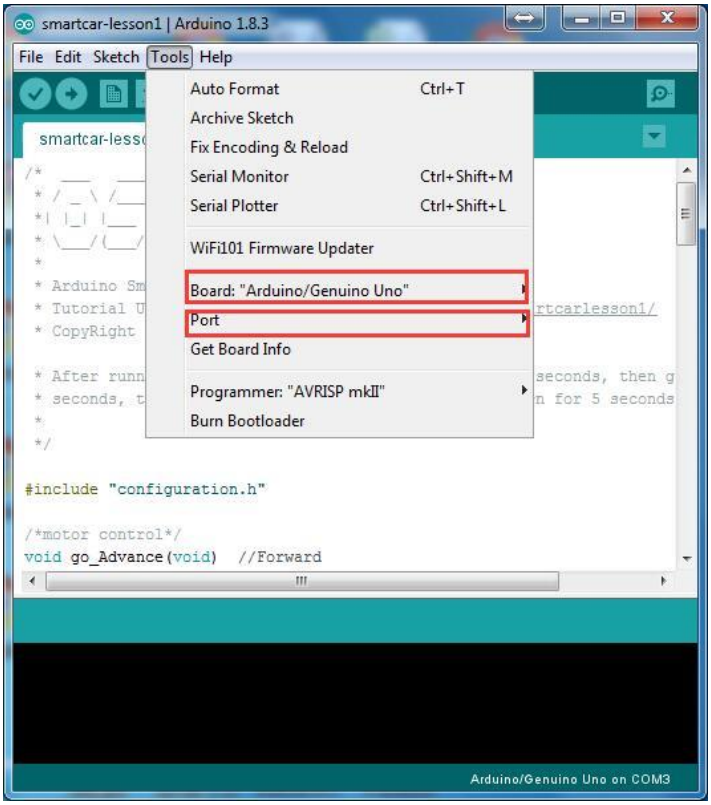
Step 2 :Download Lesson One sample code from https://osoyoo.com/driver/TR300_tank/arduino_tank_carV2.0/tankcarV2.0-lesson5.zip , unzip the download zip file, you will see a folder called tankcar-lesson5.

Step 3: Connect Arduino UNO to PC with USB cable, Open Arduino IDE -> click file -> click Open -> choose code "tankcar-lesson5.ino" in lesson5 folder, load the code into arduino. (Notice: Shut off your battery or Unplug your power adapter when upload sketch code to Arduino.)

Step 4: Connect Arduino UNO to PC with USB cable, Open Arduino IDE -> click file -> click Open -> choose code "tankcarV2.0-lesson5.ino" in tankcarV2.0-lesson5 folder, load the code into arduino.



Step 5: Choose corresponding board/port for your project, upload the sketch to the board.



Step 6: Ultrasonic sensor servo initial direction alignment.

After turning on the battery, you will hear a long beep sound, then 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. After hearing the long beep, the sensor should face front same as following picture. If its direction is not straight forward, turn off battery and do direction alignment again.

HOW TO PLAY

Final Testing :

After Turning on the battery switch on the battery box, 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 as per Ultrasonic sensor servo initial direction alignment.

Lesson6: WiFi IoT controlled

OBJECTIVE

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.

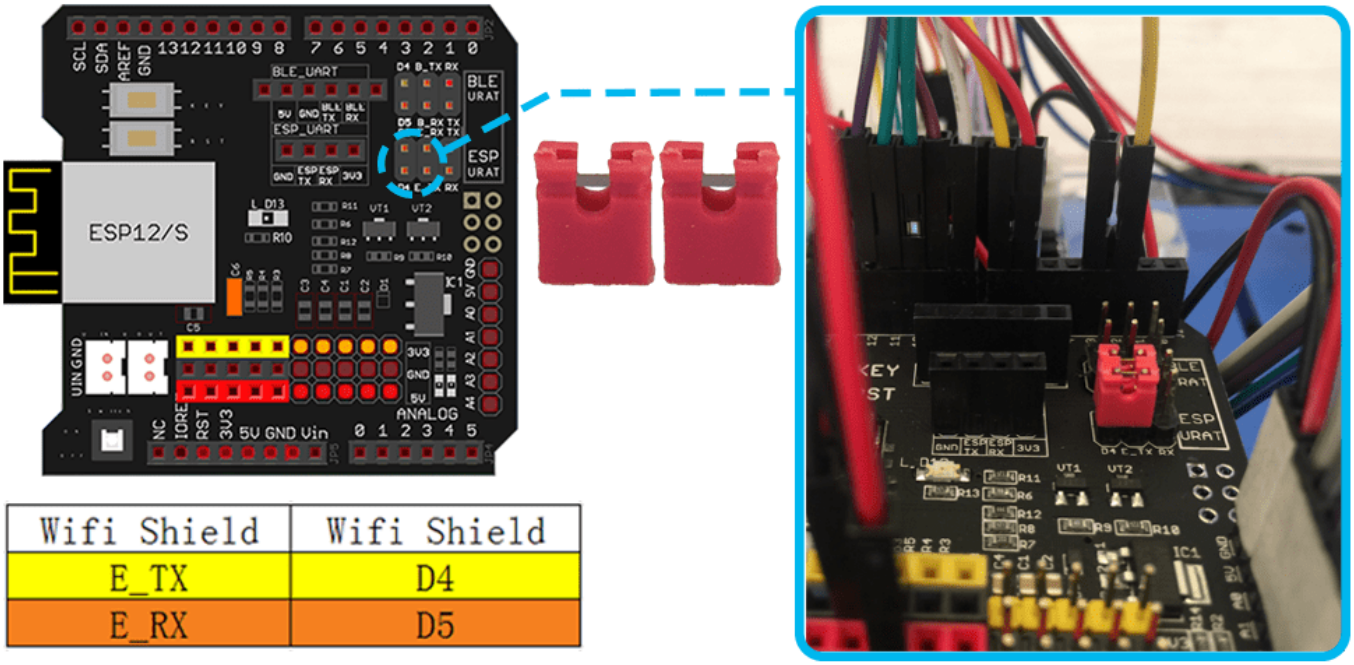
PARTS & DEVICES

TR300 tank car chassis x1 +Acrylic board chassis x1
OSOYOO UNO R3 board fully compatible with Arduino x1
OSOYOO V1.3 Wifi shield x1
OSOYOO Model X motor driver x1
OSOYOO Battery box x 1
OSOYOO Voltage meter x1
OSOYOO SG90 Micro Servo Motor x1
OSOYOO Ultrosonic avoidance module x1
OSOYOO 5-Point tracking sensor module x1
18650 batteries(3.7V) x 2
some screws and jumper wires

CIRCUIT CONNECTION

Install the tank car basic frame work as per Lesson 5 .If you have already completed installation in Lesson 5 , Everything keep it as it is.

Connect E_TX (in wifi shield)to D4 (in Arduino) and and E_RX(in wifi shield) to D5 (in Arduino) as per following picture.



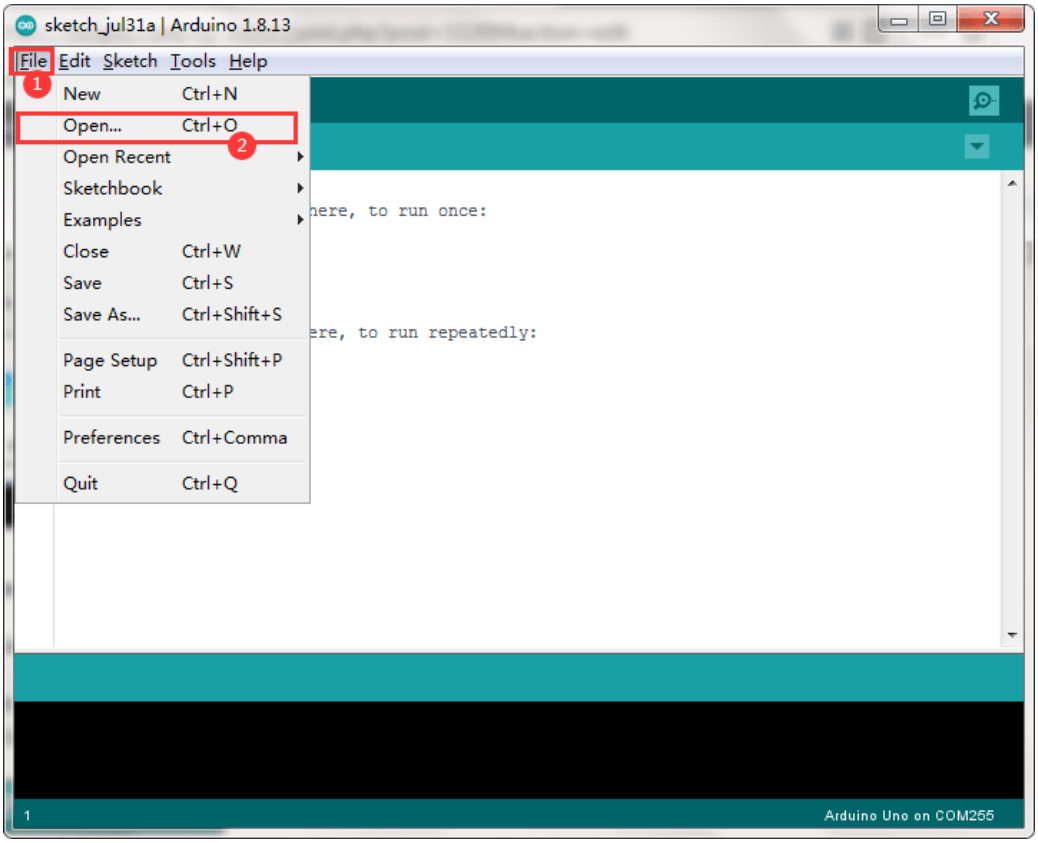
Wifi Shield	Wifi Shield
E_TX	D4
E_RX	D5

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/
Osoyoo Wifi Robot APP		Search Google Play or Apple Store with the Keywords “OSOYOO Wifi UDP Robot Car Controller APP”

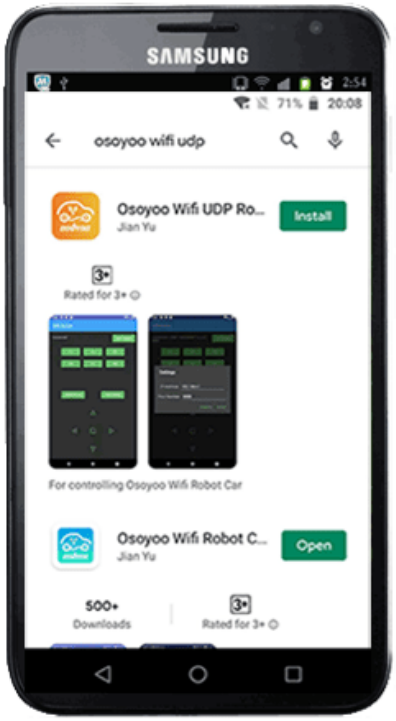
STEP 1: Install latest Arduino IDE (If you have Arduino IDE version after 1.1.16, please skip this step). Download Arduino IDE from https://www.arduino.cc/en/Main/Software?setlang=en , then install the software.

STEP2: Please download the library zip file from WiFiEsp-master .Open Arduino IDE ->click Sketch ->Include Library ->Add .ZIP library , then load above zip file into Arduino.



STEP3: Search Google Play or Apple Store with the Keywords “OSOYOO Wifi UDP Robot Car Controller ” and Download the APP.

Android Phone



Apple iOS

You can also directly download APP from https://osoyoo.com/driver/arduino-udp/udp-robot.apk

Step 4: Please download sketch from following link: https://osoyoo.com/driver/TR300_tank/arduino_tank_carV2.0/tankcarV2.0-lesson6.zip Unzip the file and you will see a folder named tankcarV2.0-lesson6C and tankcarV2.0-lesson6D , upload the code into Arduino. (Notice: Shut off your battery or Unplug your power adapter when upload sketch code to Arduino.)

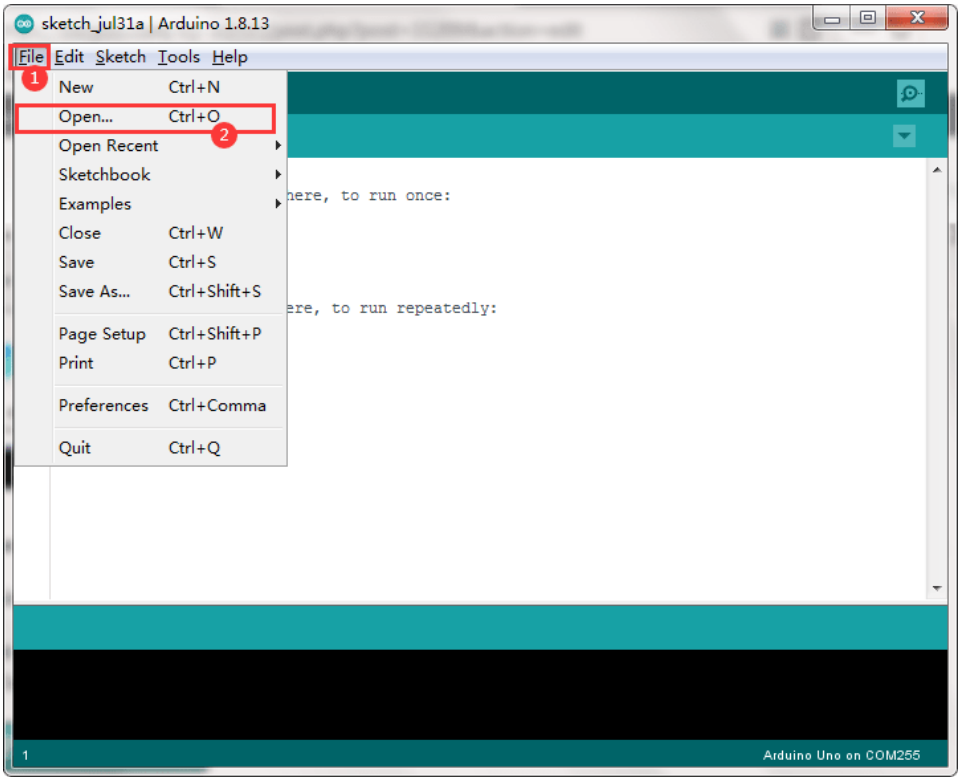
Arduino Sketch code Installation:

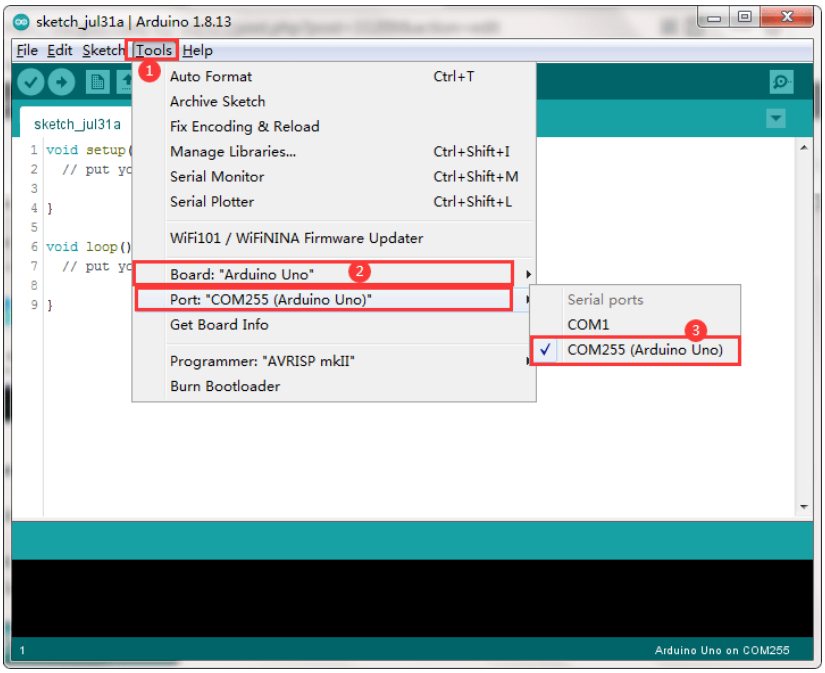
Robot Car can work in two Wifi modes:AP mode and STA mode. The Arduino sketches for these two modes are different. Let's explain these two modes one by one as following:

"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 file and you will see a folder named tankcarV2.0-lesson6C, then load the tankcarV2.0-lesson6C.ino code into Arduino.

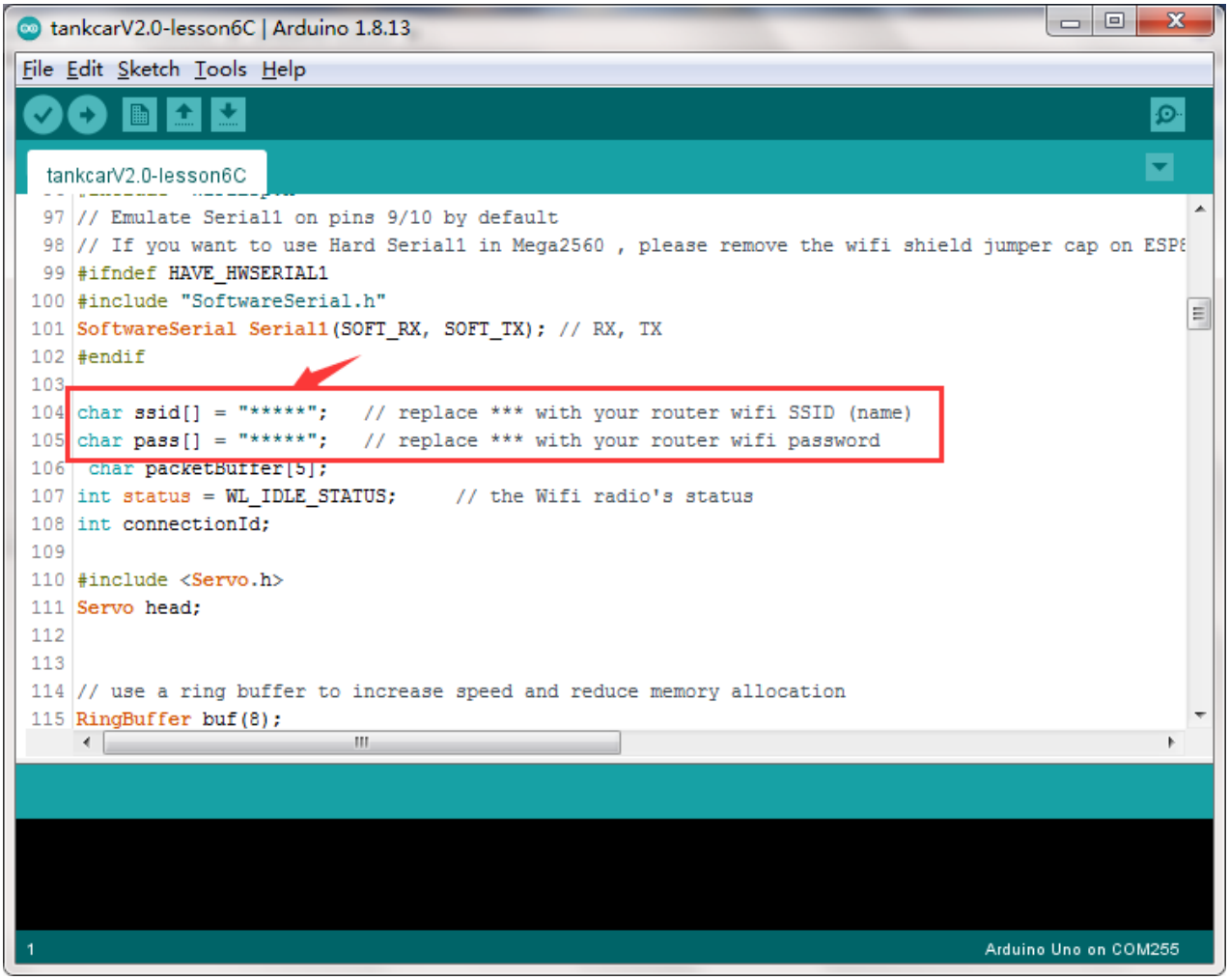




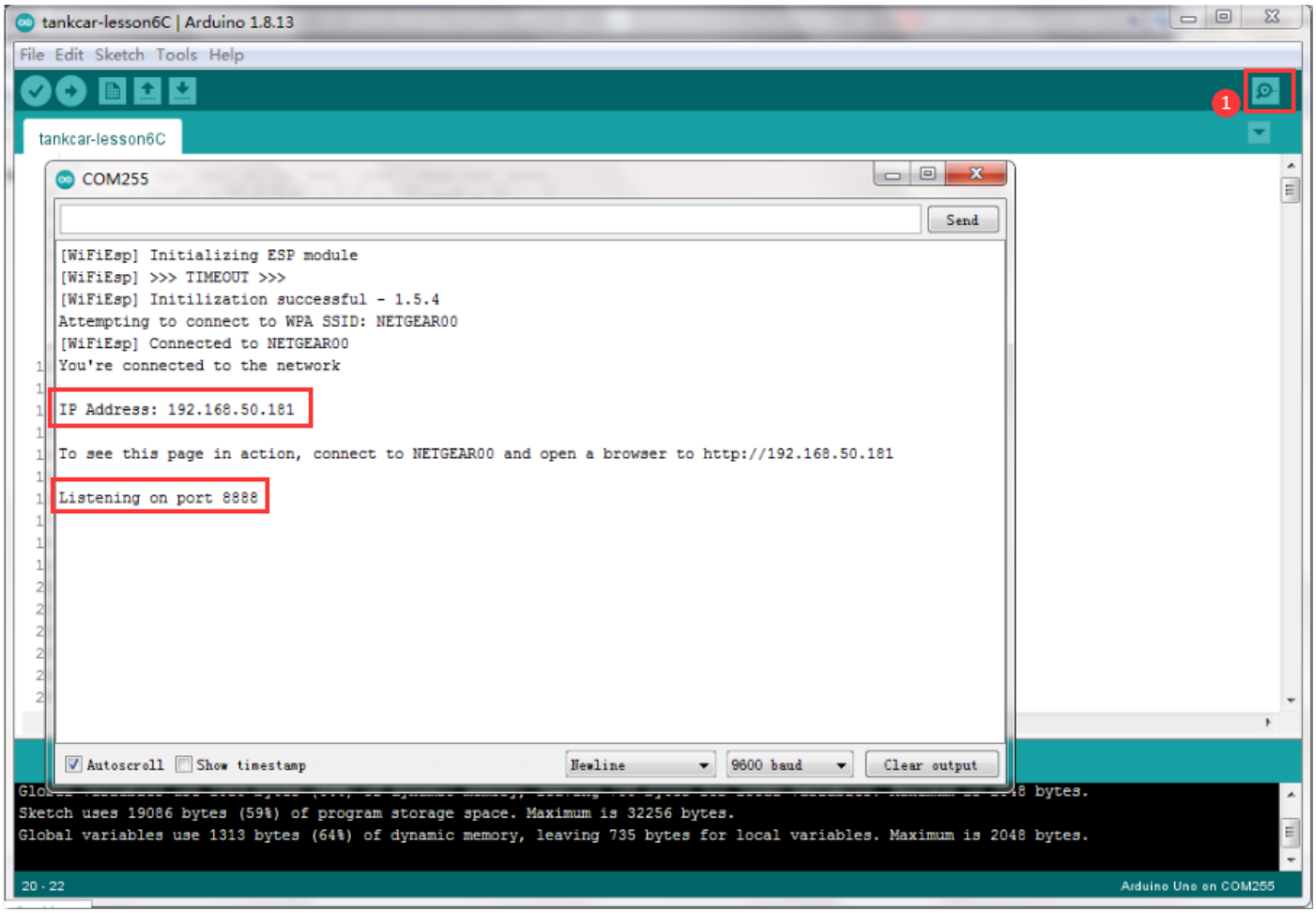
(2) You need change the code Line 104 and Line 105 :

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

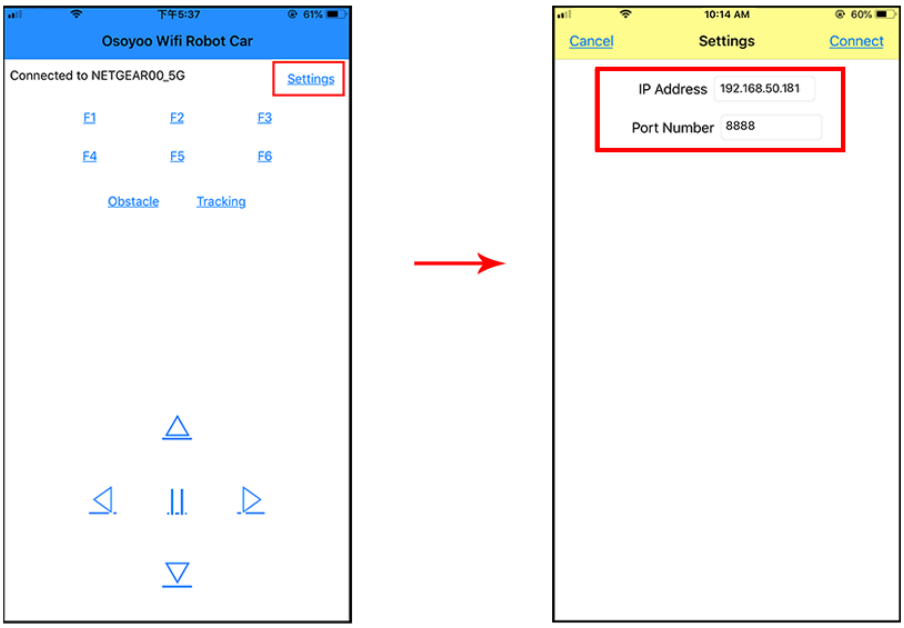
char pass[] = "YOUR_ROUTER_WIFI_PASSWORD" ; // replace with your wifi *password*



(3) Upload the sketch to Arduino. Finally, 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 8888 in APP).

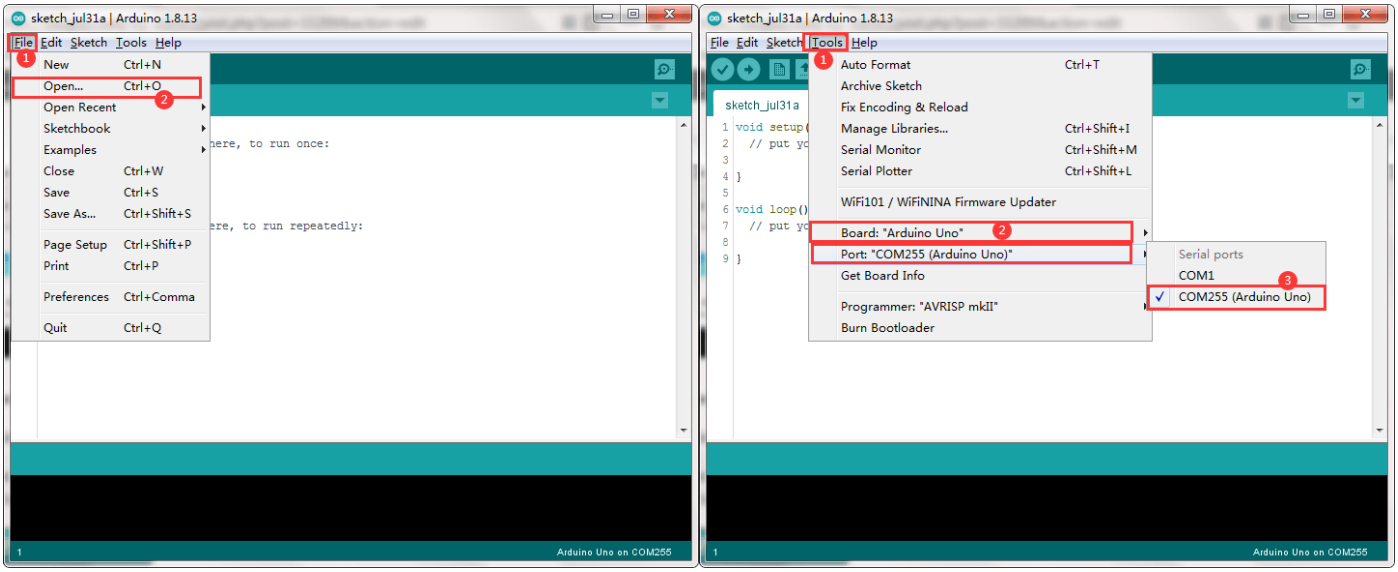


(5)Now your Robot car is connected to your LAN, you can use Mobile phone under same LAN to control the robot car. If your APP is in WAN, you need to go to your Router Control Panel, forward Port 8888 to Robot car LAN IP address, then you can use Router IP to control the car. This feature makes our robot car A REAL INTERNET OF THING device

(6)You can click the "< ″ ″>" " ^" " v " direction keys to make the car move. Use "||" pause key to stop the car movement.

AP MODE

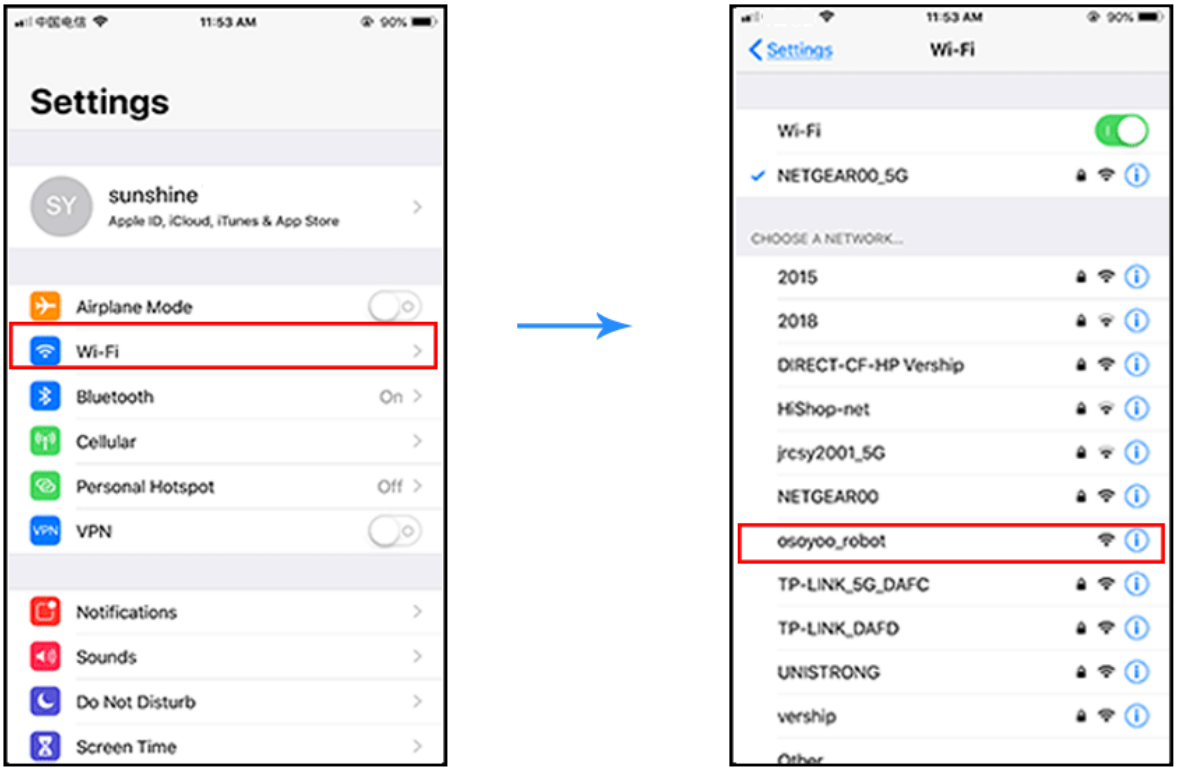
When working in AP mode, our robot car itself will become a Wifi Hot Spot. Our cell phone can connect to Robot Car as its wifi client. The IP address of Robot is fixed as 192.168.4.1 and It is not connected to WAN.
(1) Unzip the file and you will see a folder named tankcarV2.0-lesson6C, then load the tankcarV2.0-lesson6C.ino code into Arduino.



(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.

(4) Connect your cell phone to “osoyoo_robot” wifi hot_spot, and you can use Mobile phone control the robot car.



(5)You can click the “< " ">” ” ^” ” v ” direction keys to make the car move. Use “||” pause key to stop the car movement.

Lesson7: Simulator driving with bluetooth

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.

PARTS & DEVICES

TR300 tank car chassis x1 +Acrylic board chassis x1
OSOYOO UNO R3 board fully compatible with Arduino x1
OSOYOO V1.3 Wifi shield x1
OSOYOO Model X motor driver x1
OSOYOO Battery box x 1
OSOYOO Voltage meter x1
OSOYOO Bluetooth Module x1
18650 batteries(3.7V) x 2
some screws and jumper wires

CIRCUIT CONNECTION

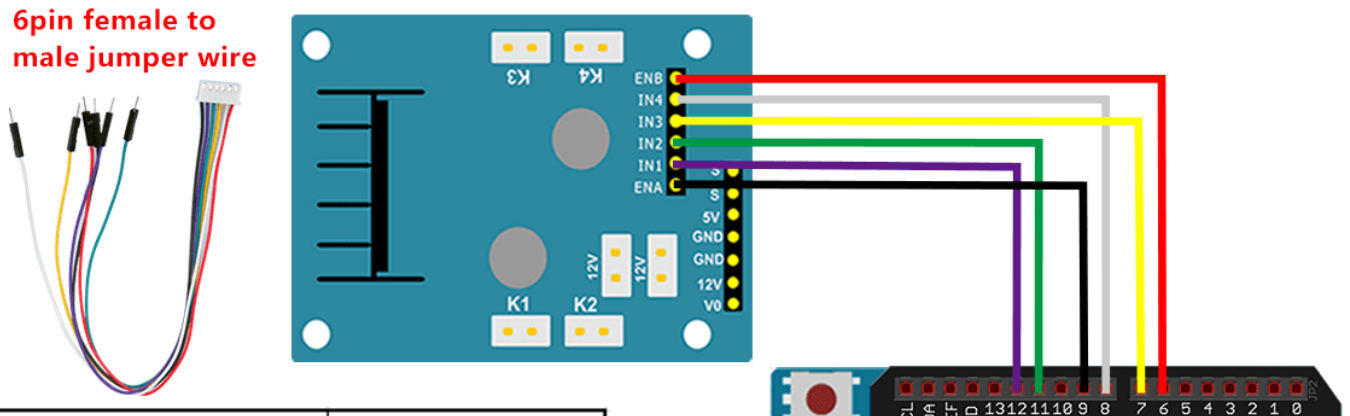
Remember following tips restore your motor control system to lesson 1:

- If your last project is lesson 1,2,3,4, your motor control system is same as Lesson 1, no need do anything.
- If your last project is lesson 5,6, you need change ENA wire from D3 to D9, keep wiring in D6,D7,D8,D11,D12 at same position.

I suggest you run the sketch code in Lesson 1 and make sure motor connection is correct. This is very important for next steps.

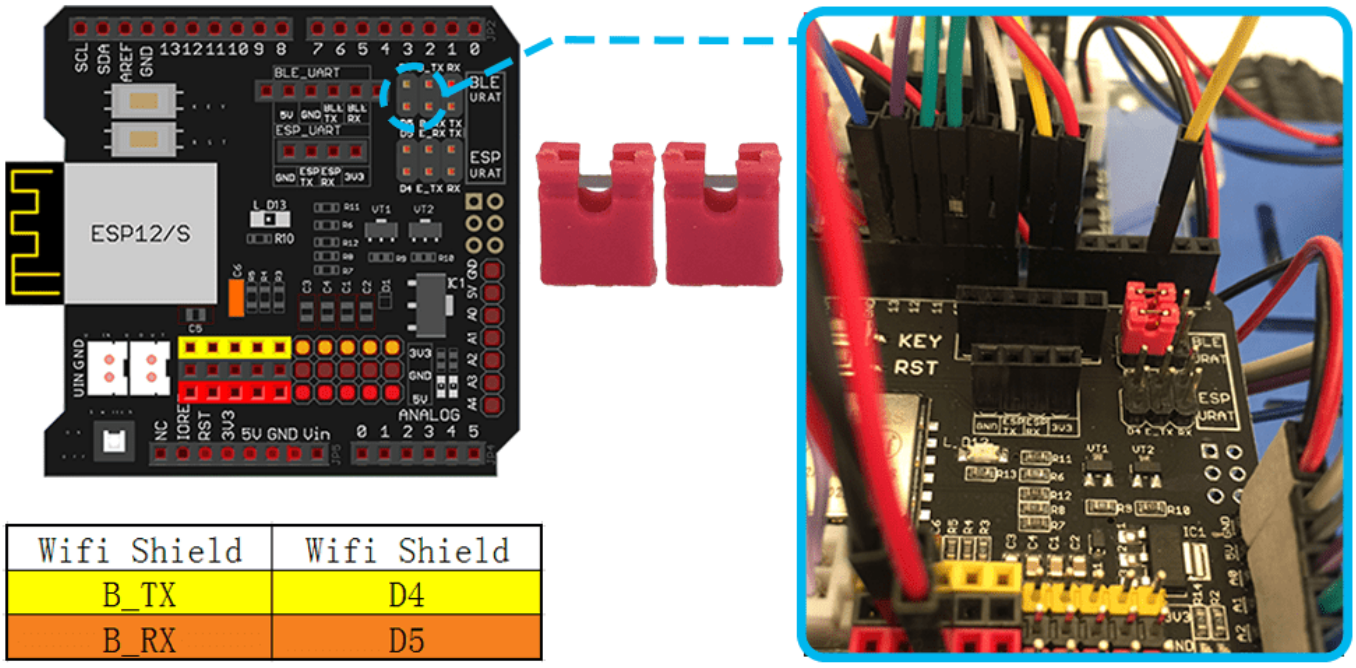
Step 1: Connect the Uno board, model X motor driver board according below connection diagram.

Connect ENA wire from D3 to D9, keep wiring in D6,D7,D8,D11,D12 at the same position.



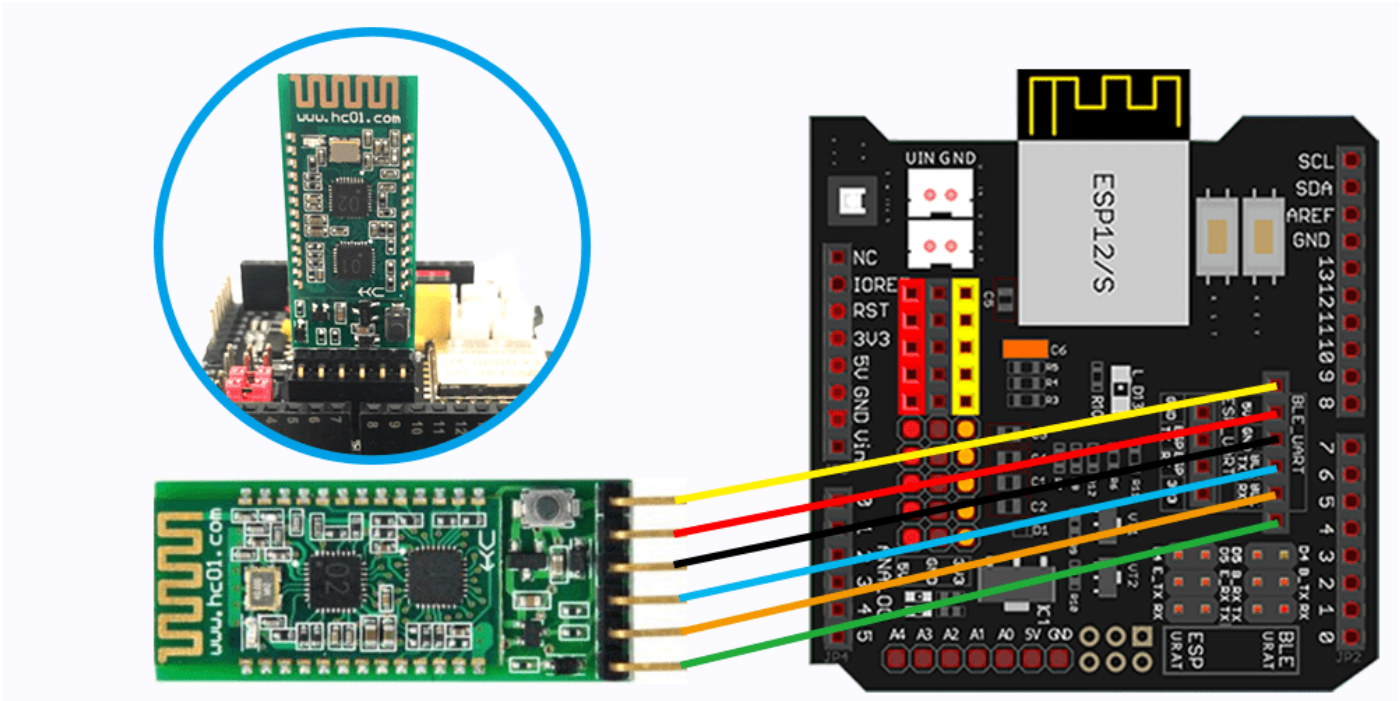
Motor X Driver	Wifi Shield
ENA	D9
N1	D12
N2	D11
N3	D7
N4	D8
ENB	D6

Step 2: Connect B_TX (in wifi shield)to D4 (in Arduino) and and B_RX(in wifi shield) to D5 (in Arduino) as per following picture.



Wifi Shield	Wifi Shield
B_TX	D4
B_RX	D5

Step 3: Insert Bluetooth Module into Osoyoo Wifi Shield Bluetooth slot as following graph.

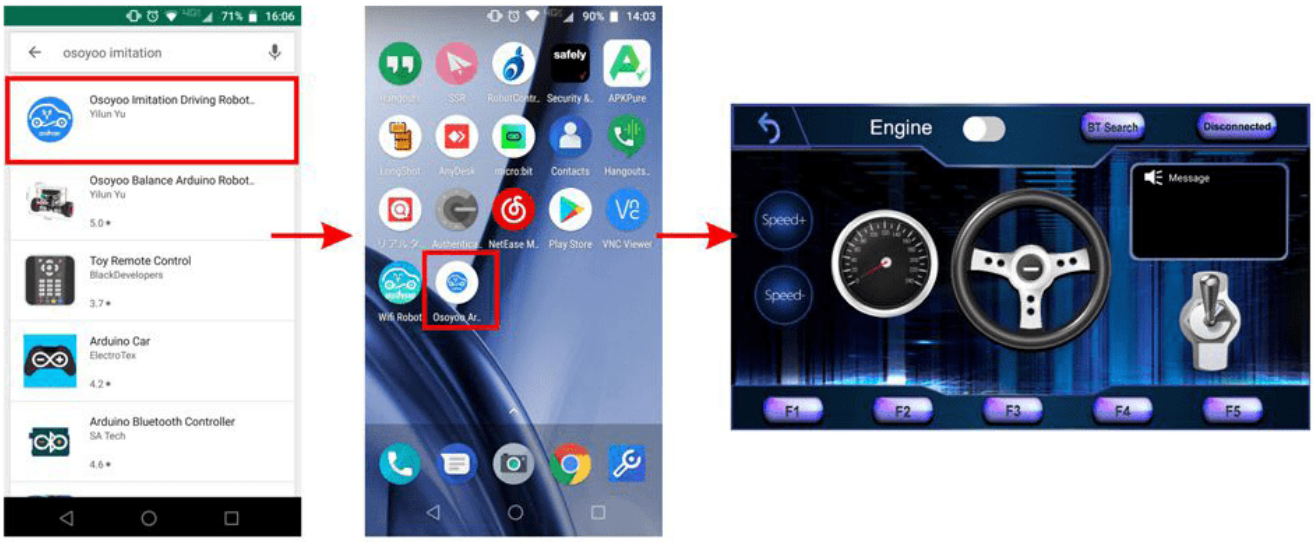


SOFTWARE INSTALLATION

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/
Osoyoo Wifi Robot APP		Search Google Play or Apple Store with the Keywords “OSOYOO Wifi UDP Robot Car Controller APP"

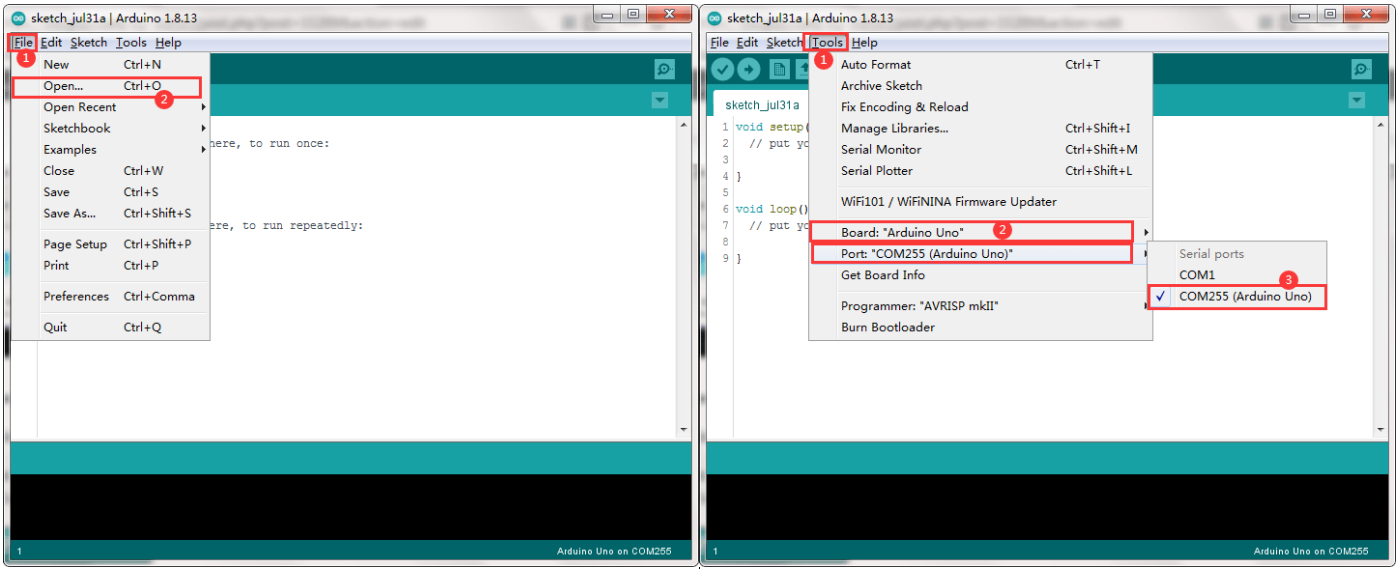
Step 1: Install APP into your mobile phone:
Go to your Apple APP store and search APP name “OSOYOO imitation driving”, Download the APP as following and install it in your smart phone.

If you are using Android cell phone, please Download the APP from following link : https://osoyoo.com/driver/v1car.apk.



Step 2: Please download sketch from following link: https://osoyoo.com/driver/TR300_tank/arduino_tank_carV2.0/tankcarV2.0-lesson7.zip ,Unzip the file and you will see a folder named tankcarV2.0-lesson7, then load the tankcarV2.0-lesson7.ino code into Arduino. (Notice: Shut off your battery or Unplug your power adapter when upload sketch code to Arduino.)

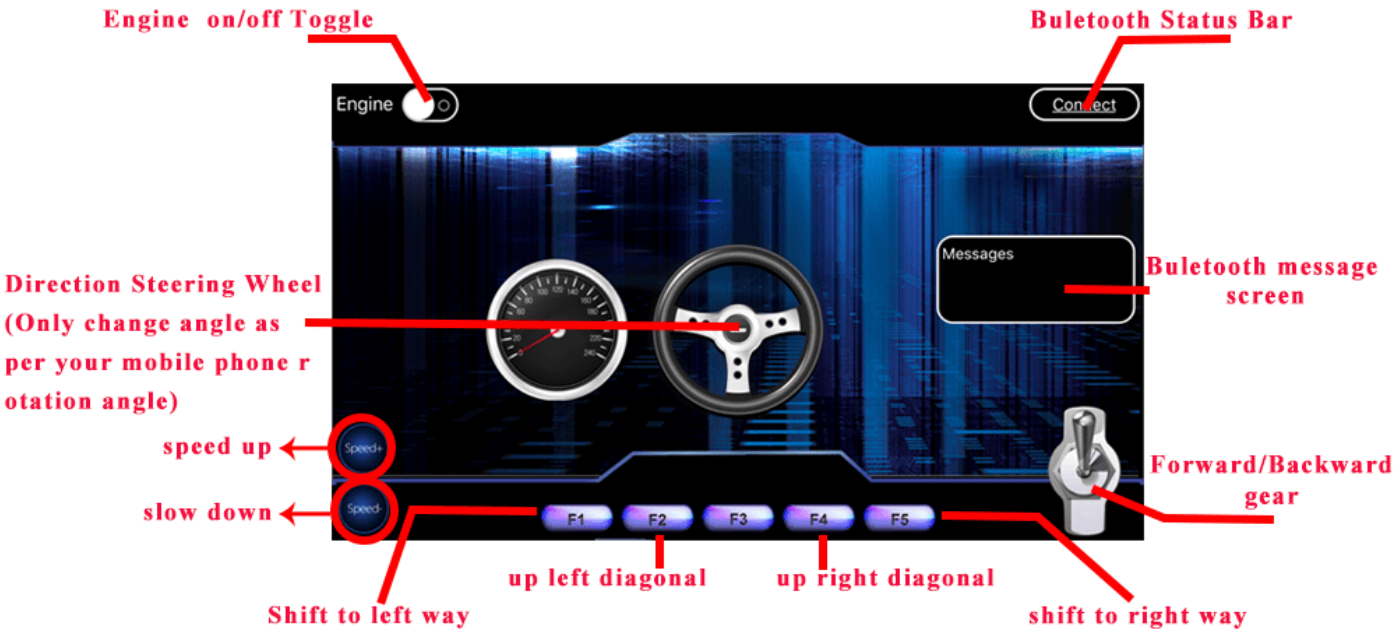
Step 3: Choose corresponding board/port for your project, upload the sketch to the board.



HOW TO PLAY

Drive your Robot Car

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


Engine on/off Toggle
Buletooth Status Bar
Engine
Connect
Messages
Buletooth message screen
Direction Steering Wheel (Only change angle as per your mobile phone r otation angle)
speed up
Speed+
slow down
Speed-
Forward/Backward gear
F1
F2
F3
F4
F5
up left diagonal
up right diagonal
Shift to left way
shift to right way

Lesson8: Use encoder to synchronize motor speed

OBJECTIVE

In our previous lesson, we know that the motor speed is powered and controlled by PWM(Pulse Width Modulation) current from L298N. However, due to manufacturing inaccuracy, left and right motors might run at different speed even if they powered with same PWM signal. This will cause the robot car offtrack straight line.

To solve the problem, we need collect the speed data from left and right motors and use the data to adjust PWM current and synchronize the speed of both side motors.

In this lesson, we will use build-in Hall Encoder in the motor to collect speed data and send the data to Arduino, then use the data to synchronize motor speed and make car running straight.

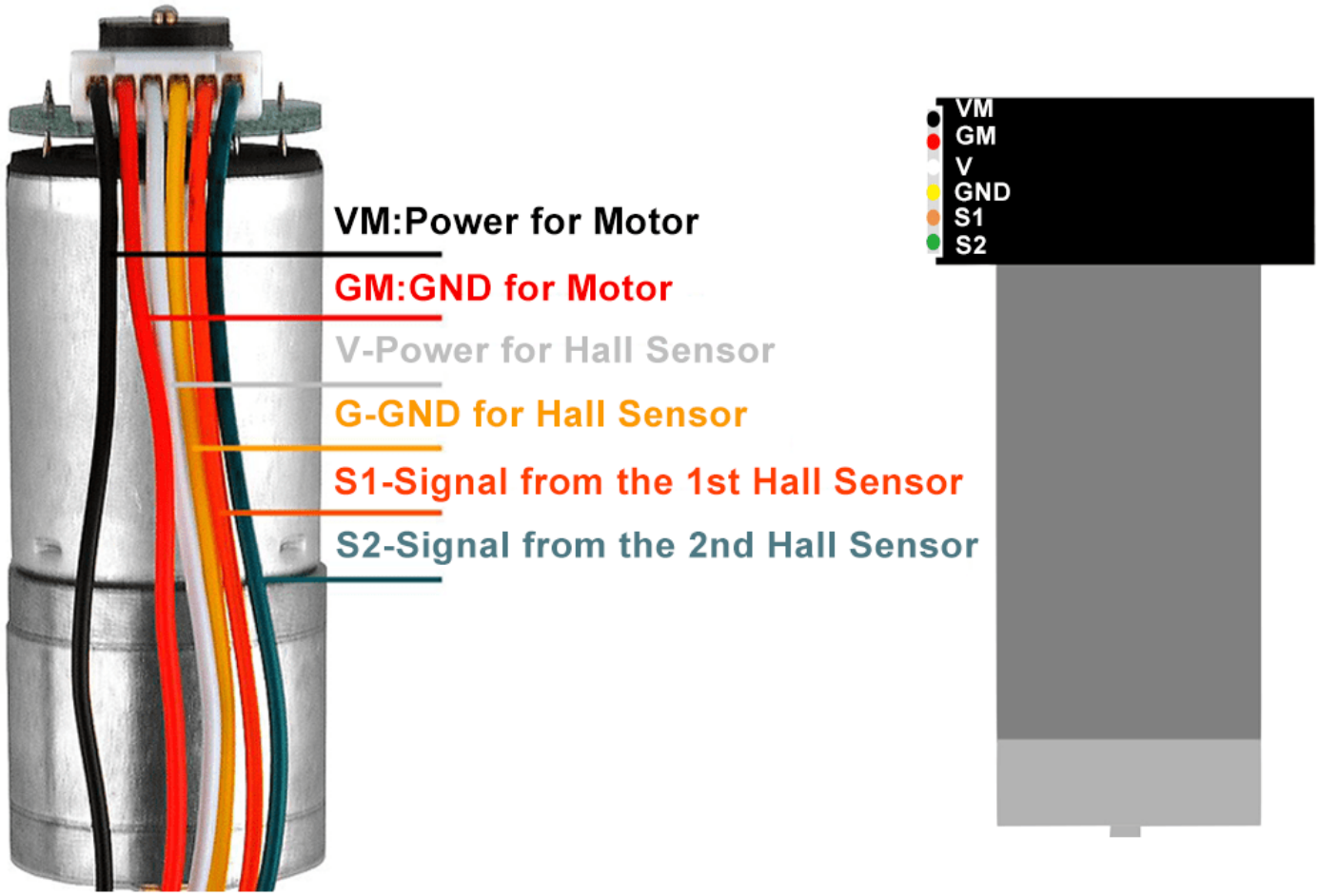
PARTS & DEVICES

TR300 tank car chassis x1 +Acrylic board chassis x1
OSOYOO UNO R3 board fully compatible with Arduino x1
OSOYOO V1.3 Wifi shield x1
OSOYOO Model X motor driver x1
OSOYOO Battery box x 1
OSOYOO Voltage meter x1
18650 batteries(3.7V) x 2
some screws and jumper wires

HARDWARE INSTALLATION

The wire connection of Hall encoder(speed sensor).

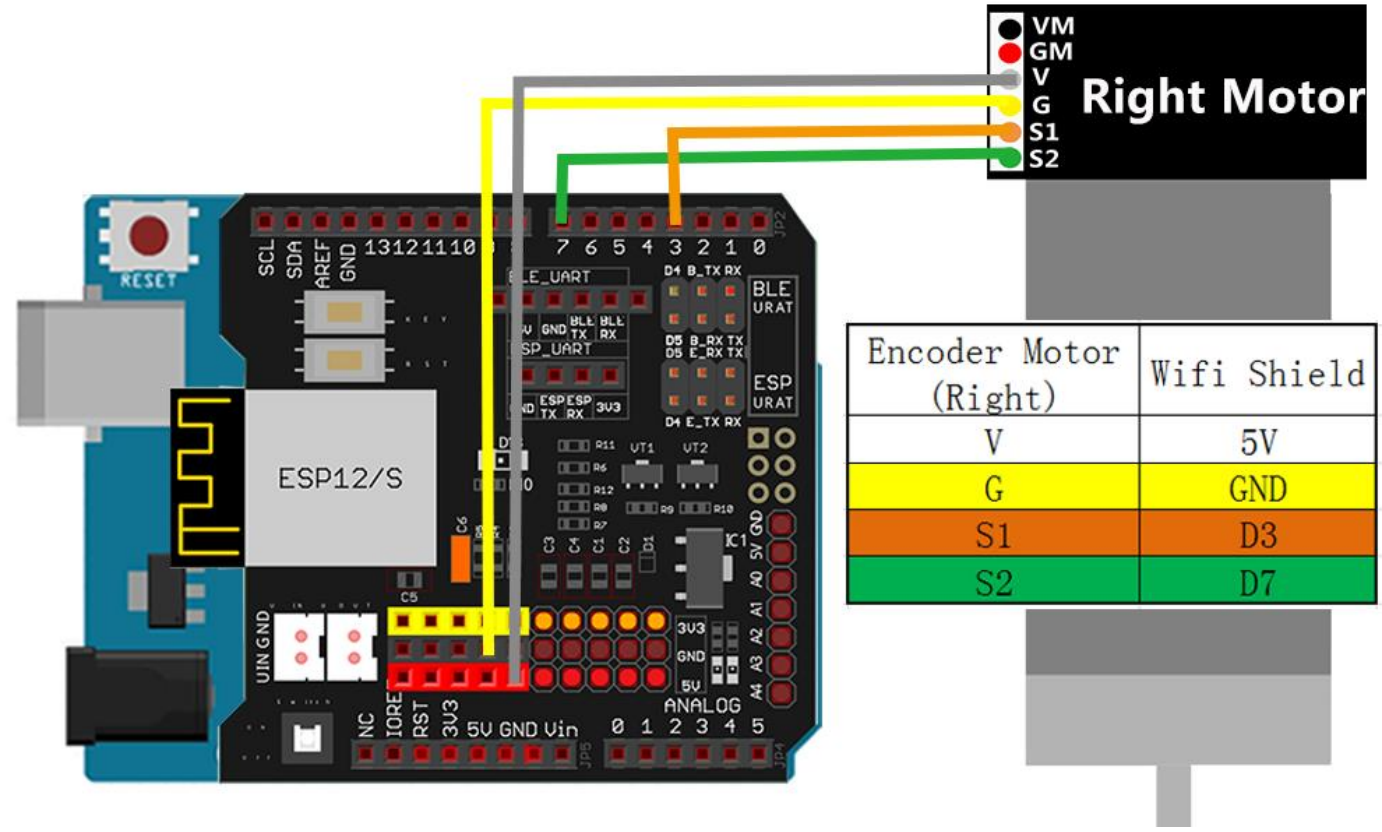
Black wire(VM): Power for Motor
Red wire (GND): GND for Motor
White wire(V): Power for hall sensor (5V)
Yellow wire(G) : GND for hall sensor
Orange wire (S1): Signal for the 1st hall sensor
Green(S2): Signal for the 2st hall sensor
Connect the wires to the ESP8266 wifi board as per the following diagram:



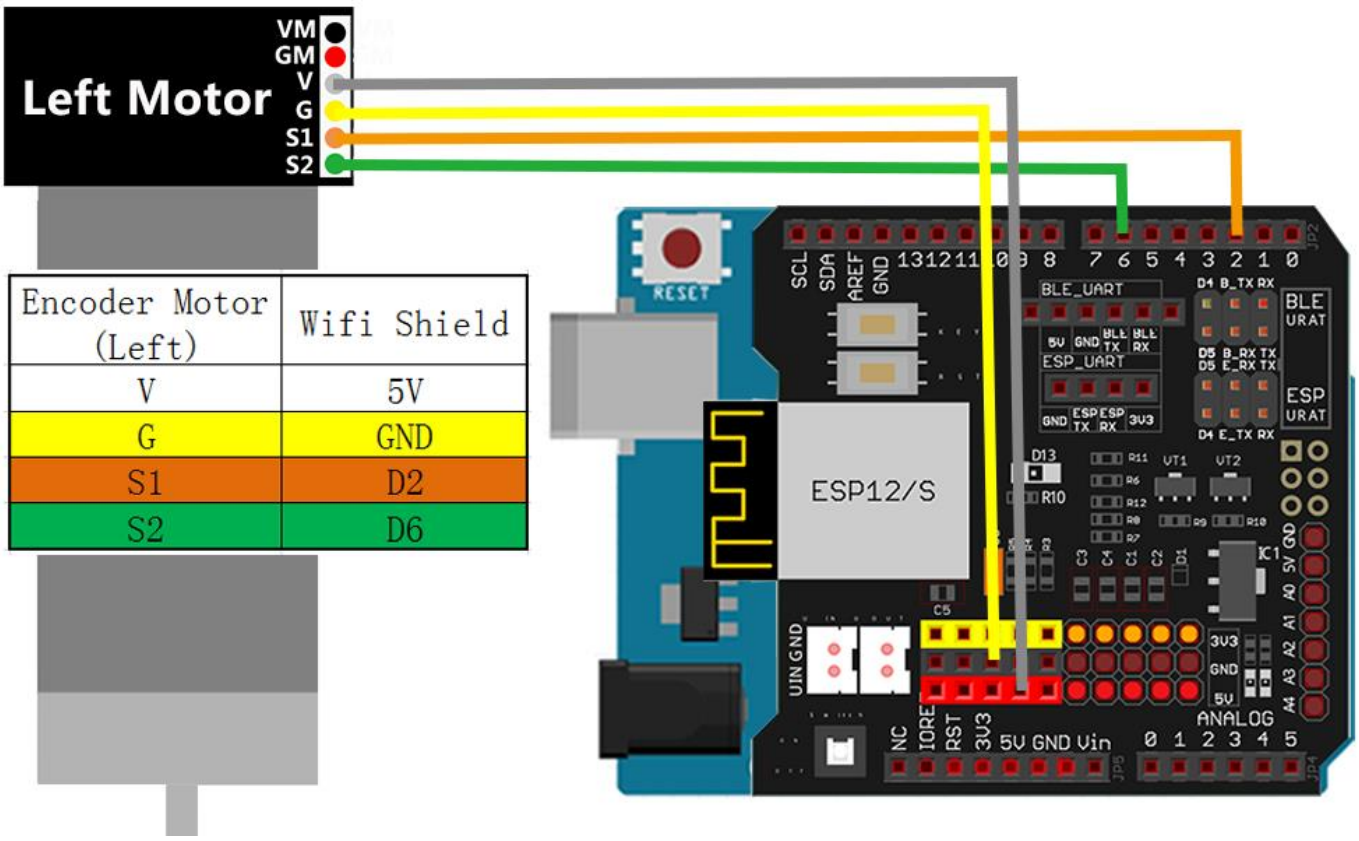
Unlike other sensor, Hall encoder has two signal pin S1 and S2 which should work together to get speed data. Arduino also needs two digital pins to input data from S1 and S2. Our Arduino sample code will use an algorithm called PID to synchronize the speed of left and right motor. The detail of PID algorithm is beyond the scope of this lesson. If you are interested in this algorithm, you can google it for detail.

CIRCUIT CONNECTION

Step1: Remove all wire on wifi board ,then connect the left and right motor wire to wifi board as per following pictures.

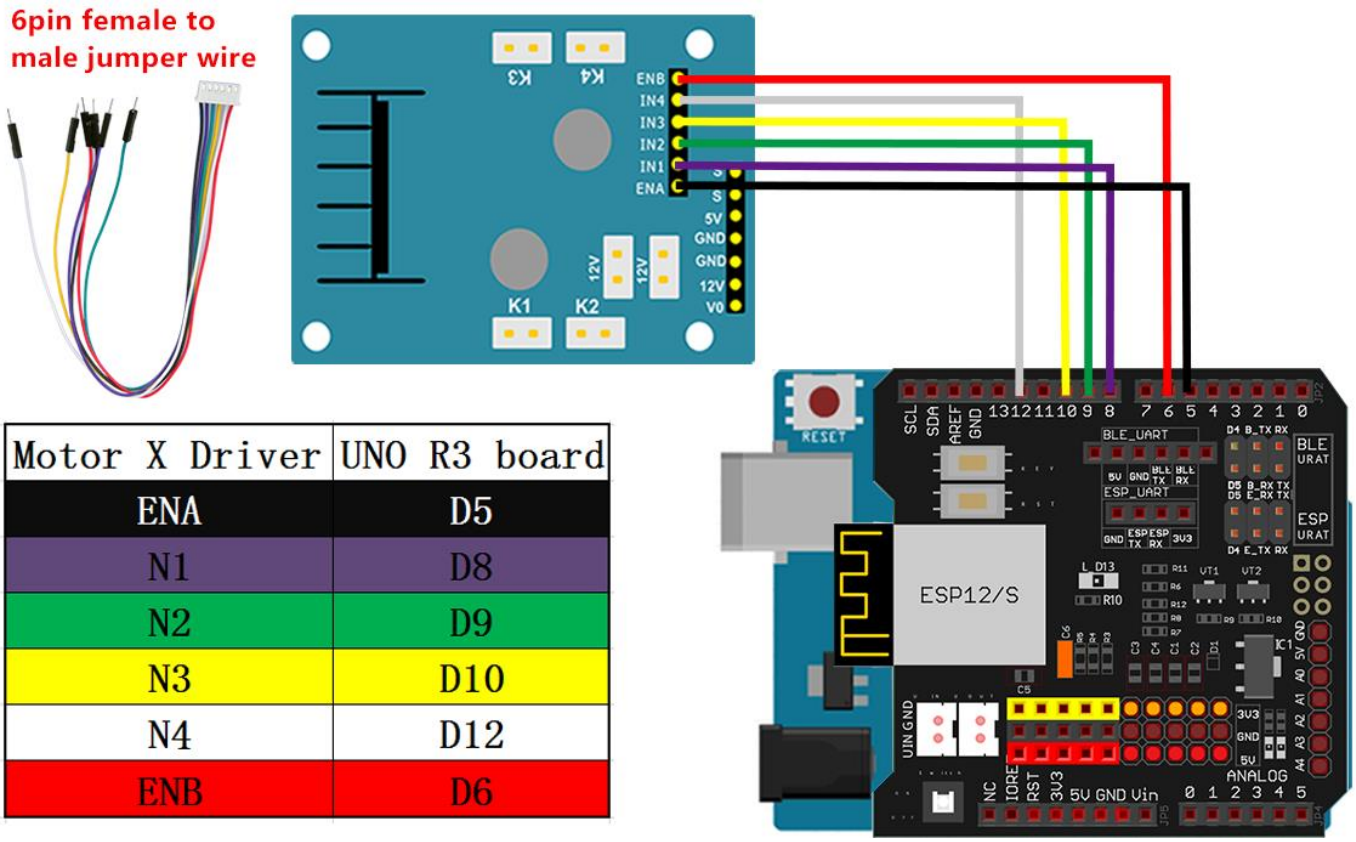


Encoder Motor (Right)	Wifi Shield
V	5V
G	GND
S1	D3
S2	D7



Encoder Motor (Left)	Wifi Shield
V	5V
G	GND
S1	D2
S2	D6

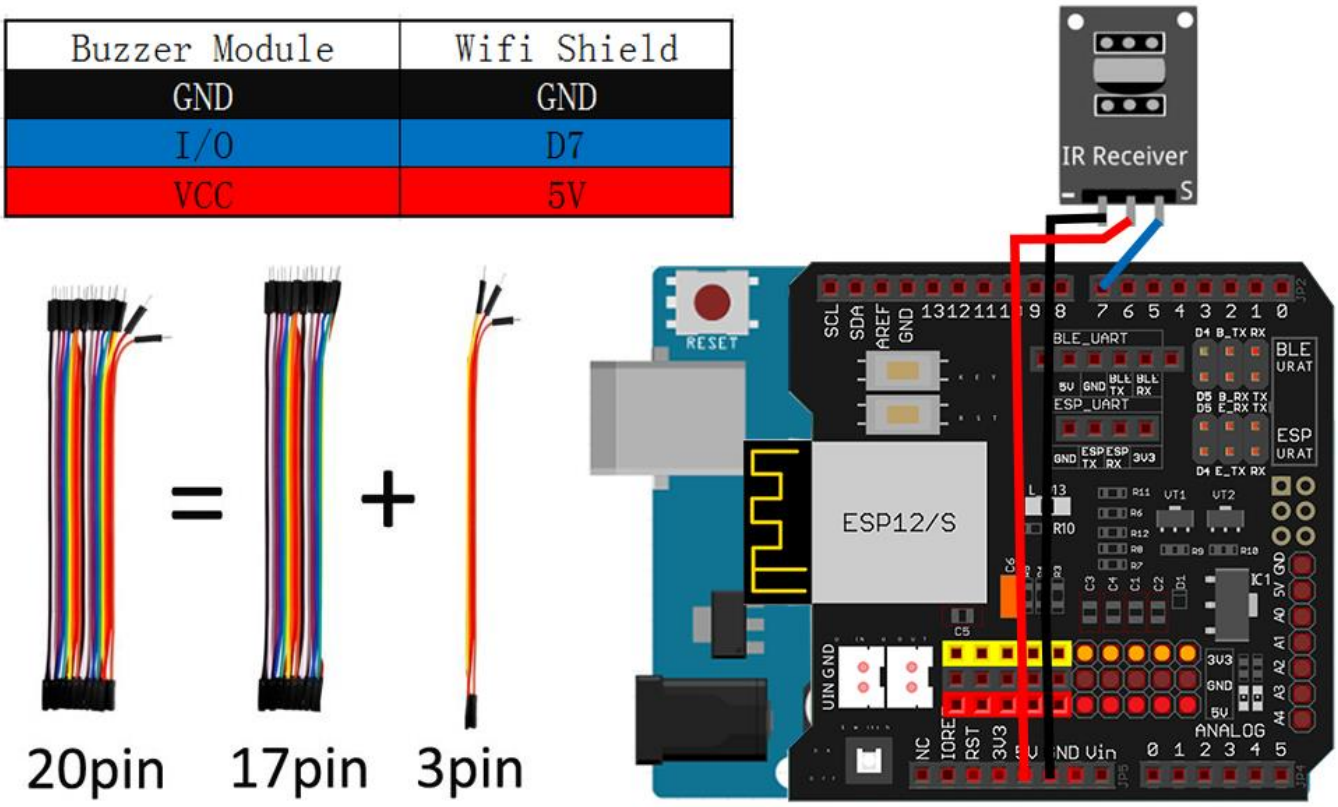
Step2: Move the wire connected to digit ports(D5,D6,D8,D9,D10,D12) in UNO R3 board to its counterpart digit pin in wifi Board.



Motor X Driver	UNO R3 board
ENA	D5
N1	D8
N2	D9
N3	D10
N4	D12
ENB	D6

Step3: Connect the S pin in IR receiver to D7 pin in UNO board, GND to GND, VCC to 5V, as the following photo :

Buzzer Module	Wifi Shield
GND	GND
I/O	D7
VCC	5V



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.

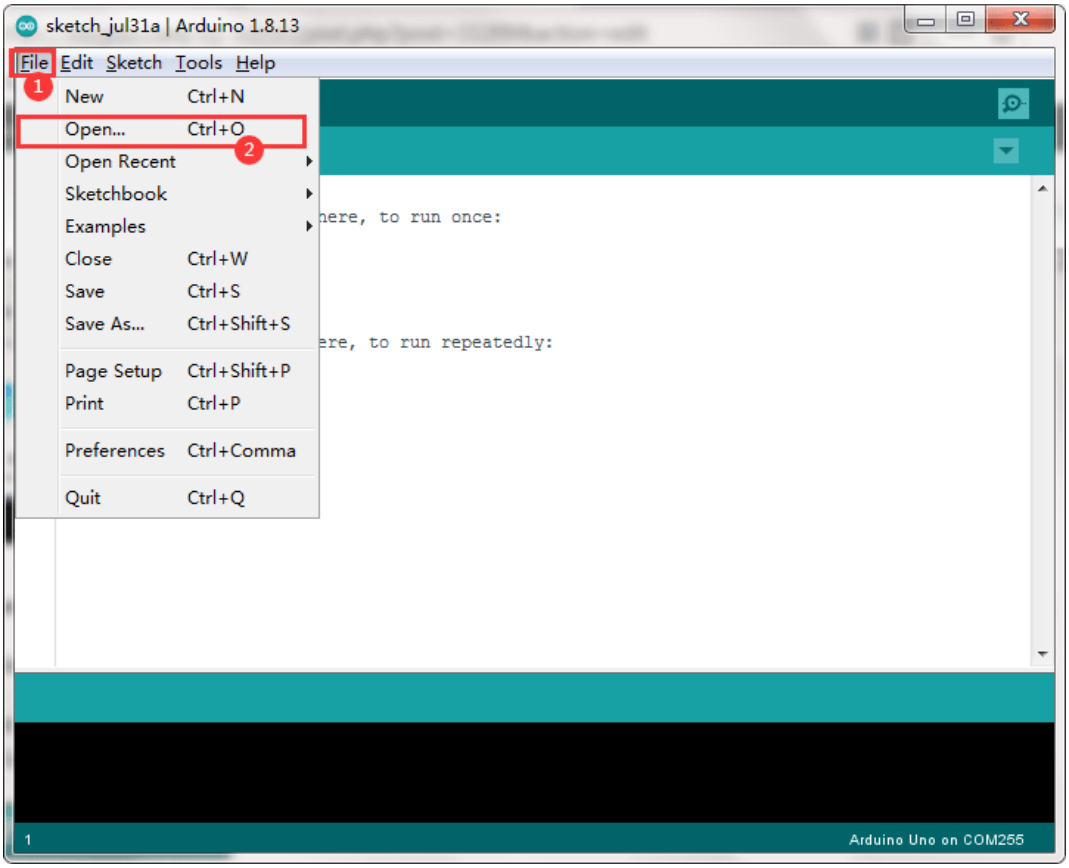
Step 2: Download the libraries from

http://osoyoo.com/picture/TR300_tank/arduino_tank_carV2.0/lesson8/datascope.zip
http://osoyoo.com/picture/TR300_tank/arduino_tank_carV2.0/lesson8/MsTimer2.zip
http://osoyoo.com/picture/TR300_tank/arduino_tank_carV2.0/lesson8/PinChangeInt.zip

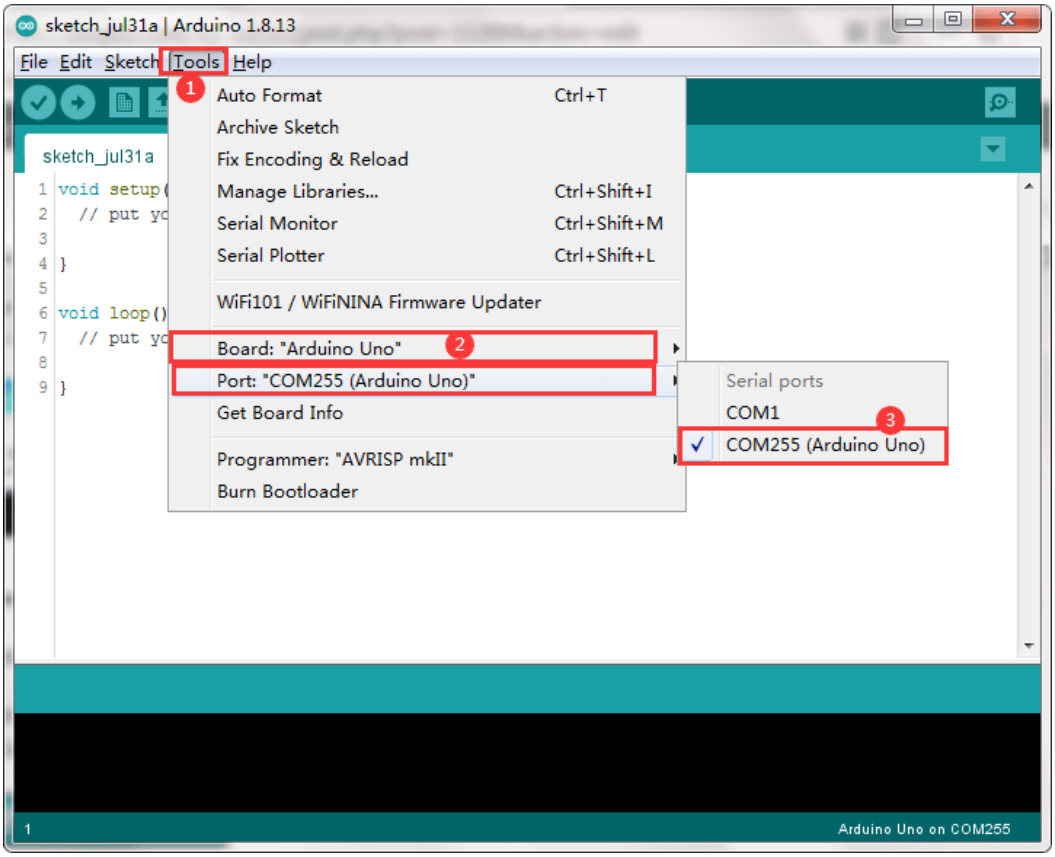
Step 3: Open arduino IDE -> click sketch -> Include Libraries->Add .zip Libraries -> choose zip file "datascope.zip", "MsTimer2.zip" and "PinChangeInt.zip" in turns -> Upload three .zip files

Step 4: Download Lesson 8 sample code from http://osoyoo.com/picture/TR300_tank/arduino_tank_carV2.0/lesson8/tankcarV2.0-lesson8.zip, unzip the download zip file tankcarV2.0-lesson8.zip, you will see a folder.

Step 5: Connect Arduino UNO to PC with USB cable, Open Arduino IDE -> click file -> click Open -> choose code "tankcarV2.0-lesson8.ino" in lesson8 folder, load the code into arduino.(Notice: Shut off your battery or Unplug your power adapter when upload sketch code to Arduino.)



Step 6: Choose corresponding board/port for your project, upload the sketch to the board.



Step 7: Ultrasonic sensor servo initial direction alignment.

After turning on the battery, you will hear a long beep sound, then the servo will make some movement and finally stops at a direction for 5 seconds.

Understand the Code:

1) Define the pinout of left and right motor

```
const byte encoder0pinA = 2;//A pin -> the interrupt pin 0
const byte encoder0pinB = 4;//B pin -> the digital pin 4
const byte rencodPinA = 3;  //rencodPinA -> the interrupt pin 1
const byte rencodPinB = 7;  //rencodPinB -> the digital pin 11
```

2) Set the sampling period to be 10ms. When up to 10ms, enter to the interrupt instructure control

```
MsTimer2::set(10, control);  //use timer2 to set the 10ms timer interrupt
MsTimer2::start();          //enable interrupt
```

3) Initialization of encoder pinout and use the arduino external interruption via pinout

```
  l_direction = true;//default -> Forward
  r_direction = true;//default -> Forward
  pinMode(encoder0pinB,INPUT);
  pinMode(rencodPinB,INPUT);
  attachInterrupt(0, lwheelSpeed, CHANGE);
  attachInterrupt(1, rwheelSpeed, CHANGE);
```

4) Count pluse when the motor spin .

```
void lwheelSpeed()
{
  int Lstate = digitalRead(encoder0pinA);
  if((encoder0PinALast == LOW) && Lstate==HIGH)
  {
    int val = digitalRead(encoder0pinB);
    if(val == LOW && l_direction)
    {
      l_direction = false; //Reverse
    }
    else if(val == HIGH && !l_direction)
    {
      l_direction = true;  //Forward
    }
  }
  encoder0PinALast = Lstate;
```

```
  if(!l_direction)  duration++;
  else  duration--;
}

void rwheelSpeed()
{
  int Lstate = digitalRead(rencodPinA);
  if((encoder0PinALast1 == LOW) && Lstate==HIGH)
  {
    int val = digitalRead(rencodPinB);
    if(val == LOW && r_direction)
    {
      r_direction = false; //Reverse
    }
    else if(val == HIGH && !r_direction)
    {
      r_direction = true;  //Forward
    }
  }
  encoder0PinALast1 = Lstate;

  if(!r_direction)  duration1++;
  else  duration1--;
}
```

5)Getting error correction power via PI algorithm and use the power to adjust the motor speed.

```
int PID_controller(int master,int slave)
{
  static float power,error,integralerror,lasterror;
  if(master < 0) master = -master;
  if(slave < 0) slave = -slave;
  error = master - slave;
  integralerror += error;
  power += Kp *(error-lasterror) + Ki * error;
  lasterror = error;
  return power;
}
```

6) Run the function control ( ) per 10ms.

```
void control()
{
   sei();//enable global interrupts
```

```
    if(++i >=4)//20ms
    {
    master_pulse = duration ,duration = 0;
    slave_pulse = duration1, duration1 = 0;
    pwm = PID_controller(master_pulse,slave_pulse);
    i = 0;
    }
    int newpower1 = motorspeed+pwm;
    constrain(newpower1,0,255);
    analogWrite(ENB,newpower1),analogWrite(ENA,motorspeed);
    cli();//disenable global interrupts
}
const float Kp =20;
const float Ki =1;
```

HOW TO PLAY

Testing:

Mark a red label on both side tracks and turn on the battery switch so as to see if it synchronizes. You can adjust Kp and Ki parameter to make the speed synchronized.(Note:The car can not go straight if the smooth ground created the least friction to slip),