
Lesson 2 Bluetooth Car

Points of This Section

It is very important and so cool to control your car wirelessly in a certain space when we learn the Arduino. So in this lesson, we will teach you how to control a car by Bluetooth.

Learning Objectives:

- ◆ *Learn how to use the Bluetooth module and the Bluetooth APP*
- ◆ *Learn how to control the light by using Bluetooth*
- ◆ *Learn how to control the vehicle via Bluetooth*

Preparations:

- ◆ *A vehicle (equipped with battery)*
- ◆ *A USB cable*
- ◆ *A Bluetooth module*
- ◆ *A Phone or tablet*

I . Bluetooth module (BT16 4.2)



The Bluetooth is a wireless technology standard for exchanging data between fixed and mobile devices over short distances using short-wave UHF radio waves in the industrial, scientific, and medical radio bands (2.400 to 2.485 GHz), and building personal area networks (PANs). There are also RF protocols such as ZigBee and Wi-Fi.



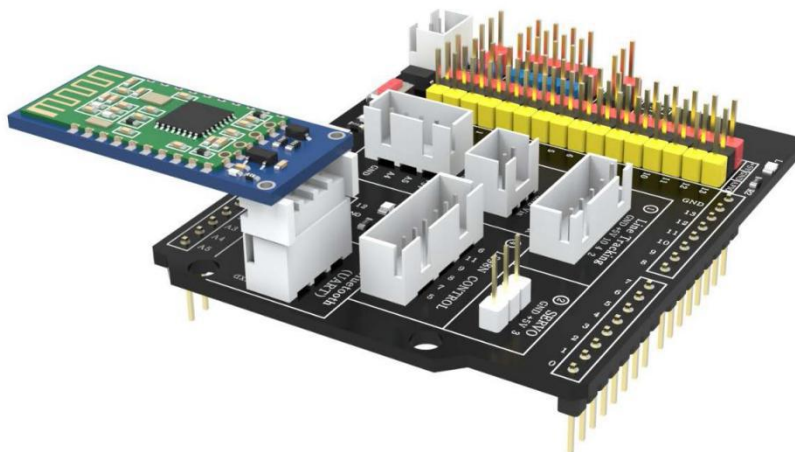
In Smart Car Kit, we use the Bluetooth module model "DX-BT16", it can send serial data to other devices via Bluetooth.



DX-BT16 communicates with UNO through the **RX/TX** pin on the shield.

***WARNING:**

The RX/TX pin will be occupied when the sketch is uploading.
Please unplug the Bluetooth module until done uploading.



II. Getting Started with the ELEGOO BLE Tool APP

Before beginning, connect the DX-BT16 4.2 Bluetooth module to the expansion board and turn on the power.

STEP1: Install the application

For Android

There are two ways to install the Android application.



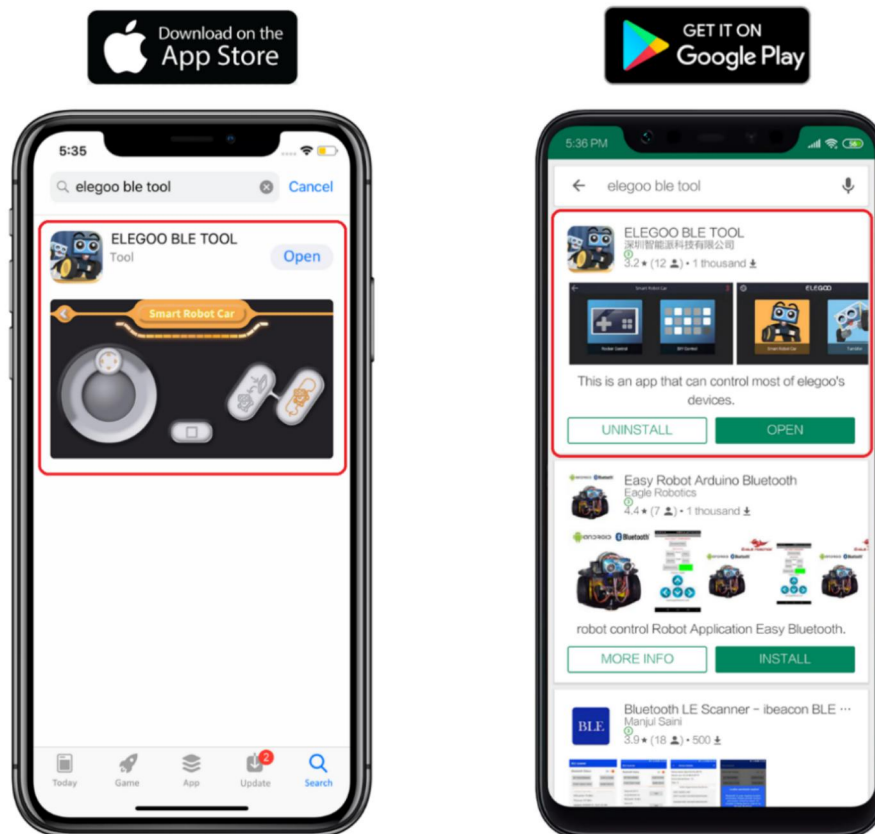
ELEGOO BLE Tool

1. For Android system, copy the APK file to the Android products devices and install it. The APK file located in "Elegoo Smart Robot Car Kit V3.0_plus \ ELEGOO BLE Tool.apk"

2. Search "ELEGOO BLE Tool" in Google Play Store and install it.

For IOS

Search "ELEGOO BLE Tool" in Apple APP Store and install it.



Tips: If you have any questions or run into any problems during assembling and testing Smart Robot Car please feel free to contact us at service@elegoo.com or euservice@elegoo.com (Europe customers).

STEP2: Open the APP

As below, we use an iPhone for example to show you how to control the Elegoo Smart Robot Car via this App:

First of all, turn on your cellphone's Bluetooth function.



Please note:

**The Smart Cars CANNOT be paired in settings page,
it can only be connected with "Elegoo BLE Tool" App.**

Open the "Elegoo BLE Tool" App.



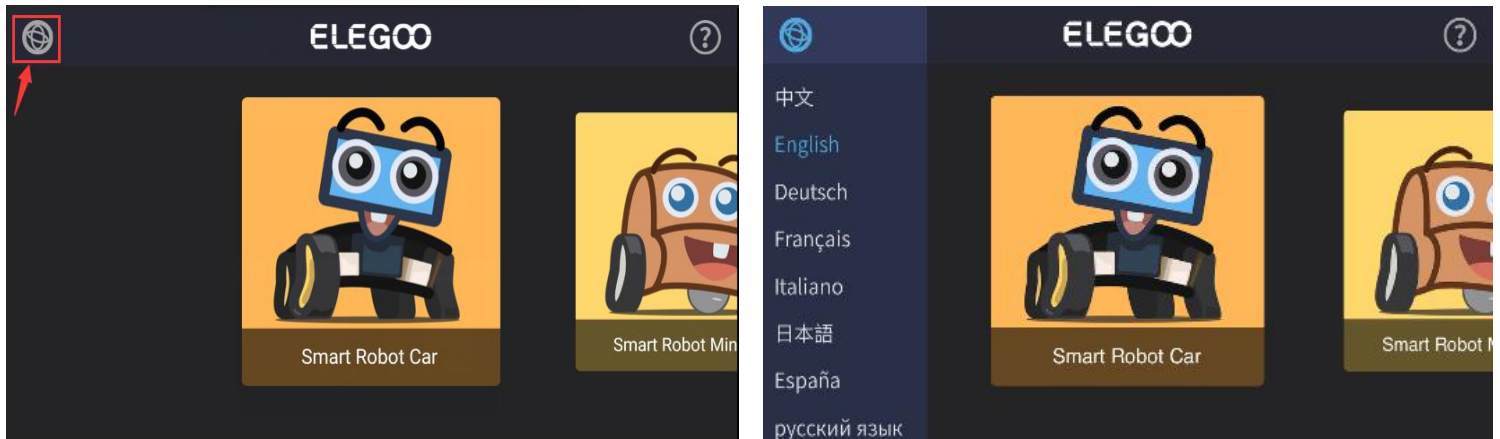
Click OK (Please click OK when the App requests for the location permission, otherwise it will affect the Bluetooth function.)




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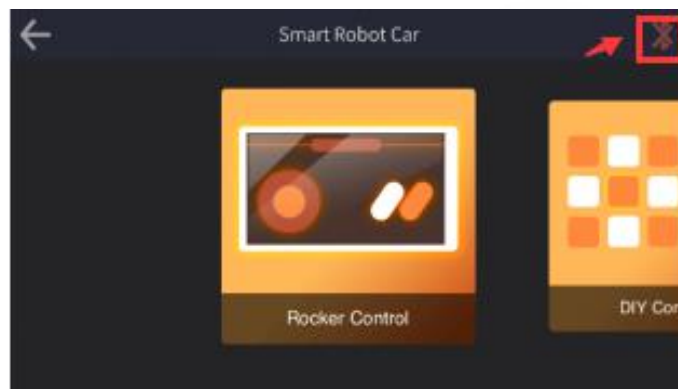
STEP3: Choose the language

First, run the installed App, and click the icon in the top left corner to open the language list.



STEP4: Connect Bluetooth


Click Smart Robot Car to enter the control page. Then tap the “” icon to enter the Bluetooth searching interface.

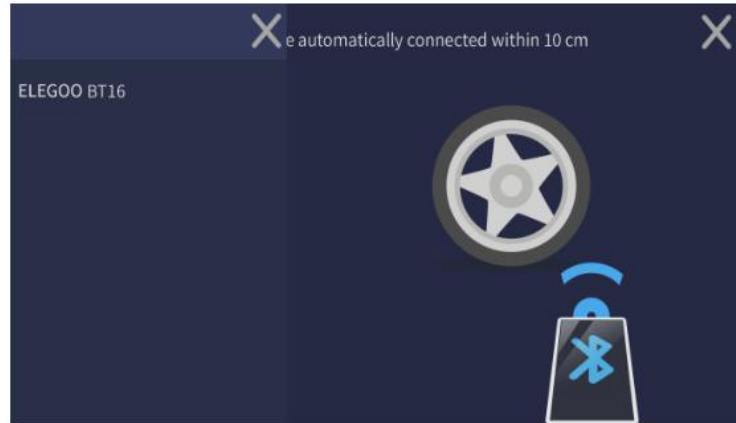


Put your phone close to the Smart Robot Car (within 10cm), the app will connected to the Smart Robot Car automatically.

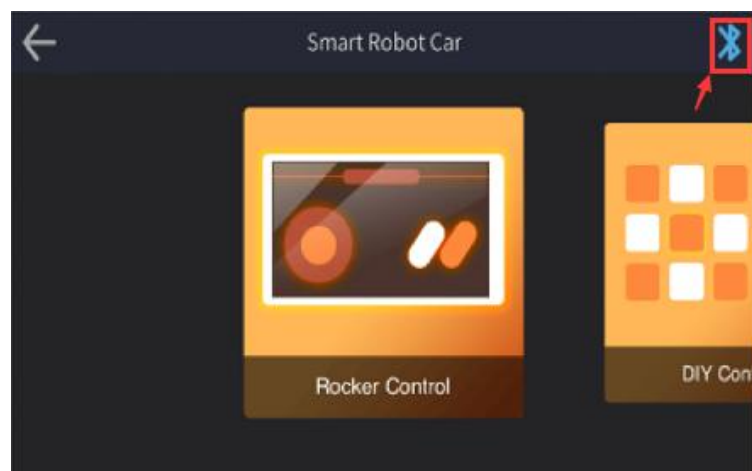


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You can also open the Bluetooth device list by tapping the menu icon “” in the upper left corner and select “**ELEGOO BT16**” to connect the Smart Robot Car manually.



The Bluetooth status icon will turn blue when the Smart Robot Car is connected.



III. Control the light

Open the code file in the path “**\Elegoo Smart Robot Car Kit V3.0 Plus\bluetooth_blink\bluetooth_blink.ino**” and upload the program to the UNO board.



Disconnect it from the computer, and then switch on the car’s power supply.

(TIPS: Please disconnect the Bluetooth when you upload the program, otherwise it will be failed to upload the program.)

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Open APP

After connecting the phone to the car through Bluetooth, we set the data as below:



After set-up, press this button. You will find that the light on the UNO board changes with the switch.

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The code

```
Serial.begin(9600);
```

The purpose of this block of code is to set the baud rate of the UNO control board as 9600 and open the serial port. In this way, they can communicate with each other, because the original baud rate of the Bluetooth module is 9600.

```
getstr = Serial.read(); //The Bluetooth serial port to receive the data in the function
if(getstr == 'a'){
    stateChange();
}
```

This function is executed repeatedly within the circulating function. It will first read the data from the serial port and then check the data. If it meets the condition, it will execute the corresponding sub-function. For example, if it reads the letter 'a' from the serial port, it will execute the sub-function responsible for switching on/off the LED light.

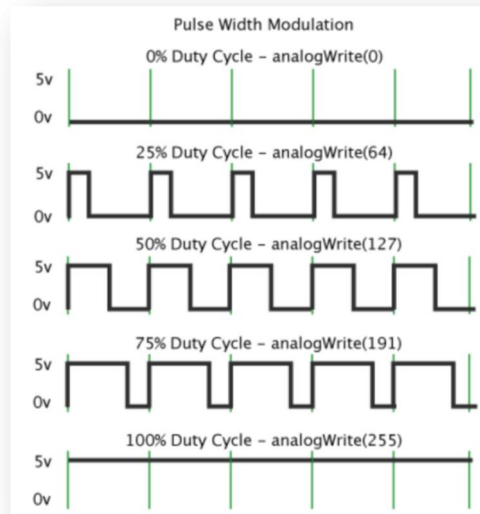
IV. Make a Bluetooth Car

When the car turns left or right, it's not necessary to set the speed too fast. On the contrary, we need to control the speed of the car. But how to control?

The answer is PWM.

PWM is the abbreviation of "Pulse Width Modulation", is called pulse modulation in short, is an effective technique to control analog circuit with digital output of microprocessor, car is used to change the speed of motor by altering duty cycle of a square wave. In other words, connect and break circuit between two sides of motor constantly is the switch of holding motor work, and motor will not be off when power is off because of the fast speed. So we can control the speed of car if we control specific value of power-on time and power-off time. The speed of car will be maximum when circuit is holding still. The speed of car will be minimum if circuit is holding off. The speed of car will be median in half time. PWM is a technology to get analog quantity through digital method. A square wave is formed by digital control, there are only two states: on and off. (That is high-low of digital pins). Simulate voltage changing from 0 to 5V by controlling specific value of duration on and off time. Occupied time of on (That is high level in academy) is called pulse width, so PWM is also called pulse

width modulation. Let's learn about PWM through five square waves below.



Green vertical line above represent a period of square wave. The value written into every `analogWrite(pin,value)` corresponds to the percentage, the percentage is also called Duty Cycle, refer to the percentage gotten from specific value between duration high level and low level time in a period. In the above figure, from top to bottom, the first square wave, duty cycle is 0%, corresponding value is 0. Output circuit current is minimum, motor hold still. The longer duration time is, the bigger circuit current motor gets, the faster the speed is. So, the final one's duty cycle is 100%, corresponding value is 255, motor rotates in full speed. 50% is medium hyponastic rotate speed, 25% is relatively slower, even can't start. (The circuit current is relatively big to start motor because of static friction) PWM is mostly used to adjust light of LED and rotate speed of motor, wheel speed controlled by motor is easily be controlled. The advantage of PWM can be more reflected when you play with some Arduino cars.

```
analogWrite(pin, value);
```

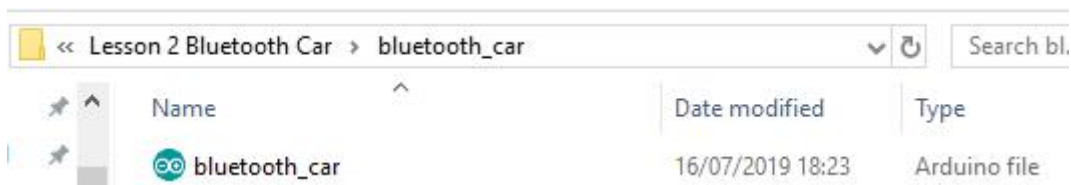
`analogWrite()` is used to write analog value of 0 to 255 for PWM ports. What you need to note is that, `analogWrite()` is only used to digital pins with function of PWM. Pins with function of PWM in UNO are only digital pins 3, 5, 6, 9, 10 and 11.

Our car's speed is controlled by connecting pin5 and pin6 of ENA and ENB. The program below, have set a digital function `int carSpeed = 150;`

The speed is controlled in below program, so you can control the speed on your own.

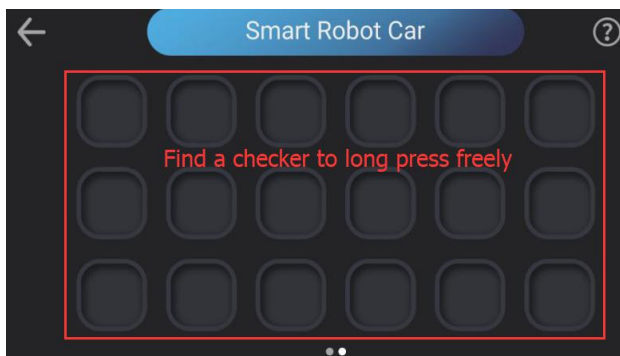
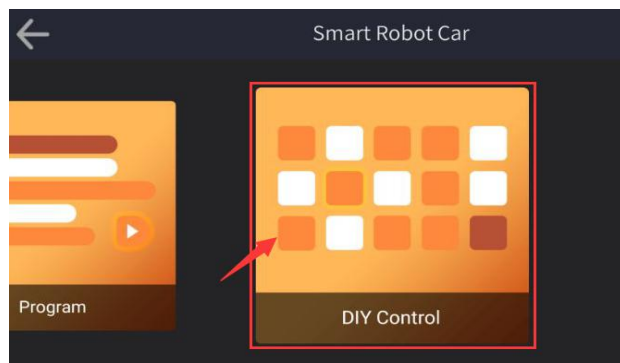
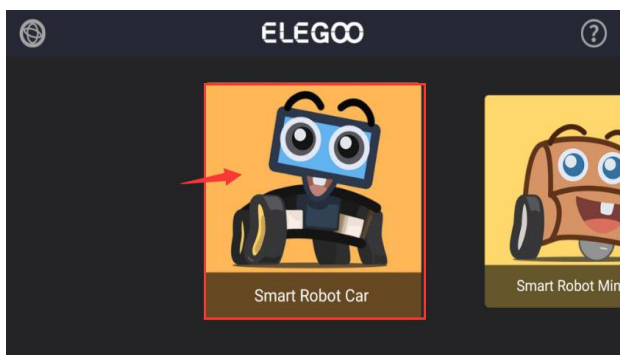
```
analogWrite(ENA, carSpeed);
analogWrite(ENB, carSpeed);
```

After learning the basic knowledge, we will upload the program as below to the car, open the code file in the path “\Elegoo Smart Robot Car Kit V3.0 Plus\bluetooth_car\ bluetooth_car.ino” and then upload the program to the UNO control board.



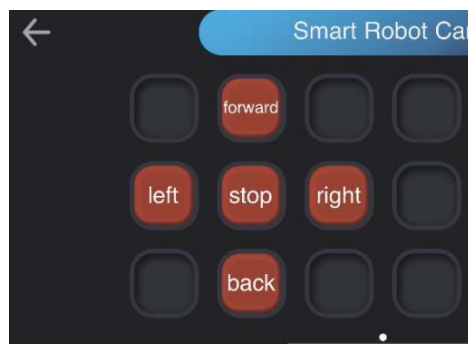
Switch on the power supply of the vehicle and put the car on the ground.

Open the mobile APP, and set up parameters as follows.



The comparison table of default Message and the Function is below.

function	FORWARD	BACK	LEFT	RIGHT	STOP
Message	f	b	l	r	s



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Now we can control the car by Bluetooth and play with it.