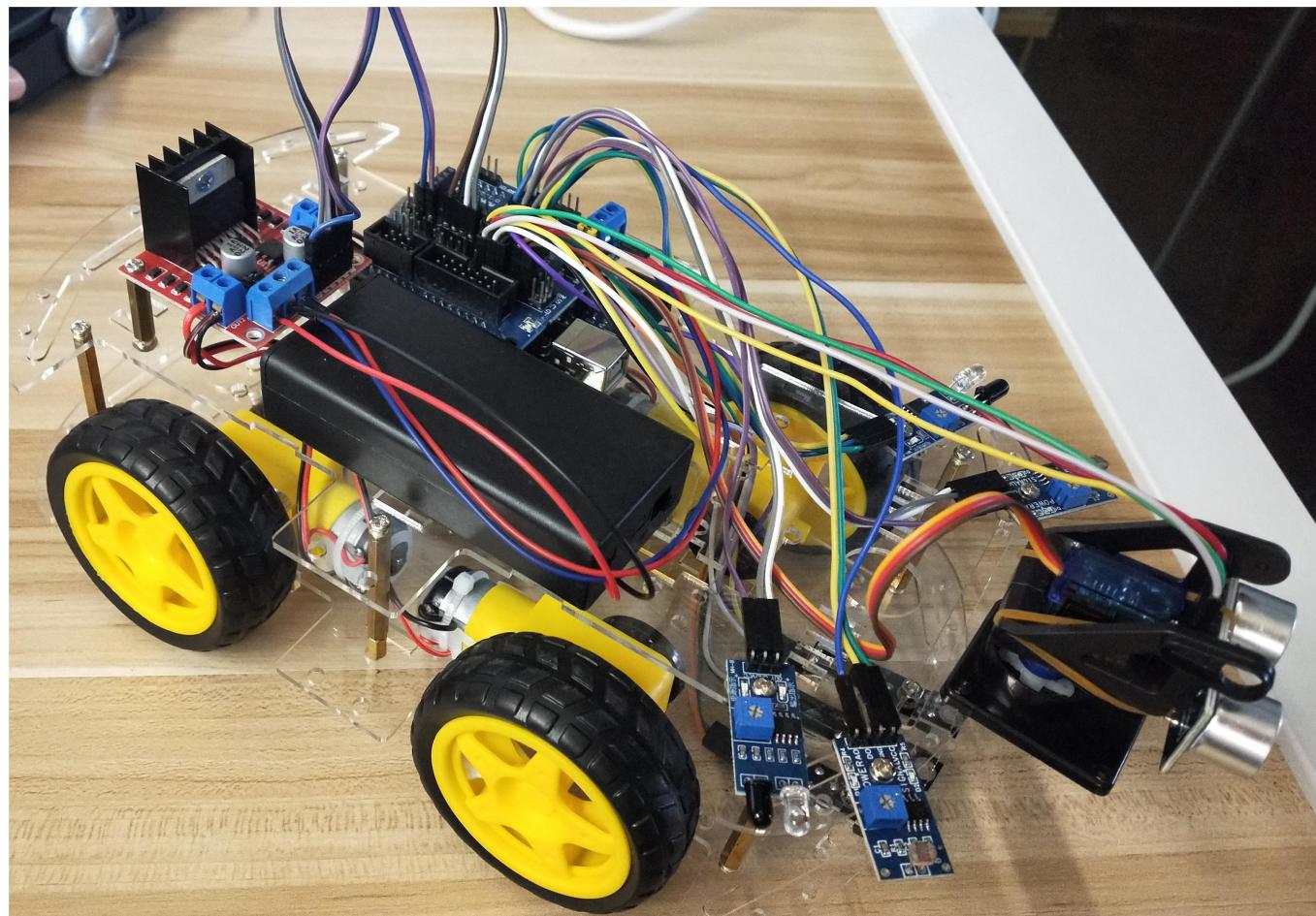


LROBRYA

**4WD Smart Robot Car Kit V2.0**

# LROBRUYA

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# LROBRUYA

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## Preface

### Company Profile

Founded in 2014, Shenzhen Lonten Technology Co., Ltd. focuses on the design, research production of Electronics Module for robotics related products. Consisting of professional researchers and skilled engineers, our R&D team constantly strives for creative function and excellent user experience. The company's R&D investments on arduino kits raspberry pi kits, as well as 3D printer and robots that back up STEAM education.

### Customer Service

Our self-owned factory is certificated with BSCI and SO, covering an area of 5,000 square meters, and achieving an annual production capacity of over 10,000 units. Our products are all certified to CE, FCC, and ROHS standards, have exported to more than 100 countries including, but not limited to France, the United States of America, Australia, Russia, the United Kingdom, Germany, Singapore, Egypt, and India, bringing technological innovation to all walks of life.



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By the way, We also look forward to hearing from you and any of your critical comment or suggestions. Pls email us by [lonten3@qq.com](mailto:lonten3@qq.com) or [info@lontentech.com](mailto:info@lontentech.com), if you have any questions or suggestions. As a continuous and fast growing company. We keep striving our best to offer you excellent products and quality service.

## **Our Store**

store: <https://www.lontentech.com/>

Brand: LONTEN

## **Product Catalog**

<https://www.lontentech.com/collections/steam-robot>

## **Tutorial**

This tutorial include codes,libraries and lessons. It is designed for beginners. It will teach every users how to assembly the robot kit and use UNO controller board, sensors,servo.

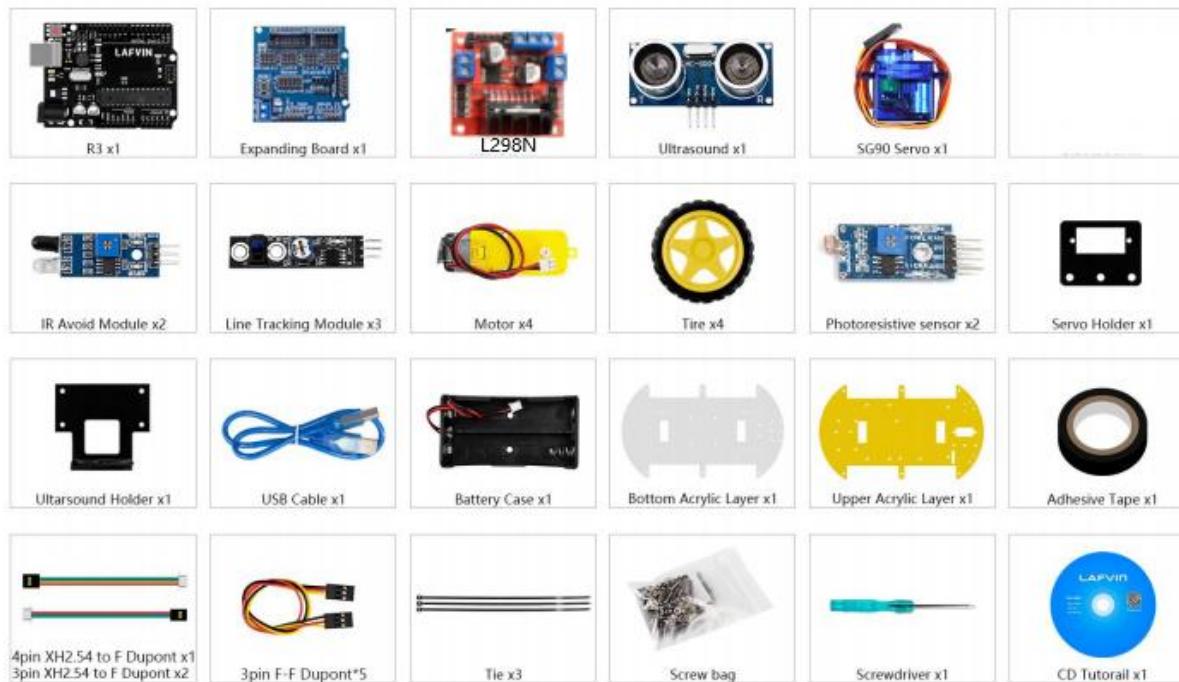
# LROBRUYA



## Packing list

DIY Smart Car Kit V2.0

<https://www.lontentech.com>





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## How to Install Arduino IDE

### Introduction

The Arduino Integrated Development Environment (IDE) is the software side of the Arduino platform.

In this Project, you will learn how to setup your computer to use Arduino and how to set about the Projects that follow.

The Arduino software that you will use to program your Arduino is available for Windows, Mac and Linux. The installation process is different for all three platforms and unfortunately there is a certain amount of manual work to install the software.

**STEP 1: Go to <https://www.arduino.cc/en/software>.**

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## Arduino IDE 2.1.1

The new major release of the Arduino IDE is faster and even more powerful! In addition to a more modern editor and a more responsive interface it features autocompletion, code navigation, and even a live debugger.

For more details, please refer to the [Arduino IDE 2.0 documentation](#).

Nightly builds with the latest bugfixes are available through the section below.

[SOURCE CODE](#)

The Arduino IDE 2.0 is open source and its source code is hosted on [GitHub](#).

### DOWNLOAD OPTIONS

**Windows** Win 10 and newer, 64 bits  
**Windows** MSI installer  
**Windows** ZIP file

**Linux** AppImage 64 bits (X86-64)  
**Linux** ZIP file 64 bits (X86-64)

**macOS** Intel, 10.14: "Mojave" or newer, 64 bits  
**macOS** Apple Silicon, 11: "Big Sur" or newer, 64 bits

[Release Notes](#)

**The version available at this website is usually the latest version, and the actual version may be newer than the version in the picture.**

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## STEP2: Download the development software that is compatible with the operating.

system of your computer. Take Windows as an example here.



Click Windows Win 10 and newer, 64 bits.

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## Support the Arduino IDE

Since the release 1.x release in March 2015, the Arduino IDE has been downloaded **74,111,896** times — impressive! Help its development with a donation.

[\\$3](#) [\\$5](#) [\\$10](#) [\\$25](#) [\\$50](#) [Other](#)



Learn more about [donating to Arduino](#).

Click JUST DOWNLOAD.

Also version 2.1.1 is available in the material we provided, and the versions of our materials are the latest versions when this course was made.

# LROBRUYA

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 arduino-ide\_2.1.1\_Windows\_64bit

 arduino-ide\_2.1.1\_macOS\_64bit

 arduino-ide\_2.1.1\_Linux\_64bit

 arduino-ide\_2.1.1\_Windows\_64bit

## Installing Arduino (Windows)

Install Arduino with the exe. Installation package.

 arduino-ide\_2.1.1\_Windows\_64bit

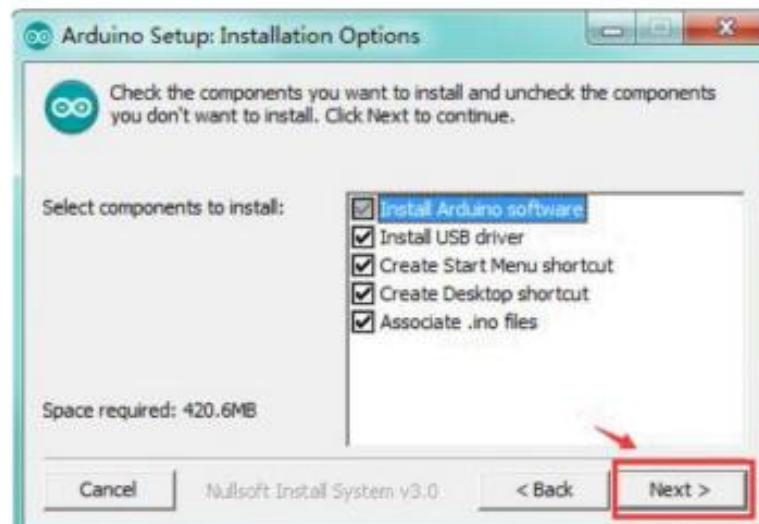
# LROBRUYA



Click I Agree to see the following interface.

# LROBRUYA

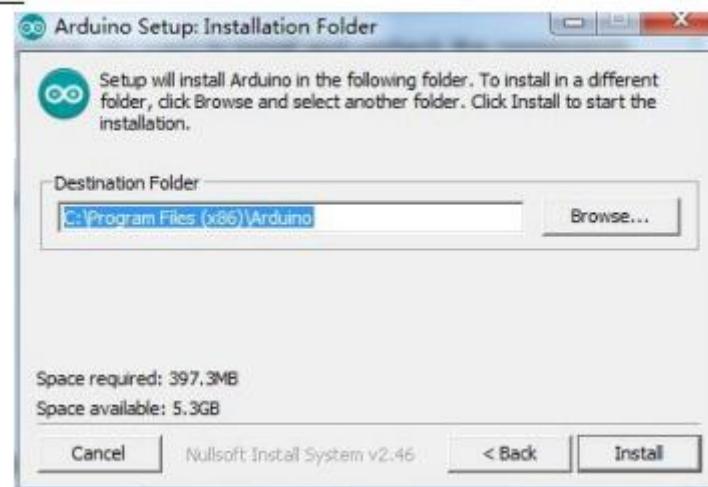
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Click Next

# LROBRUYA

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You can press **Browse...** to choose an installation path or directly type in the directory you want.

# LROBRUYA

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Click Install to initiate installation

# LROBRUYA

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Finally, the following interface appears, click Install to finish the installation.

# LROBRUYA

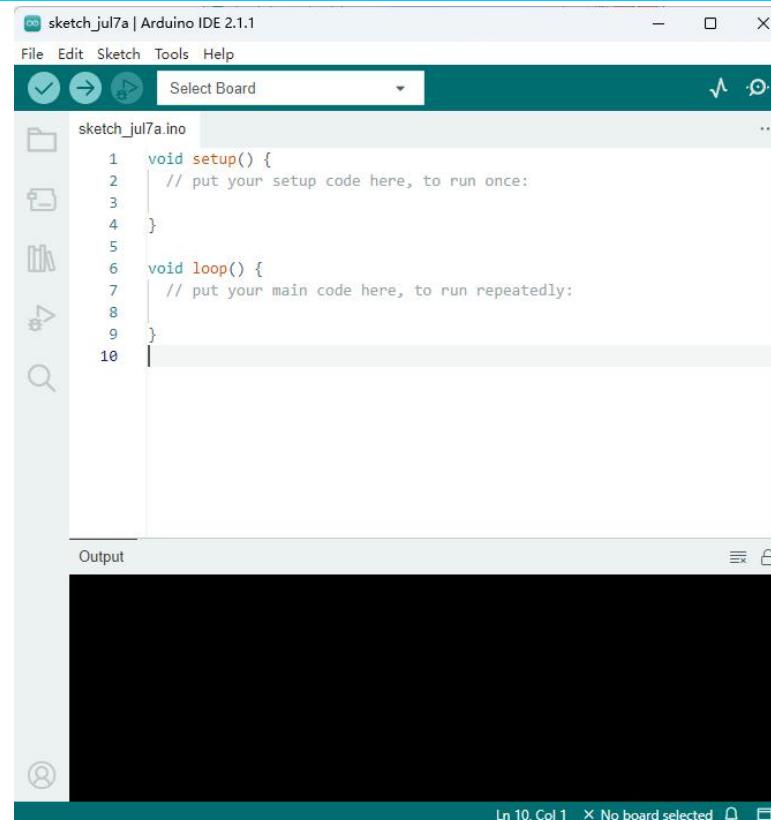


Next, the following icon appears on the desktop



Double-click to enter the desired development environment

# LROBRUYA



You may directly choose the installation package for installation and skip the contents below and jump to the next section.

But if you want to learn some methods other than the installation package, please continue to read the section.

# LROBRUYA

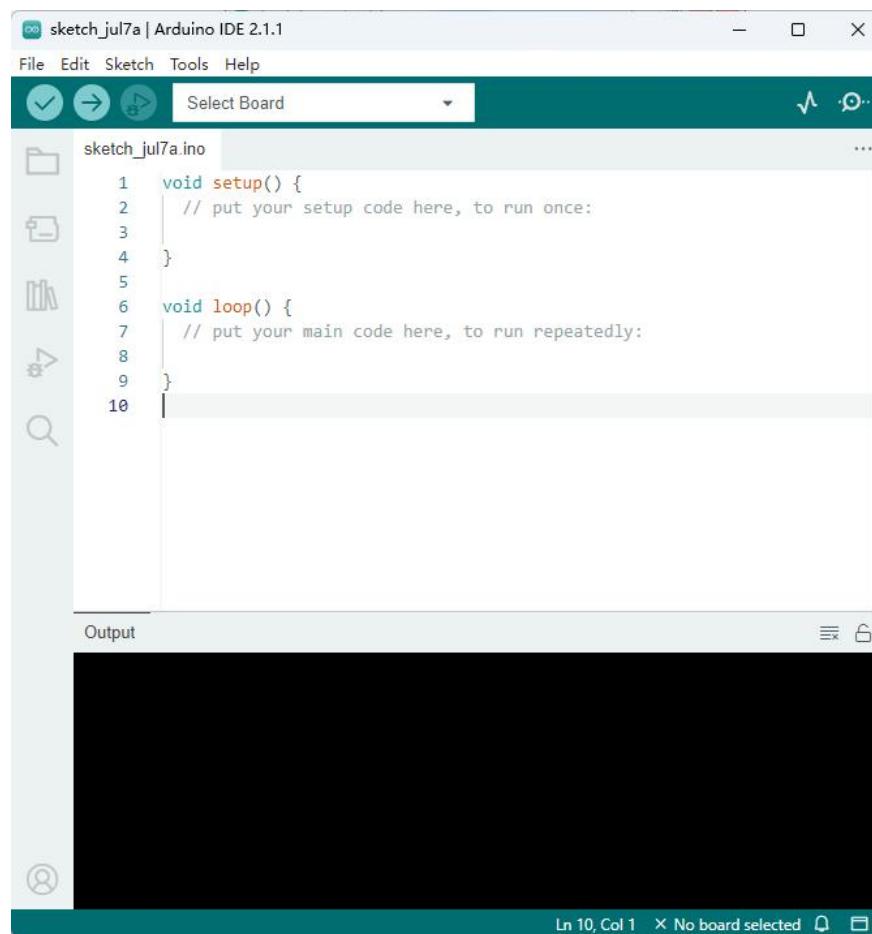
Unzip the zip file downloaded, Double-click to open the program and enter the desired development environment.

arduino-ide\_2.1.1\_Windows\_64bit

名称	修改日期	类型	大小
drivers	2023/7/5 21:45	文件夹	
examples	2023/7/5 21:45	文件夹	
hardware	2023/7/5 21:45	文件夹	
java	2023/7/5 21:45	文件夹	
lib	2023/7/5 21:45	文件夹	
libraries	2023/7/5 21:45	文件夹	
reference	2023/7/5 21:45	文件夹	
tools	2023/7/5 21:45	文件夹	
tools-builder	2023/7/5 21:45	文件夹	
arduino	2017/6/1 0:58	应用程序	395 KB
arduino.l4j	2017/6/1 0:58	配置设置	1 KB
arduino_debug	2017/6/1 0:58	应用程序	393 KB
arduino_debug.l4j	2017/6/1 0:58	配置设置	1 KB
arduino-builder	2017/6/1 0:58	应用程序	3,214 KB
libusb0.dll	2017/6/1 0:58	应用程序扩展	43 KB
msvcp100.dll	2017/6/1 0:58	应用程序扩展	412 KB
msvcr100.dll	2017/6/1 0:58	应用程序扩展	753 KB
revisions	2017/6/1 0:58	文本文档	83 KB
uninstall	2023/7/5 21:45	应用程序	404 KB



# LROBRUYA

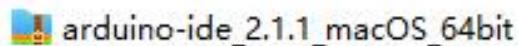




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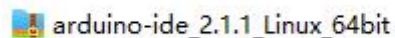
## Installing Arduino (Mac OS X)

Download and Unzip the zip file, double click the Arduino.app to enter Arduino IDE; the system will ask you to install Java runtime library if you don't have it in your computer. Once the installation is complete you can run the Arduino IDE.



## Installing Arduino (Linux)

You will have to use the make install command. If you are using the Ubuntu system, it is recommended to install Arduino IDE from the software center of Ubuntu.



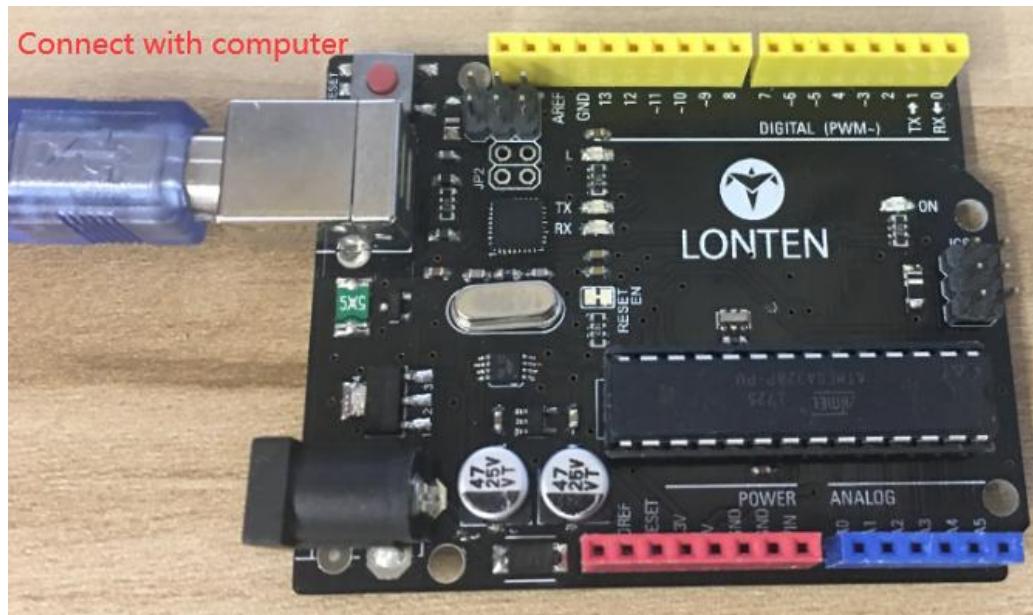
# LROBRUYA

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## How to Install Arduino Driver

For Windows

Arduino UNO R3 board



# LROBRUYA

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Serial communication interface: D0 is RX, D1 is TX

PWM interface (pulse width modulation): D3 D5 D6 D9 D10 D11

External interrupt interface: D2 (interrupt 0) and D3 (interrupt 1)

SPI communication interface: D10 is SS, D11 is MOSI, D12 is MISO, D13 is SCK

IIC communication port: A4 is SDA, A5 is SCL

In different systems, the driver installation is similar. Here we start to install the driver on the Win10 system. You can find the “USB\_Drive\_CH341\_3\_1” folder in the information we provide, this is the driver file we want to install.



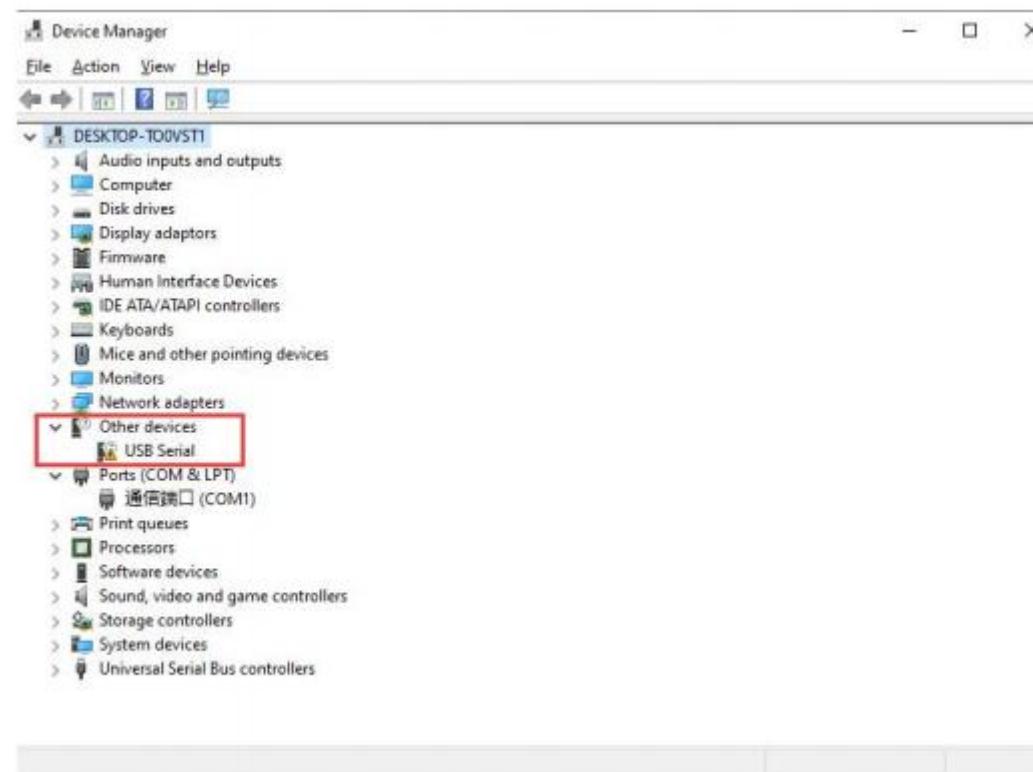
Plug one end of your USB cable into the Arduino UNO R3 Board and the other into a USB socket on your computer.



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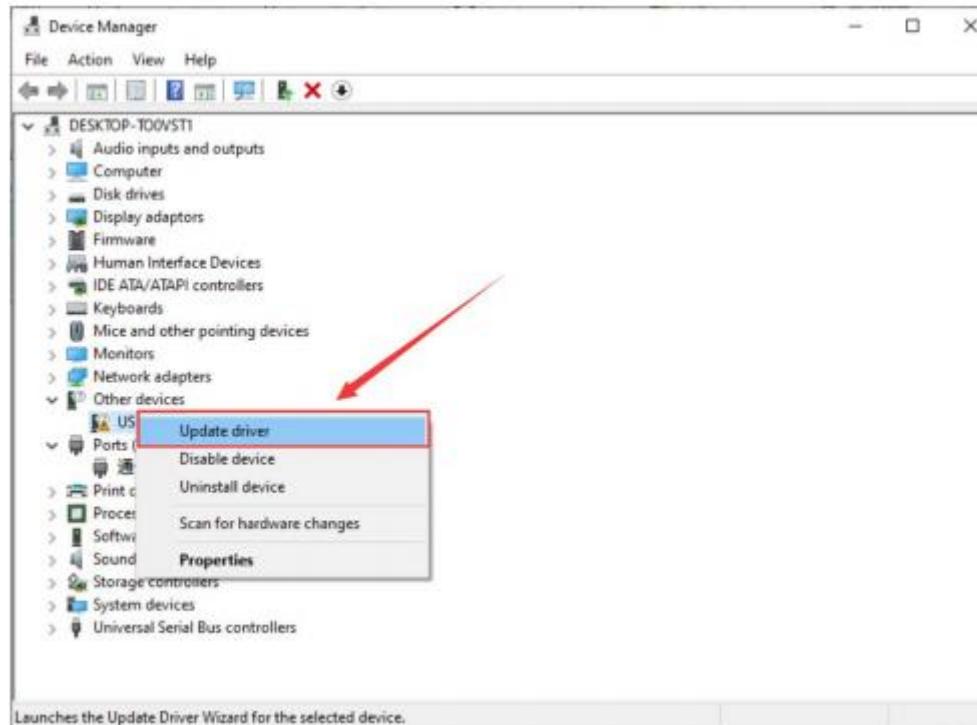
When you connect the Arduino UNOR3 Board to your computer at the first time, right click your "My Computer"—>for "Properties"—>click the "Device manager", under Other devices, you should see the "USB-Serial" or "Unknown device ". Or you can search for "devi" in your computer, or you can open the device manager of your computer.

# LROBRUYA



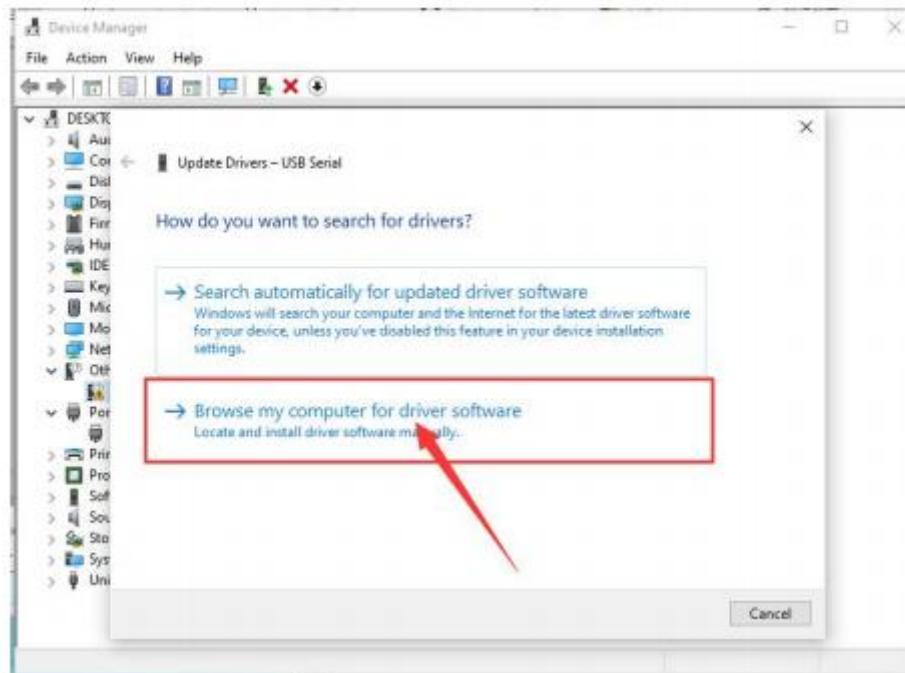
Then right-click on the device and select the top menu option (Update Driver Software...) shown as the figure below.

# LROBRUYA



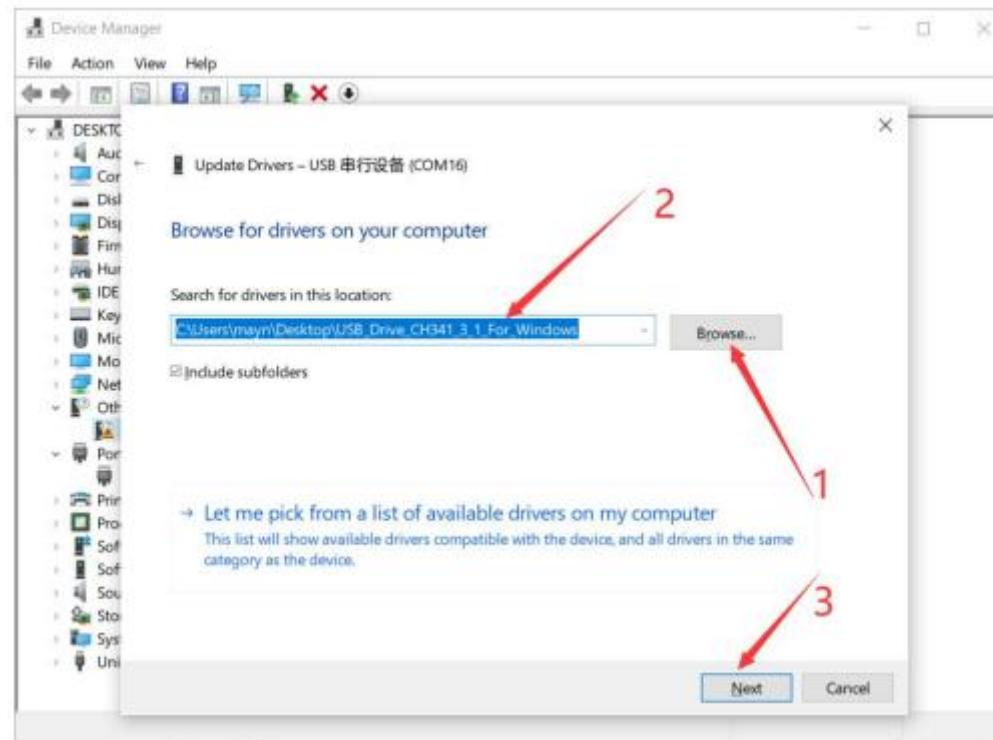
Then it will be prompted to either “Search Automatically for updated driver software” or “Browse my computer for driver software”. Shown as below. In this page, select “Browse my computer for driver software”.

# LROBRUYA



After that, select the browse option and navigate to the drive folder "USB\_Drive\_CH341\_3\_1", which can be found in the information we provide.(Note that the file path selects the location of the. For example, I store this driver file on the computer desktop, so the file path I choose is [C:\Users\mayn\Desktop\USB\\_Drive\\_CH341\\_3\\_1\\_For\\_Windows](C:\Users\mayn\Desktop\USB_Drive_CH341_3_1_For_Windows) )

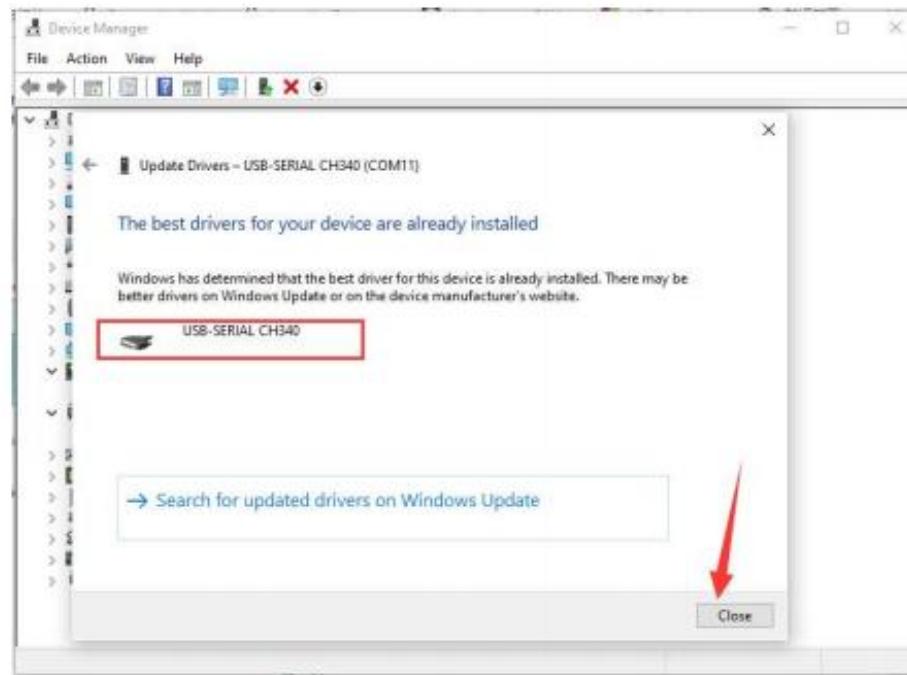
# LROBRUYA



Once the software has been installed, you will get a confirmation message.

Installation completed, click “Close”.

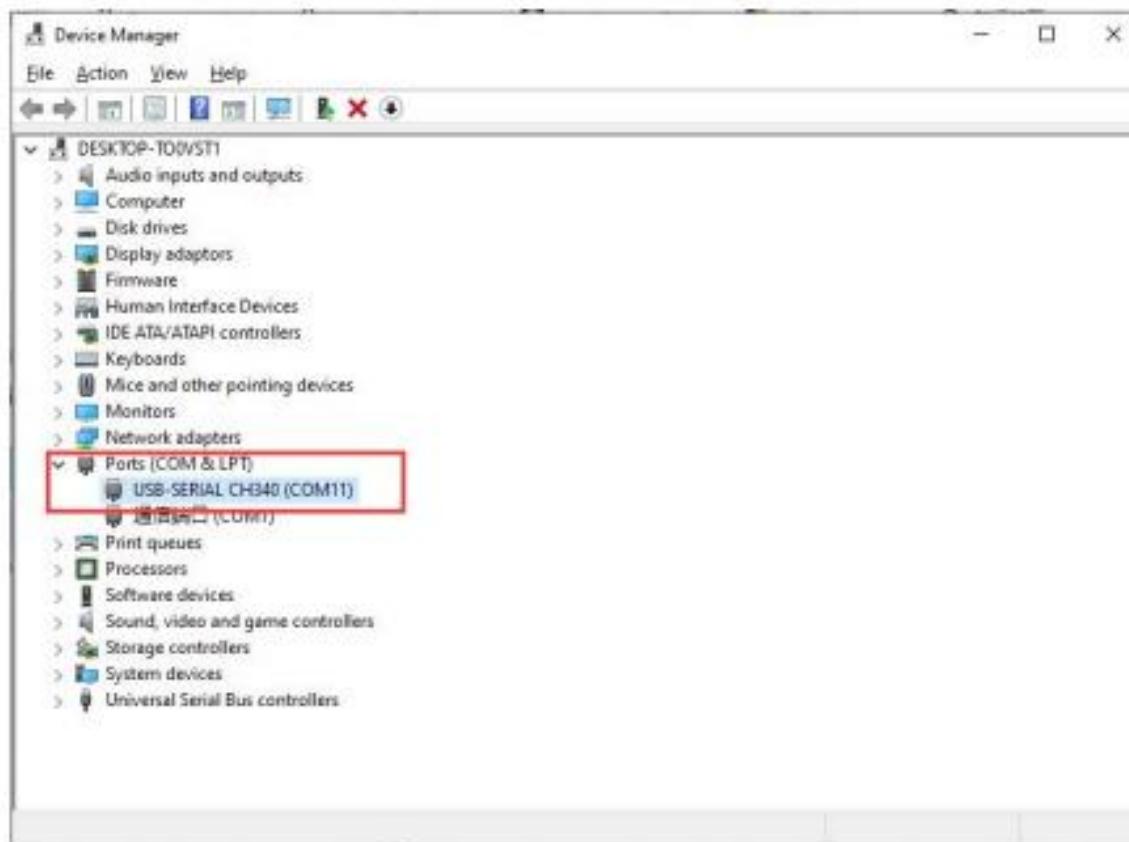
# LROBRUYA



Up to now, the driver is installed well. Then you can right click "My Computer" —> for "Properties" —> click the "Device manager", you should see the device as the figure shown below. Or you can search for "devi" in your computer, or you can open the device manager of your computer.

# LROBRUYA

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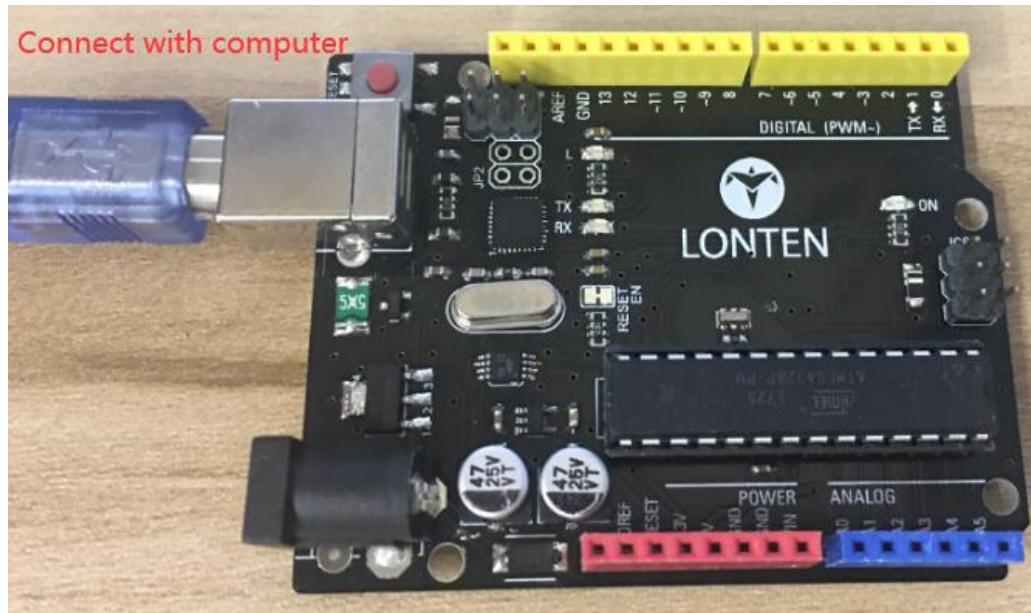
# LROBRUYA

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## For MAC System

### Arduino UNO R3 board

Plug one end of your USB cable into the Arduino UNO R3 Board and the other into a USB socket on your computer.



The driver file of the R3 of the MAC system is provided in the tutorial data package.

# LROBRUYA

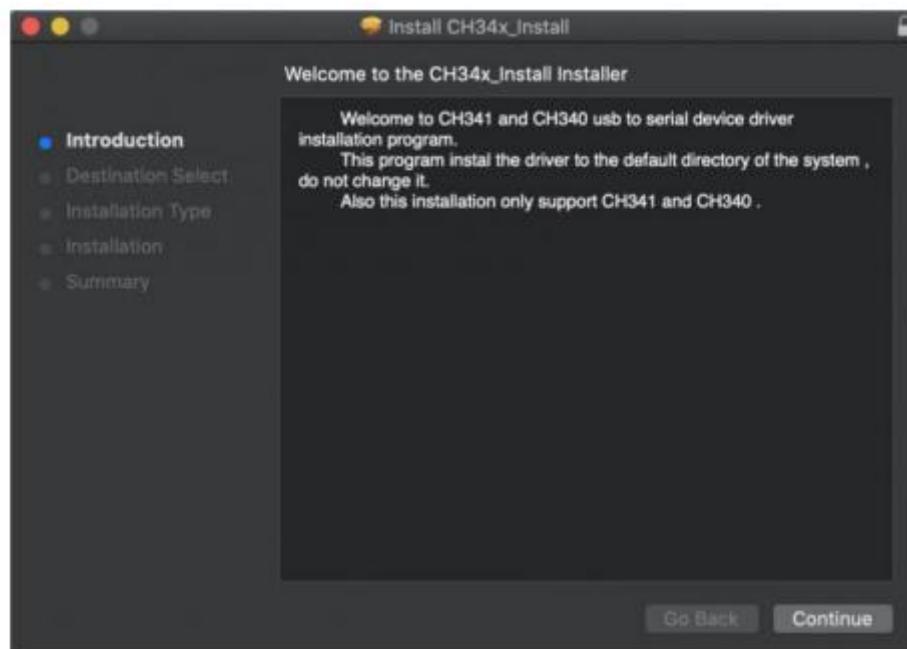
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Double-click installation package and tap Continue

# LROBRUYA

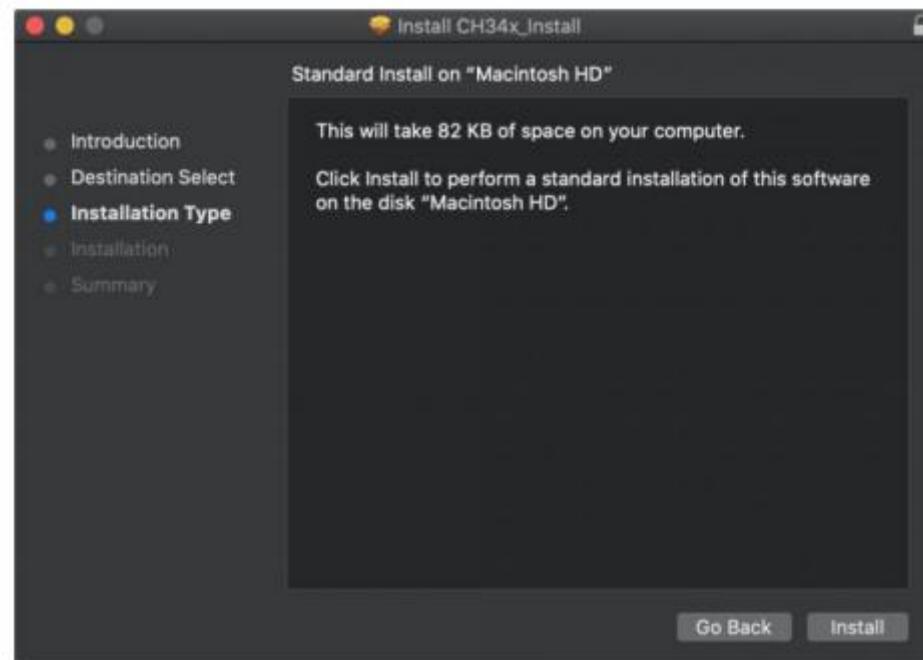
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Click Install

# LROBRUYA

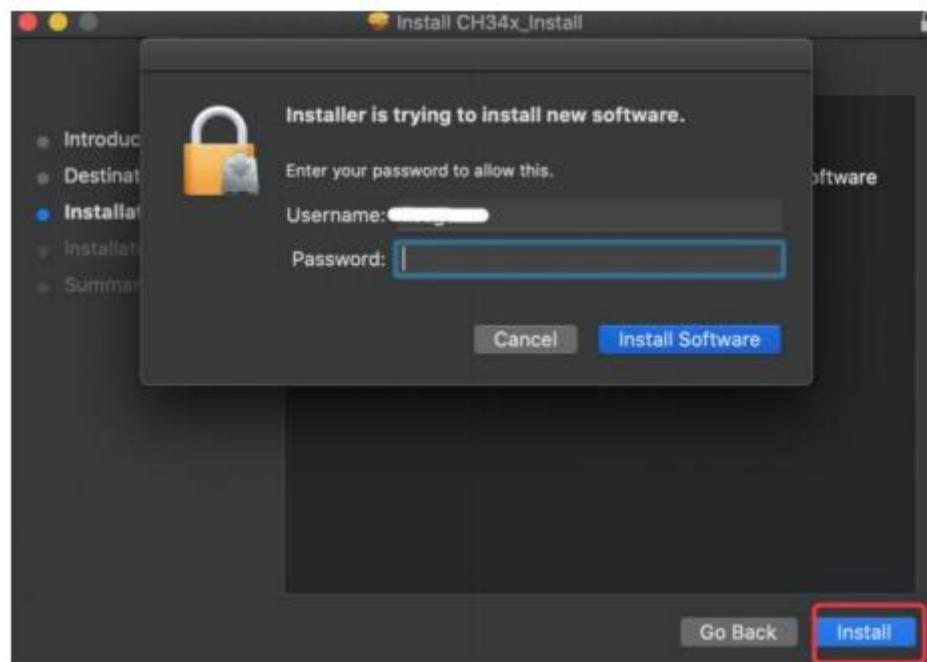
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Input your user password and click Install Software

# LROBRUYA

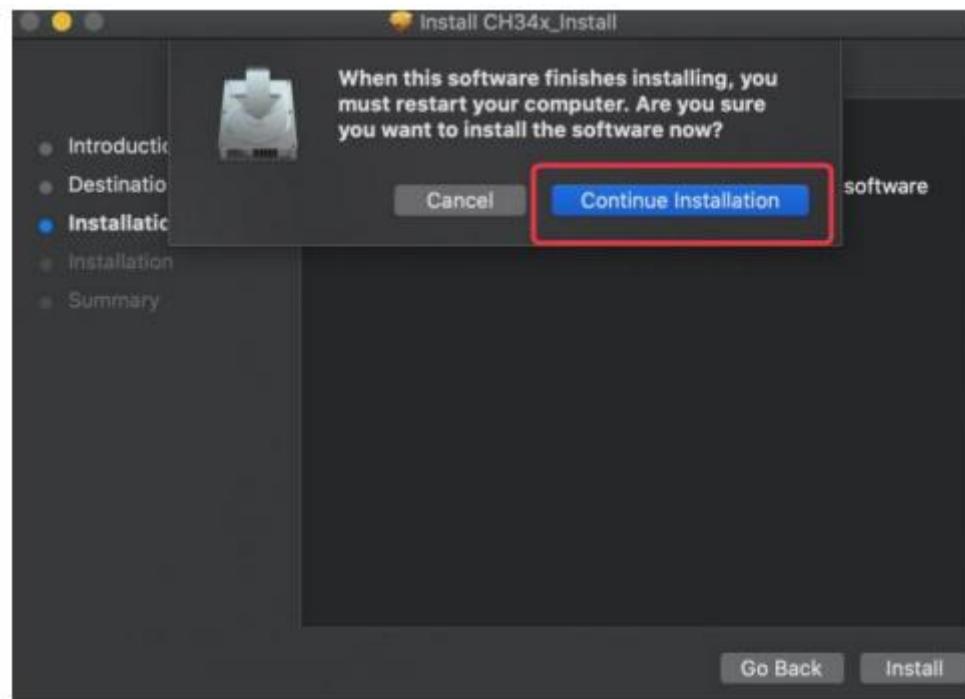
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Tap Continue Installation

# LROBRUYA

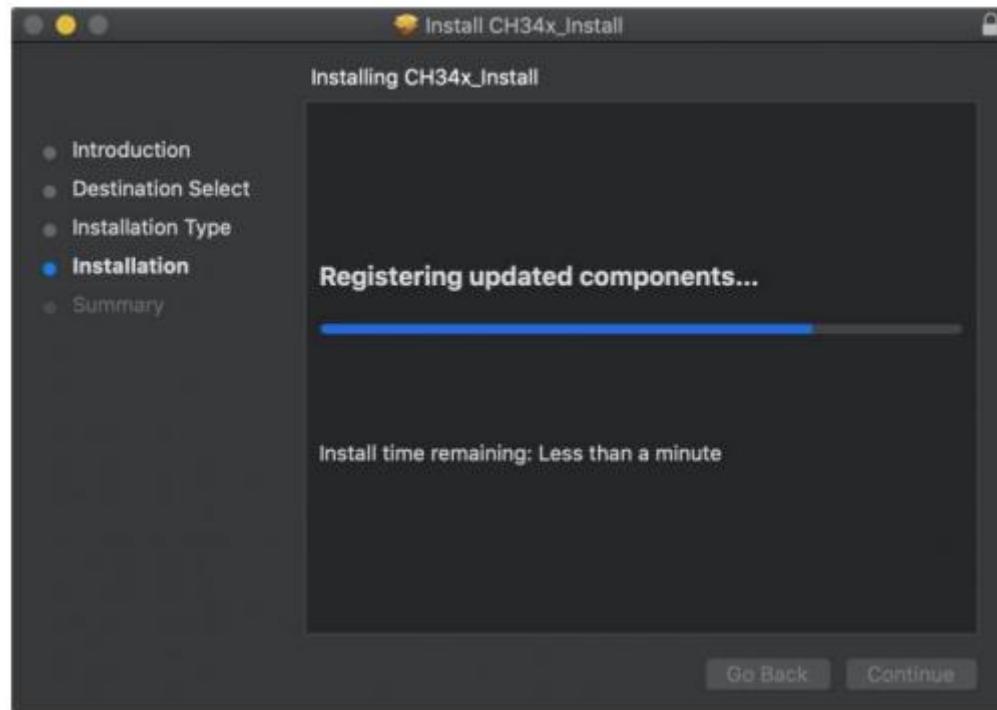
---



Wait to install

# LROBRUYA

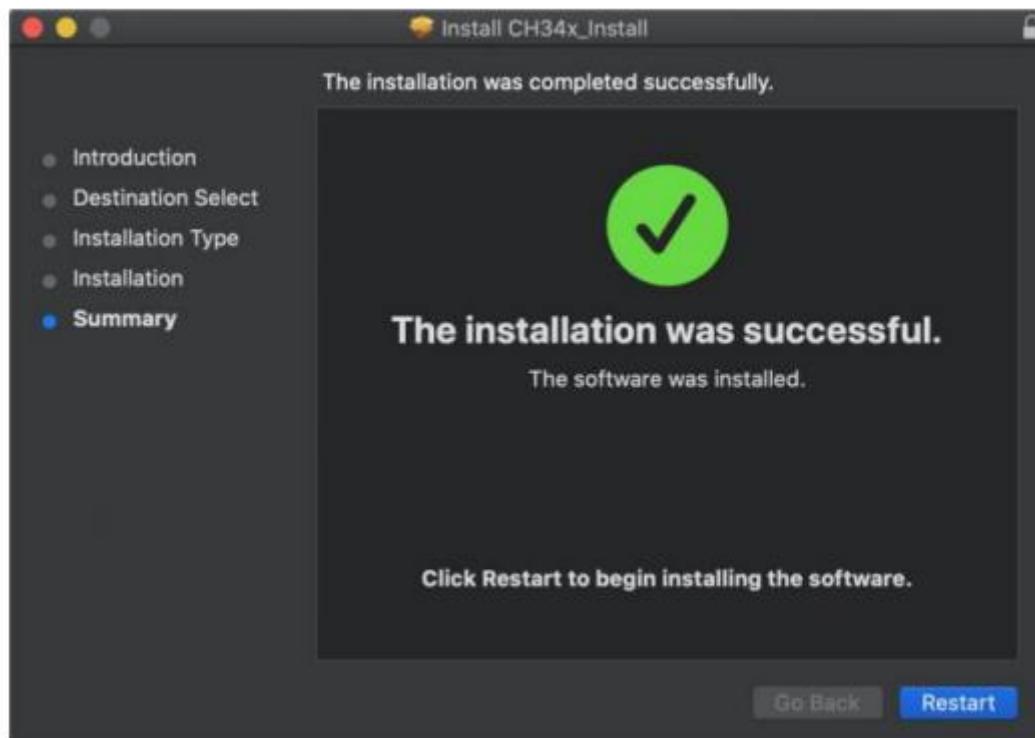
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Click Restart after the installation is finished

# LROBRUYA

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## How to Add Arduino Libraries

### Installing Additional Arduino Libraries

Once you are comfortable with the Arduino software and using the built-in functions, you may want to extend the ability of your Arduino with additional libraries.

### What are Libraries?

Libraries are a collection of code that makes it easy for you to connect to a sensor, display, module, etc. For example, the built-in Liquid Crystal library makes it easy to talk to character LCD displays. There are hundreds of additional libraries available on the Internet for download.

The built-in libraries and some of these additional libraries are listed in the reference. To use the additional libraries, you will need to install them.

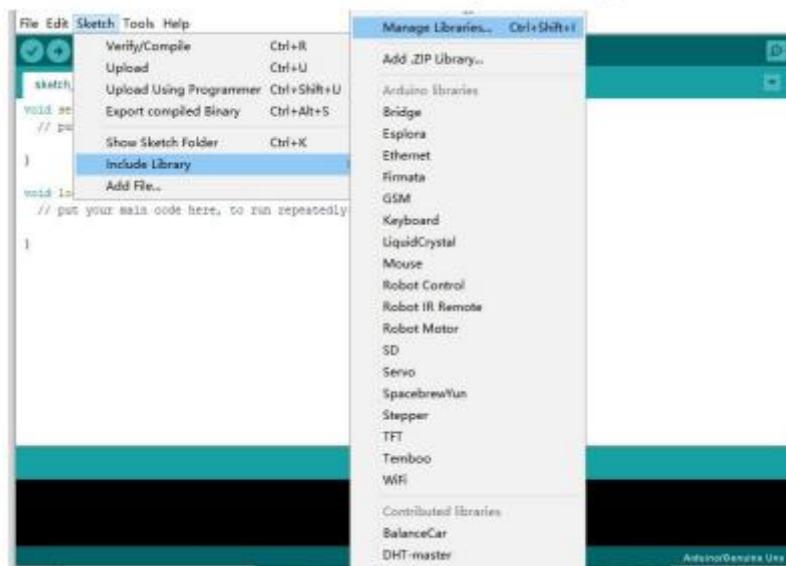
# LROBRUYA

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## How to Install a Library

### Using the Library Manager

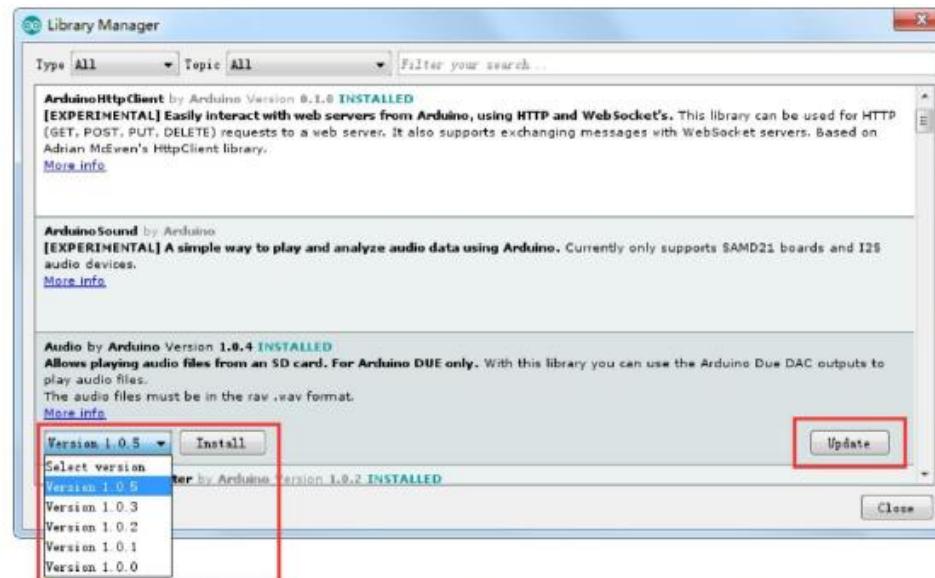
To install a new library into your Arduino IDE you can use the Library Manager (available from IDE version 1.8.0). Open the IDE and click to the "Sketch" menu and then Include Library > Manage Libraries.



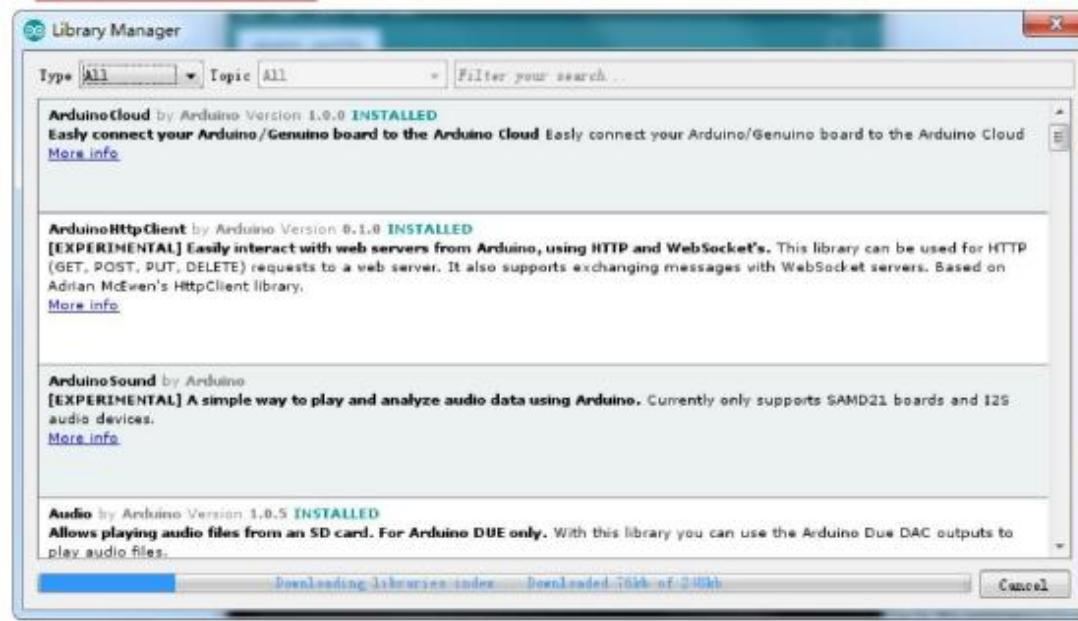
# LROBRUYA

Then the library manager will open and you will find a list of libraries that are already installed or ready for installation. In this example we will install the Bridge library. Scroll the list to find it, then select the version of the library you want to install. Sometimes only one version of the library is available. If the version selection menu does not appear, don't worry: it is normal.

There are times you have to be patient with it, just as shown in the figure. Please refresh it and wait.



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Finally click on install and wait for the IDE to install the new library.

Downloading may take time depending on your connection speed. Once it has finished, an Installed tag should appear next to the Bridge library.

You can close the library manager.

# LROBRUYA



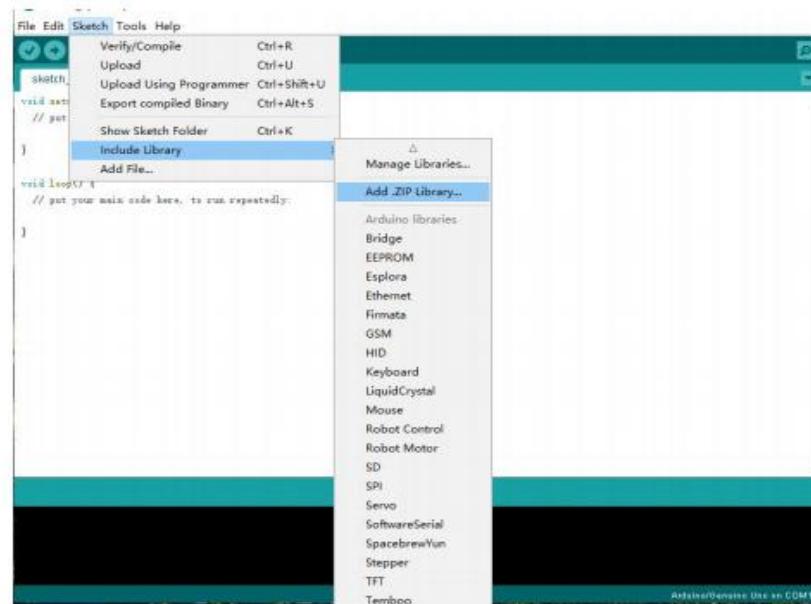
You can now find the new library available in the Include Library menu. If you want to add your own library open a new issue on [Github](#).

## Importing a .zip Library

# LROBRUYA

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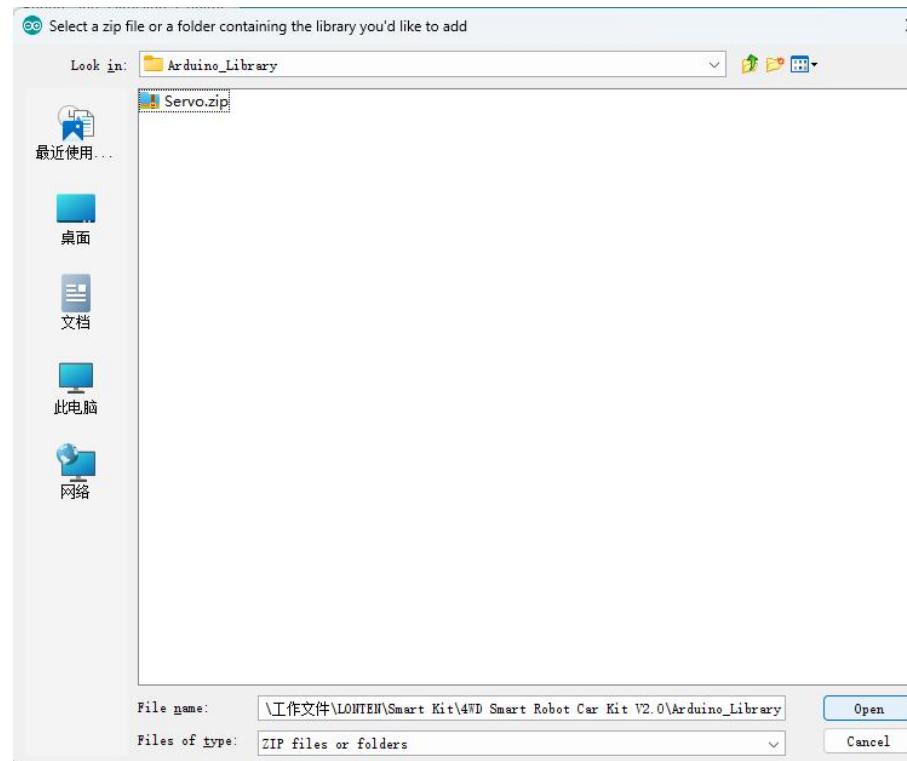
Libraries are often distributed as a ZIP file or folder. The name of the folder is the name of the library. Inside the folder will be a .cpp file, a .h file and often a keywords.txt file, examples folder, and other files required by the library. Starting with version 1.0.5, you can install 3rd party libraries in the IDE. Do not unzip the downloaded library, leave it as is. In the Arduino IDE, navigate to Sketch > Include Library. At the top of the drop down list, select the option to "Add .ZIP Library".



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You will be prompted to select the library you would like to add.

Navigate to the .zip file's location and open it.



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Return to the Sketch > Import Library menu. You should now see the library at the bottom of the drop-down menu. It is ready to be used in your sketch. The zip file will have been expanded in the libraries folder in your Arduino sketches directory. NB: the Library will be available to use in sketches, but examples for the library will not be exposed in the File > Examples until after the IDE has restarted.

### **Blink Test**

## **Overview**

In this Project, you will learn how to program your UNO R3 controller board to blink the Arduino's built-in LED, and how to download programs by basic steps.

### **Component Required:**

LONTEN Uno R3 Board\* 1

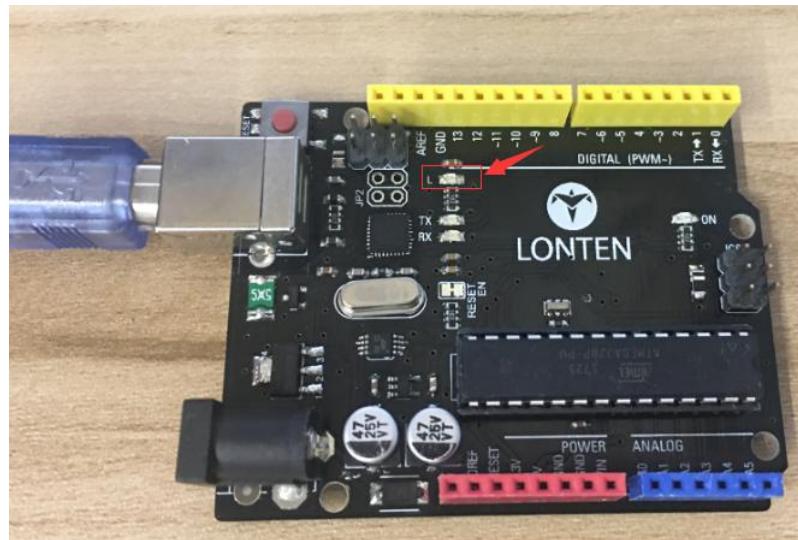
# LROBRUYA

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## Principle

The UNO R3 board has rows of connectors along both sides that are used to connect to several electronic devices and plug-in 'shields' that extends its capability.

It also has a single LED that you can control from your sketches. This LED is built onto the UNO R3 board and is often referred to as the 'L' LED as this is how it is labeled on the board.



# LROBRUYA

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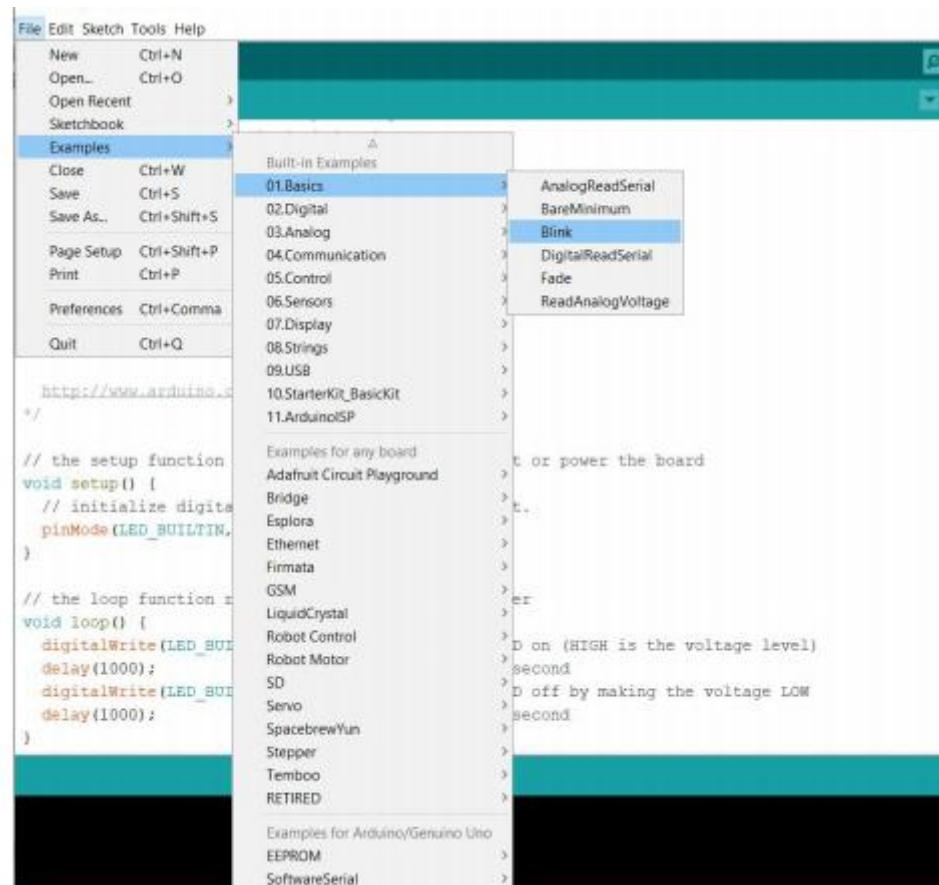
In this Project, we will reprogram the UNO board with our own Blink sketch and then change the rate at which it blinks.

In the previous chapter-How to install Arduino IDE, you set up your Arduino IDE and made sure that you could find the right serial port for it to connect to your UNO board. The time has now come to put that connection to the test and program your UNO board.

The Arduino IDE includes a large collection of example sketches that you can load up and use. This includes an example sketch for making the 'L' LED blink.

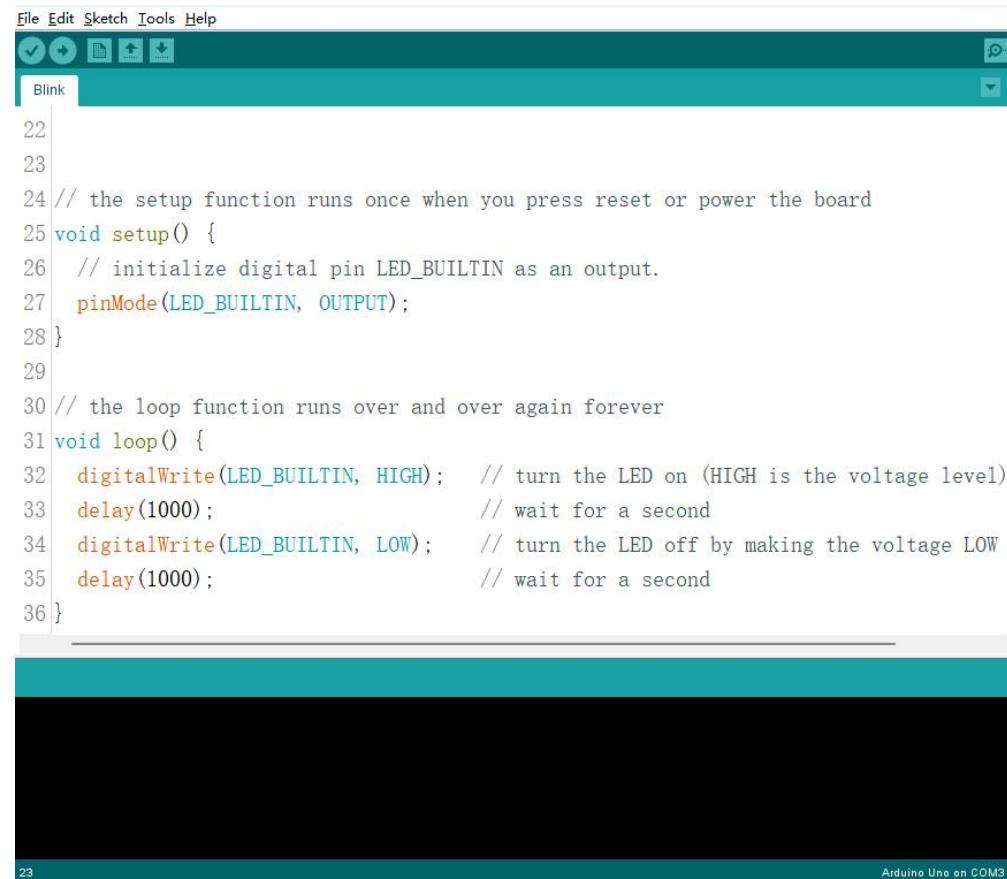
Load the 'Blink' sketch that you will find in the IDE's menu system under File > Examples > 01.Basics>Blink

# LROBRUYA



When the sketch window opens, enlarge it so that you can see the entire sketch in the window.

# LROBRUYA



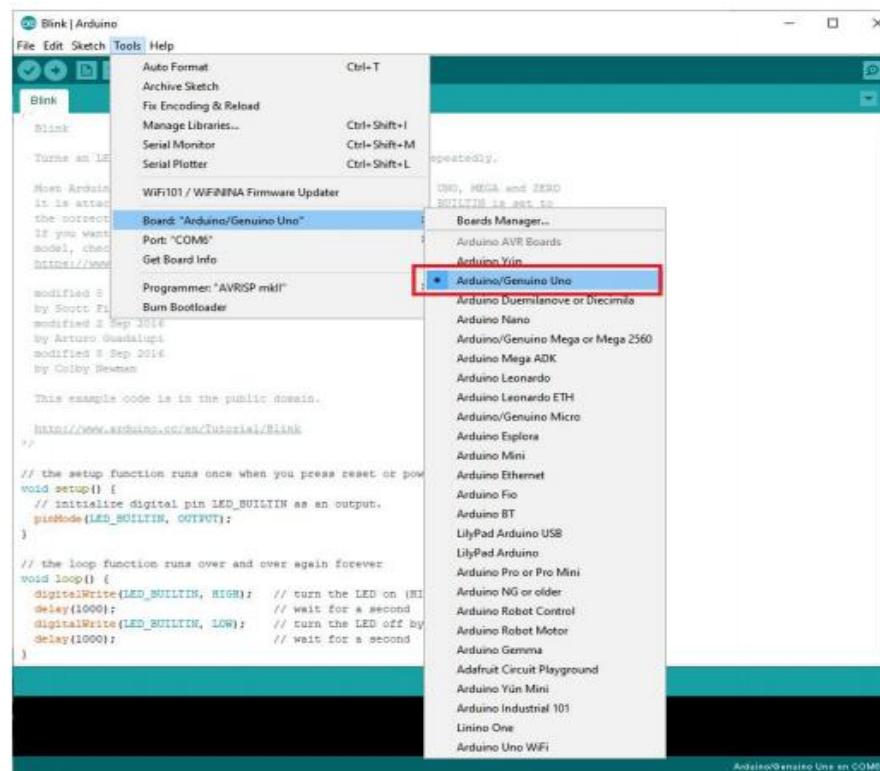
The image shows a screenshot of the Arduino IDE. The menu bar includes File, Edit, Sketch, Tools, and Help. The toolbar has icons for file operations and a serial monitor. The title bar says "Blink". The code editor contains the following C++ code:

```
File Edit Sketch Tools Help
Blink
22
23
24 // the setup function runs once when you press reset or power the board
25 void setup() {
26   // initialize digital pin LED_BUILTIN as an output.
27   pinMode(LED_BUILTIN, OUTPUT);
28 }
29
30 // the loop function runs over and over again forever
31 void loop() {
32   digitalWrite(LED_BUILTIN, HIGH);    // turn the LED on (HIGH is the voltage level)
33   delay(1000);                      // wait for a second
34   digitalWrite(LED_BUILTIN, LOW);     // turn the LED off by making the voltage LOW
35   delay(1000);                      // wait for a second
36 }
```

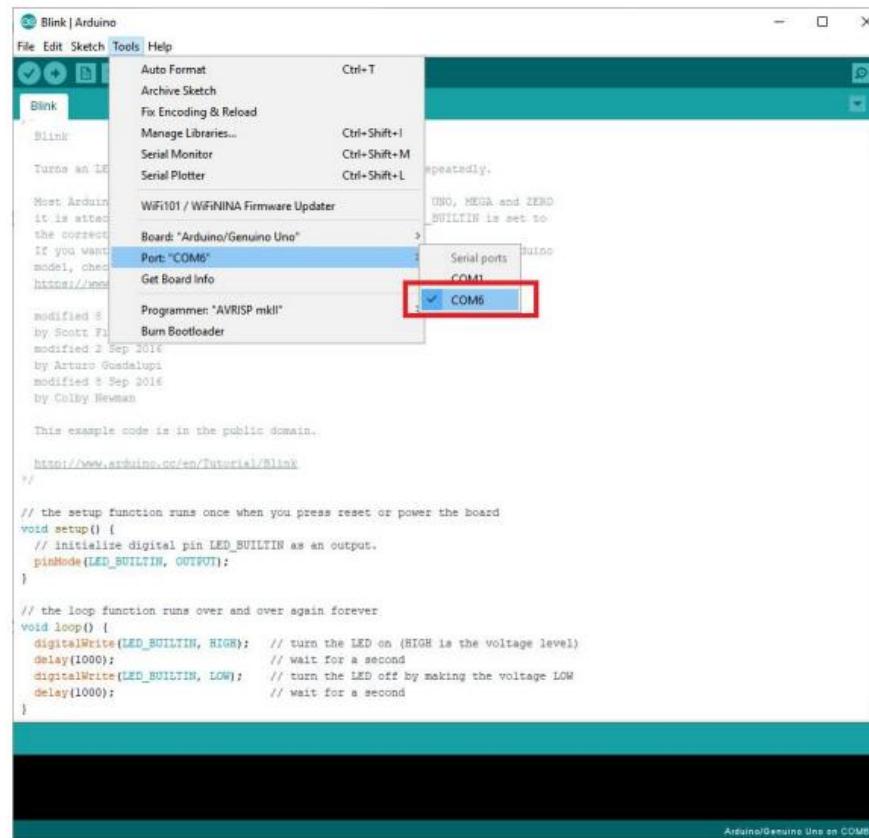
The status bar at the bottom shows "23" on the left and "Arduino Uno on COM3" on the right.

# LROBRUYA

Attach your Arduino board to your computer with the USB cable and check that the 'Board Type' and 'Serial Port' are set correctly.

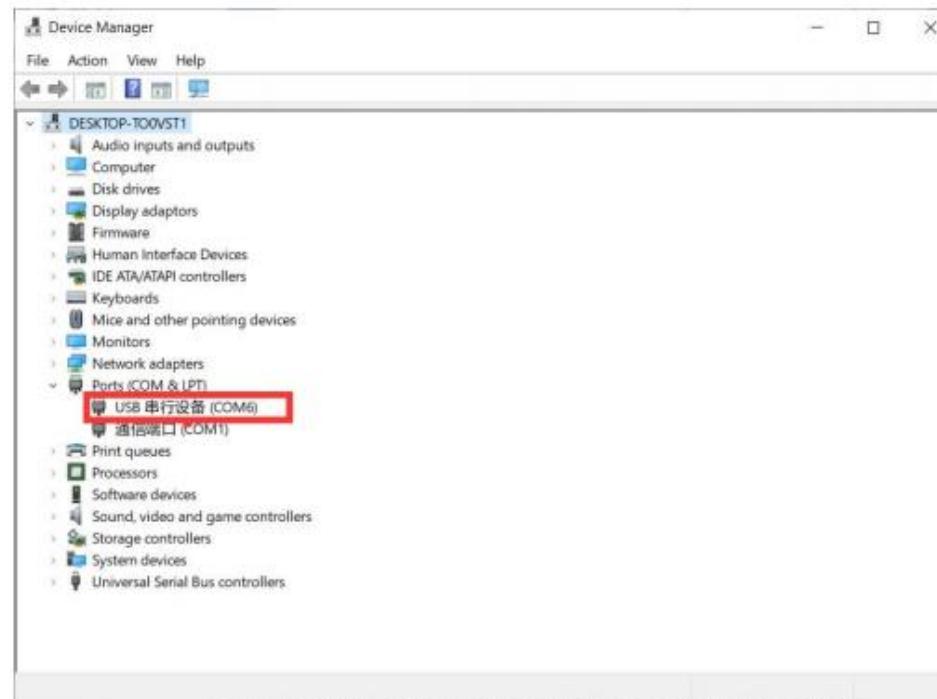


# LROBRUYA



# LROBRUYA

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**Note: The Board Type and Serial Port here are not necessarily the same as shown in picture. If you are using UNO, then you will have to choose Arduino UNO as the Board Type, other choices can be made in the same manner. And**

# LROBRUYA

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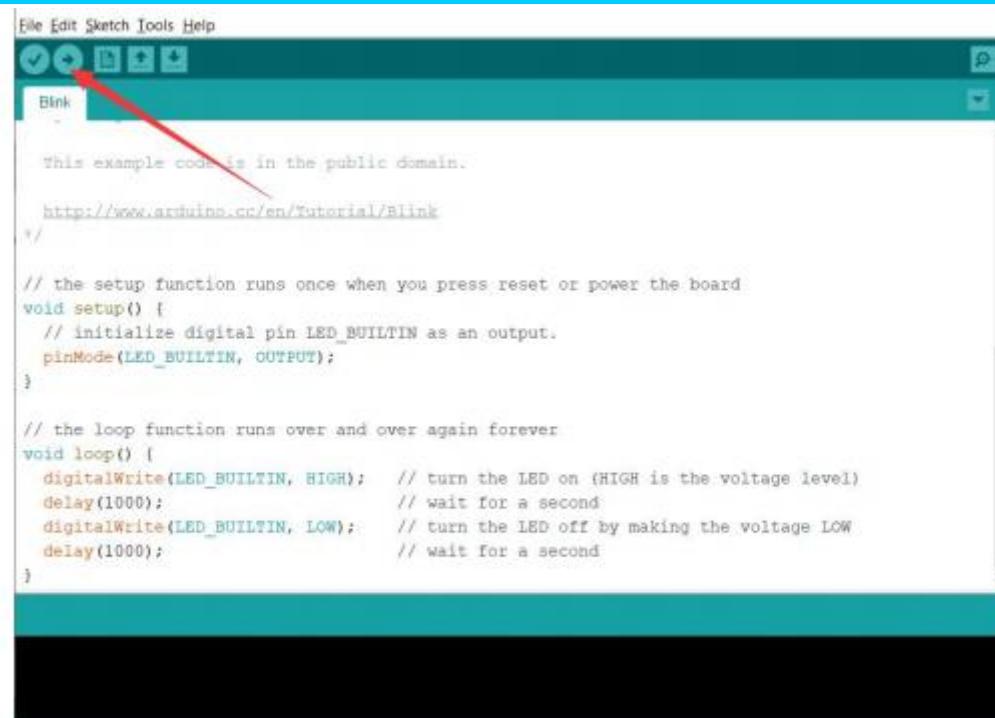
**the Serial Port displayed for everyone is different, despite COM 6 chosen here, it could be COM3 or COM4 on your computer. A right COM port is supposed to be COMX (arduino XXX), which is by the certification criteria.**

The Arduino IDE will show you the current settings for board at the bottom of the window.



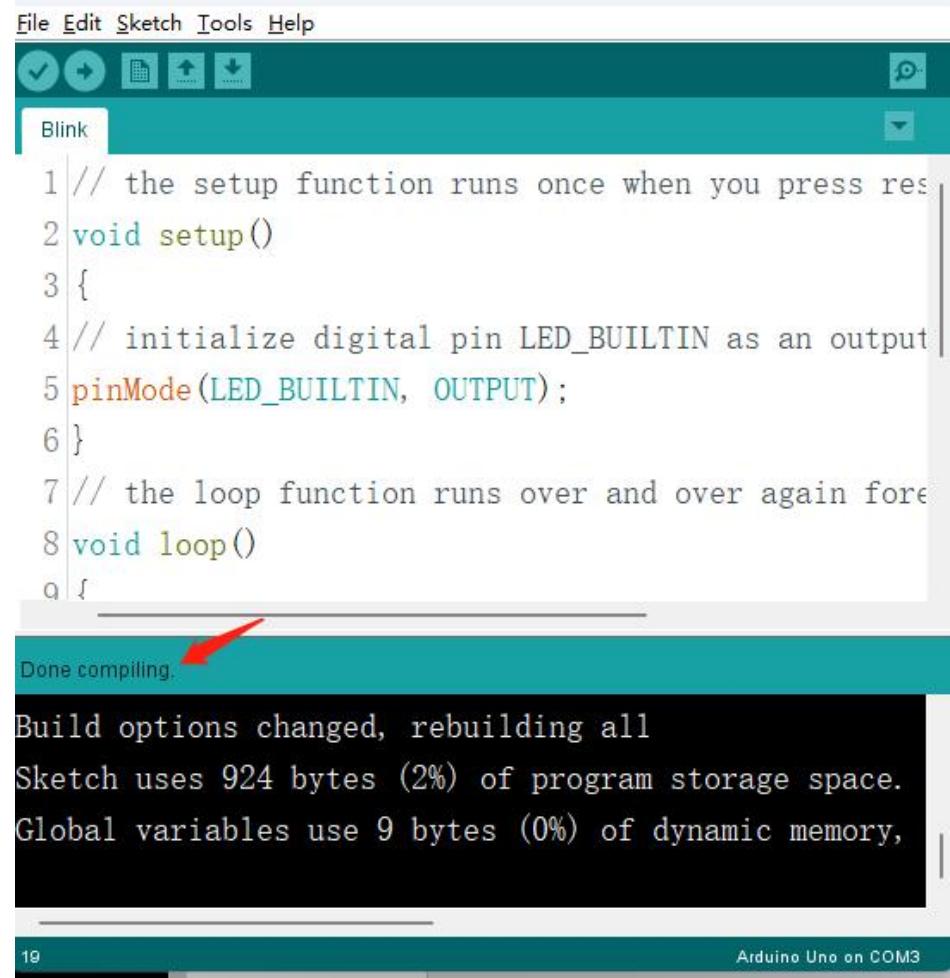
Click on the 'Upload' button. The second button from the left on the toolbar.

# LROBRUYA



When the status bar prompts "Done uploading", it means the code upload is successful

# LROBRUYA



File Edit Sketch Tools Help

Blink

```
1 // the setup function runs once when you press res
2 void setup()
3 {
4 // initialize digital pin LED_BUILTIN as an output
5 pinMode(LED_BUILTIN, OUTPUT);
6 }
7 // the loop function runs over and over again forever
8 void loop()
9 {
```

Done compiling.

Build options changed, rebuilding all

Sketch uses 924 bytes (2%) of program storage space.

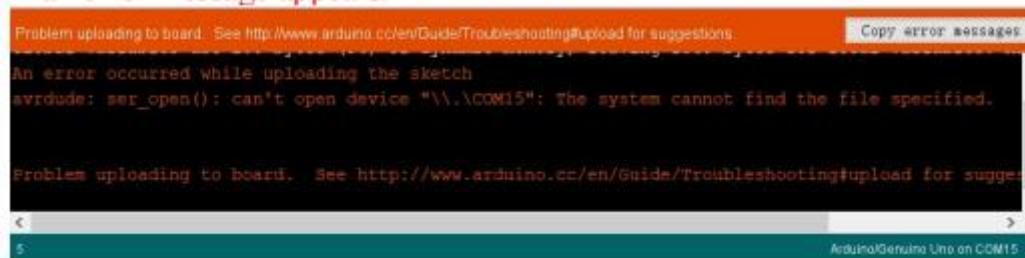
Global variables use 9 bytes (0%) of dynamic memory,

19 Arduino Uno on COM3

# LROBRUYA

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If an error message appears.

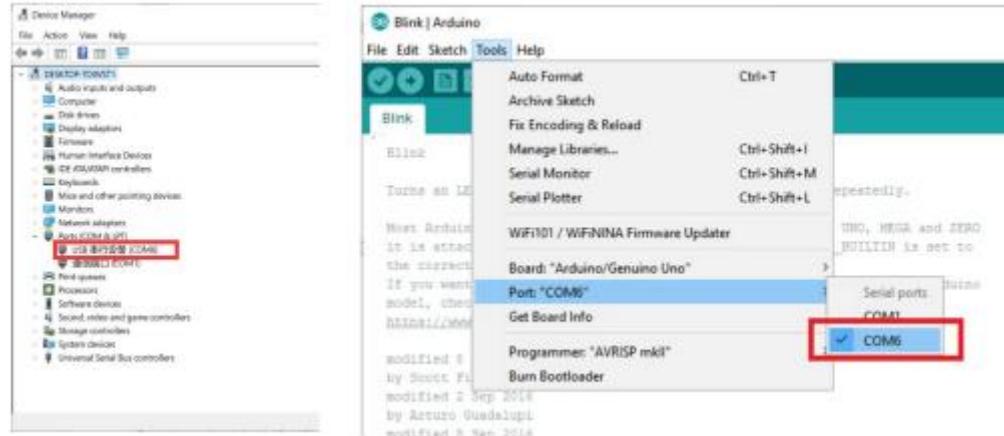


There can be several reasons:

1. The arduino uno driver software is not installed successfully, please refer to the course for the installation steps: [How to Install Arduino Driver](#).
2. The communication serial port selection of arduino uno is wrong;

you can check the communication port COMx of your arduino uno in the computer in the device manager.

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3. If your Arduino uno is connected to a Bluetooth module, it will occupy the communication serial port. **You need to remove the Bluetooth module connection before uploading the code.**
4. The USB data cable is not firmly connected. Check if there are any of the above problems. After correcting, follow the previous steps to re-operate.



---

## Test Code

```
void setup() // the setup function runs once when you press reset or power the board
{
    pinMode(LED_BUILTIN, OUTPUT); // initialize digital pin LED_BUILTIN as an output.

}

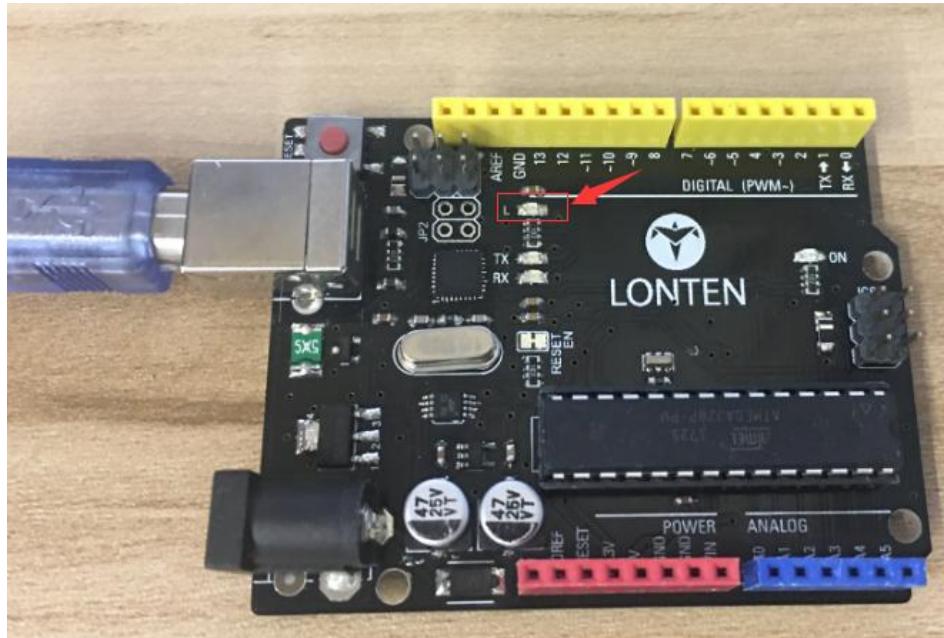
void loop() // the loop function runs over and over again forever
{
    digitalWrite(LED_BUILTIN, HIGH); // turn the LED on (HIGH is the voltage level)
    delay(1000); // wait for a second

    digitalWrite(LED_BUILTIN, LOW); // turn the LED off by making the voltage LOW
    delay(1000); // wait for a second

}
```

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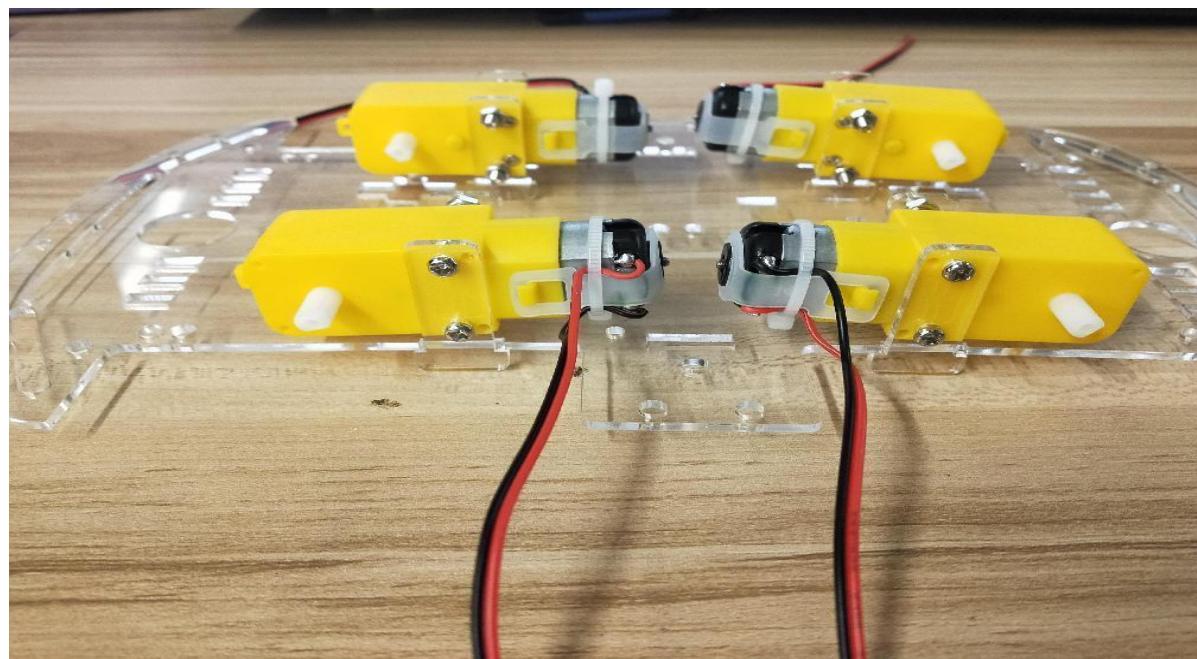
After the code is successfully uploaded, the "L" character LED will flash once per second. So far, you have completed the testing process of your first program.

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## Lesson 1 Installation Method

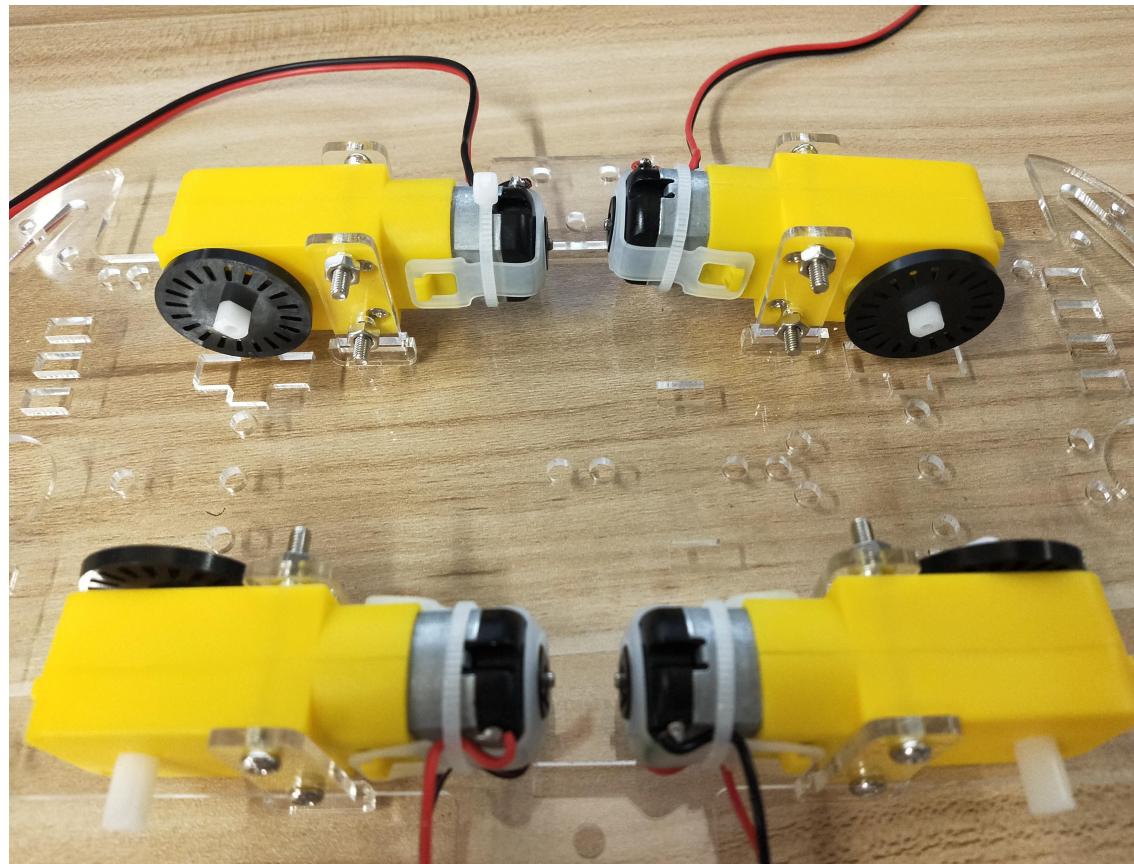
**Step1:** The positive and negative poles of two motors on the same side must be opposite, otherwise it will affect the operation of the car.



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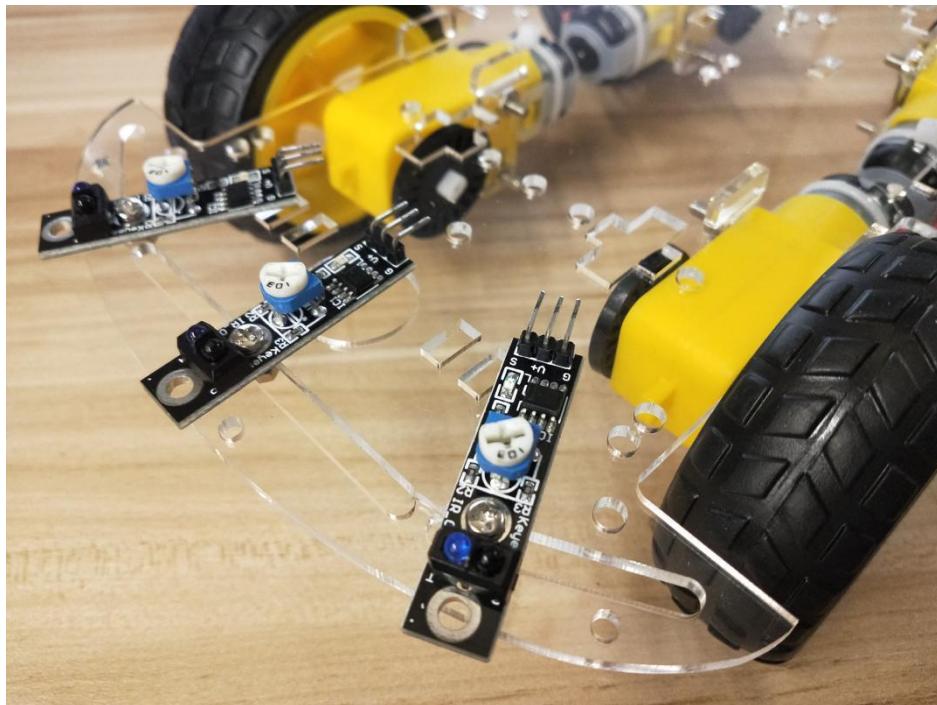
---

Step2:



# LROBRUYA

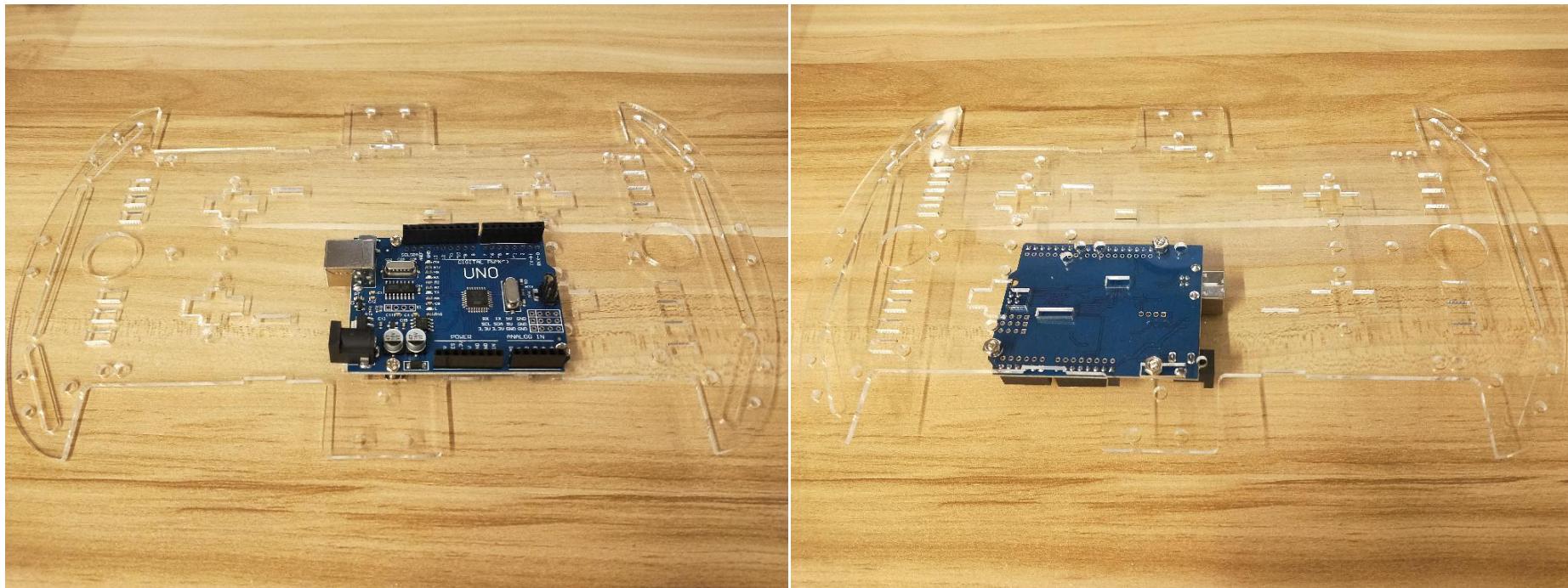
Step3:



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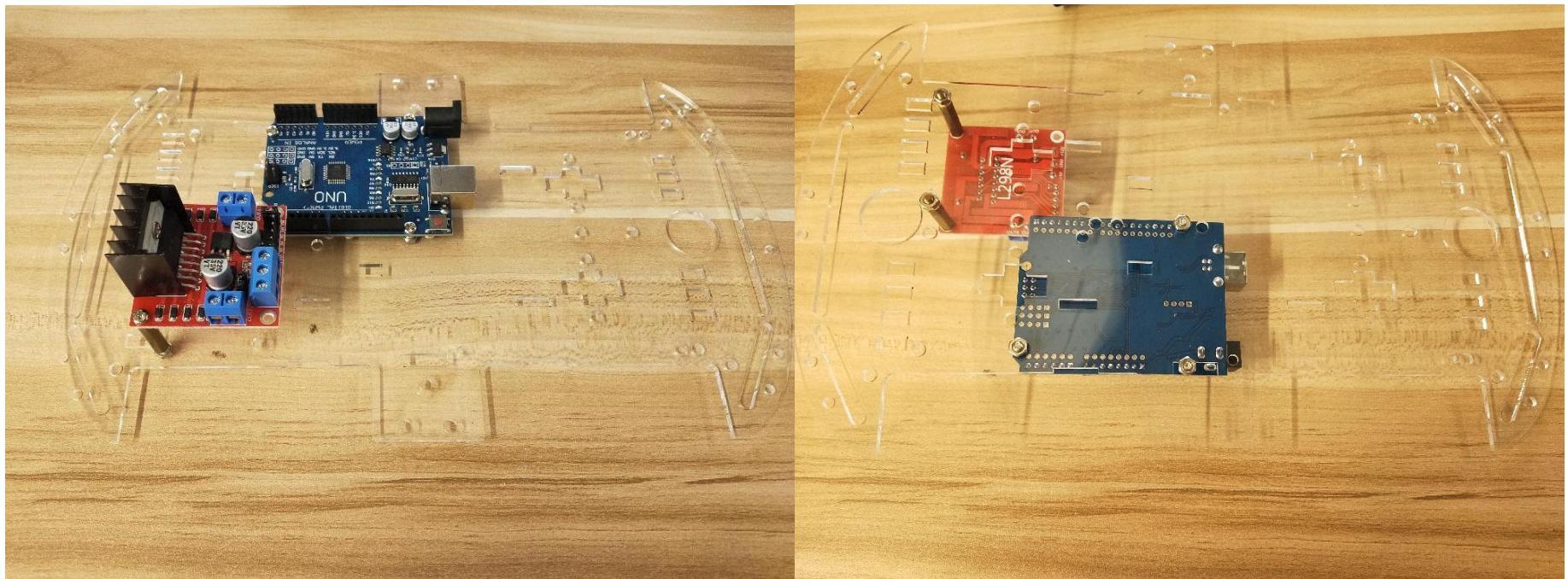
## Step4:



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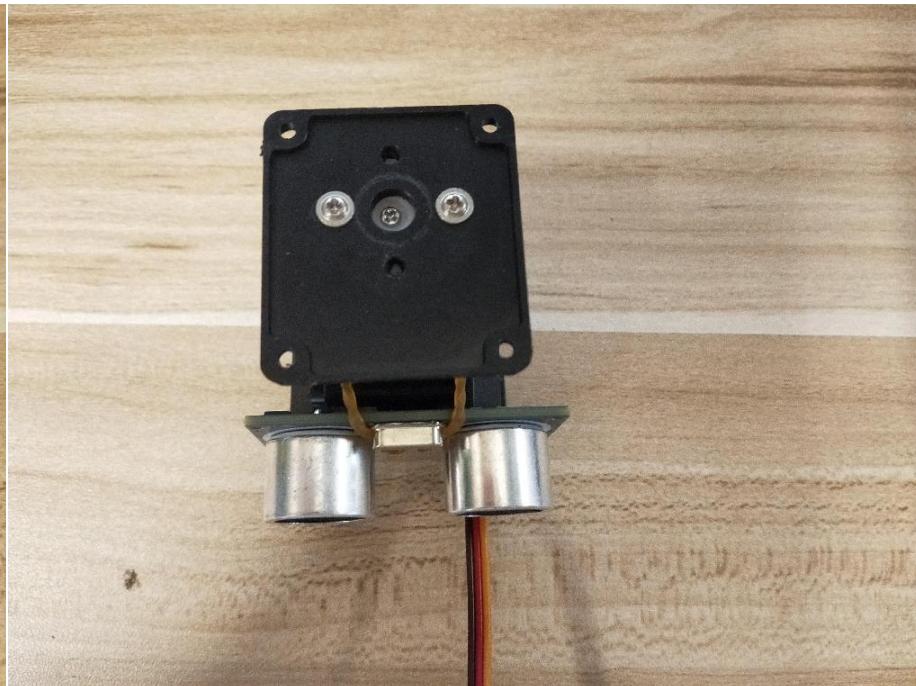
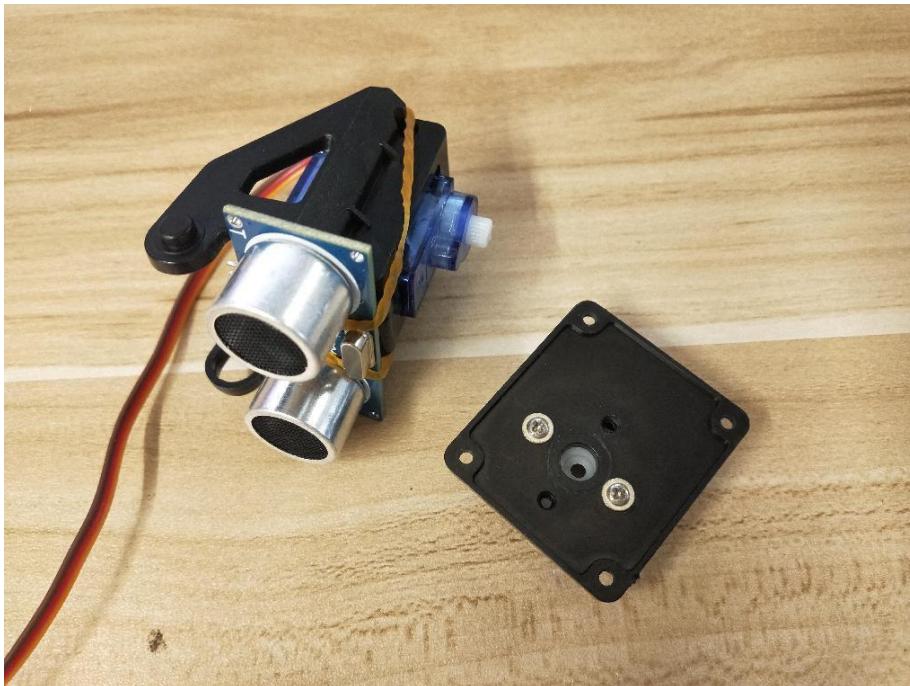
Step5:



# LROBRUYA

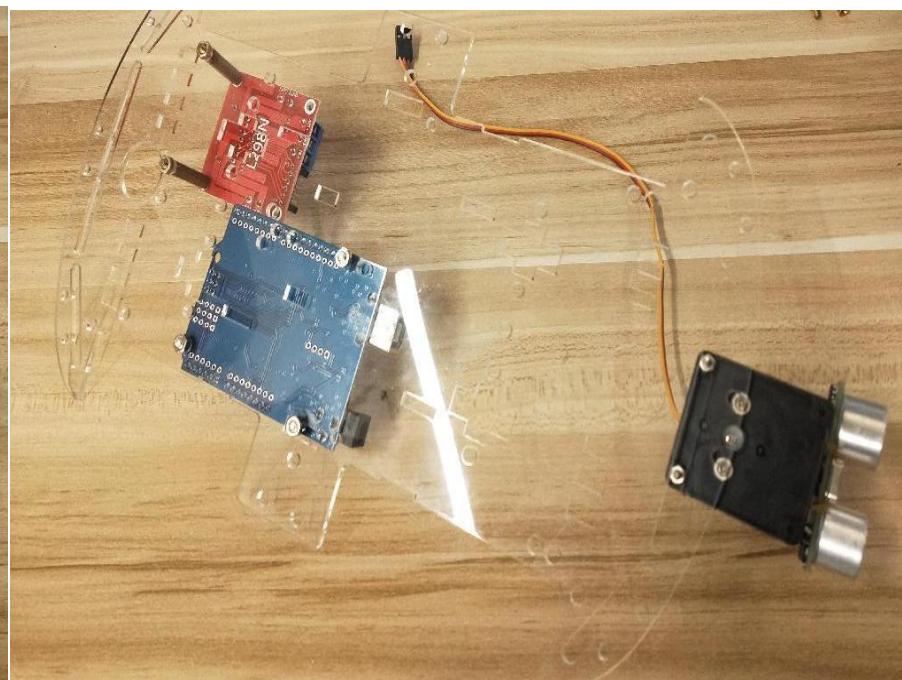
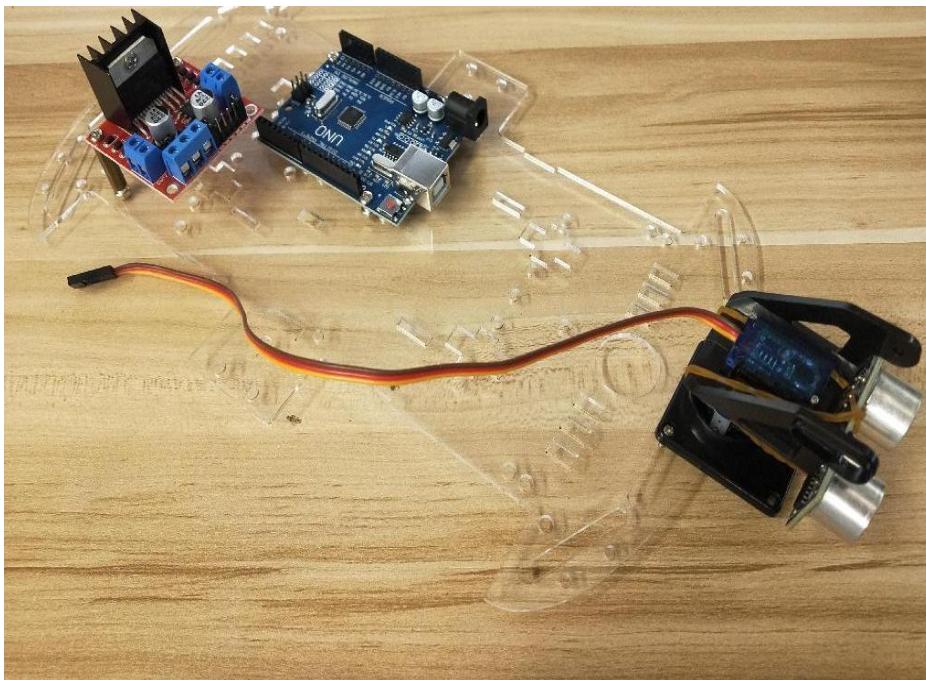
---

Step6:



# LROBRUYA

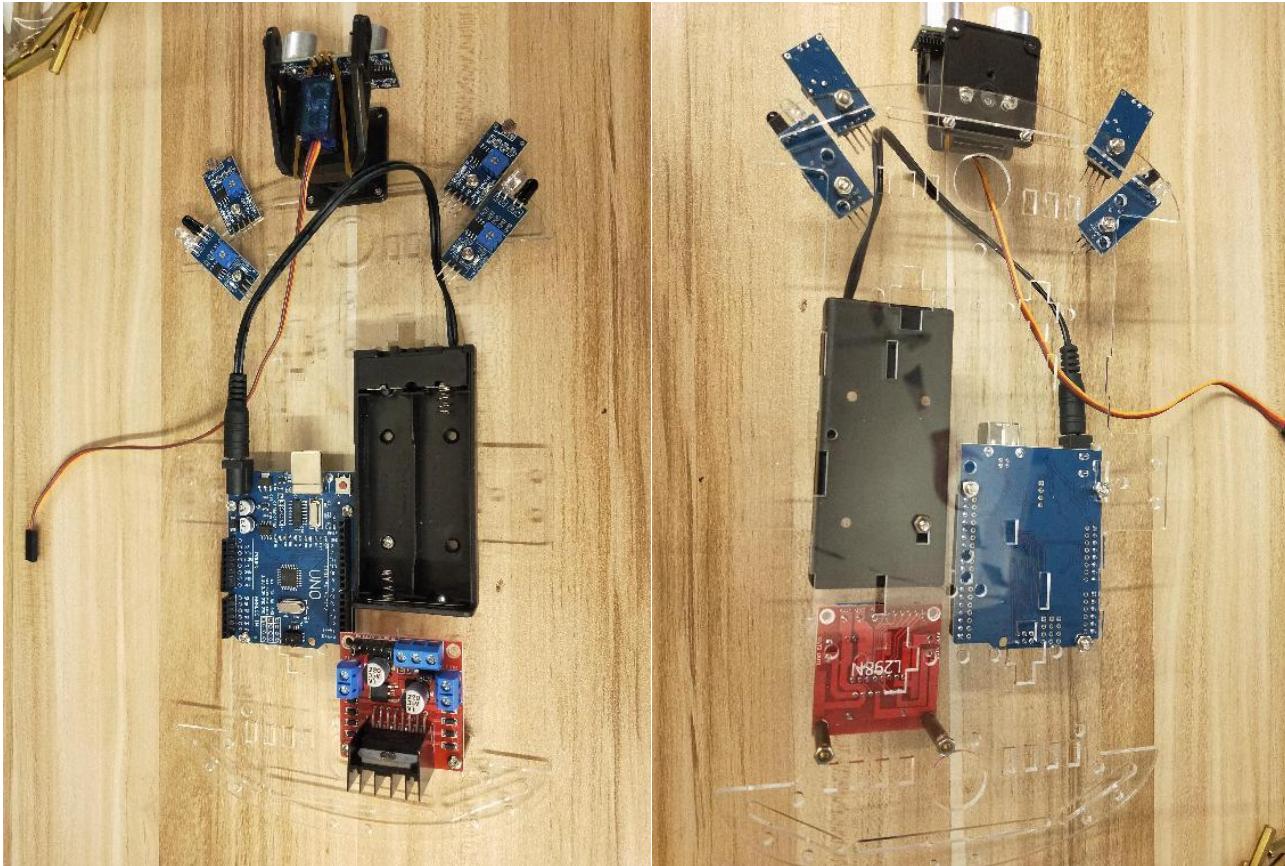
---



# LROBRUYA

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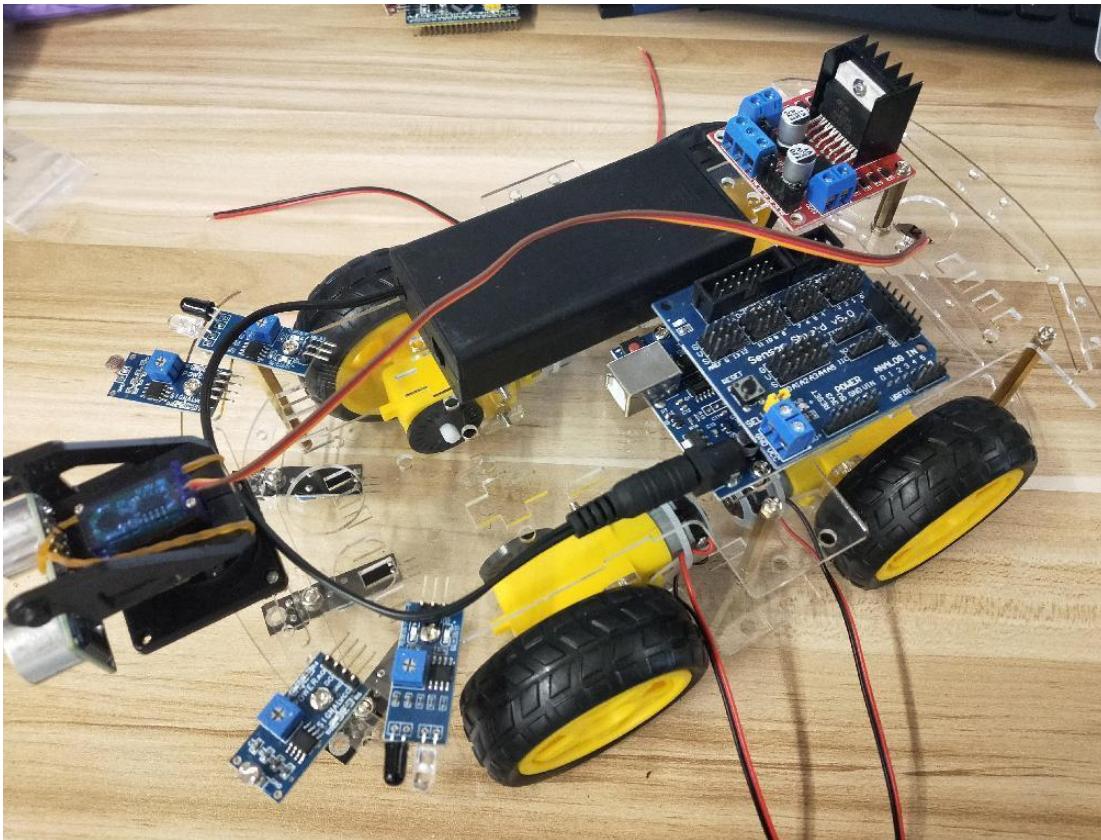
Step7:



# LROBRUYA

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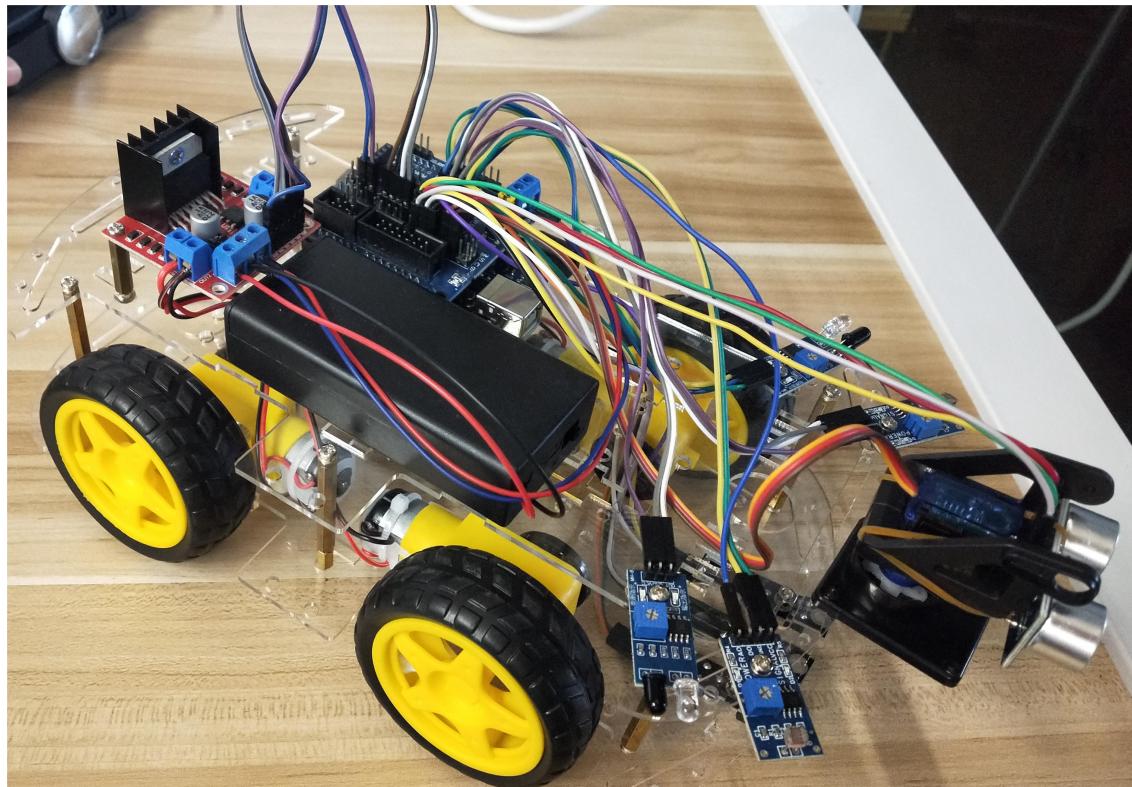
Step8:



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Step9:





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## Lesson 2 Motor Speed and Direction Control

### About this lesson:

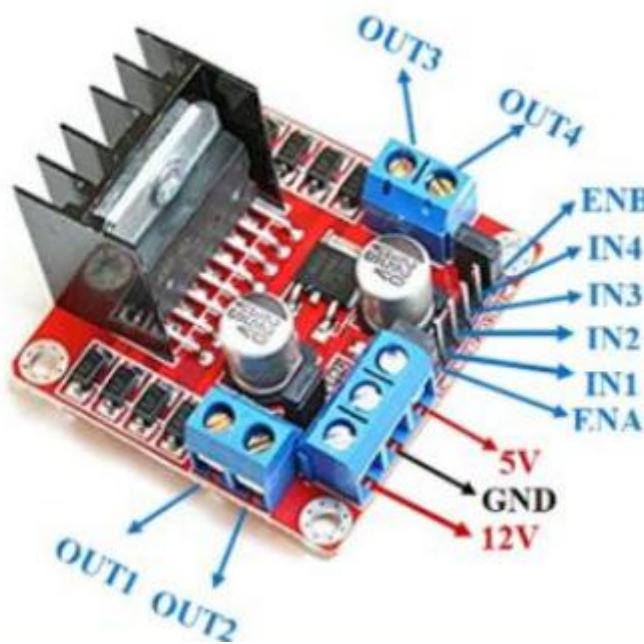
In this lesson, you will learn how to use a L298N Motor Driver module control the direction and speed control of the robot car.

### Component Introduction

This L298N Motor Driver Module is a high power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. L298N Module can control up to 4 DC motors, or 2 DC motors with directional and speed control.

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Using L298N made by ST Company as the control chip, the module has characteristics of strong driving ability, low calorific value and strong anti-interference ability.

This module can use built-in 78M05 for electric work via a driving power supply part. But to avoid the damage of the



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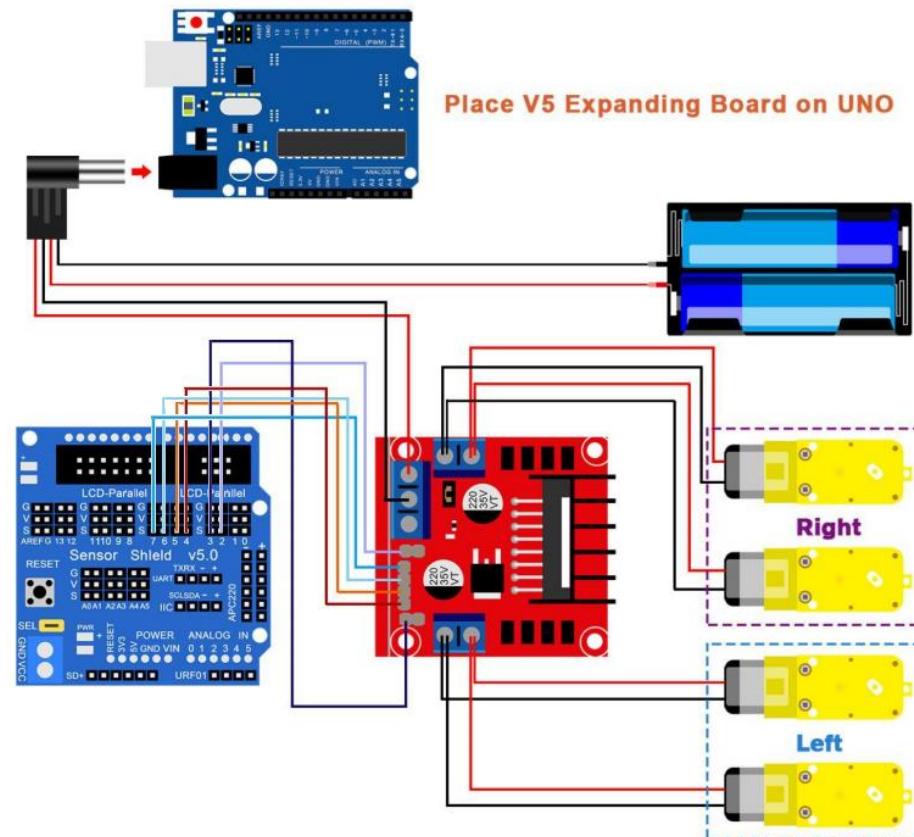
voltage stabilizing chip, please use an external 5V logic supply when using more than 12V driving voltage.

Using large capacity filter capacitor, this module can follow current to protect diodes, and improve reliability.

4WD Robot	D4	D5	D6	D7
Forward	LOW	HIGH	LOW	HIGH
Backward	HIGH	LOW	HIGH	LOW
Rotate to left	HIGH	LOW	LOW	HIGH
Rotate to right	LOW	HIGH	HIGH	LOW
Stop	LOW	LOW	LOW	LOW

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## Wiring diagram





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## Attention

When connecting, the jumper caps of ENA and ENB must be removed.

After wiring, please open the program in the code `Test_1_Motor_Speed_and_Direction_Control` and click **UPLOAD** to upload the program.

## Result

In experimental test 1, we will write code to control the robot car to move forward, backward, rotate to left, rotate to right, stop.

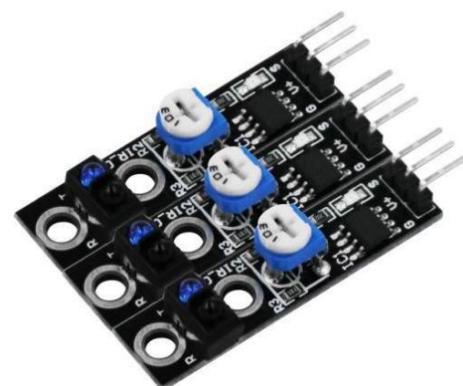
# LROBRUYA

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## Lesson 3 Line Tracking Smart Car

### About this lesson:

In this lesson, we will complete the test of two experimental codes. In experimental test 1, we learned how to use the infrared line-following sensor, and observed the results returned by the sensor to distinguish black and white objects. In the experimental test 2, we learned to combine the infrared line-following sensor with the motor to control the robot car to complete the line-following function.





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## Component Introduction

The tracking sensor is actually an infrared sensor. The component used here is the TCRT5000 infrared tube. Its working principle is to use the different reflectivity of infrared light to the color, then convert the strength of the reflected signal into a current signal. During the process of detection, black is active at HIGH level, but white is active at LOW level. The detection height is 0-3 cm. By rotating the adjustable potentiometer on the sensor, it can adjust the detection sensitivity of the sensor.

### Specification:

Operating Voltage: 3.3-5V (DC)

Interface: G(GND) V+(VCC) S(Signal)

Output Signal: Digital signal

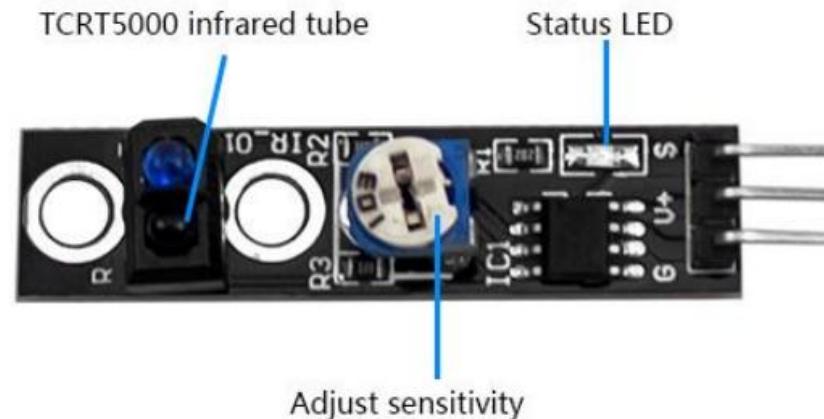
Detection Height: 0-3 cm

**Special note:** before testing, turn the potentiometer on the sensor to adjust the detection sensitivity. When adjust the LED at

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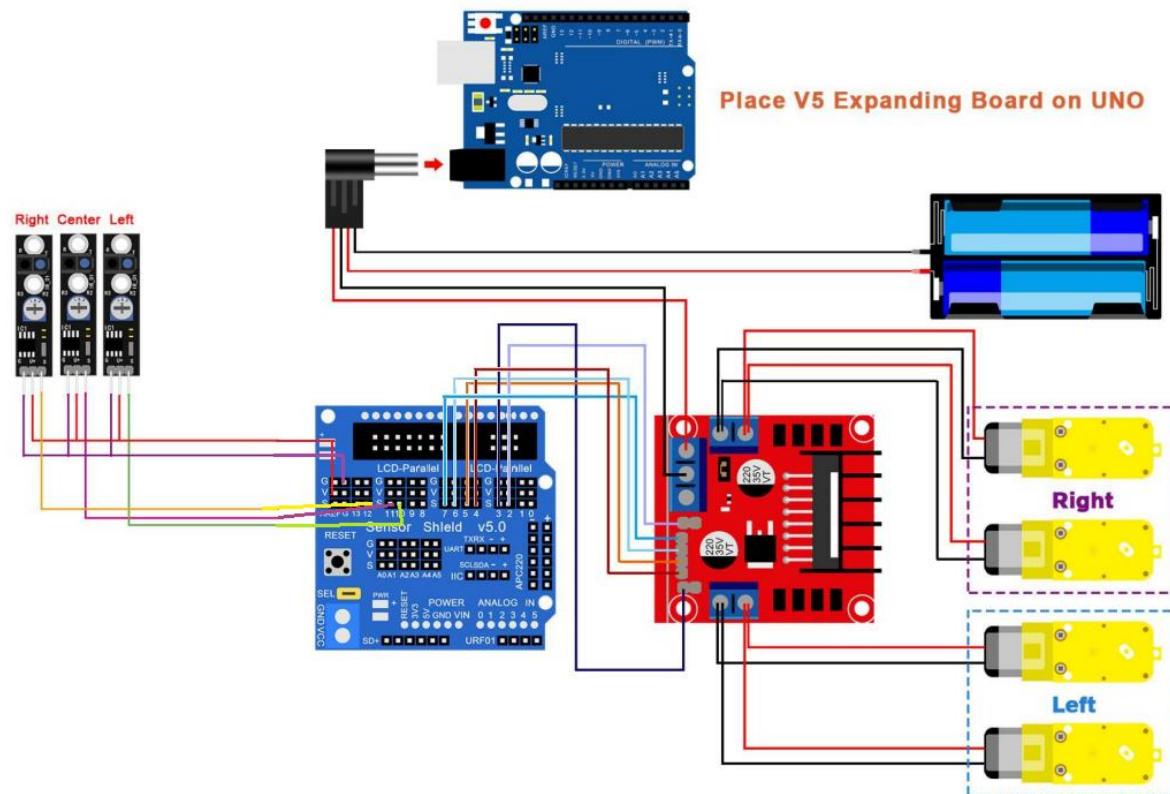
---

the threshold between ON and OFF, the sensitivity is the best.



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## Wiring diagram





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## Let's program

### Test 1--Line Tracking Sensor

The main purpose of the test experiment is to read the return signal of the line tracking sensor and print it to the serial port monitor. When detects white paper, sensor's signal pin outputs LOW (display 0), and status LED is on; When detects black, sensor's signal pin outputs HIGH (display 1), and status LED is off.

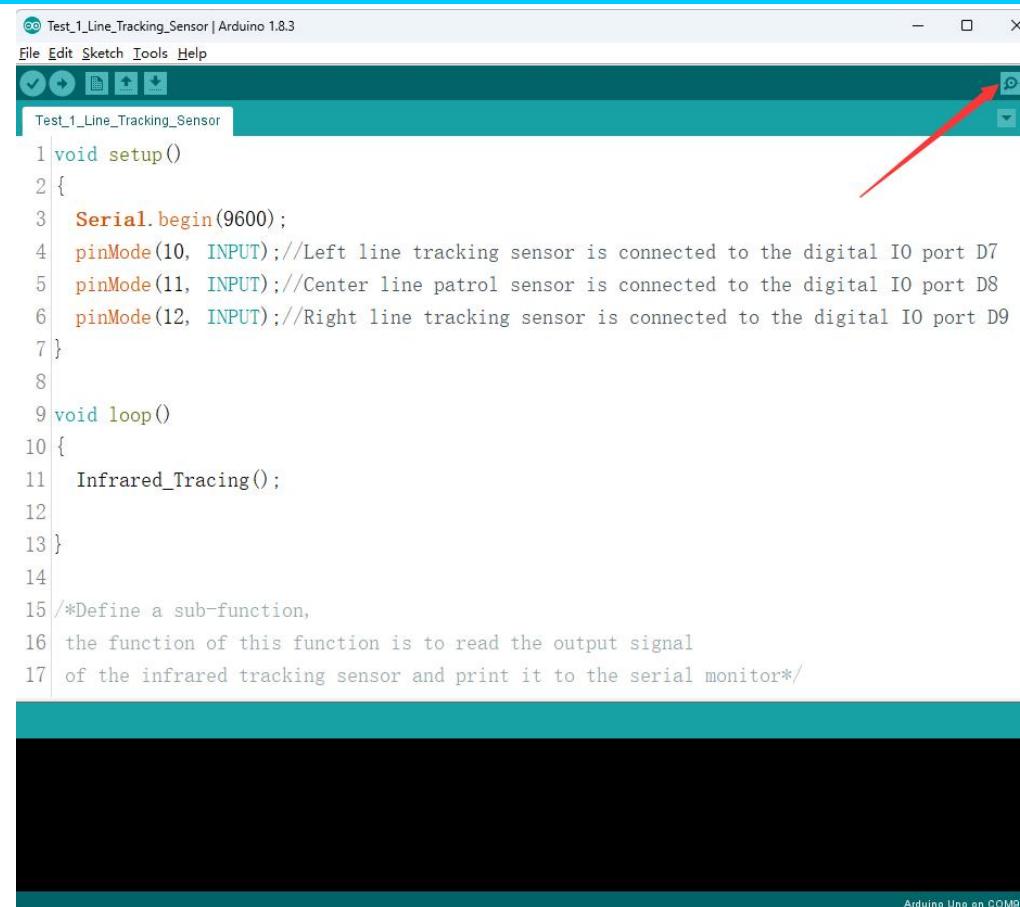
## Result

if you want to refer to the program we provide. open the reference code for this lesson

"Test\_1\_Line\_Tracking\_Sensor.ino" in the reference materials we provided.

After uploading the code, click the button in the upper right corner to open the serial monitor to view the measured distance.

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```
Test_1_Line_Tracking_Sensor | Arduino 1.8.3
File Edit Sketch Tools Help
Test_1_Line_Tracking_Sensor
1 void setup()
2 {
3     Serial.begin(9600);
4     pinMode(10, INPUT); //Left line tracking sensor is connected to the digital IO port D7
5     pinMode(11, INPUT); //Center line patrol sensor is connected to the digital IO port D8
6     pinMode(12, INPUT); //Right line tracking sensor is connected to the digital IO port D9
7 }
8
9 void loop()
10 {
11     Infrared_Tracing();
12
13 }
14
15 /*Define a sub-function,
16 the function of this function is to read the output signal
17 of the infrared tracking sensor and print it to the serial monitor*/
```

Then you can see the data as blow:

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When detects white paper, sensor's signal pin outputs LOW (display 0),and status LED is on;When detects black, sensor's signal pin outputs HIGH (display 1),and status LED is off.



Important note: Before you upload the program, you need to close the serial monitor, otherwise the serial monitor will occupy the communication interface of the uploaded program.



---

## Test 2--Line Tracking Smart Car

In the experimental test 2, we learned to combine the infrared line-following sensor with the motor to control the robot car to complete the line-following function.

**Step 1:** Prepare a black track on white ground. (the width of the black track is more than 15mm and less than 20mm).

Please note, the bend angle of the track can't be larger than 90 degree. If the angle is too large, the car will move out of the track.

**Step 2:** Adjust the sensitivity of tracking sensor modules.

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

Signal Indicate LED ON: White Ground



---

Signal Indicate LED OFF: Black Track

**Step 3:** Turn on the car and put the car over the black track, then the car will move along the black track.

**If the car can't move, please check the following:**

If adjusted well the sensibility of the tracking sensor

### **Car tracking flow chart**

The car entered the tracking mode, namely began constantly scanning and detector connected to the I/O port of the SCM, once detected a signal of a I/O port, enter judgment processing procedures, to determine which one of 3 detectors detect the black line.

### **Result**

Turn the POWER switch ON. The robot car will move forward along the black track.



---

## Lesson 4 Ultrasonic Infrared Obstacle Avoidance Robot Car

### About this lesson:

In this lesson, we will complete the test of 4 experimental codes. In experimental test 1, we separately learn how to use infrared obstacle- avoidance sensors to detect obstacles, and observe the results returned by the sensors to determine whether obstacles are detected. In the second experimental test 2, we will learn to use the ultrasonic module to measure distance. In the experimental test 3, we will learn how to control the servo motor to rotate to any angle. In the experimental test 4, the infrared obstacle avoidance sensor, the ultrasonic module and the servo motor were assembled on the robot car at the same time, and the data of these sensors were used at the same time to assist the robot car to complete the obstacle avoidance function more accurately.



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## What is infrared obstacle avoidance sensor

The infrared obstacle detector sensor has a pair of infrared transmitting and receiving tubes. The transmitter emits an infrared rays of a certain frequency. When the detection direction encounters an obstacle (reflecting surface), the infrared rays are reflected back, and receiving tube will receive it. At this time, the indicator ( green LED) lights up. After processed by the circuit, the signal output terminal will output Digital signal. You can rotate the potentiometer on the shield to adjust the detection distance. It is better to adjust the potentiometer to make the green LED in a state between on and off. The detection distance is the best,almost 10cm.

## How to use the infrared obstacle avoidance sensor

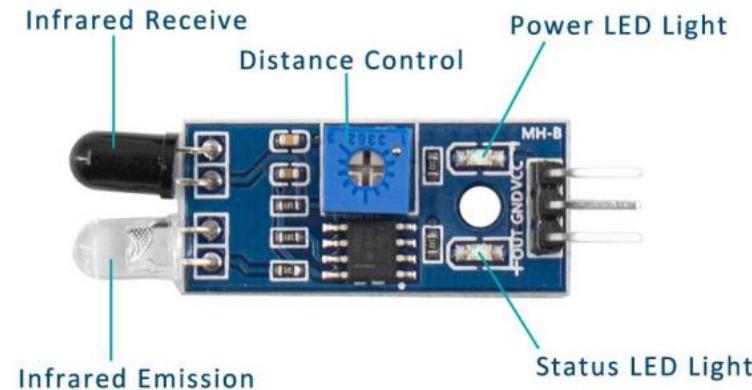
we read the signal level of obstacle detector sensor to judge whether detect obstacles or not.

When detects an obstacle, sensor' s signal pin outputs LOW (display 0); otherwise, output HIGH (display 1).

Show the result on the serial monitor, and control the external LED module turn ON/OFF.

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## What is an ultrasonic sensor



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Ultrasonic sensor module HC-SR04 provides 2cm-400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit.

The basic principle of work:

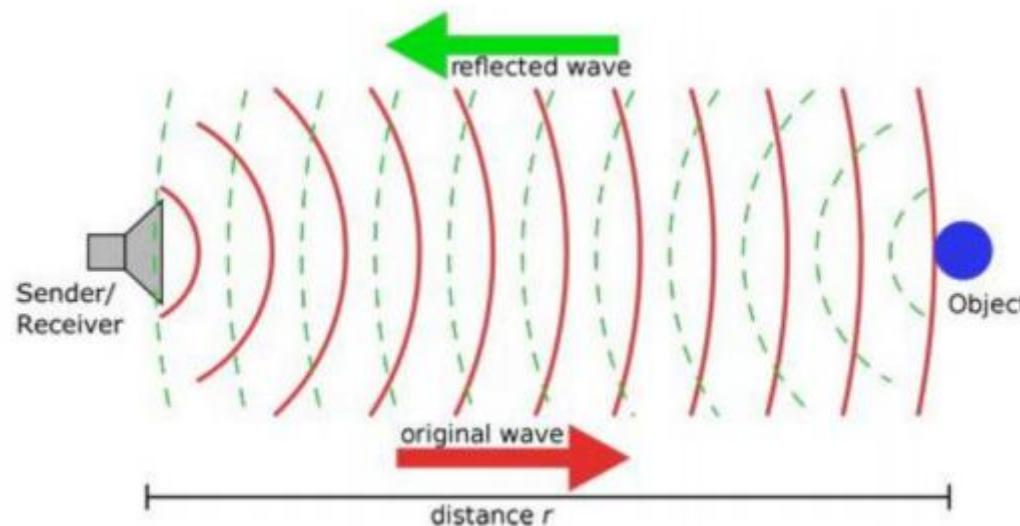
- (1) Using IO trigger for at least 10us high level signal
- (2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
- (3) IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to receiving.

Test distance =  $(\text{high level time} \times \text{velocity of sound (340m/s)}) / 2$

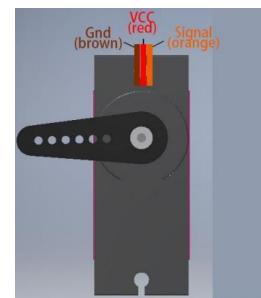
The Timing diagram is shown below. You only need to supply a short 10us pulse to the trigger input to start the ranging, and then the module will send out an 8 cycle burst of ultrasound at 40 kHz and raise its echo. The Echo is a distance object that is pulse width and the range in proportion .You can calculate the range through the time interval between sending trigger signal and receiving echo signal. Formula:  $\text{us} / 58 = \text{centimeters}$  or  $\text{us} / 148 = \text{inch}$ ; or: the range = high level time \* velocity (340M/S) / 2; we suggest to use over 60ms measurement cycle, in order to prevent trigger signal to the echo signal.

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**What is a servo motor**

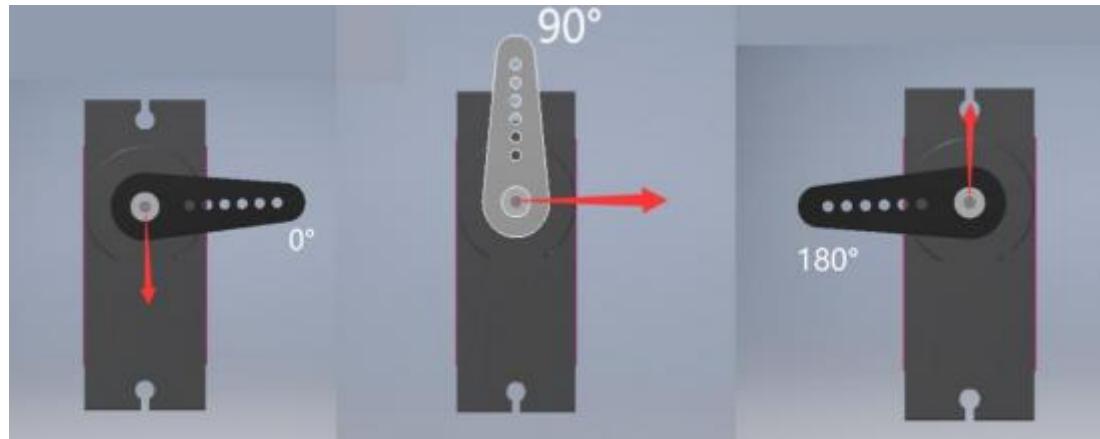


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Servo motors are great devices that can turn to a specified position.

Usually, they have a servo arm that can turn 180 degrees. Using the Arduino, we can tell a servo to go to a specified position and it will go there. As simple as that!



Servo motors were first used in the Remote Control (RC) world, usually to control the steering of RC cars or the flaps on a RC plane. With time, they found their uses in robotics, automation, and of course, the Arduino world.

There are two ways to control a servomotor with Arduino. One is to use a common digital sensor port of Arduino to



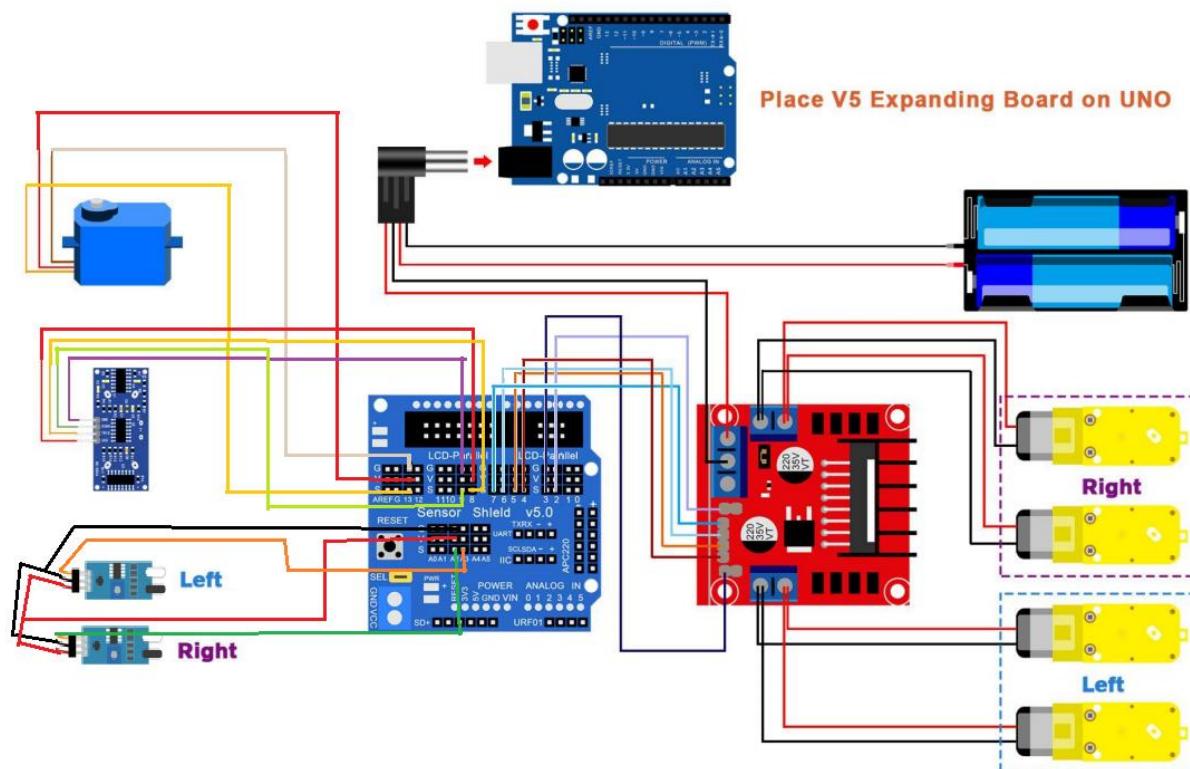
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produce square wave with different duty cycle to simulate PWM signal and use that signal to control the positioning of the motor. Another way is to directly use the Servo function of the Arduino to control the motor.

The Arduino drive capacity is limited. So if you need to control more than one motor, you will need external power.

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## Wiring diagram





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## Let's program

### **Test 1--infrared obstacle avoidance sensor**

The main purpose of the test experiment is to read the return signal of the infrared obstacle avoidance sensor and print it to the serial port monitor. When detects an obstacle, sensor's signal pin outputs LOW (display 0); otherwise, output HIGH (display 1).

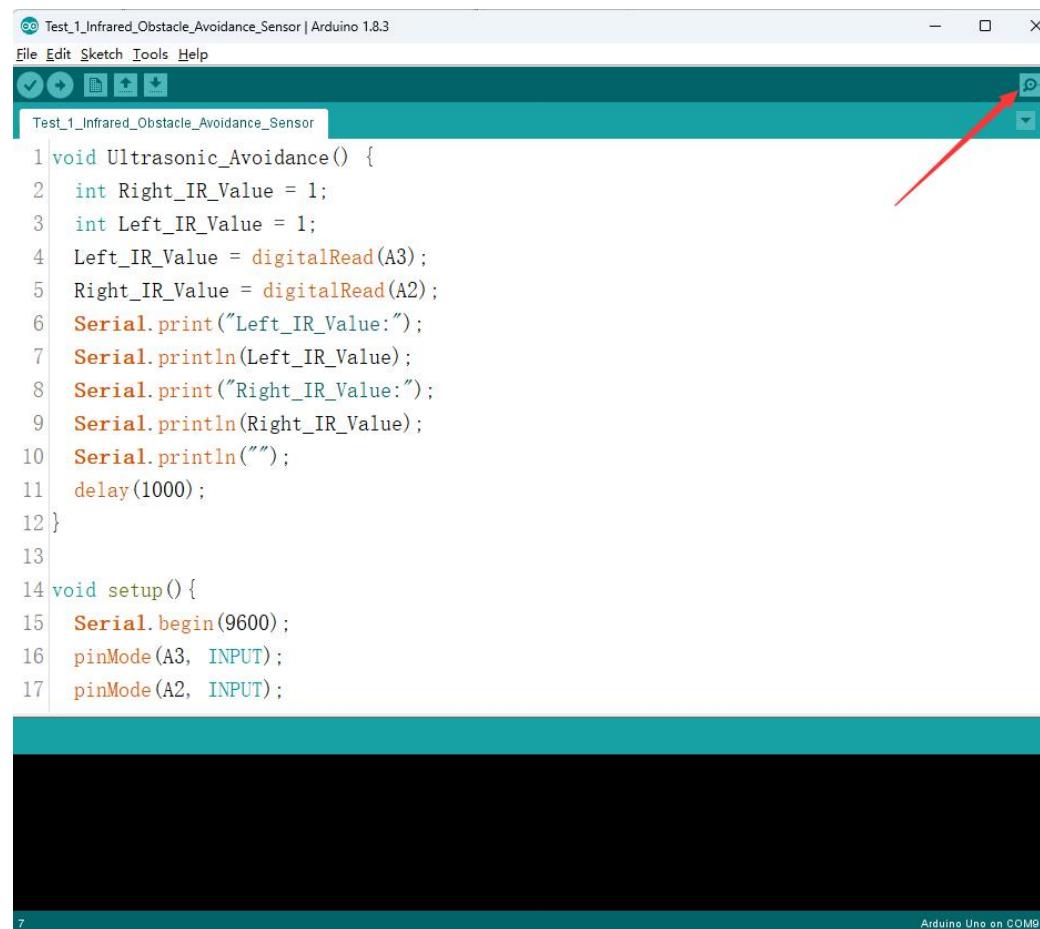
### **Result**

If you want to refer to the program we provide.open the reference code for this lesson

**"Test\_1\_Infrared\_Obstacle\_Avoidance\_Sensor.ino"** in the reference materials we provided.

After uploading the code, click the button in the upper right corner to open the serial monitor to view the measured distance.

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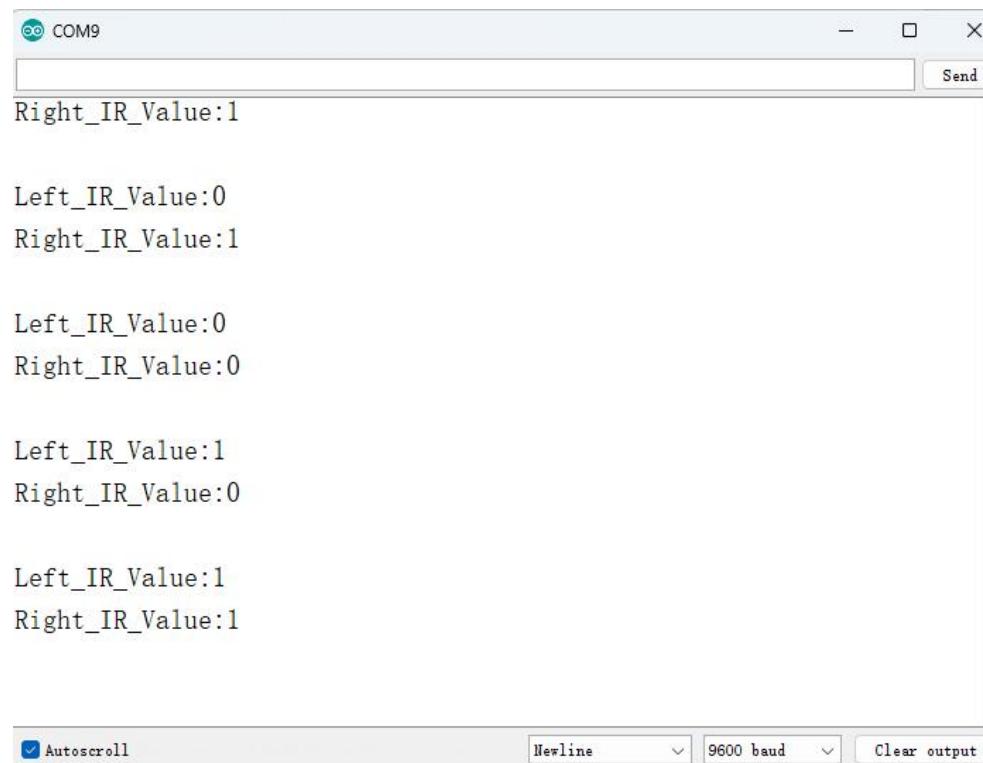


# LROBRUYA

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Then you can see the data as blow:

When there is an obstacle in the front, IR\_value=0, and the indicator light on the sensor lights up.



```
Right_IR_Value:1
Left_IR_Value:0
Right_IR_Value:1

Right_IR_Value:0
Left_IR_Value:0

Left_IR_Value:1
Right_IR_Value:0

Left_IR_Value:1
Right_IR_Value:1
```



---

## Test 2--Servo Control

In this experimental test , we learn how to control the servo motor and control the servo motor to rotate to the specified angle.

### Result

If you want to refer to the program we provide.open Arduino IDE software and open the reference code for this lesson "Test\_2\_Servo\_Control.ino" in the reference materials we provided.

Before you can run this, make sure that you have installed the < Servo> library or re-install it, if necessary. Otherwise, your code won't work.For details about loading the library file, see Lesson about how to add libraries .

### Code Explanation

Arduino comes with #include <Servo.h> (servo function and statement)

The following are some common statements of the servo function:



- 
1. `attach (interface)` ——Set servo interface, port 13 is available
  2. `write (angle)` ——The statement to set rotation angle of servo, the angle range is from 0° to 180°
  3. `read ()` ——used to read angle of servo, read the command value of “`write()`”
  4. `attached ()` ——Judge if the parameter of servo is sent to its interface

Note: The above written format is “servo variable name, specific statement `( )`”, for instance: `myservo.attach(13)`

After uploading the code, The servo motor rotates to 15° and waits for 2 seconds and then rotates to 165°, and after 2 seconds, it rotates to 90°, and repeats the above process.

### **Test 3--Ultrasonic Sensor Module**

In Experimental Test 3, we will learn how to control the ultrasonic sensor, and display the distance measured by the ultrasonic sensor on the serial monitor.

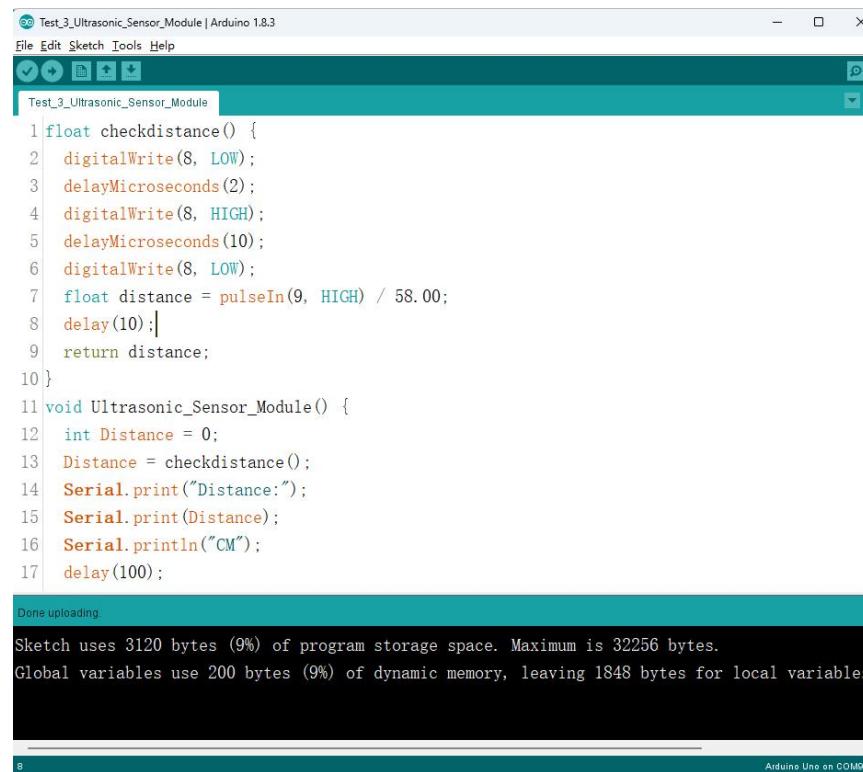
### **Result**

If you want to refer to the program we provide.open Arduino IDE software and open the reference code for this lesson

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"Test\_3\_Ultrasonic\_Sensor\_Module.ino" in the reference materials we provided.

After uploading the code, click the button in the upper right corner to open the serial monitor to view the measured distance



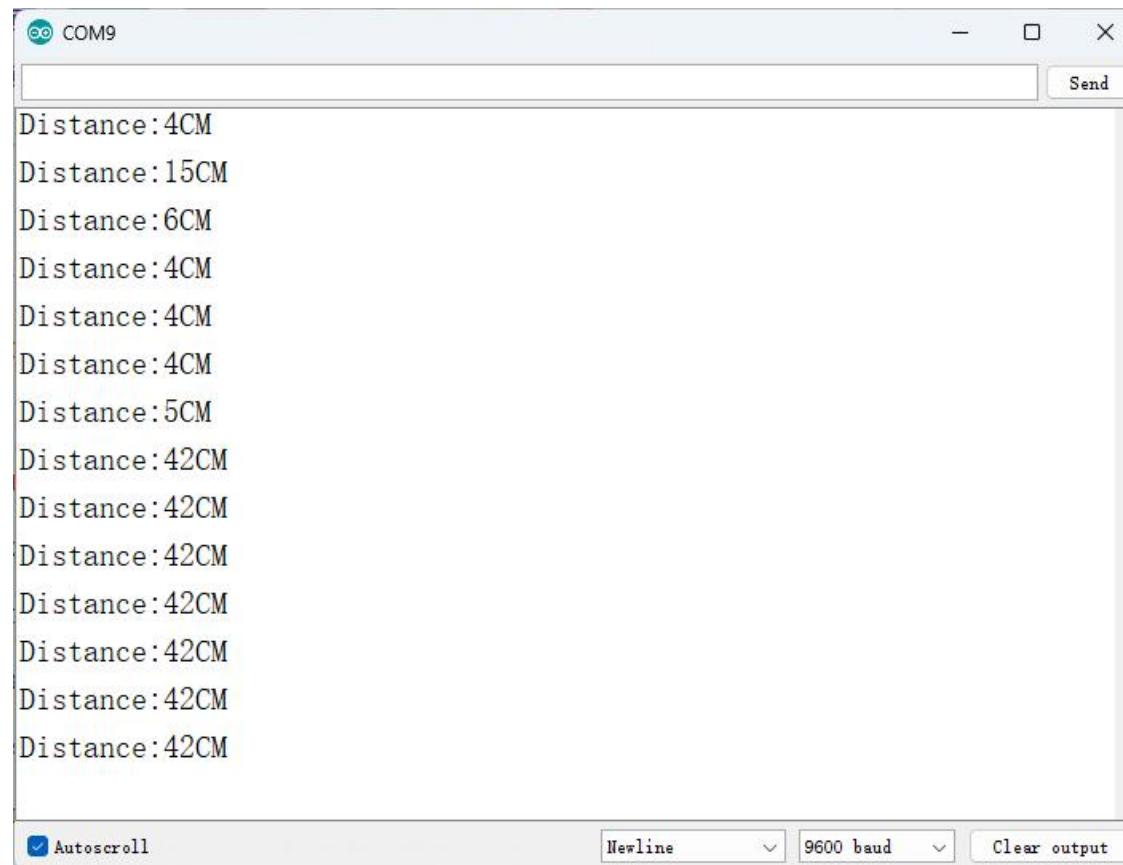
```
Test_3_Ultrasonic_Sensor_Module | Arduino 1.8.3
File Edit Sketch Tools Help
Test_3_Ultrasonic_Sensor_Module
1 float checkdistance() {
2   digitalWrite(8, LOW);
3   delayMicroseconds(2);
4   digitalWrite(8, HIGH);
5   delayMicroseconds(10);
6   digitalWrite(8, LOW);
7   float distance = pulseIn(9, HIGH) / 58.00;
8   delay(10);
9   return distance;
10 }
11 void Ultrasonic_Sensor_Module() {
12   int Distance = 0;
13   Distance = checkdistance();
14   Serial.print("Distance:");
15   Serial.print(Distance);
16   Serial.println("CM");
17   delay(100);
}

Done uploading
Sketch uses 3120 bytes (9%) of program storage space. Maximum is 32256 bytes.
Global variables use 200 bytes (9%) of dynamic memory, leaving 1848 bytes for local variables.

8
Arduino Uno on COM9
```

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Then you can see the data as blow:





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## **Test 4--Ultrasonic\_Infrared\_Obstacle\_Avoidance\_Robot\_Car**

In the experimental test 4, the infrared obstacle avoidance sensor, the ultrasonic module and the servo motor were assembled on the robot car at the same time, and the data of these sensors were used at the same time to assist the robot car to complete the obstacle avoidance function more accurately.

### **Result**

If you want to refer to the program we provide.open the reference code for this lesson

"Test\_4\_Ultrasonic\_Infrared\_Obstacle\_Avoidance\_Robot\_Car.ino" in the reference materials we provided.

### **What will you see**

Upload the code to UNO R3 control board, and turn the POWER switch ON.

**Note: It is recommended that the height of the obstacle is greater than 15cm.which means that the height of the obstacle is greater than the height of the ultrasonic sensor.**

Because of receiving the detection signals of ultrasonic and infrared obstacle avoidance modules at the same time, the robot

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car can complete the obstacle avoidance function more accurately. When obstacles are on the left and right sides of the robot car, they can be discovered by the infrared obstacle avoidance module in time and turn to avoid. When the obstacle is directly in front, the ultrasonic will be able to measure the distance between the robot car and the obstacle.

## Lesson 5 Ultrasonic Follow Robot Car

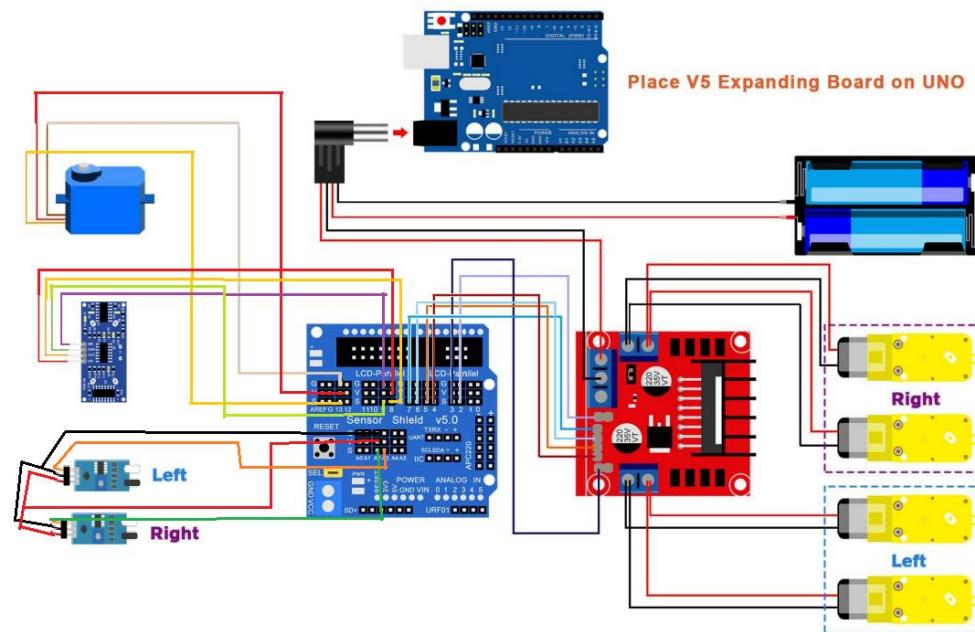
### About this lesson:

In the last course, I learned how to use the ultrasonic module and infrared obstacle avoidance module. Similarly, combining these two modules can control the robot car to complete the following function. When the guiding object is on the left and right sides of the robot car, the infrared obstacle avoidance module can detect and judge the direction of the guiding object, and control the robot car to turn to the guide object. When the guided object is directly in front of the robot car, the ultrasonic sensor can detect the distance between the robot car and the guide object. When the distance is greater than 10mm,

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control the robot car to approach the guide; When the distance is less than 5mm, control the robot car to move backward and keep a proper distance,  $5\text{mm} < D < 10\text{mm}$ .

## Wiring diagram





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## Let's program

### Test 1--Ultrasonic Follow Robot Car

When the guiding object is on the left and right sides of the robot car, the infrared obstacle avoidance module can detect and judge the direction of the guiding object, and control the robot car to turn to the guide object.

When the guided object is directly in front of the robot car, the ultrasonic sensor can detect the distance between the robot car and the guide object. When the distance is greater than 10mm, control the robot car to approach the guide;

When the distance is less than 5mm, control the robot car to move backward and keep a proper distance,  $5mm < d < 10mm$ .

## Result

If you want to refer to the program we provide. open the reference code for this lesson

"Test\_1\_Ultrasonic\_Follow\_Robot\_Car.ino" in the reference materials we provided.

## What will you see

Upload the code to UNO R3 control board,, and turn the POWER switch ON.



---

Note: It is recommended to use a rectangular object box to guide the robot car. Length>10cm.Width>15cm.

The robot car detects the distance of the object in front through the ultrasonic sensor. When the front object moves, the robot car will follow the movement, keeping the distance between the tank and the object in front between 5cm~8cm.

## **Lesson 6 Light Seeking Robot Car**

### **About this lesson:**

In this lesson, we mainly study two experimental tests. In the first test experiment, we learn the photoelectric sensor and use it to obtain the light intensity in the environment; in the second test experiment, the photoelectric sensor and motor control need to be combined, so that when the car senses strong light, Will move in the direction of the light.

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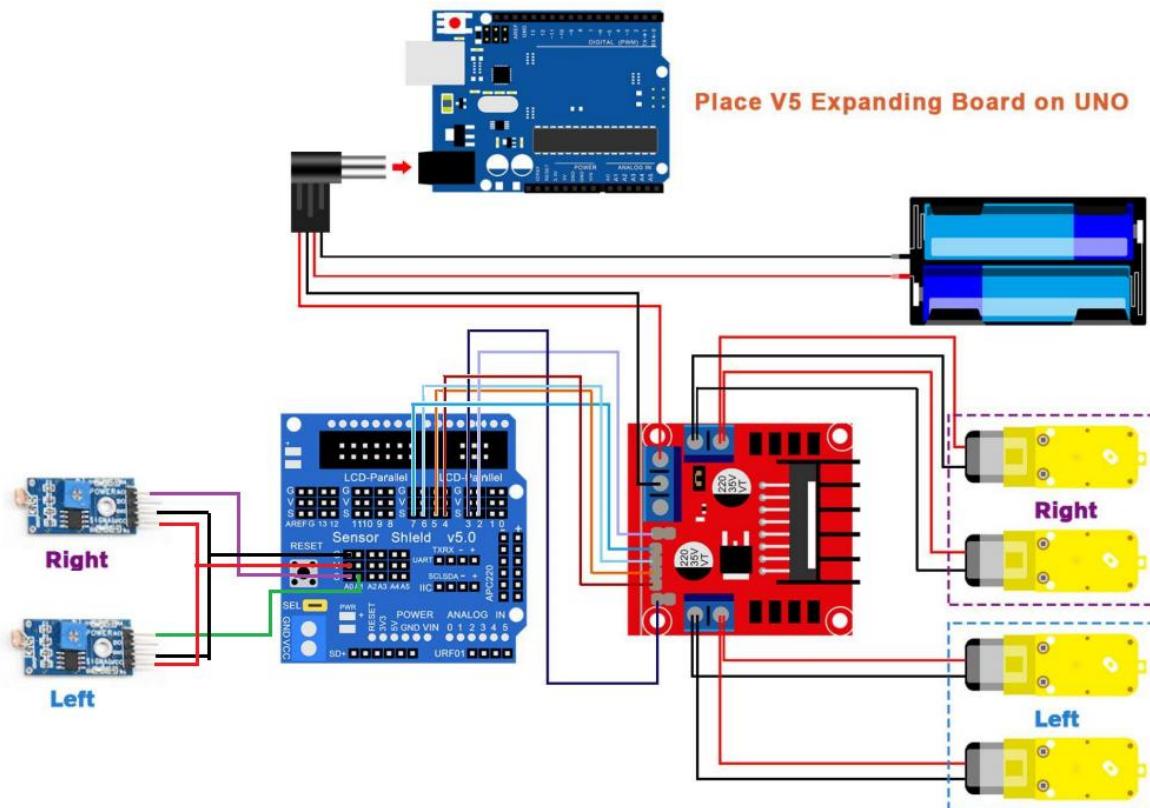
## What is photoelectric sensor



The photoelectric sensor (photoresistor) is a resistor semiconductor made by the photoelectric effect. It is very sensitive to ambient light, so its resistance value changes with different light intensities. We use its functions to design circuits and generate photoresistor sensor modules. The signal end of the module is connected to the microcontroller. When the light intensity increases, the resistance decreases, and the voltage of the signal output port of the module decreases, that is, the voltage detected by the analog port of the microcontroller will decrease. Otherwise, when the light intensity decreases, the resistance increases, and the voltage of the signal output port of the module increases, that is, the voltage detected by the analog port of the microcontroller will increase. Therefore, we can use the photoresistor sensor module to read the corresponding analog value and sense the light intensity in the environment. It is usually used in light measurement, control and conversion, and light control circuits.

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## Wiring diagram





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## Let's program

### Test 1--Light Seeking Signal

On the module , When the photoresistor is illuminated by strong light , Its resistance value drops rapidly , the current passed increases, the resistance of the photoresistor rises rapidly in a dark environment, the current passed through is reduced, The main control board determines whether there is a light source.

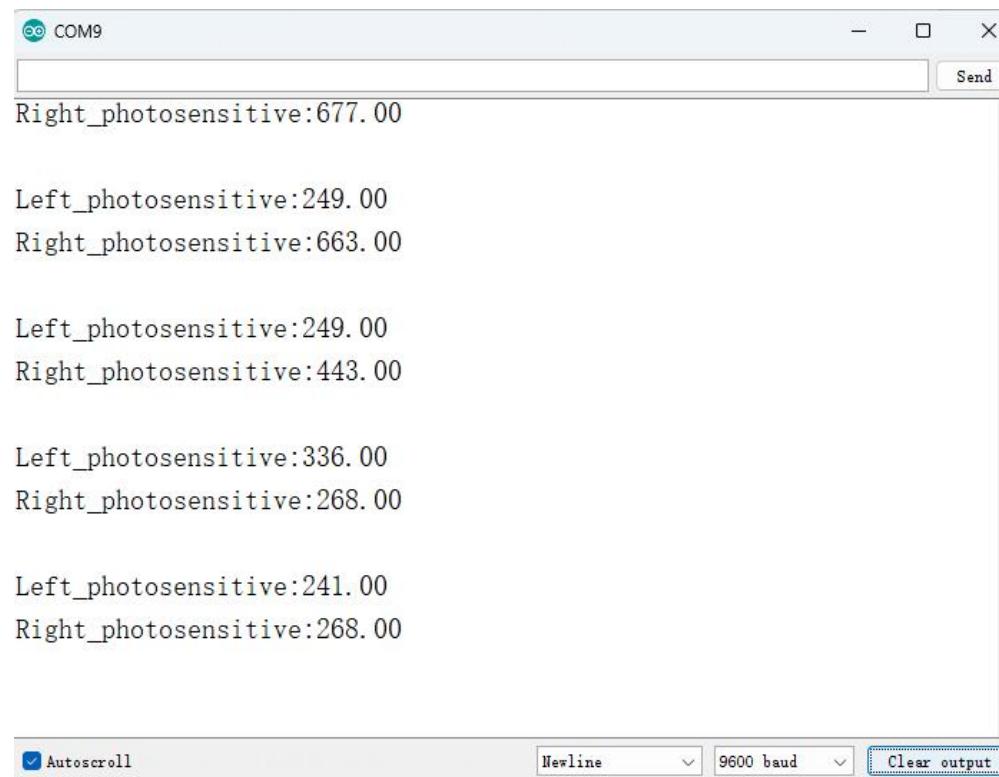
#### Result

If you want to refer to the program we provide. Open the reference code for this lesson "**Test\_1\_Light\_Seeking\_Signal.ino**" in the reference files we provided in tutorial.

After uploading the program, Use a cover to block the light near the photoresistor, and then observe that the output value of the light-seeking signal on the serial monitor is relatively large, and then remove the obstruction. It is found that the output value of the light-seeking signal on the serial monitor becomes smaller. You can also

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use the flashlight of the mobile phone to illuminate the photoresistor to observe the change of the output value of the light-seeking signal on the serial monitor.



COM9

Right\_photosensitive:677.00

Left\_photosensitive:249.00

Right\_photosensitive:663.00

Left\_photosensitive:249.00

Right\_photosensitive:443.00

Left\_photosensitive:336.00

Right\_photosensitive:268.00

Left\_photosensitive:241.00

Right\_photosensitive:268.00

Autoscroll

Newline

9600 baud

Clear output



---

## Test 2--Light Seeking Robot Car

The photoelectric sensor and the motor control need to be combined, so that when the car senses strong light, it will move in the direction of the light.

### Result

If you want to refer to the program we provide. Open the reference code for this lesson

"Test\_2\_Light\_Seeking\_Robot\_Car.ino" in the reference files we provided in tutorial.

### What will you see

Upload the code to UNO R3 control board, and turn the POWER switch ON.

**Test in a dark environment and turn off the lights in the room.**

The light of the flashlight faces the photoelectric sensor on the right, and the robot car turns right. The light of the flashlight faces the photoelectric sensor on the left, and the robot car turns left. The light is detected on both sides, and the car is moving forward.