LROBRUYA

LONTEN Super Starter Kit for Arduino Uno

Content

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.

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 or 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/sensor-module

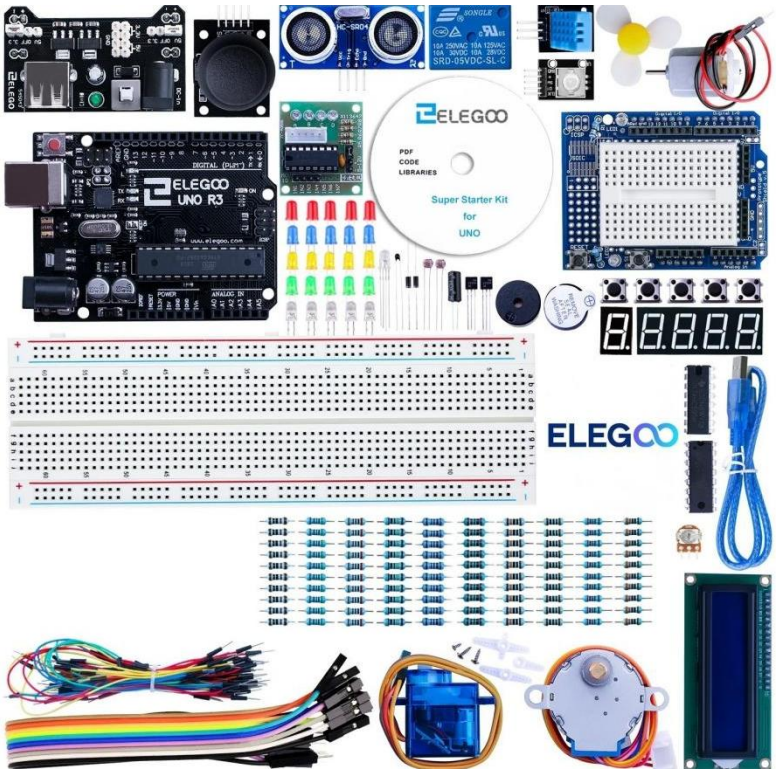
Tutorial

This tutorial include codes, libraries and detailed user documentation. It is designed for beginners. You will learn all the basic knowledge about how to use Arduino controller board, sensors and components.

LROBRUYA

Kit Introduction

This is a Super Starter Kit for Arduino, rolled out by LONTEN.



This tutorial include codes,labraries and lessons. It is designed for beginners. You will learn all the basic knowledge about how to use Arduino controller board, sensors and components.

Now, let’s start from the lessons.

LONTEN

Kit List

Super Starter Kit

Contact us:

https://www.lontentech.com/pages/contact-us

LROBRUYA

4 digit 7 - segment Display 1PC

1 digit 7 -segment Display 1PC

Tilt Ball Switch 1PC

Fan Blade and 3-6V DC Motor (with wire) each 1PC

Joystick Module 1PC

DHT11 Temperature and Humidity Module 1PC

Ultrasonic Sensor 1PC

LROBRUYA

Button (Small) 5PCS

Potentiometer 1PC

Passive Buzzer 1PC

Active Buzzer 1PC

Rotary Encoder Module 1PC

USB Cable 1PC

Female-to-male Dupont wire 10PCS

Breadboard Jumper Wire 65PCS

74HC595 IC 1PC

L293D 1PC

830 Tie-Points Breadboard 1PC

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.

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

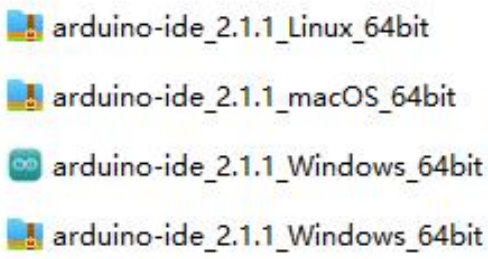
STEP2：Download the development software that is compatible with the operating.

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

Click Windows Win 10 and newer,64 bits.

Click JUST DOWNLOAD.

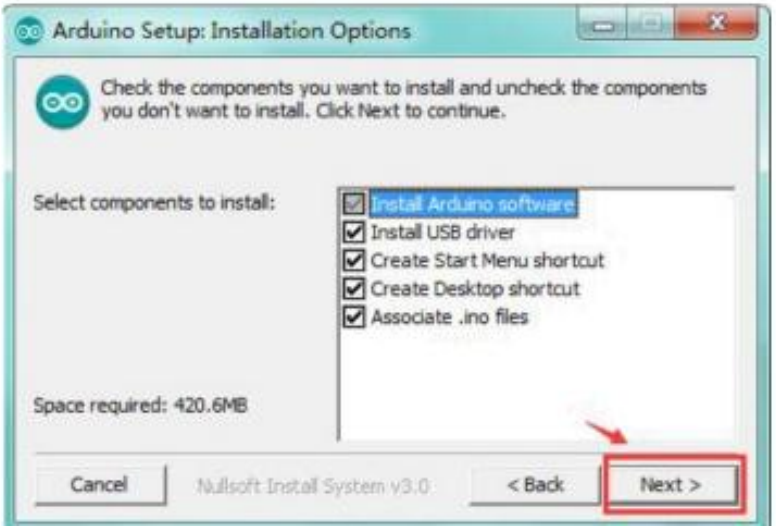
Also version 2.1.1 is available in the material we provided, and the versions of our materials are the latest versions when this course was made.



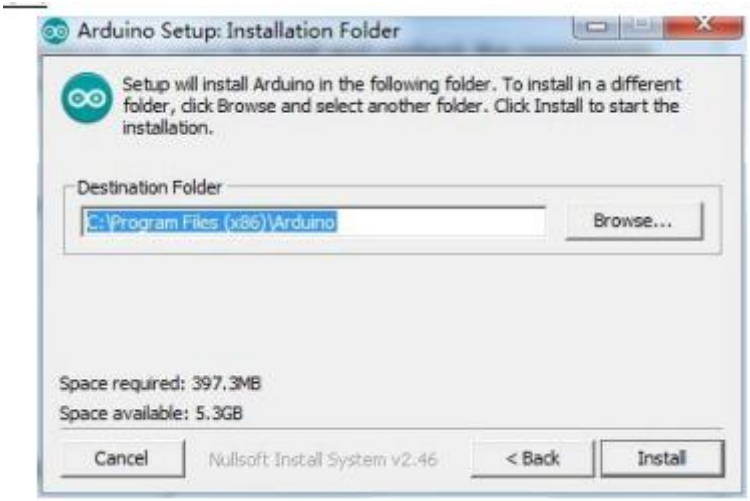
Installing Arduino (Windows)

Install Arduino with the exe. Installation package.

Click I Agree to see the following interface.

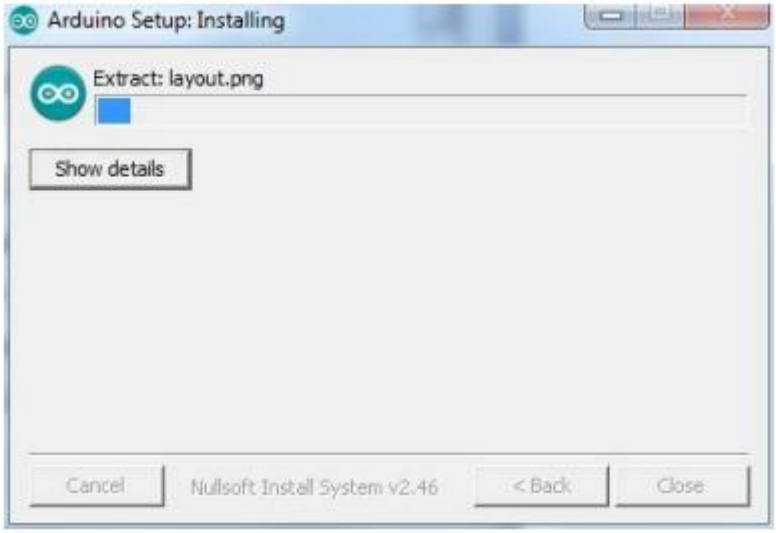


Click Next



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

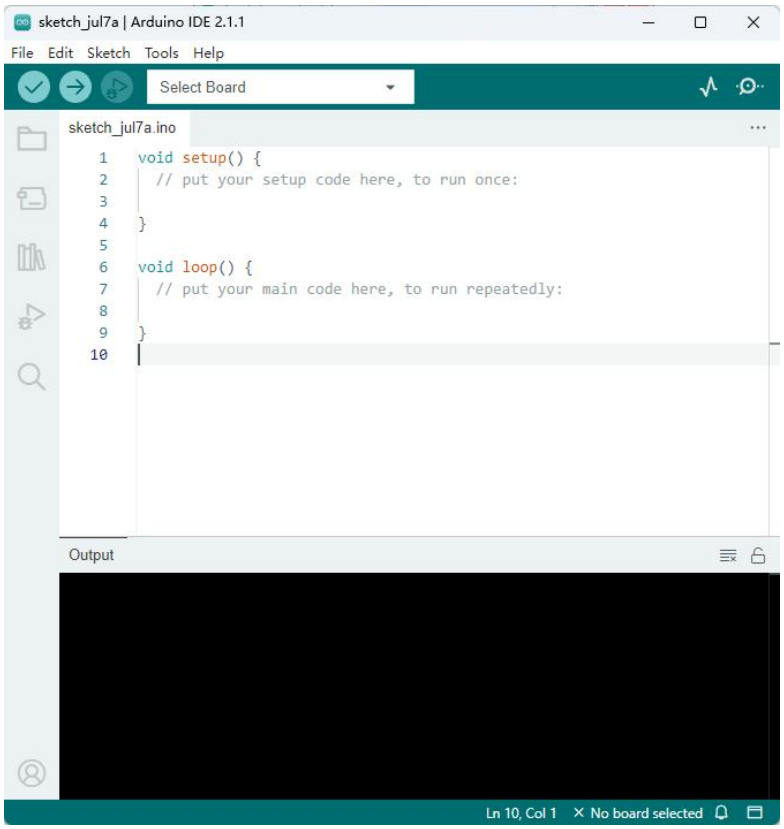
Click Install to initiate installation



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

Next, the following icon appears on the desktop

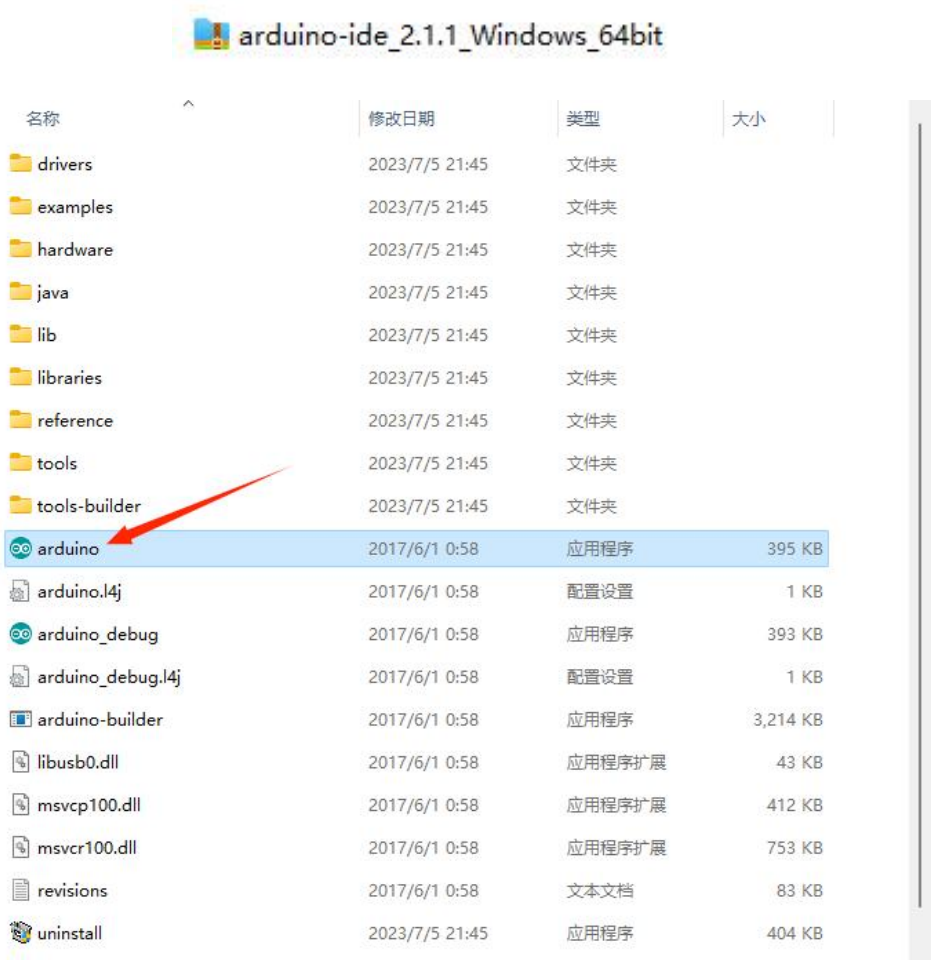
Double-click to enter the desired development environment

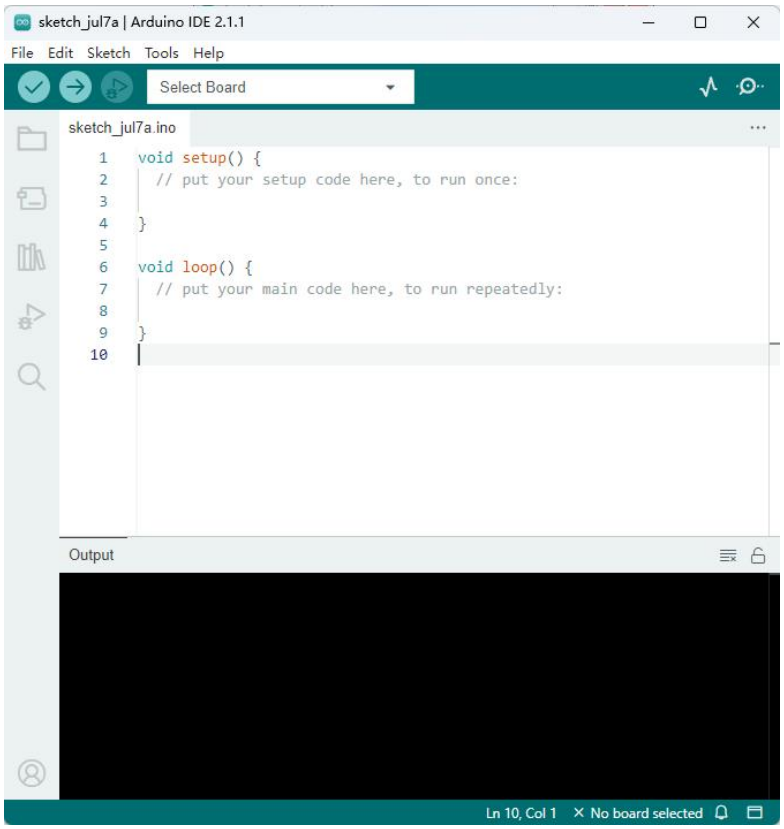


You may directly choose the installation package for installation and

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.

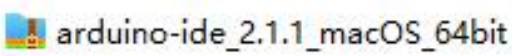
Unzip the zip file downloaded, Double-click to open the program and enter the desired development environment.





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)

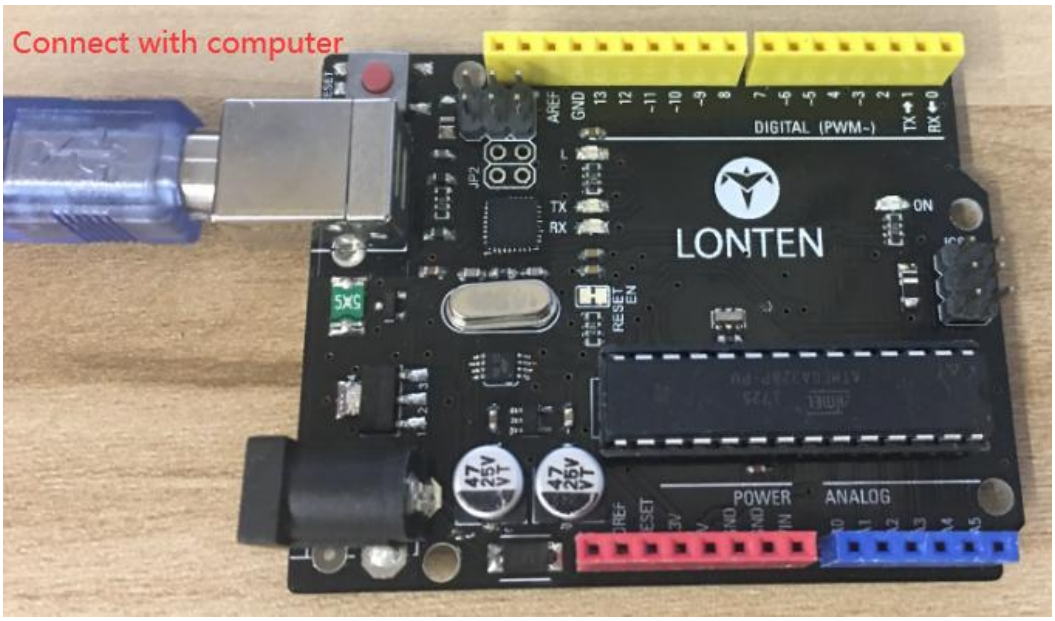
You will have to use the make install command. If you are using the Ubuntu system, it is recommended to install Arduino IDE from the software center of Ubuntu.

arduino-ide_2.1.1_Linux_64bit

How to Install Arduino Driver

For Windows

Arduino UNO

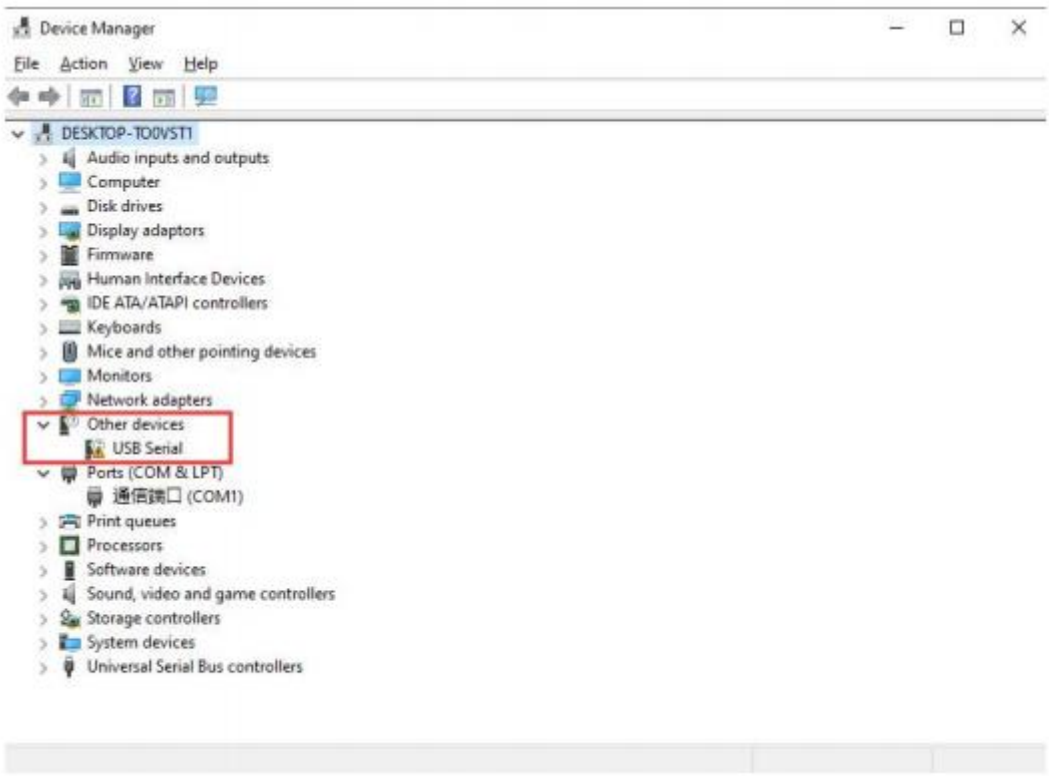


The USB to serial port chip of this control board is CH340G. So you need to install the driver for the chip. You can click the driver file here.

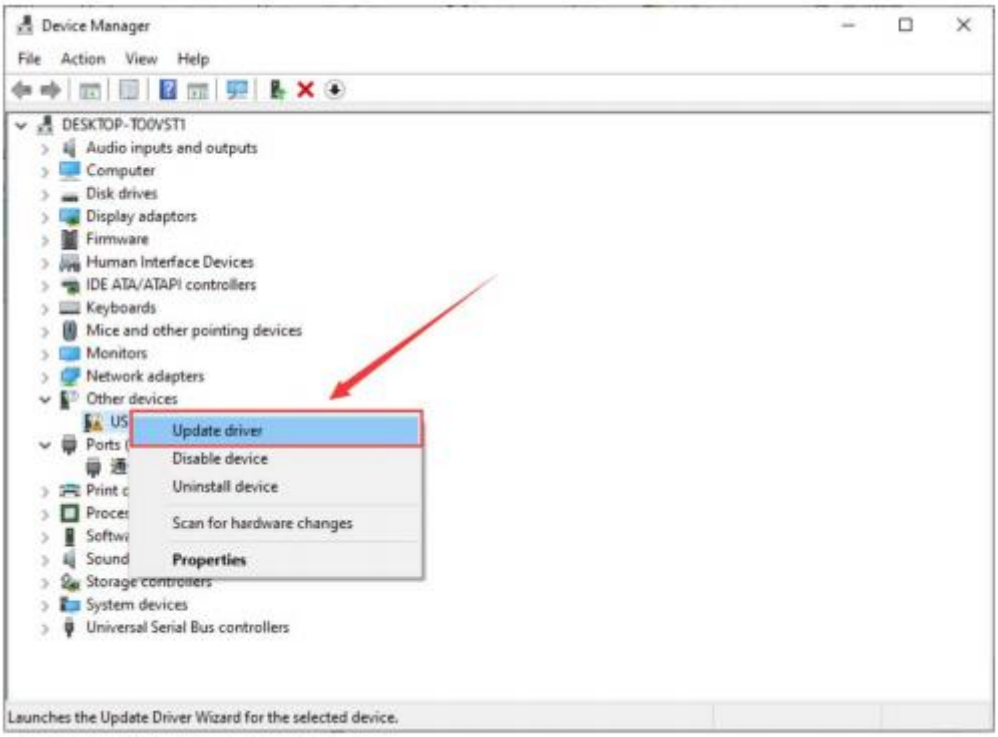
In different systems, the driver installation is similar. Here we start to install the driver on the Win10 system. You can find the "USB_Drive_CH341_3_1" folder in the information we provide, this is the driver file we want to install.

Plug one end of your USB cable into the Arduino UNO CH340 Board and the other into a USB socket on your computer.

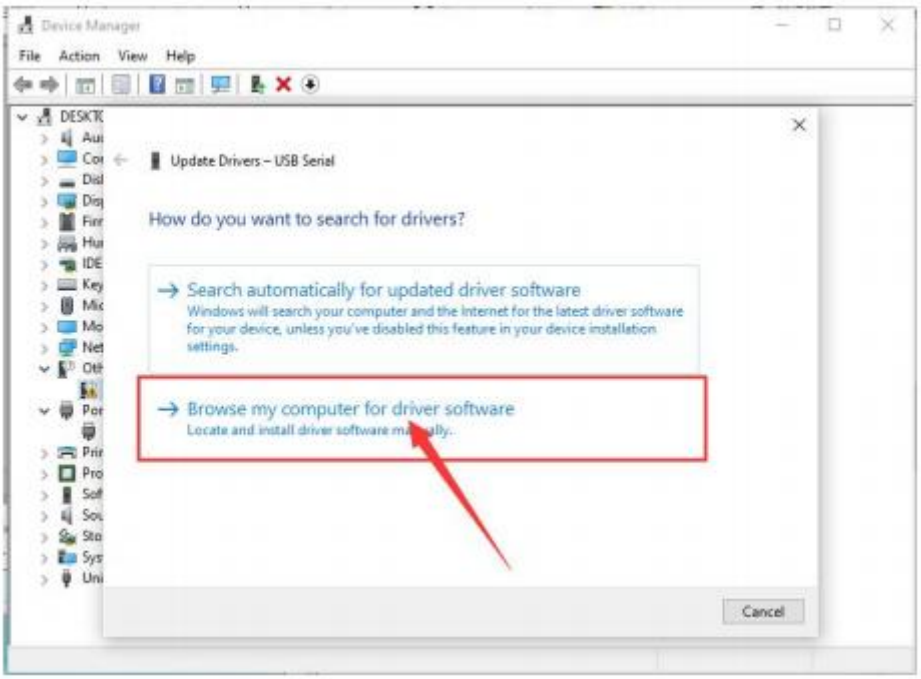
When you connect the Arduino UNO CH340 Board to your computer at the first time, right click your “My Computer”—>for “Properties”—>click the “Device manager”, under Other devices, you should see the “USB-Serial” or “Unknown device ”.Or you can search for "devi" in your computer, or you can open the device manager of your computer.



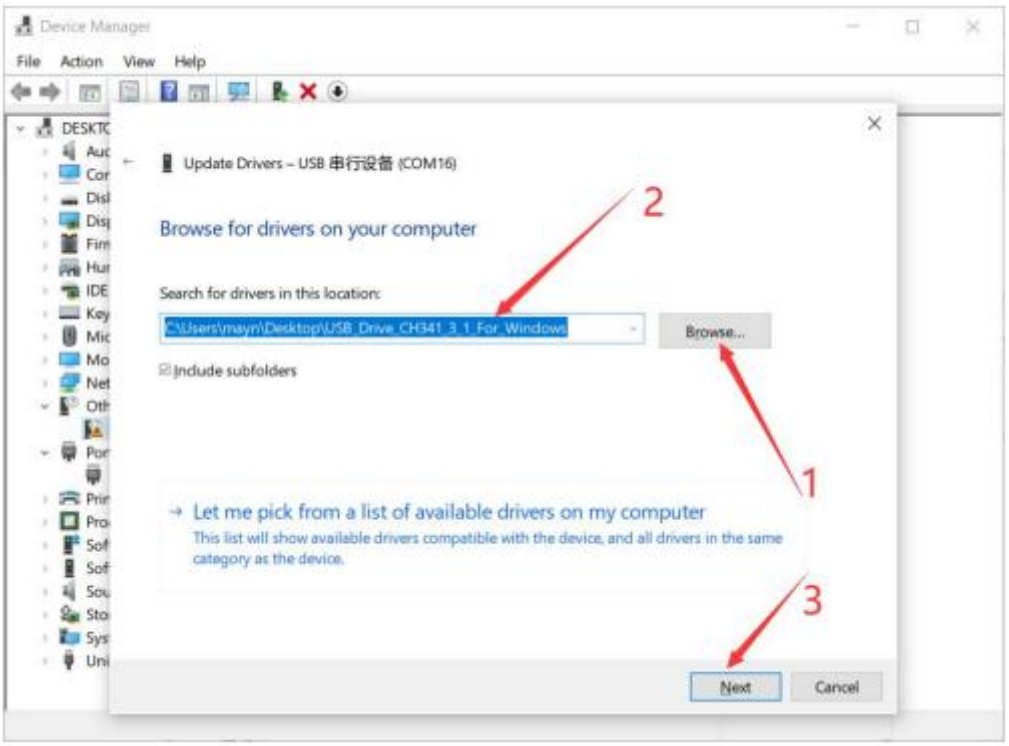
Then right-click on the device and select the top menu option (Update Driver Software...) shown as the figure below.



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”.

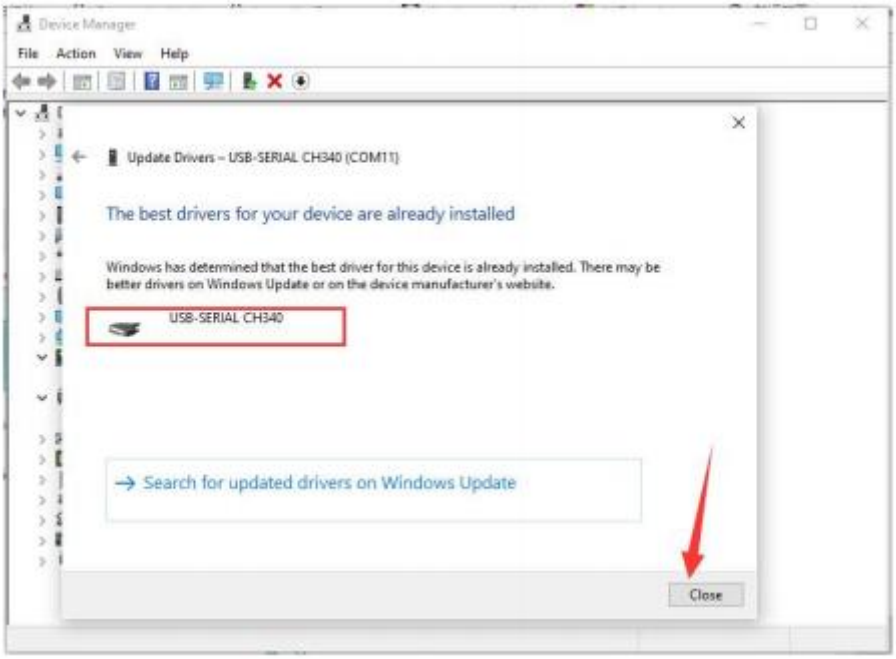


After that, select the browse option and navigate to the drive folder "USB_Drive_CH341_3_1", which can be found in the information we provide.(Note that the file path selects the location of the .For example, I store this driver file on the computer desktop, so the file path I choose is C:\Users\mayn\Desktop\USB_Drive_CH341_3_1_For_Windows)

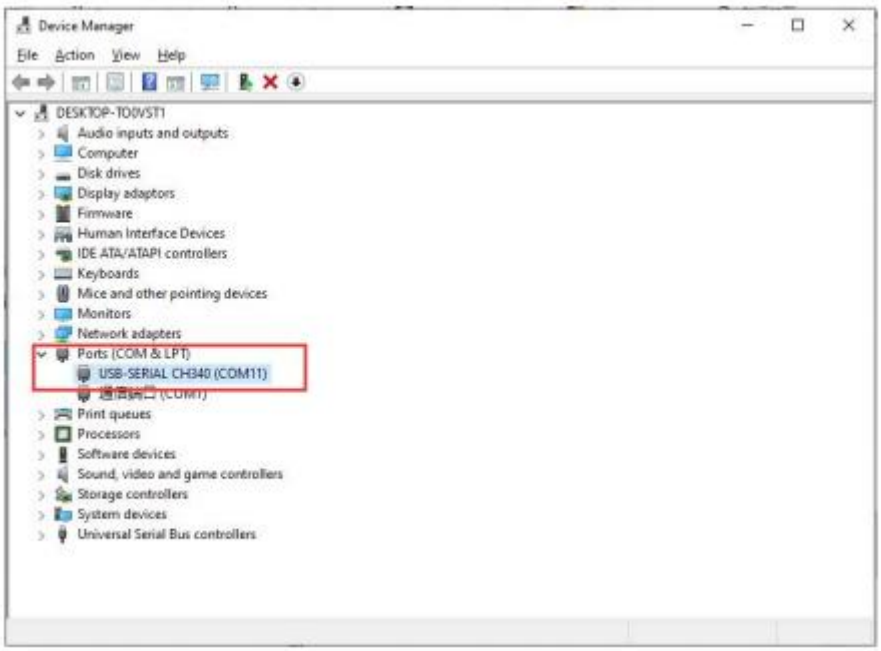


Once the software has been installed, you will get a confirmation message.

Installation completed, click “Close”.



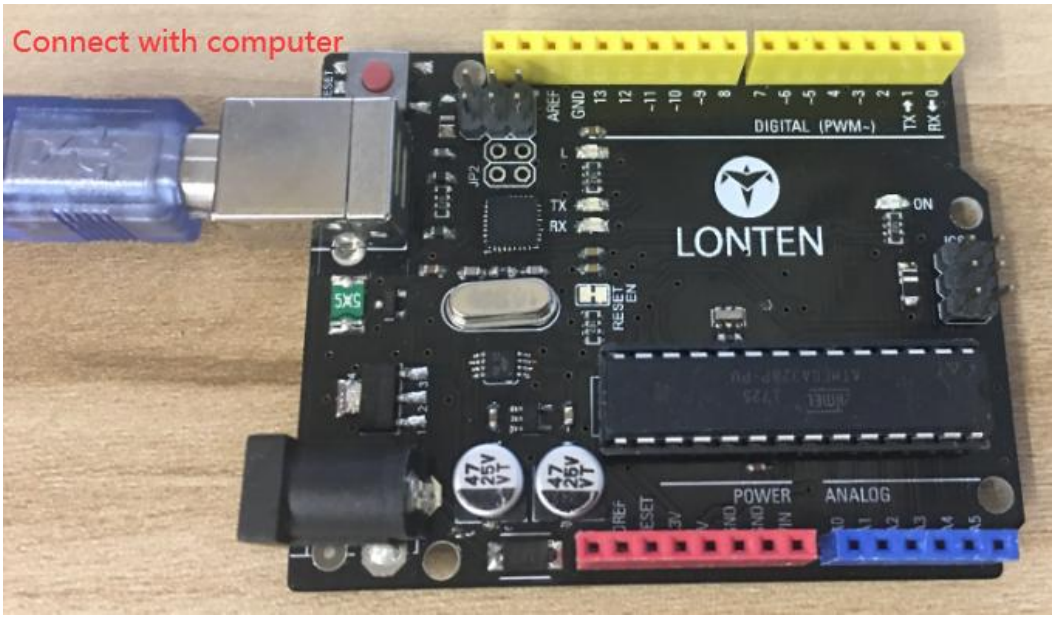
Up to now, the driver is installed well. Then you can right click “My Computer”—>for “Properties”—>click the “Device manager”, you should see the device as the figure shown below. Or you can search for "devi" in your computer, or you can open the device manager of your computer.



For MAC System

Arduino UNO

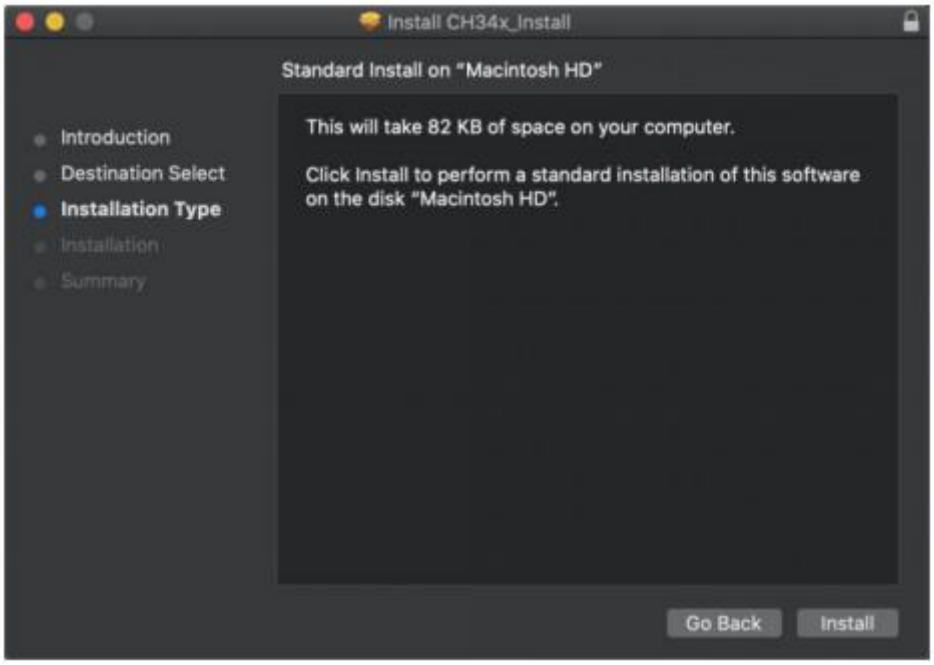
Plug one end of your USB cable into the Arduino UNO CH340 Board and the other into a USB socket on your computer.



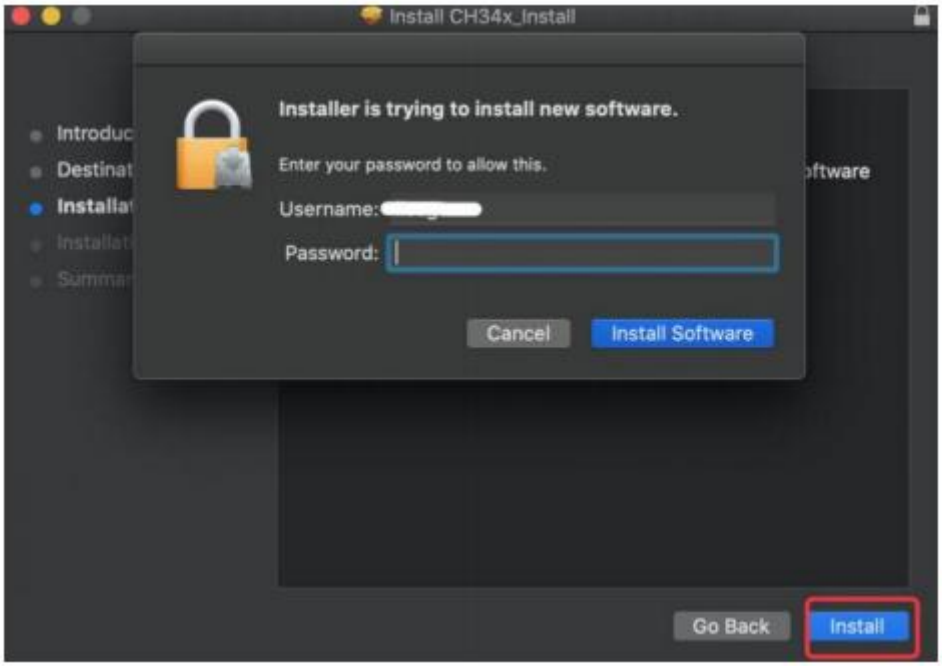
The driver file of the CH340G of the MAC system is provided in the tutorial data package.

Double-click installation package and tap Continue

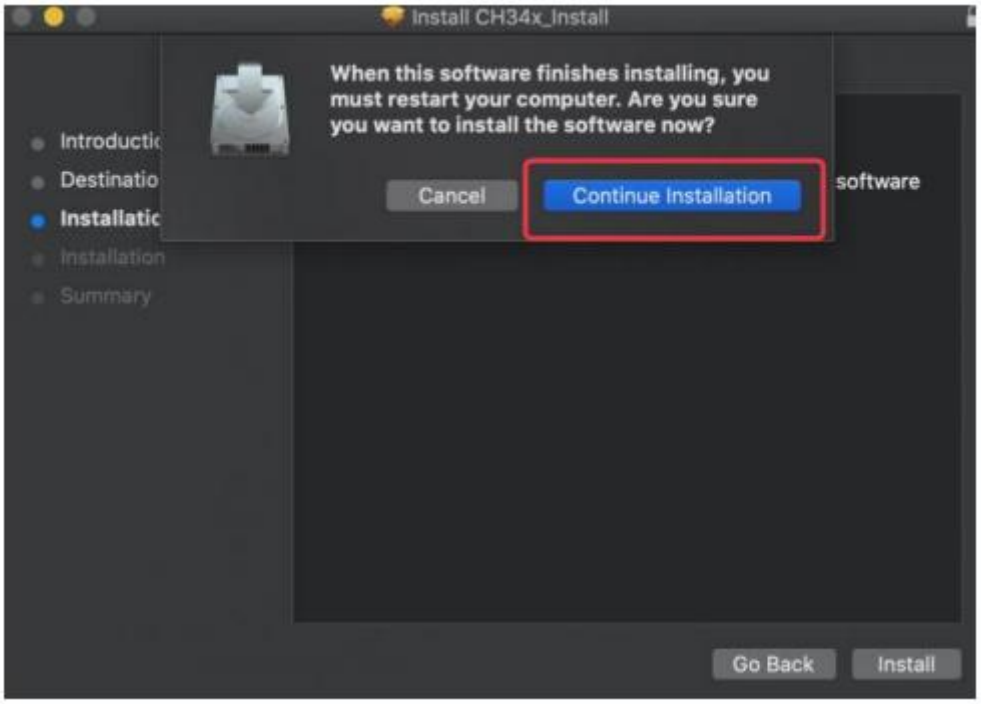
Click Install



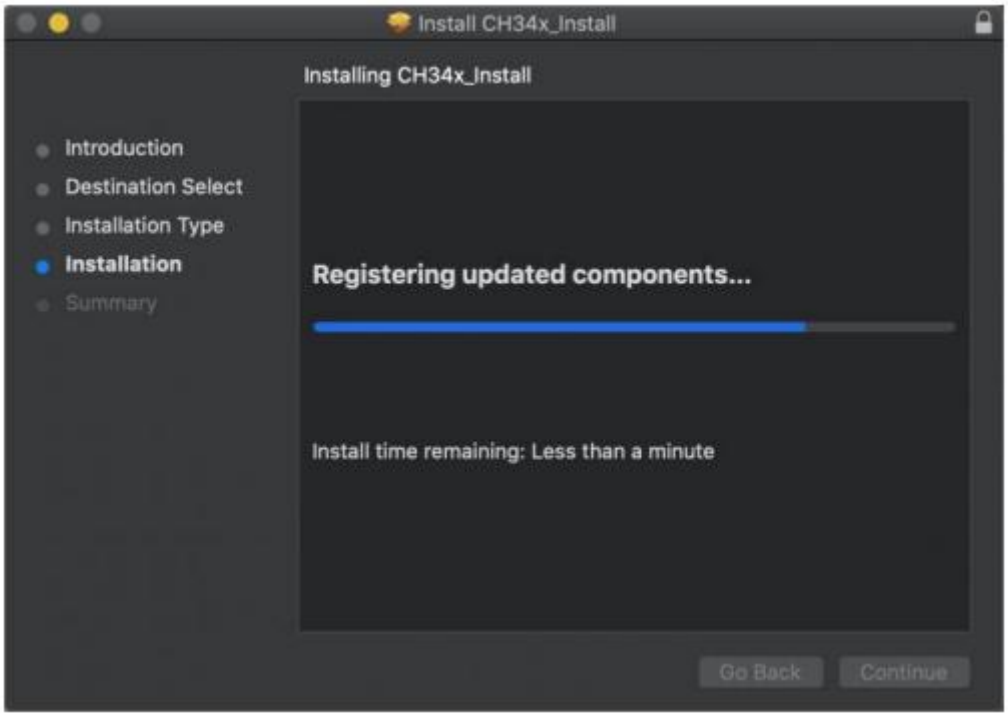
Input your user password and click Install Software



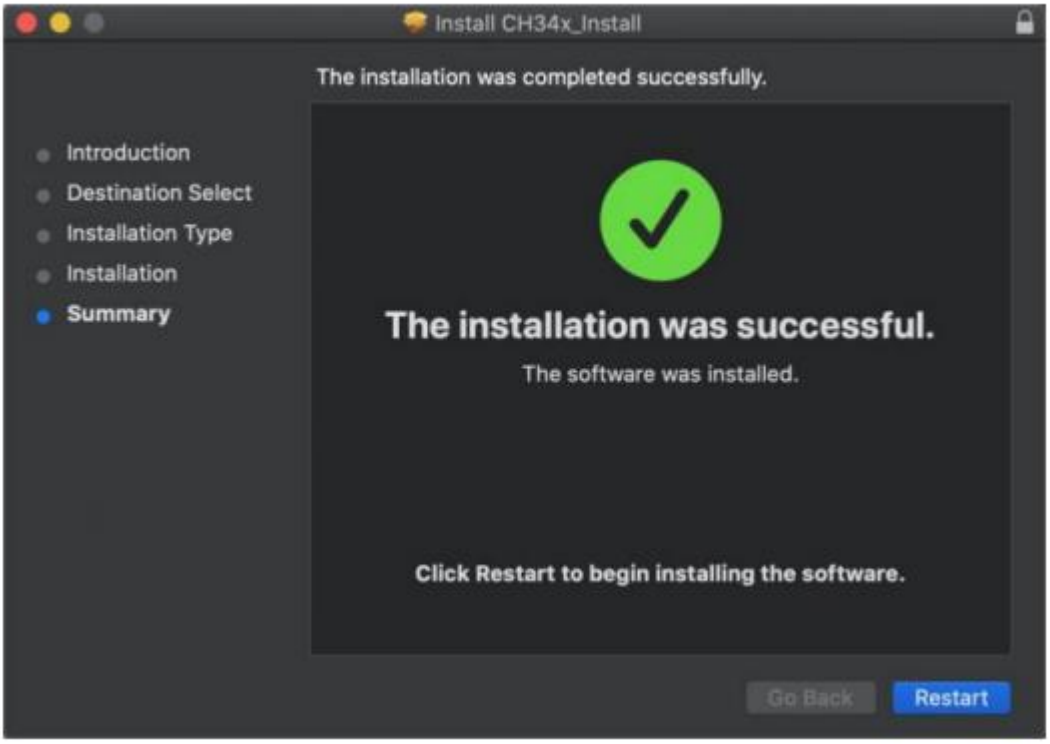
Tap Continue Installation



Wait to install



Click Restart after the installation is finished



A

dd Libraries and Open Serial Monitor

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?

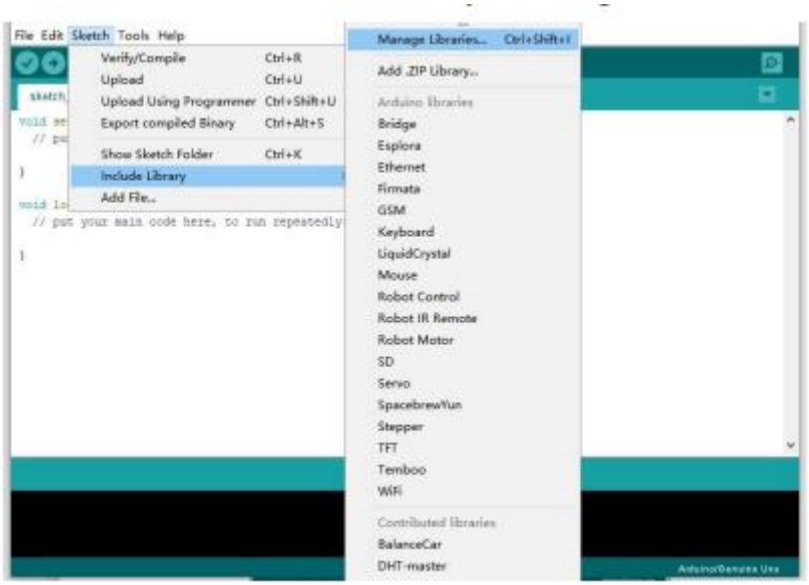
Libraries are a collection of code that makes it easy for you to connect to a sensor, display, module, etc. For example, the built-in Liquid Crystal library makes it easy to talk to character LCD displays. There are hundreds of additional libraries available on the Internet for download. The built-in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

the reference. To use the additional libraries, you will need to install them.

How to Install a Library

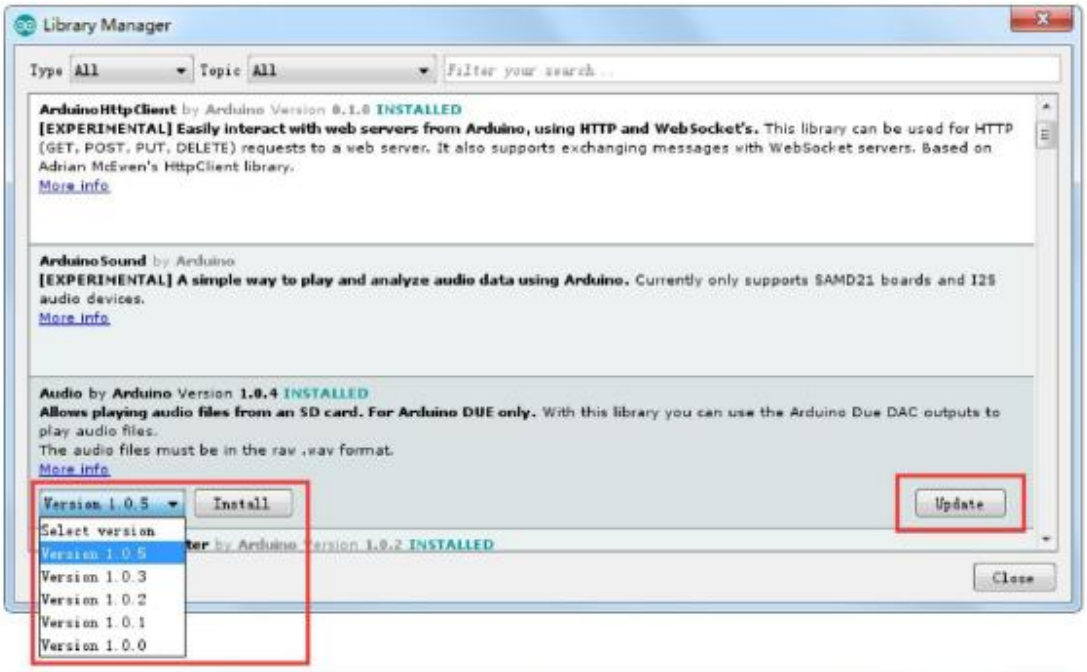
Using the Library Manager

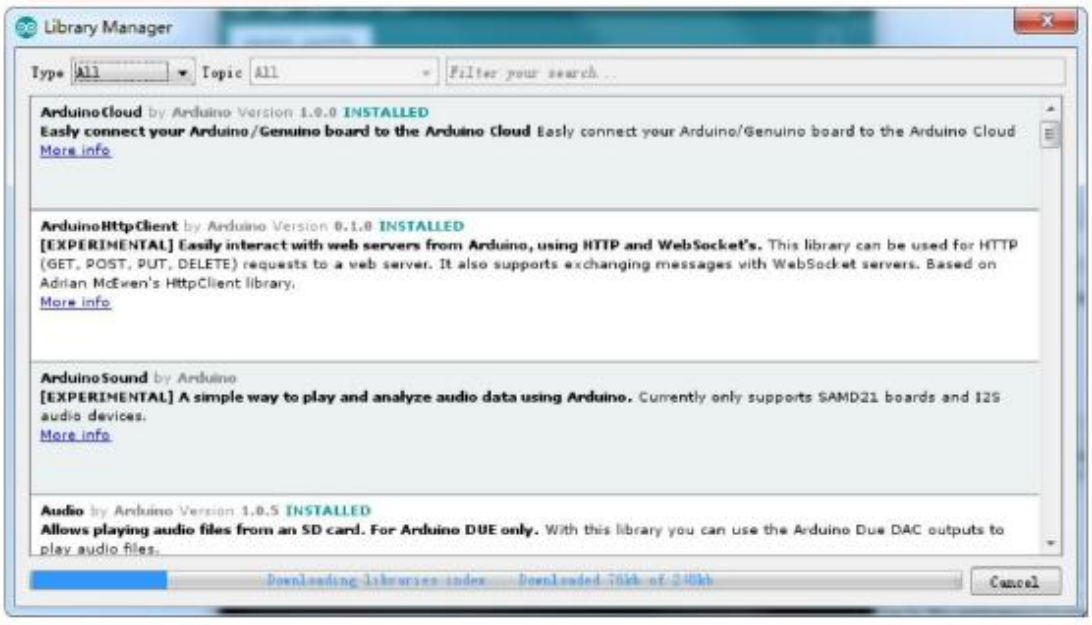
To install a new library into your Arduino IDE you can use the Library Manager (available from IDE version 1.8.0). Open the IDE and click to the "Sketch" menu and then Include Library > Manage Libraries.



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.

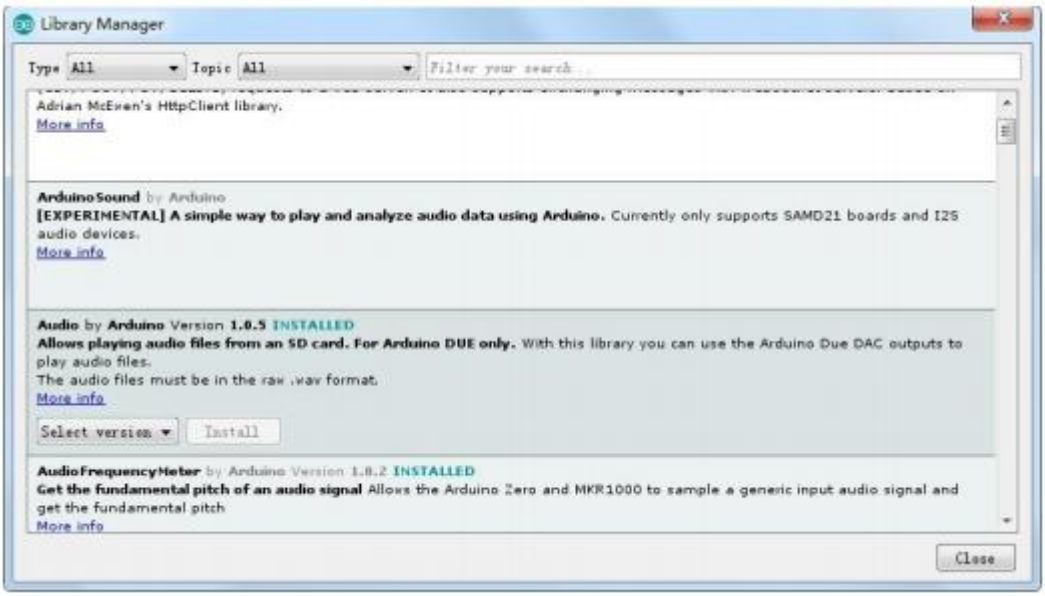




Finally click on install and wait for the IDE to install the new library.

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.



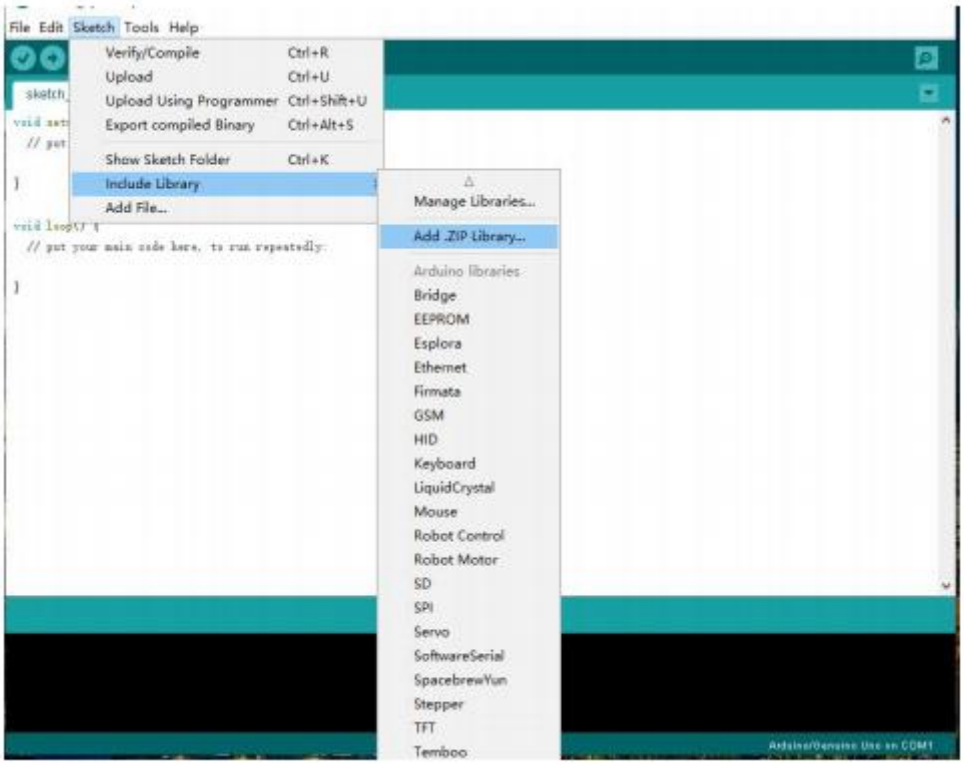
You can now find the new library available in the Include Library menu.

If you want to add your own library open a new issue on Github.

Importing a .zip Library

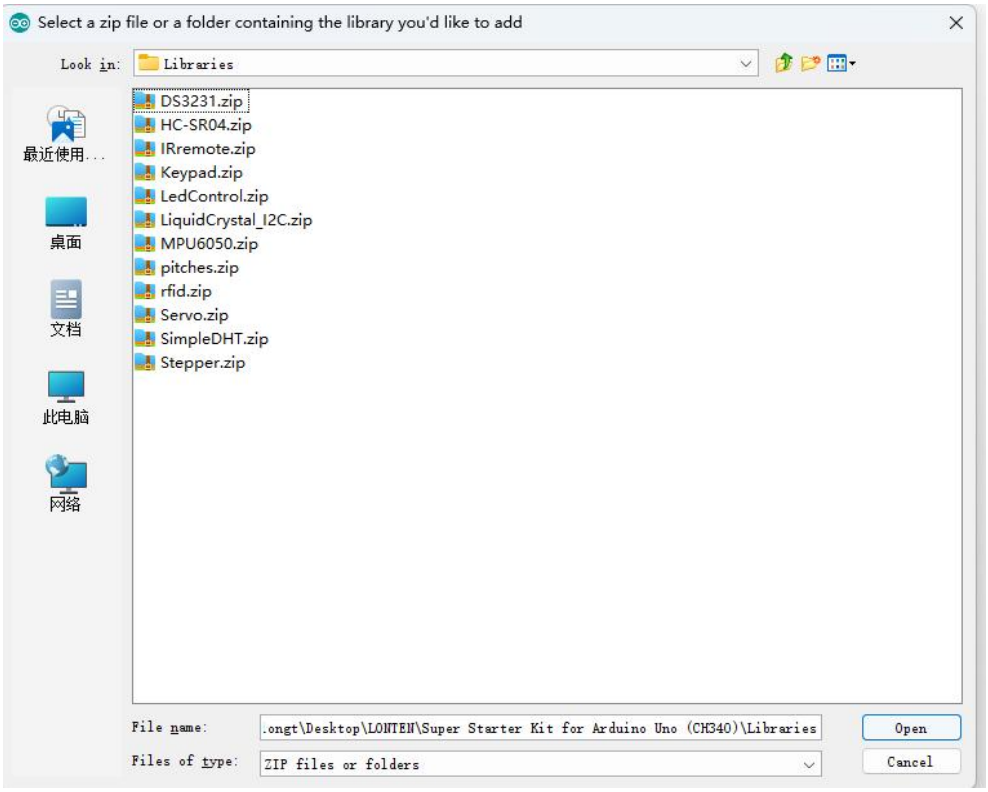
Libraries are often distributed as a ZIP file or folder. The name of the folder is the name of the library. Inside the folder will be a .cpp file, a .h file and often a keywords.txt file, examples folder, and other files required by the library. Starting with version 1.0.5, you can install 3rd party libraries in the IDE. Do not unzip the downloaded library, leave it as is.

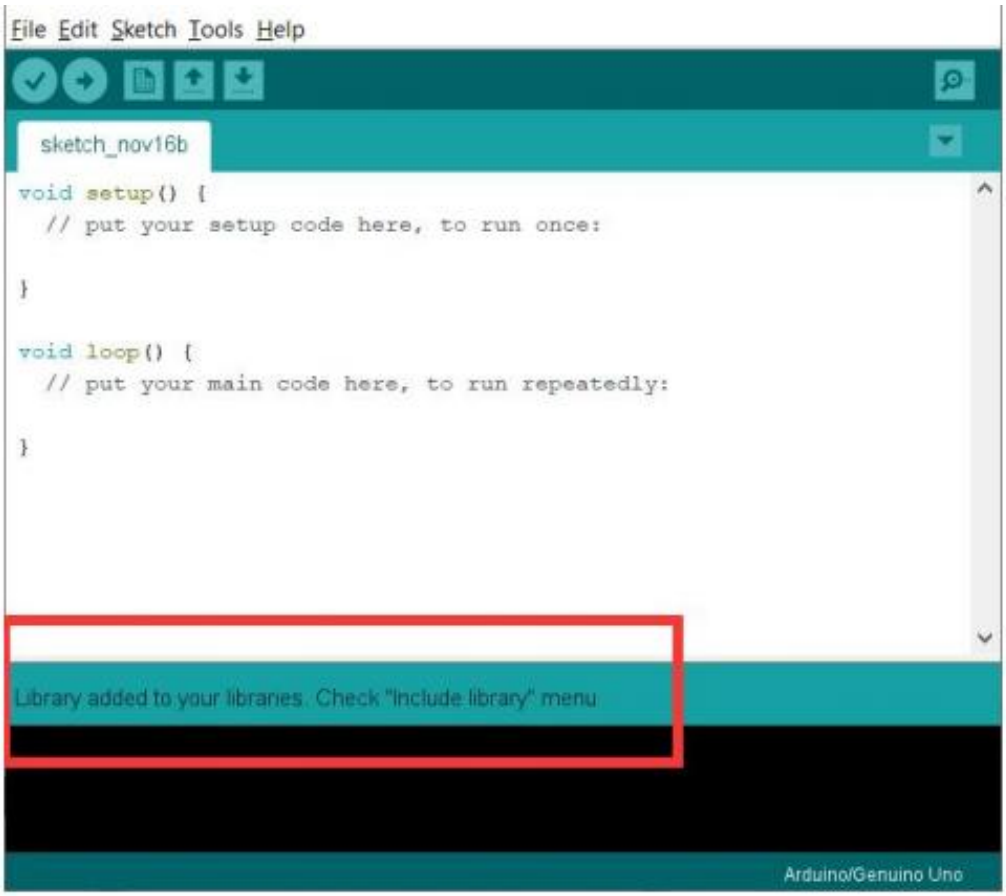
In the Arduino IDE, navigate to Sketch > Include Library. At the top of the drop down list, select the option to "Add .ZIP Library".



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

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


Select a zip file or a folder containing the library you'd like to add
Look in: Libraries
DS3231.zip
HC-SR04.zip
IRremote.zip
Keypad.zip
LedControl.zip
LiquidCrystal_I2C.zip
MPU6050.zip
pitches.zip
rfid.zip
Servo.zip
SimpleDHT.zip
Stepper.zip
最近使用...
桌面
文档
此电脑
网络
File name: .ongt\Desktop\LOUTEN\Super Starter Kit for Arduino Uno (CH340)\Libraries
Files of type: ZIP files or folders
Open
Cancel


File Edit Sketch Tools Help
sketch_nov16b
void setup() {
// put your setup code here, to run once:
}
void loop() {
// put your main code here, to run repeatedly:
}
Library added to your libraries. Check "include library" menu
Arduino/Genuino Uno

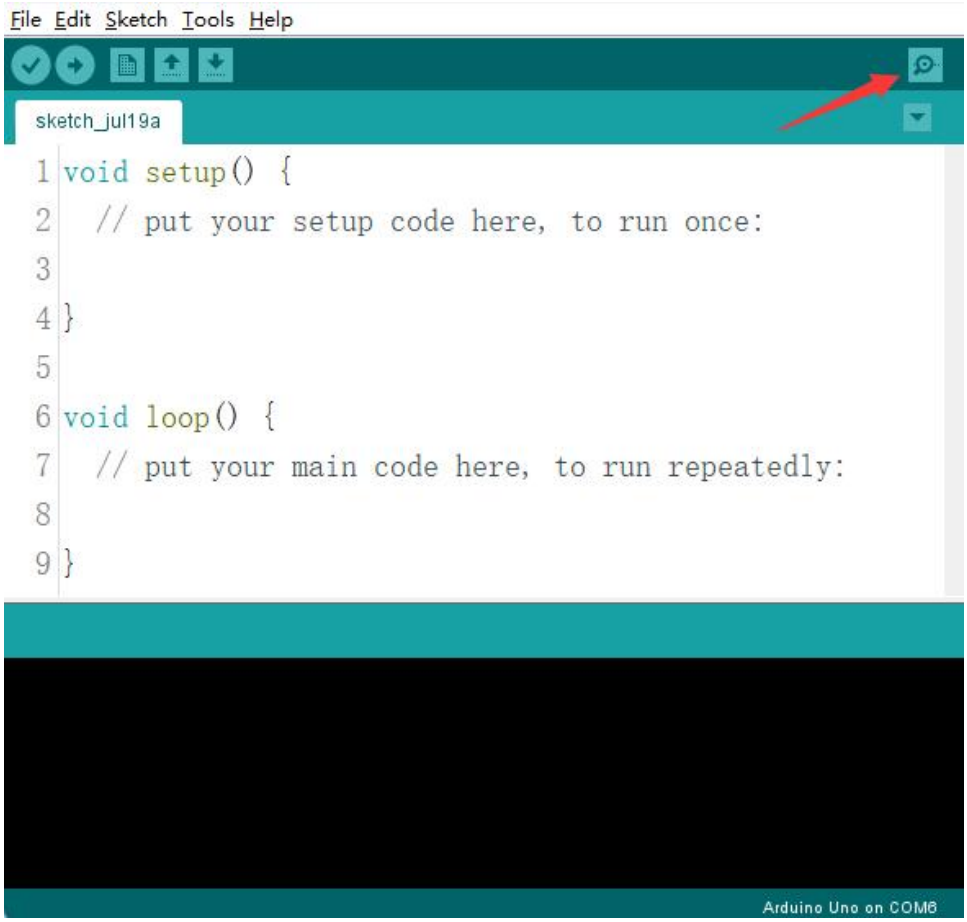
Return to the Sketch > Import Library menu. You should now see the library at the bottom of the drop-down menu. It is ready to be used in your sketch. The zip file will have been expanded in the libraries folder in your Arduino sketches directory. NB: the Library will be available to use in sketches,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

Arduino Serial Monitor (Windows, Mac, Linux)

The Arduino Integrated Development Environment (IDE) is the software side of the Arduino platform. And, because using a terminal is such a big part of working with Arduinos and other microcontrollers, they decided to include a serial terminal with the software. Within the Arduino environment, this is called the Serial Monitor.

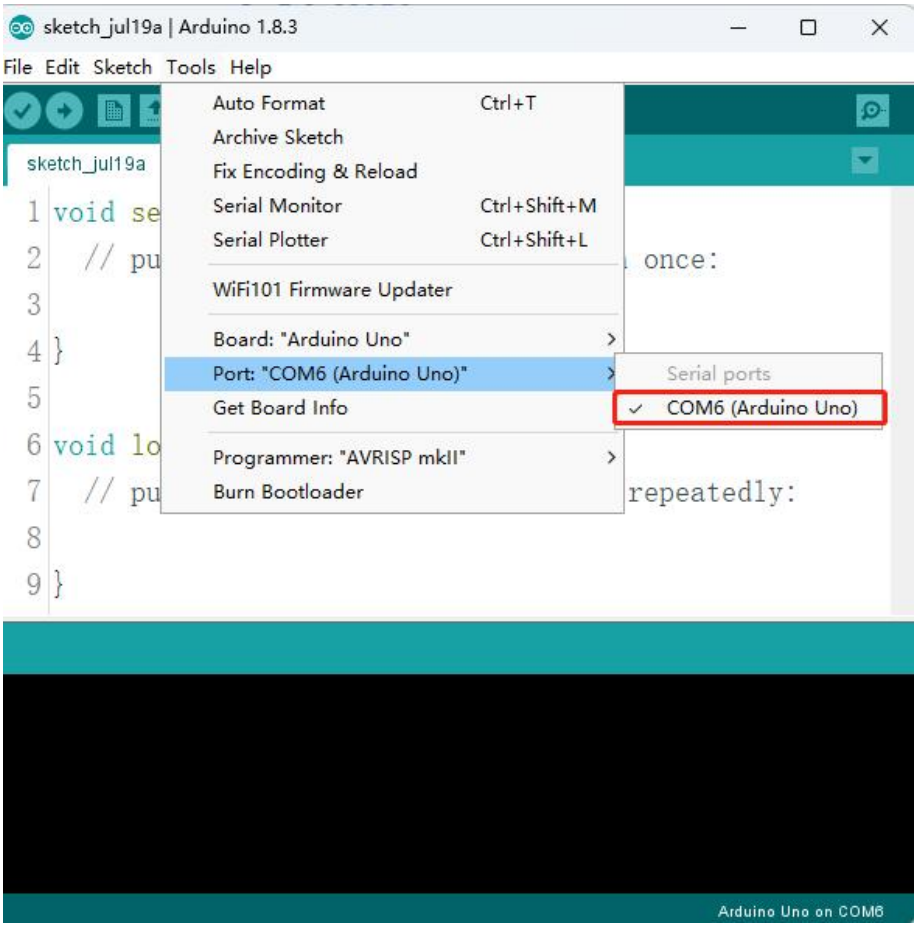
Making a Connection

Serial monitor comes with any and all version of the Arduino IDE. To open it, simply click the Serial Monitor icon.

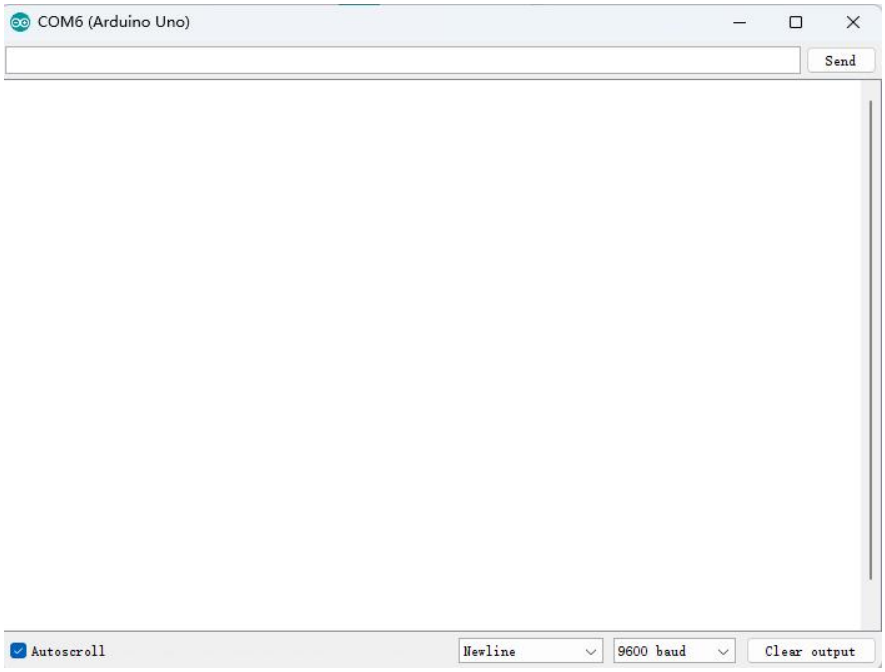


Selecting which port to open in the Serial Monitor is the same as selecting a port for uploading Arduino code. Go to Tools -> Serial Port, and select the correct port.

Tips: Choose the same COM port that you have in Device Manager.

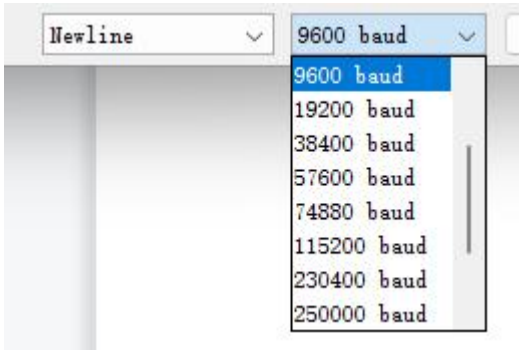


Once open, you should see something like this:



Settings

The Serial Monitor has limited settings, but enough to handle most of your serial communication needs. The first setting you can alter is the baud rate. Click on the baud rate drop-down menu to select the correct baud rate. (9600 baud)



Last, you can set the terminal to Autoscroll or not by checking the box in the bottom left corner.

Pros

The Serial Monitor is a great quick and easy way to establish a serial connection with your Arduino. If you're already working in the Arduino IDE, there's really no need to open up a separate terminal to display data.

Cons

The lack of settings leaves much to be desired in the Serial Monitor, and, for advanced serial communications, it may not do the trick.

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.

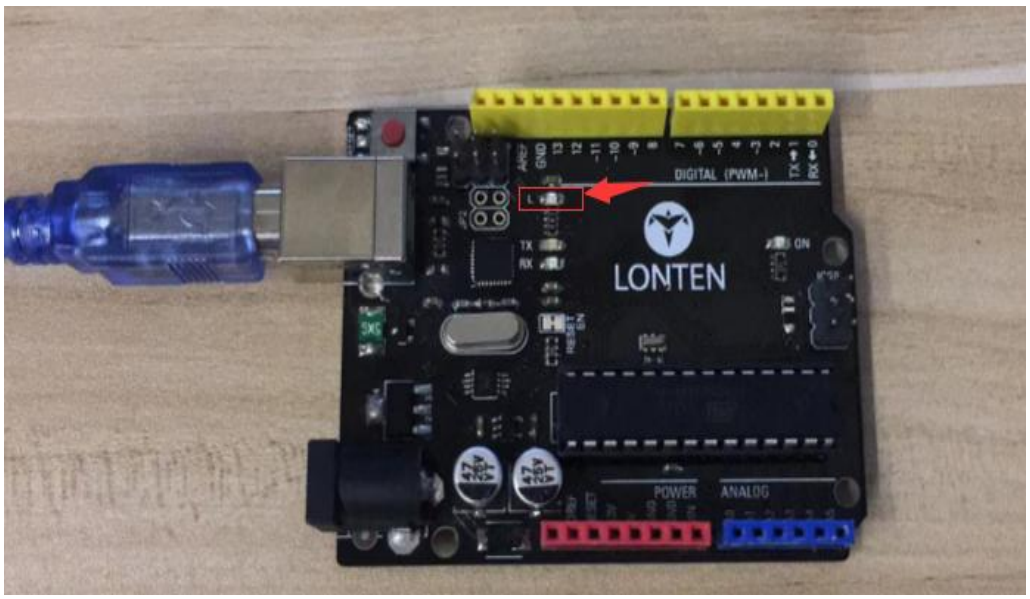
Component Required:

LONTEN Uno R3 Board* 1

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.

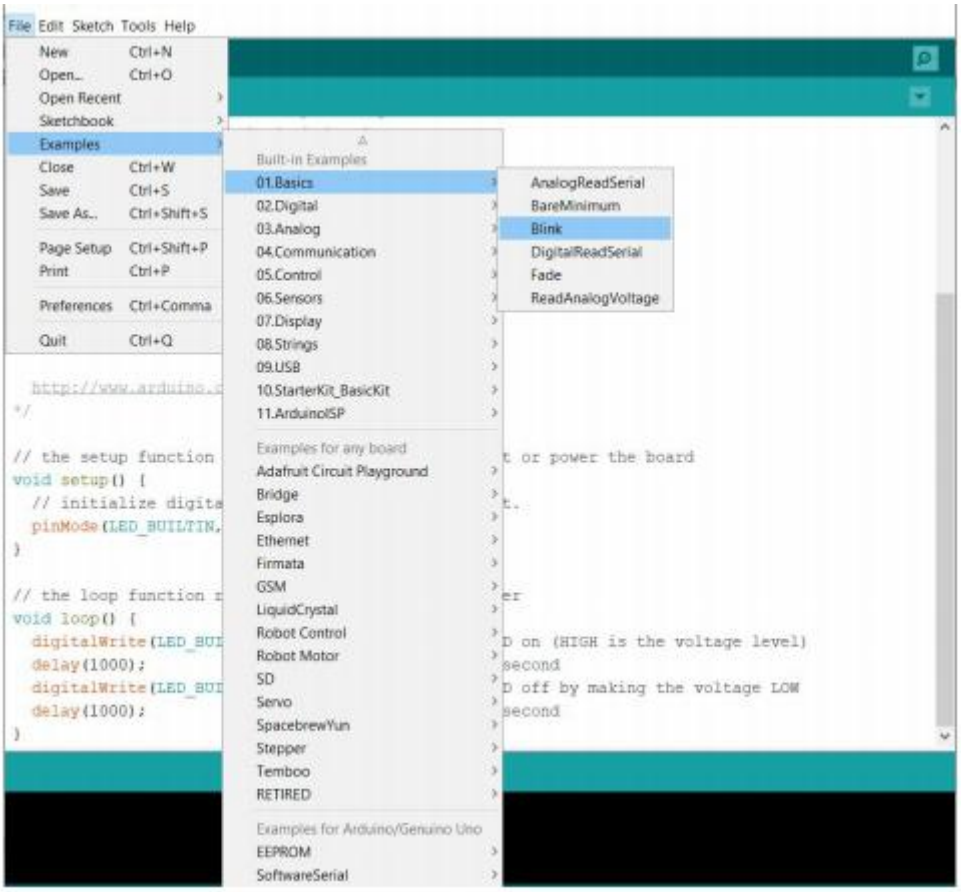


In this Project, we will reprogram the UNO board with our own Blink sketch and then change the rate at which it blinks.

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.

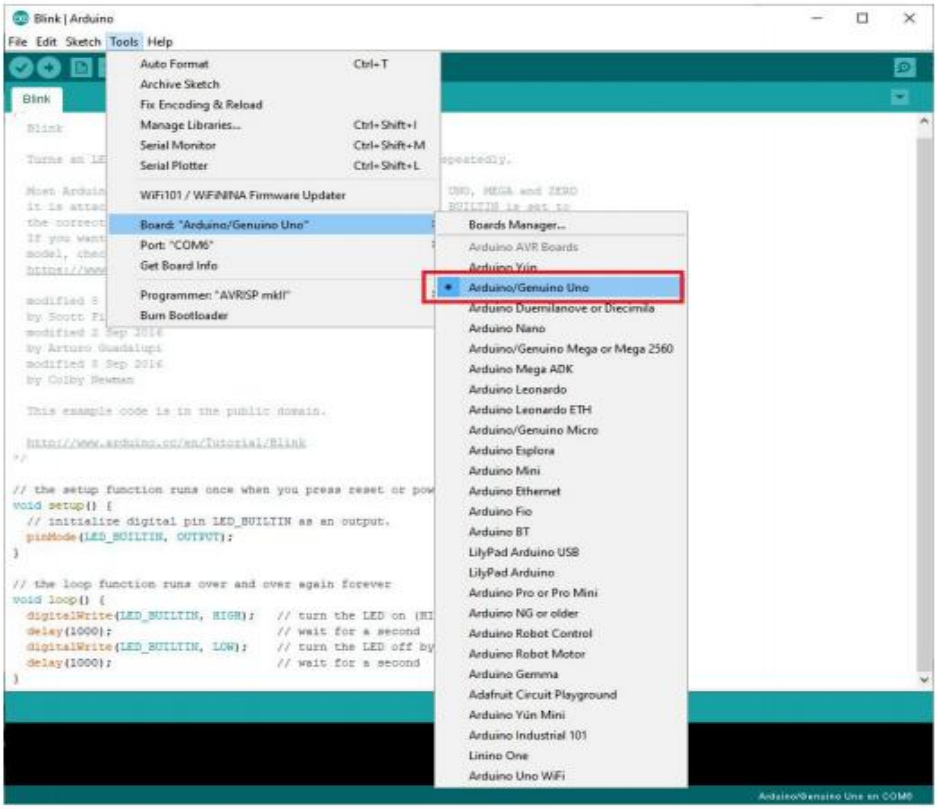
The Arduino IDE includes a large collection of example sketches that you can load up and use. This includes an example sketch for making the 'L' LED blink.

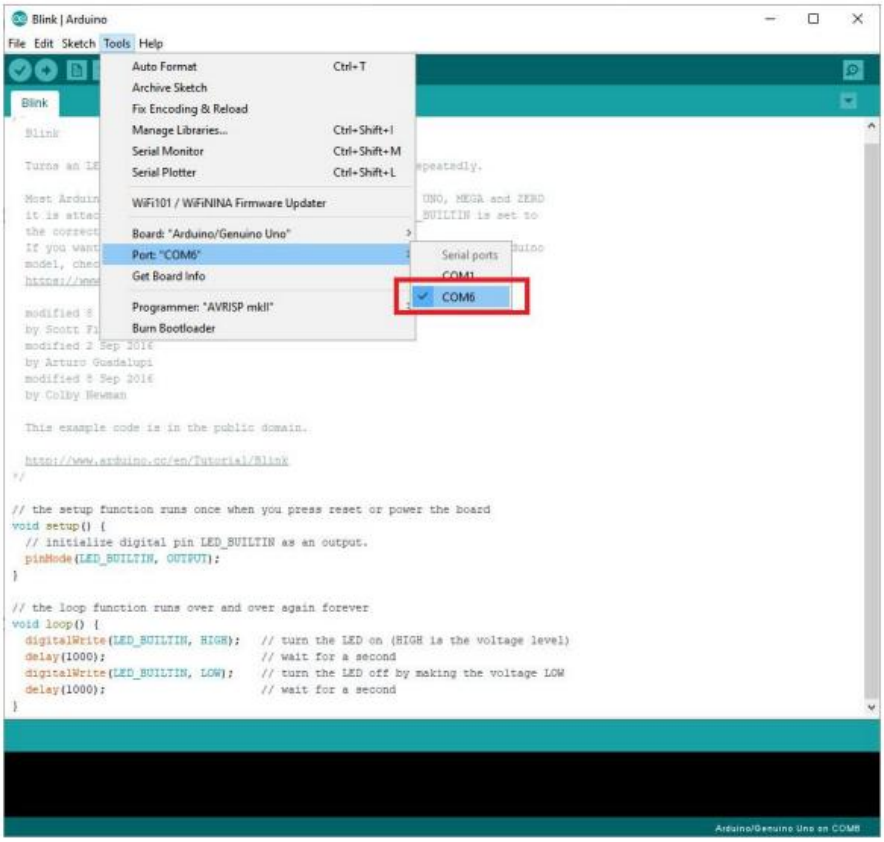
Load the 'Blink' sketch that you will find in the IDE's menu system under File > Examples > 01.Basics>Blink

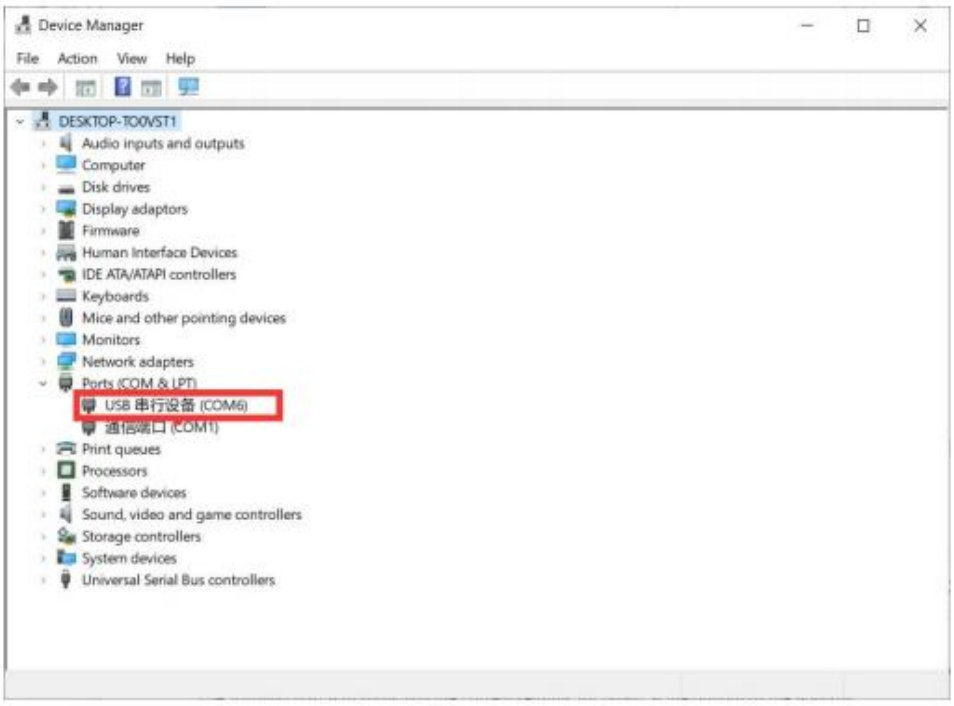


When the sketch window opens, enlarge it so that you can see the entire sketch in the window.

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


Blink | Arduino
File Edit Sketch Tools Help
Auto Format Ctrl+T
Archive Sketch
Fix Encoding & Reload
Manage Libraries... Ctrl+Shift+I
Serial Monitor Ctrl+Shift+M
Serial Plotter Ctrl+Shift+L
WiFi101 / WiFiNINA Firmware Updater
Board: "Arduino/Genuino Uno"
Port: "COM6"
Get Board Info
Programmer: "AVRISP mkII"
Burn Bootloader
Boards Manager...
Arduino AVR Boards
Arduino Yún
Arduino/Genuino Uno
Arduino Duemilanove or Diecimila
Arduino Nano
Arduino/Genuino Mega or Mega 2560
Arduino Mega ADK
Arduino Leonardo
Arduino Leonardo ETH
Arduino/Genuino Micro
Arduino Esplora
Arduino Mini
Arduino Ethernet
Arduino Fio
Arduino BT
LilyPad Arduino USB
LilyPad Arduino
Arduino Pro or Pro Mini
Arduino NG or older
Arduino Robot Control
Arduino Robot Motor
Arduino Gemma
Adafruit Circuit Playground
Arduino Yún Mini
Arduino Industrial 101
Linino One
Arduino Uno WiFi

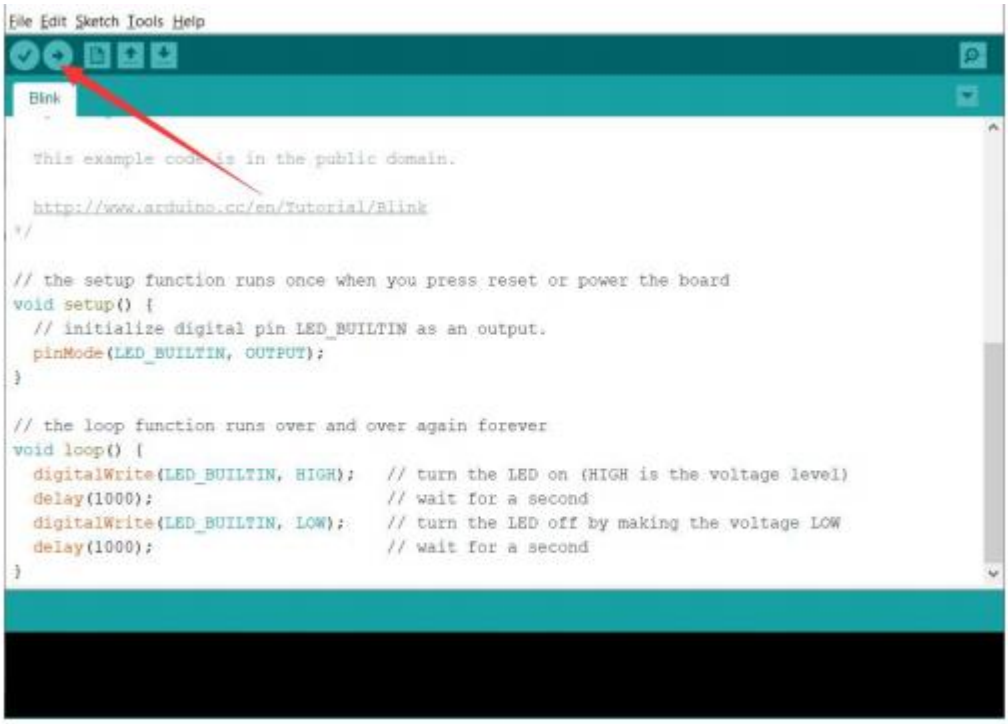

Blink | Arduino
File Edit Sketch Tools Help
Auto Format Ctrl+T
Archive Sketch
Fix Encoding & Reload
Manage Libraries... Ctrl+Shift+I
Serial Monitor Ctrl+Shift+M
Serial Plotter Ctrl+Shift+L
WiFi101 / WiFiNINA Firmware Updater
Board: "Arduino/Genuino Uno"
Port: "COM6"
Get Board Info
Programmer: "AVRISP mkII"
Burn Bootloader
Serial ports
COM1
COM6
// the setup function runs once when you press reset or power the board
void setup() {
// initialize digital pin LED_BUILTIN as an output.
pinMode(LED_BUILTIN, OUTPUT);
}
// the loop function runs over and over again forever
void loop() {
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
}



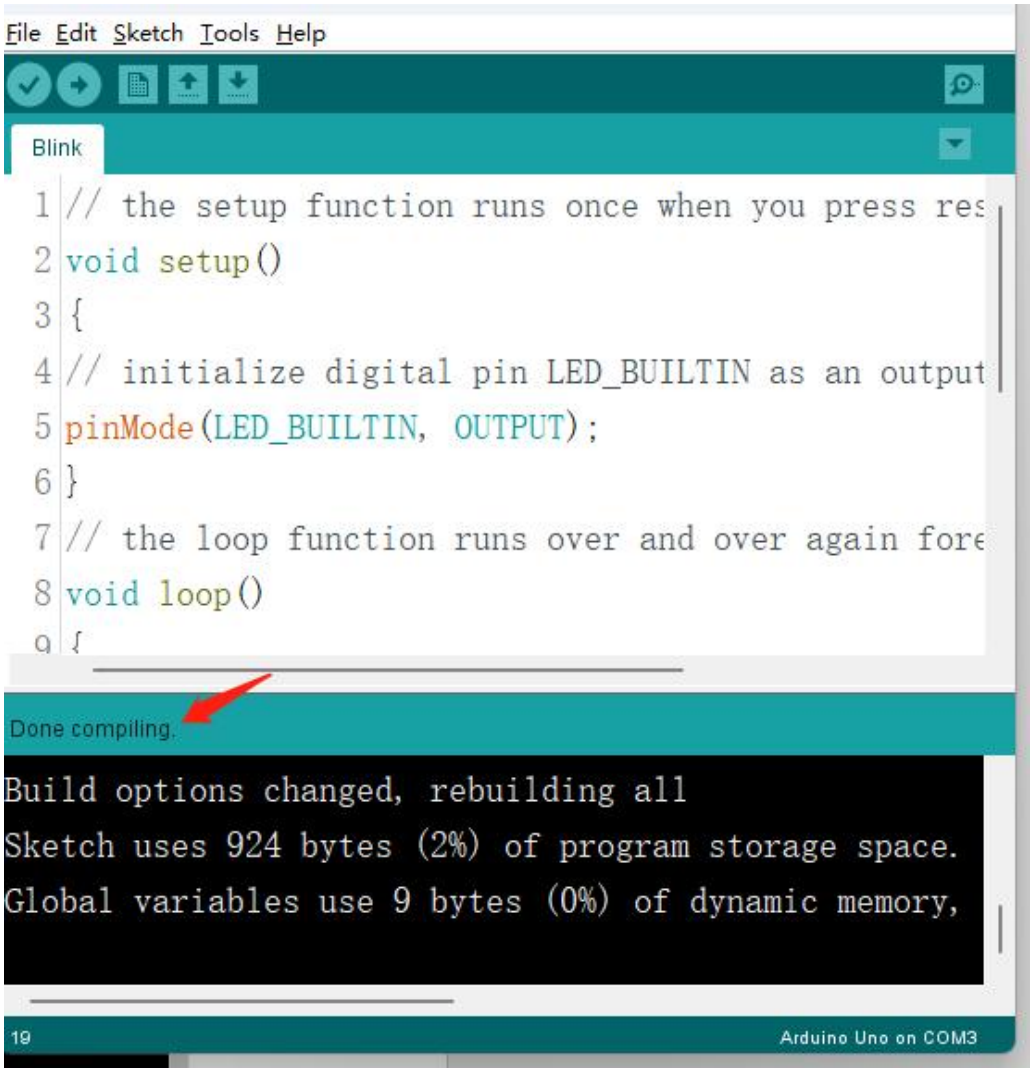
Note: The Board Type and Serial Port here are not necessarily the same as shown in picture. If you are using UNO, then you will have to choose Arduino UNO as the Board Type, other choices can be made in the same manner. And the Serial Port displayed for everyone is different, despite COM 6 chosen here, 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.

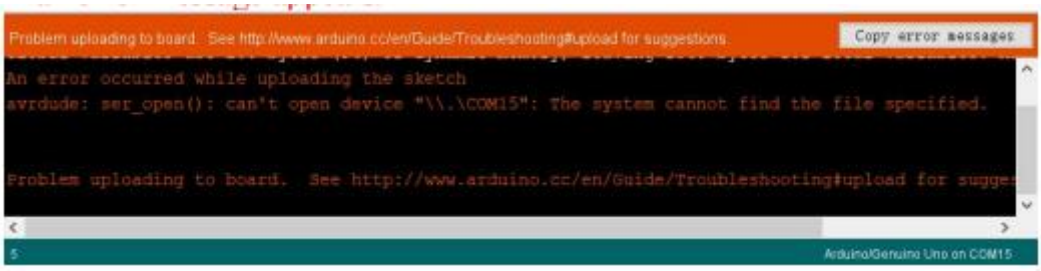
Click on the 'Upload' button. The second button from the left on the toolbar.



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



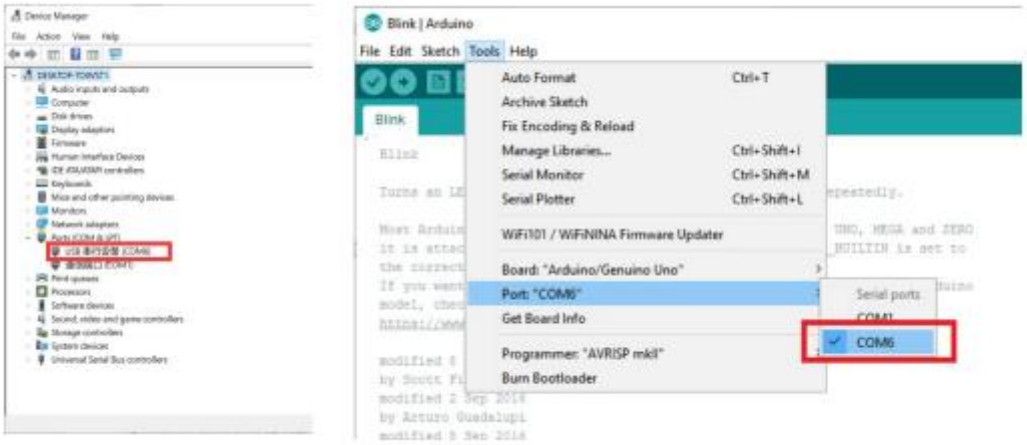
If an error message appears.



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.

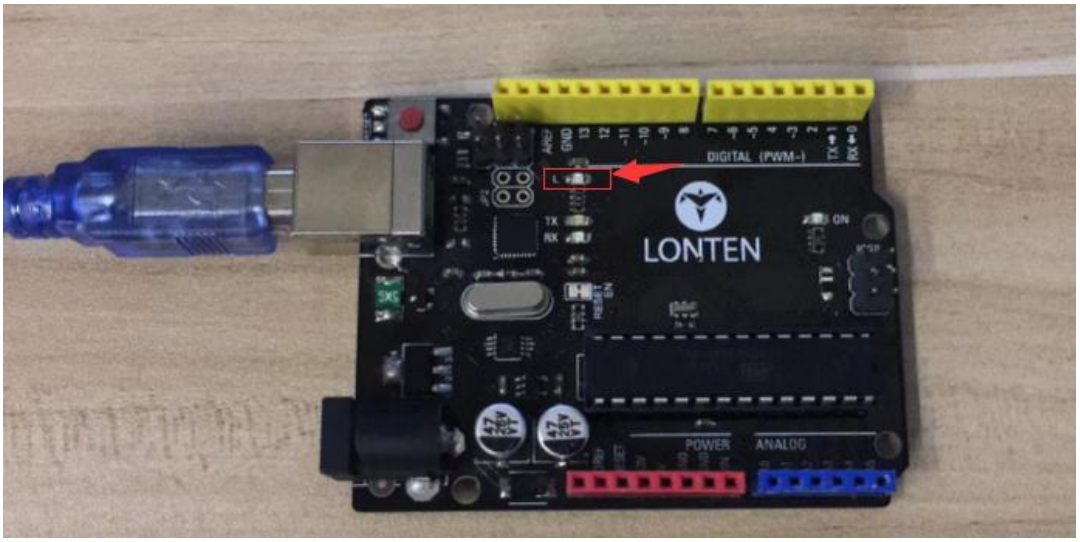


3. If your Arduino uno is connected to a Bluetooth module, it will occupy the communication serial port. You need to remove the Bluetooth module connection before uploading the code.

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.

Sample Program

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



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.

Lesson 1 LED

Overview

In this lesson, you will learn how to change the brightness of an LED by using different values of resistor.

Component Required:

(1) x LONTEN Uno R3 Board

(1) x 5mm red LED

(1) x 220 ohm resistor

(1) x 1k ohm resistor

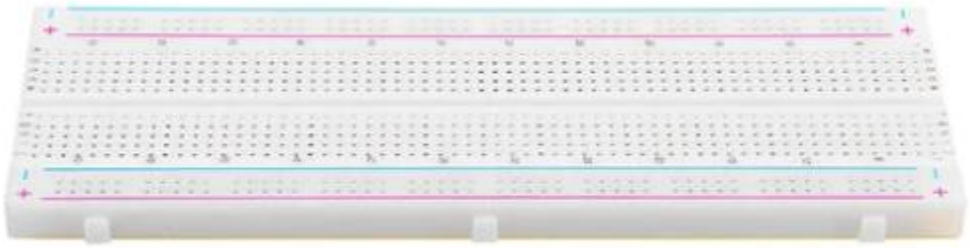
(1) x 10k ohm resistor

(2) x M-M wires (Male to Male jumper wires)

Component Introduction

BREADBOARD MB-102:

A breadboard enables you to prototype circuits quickly, without having to solder the connections. Below is an example.



Breadboards come in various sizes and configurations. The simplest kind is just a grid of holes in a plastic block. Inside are strips of metal that provide electrical connection between holes in the shorter rows. Pushing the legs of two different components into the same row joins them together electrically. A deep channel running down the middle indicates that there is a break in connections there, meaning, you can push a chip in with the legs at either side of the channel without connecting them together. Some breadboards have two strips of holes running along the long edges of the board that are separated from the main grid. These have strips running down the length of the board inside and provide a way to connect a common voltage. They are usually in pairs for +5 volts and

ground. These strips are referred to as rails and they enable you to connect power to many components or points in the board.

While breadboards are great for prototyping, they have some limitations. Because the connections are push-fit and temporary, they are not as reliable as soldered connections. If you are having intermittent problems with a circuit, it could be due to a poor connection on a breadboard.

LED:

LEDs make great indicator lights. They use very little electricity and they pretty much last forever.

In this Lesson, you will use perhaps the most common of all LEDs: a 5mm red LED. 5mm refers to the diameter of the LED. Other common sizes are 3mm and 10mm. You cannot directly connect an LED to a battery or voltage source because 1) the LED has a positive and a negative lead and will not light if placed the wrong way and 2) an LED must be used with a resistor to limit or 'choke' the amount of current flowing through it; otherwise, it will burn out!

If you do not use a resistor with an LED, then it may well be destroyed. almost immediately, as too much current will flow through, heating it and destroying the ‘junction’ where the light is produced.

There are two ways to tell which is the positive lead of the LED and which the negative.

Firstly, the positive lead is longer.

Secondly, where the negative lead enters the body of the LED, there is a flat edge to the case of the LED.

If you happen to have an LED that has a flat side next to the longer lead, you should assume that the longer lead is positive.

RESISTORS:

As the name suggests, resistors resist the flow of electricity. The higher the value of the resistor, the more it resists and the less electrical current. will flow through it. We are going to use this to control how much electricity flows through the LED and therefore, how brightly it shines.

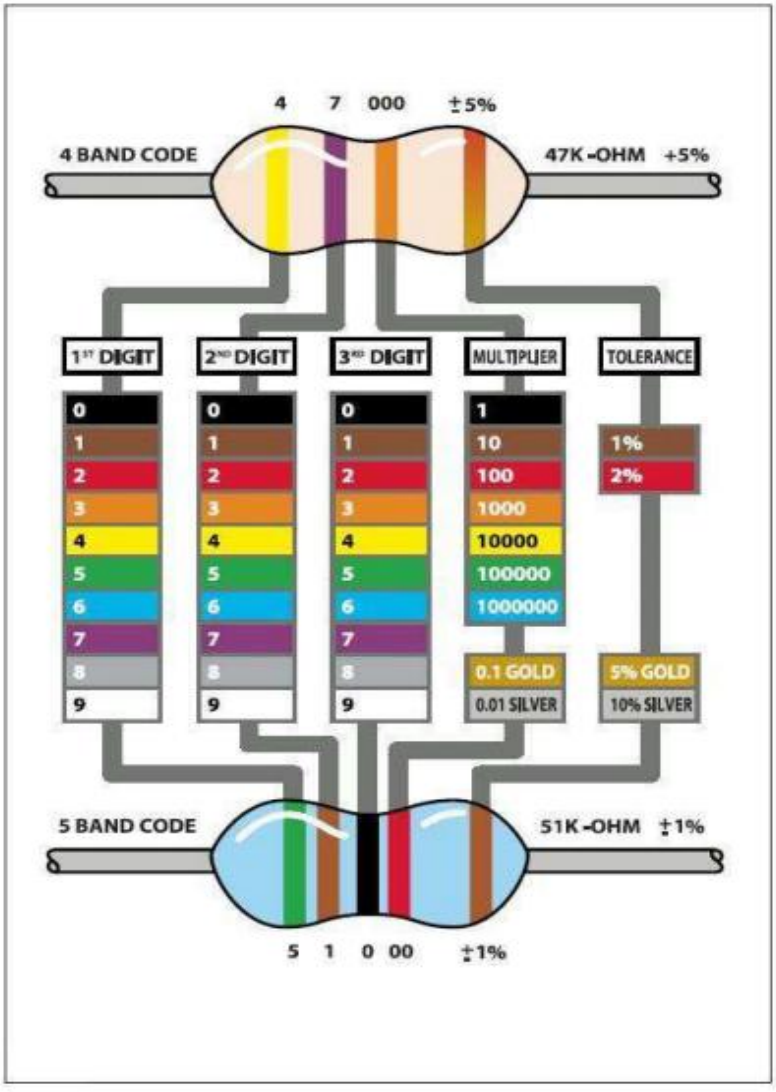
But first, more about resistors…

The unit of resistance is called the Ohm, which is usually shortened to Ω the Greek letter Omega. Because an Ohm is a low value of resistance (it doesn’t resist much at all), we also denote the values of resistors in Kω (1,000 Ω) and MΩ (1,000,000 Ω).

These are called kilo-ohms and mega-ohms.

In this learning kit, we are going to use three different values of resistor: 220Ω, 1Kω and 10Kω. These resistors all look the same, except that they have different colored stripes on them. These stripes tell you the value of the resistor.

The resistor color code has three colored stripes and then a gold stripe at one end.



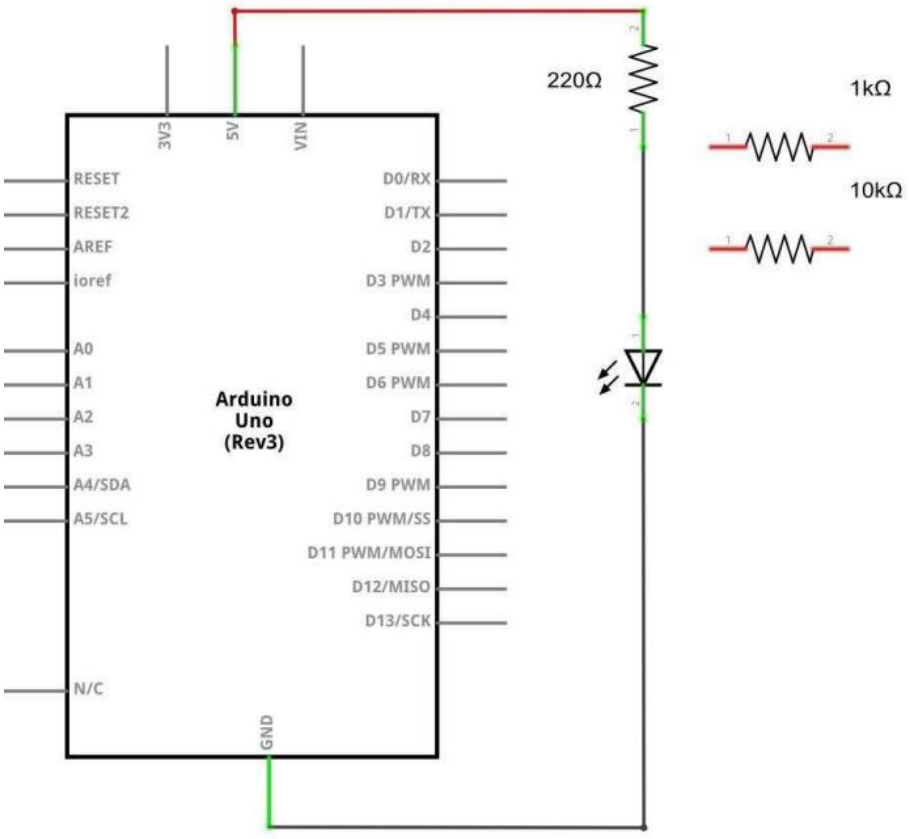
Unlike LEDs, resistors do not have a positive and negative lead. They can be connected either way around.

If you find this approach method too complicated, you can read the color ring flag on our resistors directly to determine its resistance value. Or you may use a digital multimeter instead.

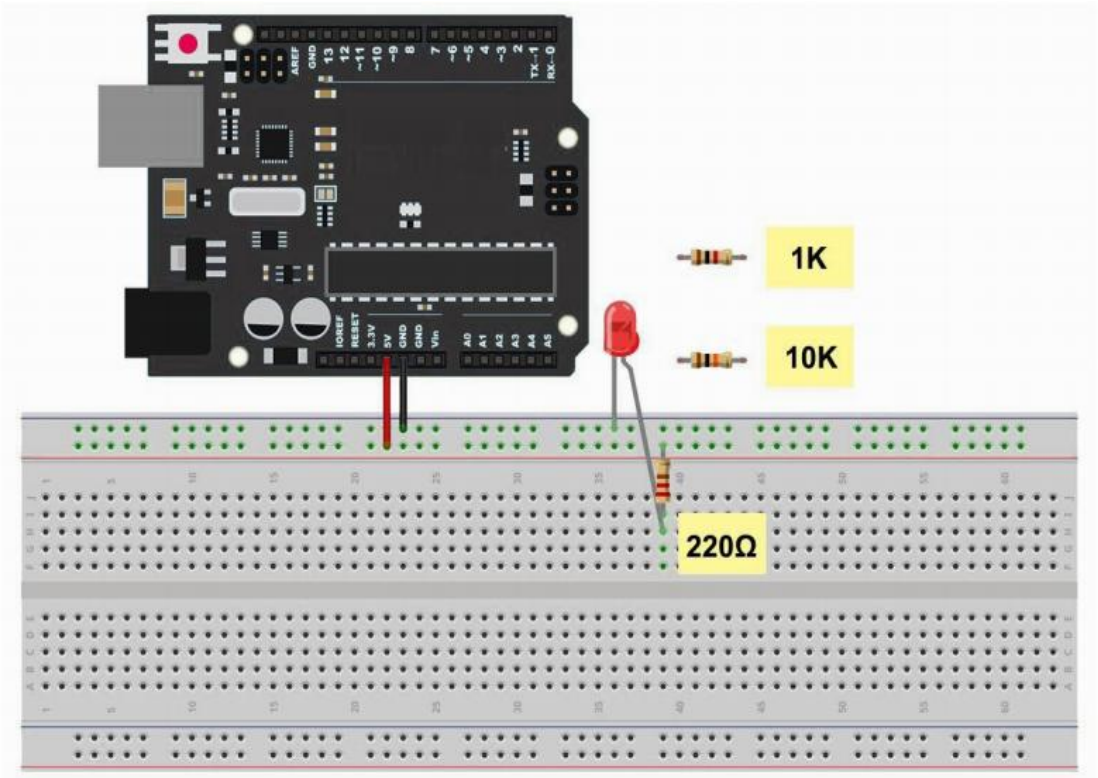
We follow below diagram from the experimental schematic link. Here we use digital pin 10. We connect LED to a 220-ohm resistor to avoid high current damaging the LED.

Connection

Schematic



Circuit Connection



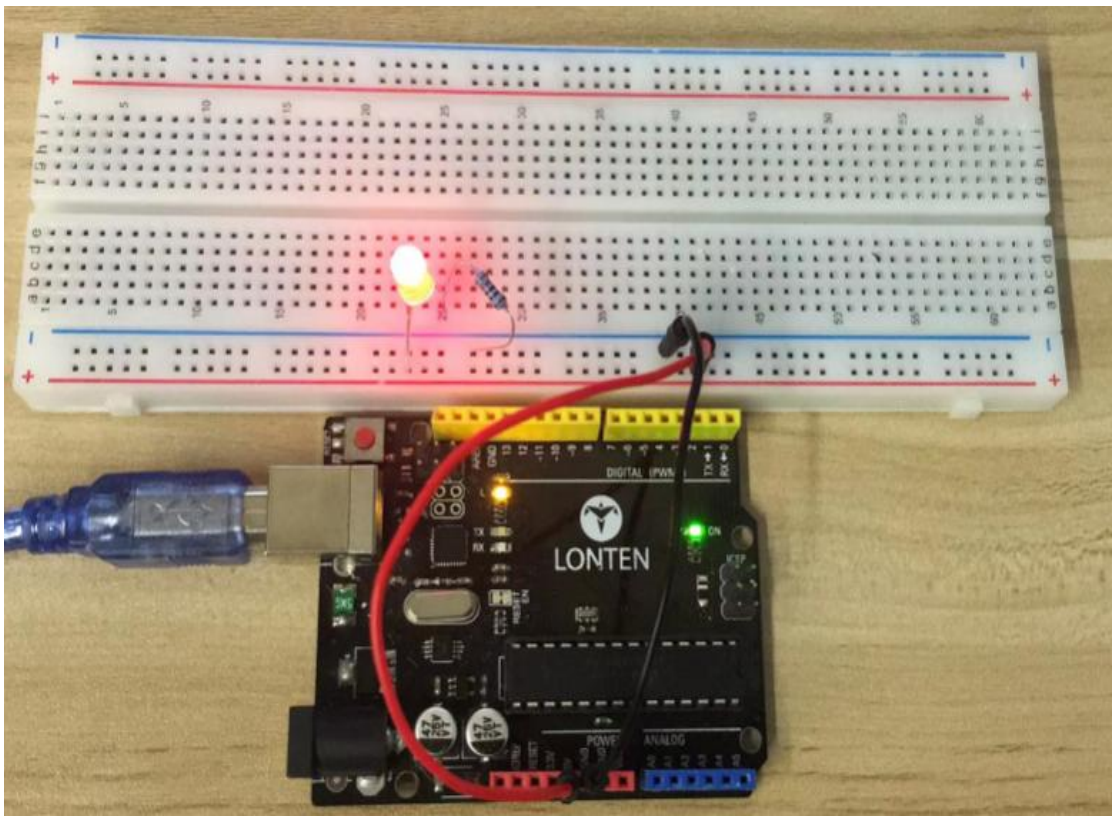
The UNO is a convenient source of 5 volts, which we will use to provide power to the LED and the resistor. You do not need to do anything with your UNO, except to plug it into a USB cable.

With the 220 Ω resistor in place, the LED should be quite bright. If you swap out the 220 Ω resistor for the 1k Ω resistor, then the LED will appear a little dimmer. Finally, with the 10k Ω resistor in place, the LED will be just about visible. Pull the red jumper lead out of the breadboard and touch it into the hole and remove it, so that it acts like a switch. You should just be able to notice the difference.

At the moment, you have 5V going to one leg of the resistor, the other leg of the resistor going to the positive side of the LED and the other side of the LED going to GND. However, if we moved the resistor so that it came after the LED, as shown below, the LED will still light.

You will probably want to put the 220 Ω resistor back in place. It does not matter which side of the LED we put the resistor, as long as it is there somewhere.

Example picture



LROBRUYA

Lesson 2 RGB LED

Overview

RGB LEDs are a fun and easy way to add some color to your projects. Since they are like 3 regular LEDs in one, how to use and connect them is not much different.

They come mostly in 2 versions: Common Anode or Common Cathode. Common Anode uses 5V on the common pin, while Common Cathode connects to ground.

As with any LED, we need to connect some resistors inline (3 total) so we can limit the current being drawn.

In our sketch, we will start with the LED in the Red color state, then fade to Green,then fade to Blue and finally back to the Red color. By doing this we will cycle through most of the color that can be achieved.

Component Required:

(1) x LONTEN Uno R3

(1) x 830 Tie Points Breadboard

(4) x M-M wires (Male to Male jumper wires)

(1) x RGB LED

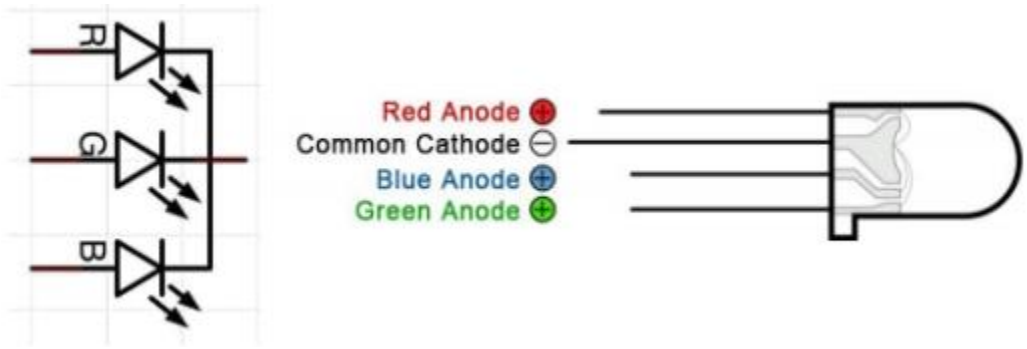
(3) x 220 ohm resistors

Component Introduction

RGB LED:

At first glance, RGB (Red, Green and Blue) LEDs look just like regular LEDs. However, inside the usual LED package, there are actually three LEDs, one red, one green and one blue. By controlling the brightness of each of the individual LEDs you can mix pretty much any color you want. We mix colors the same way you would mix paint on a palette by adjusting the brightness of each of the three LEDs. Fortunately for us, UNO R3 board has an analogWrite function that you can use with pins marked with a to output a variable amount of power to the appropriate LEDs.

The RGB LED has four leads. There is one lead going to the positive connection of each of the single LEDs within the package and a single lead that is connected to all three negative sides of the LEDs.



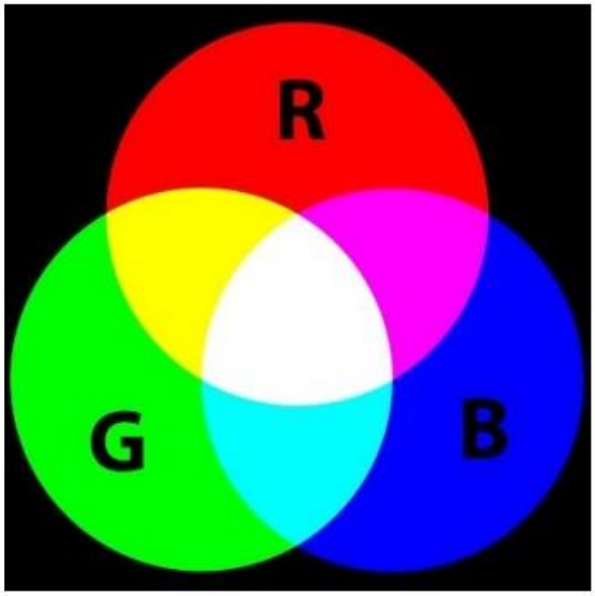
Here on the photographs you can see 4 electrode LED. Every separate pin for Green or Blue or Red color is called Anode. You will always connect "+" to it. Cathode goes to "-"(ground). If you connect it other way round the LED will not light.

The common negative connection of the LED package is the second pin from the flat side. It is also the longest of the four leads and will be connected to the ground. Each LED inside the package requires its own 220Ω resistor to prevent too much current flowing through it. The three positive leads of the LEDs (one red, one green and one blue) are connected to UNO output pins using these resistors.

Three Primary Colors:

The reason that you can mix any color you like by varying the quantities of red, green and blue light is that your eye has three types of light receptor in it (red, green and blue). Your eye and brain process the amounts of red, green and blue and convert it into a color of the spectrum.

In a way, by using the three LEDs, we are playing a trick on the eye. This same idea is used in TVs, where the LCD has red, green and blue color dots next to each other making up each pixel.



If we set the brightness of all three LEDs to be the same, then the overall color of the light will be white. If we turn off the blue LED, so that just the red and green LEDs are the same brightness, then the light will appear yellow.

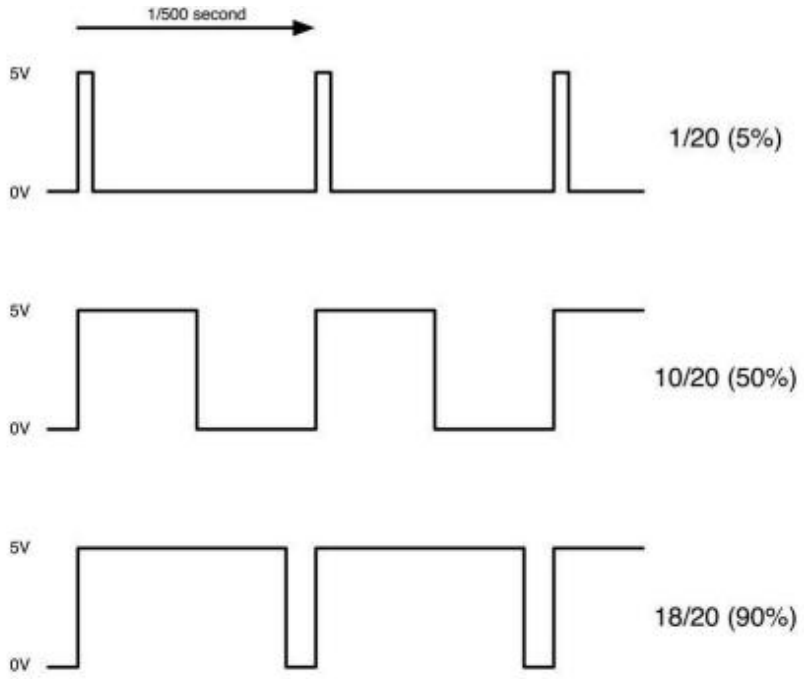
We can control the brightness of each of the red, green and blue parts of the LED separately, making it possible to mix any color we like.

Black is not so much a color as an absence of light. Therefore, the closest we can come to black with our LED is to turn off all three colors.

Theory (PWM)

Pulse Width Modulation (PWM) is a technique for controlling power. We also use it here to control the brightness of each of the LEDs.

The diagram below shows the signal from one of the PWM pins on the UNO.



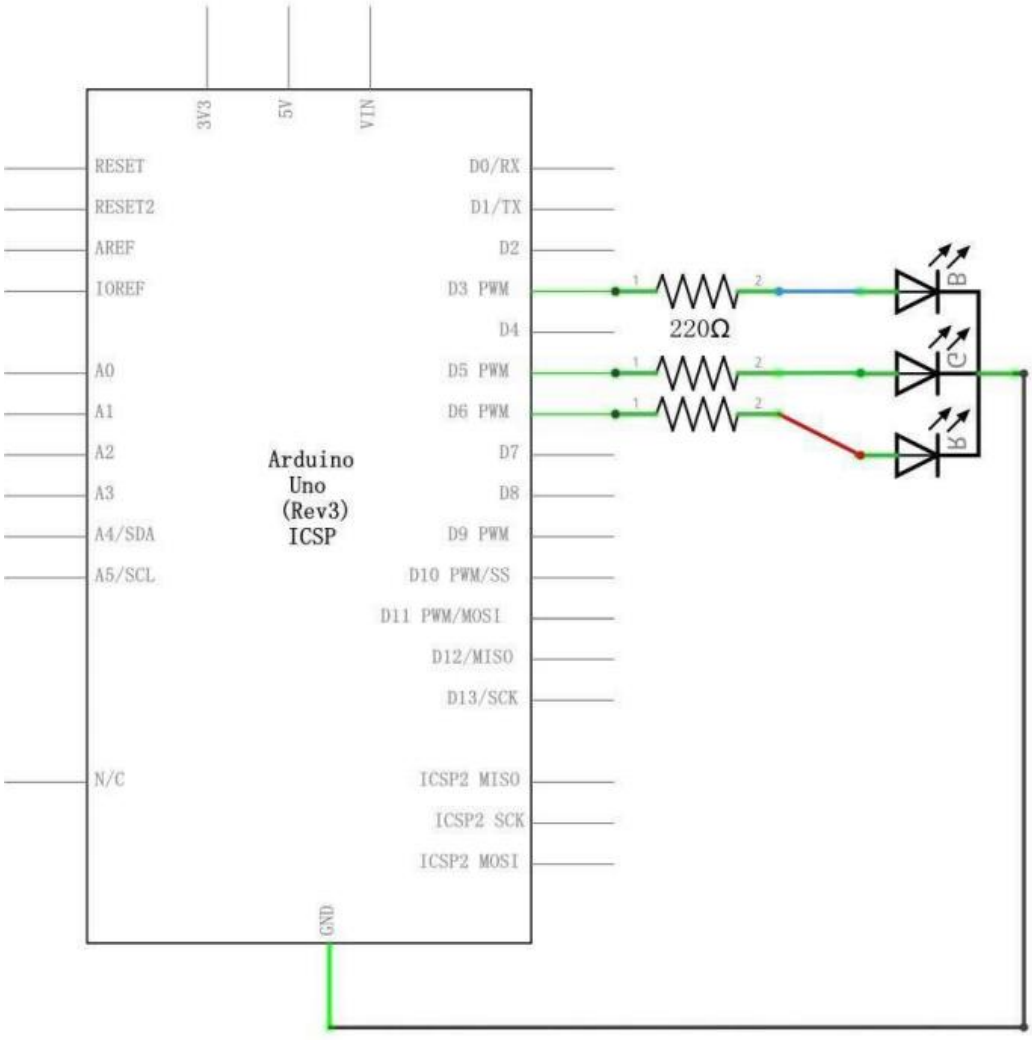
Roughly every 1/500 of a second, the PWM output will produce a pulse. The length of this pulse is controlled by the “analogWrite” function. So “analogWrite(0)” will not produce any pulse at all and “analogWrite(255)”will produce a pulse that lasts all the way until the next pulse is due, so that the output is actually on all the time.

If we specify a value in the “analogWrite” that is somewhere in between 0 and 255, then we will produce a pulse. If the output pulse is only high

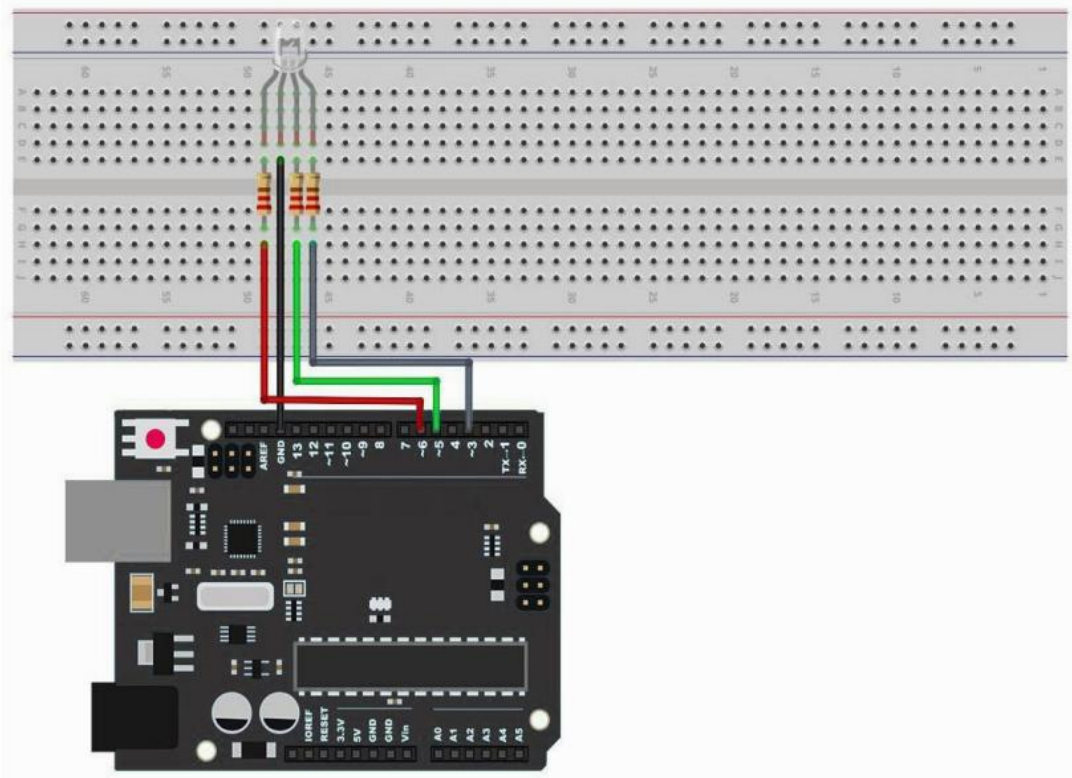
for 5% of the time, then whatever we are driving will only receive 5% of full power. If, however, the output is at 5V for 90% of the time, then the load will get 90% of the power delivered to it. We cannot see the LEDs turning on and off at that speed, so to us, it just looks like the brightness is changing.

Connection

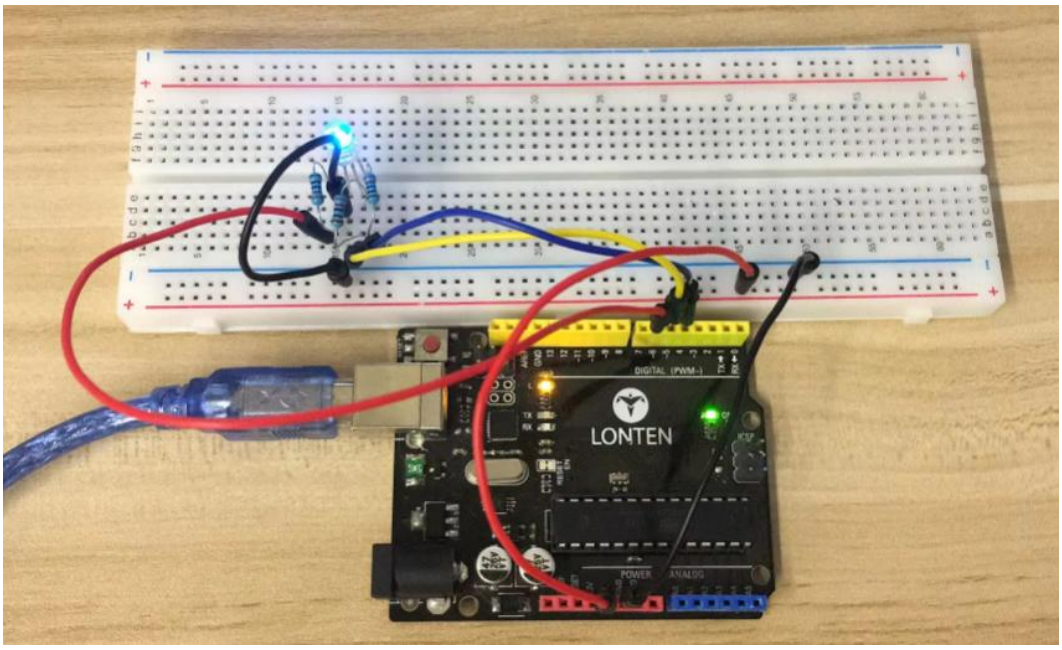
Schematic



Circuit Connection

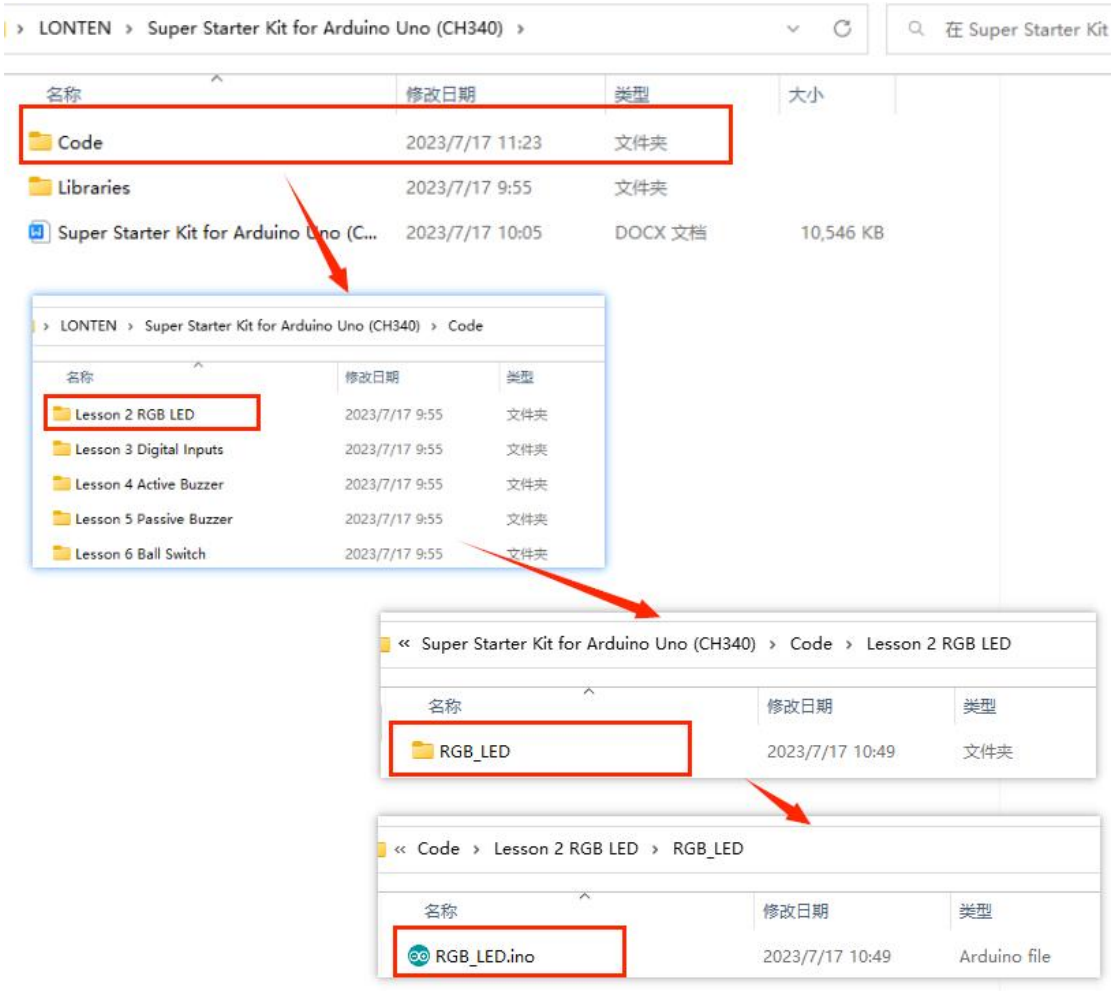


Example picture



Code

After wiring, please open the Sketch in folder path: Tutorial > code > Lesson 2 RGB LED > RGB_LED, and click UPLOAD to upload the program.



The sketch starts by specifying which pins are going to be used for each of the colors:

```
// Define Pins
#define BLUE 3
#define GREEN 5
#define RED 6
```

The next step is to write the 'setup' function. As we have learnt in earlier lessons, the setup function runs just once after the Arduino has reset. In this case, all it has to do is define the three pins we are using as being outputs.

```
void setup()
{
pinMode(RED, OUTPUT);
pinMode(GREEN, OUTPUT);
pinMode(BLUE,OUTPUT);
digitalWrite(RED, HIGH);
digitalWrite(GREEN, LOW);
digitalWrite(BLUE, LOW);
}
```

Before we take a look at the 'loop' function, let’s look at the last function in the sketch.

The define variables

```
redValue = 255; // choose a value between 1 and 255 to change the color.
greenValue = 0;
blueValue = 0;
```

This function takes three arguments, one for the brightness of the red, green and blue LEDs. In each case the number will be in the range 0 to 255, where 0 means off and 255 means maximum brightness. The function then calls 'analogWrite' to set the brightness of each LED.

Try adding a few colors of your own to the sketch and watch the effect on your LED.

Lesson 3 Digital Inputs

Overview

In this lesson, you will learn to use push buttons with digital inputs to turn an LED on and off.Pressing the button will turn the LED on; Pressing the other button will turn the LED off.

Component Required:

(1) x LONTEN Uno R3

(1) x 830 Tie-points Breadboard

(1) x 5mm red LED

(1) x 220 ohm resistor

(2) x push switches

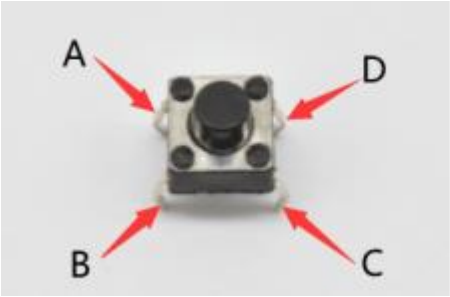
(7) x M-M wires (Male to Male jumper wires)

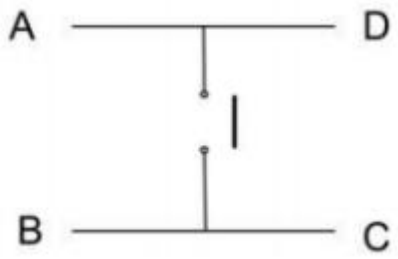
Component Introduction

PUSH SWITCHES:

Switches are really simple components. When you press a button or flip a lever,they connect two contacts together so that electricity can flow through them.

The little tactile switches that are used in this lesson have four connections, which can be a little confusing.

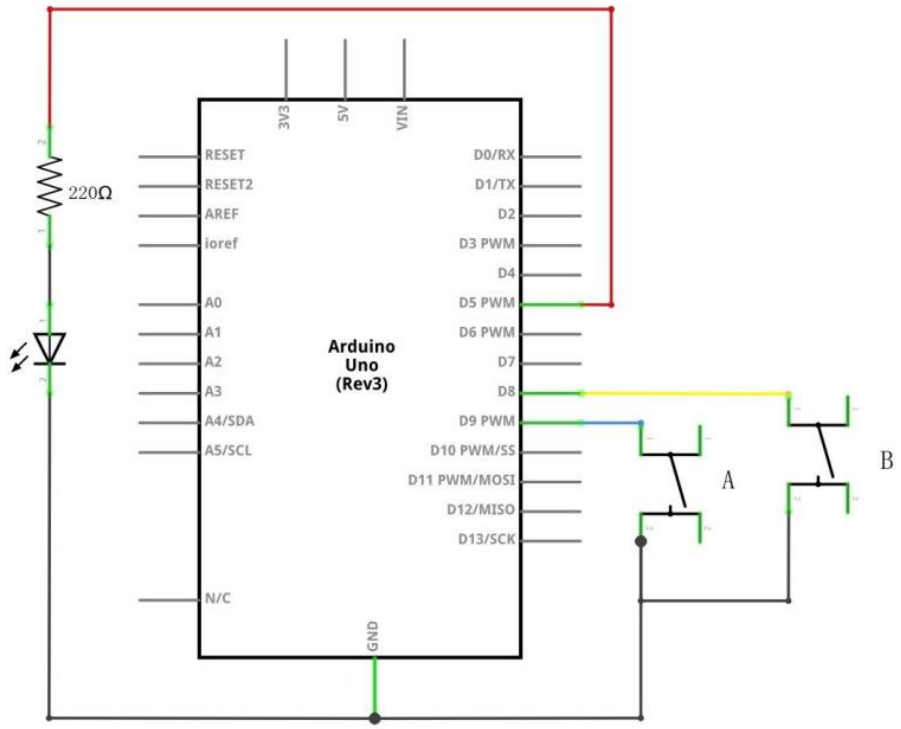




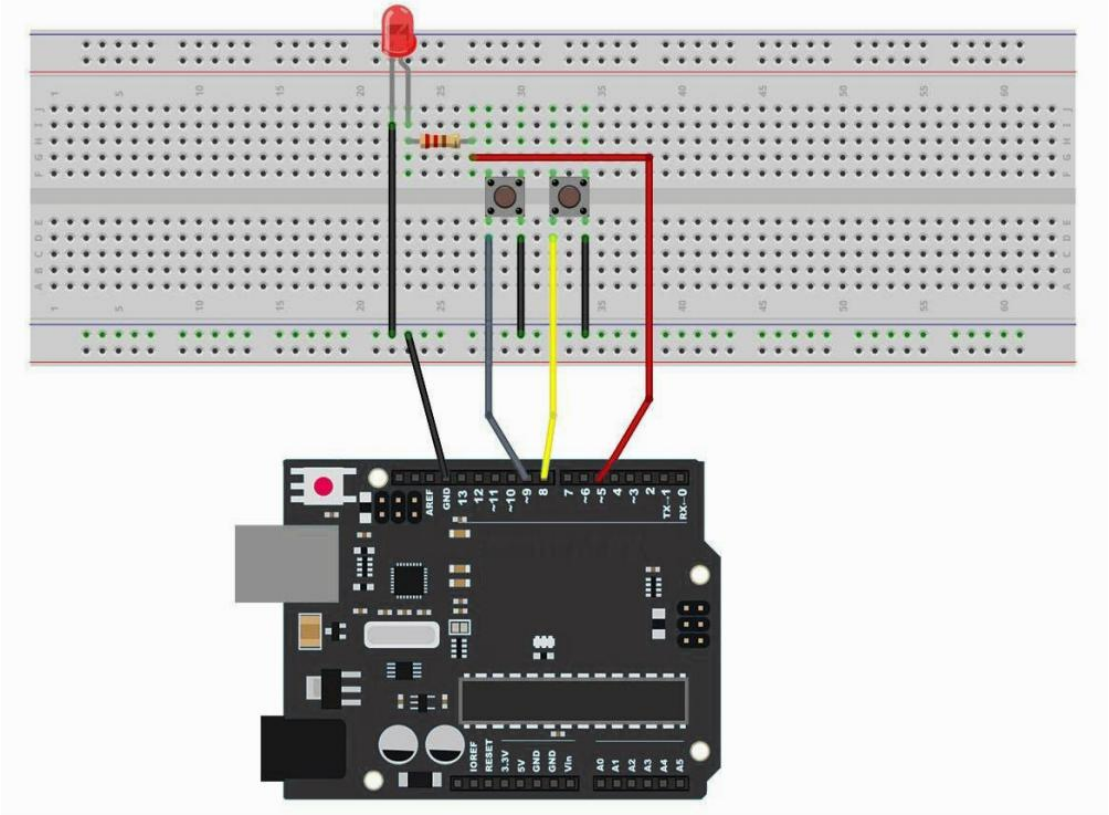
Actually, there are only really two electrical connections. Inside the switch package,pins B and C are connected together, as are A and D.

Connection

Schematic



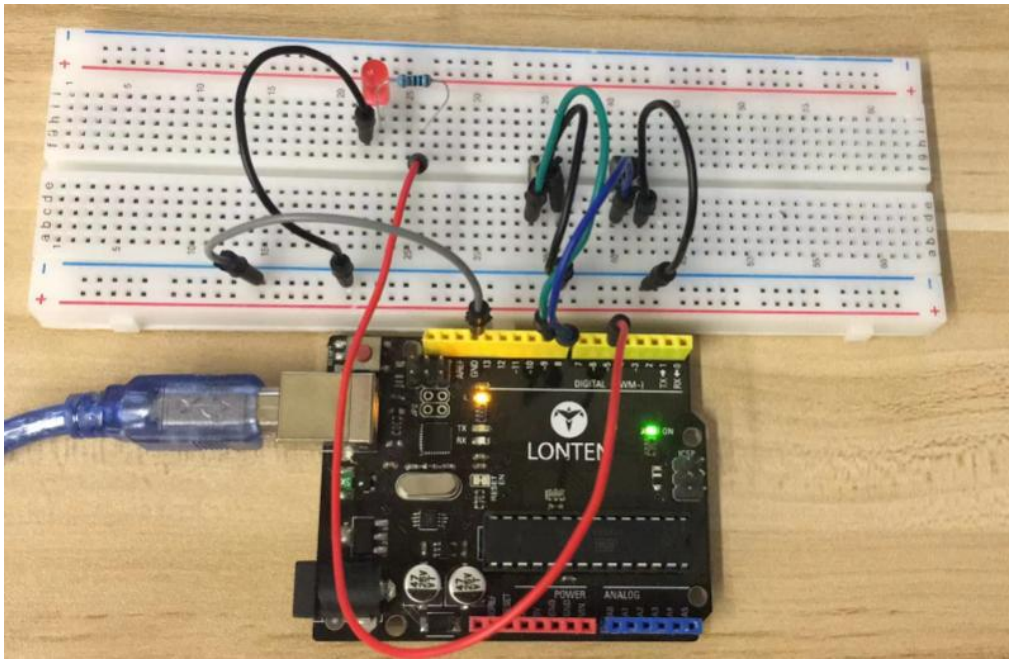
Circuit Connection



Although the bodies of the switches are square, the pins protrude from opposite sides of the switch. This means that the pins will only be far enough apart when they are placed correctly on the breadboard.

Remember that the LED has to have the shorter negative lead to the left.

Example picture



Code

After wiring,please open program in the code folder- Lesson 3 Digital Inputs, and press UPLOAD to upload the program.

Load the sketch onto your UNO board. Pressing the left button will turn the LED on while pressing the right button will turn it off.

The first part of the sketch defines three variables for the three pins that are to be used. The 'ledPin' is the output pin and 'buttonApin' will refer to

the switch nearer the top of the breadboard and 'buttonBpin' to the other switch.

The 'setup' function defines the ledPin as being an OUTPUT as normal, but now we have the two inputs to deal with. In this case, we use the set the pinMode to be 'INPUT_PULLUP' like this:

```
pinMode(buttonApin, INPUT_PULLUP);
pinMode(buttonBpin,INPUT_PULLUP);
```

The pin mode of INPUT_PULLUP means that the pin is to be used as an input, but that if nothing else is connected to the input, it should be 'pulled up' to HIGH. In other words, the default value for the input is HIGH, unless it is pulled LOW by the action of pressing the button.

This is why the switches are connected to GND. When a switch is pressed, it connects the input pin to GND, so that it is no longer HIGH.

Since the input is normally HIGH and only goes LOW when the button is pressed, the logic is a little upside down. We will handle this in the 'loop' function.

```
void loop()
{
if (digitalRead(buttonApin) == LOW)
{
```

```
digitalWrite(ledPin,HIGH);
}
if (digitalRead(buttonBpin) == LOW)
{
digitalWrite(ledPin, LOW);
}
}
```

In the 'loop' function there are two 'if' statements. One for each button. Each does an 'digitalRead' on the appropriate input.

Remember that if the button is pressed, the corresponding input will be LOW, if button A is low, then a 'digitalWrite' on the ledPin turns it on. Similarly, if button B is pressed, a LOW is written to the ledPin.

Lesson 4 Active Buzzer

Overview

In this lesson, you will learn how to generate a sound with an active buzzer.

Component Required:

(1) x LONTEN Uno R3

(1) x Active buzzer

(2) x F-M wires (Female to Male DuPont wires)

Component Introduction

BUZZER:

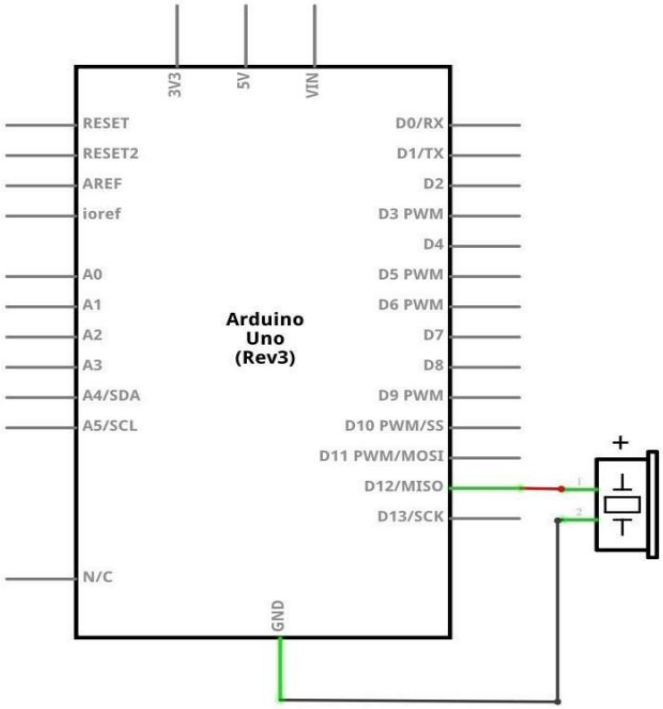
Active buzzer is widely used on computer, printer, alarm, electronic toy, telephone, timer etc.. It has an inner vibration source. Simply connect it with 5V power supply, it can buzz continuously.

Turn the pins of two buzzers face up. The one with a green circuit board is a passive buzzer, while the other enclosed with a black tape is an active one.

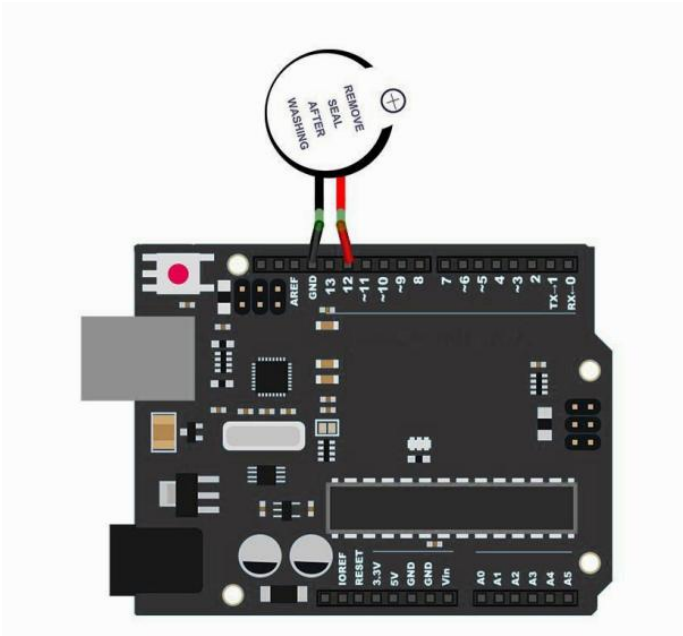
The difference between the two is that an active buzzer has a built-in oscillating source, so it will generate a sound when electrified. A passive buzzer does not have such a source so it will not tweet if DC signals are used; instead, you need to use square waves whose frequency is between 2K and 5K to drive it. The active buzzer is often more expensive than the passive one because of multiple built-in oscillating circuits.

Connection

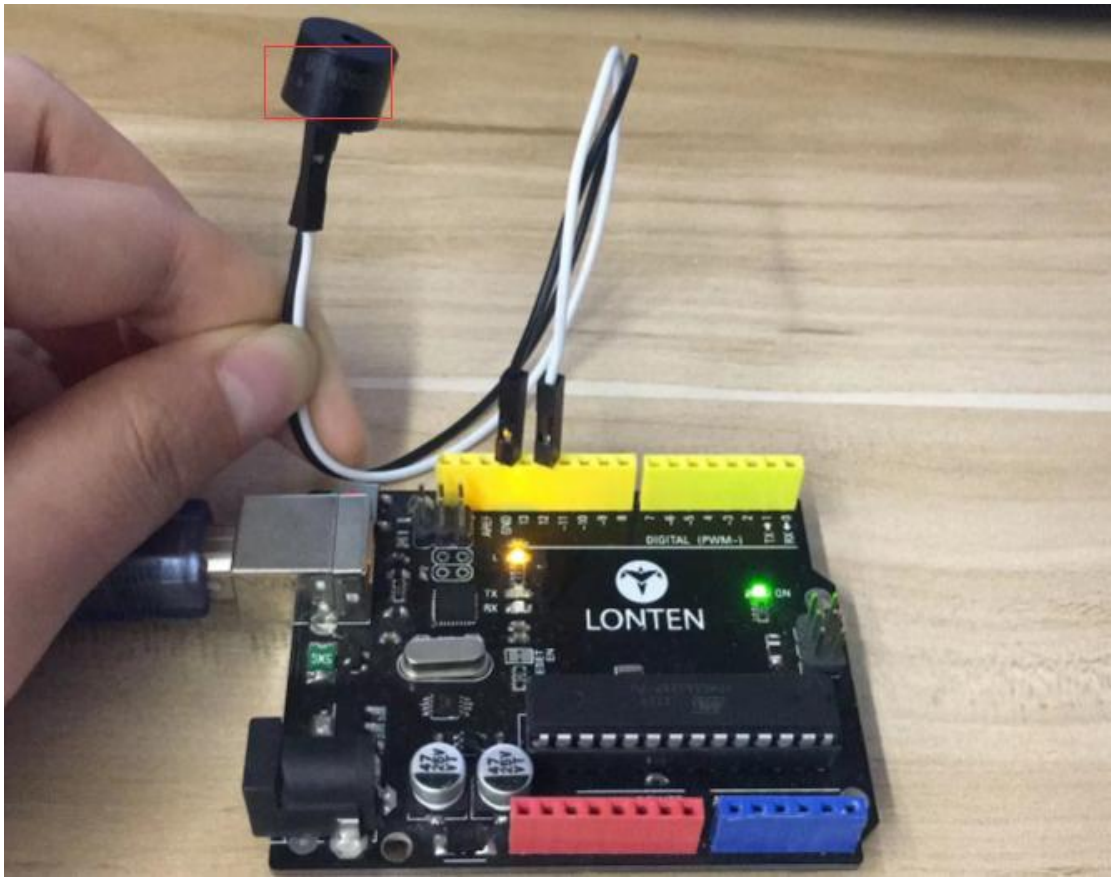
Schematic



Circuit Connection



Example picture



Code

After wiring, please open the program in the code folder- Lesson 4 Making Sounds and click UPLOAD to upload the program.

Lesson 5 Passive Buzzer

Overview

In this lesson, you will learn how to use a passive buzzer.

The purpose of the experiment is to generate eight different sounds, each sound lasting 0.5 seconds: from Alto Do (523Hz), Re (587Hz), Mi

(659Hz), Fa (698Hz), So (784Hz), La (880Hz), Si (988Hz) to Treble Do (1047Hz).

Component Required

(1) x LONTEN Uno R3

(1) x Passive buzzer

(2) x F-M wires (Female to Male DuPont wires)

Component Introduction

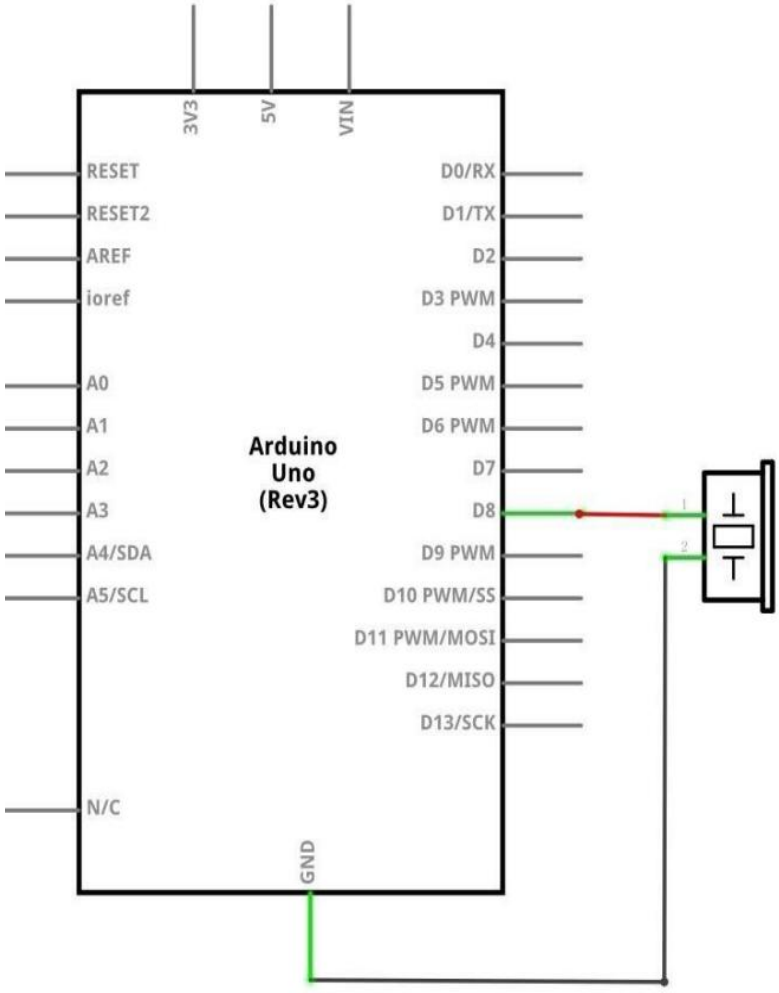
Passive Buzzer:

The working principle of passive buzzer is using PWM generating audio to make the air to vibrate. Appropriately changed as long as the vibration frequency, it can generate different sounds. For example, sending a pulse of 523Hz, it can generate Alto Do, pulse of 587Hz, it can generate midrange Re, pulse of 659Hz, it can produce midrange Mi. By the buzzer, you can play a song.

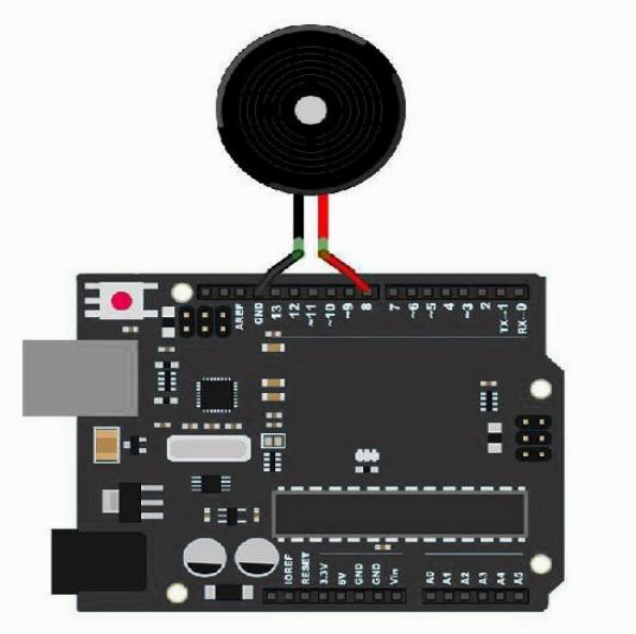
We should be careful not to use the UNO R3 board “analogWrite ()” function to generate a pulse to the buzzer, because the pulse output of analog Write () is fixed (500Hz).

Connection

Schematic

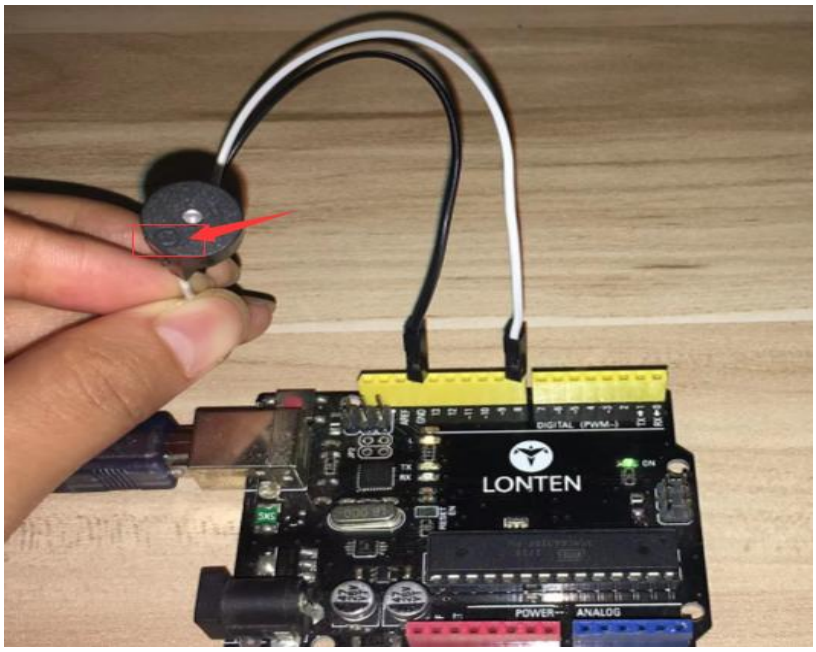


Circuit Connection



Wiring the buzzer connected to the UNO R3 board, the red (positive) to the pin8, black wire (negative) to the GND.

Example picture



Code

After wiring, please open the program in the code folder- Lesson 5 Passive Buzzer and click UPLOAD to upload the program.

Lesson 6 Tilt Ball Switch

Overview

In this lesson, you will learn how to use a tilt ball switch in order to detect small angle of inclination.

Component Required

(1) x LONTEN Uno R3

(1) x Tilt Ball switch

(2) x F-M wires (Female to Male DuPont wires)

Component Introduction

Tilt sensor:

Tilt sensors (tilt ball switch) allow you to detect orientation or inclination. They are small, inexpensive, low-power and easy-to-use. If used properly,

they will not wear out. Their simplicity makes them popular for toys, gadgets and appliances. Sometimes, they are referred to as "mercury switches", "tilt switches" or "rolling ball sensors" for obvious reasons.

They are usually made up of a cavity of some sort (cylindrical is popular, although not always) with a conductive free mass inside, such as a blob of mercury or rolling ball.

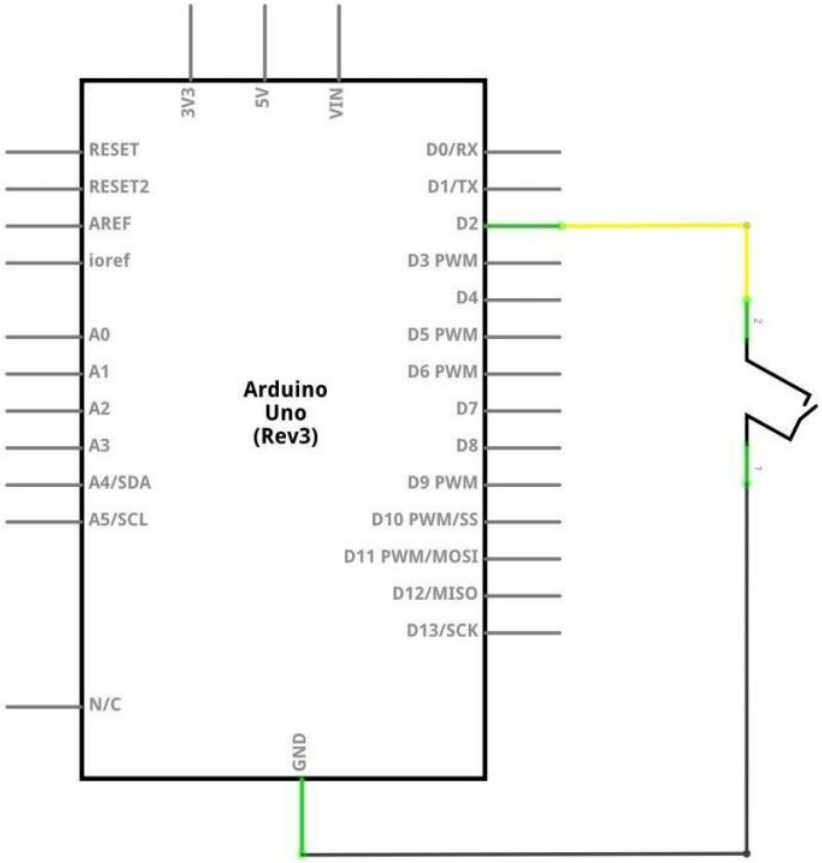
One end of the cavity has two conductive elements (poles). When the sensor is oriented so that that end is downwards, the mass rolls onto the poles and shorts them, acting as a switch throw.

While not as precise or flexible as a full accelerometer, tilt switches can detect motion or orientation. Another benefit is that the big ones can switch power on their own.

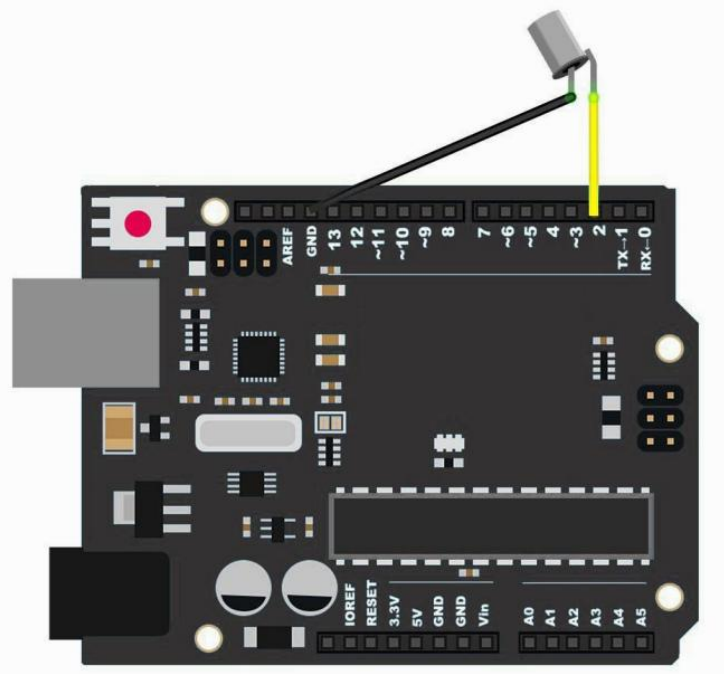
Accelerometers, on the other hand, output digital or analog voltage that must then be analyzed using extra circuitry.

Connection

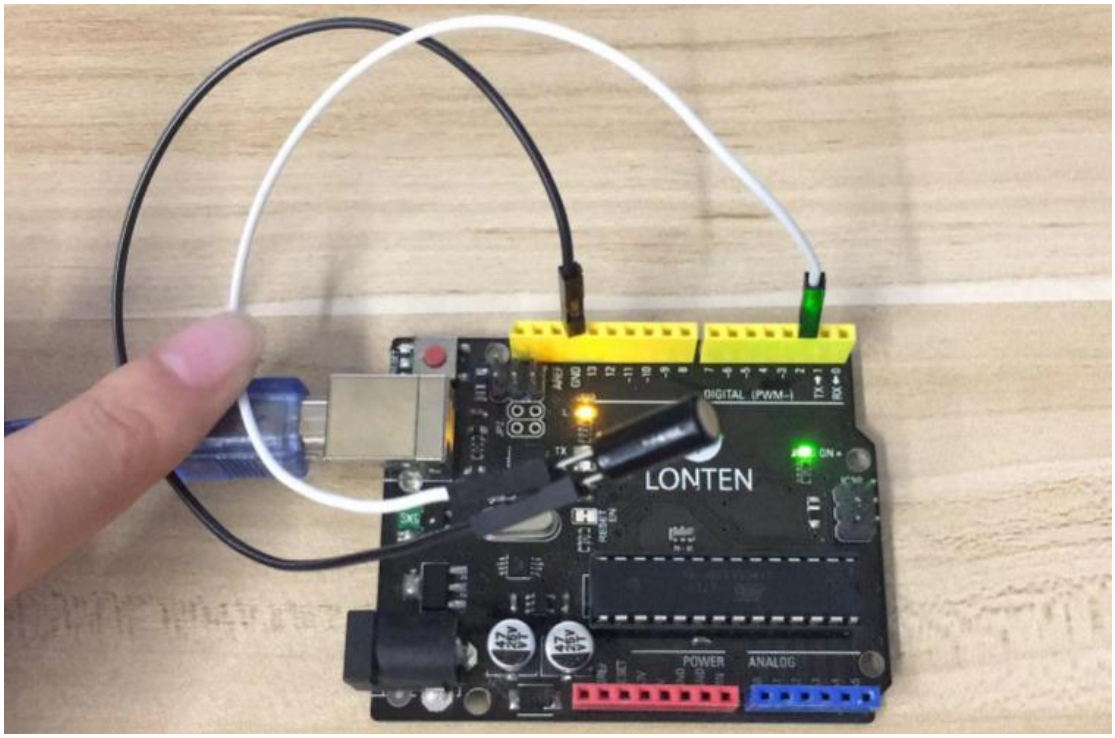
Schematic



Circuit Connection



Example picture



Code

After wiring, please open the program in the code folder- Lesson 6 Ball Switch and click UPLOAD to upload the program.

Lesson 7 Servo

Overview

Servo is a type of geared motor that can only rotate 180 degrees. It is controlled by sending electrical pulses from your UNO R3 board. These pulses tell the servo what position it should move to. The Servo has three wires, of which the brown one is the ground wire and should be

connected to the GND port of UNO, the red one is the power wire and should be connected to the 5v port, and the orange one is the signal wire and should be connected to the Dig #9 port.

Component Required

(1) x LONTEN Uno R3

(1) x Servo (SG90)

(3) x M-M wires (Male to Male jumper wires)

Component Introduction

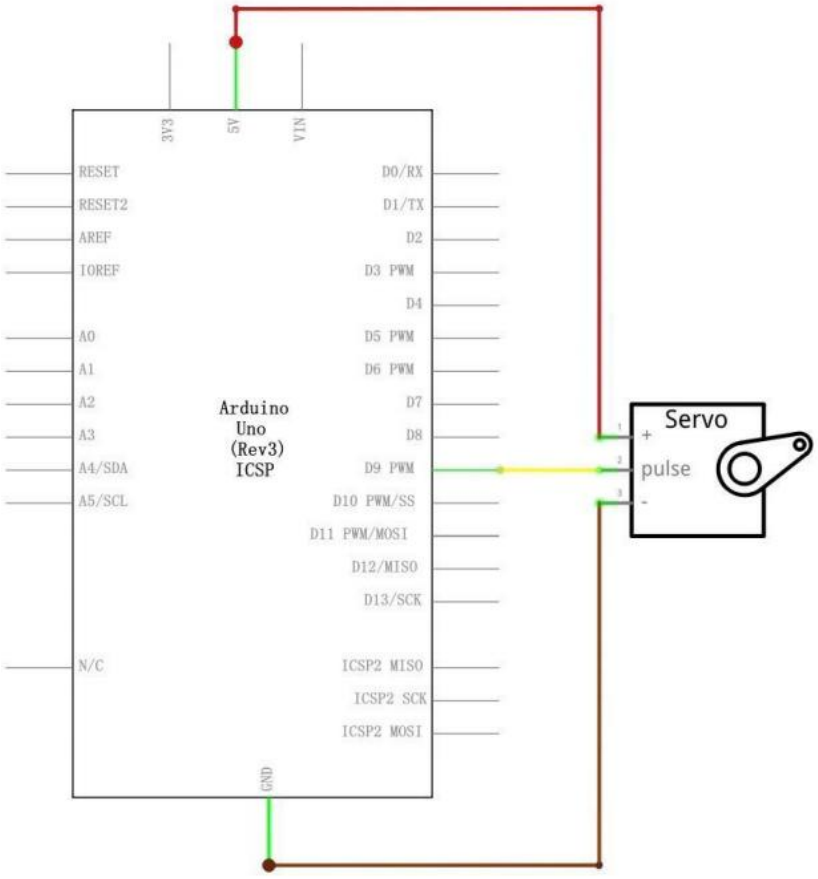
SG90

- Universal for JR and FP connector
- Cable length : 25cm
- No load; Operating speed: 0.12 sec / 60 degree (4.8V), 0.10 sec / 60 degree (6.0V)
- Stall torque (4.8V): 1.6kg/cm
- Temperature : -30~60'C

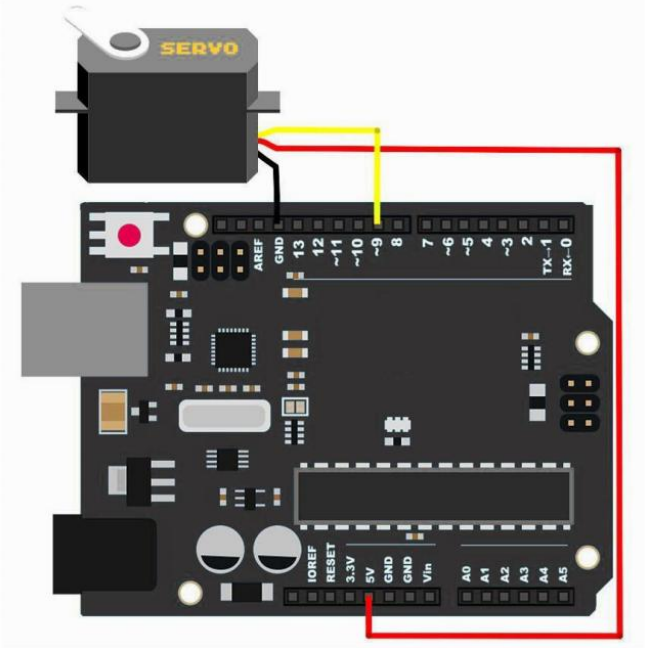
- Dead band width: 5us Working voltage: 3.5~6V
- Dimension : 1.26 in x 1.18 in x 0.47 in (3.2 cm x 3 cm x 1.2 cm)
- Weight : 4.73 oz (134 g)

Connection

Schematic

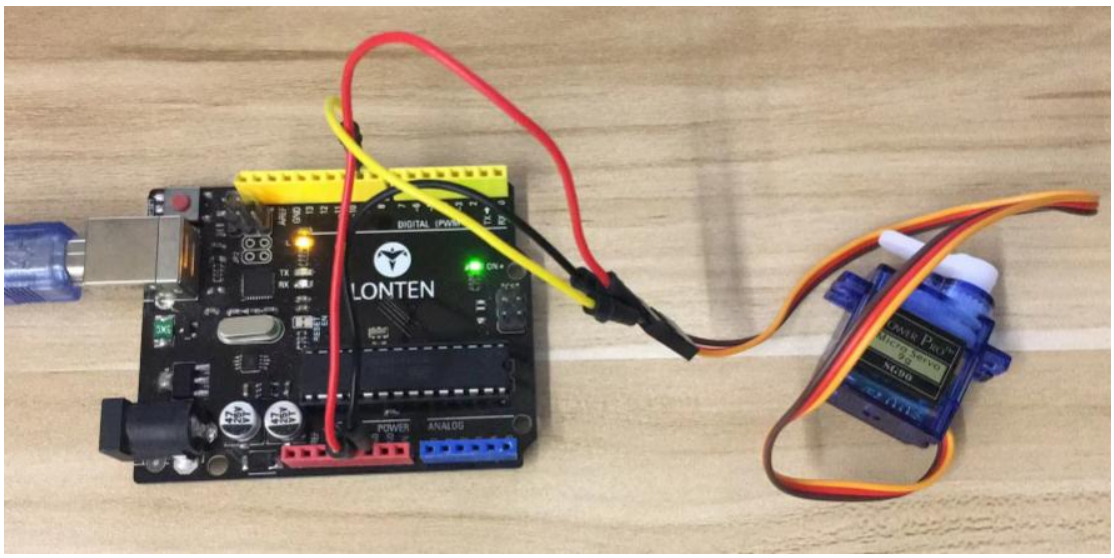


Circuit Connection



Example picture

In the picture, the brown wire of servo is adapted via the black M-M wires, the red one is adapted via the red M-M wires, and the orange one is adapted via the yellow M-M wires.



Code

After wiring, please open the program in the code folder- Lesson 7 Servo and click UPLOAD to upload the program.

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.

Lesson 8 Analog Joystick Module

Overview

Analog joysticks are a great way to add some control in your projects. In this tutorial we will learn how to use the analog joystick module.

Component

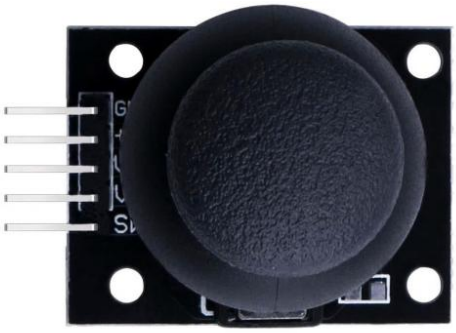
(1) x LONTEN Uno R3

(1) x Joystick module

(5) x F-M wires (Female to Male DuPont wires)

Component Introduction

Joystick

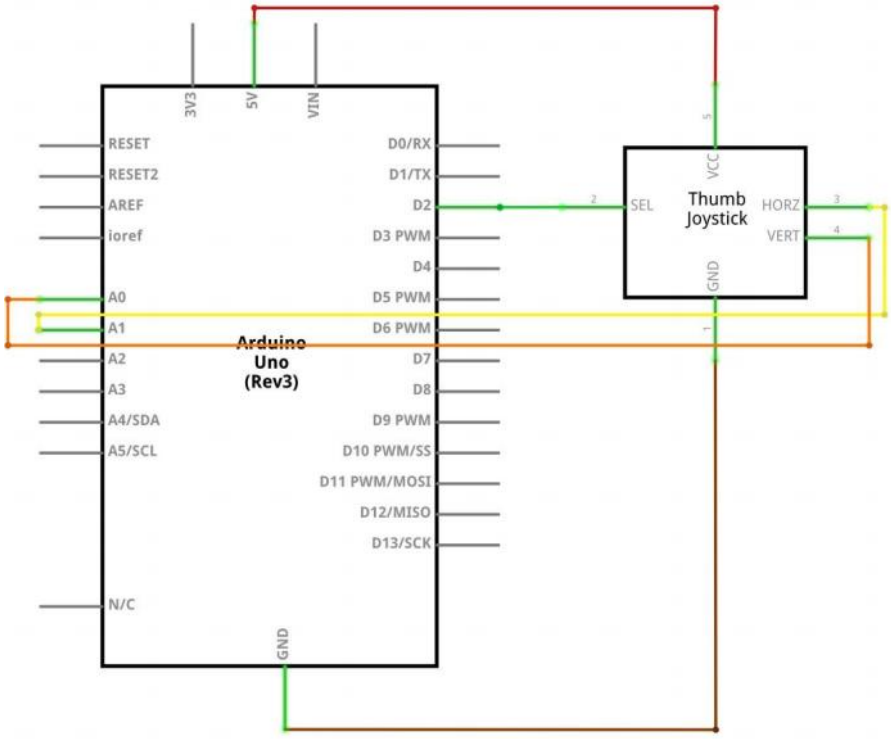


The module has 5 pins: VCC, Ground, X, Y, Key. Note that the labels on yours may be slightly different, depending on where you got the module from. The thumb stick is analog and should provide more accurate readings than simple ‘directional’ joysticks tact use some forms of buttons, or mechanical switches. Additionally, you can press the joystick down (rather hard on mine) to activate a ‘press to select’ push-button.

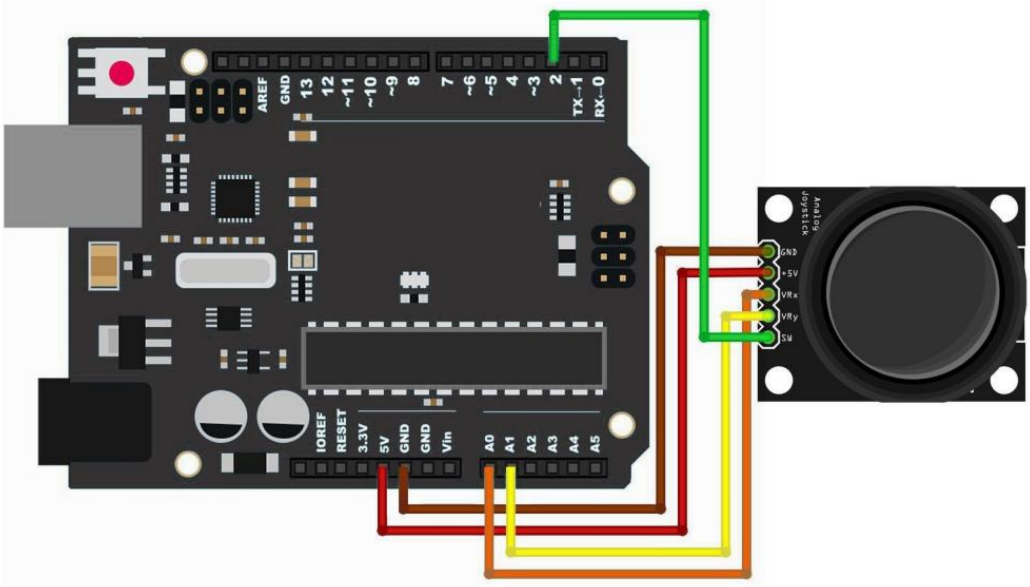
We have to use analog Arduino pins to read the data from the X/Y pins, and a digital pin to read the button. The Key pin is connected to ground, when the joystick is pressed down, and is floating otherwise. To get stable readings from the Key /Select pin, it needs to be connected to VCC via a pull-up resistor. The built in resistors on the Arduino digital pins can be used. For a tutorial on how to activate the pull-up resistors for Arduino pins, configured as inputs.

Connection

Schematic



Circuit Connection

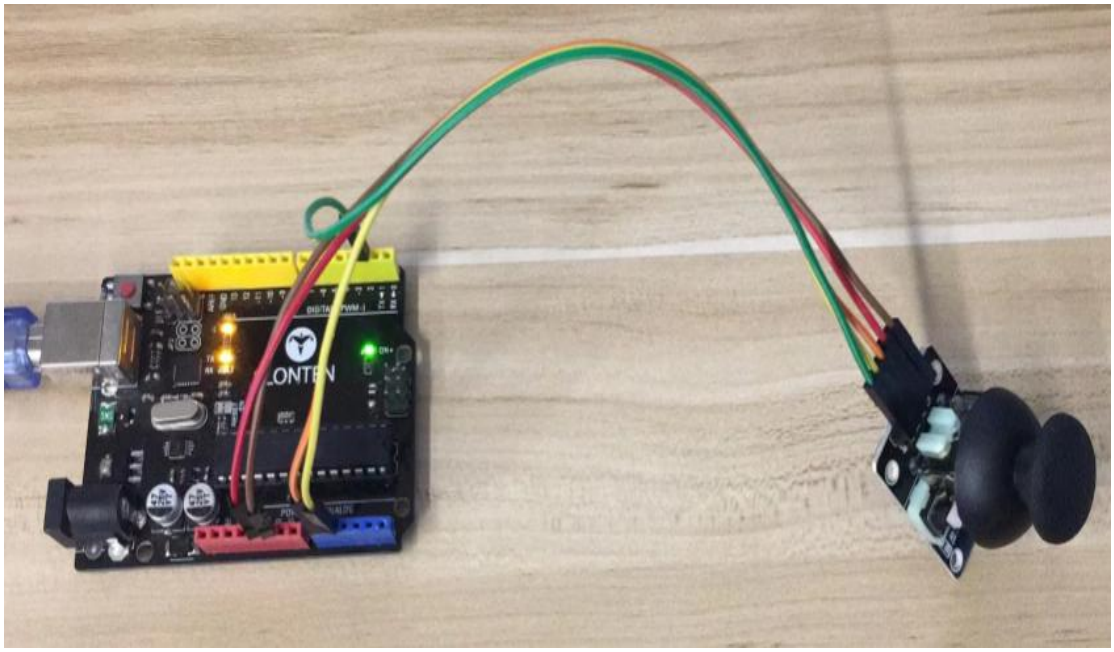


We need 5 connections to the joystick.

The connections are: Key, Y, X, Voltage and Ground.

“Y and X” are Analog and “Key” is Digital. If you don’t need the switch then you can use only 4 pins.

Example picture



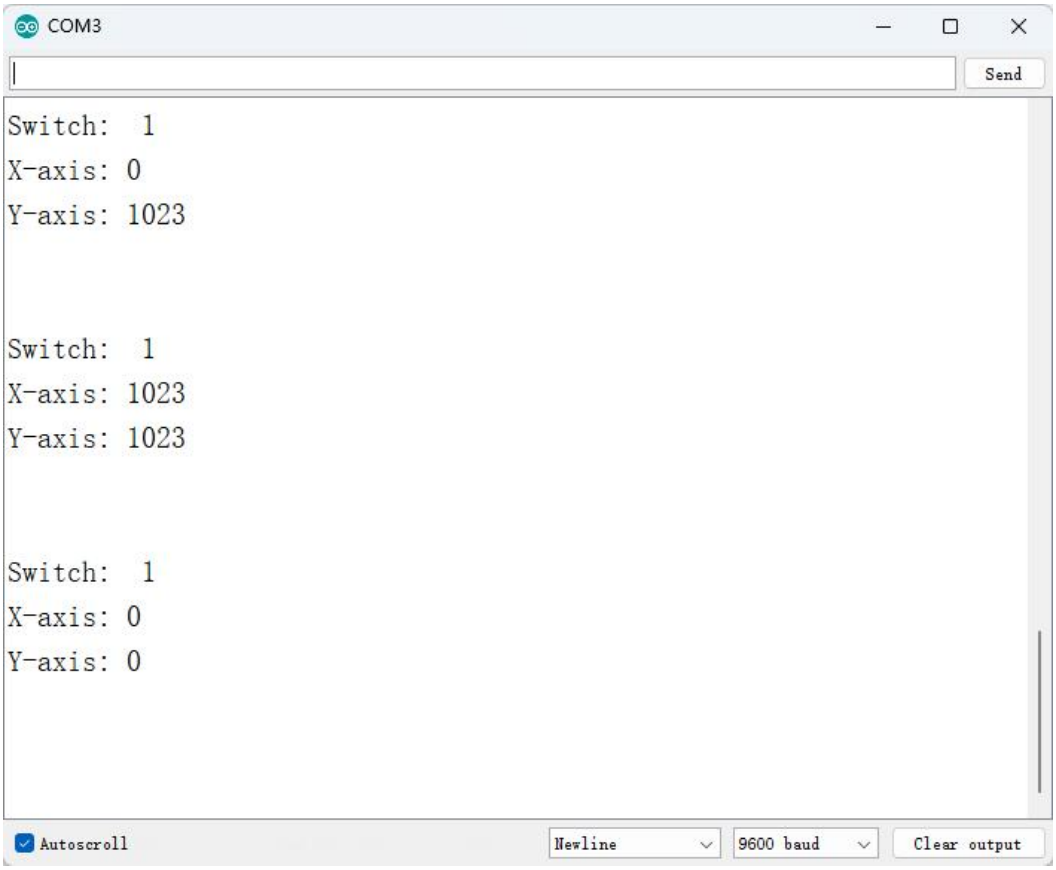
Code

After wiring, please open the program in the code folder- Lesson 8 Analog Joystick Module and click UPLOAD to upload the program.

Analog joysticks are basically potentiometers so they return analog values.

When the joystick is in the resting position or middle, it should return a value of about 512.

The range of values goes from 0 to 1024.



Lesson 9 DHT11 Temperature and Humidity Sensor

Overview

This DHT11 Temperature and Humidity Sensor features calibrated digital signal output with the temperature and humidity sensor complex. Its technology ensures high reliability and excellent long-term stability. Ahigh-performance 8-bit microcontroller is connected. This sensor includes a resistive element and a sense of wet NTC temperature

measuring devices. It has excellent quality, fast response, anti-interference ability and high cost performance advantages.

Component Required

(1) x LONTEN Uno R3

(1) x DHT11 Temperature and Humidity module

(3) x F-M wires (Female to Male DuPont wires)

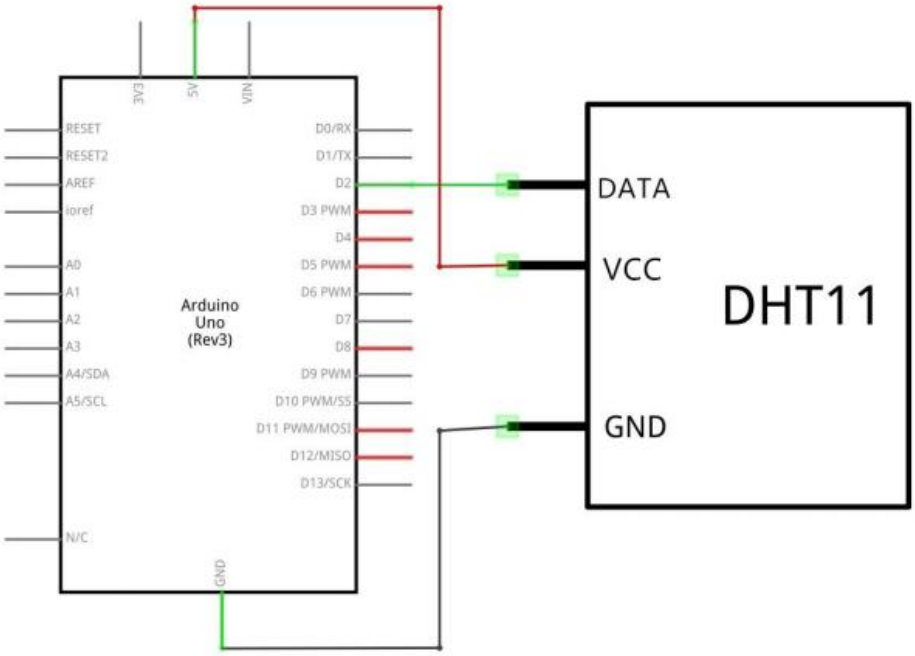
Component Introduction

Temp and humidity sensor:

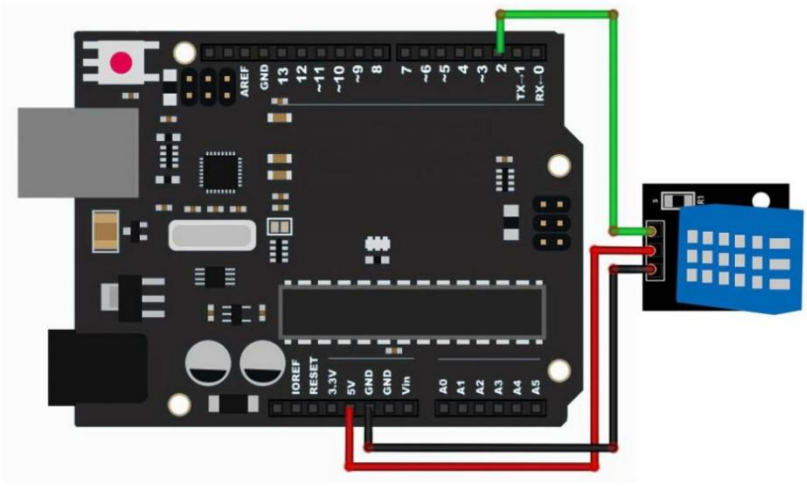
Each DHT11 sensor features extremely accurate calibration data of humidity calibration chamber. The calibration coefficients stored in the OTP program memory, internal sensors detect signals in the process, and we should call these calibration coefficients. The single-wire serial interface system is integrated to make it quick and easy. Qualities of small size, low power, and 20-meter signal transmission distance make it a wide applied application and even the most demanding one. Convenient connection, special packages can be provided according to users need.

Connection

Schematic



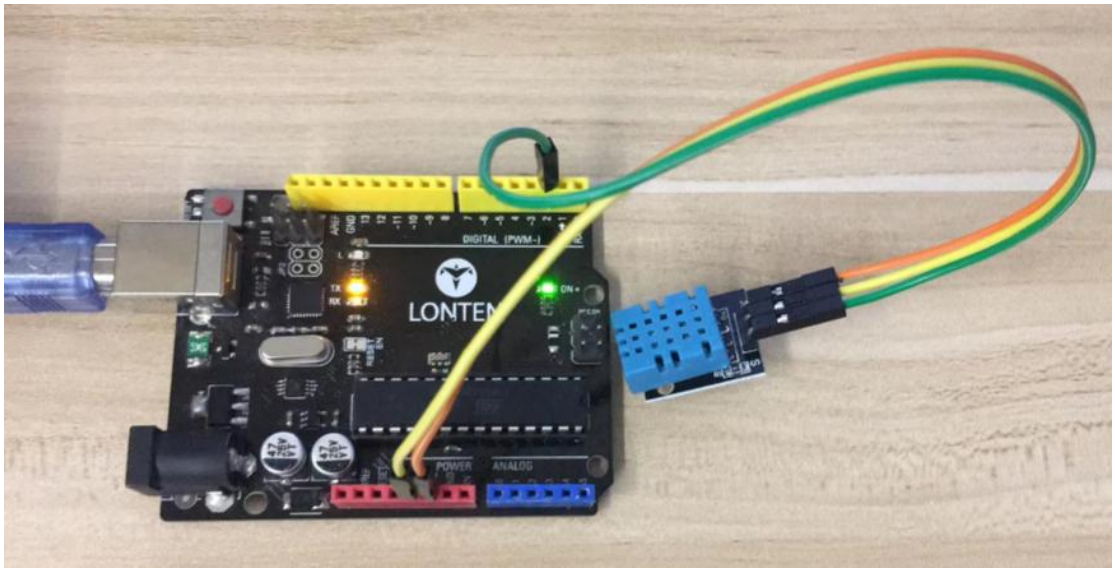
Circuit Connection



As you can see we only need 3 connections to the sensor, since one of the pin is not used.

The connections are: Voltage, Ground and Signal which can be connected to any Pin on our UNO.

Example picture



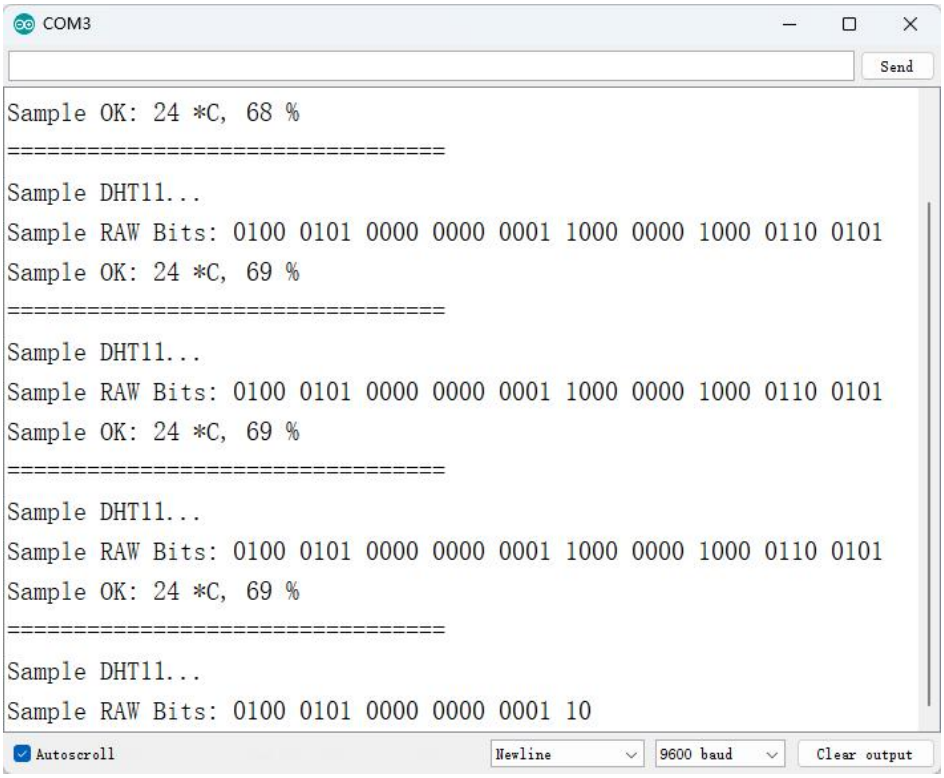
Code

After wiring, please open the program in the code folder- Lesson 9 DHT11 Temperature and Humidity Sensor and click UPLOAD to upload the program.

Before you can run this, make sure that you have installed the <SimpleDHT> library or re-install it, if necessary. Otherwise, your code won't work.

Upload the program then open the monitor, we can see the data as below:

(It shows the temperature of the environment, we can see it is 24 degree)



Lesson 10 Ultrasonic Sensor Module

Overview

Ultrasonic sensor is great for all kind of projects that need distance measurements, avoiding obstacles as examples.

The HC-SR04 is inexpensive and easy to use since we will be using a Library specifically designed for these sensor.

Component Required:

(1) x LONTEN Uno R3

(1) x Ultrasonic sensor module

(4) x F-M wires (Female to Male DuPont wires)

Component Introduction

Ultrasonic sensor

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 tore turning.

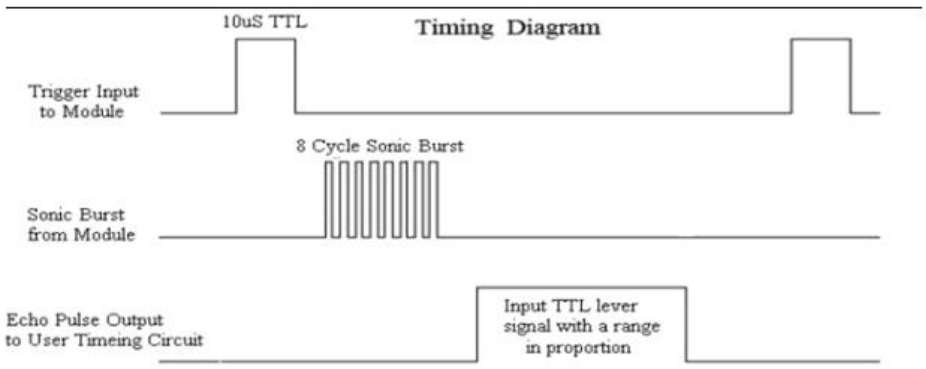
Test distance = (high level time × velocity of sound (340m/s) /2

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.

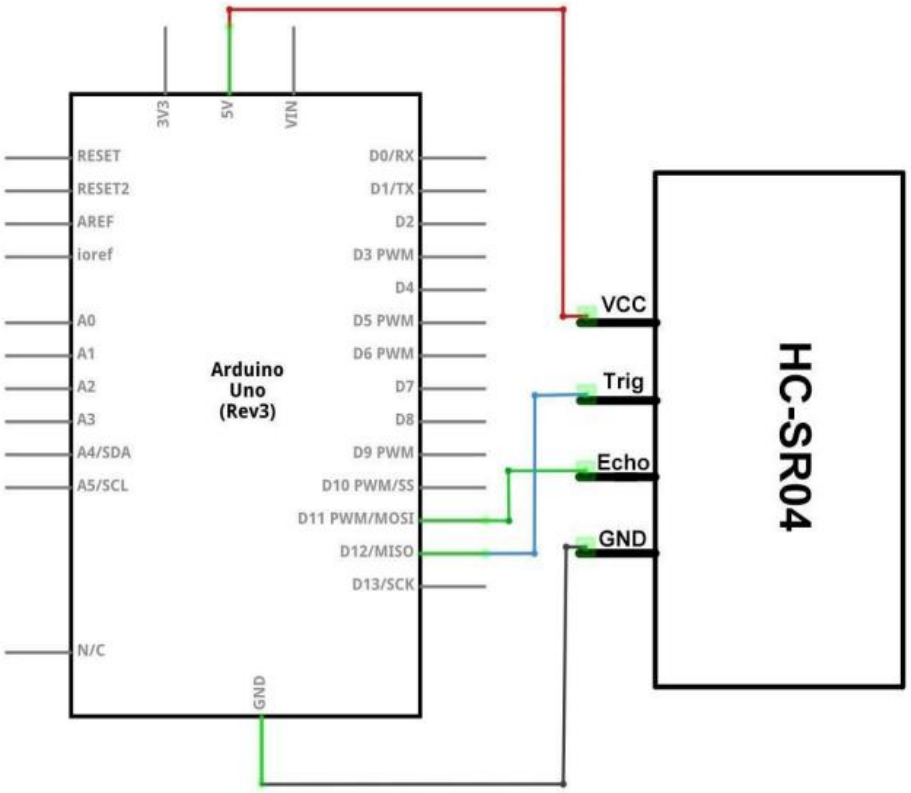
Formula: us / 58 = centimeters or us / 148 =inch; or: the range = high level time * velocity (340M/S) / 2;

we suggest to use over 60ms measurement cycle, in order to prevent trigger signal to the echo signal.

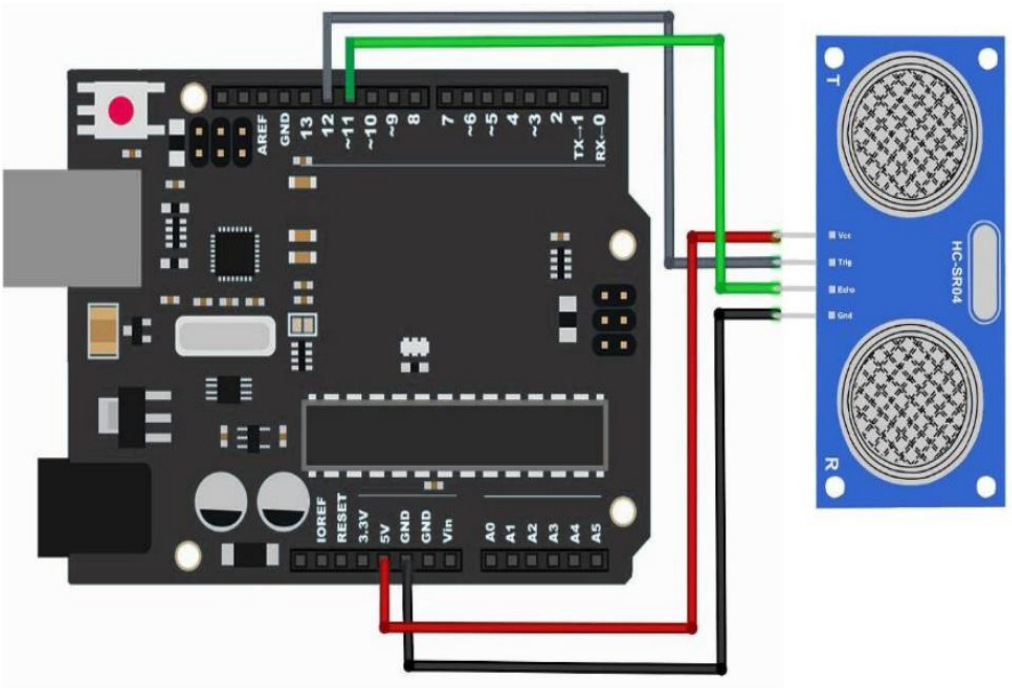


Connection

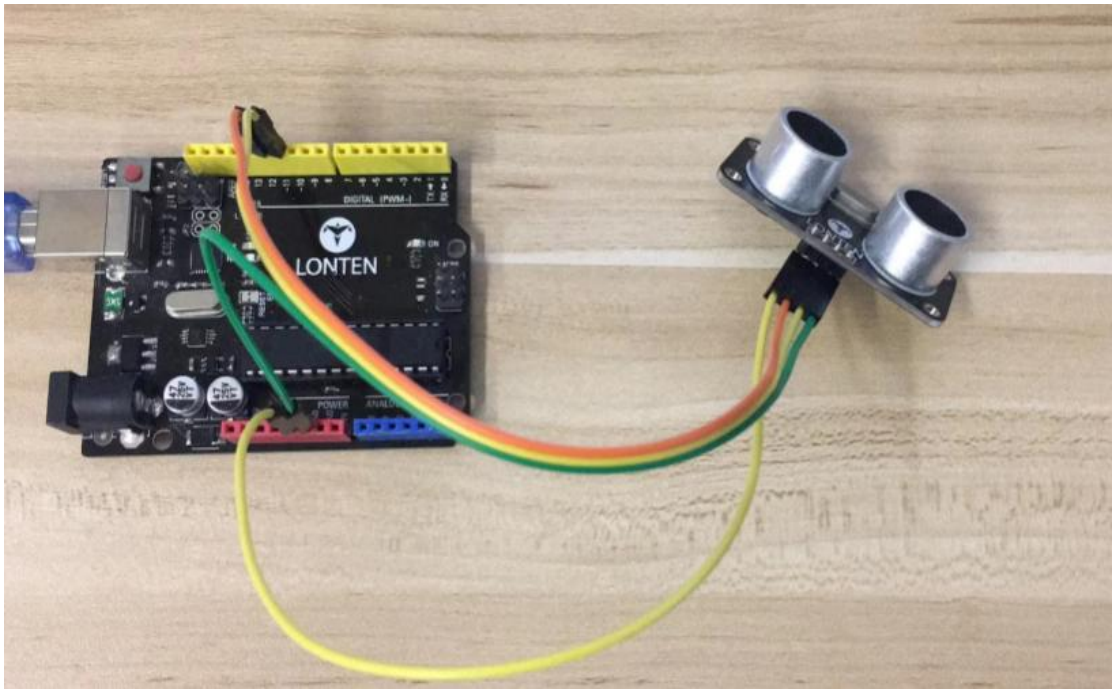
Schematic



Circuit Connection



Example picture

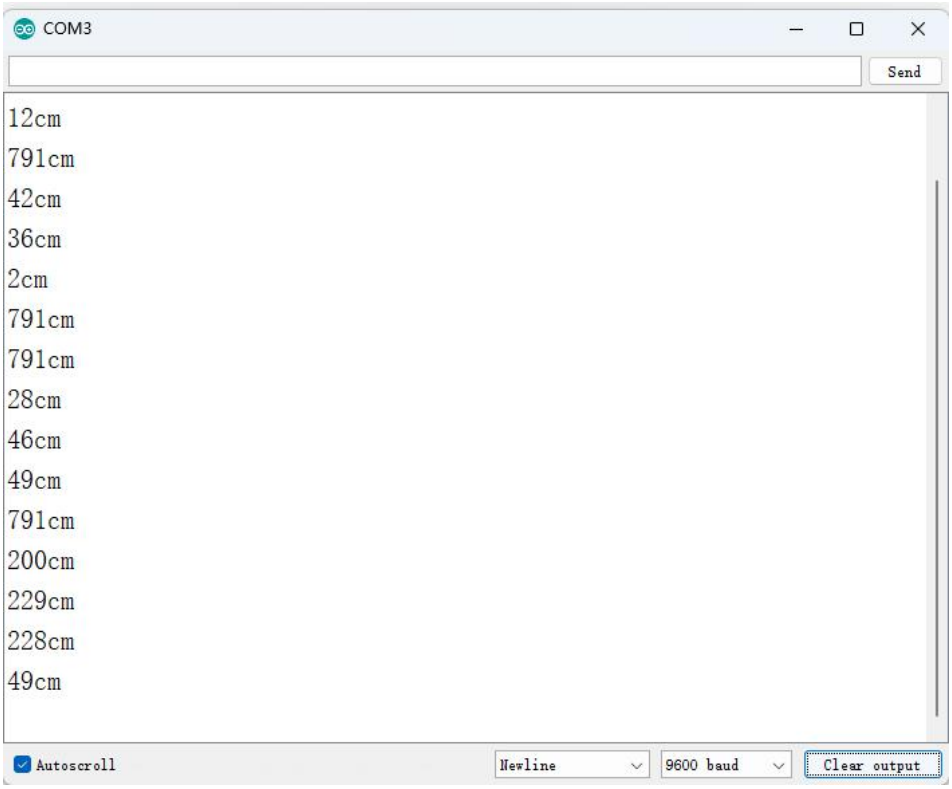


Code

Using a Library designed for these sensors will make our code short and simple. We include the library at the beginning of our code, and then by using simple commands we can control the behavior of the sensor.

After wiring, please open the program in the code folder- Lesson 10 Ultrasonic Sensor Module and click UPLOAD to upload the program. Before you can run this, make sure that you have installed the <HC-SR04> library or re-install it, if necessary. Otherwise, your code won't work.

Open the monitor then you can see the data as blow:



Lesson 11 Eight LED with 74HC595

Overview

In this lesson, you will learn how to use eight large red LEDs with an UNO without needing to give up 8 output pins!

Although you could wire up eight LEDs each with a resistor to an UNO pin you would rapidly start to run out of pins on your UNO. If you don't have a lot of stuff connected to your UNO. It's OK to do so - but often times we want buttons, sensors, servos, etc. and before you know it you've got no pins left. So, instead of doing that, you are going to use a chip called the 74HC595 Serial to Parallel Converter. This chip has eight

outputs (perfect) and three inputs that you use to feed data into it a bit at a time.

This chip makes it a little slower to drive the LEDs (you can only change the LEDs about 500,000 times a second instead of 8,000,000 a second) but it's still really fast, way faster than humans can detect, so it's worth it!

Component Required:

(1) x LONTEN Uno R3

(1) x 830 tie-points breadboard

(8) x leds

(8) x 220 ohm resistors

(1) x 74hc595 IC

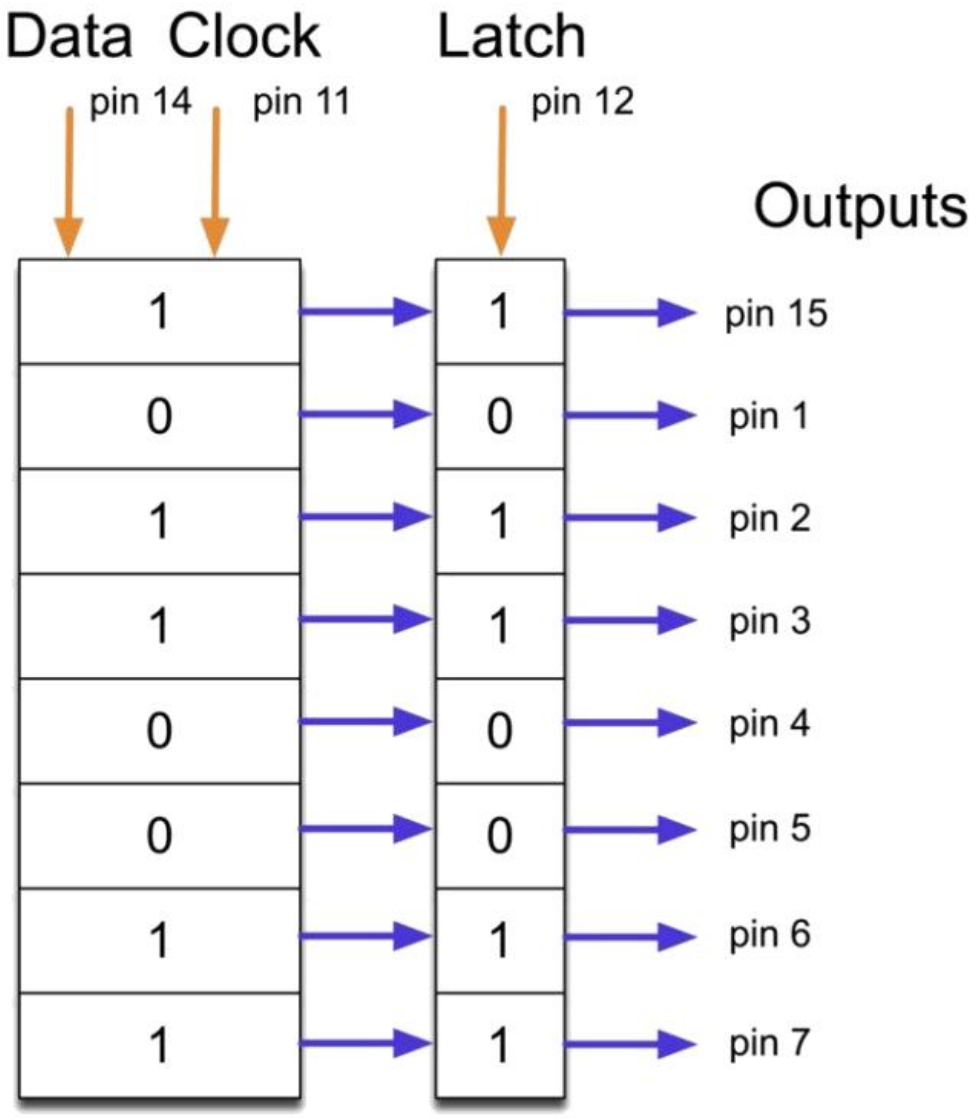
(14) x M-M wires (Male to Male jumper wires)

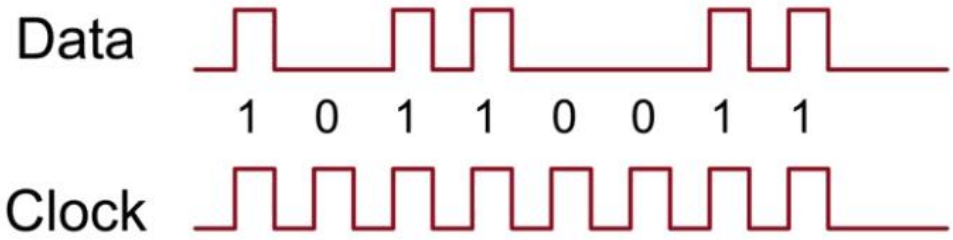
Component Introduction

74HC595 Shift Register:

The shift register is a type of chip that holds what can be thought of as eight memory locations, each of which can either be a 1 or a 0. To set

each of these values on or off, we feed in the data using the 'Data' and 'Clock' pins of the chip.



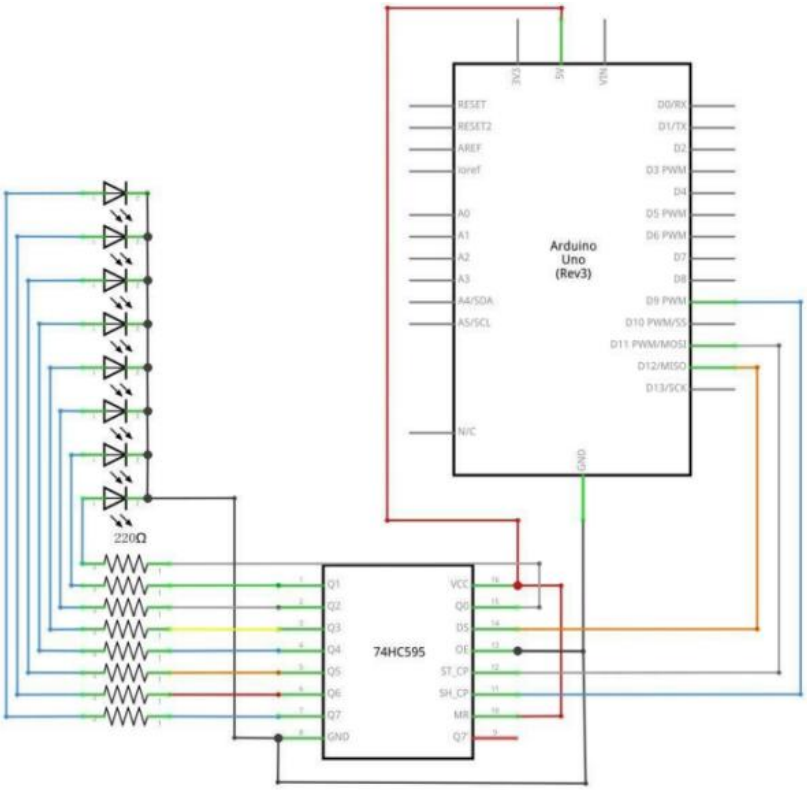


The clock pin needs to receive eight pulses. At each pulse, if the data pin is high, then a 1 gets pushed into the shift register; otherwise, a 0. When all eight pulses have been received, enabling the 'Latch' pin copies those eight values to the latch register. This is necessary; otherwise, the wrong LEDs would flicker as the data is being loaded into the shift register.

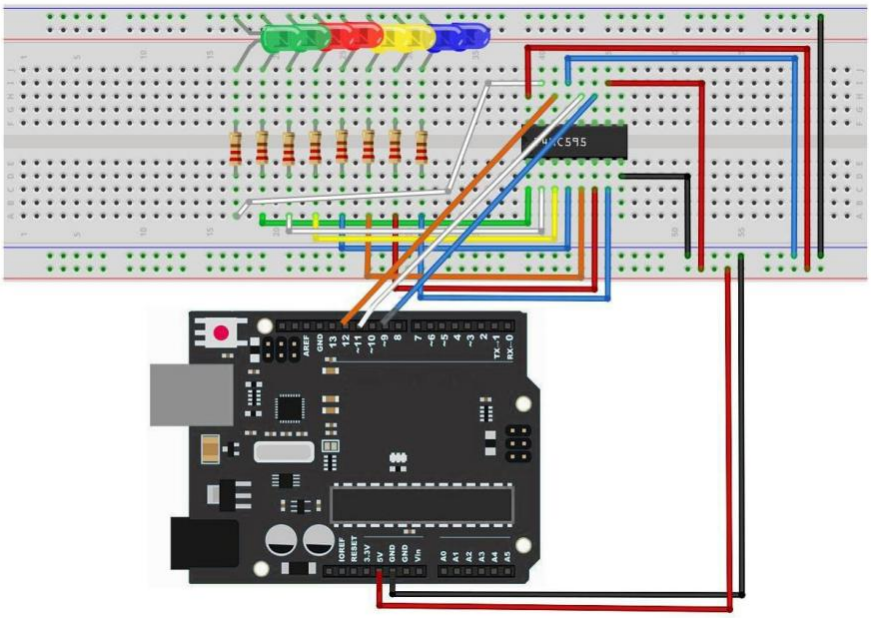
The chip also has an output enable (OE) pin, which is used to enable or disable the outputs all at once. You could attach this to a PWM-capable UNO pin and use 'analogWrite' to control the brightness of the LEDs. This pin is active low, so we tie it to GND.

Connection

Schematic



Circuit Connection



As we have eight LEDs and eight resistors to connect, there are actually quite a few connections to be made.

It is probably easiest to put the 74HC595 chip in first, as pretty much everything else connects to it. Put it so that the little U-shaped notch is towards the top of the breadboard. Pin 1 of the chip is to the left of this notch.

Digital 12 from the UNO goes to pin #14 of the shift register

Digital 11 from the UNO goes to pin #12 of the shift register

Digital 9 from the UNO goes to pin #11 of the shift register

All but one of the outputs from the IC is on the left side of the chip. Hence, for ease of connection, that is where the LEDs are, too.

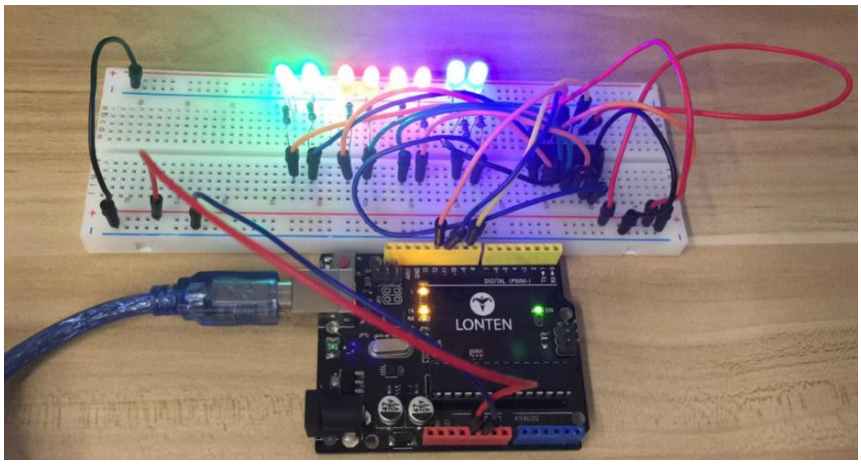
After the chip, put the resistors in place. You need to be careful that none of the leads of the resistors are touching each other. You should check this again before you connect the power to your UNO. If you find it difficult to arrange the resistors without their leads touching, then it helps to shorten the leads so that they are lying closer to the surface of the breadboard.

Next, place the LEDs on the breadboard. The longer positive LED leads must all be towards the chip, whichever side of the breadboard they are on.

Attach the jumper leads as shown above. Do not forget the one that goes from pin 8 of the IC to the GND column of the breadboard.

Load up the sketch listed a bit later and try it out. Each LED should light in turn until all the LEDs are on, and then they all go off and the cycle repeats.

Example picture



Code

After wiring, please open the program in the code folder- Lesson 11 Eight LED with 74HC595 and click UPLOAD to upload the program.

The first thing we do is define the three pins we are going to use. These are the UNO digital outputs that will be connected to the latch, clock and data pins of the 74HC595.

```
int latchPin = 11;
int clockPin = 9;
int dataPin = 12;
```

Next, a variable called 'leds' is defined. This will be used to hold the pattern of which LEDs are currently turned on or off. Data of type 'byte'

represents numbers using eight bits. Each bit can be either on or off, so this is perfect for keeping track of which of our eight LEDs are on or off.

```
byte leds = 0;
```

The 'setup' function just sets the three pins we are using to be digital outputs.

```
void setup()
{
pinMode(latchPin, OUTPUT);
pinMode(dataPin, OUTPUT);
pinMode(clockPin, OUTPUT);
}
```

The 'loop' function initially turns all the LEDs off, by giving the variable 'leds' the value 0. It then calls 'updateShiftRegister' that will send the 'leds' pattern to the shift register so that all the LEDs turn off. We will deal with how 'updateShiftRegister' works later.

The loop function pauses for half a second and then begins to count from 0 to 7 using the 'for' loop and the variable 'i'. Each time, it uses the Arduino function 'bitSet' to set the bit that controls that LED in the variable 'leds'. It then also calls 'updateShiftRegister' so that the leds update to reflect what is in the variable 'leds'.

There is then a half second delay before 'i' is incremented and the next LED is lit.

```
void loop()
{
leds = 0;
updateShiftRegister();
delay(500);
for (int i = 0; i < 8; i++)
{
bitSet(leds, i);
updateShiftRegister();
delay(500);
}
}
```

The function 'updateShiftRegister', first of all sets the latchPin to low, then calls the UNO function 'shiftOut' before putting the 'latchPin' high again. This takes four parameters, the first two are the pins to use for Data and Clock respectively.

The third parameter specifies which end of the data you want to start at. We are going to start with the right most bit, which is referred to as the 'Least Significant Bit' (LSB).

The last parameter is the actual data to be shifted into the shift register, which in this case is 'leds'.

```
void updateShiftRegister()
{
digitalWrite(latchPin, LOW);
shiftOut(dataPin, clockPin, LSBFIRST, leds);
digitalWrite(latchPin, HIGH);
}
```

If you wanted to turn one of the LEDs off rather than on, you would call a similar Arduino function (bitClear) with the 'leds' variable. This will set that bit of 'leds' to be 0 and you would then just need to follow it with a call to 'updateShiftRegister' to update the actual LEDs.

Lesson 12 Photocell

Overview

In this lesson, you will learn how to measure light intensity using an Analog Input.

You will build on lesson 11 and use the level of light to control the number of LEDs to be lit. The photocell is at the bottom of the breadboard, where the pot was above.

Component Required:

(1) x LONTEN Uno R3

(1) x 830 tie-points breadboard

(8) x leds

(8) x 220 ohm resistors

(1) x 1k ohm resistor

(1) x 74hc595 IC

(1) x Photoresistor (Photocell)

(16) x M-M wires (Male to Male jumper wires)

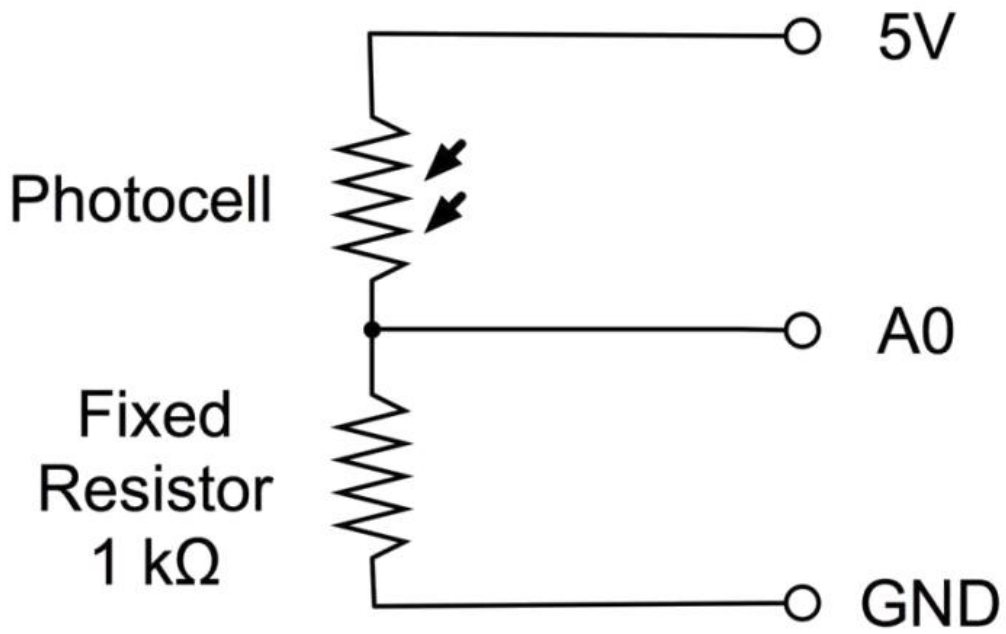
Component Introduction

PHOTOCELL:

The photocell used is of a type called a light dependent resistor, sometimes called an LDR. As the name suggests, these components act just like a resistor, except that the resistance changes in response to how much light is falling on them.

This one has a resistance of about 50 kΩ in near darkness and 500 Ω in bright light.

To convert this varying value of resistance into something we can measure on an UNO R3 board's analog input, it needs to be converted into a voltage. The simplest way to do that is to combine it with a fixed resistor.



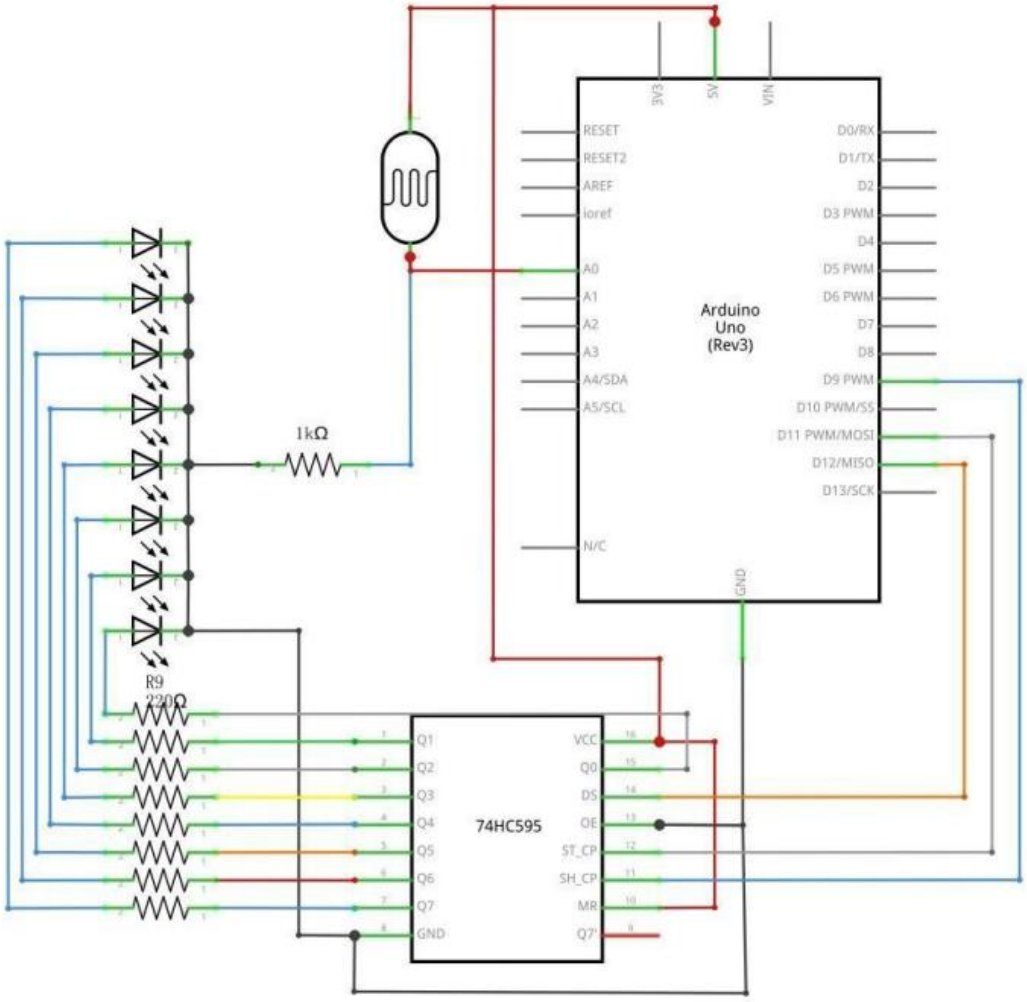
The resistor and photocell together behave like a pot. When the light is very bright, then the resistance of the photocell is very low compared

with the fixed value resistor, and so it is as if the pot were turned to maximum.

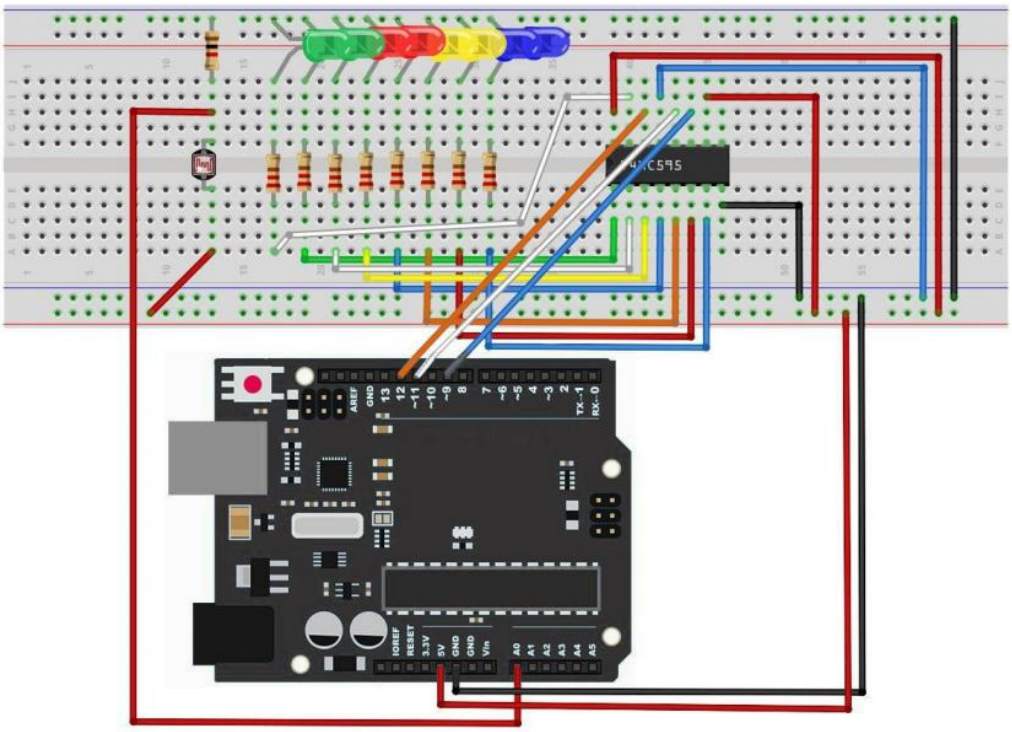
When the photocell is in dull light, the resistance becomes greater than the fixed 1 kΩ resistor and it is as if the pot were being turned towards GND. Load up the sketch given in the next section and try covering the photocell with your finger, and then holding it near a light source.

Connection

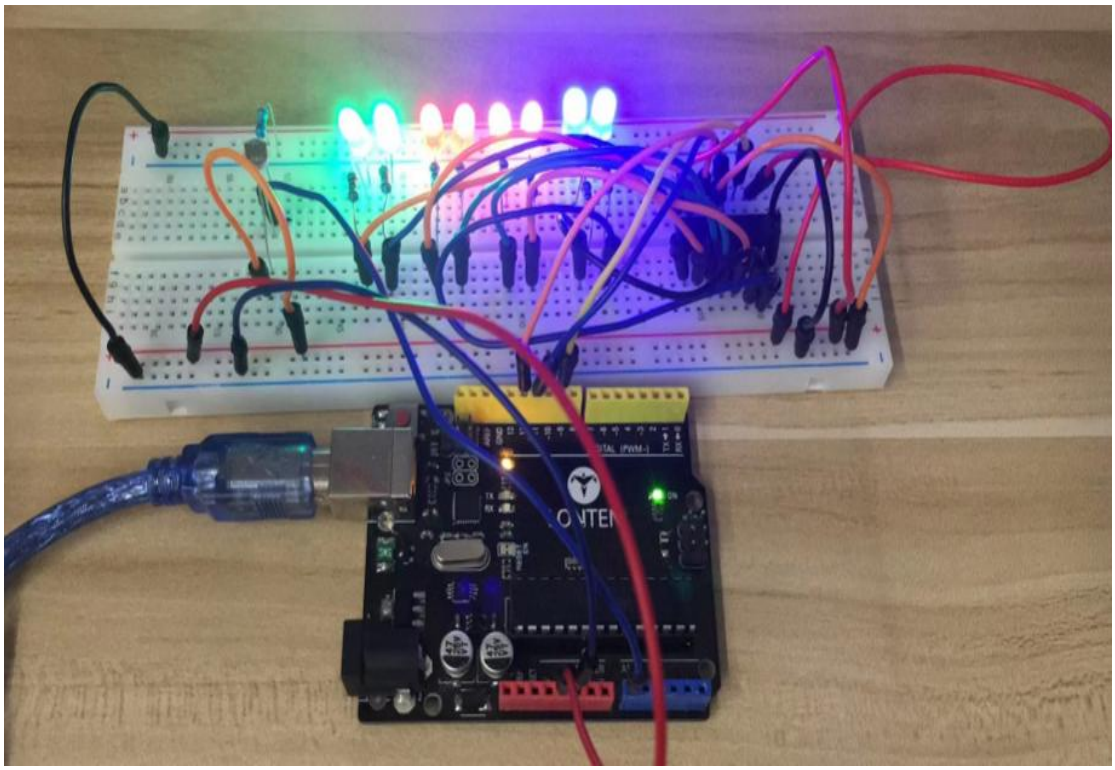
Schematic



Circuit Connection



Example picture



Code

After wiring, please open the program in the code folder- Lesson 12 Photocell and click UPLOAD to upload the program.

The first thing to note is that we have changed the name of the analog pin to be 'lightPin' rather than 'potPin' since we no longer have a pot connected.

The only other substantial change to the sketch is the line that calculates how many of the LEDs to light:

```
int numLEDSLit = reading / 57; // all LEDs lit at 1k
```

This time, we divide the raw reading by 57 rather than 114. In other words, we divide it by half as much as we did with the pot to split it into nine zones, from no LEDs lit to all eight lit. This extra factor is to account for the fixed 1 kΩ resistor. This means that when the photocell has a resistance of 1 kΩ (the same as the fixed resistor), the raw reading will be 1023 / 2 = 511. This will equate to all the LEDs being lit and then a bit (numLEDSLit) will be 8.

Lesson 13 74HC595 And Segment Display

Overview

In learning Lesson, we will use the 74HC595 shift register to control the segment display. The segment display will show number from 9-0.

Component Required

(1) x LONTEN Uno R3

(1) x 830 tie-points breadboard

(1) x 74HC595 IC

(1) x 1 Digit 7-Segment Display

(8) x 220 ohm resistors

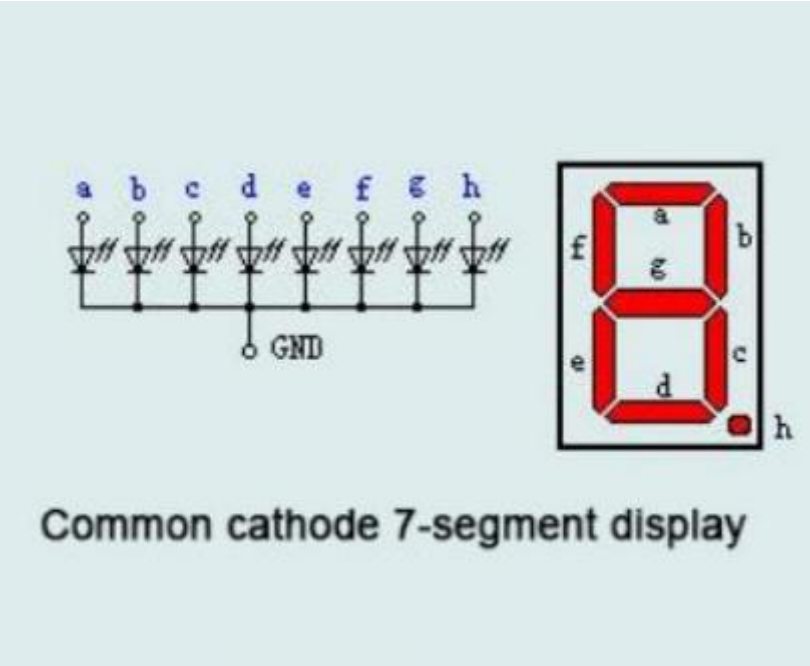
(26) x M-M wires (Male to Male jumper wires)

Component Introduction

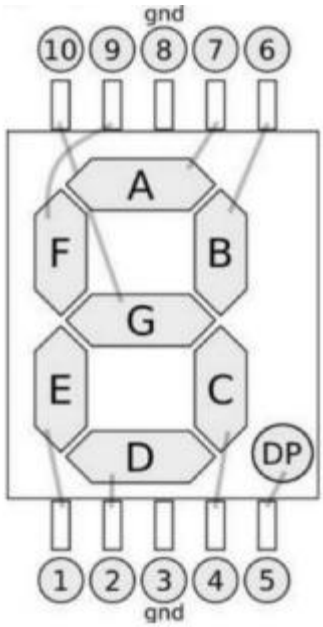
Seven segment display

LED segment displays are common for displaying numerical information. It's widely applied on displays of electromagnetic oven, full automatic washing machine, water temperature display, electronic clock etc. It is necessary that we learn how it works. LED segment display is a semiconductor light-emitting device. Its basic unit is a light-emitting diode (LED). LED segment display can be divided into 7-segment display and 8-segment display according to the number of segments.

8-segment display has one more LED unit (for decimal point display) than 7-segment one. In this experiment, we use a 8-segment display.



According to the wiring method of LED units, LED segment displays can be divided into display with common anode and display with common cathode. Common anode display refers to the one that combine all the anodes of LED units into one common anode (COM).For the common anode display, connect the common anode (COM) to +5V. When the cathode level of a certain segment is low, the segment is on; when the cathode level of a certain segment is high, the segment is off. For the common cathode display, connect the common cathode (COM) to GND. When the anode level of a certain segment is high, the segment is on; when the anode level of a certain segment is low, the segment is off.



Each segment of the display consists of an LED. So when you use it, you also need use a current-limiting resistor. Otherwise, LED will be burnt out. In this experiment, we use a common cathode display. As we mentioned above, for common cathode display, connect the common cathode (COM) to GND. When the anode level of a certain segment is high, the segment is on; when the anode level of a certain segment is low, the segment is off.

74HC595

The following table shows the seven-segment display 74HC595 pin correspondence table:

74HC595 pin	Seven shows remarkable control pin (stroke)
Q0	7(A)
Q1	6(B)
Q2	4(C)
Q3	2(D)
Q4	1(E)
Q5	9(F)
Q6	10(G)
Q7	5(DP)

Step one: Connect 74HC595

First, the wiring is connected to power and ground:

VCC (pin 16) and MR (pin 10) connected to 5V

GND (pin 8) and OE (pin 13) to ground

Connection DS, ST_CP and SH_CP pin:

DS (pin 14) connected to UNO R3 board pin 2 (the figure below the yellow line)

ST_CP (pin 12, latch pin) connected to UNO R3 board pin 3 (FIG blue line below)

SH_CP (pin 11, clock pin) connected to UNO R3 board pin 4 (the figure below the white line)

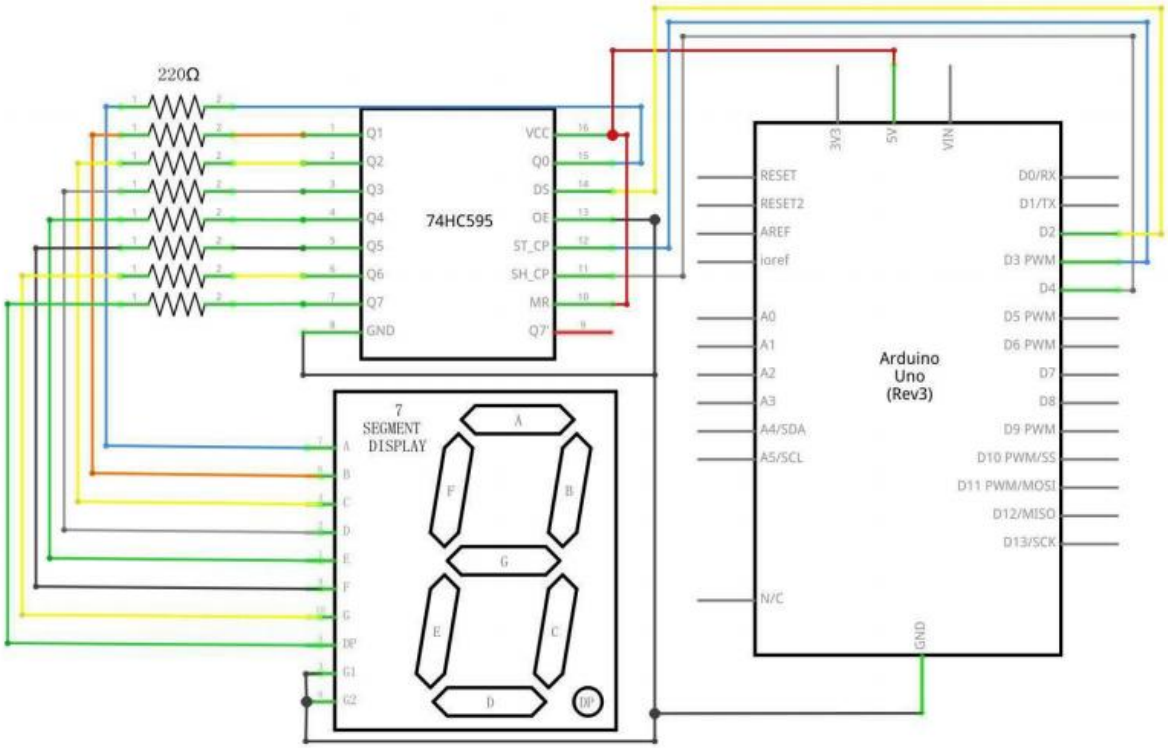
Step two: Connect the seven segment display

The seven-segment display 3, 8 pin to UNO R3 board GND (This example uses the common cathode, if you use the common anode, please connect the 3, 8 pin to UNO R3 board + 5V)

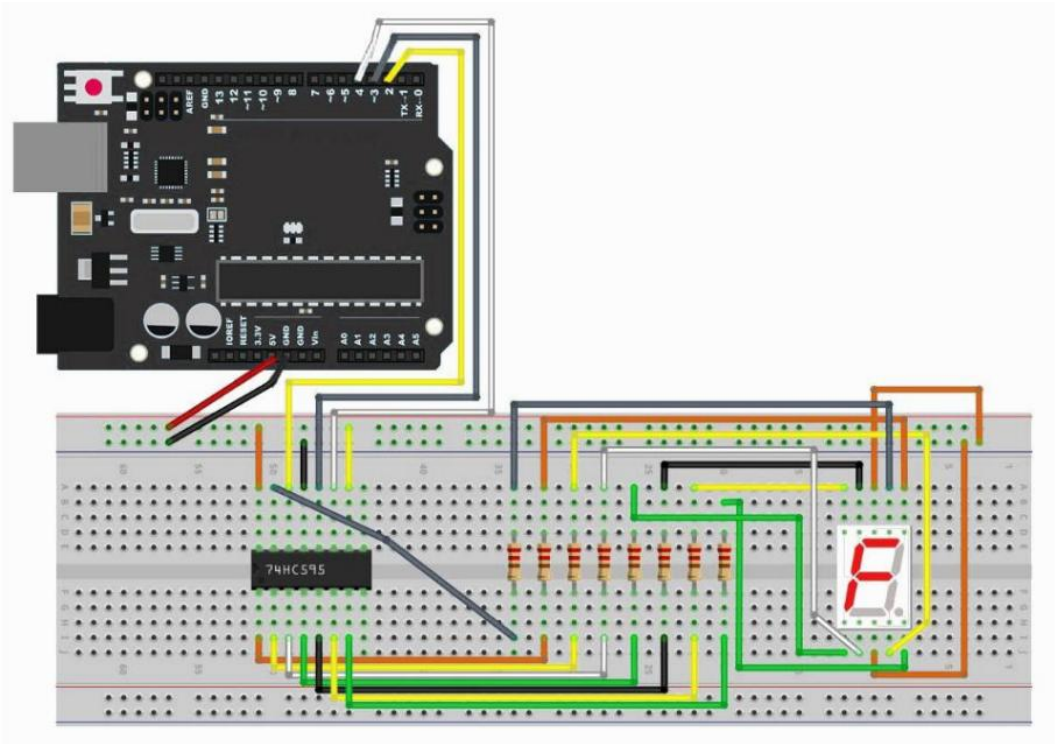
According to the table above, connect the 74HC595 Q0 ~ Q7 to seven-segment display corresponding pin (A ~ G and DP), and then each foot in a 220 ohm resistor in series.

Connection

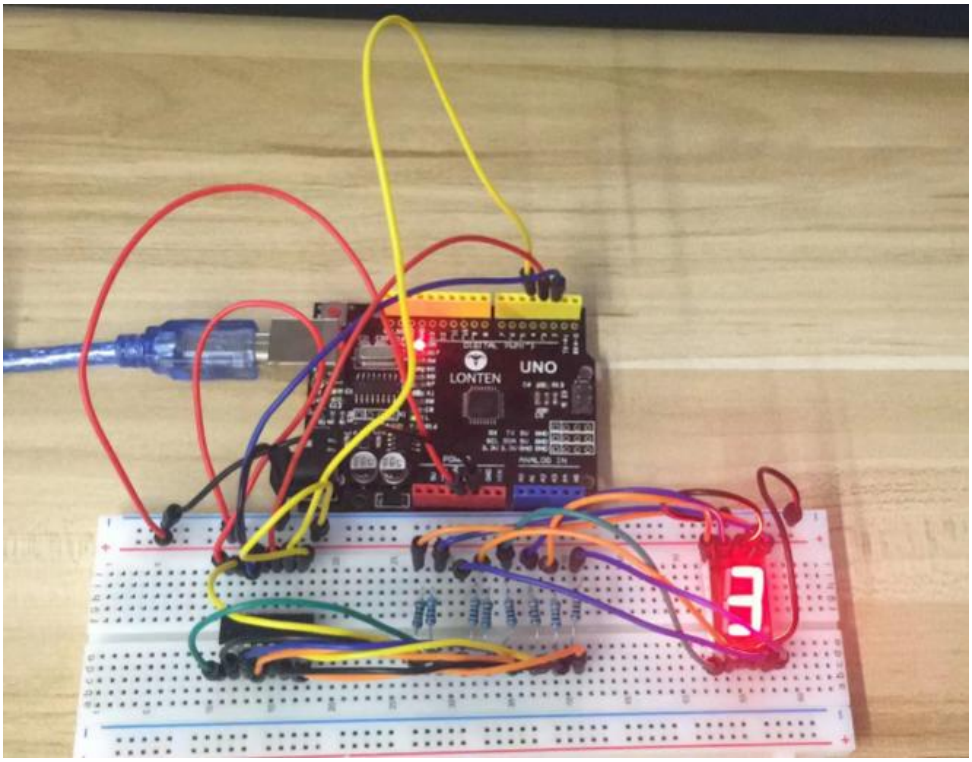
Schematic



Circuit Connection



Example picture



Code

After wiring, please open the program in the code folder- Lesson 13 74HC595 And Segment Display and click UPLOAD to upload the program.

LED segment display repeat displays number 9 to 0.

Lesson 14 Four Digital Seven Segment Display

Overview

In this lesson, you will learn how to use a 4-digit 7-segment display.

When using 1-digit 7-segment display, please notice that if it is common anode, the common anode pin connects to the power source; if it is common cathode, the common cathode pin connects to the GND.

When using 4-digit 7-segment display, the common anode or common cathode pin is used to control which digit is displayed. Even though there is only one digit working, the principle of Persistence of Vision enables you to see all numbers displayed because each the scanning speed is so fast that you hardly notice the intervals.

Component Required:

(1) x LONTEN Uno R3

(1) x 830 tie-points breadboard

(1) x 74HC595 IC

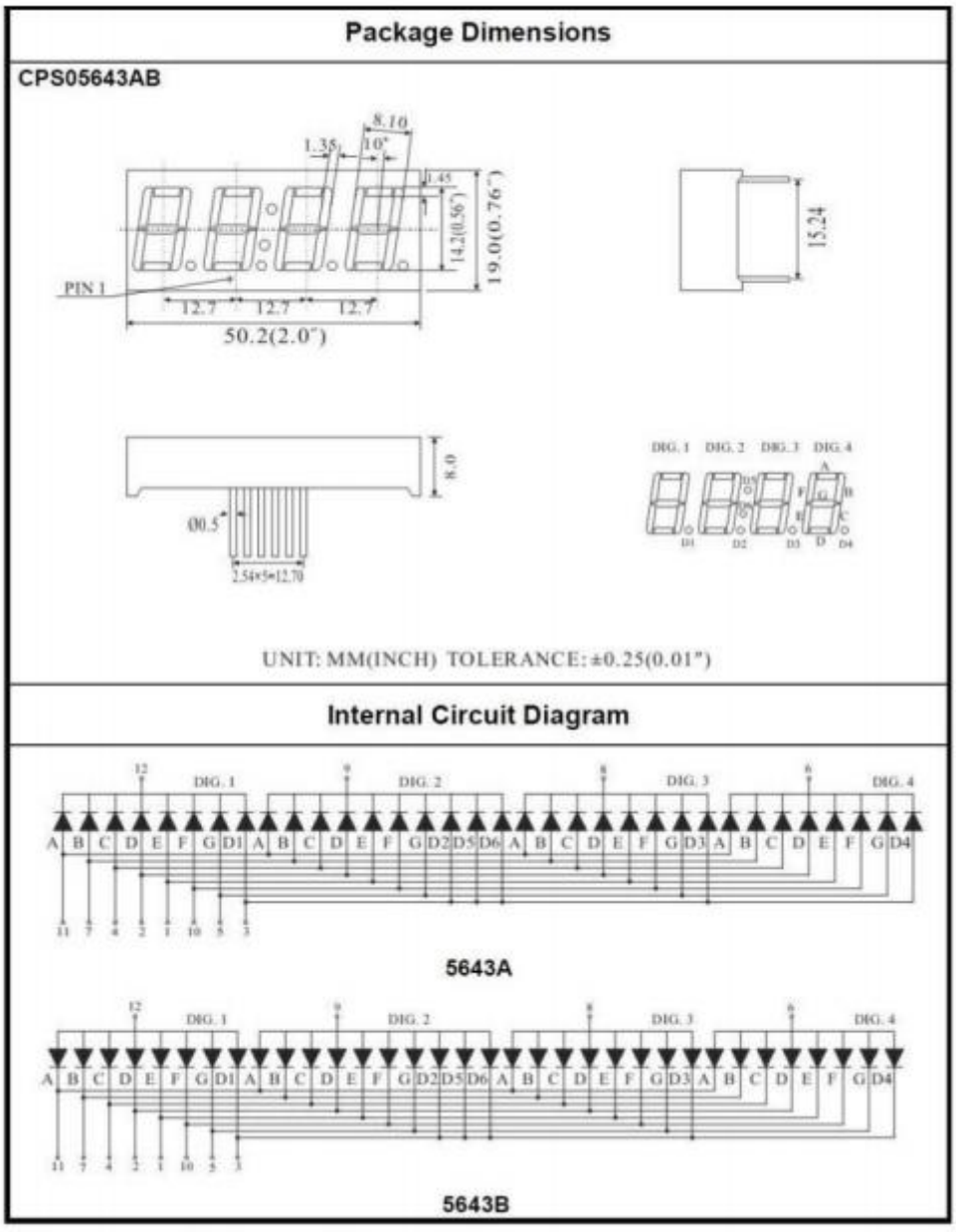
(1) x 4 Digit 7-Segment Display

(4) x 220 ohm resistors

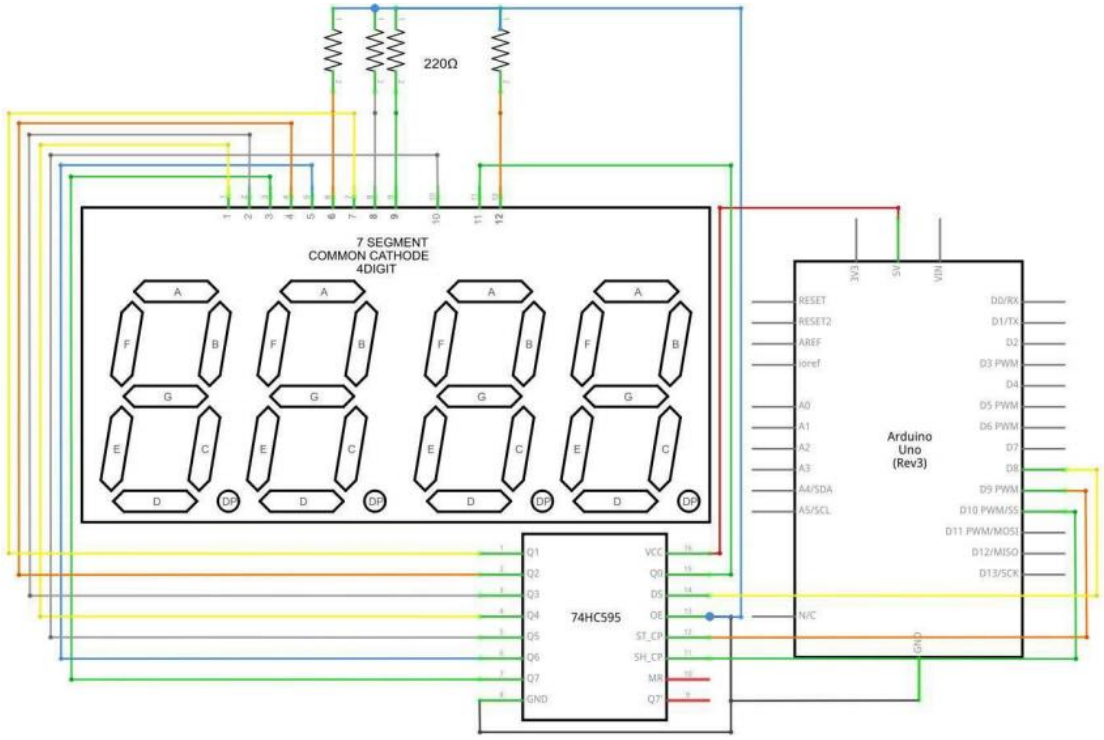
(23) x M-M wires (Male to Male jumper wires)

Component Introduction

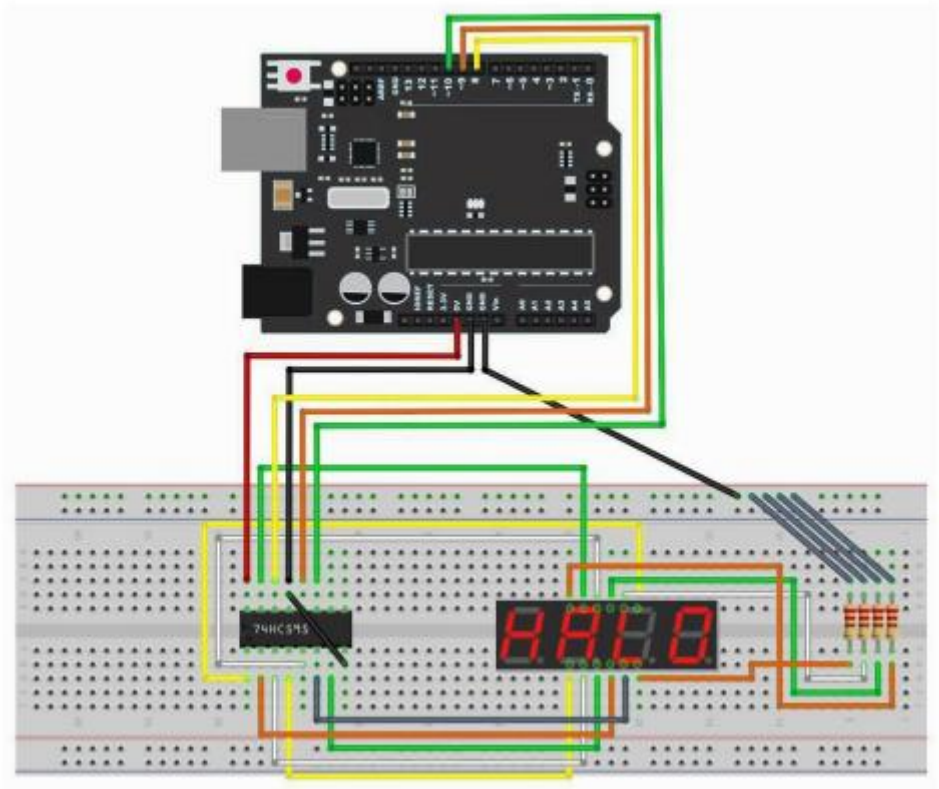
Four Digital Seven segment display



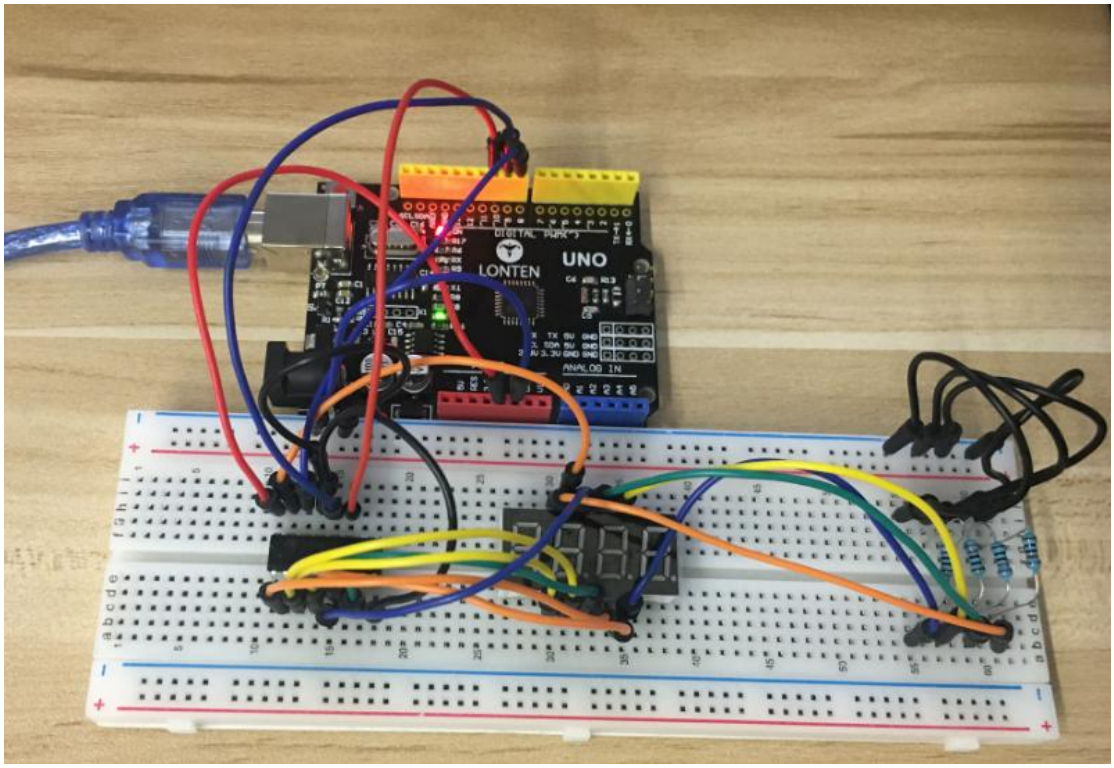
Connection
Schematic



Circuit Connection



Example picture



Code

After wiring, please open the program in the code folder- Lesson 14 Four Digital Seven Segment Display and click UPLOAD to upload the program.

Lesson 15 LCD display

Overview

In this lesson, you will learn how to wire up and use an alphanumeric LCD display.

The display has an LED backlight and can display two rows with up to 16 characters on each row. You can see the rectangles for each character on the display and the pixels that make up each character. The display is just white on blue and is intended for showing text.

In this lesson, we will run the Arduino example program for the LCD library, but in the next lesson, we will get our display to show the temperature, using sensors.

Component Required:

(1) x LONTEN Uno R3

(1) x LCD1602 module

(1) x Potentiometer (10k)

(1) x 830 tie-points Breadboard

(16) x M-M wires (Male to Male jumper wires)

Component Introduction:

LCD1602

Introduction to the pins of LCD1602:

VSS: A pin that connects to ground

VDD: A pin that connects to a +5V power supply

VO: A pin that adjust the contrast of LCD1602

RS: A register select pin that controls where in the LCD's memory you are writing data to. You can select either the data register, which holds what goes on the screen, or an instruction register, which is where the LCD's controller looks for instructions on what to do next.

R/W: A Read/Write pin that selects reading mode or writing mode

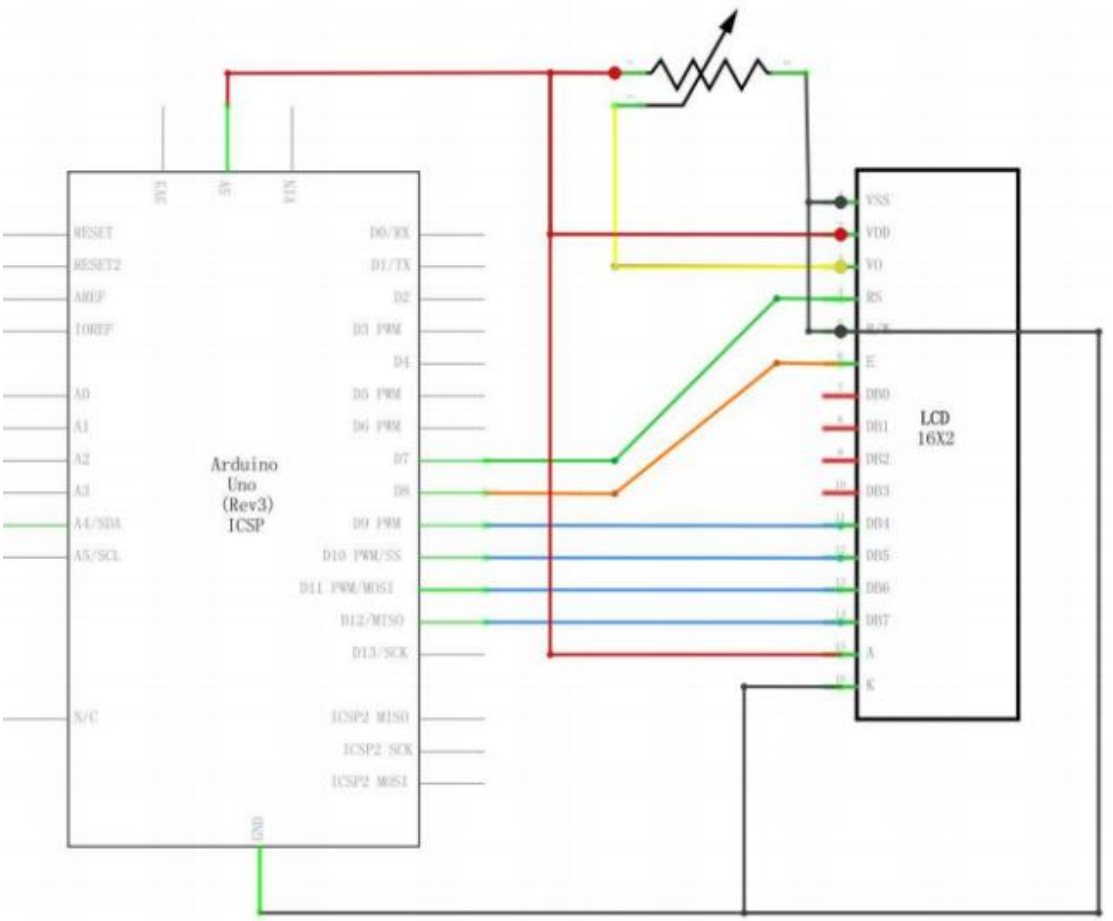
E: An enabling pin that, when supplied with low-level energy, causes the LDC module to execute relevant instructions.

D0-D7： Pins that read and write data

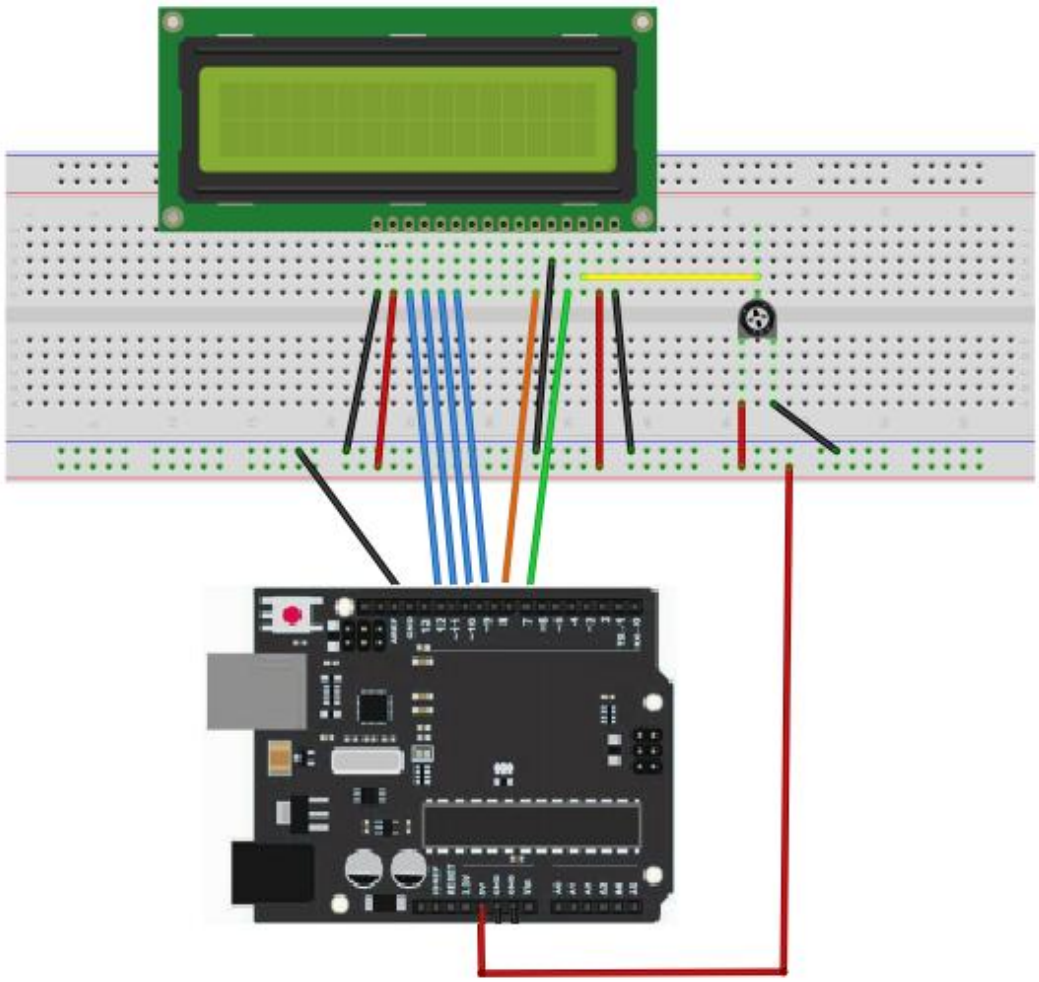
A and K: Pins that control the LED backlight

Connection

Schematic



Circuit Connection



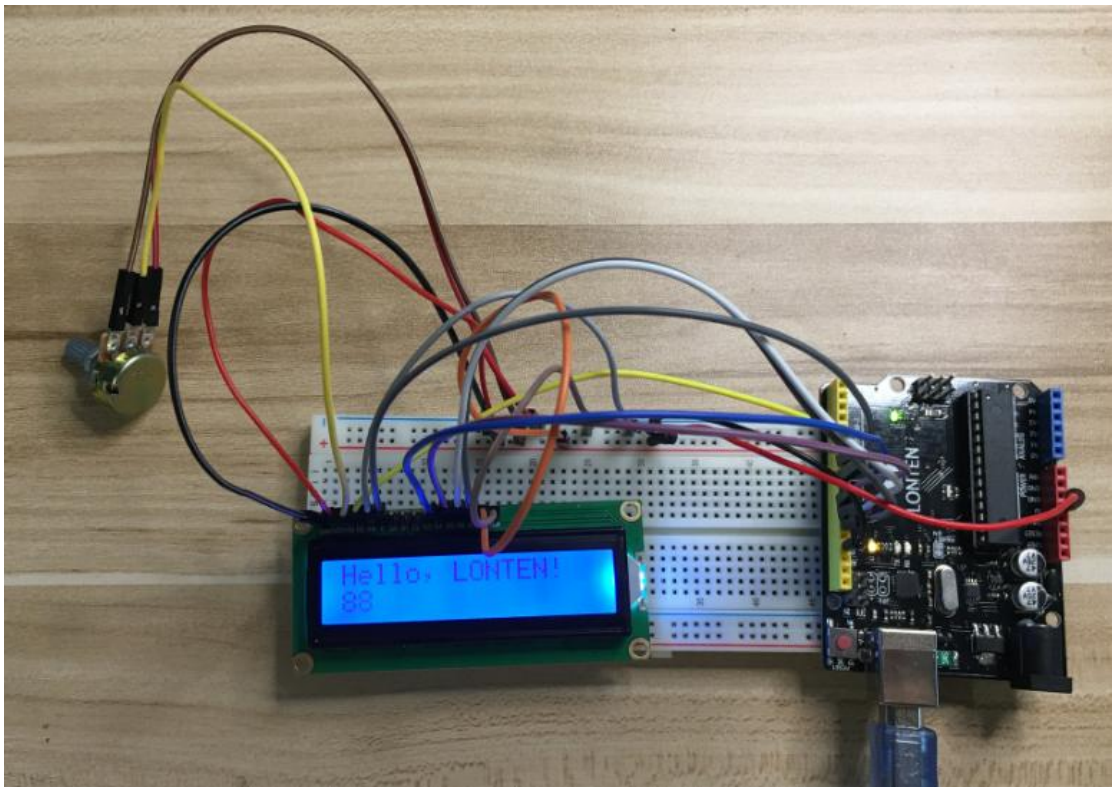
The LCD display needs six Arduino pins, all set to be digital outputs. It also needs 5V and GND connections.

There are a number of connections to be made. Lining up the display with the top of the breadboard helps to identify its pins without too much counting, especially if the breadboard has its rows numbered with row 1 as the top row of the board. Do not forget, the long yellow lead that links the slider of the pot to pin 3 of the display.

The 'pot' is used to control the contrast of the display.

You may find that your display is supplied without header pins attached to it. If so, follow the instructions in the next section.

Example picture



Code

After wiring, please open the program in the code folder- Lesson 15 LCD Display and click UPLOAD to upload the program.

Before you can run this, make sure that you have installed the <LiquidCrystal > library or re-install it, if necessary. Otherwise, your code won't work.

Upload the code to your Arduino board and you should see the message 'hello, world' displayed, followed by a number that counts up from zero.

The first thing of note in the sketch is the line:

```
#include <LiquidCrystal.h>
```

This tells Arduino that we wish to use the Liquid Crystal library.

Next we have the line that we had to modify. This defines which pins of the Arduino are to be connected to which pins of the display.

```
LiquidCrystal lcd(7, 8, 9, 10, 11,12);
```

After uploading this code, make sure the backlight is lit up, and adjust the potentiometer all the way around until you see the text message

In the 'setup' function, we have two commands:

```
lcd.begin(2, 16);
lcd.print("Hello,LONTEN!");
```

The first tells the Liquid Crystal library how many columns and rows the display has. The second line displays the message that we see on the first line of the screen.

In the 'loop' function, we also have two commands:

```
lcd.setCursor(0, 1);
lcd.print(millis()/1000);
```

The first sets the cursor position (where the next text will appear) to column 0 & row 1. Both column and row numbers start at 0 rather than 1. The second line displays the number of milliseconds since the Arduino was reset.

Lesson 16 Thermometer

Overview

In this lesson, you will use an LCD display to show the temperature.

Component Required:

(1) x LONTEN Uno R3

(1) x LCD1602 module

(1) x 10k ohm resistor

(1) x Thermistor

(1) x Potentiometer

(1) x 830 tie-points Breadboard

(18) x M-M wires (Male to Male jumper wires)

Component Introduction

Thermistor

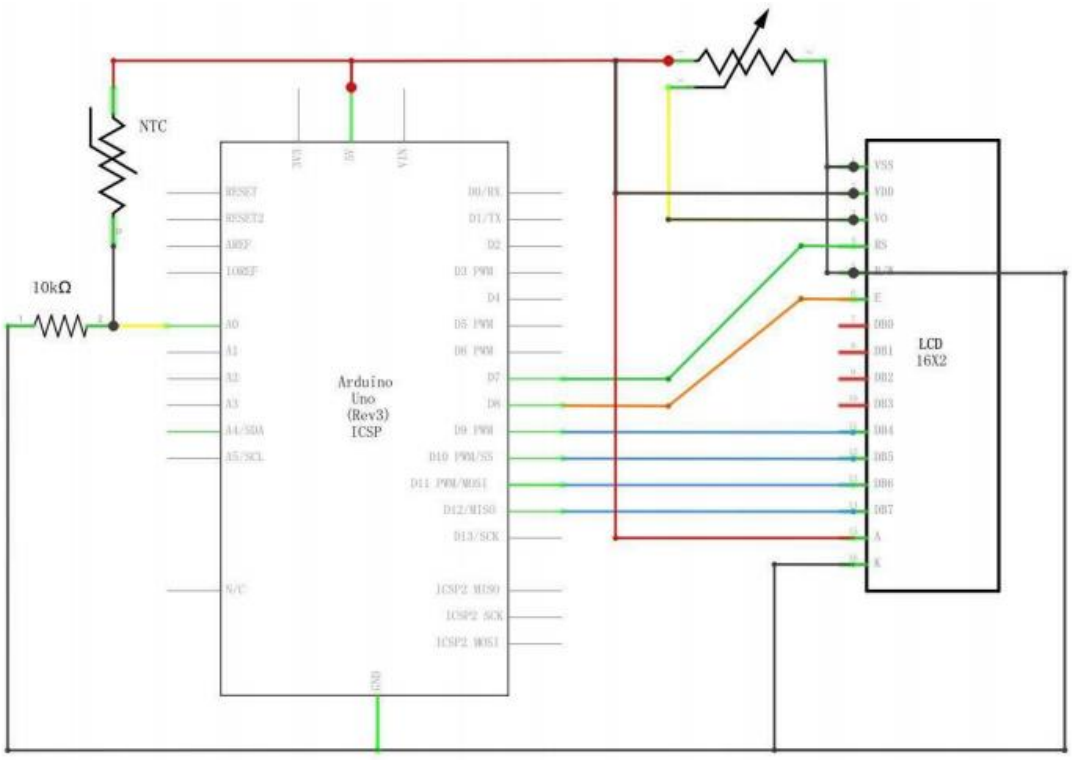
A thermistor is a thermal resistor - a resistor that changes its resistance with temperature. Technically, all resistors are thermistors - their

resistance changes slightly with temperature - but the change is usually very small and difficult to measure. Thermistors are made so that the resistance changes drastically with temperature so that it can be 100 ohms or more of change per degree!

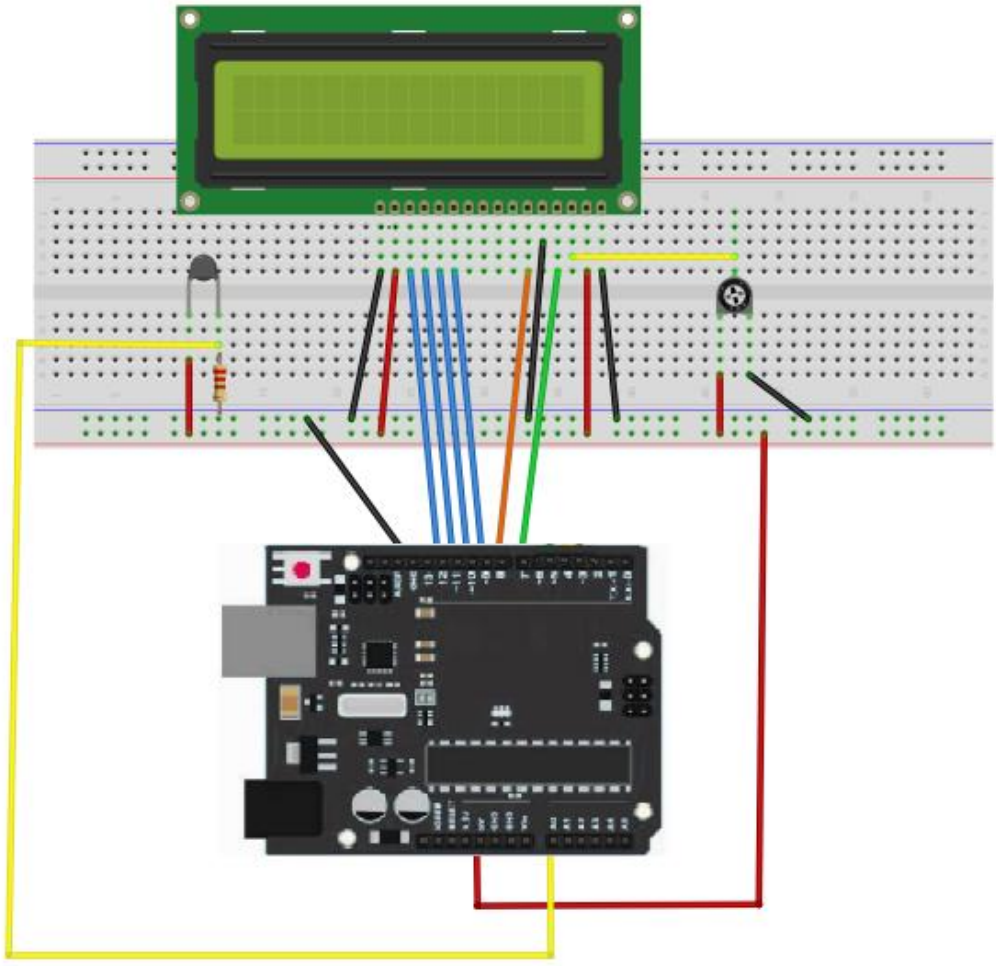
There are two kinds of thermistors, NTC (negative temperature coefficient) and PTC (positive temperature coefficient). In general, you will see NTC sensors used for temperature measurement. PTC's are often used as resettable fuses - an increase in temperature increases the resistance which means that as more current passes thru them, they heat up and 'choke back' the current, quite handy for protecting circuits!

Connection

Schematic



Circuit Connection

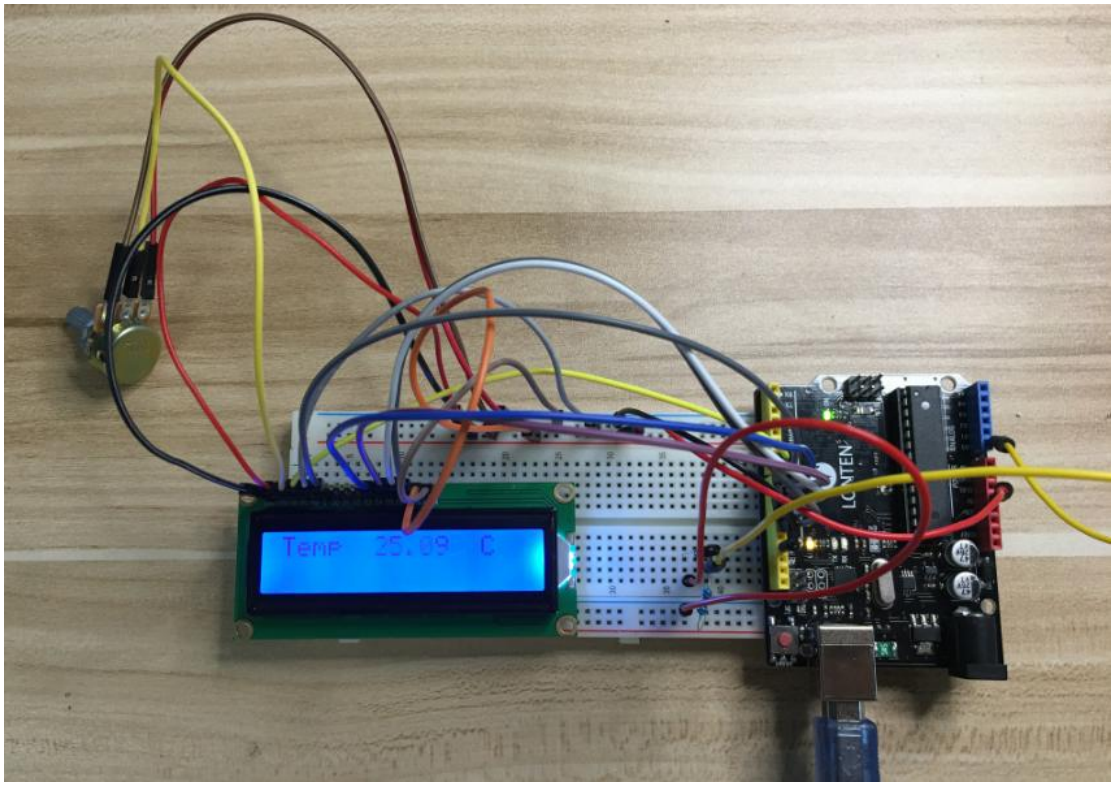


The breadboard layout is based on the layout from Lesson 15, so it will simplify things if you still have this on the breadboard.

There are a few jumper wires near the pot that have been moved slightly on this layout.

The 10 kΩ resistor and thermistor are all new additions to the board.

Example picture



Code

After wiring, please open the program in the code folder- Lesson 16 Thermometer and click UPLOAD to upload the program.

Before you can run this, make sure that you have installed the <LiquidCrystal > library or re-install it, if necessary. Otherwise, your code won't work.

The sketch for this is based on that of lesson 15. Load it up onto your Arduino and you should find that warming the temperature sensor by putting your finger on it will increase the temperature reading.

I find it useful to put a comment line above the 'lcd' command.

```
// BS E D4 D5 D6 D7
LiquidCrystal lcd(7, 8, 9, 10, 11,12);
```

This makes things easier if you decide to change which pins you use.

In the 'loop' function there are now two interesting things going on.

Firstly we have to convert the analog from the temperature sensor into an actual temperature,and secondly we have to work out how to display them.

First of all, let's look at calculating the temperature.

```
int tempReading =analogRead(tempPin);
double tempK = log(10000.0 * ((1024.0 / tempReading - 1)));
tempK = 1 / (0.001129148 + (0.000234125 + (0.0000000876741 *
tempK* tempK )) * tempK );
float tempC = tempK - 273.15;
float tempF = (tempC * 9.0)/ 5.0 +32.0;
```

Displaying changing readings on an LCD display can be tricky. The main problem is that the reading may not always be the same number of digits. So, if the temperature changed from 101.50 to 99.00 then the extra digit from the old reading is in danger of being left on the display.

To avoid this, write the whole line of the LCD each time around the loop.

```
lcd.setCursor(0, 0);
lcd.print("Temp C ");
lcd.setCursor(6, 0);
lcd.print(tempF);
```

The rather strange comment serves to remind you of the 16 columns of the display. You can then print a string of that length with spaces where the actual reading will go.

To fill in the blanks, set the cursor position for where the reading should appear and then print it.

Lesson 17 DC Motors

Overview

In this lesson, you will learn how to control a small DC motor using an UNO R3 and a transistor.

Component Required:

(1)x LONTEN Uno R3

(1) x 830 tie-points breadboard

(1) x L293D IC

(1) x Fan blade and 3-6v motor

(5) x M-M wires (Male to Male jumper wires)

(1) x Power Supply Module

(1) x 9V1A adapter

Component Introduction

Breadboard Power Supply

The small DC motor is likely to use more power than an UNO R3 board digital output can handle directly. If we tried to connect the motor straight to an UNO R3 board pin, there is a good chance that it could damage the UNO R3 board. So we use a power supply module provides power supply.

Product Specifications:

Locking On/Off Switch

LED Power Indicator

Input voltage: 6.5-9v (DC) via 5.5mm x 2.1mm plug

Output voltage: 3.3V/5v

Maximum output current: 700 mA

Independent control rail output. 0v, 3.3v, 5v to breadboard

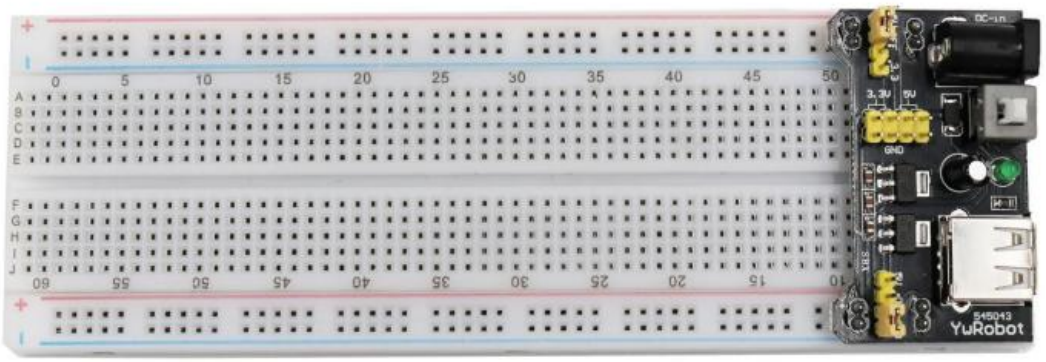
Output header pins for convenient external use

Size: 2.1 in x 1.4 in

USB device connector onboard to power external device

Setting up output voltage:

The left and right voltage output can be configured independently. To select the output voltage, move jumper to the corresponding pins. Note: power indicator LED and the breadboard power rails will not power on if both jumpers are in the “OFF” position.



Important note:

Make sure that you align the module correctly on the breadboard. The negative pin(-) on module lines up with the blue line(-) on breadboard and that the positive pin(+) lines up with the red line(+). Failure to do so could result in you accidently reversing the power to your project

L293D

This is a very useful chip. It can actually control two motors independently. We are just using half the chip in this lesson, most of the pins on the right hand side of the chip are for controlling a second motor.

Product Specifications:

• Featuring Unitrode L293 and L293D Products Now From Texas Instruments

• Wide Supply-Voltage Range: 4.5 V to 36 V

• Separate Input-Logic Supply

• Internal ESD Protection

• Thermal Shutdown

• High-Noise-Immunity Inputs

• Functionally Similar to SGS L293 and SGS L293D

• Output Current 1 A Per Channel (600 mA for L293D)

• Peak Output Current 2 A Per Channel (1.2 A for L293D)

• Output Clamp Diodes for Inductive T ransient Suppression (L293D)

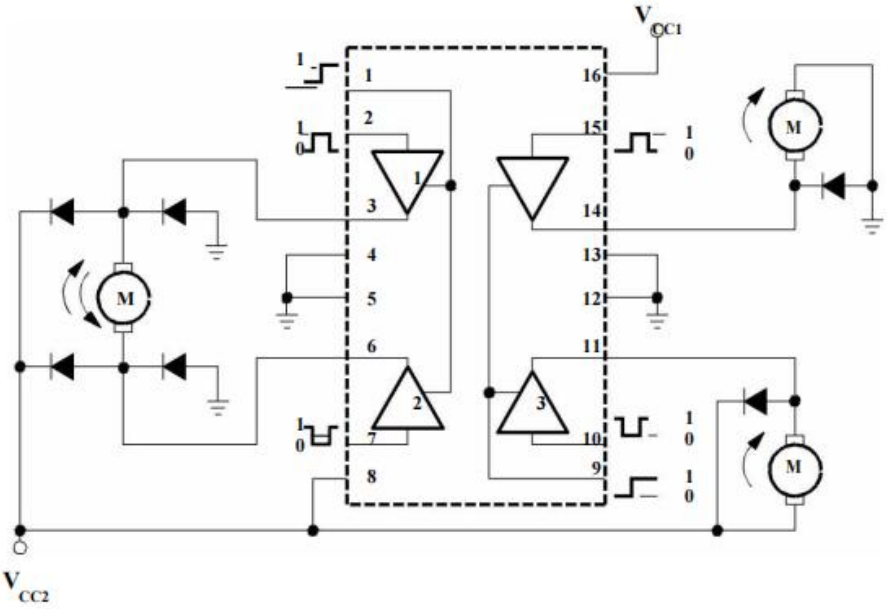
Description/ordering information

The L293 and L293D are quadruple high-current half-H drivers. The L293 is designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is designed to provide

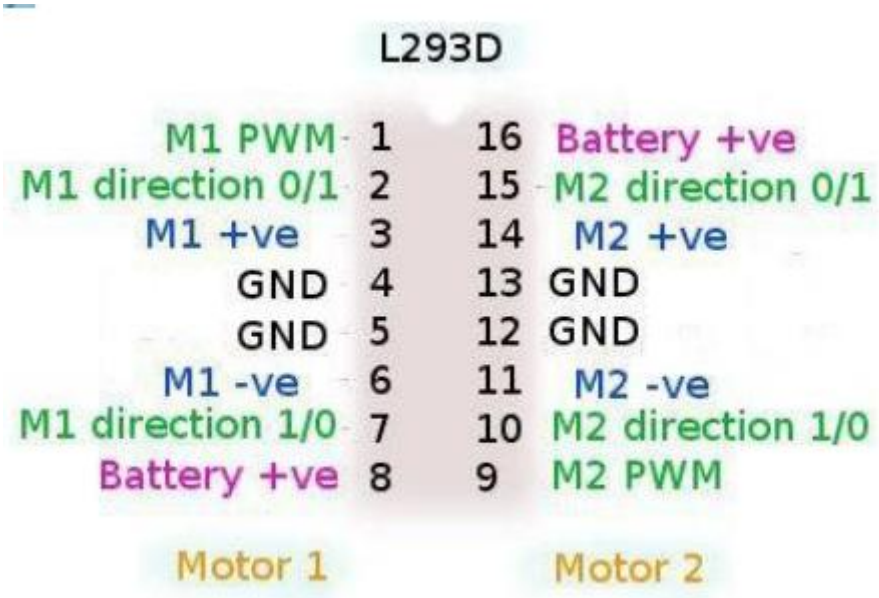
bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. Both devices are designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications.

All inputs are TTL compatible. Each output is a complete totem-pole drive circuit, with a Darlington transistor sink and a pseudo-Darlington source. Drivers are enabled in pairs, with drivers 1 and 2 enabled by 1,2EN and drivers 3 and 4 enabled by 3,4EN. When an enable input is high, the associated drivers are enabled, and their outputs are active and in phase with their inputs. When the enable input is low, those drivers are disabled, and their outputs are off and in the high-impedance state. With the proper data inputs, each pair of drivers forms a full-H (or bridge) reversible drive suitable for solenoid or motor applications.

Block diagram



I got fed up with indecipherable pinout diagrams within datasheets, so have designed my own that I think gives more pertinent information. There are 3 wires connected to the Arduino, 2 wires connected to the motor, and 1 wire connected to a battery.



To use this pinout:

The left hand side deals with the first motor, the right hand side deals with a second motor. Yes, you can run it with only one motor connected.

Arduino Connections

M1 PWM - connect this to a PWM pin on the Arduino. They're label led on the Uno, pin 5 is an example. Output any integer between 0 and 255, where 0 will be off, 128 is half speed and 255 is max speed.

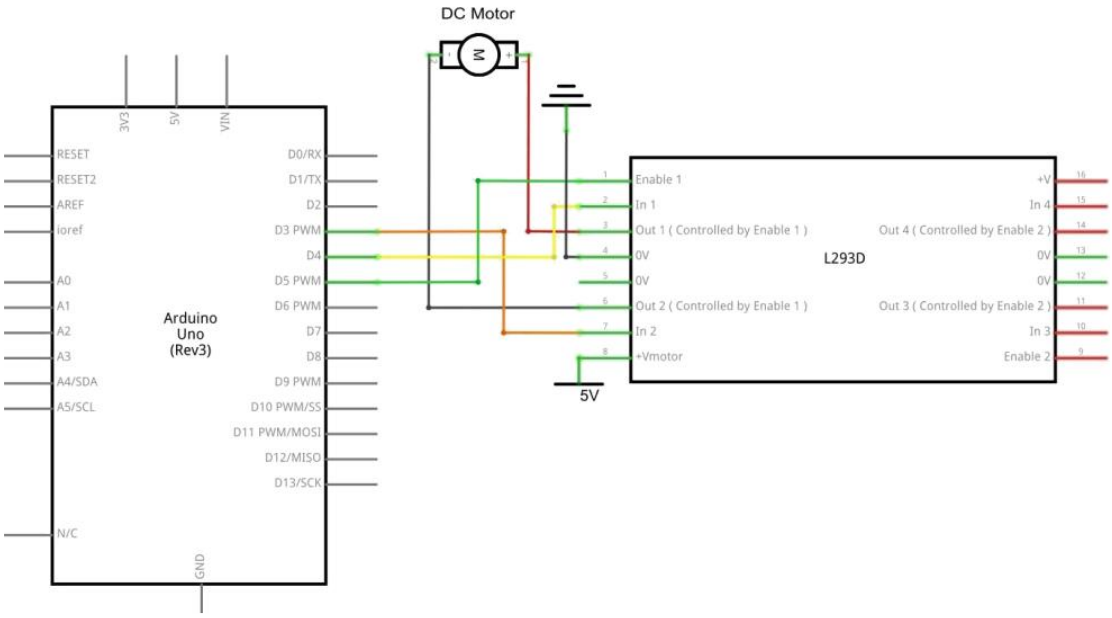
M1 direction 0/1 and M1 direction 1/0 - Connect these two to two digital Arduino pins.

Output one pin as HIGH and the other pin as LOW, and the motor will spin in one direction.

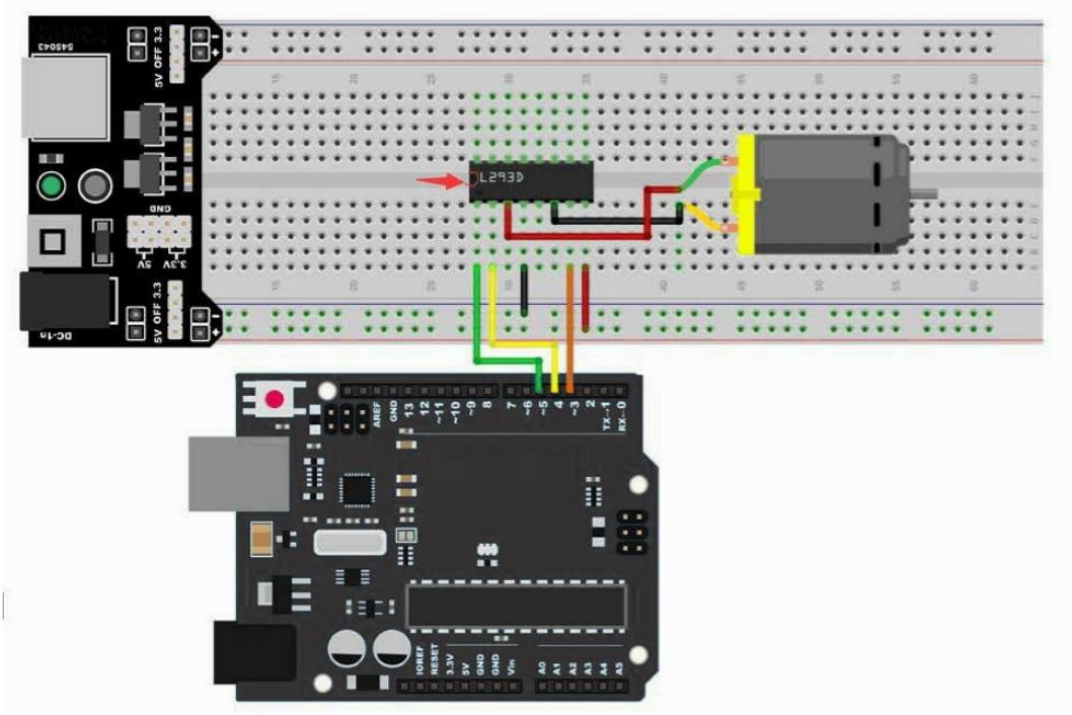
Reverse the outputs to LOW and HIGH, and the motor will spin in the other direction.

Connection

Schematic

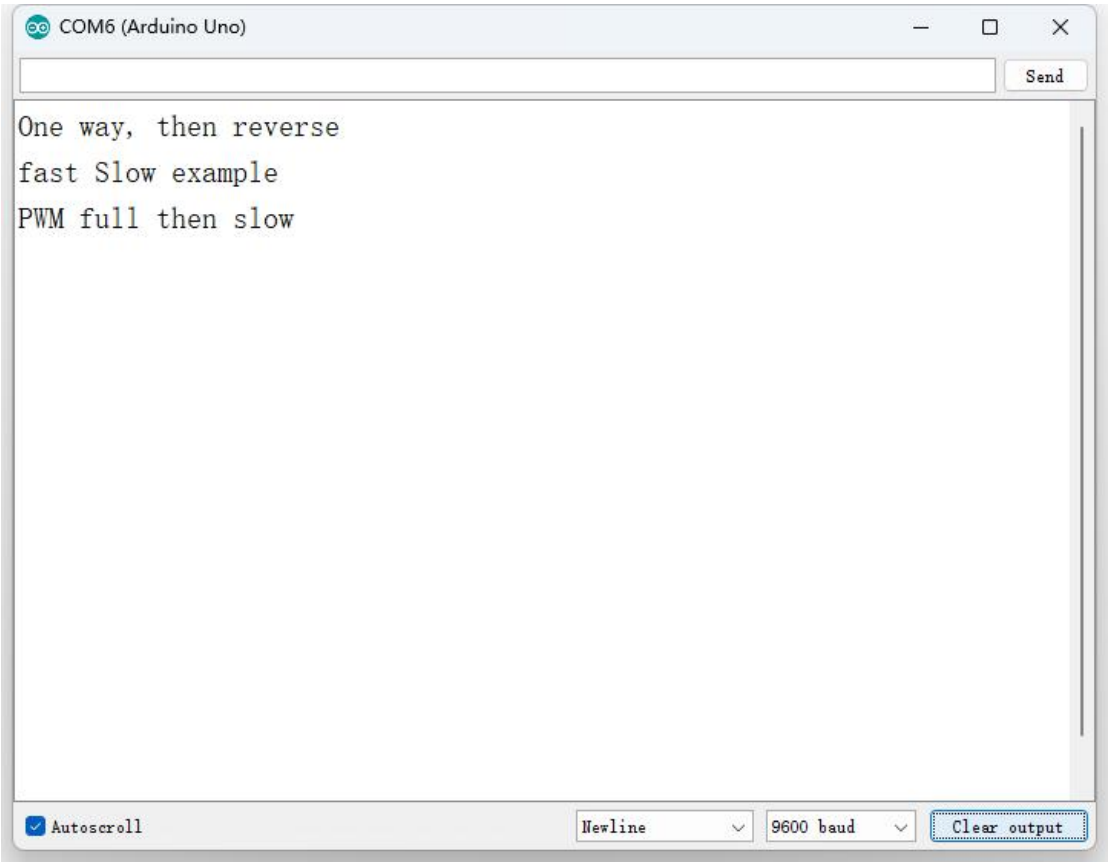


Circuit Connection

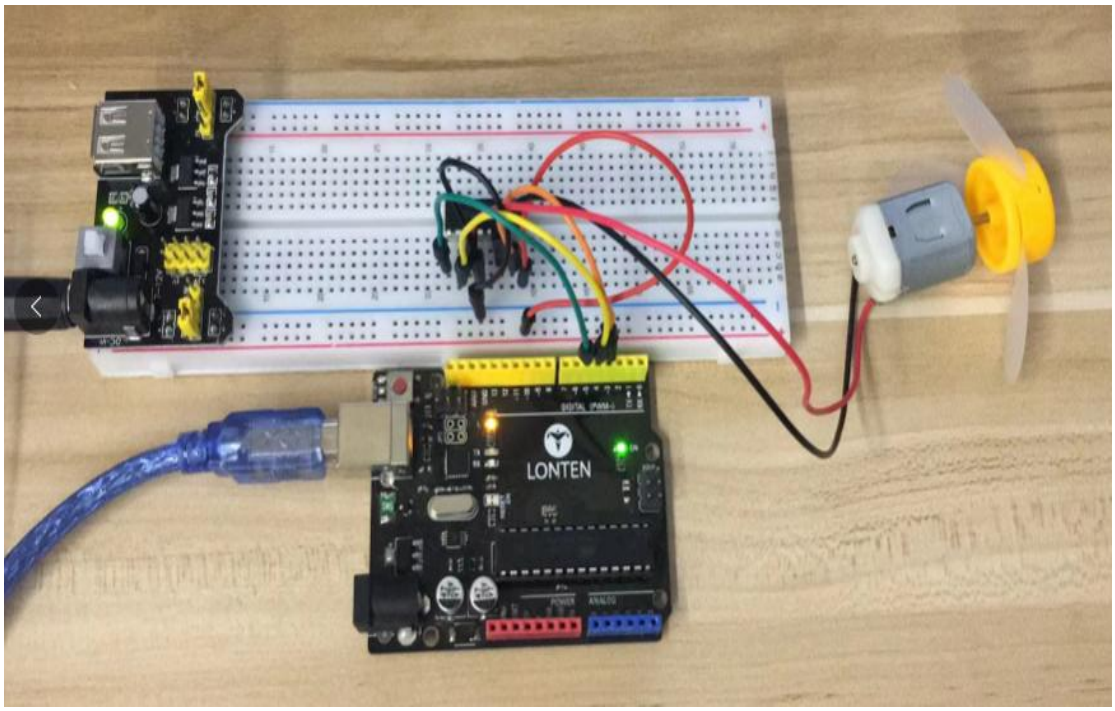


The code below does not use a separate power supply (is a battery), it uses instead the 5v power from the Arduino. Note that this would be risky without the L293D controlling it.

You should _never_ connect a motor directly to the Arduino, because when you switch a motor off you get an electrical feedback. With a small motor, this will damage your Arduino, and with a large motor, you can watch an interesting flame and sparks effect.



Example picture



Code

After wiring, please open the program in the code folder- Lesson 17 DC Motors and click UPLOAD to upload the program.

After program loading, turn on all the power switches. The motor will slightly rotate clockwise and anticlockwise for 5 times. Then, it will continue to dramatically rotate clockwise. After a short pause, it will dramatically rotate anticlockwise. Then the controller board will send PWM signal to drive the motor, the motor will slowly reduce its maximum RPM to the minimum and increase to the maximum again. Finally, it comes to a stop for 10s until the next cycle begins.

LROBRUYA

Lesson 18 Relay

Overview

In this lesson, you will learn how to use a relay.

Component Required:

(1) x LONTEN Uno R3

(1) x 830 tie-points breadboard

(1) x Fan blade and 3-6v dc motor

(1) x L293D IC

(1) x 5v Relay

(1) x Power Supply Module

(1) x 9V1A Adapter

(8) x M-M wires (Male to Male jumper wires)

Component Introduction

Relay:

LROBRUYA

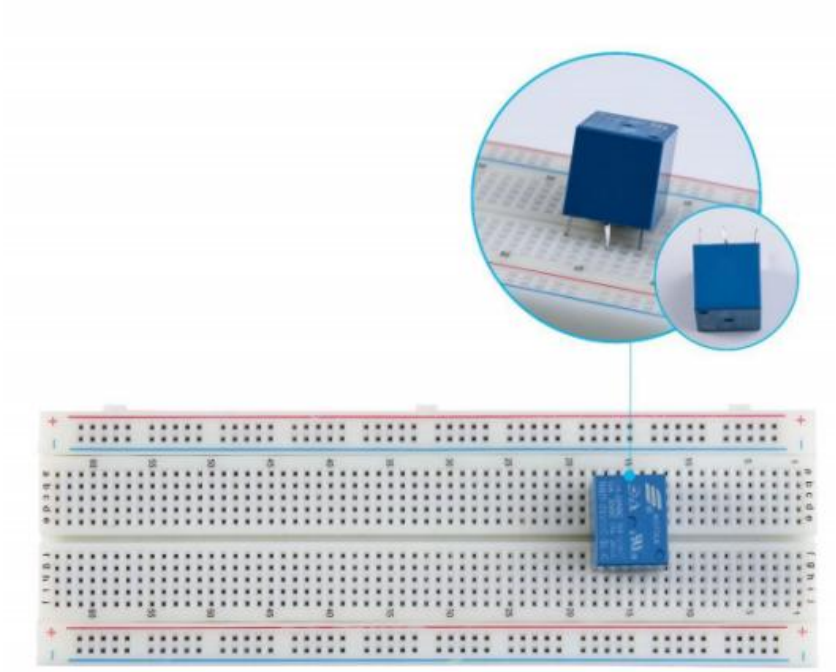
A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used as in solid-state relays. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. The first relays were used in long-distance telegraph circuits as amplifiers. They repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform the switching.

Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults. In modern electric power systems, these functions are performed by digital instruments called "protective relays".

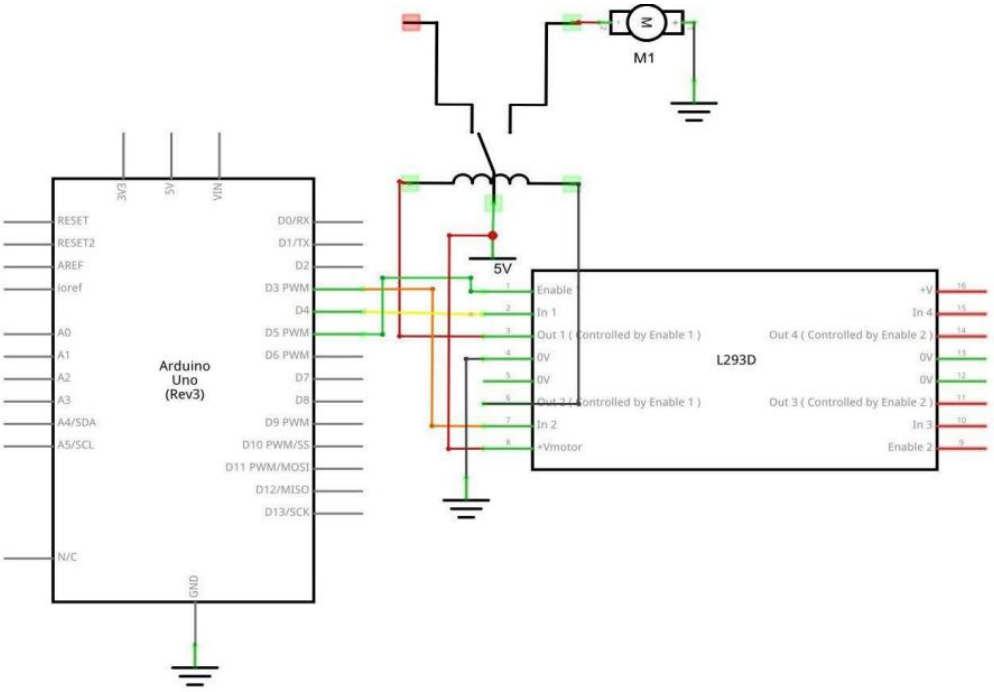
Below is the schematic of how to drive relay with Arduino.

You may be confused about how to insert the relay into the bread board. As the picture below shows, you will have to bend one of the pins of the relay slightly then you can insert it into the bread board.

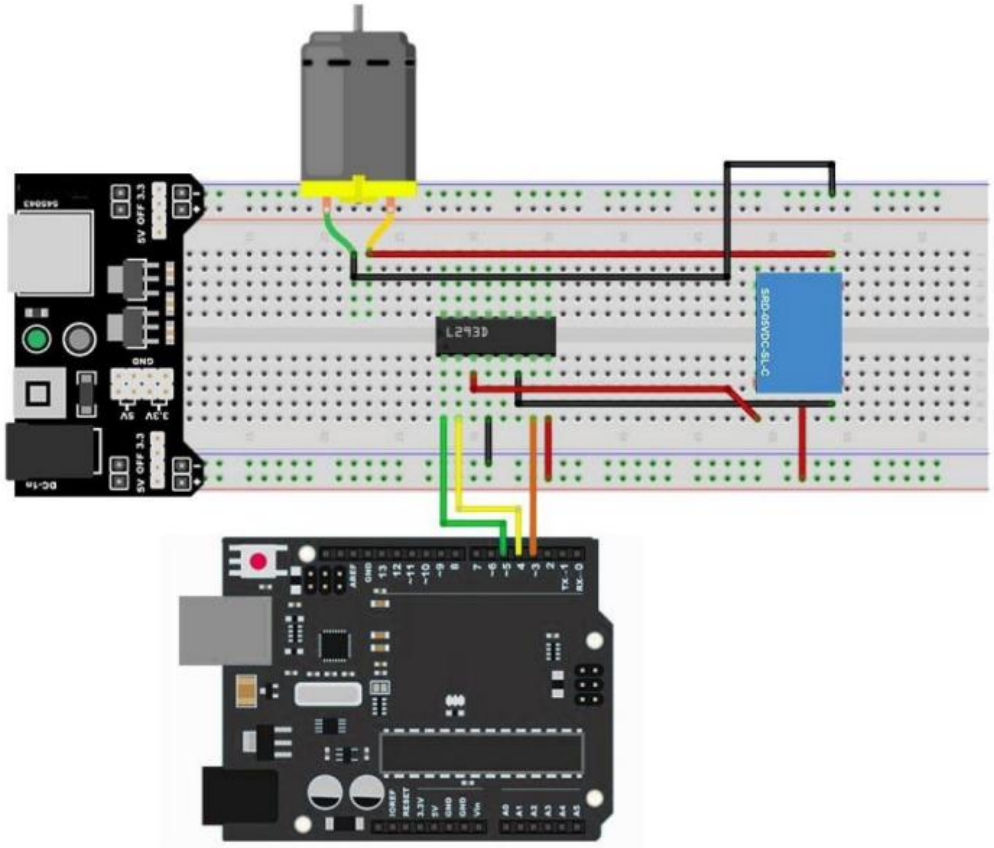


Connection

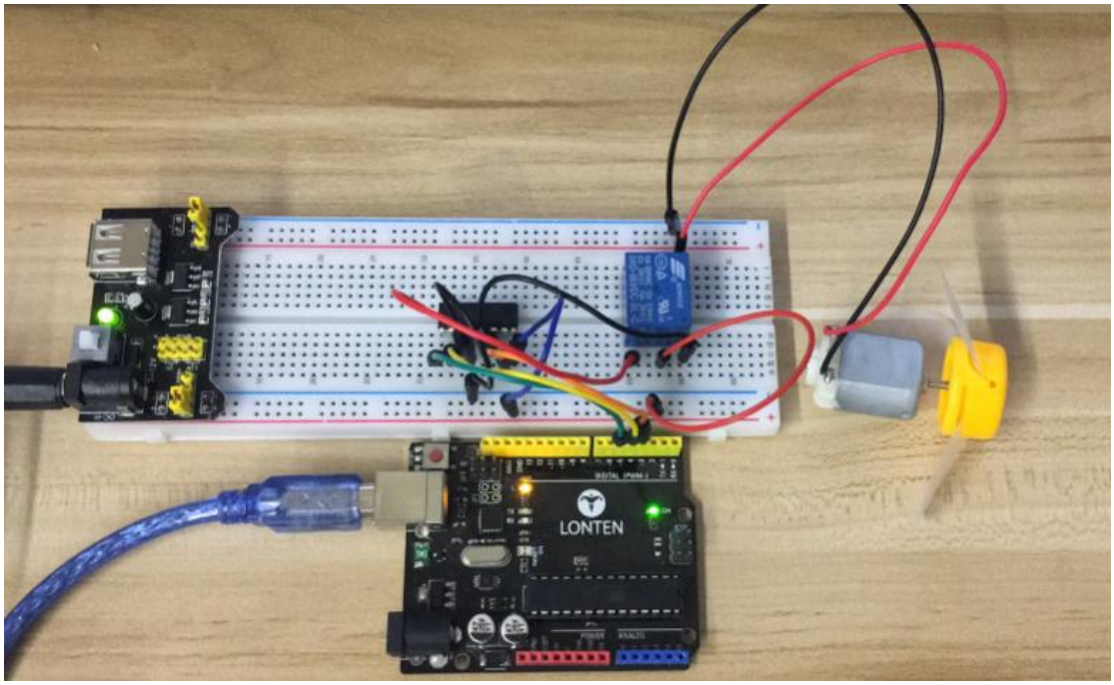
Schematic



Circuit Connection



Example picture



Code

After wiring, please open the program in the code folder- Lesson 18 Relay and click UPLOAD to upload the program.

After program loading, turn on all the power switches. The relay will pick up with a ringing sound. Then, the motor will rotate. After a period of time, the relay will be released, and the motor stops.

Lesson 19 Stepper Motor

Overview

In this lesson, you will learn a fun and easy way to drive a stepper motor. The stepper we are using comes with its own driver board making it easy to connect to our UNO.

Component Required:

(1) x LONTEN Uno R3

(1) x 830 tie-points breadboard

(1) x ULN2003 stepper motor driver module

(1) x Stepper motor

(1) x 9V1A Adapter

(1) x Power supply module

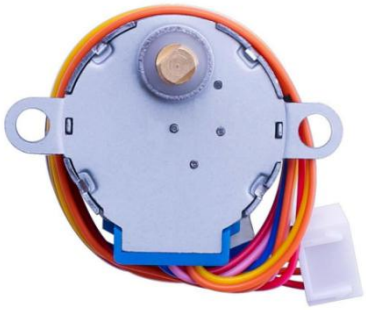
(6) x F-M wires (Female to Male DuPont wires)

(1) x M-M wire (Male to Male jumper wire)

Component Introduction

Stepper Motor

LROBRUYA



A stepper motor is an electromechanical device which converts electrical pulses into discrete mechanical movements. The shaft or spindle of a stepper motor rotates in discrete step increments when electrical command pulses are applied to it in the proper sequence. The motors rotation has several direct relationships to these applied input pulses. The sequence of the applied pulses is directly related to the direction of motor shafts rotation. The speed of the motor shafts rotation is directly related to the frequency of the input pulses and the length of rotation is directly related to the number of input pulses applied. One of the most significant advantages of a stepper motor is its ability to be accurately controlled in an open loop system. Open loop control means no feedback information about position is needed. This type of control eliminates the need for expensive sensing and feedback devices such as optical encoders. Your position is known simply by keeping track of the input step pulses.

Stepper motor 28BYJ-48 Parameters

Model: 28BYJ-48

Rated voltage: 5VDC

Number of Phase: 4

Speed Variation Ratio: 1/64

Stride Angle: 5.625° /64

Frequency: 100Hz

DC resistance: 50Ω±7%(25°C)

Idle In-traction Frequency: > 600Hz

Idle Out-traction Frequency: > 1000Hz

In-traction Torque >34.3mN.m(120Hz)

Self-positioning Torque >34.3mN.m

Friction torque: 600-1200 gf.cm

Pull in torque: 300 gf.cm

Insulated resistance >10MΩ(500V)

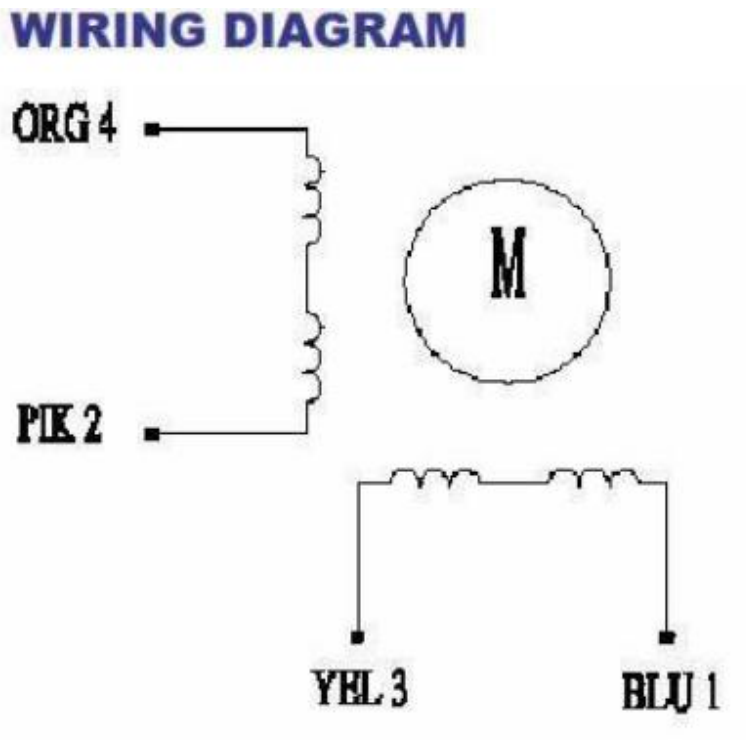
Insulated electricity power：600VAC/1mA/1s

Insulation grade：A

Rise in Temperature <40K(120Hz)

Noise <35dB(120Hz,No load,10cm)

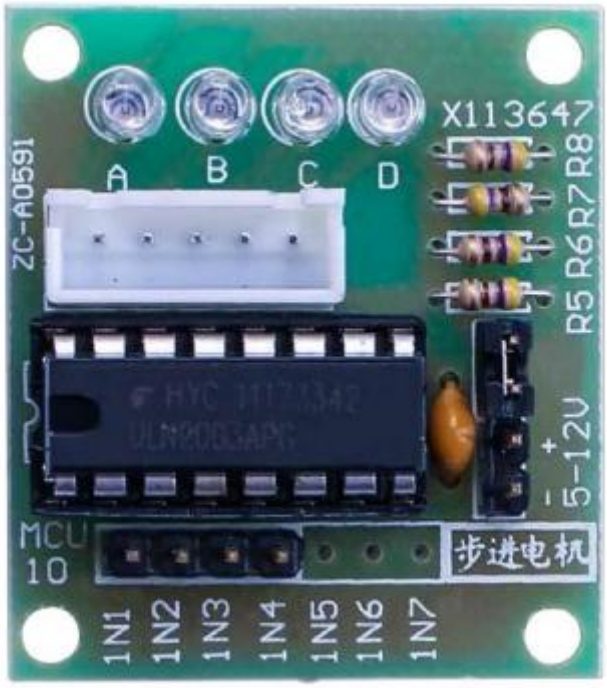
Interfacing circuits



The bipolar stepper motor usually has four wires coming out of it. Unlike unipolar steppers, bipolar steppers have no common center connection. They have two independent sets of coils instead. You can distinguish them from unipolar steppers by measuring the resistance between the wires. You should find two pairs of wires with equal resistance. If you've got the leads of your meter connected to two wires that are not connected (i.e. not attached to the same coil), you should see infinite resistance (or no continuity).

LROBRUYA

ULN2003 Driver Board



Product Description

o Size: 42mmx30mm

o Use ULN2003 driver chip, 500mA

o A. B. C. D LED indicating the four phase stepper motor working condition.

o White jack is the four phase stepper motor standard jack.

o Power pins are separated

o We kept the rest pins of the ULN2003 chip for your further prototyping.

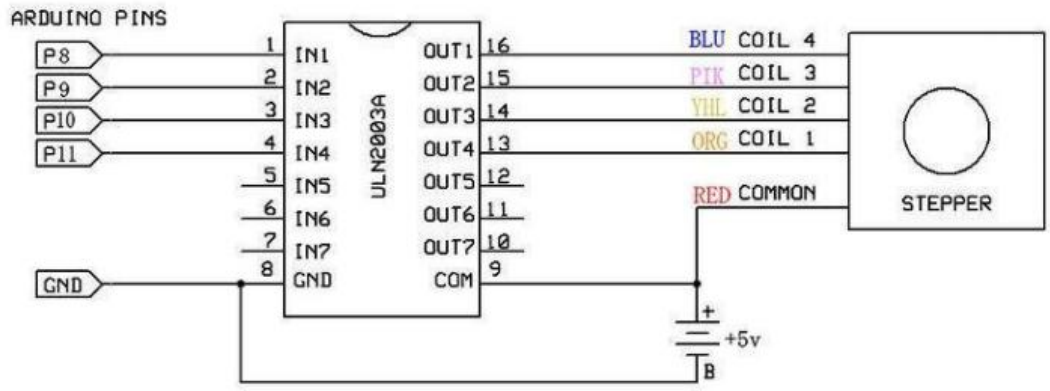
The simplest way of interfacing a unipolar stepper to Arduino is to use a breakout for ULN2003A transistor array chip. The ULN2003A contains

seven Darlington transistor drivers and is somewhat like having seven TIP120 transistors all in one package. The ULN2003A can pass up to 500 mA per channel and has an internal voltage drop of about 1V when on. It also contains internal clamp diodes to dissipate voltage spikes when driving inductive loads. To control the stepper, apply voltage to each of the coils in a specific sequence.

The sequence would go like this:

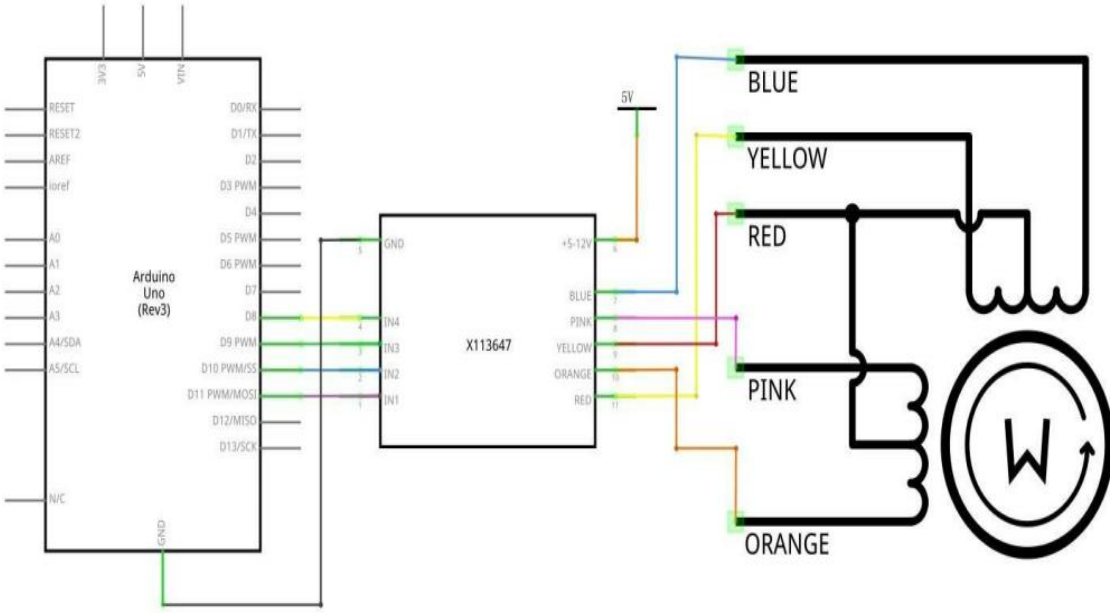
Lead Wire Color	---> CW Direction (1-2 Phase)							
	1	2	3	4	5	6	7	8
4 ORG	-	-						-
3 YEL		-	-	-				
2 PIK				-	-	-		
1 BLU						-	-	-

Here are schematics showing how to interface a unipolar stepper motor to four controller pins using a ULN2003A, and showing how to interface using four com.

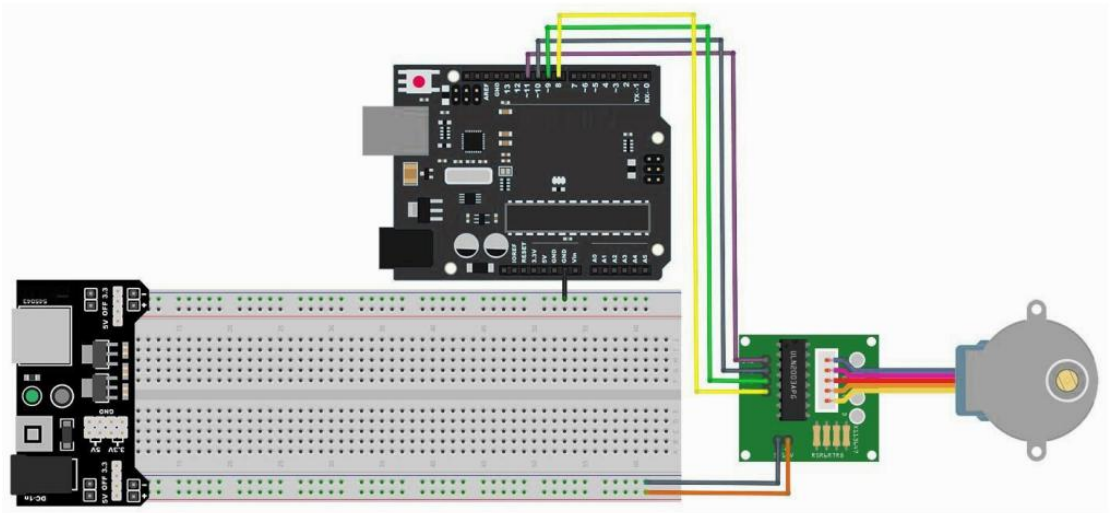


Connection

Schematic



Circuit Connection

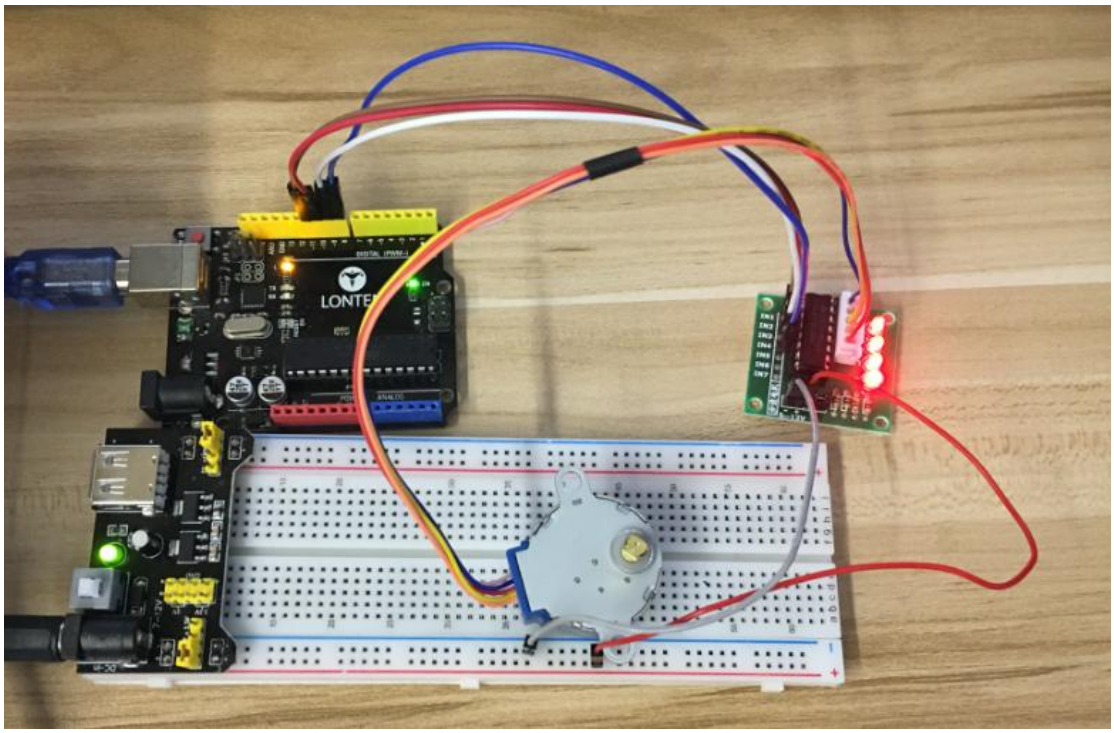


We are using 4 pins to control the Stepper.

Pin 8-11 are controlling the Stepper motor.

We connect the Ground from to UNO to the Stepper motor.

Example picture



Code

After wiring, please open the program in the code folder- Lesson 19 Stepper Motor and click UPLOAD to upload the program.

Before you can run this, make sure that you have installed the < Stepper > library or re-install it, if necessary. Otherwise, your code won't work.

LROBRUYA

Lesson 20 Controlling Stepper Motor With Rotary Encoder

Overview

In this lesson, you will learn how to control stepper motors using a rotary encoder. We will use the inexpensive and popular stepper motor that comes with its own control board: the 28BYJ-48 stepper motor with the ULN2003 board.

The 28BYJ-48 motor is not very fast or very strong, but it's great for beginners to start experimenting with controlling a stepper motor with an Arduino.

We will write some code to have the motor move in the direction that we turn the rotary encoder, and will also keep track of how many steps we have taken, so that we can have the motor move back to the starting position by pressing down on the rotary encoder switch.

Component Required:

(1)x LONTEN Uno R3

(1) x 830 tie-points breadboard

(1) x Rotary Encoder Module

(1) x ULN2003 stepper motor driver module

(1) x Stepper motor

(1) x Power supply module

(1) x 9V1A Adapter

(9) x F-M wires (Female to Male DuPont wires)

(1) x M-M wire (Male to Male jumper wire)

Component Introduction

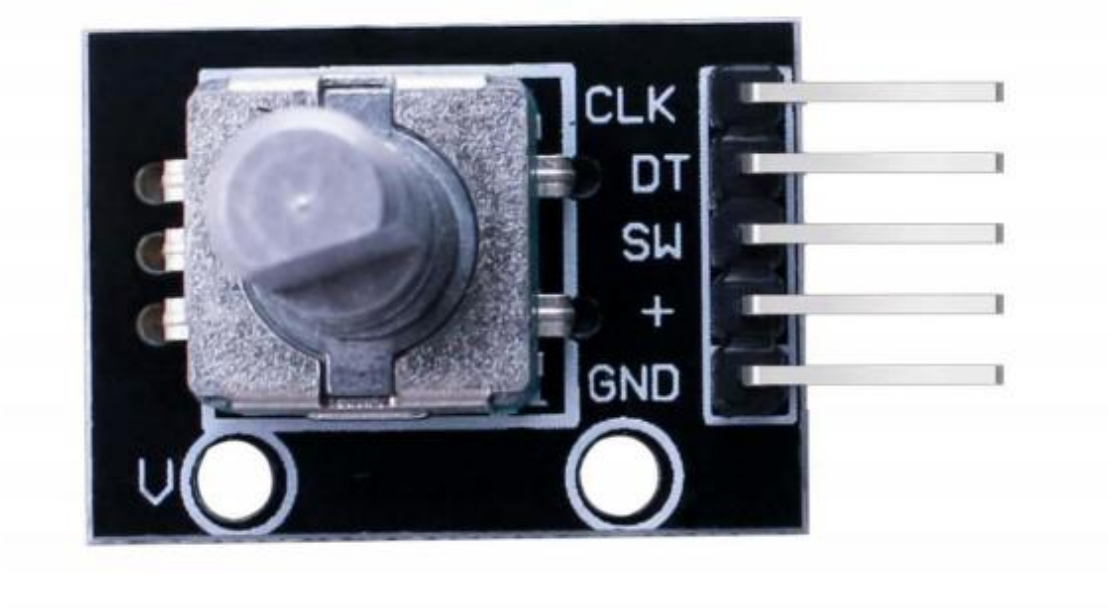
Rotary encoder

A rotary encoder, also called a shaft encoder, is an electro-mechanical device that converts the angular position or motion of a shaft or axle to an analog or digital code.

There are two main types: absolute and incremental (relative). The output of absolute encoders indicates the current position of the shaft, making them angle transducers.

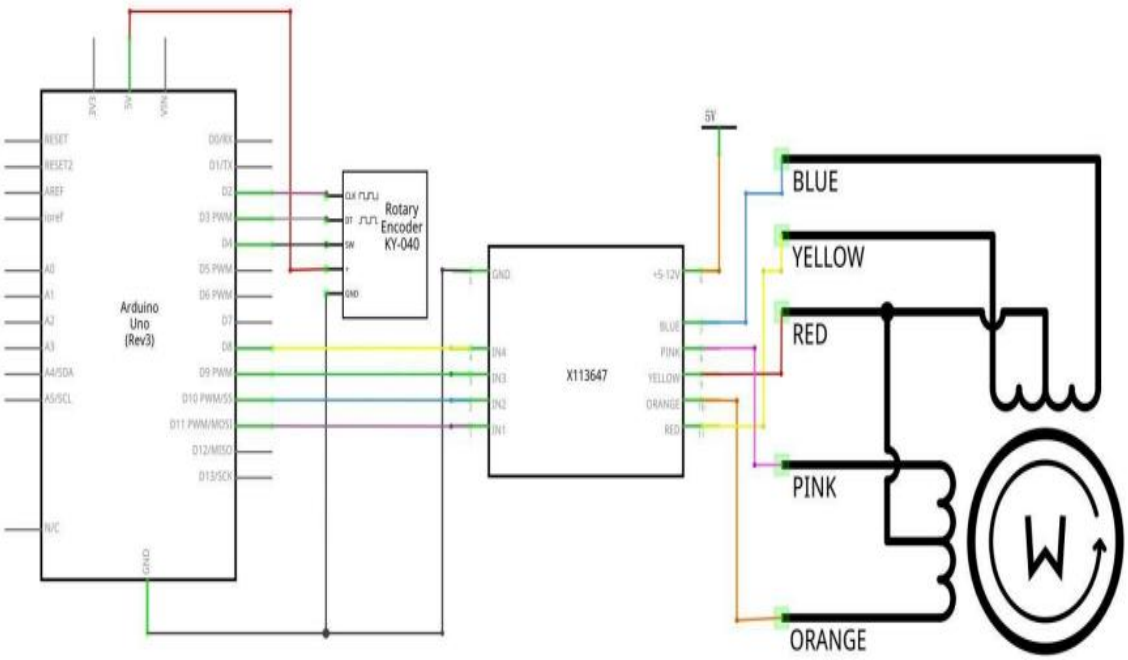
The output of incremental encoders provides information about the motion of the shaft, which is typically further processed elsewhere into information such as speed, distance and position.

Rotary encoders are used in many applications that require precise shaft unlimited rotation—including industrial controls, robotics, special purpose photographic lenses, [1] computer input devices (such as opt mechanical mice and trackballs), controlled stress rheometers, and rotating radar platforms.

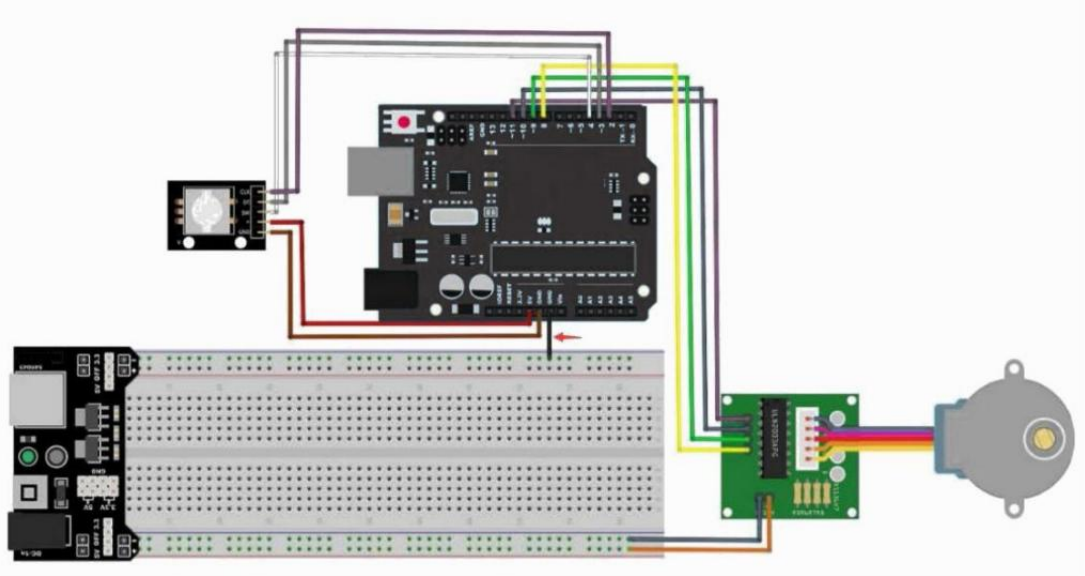


Connection

Schematic



Circuit Connection

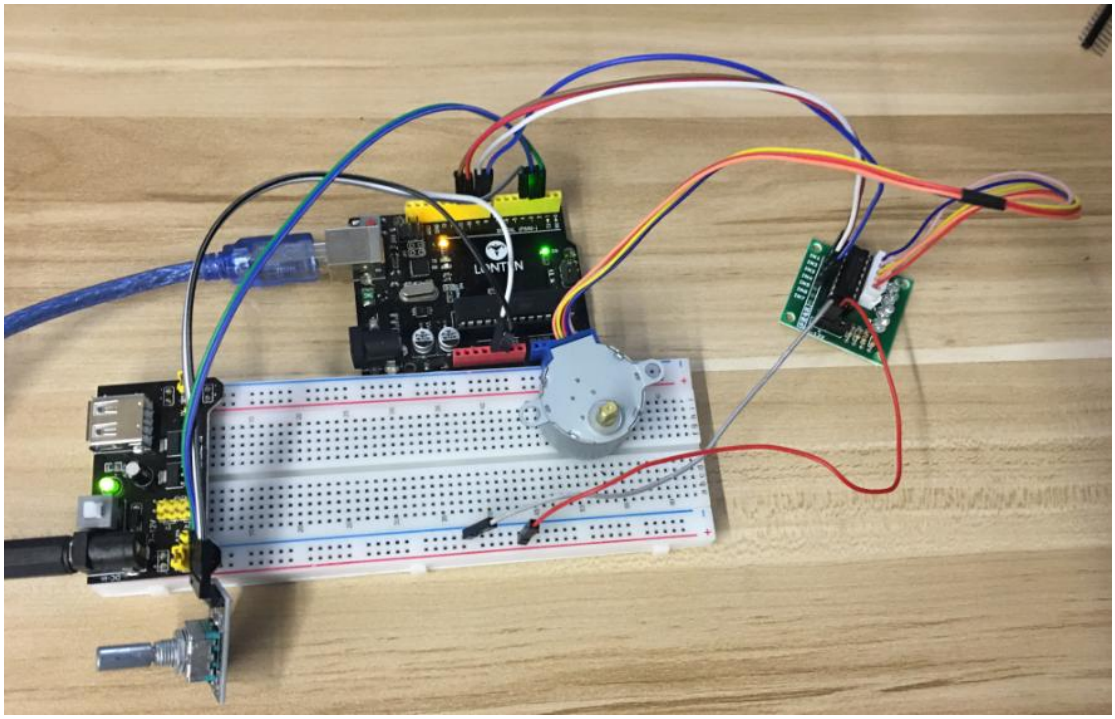


We are using 4 pins to control the Stepper and 3 pins for the rotary encoder module. Pins 8-11 are controlling the Stepper motor and pins 2-4 are receiving information from the rotary encoder.

We connect the 5V and Ground from to UNO to the rotary encoder and as a precaution, use a breadboard power supply to power the stepper motor since it can use more power that the UNO can provide.

We also connect the UNO Ground to the breadboard to serve as a reference.

Example picture



Code

After wiring, please open the program in the code folder- Lesson 20 Controlling Stepper Motor With Rotary Encoder and click UPLOAD to upload the program.

Before you can run this, make sure that you have installed the < Stepper > library or re-install it, if necessary. Otherwise, your code won't work.

We are using some variables to store the current position, since we want to keep track of the position of the stepper motor so we can make it move back to the starting position.

We also included some error checking code to make sure that the rotary encoder is not missing steps, since that would make our motor position inaccurate.