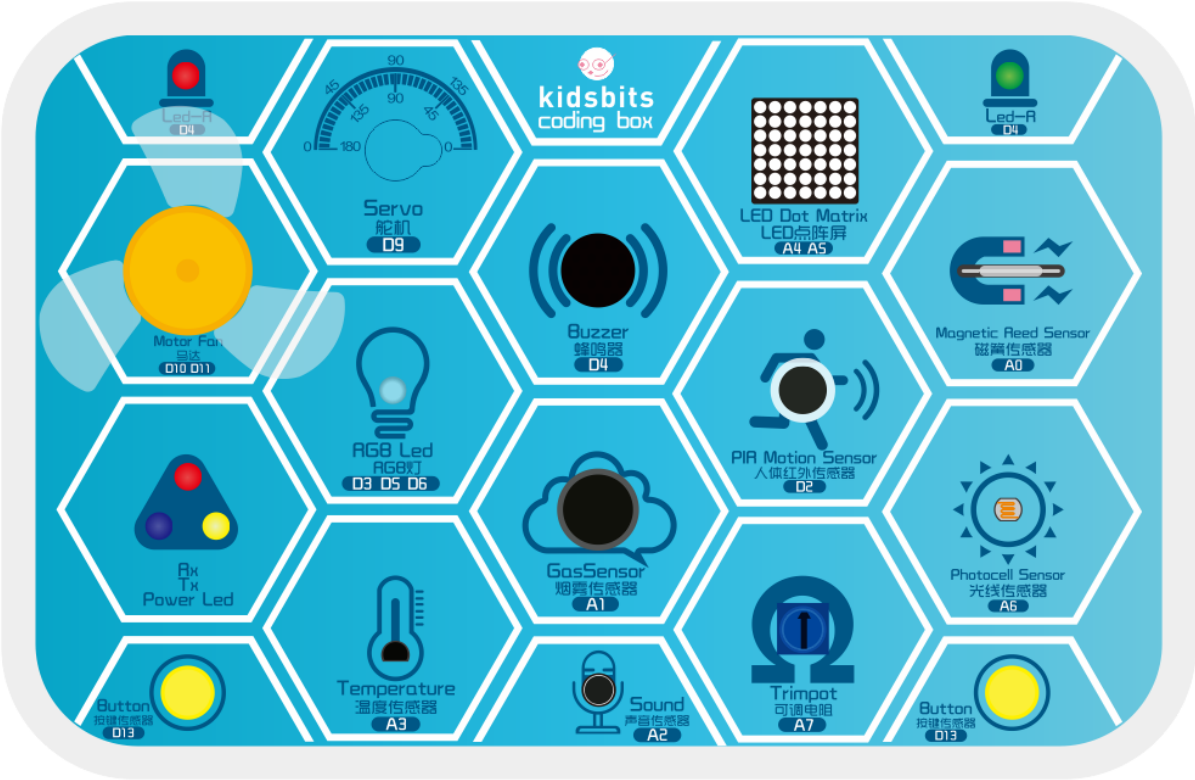
Kidsbits Wiki

kidsbits

Feb 02, 2024

KD0001 CODING BOX KIT FOR ARDUINO


kidsbits
coding box
Led-R
D4
Servo
舵机
D9
LED Dot Matrix
LED点阵屏
A4 A5
Led-R
D4
Motor Fan
D10 D11
Buzzer
蜂鸣器
D4
Magnetic Reed Sensor
磁簧传感器
A0
RGB Led
RGB灯
D3 D5 D6
PIR Motion Sensor
人体红外传感器
D2
Rx
Tx
Power Led
GasSensor
烟雾传感器
A1
Photocell Sensor
光线传感器
A6
Button
按键传感器
D13
Temperature
温度传感器
A3
Sound
声音传感器
A2
Trimpot
可调电阻
A7
Button
按键传感器
D13

CHAPTER

ONE

DOWNLOAD TUTORIAL AND PROJECT CODE

https://kd.kidsbits.cc/KD0001

CHAPTER

TWO

INTRODUCTION

Coding Box is a programming learning toolbox based on Arduino, which is a programming tool specially designed for children over 6 years old.

It integrates some of the most basic electronic components and sensors, such as LEDs, buttons, motors, light, sound, infrared and a temperature sensor.

Besides, multitudes of interesting projects can be carried out via the Coding Box, including LED flashing, intrusion alarms, smart fans as well as temperature testers.

Coding Box uses Arduino for programming, and is also compatible with Mixly graphical programming software and Scratch graphical programming softwareallowing children to learn from the simplest code and master the system's programming knowledge step by step.

CHAPTER

THREE

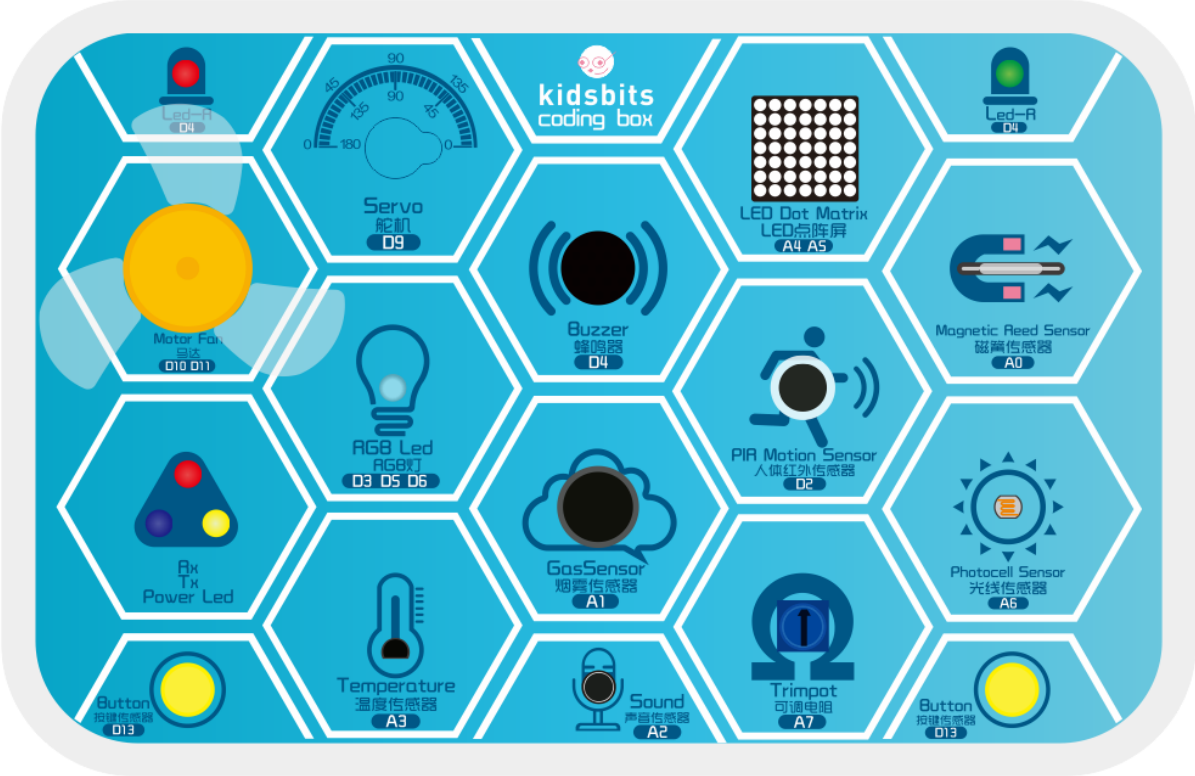
COMPONENT LIST

Name	Picture	Pins	Summary
LED		D7 and D8	LIGHT-EMITTING DIODES (LEDS) have a positive (+) leg and a negative (-) leg, which make electricity flow through in one direction. LEDs can also burn out if too much electricity flows through them, so you should use a resistor to limit the high current when you wire an LED into a circuit. They can be used to make equipment indicator light. Set the signal pin to HIGH, LED will be on; set to LOW, LED will be off.
RGB		D6,D5,D3	RGB LED is actually three small LEDs — a red, green and blue LED— inside a normal LED housing. It has all the internal LEDs sharing the same ground wire, so there are four pins in total. It can emit many different color, which is. used widely for building lighting and exhibition lighting.
LED Dot Matrix		A4, A5	LED Dot Matrix: This tiny display has 64 LEDs packed into a 8*8 dot matrix. It is great for displaying image/text or creating animations, and is highly portable and convenient to use, which is widely used in train stations, advertising screens and bulletin boards.
Servo		D9	Servo is a position control rotary actuator. Common servos rotate over a range of about 0°to 180°. It has three wires: one for power, one for grounding and one for signal. When you send the right signal through the signal wire, the servo will move to a specific angle and stay there. It is widely applied to mechanical arm.
Buzzer		D4	Buzzer is a consumable component that can generate sound of a specified frequency according to the input signal. It is widely used in alarm, electronic toys, automotive electronics, telephones and other electronic products.
Motor fan		D10, D11	Motor fan module is a consumable component that is connected with a fan blade and a motor (130 DC motor). It can rotate more than 12,000 times per minute, which is widely used in helicopters, windmills, etc.
Button		D12, D13	Button is a component that controls the circuit to turn on and off. When the button is pressed, it sends a high level signal (the Arduino Uno reads 0) to the kidsbits coding box (based on Arduino Uno) through the pins. We can interact with the device by using buttons, such as those used in the course to control the leds on and off.
Photoresistor		A6	Photoresistor is a light-sensitive and variable resistor, which is an element that changes its resistance as light strength changes. The stronger the ambient light, the smaller the value output from the pin A. It is widely applied to various light control circuit, such as optical switches, and smart home system etc.
Potentiometer		A7	Potentiometer (also known as ‘’trimpot”) is a sensor that controls the output signal of the pin by changing the resistance value. A potentiometer is a 3-pin variable resistor. When powered with 5V, the middle pin outputs a voltage between 0V and 5V, depending on the position of the knob on the potentiometer. It is mainly used to set the threshold value in the program or as a controller to control the Servo motion, etc.
Sound Sensor		A2	Sound Sensor is a device which convert energy from one form to another. A microphone is a transducer which converts sound energy to electrical signals. The microphones are widely

CHAPTER

FOUR

ARDUINO TUTORIAL



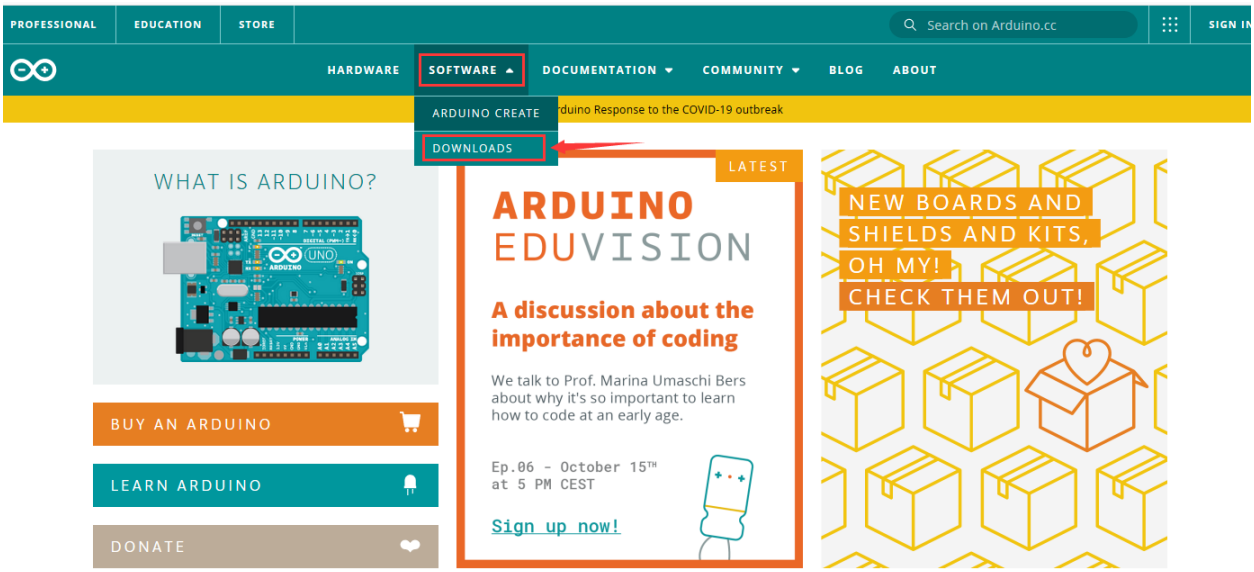
4.1 Download Software & Install Driver

4.1.1 1. Windows System

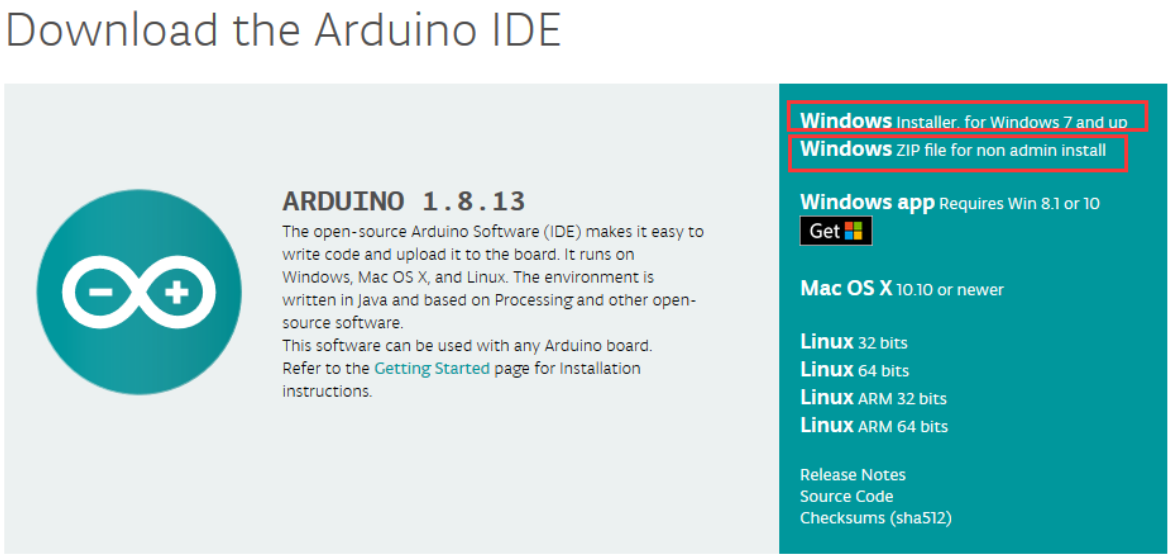
(1) Download the Arduino IDE

When getting this control board, we need to install Arduino IDE

Enter the website https://www.arduino.cc/click SOFTWARE and DOWNLOADS

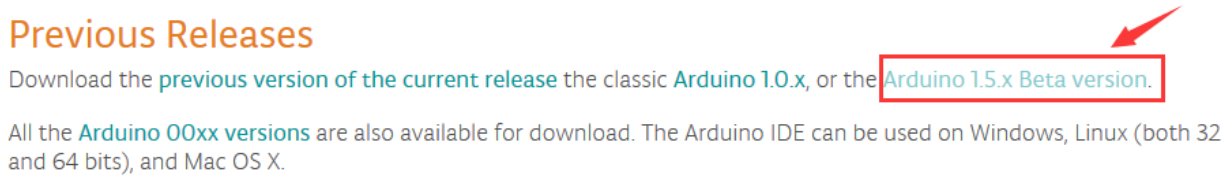


Select the version you want to download, the latest version could be downloaded.

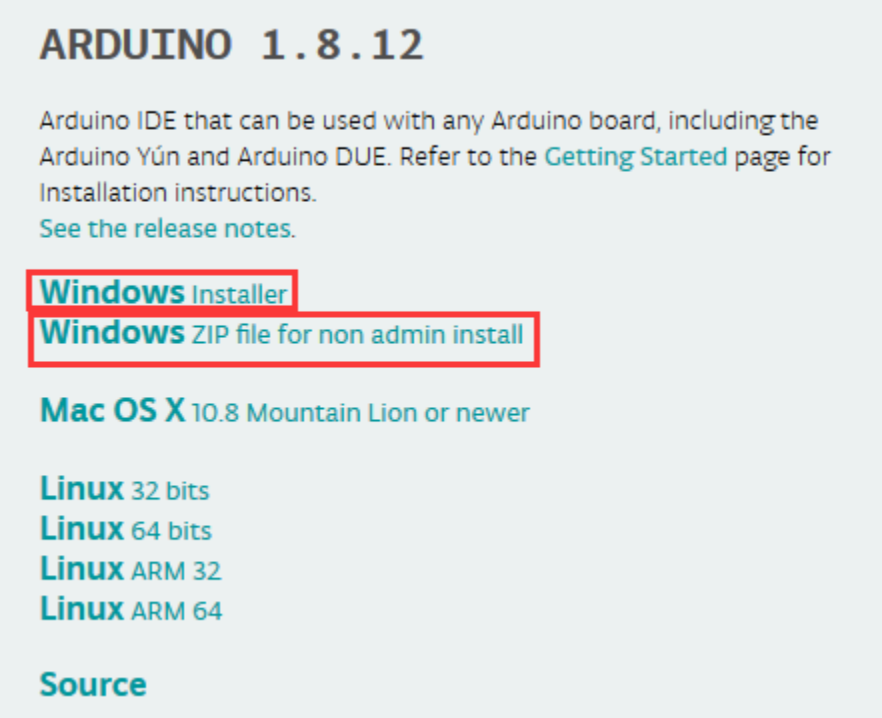


Alternatively, you could select previous release.

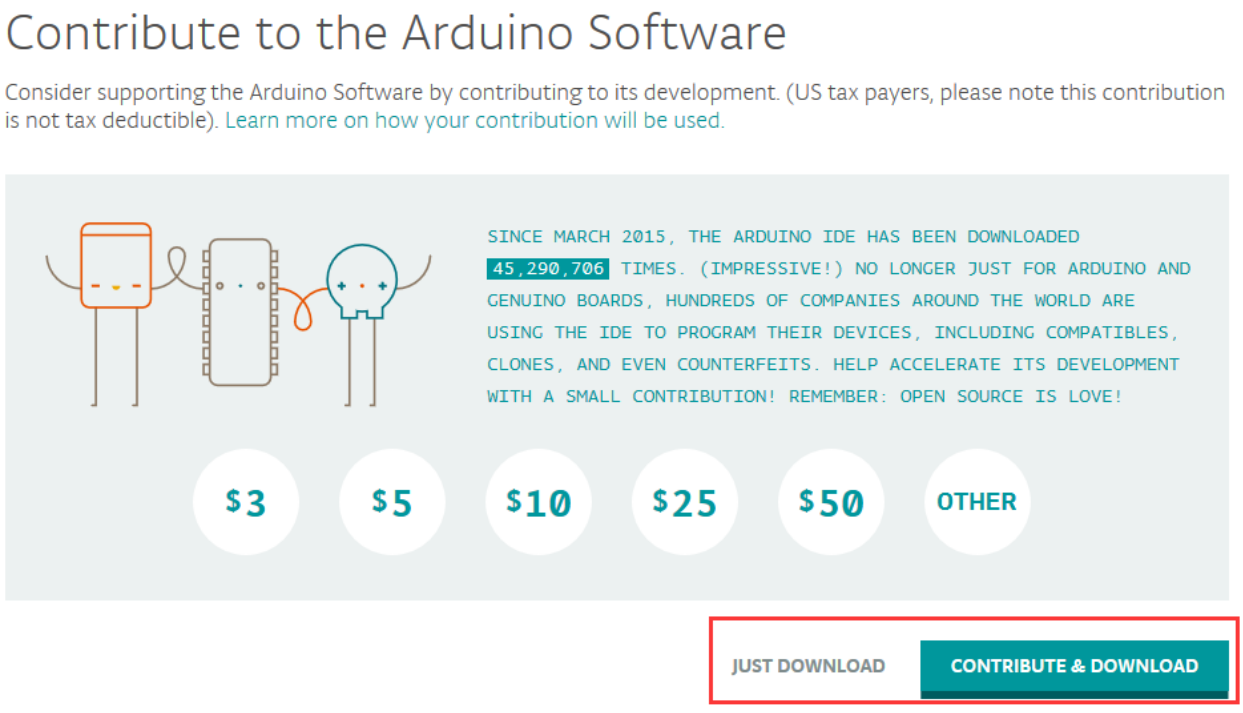
In this project, we use 1.8.12 version

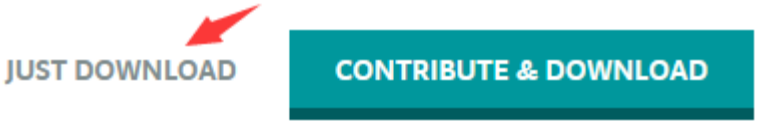


Click previous version of the current release to view the below page



Click **Windows** Installer to download an installer of Arduino 1.8.12 versionwhich needs to be installed manually. When you tap **Windows** ZIP file for non admin install a zip file of Arduino 1.8.12 version will be directly downloaded, and you only need to unzip it to finish installation.





Click icon to download Arduino IDE.

(2) Download Driver of CH340

CH340 Chip Driver

(3) Install the Driver

The driver will be installed after downloading Arduino IDE.

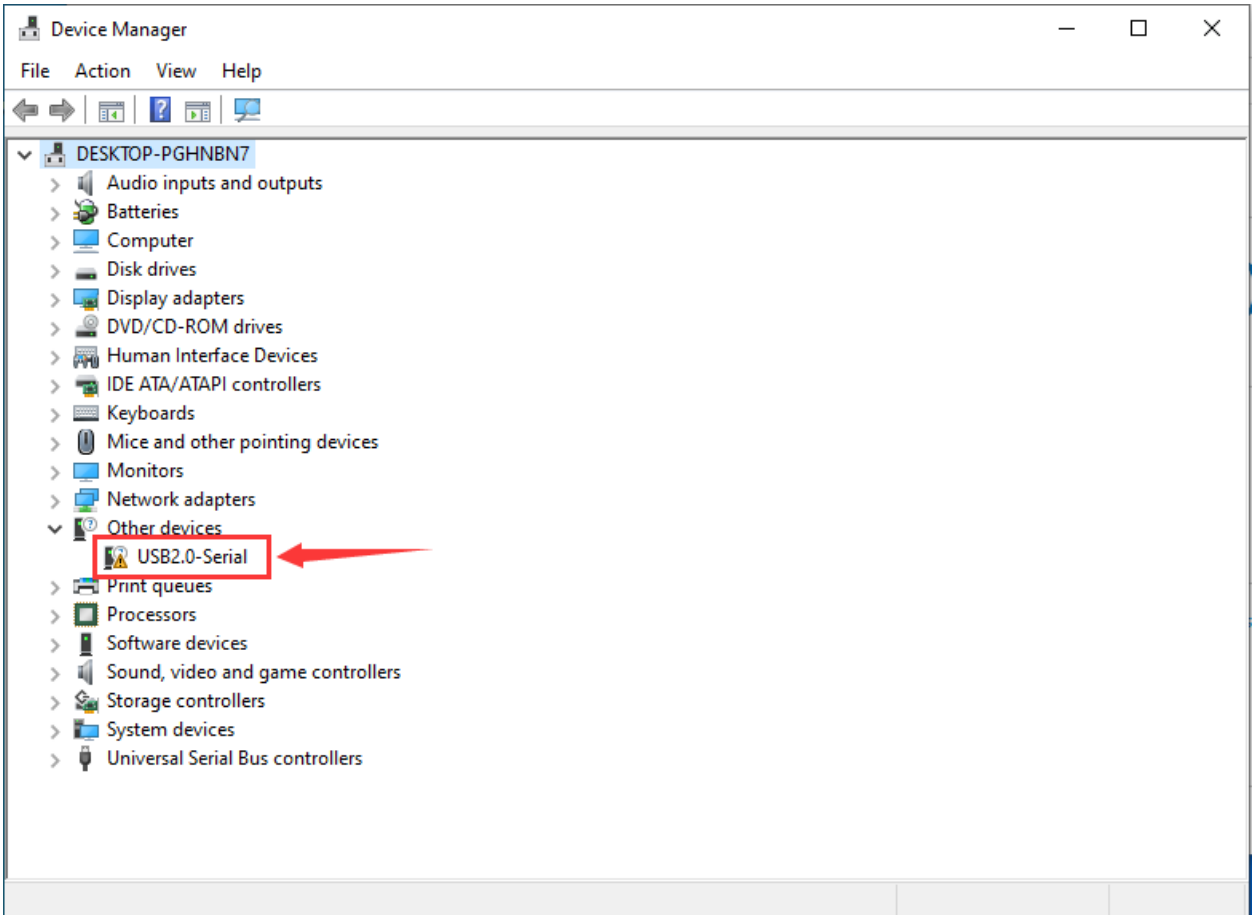
If your system is Windows 10, the computer will automatically install driver.

For other systems, like Windows7, we need to install driver manually.

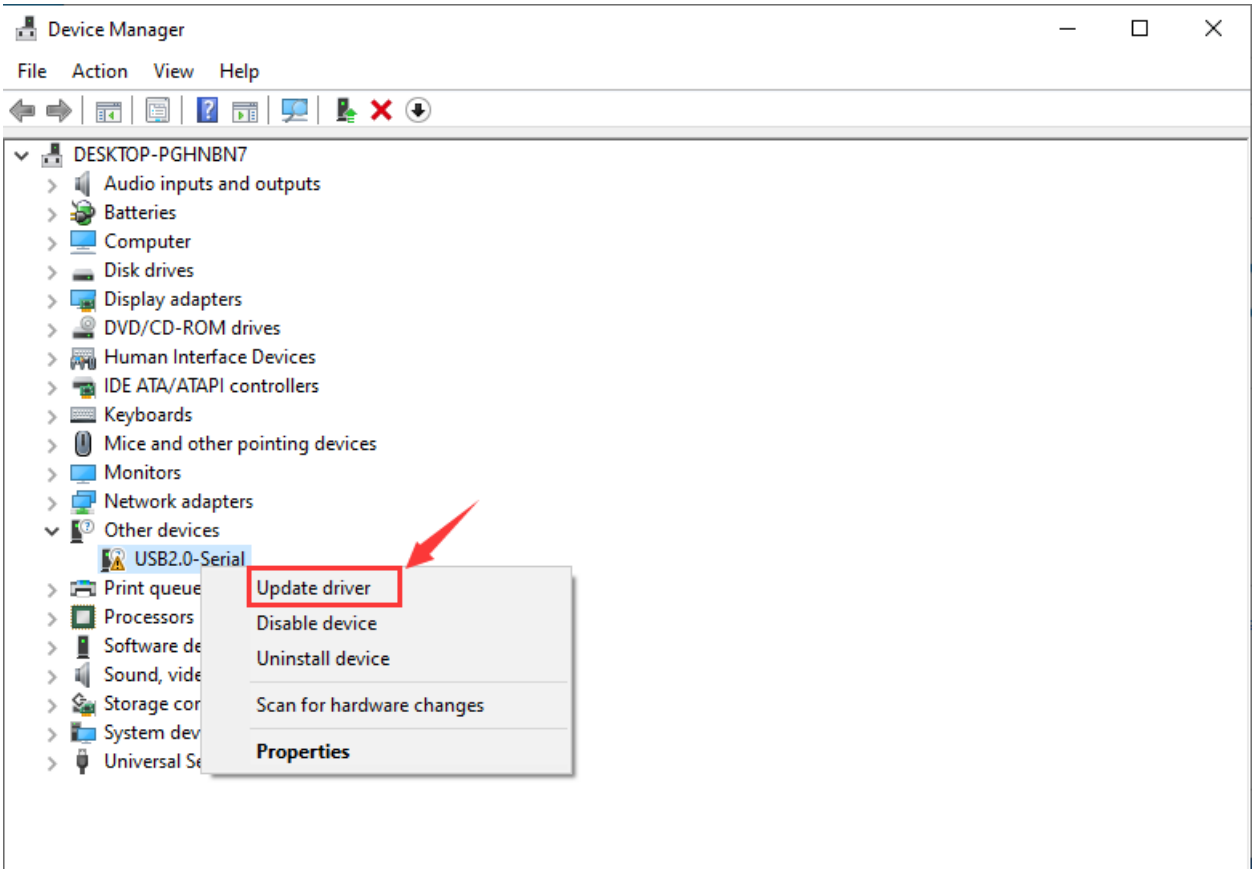
The USB to serial chip of control board is CH340G. Therefore, we will install the driver(usb_ch341_3.1.2009.06) for it.

Connect control board to computer with USB cable.

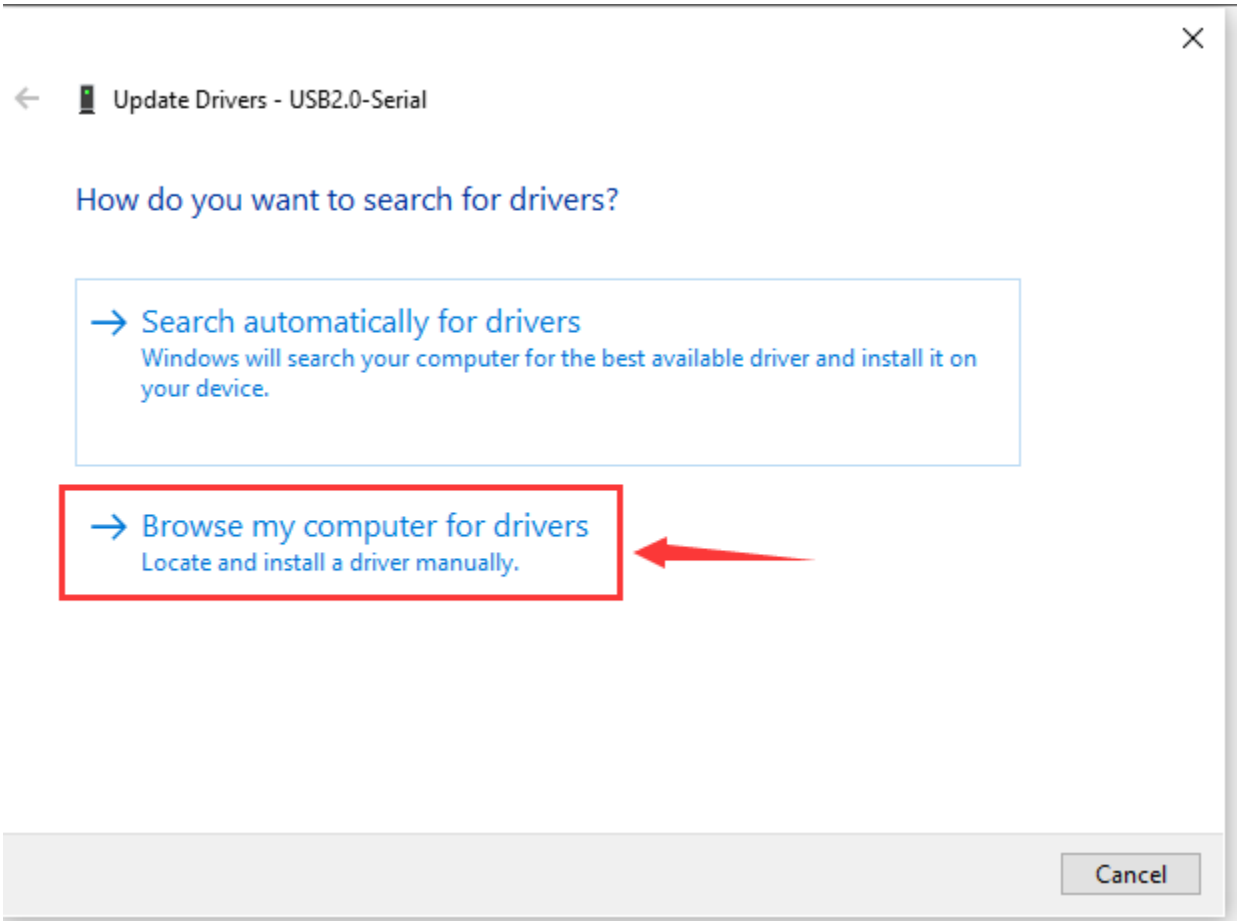
Click Computer—— Properties—— Device Manager, as shown below:



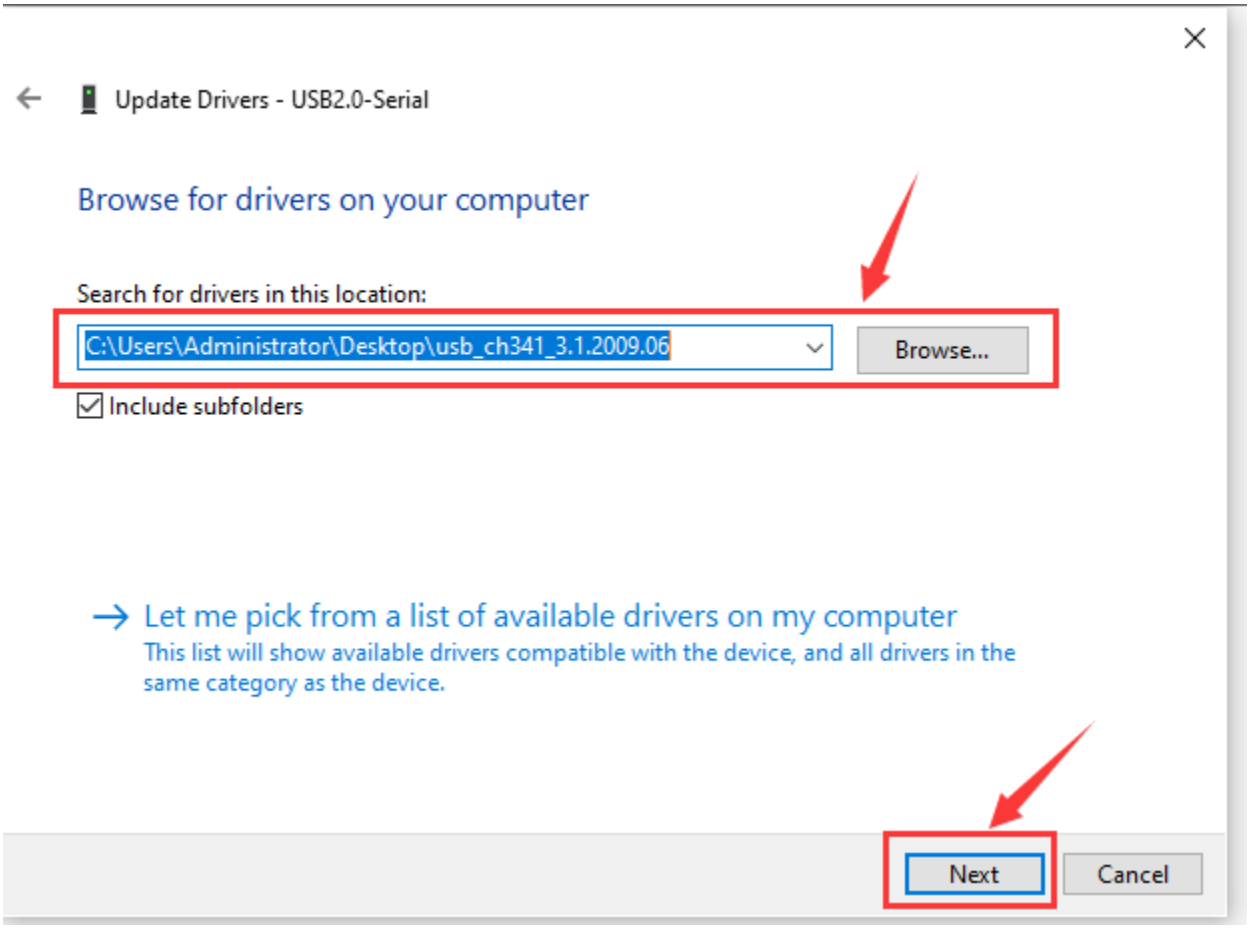
Then right-click on the USB2.0-Serial and select the top menu option (Update Driver) shown as the figure below.



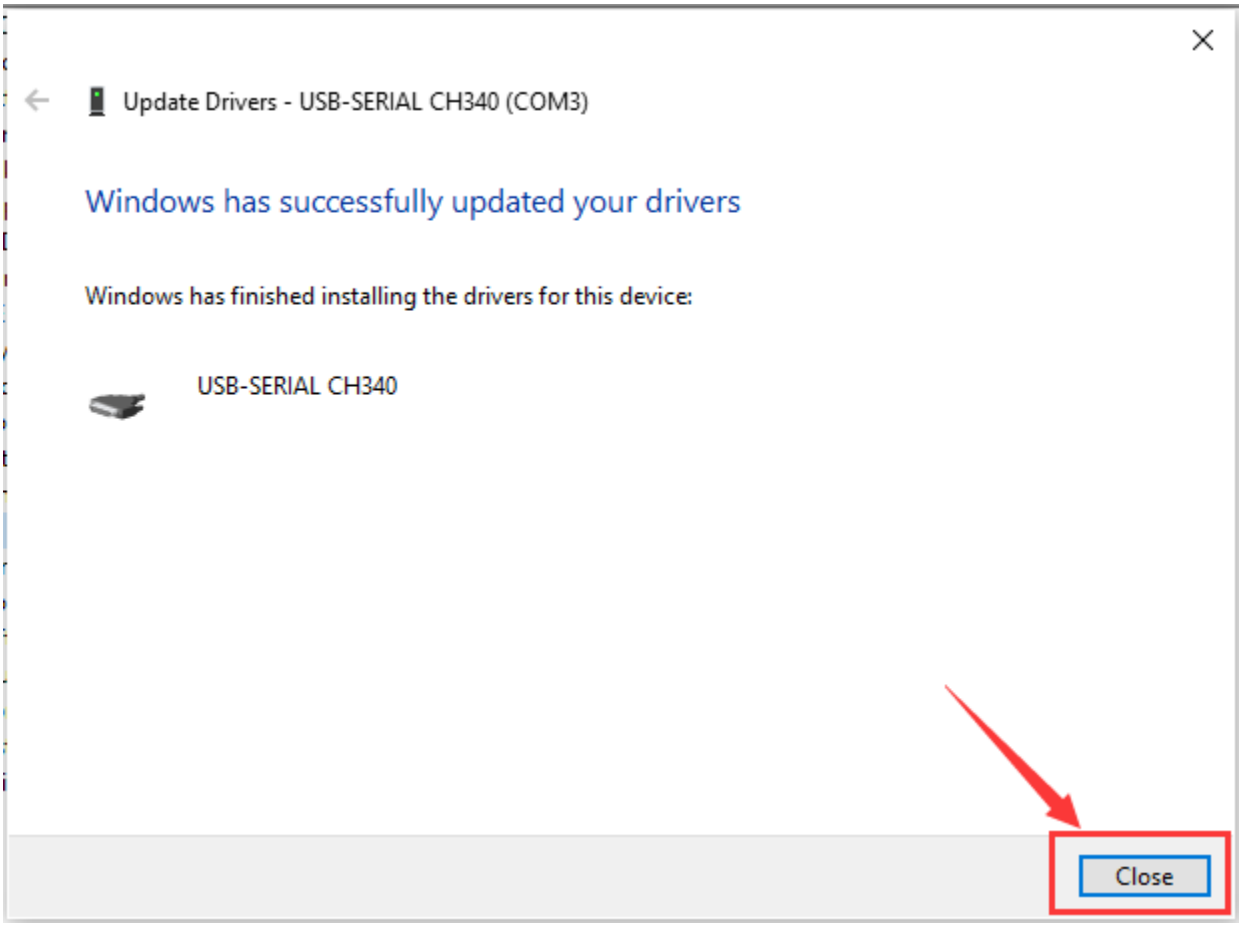
Then it will be prompted to either“Search automatically for driver ” or “Browse my computer for drivers”. Shown as below. In this page, select “Browse my computer for drivers”.



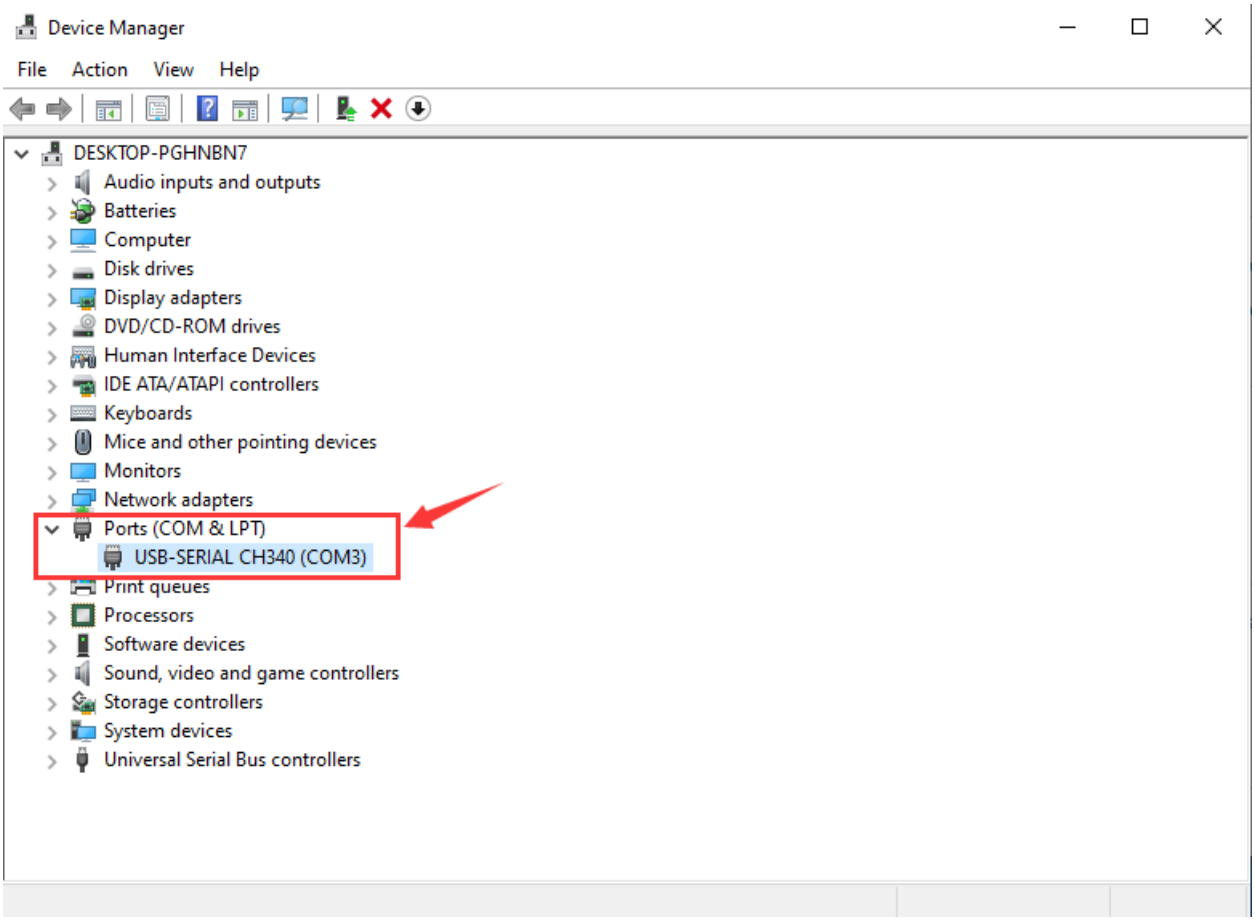
After that, select the option to browse and navigate to the “drivers” folder of usb_ch341_3.1.2009.06 installation.



Once the software has been installed, you will get a confirmation message. Installation completed, click“Close”. http://wiki.keyestudio.com/index.php/File:Driver_6.png



Now, the driver is installed well. Then you can right click "Computer" —>"Properties"—>"Device manager", you should see the device as the figure shown below.



4.1.2 2. MAC System

(1) Install Arduino IDE on MAC System

The installation instruction is as same as chapter 3.1, as shown below:

(2) Download Driver of CH340

https://fs.keyestudio.com/CH340-MAC

(3) How to Install Driver of CH340

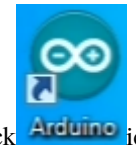
Please refer to the following link:

https://wiki.keyestudio.com/Download_CH340_Driver_on_MAC_System

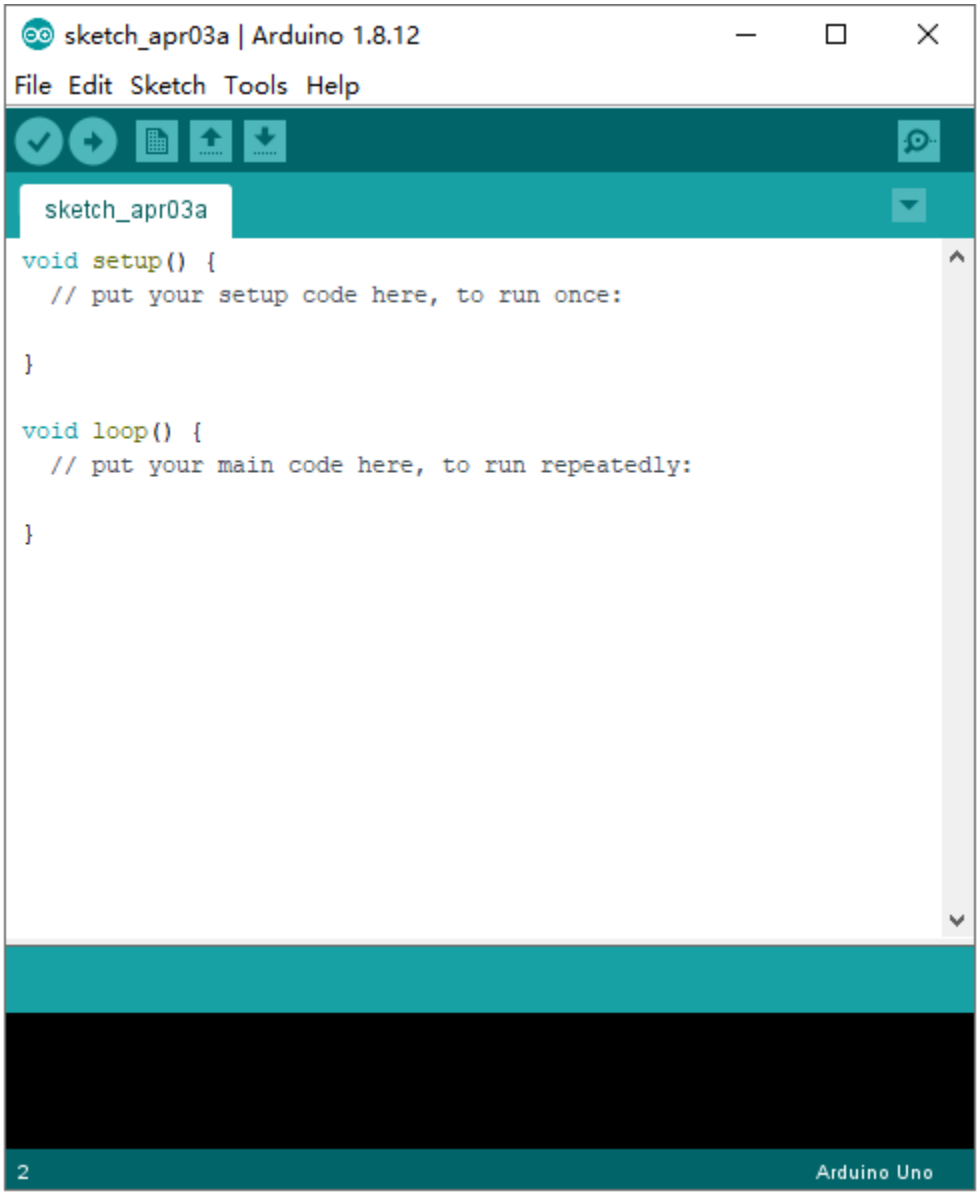
There are various versions for Arduino, just download a suitable version for your system. We will take WINDOWS system as an example to show you how to download and install.

There are two versions for WINDOWS system, one is installed version, another one is download version. You just need to download the file to computer directly and unzip it. These two versions can be used normally. Choose one and download on your computer.

4.1.3 3. Arduino IDE Setting

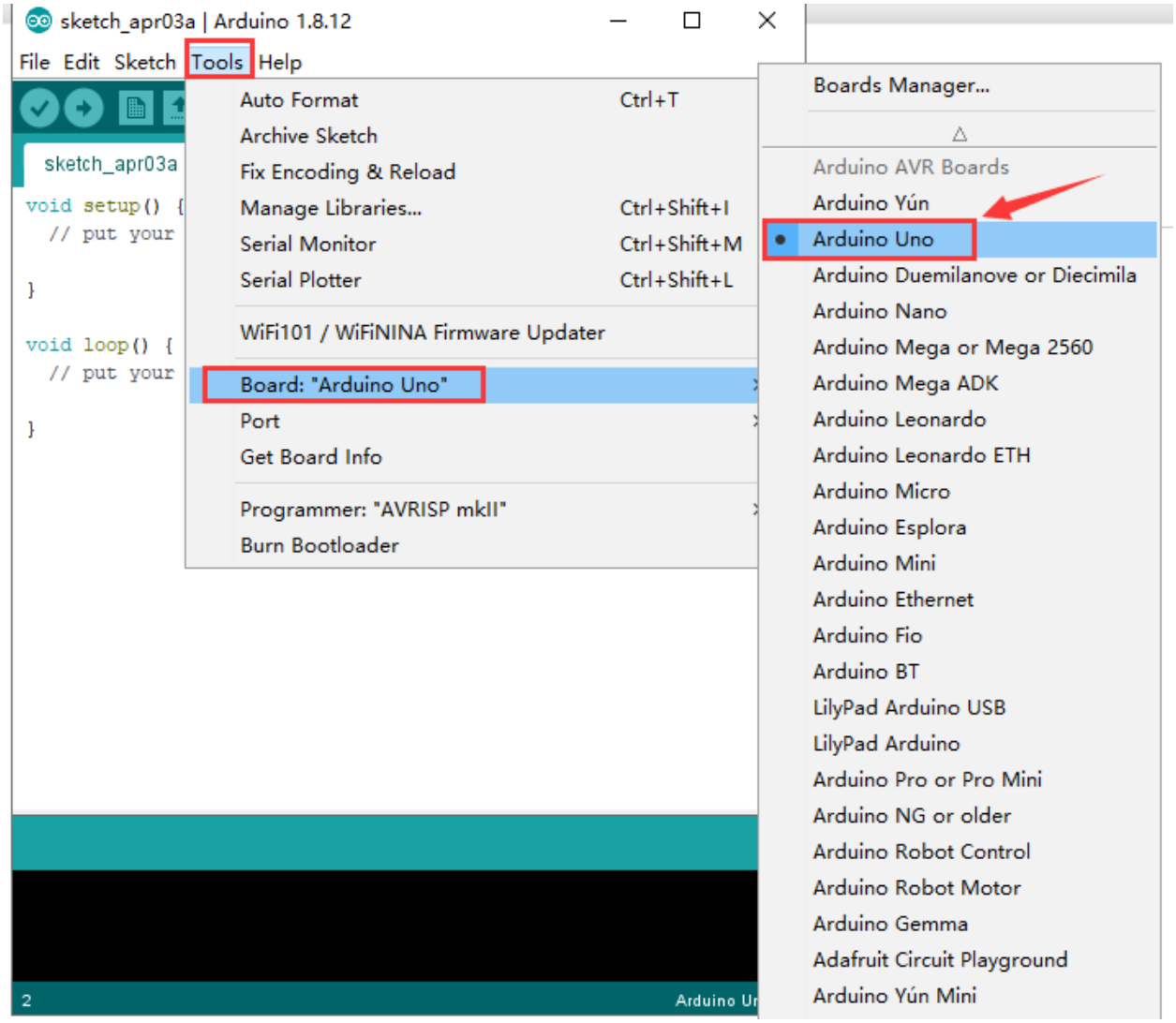
Click 

iconopen Arduino IDE.

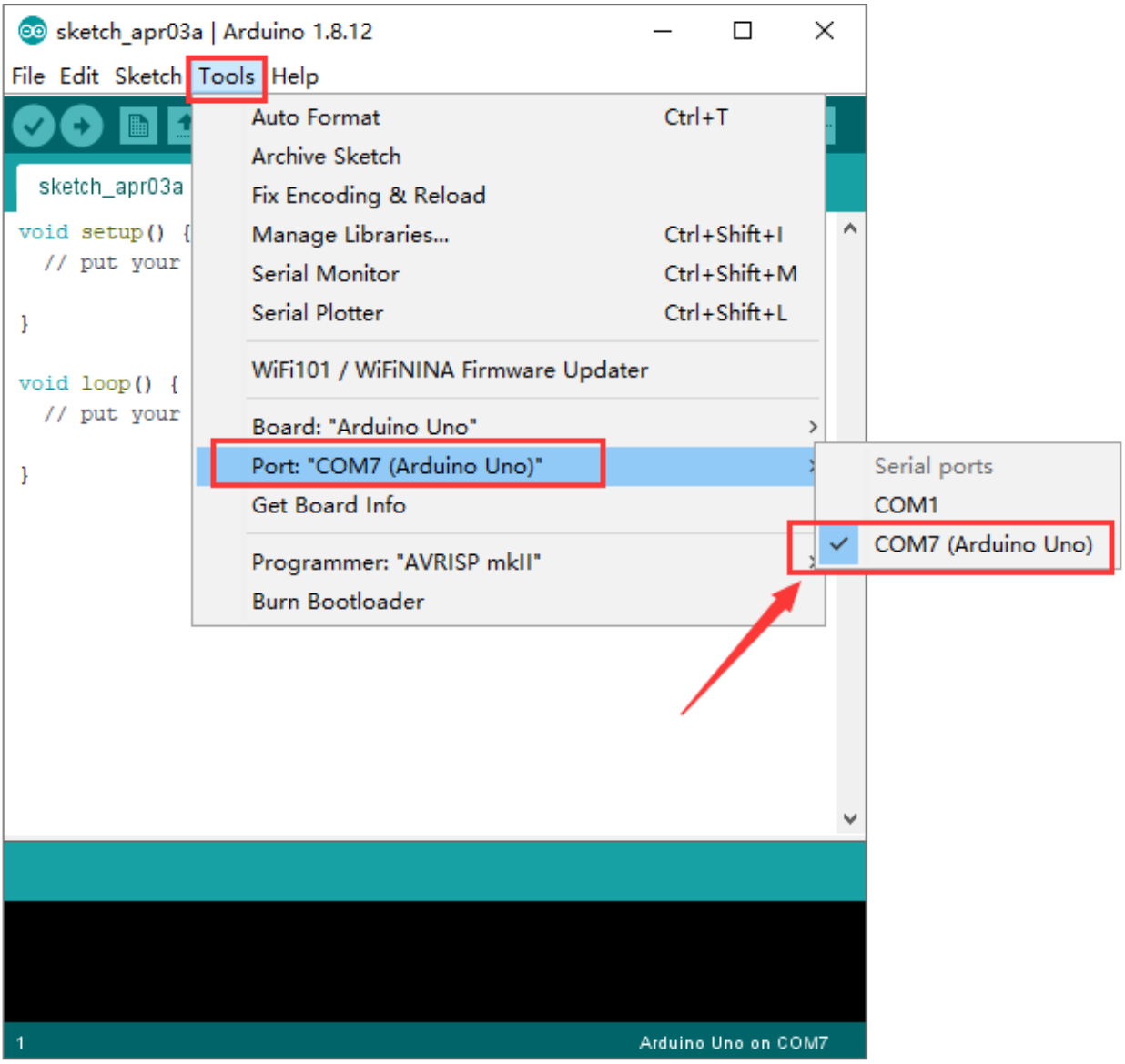


To avoid the errors when uploading the program to the board, you need to select the correct Arduino board that matches the board connected to your computer.

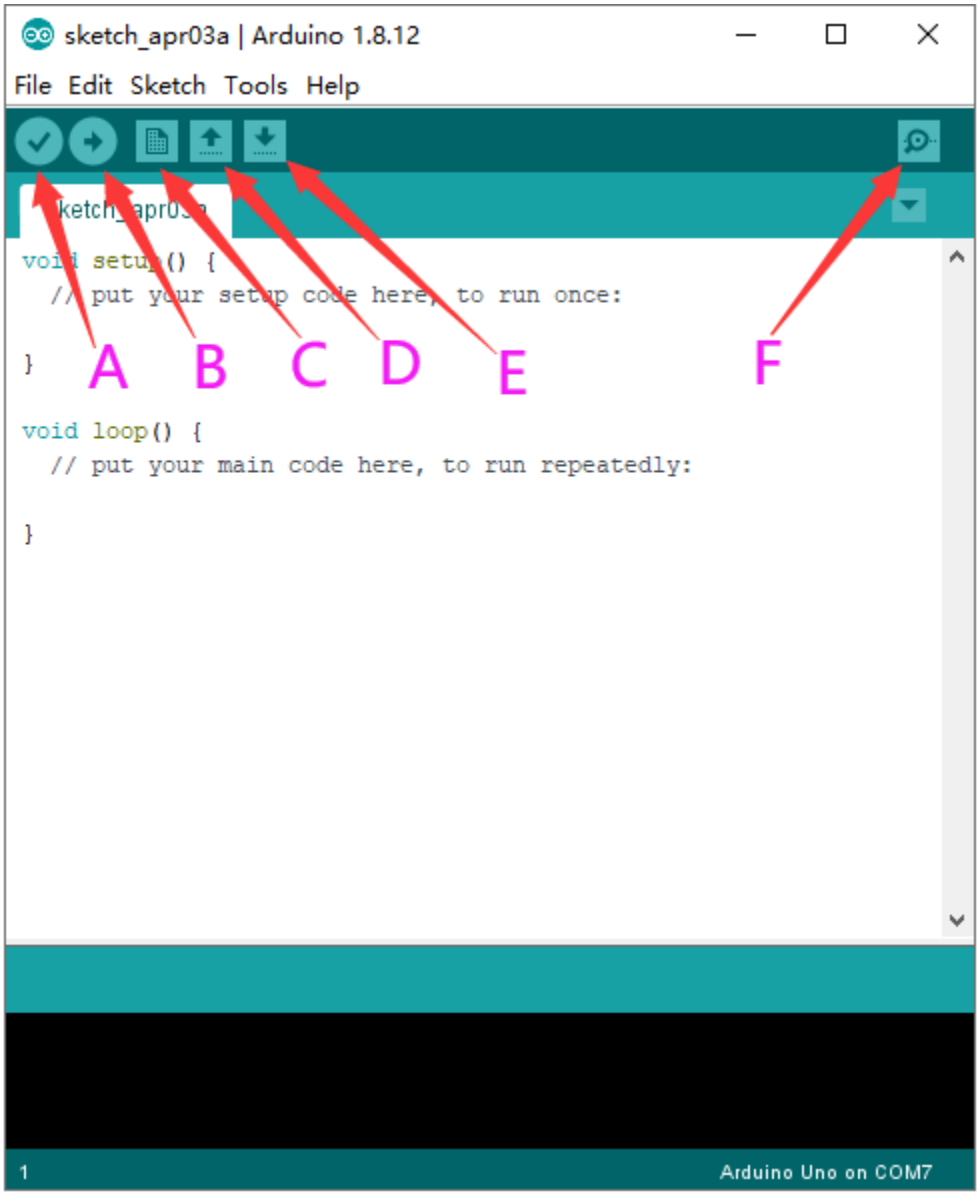
Then come back to the Arduino software, you should click Tools→Board, select the board. (as shown below)



Then select the correct COM port (you can see the corresponding COM port after the driver is successfully installed)



Before uploading the program to the board, let's demonstrate the function of each symbol in the Arduino IDE toolbar.



A- Used to verify whether there is any compiling mistakes or not.

B- Used to upload the sketch to your Arduino board.

C- Used to create shortcut window of a new sketch.

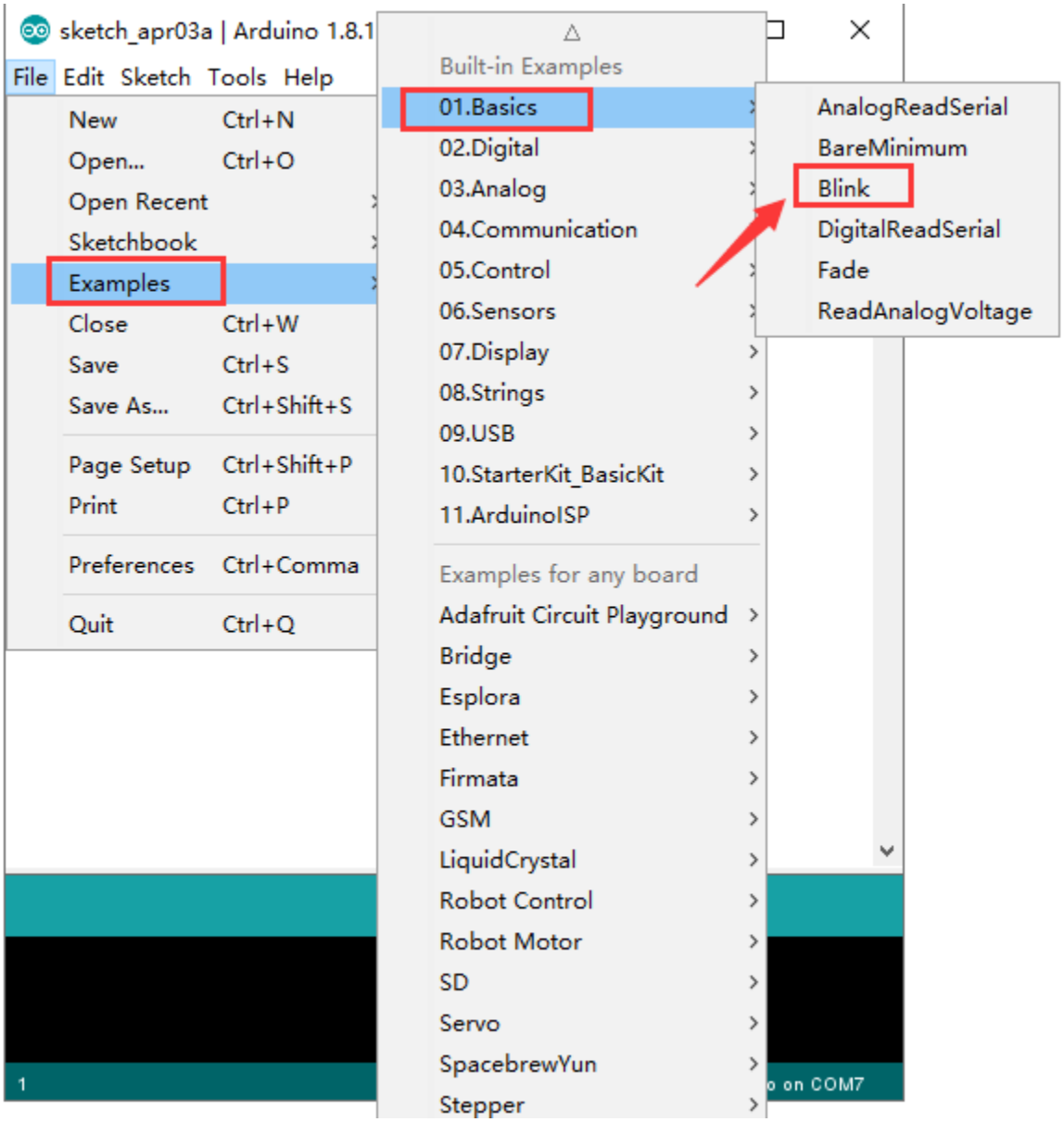
D- Used to directly open an example sketch.

E- Used to save the sketch.

F- Used to send the serial data received from board to the serial monitor.

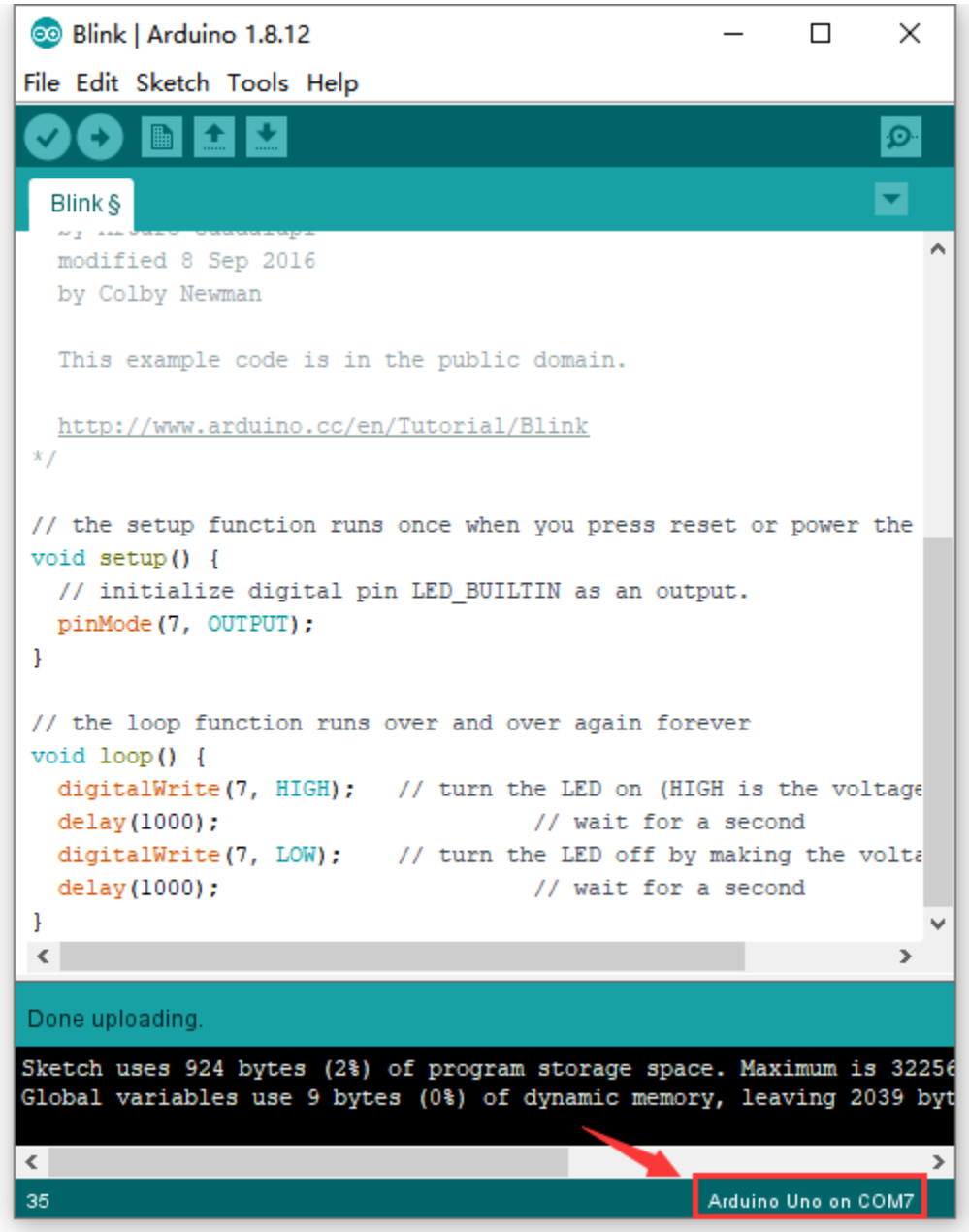
4.1.4 4. Start your first program

Open the file to select Example, choose BLINK from BASIC, as shown below:

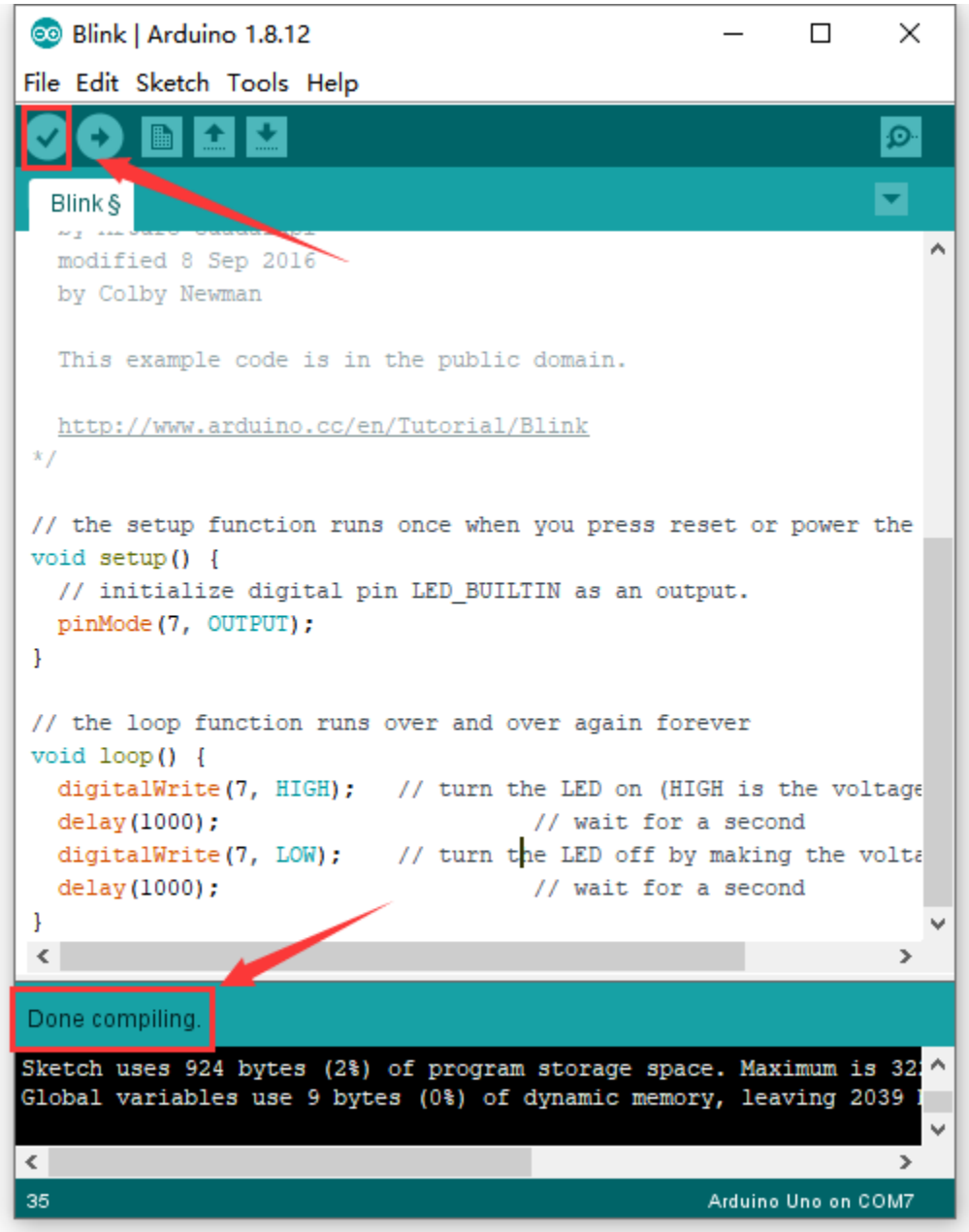


dfInterface D3, D5, D6, D7, D8 in the coding box all can control LEDs. During the test, it is necessary to change the code in LED_BUILTIN to the corresponding interface. For example, in the picture below, it is D7.

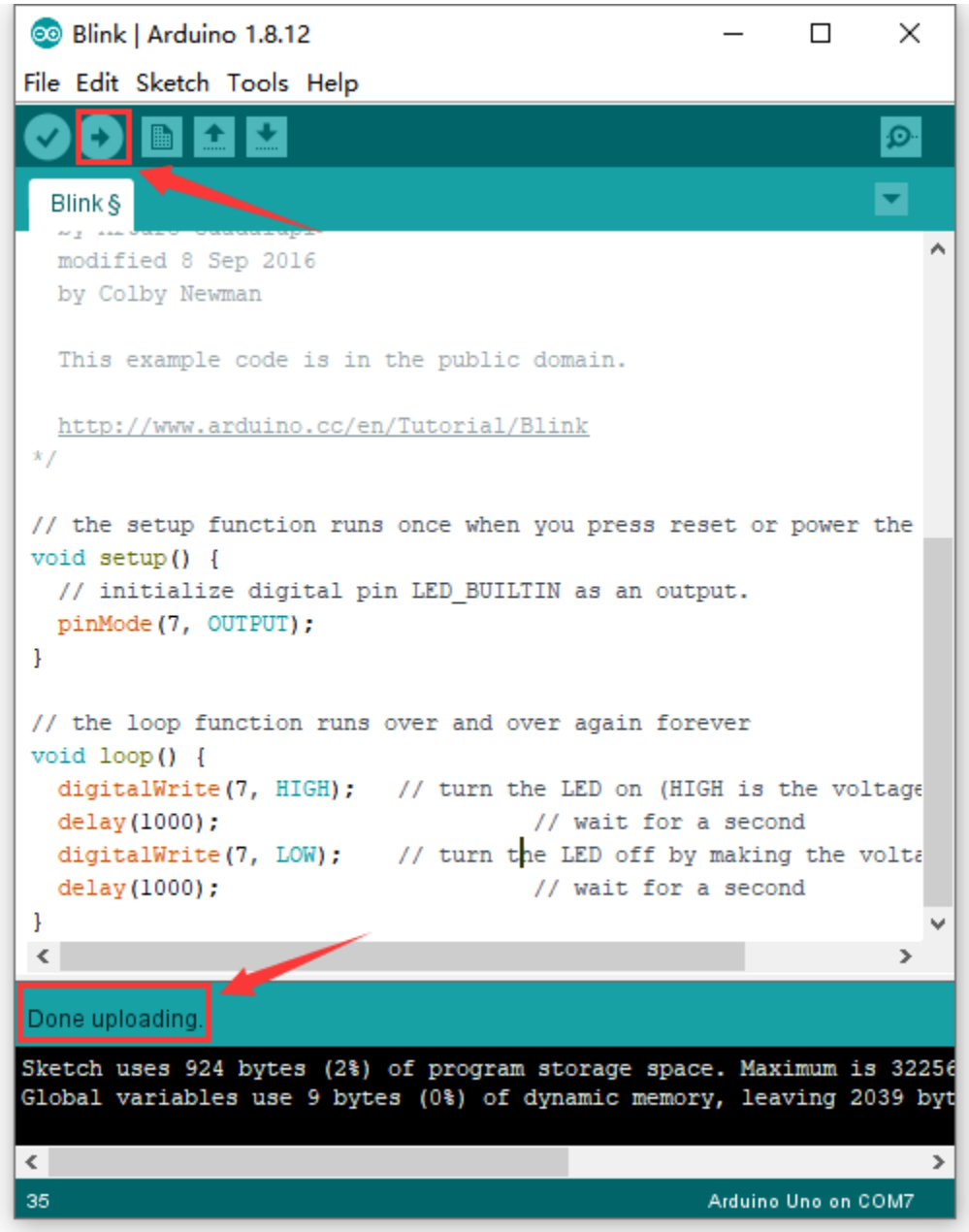
Set board and COM port, the corresponding board and COM port are shown on the lower right of IDE.



Click  to start compiling the program, and check errors.



Click  to upload the program, upload successfully.



Upload the program successfully, the on-board LED lights on for 1s, lights off for 1s. Congratulation, you have finished the first program.

4.1.5 5. Add Libraries to Arduino

What are Libraries ?

Libraries are a collection of code that makes it easy for you to connect to a sensor, display, module, etc.

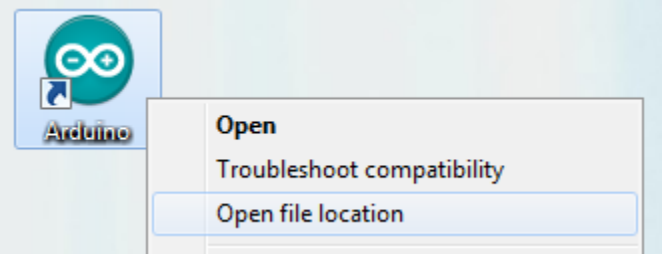
For example, the built-in LiquidCrystal library helps LCD displays.

There are hundreds of additional libraries available on the Internet for download.

Here we will introduce the most simple way for you to add libraries .

Step 1After downloading well the Arduino IDE, you can right-click the icon of Arduino IDE.

Find the option “Open file location” shown as below:

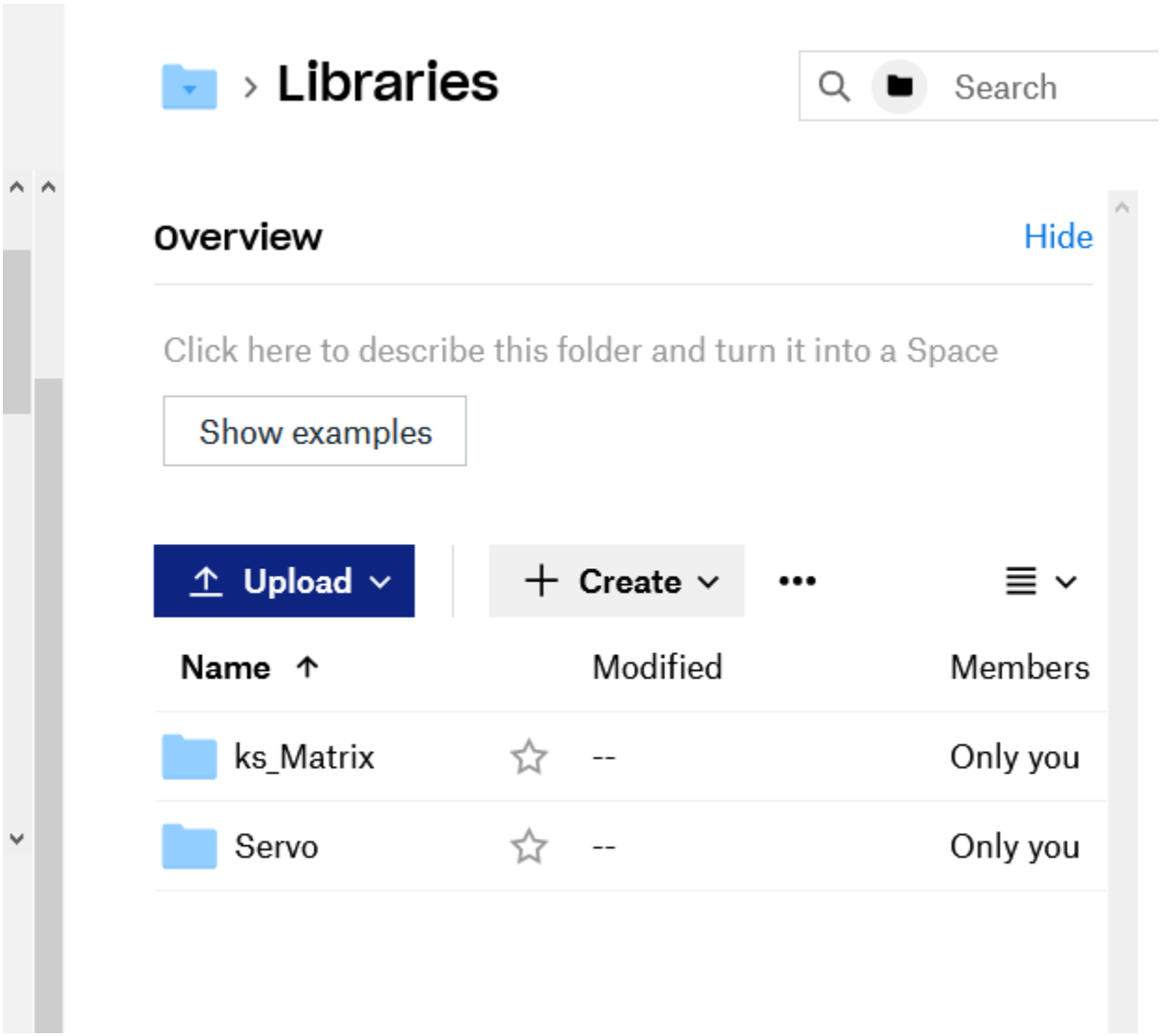


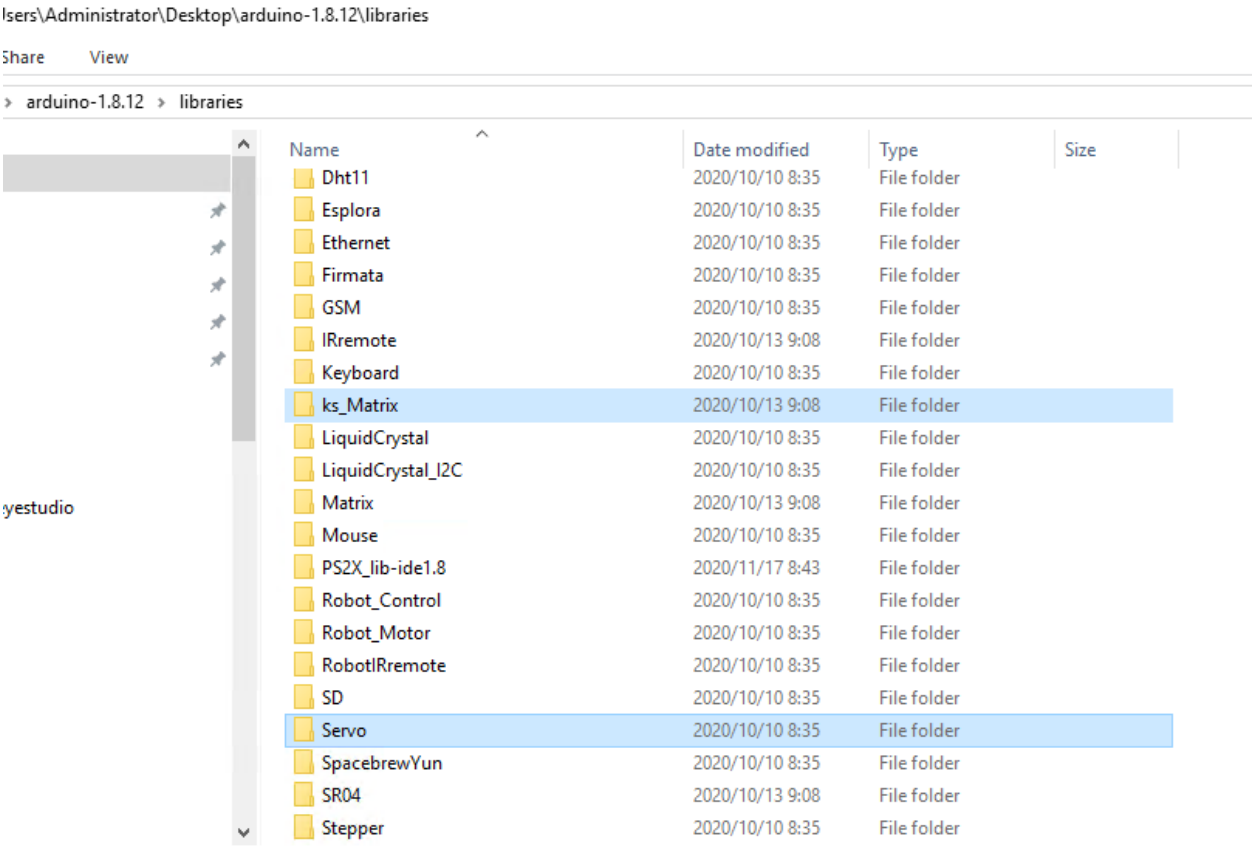
Step 2: Enter it to find libraries folder which is the library file of Arduino.

Step 3Next to find out the“libraries”of coding box kit(seen in the link:

You just need to replicate and paste its libraries into the libraries of Arduino IDE.

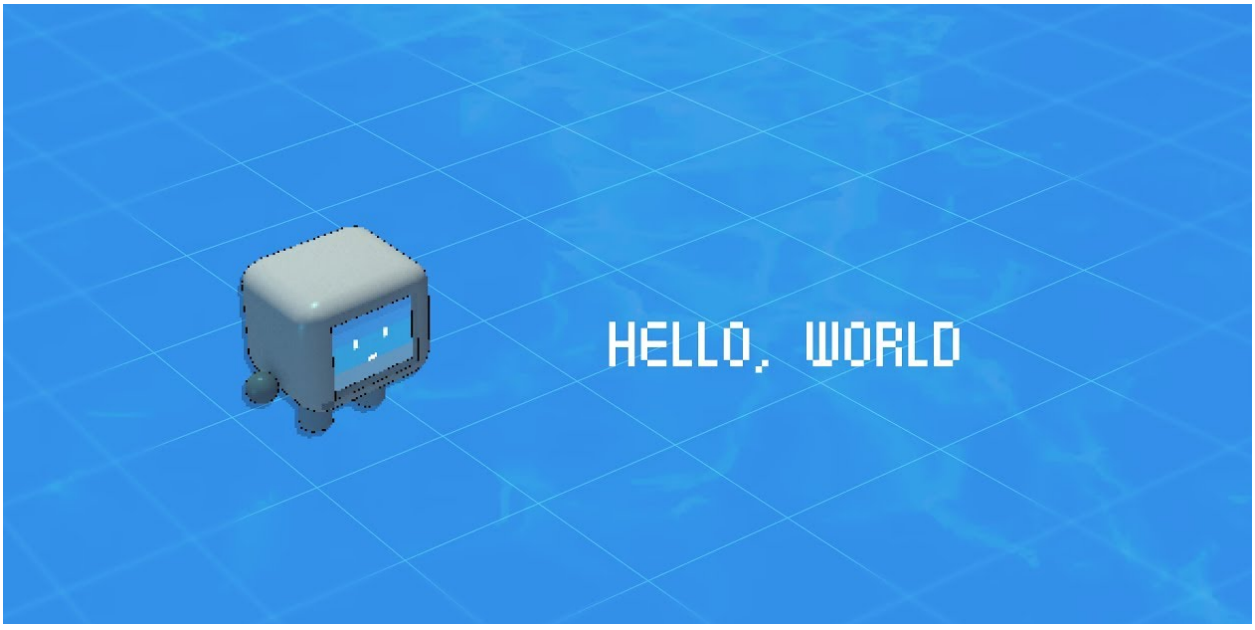
The library of this kit is successfully installed, as shown below:


Libraries
Search
Overview
Hide
Click here to describe this folder and turn it into a Space
Show examples
Upload
Create
Name
Modified
Members
ks_Matrix
--
Only you
Servo
--
Only you



4.2 Projects

4.2.1 Project 1: Hello World



Project Introduction

As for starters, we will begin with something simple. In this project, you only need a PLUS board and a USB cable to start the "Hello World!" project. It is not only a communication test of your Arduino and PC, but also an enlightening project for you to have your first try in the Arduino world!

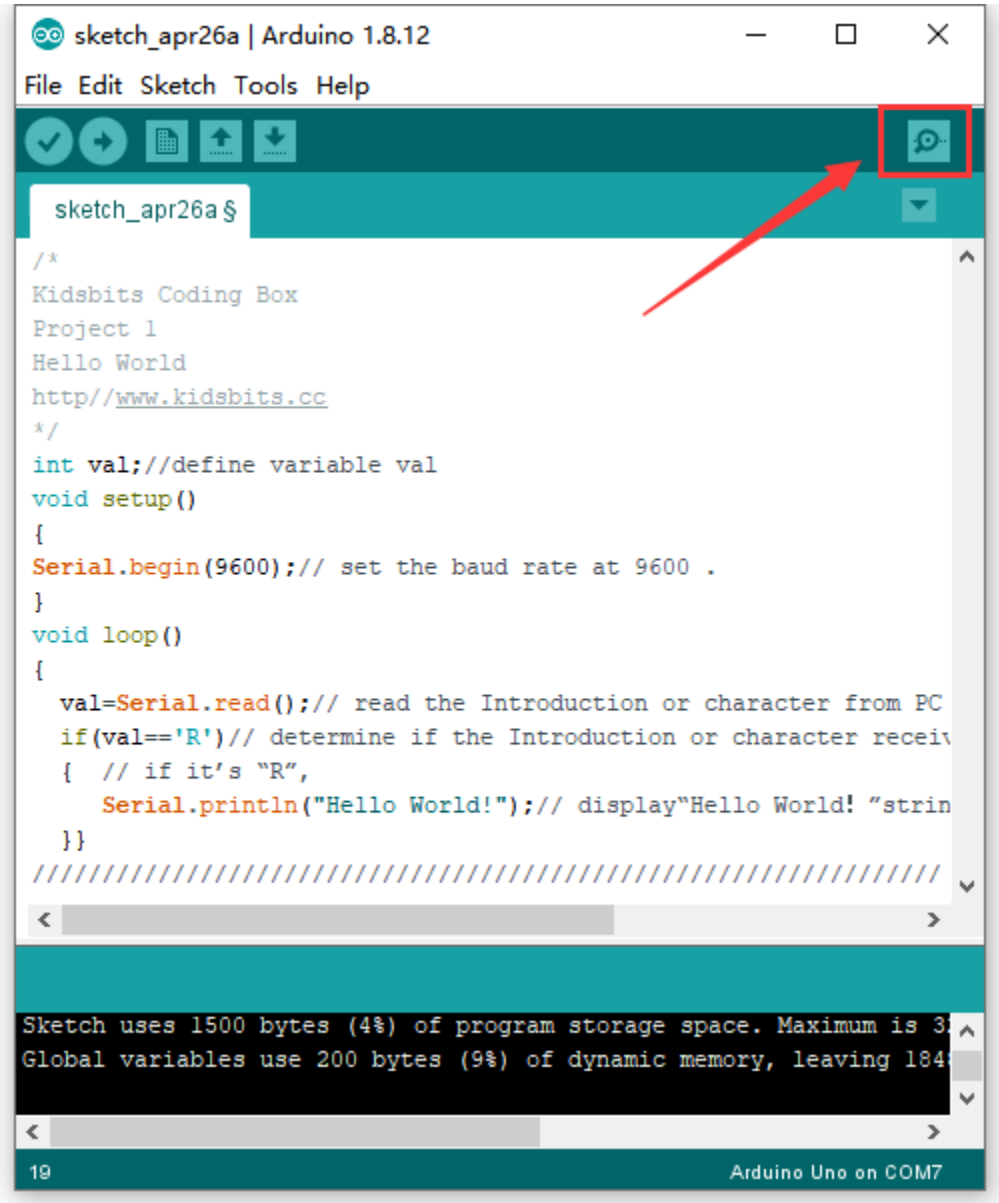
Project Code

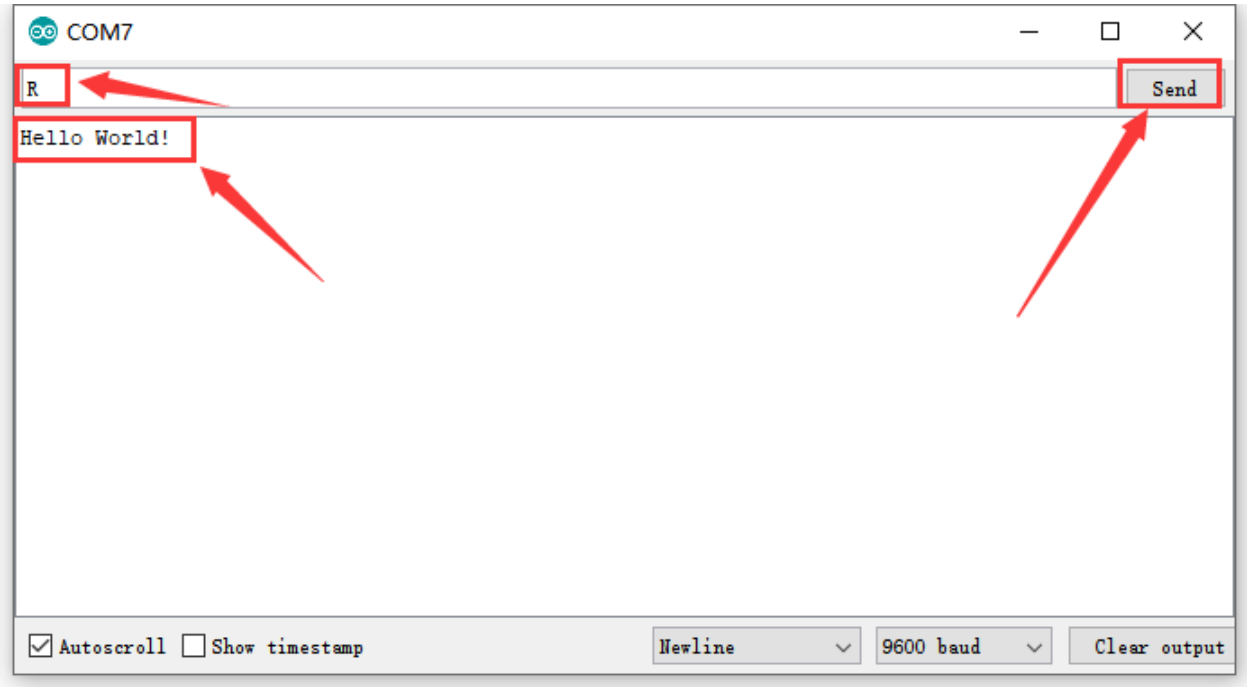
After installing driver for Arduino, let's open Arduino software and compile code that enables Arduino to print "Hello World!" .

```
\*Kidsbits Coding Box

Project 1

Hello World

http//www.kidsbits.cc

*/

int val;//define variable val

void setup()

{

Serial.begin(9600);// set the baud rate at 9600 .

}

void loop()

{

val=Serial.read();// read the Introduction or character from PC to Arduino, and
assign them to Val.

if(val=='R')// determine if the Introduction or character received is "R".

{ // if it's "R",

Serial.println("Hello World!");// display"Hello World"string.

}}

//////////////////////////////////////////////////////////////////
```

Project Result

Click to open the serial monitor, input an"R", PC will receive the information from Arduino Hello World!

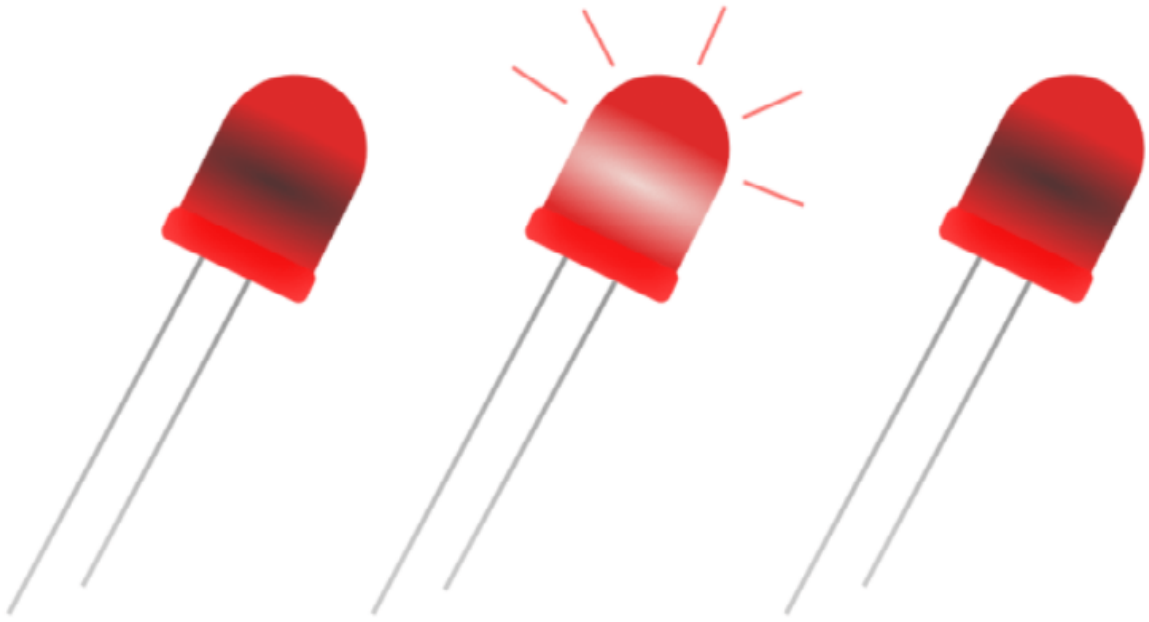

sketch_apr26a | Arduino 1.8.12
File Edit Sketch Tools Help
sketch_apr26a §
/*
Kidsbits Coding Box
Project 1
Hello World
http//www.kidsbits.cc
*/
int val;//define variable val
void setup()
{
Serial.begin(9600);// set the baud rate at 9600 .
}
void loop()
{
val=Serial.read();// read the Introduction or character from PC
if(val=='R')// determine if the Introduction or character receiv
{ // if it's "R",
Serial.println("Hello World!");// display"Hello World! "strin
}}
Sketch uses 1500 bytes (4%) of program storage space. Maximum is 3
Global variables use 200 bytes (9%) of dynamic memory, leaving 184
19
Arduino Uno on COM7



After choosing the proper port, the project is easy for you!

next project***

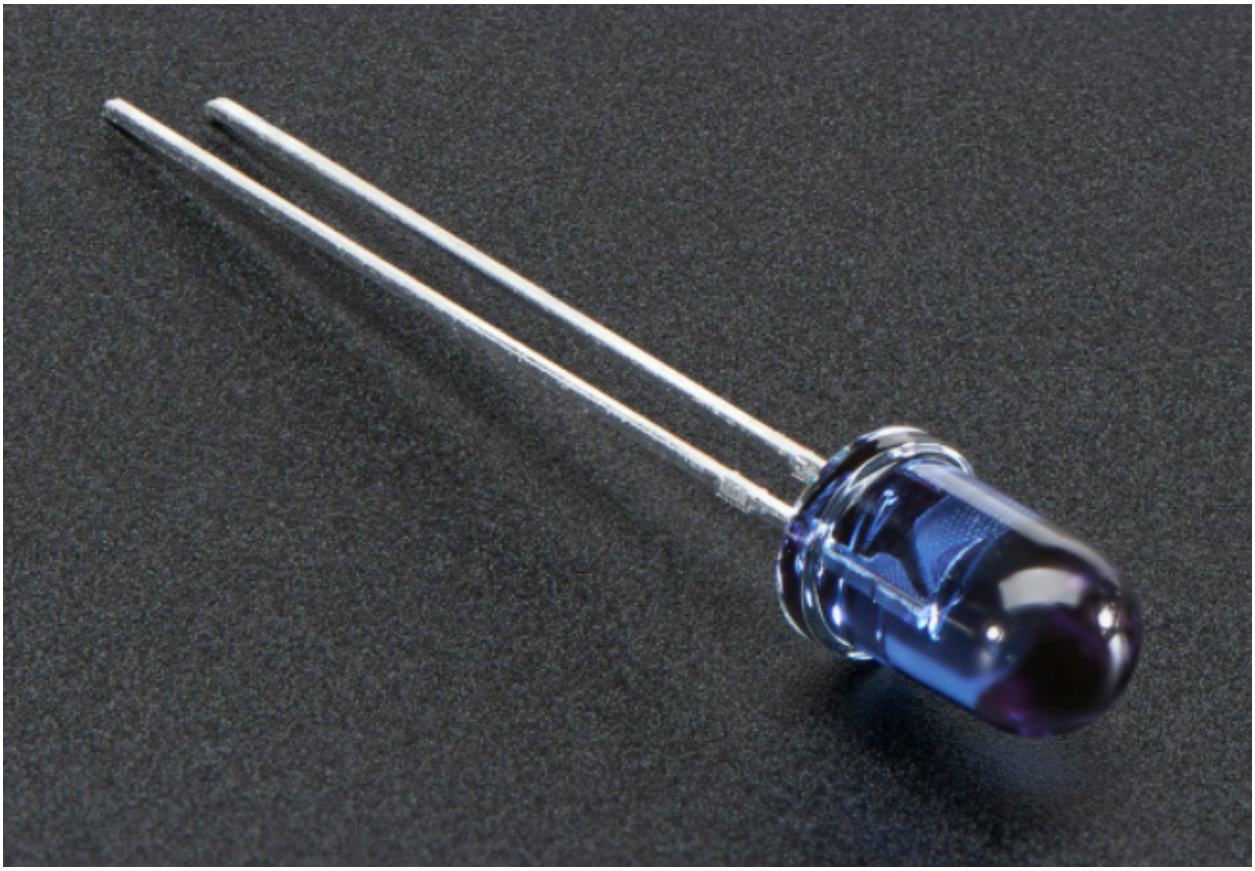
4.2.2 Project 2: Blink



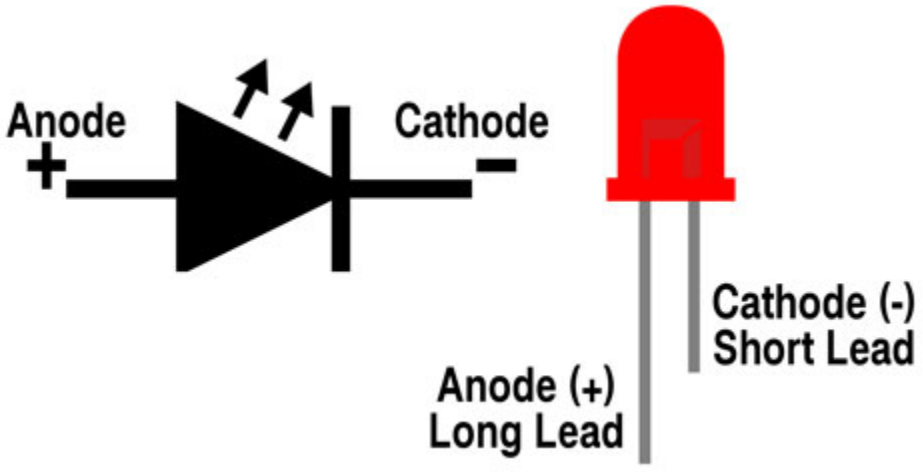
Project Introduction

In this project, we start to learn the digital output of Arduino. We used the digital pin of Arduino to turn on an LED and let it blink.

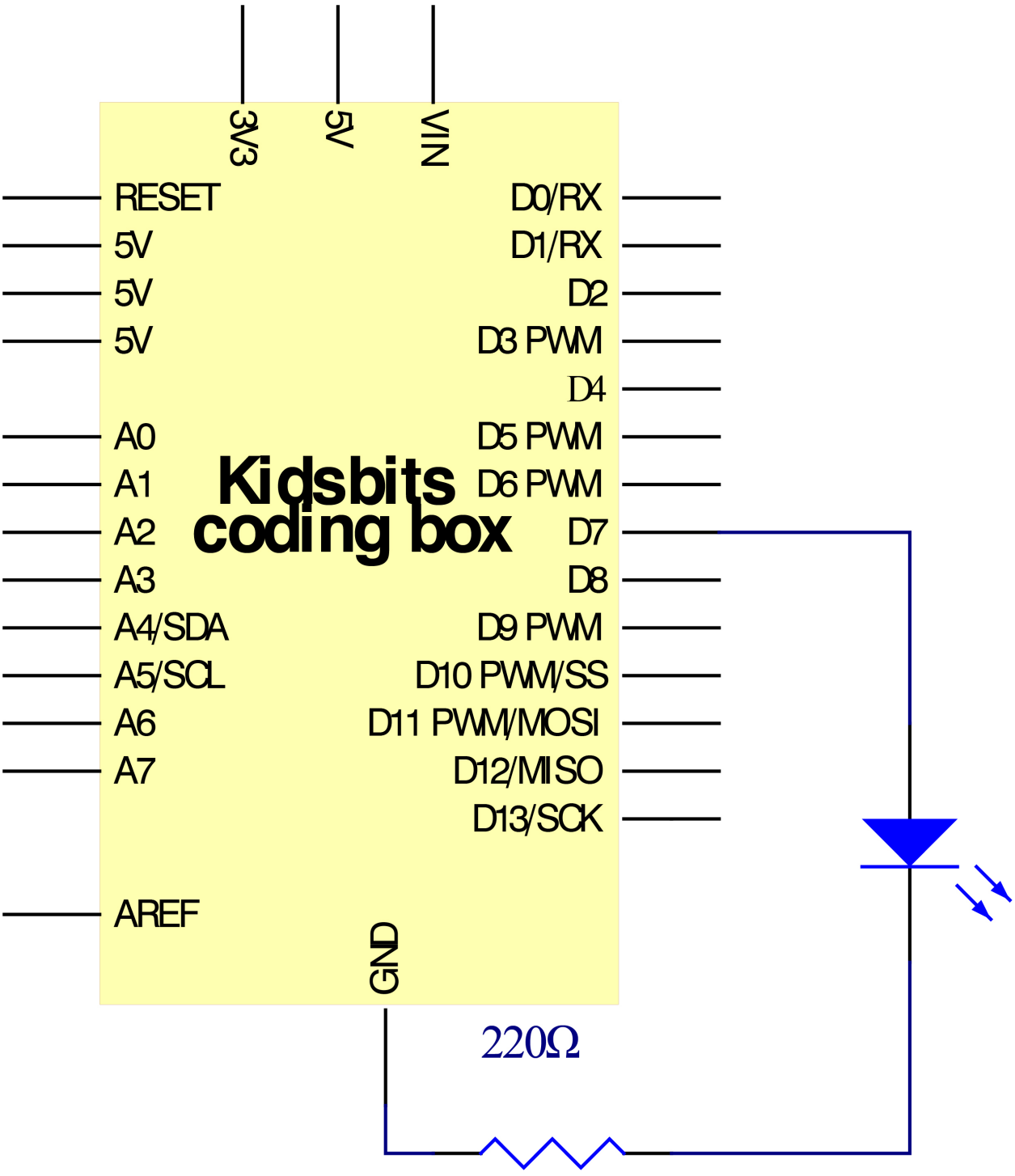
Working Principle



LED is a type of semiconductor called “Light Emitting Diode “which is an electronic device made of semiconductor materials (silicon, selenium, germanium, etc.). It is dubbed indicator, digital and word display in circuit and device. It has positive and negative poles. The short leg is the negative pole, and the long one is the positive pole.



Circuit Connection



Project Code

```
\*Kidsbits Coding Box

Project 2

Blink
```

(continues on next page)

(continued from previous page)

```
http//www.kidsbits.cc

*/

int ledPin = 7; // define digital pin 7.

void setup()

{

pinMode(ledPin, OUTPUT);// define led pin as output.

}

void loop()

{

digitalWrite(ledPin, HIGH); // set the LED on.

delay(1000); // wait for a second.

digitalWrite(ledPin, LOW); // set the LED off.

delay(1000); // wait for a second

}

//////////////////////////////////////////////////////////////////
```

Project Result

Upload the code to the coding box successfully, you can see that the red LED of D7 starts blinking, which is on for 1 second and off for 1 second.

next project***

4.2.3 Project 3: SOS

Project Introduction

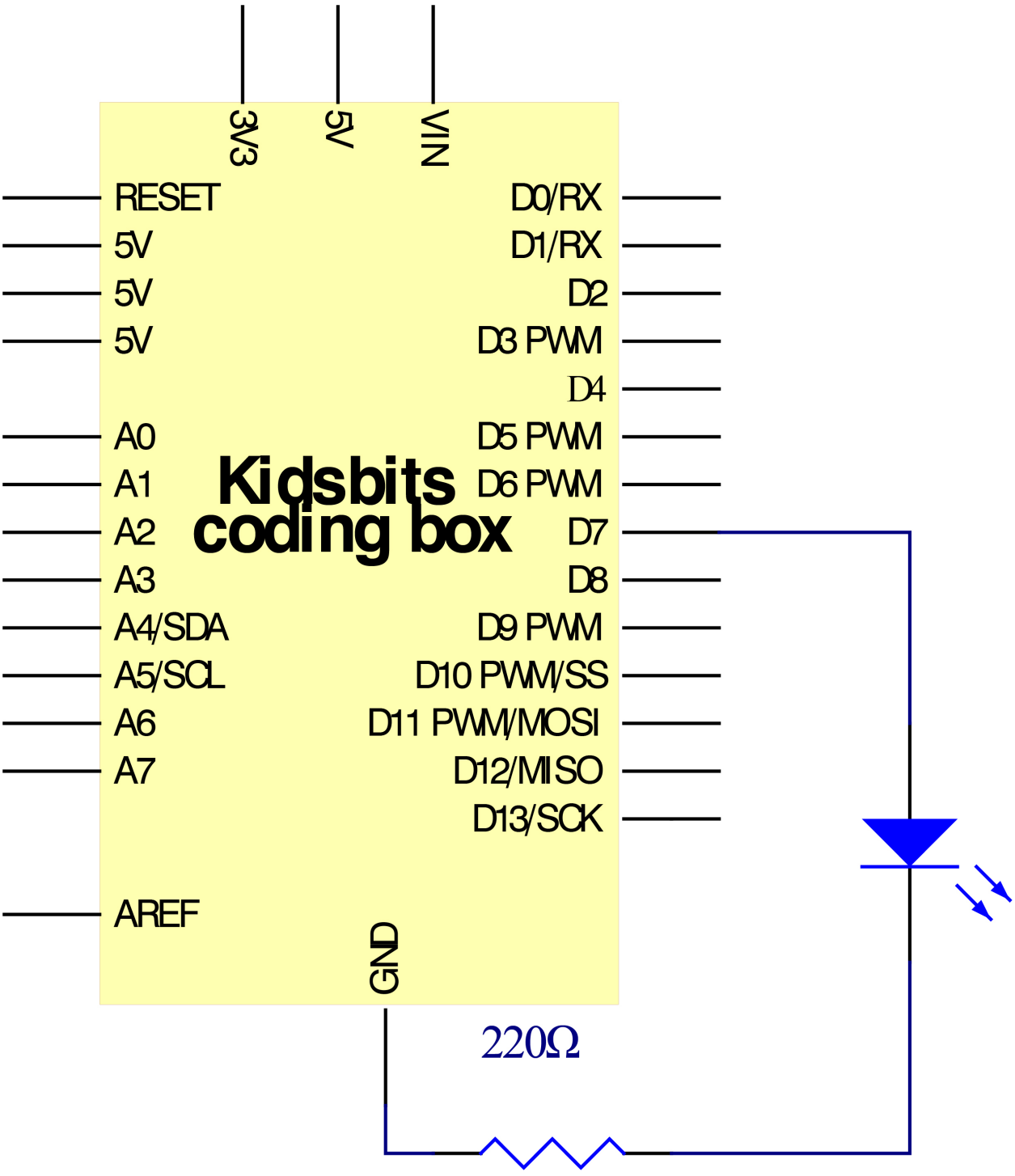
The SOS distress signal is an international Morse code distress signal asking for help. Morse code is a character encoding. Each letter of English is composed of different combinations of bars and dots. The advantage of this is that using the simple two symbols all letters and numbers can be transmitted, which is very simple!

Working Principle

The letters can be spelled out through the two states of the LED switch, using long flashing and short flashing to indicate dots and bars. Just spell the three letters S.O.S.

By consulting the Morse code table, we can know that the letter "S" is represented by three dots, and we use short blinking instead, and the letter "O" is represented by three horizontal bars, which is replaced by long blinking here.

Circuit Connection



Project Code

```
\*Kidsbits Coding Box

Project 3

s o s
```

(continues on next page)

(continued from previous page)

```
http//www.kidsbits.cc

*/

int ledPin = 7;

void setup()

{

pinMode(ledPin, OUTPUT);

}

void loop() {

// Three fast flashes to indicate the letter "S"

for(int x=0;x\<3;x++){

digitalWrite(ledPin,HIGH); //Set the LED to on

delay(150); //Delay 150 milliseconds

digitalWrite(ledPin,LOW); //Set the LED to off

delay(100); //Delay 100 milliseconds

}

delay(100);

//Three short flashes to indicate the letter "O"

for(int x=0;x\<3;x++)

{

digitalWrite(ledPin,HIGH); //Set the LED to on

delay(400); //delay 400 milliseconds

digitalWrite(ledPin,LOW); //Set the LED to off

delay(100); //delay 100 milliseconds

}

delay(100);

// three quick flashes to represent the letter "S"
```

(continues on next page)

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```
for(int x=0;x\<3;x++)

{

digitalWrite(ledPin,HIGH); //Set the LED to on

delay(150); //Delay 150 milliseconds

digitalWrite(ledPin,LOW); //Set the LED to off

delay(100); //delay 100 milliseconds

}

// Wait 5 seconds before repeating the S.0.S signal

delay(5000);

}

\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
```

Project Result

After uploading the code to the coding box, you can see that the red LED at D7 fast flash 3 times and then slowly flash 3 times alternatively, which can stimulate SOS alarm in Morse code.

next project***

4.2.4 Project 4: PWM

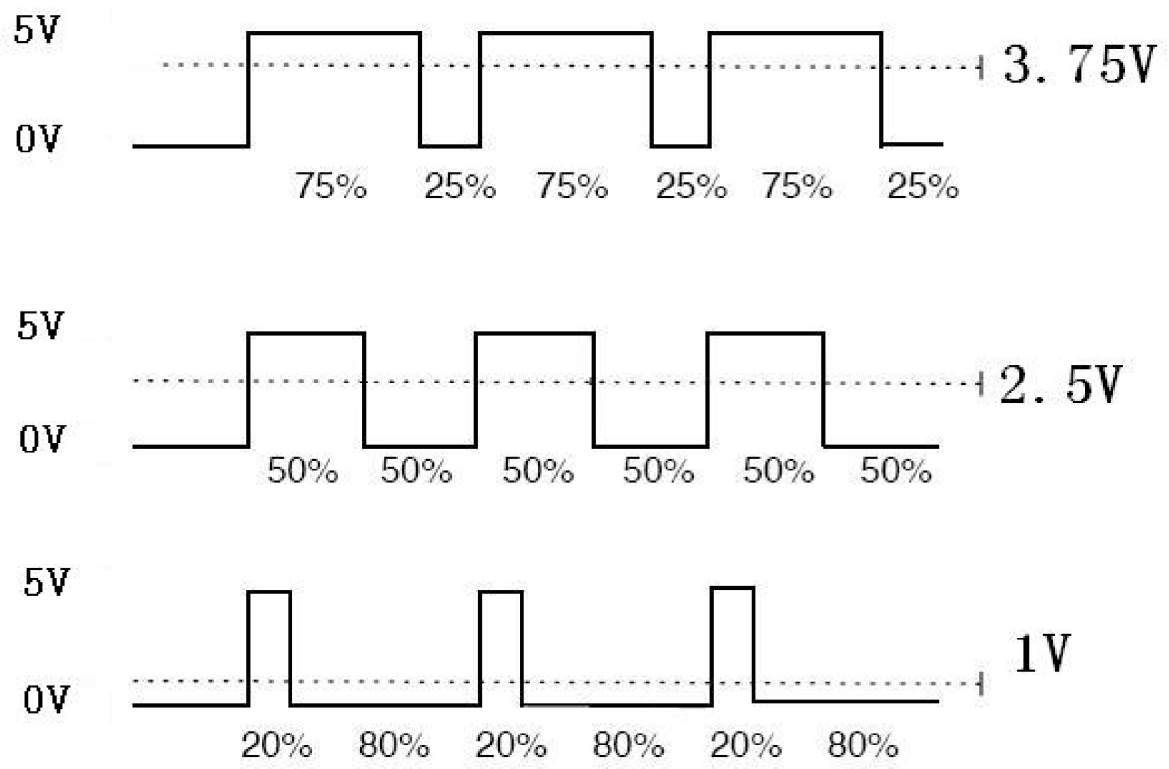
Project Introduction

In this project, we will learn the PWM control of ARDUINO. PWM is the abbreviation of Pulse Width Modulation, which is a technology that encodes analog signal level into digital signal level. We use PWM to control an LED gradually from bright to dark.

Working Principle

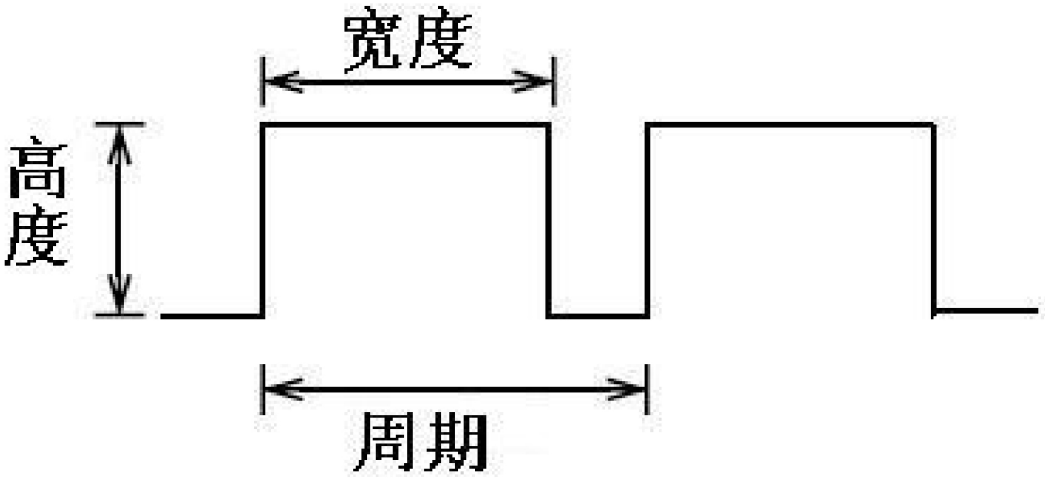
The PWM signal is also digitalized because in any given moment, fully on DC power supply is either 5V (ON), or 0V (OFF). The voltage or current is fed to the analog load (the device that uses the power) by repeated pulse sequence being ON or OFF. Being on, the current is fed to the load; being off, it's not. With adequate bandwidth, any analog value can be encoded using PWM. The output voltage value is calculated via the on and off time.

Output voltage = (turn on time/pulse time) maximum voltage value



PWM has many applications like lamp brightness regulating, motor speed regulating, sound making, etc.

The following are the three basic parameters of PMW.



1. The amplitude of pulse width (minimum / maximum)

2. The pulse period (The reciprocal of pulse frequency in one second)

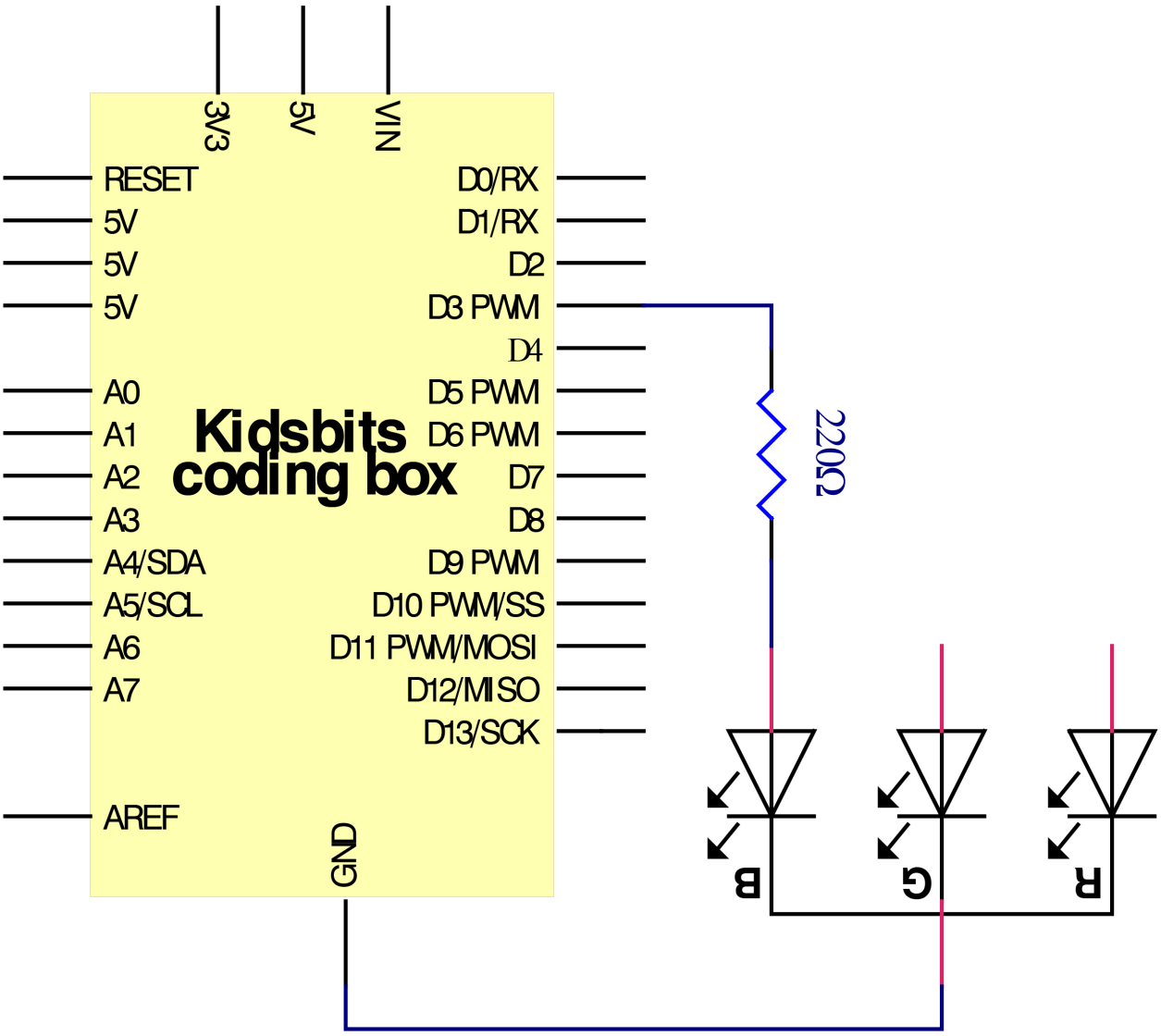
3. The voltage levelsuch as 0V-5V

There are 6 PMW interfaces on Arduino, namely digital pin 3, 5, 6, 9, 10, and 11.

In previous experiments, we have done “button-controlled LED”, using digital signal to control digital pin, also one about potentiometer.

This time, we will use a potentiometer to control the brightness of the LED.

Circuit Connection



Project Code

```
\*Kidsbits Coding Box

Project 4

PWM

http//www.kidsbits.cc

*/

int ledPin = 3;

void setup()
```

(continues on next page)

(continued from previous page)

```
{

pinMode(ledPin,OUTPUT);

}

void loop(){

for (int value = 0 ; value \< 255; value=value+1){

analogWrite(ledPin, value);

delay(5);

}

for (int value = 255; value \>0; value=value-1){

analogWrite(ledPin, value);

delay(5);

} }

//////////////////////////////////////////////////////////////////
```

Project Result

After uploading the code to the coding box, you can see the blue light in the RGB on the coding box constantly brightening and dimming, just like a breathing light.

next project***

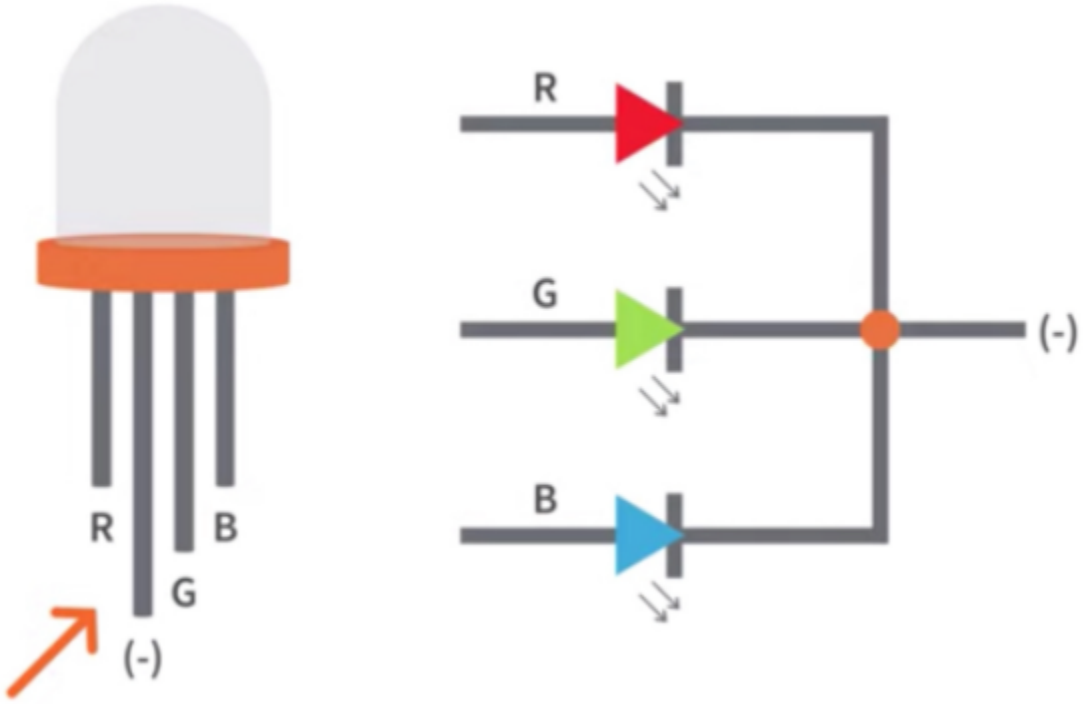
4.2.5 Project 5: RGB Color

Project Introduction

The RGB color mode is a color standard in the industry. It obtains various colors by changing the three color channels of red (R), green (G), and blue (B) and integrating them. RGB denotes the three colors of red, green and blue.

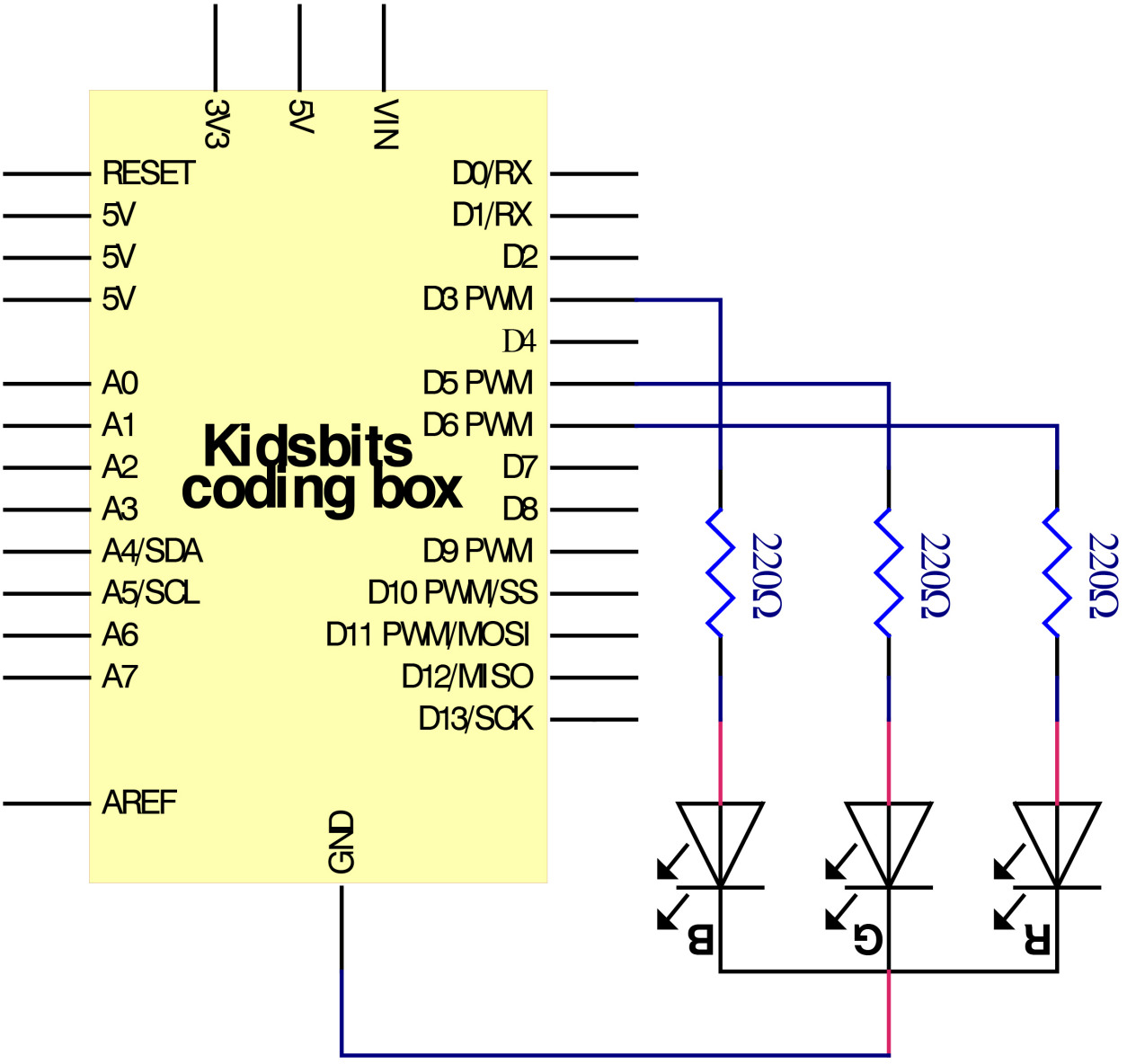
Working Principle

The monitors mostly adopt the RGB color standard, and all the colors on the computer screen are composed of the three colors of red, green and blue mixed in different proportions.



And we could adjust the LED brightness by PWM.

Circuit Connection



Project Result

After uploading the code to the coding box, you can see the light of the RGB light on the coding box, and the color keeps changing.

next project***

4.2.6 Project 6: Play Music

Project Introduction

In the previous project, we studied the active buzzer, which can only emit one sound, which feels rather monotonous.

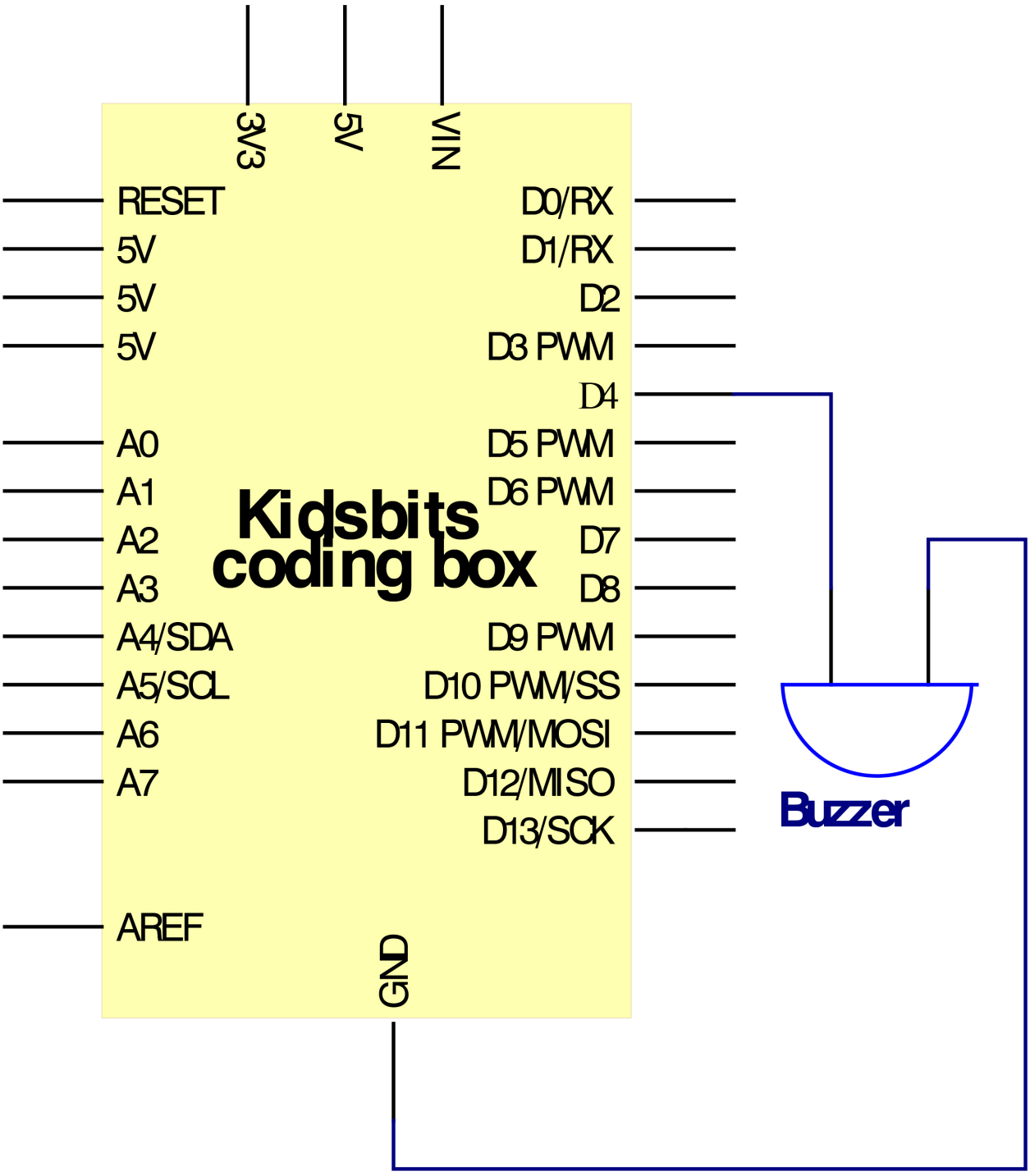
This project will learn another buzzer, passive buzzer. The characteristic of the passive buzzer is that it can emit sounds of different frequencies. This characteristic allows the buzzer to play music melody.

We used the shape of a bird that really likes to sing to complete this project. We can code some different songs, which is very interesting.

Working Principle

Passive buzzer is an integrated electronic buzzer without vibration source inside. It must be driven by 2K-5K square wave instead of direct current signals. There is little difference between the two kinds of buzzers, but when the pins of the two buzzers are placed up, the passive buzzer comes with green circuit board, and the one sealed with vinyl is an active buzzer.

Circuit Connection



Project Code

```
\*Kidsbits Coding Box

Project 6

Play Music
```

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```
http//www.kidsbits.cc

*/

\#define NOTE_B0 31

\#define NOTE_C1 33

\#define NOTE_CS1 35

\#define NOTE_D1 37

\#define NOTE_DS1 39

\#define NOTE_E1 41

\#define NOTE_F1 44

\#define NOTE_FS1 46

\#define NOTE_G1 49

\#define NOTE_GS1 52

\#define NOTE_A1 55

\#define NOTE_AS1 58

\#define NOTE_B1 62

\#define NOTE_C2 65

\#define NOTE_CS2 69

\#define NOTE_D2 73

\#define NOTE_DS2 78

\#define NOTE_E2 82

\#define NOTE_F2 87

\#define NOTE_FS2 93

\#define NOTE_G2 98

\#define NOTE_GS2 104

\#define NOTE_A2 110

\#define NOTE_AS2 117
```

(continues on next page)

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```
\#define NOTE_B2 123

\#define NOTE_C3 131

\#define NOTE_CS3 139

\#define NOTE_D3 147

\#define NOTE_DS3 156

\#define NOTE_E3 165

\#define NOTE_F3 175

\#define NOTE_FS3 185

\#define NOTE_G3 196

\#define NOTE_GS3 208

\#define NOTE_A3 220

\#define NOTE_AS3 233

\#define NOTE_B3 247

\#define NOTE_C4 262

\#define NOTE_CS4 277

\#define NOTE_D4 294

\#define NOTE_DS4 311

\#define NOTE_E4 330

\#define NOTE_F4 349

\#define NOTE_FS4 370

\#define NOTE_G4 392

\#define NOTE_GS4 415

\#define NOTE_A4 440

\#define NOTE_AS4 466

\#define NOTE_B4 494

\#define NOTE_C5 523
```

(continues on next page)

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```
\#define NOTE_CS5 554

\#define NOTE_D5 587

\#define NOTE_DS5 622

\#define NOTE_E5 659

\#define NOTE_F5 698

\#define NOTE_FS5 740

\#define NOTE_G5 784

\#define NOTE_GS5 831

\#define NOTE_A5 880

\#define NOTE_AS5 932

\#define NOTE_B5 988

\#define NOTE_C6 1047

\#define NOTE_CS6 1109

\#define NOTE_D6 1175

\#define NOTE_DS6 1245

\#define NOTE_E6 1319

\#define NOTE_F6 1397

\#define NOTE_FS6 1480

\#define NOTE_G6 1568

\#define NOTE_GS6 1661

\#define NOTE_A6 1760

\#define NOTE_AS6 1865

\#define NOTE_B6 1976

\#define NOTE_C7 2093

\#define NOTE_CS7 2217

\#define NOTE_D7 2349
```

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(continued from previous page)

```
\#define NOTE_DS7 2489

\#define NOTE_E7 2637

\#define NOTE_F7 2794

\#define NOTE_FS7 2960

\#define NOTE_G7 3136

\#define NOTE_GS7 3322

\#define NOTE_A7 3520

\#define NOTE_AS7 3729

\#define NOTE_B7 3951

\#define NOTE_C8 4186

\#define NOTE_CS8 4435

\#define NOTE_D8 4699

\#define NOTE_DS8 4978

\#define REST 0

// change this to make the song slower or faster

int tempo=114;

// change this to whichever pin you want to use

int buzzer = 4;

// notes of the moledy followed by the duration.

// a 4 means a quarter note, 8 an eighteenth , 16 sixteenth, so on

// !!negative numbers are used to represent dotted notes,

// so -4 means a dotted quarter note, that is, a quarter plus an eighteenth!!

int melody[] = {

NOTE_E4,4, NOTE_E4,4, NOTE_F4,4, NOTE_G4,4,//1

NOTE_G4,4, NOTE_F4,4, NOTE_E4,4, NOTE_D4,4,

NOTE_C4,4, NOTE_C4,4, NOTE_D4,4, NOTE_E4,4,
```

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```
NOTE_E4,-4, NOTE_D4,8, NOTE_D4,2,

NOTE_E4,4, NOTE_E4,4, NOTE_F4,4, NOTE_G4,4,//4

NOTE_G4,4, NOTE_F4,4, NOTE_E4,4, NOTE_D4,4,

NOTE_C4,4, NOTE_C4,4, NOTE_D4,4, NOTE_E4,4,

NOTE_D4,-4, NOTE_C4,8, NOTE_C4,2,

NOTE_D4,4, NOTE_D4,4, NOTE_E4,4, NOTE_C4,4,//8

NOTE_D4,4, NOTE_E4,8, NOTE_F4,8, NOTE_E4,4, NOTE_C4,4,

NOTE_D4,4, NOTE_E4,8, NOTE_F4,8, NOTE_E4,4, NOTE_D4,4,

NOTE_C4,4, NOTE_D4,4, NOTE_G3,2,

NOTE_E4,4, NOTE_E4,4, NOTE_F4,4, NOTE_G4,4,//12

NOTE_G4,4, NOTE_F4,4, NOTE_E4,4, NOTE_D4,4,

NOTE_C4,4, NOTE_C4,4, NOTE_D4,4, NOTE_E4,4,

NOTE_D4,-4, NOTE_C4,8, NOTE_C4,2

};

// sizeof gives the number of bytes, each int value is composed of two bytes (16
bits)

// there are two values per note (pitch and duration), so for each note there
are four bytes

int notes=sizeof(melody)/sizeof(melody[0])/2;

// this calculates the duration of a whole note in ms (60s/tempo)4 beats

int wholenote = (60000 4) / tempo;

int divider = 0, noteDuration = 0;

void setup() {

// iterate over the notes of the melody.

// Remember, the array is twice the number of notes (notes + durations)

for (int thisNote = 0; thisNote \< notes 2; thisNote = thisNote + 2) {

// calculates the duration of each note
```

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```
divider = melody[thisNote + 1];

if (divider \> 0) {

// regular note, just proceed

noteDuration = (wholenote) / divider;

} else if (divider \< 0) {

// dotted notes are represented with negative durations!!

noteDuration = (wholenote) / abs(divider);

noteDuration = 1.5; // increases the duration in half for dotted notes

}

// we only play the note for 90% of the duration, leaving 10% as a pause

tone(buzzer, melody[thisNote], noteDuration0.9);

// Wait for the specief duration before playing the next note.

delay(noteDuration);

// stop the waveform generation before the next note.

noTone(buzzer);

}

}

void loop() {

// if you want to repeat the song forever,

// just paste the setup code here instead.

}

////////////////////////////////////////////////////////////////
```

Project Result

After uploading the code to the coding box, you can hear the buzzer playing the song “Ode to Joy” on the coding box.

next project***

4.2.7 Project 7: Small Desktop Lamp

Project Introduction

The button switch is an electronic switch. When we press the button, the switch function is turned on. When the pressure is removed, the switch is turned off. Its internal structure is realized by changing the force of the metal shrapnel.

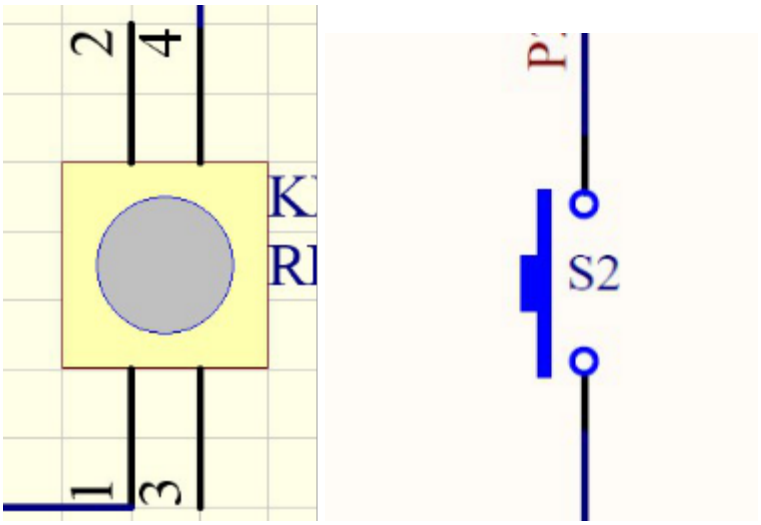
In this project, we use a button switch and an LED to make a small desk lamp project. Press the button to turn on the LED, and press button to turn off the LED.

Working Principle

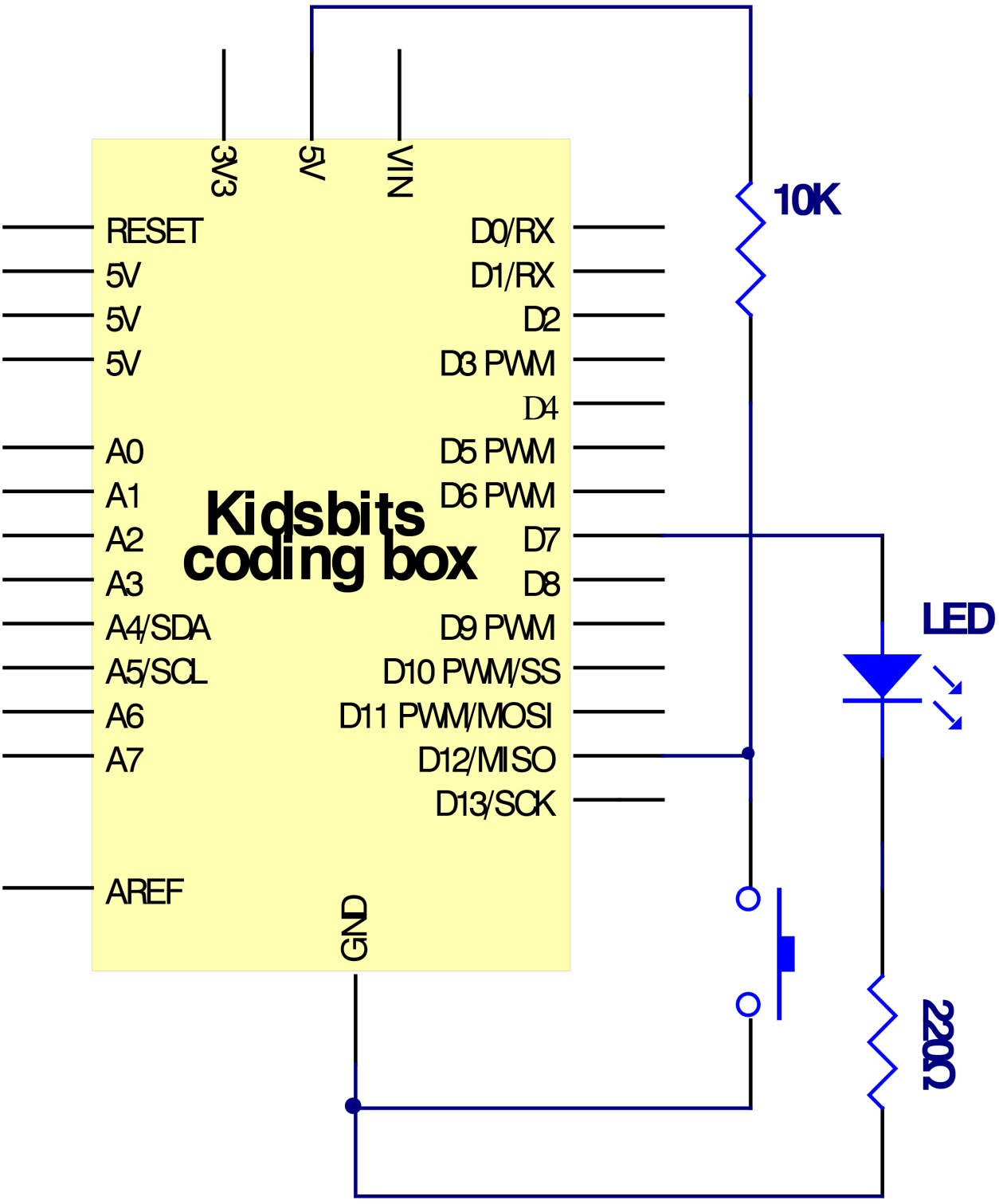
I believe that button switch is common and popular for people. It belongs to switch quantity(digital quantity)component. Composed of normally open contact and normally closed contact,its working principle is similar with ordinary switch.

When the normally open contact bears pressure, the circuit is on state ; however, when this pressure disappears, the normally open contact goes back to initial state, that is, off state. The pressure is the act we switch the button.

Schematic Diagrams:



Circuit Connection



Project Code

```
\*Kidsbits Coding Box

Project 7
```

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```
Small desktop lamp

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*/

volatile int PushCounter;

volatile int State;

volatile int lastState;

int ledpin=7;// initialize pin 7

int inpin=12;// initialize pin 12

void setup()

{

PushCounter = 0;

State = 0;

lastState = 0;

pinMode(ledpin,OUTPUT);// set LED pin as “output”

pinMode(inpin,INPUT);// set button pin as “input”

}

void loop()

{

State = digitalRead(inpin);

if (State != lastState) {

if (State == 1) {

PushCounter = PushCounter + 1;

}

}

delay(100);

lastState = State;
```

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```
if(PushCounter%2==0)

{ digitalWrite(ledpin,HIGH);}

else

{ digitalWrite(ledpin,LOW);}

}

//////////////////////////////////////////////////////////////
```

Project Result

After uploading the code to the coding box, when the button at D12 is pressed once, the light at D7 is on;when the button is pressed again, the light at D7 goes out; the same working situation as the desk lamp.

next project***

4.2.8 Project 8: PIR Motion Alarm

Project Introduction

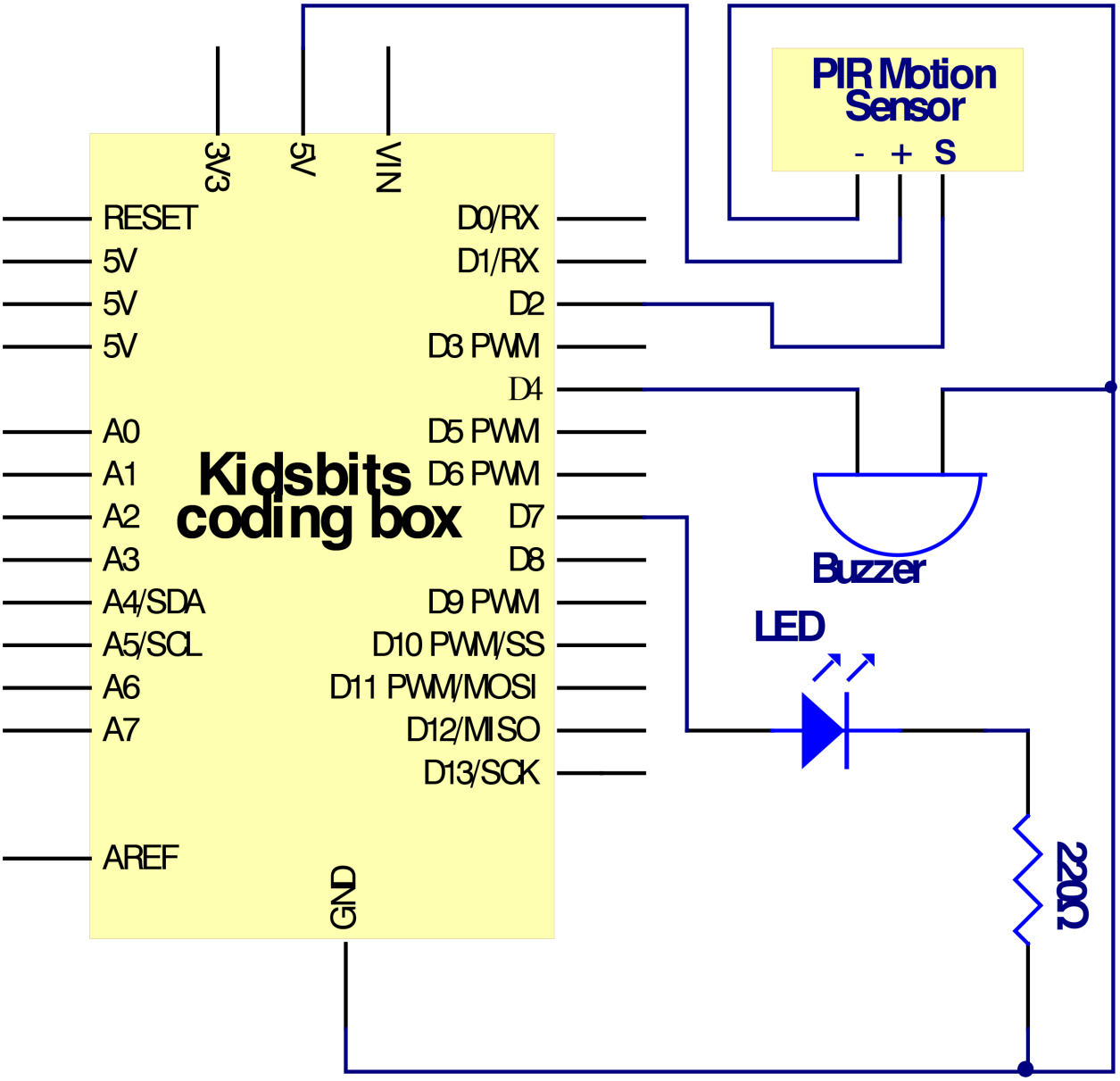
PIR motion sensor can detect infrared signals from a moving person or moving animal, and output switching signals. It can be applied to a variety of occasions to detect the movement of human body.

For example, in the corridor at night, the PIR motion sensor senses someone going upstairs, and the light turns on automatically, which is not only practical but also environmentally friendly.

PIR Motion Sensor Specification

- Input Voltage 3.3 ~ 5V (6V Maximum)
- Working Current 15uA
- Working Temperature -20 ~ 85 ℃
- Output Voltage High 3V, Low 0V
- Output Delay Time (High Level) About 2.3 to 3 Seconds
- Detection Angle 100 °
- Detection Distance 7 meters
- Output Indicator LED (When output HIGH, it will be ON)
- Pin limit Current 100mA

Circuit Connection



Project Code

```
\*Kidsbits Coding Box

Project 8

PIR Motion Alarm

http//www.kidsbits.cc

*/

int Sensor_pin = 2; //define pin D2 of PIR sensor

int Buzzerpin = 4; //Define the pin D4 of the buzzer
```

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```
int ledpin =7; //Define the pin D7 of the LED light

void Alarm() //The buzzer sounds an alarm

{

for(int i=0;i\<100;i++)

{

digitalWrite(Buzzerpin,HIGH); //make a sound

delay(2);

digitalWrite(Buzzerpin,LOW); //No sound

delay(2); //Modify the delay time, change the sound frequency

}

}

void setup()

{

pinMode(Sensor_pin,INPUT); //Define PIR sensor interface as input

pinMode(Buzzerpin,OUTPUT); //Define the buzzer interface as output

pinMode(ledpin,OUTPUT); //Define the LED interface as output

}

void loop()

{

int val=digitalRead(Sensor_pin); //Define the parameter to store the state read
by the PIR sensor

if(val == 1) //If someone is detected (within the detection range)

{

Alarm();//The buzzer sounds an alarm

digitalWrite(ledpin, HIGH); // LED flashes

delay(10);
```

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```
  digitalWrite(ledpin, LOW);

  delay(10);

  }

  else//If no person is detected

  {

  return;

  }

  delay(100); //delay 100 milliseconds

  }
////////////////////////////////////////////////////////////
```

Project Result

Uploading the code to the coding box, when the human infrared sensor detects people moving nearby,the LED starts flashing, the buzzer sounds. If no one is detected nearby, the LED is off and the buzzer does not sound.

next project***

4.2.9 Project 9: Reed switch

Project Introduction

Reed switch is basically an electrical switch which is operated when a magnetic field is brought near to it. It is made up of two small metal pieces kept inside a glass tube under vacuum. In a typical reed switch, two metal pieces will be made of a ferromagnetic material and covered with rhodium or ruthenium to give them long life. The switch will be activated when there is a presence of magnetic field around the switch.

Reed switch is used in many of the real-life applications such as magnetic door switch, laptops, smart phones etc.

Sensor Specification

There are two types of reed switch.

Normally open reed switch

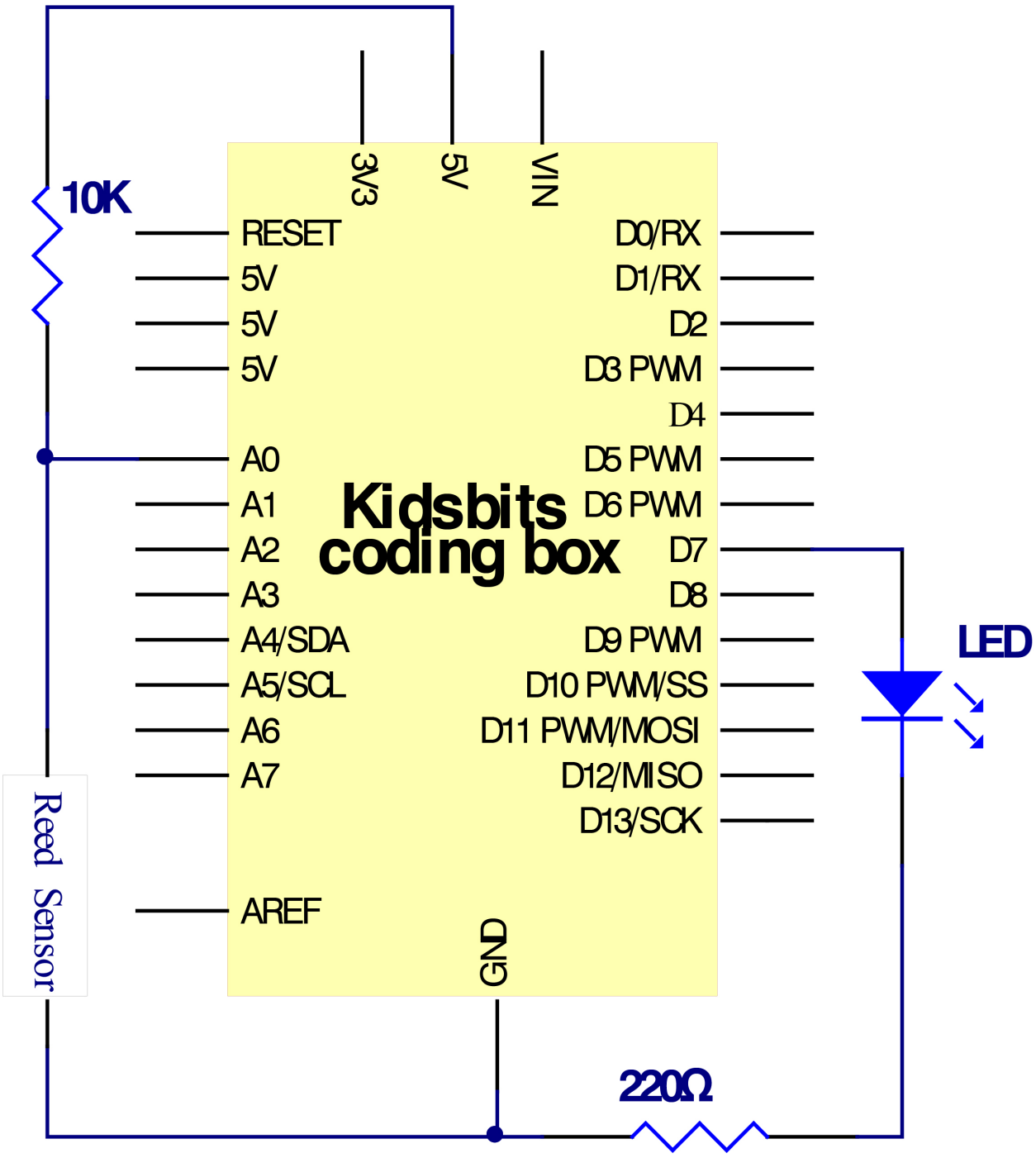
Normally closed reed switch

In normally open reed switch, switch is open in the absence of magnetic field and it is closed in the presence of magnetic field. Under the presence of magnetic field, two metal contacts inside the glass tube attract each other to make contact.

In normally closed reed switch, switch is closed in the absence of magnetic field and it is open in the presence of magnetic field.

The glass enclosure of the two metal pieces protect them from dirt, dust and other particles. Reed switch can be operated in any environment such as environment where flammable gas is present or environment where corrosion would affect open switch contacts.

Circuit Connection



Project Code

```
\*Kidsbits Coding Box

Project 9

Reed switch

http//www.kidsbits.cc
```

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```
*/

int LED = 7;

int reed_switch = A0;

int reed_status;

void setup()

{

pinMode(LED, OUTPUT);

pinMode(reed_switch, INPUT);

}

void loop()

{

reed_status = digitalRead(reed_switch);

if (reed_status == 1)

digitalWrite(LED, LOW);

else

digitalWrite(LED, HIGH);

}

//////////////////////////////////////////////////////
```

Project Result

After uploading the code to the coding box, when the magnetic reed detects nearby magnetic force, the LED lights up. If no magnetic force is detected, the LED is off.

next project***

4.2.10 Project 10: DC motor

Project Introduction

With this coding box, we can make our own adjustable fan.Usually a simple electric fan is made up of blade, motor and switch. You can see a motor fan module on the Kidsbits Coding Box. The motor is actually the electric motor. If there is electricity, the fan blade will rotate. The motor with the fan blade is also called a fan module. Inputting HIGH or LOW level to two pins of fan module, we can make fan rotate.

Connection Diagram

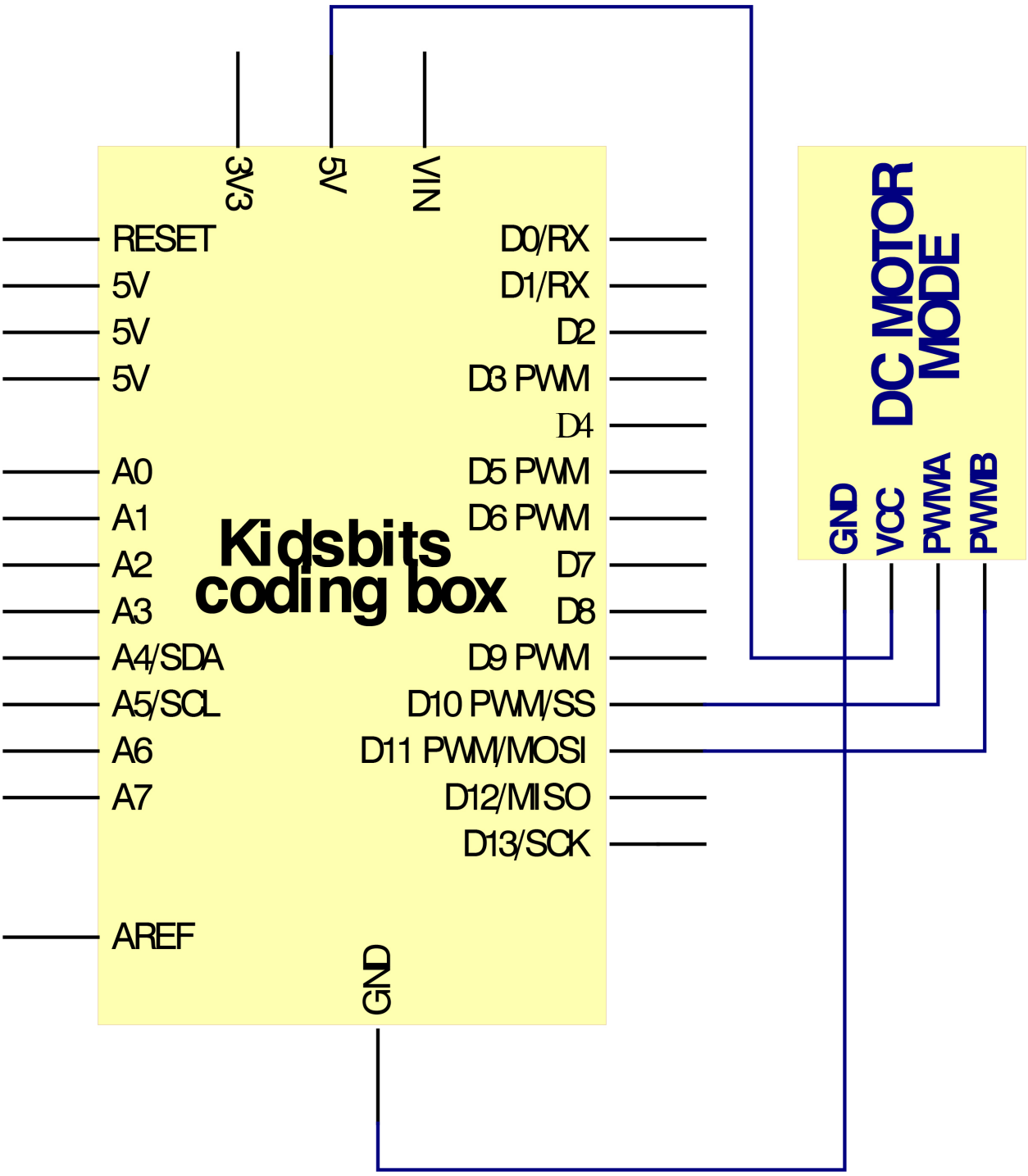
So set to D10, LOW; D11 to HIGH. Upload the code and motor fan will turn clockwise.

If we set the D10 to HIGH, D11 to LOW, the fan will turn anticlockwise.

If we set to D10 and D11 to LOW, the fan won't turn.

Now, we've known how to control fan. But how about making fan rotate slowly? Here we can use PWM pins.

PWM pins can steadily output the HIGH and LOW level, and can continuously change HIGH or LOW in a regular time period. The D10 and 11 of motor fan are PWM pins. We can adjust the motor's speed via PWM pins.



Project Code

```
\*Kidsbits Coding Box

Project 10

small fan
```

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```
http//www.kidsbits.cc

*/

// the setup function runs once when you press reset or power the board

void setup() {

// initialize digital pin 10 11 as output.

pinMode(10, OUTPUT);

pinMode(11, OUTPUT);

digitalWrite(10, LOW);

digitalWrite(11, LOW);

}

// the loop function runs over and over again forever

void loop() {

analogWrite(10, 150);

digitalWrite(11, LOW);

delay(1000);

digitalWrite(10, LOW);

digitalWrite(11, LOW);

delay(3000);

digitalWrite(10, LOW);

analogWrite(11, 150);

delay(1000);

digitalWrite(10, LOW);

digitalWrite(11, LOW);

delay(3000);

}

//////////////////////////////////////////////////////
```

Project Result

After uploading the code to the coding box, the motor on the coding box rotates clockwise for 1 second, with a delay of 3 seconds.Then turn counterclockwise for 1 second, delay 3 seconds, and loop.

next project***

4.2.11 Project 11: Servo

Project Introduction

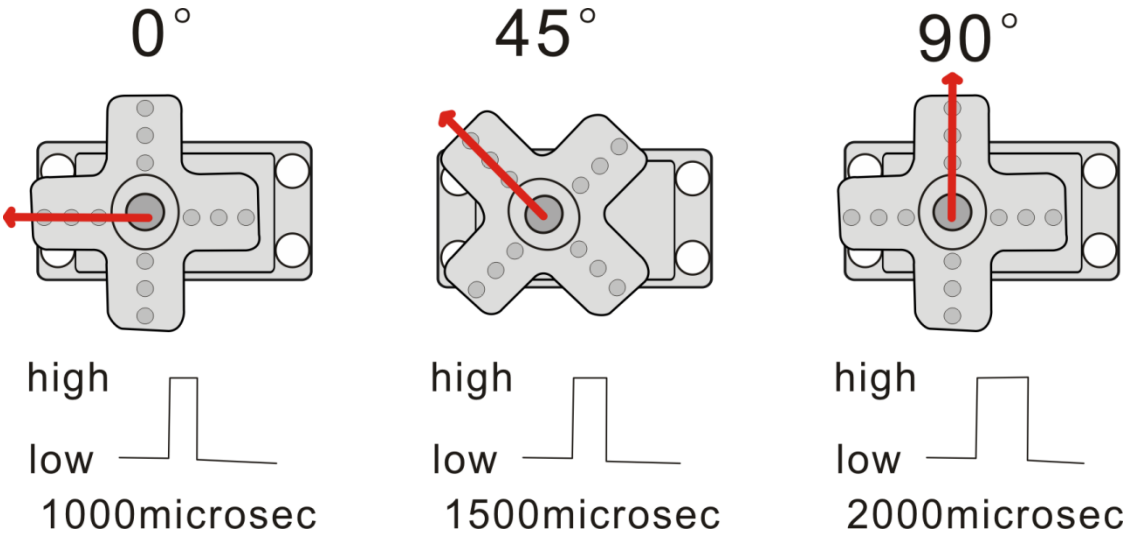
Servo is a position (angle) servo drive, which is suitable for those control systems that require constant angle changes and can be maintained. It has been widely used in remote control toys, airplane models, submarine models, and remote control robots.

In this project, we use the servo rotation angle change to DIY a car speed dial. You can intuitively understand the servo's movement trajectory.

Working Principle

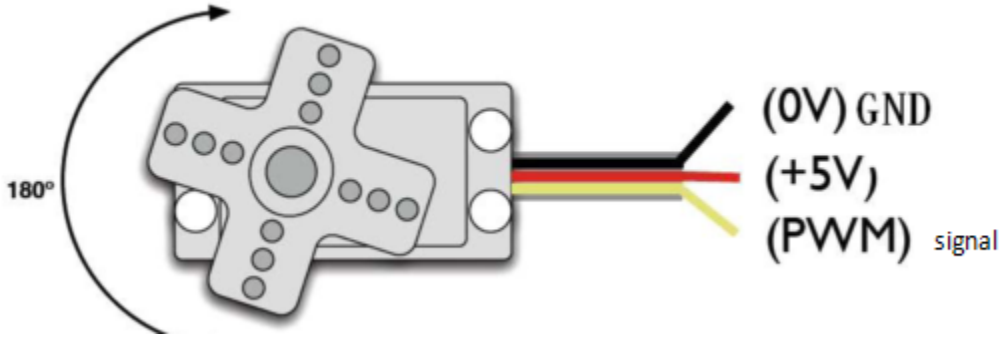
Servo is composed of rudder disc, position feedback potentiometer, reduction gear set, DC motor and control circuit. The reduction gear set is driven by a DC motor, and its output shaft drives a position feedback potentiometer with linear proportional characteristics as position detection. According to the feedback voltage of the potentiometer, the control circuit compares with the external input control pulse, generates a correction pulse, controls and drives the DC motor to rotate forward or reverse, so that the output position of the reduction gear is combined with the desired value. So as to achieve the purpose of accurately controlling the steering angle.

Servo's control pulse cycle is 20ms, and the pulse width ranges from 0.5ms to 2.5ms, corresponding to positions from -90 degrees to +90 degrees, taking a 180 degree angle servo as an example

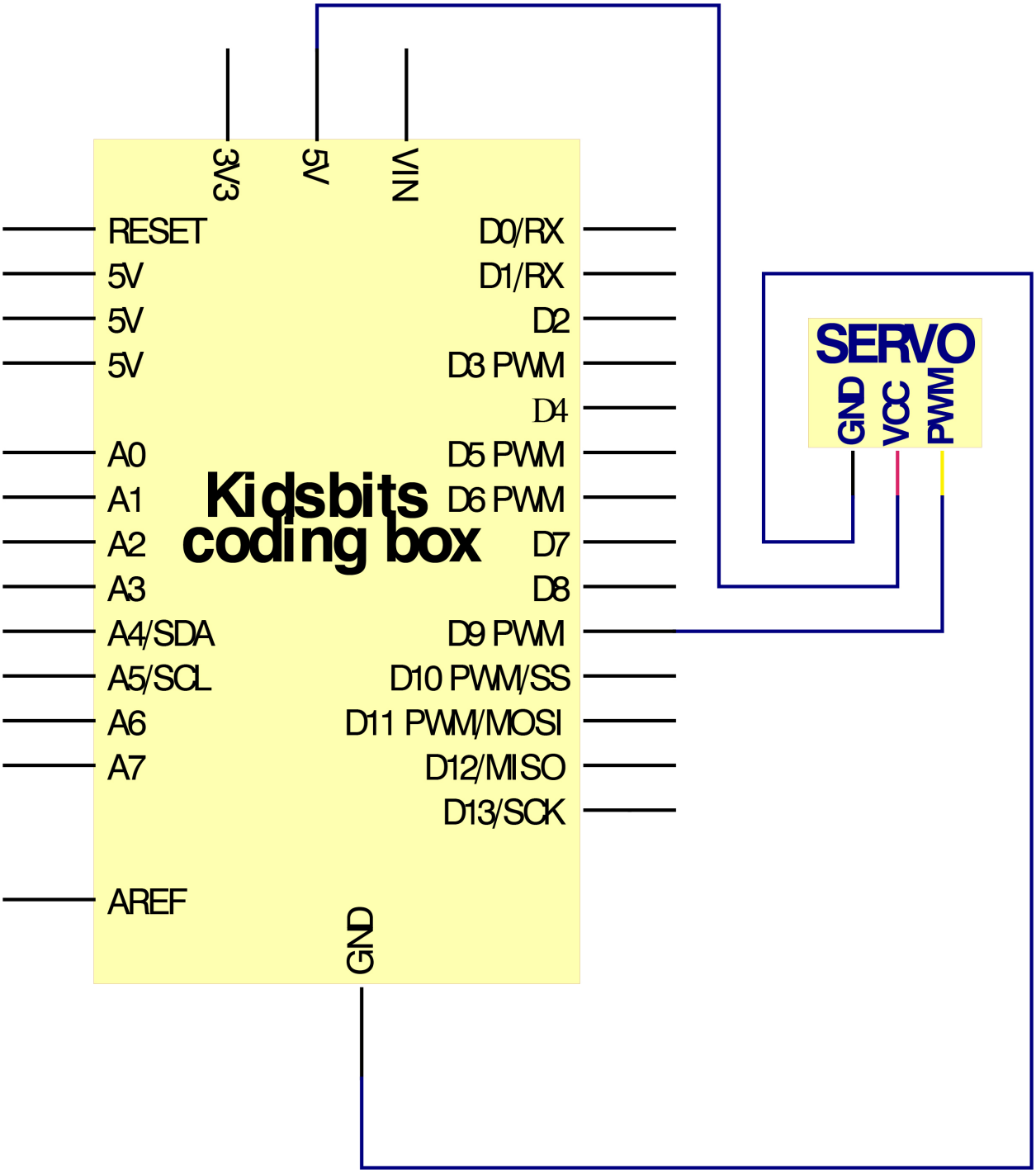


Servo motor comes with many specifications. But all of them have three connection wires, distinguished by brown, red, orange (different brand may have different color).

Brown one is for GND, red one for power positive, orange one for signal line.



Connection Diagram



Project Code

```
\*Kidsbits Coding Box

Project 11

Servo
```

(continues on next page)

(continued from previous page)

```
http//www.kidsbits.cc

*/

\#include \<Servo.h\>

Servo myservo;// define servo variable name

void setup()

{

myservo.attach(9);// select servo pin(9 or 10)

}

void loop()

{

myservo.write(0);// set rotate angle of the motor

delay(500);

myservo.write(45);// set rotate angle of the motor

delay(500);

myservo.write(90);// set rotate angle of the motor

delay(500);

myservo.write(135);// set rotate angle of the motor

delay(500);

myservo.write(180);// set rotate angle of the motor

delay(500);

}////////////////////////////////////////////////////
```

Above are the two methods to control the servo. You can choose either one according to your liking or actual need.

Project Result

After uploading the code to the coding box, the servo rotates, the angle starts from 0°, increases by 45° every 0.5 seconds, and when it reaches 180°, it turns to the 0° position.

next project***

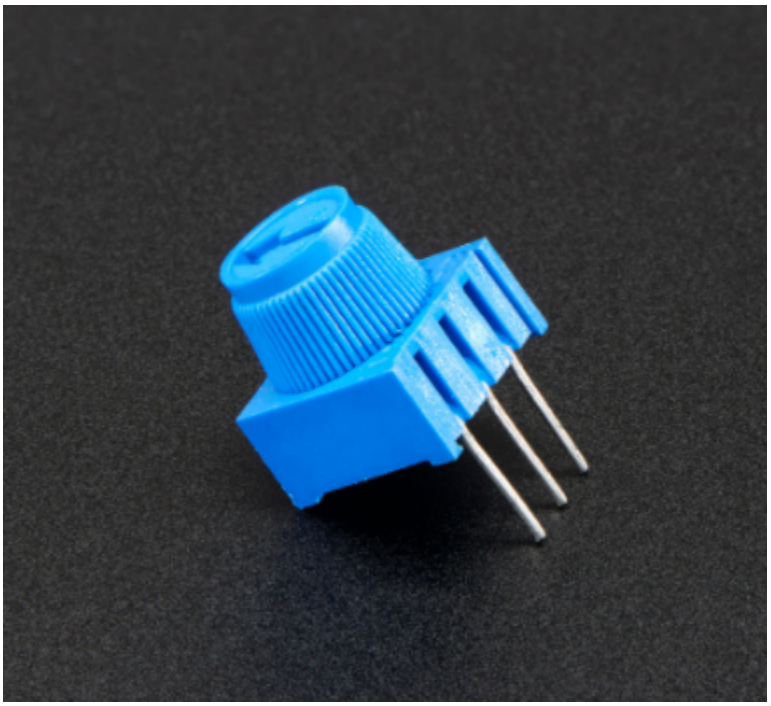
4.2.12 Project 12: Potentiometer

Project Introduction

The potentiometer is an electronic component that we are very familiar with. It is an analog component. The switch for adjusting the volume on the electrical appliance and the button for adjusting the wind on the fan are all applications of the potentiometer.

In this project, we are going to learn how to use Arduino to read the value of the potentiometer, and then cooperate with the LED light to make a Dimming table lamp.

Features



Adjustable potentiometer is just a kind of resistor. The resistance is changed by rotating the potentiometer, so is the voltage, speed, brightness and temperature. It is an analog electronic component, which has two states of 0 and 1(high level and low level). The analog quantity is different. Its data state presents a linear state such as 1 to 1000.

Read Values

We connect the adjustable potentiometer to the analog pin of Arduino to read its value. Please refer to the following wiring diagram for wiring.

```
\*Kidsbits Coding Box

Project 12.1

Read Potentiometer value

http//www.kidsbits.cc

*/

int potpin=A7;// initialize analog pin A7
```

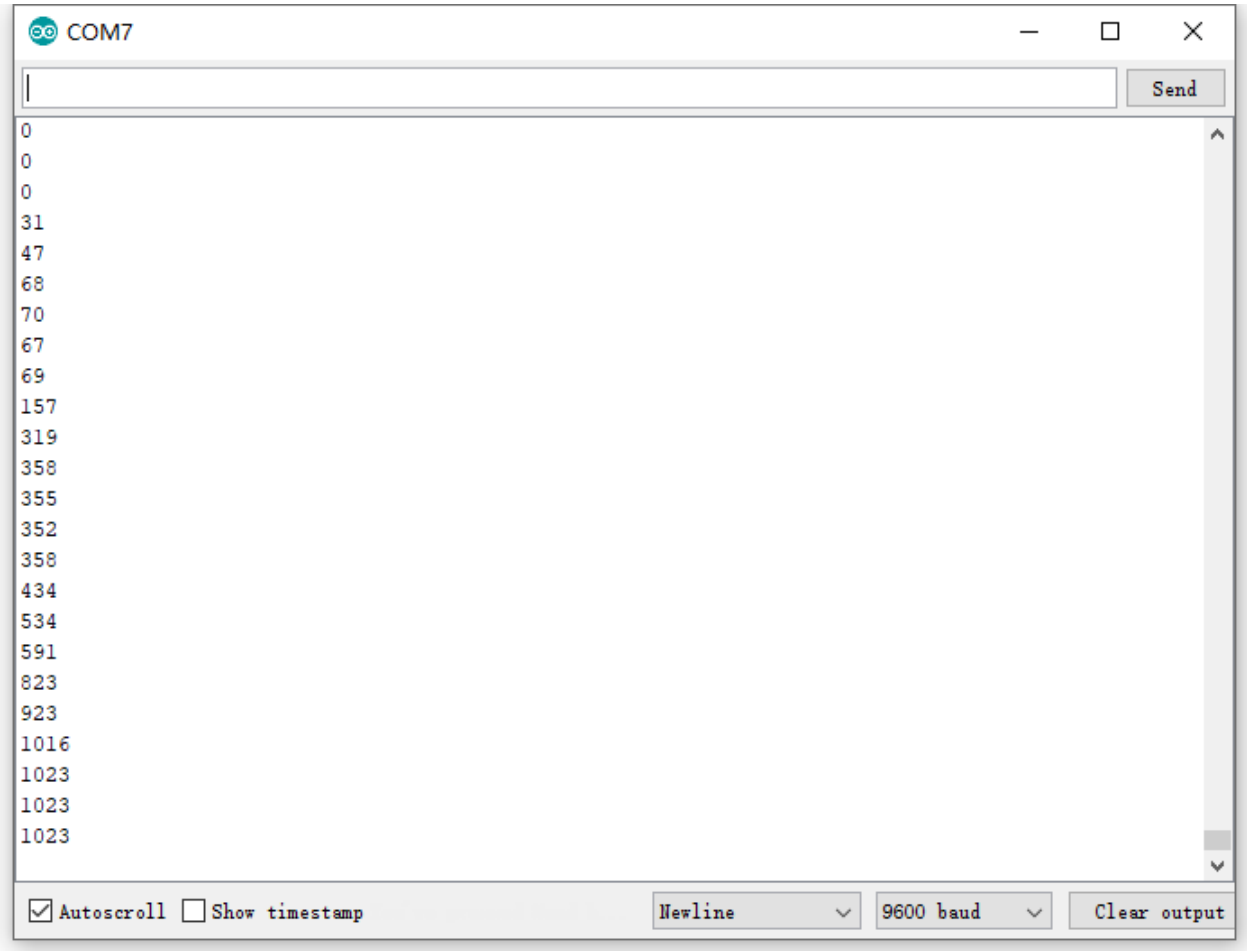
(continues on next page)

(continued from previous page)

```
int val=0;// define val, assign initial value 0

void setup()

{

Serial.begin(9600);// set baud rate at 9600

}

void loop()

{

val=analogRead(potpin);// read the analog value of analog pin 0, and assign it
to val

Serial.println(val);// display val's value

}

///////////////////////////////////////////////////////////////
```

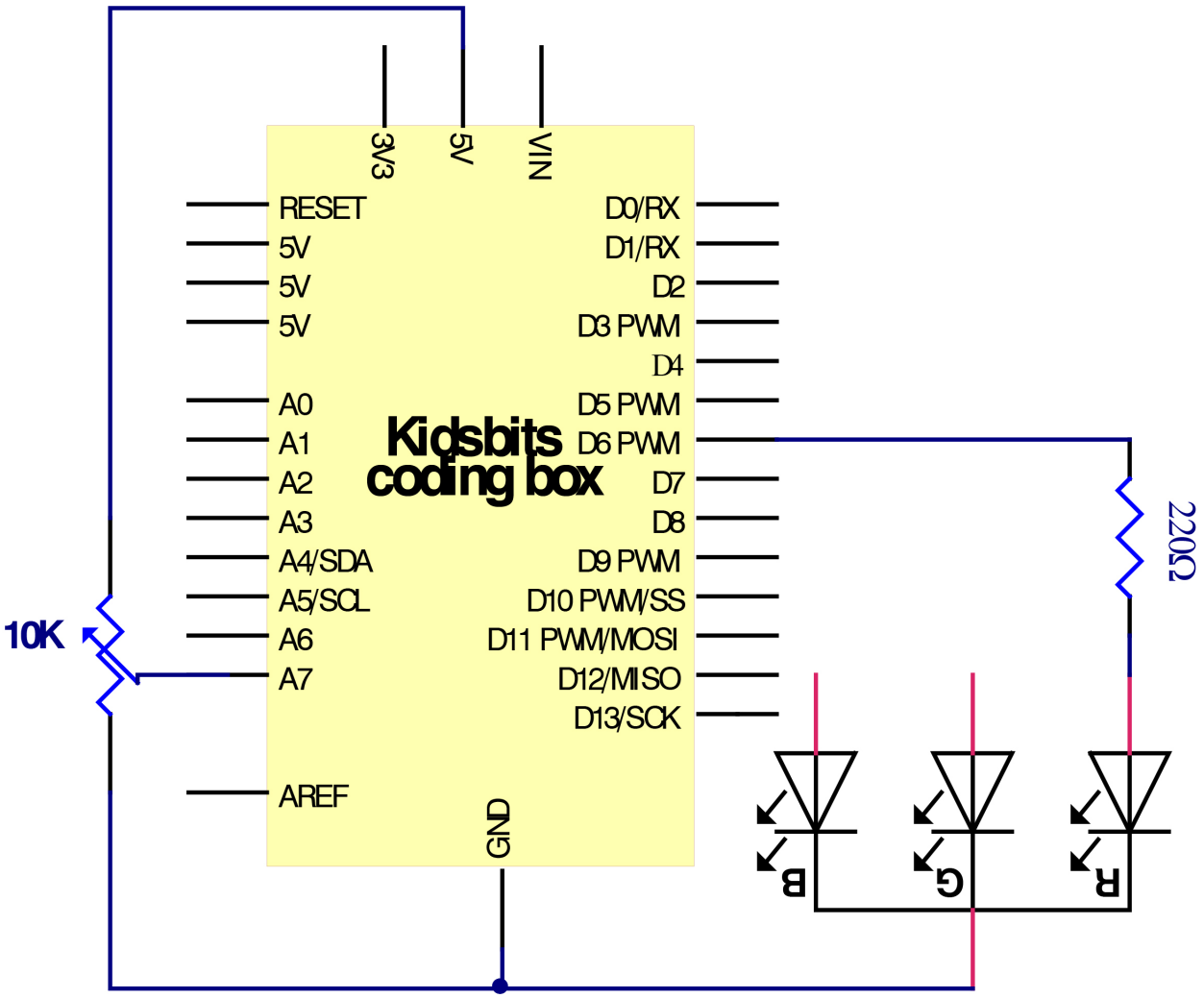
When you rotate the potentiometer knob, you can see the displayed value change. The reading of analog value is a very common function since most sensors output analog value. After calculation, you can get the corresponding value you need.

Below figure shows the analog value it reads.



Circuit Connection

In the last step, we read the value of the potentiometer, and now we need to convert the value of the potentiometer into the brightness of the LED to make a small desk lamp with adjustable brightness. See the wiring diagram.



Project Code

```
\*Kidsbits Coding Box

Project 12.2

Dimming table lamp

http//www.kidsbits.cc

*/

int potpin=A7;// initialize analog pin 7

int ledpin=6;//initialize digital pin 6PWM output

int val=0;// Temporarily store variables' value from the sensor

void setup()
```

(continues on next page)

(continued from previous page)

```
{

pinMode(ledpin,OUTPUT);// define digital pin 6 as “output”

Serial.begin(9600);// set baud rate at 9600

// attention: for analog ports, they are automatically set up as “input”

}

void loop()

{

val=analogRead(potpin);// read the analog value from the sensor and assign it to
val

Serial.println(val);// display value of val

analogWrite(ledpin,val/4);// turn on LED and set up brightnessmaximum output
of PWM is 255

delay(10);// wait for 0.01 second

}

//////////////////////////////////////////////////////
```

Project Result

After uploading the code to the coding box, you can control the brightness of the red LED in the RGB through the potentiometer.

next project***

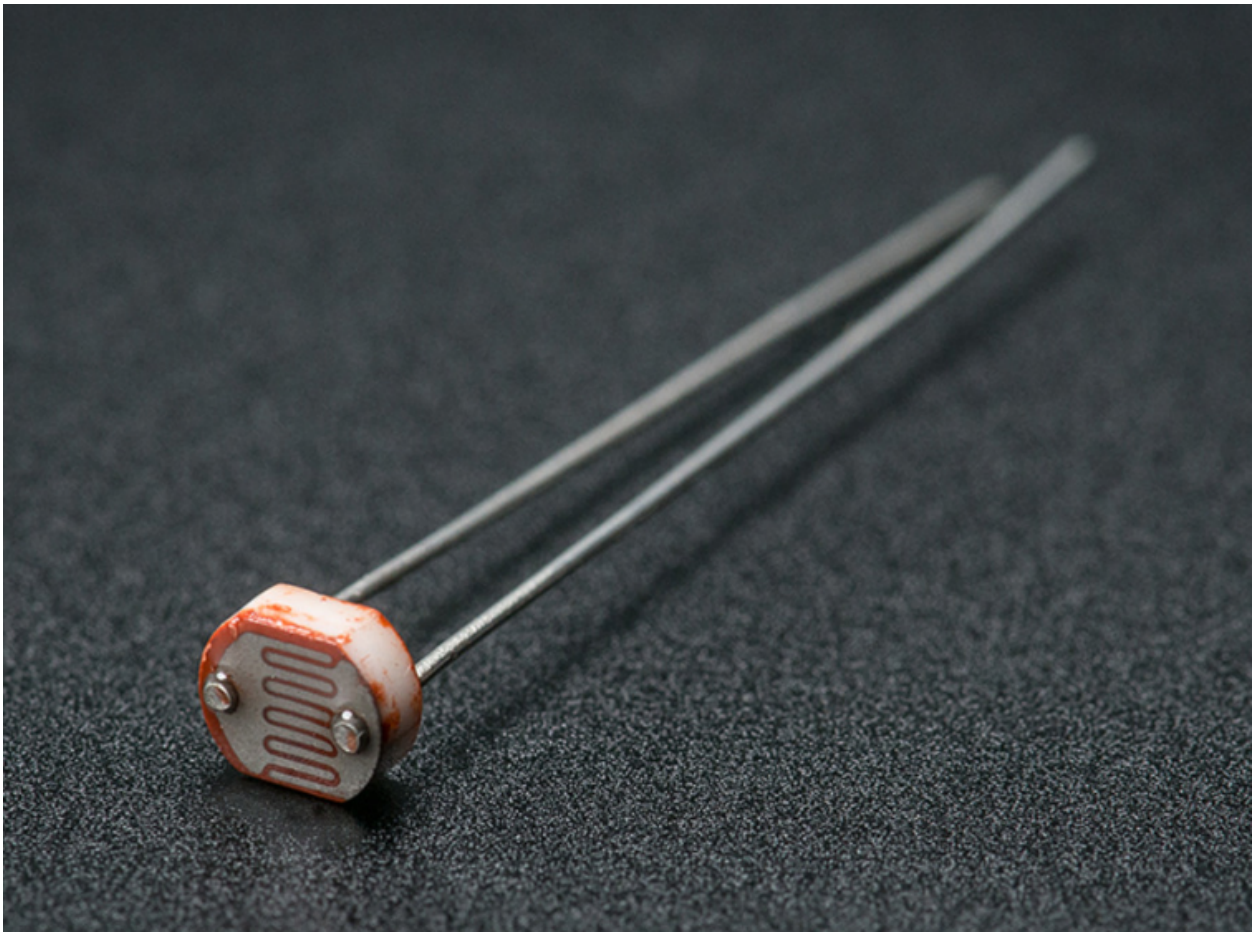
4.2.13 Project 13: Light

Project Introduction

Photocell is a resistor whose resistance varies from different incident light strength. It's based on the photoelectric effect of semiconductor. If the incident light is intense, its resistance reduces; if the incident light is weak, the resistance increases.

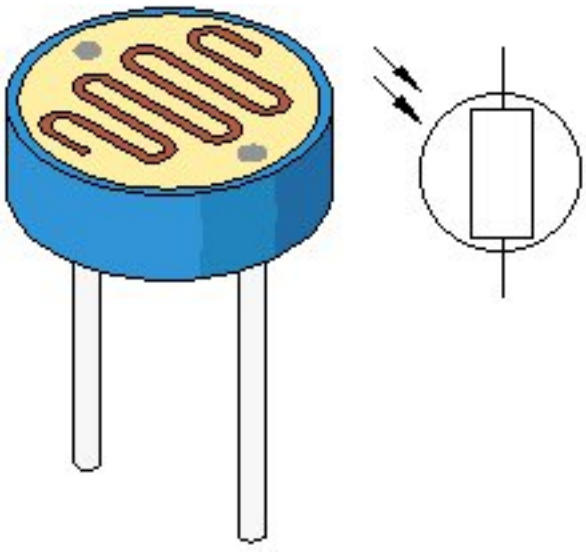
We use the characteristics of Photocell to make a light-controlled table lamp. When the light is dimmed, the light turns on.

Photocell Little Knowledge



Photocell is commonly applied in the measurement of light, light control and photovoltaic conversion (convert the change of light into the change of electricity).

Photocell is also being widely applied to various light control circuits, such as light control and adjustment, optical switches, etc.



We will start with a relatively simple experiment regarding to photovaristor application.

Photocell is an element that can change its resistance as light strength changes. So need to read the analog value. You can refer to the PWM experiment, replacing the potentiometer with photocell`. When there is change in light strength, it will make corresponding change on the LED.

Read Photocell value

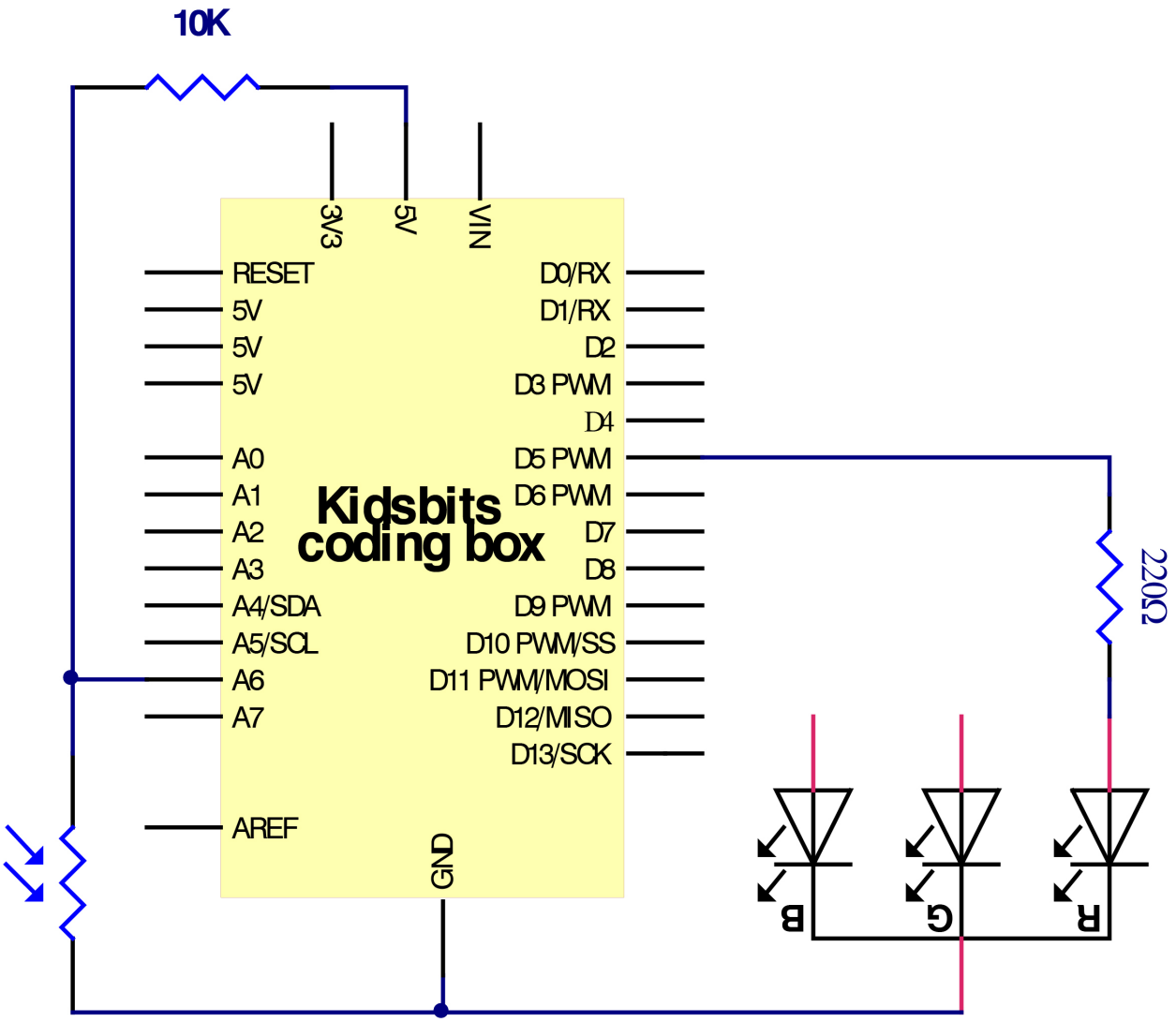
We first use a simple code to read the value of the photocell, print it in the serial monitor, and wire it as shown below.

```
\*Kidsbits Coding Box

Project 13.1

Read Photocell value

http//www.kidsbits.cc

*/

int photocellpin=A6;// initialize analog pin 6, connected with photocell

int val=0;// initialize variable va

void setup()

{

Serial.begin(9600);// set baud rate at “9600”

}

void loop()

{

val=analogRead(photocellpin);// read the value of the sensor and assign it to
val

Serial.println(val);// display the value of val

delay(1000);// wait for 1 s

}

//////////////////////////////////////////////////////////////
```

Upload the code to the PLUS development board, open the serial monitor, and then you can read the current photocell value.We put our hands on the photocell, and the value became larger.

Circuit Connection

We made a small dimming table lamp before, and now we want to make a light-controlled small table lamp. The basic principles of the two are the same. Both are obtained by obtaining the analog value of the sensor and then adjusting the brightness of the LED.



Project Code

```
\*Kidsbits Coding Box

Project 13.2

Light control LED

http//www.kidsbits.cc

*/

int potpin=6;// initialize analog pin 6, connected with photocell

int ledpin=5;// initialize digital pin 5,

int val=0;// initialize variable va

void setup()
```

(continues on next page)

(continued from previous page)

```
{

pinMode(ledpin,OUTPUT);// set digital pin 11 as “output”

Serial.begin(9600);// set baud rate at “9600”

}

void loop()

{

val=analogRead(potpin);// read the value of the sensor and assign it to val

Serial.println(val);// display the value of val

analogWrite(ledpin,val/4);// set up brightnessmaximum value 255

delay(10);// wait for 0.01s

}

//////////////////////////////////////////////////////////////
```

Project Result

After uploading the code to the coding box, the photoresistor can detect the intensity of the light. The brighter the light, the brighter the red LED in RGB.

next project***

4.2.14 Project 14: Sound

Project Introduction

The sound sensor is a common sensor. It has a built-in capacitive electret microphone and power amplifier. It can be used to detect the sound intensity of the environment.

In this project, we use a sound sensor and a DC motor to make a voice-activated smart fan. When we make a sound, the fan starts.

Sound Sensor

Sound sensor is typically used in detecting the loudness in ambient environment. The Arduino can collect its output signal by analog input interface.

The S pin is analog output, that is voltage signal real-time output of microphone. The sensor comes with a potentiometer, so that you can turn it to adjust the signal gain.

It also has a fixed hole so that you can mount the sensor on any other devices. You can use it to make some interactive work, such as a voice operated switch.

Read Sound Sensor Value

We first use a simple code to read the value of the sound sensor, print it in the serial monitor, and wire it as shown below.

```
\*Kidsbits Coding Box

Project 14.1

Read Sound Sensor value

http//www.kidsbits.cc
```

(continues on next page)

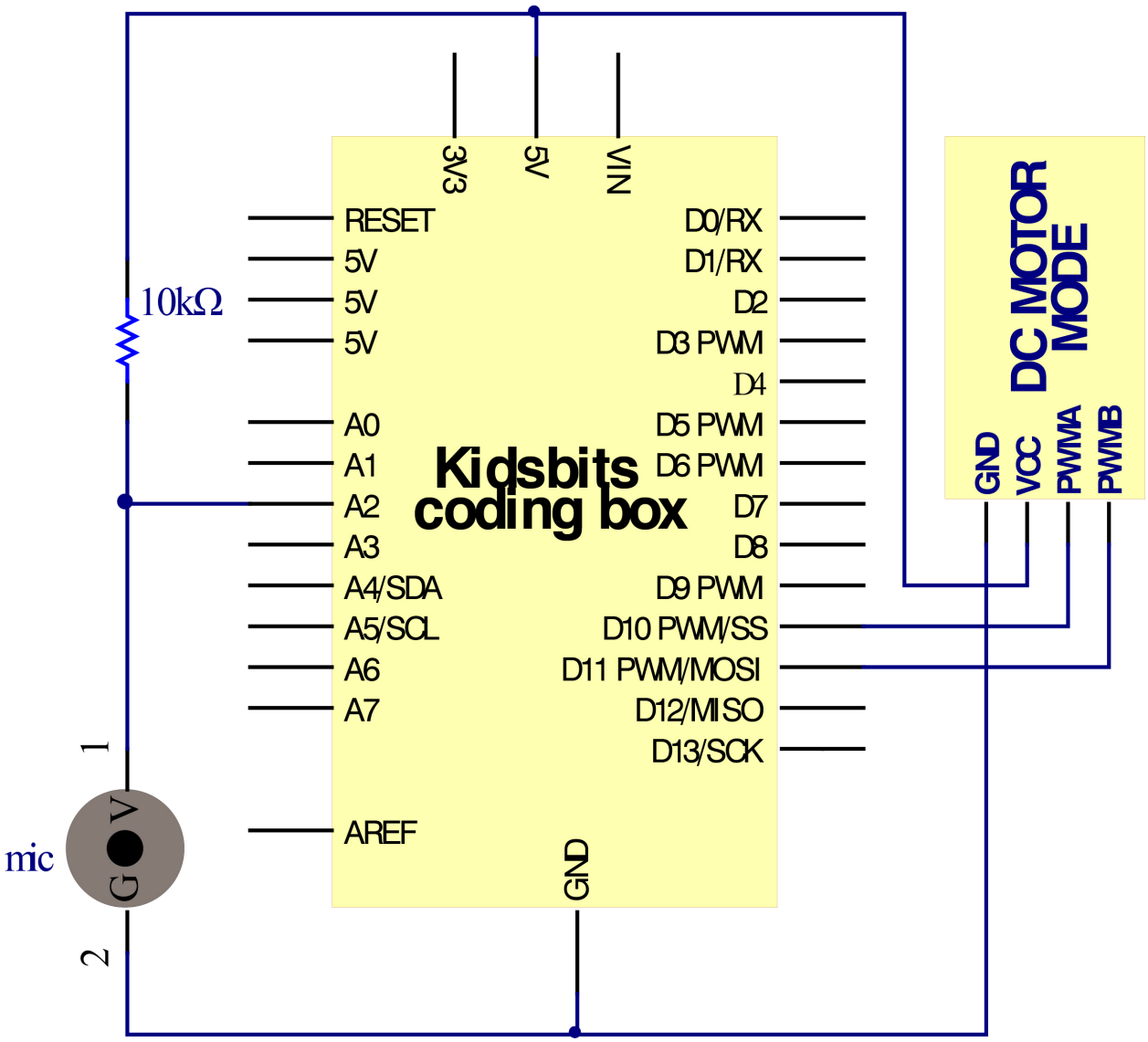
(continued from previous page)

```
*/

int soundpin=A2;// initialize analog pin 2, connected with sound sensor

int val=0;// initialize variable va

void setup()

{

Serial.begin(9600);// set baud rate at “9600”

}

void loop()

{

val=analogRead(soundpin);// read the value of the sensor and assign it to val

Serial.println(val);// display the value of val

delay(1000);// wait for 1 s

}

//////////////////////////////////////////////////////////////
```

Upload the code to the PLUS development board, open the serial monitor, blow or clap your hands at the sensor, you can see the sensor's value changes significantly.

Connection Diagram

Next, we formally enter this project. We use a sound sensor and a small motor to make a sound-activated fan. Connect to the circuit diagram below.



Project Code

```
\*Kidsbits Coding Box

Project 14.2

Voice-activated smart fan

http//www.kidsbits.cc

*/

void setup() {

Serial.begin(9600);

// initialize digital pin 10 11 as output.
```

(continues on next page)

(continued from previous page)

```
pinMode(10, OUTPUT);

pinMode(11, OUTPUT);

digitalWrite(10, LOW);

digitalWrite(11, LOW);

}

void loop() {

int Soundvalue = analogRead(A2); // read the input analog value

Serial.println(Soundvalue);

if(Soundvalue\>650)

{

analogWrite(10, 150);

digitalWrite(11, LOW);

delay(1000);

}

else{

digitalWrite(10, LOW);

digitalWrite(11, LOW);

}

}

//////////////////////////////////////////////////////
```

Project Result

After uploading the code to the coding box. success, the microphone sensor can detect the sound. When the value of the sound is greater than 650, the motor fan starts to rotate. If it does not reach 650, the motor fan does not rotate.

next project***

4.2.15 Project 15: Gas Sensor

Project Introduction

MQ-2 Gas Sensor module is useful for gas leakage detecting in homes and industries. It can detect LPG, i-butane, propane, methane, alcohol, hydrogen and smoke.

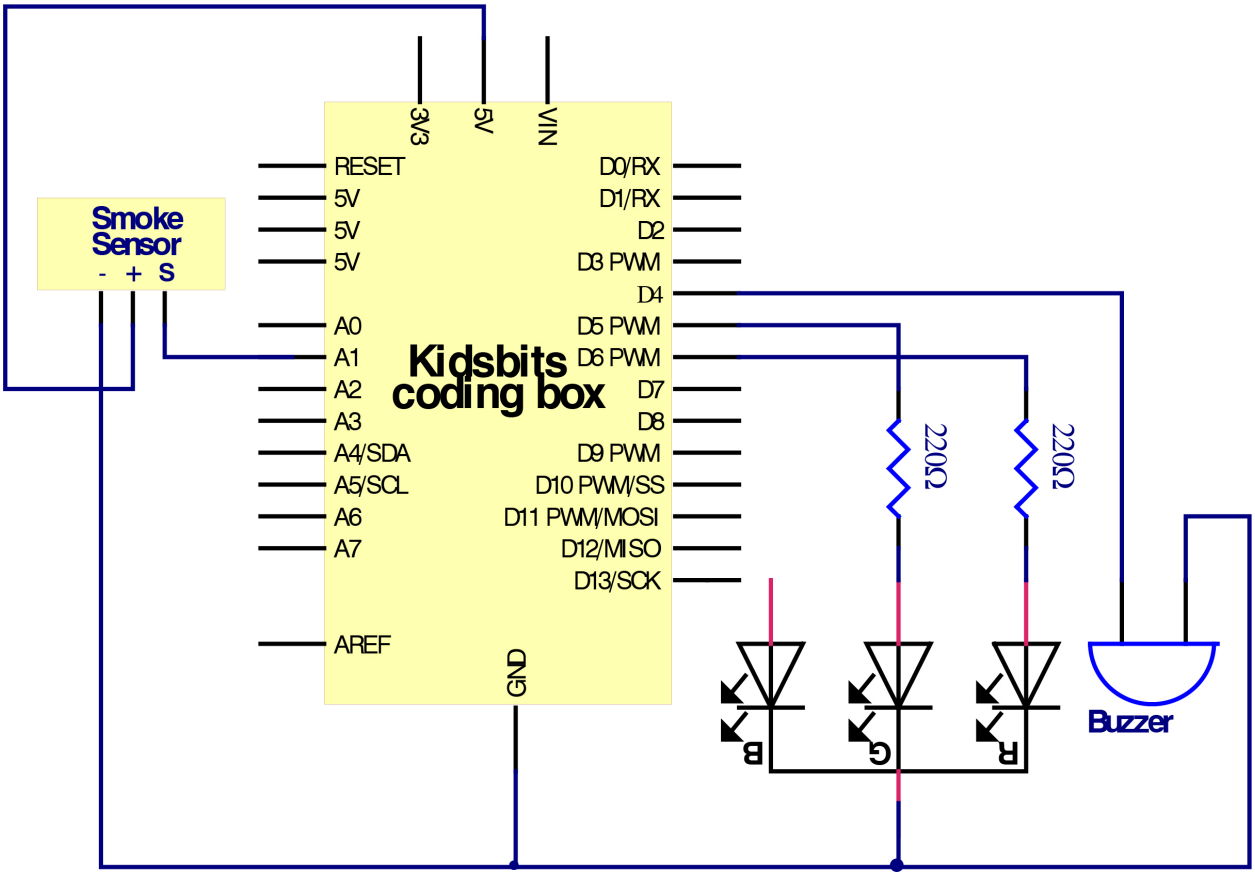
Sensor Specification

Whenever the concentration of gas increases the resistance will decrease (but the current flow will get increased). It leads to change in voltage and it is read at Analog out pin which tells how much gas is concentrated in normal Air. This varied analog voltage is used to calculate the PPM of Gas.

Similarly, the Module has a Digital output (connected with an Op-Amp) along with a Potentiometer. The Threshold/Sensitivity can be adjusted using the Potentiometer. Because to calibrate the sensor to an Idle condition. Once it reaches the threshold, it will produce the output signal at D0 Pin.

Note: All MQ Sensor takes some time to work properly because of the Heater needs to be heated for a while.

Circuit Connection



Project Code

```
\*Kidsbits Coding Box

Project 15

Gas Sensor

http//www.kidsbits.cc

*/

int redLed = 6;

int greenLed = 5;

int buzzer = 4;

int smokeA0 = A1;

// Enter Your threshold value

int sensorThres = 400;

void setup() {
```

(continues on next page)

(continued from previous page)

```
pinMode(redLed, OUTPUT);

pinMode(greenLed, OUTPUT);

pinMode(buzzer, OUTPUT);

pinMode(smokeA0, INPUT);

Serial.begin(9600);

}

void loop() {

int analogSensor = analogRead(smokeA0);

Serial.print("Sensor Value from A0: ");

Serial.println(analogSensor);

// Checks if it has reached the threshold value

if (analogSensor \> sensorThres)

{

digitalWrite(redLed, HIGH);

digitalWrite(greenLed, LOW);

tone(buzzer, 1000, 200);

}

else

{

digitalWrite(redLed, LOW);

digitalWrite(greenLed, HIGH);

noTone(buzzer);

}

delay(100);

}
```

Project Result

After uploading the code to the coding box, the gas sensor can detect combustible gas. After detecting combustible gas, the buzzer will issue an alarm and the light on RGB will be red. If no combustible gas is detected, the buzzer will not make a sound, and the light on it lights up green.

next project***

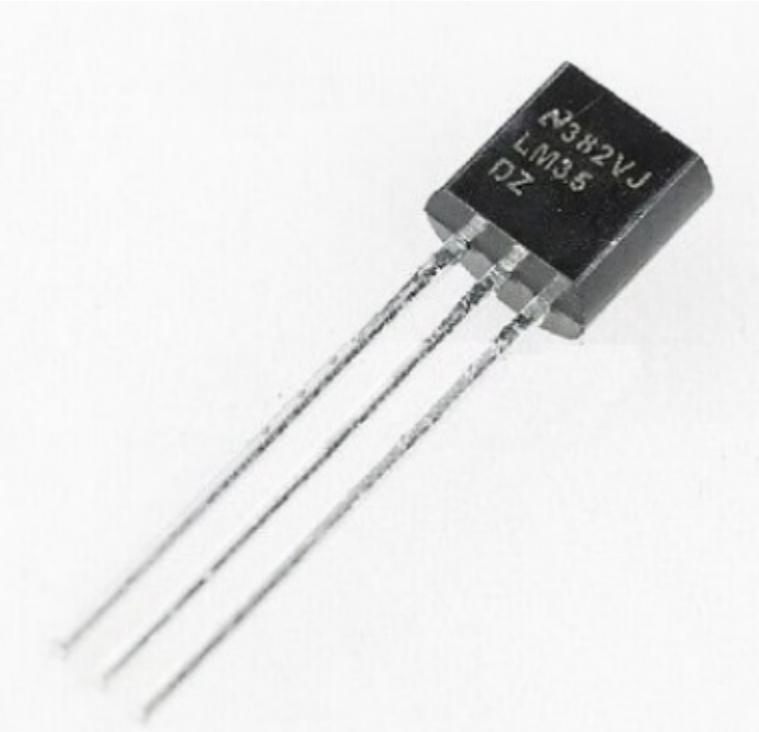
4.2.16 Project 16: Temperature Tester

Project Introduction

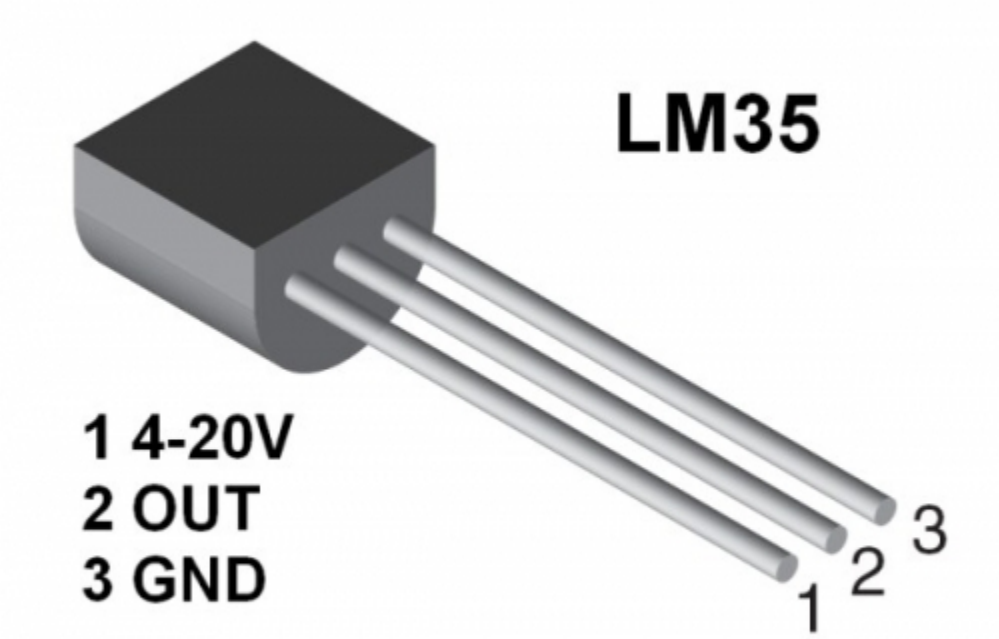
LM35 is a common and easy-to-use temperature sensor. It does not require other hardware. You just need an analog port to make it work. The difficulty lies in compiling the code to convert the analog value it reads into Celsius temperature.

In this project, we use a temperature sensor and 3 LED lights to DIY a temperature tester. When the temperature sensor touches different temperature objects, the LED lights will show different colors.

Working Principle



LM35 is a widely used temperature sensor with many different package types. At room temperature, it can achieve the accuracy of $\pm$1/4°C without additional calibration processing.



LM35 temperature sensor can produce different voltage by different temperature

When temperature is 0 ℃, it outputs 0V; if increasing 1 ℃, the output voltage will increase 10 mv.

The output temperature is 0℃100℃, the conversion formula is as follows:

$$V_{\text{out\_LM35}}(T) = 10\,\text{mV}/^{\circ}\text{C} \times T^{\circ}\text{C}$$

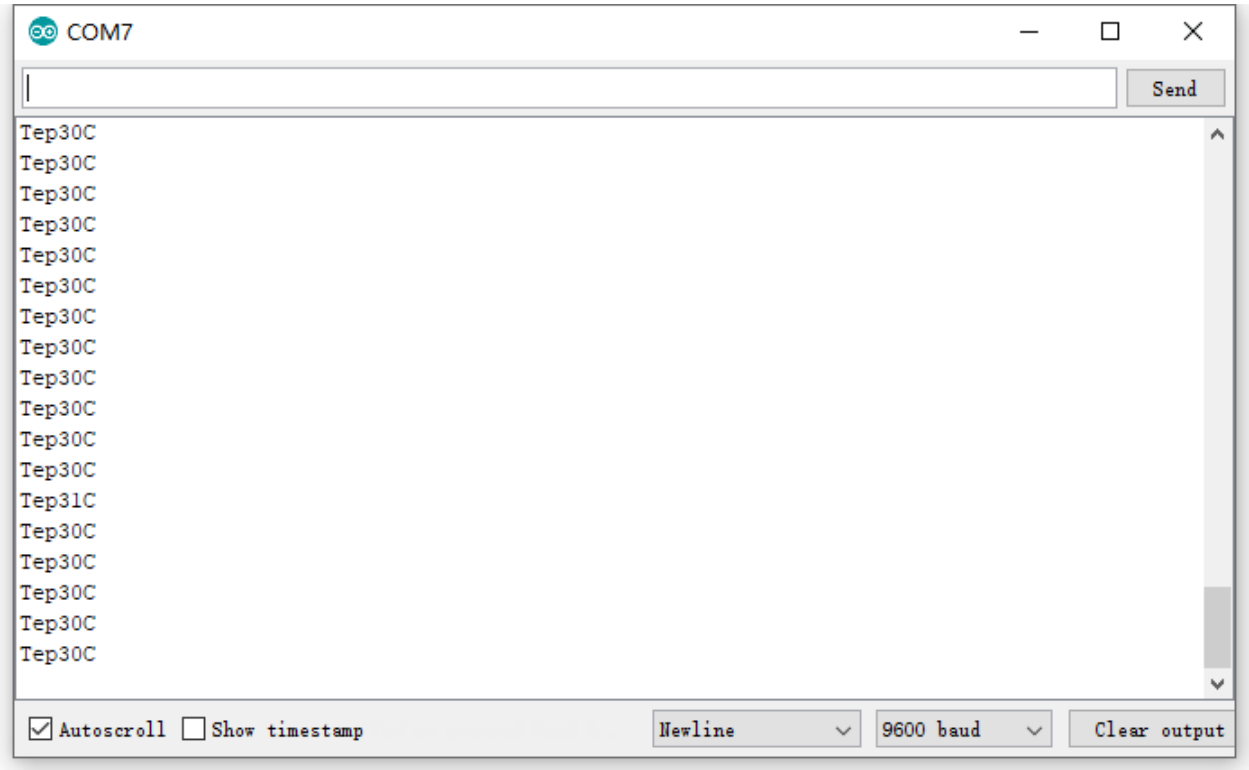
Read temperature value

We first use a simple code to read the value of the temperature sensor, print it in the serial monitor, and wire it as shown below.

Here, LM35 output is given to analog pin A0 of Plus board. This analog voltage is converted to its digital form and processed to get the temperature reading.

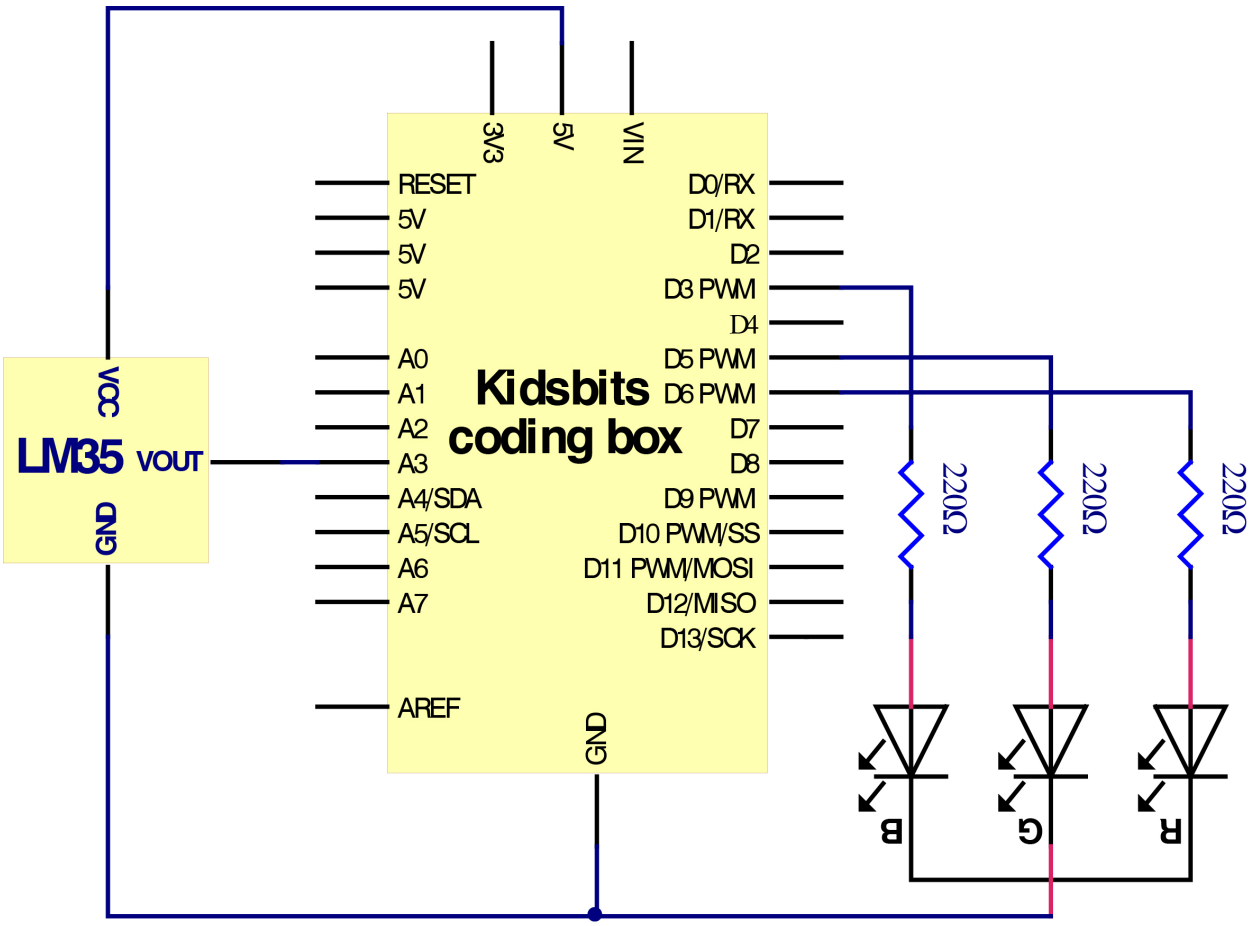
```
\*Kidsbits Coding Box

Project 16.1

Read temperature value

http//www.kidsbits.cc

*/

void setup()

{

Serial.begin(9600);//Set Baud Rate to 9600 bps

}

void loop()

{ unsigned int val;

unsigned int dat;

val=analogRead(3);//Connect LM35 on Analog 3

dat=(500 val) /1024;

Serial.print("Temp:"); //Display the temperature on Serial monitor

Serial.print(dat);

Serial.println("C");

delay(500);

}

//////////////////////////////////////////////////////////////////
```

Upload the code to the PLUS development board, open the serial monitor, and then you can read the current temperature value.



Circuit Connection

Now use the LM35 temperature sensor and 3 LEDs to do a temperature tester. When the temperature tester senses different temperatures, different LEDs will light up. Follow the diagram below for wiring.



Project Code

```
\*Kidsbits Coding Box

Project 16.2

Temperature tester

http//www.kidsbits.cc

*/

int redpin = 6; //select the pin for the red LED

int greenpin =5;// select the pin for the green LED

int bluepin =3; // select the pin for the blue LED

void setup()

{

pinMode(redpin, OUTPUT);
```

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(continued from previous page)

```
pinMode(bluepin, OUTPUT);

pinMode(greenpin, OUTPUT);

Serial.begin(9600);//Set Baud Rate to 9600 bps

}

void loop()

{ unsigned int val;

unsigned int dat;

val=analogRead(3);//Connect LM35 on Analog 3

dat=(500 val) /1024;

Serial.print("Temp:"); //Display the temperature on Serial monitor

Serial.print(dat);

Serial.println("C");

if (dat \>= 50) {

digitalWrite(greenpin, LOW);

digitalWrite(bluepin, LOW);

digitalWrite(redpin, HIGH);

}

else if (dat \>= 30 && dat \< 50) {

digitalWrite(greenpin, LOW);

digitalWrite(bluepin, HIGH);

digitalWrite(redpin, LOW);

}

else {

digitalWrite(greenpin, HIGH);

digitalWrite(bluepin, LOW);

digitalWrite(redpin, LOW);
```

(continues on next page)

(continued from previous page)

```
}

delay(200);

}

//////////////////////////////////////////////////////////////////
```

Project Result

After uploading the code to the coding box, the temperature sensor can detect the outside temperature.

When the temperature is greater than or equal to 50°C, the RGB LED lights up red;

When the temperature is greater than or equal to 30°C and less than 50°C, the RGB LED lights up green;

When the temperature is less than 30°C, the RGB LED lights up blue,

You can use this item to make a temperature reminder water cup.

next project***

4.2.17 Project 17 Turns An LED On

Project Introduction

Dot matrices seem to be very unfamiliar, but in fact it is everywhere in our lives. It is widely used in some outdoor billboards, game consoles, and supermarkets.

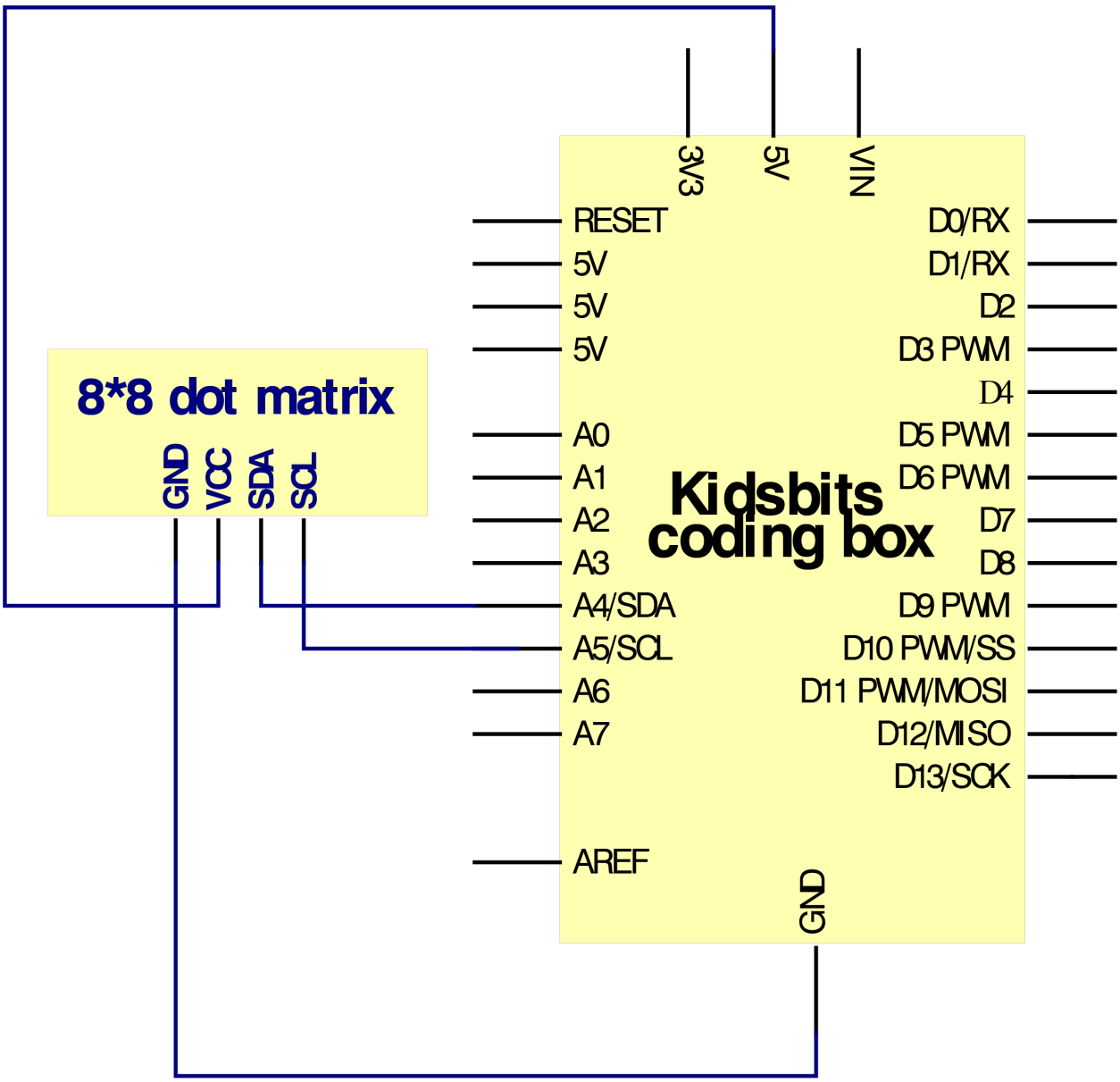
And a LED dot matrix has many advantages, such as power saving, long service life, low cost, high brightness, wide viewing angle, long visual range, waterproof and so on. It can meet different needs, so it has great prospects.

The 88 dot matrix integrated on the coding box uses I2C communication. It can control up to 64 LEDs and display interesting patterns, including numbers, characters, and graphics with only two signal pins.

What's more, the 88 dot matrix is equipped with a HT16K33 driver chip .Through a simple I2C interface, we can control the chip to work and drive the 88 dot matrix screen.

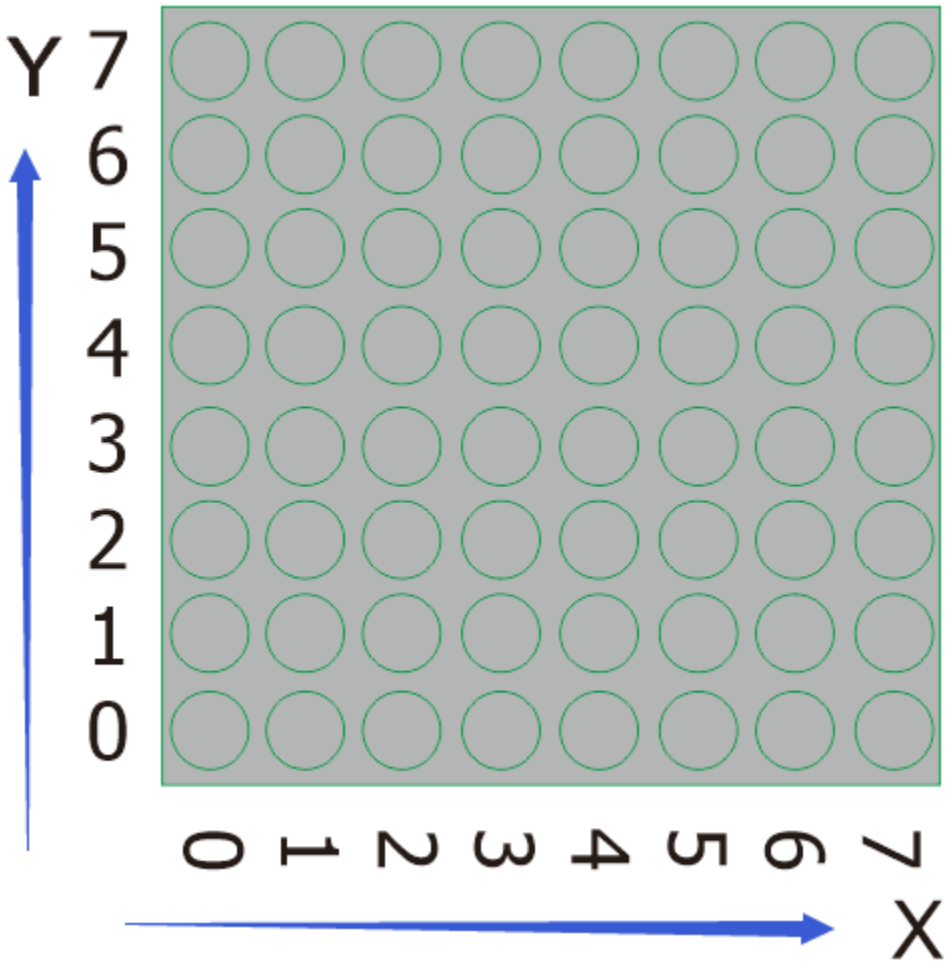
Now we are about to start many 88 dot matrix projects. Firstly, let's turn on a led on the dot matrix.

Project Circuit



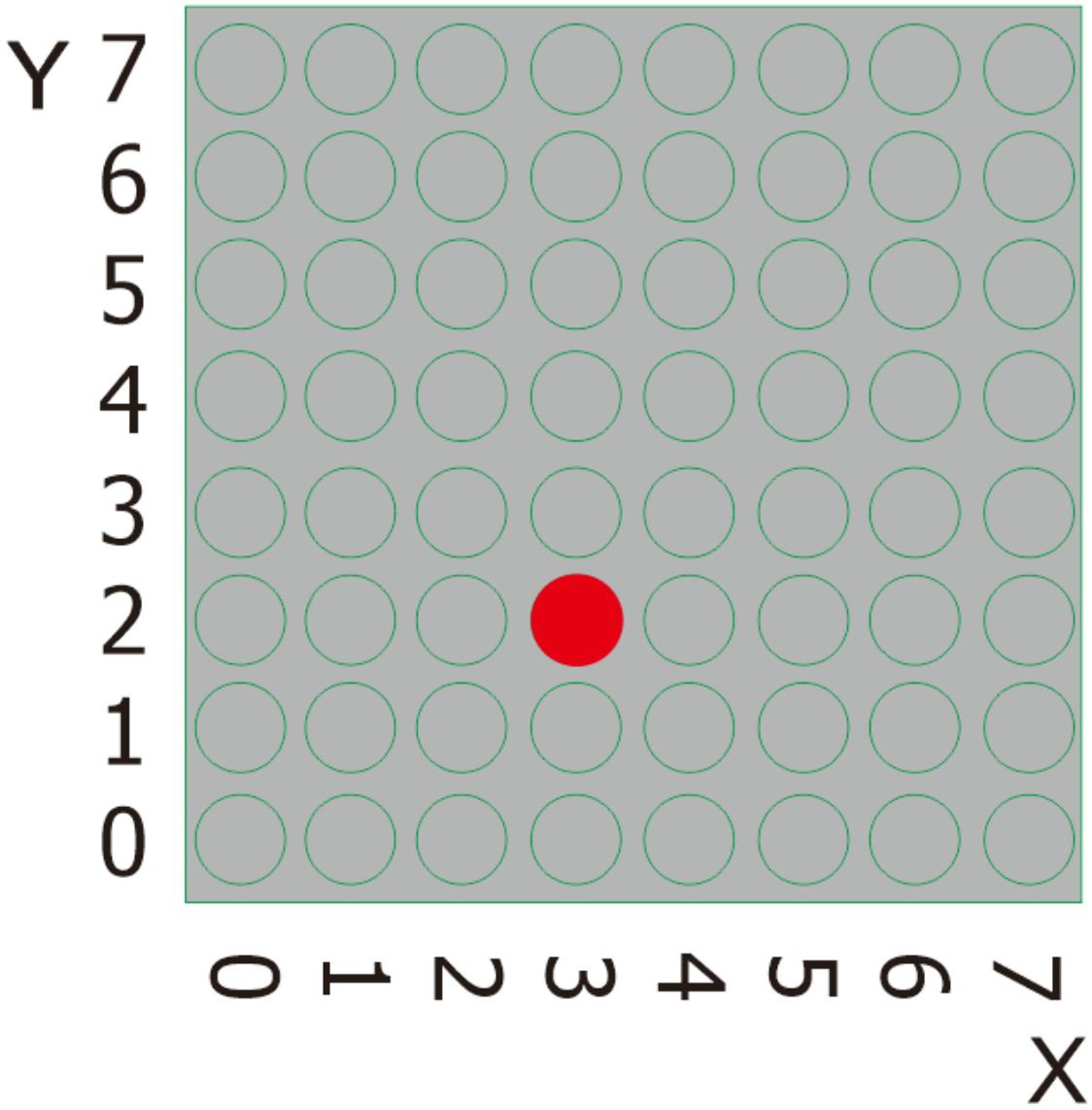
Project Principle

The theory behind the 88 dot matrix is quite simple. It is driven by the chip HT16K33 of the micro-controller. It has 64 LEDs, sitting in 8 rows and 8 columns. In order to locate these LEDs quickly, as the figure shown below, we can regarded this matrix as a coordinate system and create two aces by marking those in rows from 0 to 7 from bottom to top, and the ones in columns from 0 to 7 from the left to the right.



Then,what we should do to light a LED ?

Please have a look at the following picture.



According to coordinate system created, the red spot in the above picture can be recorded as (3,2). Then we integrate its position into the code to write the following code.

Project Code

```
\*Kidsbits Coding Box

Project 17

88 dot matrix-turn on a LED

http//www.kidsbits.cc

*/
```

(continues on next page)

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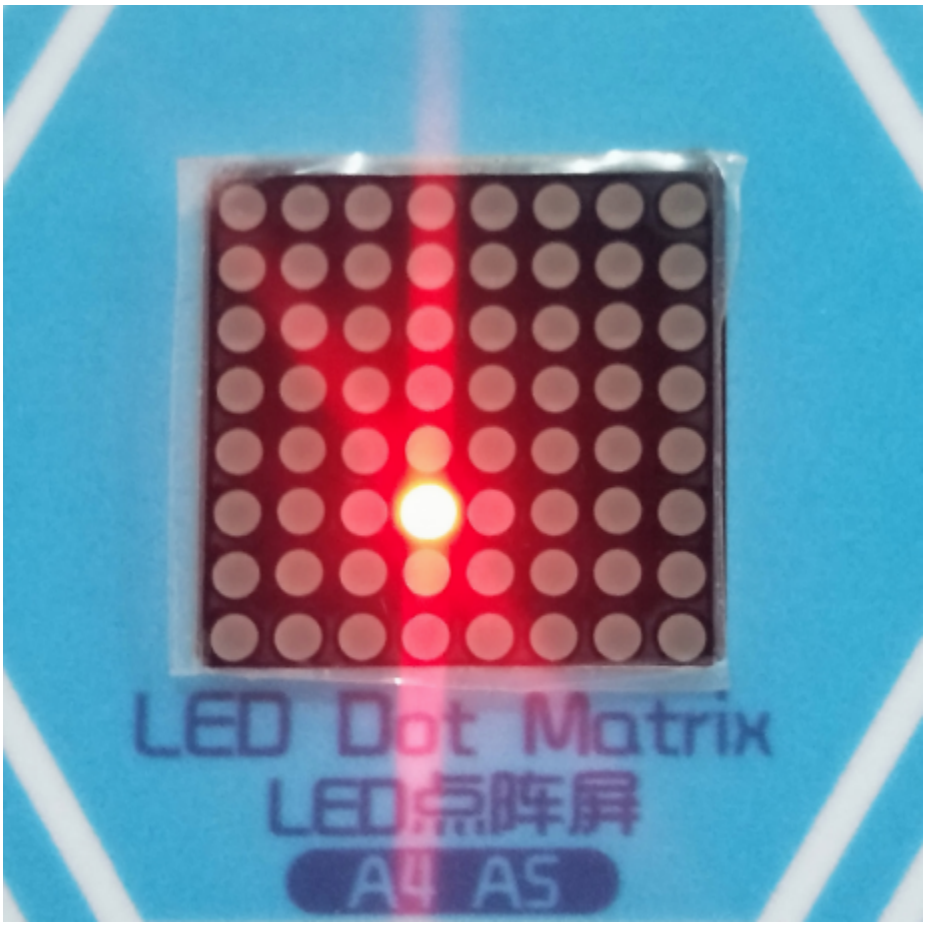
```
\#include <ks_Matrix.h\>

Matrix myMatrix(A4,A5);

void setup() {

myMatrix.begin(112);

myMatrix.clear();

}

void loop() {

myMatrix.drawPixel(3,2,HIGH);

myMatrix.writeDisplay();

}
```

Project Result:

Upload the code to the coding box successfully, the LED dot matrix will display the required LED as shown in the figure below.



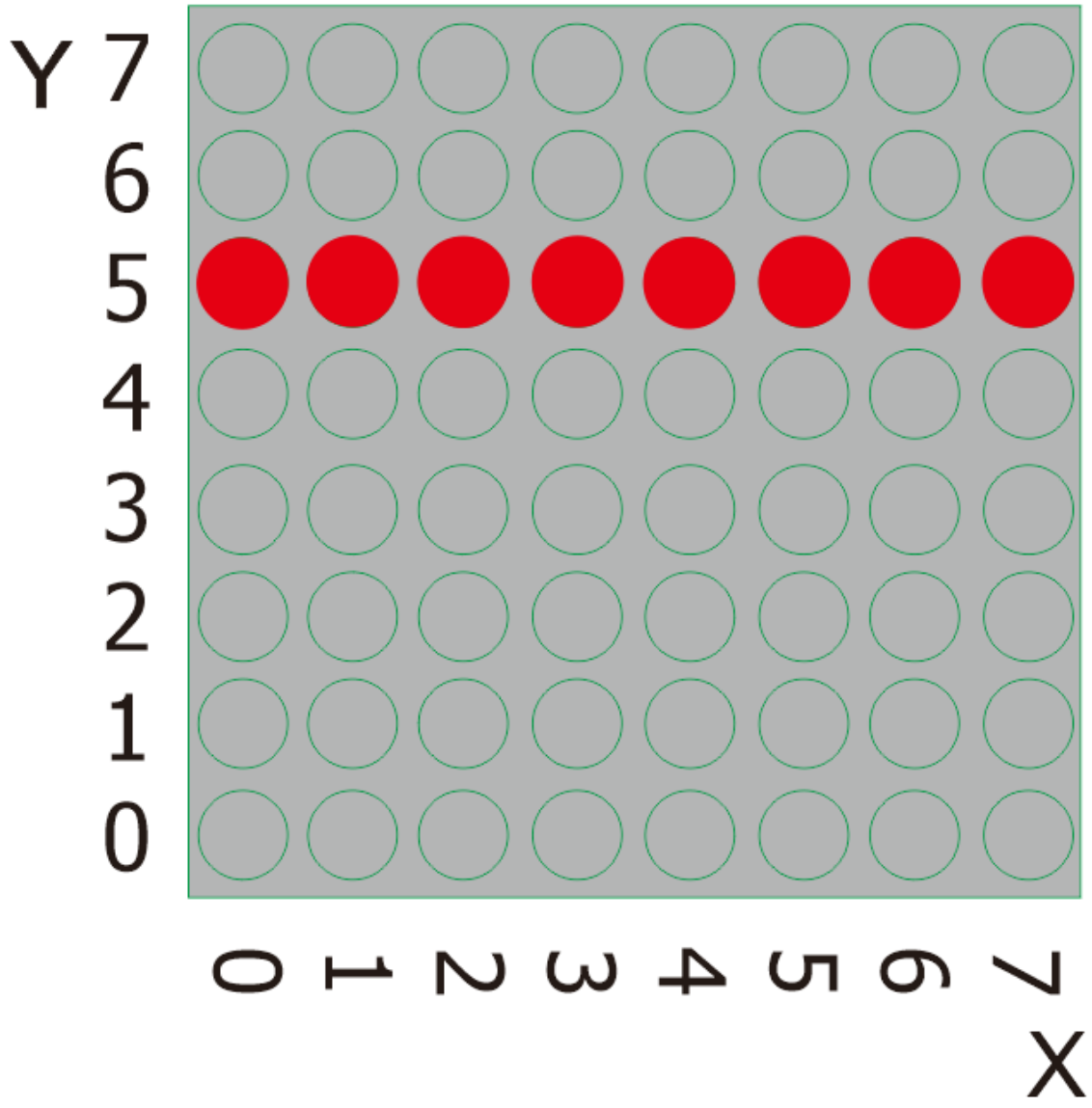
next project*

4.2.18 Project 18 Turn On A Line

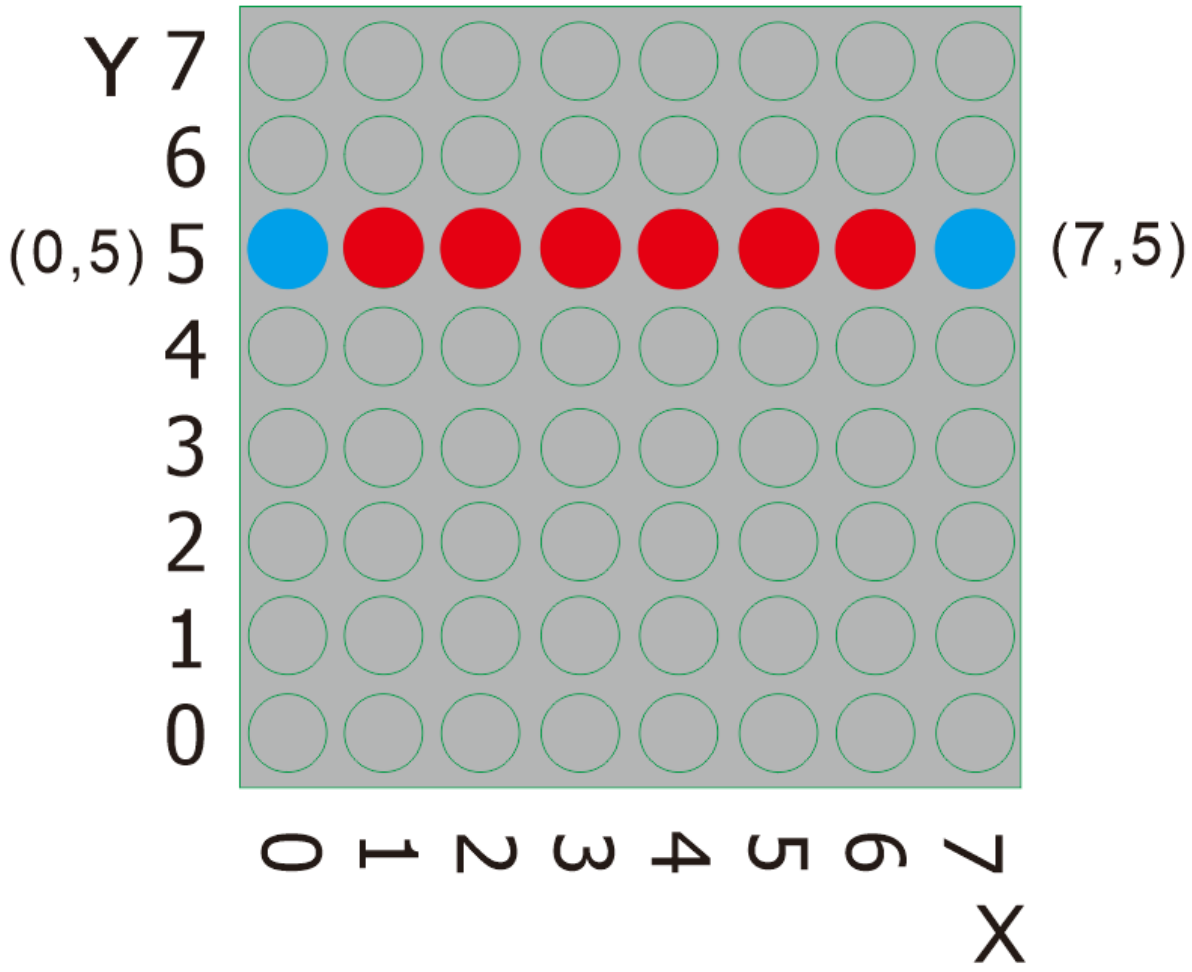
Project Introduction

In the previous project, we have turned on one LED while in this lesson we will light a row of LEDs, that's 8 LEDs.

Project Principle



Please look at the above picture. What we can do to light this whole line of red spots? The solution we resort to is a function, matrix.drawLine. We just need to input the position of the starting and ending points of this a row of LEDs.



From the figure above, it is clear that the starting point of this line is (0,5) and the ending point is (7,5). Then we log them and place them into the code.

Project Code

```
\*Kidsbits Coding Box

Project 18

88 dot matrix-turn on a line

http//www.kidsbits.cc

*/

\#include <ks_Matrix.h\>

Matrix myMatrix(A4,A5);

void setup()
```

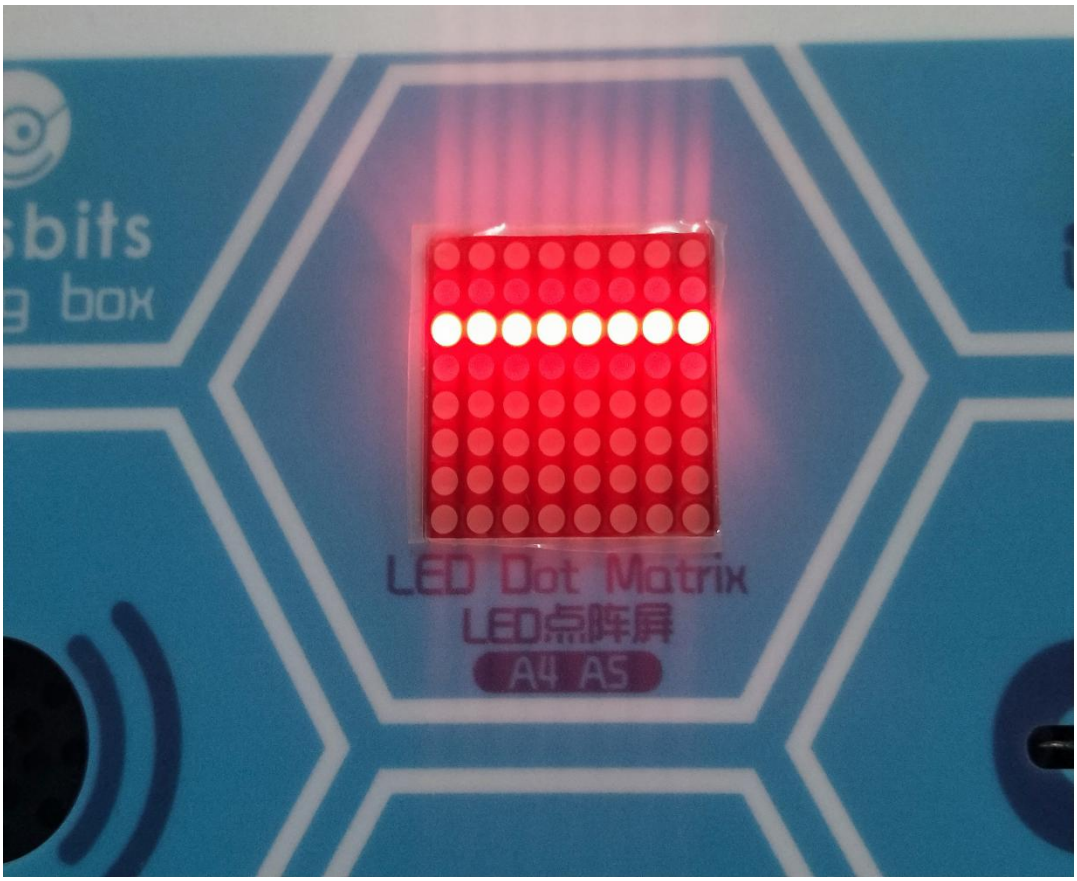
(continues on next page)

(continued from previous page)

```
{
myMatrix.begin(112);
myMatrix.clear();
}
void loop()
{
myMatrix.drawLine(0, 5, 7, 5, HIGH);
myMatrix.writeDisplay();
}
```

Project Result:

Upload the code to the coding box successfully, the LED dot matrix will display as shown in the figure below.



next project***

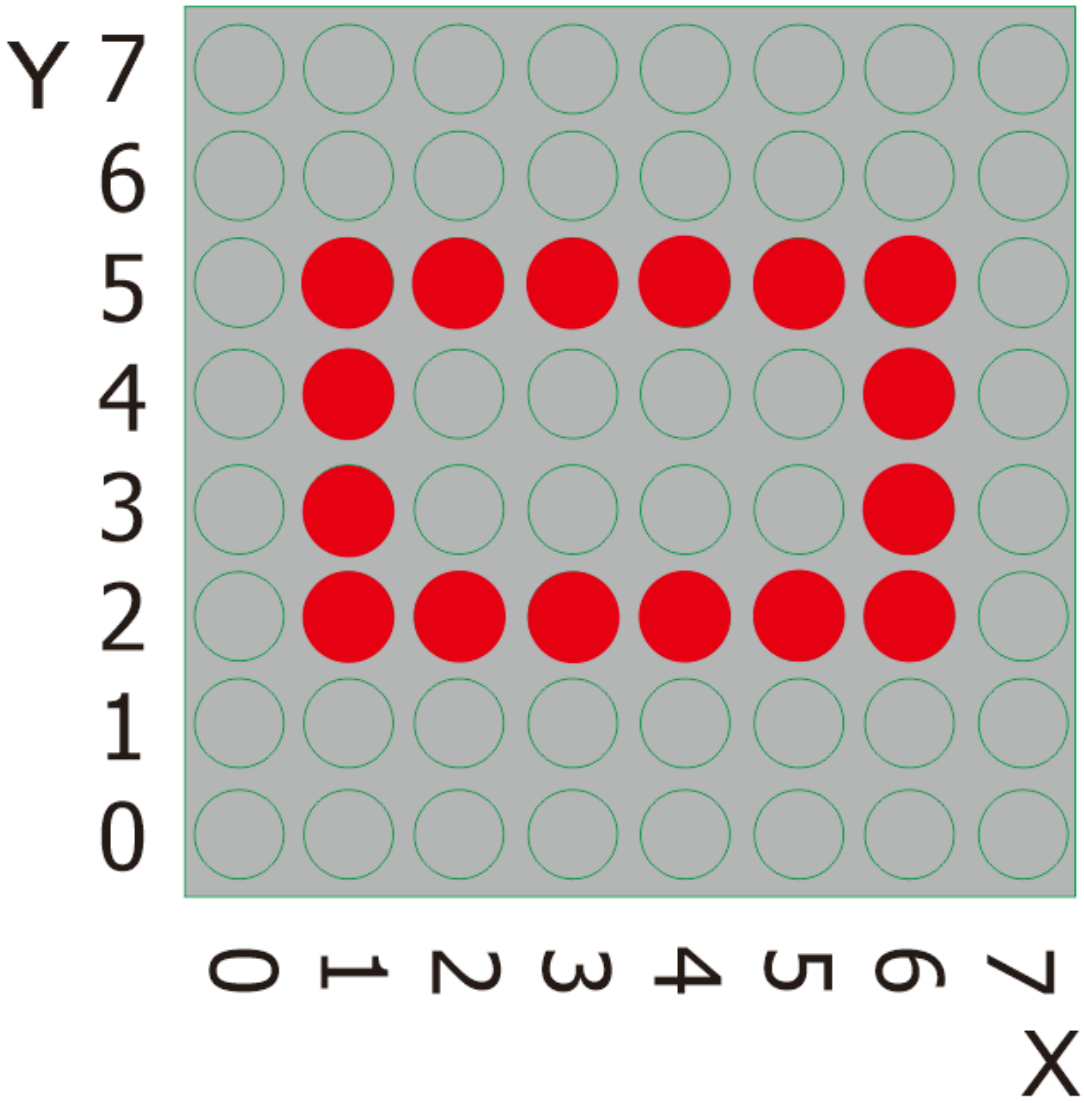
4.2.19 Project 19 Display A Rectangle

Project Introduction

Are you getting more excited about our next project?

This time, we intend to make it more challenging and let the matrix display a rectangle.

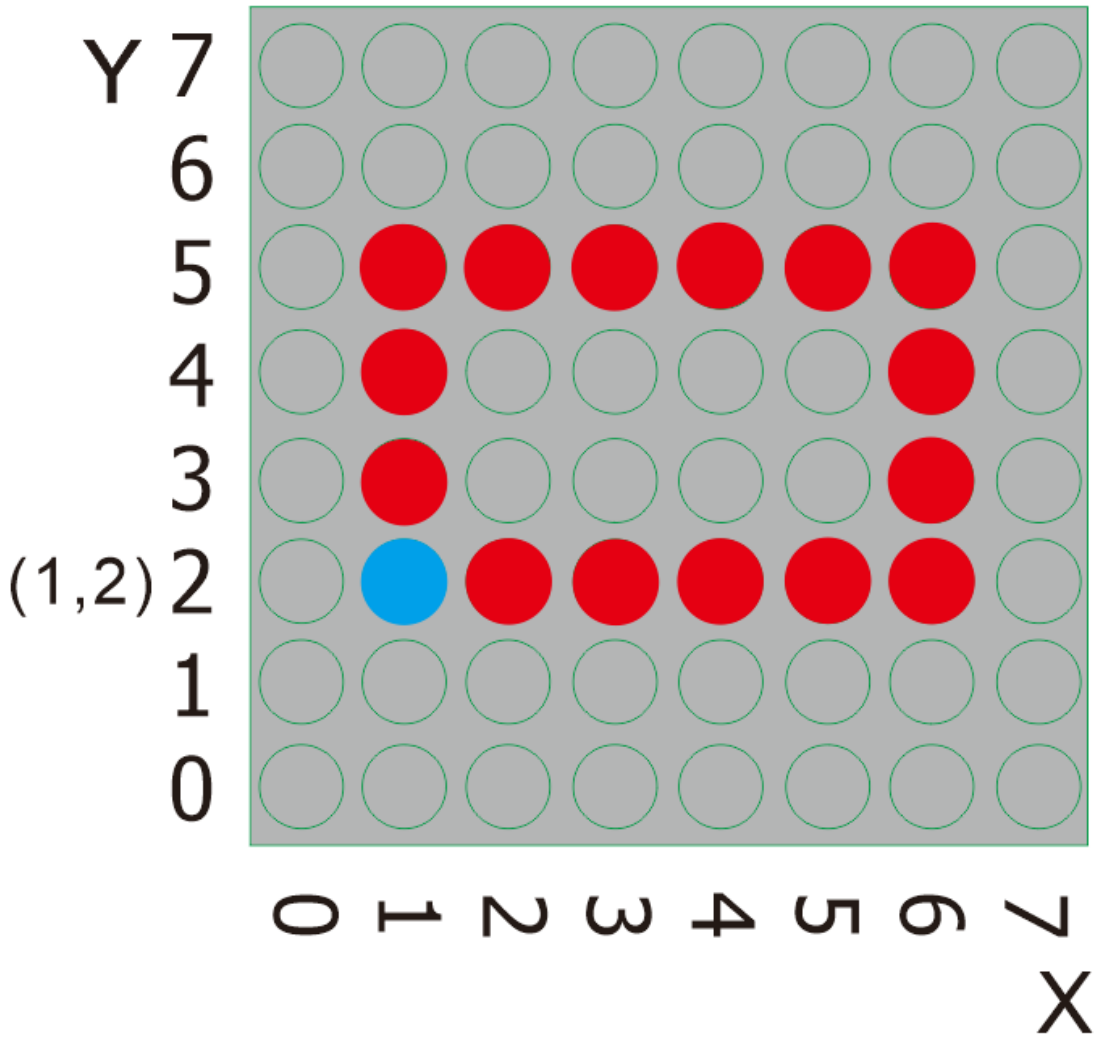
Project Principle



Likewise, please eye the picture above.

What we should do to light all these red spots shaped in a rectangle? Our solution is another function, matrix.fillRect. With the help of this function, to showcase a rectangle or a square with these LEDs, we just need to determine the position of a starting point.

Let's find the position of the blue spotthe starting point, in the picture below.



It is explicit that the position of the blue spot is (1,2). To light this rectangle, what required to do is adding the dimension of the rectangle behind the position value of this point. Therefore, for this rectangle, it is (1,2,6,4). Likewise, if we use this blue sport as a starting point to achieve a square with the dimension of 44, it is (1,2,4,4).

Project Code

```
\*Kidsbits Coding Box

Project 19

88 dot matrix-turn on a rectangle

http//www.kidsbits.cc

*/

\#include <ks_Matrix.h\>

Matrix myMatrix(A4,A5);
```

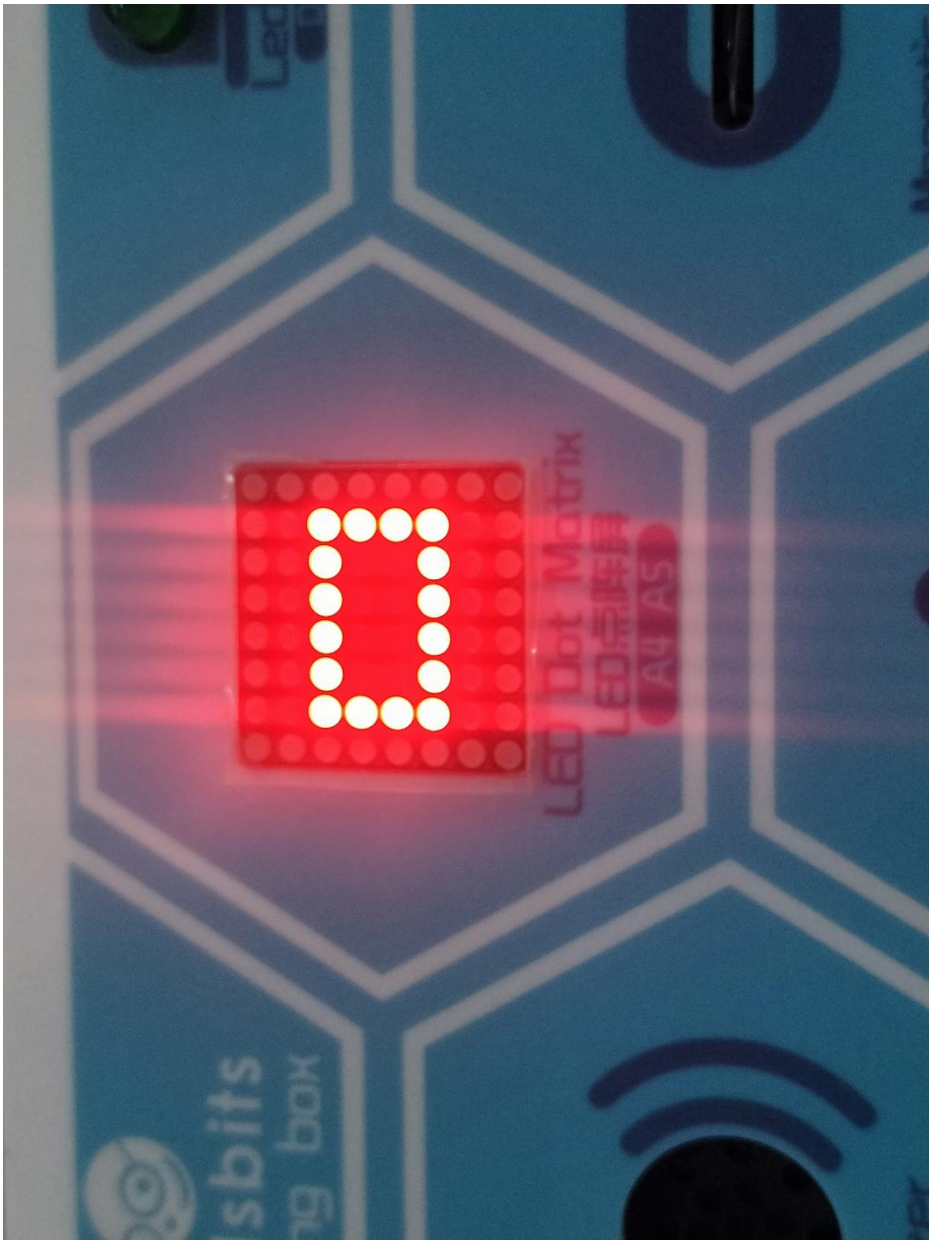
(continues on next page)

(continued from previous page)

```
void setup() {

myMatrix.begin(112);

myMatrix.clear();

}

void loop() {

myMatrix.drawRect(1, 2, 6, 4, HIGH);

myMatrix.writeDisplay();

}
```

Project Result:

Upload the code to the coding box successfully, the LED dot matrix will display the pattern as shown in the figure below.

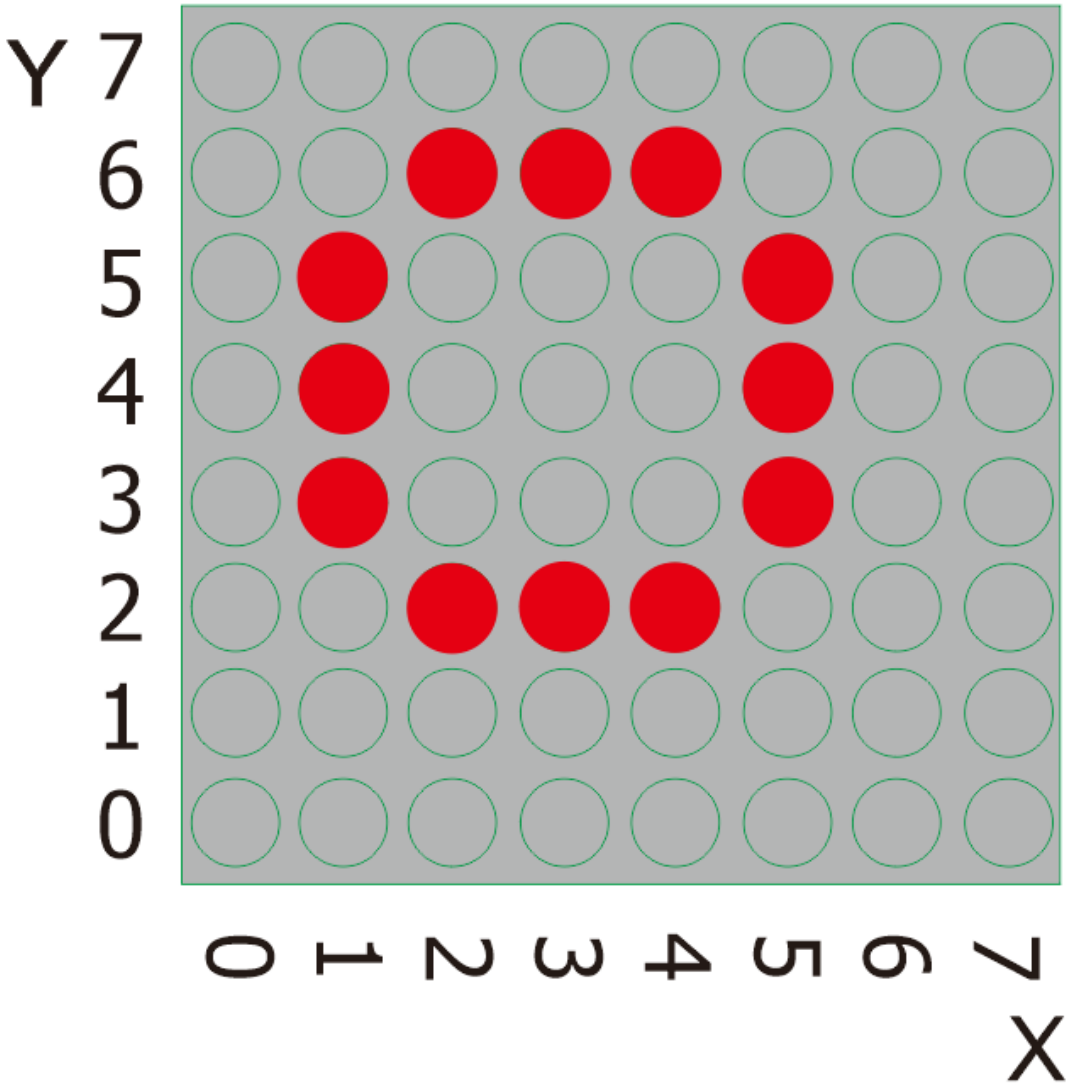


next project***

4.2.20 Project 20 Display A Circle

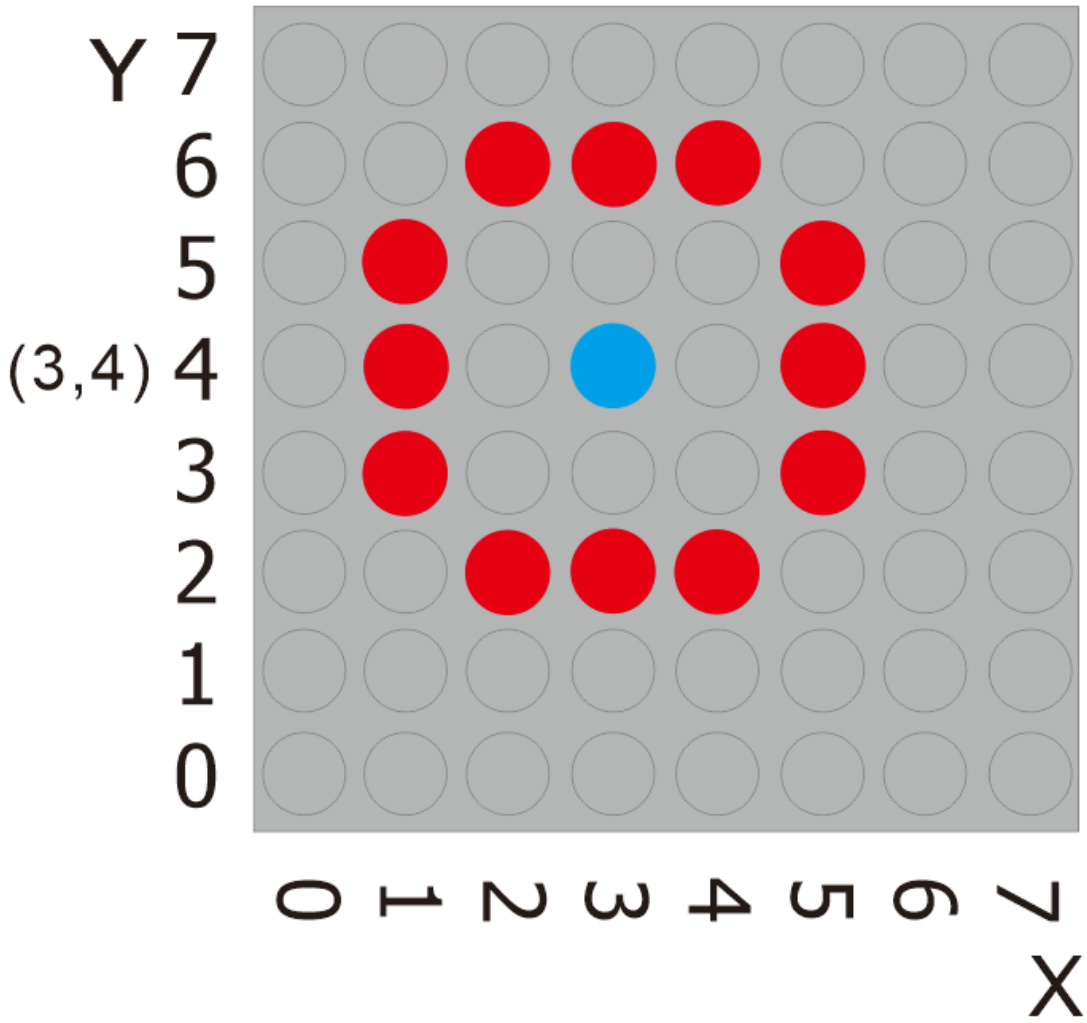
Project Introduction

In the previous project, the matrix has shown a rectangle with its LEDs. In this one, we will help it exhibit a circle.
Working Principle



As the picture shown below, the circle we plan to create is 2 units in radius.

However, to achieve this goal by applying the knowledge learned before, we can only light them one by one, which is very time-consuming. We have a better and simpler way. That's come to another function, matrix.drawCircle for help.



What we should do is to find the central point of a circle and mark its position as well as record the radius of the circle. In this case, the central point is (3,4) and the radius is 2 units. We combine these data together to obtain value (3,4,2) and add it to the code.

Therefore, if we want to draw a circle 3 units in radius with the same point, just alter the value to(3,4,3).

The following is the code.

Project Code

```
\*Kidsbits Coding Box

Project 20

88 dot matrix-turn on a LED

http//www.kidsbits.cc

*/
```

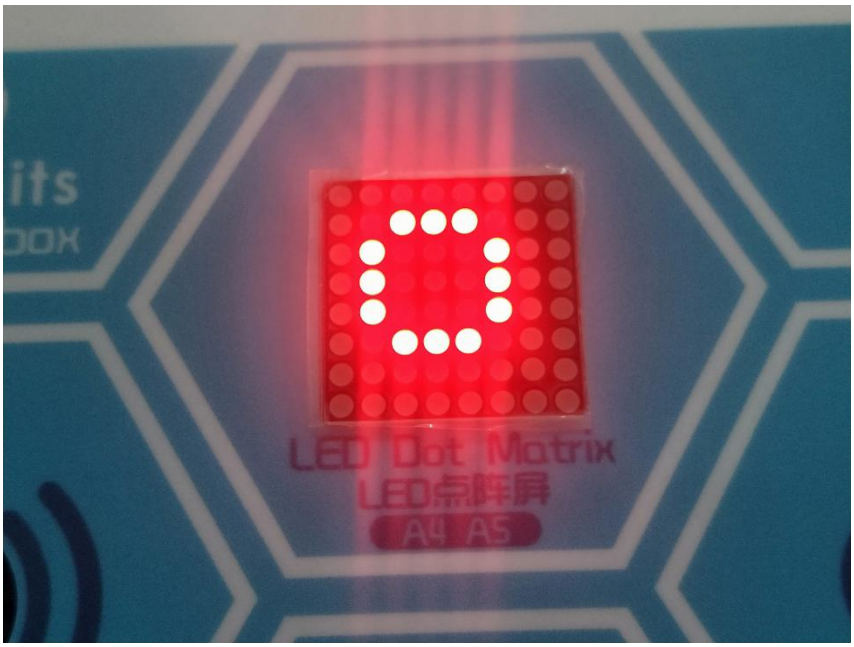
(continues on next page)

(continued from previous page)

```
\#include <ks_Matrix.h\>

Matrix myMatrix(A4,A5);

void setup() {

myMatrix.begin(112);

myMatrix.clear();

}

void loop() {

myMatrix.drawCircle(3, 4, 2, HIGH);

myMatrix.writeDisplay();

}
```

Project Result:

Upload the code to the coding box successfully, the LED dot matrix will display as shown in the figure below.



next project***

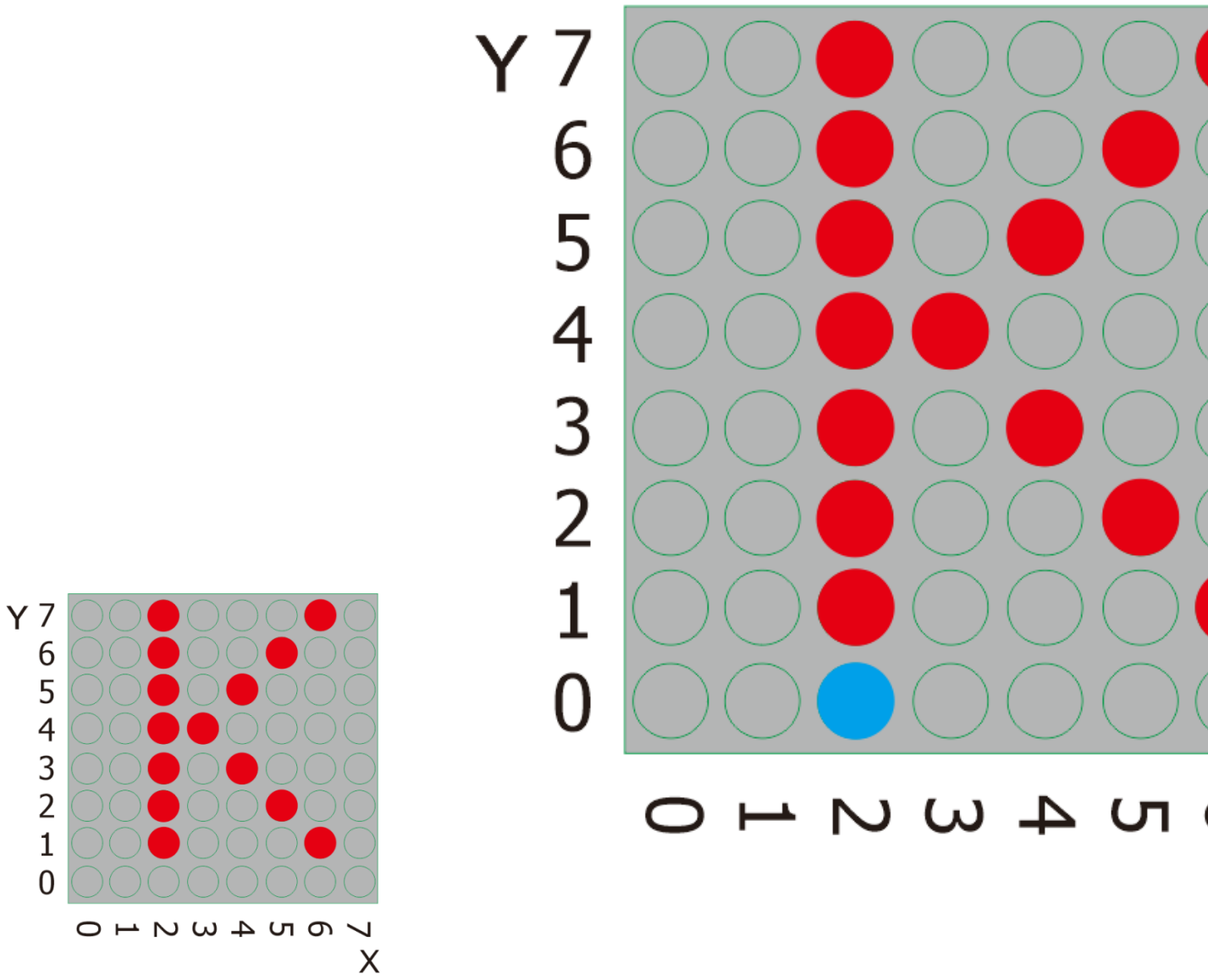
4.2.21 Project 21 Display Text and Numbers

Project Introduction

In the previous projects, we just use the matrix to show a point, a line, a rectangle and a circle. From this one, we will make the matrix to show digits and characters, which is pretty cool. With this skill, we are able to deliver information, like what price tags and billboards do.

Project Principle

This project is also relatively simple. To render the matrix to display numbers or characters we need to decide a starting point. For example, in the figure below, the blue point spot(2,0) is the starting point of the letter K.



Then we also need to input the position value(2,0) to the code so as to display the letter K.

Project Code

```
\*Kidsbits Coding Box

Project 21

88 dot matrix-display text and numbers

http//www.kidsbits.cc

*/

\#include <ks_Matrix.h\>

Matrix myMatrix(A4,A5);

void setup() {

myMatrix.begin(112);

myMatrix.clear();

}

void loop() {

myMatrix.setTextSize(1);//Set the size of characters

myMatrix.setTextWrap(false); // we dont want text to wrap
so it scrolls nicely

myMatrix.setTextColor(1);

myMatrix.setRotation(0);// Rotation

myMatrix.clear();

myMatrix.setCursor(2,0);//Input the value of the position

myMatrix.print("K"); //Input characters or letters

myMatrix.writeDisplay();

delay(1000);

}
```

next project*

4.2.22 Project 22 Display Images

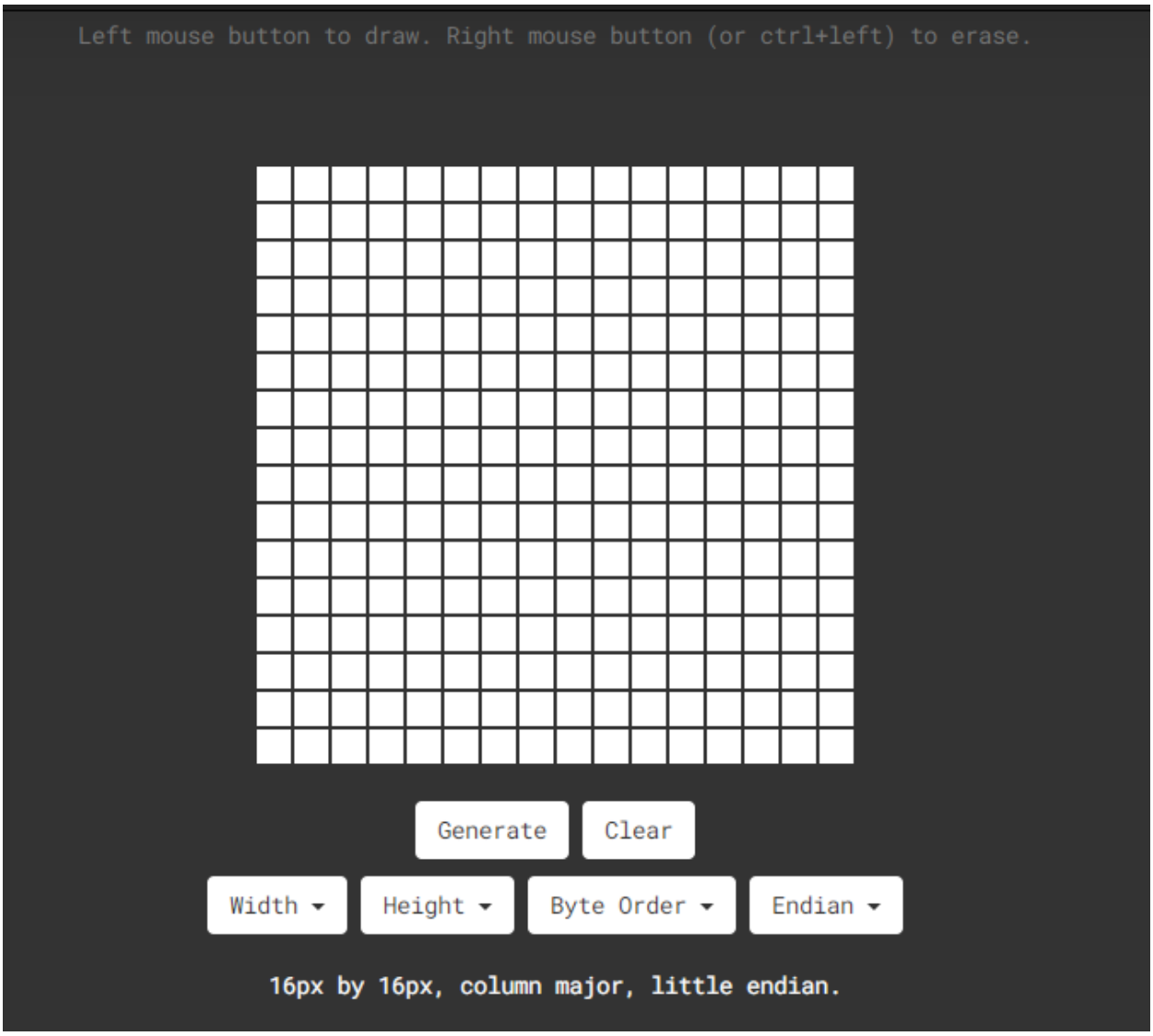
Project Introduction

Mobile phones, computer screens, billboards and other display devices all consist of many small luminous units. However, the 88 dot matrix has only 64 luminous units. Though it can't display some nice images with high-resolution, it can show some cute pictures, such as patterns shaped in little heart, cute facial expressions, avatars and others.

Project Principle

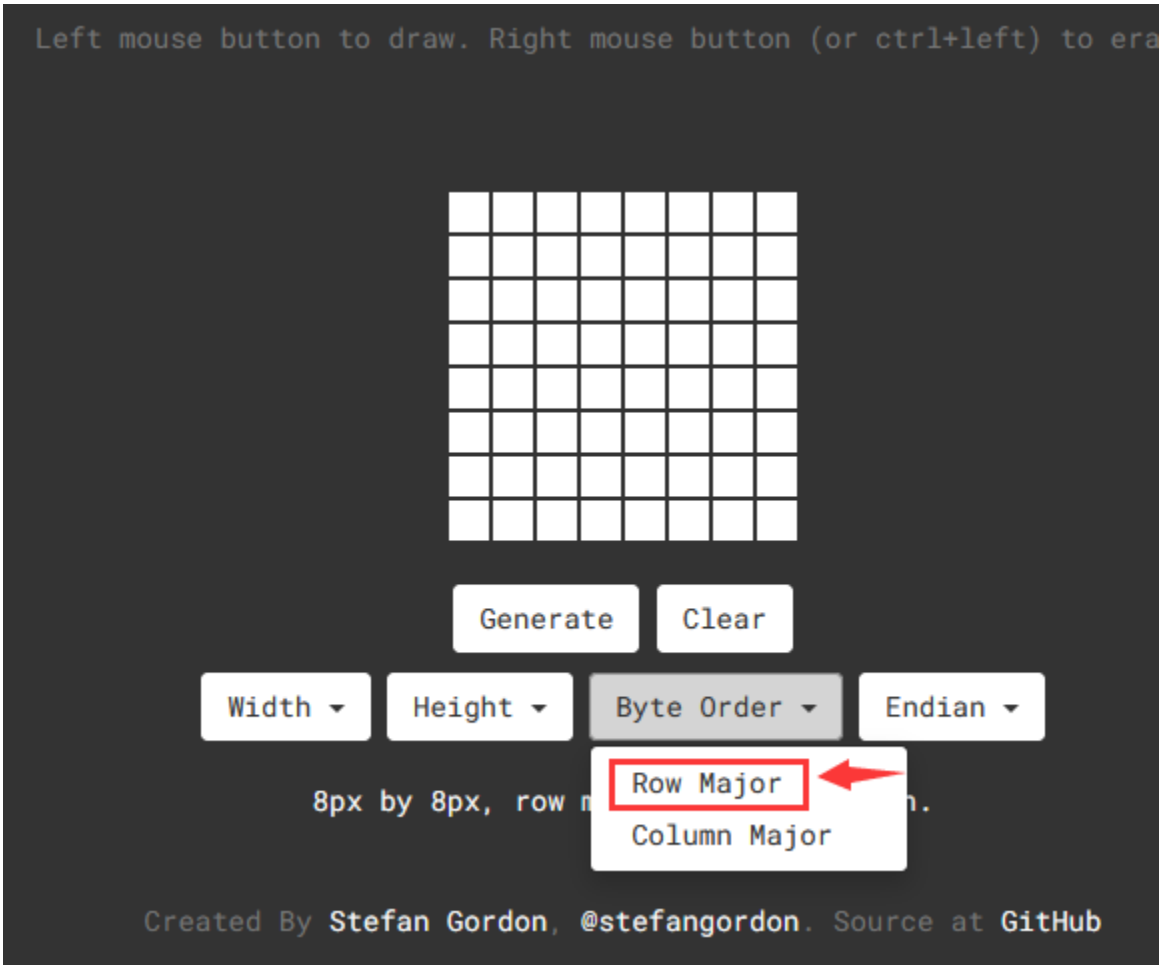
To this end, we will need the help of an online version of dot matrix modulus tool:http://dotmatrixtool.com

Please open the link to enter the following page.

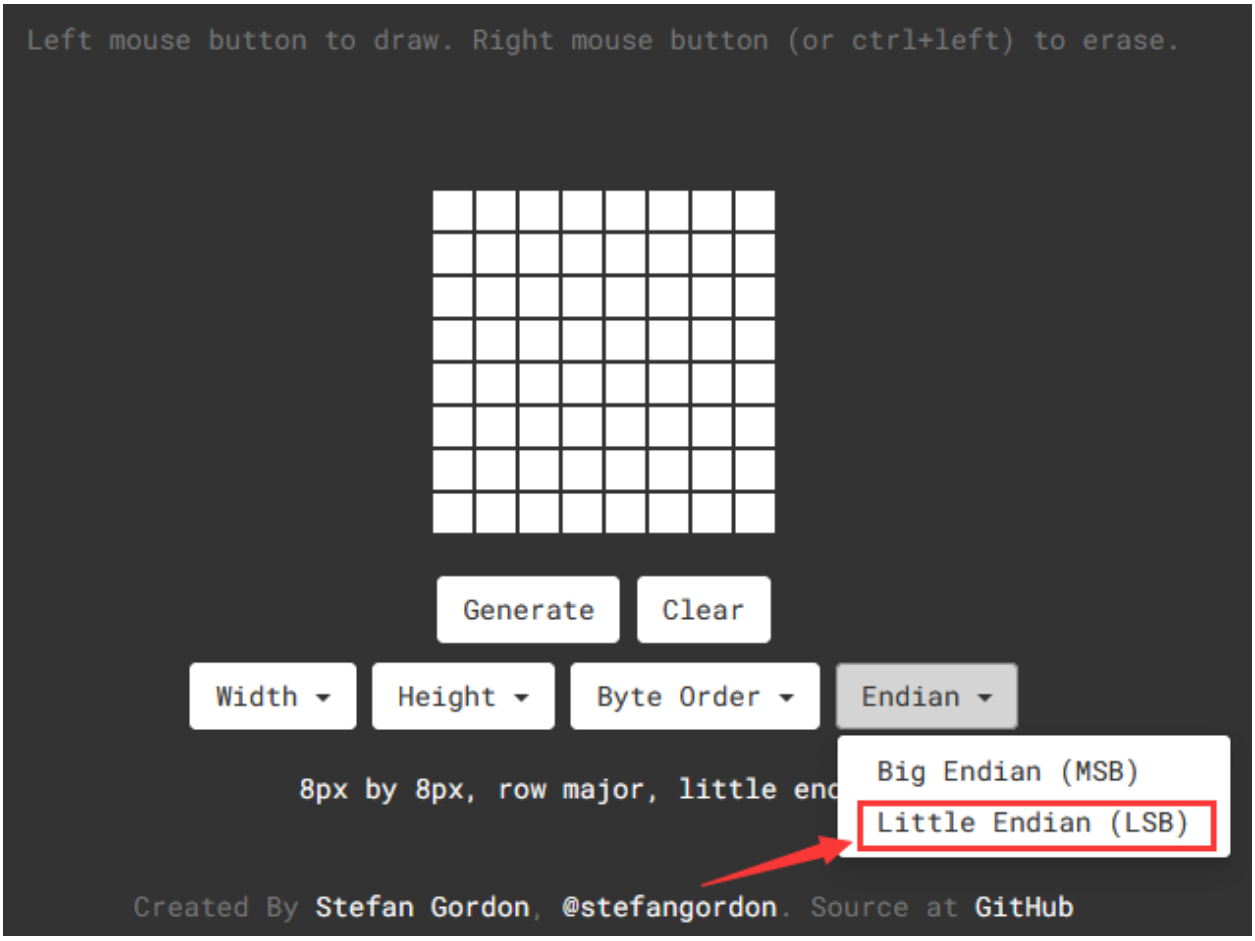


Firstly, as the dot matrix is 88 in this project, please set the height to 8, width to 8, as shown below.

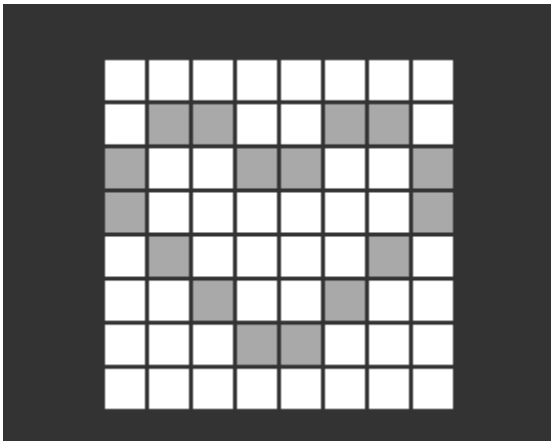
Secondly, Click the Byte order and then choose Row Major as shown below.



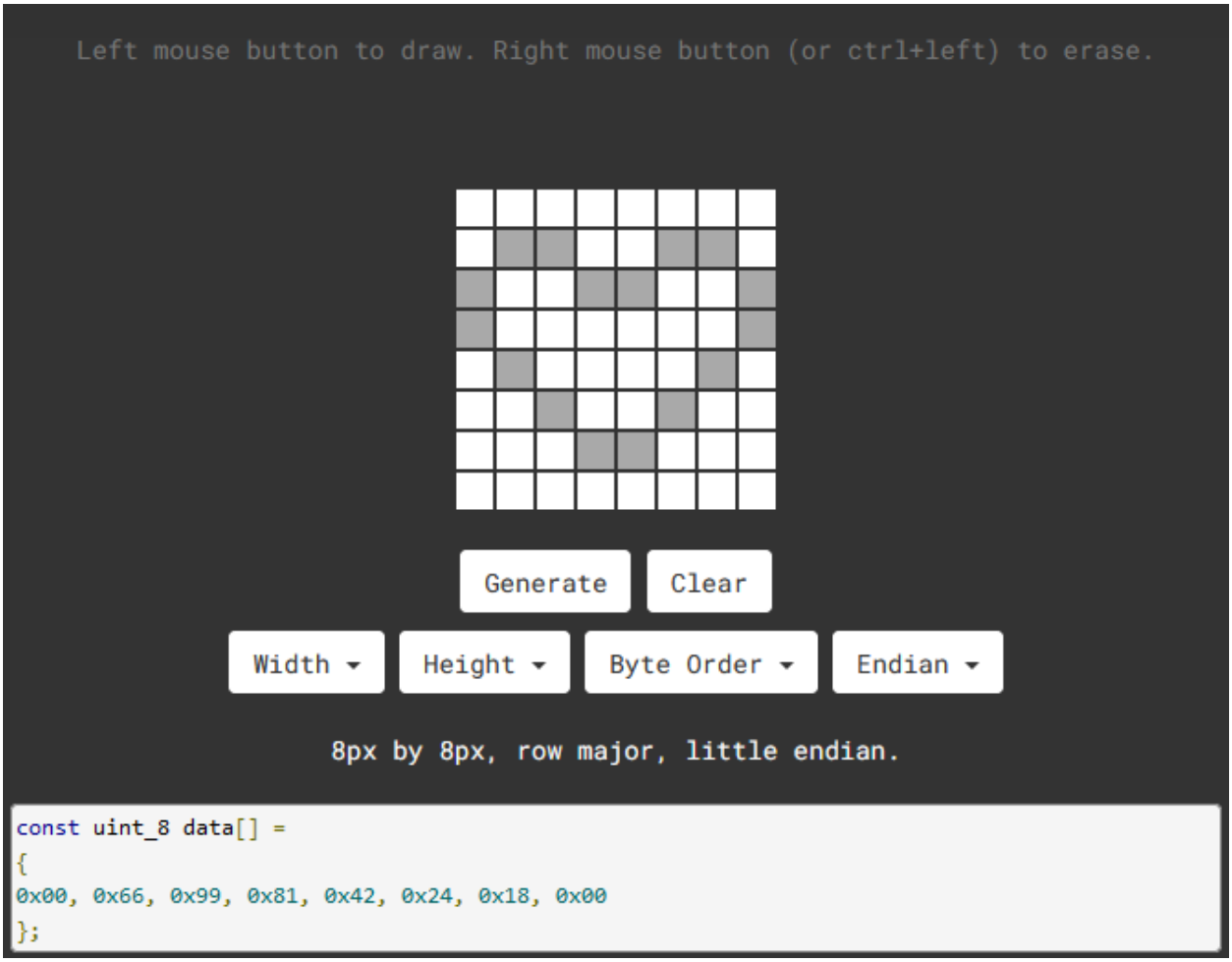
And click the Endian and choose Little Endian(lsb) as shown below;



Thirdly, draw the pattern wanted.



Lastly, click **Generate**, to yield the hexadecimal data needed.

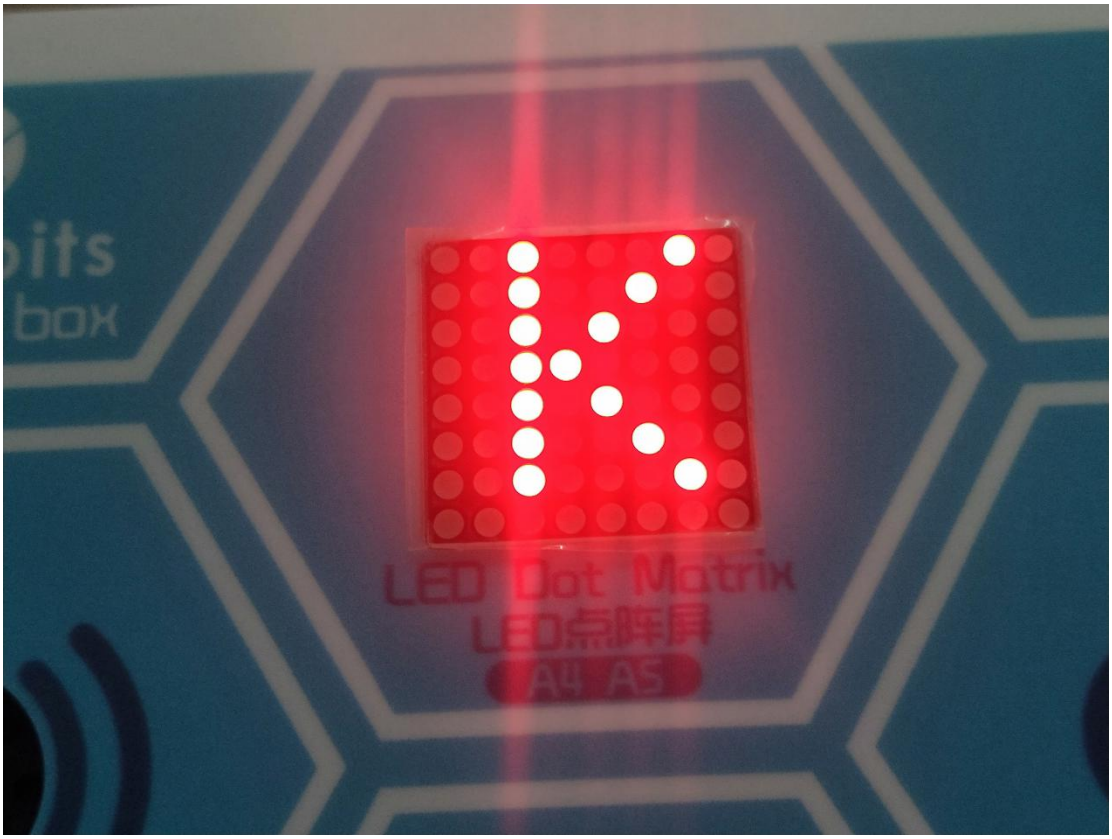


0x00, 0x66, 0x99, 0x81, 0x42, 0x24, 0x18, 0x00

And then integrate the above hexadecimal data into the code

Project Result

Upload the code to the coding box successfully, the LED dot matrix will display as shown in the figure below.



Project Code

```
\*Kidsbits Coding Box

Project 22

88 dot matrix-display images

http//www.kidsbits.cc

*/

\#include <ks_Matrix.h\>

Matrix myMatrix(A4,A5);

uint8_t LedArray1[8]={0x00, 0x66, 0x99, 0x81, 0x42, 0x24, 0x18, 0x00};

uint8_t LEDArray[8];

void setup(){

myMatrix.begin(0x70);

}

void loop(){
```

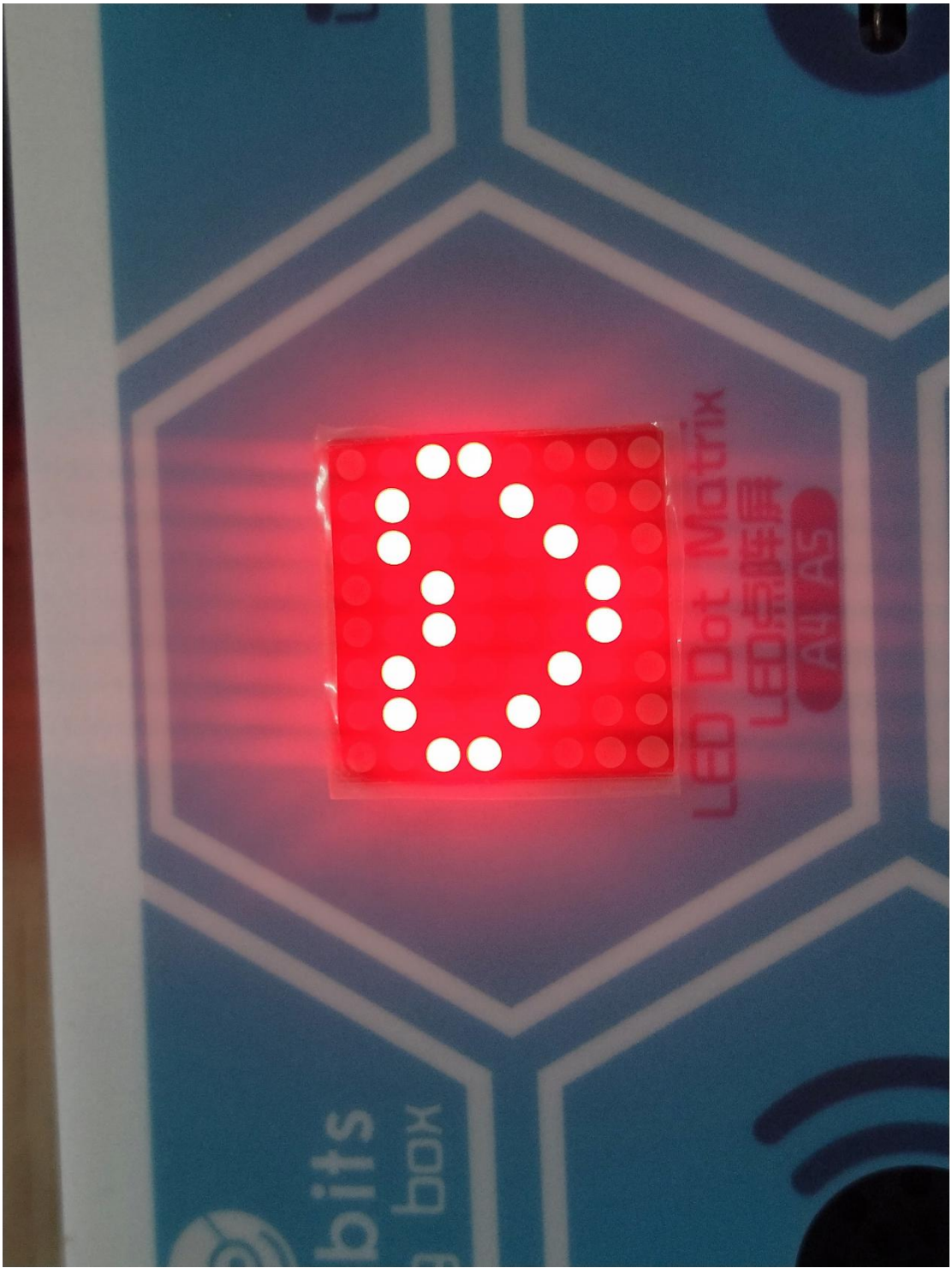
(continues on next page)

(continued from previous page)

```
myMatrix.clear();

for(int i=0; i\<8; i++)

{

LEDArray[i]=LedArray1[7-i];

for(int j=7; j\>=0; j--)

{

if((LEDArray[i]&0x01)\>0)

myMatrix.drawPixel(j, i,1);

LEDArray[i] = LEDArray[i]\>\>1;

}

}

myMatrix.writeDisplay();

}
```

Project Result

Upload the code to the coding box successfully, the LED dot matrix will display as shown in the figure below.



next project***

4.2.23 Project 23 Buttons+88 Dot Matrix

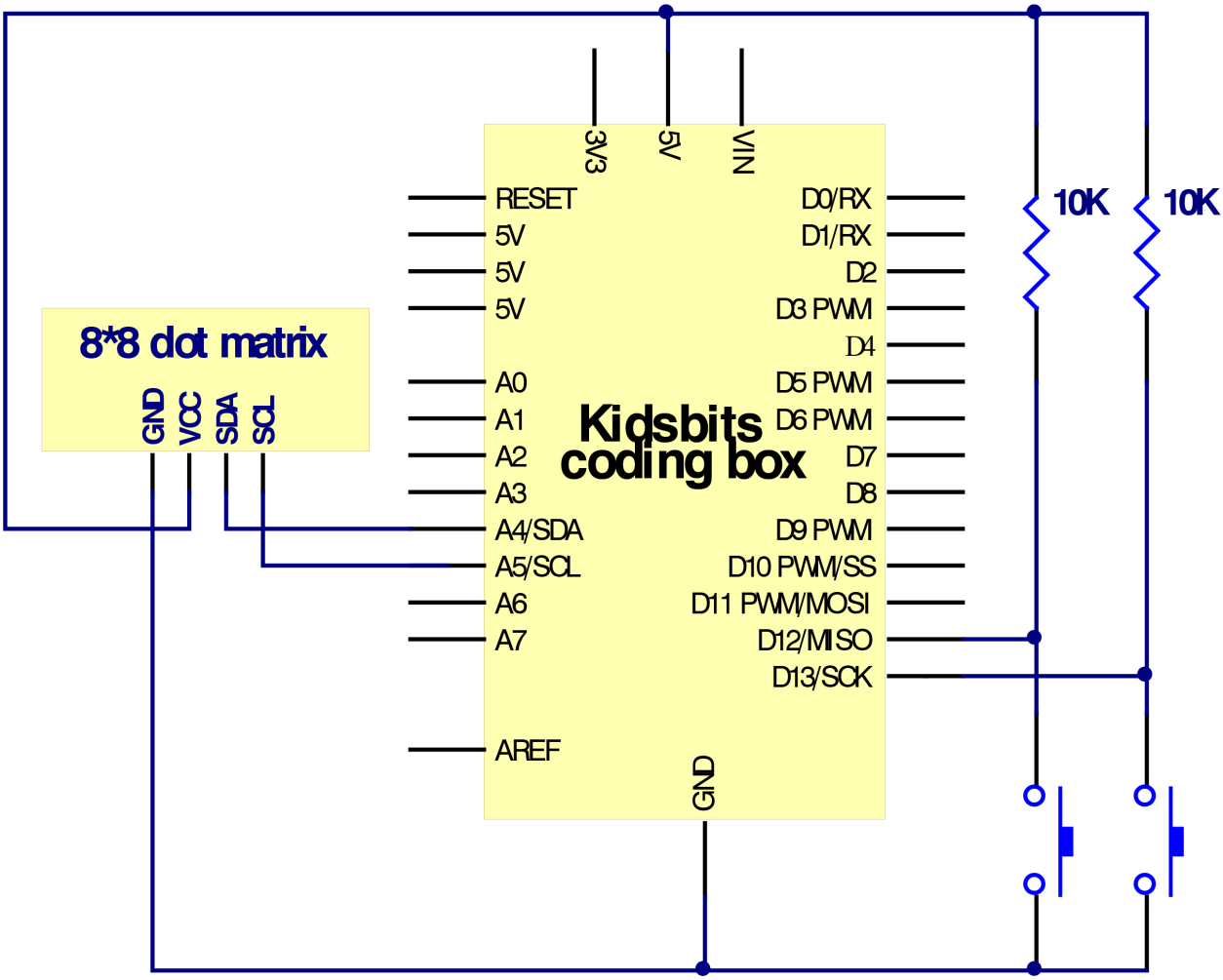
Project Introduction

There are two built-in buttons on the MAX board, which we have used to control DIY lamps in previous project. While in this project, we will combine these buttons with the 88 dot matrix to make displays.

Working Principle

Preciously,we learned that the signal pins of the two buttons should be connected with D2 and D3 and how to make the matrix to show characters. Bearing these knowledge in mind, we will complete this project. When the button on the left side is pressed, the letter L will be displayed while when the right is pressed, R will be shown.

Project Circuit



Project Code

```
\*Kidsbits Coding Box

Project 23

88 dot matrix-knob control

http//www.kidsbits.cc
```

(continues on next page)

(continued from previous page)

```
*/

\#include <ks_Matrix.h\>

Matrix myMatrix(A4,A5);

int K1=12;

int K2=13;

int x;

void setup()

{

myMatrix.begin(112);

myMatrix.clear();

pinMode(K1,INPUT);

pinMode(K2,INPUT);

myMatrix.drawCircle(3,3, 2, 1);

myMatrix.writeDisplay(); // write the changes we just made to the display

}

void loop()

{

int K1_level=digitalRead(K1);

int K2_level=digitalRead(K2);

if(K1_level==0)

{

myMatrix.setTextSize(1);

myMatrix.setTextWrap(false); // we dont want text to wrap
so it scrolls nicely

myMatrix.setTextColor(1);

myMatrix.setRotation(0);
```

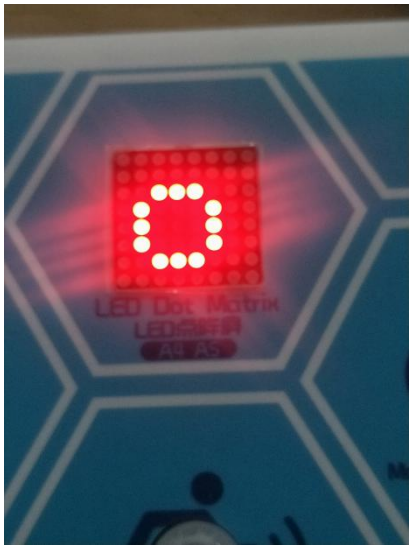
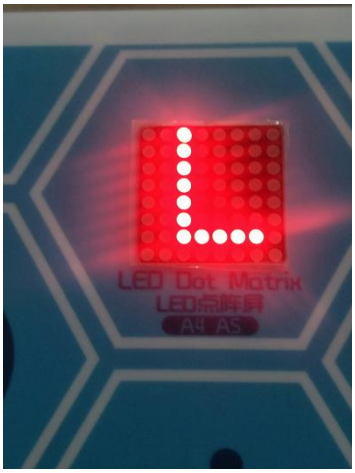
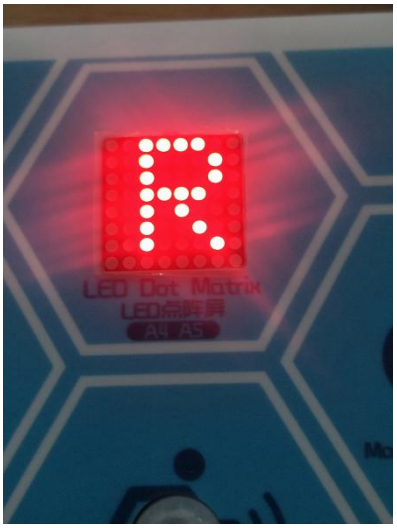
(continues on next page)

(continued from previous page)

```
myMatrix.clear();

myMatrix.setCursor(2,0);

myMatrix.print("L");

myMatrix.writeDisplay();

}

if(K2_level==0)

{

myMatrix.setTextSize(1);

myMatrix.setTextWrap(false); // we dont want text to wrap
so it scrolls nicely

myMatrix.setTextColor(1);

myMatrix.setRotation(0);

myMatrix.clear();

myMatrix.setCursor(2,0);

myMatrix.print("R");

myMatrix.writeDisplay();

}}
```

Project Result

A successful uploading of the code to the coding box, the LED dot matrix first displays a circle; Press the left button and the LED dot matrix displays the letter “L”;Press the right button and the LED dot matrix displays the letter “R”.

next project*

4.2.24 Project 24 Light Sensor+88 Dot Matrix

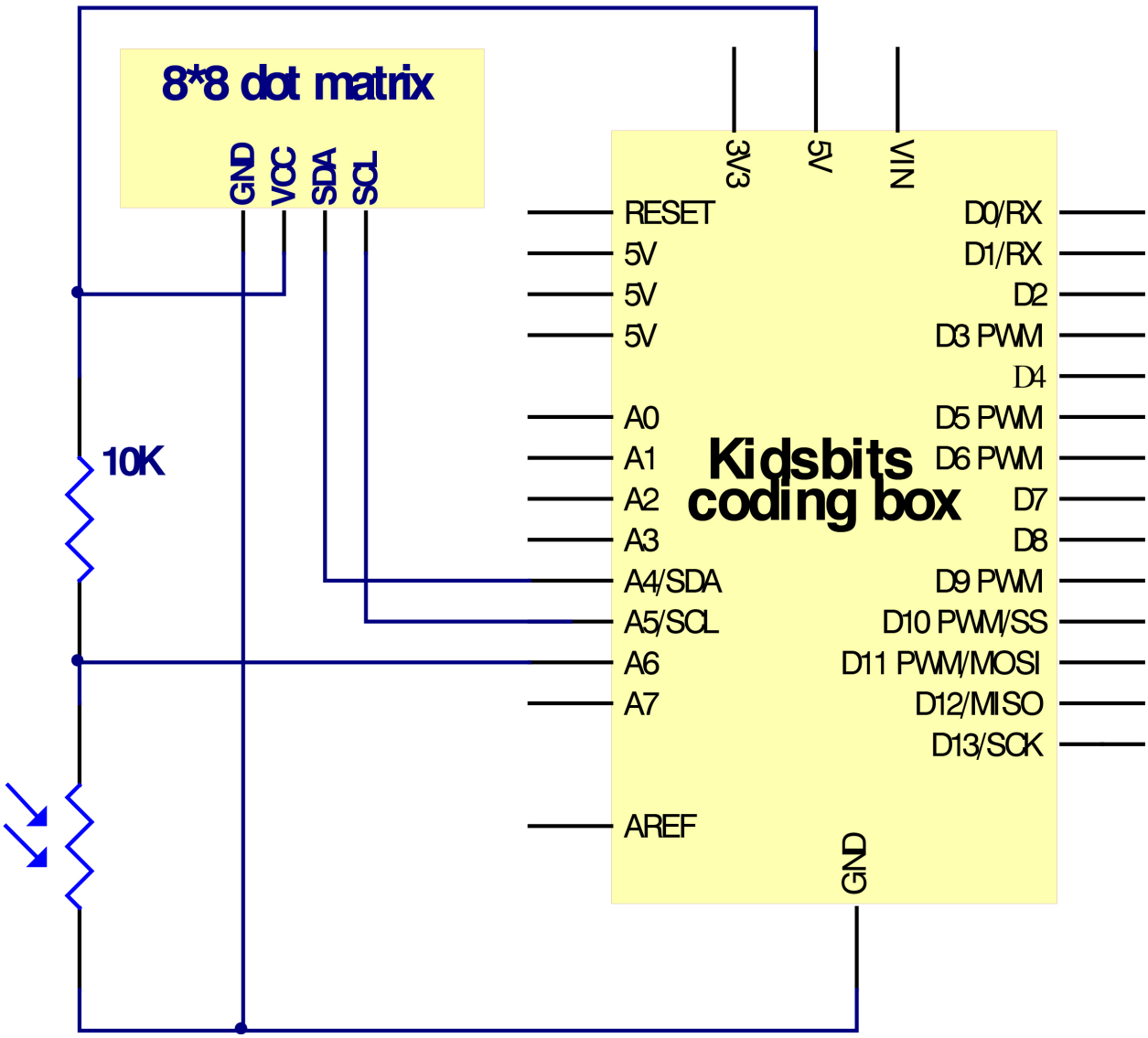
Project Introduction

We have made a night light based on the property of the light sensor that its resistance decreases with the increasing of the light. In this project, we will show you something intriguing too. We will combine the matrix with the light sensor to display the length of the light.

Project Principle

The signal pin of the light sensor is wired with the A6 of the MAX development board. And the light column displayed on the 88 dot matrix will change with the external light detected by the light sensor. When the detected light is darker, the light column displayed is shorter; when the light becomes brighter, the light column gets longer;

Project Circuit



Project Code

```
\*Kidsbits Coding Box

Project 24

88 dot matrix-light control

http//www.kidsbits.cc

*/

\#include <ks_Matrix.h\>

Matrix myMatrix(A4,A5);

int light = A6;
```

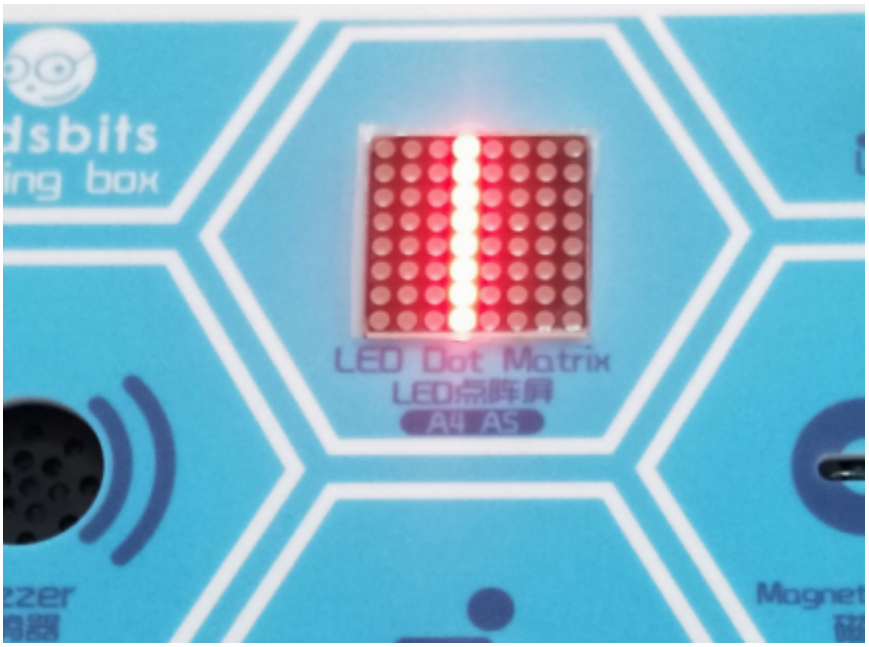
(continues on next page)

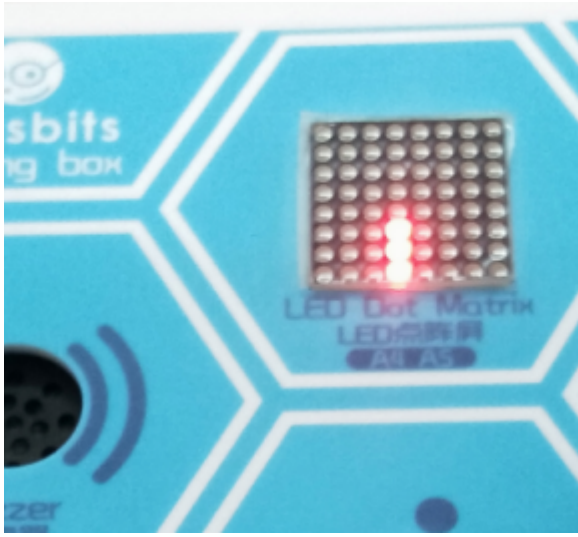
(continued from previous page)

```
int Light_val;

void setup() {

pinMode(A6,INPUT);

myMatrix.begin(112);

myMatrix.clear();

}

void loop() {

Light_val=analogRead(A6);

Light_val=map(Light_val,0,1023,0,15);

myMatrix.clear();

myMatrix.drawLine(3,0, 3,Light_val, 1);

myMatrix.writeDisplay(); // write the changes we just made to the display

delay(10);

}
```

Project Result

After uploading the code to the coding box, the LED dot matrix displays a line when the sensor detect light. And when the light sensor is blocked, the height of the dot matrix decreases.The stronger the light detected by the light sensor, the higher the height of the dot matrix displays.





next project***

4.2.25 Project 25 Sound Sensor+88 Dot Matrix

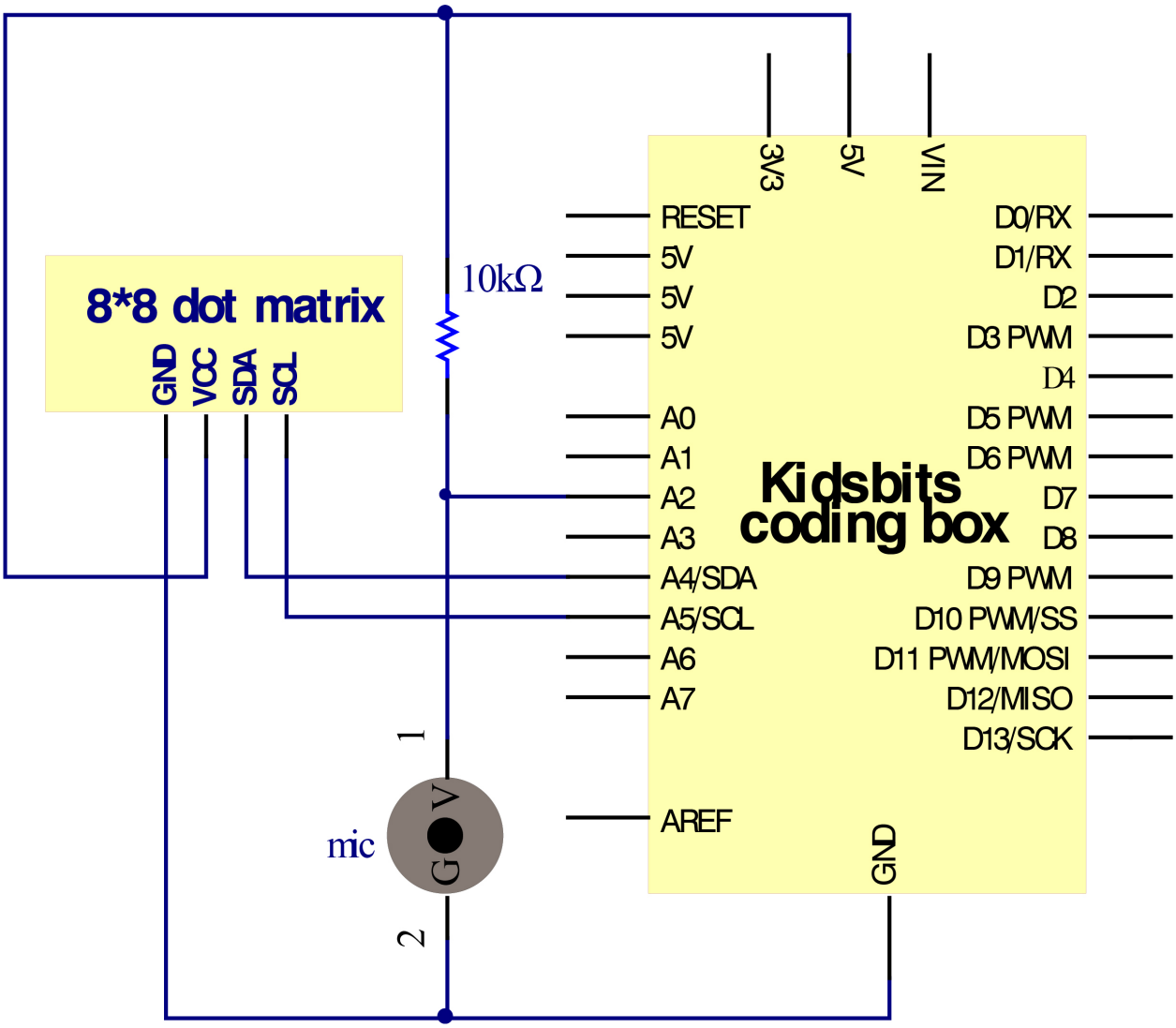
Project Introduction

Previously, we used a sound sensor and LED to make a voice-controlled lamp. Here we will use the sound sensor and the 88 dot matrix to interact together and do some interesting projects.

Working Principle

The signal pin of the sound sensor is connected with the A2 on the MAX development board. And the cycle displayed on the matrix can get bigger as the sound sensed increases.

Project Circuit



Project Code

```
\*Kidsbits Coding Box

Project 25

88 dot matrix-sound control

http//www.kidsbits.cc

*/

\#include \<ks_Matrix.h\>

Matrix myMatrix(A4,A5);

int mic = A2;

int Mic_val;
```

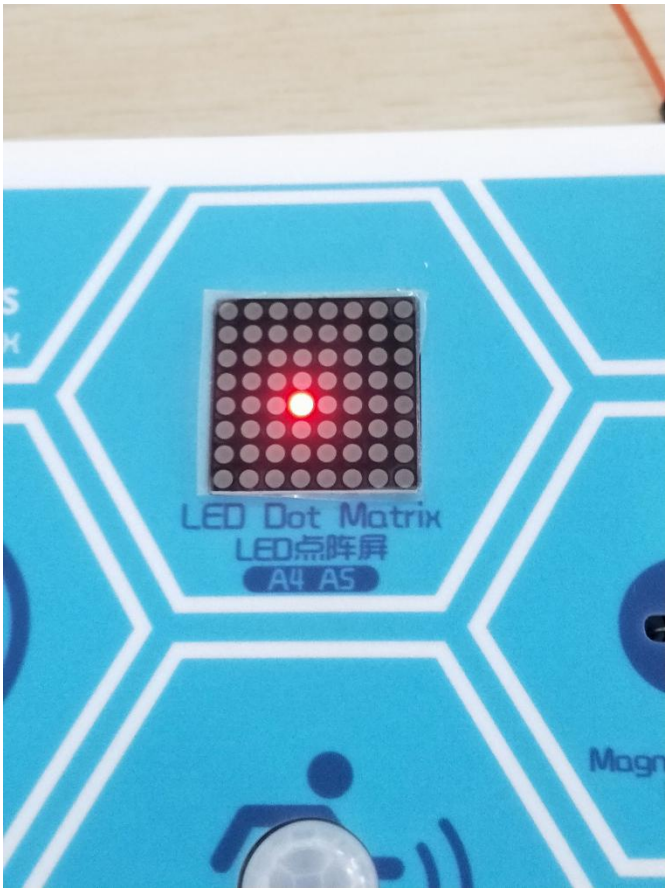
(continues on next page)

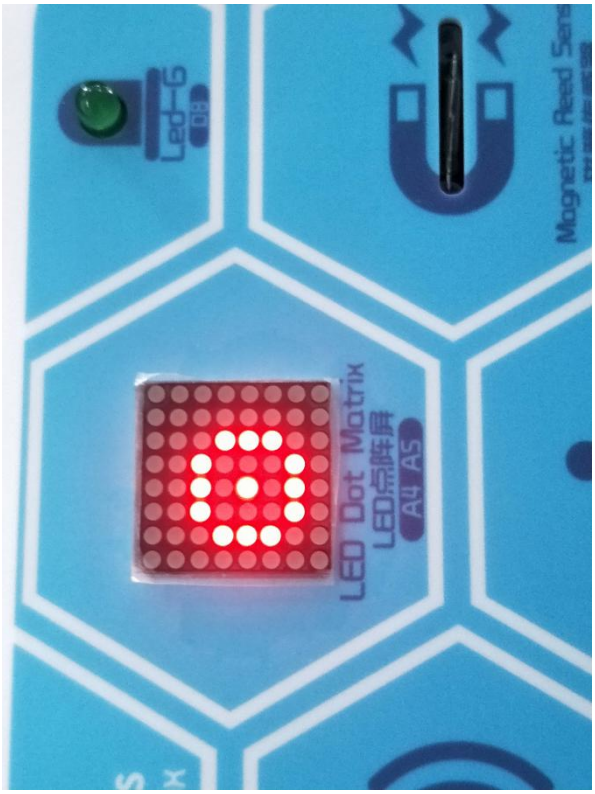
(continued from previous page)

```
void setup() {

pinMode(mic,INPUT);

myMatrix.begin(112);

myMatrix.clear();

}

void loop() {

Mic_val=analogRead(mic);

Mic_val=map(Mic_val,0,1023,0,10);

myMatrix.clear();

myMatrix.drawCircle(3,3,Mic_val, 1);

myMatrix.writeDisplay(); // write the changes we just made to the display

delay(10);

}
```

Project Result

After uploading the code to the coding box, we find that the LED dot matrix displays a dot when the sound sensor detects a sound. When the sound is loud enough, the LED dot matrix displays a circle with a dot as the center. The louder the sound, the larger the circle.


LED Dot Matrix
LED点阵屏
A4 A5


Led-G
LED Dot Matrix
LED点阵屏
A4 A5
Magnetic Reed Sens

CHAPTER

FIVE

KIDSBLOCK TUTORIAL

5.1 Getting started with kidsblock

Instruction

The Kidsblock, based on the Scratch graphical programming software, integrates multiple mainstream mainboards, sensors as well as modules. It can be programmed by dragging graphical blocks and using the C/C++ programming language, making programming easy and interesting for children to learn.

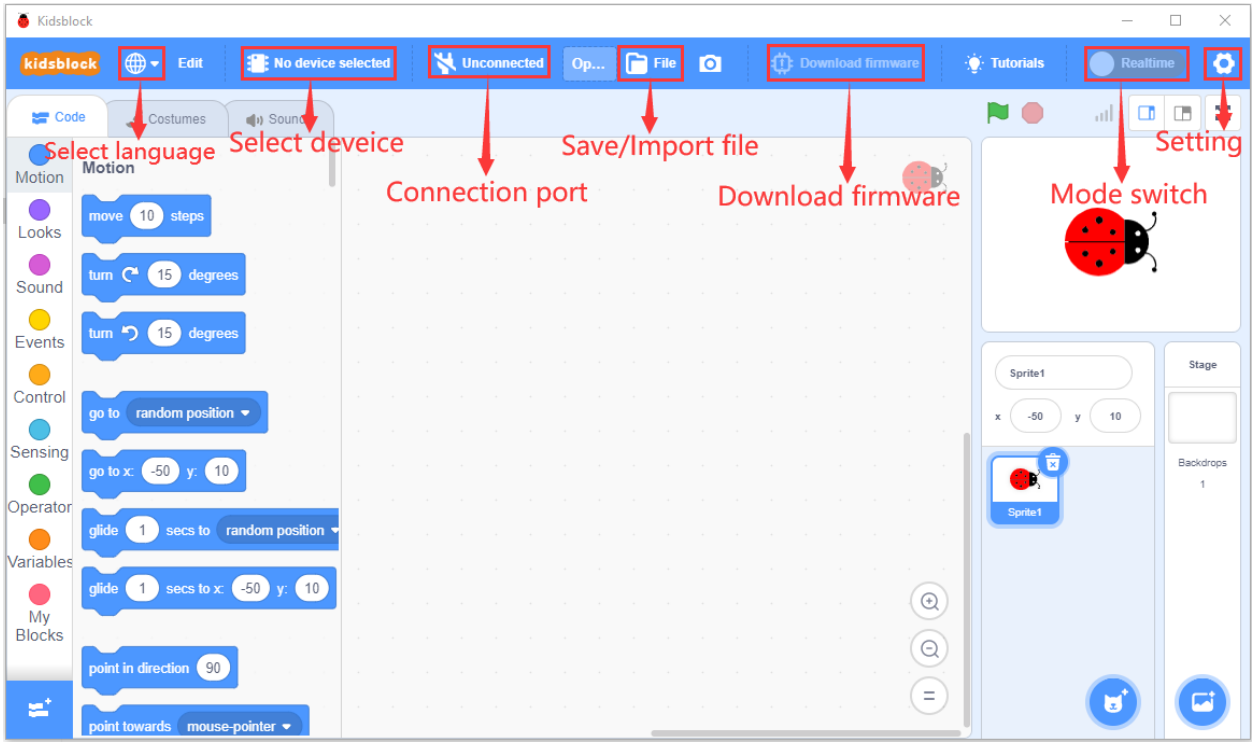
Download and install KidsBlock software

Windows system

MACOS system

How to use KidsBlock

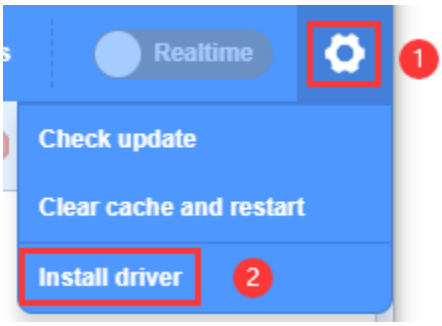
Interface



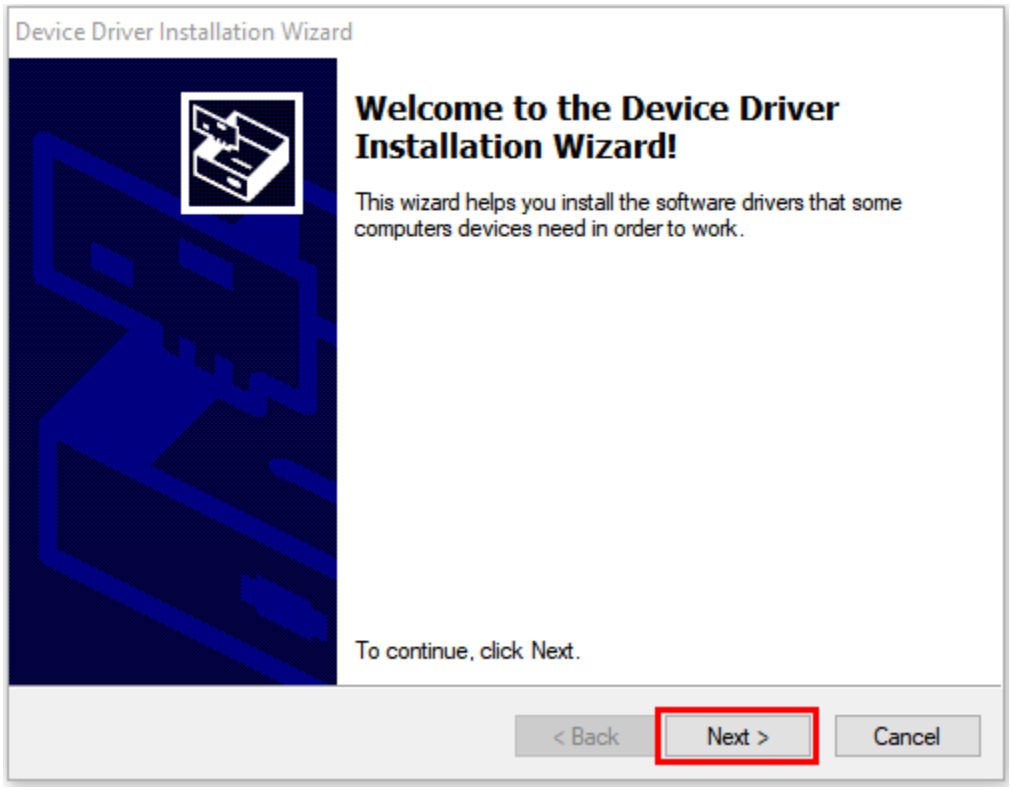
Click to switch to different languages

3. Click  to select“**Install driver**”.

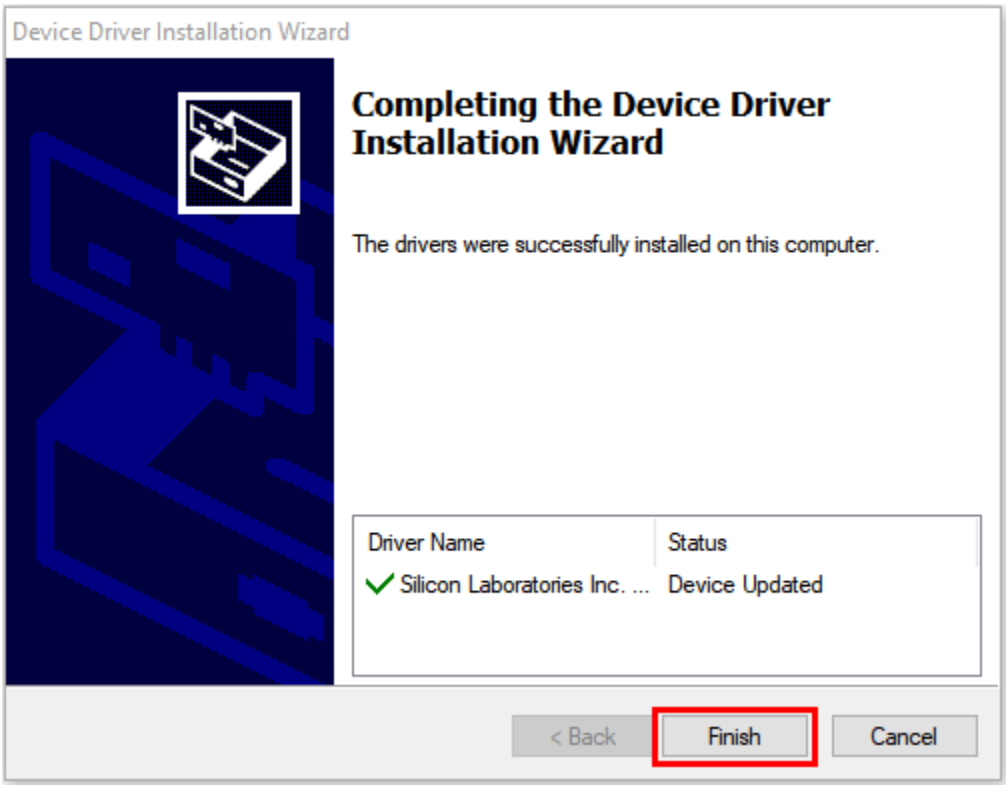
Note: If the driver is not installed, as shown below;



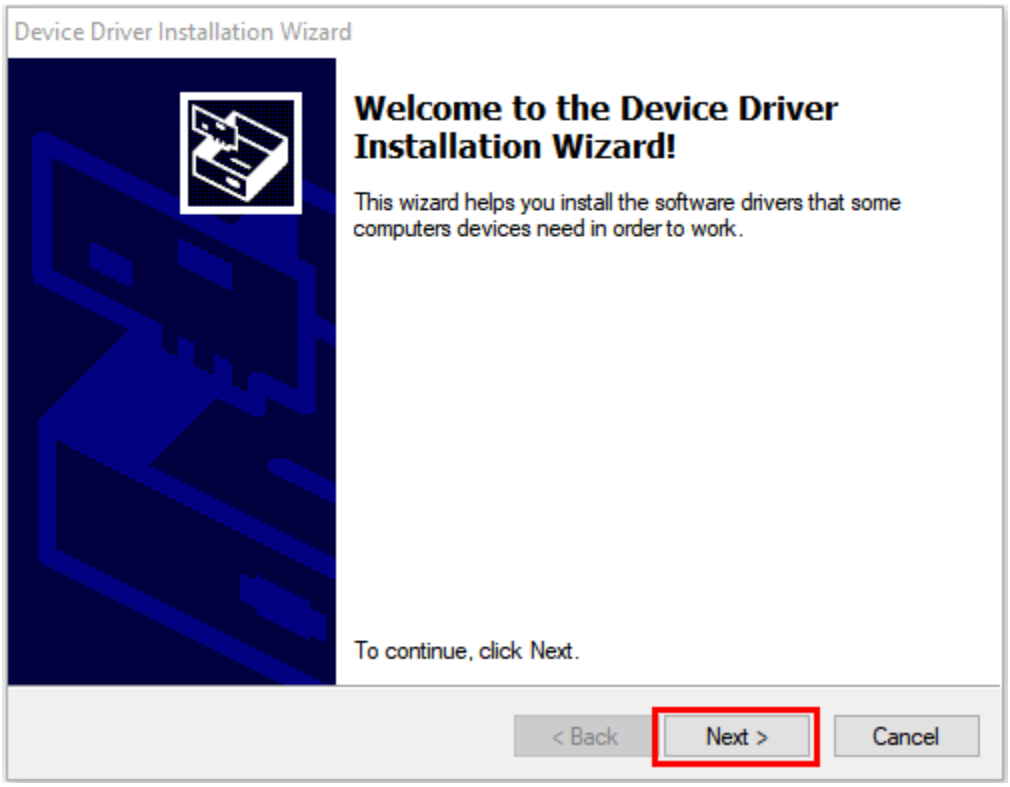
Click “Next” at the **Device Driver Installation Wizard** page.



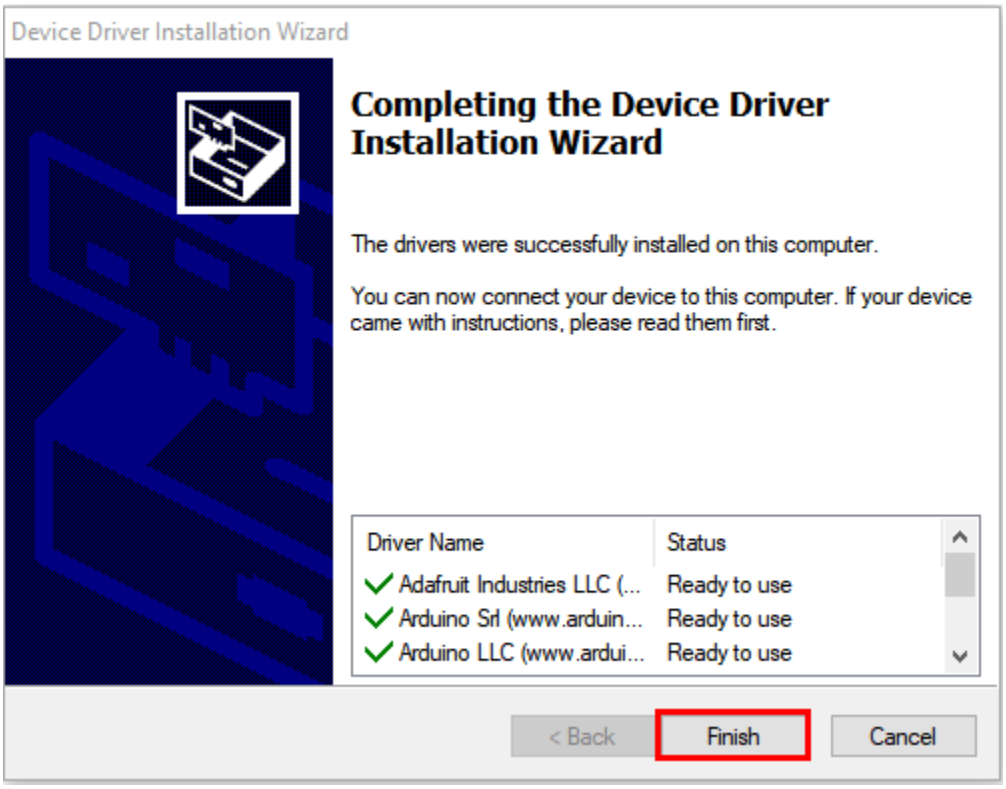
After a while, click“Finish”



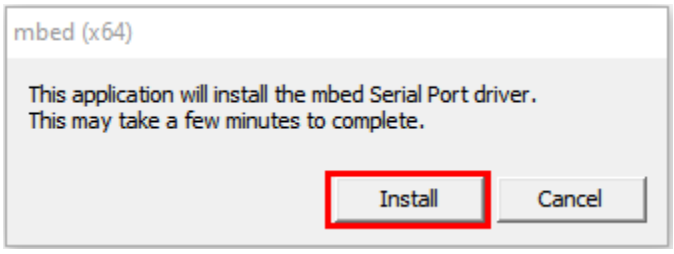
Then click“Next”.

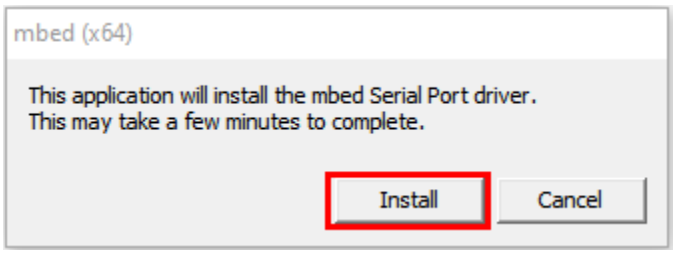


And click“Finish”.

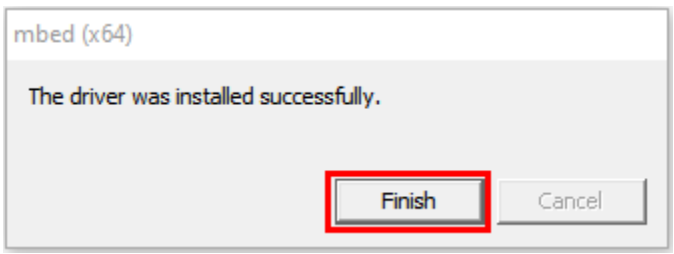


Then click“**Allow**”and“**Install**”

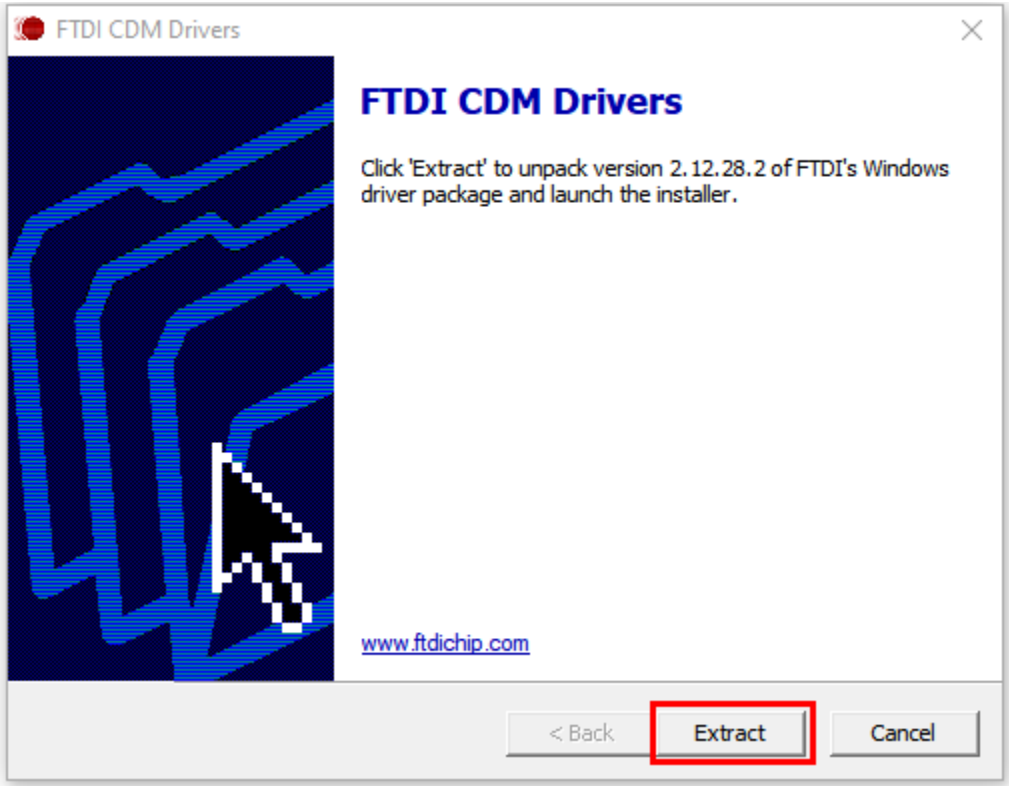




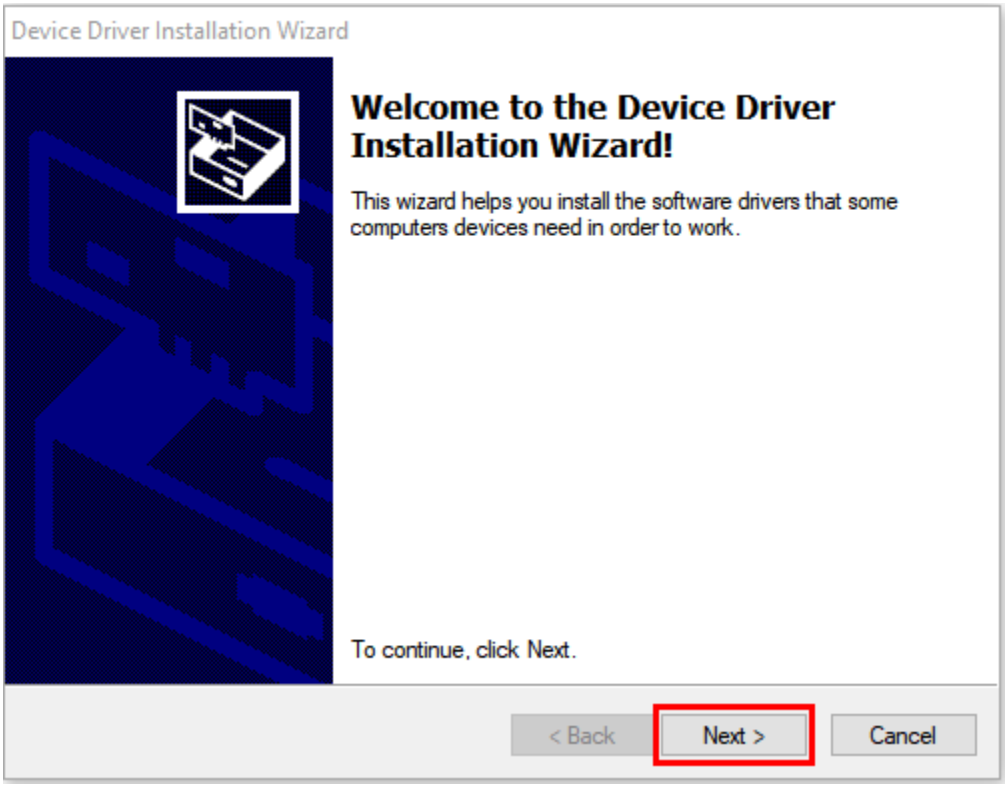
After a whileclick“Finish”



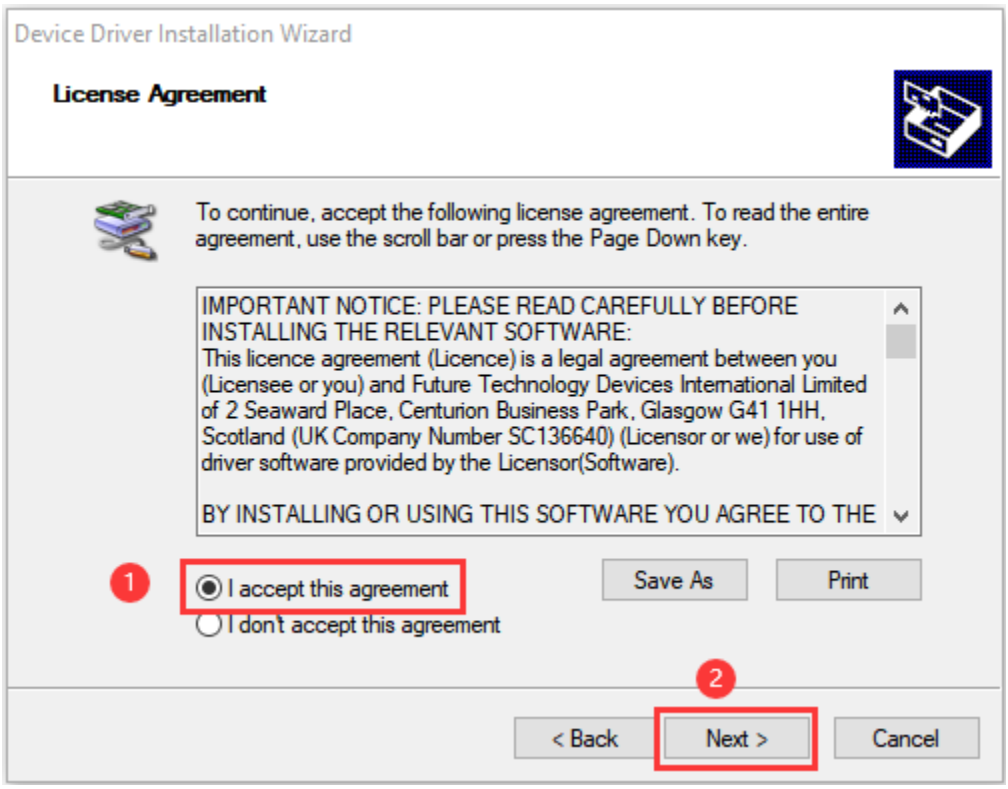
Select“Extract”



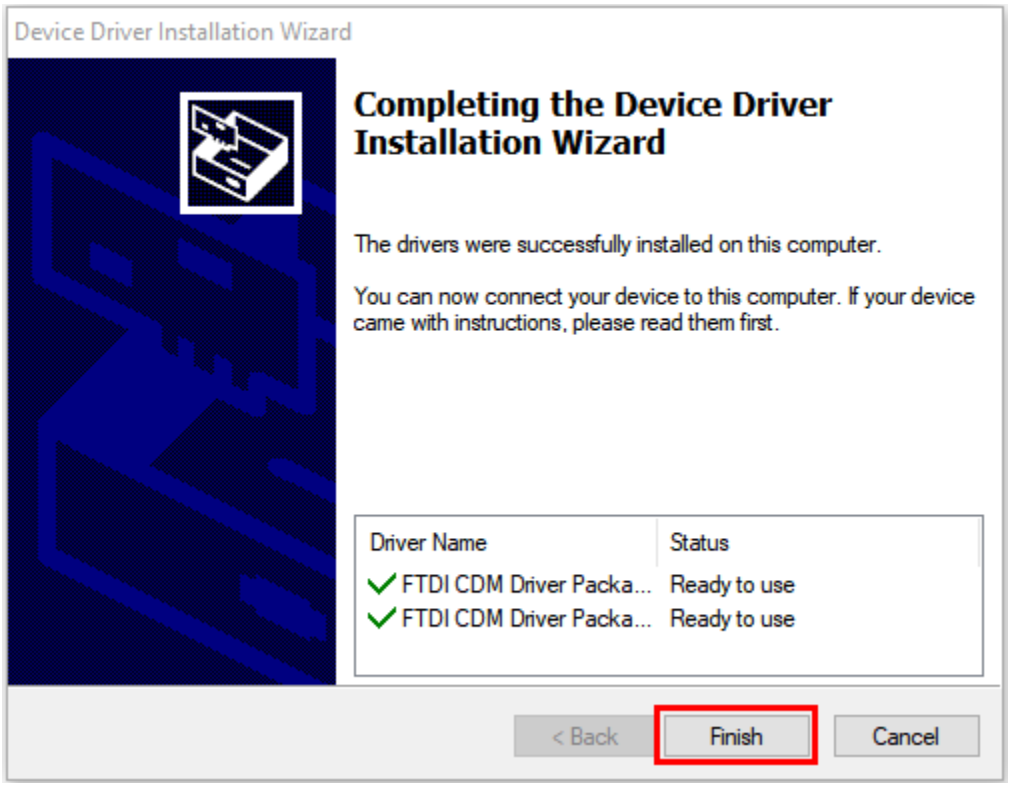
Click“**Next**”



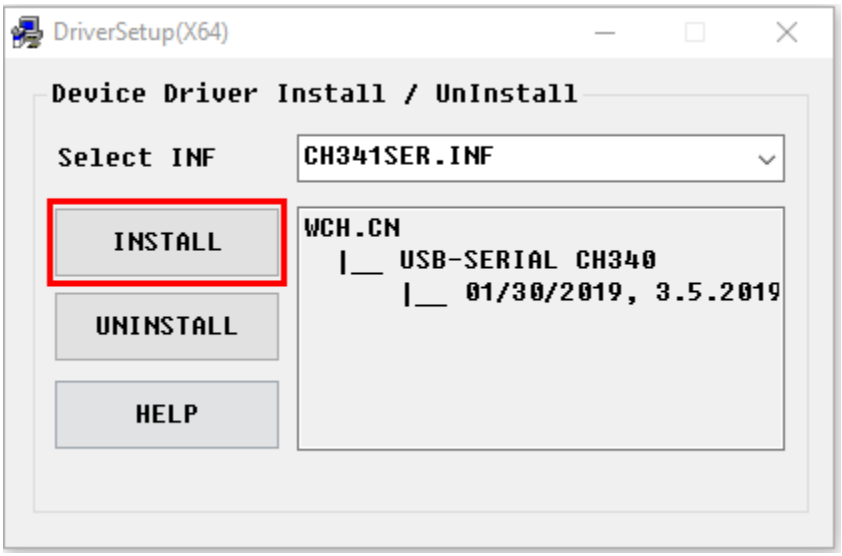
Next, click“**I accept this agreement**”and“**Next**”



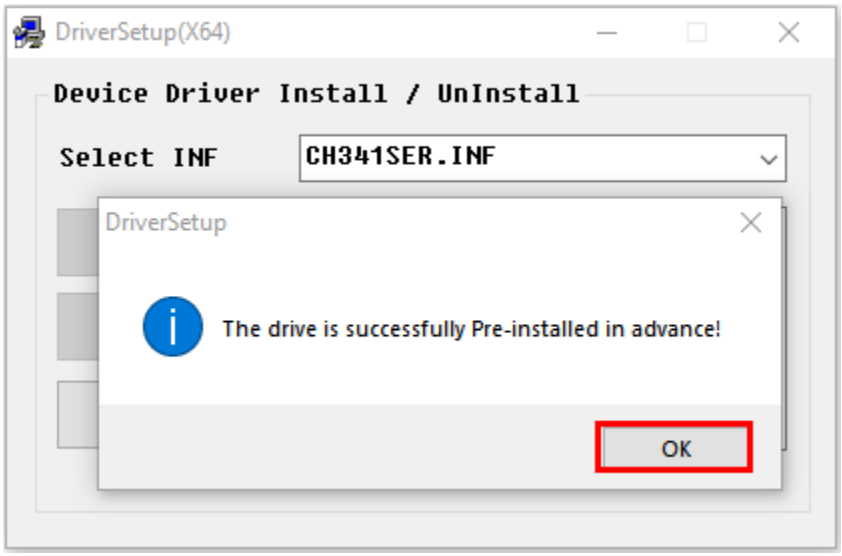
Click“Finish”.



After a while, click“**INSTALL”**



After a few seconds, when the driver is installed, just click"**OK**"



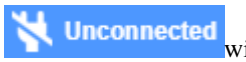
Click 

to enter the main page, select the control board needed. In this project, we select"**Codingbox**"and click **Connect,** then it is connected.

Click **Go to Editor** to return the code editor.

Icon 

will change into 

and 

will change into 

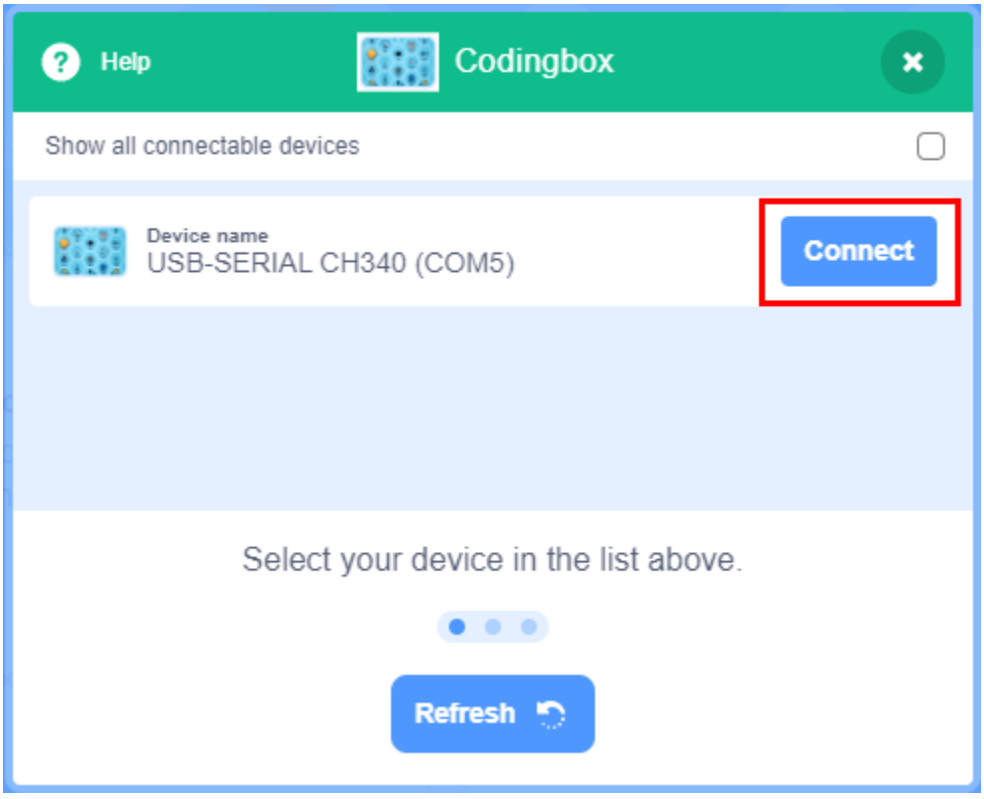
. This means the **Codingbox** and portsCOMare connected.

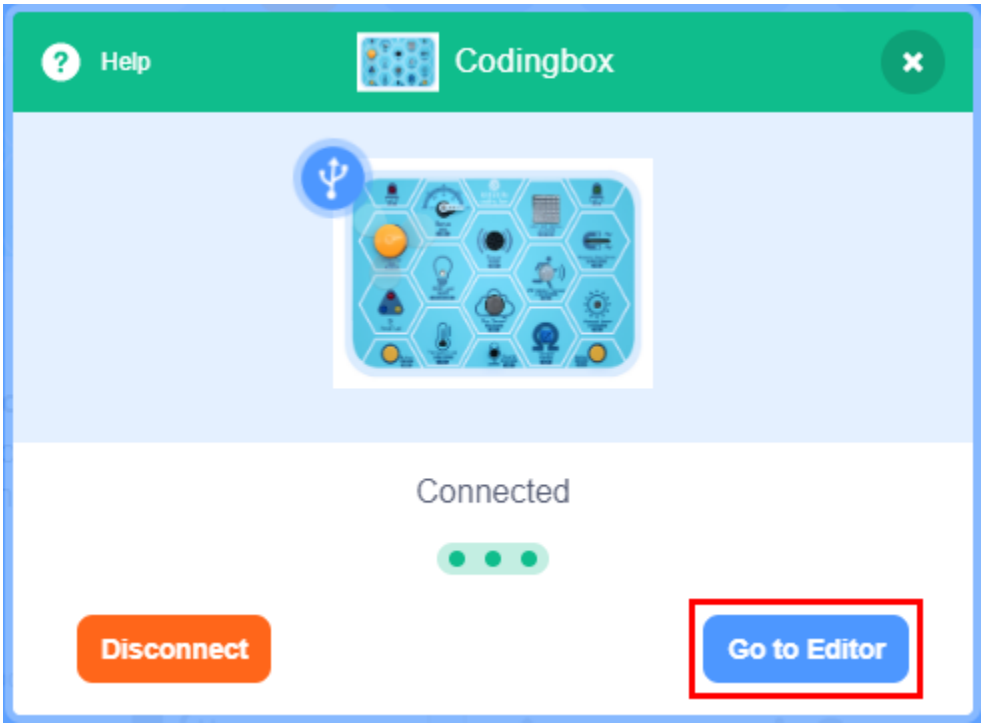
Codingbox

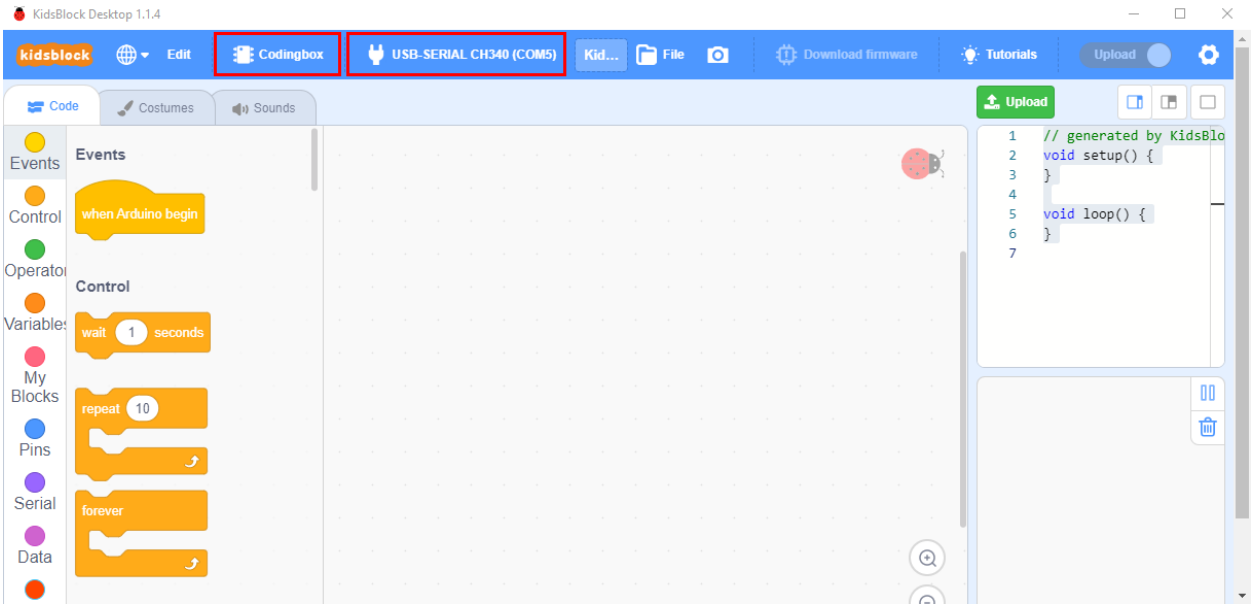
Coding box Based on Arduino STEM Education

Requires	Manufactor
	kidsbits

Program mode	Program language



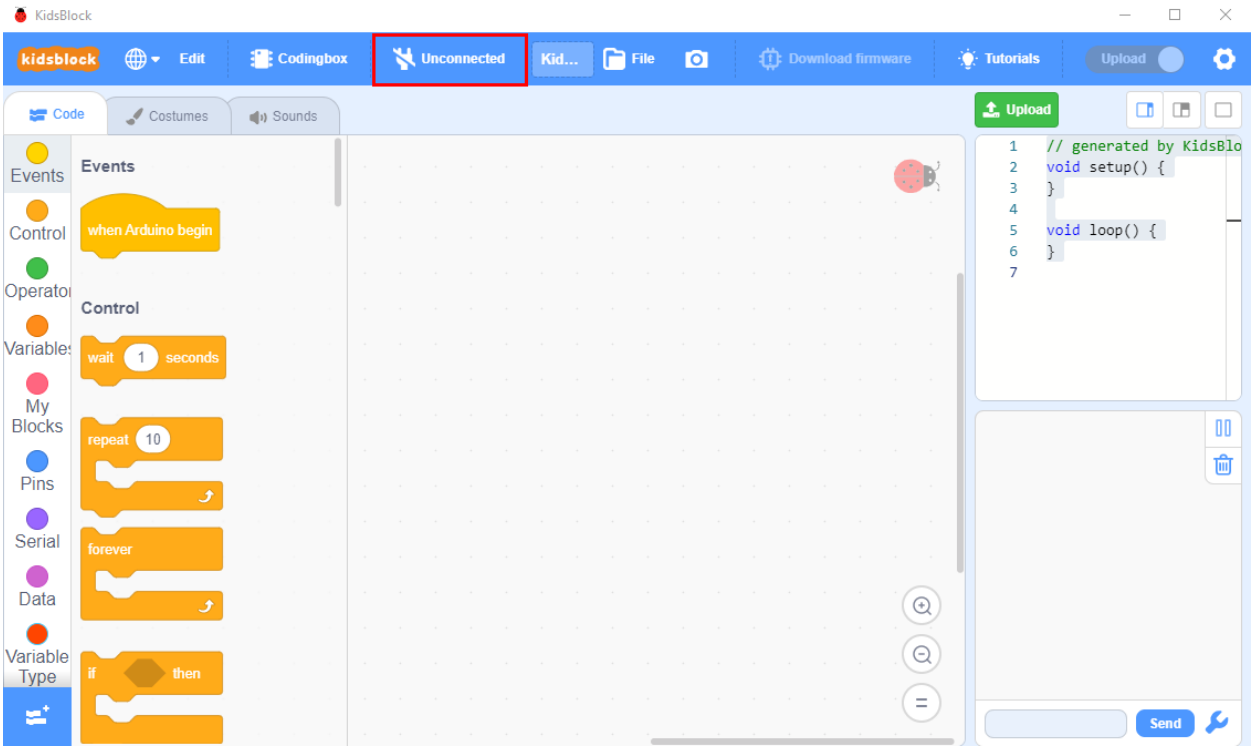


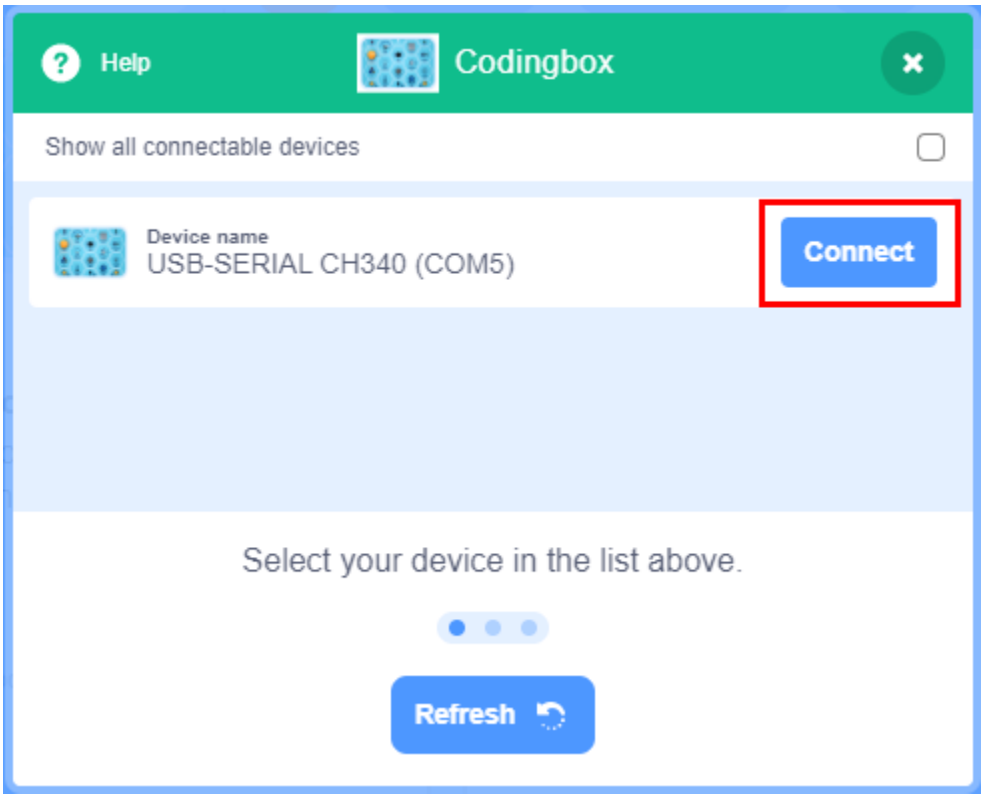


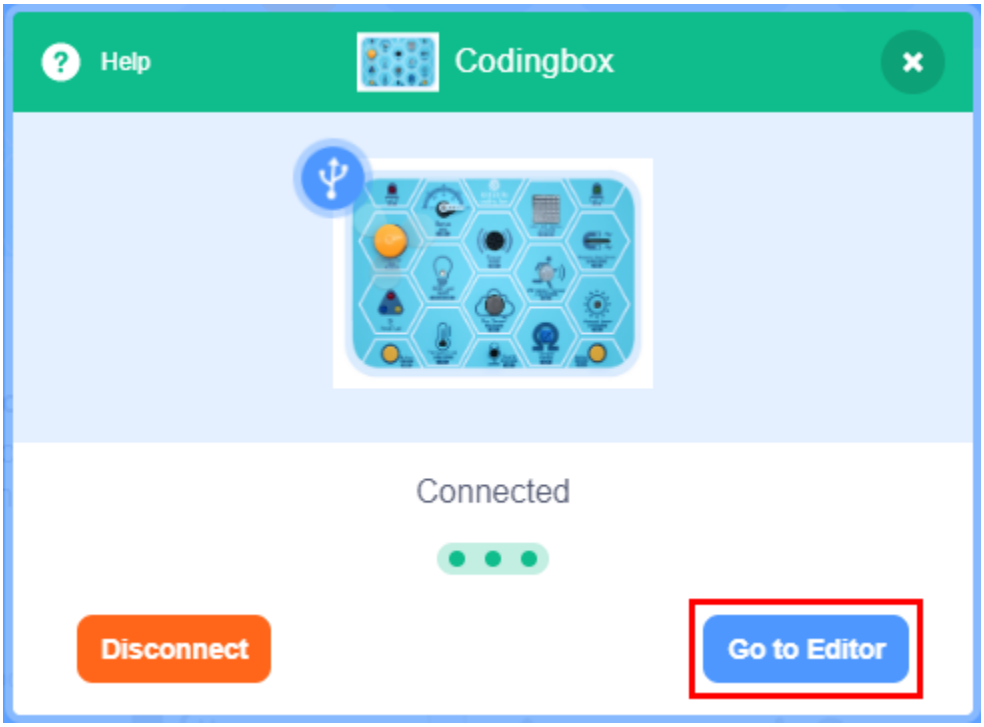
If the"**Codingbox**" is connected , but icon Unconnected doesn't change into USB-SERIAL CH340 (COM5). You need to click Unconnected to connect the COM port.

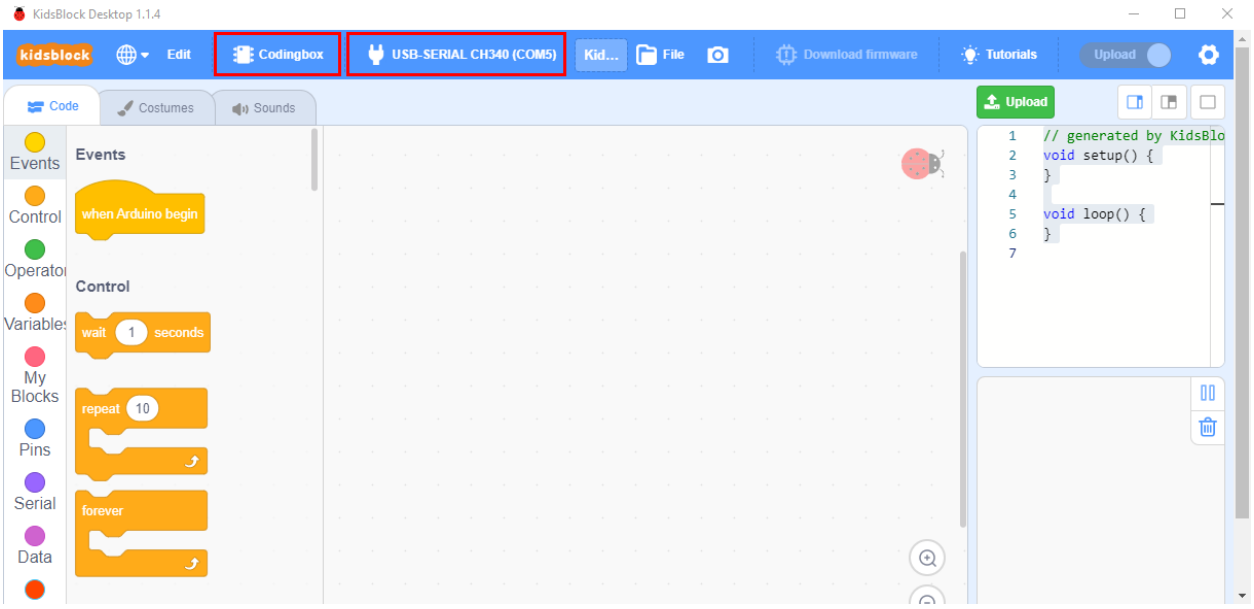
Click Unconnected and **Connect.**

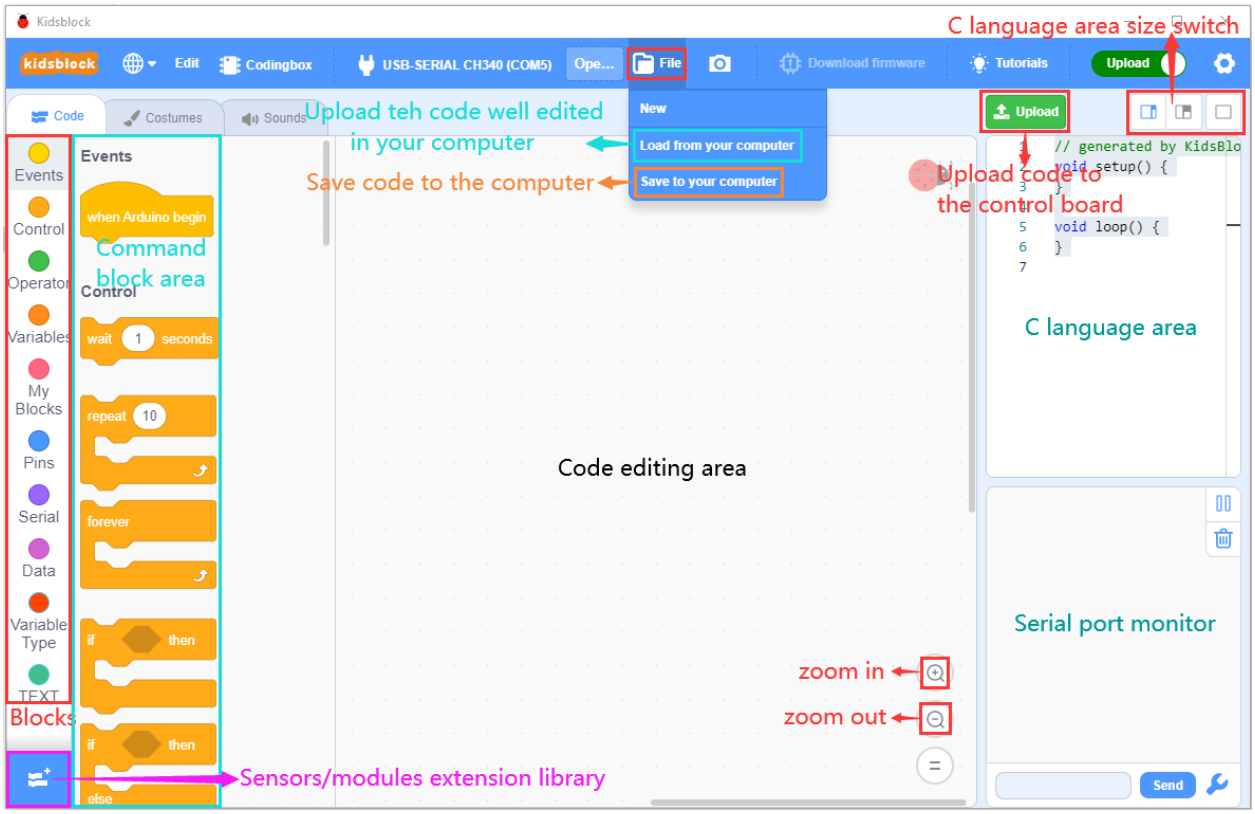
Then you will find a page pop up, showing **Connected.**


KidsBlock
kidsblock
Edit
Codingbox
Unconnected
Kid...
File
Download firmware
Tutorials
Upload
Code
Costumes
Sounds
Events
Control
Operator
Variables
My Blocks
Pins
Serial
Data
Variable Type
Events
when Arduino begin
Control
wait 1 seconds
repeat 10
forever
if then
Upload
1 // generated by KidsBlo
2 void setup() {
3 }
4
5 void loop() {
6 }
7
Send

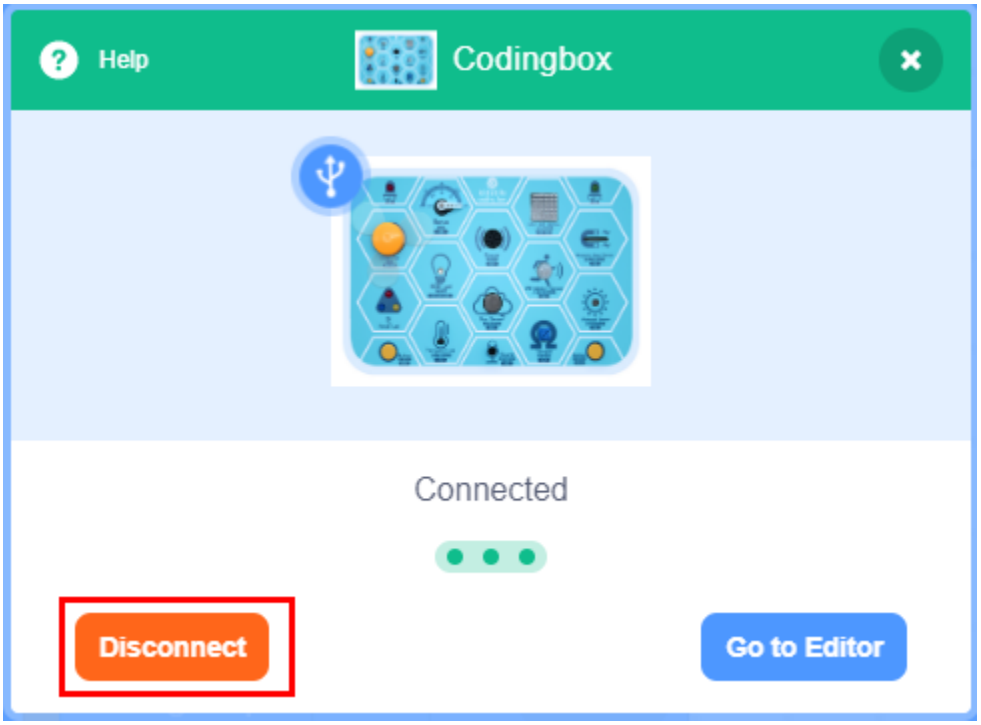

Help
Codingbox
Show all connectable devices
Device name
USB-SERIAL CH340 (COM5)
Connect
Select your device in the list above.
Refresh


Help
Codingbox
Connected
Disconnect
Go to Editor

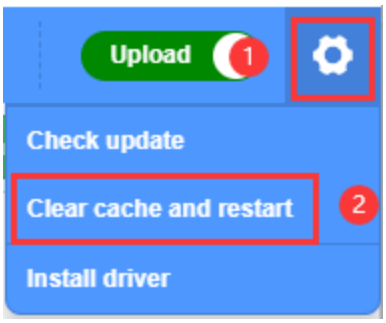

KidsBlock Desktop 1.1.4
kidsblock
Edit
Codingbox
USB-SERIAL CH340 (COM5)
Kid...
File
Download firmware
Tutorials
Upload
Code
Costumes
Sounds
Events
Control
Operator
Variables
My Blocks
Pins
Serial
Data
Events
when Arduino begin
Control
wait 1 seconds
repeat 10
forever
Upload
// generated by KidsBlo
void setup() {
}
void loop() {
}



To disconnect the port, just click USB-SERIAL CH340 (COM5) and **Disconnect**



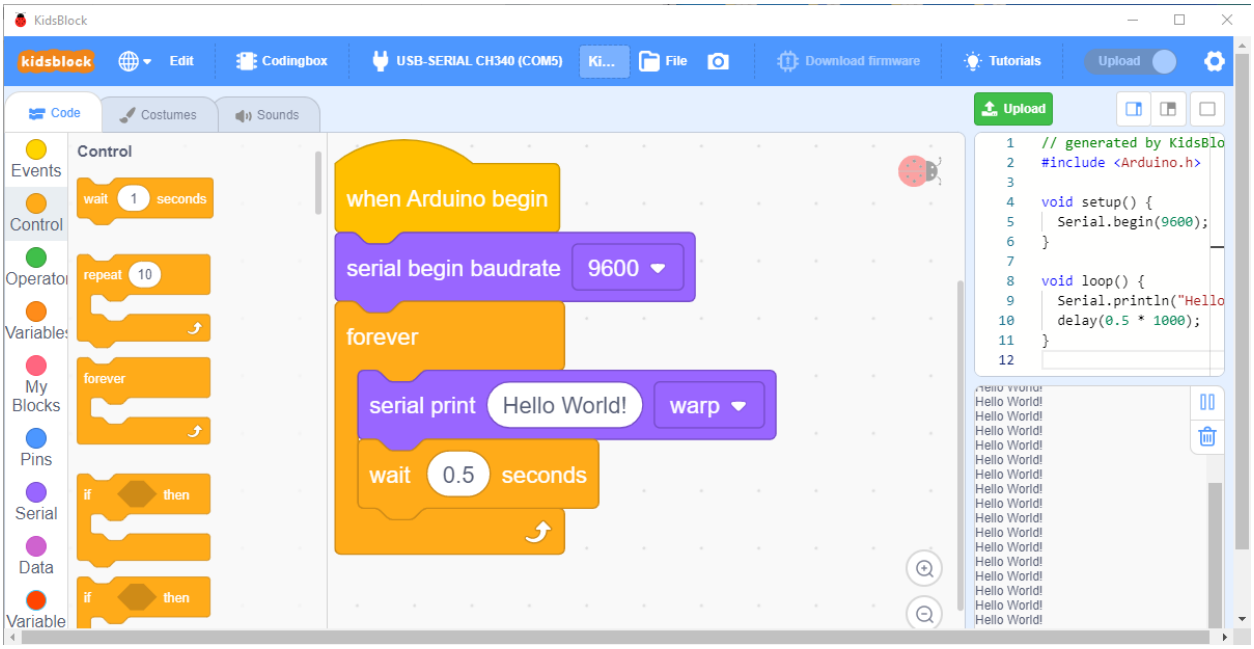
Note: if you want to update libraries of KidsBlock, click then Clear cache and restart



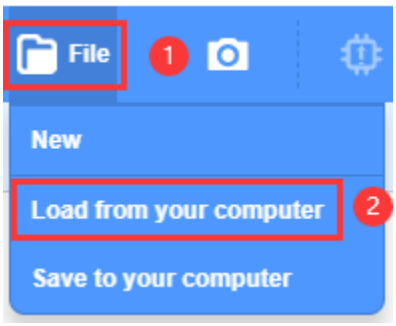
How to open SB3 type files

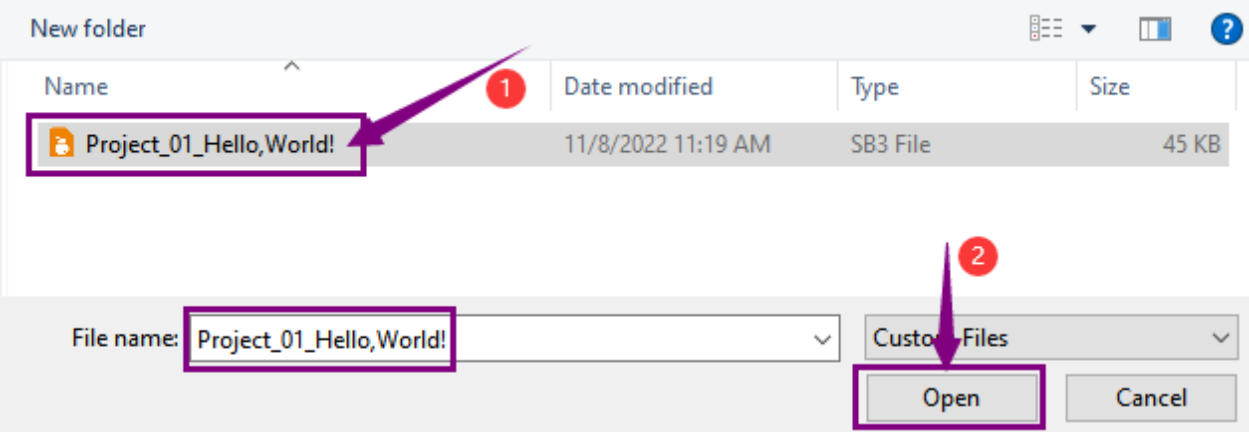
1Double-click SB3 type files to open them.

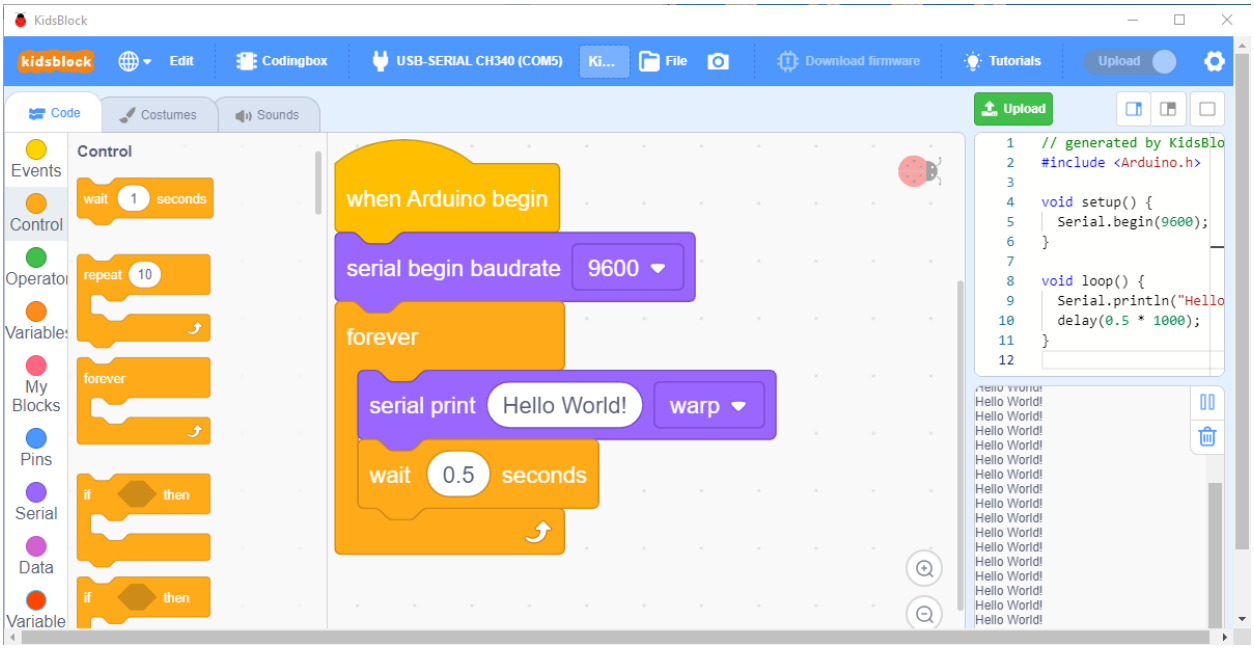
For instance, open Project_01_Hello,World! , then we need to double-click Project_01_Hello,World! .



Open Kidsblockclick **file and Load from your computer**then select the SB3 type file on the computer.for example Project_01_Hello,World!







5.2 Projects

5.2.1 Project 01:Hello,World!

Project Introduction

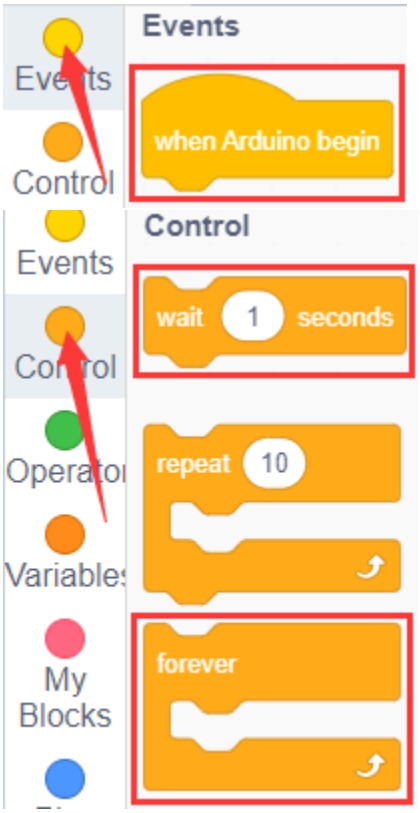
As for starters, we will begin with something simple. In this project, you only need a Mainboard and a USB cable to start the “Hello World!” project. It is not only a communication test of your Arduino and PC, but also an enlightening project for you to have your first try in the Arduino world!

Project Code

After installing driver for Scratch, let’s open Scratch software and compile code that enables Scratch to print “Hello World!” .

Look for Code Blocks

You can drag blocks to edit. Blocks listed below are for your reference

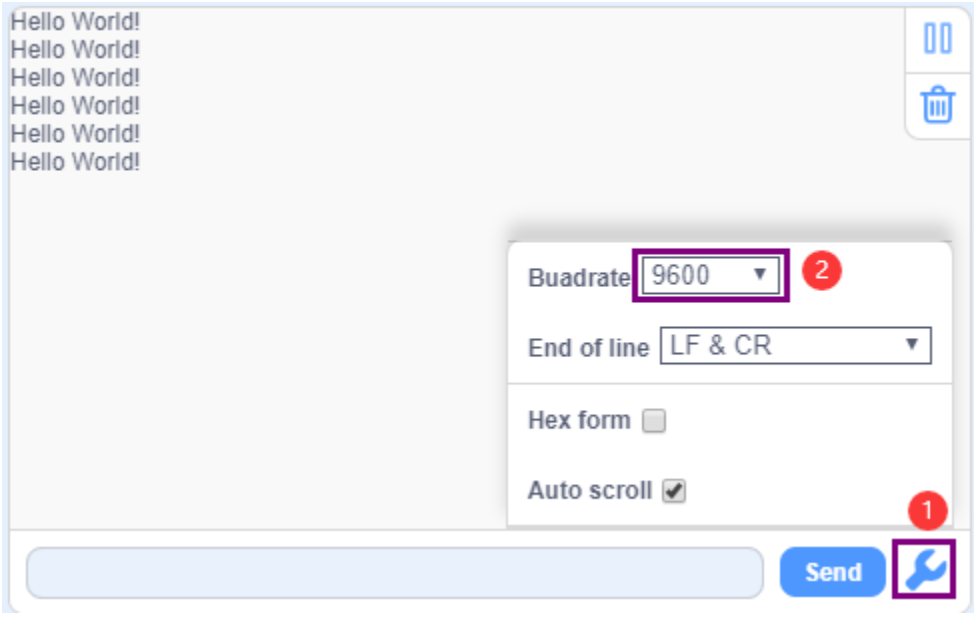


Complete Program

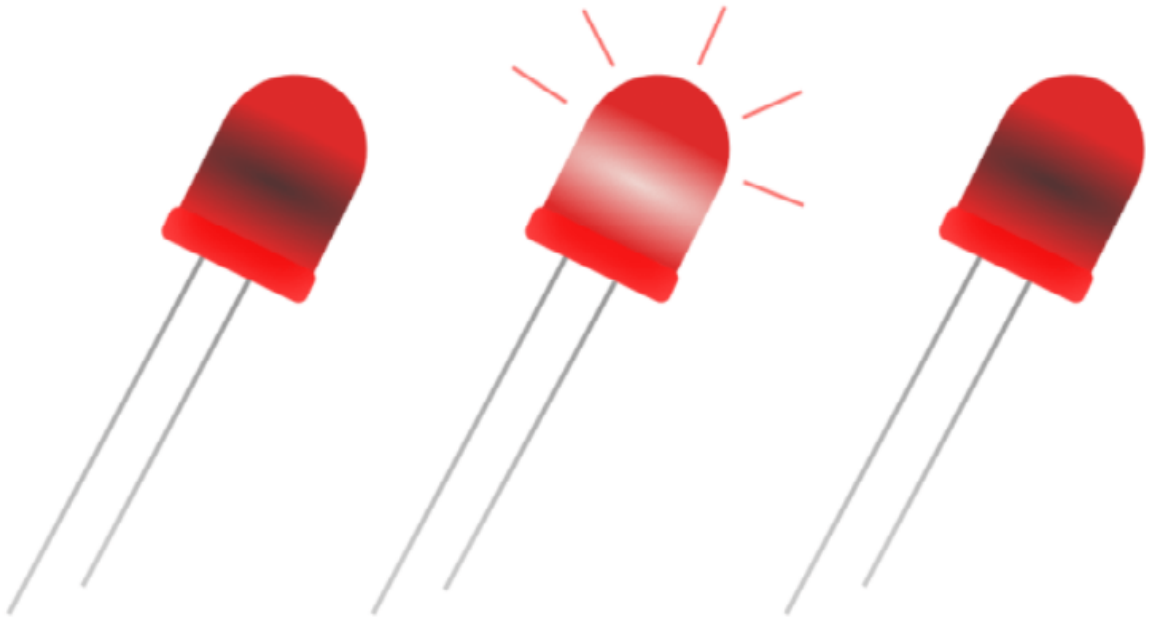
Project Result

Click 

to upload the program, after uploading it successfully, click  to set the baud rate to 9600, then the serial monitor will print “Hello World!”.



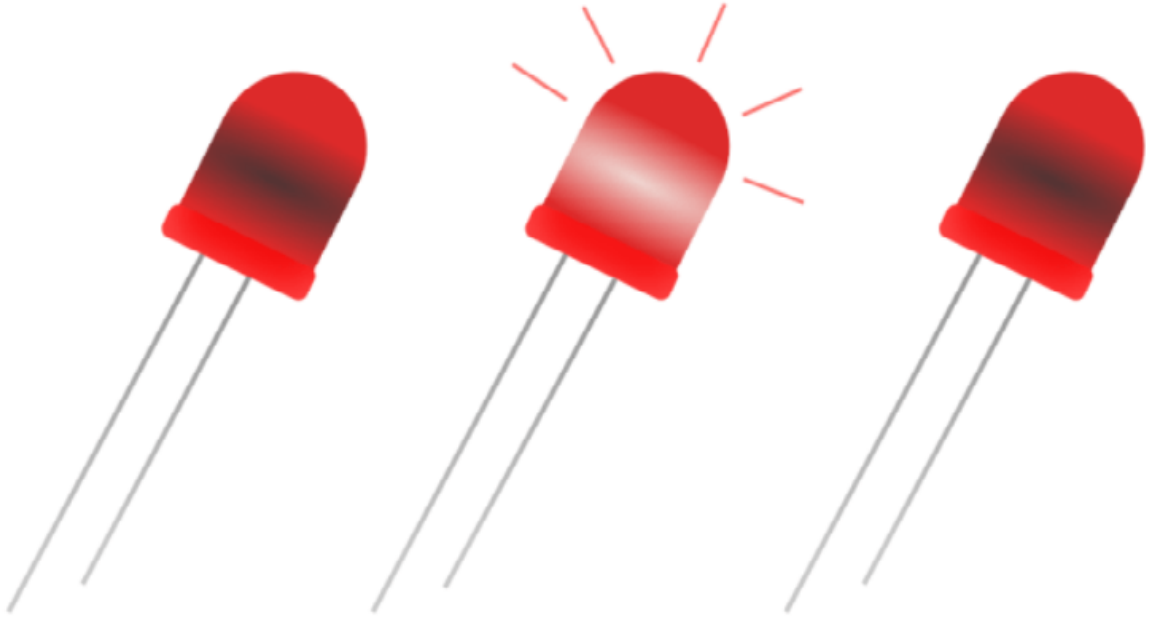
5.2.2 Project 02: Blink



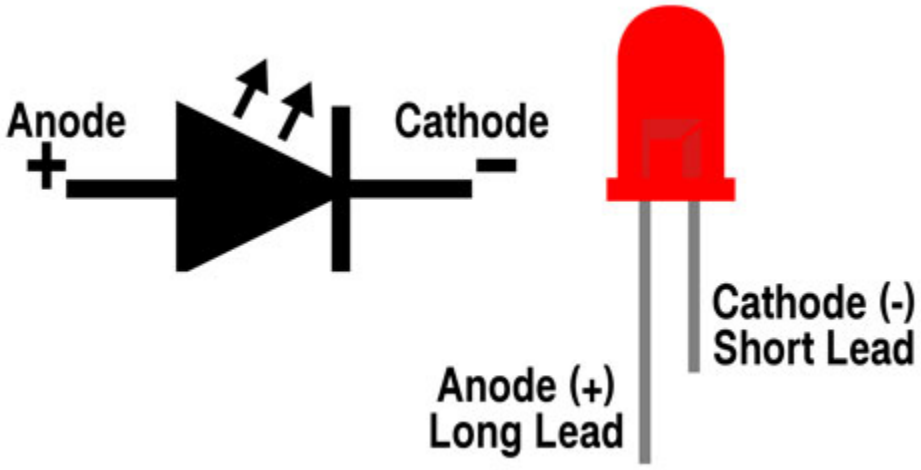
Project Introduction

In this project, we start to learn the digital output of Arduino. We will use the digital pin of Arduino to turn on an LED and let it blink.

Working Principle



LED is a type of semiconductor called “Light Emitting Diode “which is an electronic device made from semiconductor materials (silicon, selenium, germanium, etc.). It is dubbed indicator, digital and word display in circuit and device. It has positive and negative poles. The short leg is the negative pole, and the long one is the positive pole.



Circuit Connection

Project Code

Look for Code Blocks

You can drag blocks to edit. Blocks listed below are for your reference

Complete Program

Project Result

Click 

to upload the code to the coding box successfully, you can see that the red LED of D7 starts blinking, which is on for 1 second and off for 1 second.

5.2.3 Project 03: SOS

Project Introduction

The S.O.S distress signal is an international Morse code distress signal asking for help. Morse code is a character encoding. Each letter of English is composed of different combinations of bars and dots. The advantage of this is that using the simple two symbols all letters and numbers can be transmitted, which is very simple!

Working Principle

The letters can be spelled out through the two states of the LED switch, using long flashing and short flashing to indicate dots and bars. Just spell the three letters S.O.S.

By consulting the Morse code table, we can know that the letter "S" is represented by three dots, and we use short blinking instead, and the letter "O" is represented by three horizontal bars, which is replaced by long blinking here.

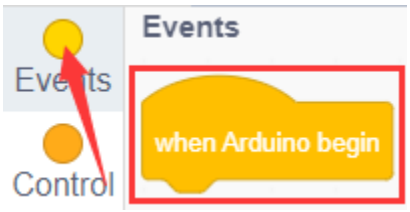
Morse Code Meter					
Character	Code Symbol	Character	Code Symbol	Character	Code Symbol
A	• —	N	— •	1	• ————
B	— • • •	O	———	2	• • ———
C	— • — •	P	• ——— •	3	• • • ——
D	— • •	Q	—— • —	4	• • • • —
E	•	R	• — •	5	• • • • •
F	• • — •	S	• • •	6	— • • • •
G	—— •	T	—	7	—— • • •
H	• • • •	U	• • —	8	——— • •
I	• •	V	• • • —	9	———— •
J	• ———	W	• ———	0	—————
K	— • —	X	— • • —	?	• • —— • •
L	• — • •	Y	— • • ——	/	— • • — •
M	——	Z	—— • •	( )	— • —— • —

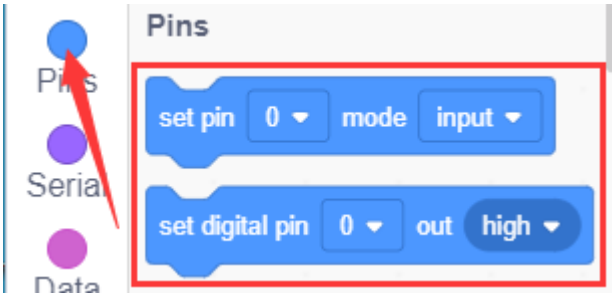
Circuit Connection

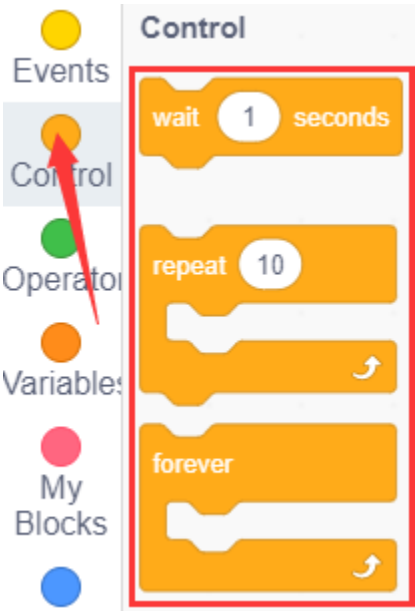
Project Code

Look for Code Blocks

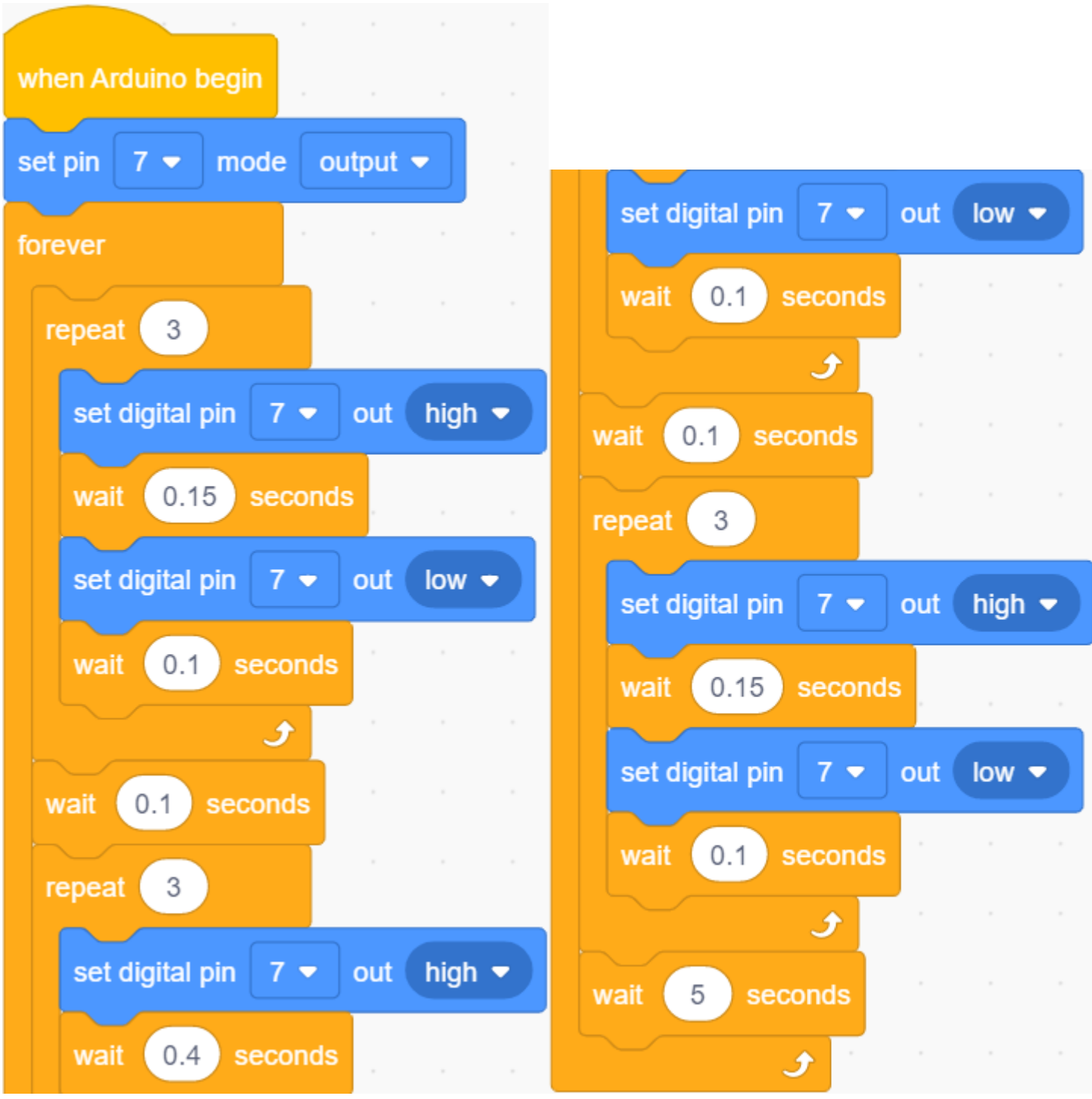
You can drag blocks to edit. Blocks listed below are for your reference







Complete Program



Project Result

Click Upload to upload the code to the coding box successfully, you can see that the red LED at D7 fast flash 3 times and then slowly flash 3 times alternatively, which can stimulate SOS alarm in Morse code.

5.2.4 Project 04: PWM

Project Introduction

In this project, we will learn the PWM control of ARDUINO. PWM is the abbreviation of Pulse Width Modulation, which is a technology that encodes analog signal level into digital signal level. We will use PWM to control an LED gradually from bright to dark.

Working Principle

The PWM signal stands for Pulse Width Modulation, and is a technique for controlling the brightness of the LED and the speed of the DC motor and servo motor. The Arduino digital pins either produce 5V(when turned high) or 0V(when turned low).

However, PWM outputs a square wave signal. So if we want to dim the LED, we can't get the voltage between 0 and 5V from the digital pins, but we can change the ON (on) and OFF (off) times of the signal. If we will change the on and off time fast enough, then the brightness of the led will change.

Output voltage = (turn on time/pulse time) * maximum voltage value

PWM has many applications like lamp brightness regulating, motor speed regulating, sound making, etc.

The following are the three basic parameters of PMW.

Duty cycle: The percentage of time when the signal is at a high level during a certain period of time

2. The pulse period (The reciprocal of pulse frequency in one second)

3. The voltage levelsuch as 0V-5V

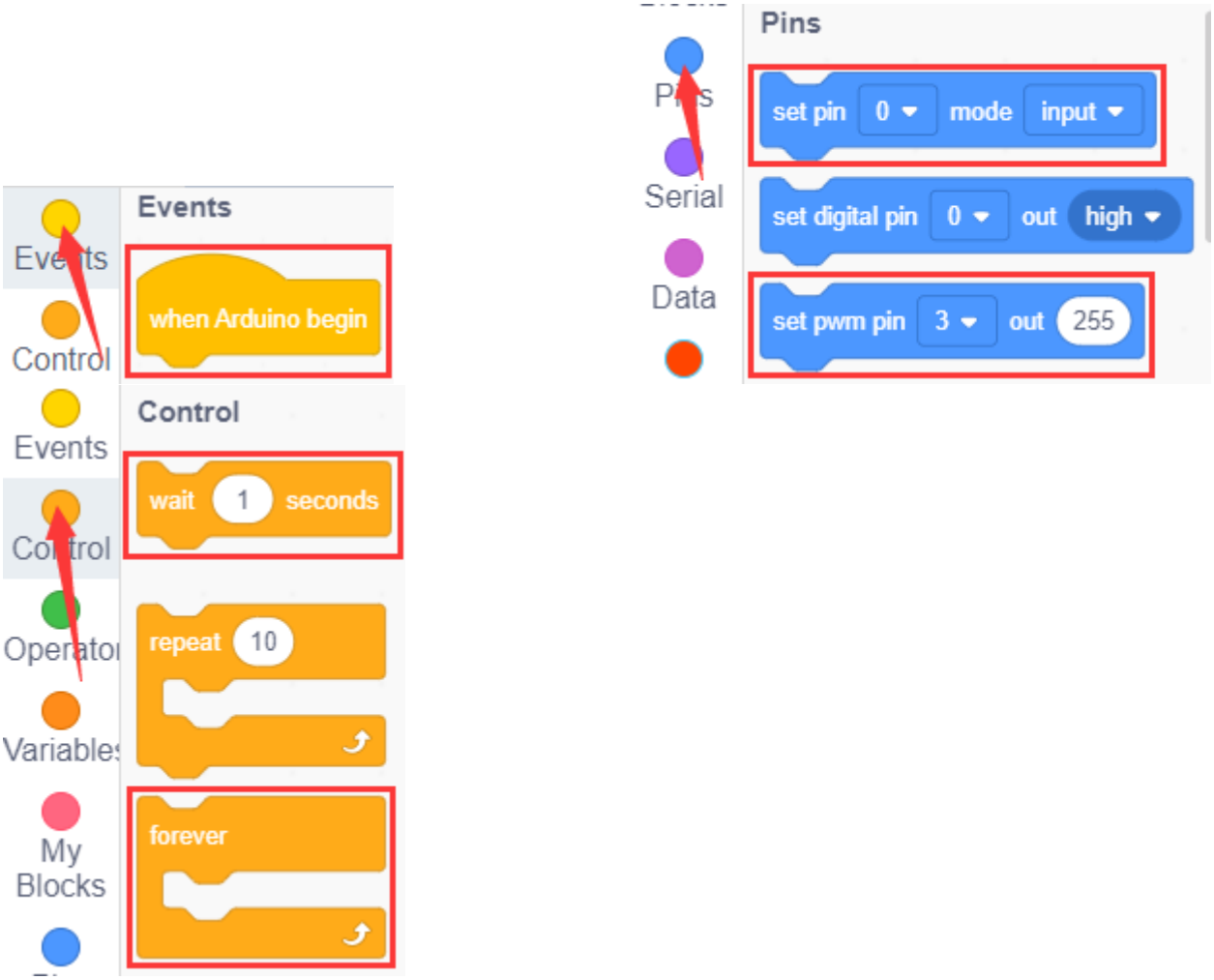
There are 6 PMW interfaces on Arduino, namely digital pin 3, 5, 6, 9, 10, and 11.

3. Circuit Connection

Project Code

Look for Code Blocks

You can drag blocks to edit. Blocks listed below are for your reference



Complete Program

Project Result

Click 

to upload the code to the coding box successfully, you can see the blue light in the RGB on the coding box constantly brightening and dimming, just like a breathing light.

5.2.5 Project 05: RGB

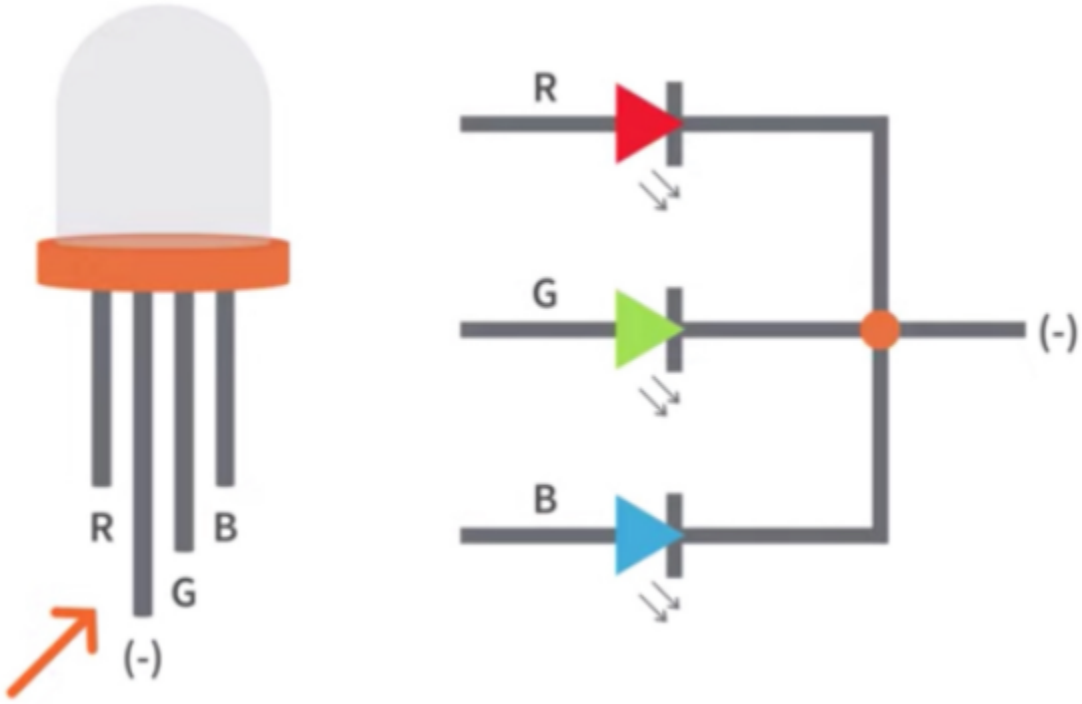
Project Introduction

In this project, we will introduce RGB to you and show you how to control it to emit different colors of light.

Working Principle

The RGB color mode is a color standard in the industry. It obtains various colors by changing the three color channels of red (R), green (G), and blue (B) and integrating them. RGB denotes the three colors of red, green and blue.

The monitors mostly adopt the RGB color standard, and all the colors on the computer screen are composed of the three colors of red, green and blue mixed in different proportions.



And we could adjust the LED brightness by PWM.

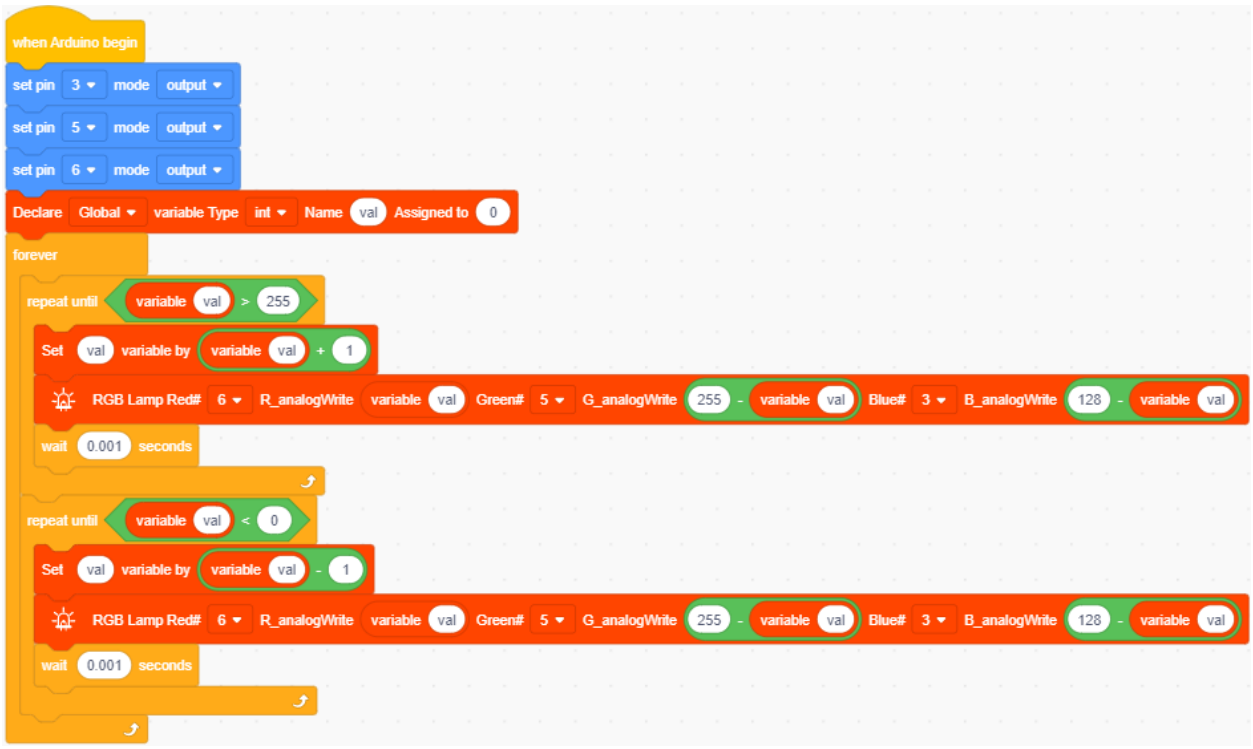
Circuit Connection

Project Code

Look for Code Blocks

You can drag blocks to edit. Blocks listed below are for your reference

Complete Program



Project Result

Click 

to upload the code to the coding box successfully, you can see the light of the RGB light on the coding box, and the color keeps changing.

5.2.6 Project 06: Play Music

Project Introduction

In the previous , you had heard about active buzzers, which can only emit one sound,and it's very monotonous.

In this program we're going to take you to learn a passive buzzer, which can emit sounds of different frequencies. This

characteristic allows the buzzer to play music melody.

The buzzer on the programming box is a passive buzzer.

Working Principle

Passive buzzer is an integrated electronic buzzer without vibration source inside. It must be driven by 2K-5K square wave instead of direct current signals.

There is little difference between the two kinds of buzzers, but when the pins of the two buzzers are placed up, the passive buzzer comes with green circuit board, and the one sealed with vinyl is an active buzzer.

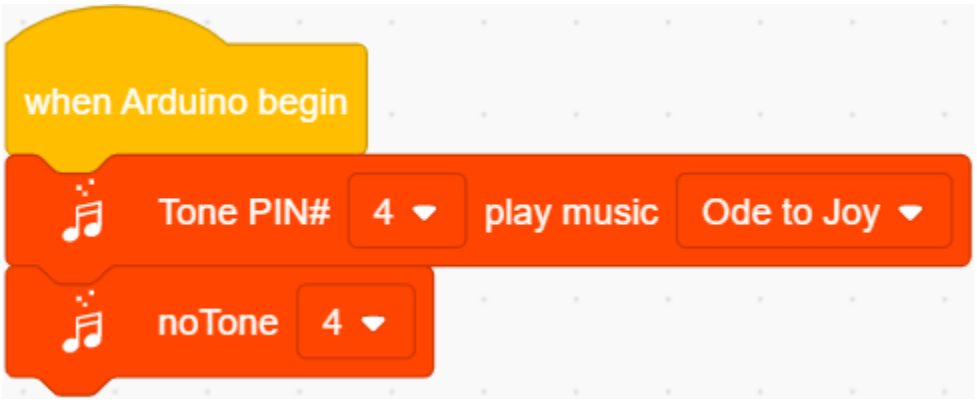
Circuit Connection

Project Code

Look for Code Blocks

You can drag blocks to edit. Blocks listed below are for your reference

Complete Program



Project Result

Click 

to upload the code to the coding box successfully, you can hear the buzzer playing the song “Ode to Joy” on the coding box

5.2.7 Project 07: Small Desktop Lamp

Project Introduction

The button switch is an electronic switch. When we press the button, the switch function will be turned on. When the pressure is removed, the switch will be turned off. Its internal structure can be realized by changing the force of the metal shrapnel.

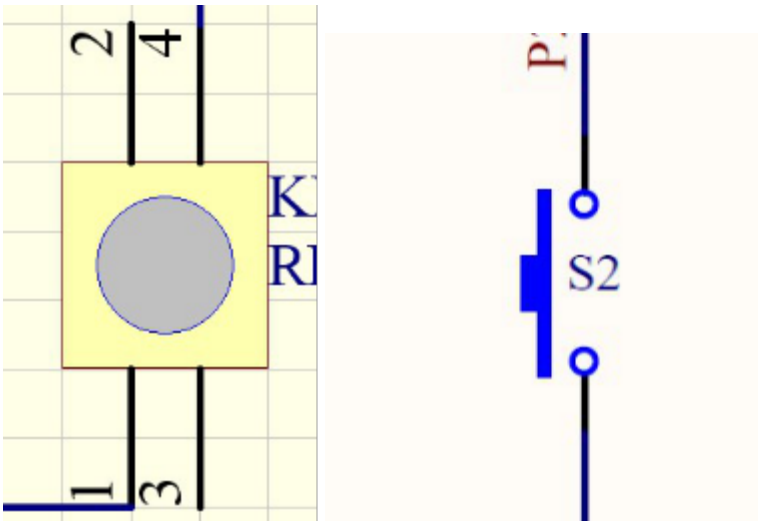
In this project, we will use a button switch and an LED to make a small desk lamp project. Press the button can turn on and turn off the LED.

Working Principle

I believe that button switch is common and popular for people. It belongs to switch quantity(digital quantity)component. Composed of normally open contact and normally closed contact, its working principle is similar to ordinary switches.

When the normally open contact bears pressure, the circuit is on state ; however, when this pressure disappears, the normally open contact goes back to initial state, that is, off state. The pressure is the act we switch the button.

Schematic Diagrams:

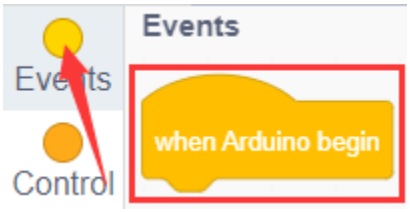


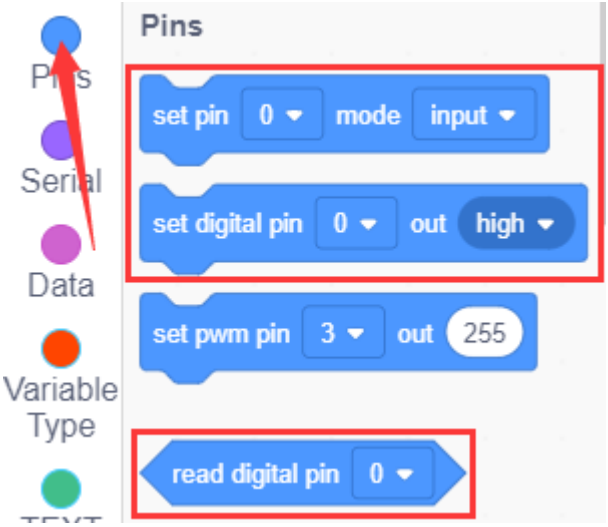
Circuit Connection

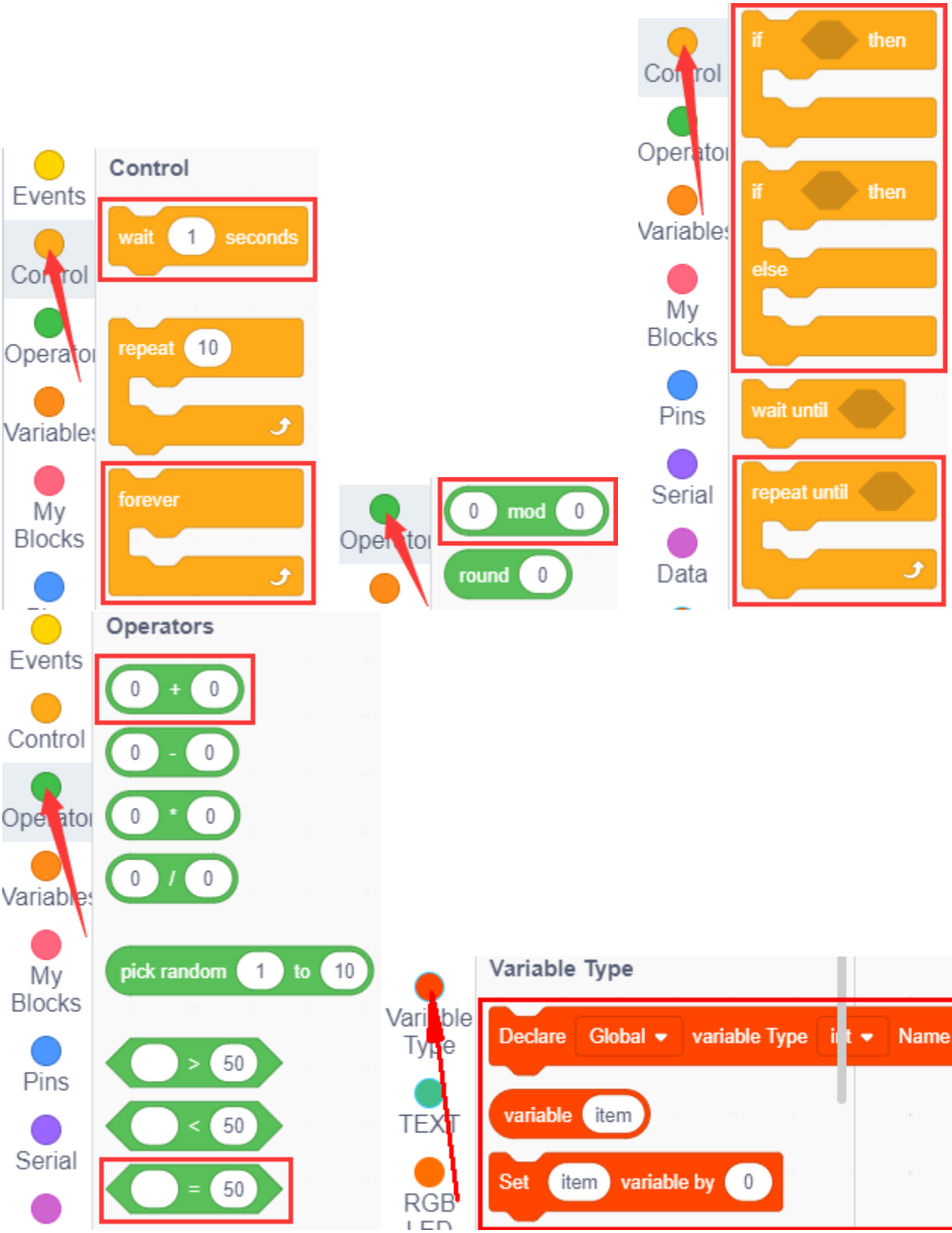
Project Code

Look for Code Blocks

You can drag blocks to edit. Blocks listed below are for your reference

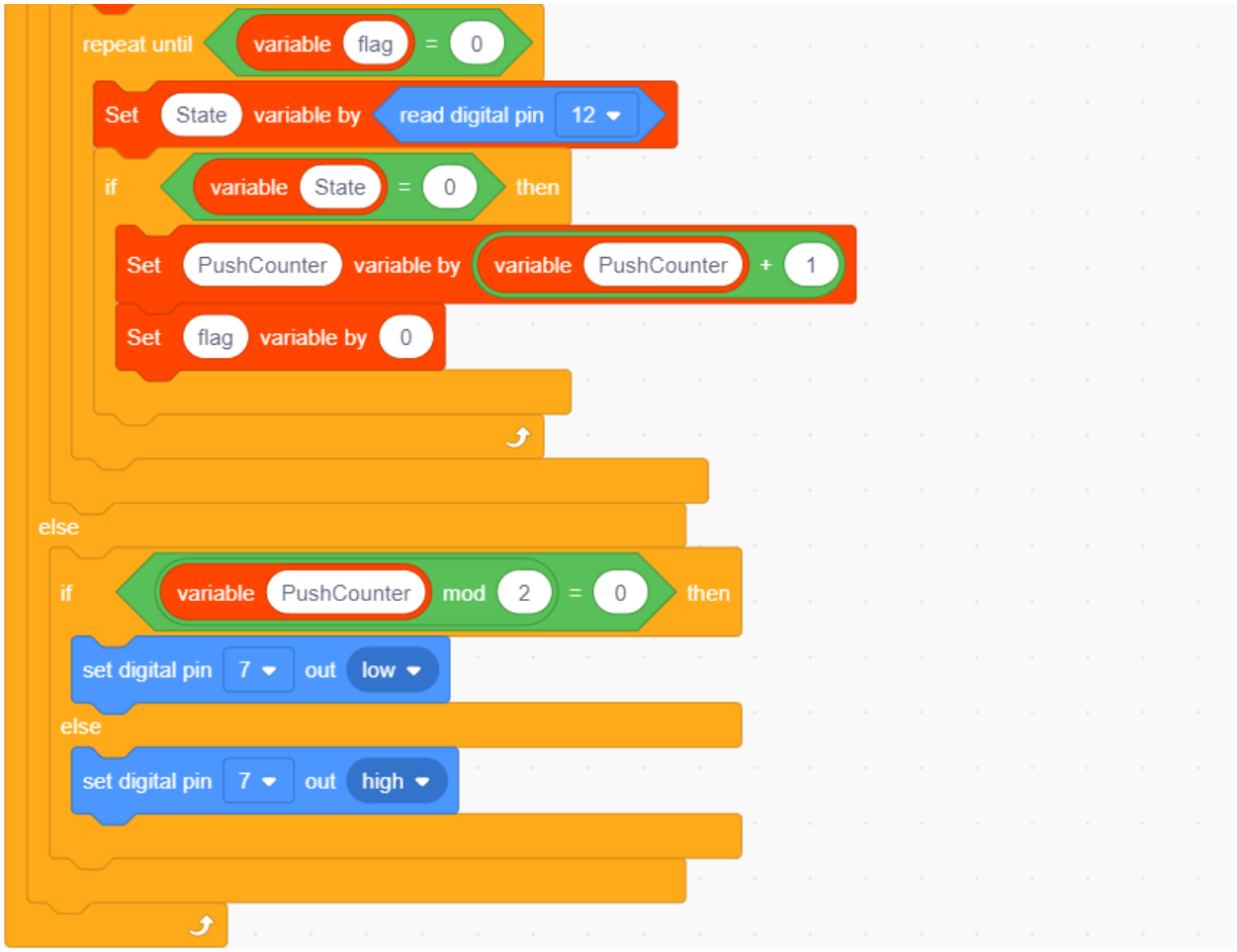






Complete Program


when Arduino begin
Declare Global variable Type int Name PushCounter Assigned to 0
Declare Global variable Type int Name State Assigned to 0
Declare Global variable Type int Name Laststate Assigned to 1
Declare Global variable Type int Name flag Assigned to 1
set pin 12 mode input
set pin 7 mode output
set digital pin 7 out low
forever
Set State variable by read digital pin 12
if variable State = variable Laststate then
wait 0.05 seconds
Set State variable by read digital pin 12
if variable State = variable Laststate then
Set flag variable by 1



Project Result

Click 

to upload the code to the coding box successfully, when the button at D12 is pressed once, the light at D7 will be on; when the button is pressed again, the light at D7 goes out, the same working situation as the desk lamp.

5.2.8 Project 08: PIR Motion Alarm

Project Introduction

PIR motion sensor can detect infrared signals from a moving person or moving animal, and output switching signals. It can be applied to a variety of occasions to detect the movement of human body.

For example, in the corridor at night, the PIR motion sensor senses someone going upstairs, and the light turns on automatically, which is not only practical but also environmentally friendly.

PIR Motion Sensor Specification

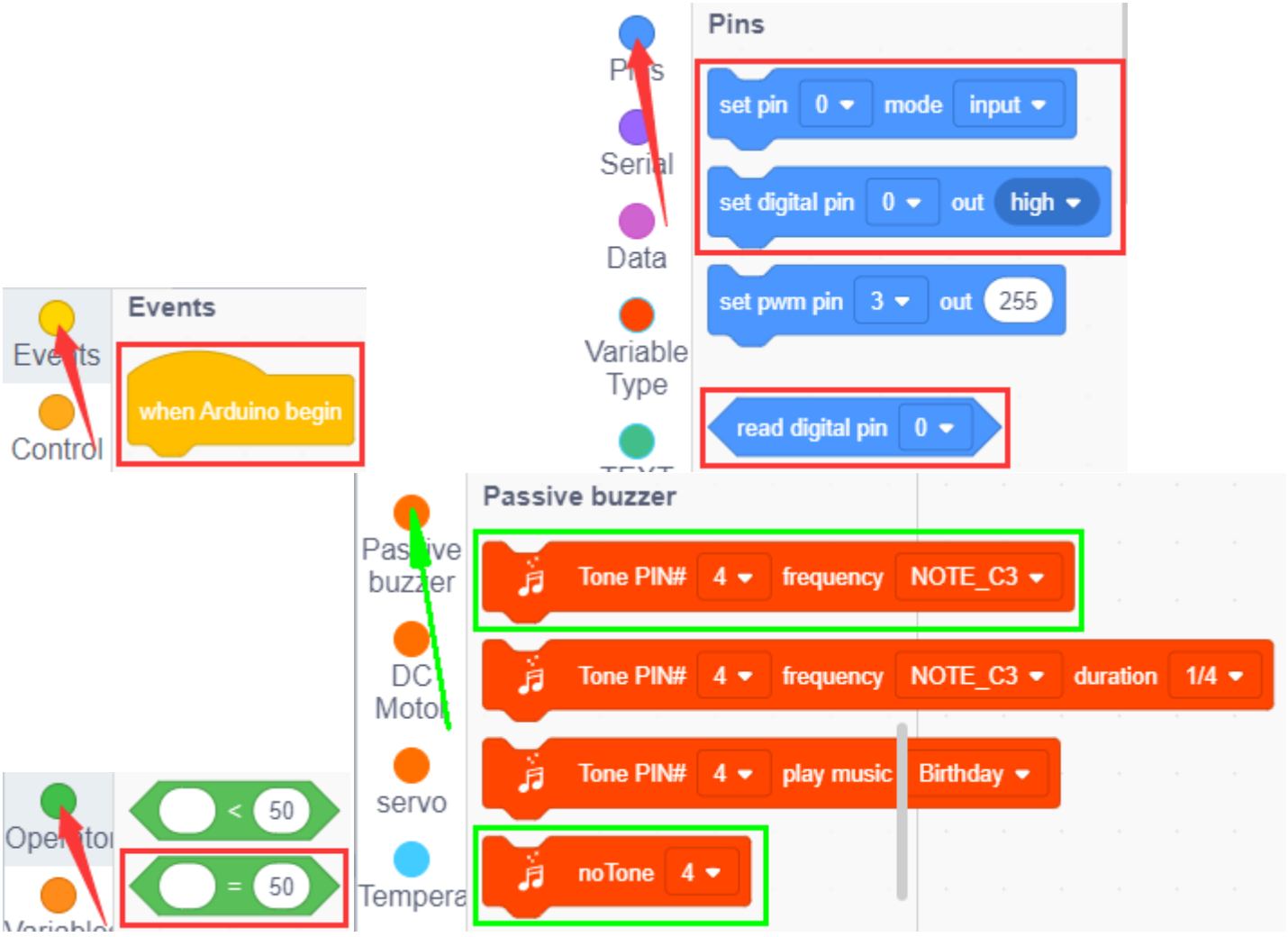
- Input Voltage 3.3 ~ 5V (6V Maximum)
- Working Current 15uA
- Working Temperature -20 ~ 85 ℃
- Output Voltage High 3V, Low 0V
- Output Delay Time (High Level) About 2.3 to 3 Seconds
- Detection Angle 100 °
- Detection Distance 7 meters

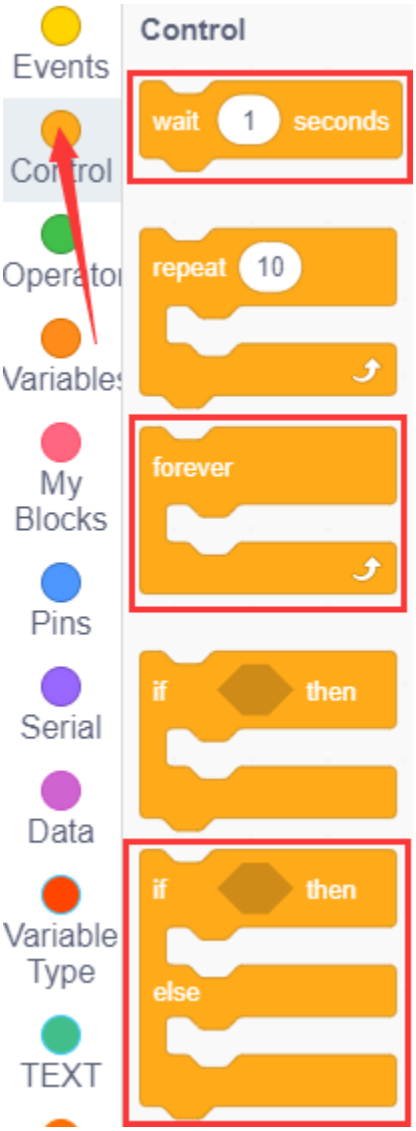
- Output Indicator LED (When output HIGH, it will be ON)
- Pin limit Current 100mA **Circuit Connection**

Project Code

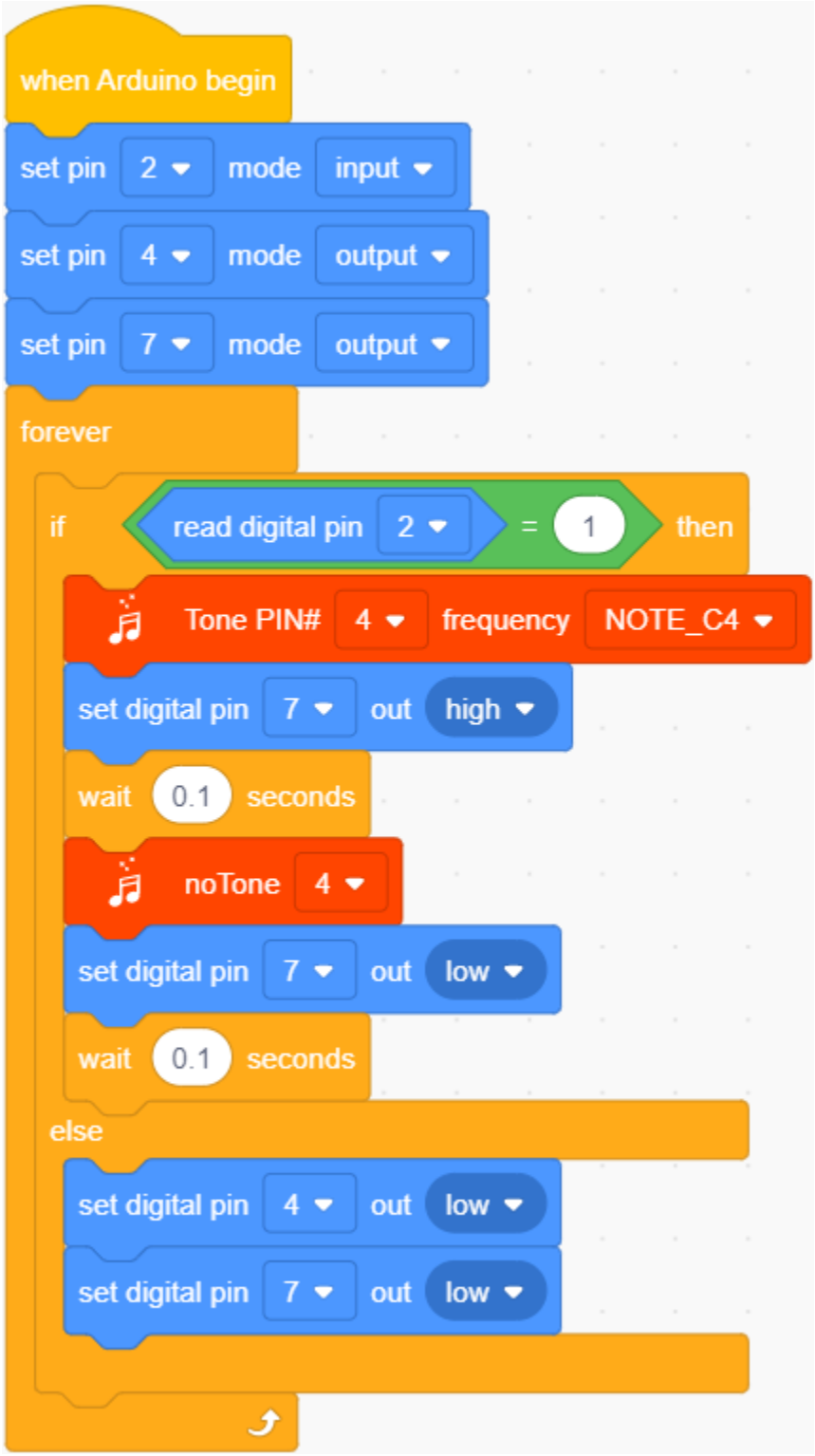
Look for Code Blocks

You can drag blocks to edit. Blocks listed below are for your reference





Complete Program



Project Result

Click Upload to upload the code to the coding box successfully,when the human infrared sensor detects people moving nearby,the LED starts flashing, the buzzer sounds. If no one is detected nearby, the LED is off and the buzzer does not sound.

5.2.9 Project 09: Reed Switch

Project Introduction

Reed switch is basically an electrical switch which is operated when a magnetic field is brought near to it. It is made up of two small metal pieces kept inside a glass tube under vacuum. In a typical reed switch, two metal pieces will be made of a ferromagnetic material and covered with rhodium or ruthenium to give them long life. The switch will be activated when there is a presence of magnetic field around the switch.

Reed switch is used in many of the real-life applications such as magnetic door switch, laptops, smart phones etc.

Sensor Specification

There are two types of reed switch:

Normally open reed switch

Normally closed reed switch

In normally open reed switch, switch is open in the absence of magnetic field and it is closed in the presence of magnetic field. Under the presence of magnetic field, two metal contacts inside the glass tube attract each other to make contact.

In normally closed reed switch, switch is closed in the absence of magnetic field and it is open in the presence of magnetic field.

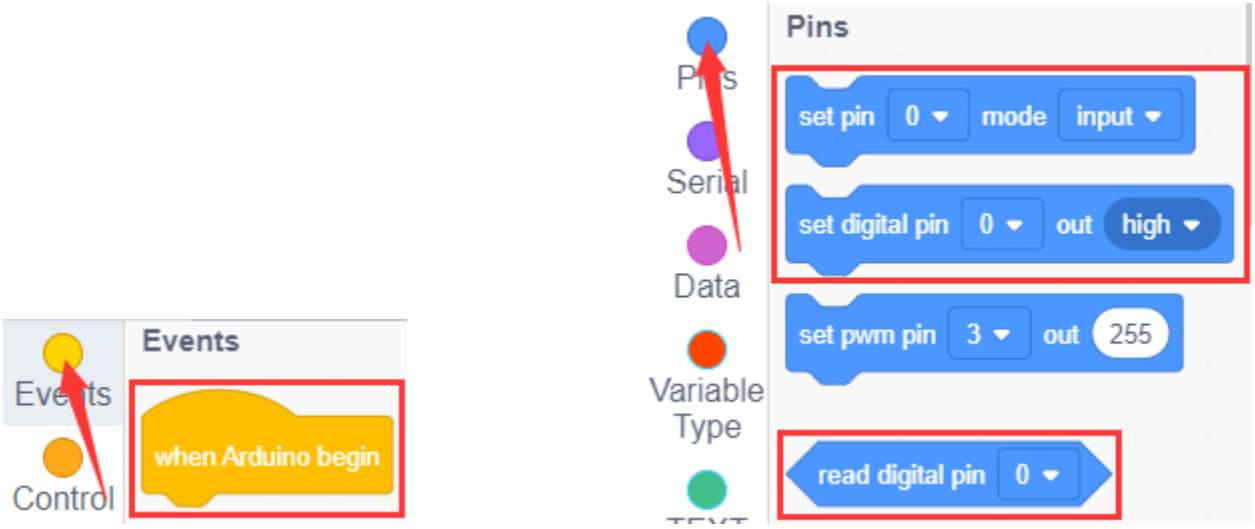
The glass enclosure of the two metal pieces protect them from dirt, dust and other particles. Reed switch can be operated in any environment such as environment where flammable gas is present or environment where corrosion would affect open switch contacts.

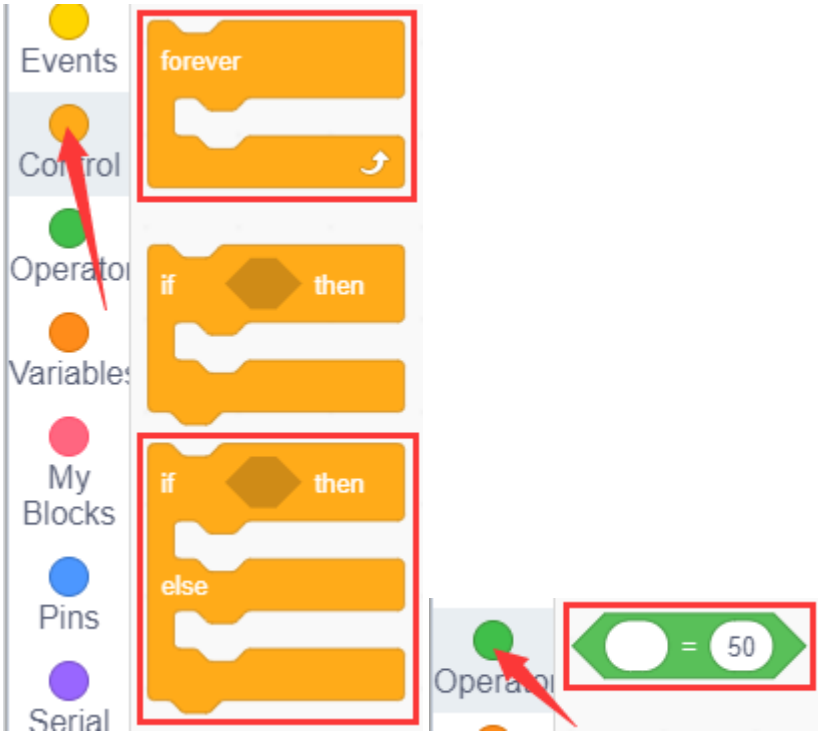
Circuit Connection

Project Code

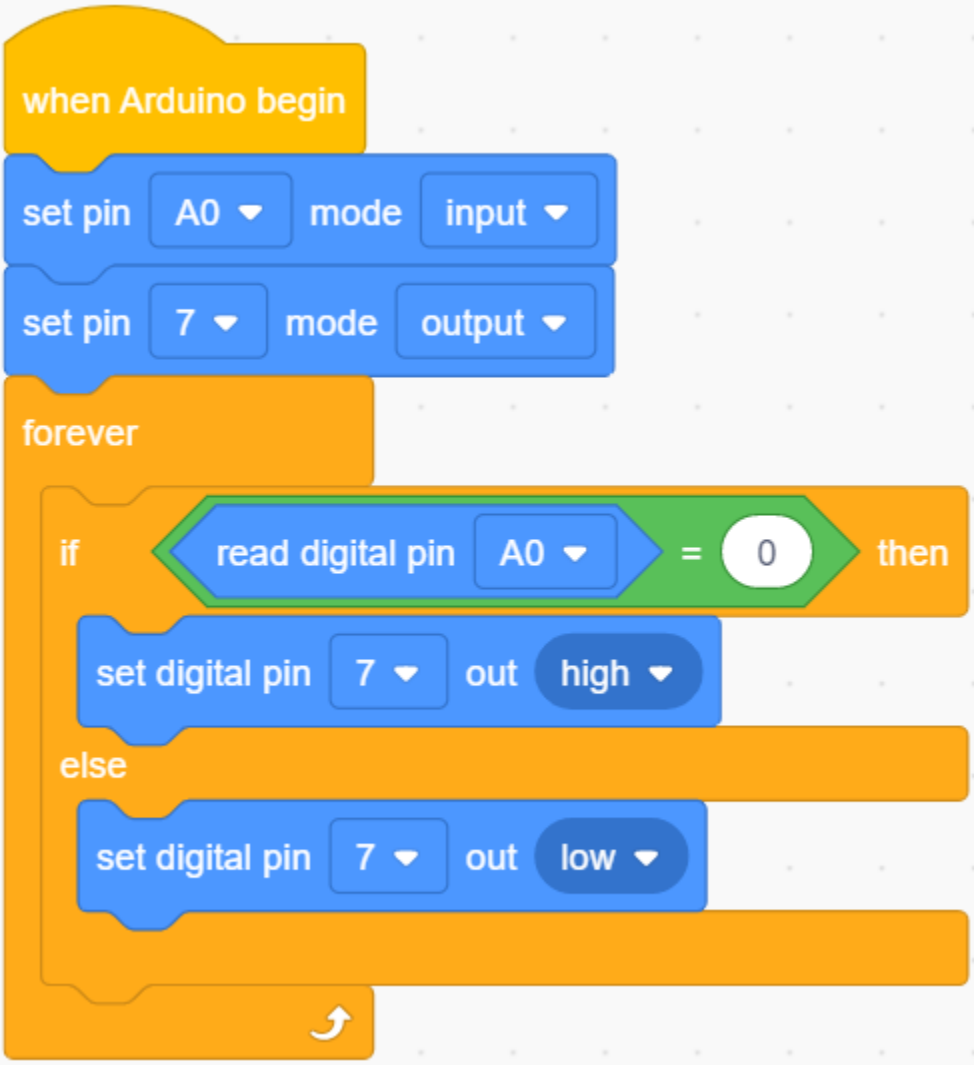
Look for Code Blocks

You can drag blocks to edit. Blocks listed below are for your reference





Complete Program



Project Result

Click Upload to upload the code to the coding box successfully,when the magnetic reed detects nearby magnetic force, the LED lights up. If no magnetic force is detected, the LED is off.

5.2.10 Project 10: DC motor

Project Introduction

With this coding box, we can make our own adjustable fan. Usually a simple electric fan is made up of blades, a motor and a switch. You can see a motor fan module on the kidsbits coding box. The motor is actually the electric motor. If there is electricity, the fan blade will rotate. The motor with the fan blade is also called a fan module. Inputting HIGH or LOW level to two pins of fan module, we can make the fan rotate.

Connection Diagram

So set to D10, LOW, D11 to HIGH. Upload the code and the motor fan will turn clockwise. If we set the D10 to HIGH, D11 to LOW, the fan will turn anticlockwise. If we set to D10 and D11 to LOW, the fan won't turn.

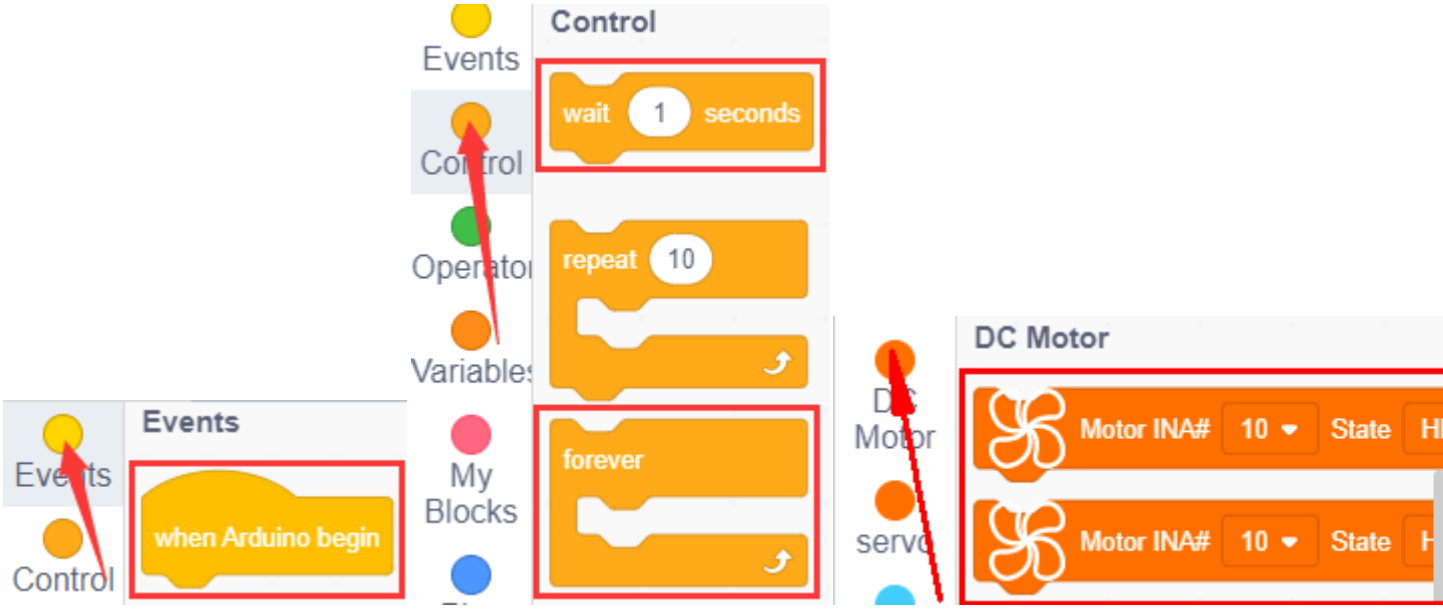
Now, we've known how to control fan. But how about making fan rotate slowly? Here we can use PWM pins.

PWM pins can steadily output the HIGH and LOW level, and can continuously change HIGH or LOW in a regular time period. The D10 and 11 of motor fan are PWM pins. We can adjust the motor's speed via PWM pins.

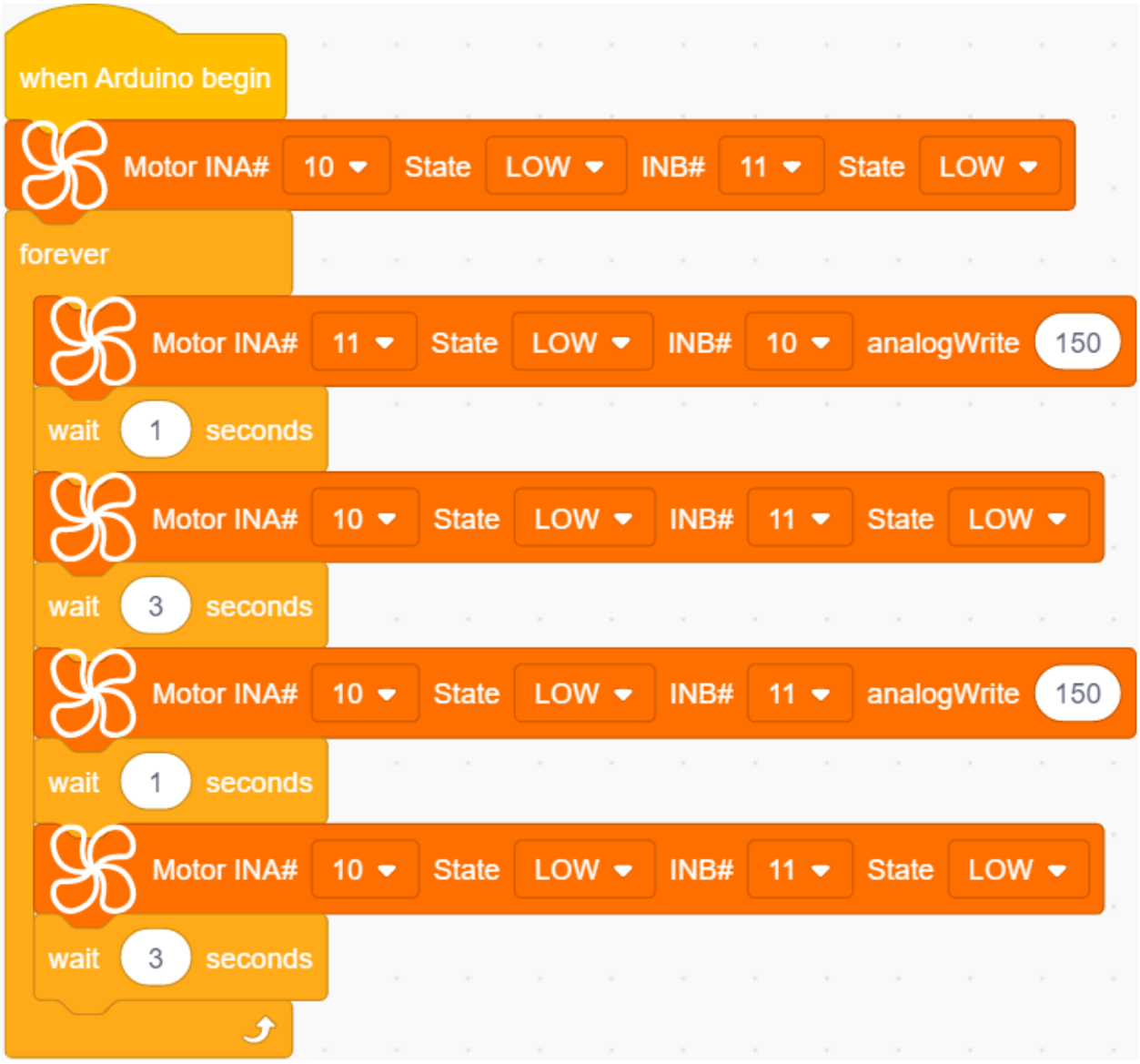
Project Code

Look for Code Blocks

You can drag blocks to edit. Blocks listed below are for your reference



Complete Program



Project Result

Click 

to upload the code to the coding box successfully, the motor on the coding box rotates clockwise for 1 second, with a delay of 3 seconds. Then turn counterclockwise for 1 second, delay 3 seconds, and loop.

5.2.11 Project 11: Servo

Project Introduction

Servo is a position (angle) servo drive, which is suitable for those control systems that require constant angle changes and can be maintained. It has been widely used in remote control toys, airplane models, submarine models, and remote control robots.

In this project, we use the servo rotation angle change to DIY a car speed dial. You can intuitively understand the servo's movement trajectory.

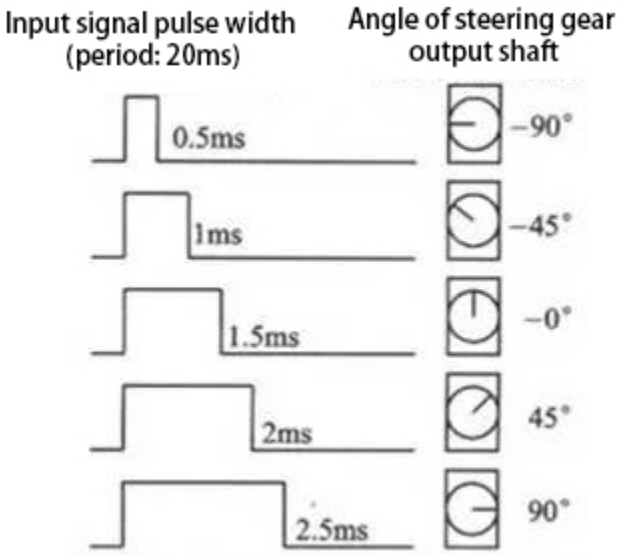
Working Principle

Servo is composed of rudder disc, position feedback potentiometer, reduction gear set, DC motor and control circuit.

The reduction gear set is driven by a DC motor, and its output shaft drives a position feedback potentiometer with linear proportional characteristics as position detection.

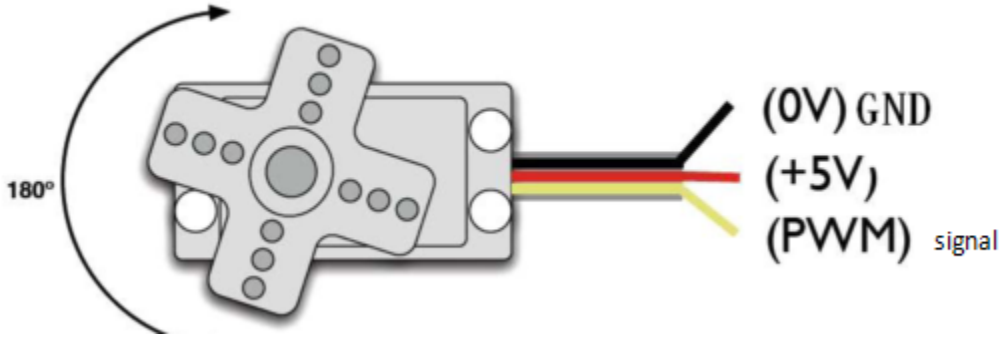
According to the feedback voltage of the potentiometer, the control circuit compares with the external input control pulse, generates a correction pulse, controls and drives the DC motor to rotate forward or reverse, so that the output position of the reduction gear is combined with the desired value. So as to achieve the purpose of accurately controlling the steering angle.

Servo's control pulse cycle is 20ms, and the pulse width ranges from 0.5ms to 2.5ms, corresponding to positions from -90 degrees to +90 degrees, taking a 180 degree angle servo as an example



Servo motor comes with many specifications. But all of them have three connection wires, distinguished by brown, red, orange (different brand may have different color).

Brown one is for GND, red one for power positive, orange one for signal line.



Connection Diagram

Project Code

Look for Code Blocks

You can drag blocks to edit. Blocks listed below are for your reference

Complete Program

Project Result

Click 

to upload the code to the coding box successfully,the servo rotates, the angle starts from 0°, increases by 45° every 0.5 seconds, and when it reaches 180°, it turns to the 0° position.

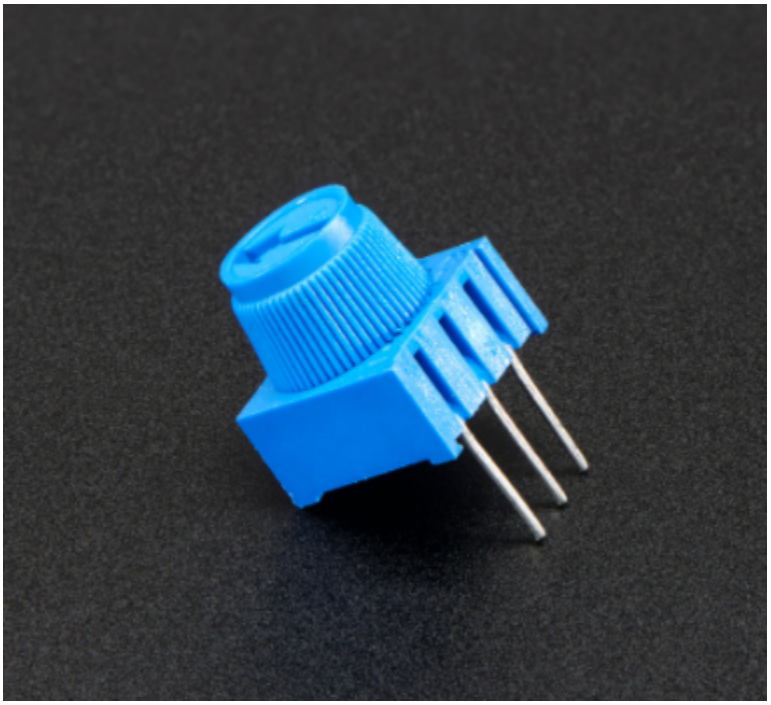
5.2.12 Project 12: Potentiometer

Project Introduction

The potentiometer is an electronic component that we are very familiar with. It is an analog component. The switch for adjusting the volume on the electrical appliance and the button for adjusting the wind on the fan are all applications of the potentiometer.

In this project, we are going to learn how to use Arduino to read the value of the potentiometer, and then cooperate with the LED light to make a Dimming table lamp.

Features



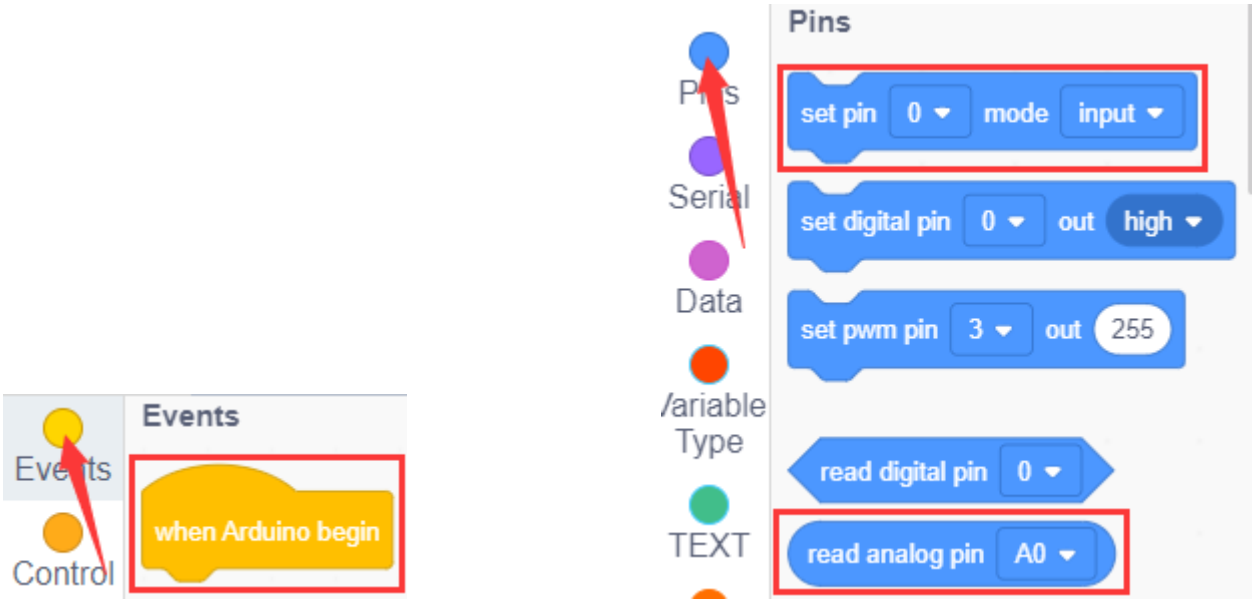
Adjustable potentiometer is just a kind of resistor. The resistance is changed by rotating the potentiometer, so is the voltage, speed, brightness and temperature. It is an analog electronic component, which has two states of 0 and 1(high level and low level). The analog quantity is different. Its data state presents a linear state such as 1 to 1000.

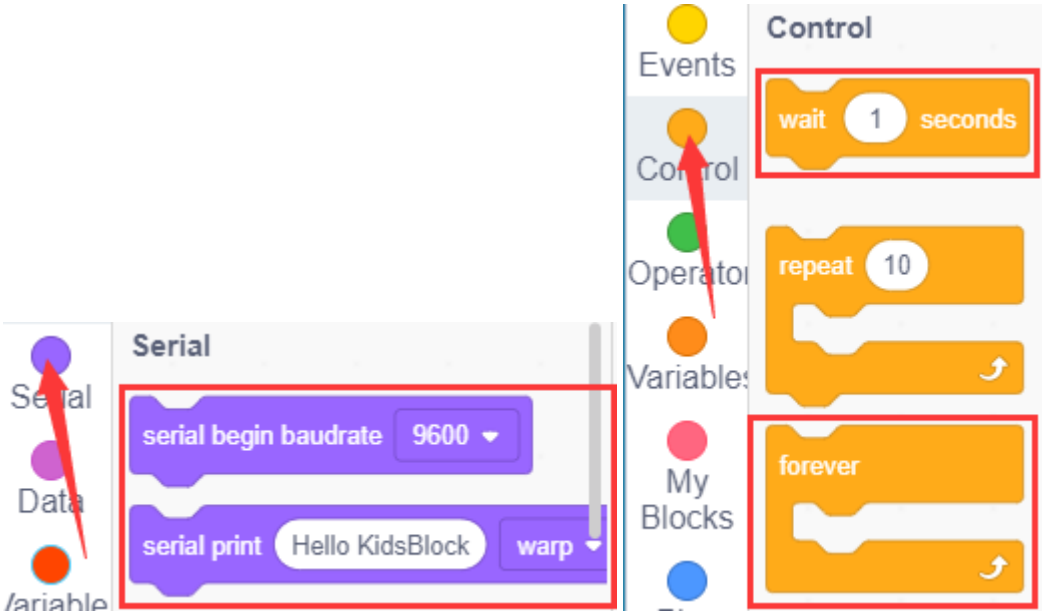
Read Values

We connect the adjustable potentiometer to the analog pin of Arduino to read its value. Please refer to the following wiring diagram for wiring.

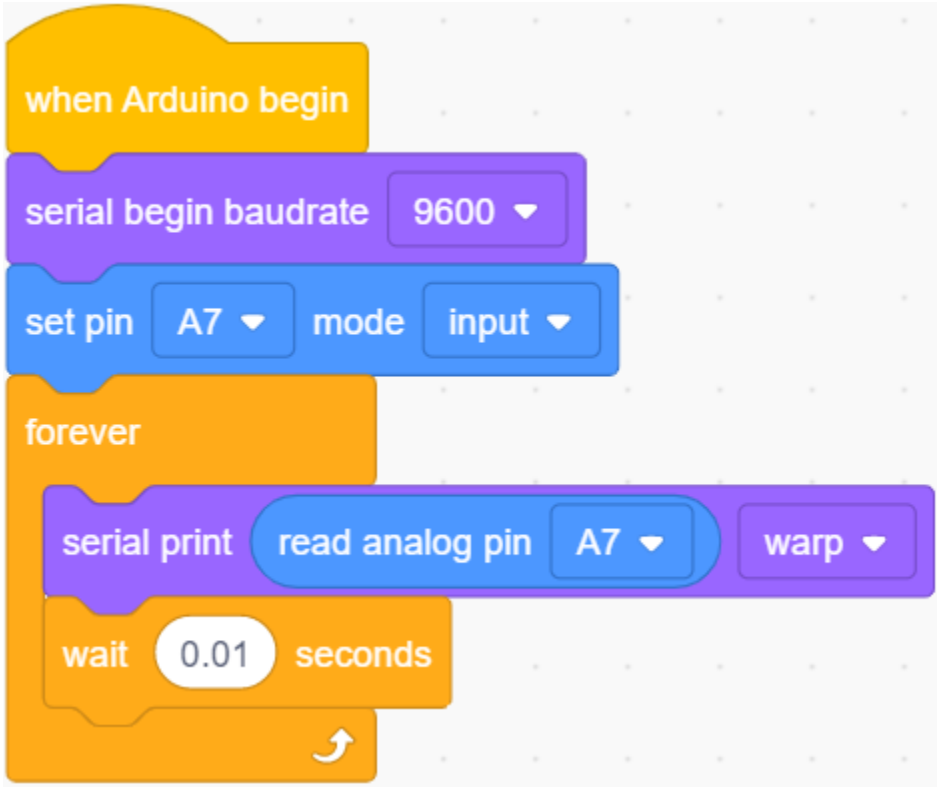
Look for Code Blocks

You can drag blocks to edit. Blocks listed below are for your reference



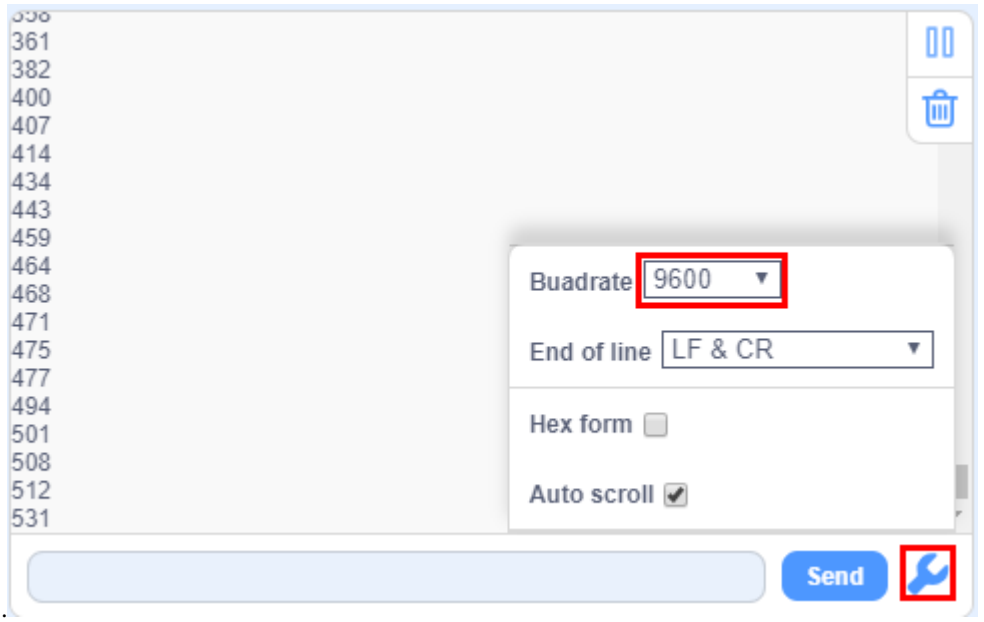


Complete Program



Project Result 1

Click Upload to upload the code to the coding box successfullythen click to set the baud rate to 9600. When you rotate the potentiometer knob, you can see the displayed value change. The reading of analog value is a very common function since most sensors output analog value. After calculation, you can get the corresponding value you need.



Below figure shows the analog value it reads.

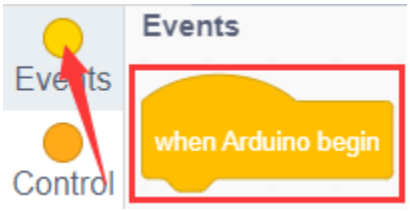
Circuit Connection

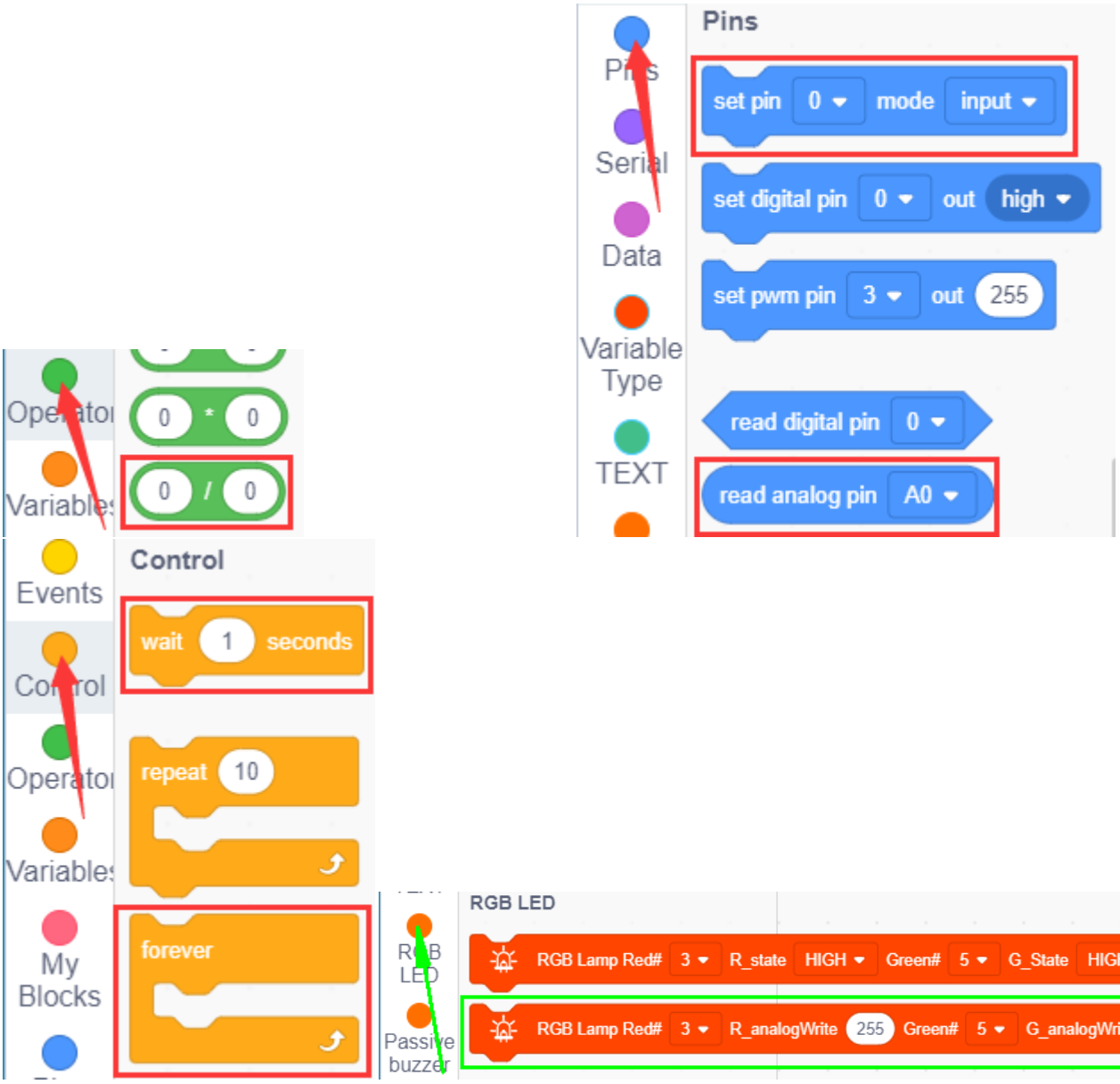
In the last step, we read the value of the potentiometer, and now we need to convert the value of the potentiometer into the brightness of the LED to make a small desk lamp with adjustable brightness. See the wiring diagram.

Project Code

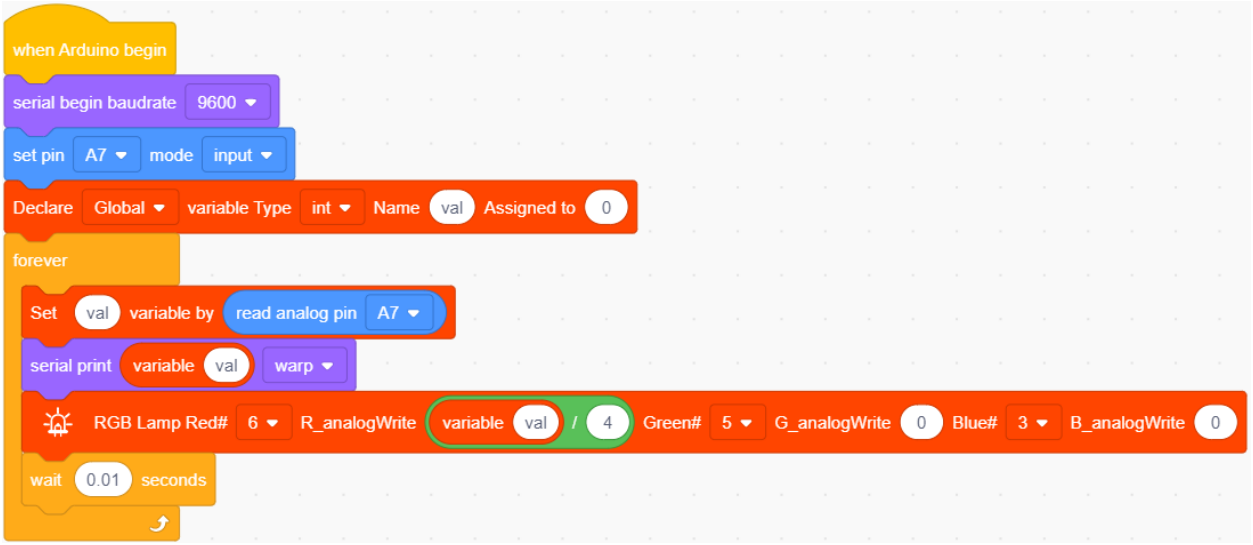
Look for Code Blocks

You can drag blocks to edit. Blocks listed below are for your reference





Complete Program



Project Result 2

Click 

to upload the code to the coding box successfullyyou can control the brightness of the red LED in the RGB through the potentiometer.

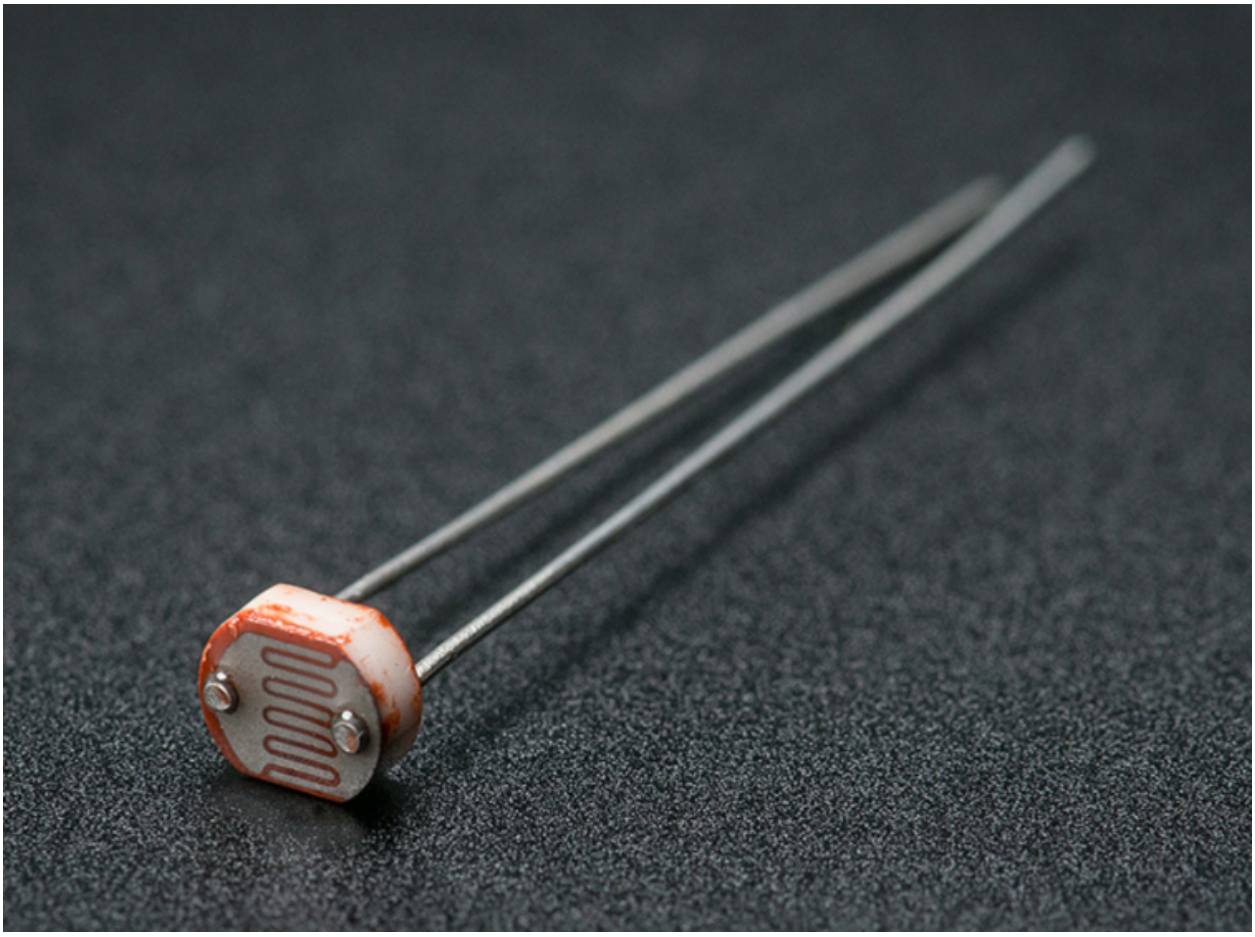
5.2.13 Project 13: Light

Project Introduction

Photocell is a resistor whose resistance varies from different incident light strength. It's based on the photoelectric effect of semiconductor. If the incident light is intense, its resistance reduces; if the incident light is weak, the resistance increases.

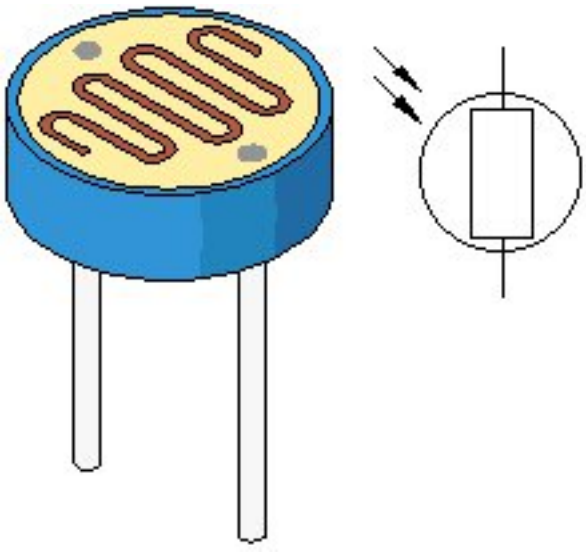
We use the characteristics of Photocell to make a light-controlled table lamp. When the light is dimmed, the light turns on.

Photocell Little Knowledge



Photocell is commonly applied in the measurement of light, light control and photovoltaic conversion (convert the change of light into the change of electricity).

Photocell is also being widely applied to various light control circuits, such as light control and adjustment, optical switches, etc.



We will start with a relatively simple experiment regarding to photovaristor application.

Photocell is an element that can change its resistance as light strength changes. So we need to read the analog value. You can refer to the PWM experiment, replacing the potentiometer with photocell`.

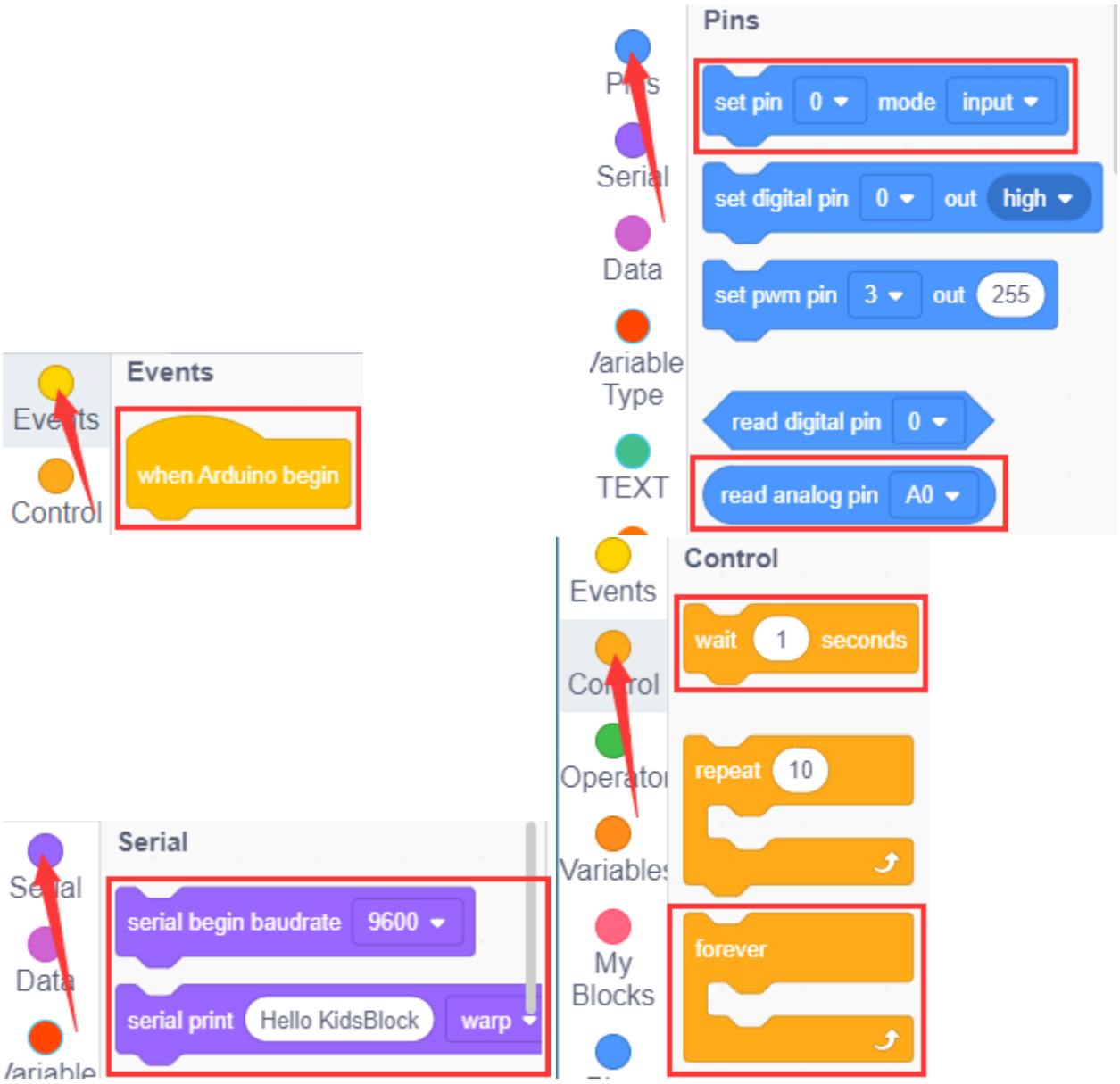
When there is change in light strength, it will make corresponding change on the LED.

Read Photocell values

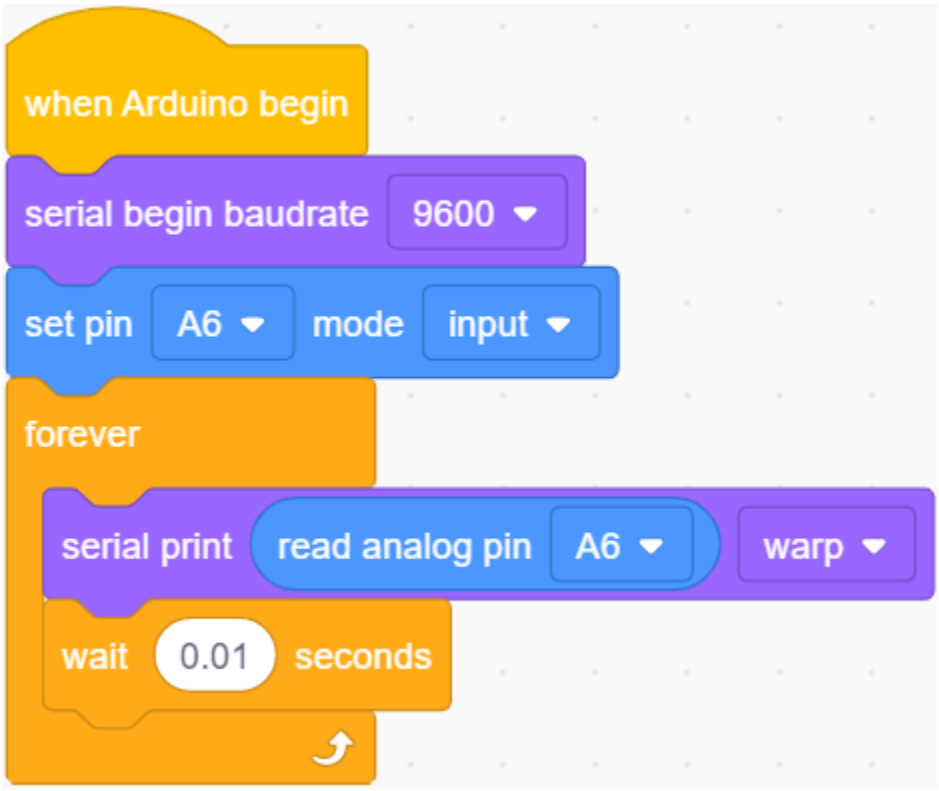
We first use a simple code to read the value of the photocell, print it in the serial monitor, and wire it as shown below.

Look for Code Blocks

You can drag blocks to edit. Blocks listed below are for your reference

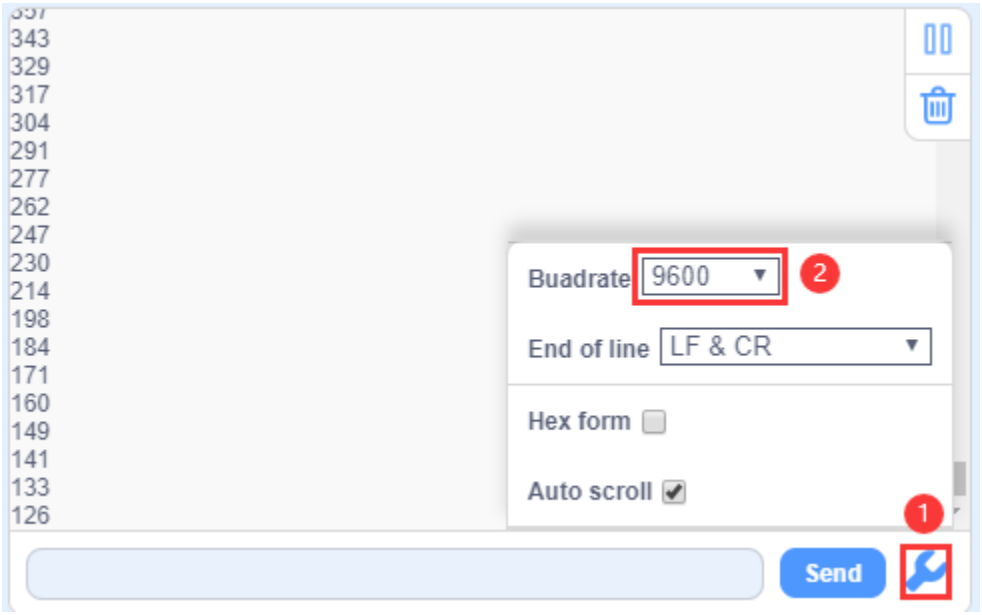


Complete Program



Project Result 1

Click Upload to upload the code to the coding box successfullythen click to set the baud rate to 9600and you can read the current photocell value. We put our hands on the photocell, and the value became smaller.



Circuit Connection

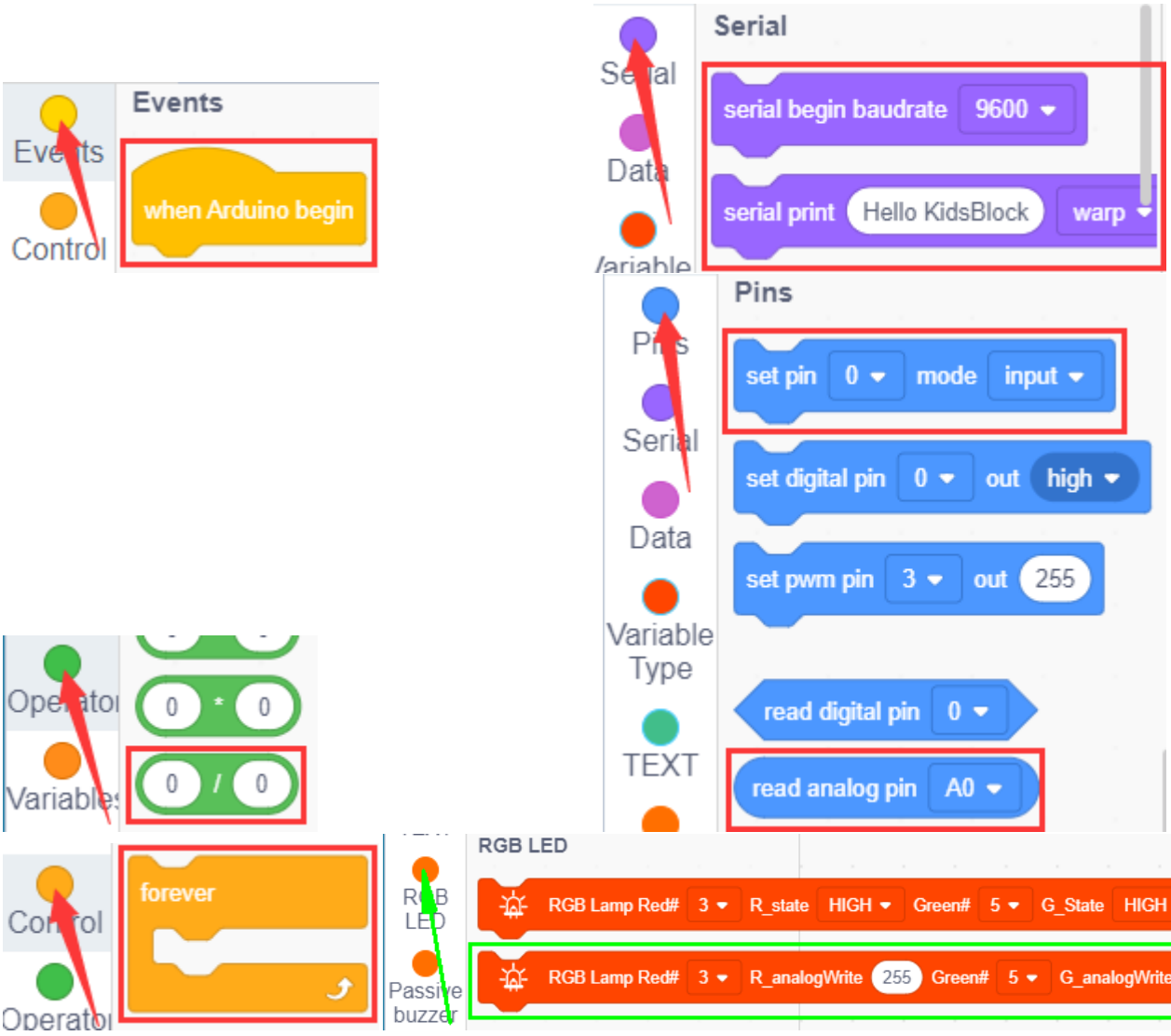
We made a small dimming table lamp before, and now we want to make a light-controlled small table lamp. The basic principles of the two are the same. Both are obtained by obtaining the analog value of the sensor and then adjusting

the brightness of the LED.

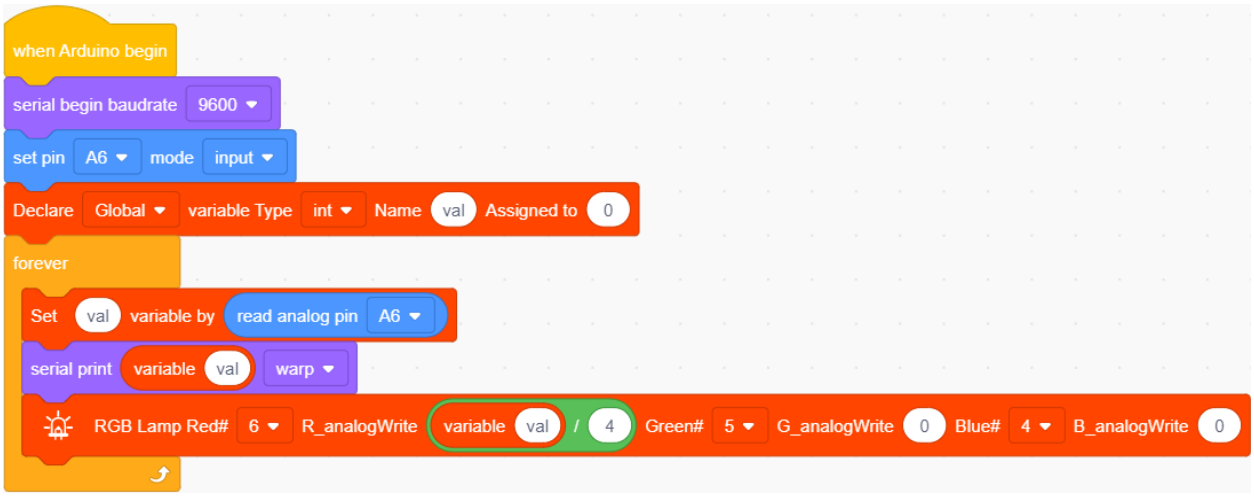
Project Code

Look for Code Blocks

You can drag blocks to edit. Blocks listed below are for your reference



Complete Program



Project Result 2

Click 

to upload the code to the coding box successfullythe photoresistor can detect the intensity of the light. The brighter the light, the brighter the red LED in RGB.

5.2.14 Project 14: Sound

Project Introduction

The sound sensor is a common sensor. It has a built-in capacitive electret microphone and power amplifier. It can be used to detect the sound intensity of the environment.

In this project, we use a sound sensor and a DC motor to make a voice-activated smart fan. When we make a sound, the fan starts.

Sound Sensor

Sound sensor is typically used in detecting the loudness in ambient environment. The Arduino can collect its output signal by analog input interface.

The S pin is analog output, that is voltage signal real-time output of microphone. The sensor comes with a potentiometer, so that you can turn it to adjust the signal gain.

It also has a fixed hole so that you can mount the sensor on any other devices. You can use it to make some interactive work, such as a voice operated switch.

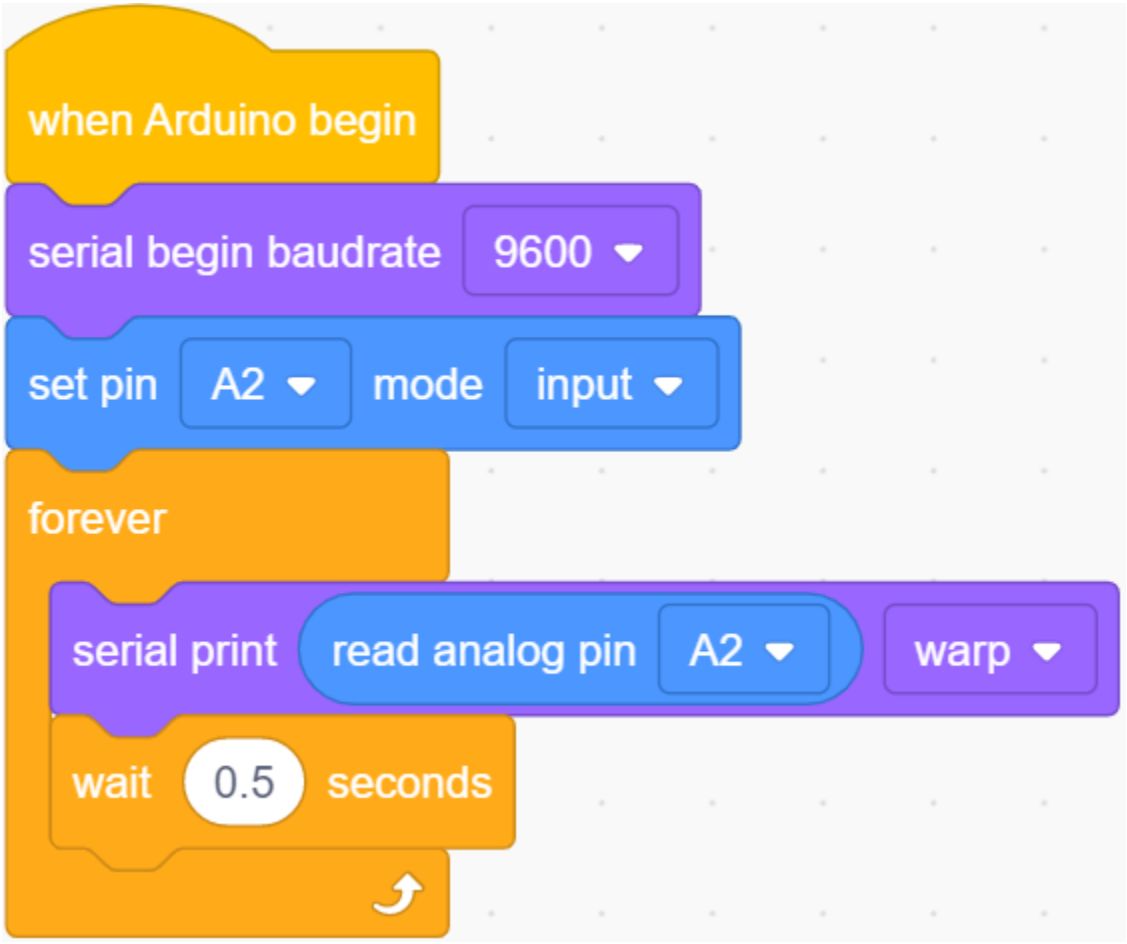
Read Sound Sensor Values

We first use a simple code to read the value of the sound sensor, print it in the serial monitor, and wire it as shown below.

Look for Code Blocks

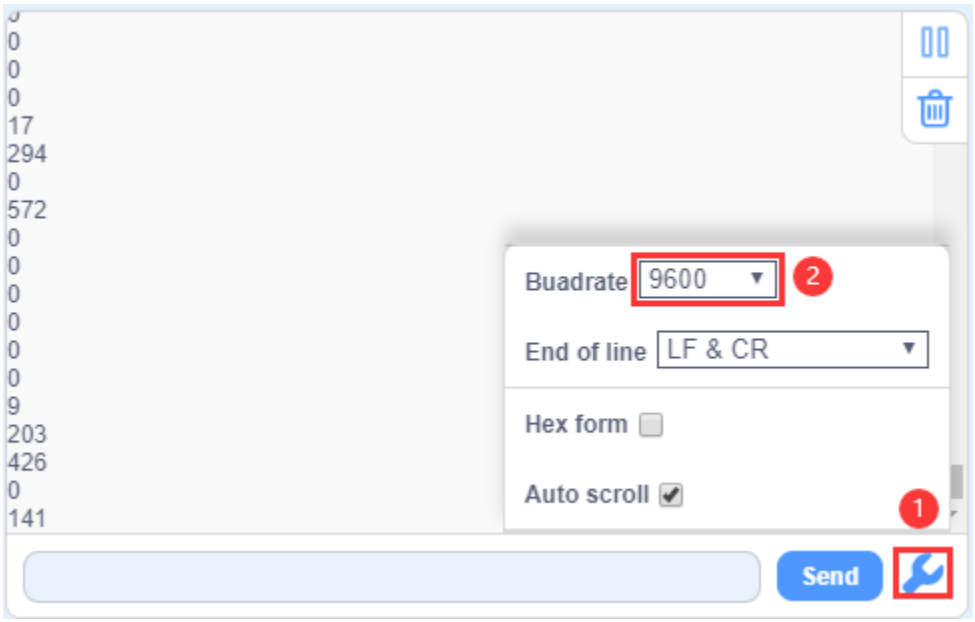
You can drag blocks to edit. Blocks listed below are for your reference

Complete Program



Project Result 1

Click Upload to upload the code to the coding box successfullytap to set the baud rate to 9600then blow or clap your hands at the sensor, you can see the sensor's value changes significantly.



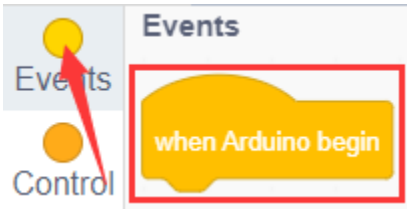
Circuit Connection

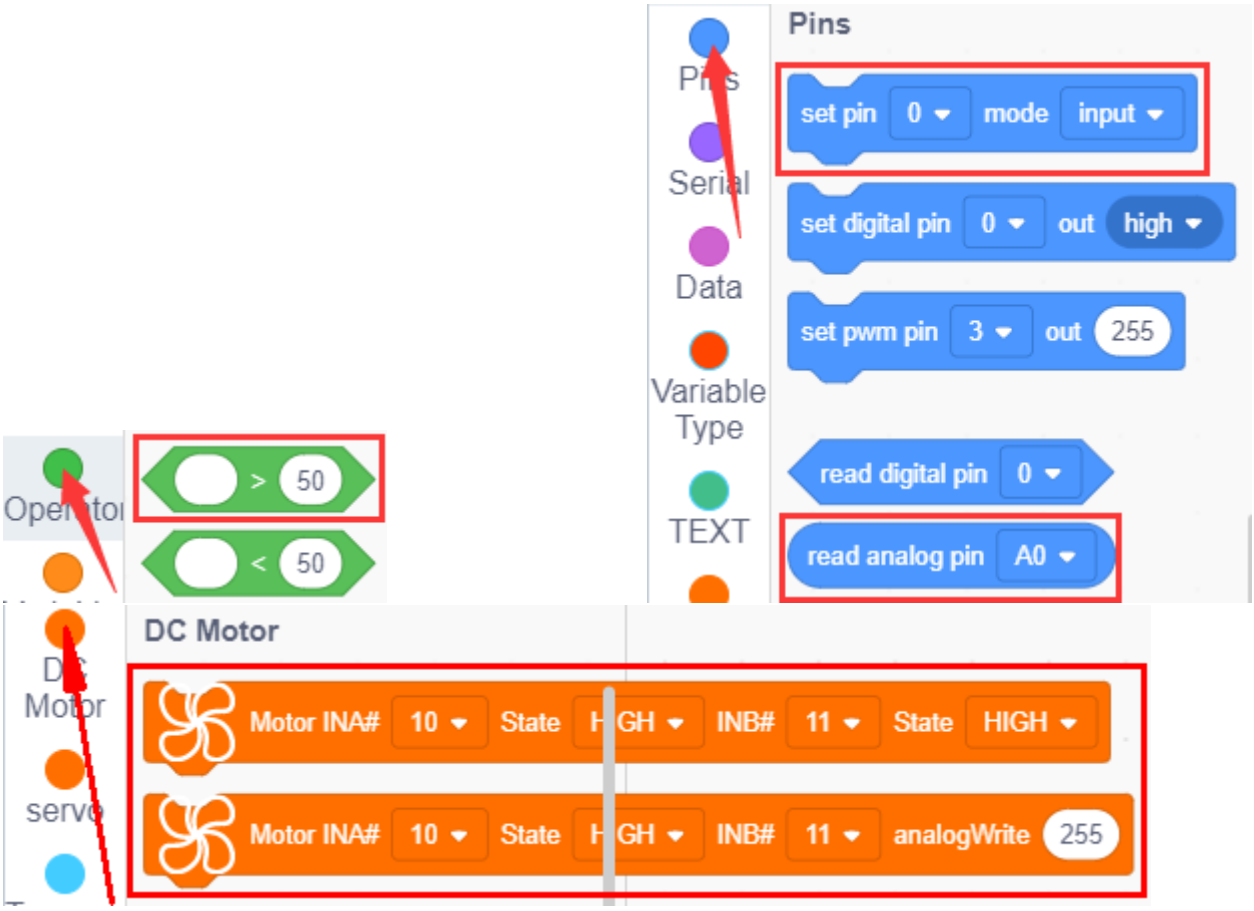
Next, we formally enter this project. We use a sound sensor and a small motor to make a sound-activated fan. Connect to the circuit diagram below.

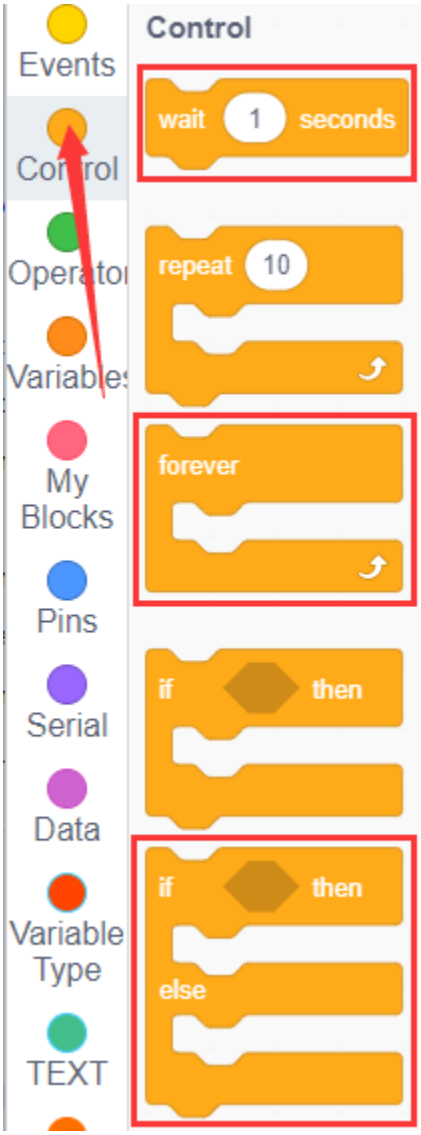
Project Code

Look for Code Blocks

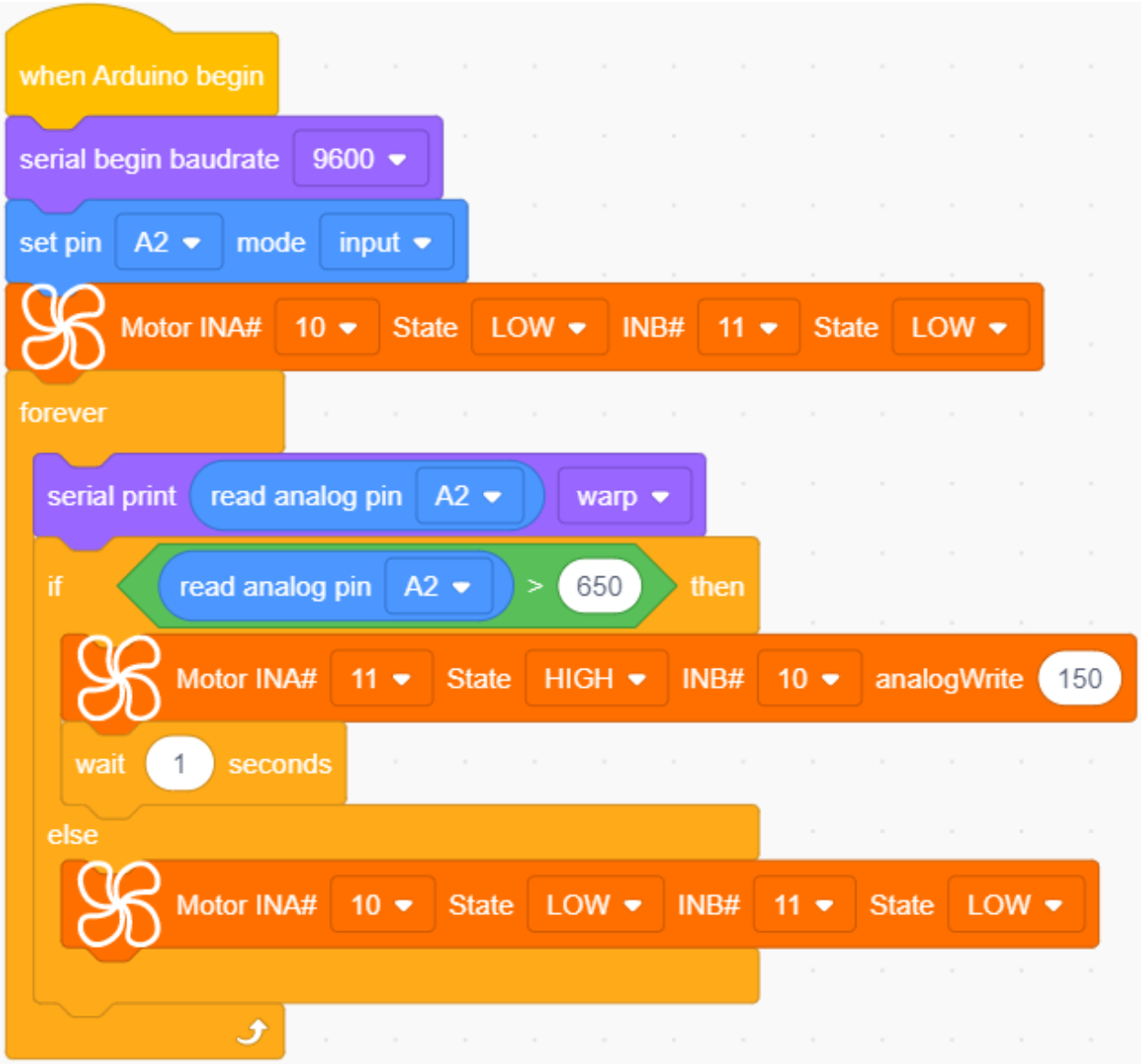
You can drag blocks to edit. Blocks listed below are for your reference




Pins
Pins
Serial
Data
Variable
Type
TEXT
set pin 0 mode input
set digital pin 0 out high
set pwm pin 3 out 255
read digital pin 0
read analog pin A0
> 50
< 50
DC Motor
Motor
servo
Motor INA# 10 State HIGH INB# 11 State HIGH
Motor INA# 10 State HIGH INB# 11 analogWrite 255



Complete Program



Project Result 2

Click Upload to upload the code to the coding box successfullythe microphone sensor can detect the sound. When the value of the sound is greater than 650, the motor fan starts to rotate. If it does not reach 650, the motor fan does not rotate.

5.2.15 Project 15: Gas Sensor

Project Introduction

MQ-2 Gas Sensor module is useful for gas leakage detecting in homes and industries. It can detect LPG, i-butane, propane, methane, alcohol, hydrogen and smoke.

Sensor Specification

Whenever the concentration of gas increases the resistance will decrease (but the current flow will get increased). It leads to change in voltage and it is read at Analog out pin which tells how much gas is concentrated in normal Air. This varied analog voltage is used to calculate the PPM of Gas.

Similarly, the Module has a Digital output (connected with an Op-Amp) along with a Potentiometer. The Threshold/Sensitivity can be adjusted using the Potentiometer. Because to calibrate the sensor to an Idle condition. Once it reaches the threshold, it will produce the output signal at A1 Pin.

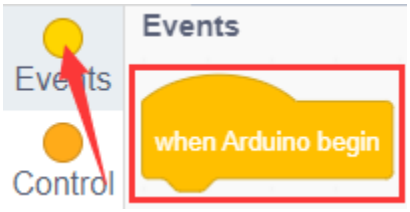
Note: All MQ Sensor takes some time to work properly because of the Heater needs to be heated for a while.

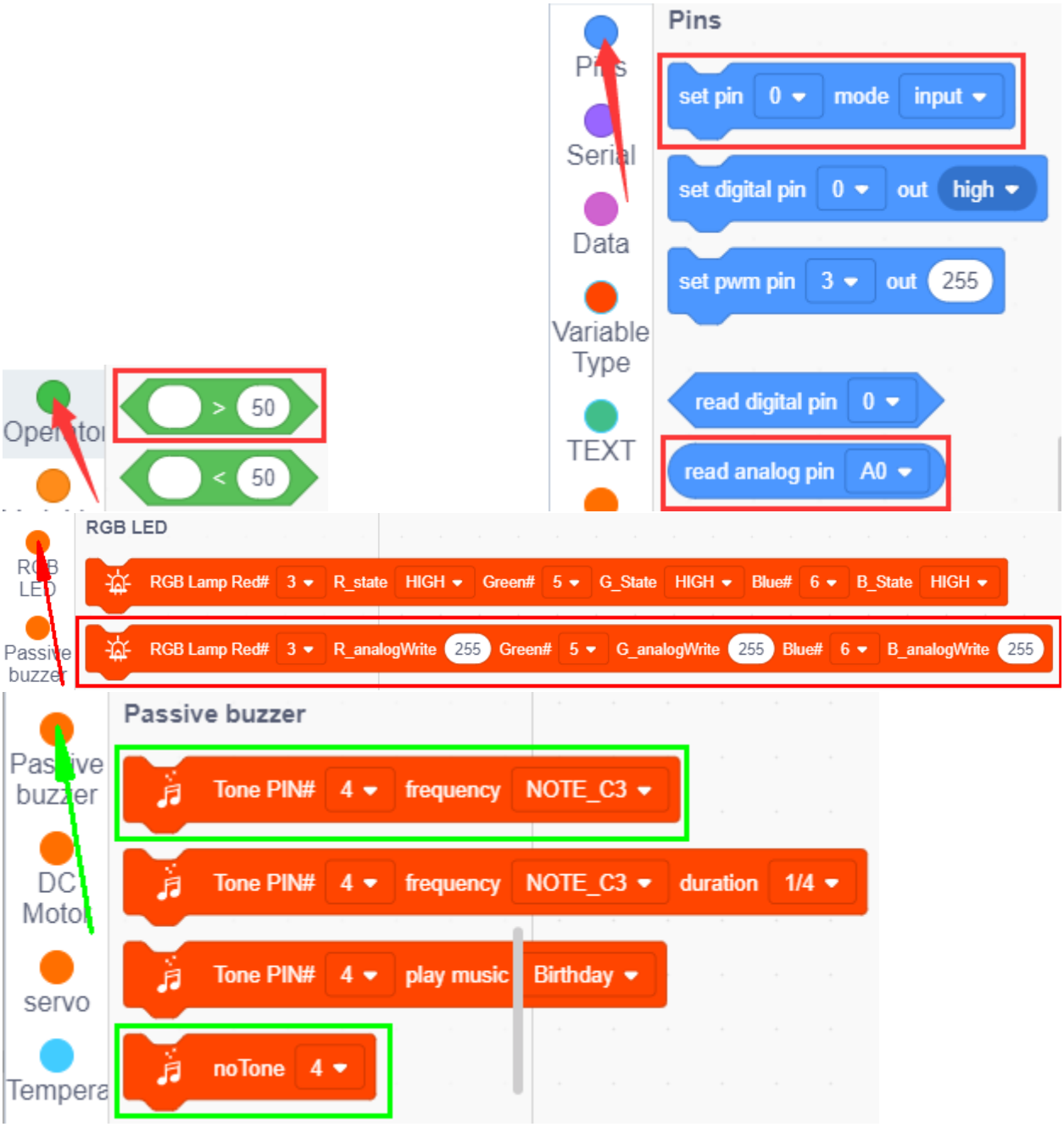
Circuit Connection

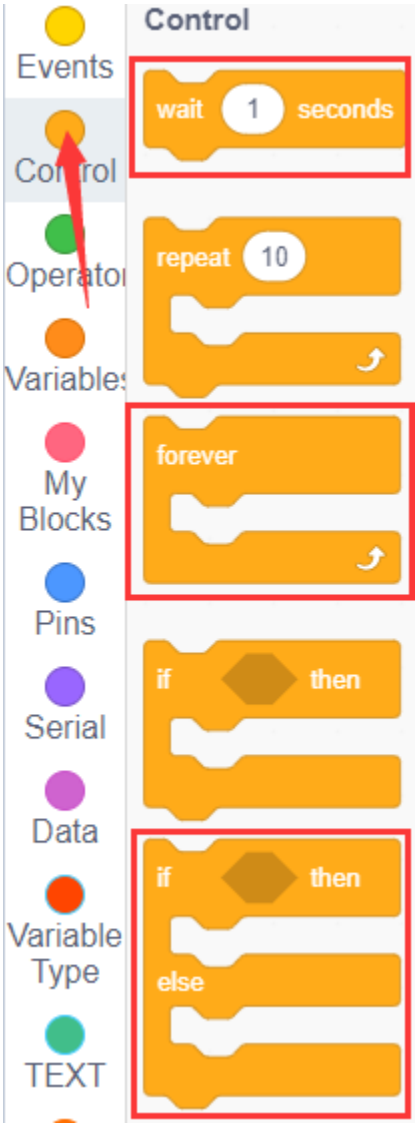
Project Code

Look for Code Blocks

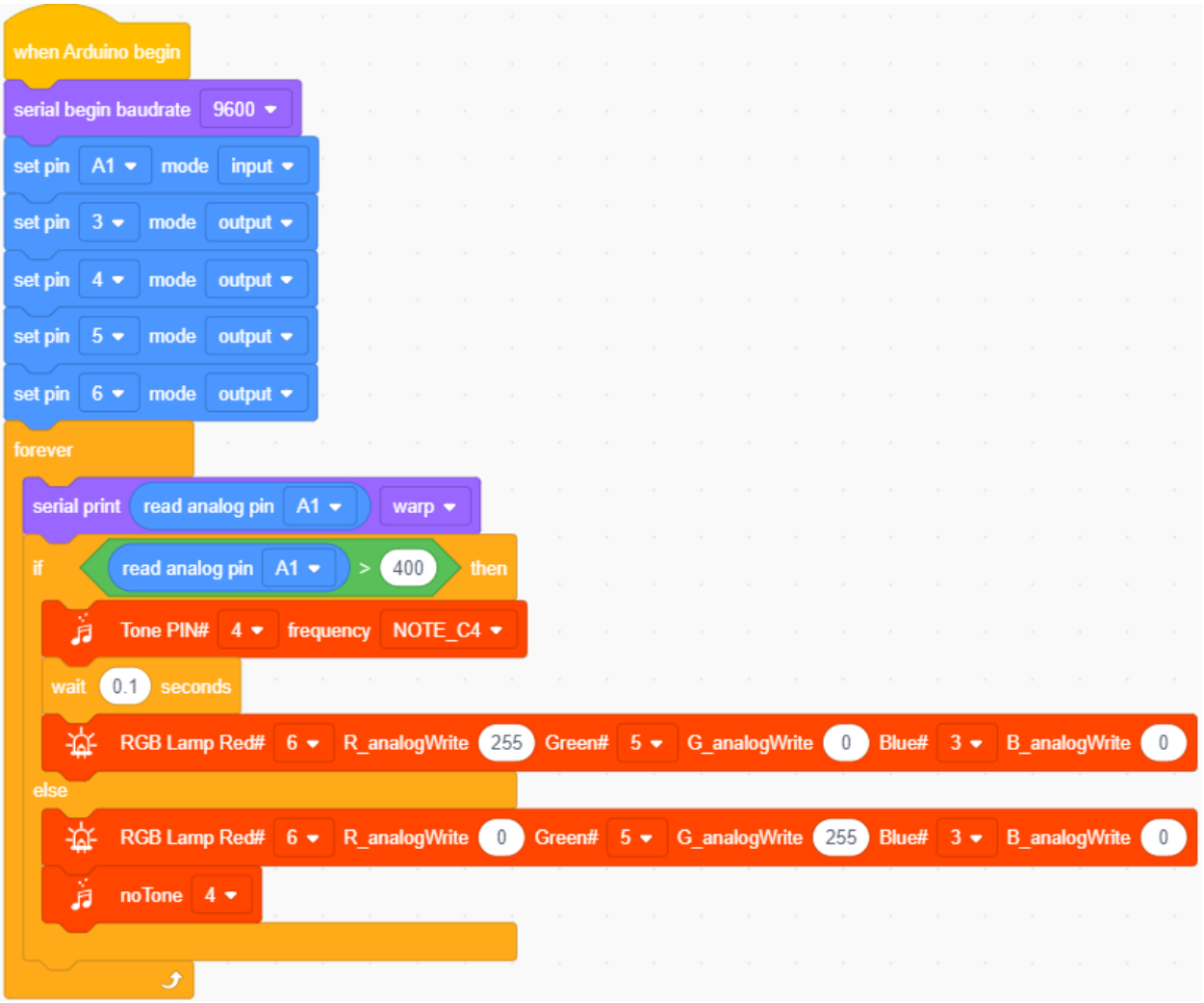
You can drag blocks to edit. Blocks listed below are for your reference




Pins
Pins
Serial
Data
Variable
Type
TEXT
set pin 0 mode input
set digital pin 0 out high
set pwm pin 3 out 255
read digital pin 0
read analog pin A0
> 50
< 50
RGB LED
RGB LED
Passive buzzer
RGB Lamp Red# 3 R_state HIGH Green# 5 G_State HIGH Blue# 6 B_State HIGH
RGB Lamp Red# 3 R_analogWrite 255 Green# 5 G_analogWrite 255 Blue# 6 B_analogWrite 255
Passive buzzer
Passive buzzer
DC Motor
servo
Tone PIN# 4 frequency NOTE_C3
Tone PIN# 4 frequency NOTE_C3 duration 1/4
Tone PIN# 4 play music Birthday
noTone 4



Complete Program



Project Result

Click 

to upload the code to the coding box successfullythe gas sensor can detect combustible gas. After detecting combustible gas, the buzzer will issue an alarm and the light on RGB will be red. If no combustible gas is detected, the buzzer will not make a sound, and the light on it lights up green.

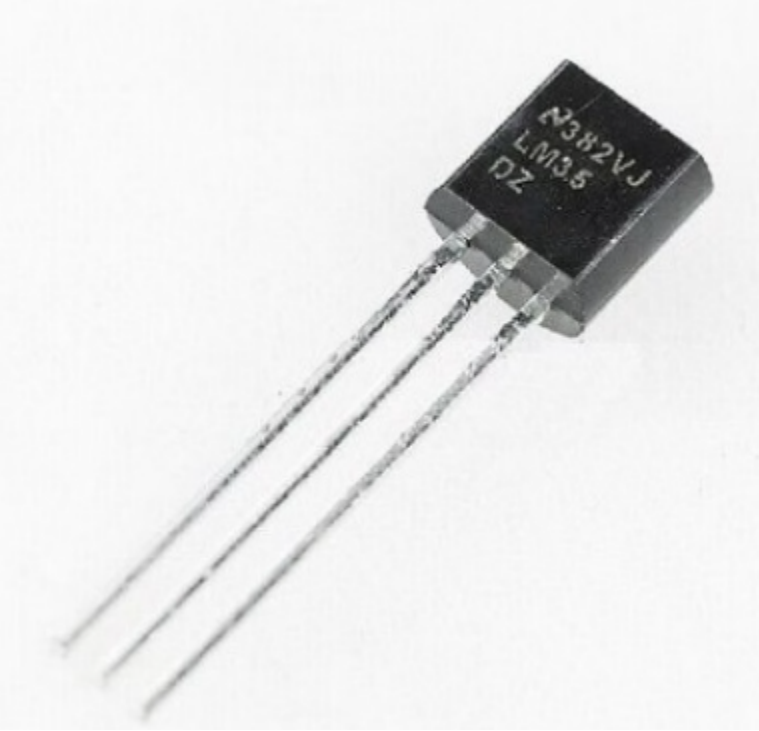
5.2.16 Project 16: Temperature Tester

Project Introduction

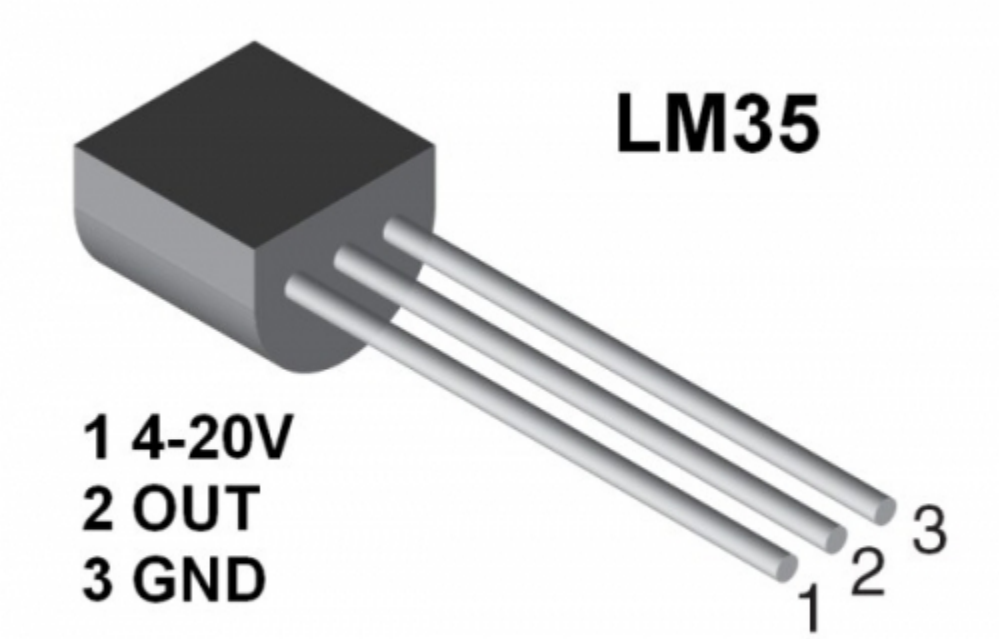
LM35 is a common and easy-to-use temperature sensor. It does not require other hardware. You just need an analog port to make it work. The difficulty lies in compiling the code to convert the analog value it reads into Celsius temperature.

In this project, we use a temperature sensor and RGB to DIY a temperature tester. When the temperature sensor touches different temperature objects, the LED lights will show different colors.

Working Principle



LM35 is a widely used temperature sensor with many different package types. At room temperature, it can achieve the accuracy of ±1/4°C without additional calibration processing.



LM35 temperature sensor can produce different voltage by different temperature

When temperature is 0 ℃, it outputs 0V; if increasing 1 ℃, the output voltage will increase 10 mv.

The output temperature is 0℃100℃, the conversion formula is as follows:

$$V_{\text{out\_LM35}}(T) = 10\,\text{mV}/^{\circ}\text{C} \times T^{\circ}\text{C}$$

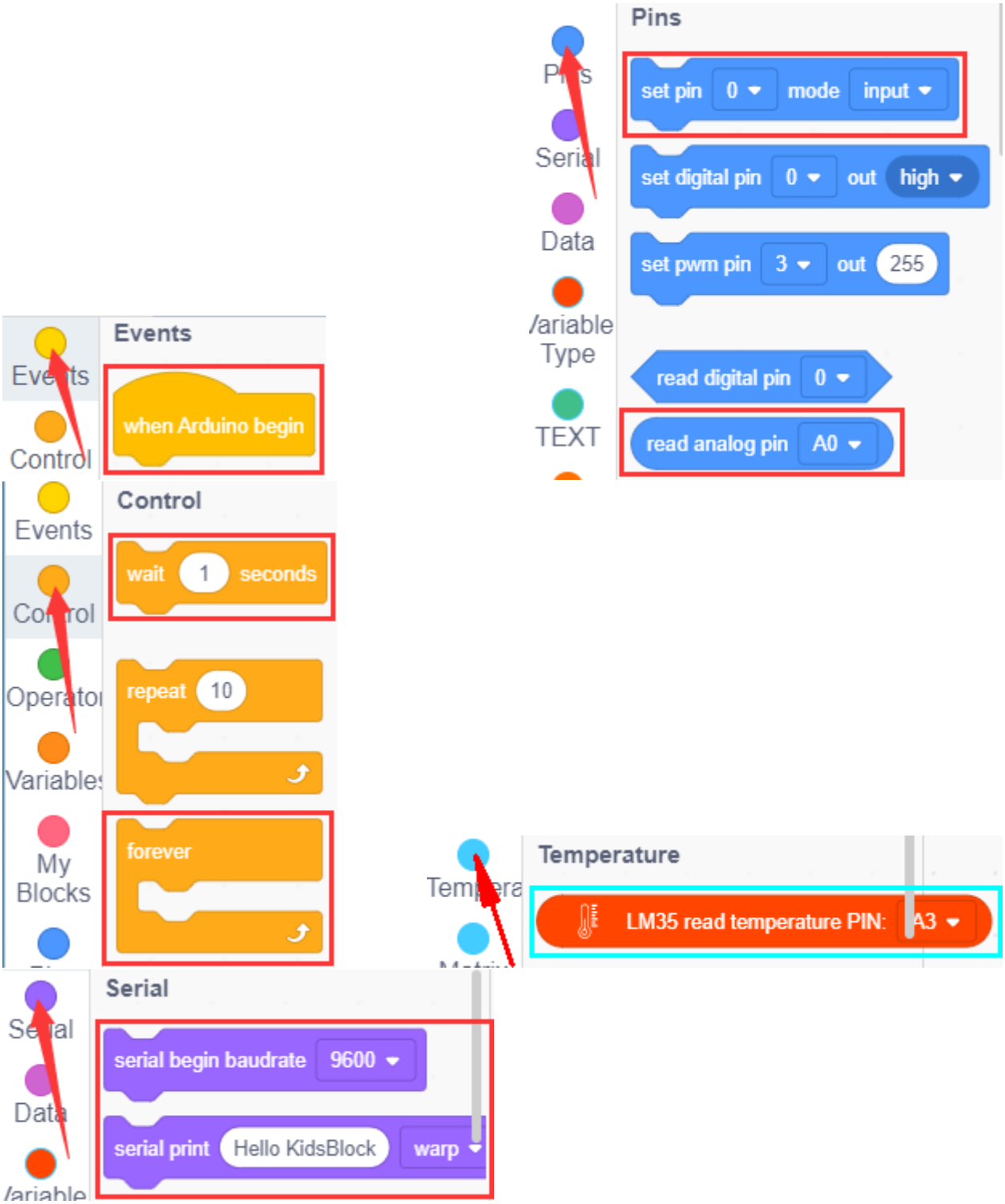
Read temperature value

We first use a simple code to read the value of the temperature sensor, print it in the serial monitor, and wire it as shown below.

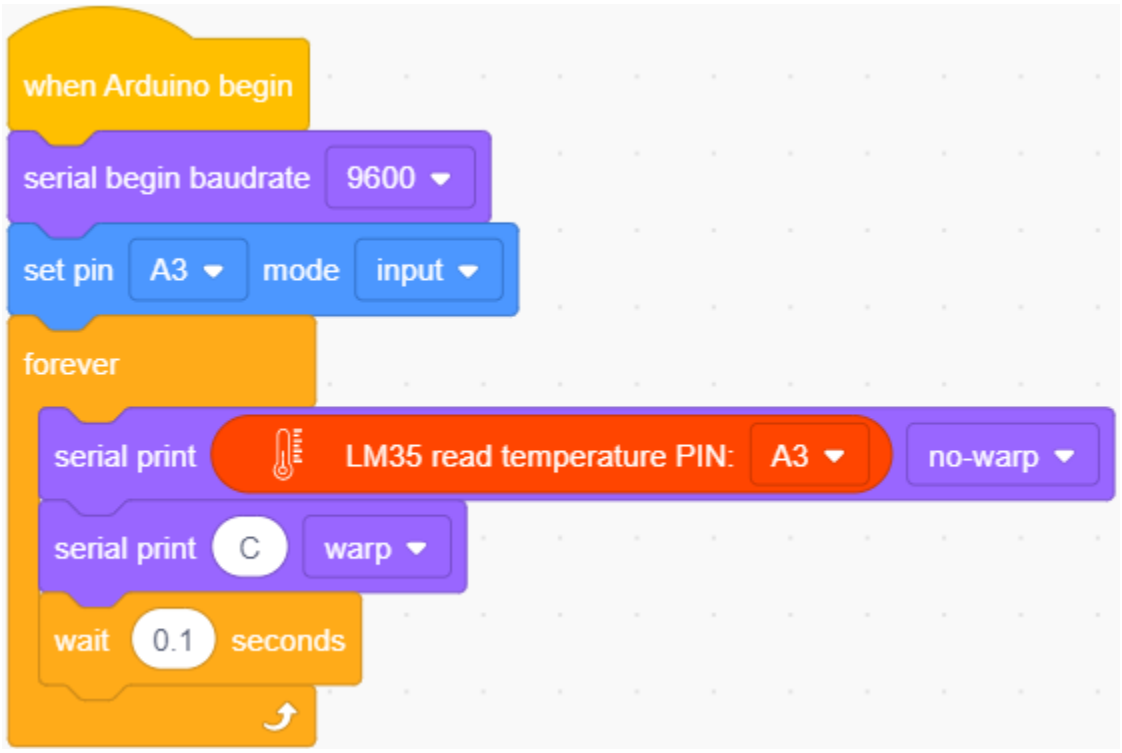
Here, LM35 output is given to analog pin A3 of Mainboard. This analog voltage is converted to its digital form and processed to get the temperature reading.

Look for Code Blocks

You can drag blocks to edit. Blocks listed below are for your reference

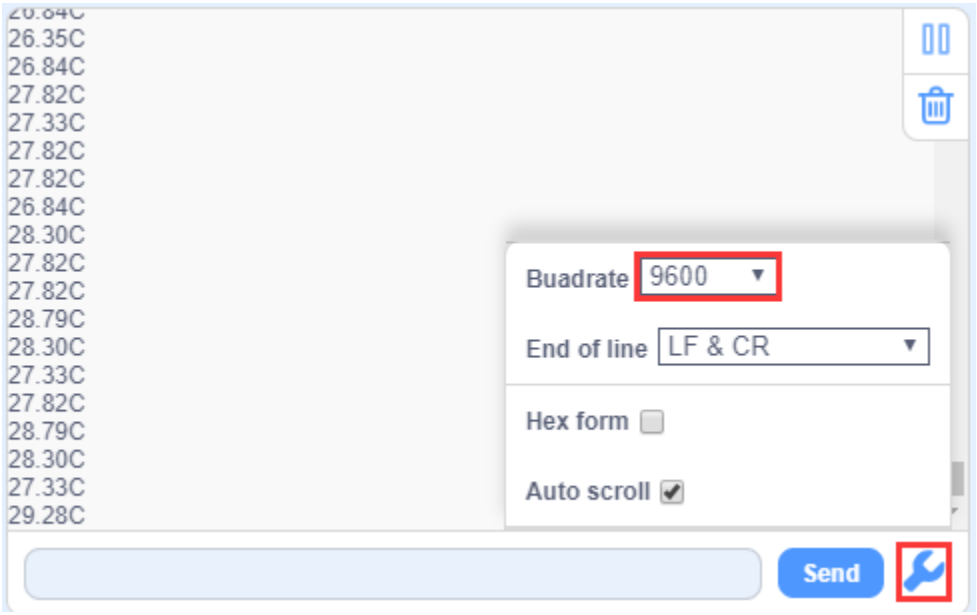


Complete Program



Project Result 1

Click Upload to upload the code to the coding box successfullytap to set the baud rate to 9600and then you can read the current temperature value.



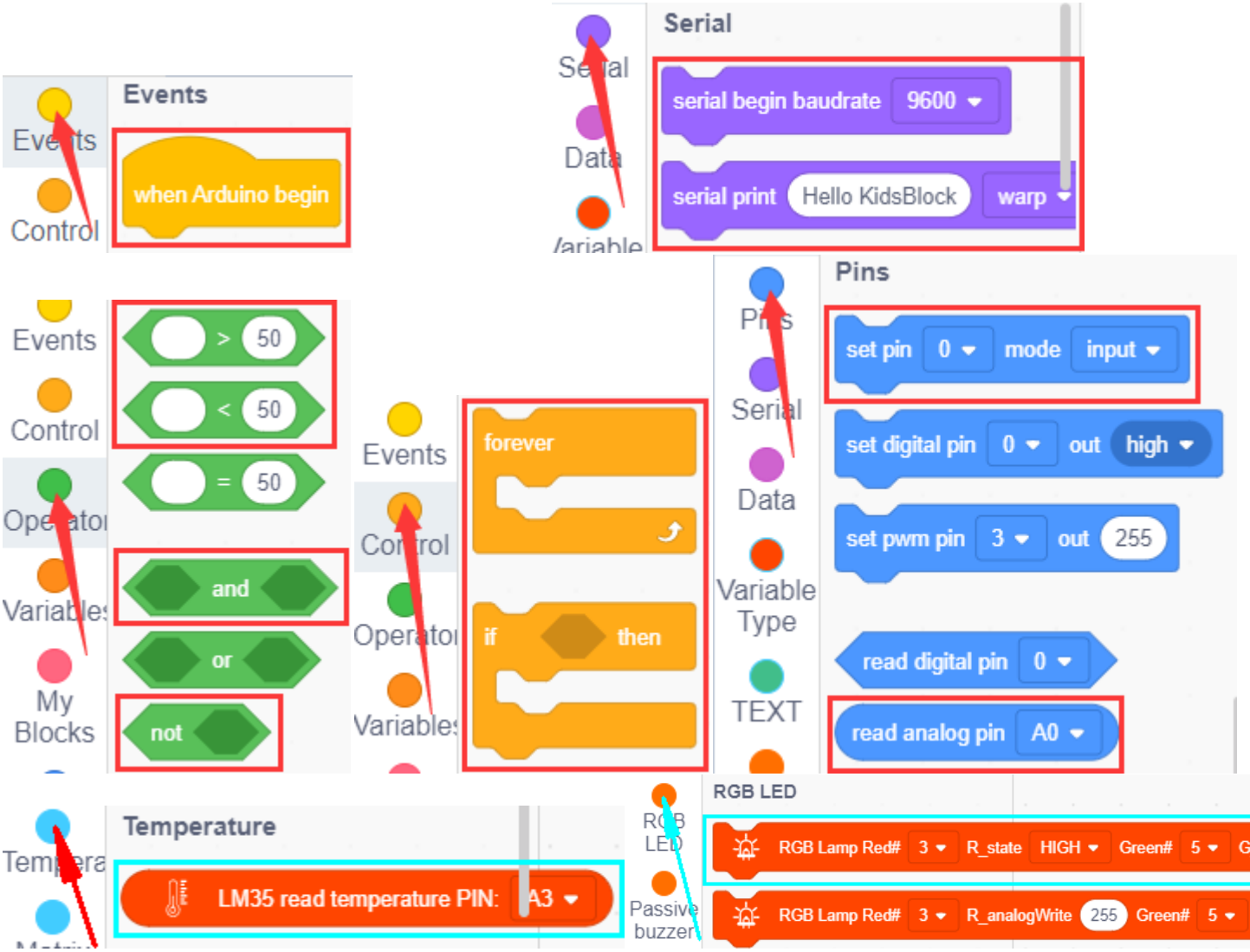
Circuit Connection

Now use the LM35 temperature sensor and RGB to do a temperature tester. When the temperature tester senses different temperatures, different LEDs will light up. Follow the diagram below for wiring.

Project Code

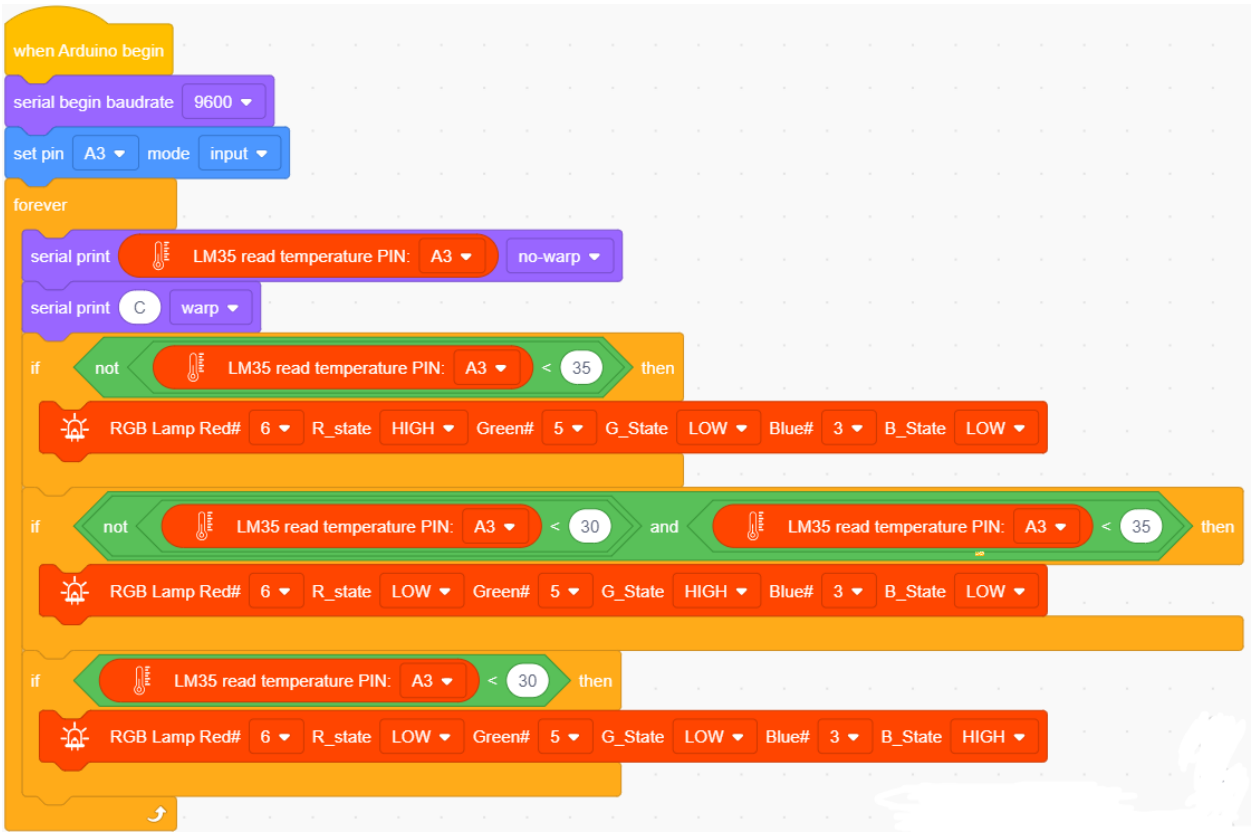
Look for Code Blocks

You can drag blocks to edit. Blocks listed below are for your reference



Complete Program

Note: The temperature value in the program can be changed depending on the situation.



Project Result

Click 

to upload the code to the coding box successfullythe temperature sensor can detect the outside temperature.

When the temperature is greater than or equal to 35°C, the RGB LED lights up red.

When the temperature is greater than or equal to 30°C and less than 35°C, the RGB LED lights up green;

When the temperature is less than 30°C, the RGB LED lights up blue,

You can use this item to make a temperature reminder water cup.

5.2.17 Project 17: Turns An LED On

Project Introduction

Dot matrices seem to be very unfamiliar, but in fact it is everywhere in our lives. It is widely used in some outdoor billboards, game consoles, and supermarkets.

And a LED dot matrix has many advantages, such as power saving, long service life, low cost, high brightness, wide viewing angle, long visual range, waterproof and so on. It can meet different needs, so it has great prospects.

The 8*8 dot matrix integrated on the coding box uses I2C communication. It can control up to 64 LEDs and display interesting patterns, including numbers, characters, and graphics with only two signal pins.

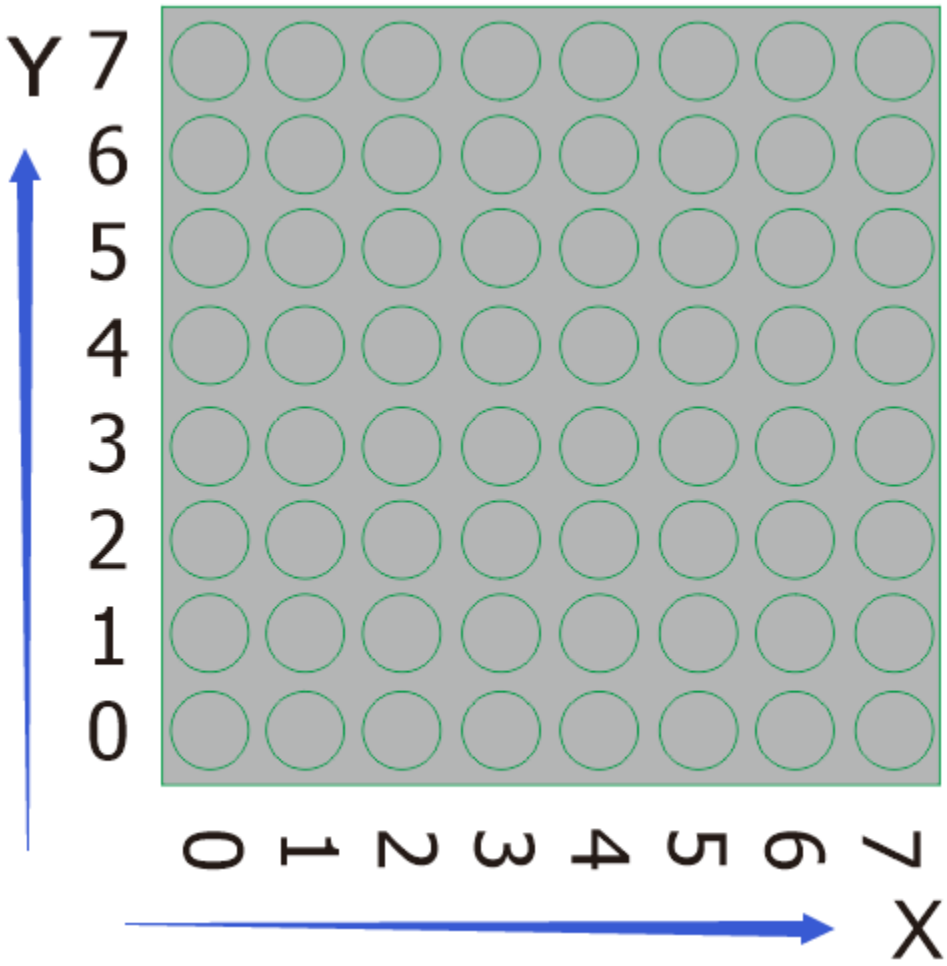
What's more, the 8*8 dot matrix is equipped with a HT16K33 driver chip .Through a simple I2C interface, we can control the chip to work and drive the 8*8 dot matrix screen.

Now we are about to start many 8*8 dot matrix projects. Firstly, let's turn on a led on the dot matrix.

Project Circuit

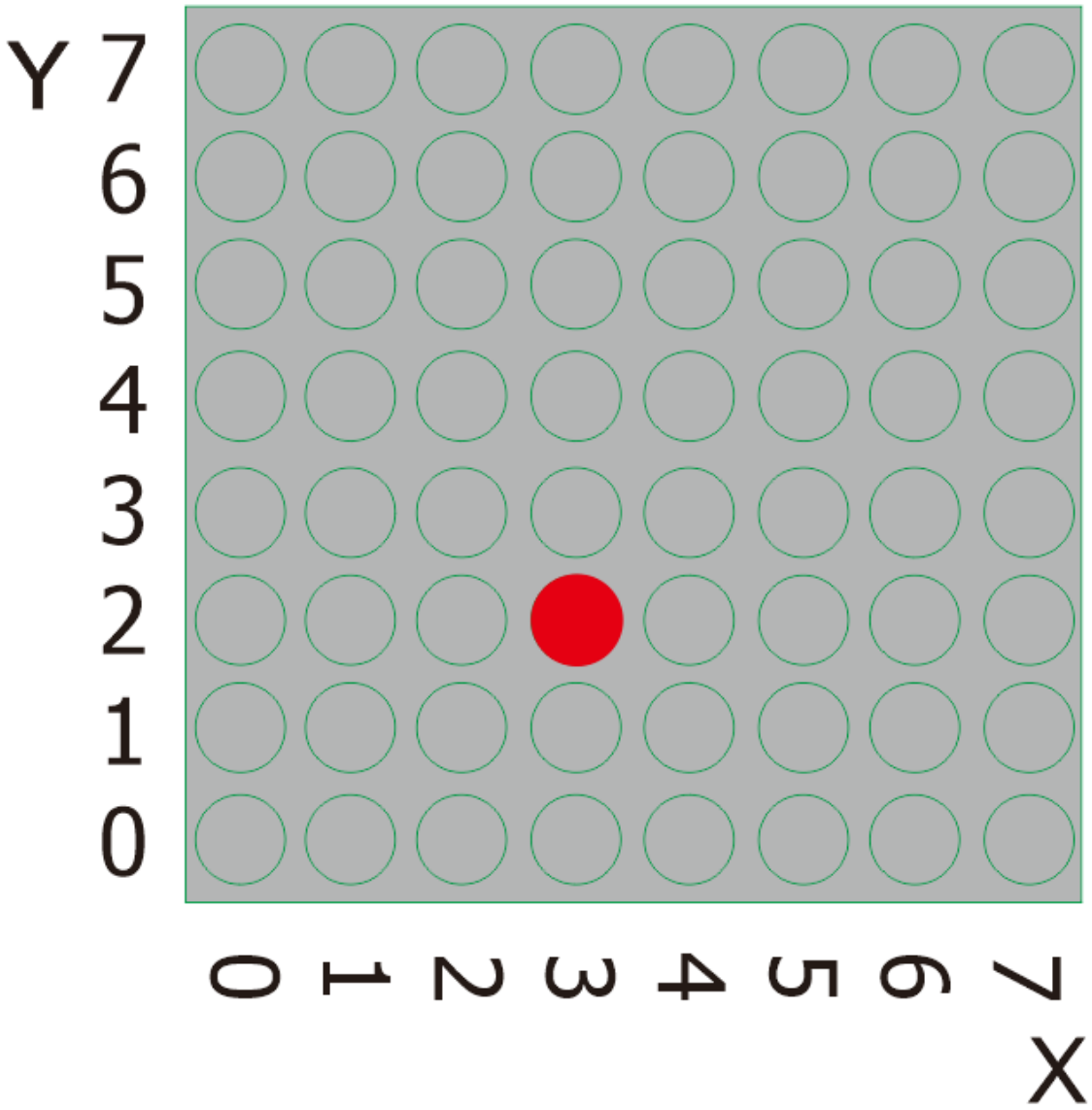
Project Principle

The theory behind the 8*8 dot matrix is quite simple. It is driven by the chip HT16K33 of the micro-controller. It has 64 LEDs, sitting in 8 rows and 8 columns. In order to locate these LEDs quickly, as the figure shown below, we can regarded this matrix as a coordinate system and create two aces by marking those in rows from 0 to 7 from bottom to top, and the ones in columns from 0 to 7 from the left to the right.



Then,what we should do to light a LED ?

Please have a look at the following picture.

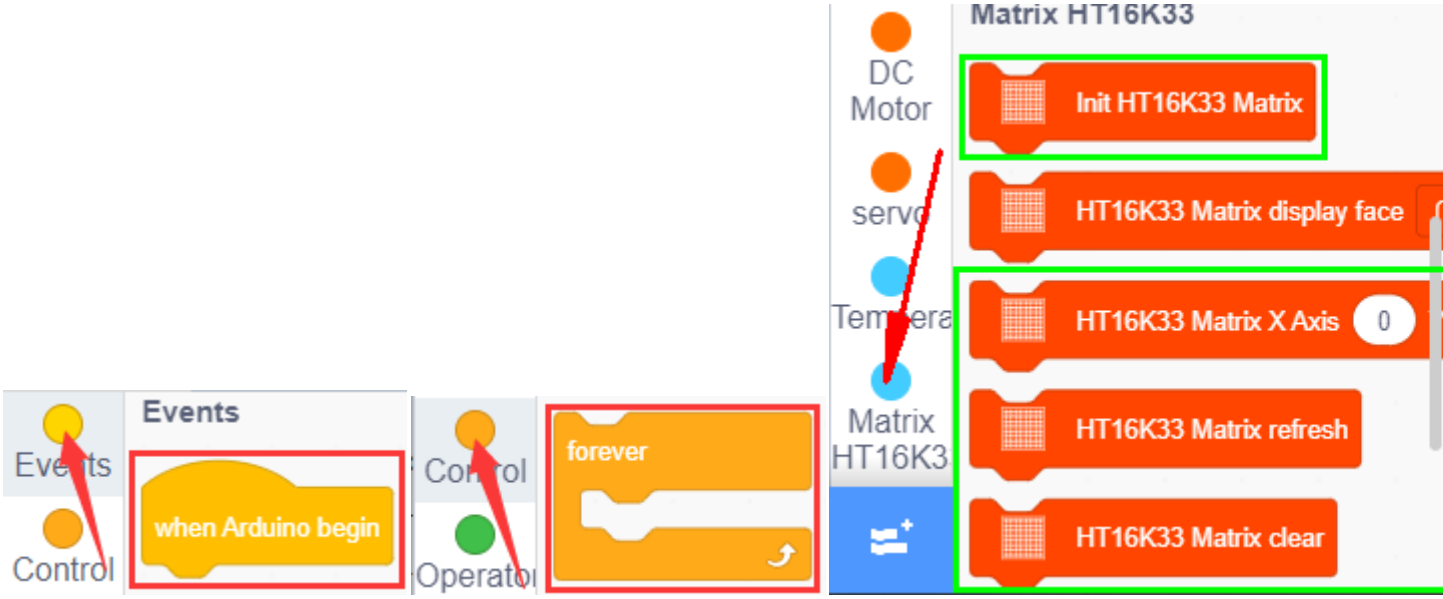


According to coordinate system created, the red spot in the above picture can be recorded as (3,2). Then we integrate its position into the code to write the following code.

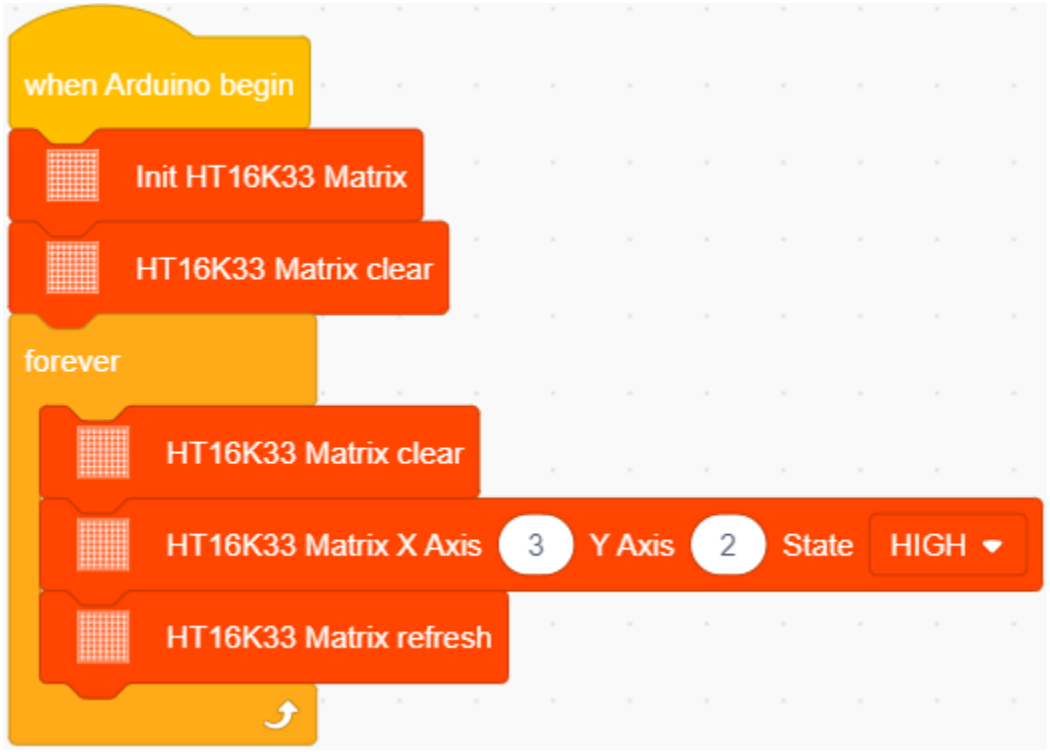
Project Code

Look for Code Blocks

You can drag blocks to edit. Blocks listed below are for your reference



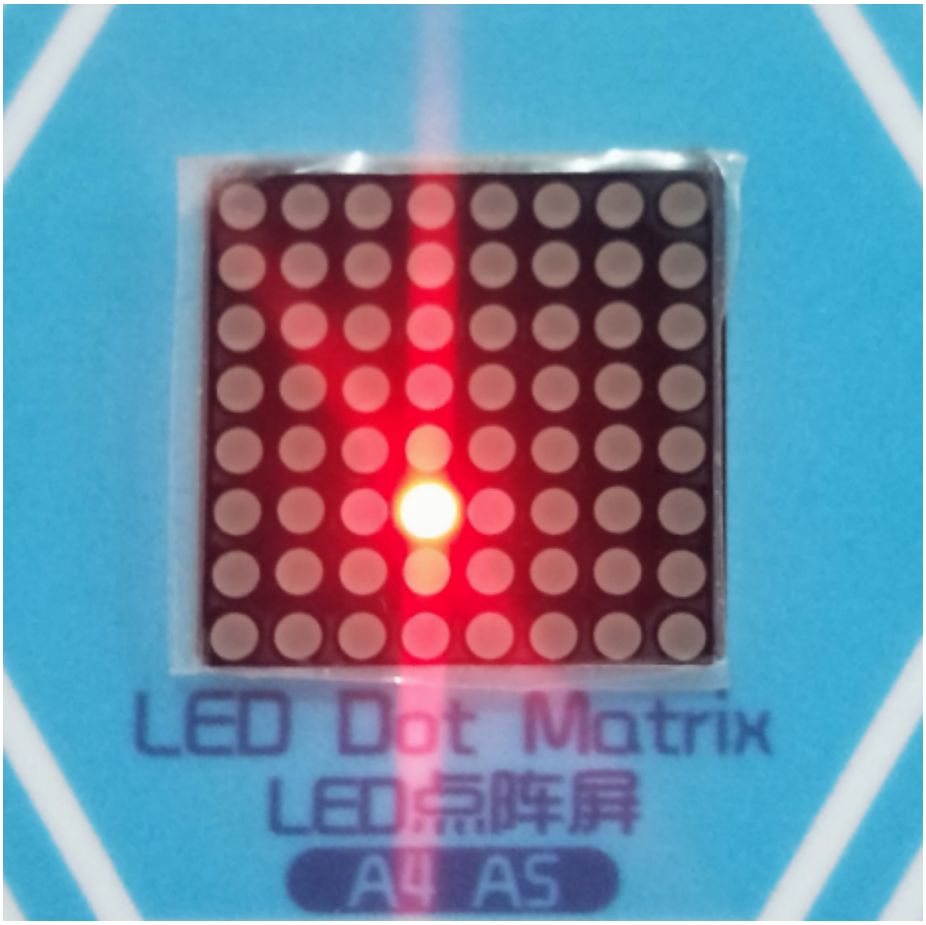
Complete Program



Project Result

Click 

to upload the code to the coding box successfullythe LED dot matrix will display the required LED as shown in the figure below.

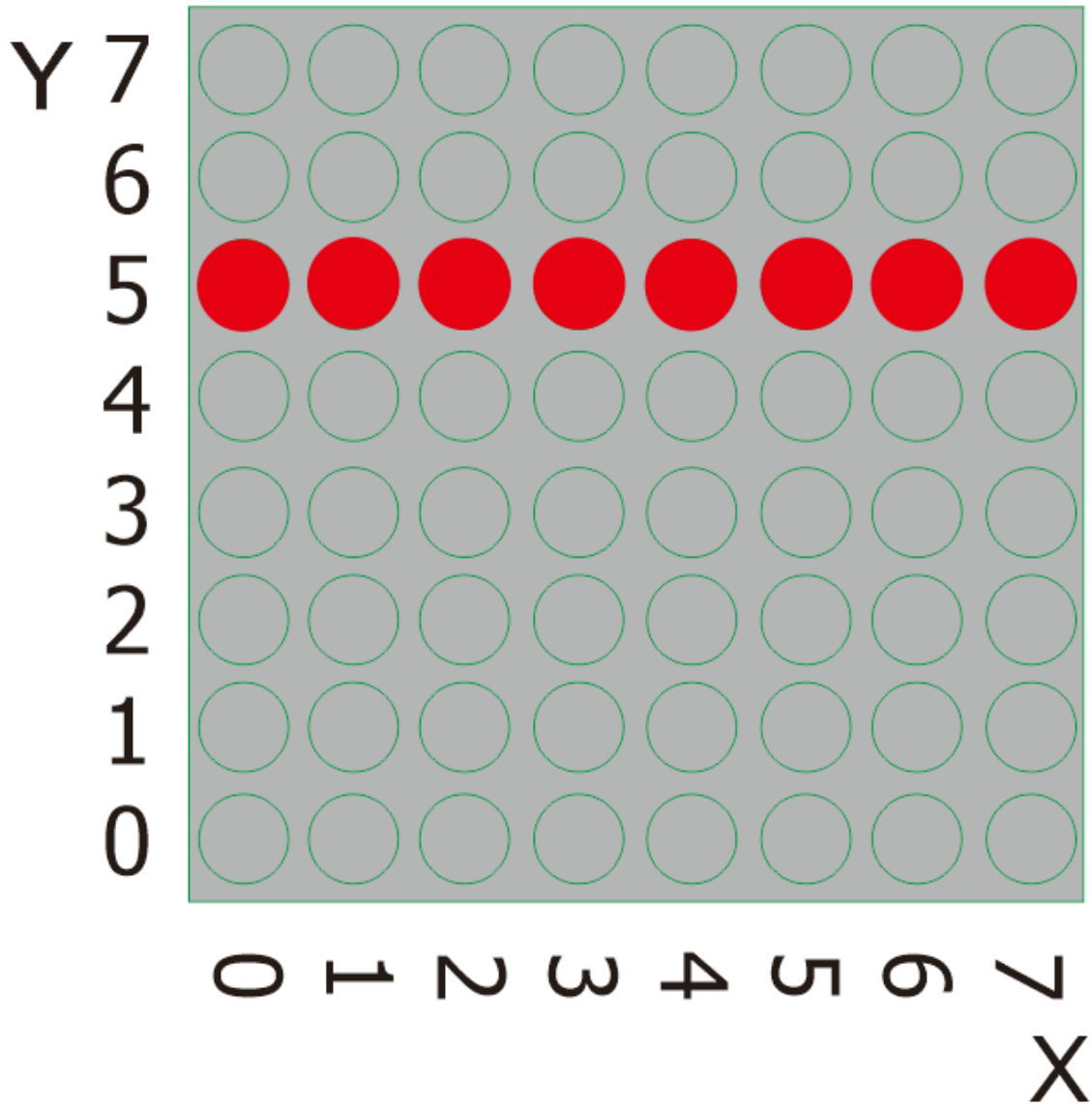


5.2.18 Project 18: Turn On A Line

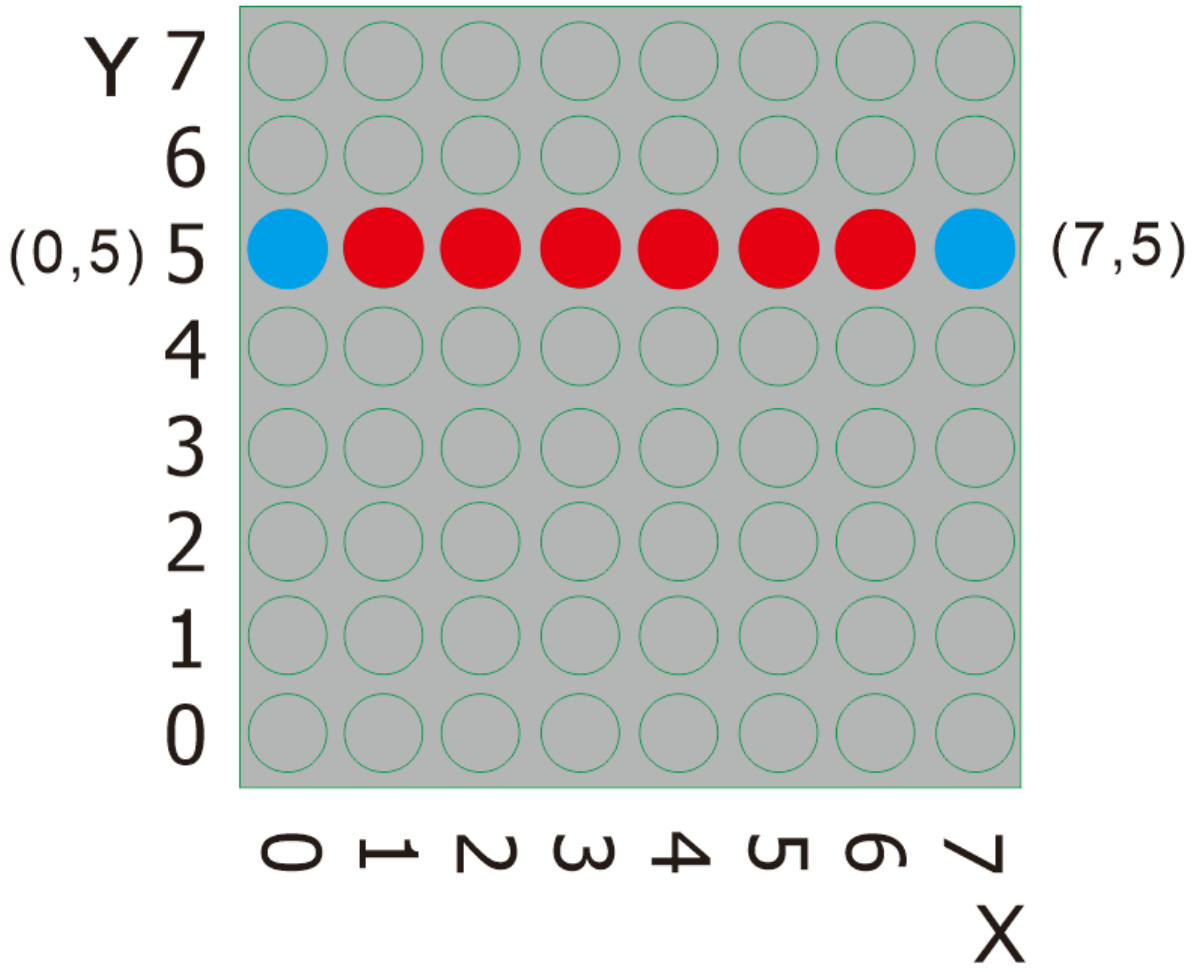
Project Introduction

In the previous project, we have turned on one LED while in this lesson we will light a row of LEDs, that's 8 LEDs.

Project Principle



Please look at the above picture. What we can do to light this whole line of red spots?

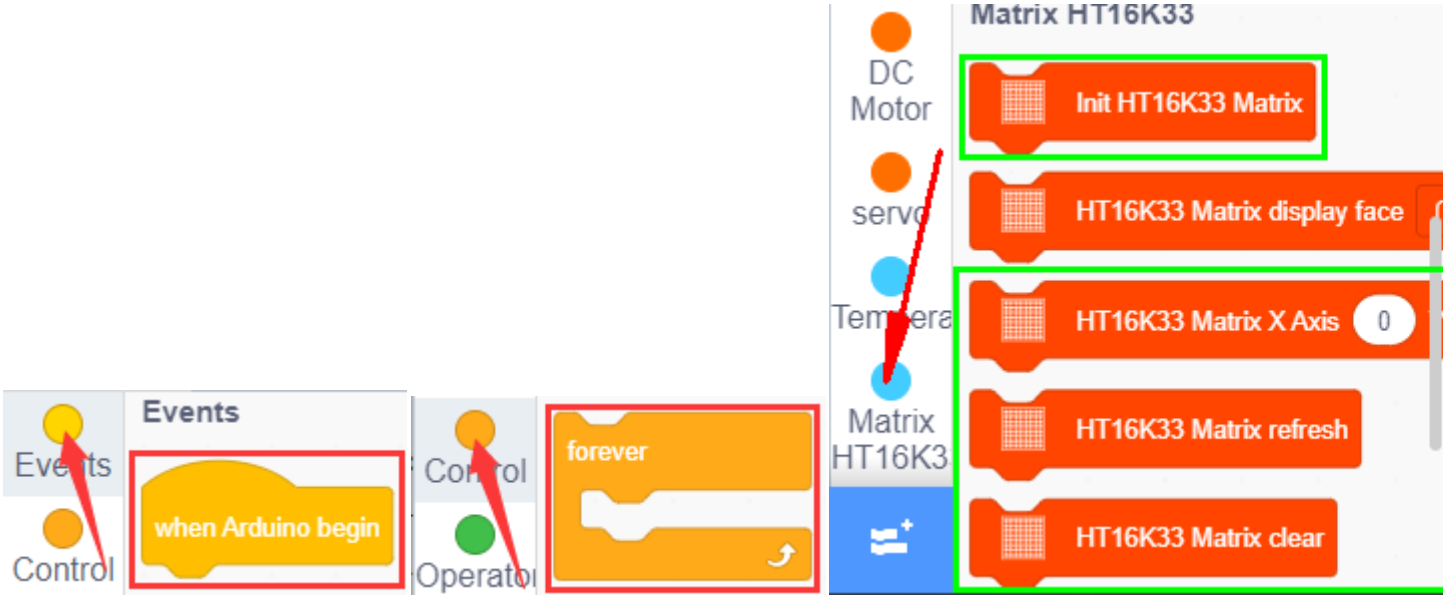


From the figure above, it is clear that the starting point of this line is (0,5) ,follow by1,5,2,5,35,4,5,55,6,5and then the ending point is (7,5)Then we log them and place them into the code.

Project Code

Look for Code Blocks

You can drag blocks to edit. Blocks listed below are for your reference

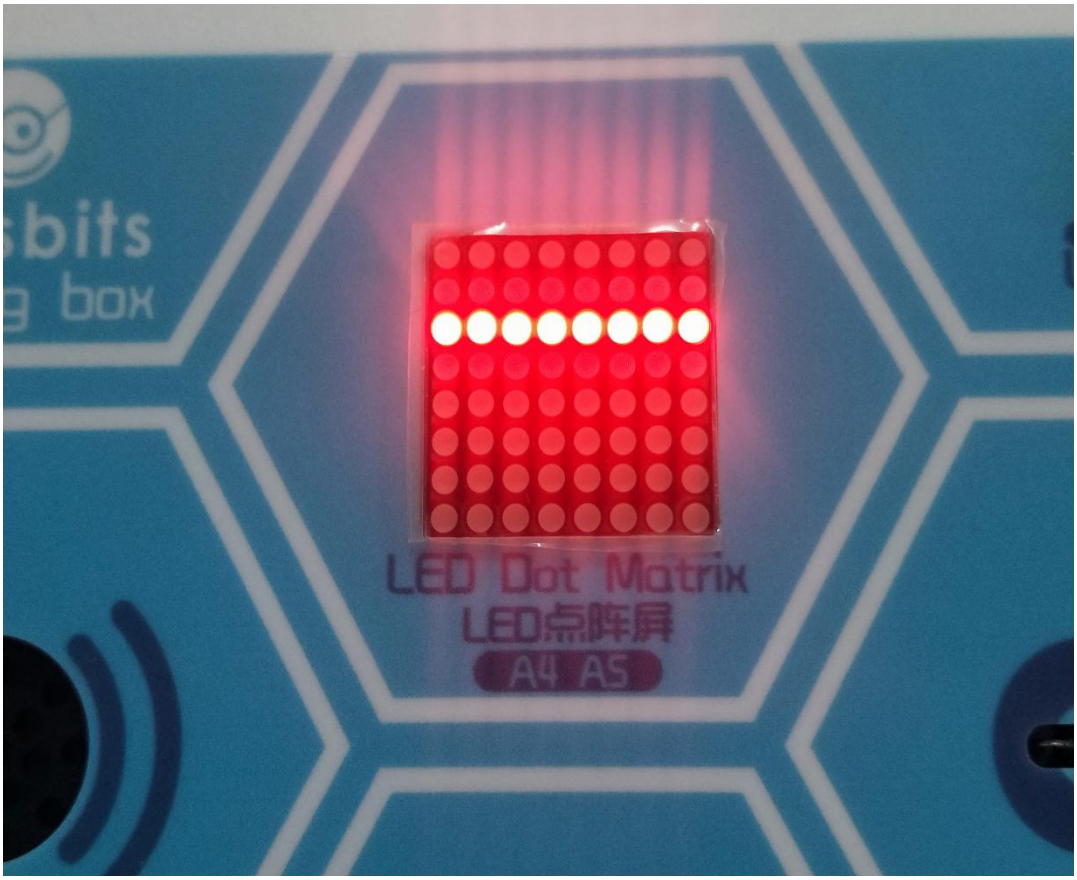


Complete Program

Project Result

Click 

to upload the code to the coding box successfullythe LED dot matrix will display as shown in the figure below.



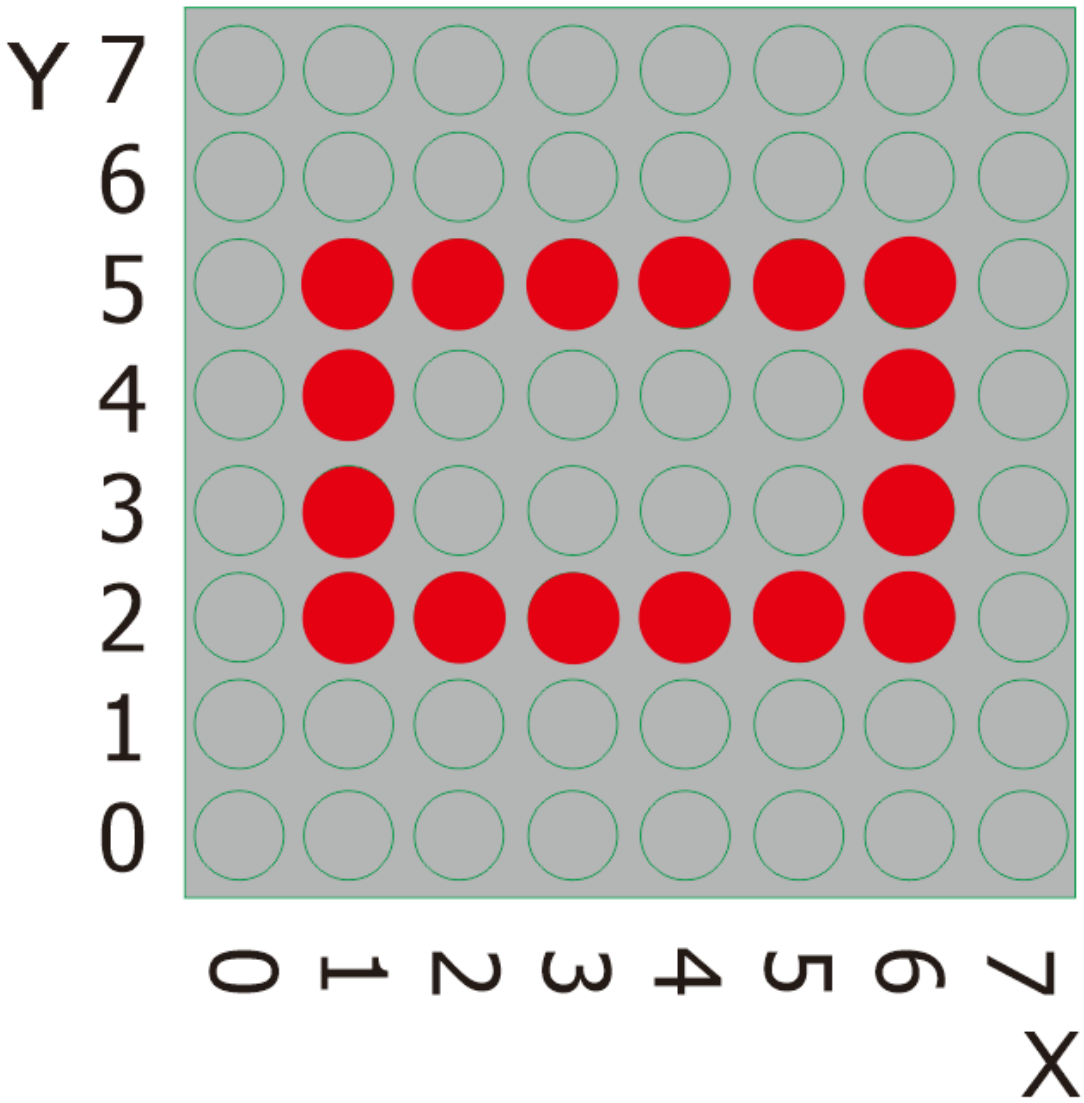
5.2.19 Project 19: Display A Rectangle

Project Introduction

Are you getting more excited about our next project?

This time, we intend to make it more challenging and let the matrix display a rectangle.

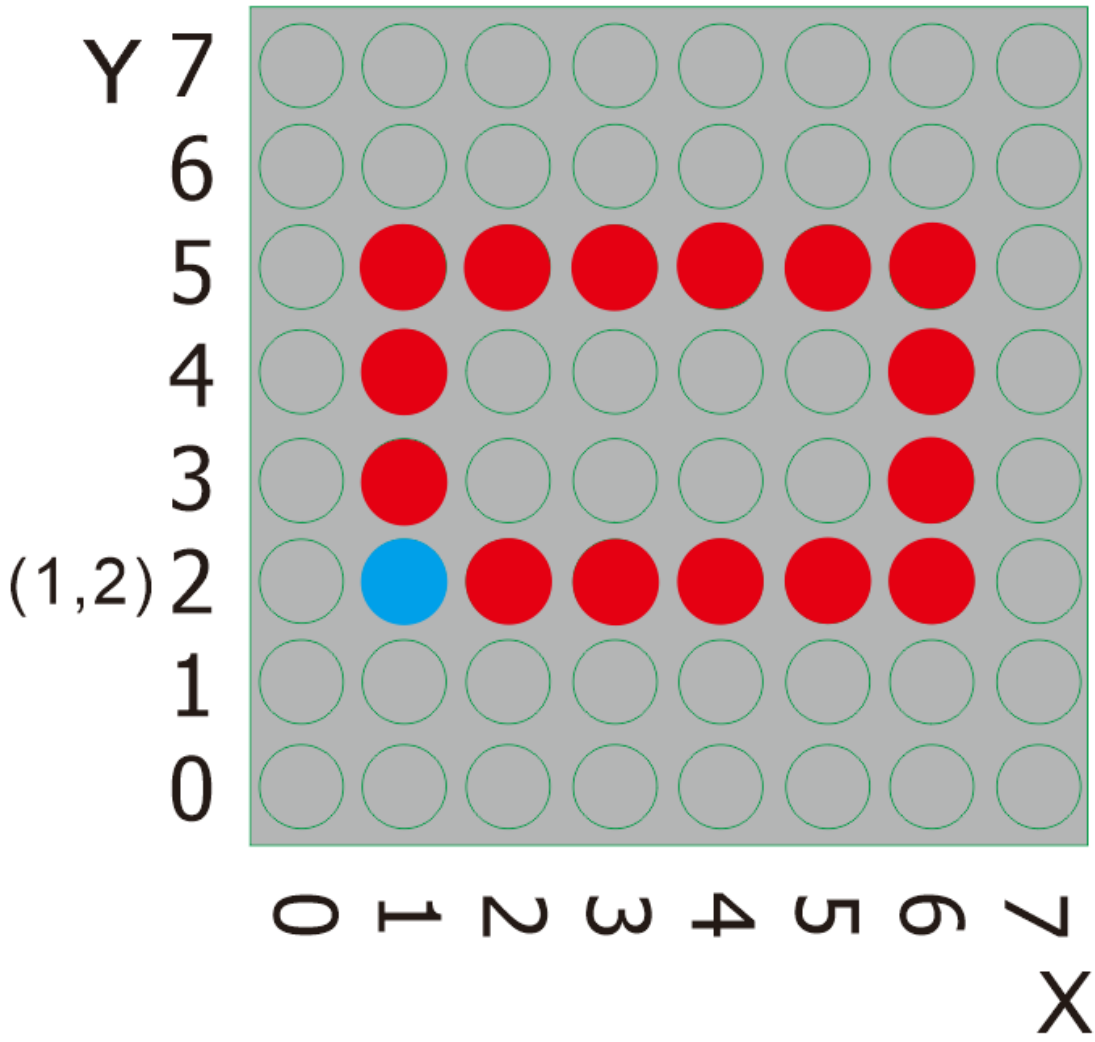
Project Principle



Likewise, please eye the picture above.

What we should do to light all these red spots shaped in a rectangle? We need to light the corresponding LED. To showcase a rectangle or a square with these LEDs, We need to figure out exactly where these points are.

Let's find the position of the blue spotthe starting point, in the picture below.

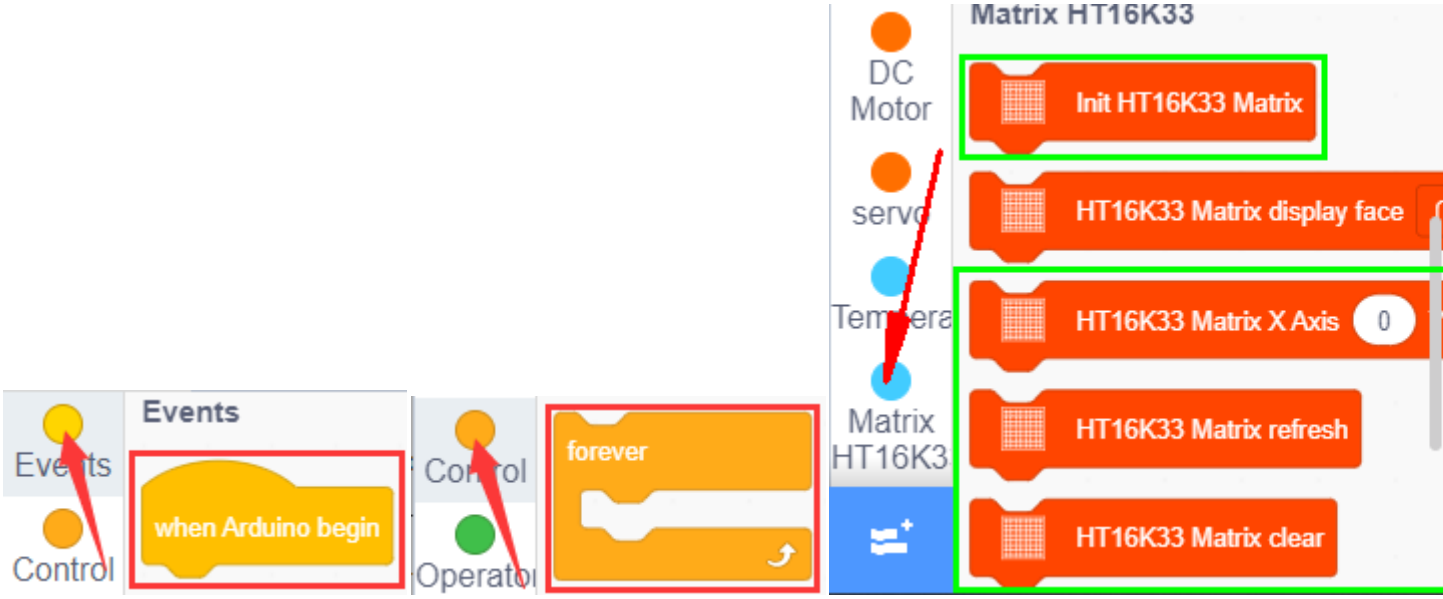


It is explicit that the position of the blue spot is (1,2). To light this rectangle, what required to do is adding the dimension of the rectangle behind the position value of this point. Then find the corresponding position X and Y values of LED that need to be lit one by one.

Project Code

Look for Code Blocks

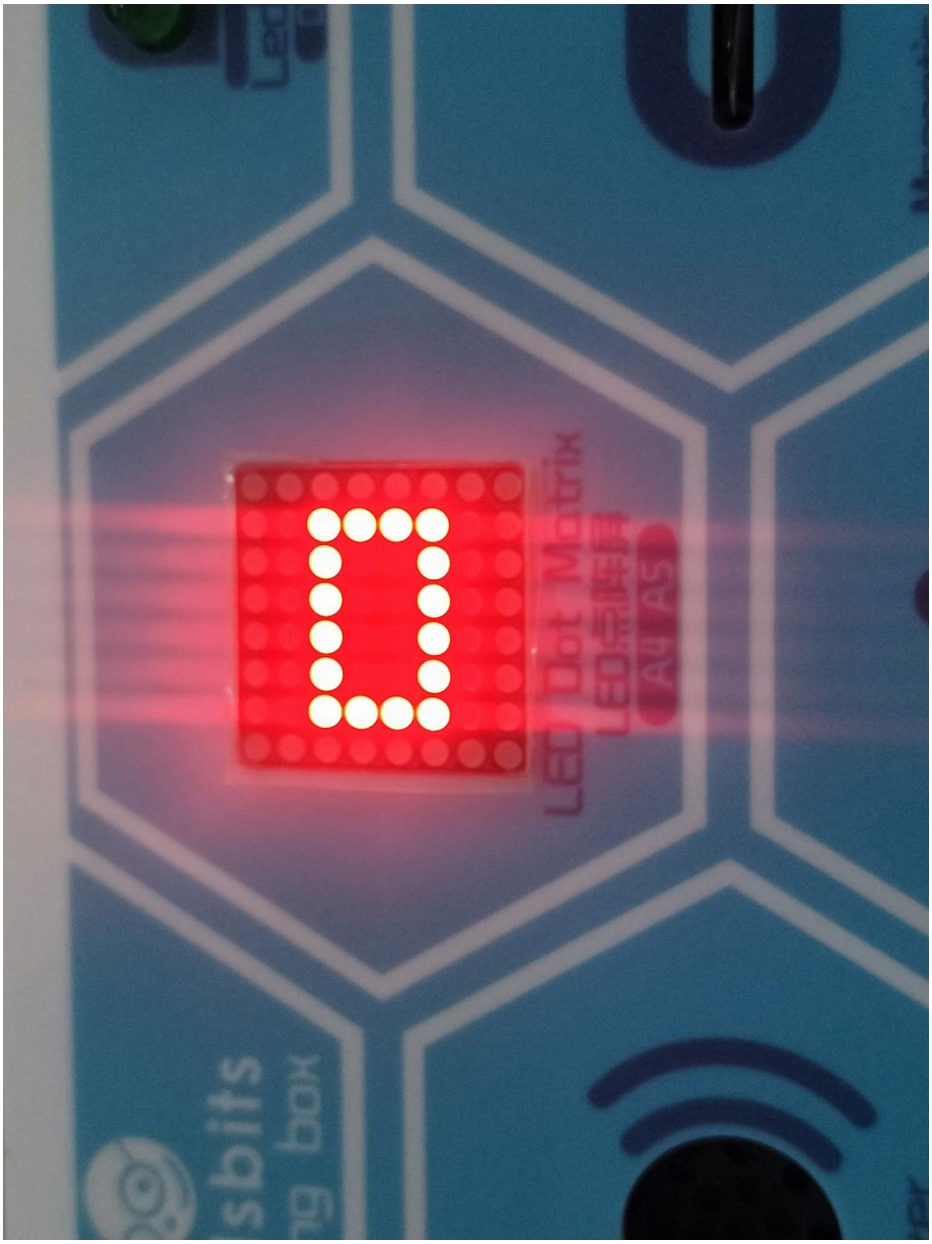
You can drag blocks to edit. Blocks listed below are for your reference



Complete Program

Project Result

Click Upload to upload the code to the coding box successfullythe LED dot matrix will display the pattern as shown in the figure below.



5.2.20 Project 20: Display Images

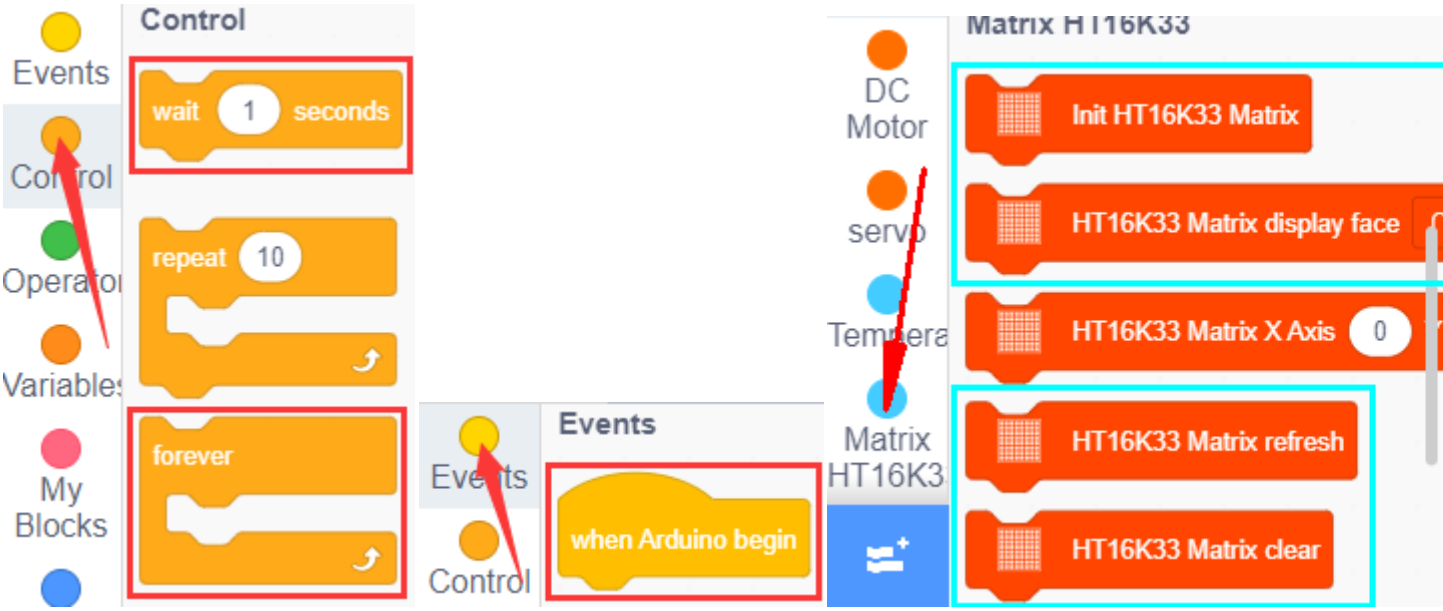
Project Introduction

Mobile phones, computer screens, billboards and other display devices all consist of many small luminous units. However, the 8*8 dot matrix has only 64 luminous units. Though it can't display some nice images with high-resolution, it can show some cute pictures, such as patterns shaped in little heart, cute facial expressions, avatars and others.

Project Code

Look for Code Blocks

You can drag blocks to edit. Blocks listed below are for your reference



Complete Program

Project Result

Click Upload to upload the code to the coding box successfullythe LED dot matrix will

display ∩_∩ ♥ >_< └_┘.

5.2.21 Project 21: Buttons+8*8 Dot Matrix

Project Introduction

There are two built-in buttons on the coding box, which we have used to control DIY lamps in previous project. While in this project, we will combine these buttons with the 8*8 dot matrix to make displays.

Working Principle

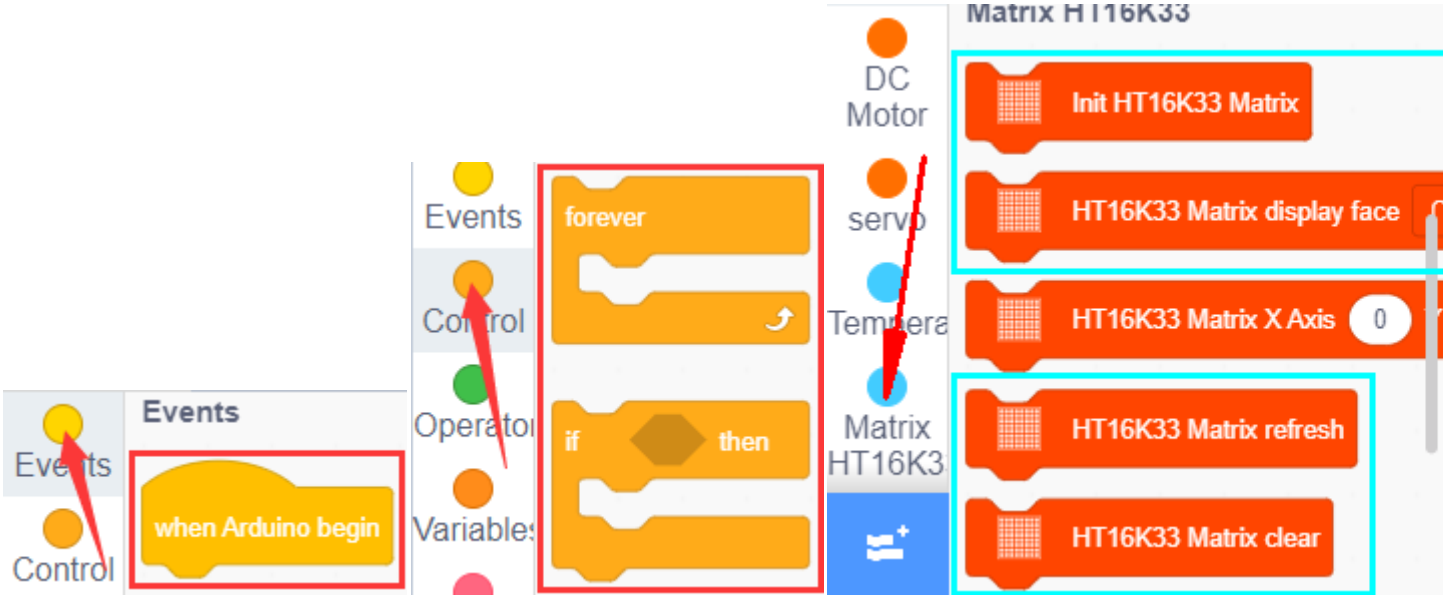
Preciously,we learned that the signal pins of the two buttons should be connected with D12 and D13 and how to make the matrix to show characters. Bearing these knowledge in mind, we will complete this project. When the button on the left side is pressed, ♥ will be displayed while when the right is pressed, >_< will be shown.

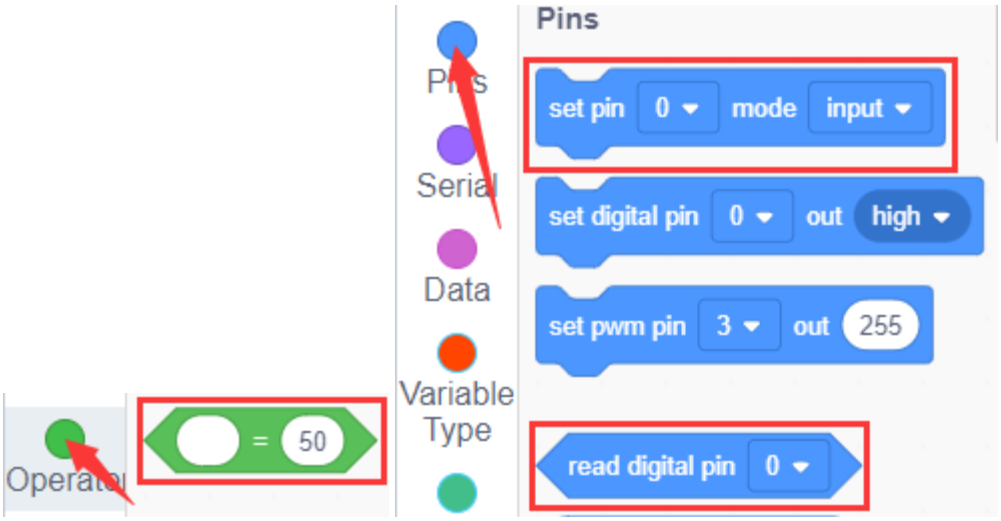
Project Circuit

Project Code

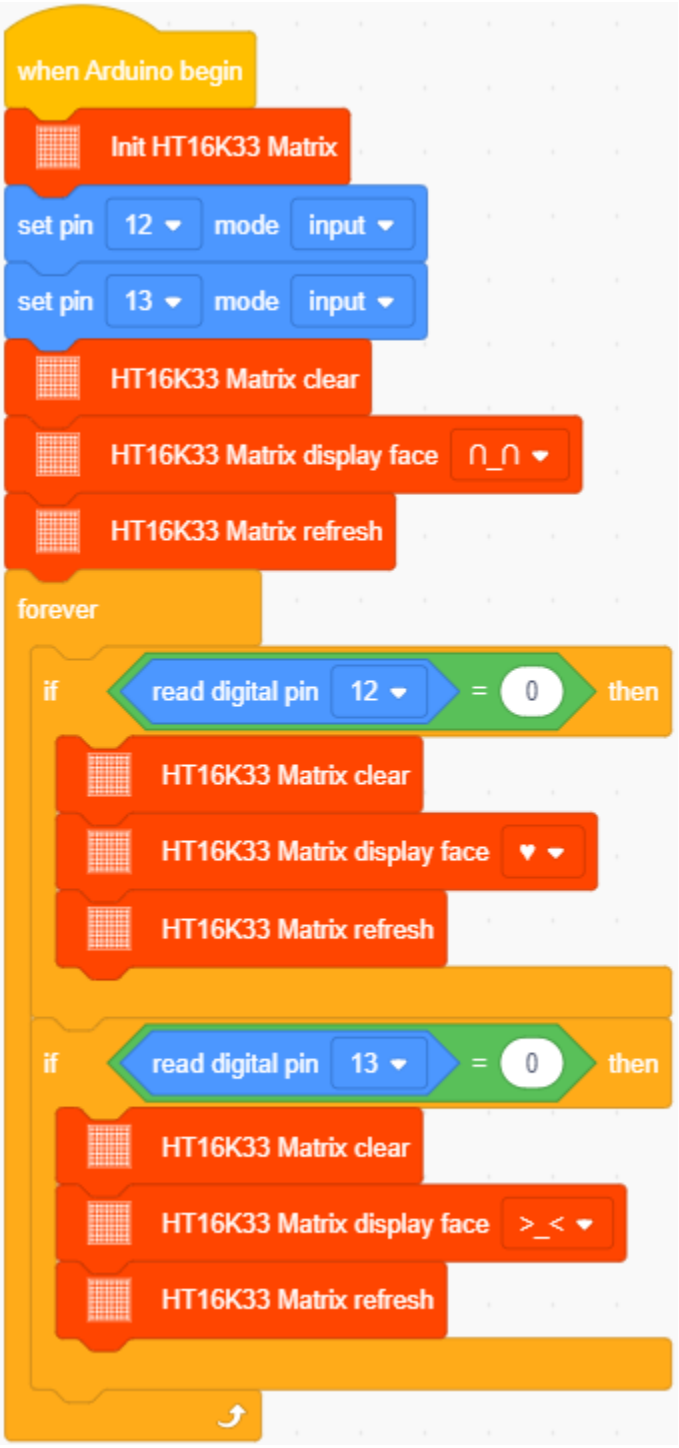
Look for Code Blocks

You can drag blocks to edit. Blocks listed below are for your reference





Complete Program



Project Result

Click Upload to upload the code to the coding box successfully

the LED dot matrix first displays ∩_∩ Press the left button and the LED dot matrix displays ♥. Press the right button and the LED dot matrix displays >_<.

5.2.22 Project 22: Light Sensor+8*8 Dot Matrix

Project Introduction

We have made a night light based on the property of the light sensor that its resistance decreases with the increasing of the light.

In this project, we will show you something intriguing too. We will combine the matrix with the light sensor to display the length of the light.

Project Principle

The signal pin of the light sensor is wired with the A6 of the MAX development board. And the light column displayed on the 8*8 dot matrix will change with the external light detected by the light sensor.

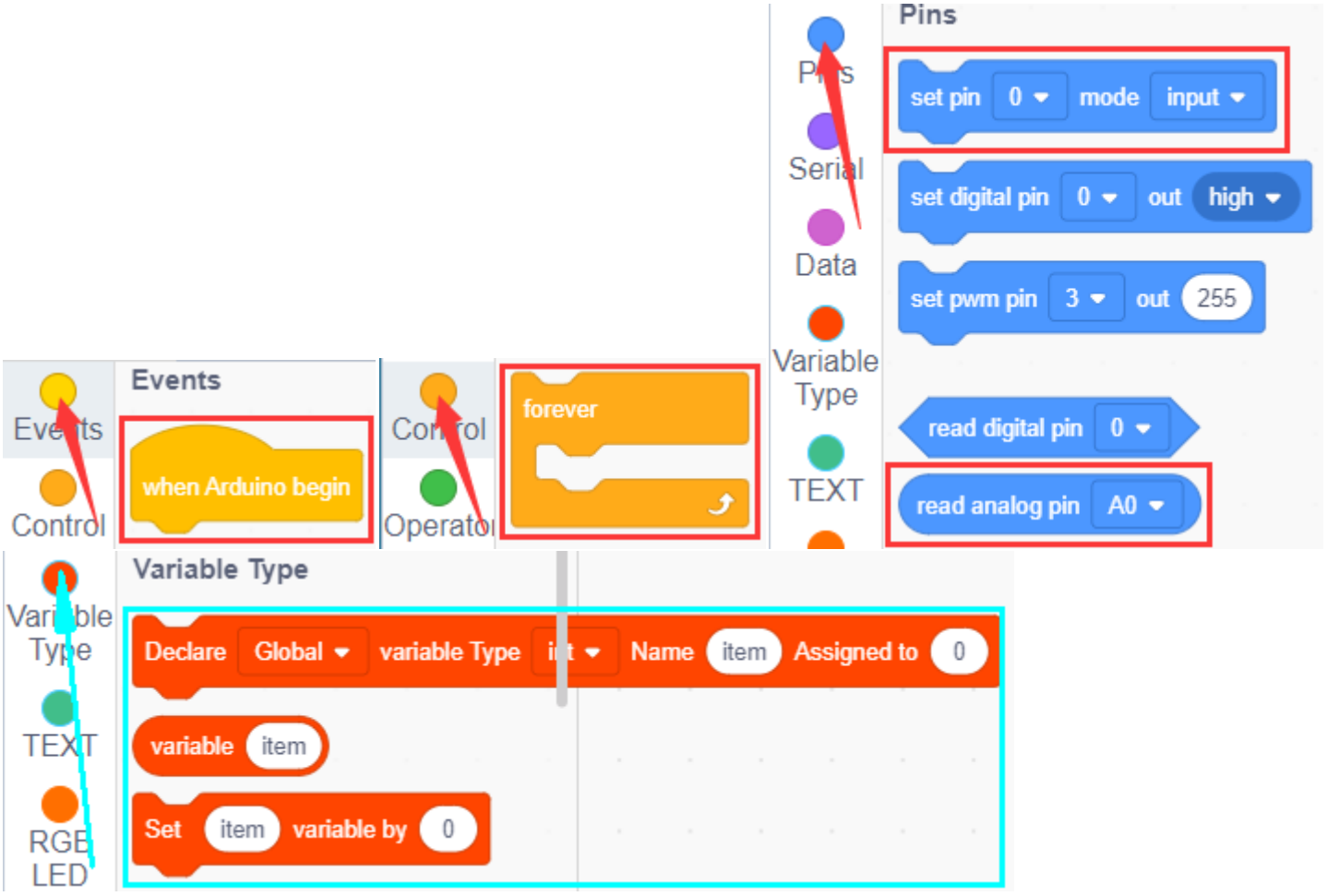
When the detected light is darker, the light column displayed is shorter; when the light becomes brighter, the light column gets longer;

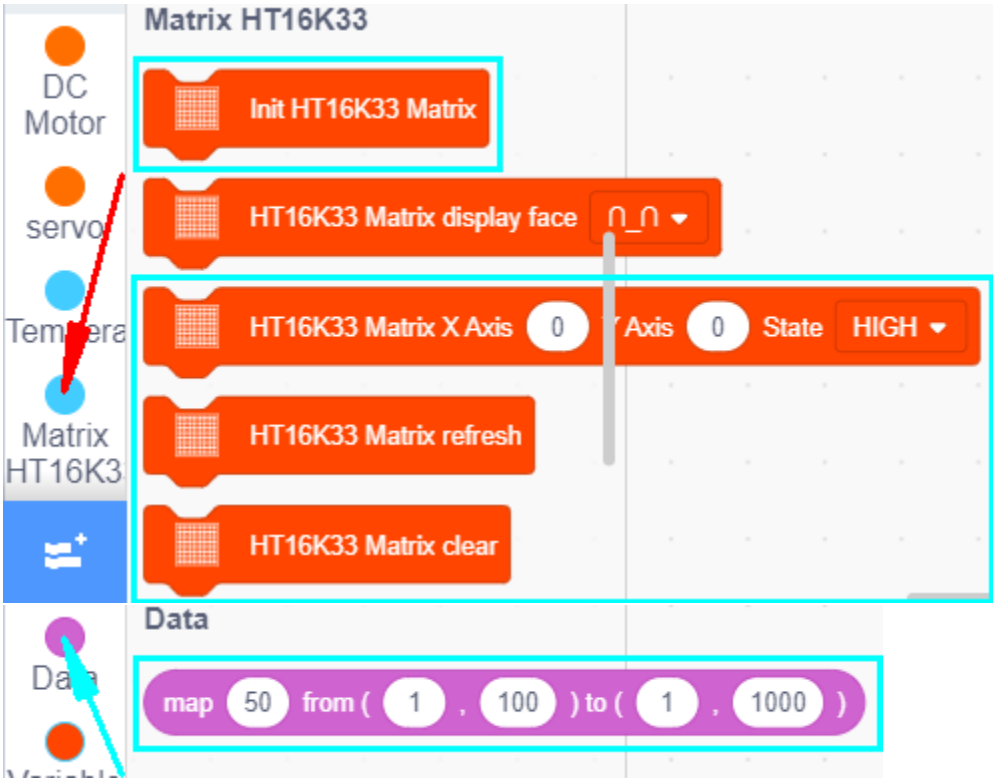
Project Circuit

Project Code

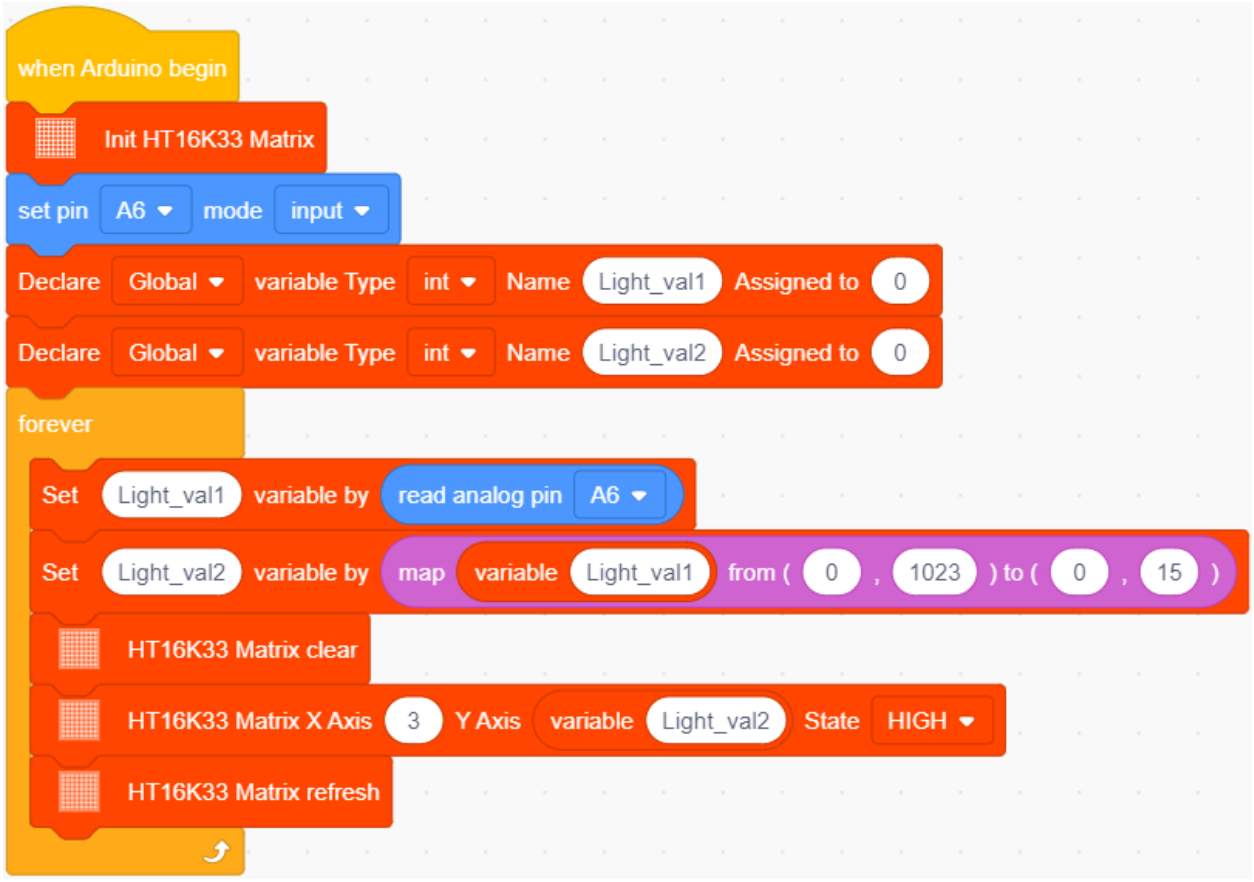
Look for Code Blocks

You can drag blocks to edit. Blocks listed below are for your reference





Complete Program



Project Result

Click 

to upload the code to the coding box successfullythen cover the photoresistor with your hand and change the intensity of the light, the LED on the dot matrix will move according to the intensity of the light.