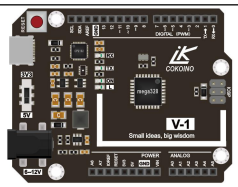
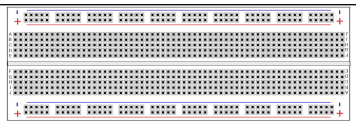
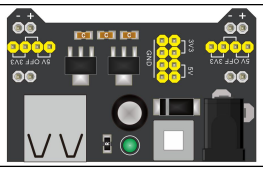
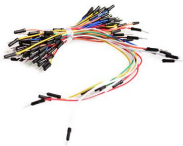
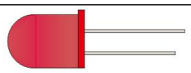
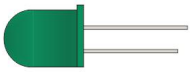
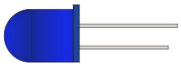
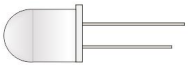
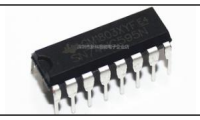
17.Extend the I/O port of V-1 board

ABOUT THIS PROJECT：

You will learn：

- How to use the 74HC595 Shift Register to extend the i/O port of V-1 board

Things used in this project：

Hardware components	Picture	Quantity
V-1 board		1 PCS
Breadboard		1 PCS
9V Battery Snap Connector		1 PCS
Breadboard power module		1 PCS
Male to Male DuPont Line		19 PCS
Type C USB Cable		1 PCS
F3 Red LED Light		2 PCS
F3 Green LED Light		2 PCS
F3 Blue LED Light		2 PCS
F3 White LED Light		2 PCS
74HC595 Shift Register		1 PCS
220R Resistor		8 PCS

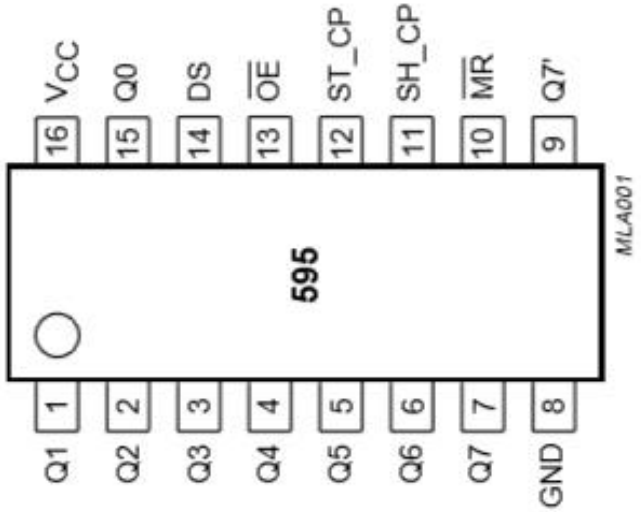
1. About 74HC595 Shift Register

The 74HC/HCT595 is an 8-stage serial shift register with a storage register and 3-state outputs. The shift register and storage register have separate clocks.

Data is shifted on the positive-going transitions of the SH_CP input. The data in each register is transferred to the storage register on a positive-going transition of the ST_CP input. If both clocks are connected together, the shift register will always be one clock pulse ahead of the storage register.

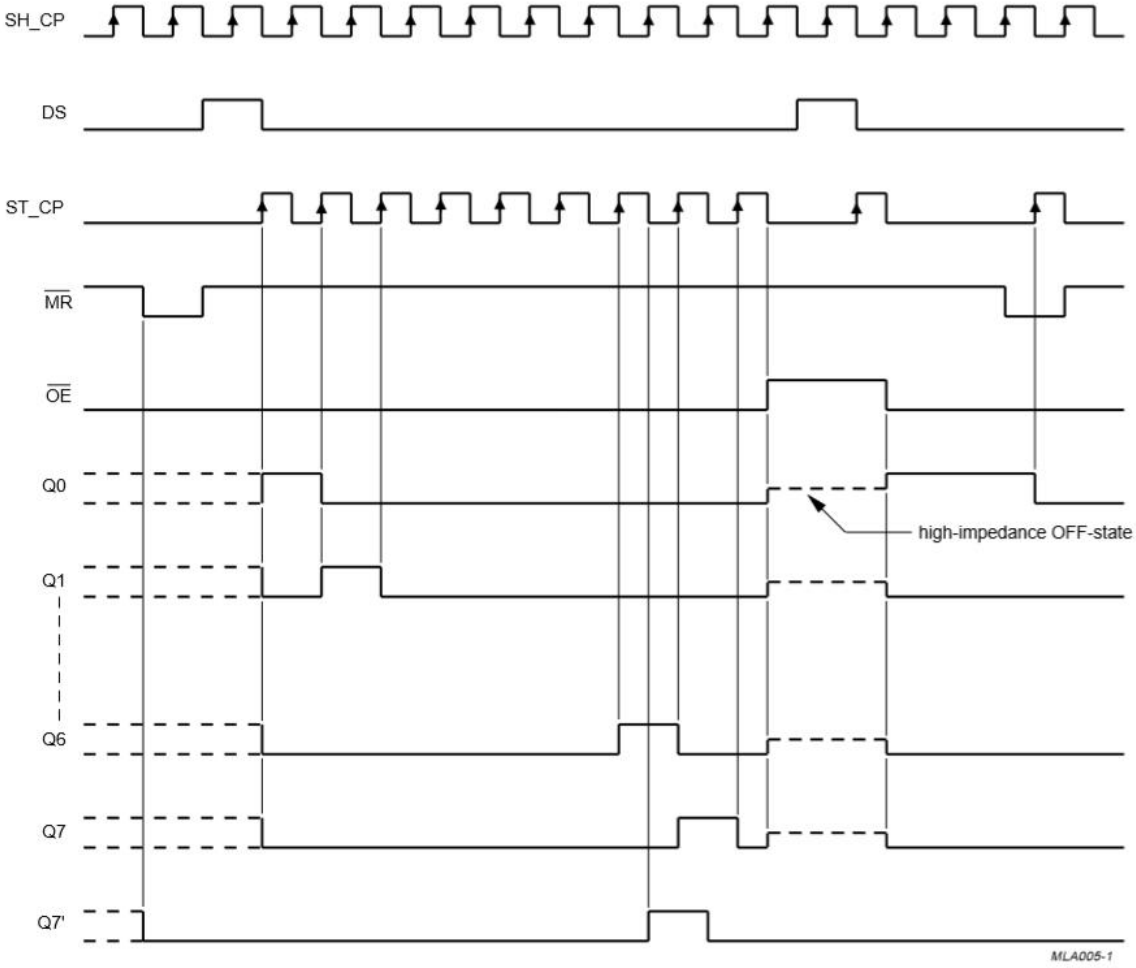
The shift register has a serial input (DS) and a serial standard output (Q7') for cascading. It is also provided with asynchronous reset (active LOW) for all 8 shift register stages. The storage register has 8 parallel 3-state bus driver outputs. Data in the storage register appears at the output whenever the output enable input (OE) is LOW.

PINOUT：



PIN	SYMBOL	DESCRIPTION
1	Q1	parallel data output
2	Q2	parallel data output
3	Q3	parallel data output
4	Q4	parallel data output
5	Q5	parallel data output
6	Q6	parallel data output
7	Q7	parallel data output
8	GND	ground (0 V)
9	Q7'	serial data output
10	$\overline{MR}$	master reset (active LOW)
11	SH_CP	shift register clock input
12	ST_CP	storage register clock input
13	$\overline{OE}$	output enable (active LOW)
14	DS	serial data input
15	Q0	parallel data output
16	V_{CC}	positive supply voltage

Timing diagram：



2. Extend your Arduino with one shift register

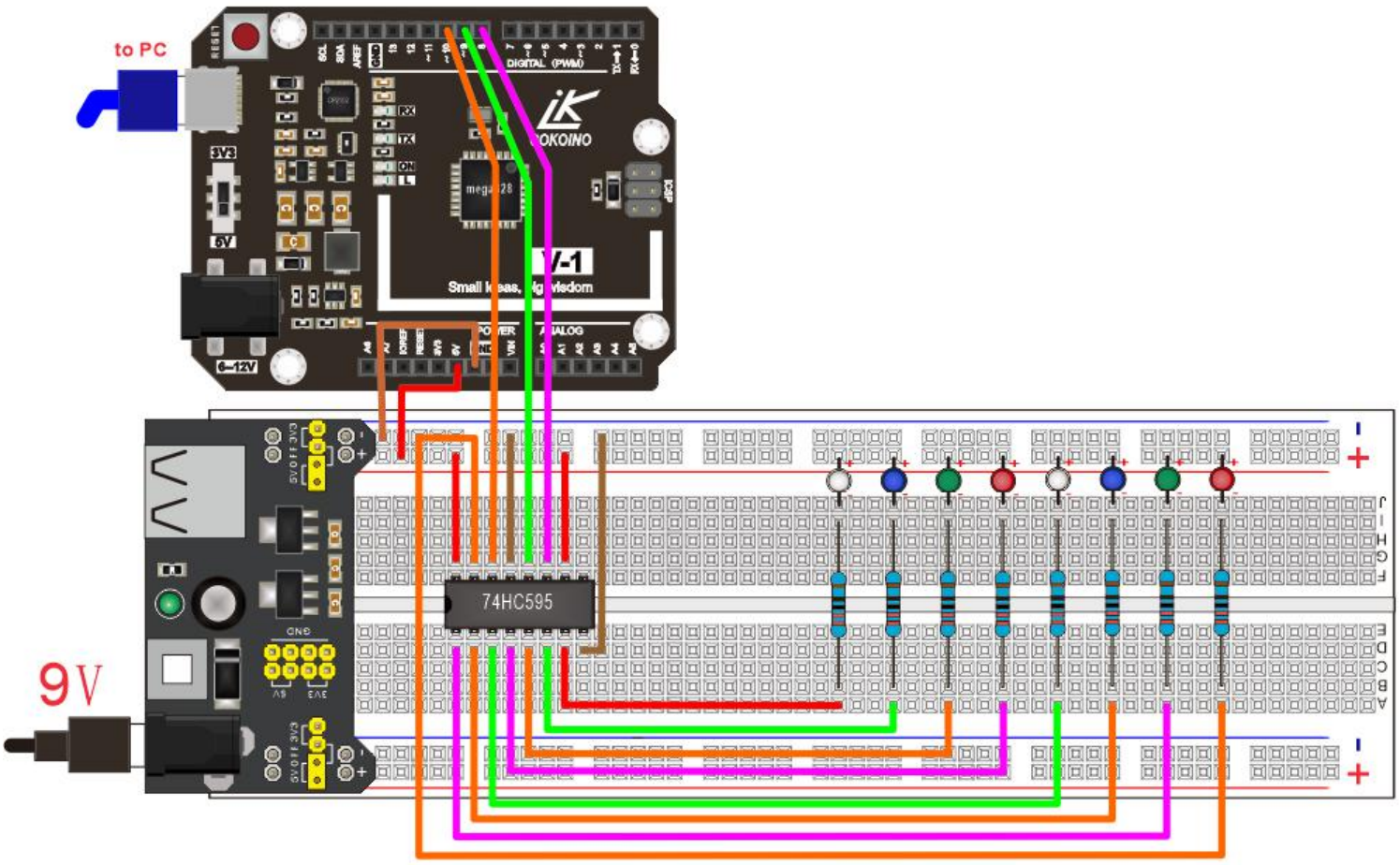
When you want V-1 board to drive multiple peripherals, such as LEDs, IO resources may not be enough. You can use IO expansion chips, such as 74HC595. The main statements used in this section are: shiftOut(); The specific usage can refer to This page: https://www.arduino.cc/reference/en/language/functions/advanced-io/shiftout/
Or open IDE:help-->Reference-->Advanced I/O--->shiftOut().

2.1 Sketch

```
int clockPin = 8;    //SH_CP
int latchPin = 9;    //ST_CP
int dataPin = 10;    //DS
int leds[8]={0xfe,0xfd,0xfb,0xf7,0xef,0xdf,0xbf,0x7f};
////////////////////////////////////////////////////////////
void led_clear(void){
  digitalWrite(latchPin,LOW);
  shiftOut(dataPin, clockPin, MSBFIRST ,0xff);
  digitalWrite(latchPin,HIGH);
}
```

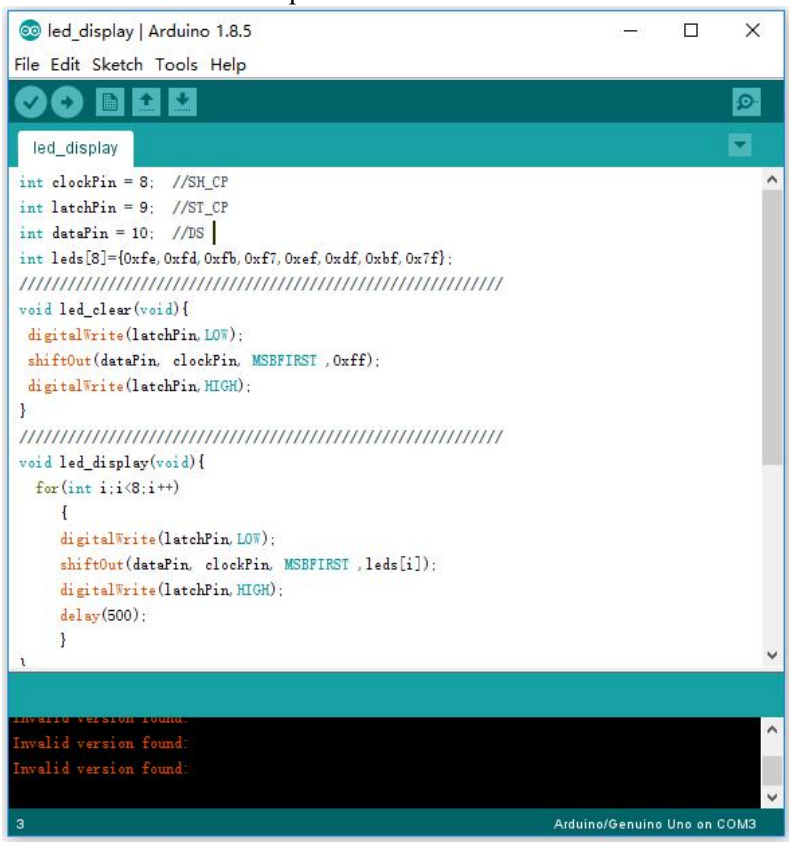
```
//////////////////////////////////////////////////////////////
void led_display(void){
   for(int i;i<8;i++)
        {
        digitalWrite(latchPin,LOW);
        shiftOut(dataPin, clockPin, MSBFIRST ,leds[i]);
        digitalWrite(latchPin,HIGH);
        delay(500);
        }
}
//////////////////////////////////////////////////////////////
void setup (){
   pinMode(latchPin,OUTPUT);
   pinMode(clockPin,OUTPUT);
   pinMode(dataPin,OUTPUT);
   led_clear();
}
//////////////////////////////////////////////////////////////
void loop(){
   led_display();
}
```

2.2 Wiring the LEDs and 74HC595 Shift Register to V-1 board

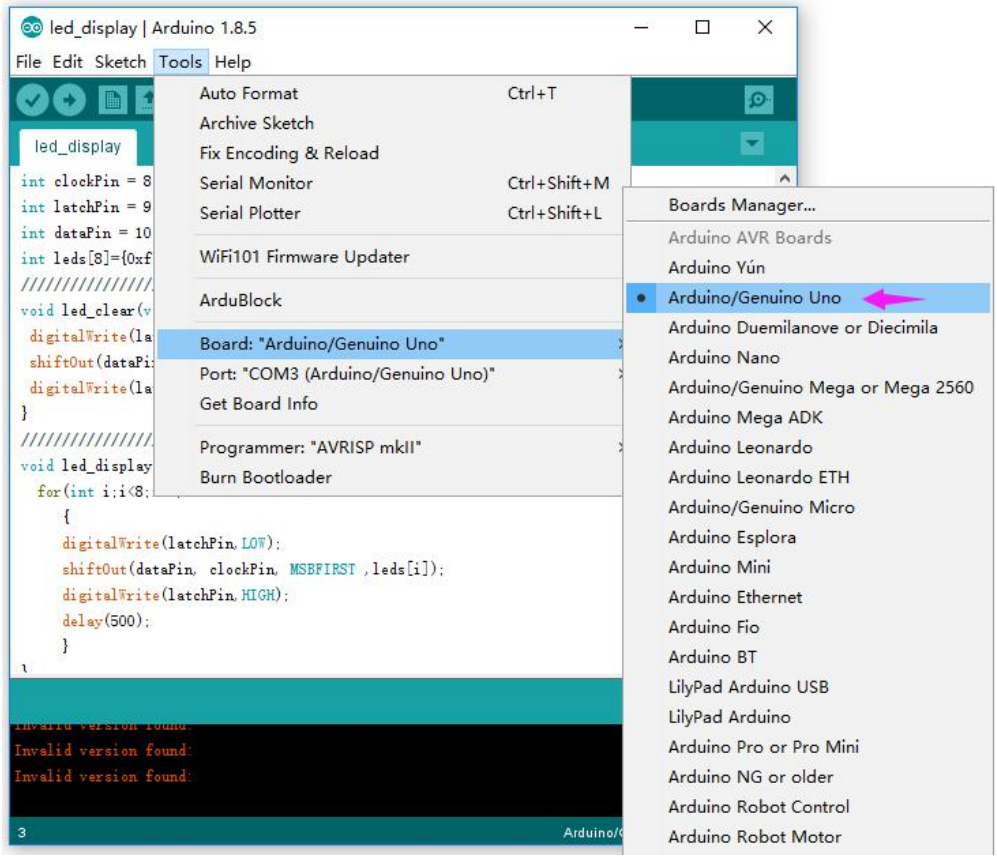


2.3 Steps:

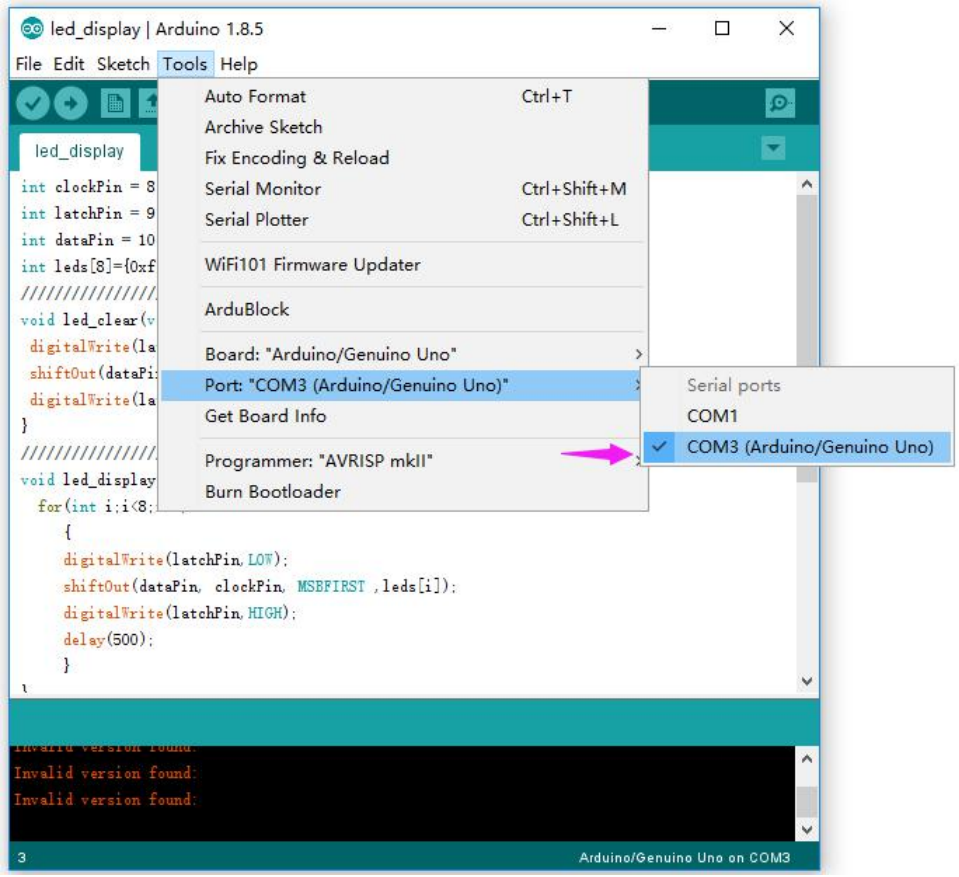
2.3.1、Connect the computer to the V-1 board with a USB cable and copy the sample code above to the Arduino IDE:



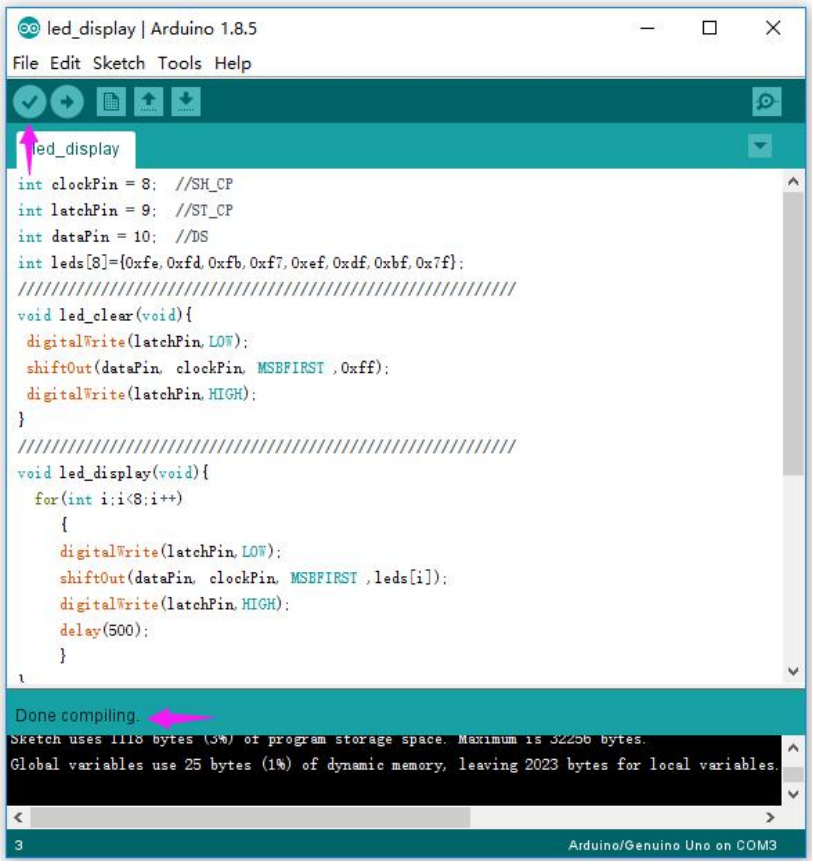
2.3.2、Select board type



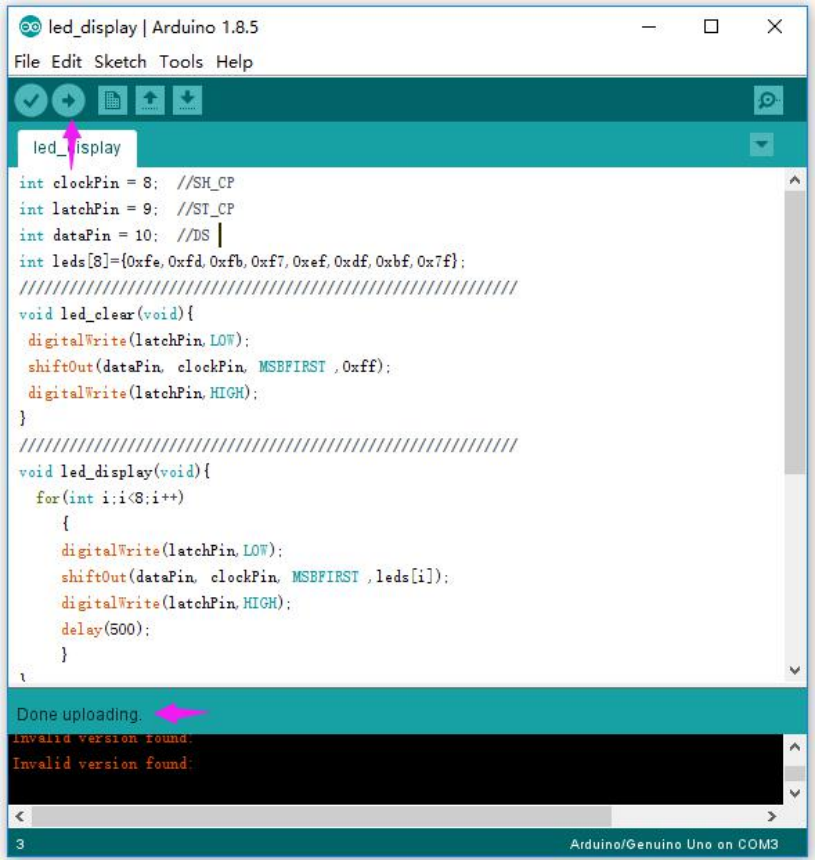
2.3.3、Select port



2.3.4、Compile the sketch



2.3.5、Upload the sketch



2.3.6、Unplug the USB cable from the V-1 board, connect the external power supply to the power module, and then turn on the power switch on the power module. The LED lights on the breadboard will light up from right to left, as shown below.