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:

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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	REFERE	1 PCS
220R Resistor	REFERE	8 PCS

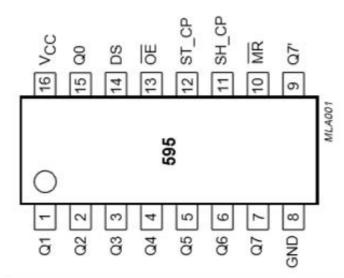
1. About 74HC595 Shift Register

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.

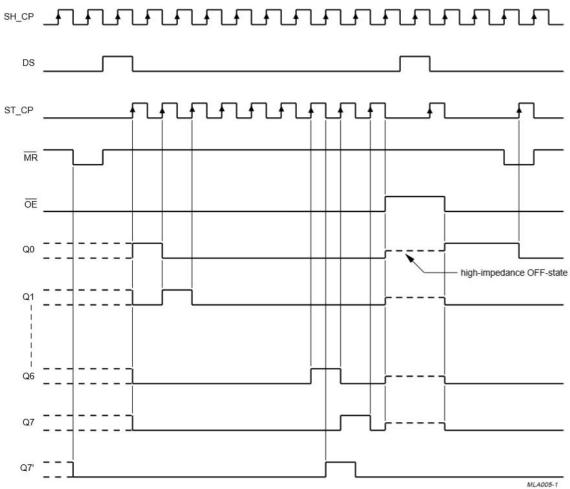
The shift register has a serial input (DS) and a serial standard output (Q7') for cascading. It is also provided with asynchronous reset (active LOW) for all 8 shift register stages. The storage register has 8 parallel 3-state bus driver outputs. Data in the storage register appears at the output whenever 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	MR	master reset (active LOW)	
11	SH_CP	shift register clock input	
12	ST_CP	storage register clock input	
13	ŌE	output enable (active LOW)	
14	DS	serial data input	
15	Q0	parallel data output	
16	Vcc	positive supply voltage	

Timing diagram:



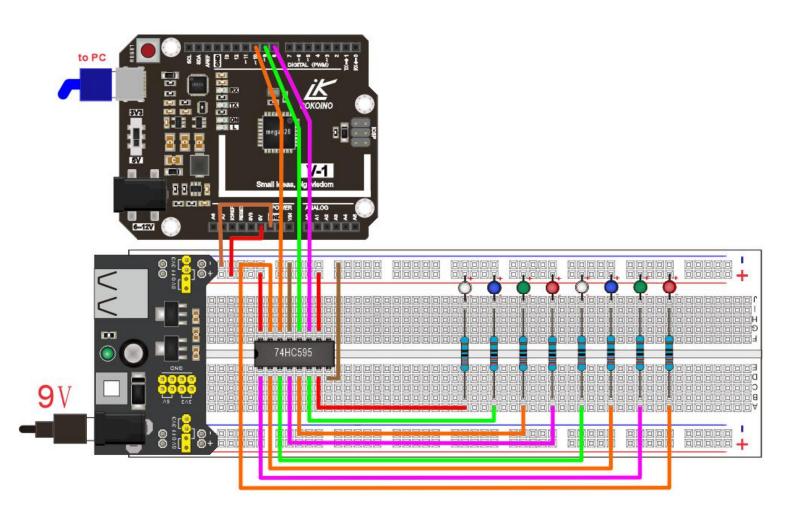
2. Extend your Arduino with one shift register

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

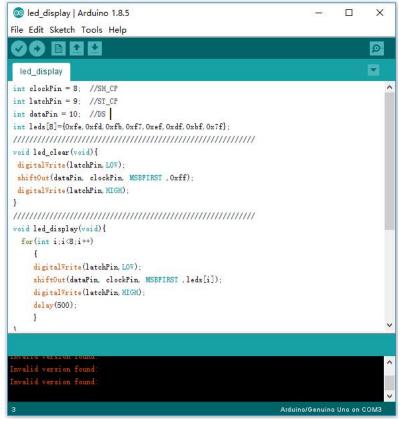
```
void led_display(void){
 for(int i;i<8;i++)
    digitalWrite(latchPin,LOW);
    shiftOut(dataPin, clockPin, MSBFIRST ,leds[i]);
    digitalWrite(latchPin,HIGH);
    delay(500);
void setup (){
 pinMode(latchPin,OUTPUT);
 pinMode(clockPin,OUTPUT);
 pinMode(dataPin,OUTPUT);
 led clear();
void loop(){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

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

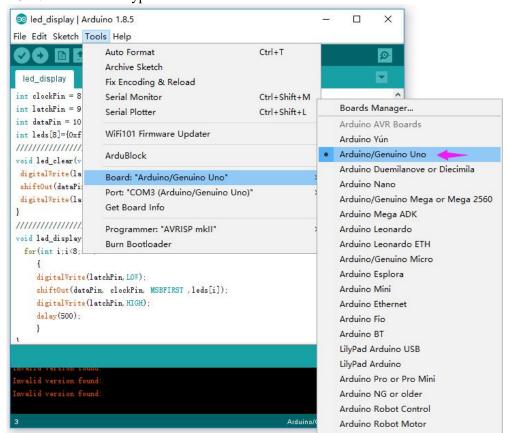


2.3 Steps:

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



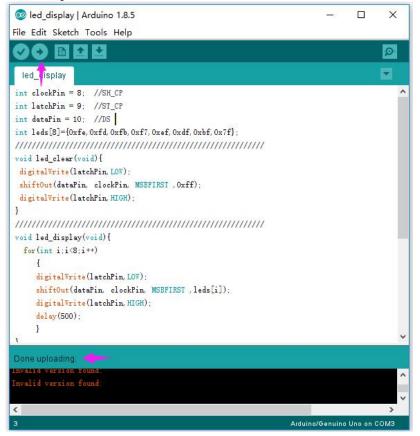
2.3.3 Select port

```
oo led_display | Arduino 1.8.5
                                                                                П
                                                                                        X
File Edit Sketch Tools Help
                     Auto Format
                                                          Ctrl+T
                     Archive Sketch
  led_display
                     Fix Encoding & Reload
int clockPin = 8
                     Serial Monitor
                                                          Ctrl+Shift+M
int latchPin = 9
                                                          Ctrl+Shift+L
                     Serial Plotter
int dataPin = 10
                     WiFi101 Firmware Updater
int leds[8]={0xf
ArduBlock
void led_clear(v
 digitalWrite(la
                     Board: "Arduino/Genuino Uno"
 shiftOut(dataPi
                     Port: "COM3 (Arduino/Genuino Uno)"
                                                                             Serial ports
 digitalWrite(la
                     Get Board Info
                                                                             COM1
                                                                             COM3 (Arduino/Genuino Uno)
Programmer: "AVRISP mkII"
void led_display
                     Burn Bootloader
  for (int i; i <8;
     digitalWrite(latchPin, LOW);
     shiftOut(dataPin, clockPin, MSBFIRST ,leds[i]);
     digitalWrite(latchPin, HIGH);
     delay(500);
 nvalid version found
nvalid version found
```

2.3.4 Compile the sketch

```
oo led_display | Arduino 1.8.5
                                                                     File Edit Sketch Tools Help
00
        Ted_display
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);
Done compiling.
ketch uses III8 bytes (3%) of program storage space. Maximum is 32256 bytes
Global variables use 25 bytes (1%) of dynamic memory, leaving 2023 bytes for local variables.
```

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.

