



Study Notes of Iteaduino Part V

- To Operate 1602 LCD Screen

In the last notes, I have introduced the input and output of Iteaduino pin and done some simple tests on single pin. Today, I want to use 6 pins of Iteaduino together to control 1602 LCD screen to display characters.

1602 LCD also called 1602 character LCD, which is one type of dot-matrix LCD module designed to display letters, numbers, symbols, etc., where 16X2 or 32 characters can be displayed simultaneously. It consists of several 5×7 or 5X11 dot matrix character bits, each dot matrix character bit can display one character. There is a dot interval between each bit and between each line, which has played a role of character spacing and line spacing, and as such it can not display graphics.

1602LCD adopts standard 16-pin interface:

- Pin 1 : VSS is the grounding terminal.
- Pin 2 : VCC is connected to positive electrode of 5V power supply
- Pin 3 : V0 is the LCD display contrast adjustment terminal. When connected to the positive electrode, contrast is the weakest; when connected to the ground, contrast is the highest. A 10K potentiometer can be used to adjust the contrast.
- Pin 4 : RS is register selection, selecting data register under high level(1) and instruction register under low level(0) .
- Pin 5 : RW is signal cable for reading and writing, read on high level (1) and write under low level (0)
- Pin 6 : E(or EN) is enable terminal



- Pins 7 ~ 14 : D0 ~ D7 are 8-bit bi-directional data terminals
- Pin 15 : backlight positive.
- Pin 16 : backlight negative.

To do this test, we need:

- Iteaduino board x 1
- Arduino 1602 LCD shield x 1

Introduction to materials

The actual Arduino 1602 LCD shield is shown as in figure 1:

- ① 10K potentiometer, used to adjust character display contrast
- ② 1602 LCD screen with blue background and white character
- ③ Keyboard : 6 buttons: up, down, left, right, select and reset.

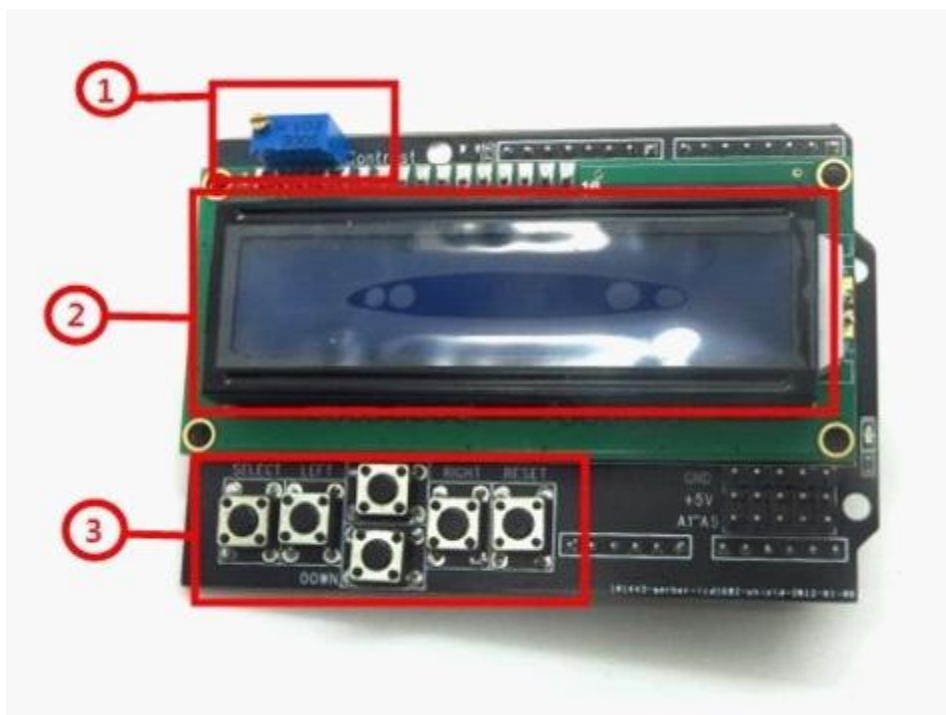


Figure 1

Construction of hardware circuit

Arduino 1602 shield is specifically designed for Arduino and Iteaduino, which can be directly inserted into Iteaduino board, as shown in Figure 2. Hardware construction is quite convenient.

Next, I will introduce connection of pins after Arduino 1602 LCD shield is inserted into Iteaduino board:

There are two ways for connecting to 1602 LCD screen: 8-bit and 4-bit, as 8-bit method occupies too many interfaces, Arduino 1602 LCD shield adopts 4-bit connection, that is, to connect the 4 pins D4-D7 on Iteaduino to the data pins D4-D7 of 1602 LCD screen, D8 pin on Iteaduino to the RS control pin of 1602 LCD screen, and D9 pin on Iteaduino to the EN control pin of 1602 LCD screen. As 'read' operation is seldom used, Arduino 1602 LCD shield directly pulls down the R / W control pin of 1602 LCD screen to save pin resources, that is, it is always under a 'write' mode.





Figure 2

Writing of control program

The complete program used in the test is as below:

```
int LCD1602_RS=8;

int LCD1602_RW=21;

int LCD1602_EN=9;

int DB[] = {7, 6, 5, 4};

char str1[]="Welcome to";

char str2[]="ITEAD STUDIO";

void LCD_Command_Write(int command)

{

    int i,temp;

    digitalWrite( LCD1602_RS,LOW);

    digitalWrite( LCD1602_RW,LOW);

    digitalWrite( LCD1602_EN,LOW);

    temp=command & 0xf0;

    for (i=0; i <4; i++)

    {

        digitalWrite(DB[i],temp & 0x80);

        temp <<= 1; }

    digitalWrite( LCD1602_EN,HIGH);

    delayMicroseconds(1);
```



```
digitalWrite( LCD1602_EN,LOW);

temp=(command & 0x0f) << 4;

for (i=0; i < 4; i++)

{

digitalWrite(DB[i],temp & 0x80);

temp <<= 1;

}

digitalWrite( LCD1602_EN,HIGH);

delayMicroseconds(1);

digitalWrite( LCD1602_EN,LOW);}

void LCD_Data_Write(int dat)

{

int i=0,temp;

digitalWrite( LCD1602_RS,HIGH);

digitalWrite( LCD1602_RW,LOW);

digitalWrite( LCD1602_EN,LOW);

temp=dat & 0xf0;

for (i=0; i < 4; i++)

{

digitalWrite(DB[i],temp & 0x80);

temp <<= 1;

}

}
```



```
digitalWrite( LCD1602_EN,HIGH);

delayMicroseconds(1);

digitalWrite( LCD1602_EN,LOW);

temp=(dat & 0x0f)<<4;

for (i=0; i< 4; i++)

{   digitalWrite(DB[i],temp & 0x80);

temp <<= 1;

}

digitalWrite( LCD1602_EN,HIGH);

delayMicroseconds(1);

digitalWrite( LCD1602_EN,LOW);}

void LCD_SET_XY( int x, int y )

{

int address;

if (y ==0)   address = 0x80 + x;

else        address = 0xC0 + x;

LCD_Command_Write(address); }

void LCD_Write_Char( int x,int y,int dat)

{

LCD_SET_XY( x, y );

LCD_Data_Write(dat);
```



```
}  
  
void LCD_Write_String(int X,int Y,char *s)  
  
{ LCD_SET_XY( X, Y); //to set address  
  
while (*s) //to write character string  
  
{ LCD_Data_Write(*s); s ++; }  
  
}  
  
void setup (void)  
  
{  
  
int i = 0;  
  
for (i=4; i <= 9; i++) //to set D4-D9 as output terminals via cycling  
  
{ pinMode(i,OUTPUT); }  
  
  
delay(100);  
  
LCD_Command_Write(0x28);//4strings 2rows 5x7  
  
delay(50);  
  
LCD_Command_Write(0x06);  
  
delay(50);  
  
LCD_Command_Write(0x0c);  
  
delay(50);  
  
LCD_Command_Write(0x80);  
  
delay(50);
```



```
LCD_Command_Write(0x01);  
  
delay(50);  
  
LCD_Command_Write(0x01);  
  
delay(50);  
  
LCD_Write_String(3,0,str1);//1st row, from the fourth address  
  
delay(50);  
  
LCD_Write_String(1,1,str2);//2nd row , from the second address  
  
}  
  
void loop (void)  
{ }
```

Compiling and uploading of program

Next, compile and download the above program to Iteaduino , the operation is the same as that in last test.

After the program is downloaded, you can find "Welcome to" on first row and "ITEAD STUDIO" on second row on 1602 display, as shown in figure 3.



Figure 3

You can click <http://shop67031626.taobao.com/> to visit our Taobao store.

For Arduino 1602 LCD shield, please click the following link :

<http://item.taobao.com/item.htm?id=14260564747&>