w14: Microcontroller Experiments

Dates	@December 15, 2022
Topic	Graphics-mode LCD display

Problem Description

基礎：畫任一看的出來是圖形的圖在GLCD面板上。

進階：在整個面板上畫出圖形。

Code and Explanations

```
void draw(){
  int i;
  Set_DisplayStartLine (0);
  Set_Yaddr (0);
  Set_Xaddr (0);
  for (i=0;i<64;i++)
    Send_Data (0x00);

  Set_Xaddr (1);
  for (i=0;i<64;i++)
    Send_Data (0x00);

  Set_Xaddr (2);
  for (i=0;i<64;i++)
    Send_Data (0x00);

  Set_Xaddr (3);
  for (i=0;i<14;i++)
    Send_Data (0x00);

  for (i=14;i<18;i++)
    Send_Data (0xc0);
  for (i=18;i<22;i++)
    Send_Data (0xf0);
  for (i=22;i<26;i++)
    Send_Data (0x3c);
  for (i=26;i<30;i++)
    Send_Data (0x0f);
  for (i=30;i<34;i++)
    Send_Data (0x0f);
  for (i=34;i<38;i++)
    Send_Data (0x3c);
```

```
  for (i=38;i<42;i++)
    Send_Data (0xf0);
  for (i=42;i<48;i++)
    Send_Data (0xc0);

  for (i=48;i<64;i++)
    Send_Data (0x00);

  Set_Xaddr (4);
  for (i=0;i<12;i++)
    Send_Data (0x00);

  for (i=12;i<18;i++)
    Send_Data (0xc0);
  for (i=18;i<22;i++)
    Send_Data (0xf0);
  for (i=22;i<26;i++)
    Send_Data (0x3c);
  for (i=26;i<30;i++)
    Send_Data (0x0f);
  for (i=30;i<34;i++)
    Send_Data (0x0f);
  for (i=34;i<38;i++)
    Send_Data (0x3c);
  for (i=38;i<42;i++)
    Send_Data (0xf0);
  for (i=42;i<50;i++)
    Send_Data (0xc0);

  for (i=50;i<64;i++)
    Send_Data (0x00);

  Set_Xaddr (5);
  for (i=0;i<10;i++)
    Send_Data (0x00);

  for (i=10;i<18;i++)
    Send_Data (0xc0);
  for (i=18;i<22;i++)
    Send_Data (0xf0);
  for (i=22;i<26;i++)
    Send_Data (0x3c);
  for (i=26;i<30;i++)
    Send_Data (0x0f);
  for (i=30;i<34;i++)
    Send_Data (0x0f);
  for (i=34;i<38;i++)
    Send_Data (0x3c);
  for (i=38;i<42;i++)
    Send_Data (0xf0);
  for (i=42;i<52;i++)
    Send_Data (0xc0);

  for (i=52;i<64;i++)
    Send_Data (0x00);


  Set_Xaddr (6);
```

```
  for (i=0;i<8;i++)
    Send_Data (0x00);
  for (i=10;i<27;i++)
    Send_Data (0x03);
  for (i=27;i<35;i++)
    Send_Data (0xff);
  for (i=35;i<56;i++)
    Send_Data (0x03);
  for (i=56;i<64;i++)
    Send_Data (0x00);

  Set_Xaddr (7);
  for (i=0;i<27;i++)
    Send_Data (0x00);
  for (i=27;i<35;i++)
    Send_Data (0xff);
  for (i=35;i<64;i++)
    Send_Data (0x00);
}
```

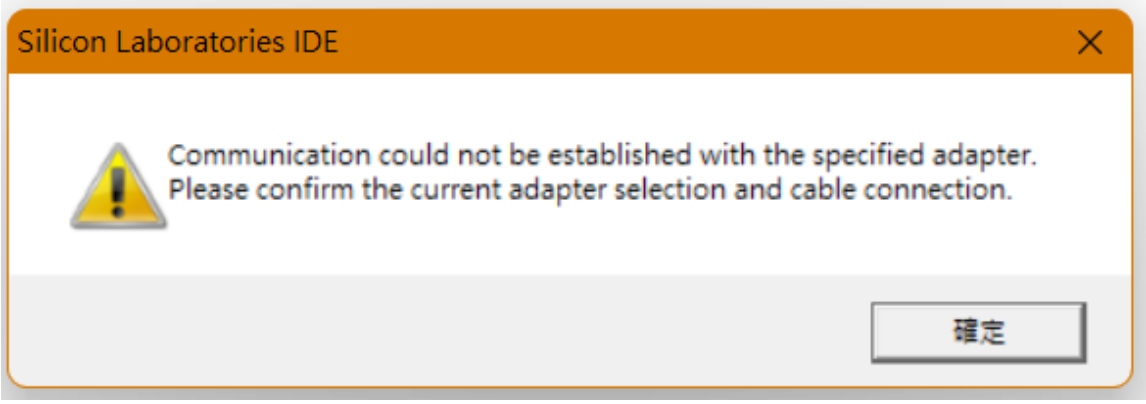
Set_Yaddr()是指行的位置，GLCD的半側有64行，Set_Xaddr()則是列，GLCD半側有8大列。Send_Data()中的數值是一小列(1*8)中的圖形設置。

```
void main (){
  system_init_config ();

  GLCD_Reset ();

  Set_DisplayOn (0);

  draw();

  Set_DisplayOn (1);

  draw();

  while (1);
}//end of function main
```

呼叫兩次Set_DisplayOn()屬於bonus的範疇，目的是為了要畫另外一側的GLCD面板。

Difficulties and Solutions

▼ 無法連接至8051



測試過輸入線沒問題，板子沒問題，是電源供應的問題，連接時板子燈光黯淡，換一條電源線就解決了。

▼ 繪製左方面板

需要額外設置和更改Set_DisplayOn()的mode判斷

```
char P2_CWORD_TEMPLATE=0x21;
void
Set_DisplayOn (int mode){
  char P2_cword, P4_cword;
  if(mode == 0){
    P2_CWORD_TEMPLATE = 0x21;
    // P2_cword = P2_CWORD_TEMPLATE | P2_CS1; //set right
  }
  if(mode == 1){
    P2_CWORD_TEMPLATE = 0x22;
    // P2_cword = P2_CWORD_TEMPLATE | P2_CS2; //set left
  }
  ///prepare control words
  P2_cword = P2_CWORD_TEMPLATE  ;
  P2_cword = P2_cword & (~P2_RS);   //set RS bit
  P2_cword = P2_cword & (~P2_RW);   //clear RW bit
  P4_cword = P4_Set_Display_TMPL;
  P4_cword = P4_cword | P4_Display_On;  //set display ON bit

  ///flush out control signals
  while (GLCD_IsBusy());
  GLCD_Write (P2_cword, P4_cword);
}//end of function Set_DisplayOn
```

Discussions

本次實驗花最多時間在於繪製圖形，網路上尋找的圖形轉換成數值既麻煩變數又多，完全無法塞入8051，因此只得用手算圖形數值，而我又無法忍受糟糕的圖形，所以真的花了非常多時間在畫基礎題的圖形，反倒是進階題非常快速就完成了。