Lab5 STM32 Keypad Scanning

實驗五 STM32 Keypad Scanning

1. Lab objectives實驗目的

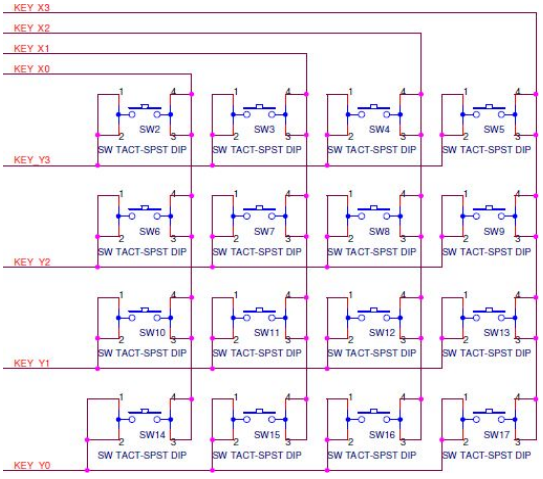
- Understand the principle of STM32
- Use C code to controll STM32
- design program for 7-seg LED and keypad

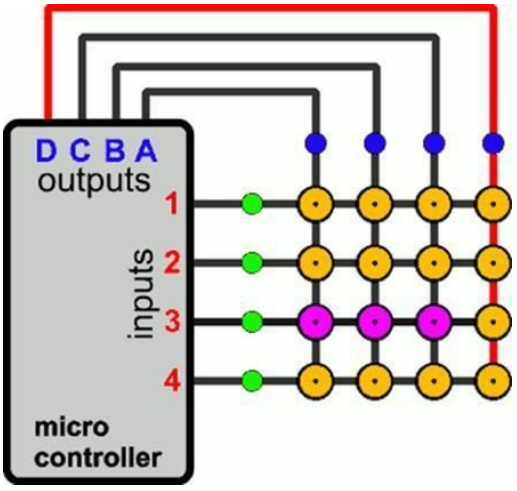
- 了解 STM32 使用原理
- 了解如何使用 C code 控制 STM32
- 設計 7-Seg LED 和 keypad 程式

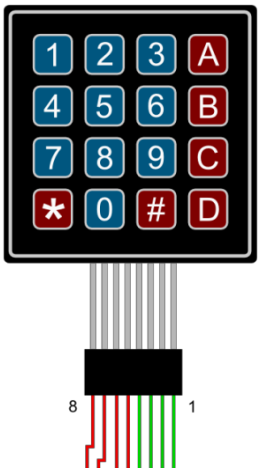
2. Lab principle實驗原理

The circuit diagram of keypad is given below. You're supposed to use 4 input pins and 4 output pins. Use output pins to determine which row you're scanning. For example, when output value of KEY X0~3 is 1000 and input value of KEY Y0~3 is 1000, then we can say that SW14 is pressed.

Keypad 電路組成如下，主要是一個 4x4 的鍵盤按鈕所組成會用到 4 個 Input pin 與 4 個 Output pin，其控制原理是利用 Output pin 掃描的方式來決定目前所選擇到的是哪一行按鍵，例如當 KEY X0~3 輸出 1000 而此時若KEY Y0~3所讀到的值是 1000 的話則代表 SW14 按鈕被按下。







KEYPAD PINOUT:

PIN 1: COL 4
PIN 2: COL 3
PIN 3: COL 2
PIN 4: COL 1
PIN 5: ROW 4
PIN 6: ROW 3
PIN 7: ROW 2
PIN 8: ROW 1

3. Steps 實驗步驟

3.1. Lab5.1: Max7219 displayer (30%)

Modify GPIO_init(), max7219_init() and max7219_send() finished in Lab4 to make it callable by C. Add a C file to complete code below. Finally, display your student ID on 7-Seg LED.

將 Lab4 所完成的 GPIO_init()，max7219_init() 與 max7219_send() 改成可以被 C 所呼叫的版本，並新增一個 C file 完成以下程式碼。最終將學號顯示於 7 段顯示器上。

```
//These functions inside the asm file
extern void GPIO_init();
extern void max7219_init();
extern void max7219_send(unsigned char address, unsigned char data);
/**
* TODO: Show data on 7-seg via max7219_send
*   Input:
*     data: decimal value
*     num_digs: number of digits will show on 7-seg
*   Return:
*     0: success
*     -1: illegal data range(out of 8 digits range)
*/
int display(int data, int num_digs)
{
}
void main()
{
   int student_id = 1234567;
   GPIO_init();
   max7219_init();
   display(student_id, 8);
}
```

3.2. Lab5.2: KeypadScanning (30%)

Use 4 input GPIO pins and 4 output GPIO pins to connect with keypad. Show the corresponding number of pressed button on 7-Seg LED. Don't show number when released button.

Note: Use C to init GPIO used by keypad. Please refer to stm32l476xx.h for GPIO register address and structure define.

利用 4 個 input GPIO 與 4 個 output GPIO pin 連接 keypad，當按下 keypad 利用七段顯示器顯示所對應的數字。放開 keypad 則不顯示數字。

Note: keypad 所使用到的 GPIO 請利用 C 語言的方式初始化，各 GPIO register address 與 structure define 請參考 stm32l476xx.h

```
#include “stm32l476xx.h”

//TODO: define your gpio pin
#define X0
#define X1
#define X2
#define X3
#define Y0
#define Y1
#define Y2
#define Y3

unsigned int x_pin[4] = {X0, X1, X2, X3};
unsigned int y_pin[4] = {Y0, Y1, Y2, Y3};

/* TODO: initial keypad gpio pin, X as output and Y as input */
void keypad_init()
{
}

/* TODO: scan keypad value
return:
  >=0: key pressedvalue
  -1: no keypress
*/
char keypad_scan()
{
}
```

各按鍵對應值為：

	X0	X1	X2	X3
Y0	1	2	3	10
Y1	4	5	6	11
Y2	7	8	9	12
Y3	15	0	14	13

3.3. Lab5.3: multi buttons 處理多按鍵 (40%)

Based on Lab5.2. The difference is allowing pressed at most two button (including two button) at same time. Then show sum of values that buttons pressed representing on 7-seg LED.

基於 Lab5.2， 不同地方在於可以同時按下不超過兩個按鍵 (包含兩個按鍵)。並且將表示的按鍵值相加後，顯示於七段顯示器上。

e.g.

- Initial, don’t display number on 7-Seg
- Press 1, display 1
- Press 3 under pressing 1, display 4
- Release 1 under pressing 3, display 3
- Press 9 under pressing 3, display 12
- Release all, don’t display number
- Press 1, 5 at same time, display 6

範例

- 初始化，沒有顯示任何數字在七段顯示器
- 按住 1，顯示 1
- 按住 1 之下按住 3，顯示 4
- 按住 3 之下放開 1， 顯示 3
- 按住 3 之下按住 9， 顯示 12
- 放開全部，沒有顯示任何數字
- 按住 1, 5， 顯示 6