Brunel University London

重庆邮电大学

CHONGQING UNIVERSITY OF POSTS AND TELECOMMUNICATIONS

Lab Report

TERM: Spring 2021

Module: EE1616 Electronic Workshop

CLASS: 34092102

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PIC Lab 3: PICmicro Interfacing with LCD and Keypad

0 Aims (5 Marks)

- To further understand LCD and matrix keypad.
- Try to use assembly language to create some characters on the LCDs and know the principle of matrix keypad.
- Try to use assembly language to connect LCD and matrix keypad. Enter some words on the keypad and then LCD will display the characters.

1 Task 1 (30 Marks)

1.1 Task 1.1 (10 Marks)

Pin Assignment		
Pin no.	Symbol	function
1	Vss	Power supply (GND)
2	Vdd	Power supply (+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/$\overline{W}$	Data read/write
6	E	Enable signal
7~14	DB0-DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

Before I modify the code, the LCD can display some words, but the cursor and blink are off.

```
TABLCD  ADDWF   PCL,F           ;LCD initialisation table
    RETLW       B'00111000'     ;Function Set: 8-bit operation and 2 lines
    RETLW       B'00001111'     ;Display ON/OFF Control: set display on, cursor off, blink off
    RETLW       B'00000001'     ;Clear Display
    RETLW       B'00000010'     ;Return Home: Set cursor to home position
    RETLW       0X00            ;End of initialisation table
```

This is my modified code, I turn the code to B’00001111’, so the cursor and blink are displayed.

When I modify the code to B’00001110’, the cursor is on and the blink is off.

From this experiment, I know the function of each pins of LCDs. I also further understand how to modify some codes to change some display on LCD, such as let cursor and blink on or off.

1.2 Task 1.2 (10 Marks)

```
1   TABLCD  ADDWF   PCL,F           ;LCD initialisation table
2       RETLW       B'00111000'     ;Function Set: 8-bit operation and 2 lines
3       RETLW       B'00001110'     ;Display ON/OFF Control: set display on, cursor off, blink off
4       RETLW       B'00000001'     ;Clear Display
5       RETLW       B'00000010'     ;Return Home: Set cursor to home position
6       RETLW       0X00            ;End of initialisation table
7
8   ;sub-routine which consists of a string of alphanumeric letters to be displayed on LCD module
9   ;0x00 (or 0) is an indicator for end of string
10  MESSAG  ADDWF   PCL,F
11  DT "HELLO KUGO",0
12      RETLW       0X00            ;End of string
```

This is my subroutine, my message is “HELLO KUGO”.

1.3 Task 1.3 (10 Marks)

```
20  START
21                  ;BANKSEL        TRISB
22      BANKSEL     TRISB
23      CLRF        TRISD           ;Port B0-B7 as output
24      MOVLW       B'00000110'     ;set timer ratio 1:128
25      MOVWF       OPTION_REG
26      CLRF        TRISC           ;Port C0-C7 as output
27      BANKSEL     PORTB
28      CALL        LCDSET          ;Configure the LCD display
29      MOVLW       0X80            ;set cursor location at 0x00 of the LCD
30      CALL        LCDCMD
31      CALL        LCDMSG          ;display message on LCD
32
33      MOVLW       0XC0
34      CALL        LCDCMD1
35      CALL        LCDMSG1
36
37  MAIN
38      GOTO        MAIN            ;and repeat
39
```

Firstly, I add some codes on START subroutine to set cursor location at 0x40 of the LCD.

```
77    ;sub-routine to send a string of alphanumeric letter to LCD module
78    LCDMSG  CLRF    LOOP            ;clear loop
79        BSF         RSLINE,4        ;set RS for data send
80    LCDMS2  MOVF    LOOP,W          ;get table address
81        CALL        MESSAG          ;get message letter
82        XORLW       0X00            ;0x00 is the indicator for last data
83        BTFSC       STATUS,Z        ;has last LCD letter been sent?
84        GOTO        MSGEND          ;YES, so end the DATA SEND routine
85        CALL        LCDOUT          ;No, send the data to LCD for display
86        INCF        LOOP,F          ;inc loop
87        GOTO        LCDMS2          ;repeat for next one letter
88    MSGEND  RETURN
89
90    LCDMSG1 CLRF    LOOP            ;clear loop
91        BSF         RSLINE,4        ;set RS for data send
92    LCDMS3  MOVF    LOOP,W          ;get table address
93        CALL        MESSAG1         ;get message letter
94        XORLW       0X00            ;0x00 is the indicator for last data
95        BTFSC       STATUS,Z        ;has last LCD letter been sent?
96        GOTO        MSGEND1         ;YES, so end the DATA SEND routine
97        CALL        LCDOUT          ;No, send the data to LCD for display
98        INCF        LOOP,F          ;inc loop
99        GOTO        LCDMS3          ;repeat for next one letter
100   MSGEND1 RETURN
101
```

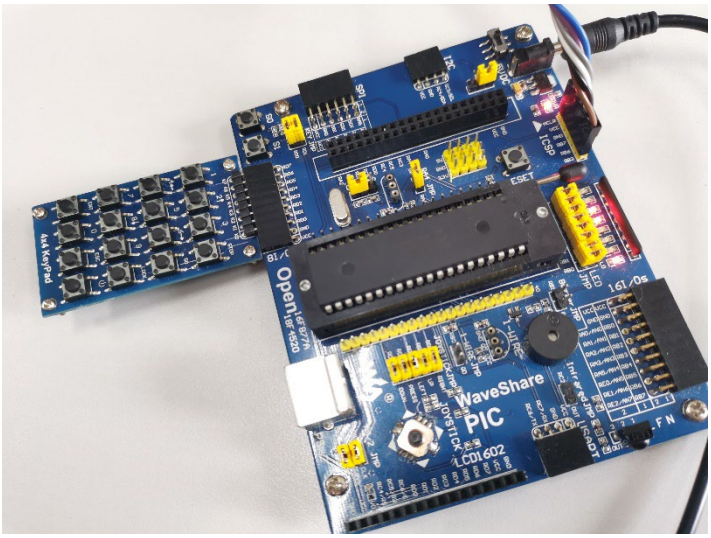
```
69    MESSAG  ADDWF   PCL,F
70    DT "CQUPT HELLO",0
71        RETLW       0X00            ;End of string
72
73    MESSAG1  ADDWF  PCL,F
74        DT"Liu Xu Kang",0
75        RETLW  0X00
```

I also add some subroutines to make my code work properly.

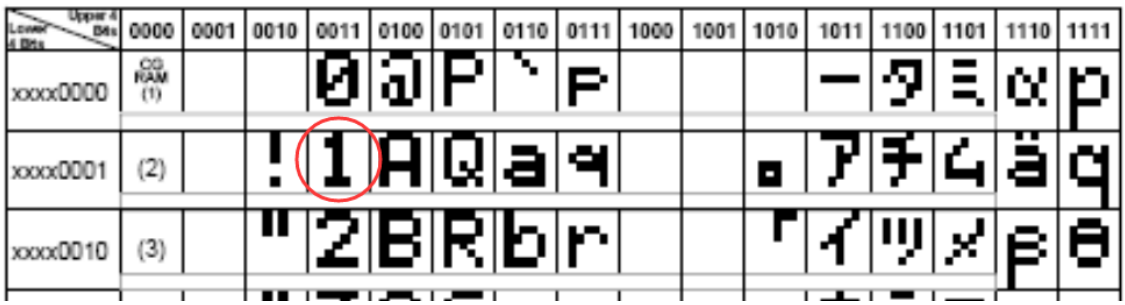
Therefore, the result is:

2 Task 2 (30 Marks)

2.1 Task 2.1 (10 Marks)



When I click “1” on the keypad, the LED “0”, “4”, “5” are on. Convert is to binary value, it means “00110001”.



This is the figure of Alphanumeric characters displayable by the LCD module. I can

find that the upper 4 bits is 0011 and lower 4 bits is 0001. It is corresponding to the LEDs, so the result is correct.

2.2 Task 2.2 (20 Marks)

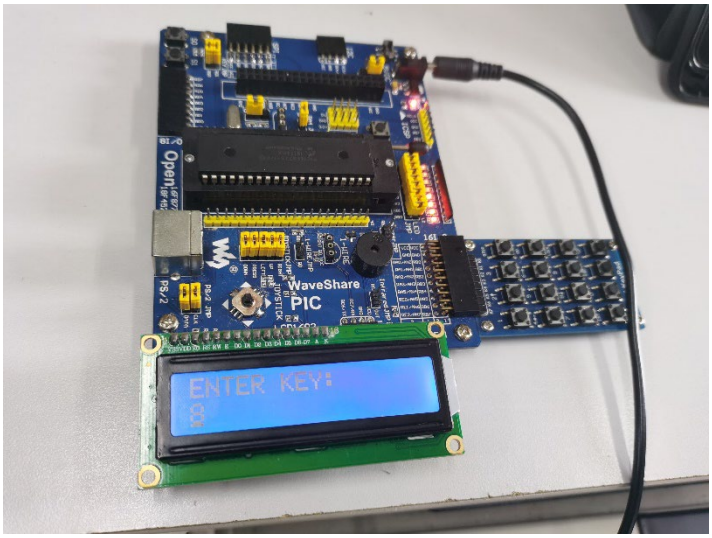
a) TRISD is defined as “B‘11110000’”, it means Port D0-D3 as output and D4-D7 as input.

b) Pin 1 is defined as output and pin 6 is defined as input.

c) Firstly, set all pins as high level. For detecting 5, pin 1 output low level, if 5 is pressed, pin 6 is input as low level.

3 Task 3 (30 Marks)

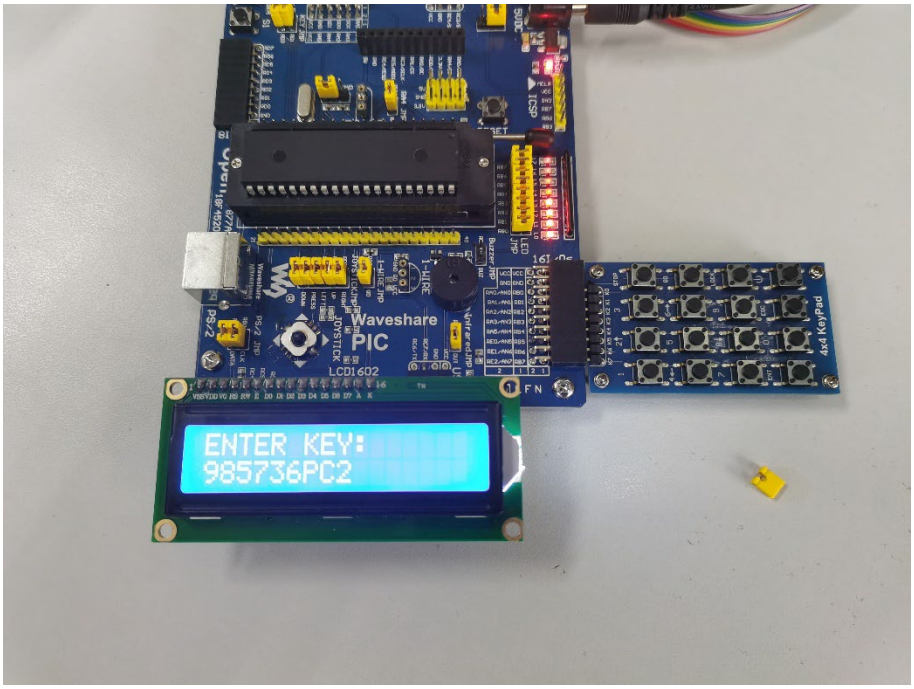
After I add “GETKEY” subroutine to the code, I can find the result:



If I click some keys on the keypad, the second line can only display one character.

```
36                  ;set keypad here
37      MOVLW       B'11110000'         ;Port D or Pord B ? pin0-pin3 as output and pin4-pin7 as input
38      MOVWF       TRISB
39
40      BANKSEL     PORTB
41      CALL        LCDSET          ;Configure the LCD display
42      MOVLW       0X80            ;set cursor location at first position of the first line of the LCD
43      CALL        LCDCMD
44      CALL        LCDMSG          ;display message on LCD
45
46      MOVLW       0XC0            ;set cursor location at first position of the second line of LCD
47      CALL        LCDCMD
48  MAIN
49      CALL        GETKEY
50      CALL        LCDMSGK
51      GOTO        MAIN            ;and repeat
52
```

I change the code, such that it can continuously output characters. The result is:



4 Conclusions (5 Marks)

In the experiment, I knew how to display characters I wanted on the LCD. I also further understanded the principle of matrix keypad. Finally, I connect the LCD and keypad together, I can input any letters or numbers and output them on the LCD. But I also didn’t know some detail of the code, some subroutine I don't know what it mean in this code, so I need to study deeply after class.