

Lab 01

Pushbutton to Toggle LED

EECE 4038C Embedded Systems Design

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Abstract:

The purpose of this lab is to familiarize ourselves with the PIC Microcontroller and the MPLAB X IDE. The simple experiment is designed to go through the documentation provided and reproduce an experiment of turning on and off the 4th LED on the demo board when onboard push button is depressed. It is to be noted that the initial state of the LED is to be set to off and when the button is depressed to be turned to the on state and this cycle is to continue indefinitely.

Methodology:

Pre-lab Preparation:

- I began by installing MPLAB X IDE and the XC8 compiler on my laptop computer, following the provided links and documentation from the course and lab assignment.
- I established a physical connection between my laptop computer and the Microchip PIC DM164130-3 28-Pin LIN Demo Board using a USB cable.
- In preparation for the lab, I wrote an assembly code to implement the required functions on the demo board:
- Initially ensuring that the on-board LED DS4 is OFF.
- Creating a program that responds to the on-board pushbutton as instructed.

Lab Experiments:

- After assembling the Microchip PIC DM164130-3 28-Pin LIN Demo Board as per the pre-lab preparation steps, I loaded the assembly code I had developed onto the demo board.
- I powered on the demo board and observed the initial state of the on-board LED DS4, which was OFF.
- I proceeded to momentarily press the on-board pushbutton once, noting the change in LED DS4 status.
- Repeating the previous step for a second time, I ensured that the LED DS4 toggled OFF.
- I continued this process of momentarily pressing the pushbutton and observed the LED DS4 state change with each press, as per the lab instructions.

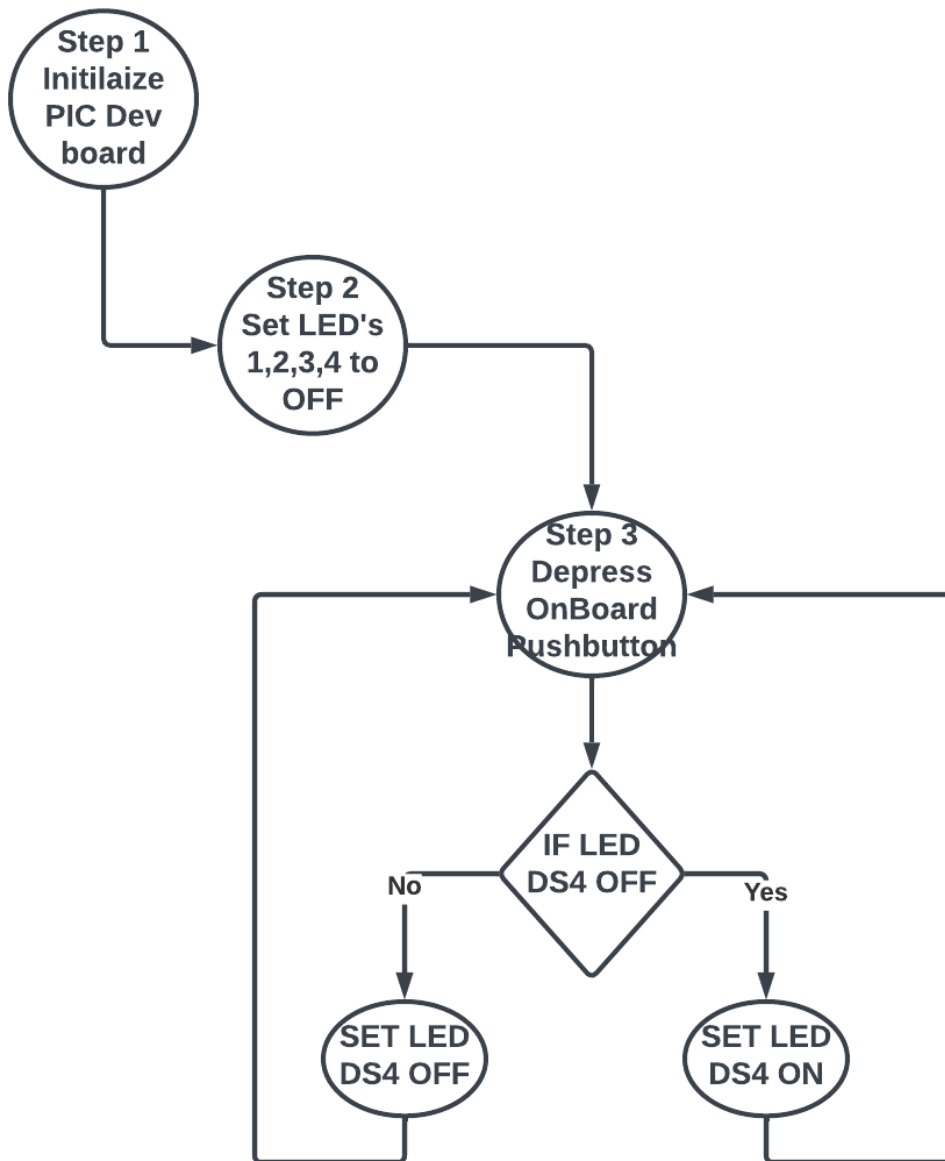
Lab Documentation:

- During the experiment, I took clear photographs and captured screenshots at key stages of the experiment, including the initial state, the LED turning ON, and the LED turning OFF.

Project Requirements:

Microchip PIC DM164130-3 28-Pin LIN Demo Board, MPLAB X IDE, USB cable, Windows Laptop

Design Diagram:



Code:

; Assembly source line config statements

```
#include "p16f886.inc"
```

; CONFIG1

```
__config 0x20D4
```

```
__CONFIG __CONFIG1, _FOSC_INTRC_NOCLKOUT & _WDTE_OFF & _PWRTE_OFF & _MCLRE_OFF & _CP_OFF & _CPD_OFF & _BOREN_OFF & _IESO_OFF & _FCMEN_OFF & _LVP_OFF
```

; CONFIG2

```
__config 0x3EFF
```

```
__CONFIG __CONFIG2, _BOR4V_BOR21V & _WRT_OFF
```

; Place code below this line

```
PwrOnRst  CODE  0x0  ; Execution begins at address 0 after power on
```

```
    goto Main      ; Branch to main to begin execution
```

```
IntVect   CODE  0x4  ; Interrupt code must be placed at address 0x4
```

```
    ; Left blank for now, there are no interrupts to service
```

```
UsrCode   CODE      ; User code space. Not providing an address allows the
```

```
                ; assembler to place it where it thinks most
```

```
                ; convenient
```

Main:

```
    banksel    ANSELH  ; Tell the assembler to access the memory bank this
```

```
    clrf       ANSELH  ; Set all I/O on PORTB to digital (0 or 1)
```

```
    banksel    TRISB   ; Selects bank containing register TRISB
```

```
    clrf       TRISB   ; All port B pins are configured as outputs
```

```
    movlw      b'00100000'
```

```
    movwf      TRISB   ; Pin RA1 is input
```

```
    banksel    PORTB   ; Selects bank containing register TRISB
```

```
    clrf       PORTB
```

Off:

```
    bcf PORTB, 3
```

```
    btfs PORTB, 5      ; Check if S1 (bit 5 of PORTB) is pressed
```

```
    goto On
```

```
    goto Off
```

On:

bsf PORTB, 3

btfs PORTB, 5 ; Check if S1 (bit 5 of PORTB) is pressed

goto Off

goto On

end

Inserted below is a screen shot of the code:

```
Tools Window Help
2 Lab_01.asm
ASM Source History
1 ; Assembly source line config statements
2 #include "p14c00.inc"
3
4 ; CONFIG
5 ; _config_SECTION
6 ; _config_CONFIG1, _FOSC_INTOSC_HFOSC1000 & _WDT_OFF & _PWRTE_OFF & _MCLRE_OFF & _CP_OFF & _CFR2_OFF & _BOREN_OFF & _RESC_OFF & _PWRSEN_OFF & _VREG_OFF
7
8 ; CONFIG2
9 ; _config_SECTION
10 ; _config_CONFIG2, _BORV_BOR11V & _WDT_OFF
11
12
13 ; Place code below this line
14 #ifndef __CODE__
15 ; Execution begins at address 0 after power on
16 ; Branch to main to begin execution
17 goto Main
18
19 ; Interrupt code must be placed at address 0x01
20 ; Left blank for now, there are no interrupts to service
21
22 ; User code space. Not providing an address allows the
23 ; assembler to place it where it thinks most
24 ; convenient
25
26 Main:
27 ; Tell the assembler to address the memory bank this
28 ; if the assembler is set to digital (0 or 1)
29 ; Selects bank containing register TRISB
30 banksel TRISB
31 ; All port B pins are configured as outputs
32 cfb TRISB
33 ; Pin RA1 is input
34 movlw B'00100000'
35 movwf TRISB
36 ; Selects bank containing register PORTB
37 banksel PORTB
38 cfb PORTB
39
40 Off:
41 btf PORTB, 5
42 ; Check if S1 (bit 5 of PORTB) is pressed
43 goto On
44 goto Off
45
46 On:
47 btf PORTB, 3
48 ; Check if S1 (bit 5 of PORTB) is pressed
49 btfsc PORTB, 5
50 goto Off
51 goto On
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53 end
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Conclusion:

We can conclude from this experiment that we are successfully able to demonstrate that we can use the PIC DM164130-3 28-Pin LIN Demo Board and its physical controls, ie we are able to take inputs from the switch and convert them into physical changes to specific LED lights on the board.