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Embedded Systems – Assignment 5

Problem Description:
Use MPLAB X IDE and the PIC18F45K50's assembly language to enable the MCU's interrupts and show a value on a 7-segment LED display. The source code must use an external interrupt and indirect addressing in some way.

Pseudocode:

```
LED_seg[5] = {H, E, L, L, O};        // LED segment configuration.
int val0 = 0;
int *x = &val0;   // x points to val0 (indirect addressing).

LED = '-';          // LED display currently shows a hyphen.

while(true) {
        if (RB4 is pushed) {
                ISR_0();
        }
} // while(true) closing bracket

void ISR_0() {
        LED = LED_seg[val0];
        *x += 1;

        if (*x == 6)
                *x = 0;
}
```

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Assembly Code:
Code from “ES_A5.asm”; included in .zip file.

```
#include <p18F45K50.inc>

    CONFIG WDTEN = OFF      ; Disable the watchdog timer.
    CONFIG MCLRE = ON       ; MCLEAR pin is on.
    CONFIG DEBUG = ON       ; Enable debug mode.
    CONFIG LVP = ON         ; Low-voltage programming is on.
    CONFIG PBADEN = OFF     ; RB[5:0] will be configured as digital inputs (datasheet, pg. 133)
    CONFIG FOSC = INTOSCIO  ; Internal oscillator (port function on RA6)

    ; Used for looking up the LED segment configuration.
    VAL0 EQU 0x00

    ORG 0x0000
    BCF INTCON, INT0IF
    GOTO Start

    ORG 0x0008          ; Interrupt vector.
Int_Vector:
    BTFSC INTCON, INT0IF
    BRA Set_VAL0
    RETFIE              ; Return from interrupt enable.

Set_VAL0:
    MOVLW 0x06
    SUBWF VAL0, 0
    BNZ Call_Lookup
    CLRF INDF0          ; VAL0 indirectly modified (cleared).

Call_Lookup:
    MOVF VAL0, 0
    CALL Lookup_LED
    MOVWF PORTD
    BCF INTCON, INT0IF
    INCF INDF0, 1       ; VAL0 indirectly modified (incremented).
    BRA Int_Vector

Lookup_LED:
    MULLW 0x02
    MOVF PRODL, 0
```

```
    MOVF PRODL, 0
    ADDWF PCL, 1
    RETLW b'11001000'    ; H
    RETLW b'10110000'    ; E
    RETLW b'11110001'    ; L
    RETLW b'11110001'    ; L
    RETLW b'10000001'    ; O

Start:
    CLRF PORTB
    CLRF LATB
    CLRF TRISB
    BSF TRISB, 4         ; RB4 (push button) used for input.
    BSF TRISB, 0         ; RB0 used to activate interrupt.

    CLRF PORTD           ; PORTD used for 7-segment LED display.
    CLRF LATD
    CLRF TRISD           ; Clear PORTD and use it for output.

    ; Configure interrupts.
    MOVLW b'10010000'    ; INT0 enabled.
    MOVWF INTCON
    MOVLW b'10000000'    ; INT0's interrupt occurs on falling edge.
    MOVWF INTCON2

    ; Setting up indirect addressing.
    LFSR 0, VAL0     ; If VAL0 needs to be modified, it will be done
                     ; through INDF0.

    CLRF INDF0

    MOVLW 0xFE
    MOVWF PORTD          ; LED will show '-' (a hyphen).

Main:
    BRA Main

end
```

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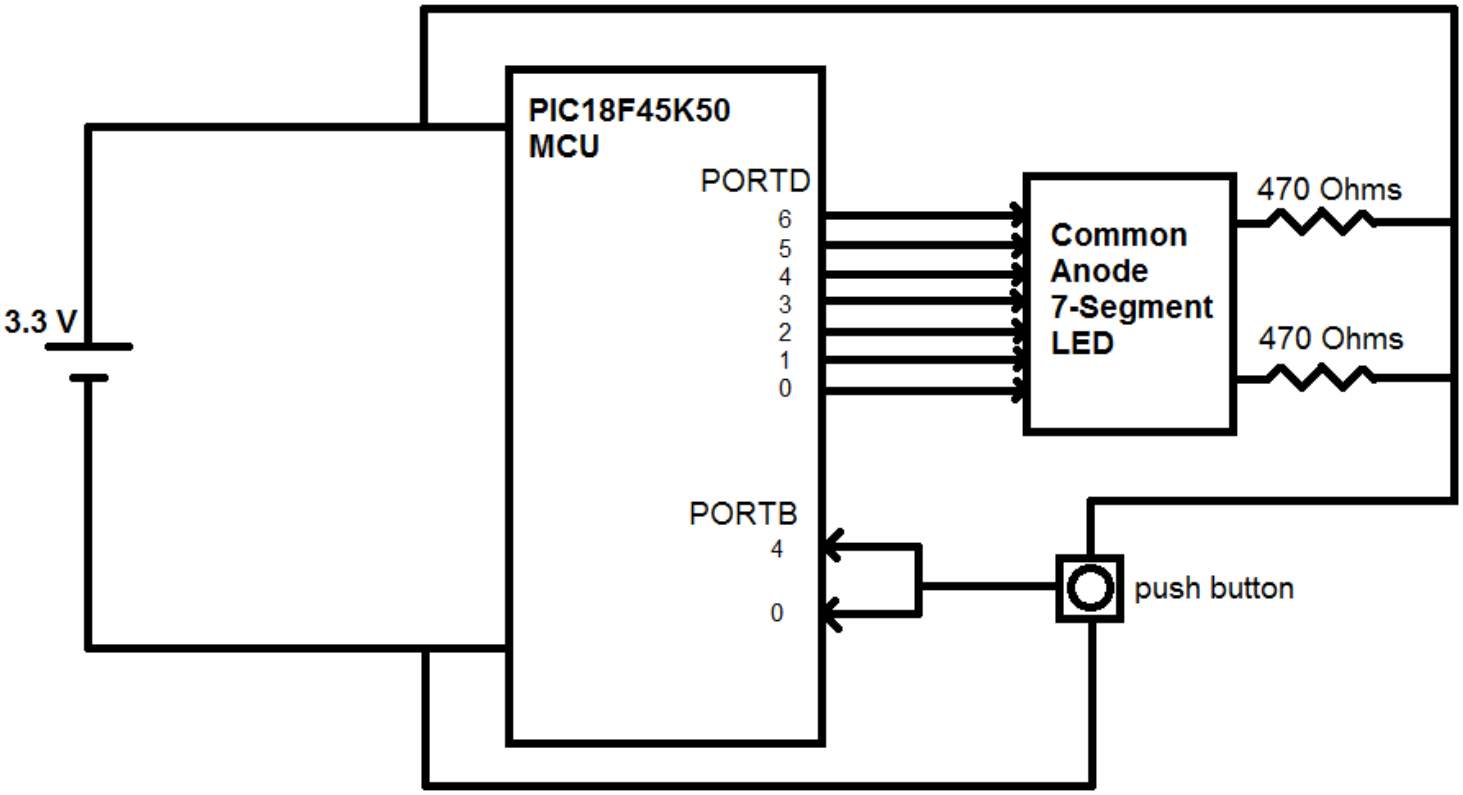
Wiring Diagram:



System's Picture: