CPE 325: Embedded Systems Laboratory
Laboratory Assignment #7

Assignment [100 pts]

1. **[75 pts]** Pulse width modulation (PWM) can be used to control power supplied to some devices from the microcontroller. For example, using PWM you can change the brightness of your LEDs. If the frequency of the PWM signal supplied to an LED is high enough, you will not notice any blinking, but will be able to adjust the brightness by changing the duty cycle of the signal. Write a C program that implements the following functionality:
    a. LED1 is initially off. Then it starts gradually turning on until it gains the full brightness. Upon that it should start gradually turning off. Then the cycle repeats. The time between fully on and fully off states should be 3 seconds (full cycle takes 6 seconds).
    b. SW1 should stop the brightness change process. After it is pressed, LED1 should keep its current brightness.
    c. SW2 should start the brightness change process from the point where it was stopped by SW1. You do not have to use interrupts to process switches.
    d. Use TimerA to produce the PWM signal for controlling LED1 brightness. Make it control the LED. Choose appropriate counting and output modes to do that.
    e. Use interrupts from the watchdog timer in the interval mode to change LED1 brightness.
    f. The process of changing brightness should be smooth. That is, the transition between adjacent brightness levels should be barely noticeable.

2. **[25 pts]**: Write a program in C that achieves the following:
    a. Initializes watchdog timer to raise interrupt every 0.5 mili-seconds.
    b. On every 1000^{th} interrupt you raise an interrupt on pin where SW1 is interfaced.
    c. The ISR for SW1 toggles LED2.

Questions To Be Addressed

Please make sure that you have addressed following questions in your demonstration:

1. For Q1, how do you implement PWM? What part of your code changes the brightness? How do you handle SW press?
2. For Q2, what is the blinking frequency of LED2?
3. Display, in your video if you are making a video, the operation for both Q1 and Q2.

Topics For Thoery

1. Watchdog Timer
2. Timers
3. Continuous Mode, Up Mode and Up/Down Mode of operation

Deliverables

1. Source code or report as instructed
2. Your calculations