CPE 325: Embedded Systems Laboratory
Laboratory Assignment #6

Assignment [100 pts]

1. Pulse width modulation (PWM) can be used to control the power supplied to some devices from the microcontroller. For example, using PWM, you can change the brightness of your LED. 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.

   Keeping the above-mentioned in mind, write a program that allows getting **7 levels** of brightness (0, 16.67%, 33.33%, 50%, 66.67%, 83.34%, 100%) of LED2, using **Timer A** as the source of PWM signal. Make sure the following conditions are met:

   a. No blinking is noticeable due to the High PWM frequency.
   b. Initial brightness should be at 50%.
   c. SW2 increases the level of brightness. If it is clicked at the highest level, nothing happens.
   d. SW1 decreases the level of brightness. If it is clicked at the lowest level, nothing happens.
   e. The microcontroller should stay in the sleep mode when no actions are required.
   f. Take care of SW1 and SW2 debouncing, so that switching between 7 levels of brightness can be clearly observed (without debouncing, some levels may be skipped on a key press).

2. Use **Timer B** and the buzzer to produce sound at approximately **1 KHz**. Turn this sound on and off every second (on after 1 second, off after another second, and so on) in the ISR call induced by the watchdog timer. Set the microcontroller to the sleep mode when no actions are required.

Bonus (Fun Assignment) [10 pts]

Modify part one so that when you hold both buttons simultaneously, LED1 starts blinking at approximately 0.17 Hz (turning on for 3 seconds and off for 3 seconds) with the current level of brightness. Use a watchdog timer for that purpose. Make sure your program returns to the normal mode when the buttons are released.

Topics for Theory

1. Watchdog timer (what is it, how can it be used, different modes, etc.). Give an example of where each mode could be utilized.

2. Timers (TimerA/TimerB – what are they, how are they used, different modes, etc.).

Deliverables

1. Source files (.asm files or C files)
2. Flowchart for Q1
3. Calculation for producing 1 KHz sound for Q2