Lab 9
Topics and Questions

ECE341, University of Idaho

Spring 2015

Demonstration

In addition to the functional specifications defined in the lab handout, all PWM related code should be partitioned into two files, `pwm.c` and `pwm.h`. The two files should include at least the following functions:

- `int pwm_init(int dutyCycle, int cycleFrequency);`
  This function should include all the code required to initialize the PWM output to a specific duty cycle (a number in the range $[0, 100]$), as well as set the PWM cycle frequency (specified in Hz). For this lab, the PWM should be initialized with a 40% duty cycle and a cycle frequency of 1 kHz. The function should return zero on success, or a non-zero value otherwise.

- `int pwm_set(int dutyCycle);`
  This function should set the PWM duty cycle to the value specified by `dutyCycle`, where `dutyCycle` is a number in the range $[0, 100]$ representing the percent duty cycle the PWM should be set to on the next PWM cycle. The function returns zero on success and non-zero otherwise.

- The Timer 2 ISR should be defined in `pwm.c`.

Report

In addition to the standard report requirements:

- Include oscilloscope captures of the 1 ms cycle period, the button detect ISR, and the duty cycle for each button combination. Use the measurement menu on the oscilloscope to measure the duty cycle. See Figure 5 of the lab handout for an example.

- Address the following questions:

  - Derive an expression that approximates the number of bits required by a conventional DAC to achieve the same resolution as the PWM. Assume a 10MHz peripheral bus clock.
  - What is the relationship between the PWM cycle period (the carrier period) and the PWM duty cycle resolution (the "fineness")?
  - What is the purpose of the shadow register in the PWM peripheral (OCxRS)?
  - The PWM output is a digital signal that has essentially two values: VDD and GND. How could a design use a PWM signal to generate a continuous signal (such as a sine wave)?
  - What is the effect of changing ONLY the timer prescale value (the PR value and the OCxR value are constant)?