

CSCE 611

Lab 1

7-Segment Decoder and Variable PWM "Comet"

Due Date: 9/19 (by midnight)

Objective

Design a module that uses the 26 LEDs on the DE2-115 to display a left-to-right and right-to-left sweeping cursor with the following behavior:

- The cursor should move one position every 0.04 seconds (divide the 50 MHz clock by $2^{21} \approx 2$ million).
- The cursor should never move beyond the boundaries of the edges, i.e. should not disappear from the array of LEDs, even temporarily.
- The cursor should leave a "trail" of less brightly-lit LEDs behind it whose intensity falls off logarithmically, i.e. half the intensity one position behind, fourth the intensity two positions behind, eighth the intensity three positions behind, etc.
- The intensity of the cursor is controllable on a scale from 0 to 255 by the user using the left two blue buttons (keys 3 and 2) and the current intensity level is displayed in hexadecimal on the right-most two 7-segment displays. On startup the value should be 255 (shown as FF). The other six HEX digits must be blank.

A video of the lab solution is shown at the following link:

<http://bit.do/611lab1>

Design Specifics

Your design must be comprised of at least three modules, the top-level module, the seven segment decoder, and a pulse-width modulator.

Hints

- The pulse-width modulator (PWM) should take, as input, the 50 MHz clock and an 8-bit pulse width. It will output a single-bit PWM value to one LED having a period of 256 cycles / 50e6 cycles/sec = 5 us (195 KHz). This way, each of the 26 LEDs will have its own corresponding PWM width.
- Every cycle, right-shift the values of all the widths to implement the "decay" of the comet trail.
- The top-level design can use a shifter to keep track of the position of the cursor. Whenever the cursor position changes, change the corresponding LED's PWM width to be the intensity specified by the user.
- Use a generate loop to simplify the instantiation of the PWMs, the width decay, and setting the cursor position (resetting the PWM width).

Submission

Submit your projects (tar.gz of your project directory) through the course Moodle site (<http://dropbox.cse.sc.edu>). Demo your project to the TA within a week of the due date (9/26).