ECE 3710 Lab 3 – Fall 2017

Due Date: Week of October 9 at the beginning of your lab section (50 points)

Objectives

The student will demonstrate their ability to implement a project that meets the requirements of a customer. They will also become familiar with the process of documenting their work for other engineers and with the demands of working on a complex project with a short time line. The project has been designed to bring together all of the material presented in the course so far to give the student practice in, and show the importance of, integrating knowledge and mastering concepts.

Overview

In this project, you will design a two-player game using the bar graph and two push buttons. Each player will control one of two sumo wrestlers and each will try to push the other out of the ring. As the match goes on, the wrestlers periodically shove each other apart, and the first to regain his balance is able to push the other a little closer to the edge of the ring.

Preparation

1. **Make sure that you understand the project requirements.**
2. The algorithm is complex; use diagrams, write pseudo-code and plan ahead. It will help you write efficient code and provide a baseline to aid in debugging.
3. This lab is time intensive so do not procrastinate.
4. **Use all of your resources**: the course wiki, the discussion page, all of the datasheets, previous labs and the lecture slides will all be valuable.

Requirements

Working with your customer, the design team has drawn up the following set of requirements for the project:

1. The display shall consist of a 10-LED bar graph mounted horizontally.
2. There shall be 2 buttons, each in the proximity of a different end of the bar graph. Player 1 uses the button on the left and player 2 uses the button on the right.
3. There shall be a DIP switch to configure the speed of each player. The speed S_n for player n shall be interpreted as a 2-bit binary number, one switch per bit.
4. The buttons shall be sampled at least every 5 ms (milliseconds).

5. After the system is reset, the two center LEDs of the bar graph shall flash at a rate of 2 Hz. This rate will be controlled using a timer. The LED on the left represents player 1 and the LED on the right represents player 2.
6. Each player must press their button to indicate their readiness to play. Once a player presses their button, their LED shall be lit solidly.
7. At some random time at least 1 second but no more than 2 seconds after (a) both players indicate their readiness to play or (b) a move concludes that does not end the game, the leftmost lit LED shall move one spot to the left and the rightmost lit LED shall move one spot to the right. This event starts the move.
8. After the move starts, each player races to press their button. As soon as a button is pressed, the corresponding player's lit LED moves back to its prior position and a timer is started.
9. If the timer in (8) expires before the opponent presses their button (and moves their lit LED), the quicker player's lit LED shall move again and be adjacent to their opponent's lit LED. Otherwise, the move is a draw.
10. If the result of this move is that the two lit LEDs are on the leftmost or rightmost side of the bar graph, the game is over and the 2 lit LEDs shall flash at a rate of 2 Hz until the system is reset.
11. The delay time in (8) shall be based on the player's speed, S_n, and the number of contiguous drawn moves, d. If player n is the first to press their button, the delay in milliseconds shall be $2\text{-}\min(d,4)\ (320 - 80S_n)$.

Documentation

Rather than a lab report, you will produce complete documentation so that other engineers can understand how you met the requirements, how you verified that you met them, and why you made the decisions you did. **Please submit one document per team.**

Any product, such as this sumo wrestling game, will have hardware, software and mechanical designs. You will need only to document the (electrical) hardware and software designs, but be aware that there are circuit boards that need to be laid out, plastics to mold, connectors to fit, etc. All these things are covered by the mechanical design but are beyond the scope of this class.

Often, engineers buy a development kit such as the Tiva C Series LaunchPad Evaluation Kit to build a prototype so that hardware can be tested before it is rendered to a circuit board and so that software can be written while the physical parts are in fabrication. The development kit itself is not part of the design, but designers borrow liberally from it for their designs. For example, an engineer may use the power supply from the evaluation board for his design. Your design will need to include the power supply, crystal oscillator, reset circuit, etc. You can get that part of the design from the development kit schematic (don't just copy the images, use

a schematic capture program such as EAGLE or PSpice, to incorporate the parts you need). You won't need, for example, the serial port, so you should not include the parts associated with it in your design.

Remember, the design document describes the design of the finished product, not the evaluation kit and NOT the experiences you had while developing it. Be as clear, complete and concise as possible, and remember that your audience consists of engineers with similar technical background to your own. Since this is your first time creating a design document, we have provided guidelines and a sample document on the course wiki.

Design Steps

1. Get the requirements.
2. Understand the Concept(s)
3. Understand or Develop the Algorithm
4. If necessary, make functional partitions and repeat steps 1-4 for each
5. Test from bottom up
6. It will be necessary to use a logic analyzer or an oscilloscope to test requirements (9) and (11).
7. For the random timer in (7), consider using user input along with the systick to generate a random value.