

CSE 490/590

Summer 2015

BASYS 2 Board Project #2

Project Selection due Wednesday, June 17, 2015 at 11:59 PM

Project due Wednesday, June 24, 2015 at 11:59 PM

For your design project, you may select from any one of the following or submit a proposal for your own project. Your design can be implemented using structural Verilog, behavioral Verilog, schematic capture, or any combination of these. It must be able to be downloaded to the BASYS 2 board as a nonvolatile design stored in the board's onboard flash memory. The project you select must be registered using the project registration form on the course website no later than Wednesday, June 17, 2015 at 11:59 PM.

Documentation & Submission Requirements

Submit your Verilog source code (*project2.v*) or schematic (*project2.sch*), bit file (*project2.bit*), documentation describing how to use your project and details about the design (*project2_docs.pdf*), and a README file with additional pertinent information regarding the project (*README*) electronically on *timberlake.cse.buffalo.edu* using the submit command (***submit_cse490 filelist***) or (***submit_cse590 filelist***) where *filelist* is a space delimited list of your files. If the files were submitted successfully, a message will be displayed confirming successful submission.

Electronic Lock

Design an electronic combination lock. A four digit code can be entered by using the pushbuttons and slider switches. As the number is entered, it should be displayed on the seven-segment display. The number is entered as follows. Slider switches 3 through 0 should be used to enter the binary value to be displayed on a particular digit of the seven-segment display. Slider switch 3 corresponds to the most significant bit and slider switch 0 the least significant bit. When a momentary push button is pressed the number represented on the slider switches should be latched and displayed on the corresponding digit on the seven-segment display. After the number has been entered, the user should move switch 4 from the low position to the high position, and then back to the low position to indicate that the code entering is complete. When the correct combination is entered and the device unlocks, the LEDs will flash. If two attempts are made to unlock the device without correctly entering the combination, the device should be deactivated for 20 seconds. The seven segment display will be used to display the state of the lock. The states are: LOC (locked), UnLC (unlocked), and PAUS (deactivated). When the device is unlocked, it can be locked by moving DIP switch 5 from the low to the high position, and then back to the low position. The entire code must be entered within 30 seconds (from the first button press to the last button press). The combination for your lock should be the your two digit seat number in CSE 490/590, followed by the number of digits in your username, followed by the sum of the first three digits mod 10. For example, if your seat number is 59, and your username is *csestaff*, your combination would be 5982.

Guessing Game

Design a two player guessing game. The game starts with the four digit seven segment display illuminated with "PL 1" indicating that player #1 should enter a number between 0x0000 and 0xFFFF. The number is entered as follows. Slider switches 3 through 0 should be used to enter the binary value to be displayed on a particular digit of the seven-segment display. Slider switch 3 corresponds to the most significant bit and slider switch 0 the least significant bit. When a momentary push button is pressed the number represented on the slider switches should be latched and displayed on the corresponding digit on the seven-segment display. After the number has been entered, player #1 should move switch 5 from the low position (player #1) to the high position (player #2). The seven segment displays are used to indicate this by displaying "PL 2". It is now player #2's turn. Player #2 repeatedly enters four digit numbers until he or she correctly guesses the number entered by player #1. The procedure for entering the four digit number is the same as it was for player #1. When the complete four digit number has been entered, switch 4 can be used to latch or register that value as a guess. Moving switch 4 from the low to the high position, and then back to the low position will latch the number. When an incorrect number is entered, the display should indicate if the guess was too high ("2 HI") or too low ("2 LO"). When the correct guess is entered the LEDs should blink in celebration, and the number of guesses required should be displayed on the seven segment display.

Message Board

Design a circuit which will scroll a message across the seven-segment display. The data is entered via a keyboard. The scroll rate should be variable, and can be changed by the user. The scroll rate should be set using the 4 push buttons and/or the slider switches.

Video Controller

Design a video controller which should be able to display characters on a VGA display in different colors. The characters displayed should be input by the user using either the keyboard, push buttons, and/or slider switches.

16-Bit RISC Microprocessor

Design a 16-bit RISC microprocessor that adheres to the ISA on the projects page of the course website. As part of the design, one must consider how memory will be implemented, how programs and data will be loaded into memory, and how to view memory to verify program correctness after it the program executes.

Your Own Design

If you desire, you may come up with your own project, but your idea must be approved by Dr. Schindler. Your idea must be submitted for approval on using the project registration form on the course website. You will receive email indicating whether your proposal was approved. If it was not approved, feedback will be provided so you can amend your proposal and resubmit.