Class Project
Fall 2021 / EC311
Instructor: Ajay Joshi
Mid-project review: Week of November 29, 2021
Project demo deadline: December 10, 2021 at 2 pm
Project presentation: December 6, 2018 and December 8, 2021 in class
Final Project report submission deadline: December 10, 2021

For the class project, you have the following options:

1. Frogger
Here you have to design the game of Frogger. At a high-level the game should be designed to be played as follows:

- When the user hits the reset button, a 5-second count down is displayed on the 7-segment LED unit.
- When the counter reaches 0, the game starts.
- During the 5 second count down you should display the 4 lanes that the frog has to cross on the LCD monitor. The LCD monitor will connected to the FPGA board via VGA port. We will give you the code to control the LCD monitor using FPGA via the VGA port.
- You will use the push buttons for the frog to move up, down, left and right. Each push button should enable the frog to move one lane up, one lane down, one slot to the left or one slot to the right. You can decide how you want to divide up the LCD monitor screen in terms of width of each lane, length of each lane and the number of slots in each lane.
- You can have objects of different sizes in each lane. You can control the spacing between the objects within each one of the 4 lanes.
- A player gets 3 chances to get the frog to cross the 4 lanes. game lasts for 30 seconds. You can use the 7-segment display to track the time.
- You can have multiple levels in the game, where you control the speed at which objects move across the screen.

2. Whack-a-mole - LED style
Here you will implement the game of Whack-a-mole. Instead of a mole popping out of a hole and going back in, we will use LEDs switching ON and OFF, and instead of using a hammer to whack the mole, we will use push buttons to switch OFF the LEDs. At a high-level the game should be designed to be played as follows:

- When the user hits the reset button, a 5-second count down is displayed on the 7-segment LED unit.
- When the counter reaches 0, the game starts.
- We will use 5 LEDs corresponding to the 5 moles. At a time only 1 LED will be ON. The LED will switch OFF after 1 second.

- When an LED is ON, the player has to use the associated push button to switch OFF the LED. After the player switches OFF the LED, another randomly chosen LED will switch ON. The user then has to use the corresponding push button to switch OFF the LED, and so on.
- We will use the 7-segment display to keep track of the score.
- A game lasts for 30 seconds.
- You can have multiple levels in the game where you control the time for which the LED stays ON. In this case, you will need to provide a way for the player to chose the level of the game.

3. Pick your own game
Here you have the option to pick a game other than Frogger and Whack-a-mole and design it. If you want to choose this option 3, please talk to the instructor immediately. Note that the complexity of the game design should be similar to Frogger and Whack-a-mole.

General Remarks

- Please form your own team of 4 members.
- Projects are somewhat open-ended on purpose; it's your job to formulate the specifications and to design the system.
- You have a great deal of flexibility in designing your system. You should make suitable assumptions wherever necessary.
- All of your design specifications and decisions should be clearly explained in your final report.
- Please define the functionality of the entire system in detail before starting Verilog coding.
- Verilog coding will take more than a week, so please make sure you start coding well in advance. Use procedural Verilog assignment coding style.
- We recommend using github for sharing the code of this project.
- This project will involve some research on your part.
- Distribute the workload. Make sure each member of your teams has a tangible contribution towards completing the project.
- Don't be afraid to seek help from the instructor and TAs.

Deliverables and Deadlines
The class project has the following deliverable/deadlines:

- Week of November 29 (Mid-project review): You should have your entire system designed (all block diagrams/schematics drawn, all state machine diagrams drawn, all logic planned out, etc.) by November 29. The project reviews will happen in the PHO 334. Please sign up for a meeting slot on Piazza. It is highly recommended that you use powerpoint slides or Google slides to present your work.

- December 6 and 8 (Final project submission): For the final project submission, each team has to present their work to class, submit a report and demo their project. The project presentations will be during the last two lectures (Dec 6 and Dec 8) of the class. Each team will get a 10-minute slot (8 minutes for presentation + 2 minutes for Q&A) to present their work. Please sign-up for a time slot on Piazza. Note that each team is expected to attend the presentations of other teams. The project presentation should be powerpoint format and should include the following sections

  - Project title and team members
  - Project goal
  - Design specifications
  - Design functionality
  - Do's and dont's
  - If we got a chance to redesign the whole system from scratch ...

  You have to submit a report (up to 10 pages long) describing your work (schematics, block diagrams, explanation of design choices and system functionality, etc) via Blackboard by December 10, 2021. Do not include any verilog code in your report (we'll look at your code during your project demonstrations.). The project demos need to be done by 2 pm on December 10. The project demos need to be done during the lab sessions or by setting up an appointment with the instructor or TA.

- December 12 (Group evaluation) Confidential emails should be sent by each student to the instructor evaluating the contribution of the other team members of his/her group. The subject of the email should read "EC311 Project Contributions". In the body of the email, list each team member's name (other than yours) and state if the contribution was Superior, Equal or Deficient.