EEL 4712C: Digital Design
Spring 2024

LAB 05: Pong
(80 Points)

Pre-Lab Objectives

This lab is designed to test the cumulative knowledge of the digital design skills you have learned during this course. Using the code you wrote in Lab 4, you will be expected to design a 2 person VGA Pong game. This game will have 3 screens: Start, Gameplay, and Game Over: Additionally it will have 7 user inputs for player 1 left and right, player 2 left and right, Start game, Pause game, and reset.

While many of the components of this game will closely mirror the movement task from Lab 4, but please continue to be thoughtful and careful in your design. In a large scale design there are many places where things can go wrong, so make use of the tools we have used this semester like the RTL Viewer.

Pre-Lab Requirements

Part 1: Start & Game Over Screen (20 points)

The Start menu and Game Over screen should each be a static screen. The Start menu should display the name of the game "PONG" and "Press B1". This indicates that button B1 on the DE-10 Lite should be pressed from the Start menu in order to begin a game. Game Over should be a similar screen displaying "Game Over" and "Player <X>" wins where <X> is replaced by the number of the winning player. From this screen B2 should be pressed to reset the game back to the start menu.

To display the text on screen you can use bitmaps which are an array of values used to represent a 2d array of pixels as shown below. There are many resources online for how to create bitmaps.
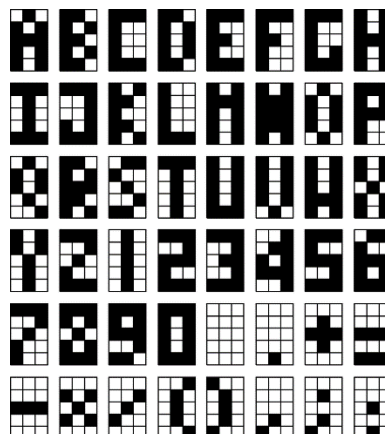
Part 2: Ball Movement (20 points)

The Pong ball should move very similarly to the motion of the ball in Lab 4, but will need to bounce off the top of the paddles rather than off the top and bottom edge the screen. You may decide for yourself how far from the edge of the screen the top of the paddle should be.

When the ball hits a location where the paddle is not, it should move back to the center of the screen. After respawning in the center of the screen, the ball should continue to move in the opposite direction that it was moving when a goal was made.

To pause the ball movement and all gameplay, input from SW5 will be used. When it is high, there should be no ball movement and no paddle inputs should be accepted.

Part 3: Paddle Movement (20 points)

Pong requires 2 paddles, one for each player. One should be on the top edge of the monitor and one on the bottom. Rather than being constantly in motion like the Pong ball, the paddles will be moved using SW1/SW2 for Player 1 and SW8/SW9 for Player 2. The paddles can be drawn very similarly to the original square in the center of the screen but with different dimensions and locations.

Part 4: Scoreboard (20 pts)

The scoreboard should be implemented using bitmaps similar to the Start and Game Over menu. Each player should have their own score than increments with each goal and is clearly visible on screen during the game. When the score reaches 10, the screen should immediately change to the Game Over menu.

Demo Procedure

The demo for this lab will be based on the working components of the Pong game. Full credit will be earned by a fully working game.

Deliverables & Submission Guidelines

- Summarize your work in a report. Template for lab report is provide on Canvas
- Zip your lab solutions and report in a file name <Your_UFID>.zip with a folder structure as shown below.
  - Make sure to use the file names shown below in your submission

```
Your_UFID/
├── lab_report.pdf
├── <lab files>.vhd
```