

CS 152A

Introductory Digital Design Lab

LAB #4

Snake

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Grade:

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Introduction and requirement

The goal of this lab was to design the classic game Snake using the VGA output of the Nexys3 board to display it on our monitor. Additionally, we aimed to display the player's score using the Seven Segment Display of the Nexys3 board. The game takes several inputs: a button that resets the game (center button), 4 buttons that tell the snake which direction to turn (the surrounding 4 buttons), and all the switches to manually increase the difficulty of the game.

We had to split a 100 MHz Master Clock into 3 clocks to use elsewhere in the timer: a 50 MHz clock that controlled the timing of the output signals to the VGA port, a clock that controlled the movement of the player (variable frequency depending on the difficulty of the game), and a 200 Hz clock to show the score on the seven-segment display.

Design Description

We designed the architecture of the Snake Game using 5 main modules.

ClockSplitter:

We used almost the same module that we used in Lab3 to output the 3 clocks we needed in this lab. The only difference is that the clock controlling the player movement was dependent on the current difficulty of the game.

DifficultySelector:

This module just looks at the current score and the position of the most significant active switch on the board to determine the current difficulty of the game. When they are not equal, the higher of the two takes priority.

Game:

This module does the heavy-lifting. It moves the player, determines what color should be shown at a given pixel, and detects collisions (between the player and itself (ending the game), between the player and the wall (ending the game), and between the player and the food (increasing the length of the snake)). It also regenerates the piece of food in a pseudo-random location after the player eats it.

SevenSegmentDisplay:

We used the same module that we used in Lab3 (that displayed the time) to display the player's score in this lab.

vga_800x600:

We were given a sample project that used the VGA output, so we slightly modified the module from that project to meet our needs.

Simulation Documentation

During testing of the snake game, we only used testbench initially to check if the pixels and RGB elements were being turned on properly. Most of the testing was done in the actual usage of the Nexys3. We incrementally tested the game. We were initially concerned with how to display colors on a screen. After that, we slowly started building the snake game by adding in feature by feature. By modularizing the process, we were able to continuously add to the game without breaking it's previous functionality. By actually playing the game, we could see what was wrong and what needed to be done.

Conclusion

We were able to complete every part that we wanted to accomplish. The main difficulties we faced were related to the implementation of the snake body and how to handle each body part's movement since it involves the previous body part. Another difficulty we faced was the color output. We initially thought there were some issues with how we were setting the bits for RGB, but the error turned out to be caused by a faulty VGA cable.

Individual Contribution

We each split the contribution on the lab. We were both working on the snake game during lab times (Anthony writing the code while Jason helped with the logic). Anthony did the first half of the lab report and Jason did the last half.