ECE 480/580: Digital Systems Design – Project 2

FPGA snake game

Introduction

From previous lab assignments, you have learned how to drive a VGA monitor from an Intel FPGA, specifically, the one that comes with the DE1-SoC development board. In this project, you will use the Quartus software package to design and test a snake game on the DE1-SoC board. The requirements for this project consist of completing the Quartus design and printing the VHDL/Verilog files and laboratory report. You will also be required to demonstrate the game to the TA.

Design

The screen should be blank at the beginning of the game. Moving SW[0] from low to high initiates a new game. A "snake' should begin moving from the left edge of the screen. At this point in the game, the snake should be relatively short.

The pushbuttons will control the movement of the snake from this point forward. The scrolling graphic should respond to the arrow key presses beginning with the *head* of the snake in the following way:

Original orientation	**Change**	
Horizontal	KEY[0]	Flip to vertical movement and scroll up
	KEY[1]	Flip to vertical movement and scroll down
	KEY[2]	No change
	KEY[3]	No change
Vertical	KEY[0]	No change
	KEY[1]	No change
	KEY[2]	Flip to horizontal movement and scroll left
	KEY[3]	Flip to horizontal movement and scroll right

Note that the pushbuttons KEY[0], KEY[1], KEY[2], and KEY[3] correspond to the original concepts of the UP, DOWN, LEFT, and RIGHT keys, respectively.

Movement of the snake should mirror traditional snake games where the body follows the "link" in front of it. If you are confused about what I mean here, please ask me for clarification.

As stated earlier, SW[0] should serve as the New Game/Reset switch. When the switch is up, or "on," a new game should commence. When the switch is down, or "off," the game should reset to a blank (or menu) screen.

SW[1] should serve as the "pause" button. When up/on, the game should pause. When down/off, the game should continue.

Apples should appear periodically in different locations on the screen. When the head of the snake rolls over an apple, the apple is consumed, and the length of the snake should increase by 10 pixels. An apple should be on the screen at the start of a game and a fresh one should appear in a new location when one is consumed.

When the snake touches any edge of the screen or itself, the snake should freeze and no longer respond to pushbutton presses.

Notable game parameters are given below:

Parameter	Value
Background color of the screen	Black
Color of the snake	Green
Color of apples	Red
Length and width of the snake (at the beginning)	40 (length) x 10 (width) pixels
Speed of the snake	50 pixels per second (smooth motion, not choppy)

You are encouraged to make additions to this description to make your game “yours.” Examples could include a start screen, a high score monitor, credits, a “hard” mode where the snake moves faster controlled by an additional switch, interfacing with a PS/2 or USB keyboard (recommended only after your base system is functional), etc.