Lab 5 Fall 2021

Goal: To create a Nios II based system utilizing pixel-based VGA graphics, color, and switch inputs.

Materials: DE10-Lite board, VGA compatible monitor

Due: Lab 5 checkoff is due by the end of lab in week 8, report is due by midnight of that day.

Basic Assignment (85%)

Create a Nios II based system that outputs graphical information to a VGA monitor. An example hardware system is briefly discussed in the tutorial on Dr. Johnson’s web site. After creating the embedded microcontroller design in Platform Designer, add it as a component to your top-level design. Make any necessary connections or additional logic required in your top-level design. Download the design into the DE10-Lite. Write software using the Eclipse tool to run the embedded microcontroller design. The software needs to draw a white rectangle somewhere on the screen. You can find various pixel-based functions in “Altera\_up\_avalon\_video\_pixel\_buffer\_dma.h”.

Medium Assignment (93%) (Also covers the basic assignment)

Add color selection functionality to your design. Use at least one switch input for each color (R, G, & B), more if you want more color options. Draw the rectangle using the selected color. Check the switches at least twice per second so it will pick up any changes in the switch settings. Also, draw an ‘X’ in the rectangle (corner-to-corner) using the same color. Note that the pixel software defaults to 16-bit color, with 5 bits for red (starting with the MSB), then 6 bits for green, and finally 5 bits for blue (ending in the LSB).

Advanced Assignment (100%) (Also covers the basic and medium assignments)

Create an ‘Etch-a-sketch’. Start by drawing a pixel in the center of the VGA screen. Draw another pixel based on the switch settings. Use some combination of slide switches and pushbuttons to implement the ability to put the next pixel either up, down, left, or right of the previous one.

Provide a mechanism for clearing the screen and starting over. Suggestions include using a slide switch, or one of the pushbuttons.

Report

Follow standard report format. Required attachments are: your commented VHDL code for the top-level design and any components you created. If you have state machine(s) in your code, attach a state diagram of the state machine. Also attach a screen capture of the ‘system contents’ from Platform Designer.