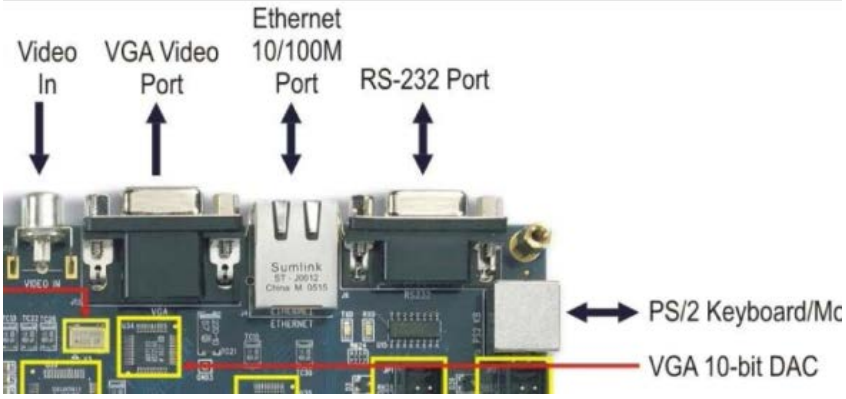
Lab #2
Creating a VGA Video interface for the DE2

EELE 466
COMPUTATIONAL COMPUTER ARCHITECTURE

Assignment Date: 2/03/15
Due Date: 2/24/15

Lab Description

The DE2 board has a VGA port and 10-bit DAC that we will use to create some images on a VGA monitor.



The goal of the lab will be to meld the approaches from two VHDL VGA code sources. The first VHDL source is the component vga_sync.vhd (which is one of the blocks found in chapter 5 of the text Rapid Prototyping of Digital Systems : SOPC Edition) . The idea here is the generation of the pixel_row and pixel_column signals that can be used to grab image data from a matrix, which will be a useful abstraction. The second approach is to use the VHDL code from Prof Edwards (Columbia University) that explicitly encodes the VGA timing signals. This code is posted on the D2L site in the file VGA_VHDL_Edwards.pdf. This approach will useful when switching resolutions.

Functional Goal

The functional goal of the lab is to display the largest color image that can be held in cyclone II block memory and be able to change display resolution.

Task 1

Get the example code with explicit VGA timing working on the DE2 board. The display should be a white rectangle centered on a blue background.

Task 2

Be able to change the resolution of the VGA monitor from 640x480 to another resolution of your choice (one that the Dell 1908fp monitor supports, which is the 19-inch VGA monitor in the digital lab.). Create an additional small white square in the blue background region in order to demonstrate the resolution change. Pressing Key3 should change the resolution to 640x480. Pressing Key2 should change the resolution to the resolution of your choice (greater than 640x480).

Note: You will need to conform to the **entity** found in the VHDL file vga_sync_controller.vhd

Task 3

Determine the maximum amount of block RAM available on the DE2 board. How much is available? **Take a color image of your choice** and scale it to the size that the memory will support (you will need three memory blocks of the same size for RGB color). You will need to create three .mif files to place the image in memory using ROM memory blocks. Use the Altera MegaWizard Plug-In Manager (Tools-> MegaWizard Plug-In Manager) to create the three ROM memory blocks (Note: you can also create just one memory block and put the RGB values in one word). The image should be initially centered in the VGA monitor with a colored border (the border color is your choice and should be changed from the blue color). You should be able to change the resolution while displaying the color image as in task 2.

Task 4

Using Key1, move your image relative to the background color given the following switch inputs:

- SW17 – sign bit (‘1’ – movement is positive, ‘0’ – movement is negative)
- SW16 – direction(‘1’ – move up/down, ‘0’ – move left/right)
- SW[7:0] – step size (movement in pixels)

Each time you press Key1, the image should move in the direction indicated by SW17 and SW16 and by the amount indicated by switches SW[7:0]. How will you handle the image when it gets past the monitor edge (wrap-around, stop moving)?

Note: Turn in the instructor verification sheet and upload your ***commented*** VHDL code to the lab dropbox folder on the D2L site.

Have the instructor verification sheet (given below) signed off when you get the tasks working.

Instructor Verification Sheet
Turn this sheet in along with your VHDL code to get credit for the lab.

Lab #2
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Due Date: 2/24/15

Name : _____

Demo #1 : Display a white rectangle on a blue background on a VGA monitor.

Verified: _____ Date:_____

Demo #2 : Demonstrate resolution changes.

Key3 = 640x480

Key2 = _____

One of the Entities conforms to the entity found in
vga_sync_controller.vhd

Verified: _____ Date:_____

Demo #3 : Display a color image in the VGA monitor that can be moved around when Key1 is pressed..

Verified: _____ Date:_____