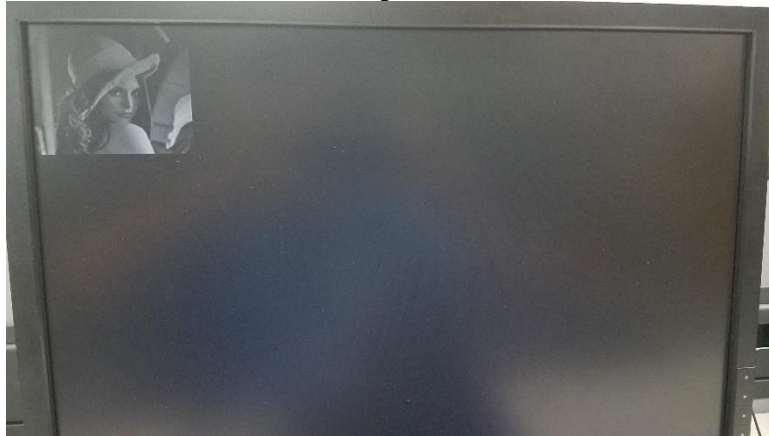


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09/19/2017
CpE 409

Homework 1

1. Run the project demo for Lena

Lena picture:



2. Rescale and center Lena 3x with green border

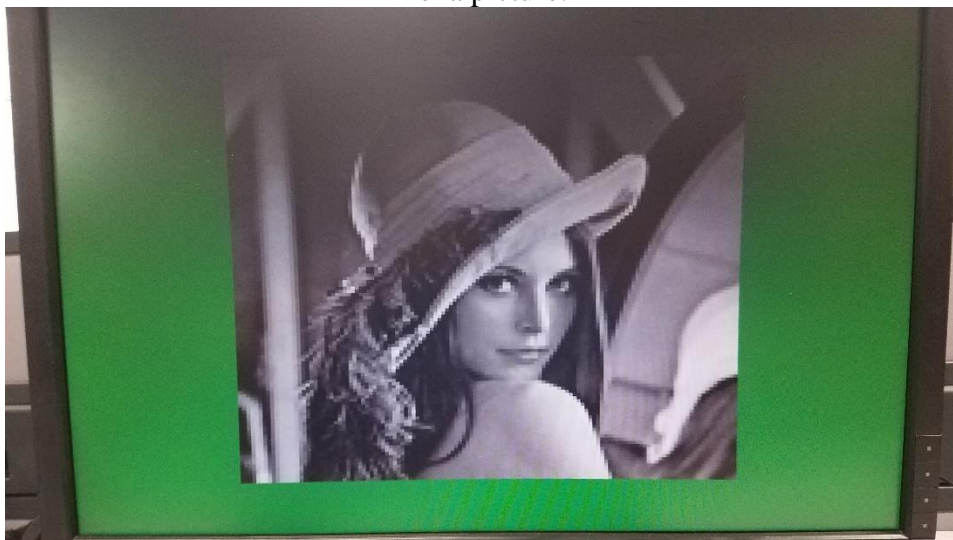
For this part, I used the nearest neighbor algorithm to scale up the Lena picture three times as big as the original picture. In other words, I repeated the pixels every three columns and three rows, or 3x3 window will have the same pixel. To center Lena, I calculated the length of each border by subtracting the rescaled size of the image to the dimensions of the VGA. These numbers provide origin transformation. The calculation for that transformation is as follows:

$$\text{Left/Right Border} = \frac{\text{VGA Width} - \text{Image Width} \cdot \text{Resize Factor}}{2} = \frac{640 - 128 \cdot 3}{2} = \boxed{128}$$

$$\text{Up/Down Border} = \frac{\text{VGA Height} - \text{Image Height} \cdot \text{Resize Factor}}{2} = \frac{480 - 128 \cdot 3}{2} = \boxed{48}$$

The top left corner (0,0) of the image onto the VGA will be at (48, 128).

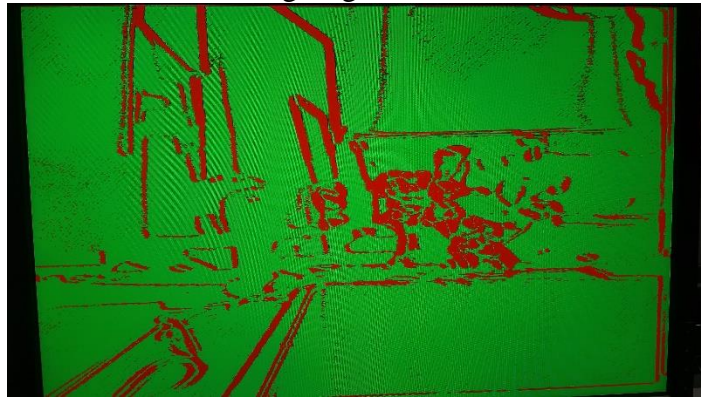
Lena picture:



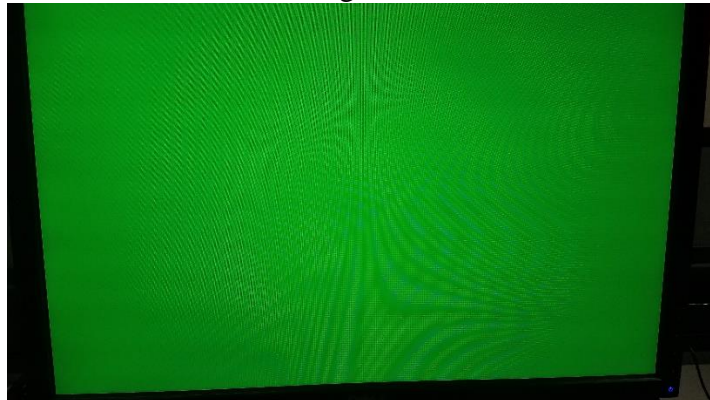
3. Sobel edge detector with red edges and green for everything else

For this part, I modified the top module of the Cornell/Purdue project by modifying the color of the edges and of everything else that is being displayed onto the VGA. For the edges, I selected Red to display them which are determined using the Sobel filters. Green is used to display all other artifacts of the live image. The key buttons control the edge threshold, either (2) to increase and (1) to decrease. The default edge threshold is 0x80.

Starting Edge Threshold:



Increasing Threshold:



Decreasing Threshold:



4. Crossfading Lena with live camera video

For this part, I utilized both the Lena project from part 2 and the live image stored in the SDRAM. The crossfading between these two images are dictated by the following equation:

$$newimage = (1 - \alpha) \cdot Video\ pixel + \alpha \cdot Lena\ pixel$$

which can be simplified for hardware use as follows:

$$newimage = Video\ pixel - \alpha \cdot Video\ pixel + \alpha \cdot Lena\ pixel$$

$$\boxed{newimage = Video\ pixel - (Lena\ pixel - Video\ pixel) \cdot \alpha}, \text{ where } \alpha = \frac{N}{16}$$

The value 16 is chosen to crossfade the video for about 16 seconds.