CALIFORNIA STATE UNIVERSITY

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LONG BEACH

CECS 360 Project 3 – Graphic Generation with an Object-mapped Scheme

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Introduction

This project is a continuation of the VGA sync project. From there, we will create a graphic generator circuit that will display three objects—a wall, a ball, and a bar (paddle). These objects will be created by defining pixel locations and assigning an rgb output for those locations. For this project the wall is colored blue, the ball is red, and the bar is green. They are also tied to the video enable—the objects will only be generated if “video on” is enabled.

VGA synchronization

The vga sync module will generate the hysnc signal which specifies the time required to scan a row. It will also have the vsync signal which specifies the time required to scan the entire screen. For this project we will have a screen resolution of 640 x 480 with a refresh rate of 25Mhz. This refresh rate tells us the number of pixels processed every second. The resolution of the screen is also known as vga mode.

Horizontal and Vertical Synchronization

The hsync signal will be obtained from a 0-799 counter and a decoding circuit. The counts will then be used to mark the end of the horizontal display indicated by endh. The hsync signal is also specified to be low active from count 656 to 751 and high active from 0 to 639.

The vsync signal will be obtained from a 0-524 counter and a decoding circuit. The counts will then be used to mark the end of the vertical display indicated by endv. Note that the vsync will also wait for the horizontal counter before it starts counting up. The vsync signal is also specified to be low active from vertical count 490 to 491 and high active from 0 to 479.

The hsync and the vsync signal determines if video on will be high active—video on will be active when hsync and vsync are active at the same time.

Graphic Generation and Operation

Three fixed objects will be generated based on the requirements given—a wall, a ball and a bar (paddle). Each object is given a specified region and a color to be selected. The wall occupies the region from horizontal count 32 through 35 and is given the color blue. The bar occupies the region from horizontal count 600 through 603, vertical count 204 through 276 and is given the color green. The ball occupies the region from horizontal count 580 through 588, vertical count 238 through 247 and is given the color red.

The operation is pretty straightforward. We do not have to do anything with it, we just verify the objects through a monitor and with our simulation.

Verification

This project has been verified through a monitor and simulation. We will see a 2D image of a square ball, a wall, and a paddle. As for the simulation, each pixel is checked if it would have the proper color. For example if at some pixel x and some pixel y the color is wrong then we increment and display an error counter that will notify us if there is an error with our simulation. If there are no errors, it has been set to do nothing at all.