CECS 360 Project 4 – Animated VGA: Complete Pong Game

Marc Dominic Cabote

014938597

14 November 2017

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. After creating the objects, the goal was to make the paddle and the ball move. The paddle being controlled by the user and the ball moving by itself in a predictable pattern.

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, Animation 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 paddle is also set to be able to move up and down by changing the top and bottom constants with registers. The paddle should then stop when it hits the top or the bottom of the screen. As for the ball, there are four boundaries created by two registers ball x and y. It changes direction when it hits the wall, the paddle, and the top or bottom of the screen. It is also given a certain speed slower than the paddle movement so that the user will be able to react in time to make the ball bounce back from the paddle. The animated objects will also have a refresh rate of 60 Hz to make it move with fluidity.

The operation for this project is pretty straightforward. The move will move by itself in the beginning and the goal is to move the paddle so that the ball will hit it and bounce back. You will be able to move the paddle up or down with the up and down buttons on your board. This project has also been verified from the previous lab.