Project Report
“Flappy Bird”
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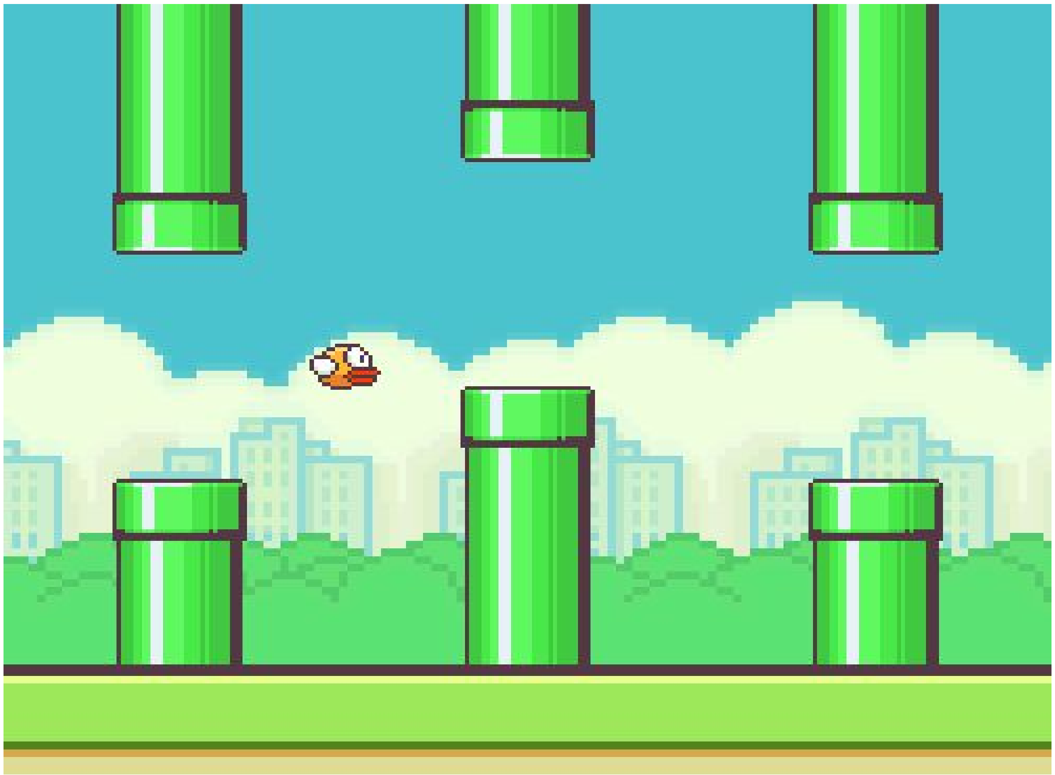
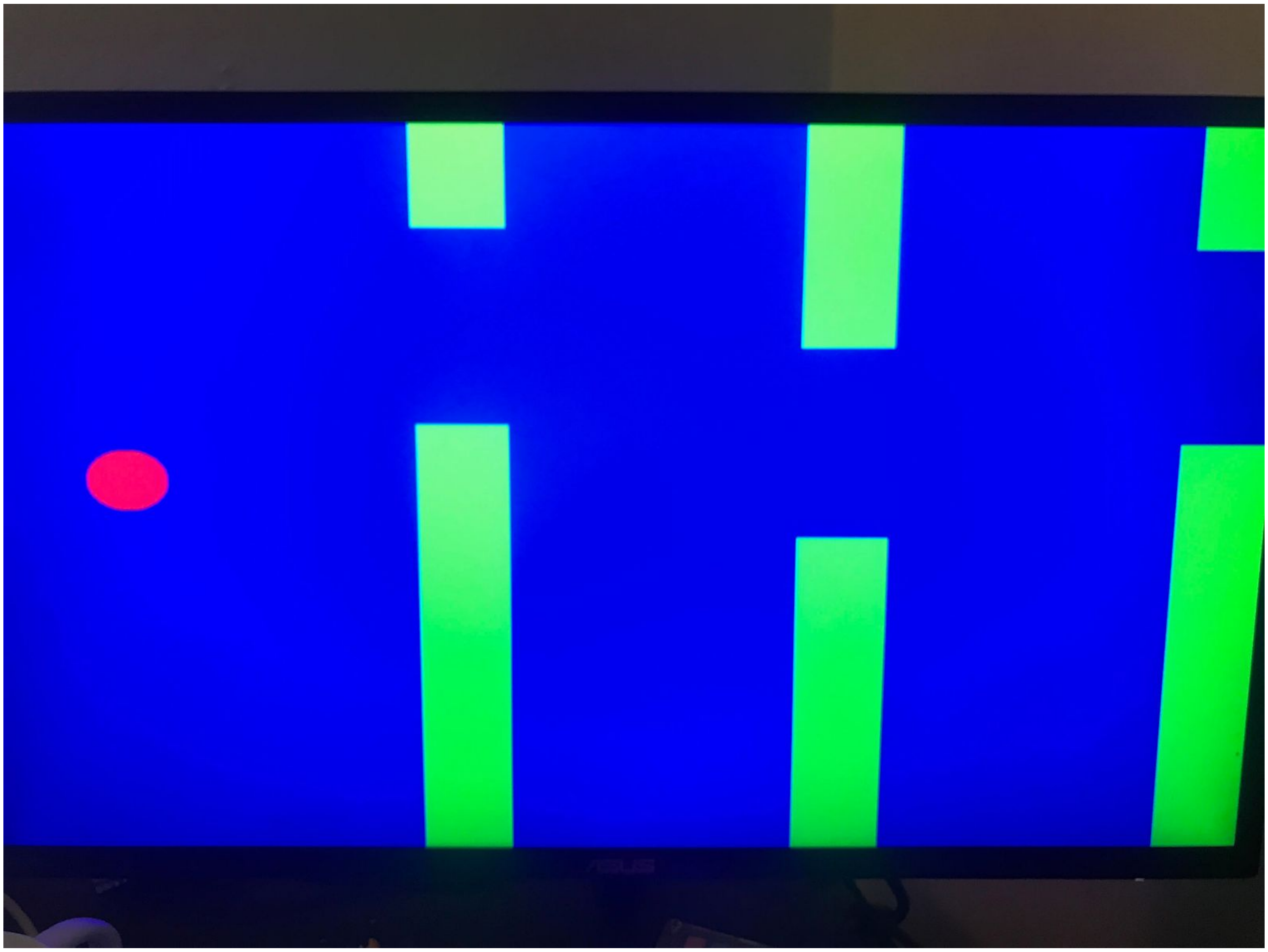
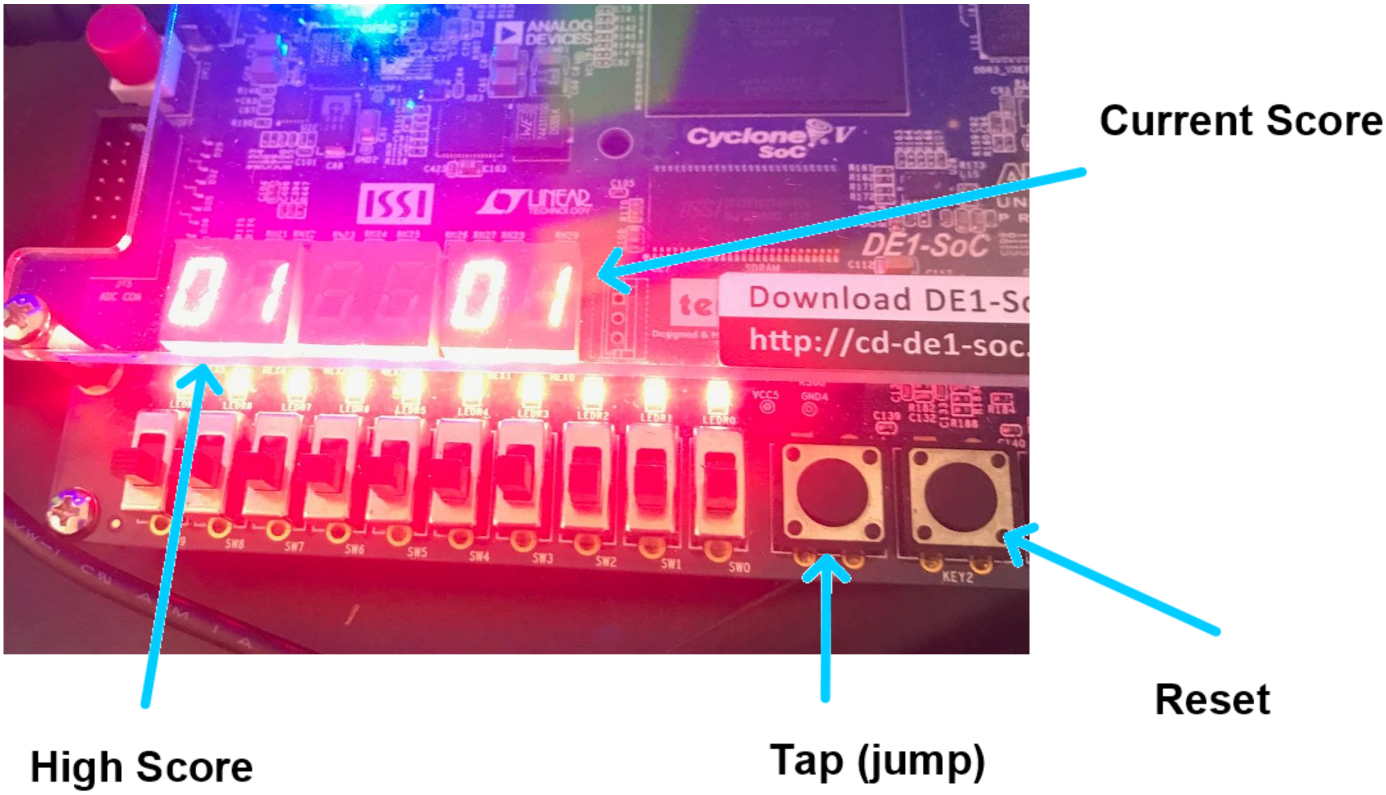
Project Overview:

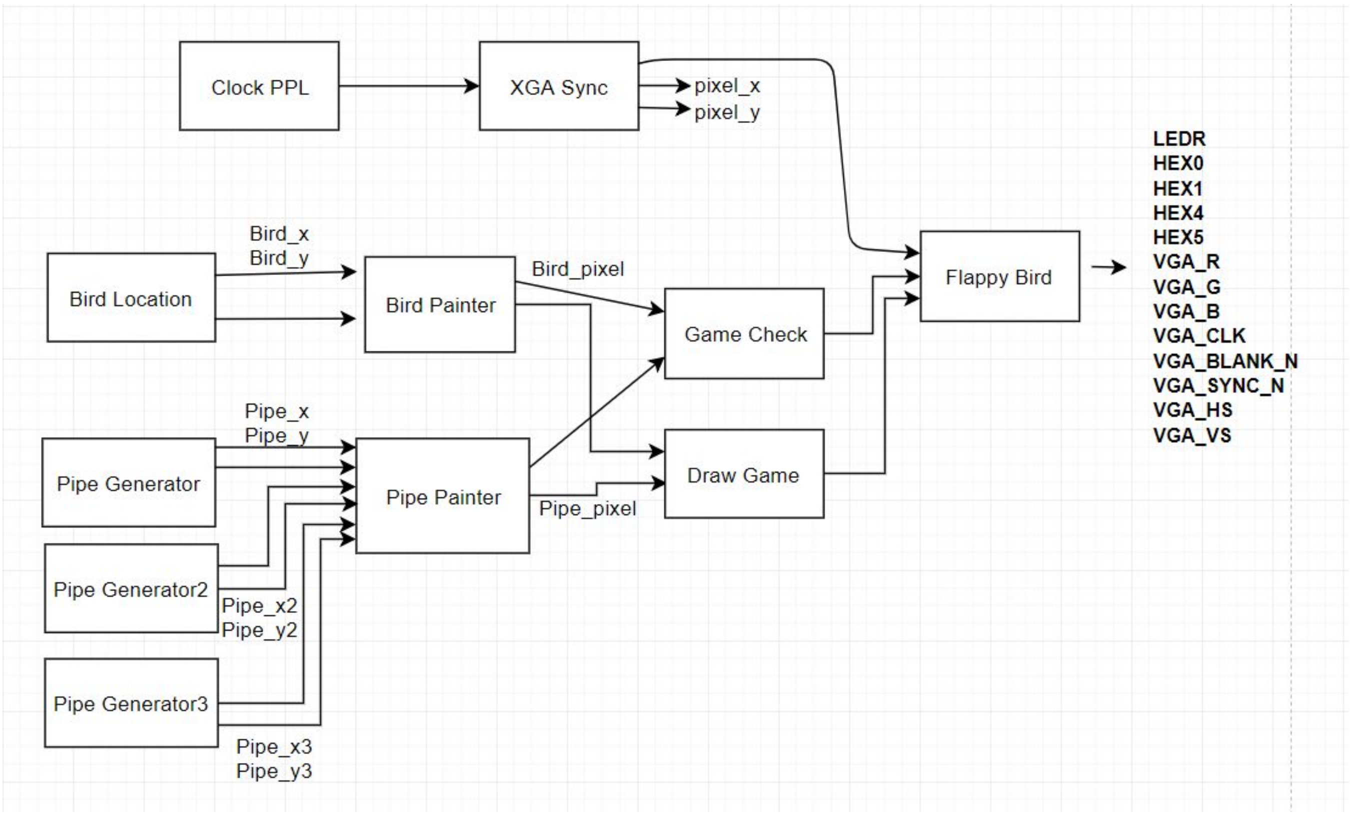
My project consists of all of the main game components of the former popular phone game, Flappy Bird. This project uses the De1-SoC kit hooked up to a monitor to display the game. I will use the KEYs on the board to be the main gameplay buttons. There will be two main keys, one being the “flap” button and the other will be the game reset. KEY[0] will, of course, be a complete reset. When playing the user will see a ball that will be used as the “bird” in the game. The ball will remain on the left side of the screen as pipes with various lengths will be shifted left towards it. The ball can be controlled using the “flap” key which will raise the ball upward a certain number of pixels. When the pipes reach the ball if the user does not successfully go through them, they will lose. A timer is kept that will be the players score. When the game is over, a highscore will be kept. The colors of the game will match below with the bird being yellow and the pipes green. The background will be the same light blue color as well.






Current Score
High Score
Tap (jump)
Reset

Design Description:



Clock PPL:

This module is needed to generate the 75MHz clock signal.

XGA_Sync:

I used one of the provided modules from previous homeworks to aid in my design. It is used to get the current x and y coordinates of the pixels when writing to the screen. It also sets the VGA signals.

Bird Location:

This module is used to change the location of the bird in the game. It changes the y coordinate of the bird whenever the user presses the key. It also decreases the y coordinate every screen fill to simulate the “falling” of the bird as the game goes on.

Pipe Generators 1-3:

This module gives the x and y coordinates of the pipes in the game. With each complete screen-write, it will shift the current pipes on the screen to the left 1 pixel thus causing the side-scroll game. I used three different modules to control 3 different pipes as the game goes on. Once a pipe reaches the end (left side of screen) it is moves to the right side again and the y-coordinate (the space in the pipe) is changed. I used a constant running timer in the modules and each time the pipe reaches the end, it pulls a value from the timer to get a random space location.

Pipe Painter:

This module will take in the coordinates of the pipes and will send out a signal that is set high when a pipe is in that location.

Bird Painter:

This module will take in the coordinates of the bird and will send out a signal that is set high when a bird is in that location.

Draw Game:

This module takes in the bird/pipe pixel and then sets the VGA colors. Pipe = green / Bird = Red / else = Blue.

Check Game:

This module will take the coordinates of the bird and the pipes to determine the status of the game. If the bird touches the pipe, that will be game over. As the player goes on a timer is kept in HEX1 and HEX0 that is the players score. Whenever the game is over, if the player beat the high score, it will be changed. The high score is in HEX5 and HEX4. This module also blinks the LEDs when the game is over and will continue until the game is reset.

Testing:

I created some test benches to help test my solutio. The main two i created was making sure that the bird location was working (KEY press made bird “flap”) and the pipes were being generated and moving correctly. I also created a test bench to make sure I was generating correct VGA outputs and 75MHz clock (vesasync). However, I believe the best source of testing was manual testing using the display.

Bird_Move_tb

Pipe_Gen_tb

Vesasync_tb

Draw_Game_tb

The following data sheets were referenced for my project:

De1-SoC User Manual
RTL Coding Guidelines
De1-SoC VGA