EE/CS 172/130 Digital Logic & Design (DLD)

PROJECT PROGRESS REPORT

Project Title

Flappy Bird Game

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Home Section

T-3

Table of Contents:

1. Introduction:

Project Description:

For our project of the course Digital logic and Design, abbr DLD, we are aiming to develop the famous Flappy Bird game, since we believe that while using a basys-3 board and Verilog we can showcase the maximum implementation of the course learnings through a game. Flappy Bird is a timeless game which each of us have played uncountable times, so we thought of making our very own flappy bird game. It is a single-player game and consists of a single input - Jump. The player must jump through the gap between two randomly sized hurdles in the form of pillars as in the original game, also shown in Figure 1. The goal is to score as many points by crossing the hurdles as possible and try to beat your personal best.

Player Instructions:

Start the game by toggling the V17 pin on the fpga board. Prepare yourself for the first set of pipes to appear. Immediately after starting the game, the bird starts moving towards the right hand side while decreasing its vertical (y-axis) position as a result of gravity. Every jump represents a wing flap which makes the bird go up vertically. The faster the bird jumps, the higher it goes and when the bird is not jumping, it moves downwards gradually. The player has to make the jumps such that the bird stays in a position that crosses through the gap between the two pipes. If you hit a pipe or the ground, the game ends. Find your rhythm for higher and lower pipes. It is important to determine when you need to go higher or drop, or else you will hit a pipe. Try not to go high. You can still bump into a pipe. Don't forget to have fun while playing it!

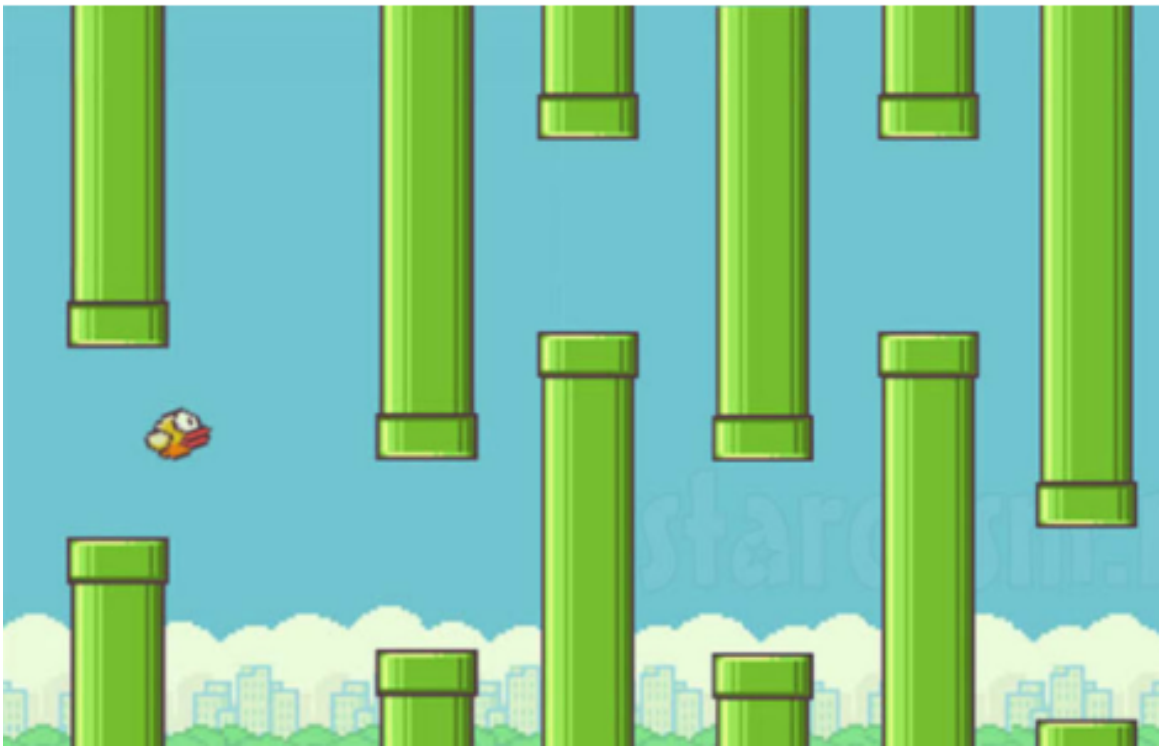


Figure 1. A Sample game snippet from the original Flappy Bird Game

Software & Hardware Requirements:

In order to run this game, the user must have the Xilinx Vivado design suite preferably a 2020 version or newer installed on their machine (Windows & Linux only, Vivado is not available for macOS as of writing of this report dated November 2022). As for the hardware requirements, the user must have a Basys 3 Artix-7 FPGA Board and a monitor for the display with a VGA cable.

2. User Flow Diagram:

User flow diagram:

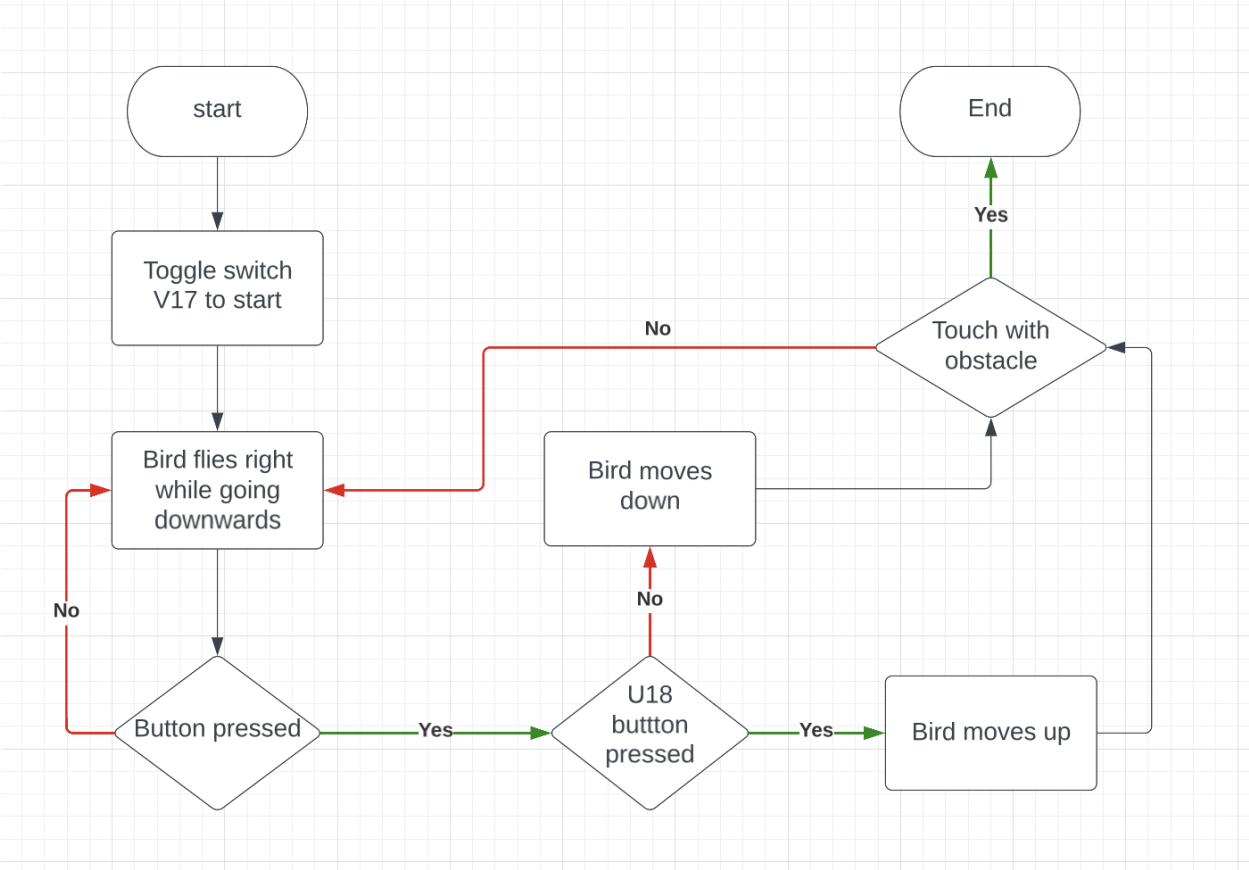


Figure 2. User Flow Diagram

All of the options available to a player in this game are neatly laid out in the user-flow diagram above. Only the jump button is under the user's control. Navigation of the bird without colliding with the tubes is crucial to the user's success of the game. The user can ascend through the U18 button and descend automatically by gravity. The tubes will continue to appear at random until the user hits the bird by colliding with the tube. Every time it successfully completes a set of tubes, the user's score will increase.

System Block Diagram:

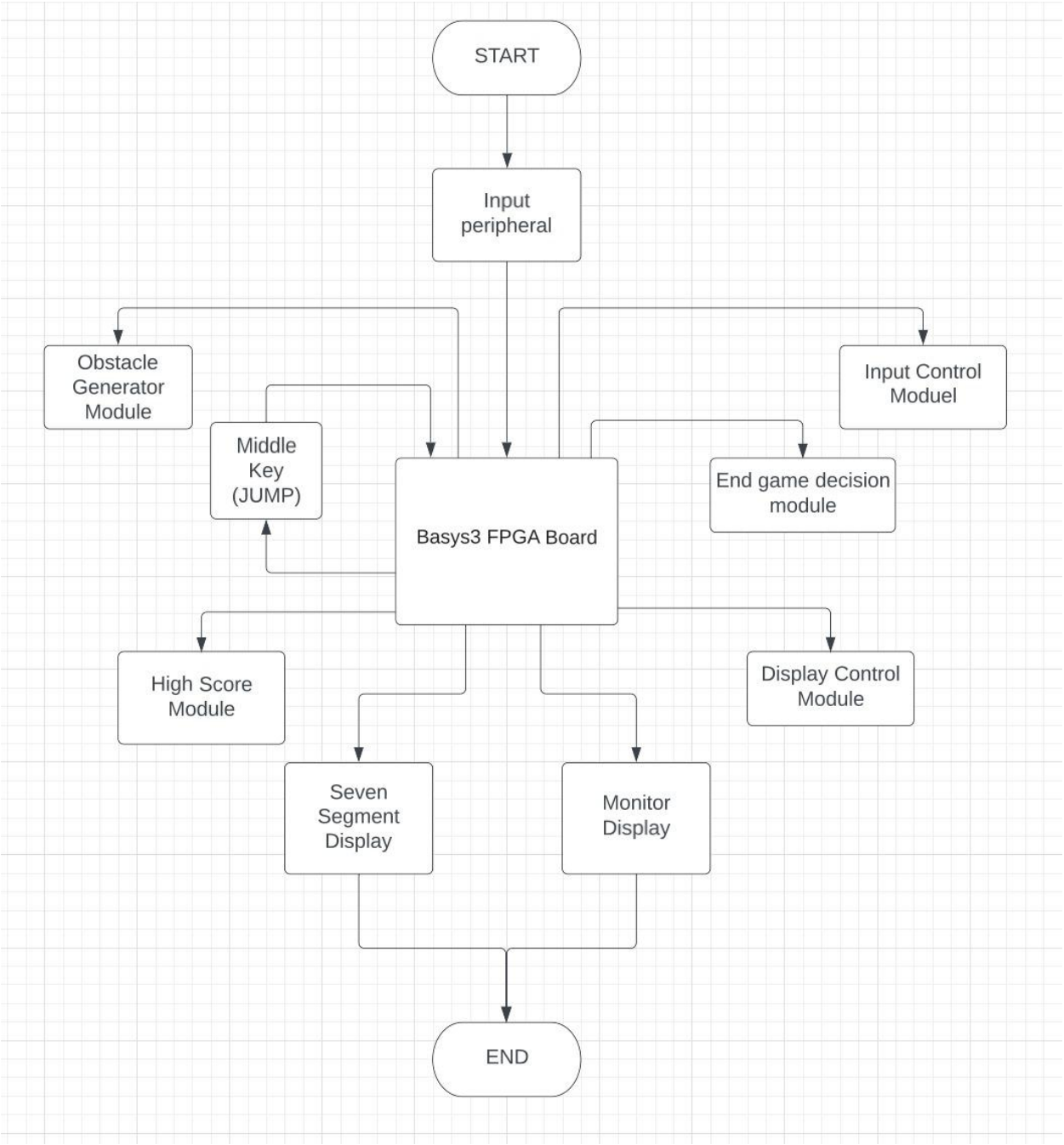


Figure 3. Block Diagram

3. Input Block:

Input implementation:

We will be using basys board's middle key (U18) for jump functionality, as it is the only input in our game. V17 is used for starting the game (initialization), and another button for reset.

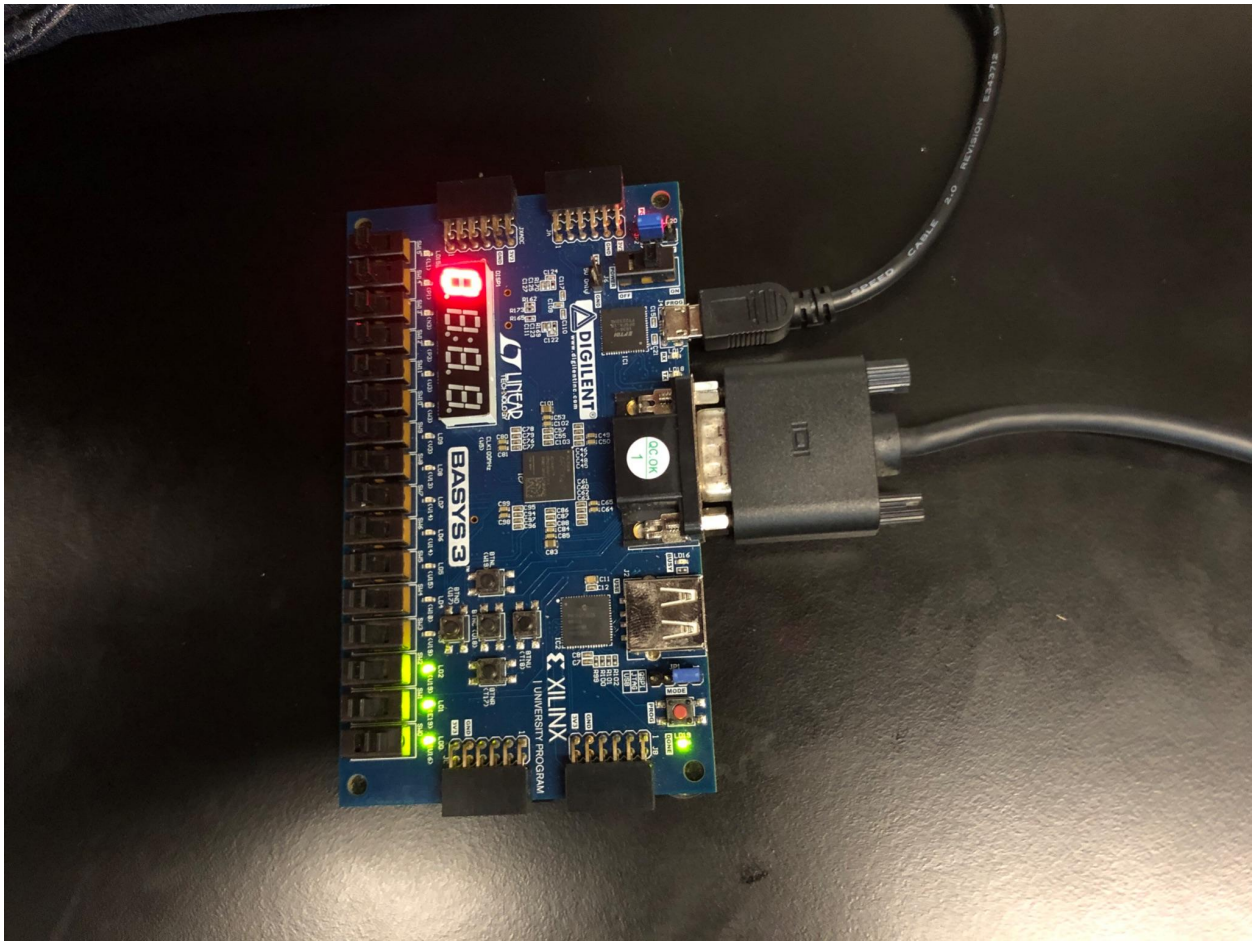


Figure 4. Basys 3 FPGA Board for Input

Schematic Diagram:

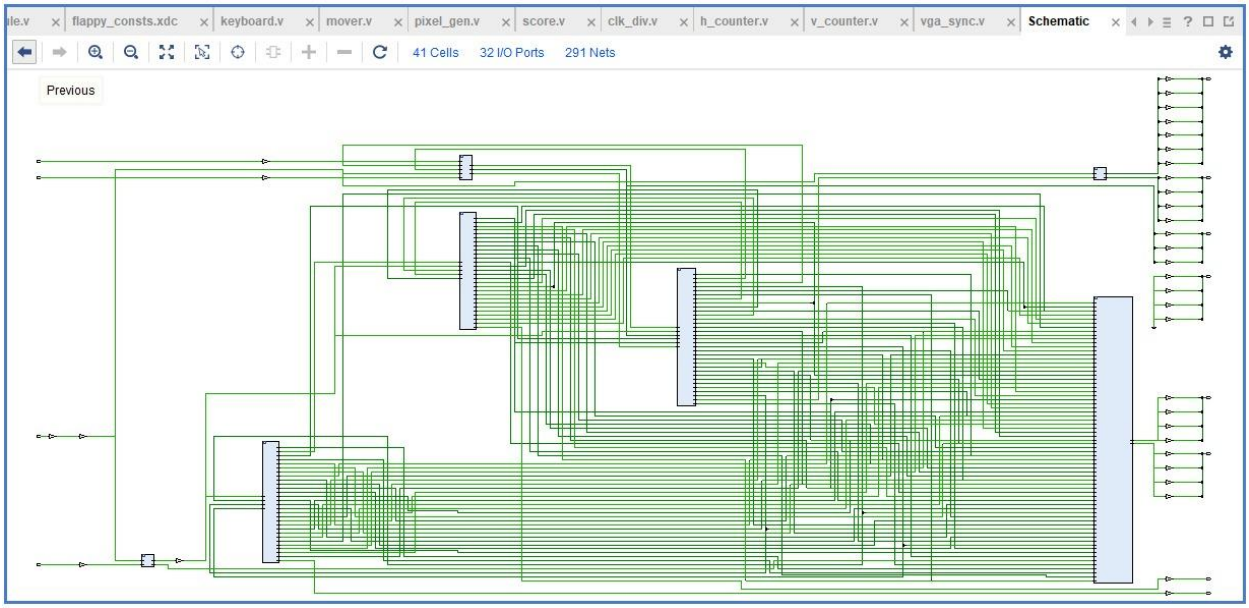


Figure 5. Schematic Diagram

4. Output Block:

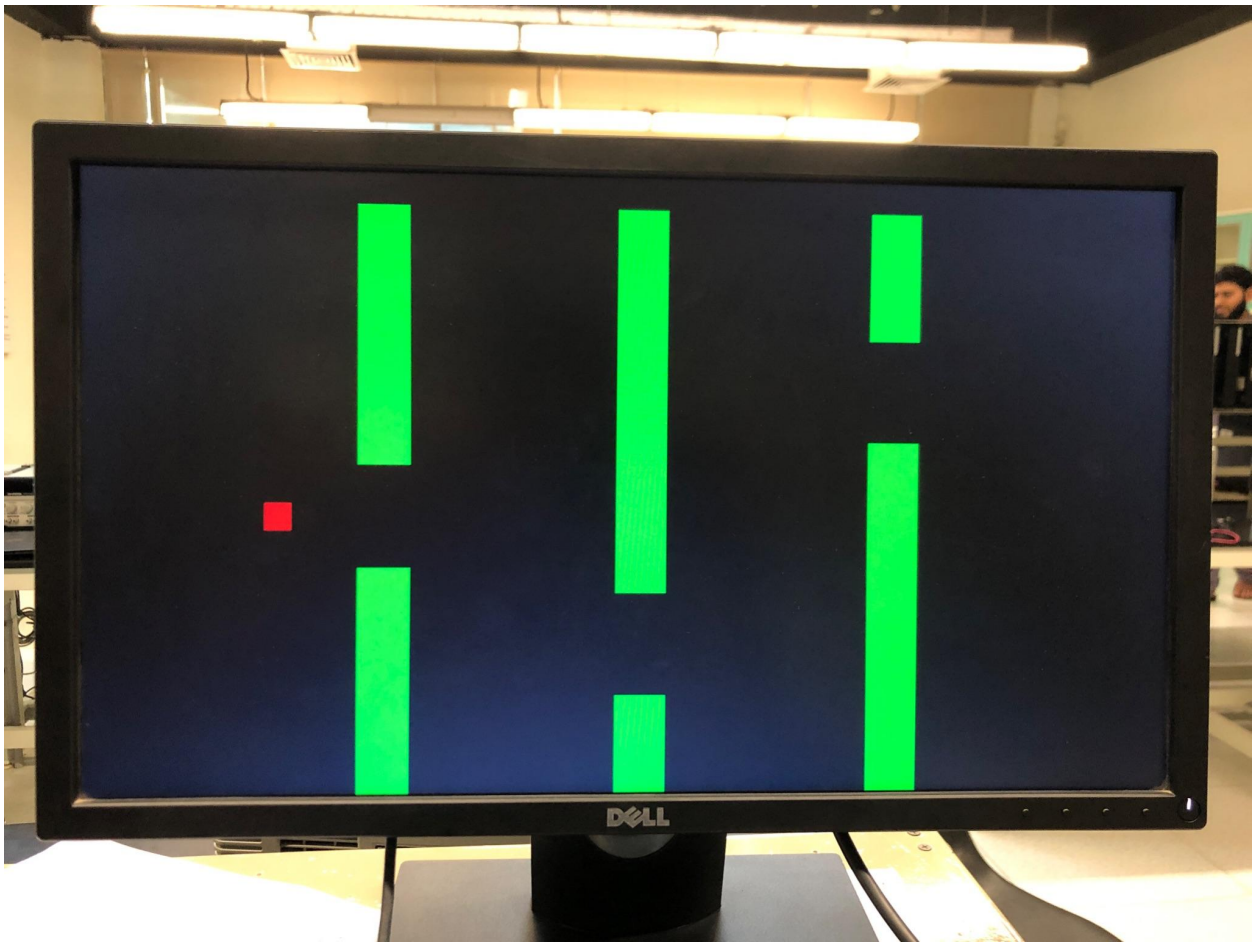


Figure 6. Working output of VGA Display

Using our previous lab practices, we created a primary screen similar to the game. Our VGA output is shown in Figure 6.

5. Control Block:

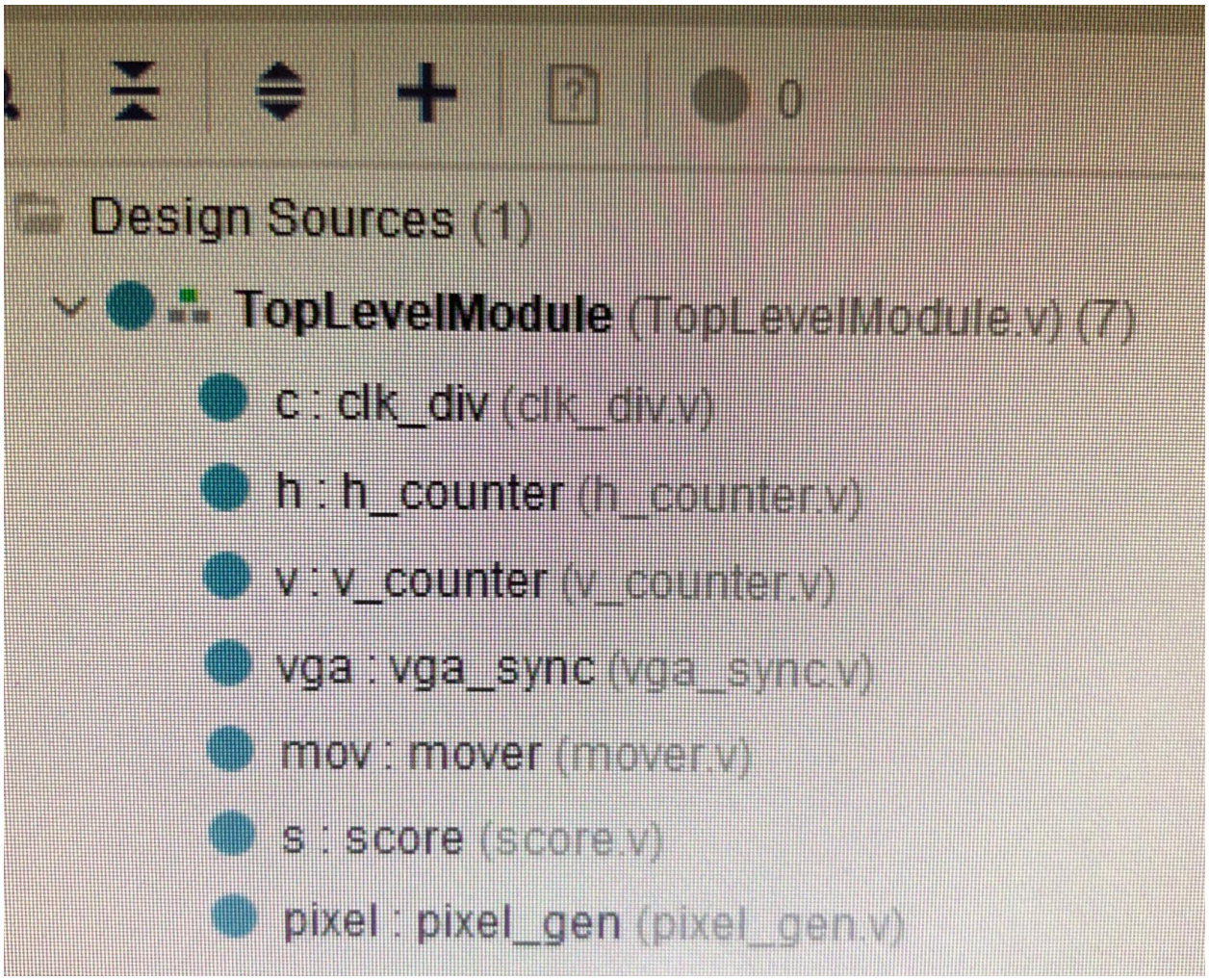


Figure 7. Top Level Module

FSM:

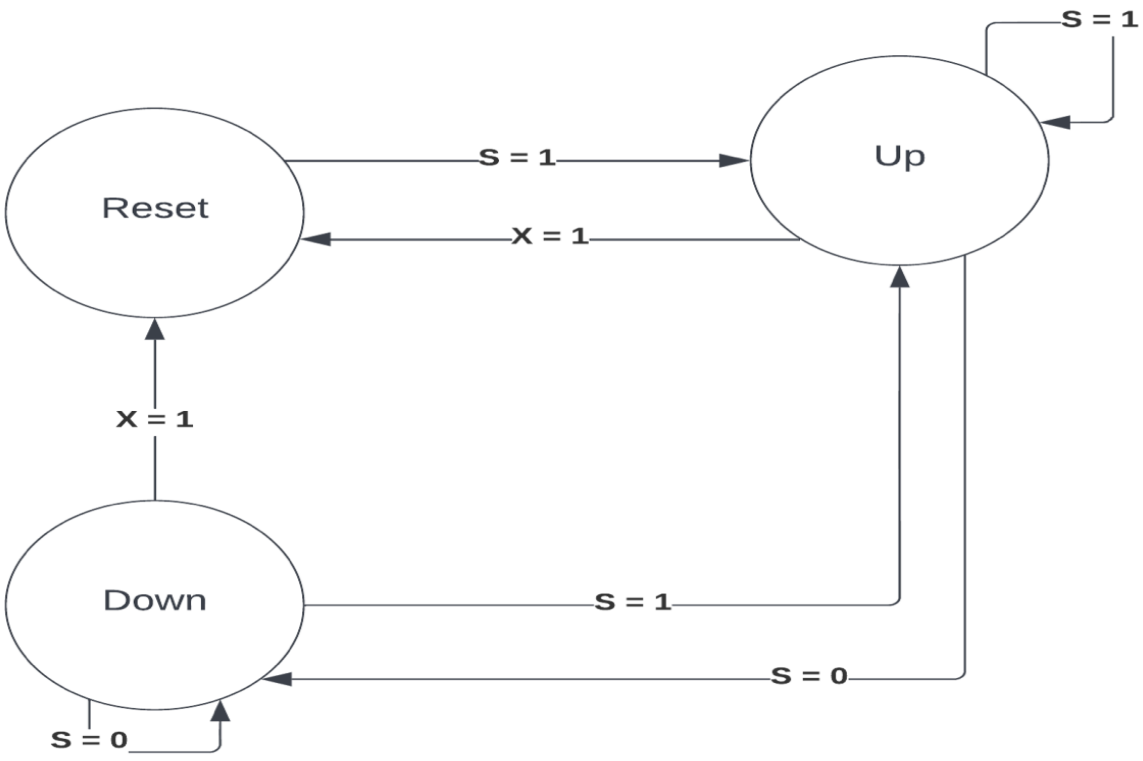
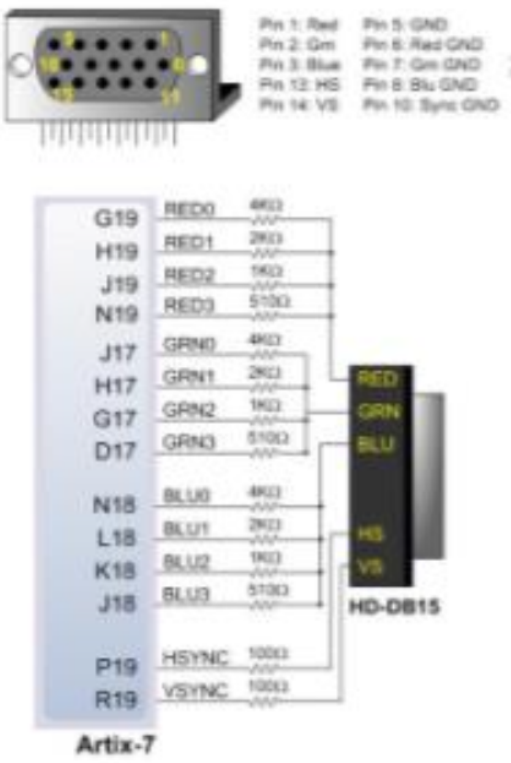


Figure 8. FSM - Finite State Machine

Pin Configuration:



6. References

1. https://en.wikipedia.org/wiki/Flappy_Bird
2. https://flappybird.io/
3. https://psmag.com/economics/flappy-bird-candy-crush-still-making-much-money-75048