Project Connect Four by Adrian Cagaanan and Andrew Tenno

Project Description

      Connect Four is a two-player game in which the players first choose a color and then take turns dropping colored discs from the top into a vertically-suspended grid. The pieces fall straight down, occupying the next available space within the column. The object of the game is to connect four of one's own discs of the same color next to each other vertically, horizontally, or diagonally before your opponent.

Project Implementation of Connect Four

Inputs Description

      We will be using registers to store the states and color of the slots, determine the player turn and player win, and indicate how many rows are left for each column. This counter will increment 2 until it reaches 12. When the counter reaches 12, the column will be full. Each switch will be used to fill its corresponding column. There are 8 columns in our grid. The acknowledge input will be associated with the center button of the FPGA board. The acknowledge input will be used to move to the fill state.

States

- ⏱ Initial- All counters are initialized to 0. Each column register is initialized to 0.

- ⏱ Check- Determines the player turn.

- ⏱ Pick- If the acknowledge button is pressed, move to fill the state. If counter associated with the switch is not full, move to the fill state. Else, move to the error state. If two ore more switches are enabled, move to the error state.

- ⏱ Fill- For whichever switch was flipped, increment its associated counter. Fill the column with the player's color. Transfer to done state

- ⏱ Error - Displays error.

- ⏱ Done – Determines whether to go to win state or check state.

- ⏱ Win – displays whoever won

Top Design

Wires R, G, and B determine which parts of the display are colored red, green, or blue. Inputs C0 to C7 are the columns. If any of their elements are 2'b01, the corresponding rectangle will turn red. If any of their elements are 2'b10, the corresponding rectangle will turn green. The grid is automatically colored blue on the vga display.

Challenges Encountered During Implementation

- Figuring out how to draw circles on the VGA display

- Understanding the VGA

Final Result

Features our project implemented

- Display of the suspended grid

- The use of squares to emulate the colored disks

- Smiley Face after a player win

- Display of the tie condition

- Error checking for incorrect inputs

- LED indication of the states

Features we wished we had time to implement

- Having Circled slots instead of square slots

  - Figure out how to draw circles on the vga

- Improve the immediate transition into the tie condition

  - What combinations on the grid would immediately determine the tie condition?

- Be able to change grid size

- Be able to change the win conditions(Ex: Connect 3, Only 4 horizontal, blackout)

- Added Animation State

- In the animation state, we would decrement a copy of the counter for the corresponding column until it reaches 0. The square would seem like it was moving from the top element of the column until it reaches the last empty slot on the column.

Conclusion

Overall, we are able to successfully emulate the game connect four. If we had more time, we would have added more features. Features such as animations and circled pieces would have made the game more impressive, but our game is capable of running without these features.