

How To Play

- 1) Once uploaded to DE1-SoC FPGA board, flip SW[9] on and then off to reset/start a game of Connect 4.
 - Player 1 (Red LED) starts off the game.
- 2) Use KEY[3] and KEY[2] to move the player's piece placement to any column.
- 3) Use KEY[1] to place the piece.
- 4) Now, you know how to play Connect 4 on the FPGA board! Good luck!
 - But remind me? How do you win a game of Connect 4?
 - There are three victory conditions: diagonal, horizontal, and vertical. In order for either player 1 (Red LED) or 2 (Green LED) to win, 4 pieces of the same color must connect together to fulfill one of these victory conditions.
 - Once that is done, HEX5 (*the leftmost HEX on the FPGA board*) will light up with whoever won the game. ('1' for player 1 or '2' for player 2).
- 5) After a player has won the current game, reset the board with SW[9] to start a new one!

Modules

There are 18 modules used in this Connect 4. A summarized description of what each module does is written down below.

- DE1-SoC: Top module that calls for all other modules below. Also, in the module is a combinational logic to display on HEX5 for the victory module below.
- LEDDriver: Sets up the LED board.
- clock_divider: Sets up a clock system for the FPGA board and ModelSim.
- d_ff: DFF module to account for metastability in userInput.
- userInput: Has the defined keys and switches for the Connect 4 game. SW[9] is the reset switch needed to start a new game, KEY[3] and KEY[2] to move the column placement (*left and right, respectively*) and KEY[1] to drop the piece.
- color: When KEY[1] is pressed, the current player's turn is complete and swaps to the other player to have them play their turn.
- centerPoint: Displays the starting LED column placement at the center of the top row on the LED board.
- columnInput: Defines the column on the LED board.
- animatedLED: Animates the piece falling to an open LED spot.
- animatedStart: Displays the current column placement as a single LED on the top row of the LED board.

- Victory: Listed below are all the win conditions for each player (*diagonal, horizontal, and vertical*).
 - Player 1's win conditions
 - p1Diagonal1Victory
 - p1Diagonal2Victory
 - p1HorizontalVictory
 - p1VerticalVictory
 - Player 2's win conditions
 - p2Diagonal1Victory
 - p2Diagonal2Victory
 - p2HorizontalVictory
 - p2VerticalVictory