Game Access Control on FPGA User Manual

The Game Access Control is an addition to the Mental Binary Math game on FPGA. The Mental Binary Math game is implemented using a DE-2 FPGA Board. Two players input two 4-bit binary numbers (numbers ranging from 0-15) using switches. Both numbers will be displayed in binary on a seven segment displays. The sum of the two numbers will be displayed on another seven-segment display. All numbers displayed are in hexadecimal. Figure 1 below shows the pins that are to be used by player one and player two along with the corresponding seven-segment displays for the numbers and sum. The figure below also indicates which LED’s light up when player two correctly matches player one’s number (green LED) and when player two does not correctly match player one’s number (red LED). The Game Access control limits the users who can play the game. The Game Access control has an added Access Controller feature. Prior to being able to play the game a user must input the password (4207). Each number must be input one at a time using the indicated switches (Access Control Switches) and pressing the access confirm button after every input. Once granted access player one and two may input their number but must confirm their number using the player one and player two confirm buttons respectively.

A circuit board

Description automatically generated

*Figure 1. FPGA Board with all indicated switches buttons and LEDs*

When starting the game, after turning the FPGA on, the user is to input the pass code using the access control switches and button. Each digit of the four-digit passcode is to be input one at a time by pressing the access confirm button afterwards. Once given access, indicated by green LED number 2, player one is to input their 4-bit binary number using the pins and player 1 confirm button indicated by Figure 1 for player one. Without looking at player one’s switches and only looking at the seven-segment display of player one’s number, player two is to input their number so that the sum of their number and player one’s number adds up to 15 (F in Hexadecimal). If player two inputs the correct number so that the sum total is 15, a green light will light up on the FPGA board. If player two inputs an incorrect number so that the sum is not 15, a red light will light up on the FPGA board. Figure 2 shows the board when player two’s number is not correct, and Figure 3 shows the board when player two’s number is correct. When player two inputs the correct number player two gets a point. When player two does not input a correct number player one gets the point. At the end of the round both players will switch roles and play until they decide when the game is over. When the game is over the board can be reset using the reset button or the players can log out by pressing the access confirm button once and pick up where they left off.

A circuit board

Description automatically generated

*Figure 2. FPGA Board When Player Two’s Number Does Not Add to 15 With Player One’s Number*

A circuit board

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*Figure 3. FPGA Board When Player Two’s Number Adds to 15 With Player One’s Number*