Hardware-Based True Random Number Generator and Time Control on FPGA

The Hardware-Based True Random Number Generator and Time Control on FPGA is an addition to the Game Access Control and the Mental Binary Math game on FPGA. The Hardware-Based True Random Number Generator and Time Control is implemented using the DE-2 FPGA Board. After logging in to the board the player will select how long they want to play the Mental Binary Math Game. Once the game starts the player will push another button to generate random numbers for which the player must input the matching number that will result in a sum of 15. A player will input a 4-bit binary number (ranging from 0-15) using the boards switches. The number input will appear on the board’s seven segment display. All number are displayed in hexadecimal. Figure 1 below shows the pins that are to be used by the player for access control, time input, number input as well as the corresponding seven segment displays for the numbers and the sum of the numbers. The figure also indicates which LED’s light up when the player correctly matches the random number (green LED) and when the player does not match the random number generated correctly (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 the player can input the time they desire to play and begin generating random numbers and inputting their matching numbers.

A picture containing building

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

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, the player can input the amount of time they wish to play the game for. Once input and confirmed using the access confirm button the player can begin the game by pressing the access confirm button once again. The player can then generate random numbers using the random number generator button and attempt to input the matching number using the player switches and the player confirmation button. If the player inputs the correct number so that the sum total is 15, a green light will light up on the FPGA board. If the player 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 the player’s number is not correct, and Figure 3 shows the board when the player’s number is correct. When the player inputs the correct number, the player gets a point. When the game is over the board can be reset using the reset button or the player can begin the game over by pressing the access confirm button once again.

A lit up city at night

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*Figure 2. Player Matches the Random Number Generated Incorrectly While the Clock Counts Down*

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*Figure 3. Player Matches the Random Number Generated Correctly While the Clock Counts Down*