

USER MANUAL

Lab4 (Bonus)

***Lab 4: Timer, Hardware-based True
Random Number Generator, ROM-
based Game Access Control on FPGA***

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1. Project Description

“Lab 4 Bonus” project introduces many changes to the previous Lab 4 project. Here we have implemented reconfigurable timer to the game using two 7-segment display devices, where each digit is updated with 4 toggle switches. The timer can be set after the board is authenticated and that is triggered to reload by using the password entering button. The timer is a BCD timer and any value over 9 will be loaded to the timer as 9. The maximum value of the timer is 99 seconds. The timer starts to count down after the random number generator button is pushed. When the timer value reaches 0, the inputs from Player 2 are no longer taken. To play the next round, the timer reload button should be pushed before the random number generator button is pushed.

2. Password Verification

Before The Game start, Player1 has to verify his password . He has to verify 16 bit password with 4 bit each time .Once the password is verified the green signal has to be ON and on failure the Red light will be ON.

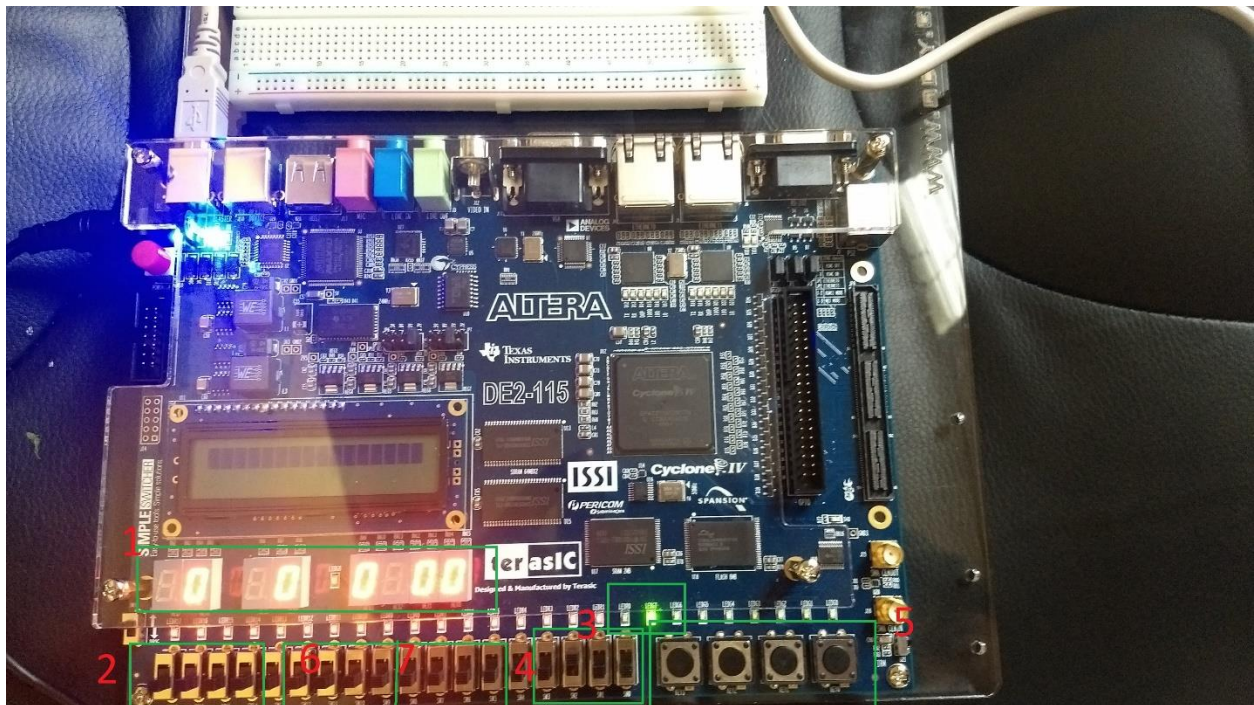
3. Secret Mapping Table

| Unscrambled | | Scrambled |
|-------------|---|-----------|
| 0 | → | D |
| 1 | → | 7 |
| 2 | → | 4 |
| 3 | → | 0 |
| 4 | → | F |
| 5 | → | 8 |

| | | |
|---|---|---|
| 6 | → | 1 |
| 7 | → | C |
| 8 | → | 6 |
| 9 | → | E |
| A | → | 3 |
| B | → | A |
| C | → | 5 |
| D | → | 2 |
| E | → | 9 |
| F | → | B |

This mapping is randomly set by the user where value of each is change and given to some other number. Before Game starts Users/Players are allowed to see this card . ample time is given to player to go through whole table .Once game starts player has to decide the correspondence number .Second player deciding decides the result of the game .

4. FPGA BOARDS



Once we finish installation of Quartus in local machine ,user can proceed to dump the code after he move left middle toggle to programming mode.

In the above diagram, I have marked the parts on Quartus board to understand the parts of Quartus. Here point number is 2 is the toggle switches for player . This are read from left to right . I.e, for 8 we need to switch on the left most toggle to represent 1000.

Here point number is 6& 7 is the toggle switches for timer . This are read from left to right . I.e, for 8 we need to switch on the left most toggle to represent 1000

In above diagram,Point4 is the toggle switches used to insert the password into the module .This password is matched with the password saved in the ROM module.

We don't need switches for 1st player as it is decided by the random number generator and that number can be seen on 1st 7 segment of Point 1 . Here user set the mapping index to the system using the toggle switch by player 2. Number shown on the 1nd 7 segment of Point 1 is the normal random number as system convert the 4 digit number. So 2nd one is the unscrambled version of the he given number by player 2.The last 7 segment display show the sum of first and second number . This does not bother about carry.

In the diagram ,point 3 is the LED lights where Red light will be ON if the password doesnot matches and Green Led will be ON only when password matches.

In the diagram, Point 5 are the Buttons , where 1st is the Reset button , 2nd is the button used to verify the password 4 bit each time and 3rd is the random number generator button and last one is the load button for the player.

5. RULES AND REGULATIONS OF GAME.

The following are the steps to be taken while playing this game.

1. Scrambled Number Mapping Index Card is given to a player to look and remember them.
2. Before they start the game, player must decide how many rounds of game he is going to play. It is always better to play odd games such that last round can be decider in case of tie. Once Player is ready before password verification player has to press 2nd button on board to initiate the game.
3. First user has to verify 16 bit password by entering 4 bit each time using toggle switch and 2nd Button on board, where player presses button each time to verify to its 4 bit password.
4. once password is verified he must make sure Green LED is ON (Green LED represent the password is verified and RED led represent that password is incorrect) .
5. Once Green Led is ON the player has to press 2nd button again to reload the timer . which hae has set using the toggle switches.

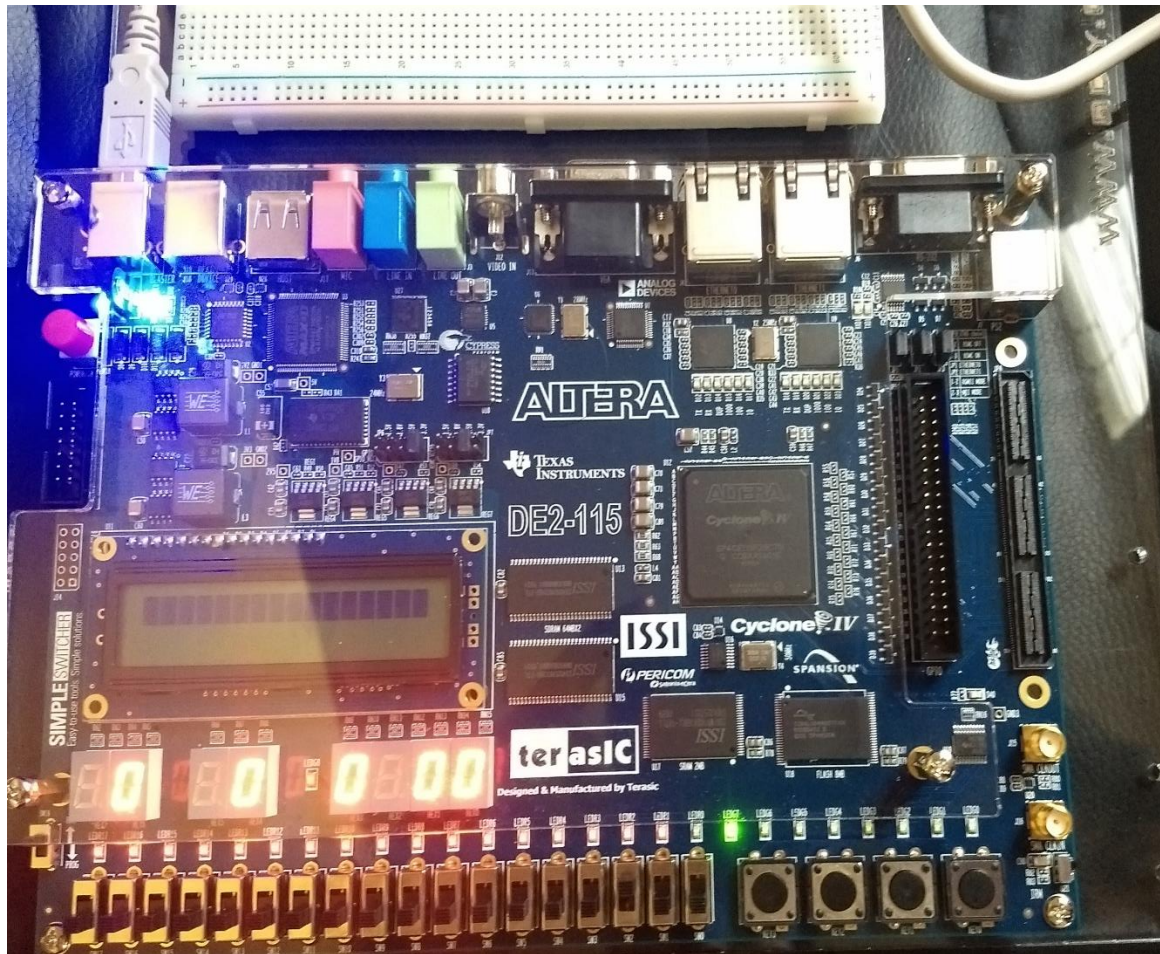


Figure 1: Green LED is ON (Password is verified.

Password not verified Incident:

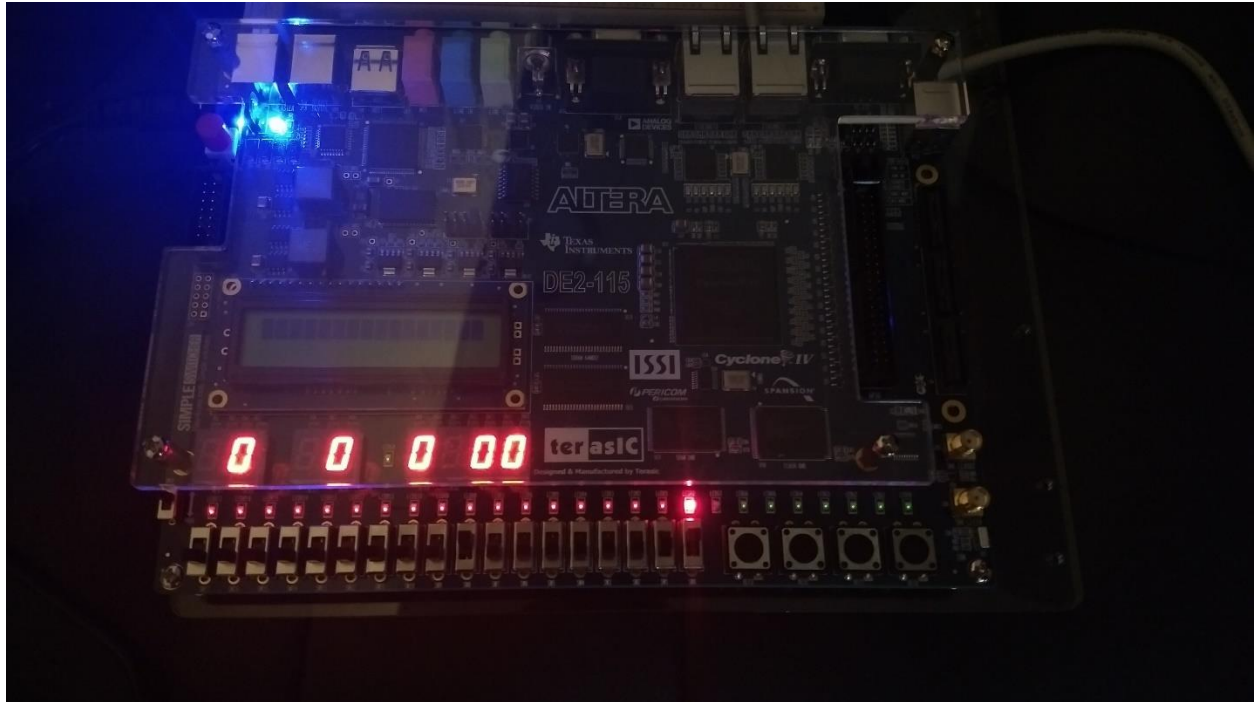


Figure 2: RED LED is ON (password is not verified)

6. Once password is verified then Player can set the Timer using the toggle switches and and it will start counting Once we click on the random number.

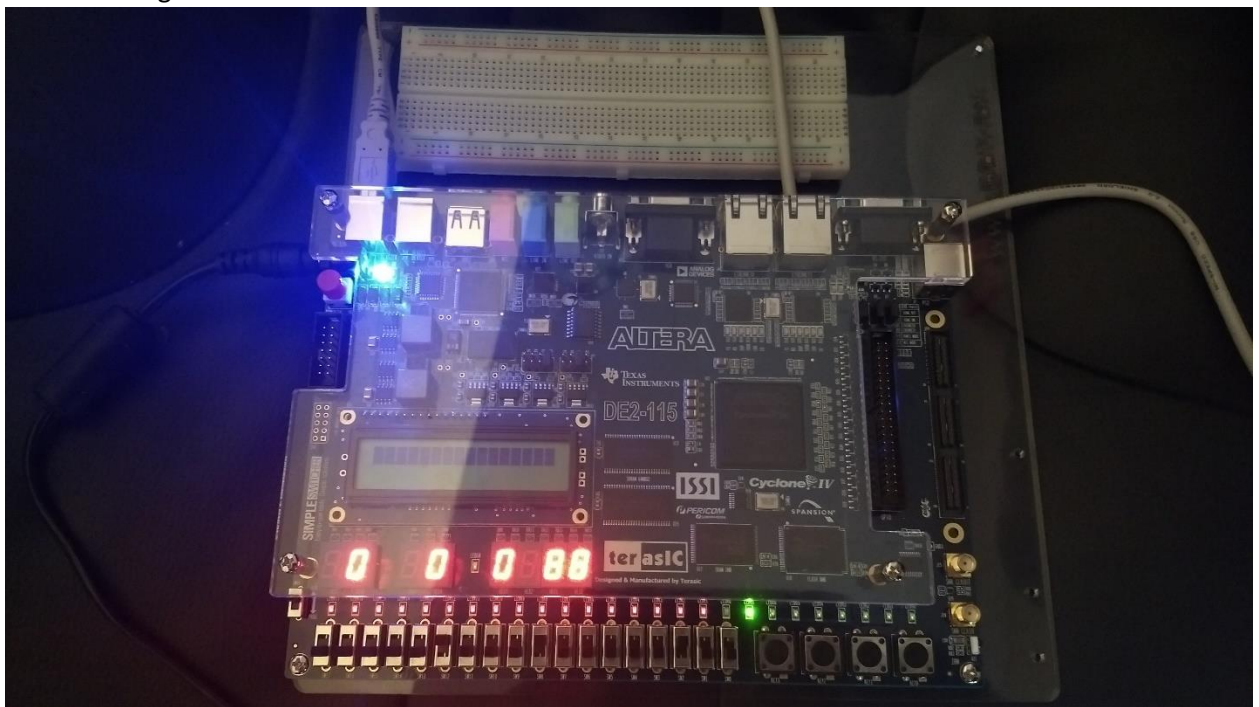


Figure 3: Random NUmber generation after long pressing button and Timer Initiation

7. Now he can generate random Number ,so he must long press the random number generator button. Depending on how long he press a random number will be generated and displayed on the 7 segment.As we press random number generator we can observe that Timer is also ON.

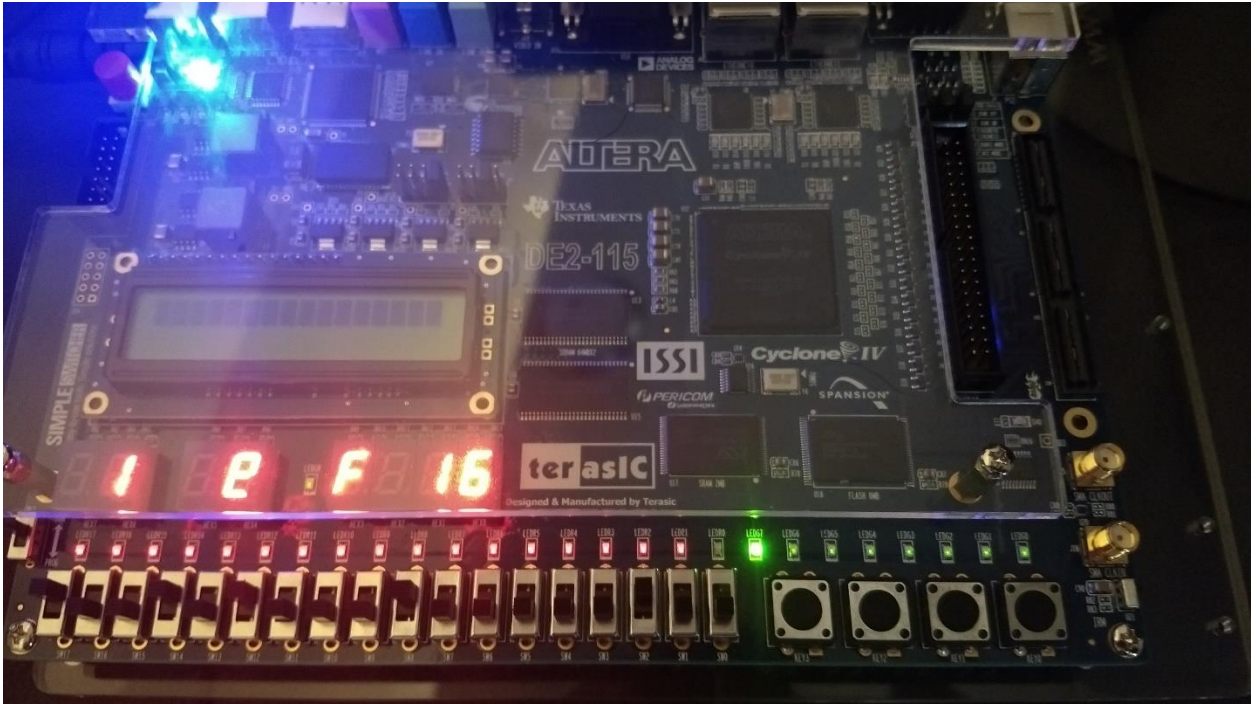


Figure 4: Random NUmber generation after long pressing button and Timer Initiation

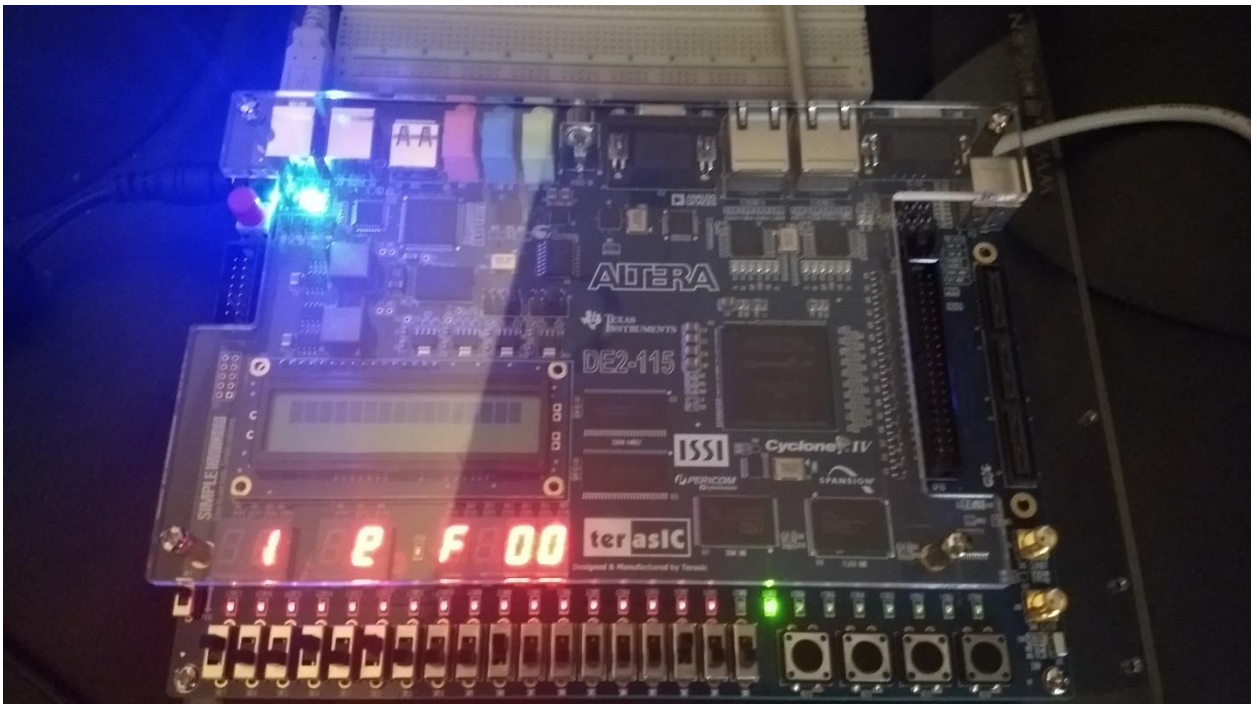
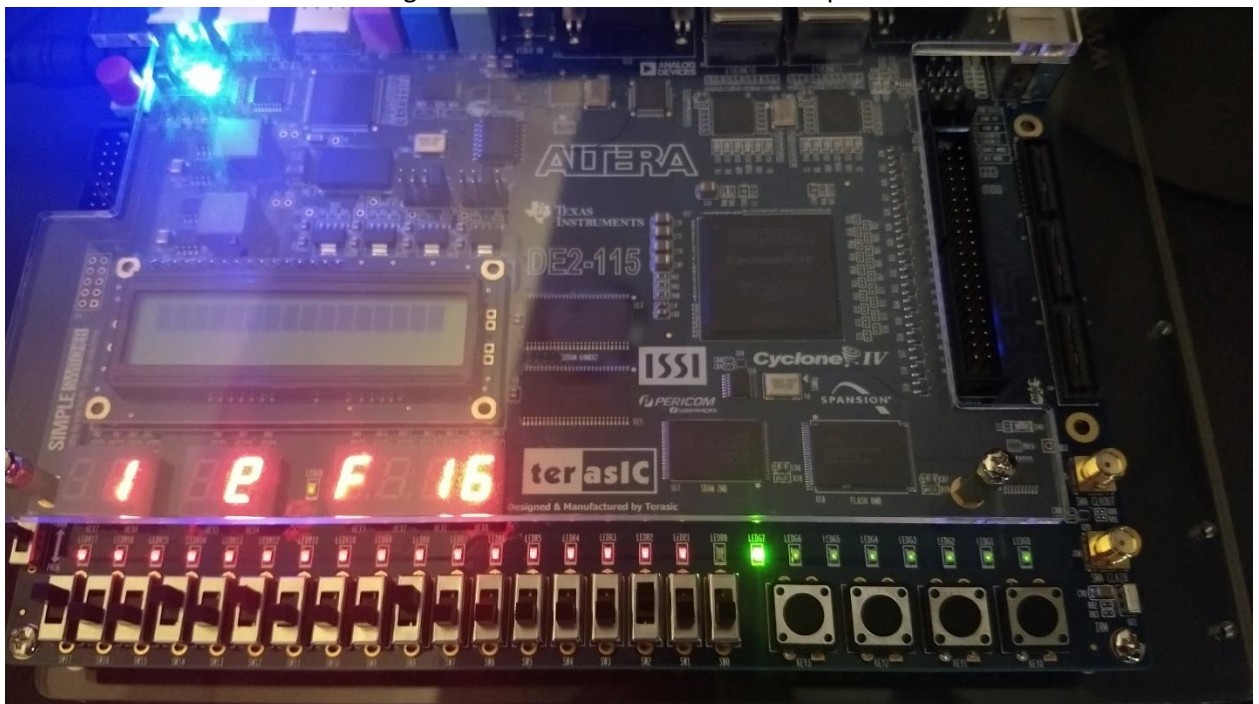


Figure 4: Random NUmber generation after long pressing button and Timer Initiation

8. Then player must now calculate how much number he must add to get sum of 15. But twist in the game is that user must give scrambled input of that number as input to the system and he has to give input within time. He has then to press the load button so that number get loaded on to the system.

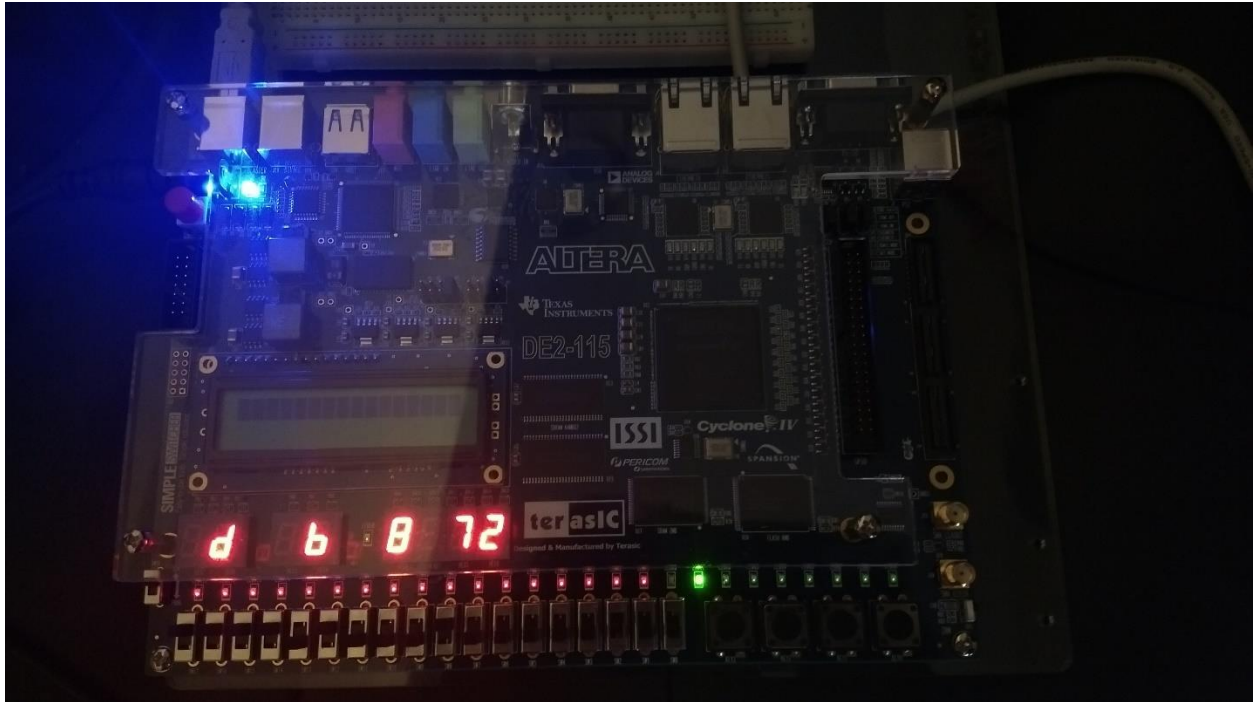
Wining Case

9. If we assume player one has pressed the random number button and that is displayed on 7 segments as 9 and now player user calculate that he need to add 5 more to get the result but he can't give 6 directly rather he has to give scrambled input of 5. If we assume he remember correct mapping number of 6 which was for example was 8 then upon selecting the scrambled number using toggle switches we get the sum of the result on the 7segment.
10. System will unscramble the input given by 2nd player and will calculate sum using adder and result will be reflected on the 7segment .This can also be seen in the picture bellow.



Loosing Case

11. If we assume that 1st person was unsuccessful to assume the right scrambled number which can also be seen in the 7Segment as the sum value on the 7Segment won't reflect the "F" value .
12. In such cases 1st person will loose points as he loss the game and meanwhile 2nd person gets extra points as he won the game again.
13. This can also be shown in below picture



14. In above example we can see that player was unsuccessful to assume the right answer to get 15 values.
15. Thus they can continue for any number of time as they want and at the end they can compare point to find the winner of the game.