User Manual

for

Final Project: Enigma Encryption Game

By

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ECE 6370: Advanced Digital Design

SPRING'19

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This Enigma Encryption game is a multi-user (4 dedicated users and 1 guest user) authenticated random number encrypted game with timer control. Verilog description of the game is written in Modelsim and debugged using Quartus Prime and implemented on Altera DE-2 115 board.

The game consists of three levels. The first level is a training level. First, the player must enter the user ID and press the button to verify it. If it's correct, then green led turn on or else red led will turn on, and if the user ID is verified then the player must enter the password and press the button to authenticate the game. if the password is correct then the game is accessed by indicating through a green led. Once the game is accessed level must be set by using the toggle switches and pressing the game button.

In the first level, the player should identify the encrypted number and the corresponding input and should get familiarized with it. For each button push, encrypted number and its corresponding input number is displayed. The encrypted numbers are from 0 to 9. After completion of this training, a button push makes the game to shift to the second level.

In the second level, a random encrypted number is generated, and the player needs to identify it by matching it with corresponding input in the given time. The timer is set to 90s. When a button is pushed a random encrypted number is generated from 0-9. Player needs to identify that number and give corresponding input from a set of toggle switches and push a button. If the input matches the encrypted number, then the score is updated and green led turns on indicating a correct guess. If the player guesses wrong, then red led turns on and the score is not updated. The player can play any number of rounds in the given time. After the time out, the game enters the third level.

In the third level, two random encrypted numbers are generated, and the player needs to input the sum of those two encrypted number and enter through toggle switches in the given time. The timer is set to 60s. When a button is pushed a random encrypted number is generated and one more button push generated another encrypted number. Player needs to calculate the sum of both random numbers encrypted numbers and enter it through toggle switches and push the button to verify. If the sum is verified correctly then, the score is updated.

After completion of the game highest score of a player with the player's index is displayed. There are some additional features in the game. if the button is pushed

single time level is shifted, if it is pushed two times in a second then the game is paused. If it's pressed three times, the game is logged out. The progress of the game can be retrieved even if it is logged out. Player can again login using user ID and password and play the game from where he stopped.

This module is operated on a 50 MHz clock and can be reset by pressing a button.
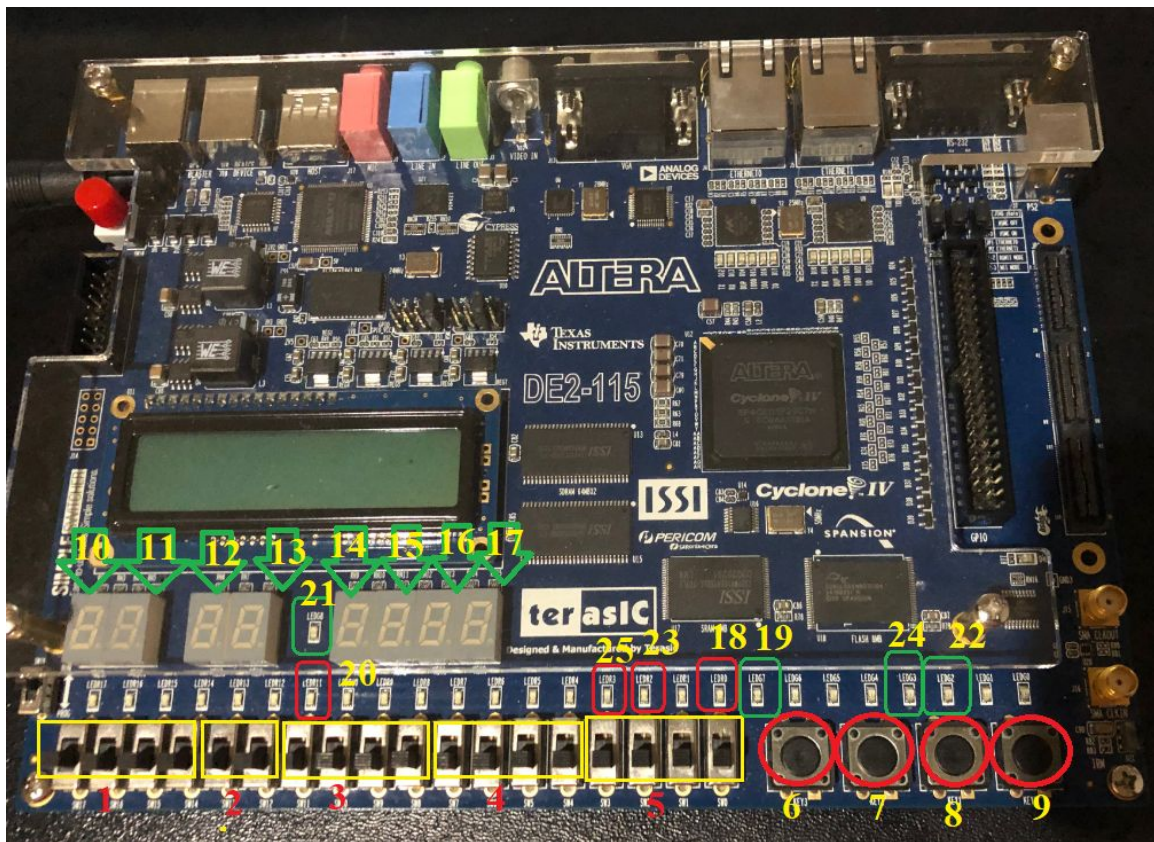
BOARD PICTURE

Fig.1. Board image with inputs, outputs, green and Red LED

1. Password: Toggle switches SW17 – SW14
2. Game level selector: Toggle switches SW13 – SW12
3. Tens_digit_in: Toggle switches SW11 – SW8
4. Units_digit_in: Toggle switches SW7 – SW4
5. User id: Toggle switches SW3 – SW0
6. Game\user_id\password Button: Button Key 3
7. Player_Load: Button KEY2
8. RNG_Load: Button KEY1
9. Reset: Button KEY0
10. Timer_Tens_Digit: HEX7
11. Timer_Units_Digit: HEX6
12. Password_last_digit_display/encrypted symbol RNG in 3rd level: HEX5
13. User_id display/ Decoded value for encrypted symbol in level 1,2 and encoded symbol RNG in level-3: HEX4
14. encrypted symbol in 2nd & 3rd level/ Tens digit sum entered by player in level 3(which is also in encrypted symbol): HEX3
15. Units digit sum entered by player in level 3(encrypted symbol): HEX2
16. Score_Tens_display: HEX1
17. Score_Units_display: HEX0
18. User_id_Wrong: LEDR0
19. User_id_Correct: LEDG7
20. Pwd_Wrong: LEDR11
21. Pwd_Correct: LEDG8
22. Level2_encryption_Correct: LEDG2
23. Level2_encryption_Wrong: LEDR2
24. Level3_encryption_Correct: LEDG3
25. Level3_encryption_Wrong: LEDR3

Note: **Game Button: Button KEY3** this button is used for all the below purposes in this game:

- Loading user id & Password to the board.
- Game level selector.
- Loading the Timer.

- Starting the game.
- Pausing the game. (2 times push button)
- Resume the game. (1-time push button)
- Logout the game. (3 times push button)

Note: Level Selector (SW13 & SW12):

00 – scores along with index numbers

01 – level1 (training)

10 – level2 (guessing encrypted symbol)

11 - level3(guessing 2 encrypted symbols and toggling sum)

STEP-BY-STEP INSTRUCTIONS TO PLAY THE GAME

This game requires to individuals.

1. First, user has to enter user id using SW0 to SW4 and load it with Key 3 game button if it correct Green led is ON, then only user can enter password using SW14 to SW17 and load it with Key 3 game button (one digit at a time and load it using the load button for user id & password).
2. When the last digit is loaded, it can be seen by user on seven-segment display.

If user id & password entered is correct:

1. Green LED is glow showing successful login.
2. Once the Authentication is successful, user has to select game level with SW12 & SW13 and push game button. If user didn't select game level and just pushes game button (key 3) nothing will be displayed on seven segment displays and you cannot move forward.
3. User has to push player button to learn encoded symbols (on seven segment display 3) with corresponding value (on seven segment display 4), no timer in level1. If user completes training at least for 1 time (0-9 encoded symbols), user can go to level-2 by pushing game button (key 3).

4. Now timer value is loaded to 90 and user has to push game button again to start the level-2 game (timer starts decreasing).

5. Now User has to push RNG Button(key1) to generate RNG on Seven segment display 3, and user need to toggle from SW4 TO SW7 & push key 2 to guess the encrypted symbol on HEX3. (Player input displays on HEX4 as decode numeric value).

6. For each successful attempt the score is calculated automatically and is displayed using seven segment displays on HEX0 & HEX1. (maximum score user can get is 99).

7. Green Led is ON when user guesses correctly and Red led is ON when user fails to guess.

8. Now user can play level-2 till timer reaches to 0. User can use game button(key-3) in-between game to PAUSE/RESUME//LOGOUT. If user has already completed the current level, he can move to next level by pushing game button once.

Note: User cannot select level while he is in-between the game levels. He needs to logout to select the level. User can also select level after level-3 completion. User can go to succeeding level only if he completes preceding level

9. Once timer reaches to 0 in level-2, user can go to level-3 by pushing game button (key 3), we can see timer loaded to 60 seconds here.

10. User need to push game button again to start game level-3(timer starts decreasing to 0).

11. User need to push key1 to generate 2 RNG encrypted symbols on HEX4 & HEX5. After releasing button, user needs to decode and calculate (mentally) sum of these 2 encrypted symbols and toggle the sum inputs with Unit digit of sum (SW4 to SW7) & tens digit of sum (SW8 to SW11).

12. User toggles sum inputs, it displays on HEX3(Tens sum encrypted symbol) & HEX2(Units sum encrypted symbol). If user guesses or enters correct sum, the score is calculated automatically and is displayed using seven segment displays on HEX0 & HEX1. (maximum score user can get is 99).

13. User can play level-3 till timer reaches to 0. Once, timer reaches to 0 user can go to any selected game level by using SW12 & SW13.

14. If user selects 00, scores of level-2 & level-3 will be displayed along with player index number on seven segment displays (HEX 0,1-level-3 score), (HEX2,3-level 2 scores), (HEX4-Player index number).

15. If more than 1 player plays without pushing reset button (key 0) in between, winner index along with scores is displayed in above step.
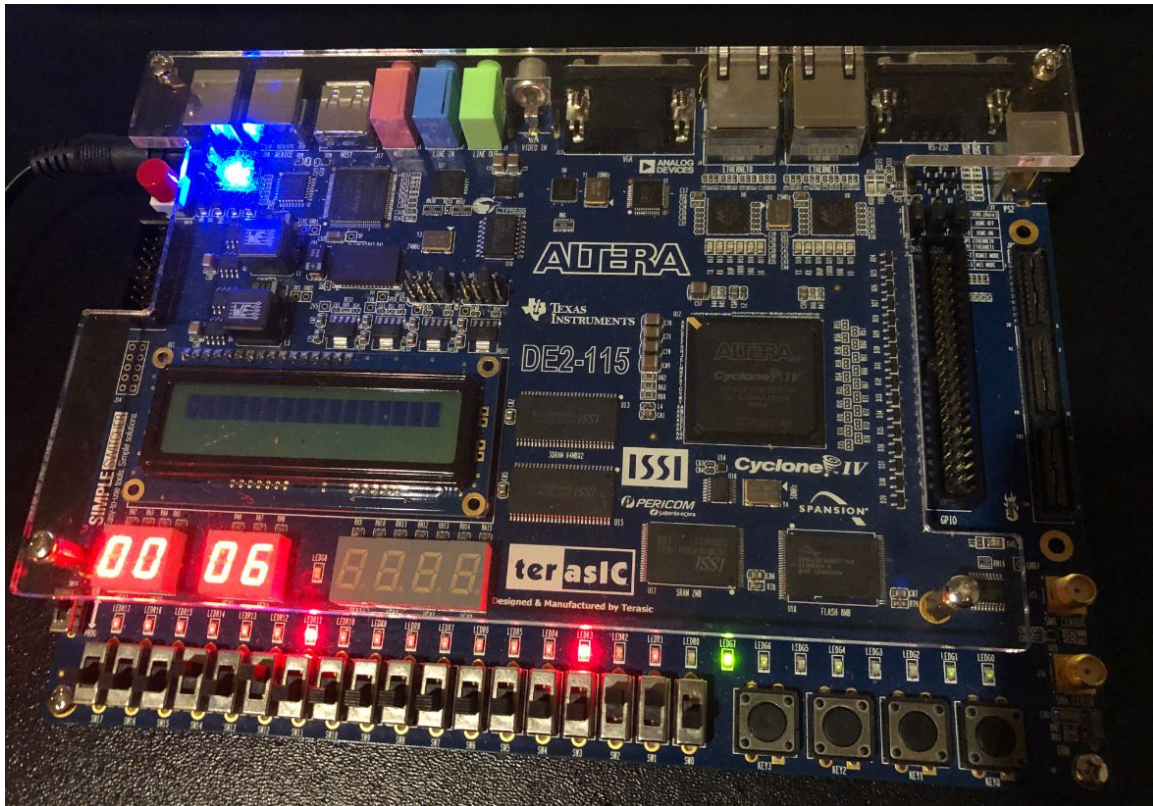
If Password entered is incorrect:

1. A Red LED will keep glowing.
2. Player inputs cannot be loaded into the board.
3. User has to press reset button to enter password again.

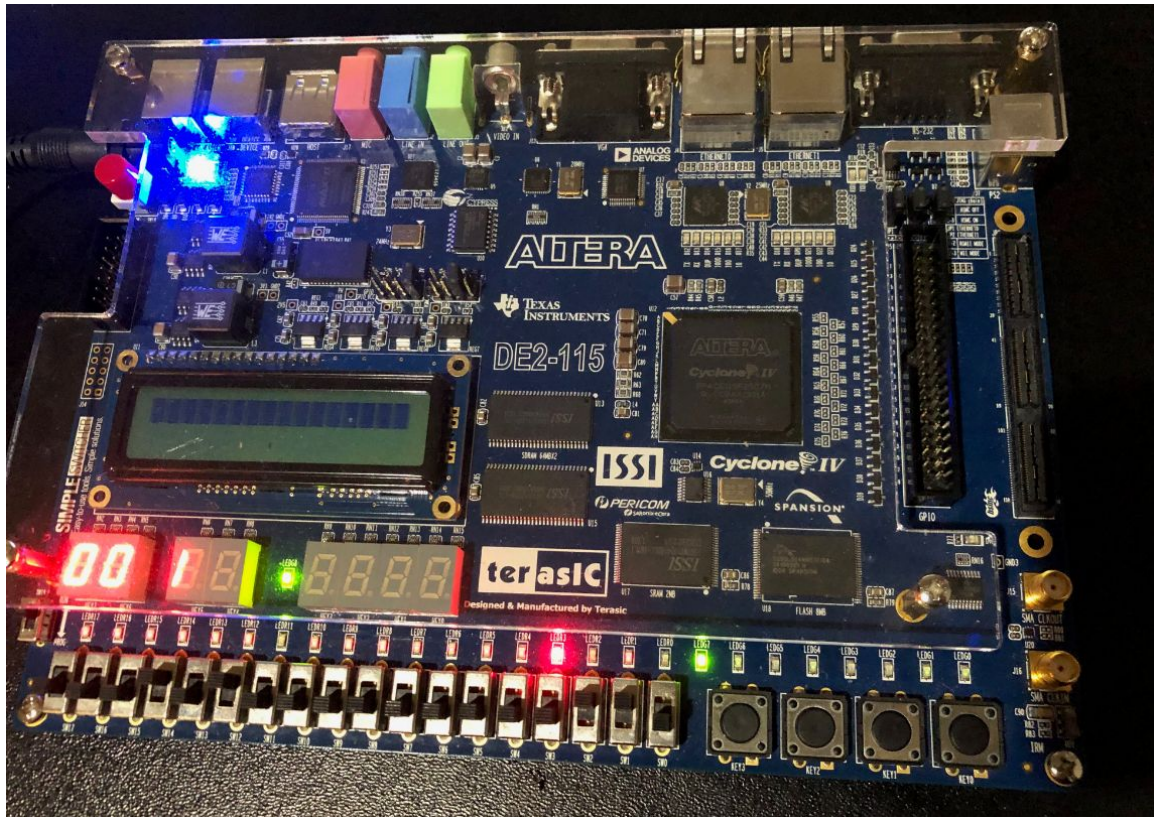Below are the screenshots taken for each case:

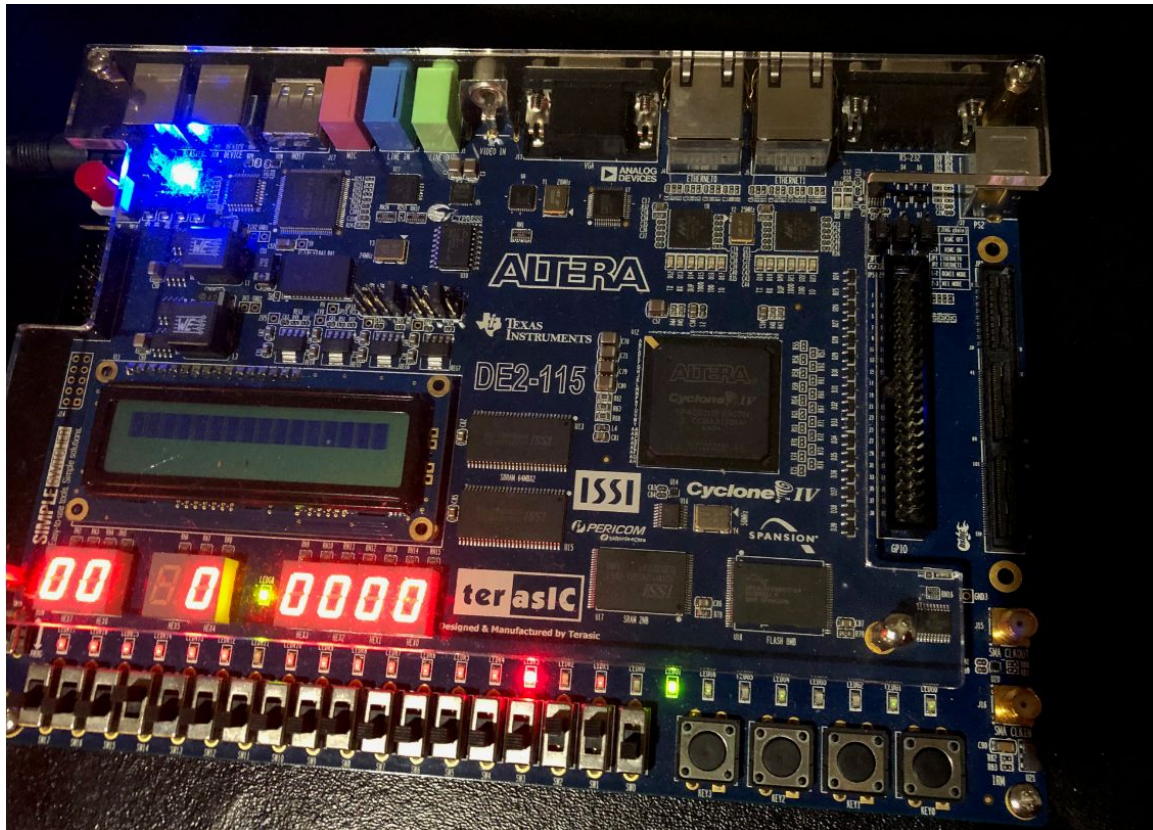1. WHEN BOARD IS IN RESET CONDITION
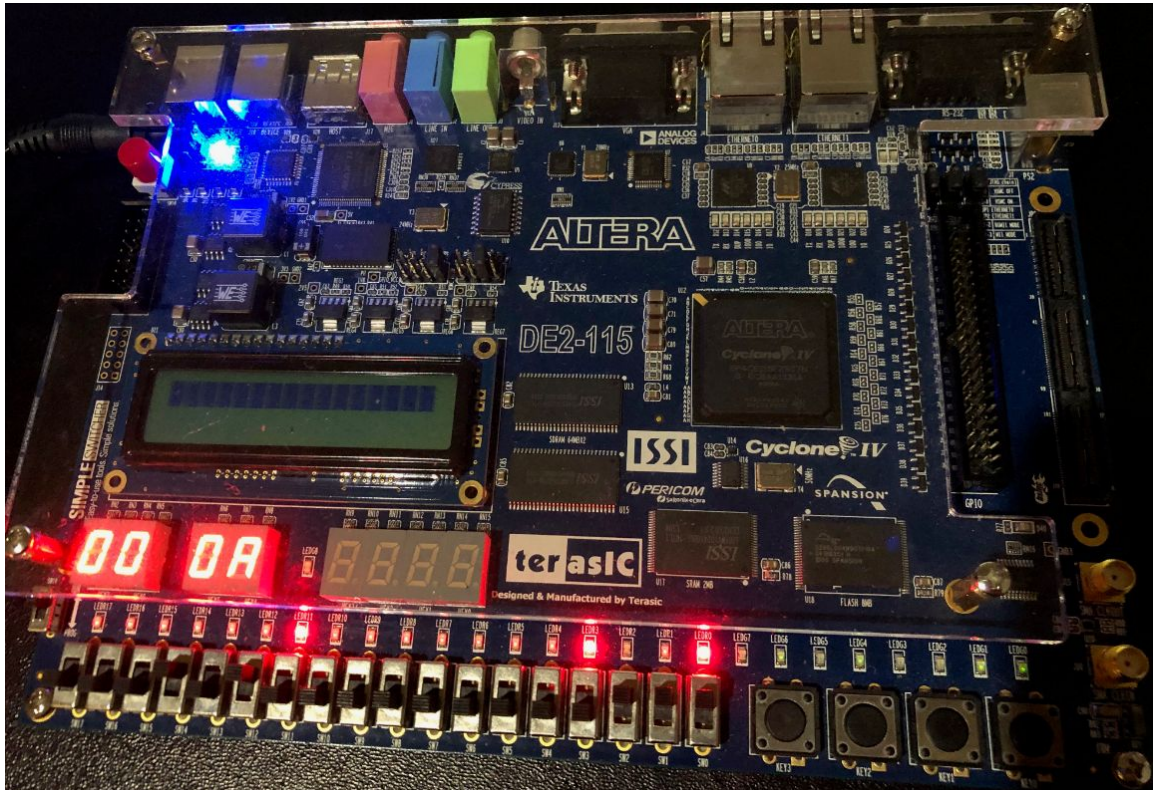
2. SUCCESSFUL USER-ID AUTHENTICATION
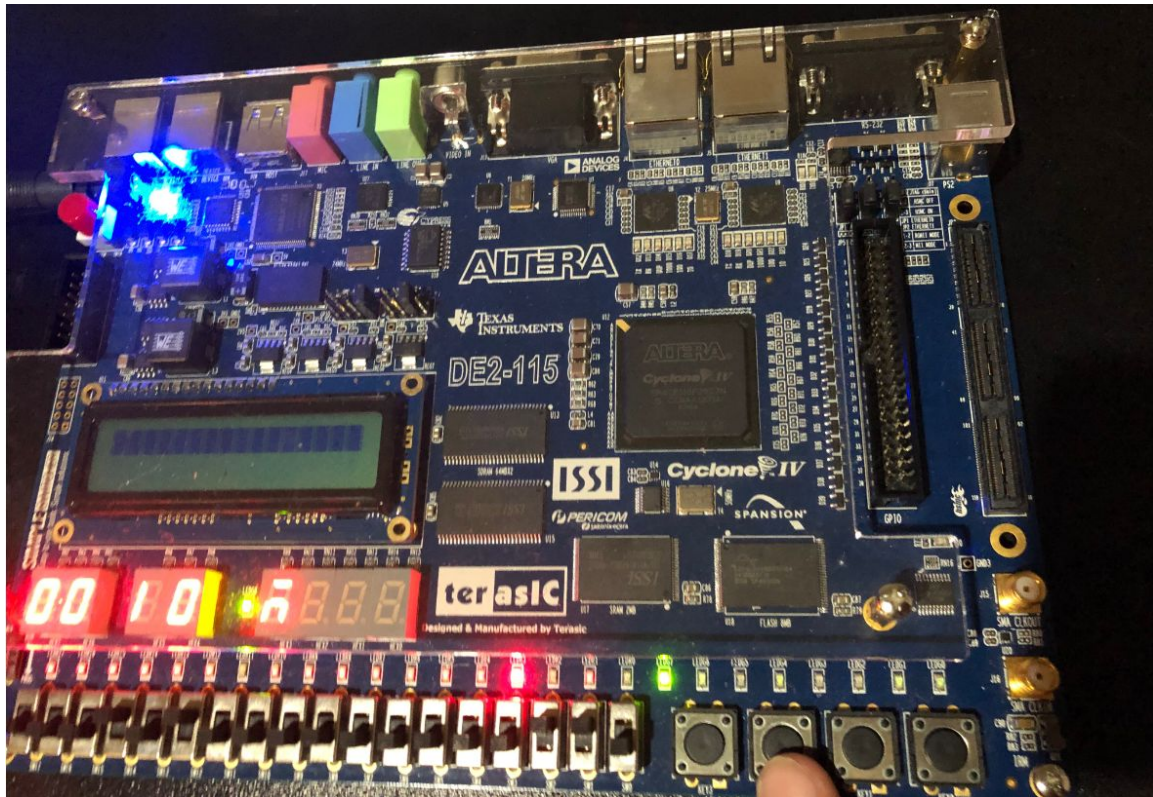
3. SUCCESSFUL PASSWORD AUTHENTICATION

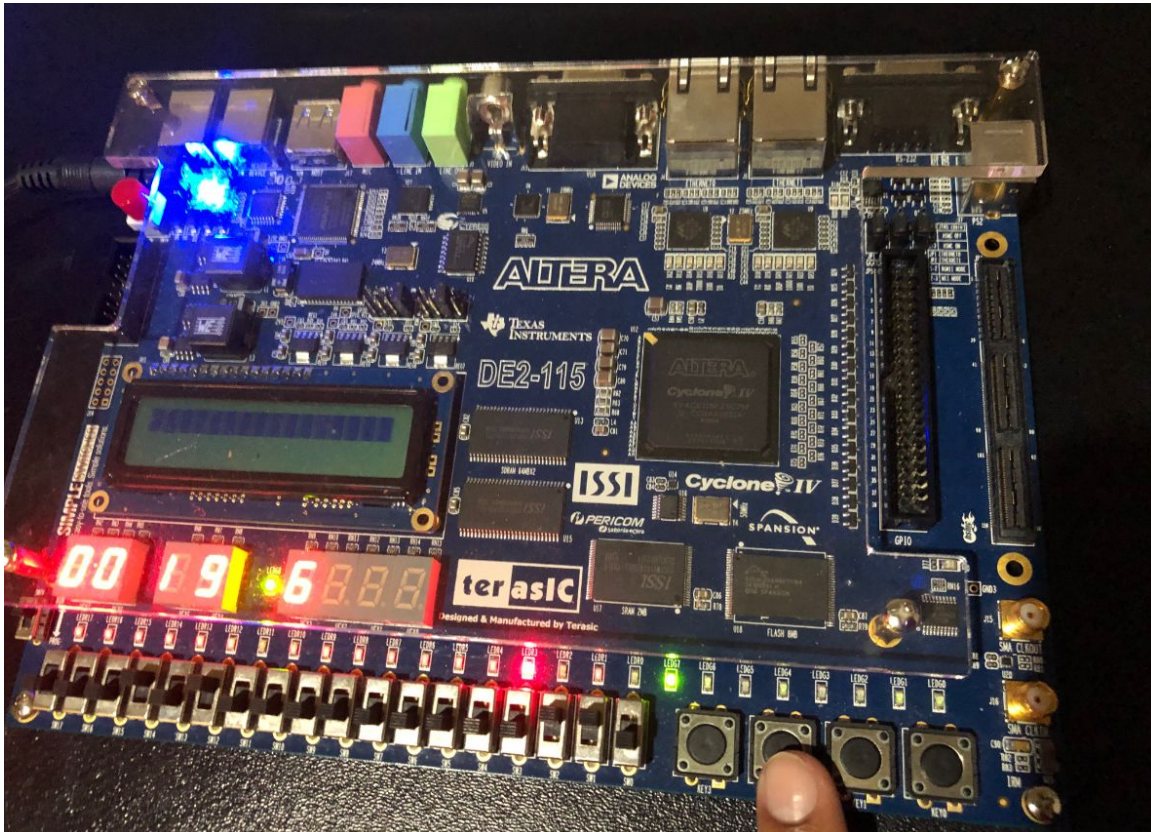4. WITHOUT LEVEL SELECTOR PUSHING GAME BUTTON (KEY 3):

5. **AFTER LEVEL SELECTOR LEVL-1 TRAINING (0 TO 9):**
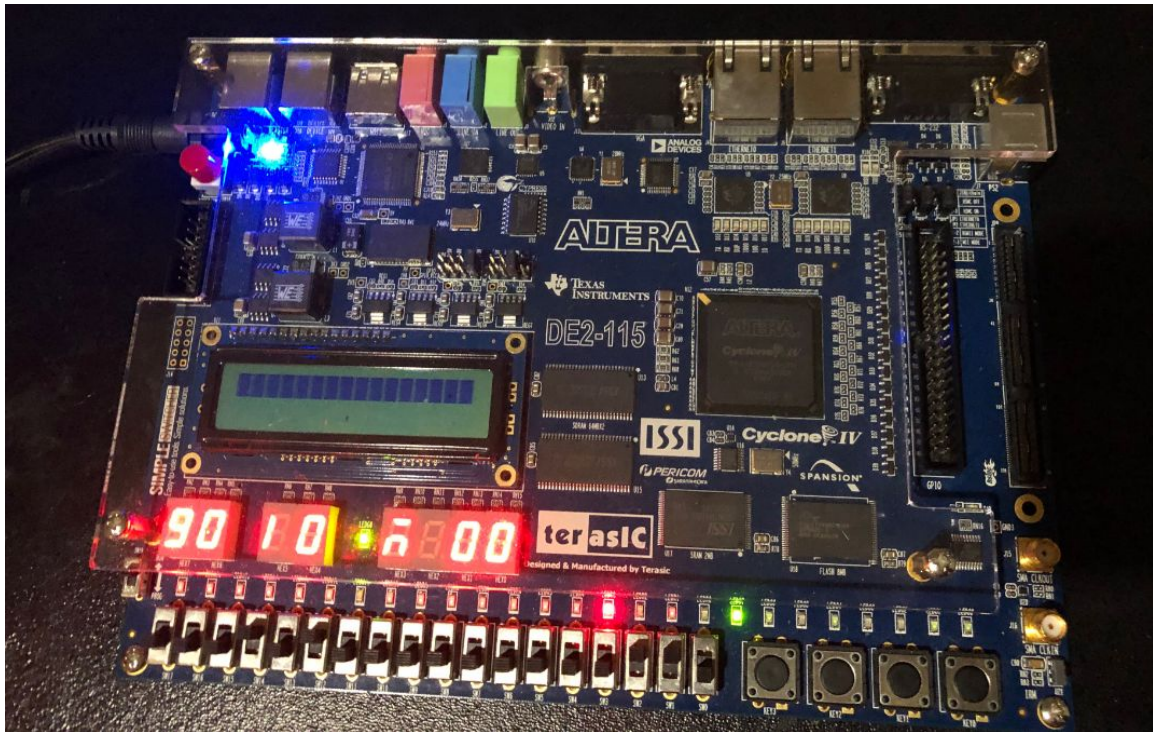
5.1) User Pushing player load (key 2 button) starting from 0

5.2) User Pushing player load (key 2 button) ending to 9:

6. LEVEL-2: (SUCCESSFUL ATTEMPT) AFTER TIMER STARTS, USER PUSHES RNG LOAD, GUESSES CORRECT ENCRYPTED SYMBOL, SCORE INCREASES AND GREEN LED ON:

6.1) Level-2 when timer loads to 90 secs:

6.2) Level-2 Timer starts decreasing to 0:
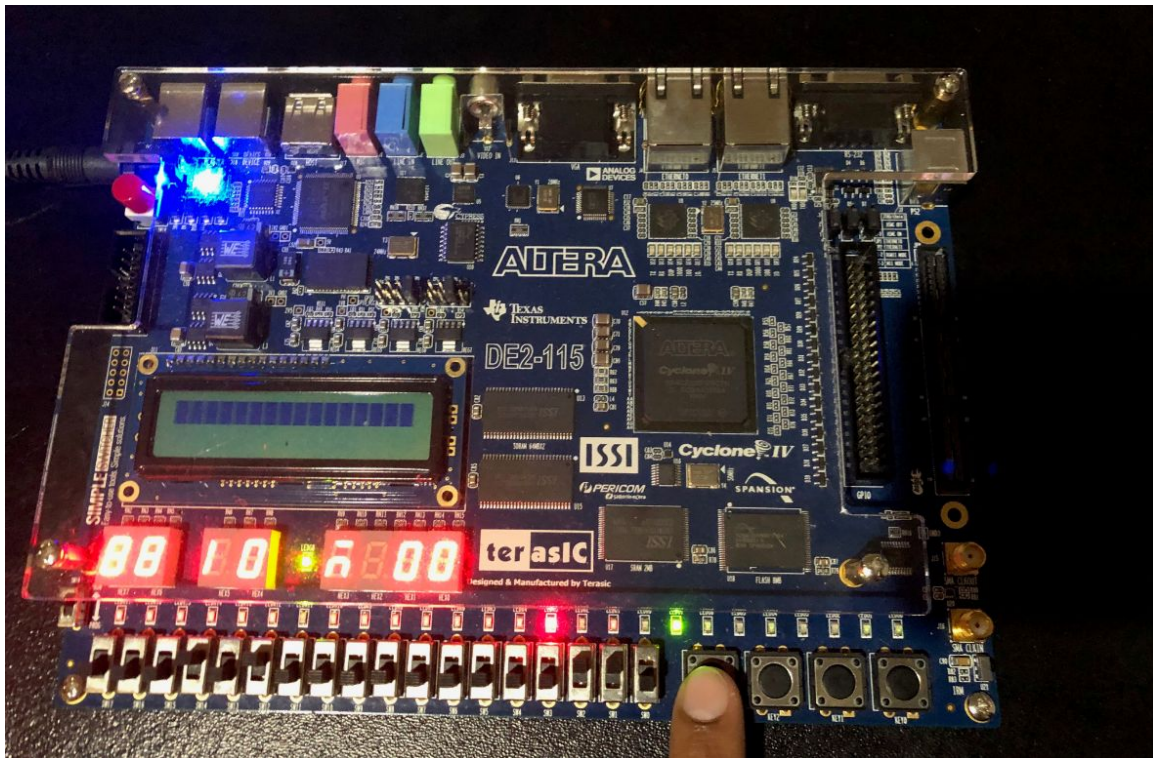
6.3) successful attempt of player input and green led ON in level-2:
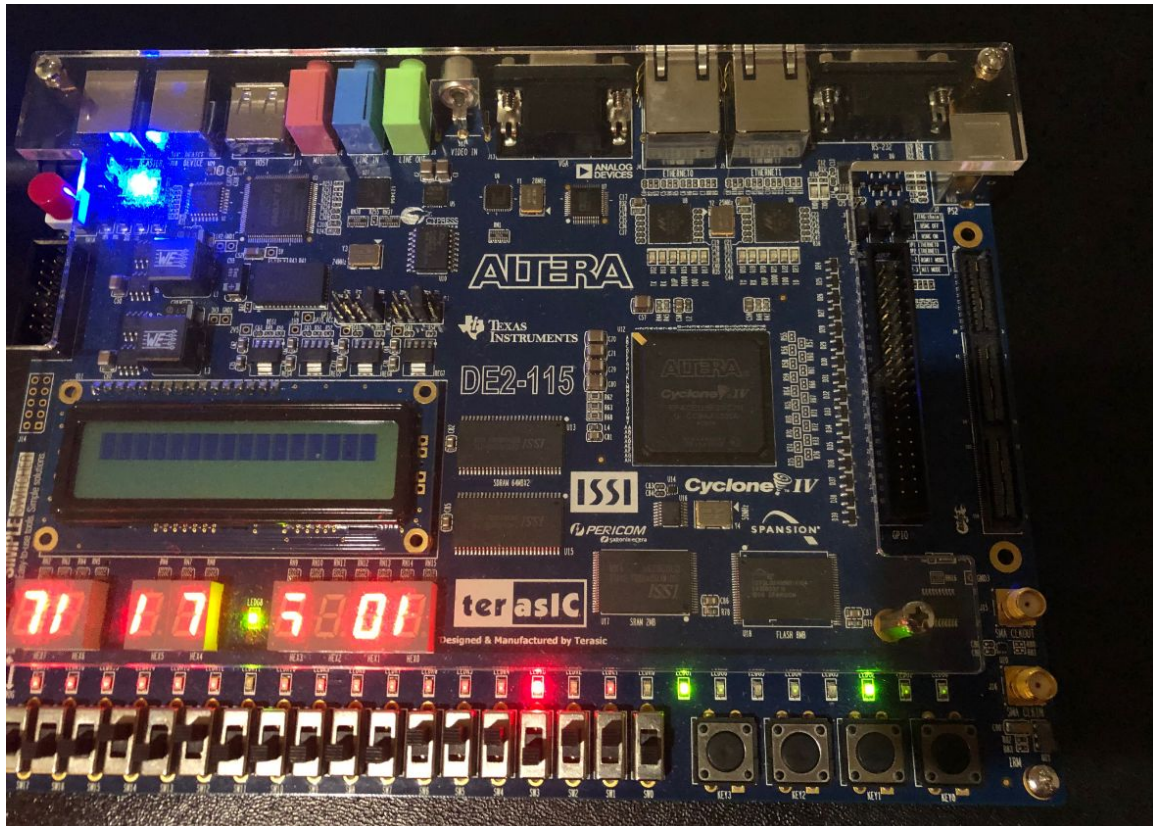
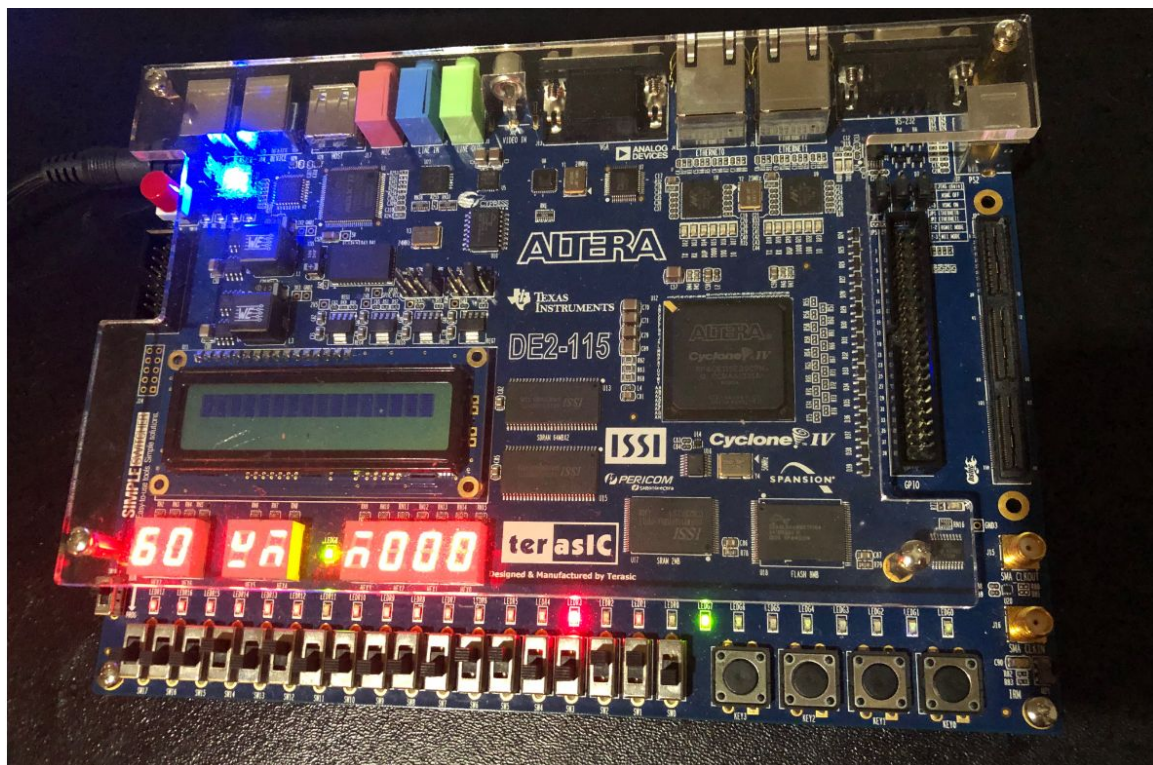6.4) Failed attempt of player input and Red led ON in level-2:
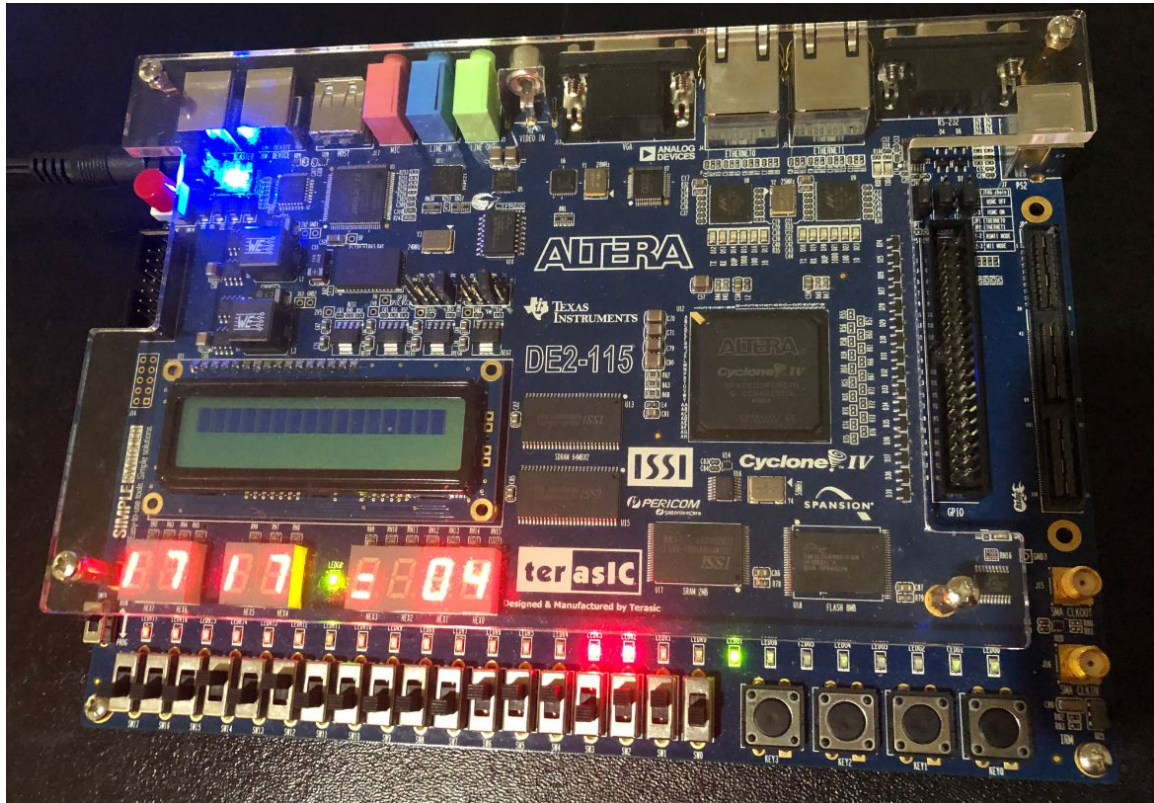
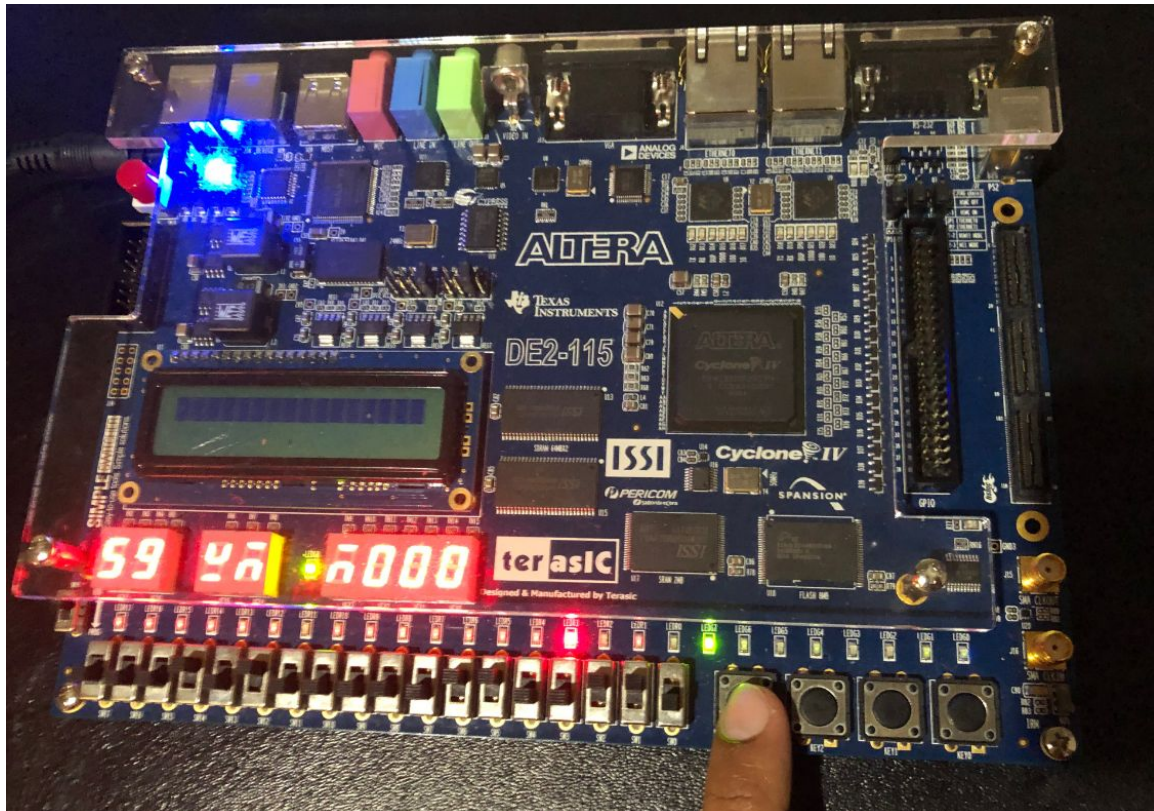6.5) Total sum when timer reaches to 0 & successful attempt of player input and green led ON in level-2:
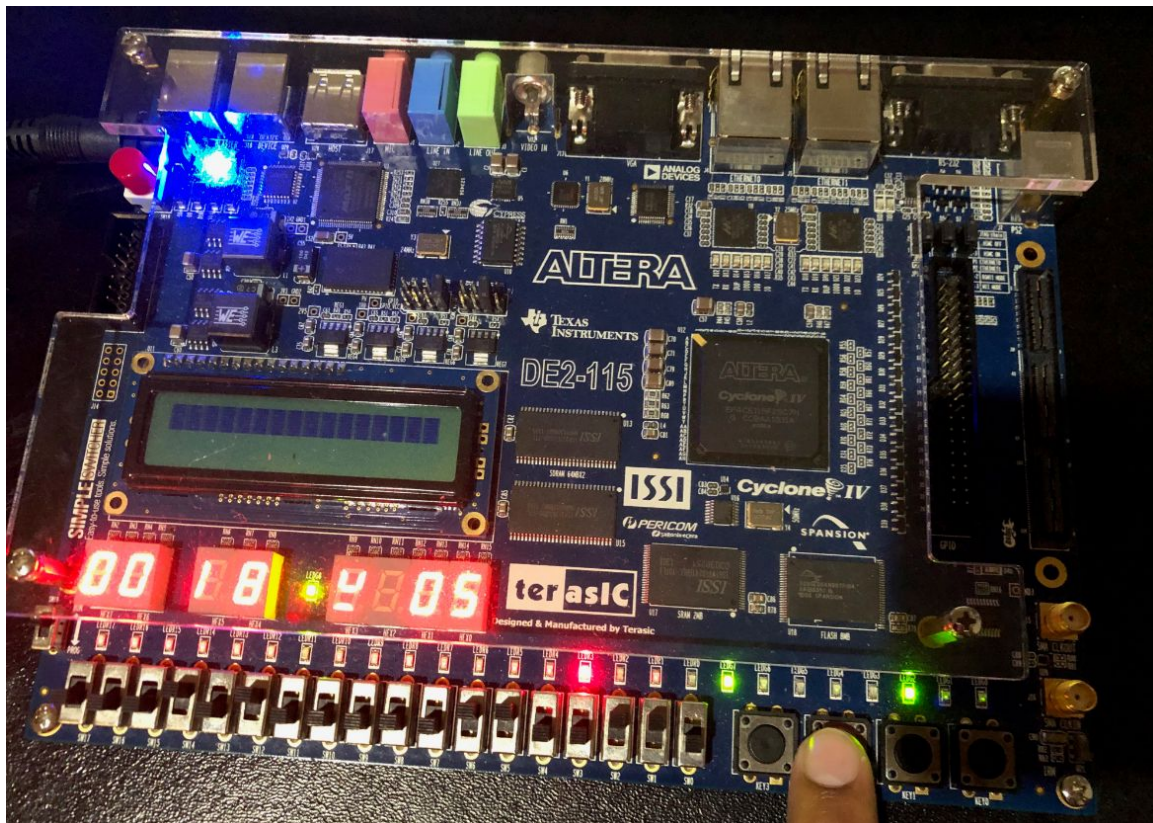
7. LEVEL-3: (SUCCESSFUL ATTEMPT) AFTER TIMER STARTS, USER PUSHES 2 RNG LOAD, GUESSES CORRECT ENCRYPTED SYMBOL AND SUM, SCORE INCREASES AND GREEN LED ON:
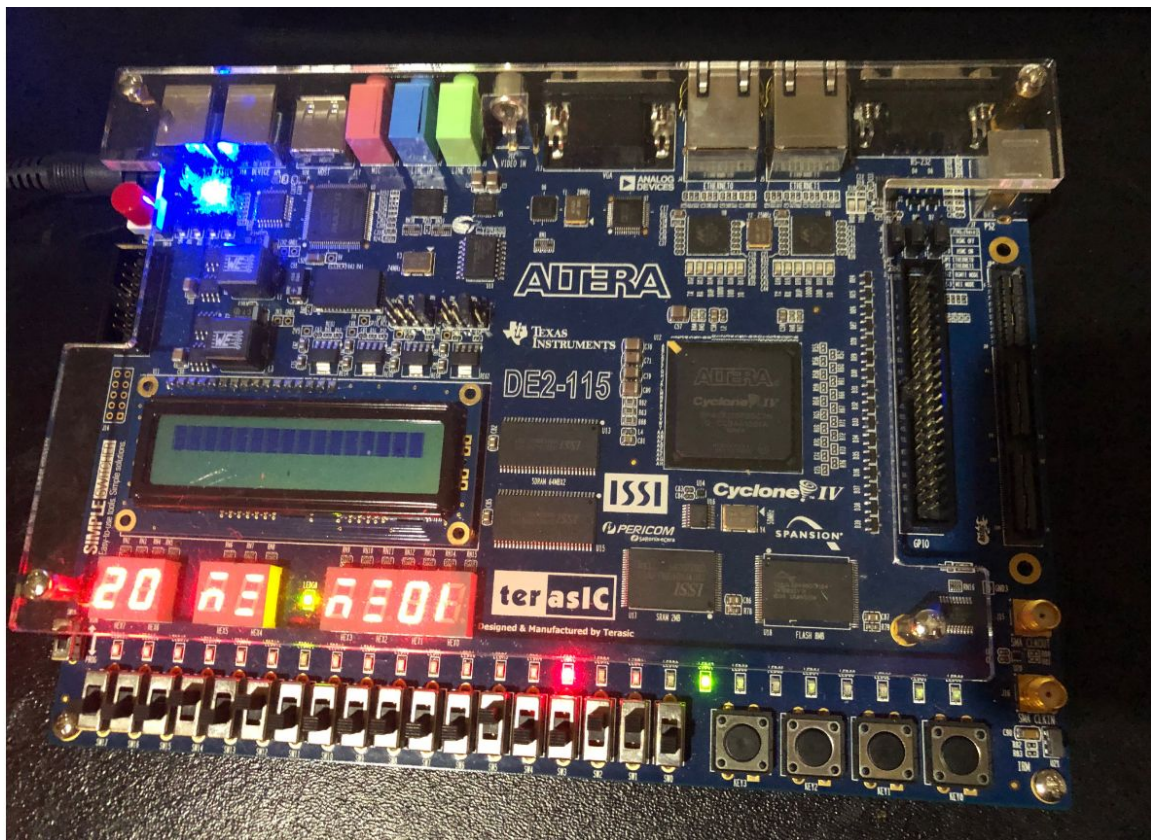
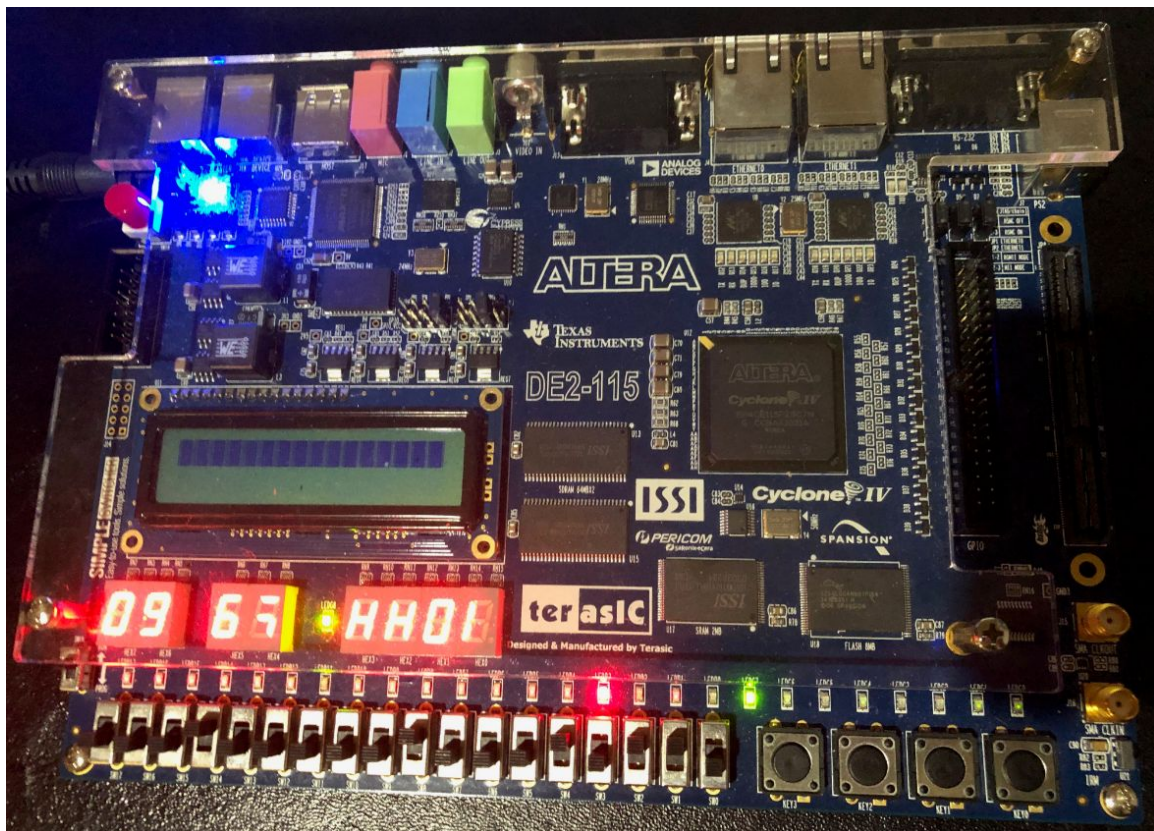7.1) Level-3 when timer loads to 60 secs:

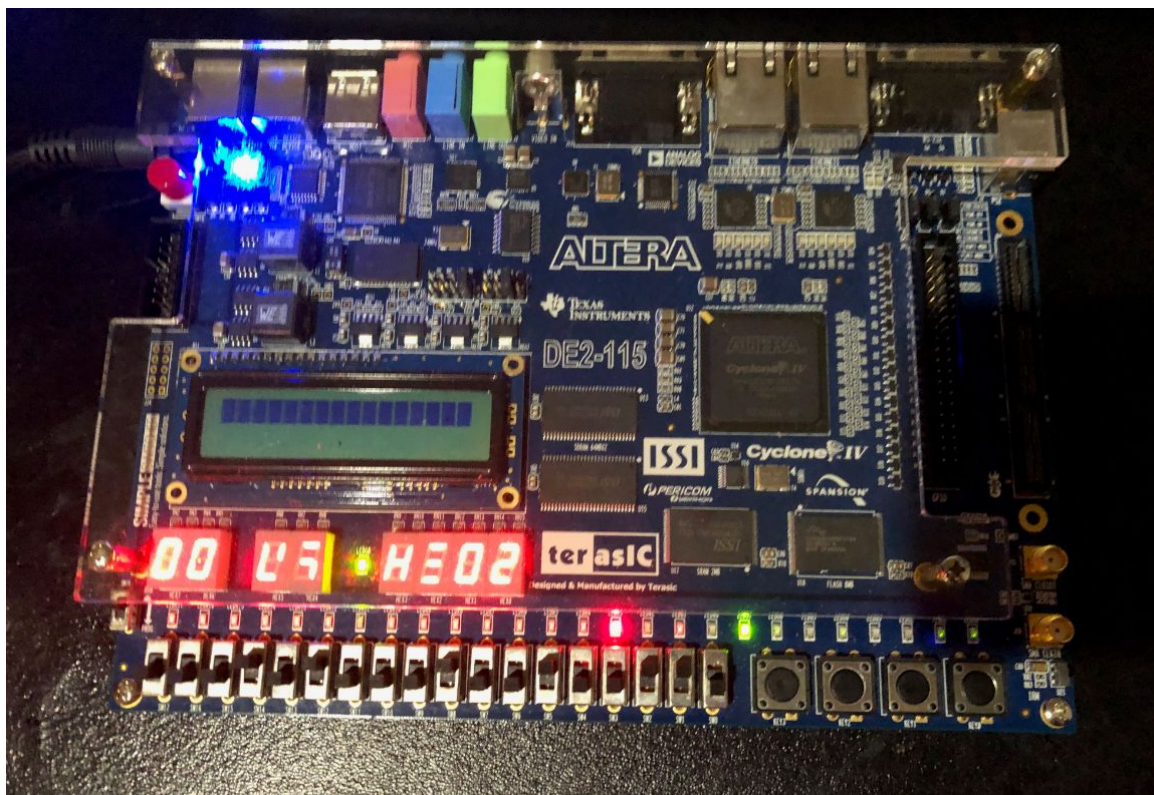7.2) Level-3 Timer starts decreasing to 0:

7.3) successful attempt of player input in level-3:

7.4) Failed attempt of player input in level-3:

7.5) Total sum when timer reaches to 0 & successful attempt of player input in level-3:

8. LEVEL–0: DISPLAYING WINNER INDEX AND CORRESPONDING LEVEL-2 & LEVEL-3 SCORES: