
Reflex Tester - Final Report

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Reflex_Test - The GAME

The reflex_test is a fun project/game implemented using VHDL on the FPGA Board . It gives a quantitative approximation of the hand eye coordination of the player. It displays the reaction time of the player i.e. the time taken by the player to respond to glowing of a LED by pressing a button ,upto a precision of 1 ms.

Specifications

- There is a "reset" button which when pressed at any time would reset all the states i.e. make the counts of all the counters to "0" and would display a "HI" message on the SSD.
- There is a random number generator (which is a counter) that generates a random number(counts) between 200000000 to 1000000000 ;as the period of clock is 10 ns this would account to 2s to 10s.
- This randomly generated interval will act as the random interval after which the "output led" needs to be lighted up.
- The "Start" button would initialise another counter. There would be clock "timer" counter whose value gets incremented by 1 in each clock cycle . Once it reaches the random number generated the i^{th}
- "Output LED " is lighted up where i would be $(\text{random_number_generated} \bmod 16)$ which is calculated with last 4 digits of it's binary representation).This(Lighting of LED) would begin a new_counter which stops when the stop button is pressed.
- Now "HI" would disappear and the reaction time (value of new_counter) would appear.The least count of the reaction time is 1 millisecond ,If a person takes 10s or above to complete the task the a "----" would be displayed

ASSUMPTIONS

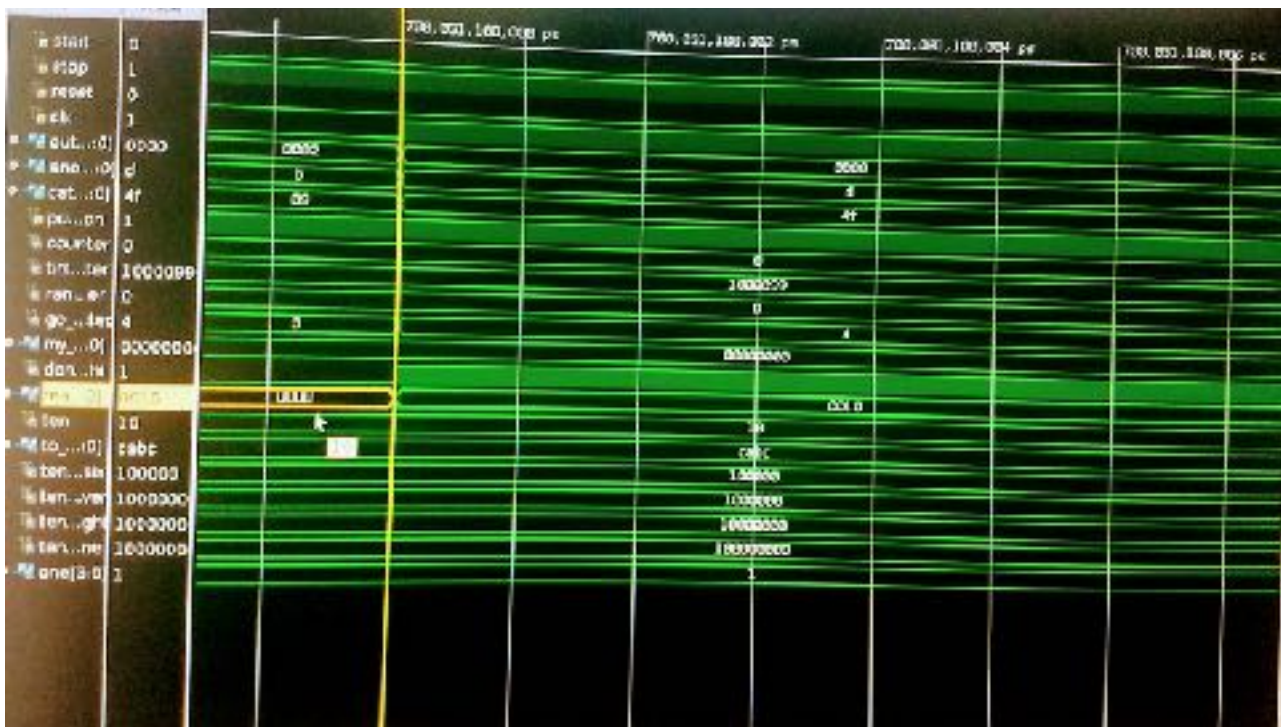
- "Output led" could be any one of the 16 led's present on the Basys Board which would be chosen randomly in each test.
- The "Stop" button is one of the five pushbuttons.
- Time is to be displayed with a least count of 1ms.

OVERALL APPROACH

- We could have "Stop" when the slide switch corresponding to the "Output LED" lighted is turned on. This could however pose a problem as this would then have to be turned off.
- Randomness is achieved using the time a player takes to press start after reset and manipulating the time obtained.
- We made a counter which starts when reset is pressed.
- It stops as soon as the start button is pressed.
- Now a number is obtained from the value of this counter.
- We take the last three digits of this random_number xyz. Now x.yz seconds is the time after which the led will glow. (For doing this xyz is multiplied with 10^8).

- The led number(one of the 16 LEDs of the board) required to glow is obtained by converting the random_number above into binary and taking the last four digits(this acts as mod 16 and gives us the number of LED that has to be glowed).
- Once the LED glows another counter namely the Reaction_Time_Counter starts and this stops when the stop button is pressed.
- This gives us the Reaction_Time which is then send to the display block to be displayed on the SSD .
- If the Reaction_Time is greater than or equal to 10s then we display "— — — —" on the board which signifies time limit exceeded .

TEST AND DEMONSTRATION



VALIDATION METHODOLOGY

- For testing we fix the random_number_generated to a particular value and then forced it. And then checked in the simulation whether the reaction time came to be as expected.
- We also did a real time check on the board by running a parallel stop_watch which is stopped at the same time "Stop" button of the Basys Board is pressed.

Attempt Number		Time Taken to light the LED	Led which lighted
1		1.96	4
2		4.73	14
3		9.95	10
4		5.46	3
5		2.75	5
6		8.46	12

- It was easier and more efficient to check the corner cases on board, so we opted not to make a test bench as that helps in verifying the reflex test and real time randomness in a better way.

Time for Led to Glow after start is pressed	Time taken to press stop after led glow	Time in stop Watch b/w led glow and stop
1 s	1.587	1.602
2 s	13.162	----
1.5 s	8.765	8.701
2 s	0.354	0.389
3s	3.678	3.721

Time for Led to Glow after start is pressed	Time taken to press stop after led glow	Time in stop Watch b/w led glow and stop
4s	0.234	0.298
5s	0.563	0.551
6s	2.345	2.456

The 2nd and 3rd column of the above table differ slightly because this includes the reaction of two different hands which is generally different for every human being. However, these errors are negligible if considering real time experiment. Hence, it gives a validity signal.

- We checked the display block separately by making a separate xdc file for the display block and running it directly on board.
- Testing is done by simulating the code with a test-bench file

4 bit input	Display
"0000"	0
"0001"	1
"0010"	2
"0011"	3
"0100"	4
"0101"	5

4 bit input	Display
"0110"	6
"0111"	7
"1000"	8
"1001"	9
"1010"	H
"1011"	I
"1100"	-

BLOCK DIAGRAMMATIC REPRESENTATION OF THE CODE

