Digital Battle Ship

A Modern Twist on a Clssic Board Game

Kristian Ivanaj, Nathan Balint, Patrick Pantis, Chris Guiterrez
Electrical and Computer Engineering Department
School of Engineering and Computer Science
Oakland University, Rochester, MI
e-mails: kristianivanaj@oakland.edu, nathanbalint@oakland.edu, pjpantis23@oakland.edu, cguiterrez2@oakland.edu

***Abstract*—A digitalization of a popular board game. The logic from the board games original rules are slightly bended and modified to create a more modern twist on the game itself. The Digital Battleship Game designed and created by this group is focused on providing the user a new approach to a classic game with more focus on the mere competition of it all.**

I. Introduction

In the hopes of digitizing a popular childhood game comes the challenges of hardware and software implementation. Our team is taking a unique approach to project creation. The team dynamic has been a major focus, laying out what is necessary to get everyone's ideas implemented to the best of our ability.

This has come with its own challenges but never the less progress is being made and the team is getting closer to a completed project. Ultimately, the team has planned multiple modes of execution and remaining open to new ideas as the software and hardware implementation continues in the following weeks.

The game of battleship consists of two players, both of which are designated to implement little ships on a board. These ships are the target of the opposing player. The opposing player will attempt to sink the ships of player one. Both players will have their boards facing away from one another as to keep the secret of where the ships are being placed. The player to sink all of the ships before the game is over is the winner.

II. Methodology

The Methodology is focused around an in depth understanding of the approach taken by the group to complete the goal at hand. The methodology is solely based on both software and hardware implementation. Not to mention the complications of combining the two to create the overall system

A. Software

In terms of software, there will be a definitive layout for what is needed. That being a counter, a way of implementing hypothetical ships, and a way of display digitally the progress of the game.

The timer essentially is designed to keep the game going at a reasonable pace. The timer will countdown from 20 sec, in this time the player will have to decide what part of the opposing players board they are aiming for.

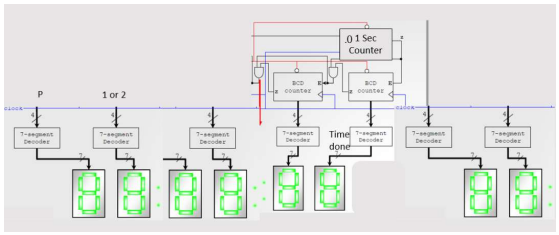


Figure 1. Counter and Serializer

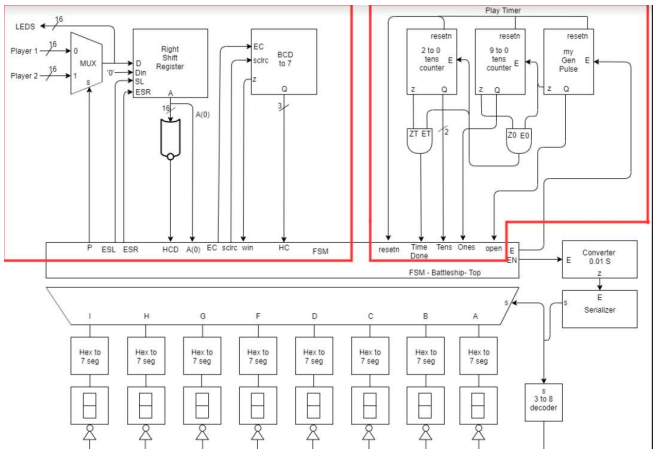


Figure 2. Program Design Layout

Next, the ships are implemented using hardware but the signals from switches are used to define the progress of each player and what they are choosing for the opposing players board. The guesses are then generated through the software to display an LED on the board.

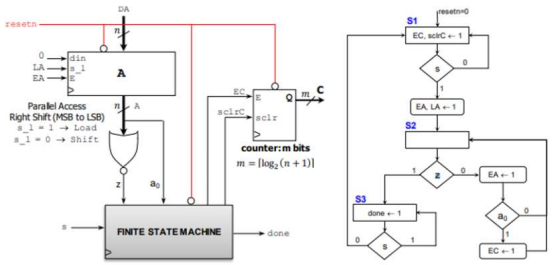


Figure 3. Hit Counter

Finally, the board will process the hits, to see if the goal of 7 hits is reached. When one player hits the goal of seven hits then the opposing player automatically loses the game. The board is programmed to display the words “P1 LOSE” or “P2 LOSE”, depending on the outcome at hand and the summation of total hits.

B. *Hardware*

As far as Hardware, the implementation consisted of using buttons that will be implemented on two boxes. Both of which will be wired up accordingly as to send signals from board to board. This would provide the necessary tracking needed as you play the game as well as the goal of knowing when you hit a player’s ship.

The boxes will be the main interface for user input, meanwhile the board itself will display the progress of the player in terms of hits. Essentially, LEDs are used as a method of tracking in this system.

The LED’s placed on the box itself are used to keep track of where the plater has placed and made a hit. Yet, the LEDs on the actual FPGA are used to track the progress of the 7 hits needed to win the round.

Meanwhile the wiring of the boxes is based on the basic switch layout of a button. The buttons will complete the circuit between the boards and provide a voltage to the LED, which will cause it to light up accordingly.

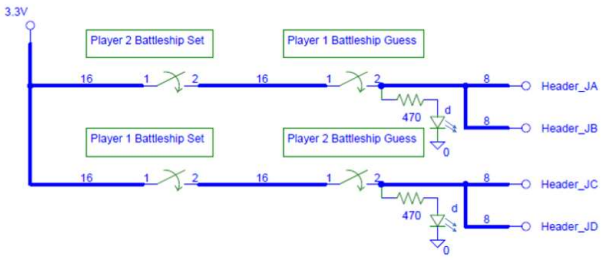


Figure 4. Hardware wiring

All of this is done in coordination with above software to complete the gaming interface for digitalizing the Digital Battleship that was intended as a project since the beginning of the design stages.

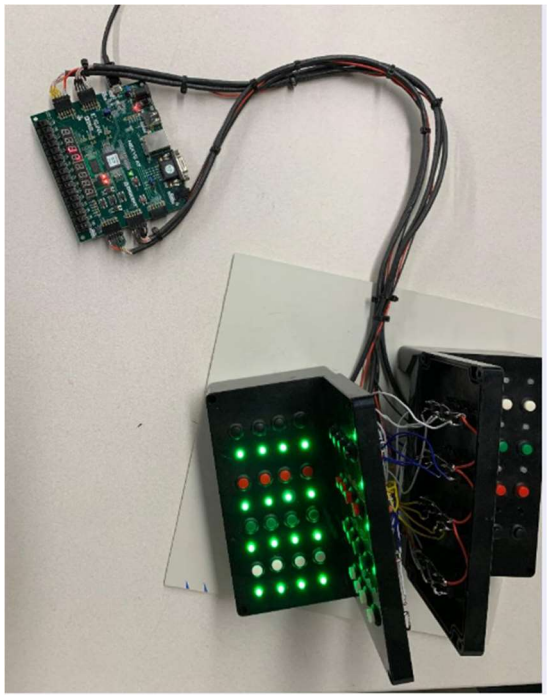


Figure 5. Overall System of User interface

III. Experimental Setup

The setup of the project was based on the software of all subsystems being tested solo, then implemented into an overall system. The testing consists of software testbenches along with real world application of the software into the hardware.

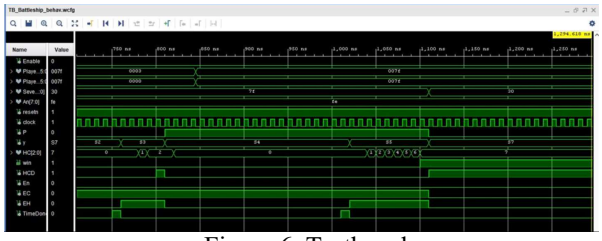


Figure 6. Testbench

The subcomponents consist of having their own challenges, but often time are very simple to debug because the steps themselves are focused in the code that the software is using to program the FPGA.

The biggest challenge comes with the implementation of all the subcomponents into an overall system. This is where the testbench is used to understand the logic of everything. Yet, regardless of the testbench setup the testing must occur with hardware to guarantee that the implementation is running smooth.

IV. Results

Overall the results were astoundingly successful and the implementation of the system design to real world application ran very smooth. The system was designed to implement everything from the original game of battleship and more. The

digital side of the design ran smoothly and defined the goals of the game without the needs of verbal callouts from the players themselves.

CONCLUSIONS

All in all, the project itself has defined the conceptual meaning of things learned in class and gave the group an opportunity to apply the meanings in the real world using the software concepts learned in class and hardware implementation learned from other classes.

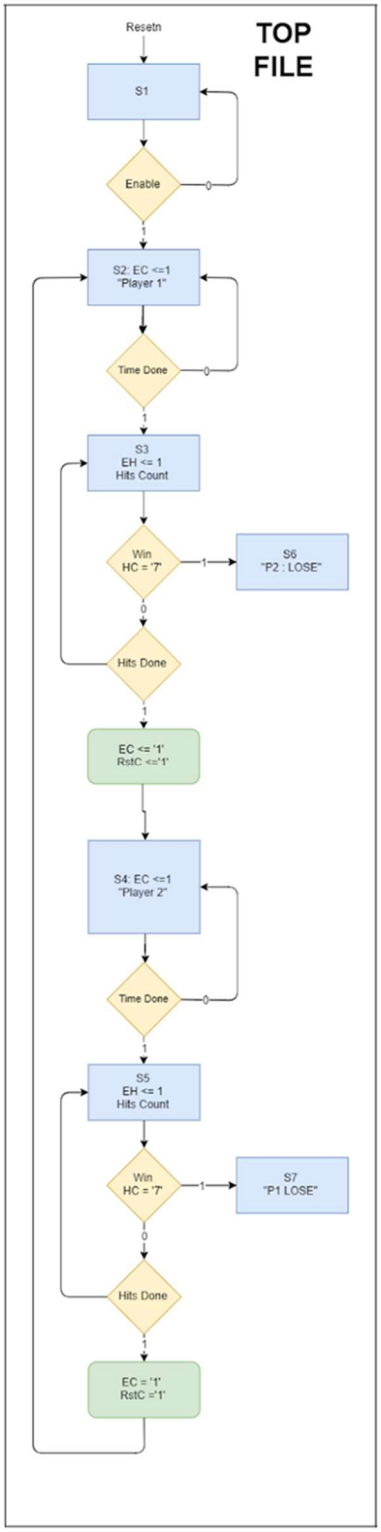
The process of the project really gave way for countless nights of debugging and focus around the mistakes that could potentially have been made when coding or designing the system of The Digital Battleship Game.

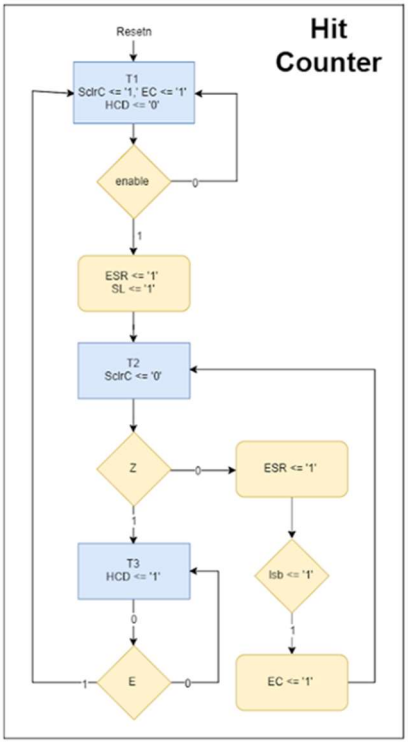
REFERENCES

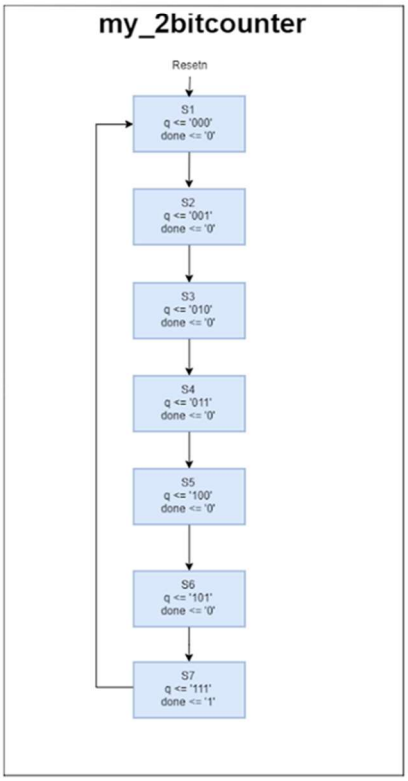
[1] S. Brown and Z. Vranesic, Fundamentals of Digital Logic with VHDL Design, 3rd ed., New York, NY: McGraw-Hill, 2009.

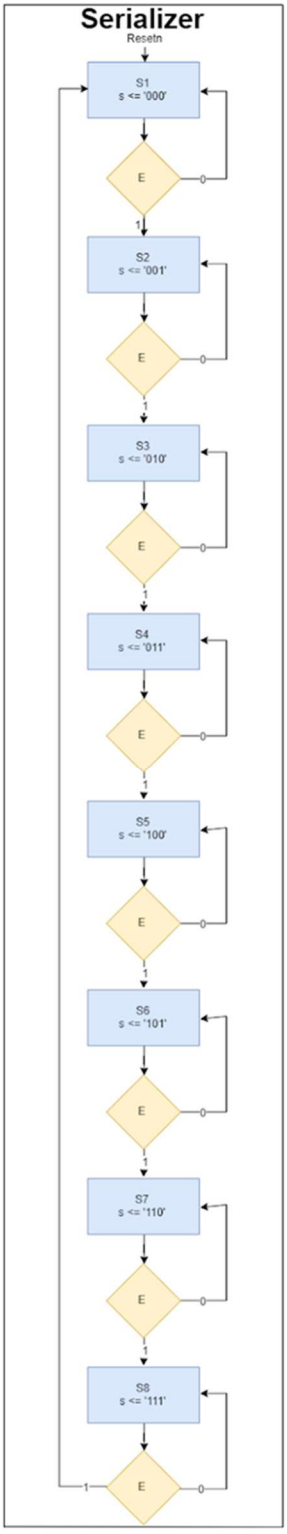
[2]http://www.secs.oakland.edu/~llamocca/VHDLforFPGAs.html

APPENDIX









An overall Block Diagram of the systems described and broken down in the report. Included in the Appendix for the sake of visibility and format.