Ben Smieja, Khantil Desai

BattleShip ECE243 Final Project

Basic Description of Game

Here we present Battleship for our Open Software project. The game will allow a player to play against a computer or another player where they will be able to place down ships on a 10x10 grid and guess the location of the computer's ships. The first player to guess the location of their opponents' ships wins. The grid, whose turn it is, and other game information will be shown on the VGA display. We will be using the push button keys to move around the board and a switch to confirm a shot. To gather the inputs, we will be using a polled IO technique. We will also have a counter for the player giving them 30sec to make a move. This counter will use the inbuilt timer/counter of the DE1-SoC board. We will also display information like the score and the counter time on the Hex Displays. Lastly the Led displays will be synchronized with the timer when it is on and will also display a pattern when a ship is "hit" in the game.

Instructions (Setup)

This open software project is intended to run on the cpulator online development tool. To load this project, open CPUlator Computer System Simulator (01xz.net) and select ARMv7 architecture and ARMv7 DE1-SoC system. Under language, select C and then open the BattleShip.c file. Then click compile and load and then continue.

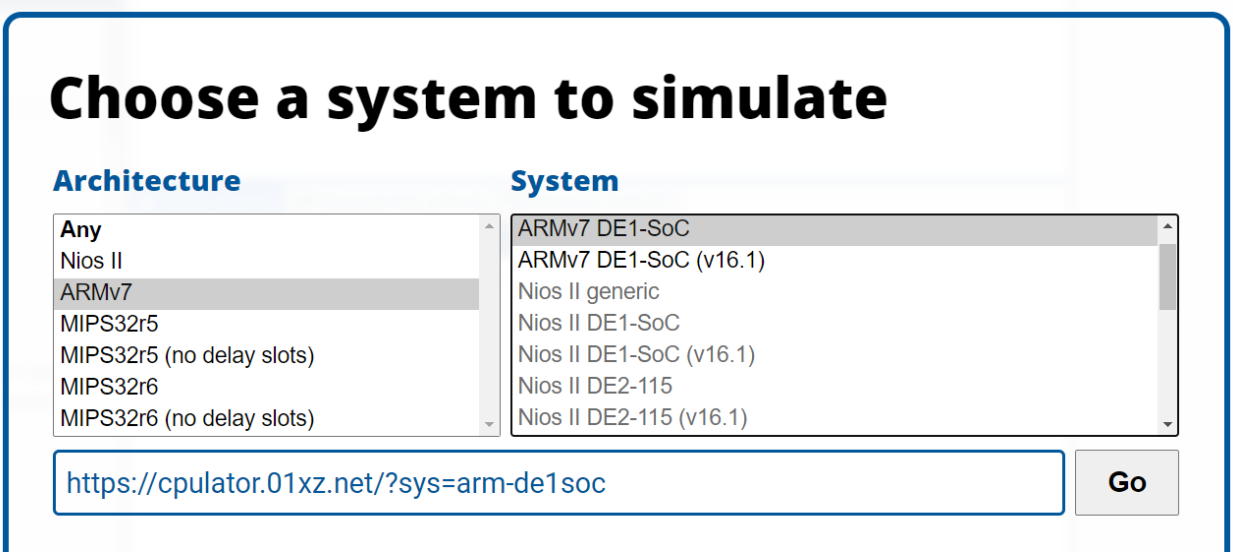

Figure1: System and architecture selection in cpulator

Ben Smieja, Khantil Desai

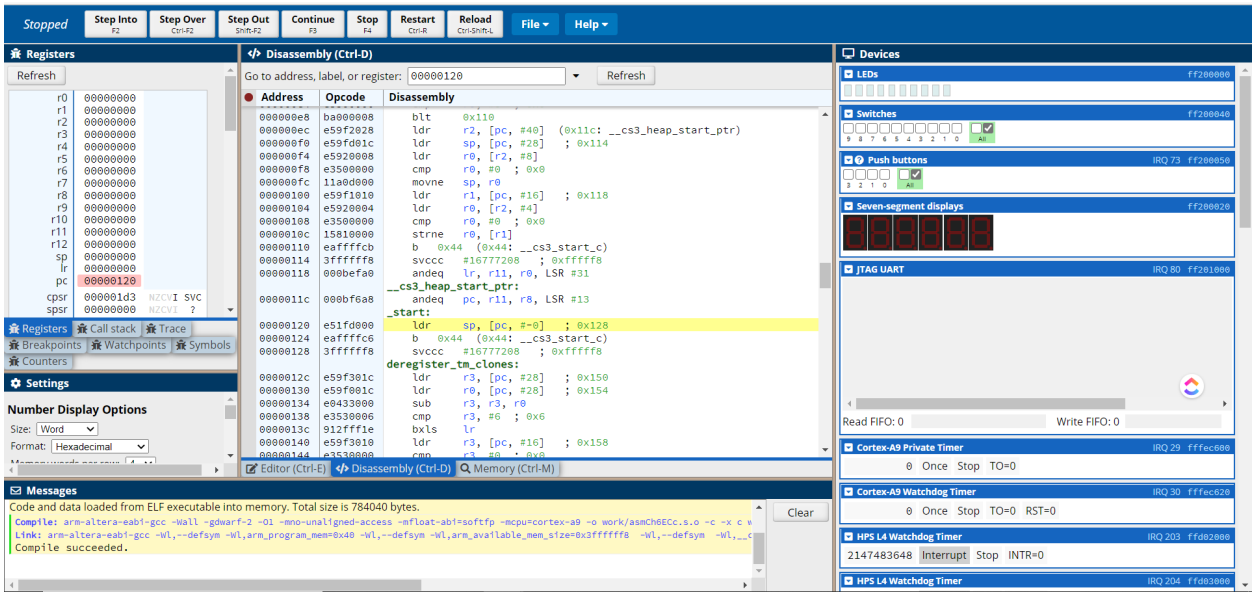

Figure2: cpulator after selecting language, opening BattleShip.c, and compiling

This will start the BattleShip game. The game controls are the switches and pushbuttons on the side panel, and the game outputs are the VGA display, Hex displays and LEDs. It is recommended to move the VGA display from the side panel to a separate box and resize to 1x. What you should see at this stage is in the image below.

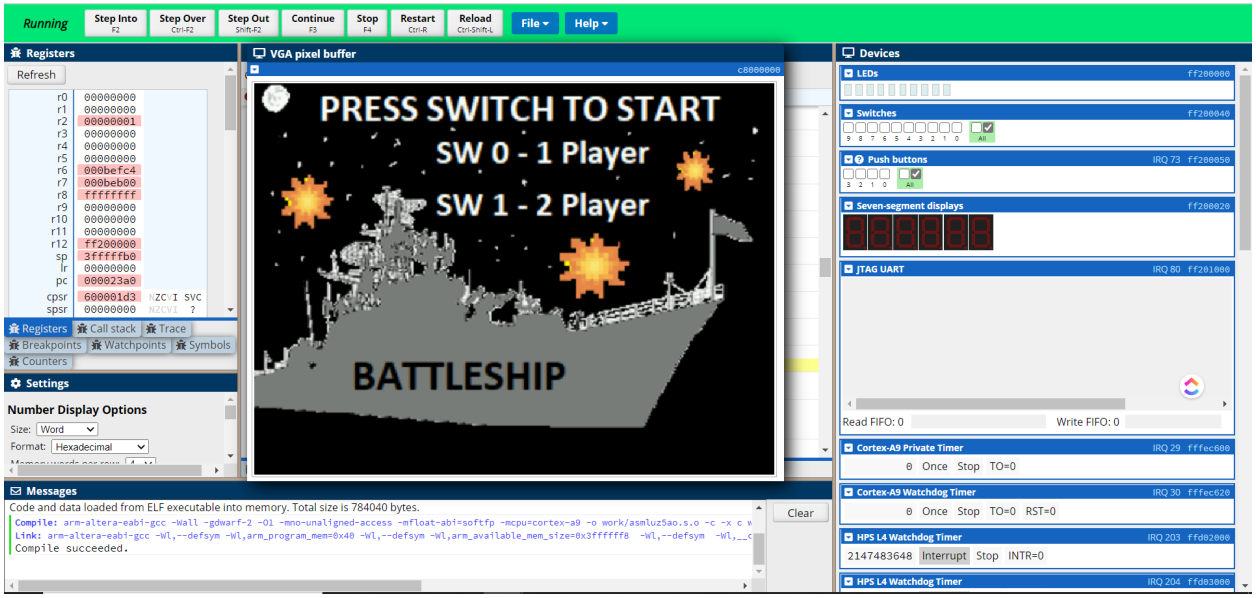

Figure3: cpulator after pressing continue, moving VGA pixel buffer to separate box and resizing the box to 1x

Now, we can begin the setup of the game. The switches are used to choose the game mode. Flipping switch0 will launch the game in Single Player mode whilst flipping switch 1 will launch the game in Two Player mode.

Either way, the game now enters the Player1 setup phase. In this phase the player chooses where to place down their ships on the game board. The Pushbuttons as described in the image below, are used to translate the ship across the board, the Switch1 rotates the ship, and the Switch0 places the switch at its current location if no other ships occupy that location already.

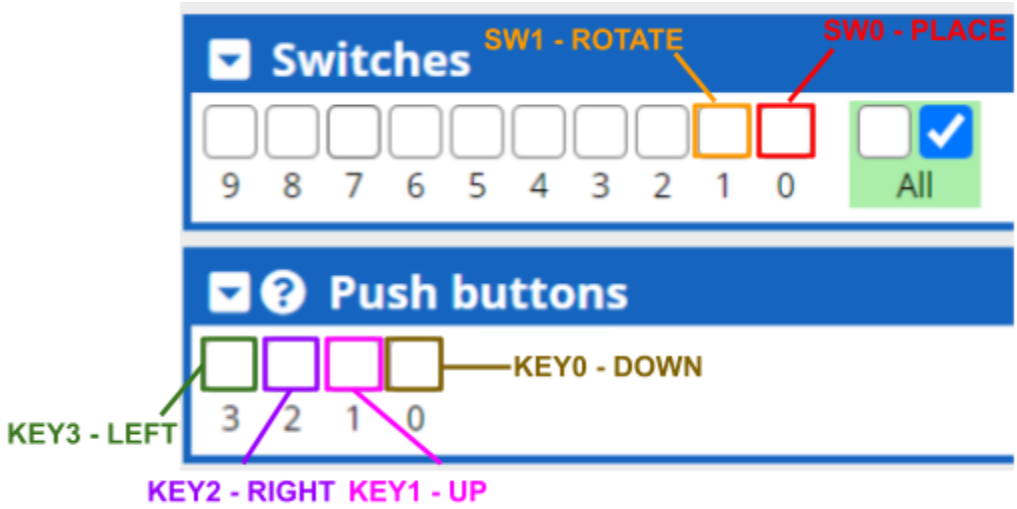

Figure4: Switches and Push Buttons and their mapping during setup

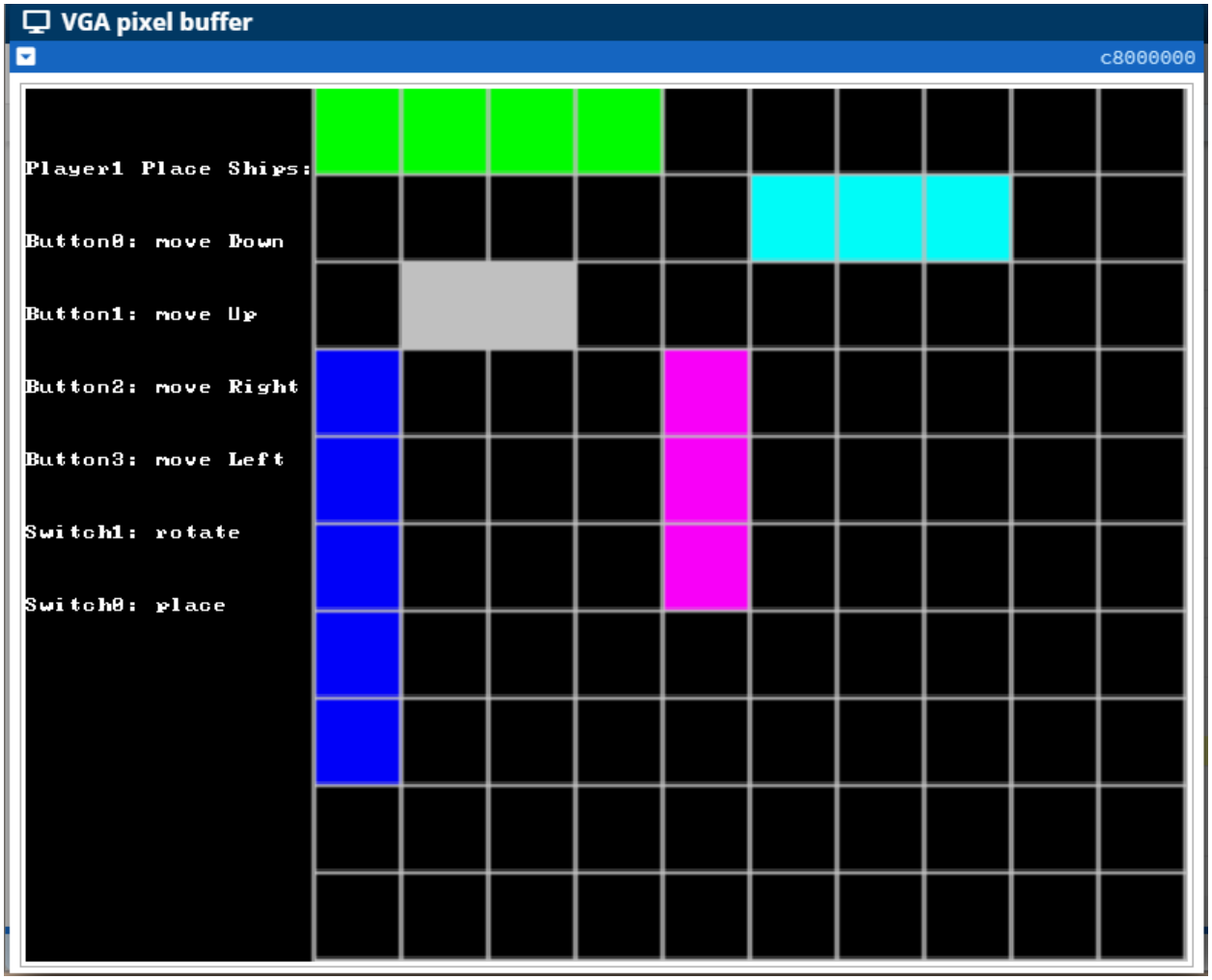

Figure5: Setup screen while Player 1 has placed 4 ships and is currently placing the last ship.

If the selected mode was Single Player, then the game will automatically randomly place the computers' ships.

If the selected mode was 2 Player, then the game asks the second player to place their ships, the same way the first player did.

Instructions (Gameplay)

Once setup is complete the game immediately starts with Player 1 guessing first. The Player will see a grid with a red cursor in the middle as seen in Figure 6. The cursor can be moved around the grid using the Keys as shown in Figure 7. Once the cursor has been moved to the desired location the player can toggle SW0 to confirm the position and 'Fire'.

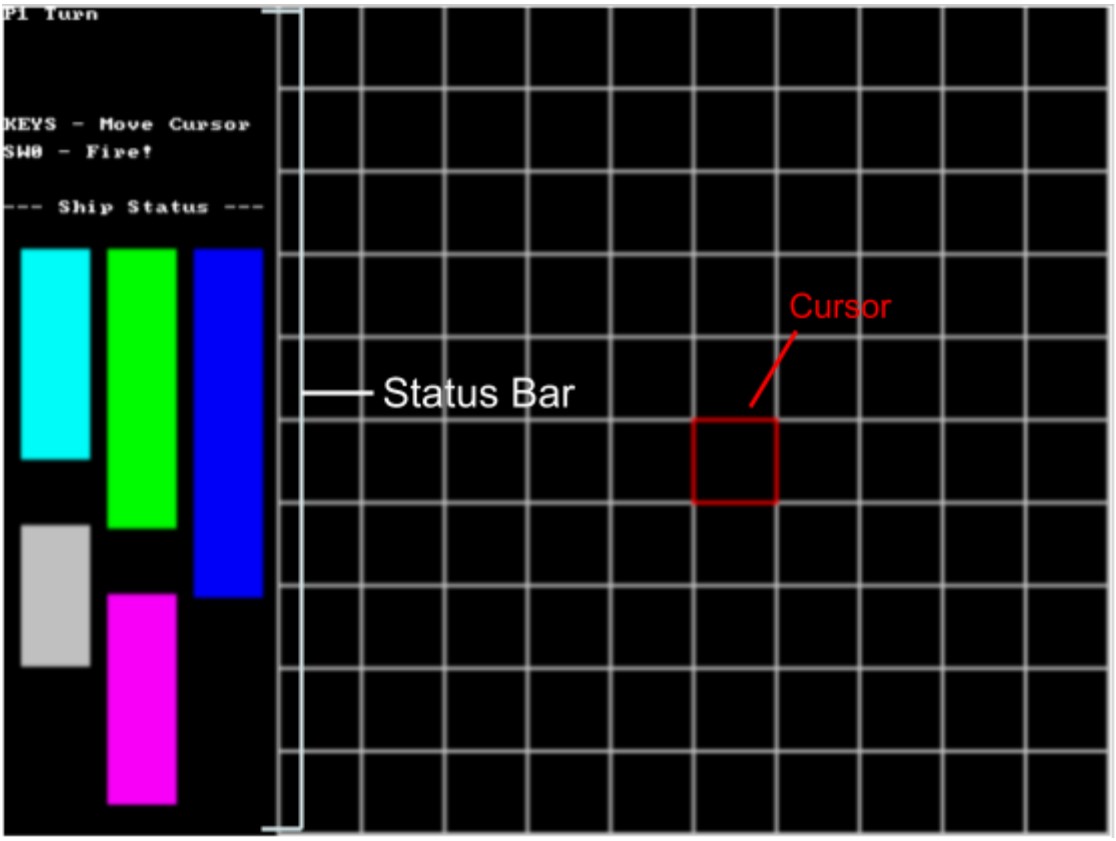

Figure 6. Game start screen showing status bar on the left and red cursor

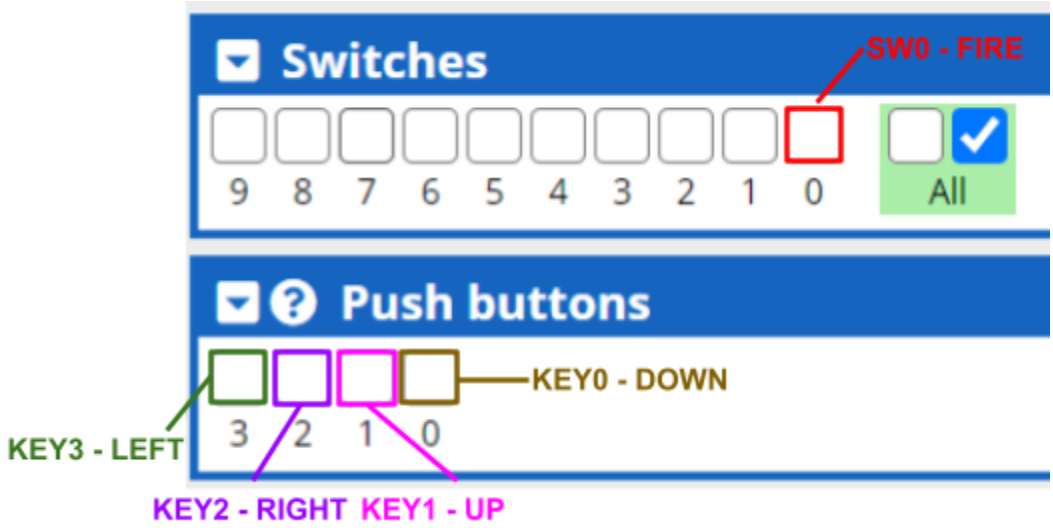

Figure 7. Game controls shown on SW0 and KEYS 0 to 3

If the player hits one of their opponents segments a red X will be drawn and the word “HIT” will be displayed in the left status bar as seen in Figure 8. The ship preview will also update to show which ship was hit. If they did not hit a ship a green dot will be drawn to represent a miss and the word “MISS” will appear in the left status bar as seen

in Figure 9. The Player scores are displayed on Hex32 (P1) and HEX10 (P2) as shown in Figure 10.

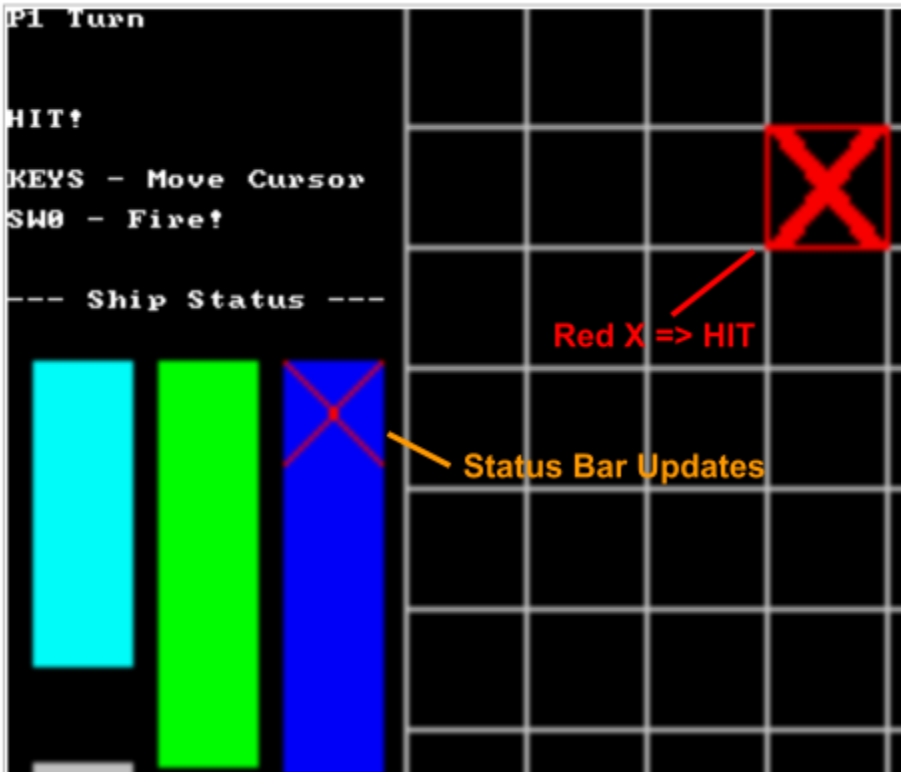

Figure 8. Game reaction when a player hits a ship

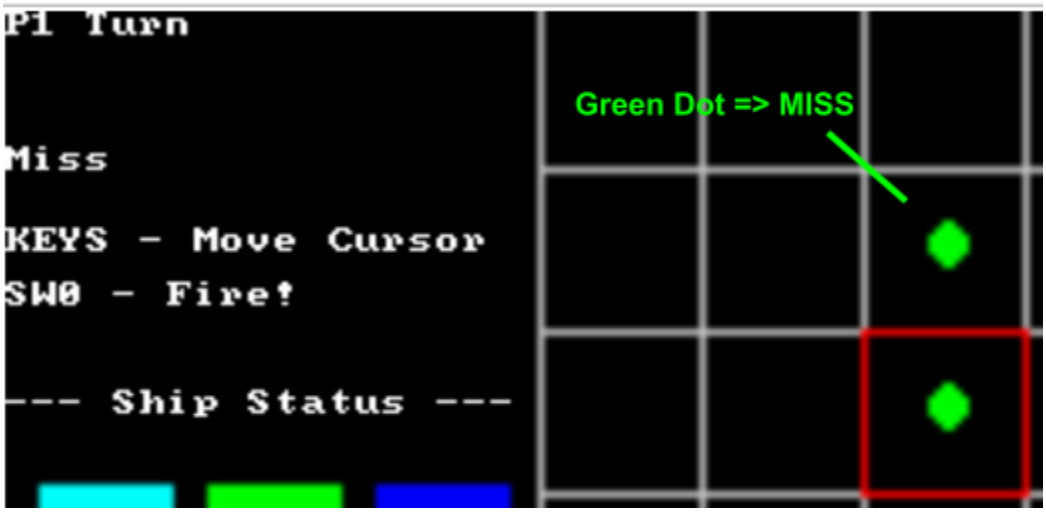

Figure 9. Game reaction when a player misses a ship

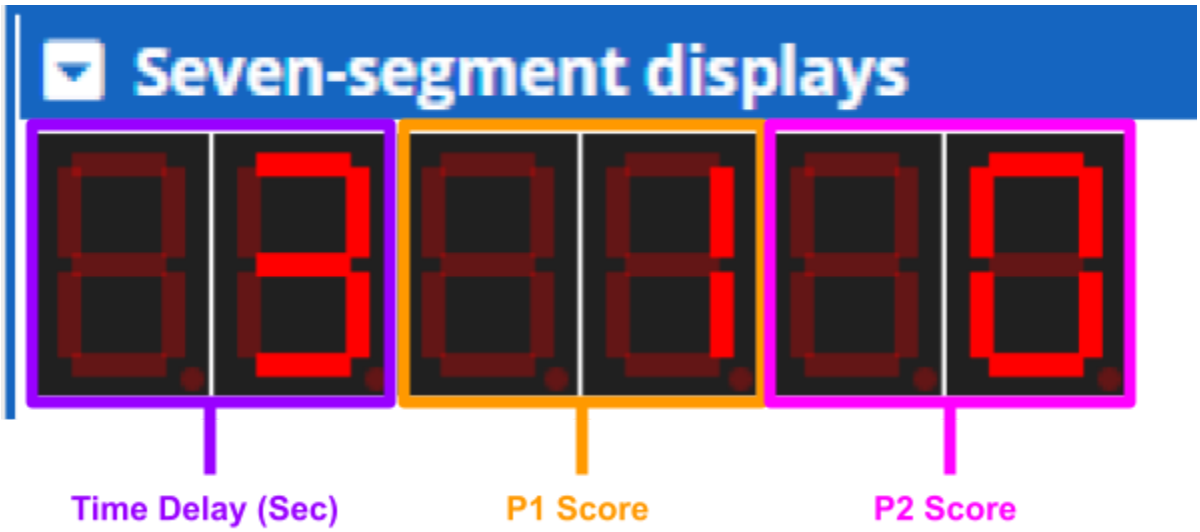

Figure 10. HEX display values and what they represent

The game will then change to Player 2. If two player mode is enabled there will be a transition slide(Figure 11) and a timer countdown as shown in Figure 10, then the second player will get to choose a position. If two player mode is not enabled the computer will generate a random guess. If a player guesses a position that was already taken they will have to keep guessing until they find an unguessed position. If a player hits all the segments in a ship the status bar will display sunk in addition to Hit.

Figure 11. Transition Slide from Player 2 to PLayer 1

The game will go back and forth between the two players until one player and hit all the opponents ship segments. The game will then enter the end sequence.

Instructions (End Sequence)

Once a player has won the losing player will get to see where their opponents ships were located. Then after a KEY press the game will advance to the win screen where the winning play will be shown as seen in Figure 12 and their name output on the HEX displays “P1 - 1st” or “P2-1st” which will shift left and right as shown in Figure 13.

Figure 12. End game Win Screen

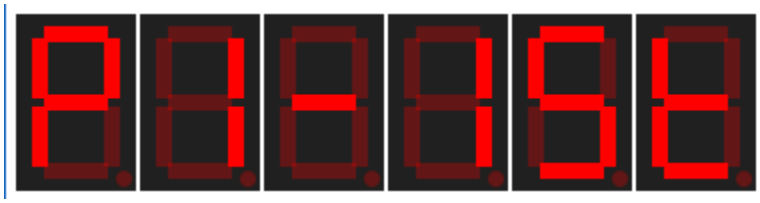

Figure 13. “P1-1st” Winning player displayed on Hex after game over

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Attribution

It is our opinion that the work distribution was made as even as possible between the two collaborators of this project; Ben Smieja, and Khantil Desai. The following is the breakdown of the functions/data structures in the game as well as who made them.

Ben Smieja	**Khantil Desai**
drawTitleScreen	Ship Segment Struct
DrawGrid	Ship Struct
DrawCursor	Ship Array for Players
ChooseHitPlacement	Ship Segment Array for Players
WaitForButtonPress	DrawShipSegment
ClearBoard	DrawShip
DrawWordLine	undrawShips
PlacementValid	DrawHit
hitType	DrawMiss
updateSunkFlag	RotateShip
SegmentHit	TranslateShip
SegmentHitSetup	selectShip
playGame	PlacementValid
drawHits_Miss	DrawAllPlacedShips
takeTurn	DrawHex
drawRectangle	DrawLed
drawPreviewHit	DrawShipBlowPattern
drawPreview	drawLed
selectGameMode	clearLed
WaitForTime	Setup
drawHex2Dig	
drawHexWinner	
drawTransitionTo	