Software Design Document

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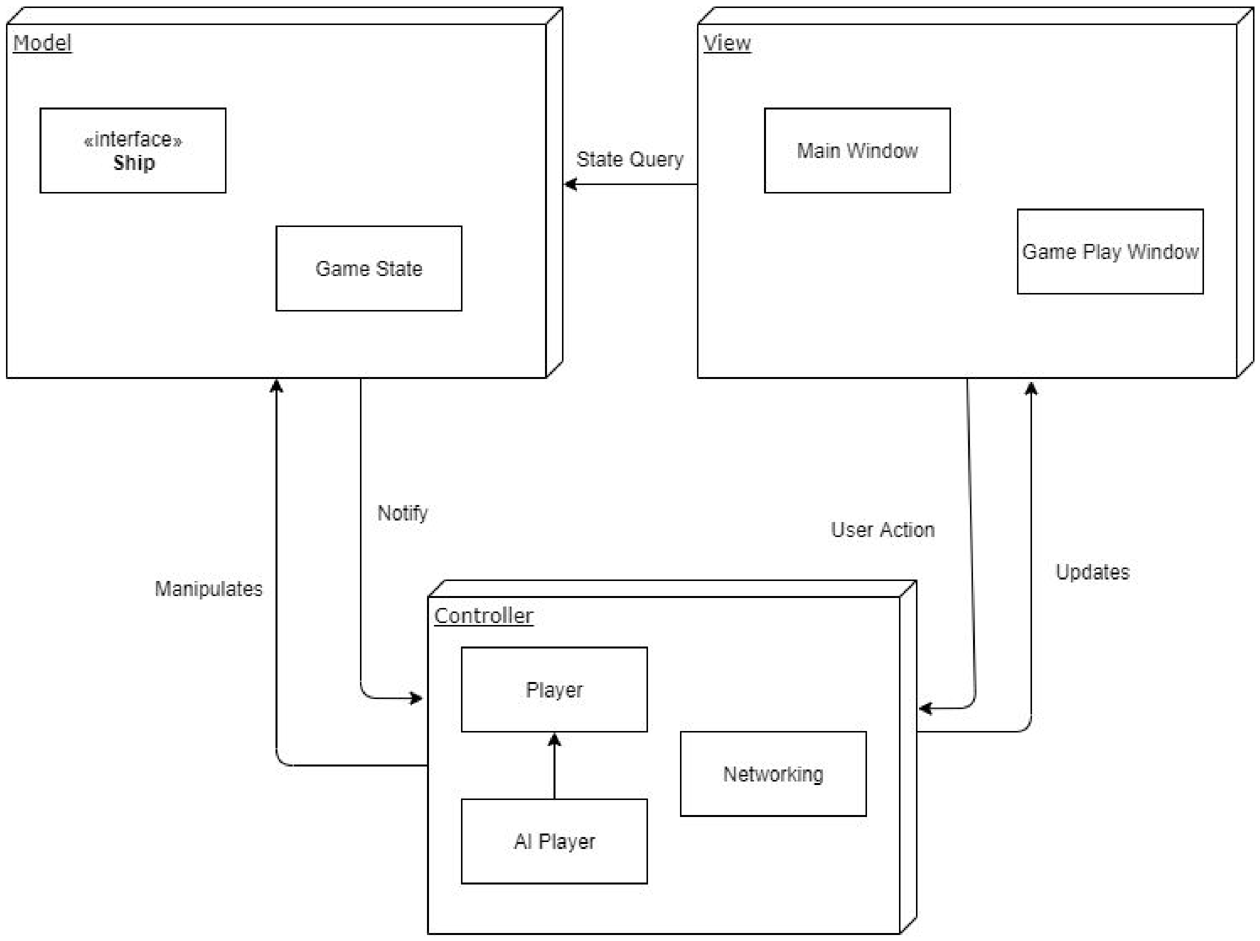
Introduction

The purpose of this document is to guide the implementation phase of creating an online game of Battleship. The purpose of the product is to create a way for a person to play a game of Battleship by themselves or for two people who are unable to play in person (either due to not having the physical game or not being in the same physical location) to play a game of Battleship together via the Internet. This project is completed in partial fulfillment of the requirements for Otterbein University's COMP 3100 course. This has been implemented under the guidance of a university professor. This product is useful for the entertainment of 1-2 people.

The remainder of this document outlines ~~how the style and~~ the implementation of the various classes that make up this product. We begin with specifying the overall architecture of the system and then go on to specify the design of the data structures and the classes that will be used in the implementation. We also include depictions of the user interface as well as a small working prototype. Lastly milestones for the implementation phase are laid out and depicted using a Gantt chart.

System Architecture

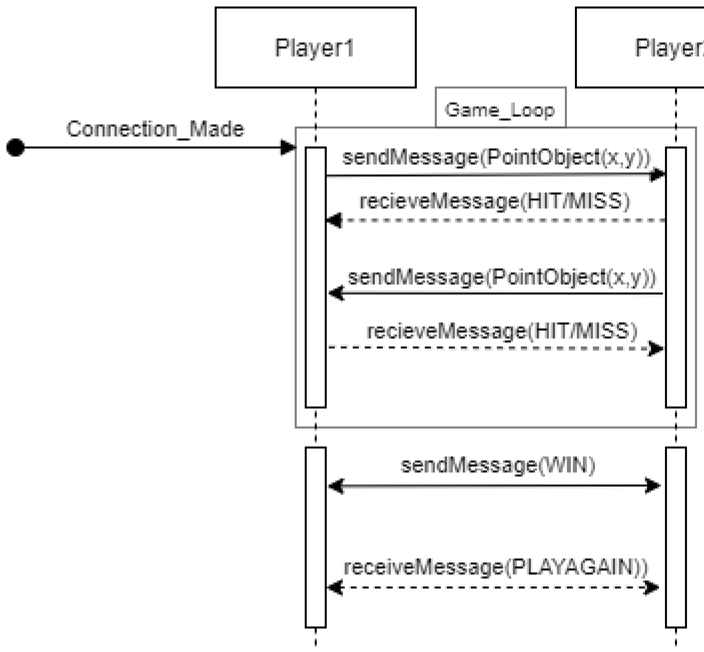
Overall, our software will be modeled using the Model-View-Controller architecture. Our model classes will include ships and the state of the game board. The view will include a main window class and a game play window class. The controllers will be a networking class, a Player class, and an AIPlayer class, which extends the player class. The networking will handle all the network interactions between the two players. The Player class will coordinate all the interactions between the model and the view as well as running the AI's turn when necessary. Below is a block diagram depicting the basic interactions between the components.



Data Design

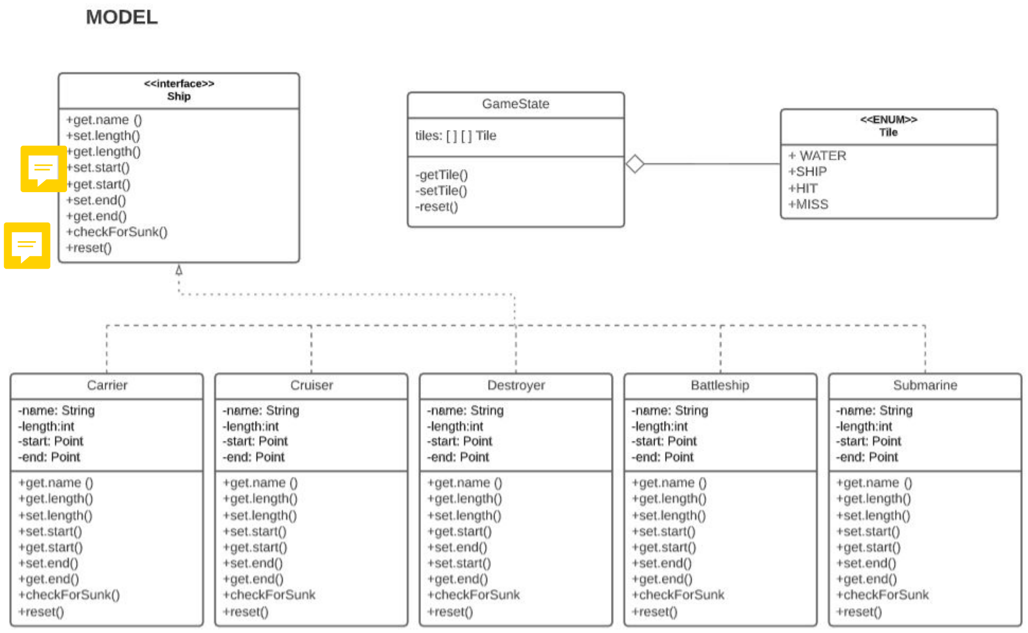
This section outlines the basic data structures that will be employed in this product. We define an enum called Tile that has four values that represent the different states that a given position on the board could have. Each Ship class has members of type Point that define its start and end coordinates. In the GameState class, we use a 2D array with Tile values to represent the current state of a player's game. The Board class uses a 2D array of JButtons to visually depict what is stored in the GameState class.

For the two player mode, the network interaction is described by the figure below. The connection will be created as Player 1 taking the role of server and Player 2 taking the role of client. After the connection is created and the game is started, Player 1 will start by sending a guess selected by the player across the socket. Player 2's game will respond with whether the guess was a hit or miss. The turn will change and then Player 2 will guess and Player 1 will respond with a hit or miss. This will continue in a loop until there is a winner declared. The winner will notify the other player and then wait for a Play_Again_Response to start another game or for the connection to end.



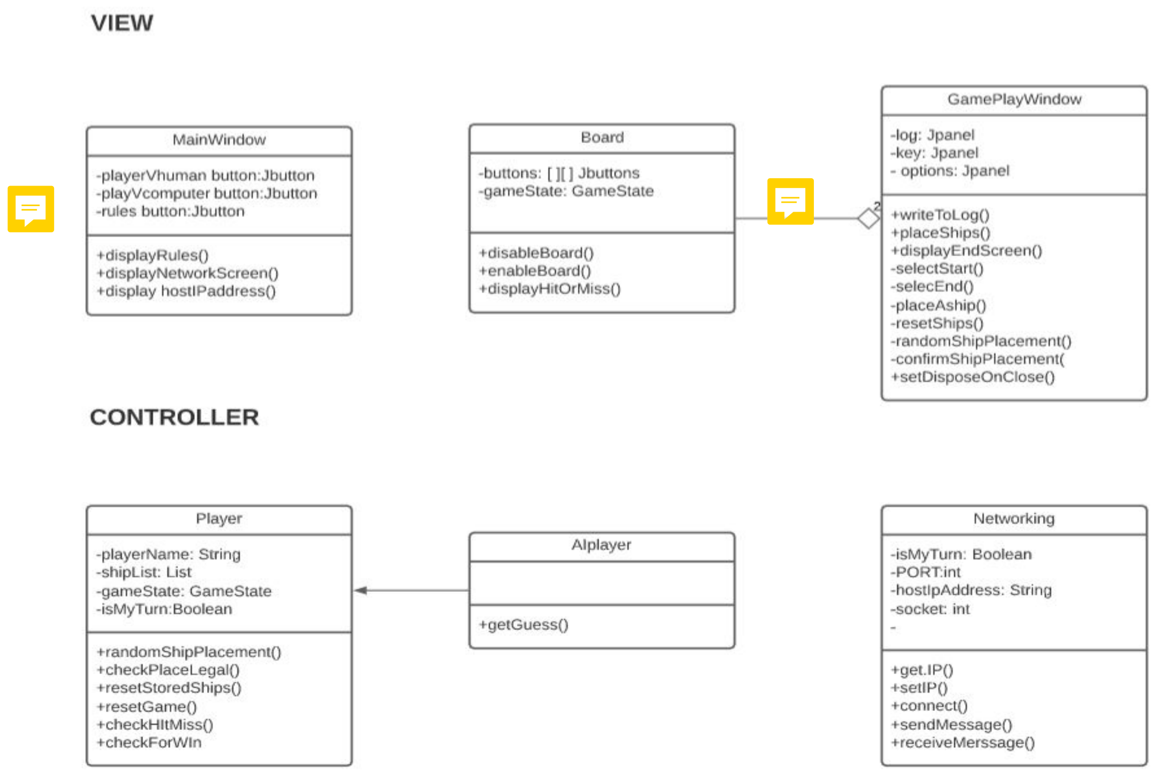
Component Design

The model holds the Ship interface which is implemented by the five ship classes and implements functional requirements 2.10 and 2.12. We have an enum called Tile that represents the states that a position on the board can have. The GameState has a 2D array of Tile values which represents the current state of a player's board and implements functional requirement 2.11.



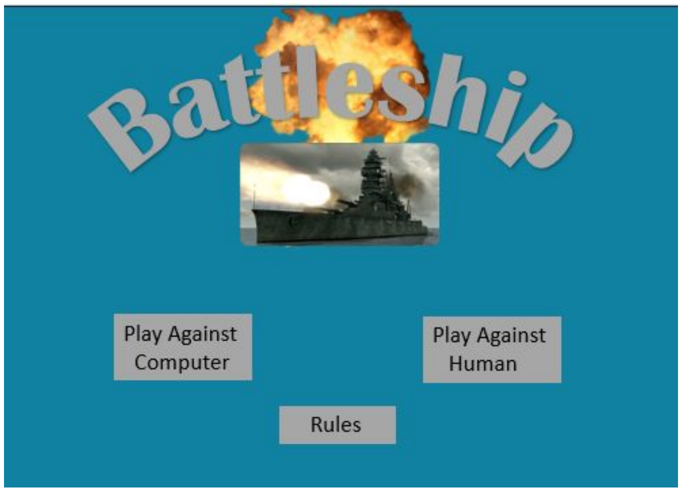
The MainWindow class will run the main menu and start the network connection process and implements functional requirements 1.1-1.8, and 2.14. The Board class visually represents the current GameState and implements functional requirements 1.21, 2.8, and 2.9. The GamePlayWindow class holds two Board objects, one for the current player's board and one for the opponent's board, and will show all of the results from game play. It will also display a window at the end of the game with various options and will implement functional requirements 1.9-1.20, 1.22-1.24, 2.14 and 2.15.

The Networking class establishes connection between two players as well as sends and receives messages throughout the game and implements functional requirements 3.1-3.8. The Player class houses all of the view and model classes and controls the interactions between them during the game and implements functional requirements 2.2-2.7, 2.13, and 2.15. The AIPlayer class extends Player and will implement a strategy for an AI opponent implementing functional requirement 2.1.

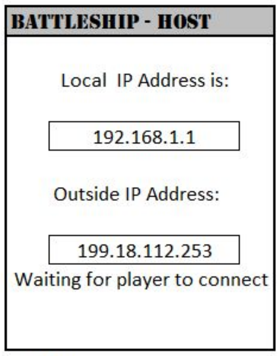


Interface Design

(menu screen and networking screen)



Networking View



Local IP Address is:

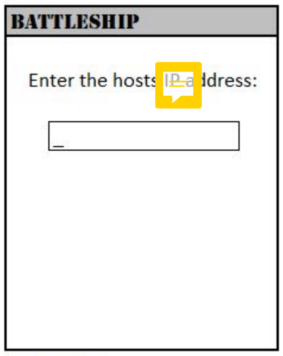
192.168.1.1

Outside IP Address:

199.18.112.253

Waiting for player to connect

Host view



Enter the hosts IP address:

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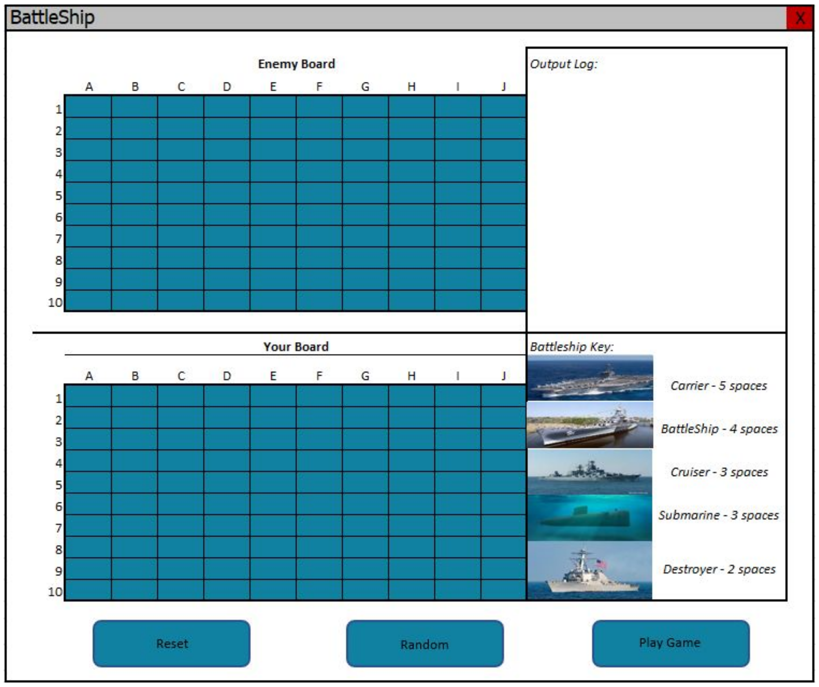
Player to join

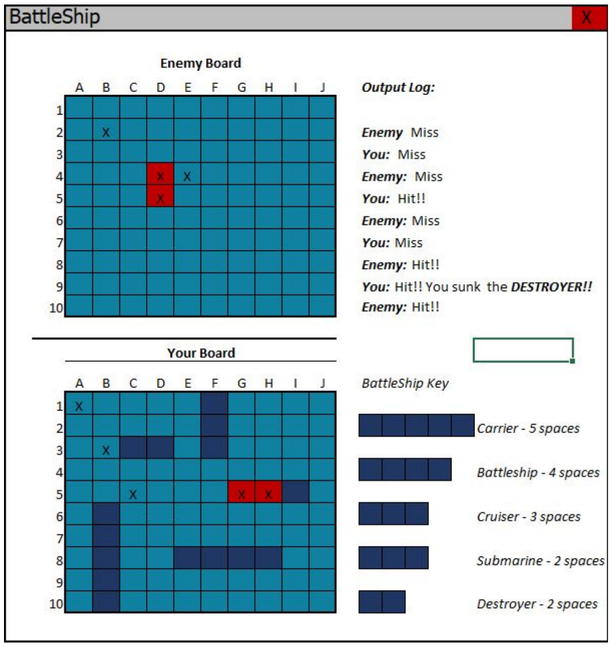
During the ship placement phase, the buttons on the enemy board are all disabled. The buttons on the player's board are enabled so that the player can place their ships on the board. These buttons disable when a ship is placed down so that no ships are placed on top of each other.

Game board during ship placement



During gameplay, all of the buttons on the player's board are disabled. The buttons on the enemy's board are enabled on the player's turn and disabled on the enemy's turn. When the player clicks on the enemy's board to make a guess, the icon on the clicked button changes to show whether it was a hit or a miss. The clicked button then permanently disables. When the enemy makes a guess, the icon of the corresponding button on the player's board changes to reflect whether the guess was a hit or a miss.

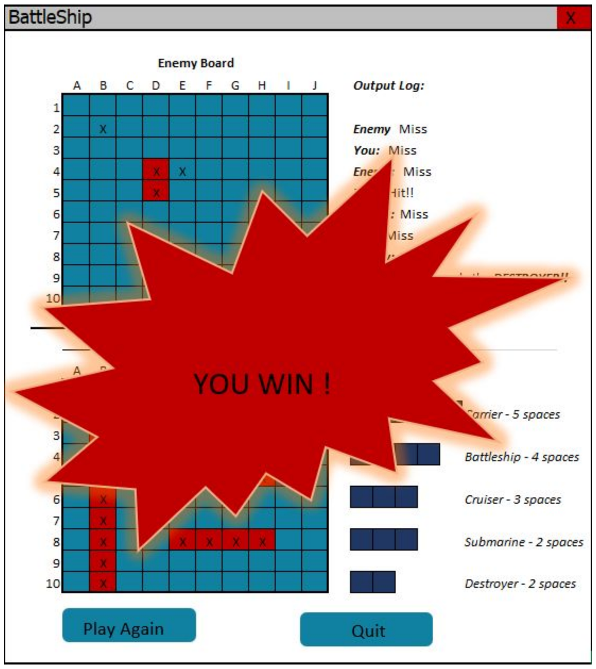
Game board during gameplay



Output Log:

Enemy Miss
You: Miss
Enemy: Miss
You: Hit!!
Enemy: Miss
You: Miss
Enemy: Hit!!
You: Hit!! You sunk the ***DESTROYER!!***
Enemy: Hit!!

Game Board - Win view

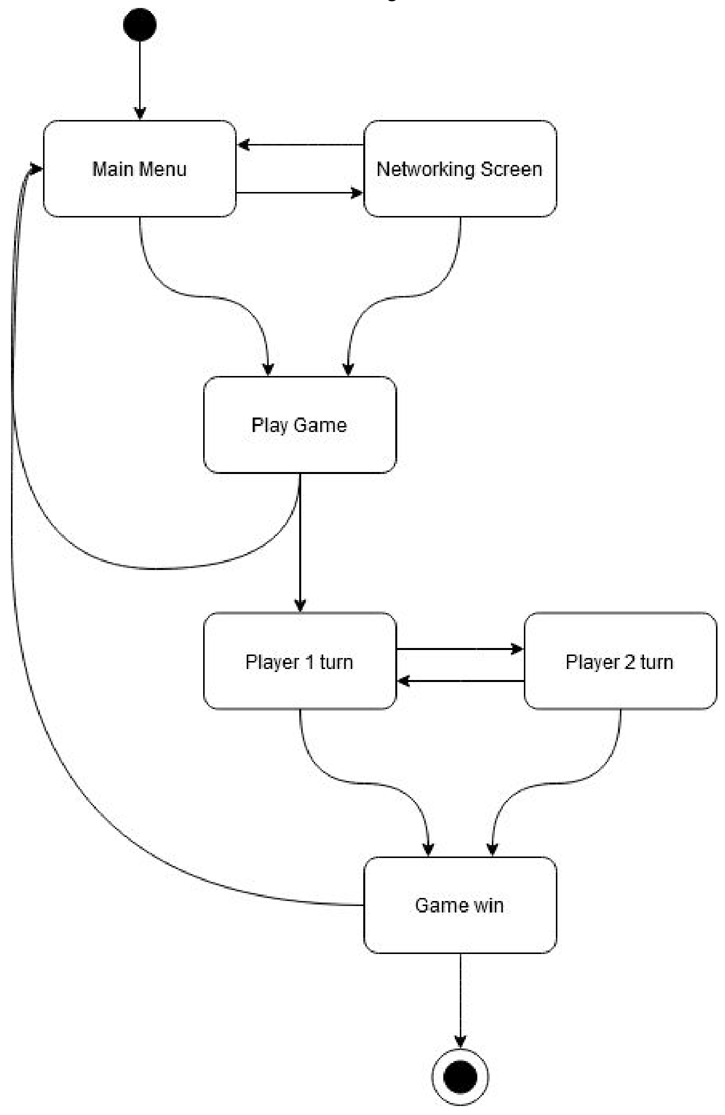


Output Log:

Enemy Miss
You: Miss

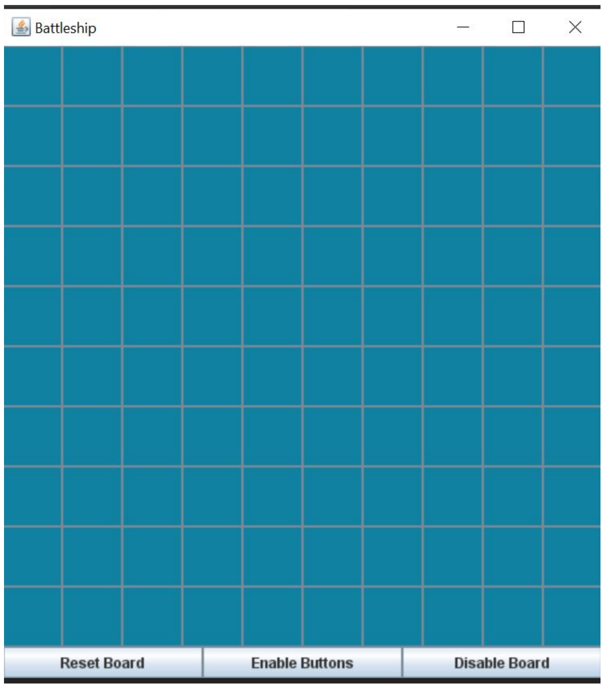
This diagram maps the states that the program can be in and which states transition into each other.

State Diagram

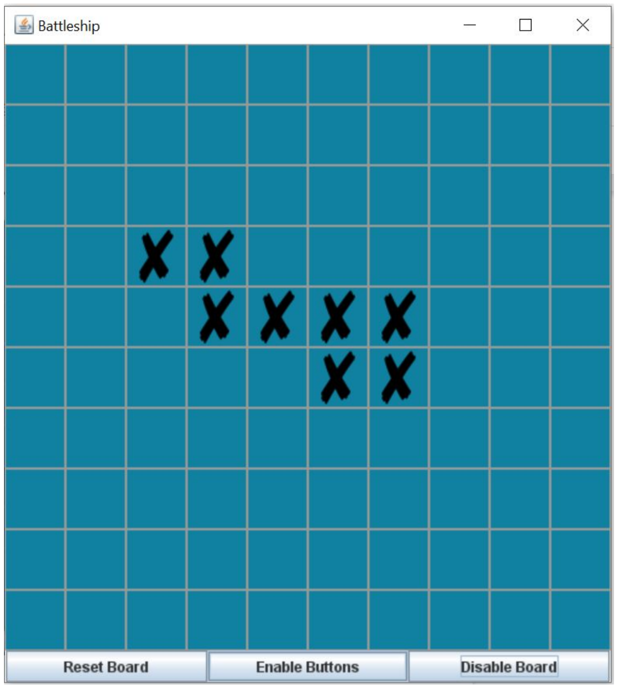


Prototype

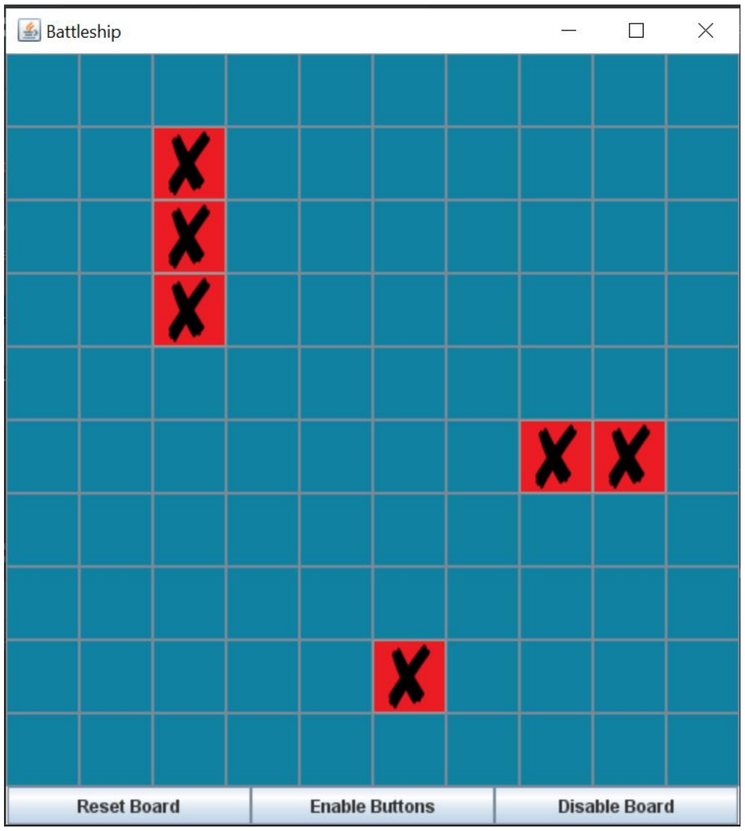
Our prototype models the functions of a single Board object and its interactions with the GameState and Player objects. The Player class is left unimplemented for this prototype. The Board class houses the buttons that make up a player's board, a reference to the player's GameState, and the methods for enabling and disabling buttons. The enableButtons method enables only the buttons that have not already been guessed. For this prototype, a panel of options has been added for interaction with the board. The checkForHit method is left unimplemented and thus in its current form will only ever display hits or misses depending on if the return value is set to true or false respectively. Below are screenshots of the prototype in different states, source code can be found in our repository on github and be run by running the main method in the Player class.



Board at startup



Board with some spaces missed



Board with some spaces hit

Tasks & Milestones

Task 1 - 2.10, 2.12 - Finish ship classes	10/16/2020
Task 2 - 1.21, 2.8, 2.9, 2.11 - GameState and Board classes	10/16/2020
Task 3 - 1.1-1.8, 2.14 - Menu window with popups	10/16/2020
Task 4 - 1.9,1.11-1.13, 1.15-1.19, 2.3-2.6, 2.15 - Ship placement	10/23/2020
Milestone 1 - Place Ships on Board	
Task 5 - 1.10, 1.20-1.22, 2.2, 2.7, 2.13 - Game play	10/30/2020
Task 6 - 2.1 - AIPlayer	10/30/2020
Milestone 2 - Playable game	
Task 7 - 1.14, 1.23, 1.24 - End game options	11/6/2020
Task 8 - 3.1-3.8 - Networking	11/6/2020
Milestone 3 - Finished Implementation	

Battleship Gantt Chart

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▨ Plan Duration

ACTIVITY	PLAN START	PLAN DURATION	Weeks				
			1	2	3	4	5
Task 1	1	1	▨				
Task 2	1	1	▨				
Task 3	1	1	▨				
Task 4	2	1		▨			
Task 5	3	1			▨		
Task 6	3	1			▨		
Task 7	4	1				▨	
Task 8	4	1				▨	