# ONLINE "GAME OF THE GENERALS" WEB GAME

An Application Development Project

Presented to the Faculty of the

College of Computer Studies

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**Table of Contents**

**List of Figures**

**List of Tables**

# SOFTWARE

# DEVELOPMENT PLAN

# (SDP)

## I. Introduction

The gaming industry continues to grow with the online field bringing competitive multiplayer games accessible and entertaining throughout the world. Part of the industry is the board games market, which is projected to grow by 2.56 billion US dollars from around 2021 to 2025 [1]. Online board games have been increasingly become popular due to their exposure in media, such as TV shows and streaming services of internet icons, and their simple gameplay and accessibility to all possible age groups. One case of a board game that has had its online version become popular is chess, with the most popular online platform being chess.com. During the lockdown and pandemic of 2020, online games gained a surge in popularity, especially board games, through their easy-to-learn nature. Moreover, the media has helped through the Netflix show "The Queen's Gambit" and the virality of the streams from internet icons such as Twitch streamers xQc and Hikaru Nakamura [2].

Most classic board games have their online version made, and they are subjected to the possibility of gaining popularity and profit like the case of chess. It would help Filipino awareness and be a good source of profit if a known Filipino board game is made online. One case is Tongits Go, an online game of Tongits, which has mostly placed in the top 50 games on the Apple App Store in multiple categories in the Philippines [3]. A possible game to tap into is the Filipino board game "Game of the Generals" or "*Salpakan*". The game simulates armies at war with the fog of war feature applied by making a player not see the unit's details of the opponent [4].

The developer aims to create an online web version of the game "Game of the Generals". The development will be done in an incremental model, implementing the online server followed by the core features of the application, which are, in the specified order:

- Create room

- Join room

- Quick match function

- Piece placement

- Game

These features would allow the application to function as the online version of the Filipino board game, opening it to a vast market that will increase awareness of the game and its potential for profit.

## II. Project Organization

The project will be developed by a single developer. The developer will assume a role depending on the stage of the development. The roles are back-end developer, game developer, and quality assurance.

The back-end developer role will be the first out of the three roles to be assumed by the developer. This role will focus on setting up the requirements to handle the system to route two different clients into the application's online server and ultimately the

multiplayer for the game. This includes the creation and joining of rooms for games, queueing users for games, and handling connections and temporary disconnection from users. Testing and debugging of all these functions are to be done in this role before developing the game to ensure two users can interact online.

The game developer role will be the second out of the three roles to be taken by the developer. This role will focus on designing the game aspect of the project, which is the "Game of Generals". The role shall focus on developing the base engine of the game, including all the logic, rules, interactions, assets, and other aspects of developing the game. Testing and debugging of the game functionalities are to be done in this role before progressing to the next role. The developer would switch back to the back-end developer role should there be problems encountered outside game functions. Completing this stage of development assume that the system is complete.

The last role is quality assurance. Assuming this role would require the entire system to be completed. This will include the quality control of the application, ensuring that all intended features and functionalities are present. Also included is the testing of all components of the application to ensure that they work under all possible interactions and scenarios.

Each role is taken and done successively, returning to the previous roles if there are unexpected needs for adjustments discovered while assuming the next role.

### III. Software Process Model Description
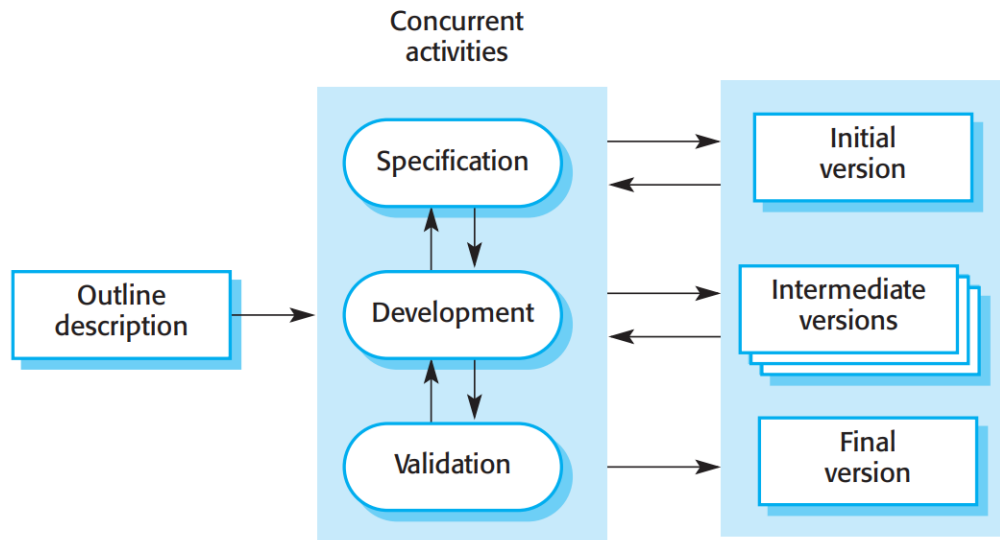


**Figure 1:** *Incremental Development*

Incremental software development [5], as shown in Figure 1, divides the development into versions, first starting with an initial version, followed by important versions that are developed successively, and finally ending with a final version. Each version is treated as a working system that needs to be completed before moving on to the next. As the project organization for the development of this application relies on one developer, it is clear that switching between roles will be done incrementally, without any parallel progress. An incremental model was determined to be the best approach given the situation.

The first version, which is before any role is assumed, will be setting up the foundations of the application by exploring the requirements and needs for building up the complete system. In chronological order, the intermediate versions would consist of:

**Online Server:** This is the server logic that would allow users to connect to and where the system could create rooms, direct users to these rooms, and set up room properties that are updated in parallel with the game where two users are playing in a room. Included in this version is the lobby, which is a scene in the client where the users stay after they connected to the server, and where they can access the features to create or join rooms.

**Create and Join Room Functions:** These are client functions that would allow users to create or join custom rooms in the online server. These functions allow two users to get into the same room and play against each other.

**Quick Match Function:** This is one of the client functions that would allow users to create or join rooms randomly without the need to input room names. This function would allow a user to join a game and go against a random opponent.

**Piece Placement:** This is one of the client functions that would allow users to place their pieces on the field in preparation to join and start the game. After setting up the pieces, the user would wait for the other user in the room to finish setting up their pieces. Once both users are finished, the game would start. Included in this version is the system's handling of disconnections and redirecting of users back to the lobby should there be problems where a game cannot start. This version is still under the back-end role.

**Game:** This is the most important version of the application. This version is developed by the game developer role. Included in this version is the system's handling for ending the game, which would terminate the room and let users return to the lobby, should they wish to play another game.

The final version would be testing and improving the overall system under the role of quality assurance. Each version will have its own planning, modeling, construction, and deployment.

## IV. Risk Analysis

Online board games are defined by the need for two players to play the game in a shared session, and in most cases, these sessions are numerous especially when the application is popular, as it is intended to be. This is the main focus on where the important risks are to be found and managed properly. Other risks include the game itself, which is a local-made game, needs an introduction and clear communication to users of different backgrounds on how to play it, and the user interface of the application on how to translate the game to an interface that would be as easy or even easier and intuitive to interact with.

**Table 1:** *SWOT Analysis*

| SWOT ANALYSIS | | | |
|---|---|---|---|
| **Strength** | **Weaknesses** | **Opportunity** | **Threats** |
| - Accessibility to the game for more users compared to the physical version | - Current lack of exposure to the game for users to have the interest to play | - Rise in the popularity of the physical version of the game may contribute to a rise in the popularity of the application | - Incompatibility and instability in the technology, hosting and plug-ins used may cause unexpected bugs to occur spontaneously in the long run after deployment |

| | | | |
|---|---|---|---|
| - Relatively new game for the online tabletop games market | - Lack of a large userbase to sustain a fast-loading time for matching stage of the game in the multiplayer feature<br><br>- Lack of multiple well-known features of online tabletop games in the initial version of the application | - General popularity and trend of the tabletop games market directly contributes to the popularity of the application | - Hosting problems that may give unfair disadvantages in playing the game to users in certain regions<br><br>- Server problems due to lack of capabilities to hold an unexpectedly high number of concurrent users |

**Table 2:** *Identified Risks and Proper Management/Mitigation*

| Identified Risks and Proper Management/Mitigation | |
|---|---|
| **Risk** | **Management/Mitigation** |
| **Technical -** Issue on an increase of concurrent users and insufficient server capacity | Update budget for hosting when trends show that the application holds a stable high number of concurrent users |
| **Design -** Lack of additional features similar to popular online tabletop games | Communicate with the users by establishing platforms and communities to get dynamic feedback and suggestions, allowing for the proper transition of better |

| | designs by adding or adjusting features |
|---|---|
| **Communication -** Difficulty of getting to learn the game and other features of the application | Adjust instructions and design according to user feedback from future surveys |
| **User Acceptance -** Deviation of design and intended user experience as new features are added | Focus on quality assurance as the application improves and expands, utilizing platforms and communities to gauge their acceptance of the improving design |
| **Commercial -** Exposure of the game to potential users | Establish a community of users, maintaining a proper communication with them, while utilizing media to increase popularity, such as advertisements and integration with influencers and streamers |
| **External -** Competition with other online versions of the game | Focus on expanding established communities for loyalty and improve features in parallel with the wants of the communities |

There are multiple risks involved in an established game having its online version deployed while its awareness and popularity are still low. It is important that throughout its lifespan after deployment, it is constantly monitored and maintained to adjust for the current state of both the application and the game itself.

## V. Work Breakdown Structure
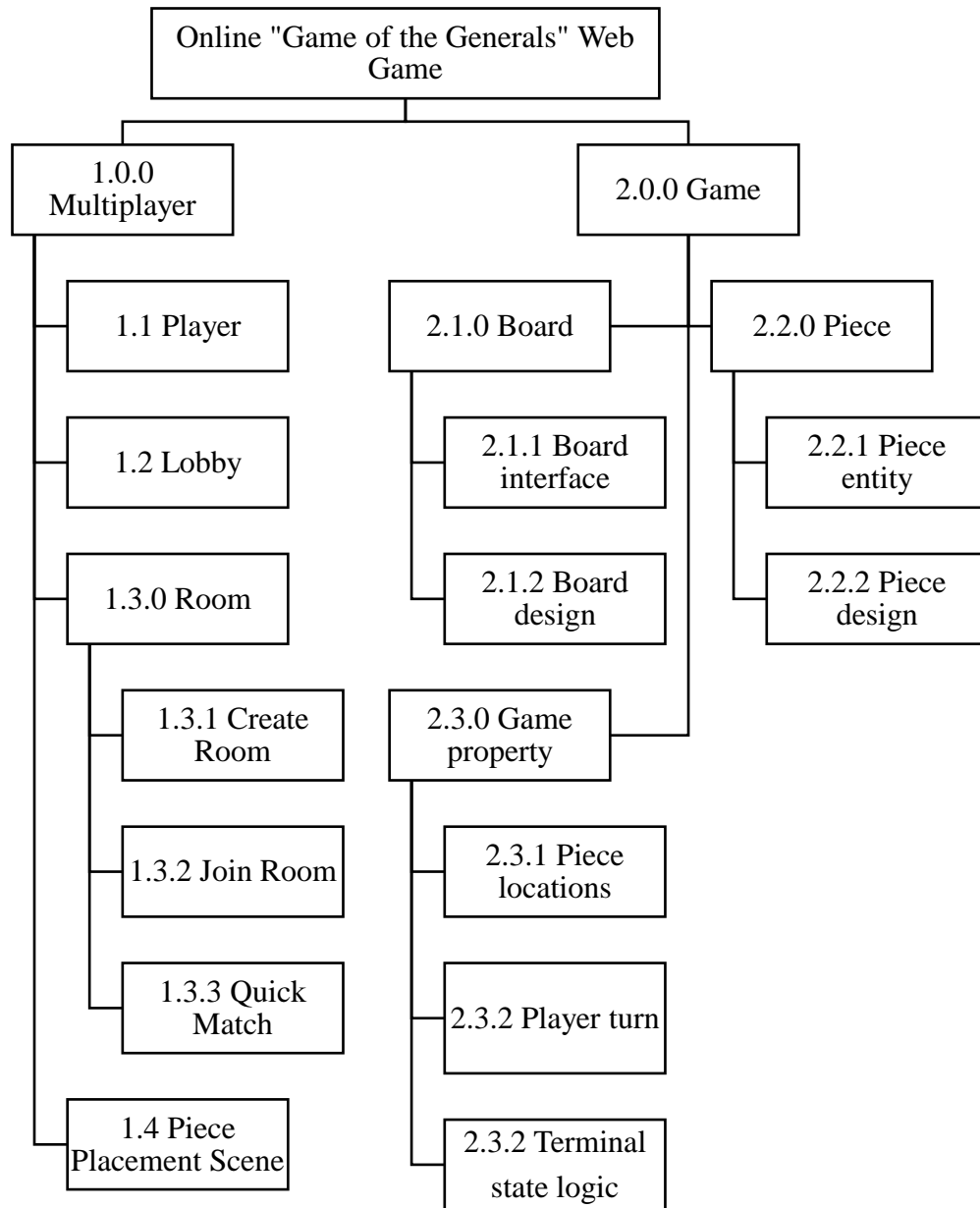


**Figure 2:** *Work Breakdown Structure*

Shown in Figure 2 is the work breakdown structure of the Online "Game of the Generals" Web Game. It is subdivided into parts that reflect the versions stated in the incremental model.

The multiplayer system is the system that the back-end developer role covers. In the online server version, the player and lobby subsystems are. The player subsystem represents the user identity in the online server and how they would interact in each room, and the lobby is the scene in a client where a user would stay when they are connected to the server. The room subsystem would cover the creation and joining of rooms, which would hold two users and handle a game between those users. The subsystems under it would be the versions create and join room functions and the quick match function. The last subsystem would be the piece placement scene, which is the last version to be developed under the back-end developer role.

The game system is composed of all components of the game. It is expected that it will be subdivided into the board, piece, and game property subsystems in development. The board system involves a board interface, which handles how players see and interact with the board, and the board design, which dictates how the board looks in the game. The piece system includes the piece entity, which holds information and interaction of the pieces, and the design of the pieces in the piece design subsystem. The game property is a subsystem that is attached to the room in which the game is held, which means this is the logic of handling the game in the online server. The game property has the piece locations subsystem, which keeps track of where the pieces are in a game and handles the movement and challenges of each piece. It also has the player turn subsystem, which handles the passing of turns between players, and the terminal state logic, which checks the state of the game end condition that has been reached.

## VI. Project Schedule

**Table 5:** *Project Schedule*

| Activity ID | Specific Activity | Predecessor | Duration (in Weeks) |
|---|---|---|---|
| First Version | | | |
| A | Making the Software Development Plan | None | 3 |
| B | System Analysis | A | 1 |
| C | Formulating the Software Requirements Specification | A | 3 |
| Back-end Versions | | | |
| D | Development of the Online Server | B | 1 |
| E | Development of the Create and Join Room and Quick Match Functions | D | 2 |
| F | Development of the Piece Placement Scene | E | 1 |
| Game Version | | | |
| G | Organizing of Requirements for the Game System | E | 1 |
| H | Development of the Game | G | 1 |
| I | Conducting Tests for the Game | H | 1 |
| Final Version | | | |
| J | Conduct Final Tests | F, I | 1 |
| K | Finalize Documents | H, C | 1 |
| L | Presentation | J, K | 1 |

**Table 6:** *Gantt Chart*

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Making the Software Development Plan | ■ | ■ | ■ | | | | | | | | | |
| System Analysis | | | | ■ | | | | | | | | |
| Formulating the Software Requirements Specification | | | | ■ | ■ | ■ | | | | | | |
| Development of the Online Server | | | | | ■ | | | | | | | |
| Development of the Create and Join Room and Quick Match Functions | | | | | | ■ | ■ | | | | | |
| Development of the Piece Placement Scene | | | | | | | | ■ | | | | |
| Organizing of Requirements for the Game System | | | | | | | | ■ | | | | |
| Development of the Game | | | | | | | | | ■ | | | |
| Conducting Tests for the Game | | | | | | | | | | ■ | | |
| Conduct Final Tests | | | | | | | | | | | ■ | |
| Finalize Documents | | | | | | | | | | | ■ | |
| Presentation | | | | | | | | | | | | ■ |

**Legend:**

■  Finished

□  Unfinished

## VII. Ethical Considerations

"Games of the General" is a board game invented by Mr. Sofronio Pasola Jr. and was patented on March 15, 1973 [6]. This patent expired in 2012, which means there are no concerns about copyright issues other than the need to inform the users of the history of the game as part of the application. There will be no monetization on the release version of the game directly to avoid commercial issues. Due to this, there are not many ethical considerations for the game part.

Licensing of the platforms to be used for the application will focus on the free versions of Unity, which will be the platform for developing the game, and Photon Server, which will be the platform for handling the multiplayer feature.

# SOFTWARE

# REQUIREMENTS

# SPECIFICATION (SRS)

## I. Introduction

### A. Purpose

The main purpose of this system is to create an online multiplayer version of the game "Game of the Generals". It is designed to be a web application so that people can access the game easily without the worry of downloading the software and what device to use. The main feature of the system is the multiplayer game, which, in addition to the game itself, would allow two different users to interact with the game. This is manifested through the core features of the application, which are the create and join room functions, the quick match function, the piece placement scene, and the game. These features allow for a better user experience and accentuate the game. The overall goal of developing this application is to explore the possible share of the board game "Game of the Generals" in the popular online board games market.

### B. Intended Audience

Board games are designed so that it is understandable and playable by almost all age groups. The system features only the board game "Game of the Generals", with other features serving to improve the user experience playing the game. The intended audience is all age groups that are interested to play the game with random people or with their friends. These audiences must

## II. Glossary

**User:** A person using the application. A user interacting in a room or a game is referred to as a player.

**Client:** The local version of the application a user is interacting with. Other users cannot directly interact with it.

**Game of the Generals:** The game of the system. The rules and interactions are based on the game "Game of the Generals" developed by Sofronio H. Pasola Jr. in 1970 [7].

**Room:** A shared space in the server where a copy of the game is set for users can interact. A game in one room does not reflect games in other rooms.

**Random Room:** A type of room that is randomly generated, which means it has no room name that users can selectively enter. Random rooms are only created from the quick match feature.

**Player:** The user that interacts in a room and controls one color set of pieces. A player can either be a red player, who has pieces at the top of the board, or a blue player, which has pieces at the bottom of the board.

**Turn:** A capability that can be inherited by only one player. A player who has their turn can interact with their pieces. Once a piece has been moved, the turn is passed to the other player.

**Tile:** A rectangular platform that serves as a position in a board. A tile can hold one piece or can be empty.

**Adjacent Tile:** The tile directly next to another tile. A tile has four adjacent tiles, which are tiles that are directly above, below, to the left, and the right of the tile. Pieces can only move to empty tiles or challenge the other player's pieces that are on adjacent tiles.

**Piece:** The individual movable item a user can move on the board. A piece has a value and is subject to rules in the Game of the Generals. Red pieces belong to the first player to enter a room while blue pieces belong to the last player. Each player has a total of 21 pieces at the start of a game.

**Unidentifiable Piece:** The piece that is owned by the other player and viewed by the user's client. The piece's identity and value are hidden from the user, and all other pieces of the other player look similar.

**Challenge:** An attack from a piece that is moving towards a tile occupied by a piece from the other player. The result of a challenge depends on the value of the pieces involved in the challenge. When an attacking piece wins a challenge, it will stay on the board and the other player's piece will be removed. When an attacking piece loses a challenge, it will be removed from the board and the other player's piece will stay. When the challenge results in a draw, both pieces are removed from the board.

**Marker:** This is a highlighted tile that is adjacent to a user's piece that they last clicked. Move markers refer to the highlighted empty tiles that the piece can move into. Challenge markers refer to the highlighted tiles occupied by the other player's pieces that the user's piece can move into and challenge. The two markers have designs different from the other.

**"Flag" Piece:** The most important piece of a player. This piece will win a challenge when attacking the other player's "Flag" piece. A "Private" piece, "Spy" piece, any ranked piece, or the other player's "Flag" piece will win a challenge when attacking this piece. A player with a defeated "Flag" piece is considered defeated. A player that can place their "Flag" piece to the other end row and have it stay there for one turn is considered victorious. Each player has only one "Flag" piece at the start of a game.

**"Private" Piece:** The lowest valued piece of a player. This piece will win a challenge when attacking the other player's "Flag" piece. A "Spy" piece or any ranked piece will win a challenge when attacking this piece. A draw will occur when another "Private" piece attacks this piece. Each player has six "Private" pieces at the start of a game.

**"Spy" Piece:** The highest valued piece of a player. This piece will win a challenge when attacking any ranked piece or the other player's "Flag" piece. A "Private" piece will win a challenge when attacking this piece. A draw will occur when another "Spy" piece attacks this piece. Each player has two "Spy" pieces at the start of a game.

**Ranked Piece:** The common set pieces of a player that has varying values. This piece will win a challenge when attacking a "Private" piece, the other player's "Flag" piece, or a ranked piece of a lower value. A "Spy" piece or a ranked piece of a higher value will win a challenge when attacking this piece. A draw will occur when another "ranked" piece with the same value attacks this piece. Each player has twelve unique ranked pieces at the start of a game. These are the ranks of the pieces arranged from the highest value to the lowest: Five Star General, Four Star General, Three Star General, Two Star General, One Star General, Colonel, Lt. Colonel, Major, Captain, 1st Lieutenant, 2nd Lieutenant,

and Sergeant. Each piece has a unique design that is different from the other ranked pieces.

**Board:** The space in which pieces are placed and moved in. The board is a two-dimensional placement of nine-by-eight tiles.

**Field:** A section of the board. This is a two-dimensional placement of nine-by-three tiles. A player can place pieces in any of the tiles on the field before entering the main game scene. This field is placed at the top section of the board for red pieces and the bottom section for blue pieces.

**End Row:** The row of tiles at the very edge of the board. The end row for the blue player is at the bottom row and the end row for the red player is at the top row. The other end row for a player is the end row of the other player.

**Piece Placement Scene:** The window a player is interacting with where they can place their pieces onto their field before the start of the game. Included is the waiting scene that the player transitions to when they have finished placing their pieces and is now waiting for the other player to finish placing their pieces. This scene is active when referring to the piece placement feature.

**Game Scene:** The window a player is interacting with where the board and pieces of the player and the opposing player are seen and interacting with each other. This scene is active when a game has started and when referring to the game feature.

**Terminal State:** A state where the game ends by entering into a situation where one player is victorious, and the other player is defeated. This state is used to determine when a system will end a room.

## III. Operating Environment

The operating environment for the Online "Game of the Generals" Web Application is as follows:

**Hardware:** Desktop Computer, Tablet, and Smartphone

**Operating system:** Windows 7 or later, macOS 12 or later, iOS 15 or later, ipadOS 15 or later, Android 5 or later, and other operating systems that support the following software

**Software:** Chrome 56 and above, Edge 79 and above, Safari 15 and above, Firefox 51 and above, Opera 43 and above, Chrome 106 for Android, Safari & other browsers on iOS 15 and above, Samsung Internet 7.2 and above, Opera 64 for Android, UC Browser 13.4 for Android, Android 5-6.x WebView: Chromium 106, Firefox 105 for Android, QQ Browser 13.1, Baidu Browser 13.18

**Online Server:** Photon Server

**IV. System Features**

**A. Create Room**

  **i. Description and Priority**

  A user can create a room in the server and join that room. This feature would allow a user to input a name for a room that does not exist on the server, and the system would create the room with that name. The other player can join the room through the join room function, inputting the same name. Creating a room would make the user a red player in the game inside the room,

  Priority: **High**

  **ii. Stimulus / Response Sequences**

  1. The user inputs any text in the textbox in the lobby as the room name and clicks on the "Create Room" button.

  2. The system checks the server for a room with a matching room name.

  3. If a room with the room name inputted already exists in the server, the system outputs an error message saying that the room already exists.

  4. If there are no rooms with the same room name inputted by the user, the system creates a room in the server with the inputted room name.

  5. The user joins the room and is directed to the red player placement scene, which means the user is the red player for the game in the room.

### iii. User Functional Requirements Definition

UREQ 1: The user shall be able to create a room in the server by inputting a room name.

### iv. System Requirements Specification

SREQ 1: The system shall be able to create a room in the server by using the room name inputted by the user as the name of the room.

### v. Non-functional Requirements

NREQ 1: The system shall notify the user when there is a room cannot be created and the reason for it (no text inputted, disconnected from the internet, etc.).

NREQ 2: When creating a room is possible, the system shall be able to create the room and direct the user to that room with little time to wait.

## B. Join Room

### i. Description and Priority

A user can join a room that already existed on the server. This feature would allow a user to input a name for a room that exists on the server, and the system would join the room with that name. Joining a room would make the user a blue player in the game inside the room.

Priority: **High**

**ii. Stimulus / Response Sequences**

1. The user inputs any text in the textbox in the lobby as the room name and clicks on the "Join Room" button.

2. The system checks the server for a room with a matching room name.

3. If there are no rooms with the same room name inputted by the user, the system outputs an error message saying that the room does not exist.

4. If a room with the room name inputted exists in the server, the user joins the room.

5. The user is directed to the blue player placement scene, which means the user is the blue player for the game in the room.

**iii. User Functional Requirements Definition**

UREQ 1: The user shall be able to join a room in the server by inputting a room name to join.

**iv. System Requirements Specification**

SREQ 1: The system shall be able to allow the user to join a room in the server by using the room name inputted by the user as the name of the room to search.

**v. Non-functional Requirements**

NREQ 1: The system shall notify the user why they cannot join a room with the inputted room name (no text inputted, disconnected from the internet, etc.).

NREQ 2: When joining a room is possible, the system shall be able to direct the user to that room with little time to wait.

## C. Quick Match

### i. Description and Priority

A user can join a random room and be matched with any player. This feature would allow a user to instantly enter a room by either creating or joining a random room. A user who joins through a quick match would randomly result in them being a red player or a blue player.

Priority: **Medium**

### ii. Stimulus / Response Sequences

1. The user clicks on the "Quick Match" button.

2. If there are no random rooms created, the system creates a random room and the user joins that room as a red player.

3. If there is a random room in the server, the user joins the room.

4. The user is directed to the red player placement scene if they are the red player or the blue player placement scene if they are the blue player.

### iii. User Functional Requirements Definition

UREQ 1: The user shall be able to randomly join a random room in the server by clicking the "Quick Match" button.

### iv. System Requirements Specification

SREQ 1: The system shall be able to create a random room or joins one when the user clicks on the "Quick Match" button.

**Non-functional Requirements**

NREQ 1: When a quick match is possible, the system shall be able to direct the user to a random room with little time to wait.

## D. Piece Placement

### i. Description and Priority

A user can place their pieces onto the field before joining the game. This feature would allow the user to drag their pieces onto the field and allow any arrangements they can make. Once the user deploys his pieces, the arrangement is placed on the player's field or side of the board when the game starts.

Priority: **High**

### ii. Stimulus / Response Sequences

1. The user drags the pieces from the outside of the field onto any tiles of the field.

2. If a piece is dragged from outside the field and dropped onto any area outside the field, the piece returns to its original location outside the field.

3. If a piece is dragged onto an empty tile in the field, the piece is placed onto that tile.

4. If a piece is dragged onto a tile in the field that already has another piece in it, the piece is placed onto that tile and the piece that was already on the tile returns to its original location outside the field.

5.  If all the pieces are placed on the field and the user clicks the "Deploy" button, they are directed to a waiting scene to wait for the other player.

6.  When the other player finishes placing their pieces, both the user and the other player are directed to the game.

7.  The pieces are placed on the player's field or side of the board and the game starts.

iii. **User Functional Requirements Definition**

UREQ 1: The user shall be able to place his pieces onto the field.

UREQ 2: The user shall be able to deploy his pieces onto the board and wait for the other player.

UREQ 3: The user shall be able to enter the game once the other player has deployed their pieces.

UREQ 4: The user shall be able to quit the piece placement scene and return to the lobby by clicking the "Exit" button.

iv. **System Requirements Specification**

SREQ 1: The system shall allow the user to place his pieces onto the field.

SREQ 2: The system shall be able to transfer the user's pieces onto their field on the board and direct the user to a waiting scene once they finished placing the pieces.

SREQ 3: The system shall be able to direct the user and the other player to the game once they are finished placing the pieces.

SREQ 4: The system shall be able to remove the user from the room and direct them to the lobby when the user clicks the "Exit" button.

## v. Non-functional Requirements

NREQ 1: The system shall notify the user when they cannot deploy their pieces and the reason for it (not all pieces have been placed, disconnected from the internet, etc.).

NREQ 2: The system shall cancel the piece placement, remove the user from the room, and redirect them to the lobby when the other player quits the room, notifying them about the scenario.

NREQ 3: The system shall cancel the game, remove the players from the room, and redirect them to the lobby when one of them has been in the scene for too long, notifying them about the scenario.

NREQ 4: The system shall cancel the game, remove the users from the room, and redirect them to the lobby when one of them has finished placing their pieces but has been waiting for the other player for too long, notifying them about the scenario.

## E. Game

### i. Description and Priority

This feature serves as the game "Game of the Generals" in the system. The user plays against another user in one of the rooms they have created or joined in the server. The users take turns in making a move in the game until a certain state of the game is reached where one of the users is considered the winner. The game ends when one of the users wins.

Priority: **High**

**ii. Stimulus / Response Sequences**

1. When the game starts, the user is placed in the game scene as the red or blue player, depending on how they joined the room.

2. If the user is the red player, then they have the turn.

3. If the user is the blue player, they wait for the other player to finish their turn.

4. If the user has their turn and clicks on one of their pieces, markers are created next to the piece and all previous markers are deleted.

5. If the user does not have their turn and clicks on one of their pieces, no markers appear.

6. If a user clicks on a move marker, the piece that created the marker moves into the tile highlighted by the marker, ending their turn and starting the other player's turn.

7. If a user clicks on a challenge marker, the piece that created the marker moves into the tile highlighted by the marker and challenges the other player's piece that was on the marker, ending their turn and starting the other player's turn after the challenge.

8. If at the start of the user's turn, the user has their "Flag" piece already at the end row, then a terminal state is reached, and the user wins the game while the other player loses.

9. If at the end of a player's turn, the player's "Flag" piece loses a challenge, then a terminal state is reached, and the player loses the game while the other player wins

10. If at the end of a player's turn, the other player surrendered by clicking the "Surrender" button, has consumed spent a total of 30 minutes on their turn or has disconnected for too long, then a terminal state is reached, and the player loses the game while the other player wins.

11. When a terminal state is reached, the game ends, the system shows the user who won and who lost, and the user is removed from the room.

12. The user returns to the lobby when he clicks the "Exit" button.

iii. **User Functional Requirements Definition**

UREQ 1: The user shall be able to play as one of the players in the game.

UREQ 2: The user shall be able to move one of their pieces and end their turn.

UREQ 3: The user shall be able to surrender the game by clicking the "Surrender" button.

UREQ 4: The user shall be able to win or lose the game.

UREQ 5: The user shall be able to exit the game by clicking the "Exit" button after the game ends.

iv. **System Requirements Specification**

SREQ 1: The system shall be able to designate the users to be players in the game.

SREQ 2: The system shall be able to allow the user who has their turn to be able to move one of their pieces and pass the turn to the other player.

SREQ 3: The system shall be able to allow the user to click the "Surrender" button and end the game, declaring the user as the loser.

SREQ 4: The system shall be able to determine a terminal state that has been reached and declare a winner and a loser to the players.

SREQ 5: The system shall be able to allow the user to return to the lobby when they click on the "Exit" button.

SREQ 6: The system shall be able to keep track of the players' total time on their turn and declare that a player loses on default when they spent a total of 30 minutes on their turn.

## v. Non-functional Requirements

NREQ 1: The system shall be able to detect when a user disconnects and allow them to reconnect within 60 seconds, otherwise the user loses on default.

NREQ 2: The system shall be able to restrict the user from making any moves on the game when they have disconnected.

## V. System Evolution

This system focuses on implementing the game "Game of the Generals" in an online multiplayer environment with easy access through its nature of being a web application. Because of this, minimal yet important resources and features are selected to be developed to ensure that this system is deployed within the short development time allocated.

The evolution of this system depends on the evolving user requirements, as more users discover and play this application when it is deployed. Monetization strategies, such as advertisement placements, will be explored when concurrent users increase to a level

beyond the capacity of the hosting services to supply a sufficient budget for the expansion of capacity.

Communities and communication strategies with users will be explored to allow for user feedback on what features to prioritize adding to the system, such as rank and social features, in a reasonable interval of increments. Once there are enough features added to satisfy most of the basic user needs, the system would expand to include other platforms such as mobile and desktop platforms.

The game will be also developed with the consideration that this subsystem can be integrated into third parties, allowing for future development of other related systems, such as a tournament system.

# SOFTWARE

# DESIGN DESCRIPTION

# (SDD)

# I. Data Design

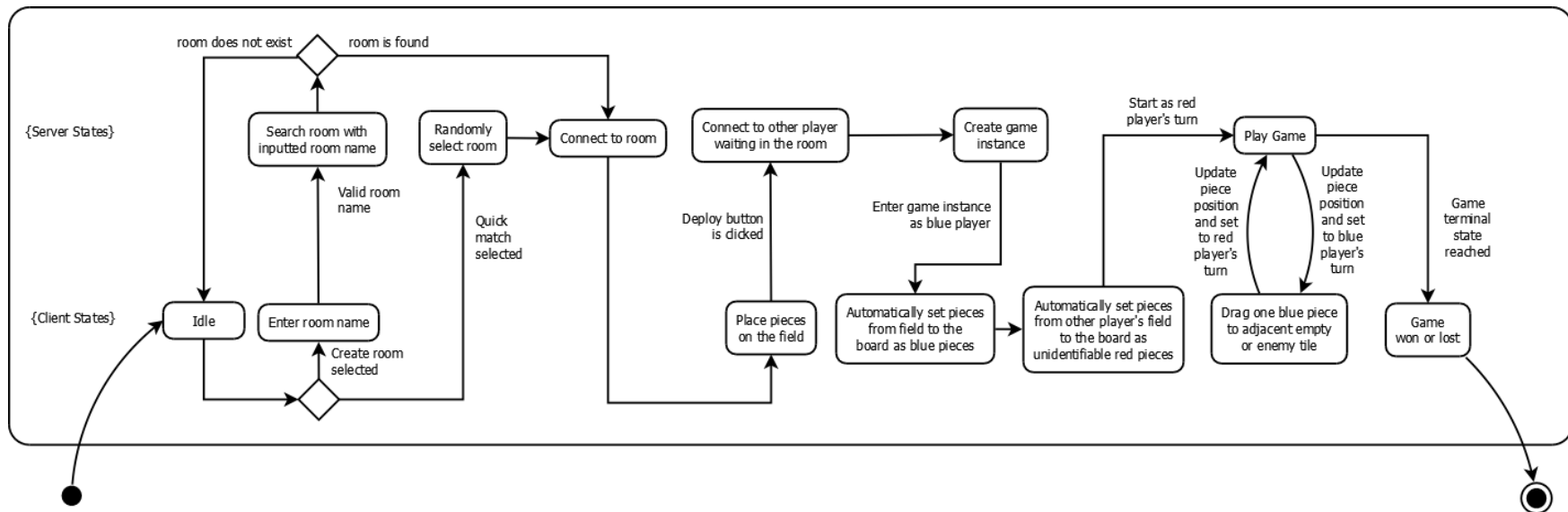## A. Client-Server State Diagrams
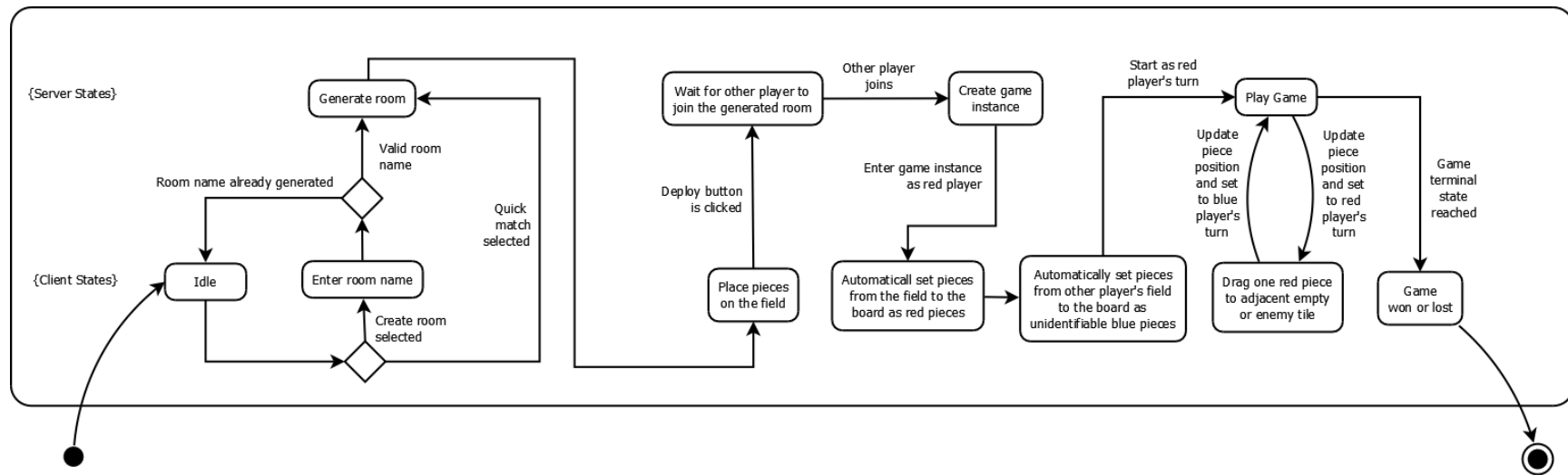


**Figure 3.1:** *Client-Server State Diagram for Red Player*

**Figure 3.2:** *Client-Server State Diagram for Blue Player*

Figure 3.1 and Figure 3.2 represent the state diagrams of how the clients and the server interacts. Figure 3.1, which is the state diagram for the client that will become the red player would either enter a game by creating a room, by entering a room name, or by randomly generating a room, through a quick match if no other randomly generated room is made. Figure 3.2, which is the state diagram for the client that will become the blue player would either enter a game by joining a room, by entering the room name of one of the rooms available in the server, or by joining a randomly generated room, through quick match if there is a randomly generated room that is made from another client.
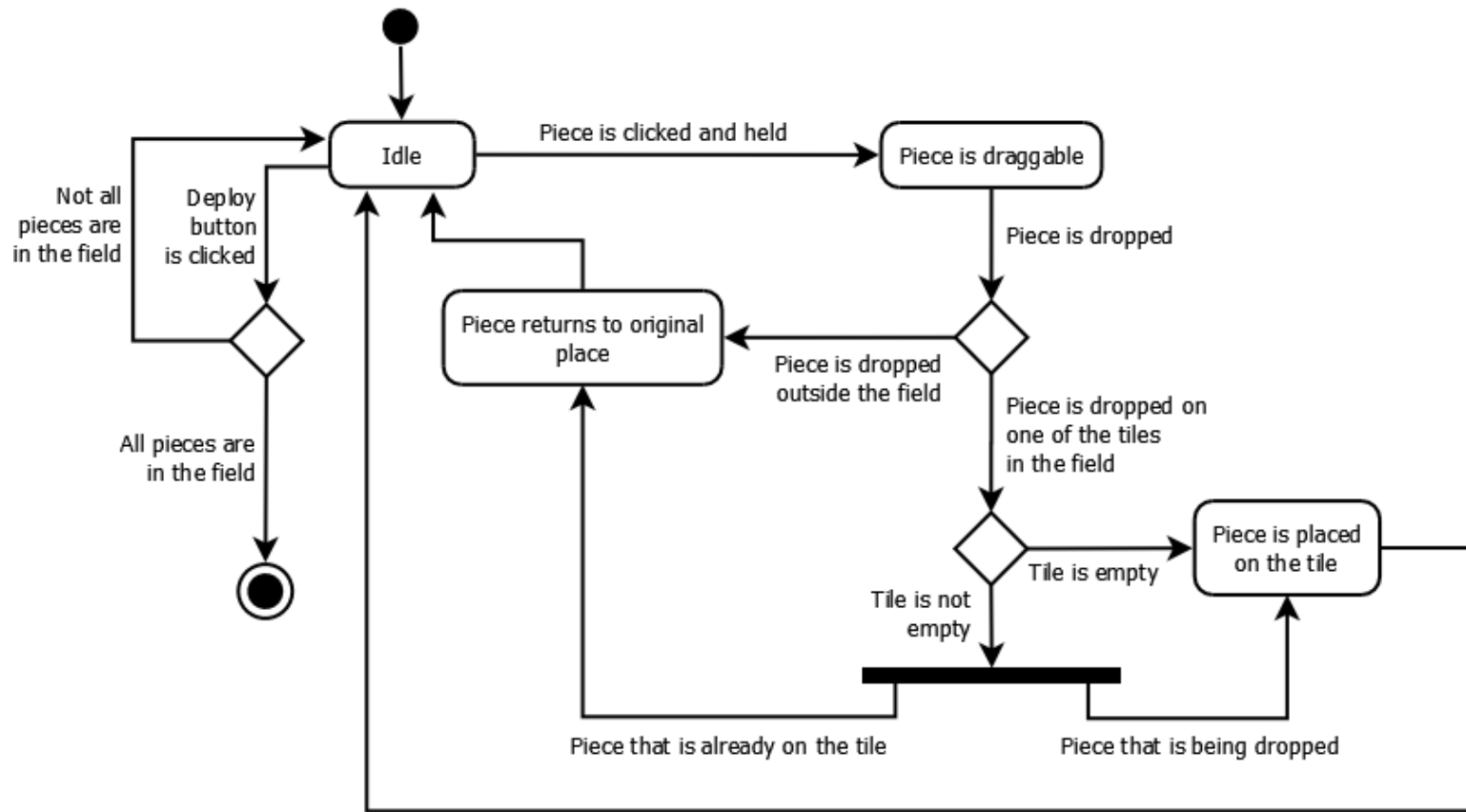
**Figure 4:** *Piece Placement State Diagram*

Figure 4 represents the state diagram that would be followed in the state "Place pieces on the field" after the states "Generate room" or "Connect to room" in figure 3.1 and figure 3.2, respectively.

**B. Game State Diagrams**
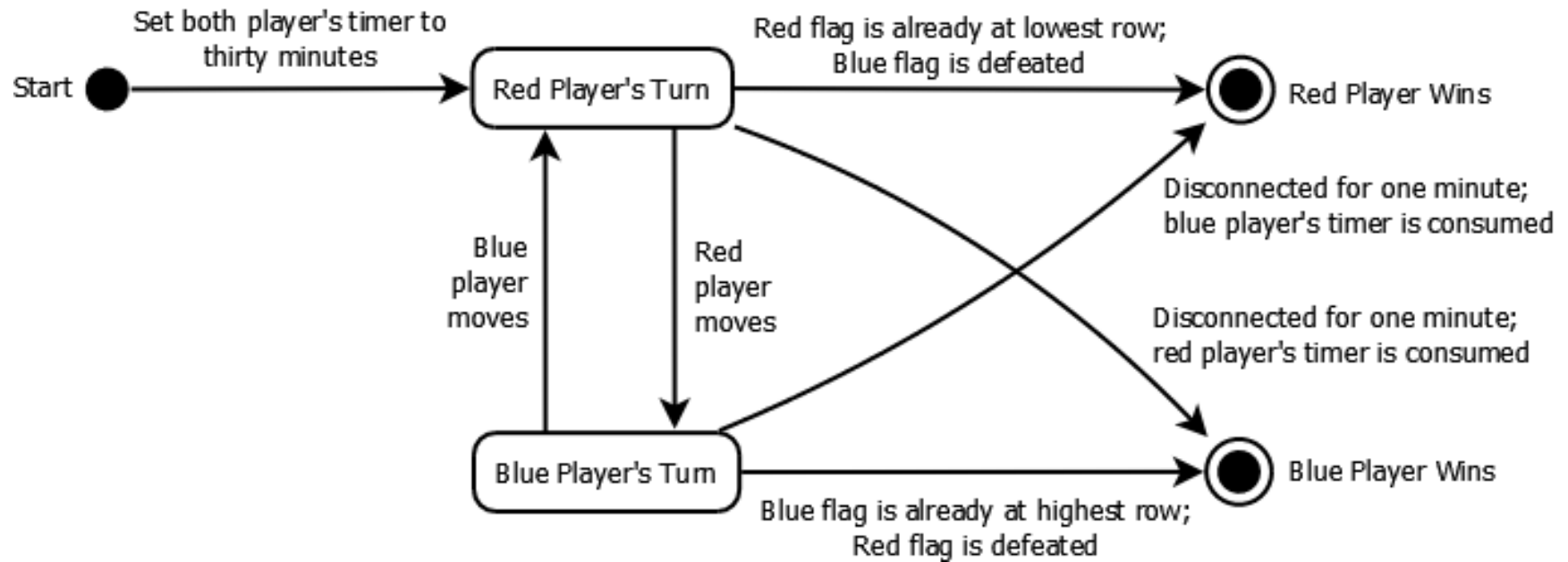


**Figure 5:** *Game State Diagram*

Figure 5 represents the state diagram in the game scene when the players have both finished placing their pieces. Figure 6 represents the state diagram for the states Red Player's Turn and Blue Player's Turn.

**Figure 6:** *Player Turn State Diagram*

## II. Human Interface Design

### A. Loading Scene
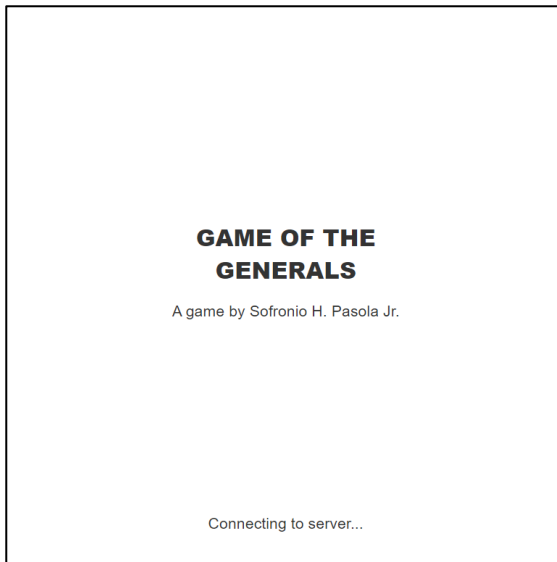


**Figure 7.1:** *Loading Scene Wireframe*
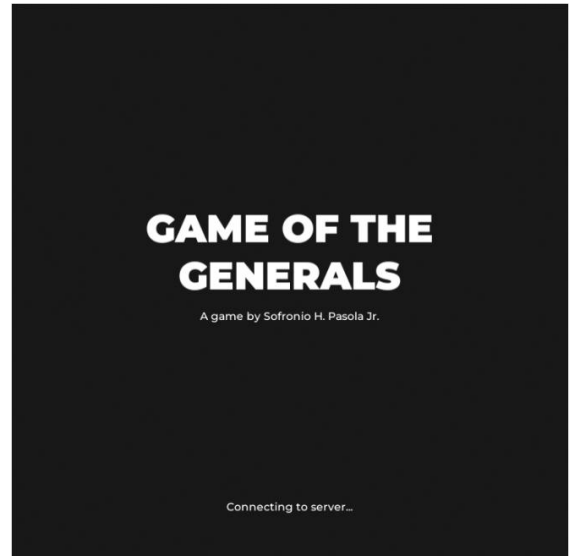
**Figure 7.2:** *Loading Scene Screen Image*

Figures 7.1 and 7.2 represent the user interface for the users will first see when opening the web application. This scene does not have interactions and will change to a lobby once the client has connected to the server.

**B. Lobby**



| **Figure 8.1:** *Lobby Wireframe* | **Figure 8.2:** *Lobby Scene Screen Image* |
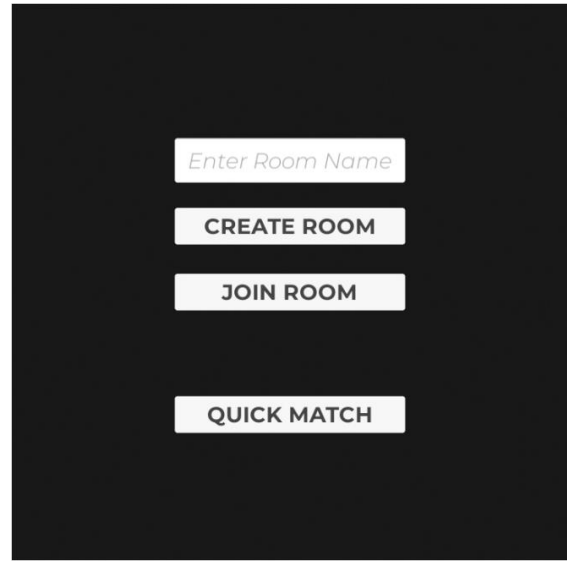
Figures 8.1 and 8.2 represent the user interface that the users will see once the client has connected to the server. There are two ways to enter a game through the lobby. The first option is the create room or joins room options. After entering a room name, pressing the create room button would let the user enter a game as a red player, as detailed in figure 3.1. Pressing the join room button after entering a room name would let the user enter a game as a blue player, as detailed in figure 3.2. The create and join room buttons require the user to have inputted a room name first. Pressing the quick match button would let the user enter a game without inputting a room name, either as a red or blue player, as detailed in the client-server diagrams in figures 3.1 and 3.2.

## C. Piece Placement
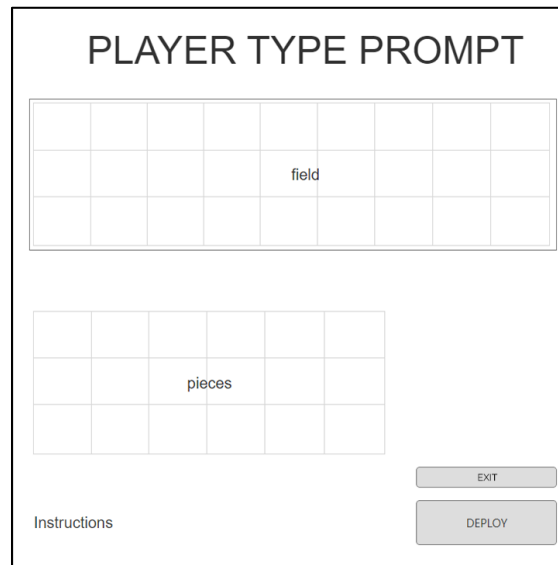


**Figure 9.1:** *Piece Placement Wireframe*
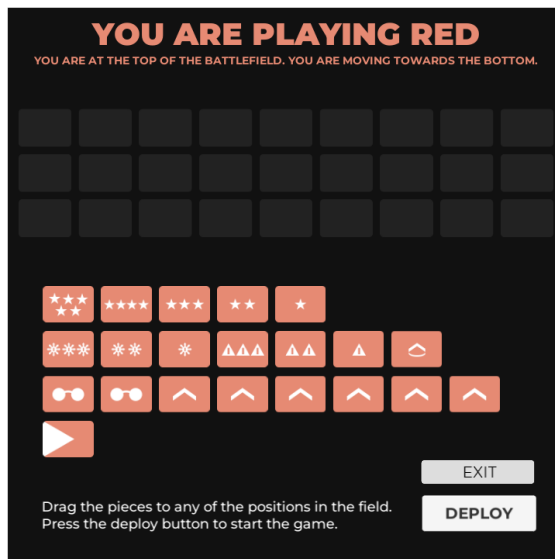


**Figure 9.2.1:** *Piece Placement Screen Image for Red Player*



**Figure 9.2.2:** *Piece Placement Screen Image for Blue Player*

Figures 9.1, 9.2.1, and 9.2.2 represent the user interface where the players place their pieces on the field, with interaction details stated in Figure 4 or the piece placement state diagram. Player-type prompts are made clear to let players understand the placement of the pieces and where they are set on the board once deployed. The user can proceed to the game by clicking on the "Deploy" button or exit the game by clicking on the "Exit" button.

### D. Game Interface



| | |
|---|---|
| **TURN PROMPT** <br> timer <br><br> Board <br><br> **TURN PROMPT** <br> timer — surrender | **DISCONNECTED** <br> 1-minute timer <br><br> Board <br><br> **TURN PROMPT** <br> timer |
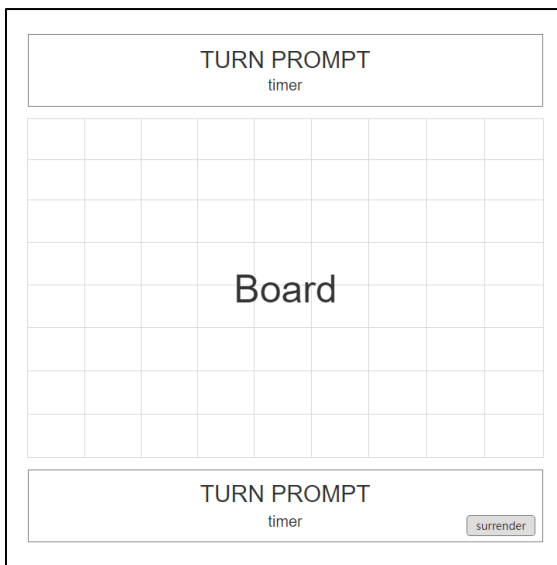
**Figure 10.1.1:** *Game Interface Wireframe*     **Figure 10.1.2:** *Game Interface Wireframe with a Disconnected Player*
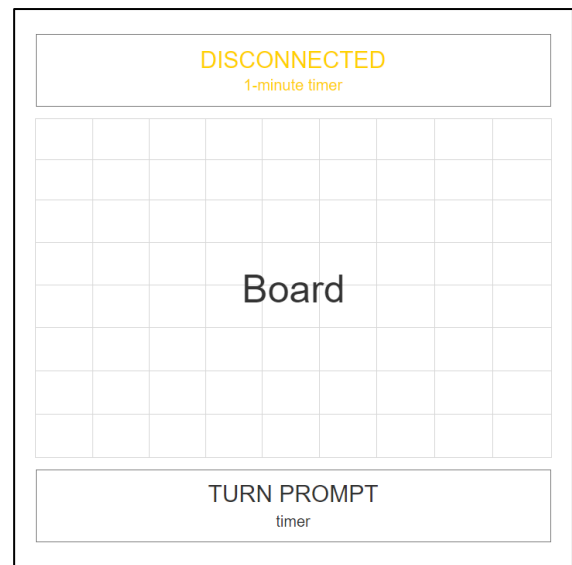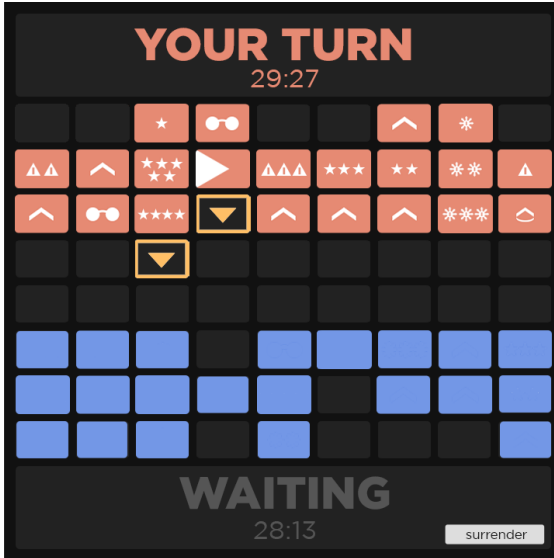
**Figure 10.2.1:** *Game Interface Screen Image for Red Player*



**Figure 10.2.2:** *Game Interface Screen Image for Blue Player while Their Turn*



**Figure 10.2.3:** *Game Interface Screen Image for Blue Player while Their Turn with a Challenge Marker*
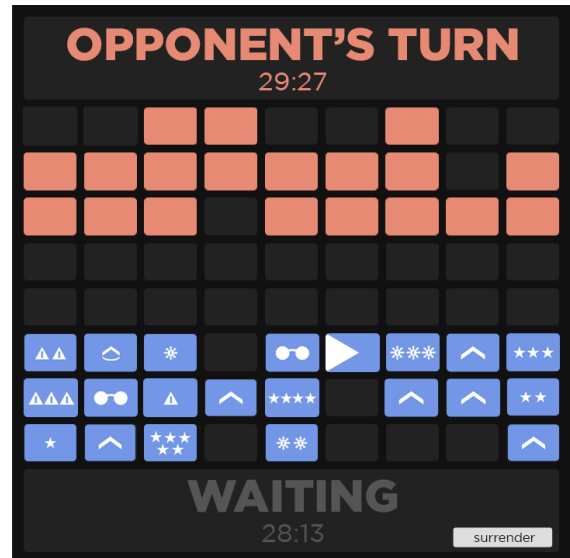


**Figure 10.2.4:** *Game Interface Screen Image for Blue Player while Waiting*
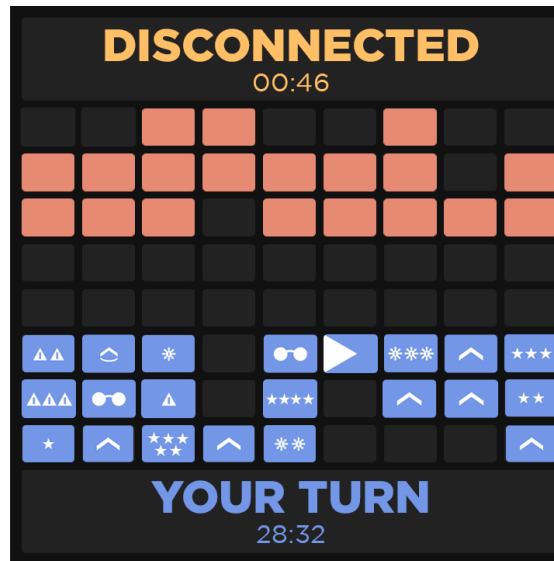
**Figure 10.2.5:** *Game Interface Screen Image for Blue Player while Red Player is Disconnected*

Figures 10.1.1, 10.2.1, 10.2.2, 10.2.3, and 10.2.4 represent the user interface during a game. Each player can make a move, as stated in figure 6, or the player turn state diagram. Clicking on a piece that the player owns creates move markers on adjacent tiles from the piece being selected. These are outlined tiles with inverted triangles in the center, as seen in Figures 10.2.1, next to the blue "Flag" piece, and 10.2.2, next to the red "Four Star General" ranked piece. Challenge markers appear on adjacent tiles occupied by the other player's pieces. These are outlined tiles with a cross in the center, as seen in Figure 10.2.3, at the top of the blue "Spy" piece. A user can end the game by clicking on the "Surrender" button When it is not the user's turn, as seen in figure 10.2.4, there are no moves to be made and a "Waiting" prompt is shown on the user's side of the board. A disconnected player would have a "Disconnected" prompt, as seen in Figures 10.1.2 and 10.2.5, with a one-minute timer counting down the time left. A user automatically loses when they surrendered or their timer reached zero.

## E. End Game Scene



**Figure 11.1:** *End Game Scene Wireframe*



**Figure 11.2.1:** *End Game Scene Screen Image for Blue Player's Loss*



**Figure 11.2.2:** E*nd Game Scene Screen Image for Blue Player's Win*

Figures 11.1, 11.2.1, and 11.2.2 represent the end game scene after a game has concluded. Players have prompted which side is victorious or defeated, and the "Surrender" button is replaced with the "Exit" button to allow the user to quit the game when clicked, returning to the lobby.

# SOFTWARE TEST

# PLAN (STP)

# and TEST CASES

**I. Test Plan**

The Online "Game of the Generals" Web Game will be tested on its complete release version, which means the test cases will be comprised of only system testing. This is because development testing will be done in the iterative development process, ensuring that a preliminary system test on a developmental environment, done by the developer, is completed. These series of tests must ensure that the application is ready before performing these test cases on a release version. The multiplayer function, which is reliant on the Photon service and servers, will need to be tested in a non-developmental environment to ensure that the multiplayer function is working properly after release. The application would be accessible through Itch.io, a hosting platform for video games. Testing will be done by willing participants who can follow the test cases. These participants shall access the game through the site using the link: https://mikhail-panzo.itch.io/game-of-the-generals. Some test cases require two players to be interacting in certain situations, which means a participant must use two clients (which could be two separate devices or two separate browsers on the same device) or two participants cooperate. The time frame for testing is expected to last one week.

**II. Test Cases**

| Project Name: Online "Game of the Generals" Web Game | |
|---|---|
| **Test Case ID:** TC_UI_1 | **Test Designed By:** Mikhailangelo B. Panzo |
| **Test Priority (Low/Medium/High):** High | **Test Design Date:** 11/30/2022 |
| **Module Name:** Lobby | **Test Executed By:** |
| **Test Title:** Entering the Lobby with Internet Connection | **Test Execution Date:** |
| **Description:** Test the system's capability to connect the user and their client to the server as they enter the application | |
| **Pre-condition(s):** The user has not started the application and has an internet connection | |
| **Dependencies:** None | |
| | |

| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
|---|---|---|---|---|---|---|
| 1 | Start the application with an internet connection | | - The user will see the Unity splash screen followed by the game's loading screen<br><br>- After some time on the loading screen, the user will be directed to the lobby | | | |

**Post-Condition(s):** The user is now in the lobby

| Project Name: Online "Game of the Generals" Web Game | |
|---|---|
| **Test Case ID:** TC_UI_2 | **Test Designed By:** Mikhailangelo B. Panzo |
| **Test Priority (Low/Medium/High):** Medium | **Test Design Date:** 11/30/2022 |
| **Module Name:** Lobby | **Test Executed By:** |
| **Test Title:** Entering the Lobby while Waiting for Internet Connection | **Test Execution Date:** |
| **Description:** Test the system's capability to connect the user and their client to the server as they enter the application after the user has connected to the internet | |
| **Pre-condition(s):** The user has not started the application without an internet connection | |
| **Dependencies:** None | |

| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
|---|---|---|---|---|---|---|
| 1 | Start the application without an internet connection | | - The user will see the Unity splash screen followed by the game's loading screen<br><br>- A message will notify the user that there is no internet connection | | | |
| 2 | Connect to the internet | | - The user will be directed to the lobby | | | |

**Post-Condition(s):** The user is now in the lobby

| Project Name: Online "Game of the Generals" Web Game | |
|---|---|
| **Test Case ID:** TC_UI_3 | **Test Designed By:** Mikhailangelo B. Panzo |
| **Test Priority (Low/Medium/High):** Medium | **Test Design Date:** 11/30/2022 |
| **Module Name:** Lobby | **Test Executed By:** |
| **Test Title:** Internet Disconnection from the Lobby | **Test Execution Date:** |

**Description:** Test the system's reaction to a disconnection of the internet while in the lobby and attempt to reconnect to the server

**Pre-condition(s):** The user is already in the lobby and has an internet connection

**Dependencies:** TC_UI_1 or TC_UI_2

| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
|---|---|---|---|---|---|---|
| 1 | Disconnect from the internet | | - A message will notify the user that there is no internet connection; this message will persist while the user has not reconnected | | | |
| 2 | Press any button in the lobby | | - Nothing happens | | | |
| 3 | Connect to the | | - The client is | | | |

| | internet | | connected to the server<br><br>- The message will disappear | | | |
|---|---|---|---|---|---|---|

**Post-Condition(s):** The user can interact with the features in the lobby

| Project Name: Online "Game of the Generals" Web Game | |
|---|---|
| **Test Case ID:** TC_UI_4 | **Test Designed By:** Mikhailangelo B. Panzo |
| **Test Priority (Low/Medium/High):** High | **Test Design Date:** 12/03/2022 |
| **Module Name:** Create Room | **Test Executed By:** |
| **Test Title:** Creating a Room | **Test Execution Date:** |

**Description:** Test the create room function to create a room from the server with the inputted name and join the created room and the case of no input

**Pre-condition(s):** The user is already in the lobby and has an internet connection, and there is no text in the text box field

**Dependencies:** TC_UI_1 or TC_UI_2

| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
|---|---|---|---|---|---|---|
| 1 | Click on the "create room" button | | - A message will appear to notify the user to input a room name first | | | |
| 2 | Click on the text box field | | - A cursor will appear on the text box field, and anything can be typed on it | | | |
| 3 | Type in a room name | sample | - The text will appear on the text box field | | | |
| 4 | Click on the "create room" button | | - The user will be directed to the piece placement scene for the red player | | | |

**Post-Condition(s):** A room named "sample" is available in the server, and the user is now in the room playing as the red player and is now asked to place pieces on the field

| Project Name: **O**nline "Game of the Generals" Web Game | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Test Case ID:** TC_UI_5 | | | **Test Designed By:** Mikhailangelo B. Panzo | | | | |
| **Test Priority (Low/Medium/High):** High | | | **Test Design Date:** 12/03/2022 | | | | |
| **Module Name:** Create Room | | | **Test Executed By:** | | | | |
| **Test Title:** Creating a Room that Already Exists | | | **Test Execution Date:** | | | | |
| **Description:** Test the create room function to deny the user the ability to create a room with a room name that already exists in the server | | | | | | | |
| **Pre-condition(s):** The user is already in the lobby and has an internet connection, and the server has a room named "sample" | | | | | | | |
| **Dependencies:** TC_UI_1 or TC_UI_2 | | | | | | | |
| | | | | | | | |
| **Step No.** | **Test Steps** | **Test Data** | **Expected Result** | | **Actual Result** | **Status (Pass/Fail)** | **Notes** |
| 1 | Click on the text box field | | - A cursor will appear on the text box field, and anything can be typed on it | | | | |
| 2 | Type in a room name | sample | - The text will appear on the text box field | | | | |
| 3 | Click on the "create room" button | | - A message will notify the user that a room with the same name already exists | | | | |
| **Post-Condition(s):** The user is still in the lobby | | | | | | | |

| Project Name: **O**nline "Game of the Generals" Web Game | |
|---|---|
| **Test Case ID:** TC_UI_6 | **Test Designed By:** Mikhailangelo B. Panzo |
| **Test Priority (Low/Medium/High):** High | **Test Design Date:** 12/03/2022 |
| **Module Name:** Join Room | **Test Executed By:** |
| **Test Title:** Joining a Room | **Test Execution Date:** |
| **Description:** Test the join room function where the user joins a room with the name inputted by the user and when the room does not exist | |
| **Pre-condition(s):** The user is already in the lobby and has an internet connection, a room named "sample" is the only room created in the server, and there is no text in the text box field | |
| **Dependencies:** TC_UI_1 or TC_UI_2 | |

| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
|---|---|---|---|---|---|---|
| 1 | Click on the "join room" button | | - A message will appear to notify the user to input a room name first | | | |
| 2 | Click on the text box field | | - A cursor will appear on the text box field, and anything can be typed on it | | | |
| 3 | Type in a room name that does not exist in the server | wrongname | - The text will appear on the text box field | | | |
| 4 | Click on the "join room" button | | - A message will notify that the room does not exist | | | |
| 5 | Type in a room name that exists in the server | sample | - The text will appear on the text box field | | | |
| 6 | Click on the "join room" button | | - The user will be directed to the piece placement scene for the blue player | | | |

**Post-Condition(s):** A room named "sample" is available in the server, and the user is now in the room playing as the blue player and is now asked to place pieces on the field

| Project Name: Online "Game of the Generals" Web Game | | | | | | |
|---|---|---|---|---|---|---|
| **Test Case ID:** TC_UI_7 | | | **Test Designed By:** Mikhailangelo B. Panzo | | | |
| **Test Priority (Low/Medium/High):** High | | | **Test Design Date:** 12/03/2022 | | | |
| **Module Name:** Quick Match | | | **Test Executed By:** | | | |
| **Test Title:** Quick Match | | | **Test Execution Date:** | | | |
| **Description:** Test the quick match function to direct the user to a random room either as a red or blue player | | | | | | |
| **Pre-condition(s):** The user is already in the lobby and has an internet connection | | | | | | |
| **Dependencies:** TC_UI_1 or TC_UI_2 | | | | | | |
| | | | | | | |
| **Step No.** | **Test Steps** | **Test Data** | **Expected Result** | **Actual Result** | **Status (Pass/Fail)** | **Notes** |
| 1 | Click on the "quick match" button | | - The user will be directed to the piece placement scene either for the blue player or for the red player | | | |
| **Post-Condition(s):** The user is now in a random room playing either as the red player or the blue player and is now asked to place pieces on the field | | | | | | |

| Project Name: Online "Game of the Generals" Web Game | | | | | | |
|---|---|---|---|---|---|---|
| **Test Case ID:** TC_UI_8 | | | **Test Designed By:** Mikhailangelo B. Panzo | | | |
| **Test Priority (Low/Medium/High):** High | | | **Test Design Date:** 12/03/2022 | | | |
| **Module Name:** Piece Placement | | | **Test Executed By:** | | | |
| **Test Title:** Deploying pieces | | | **Test Execution Date:** | | | |
| **Description:** Test the piece placement scene and check reactions for disconnection, incomplete placement, and deployment | | | | | | |
| **Pre-condition(s):** The user has created or joined a room or joined one through quick match and has an internet connection | | | | | | |
| **Dependencies:** TC_UI_4, TC_UI_6 or TC_UI_7 | | | | | | |
| | | | | | | |
| **Step No.** | **Test Steps** | **Test Data** | **Expected Result** | **Actual Result** | **Status (Pass/Fail)** | **Notes** |
| 1 | Click and drag a piece | | - The piece follows the cursor around | | | |

| | | | while the mouse button is held | | | |
|---|---|---|---|---|---|---|
| 2 | Drop or release the piece over an area that is not in the field | | - The piece returns to its original place outside the field | | | |
| 3 | Click and drag a piece, and drop it over an empty tile on the field | | - The piece occupies the tile on the field | | | |
| 4 | Click and drag another piece that is outside the field, and drop it over an empty tile on the field | | - The piece occupies the tile on the field | | | |
| 5 | Click and drag a piece from the field, and drop it over another empty tile on the field | | - The piece is moved to another tile on the field | | | |
| 6 | Click and drag a piece from the field, and drop it over another piece on the field | | - The piece is moved to the tile occupied by another piece on the field, and the piece that was already on the tile returns to its original place outside the field | | | |
| 7 | Disconnect from the internet | | - A message will notify the user that there is no internet connection; this message will persist while the user has not reconnected | | | |
| 8 | Reconnect from the internet | | - The message will disappear | | | |
| 9 | Click the "deploy" button | | - A message will notify the user to | | | |

| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
|---|---|---|---|---|---|---|
| | | | place the other pieces outside the field onto the field | | | |
| 10 | Drag and drop all pieces outside the field to empty tiles on the field | | - All pieces are in the field | | | |
| 11 | Click the "deploy" button | | - The user will be directed to a scene waiting for the other player | | | |

**Post-Condition(s):** The user is now waiting for the other player to finish deploying their pieces

| | |
|---|---|
| **Project Name: O**nline "Game of the Generals" Web Game | |
| **Test Case ID:** TC_UI_9 | **Test Designed By:** Mikhailangelo B. Panzo |
| **Test Priority (Low/Medium/High):** High | **Test Design Date:** 12/03/2022 |
| **Module Name:** Piece Placement | **Test Executed By:** |
| **Test Title:** Exiting the Piece Placement | **Test Execution Date:** |

**Description:** Test the exit function in the piece placement scene

**Pre-condition(s):** The user has created or joined a room or joined one through quick match and has an internet connection

**Dependencies:** TC_UI_4, TC_UI_6 or TC_UI_7

| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
|---|---|---|---|---|---|---|
| 1 | Click the "exit" button | | - The user leaves the room and is directed to the lobby | | | |

**Post-Condition(s):** The user is now in the lobby

| Project Name: Online "Game of the Generals" Web Game | | | | | | |
|---|---|---|---|---|---|---|
| Test Case ID: TC_UI_10 | | | Test Designed By: Mikhailangelo B. Panzo | | | |
| Test Priority (Low/Medium/High): Medium | | | Test Design Date: 12/03/2022 | | | |
| Module Name: Piece Placement | | | Test Executed By: | | | |
| Test Title: Staying in the Piece Placement Scene for too Long | | | Test Execution Date: | | | |
| Description: Test the system's capability to remove the user from the piece placement scene if they stayed for too long | | | | | | |
| Pre-condition(s): The user has created or joined a room or joined one through quick match and has an internet connection | | | | | | |
| Dependencies: TC_UI_4, TC_UI_6 or TC_UI_7 | | | | | | |
| | | | | | | |
| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
| 1 | Stay on the scene for at least three (3) minutes | | - The user leaves the room and is directed to the lobby after three (3) minutes<br><br>- A message will notify the user that they have waited at the scene for too long | | | |
| Post-Condition(s): The user is now in the lobby | | | | | | |

| Project Name: Online "Game of the Generals" Web Game | |
|---|---|
| Test Case ID: TC_UI_11 | Test Designed By: Mikhailangelo B. Panzo |
| Test Priority (Low/Medium/High): Low | Test Design Date: 12/03/2022 |
| Module Name: Piece Placement | Test Executed By: |
| Test Title: Other Player Quits During Piece Placement | Test Execution Date: |
| Description: Test the system's capability to notify the user that the other player has quit and direct them to the lobby | |
| Pre-condition(s): The user has created or joined a room or joined one through quick match and has an internet connection, and another user is in the room as the other player | |
| Dependencies: TC_UI_4, TC_UI_6 or TC_UI_7 | |
| | |

| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
|---|---|---|---|---|---|---|
| 1 | Let the other player exit the room | | - The user is redirected to the lobby<br><br>- A message will notify the user that there is no other player in the game | | | |

**Post-Condition(s):** The user is in the lobby

| | |
|---|---|
| **Project Name: O**nline "Game of the Generals" Web Game | |
| **Test Case ID:** TC_UI_12 | **Test Designed By:** Mikhailangelo B. Panzo |
| **Test Priority (Low/Medium/High):** High | **Test Design Date:** 12/03/2022 |
| **Module Name:** Waiting Scene | **Test Executed By:** |
| **Test Title:** Starting the game | **Test Execution Date:** |

**Description:** Test the system's capability to start the game once the two players have deployed their pieces and handles internet disconnection

**Pre-condition(s):** The user has deployed his pieces and has an internet connection, and the other player has not yet deployed their pieces

**Dependencies:** TC_UI_8

| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
|---|---|---|---|---|---|---|
| 1 | Disconnect from the internet | | - A message will notify the user that there is no internet connection; this message will persist while the user has not reconnected | | | |
| 2 | Reconnect from the internet | | - The message will disappear | | | |
| 3 | Allow the other player to deploy their pieces | | - The game starts with the user's pieces on their side of the board and the other player's | | | |

58

| | | | pieces are visible on the other side of the board but are unidentifiable | | | |
|---|---|---|---|---|---|---|

**Post-Condition(s):** The game has started and the red player starts their turn; both timers start at 30 minutes, with the red player's timer counting down first; all the user's pieces are identifiable; all the other player's pieces are unidentifiable

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| Project Name: Online "Game of the Generals" Web Game | |
|---|---|
| **Test Case ID:** TC_UI_13 | **Test Designed By:** Mikhailangelo B. Panzo |
| **Test Priority (Low/Medium/High):** High | **Test Design Date:** 12/03/2022 |
| **Module Name:** Waiting Scene | **Test Executed By:** |
| **Test Title:** Exiting the Waiting Scene | **Test Execution Date:** |

**Description:** Test the exit function in the waiting scene

**Pre-condition(s):** The user has deployed his pieces and has an internet connection

**Dependencies:** TC_UI_8

| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
|---|---|---|---|---|---|---|
| 1 | Click the "exit" button | | - The user leaves the room and is directed to the lobby | | | |

**Post-Condition(s):** The user is now in the lobby

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| Project Name: Online "Game of the Generals" Web Game | |
|---|---|
| **Test Case ID:** TC_UI_14 | **Test Designed By:** Mikhailangelo B. Panzo |
| **Test Priority (Low/Medium/High):** Medium | **Test Design Date:** 12/03/2022 |
| **Module Name:** Waiting Scene | **Test Executed By:** |
| **Test Title:** Staying in the Waiting Scene for too Long | **Test Execution Date:** |

**Description:** Test the system's capability to remove the user from the waiting scene if they stayed for too long

**Pre-condition(s):** The user has deployed his pieces and has an internet connection

**Dependencies:** TC_UI_8

| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
|---|---|---|---|---|---|---|
| 1 | Stay on the scene for at least five (5) minutes | | - The user leaves the room and is directed to the lobby after five (5) minutes<br><br>- A message will notify the user that they have waited at the scene for too long | | | |

**Post-Condition(s):** The user is now in the lobby

| Project Name: Online "Game of the Generals" Web Game | |
|---|---|
| **Test Case ID:** TC_UI_15 | **Test Designed By:** Mikhailangelo B. Panzo |
| **Test Priority (Low/Medium/High):** Low | **Test Design Date:** 12/03/2022 |
| **Module Name:** Waiting Scene | **Test Executed By:** |
| **Test Title:** Other Player Quits While Waiting | **Test Execution Date:** |

**Description:** Test the system's capability to notify the user that the other player has quit and direct them to the lobby

**Pre-condition(s):** The user has deployed his pieces and has an internet connection, and another user is in the room as the other player but has not deployed their pieces

**Dependencies:** TC_UI_8

| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
|---|---|---|---|---|---|---|
| 1 | Let the other player exit their piece placement scene | | - The user is redirected to the lobby<br><br>- A message will notify the user that there is no other player in the game | | | |

**Post-Condition(s):** The user is in the lobby

| Project Name: Online "Game of the Generals" Web Game | | | | | | |
|---|---|---|---|---|---|---|
| **Test Case ID:** TC_UI_16 | | | **Test Designed By:** Mikhailangelo B. Panzo | | | |
| **Test Priority (Low/Medium/High):** High | | | **Test Design Date:** 12/05/2022 | | | |
| **Module Name:** Game | | | **Test Executed By:** | | | |
| **Test Title:** Move Turn | | | **Test Execution Date:** | | | |
| **Description:** Test the system's capability to switch turns and moving of pieces | | | | | | |
| **Pre-condition(s):** The game is ongoing, the user has the turn, and no game-ending condition has been or will be met | | | | | | |
| **Dependencies:** TC_UI_12 | | | | | | |
| | | | | | | |
| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
| 1 | Wait for turn | | - The other player's prompt would change to "WAITING" and their timer is paused<br><br>- The user's prompt would change to "YOUR TURN" and their timer will continue counting down | | | |
| 2 | Click all the pieces | | - No move or challenge marker appears when clicking on the other player's pieces<br><br>- When clicking on a user's piece, all previous move or challenge markers are deleted, new move markers appear on empty tiles adjacent to the piece, and new challenge markers appear on the other | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | player's pieces adjacent to the user's piece | | | |
| 3 | Click on a move marker | | - The piece that was clicked before the move marker appeared will move to the tile of the marker clicked<br><br>- The user's turn ends and the other player's turn starts<br><br>- The user's prompt would change to "WAITING" and their timer is paused<br><br>- The other player's prompt would change to "OPPONENT'S TURN" and their timer will continue counting down | | | |

**Post-Condition(s):** The piece has moved, and the other player has the turn

| Project Name: **O**nline "Game of the Generals" Web Game | |
|---|---|
| **Test Case ID:** TC_UI_17 | **Test Designed By:** Mikhailangelo B. Panzo |
| **Test Priority (Low/Medium/High):** High | **Test Design Date:** 12/05/2022 |
| **Module Name:** Game | **Test Executed By:** |
| **Test Title:** Challenge Turn for "Private" Piece | **Test Execution Date:** |
| **Description:** Test the challenge function for a challenge from a "Private" piece | |
| **Pre-condition(s):** The game is ongoing, the user has the turn, and a piece from the other player is adjacent to a user's "Private" piece | |
| **Dependencies:** TC_UI_12 and TC_UI_16 | |

| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
|---|---|---|---|---|---|---|
| 1 | Click on a "Private" piece adjacent to a piece from the other player | | - A challenge marker appears on the other player's piece adjacent to the "Private" piece | | | |
| 2 | Click on the challenge marker | | - The "Private" piece will move to the tile of the marker clicked<br><br>- If the other player's piece that is being challenged is a "Flag" piece, then the other player's piece will be removed from the board<br><br>- If the other player's piece that is being challenged is a "Spy" piece or a rank piece, then the user's piece will be removed from the board<br><br>- If the other player's piece that is being challenged is a "Private" piece, then both pieces will be removed from the board | | | |
| **Post-Condition(s):** The challenge is resolved, and the other player has the turn | | | | | | |

| Project Name: Online "Game of the Generals" Web Game | | | | | | |
|---|---|---|---|---|---|---|
| Test Case ID: TC_UI_18 | | | Test Designed By: Mikhailangelo B. Panzo | | | |
| Test Priority (Low/Medium/High): High | | | Test Design Date: 12/05/2022 | | | |
| Module Name: Game | | | Test Executed By: | | | |
| Test Title: Challenge Turn for "Spy" Piece | | | Test Execution Date: | | | |
| Description: Test the challenge function for a challenge from a "Spy" piece | | | | | | |
| Pre-condition(s): The game is ongoing, the user has the turn, and a piece from the other player is adjacent to a user's "Spy" piece | | | | | | |
| Dependencies: TC_UI_12 and TC_UI_16 | | | | | | |
| | | | | | | |
| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
| 1 | Click on a "Spy" piece adjacent to a piece from the other player | | - A challenge marker appears on the other player's piece adjacent to the "Spy" piece | | | |
| 2 | Click on the challenge marker | | - The "Spy" piece will move to the tile of the marker clicked<br><br>- If the other player's piece that is being challenged is a "Flag" piece or a rank piece, then the other player's piece will be removed from the board<br><br>- If the other player's piece that is being challenged is a "Private" piece, then the user's piece will be removed from the board<br><br>- If the other player's | | | |

| | | | piece that is being challenged is a "Spy" piece, then both pieces will be removed from the board | | | |
|---|---|---|---|---|---|---|

**Post-Condition(s):** The challenge is resolved, and the other player has the turn

| Project Name: Online "Game of the Generals" Web Game | |
|---|---|
| **Test Case ID:** TC_UI_19 | **Test Designed By:** Mikhailangelo B. Panzo |
| **Test Priority (Low/Medium/High):** High | **Test Design Date:** 12/05/2022 |
| **Module Name:** Game | **Test Executed By:** |
| **Test Title:** Challenge Turn for "Flag" Piece | **Test Execution Date:** |
| **Description:** Test the challenge function for a challenge from a "Flag" piece | |
| **Pre-condition(s):** The game is ongoing, the user has the turn, and a piece from the other player is adjacent to a user's "Flag" piece | |
| **Dependencies:** TC_UI_12 and TC_UI_16 | |

| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
|---|---|---|---|---|---|---|
| 1 | Click on the "Flag" piece adjacent to a piece from the other player | | - A challenge marker appears on the other player's piece adjacent to the "Flag" piece | | | |
| 2 | Click on the challenge marker | | - The "Flag" piece will move to the tile of the marker clicked<br><br>- If the other player's piece that is being challenged is a "Flag" piece, then the other player's piece will be removed from the board | | | |

65

| | | | - If the other player's piece that is being challenged is a "Spy" piece, "Private" piece, "Flag" piece, or a rank piece, then the user's piece will be removed from the board | | | |
|---|---|---|---|---|---|---|

**Post-Condition(s):** The challenge is resolved, and the other player has the turn

| Project Name: **O**nline "Game of the Generals" Web Game | | | | | | |
|---|---|---|---|---|---|---|
| **Test Case ID:** TC_UI_20 | | | **Test Designed By:** Mikhailangelo B. Panzo | | | |
| **Test Priority (Low/Medium/High):** High | | | **Test Design Date:** 12/05/2022 | | | |
| **Module Name:** Game | | | **Test Executed By:** | | | |
| **Test Title:** Challenge Turn for Rank Piece | | | **Test Execution Date:** | | | |
| **Description:** Test the challenge function for a challenge from a rank piece | | | | | | |
| **Pre-condition(s):** The game is ongoing, the user has the turn, and a piece from the other player is adjacent to a user's rank piece | | | | | | |
| **Dependencies:** TC_UI_12 and TC_UI_16 | | | | | | |
| | | | | | | |
| **Step No.** | **Test Steps** | **Test Data** | **Expected Result** | **Actual Result** | **Status (Pass/Fail)** | **Notes** |
| 1 | Click on a rank piece adjacent to a piece from the other player | | - A challenge marker appears on the other player's piece adjacent to the rank piece | | | |
| 2 | Click on the challenge marker | | - The rank piece will move to the tile of the marker clicked<br><br>- If the other player's piece that is being challenged is a "Flag" piece, "Private" piece, or a rank piece with a | | | |

| | | | lower rank, then the other player's piece will be removed from the board | | | |
|---|---|---|---|---|---|---|
| | | | - If the other player's piece that is being challenged is a "Spy" piece or a rank piece with a higher rank, then the user's piece will be removed from the board | | | |
| | | | - If the other player's piece that is being challenged is a rank piece of similar rank, then both pieces will be removed from the board | | | |

**Post-Condition(s):** The challenge is resolved, and the other player has the turn

| Project Name: Online "Game of the Generals" Web Game | |
|---|---|
| **Test Case ID:** TC_UI_21 | **Test Designed By:** Mikhailangelo B. Panzo |
| **Test Priority (Low/Medium/High):** High | **Test Design Date:** 12/05/2022 |
| **Module Name:** Game | **Test Executed By:** |
| **Test Title:** Temporary Disconnect | **Test Execution Date:** |
| **Description:** Test the system's capability to handle temporary disconnection from both players | |
| **Pre-condition(s):** The user has started the game and both players have not disconnected from the game | |
| **Dependencies:** TC_UI_12 | |
| | |

| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
|---|---|---|---|---|---|---|
| 1 | Disconnect from the internet | | - The user's prompt will change to "DISCONNECTED" | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | and a one-minute timer starts to allow the user to reconnect within the time frame<br><br>- All other timers are paused<br><br>- Pieces cannot be moved<br><br>- "Surrender" button is hidden | | | |
| 2 | Reconnect to the internet before the timer is consumed | | - The players' prompts, timer, and board state will be updated to reflect the current game state from the server<br><br>- All other timers are resumed<br><br>- Pieces can be moved<br><br>- "Surrender" button is visible | | | |
| 3 | Let the other player disconnect from the game | | - The other player's prompt will change to "DISCONNECTED" and a one-minute timer starts to allow the other player to reconnect within the time frame | | | |
| 4 | Let the other player reconnect to the game before the timer is consumed | | - The other player's prompt will revert to normal game prompts<br><br>- The other player's timer reflects the remaining time and is | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | not paused from the disconnection other than from not having their turn | | | |
| 5 | Let the other player disconnect from the game, then disconnect from the internet after some time | | - The user's prompt will change to "DISCONNECTED" and a one-minute timer starts to allow the user to reconnect within the time frame<br><br>- A message will notify the user to reconnect within 60 seconds or they will be automatically declared defeated<br><br>- All other timers are paused<br><br>- Pieces cannot be moved<br><br>- "Surrender" button is hidden | | | |
| 6 | Reconnect to the internet before the timer is consumed | | - The players' prompts, timer, and board state will be updated to reflect the current game state from the server<br><br>- All other timers are resumed<br><br>- Pieces can be moved<br><br>- "Surrender" button is visible | | | |
| 7 | Let the other | | - The other player's | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | player reconnect to the game before the timer is consumed | | prompt will revert to normal game prompts<br><br>- The other player's timer reflects the remaining time and is not paused from the disconnection other than from not having their turn | | | |
| 8 | Let the other player disconnect from the game, then disconnect from the internet after some time | | - The user's prompt will change to "DISCONNECTED" and a one-minute timer starts to allow the user to reconnect within the time frame<br><br>- All other timers are paused<br><br>- Pieces cannot be moved<br><br>- "Surrender" button is hidden | | | |
| 9 | Let the other player reconnect to the game before the timer is consumed | | - Nothing different changes in the application | | | |
| 10 | Let the other player reconnect from the Reconnect to the internet before the timer is consumed | | - The players' prompts, timer, and board state will be updated to reflect the current game state from the server<br><br>- All other timers are resumed<br><br>- Pieces can be moved | | | |

| | | | - "Surrender" button is visible | | | |
|---|---|---|---|---|---|---|
| 11 | Disconnect from the internet | | - The user's prompt will change to "DISCONNECTED" and a one-minute timer starts to allow the user to reconnect within the time frame<br><br>- All other timers are paused<br><br>- Pieces cannot be moved<br><br>- "Surrender" button is hidden | | | |
| 12 | Let the other player disconnect from the game | | - Nothing different changes in the application | | | |
| 13 | Reconnect to the internet before the timer is consumed | | - The players' prompts, timer, and board state will be updated to reflect the current game state from the server<br><br>- All other timers are resumed<br><br>- Pieces can be moved<br><br>- "Surrender" button is visible<br><br>- The other player's prompt will change to "DISCONNECTED" and a one-minute timer starts to allow | | | |

| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
|---|---|---|---|---|---|---|
| | | | the other player to reconnect within the time frame | | | |
| 14 | Let the other player reconnect to the game before the timer is consumed | | - The other player's prompt will revert to normal game prompts<br><br>- The other player's timer reflects the remaining time and is not paused from the disconnection other than from not having their turn | | | |

**Post-Condition(s):** The game continues

| | |
|---|---|
| **Project Name: O**nline "Game of the Generals" Web Game | |
| **Test Case ID:** TC_UI_22 | **Test Designed By:** Mikhailangelo B. Panzo |
| **Test Priority (Low/Medium/High):** High | **Test Design Date:** 12/07/2022 |
| **Module Name:** Terminal State | **Test Executed By:** |
| **Test Title:** Disconnect from Game | **Test Execution Date:** |

**Description:** Test the system's capability to end the game as a defeat for the user if the user is disconnected for more than 60 seconds

**Pre-condition(s):** The game is ongoing, the user has the turn, and no game-ending condition has been met

**Dependencies:** TC_UI_21

| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
|---|---|---|---|---|---|---|
| 1 | Disconnect from the internet | | - The user's prompt will change to "DISCONNECTED" and a one-minute timer starts to allow the user to reconnect within the time frame<br><br>- All other timers are | | | |

| | | | paused |
|---|---|---|---|
| | | | - Pieces cannot be moved |
| | | | - "Surrender" button is hidden |
| 2 | Wait for 60 seconds | | - Defeat is declared to the user |
| | | | - The "surrender" button is replaced with the "exit" button |

**Post-Condition(s):** The game has ended, and the user can go back to the lobby

| Project Name: Online "Game of the Generals" Web Game | |
|---|---|
| **Test Case ID:** TC_UI_23 | **Test Designed By:** Mikhailangelo B. Panzo |
| **Test Priority (Low/Medium/High):** High | **Test Design Date:** 12/07/2022 |
| **Module Name:** Terminal State | **Test Executed By:** |
| **Test Title:** Other Player has Disconnected from Game | **Test Execution Date:** |

**Description:** Test the system's capability to end the game as a defeat for the other player if they are disconnected for more than 60 seconds

**Pre-condition(s):** The game is ongoing, the user has the turn, and no game-ending condition has been met

**Dependencies:** TC_UI_21

| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
|---|---|---|---|---|---|---|
| 1 | Let the other player disconnect from the game | | - The other player's prompt will change to "DISCONNECTED" and a one-minute timer starts to allow the other player to reconnect within the time frame | | | |
| 2 | Wait for 60 | | - Victory is declared | | | |

| | seconds after the other player has disconnected | | to the user<br><br>- The "surrender" button is replaced with the "exit" button | | | |

**Post-Condition(s):** The game has ended, and the user can go back to the lobby

| Project Name: Online "Game of the Generals" Web Game | |
|---|---|
| **Test Case ID:** TC_UI_24 | **Test Designed By:** Mikhailangelo B. Panzo |
| **Test Priority (Low/Medium/High):** High | **Test Design Date:** 12/07/2022 |
| **Module Name:** Terminal State | **Test Executed By:** |
| **Test Title:** Surrender Declared | **Test Execution Date:** |

**Description:** Test the system's capability to end the game as the user clicked the "surrender" button

**Pre-condition(s):** The game is ongoing, the user has the turn, and no game-ending condition has been met

**Dependencies:** TC_UI_12

| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
|---|---|---|---|---|---|---|
| 1 | Click the "surrender" button | | - Defeat is declared to the user<br><br>- The "surrender" button is replaced with the "exit" button | | | |

**Post-Condition(s):** The game has ended, and the user can go back to the lobby

| Project Name: Online "Game of the Generals" Web Game | | |
|---|---|---|
| **Test Case ID:** TC_UI_25 | **Test Designed By:** Mikhailangelo B. Panzo | |
| **Test Priority (Low/Medium/High):** High | **Test Design Date:** 12/07/2022 | |
| **Module Name:** Terminal State | **Test Executed By:** | |
| **Test Title:** Flag Reached Other End Row | **Test Execution Date:** | |
| **Description:** Test the system's capability to end the game as one of the "Flag" pieces reached the end row of the other player | | |
| **Pre-condition(s):** The game is ongoing, the user has the turn, no game-ending condition has been met, and the "Flag" piece is near the other end row | | |
| **Dependencies:** TC_UI_12 and TC_UI _16 | | |

| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
|---|---|---|---|---|---|---|
| 1 | Move the "Flag" piece to the other end row | | - The "Flag" piece is now at the other end row<br><br>- It is now the other player's turn | | | |
| 2 | Let the other player make a move except for challenging the "Flag" piece | | - Victory is declared to the user<br><br>- The "surrender" button is replaced with the "exit" button | | | |
| **Post-Condition(s):** The game has ended, and the user can go back to the lobby | | | | | | |

| Project Name: Online "Game of the Generals" Web Game | | | | | | |
|---|---|---|---|---|---|---|
| Test Case ID: TC_UI_26 | | | Test Designed By: Mikhailangelo B. Panzo | | | |
| Test Priority (Low/Medium/High): High | | | Test Design Date: 12/07/2022 | | | |
| Module Name: Terminal State | | | Test Executed By: | | | |
| Test Title: Flag is Challenged | | | Test Execution Date: | | | |
| Description: Test the system's capability to end the game as one of the "Flag" pieces is challenged | | | | | | |
| Pre-condition(s): The game is ongoing, the user has the turn, no game-ending condition has been met, and the "Flag" piece is near a piece from the other player | | | | | | |
| Dependencies: TC_UI_12 and TC_UI_19 | | | | | | |
| | | | | | | |
| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
| 1 | Let the other player challenge the user's "Flag" piece | | - Defeat is declared to the user<br><br>- The "surrender" button is replaced with the "exit" button | | | |
| Post-Condition(s): The game has ended, and the user can go back to the lobby | | | | | | |

| Project Name: Online "Game of the Generals" Web Game | | | | | | |
|---|---|---|---|---|---|---|
| Test Case ID: TC_UI_27 | | | Test Designed By: Mikhailangelo B. Panzo | | | |
| Test Priority (Low/Medium/High): High | | | Test Design Date: 12/07/2022 | | | |
| Module Name: Terminal State | | | Test Executed By: | | | |
| Test Title: Turn Timer Consumed | | | Test Execution Date: | | | |
| Description: Test the system's capability to end the game as one of the player's turn timers is consumed | | | | | | |
| Pre-condition(s): The game is ongoing, the user has the turn, and no game-ending condition has been met | | | | | | |
| Dependencies: TC_UI_12 | | | | | | |
| | | | | | | |
| Step No. | Test Steps | Test Data | Expected Result | Actual Result | Status (Pass/Fail) | Notes |
| 1 | Spend an accumulated total | | - Defeat is declared to | | | |

| | of more than 30 minutes interacting with the board while the user has their turn and do not trigger any other game-ending conditions | | the user<br><br>- The "surrender" button is replaced with the "exit" button | | | |
|---|---|---|---|---|---|---|
| **Post-Condition(s):** The game has ended, and the user can go back to the lobby | | | | | | |

## References

[1]     "Board games market size to grow by USD 2.56 billion | market research insights

highlight rapid improvements in content and gameplay as key driver |

technavio,"Yahoo! Finance, 25-Jan-2022. [Online]. Available:

https://finance.yahoo.com/news/board-games-market-size-grow-

060000057.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ

2xlLmNvbS9zZWFyY2g_cT1yaXNlK2luK3BvcHVsYXJpdHkraW4rdHJhZGl0a

W9uYWwrYm9hcmQrZ2FtZXMmc3hzcmY9QUxpQ3pzWWxKS3c5cmd3dEetke

kplZnBQN184SkVINkpXZyUzQTE2NjM4MTUwOTU3OTQmc291cmNlPWxu

dCZ0YnM9cWRyJTNBeSYYJnZlZD0yYWhVS0V3aVS0V3aTZ3WWFlc3FmNkF

oVklwbFlCSFRFQUNBTVFVFwd1Y2QkFnQkVCayZiaXc9MTUzNiZiaWg9NzE0

JmRwcj0xLjI1&guce_referrer_sig=AQAAANz5qjdjl7WnlEkQrKpfQug10q

T8VZ3QcwLpN4BPS_Fcdw-

5LNmntagKPBRIThCgcHWLdVXh_JreVI9pq5239RfAEdW2tEbIq_Iuq8cAQPE

agljZ7P1zqpaidDs63W8JaXl9wU1HghHFnbr0Kp4Qq

mXjxu4xL4RHMku85RQJw3. [Accessed: 02-Oct-2022].

[2]     N. Green, "Why is chess so popular right now?," Chess.com, 26-Aug-2021.

[Online]. Available: https://www.chess.com/article/view/why-is-chess-sopopular-

right-now. [Accessed: 02-Oct-2022].

[3]     https://app.sensortower.com/category-

rankings?os=ios&country=PH&app_id=1443568670&start_date=2022-08-

23&end_date=2022-09-

22&countries=PH&category=6016&category=0&category=7006&category=6014

&category=7005&chart_type=free&chart_type=grossing&device=iphone&hourly

=false&selected_tab=charts&date=2022-09-

22&summary_chart_type=topfreeapplications

[4]    D. R. Paciente, "Game of the generals," HobbyLark, 04-Dec-2019. [Online].

Available: https://hobbylark.com/board-games/how-to-play-game-of-the-generals.

[Accessed: 02-Oct-2022].

[5]    I. Sommervile, Software Engineering, 10th ed. Pearson.

[6]    https://www.facebook.com/IPOPHL/photos/a.127946453920468/

2519687921412964/

[7]    S. H. Pasola, Game of the Generals. [Online]. Available:

https://ggsalpakan.weebly.com/. [Accessed: 20-Oct-2022].