



**CS319 Object Oriented Software
Engineering
Project Analysis Report
Second Iteration**

RISE OF EMPIRES

Group 2E

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1.Introduction

It was the coldest night of 1939. Europe is at the edge of another chaos. Dark times are upon us! Take command of your troops and save your homeland from total annihilation. Empower your troops and defend your land. When you are no longer satisfied with defending your land, conquer the enemy lands and expand your empire.

Rise Of Empires is a turn-based combat strategy game with GUI and designed for Windows desktop machines. Main point of the game is to command your troops each turn and try to either defend or attack your opponents lands in order to take control of the map. In order to conquer all the map, the player needs both luck and strategy as the attack and defend value of the units are decided by research (base) and dice (multiplicative).

2. Overview

When the player launches the game, he/she is welcomed by the main menu. Here they can choose to start a new game from the Start Game button with their desired player count, get tutorial tips from the How To Play button, go to settings from the Settings button and access the credits from the Credits button. Game starts as the players choose the player count and their starting countries and their respected generals.

2.1 Gameplay

After selecting their starting countries, the game begins by automatically giving each player their armies. After this each player casts a dice and from the highest die to the lowest, they start to take land until there remains no land to take. The real game starts from this point. The order being again the highest die cast to lowest, players start to attack their opponents and the attacked opponent defends.

Attacking and Defending:

Each unit type has their base attack and defend values. After deciding to attack a player, first the attacker chooses the number of units he/she is attacking, and casts the dice. Depending on the number of units attacking the attacker chooses up to two dice to multiply the base values of the attack units (i.e infantry base attack = 3, cavalry base attack = 5. The dice are 2&4, The total attack value is $(3+5)*(2+4)$). After this the defender chooses the number of units he/she is putting onto defence. Although the dice system is similar to the

attacker's, the defender may have a fort in that land. After choosing the number of defenders, the defending player casts up to two dice and multiplies the base values of the attack units. After this operation the defence value of the fort is added to the defence value (i.e infantry base defence = 3, cavalry base defence = 1. The dice are 2&4, The total defence of the troops is $(3+1)*(2+4)=24$ and the fort's defence value is 8. This brings the total defence value to $24+8$).

Forts:

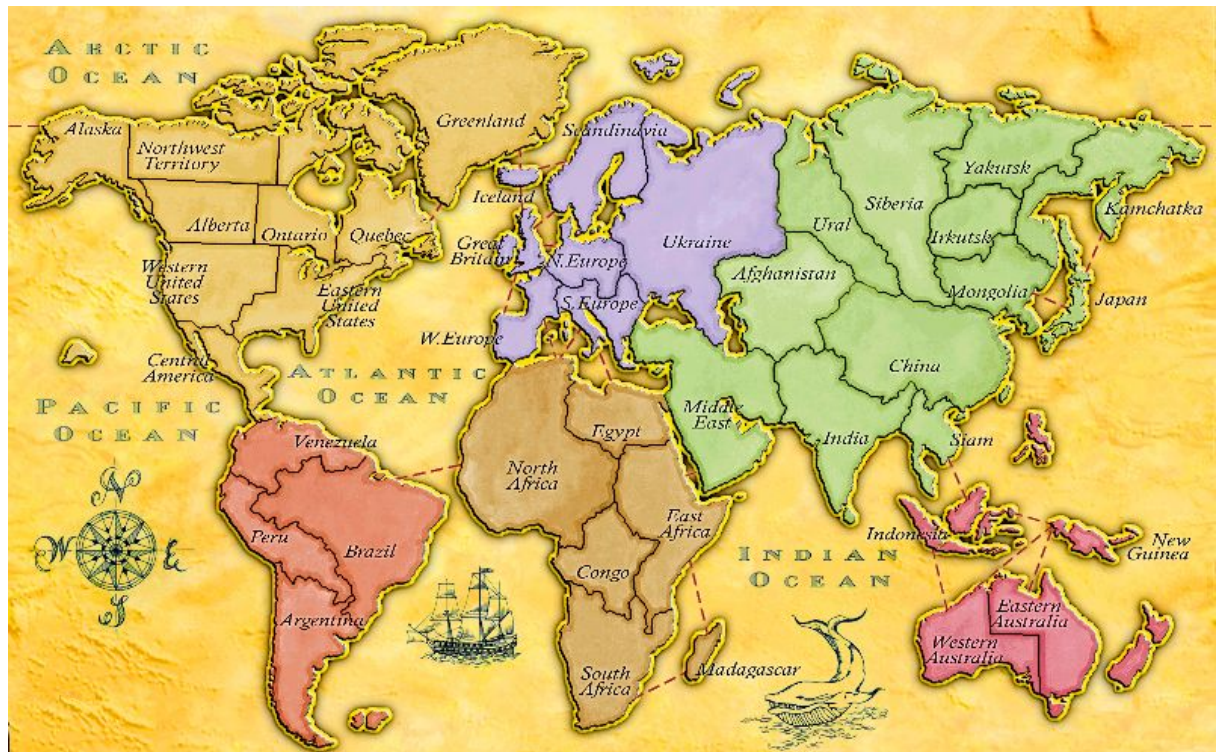
The players can choose to fortify their lands to increase their lands defence bonus but in order to give a chance to the attackers, depending on the fortified land's unit number, forts take 3-5 turns to build. After building a fort in that land players gain a significant defence boost on that land.

Research:

Each country will have their own research paths that will allow them to gain buffer effects. Each research will have a duration in terms of turns in exchange to those buffer effects. Research will be shown in a "Doctrine Tree". Doctrine is an upgrade for the army. Doctrine trees will differ for different countries and leaders.

2.2 Map

The game will take place in a Europe map with some additional countries that are not entirely in Europe: Turkey, Soviet Union, China, Japan. Country boundaries may differ from the real boundaries due to lack of countries.



This is the original Risk map. Our map will be focused on Europe with some additions

2.3 Characters

2.3.1 Countries and Leaders

Leaders are real historical characters that lived during World War II. Most of the countries will have two options to select a leader according to their ideologies. All leaders have their own positive and negative effects upon the country. Some countries like China, Japan have only one leader because those leaders didn't have a realistic opposition in their times. Positive effects will be shown with plus (+) sign, negatives will be shown with minus (-) sign.

Germany

Germany starts the game with Adolf Hitler in charge.

Germany - Adolf Hitler: He is the Nazist Leader of the German Reich.

- + Every fourth research turn will be completed before the turn starts.
- Troops will gain 3 points in attack.
- Troops will lose 5 points in defense.

Germany - Wilhelm II: He is the old emperor(Kaizer) of the old German Empire. He has been exiled in The Netherlands but can come to power by opposing Hitler.

- + Troops will gain 2 points in attack and defense.
- Every fifth research turn will take two turns to complete

Soviet Union

Soviet Union starts with Joseph Stalin in charge.

Soviet Union - Joseph Stalin: He is the Communist Leader of the Soviet Union.

- + Troops will gain 2 points against democrat leaders.
- Every fifth research turn will take two turns to complete

Soviet Union - Leon Trotsky: He is the other student of Lenin. He is also Communist, and can come to power with a coup against Stalin(civil war) (Trotskyist Coup).

- + Troops will gain 2 points against non-communist leaders.
- Every fourth research turn will take two turns to complete.

France

France starts with Charles de Gaulle in charge.

General Effect:

- French Army gets distracted so easily in the war. Every defeat the army takes will end up 1 point loss for every troop in defense.

France - Charles de Gaulle: He is the democrat leader of France. He is the founder of the Free France

France - Philippe Pétain: He is the fascist candidate of France. He can come to power with an election.

UK

United Kingdom starts with Winston Churchill in charge.

United Kingdom - Winston Churchill: He is the democrat leader of the United Kingdom.

- + Troops will gain 3 points against German Reich.
- Infantry Troops will lose 1 point.

United Kingdom - Oswald Mosley: He is the fascist candidate of United Kingdom

- + Troops will gain 3 points to non-fascist leaders in attack.
- Troops will lose 6 points against German Reich.

USA

USA starts with Roosevelt in charge

USA - Franklin Delano Roosevelt: He is the Democrat Leader of USA

- + Every trade will grant +1 unit. Troops will gain 2 points against Japan in attack.
- Troops will lose 3 points against Japan in defense.

USA - Alf London: Republican Leader

- + After every victory, player will lose -2 less units.
- Every trade will grant -1 unit.

Italy

Italy starts with Mussolini in charge.

Italy - Benito Mussolini: He is the fascist leader of Italy.

- + Troops will gain 4 points against non-fascist leaders.
- Troops will lose 2.5(??) in defense.

Italy - Ferruccio Parri: He is the democrat - socialist candidate of Italy.

Japan

Japan doesn't have another leader option than Hirohito

Japan - Hirohito: He is the Fascist leader of Japan

China

China has a army-corruption nerf

China doesn't have another leader option than Kai-shek

China - Chiang Kai-shek: He is an old warlord, currently a non-aligned leader.

Turkey

Turkey starts with Ismet Inonu in charge.

Turkey - Ismet Inonu: He is the authoritarian leader of Turkey.

- + Every trade will grant +2 units.

- Troops will lose 1 point in attack.

Turkey - Abdulmejid II: He is the last caliph of the Islamic world. He can come to power by a coup, aiming to bring back the Ottoman Empire.

- + Troops will gain 2 points in attack.
- Trades will grant -1 units. Every fifth research turn will take two turns to complete.

Players will select countries and according to their gameplay, a leader will be appointed. Other countries will be selected by the bots according to historical events.

2.3.2 Generals

All countries have a set of generals that provide positive and negative effects on the army. Positive effects will be shown with plus (+) sign, negatives will be shown with minus (-) sign.

Germany

Erich von Manstein: + He is known for his intelligence. Every fifth research turn won't spend the current turn player in.

- He is an aggressive general. Troops will lose 2(?) points in defence.

Erwin Rommel: + He is a very skilled general. Troops will gain 1(?) points in attack and defence.

- His biggest defeat was against Soviet Union, Operation Barbarossa. Troops will lose 4(?) points against Soviet Union in attack and defense.

Fedor von Bock: +He has special infantry troops at his command. Infantry troops will gain 2(?) points in attack and defense.

- He is an old-fashioned general. Cavalry troops will lose 1(?) points in attack and defense.

Soviet Union

Georgy Zhukov: + He played a key role during the Siege of Stalingrad against German Reich. Troops will gain 2(?) points against Germany in defense.

- He had a massive defeat against Japan. Troops will lose 3(?) points against Japan only in attack.

Mikhail Tukhachevsky: + He is a field marshal. Troops will have 1(?) point in attack and defense.

- He was executed by Stalin. He can't be played while Stalin is the leader of the Soviet Union

Konstantin Rokossovsky: + He is an armor officer. Cavalry troops will have 3(?) points in attack and defense.

- He is not one of the world revolutionists. He can't be played while Trotsky is the leader of the Soviet Union.

France

Since the negative effect of France is overwhelming, French generals don't have a negative effect.

Jean de Lattre de Tassigny: + He won a great victory against German Reich. Troops will have 3 points against German Reich in attack.

Alphonse Georges: + He defended Maginot against German Reich. Troops will have 3 points against German Reich in defense.

UK

2 points loss against democrats

Bernard Montgomery: + He is an experienced defence commander. Troops will gain 2 points in defence.

Alan Brooke: + He commanded the Invasion of Normandy. Troops will gain 3 points against German Reich in attack.

USA

Douglas MacArthur: +/- He is a great offensive leader but an insufficient defender. Troops will gain 3 points in attack but lose 3 points in defence.

George S. Patton: + He is an armor officer. Cavalry troops will have 2(?) points in attack and defense.

- He has a bad influence on his soldiers. Infantry troops will lose 1(?) point in attack and defense

Dwight D. Eisenhower: + He is a peacekeeper field marshal. Troops will gain 2 points against non-democratic leaders in attack and defence

- He is a rebuplicant. He can't be played with Roosevelt in charge.

Italy

Giovanni Messe: He is an armor officer. Cavalry troops will have 2 points in attack and defence.

- He faced overwhelming offenses of Soviet Union, Saturn Operation. Troops will lose points against Soviet Union in defense.

Ugo Cavallero : + He fought against France in the Piedmont-Savoy border. Troops will have 2(?) points against France in attack.

- He is an old-fashioned officer. Every eighth research turn will take two turns to complete.

Japan

Tomoyuki Yamashita: + He is an anti democrat. Troops will gain 4(?) points against democrat leaders in attack and defense.

- He lost a massive defeat against Soviet Union. Troops will lose 3(?) points against Soviet Union in attack.

Hisaichi Terauchi: + He is an offensive commander in Beijing Offense. Troops will gain 2(?) points against China in attack.

- He is an old-fashioned officer. Every seventh research turn will take two turns to complete.

China

Since China has an army-corruption nerf, generals don't have negative effects.

Sun Li Jen: + He is an offensive commander. Troops will gain 4 points in attack.

Hu Zongnan: + He is a defensive commander. Troops will gain 4 points in defence.

Turkey

Fevzi Çakmak: He is a field marshal. + Troops will gain 1 points in attack and defense.

- He is a right-wing politician. His buffer will not work while Inonu is in charge.

Kazım Karabekir: + He is an experienced offense commander. Troops will have 2 points in attack.

- He is a loyal Ottoman officer. He can't be played with Inonu as the leader of Turkey

Fahrettin Altay: + He is the first commander to enter the Izmir with Cavalry troops.

- He is a republican officer. He can't be played with Abdulmejid II is the leader of Turkey

2.3.3 Units

Armor(Cavalry) Troops: Armored heavy tanks with high attack, mid defense stats. Producing is expensive

Infantry Troops: Soldiers with mid defense, low attack stats. Producing is cheap.

Artillery Troops: Artillery units with high defense, low attack stats. Producing is balanced.

2.4 Rules

2.4.1 Goal

Occupy every territory on the board and eliminate all of your opponents.

2.4.2 Setup

Depending on the player count, each player will start with the following:

If there are 3 players each player counts out 35 units.

If there are 4 players each player counts out 30 units.

If there are 5 players each player counts out 25 units.

If there are 6 players each player counts out 20 units.

Every player rolls dice once. Starting from the player who rolled the highest to who rolled lowest, players put one unit to any territory to claim the territory. After all territories are claimed, players put their units to any territory they claim until everyone runs out of armies. Whoever placed the first unit takes the first turn.

2.4.3 Gameplay

The game is played turn by turn. Every turn consists of 4 stages.

2.4.3.1 Stage 1 (mandatory)

Note: If there is an ongoing research or construction the player can still receive new armies.

In this stage, the player will receive new armies and place them on their territories. The number of the new armies player will receive depends on:

1) The number of territories he has.

The number of new armies he'll receive is calculated by: territories he occupies divided by 3 (fractions are ignored). Every player receives at least 3 armies.

2) The continents he controls.

To control a continent, a player needs to occupy all of its territories at the start of the turn. A player receives different amount of armies by controlling each continent. The amounts are as follows:

North America: 5

South America: 2

Africa: 3

Asia: 7

Europe: 5

Australia: 2

3) The value of the set of cards he trades.

If the player has a set of 3 cards in any of the following conditions:

1) 3 cards of the same design

2) 1 each of 3 designs

3) Any 2 + 'wild' card

The player might choose to trade their cards to receive additional armies. The additional armies get greater every time a player trades cards.

The pattern is as follows:

The first trade: 4 armies

The second trade: 6 armies

The third trade: 8 armies

The fourth trade: 10 armies

The fifth trade: 12 armies

The sixth trade: 15 armies

After the sixth trade, every additional trade is worth 5 more armies. If the player has more than 5 cards, he has to spend his cards.

2.4.3.2 Stage 2 (optional)

Note: If there is an ongoing research or construction from previous turns the player has to skip this stage.

In this stage, the player might choose to attack, research or build a fort.

2.4.3.2.1 Attack

The player might attack to occupy a territory. Each unit has its own attack and defense values. If the player chooses to attack the following steps will be followed:

Step 1) The attacker decides how many units he wants to use on the attack. The attacker rolls 2 dice. The attack value is calculated by:

$(\text{First dice} * \text{infantry attack value} * \text{infantry count}) + (\text{Second dice} * \text{cavalry attack value} * \text{cavalry count})$.

Step 2) The defender decides how many units he wants to use on defense. The defender rolls 2 dice. The defense value is calculated by: $(\text{First dice} * \text{infantry defense value} * \text{infantry count}) + (\text{Second dice} * \text{cavalry defense value} * \text{cavalry count}) + \text{Fort defense value}$.

Step 3) If the attack value is bigger, the attacker wins. Otherwise the defender wins, even if the attack and defense values are equal!

The loser loses all of their units whereas winner loses:

$\text{Loser unit count} / (\text{The bigger value} / \text{The smaller value})$ [fractions are ignored].

Note: The meaning of the calculation is that the winner will always lose less than the loser(or the same). Additionally the bigger the difference between bigger-smaller values, the less units the winner will lose. Fort is counted as 5 units.

- * The player must have at least 2 units to attack and leave at least 1 unit left in the territory where he is attacking from.

- * The player can only attack territories that are adjacent to him.

- * There can be more than 1 attack each turn.

If the attacker eliminates an opponent(the opponent loses all of his territories), he earns all the cards the opponent currently has. If the card count exceeds 5(6 or more), he must use the cards until he has less than 5(thus receive new armies and place it on any territory they currently have). Otherwise, the cards cannot be used until the next turn.

2.4.3.2.2 Research

The player might choose to conduct research to upgrade his army. The duration of the research and the effects of it depends on the country/leaders. For more info check 'Doctrine Tree'.

2.4.3.2.3 Build a Fort

The player can build a fort to a certain territory. The fort increases the defence value of the territory by 8. The duration of the construction depends on the current army on the territory and is calculated as follows:

The construction takes 5 days if there are 1-5 units on the territory.

The construction takes 4 days if there are 6-11 units on the territory.

The construction takes 3 days if there are 12+ units on the territory.

* If the territory is occupied while being constructed the fort gets CANCELLED.

* The forts do not increase the defence value of the territory until the construction is over.

* If a territory with a built fort gets occupied, the fort becomes unusable.

2.4.3.3 Stage 3 (optional)

Note: If there is an ongoing research or construction from previous turns the player has to skip this stage.

In this stage the player can move their troops from one territory to one of the ADJACENT territories. It can be done only once.

2.4.3.4 Stage 4

In this stage, the player will receive a card if and only if the player captured a territory in this turn.

2.4.4 The End Of The Game

The first player to capture all territories wins the game.

2.5 Settings

With the button Settings player will be able to change the settings, like turning up and down the volume, according to his/her desire.

3. Functional Requirements

3.1 New Game

Players will be able to reach Start Game from the Main Menu. By entering this screen, the Conquer will start. After every player chooses their own country, the actual game begins. At the beginning, each player has the same amount of units in their army and in order to defeat the game a player should conquer all other player's countries.

3.2 Load Game

Players will be able to reach Load Game from the Main Menu. By entering this screen, if a player played the game before but left for any reason we give him/her a chance to load his/her game from the last turn he/she finished.

3.3 How To Play

Players will be able to reach How To Play from the Main Menu. This section gives basic information about the gameplay together with rules. By this section we intend to inform players about what to do instead of the idea "push buttons, see what happens" and by this we hope that new players will be more eager to continue playing.

3.4 Settings

Players will be able to reach Settings from the Main Menu. This section gives players a chance to change the certain options according to their desire (ex: Volume).

3.5 Credits

Players will be able to reach Credits from the Main Menu. This section simply gives information about who designed this game together with our eternal thanks.

4. Non-Functional Requirements

4.1 Extendibility

Our game is implemented in a way that if we want to change, add or remove a feature, we should not have to make huge changes in our code for a new version update. Thus, object oriented design concepts should be used.

4.2 Usability

Together with the button How To Play the game has a user-friendly interface because the user will be able to understand what he/she is going to encounter and what he/she is supposed to do according to the rules. Therefore, the maximum number of clicks should not exceed 5 for any kind of interaction.

4.3 Reliability

Players' game process will be kept locally so that the user can load his/her game and continue from the last turn he/she left. As a result, there should be no data loss while storing the game process even if there is a system failure or power loss.

4.4 Maintainability

Since this is a group project maintainability is too important. Since every person involved in this project needs to understand what others did when writing a new part or changing the broken part. So, comments in necessary places will be used to explain the certain codes of that place.

4.5 User Experience

To increase user's immersion, we will implement visual and audio cues that will play when a territory is conquered or lost, victory over a player has been achieved or when certain game items such as troops are selected. In addition, an ethnic background music will play depending on the nation that has been selected; for example "Mehter Marşı" for Turks or

“Cheeki breeki” for Russians, though that option can be tweaked in the Settings menu. Troops will respond in their native language as they are selected and given a command.

Another addition will be small animations that will play when troops are marching towards a new objective or when they engage the enemy. Sections of the map will change their color when a new player conquers them, indicating the flag of the nation that conquered it. To conclude, the chosen country should reflect its own characteristics, and the countries should affect the user experience significantly.

4.6 Game Performance

In order to increase the players' game quality we will try to sustain high FPS from beginning till the end. So, since we want to reach as many players as possible, we need to hold system requirements as minimum as possible and this will help sustaining high FPS too. Thus, the minimum frame rate should be 20 frames per seconds and average frames per seconds should be greater than 40. However, we will not restrain ourselves with just high FPS. Risk should also offer a good response time to its players. The average response time should not exceed 0.5 seconds, meaning that when the player makes a move, the system should respond in 0.5 seconds generally.

5. System Models

5.1 Class Diagram

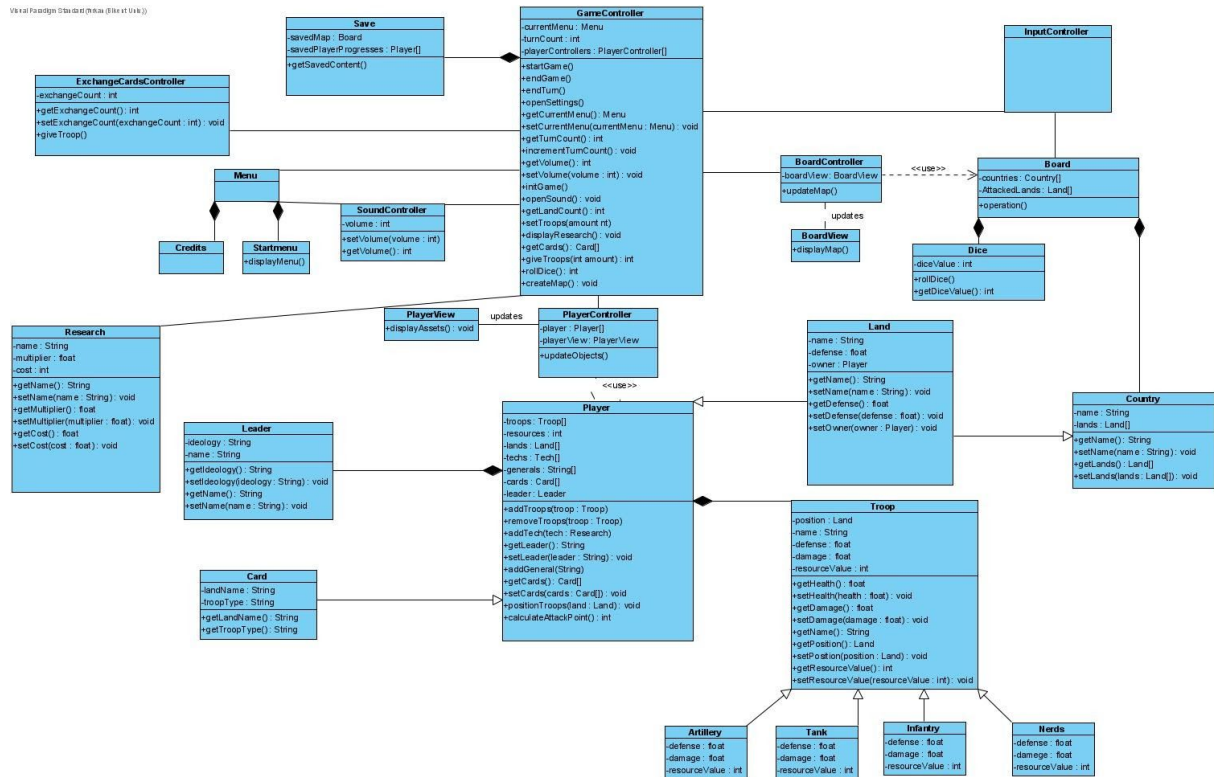


Figure 1 Class Diagram

Artillery, Tank, Infantry, Nerds Class: Each one of them is a subclass of Troop class. The difference between them is the values they take in defense, damage and resource values.

Troop Class: Represents the four kinds of troops a player can have. Each instance of Troop has a position on the board, a name, defense and damage values and a resource value. The resource value represents how many troops it takes to convert to another troop.

setPosition(position: Land): void is called every time a troop is placed into new land, such as when a new troop has been given to the player at the beginning of the turn or when the player is attacking another land that does not yet belong to them.

Card Class: Represents a single card that the user gets when he/she attacks a land and wins the conflict. A random card is given to the player. Each card has a land name and a troop type on it.

Land Class: Represents the tiles on the board that players can conquer. Each instance of the Land class has a name, income, an owner and a defense value. Defense value acts as a multiplier that boosts the defending player's chances when the dice are rolled. The owner attribute changes when the land has been conquered.

Board Class: The board class holds an array of each land in the game.

BoardController: Updates the board according to the changes the players make. After the end of each turn, changes the owner of conquered lands.

BoardView: Draws the board to the screen. Gets updated by the BoardController.

InputController: Passes the mouse and keyboard to the controllers so that the game can be updated.

Leader Class: Each instance of the leader class has a name and an ideology. Different leaders affect various aspects of gameplay such as added bonuses to troops or research.

Research Class: The Research class represents the research options that players have. Each research buffs various aspects of the game such as troops or defense values.

Player Class: The player class has the lands, troops, techs, generals, resources and cards a player has.

Player View: Draws the items the player has such as troops and cards(when the player wishes to see his deck).

PlayerController: Updates the player's assets. For example when a player gains or loses troops, conquers lands etc.

GameController: GameController updates the game state. When the player presses the next turn button, GameController calculates what kind of changes will occur within the game.

ExchangeCardsController: Enables the exchange of cards within the board. The players will be able to hand in their cards to receive troops or receive cards.

5.2 Use Case Diagram

Visual Paradigm Standard (UML-like Notation)

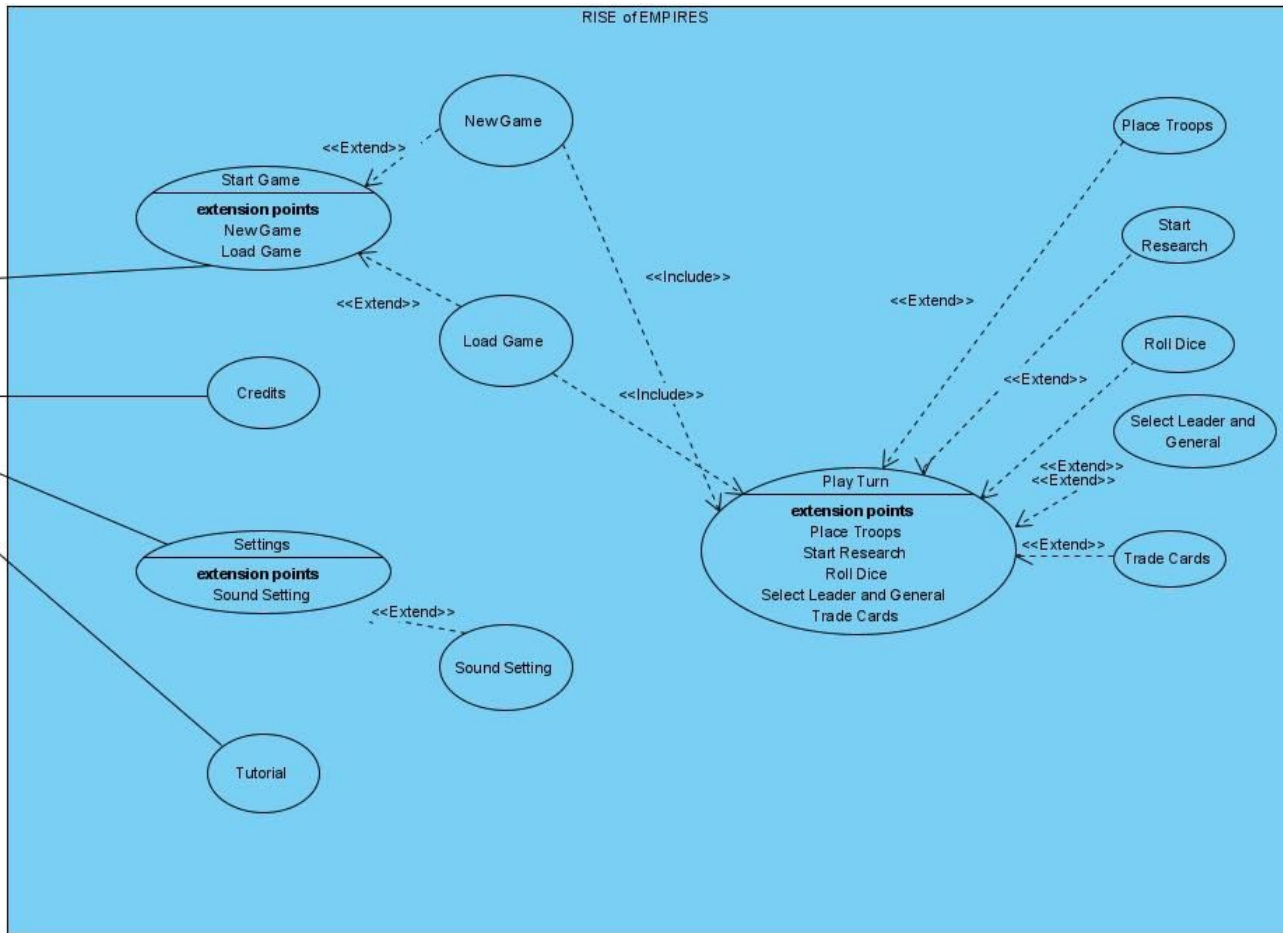


Figure 2 Use Case Diagram

5.2.1 Use Case Diagrams

5.2.1.1 New Game (Start Game)

Main Actor: Player

Stakeholders and Interests: Player may start a new game.

Pre Condition:

- Player must be in the main menu.

Post Condition:

- No post condition.

Entry Condition:

- Player joins the new game by clicking the Start Game button.
- Player selects the number of players.

- Players select their countries.
- Players select their leaders.
- Players select their generals.

Exit Condition:

- There is a winner
- Player get back to the Menu

Main Events:

- Each player casts a die and from the biggest to smallest value dictates the order of the players.
- Player 1 decides on his/her orders. As long as the player does not press the end turn button, he/she can continue to order.
- After pressing on the end turn button, if the player chose to attack someone, the player casts dice for each land he/she attacked. After each cast dice, the attack value of the troops are calculated.
- After calculating the attack values of each attacking troops, the turn ends for the first player.
- If the second player is attacked, the attacked lands are shown. Again the player decides on their orders. As long as the player does not press the end turn button, they can continue to order.
- After pressing on the end turn button, if player 2 is attacked and chooses to defend their land, the player casts dice for each land they chose to defend. After each cast dice, the defend value of the troops are calculated and after comparing the attack value of the attackers and the defend value of the defenders, the land is either given to the attacker or to the defender.
- Depending on who won the fight on the land, the winning side keeps their troops while the losing side loses their troops. If the attacker won this conflict, the attacker is awarded a land card.
- After all the conflicts are resolved, if the player 2 chose to attack a land, their troops attack values are calculated just like the player 1.
- The game continues like this after the first end of the last player's turn.
- When the first circle of the game ends and it is the player's 1 turn, The players start to get troops depending on the count of land they have.
- The player puts the given troops to their land as they wish.
- After placing their troops, the player can continue to place their orders. After the first cycle of the game, if the player has 3 of the same type of land card, they can choose to exchange their cards for extra troops.
- If the player exchanged a set of 3 cards, again they have to place their troops on their lands.
- Other than the new system of exchanging cards, the game continues just like the previous cycle.
- This cycle continues until one player remains.

Alternative Events:

- User closes the program while game continues:
 - The game will save itself automatically after each turn. If the user wants to continue playing, They can choose to load their game. If they choose to play a new game a new load is created and the previous game is destroyed.
- Game crashes while the game continues:
 - The game will save itself automatically after each turn. If the user wants to continue playing, They can choose to load their game. If they choose to play a new game a new load is created and the previous game is destroyed.
- The player chooses not to defend their land:
 - If the player chooses not to defend their land, the game takes the number of defenders as 0 and gives the land to the attacker.
- The player attacks a land with 0 units:
 - The land is given to the attacker without a conflict.

The game will save itself automatically after each turn. If the user wants to continue playing, They can choose to load their game. If they choose to play a new game a new load is created and the previous game is destroyed.

5.2.1.2 Load Game

Main Actor: Player

Stakeholders and Interests: Players who want to continue unfinished game.

Pre Condition:

- Player must be in the main menu

Post Condition:

- No post condition

Entry Condition:

- At the end of every turn the game will be saved, so when the player wants to save that turn must be ended.
- Player should click on the Load Game button in the main menu.

Exit Condition:

- There is a winner
- Player get back to the Menu

Main Events:

- Player started to the game where the last turn ended and player left

- New Game Main Events occur.

Alternative Events:

- Player does not finish the game.

5.2.1.3 Tutorial (How To Play)

Main Actor: Player

Stakeholders and Interests: New players or the players who want to recall the rules of RISK, may want to reach how to play section of the game.

Pre Condition:

- Player must be in the main menu

Post Condition:

- No post condition

Entry Condition:

- Player selects the How To Play.

Exit Condition:

- Player selects the Back button to get back to the Main Menu.

Main Events:

- Player opens the How To Play section from the Main Menu.
- Player understands or recalls the rules or hints.
- Player turns back to the Main Menu with the Back Button.

Alternative Events:

- Player may want to return back to the Main Menu

5.2.1.4 Settings

Main Actor: Player

Stakeholders and Interests: Player may want to change the sound settings.

Pre Condition:

- Player must be in the Main Menu
- Player must be in the pause screen

Post Condition:

- Sound settings updated according to the Player's desire.

Entry Condition:

- Player selects the Settings button in the main menu.
- Player selects the Settings button in the pause screen.
- Player changes the sound value from the sound bar.

Exit Condition:

- Player selects the Back button to get back to the Main Menu.

Main Events:

- Player selects the Settings button
- Player changes the settings according to his/her desire.
- System applies the modified settings.
- Player returns to the pause screen or main menu.

Alternative Events:

- Player may not change the settings.
- Player did not save his/her choices, so old values are preserved.

5.2.1.5 Credits

Main Actor: Player

Stakeholder and Interest: Player may want to see who developed this game.

Pre Condition:

- Player must be in the Main Menu

Post Condition:

- No post condition

Entry Condition:

- Player selects the Credits button.

Exit Condition:

- Player selects the Back button to get back to the Main Menu.

Main Events:

- System shows the developers

Alternative Events:

- Player may want to return back to the Main Menu.

5.3 Sequence Diagrams

5.3.1 Start a New Game

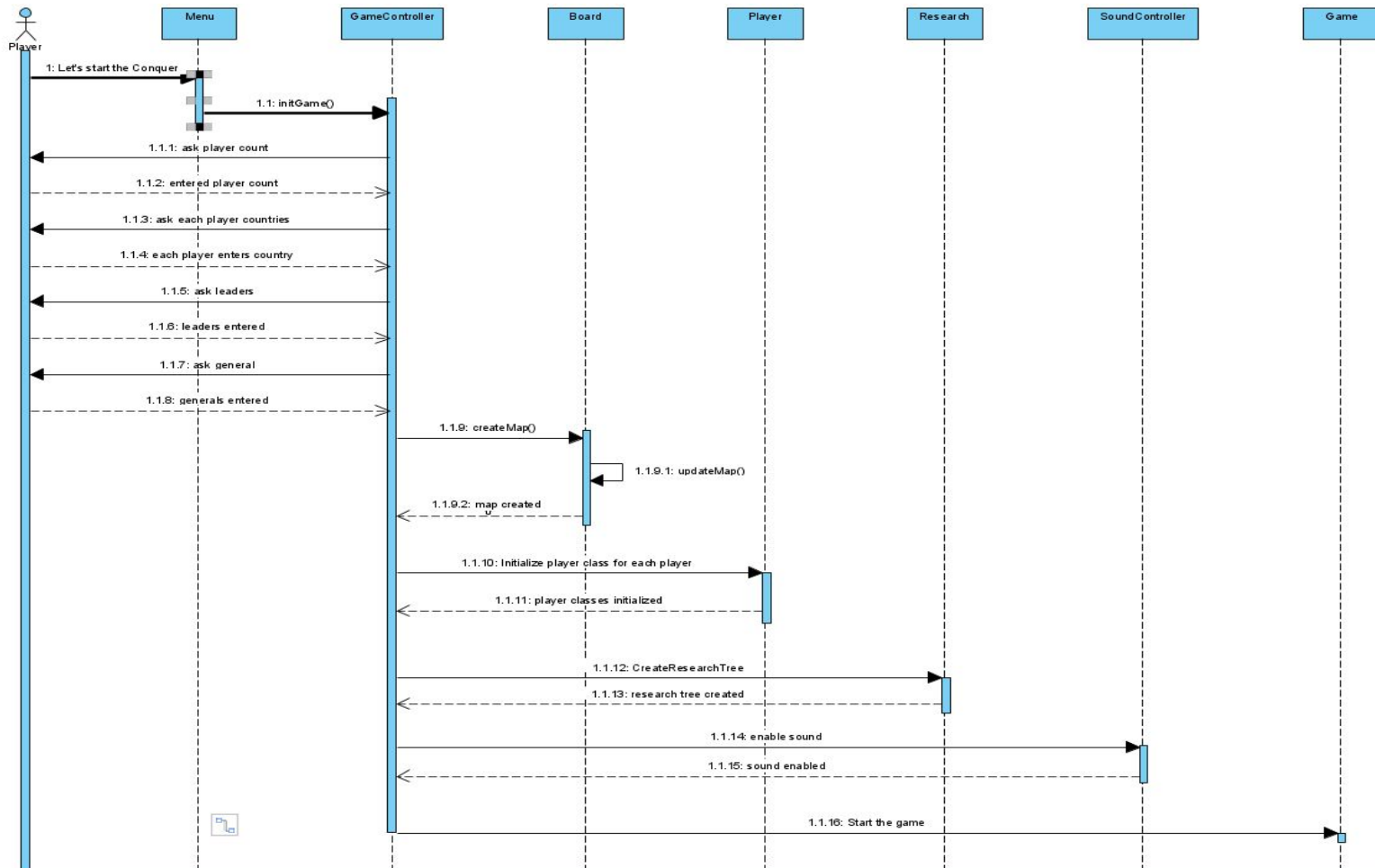


Figure 3.1 New Game Sequence Diagram

Player clicks on the Start Game button. Menu calls the GameController to initialize the game. GameController asks the user how many players there are, each player's country, leader and general and gets the info back. After getting all the info needed GameController calls the board to create the map and updates it until all the map is finished. After the map is created, GameController initializes each player using Player class, creates the research tree using research class and applies the sound settings. After all this is done, the game starts.

5.3.2 Load Game

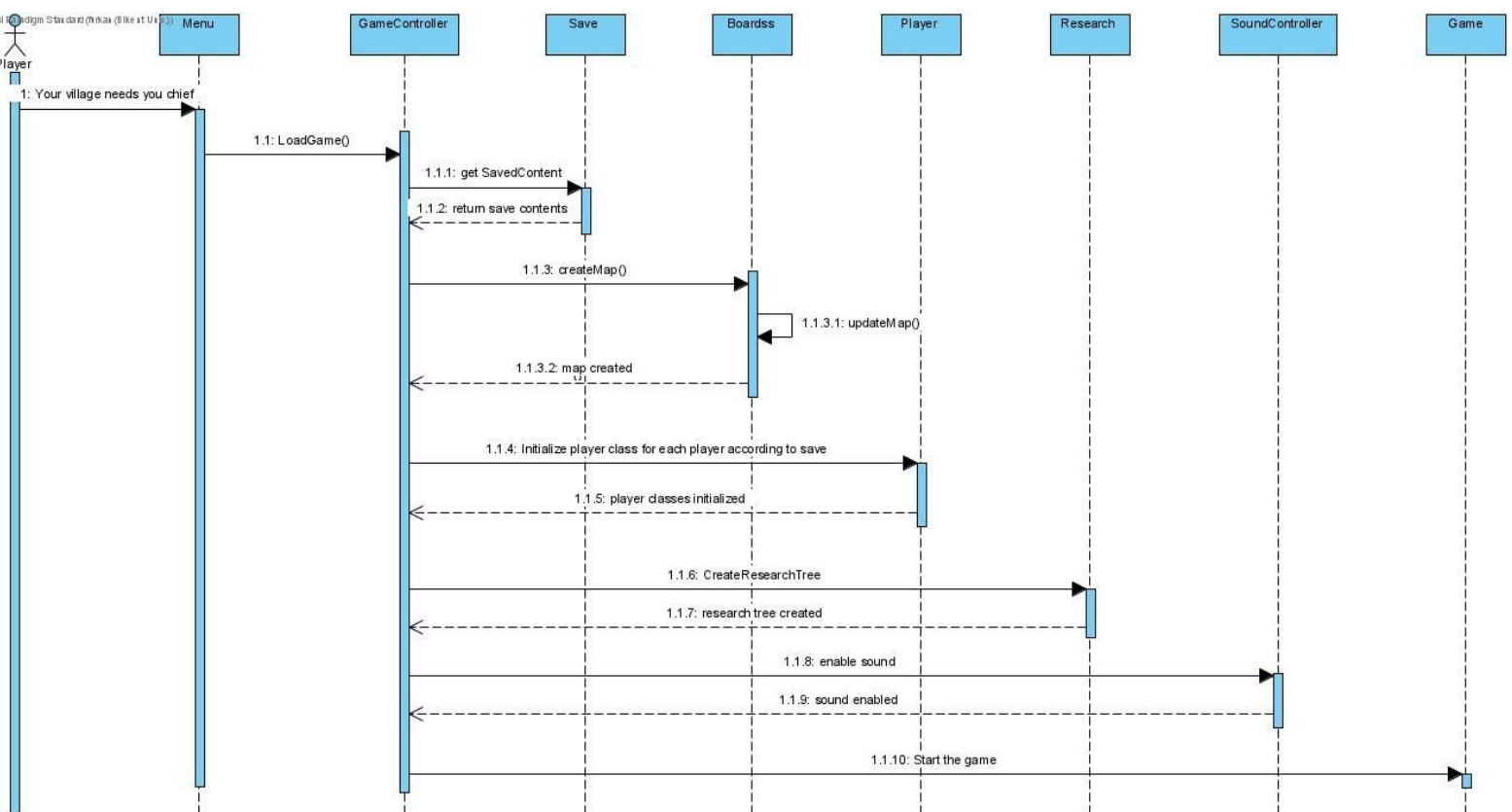


Figure 3.2 Load Game Sequence Diagram

User presses the Load Game button. Menu calls GameController to load the previous game. GameController calls Save class to get the save file. After the GameController gets the save file, instead of initializing the game with default values, initializes the game with the saved values.

5.3.3 Player's Turn

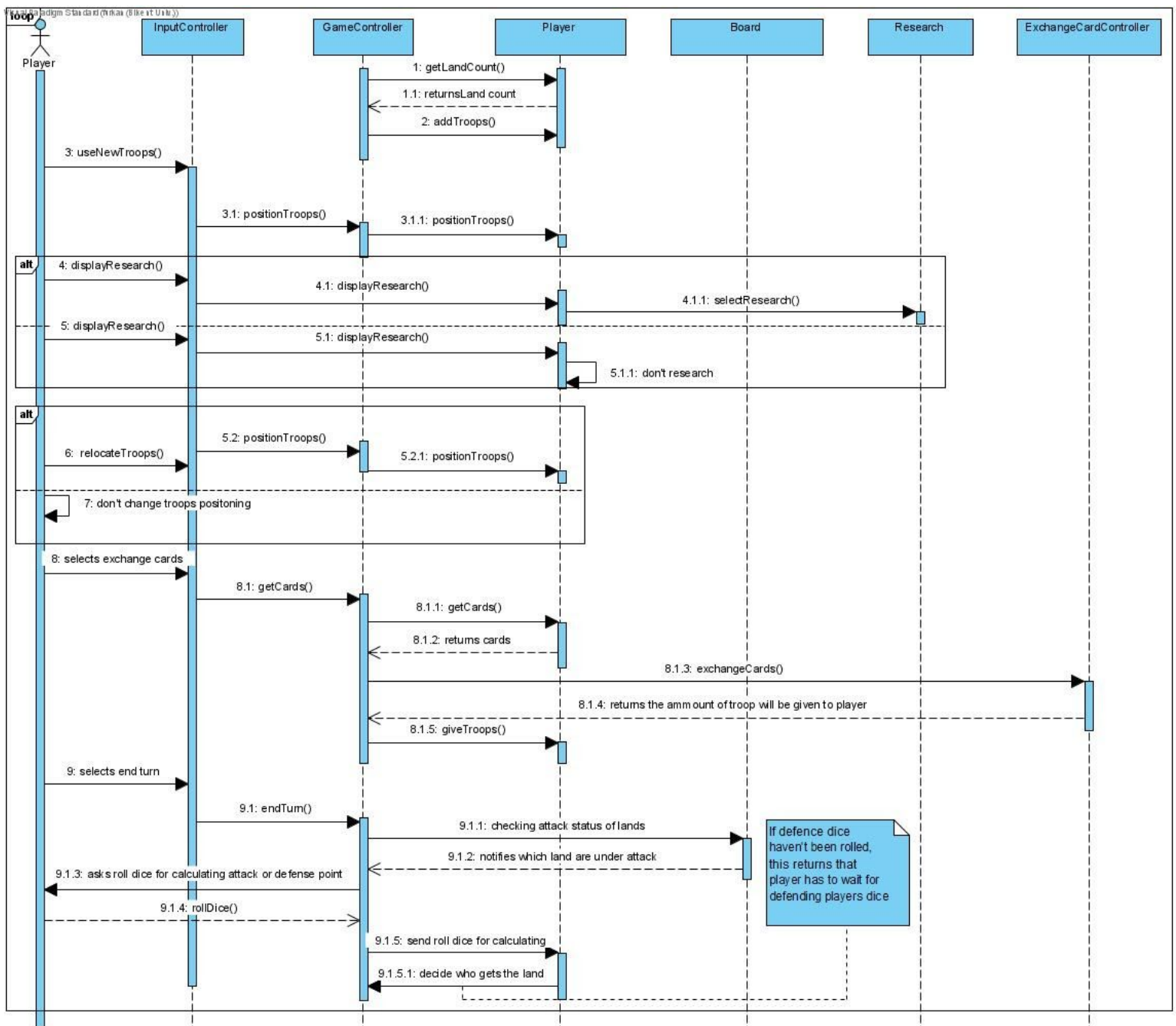


Figure 3.4 Players' Turn Sequence Diagram

At the start of each turn, GameController gets the land count from the user and gives the player the calculated troops. After getting their new troops, the player positions their troops on their land. After finishing positioning their troops the player can do a combination of the following:

Research: Player clicks on the research tree and calls the displayResearch. When they click on one research their option is saved. The player can also choose not to research.

Reallocate Troops: The player can reallocate their current troops to other lands.

Exchange Cards: When clicked on the exchange cards, GameController gets the player's cards and displays it. After confirming that the player exchanged cards, GameController calls the

ExchangeCardController and gets the count of the troops that must be given to the player. After getting this value, GameController gives the player the amount of troops that was taken from ExchangeCardController. The player must then allocate their troops.

After deciding on their orders, the player clicks on the end turn button and ends the turn for themselves. After the button is pressed GameController checks whether the player is attacking someone or being attacked. After getting this information, GameController asks the player to roll the dice for the conflicted lands. After each dice cast, GameController decides who that land belongs to. If only one player casted their dice, this calculation is delayed until the defending player casts their dice. After all land conflicts are solved the turn ends and begins for another player.

5.3.4 Gameplay Sequence

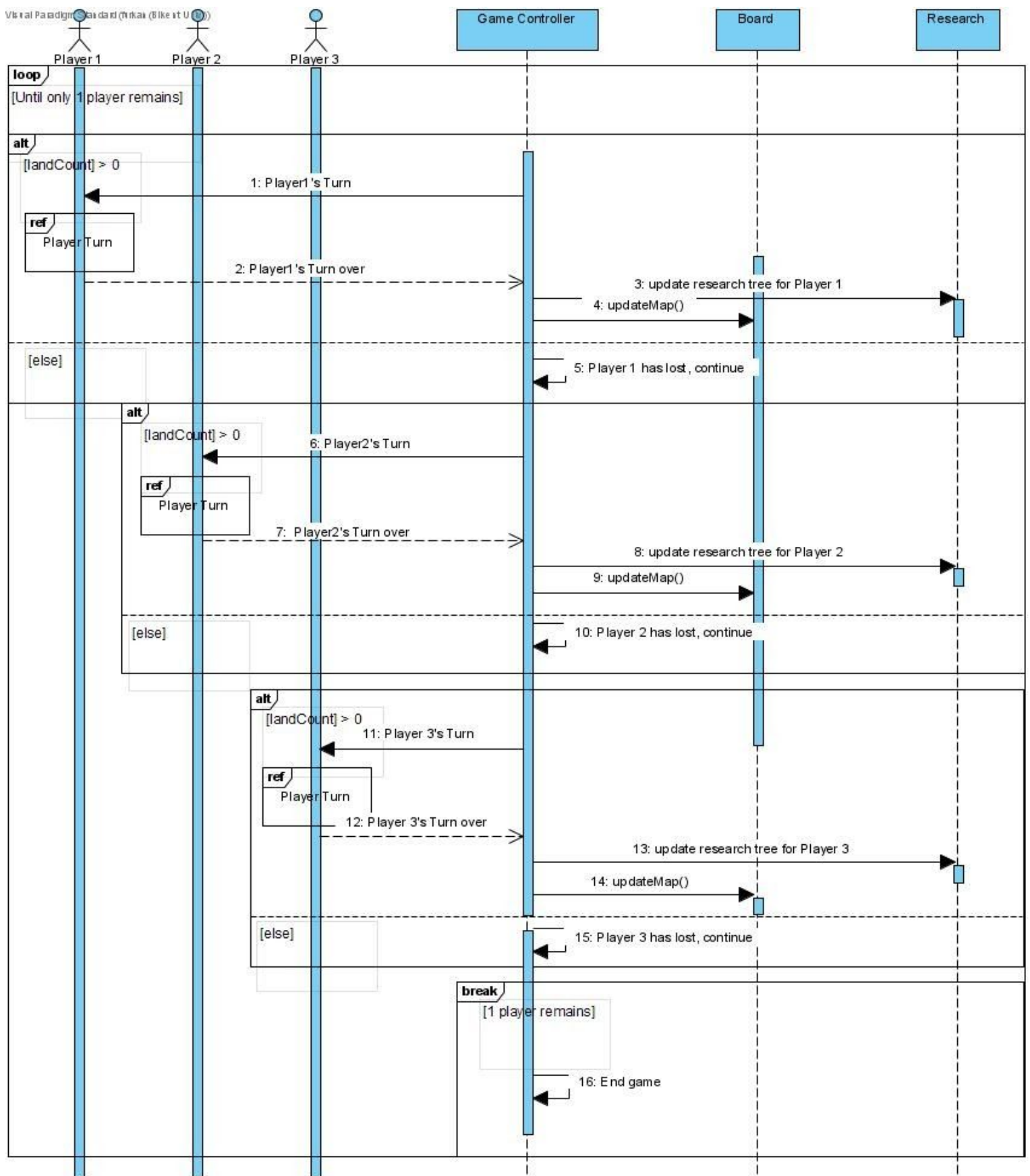


Figure 3.5 Gameplay Sequence Diagram

Whole game works in a loop until only 1 player remains or the program shuts down. Players lose when they lose all their lands, when landCount becomes 0. GameController makes every player play their turn one by one. When a player's turn ends, GameController updates the map and researches tree progress. When the program exits the loop, GameController finishes the game.

6. MockUps

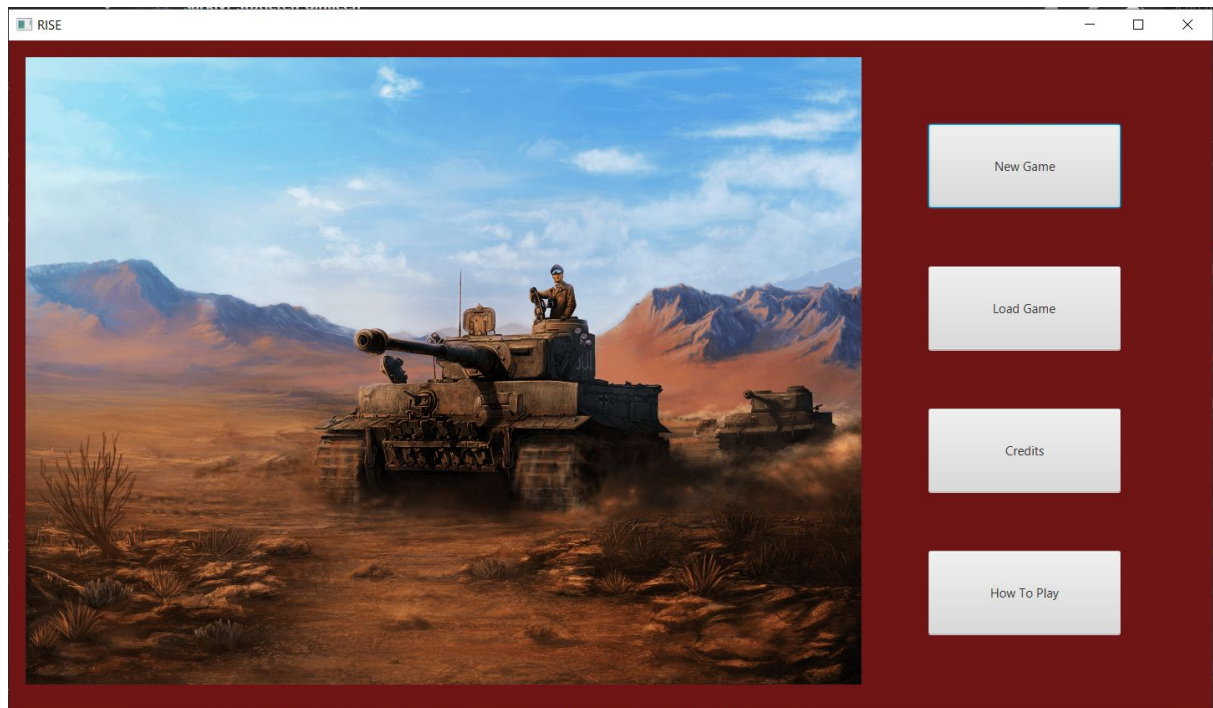


Figure 4 Start Screen Mock Up

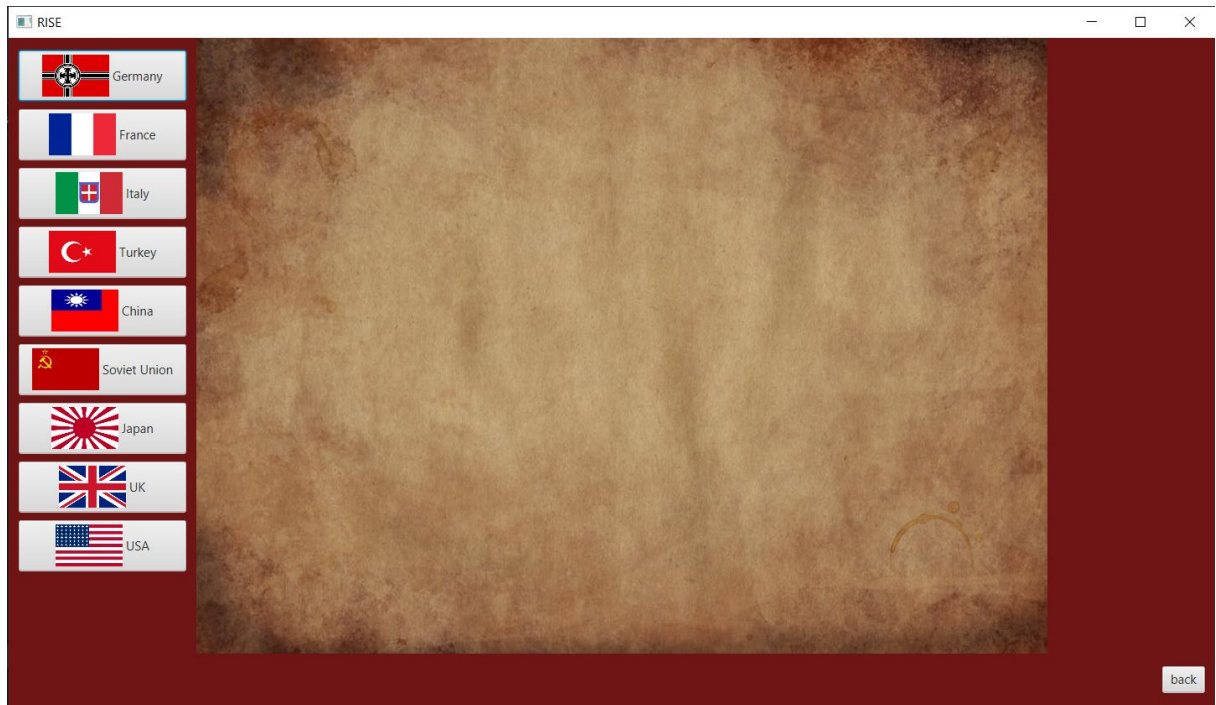


Figure: 5 Country Selection Mock Up

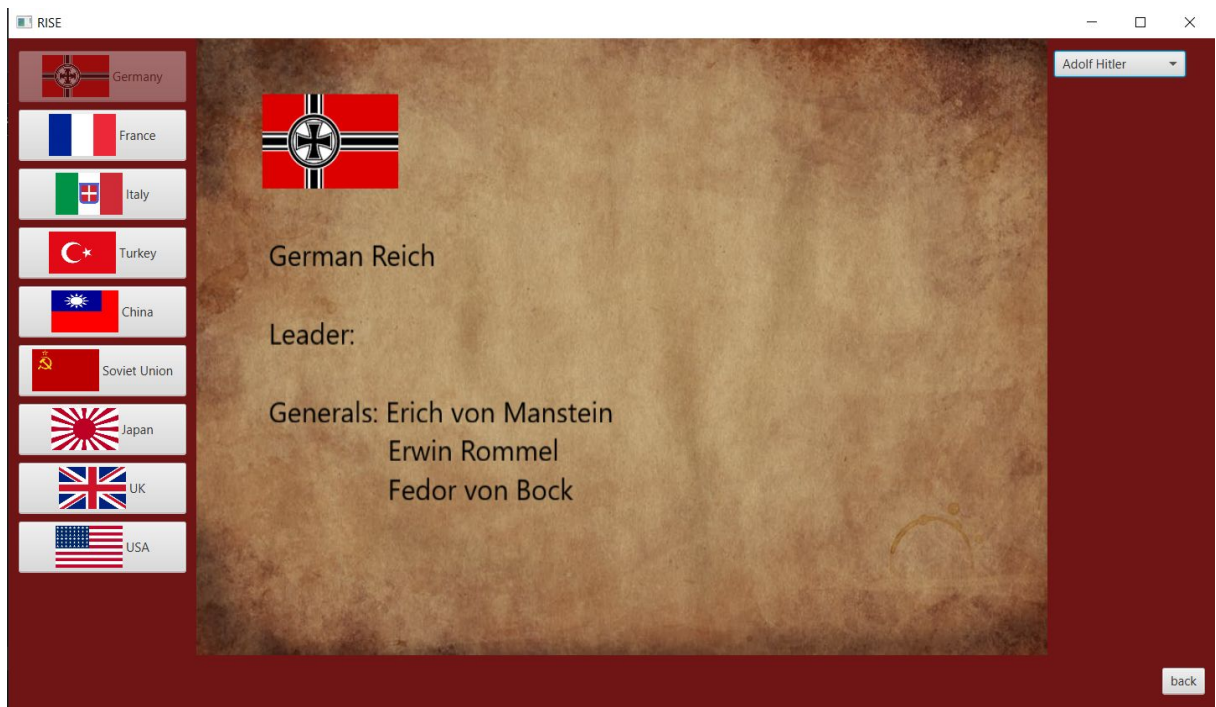


Figure 6 Leader Selection Mock Up

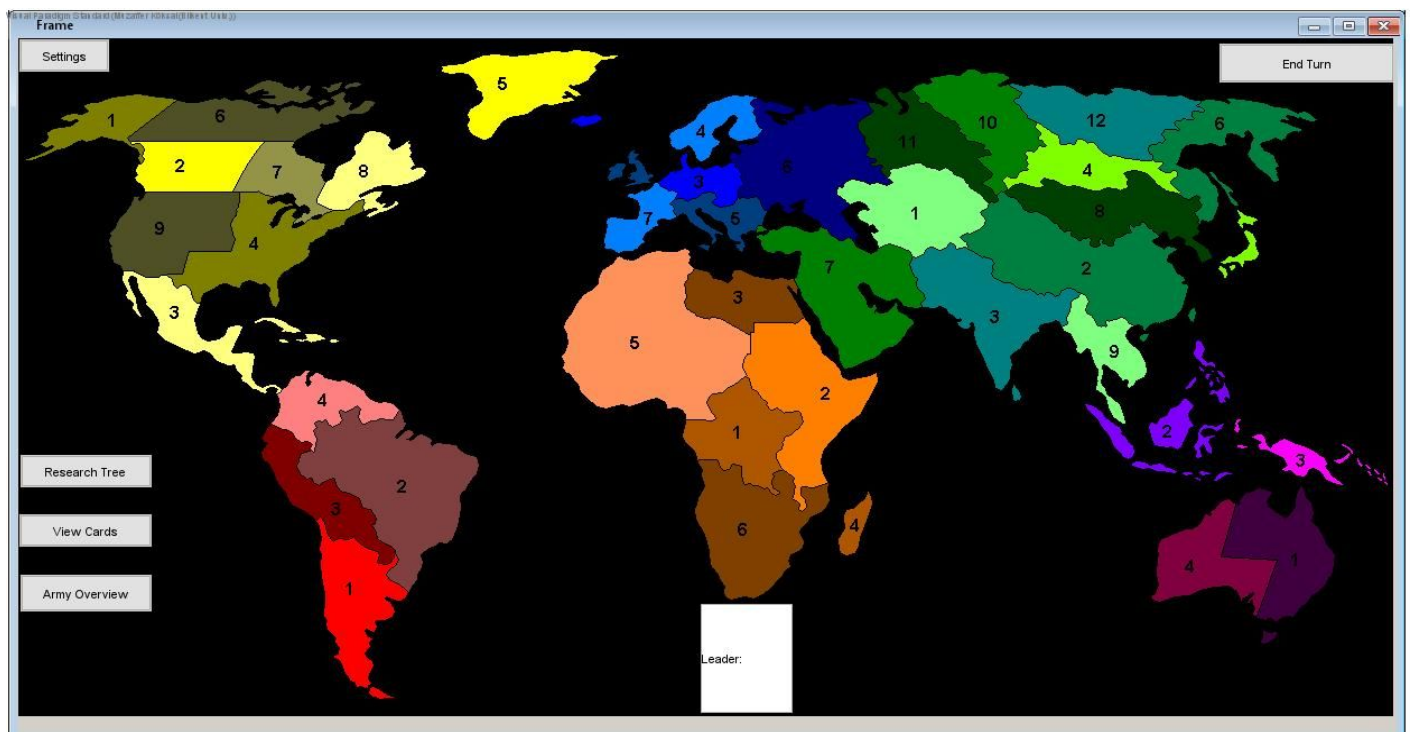


Figure 7 Game Screen Mock Up

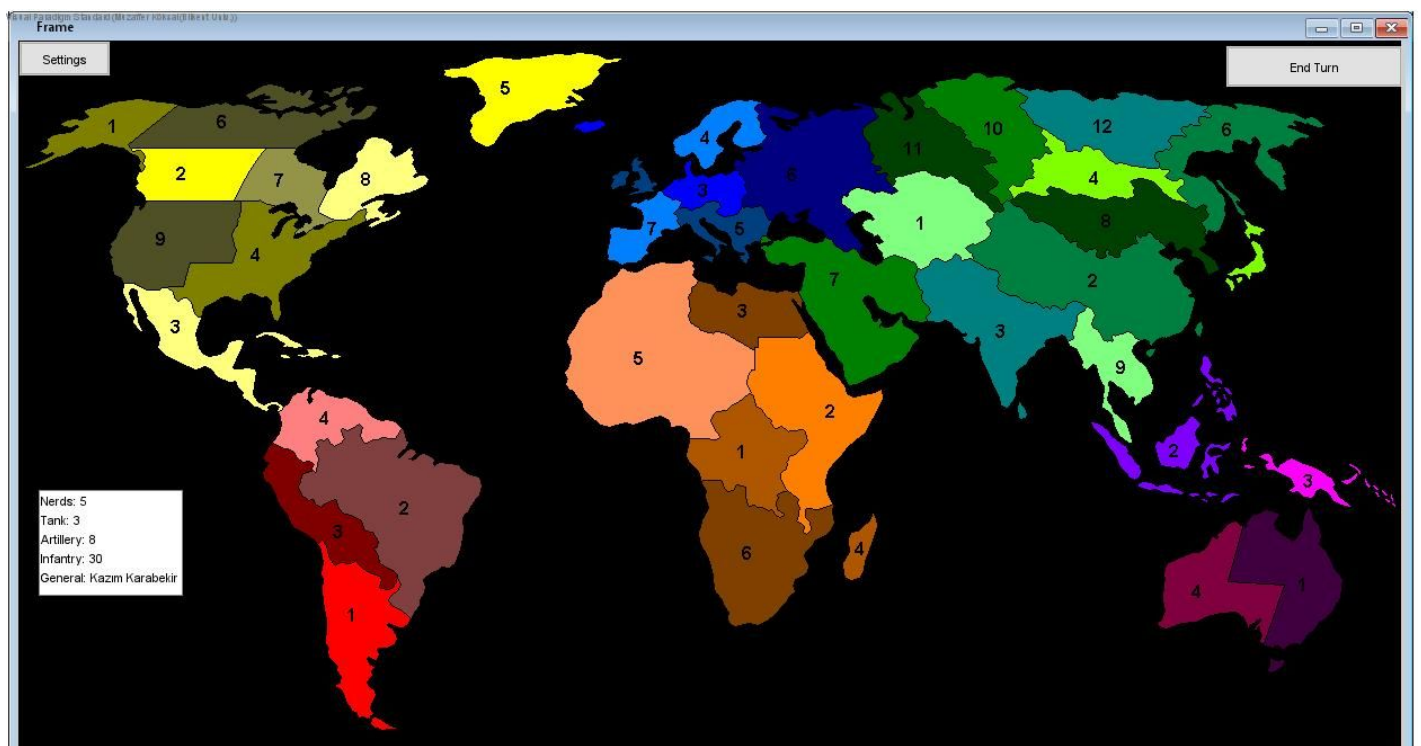


Figure 8 Game Screen Mock Up

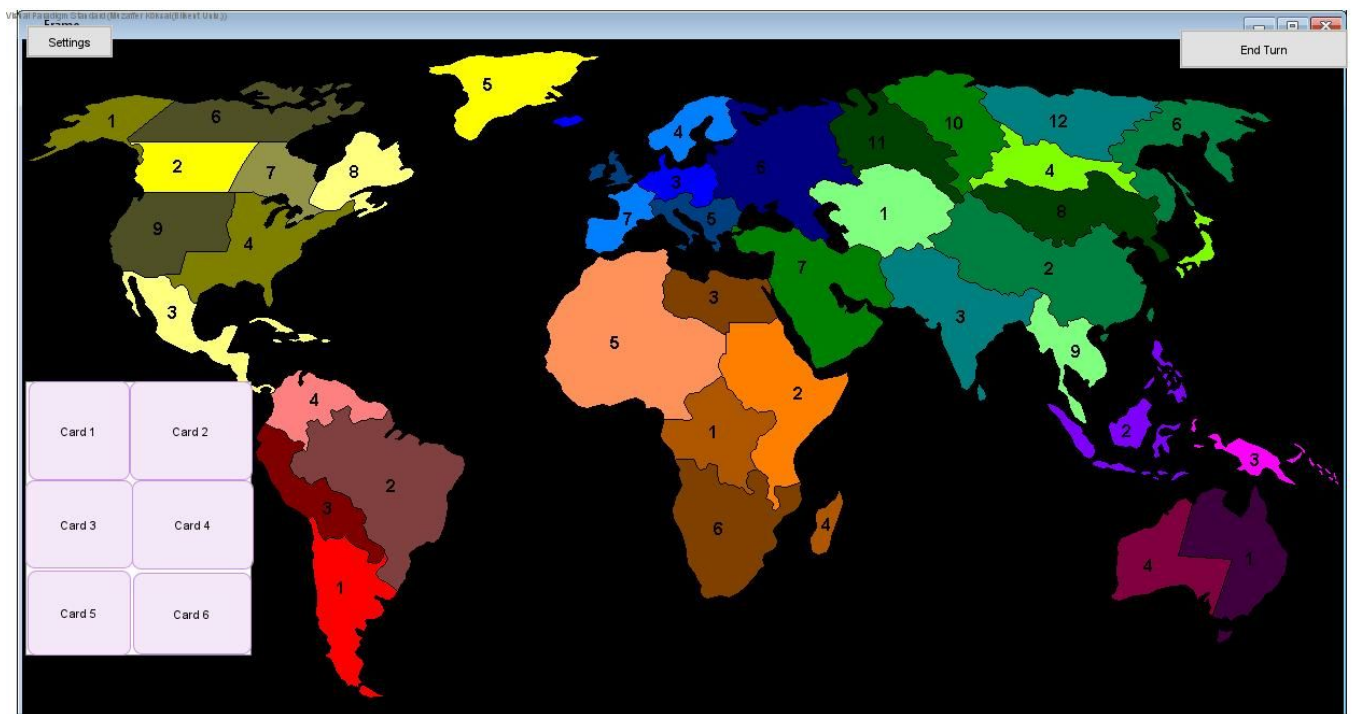


Figure 9 Start Screen Mock Up

7. Glossary & References

- Paradox Development Studio(2016), *Hearts of Iron IV* [Computer Game]. Available at <https://www.heartsofiron4.com/> (Downloaded: 19 September 2019).
- “Risk (Game).” Wikipedia, Wikimedia Foundation, 21 Oct. 2020, [https://en.wikipedia.org/wiki/Risk_\(game\)](https://en.wikipedia.org/wiki/Risk_(game)) (Accessed: 25 October 2020).