Bilkent University
Department of Computer Engineering

Object-Oriented Software Engineering

CS 319 Project: Terra Historica

Analysis Report

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Analysis Report

CS 319: Terra Mystica

1. Introduction

Terra Mystica is a round-based board game where players choose a faction from 14 different factions, trying to have the highest point until the end of the last round. Every faction has its own specific abilities and a corresponding terrain tile.

There are 7 different terrain tiles on the map of the game. On the map, players can terraform those tiles corresponding to their faction on condition that the player has dwelling adjacent to the target terrain. Each player has resources to execute actions such as improving their structures, progressing in religion while they also earn those resources through their buildings and advancements. After 6 rounds, the points get summed up and the winner gets chosen.

In this project, the aim is to implement Terra Mystica into the digital multiplayer platform. The name of the game in the digital platform is *"Terra Historica"* as the factions of the board game are replaced with real historical figures.

2. Overview

2.1. Gameplay and Controls

The game begins with the first player choosing a faction from 14 different factions. Each player keeps choosing a faction in clockwise order. In a game, there can be only one faction chosen from a specific terrain type. After choosing factions, players place the smallest structures on the map and the number of structures will be built varies according to the players' faction. The player can place structures only to the faction's Home Terrain. Before starting to first round, beginning with the last player in counterclockwise order, each player chooses a Bonus card, providing additional income or specific skills.

The game has a total of six rounds each having different specialties. Every round continues until every player has passed the round. The purpose of each player is to collect the most victory points until the end of the sixth round. To get Victory Points, different strategies are available and no luck is rewarded.

The game can be played on the computer and the control device of the game is a mouse. The player can choose the terrain on the map with a mouse click and also do any operation with a mouse. Additionally, when the player transforms terrain space, the color of space changes faction's color player chose.

2.2. Game Map

Figure 1: Game Map

There are river and seven different terrain spaces on the map of Terra Historica and these terrains are distributed over the map. Those seven terrains are Plains, Swamp, Lakes, Forest, Mountains, Wasteland and Desert. Each terrain has the shape of a hexagon and it means each terrain has at most 6 adjacent terrains. Players build their structures according to the corresponding terrain type of factions they have chosen. As they can only build a structure on a space adjacent to their other buildings, there are no two adjacent terrains of the same type on the map. So, they first need to transform the target space to their Home terrain. There is also a river, which separates terrains from each other. To reach across the river and build structures or transform spaces, players must construct bridges, improve shipping skills or use their faction abilities.

2.3. Components

In the game, there are different types of components such as resources, structures, cards and religion board. In this section, each component will be explained in general. For detailed information about game components, rulebook of the original game [2] can be checked.

2.3.1. Resources

Throughout the game, players need some resources to build and upgrade structures, progressing in religions and gaining points to win. Those resources are Workers, Coins, Power, Priests and Spade.

2.3.1.1. Workers

Workers are the basic resources of the game that enable users to take actions like constructing and upgrading buildings, terraforming lands. Just like real life, workers represent the labor requirement of an action. Players can gain workers by building dwellings, using special abilities of their factions or choosing different tiles.

2.3.1.2. Coins

Coins are another resource that enables users to take action. Just like real life, coins represent the economic requirement of an action. Players can increase gold production by upgrading dwellings to trading houses.

2.3.1.3. Power Tokens

Power tokens can be used for many different purposes. Power can be exchanged for other sources like workers, priests, golds or spades. Also, players can construct bridges by using power. There are different levels of power tokens. It will be automatically upgraded to the next level if enough power accumulated at any level. Powers can be gained by advancing on Religions, choosing between bonus cards, favor tiles or town tiles.

2.3.1.4. Priests

Priests are another important resource that enables players to advance on religions. Players can place their priests to a religion’s board in order to advance on that religion. Priests can be gained by upgrading trading houses to temples.

2.3.1.5. Spade

Spade is a resource to transform an adjacent Terrain into a Home Terrain. Transformation of a Terrain space costs 1 Spade to 3 Spades. It can be earned by exchanging for other resources or from tiles.

2.3.2. Structures

2.3.2.1. Dwellings

Dwellings are the smallest structures to build. At the beginning of the game, before rounds start, each player places a dwelling on any place on the map according to their Home Terrain. They are also able to place Dwellings after transforming other types of terrain to their Home Terrain. After transforming, there is no need to wait for the next turn to build a dwelling in the same round.

The cost of building a dwelling is generally 1 Worker and 2 Coins. Each dwelling brings generally one worker as income in the next round. The cost and the income of a dwelling may change according to faction chosen.

2.3.2.2. Trading Houses

A Dwelling can be upgraded to a Trading House. This costs 2 Workers and 6 Coins unless there is no adjacent structure of opponents'. If an opponent's structure is directly adjacent to the target space, the payment of coins reduces to 3.

Each trading house brings coins and powers as income in the next round. Income may change according to the flow of the game.

2.3.2.3. Stronghold

A Trading House can be upgraded to a Stronghold. After building a Stronghold, player gains a specific special ability. Special ability is different for all factions.

Stronghold brings coins and powers as income in the next round. Income may change according to the flow of game.

Each player can build only one Stronghold and a Stronghold cannot be upgraded.

2.3.2.4. Temples

A Trading House can be upgraded to a Temple by paying 2 Workers and 5 Coins. The cost of a Temple may change according to faction chosen. After building a temple, the player chooses one favor tile *(see in page 8)*. The player can use the advantages of favor tile immediately or during the current turn.

Each temple brings priests as income in the next round. The number of the priest as income can change.

2.3.2.5. Sanctuary

A Temple can be upgraded to a Sanctuary. This is the only way a Sanctuary can be built. Building a Sanctuary costs a number of Workers and Coins depending on faction. After building a sanctuary, the player chooses one favor tile. The player can use the advantages of favor tile chosen by the player immediately or during the current turn. Sanctuary also brings priests as income in the next round.

Each player can build only one Sanctuary and a Sanctuary cannot be upgraded.

2.3.2.6. Bridges

The player can build a bridge just to provide a connection between two terrains. After building a bridge, Terrains adjacent to the other side of the bridge are counted as indirectly adjacent spaces to the player's Terrain spaces. Therefore, the player can do actions, namely transforming the Terrains and build a Dwelling on Terrains across the river.

The cost of building a Bridge depends on the faction and each player can build only three Bridges.

2.3.3. Tiles

2.3.3.1. Favor Tiles

Players can choose their prizes from favor tiles if they build temples. These prizes provide them some advantages, especially in religion area. They can also earn power or victory points with favor tiles.

2.3.3.2. Scoring Tile

There are 8 Scoring Tiles in the game. As there are six rounds total, 6 Scoring Tiles are distributed to each round. Each of those Scoring Tiles represents how to

gain Victory Points for that round. Victory Points advantages by building Structures(Dwellings, Trading Houses, Stronghold, Sanctuary) vary for rounds. These advantages are announced at the beginning of the game.

2.3.3.3. Town Tiles

Players can found towns by having a total of 7 points with their adjacent buildings. Dwellings have a 1 power value, Trading Houses and Temples have 2 power values, Stronghold and Sanctuary have 3 power values. If players found town they will counter with a screen that they can choose special prizes.

There are 10 different Town Tiles that have different resource prizes such as Victory Points, Priests, Power, Workers or Cult Track progressing. Players will have an opportunity to choose a Town Tile by founding towns.

2.3.4. Religions

There are 4 different religions in Terra Historica. Players can earn victory points by advancing on them. There are 10 levels in each religion.

Players can advance one by one by using their priests or if they can occupy necessary places with their priests on the board they can move forward by 2 or 3 steps. Players must place their priests to these advantageous places before other players occupy them.

Players can earn power by reaching level 3,5,7 and 10 on each religion. Only one player can reach level 10 in a religion and players can reach level 10 only and only if they have town key.

There are 4 religions in Terra Historica, each one is counterpart of a cult in Terra Mystica. They are chosen by considering the most widespread religions in the world. These religions are Islam, Christianity, Judaism and Hinduism.

2.3.5. Bonus Cards

At the end of each round players choose a bonus card among 9 bonus cards. These bonus cards offer some advantages like gaining power, golds or spades; upgrading the shipping level. A player cannot choose a bonus card that is already taken by another player. The priority of choosing a bonus card is given to the first player who passes the round. Bonus cards that have not been chosen for that round will have an additional Coin bonus for the next round.

2.4. Actions

After the Income Phase, players will get through the Action Phase that they can choose an action from 8 possible choices. These action choices can be used multiple times in a single round. However, a player can use an action only once per turn. Action Phase will be over after all players selected the passing option.

2.4.1. Transform and Build

This action can be used in 3 ways:

- The player can change the type of a single terrain space
- The player can build a dwelling on a terrain space if this terrain is from his home terrain and it is directly or indirectly adjacent to one of the player's structures
- The player can change the type of a single terrain space to his home terrain. Then, the player can immediately build a dwelling on that space

2.4.2. Advancing on the Shipping Track

Shipping Track is an important feature of the game because it allows players to expand beyond river spaces. Thus, the player can transform terrain spaces or build structured beyond river spaces. Using this action increases Shipping Track capacity by one. In addition, the player will get Victory Points as a reward for taking this action.

2.4.3. Lowering the Exchange Rate for Spades

Transforming a terrain space is paid by Spades and one Spade is equal to three workers for most of the factions. However, this exchange rate can be lowered to 2 workers or even 1 worker by using this action. As a reward for taking this action, the player will get 6 Victory Points.

2.4.4. Upgrading a Structure

This action allows the player to upgrade one of the structures. Upgrading cost differs from faction to faction. Although the player will get the income of the new structure in the next round, the income of the old structure will be cut from the player as a consequence of this structure is removed from the board.

2.4.5. Send a Priest to the Order of a Religion

This action can be used in 2 ways:

- ❖ The player can put his priest on track spaces of religion to advance 3 or 2 spaces on the corresponding religion track. However, this priest cannot be used by the player again.
- ❖ The player can advance on the religion just for 1 space without sacrificing his priest. This option allows players to use their priest again in the next round.

2.4.6. Power Actions

The player can use powers in 2 ways:

- ❖ The Power Actions on the game board can be used as an action. This option allows the player to gain Spades, bridges, coins or workers with a relatively good deal. On the other hand, these Power Actions can be used once in a single round. Also, a player cannot choose a power action if it is used by another player already.
- ❖ Apart from Power Actions, players can convert their powers to a single priest, worker or a coin. These exchange rates are worse than Power Actions. However, this option can be used multiple times in a player's turn.

2.4.7. Special Actions

Most of the factions has Special Action that they can use once per round. Also, some factions unlock their Special Action after building their Stronghold. In addition, players can get other special actions from a favor tile or bonus card.

2.4.8. Passing and New Starting Player

On a player's turn, if the player cannot take an action or does not want to take anymore, the player have to pass and wait until the end of the round. The first player to pass becomes the starting player for the next round.

3. Factions And Terrains

3.1. Wasteland

Factions whose terrain types are Wasteland can build Structures on Wasteland Terrain in map.

3.1.1. Vlad The Impaler

Figure 2: Faction Vlad the Impaler

Vlad the Impaler represents the faction corresponding to “Chaos Magicians” in the original game, Terra Mystica.

Special to Vlad the Impaler:

- At the beginning of the game, Vlad can place only one Dwelling. He can place his one Dwelling after every other player have placed their own Dwellings.
- He gets two Favor Tiles (explained later) whenever he builds a Temple or a Sanctuary (explained later)
- His Special Action is that he can take a double turn, choosing two actions one after another.

3.1.2. Gilgamesh

Figure 3: Faction Gilgamesh

Gilgamesh represents the faction corresponding to “Giants” in the original game.

Special to Gilgamesh:

- Transforming a space on map into his Home terrain, he must pay 2 Spades including Mountains and Desert terrains.
- His Special Action is that he gets 2 free Spades to transform a terrain into his Home terrain. He also can build a Dwelling by paying its cost after transforming the terrain.

3.2. Forest

Factions whose terrain types are Forest can build Structures on Forest Terrain on map.

3.2.1. Morgan Le Fay

Figure 4: Faction Morgan Le Fay

Morgan Le Fay represents the faction corresponding to “Witches” in the original game.

Special to Morgan Le Fay:

- She gets 5 additional Victory Points after founding a Town
- Her Special Action is that she can build a Dwelling on a Forest terrain without paying. She also may ignore the adjacency rule while using her Special Action.

3.2.2. Helen of Troy

Figure 5: Faction Helen of Troy

Helen of Troy represents the faction corresponding to “Auren” in the original game.

Special to Helen:

- She gets 1 Favor tile after building the Stronghold.
- Her special action is that she can advance 2 spaces on Religion she chooses.

3.3. Lakes

Factions whose terrain types are Lakes can build Structures on Lakes Terrain on map.

3.3.1. Amerigo Vespucci

Figure 6: Faction Amerigo Vespucci

Amerigo Vespucci represents the faction corresponding to “Mermaids” in the original game.

Special to Amerigo Vespucci:

- He is able to skip a River space when founding a Town.
- He moves forward 1 space on the Shipping track without paying after building the Stronghold.

3.3.2. Erik the Red

Figure 7: Faction Erik the Red

Erik the Red represents the faction corresponding to “Swarmlings” in the original game.

Special to Erik the Red:

- He gains 3 Workers when founding a Town.
- His special ability is that he can upgrade a Dwelling to a Trading House without paying.

3.4. Desert

Factions whose terrain types are Desert can build Structures on Desert Terrain on map.

3.4.1. Ramesses II

Figure 8: Faction Ramesses II

Ramesses II represents the faction corresponding to “Fakirs” in the original game.

Special to Ramesses II :

- When he uses the action “Transform and Build”, he can skip a space (no matter if it is a terrain or river) by paying 1 Priest. He also gets 4 additional Victory Points every time he skips a space. Those places reached with skipping are considered to be connected in final scoring.
- He can skip 2 spaces using the action “Transform and Build” after building a Stronghold.

3.4.2. Darius the Great

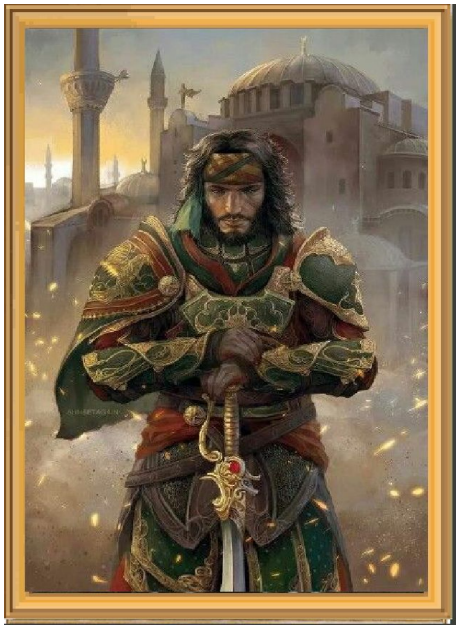


Figure 9: Faction Darius the Great

Darius the Great represents the faction corresponding to “Nomads” in the original game.

Special to Darius the Great :

- At the beginning of the game, he can place 3 Dwellings instead of 2. He places his third Dwelling after each player (excluding Vlad the Impaler) have placed their own Dwellings.
- His special action is that he can transform a Terrain adjacent to his Structures into his Home Terrain and immediately place a Dwelling by paying it cost. However, he cannot use this special action to a Terrain across the River no matter there is a Bridge or not.

3.5. Mountains

Factions whose colors are gray can build Structures on Mountains Terrain.

3.5.1. Leonardo Da Vinci

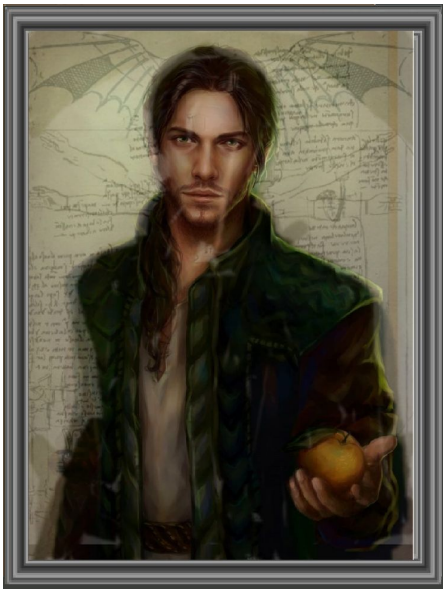


Figure 10: Faction Leonardo Da Vinci

Leonardo Da Vinci represents the faction corresponding to “Engineers” in the original game.

Special to Leonardo Da Vinci :

- He can build a Bridge for 2 Workers.
- In each round passing, he gains 3 Victory points for every Bridge connecting his Structures.

3.5.2. St. Patrick

Figure 11: Faction St. Patrick

St. Patrick represents the faction corresponding to “Dwarves” in the original game.

Special to St. Patrick :

- When he uses the action “Transform and Build”, he can skip one space (Terrain or River) by paying 2 more Workers. He gains additional 4 Victory Points for every time skipping a space.
- He does not have shipping.
- Places reached with skipping are considered to be connected in final scoring.
- He pays only 1 Worker for skipping after building the Stronghold.

3.6. Swamp

Factions whose terrain types are Swamp can build Structures on Swamp Terrain on map.

3.6.1. Aleister Crowley

Figure 12: Faction Aleister Crowley

Aleister Crowley represents the faction corresponding to “Darklings” in the original game.

Special to Aleister Crowley:

- He pays Priests instead of Workers when transforming Terrains. For each Priests in a transformation, he gains additional 2 Victory Points.
- He can trade 3 Workers for 1 Priest once after building the Stronghold.

3.6.2. Marie Curie

Figure 13: Faction Marie Curie

Marie Curie represents the faction corresponding to “Alchemists” in the original game.

Special to Marie Curie:

- She can trade 1 Victory Point for 1 Coin or 2 Coins for 1 Victory Point. She is able to use this ability any time.
- She gains 12 Powers after building the Stronghold. She gains 2 Powers for each Spade she gets.

3.7. Plains Terrain

Factions whose colors are Plains can build Structures on Plains Terrain on map

3.7.1. Buddha

Figure 14: Faction Buddha

Buddha represents the faction corresponding to “Cultists” in the original game.

Special to Buddha:

- When his opponents take Power owing to adjacency Structures, he advances 1 space on Religion he chooses.
- He gets additional 7 Victory Points after building the Stronghold.

3.7.2. Hussein the Tea Maker

Figure 14: Faction Hussein the Tea Maker

Hussein the Tea Maker represents the faction corresponding to “Halflings” in the original game.

Special to Hussein the Tea Maker:

- He gets an additional 1 Victory Point for each Spade he gains.
- He gets 3 Spades to transform Terrain Spaces and can build a Dwelling by paying its cost after building a Stronghold.

4. Functional Requirements

4.1. Create Game

- The user should be able to create a game.
- The user should be able to write his/her name.
- The user is able to click the play button.
- The user should be able to choose his/her faction.
- The user should be able to set player numbers.
- User should be able to choose the difficulty of the game.
- The user should be able to exit the Create Game section and return Mein Menu.
- The System should check the player name is valid.
- The system should control and validate data of the game taken from the database.
- The system should control that every player chooses a different faction.
- If players choose the same faction or same color faction, the System should show warning or informative message.
- The system should adjust the game according to the selected difficulty.
- If the player returns to the Main Menu section, the system should show the Main Menu screen.
- If the player exits, the system should shut down the game.

4.2. Load Game

- The user should be able to load game that is not finished before.
- The user should be able to exit Load Game section or return Main Menu.
- The user should be able to see which faction was choose in selected game and his/her points.
- The system should set game's setting chosen by the player.
- The system should take input or data from database.
- The system should control that selected game's data is valid.
- The system should show that not finished and saved game.
- The system should show information about not finished and saved games.
- The system should resume the game.
- If the player returns to the Main Menu section, the system should show the Main Menu screen.
- If the player exits, the system should shut down the game.

4.3. Change Settings

- The user should be able to change settings or keep it as default settings.
- The user should be able to change default settings such as “Music Volume”, “Game Volume” or “Screen Resolution”.
- The user should be able to exit Change Settings section or return Main Menu.
- If the user returns to the Main Menu section, the system should show the Main Menu screen.
- System should change settings according to the users’ desire.
- If the player exits, the system should shut down the game.

4.4. Help

- The user should be able to get more information about game and its rules(how to play).
- The user should be able to click the link of rules book or manual book for the game.
- The user should be able to exit Help section or return Main Menu.
- If the user returns to the Main Menu section, the system should show the Main Menu screen.
- The system should provide connection between link of rules book and Terra Mystica rule book website.
- If the player exits, the system should shut down the game.

4.5. Credits

- The user should be able to learn more about the contributors of the game.
- The user should be able to report the bug/s to contributors of the game.
- The system should show contributors of the game.
- The system should forward feedback player report to the contributors of the game.
- The user should be able to exit Credits section or return Main menu..
- If the user returns to the Main Menu section, the system should show the Main Menu screen.
- If the player exits, the system should shut down the game.

4.6. Play Game

- The players should be able to play the game.
- The players should be able to win the game by collecting the most Victory Point.
- The players should be able to play game six rounds.
- The user should be able to pause and save the game.
- The players should be able to resume the game.
- The players should be able to build structure, terraform terrain and get income as a result of players' action.
- The players should be able to make/do action during their rounds.
- The players should be able to choose bonus card after end of each round.
- The player should be able to skip their round.
- The player should be able to exit game section or return Main Menu.
- The system should allow user to resume, pause and save the game.
- The system should continue game until six rounds are over.
- The system should play the game counterclockwise order.
- The system should start the game after all player choose their faction.
- The system should change map or set the game according to players' actions.
- The system should the system should adjust the players' income and their properties.
- The system should start new round after all players skip their round.
- The system should keep all players' properties, such as victory build, number of structure, bridge etc..
- The system should provide players with some properties according to their bonus card.
- If the player returns to the Main Menu section, the system should show the Main Menu screen.
- If the player exits, the system should shut down the game.

4.7. Add Player

- The Player should be able to add other players.
- The user should be able to exit Add Player section or return Main Menu.
- The Players should be able to determine how many player can play created game.

- The Players should be able to play game via local network in one or more computer.
- The system should create and adjust game according to number of player.
- The system should make connection among computers via local network
- If the player returns to the Main Menu section, the system should show the Main Menu screen.
- If the player exits, the system should shut down the game.

4.8. Save Game

- Players should be able to save their game in order to continue on later.
- Players must choose save the game to any slot available.
- Player can choose save their game to already filled slot.
- System must warn player if they try to save their game to already filled slot.
- Players must reach their saved games anytime they want, regardless of if the system is shutted down or game is closed.

4.9. Choose Action

- In their turns, players should be able to choose their action for this turn, from 8 actions, if they have enough resources to take this action.
- System must inform players about which actions are available for them.
- System must force players to end their turns, after they took their actions.
- Only 1 action can be taken in one turn.

4.10. Terraforming

- Players must be able to terraform a type of terrain into another type.
- System must show available terrains to players, they can only terraform a terrain if they have structure on any adjacent terrain.
- Each terraforming activity requires different quantity of resources, players can terraform a terrain into any type, only if they have enough resources.
- System must show which terraform operations available at the moment.

4.11. Advancing on the Shipping Track

- Players must be able to upgrade their shipping level (carpet flight if the faction is Fakirs).
- System must inform players if they have enough resources.
- If they do not, system must show how many power are required to replace missing resources.
- Players must earn victory points after this action is completed.

4.12. Upgrading a Structure

- Players must be able to upgrade one of their available structures during their turn.
- There are different requirements of upgrading each structure; available structures should be determined considering these resource requirements.
- System must show available structures.
- System must show the cost of the action to players.

4.13. Send a Priest to the Order of a Religion

- Players must be able to send their priest to the order of a religion, if they have priests.
- Players must advance 1 step and take their priest back at the end of the turn if they send him temporarily.
- Players must advance 2/3 step and do not take their priest back at the end of the turn if they place him permanently.
- System must show players to location of their priests and other players' priests.
- Players must be able to reach level 10 if they are already in level 9 in any religion and have at least one town key.

4.14. Using Power Actions

- ❖ Players must be able to use their powers to earn other privileges.
- ❖ System must show which power actions are available, based on how many power does player have and is one of these actions are already taken by another player.
- ❖ System must take powers of players and should provide the resource that they select to them.

4.15. Using Special Actions

- ❖ Players must be able to use special actions of their factions.
- ❖ Players also must earn another type of special action if they build strongholds.
- ❖ System must show players to which special actions are available at the moment based on players' resources.

4.16. Lowering the Exchange Rate for Spades

- ❖ Players must be able to upgrade their spade levels if they have enough coin, by this action resource requirements of future terraform operations will reduce.
- ❖ System must reduce the worker requirement of the player, for future terraform operations.

4.17. Passing the Turn

- ❖ Player must be able to pass their turns.
- ❖ System must show bonus card screen to players and let the players choose their bonus cards.
- ❖ Players cannot take any actions for the round if they passed their turns.
- ❖ System must continue with other players until the end of the round, in other words until all players pass their turns.
- ❖ Other round must begin with player who skipped first.

5. Nonfunctional Requirements

5.1. Usability

- ❖ Players should be able to play the entire game via mouse only.
- ❖ The player should be able to navigate through all tab menus of the game at most 5 mouse clicks.
- ❖ Players should be able to create a new game within 1 minute*. (In this time period they create the game and decide how many players the game includes, choose their player names, choose their factions and finally initialize the game)

5.2. Performance

- ❖ The graphics should be implemented in a 2D environment.
- ❖ The game should be played at 60 frames per second*.
- ❖ The response time should be less than 1 second*.

* Estimated time values were estimated for Windows 10 i7 770HQ PC's.

5.3. Reliability

- ❖ The game crash should not result in data loss.
- ❖ The game should ensure that saved game data exactly matches the corresponding data in the database.

5.4. Security

- ❖ Any private information about players should not be stored. The only data to be stored should be the saved game data.

5.5. Supportability

- ❖ The player must be able to create new games without modifications to the existing system.

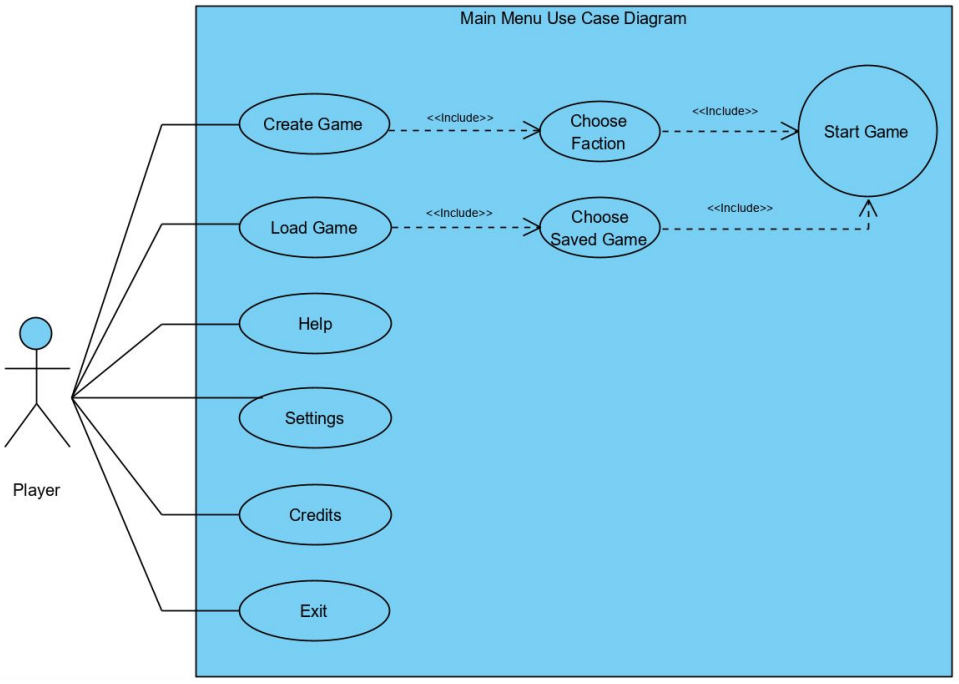
5.6. Visibility

- ❖ The game view should be suitable for 1280*720 pixels resolution.

6. System Models

6.1. Use Case Models

6.1.1. Main Menu Use Case Model



Model 1 : Use Case Model of the Main Menu

6.1.1.1. Use Case: Create Game

Use Case: Create Game

Participating Actor: User

Stakeholders and Interests: User may want to create a new game.

Entry condition: User opens game and creates a game by clicking “Create Game” button.

Exit Condition: User returns to “Main Menu”

Success Scenario Event Flow:

1. User adds players to the game being created.
2. Players write down their nicknames.
3. “Play Game” is clicked.

6.1.1.2. Use Case: Choose Faction

Use Case: Choose Faction

Participating Actor: User

Stakeholders and Interests: Users may want to choose factions

Entry condition: User creates game and "Play Game" is clicked

Exit Condition: User returns to "Main Menu"

Success Scenario Event Flow:

1. Players choose factions in clockwise order.
2. Systems starts the game.

6.1.1.3. Use Case: Load Game

Use Case: Load Game

Participating Actor: User

Stakeholders and Interests: User may want to load game that is not finished before.

Entry condition: User opens game and opens loaded games by clicking "Load Game" button.

Exit Condition: User returns to "Main Menu"

Success Scenario Event Flow:

1. User clicks "Load Game" button
2. Saved Game datas will be displayed

6.1.1.4. Use Case: Choose Saved Game

Use Case: Load Game

Participating Actor: User

Stakeholders and Interests: User may want to load specific game data

Entry condition: Saved Game datas are available for users

Exit Condition: User returns to "Main Menu"

Success Scenario Event Flow:

1. User picks one of the games that has been played before but never finished.
2. "Play" is clicked.
3. System loads the game that is chosen.
4. Players of chosen game will resume the game.

6.1.1.5. Use Case: Settings

Use Case: Change Settings

Participating Actor: User

Stakeholders and Interests: User wants to change settings.

Entry condition: User enters "Settings" menu to make changes.

Exit Condition: User returns to main menu after changing default settings.

Success Scenario Event Flow:

1. User opens settings menu.
2. User changes default settings such as "Music Volume", "Game Volume" or "Screen Resolution". User can also do nothing.
3. System changes settings according to the users' desire.
4. User returns to main menu.

6.1.1.6. Use Case: Help

Use Case: Help

Participating Actor: User

Stakeholders and Interests: User wants to learn more about the game to understand game rules.

Entry condition: User enters "Help" to read detailed description of game.

Exit Condition: User returns to main menu after getting help.

Success Scenario Event Flow:

1. User opens the "Help" section.
2. User enters the link in that section.
3. The link forwards user to the rule book of Terra Mystica.
4. User can return to main menu after opening the link.

6.1.1.7. Use Case: Credits

Use Case: Credits

Participating Actor: User

Stakeholders and Interests: User wants to learn more about the contributors of the game or report a bug to them.

Entry condition: User enters "Credits" to learn detailed information about contributors.

Exit Condition: User returns to main menu after getting information.

Success Scenario Event Flow:

1. User opens the “Credits” section.
2. User gets contact information with the names of contributors.
3. User can return to main menu after learning more about contributors.

6.1.1.8. Use Case: Exit

Use Case: Exit

Participating Actor: User

Stakeholders and Interests: User wants to exit game.

Success Scenario Event Flow:

1. User selects “Exit” to close the game.
2. The game is closed.

6.1.1.9. Use Case: Start Game

Use Case: Start Game

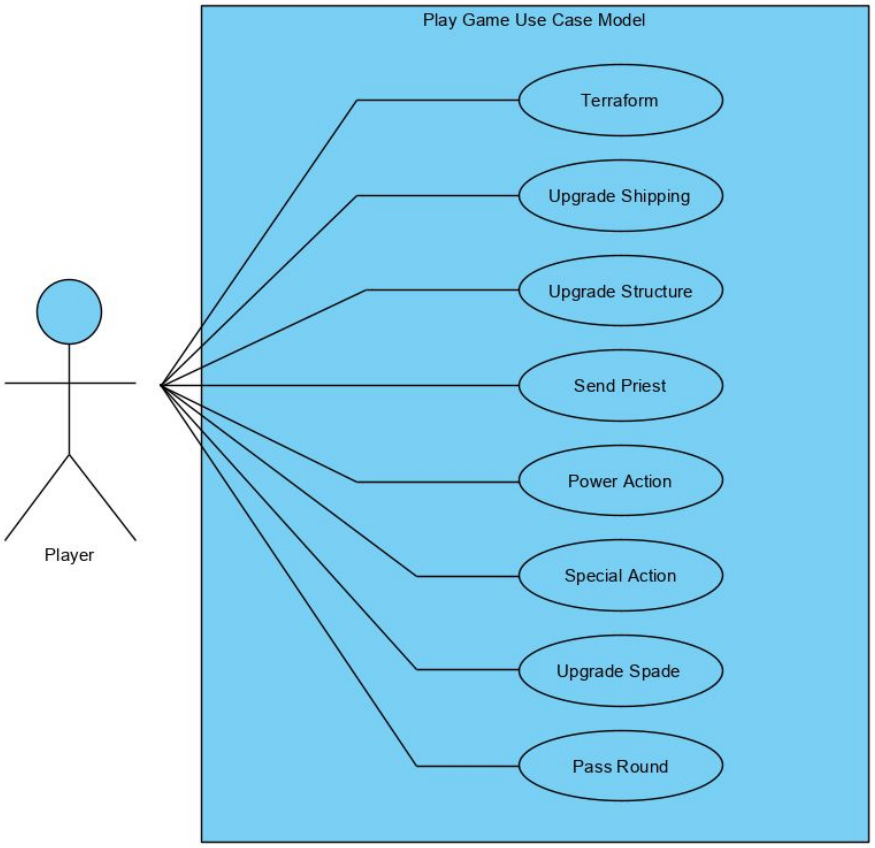
Participating Actor: User

Stakeholders and Interests: User wants to start game

Success Scenario Event Flow:

1. User selects “Start Game” in order to begin playing game.
2. The game is started.

6.1.2. Play Game Use Case Model



Model 1 : Use Case Model of the Play Game

6.1.2.1. Use Case: Terraform

Use Case: Terraform

Participating Actor: User

Stakeholders and Interests: User may want to terraform a terrain space

Entry condition: User has enough resources to Terraform

Exit Condition: User returns to "Play Game"

Success Scenario Event Flow:

1. User picks one of the terrains that are adjacent to player's home terrain with the structure
2. Game updates the map and checks if user wants to build a dwelling to the recently terraformed terrain
3. Game checks that if user has enough resources to build a dwelling.
4. Player will resume the game.

6.1.2.2. Use Case: Upgrade Shipping

Use Case: Upgrade Shipping

Participating Actor: User

Stakeholders and Interests: User may want to upgrade shipping level

Entry condition: User has enough resources to upgrade shipping

Upgrade shipping level is not maximum

Exit Condition: User returns to “Play Game”

Success Scenario Event Flow:

1. User upgrades the shipping level.
2. Player will resume the game.

6.1.2.3. Use Case: Upgrade Structure

Use Case: Upgrade Structure

Participating Actor: User

Stakeholders and Interests: User may want to upgrade a structure

Entry condition: User has enough resources to upgrage structure

Exit Condition: User returns to “Play Game”

Success Scenario Event Flow:

1. User picks one of the terrains that has a structure on it.
2. Game updates the map.
3. Player will resume the game.

6.1.2.4. Use Case: Send Priest

Use Case: Send Priest

Participating Actor: User

Stakeholders and Interests: User may want to send priest to the order of a religion

Entry condition: User has priest

Exit Condition: User returns to “Play Game”

Success Scenario Event Flow:

1. User chooses that preist will be added or placed to the order
2. Game updates the Religion View.
3. Player will resume the game.

6.1.2.5. Use Case: Power Action

Use Case: Power Action

Participating Actor: User

Stakeholders and Interests: User may want to use one of the power actions

Entry condition: User has enough powers

Selected power action is not taken by other players

Exit Condition: User returns to “Play Game”

Success Scenario Event Flow:

1. User chooses the power action
2. Game updates player’s powers and gives corresponding resources
3. Player will resume the game.

6.1.2.6. Use Case: Special Action

Use Case: Special Action

Participating Actor: User

Stakeholders and Interests: User may want to use special action

Entry condition: User has enough resources to activace special action

Exit Condition: User returns to “Play Game”

Success Scenario Event Flow:

1. User chooses the special action
2. Game updates player’s resources and gives corresponding resources
3. Player will resume the game.

6.1.2.7. Use Case: Upgrade Spade

Use Case: Upgrade Spade

Participating Actor: User

Stakeholders and Interests: User may want to use upgrade spade level

Entry condition: User has enough resources to upgrade spade level

Exit Condition: User returns to “Play Game”

Success Scenario Event Flow:

1. Game updates player’s spade level.
2. Player will resume the game.

6.1.2.8. Use Case: Pass Round

Use Case: Special Action

Participating Actor: User

Stakeholders and Interests: User may want to use special action

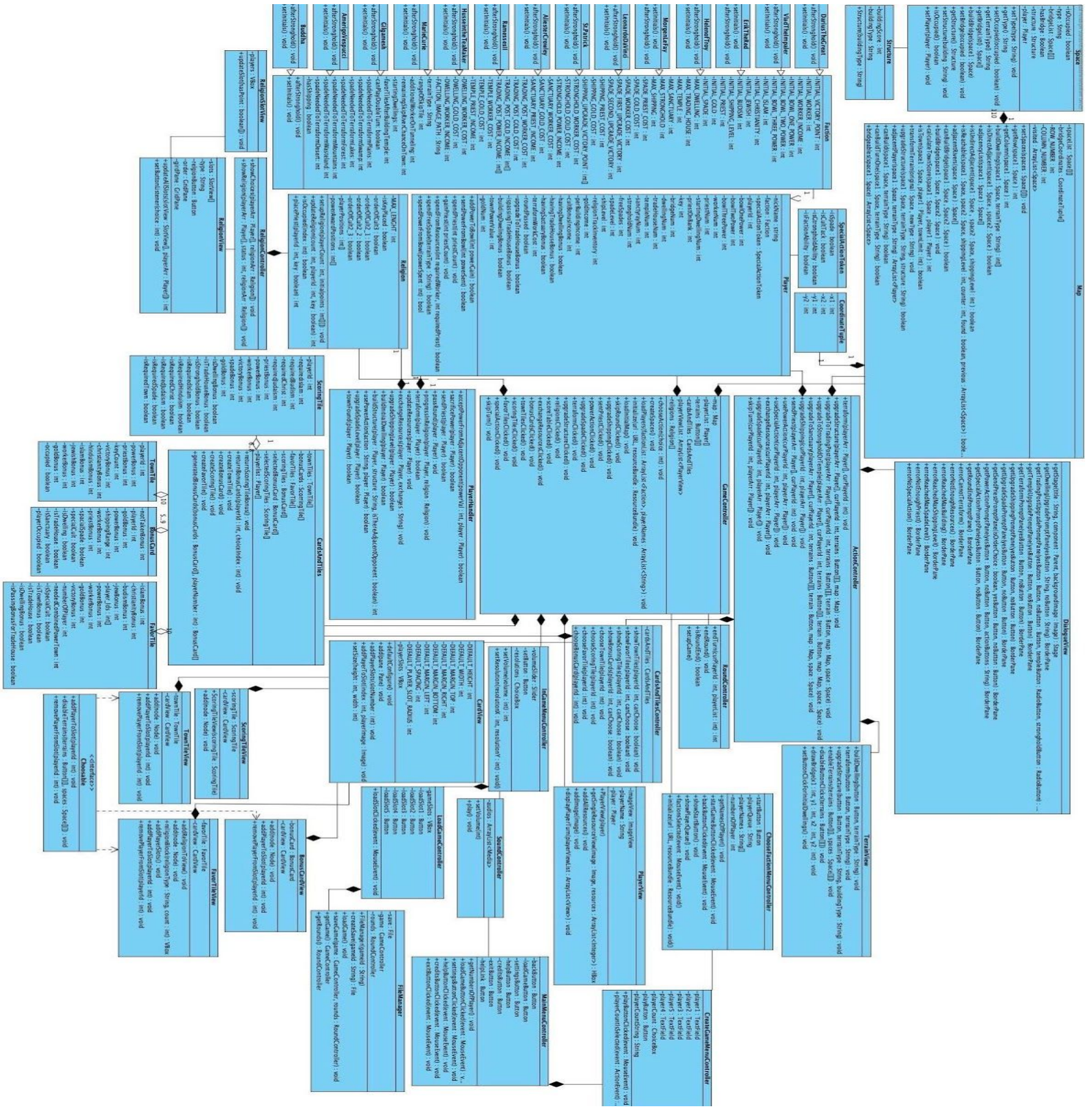
Entry condition: No entry condition is needed for this action.

Exit Condition: User returns to “Play Game”

Success Scenario Event Flow:

1. Game passes to the next player.
2. Player will not resume the game until the next round begins.

6.2. Class Model



Model 2: Class Diagram

The above diagram indicates classes in the Terra Historica application. In the Class diagram, there are Boundary, Control and Entity objects. The relations among these objects are demonstrated in the Class diagram.

Entity Objects

Space: It includes terrain, rivers and bridge. It is main component of map class.

Structure: It holds all structures namely Sanctuary, Dwelling, Stronghold, Temple, Trading House as string.

CordinateTuple: controls and coordinates mouse click for map.

Map: It is model class and It composed of spaces.initializes spaces and map which are terrains and rivers. It also includes functions associated with map and its updates.

SpecialActionToken: It holds special actions which control whether player has or not.

Faction: Superclass for holding attributes and special ability of each faction.

Player: Hold the information about player and possessions in the game.

Religion: Religion class holds Hinduism, Jewish, Christianity, and Islam as string. It also includes function associated with religion and its updates.

CardsAndTiles: holding bonus cards and tower, scoring, favor tiles as array.

TowerTile: holding the different type of bonus incomes of different Tower tiles.

ScoringTile: holding round requirement to gain bonus incomes.

FavorTile: holding the different type of bonus incomes of different achievement in religions.

BonusCard: holding the different type of incomes.

FileManager: holds the information about saved gama datas

Boundary Objects

DialogueView: shows some informative message, such as errors and actions that player cannot do.

TerrainView: updates the view of the terrains

ReligionView: shows the religion tracks with players on it

PlayerView: shows player cards

BonusCardView: shows Bonus Card

FavorTileView: shows favor tile

ScoringTileView: shows scoring tile

TownTileView: shows town tile

CardView: It shows cards general bound.

Choosable: It is view interface and it is to show choosable view.

ReligionSlotView: It shows religion slots.

Control Objects

MainMenuController: provides settings and; integrate and start game by these settings.

CreateGameMenuController: provides player counts and player names that user can initialize

LoadGameController: provides saved game datas that user can choose

ChooseFactionMenuController: provides factions that will be chosen by players

SoundController: provides tools to manipulate the sound of the game

InGameMenuController: provides save game and change settings features that players can choose while they are playing the game.

PlayerHandler: manipulates player resources and infos

GameController: connects important game features such as Actions, Map, Religions and in-game views.

ActionController: provides the 8 actions that player will choose play game

RoundController: controls the ends of round and turn

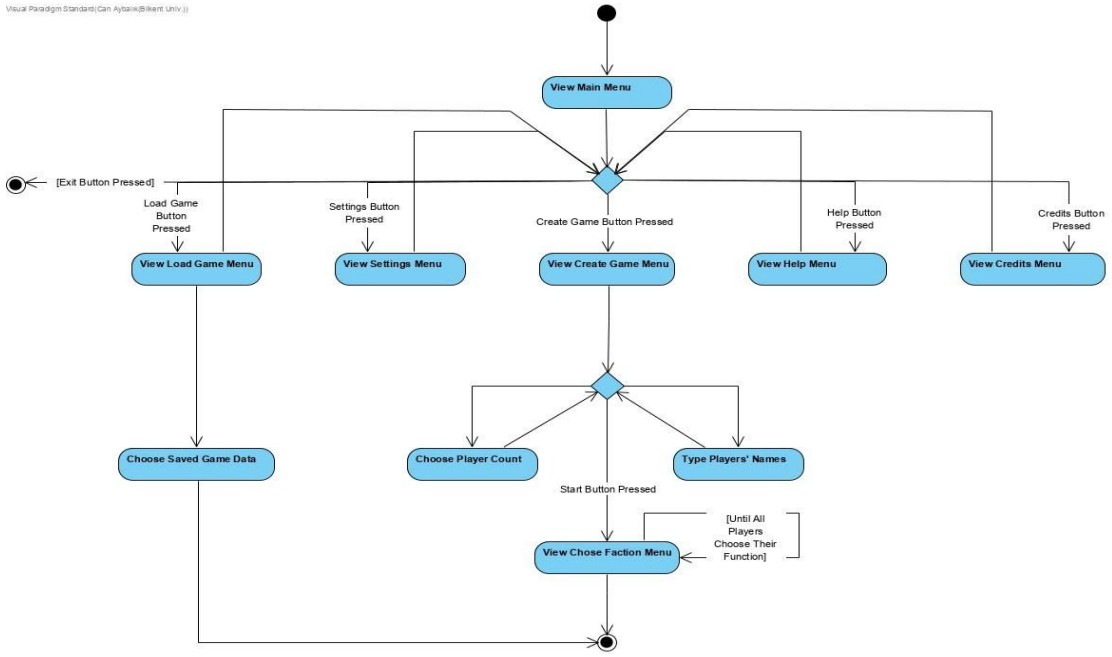
CardsAndTilesCountroller: connects cards and tiles with players

ReligionController: connects religions with players

6.3. Dynamic Models

6.3.1. Activity Diagram

6.3.1.1. Main Menu Activity

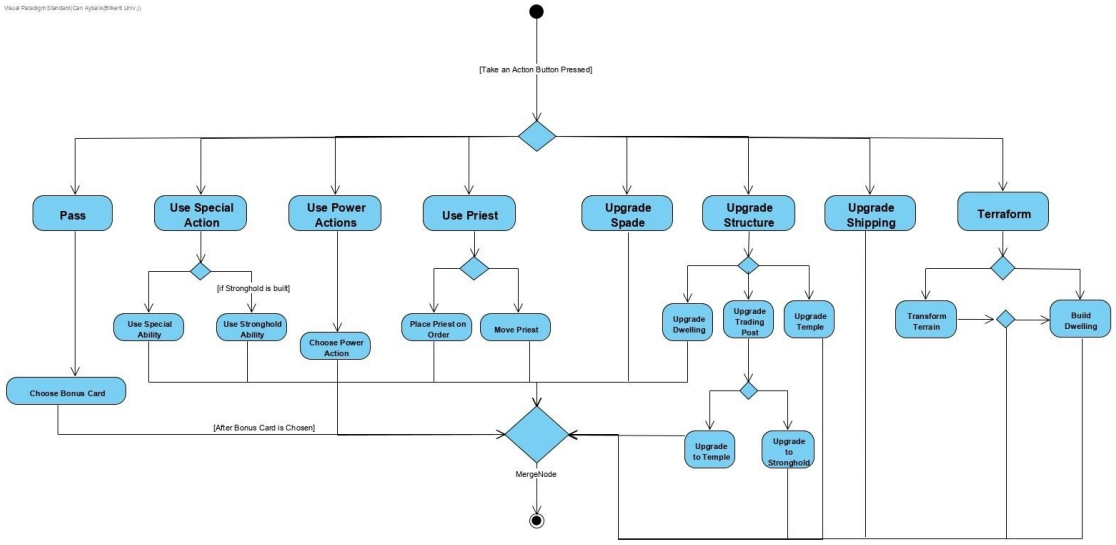


Model 3: Activity Diagram of Main Menu

In main menu, users can choose 6 activity. They can exit the game by pressing exit button, load their old games if they have saved, monitor the online manual by clicking help button, see the contributors by clicking credits and create a new game. After they choose create game, they can add or remove players and continue with choosing factions. After each player choose their faction or a previously saved game is loaded, main menu terminates and the game begins

Users can choose any activity they want without clicking a back button regardless of previously clicked buttons, because all options will be always visible at the main menu.

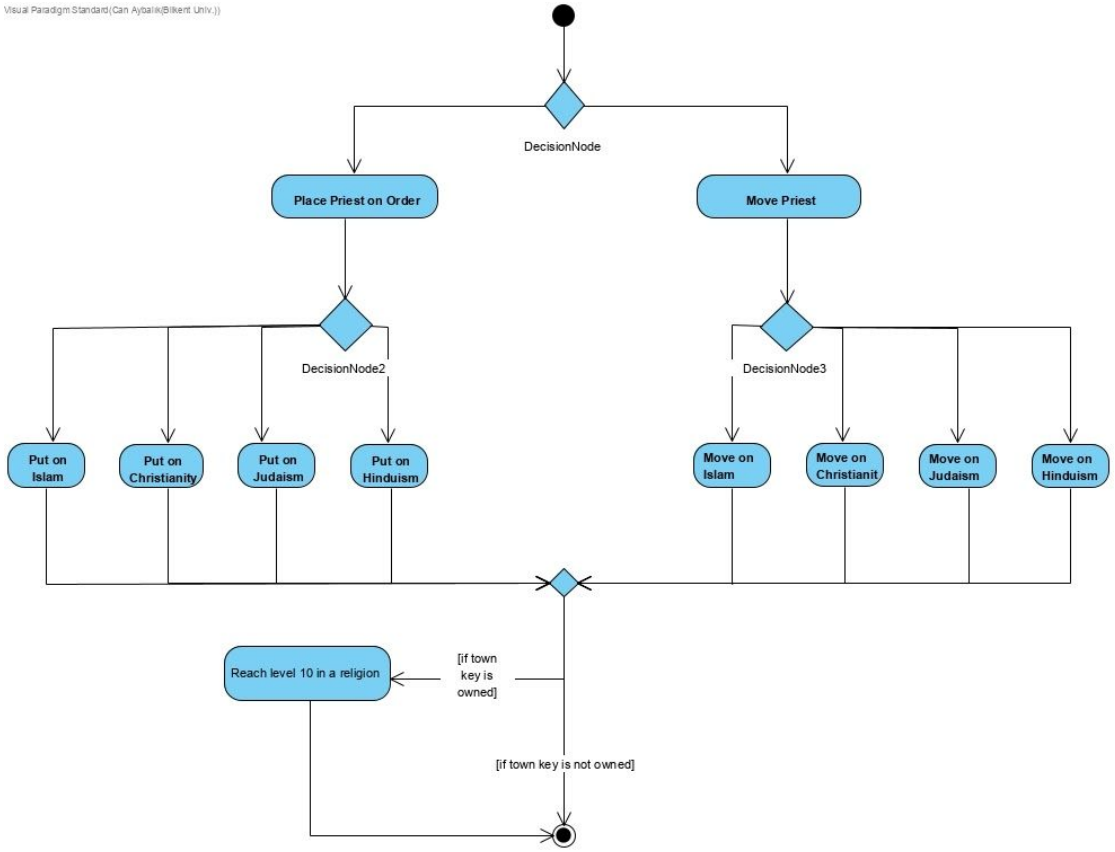
6.3.1.2. Player Actions Activity



Model 4: Activity Diagram of Player Actions

In the game players must choose an option from eight actions during their turns. After the chosen action is completed their turn ends they must wait for their next turn in order to take new actions. Players may choose passing, using power actions, using special actions, using priest, terraforming a land, upgrade their spades, upgrade their structure or upgrade their shipping levels. Players will encounter with some sub-options in some specific activities.

6.3.1.3. Religion Activity

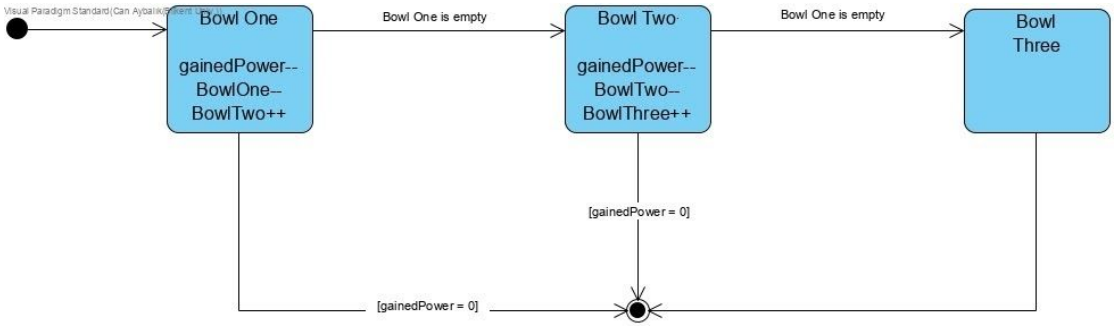


Model 5: Activity Diagram of Religions

In this diagram there are two main activities. Players can move by 2 or 3 steps in a religion or they can move by one step. If they want to move multiple steps they must have multiple religion points or they must place their priest to convenient places. After players decide they must choose which religion they want to move on. If a player in level 9 at a religion and have town key, that player can reach level 10 in this religion.

6.3.2. State Diagrams

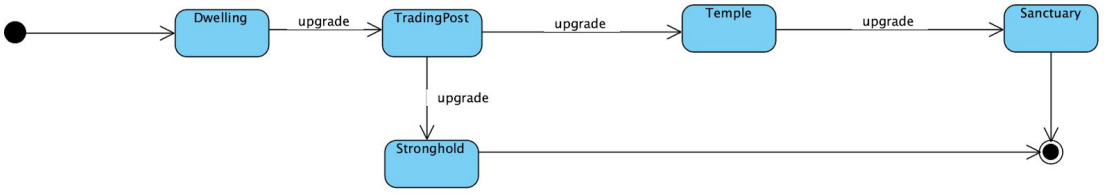
6.3.2.1. Gaining Power State Diagram



Model 6: State Diagram of Gaining Power

All players start the game with 12 Power tokens distributed among the three bowls. Power tokens can be transferred from one bowl to another if the current bowl is full. In order to use Power actions, player must have powers in Bowl Three. However, player can still use Power actions even though there are not enough powers in Bowl Three. This way, player can transfer Power tokens from Bowl Two into the Bowl Three regardless of checking whether the Bowl Two is full or not. However, this causes the player to sacrifice an equal amount of transferred powers. After spending Powers from Bowl Three, this Powers will return back to the Bowl One.

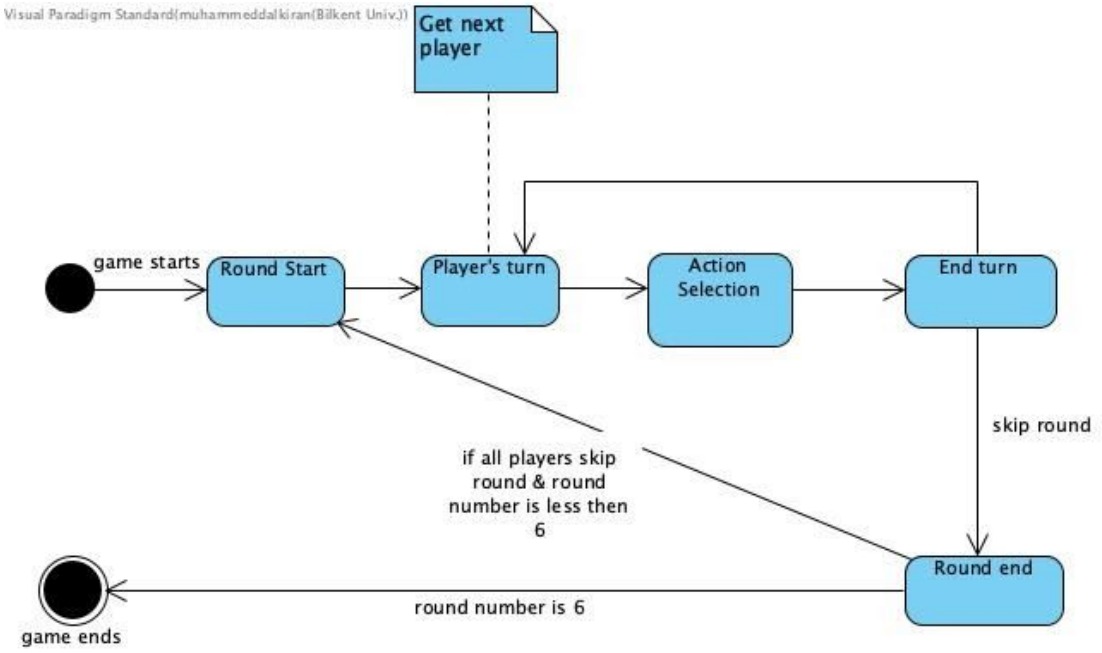
6.3.2.2. Structures State Diagram



Model 7: State Diagram of Structures

There are 5 different types of structures in the game and each one is represented by different stateş. Initial structure is dwelling, it can be upgraded to Trading Post. Users can pass to two different states, one of them is temple and other one is stronghold, which is the one of the two final states. Temple can be upgraded to sanctuary, the other final state of this state diagram.

6.3.2.3. Round State Diagram

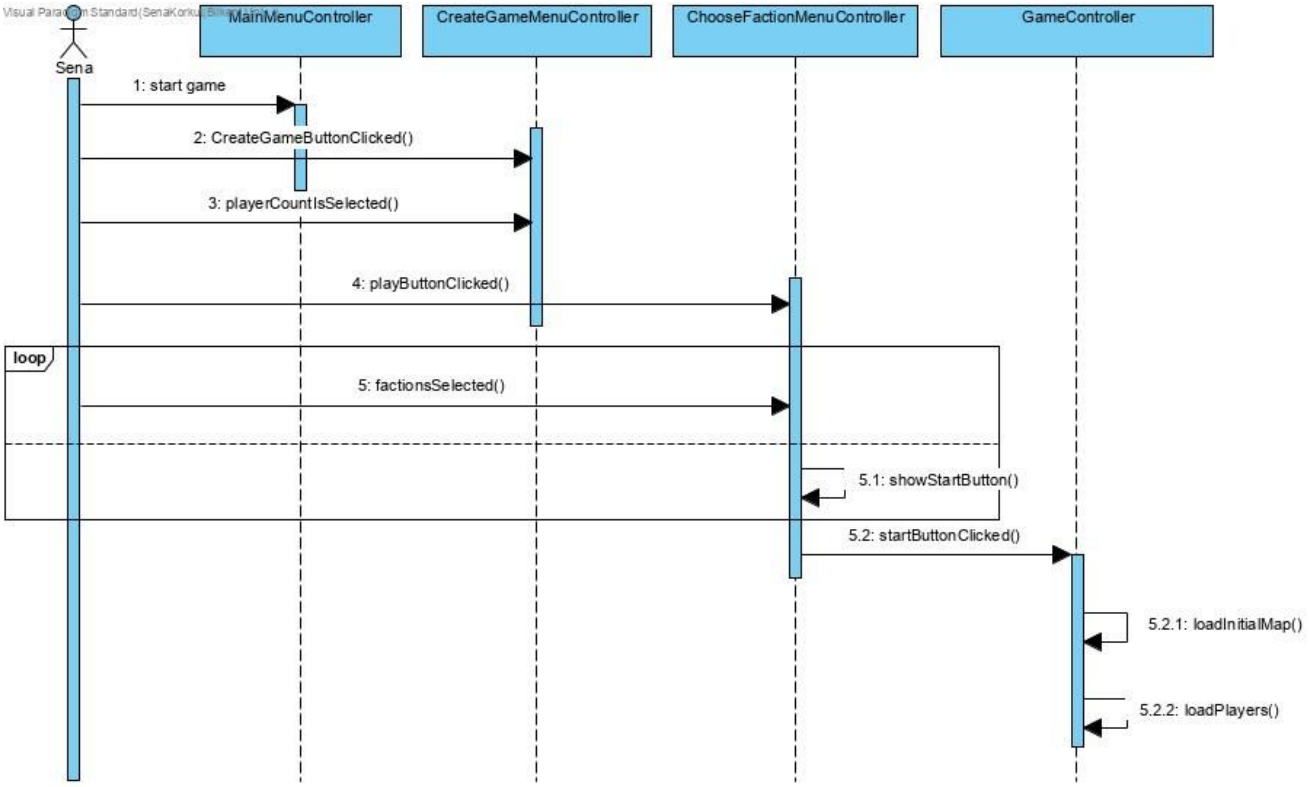


Model 8: State Diagram of Rounds

There are total 6 rounds in the game. In a round, players can choose their action. After they chose, their turns end and turn of other player starts. If a player chooses to skip round, this player will not take any new action in this round. When all players chose to skip their turn, the round will over and new round will start with new order of players. After 6 rounds ended, the game will also over.

6.3.3. Sequence Diagrams

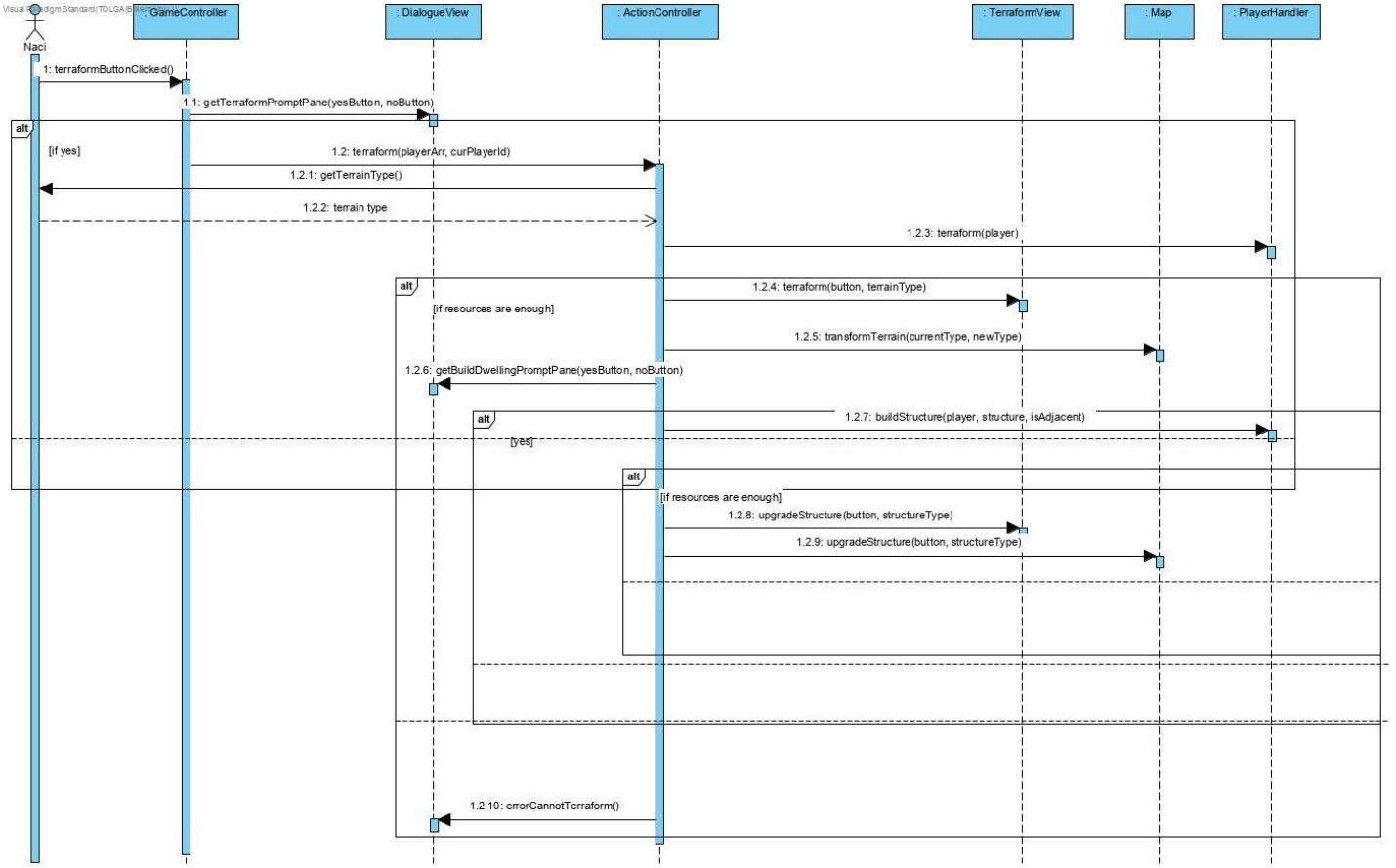
6.3.3.1. Start New Game Scenario



Model 9: Start Game Sequence Diagram

Scenario 1: User of the game, Sena, requests to create a game to play with her friends. She opens the game and presses the button “Create Game”. System shows a screen for user to decide how many players will play the game. Sena adds players to the game. The system initializes players to the game with their nicknames. Sena click “Play” button to start the game. The system starts asking to choose faction for every player. After each player choose their factions, start button becomes visible. After starting, game initializes map and players according to chosen factions.

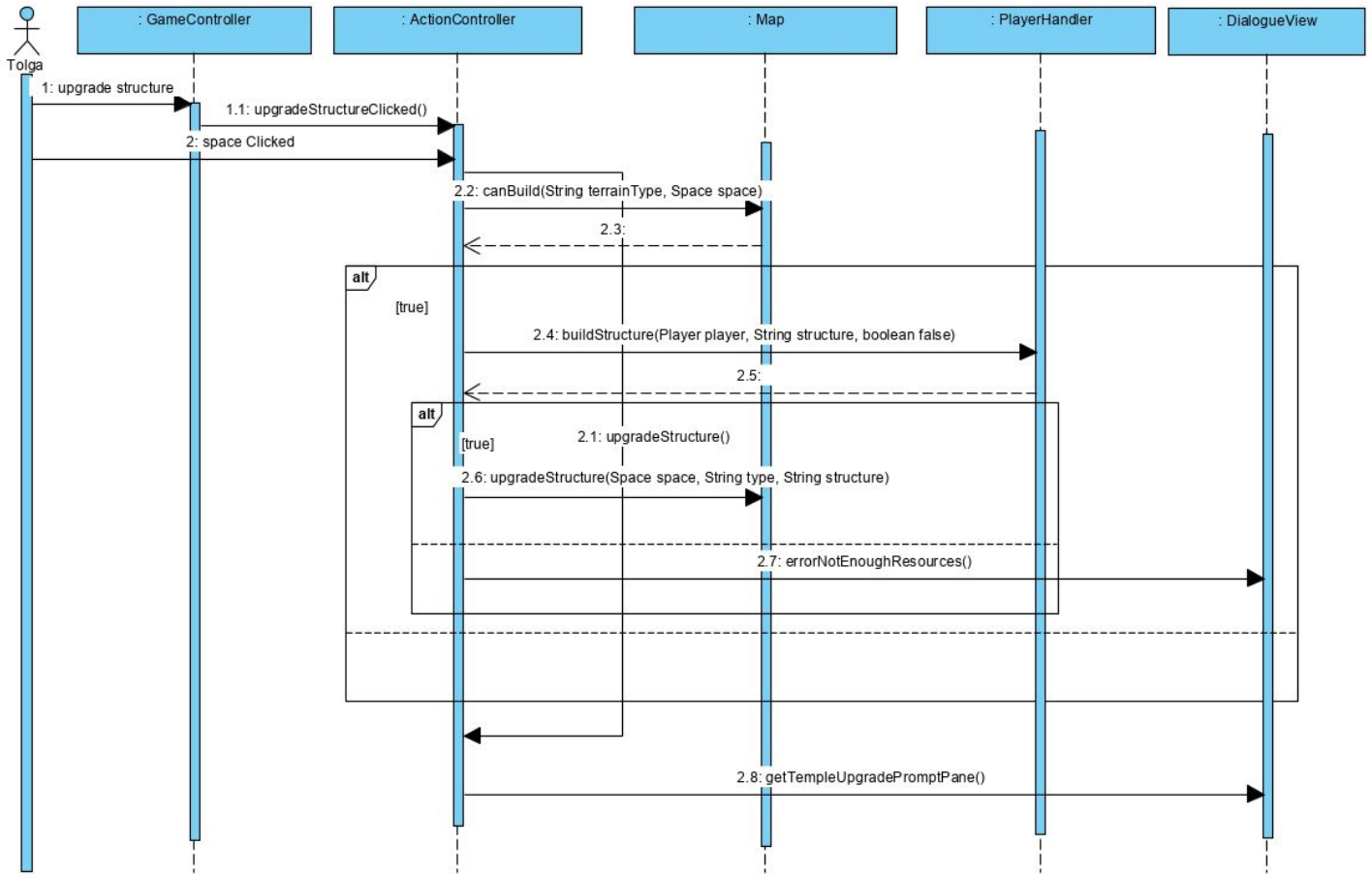
6.3.3.2. Terraforming Action Scenario



Model 11: Terraform Action Sequence Diagram

Scenario 2: In the turn of player, Naci, decides to change a terrain with a terrain which has same color with his faction. The request of terraforming, reaches ActionController object with coordinates where Naci clicked to map and the data of object which represents him in the game. By obtaining space on map from Map object ActionController calculates the transition amount between desired type of terrain and currently existing terrain on map, in order to check whether Naci has enough resources. Assume Naci has enough materials to change the terrain, ActionController calls Map to change the terrain on map and calls PlayerHandler object to decrease amount of material of Naci by the cost of transition. After that ActionController causes GameDialogue object to ask if he wants to place a dwelling on new terrain. Assume Naci accepted to build a dwelling, ActionController ensures Naci can afford the building cost, decreases material of Naci and calls map to do change on map.

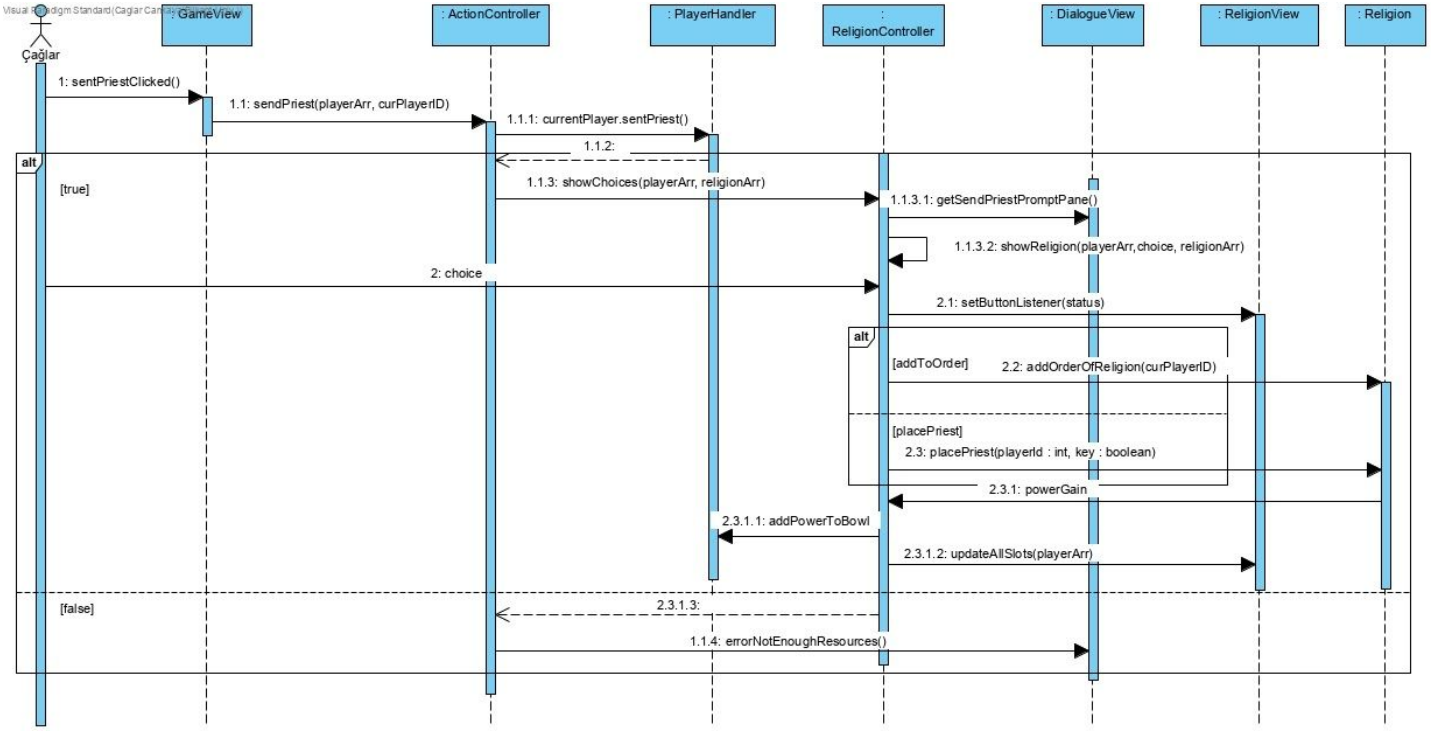
6.3.3.3. Upgrade Building Scenario



Model 12: Upgrade Building Scenario Sequence Diagram

Scenario 3: One of the players, Tolga, has his turn. He wants to upgrade his structure to the next level building. He decides to upgrade his Temple to a Sanctuary. He chooses the upgrade structure action and picks the terrain where his Temple is built. The system gets the coordinates of the terrain chosen and decides if this terrain holds a Temple that is the structure of Tolga's. After verifying that he can upgrade his structure, the system then upgrades structure if Tolga has enough resources. Tolga has enough resources, so system updates his resources and then updates the map. Then a prompt is shown that he upgraded the temple.

6.3.3.4. Advancing on Religion Scenario



Model 14: Advancing on Religion Scenario Sequence Diagram

Scenario 5: Çağlar has decided to progress in a religion to increase his power points. Assuming he decides to make a move on one of the religions, the system will check if he has enough Priests. After verifying that he has enough Priests to move on, the system will update his position in Religion object and reduce his number of Priests. He chooses whether advancing by placing priest to order or directly adding to the track by clicking a button emerged in screen. After his choice progress. After that the view that shows all players' position emerges and by simply clicking corresponding button on religion, Çağlar advances on given religion. After progressing in religion, the amount of power he obtained by progressing will be given to Çağlar. If there is no enough Priests, the system will show an error message to inform the Çağlar.

6.4. User Interface

6.4.1. Main Menu Screen

Figure 16: Main Menu Screen

This is the main menu screen of the game. Users will see this screen first when they open the game. The user can create game, load game, see the settings, get help, see the credits or exit the game on this screen.

6.4.2. Create Game Screen

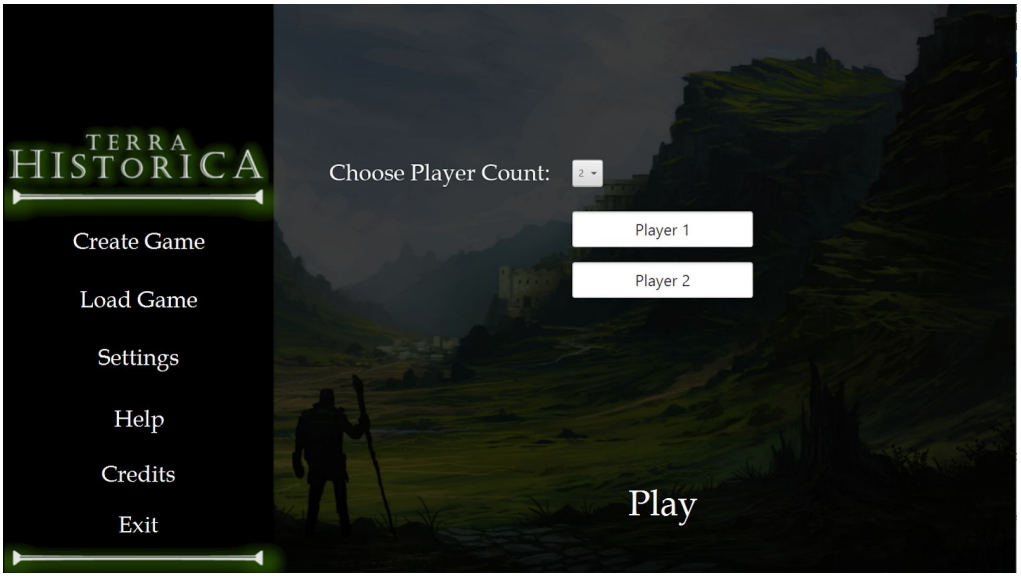


Figure 17: Create Game Screen

If the user clicks “Create Game” button, this screen will appear. In this screen, the user can add or remove players. Also, player names can be identified by typing on the green bars. After players’ count and names are decided, the user can click the “PLAY” button.

6.4.3. Choose Faction Screen

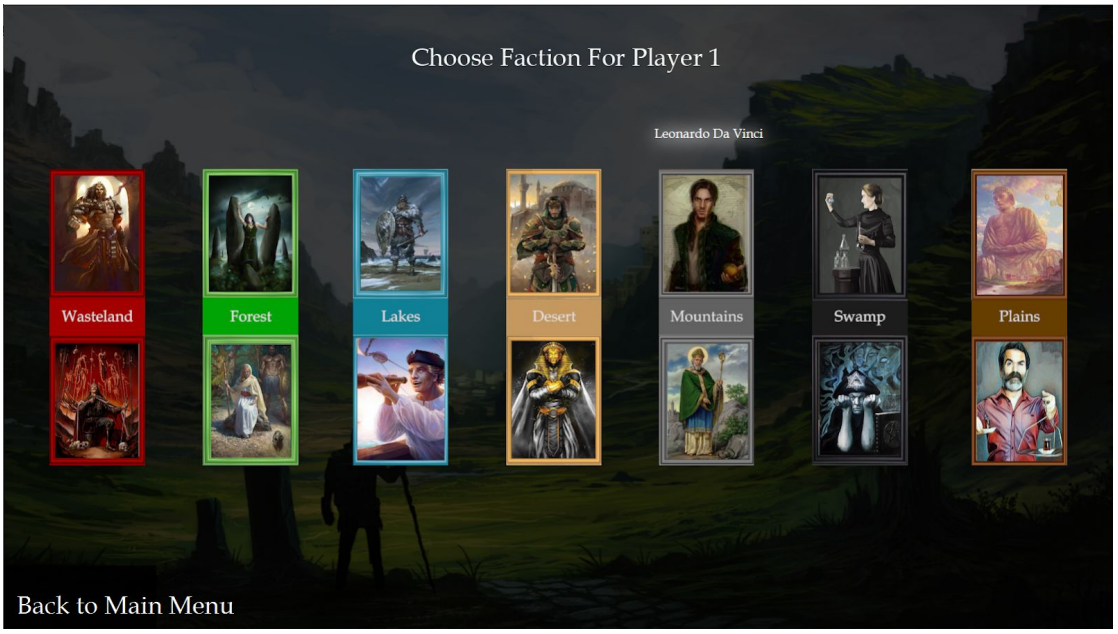


Figure 18: Choose Faction Screen

This screen will appear after the user clicks the “PLAY” button on the create game screen. In this screen, players can choose their factions. Every player select their faction one by one. Faction choice turns of the players will be displayed on the top of the screen.

6.4.4. Settings Screen

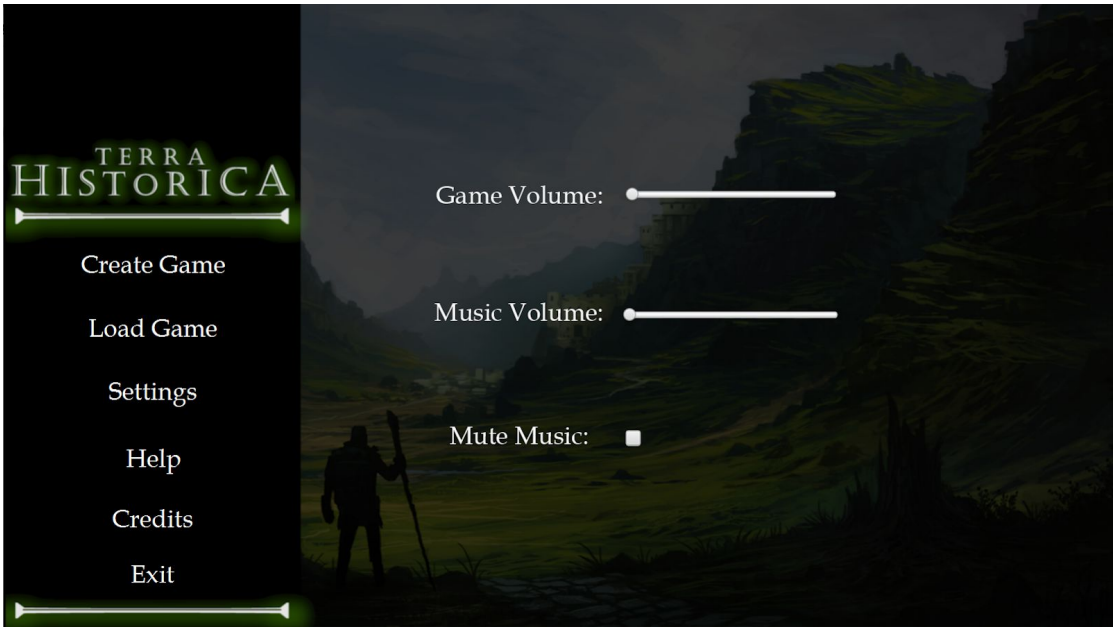


Figure 19: Settings Screen

In the Settings Screen, the user can change the volume of the game or music. Also, screen resolution can be changed on this screen too.

6.4.5. Help Screen

Figure 20: Help Screen

In the Help Screen, there is a link for Terra Mystica Online Manual. This manual describes all of the features in the game.

6.4.6. Credits Screen

Figure 21: Credits Screen

This screen will show the credits of the game.

6.4.7. Gameplay Screen

Figure 22: Gameplay Screen

This screen is a mockup for gameplay. The buttons on the top shows additional tabs that user can navigate through. The map of the game is placed on the center of the screen and its size will be fixed throughout the game. On the bottom part, there are faction cards for each player. These faction cards show the victory points, coins, workers, priests and power bowls of that player. The name of the player will be shown on the top of the faction card. Also, player can recognize their turn by looking at their names on the faction card. Player name will be bolder than the others if it is his or her turn. Left side of the screen shows actions that a player can do. After choosing an action, player can act accordingly.

7. Improvement Summary

In the first iteration, there were ambiguities in our non-functional requirements such as missing system specifications and unclear performance requirements. Therefore, we have included a system specification and we made our ambiguous non-functional requirements more clear. In the use case models, due to the feedback we got, we split our first use case model as main manu use case model and play game use case model. Thus, we increased the readibilitiy of our use case models. Also, following the use cases are easier now. For our class model, we did not show detailed information about Space and Terrains. In order to avoid data loss, we added new attributes and made class model connections more clear. Our activity, state and sequence diagrams were little problematic so we updated them in the light of the feedback we got. Finally, our mockups are updated with their current versions.

8. Glossary & References

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