



Bilkent University

Department of Computer Engineering

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# CS319 Term Project

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## Analysis Report

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# Analysis Report

Terra Mystica

## 1. Introduction

Terra Mystica is a game with a magical world where the terrain is open to alteration. The players aim to improve a faction, which they choose from the existing fourteen factions. Each faction has its own bonus cards, special abilities, terrain boundaries and the map is not big enough for all. Hence, you have to both compete for claiming new territories and change the terrain to sustain your faction. You have to expand your land and build in order to gain important sources like money and power. The way to victory is not unique so that it is possible to beat your rivals in many ways.

## 2. Overview

### 2.1. Components

#### 2.1.1. Gameboard

Gameboard contains a map that is composed of hexagons of different colors. Colors denote the terrain type or rivers. Power actions are demonstrated below the map. On the bottom left of the gameboard scoring tiles reside. On the top left of the gameboard cult bonuses and scoring rules are depicted. Moreover, victory point progress is placed as a frame surrounding the gameboard.

#### 2.1.2. Cult Board

Cult board contains 4 tracks for the cult of fire, water, earth and air. Each track has 10 spaces players can advance with different rewards. On the bottom of the tracks, there are places for priests.

#### 2.1.3. Faction Boards

##### 2.1.3.1. Transformation Cycle

In transformation cycle each terrain type is demonstrated separated by one spade symbol. The smaller number spades from one terrain type to the other is the cost of the transformation.

### 2.1.3.2. Supply

Each player starts the game with the following supply materials of their color.

- 8 Dwellings
- 4 Trading houses
- 1 Stronghold
- 3 Temples
- 1 Sanctuary
- 7 Priests
- 7 Markers
- 3 Bridges

### 2.1.3.3. Depicted Starting Resources

Depicted resources are on the top right corner of the fraction board. Number of workers, coins and cult advancement together with the cult type are depicted.

### 2.1.3.4. Bowls of Power

Bowls of power section resides on the top left corner of the faction. Power tokens are placed on top these bowls.

## 2.1.2. Terrains and Structures

Structures are mentioned in 2.1.3.2. Terrains are to cover the terraformed terrains with the new terrain type.

### 2.1.3. Power Tokens, Coins, Workers and Priests

Power tokens only have one color, purple. Coins are distributed as 1, 2, and 5 coins.

Workers are white cubes. Priests are mentioned in 2.1.3.2.

### 2.1.4. Scoring Tiles

Scoring tiles depict the end of round rewards. Beginning of the game, six of which are chosen and placed on the gameboard. One of them is covered with end of game token.

### 2.1.5. Favor Tiles

Favor tiles are lay out as 3x4 matrix. Each favor tile has a reward on their face.

### 2.1.6. Bonus Cards

There are 9 bonus cards in the game. Each bonus card has a reward on their face.

### **2.1.7. Town Tiles**

There are 10 town tiles in the game. Each town tile has a reward on their face.

## **2.2. Game setup**

### **2.2.1. Setup of the Faction Boards**

Setup of Terra Mystica begins with assignment of factions. 2 to 5 faction boards are distributed to the players. Each player chooses one side of the faction board. After the distribution of the faction boards, each player places their supply(priests, bridges and structures) on the faction board. Then, each player collects their starting resources and makes the cult advancements. Moreover, each player places their power tokens onto the power balls on their faction boards.

### **2.2.2. Setup of the Gameboard**

6 randomly selected scoring tiles are placed on the gameboard and one that corresponds to the 6th round is covered with the game end token. Favor tiles are placed near the gameboard in a 3x4 matrix. Cult board is also placed near the gameboard. Then bonus cards are randomly selected. The number of bonus cards is 3 more than the number of players. One action token is put on each power action that are on the bottom of the gameboard. Town tiles, workers and coins resides next to the game board.

### **2.2.3. Setup of the First Structures**

After starting player is set each player place one Dwelling on their home terrains in clockwise order, then starting from the last player, this action is repeated in reverse order.

### **2.2.4. Choosing of Bonus Cards**

Beginning with the last player, each player chooses one bonus card in counter clockwise order. Consequently, 3 bonus cards remain unpicked on each of which one coin is placed.

## **2.3. Gameplay**

Terra Mystica consists of 6 rounds and each of which has 3 phases.

### 2.3.1. Phase 1: Income

#### 2.3.1.1. Income for Structures

Each player takes workers equal to the number of visible Worker symbols on the Dwelling track of their faction board; coins equal to the number of visible Coin symbols on the Trading House track of their faction board; priests equal to the number of visible Priest symbols on the Temple track and Sanctuary spot of their faction board and power equal to the number of visible Power symbols on the Trading House track and (not always) on the Sanctuary spot of their faction board.

#### 2.3.1.2. Income for Cards and Tiles

Each player gets the income depicted on the bonus cards and favor tiles they possess in the beginning of each round.

#### 2.3.1.3. Gaining Power

Each player is given 12 power tokens in the setup phase and there is no way to increase the number of tokens one player has. Gaining power; therefore, does not mean gaining power tokens. Gaining power enables players to move their tokens from the first bowl to the second one or from the second one to the third one.

Even though gaining power is explained under the section of Income Phase, it can happen in the other stages too.

### 2.3.2. Phase 2: Actions

There are 8 different actions players can take once per turn. In addition there are 2 more actions.

#### 2.3.2.1. Transform and Build

##### 2.3.2.1.1. Transform

To transform a terrain, each faction has different requirements depicted in the transformation cycle of the faction board. Players are allowed to transform terrains into any terrain provided that the terrain they wish to transform is unoccupied and adjacent to their structures.

##### 2.3.2.1.2. Build

Players can build a dwelling on a terrain if and only if the terrain is of their color(home terrain of their faction), unoccupied and adjacent to their structures. Dwellings normally cost 1 worker and 2 coins.

### 2.3.2.2. Advancing on the Shipping Track

Players may choose to expand beyond River spaces, resulting in indirect adjacency. This is allowed to a extent that is indicated in the shipping track of faction boards. So as to be able to expand to a further extent, a player has to pay 1 Priest and 4 Coins. Each advancing on the shipping track is rewarded with victory points.

### 2.3.2.3. Lowering the Exchange Rate for Spades

Spades cost 3 workers by default. Players can reduce this rate by paying 2 workers, 5 coins and 1 priest. This rate is indicated in the exchange track of the faction boards. This action is rewarded with 6 victory points.

### 2.3.2.4. Upgrading a Structure

There are four possible upgrades and two of which can only be done once.

#### 2.3.2.4.1. From Dwelling to Trading House

This upgrade costs 2 workers and 6 coins unless there is structures of other players directly adjacent to the dwelling. In that case, the cost is 2 workers and 6 coins.

#### 2.3.2.4.2. From Trading House to Stronghold

The cost of this upgrade varies between factions. This upgrade unveils a special ability of the faction.

#### 2.3.2.4.3. From Trading House to Temple

This upgrade costs 2 workers and 5 coins and is rewarded with one favor tile.

#### 2.3.2.4.4. From Temple to Sanctuary

The cost of this upgrade varies between factions and is rewarded with one favor tile.

#### 2.3.2.4.5. Gaining Power via Structures

Players do not gain power for their own structures. However, players gain power when one of their opponents build or upgrade a structure that is directly adjacent to them. Amount of gained power for each structure is depicted in the structure track on the faction board. Players can gain as many power as the total number of power corresponding to the structures that are directly adjacent to the newly built or upgraded structure. Gaining power in this way is up to the player as it requires them to lose victory points equal to one fewer than the total number of power gained.

### 2.3.2.5. Send a Priest to the Order of a Cult

Players can place a priest to the spaces on the bottom of the cult track. This results in 2 or 3 space advancements on the corresponding track. This action may also result in gaining

power as each cult track has power income in their 3rd,5th,7th and 10th spaces providing the player that passes by with 1,2,2, and 3 power(s) respectively.

#### 2.3.2.6. Power Actions

Power actions are indicated by orange octagons and cost players power. Those that are on the bottom of the gameboard can only be taken once per round. Upon having been taken, a power action is blocked for the rest of the round and is covered by an action token.

#### 2.3.2.7. Special Actions

Special actions are also indicated by orange octagons and can only be taken once per round. Special actions can be gained via Strongholds(for some factions), favor tiles and bonus cards. Upon having been taken, a special action is blocked for the rest of the round and is covered by an action token.

#### 2.3.2.8. Pass

Players may choose to stop taking actions or may no longer be able to take actions for the rest of the round. If this is so, they can pass. The first player to pass becomes the starting player of the next round by taking the starting player token. Upon passing, a player should return their bonus card and take a new one.

#### 2.3.2.9. Power Bowl Conversions

Anytime during their turn, a player can do as many of the following conversions as they want. These conversions are indicated below the 3rd power bowl on the faction board.

- Spend 5 power for 1 priest
- Spend 3 power for 1 worker
- Spend 1 power for 1 coin
- Convert a priest to a worker
- Convert a worker to a coin

If a player does not have enough power in the 3rd power bowl for the action or the conversion they wish to take, they can move power tokens from the 2nd bowl to the 3rd bowl by sacrificing half of the tokens. Sacrificed tokens are removed from the game till the game ends.

#### 2.3.2.10. Founding a Town

Players can found one or more towns throughout the game. In order for a town to be founded, there should be at least 4 structures that are directly adjacent to each other unless one of them is a sanctuary. If one of the structures is a sanctuary then having 3 structures suffices. In addition to the direct adjacency condition, the structures should have more power value than 7 in total. Upon building a town, a player gets a town tile and places it under one of the structures of which the town consists.

### **2.3.3. Phase 3: Cult Bonuses and Clean-up**

After each player passes for the round, action phase ends and clean-up phase begins.

#### **2.3.3.1. Cult Bonuses**

Cult bonuses that are depicted on the scoring tile of the current round is rewarded for the players whose progress matches the condition. Multiples rewards can be given to one player.

#### **2.3.3.2. Return of Action Tokens**

Any action token that resides on one of the power actions on the gameboard, special actions on the faction boards, favor tiles, and bonus cards are removed.

#### **2.3.3.3. Coins on Bonus Cards**

1 coin is put on the unpicked bonus cards. There can be multiple coins on a bonus card if a card remains unpicked for multiple rounds.

#### **2.3.3.4. Turn the Scoring Tile Face Down**

The scoring tile corresponding to the current round is turned face down in the cleanup phase of the round.

## **2.4. End of the Game and Final Scoring**

After each player passes in the action phase of the 6th round, the game ends.

### **2.4.1. Cult Scoring**

No cult bonuses are given in the 6th round hence the game end token covers the scoring tile of the round. Score of the each cult track is evaluated separately in the following manner.

- The highest player on the track gets 8 victory points.
- The second highest player on the track gets 4 victory points.
- The third highest player on the track gets 2 victory points.

Even if they meet one of the conditions above, no victory points is given from the cult track to a player if they are on the 0th space of the track.

In case of a tie, victory points are divided(rounded down if necessary) and shared.

## 2.4.2. Area Scoring

Structures that are directly or indirectly adjacent to each other are considered as connected. The number of connected structures may result in victory points in the following manner.

- The player with the highest number of connected structures gets 18 victory points.
- The player with the highest number of connected structures gets 12 victory points.
- The player with the highest number of connected structures gets 6 victory points.

In case of a tie, victory points are divided(rounded down if necessary) and shared.

## 2.4.3. Resource Scoring

Players get 1 victory point for every 3 coins they possess.

## 2.4.4. The Winner(s)

The player with the highest number of victory points wins the game. In case of a tie, there is more than one winner.

## 2.5. Rules

1. Player can take actions only in their own turn.
2. In his/her turn, a player can take only one action.
3. All actions, except for passing, can be taken several times per round.
4. Power cannot be moved from the second bowl to the third if the first bowl is empty.
5. Provided that all power tokens are in the third bowl, player cannot gain more power.
6. Power can only be spent from the third power bowl.
7. Transformations are priced with spades. The rates are depicted in transformation cycle of each faction board.
8. Spades cannot be saved and thus must be used immediately.
9. In one turn, a player can transform several terrains and put one and only one dwelling on one of them.
10. Transformations do not have to be followed by building dwellings.
11. From any terrain to any terrain, transformation is possible.
12. Terrains having structures on them cannot be transformed.
13. In building and upgrading, structures are removed from the faction board from left to right.
14. Terrains and structures can be adjacent to each other either directly or indirectly.
15. Two terrains or structures are directly adjacent to each other if they share a hexagon edge or are connected with a bridge.

16. Two terrains or structures are indirectly adjacent to each other if they are separated by a number of river spaces not exceeding the player's shipping level.
17. A player cannot take a favor tile which s/he already possesses.
18. A favor tile can be used immediately after it is earned.
19. Affected parties decide in clockwise order when a situation results in gaining power via structures (see 2.3.2.4.5.). Decision making starts with the player that precedes the active player in play order.
20. Players cannot have negative victory points.
21. Each cult track can house only one player in their 10th space.
22. Once a priest is sent to a cult track, it cannot be returned.
23. Power bowl conversions are not considered as turn actions; therefore, can be taken multiple times in a single turn.
24. All resources can be kept for the next round.
25. Cult bonuses are distributed in the play order of the next round.
26. Players cannot build dwellings in the cleanup phase.

## 3. Functional requirements

### 3.1. Multiplayer game

Players must be able to play Terra Mystica with each other on a server. Each player has to choose a color to represent himself. Players must be able to perform all the activities listed above in the gameplay section and server should be able to handle these interactions.

### 3.2. Help

Players must be equipped with help pages containing all the information about the game. Help pages should be properly categorized and easy to be navigated through.

### 3.3. Choose a faction

Each player must choose a faction before starting the game. Factions should be represented informatively to ease this process.

### **3.4. Building Dwellings**

Players must be able to build dwellings if the game is on the action phase of a round and the necessary conditions are met. Dwellings must be demonstrated on the map clearly indicating its owner.

### **3.5. Transforming Terrains**

Players must be able to transform terrains if the game is on the action phase of a round and the necessary conditions are met. After transformation, terrains should demonstrate not only the new terrain but also the old terrain slightly.

### **3.6. Improvements in Faction Abilities**

Players must be able to improve shipping skills and terraforming skill whenever the conditions for either of them is met in the action phase of a round.

### **3.7. Use of Priests**

Players must be able to use the priests in their supplies for the actions that require. The owner, removal and displacement of the priests should be demonstrated clearly.

### **3.8. Power Actions**

Players must be able to take power actions if the necessary conditions are met. Conditions and the after effects of power actions must be informatively documented and clearly demonstrated.

### **3.9. Special Actions**

Players must be able to take power actions if the necessary conditions are met. Conditions and the after effects of special actions must be informatively documented and clearly demonstrated.

### **3.10. Upgrading Structures**

Players must be able to upgrade structures if the necessary conditions are met. All structures should be distinctively demonstrated on the gameboard.

### **3.11. Power Bowl Conversions**

Players must be able to manipulate the power bowls on their faction boards. The game should demonstrate the content of each bowl. All the conversions should be informatively documented and clearly demonstrated.

## **4. Nonfunctional requirements**

### **4.1. Documentation**

Terra Mystica game should provide its players with instructive documentations about the game. Consequently, introduction of new players to the game will be easier.

For its developers, design and implementation process should be recorded and documented. All methods, classes and algorithms used should be explained in the documents and in the code segments. Also, changes between versions should be recorded for further bug detections and fixes.

### **4.2. Extensibility**

Even though the game is highly complex, it is still open for development. So the design and the implementation should pave the way for future development. To do so, an object oriented design in which all classes have single responsibility will be followed.

Consequently, the game can be improved without requiring vast changes in its structure.

### **4.3. Efficiency**

The graphical user interface must be responsive to the user inputs with 1 ms. For this, brute-force solutions are to be averted. Because of this, there can be a trade off in memory as increase in time efficiency may result in decrease in memory usage.

### **4.4. Usability**

The game must avoid ambiguity and be informative not only in explanation of the game but also in the active game. The game must have clear images to represent all the components of the game. If an action is prohibited at an instant of the game, player should be notified and be informed about the reasons.

# 5. System models

## 5.1. Use case model

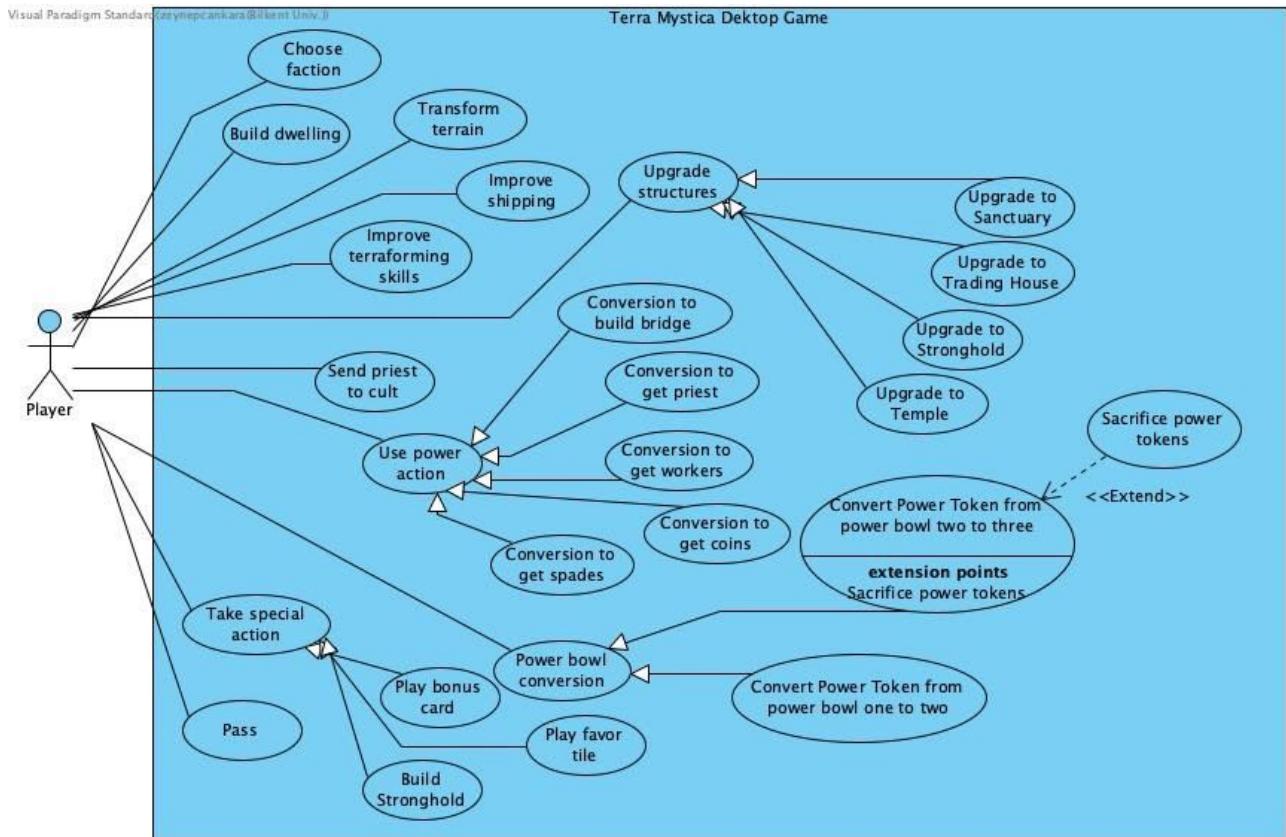


Figure 1: Use case diagram

### 5.1.1. Use Case Descriptions

#### 5.1.1.1. Name: Choose faction

- Participating Actor: Player
- Entry Condition:
  - Beginning of the game.
  - Current player has not selected a faction yet.
- Exit Condition:
  - Every player in the game choose a faction.
- Flow of Events
  1. Current player chooses a faction from available factions.
  2. The faction board assigned to the player.

- Special Requirements: *None*

#### 5.1.1.2. Name: Transform terrain

- Participating Actor: Player
- Entry Condition:
  - Current player must have enough spade resources for the terrain type.
  - No structures on the terrain space.
  - Terrain space needs to be directly or indirectly adjacent to one of current player's Structures.
- Exit Condition:
  - Player puts marker of home terrain on the terrain space.
- Flow of Events:
  1. Current player chooses an unoccupied terrain.
  2. Current player use the spades in accordance with the terrain type.
  3. Current player marks the selected terrain space with the home terrain marker.
- Special Requirements: *None*

#### 5.1.1.3. Name: Build dwelling

- Participating Actor: Player
- Entry Condition:
  - The terrain matches player's home terrain.
  - The terrain is unoccupied.
  - Directly or indirectly adjacent to one of the player's structures.
  - When player is at the first round player can ignore direct and indirect adjacency rule when building a dwelling.
- Exit Condition:
  - Player builds the dwelling.
- Flow of Events:
  1. Current player selects a terrain which matches player's home terrain.
  2. Current player has to choose an unoccupied terrain space.
  3. At the first round player can build dwelling without considering direct-indirect adjacency rule.
  4. Current player chooses a terrain space which directly or indirectly adjacent to it's structures.
  5. Current player pays resources to build the dwelling.
  6. Current player places the dwelling onto the selected terrain space.
- Special Requirements: *None*

#### 5.1.1.4. Name: Improve Shipping

- Participating Actor: Player
- Entry Condition:
  - Current player is at the 'Action Phase' of the round.
  - Current player has enough resources to improve its 'Shipping'.
- Exit Condition:
  - Current player advances the marker on the Shipping track.
- Flow of Events:
  1. Current player choose action 'improve Shipping' at the action phase of the round.
  2. Current player pays the cost of the action indicated as 1 Priest and 4 Coins.
  3. Current player advances the marker on the Shipping track.
- Special Requirements: *None*

#### 5.1.1.5. Name: Improve terraforming skills

- Participating Actor: Player
- Entry Condition:
  - Current player has enough resources to lower the exchange rate of spades.
  - Current player must be at the 'Action Phase'.
- Exit Condition:
  - Update the exchange rate of spades.
- Flow of Events:
  - Player use 2 workers 5 coins and 1 priest.
  - Lowers the exchange rate of spades as an action.
- Special Requirements: *None*

#### 5.1.1.6. Name: Upgrade Structures

- Participating Actor: Player
- Entry Condition:
  - Current player must have enough resources to upgrade the structure.
- Exit Condition:
  - Current player places the new structure on the game board.
- Flow of Events:
  1. Replace the current structure with the structure to upgrade.
  2. Return the old structure.
  3. Update faction board.
- Special Requirements: *None*

#### 5.1.1.7. Name: Send priest to cult

- Participating Actor: Player
- Entry Condition:
  - Current player has enough priests in supply.
- Exit Condition:
  - Current player moves the marker on the cult track as much spaces based on the priest's location on the cult track.
- Flow of Events:
  1. Current player chooses one of the cult tracks.
  2. Current player chooses one of the 4 places on the cult track to send the priest.
  3. Current player advances on the cult track based on the value indicated on the marker priest placed on.
  4. If priest pass power symbols convert that many power tokens.
- Special Requirements: *None*

#### 5.1.1.8. Name: Use power action

- Participating Actor: Player
- Entry Condition:
  - Power action should be available.
  - Current player must have enough power resources to take power action.
- Exit Condition:
  - All power tokens required to take power action moved from bowl 3 to bowl 1.
- Flow of Events:
  1. Current player moves power tokens required to take power action moved from bowl 3 to bowl 1.
  2. The power action becomes unavailable to use until next round.
- Special Requirements: *None*

#### 5.1.1.9. Name: Power bowl conversion

- Participating Actor: Player
- Entry Condition:
  - Power bowl 1 or bowl 2 is not empty.
- Exit Condition:
  - Player converts the Power Tokens in between the power bowls
- Flow of Events:
  1. Current player gains power as income or by advancing the cult tracks.
  2. Gained power corresponds to power tokens.

- 3. Current player converts power tokens depending on the number of power tokens in the power bowls.
- Special Requirements: *None*

#### 5.1.1.10. Name: Convert Power Token from power bowl 2 to 3

- Participating Actor: Player
- Entry Condition:
  - Power bowl 1 is empty.
  - There are Power Tokens in power bowl 2.
- Exit Condition:
  - Current player moves the Power Tokens according to the power gained.
- Flow of Events:
  1. Current player gains power as income or by advancing the cult tracks.
  2. Gained power corresponds to power tokens.
  3. Current player converts power tokens from power bowl 2 to 3.
- Special Requirements: *None*

#### 5.1.1.11. Name: Sacrifice power tokens

- Participating Actor: Player
- Entry Condition:
  - Current player has power tokens in the power bowl 2.
  - Current player has not enough power to take action.
- Exit Condition:
  - Current player sacrifices power tokens from bowl 2 to bowl 3.
- Flow of Events:
  1. Current player decides the number of power tokens to sacrifice.
  2. Current player converts power tokens from bowl 2 to bowl 3.
  3. Current player takes out as many power tokens as many as it converts from power bowl 2 to bowl 3.
- Special Requirements: *None*

#### 5.1.1.12. Name: Convert Power Token from power bowl 1 to 2

- Participating Actor: Player
- Entry Condition:
  - Power bowl 1 is not empty.
- Exit Condition:
  - Player moves the Power Tokens according to the power gained.
- Flow of Events:
  1. Player gains power as income or by advancing the cult tracks.
  2. Gained power corresponds to power tokens.

- 3. Player converts power tokens from power bowl 2 to 3.
- Special Requirements: *None*

#### 5.1.1.13. Name: Take special action

- Participating Actor: Player
- Entry Condition:
  - Current player is at the 'Action Phase' of the round.
  - Player must have one of the favor tiles or bonus cards with an orange hex or a stronghold with orange hex symbol.
- Exit Condition:
  - Player's special action becomes unavailable until the next round.
- Flow of Events:
  1. Current player choose to take special action.
  2. The orange hex indicating special action becomes unavailable until the next round.
- Special Requirements: *None*

#### 5.1.1.14. Name: Pass

- Participating Actor: Player
- Entry Condition:
  - Current player is at the Action Phase of the game.
- Exit Condition:
  - Current player takes the 'Pass' action.
- Flow of Events:
  1. Current player's turn in the Action Phase.
  2. Current player selects the 'Pass' action.
  3. Current player won't be able to participate action turns for the current round.
  4. Current player takes the starting player token for the next round.
  5. Current player chooses a new bonus card from the remaining bonus cards.
  6. Current player returns the old bonus card.
- Special Requirements: *None*

## 5.2. Dynamic models

### 5.2.1. Sequence Diagrams

#### 5.2.1.1. Sequence Diagram for Terraforming, Building Dwelling and upgrading a Structure

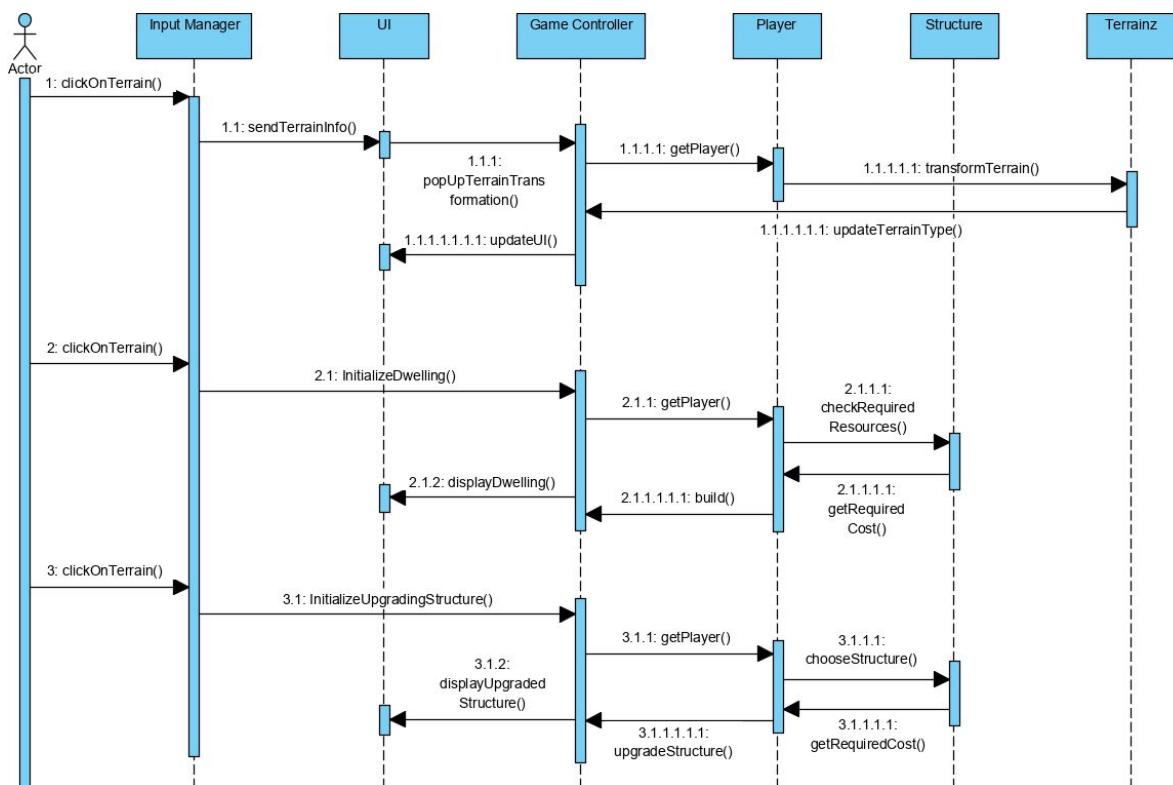


Figure 2: Sequence Diagram for Terraforming, Building Dwelling and Upgrading Structure

In this scenario, if a user wants to transform the terrain type the user clicks on an available terrain on the map. After clicking the terrain, the terrain information will be sended to the Game Controller and the terrain transformation popup will appear on the screen. The player will select the type of dwelling and the user choice will sent to the Game Controller. Information will be taken as an input and change the selected terrain type. Afterwards, the Game Controller sends an update command to the UI. If a user wants to build a dwelling on an available terrain, after clicking on the dwelling type, the required resources will calculated together with the resources of player has to check whether it satisfies the conditions. After validation, dwelling will display on the terrain. If a user wants to upgrade the structures, the same steps will be taken. However, this time

users will be able select the structure to be upgraded. For example, the trading houses can be upgraded to a stronghold or temple.

#### 5.2.1.2. Sequence Diagram for converting power tokens

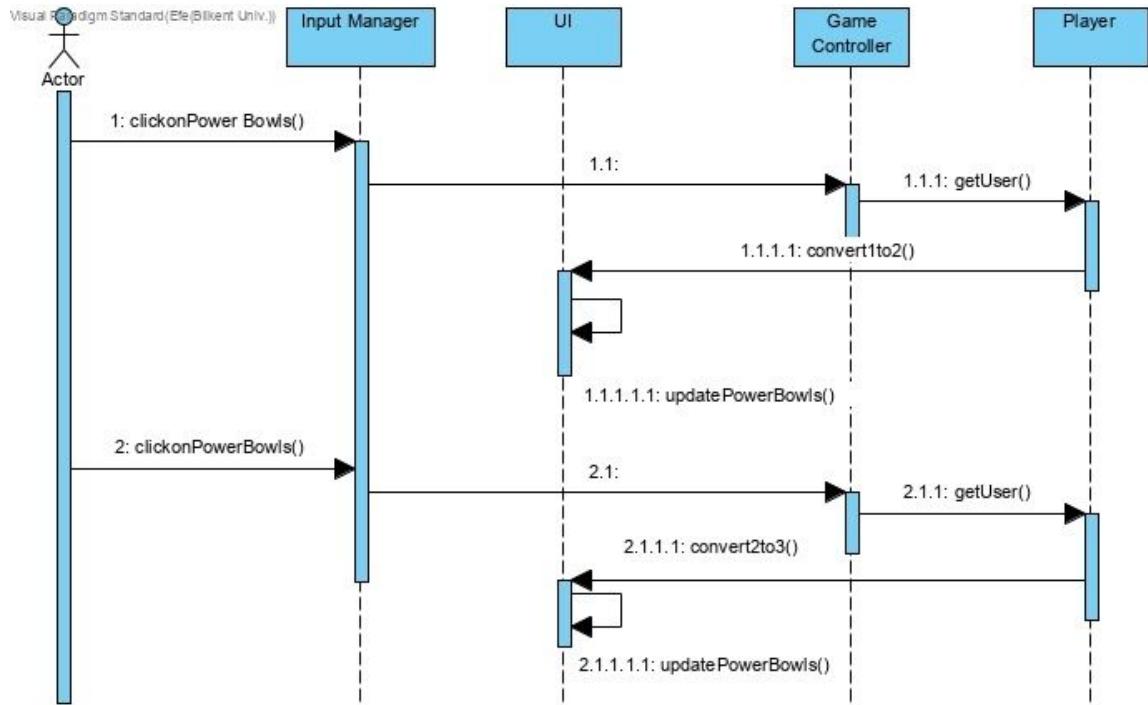


Figure 3: Sequence Diagram for converting power tokens

In this diagram, the user clicks on the power bowls to select the power which the power tokens will transferred. The Game Controller takes the user information from UI. Afterwards, the user has two options between converting from bowl 1 to 2 or from bowl 2 to 3. If the selected power satisfies power conversion rules the UI will update the power bowls.

#### 5.2.1.3. Sequence Diagram for transforming terrains

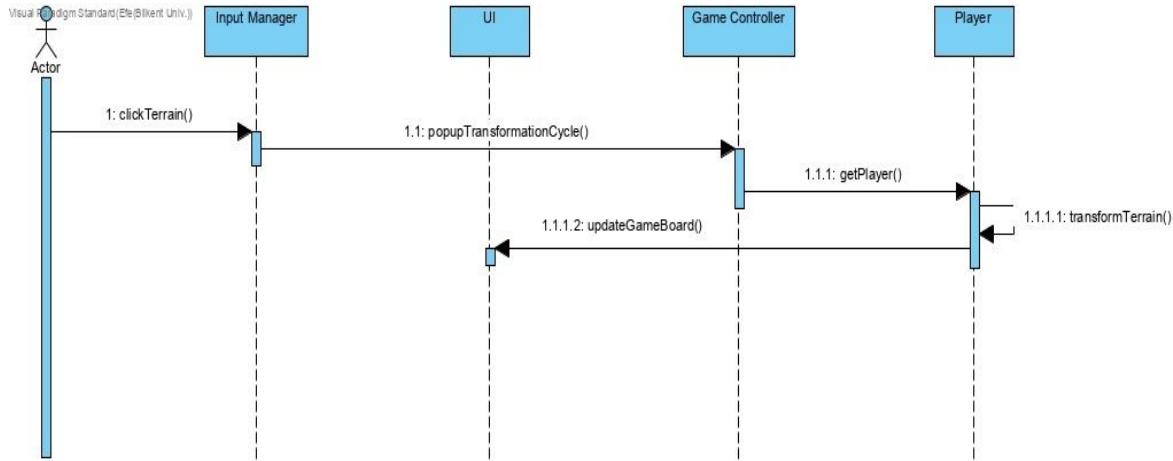


Figure 4: Sequence Diagram for Transforming Terrains

In this scenario, if a user wants to transform the terrain type the user clicks on an available terrain on the map. After clicking the terrain, the terrain information will be sended to the Game Controller and the terrain transformation popup will appear on the screen. The player information will be taken and the terrain type has changed. Afterwards, the Game Controller sends an update command to the UI.

#### 5.2.1.4 Sequence Diagram for building a bridge

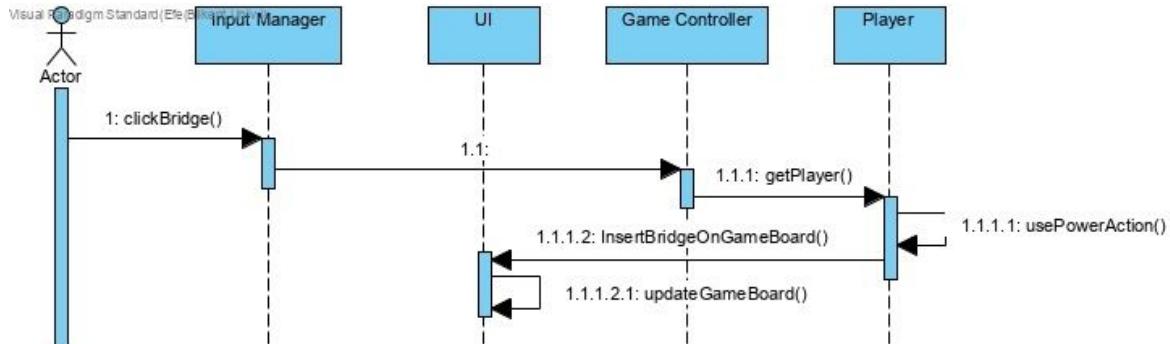


Figure 5: Sequence Diagram for Building a Bridge

In this diagram, the player clicks on the build bridge power action on the choose action pop-up, Game controller takes the player information to check whether it satisfies the conditions required to take the power action. After verification, the player uses the power action. Then, the player selects the available place to build a bridge on the game board and UI updates the game board.

### 5.2.1.5 Sequence Diagram for improving shipping

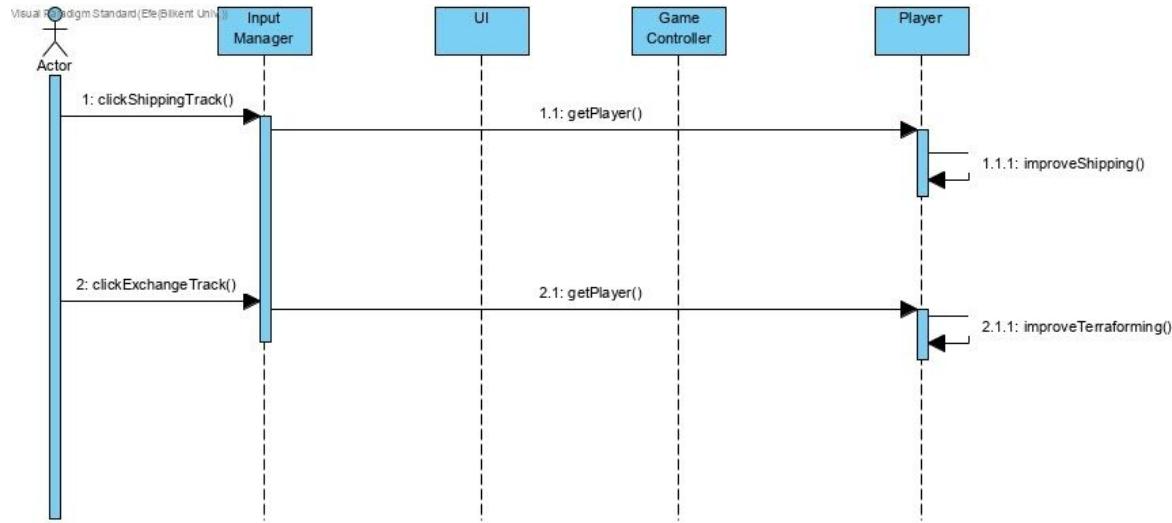


Figure 6: Sequence Diagram for improve shipping

In this diagram, the user clicks on the shipping track then the player information verify user has required resources to improve the shipping. Afterwards, the user's shipping ability updated. As an alternative, the user clicks on the shipping track then the player information has been taken after that improve shipping has been taken.

### 5.2.1.6 Sequence Diagram for advancing in cult board

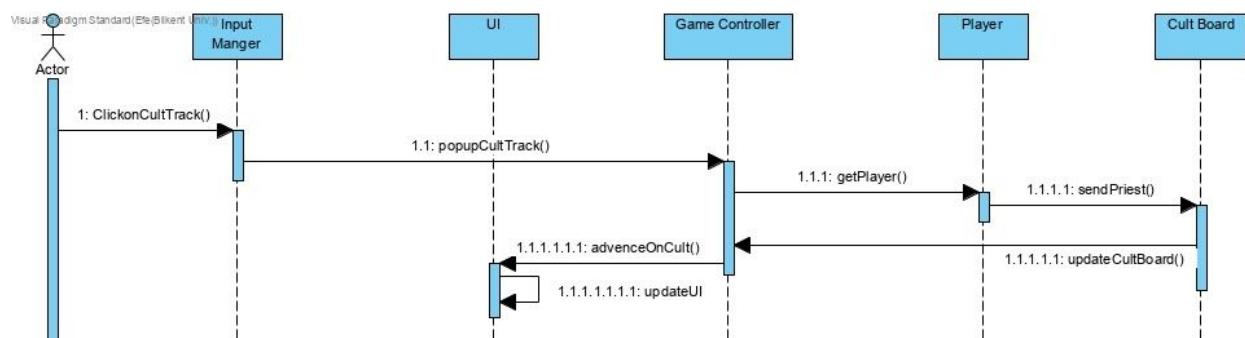


Figure 7: Sequence Diagram for Advancing in Cult Board

In this diagram, the user clicks on the cult track then cult track popup on the screen. Game Controller takes the player information and player sends the priest to cult board. Cult boards updates and Game Controller takes advance on the cult board and UI updates.

## 5.2.2 State Diagrams

### 5.2.2.1 Initial Setup State Diagram

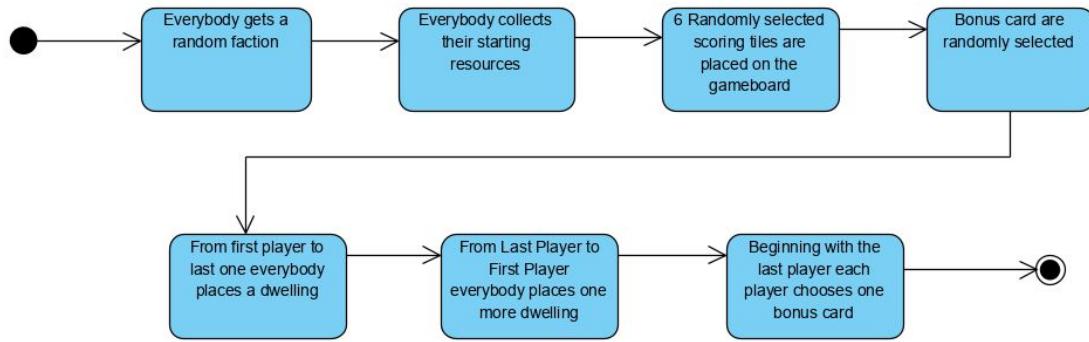


Figure 8: Initial Setup State Diagram

The game starts with everybody getting a random faction board. For every faction everybody gets their resources specified on the board. Afterwards, everybody get their resources which are 6 random scoring tiles, get selected and placed on the board. Additionally, everybody gets a random bonus card. Then, everybody has to build their first dwellings. From first player to last player(clockwise) each player places a dwelling on the board. Then this step is repeated once more but in counter clockwise. The last step is to get a bonus card in counter-clockwise order.

#### 5.2.2.2 End Game State Diagram

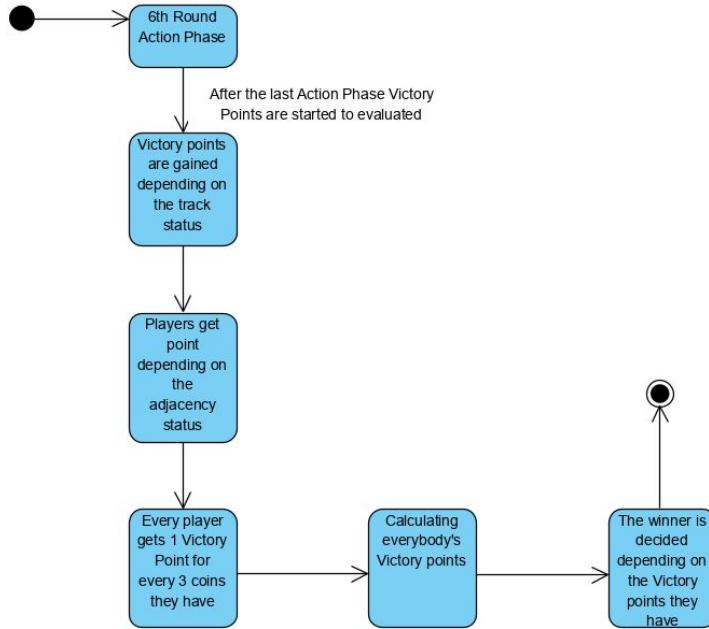


Figure 9: Endgame State Diagram

To decide who wins the game, after the last rounds action phase which is the 6th Round. Each player's victory points have to be calculated to calculate the highest victory points (top 3). In order to calculate the total Victory Points earned; first the points coming from the track status are added. Then, victory points are given to ones who have highest(top 3) adjacency then each players victory points is calculated. Finally the winner is the one who has the highest victory points. (There can be more than 1 winners(when 2 or more people have the same highest score))

## 5.2.3 Activity Diagrams

### 5.2.3.1 Gaining Power via Adjacency

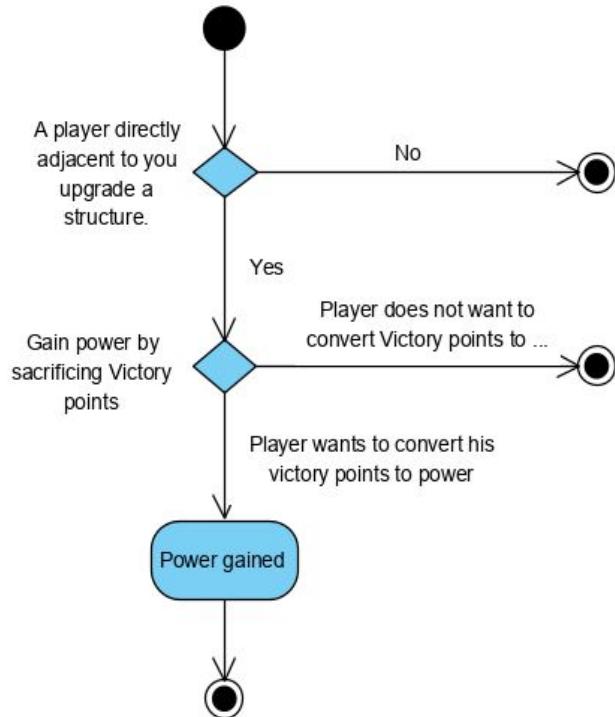


Figure 10: Activity Diagram for Gaining Power via Adjacency

In Terra Mystica, power is a fundamental resource that you want to hold. To gain power from structures, someone else has to build a structure adjacent to you, you can not gain any power from your own structures. So , if no one build a structure near (adjacent) to you, you can not gain power from structures. However, if someone builds a structure adjacent to your structures, you can gain power by sacrificing ( $\text{gainedPower} - 1$ ) victory points. You have the right to not sacrifice your victory points but you will not get any powers if you do so.

### 5.2.3.2 Founding Town

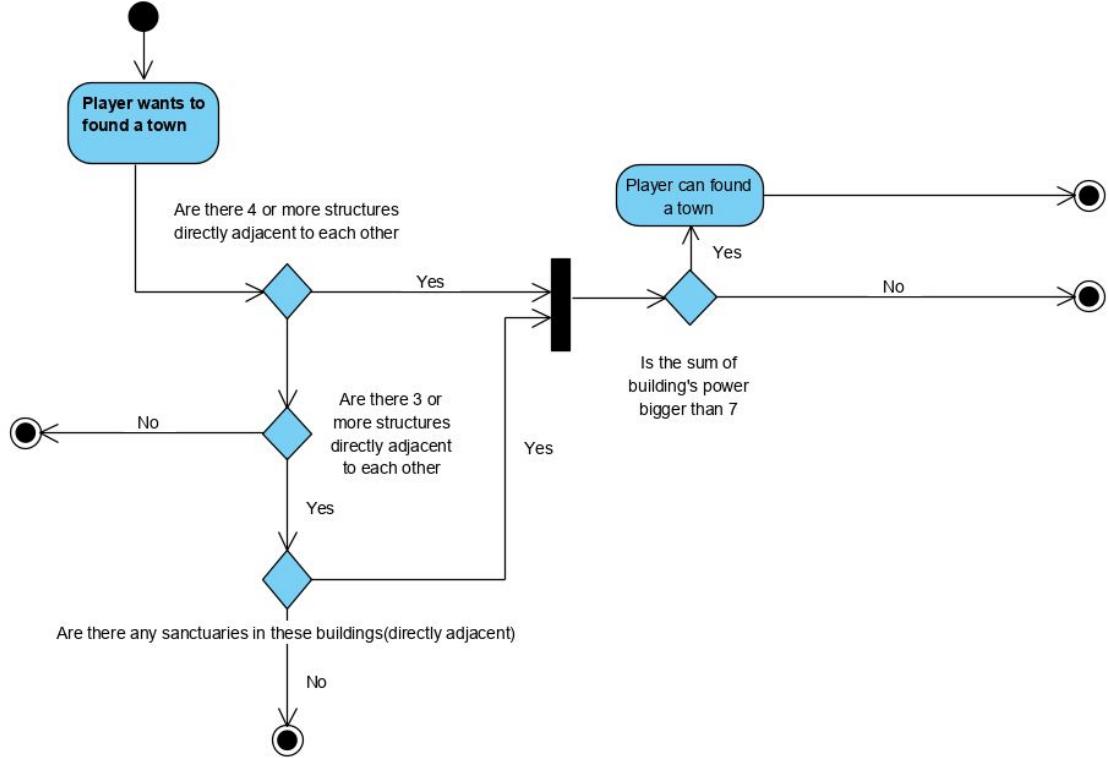


Figure 11: Activity Diagram of Building a Town

One of the actions that you can do in Action Phase is to found a town. However, there are some conditions to fill. There are two ways: One you have to have 4 or more structures directly adjacent to each other. Two, you can have 3 structures but one of them has to be sanctuary. After filling one of these conditions, then your have to have a power bigger than 7. If that condition is met you can found your town. In other cases you can not build a town.

### 5.3. Object and class model

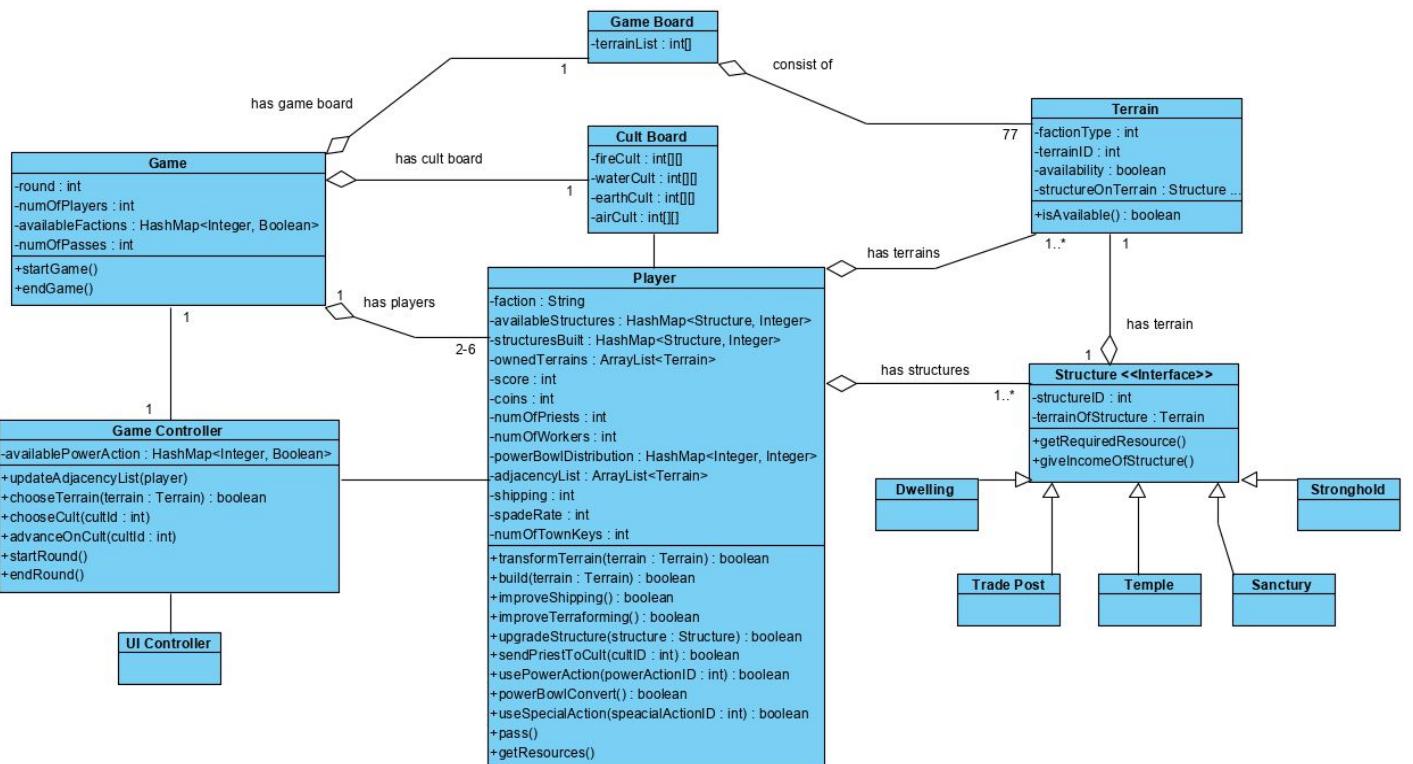


Figure 12: Object Model

- **Game Class** : Controls the main variables and main flows of the game.
- **Game Controller Class** : Controls the action interactions, action effects on objects and interaction of classes..
- **Cult Board Class** : Represents the cult board in the game which consists of 4 cults : air, water, earth, fire.
- **Game Board Class** : Represents the terrain map of the game.
- **Player Class** : Controls the player specific variables and player action functions
- **Terrain Class** : Represents the terrains in the game board.
- **Structure Interface** : Represents the main form, variables and function signatures of structure classes.
- **Dwelling, Trade Post, Temple, Sanctuary, Stronghold Class** : Represents the varying classes and their specifications.

## 5.4. User interface

### 5.4.1 Main Menu Mockup Screen

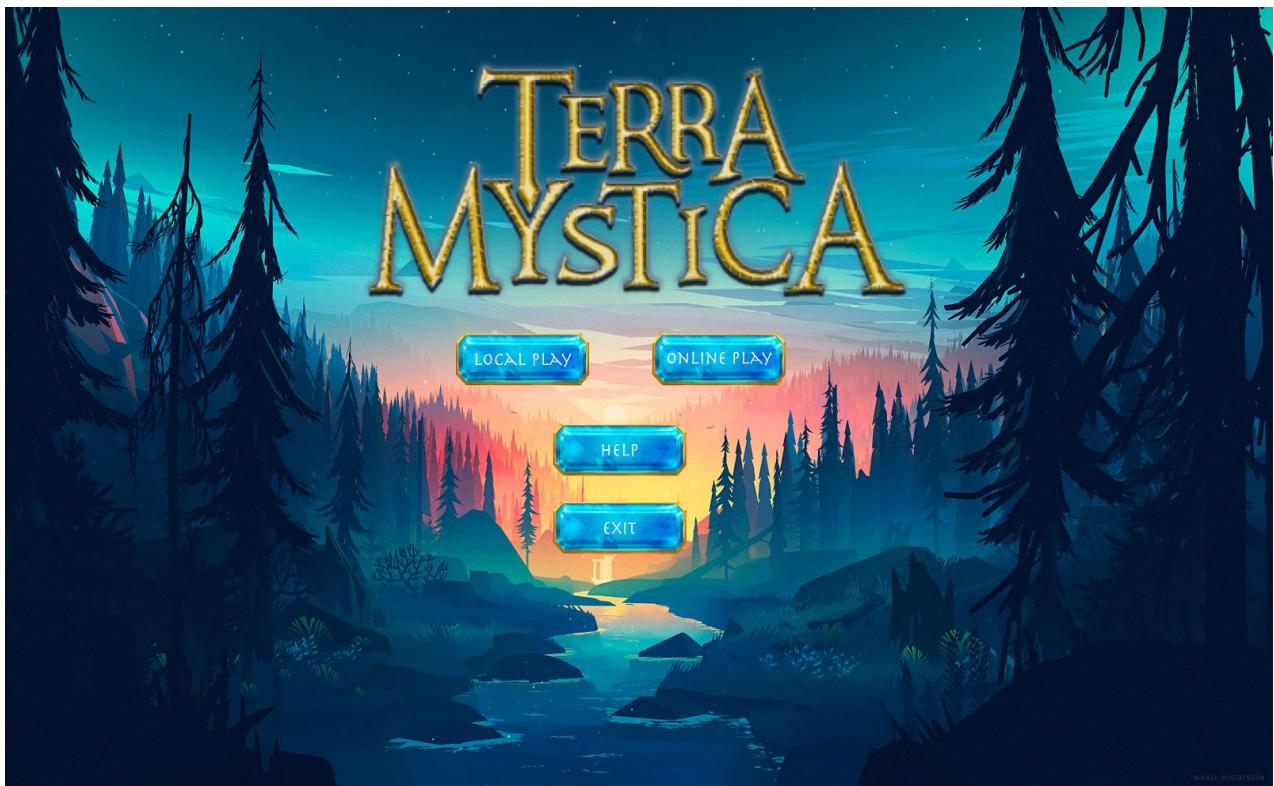


Figure 13: Main Menu Mockup

Terra Mystica's main menu will divided into 3 main sections: *Game Play*, *Help* and *Exit*. In the *Game Play* section user have 2 options to choose from which are *Play Online* and *Play Local*. By pressing the *Play Local* button user can play with other people around or with a bot. In *Online Play*, user will connect to a Wi-Fi network to match and play with other people. By pressing the *Help* button user can see the game rules. User will have an option to exit the game by pressing the *Exit* button.

#### 5.4.2 Game Board Screen (4 Players):

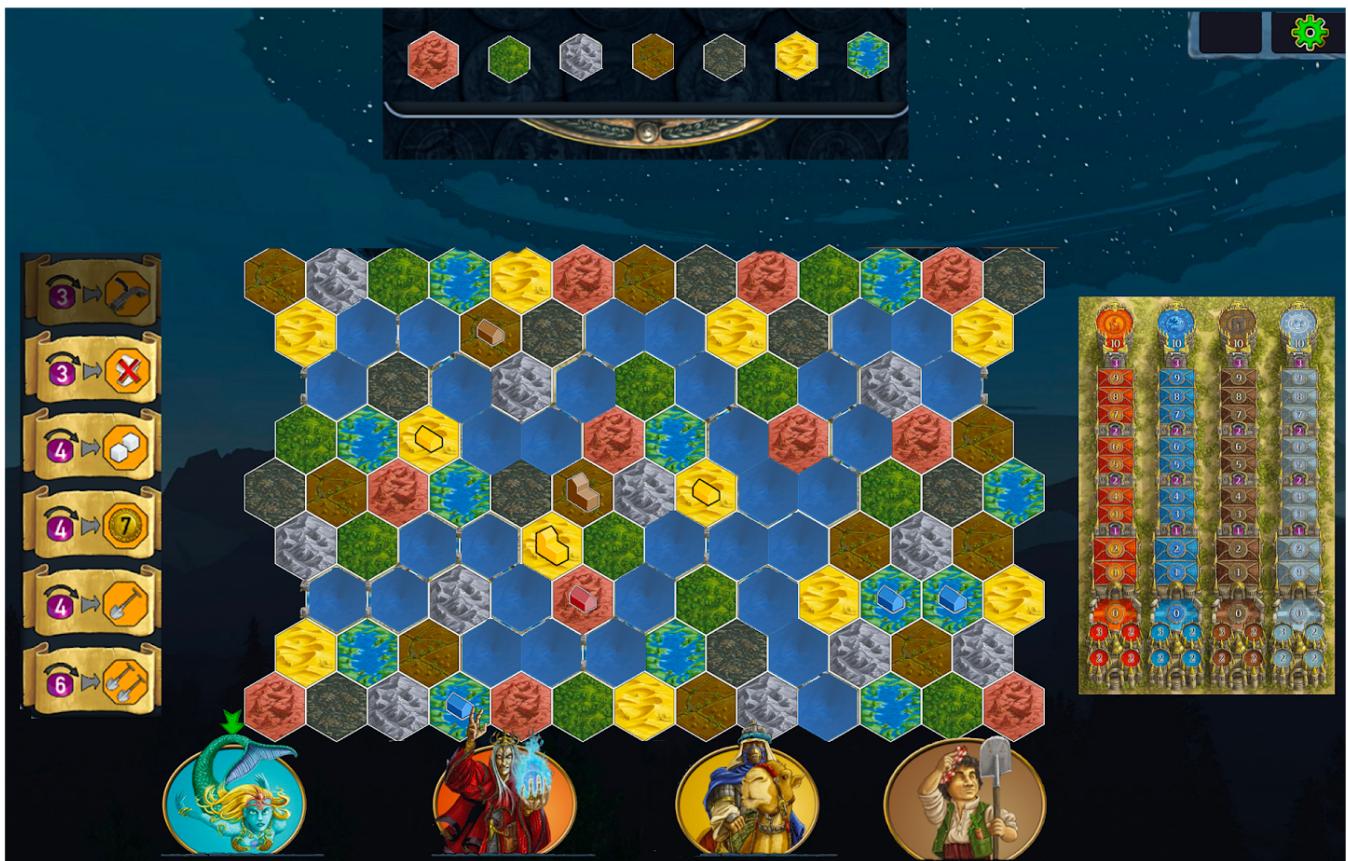


Figure 14: Gameboard Mockup

Game board displays the current state of the game. The player will be able to see other player's Faction board by clicking on top of the other player's Group symbol. The 6 cards at the left pane displays the possible Power Actions one take in each round. The right pane displays the state of the Cult Track. Player needs to select the terrain type from the upper pane in order to build structures on the map.

### 5.4.3 Player Faction Board:



Figure 15: Faction Board Mockup

When a user clicks on a Faction board. They will be able to see the other player's Faction board state. The design of the faction board is open to change according to the requirements.

#### 5.4.4 Choosing an action:



Figure 16: Choose an Action Mockup

The possible action a player can take will appear as a pop-up. User will be able to choose an action by clicking on the action. If the resources of the player satisfies the action condition user will take the selected action.