



# **Bilkent University**

## **Department of Computer Engineering**

**CS 319 - Object-Oriented Software Engineering**

### **Term Project - Analysis Report Final**

**Project Name :** Slay The Spire

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# **1. Introduction**

The game we are implementing is called "Slay the Spire" which is a roguelike game and it is a single player game [17]. Player's aim is to defeat the enemies by setting his own decks. There is a map in the game which includes merchants, rest areas and enemies. Also there is a boss enemy at the end of each map. Player has to track this map to reach the boss enemy. Throughout the game, the player has a specific health point(HP) and if the player loses all his HP, he has to restart from the beginning of the map. Our group aims on implementing this game as a desktop game which is played with a mouse. The game will be played with bots. The programming language will be JAVA, and also JavaFx framework will be used for the graphical interface.

The report which includes our initial and expected progress plan will be a record of our progress that can be seen in the analysis part. This report also will give a brief and basic expression about how to play "Slay the Spire". Afterwards, functional and non-functional requirements of our estimated work will be indicated and by various UML diagrams that are mainly related to our analysis will clarify our project structure. Lastly, In an effort to give an idea about our ideal and initial graphical interface there will be some draft images from our project.

## 2. Overview

### 2.1 Enemies

In this game, there are 3 types of enemies.



#### Enemy

The first type of enemies are the regular ones. They are the most prevalent ones in the map and do not have extra features.



#### Elite

The second type of enemies are called "elites". They are not common like regular enemies and they also have extra features such as when a player defeats the elite one, he can achieve rare cards that are more powerful than regular cards. If there is an animated flame behind the Elite then it holds a key for Act 4 (This only shows up once you have reached the Heart with all three characters)[1]



The third type of enemies, which are placed at the end of each map, are called "Boss enemies". They are the most powerful type of all enemies, therefore it is hard to defeat them. If the player can win the battle, his HP will be renewed, and consecutive act is activated.

### 2.2 Relics

Relics are permanent items which ensure a passive bonus for the rest of the game. Most relics are available to all characters, with some exceptions (indicated for each relic). There are eight types of cards which are starter, common, uncommon, rare, boss, event, shop and special relics.

#### 2.2.1 Starter Relics

They are basic relics of the game gained at the start of the game.



The starting relic for the Ironclad class, which is one of the four characters, can later be upgraded into Black Blood. Black Blood relic is found in a boss's chest. [2]



The starting relic for The Silent, which is one of the four characters. Functions identically to Bag of Preparation, a common relic which can

be found by all classes. Can later be upgraded into the Ring of the Serpent.[3]



The starting relic for The Defect, which is one of the four characters. This relic can be upgraded to Frozen Core as a boss relic reward.[4]



The starting relic for The Watcher. This relic can be upgraded to Holy Water as a boss relic reward.[5]

### 2.2.2 Common Relics

They are found commonly. Nevertheless, they are weak relics in comparison to other types of relics.



The Akabeko is a common relic that makes the first attack played each combat deal an additional 8 damage. [6]



Anchor is a common relic that provides 10 Block at the start of each combat. [7]



The Ancient Tea Set is a common relic that provides 2 Energy at the start of the first combat encountered after entering a Rest Site. [8]



The Art of War is a Common Relic that provides an additional Energy next turn if you do not play any attack cards in your current turn.[9]

### 2.2.3 Uncommon Relics

This type of relic is seen less frequently than common relics and they are more powerful than common ones.



"Lose 1 HP" will completely ignore Block and deal direct damage.

Playing a Curse does not cost any Energy. [10]



Upon pick up, choose an Attack card. At the start of combat, it will be in your hand. The card is added to your normal starting hand. It takes the place of a drawn card. This relic will not appear if all your attack cards are starter-type.

Bottle Relics effect is not the same as Innate. Duplicating a Bottled card will NOT draw the copy at the start of your hand (whereas it would if the card had Innate). [11]



Upon pick up, choose a Skill card. At the start of combat, it will be in your hand. The card is added to your normal starting hand. It takes the place of a drawn card. This relic will not appear if all your skill cards are starter-type. Bottle Relics effect is not the same as Innate. Duplicating a Bottled card will NOT draw the copy at the start of your hand (whereas it would if the card had Innate). [12]



Upon pick up, choose a Power card. At the start of combat, it will be in your hand. The card is added to your normal starting hand. It takes the place of a drawn card. Bottled Tornado is one of the three Bottle Relics. All Bottle Relics let the user choose a card of one type and start each combat with that card in hand. Bottle Relics effect is not the same as Innate. Duplicating a Bottled card will NOT draw the copy at the start of your hand (whereas it would if the card had Innate). It can only appear if your deck has at least 1 Power card. [13]

#### 2.2.4 Rare Relics

This type of relic is seen rarely and they are powerful.



At the end of the turn, it adds 2 HP.



All blocks you gain disappear at the end of the turn, however, this type of relic provides that you lose at most 15 blocks you gain.



At the start of the third turn, the character you play gains 18 blocks.



Whenever vulnerable property is applied, the relic also applies 1 weak to the enemy.

### **2.2.5 Boss Relics**

They can only be found from boss chests.



It is black blood. As it is mentioned above, it is gained when burning blood is upgraded. At the end of the combat ironclad gains 12 HP.



Whenever an elite monster is defeated, this type of relic drops 2 random relics.

### **2.2.6 Event Relics**

Relics that can only be obtained through events.



Whenever you gain gold, heal 5 HP(health point) [13]



At the beginning of your turn, upgrade one random card in the player hand for the rest of the battle.

### **2.2.7 Shop Relics**

Some relics can only be bought from the merchants by using gold.



Whenever you play a power, attack and skill in the same turn, remove all of your debuffs.[14]



Gain 6 block whenever you shuffle your draw pile.

## 2.2.8 Special Relics

Relic that only appears if you have every other relic in a relic pool.



Relic starts to appear once you have exhausted the pool of obtainable Relics. They stack in your Relic inventory when collecting them. [15]

## 2.3 Merchant



### Merchant

Merchant is one of the map locations. In this area, player can buy new cards, relics, and potions to make his deck stronger by using his gold that is won from the battles. Also, player can discard the cards that he does not want to use by using his gold.

## 2.4 Rest



### Rest

Rest is the area where a player can heal his character or he can upgrade his cards by using his gold. However, player can only choose either upgrading his cards or healing his character's HP.

## 2.5 Treasure



### Treasure

Treasure is one of the map locations where player gain random relics and gold. These rewards are non-boss treasures.

## 2.6 Unknown



### Unknown

In the map, there are unknown places. In these areas, player may encounter non-elite enemies, treasures, or shops. What the player will encounter is determined randomly.

## 2.7 Cards

In total there are 283 cards in the game which can be classified by rarity level, category, type and energy cost [18]. Cards are distributed based on the rarity levels that are common, uncommon and rare levels which can be differentiated by card's banner color that is behind of the name in the card. Common cards are represented by gray, uncommon cards are represented by blue and rare cards are represented by yellow or gold colors

Cards have 4 categories that are skill, power, attack and status which are collected under 3 types: reusable, exhaust and unplayable. While reusable cards can be reused unless the entire combat encounter is finished and there are no cards to use on the bag, exhaust cards can be used only one time on an entire combat encounter. Unplayable cards are for preventing users from drawing beneficial cards. In addition to these, all cards have energy costs which lessen the energy of character on the combat encounter.

### 2.7.1 Skill Cards

A reusable card (Unless it has Exhaust) that has more unique effects to it. There isn't a clear direction with offensiveness and defensiveness unlike attacks.



### 2.7.2 Power Cards

A permanent upgrade for the entire combat encounter. Some Powers give flatstats like Strength or Dexterity. Others require certain conditions to be met that combat. Each copy of a given power can only be played once per combat.



### 2.7.3 Attack Cards

A reusable card (Unless it has Exhaust) that deals direct damage to an enemy and may have a secondary effect.



### 2.7.4 Status Cards

Unplayable cards added to the deck during combat encounters. They are designed to bloat the deck and prevent the player from drawing beneficial cards, with some of them having additional negative effects. Unlike Curses, Status cards are removed from the deck at the end of combat.



## 2.8 Characters

There are 4 playable characters in the game. Ironclad, Silent, Defect and Watcher. These characters have different offensive moves and every character has three starting cards. New cards can be obtained by progression throughout the game. All attacks are categorized under 3 types. Attacks, Skills and Powers. Moreover Attacks,

Skills and Powers are categorized under three classes Common, Uncommon and Rare.

### 2.8.1 Ironclad



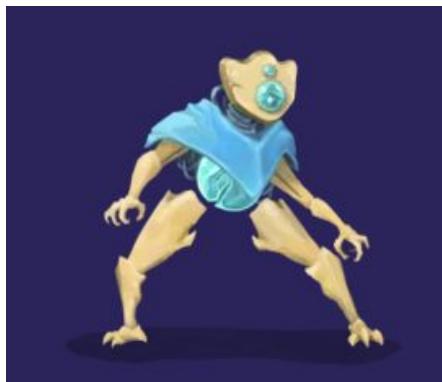
The Ironclad is one of four playable characters in Slay the Spire. He wields an arsenal of powerful strikes, boasts formidable defensive options, and can draw fiendish power from his demonic benefactors. He starts with 80 hp, the highest of the playable characters. Ironclad has three starting cards Bash, Defend and Strike. Further into the game Ironclad can obtain many more cards such as Anger, Clash, Cleave (Attacks), Armaments, Flex, Havoc (Skills), Combust, Evolve, Metallicize (Powers) and many more. The Ironclad's starting Relic is Burning Blood, which heals 6 HP after combat.

### 2.8.2 Silent



The Silent is one of four playable characters in Slay the Spire. She is a huntress themed on a rogue fantasy build. This cunning character weakens her foes with numerous cuts and poison, while using cheap tricks and agility to avoid their attacks. With many powerful cards that draw and discard, the Silent ensures that she will always be one step ahead of her enemy. She starts with a relatively low 70 hp. Silent has the four starting cards Defend, Strike, Survivor and Neutralize. Silent can obtain more cards throughout the game such as Bane, Strike, Unload, Backflip, Blur, Adrenaline, Accuracy, Envenom and many more. The Silent's starting Relic is Ring of the Snake, which draws 2 additional cards when starting combat.

### 2.8.3 Defect



The Defect is one of four playable characters in Slay the Spire. Once was among the like of Orb Walkers and Bronze Automaton as one of many ancient automatons, it has since gained sentience and seeks its way out of the Spire. It attacks foes with a high-tech arsenal, array of Powers, and elemental evocations. The Defect has a unique mechanic, the Orbs. Using cards and Relics, The Defect Channels these elemental spheres into a set of Orb slots, activating their passive effects each turn or Evoking them for a one-time burst. The Defect starts with three Orb slots, though cards and relics can add or consume them. It starts with 75 hp. The Defect has the four starting cards Defend, Dualcast, Strike and Zap. The Defect can obtain more cards throughout the game such as Claw, Scrape, Thunder Strike, Hologram, Equilibrium, Rainbow, Capacitor, Buffer and many more. The Defect's starting Relic is Cracked Core, which Channels 1 Lightning at the start of each combat.

### 2.8.4 Watcher



The Watcher is one of four playable characters in Slay the Spire. She is a monk that utilizes the effects of her different stances to her advantage, boasts an arsenal oriented around deck control via scrying and/or Icon Retain retaining, and possesses the unique strategy of cards generation. She starts with 72 HP. The Watcher starts with the four cards Defend, Eruption, Strike and Vigilance. The Watcher can obtain more cards throughout the game such as Sleeves, Tantrum, Brilliance, Evaluate, Collect, Vault, Foresight, Devotion and many more. The Watcher's starting Relic is Pure Water, which adds a Miracle to your hand at the start of each combat.

## 3. Functional Requirements

### 3.1 How To Play Combat Phase

#### 3.1.1 Combat Phase Visual Attributes

The combat level interface has quite a few properties. First of all, there is the top screen bar which is the same in all of the screens except the main menu ( After starting to play the game ). This bar contains the statistics of the player character. For example there is the current health and total health ratio. This is updated each

time the health pool of the player is increased, or the player takes damage from the enemies. Other than that, there is the amount of gold the character currently has. There are potion slots - Which can be filled or empty depending on the progress of the player - and these potions can be discarded or used by choice of the player during combat. There is also the stage number of the level. Stage number of the level is the nth combat encounter in the level. Each level has it's own stages and different enemies. The effects of the player's relics can also be seen here.

### **3.1.2 Combat Phase Actional Attributes**

#### **3.1.2.1 General Combat Attributes**

Below the top screen bar, the character and enemies are placed. At the bottom of the page, there are three parts. To the left, is the draw deck. If the player clicks here they can view the cards that are not currently playable by the player during their turn. The middle part is where the playable cards are lined up. The player can see the attributes of these cards and may or may not use them. Cards have specific energy requirements and the player has a limited energy capacity and when a card is played, the amount is reduced from the pool of energy of the player. Finally to the right there is the discard deck. When the player ends their turn, the playable cards of the turn are sent to the discard deck and cannot be used again until all cards from the draw deck are sent to the discard deck. During combat the player can view all the cards which are not playable anymore. Besides the bottom of the page, there is the end turn option, which needs to be used by the player in order to proceed with the combat. The end turn option can be used whether the player still has energy left or not. When the player ends their turn, each one of the enemies use an ability, offensive or defensive, and then it is players turn again. After each enemy turn the energy of the player is refilled and another deck of playable cards is drawn from the draw deck. If the draw deck is empty, all the cards in the discard deck are sent back to the draw deck and shuffled.

#### **3.1.2.2 Cards, Relics and Potions**

Cards, relics and potions have different effects on the player. The cards have specific attributes, for example they can give the player extra defense, or simply do a certain amount of damage to the chosen enemy. Relics provide permanent boosts for the player. For example one of the relics allows the player to draw 2 extra cards from the draw deck in each turn. So if the character is allowed to draw 5 random cards from the draw deck each turn, it is then increased by 2, so that the player can draw 7 cards from the deck each turn. These attributes can also affect defense and offense. The potions have similar effects but some of them last for only one turn. The player can have 3 potions at max, and can obtain them from spoils of battle or buy from the merchant. If the player dies in combat, they can retry, or just abandon the combat and return to the map or the main menu. If the player wins, they are awarded. The awards can be a new card which is chosen from 3 options, gold, or

potions. Then the player can proceed to the map and choose a new combat phase from the map as they want.

### 3.1.2.3 Additional Feature

In addition to the game features, a group, our idea for adding a new feature to the game is a critical damage system. Critical damage system is used among many varieties of computer games and this system has crucial effect on randomness in gameplay mechanics. The critical damage system works pretty similar. For the players, our group is going to implement a luck parameter to players, and this is going to hold an integer value which will basically work like luck. The higher this integer value gets, the more likely the player will execute a critical hit on the enemy, and enemies will less likely execute a critical hit on the player. At the beginning of the game, the player will have a low luck value, but as the game progresses, and the player's luck is increased, player will be able to execute more and more critical hits on the enemies and this way the progression of the game will speed up and it will be more fun and easier for the player to play the game as it becomes more and more unpredictable.

## 3.2 Settings

It is located on the main menu, and game settings can be adjusted. There are 2 sections in the game settings, which are sound and quit the game.



### 3.2.1 Graphics

Users can set display options of the game according to his or her computer properties. For example, resolution and max framerate can be adjusted. There are 4 options for resolution, and 5 options for max framerate which is frame per second (fps). There are also 4 options with checkbox, which are fullscreen, borderless fullscreen, screenshake, VSync. When the fullscreen checkbox is checked, the game turns into a full screen from the window. On the other hand, if borderless fullscreen is selected, the game's resolution is adjusted with the same as desktop resolution. This makes it easier to alt-tabbing because Slay the Spire is not a demanding game. Otherwise, it would be difficult to alt-tab. That is why borderless fullscreen is recommended. As for screenshake, the screen can shake during some animations. Lastly, If VSync is selected max framerate cannot go above users monitor refresh rate.

### **3.2.2 Preferences**

There are 6 options with checkbox, which are display summed up damage in gold, display blocked damage in blue, disable confirmation when choosing 1 card, disable particle effects, fast mode, show card quick select keys.

### **3.2.3 Sound**

There are 3 options with a sliding bar. The options are master, music and effects volume. In addition to these 3 options, there are 2 options with checkbox, which are ambient sound effects and mute while in background. When mute while in background is checked, sound is muted when the user alt-tab. If ambient sound effects are checked, the user hears environmental sounds in the game.

### **3.2.2 Quit**

There is an option to quit the game via settings screen. This option is placed as a button and when it is clicked game will be ended.

### **3.2.4 Miscellaneous**

There are 16 different language choices in the game in the miscellaneous section. In addition, upload gameplay data option exists. When it is checked, the user gameplay data and error logs are sent to the producer of the game in order to develop the game and fix the bugs.

## **3.3 Map**

The game "Slay the Spire" is based on the map. On the map screen, there are several paths and the path shapes according to player's choices. The map is built up from non-elite enemies, unknown places and also merchants. The map most commonly involves non-elite enemies and these enemies do not have extra features. In unknown places, player may encounter elite enemies or may gain gold or extra

cards. If the player does not want to use unknown places, he can just skip this area and move on to his next destination. On the map screen, there are also merchants, where player can buy new cards, potions or relics and also he can discard cards from his deck. If player wants to get a new card, he can use merchants. Otherwise, he can just skip, and choose his next step. Additionally, the map explains the place icons and their meanings as a list.

### 3.4 Merchant

The Merchant is the friendly NPC who sells items at the Shop. The Shop is one of the Map Locations, and it is the primary way for the player to spend their Gold. Users may use merchants to realize some feature of the slay the spire. To give examples, users can buy cards, relics and poisons from the merchant's shop. Furthermore users can remove a card from their desk by requesting a card removal option. The corresponding values of the items that are bought by the user will decrease user money as precisely as what the user spent. Some of the merchants differ from other merchants' features, some of them may sell some rare cards, relics, poisons. These features are basic interaction with a user, there are also some further interactions that are offered by merchants.



These interactions can be listed as:

- The Courier: When you buy a Card, Relic, or Potion, it is replaced by a random item of the same type. In addition, all items have a 20% discount. This stacks with Membership Card.

- The Colorless cards may be replaced by a colorless card of a different rarity, however, and the Shop Relic will be replaced by a Common, Uncommon, or Rare relic.
- Membership Card: All shop items and services have a 50% discount. Stacks with The Courier.
- Smiling Mask: The Card Removal Service now always costs 50 gold.
- Meal Ticket: Whenever you enter a shop room, heal 15 HP.
- Maw Bank: If you buy an item at the shop, Maw Bank is disabled and no longer provides 12 gold per floor. This includes the card removal service.[16]

### 3.5 Main Menu

Main menu screen is displayed when the game starts. Players can select the following options from the menu which contains Play, Compendium, Settings, and Quit. Play option directs the player to the combat screen in which the battle starts. In compendium selection, the user is directed to the next menu that contains card library, relic collection and potion lab options. Users examine all cards, various trinkets and artifacts that obtained throughout the run and observe the numerous potions found in the game from this menu. Users can access game settings from the main menu by selecting settings option which contains graphics, sound and different game preferences. In addition, these users have options to get information about the creators of the game. Quit option exits from the game and directs the player to the desktop screen.



## 4. Non-Functional Requirements

### 4.1 User-Friendly Interface

“Slay the Spire” is a game and it is designed to provide a smooth play experience. Therefore, user-friendliness of the game is highly significant.

- To provide this game experiment, actions should be easy to perform.
- Load times and screen changes should be fast (1-2 second per screen change).
- In addition, to make the game user friendly and easy to understand, straightforward and understandable icons will be used.
- Also, descriptions and information boxes will be added to the game. It is planned to attract player’s attention by using these features.

## **4.2 Game Performance**

To make the game in high quality, extra features such as music and sounds will be used. Although these extra components will be used, the speed of the game will not be decreased. First executing the program and loading of the main menu should take 5 seconds at most. Thus, the player will be more focused while playing the game.

## **4.3 Platform**

The game can be played on every platform with JVM(Java virtual machine).

## **4.4 Implementation**

The implementation will be done by using Java and JavaFX library.

## **4.5 Time Constraints**

To provide a smooth game play experience, it is planned to make code as efficient as can be done. Thus, the transactions between different screens should take 1-2 seconds at most.

## **4.6 Extendability**

“Slay the spire” is designed to be extendible easily.

- To make this, the algorithms that run in the game should be able to run with any type of cards, relics, characters and potions.
- The merchant and map should be extendible as well. A new type of cards, potions, and relics should be able to be added to game easily without changing the other entities.

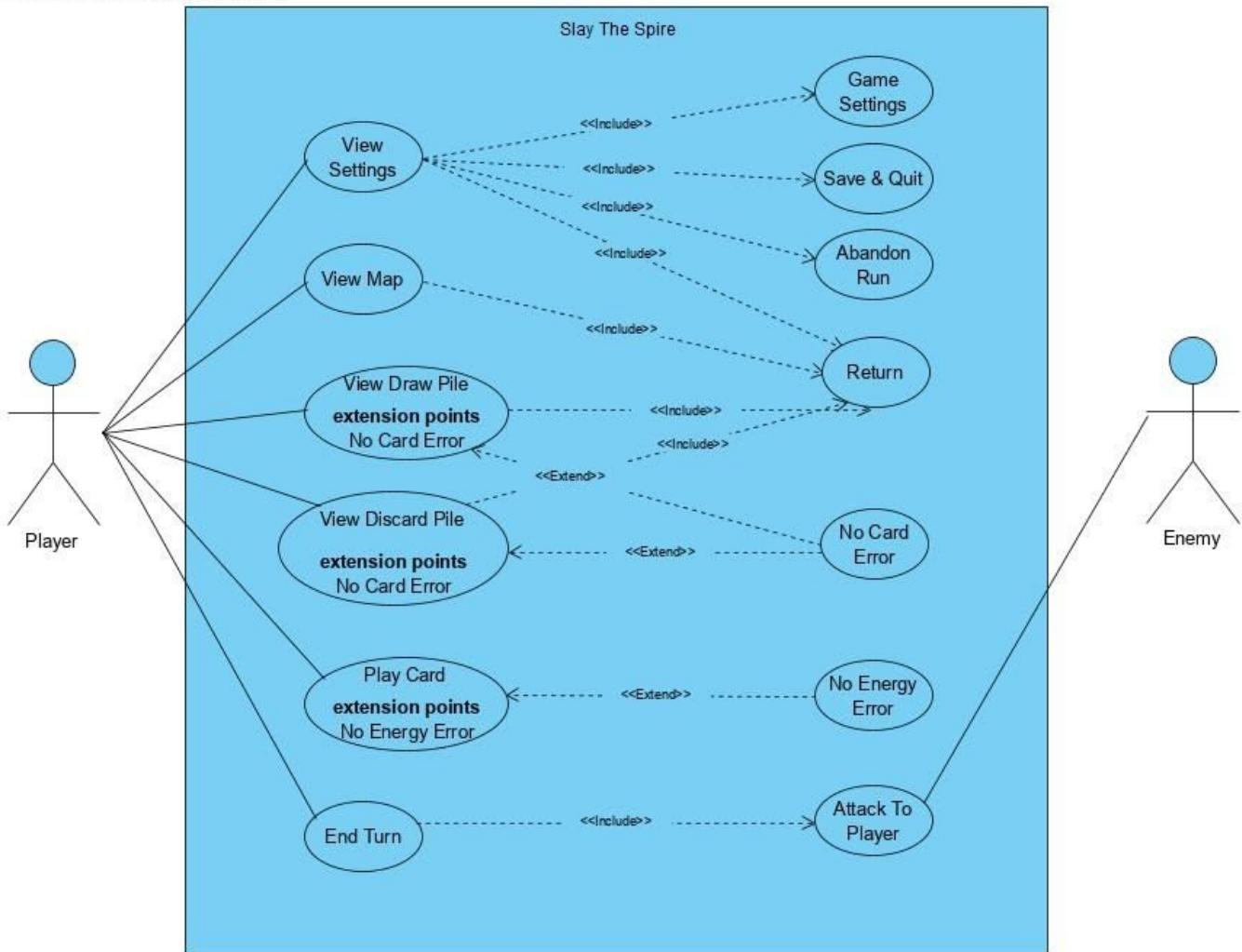
## **4.7 Reliability**

The algorithms should check each action’s validity and should check the win conditions of the combat.

# 5. System Models

## 5.1 Use Case Diagram

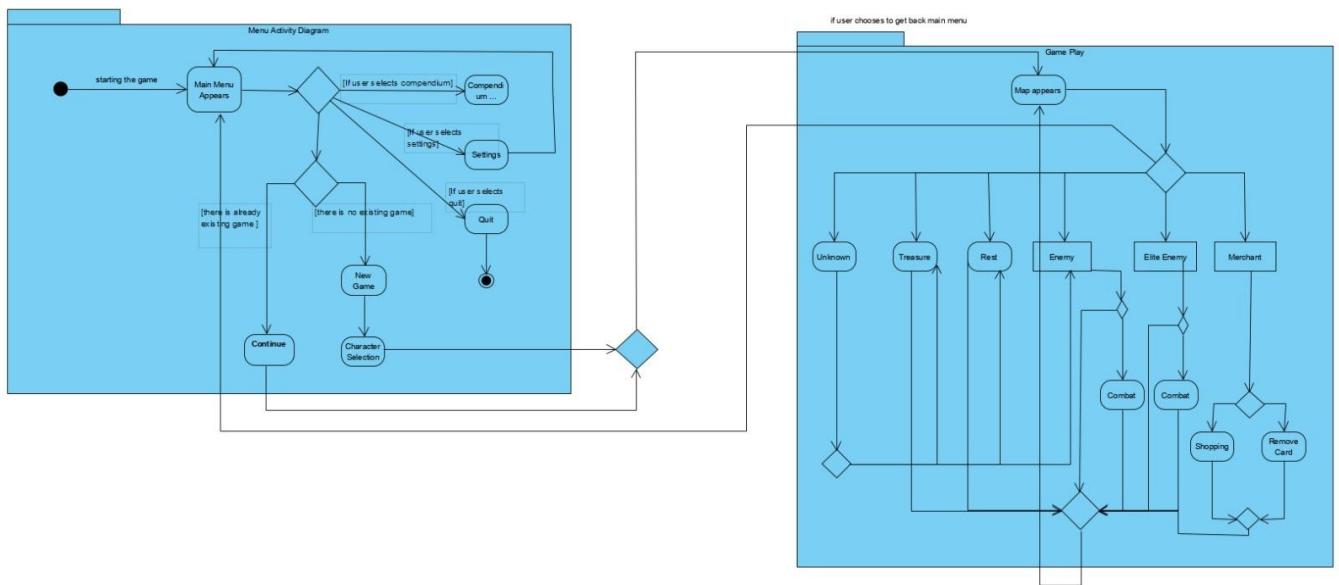
Visual Paradigm Standard (Nihat Barlu Seittag/Bilkent Univ.)



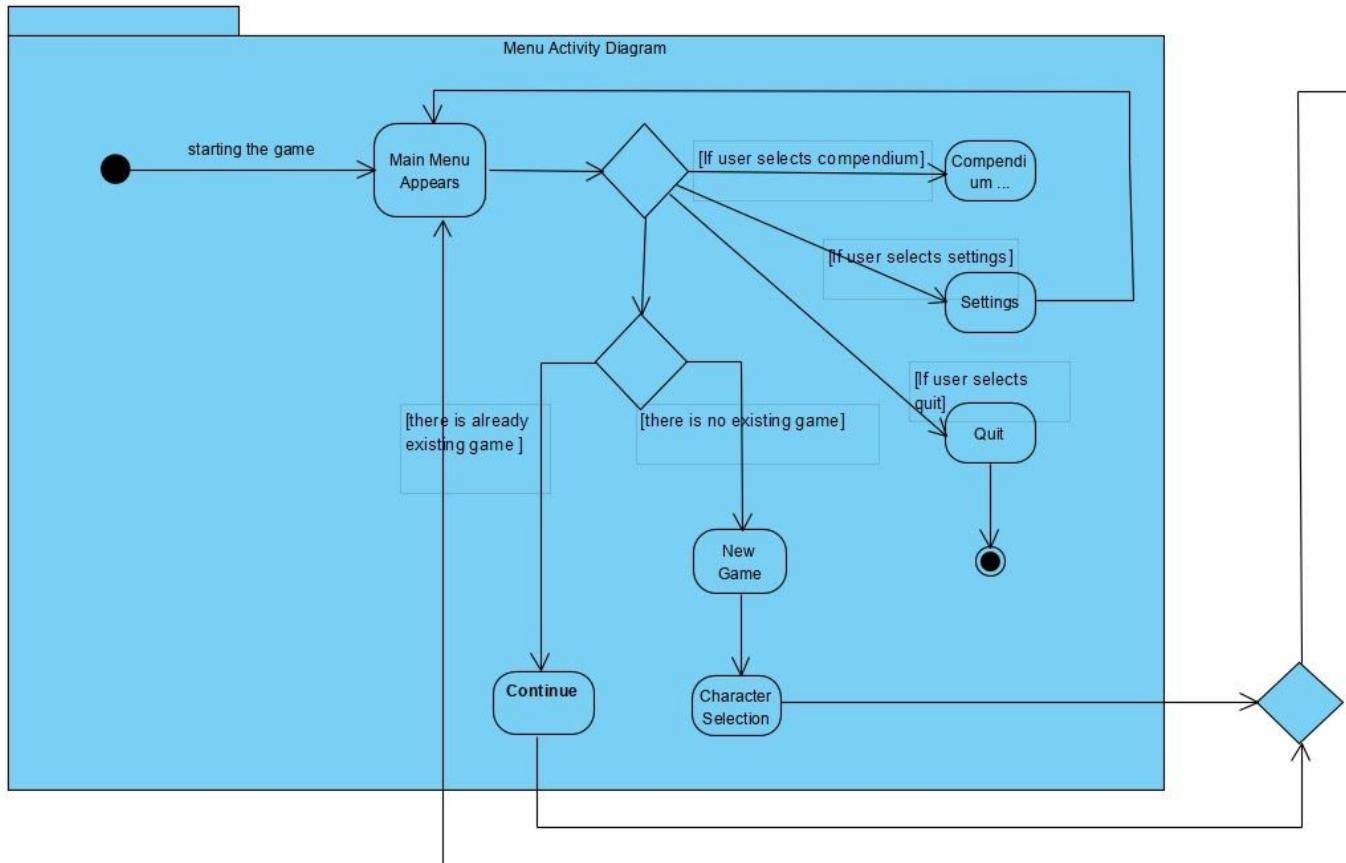
## 5.2 Dynamic Models

### 5.2.1 Activity Diagrams

#### 5.2.1.1 Full Activity Diagram

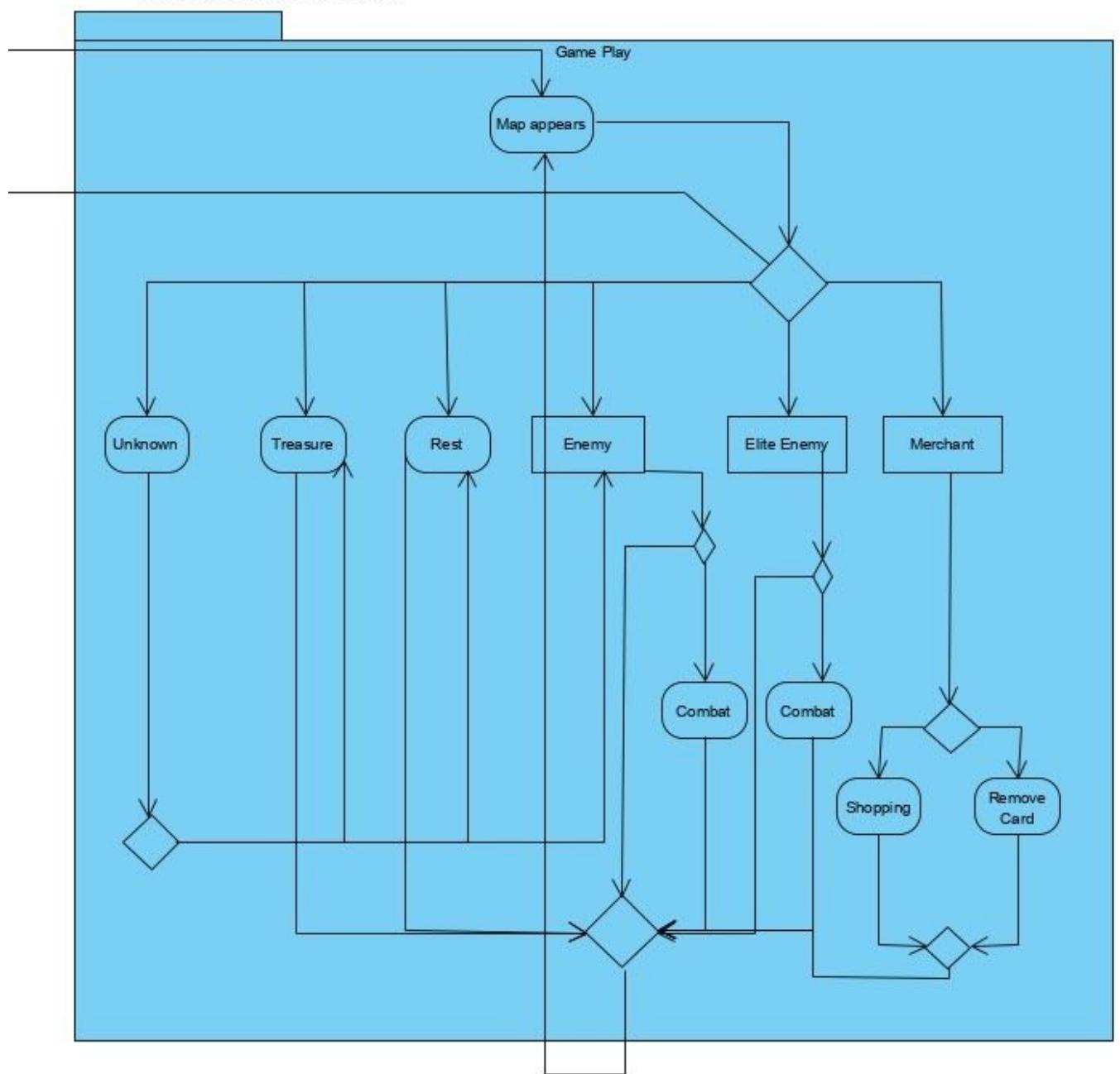


#### 5.2.1.2 Activity Diagram for the Main Menu



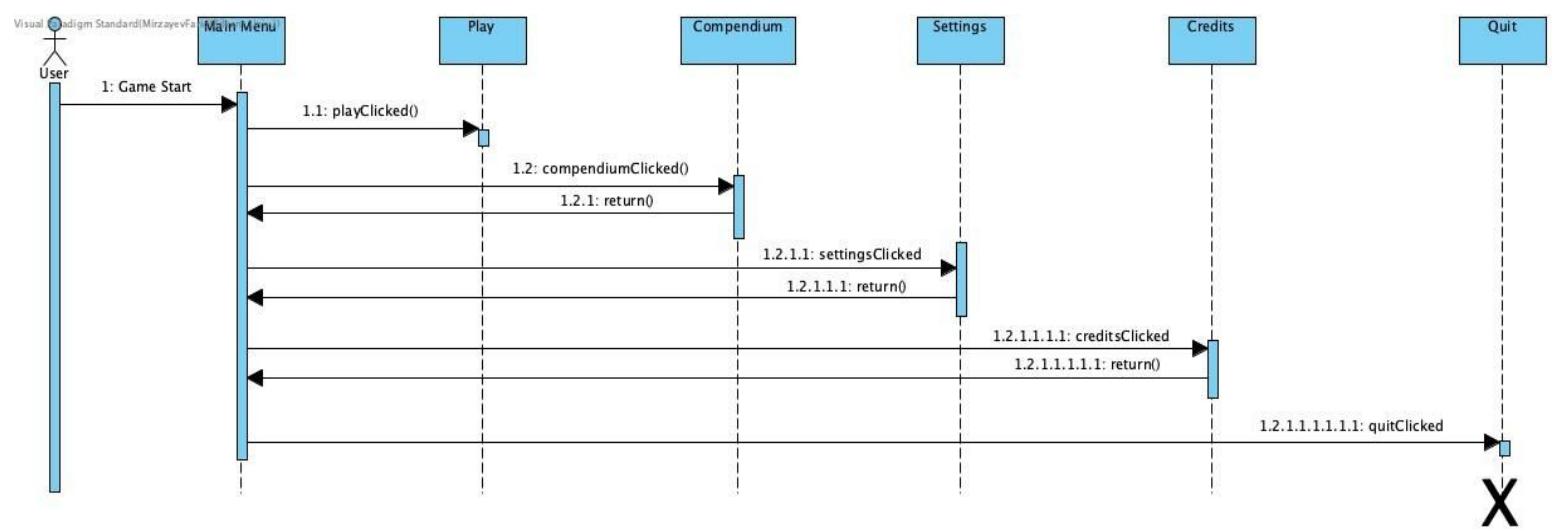
### **5.2.1.3 Gameplay Activity Diagram**

if user chooses to get back main menu



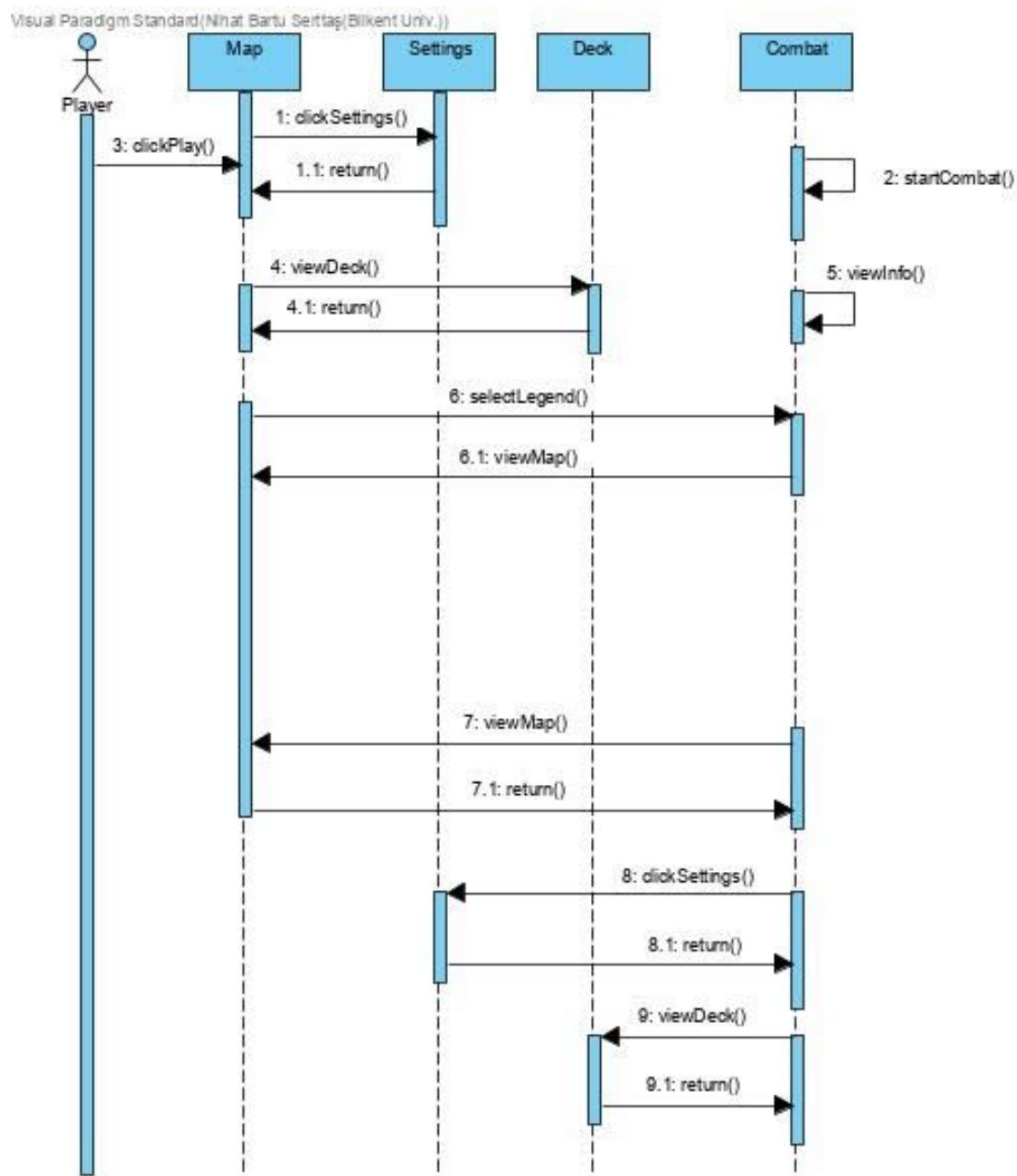
## 5.2.2 Sequence Diagram

### 5.2.2.1 Main Menu Screen Sequence Diagram



The user can click 5 buttons, which are play, compendium, settings, credits, quit. Play button initializes or continues the game. The User is able to see card, relic and potion collections by clicking the compendium button. Settings button ensures that the user can change some properties of the game which are, effect volume, music volume, adjusting resolution and abandoning run that is restarting the game. If a user clicks credits button, he or she can see the producers of the game who are Ekin Doğaç Öztürk, Farid Mirzayev, Okan Alp Ünver, Gamze Burcu Ayhan, Nihat Bartu Serttaş. Lastly, the game terminates if the user clicks quit button.

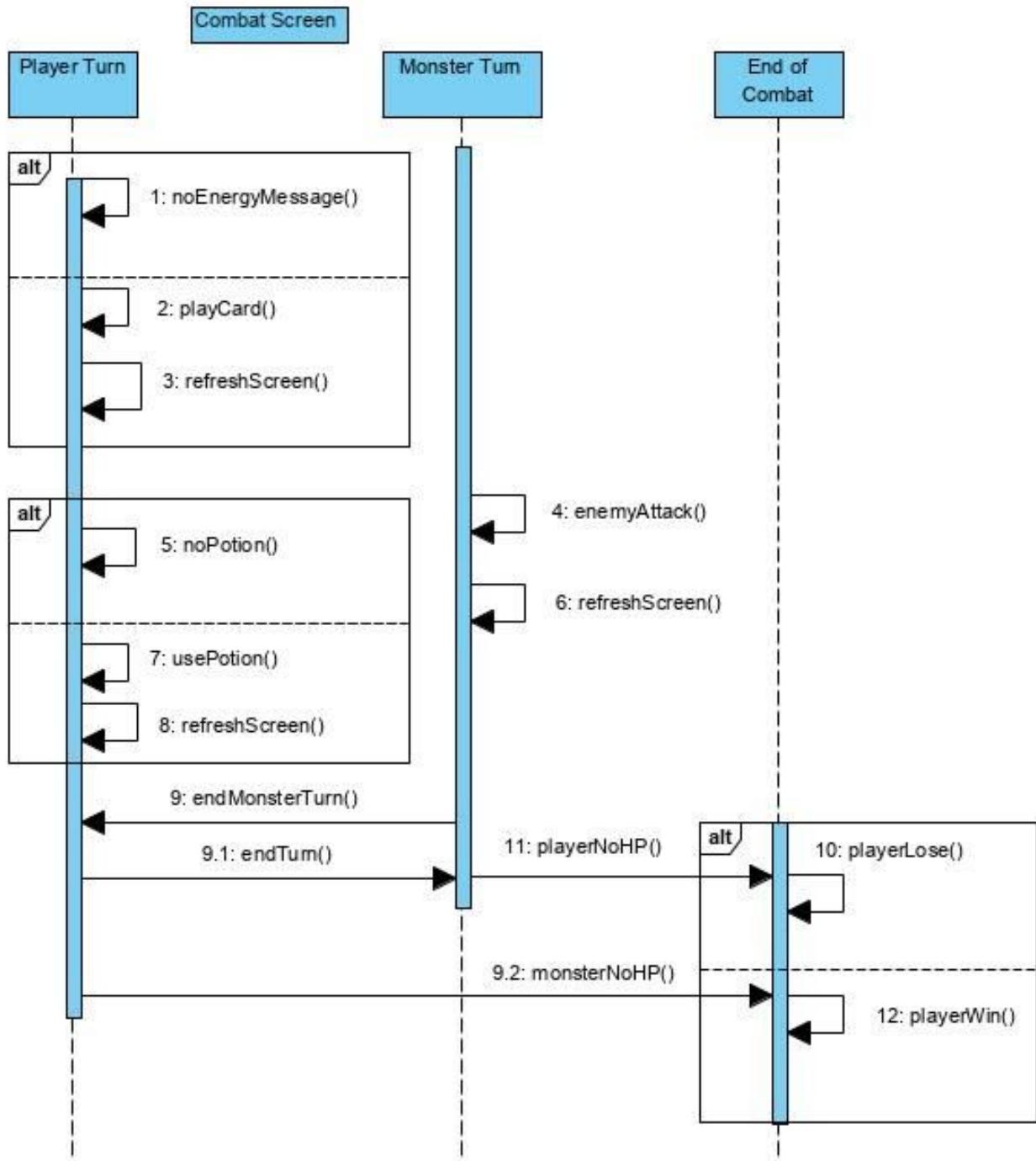
### 5.2.2.2 Gameplay Sequence Diagram



The gameplay sequence diagram shows the actions the player can take after the initialization of the game in main menu ( after clicking play ). The map is created for the player. From here the player can view their collection of cards. The player can also view the setting screen. And finally the player can choose and enter a level.

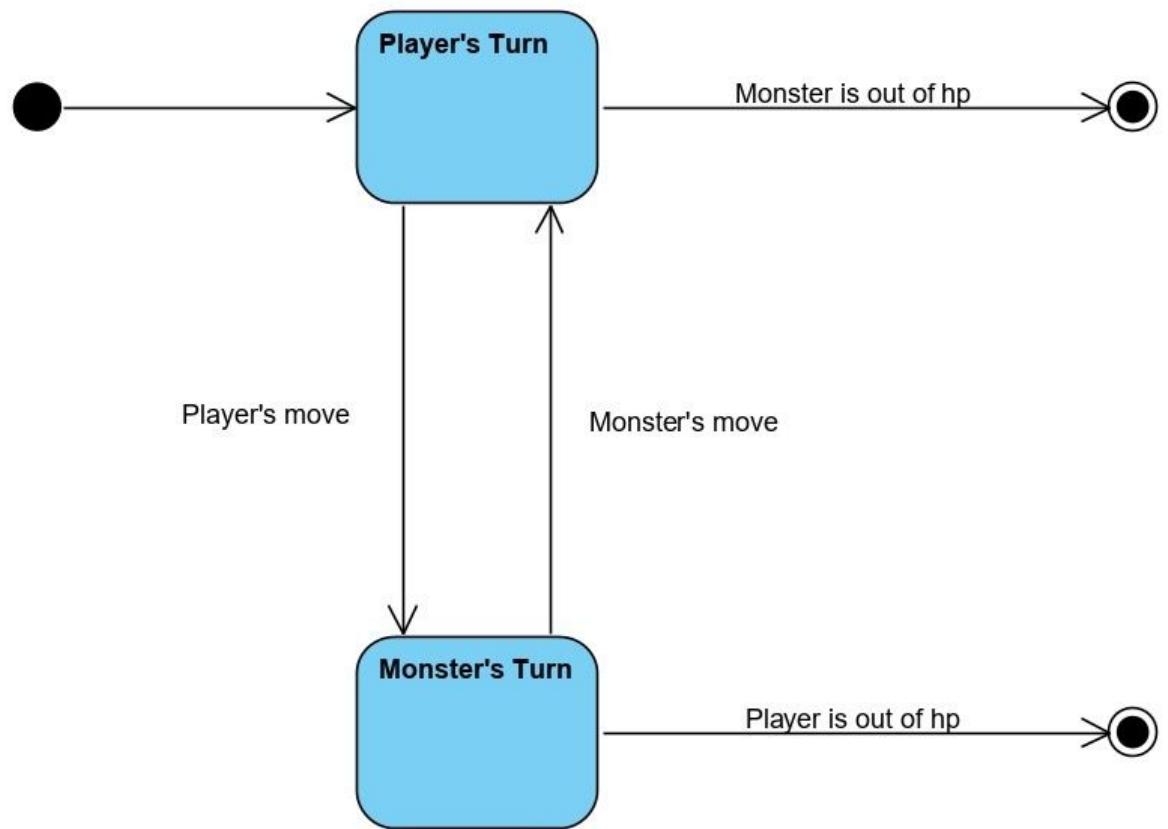
### 5.2.2.3 Combat Sequence Diagram

Visual Paradigm Standard (Nihat Bartu Seittag/Bilkent Univ.)



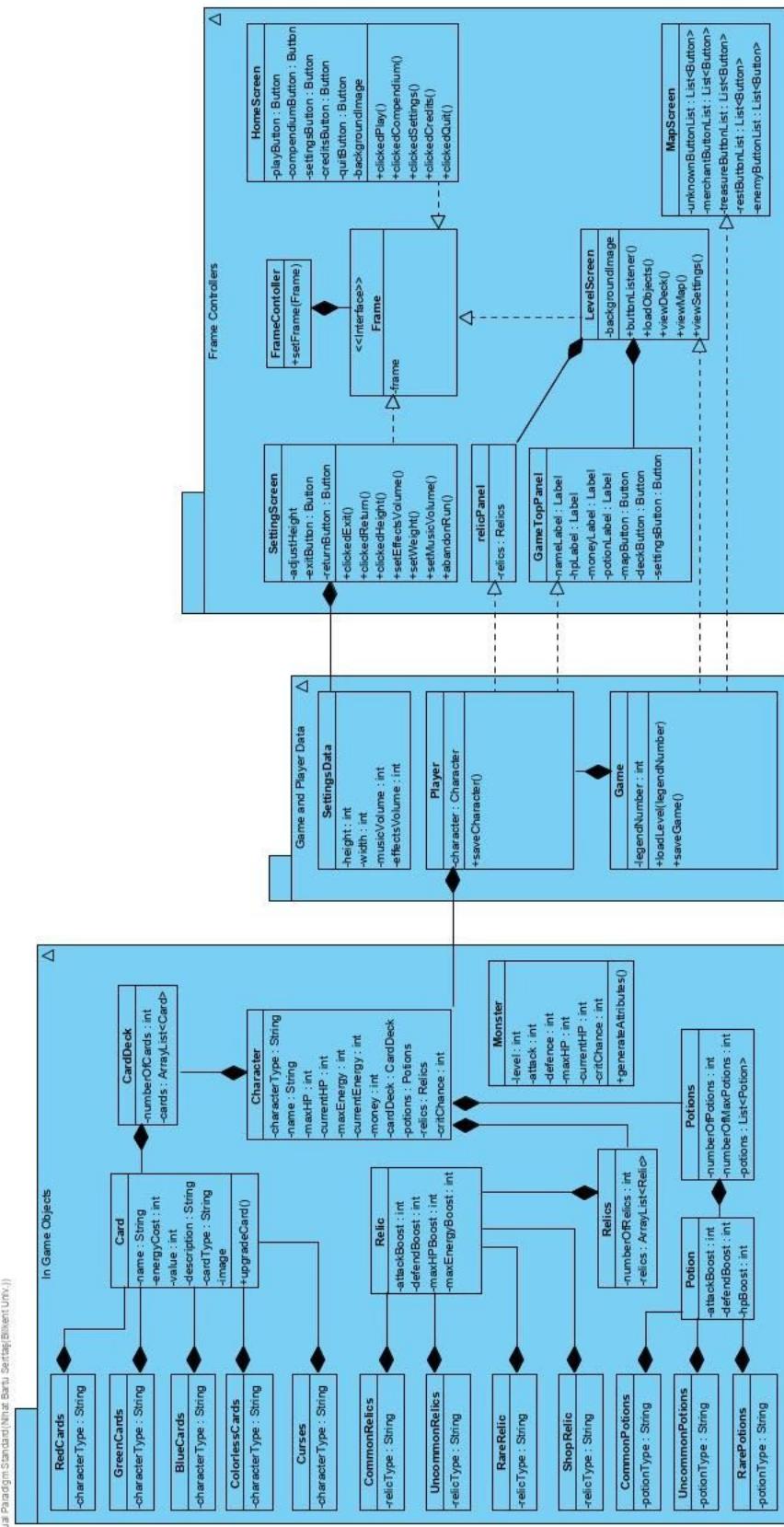
When the user selects a legend, a combat starts. The user is able to see discard pile, draw pile, choose a card to play, drink a potion which player is carrying. Whether the user has energy or not, they can finish the turn, which ensures that the enemy attacks, and goes back to player turn if the player still has HP.

### 5.2.3 State Diagram



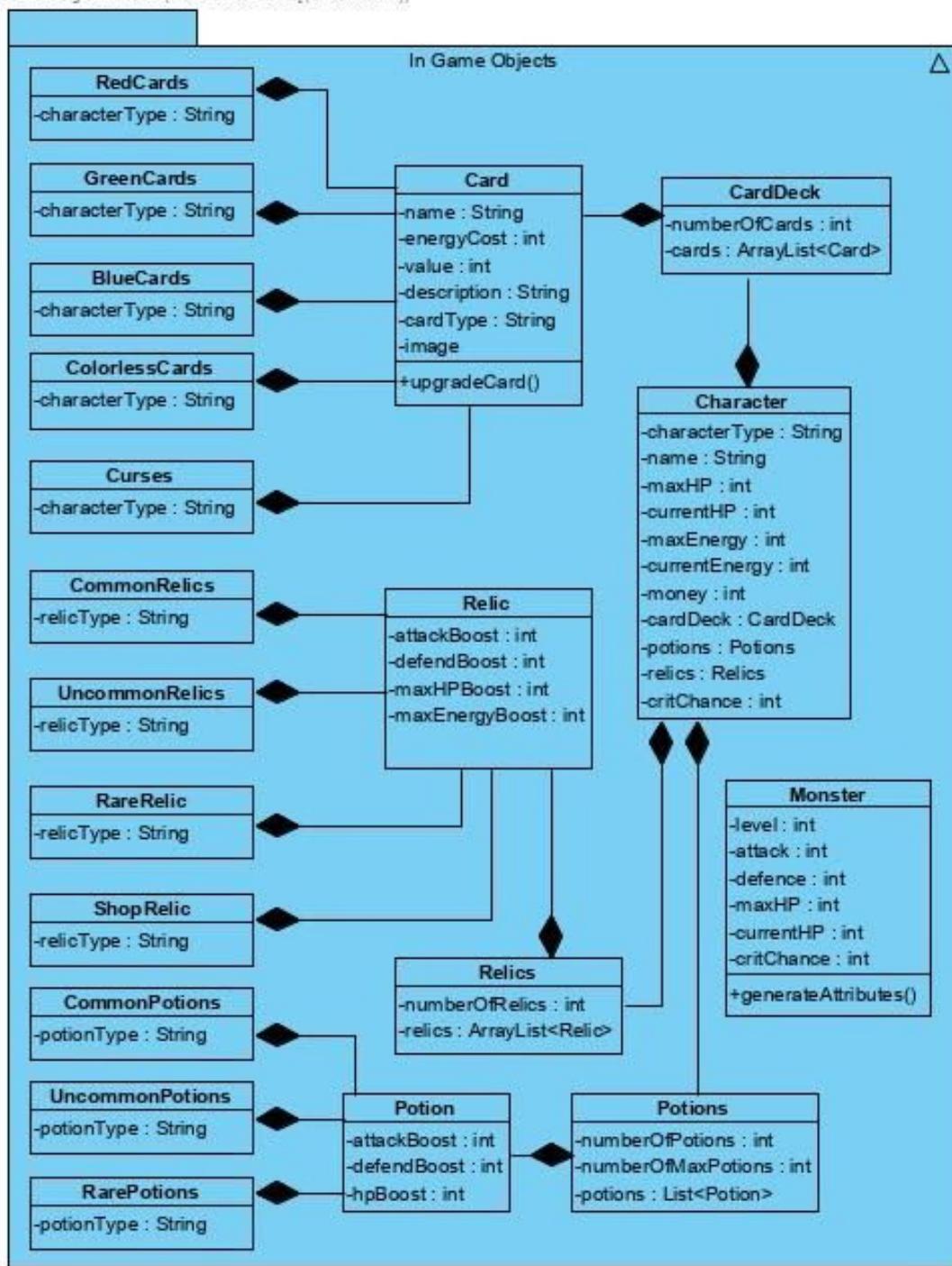
## 5.3 Class Diagrams

### 5.3.1 Object and Class Model Including UI



### 5.3.2 In Game Objects Class Diagram

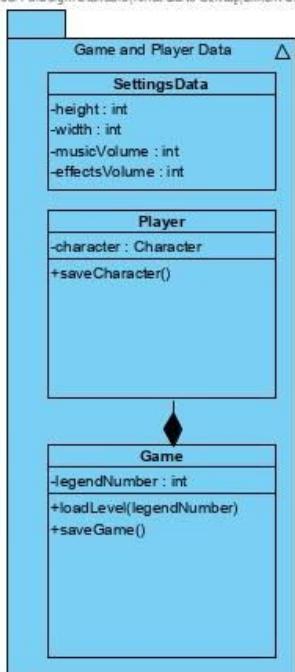
Visual Paradigm Standard (Nihat Bartu Seittag/Bilkent Univ.)



This diagram indicates the relations and associations between the gameplay level objects and classes.

### 5.3.3

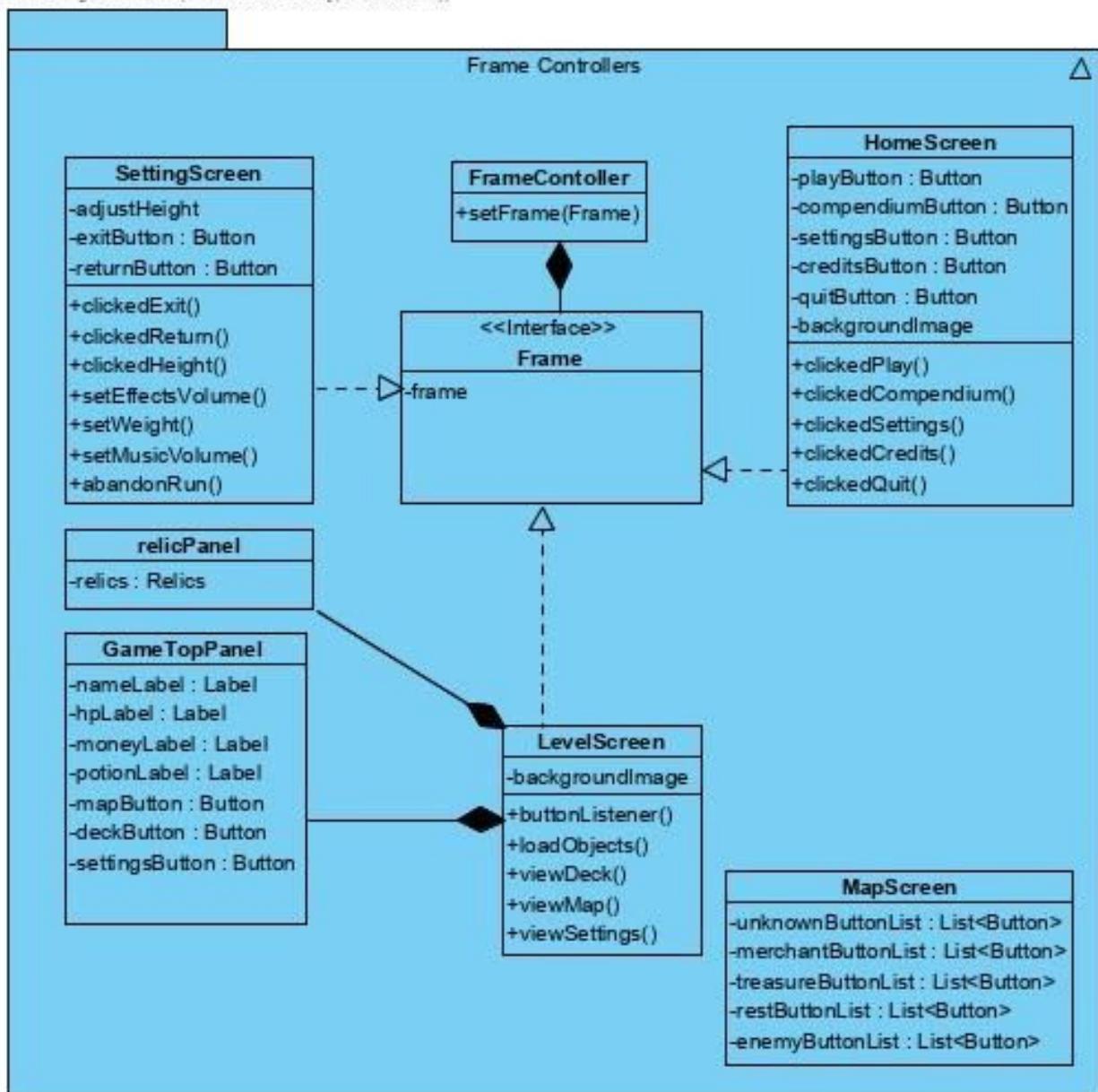
Visual Paradigm Standard(Nihat Bartu Seittag(Bilkent Univ.))



These classes are responsible from keeping, overwriting and extracting data from the save files, and passing the necessary information from in game objects and the UI.

## 5.4 UI Class Model Diagram

Visual Paradigm Standard (Nihat Bartu Seftag/Bilkent Univ.)



There are controllers for each screen presented for the user, and fxml files which are not included in the diagram. For managing the data transaction between the fxml files and their controllers, there is a main controller which contains an instance of all the controllers. This implementation saves memory usage. Otherwise, for data transaction between the fxml files and their controllers, each time a file must be created containing the necessary data, and the new controller must read and change it each time there is a transaction.

## 6. References

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