Bilkent University
Department of Computer Engineering

CS 319 Term Project

Design Report

Bilpoly (Monopoly Bilkent)

Section 3

Group 3H

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1. Introduction

1.1 Purpose of the System

Bilpoly is a computer game which can be played by two to four people on the same computer. It has two game modes: Bilkent Buildings Mode, Bilkent CS Mode and has two time modes: Normal Mode, Timed Mode. In Bilkent Buildings Mode the aim of each time mode is to dominate the whole Bilkent by opening Bilkas and Starbuckses to places and pushing the other players to go bankrupt. In Bilkent CS Mode, the gameplay is the same but instead of Bilkent buildings as lands there are CS courses and instead of money there is time that is measured with “hours”. Players roll dice, move their pawns on the game board and try to win. The game’s purpose is to provide a different version of the game Monopoly to make it exclusive to Bilkent, easy to navigate and play, fast and fun.

1.2 Design Goals

1.2.1 End User Criteria

1.2.1.1 Usability

Any user that knows how to play the classic Monopoly game can learn how to play and navigate through the game in their first trial of the game, as long as we implement the project according to the rules that stated below to keep the game navigation and game play easy to learn, also to provide a pleasant game experience.

- At the game screen, with the game board, credit cards, stop button, roll dice button, next turn information, remaining time information and pop-ups that shows the recent player activities, the number of items does not exceed seven to make the gameplay less confusing. The players can also see whose turn it is from the credit card at the top from the credit card deck at the upper right. Also, to provide a pleasant game experience, they can see recent activities of the previous players from the pop-ups placed at the lower right bottom. Remaining time also will be displayed at the right part of the screen if the game is in the timed mode. The next turn information, which is placed at the right part of the screen, will be displayed to make the gameplay less confusing.

- At the main menu screen, there are only 4 buttons to make the user interface simple.

- At the player selection screen, there are two parts: one with the three buttons to choose player number and another one to choose player properties. In this part, panes that let the players enter their names and select pawns will be activated according to the number of players to avoid confusion.

- At the pre-game settings screen, there are three buttons to let the user decide the initial money, two buttons for board mode and two buttons for the time mode. All of them are labeled according to what they do to make the game self-explanatory. Also, there is a slider to let the user the time limit. When the cursor of the slider stops at some point, the user can see the time limit they choose in the label placed at the bottom of the slider.

- The background images are in lighter tones compared to other items on the screens to make the user experience more pleasant.

1.2.1.2 Performance

The response time for the game is less than 0.5 seconds, the maximum amount that decided to not disrupt the game flow.

1.2.2 Developer/Maintainer Criteria

1.2.2.1 Portability

The most important feature of the game developed is that it can be played on multiple platforms. Since this project is written in Java language and can be easily integrated into PC, MacOS and mobile platforms.

1.2.2.2 Extendibility

The project can be improved according to the feedback from the user, developer and observers. Object-oriented class designs, interfaces and behaviors are designed in a way that will not affect the whole project in case the project is developed. As long as the new classes to be added do not change the gameplay, they enrich the project and create new modes and boards.

1.2.2.3 Modifiability

Writing the classes and interfaces directly allows the sub-parts of the project to be easily modified. Therefore, the change made on one side does not affect the parts of the other class unnecessarily. In addition, since a change made on the upper part will affect all lower parts, the implementation will be easier accordingly.

1.2.2.4 Reusability

Since the general gameplay and rules of the game are largely fixed, changes made to the modes and boards do not have a great impact on the main code flow. Many of the new features that can be added will be able to be integrated into the game by reusing the source code and adapting it to the mode that will be designed with a few minor modifications.

2. High-level Software Architecture

2.1 Subsystem Decomposition

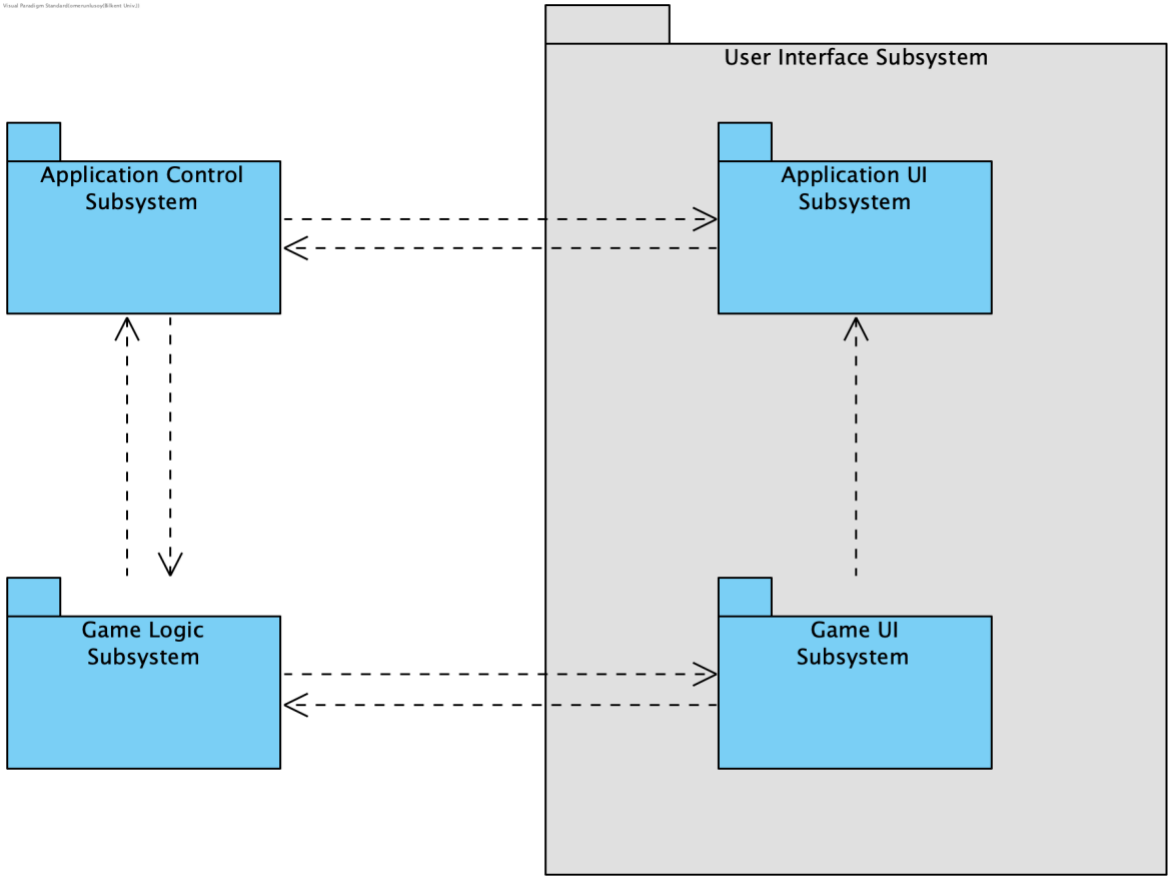


Figure 1. Subsystem Decomposition

Bilpoly application has 3 main subsystems one of which consists of 2 subsystems;

Application Control Subsystem

- This subsystem has two main purposes, controlling the application with AssetManager and controlling the Main Menu elements with Application UI Subsystem.
- It includes control and entity objects of the application.
- It initializes the application and navigates players to create a game.
- It handles the screen changes in the Main Menu.
- It handles the sound effects, music, and background images.
- It creates a board and game elements to initialize a game.

Game Logic Subsystem

- This subsystem has two main purposes, controlling the game flow and controlling the game user interface with Game UI Subsystem.
- It includes control and entity objects of the application.
- This subsystem handles each turn during a game.
- It handles players and their properties as well as all the lands on the board.
- It handles all money flow and decides the winner at the end.
- This subsystem controls the game user interface by controlling the components of Game UI Subsystem.

User Interface Subsystem

- User Interface Subsystem handles Bilpoly application’s front-end (User Interface).
- It consists of two subsystems which control two separate user interface parts in the application.

- It includes boundary objects of the application.

1. Application UI Subsystem
    - Application UI Subsystem manages the User Interface of the Main Menu with its components; Options, Credits, How to Play, Player Selection, and Pre-Game Settings.
    - This user interface helps players initialize a game, open Credits and How to Play screens, etc.
    - User inputs via boundary objects of this subsystem manage the entity objects of Application Control Subsystem.

2. Game UI Subsystem
    - Game UI Subsystem manages the User Interface of the game screen, Pause Menu, and Game Over Screen.
    - This subsystem handles players' inputs during their turn.
    - It consists of the board, player deck, dice, history, and Pause Menu components.
    - User inputs via boundary objects of this subsystem manage the entity objects of Game Logic Subsystem.

2.2 Hardware/Software Mapping

Bilpoly game will be implemented in Java programming language and JavaFX libraries will be used for User Interface. For the execution of the application, Java Runtime Environment will be needed. Since the application will be lightweight, any computer with minimal hardware can be used.

Bilpoly can be run and played on macOS, Windows, and Linux systems with required software, Java Runtime Environment.

Players will not need any local or internet connection as Bilpoly can be played on one computer regardless of single or multiplayer game.

Database for data storage will not be needed since we will store any necessary data in local config files.

2.3 Persistent Data Management

Bilpoly application does not need a database system for data management. It will store data as TXT files, and PNG or JPG files for images. Since Bilpoly does not need any previous data to initialize a game and will not modify these files, complex database system would be redundant. Since Bilpoly will not save any player object after the game, Bilpoly will not use JSON format. However, WAW, PNG, JPG, GIF formats will be used to store sound effects, music, and images. Chance Cards, Rector's Whisper Cards for each game mode will be stored in TXT files. Moreover, each Land with its data will be stored as TXT file.

2.4 Access Control and Security

Bilpoly will not use any kind of network connection or database system. Moreover, any personal or sensitive data will not be required or demanded rather than the players' names. It will not use any password protection, registration or login as it is not needed and anybody who downloaded the game can play Bilpoly. Most data will be deleted after each game.

Therefore, there will be no safety issues concerning the leakage of user passwords or sensitive data.

2.5 Boundary Conditions

2.5.1 Initialization

Bilpoly application will be started by opening the executable .jar file which will call the main method. The application will load the Main Menu with its components from the local filesystem. The background images and music will be loaded and initialized here. Players can upload new images and music via their local filesystem. After the Pre-Game Settings, the application will load the game screen components with a gameboard, player deck, etc.
Bilpoly will not use a database or local/internet network connection so it will not load any data from a database or make any request.

2.5.2 Termination

Bilpoly can be terminated by the “Exit” button on the Main Menu or the “Close” button of its window. If players decide to end the game and exit during a game; they can Pause the game, go to the Main Menu, and then push the “Exit” exit button to terminate the application.

2.5.3 Failure

The game will terminate itself if it cannot find any required file in its local file path such as class files or UI images. However, the application will not terminate itself immediately if any sound

effects, music, or background images files cannot be found. Rather the application will show a warning and players can close the application if they want.

Application will terminate itself, if it crushes during a game. Since Bilpoly does not save any data, the only possible loss would be the current state of the game which the game will not try to recover. Players can start a new game.

3. Subsystem Services

3.1 Application Control Subsystem

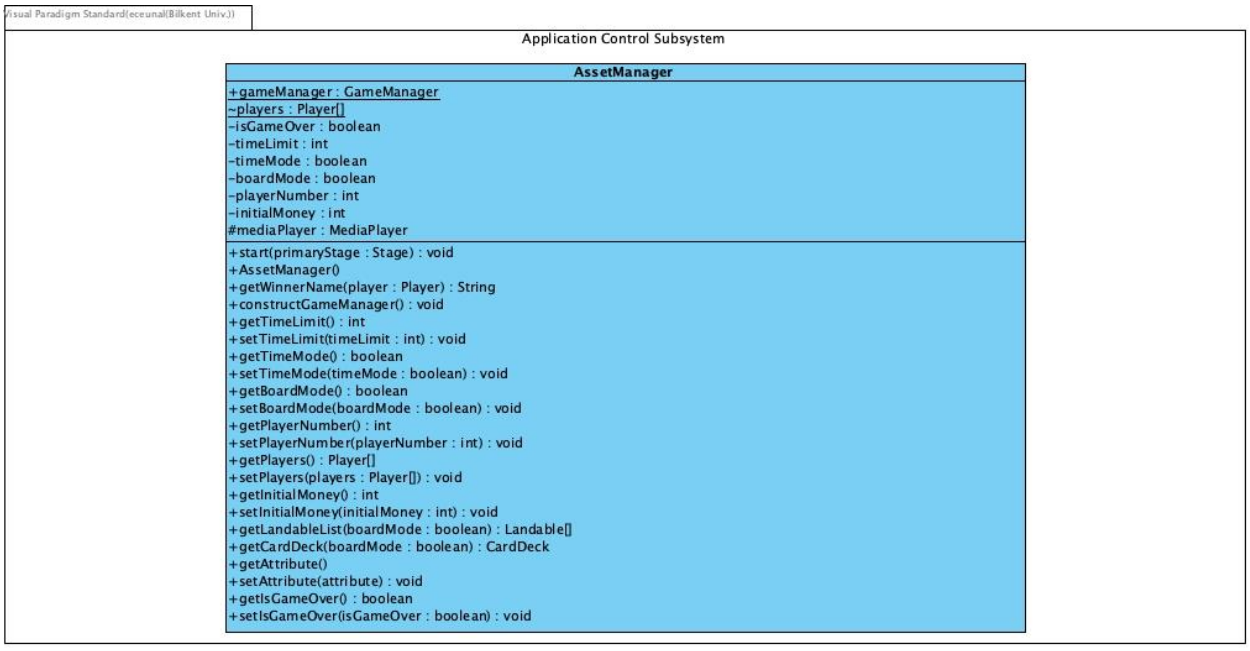


Figure 2. Application Control Subsystem

Application Control Subsystem consists of a class which is responsible for the main data flow in the game. AssetManager class gets data from UI and initializes players' properties as well as game board and time modes.

AssetManager Class

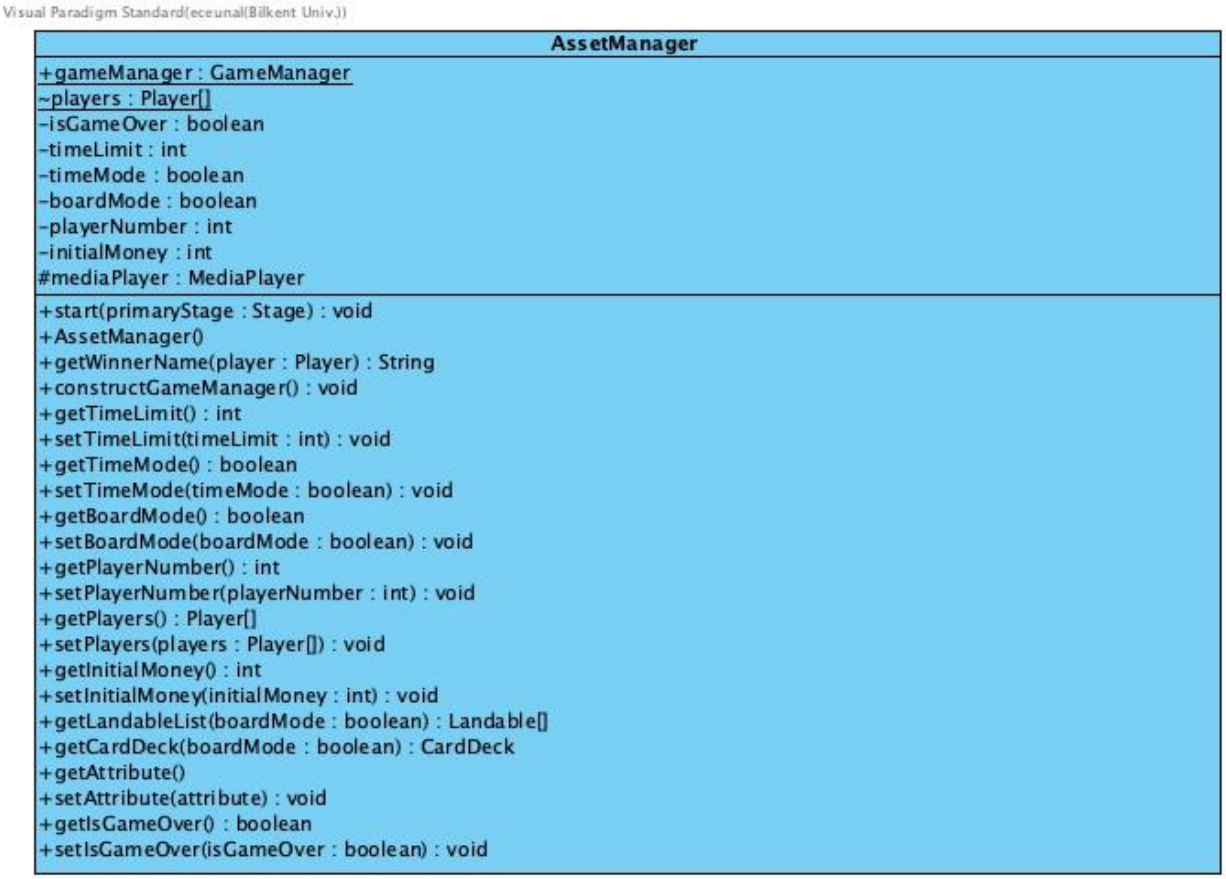


Figure 3. AssetManager

Attributes

private GameManager gameManager: This attribute is an instance of GameManager which initializes the GameManager with the information that comes from PreGameSettings and PlayerSelection UI classes.

private Player[] players: This attribute initializes players with the information comes from PlayerSelection UI class.

private boolean isGameOver: This attribute holds the information about the state of the game (if it's over or not). This information comes from GameManager which is a class in Game Logic Subsystem and the information is used in GameOver UI class.

private int timeLimit: This attribute is to keep the time limit which is decided by the user in Timed Mode. This information comes from PreGameSettings UI class.

private boolean timeMode: This attribute holds the information whether the Time Mode is Normal Mode or Timed Mode. This information comes from PreGameSettings UI class. It is true if the game is in Timed Mode.

private boolean boardMode: This attribute holds the information whether the Game Board Mode is Bilkent Buildings Mode or Bilkent CS Mode. This information comes from PreGameSettings UI class. If the Game Board Mode is Bilkent Buildings Mode, it returns true.

private int playerNumber: This attribute is to keep the number of players which is decided by the user. This information comes from PlayerSelection UI class.

private int initialMoney : This attribute is used to keep decided initial money, which is the money amount that every player has at the start of the game.

protected MediaPlayer mediaPlayer: This attribute is an instance of MediaPlayer. Information comes from Options or PauseMenu UI classes. This attribute is protected because it is used in other classes in the package.

Methods

public void start(primaryStage : Stage): In this method, the first scene of the game is initialized. Also this method is used to start the music as calling the play() method for mediaPlayer.

public AssetManager(): The constructor for AssetManager.

public String getWinnerName(player: Player): This method takes information from GameManager and sends this information to GameOver UI class.

public void constructGameManager(): Calls the constructor of GameManager with the information come from UI.

public int getTimeLimit(): This method returns the value of timeLimit.

public void setTimeLimit(timeLimit : int): This method sets the time limit of the game.

public boolean getTimeMode(): This method returns the value of timeMode.

public void setTimeMode(timeMode : boolean): This method takes a parameter and assigns it to timeMode variable.

public boolean getBoardMode(): This method returns the value of boardMode.

public void setBoardMode(boardMode : boolean): This method takes a parameter and assigns it to boardMode variable.

public int getPlayerNumber(): This method returns the value of playerNumber.

public void setPlayerNumber(playerNumber : int): This method takes a parameter and assigns it to playerNumber variable.

public Player[] getPlayers(): This method returns the array of players.

public void setPlayers(players : Player[]): This method takes an array as a parameter and assigns it to players array.

public int getInitialMoney(): This method returns the value of initialMoney.

public void setInitialMoney(initialMoney: int): This method takes a parameter and assigns it to initialMoney variable.

public Landable[] getLandableList(boardMode: boolean): This method returns the array of landables according to the selected board mode.

public CardDeck getCardDeck(boardMode : boolean): This method returns the card deck according to the selected board mode.

public boolean getIsGameOver(): This method returns the value of isGameOver.

public void setIsGameOver(isGameOver: boolean): This method takes a parameter and assigns it to isGameOver variable.

3.2 Game Logic Subsystem

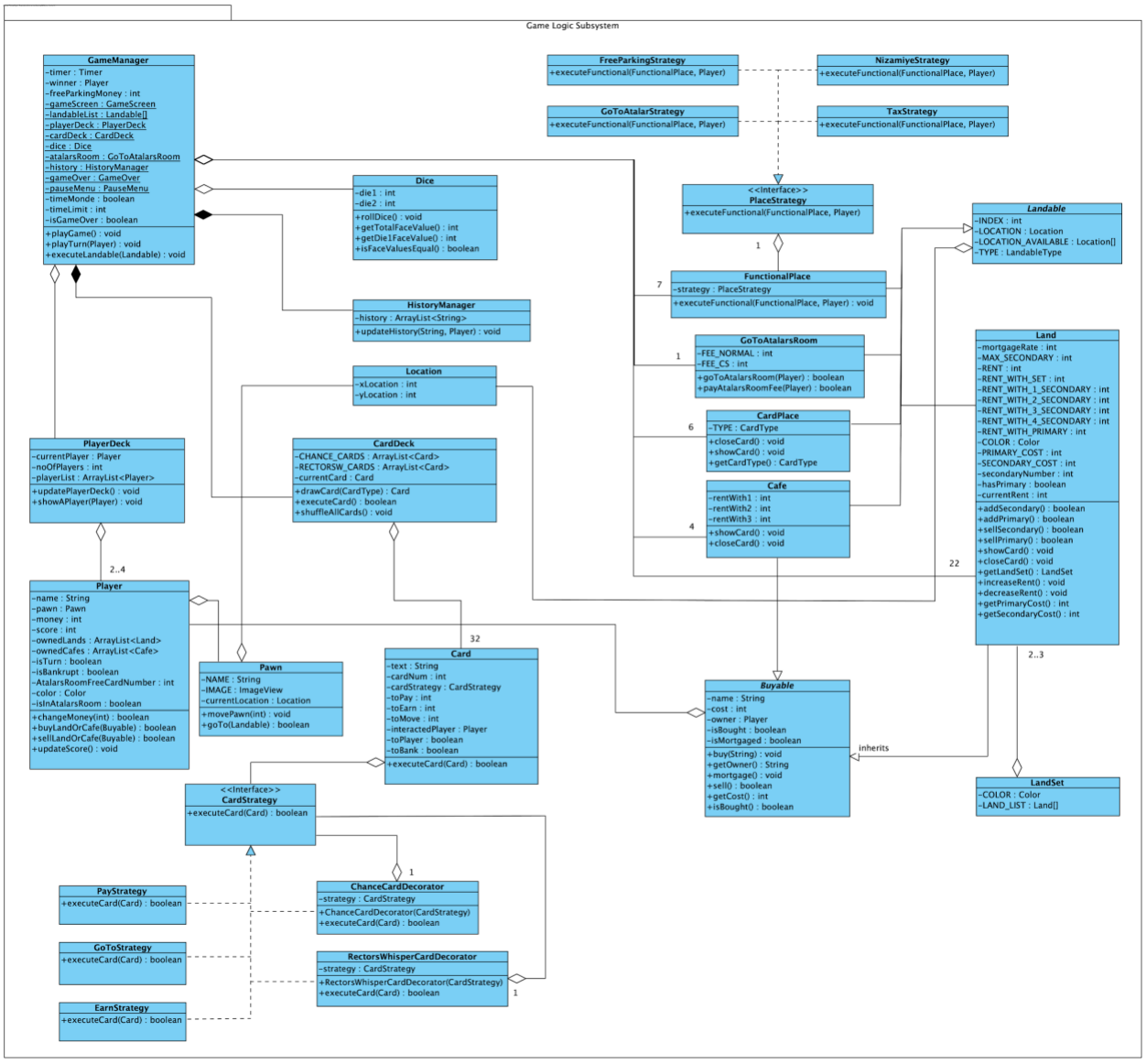


Figure 4. Game Logic Subsystem

Game Logic Subsystem consists of 15 classes, 1 abstract class, and 1 interface, and is responsible for the in-game flow of the software. It consists of real-life Monopoly objects as classes and has functions needed to apply the game rules and game functionality.

The main class managing this subsystem is GameManager, which has the instances of every object and handles all of their operations. It has an instance of PlayerDeck, which holds all players inside it as an ArrayList and sorts it according to player turns. It has the list of Landables that differ in functionality as an array. It has the CardDeck instance which holds the Chance and Rector's Whisper cards inside it. It has the Dice instance which has several functionalities through the game such as moving, getting out of jail, or picking the one who starts the game first. It has the HistoryManager in which the last three moves in the game are held. It also has the instances of GameOver and PauseMenu classes which are handled in the in-game UI.

GameManager Class

Figure 5. GameManager

Attributes

private Timer timer: This attribute is the timer that counts down from the selected time limit for Timed Mode.

private Winner winner: This attribute is the Player object that wins the game which will be passed to the UI to display the winner.

private int freeParkingMoney: This attribute holds the free parking money. All money paid by the players to the bank (excluding the land sales) goes to the middle area. This attribute holds the money that is gone to the middle area. The player that lands on the “Free Parking” Landable takes all the money that piled up.

private GameScreen gameScreen: This attribute is the game screen UI class’s instance.

private Landable[] landableList: This attribute is an array of 40 Landables which are the each single cell of the board that the players can land. Landables differ in functionality. Some are buyable such as buildings, some are functional such as Atalar’s Room, and some make a player pick a card such as Rector’s Whisper Card.

private PlayerDeck playerDeck: This attribute is the instance of the PlayerDeck class which holds all players in an ArrayList. This instance is responsible for the operations on players (money changes, buying/mortgaging, going to Atalar’s Room etc.).

private CardDeck cardDeck: This attribute is the instance of the CardDeck class which holds all Chance and Rector’s Whisper Cards which all have different functionalities as arrays.

private Dice dice: This attribute is the instance of the class Dice which is used for selecting who starts the game and which is rolled each turn.

private GoToAtalarsRoom atalarsRoom: This attribute is the instance of GoToAtalarsRomm which is the jail of Bilpoly.

private HistoryManager history: This attribute is the instance of HistoryManager. HistoryManager holds the last 3 turns played in the game and shows them on the user interface. In each turn, history is updated.

private GameOver gameOver: This attribute is an instance of GameOver class which handles the GameOver screen (e.g. passing the winner) of the game.

private PauseMenu pauseMenu: This attribute is an instance of PauseMenu class which handles the pausing and resuming of the game.

private boolean timeMode: This attribute shows if the game is initialized with time mode, false means normal mode, true means Timed Mode.

private int timeLimit: This attribute is the time limit in minutes if the game is in Timed Mode.
private boolean isGameOver: This attribute shows if the game is over.

Methods

public void playGame(): This method manages the main game loop of the game. This method runs until the game ends.

public void playTurn(Player): This method manages the player turn, which is called continuously from the playGame() method.

public void executeLandable(Landable): This method executes the function of the Landable that the player has landed, according to the functionality of the Landable.

PlayerDeck Class

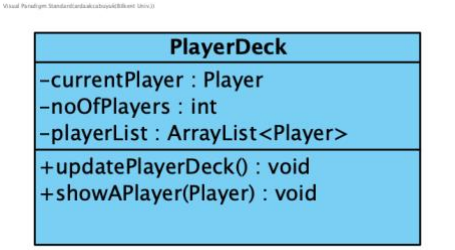


Figure 6. PlayerDeck

Attributes

private Player currentPlayer: This attribute is the Player object that has the turn.

private int noOfPlayers: This attribute holds the number of players in the game, which is initialized at the game setup stage.

private ArrayList<Player> playerList: This attribute holds the players in the game, sorted according to player turns. This list will be used to sort the credit cards which represent the players.

Methods

public void updateDeck(): This function updates the deck when a player plays his/her turn. The function re-sorts *playerList* by moving the first player to the end.

public void showAPlayer(Player s): This function returns the information of the passed player, calls Game UI components to display selected player's info.

Player Class

Figure 7. Player

Attributes

private String name: This attribute is the name of the player.

private Pawn pawn: This attribute is the Pawn object that the player selects in game setup.

private int money: This attribute is the current balance of the player.

private int score: This attribute is the calculated score of the player which helps determine the winner when the time runs out.

private ArrayList<Buyable> ownedLands: This attribute contains all the Lands that the player has bought so far.

private ArrayList<Buyable> ownedCafes: This attribute contains all the Cafes that the player has bought so far.

private boolean isTurn: This attribute is true only when this player has the turn.

private boolean isBankrupt: This attribute tells whether the player has bankrupted or not. Bankrupted players cannot play in the game session anymore.

private int atalarsRoomFreeCardNumber: This attribute is the index of the card that enables a player to get out of Atalar's Room. When players pick that card, they can use it whenever they want until the end of the game.

private Color color: This attribute is the color of the player. Each player has a unique color that is utilized for player UI purposes (border of player info, credit card of the player, next turn etc.).

private boolean isInAtalarsRoom: This attribute represents whether the player is in Atalar's Room or not. If true, the player can use the atalarsRoomFreeCardNumber if they have that card. If not, the player can roll the dice and if both have equal values, they can leave Atalar's Room.

Methods

public boolean changeMoney(int amount): This method is called whenever the player makes operations with money. The parameter amount is deduced or added to the balance of the player. The function returns true if successful.

public boolean buyLandOrCafe(Buyable b): This method is called whenever the player buys a Land or Cafe (Buyable). The Buyable is added to the ArrayList ownedLands. The function returns true if successful.

public boolean sellLandOrCafe(Buyable b): This method is called whenever the player sells a Land or Cafe (Buyable). The Buyable is removed from the ArrayList ownedLands. The function returns true if successful.

Pawn Class

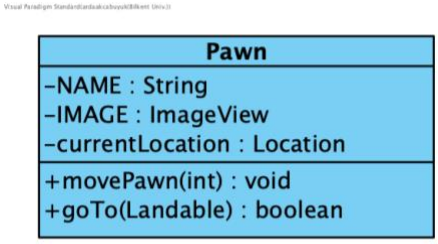


Figure 8. Pawn

Attributes

private final String NAME: This attribute is the name of the Pawn.

private final ImageView IMAGE: This attribute is the image of the Pawn which will be displayed on the game board.

private Location currentLocation: This attribute is the location of the Pawn on the game board.

Methods

public void movePawn(int move): This method moves the pawn on the game board according to the move count that is passed as parameter.

public boolean goTo(Landable land): This method sends the Pawn to the Landable that is passed as the parameter. The function returns true if successful.

Dice Class

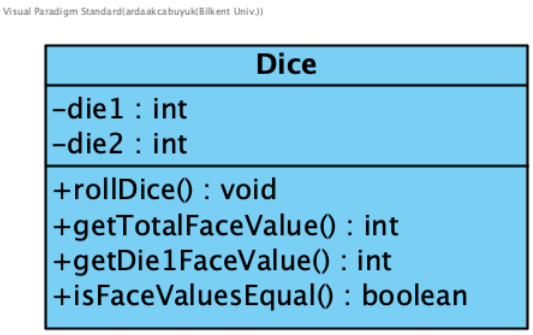


Figure 9. Dice

Attributes

private int die1: This attribute is the value of the die1 (1-6).

private int die2: This attribute is the value of the die2 (1-6).

Methods

public void rollDice(): This method rolls the dice. It basically generates a random number between 1 and 6 for each die.

public int getTotalFaceValue(): This method sums up the values of die1 and die2 and returns it. It is used for moving the Pawn of the Player.

public int getDie1FaceValue(): This method returns the value of die1, which will be used in single dice operations (e.g. choosing the player that starts the game).

public boolean isFaceValuesEqual(): This method returns true if the values of die1 and die2 are the same. If true, either the player will roll the dice for one more turn, or if the player is in Atalar's Room, they will leave it.

HistoryManager Class

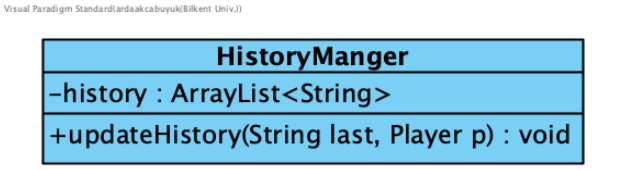


Figure 10. HistoryManager

Attributes

private ArrayList<String> history: This attribute holds the last three moves that have been done in the game, as sentences.

Methods

public void updateHistory(String last, Player p): In each turn, this function is called and the most recent move is added to the history, while the oldest is removed from the history.

Location Class

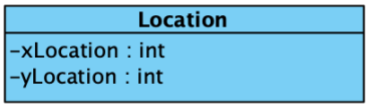


Figure 11. Location

Attributes

private int xLocation: This attribute holds the x location of whatever has a coordinate (e.g. Pawn, *Landable*).

private int yLocation: This attribute holds the x location of whatever has a coordinate (e.g. Pawn, *Landable*).

CardDeck Class

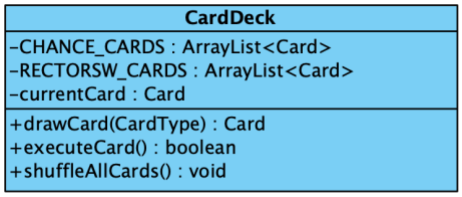


Figure 12. CardDeck

Attributes

private Card currentCard: This attribute holds the Card at the top of the deck which a player picks when landed on the according CardPlace.

private final ArrayList<Card> CHANCE_CARDS: This attribute holds the Chance Cards.

private final ArrayList<Card> RECTORSW_CARDS: This attribute holds the Rector's Whisper Cards.

Methods

public Card drawCard(CardType type): This method returns the Card at the top (currentChanceCard or currentRectorsWCard, according to the type passed).

public boolean executeCard(): This method executes the current card by calling executeCard() of that card and returns true. If no card is selected returns false.

public void shuffleAllCards(): This method shuffles all the cards in the ArrayLists.

Card Class

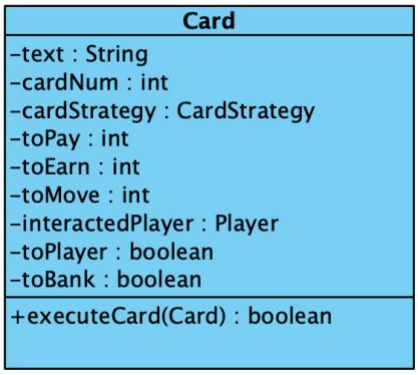


Figure 13. Card

Attributes

private String text: This attribute is the content (text) of the card.

private int cardNum: This attribute is the index of the card in the CardDeck.

private CardStrategy cardStrategy: This attribute is the strategy of the Card.

private int toPay: This attribute is the paid amount in the cards that make the player pay.

private int toEarn: This attribute is the earned amount in the cards that make the player earn.

private int toMove: This attribute is the moved amount in the cards that make the player move.

private Player interactedPlayer: This attribute is the player that picked the card.

private boolean toPlayer: This attribute is a boolean value that specifies whether there is a money flow between players.

private boolean toBank: This attribute is a boolean value that specifies whether there is a money flow from a player to the bank.

Methods

public boolean executeCard(): This method executes the card and returns true. If it cannot be executed, returns false (ex: Player does not have sufficient money).

CardStrategy Interface

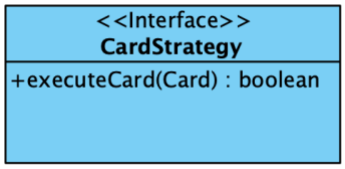


Figure 14. CardStrategy

Methods

public boolean executeCard(Card): This method executes the card's functionality in different strategies.

PayStrategy Class

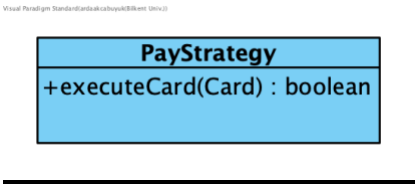


Figure 15. PayStrategy

Methods

public boolean executeCard(Card): This method executes the card's functionality (card that makes the player pay some amount).

GoToStrategy Class

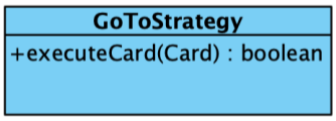


Figure 16. GoToStrategy

Methods

public boolean executeCard(Card): This method executes the card's functionality (card that makes the player go to somewhere on the board).

EarnStrategy Class

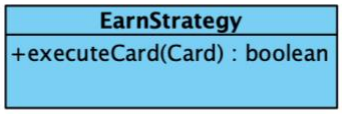


Figure 17. EarnStrategy

Methods

public boolean executeCard(Card): This method executes the card's functionality (card that makes the player earn some amount).

ChanceCardDecorator Class

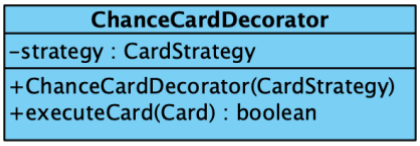


Figure 18. ChanceCardDecorator

Attributes

private CardStrategy strategy: This attribute is the strategy of the Chance Card.

Methods

public boolean executeCard(Card): This method executes the card's functionality. In the Chance Card case, the numerical values of the task are randomized.

RectorsWhisperCardDecorator Class

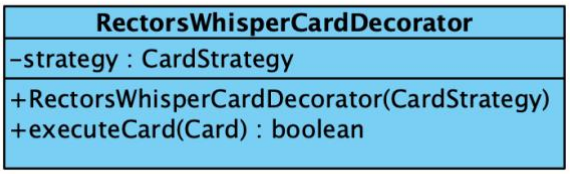


Figure 19. RectorsWhisperCardDecorator

Attributes

private CardStrategy strategy: This attribute is the strategy of the Rector's Whisper Card.

Methods

public boolean executeCard(Card): This method executes the card's functionality. In the Rector's Whisper Card case, the numerical values of the task are dependent on the current balance of the player.

Landable Class

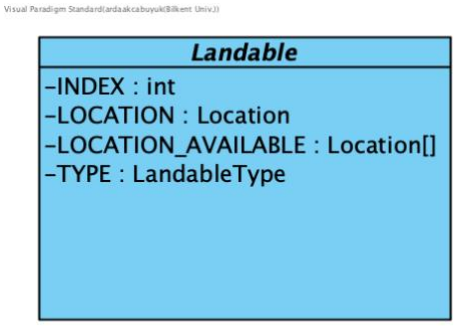


Figure 20. Landable

Attributes

private final int INDEX: This attribute is the index of the Landable in the landableList ArrayList of GameManager.

private final Location LOCATION: This attribute is the location of the Landable on the game board.

private final Location[] LOCATION_AVAILABLE: This attribute is the Locations that Pawns could be placed on the Landable. If there are more than one Pawn on a Landable, this attribute helps to arrange the Pawns.

private LandableType TYPE: This attribute holds the type of the Landable (e.g. Cafe, Land, CardPlace etc.)

Land Class

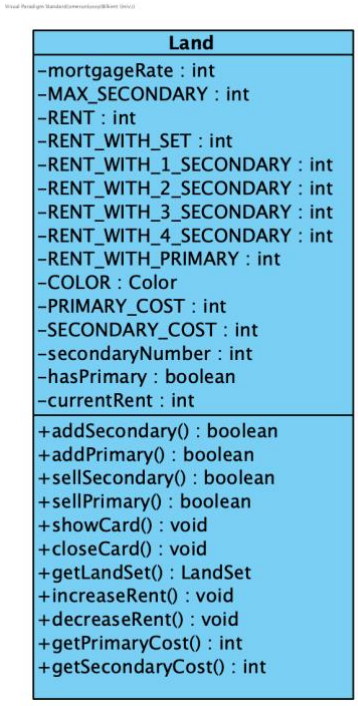


Figure 21. Land

Attributes

private int mortgageRate: This attribute is the mortgage rate, the money player will get when he mortgaged the land.

private final Color COLOR: This attribute is the color of the Land which represents the ColorSet that the Land belongs.

private final int PRIMARY_COST: This attribute is the cost of building Bilka / A+ on the Land.

private final int SECONDARY_COST: This attribute is the cost of building Starbucks / Assignment in the Land.

private final int RENT: This attribute is the rent of the Land (Building) with no Starbucks or Bilkas for Normal Mode.

private final int RENT_WITH_SET: This attribute is the rent of the Land (Building) with all ColorSet bought.

private final int RENT_WITH_1_SECONDARY: This attribute is the rent of the Land (Building) with 1 Starbucks / Assignment.

private final int RENT_WITH_2_SECONDARY: This attribute is the rent of the Land (Building) with 2 Starbuckses / Assignments.

private final int RENT_WITH_3_SECONDARY: This attribute is the rent of the Land (Building) with 3 Starbuckses / Assignments.

private final int RENT_WITH_4_SECONDARY: This attribute is the rent of the Land (Building) with 4 Starbuckses / Assignments.

private final int RENT_WITH_PRIMARY: This attribute is the rent of the Land (Building) with Bilka / A+.

private int secondaryNumber: This attribute is the number of Starbuckses / Assignments on the Land (number of assignments in CS Mode).

private boolean hasPrimary: This attribute tells whether the Land has Bilka (or A+ in CS Mode) on it or not.

private int currentRent: This attribute is the current rent of the Land. It depends on the primary and secondary number.

Methods

public boolean addSecondary(): This method adds a Starbucks on the Land for Normal Mode or adds an Assignment for CS Mode. Return value is a success indicating boolean.

public boolean addPrimary(): This method adds a Bilka on the Land for Normal Mode or adds an A+ for CS Mode. Return value is a success indicating boolean.

public boolean sellSecondary(): This method removes a Starbucks on the Land for Normal Mode or removes an Assignment for CS Mode. Return value is a success indicating boolean.

public boolean sellPrimary(): This method removes a Bilka on the Land for Normal Mode or removes an A+ for CS Mode. Return value is a success indicating boolean.

public void showCard(): This method shows the card of the Land when a player lands on.

public void closeCard(): This method closes the card of the Land.

public LandSet getLandSet(): This method returns the LandSet which the Land belongs to. It will help us to point to its land set (color set).

public int getPrimaryCost(): This method returns the cost of primary.

public int getSecondaryCost(): This method returns the cost of one secondary.

public void increaseRent(): This method increases the current rent.

public void decreaseRent(): This method decreases the current rent.

Buyable Abstract Class

Figure 22. Buyable

Attributes

private String name: This attribute is the name of the Buyable.

private int cost: This attribute is the cost of the Buyable.

private Player owner: This attribute is the owner of the Buyable.

private boolean isBought: This attribute indicates if the Buyable is bought or not.

private boolean isMortgaged: This attribute indicates if the Buyable is mortgaged or not.

Methods

public void buy(Player): This method buys the Buyable for the player.

public Player getOwner(): This method returns the owner of the Buyable.

public void mortgage(): This method mortgages the Buyable.

public boolean sell(): This method sells the Buyable.

public int getCost(): This method returns the cost of the Buyable

public boolean isBought(): This mother returns if the Buyable is bought or not.

LandSet Class

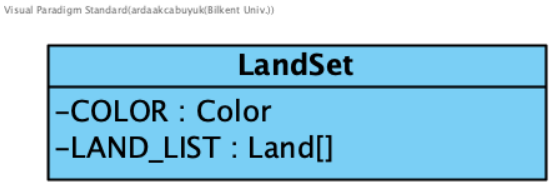


Figure 23. LandSet

Attributes

private final Color COLOR: This attribute is the color of the LandSet.

private final Land[] LAND_LIST: This attribute holds the lands that this LandSet has.

FunctionalPlace Class

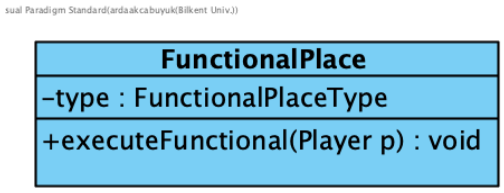


Figure 24. FunctionalPlace

Attributes

private FunctionalPlaceType type: This attribute indicates the type of the FunctionalPlace (e.g. Nizamiye, Free Parking, Go to Atalar's Room).

Methods

public void executeFunctional(): This method executes the function of the FunctionalPlace and updates player attributes (e.g. player earns money when passed Nizamiye).

PlaceStrategy Interface

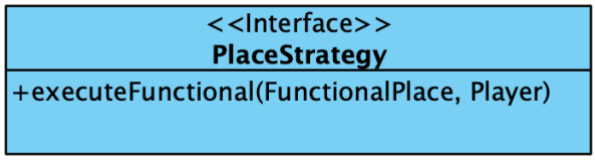


Figure 25. PlaceStrategy

Methods

public boolean executeCard(Card): This method executes the place's functionality in different strategies.

FreeParkingStrategy Class

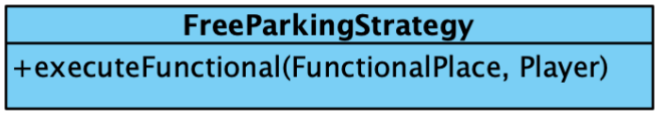


Figure 26. FreeParkingStrategy

Methods

public boolean executeFunctional(FunctionalPlace, Player): This method executes the Free Parking Rule for the landed player.

NizamiyeStrategy Class

Figure 27. NizamiyeStrategy

Methods

public boolean executeFunctional(FunctionalPlace, Player): This method gives the player the Nizamiye passing money.

GoToAtalarStrategy Class

Figure 28. GoToAtalarStrategy

Methods

public boolean executeFunctional(FunctionalPlace, Player): This method sends the landed player to Atalar's Room.

TaxStrategy Class

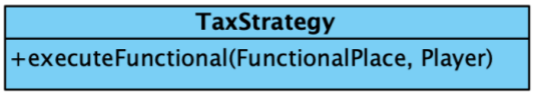


Figure 29. TaxStrategy

Methods

public boolean executeFunctional(FunctionalPlace, Player): This method makes the landed player pay the tax of the landed tax place.

AtalarsRoom Class

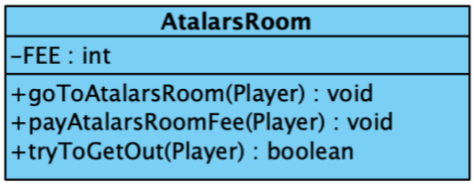


Figure 30. AtalarsRoom

Attributes

private int fee: This attribute is the fee to pay to get out from Atalar's Room.

Methods

public void goToAtalarsRoom(Player): This method sends the Player passed to Atalar's Room.

public void payAtalarsRoomFee(Player): This method deduces the fee from the Player that is about to leave Atalar's Room.

public boolean tryToGetOut(Player): This method helps player to get out of the Atalar's Room by rolling dice or paying the fee .

CardPlace Class

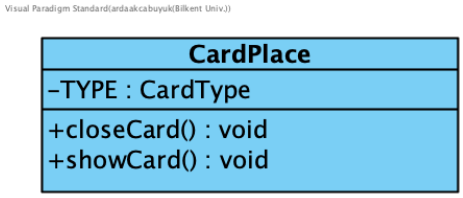


Figure 31. CardPlace

Attributes

private final CardType TYPE: This attribute is the type of the CardPlace (Chance/Rector's Whisper)

Methods

public void showCard(): This method displays the popup of the picked Card on the screen.

public void closeCard(): This method closes the picked Card.

Cafe Class

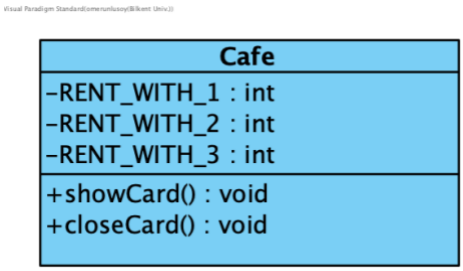


Figure 32. Cafe

Attributes

private final int RENT_WITH_1: This attribute is the rent of the Cafe if the owner has only 1 cafe.

private final int RENT_WITH_2: This attribute is the rent of the Cafe if the owner has 2 cafes.

private final int RENT_WITH_3: This attribute is the rent of the Cafe if the owner has 3 cafes.

Methods

public void showCard(): This method shows the popup of the Cafe when a Player lands on it.

public void closeCard(): This attribute closes the popup of the Cafe.

3.3 User Interface Subsystem

3.3.1 Application UI Subsystem

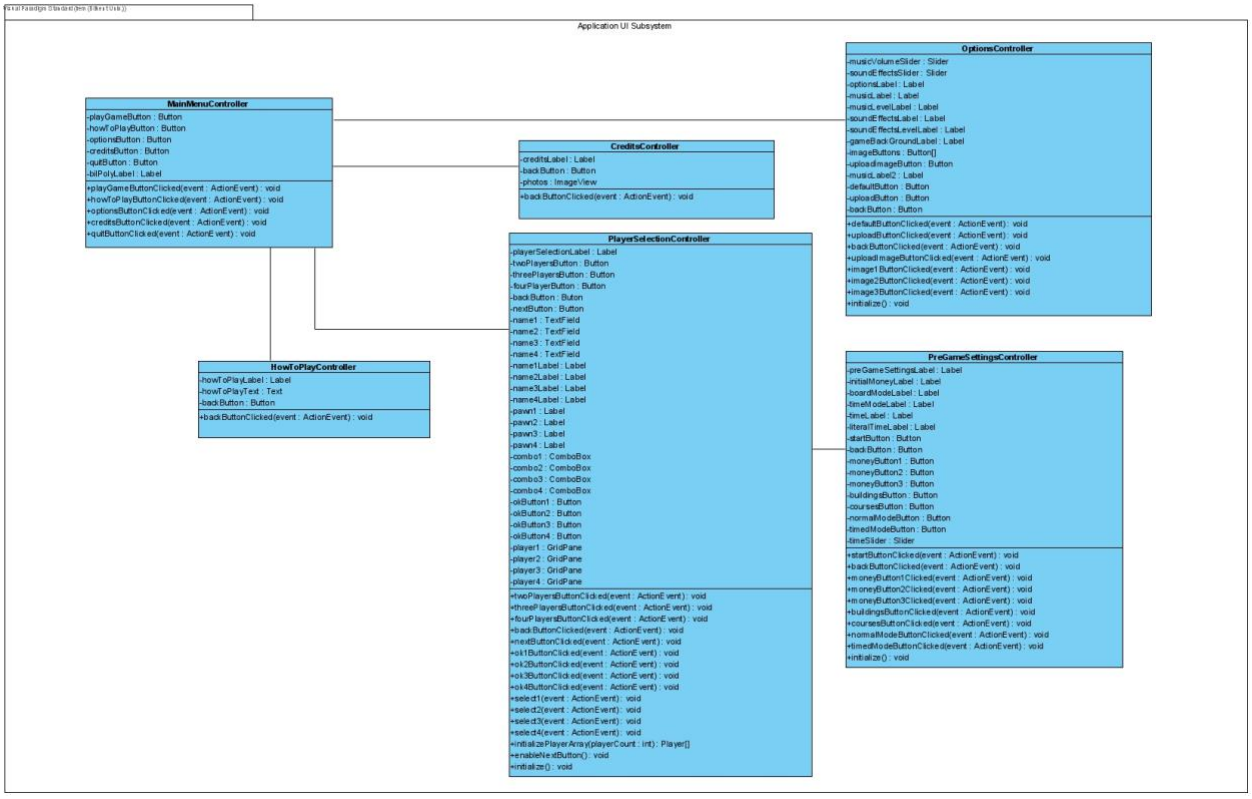


Figure 33. Application UI Subsystem

This subsystem consists of 6 classes. Each class includes the UI objects and listener methods.

MainMenuController Class

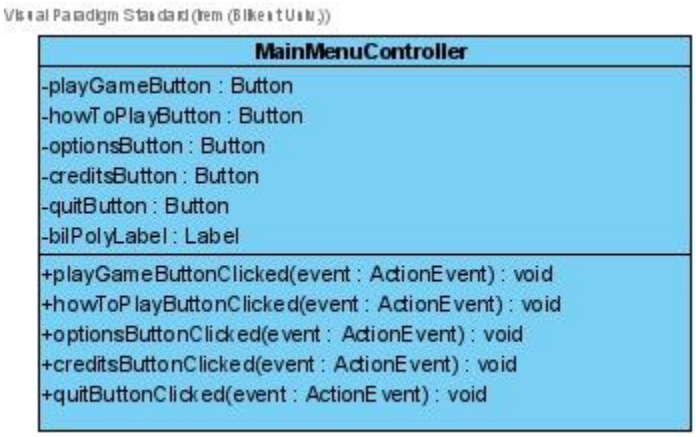


Figure 34. MainMenuController

Attributes

private Button playGameButton: This is a button instance for play game button.

private Button howToPlayButton: This is a button instance for how to play button.

private Button optionsButton: This is a button instance for options button.

private Button creditsButton: This is a button instance for credits button.

private Button quitButton: This is a button instance for quit game button.

private Label bilPolyLabel: This is a label instance for the label BilPoly.

Methods

public playGameButtonClicked(event : ActionEvent): This is a listener method for the play game button. It is used to navigate to the player selection.

public howToPlayButtonClicked(event : ActionEvent): This is a listener method for the how to play button. It is used to navigate to how to play.

public optionsButtonClicked(event : ActionEvent): This is a listener method for the options button. It is used to navigate to options.

public creditsButtonClicked(event : ActionEvent): This is a listener method for the credits button. It is used to navigate to credits.

public quitButtonClicked(event : ActionEvent): This is a listener method for the credits button. It is used to quit the game.

PreGameSettingsController Class

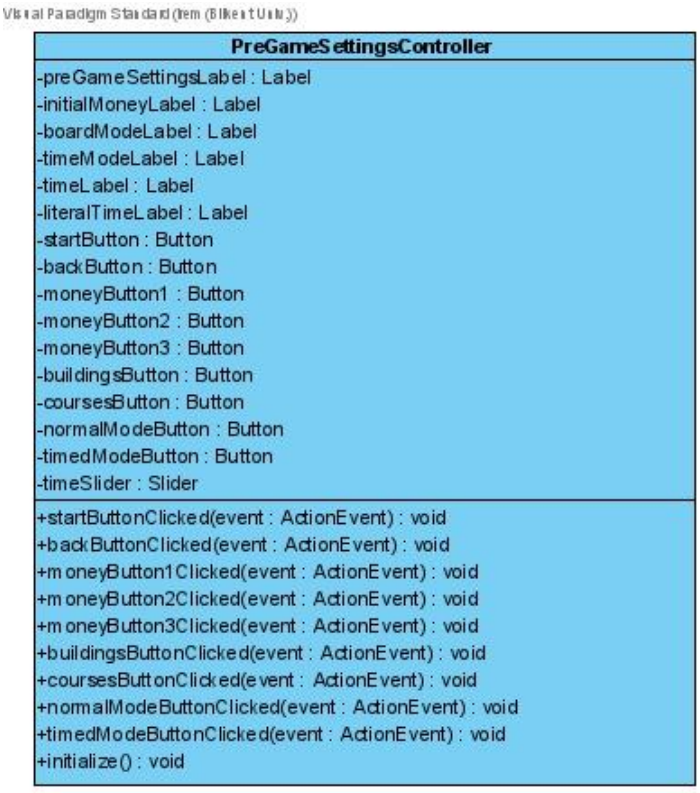


Figure 35. PreGameSettingsController

Attributes

private Label preGameSettingsLabel : This is a Label instance for the Pre-Game Settings.

private Label initialMoneyLabel : This is a Label instance for the Initial Money label.

private Label boardModeLabel : This is a Label instance for the board mode label.

private Label timeModeLabel : This is a Label instance for the time mode label.

private Label timeLabel : This is a Label instance for the time label.

private Label literalTimeLabel : This is a label instance to show the time limit that is decided by the user.

private Button startButton : This is a button instance for start button. After clicking this button, the game will start.

private Button backButton : This is a button instance for back button. It is used to go back to the Player Selection.

private Button moneyButton1 : This is a button instance to choose the money amount that everyone will have at the start of the game.

private Button moneyButton2 : This is a button instance to choose the money amount that everyone will have at the start of the game.

private Button moneyButton3 : This is a button instance to choose the money amount that everyone will have at the start of the game.

private Button buildingsButton: This is a button instance to let the user decide if the Game Board Mode is in the Bilkent Buildings Mode when it is clicked.

private Button coursesButton:This is a button instance to let the user decide if the Game Board Mode is in the Bilkent CS Mode when it is clicked.

private Button normalModeButton: This is a button instance to let the user decide if the Time Mode is in the Normal Mode when it is clicked.

private Button timedModeButton: This is a button instance to let the user decide if the Time Mode is in the Timed Mode when it is clicked.

private Slider timeSlider: This is a slider instance to let the user decide the time limit.

Methods

public void startButtonClicked(event : ActionEvent): This is a listener method for start button.

public void backButtonClicked(event : ActionEvent): This is a listener method for back button.

public void moneyButton1Clicked(event : ActionEvent): This is a listener method for the money button at the top.

public void moneyButton2Clicked(event : ActionEvent): This is a listener method for the money button at the middle.

public void moneyButton3Clicked(event : ActionEvent): This is a listener method for the money button at the bottom.

public void buildingsButtonClicked(event : ActionEvent): This is a listener method for buildings button.

public void coursesButtonClicked(event : ActionEvent): This is a listener method for courses button.

public void normalModeButtonClicked(event : ActionEvent): This is a listener method for normal mode button.

public void timedModeButtonClicked(event : ActionEvent): This is a listener method for timed mode button.

public void initialize(): Initializes slider.

OptionsController Class

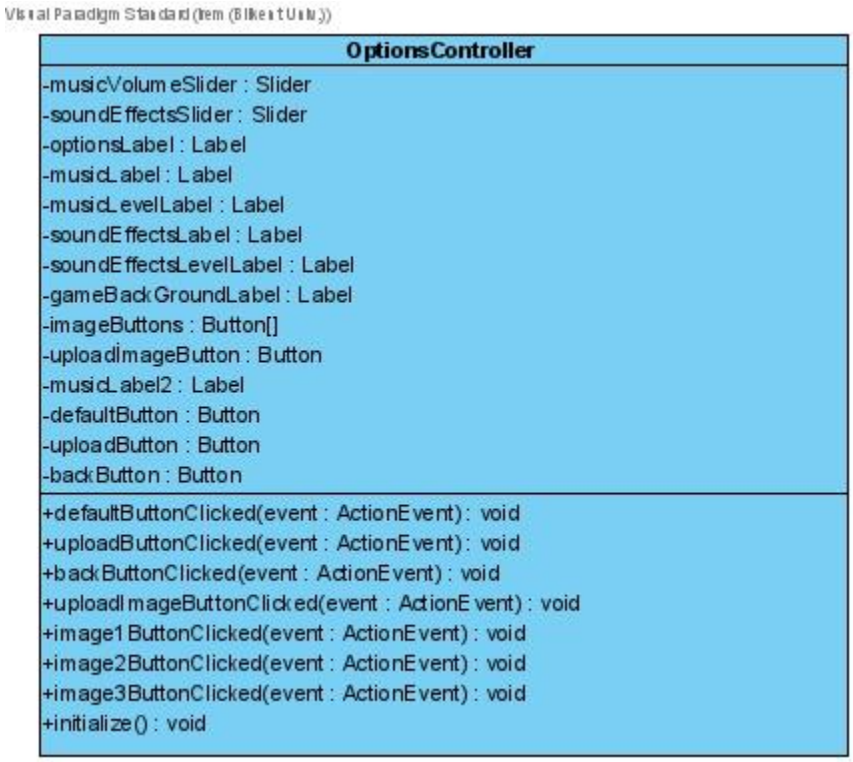


Figure 36. OptionsController

Attributes

private Slider musicVolumeSlider: This is a Slider instance for the music volume.

private Slider soundEffectsSlider: This is a Slider instance for the sound effects volume.

private Label optionsLabel: This is a Label instance for the options label.

private Label musicLabel: This is a Label instance for the music level label.

private Label musicLevelLabel: This is a Label instance for the music level label.

private Label soundEffectsLabel: This is a Label instance for the sound effects label.

private Label soundEffectsLevelLabel: This is a Label instance for the sound effects level label.

private Label gameBackGroundLabel: This is a label instance for the label “Game Background”.

private Button imageButtons[]: This is an instance of an array of Button. It holds the default images’ buttons.

private Button uploadImageButton: This is a Button instance for the upload image button. It is used to upload tracks from the local files.

private Label musicLabel2: This is a Label instance for the second music label.

private Button defaultButton: This is a Button instance for the default button. It is used to select the default music.

private Button uploadButton: This is a Button instance for the upload button. It is used to upload music.

private Button backButton: This is a Button instance for the back button. It is used to navigate the main menu.

Methods

public void defaultButtonClicked(event: ActionEvent): This is a listener method for the default button.

public void uploadButtonClicked(event: ActionEvent): This is a listener method for the upload button.

public void backButtonClicked(event: ActionEvent): This is a listener method for the back button.

public void uploadImageButtonClicked(event: ActionEvent): This is a listener method for the upload image mode button.

public void image1ButtonClicked(event: ActionEvent): This is a listener method for the first background image button. It changes the background of the application to the first image.

public void image2ButtonClicked(event: ActionEvent): This is a listener method for the second background image button. It changes the background of the application to the second image.

public void image3ButtonClicked(event: ActionEvent): This is a listener method for the third background image button. It changes the background of the application to the third image.

public void initialize(): Initializes slider.

CreditsController Class

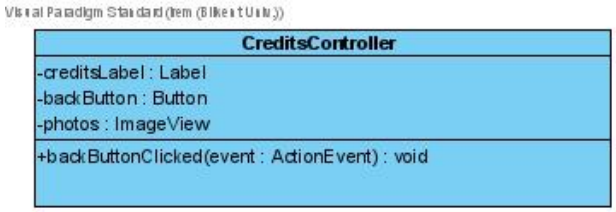


Figure 37. CreditsController

Attributes

private Label creditsLabel: This is a Label instance for the credits label.

private Button backButton: This is a Button instance for the back button.

private ImageView photos: This is an instance of an ImageView for the photos of the developers.

Methods

public void backButtonClicked(event: ActionEvent): This is a listener method for the back button. It is used to navigate to the main menu.

HowToPlayController Class

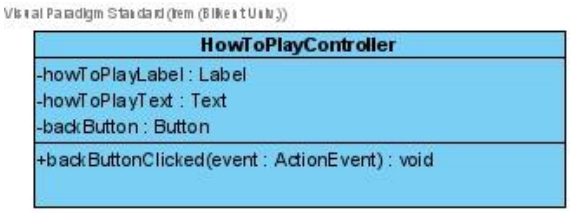


Figure 38. HowToPlayController

Attributes

private Label howToPlayLabel: This is a Label instance for the how to play label.

private Text howToPlayText: This is a Text instance that holds the how to play text.

private Button backButton: This is a Button instance for the back button.

Methods

public void backButtonClicked(event: ActionEvent): This is a listener method for the back button. It is used to navigate to the main menu.

PlayerSelectionController Class

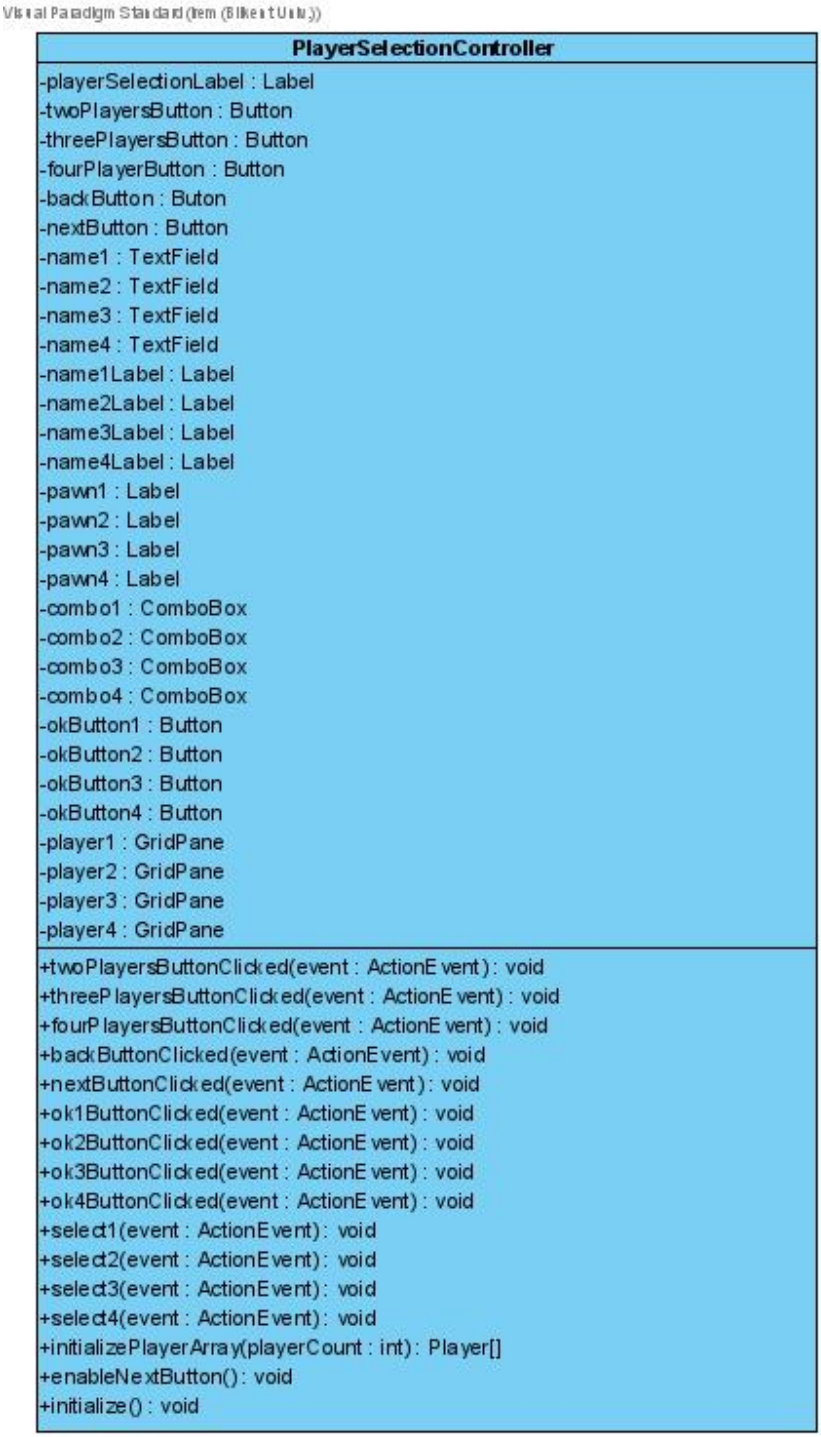


Figure 39. PlayerSelectionController

Attributes

private Label playerSelectionLabel: This is a Label instance for the player selection label.

private Button twoPlayersButton: This is a Button instance for the two players button. It is used when there are two players.

private Button threePlayersButton: This is a Button instance for the three players button. It is used when there are three players.

private Button fourPlayersButton: This is a Button instance for the four players button. It is used when there are four players.

private Button backButton: This is a Button instance for the back button.

private Button nextButton: This is a Button instance for the next button.

private TextField name1: This is a TextField for the first player to enter his/her name.

private TextField name2: This is a TextField for the second player to enter his/her name.

private TextField name3: This is a TextField for the third player to enter his/her name.

private TextField name4: This is a TextField for the fourth player to enter his/her name.

private Label name1Label: This is a Label instance for the name label in the first GridPane

private Label name2Label: This is a Label instance for the name label in the second GridPane

private Label name3Label: This is a Label instance for the name label in the third GridPane

private Label name4Label: This is a Label instance for the name label in the fourth GridPane

private Label pawn1: This is a Label instance for the pawn label in the first GridPane

private Label pawn2: This is a Label instance for the pawn label in the second GridPane.

private Label pawn3: This is a Label instance for the pawn label in the third GridPane.

private Label pawn4: This is a Label instance for the pawn label in the fourth GridPane.

private ComboBox combo1: This is a ComboBox instance for the pawn selection combo box in the first GridPane

private ComboBox combo2: This is a ComboBox instance for the pawn selection combo box in the second GridPane

private ComboBox combo3: This is a ComboBox instance for the pawn selection combo box in the third GridPane

private ComboBox combo4: This is a ComboBox instance for the pawn selection combo box in the fourth GridPane

private Button okButton1: This is a Button instance for the first ok button.

private Button okButton2: This is a Button instance for the second ok button.

private Button okButton3: This is a Button instance for the third ok button.

private Button okButton4: This is a Button instance for the fourth ok button.

private GridPane player1: This is a GridPane instance to get the first player's information.

private GridPane player2: This is a GridPane instance to get the second player's information.

private GridPane player3: This is a GridPane instance to get the third player's information.

private GridPane player4: This is a GridPane instance to get the fourth player's information.

Methods

public void twoPlayersButtonClicked(event: ActionEvent): This is a listener method for the two players button.

public void threePlayersButtonClicked(event: ActionEvent): This is a listener method for the three players button.

public void fourPlayersButtonClicked(event: ActionEvent): This is a listener method for the four players button.

public void backButtonClicked(event: ActionEvent): This is a listener method for the back button. It is used to navigate to the main menu.

public void nextButtonClicked(event: ActionEvent): This is a listener method for the next button. It is used to navigate to the pregame settings.

public void ok1ButtonClicked(event: ActionEvent): This is a listener method for okButton1.

public void ok2ButtonClicked(event: ActionEvent): This is a listener method for okButton2.

public void ok3ButtonClicked(event: ActionEvent): This is a listener method for okButton3.

public void ok4ButtonClicked(event: ActionEvent): This is a listener method for okButton4.

public void select1(event: ActionEvent): This is a listener method for combo1.

public void select2(event: ActionEvent): This is a listener method for combo2.

public void select3(event: ActionEvent): This is a listener method for combo3.

public void select4(event: ActionEvent): This is a listener method for combo4.

public Player[] initializePlayerArray(playerCount : int) : Initializes the player array according to the information come from UI.

public void enableNextButton(): Enables next button according to the player number and combobox selections.

public void initialize(): Inıtializes comboboxes.

3.3.2 Game UI Subsystem

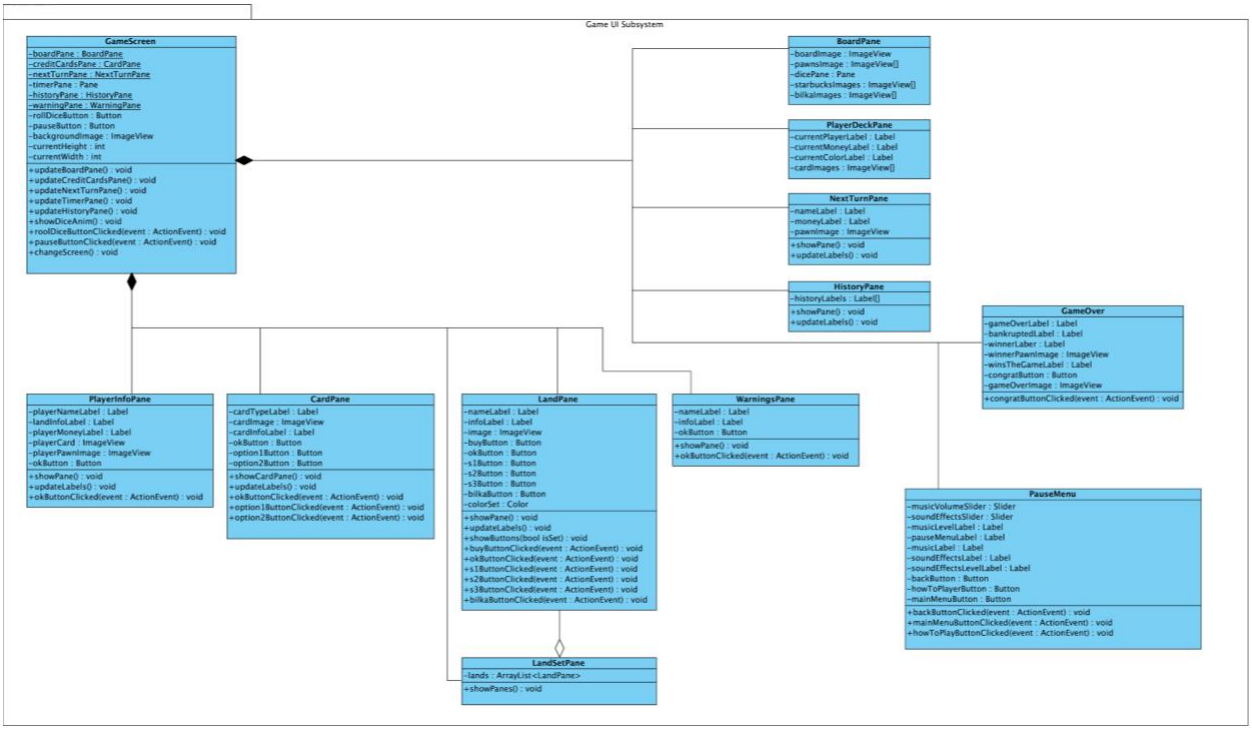


Figure 40. Game UI Subsystem

Game UI Subsystem consists of 12 classes that assemble the in-game user interface.

The main class of this subsystem is GameScreen, which contains Game Over and Pause screens and Panes that compose the in-game screen. The Panes are PlayerInfoPane which shows the information about a Player, CardPane which shows the content of the picked Card, LandPane which pops on the screen when a Player lands on a Buyable, LandSetPane which shows all Lands in the same LandSet, WarningsPane for warning popups, BoardPane which contains the game board, PlayerDeckPane which displays the credit cards of the Players, NextTurnPane which shows the Player who has the next turn, and HistoryPane which shows the history.

GameScreen Class

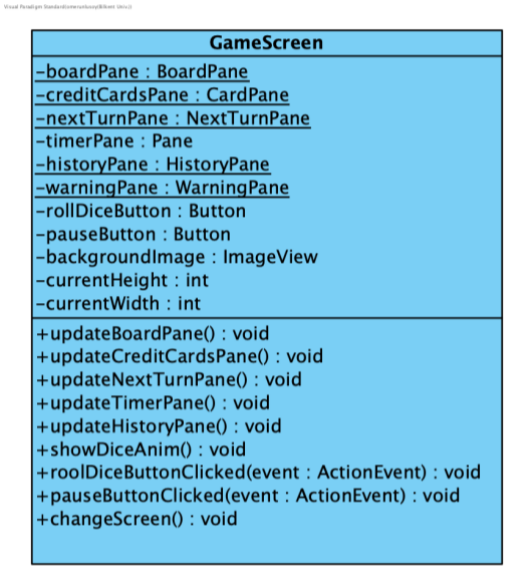


Figure 41. GameScreen

Attributes

private BoardPane boardPane: This attribute is the Pane in which the game board will be placed.

private NextTurnPane nextTurnPane: This attribute is the Pane in which the next turn panel will be placed.

private Pane timerPane: This attribute is the Pane in which the Timer will count down in Timed Mode.

private HistoryPane historyPane: This attribute is the Pane in which the history information will be held.

private WarningPane warningPane: This attribute is the Pane in which the warning information will be placed. Warning popups will contain this Pane.

private Button rollDiceButton: This attribute is the Button which rolls the dice for the player who has the turn.

private Button pauseButton: This attribute is the pause button at the top-right of the screen.

private ImageView backgroundImage: This attribute is the background image of the game screen (which was the B Building on the mockups).

private int currentHeight: This attribute is the height of the game screen which changes from computer to computer.

private int currentWidth: This attribute is the width of the game screen which changes from computer to computer.

Methods

public void updateBoardPane(): This method updates the BoardPane, therefore displays the changes on the Pane.

public void updateCreditCardsPane(): This method updates the CreditCardsPane after each turn.

public void updateNextTurnPane(): This method updates the NextTurnPane after each turn.

public void updateTimerPane(): This method updates the TimerPane each second.

public void updateHistoryPane(): This method updates the HistoryPane after each turn.

public void showDiceAnim(): This method shows the dice animation in the middle of the game board when rolled.

public void rollDiceButtonClicked(event : ActionEvent): This listener method is called when the rollDiceButton is clicked.

public void pauseButtonClicked(event : ActionEvent): This listener method is called when the pauseButton is clicked.

public void changeScreen(): This method calls the ScreenManager class to change the screen, if necessary.

PlayerInfoPane Class

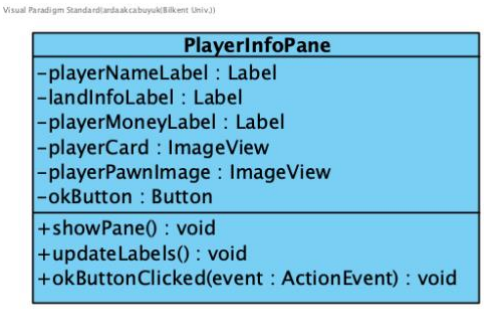


Figure 42. PlayerInfoPane

Attributes

private Label playerNameLabel: This attribute is the name label of a player.

private Label landInfoLabel: This attribute is the land list of a player.

private Label playerMoneyLabel: This attribute is the balance of a player.

private ImageView playerCard: This attribute is the credit card image of a player.

private ImageView playerPawnImage: This attribute is the pawn image of a player.

private Button okButton: This attribute is the ok button that closes the pane.

Methods

public void showPane(): This method shows the player info pane.

public void updateLabels(): This method updates the labels in the pane.

public void okButtonClicked(ActionEvent event): This method is the listener of the ok button.

CardPane Class

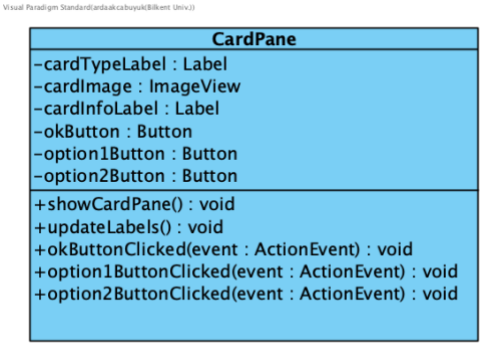


Figure 43. CardPane

Attributes

private Label cardTypeLabel: This attribute is the card type.

private Label cardInfoLabel: This attribute is a text about the contents of the card.

private ImageView cardImage: This attribute shows a picture about the contents of the card.

private Button okButton: This attribute is the ok button that closes the pane.

private Button option1Button: This attribute is a button created so that the player can choose one of the choice.

private Button option2Button: This attribute is a button created so that the player can choose one of the choice.

Methods

public void showCardPane(): This method shows the card pane.

public void updateLabels(): This method updates the labels in the pane.

public void option1ButtonClicked(ActionEvent event): This method is the listener of the option1 button.

public void option2ButtonClicked(ActionEvent event): This method is the listener of the option2 button.

LandPane Class

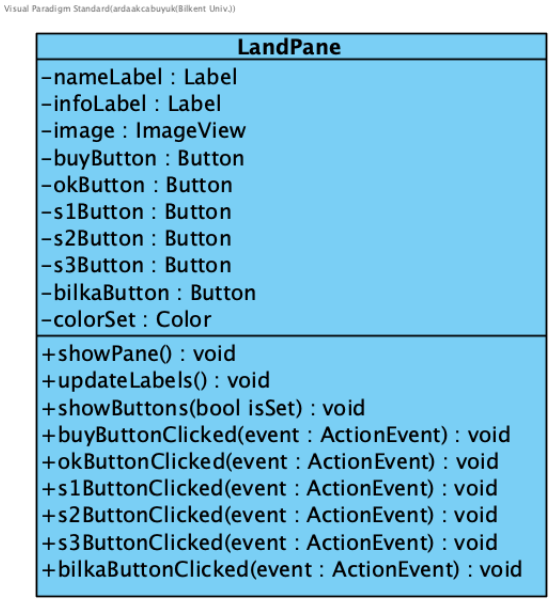


Figure 44. LandPane

Attributes

private Label nameLabel: This attribute is the name label of the building.

private Label infoLabel: This attribute is the rent and buy information label of the building.

private ImageView image: This attribute is the image of the building.

private Button buyButton: This attribute is the buy button of the building.

private Button okButton: This attribute is the ok button that closes the pane.

private Button s1Button: This attribute is the buy button for 1 Starbucks of the building.

private Button s2Button: This attribute is the buy button for 2 Starbucks of the building.

private Button s3Button: This attribute is the buy button for 3 Starbucks of the building.

private Button bilkaButton: This attribute is the buy button for Bilka of the building.

private Color colorSet: This attribute is the color of the building.

Methods

public void showPane(): This method shows the building pane.

public void updateLabels(): This method updates the labels in the pane.

public void showButtons(boolean isSet); This method decides what buttons to show depending on whether the player is displaying one land or the land set.

public void buyButtonClicked(ActionEvent event): This method is the listener of the buy button.

public void okButtonClicked(ActionEvent event): This method is the listener of the ok button.

public void s1ButtonClicked(ActionEvent event): This method is the listener of the s1 button.

public void s2ButtonClicked(ActionEvent event): This method is the listener of the s2 button.

public void s3ButtonClicked(ActionEvent event): This method is the listener of the s3 button.

public void bilkaButtonClicked(ActionEvent event): This method is the listener of bilka buy button.

LandSetPane Class

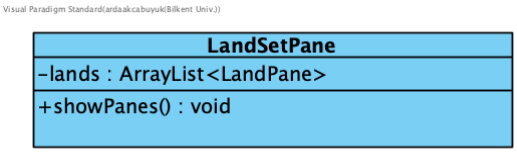


Figure 45. LandSetPane

Attributes

private ArrayList<LandPane> lands: This attribute is the array list of the LandPanes that belongs to the same color set. It allows us to display all color set at the same time.

Methods

public void showPanes(): This method displays the all color set.

WarningsPane Class

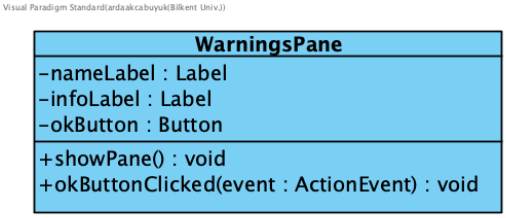


Figure 46. WarningsPane

Attributes

private Label nameLabel: This attribute is the title of the warning pane.

private Label infoLabel: This attribute is the text info of the warning pane.

private Button okButton: This attribute is the ok button of the warning pane that closes the pane.

Methods

public void showPane(): This method displays the pane.

public void okButtonClicked(ActionEvent event): This method is the listener of the ok button.

BoardPane Class

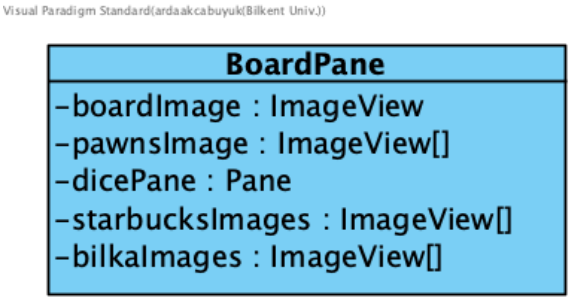


Figure 47. BoardPane

Attributes

private ImageView boardImage: This attribute is the image of the game board.

private ImageView[] pawnsImage: This attribute is the images of the Pawns on the game board.

private Pane dicePane: This attribute is the Pane in which the roll dice animation is shown.

private ImageView[] starbucksImages: This attribute is Starbucks images currently on the game board.

private ImageView[] bilkaImages: This attribute is Bilka images on the game board.

PlayerDeckPane Class

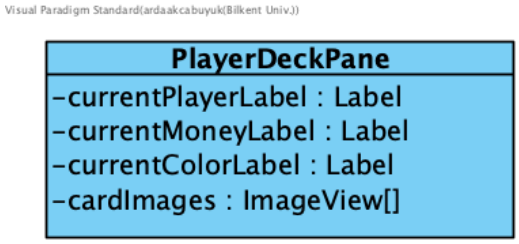


Figure 48. PlayerDeckPane

Attributes

private Label currentPlayerLabel: This attribute is the name of the player who has the turn which will be displayed on the front credit card.

private Label currentMoneyLabel: This attribute is the balance of the player who has the turn which will be displayed on the front credit card.

private Label currentColorLabel: This attribute is the color of the player who has the turn which will be the border color of their credit card.

private ImageView[] cardImages: This attribute is the images of the credit cards that the players are represented with.

NextTurnPane Class

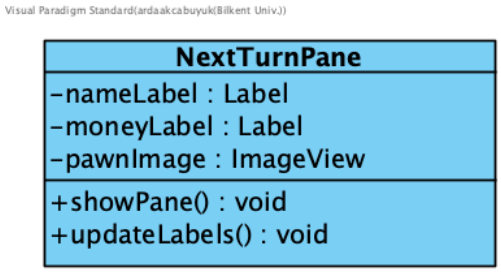


Figure 49. NextTurnPane

Attributes

private Label nameLabel: This attribute is the name of the Player that will play in the next turn.

private Label moneyLabel: This attribute is the balance of the Player that will play in the next turn.

private ImageView pawnImage: This attribute is the Pawn image of the Player that will play in the next turn.

Methods

public void showPane(): This method shows the NextTurnPane.

public void updateLabels(): This method is called in each turn, changing the player info on the pane. It updates the player that is displayed on this panel.

HistoryPane Class

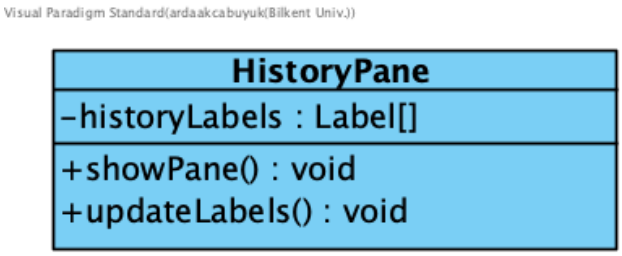


Figure 50. HistoryPane

Attributes

private Label[] historyLabel: This attribute keeps track of the events that take place within the game.

Methods

public void showPane(): This method shows the history pane.

public void updateLabels(): This method updates the labels in the pane.

GameOver Class

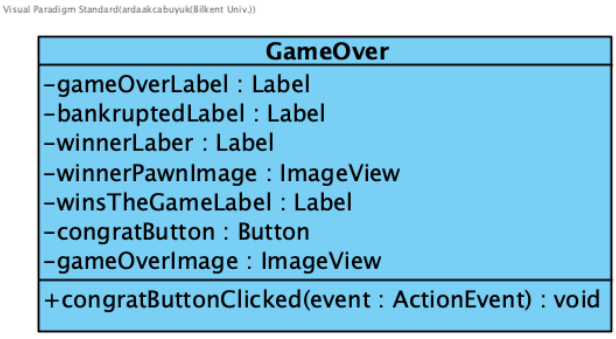


Figure 51. GameOver

Attributes

private Label gameOverlabel: This attribute is the game over text.

private Label bankruptedLabel: This attribute is “Everyone bankrupted” text.

private Label winnerLabel: This attribute is the winner player.

private Label winsTheGameLabel: This attribute is “Wins the game” text.

private ImageView winnerPawnImage: This attribute isa picture of the winner player’s pawn.

private ImageView gameOverImage: This attribute is a cash picture.

private Button congratButton: This attribute is the congrats button that closes the pane.

Methods

public void congratButtonClicked(ActionEvent event): This method is the listener of the congratButton.

PauseMenu Class

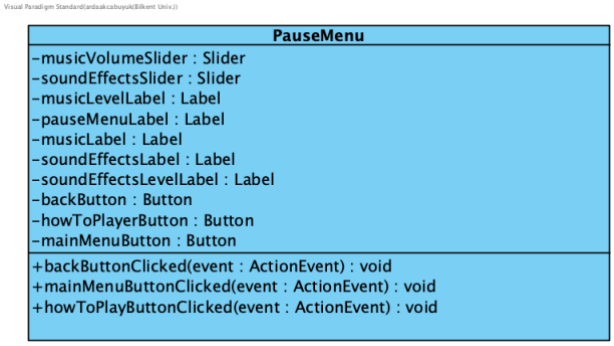


Figure 52. PauseMenu

Attributes

private Slider musicVolumeSlider: This attribute is the music volume slider that allows players to adjust music level.

private Slider soundEffectsSlider: This attribute is the sound effects volume slider that allows players to adjust sound effects level.

private Label musicLevelLabel: This attribute shows the music slider level.

private Label pauseMenuLabel: This attribute is the title of the pane.

private Label musicLabel: This attribute is the name of the music slider.

private Label soundEffectsLabel: This attribute is the name of the sound effects slider.

private Label soundEffectsLevelLabel: This attribute shows the sound effects slider level.

private Button backButton: This attribute is the back button.

private Button howToPlayButton: This attribute is the how to play button.

private Button mainMenuButton: This attribute is the main menu button.

Methods

public void backButtonClicked(ActionEvent event): This method is the listener of the back button that closes the Pause Menu.

public void mainMenuButtonClicked(ActionEvent event): This method is the listener of the Main Menu button that closes the game and goes back to the Main Menu.

public void howToPlayButtonClicked(ActionEvent event): This method is the listener of the How To Play button that opens How To Play pane during the game.

4. Low-level Design

4.1 Object Design Trade-offs

4.1.1 Efficiency v. Portability

The fact that the project can be used on more than one platform may adversely affect its efficiency on these platforms. Because the different requirements and operating styles of each platform may not be fully efficient with the Java language in which the project was written. However, such a trade-off was made, as the game was thought to be on multiple platforms and it would not feel much negativity in the user experience in terms of performance/efficiency.

4.1.2 Cost v. Readability

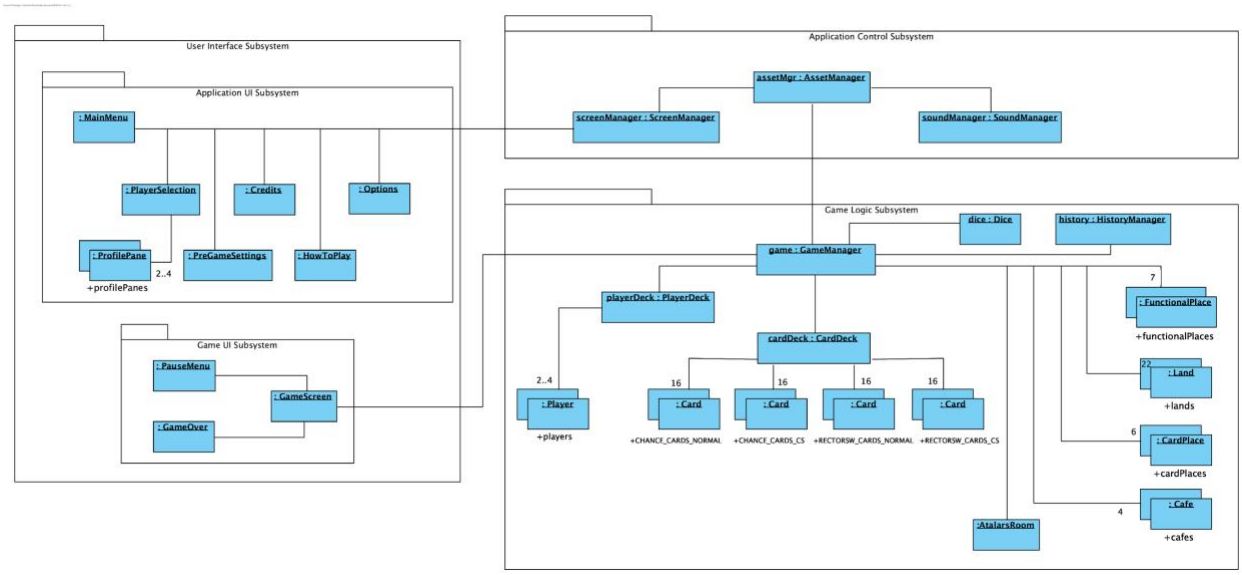
In the design part of the project, care was taken to establish a more readable and clear hierarchy among classes and interfaces, although it is longer, more complex and more time consuming.

4.1.3 Lite development vs. Functionality

Due to the limited time to develop the game, it was decided not to add some features that would make the game more functional (more competitive and fun). As mentioned in the analysis report, some optional features can be added when the game is extended. However, we took care to postpone these features that do not affect the gameplay but only improve the gameplay in the rapid development process and create a game that can be played sufficiently. In the

future versions, features such as chatroom and bargaining can be added to further increase the interaction between users.

4.2 Final Object Design



The final object design shows the connections between packages and the classes. The diagram includes the instances which will be created during the execution of the software. The attribute names are not included since they are explained in the above sections.

4.3 Design Patterns

4.3.1 Strategy Design Pattern

In Game Logic subsystem there is a class called FunctionalPlace. It is designed to hold four different types of spaces on the board. Strategy pattern is applied to the FunctionalPlace by creating an interface called PlaceStrategy and four classes that implement this interface which

are FreeParkingStrategy, GoToAtalarsRoomStrategy, NizamiyeStrategy, FeeStrategy. All of these classes have a method called executeFunctional(FunctionalPlace, Player).

4.3.2 Strategy Design Pattern and Decorator Design Pattern Combined

In Game Logic subsystem there is a class called Card and it is designed to hold two types of Cards which can have three types of behaviours. Those three types of behaviours are implemented using Strategy Design Pattern, their names are PayStrategy, GoToStrategy, EarnStrategy and they implement CardStrategy interface. Two types of cards are implemented using Decorator Design Pattern, their names are ChanceCardDecorator, RectorsWhisperCardDecorator and these classes implement CardStrategy interface and also have CardStrategy instances. Card class has CardStrategy instance. These classes have executeCard(Card) method. In ChanceCardDecorator, the player confronts randomized values of the actual values of the cards, therefore executeCard(Card) function will be called with randomized values of the card. For instance, if the card says pay some amount, ChanceCardDecorator will randomize that amount reasonably and call executeCard function. In RectorsWhisperCardDecorator, the player does the instruction that is written on the cards that make the player pay or earn money, however, the amounts vary according to the current balance of the player.

4.4 Packages

javafx.*: The JavaFX package is a GUI library that allows us to use JavaFX User Interface components such as Panes, Labels, Buttons, etc. It also allows us to create simple animations and 3D objects.

java.io.*: Input output library of Java.

java.util.*: Java library that allows us to use ArrayList and Scanner.

5. Improvement Summary

Some changes were made in line with the feedback given:

- Some elements mentioned in the Hardware/Software Mapping section were removed from the report because they seem unnecessary
- In the Data Management section, it was stated more clearly for what purpose and where the data will be obtained.
- In the Subsystem Services section, captions have been added to the sections without captions and the access modifiers of some methods have been updated.
- Some links in class diagram have been updated
- While writing the first iteration, the design pattern issue that could not be fully decided has been solved:
    - Accordingly, the classes with cards and places were changed on the diagram using Strategy and Decorator design patterns.
- Some classes had attributes that are functionally the same from the different boards and they all had to be initialized together. We simplified these in line with the feedback received:

    - Instead of initializing the values of 2 boards, different text files will hold the information of different boards.
    - Thus, extra memory usage will be avoided.
- Various methods have been added / changed to the classes of Application.Control and Application UI Subsystem
- Added some attributes missing in the first iteration, such as the mortgage penalty.
- Captions added to figures

6. References

[1] JavaFX. [Online]. Available: https://openjfx.io/. [Accessed: 28-Nov-2020].

[2] “Package java.io,” *java.io (Java Platform SE 7)*, 24-Jun-2020. [Online]. Available: https://docs.oracle.com/javase/7/docs/api/java/io/package-summary.html. [Accessed: 28-Nov-2020].

[3] *What is Object Diagram?* [Online]. Available: https://www.visual-paradigm.com/guide/uml-unified-modeling-language/what-is-object-diagram/. [Accessed: 28-Nov-2020].

[4] *UML: Modeling Software Architecture with Packages*. [Online]. Available: https://www.visual-paradigm.com/guide/uml-unified-modeling-language/modeling-software-architecture-with-package/. [Accessed: 28-Nov-2020].