CS 319

Object- Oriented Software Engineering

Analysis Report

IQ Puzzler Pro

Unknown - Group 1-I

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1. Introduction:

IQ Puzzler Pro is a board game which improves players intelligence. It is beneficial especially for children in terms of concentration skill. This game appeals up to 6 to adult. In this Project, we are going to adapt the original IQPuzzlerPro board game to the digital platform.

The game will include different game mods and each game mode, there will be different difficulty levels. In addition, each difficulty level has one unlocked level. Other levels will be locked. The user must unlock all levels in order to finish the game.

The goal of each level is to fit each of the puzzle pieces together onto the board. In each level, we give some of the pieces on their correct places and we expect from user to fill the blanks with remaining pieces.

2. Overview:

The purpose of the game is to create several shapes with the puzzle pieces. There will be 12 puzzle pieces in different shapes and colors. Some of the puzzle pieces placed their correct places in advance and the user asked to fill the rest of the shape. The user can rotate, move and flip the puzzle pieces. In order to move the shape, the user must use the left click of the mouse and drag the shape to the desired place. In order to flip the shape, the user must use the right click of the mouse. In order to rotate the shape, the user must hold right click of the mouse and use mouse wheel at the same time.

We record the time of user complete the level. Thus, the user can pause the game and then continue the game anytime he/she wants. Also, there will be music during the game, the user can use the setting menu to close it or change it.

2.1 Game Modes

The user will select the game mode before he/she starts the game. There will be two game modes in the game which are single player mode and multiplayer mode.

2.1.1 Single Player Mode

In single player mode, the purpose of the user will be the opening unlock levels. If the user chooses to play in this mode, he/she first enter a name to the game. Then the user selects the board that he/she wants to play. After then, the user selects the difficulty he/she wants to play with it. In each difficulty level, there will be several levels. Only the first level will be unlocked. Thus, the user has to start at this level. As the user completes the levels, next level will become unlocked. After all levels will be unlocked and finished successfully, the user completes the game. In addition, the game will record the time user complete each level and move count of pieces in each level will holded and score is computed with them. Score of the user is hold on to the leaderboard. In order to go up in the leaderboard, the user must complete the level as soon as possible with minimum moves.

2.1.2 Multiplayer Mode

In multiplayer mode, there will be several users than play the game. Users must enter their name. In addition, as in the singleplayer mode, they select a board and a difficulty level to play the game. After they select them, the game will give them a random level in this difficulty level with the board they select. Users start to play at the same level in order. Each of the users time to complete the level will be recorded. After they all complete the level, user that complete the level in shorter time win the game. In this mode, there can be four users at most and two users at least.

2.2 Boards

Users can select the board they want to play. There will be 3 option in this section. Two of them is different boards with 2d gameplay (black and gray boards) and one of them is 3d gameplay with the blackboard.

2.2.1 Black Board

Black board will be an 11x5 grid. The user must complete all places in the board with the puzzle pieces.

2.2.2 Gray Board

The user again must fill all places on the board.

2.2.3 Pyramid with Black Board

The user must create a pyramid shape on the blackboard. Not all the places must be filled on the board in this time. Only a subsection of them will be used.

2.3 Levels

In the game, each board has a different difficulty level. They are easy, medium and hard levels. The user selects one of them to play. In easy mode, there will be more pieces placed in advance. In medium mode, there will be fewer pieces played in advance compare to easy levels. In hard mode, there will few pieced placed in advance. In each difficulty level, as levels are unlocked, they become more difficult compared to the previous ones.

3. Functional Requirements:

In this section, we will mention about additional requirements, play game, how to play, options and credits.

3.1   Additional Requirements

We want game to be more enjoyable and we want to add that we cannot achieve in real life. With this approach we want to add multiplayer mode to IQ Puzzler Pro. In this mode, more than one player can play with other. Second feature that we want to add is "time challenge" mode. We want to add this mode because we want the game more challenging. The Players will try to finish the game in a specific time period. Third addition we want to add is "Hint" feature. The players can get help by clicking Hint button. Lastly, the players can earn stars which will be used for buying extra boards and piece appearances.

3.1.1 Time Challenge

This mode is to make game more challenging. Since actual game is hard, we make it harder to play, which makes game more enjoyable. In this mode, the players try to finish game in a given time period. they can take pauses and use hints. When

time is finish and the player still does not finish the level, this level will be considered as fail, thus the players have to play the same level to pass the other level.

3.1.2 Hint

Hint will show the board with two extra pieces within a specific time period regardless looking which pieces on the board. For example, by default board has 4 pieces and the player add 2 pieces and wants to use hint. Six pieces are on the board and hint will show seventh and eighth pieces places in a picture within a given short time.

3.1.3 Bonuses

Each level they pass they earn stars to unlock more background for boards and pieces. With these stars also, players also buy hints to help while playing the game.

3.2 Play game

When player open the application, he\she can choose whether players play our game as single player or multiplayer. After they choose how they want to play the game, they need to select board from two options, then in terms of what board players chose, levels will show up. When players fill all empty places with correctly pieces, game will be finished. Thus, we have two option for boards, as one boards' shape is rectangle, it is more straightforward, namely it is easier than other whose shape is more broken. Each level they pass, the difficulty of that level increases, and for example less pieces will be put into board so it can be more challenging.

3.2.1 Single Player Mode

The players access this mode from main menu, and they can start game where they left or can select the level they want. When they start the game, they try to place each pieces correctly. End of the levels, the players can choose to go to next level or go back to menu, moreover, same screen the players can see their time and how much move they made in that level.

3.2.2 Multiplayer Mode

Players should enter how much player they want to play and select which level they want to contest. Each player plays in order. When first player finishes the level, second player will play and then next player. Whenever all players finish their game, leaderboard will come and it will be sorted according to their time and the players can compare their time and number of moves.

3.3 How to Play

They can enter this screen from menu and the players are informed about:

Ø Game,

Ø Board,

Ø Levels,

Ø How to control pieces.

We want players to play smoothly and less errors, therefore this can be a good opportunity to learn about game and make less errors during the game.

3.4 Options

In option menu players can control sound volume in game. They can mute it, change the volume of it and also they can select which song they want to listen while they play the game.

3.5 Credits

The players can enter this screen by clicking "Credits" in menu. They will be informed about developers' e-mail addresses and names. This can be used for sending feedbacks or suggestions about game for further improvements.

4. Non-Functional Requirements:

4.1 Game Performance

As our game does not need high requirements, the game will be smooth and played in high FPS (60 frame per second). The extra features that we implement to the game, such as sound and music, will not affect the overall performance of the game.

4.2 Usability

We try to make interface as simple as possible to access wide range of players. Since game needs drag and release concept, the frame rate is crucial and the graphics need to be good looking and obvious that every pieces can be seen clearly. In addition, our games appeals up to 6 to adult, so even users with small age groups (eg: kids in age 8) can learn how to play the game in short time(like in 15 minutes).

4.3 Additional requirements

4.3.1 Reliability

Player's game progress will be kept in database so that user can load his/her game and continue from last level he/she left. This data will not be lost because of a system failure of a power loss. So even in case of power loss, user can continue from the level he unlock.

5. System Models

System models section includes mock-ups , dynamic and functional models. First of all, Use Case Model section demonstrates use case model and some brief scenarios are stated below. These scenarios give some ideas about game logic of the game. Also, dynamic model section includes sequence and activity diagrams of project. Moreover, object model section includes class diagram. Finally, User Interface - Navigational Paths and Screen Mock-ups section demonstrates mock-ups and navigational part for project.

5.1   Use Case Model
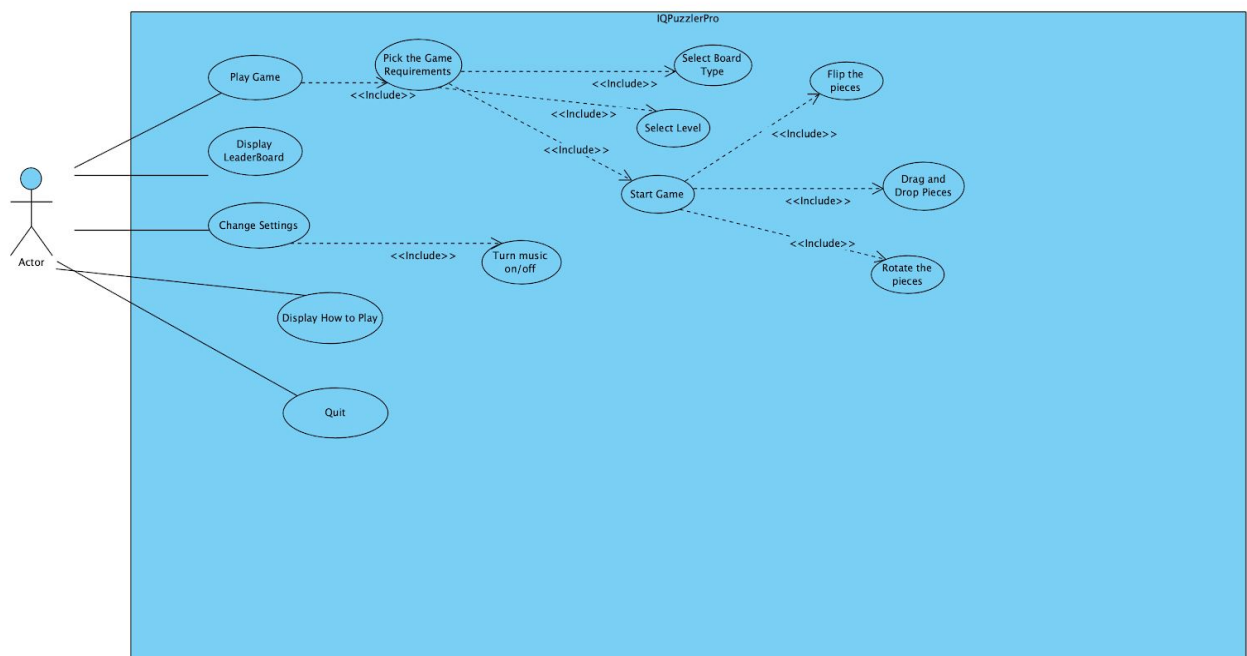
Figure 1 Use Case Diagram

Actor can choose playing or investigating the leaderboard, settings or directly quit in game user interface. In playing selection game modes can be selected as single or multiplayer simultaneously, board type selection for 3d models black board or gray board. Also level selection is needed to be chosen by actor. To display leaderboard actor should tap its button, or other functions need to be tapped in user interface menu. In change settings actor could change volume level, turn it off or on and select the music itself.

Use Case #1

Use Case: Play Game

Primary Actor: User

Stakeholders and Interests:

- User wants to play IQ Puzzler Pro

Pre-Conditions

- User must be in the menu

Post-Conditions

- System requires to be chosen board, level selections to start

Entry Conditions

- Playing button should be tapped by actor

Exit Conditions

- Back button should be tapped
- Esc key should be tapped during the game from keyboard.

Use Case #2

Use Case: Display the Leaderboard

Primary Actor: User

Stakeholders and Interests:

- User wants to check leaderboard

Pre-Conditions

- User must be in the menu

Post-Conditions

- No post conditions

Entry Conditions

- Display Leaderboard button should be tapped by user

Exit Conditions

- Back button should be tapped
- Esc key should be tapped during the game from keyboard.

Use Case #3

Use Case: Display How To Play

Primary Actor: User

Stakeholders and Interests:

- User wants to learn how to play IQ Puzzler Pro

Pre-Conditions

- User must be in the menu

Post-Conditions

- No post conditions

Entry Conditions

- How to Play button should be tapped by user

Exit Conditions

- Back button should be tapped
- Esc key should be tapped during the game from keyboard.

Use Case #4

Use Case: Change Settings

Primary Actor: User

Stakeholders and Interests:

- User wants to change settings in IQ Puzzler Pro

Pre-Conditions

- User must be in the menu

Post-Conditions

- Changing volume, sound on off or choosing music should be chosen

Entry Conditions

- Playing button should be tapped by user

Exit Conditions

- Back button should be tapped
- Esc key should be tapped during the game from keyboard.

Use Case#5

Use Case: Quit Game

Primary Actor: User

Stakeholders and Interests:

- User wants to quit

Pre-Conditions

- User must be in the menu

Post-Conditions

- No post conditions

Entry Conditions

- Quit button should be tapped by user

Exit Conditions

No exit conditions

5.2   Dynamic models

5.2.1   Sequence Diagram

5.2.1.1 Menu Sequence Diagram
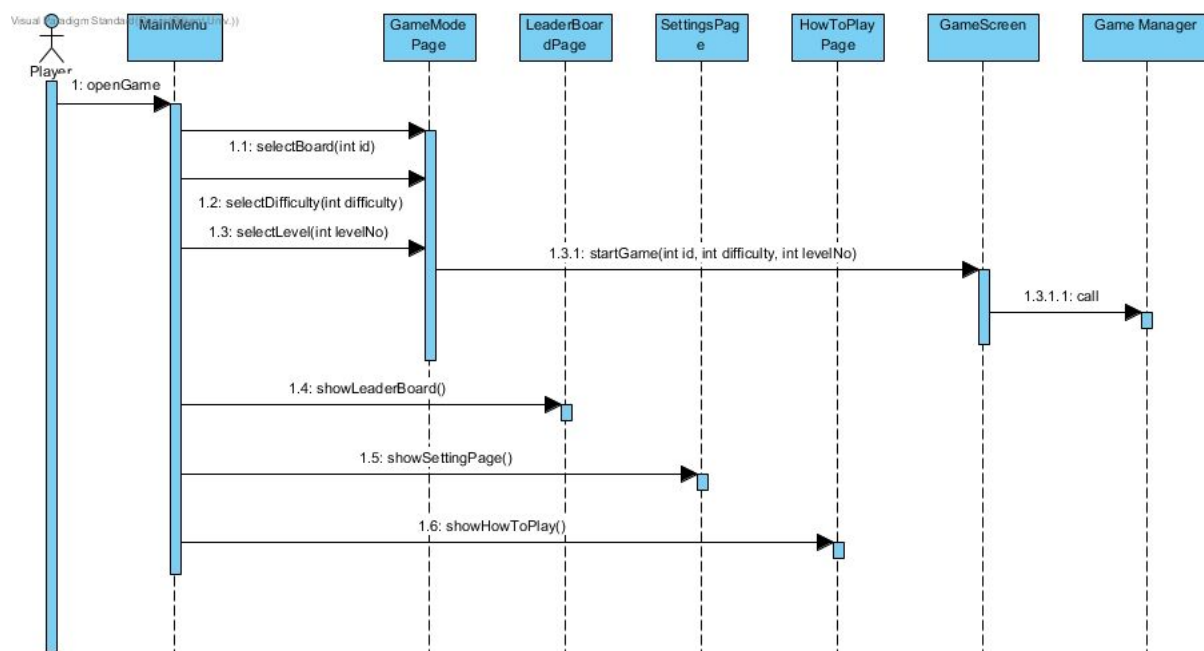
Figure 2 Menu Sequence Diagram

This diagram basically show how user interact with menu panels. First, actors interact with main menu when they start the game. Then, they select the game mode between single player and multiplayer options, after they determine how they play, they need to select which level they will play. All these processes are controlled by Game Manager and it will interact with the other classes when it is needed.

5.2.1.2 Game Logic Sequence Diagram
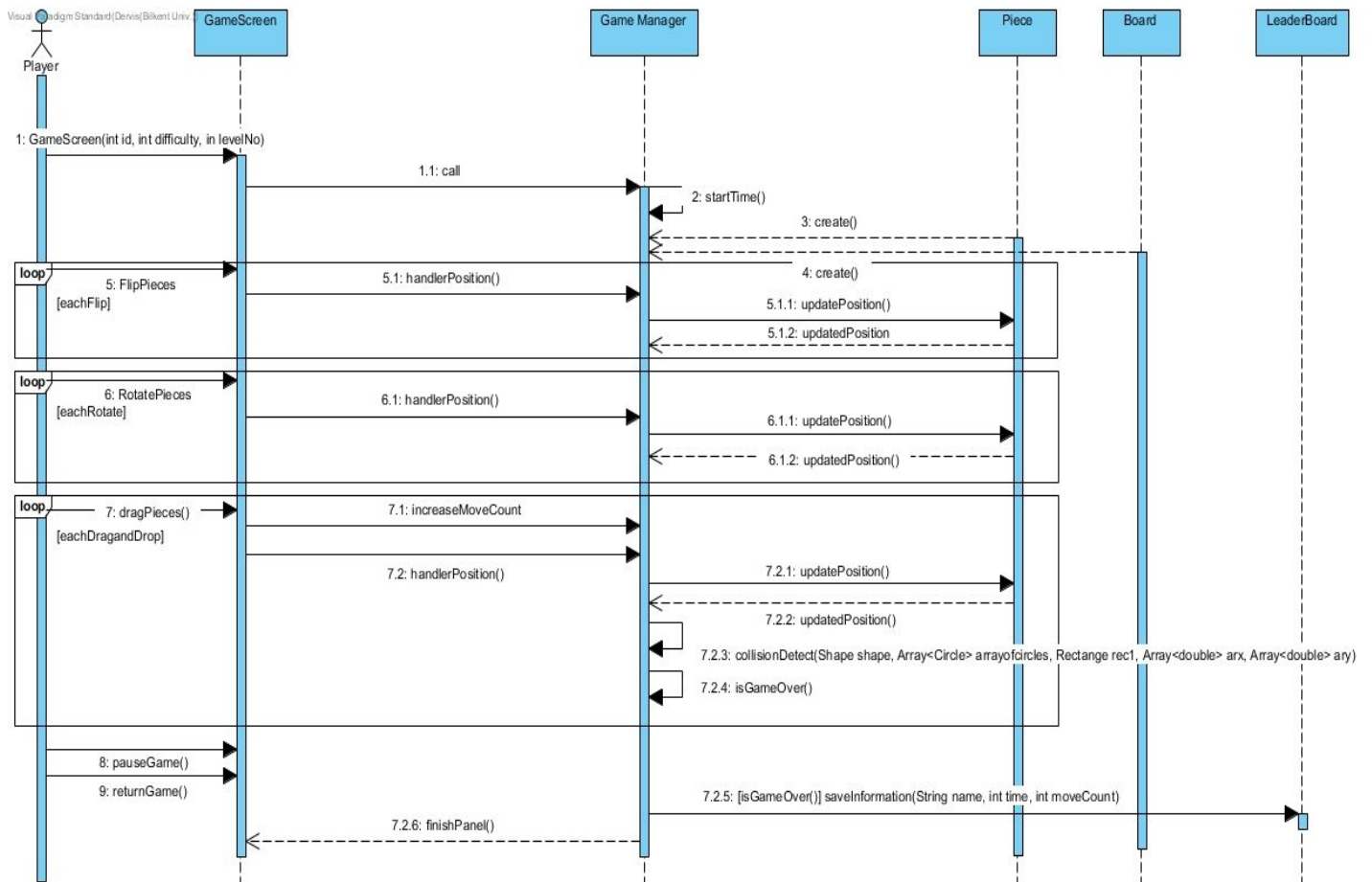
Figure 3 Game Logic Sequence Diagram

After the player selects the one of the three boards, difficulty level, and the level he wants to play, GameScreen calls the GameManager according to these identities and create the level accordingly. For each flip and rotate action GameManager update the positions of the pieces and update the GameScreen. Each drag and drop pieces increase the moveCount that holds the move number, and updates the positions of the pieces, and after he place the piece GameManager checks the position of the piece and replace it to nearest center, and checks whether the game is over or not. Also the players can pause the game and resume it through GameScreen. If the game is over, the players informations will be saved to show in leaderboard, then finishPanel will be shown to the player, where time he/she spends in that level and how many moves the player did will be demonstrated.

5.2.1.3 Game Finish Condition Sequence Diagram
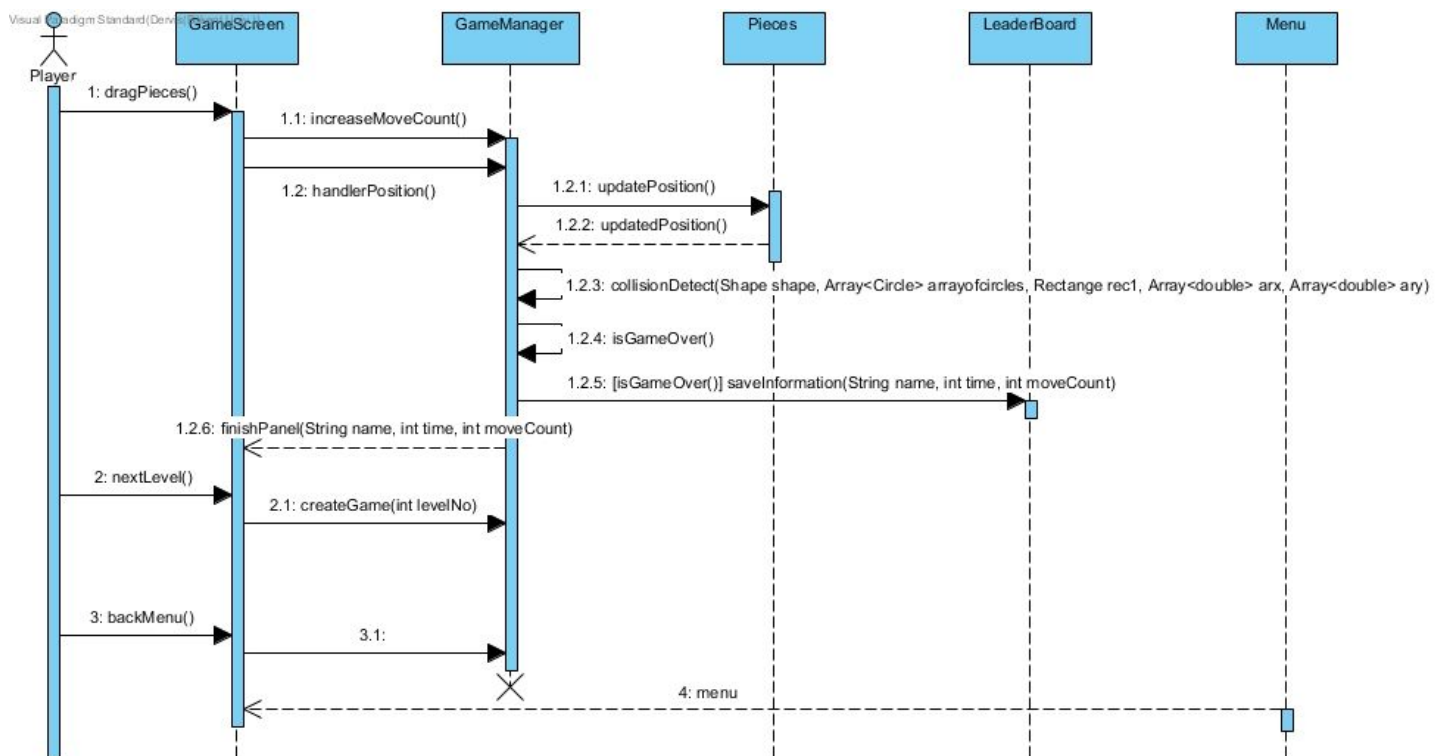
Figure 4 Game Finish Condition Sequence Diagram

In addition to previous diagram, this diagram has what can be done after the game finish. When the player fill the board correctly, finishPanel shows the brief informations about the player's move count and time. From that panel, the players can go to next level or they can go back to the menu.
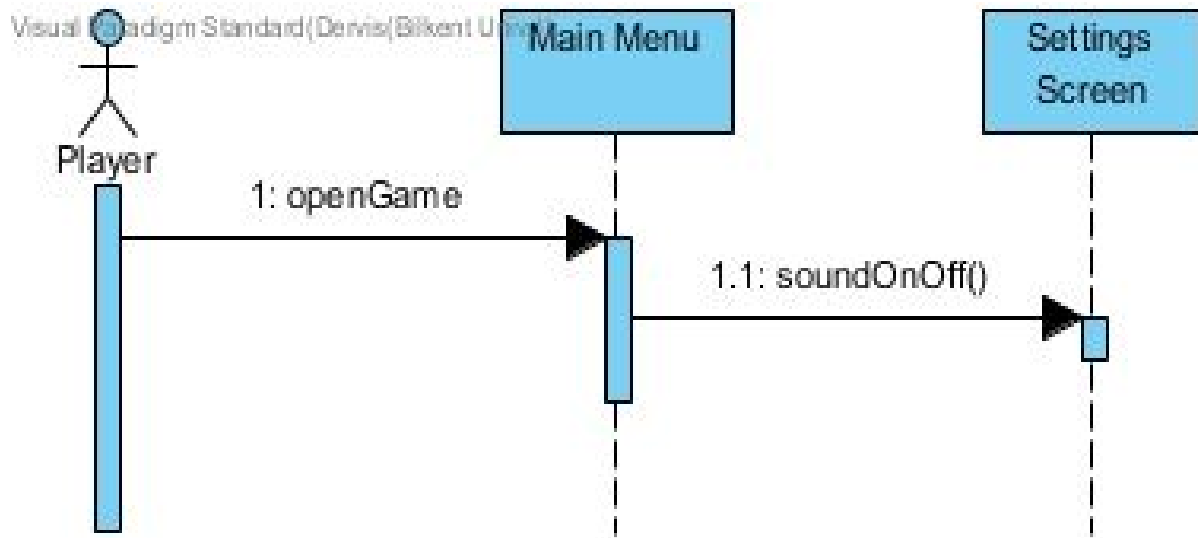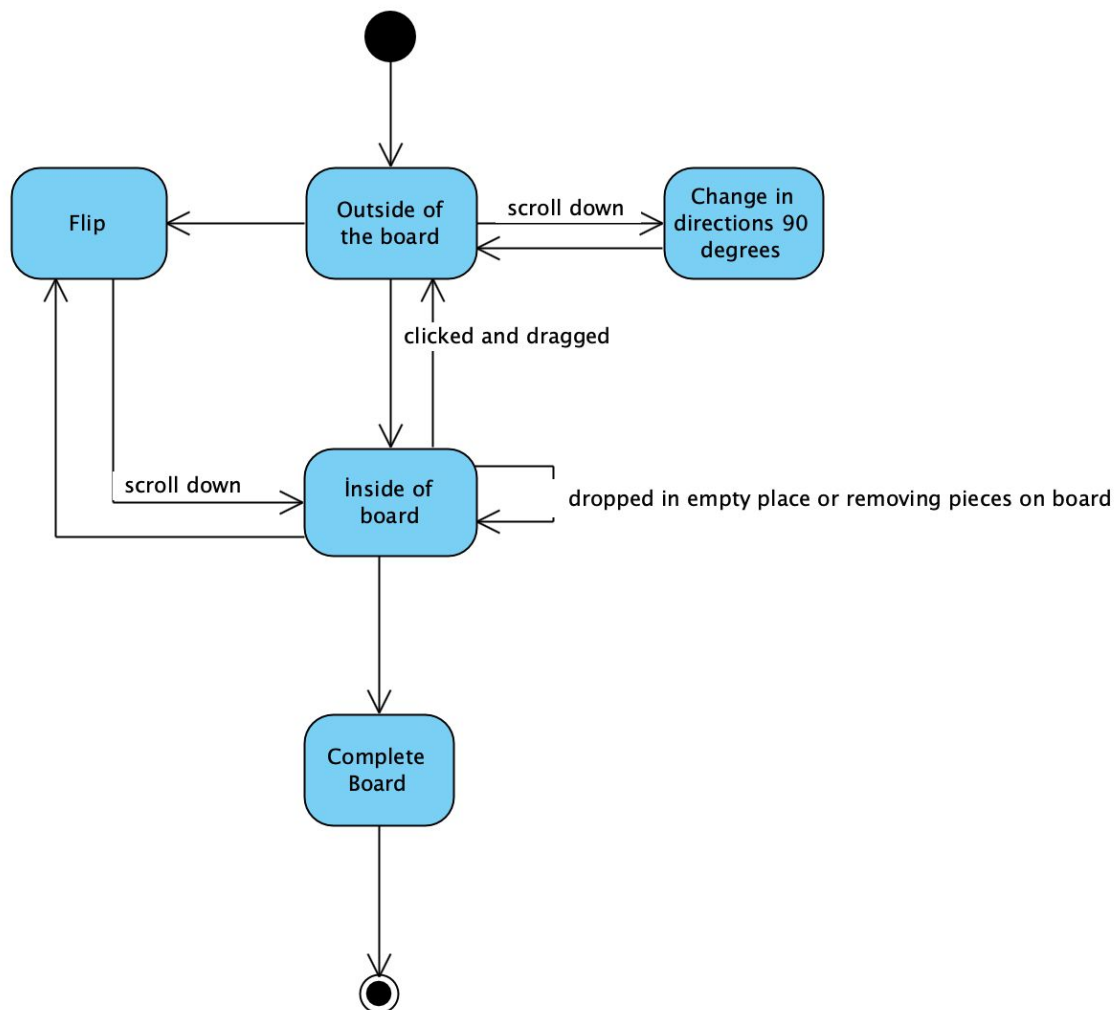
5.2.1.4 Setting Sequence Diagram

Figure 5 Setting Sequence Diagram

This diagram shows that how settings interacts with the classes. Players, actor, go to the setting from menu. What they can do in setting menu, is shown in diagram. They can turn on/off the music while they can play the game.

5.2.2 State Diagram

This diagram shows what are the states of the game and the transitions between these states. It focuses on game object states, which are piece and board. The piece can outside of the board. If it is clicked and dragged, it goes to the state of the inside of the board. Also, it can be flip with scroll down and change in direction 90 degrees with scroll down. After all, pieces go to state inside of the board and board is completed, the game is over.

5.2.3 Activity Diagram

When the game is opened, firstly the main menu is opened. In the main menu, several choices are offered to the user. These are settings, playing game,

leaderboard, how to play and quit. If settings are clicked, settings will be shown to the user. If playing game will be clicked, two option will be shown, multiplayer and single player. One of them must be selected. After that, board selection will be done. In addition, level selection will be done between easy mode, medium mode and hard mode. After the game is started. Time started to count. In the game, if the pause is pressed, the game will stop and time count will stop. If resume will be pressed, the game continues and time count will continue. If a piece is selected, it can be flipped, rotated or moved. When the piece is placed in some place, and this place is full, the piece goes its previous place. If the place is empty, piece placed in this place. Until the board will become full, this movement repeats itself. If the board become full, the game ends and it is returned to the main menu. If leaderboard will be clicked, the leaderboard will be shown. If how to play will be opened, it will show how to play. If quit is clicked, the program will be closed.
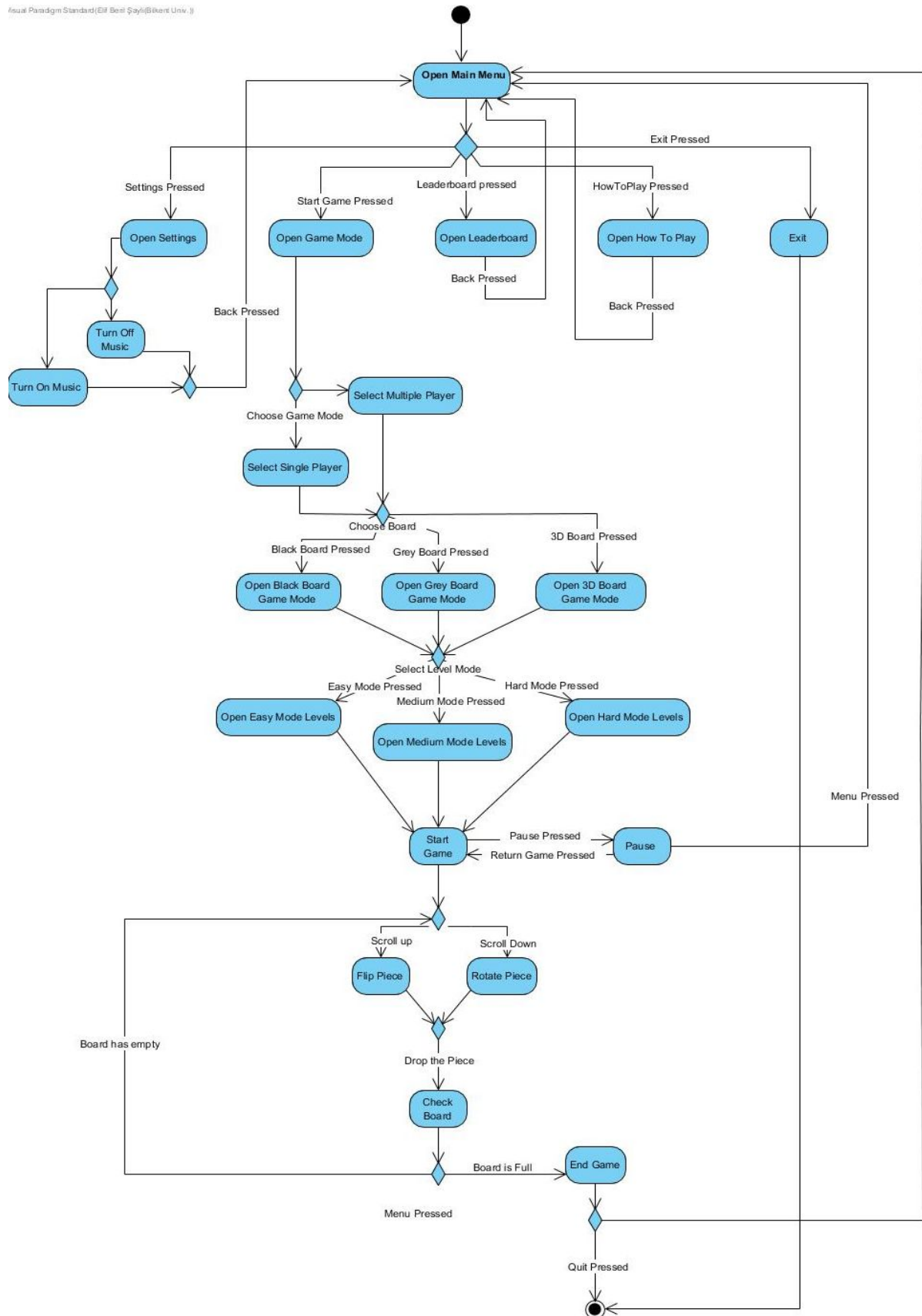
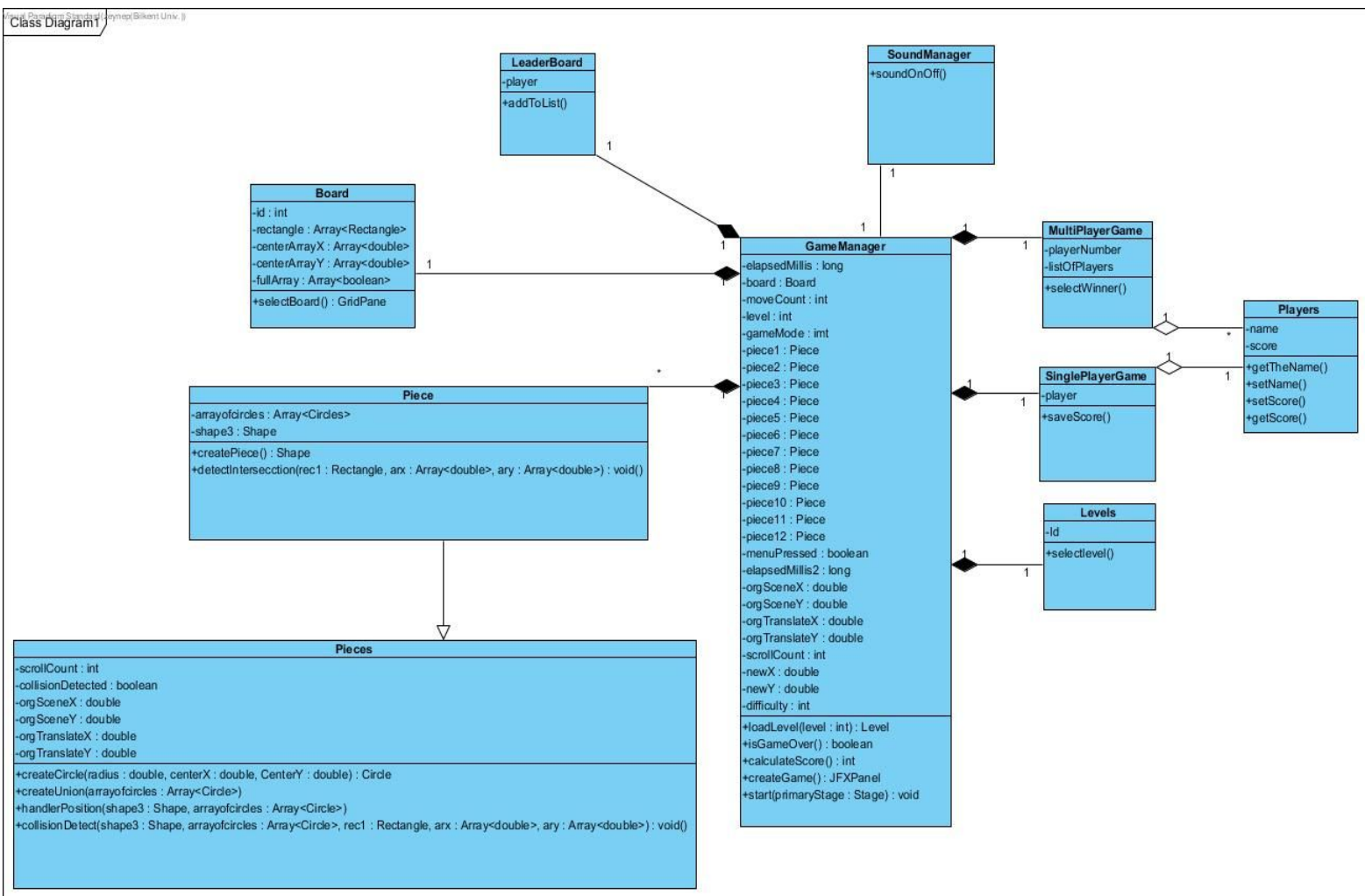**Figure 6 Activity Diagram**

5.3 Object and class model

Figure 7 Class Diagram

Currently, there are 10 classes on the project. The main class is the GameManager class. This class controls the game flow. The SoundManager class is the class which controls the music and sounds of the game. It has functions for close and open the sound of the game. Board and pieces are the game objects of the game. Each Piece is a kind of Pieces. Each Board has a id. Each Piece has circle elements. Board can be full or empty. Multiplayer and Singleplayer game classes are modes of the game. They both have the player object (while SinglePlayerGame has one player, MultiPlayerGame can have multiple players). Players class has properties name, time, moveCount and score which calculated from time and moveCount. Levels class has three main properties which have easy mode, medium mode, and hard mode levels.

5.4. User Interface - Navigational Paths and Screen Mock-ups

5.4.1 Main Menu

The main menu is our main screen. It has five buttons.

Start Game: By using this button, the user can access selections to start the game.

Leaderboard: With this button, the user can see the leaderboard.

How to Play: The user can see a video about how to play the game.

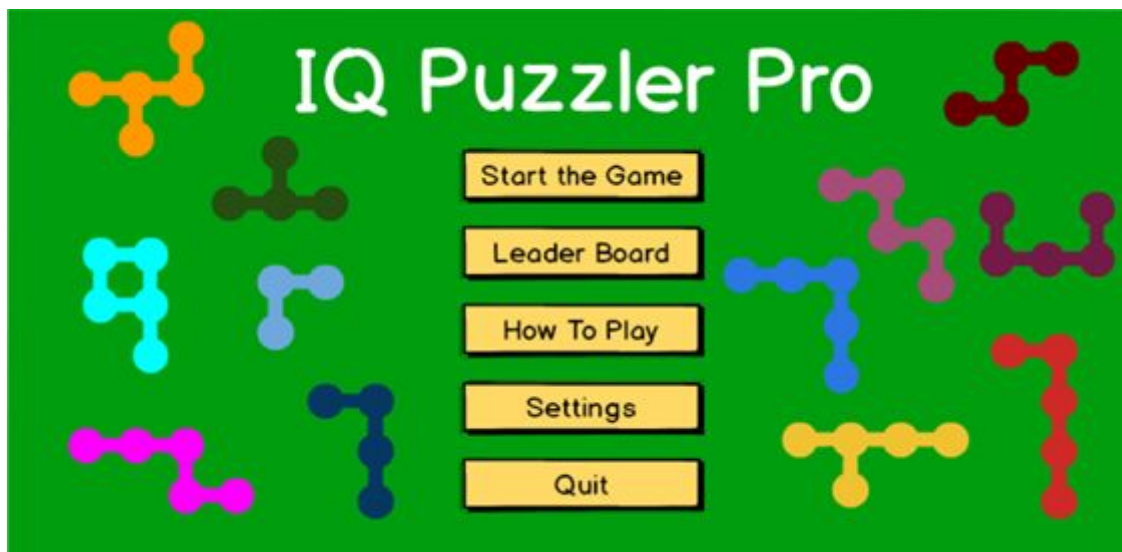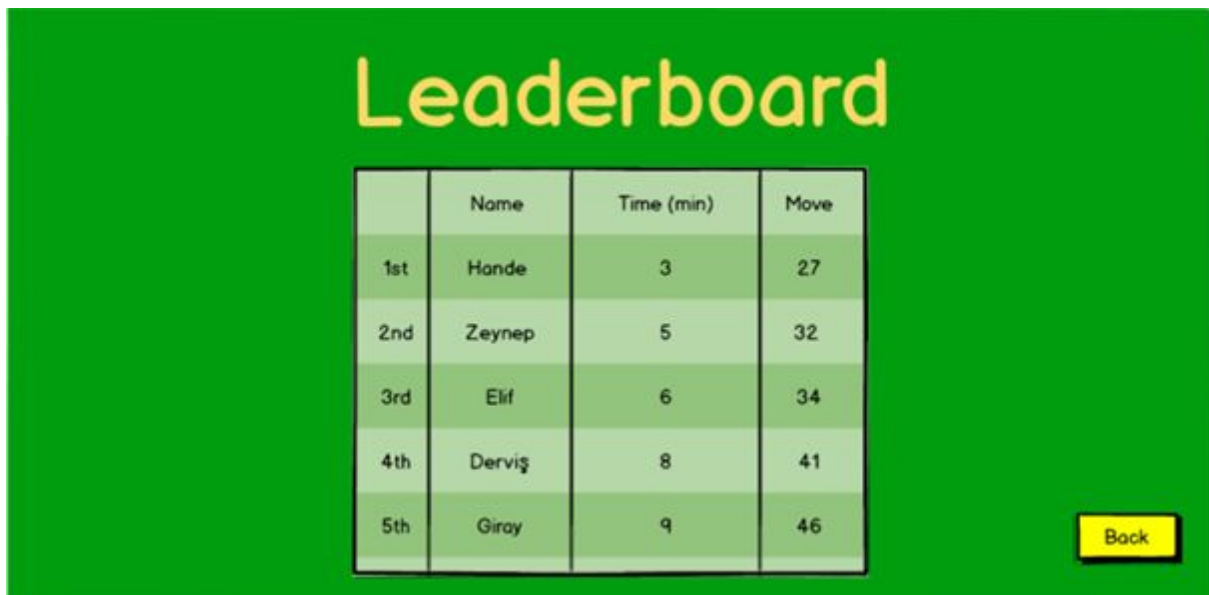**Settings:** The user can change the settings of the game by using this button.

Quit: This button is to exit the game.

Figure 8 Main Menu Screen

5.4.2 Leaderboard Screen

This screen shows the leaderboard which is a list player's game scores. The list is created according to players' number of moves and their time to finish the episode. This screen has one button

Back Button: This button is to go back to the main menu.

Figure 8 Leaderboard Screen

5.4.3 Setting Screen

This screen has four buttons. Three of them are to set the sound level (volume-off, volume-down, volume-up) and the last one is to go back to the main menu (Back button).
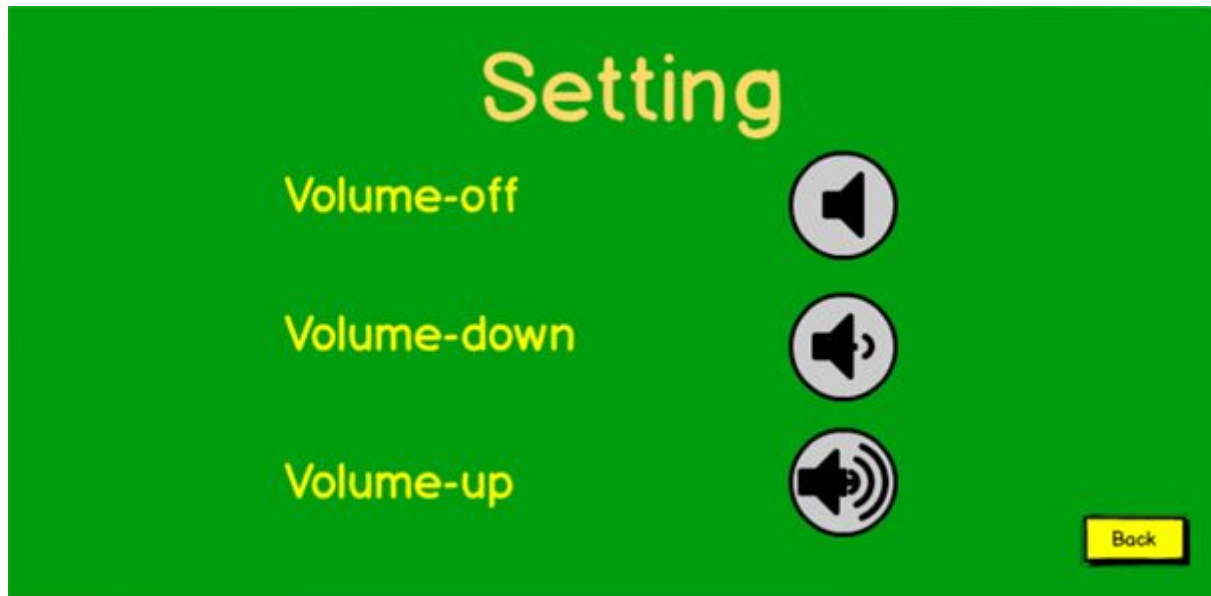

Figure 9 Setting Diagram

5.4.4 Start Game Screen

This screen is the first selection to start the game. In this screen, the player can select how many users play the game. It has two buttons and a bar.

Name bar: before start, the game user enters his name so when he wants his game score is saved to the leaderboard.

Single Player: If the user wants to play the game alone, he can click this button.

Multiple Player: If the user wants to play the game with one or more people, he can click this button.

Figure 10 Start Game Screen

5.4.5 Board Screen

After the selection in the start game screen, the user gets board screen. In this screen, there are three buttons.

Black Board: With this button, the user can select the black board with size 11x5.

Pyramid Board (3D): the user can play the game as 3D by clicking this button. In this button, the player tries to build a pyramid.

Grey Board: By choosing this button the player play the game with this board.
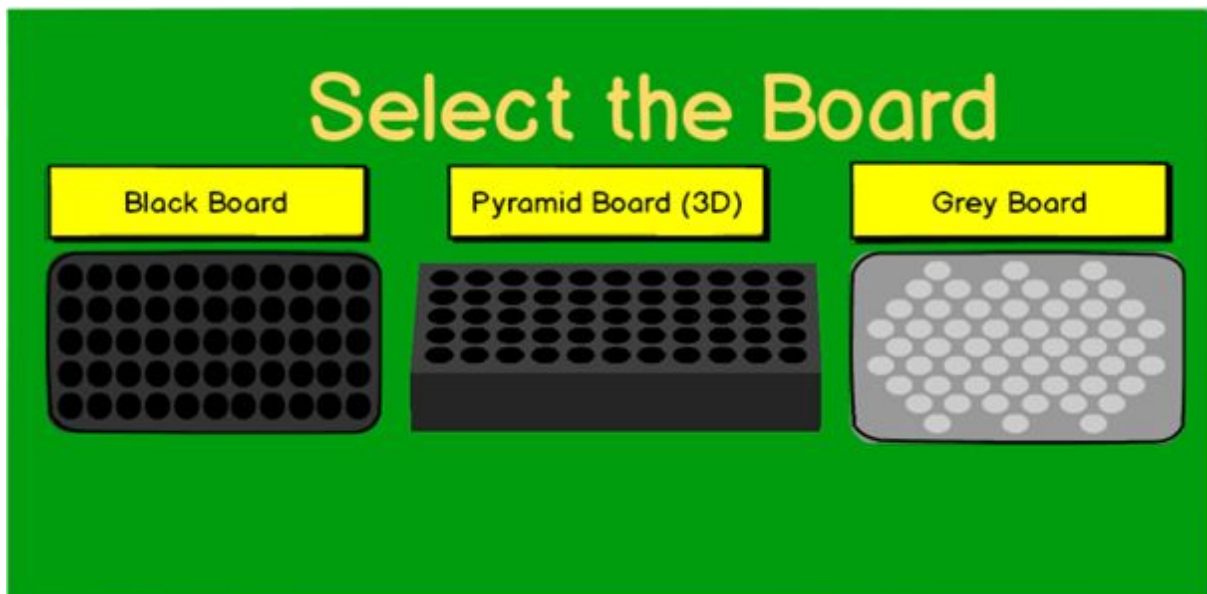

Figure 11 Board Screen

5.4.6 Mode Selection Screen

In this screen, the user can select the mode of the game. This screen has three buttons.

Easy Mode Button

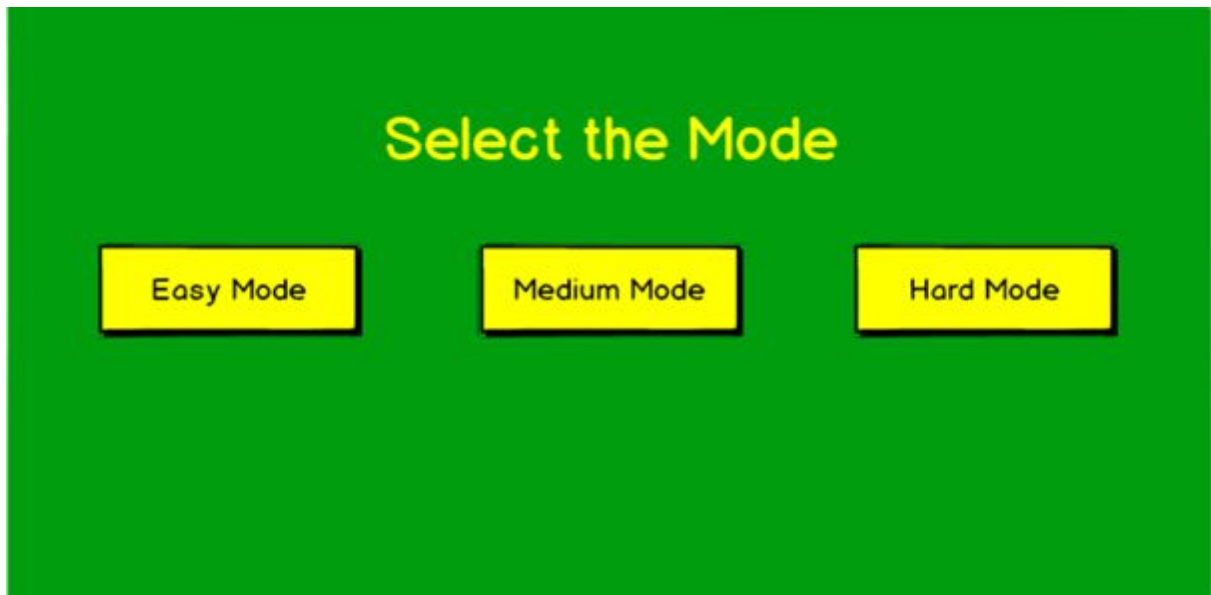**Medium Mode Button**

Hard Mode Button

Figure 12 Mode Selection Screen

5.4.7 Levels Screen

After the mode selection screen, the user gets the levels screen. In this screen, the user choose the level to play. At first, in each mode just first levels are available. Every time when the player completes a level, the next level becomes unlocked. Otherwise, they are locked.

Figure 13 Levels Screens

5.4.8 Game Screen

After all selections, the user can start to play the game. In the game, the player can see his number of moves and elapsed time. this scene has 3 buttons.

Pause Button: when the player click this button, the game and the time is stopped.

Menu Button: this button is to go back to main menu.

Hint Button: when the user couldn't find the solution, he can get help with hint button.
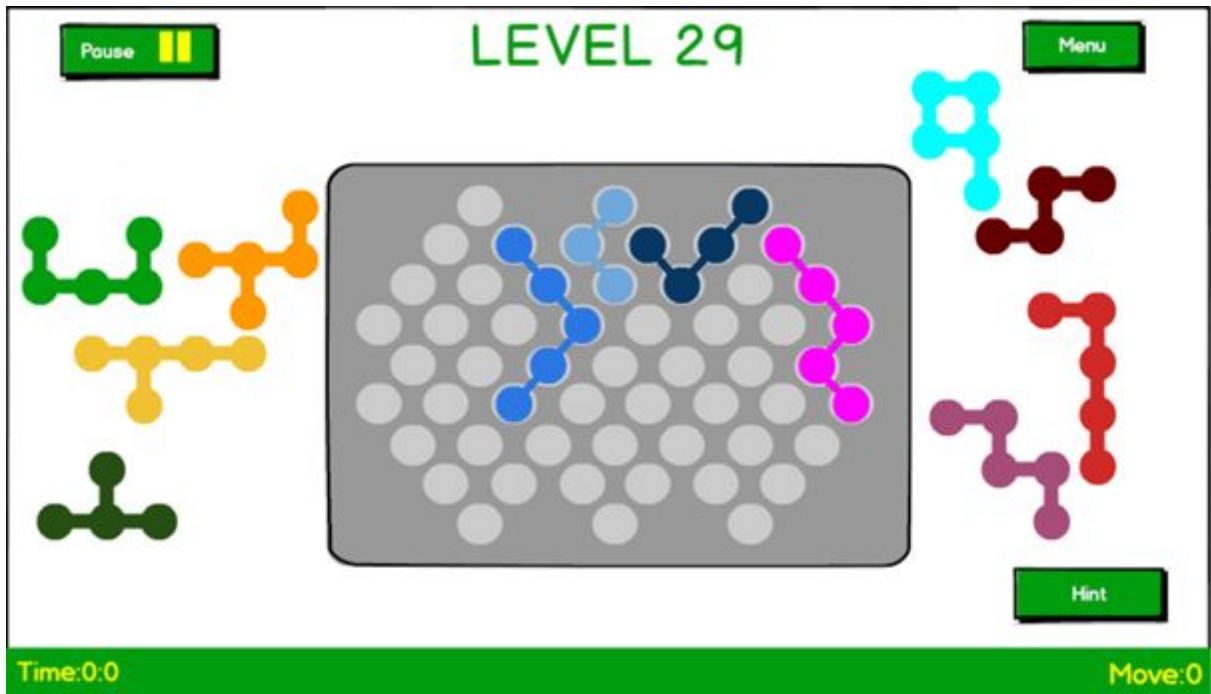

Figure 14 Black Board Game Screen

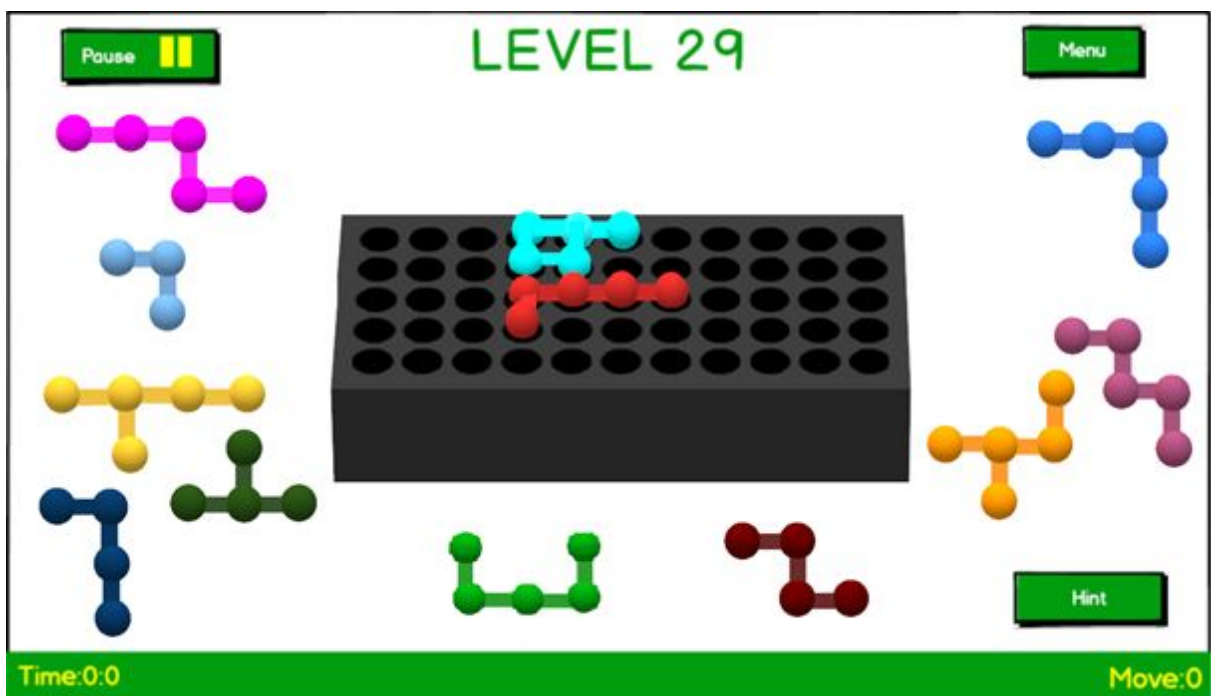**Figure 15 Grey Board Game Screen**

Figure 16 3D Board Screen

5.4.9 Paused Screen

When the player clicks the pause button in the game screen, he access paused screen. In this screen, there are two buttons.

Continue Button: when the player wants to continue to his game, click this button and the paused screen is closed. So the player can see the game screen and continue to play.

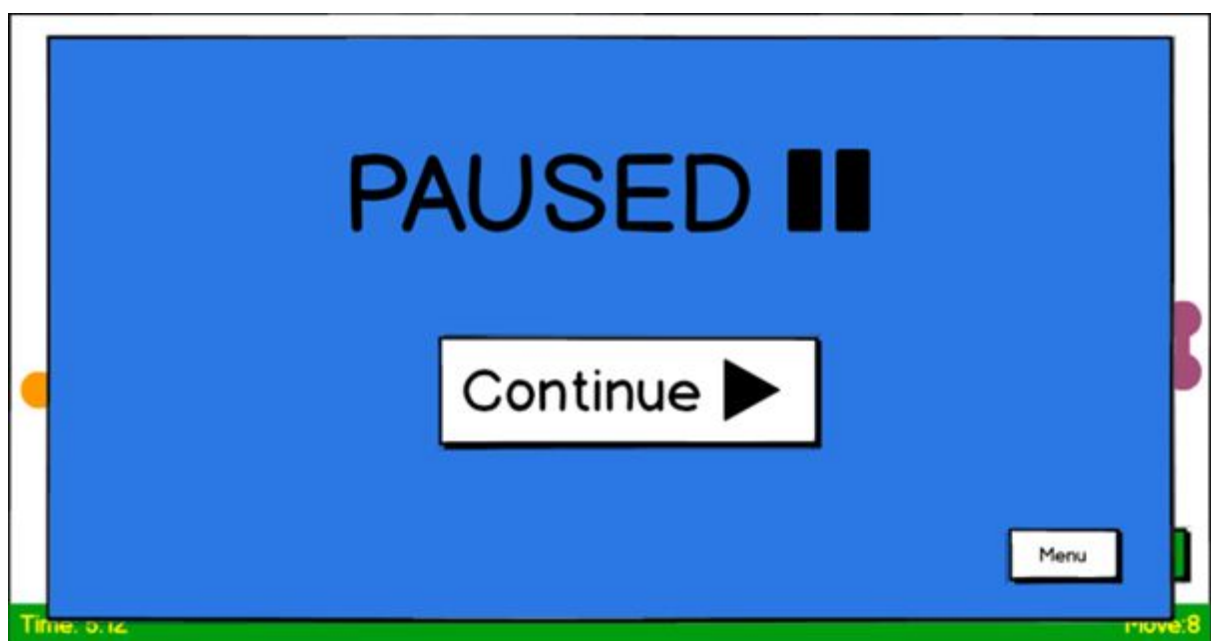**Menu Button:** when the player clicked the pause button, he can go back to the main menu screen, if he wants.

Figure 17 Paused Screen

5.4.10 Finish Screen

When the player complete the level, reaches this screen. It has two buttons.

Save Button: If the player wants to save his level score, click this button. So his move number and time saved with the name the player enter at the beginning. And it's added to leaderboard considering the score.

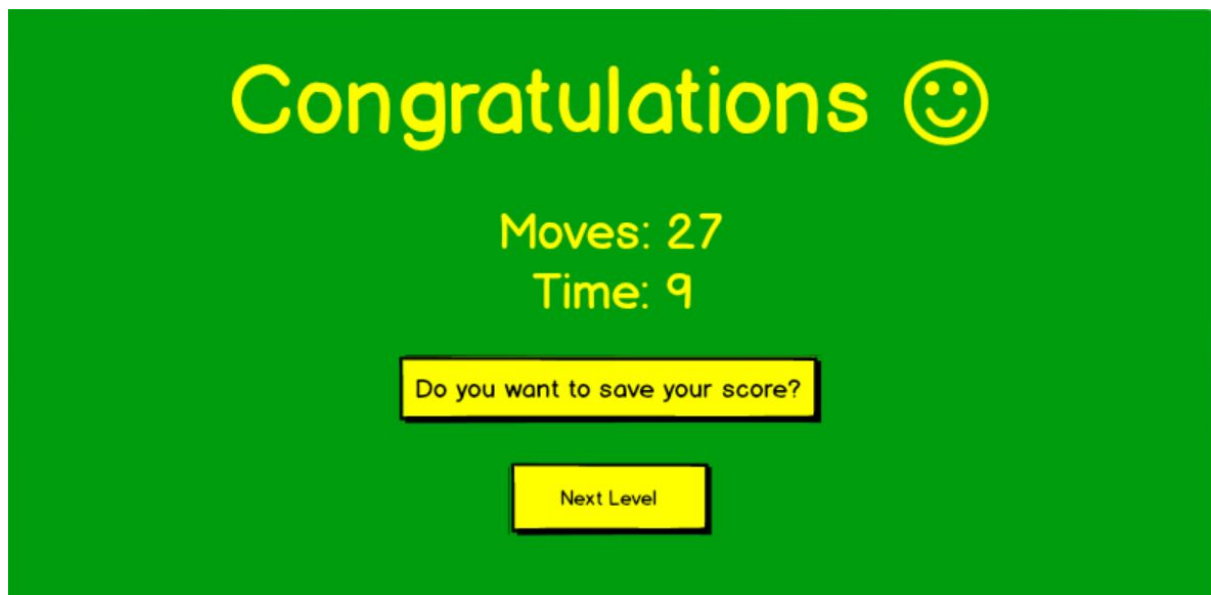**Next Level AVM:** With this button user can start to play the next level.

Figure 18 Finish Screen
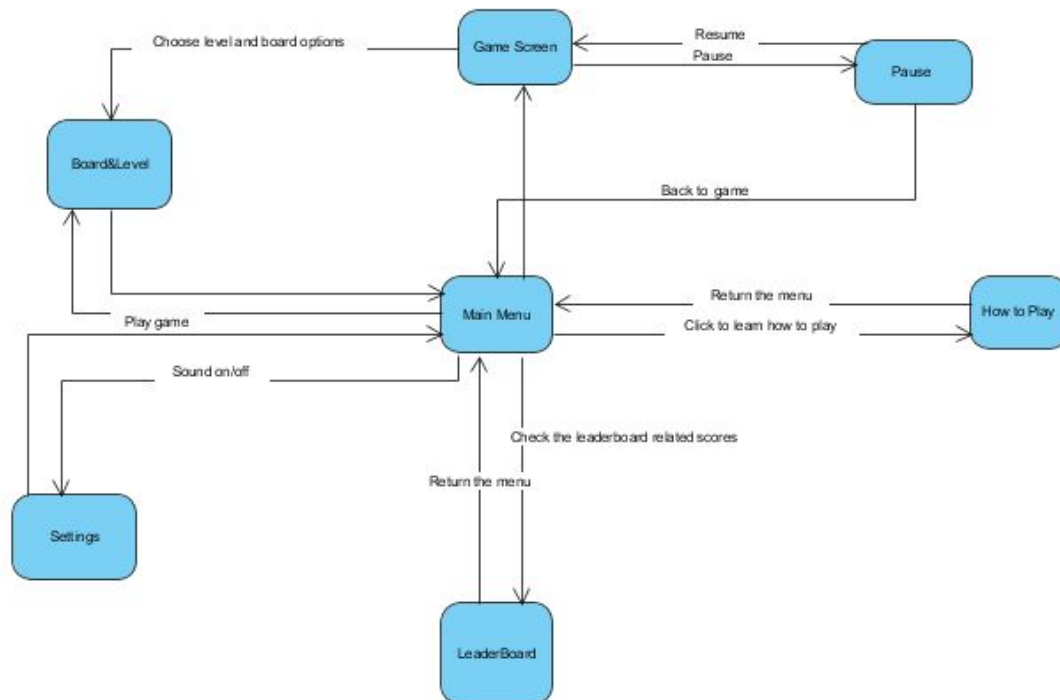
5.4.11 Navigation Path

Figure 19 Navigation Path Diagram

Navigation path diagram shows that how interfaces interacts between each other and how players go that screen and go back to specific screens

6. Improvement Summary

In first iteration, we had confusions about non-functional and functional requirements. With second iteration, we will learn and apply these concepts, comprehensively. For that step we did some minor changes about diagrams in the light of the our implementation and feedbacks from our teaching assistant and teacher. Also, we added other diagrams and edited ours. Also, we put new features onto our project as timer .

7. References

- IQ Puzzler Pro. Retriewed from
  https://www.smartgames.eu/uk/one-player-games/iq-puzzler-pro (Accessed
  27 November, 2018).