CS319 Object Oriented Software Engineering Project

Analysis Report

Iteration 2

IQ PUZZLER PRO

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1. Introduction

IQ Puzzler Pro is a puzzle board game consisting of different puzzle pieces and a board. The goal of the game is to fit all puzzle pieces together onto the map. There are different puzzle scenarios with varying difficulties. Each scenario have a different map to start from and has a unique solution.

The implemented game will include extra attributes such as score tracking and hint requesting. Furthermore, there will be online version of the game where players are able to create custom scenarios. They will be able to share them online for other players to compete for highscores.

The solo part of the game starts with easy puzzles, players should complete them to unlock harder ones. In general the easier levels have less pieces to fit. Scores are consisting of time spent and moves done in the process of completing a puzzle. The online part will not include the puzzles in the solo part, instead it will only consist of custom made maps. Every map will have a score table and popularity. To make it fair, scores include the time past since the first start of the puzzle (no option to pause). Custom maps will be proven to be completable before they are shared online.

2. Overview

The game is opened from the executable file. The main menu will be displayed which consists of “Play Online”, “Play Solo”, “Start Tutorial”, options and exit buttons. The exit button closes the application. The options button opens the configurations table where user can adjust volume. These two buttons will be available in all interfaces of the application. The “Start Tutorial” button opens a tutorial instance where basic rules of the game are presented. Any interface other than main menu will have a return button to return the prior interface.

2.1. Play Online Button

After pressing “Play Online” button the game will request the user to login to an online account in the. There will be an option to create a new account where the user enters preferred username and password to create one. After logging in to an account user will be presented with a menu consisting of three buttons: “Create Custom Puzzle”, “Browse Puzzles”, “Profile”.

2.1.1. Create Custom Puzzle

The application will request horizontal and vertical sizes of the puzzle board to create. The size values entered can be 3 at minimum and 25 at most. After entering both values the user will face an empty board (in given size values) with all kinds of puzzle pieces to select and place. There will also be buttons to rotate or flip the selected pieces. The user will then place some pieces in a not colliding way. The user will be able to refresh the board with a refresh button. After placing 3 pieces at least, the user will click the “Fill Empty Slots and Finish” button and enter a name to their puzzle to complete their custom puzzle. The game will fill the empty cells and the user will be returned back to the online interface. Created puzzles will be managed at profile interface.

2.1.2. Browse Puzzles

The user will be presented with a browsing section of custom made puzzles listed by their popularity. The puzzles will be represented by their name, creators' username and other users' scores. The user will be able to search a puzzle's name to find the puzzle. Searching can be done for usernames to find puzzles created and completed by the given name too. The user will select a puzzle and press "Play" button to start playing the puzzle.

2.1.3. Profile

The user will be presented with a browsing section of self made custom puzzles. User will be able to share these puzzles with a button near them and browse the scores done by other user. The profile interface will also have a "See Scores" button which will open the list of user's scores.

2.2. Play Solo Button

There will be 5 buttons to choose for browsing the different difficulty of puzzles. Each button will showcase how many of the puzzles are incomplete and complete. They will also show much time spent and moves done for the completed puzzles. The higher difficulty puzzles which are not accessible have a shade on their button and will not be clickable. The user will then choose one of the clickable buttons to start browsing different puzzles of same difficulty. Every puzzle will have an image of their initial board with unselectable pieces placed and scores near them if the user had already completed it. The player will select a puzzle and press "Play" button to start playing the selected puzzle.

2.3. Playing a Puzzle

There will be board and inventory parts of the panel where puzzle pieces are seen on. The interface will also contain rotating and flipping buttons to rotate and flip the selected pieces, a refresh button to return all selectable pieces to inventory, a hint button in solo

puzzles to reduce selectable pieces, time elapsed and moves done labels with their counters. The unselectable pieces will be stationed at board with a different shade than selectable pieces. The user will be able to select a piece and place it on board or drop it on inventory. Pieces' orientations can be changed on both board and inventory. The puzzle will be finished when all cells on the board are filled or the user exits.

3. Functional requirements

The core functional requirements of the puzzle are already determined by its board version. The additional requirements include using hints and score tracking. Furthermore, there are some requirements related to playing the game online.

- Player can choose the volume of sound and music
- Player can play the solo puzzles (puzzles come with the application - classic puzzles)
- Player can start a tutorial to learn how to play the game
- Solo puzzles use a 5x11 sized board and use 12 distinct puzzle pieces
- The puzzle pieces to fill in the puzzle can be both at inventory and on board
- The puzzle pieces can be rotated and flipped
- Puzzles have a timer and a move counter
- Solo puzzles have an option to get hint (places a piece to its right location on board)
- Solo puzzles are unlocked after prior difficulty levels are complete (starter / junior / expert / master / wizard)
- Player can choose to play online and create an account
- Player can log in to an already made account
- Player can browse and download a custom made puzzle online
- Player can create a custom puzzle; can choose the board size, cells available to place on board, pieces to place and give a name to it.
- Custom puzzles have their scores linked to them

- Online users have their scores linked to them
- Player can browse online scores

3.1. Additional requirements

There are no requirements added since the draft report.

4. Nonfunctional requirements

The game is required to be easy to manage and easy to play by anyone. The user-base includes various kinds of users and not everyone might have a great understanding of an usual windows game application, as this is a puzzle game targeting all ages.

- **Frame rate:** should be 15 at minimum, especially while dragging a puzzle piece. Players should see their actions on the board smoothly
- **Usability:** any intended action should be achievable under 5 clicks, menu navigation should be unambiguous
- **Response Time:** requested actions should register in the system and display updated data under 2 seconds at most
- **Scalability:** the game will have a online option where every user can access each other's shared puzzles and achievements
- **Platform compatibility:** the game should be playable on most windows operating systems; including Windows 7, Windows 8.1, Windows 10
- **Variety in custom puzzles:** There should be at least 25 different types of puzzle pieces for custom puzzles

Note: this section has no "additional requirements" section, because it is already revamped completely.

5. System models

5.1. Use case model

5.1.1. Use Case Diagram

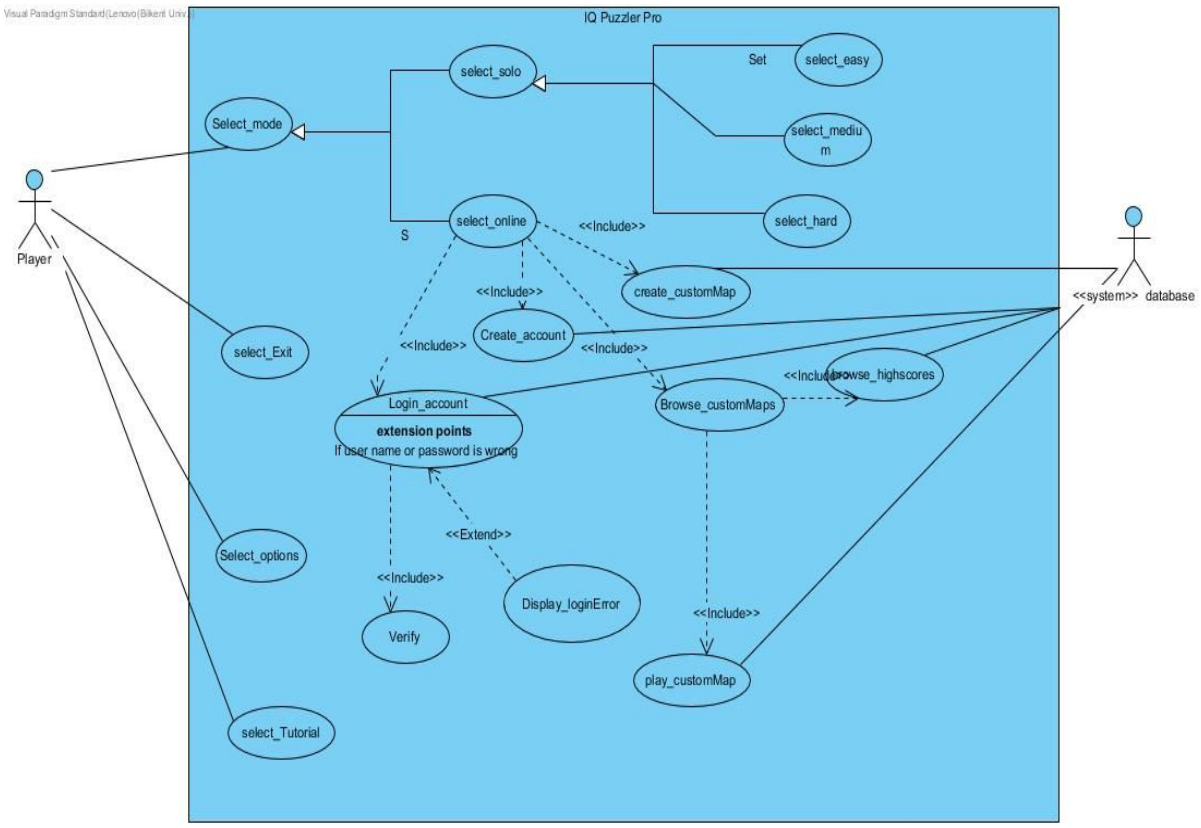


Figure 5.1.1.01 : Use Case Diagram

5.1.2. Use Case Diagram Descriptions

Use Case Name:	Select_mode
Participating Actor:	Player
Flow of events:	1. Player open game 2. Select the mode which he/she wants to play 3. System leads player to the panel of the selected option
Entry condition:	The Player opens the game
Exit condition:	The Player makes a selection between two modes
Special requirement: None	

Use Case Name:	select_solo
Participating Actor:	Player
Flow of events:	1. After select the solo option, player have to choose level he/she wants to play 2. After selecting the level, game will show up with selected level
Entry condition:	The Player selects solo from the select_mode part
Exit condition:	The Player selects level from the game
Special requirement: None	

Use Case Name:	Login_account
Participating Actor:	Player Database
Flow of events:	1. After player chose online option from the menu, the player selects log in to account 2. The Player enter user name and password correctly 3. The Player enter the account
Alternative Flow:	1. After player chose online option from the menu, select log in to account 2. Enter user name and password wrongly 3. System will give an error
Entry condition:	The Player selects online option
Exit condition:	The Player enter true user name and password
Special requirement: None	

Use Case Name:	Create_account
Participating Actor:	Player Database
Flow of events:	1. After player chose online option from the menu, player selects create account 2. Player enters user name and password 3. Player creates new account
Entry condition:	The Player chooses online option
Exit condition:	The Player creates new account

Special requirement: None

Use Case Name:	create_customMap
Participating Actor:	Player Database
Flow of events:	1. After log in the account, player may choose create a new map for other players to play 2. The player creates acceptable map 3. The player sends to the system
Entry condition:	After log in the account, the player selects to create map
Exit condition:	The Player creates new account
Special requirement: None	

Use Case Name:	browse_customMap
Participating Actor:	Player Database
Flow of events:	1. After log in the account,the player selects browse option 2. The player browses through existent maps 3. The player selects one of them
Entry condition:	The player selects browse option after log in the account

Exit condition: The Player selects one of the maps

Special requirement: None

Use Case Name: Exit

Participating Actor: Player

Flow of events:

1. select exit option and exit the game

Entry condition: The player selects exit option

Exit condition: Exit the game

Special requirement: None

Use Case Name: play_customMap

Participating Actor: Player

Flow of events:

1. After browsing the custom maps, the player selects one of them
2. System loads this map
3. The game starts

Entry condition: The player selects one of the custom maps

Exit condition: Start the game

Special requirement: None

5.2. Dynamic models

5.2.1. Sequence Diagrams

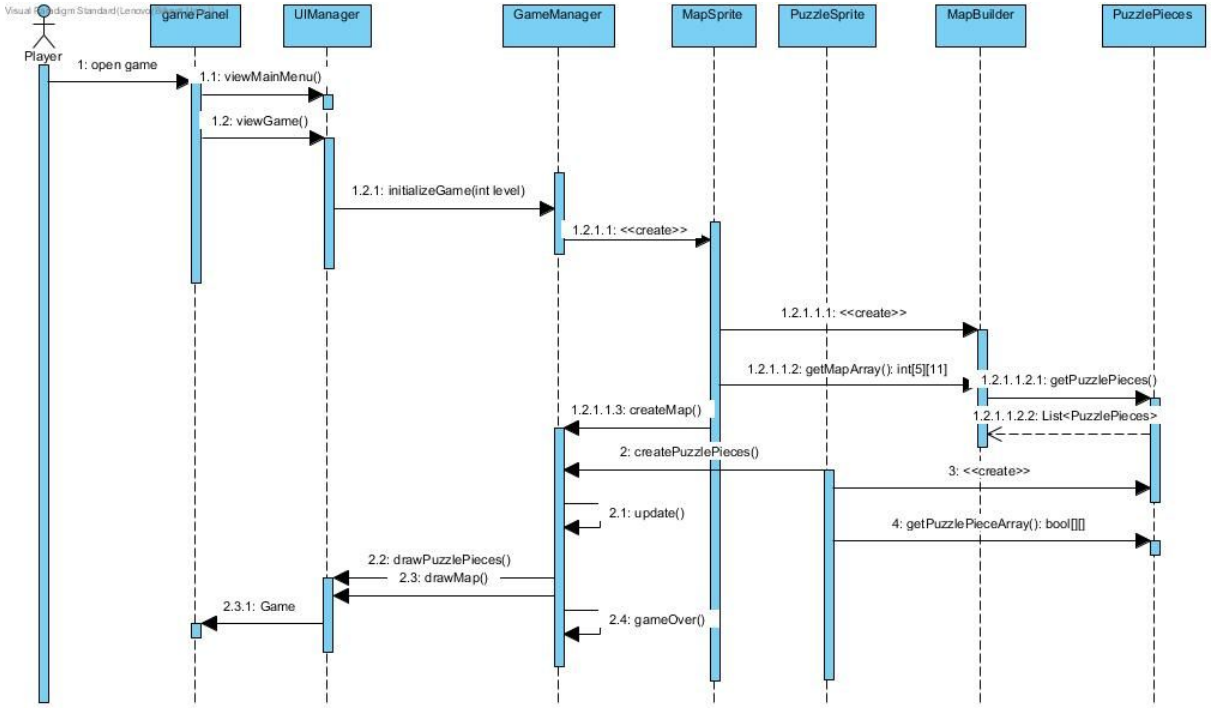


Figure 5.2.1.01: Play Solo Game Sequence Diagram

Sequence Name: Play solo game

Scenario: After the player selected the solo game option and the level player wants to play.The game manager is initialized. The game manager gets the attributes from the puzzle piece and map class based on the level. It sends these to the map sprite and puzzle piece sprite. Map sprite draws the map, puzzle sprite draws the puzzle

pieces on the panel. Thus, the game starts. There are blocks in the specific locations in the map. These blocks can’t be moved. Other than these blocks, there are blocks which are not located. The player tries to complete the map with the help of these unlocated ones. The number of the move when player tries to locate the puzzle pieces will be recorded. When the player puts an unlocated block in the puzzle, the game will be updated. The player can also change the direction of the blocks to make them fit in the blank spaces in the map. The player tries to put every pieces into the puzzle. When all the puzzle pieces is in the right place, the game will be over.

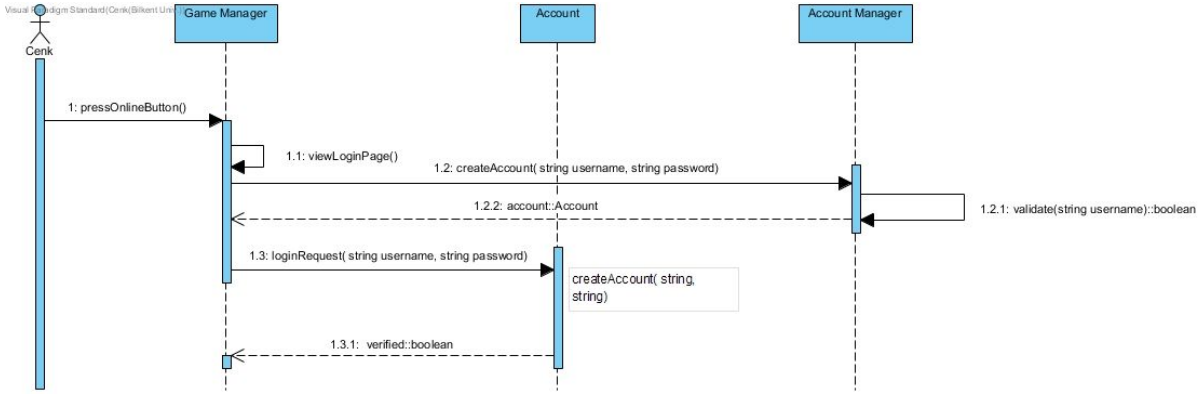


Figure 5.2.1.02: Login and Create Account Sequence Diagram

Sequence Name: Login to account or create Account

Scenario: When actor chooses the online option in the game, he/she views the login page of the game. If the actor already have an account he/she can play the online iq puzzler pro easily after typing his/her correct username, password and clicking on the login button. Also, if the actor don’t have an account they can easily get one by completing the same steps of the login part on the same page but they only have to

click on the create account button. Afterwards, if the username is already taken it will ask user to pick another one. When player creates an account they will able to play the IQ Puzzler Pro online after they login.

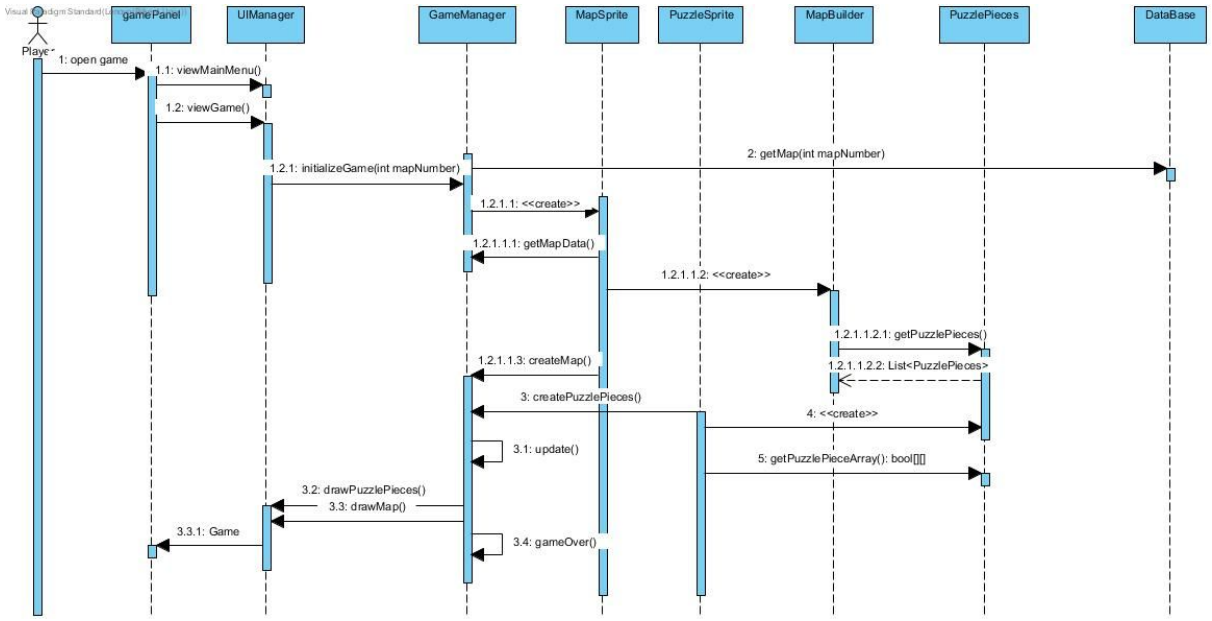


Figure 5.2.1.03: *Play Custom Map Game Sequence Diagram*

Sequence Name: Play custom map

Scenario: Firstly, the player chooses the online game option. Then, the player chooses the map which he/she wants to play. The game manager is initialized. The game manager gets the puzzle from the database manager. Game manager sends the attributes of this puzzle to the map sprite and puzzle piece sprite. Map sprite draws the map, puzzle sprite draws the puzzle pieces on the panel. Thus, the game starts. There are puzzle pieces in the specific locations in the map. These puzzle pieces can’t be moved. Other than these puzzle pieces, there are others which are not located. The player tries to complete the map with the help of these unlocated ones. The number of the move when player tries to locate the puzzle pieces will be

recorded. When the player puts an unlocated block in the puzzle, the game will be updated. The player can also change the direction of the blocks to make them fit in the blank spaces in the map. The player tries to put every pieces into the puzzle. When all the puzzle pieces is in the right place, the game will be over.

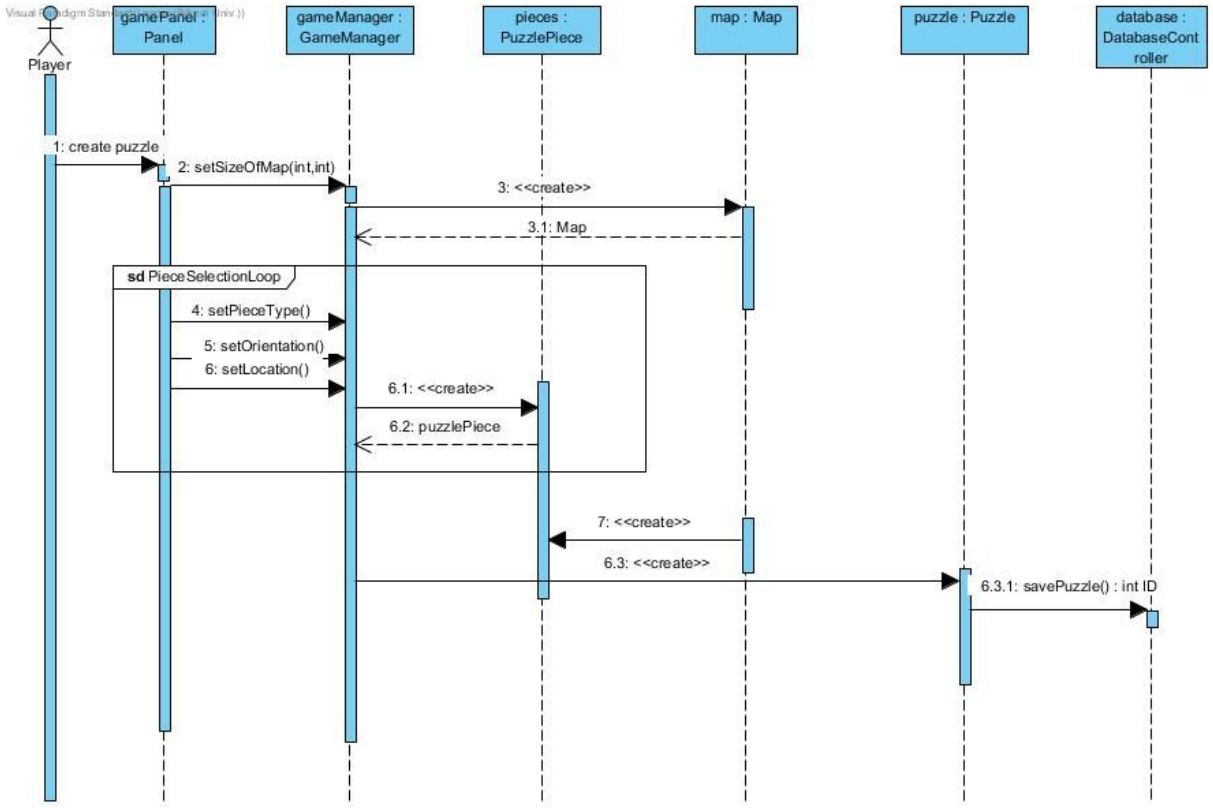


Figure 5.2.1.04 : Create Custom Puzzle Sequence Diagram

Sequence Name: Create a custom puzzle

Scenario: After an actor logs in to the online part of the game, they choose to create a custom map. They choose the size of the board by entering x and y coordinates. After setting their board size, they choose which puzzle pieces to use in their puzzle. After selecting and fitting all their puzzle pieces, they choose some pieces to be immovable. Then they complete their custom puzzle and upload it to

the online database of custom puzzles which is linked to their account automatically.

5.2.2. Activity Diagram

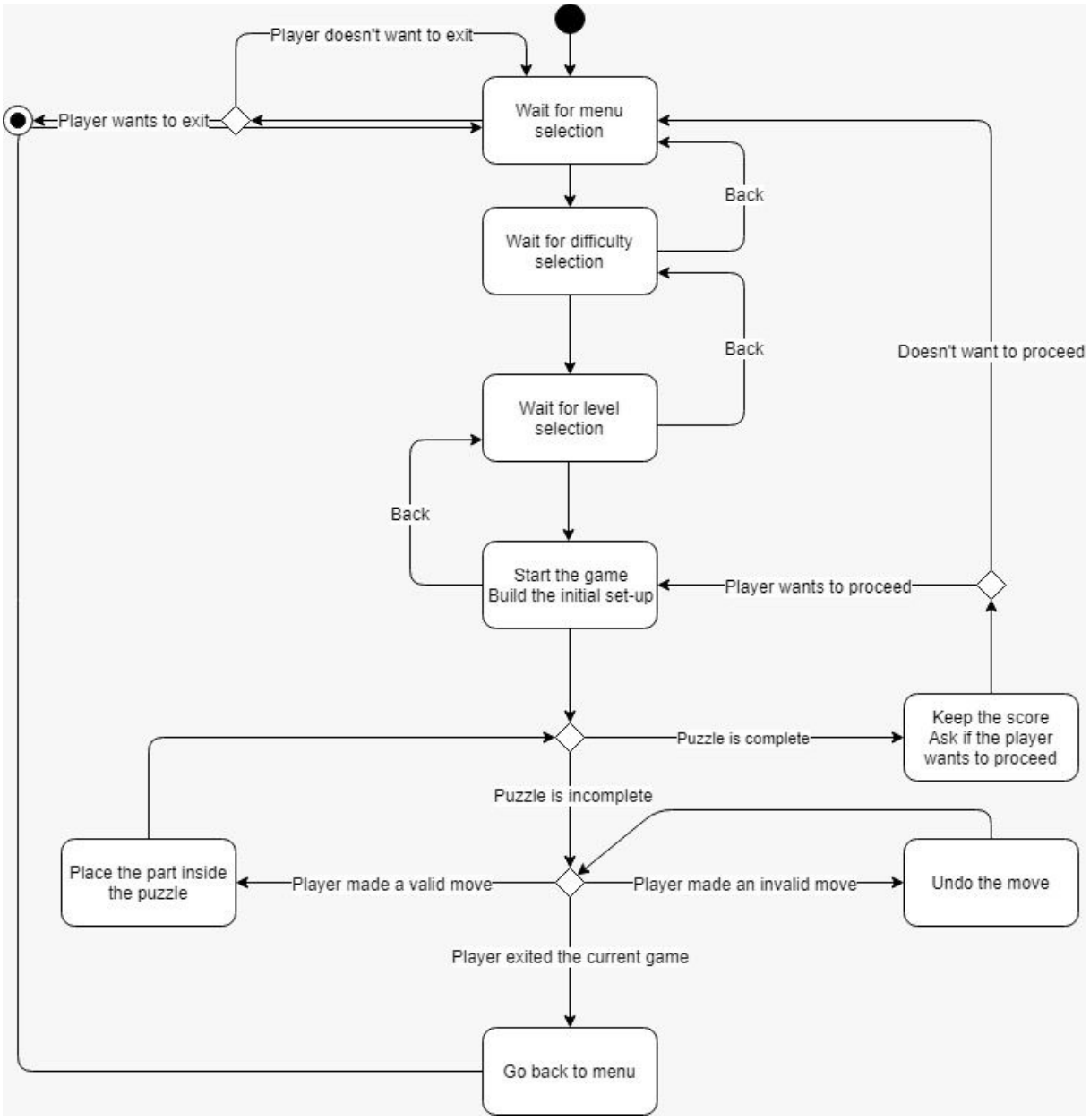


Figure 5.2.2.01: Solo Game Activity Diagram

First, the program waits until the user makes a choice in the main menu. Later the user has to choose a level from the level selection grid. After the selections are complete, the program starts the game.

Later, the program checks whether the puzzle is complete and then re-checks this after every valid move. If the puzzle is complete, the program asks if the player wants to proceed to the next level. If they do so, next level begins, if not, they are redirected back to main menu.

If the puzzle is not complete, the player has to make a move. If the move is a valid one, the program checks whether the puzzle is complete or not once again. If the move is invalid, the placement of the last block resets and the player gets to play the last move again.

If the player chooses to exit the game instead of making a move, he or she is redirected back to the level selection. Not redirected to the main menu because it’s a game with multiple puzzle’s so it is more likely for a player to exit a game without finishing it in order to play another puzzle rather than going back to the main menu where he or she needs to choose the game type again.

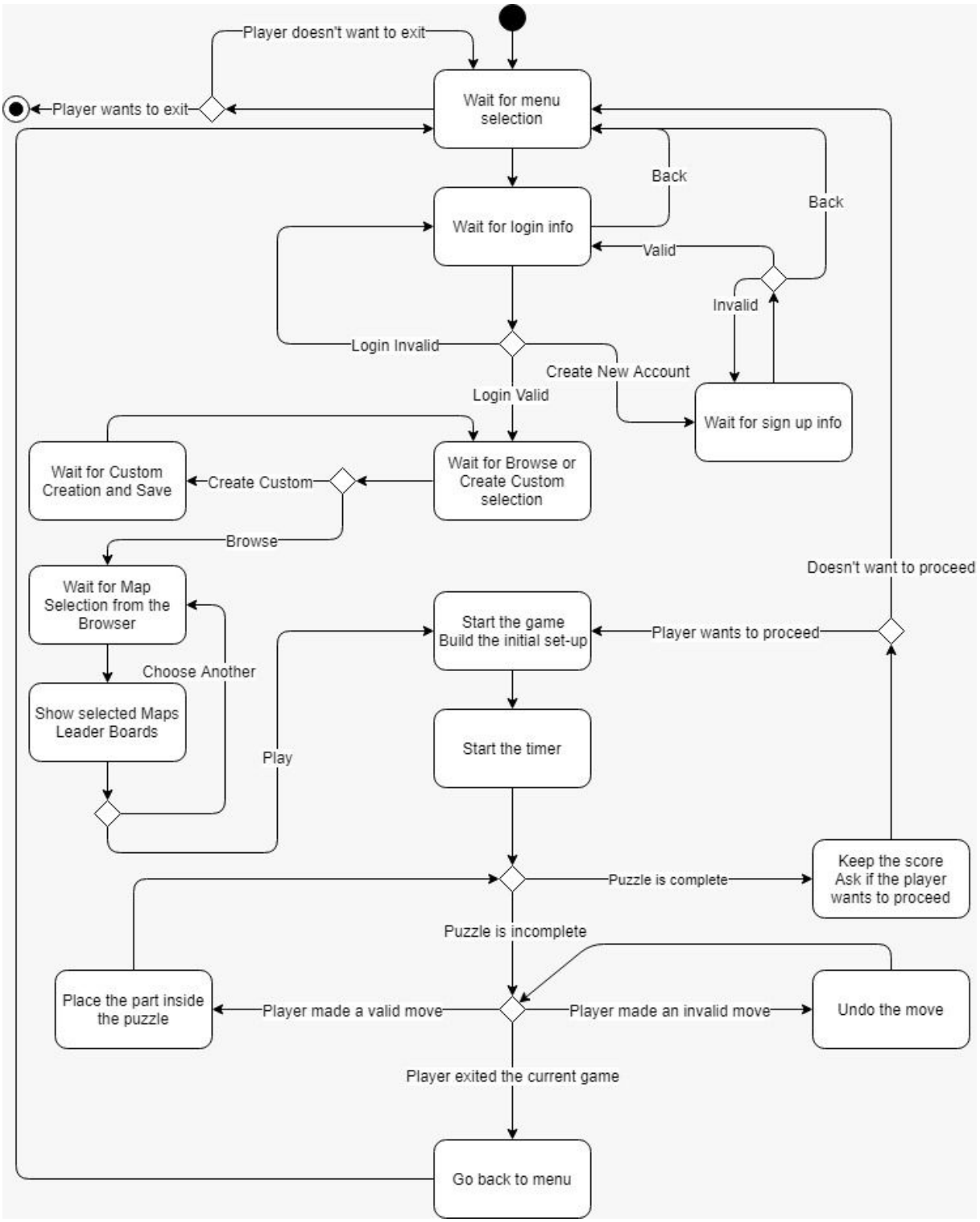


Figure 5.2.2.02: Online Game Activity Diagram

First, the program waits until the user makes a choice in the main menu. Later the user has to login the account. User can select login the account or create the

account. If the user selects the create account, program waits the user to create a new account. If the user chooses the login and the login is valid, the program gives permission to browse maps or create map. When the user browse the maps and select one of them, the game starts.

Later, the program checks whether the puzzle is complete and then re-checks this after every valid move. If the puzzle is complete, the user can select another puzzle.

If the puzzle is not complete, the player has to make a move. If the move is a valid one, the program checks whether the puzzle is complete or not once again. If the move is invalid, the placement of the last block resets and the player gets to play the last move again.

If the player chooses to exit the game instead of making a move, he or she is redirected back to menu.

If the player chooses to create custom map. The player creates and saves it. The program saves the puzzle to the data and add the puzzle in the browse custom maps section.

5.2.3. State Diagrams

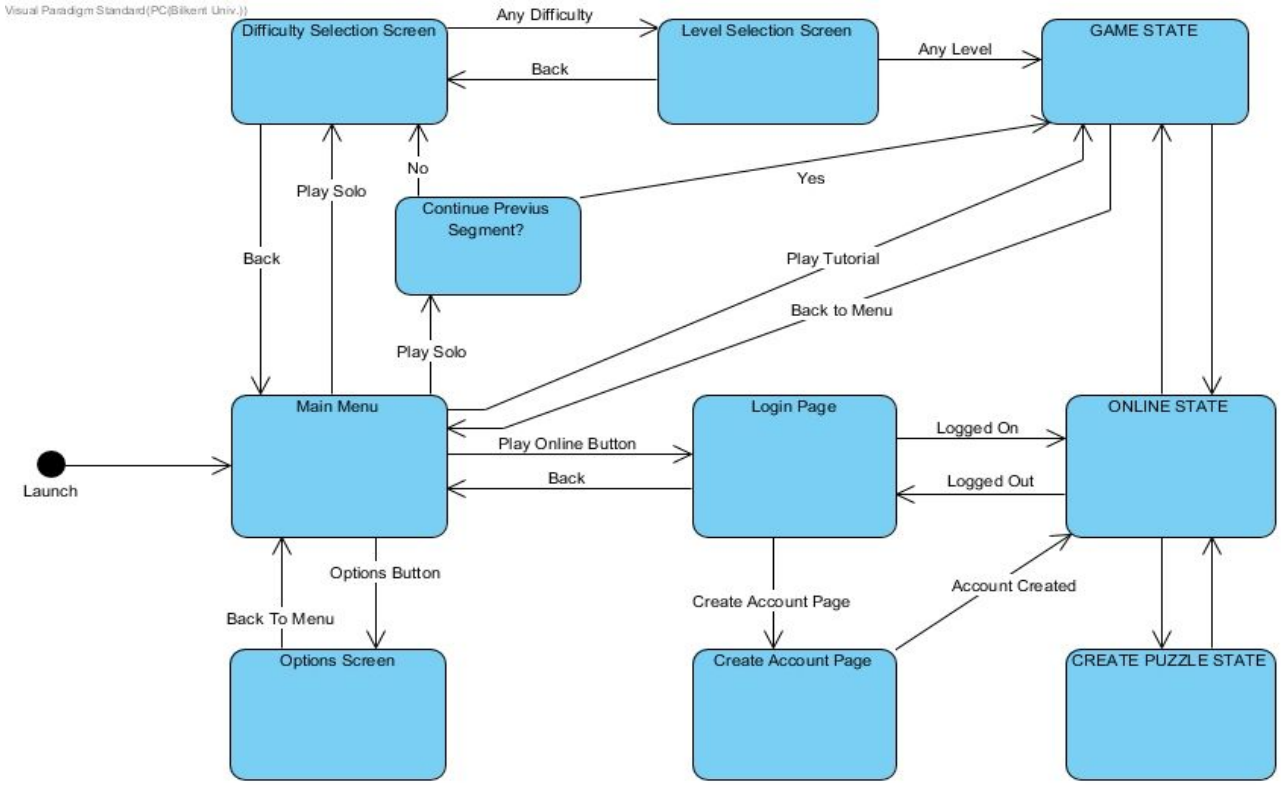


Figure 5.2.3.01 Overall State Diagram

Overall State Diagram: Above there is an overall state diagram that shows the states of the whole program. The initial state starts with clicking the game icon, and final state occurs by exiting from the main menu (the situation of directly clicking the toolbar exit button is neglected). Some of the states such as “GAME STATE” or “ONLINE STATE” form their own detailed sequence diagrams.

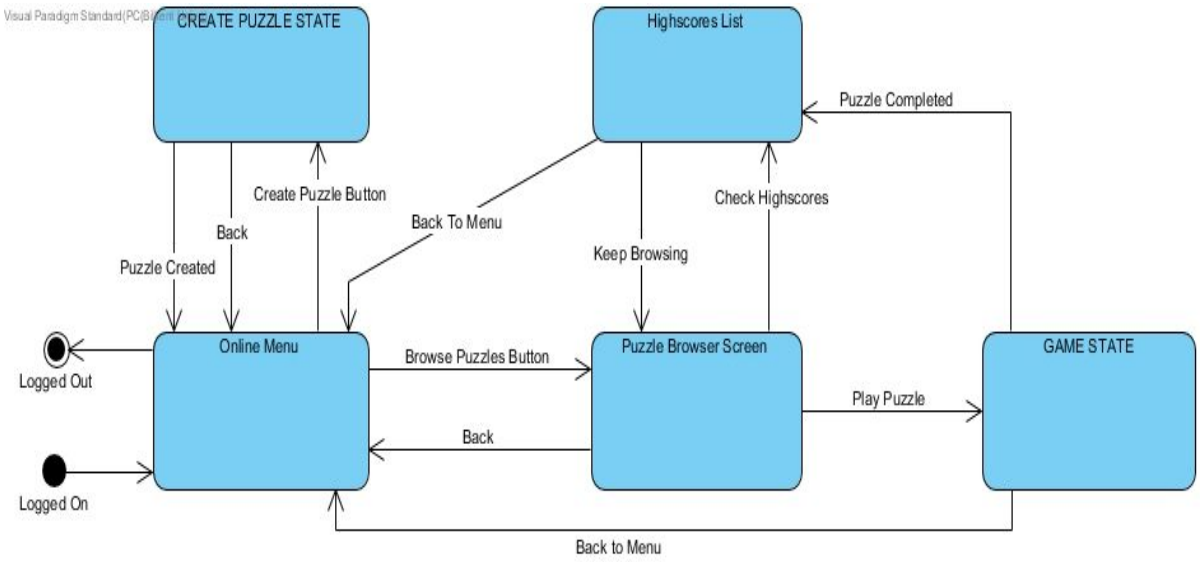


Figure 5.2.3.02 Online Mode State Diagram

Online Mode State Diagram: Above there is an online mode diagram that shows all states after opening online mode. The initial state starts with logging in or creating an account, and final state occurs by logging out. All the maps made in this mode could be browsed and played, also highscores could be checked, and new puzzles can be created. However, creating puzzle has its own state diagram.

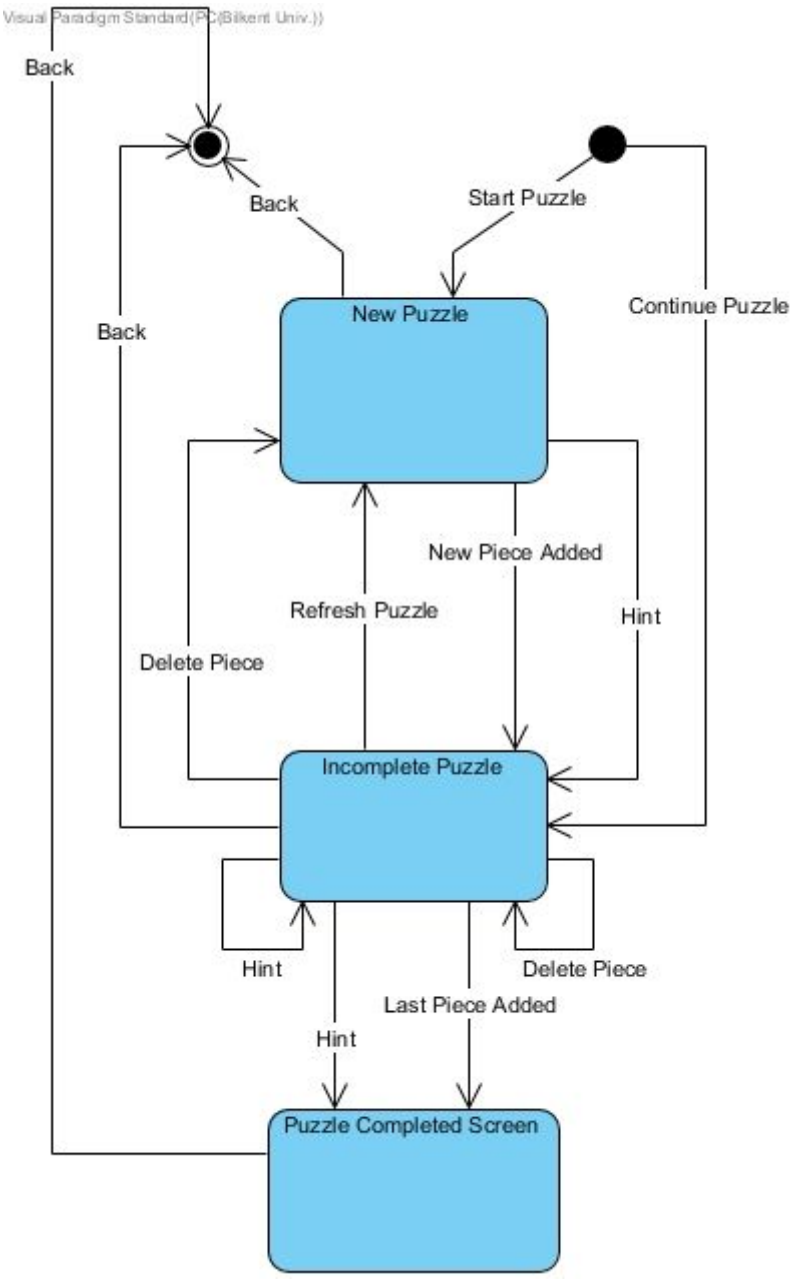


Figure 5.2.3.03 Gameplay State Diagram

Gameplay State Diagram: Above there is a gameplay state diagram which shows the states that occur during solving a puzzle. The initial state starts with choosing a puzzle through solo or online mode, or pressing tutorial button. Final state occurs by leaving the puzzle or solving it. Adding pieces can be done by drag and drop or using hints. When puzzle is completed, user can go back to main menu or online menu.

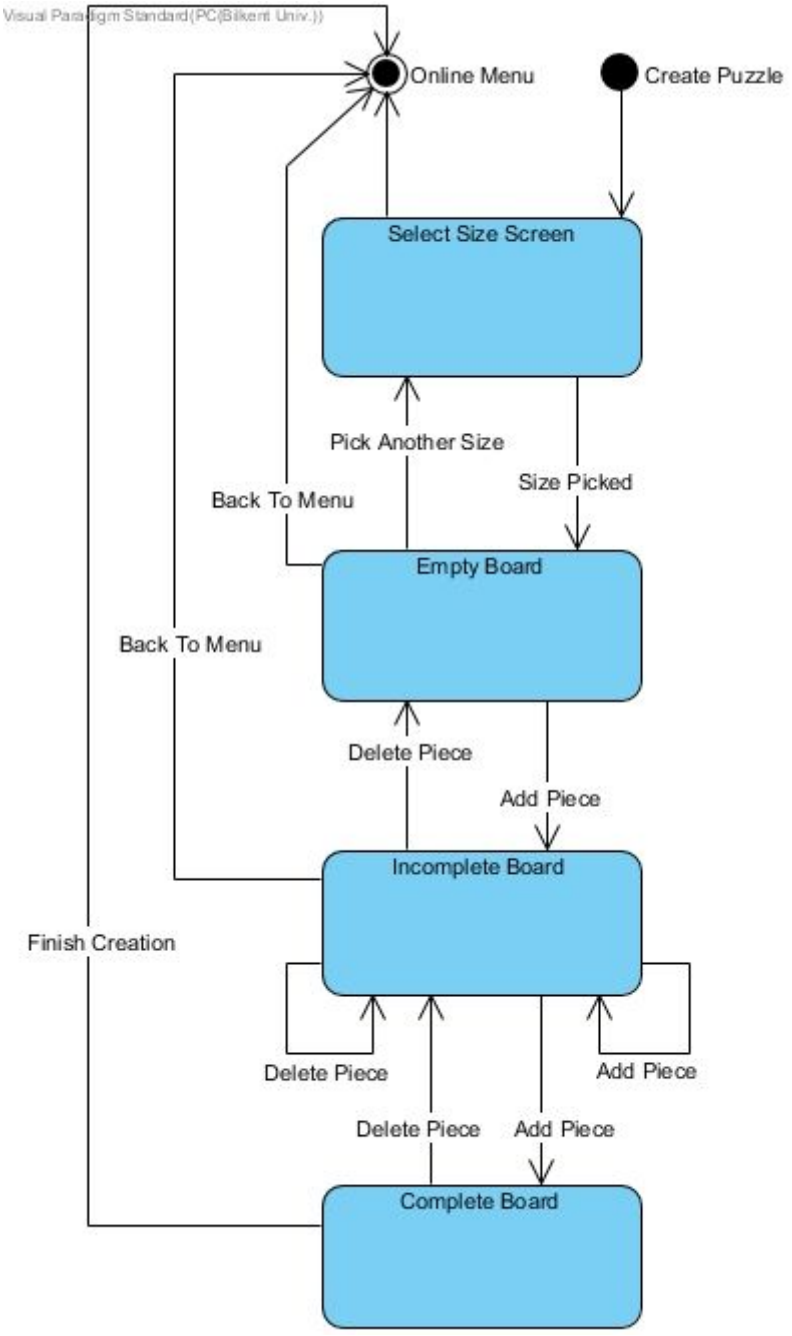


Figure 5.2.3.04 Create Puzzle State Diagram

Create Puzzle State Diagram: Above there is a create puzzle state diagram which shows the states that occur in custom puzzle creation mode. Initial state starts by choosing create custom puzzle through online mode and final state occurs by going back to menu after or before creating the puzzle

5.3. Object and class model

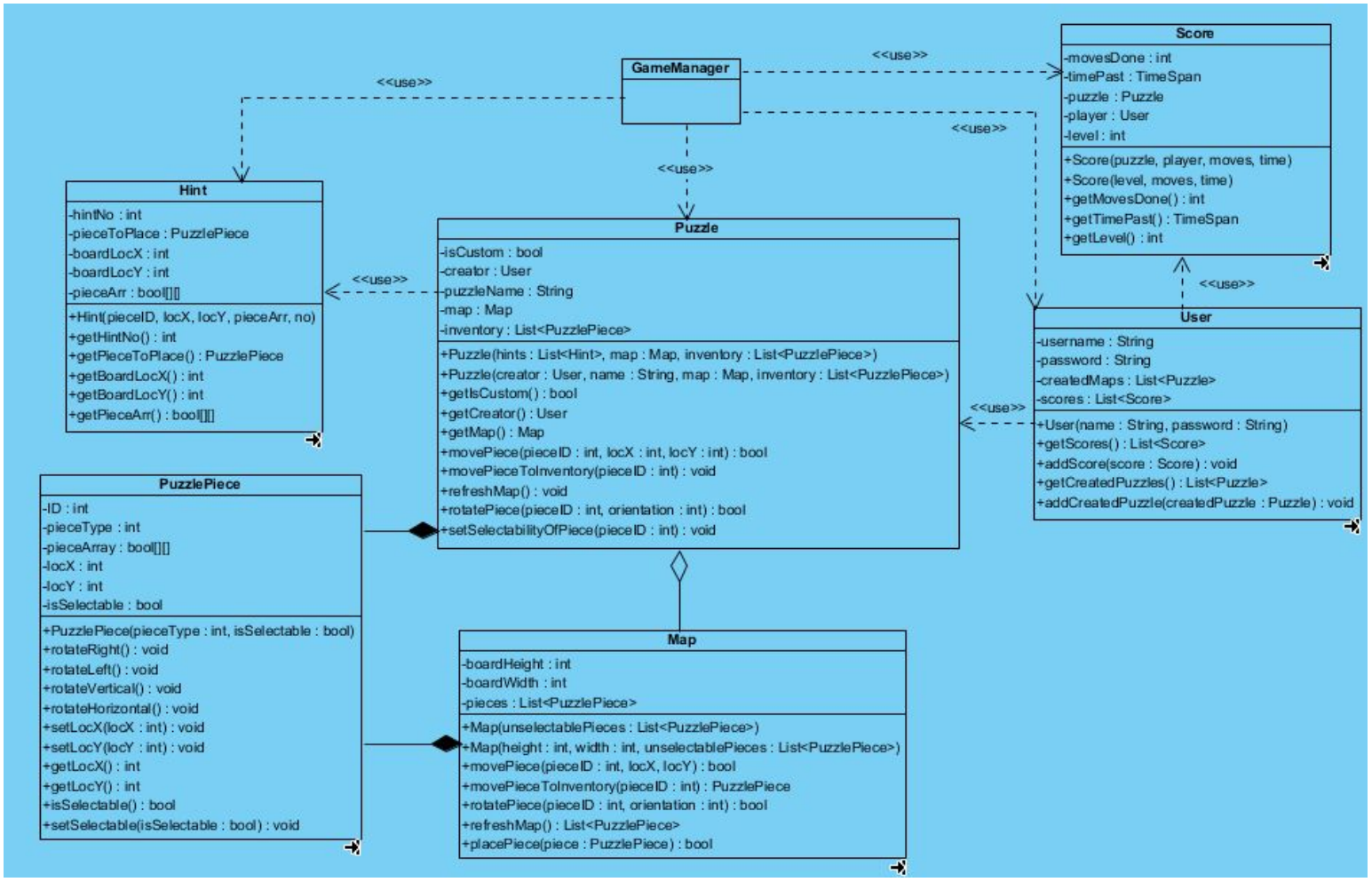
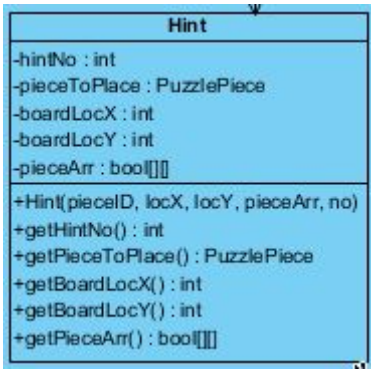


Figure 5.3.01 Class Diagram

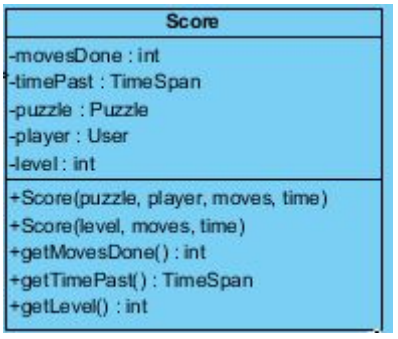
The core objects of the game can be seen in this class diagram. The GameManager class will be a controller class of these model classes. In summary, Puzzles are consisting of a map and unplaced puzzle pieces. Maps have a height and width and includes placed pieces. Puzzle pieces store how they fill a 4x4 grid and where this grid is located on the board (or if they are not located on board). Hints are used by game manager to adjust the puzzle and map to make the puzzle easier. Similarly, score objects are generated by the game manager when the puzzle is complete. Lastly, User objects are only used in playing online.

5.3.1. Hint Class



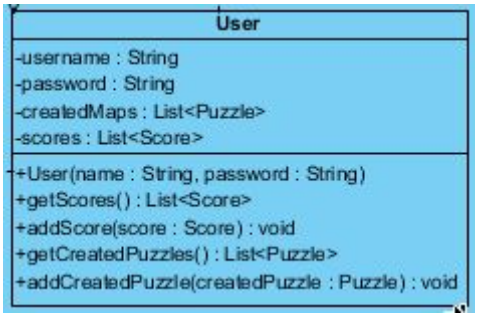
An hint object in essence is a static puzzle piece object. It has no functionalities other than storing a correct location of a puzzle piece. When the user requests using a hint, the game manager refreshes the puzzle and places a selectable piece to its correct location and makes it unselectable by using data from hint object. Hints are possible to implement for custom puzzles but are not required to be done. Easy puzzles should have few hints while harder puzzles have enough.

5.3.2. Score Class



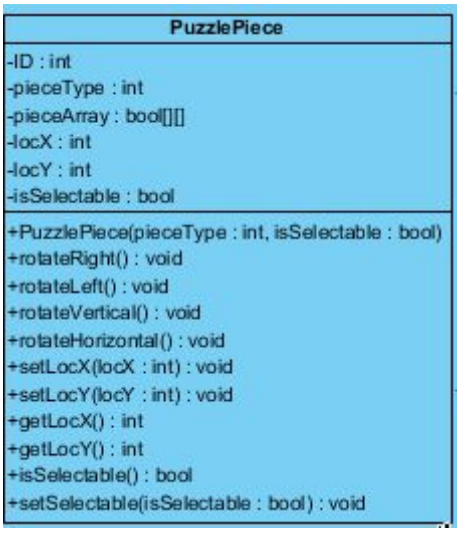
Score objects are created after completion of a puzzle. Solo puzzles' scores are constructed by passing level as an argument while custom puzzles' scores are constructed by passing a link to an user (completing player) and puzzle (completed puzzle).

5.3.3 User Class



User objects are created when a user creates a new account from the login screen. User objects have links to maps created and scores achieved by them in online. An user's password will not be available to any other user.

5.3.4 Puzzle Piece Class



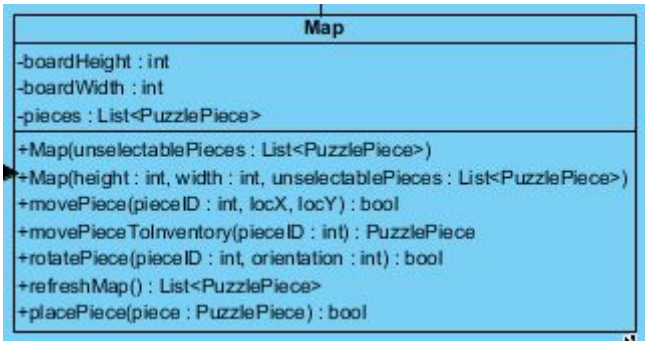
The PuzzlePiece class is the core class of the game. A singular PuzzlePiece object stores how it fills its own 4x4 grid and where this grid is located in. Thus, all pieces of a puzzle

combined represents which cells of the board is filled and which are not. Each piece has the capability to rotate and flip itself, and stores if they are selectable by the player or not.

int ID : Every piece in a puzzle has a unique ID number to differentiate between them

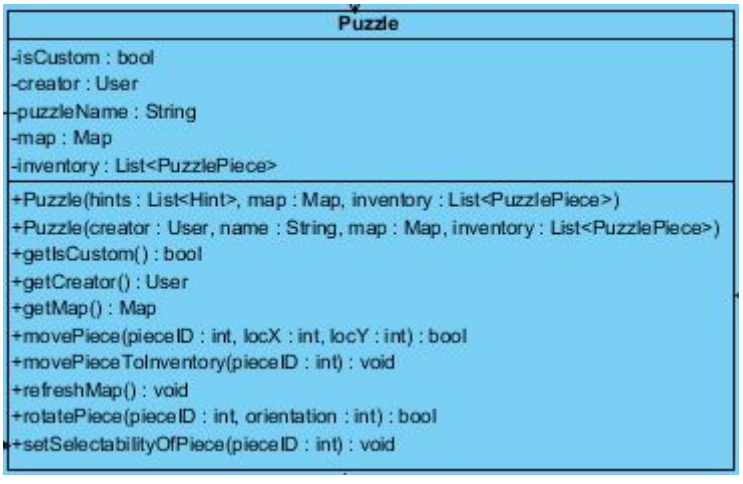
int pieceType: There are set number of piece types, each piece type has unique states after rotations and flips.

5.3.5 Map Class



Map is where placed pieces are stored at. Map objects also store the board size values. Every puzzle object will have only one map object.

5.3.6 Puzzle Class



Puzzles can be both standard or custom. Standard puzzles are used in solo play and are designed by Smart Games. Custom puzzles are designed by users of the application

online. Shared custom puzzles should be stored in an online database. Puzzle object has a map and a list of objects which represent the unplaced inventory objects. The game manager will access to puzzle pieces by accessing the puzzle.

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

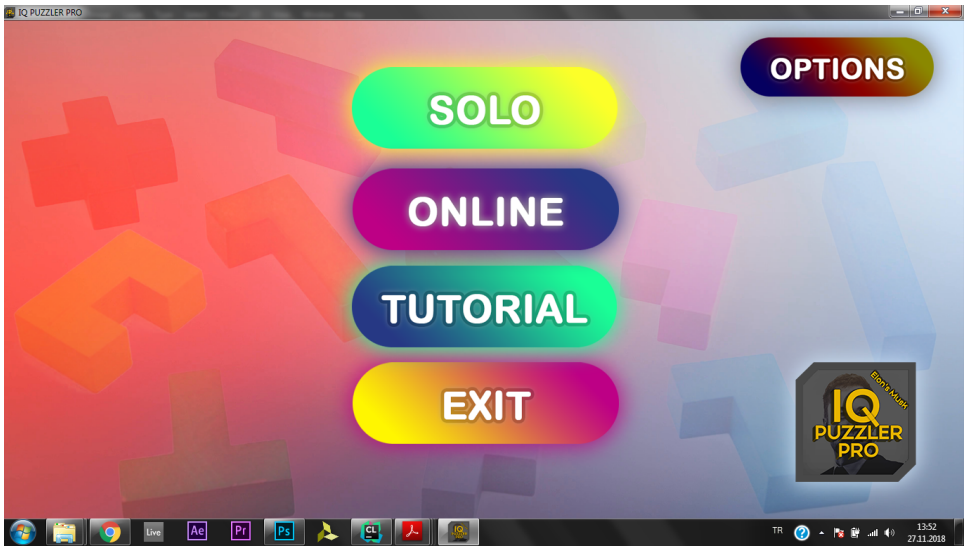


Figure 5.4.01 Main Menu Screen

On Main Menu Screen, there will be 5 buttons. Solo and Online Buttons will be leading layers to play games according to their choices. Options Button is for setting Sound Effects and Music volumes. Tutorial button is for new players who does not know how to play and learn. Once the Player clicks exit button, the program will be exited.

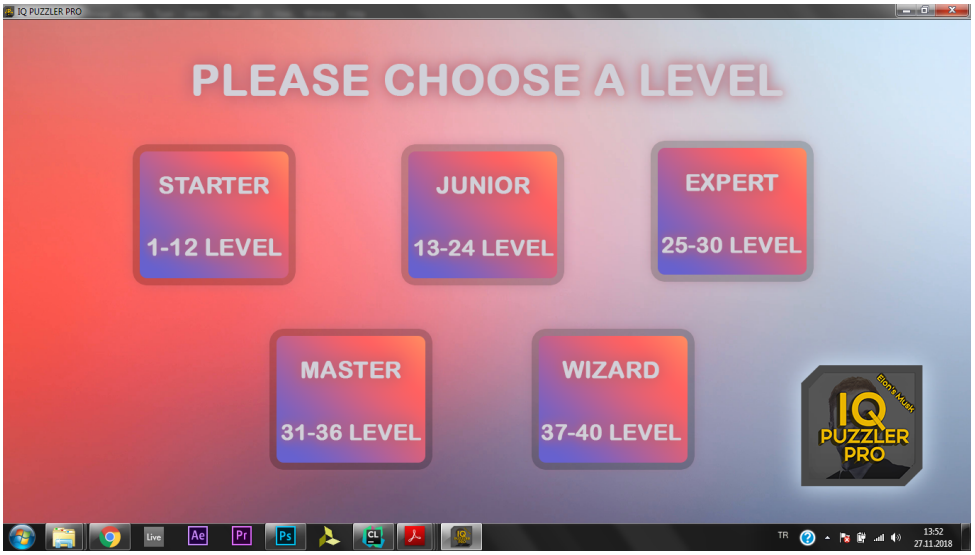


Figure 5.4.02 Solo Level Selection Menu Screen

According to Real-Board Game, there are 5 difficulty levels which are Starter, Junior, Expert, Master, Wizard.

Figure 5.4.03 Solo Map Selection Menu Screen

Solo Map Selection Screen will be showing all solo maps and allowing users to play selected map. If the map is completed, there will be check icon over map thumbnail. Once the user selected the map and pressed the Play button, Solo Play Game Play Screen will be shown.

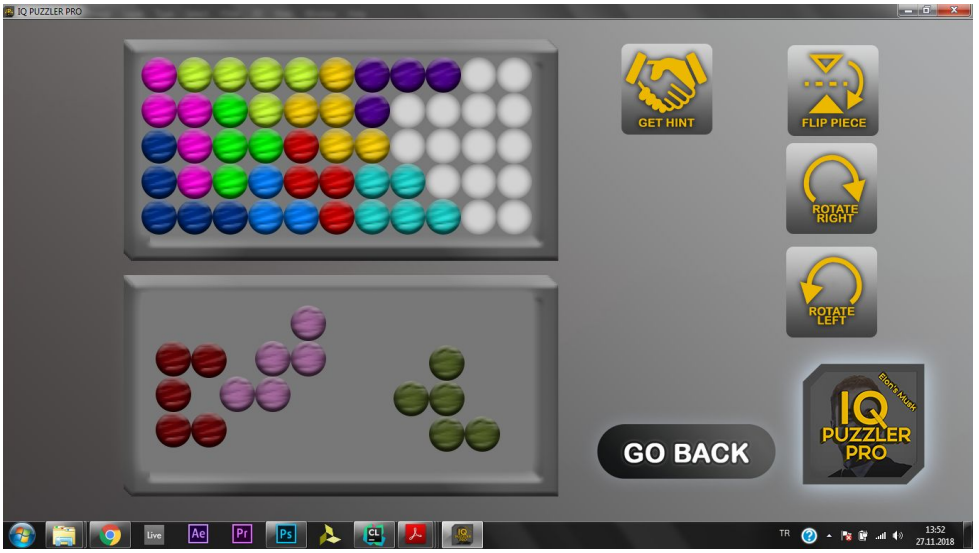


Figure 5.4.04 Solo Game Play Screen

In Solo Game Play Game Screen, number of moves will be shown. Below, the board to be completed is located. And there is a Inventory box that includes necessary pieces that will be

used to complete the board. When the Get Hint Button is pressed, hint to complete puzzle will be shown. Also on the right there are 4 buttons. One of them (Get Hint) is to get hint. Other ones for flipping and rotating.

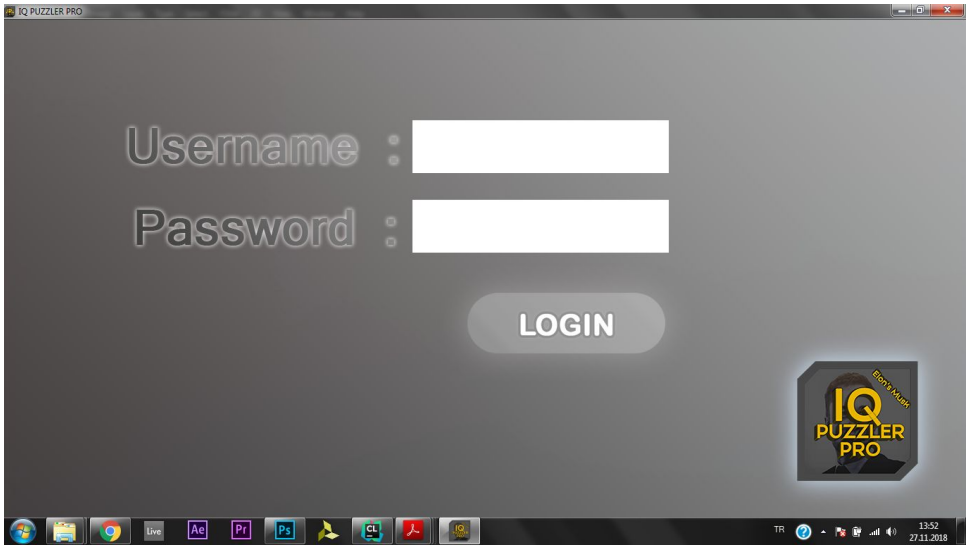


Figure 5.4.05 Online Login Screen

Online Login Screen has two input boxes to fill with Username and Password and Login Button if user created account. If not, there is a Create an Account link to Account Creation Screen.

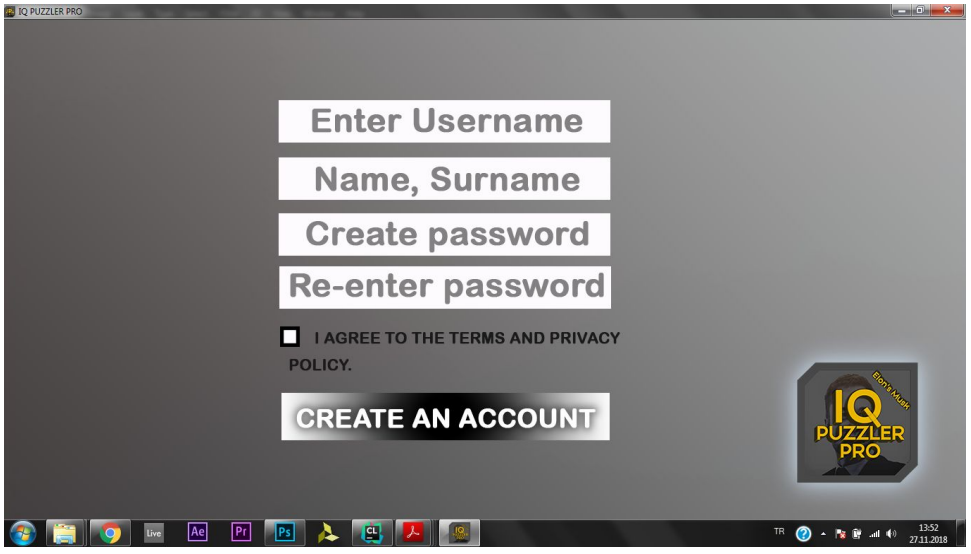


Figure 5.4.06 Account Creation Screen

Account Creation Screen will be requesting Username, Name and Surname, Password and re-writing Password again. Also there will be a checkbox which is a requirement to be selected to create a new account. Once the Create An Account Button is pressed and all of pre-mentioned text boxes are filled, the program will be directing user to Online Selection Screen.

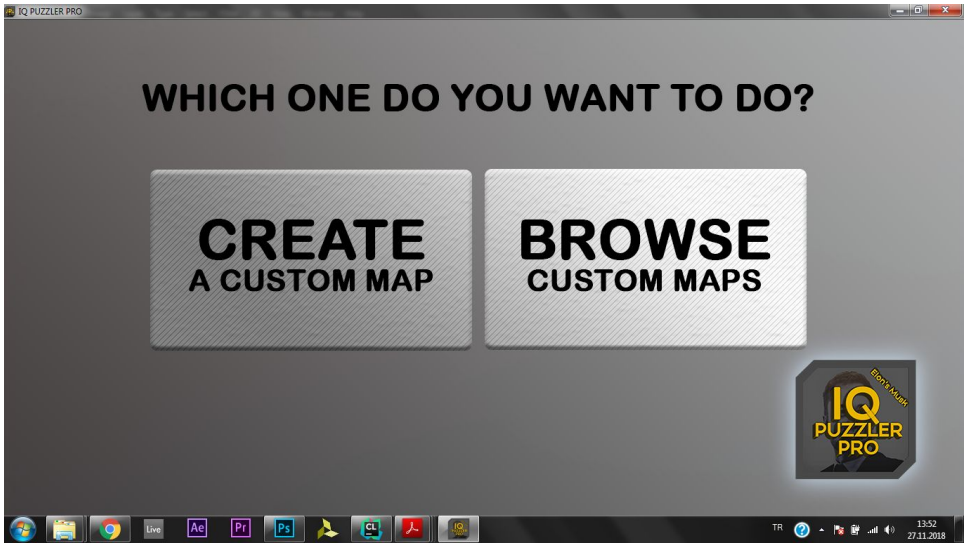


Figure 5.4.07 Online Menu Screen

Online Menu Screen have 2 buttons which is for creating a custom map and another for browsing custom maps which are created by another users.

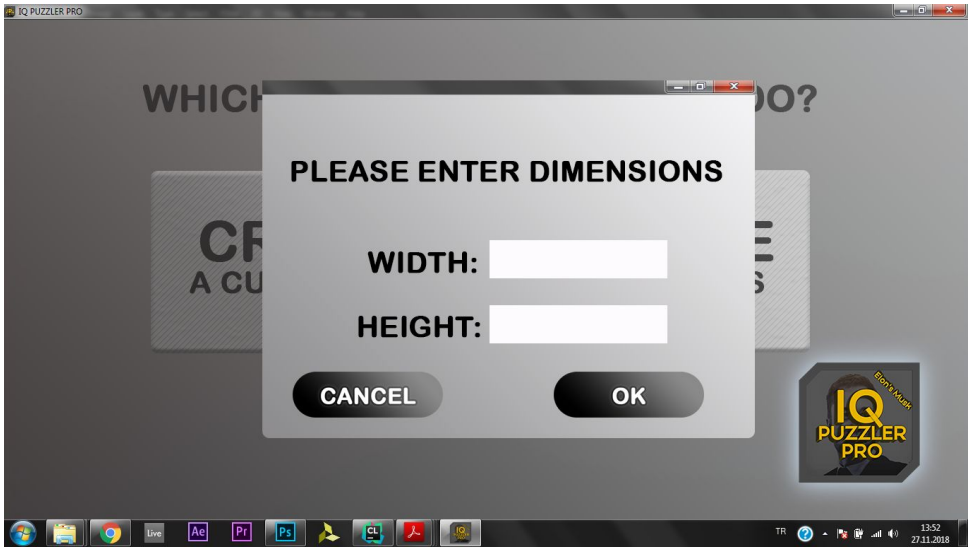


Figure 5.4.08 Online Custom Map Creation Dimension Screen

This pop-up is for user who wants to create their custom map. They will be selecting height and width of the board and once they hit the Begin Button, they will be directed to Online Custom Map Creation Screen with entered dimensions.

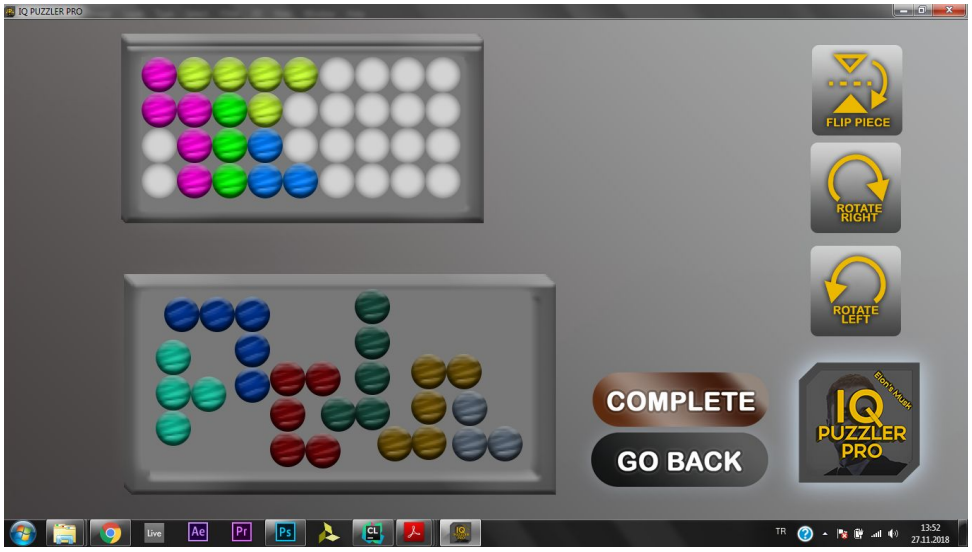


Figure 5.4.09 Online Custom Map Creation Screen

Online Custom Map Creation Screen will show the board and all blocks, instructions and user details as the same as previous screens. User can deactivate some blocks such that player who plays this map cannot relocate this block. Also rotation and refresh puzzle buttons are the same as gameplay screen.

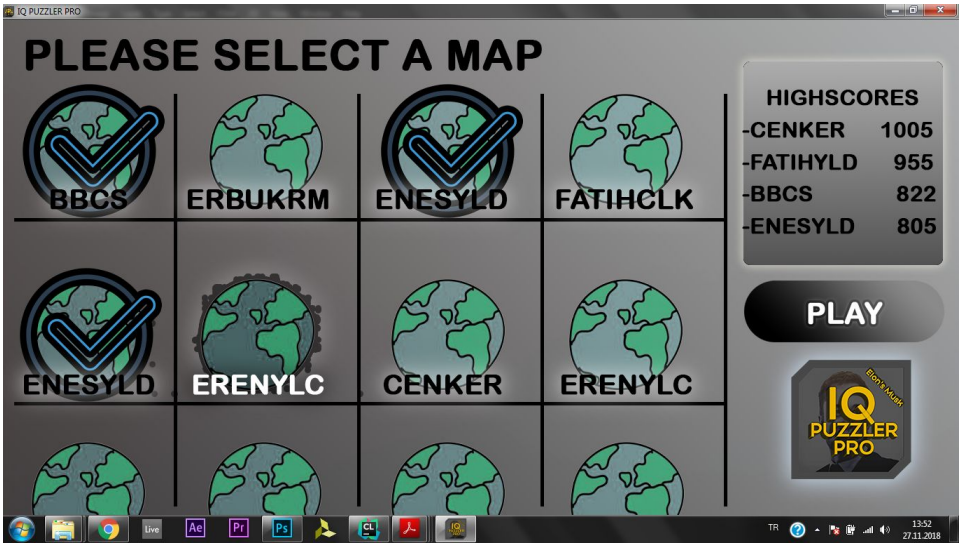


Figure 5.4.10 Online Browse Map Screen

Online Browse Maps Screen will be showing all maps in ascending order with popularity.If the user played any map, there will be check icon over this map.Also when user clicks one map High Scores of this map will be shown and by clicking Play button, user will be directed to Online Game Play Map Screen.

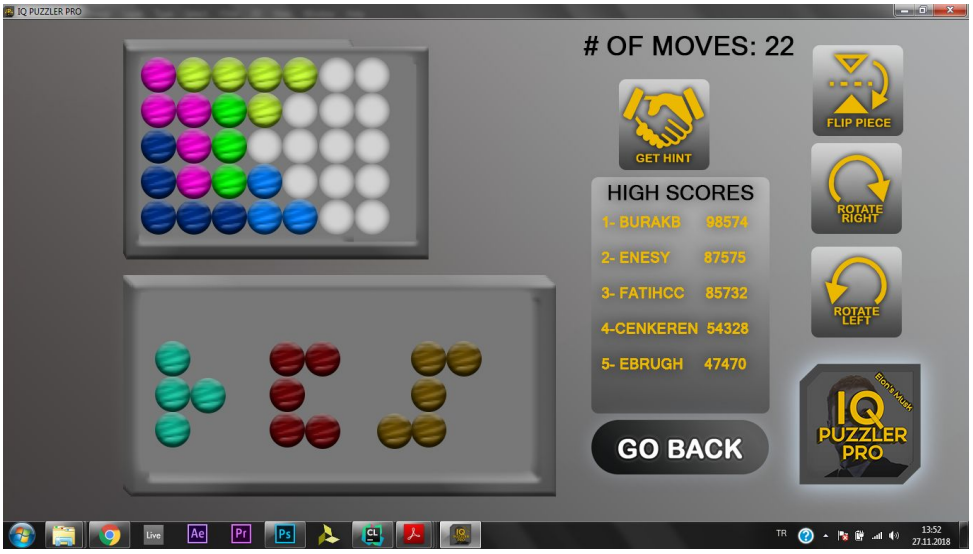


Figure 5.4.11 Online Game Play Screen

Online Game Play Screen will be counting moves and displaying it on the top. Board will be completed by dragging from inventory area to board area. Right of the board, there will be same buttons as Solo Play Game Screen and their functions will be the same. High Scores of this map will be shown as well.

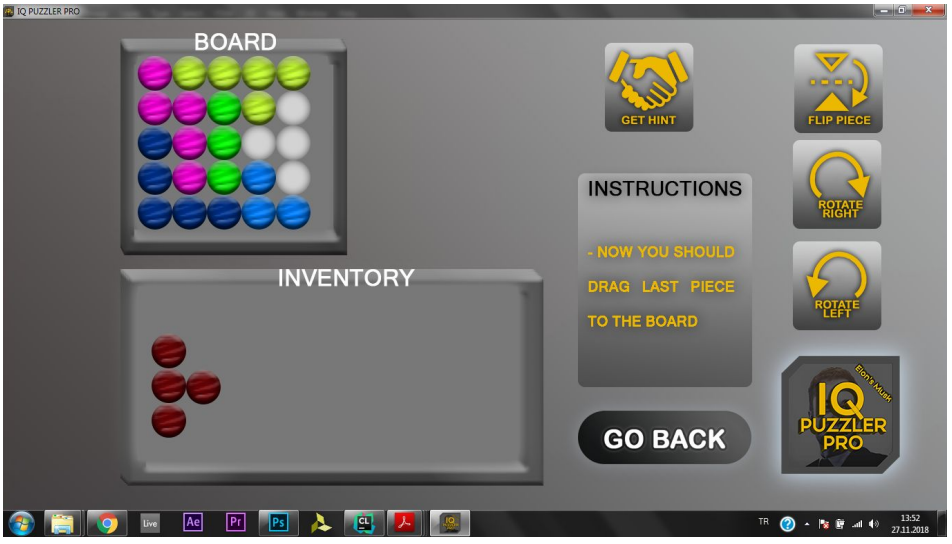


Figure 5.4.12 Tutorial Screen

Tutorial Screen will be showing a simple game with Instructions. Board with less dimensions and less blocks will help users to be familiar. Right of the board, there will be same buttons as Solo Game Play Screen and their function will be the same.

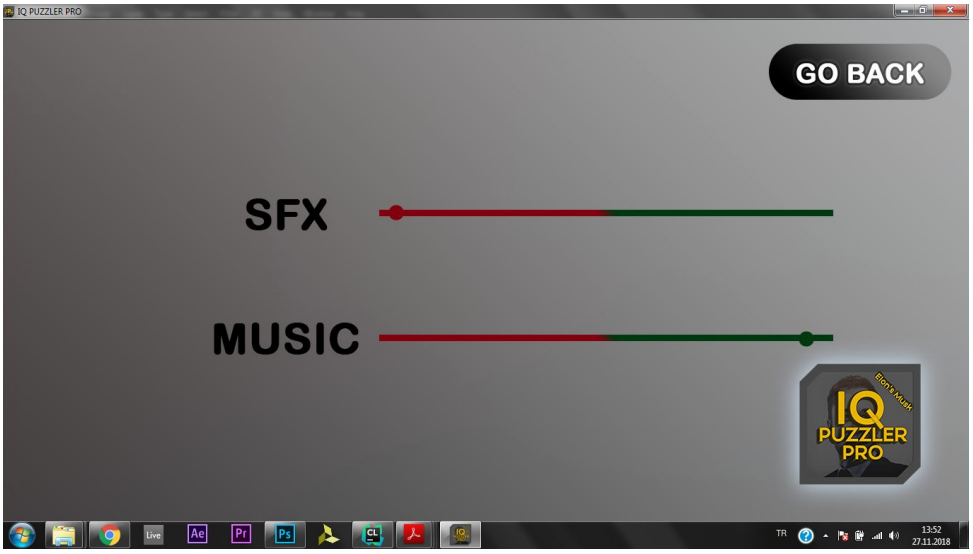


Figure 5.4.13 Options Screen

Options Screen is for setting volumes of sound effects and music by sliding. Also there are buttons to mute each of them. Clicking Go to Menu will be directing users to Welcome Screen.

Better Resolution Can Be Reached From:

http://bit.do/userInterfaceMockups

6. Improvement summary

The Overview and Nonfunctional Requirements sections had a total revamp. Overview is now more complete and nonfunctional requirements are actually nonfunctional and are based on recognizable topics. Functional requirements section had some additions

too. Object and Class Model section is changed to represent only the Model classes of the project.

7. Glossary & references

Frame rate: The frequency at which frames in the computer graphics sequence are displayed.

Application: Software designed version of IQ Puzzler Pro

Platform: A standard for the hardware of a computer system, which determines what kinds of software it can run.

Windows: A widely used operating system for personal computers.

System: A group of related hardware units or programs or both, especially when dedicated to a single application.

Executable file: A file that is used to perform various functions or operations on a computer.

Configurations table: A panel where configurations for the application can be changeable

Panel: A particular arrangement of information grouped together for presentation to users in a window or pop-up

Main menu: The starting point of the application

Puzzle piece: A piece that fits in the puzzle board

Level: A preloaded puzzle in the application

Class diagram: A type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations, and the relationships among objects.

References

[1] IQ Puzzler Pro the board game made by Smart Games, https://www.smartgames.eu/uk/one-player-games/iq-puzzler-pro

[2] Visual diagrams are made in Visual Paradigm, https://www.visual-paradigm.com/

[3] Screen mockups are made in Balsamiq, https://balsamiq.com/