



Bilkent University

Department of Computer Engineering

Senior Design Project

Project short-name: TurnTheTables

Analysis Report

Beyza Tuğçe Bilgiç

Emine Ayşe Sunar

Hareem Larik

Kaan Aktürk

Supervisor: Uğur Gündükay

Jury Members: Özgür Ulusoy and İbrahim Körpeoğlu

Project Analysis Report

Nov 12, 2018

This report is submitted to the Department of Computer Engineering of Bilkent University in partial fulfillment of the requirements of the Senior Design Project course CS491.

Contents

1.0 Introduction.....	3
2. Current System	4
3. Proposed System	5
3.1 Overview	5
3.2 Functional Requirements	5
3.3 Nonfunctional Requirements	6
3.3.1 Usability.....	6
3.3.2 Compatibility.....	6
3.3.3 Performance.....	6
3.3.4 Security	6
3.3.5 Reliability.....	6
3.3.6 Testing	6
3.3.7 Extensibility	6
3.3.8 Efficiency	6
3.4 Pseudo Requirements	7
3.4.1 Implementation Pseudo Requirements	7
3.4.2 Economic Pseudo Requirements	7
3.4.3 Social Pseudo Requirements	7
3.4.4 Sustainability Pseudo Requirements	7
3.4.5 Ethical Pseudo Requirements	7
3.4.6 Time Pseudo Requirements.....	8
3.5 System Models	8
3.5.1 Scenarios	8
3.5.2 Use Case Model.....	12
3.5.3 Object and Class Model	14
3.5.4 Dynamic Model	16
3.5.5 User Interface.....	22

1.0 Introduction

In today's society, bullying has become a serious problem for everyone. Many educators and parents attach importance to a power imbalance among children having the potential to exhibit unwanted behavior while interacting with others. Since, personality formation takes place in school ages. Whereas there are some policies to address physical bullying, a number of children are under expression of psychological bullying. Both, kids who are bullied and kids who bully others struggle with negative short term and long term problems in their daily lives. The bullied victim can experience negative social and mental health issues including depression, anxiety disorders, social isolation, low self-esteem, feeling of shame and school avoidance [1][2]. There are also significant effects on the bully such as substance abuse, poor school performance and having difficulty in social relationships. The 2017 Youth Risk Behavior Surveillance System (Centers for Disease Control and Prevention) indicates that, nationwide, 19% of students in grades 9–12 report being bullied on school property in the 12 months preceding the survey [3]. Without proper treatment, the victims will continue to face such behavioral and psychological problems and potentially get worse, even engaging suicidal behaviors.

In an attempt to come up with an efficient way of bully prevention, our application will propose a more interactive and strategic way of dealing with such a problematic social issue instead of standard methods. For our target group, we aim to comprise the infrastructure of how they can stand against bullying, defend themselves or receive professional support. With the advantage of various scenarios pointing to the interaction between children in a representative manner, our game will not only discourage school-aged children from violent behaviour but also encourage them to stop bullying by giving positive messages subconsciously.

In this report, a brief explanation of the application will be provided. Based on a comparison between the current system and the proposed system, an overview of the project will be mentioned in detail. Then, all information about the functional, nonfunctional and pseudo requirements of our application will be listed. With the advantage of various diagrams provided below, insight about the system models will be given. Finally, user interface of the application will be included at the last part of the report by means of navigational paths and screen mock-ups.

2. Current System

Examination of games related to bullying yielded a game called *Bully*, which was developed by Rockstar games in 2006. The aim of the game is to manage the life of a student named Jimmy. The game expects the player to complete the assigned missions. Jimmy shows brutal manners such as attacking other students and being disrespectful to elders during the game to complete the missions. The game also contains sexual content. Therefore, the game has an age limit constraint to play. In contrast to this, TurnTheTables is devoted to the children who are facing bullying. Its aim is completely different than '*Bully*', as it is designed for educational purposes as well as entertainment. TurnTheTables intends to educate children on how to behave and defend themselves against bullying.

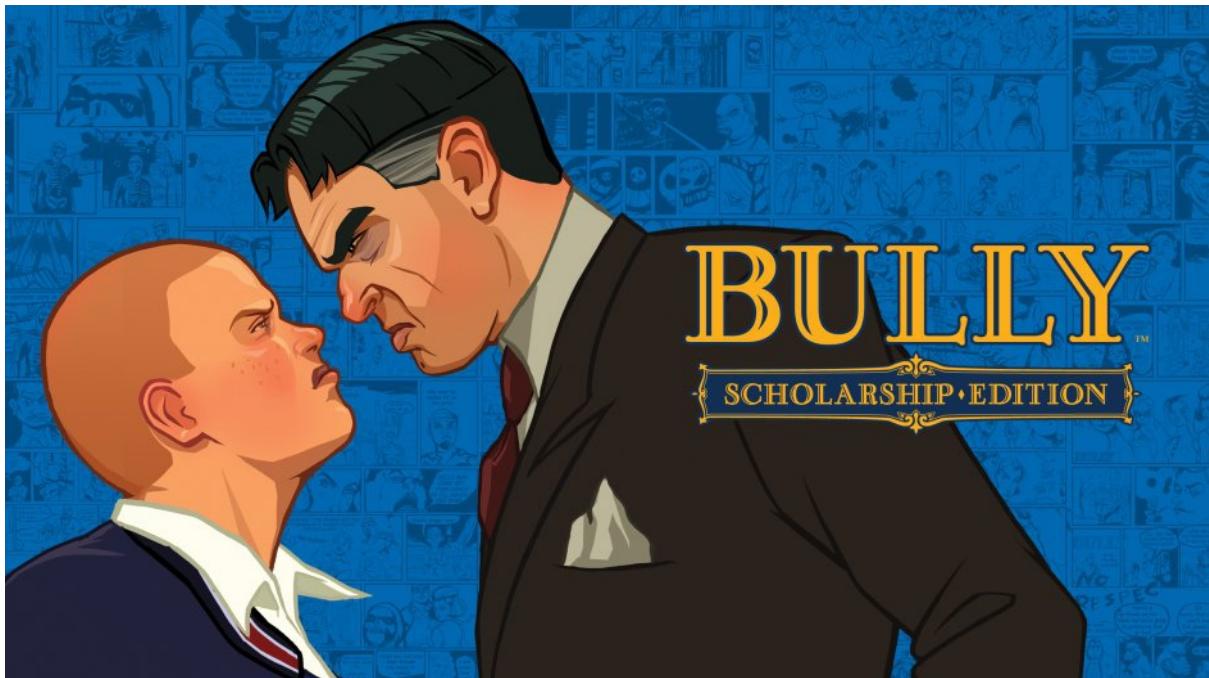


Figure 1 – “*Bully*” an action/adventure Video Game by Rockstar [4]

Another similar project is, *School Life*, a bullying prevention game which is still under development by The Giant Otter Technologies group [5]. The game is very similar to TurnTheTables. According to the developers of *School Life*, it is hard to practice some social acts in real life, thus games are perfect environments to practice these social acts and also some stressful acts which are hard to perform in real life.

3. Proposed System

3.1 Overview

The proposed system is an educational game designed to teach children how to behave and defend themselves against bullying. The main functionality of the game is to provide a child-friendly 3D gameplay to children where they interact with different characters and face various scenarios in which they directly/indirectly face bullying and are educated on how to confront such situations. The application will present the user with various scenarios, based on the recommendations of psychologists, where the main character is bullied or witnesses bullying and consequently the user will get various options, so as to react to that situation. In such situations the child will be encouraged and advised to step forward to stand against bullying, and consequently if the child does so, (s)he will be applauded, whereas, if (s)he does not, then they will be discouraged.

3.2 Functional Requirements

- The user must register to the game and fill the required information such as name, age, gender and so on.
- The user can change the registered information.
- After registration, the user can start a new game or load the saved game.
- The game should start in a school campus.
- The environment of the game should be designed according to psychological aspects. (For example, red colored walls could lead the child to take more daring actions)
- The game can be saved during playing the game or exit time.
- The user can close the game whenever it is wanted.
- The game could be paused by the user.
- The user can control and move the game character in the campus.
- There should be other characters which the user can interact with.
- The user should be given different options in the events she or he encounters throughout the game and when interacting with other characters, so the user will be able to decide his/her actions.
- The game should consist of psychological messages which will educate the child's subconscious.
- The game flow and the demeanor of the other characters towards the main character should change according to the user's decisions.
- The application will not require internet connection.

3.3 Nonfunctional Requirements

3.3.1 Usability

- The application will be user friendly.
- User interface will be simple and understandable for the children.
- The game will have enjoyable graphics for children.

3.3.2 Compatibility

- The game can be played on IOS and Android devices, and Windows desktops.

3.3.3 Performance

- The user will not wait long when he/she enters another building or exists the entered building. Thus, changing place of the player will be fast.

3.3.4 Security

- The information of the player will be stored on only the player's device. The information won't be accessible on another devices.

3.3.5 Reliability

- Psychology is a sensitive field, thus the scenarios will be confirmed by psychologists and will be ensured to not make erroneous impacts on the child's subconscious.

3.3.6 Testing

- The outcome of the behaviour of the player will be evaluated according to the psychologists' methods.
- The scenarios in the game will be tested one by one to verify whether they are having correct outcomes in the game.

3.3.7 Extensibility

- New psychological scenarios could be added to the game when new related psychological methods are published.

3.3.8 Efficiency

- The game aims to educate children on how to defend against bullying and how to behave when they encounter bullying, thus the game should efficiently give accurate psychological messages to achieve this goal.

3.4 Pseudo Requirements

3.4.1 Implementation Pseudo Requirements

- The application will be implemented for Android, IOS and Desktop platforms.
- Unity 3D will be used for creating a 3D model of the surrounding environment.
- Blender and Maya will be used for creating animations.
- Github platform will be used for making a collaborative contribution to our game.
- Open source libraries will be used in development of the software.
- Ready-made models will be bought from online stores or CC models will be used.
- C# will be used as the language for development.
- Object Oriented programming will be followed for the development.
- Surveys from third party sites, which will be directed by the Psychology Dept at Bilkent, will be used as references.
- A website will be created and maintained for observing the status of our project.

3.4.2 Economic Pseudo Requirements

- We need to buy models from various stores such as Unity3D's asset store, sketchfab, cg trader.

3.4.3 Social Pseudo Requirements

- Different cases based on today's society while creating a number of scenarios, will be considered.
- For the children who are unable to read, the application will offer an option of voice button.

3.4.4 Sustainability Pseudo Requirements

- The application will be updated frequently to provide performance enhancement.
- Different scenarios will be added to keep the game up-to-date according to the psychological effects of the app on children.

3.4.5 Ethical Pseudo Requirements

- All activities carried out will abide by the Code of Ethics put together by the National Society of Professional Engineers (NSPE).
- All instructive messages provided during the gameplay will be according to the recommendations of the Psychology Dept at Bilkent, to avoid any sort of unethical scenarios, which may adversely affect the psychology of a child.

- All scenarios will be created according to the psychological research conducted and following the guidance of the instructors of Bilkent and Hacettepe Universities' psychology departments.

3.4.6 Time Pseudo Requirements

- The application is aiming to psychologically educate children on how to pose an attitude against bullying. Thus, observing the effects of the scenarios in the game over children could take time.
- The project must be completed until the deadline.

3.5 System Models

3.5.1 Scenarios

Scenario 1:

<i>Use case name</i>	NewGame
<i>Participating actor</i>	Britney: User
<i>Flow of events</i>	<ol style="list-style-type: none"> 1) Britney clicks to the “New Game” button. 2) TurnTheTables requests the username. 3) Britney enters the username. 4) TurnTheTables requests the name. 5) Britney enters the name. 6) TurnTheTables requests the surname. 7) Britney enters the surname. 8) TurnTheTables requests the gender. 9) Britney enters the gender. 10) TurnTheTables requests the age. 11) Britney enters the age. 12) Britney is navigated to the PlayGame screen
<i>Entry condition</i>	Britney is on main menu and clicks to the “New Game” button.
<i>Exit condition</i>	Britney is navigated to the Play game screen (The next scenario is PlayGame)

Scenario 2:

<i>Use case name</i>	LoadGame
<i>Participating actor</i>	Hayaou Miyazaki: User
<i>Flow of events</i>	<ul style="list-style-type: none"> 1) Miyazaki presses the “Load Game” button. 2) The previously saved game loads and Miyazaki continues playing from the point where he left the game.
<i>Entry condition</i>	The Main menu screen of “TurnTheTables” is opened.
<i>Exit condition</i>	The play game screen loads with the game state that was saved beforehand.
<i>Quality requirements</i>	Miyazaki has played the game at least one more time beforehand and has saved the game while playing, thus there exists a saved game which he could load from the main menu.

Scenario 3:

<i>Use case name</i>	ExitGame
<i>Participating actor</i>	Justin: User
<i>Flow of events</i>	<ul style="list-style-type: none"> 1) Justin clicks to the “Exit” button. 2) TurnTheTables asks whether you want to exit or not. 3) If Justin clicks the “Yes” button, the application is closed or if Justin clicks the “No” button, the application continues.
<i>Entry condition</i>	The game is running.
<i>Exit condition</i>	Game closes or continues at the same page.

Scenario 4:

<i>Use case name</i>	PauseGame
<i>Participating actor</i>	HaruChan: User
<i>Flow of events</i>	<ul style="list-style-type: none"> 1) During the gameplay, HaruChan wants to pause the game. 2) HaruChan clicks the ‘pause’ button from the screen.
<i>Entry condition</i>	HaruChan has started the game and is in game

	play.
<i>Exit condition</i>	The gameplay is paused and a pause menu is shown.

Scenario 5:

<i>Use case name</i>	SaveGame
<i>Participating actor</i>	EmiChan: User
<i>Flow of events</i>	<ul style="list-style-type: none"> 1) During gameplay EmiChan decides to leave the game, but does not want to lose the progress she has made. 2) EmiChan pauses the game and chooses the save option from the pause menu.
<i>Entry condition</i>	EmiChan has started the game and is in gameplay.
<i>Exit condition</i>	The state of the game is saved.

Scenario 6:

<i>Use case name</i>	InteractWithCharacters
<i>Participating actor</i>	Oliver: User
<i>Flow of events</i>	<ul style="list-style-type: none"> 1) Oliver goes towards a character. 2) Oliver clicks on the character. 3) TurnTheTables shows options including “verbally assault” which Oliver could perform against the character he wants to interact with. 4) Oliver selects the “verbally assault” option. 5) Oliver shows action to the character according to the option. 6) The character who Oliver verbally assaulted decreases likings towards Oliver. 7) TurnTheTables changes the game flow in a negative way. 8) Oliver’s “being liked” skill bar decreases.
<i>Entry condition</i>	Oliver is in the game play screen.
<i>Exit condition</i>	The skills bar changes.

Scenario 7:

<i>Use case name</i>	PlayGame
<i>Participating actor</i>	Ayesha: User
<i>Flow of events</i>	<ol style="list-style-type: none"> 1. During gameplay, Ayesha decides to explore the school. 2. Ayesha explores around the school by navigating with help of the map. 3. Ayesha goes around exploring by walking in the school by pressing WSAD keys for up, down, left, right, respectively. 4. While exploring she witnesses someone being bullied. 5. She decides to look further into it and as soon as she enters the given radius of that event, TurnTheTable gives her options to act, such as, "Stay a witness", "Help him/her", "Leave", "Run away" etc. 6. Ayesha selects "help him/her" option. 7. Ayesha goes to help the kid who is being bullied. 8. Ayesha is applauded by the other characters in the game for her bravery. 9. Ayesha's bravery skill bar increases.
<i>Entry condition</i>	Ayesha is in game play mode.
<i>Exit condition</i>	Ayesha exits the game.

Scenario 8:

<i>Use case name</i>	Pick an Object
<i>Participating actor</i>	Alperen Ustaömer: User
<i>Flow of events</i>	<ol style="list-style-type: none"> 1) Alperen walks toward a pencil he wants to pick. 2) The indicator "claim" appears on top of the object which indicates the object is collectible. 3) Alperen presses E on the keyboard. 4) Alperen's inventory is displayed on top of the screen, showing the object has been added to the inventory.
<i>Entry condition</i>	Alperen is in play game mode.
<i>Exit condition</i>	The picked object is added to his inventory.

Scenario 9:

<i>Use case name</i>	Select Object From Inventory
<i>Participating actor</i>	Archie: User
<i>Flow of events</i>	<ol style="list-style-type: none"> 1) Archie presses the I key on the keyboard. 2) The inventory is displayed. 3) Archie selects the pencil he has added to his inventory beforehand. 4) The pencil is shown in Archie's hand.
<i>Entry condition</i>	Archie is in play game mode.
<i>Exit condition</i>	The objects the player selects is picked from the inventory.

3.5.2 Use Case Model

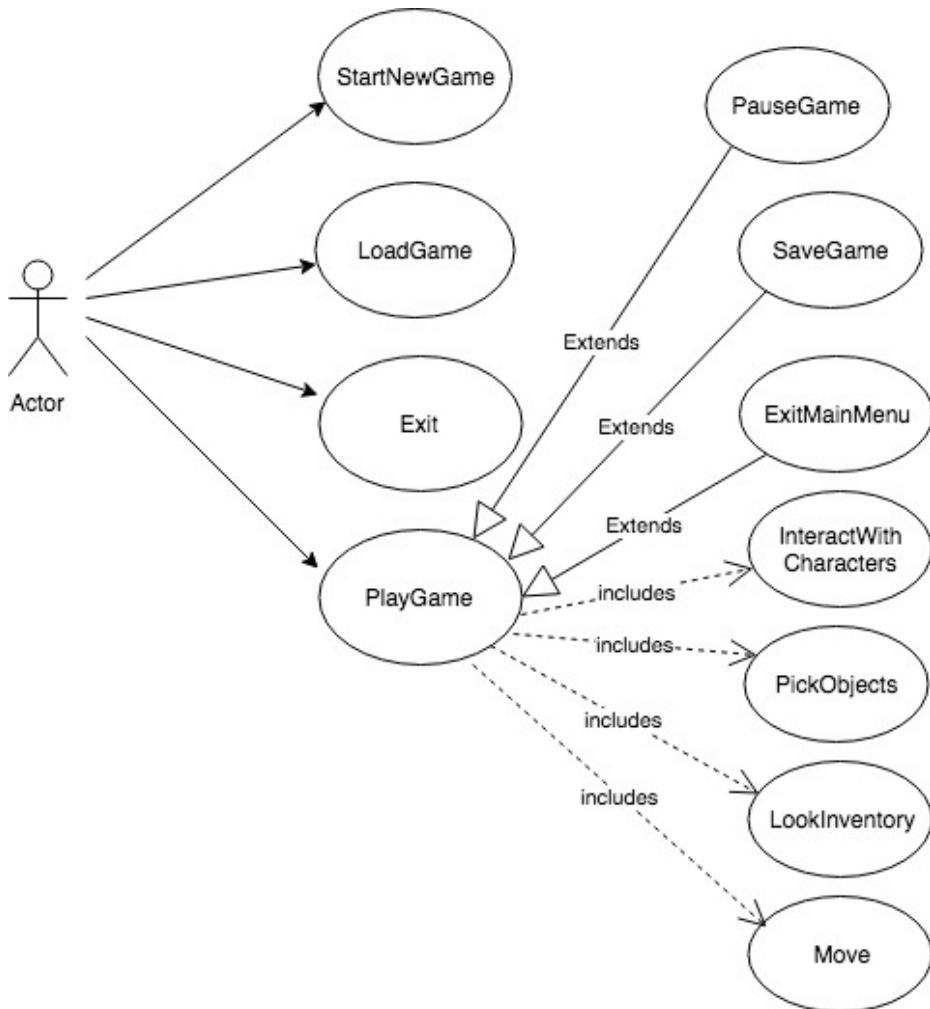


Figure 2 - Use case model

- The player can start new game by filling personal information and creating a new user account
- The player can load game which is saved to the file from the last played game.
- The player can exit the game by using exit button from main menu.
- The player can pause a game from the play game screen.
- The game is automatically saved when the player wants to exit from the play game screen.
- The player can exit to the main menu.
- The player can interact with other characters.
- The player can pick collectable objects around the game platform and put them to the inventory.
- The player can look his/her inventory including the collected objects during the game.
- The player can move by using WSAD from keyboard easily.

3.5.3 Object and Class Model

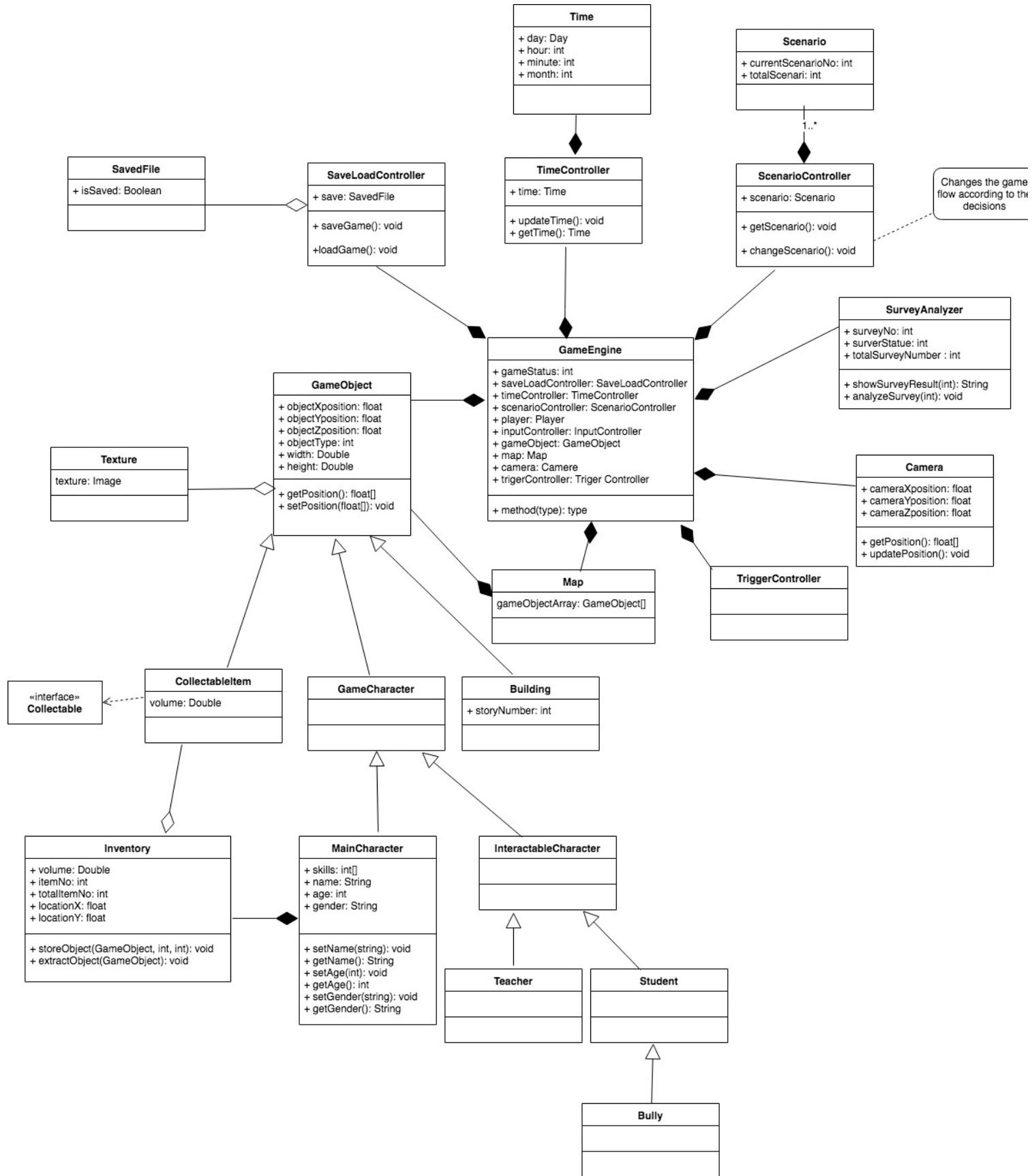


Figure 3 - Object Class Model

Time: In order to show the game time to the player, we create Time object that contains time properties such as day, hour, minute and month.

TimeController: It takes Time object. It also updates and returns the game time.

Scenario: It stores the total number of the scenarios and the current scenario's number.

ScenarioController: It takes Scenario object. Then, it updates and gets the current scenario from the scenario object.

SaveFile: We will save the current situation of the game. So, to understand whether game is saved or not, we put a isSaved Boolean variable.

SaveLoadController: It takes a SaveFile object. It saves and loads the game using the SavedFile object.

GameObject: There will be several objects in the game such as trees, furnitures and game characters. These objects contain an objectType variable to distinguish these object and their x,y and z coordinate locations.

Texture: It contains an image that defines the texture of the each GameObject.

GameEngine: It contains the controller classes and other classes in order to provide an interaction between these classes.

Camera: It defines the user's screen view location. So it contains x, y and z coordinates of the camera.

Map: GameObjects will be placed in Map object. Map contains each objects' locations.

SurveyAnalyzer: The surveys will be distinguished using their surveyNo. Each survey has also surveyStatue to understand whether the survey is applied or not. The surveys are analyzed and showed by using its functions.

TriggerController: It determines which scenarios will be applied considering the game time and the location of the main character.

CollectableItem: Some game objects can be collectable by the main character.

GameCharacter: Game characters are also game objects.

MainCharacter: It is also a GameCharacter that has also different properties such as personal information and skill bars. The user of the application manages this game character.

InteractableCharacter: It is also a GameCharacter that MainCharacter can communicate with.

Inventory: It contains information of the main character's stored GameObjects.

Teacher, Student and the **Bully** are the final classes in the project. These classes are also InteractableCharacter in the game.

3.5.4 Dynamic Model

3.5.4.1. Sequence Diagrams

SaveGame Sequence Diagram

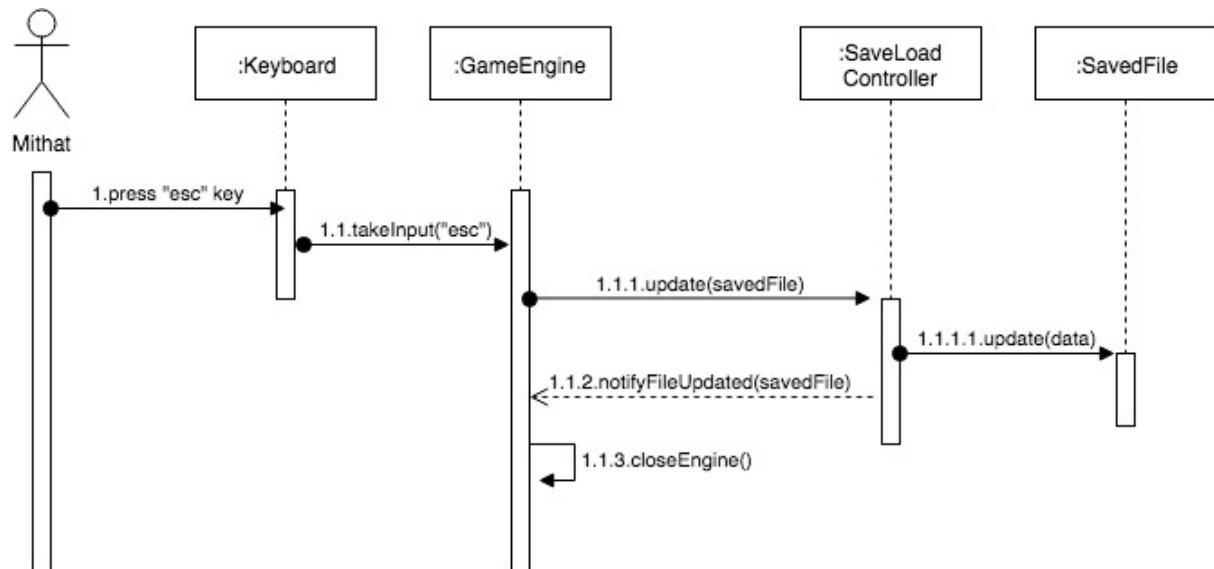


Figure 4 - Sequence diagram of 'Save game' process

Description:

This diagram indicates the flow of actions whenever the player attempts to exit from the game. If the user presses “esc” key from the keyboard anytime he/she is in the game play mode, take input method of Game Engine class will be called. Based on the detected key button, game engine will update the saved file from the current game by accessing to the save load controller object which also updates the data of saved file object. Since game engine needs to know whether the game is saved before exiting, the controller notifies the game engine.

StartGame Sequence Diagram

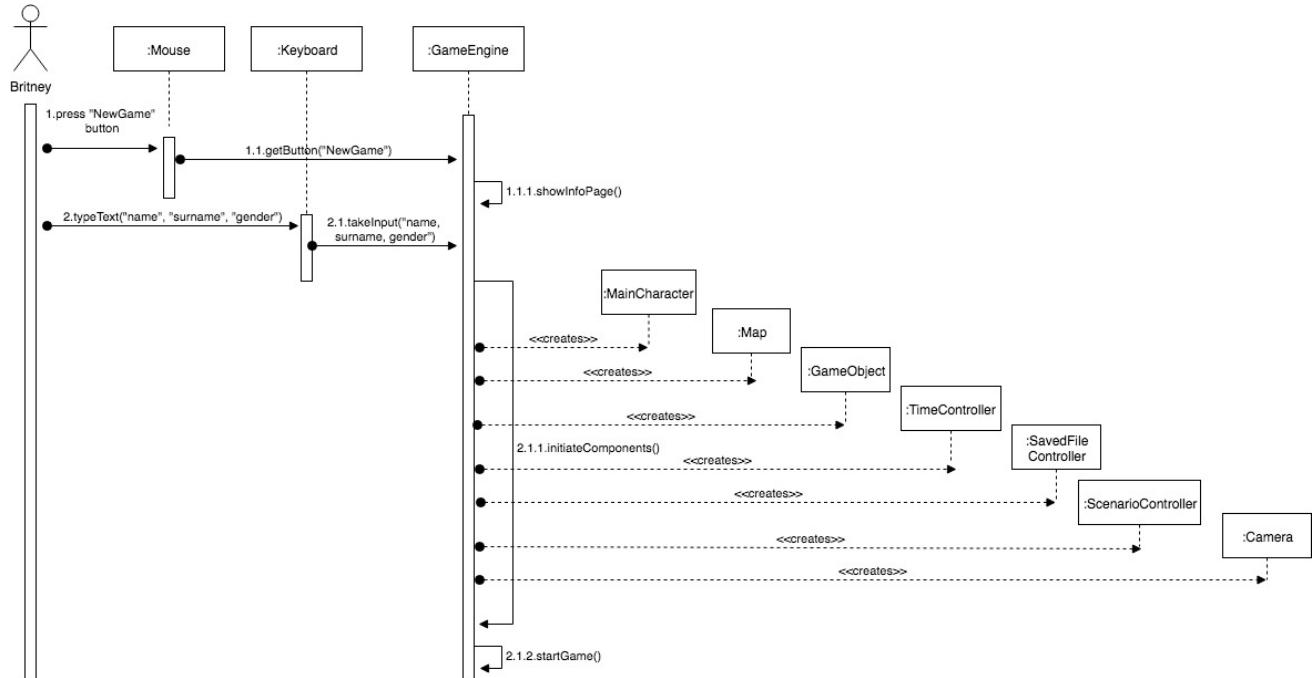


Figure 5 - Sequence diagram of 'Start game' process

Description:

This diagram indicates the situation when the user wants to start a new game. Firstly, the player has to press new game button from the main menu by using left click of mouse boundary object. Since the system will call get button method of game engine class detecting a new game state, the game will show information page including name, surname and gender blanks the player has to fill. After the player gives all necessary personal information by typing from keyboard, game engine starts to initiate components and creates main character followed by a number of class objects.

InteractWithCharacters Sequence Diagram

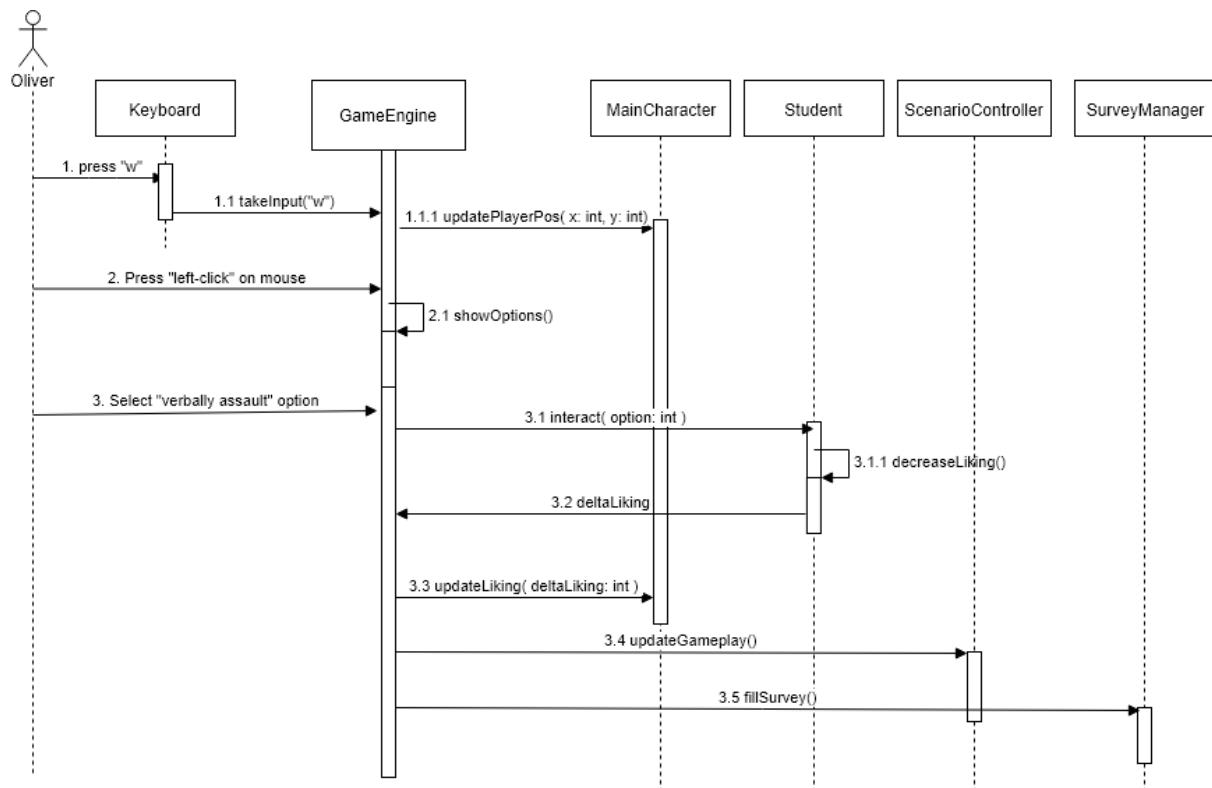


Figure 6 - Sequence diagram of 'Interact with characters' process

Description:

This diagram indicates the flow of actions whenever the player attempts to interact with the other characters of the game. The player moves forward toward the character and his/her position is updated and then player clicks on the character which calls a method which shows various options to the player, which lets the player perform different actions, including “verbally assault”. When the player chooses the “verbally assault” option, the interaction method is called which lets the **Student** object know which action is performed and in response, the liking value of the player from that character is decreased, this value is returned to the game engine where the average ‘like-ability’ from all characters is reevaluated and decreased. Also, this decrease in the like-ability of the player affects the gameplay, in such a way that the scenarios start to flow in a negative way for the player. Moreover, based on the action of the player, a survey is also filled.

PlayGame Sequence Diagram

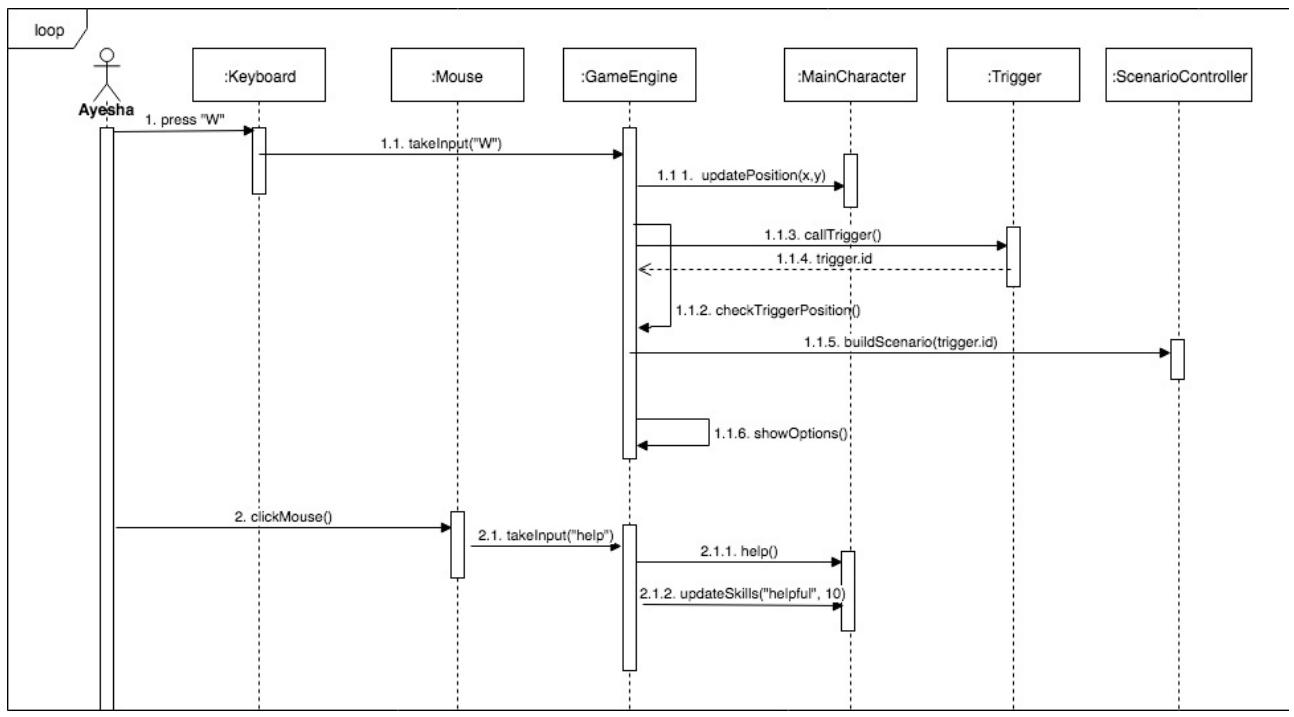


Figure 7 - Sequence diagram of 'Play game' process

Description:

The diagram demonstrates the actions of the user during the play game screen. Firstly, the Ayesha presses the "w" letter by using the keyboard. Then, the GameEngine takes the keyboard's input and then updates the main character's current position with the input value. To demonstrate accurate scenario to Ayesha, GameEngine checks the trigger position with using checkTriggerPosition(). When a specific scenario is found at a specific location, GameEngine calls the Trigger object. Then, Trigger object sends a specific scenario id to GameEngine. After taking the id, GameEngine builds the scenario and shows options to Ayesha. Ayesha selects one of the options using the mouse. The input value of the mouse is sent to the GameEngine. Game engine leads the main character to behave according to the selected option. In this scenario, Ayesha selects help option. After helping the game character, the helpful skill bar of Ayesha is increased with amount of 10.

Pick an Object Sequence Diagram

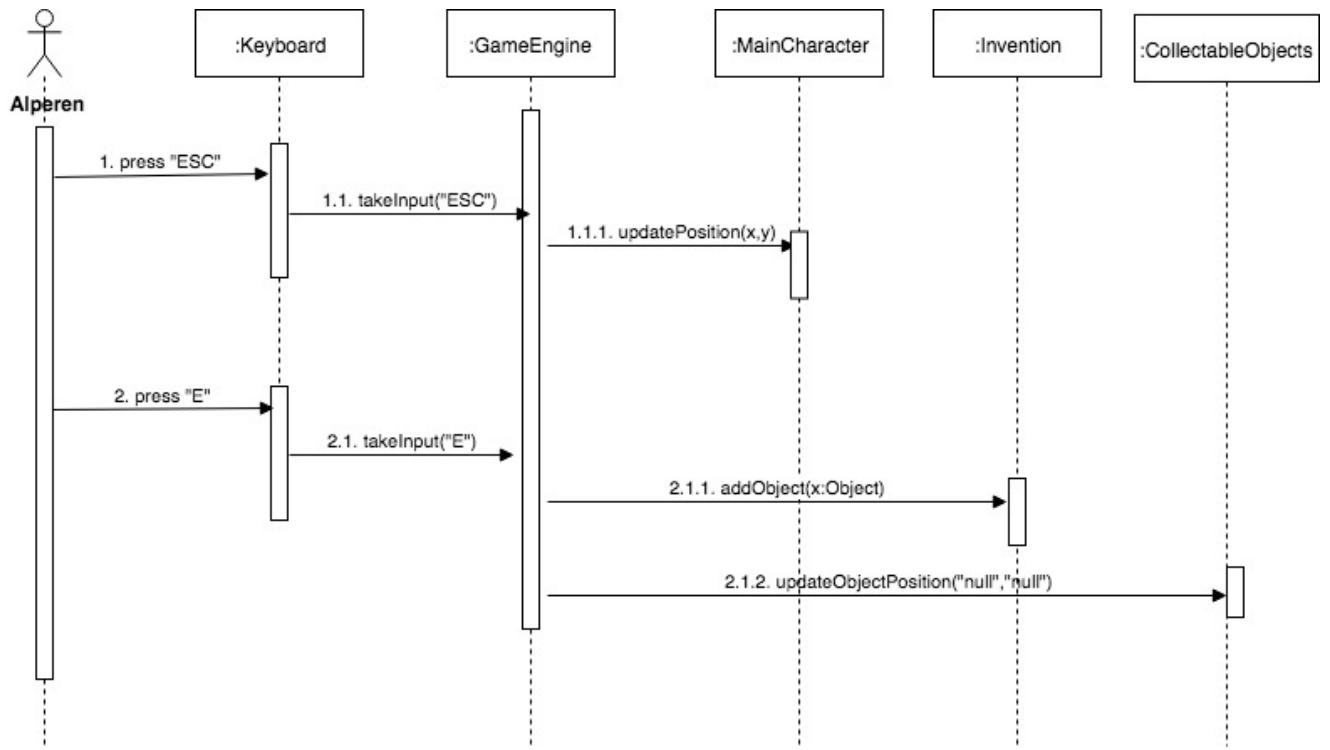


Figure 8 - Sequence diagram of 'Pick an object' process

Description:

The diagram demonstrates the actions of the user during the picking a object. Alperen firstly presses “ESC” keyboard. The key’s value is sent to the GameEngine by using the `takelInput()` function. After taking the input, the MainCharacter’s current position is updated. Alperen gets closer to an object after the update of the location. In order to take the object, Alperen presses “e” key on keyboard. The input of the keyboard is sent to the GameEngine. GameEngine adds the selected object to the inventory. Then, it updates the current location of the object as “null”.

3.5.4.2 Activity Diagram

The activity diagram given in figure 9, describes the whole activity flow of the game. The diagram has been divided into two swimlanes (activity partitions), where the left lane describes the activities followed by the user and the right lane describes the activities executed by the TurnTheTables itself.

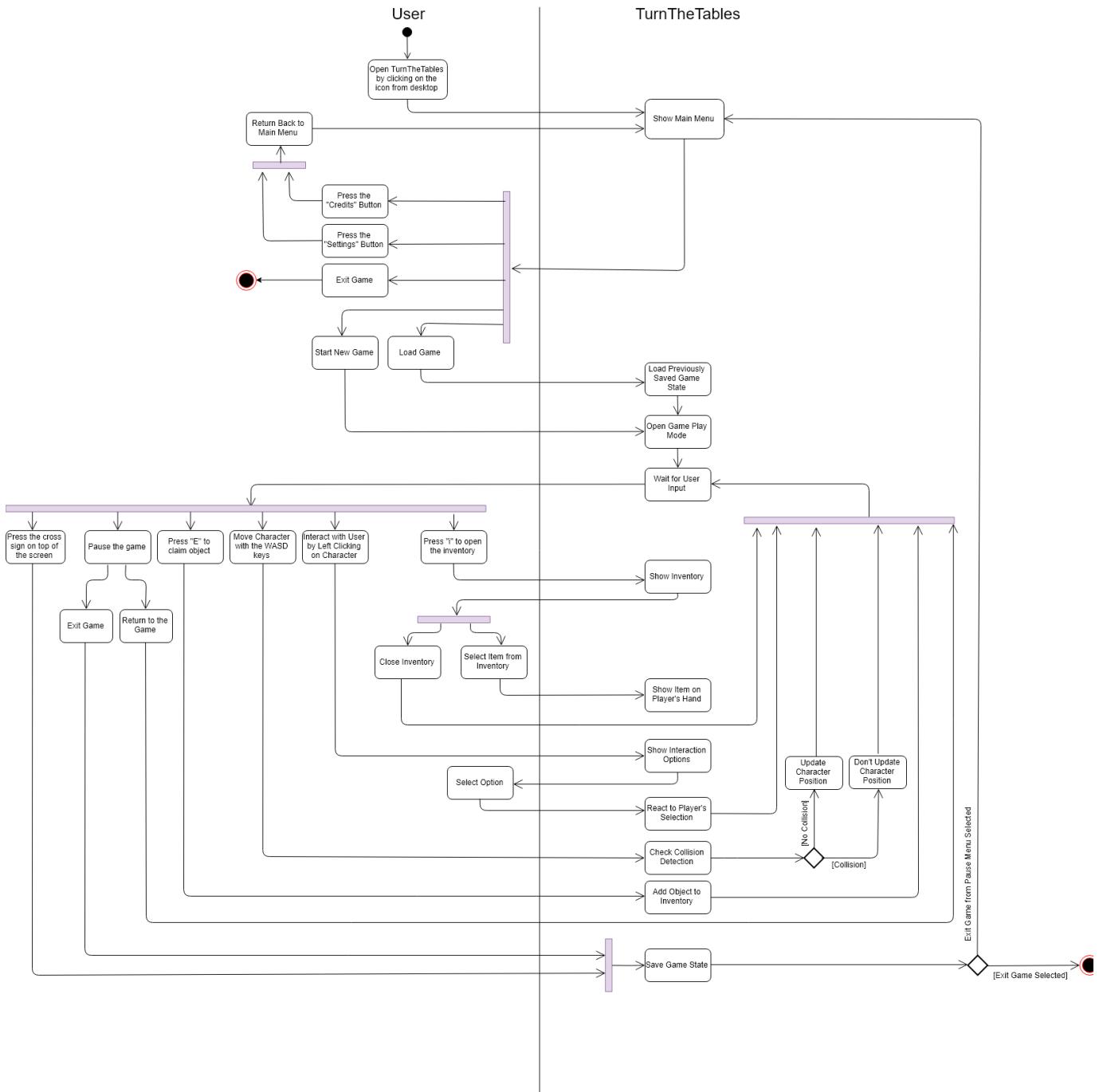


Figure 9 - Activity diagram

3.5.5 User Interface

3.5.5.1 Main Menu



Figure 10 - A mockup of the main menu screen

It is the starting screen of the game. If the user clicks the New Game button, s/he will be navigated to a new game screen. Clicking Load Game button directs user to lastly saved game. To change game properties, the user can click Settings button. The creators are displayed by clicking the Credits button. The user can leave the game by pressing the Exit.

3.5.5.2 Game Screen – Interact with character

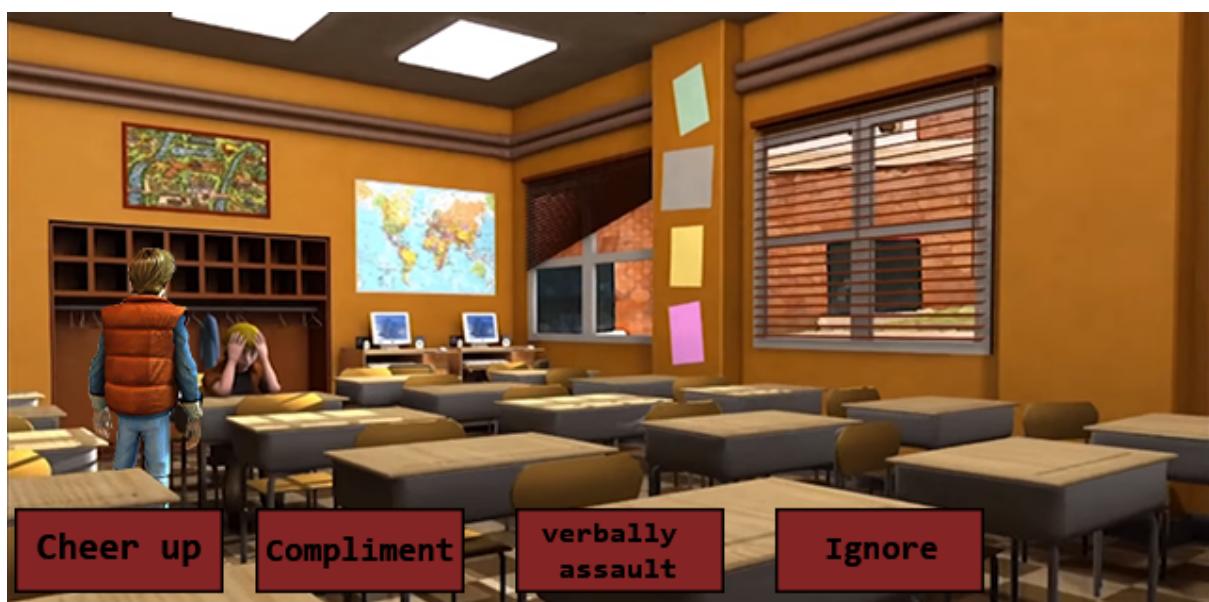


Figure 11 - A mockup of the Interact with character scenario

This mockup shows the “Interact with Characters” scenario, explained in section 3.5.1. As it could be seen in the picture, the main character (user, character which is standing up), will be able to interact with other characters in the game. When the user goes near a character and left clicks on the character, options shown in the figure will appear. The user will be able to select from these options and the game scenario will change according to the selection made. The background in the figure is a screenshot from the project “School Life”, which is under development by Giant Otter Technologies. (Note: Some changes have been made on the screenshot so as to conform to our idea) [5].

3.5.5.3 Game Screen – Pick an object



Figure 12 - A mockup of the Pick an object scenario

This mockup shows the “Pick an object” scenario, explained in section 3.5.1. As it could be seen in the picture, the main character will be able to pick certain objects in the game and be able to collect it and store it in his/her inventory. When the user goes near an object, the collectable object will highlight and a “claim” button will be shown on the screen, which upon pressing “E” key will add the object to the inventory. The inventory of the user will be visible from the top of the screen which will show that the object has been collected. The background in the figure is a screenshot from the project “School Life”, which is under development by Giant Otter Technologies. (Note: Some changes have been made on the screenshot so as to conform to our idea) [5].

References

- [1] "Effects of Bullying." *StopBullying.gov*, www.stopbullying.gov/at-risk/effects/index.html [Accessed 4 Nov. 2018].
- [2] "Short Term and Long Term Effects of Bullying: Psychological & Societal." *PsyCom.net - Mental Health Treatment Resource Since 1986*, www.psycom.net/effects-of-bullying [Accessed 4 Nov. 2018].
- [3] "What Is Bullying." *StopBullying.gov*, www.stopbullying.gov/what-is-bullying/index.html [Accessed 4 Nov. 2018].
- [4] Bully Video Game (2006). *Bully Video Game*. [image] Available at: <https://news.xbox.com/en-us/2016/12/15/bully-scholarship-edition-xbox-one-backward-compatibility/> [Accessed 4 Nov. 2018].
- [5] HarvardEducation (2014). *The Game of Bullying Prevention*. [video] Available at: <https://www.youtube.com/watch?v=L-pslzguZKE> [Accessed 4 Nov. 2018].