



Bilkent University  
Department of Computer Science

# CS319 Object-Oriented Software Engineering Project

*Siege*

## Analysis Report

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# **1. Introduction**

The game “Siege” that is proposed is a revival of the classical game Tank 1990, with additions. The goal of the game is protecting a ‘sacred object’ from the attacks of the incoming tanks, by shooting and blowing them up.

The game consists of 5 levels, each one with a different layout - a different map - with increasing difficulty. To pass a level, the player must destroy every tank that is attacking, which will be a fixed number for every level and will be available for the user to see. As each level is passed, the number of assaulting tanks will increase, new types of more durable and more dangerous tanks will be introduced, and different types of walls will constitute the map.

The player will have 3 lives. In case of losing all their lives, the game will end. There is also another way of losing the game, thus ending it, namely the destruction of the ‘sacred object’. While this object can be destroyed by the enemy tanks, a misfire can also cause its doom.

In the following sections, the game above will be described in detail.

## **2. Proposed System**

### **2.1. Overview**

#### **2.1.1. Gameplay and Control**

The player controls the tank by using WASD keys, W meaning forward (or up in the case of a 2D perspective), A means left, S means right, and D means down. The player can fire using the SPACE key. The ESC key causes the game to pause.

#### **2.1.2. Obstacles and Objects**

The obstacles in the game are walls. While some of these walls can be destroyed, either with a single shot or requiring 3 shots, some of them are indestructible. Once any wall is destroyed, the path will be cleared and the tanks will be able to pass through that tile. The three types of walls are as follows:

#### **2.1.2.1. Brick Wall**

The most basic type of wall. It can be destroyed with a single shot, either by enemy tanks or by the player.

#### **2.1.2.2 Iron Wall**

This type of wall can be destroyed only after three shots. Its appearance will change after each shot, making it seem weaker.

#### **2.1.2.3. Steel Wall**

This wall cannot be destroyed, effectively acting as a shield from the incoming attacks, if stayed behind.

The only object that the game will have that differs from the obstacles but still constitutes the layout is the ‘sacred object’. Protection of this object is the main goal of the game. This object can be destroyed with a single shot, by either the enemy tanks or the player’s tank. It is protected by surrounding brick walls, which cover its every side.

### **2.1.3. Characters**

The characters that are proposed are the player, i.e. the controlled tank, and the enemy tanks. Both types of these characters can destroy the destructible obstacles in the game, and the ‘sacred object’. All these characters have the same movement speed, except for the crazed tank after it has been hit. The enemy tanks will change their directions every time they encounter an obstacle, if they had not broken it before, or every 5 seconds if they do not encounter any obstacles. The types of tanks are described in detail below:

#### **2.1.3.1. The Player Tank**

The tank that player will control will be the most basic tank in the game. As mentioned earlier, it will have 3 lives. After losing a life, it will spawn every time in the same spot, near the ‘sacred object’ that it protects. The maximum number of lives the player can have is 3. It has

a fixed fire rate, same as the basic enemy tank, which shall be 1 shot per second. An advantage that the player tank has over the enemy tanks is its ability of gathering power-ups, which will be discussed in the upcoming sections.

#### **2.1.3.2. The Basic Enemy Tank**

This tank can be destroyed with a single shot. It also has a fixed fire rate, 1 shot per second.

#### **2.1.3.3. The Crazy Tank**

This tank can be destroyed with two shots, but its most important property is that after being hit for the first time, it gets crazy and both its movement speed and its fire rate doubles, i.e. its fire rate will be 1 shot per half a second.

#### **2.1.3.4. The Panzer**

This is the most durable tank of the game. It can be destroyed only by four shots, and it has the same movement speed and fire rate as the basic enemy tank.

### **2.1.4. Power-Ups**

The player will never know when a power up will show up. The power ups will appear on random areas and disappear if not taken by the player. With these features, the game will be more enjoyable for the player.

#### **2.1.4.1. Shield**

When taken by the player, the shield will protect the player's tank from the attacks of the enemy tanks. The shield will be available for 10 seconds and then disappear.

#### **2.1.4.2. Double Shots**

This power up will make the player's shots to the walls or to the enemy tanks two times faster. This will help the player to kill the stronger enemy tanks easier. Double shots power up will also be available for 10 seconds and then the player will shoot with the initial fire rate.

#### **2.1.4.3. Extra Life**

The player will increase their lives by 1 by taking this power up. So the player will be available to play longer. Also there is no time limit for this feature. If the player has 3 lives already, their lives will not increase, as the limit is 3.

#### **2.1.4.4. Ultimate Protection**

Since the main goal of the player is to protect the 'sacred object', this feature will be very helpful. It changes the type of the walls around the 'sacred object' to the steel wall, making them unbreakable for 10 seconds, to protect it from the enemy tanks' attacks.

### **2.1.5. Scoring**

Player will get extra points after shooting an enemy tanks or breaking a wall. This way, the player will be more motivated to play, and beat their own high-score. The scoring will be done in the following way:

- Destroying a brick wall will give 10 points.
- Destroying an iron wall will give 25 points.
- Destroying a basic enemy tank will give 100 points.
- Destroying a crazed tank will give 150 points.
- Destroying a panzer will give 200 points.
- At the end of the game, remaining lives will be multiplied by 1000 and will be added to the end score.

### **3. Functional Requirements**

#### **3.1. Play Game**

This is the most basic requirement of our project. After opening the game, the player will be able to play the game, direct the tank according to the controls specified above, pass levels if successful, and reach the end, either by winning or losing.

#### **3.2. Help**

In this feature, the player will be able to see how s/he can play the game, the functions of each key and what is the goal of the game. Also, the kinds of enemy tanks, obstacles and power-ups will be introduced and explained.

#### **3.3. Pausing the Game**

With this feature the player will have the opportunity to pause the game whenever s/he wants. Also, the status of the obstacles and the score will be saved. Being able to pause the game anytime will make the game more appealing since the player can be interrupted by something during the game and does not have to start over.

#### **3.4. Continue the Game**

This feature will allow the player to continue playing the game from where s/he left after the pause. Also, the advantage of this feature is that it will prevent players from losing any points or lives and starting over to the level.

#### **3.5. Settings**

This feature will help the player to make adjustments on the game such as turning on/off sounds, adjusting the volume and changing the level.

##### **3.5.1 Level Selection**

Tank Game will have five different levels where each level has different difficulties. The player will be able to change the level in settings.

### **3.6. High Score**

After finishing and being successful in each level, the player's score will be saved if it is one of the 5 highest scores so far. The player will be able to see the highest 5 scores.

## **4. Non-Functional Requirements**

### **4.1. Performance**

Project needs to respond the player's commands quickly since the player's tank's lives are dependent on it. The enemy tanks and the player's tanks must move smoothly.

### **4.2. Usability**

In the Tank Game, we will keep the interface as simple as possible for the users so that the possible players could learn it easily.

### **4.3. Extendability**

We will structure the program in a way that will enable us to implement any further improvements.

## **5. Constraints**

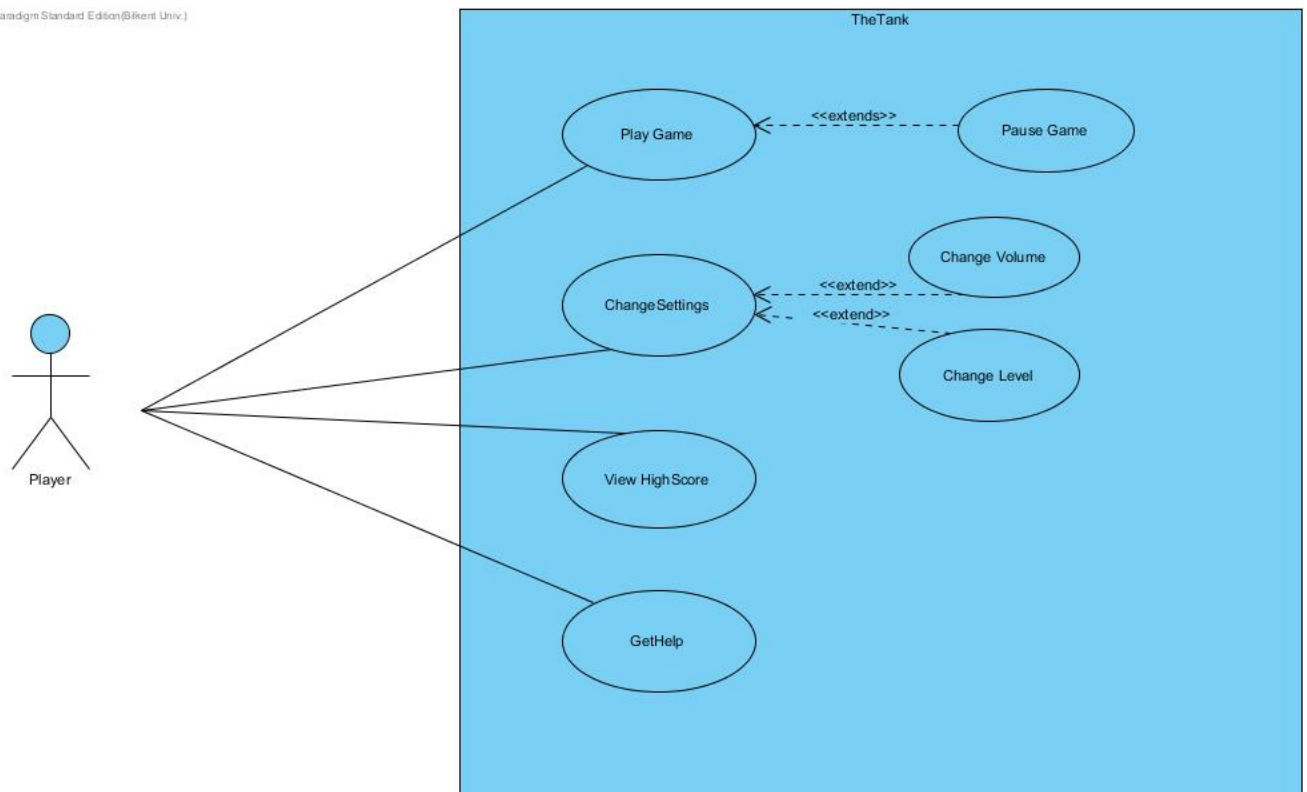
Our program will be a desktop application. The game will be implemented in Java.



## 6. System Model

### 6.1. Use-Case Model

Visual Paradigm Standard Edition (Bikent Univ.)



#### UseCase #1

**Use case name:** PlayGame

**Participating Actors:** Player

**Entry Condition:** Player opens the game.

**Main Flow of Case:**

- Player starts the game.
- The levels of the game start to flow while playing the game until the last level.
- The score of the player displayed while playing and when the levels are finished the game display the final score of the player.
- If the score is a high score, the score is written on the high score system and recorded.
- The game finishes.

**Exit Condition of Case:**

- Player loses all their lives.
- Player wants to exit.
- Player finishes the game by completing every level.

**Alternative Flow of Case:**

- Player can exit the game anytime.
- Player loses all their lives.

## **UseCase #2**

**Use case name:** ViewHighScore

**Participating Actors:** Player

**Main Flow of Case:**

- Player pushes the high score button.
- Player sees the high score list.
- Exit from the high score.

**Exit Condition of Case:** None

**Alternative Flow of Case:** None

## **UseCase #3**

**Use case name:** ChangeSettings

**Participating Actors:** Player

**Main Flow of Case:**

- Player push to the settings button.
- Player changes the game settings that he/she wants OR changes the level of the game
- Exit from the settings menu.

**Exit Condition of Case:-**

**Alternative Flow of Case:-**

## **UseCase #4**

**Use case name:** GetHelp

**Participating Actors:** Player

**Main Flow of Case:**

- Player pushes the help menu button.
- Player sees the controls, the in-game buttons, the descriptions of different types of enemies and obstacles, and information about the general gameplay.
- Exit from help.

**Exit Condition of Case:** None

**Alternative Flow of Case:** None

## **UseCase #5**

**Use case name:** PauseGame

**Participating Actors:** Player

**Entry Condition:** Player can access to the pause menu while playing the game

**Main Flow of Case:**

- Player starts the game and push the pause button
- Player pause the game encounter with the pause menu
- Changing the settings of the game OR change the level of the game
- Player continues playing the game

**Exit Condition of Case:**

- Player wants to continue playing.
- Player wants to exit the game.

**Alternative Flow of Case:**

- Player exits the game directly if player doesn't want to play
- Player wants to play a different level

## **UseCase #6**

**Use case name:** Change Volume

**Participating Actors:** Player

**Main Flow of Case:**

- Player pushes the settings button.
- After reaching settings sees the volume icon and change the volume.
- Exit from the settings.

**Exit Condition of Case:** None

**Alternative Flow of Case:** None

## **UseCase #7**

**Use case name:** Change Level

**Participating Actors:** Player

**Main Flow of Case:**

- Player push to the settings button.
- After reach the settings the user see the Change Level button and pushes it.
- User decide which level they want to play
- User plays the game
- Finishes the level and if the level is not last level keep going on the game, if not the game over message occur.

**Exit Condition of Case:** None

**Alternative Flow of Case:** None

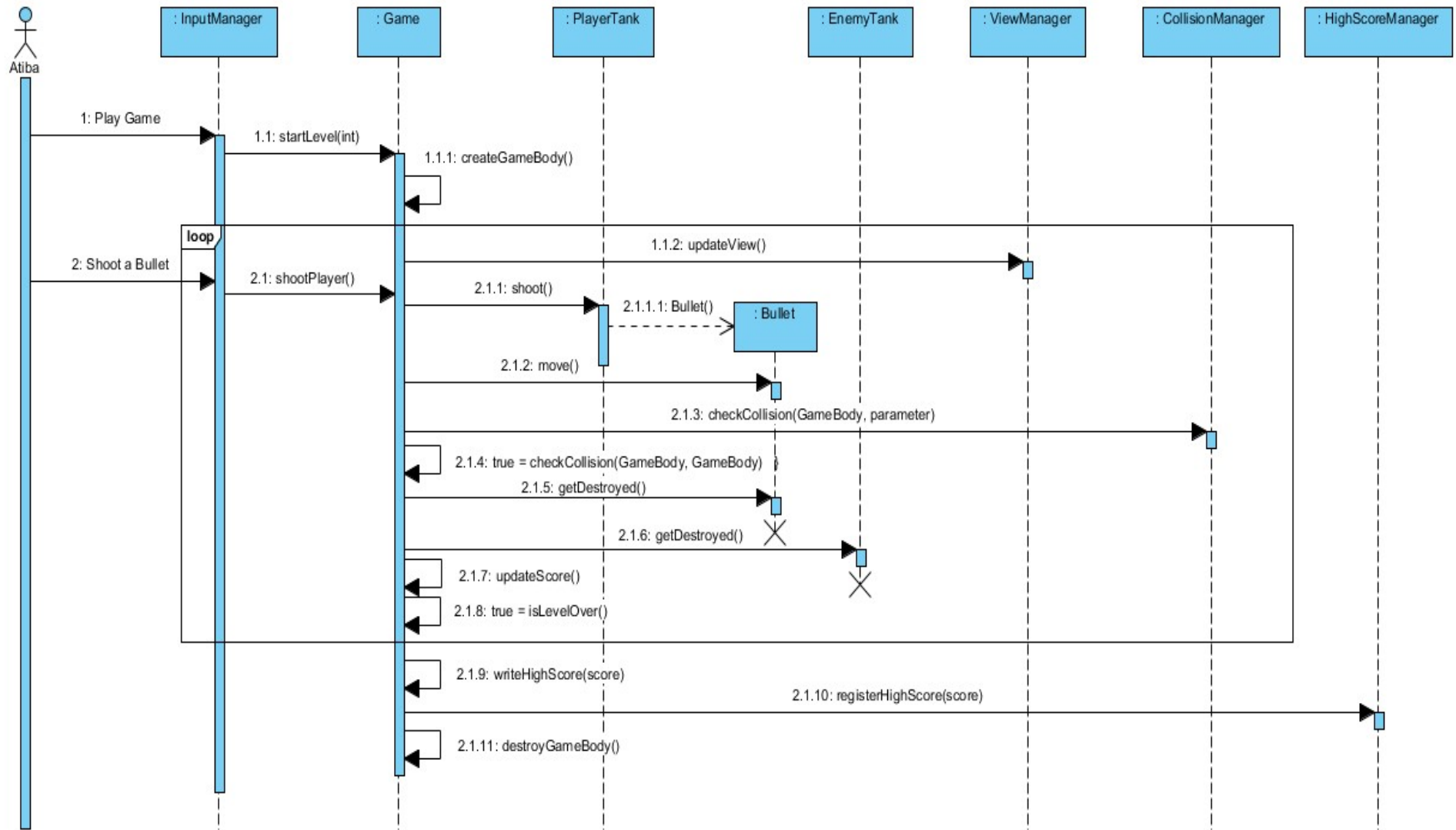
## 6.2.Dynamic Models

### 6.2.1 Sequence Diagrams

**Scenario Name:** Play Game

**Scenario:** Player Atiba starts playing the Siege from scratch and the first level is opened. Atiba shoots a bullet and this first bullet collides with the enemy tank. The destruction of the enemy tank for that particular level implies the end of the level and Atiba finishes the level with a high score. High score is saved.

**Description:** Having entered into the first level of Siege, the main game loop starts executing. In every loop, main game loop updates the view and check whether or not a collision occurs. If a collision occurs, the corresponding objects are destroyed by the game. At the end of every loop, the score is updated. If the level is over, game exits the main game loop. Providing that a high score is obtained, the score of the level is saved.

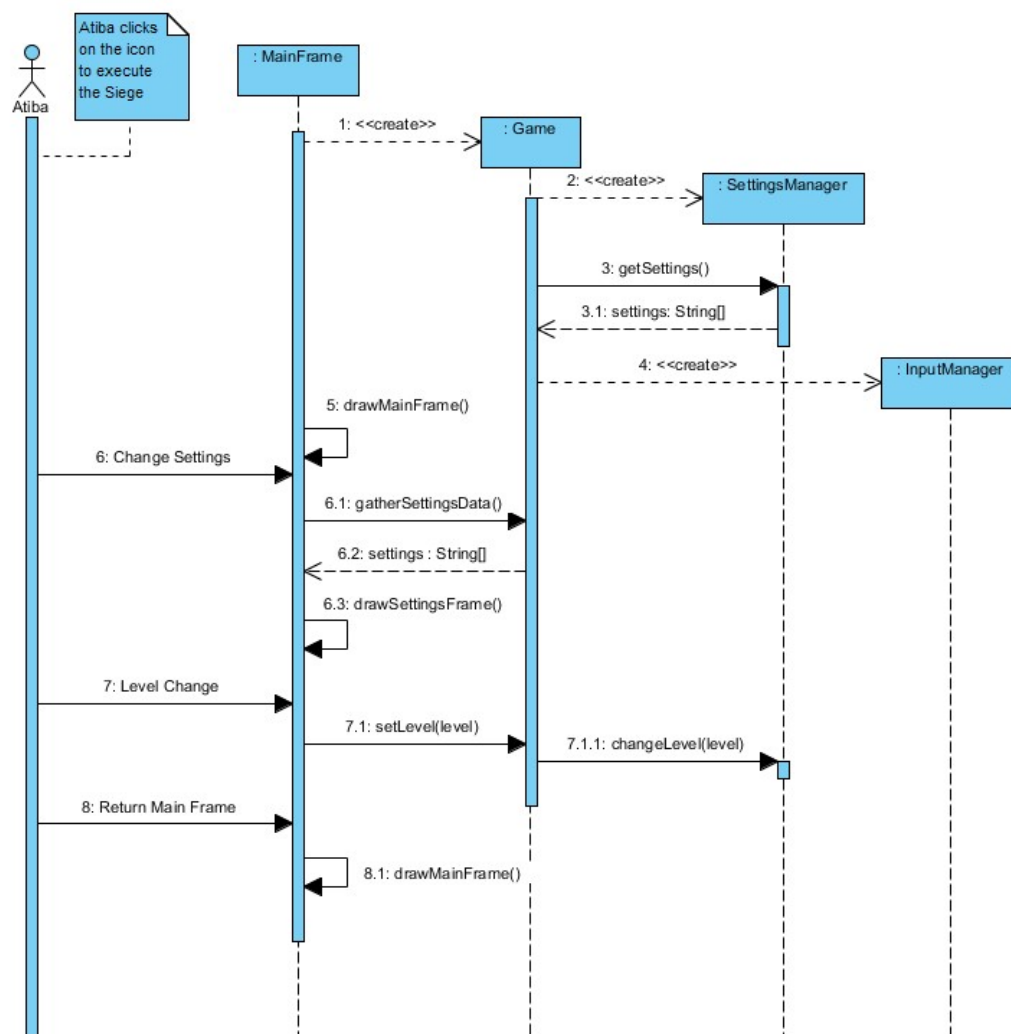


Sequence Diagram: PlayGame

### Scenario Name: Change Settings

**Scenario:** Player Atiba clicks on the desktop icon of Siege to execute the game. He encounters the main frame and decides to change level before opening a new game. He changes level and returns to the main frame again.

**Description:** Having executed the Siege, Main Frame commands the creation of the game. When the player decides to change the level, all settings data are gathered and displayed on the screen. Providing that the player changes the level, the game updates itself and gets ready to start from that particular level. Main Frame is displayed in return.

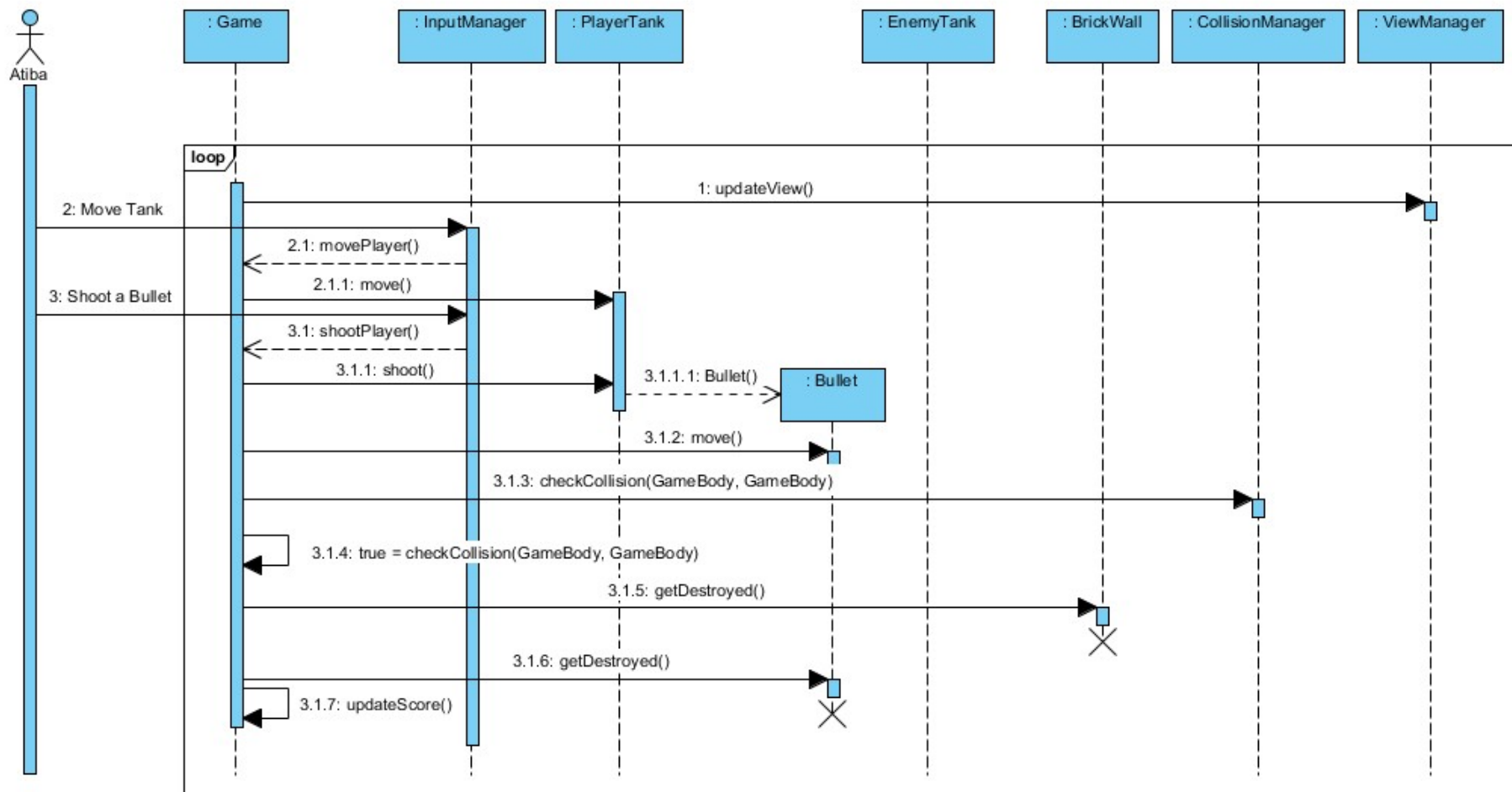


Sequence Diagram: Change Settings

**Scenario Name:** Break Brick Wall

**Scenario:** While playing the game, Player Atiba moves the tank and shoots a bullet. The bullet collides with a brick wall. Brick wall is broken with that one collision.

**Description:** During the game, main game loop is being executed until the end of the level. In that loop, the view is updated at the beginning of the loop. If the bullet shot by the player collides with a brick wall, that brick wall is destroyed by the game. At the end of each loop, the score is updated. The game still goes on and the view of the game is updated since the loop has turned back into its starting case.



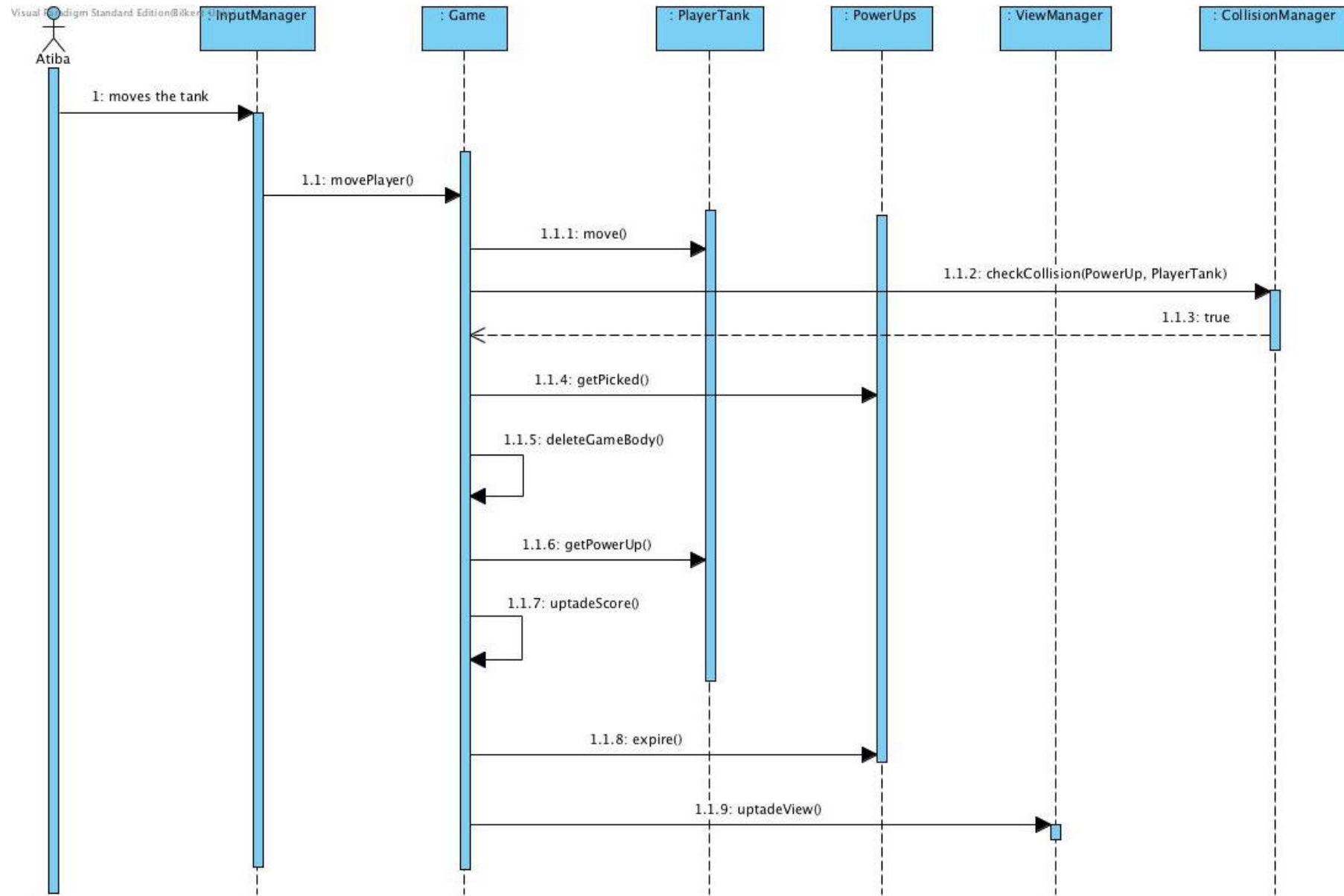
Sequence Diagram: Break a Brick Wall



**Scenario Name: Take a Power Up**

**Scenario:** Player Atiba sees a power up and moves the player tank to take it. The player tank and the power up collides. The power up gets activated and player gets bonus points. Then the power up expires.

**Description:** During the game, power ups randomly appear on the screen. If the player can move the tank towards to the power up, the power up becomes active. Player's score gets updated. At the end of 10 seconds, the power up expires.

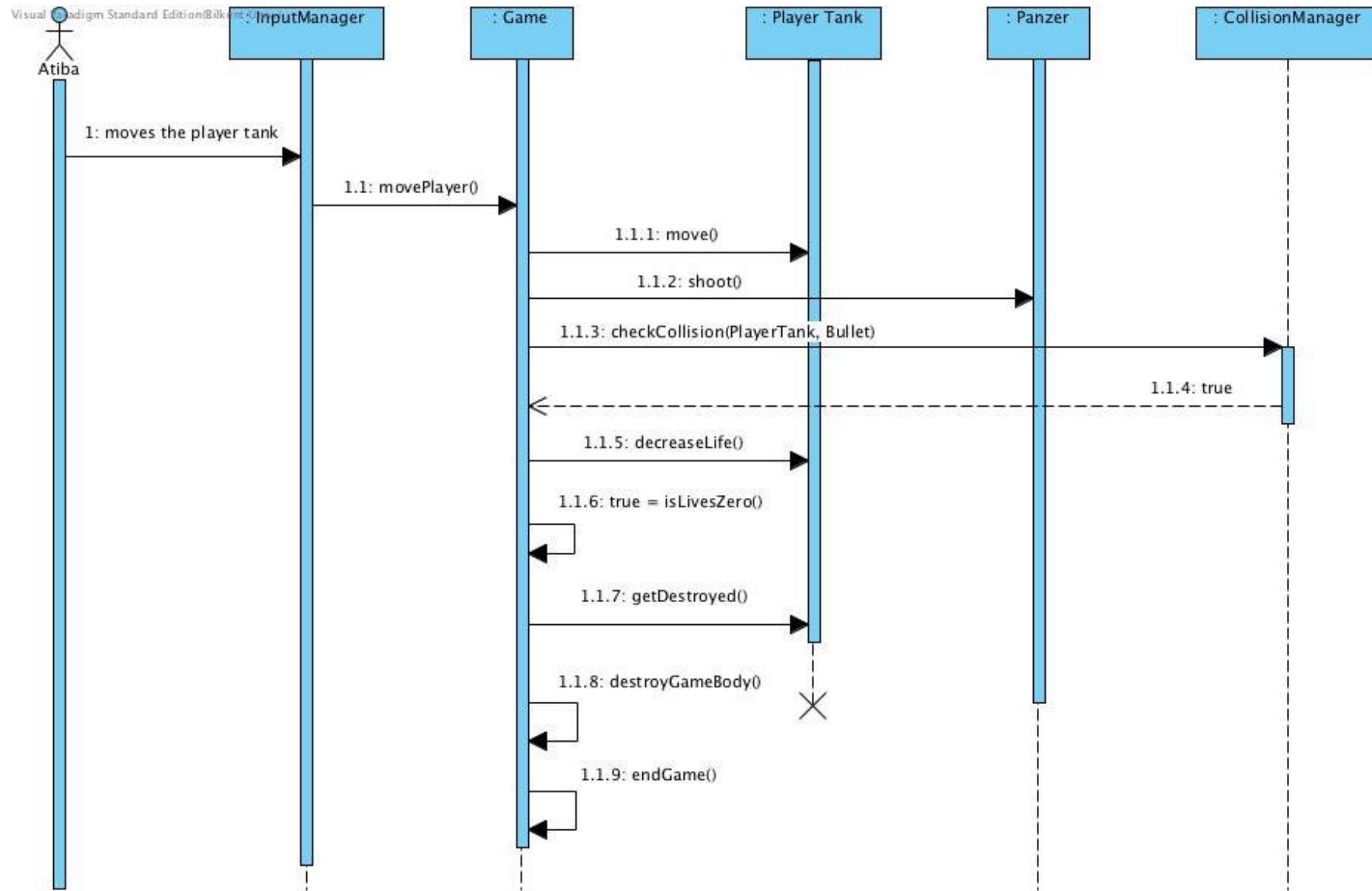


Sequence Diagram: Take a Power-up

**Scenario Name: End Game**

**Scenario:** While player Atiba plays the game and has only 1 live left. An enemy tank shoots and the bullet hits him. Atiba loses all of his lives and he loses. The game is over.

**Description:** The enemy tanks randomly tries to kill the player tank during the game. If they hit the player, player's lives are decremented by 1. If the player loses all of his/her lives, s/he loses the game.

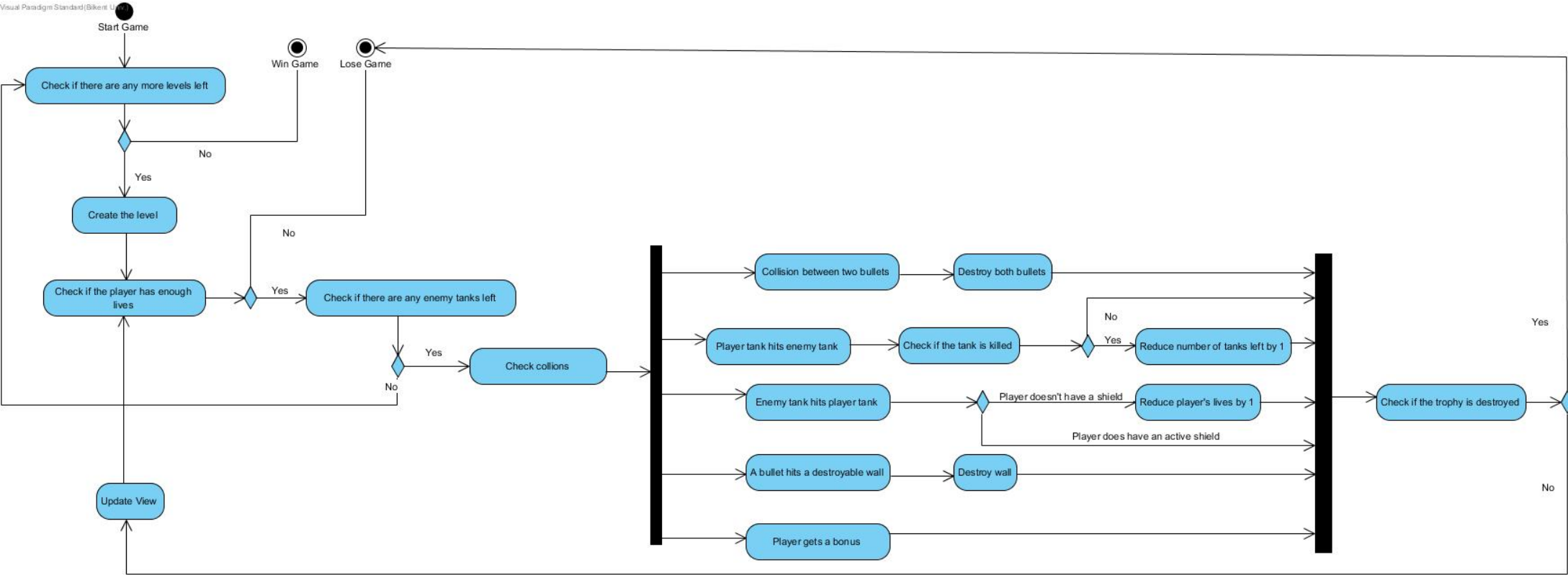


Sequence Diagram: End Game

### **6.2.2. Activity Diagram**

The following activity diagram shows the general flow of the game. The user starts playing, until one of the three conditions occur: the player beats all the levels, the player loses all their lives, or the object gets destroyed. Only in one of these circumstances, namely beating all the levels, can the player win the game.

After the levels are constructed, the player keeps on playing until every enemy tank is destroyed. This is checked after every collision that occurs during the game is checked and processed.

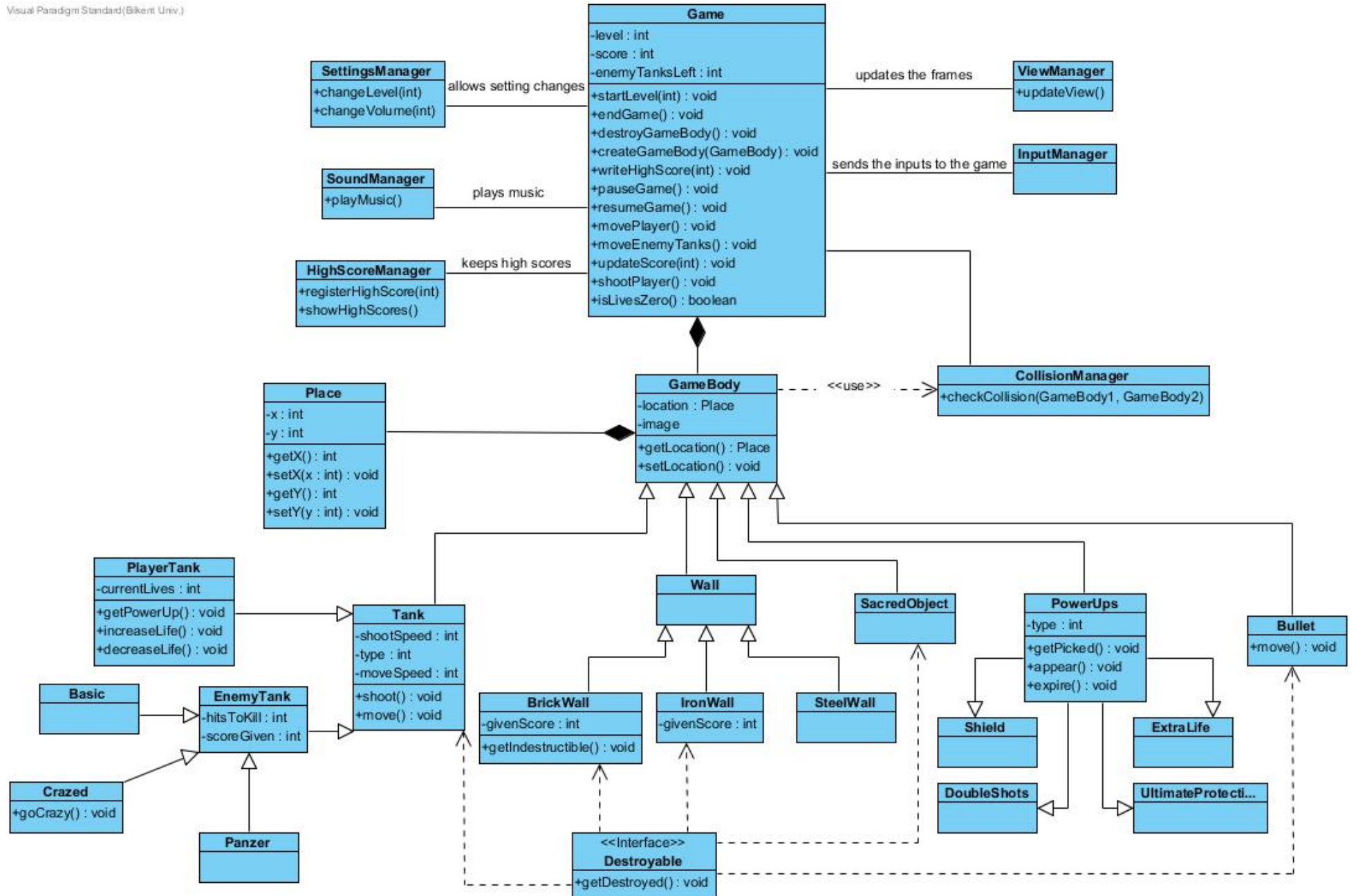


### 6.3. Object-Class Diagram

In the proposed class diagram, the **Game** object controls most of the basic functionalities that the game “Siege” will have. It basically constructs the game, with the help of manager classes. The **Game** class has the ability to start specified levels, end the game, destroying and creating game bodies, writing high score, pausing and resuming the game and moving the player.

The managers, namely **High Score Manager**, **Sound Manager**, **Settings Manager**, **Input Manager** and **View Manager**, help the **Game** class run the game.

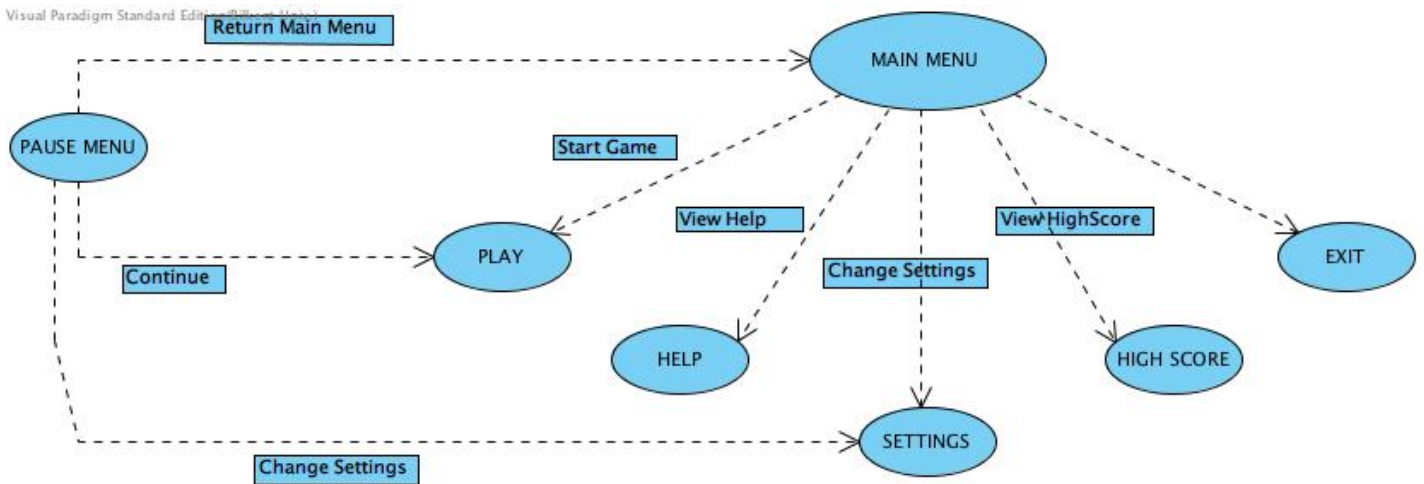
The **Game Body** represents the objects of the game. They all have the common properties of a place on the game, which is represented by the **Place** class and their respective visualization. The **Collision Manager** determines whether there has been a collision or not, and if the objects have the **Destroyable** interface, they will be destroyed as a result of this collision. This does not apply to the collisions between the **Wall** and **Tank** classes.





## 6.4. User Interface

### 6.4.1. Navigational Path



Main menu is the very first thing that player will encounter. With the main menu, user can access all the main functions of the game like play game, help, settings, high score and exit.

Play button lets the user for access the game. The game starts from the selected level in the Settings, and the game starts fresh with full lives and zero score.

Help button gives some brief information about how to play the game such as the buttons that are needed to control the tank and access the pause menu.

Settings button allows the user to change the level that they want to play or enable/disable the music which will be playing during the game.

High Score button is to give some information about the game's highest scores.

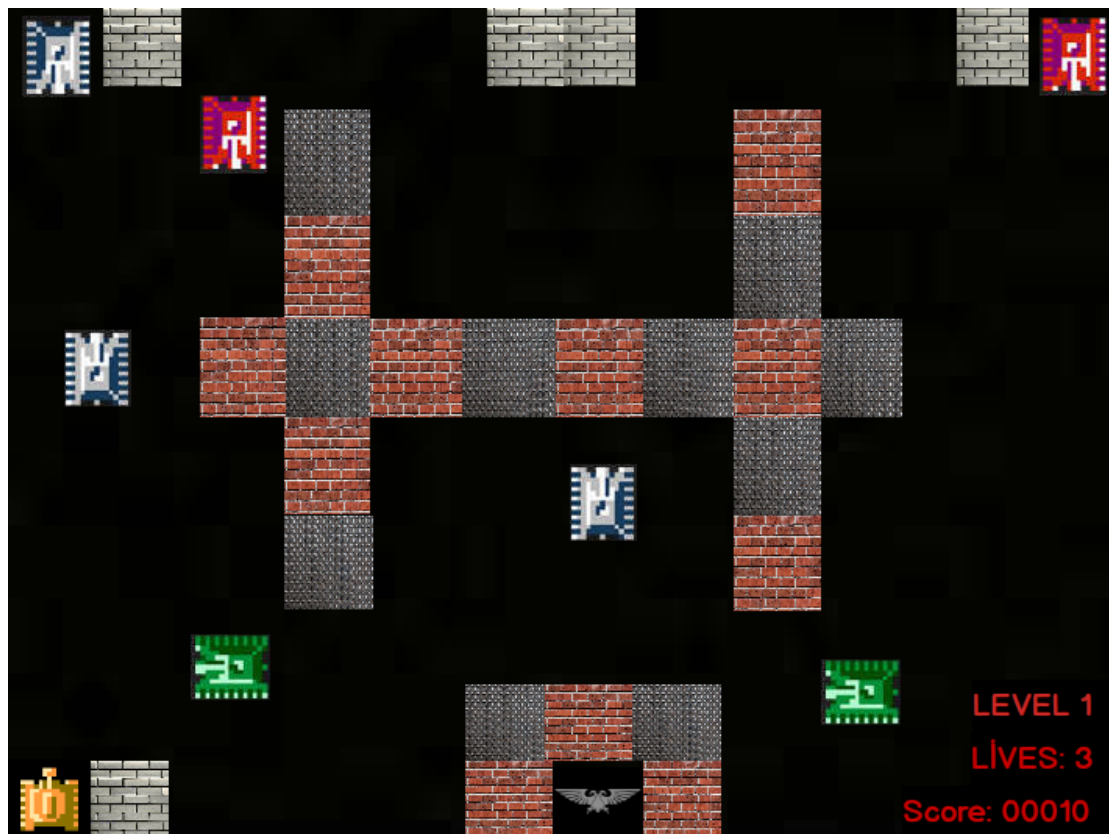
Exit button allows the user to terminate the game and reach the desktop of the computer.

### 6.4.2. Game Frames

In this section, the mock-ups for the game frames will be introduced, in the following order: main menu, game frame, pause menu, help, settings, and high score screens.

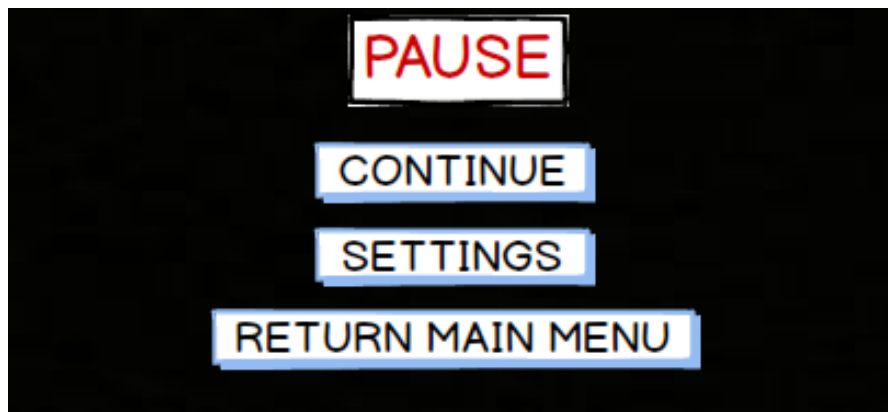


Main Menu

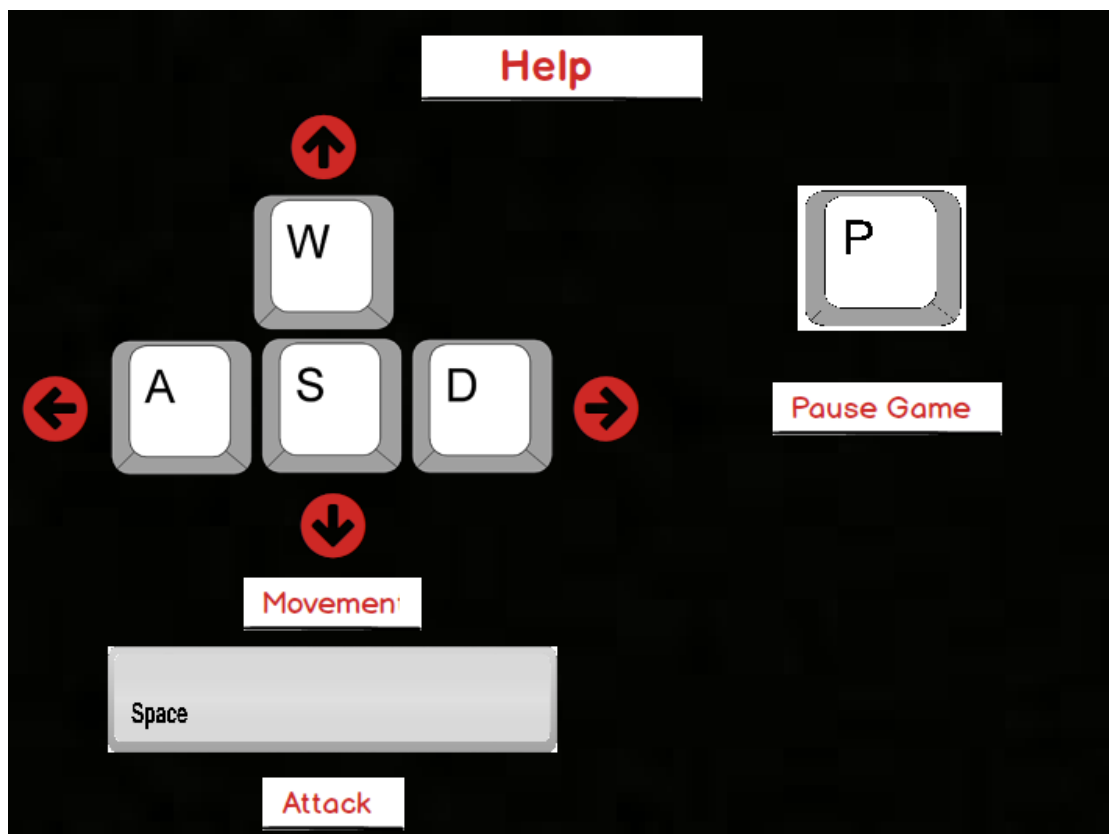


### Game Frame

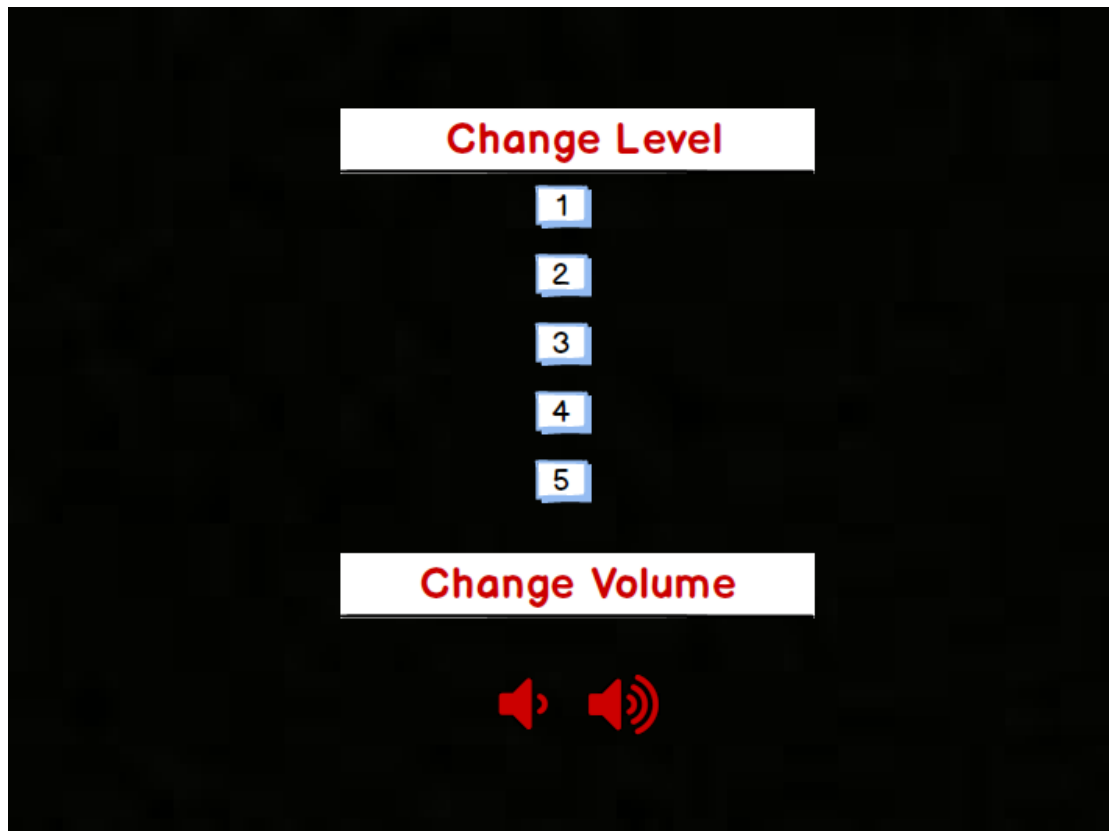
In the game screen the user can encounter 3 declarations which are lives, level of the game and the score of the player. As it is known that the tanks and walls have different type of scores when the user destroys them, the score is updated accordingly. When the user dies the lives of the player decrease by 1. When the user passes a level the level is changed and updated.



Pause Menu



Help



### Settings Menu

Settings menu allows the user to change two major function of the game which are changing the level and changing the volume. Changing the level allows the user to change the difficulty level of the game. There are 5 levels and each level has a different difficulty in the increasing order. This is creating a variety for the game. The other functionality is changing the sound level of the game. The user can close the sound or open the sound in high level.



High Scores

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