



Bilkent University

Department of Computer Engineering

CS 319

Object Oriented Software Engineering

Analysis Report

Space Invasion

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1. Introduction

The project we are planning to implement is the game called "Space Invaders".

Different from the original game, our version will have additional properties. Original game can be found at:

<http://www.oyunlar1.com/games.php?flash=603>

We chose this game since it is a simple beloved game. It does not require complex algorithms instead, it requires high number of classes to implement and different types of relationships to make. We plan to focus on object oriented design rather than algorithms. Therefore, we believe that it is a proper project for the course CS319.

2. Overview

The game has the purpose of destroying the aliens while trying to keep the spaceship alive. When the user starts the game from the main menu, there are two main objects: a block of aliens and the spaceship. In the game user can control the spaceship and tries to eliminate the whole block of aliens by the laser gun. If it hits an alien, the closer one gets destroyed. On the other hand, alien block also bombs the spaceship. Player begins the game with just one life; therefore, if a bomb hits the spaceship game will be over immediately. For simplicity, spaceship is represented as a bar and aliens as just their heads.

2.1. Controls

The only thing user can control is spaceship and the time when it sends beams to the aliens. Spaceship moves horizontally and controlled by arrow keys on the keyboard. Attack is controlled by the space bar.

2.2. Levels

There are two options of the game according to its difficulty level: easy and hard. For the each level, the speed of the aliens increases. Moreover, for each 2 levels, aliens become harder to kill. After the level 2, aliens will have more than one life; thus, it takes more than one shot to kill them.

2.3. Coins and power-ups

Player earns coins and points during the game by destroying the aliens. At the end of the each successful game player can improve the spaceship by spending the coins earned. Improvements include “attack damage”, “speed” and “beam speed”.

2.3.1. Attack damage

As mentioned above, for the further levels, aliens become harder to kill.

This power-up enables the player to destroy the aliens easily compared to the previous levels.

2.3.2. Speed

If this power-up is purchased, the speed of the spaceship will increase. It will horizontally move faster which is a necessary skill to avoid the bombs.

2.3.3. Beam speed

The beam that goes from the spaceship to the aliens should reach at the right time in order to destroy the aliens successfully. Since only one beam

can be sent at a time, this power-up not only increases the speed of the beam but also offers the player to attack more often.

2.4. What is more except than the playing itself?

The main menu proposes 4 options: "Play Game", "High Scores", "Help" and "About Us". High scores will list the top 10 scores with the usernames. The total points earned from killing the aliens and passing the levels will be shown in this section. Help button will explain the controls and the rules of the game in order to be sure that user plays the game properly. Finally about us section displays the list of the contributors.

3. Functional Requirements

3.1. Play Game

User begins the game with one life and tries to kill the aliens by shooting upwards. Aliens slide horizontally, when they reach one side of the application window, they come one step closer to the spaceship that user controls. The spaceship can slide horizontally at the bottom of the application window. There are no boundaries for the spaceship as opposed to the aliens. If the spaceship reaches left-most side and user continues to push the left button, the spaceship appears in the right-most side of the window and vice versa. User gains coins and points for each alien that the he or she kills. Aliens throw bombs to the ground to kill the user. If one of the bomb touches the spaceship, game will be over.

3.1.1. Easy Mode

In the easy mode, the direction of the bombs coming from the aliens is vertical. No directional change will occur once the bomb is released.

3.1.2. Hard Mode

In the hard mode, bombs released from aliens follow the spaceship. While the bomb is falling, the game checks two times where the spaceship is and determines a new direction for the bomb if the spaceship is not at the same vertical line with the bomb.

3.2. Next Level

If all aliens are killed, current level is succeeded. Before playing the next level, user have options to upgrade the spaceship's qualifications. Next level proposes a higher speed of aliens and it becomes harder to kill the aliens. Moreover, the number of bombs released from aliens will increase. In order to be successful in the further levels, user can be upgraded in 3 fields: Attack damage, speed of the bullets and the speed of the spaceship.

3.3. End of the game

If one of the bomb or one of the alien touches the spaceship game will be over. At the end of the game, a window will appear which asks for the name to submit the score if the score is higher than the existing top 10 scores. User can enter his/her score by typing username. By default username is "Player". Otherwise, game will just display a message that informs the player that the game is over.

3.4. Pause Game

User can pause the game for that particular moment. After pushing the pause button, 2 options can be chosen. User can either continue from where he/she left or exit the current game without saving and return to the main menu.

3.5. Exit Game

If the user pushes the exit button the application window will be closed. If the user wants to exit the game while playing the score will be lost.

3.6. High Scores

Top 10 scores will be demonstrated with usernames.

3.7. Help

The instructions to play the game will be explained. The instructions contains two parts: First, the control buttons on the keyboard will be specified. Secondly, the rules and the process will be explained in details.

3.8. About Us

The list of the contributors will be shown.

4.Non-functional Requirements

4.1. Convenience of Controls

The game should be easily remoted. The selection from the main menu should be done by clicking with mouse or touchpad. For the playing part of the game keyboard is the best option. The common controllers used in this type of games

are arrow key and the space bar. For the convenience, these controls will be used in this project too.

4.2. Performance

The input from keyboard should be immediately processed in order not to lose any time. Response time is a crucial component to provide a proper gaming experience. For example, user tries to move the spaceship but if this input were processed lately, a bomb might touch the spaceship which would cause the game to end.

4.3. Graphics

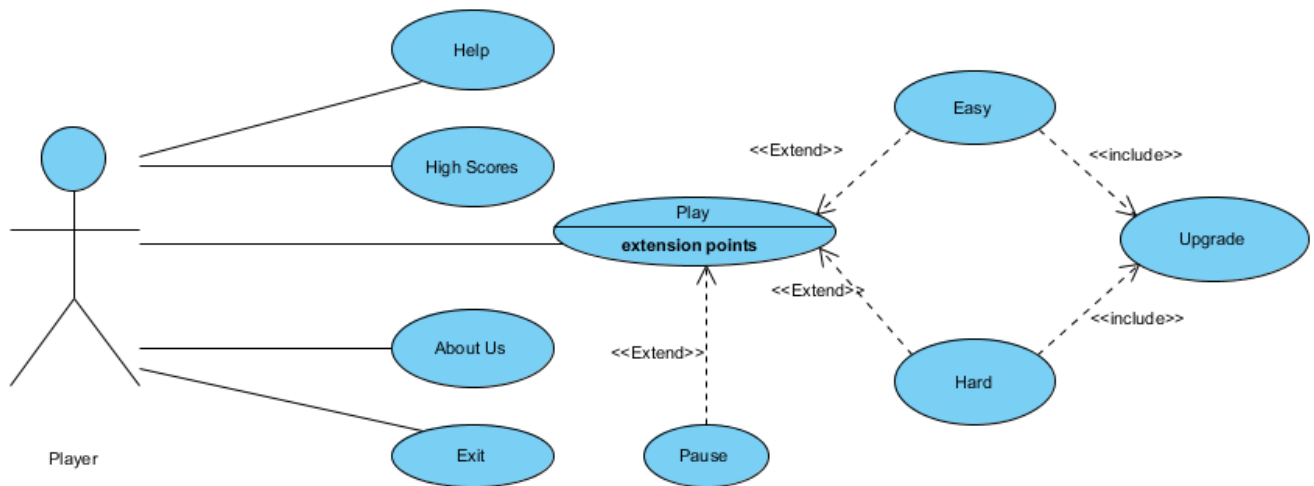
The animation of the game should be smooth in order to provide a better visualization. Furthermore, graphics should be as simple as possible to avoid the chaos that might occur when things get confused with each other.

4.4. Extendibility

Development is an important issue in the game "Space Invaders". In order to add new properties and functions, implementation should be extendable.

5. System Models

5.1. Use Case Model



5.1.1. Play

Use Case Name: Play

Primary Actor: Player

Stakeholders and Interests:

- Player: pushes the play button to begin the game. The aim is to gain coins and points by trying to stay alive.
- Play: should open the window in which the level is chosen.
- Easy: If the easy button is pushed, an easy game should be opened.
- Hard: If the hard button is pushed, a hard game should be opened.
- High Scores: should keep the track of the scores and record if it is one of the highest 10 scores.

Pre – condition: Player should currently view main menu

Post – condition: Score should be kept if it is more than current 10 scores..

Entry condition: Player should choose "Play" button from the main menu.

Exit condition: One of the following conditions should be occurred:

- Player loses the game.

- Player should choose "Exit" button in the game window. Then choose one of the options which are: returning the main menu and quitting the game.

Alternative Flows:

1. Choose of level
 - a. If player chooses easy level, bombs coming from the aliens will fall vertically.
 - b. If player chooses hard level, bombs will follow the spaceship.
2. Player kills all the aliens in the level
 - a. Player presses space bar to use a beam gun which kills aliens.
 - b. If player strikes an alien, that stroked alien gets killed.
 - c. For each alien killed player earns both coin and point.
 - d. After killing all aliens level is succeeded and player has the right to purchase a power-up and then continue with the next level.
3. Spaceship is shot
 - a. If block of alien shoots the spaceship game will be over.
 - b. A window will open if the score is high enough to get into the high scores table. The window asks for the username to submit the score.
4. Player presses the "Pause" button
 - a. Two options can be chosen: returning the main menu or continue on playing.
 - b. Current game will be lost and score will not be kept.
5. A power-up is chosen
 - a. After the level is succeeded, a power-up can be purchased.

- b. If Attack damage is purchased with coins, player gains more ability to destroy the aliens.
- c. If speed is purchased with coins, spaceship will move faster.
- d. If beam speed is purchased with coins, the beams to kill the aliens will have a higher speed.
- e. After the purchase, player can continue to play the next level.

5.1.2. Help

Use Case Name: Help

Primary Actor: Player

Stakeholders and Interests:

- Player: pushes the help button to learn more about how to play the game.
- Help: shows instructions and controllers to play the game

Pre – condition: Player should currently view main menu

Post – condition: -

Entry condition: Player should choose "Help" button from the main menu.

Exit condition: Player should choose "Back" button in the Help window.

5.1.3. High Scores

Use Case Name: High Scores

Primary Actor: Player

Stakeholders and Interests:

- Player: opens the high score page in order to see his/her ranking or view the top 10 scores with the usernames.

- High Scores: views the list of top 10 scores.

Pre – condition:

- Player should currently view main menu
- The highest 10 scores should be recorded beforehand.

Post – condition: -

Entry condition: Player should choose "High Scores" button from the main menu.

Exit condition: Player should choose "Back" button in the High Scores window.

5.1.4. About Us

Use Case Name: About Us

Primary Actor: Player

Stakeholders and Interests:

- Player: wants to see the list of the contributors.
- About Us: shows the list of the contributors.

Pre – condition: Player should currently view main menu

Post – condition: -

Entry condition: Player should choose "About Us" button from the main menu.

Exit condition: Player should choose "Back" button in the About Us window.

5.1.5.Exit

Use Case Name: Exit

Primary Actor: Player

Stakeholders and Interests:

- Player: wants to quit the game.
- Exit: If currently the playing window is open, presents the opportunity to go back to the main menu. If the player is already in the main menu, program should terminate.

Pre – condition: -

Post – condition: -

Entry condition: Player should press the "Exit" button.

Exit condition: -