Software Requirements Specification

for

DarkSide

Version 2.3

Prepared by

Group Name: Team 2

Student 1	**260xxxxxx**
Student 2	**260xxxxxx**
Student 3	**260xxxxxx**
Student 4	**260xxxxxx**
Student 5	**260xxxxxx**
Student 6	**260xxxxxx**

Instructor:	**Haibo Zeng**
Course Number:	**ECSE 321**
Course Name:	**Introduction to Software Engineering**
Teaching Assistant:	***Rami Sayar***
Date:	**2013/03/01**

Table of Contents

Revision History

Revision V2.0 (2013-02-21): Difficulty selection has been moved to post-selection of “Play Single Player” so that “Settings” becomes completely optional. Sections that have been modified include 2.2.5 Use Cases: Menu, 3.1.1.1 Menu Screen.

Revision V2.1 (2013-02-24): The Pause Menu was removed and a single menu screen will appear before gameplay and when gameplay is suspended. Sections that have been modified include 2.2.2 User Interface, 2.2.5 Use Cases: Menu, 2.2.6 Use Cases: Gameplay and 3.1.1.1 Menu Screen.

Revision V2.2 (2013-02-24): Removed unambiguous elements. Sections modified include 2.2.3 Gameplay, 3.1.2 Mode 2: Single Player Game, 3.1.2.4 Enemies and 3.1.3 Mode 3: Dual Player Alternating

Revision V2.3 (2013-03-01): The description of Stage 2 in section 3.1.2.5.2 Level Distinctions was modified. The phrase “Stage 2 will contain both Asteroids and Chaser aliens” has been corrected to “Stage 2 will contain both Shooter and Chaser aliens”. Added missing section, Section 3.1.1.1.6.4

1 Introduction

1.1 Purpose

The purpose of this software requirements specification document (SRS) is to provide the client a complete overview of the game DarkSide, presenting all of the requirements provided by the client.

This document will provide a brief development history as well as the various modules, features and interfaces. In addition, the requirements, which include the mandatory functions, the ideal conditions as well as the optional features will be presented in a traceable and quantifiable fashion.

The undertaking of this project will familiarize the developers with a practical implementation of various software engineering practices, and also the familiarization of programming in the C# language. Throughout the development process, source code will be uploaded and shared to GitHub and will be made available to the contributors of the project, as well as to the client for tracking purposes.

The end goal of this project is to create an enjoyable experience for the end user as a modern remake of one of the most popular arcade games, Atari's "Asteroids".

1.2 Scope

The game "DarkSide" will feature a single player and alternative two player adaptation of the classic video game "Asteroids". These modes will be hosted in a local computer system. The main objective of the game is to survive waves of asteroids and alien ships targeting the present player(s) while accumulating points based on asteroids and alien ships destroyed. This document will be read by Professor Haibo Zeng and teacher assistant Rami Sayar. It will also be forwarded to future employers as a reference to this project. The goal of this document is to illustrate and specify the different technical aspects of the game using use cases, listing and specifying the requirements for the project.

1.3 Definitions, Acronyms & Abbreviations

Asteroids: The game from which DarkSide was modeled

DarkSide: Title of the project/software

Enemy: An asteroid, alien or a boss

Game State: The mode of gameplay the user is currently experiencing, either Menu Selection or Gameplay

Gameplay: A game state when a player is actively playing the game. Synonymous with In-Game

Hitbox: A hitbox is a shape that outlines an object in play that allows for collision detection

HUD: Abbreviation for Heads-Up Display

In-Game:

1. A game state when a player is actively playing the game. Synonymous with gameplay In Menu selection
2. A game state when a player is navigating through a menu

Ini File: A file with initial inputs

Interval: Synonymous with stage

Level: Collection of multiple stages

Round: A state of the game initiated by selecting New Game from the main menu. Synonymous with one game

Spawn: The creation of non-playable characters in the game

SRS: Software Requirement Specification

Stage: A subsection of level

Stackable: In the context of item drops, stackable items are items whose attributes add up with attributes of other items

User: Synonymous with Player and User-Player

Unit of Space: The size of the smallest asteroid

Wave: Synonymous with level

1.4 References

E. J. Braude and M. E. Bernstein, *Software Engineering: Modern Approaches*, 2nd ed.: Wiley, 2005.

Darth Vader's "Nooo". Available: http://www.youtube.com/watch?v=WWaLxFIVX1s. Retrieved on February 10, 2013.

G. D. George. Asteroids Classics Reunited. Available: http://www.classicgaming.cc/classics/asteroids/history.php. Retrieved on February 10, 2013

IEEE Std 830-1984, IEEE Guide to Software Requirements Specifications

IEEE Std 830-1998, IEEE Recommended Practice for Software Requirements Specifications

MC Hammer's "Can't Touch This". Available: http://www.youtube.com/watch?v=otCpCn0l4Wo&noredirect=1. Retrieved on February 10, 2013

Starfox Corneria Theme. Available: http://www.youtube.com/watch?v=eclAC0JQJYk. Retrieved on February 10, 2013.

Zeng, Haibo. ECSE 321 - Introduction to Software Engineering: Lecture 5 – Requirement Modeling

1.5 Overview

The following sections of this document contain the overall description and specific requirements. The overall description of the product will give a brief overview of the system whereas the Specific Requirements Section will give a detailed description of all the requirements needed to implement this software system. This Software Requirements Specification adheres to the A2 template of the IEEE std 830-1998. The requirements priority and difficulty are mentioned next to the title of the requirement e.g. Requirement *(priority, difficulty).*

2 Overall Description

2.1 Product Perspective

The product is a modern adaptation of the popular arcade game *Asteroids*. It was first created by Atari Inc. in 1979 and is known to be the company's best creation. Lyle Rains, the senior executive at the time, originally conceived the idea. With the help of his fellow team members, he was able to program and design a game that would revolutionize gaming in his century. *Asteroids* was built to be played on an arcade machine. This two dimensional game used a vector monitor, a display device that uses drawn lines. The main objective is to destroy asteroids and flying saucers while avoiding any form of contact with the former objects. The game consists of a triangular cursor like spaceship that can rotate and shoot beams.

DarkSide inherits many attributes with its predecessor; there are many new functions (*See SRS- Section 2.2*) and features (*See SRS- Section 3*). This game will be a self-contained software system. Also, the game is designed to be able to accommodate any windows 7 computer and will simply need the keyboard to navigate through menus and play the game. The user only needs to be able to read the onscreen instructions in order to initiate the main functionality of the software. The keys required for the functions of the game can be remapped through the settings menu in *DarkSide* for the user's convenience.

2.2 Product Functions & Use Cases

2.2.1 General

The functions mentioned in this section and any other subsections are essential to the requirements unless specified otherwise. The main function of this product is to allow a user to play a game, and record a corresponding name and score, as well as to compare scores with previous players on the same local machine.

The product will be a video game playable on any Windows 7 personal computer. It will consist of inputs through the keyboard and outputs through the screen and speakers.

Upon startup of the application, the system will load the initial configurations of the game from an ini file. Upon loading, the user will be presented a menu from which a player can navigate into starting a level. Upon completion of a level, the system will record their scores and prompt for a name. Once the required information has been received, the system will then update the leaderboards. Optionally, the system will upload the scores to a remote server where the scores can be seen. The remote server can be set by the user to reside either in the local network or on the internet.

The game will have two states: Menu Selection and In Game.

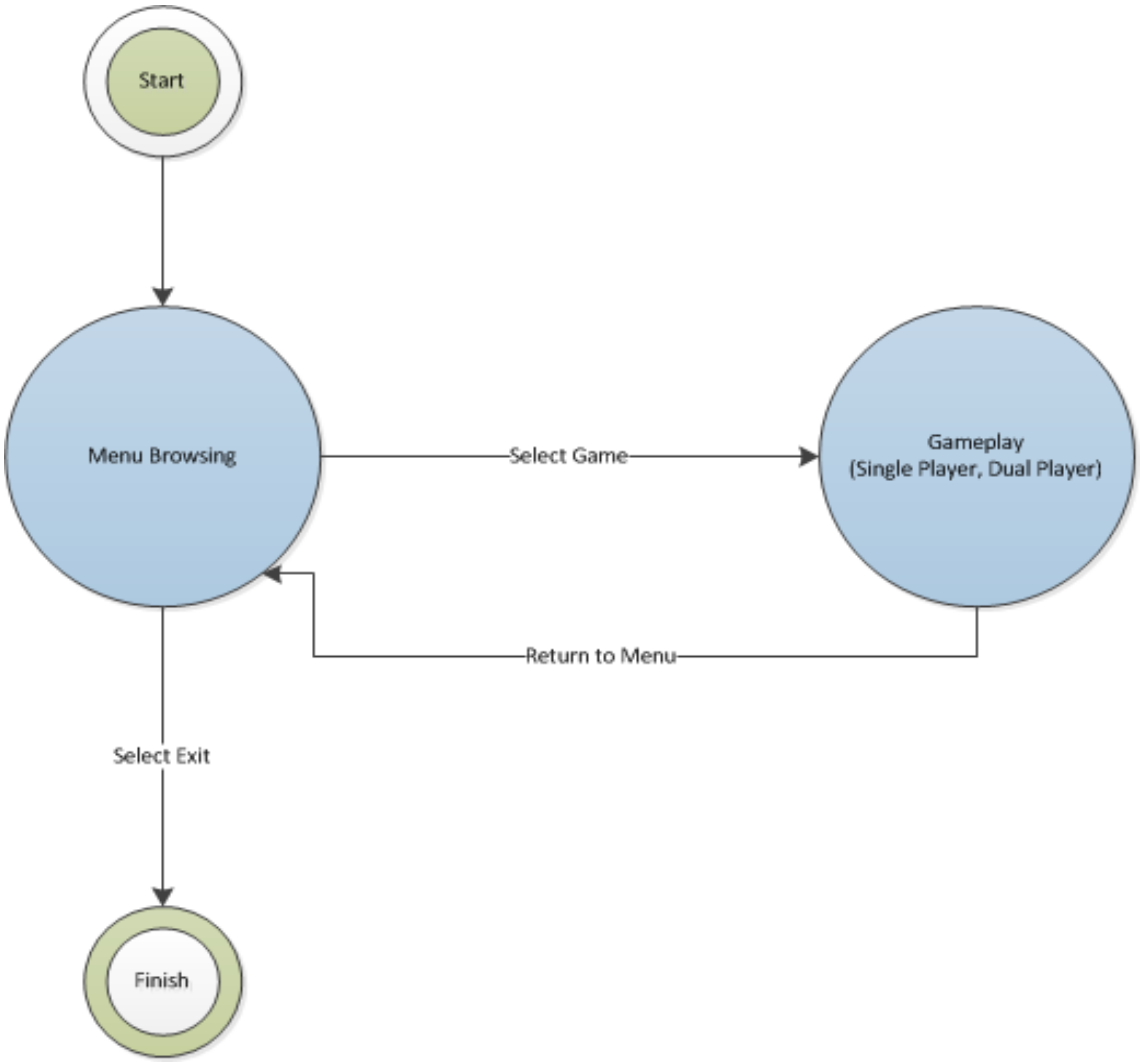

Figure 1: State Transition Diagram

Menu browsing is the state where the player can browse through options in a menu and choose options described in Section 2.2.2 of this SRS document. Gameplay is the state where the player is actively fighting asteroids and aliens.

2.2.2 User Interface (Essential, Easy)

The user interface for the Menu Selection state will consist of a menu where a user will have the following options:

1. Play Single Player
2. Play Dual Player
3. Load Saved Game (Desirable)
4. Save Game
5. Leaderboards

6. Settings
7. Quit

The implementation of the menu screen will be described in Section 3.1.1.

During the In-Game state, the user interface will consist of a celestial themed background, asteroids, enemies, friendlies and a heads up display (HUD). The HUD will contain information pertaining to the number of lives that remain, the scores, and the stage the player is currently playing.

2.2.3 Gameplay (Essential, Easy)

The objective of the game is to obtain the highest score. Points can be affected by completing the following tasks:

- Destroying an Asteroid
- Destroying an Alien
- Picking Up Items
- Defeating a Boss (Optional, if bosses are implemented)
- Clearing a Stage

The specifics of scoring and points distribution are described in Section 3.1.2 of this SRS document.

Gameplay can be single player or dual player where two players play the same game alternating turns. Optionally, there will also be a dual player simultaneous mode where two players play side by side in a cooperative gameplay on the same map.

The enemies will consist of asteroids, aliens and, optionally, bosses. The asteroids are passive shapes moving about. A player that touches an asteroid will lose a life. A player can segment an asteroid by shooting at it. If an asteroid is large, it will break into smaller and smaller pieces until it reaches its minimum size; it simply vanishes afterwards. Aliens are agents that will chase the player or shoot at the player. A player that touches an alien or gets hit by an alien shot will lose a life. A player can defeat an alien by shooting at it. When an alien is destroyed, it might drop an item. Bosses are agents that will have unique behaviors in order to defeat the user. A player will lose a life if touched by the boss or any of the boss's projectiles. A user can defeat a boss by shooting at its weak spots. All enemy agents will contain an Artificial Intelligence agent to implement the above mentioned behaviours. Detailed requirements of the enemies can be found in Section 3.1.2 of this document.

Every object on screen including the player's ship is delimited by an area not seen by the user. This contour is defined as a hit box.

The difficulty of the game can be adjusted through the main menu. The difficulty level multiplies the points obtained.

The game will have 16 levels. Optionally, at the end of levels 5, 10, 15 and 16 a boss will appear.

The player(s) will at times receive items that will enhance their effectiveness. These items include:

- Double Points
- Gun Range
- Extra Life
- Invincibility
- Gun Spread (optional)

The detailed requirements of the items can be found in Section 3.1.2.1.3.

Each player begins with a certain number of lives depending on the difficulty specified 3.1.2.7. The game will end if a player runs out of life or if a player defeats the final level.

2.2.4 Game controls (Essential, Easy)

The players will have two sets of controls for each state of the game.

During the Menu selection state, a player will only have three actions:

- Scroll up
- Scroll down
- Select

These actions will, by default, be assigned to the up, down and enter keys, respectively, on the keyboard.

During the In Game state, players will have the following actions:

- Accelerate
- Decelerate
- Turn Right
- Turn Left
- Shoot

These actions can be mapped to specified key in the settings menu. The default key binding for the first player will be the up, down, left, right and right ctrl key, respective to the above mentioned list.

The player(s) can also suspend/pause the game by pressing the pause button whose default binding is ‘P’. This will change the state to Menu Selection, causing the menu to appear.

2.2.5 Use Cases: Menu

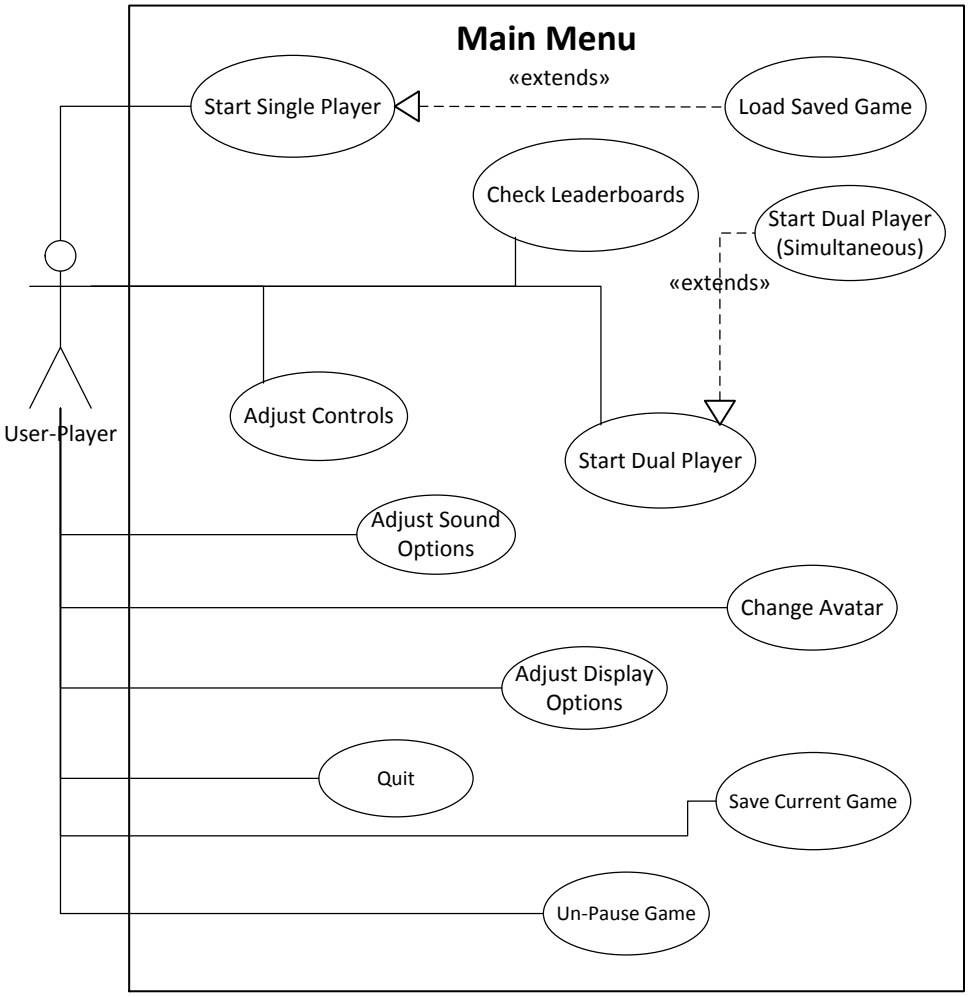

Figure 2: Main Menu Use Case

2.2.5.1 Start Single Player[1]

The User-Player can begin gameplay designed for one single player.

Use Case Name:	**Start Single Player**
Participating Actors:	User-Player
Entry Conditions:	User-Player enters menu selection
Flow of Events:	1. The User-Player scrolls to highlight “Play Single Player” 2. Presses “Select” key 3. Selects difficulty 4. Enters single player gameplay

[1] ECSE 321 - Introduction to Software Engineering: Lecture 5 - Requirements Modeling: Slide 7, Haibo Zeng

Exception Flow:	N/A
Exit Conditions:	User-Player enters gameplay
Quality Requirements:	N/A

2.2.5.2 Load Saved Game

The User-Player can continue a past game that was suspended.

Use Case Name:	**Load Save Game**
Participating Actors:	User-Player
Entry Conditions:	User-Player enters menu selection
Flow of Events:	1. The User-Player scrolls to highlight “Load Game” 2. Presses “Select” 3. Chooses a save file 4. The save file is deleted after continuing gameplay
Exception Flow:	If no save file exists: 3. The User-Player is unable to select a save file 4. Returns to Menu after selecting “Cancel”
Exit Conditions:	User-Player enters gameplay
Quality Requirements:	N/A

2.2.5.3 Start Dual Player

A User-Player can begin the gameplay designed for two players that alternate.

Use Case Name:	**Start Dual Player**
Participating Actors:	User-Player
Entry Conditions:	User-Player enters menu selection
Flow of Events:	1. The User-Player scrolls to highlight “Dual Player” 2. Presses “Select” 3. Chooses “Alternate” 4. Enters gameplay for Player-1
Exception Flow:	N/A
Exit Conditions:	User-Player enters gameplay
Quality Requirements:	N/A

2.2.5.4 Start Dual Player (Simultaneous)

The User-Player can begin gameplay designed for two players simultaneously.

Use Case Name:	**Start Dual Player (Simultaneous)**
Participating Actors:	User-Player
Entry Conditions:	User-Player enters menu selection

Flow of Events:	1. The User-Player scrolls to highlight “Dual Player” 2. Presses “Select” 3. Chooses “Simultaneous” 4. Enters gameplay for both Player-1 and Player-2
Exception Flow:	N/A
Exit Conditions:	User-Player enters gameplay
Quality Requirements:	N/A

2.2.5.4 Save Current Game

The User-Player can suspend and save current iteration of gameplay.

Use Case Name:	**Save Current Game**
Participating Actors:	User-Player
Entry Conditions:	User-Player enters menu selection
Flow of Events:	1. The User-Player scrolls to highlight “Save Game” 2. Presses “Select” 3. Enter save file name 4. Software ends
Exception Flow:	N/A
Exit Conditions:	User-Player exits DarkSide
Quality Requirements:	Refer to 3.4.1.1

2.2.5.4 Un-Pause Game

The User-Player can return to gameplay after suspending gameplay.

Use Case Name:	**Un-Pause Game**
Participating Actors:	User-Player
Entry Conditions:	User-Player enters menu selection
Flow of Events:	1. The User-Player presses the “Pause” button
Exception Flow:	If the User-Player has not entered the menu selection state by pausing, the “Pause” button is disabled
Exit Conditions:	User-Player returns to gameplay
Quality Requirements:	N/A

2.2.5.7 Check Leaderboards

The User-Player can view statistics and high scores of previous gameplay attempts.

Use Case Name:	**Check Leaderboards**
Participating Actors:	User-Player

Entry Conditions:	User-Player begins DarkSide
Flow of Events:	1. The User-Player scrolls to highlight “Leaderboards” 2. Presses “Select” 3. Views statistics
Exception Flow:	N/A
Exit Conditions:	User-Player exits “Leaderboards”
Quality Requirements:	N/A

2.2.5.8 Adjust Controls

The User-Player can remap the buttons to his or her preferences.

Use Case Name:	**Adjust Controls**
Participating Actors:	User-Player
Entry Conditions:	User-Player begins DarkSide
Flow of Events:	1. The User-Player scrolls to highlight “Settings” 2. Presses “Select” 3. Scrolls to highlight “Controls” 4. Presses “Select” 5. Chooses control configuration 6. Presses “Select”
Exception Flow:	N/A
Exit Conditions:	User-Player exits “Settings”
Quality Requirements:	N/A

2.2.5.9 Change Avatar

The User-Player can choose between different spaceships before beginning gameplay.

Use Case Name:	**Change Avatar**
Participating Actors:	User-Player
Entry Conditions:	User-Player begins DarkSide
Flow of Events:	1. The User-Player scrolls to highlight “Settings” 2. Presses “Select” 3. Scrolls to highlight “Avatar” 4. Presses “Select” 5. Chooses avatar 6. Presses “Select”
Exception Flow:	N/A
Exit Conditions:	User-Player exits “Settings”
Quality Requirements:	N/A

2.2.5.10 Adjust Display Options

The User-Player can modify display options before beginning gameplay.

Use Case Name:	**Adjust Display Options**
Participating Actors:	User-Player
Entry Conditions:	User-Player begins DarkSide
Flow of Events:	1. The User-Player scrolls to highlight “Settings” 2. Presses “Select” 3. Scrolls to highlight “Video” 4. Presses “Select” 5. Chooses screen size 6. Presses “Select”
Exception Flow:	N/A
Exit Conditions:	User-Player exits “Settings”
Quality Requirements:	N/A

2.2.5.11 Adjust Sound Options

The User-Player can modify the sound options before beginning gameplay.

Use Case Name:	**Adjust Sound Options**
Participating Actors:	User-Player
Entry Conditions:	User-Player begins “Settings”
Flow of Events:	1. The User-Player scrolls to highlight “Settings” 2. Presses “Select” 3. Scrolls to highlight “Audio” 4. Presses “Select” 5. Chooses volume 6. Presses “Select”
Exception Flow:	N/A
Exit Conditions:	User-Player exits “Settings”
Quality Requirements:	N/A

2.2.5.12 Quit

The User-Player can end the software, DarkSide.

Use Case Name:	**Quit**
Participating Actors:	User-Player
Entry Conditions:	User-Player begins DarkSide
Flow of Events:	The User-Player scrolls to highlight “Quit” Presses “Select”

	The software closes
Exception Flow:	N/A
Exit Conditions:	User-Player exits DarkSide
Quality Requirements:	N/A

2.2.6 Use Cases: Gameplay

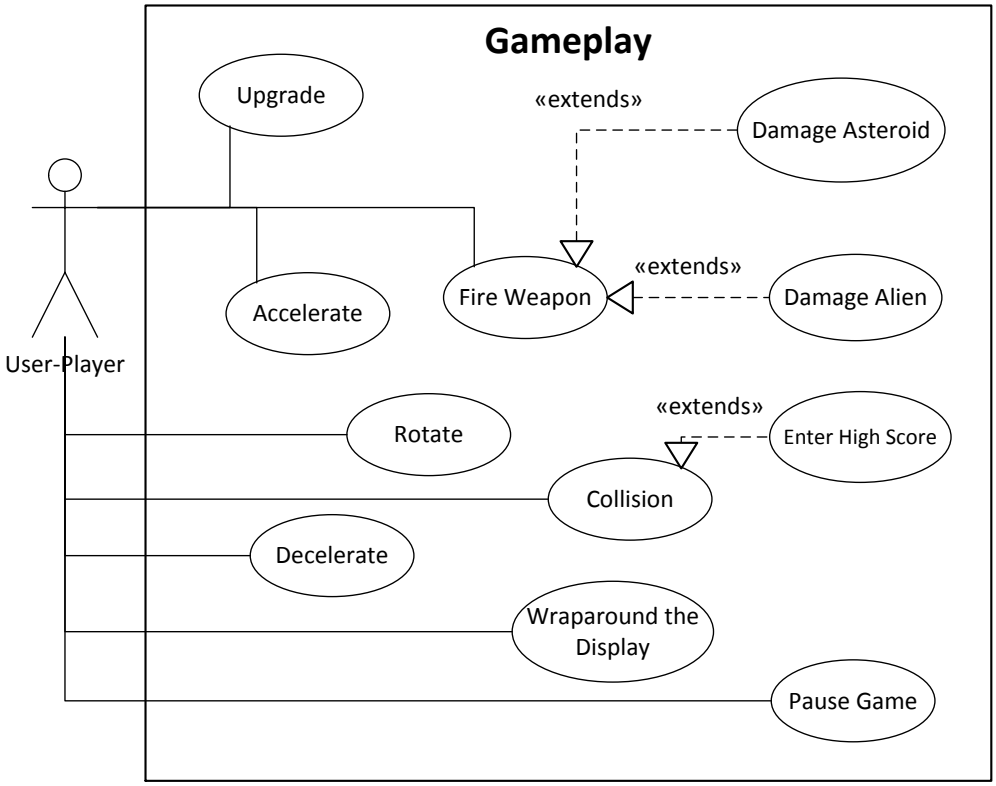

Figure 3: Gameplay Use Case

2.2.6.1 Accelerate

The User-Player can increase the speed of the avatar, i.e. the Spaceship.

Use Case Name:	**Accelerate**
Participating Actors:	User-Player
Entry Conditions:	User-Player begins gameplay
Flow of Events:	1. The User-Player presses “Accelerate” button 2. The Speed of the Spaceship increments
Exception Flow:	If the speed of the Spaceship is at maximum or if the Spaceship is destroyed: 2 The speed of the Spaceship does not change.

Exit Conditions:	User-Player exits gameplay
Quality Requirements:	Refer to Section 3.4.1.2

2.2.6.2 Decelerate

The User-Player can decrease the speed of the avatar, i.e. the Spaceship.

Use Case Name:	**Decelerate**
Participating Actors:	User-Player
Entry Conditions:	User-Player begins gameplay
Flow of Events:	1. The User-Player presses “Decelerate” button 2. The speed of the Spaceship decrements
Exception Flow:	If the speed of the Spaceship is at minimum or if the Spaceship is destroyed: 2 The speed of the Spaceship does not change
Exit Conditions:	User-Player exits gameplay
Quality Requirements:	Refer to Section 3.4.1.2

2.2.6.3 Rotate

The User-Player can adjust the heading of the avatar, i.e. the Spaceship.

Use Case Name:	**Rotate**
Participating Actors:	User-Player
Entry Conditions:	User-Player begins gameplay
Flow of Events:	1. The User-Player presses “Turn Right” or “Turn Left” button 2. The heading of the Spaceship changes accordingly, rotating clockwise for “Turn Right” and counter-clockwise for “Turn Left”
Exception Flow:	If “Turn Right” is pressed while “Turn Left” is held or vice versa or if the Spaceship is destroyed: 2 The heading of the Spaceship change according to the held button until released
Exit Conditions:	User-Player exits gameplay
Quality Requirements:	Refer to Section 3.4.1.2

2.2.6.4 Wraparound the Display

The gameplay environment will consist of two-dimensional display in which a User-Player wraparounds when reaching and traversing the display border, i.e. appears on the opposite side.

Use Case Name:	**Wraparound the Display**
Participating Actors:	User-Player
Entry Conditions:	User-Player begins gameplay
Flow of Events:	1 The User-Player reaches boundary of display 2 Continues to travel through the display border 3 Appears on opposing display border moving at the same velocity
Exception Flow:	N/A
Exit Conditions:	User-Player exits gameplay
Quality Requirements:	Refer to Section 3.4.1.2

2.2.6.5 Fire Weapon

The User-Player can fire shots from the Spaceship in the same direction as the heading.

Use Case Name:	**Fire Weapon**
Participating Actors:	User-Player
Entry Conditions:	User-Player begins gameplay
Flow of Events:	1. The User-Player presses “Shoot” button 2. A single shot is fired from the Spaceship in the same direction as the heading
Exception Flow:	If the Spaceship is destroyed: 2 No shot is fire from the Spaceship
Exit Conditions:	User-Player exits gameplay
Quality Requirements:	Refer to Section 3.4.1.2

2.2.6.6 Damage Asteroid

The User-Player can damage an Asteroid using weapon fire.

Use Case Name:	**Damage Asteroid**
Participating Actors:	User-Player
Entry Conditions:	User-Player begins gameplay
Flow of Events:	1. The User-Player presses “Shoot” button 2. A single shot is fired from the Spaceship in the same direction as the heading 3. The shot collides with an Asteroid 4. The health of the Asteroid decrements
Exception Flow:	If the health of the Asteroid decrements to 0: 5 The Asteroid gets destroyed
Exit Conditions:	User-Player exits gameplay
Quality Requirements:	Refer to Section 3.4.1.2

2.2.6.7 Damage Alien

The User-Player can damage an Alien using weapon fire.

Use Case Name:	**Damage Alien**
Participating Actors:	User-Player
Entry Conditions:	User-Player begins gameplay
Flow of Events:	1. The User-Player presses “Shoot” button 2. A single shot is fired from the Spaceship in the same direction as the heading 3. The shot collides with an Alien 4. The health of the Alien decrements
Exception Flow:	If the health of the Alien decrements to 0: 5 The Alien gets destroyed
Exit Conditions:	User-Player exits gameplay
Quality Requirements:	Refer to Section 3.4.1.2

2.2.6.8 Collision

The User-Player can collide with either an Asteroid or an Alien, causing the destruction of the User-Player’s avatar, i.e. the Spaceship.

Use Case Name:	**Collision**
Participating Actors:	User-Player
Entry Conditions:	User-Player begins gameplay
Flow of Events:	1 The User-Player collides with either an Alien or an Asteroid, or vice-versa 2 Gets destroyed
Exception Flow:	If User-Player has immunity: 2 The User-Player does not get destroyed
Exit Conditions:	User-Player exits gameplay
Quality Requirements:	Refer to Section 3.4.1.2

2.2.6.9 Enter High Score

The User-Player can increase the speed of the avatar, i.e. the Spaceship.

Use Case Name:	**Enter High Score**
Participating Actors:	User-Player
Entry Conditions:	User-Player finishes a round
Flow of Events:	1. Enters three characters as a designation 2. Presses “Select” 3. The User-Player’s score is registered if among top 10

Exception Flow:	N/A
Exit Conditions:	User-Player exits gameplay
Quality Requirements:	Refer to Section 3.4.1.3

2.2.6.10 Upgrade

The User-Player can upgrade the Spaceship or receive bonuses.

Use Case Name:	**Upgrade**
Participating Actors:	User-Player
Entry Conditions:	User-Player begins gameplay
Flow of Events:	1 The User-Player collides with/touches an Item Drop 2 Receives a weapon upgrade or a bonus
Exception Flow:	N/A
Exit Conditions:	User-Player exits gameplay or item effect expires
Quality Requirements:	Refer to Section 3.4.1.2

2.2.6.11 Pause Game

The User-Player can suspend the gameplay.

Use Case Name:	**Pause Game**
Participating Actors:	User-Player
Entry Conditions:	User-Player begins gameplay
Flow of Events:	1. The User-Player presses “Pause” button 2. The “Pause Menu” opens and gameplay is suspended
Exception Flow:	N/A
Exit Conditions:	User-Player exits gameplay
Quality Requirements:	Refer to Section 3.4.1.2

2.2.7 Audio & Video

The game will contain audio resource to enhance the entertainment value of the game. It will have background music as well as sound effects for the following actions:

- Menu Scrolling
- Menu Selection
- Shooting
- Collisions
- Shots hitting a target

The game will be displayed in a windows style window and can be maximized as an option in the Settings menu. This is an optional feature.

2.3 User Classes & Characteristics

There will be one class of user who will use the product. Familiarity with a keyboard interface will be required to operate the software as intended. The user is expected to have the understanding of computers at a level of an elementary school student or greater. The functions that will be available to this user are playing the game, browsing the menus and viewing high scores. Each user will also be able to adjust the gameplay settings available according to their own preferences on the main menu, and will have the choice between easy, medium, and hard as difficulty levels.

2.4 Constraints

The game is designed to run on a computer running a windows operating systems. Since this game will be programmed primarily in C#, systems which are compatible with the .NET framework will be compatible with the software. The intended operating system of which the game will run will be Windows 7.

2.5 Assumptions & Dependencies

It is assumed that users are all familiar with the basics of using a computer. Due to the simplicity of the system, it is also assumed that users do not need any further instructions other than the on screen instructions to play the game.

3 Specific Requirements

3.1 Functional Requirements

3.1.1 Mode 1: Menu Navigation

3.1.1.1 Menu Screen (Essential, Easy)

The menu screen is used to adjust the options of the game and to view the scoreboard. During the menu screen, the player will have the options to:

1. Play Single Player
2. Play Dual Player
3. Load Saved Game
4. Save Game
5. Leaderboards
6. Settings
7. Quit

3.1.1.1.1 Single Player (Essential, Medium)

Selecting “Play Single Player” will open a difficulty submenu. Choosing one between Easy, Medium and Hard will start a new game. The single player mode is detailed in Section 3.1.2 of this SRS.

3.1.1.1.2 Dual Player (Essential, Easy)

Selecting “Play Dual Player” game takes the user to the alternative mode dual player game. Optionally, there can be another menu where the user can select to play dual player alternative gameplay or simultaneous gameplay. Please refer to 3.1.3. and 3.1.4 for further details.

3.1.1.1.3 Load Saved Game (Desirable, Easy)

When selecting “Load Saved Game” from the main menu, the player(s) will be prompted with a dialog box to load a saved game from an XML file. This file will contain all the state information required to resume gameplay. The file will be deleted upon selection.

3.1.1.1.4 Save Game (Desirable, Easy)

When selecting “Save Game”, a file is created with name chosen by the user which contains all the state information to resume gameplay at a later point in time. The software ends afterwards.

3.1.1.1.5 Leaderboards (Essential, Essay)

When selecting “Leaderboards”, the top ten previous scores are displayed from highest to lowest.

3.1.1.1.6 Settings (Essential, Easy)

When selecting the Settings option from the main menu, users will be prompted with a sub menu consisting of the following options:

- Audio
- Video
- Change Controls
- Change Avatar

3.1.1.1.6.1 Audio (Optional, Easy)

This option will allow the user to adjust the volume settings of the game

3.1.1.1.6.2 Video (Optional, Medium)

This option will allow the user to switch between windowed and full screen mode. The default is windowed mode. The default resolution of the game will be 640x480.

3.1.1.1.6.3 Change Controls (Desirable, Hard)

This option will allow players to enter a menu in order to change the key mapping from the

Keyboard input.

The input will consist of only five buttons:

1. Accelerate
2. Brake
3. Turn right
4. Turn left
5. Fire

These controls can be mapped to a key on the keyboard. There exists a default key mapping which can only be changed by user in this menu.

3.1.1.1.6.4 Change Avatar (Optional, Easy)

This option will allow the user to change the avatar for the spaceship.

3.1.1.1.7 Quit (Desirable, Easy)

When selecting “Quit”, the software ends.

3.1.1.1.8 Pause (Desirable, Medium)

Pressing the Pause button during gameplay will suspend the gameplay and show the menu screen.

Pressing the Pause button a second time will resume the gameplay. This is only enabled after a game has started.

3.1.1.2 Startup (Desirable, Easy)

The system will load saved settings from an initial input file. The ini file will be an XML file which contains the initial configurations of the program. If such a file cannot be located, the application will load its default settings and generate the ini file in the appropriate directory. This will require the system to have file IO capabilities.

3.1.2 Mode 2: Single Player Game

3.1.2.1 Gameplay

3.1.2.1.1 Gameplay interface (Essential, Medium)

During game the player can press the pause button (default set to 'P') to open up the In Game pause menu described in Section 3.1.1.

During the game, the user will be able to navigate a two dimensional map. This map will be filled with images of asteroids, aliens and the user's character. There will also be a heads up display (HUD). The HUD will always display the following information:

- Player Lives
- Current Stage
- Player Score

Additionally the HUD can display additional information. Extra information includes but is not limited to Boss health.

3.1.2.1.2 Player Characteristics (Essential, Easy)

3.1.2.1.2.1 Shooting (Essential, Easy)

Player shooting capabilities can be characterized by the following properties:

- Bullet Lifetime: A bullet will last one second before it disappears
- Fire Rate: The user will be able to take as many shots as key presses can be pressed
- Gun Spread: Is an upgradeable feature when the item is collected see section 3.1.2.1.3.6.

3.1.2.1.2.2 Movement & Position (Essential, Easy)

Player movement and position characteristics can be defined by the following properties:

- Position Vector: An ordered pair defining position
- Velocity Vector: An ordered pair defining velocity
- Longitudinal Acceleration Vector: A constant defining Forward acceleration.

- Angular Acceleration: A constant defining rotational acceleration.

3.1.2.1.3 Item Drops

3.1.2.1.3.1 General Item Trait (Essential, Easy)

Items are activated immediately upon collision with the player and disappear from the screen. Unless specified otherwise, an item will disappear after 30 seconds if it isn't collected and it cannot be destroyed by the player's weapon.

3.1.2.1.3.2 Double Points (Essential, Easy)

The player's current speed, active upgrades, and lives remain constant. When the player's weapon destroys an alien ship or the smallest sized asteroid, the number of points earned for its destruction doubles. The effect of this item will last until either 20 seconds has elapsed, the wave has been completed, or when the player loses a life, whichever occurs first. During that period, Starfox's Corneria theme will be used from 0:06 until 0:29. The theme song will fade away from 0:26 to indicate the end of the double point's duration. This item is not stackable with other double point items. This item will appear a maximum of once every level after the completion of the 3rd level. The item has a 10 % chance of appearing on screen when an alien ship is destroyed.

3.1.2.1.3.3 Gun Range (Essential, Easy)

This item will appear at the location of every 20th enemy. This item will permanently lengthen the duration of the player's bullet lifetime by 0.5 seconds. If the player dies, the bullet lifetime will be reset to default duration.

3.1.2.1.3.4 Extra Life (Essential, Easy)

It grants the player one extra life. If the player shoots this upgrade, it disappears, can no longer be collected and the audio of Darth Vader shouting "Noooo" is played. This upgrade only appears at the end of a boss level.

3.1.2.1.3.5 Invincibility (Essential, Easy)

This item drop has a 1% chance of appearing on screen when an enemy ship or asteroid is destroyed. Once collected by the player, the ship becomes invulnerable to everything on screen for 15 seconds. The ship itself becomes a weapon and gains the abilities of bullet, i.e. if the ship collides with an asteroid, an alien ship, or boss, it will inflict damage to enemies as if it were a gunshot. For the duration of this upgrade, MC Hammer's "Can't Touch This" will be played.

3.1.2.1.3.6 Gun Spread (Optional, Medium)

When this item is collected, the player's ship will fire 3 shots simultaneously when the fire button is pressed. One shot will be in the same direction the ship is facing. The second shot will be shot straight 30 degrees clockwise from the direction the ship is facing and the third shot will be fired straight 30 degrees counter clockwise relative to the direction the ship is facing. This item will last for the remainder of the level. The weapon's range will be identical to the default's

weapon current range. It will have a 5% chance to drop when the player destroys an enemy ship. It will also appear on the position of the destroyed enemy ship.

3.1.2.2 Scoring (Essential, Easy)

Points can be obtained by means of accomplishing the following tasks:

- Destroying an Asteroid
- Defeating an Alien
- Picking Up Items
- Clearing a Stage
- Defeating a Boss (Optional: If Bosses are implemented)

The scoring is based on the difficulty.

3.1.2.2.1 Destroying Asteroids

Destroying an asteroid is defined as shooting an asteroid into its indivisible component and then destroying those components. Points will be given for a shot making contact with an asteroid. More points will be awarded when the indivisible component is destroyed.

- 10 points will be awarded per asteroid hit.
- 20 points will be awarded per asteroid destroyed.

3.1.2.2.2 Defeating Aliens

Defeating an alien consists of shooting at it until it disappears. Points will be awarded for each shot landed and for defeating an alien.

- 10 points for hitting chasers
- 15 points for hitting shooters
- 20 points for Eliminating Chasers
- 25 points for Eliminating Shooters

3.1.2.2.3 Picking up Items

Picking up items is defined having possession of an item by touching it.

15 Points will be awarded for obtaining each item

3.1.2.2.4 Clearing a Stage

A stage is cleared when the player survives the duration of the stage.

- After every stage the player will be awarded 100 points for surviving
- Clearing the final stage will grant 10000 points as a reward

3.1.2.2.5 Defeating a Boss

Defeating a boss is similar to defeating an alien.

- 15 points will be awarded per hit
- 100 points will be awarded for defeating a boss.

3.1.2.2.6 Level of Difficulty

The scores mentioned above are the assigned to the easy level of difficulty. For the medium level of difficulty, the above mentioned scores are doubled. For the hard level of difficulty the above mentioned scores are quadrupled.

3.1.2.3 Winning (Essential, Easy)

The objective of the game is to obtain the highest possible score. The game will end when the player loses all the allocated lives or if the sixteenth stage is cleared.

3.1.2.4 Enemies (Essential, Hard)

There will be two classes of enemies: asteroids and aliens. The alien class is further divided into chasers, shooters, and bosses.

3.1.2.4.1 Asteroids

These passive enemies will spawn on screen and will float around a screen in an arbitrary direction as the player attempts to shoot them. The asteroids will spawn being four units large, and as they are hit by the player, they will divide into two halves until they are only one unit large, at which point, if they are hit, they are permanently destroyed. When the asteroid is one unit large, it is in its lowest state. In the case of larger asteroids, when they are hit by a bullet, the two halves that are created will travel in a path perpendicular to the bullet with which they were struck. Larger asteroids will travel half the speed of its immediate smaller counterpart.

3.1.2.4.2 Chasers

This alien will rotate until it locates the current location of the player on the field and will move for three seconds in that direction twice as fast as its default speed. After this time, if it has not collided with the player, it will reassess the player's location, and will move towards that position for another three seconds. This repeats until either the chaser is destroyed, or it collides with the player.

3.1.2.4.3 Shooters

After being spawned in a random location on the field, this class of alien will remain in a fixed position and continuously shoot bullets in the direction of the player. Shooters will rotate towards the current position of the player and will then shoot bullets at a constant rate. On higher difficulty settings, the shooter will utilize the screen wraparound feature to shoot bullets in the direction of the shortest path towards the player, meaning that the bullets will be shot towards the edge of the screen and will wrap around in an attempt to hit the player on the opposite side of the screen.

3.1.2.4.4 Bosses

On the fourth stage of the levels specified in Section 3.1.2.5, an enemy boss will appear and must be destroyed before the player can advance to the next level. Bosses will be larger and will have a greater amount of health (needs to be hit more times) than normal enemies, and can have unique properties such as having sections of their body immune to player fire during certain intervals, or weak spots in the centre.

3.1.2.5 Level Design (Essential. Medium)

The gameplay will consist of 16 levels. Each level is divided into stages. Level 1, 2, 3, 4, 6, 7, 8, 9, 11, 12, 13, and 14 will have of three stages whereas Level 5, 10, 15, and 16 will have four stages. Stage 1 will only contain Asteroids and Stage 2 will contain both Chasers and Shooters. Stage 3 will contain Asteroids, Chasers, and Shooters. Stage 4 will have one boss. Stage 1, 2, and 3 will last for 30 seconds each. Stage 4 will not be time-dependent.

3.1.2.5.1 Difficulty Upgrade

The difficulty of each level is based on the following metrics:

- Spawn rate of all enemies
- Chaser's speed
- Shooter's rate of fire

After the end of each level, the difficulty of all the above mentioned metrics will incremented by one unit.

3.1.2.5.1.1 Unit Count

In order to keep track of the number of enemies currently on the game field, there will be a unit count. This will allow enemies to be spawned at a consistent rate, as well as to ensure that the field does not become overpopulated with enemies.

3.1.2.5.1.2 Maximum Enemies on Screen

Each level will have a specified maximum number of units that can simultaneously be on the playing field at a given point in time. This number will increase as the player advances through the game, increasing the level of difficulty for the gameplay.

3.1.2.5.1.3 Spawn Location

Each enemy will be spawned at any random position on the field, with the exception of anywhere within a 5 unit radius around the player's ship to avoid enemies being spawned too close to the user.

3.1.2.5.1.4 Default Spawn Rate

Upon beginning a stage, a predetermined number of enemies will be spawned, and for the duration of the stage, more enemies will appear to replace the ones that have been destroyed. Depending on the level, there will be different rates at which enemies appear on the screen and the type of enemy will also differ. The type of enemy will be random, and the size of the asteroid will also be random. Enemies will spawn until the maximum unit count for that particular stage has been reached.

- Stage 1:
  - Initial number of units: 16 asteroid units will be deployed
  - Spawn rate: 4 units every 6 seconds for 24 seconds
- Stage 2:
  - Spawn rate: 4 alien units every 6 seconds for 12 seconds
- Stage 3:
  - Spawn rate: 1 alien and 2 asteroid units every 6 seconds for 18 seconds
- Stage 4:
  - 1 boss is spawned

3.1.2.5.1.5 Chaser speed

Chaser speed refers to velocity at which Chaser aliens travel.

3.1.2.5.1.6 Shooter Speed

Shooter speed refers to the rate of fire of the Shooter aliens.

3.1.2.5.2 Level Distinctions

Increasing difficulty parameter refers to increasing any of the metrics mentioned in Section 3.1.2.5.1 of this SRS.

All 16 levels will contain stages 1, 2, and 3. Level 5, 10, 15, and 16 will have a fourth stage in addition to the first three.

- Stage 1 will contain Asteroids.
- Stage 2 will contain both Shooter and Chaser aliens
- Stage 3 will contain Asteroids, Shooter and Chaser aliens.
- Stage 4 will contain one Boss.

3.1.2.6 Controls (Essential, Easy)

Event	Default Button	Description
Accelerate	UP	Player accelerates in the determined direction until maximum speed(set by the developers) is reached
Decelerate	DOWN	Player's speed is slowed down until a complete stop
Turn Right	RIGHT	Player turns clockwise
Turn Left	LEFT	Player turns counter clockwise
Shoot	Right Ctrl	Player shoots in the determined direction
Pause	P	The game is paused until the button is pressed again

3.1.2.7 Levels of Difficulty (Essential, Easy)

The 3 levels of difficulty are easy, medium, and hard. The difference in difficulty is in the changes to the metrics of difficulty mentioned in Section 3.1.2.5.1. The first stage of a game, regardless of difficulty will be the same; the rate at which the difficulty increases will vary. The metrics of difficulty for medium will be double that of easy; the metrics of difficulty for hard will be quadruple that of easy.

The number of lives a player begins with varies on the chosen difficulty. The player will start with 3 lives for easy, 2 lives for medium and 1 life for hard.

Scoring is also affected by level of difficulty as defined in section 3.1.2.2.6.

3.1.3 Mode 3: Dual Player Alternating (Essential, Medium)

3.1.3.1 Gameplay (Essential, Easy)

The object of the game is to survive as long as possible. When playing with two alternating players, the same principles as the single player game (Please refer to 3.1.2) concerning levels, item drops, movements and aliens apply with the exception of the life drop. Since the objective of the game is survival, there will not be granted any lives and there will be no life bonus drops during this round. Their main objective is to outplay their opponent by remaining in the game. The winner is the one who will be able to survive the longest.

Both players will have the chance to continue through all the levels as long as they do not get defeated during gameplay. Once a level as been completed by the first player, the level will restart and allow the second player to have his turn. Once he is done, the first player will move one to the next level and so on. Also, to keep the game consistent, bosses will show up at their usual stage.

3.1.3.2 Scores (Essential, Easy)

Scoring is exactly the same for each player as mentioned in Section 3.1.2.2. Only the player who wins the game will be able to record his score regardless of the fact that the second player might have acquired enough points to be on the board as well. A separate board will be attributed for this mode.

3.1.3.3 Winning (Essential, Easy)

In order to keep the game fair, each player will have a turn playing the level. Depending on the outcome of the match, either both players will move on to the next level or one of them will be granted the winner title. Here are the following scenarios and their outcome:

Scenario	Outcome
If both players are able to complete the level.	Both players will proceed on to the next level.
If one player completes the level while the other dies during the level.	The player who completed the level will be granted victory.
If both players die during the same level.	The player with the highest score amongst them will be declared as the winner.

3.1.3.4 Stages (Essential, Medium)

Please refer to Section 3.1.2.5

3.1.3.5 Controls (Essential, Easy)
Please refer to Section 3.1.2.7

3.1.4 Mode 4: Dual Player Simultaneous

3.1.4.1 Gameplay (Optional, Medium)
This mode is an additional bonus feature of the game. Two players will be able to play together sharing the same screen and keyboard. Regarding levels, aliens, bosses and movements, the same rules as the Single Player Mode apply. However, since the players are playing as a team, if they collide with each other, the collision is disregarded. The same goes for shots fired at each other.

3.1.4.2 Scores (Optional, Easy)
Scoring is exactly the same for each player as mentioned in Section 3.1.2.2. Both players will be sharing the same scores and the same lives. If one loses, then the other one is automatically penalized as well.

3.1.4.3 Item Drops (Optional, Medium)
Regarding item drops, only the bonuses are shared within the players, but the weapons are not. Below is a list of each of these items and how they will affect the game and its players:

> **Double points:** If one of the players comes in possession of this element, both players will be accorded the same advantage.
>
> **Gun Range:** This item is considered a weapon, hence only the player who will get it can be able to use its feature.
>
> **Extra Life:** Since both players share their lives, the extra life will be granted to both players as a shared resource.
>
> **Invincibility:** This feature is considered as a weapon, therefore only the player who will get it can become invincible. The other player will remain normal.
>
> **Gun Spread:** This weapon can only be used by the one who seizes it.

For further detail regarding these items, please refer to section 3.1.2.1.3.

3.1.4.4 Stages (Optional, Medium)
Please refer to Section 3.1.2.5

3.1.4.5 Controls (Optional, Easy)

Player-1 will have the default buttons as mentioned in Section 3.1.2.7. The Pause button is shared between both players. Player-2 default buttons are listed below:

Event	Default Button	Description
Accelerate	W	Player accelerates in the determined direction until maximum (set by the developer) speed is reached
Decelerate	S	Player's speed is slowed down until a complete stop
Turn Right	D	Player turns clockwise
Turn Left	A	Player turns counter clockwise
Shoot	Q	Player shoots in the determined direction

3.2 Design Constraints

Constraints imposed upon this project include only using standard libraries available for the particular language used for development, which in this case, is C#. External libraries, such as XNA, are strictly prohibited. Also, the usage of codes taken for any external resources is not allowed, unless granted special permission from the client.

3.3 Software System Attributes

3.3.1 Portability (Optional, Easy)

This game will be playable on multiple computing platforms: Windows (Essential) and Linux (Optional)

3.3.2 Reliability (Essential, Hard)

The software will be implemented so not to crash easily by normal inputs. Good code practice and testing will be done to ensure the minimization of the likely hood of the following:

- Array out of bounds
- Stack overflow
- Out Memory Exception
- IO Exception
- Null pointer exceptions

3.4 Non-Functional Requirements

3.4.1 Quality Requirements

3.4.1.1 Filenames

Filenames lengths will be variable but is capped by the default length allowed by the operating system.

3.4.1.2 Performance (Essential, Medium)

Ideally, the input delay from the keyboard and onscreen event should only be limited by the delay of the keyboard signal. However, developers decided that the input delay should be on average 50 milliseconds for the best realistic user experience. To ensure that the user has an optimal playing experience, the input delay cannot surpass 100 milliseconds at any point during the software's runtime. This constraint can be tested by inputting several commands and getting the average lag time. The best run time performance for the user is when the game is running on average or more than 40 frames per second. The performance should not be lower than 30 frames per second at any instance while the software is running.

3.4.1.3 High Score Name Length (Essential, Easy)

When a user inputs his/her name after obtaining a high score, the length of the name shall not exceed three characters.