

Department of Computer Science

Bilkent University

CS 319  
Object Oriented Software Engineering   
Analysis Report

**Project Name:** Survival in Bilkent

Group 2M

Pelin Elbin Günay - 21402149

Kübra Nur Güzel - 21400946

Alper Şahıstan - 21501207

Semih Teker - 21300964

October 4, 2017

**Table of Contents**

1. Introduction
2. Overview
   1. Controls
   2. Levels
   3. Enemy Types
   4. Upgrades
3. Requirement Specification
   1. Functional requirements
   2. Nonfunctional requirements
4. System models
   1. Use case model
   2. Dynamic models
   3. Object and class model
   4. User interface - navigational paths and screen mock-ups
5. Glossary & references
6. **Introduction**

We decided to design a top to down 2D shooter game which is called “Survival in Bilkent”. In this game, player makes an effort to stay alive in a restricted area. There are variety of enemies such as bugs, assignments, quizzes, labs, midterms and finals. These enemies will try to kill the player which is a CS student in Bilkent University by either shooting him, crashing onto him or spawning other enemy units that will attack the player. The aim of the student is to defeat these enemies by shooting codes and pieces of his/her will to study. The game has 4 levels which represents the 4 years of the major.

The game will be a desktop application and will be controlled by a mouse and W-A-S-D keys on the keyboard.

This report contains an overview of the game, description of the basic gameplay. It also contains functional requirements, non-functional requirements, system models including use case model, dynamic models, object and class model, and user interface-navigational paths and screen mock-ups.

Inspired by the game in the following URL.

<http://diep.io/>

1. **Overview**

After launching the game player encounters game menu which has “Start Game”, “Options” and “Quit” buttons. The game commences when the player chooses “Start Game” option. “Options” will take the player to the Options menu where he will be able to modify sound settings. “Quit” option terminates the game.

When the game commences player will encounter various types of enemies that will try to kill him by shooting or crashing into it. The player’s objective is to survive the level without running out of time (player will only have time instead of health which will decrement as the time passes and additionally decrements when taken damage) by shooting the enemy units while collecting miscellaneous power-ups, keys, chests and coins. At the end of each level player will face stronger enemy units which are called “Finals”.Toplayer to proceed, player does not need to defeat every Final but a minimum number (depending on the level or circumstances) of Finals must be defeated. Yet, the undefeated Finals will come back again in the next levels Finals Phase in addition to that levels Finals. After the level is completed by the player game will enter an upgrade phase in which player will be able to upgrade his stats by spending coins on standard shop items or open chests by using a key and a chest which was collected in the previous level. Game will have a total of 4 levels and 4 upgrade phases.

* 1. **Controls**

The player can move around with W-A-S-D keys on the keyboard. W for going up, S for going down, A for left and D for right movement. Shooting and aiming will be done by using the mouse. Clicking with the left click shoots bullets around. Pointing the mouse on the screen will change the aim of shooting. Clicking the right mouse button will activate the deployable power-up and clicking the left mouse button will deploy the power up.

* 1. **Levels**

As mentioned before the game will contain 4 levels with increasing difficulty. (smarter enemy AI, higher enemy health, enemies that hit harder) Each level will bring at least one different enemy type to the game mechanism. The player will try to defeat standard enemy types without running out of time. If player does defeat the standard enemies the Finals will arrive, pushing game difficulty to higher. When required minimum number of Finals are defeated player will earn the right to proceed to next level. The level can be completed in two ways; first one being the defeating all the Final enemies which guarantees that there will be extra Final enemies in the next level, second one being defeating minimum required number of enemies which will result as undefeated Final enemies returning in the next levels Finals Phase.

* 1. **Enemy Types**

There will be various types of enemies that player will come across during the game. These enemies will be harmonious with our theme.

**Bug:** The most common and weak enemy type which will simply crash into player to damage him. Yet, this crash will damage it as well. It cannot shoot bullets, it is only capable of crashing.

**Assignments:** Basically, tougher versions of bugs that will hit harder and sustain more damage.

**Quiz:** Quizzes can spawn very close to the player. It has average damage, can move around and has low health. It can also shoot bullets.

**Lab:** A slow moving enemy type that will spawn bugs and assignments continuously unless it is destroyed. It has high health, it cannot shoot bullets.

**Midterm:** This enemy type is quite rare in comparison to others. It has more health than Labs and applies more damage by shooting bullets. It can move around. It is the most dangerous enemy type excluding Finals.

**Finals:** Finals come as a pack unlike Midterms. Yet, they spawn when there are no other enemies left for that level. They have more health and apply more damage by shooting. They will have a shield additional to their health, which will regenerate unless they are kept shot at.

* 1. **Credits, Upgrades, Keys and Chests**

Game will contain types of chests and keys. Keys will spawn in high risk locations in game arena and valuable chests will be dropped by the high risk enemies when they are killed. There will be 4 types of chests.

**Credits(Coins):** Money that can be spent in the shop. Dropped by all enemies.

**Freshmen Chest:** Least valuable chest usually dropped by weaker enemies. Requires 1 key to open. It has 90% chance of giving a standard tier item, 7% chance of giving a rare tier item and 3% chance of giving an ultra-rare tier item.

**Sophomore Chest:** Usually dropped after the 1st level is completed. Requires 2 keys to open. It has 50% chance of giving a standard tier item, 30% chance of giving a rare tier item and 20% chance of giving an ultra-rare tier item.

**Junior Chest:** Usually dropped by the stronger enemies after 1st level. Requires 3 Keys to open. It has 30% chance of giving a standard tier item, 35% chance of giving a rare tier item, 25% chance of giving an ultra-rare tier item, 10% chance of giving a “hacker” tier item.

**Senior Chest:**  Usually dropped by the stronger enemies after 2nd level. Requires 3 Keys to open. It has 18% chance of giving a standard tier item, 25% chance of giving a rare tier item, 32% chance of giving an ultra-rare tier item, 25% chance of giving a “hacker” tier item.

**Keys:** Appears in the game arena for 30 seconds at random moments (usually close to stationary or slow enemies). They can also be bought from the shop.

**Standard Items:** Gives player simple and small perks. Some of them can also be bought from the shop. Such as Increase in fire rate, speed, bullet, speed, time…

**Rare Items:** Gives player simple but better perks. They cannot be bought from the shop.

**Ultra-rare Items:** Givesplayer greater perks or they affect the overall mechanics of the game. Despite the features like standard items it has effect on game mechanics. Such as certain enemy types with less health, slower speed, less amount; more power-ups, keys or chests.

**Hacker Items:** Gives the best perks or rather affect the game in favor of the player. Yet the perks and effects of this items are so great that they all have a trade-off. Such as for reducing the minimum amount of finals to pass the level, it reduces players fire rate…

* 1. **Power-Ups**

Game will offer a variety of power ups that will appear in the arena in random moments and at random frequency. These power-ups will enhance the player temporarily. If a power up is deployable after the pick up the player must right click to activate and left click again to deploy the power up.

**Time:** Time power-ups will give player additional time.

**Slow-Time:** Slows everything in the game by 20% for 10 seconds.

**Bouncy – Bullets:** Bullets bounce off(3 times per bullet) from the borders of the game are instead of simply going out.

**Bullet-Blast:** Sends out a circular group of bullet originating from the player.

**Damage upgrade:** Player bullets hit harder for 5 seconds.

1. **Requirement Specification**
   1. **Functional Requirements**

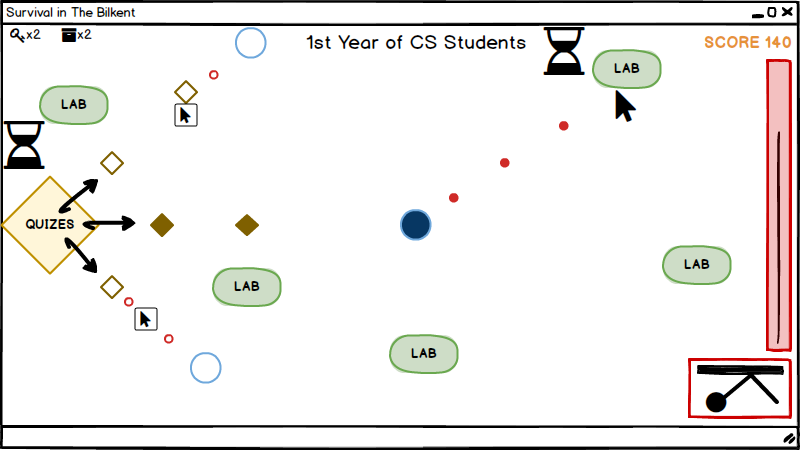
## Play Game

Survival in Bilkent is a 2D top to down shooter game. In the beginning of the game player types his/her nick name which will be displayed under the player object during the game. Player can shoot by using the mouse and move by pressing W-A-S-D keys on the keyboard. Enemies have limited health which is dependent on their type. Player kills the enemies by shooting bullets. Bullets that hit the enemies decrease the enemy’s current health by a damage value. The durations of each level are limited(due to player’s time stat). In order to stay alive, player has to kill certain amount of enemies until the end of the level without running out of time. After defeating simple enemies player must face the Finals which are a pack of bosses. Player does not have to defeat them all just a minimum number that is specified. Yet un-defeated Finals will come back in the next level. Each hit dealt by the enemy causes player to lose additional time. The player can use W for going up, S for going down, A for left and D for right movement. Shooting and aiming will be done by using the mouse. Clicking with the left mouse button shoots bullets towards the mouse position. At the end of the levels player will enter an upgrade phase where he can purchase standard items, see his/her item inventory, collected chests, coins and keys.

* + 1. **In-Game User Interface**

In game interface will display;

* Remaining time in the right edge of the screen.
* The currently picked up power up in the bottom right corner.
* Current score in the top right corner
* Current level on top edge
* Number of chests and keys in the top left corner.



* + 1. **Pause Game**

During the game, player can pause the game whenever he/she wants and then he/she can continue the game whenever he/she wants to continue. When paused a pause menu will appear offering three choices “Continue” which will unpause the game, “Settings” which will go to settings menu, “Quit” which ends the game terminating the current game session.

* + 1. **Settings Option**

Player can mute and un-mute the sound of the game by using the settings option.

## Non-Functional Requirements

* + 1. **User-Friendly Interface and Mechanics**

The game can be played easily. In other words, the mechanics are generic and self-explanatory that seen in many 2-D shooter games.

* + 1. **Game Performance**

The game must run smoothly even though there are many objects on the screen. It’s average FPS must be around 30 since if it is larger than 30 it will look like a fast forwarded video, if it is less than 30 it will not be a playable game.

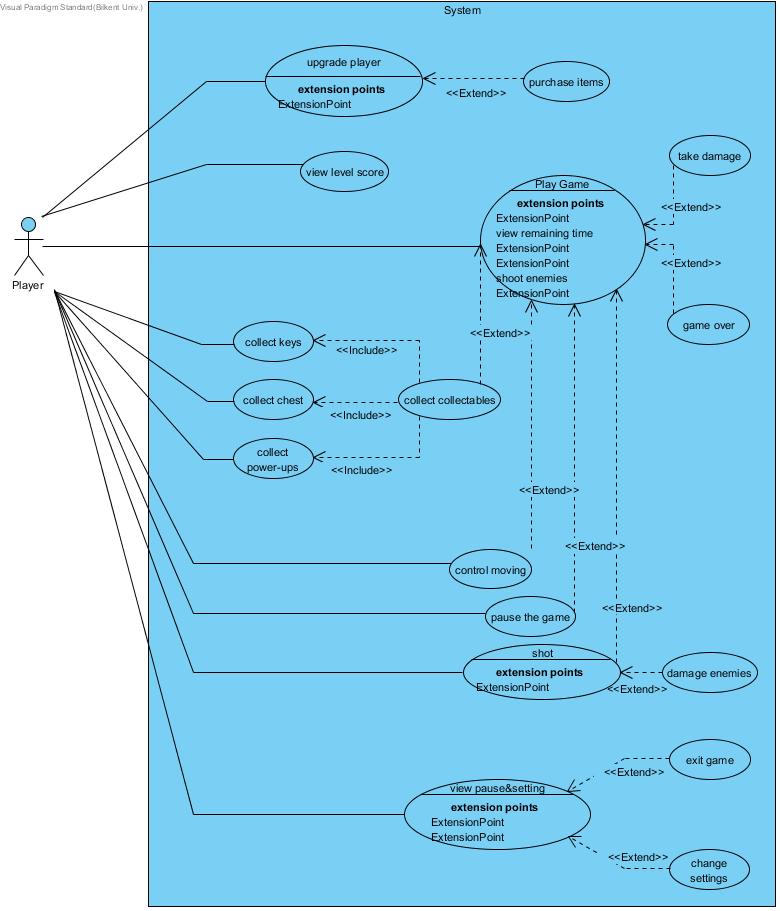
* + 1. **Extensibility**

In software engineering, reusability and extendibility are two important properties of a project. Survival in Bilkent will be able to extended and re-used for future projects. Especially we will be adding new upgrade items to the game in future iterations.

* 1. **Pseudo Requirements**

Game will be implemented in Java. Since it will run on the Java Virtual Machine, the system is highly portable due to number of machines which has Java. It has no other portability considerations. Graphics will be implemented using Java’s swing and awt libraries. ( Java Version 8 Update 144)

1. **System Models**
   1. **Use Case Model**



* + 1. **Use Case Descriptions**

**Use Case #1**

**Use case name:** PlayGame

**Participating actors:** Player

**Entry condition:** Player has opened the game and he is on the title screen.

**Exit condition:**

**•** Player has completed the all 4 levels successfully, OR

• Player has lost his health(time) in any level, OR

• Player has chosen to exit the game via pause menu.

**Main Flow of Events:**

* 1. Player launches the game
  2. Player enters the in-game-name.
  3. Upgrade screen appears.
  4. The system prepares the level.
  5. Player completes all the levels (Upgrade phase between levels).
  6. The system displays score of the player.
  7. Player returns to the title screen.

**Alternative Flow of Event:**

* 1. Player loses his health(time) in any of the levels.(Game Over screen appears.)
  2. Player exits using exit option in the pause-menu.

**Use Case #2**

**Use case name:** PlayGame

**Participating actors:** Player

**Entry condition:** Player has opened the game and he is on the title screen.

**Exit condition:**

**•** Player has completed the all 4 levels successfully, OR

• Player has lost his health(time) in any level, OR

• Player has chosen to exit the game via pause menu.

**Main Flow of Events:**

* 1. Player launches the game
  2. Player enters the in-game-name.
  3. Upgrade screen appears.
  4. The system prepares the level.
  5. Player completes all the levels (Upgrade phase between levels).
  6. The system displays score of the player.
  7. Player returns to the title screen.

**Alternative Flow of Event:**

* 1. Player loses his health(time) in any of the levels.(Game Over screen appears.)
  2. Player exits using exit option in the pause-menu.