SCHOOL OF COMPUTER SCIENCES

UNIVERSITI SAINS MALAYSIA

CAT 200 – Integrated Software Development Workshop

Semester 1

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Project

Minimalist Tower Defence Game Development

Lecturer : Dr. Tan Tien Ping , En. Azlan bin Osman

Names	Matric No.
Tang Wen Shuen	142623
Suen Kee Xian	142215
Teh Zhen Rong	143955

Content

1.0 Introduction

Background:

In this modern era of science and technology, games has became a huge part of entertainment in our daily lives. There are many famous games in the world that has greatly impacted the lives of the younger generations such as DOTA 2, Player's Unknown Battleground and Skyrim. The video game industry nowadays also has a huge impact on the economical growth of various contries such as UK. It creates many job opportunities such as game developers, software and AI engineers and graphic designers as to make a good game all these personnels play a very important role. The existence of major games such as DOTA 2 also allows the organisation of worldwide competitions such as the DOTA 2 League and introduce a new job that is professional gamers. Video games nowadays have many positive and negative effects onto the daily lives of teenagers.

Scope:

One of the purpose of this game is to reduce the stress among the people. In this era where competitions among peers within all ages are very intense, the daily lives of many average human beings are very stressful. These people often do not have enough time to do activities that can relieve stress such as exercising. This is where our game comes in. Our game is a very simple tower defence game that can bring enjoyment to people of all ages in matter of minutes as it is very fun to play. This is a very good way for them to relieve stress and face the challenges of lives with a much more positive outlook.

We choose to create a simple game because we would like to overcome a major problem that is happening in many major triple A games nowadays, which are unethical monetary practices. Many triple A good games are fun but they cost a lot to mantain their development. There are companies that choose to practice unethical monetary methods to earn money such as loots boxes implemented by EA. Our game is a simple game that can bring enjoyment in matter of minutes. Hence, there is no need to implement in-game microtransactions in our game and people can play our game without having worrying to pay more.

Overview:

Our proposal is to create a simple tower defence game that people from all ages can enjoy within minutes. Tower defence is a strategy game that designs to teach players various strategies that is very useful in our daily lives. The games is also designed to help players relieve stress from their daily lives.

2.0 Overall Description

Product perspective:

The product will be a tower defence strategy game. Its main purpose is to teach different strategies to the players and also to help them relieve stress. This game requires the players to repel enemy invasions by building single or multiple specific towers in various strategic positions. The player is provided with limited resources to build the towers. Hence, players need to learn how to manage their limited resources and build an effective defence to repel the attackers. This game is designed using Java programming language.

Product Functions:

Help to improve one's strategic skills.

Users characteristics:

The game is targeted to users of all ages regardless of background.

Constraints:

This tower defence game might be incompatible in other platforms such as linux. This is mainly due to the program is developed in a Windows 10 operating system and is designed to be played smoothly in a Windows operating system.

3.0 Facilities and Computer Resources

Computer and other Hardware Resources:

Windows XP or above is required as the operating system. As for the hardware requirements, we will need any hardware with the minimal requirement to run windows XP. The recommended specs to run this game at highest setting is i3 4th gen, 4GB RAM, NVIDIA GTX 630 and 500MB of free storage space.

Software and Operating System Resource Specifications:

The tools that we will be using to create this game is the Java programming language. The program will be coded in the IntelliJ IDE which is one of the most top-rated Java IDE worldwide. The library that we will be using for this game is the libGDX and javaFX game library.

4.0 Problem Specification

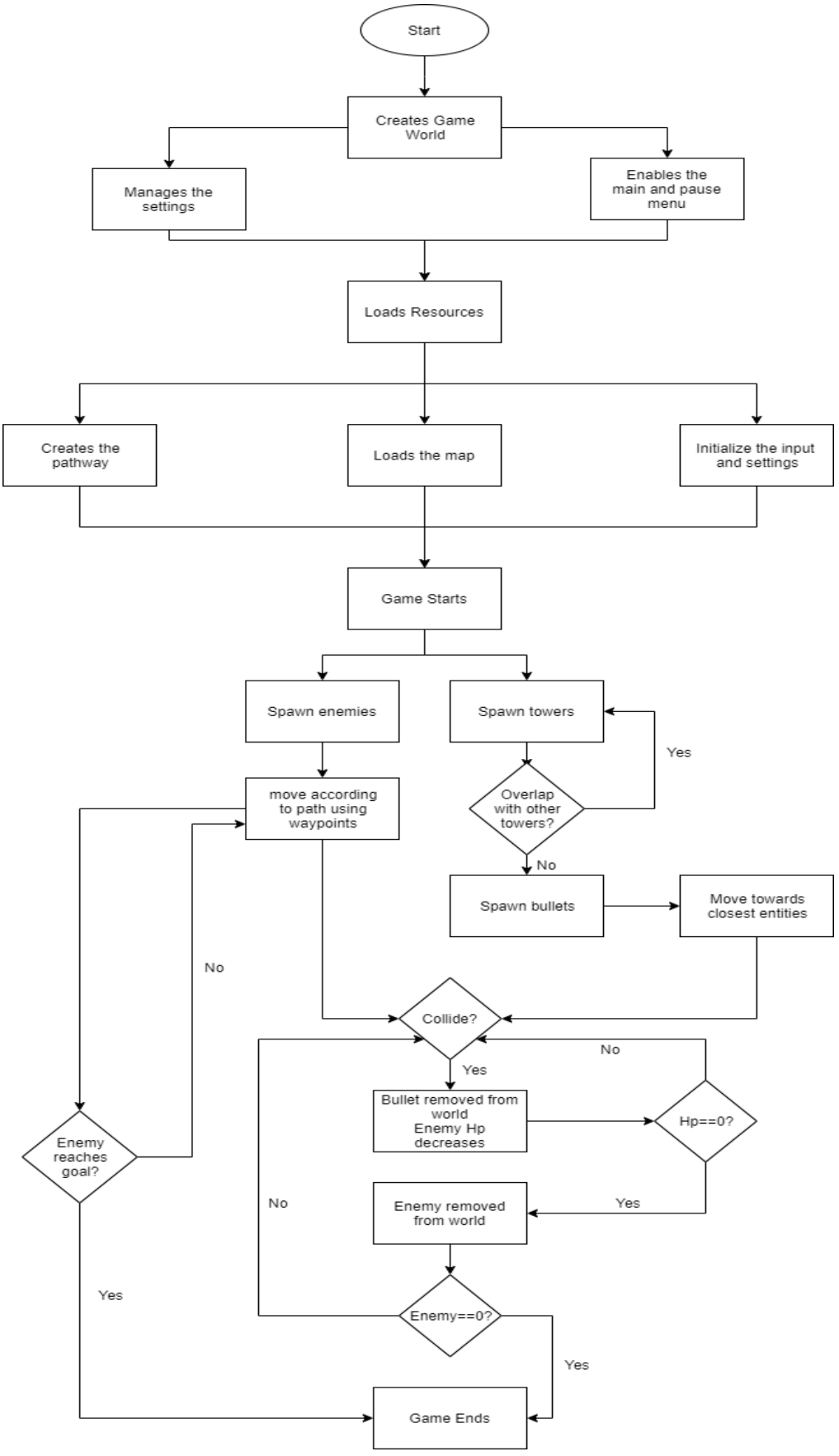
In this project, our group created a tower defence game with the aim to solve the following problems :

- To help in stress reduction among the younger generations
- To help bonding friends and families by playing and discussing this game together
- To nurture the critical thinking skills of students by practising their strategizing skills in this game
- To create a game that can be enjoyed by people of all generations within minutes
- To create a game that is free to play by anyone without the need to pay a heavy price.

5.0 Organisation of Program

Package	Class	Description
Collision	**BulletEnemyHandler**	Handles the collision among the bullet from the tower to the enemy.
Components	**EnemyComponents**	Sets the texture and speed of movement of the enemies. Sets the pathway for the enemy to move.
	TowerComponents	Adjusts how the tower shoots, the speed of projectile and the spawning of the bullet
Enemy	**EnemyDataComponent**	Contains the details of each enemy type. When enemy is spawn, the details of it will be passed over.
Event	**BulletHitEnemy**	An event that when a bullet hits an enemy, this class will attach the enemy hit to this bullet, hence making it possible to modify the enemy.
	EnemyReachedGoalEvent	An event where the enemy reaches the goal
Tower	**BulletComponent**	Contains the information for a bullet. When a bullet is spawn, the details of the bullet will be stored in this component.
	FireTowerComponent	Contains special information regarding the fire tower. Inherited from TowerDataComponent
	TowerDataComponent	Contains information regarding different types of towers. Will be called to pass information from this class whenever a tower is spawn.
Main	**Config**	
	TowerDefenceApp	The main class of the game. Creates the game world and allows the place of all entities onto the worlds.
	TowerDefenceFactory	The class that handles the spawning of different entities such as the enemy and tower.
	TowerDefenceType	An enum class that defines the important entity types such as the tower and enemy.

6.0 Flow Chart



7.0 Discussion

7.1 Introduction of FXGL

The game library that we used to create this game is known as FXGL. FXGL is created by a Almas Baimagambetov. He is a lecturer in Games Development at the University of Brighton. He is well known as a passionate software developer and also an active researcher in automated data visualization.

FXGL is an open source game library made using JavaFX and also Kotlin Game Library. In the library, there are many pre-defined functions that is ready for game developers to use. It is a game library that is suitable to be used to create small-scale games such as tower defence game. Hence, our team choose to use this library to serve as the foundation for our tower defence game.

7.2 Description of the Game

The game that we will be making is named as the Minimalist Tower Defence Game. It is based on a traditional tower defence game, where players are allowed to place towers at specific location designed by the developers to repel enemies that tries to invade our base. This game trains a player's ability to strategize correctly and repel waves of enemies that will try and invade their base.

There are mainly 2 type of enemies, namely orcs and bats. Their textures are shown as belows:

Besides that, the enemy also have different levels, which is 3 for orcs and 2 for bats. Every different level of enemies will be slightly better than their previous version. Orcs have more health than bats but bats are faster than them.

There are mainly 4 type of towers, small stone towers, big stone towers, metal ball towers and fire towers. Their textures is as shown below :

Among the four of them, fire tower is the most expensive tower. This is because of the unique property of being able to leave burnt damage onto their enemies after hitting them with a projectile for a short period. The bullets of fire towers also move as fast as the cheapest tower, the small stone tower. Excluding fire tower, according to the bullet speed, price, damage and delay between firing, the towers is arranged as shown below.

Small stone → big stone → metal ball

7.3 Instructions to Play

First, the player goes to main menu and clicks new game. After that, the map is loaded. After the map loads, enemies will start spawning at the starting point of the map. Players will need to place towers that will shoot enemies and stop their advance.

There are two regions for players to place their towers, mainly the green grass region and the rocky region as shown below:

The player clicks any of the space within the regions given and spawns a tower. There are 4 towers that can be chosen, each with a different price. After placing, it will start shooting towards the nearest enemy.

There are a total of 3 waves of enemies which consists of one type of enemy that has a set level. The towers placed will start shooting at the nearest enemy, causing their health to decrease. When their health reaches 0, the enemy dies and is removed from the world. When all three waves of enemies is killed before reaching the base, the player wins. If the player fails to do so, the player loses. At any point of the game, the player is allowed to pause at anytime and continue by pressing the ESC key.

By killing an enemy, the player receives gold. The gold received varies depending on the type and level of the enemy. Orcs fetch a higher price when compared to bats. The gold received can be used to spawn more towers.

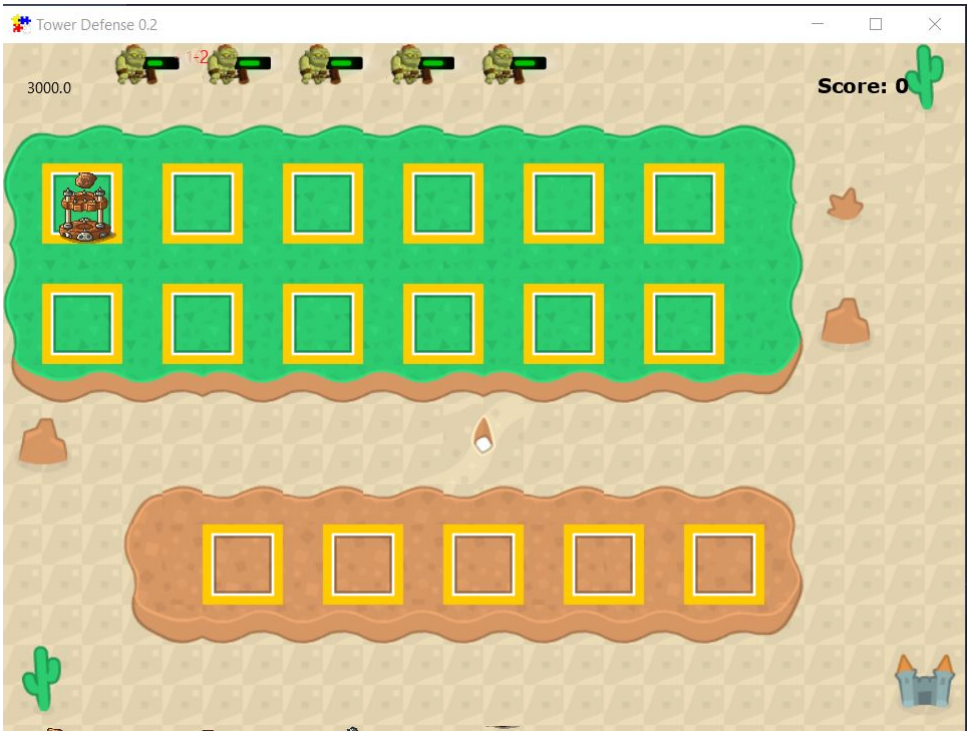
After the game finishes, the player gets a score which will be recorded in a file. A scoreboard will be used to display the highest score player at the end of the game.

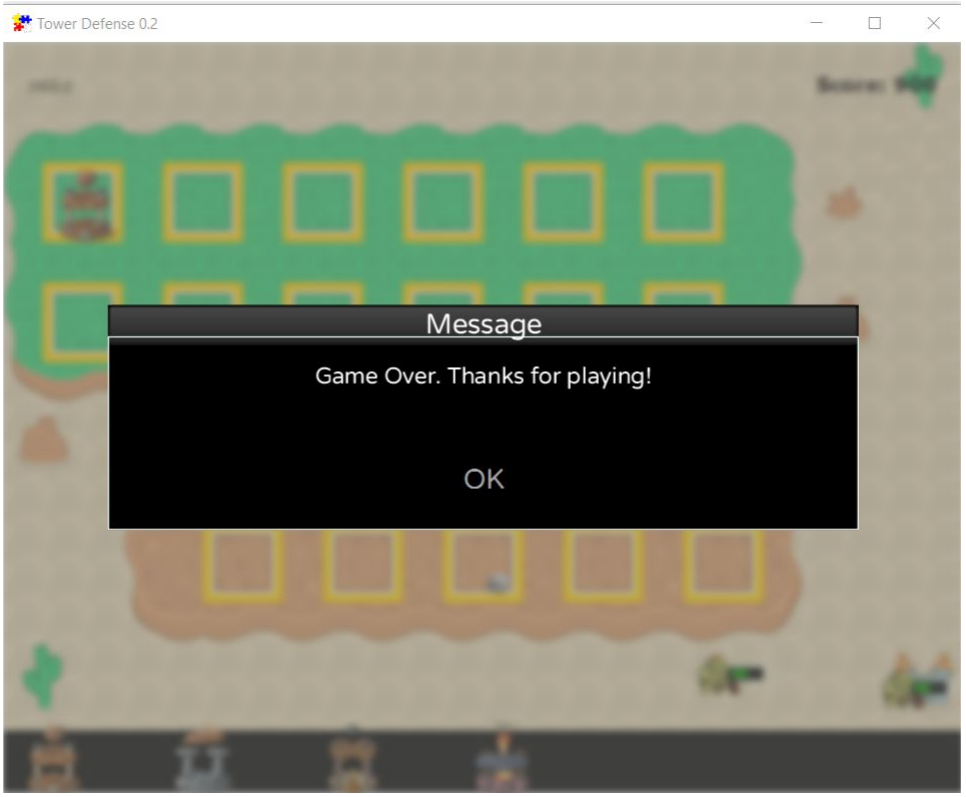
7.4 Problems faced during Game Development and Solutions

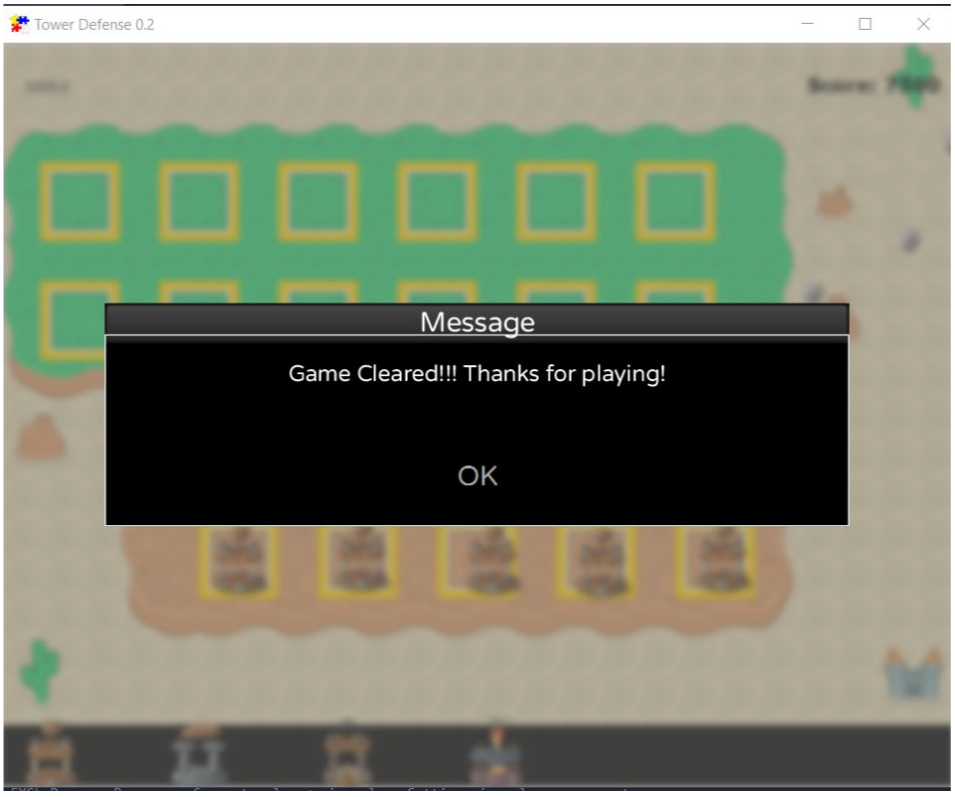
In the whole duration of the assignment, our group faced many challenges. The problems and solution is shwon as below

1) Problem : Unfamiliar with the game library
   Solution : Spend more time to research and watch tutorial videos regarding the library
2) Problem : Unattractive GUI
   Solution : Search online and find for more interesting GUI
3) Problem : Wrong coordinates of game entities
   Solution : Measure and plot each entity before coding them into the game.

8.0 Screenshots of Gameplay






Tower Defense 0.2
Message
Game Cleared!!! Thanks for playing!
OK

9.0 References

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