Creating Virtual Reality First Person Shooter Game with Head Mounted Display

Lau Pin Han

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS TESIS*

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(TANDATANGAN PENULIS)
LAU PIN HAN
Alamat tetap: 12, Lorong Intan Baiduri 4C,
Taman Intan Baiduri,
52100 Kuala Lumpur
Tarikh: 17-8-2017

(TANDATANGAN PENYELIA)
MR. NAZREEN BIN ABDULASIM
NAZREEN BIN ABDULLASIM
Pensyarah
Fakulti Teknologi Maklumat dan Komunikasi
Universiti Teknikal Malaysia Melaka (UTeM)

Tarikh: 17-8-2017

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Creating Virtual Reality First Person Shooter Game with Head Mounted Display

Lau Pin Han

This report is submitted in partial fulfilment of the requirement for the

Bachelor of Information Technology (Game Technology)

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGYUNIVERSITI TEKNIKAL MALAYSIA MELAKA
2017

DECLARATION

I hereby declare that this project report entitled

Creating Virtual Reality First Person Shooter Game with Head Mounted Display

is written by me and is my own effort and that no part has been plagiarized without citations.

STUDENT : _____ Date : 17-8-2017

(LAU PIN HAN)

SUPERVISOR : _____ Date : 17-8-2017

(MR.NAZREEN BIN ABDULASIM)

NAZREEN BIN ABDULLASIM
Pensyarah
Fakulti Teknologi Maklumat dan Komunikasi
Universiti Teknikal Malaysia Melaka (UTeM)

DEDICATION

To my beloved parents, your love and support always my greatest motive and inspiration.

To my supervisor, Mr.Nazreen bin Abdulasim and to all my lecturers, for being patient, not giving up, receptive and critical, understanding and support for me to be a better student.

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Last but not least, I would like to thank to all my beloved friends who have helped me and support me in this project, especially Aimi who helped me the most in documentation report, I appreciate all of you and the people who help me direct or indirectly during the project development process. Without all these helps, I would not able to accomplish this project on time.

ABSTRACT

The thesis of Creating a Virtual Reality First Person Shooter Game using Head Mounted Display with HTC Vive is done to fulfil the requirement for the final year student of session 2016/2017. The main purpose in developing this game is to let people experience the latest virtual reality technology that gone viral at oversea country but not in Malaysia, and also this project is to test whether the virtual reality gaming is more engaging than normal first person game. This report consists of seven chapters which are chapter one about the introduction of the project, chapter two is about the literature review and project methodology, chapter three is about the analysis of the project, chapter four is about the design of this project, chapter five is about the implementation, chapter six is about the testing and evaluation and the last chapter seven, is the conclusion of this project. Research is made in early phase of the project. It involves research about the latest virtual reality technology, its limitation and its open problem. This game target the gamer and non-gamer which has no experience in virtual reality gaming where the age from 15 and above. The main game engine or software to develop this project is Unreal Engine 4. The final outcome of this project is to create a first person shooter game that can be played in virtual reality environment.

ABSTRAK

Tesis Mencipta Realiti Maya Permainan Menembak menggunakan *Head Mounted Display* dengan HTC Vive dilakukan bagi memenuhi keperluan kepada pelajar tahun akhir sesi 2016/2017. Tujuan utama dalam membangunkan permainan ini adalah untuk memberikan orang merasai teknologi realiti maya terkini yang tersebar luas di luar negara tetapi tidak di Malaysia, dan projek ini juga adalah untuk menguji sama ada permainan realiti maya lebih menarik daripada permainan *First Person*. Laporan ini terdapat tujuh bab iaitu bab satu tentang pengenalan projek, bab dua adalah mengenai kajian literatur dan metodologi projek, bab tiga adalah mengenai analisis projek, bab empat adalah mengenai reka bentuk projek ini, bab lima adalah mengenai pelaksanaan, bab enam adalah mengenai pengujian dan penilaian dan bab terakhir, adalah kesimpulan projek. Penyelidikan dibuat dalam fasa awal projek. Ia melibatkan kajian tentang teknologi terkini realiti maya, had dan masalah umum. Permainan ini mensasarkan peminat permainan video dan bukan peminat permainan video yang tidak mempunyai pengalaman dalam permainan realiti maya di antara umur dari 15 tahun dan ke atas. Enjin permainan utama atau perisian untuk membangunkan projek ini adalah Unreal Engine 4. Terdapat banyak pengalaman dan pengetahuan yang diperolehi dalam membangunkan projek ini. Kesimpulannya, laporan ini membentangkan semua penyelidikan dan pembangunan yang dicapai oleh pelajar.

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CHAPTER I

INTRODUCTION

1.1 Project Background

This game project is about using the one of the recent Virtual Reality (VR) system which is HTC Vive with motion controller to create a game and its genre is action and simulation, the gameplay is the player using the VR headset to controller the first person camera movement by tracking their own head movement, and using the motion controller to interact in the game, such as shooting or interact with non-playable character (NPC). As the terms VR growing rapidly due to the extensive media coverage, people starting changing their way to view the virtual environment they made in game, in order to create more immersion than just a first person camera that commonly seen before. Even though news about VR getting blown up by the online media, but still not very much people knows what truly a VR is, and what is the basic principle and what is the current issue that faced by VR. The objective of this project is to explore and investigate one of the latest VR technology which is HTC Vive, and also creating a simulation or shooting game in virtual reality environment, at last will be To evaluate the new approach to new gaming device and its open problem. For the project methodology, Game development Life Cycle (GDLC) is used, there will be five stage for developing this project, which is gathering requirement and analysis, Design, Implementation, testing and Evolution, the expected outcome from this project is creating a VR game which able to help the user experience the new technology that changed the next generation of gaming.

1.2 Problem Statement

First of all, first person shooter game is very common to most people, but first person shooter is not common to be played in virtual reality or there is not many first person shooter game that available in the market.

Thus, this project is to create a first person shooter game that can be played in virtual reality environment and also to test the usability and the user experiences when the player is trying the virtual reality game.

1.3 Objective

This study embarks three main objectives:

i. To study the relationship between first person shooter game in normal mode and virtual reality mode.
ii. To develop first person shooter game in virtual reality environment.
iii. To evaluate the usability and the user experiences of the player when trying virtual reality game.

1.4 Scope

1. Target User

   The target user for this game is 15 years old and above.

2. Content/Modules

The game will be created using a game engine named Unreal Engine 4, since this game engine has a good support for the recent Virtual reality technology such as HTC Vive. The game will be created in First Person Shooter genre, so for those who does not own a head mounted display can still play the game in FPS mode, but if someone has the head mounted display, the game mode will change to VR mode if the game detect the hardware.

1.5 Project Significant

This game allow the player to experience the latest Virtual Reality technology, this game not only just about shooting stuff, it also has a story that would make the game becoming more engaging. This project is also used to test whether player rather just playing a normal first person shooter game or playing with head mounted display.

1.6 Conclusion

As a conclusion, the expected output is created a virtual reality game that can provide some new experience for those who never tried virtual reality game or other experience before, and also letting people know that virtual reality is getting more popular and might going to be the next generation of gaming. At the same time testing player's reaction when playing the game in VR mode that would prove the statement that people would be more engaging when playing a game in virtual reality.

CHAPTER II

LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 Introduction

In this literature review, it will talk about the history and the evolution of game especially for the first person shooter game for this project. Next it will talk about some previous technology or idea that has been used for virtual reality that did not work out until recent technology that allow the virtual reality to become true again. In this literature review, it will also compare some existing product that have been made for playing in virtual reality device such as oculus and HTC vive. For the project methodology, it used game development life cycle, as known as GDLC.

2.2 Domain

first of all, what is a game in general, game is any activity that has a set of criteria which is game rules, goal, competition or randomize (Wolfgang, 2000). Nowadays

games come in different genre, which are action, adventure, strategy. For this project, it will focus on first person shooter (FPS). A FPS is a genre of action video game that played from the point of view of the protagonist, those games typically map the gamer's movements and provide a view of what an actual person woild see and do in the game. Virtual Reality(VR) also known as Virtual Environment (VE), there are many definition about this term, such as it is a real time interactive graphic with three-dimensional models, combined with a display technology that gives the user the immersion in a virtual world and direct manipulation. VR has drawn much attention in last few years, and the extensive media coverage causes the interest on VR grow rapidly (Tomasz and Michael, 2015). VR is actually being introduce since 1960, but during the release of oculus Rift VR device, this VR somehow starting to grow more popular and not just in gaming industry but other multimedia usage. But still, very few people, however, really know what VR is, what its basic principles and its open problems are. So this project is to help introduce the new technology of VR nowadays and also it might be the next generation of gaming. With the help of recently game engine that can help produce a high quality environment, and the VR technology that able to display high quality image on screen, it can get the stage to allow player to have shared, "better-than-life" experiences in virtual world. Since the VR still growing recently, the VR system still require expensive hardware and customized software, and they are available for limited audiences. VR systems, unlike console nor computer, they are rather difficult to upgrade and maintain, even though the VR system nowadays able to display high quality image but still always lower resolution than it seems for most user when those games are played on home console or PC. On top of all these problem faced by VR systems, there is always one features that stand out from all other platforms, which is its unmatched sense of presence, delivered by immersion and body tracking, it make the user believe that they actually "are there". Moreover, the VR systems does not only meant to entertainment, it also a choice for medical, military and extreme condition training application. With the help of this project, we can create a new vision for those to study about technology, and maybe it could help develop easier VR system and make it more common in future. (Nils, 2017) Like smartphones in the past decade, virtual reality (VR) technology will change every day human experience in the coming decade. It's a hugely engaging, irresistible, and disruptive technology. Which mean

there is no escape that more and more people will starting to know the VR technology and its way to change human's daily life.

2.3 Existing System

2.3.1 Example of existing virtual reality game published

i. Serious Sam VR: the Last Hope

Figure 2.1: Serious Same VR: The Last Hope gameplay scene

Serious Sam is a very classic first person shooter game that created by croteam, it was discontinued but later on the games got brought back with a new company by remastering them into HD version. The classic version that published into market only last until 2 episode, even though there is more onward but the game was discontinued due to some issue, the new team able to create the third episode for the game but it has nothing related to the previous story. After that, they decided to

create a VR version for this game, since they receive a lot of positive feedback from the players, the studio decided to create a full VR game using HTC vive. The gameplay is quite dull but it is very engaging, player will have to survive by bunch of monster that going to attack and shoot them with those big hi-tech guns using the motion controller, right now, player cannot move around freely but only in the small range where the in game character will follow the player's Head mounted display location in real world.

ii. Arizona SunShine

Figure 2.2: Arizona Sunshine

This Virtual reality meets the zombie apocalypse! Arizona Sunshine is a first-person shooter built exclusively for VR that immerses you in a post-apocalyptic southwestern America overrun by zombies.

When you hear a flash of a human voice on the radio, your hopes surge - there are survivors out in the blistering heat of the post-apocalyptic Grand Canyon state! Armed with little more than your motion-controlled weapons and the scarce ammo and consumables you find along the way, you need to navigate the hordes of zombies coming for your brain in your desperate search for human contact.

Developed from the ground up for HTC Vive and Oculus, Arizona Sunshine puts you in the midst of a zombie apocalypse. Handle weapons with real-life movements, freely explore a post-apocalyptic world, and put your survival skills to the test in VR - putting the undead back to rest is more thrilling than ever before.

iii. The Brookhaven Experiment

Figure 2.3: The Brookhaven Experiment

Another recent developed VR game, is a Virtual reality survival shooter that can be played in HTC vive and PS VR. Players will have to use the weapons and tools provided to survive ever more terrifying waves of horrific monsters in an attempt to figure out what caused the beginning of the end of the world, and, if they're strong enough, stop it from happening. Keep your head on a swivel, upgrade your equipment, shoot, and if all else fails pistol whip your way through the monster hoards to survive one more day.

This game even has a campaign mode and a survival mode so it can avoid a very dull gameplay that only just a survival game that player only shoot and kill for survive but it will be more engaging if the player could have a story to follow.

2.3.2 Comparison between existing game

The similarity of these three games is their gameplay is almost the same, only the content of their game is different, the gameplay is where the player are at a fixed location and there will be a lot of enemies charging at the player in all direction and player will control their weapon using the motion controller and kill the enemy to survive. This prove that the virtual reality technology is only to this level unless they have more device that enable the player walking in real work and make the character in the game world walking as well. The only different between the Brookhaven Experiment and other two VR games is the Brookhaven Experiment has more function and content compare to the other two games, which is weapon upgrade, survival economy and a campaign mode that allow player to play in story mode.

2.4 Project Methodology

For the methodology, Game development life cycle (GDLC) is used as the game architecture for this game project.

First stage is gathering requirement and analysis, which is finding what the requirement of this game project needed and make analysis for each requirement found.

Second stage is design, the gameplay and the contains or assets of the game will be designed in this game and how the game should be played and what assets need to be made.

Third stage is implementation, in this stage, the game will be started to build up based on the design and make it playable.

Fourth stage is game testing, the game will be tested continuously to test whether the requirement of the game is reached or not, if not it will go back to the second stage and third stage.

Last stage will be evolution, after reducing the risk as minimum as possible, the game will be finalized and refined as whole piece.

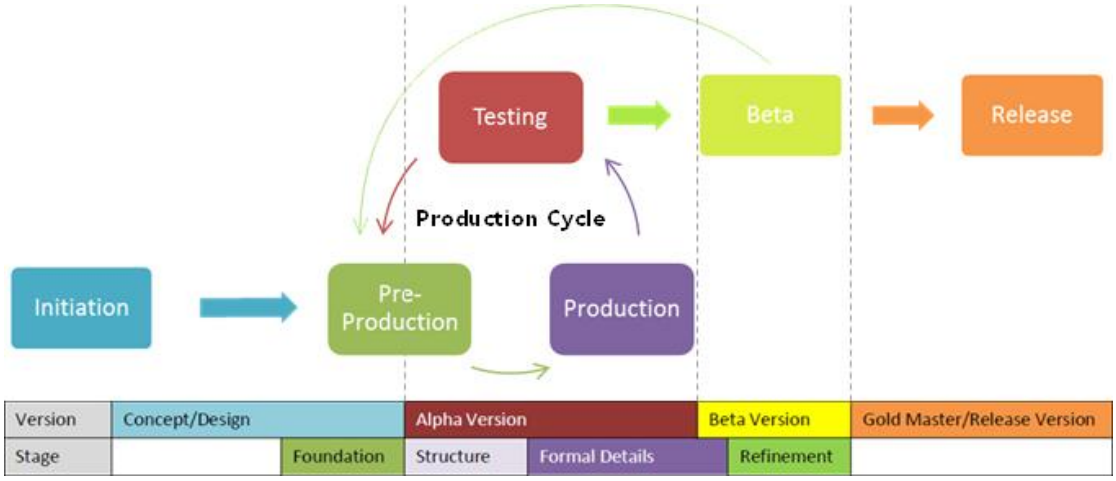

Figure 2.4: Game Development Life Cycle

2.5 Project Requirement

2.5.1 Software Requirement

Unreal Engine 4, Cinema 4D and Audacity

2.5.2 Hardware Requirement

HTC Vive, Voice Recording Device

2.6 Conclusion

As for the conclusion, after getting to know the history of Virtual Reality and also comparing the existing game that made for HTC Vive, the next activity will be analysis on the requirement of the current project need to be developed.

CHAPTER III

ANALYSIS

3.1 Current Scenario Analysis

This chapter is about finding of the requirement that needed for developing this project, such as what requirement does a game, virtual reality and the hardware or software that require to develop this project.

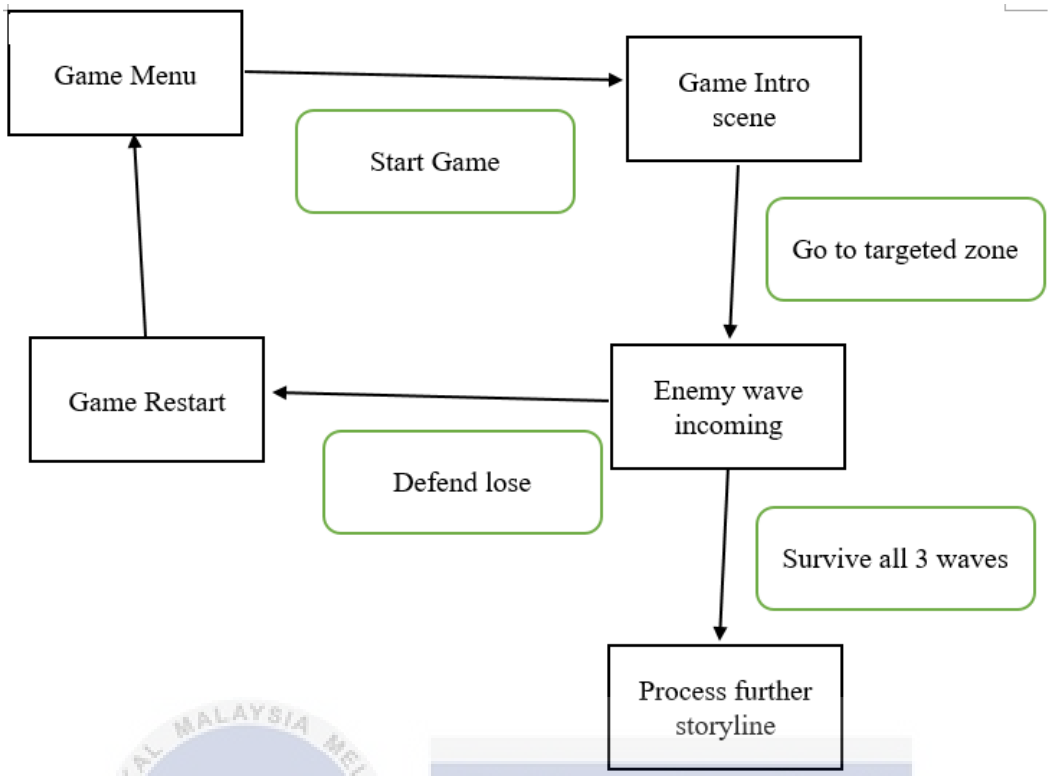

Figure 3.1: Flowchart of the benchmarked virtual reality game

3.2 Requirement Analysis

3.2.1 Project Requirement

-Virtual Reality

The device needed will be HTC vive in order to play the game in VR mode, even the user does not have the device, the game still can be played in first person mode. The proposed interaction that will be providing in the virtual reality environment is player using the head mounted display to control the first person camera movement inside

the game world, and using the hand motion controller to control the weapon. Another proposed interaction is player can move around by click the button on the motion controller.

-Games

The genre of the game going to be developed is survival first person shooter. There will be a storyline for this game, a hero which is an introvert who live in a cabin which located in a deserted forest, then one day his house surrounded by unknown monster that going to attack him and his house, after defending his home, the story will proceed to further plot which he will encounter a girl in need and also a key to end the unknown monster attack. The existing game I refer is Serious Sam VR: the Last Hope, since the game is still in early access and there will be some weaknesses that can be found, which is right now the player could not freely move around like FPS game since the movement of the character in game is tracking the location of the head mounted display itself in the real world. The gameplay of this game is mostly defending against bunch of monster that going to attack the player by using lots of big guns and shooting at them. Player will have to survive as long as possible and there will be boss fight. No much storyline is included. As for the technical analysis, the device of technologies will be used in this project is HTC Vive which is one of the latest and stable head mounted display in market.

3.2.2 Software Requirement

-Unreal Engine 4 for creating the game

-Cinema 4d for creating the 3D asset for the game

-audacity for editing the voice acting for the character and cut scene

3.2.3 Hardware Requirement

-PCs used to develop the game and testing it, also it is a platform for playing that developed game.

-HTC Vive, an alternate device to play the game in virtual reality mode, which is also the key research of this project.

-Voice recording device, for recording the voice acting for the narrator and the character.

3.3 Project Schedule and Milestone

Table 3.1: Project Schedule

Key Milestone	Start Date	End Date
Project start off	13 February 2017	26 February 2017
Creating contains/asset	14 February 2017	7 march 2017
Creating Gameplay	7 March 2017	9 April 2017
Game Testing	10 March 2017	1 May 2017
Progress Presentation	24 April 2017	28 April 2017
Game refining	2 May 2017	8 May 2017
Report submission	15 May 2017	19 May 2017
Presentation and Showcase	22 May 2017	26 May 2017

Table 3.2: Gantt Chart

Task/week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.revise proposal															
2.create contain for game.															
3.create the gameplay.															
4.game testing															
5.game refining															
6.report submission															
7.presentation/showcase															

3.4 Conclusion

As for the conclusion of this chapter, after doing the analysis on the requirement such as the project requirement, software and hardware requirement that needed for developed this project and also setting the flow and the milestone for this development, the next activity on the next chapter will be the designing.

CHAPTER IV

DESIGN

4.1 Introduction

This chapter defines the results of the analysis of the preliminary design and the result of the detailed design for this virtual reality game project. It includes the system architecture, interactive storyboard, user interface design and also the game asset.

4.2 System or Game Architecture

The game architecture will be almost similar to the existing game. As the game started, player will see the main menu of the game, upon the player clicked the play

button, player will be introduce to a cutscene that describe the main protagonist's daily life and how the event going to change his life. When player are inside the game, they can start controlling the character, if in first person mode, player simply control using keyboard and mouse, if virtual reality mode, player control using HTC Vive. To proceed to the main objective, player will have to defend his own house from incoming enemy attack. After surviving three waves of attack, player will actually proceed to further storyline in game, but the storyline is not the main concern for this project, so the game will end at that moment and giving freedom to the player to explore around the virtual environment. The figure below shows the big picture of this game project's architecture.

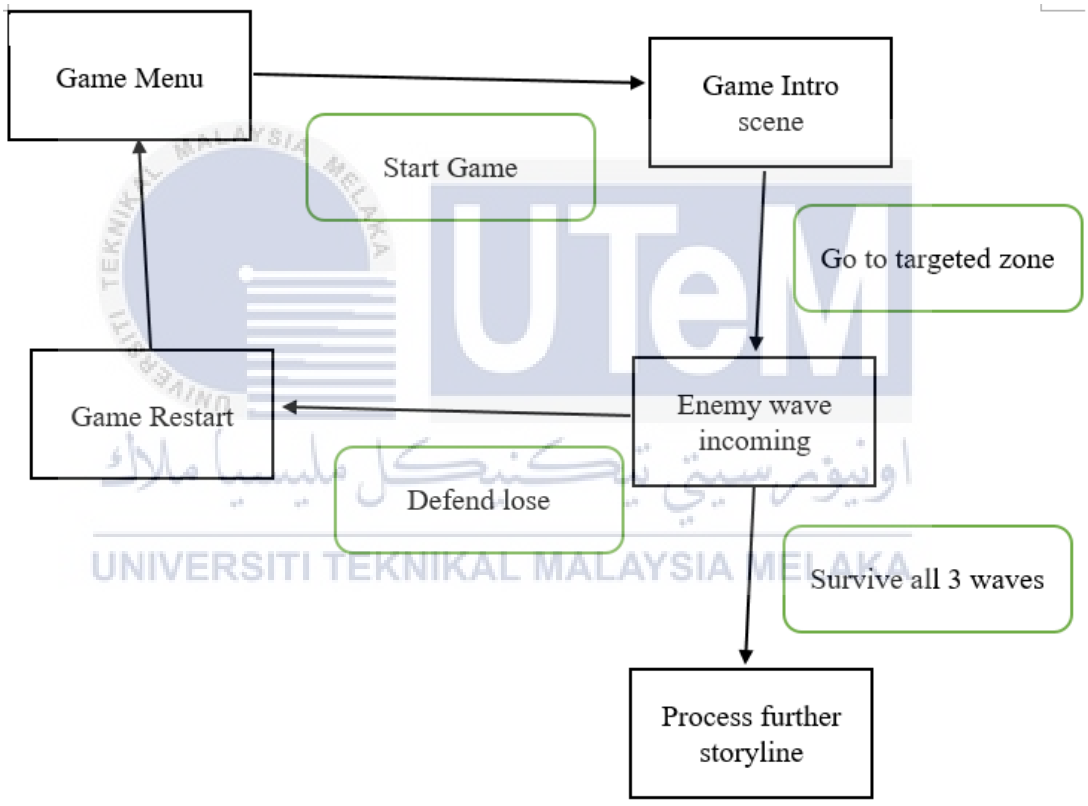

Figure 4.1: Flowchart of the game

4.3 Preliminary Design

Gameplay

Player can play this game in two mode, first one is first person mode using keyboard and mouse if the player does not have the head mounted display device, second one is the virtual reality mode which require HTC Vive to proceed. Both mode does not affect the game mechanic of the game, it is the way to approaching the experience is different from one another. In first person mode, play control the movement with keyboard, control camera movement with mouse and shooting with left mouse button, in VR mode, player control the camera movement with the head mounted display and the weapon action is controlled by the motion controller.

Game Rule

First two incoming wave that attack player, it does not have time limit, but the third wave will have time limit, so player will need to kill all the enemy within that time limit so they can end the part of the beginning story. The enemy will first destroy the defensive wall then will come after the player, once player health drain to zero, player will lose the game.

Game asset design

Figure 4.2: Model of the Stairs

Figure 4.3: Model of the door (indoor)

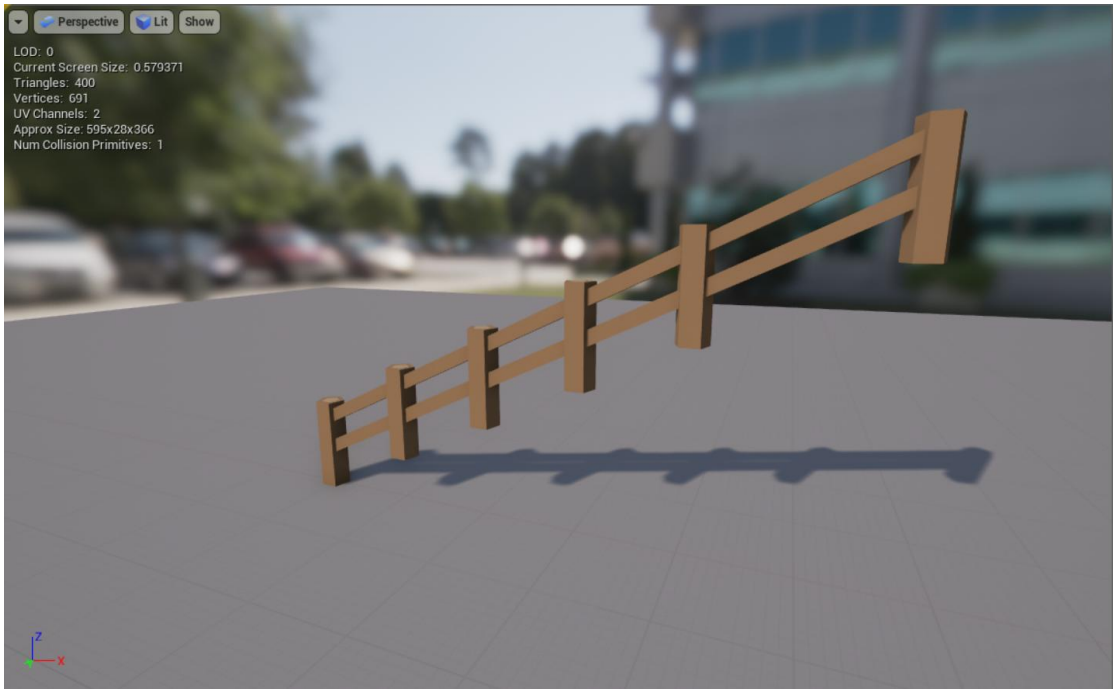

Figure 4.4: Model of the Stair Fench (outdoor)

Figure 4.5: Model of the Floor (indoor)

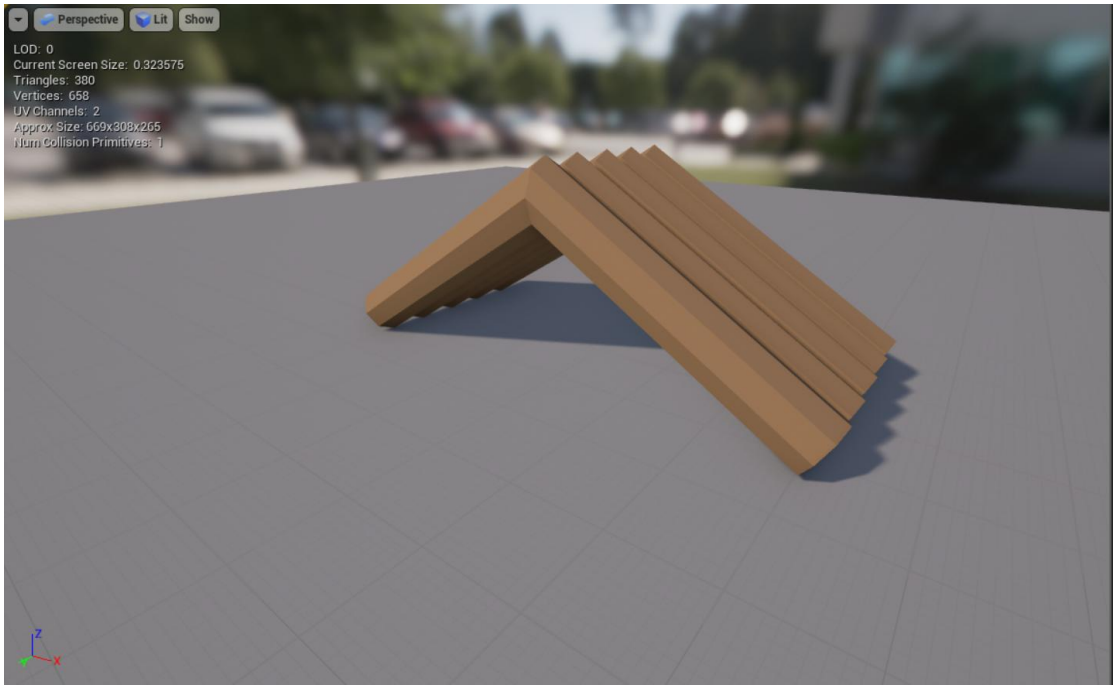

Figure 4.6: Model of the Roof

Figure 4.7: Model of the Wall (outdoor)

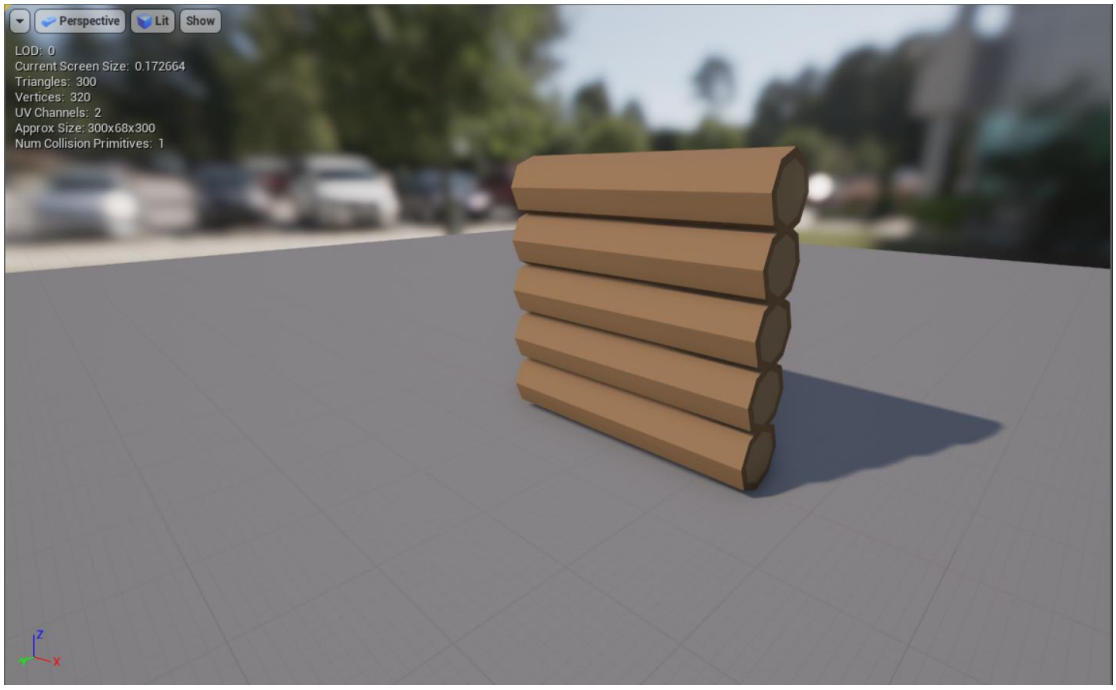

Figure 4.8: Model of the wall (indoor)

Figure 4.9 : Model of the wall with window (indoor)

Environment Design

Figure 4.10: overview of the game world from top view

4.4 Interface Design

Main Menu

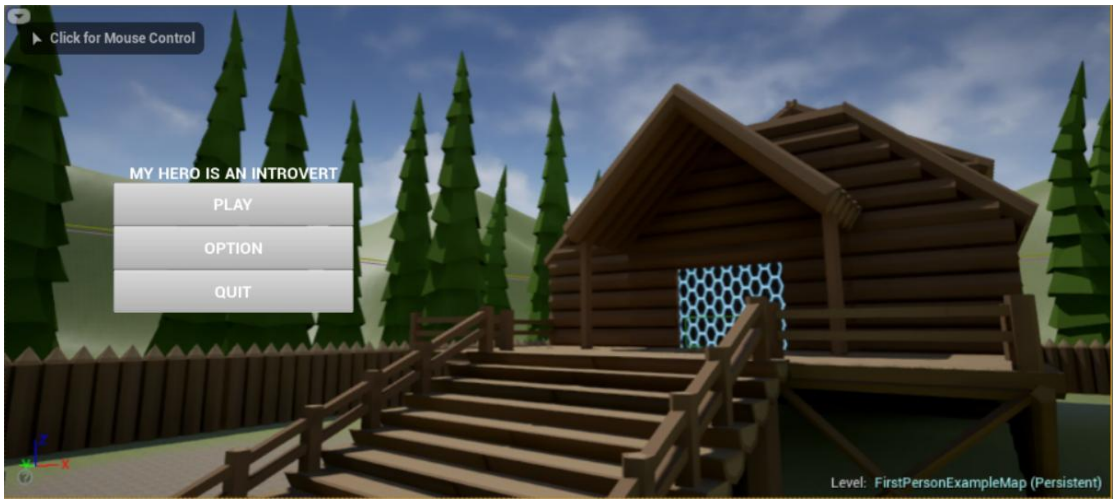

Figure 4.11: The main menu of the game before entering the game

In game's player's health bar (red) and defensive armor's health (blue) located at upper left of the screen

Figure 4.12: In game Head up display, red bar is the player's health and blue bar is the armor's health.

4.5 Audio and Sound effect

In this project, I have planned to include some simple audio and sound effect such as:

i. Weapon firing sound
ii. Door opening sound
iii. Bullet hit on enemy sound
iv. Explosion sound upon enemy's death
v. Robot dying sound
vi. Background music when the wave start
vii. Some voice acting for the narrator and main character

4.5.1 Script for voice acting

Game starting

Narrator: Yo! This is the voice coming from your head, something big is going to happen and bring down your peaceful and normal life here.

Character: What the hell was that?

Narrator: When you're ready, go outside to the marked area.

when player reach the marked area

Character: What the hell are they?

Narrator: Those are mindless killer bot and they going to attack you and your house, defend it at all cost!

Character: why suddenly there are killer bots appearing out from nowhere and attacking me for no reason?

Narrator: umm, i guess it's robot apocalypse.

Character: Huh, seems legit

when player finished first wave

Character: phew, finally beat them all.

Narrator: uh uh, not so fast, you only defeated their first wave, get ready for the second wave of killer bots.

Character: Oh my God!

when player finished second wave

Character: please tell me there is the very last one of them.

Narrator: Good news and bad news, there is one more but last wave of them.

Character: oh man..

when player finished third wave

Character: finally, i could use some rest right now.

Narrator: great job defending, actually there will be more but since this is the demo version so the game has to end here.

4.6 Character Design

First Person Player

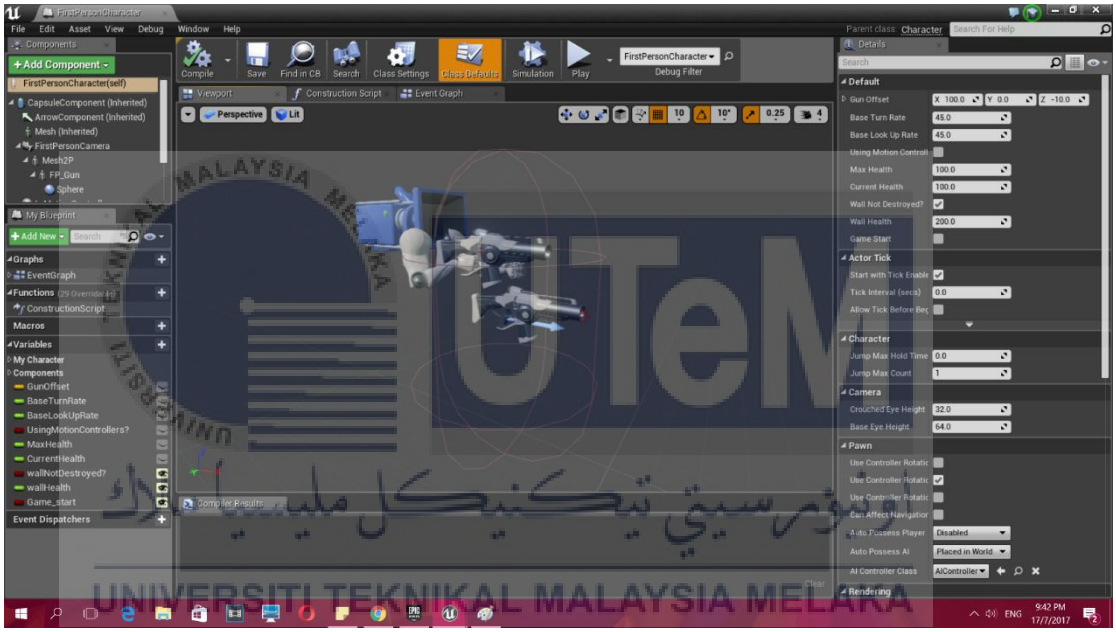

Figure 4.13 : First person model with virtual reality model

Enemy Character Design

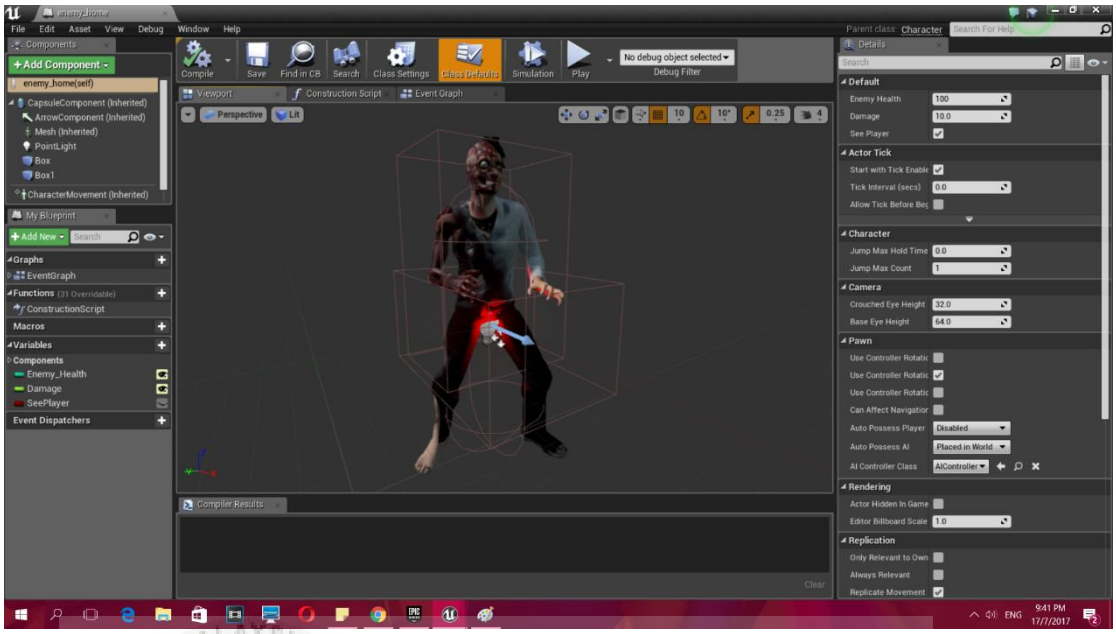

Figure 4.14: First wave zombie enemy

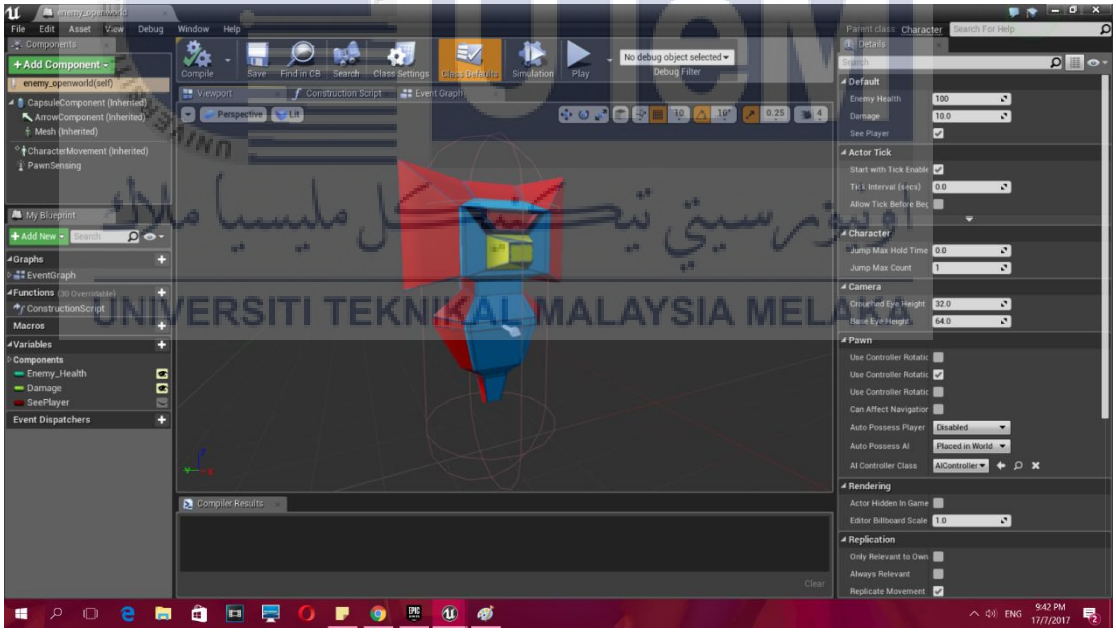

Figure 4.15: Second wave killer drone enemy

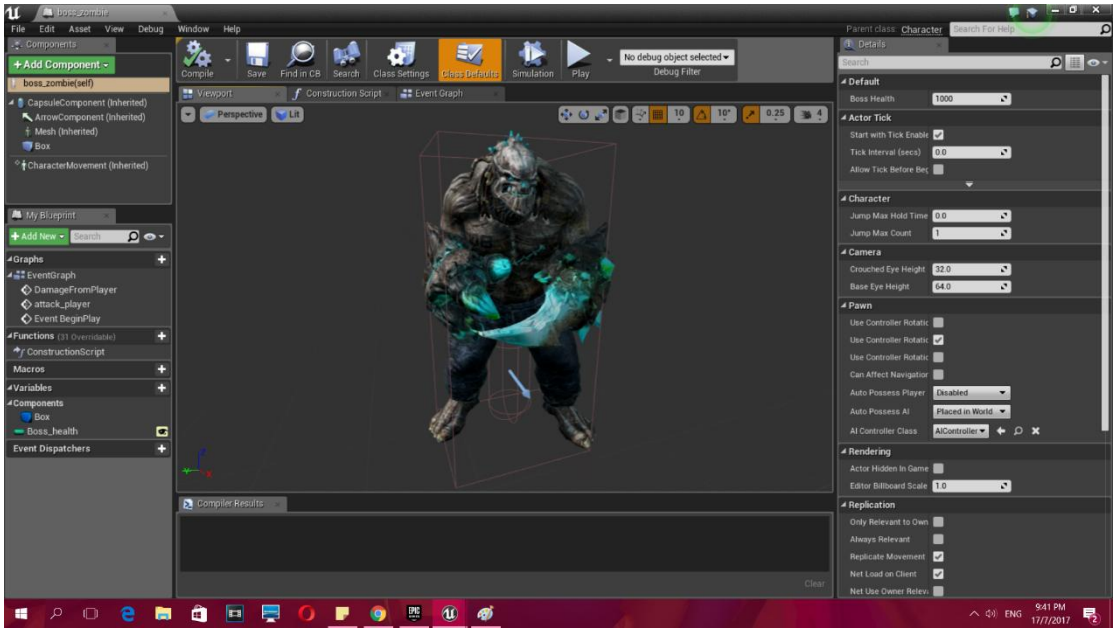

Figure 4.16: Final wave boss enemy

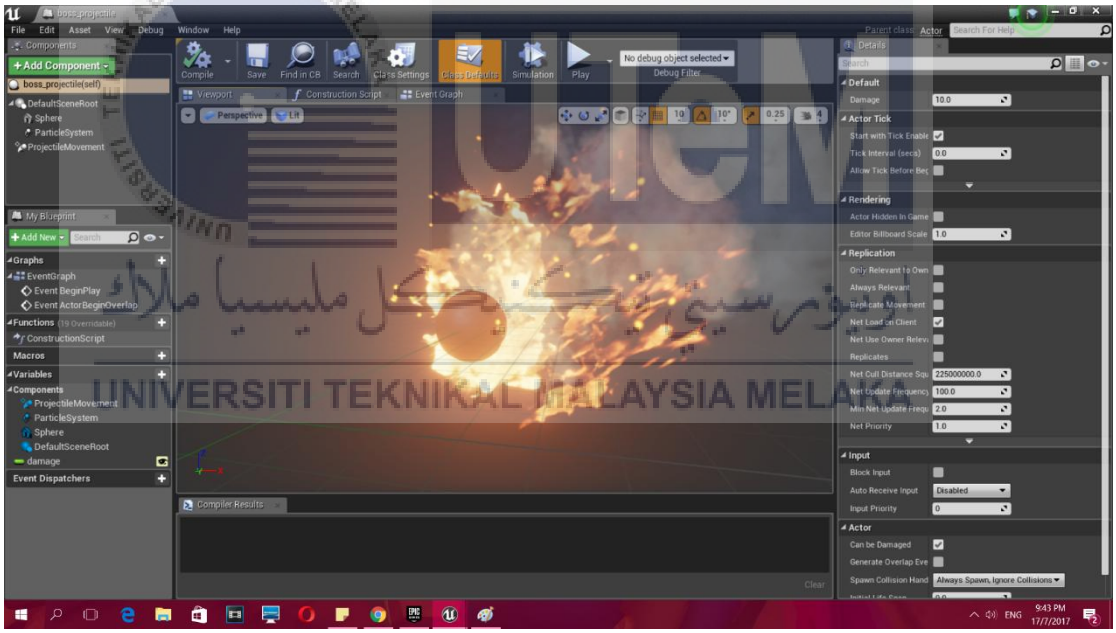

Figure 4.17: Enemy Projectile attack

4.7 Conclusion

This is all the asset design for the 3D model and the main menu with user interface design, and also the environment design. The next activity will be implementation that combining the requirement and all the design into a game prototype.

CHAPTER V

IMPLEMENTATION

5.1 Introduction

This chapter will explain about the implementation of 3D model into real time game world that allow player to interact with it through the gameplay. During the implementation phase, developer will start making the content of the game asset, such as props, character, environment, item, animation and audio. After creating all these asset, the team will combine all these game asset and using programming to make them alive which creating the game mechanic and the gameplay for the player to interact with it.

This chapter is for achieving the expected output that creating a first person shooter game and also creating a virtual reality game. Due to the delay of getting the virtual reality device, so there will be some changes on the game but it does not affect the objective during the testing chapter. The game can still be played with head mounted display as long as the player has one, but for now the game can be played as first person shooter as default.

The main goal for this chapter is to describe the process, steps and also techniques that used to developing this game. To briefly describe the process for this development, firstly is the creation of 3D asset and the game environment, then the programming for the core mechanic, and lastly is the audio and animation such as character animation and cutscene.

5.2 Creation of Game Art

For this project, self-made 3D pipeline is used but it used other 3D pipeline as reference so that the pipeline are in the right path.

Table 5.1: Self-made 3D pipeline

Phase	Explanation
Concept and design	Sketch the overall view of the characters, the props and game world.
Modeling and texture	Start creating the model using 3D software and texture them, all the model created are low poly.
Rigging	For characters such and the player and the enemy which has a human body figure are rigged with "skeleton" for animation purpose later.
Animation	Rigged characters' animations created one by one and cleaned for the implementation phase later.

Some of the models are getting from the Unreal marketplace, since the objective does not focus on the game art itself but the effectiveness and interestingness of the virtual reality game.

5.2.1 Production Graphic

For this game project, since it is a first person shooter and also a virtual reality shooter game, the player's character can be tricked such as for first person mode, since the camera act like how a real person see and they only able to see their hands, so the 3D first person character does not has face, body and legs but a pair of hands that holding a weapon. Even in virtual reality mode, the character is the player themselves, so there is no need for a person model but a 3D weapon that controlled by the motion controller. Even though in first person mode, the character only has a pair of hands with weapon, still there is rigging and animation for it such as ideal animation, shooting animation and the jumping animation.

Figure 5.1 shows how the first person character looks like, and also the mesh of the hand and the weapon are actually separated. The rigging only be done on the hands and the transformation of the weapon is locked on the hand as a child object so that when the animation is trigger on the hand, and the weapon will follow it and looks like the person is grabbing the weapon.

Figure 5.1: screen shot of the First person character's hands

Figure 5.2: screen shot of the first person character's weapon

The rest of the characters in the games is the enemies which come in 3 types, first is the zombie, second one is the killer drone and the last one is the boss, the zombie and the boss are the previous asset that taken from the Mixamo profile and the killer drone is a tutorial asset for unreal engine. There is one more Character that only can be seen on the main menu of the game, and the model is a retexture model in order to make it less heavy when running in the game engine.

Figure 5.3, 5.4 and 5.5 are the enemies in the game. Figure 5.6 shows the character in the main menu.

Figure 5.3: screen shot of the boss character in T-pose

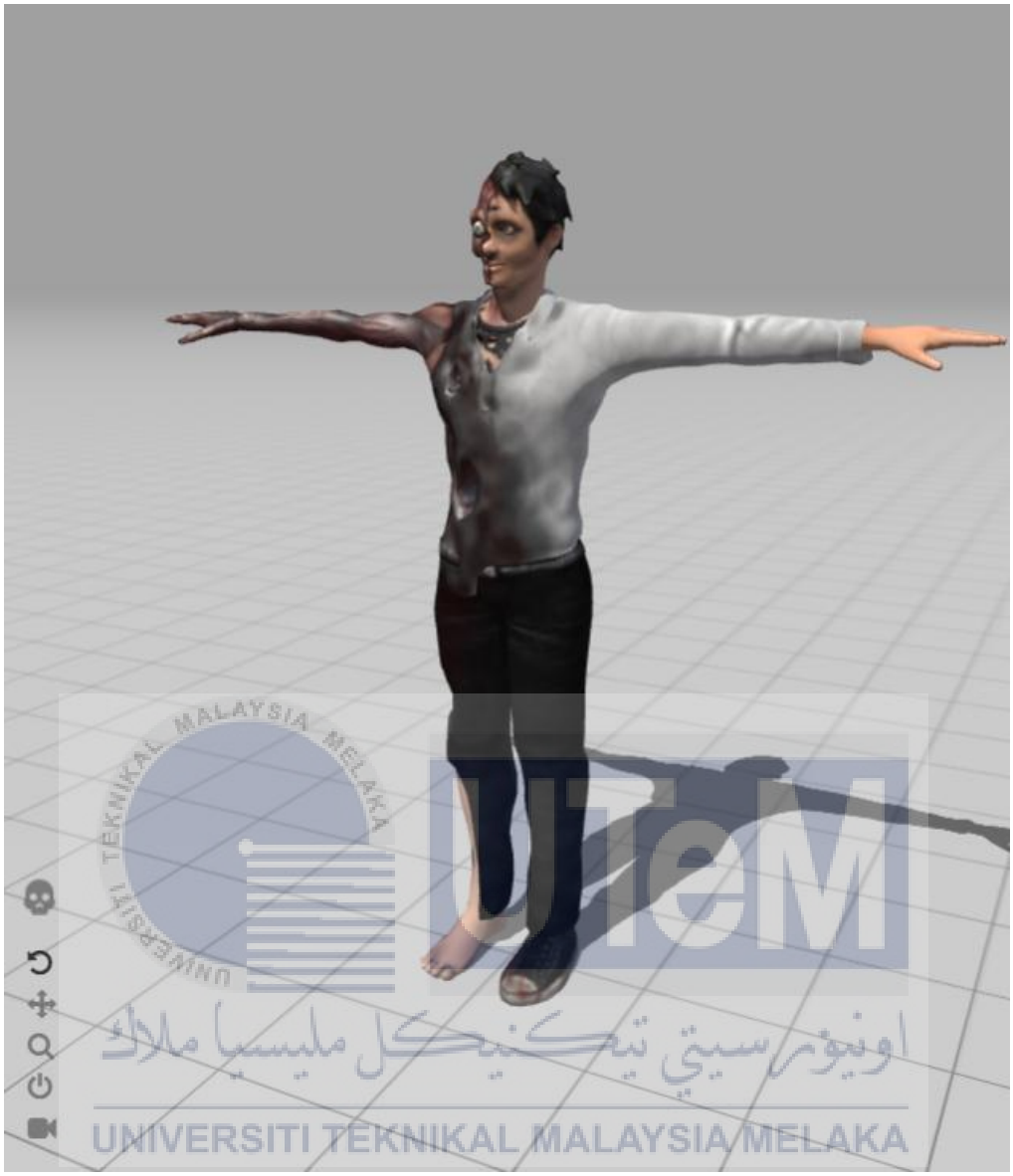

Figure 5.4: Screen shot of the normal enemy zombie in T-pose

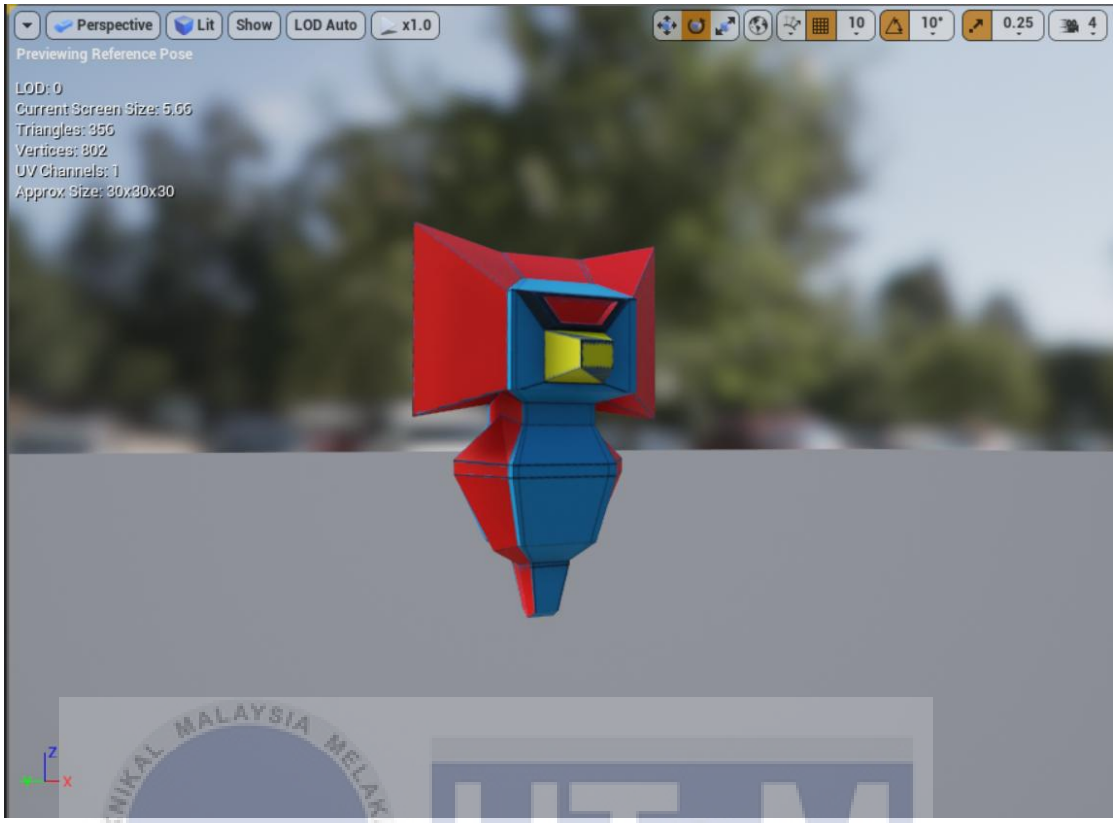

Figure 5.5: screen shot of the normal enemy killer drone

Figure 5.6: Screen shot of the character that appear in the main menu

Next is the game world or game environment, it created straight away using the game engine itself to ease up the process of creating the collision box if created using third party 3D software. The steps of creating the game world firstly is creating the landscape with 3 different materials or texture so it can allow the texture painting on the landscape directly, figure 5.7 shows the example of the 2 different textures on the same landscape.

Figure 5.7: Screen shot of the landscape with 2 texture, one is green grass another one is gravel.

After creating the landscape with different texture, sculpting is the next step to make it has mountain rather than a too unrealistically smooth surface, also the mountain created is to make a simple visual effect that player can see the end of the game environment and not able to see what's on the other side since there is nothing to show there as well.

The next step will the placing the props or static mesh on the game environment such as the walls, the house, the wooden house is actually combined with bunch of walls, floor and roof meshes that has been shown in chapter 4 design. Player can walk around inside the house as well. Figures below shows the area where the area can walk.

Figure 5.8: the outdoor, the area within the wall is walkable only

Figure 5.8: screen shot of the first room

Figure 5.9: first room with the main entrance

Figure 5.10: Stairs to the second floor

Figure 5.11: screen shot of the second floor and where the player first spawned area

Figure 5.12: an empty space preserved if there is more update later.

Figure 5.13: screen of the environment outside the walls, the moutain behind is the landscape that sculpted with the shape like it is really far away.

5.2.2 Production of animation

The process of creating 3D animation is sketch the concept then modeling, texturing, rigging, animation, capturing motion, editing then rendering. Since the some of the animation are made for real time purpose such as character, so the

process will be a slight different than the process of making 3D animation. The lighting are handled by the game engine itself.

The animation that used of the first person character hands is taken from the game engine template itself, and the rest of the character animation is taken from the mixamo profile. All the animation that need to be used are imported into the game engine according to the character mesh and skeleton itself. Zombie has 4 types of animation, idle, attack, dying and running animation, once the zombie spawn in the game, it will start chasing player, attack player and dying if get killed, so those are the animation required in this game. As for the killer drone, there is no animation since it has no arm nor leg, but floating and attacking player with projectile attack. The last is the boss, it require the animation of idle, attacking and dying animation, there is no walking or running animation since it is designed to attack player with homing projectile attack, so it only need an idle animation and attack animation to spawn the homing projectile.

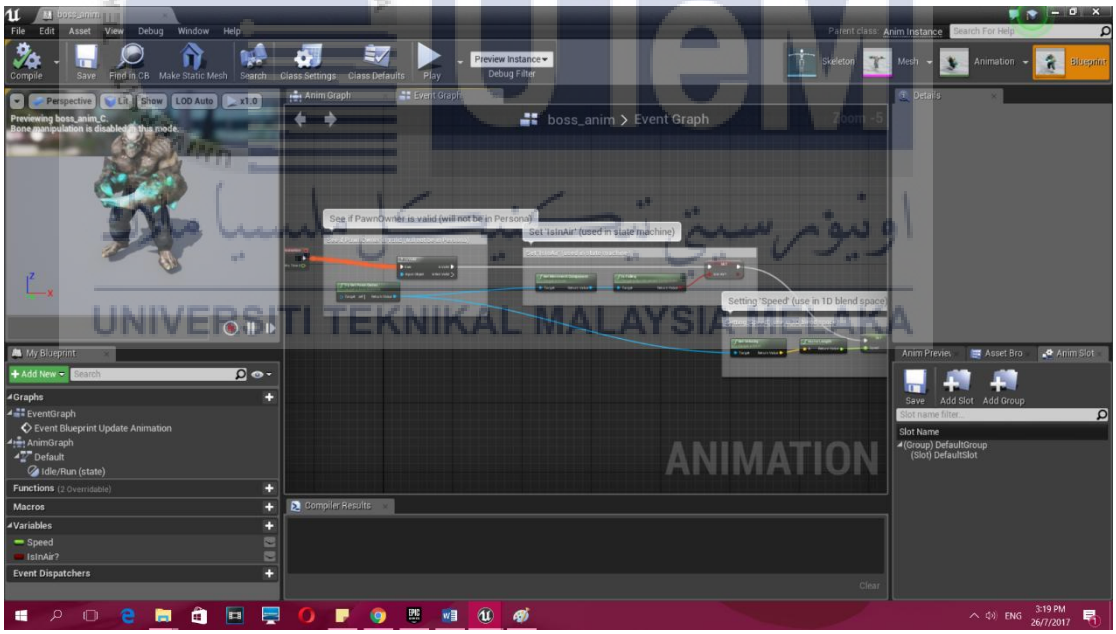

Figure 5.14: Screen shot of the boss animation that combined all the other animation for the purpose of the programming phase later, the process is the same for the other characters.

There are also 2 cutscene also known as level sequence that will be trigger during some event such as first starting wave and the last boss appearing. All the cutscene are made directly using the game engine itself with the technique of using the

animation of the character and the in game camera. To explain more detail of this technique, the animation of the character that going to be in the scene is added into the game engine, for example, the animation that the character walking around, acting or having custom movement that is not going to be used in real time. Then create an environment that suitable for the character animation, place the camera and using the timeline to make the camera move around during the scene. Last make a director cut and the camera of the first person mode will change to the cutscene camera and let the player watch the cutscene before changing back to the first person camera.

Figure 5.15: screen shot of making the cutscene or level sequence in the game engine

5.2.3 Production of Audio

Digital audio is a technology that can be used to record, store, edit and reproduce sound that using audio signal that have been encoded in digital form. Compression of audio file which is the waveform of the audio file is reduced without the loss of the quality. Creation of audio and effect are done with few processes and

steps, firstly, record the sources of the sound that either man made or comes from the nature that need to be used for editing. Then editing the raw data using audio software to reduce the noise, or amplify it or tune it for other purpose. After cleaning the audio file, exporting the audio file as MP3 for listen only purpose, if for other usage such as game and animation or video, WAV file is used to export the audio.

For this project, the audio used including sound effect and background music, sound effect including weapon sound, explosion, zombie, boss, killer drone and cutscene audio. Background music is used on the main menu and during the starting of the game. Also there are some voice acting in the game that recorded and edited using the microphone and the Audacity software, all the audio file exported and used are in WAV format, since the game engine only support WAV file for audio.

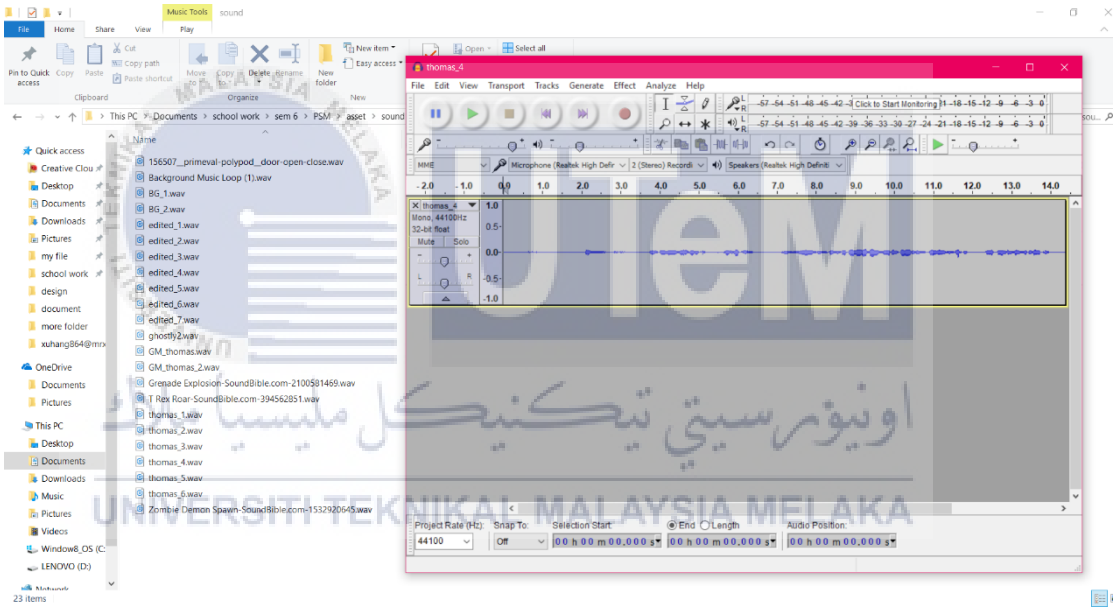

Figure 5.16: screen shot of the audio production and the asset of the sound that completed

5.3 Integration of game component

This part will explain the process of putting all the game asset into the game environment and create the gameplay with some technical aspect. The very first planing of the development of gameplay is creating a tower defense like gameplay which player are restricted in a area and defending against wave of incoming enemy that going to attack the player. There will be three waves in this game, first wave will spawn the zombie which does close range damage to the player, once player killed all the enemy in the first wave, second wave will be the killer drone which does range attack, last but not least, the final boss wave, which will spawn the boss in the specific area and will attack player with homing projectile until it killed by the player. Below is the detailed explanation with the figure of the blueprint on each of the programming that are planned and done on the characters classes and the level, all the programming is done by using Unreal Visual Blueprint coding.

First Person Character/Player

With the help of the template, the character movement and mouse camera rotation are done, it also comes with the coding that if the user has head mounted display device, the first person character will switch to virtual reality mode.

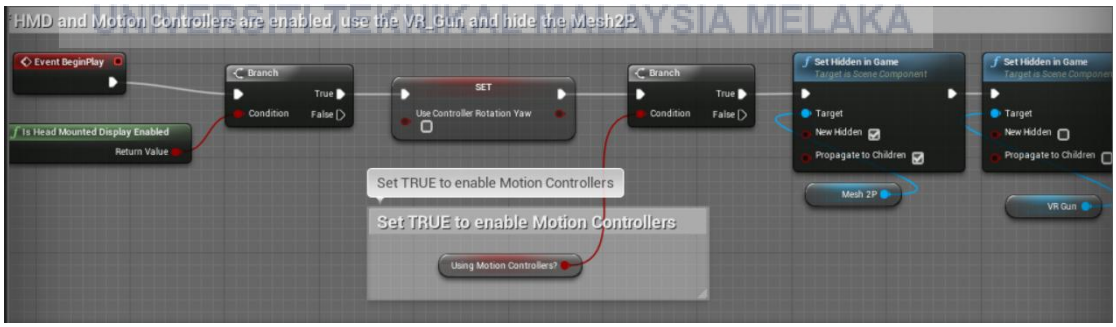

Figure 5.17: screen shot of VR mode changing coding

Next is the internal economy of the first person character, it has health, armor, damage that the player can dealt to enemy. Once the player receive any damage from the enemy, the amount of damage will deduct the armor point first, if the armor is depleted, then the damage will dealt on the player's health point. Player will have 100 health point and 200 armor point, and the damage player can dealt is 25 point.

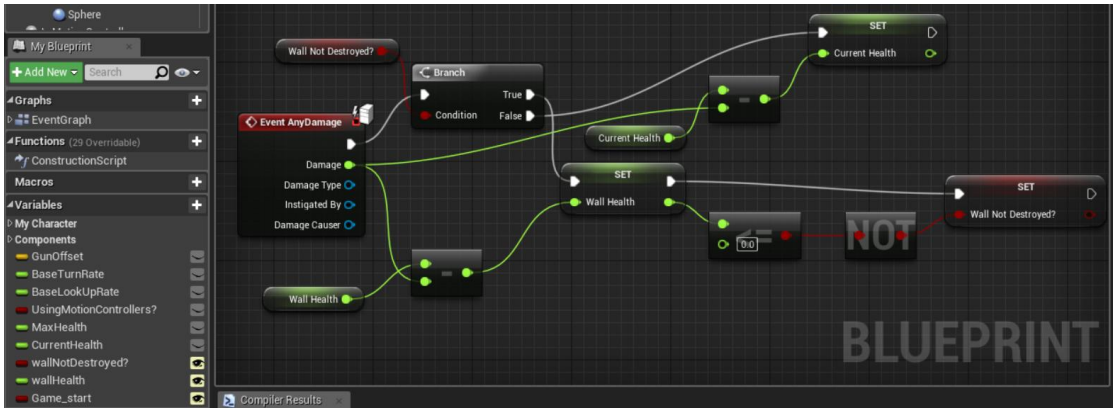

Figure 5.18: Character's internal economy variable on the left, receive any damage on the right as coding

The next will be spawning projectile from the weapon, the damage from the weapon is dealt by the character's projectile which comes from other blueprint class, that means the projectile and the character are separated class, and the character only does the job to spawn the projectile class when trigger by mouse event. The projectile will travel in straight direction and act like a ball that can bounce on static mesh, but destroyed when hit on enemy.

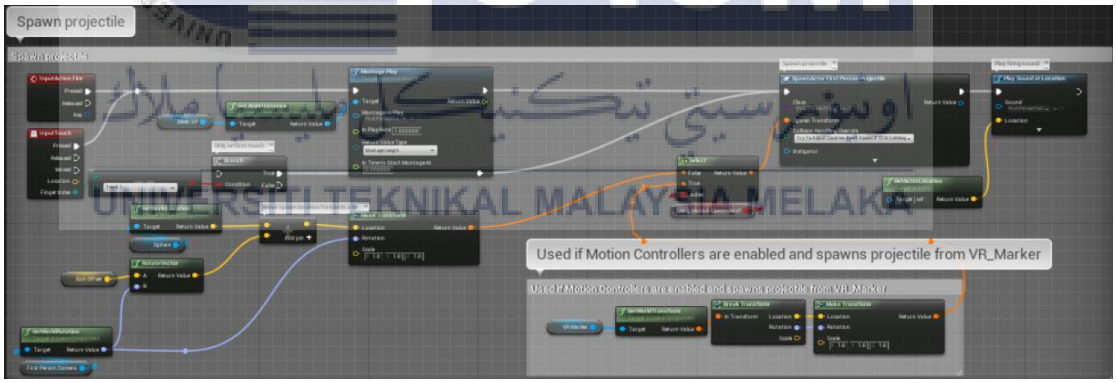

Figure 5.19: Spawning projectile coding

The figure below is the movement coding for the PC use, such as keyboard and mouse, there is another option if the user has motion controller with head mounted display, also there is gamepad coded as well in case the user prefer using gamepad to control the movement.

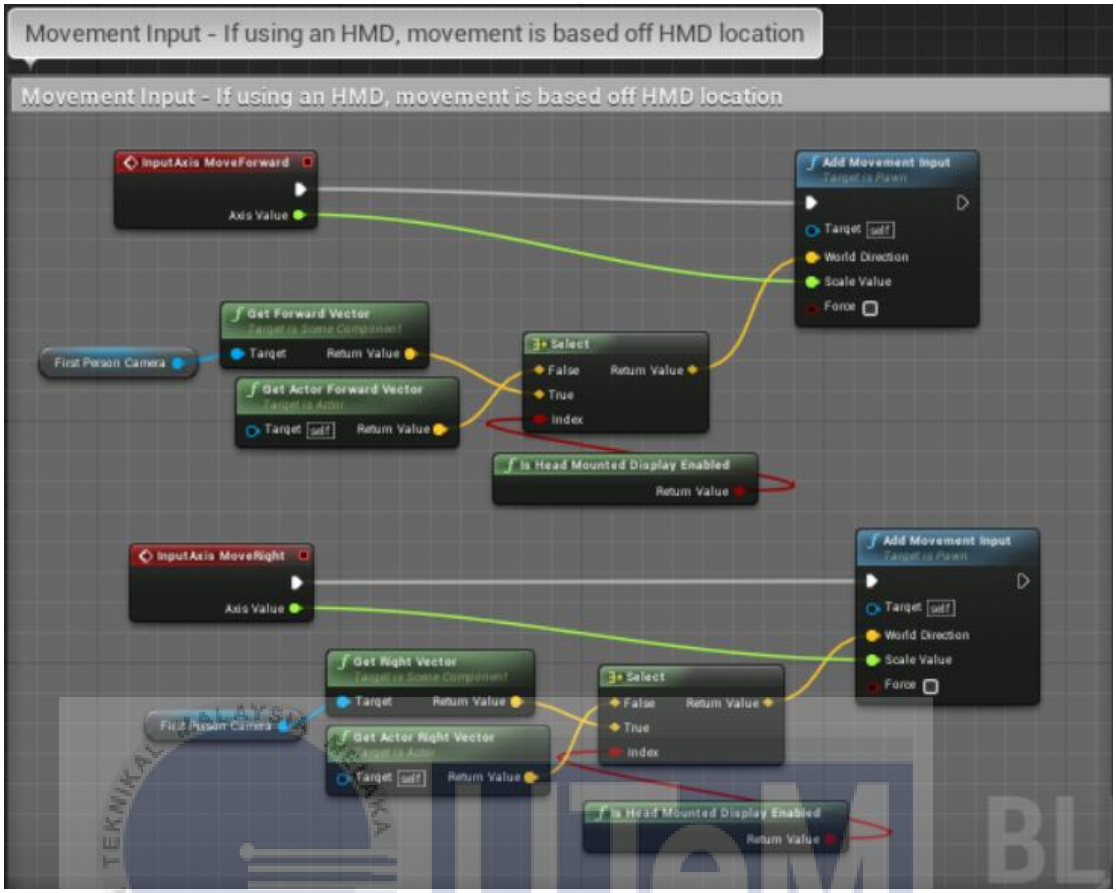

Figure 5.20: character movement when head mounted display is used

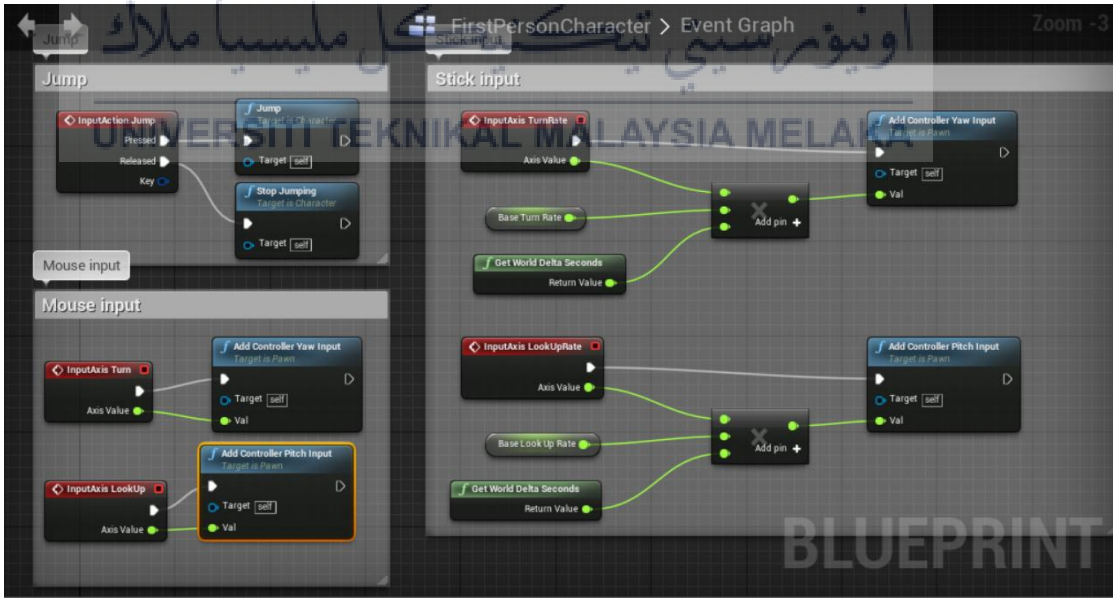

Figure 5.21: Coding for using keyboard and mouse for character movement

Last few things are the projectile actor in order to let the character spawn when trigger, and the head on display such as health bar and armor bar.

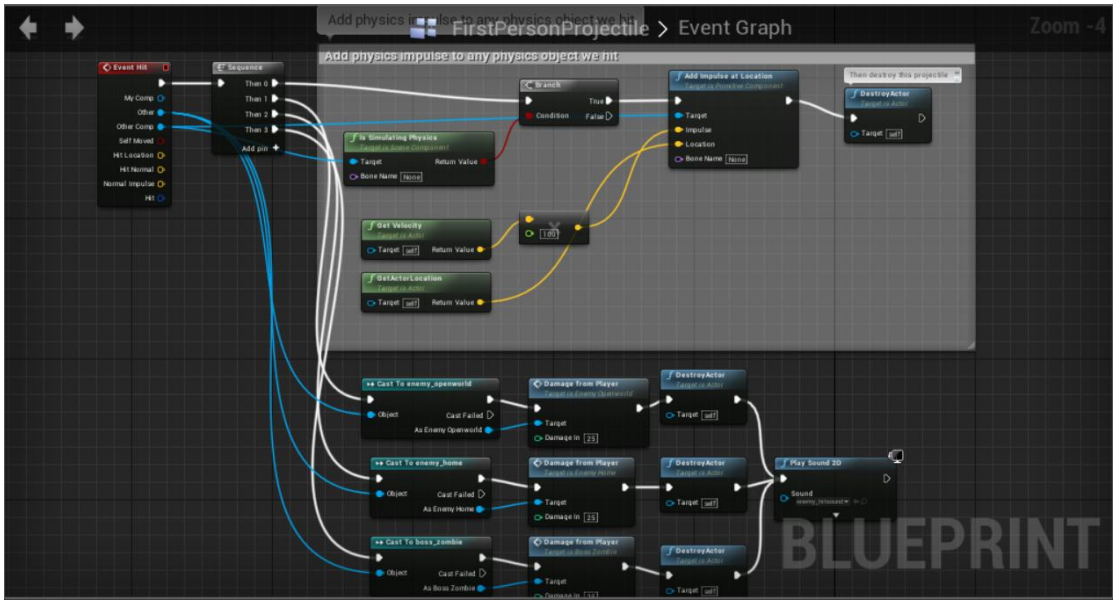

Figure 5.22: coding for first person character's projectile and dealing damage to enemy when hit

Enemy, zombie and killer drone coding

This part will explain about the coding for the normal enemy such as the zombie and the killer drone, both most likely has the same type of behavior but only the attack style are different, zombie using close range attack, and only attack when really close to player, killer drone using projectile attack, as known as range attack to attack player. The main behavior of these enemies are, when they see the player, they will start chasing the player and attack player until they get killed by player or defeated the player. Figure below will show the coding of their movement behavior and chasing player when player is been seen.

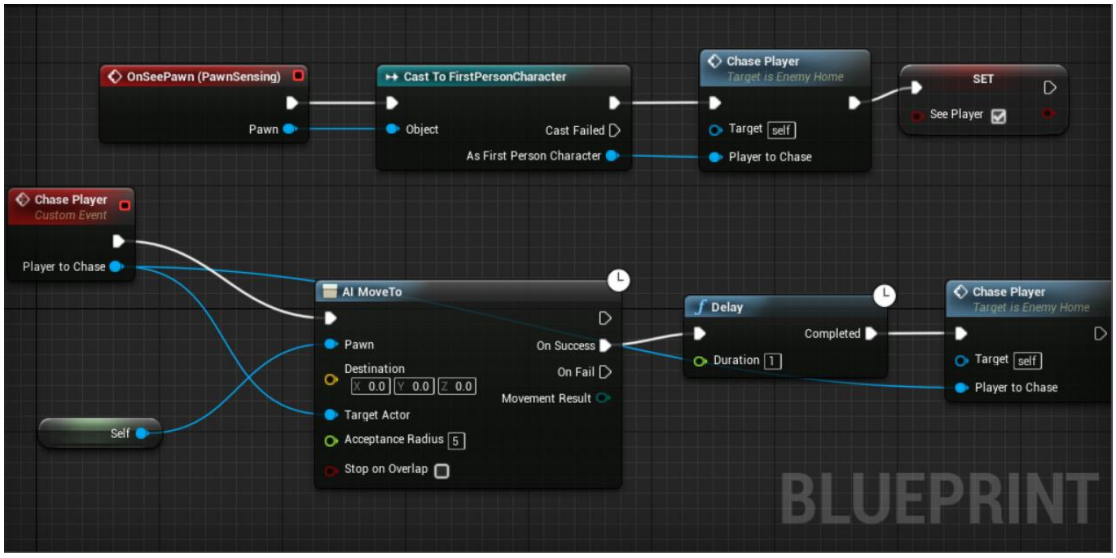

Figure 5.23: enemy's AI for chasing player

Both of the enemies also have the same coding about how they recieve damage from player, but for zombie, they will play a dying animation before the actor is removed from the world, as for killer drone, there is no need for the dying animation, and they also having the same type of internal economy such as health point and damage to player.

Figure 5.24: enemy receive damage from player coding

As stated before, zombie and killer drone having the different style of attacking player, so their coding will be different, for zombie, there is a collision box placed in front of it and will trigger damaging player when the player is in the range, for killer drone, they will continuously spawn projectile in a straight line to attack player. The projectile also the same like player's projectile which is separated as different classes.

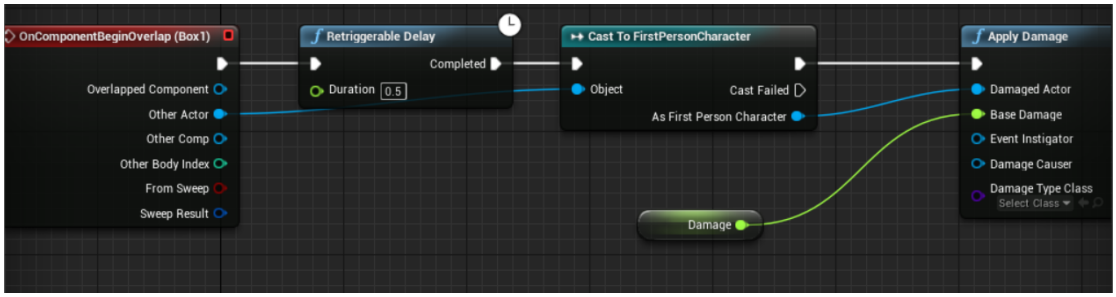

Figure 5.25: Coding of attacking and dealing damage to player.

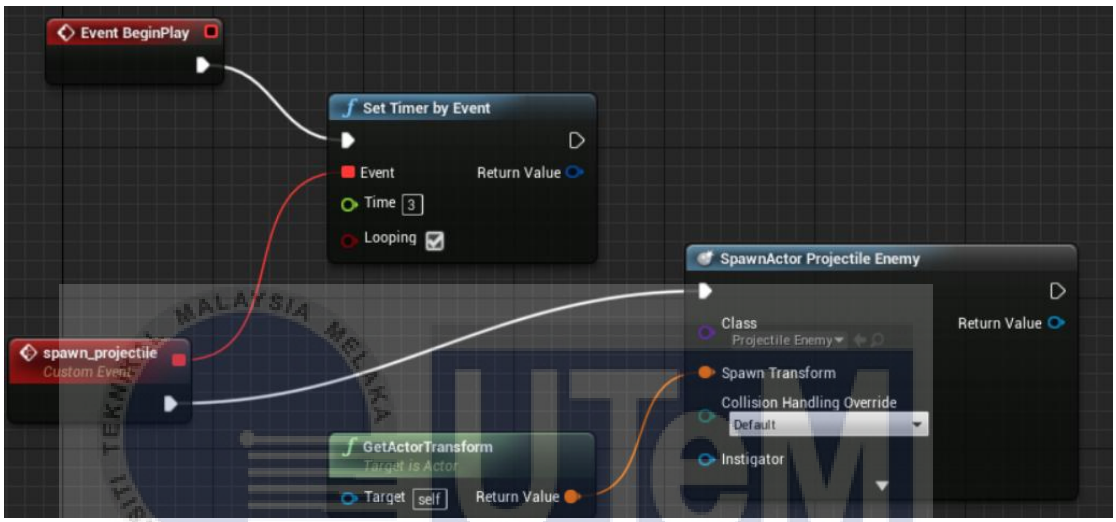

Figure 5.26: coding of killer drone spawning projectile

Boss enemy

The boss in this game does not have the behavior of chasing player, it has a bigger size and stand at the middle of the spawning zone and continuously attack player with homing projectile attack. The homing projectile is also another actor since it has a homing projectile properties to track down player. Also the boss has one internal economy which is health and has 1000 health points. Figure below will show the coding of the boss spawning projectile and play dying animation when defeated by the player,

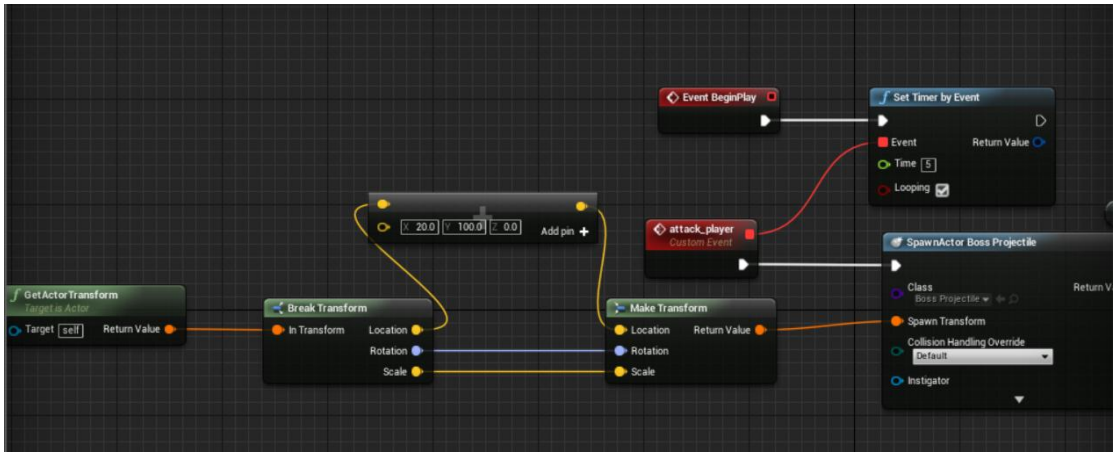

Figure 5.27: Coding of boss spawning homing projectile

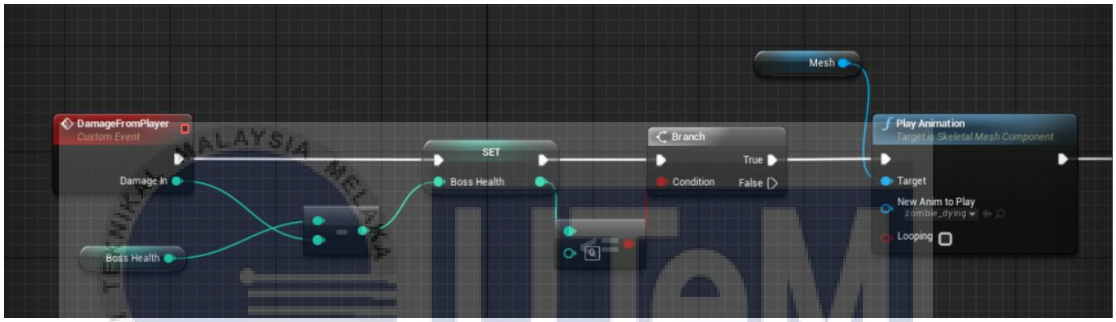

Figure 5.28: coding of boss receive damage from player and dying animation

The last thing for the enemies coding is the boss homing projectile figure below will show how it track the player and the projectile will accelerate toward player until it hits the player.

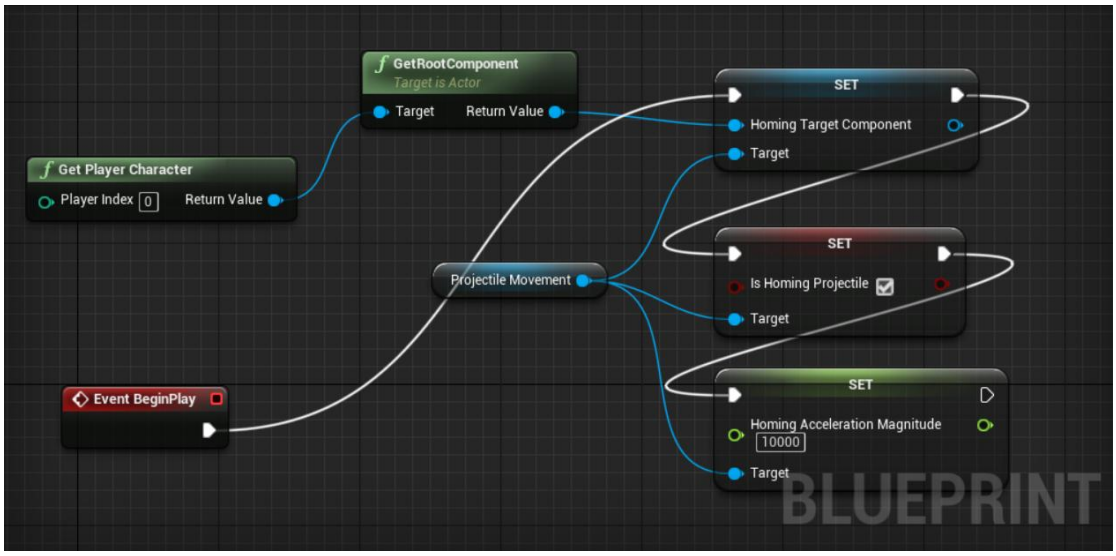

Figure 5.29: Coding of homing projectile targeting only the player.

Level blueprint, the Game mechanic

Next this part will talk about the coding of the game mechanic and creating the game level to spawn enemy and let the player defend against the waves of incoming enemy, there will be 3 waves, first is the zombie wave, second is the killer drone wave, and the last wave will be the boss. Figure below will show the part where enemy is spawn in the game environment, there will be 5 target point to spawn the enemy, array technique is used to randomly pick the target point's location to spawn enemy one by one using timer. First and second wave will only spawn 30 times of enemy, and the last wave only spawn once. There is also a function when player trigger the spawner, player cannot move back into the house until all the wave is finished.

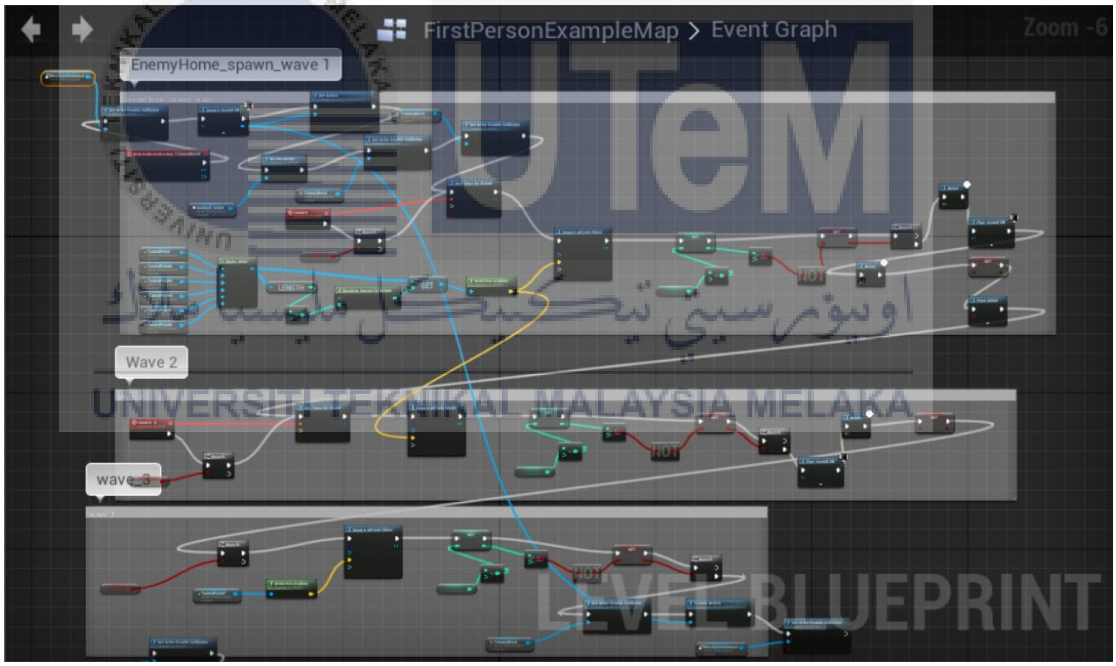

Figure 5.30: screenshot of the spawner's coding

Above is the main coding for the game mechanic in order to produce gameplay, the rest of the coding is the door opening and closing, triggering cutscene and spawn the voice acting. Figure below will show the rest of the coding. The door is automatically open when player move close to it. The door will close itself after a few seconds.

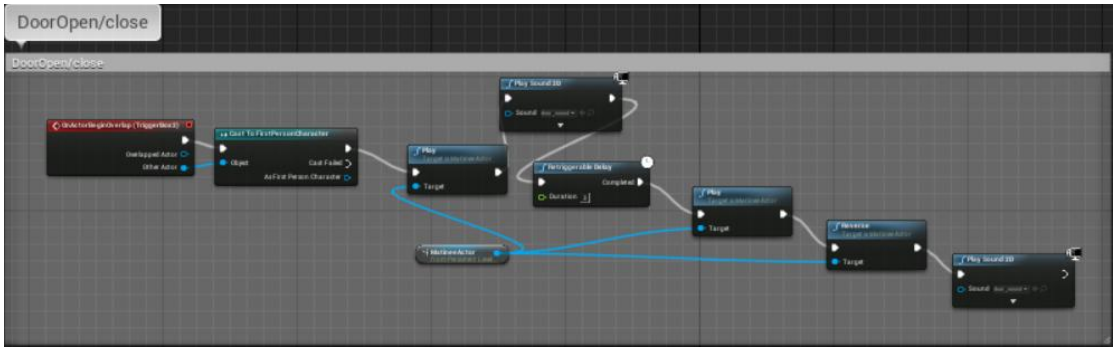

Figure 5.31: Coding of opening and closing door

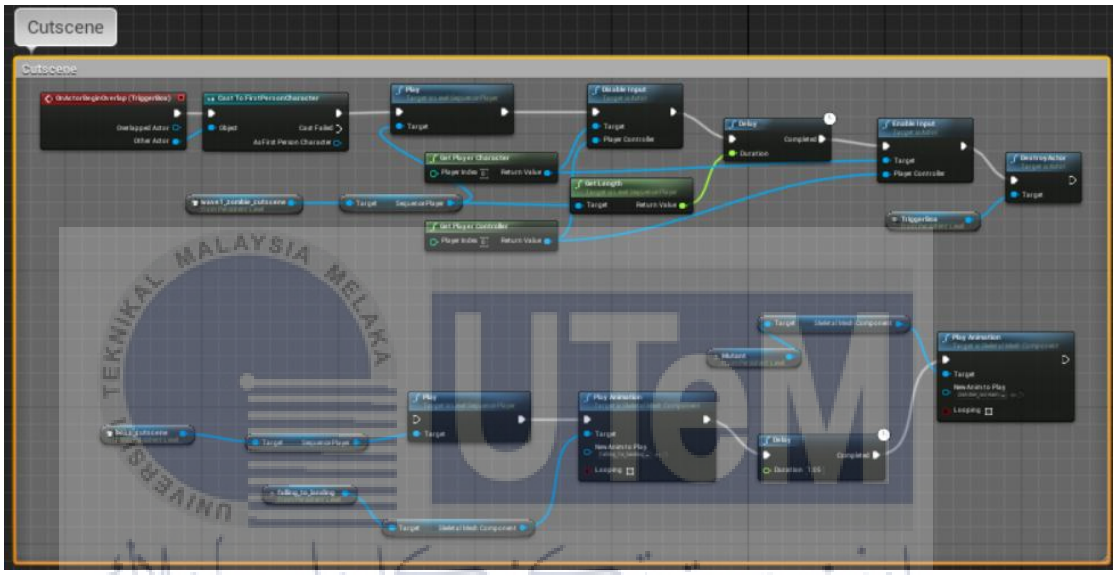

Figure 5.32: coding of triggering the first wave cutscene and the last boss cutscene.

Main Menu

Last but not least of the this part is the main menu, simple coding such as button clicking to play the game or changing the resolution or quitting the game is added to the main menu. 2 figures below will show the button that designed on the game screen and the coding to execute the button

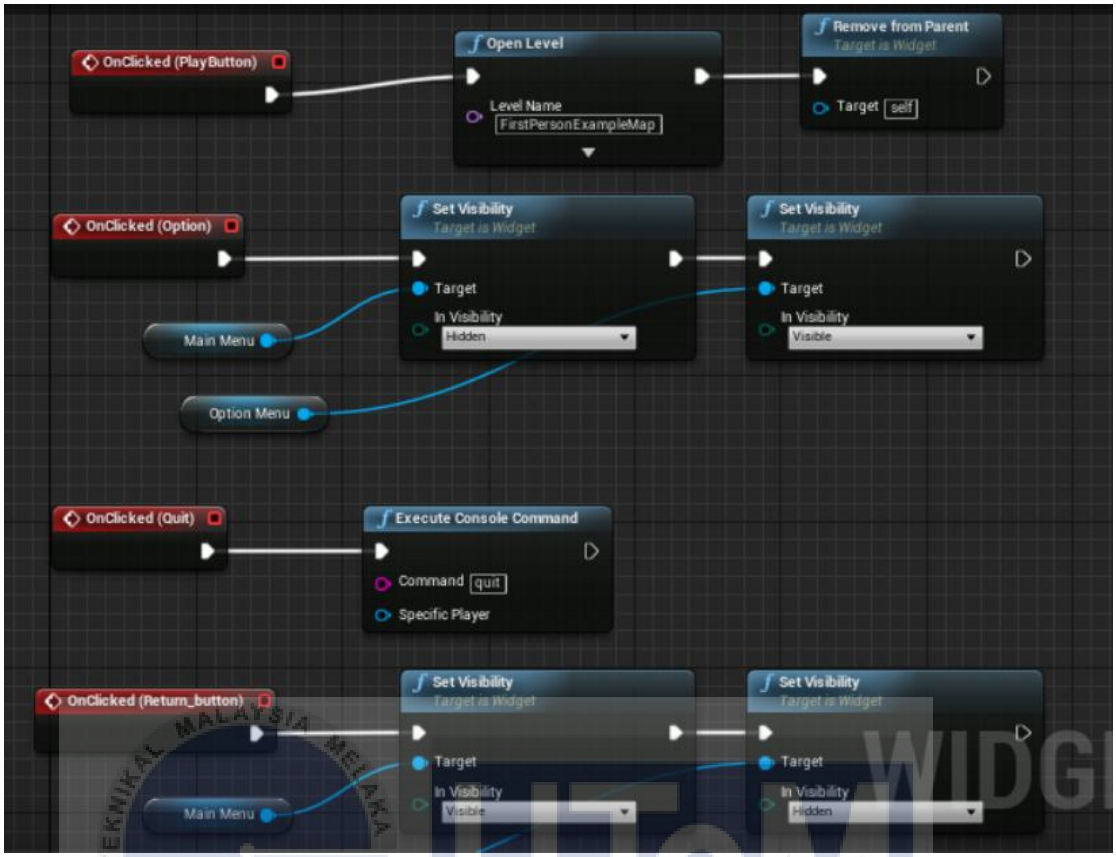

Figure 5.33: coding of the main menu button

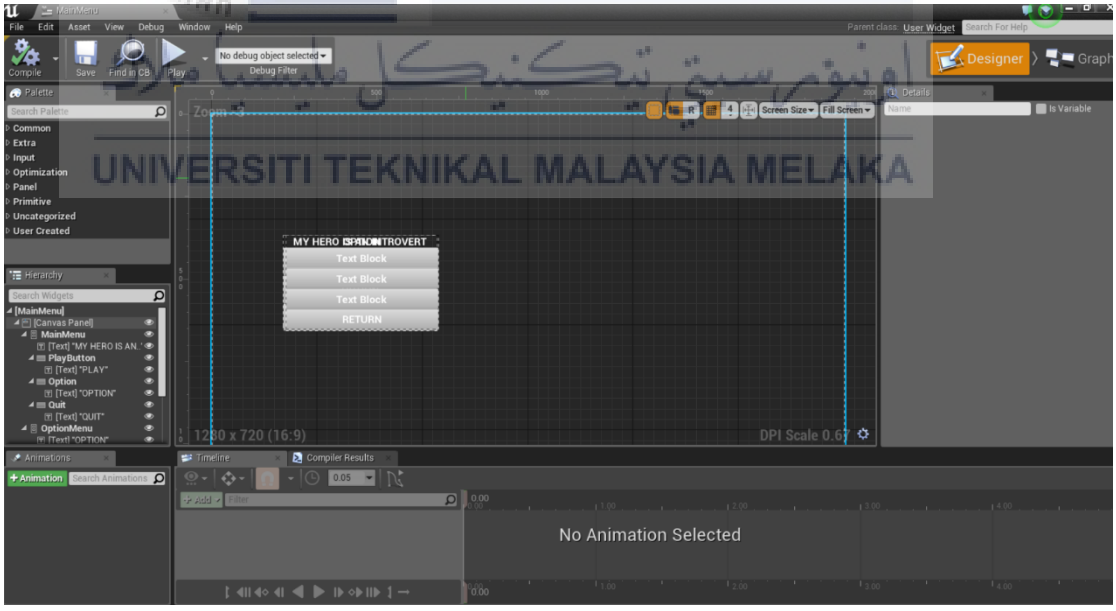

Figure 5.34: screen shot of the designing main menu button as where it should appear on the game screen

5.4 Game Configuration Management

This game is developed by using Unreal Engine 4.14 with Virtual reality ready content. This game project will simply publish with the executable file, if there is changes on the game, user will simply have to download the whole file and delete the previous file in order to keep the game in stable form of playing.

Since this project is created for virtual reality as optional, so the content quality will be moderately high for some PC to handle, there is no plug-in needed to be install to play this game unless the user has head mounted display such as HTC Vive or Oculus Rift. Simply plug in their head mounted display will allow them to play the game in VR mode when they start the game. The head mounted display has to plug in before the game start and must have the motion controller to play.

5.4.1 Configuration Setup

This project will be published in PC platform only since the project is already started develop for desktop platform. This game can be play using keyboard and mouse, and also using HTC Vive the head mounted display for VR mode optionally. There is no need for installation, the game file will exported executable file (.exe), simply run the executable file to start playing the game.

5.4.2 Version Control Procedure

Version control procedure is one of the important part of this development in order to make sure the game is actually completed and having really less bug before

really publish to the game market. But still in order to test the game more effectively, this game will publish as alpha version, and allow the user to gain early access to the game and with their help to develop this game by getting feedback from the user. After getting all the feedback from the user to remove the major bug and refine the game, beta version will be released with adding more content to the game without changing the gameplay or the game mechanic too much, only a slight change is allowed in order to remove bugs that occur during gameplay. Release Candidate 1 will only execute when most of the content is added to the game and the game still working stable without major bug that would disturb the gameplay.

5.5 Implementation Status

Implementation status shows the state of the progress of activities that have been done or canceled to complete this project. The task listed will be start from the designing until the game refinement task. In table 5.1 will show all the main task with their required duration and their status whether they are delayed or done on time or even cancelled, in this project, none of the task is cancelled. There is only a few task which is delayed such as the content or asset design and making, however, all the task still able to finish on time and an alpha version of the game is able to produce.

Table 5.2 Implementation Status of Project Development

Task	Duration	Status
Research on Virtual Reality game	1 week	On time
Designing the gameplay	2 weeks	On Time

Designing the game mechanic and rules	1 weeks	On time
Designing Flowboard	3 days	On time
Asset and content creation	1 month	Delayed
Implementation	2 months	On time
Play testing	2 weeks	On time
Game refinement	3 weeks	On time

5.6 Conclusion

As for conclusion, this chapter discuss on the implementation process and how the game asset, content and the gameplay is created during each process. This implementation is process is important to the developer to allow the team to expect the output of this project without getting off the line.

Next chapter will be the testing of the game in order to achieve the objective of this final year project.

CHAPTER VI

TESTING & EVALUATION

6.1 Introduction

In this chapter, there are two type of testing conducted, first is the game's play testing by the developer himself for finding out the major and obvious bug that occur during the game testing. The second testing is conducted using interview personally with the user who has virtual reality experience in any kind of device or technology, such as mobile VR, Playstation VR and the HTC Vive.

For this project, I was not able to conduct the game testing using the HTC Vive due to the lack of equipment from the faculty and also the specs of the PC are not able to handle the VR or it is not "VR ready". So in order to complete my objective of this project, I went to a few place which they are specially renting the VR device for the customer to play for a time and for a price. By conducting some interview with the staffs who work there and some customers who were playing at that place for asking their experience and opinion when trying the VR. It was

successful and I able to grab some data and information that able to complete my objective for my project.

6.2 Test Plan

6.2.1 Purpose

The purpose of the first testing is for the technical part and the content and it is done by the developer during the game making for bug hunting and first refinement, the next main purpose of the testing is for gathering the user experience and opinion when they are playing with the VR device, HTC Vive.

6.2.2 Phase

For the developer testing, there are few phase for it, first phase is the programming or implementing phase, which import the content such as 3D models, audio and characters, then program them in order to create the gameplay which allow the player to interact with it. The next phase which is the testing phase, in this phase, the developer will testing every new programming or function is added into the game, if the developer found any major bug or the output is not the expected one, then the phase will go back to the first phase which is implementation, if there is no major bug or the result is as expected, then the developer will move on to the next phase.

Third phase will be tuning and refining to produce a better and smooth gameplay without disturbing the main mechanic or the gameplay itself. Adding audio such as sound effect and background music is done in this phase as well. The last phase will be the final output which having all the expected outcome during the design phase and then export the game into a standalone version.

The second testing only has three phase, first is conducting interview with the user personally and asking about their experience and their opinion about the VR game they played. The next phase will be the analysis on all the data and information that collected from the users. The last phase will be the conclusion about the user experience the VR.

6.2.3 Target Group

The target group for this testing is randomly selected 20 respondent and give them the questionnaire after letting them try playing the virtual reality game and the first person shooter game, also there will be interview with 5 people where they are random customer and staff who have played with the virtual reality.

6.2.4 Testing Methods

The testing method used is play testing and usability testing. Play testing method is done by the developer and the supervisor and with the direct feedback for removing the major bug. As for the usability testing, since the game of this project is almost the same like other VR game that published these day, so I have gathered some general opinion from the users just for completing my objective and also solve the limitation for lacking HTC Vive to test the game made from this project.

6.2.5 Game Feature

The Game features will be tested is the instruction of the beginning of the game, to test whether the user know what to do or where to go next when they start playing the game, next elements would be the user interface design, sound, interaction, immersion when playing the game, and the engagement from the user. All the data is gathered when the user finished playing the game and get interviewed by the developer. All their opinion is based on the criteria that listed before.

6.3 Test Implementation

First I will start explaining the first testing on the game of this project, which is playtesting by the developer and the supervisor of this project. During the first step is to find out any major bug and correct them during the implementation phase. During this testing, The testing also follow the criteria such as visibility, feedback, affordance, mapping, constraint and consistency, so that the testing is within the right path.

The second testing will require the user who has experience on VR game, since I could not conduct the testing on my game, so in order to overcome the limitation, I have gone to some place which either specially selling VR device or the place is giving service for the customer to experience VR on the spot with some price. The places that I have gone is the shop named VR Lab, it is a company that having the service which allow customer to play the VR for an Hour for a fixed price, or the customer can purchase their very own HTC Vive. During that day I have waited there to find the chance to conduct interview with some customer who willing to share their experience and their opinion on VR game, also I have conduct an interview with the leader to manage the shop since he has the most experience on VR game and asking for his opinion would be a great help achieving my objective of this project

All the test data was documented by using the voice recorder and the video recorder upon the permission of the customer.

6.4 Test Result and Analysis

There are two testing method, first is questionnaire and second is doing interview, 20 respondents is tested with two games, first is a normal first person shooting game which make from this project and second game is a virtual reality game from smart phone device. For the interview part, there are five people which are selected randomly at the testing environment.

6.4.1 Background of Participant

In this section, data about the participant's gender and the range of their age were collected and analyzed, the data will be shown in the form of table and chart.

Table 6.1: summary of 20 respondent's gender

Gender	Number of respondent
Male	11
Female	9

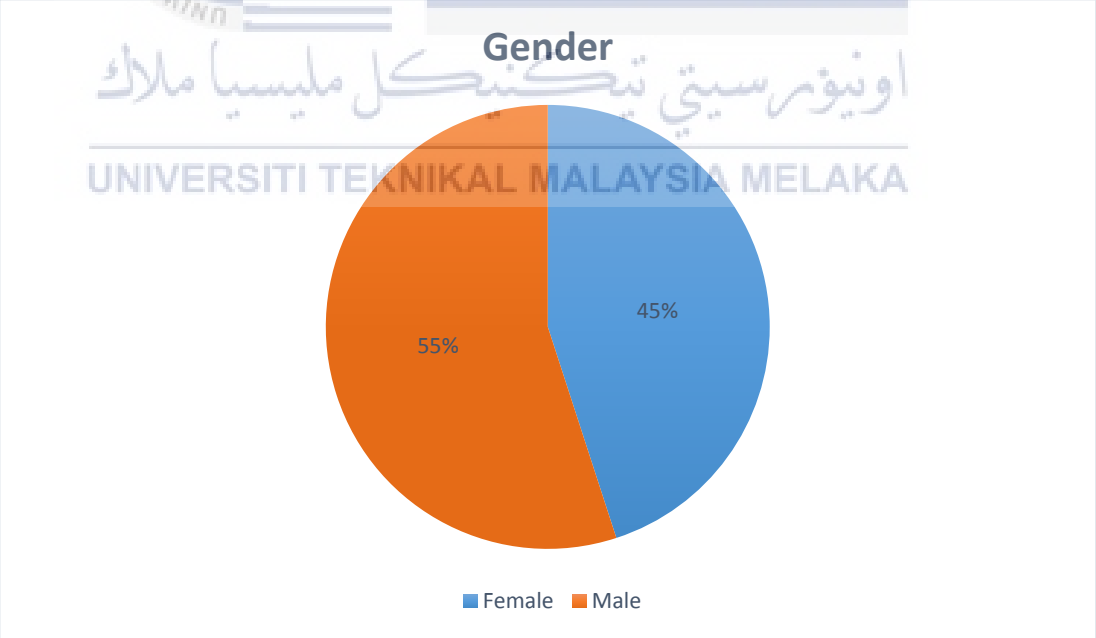

Figure 6.1: Pie chart of the respondent's gender

Based on figure 6.1, there were total of 20 respondent involved in this testing, the number of female participant are nine people which is 45% of the total

respondent and 11 people are male participant which has 55% of the total respondent.

Table 6.2: Summary of the age of the respondent

Age	Number of respondent
10-15 years old	4
16-20 years old	6
21-25 years old	8
26-30 years old	2

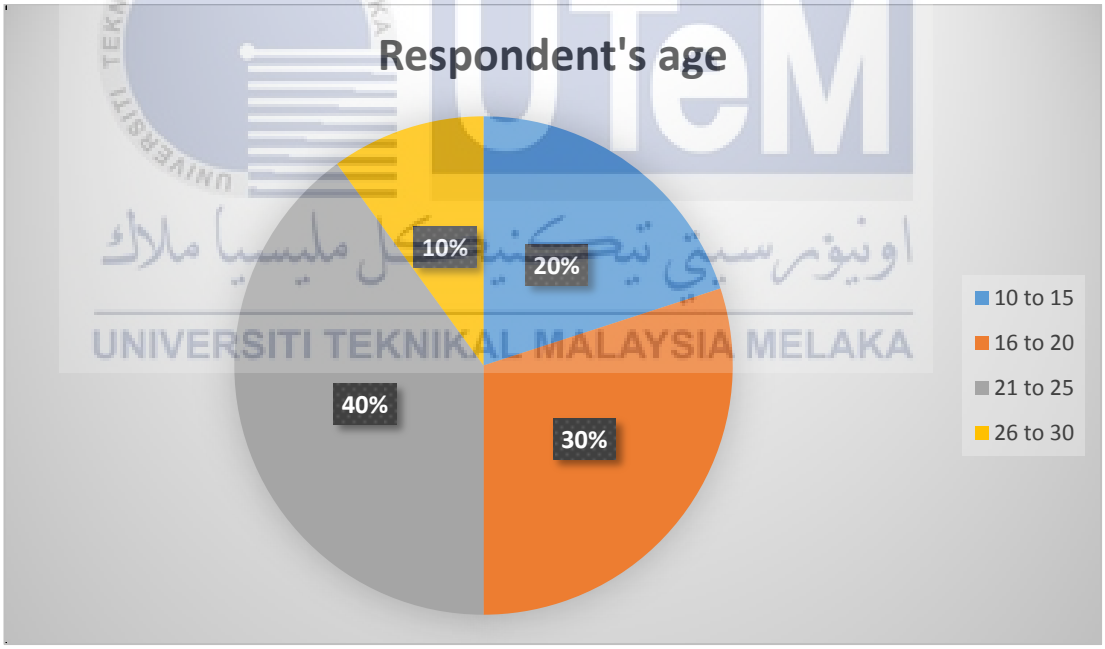

Figure 6.2: Pie chart of the respondent's age

Based on figure 6.2, there are four people who are age from 10 to 15 years old, six people who are age from 16 to 20 years old which is the second most among the respondents, and the most respondent are aged from 21 to 25 years old which is eight out of 20 respondent, the least is from age 26-30 years old which is two people.

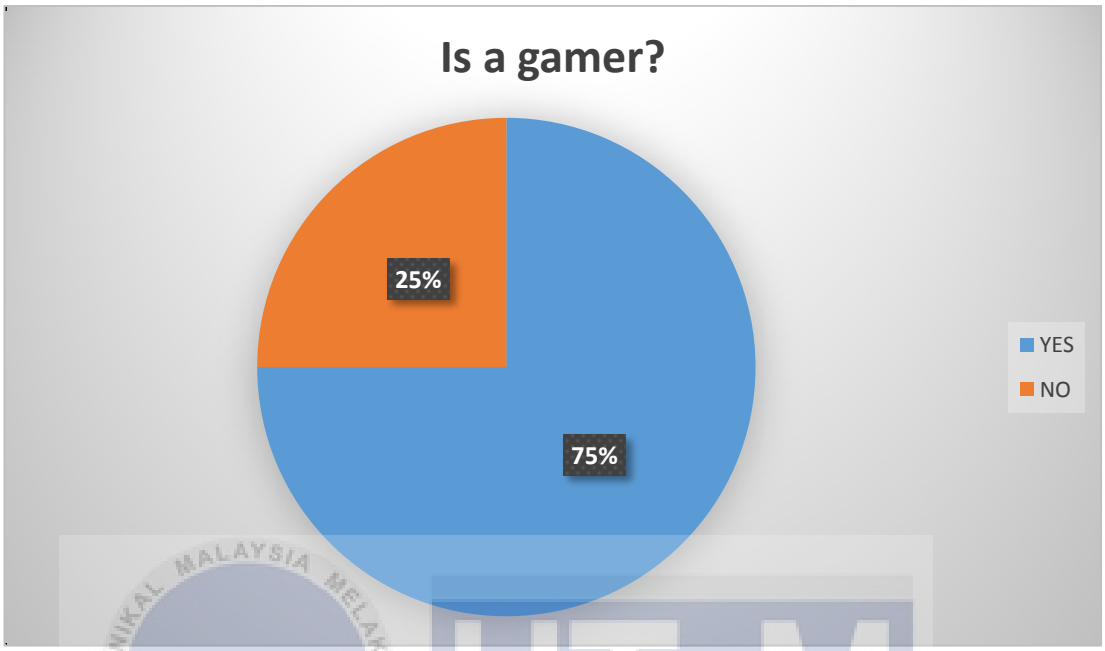

Figure 6.3: Pie Chart of respondent who is a gamer or not.

Based on figure 6.3, there are 75% of respondent are gamer, which is 15 out of 20 people, and the rest of the 5 respondent are not gamer or does not play any game other than mobile casual game.

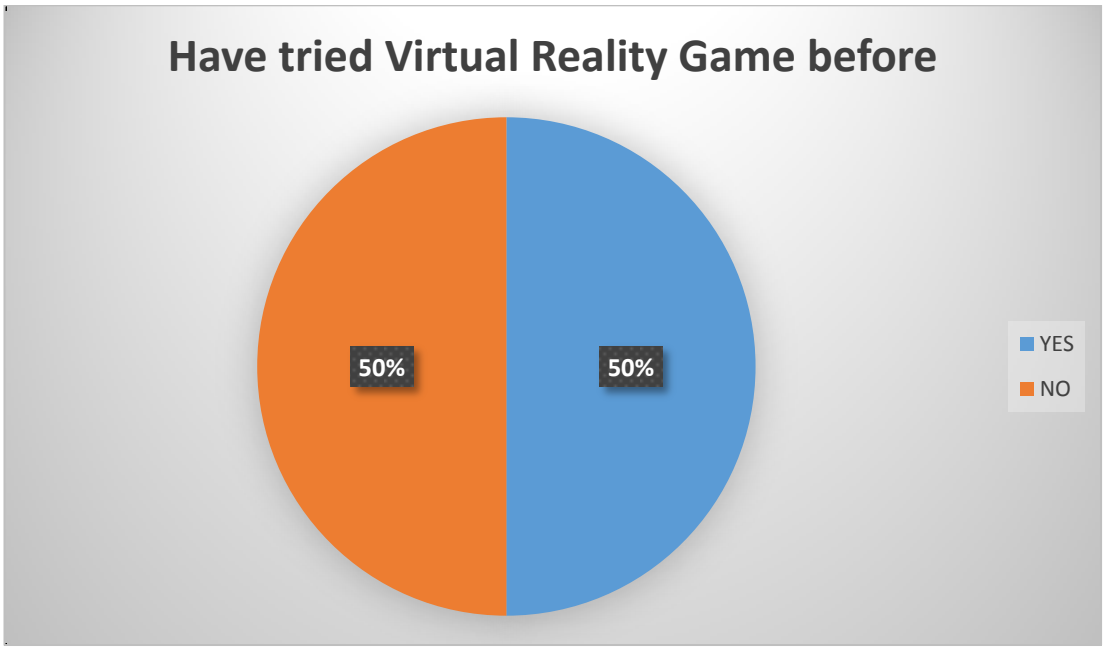

Figure 6.4: Pie chart of the respondent who have tried virtual reality game or not.

Based on figure 6.4, half of the respondent either have or have not tried virtual reality game before.

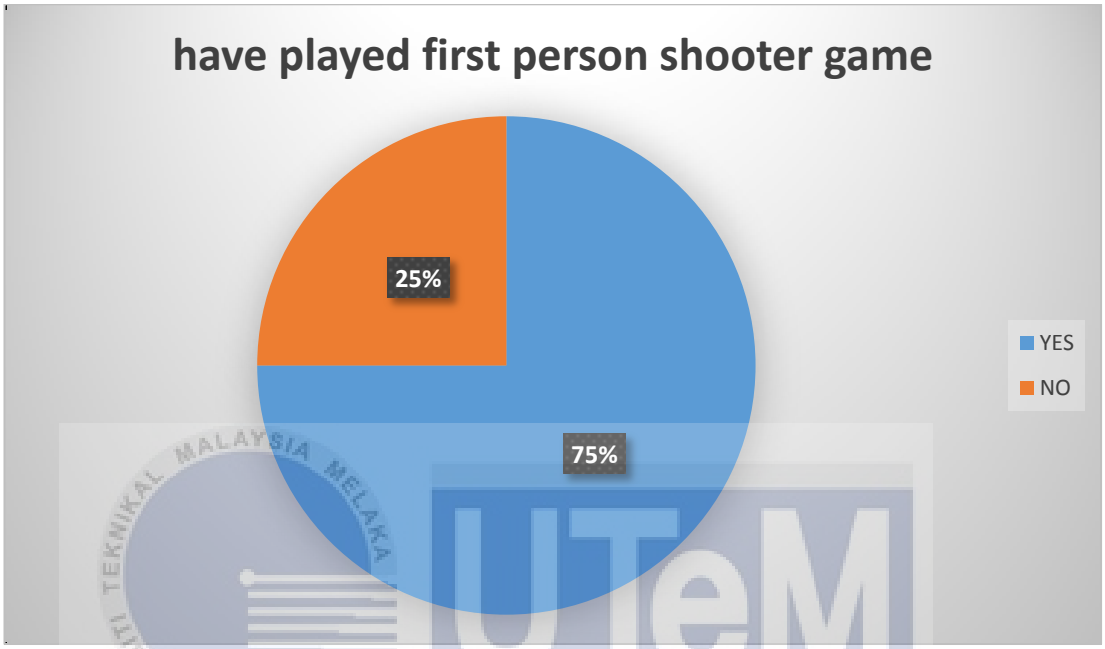

Figure 6.5: Pie chart of respondent who have played first person shooter game

Based on figure 6.5, 15 people out of 20 respondent have played first person shooter game while the rest of the five people have not play first person shooter game.

6.4.2 Usability testing on virtual reality game

For this section will survey about usability of virtual reality game from the 20 respondent.

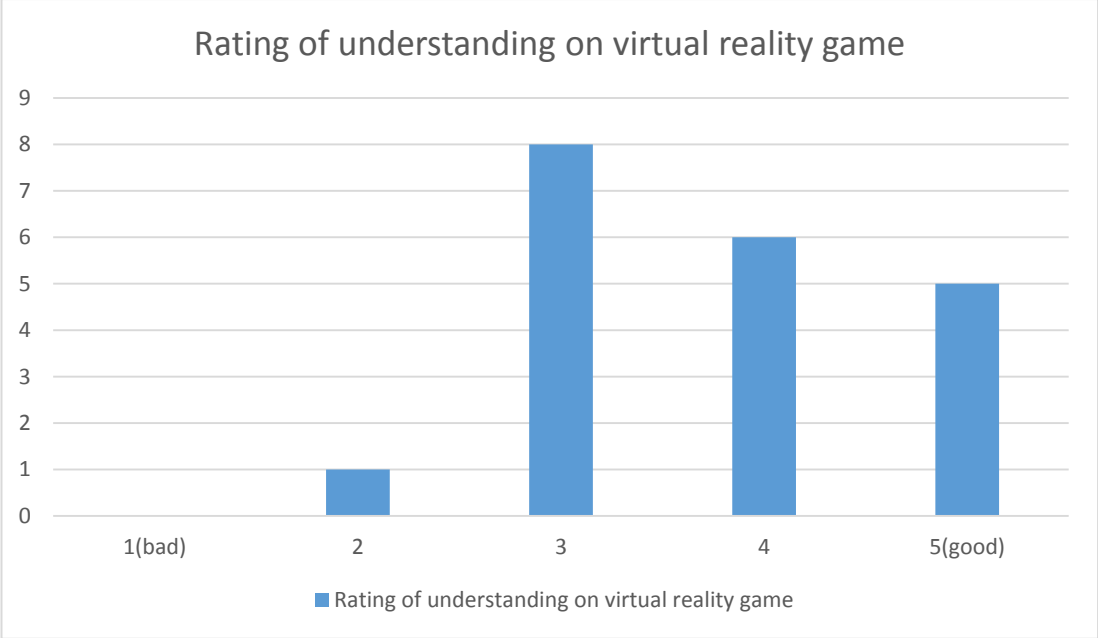

Figure 6.6: Bar graph of how well they understand how to play virtual reality game.

Based on figure 6.6, the rating is from one to five which is also from bad understanding to good understanding. There was no respondent that do not know how to play a virtual reality game, most of them were able to understand how a virtual reality game works.

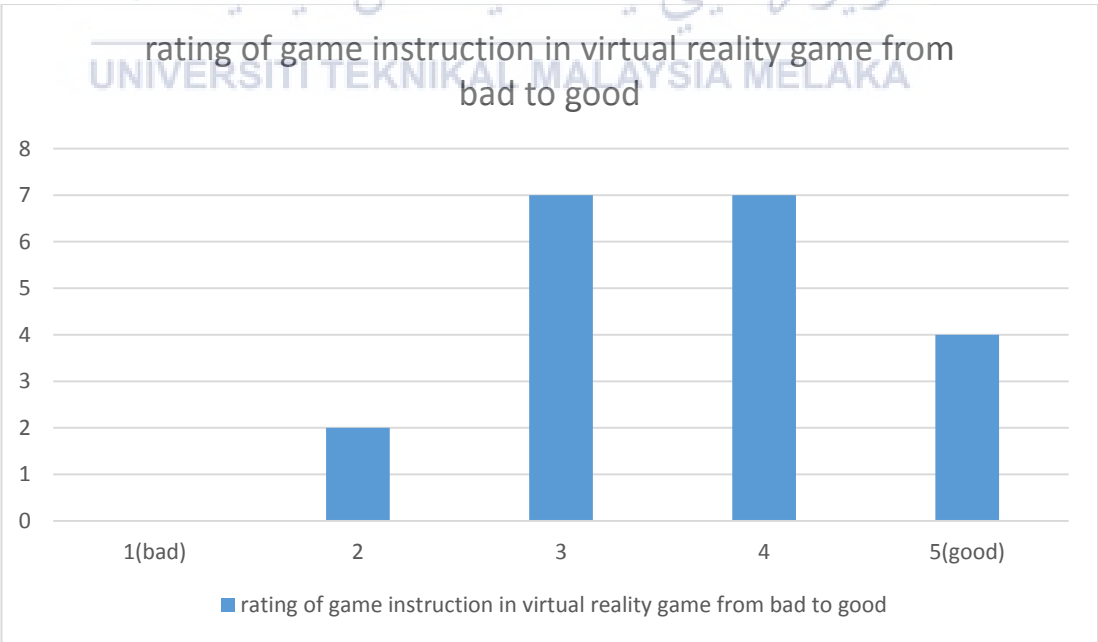

Figure 6.7: Bar graph of respondent rating the game instruction in virtual reality game.

Based on figure 6.7, most of the respondent do get enough information from the virtual reality game and only two out of 20 respondent did not get enough information from the game instruction in virtual reality game.

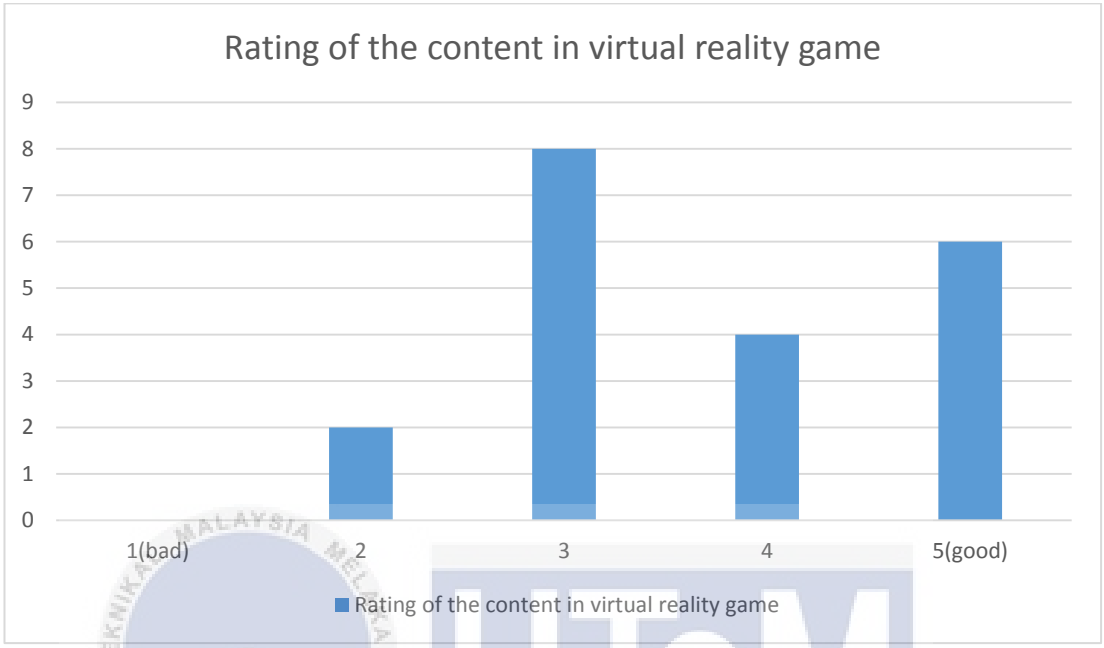

Figure 6.8: Bar graph of respondent rating the content quality in virtual reality game.

Based on figure 6.8, most of the respondent were giving an average to good rating for the content quality in virtual reality game, and only two respondent give a rating which is under average.

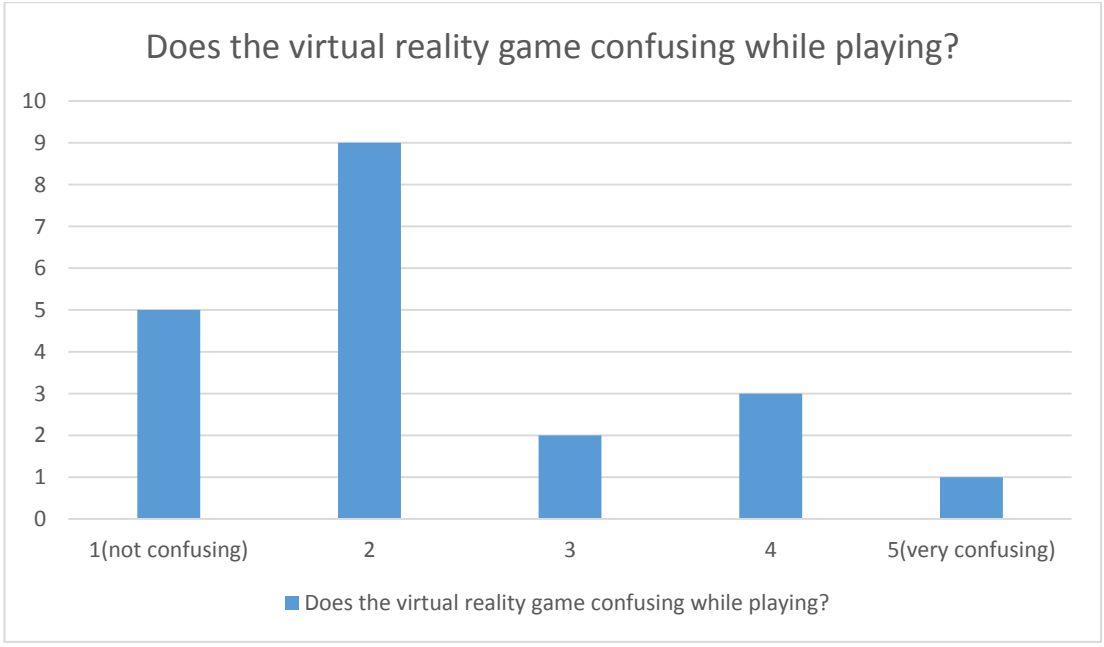

Figure 6.9: Bar graph of respondent rate the confusion of the virtual reality game during the gameplay.

Based on figure 6.9, more than half of the respondent gave the rating that they did not get confused when playing virtual reality game while there were still some respondent got confused while playing the virtual reality game.

6.4.3 User experience testing

For this section, data about the user experience about the virtual reality game is gathered and showed in the form of graph and chart.

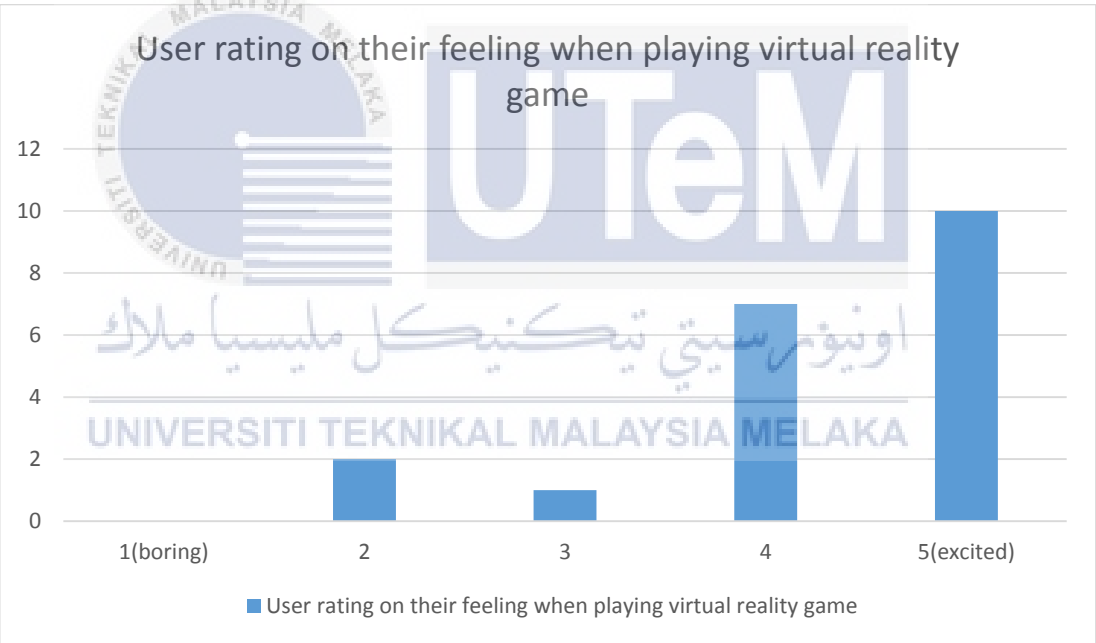

Figure 6.10: Bar graph of user's rating on their feeling when playing virtual reality game.

Based on figure 6.10, most of the respondent feel rather excited when they playing with virtual reality game, but depends on the person's taste, there were fewer respondent that feel nothing special when playing the virtual reality game.

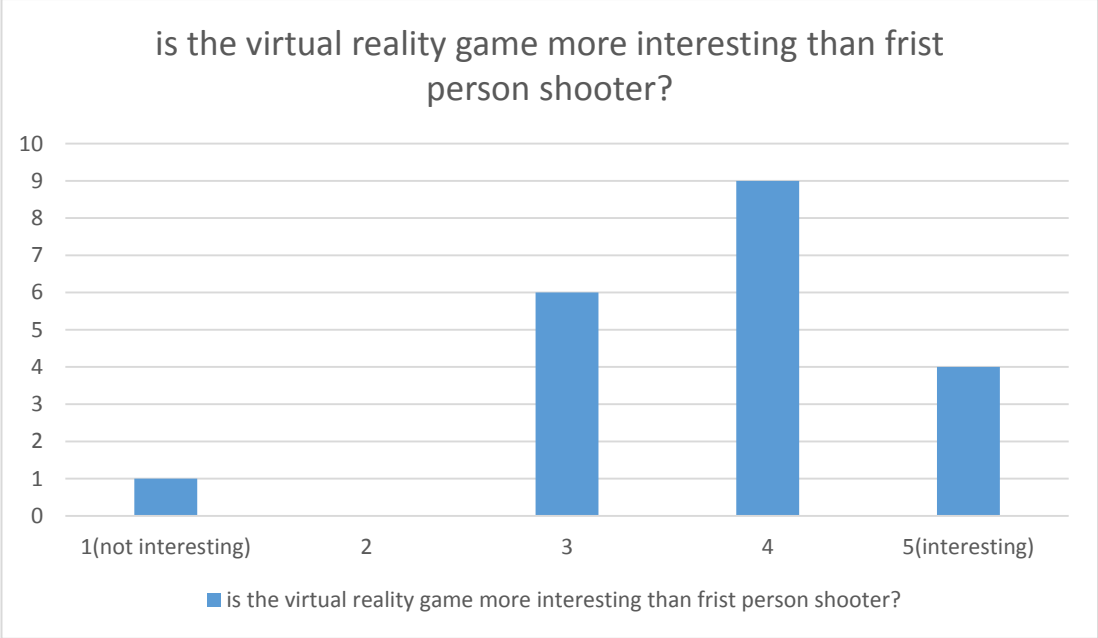

Figure 6.11: Bar graph of how user rate the interestingness of virtual reality game compare to first person shooter game.

Based on figure 6.11, most of the respondent rated that virtual reality game is more interesting to play than first person shooter game, but depends on the respondent, there is still one respondent that rather prefer first person shooter game than virtual reality game.

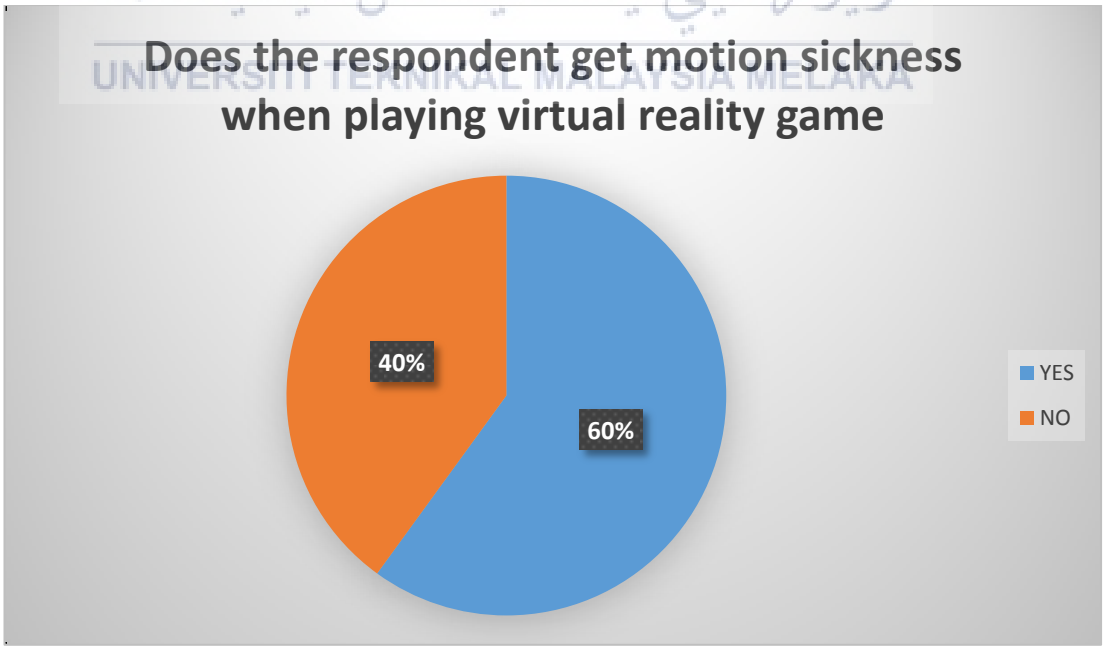

Figure 6.12: Pie chart of respondent getting motion sickness or not while playing virtual reality game.

Based on figure 6.12, out of 20 respondents, 12 of them did not getting motion sickness while playing virtual reality game, while there are 8 of them actually getting a slight dizzy or motion sickness while playing virtual reality game.

Figure 6.13: Pie chart of respondent would looking forward for the first person to be bought into virtual reality.

Based on figure 6.14, 18 respondent out of 20 prefer to have the first person shooter game they played to be bought into virtual reality game, while there were two out of 20 respondent would still prefer normal first person shooter game than bought into virtual reality.

6.4.4 Interview result and analysis

Since all the test result is recorded with only voice and the video, also the language used is other language such as Bahasa Malaysia and mandarin but no English, so all the raw conversation is translated as accurate as possible. Below is the table which are the translated conversation or interview with the targeted tester or customer who willing to share their experience. Noted that all the translated conversation only picked the important part where the target user answered the interview question.

Table 6.3: Translated Conversation or Interview with the target user

Targeted user/customer's summerized personal infomation	Translated Conversation
3 Primary school Students, they refused to provide their age, but they are pridicted to be around age of 10, language spoken was in Bahasa Malaysia	Interviewer: So how do you feel when trying this Playstation VR. Student A: It is fun to play, even though it is a bit dizzy to play Student B: It was dizzy to play for the first time, but I still like it. Student C: it looks fun to play when looking at them playing, it makes me want to try it when looking the gameplay on the screen. Interviewer: have you tried any other VR game before? Student B: only the mobile VR. Student A & C: no Interviewer: Do you understand how to play it and what to do in the game? Student B: i could understand the instruction Student A: i know by watching him playing Student C: I could only understand a bit with the help of my friends Interviewer: Do you willing to keep on playing if there are more new game coming out to the market? To simplify it, if

	there is more new game will you willing to try it? All of them agreed
1 University Student from the VR Lab, was able to ask his first name, his name is Kuan a final year student. Language used was in mandarin.	Interviewer: Are you a average gamer or a hardcore gamer? Kuan: I used to play a lot of console game until the time i start studying and working during my university life. Interviewer: What makes you come here to play the VR game? Kuan: I heard it from my friend and also when i saw some people trying VR on the internet, it makes me want to go have my very own experience on it instead of hearing what other people said. Interviewer: Do you tried any other VR device before? Kuan: Yes, i have tried the Playstation VR and now i have tried the HTC vive. Interviewer: so what are your thought on Playstation VR? Kuan: for playstation VR, it was quite dizzy to play with and also the interaction and instruction are kind of hard to understand, depending on the game itself, some game i can play and understand well, some are pretty boring to play or either i dont understand how to play. Interviewer: comparing to HTC Vive you played just now, what to you feel about it? Kuan: Compare the PSVR to HTC Vive, HTC vive is better and more fun to play, i did not feel dizzy while playing HTC Vive and also it's more immersive than PSVR and the interaction has more option than PSVR and the sensor for the display is more sync with the head movement, it feel really realistic.

	Interviewer: If you have more chance to play VR game, will you keep playing it and which device you rather choose? Kuan: i will pick HTC Vive for sure, and it's really engaging and interesting to play with, even though i have stopped playing game for quite a long time, but playing with VR really give me a different feeling and interestingness. (conversation ended)
VR Lab Kepong branch Leader who manage the shop, was not able to ask for his personal infomation but he only provide that he was previously a worker at some company and then resign to join venture with this new company to provide VR experience to the customer.	Interviewer: Are you a gamer or a hardcore gamer before you have this VR experince? VR Lab: yes, i am a hardcore gamer and play lots of game, like FPS, action adventure and all kind of common genres. Interviewer: what do you feel when you first time playing this VR game? Do you feel dizzy or struggle on knowing how to play it? VR Lab: I dont really feeling dizzy because this HTC Vive gives you a real 360 degree of accurate camera rotation that really makes you feels like you are in the world rather than feeling you are looking at a screen. Interviewer: those customer who comes here and play, are they non gamer or never touched these kind of stuff before? VR Lab: Those who come here and play are mostly mixed, and most of them are children, becasue they really like having these kind of new experience. Interviewer: are those VR games mostly FPS game? VR Lab: not all of them are FPS, but since you are wearing that HTC Vive it's already a first person genre, but not always about shooting, it has other genre like sports, or casual game that does not involve shooting, but still FPS is the most

	common in VR game for now. Interviwer: Do you keep on importing new game in to your library? VR Lab: Yes, since it's using Steam, so it's really easy for us to buy the game directly from the store. Interviewer: Do those customer come here quite often? VR Lab: Yes, some of them come here to play once a week and sometime new customer will be brought by the pervios customer, but at the end, even though if the customer get bored at some time, but after a week or two, they will return and play again, or we will just annouce there is a new update for a certain game or new game is added, they will come back and play for sure. (the rest of the conversation is more about asking the HTC Vive and the objective of the interview is already achieved.)

Analysis on the interview result

After gathering all the data and result when interviewing with the customer or the target user, all their words and experiences are then analyzed. Firstly, the objective of this project is to prove that the VR game is really engaging and able to provide interestingness and unique experience even for those who barely playing electronic game or they are not a hardcore gamer such as the children. The first place of planed test area is the Sony center where they will usually have a space where the customer can try their PS VR on the spot, from the statement of the Sony Center staff, every times mostly there will be some children sitting there and trying the PS

VR, this can prove that, the VR game also able to attract children to play it even without asking them to try. Based on an article which titled Vomit Reality stated that there will always be someone who get motion sickness when playing virtual reality game and the reason would be the frame rates of the screen itself, but during the interview, one of the student did say he got a little motion sickness when playing with the virtual reality game, but at the end he is still interested playing it more.

Figure 6.14: A photo taken when the three children are playing the PS VR at the store.

Next person that going to analyses is the university student who named Kuan, he stated that he has tried both PS VR and HTC Vive, at the same time he also giving his positive experience when playing those VR Game despite he already stopped playing game for a few years. From this it can prove that VR able to bring back the interest of someone who has stopped playing game even for a few years. He also said, some game he really does not understand what and how to play but it depends on some game, if the game able to provide a clear information and instruction on how to play the game, then he able to play it. This statement also prove that a good instruction is one of the key to attract people to play VR game. He stated that he prefer the HTC Vive more than PS VR because the HTC Vive is having rather smooth and clear screen than PS VR and it does bring any dizziness even for his first

try on HTC Vive, he said it feel really real and more fun when playing with HTC Vive and with the motion controller. For conclusion, HTC Vive does provide more immersion, interestingness and engagingness than PS VR, even though both of them provide VR experience but people would still choosing a more comfortable and more fun that a device that could provide with.

Figure 6.15: A photo of Kuan Playing with HTC Vive in VR Lab.

The last analysis will be the leader from the VR Lab, he work at that shop for a year so asking for this opinion about the VR game and the customer he served is the best choice. What he said during the interview having the same statement from the university student named Kuan, he do prefer HTC Vive over PS VR. He said HTC Vive require a different setup unlike the PS VR just plug and play, HTC Vive require an empty room scale and having two sensor placing on the top corner of the room in order to allow the player walking just like walking in the virtual world, also the sensor provide a better accuracy head movement tracking so it will prevent or reduce the dizziness cause by the device when user looking at the screen. The motion controller also able to provide a different interaction than PS VR, it will makes the user feels like they can interact with the objects in the virtual world like using their

own hand, from this it provide a more engaging and interesting experiences. He also provide information that the shop having some frequent customer that come to the place pretty often and even bringing their friend or their family, this can prove that the VR game is easily spread and influence people around those who tried it. During that day of planned testing at two different places for conducting interview, one was in Publika and another one was in Kepong, those shop were full of children making noises in the room. The leader at Kepong VR Lab also stated that, most customer come to the place are family that bringing their children to let them play with it. This could conclude that, rather having the children addicted to game such as computer game or console game, they rather let their children experience a more casual gaming experience like VR game, it is more healthy than just sitting at the same place and playing some education game when they can just move around with their body and having more interaction with the family and in the game world. The VR game has more potential to promote education game when it can greatly enhance the interestingness for the children and also making them being more engaging to explore more in the game.

Figure 6.16: Photo of the VR Lab at Kepong branch

6.5 Conclusion

As for the conclusion of this chapter, testing and evaluation is very important in order to prove that this project is not pointless and also for achieving the objectives of this project. All the testing require the users in order to gain their acknowledgement so that the data gathered has proven that this project does achieve its objective. All the test result, data collected are documented either using a voice or video recorder, and the data and feedback has been analyze in this chapter.

In the next and the last chapter, it will discuss about the strength and weaknesses of this project and also about the challenges that faced during this project and the solution that used to overcome it. Furthermore, there will be some suggestion in order to improve this project and also its contribution.

CHAPTER VII

Conclusion

7.1 Observation of Strength and weaknesses

When developing a game or a project, there will be strength and also weaknesses to cope it, furthermore, there will also be some challenges which either comes from the weaknesses itself or when during the development of this project. In this chapter, suggestion and solution that used to overcome with the challenges will be discussed as well as the limitation.

7.1.1 Project Strength

These are the strength that were found during the development of this project and during the testing phase.

1. Most of the respondent are able to understand the instruction and knowing how to play the virtual reality game without getting confused much.
2. Even there were 40% of the respondents getting a slight motion sickness while playing virtual reality game but they were still feeling excited while playing virtual reality game.
3. After letting the respondent playing first person shooter game and virtual reality game, they preferred virtual reality more than first person shooter game.
4. At the very end of the testing, 90% of the respondent prefer to have this game project to be bought into virtual reality.

7.1.2 Project weaknesses

In this project, even though VR does look very interesting to play with but there are still some weakness when playing VR game.

1. Motion sickness is the only weakness in this project and there were nearly half of the respondent were almost getting motion sickness while playing virtual reality game
2. There were still some of the respondent do prefer playing a normal first person shooter game than shooter game in virtual reality.
3. The interview section was not able to interview with an expert in the virtual reality field but a person who has better virtual reality experience than normal user.

7.1.3 Limitation

Even there is some problem occurred that can be deal with some solution but this project still have some limitation that lead to some decision that I have to changes the game on how it should be.

1. VR game still a pretty recent technology and it is still require more time until it become common just like game console, one of the limitation is, VR does not able to render a 2D user interface for now.
2. Even HTC Vive able to let the player walk around within a room but still in order to move to further places, they still need to control the movement with the controller.
3. The content in the VR game should not be huge or very detail that will burden the GPU, since running the VR device already cost amount of memory.
4. VR technology nowadays still very difficult to play a cut scene during the gameplay just like those common cutscene that can be found in every game.

7.2 Proposition for Improvement

Even there is limitation when developing this project, the developer still has to be very creative in order to produce an expected outcome or even as similar as possible, rather than giving it up. Here are some solution that used to cope with the limitation.

1. Using low poly 3D model with nice texture, the texturing technique nowadays has so many variety so, the model does not have to be high poly to look good.
2. Using a 3D user interface to solve the problem that the VR not able to render a 2D one, actually a 3D user interface is rather easy to use for VR game since the screen is unlike the PC's screen nor the console's TV screen, too many 2D Head on display might block the view of the small screen of VR device.

3. Since VR not able to play a cinematic video during gameplay, but the developer can find another way to provide a cutscence where the player is in the cutscene with all the 3D characters playing their animation, but temporary remove the player's interaction until the cutscene is done.

7.3 Contribution

There are few contribution of this project, firstly, it able to prove that VR does able to enhance the engagingness and interestingness for a game even it was played by a person who doesn't have gaming experiences or isn't a hardcore gamer. Next, it does show a great potential that educational game should make using VR since children really enjoy playing with VR game.

7.4 Conclusion

After completing this project, it was able to meet the set objectives that was planned at the beginning, such as to developing a first person shooter game, to test the player's experience when they playing with virtual reality game, and the last one is to evaluate the effectiveness of the Virtual reality game.

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APPENDICES

Virtual reality survey form

this is a questionnaire regarding usability and user experience on Virtual Reality game

* Required

Gender *

- ○ Male
- ○ Female

age *

- ○ 10-15
- ○ 16-20
- ○ 21-25
- ○ 26-30

Are you a Gamer? *

- ○ Yes
- ○ No

Do you ever try VR game? either mobile, HTC Vive or PS VR *

- ○ No
- ○ Yes

Do you play First person shooter game? *

- ○ No
- ○ Yes

how much do you understand how to play VR game?

	1	2	3	4	5	
Bad	○	○	○	○	○	Good

how do you rate the Instruction gives you? is it bad to understand or good and easy to understand?

	1	2	3	4	5	
Bad	○	○	○	○	○	Good

how do you rate the content in VR game?

	1	2	3	4	5	
Bad	○	○	○	○	○	Good

how much does the interaction in the VR game confusing?

	1	2	3	4	5	
not confusing	○	○	○	○	○	very confusing

How do you feel when you playing VR Game?

	1	2	3	4	5	
Bad	○	○	○	○	○	Good

how much would you rate that VR game is more interesting than FPS?

	1	2	3	4	5	
not interesting	○	○	○	○	○	very interesting

Do you get motion sickness when playing VR game?

- ○ YES
- ○ NO

If the FPS game you played able to bring into VR mode, will you be excited about it?

- ○ YES
- ○ NO

SUBMIT