



COMP4801

Final Year Project

Detailed Project Plan

Topic: A multi-platform multiplayer game

Chan Ting Lok, Leon (3035574763)

Supervisor: Dr. Chim, T.W.

Table of Content

1. Introduction	3
1.1. Overview	3
1.2. Outline.....	3
2. Background	4
2.1. Gaming Market	4
2.1.1. Traditional Gaming Market.....	4
2.1.2. VR Gaming Market.....	5
2.2. Reference Games	6
2.2.1. It Takes Two	6
2.2.2. Portal.....	7
3. Objective and Scope	8
3.1. Objective	8
3.2. Scope.....	8
4. Methodology.....	9
4.1. Hardware and targeted platform.....	9
4.2. Software.....	10
4.2.1. Game Engine	10
4.2.2. Multiplayer and built-in voice chat system.....	10
4.3. Design.....	10
4.3.1. Programming Design.....	10
5. Limitations.....	11
5.1. Hardware Limitation	11
5.2. Art Limitation	11
5.3. Game Design Limitation.....	11
VR is a platform that emphasizes immersive experience and VR is one of the supported platforms. This is a constraint for game design, what I can choose is first-person games. For first-person games, some players may not be comfortable playing first-person games because of issues like motion sickness.	11
6. Schedule and Milestones	12
7. Conclusion.....	13
Reference	14

1. Introduction

1.1. Overview

The gaming industry is advancing. The market will eventually get saturated with the traditional way of gaming. The game developers are, therefore, trying to include and develop new technology in their game; for instance, motion tracking, augmented reality (AR), virtual reality (VR), mixed reality (MR), etc. There are more and more devices for gaming, for example, personal computer (PC), mobile, and VR headset.

However, there is no game that is compatible with PC, mobile, and VR headsets concurrently. For a game that can support more platforms, not only more players can enjoy it, but the revenue for the game will also be drastically increased. The goal of this project is to investigate whether it is possible for a game to support multiplatform to provide players with similar gaming experience. A multiplatform, multiplayer game will therefore be developed.

1.2. Outline

This project plan is organised in the following way. In chapter 2, background of the project and two reference games will be introduced. Followed by chapter 3, project objective and scope will be brought out. After confirming the scope, in chapter 4, detailed methodology and relevant development tools will be laid down. With limited budget and labour, some limitations will be encountered, they will be listed in chapter 5. In chapter 6, schedule and milestones will be established. And finally, a summary of the main idea will be given in chapter 6.

2. Background

In this section, an overview of the traditional gaming market and VR gaming market will be given. After that, two reference games will be introduced. These games will act as a reference for the game design of the project.

2.1. Gaming Market

2.1.1. Traditional Gaming Market

Mobile, Console (e.g., PlayStations, Nintendo switch, Xbox etc) and PC are still the major medium people use to play video game. It is observed that the mobile is dominating the gaming market (generating more than 90 billion USD in 2021), followed by console and PC (generating 49.2 billion USD and 35.9 billion USD respectively in 2019) (see Figure 1) [1]. It is self-evident that a game will generate much more revenue if it supports mobile, console and PC concurrently.

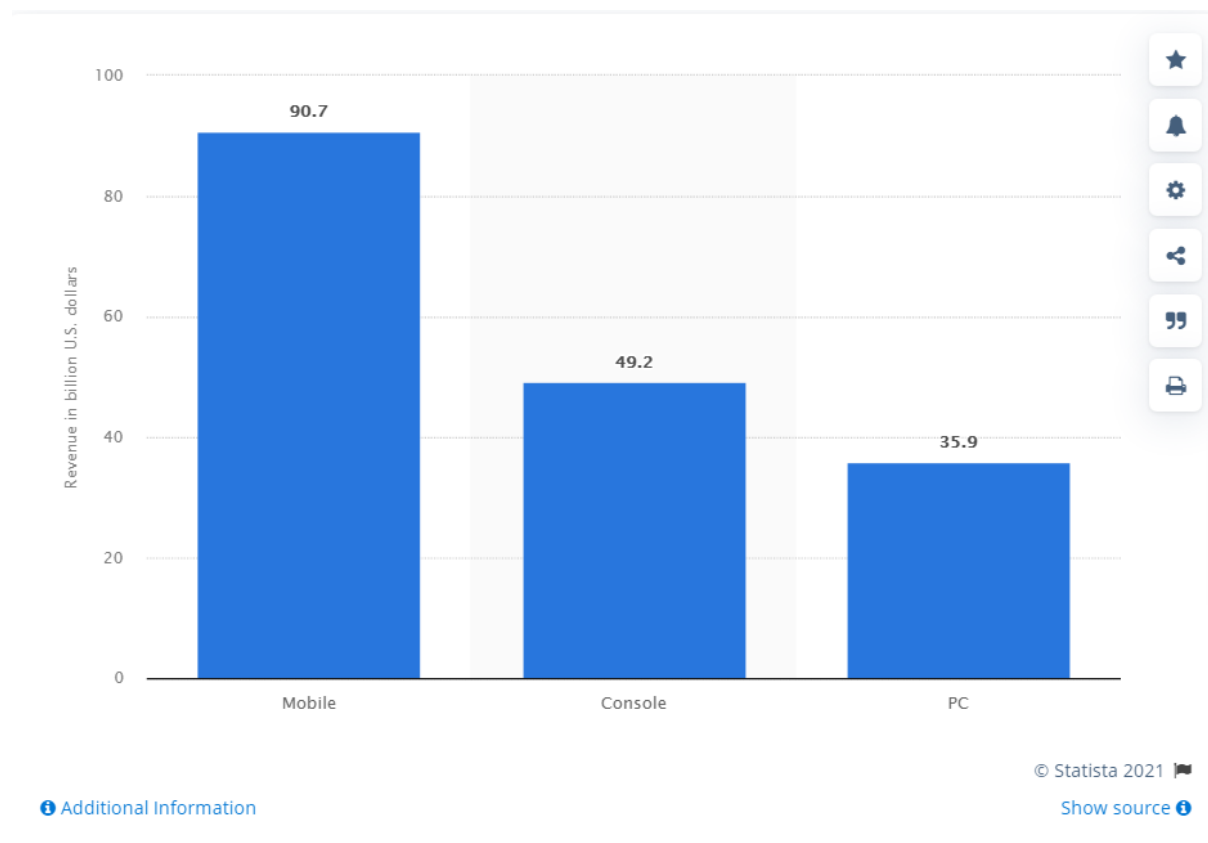


Figure 1: Virtual reality (VR) gaming revenue worldwide from 2017 to 2024 [1]

2.1.2. VR Gaming Market

Virtual Reality (VR) is a technology that provide realistic experience through visual simulation. It is a new trend for gaming. VR gaming is becoming more and more popular because of its intuitive control and immersive experience. There are many types of VR games, for example, puzzle, sport, simulation, party game, FPS (First-person shooter), social, etc. It is forecasted that the VR market size in 2024 will triple that of 2019 (see Figure 2) [2]. It is obvious that the VR gaming market is expanding rapidly.

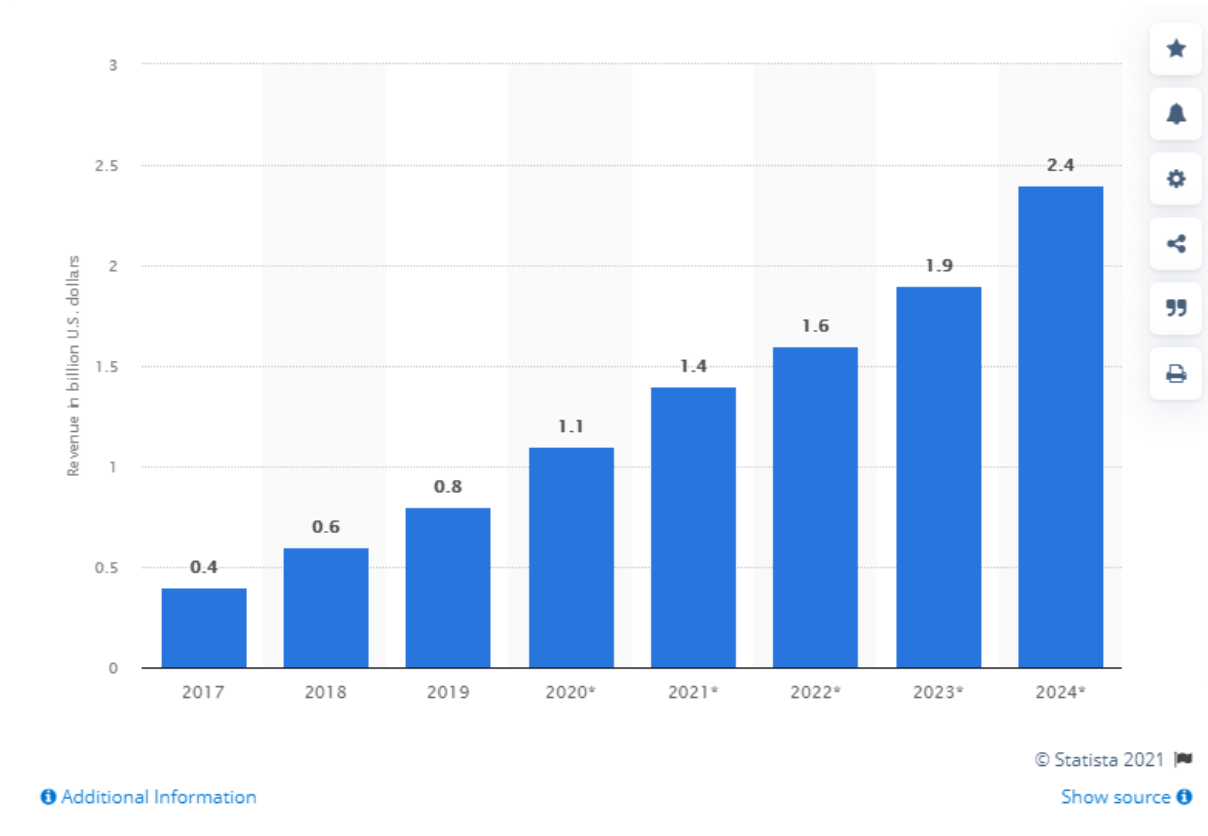


Figure 2: Virtual reality (VR) gaming revenue worldwide from 2017 to 2024 [2]

2.2. Reference Games

In this project, I will try to combine the core game experience of the following games and support multi-platform. They are *It Takes Two* (2.2.1) and *Portal* (2.2.2).

2.2.1. *It Takes Two*



Figure 2: The game cover of *It Takes Two* [2]



Figure 3: Screenshots of *It Takes Two* [2]

It Takes Two (see Figure 2) is a 2-player pure co-op adventure game, which emphasizes the importance of cooperation and communication [2]. The screen will be split into two half, one half showing the player's screen and the other half showing his partner's screen (see Figure3) [2]. ***It Takes Two*** is chosen as a reference game because it is a compulsory multiplayer cooperative game, which is extremely rare in the market. In addition, the puzzles are well designed, creative, and require players' cooperation, which matches the objective of the problem (refer to section 3.1).

2.2.2. Portal



Figure 4: Screenshot of ***Portal*** [4]

Portal is a single-player first-person puzzle game. In ***Portal***, the player will be given a portal gun (see Figure 4). He can perform actions like teleportation with the gun. He will need to solve the puzzle by using the portal gun. ***Portal*** is chosen as a reference game for the following reasons. Firstly, it is a first-person game, which makes it suitable for this project. The first-person camera suits well with PC, mobile, and VR platforms. Secondly, I found it very suitable to make ***Portal*** a multiplayer cooperative game. In ***Portal***, the player will be given a gun that can open two ports for teleportation (see figure 4), it is possible to make it cooperative by splitting the function (one player handle one port).

3. Objective and Scope

In this section, the economic value and the impact on players will be explained in section 3.1; Followed by a rough picture of what will eventually be delivered in section 3.2.

3.1. Objective

On the one hand, the traditional gaming market is still dominating the gaming industry; On the other hand, the new platform – VR is growing drastically (For detailed statistics, see 2.1.1 and 2.1.2). It is not a transition that players move from traditional gaming to VR gaming, it is a diversification instead (because the market size of the traditional game is not shrinking). This project aims at investigating the possibility to support all traditional gaming platforms and VR gaming with a single code base.

From the economic perspective, the market size is positively related to the revenue. With larger hardware coverage, the revenue will further be larger. From the player's perspective, players will no longer be discriminated against from playing a game due to hardware limitations. Players can enjoy a similar gaming experience with different types of hardware. Cross-platform support is, as a result, a win-win situation for both players and game developers. Different hardware has its advantages. PC platform offers higher computing power and best graphics; Mobile platform offers convenience and highest coverage; VR platform offers an immersive experience and intuitive control (which is a big plus for kids and the elderly).

In terms of game design, the game is designed in a way that 1 single player cannot carry in the whole game, the player must learn to rely on another partner, cooperation is the only way to ace the game. Two characters will have different abilities. On the cooperative aspect, players will learn how to cooperate with their partner and communicate to exchange information; On the puzzle-solving aspect, it will improve players' creativity, logical thinking (for example learning by observing patterns), problem-solving skill, etc.

3.2. Scope

A game will be delivered at the end of the project. It is a compulsory 2-player cooperative puzzle-solving game. Players can choose to play the game with different platforms. PC (Windows), Mobile (Android), and VR (Oculus Quest 2) will be supported. There are in total 2 characters in the game (with different functions and abilities), each player will choose one of them. To solve the puzzle, both characters' abilities are needed. To facilitate communication, a built-in voice chat system will also be available in the game.

The setting of the game is the following. Two characters are trapped in a tower, they must solve the puzzle to open the elevator's door (so that they can go to lower floor). The end goal of the game is to defeat the level one by one and eventually escape from the tower. Considering the technical complexity, for this project, I plan to make 1 level (floor) to demonstrate the possibility of a multiplatform multiplayer game experience. If time is allowed, I will expand the scope and add more levels.

4. Methodology

This section will be divided into 3 parts. The first part details the hardware setup and targeted platform. The second part will talk about the software aspect, justifying what development tools are chosen and software design. The last part will explain the programming philosophy.

4.1. Hardware and targeted platform

Different VR headsets (especially the one come from different hardware manufacturer) will have different functions supported, for example, some of them support hand tracking while others do not. In addition, different VR headsets have different function interfaces to call. Oculus device is chosen because it is the most popular VR headset player choose. As of January 2021, around half of the gamers on Steam choose Oculus devices as their VR device [5]. I choose Quest 2 as a result of budget concerns. For the mobile platform, I decided to support Android because of its popularity and operating system openness. As mentioned in the objective part (section 3.1), market size is one of my concerns, Android is still the most dominating the mobile market, in 2021 more than 70% of mobile devices are Android devices [6]. In addition, building the game on an iOS device requires a Mac Machine, which will further complex the hardware requirement. Not supporting iOS devices will not have a big effect on the FYP result, because the input of Android and iOS devices are similar (touchable monitor). For the PC platform, windows will be supported. macOS is seldom a choice for gaming, it is, therefore, not in the scope of this project.

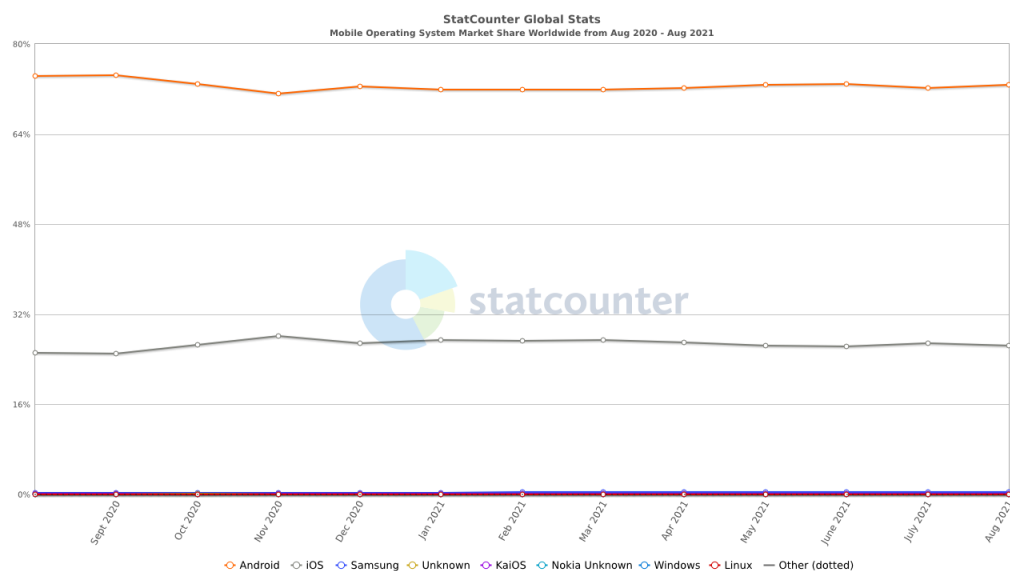


Figure 4: mobile operating system market share worldwide [6]

4.2. Software

4.2.1. Game Engine

Considering the project aims at supporting multi-platforms, Unity will be the best choice. With unity, a single code base can be deployed on more than 20 platforms [7]. Apart from that, Unity has excellent integration with VR technology. In addition, the developer community is large, and its code is comprehensively documented; In case of facing any technical difficulties, there are more resources available on the Internet. It is, therefore, a perfect choice for this project. As mentioned in 4.1. I will be targeting Windows, as a result, Windows will also be the development platform for consistency and better optimization. For programming language, C# is the only language that is supported. It is an object-oriented scripting language.

4.2.2. Multiplayer and built-in voice chat system

Photon Engine is chosen; Photon Unity Networking 2 (PUN 2) for multiplayer and Photon Voice 2 for the built-in voice chat system. Its excellent integration with Unity can smoothen the development and prevent any optimization problems [8]. Apart from that, Photon is free of charge, for free users, it supports 20 concurrent users (CCU), which is good enough for testing a small-scale multiplayer game like this [8]. In addition, Photon will host the server computer for me, extra time and cost on the maintenance of the server computer can be saved.

4.3. Design

4.3.1. Programming Design

The main difficulty of the implementation comes from supporting different types of hardware. For one action, different types of input need to be handled and interpreted. For example, picking up an object, for VR players, they may directly use their hand to grab the object; for PC players, maybe they will use their keyboard and press a certain key to act; for mobile players, maybe they will use their finger to tap a virtual button on the touchable screen. The main programming design philosophy will be trying to reuse code as much as possible. I will try to achieve it by creating some generic function, like in this example `PickUpObject(Object)` and this will be called by PC, VR, and mobile device. I will avoid creating three sets of code for three kinds of input.

5. Limitations

In this section, the limitation of the project will be discussed, and its corresponding solution will be proposed (if possible).

5.1. Hardware Limitation

In the market, there are too many gaming platforms. I cannot support all these platforms for the following reasons. Firstly, if I want to test my game on all platforms, I will need all kinds of hardware, for example, Nintendo Switch, PlayStation Machine, Xbox Machine, Mac Machine, etc. It is impossible to purchase these gaming consoles at \$1000 (FYP budget). Secondly, the time is limited, different hardware has its interface, it is infeasible to support all of them within seven months.

5.2. Art Limitation

In normal game development, there will be at least two roles – game programmer and artist. I do not know how to do 3D modelling and animation and within a limited time, I would not be able to handle it even if I had the artistic skills required. One of the possible solutions is to buy assets from the Unity asset store. But this is by no means an optimal solution because obviously, I cannot choose the theme that does not have any asset selling on the asset store.

5.3. Game Design Limitation

This is a computer science final year project; Technology will, therefore, be the main focus. The game length will be shrunk as a result. A complete game is not expected to be delivered at the end of the project. This project is more like a demonstration of the possibility of multiplatform multiplayer game.

VR is a platform that emphasizes immersive experience and VR is one of the supported platforms. This is a constraint for game design, what I can choose is first-person games. For first-person games, some players may not be comfortable playing first-person games because of issues like motion sickness.

6. Schedule and Milestones

For implementation, I will be implementing in the following sequence. Firstly, I will make the PC multiplayer version, because of easy testing. Secondly, integration of VR will be followed. After this integration, players should be able to perform PC-VR multi-play. Thirdly, integration of touchable screen control will be performed at last because it is simpler than VR integration. It is, therefore, more appropriate to handle it after VR integration.

Date	Task
Summer 2021	Choose/Draft FYP Topic
15 Sept 2021	Technical Investigation <ul style="list-style-type: none">• VR Development• Cross-platform Multiplayer• Built-in Voice Chat
3 October 2021	Deliverables of Phase 1 (Inception) <ul style="list-style-type: none">• Detailed project plan• Project web page
15 October 2021	Finalize game design
31 December 2021	Game Implementation (PC)
10-14 January 2022	First Presentation
23 January 2022	Deliverables of Phase 2 (Elaboration) <ul style="list-style-type: none">• Preliminary implementation• Detailed interim report
28 February 2022	VR Control Integration
31 March 2022	Touchable Screen (Mobile) Control Integration
15 April 2022	Final Test and Adjustment
18 April 2022	Deliverables of Phase 3 (Construction) <ul style="list-style-type: none">• Finalized tested implementation• Final report
19-22 April 2022	Final presentation
4 May 2022	Project exhibition
31 May 2022	Project competition (for selected projects only)

7. Conclusion

To summarise, there are two main goals for the project. 1) Investigate into the possibility of a multiplatform supporting game; 2) make a cooperative puzzle game that can train players' problem solving and communication skills. To achieve this, a multi-platform multiplayer cooperative puzzle game will be delivered by the end of the project. The programming philosophy to achieve this will be creating some generic functions that will be called by all platforms.

Reference

- [1] Clement, J. (2021). *Games market revenue worldwide in 2021, by device*. Retrieved from <https://www.statista.com/statistics/278181/global-gaming-market-revenue-device/>
- [2] Clement, J. (2021). *Virtual reality (VR) gaming revenue worldwide from 2017 to 2024*. Retrieved from <https://www.statista.com/statistics/499714/global-virtual-reality-gaming-sales-revenue/>
- [3] Hazelight Studios (2021). *It Takes Two*. Retrieved from <https://www.hazelight.se/games/it-takes-two/>
- [4] Watters, C. (2014). *Portal Review – With delightfully unique gameplay and fantastically witty writing, Portal is a huge success*. Retrieved from <https://www.gamespot.com/reviews/portal-review/1900-6190126/>
- [5] Finances Online (2021). *74 Virtual Reality Statistics You Must Know in 2021/2022: Adoption, Usage & Market Share*. Retrieved from <https://financesonline.com/virtual-reality-statistics/>
- [6] GlobalStats (2021). *Mobile Operating System Market Share Worldwide – September 2021*. Retrieved from <https://gs.statcounter.com/os-market-share/mobile/worldwide>
- [7] Unity (2021). *INDUSTRY-LEADING MULTIPLATFORM SUPPORT*. Retrieved from <https://unity.com/features/multiplatform>
- [8] Photon (2021). *PUN The Ease-of-use of Unity's Networking with the Performance & Reliability of Photon Realtime*. Retrieved from <https://www.photonengine.com/pun>