

3D UTAR Interactive Virtual Tour (Game)

BY

TAN CHONG MING

A REPORT

SUBMITTED TO

Universiti Tunku Abdul Rahman

in partial fulfillment of the requirements

for the degree of

BACHELOR OF INFORMATION SYSTEMS (HONS)

INFORMATION SYSTEMS ENGINEERING

Faculty of Information and Communication Technology (Perak Campus)

MAY 2016

UNIVERSITI TUNKU ABDUL RAHMAN

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DECLARATION OF ORIGINALITY

I declare that this report entitled “3D UTAR Interactive Virtual Tour (Game)” is my own work except as cited in the references. The report has not been accepted for any degree and is not being submitted concurrently in candidature for any degree or other award.

Signature : _____

Name : TAN CHONG MING

Date : 26 August 2016

ACKNOWLEDGEMENTS

Firstly, I would like to express my sincere thanks and appreciation to my supervisor, Ms. Saw Seow Hui, who have offered me the opportunity to be able to engage in this innovation project 3D UTAR Interactive Virtual Tour. It has help me to explore many new technologies when doing this project.

I would like to thank my friend, Mr. Cheng Wei Jing for supporting and helping me throughout the entire development of this project.

Lastly, I must say thanks to my family for their love, support and continuous encouragement throughout the course.

ABSTRACT

This project is to innovate the virtual tour system that to provide different user experience and raise the awareness of virtual tour system as it still not well-known in Malaysia. Virtual tour, a system that simulates an existing location to let the users explore virtually at anywhere. The current available virtual tour systems have their own methods of creation and special characteristics. However, there are also some limitations such as lack of interactivity, lack of location information provided and etc. Thus, this project will innovate the virtual tour system by integrate game elements into it to increase the user interaction and provides the important location information through gameplay. Besides that, one of the important feature is the project allow users to play with Leap Motion sensor device other than the traditional input such as keyboard and mouse. This will greatly increase the interesting of the project as the Leap Motion sensor device is fresh to most of the users to play with. Due to this is a newly develop project, it would be contains many of uncertainty and risk so the project is develop by using the Spiral model which can minimize the risk and failure of the project.

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Chapter 1: Introduction

1.1 Background

Virtual tour system is a simulation of a real location, there are many forms such as videos, photo slideshows, 360 degree panoramic-images based and etc. The virtual tour is designed to give the users a virtual reality, a 3D view of the location that being presented in the tour. Virtual tour system not only suited for tourism but also real estate, business, education and etc.

There are some reasons that virtual tour system is introduced for people to use it. First of all, users could explore the virtual locations without going out from home or maybe even using mobile in the future. Furthermore, users can view the location in a better way than through the traditional way which is photo or video.

There are also few virtual tour system that is adding video games into the system to provide a way to let users test about the understanding of the locations after using the system. Although the video game is an independent system, seems like some types of the video games such as adventure, first person shooter and horror game are suitable to integrate with virtual tour system to address some of the limitations. Horror game could be one of the suitable type of games, it can let the users to experience the location of the virtual tour system within a horror environment will give more impact to users as well. Besides that, mini games such as card games, quiz games are also suitable to use in virtual tour system to test the knowledge of location after using the system. For example, quiz game can be integrated to test users understand about history, facts and etc. of the location.

Besides that, there are some virtual tour system integrate with the Leap Motion device, a computer hardware sensor device that supports finger and palm gestures as input, but requires no hand interaction. This can be improved the experience of users when using the virtual tour system or even gaming, it will provide more reality situation by using the hand movement or gesture to perform some actions.

Chapter 1: Introduction

1.2 Problem Statements

There are several problem statements had been justified after review some related articles and similar application. The details of the system and literature review can be found in Chapter 2: Literature Review. The problem statements will be listed below:

1. Lack of attractiveness and interactivity

Most of the existing virtual tour system are using 360 degree panoramic images that doesn't provide interactivity except allow users to view in 360 degree, this will greatly decrease the attractiveness of the system. Our findings strongly reinforce the belief that a genuine association between aesthetics and usability may exist and that attractive things are perceived to work better (Chawda et al. 2005).

2. Unable to experience the location virtually

As mentioned there are many virtual tour system based on 360 degree panoramic existed but the users are yet unable to experience the location virtually through the system like playing adventure games. Although it is 360 degree view, it is not much different to ask users to view the images that taking from different angles. Thus, this might be a bit different from the actual meaning of virtual tour - simulation of a real location. Users are expect to experience the simulation of the real location but not just view the images.

3. Lack of related information

Most of the virtual tour system are just allow users to look around the virtual location but does not provide any related information such as history, facts and etc. With the information provided together in the virtual tour system, it could has improve the system by allow users to understand more about the virtual location like having a tour in real life.

1.3 Motivation

1. Innovation for virtual tour system

Most of the virtual tour system are more or less the same which using 360 degree panoramic images-based approach and there is yet the combination between virtual tour system and game combination. Thus, these reasons have motivate to innovate the virtual tour system by combine it with game. Besides that, the game that will be developed can also integrate with the Leap Motion devices.

2. To provide a different experience from traditional virtual tour system

As mentioned at point 1, the existing virtual tour systems are most likely having the same functions and features. Therefore, it will be the more or less same experience for users even though they are using different virtual tour system. Thus, integrate a game into the virtual tour system will actually giving a huge different experience for the users. This will also change the traditional impression of users on the virtual tour system.

3. To increase the awareness of virtual tour system

Nowadays, the people are more interested towards the games compared to virtual tour system or some people don't even know what virtual tour system is. Hence, develop an innovative virtual tour system that integrate with game will attract the attention from the people. Once getting more attention from people, then people awareness towards the virtual tour system will be increased as well. We suggest (the idea goes back to the last century) that what reaches visual awareness is usually the result of this attentional step. In other words, that awareness and attention are intimately bound together (Crick & Koch 1990).

Chapter 1: Introduction

1.4 Project Objectives

The main objective of this project is to develop a game that can value added to users and also to the virtual tour system. There are few sub-objectives that divided out from the main objective listed below:

1. To integrate the game into the virtual tour system

Develop a game that is able to integrate into virtual tour system and ensure the game is suitable to integrate with the system. So that users are able to have fun with the game while exploring the virtual library in the system.

2. To provide UTAR with related information through gameplay

Develop a game that contains of the information related to UTAR to let users understanding the UTAR while exploring the virtual library in gameplay. For example, user successfully found part of maps that scattered within the virtual library will give him or her the information that is related to that part.

3. To allow users play the game with Leap Motion device

Develop a game that support not only the traditional input device like keyboard, mouse but also the latest technology like Leap Motion sensor device. By achieve the objective, integrate the Leap Motion technology into the game is needed. To let users having different input experience other than keyboard and mouse.

1.5 Project Contribution

This project is to integrate the horror game element into virtual tour system which it will be a newly develop system in Malaysia. With this project, it will allow the users able to have a better experience on virtual tour through interesting gameplay and the horror element would provide a better and longer impact on users. Besides that, this project would provide the information of the location through gameplay to users. This allow users to have better understanding on the location other than only having a virtual tour. In addition, the game would support the latest technology, Leap Motion other than traditional input such as keyboard and mouse. This will be the different experience for the users to play the game with only using the fingers to control the action and movement.

1.6 Project Scope

The project scope is to develop a game that suitable to integrate into the virtual tour system. At the end of the project, a game will be develop and map into the virtual tour system. The development of this project will mainly focus on the connectivity of the game and the virtual tour system. The project also provide the users to use it with other input methods than keyboard and mouse such as motion sensor devices. Besides that, the project will also provide the virtual tour related information in the users' gameplay. Lastly, this project will further enrich the tour experience of users through gameplay.

Chapter 2: Literature Review

2.1 Literature Review

In order to improve the existing system, there are several ways to assist it. There are some existing virtual tour in the market as well as existing games that suitable to integrate into virtual tour. In order to improve the existing system, review them about the pros and cons will be needed. Besides that, review on research papers will also help to improve the existing system through reviewing the strengths, weaknesses and solution the author had provided in the paper. Thus, literature review will be divided into three sections: 2.2 Literature Review on Research Papers, 2.3 Literature Review on Virtual Tour System, and 2.4 Literature Review on Leap Motion Games.

2.2 Literature Review on Studies Paper

2.2.1 Panoramic Image-based virtual tour

Nowadays, there are a lot of virtual tours developed by using the panoramic image-based technology. Panoramic image-based technology means the virtual tour that developed by using a high dynamic range imaging camera and take pictures of the location then stitch them together to perform the browser platform to users. (Geng et al. 2000) proved that panoramas integrated with branching picture-based-animation are used to compose the scene. At the users' point of view, the system has its advantage and disadvantage.

Ease to use. The panoramic image-based virtual tour would be user-friendly to users as they can looking around by just move the camera. (Geng et al. 2000) mentioned that looking around is based on panoramas. Besides that, (Wu et al. n.d.) stated that this system is robust, adaptive and easy operating.

Lack of interactivity. As mentioned, the panoramic image-based virtual tour is to let users able to look around at the browser platform that created by stitching pictures together. Thus, users can interact with the platform only. The panoramic player is used to simulate the "Looking Around" behaviour. It allows the user to pan and navigate within a scene (Geng et al. 2000). In addition, (Tukiainen 2013) claimed that a review by the Seattle Times criticized the low level of interactivity of the panoramic image-based virtual tour system.

Chapter 2: Literature Review

Static point of view from users. For the panoramic image-based virtual tour system, users able to look around by standing on the specified static point. This will actually limit the point of view from users to explore the location virtually. (Geng et al. 2000) stated that limitations of this method are the requirements that the scene should be static and the movement be confined to particular scene nodes. Being able to move freely in a photographic scene is more difficult.

Lastly, there must be ways to improve the virtual tour from those disadvantage. For example, the virtual tour can solve the problems of lack of interactivity and static point of view by allow users to navigate and walking around. The 3D models of the scenes could then be combined together to form a virtual tour where the user could navigate around freely and examine objects from several angles (Tukiainen 2013). Moreover, (Wu et al. n.d.) also stated that if circumstances permit, the system can be transplanted into head mount display and movement pedal so that users can visit the campus virtually just like walking in it.

Strength: Ease to use and navigate with the image-based platform

Weaknesses: Users have not much interact with the system and limit point of view from the location

Chapter 2: Literature Review

2.2.2 Game-based Approach

In the past few years, the game-based approach have started to turn into real trends at educational purpose and also other systems. According to (Schwartz 2013), like game-based learning, have turned into real trends. Widespread use of commercial games the domain of game-based learning has received increasing attention (Petros et al. 2013). In addition, there are a lot of benefits gained by integrating the game-based approach into some existing systems. (Griffiths 2002) claimed that videogames have great positive potential in addition to their entertainment value and there has been considerable success when games are designed to address a specific problem or to teach a certain skill.

Awareness. Game-based approach will attract the users' interest and increase the awareness of users on the system while they are playing the games. (Petros et al. 2013) explored the use of a serious game to address these issues, which predominantly focuses upon promoting awareness whilst raising interest among students and professional. The particular study, conducted through questionnaires method, reveal that students' knowledge had been improved after playing the game. Figure 2-2-F1 shown below is getting from the study of (Petros et al. 2013) which is the students' responses to the questionnaires.

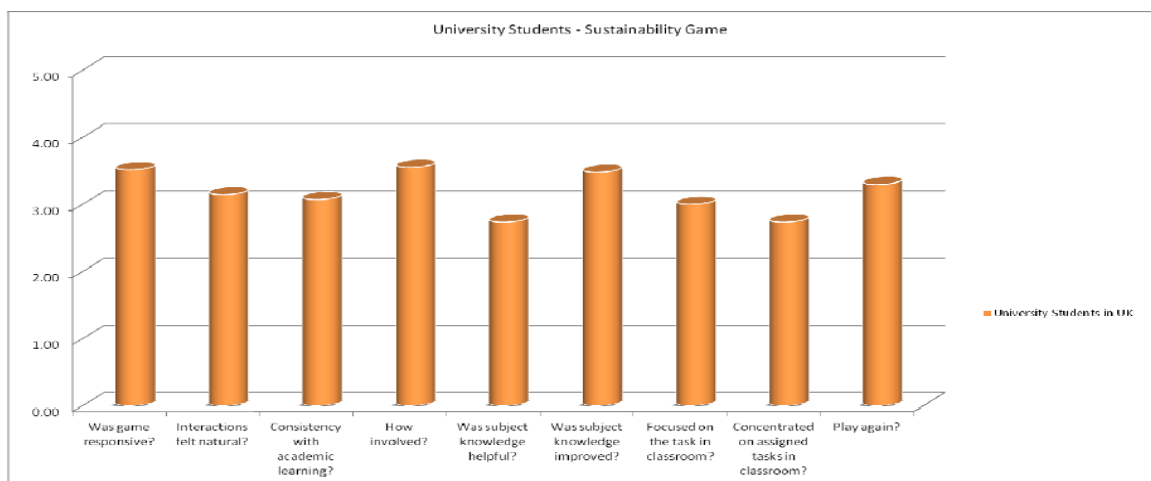


Figure 2-2-F1 University students' responses to survey questions

Chapter 2: Literature Review

Attention. Attention is a key factor that attracts the users to stay longer on the system using, using game-based approach can also attract the attention of users. (Mishra et al. 2012) stated that recent studies have evidenced that attention and working memory abilities can be enhanced by cognitive training games as well as entertainment videogames. Besides that, maintain users' attention can provide another more efficiency way of learning and absorb the information given. Videogames are fun and stimulating for participants. Consequently, it is easier to achieve and maintain a person's undivided attention for long periods of time. Because of the fun and excitement, they may also provide an innovative way of learning (Griffiths 2002).

However, too much time spending on game-based approach might lead to other problems such as health problems, addiction and etc. Excessive players are the most at-risk from developing health problems although more research appears to be much needed. (Griffiths 2002). Thus, (Griffiths 2002) recommended that adverse effects are likely to be relatively minor, and temporary, resolving spontaneously with decreased frequency of play, or to affect only a small subgroup of players.

Strengths: Raise awareness and maintain attention of users

Weaknesses: Might lead to health problems, addiction and etc.

Chapter 2: Literature Review

2.2.3 Leap Motion

Nowadays, the new rising technology are replacing the older technology system or devices. New technologies are replacing the use of devices such as a keyboard and mouse. Touchscreens are already transforming the way we interact with mobile devices. The next step is utilization of gestures and voice commands for computer interaction in our every day (Košič et al. 2013).

In 2008, technology of Leap Motion was developed as advanced motion technology for human-computer interaction. It is a computer hardware sensor device that is similar to a mouse which supports hand and palm gesture as input, but requires no hand interacting. Besides that, the Leap Motion controller do support hand gesture as well. The Leap Motion (LM) controller is a new 3D sensing device for hand gesture interaction with a computer. It is capable of sensing the position and orientation of the fingers of the hands, as well as the palm orientation and curvature (Seixas et al. 2015).

First of all, Leap Motion should not be compared to mouse and touchpad due to the different techniques for their movement. (Seixas et al. 2015) stated that the comparison between the LM, the mouse, and the touchpad is not totally fair. Both the mouse and the touchpad use non-linear mapping between device displacement and cursor displacement: faster movements translate to greater cursor displacement. This does not happen with the Touchless application. Thus, Leap Motion should only compare to the similar motion and touchless devices in market such as Kinect, Wii and etc. There must be some advantages to using Leap Motion with the virtual reality compare to others.

Higher resolution and accuracy. The Leap Motion controller have an approximately one meter distance of semi-spherical observational area which is smaller area compare to other devices. Smaller observational area does not means to be weak or less accuracy. According to (Taylor & Curran 2015) Leap Motion controller's observational area is smaller than that of the Kinect, which is designed to monitor the entire body; however, this allows the Leap Motion to operate at a higher resolution and accuracy where accuracy is defined as the ability of a 3D sensor to determine a desired position in 3D space. Thus, Leap Motion controller is actually more accurate only capturing the human motion compare to Kinect.

Chapter 2: Literature Review

Portable. The Leap Motion also benefits from its small size, coming in at 0.5 inches in height, 1.2 inches in width and 3 inches in depth with a weight of only 0.1 pounds (Leap Motion 2013). The small size, light weight of device has making it more portable than any other motion sensor devices.

Affordable. The Leap Motion is more affordable than any other device discussed in this chapter - even the Kinect (sold for UK Sterling £75 in 2014) - the Leap Motion is available for £65 UK Sterling as of 2014 (Taylor & Curran 2015).

Durability. Because of the touch less and motion sensor, the device will not easily to get spoil or malfunction which it also apply to Kinect. It is more durability than other devices like Nintendo Wii, PS4 controller and etc. (Taylor & Curran 2015) also stated that another advantage of the Leap Motion, one that also applies to Kinect, is its durability; the Leap Motion is not prone to wear and tear that eventually claims many glove-based system.

Although Leap Motion controller is more accurate than Kinect, it does not means the accuracy is good enough by comparing to others. Thus, (Taylor & Curran 2015) suggest that effort should be made to implement a means by which individual fingers can be reliably identified as this ultimately allow for more accurate readings and the addition of more complex and intricate exercises.

Strengths: Higher resolution and accuracy on hand movement, easy to carry around, price is affordable and the durability is high

Weaknesses: Limit observational area, can only detect hand movement

2.3 Literature Review on Virtual Tour System

2.3.1 Virtual Library of Alexandria



Figure 2-3-F1 Virtual Library of Alexandria

As shown in Figure 2-3-F1, Virtual Library of Alexandria (3D Mekanlar 2010) is a 360 degree panoramic images based virtual tour system of the library of Alexandria, Egypt. This system is using the Nikon D90 digital camera to take the library pictures in different angles, and later on combined together to form a full 360 degree panoramic view to perform a 3D virtual view to the users. The system is allowed to view both horizontally and vertically but not able to virtually experience the library. Besides that, there is no interactive features or function provided other than just viewing the library around at the fixed point. In addition, the system doesn't provide the history or description about the library. Not to mention that, the system is just simple 360 degree panoramic based virtual system without background music.

Strengths: Provide a 3D view of the library

Weaknesses: Lack of interactivity and attractiveness for users due to fixed position library 360 degree viewing instead of let users experience the library virtually.

Chapter 2: Literature Review

2.3.2 Virtual Tour of King's College Library



Figure 2-3-F2 Virtual Tour of King's College Library



Figure 2-3-F3 Virtual Tour of King's College Library – Floor Plan

The library of King's College is normally closed to the public but King's College Library Virtual Tour (King's College n.d.) will give users a sense of its appearance, facilities and history. This system is also using the 360 degree panoramic images based, but it is much better by comparing to the Virtual Library of Alexandria because more features are provided. Firstly, the system will provide the history and area description of the King's College Library once users click on the question mark buttons as shown in Figure 2-3-F2. Besides that, it provides a floor plan to let users to choose and explore the other area of library as shown in Figure 2-3-F3. Unfortunately, it is lack of attraction due to not having a background music and sound effect when clicking the buttons or changing to other area.

Strengths: Provide a floor plan that allow users to explore different area with providing users the history or description of the library

Weaknesses: Lack of attractiveness for users due to fixed position library 360 degree viewing instead of let user virtual experience the library

2.4 Literature Review on Leap Motion Games

2.4.1 Observatorium

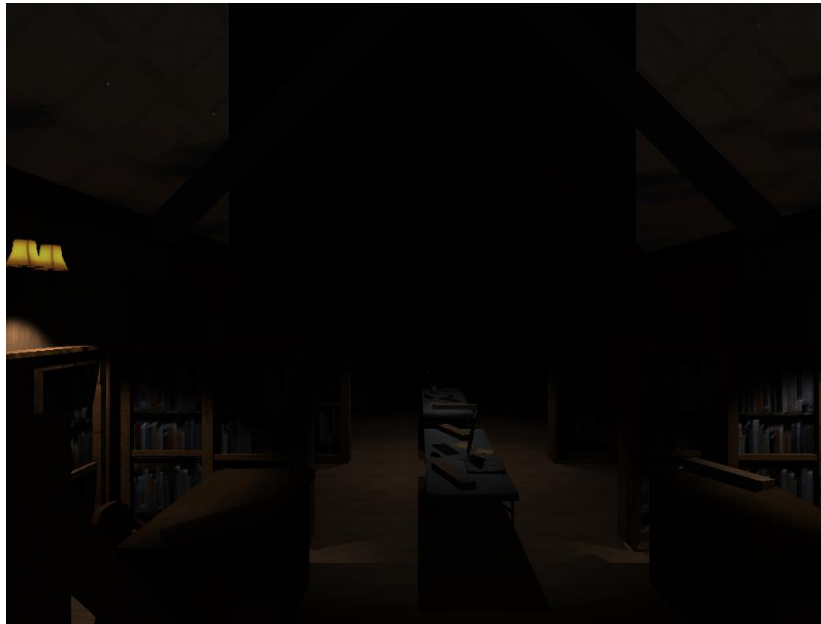


Figure 2-4-F1 Observatorium gameplay

Observatorium (Dominicdev 2014) is one of the survival horror games that developed with integration of Leap Motion and also traditional keyboard. The Leap Motion controllers act as an intermediate device to provide the player with a more immersive way to interact with what is happening in the game, and even more identify with the character. In starting of the games, the player will be sent to a strange building that out in middle of the forest, ostensibly to retrieve something left there. The player is able to explore the building by using some basic gesture to open the door, grab an items to protect self. Unfortunately, the game is still lack of some sound work. The gameplay is shown above as Figure 2-4-F1.

Strengths: Integrate with Leap Motion device provide more immersive, tension feeling for players; support also keyboards and mouse for players who doesn't own Leap Motion

Weaknesses: Lower tension feeling and interesting due to lack of sound effect in the horror genre game

Chapter 2: Literature Review

2.4.2 Hollow



Figure 2-4-F2 Hollow gameplay

Hollow (CherryPieGames 2014) is a Halloween-themed game that more relied more on classical Gothic American horror, so it turned to the horror hayride that adapted Legend of Sleepy Hollow. The big part of Hollow is the universe lighting, the lighting is fine-tune to make the universe look beautiful and interesting to the players. Besides that, the sound plays in Hollow is enhancing the experience of players while exploring the universe. For example, the world then muffles to silence at the left fork in the road before heavy church bells toll from the graveyard, the sudden silence will giving players the tension feeling. Figure 2-4-F2 had shown the gameplay in Hollow.

Strengths: Fine-tune lighting with well-chosen sound play increase the attractive and attention of players to play this game.

Weaknesses: Doesn't provide a clear objective what to do in this game and no interactivity with the objects in the game.

2.5 Comparison Table of Reviewed Systems

Table 2-5-T1 Comparison of Existing System and Proposed Project

Features System	Virtual Library of Alexandria	Virtual Tour of King’s College Library	Observatorium (Games)	Hollow (Games)	Proposed Project
3D View	✓	✓	✓	✓	✓
Object Interactivity	✗	✗	✓	✗	✓
Available to virtual experience the map	✗	✗	✓	✓	✓
Contains information that related to system	✗	✓	✗	✗	✓
Sound Effect	✗	✗	✓	✓	✓
Background Music	✗	✗	✓	✓	✓
Using Leap Motion	✗	✗	✓	✓	✓

Chapter 3: Methodology

3.1 Project Methodology

Spiral model, the methodology that used to develop this project. Spiral model is a type of iterative software development life cycle model which is alike to incremental model, but more emphasize on risk analysis. It also allow flexibility into the development process of the project. Spiral model is run through five phases in iterations as shown below at Figure 3-1-F1.

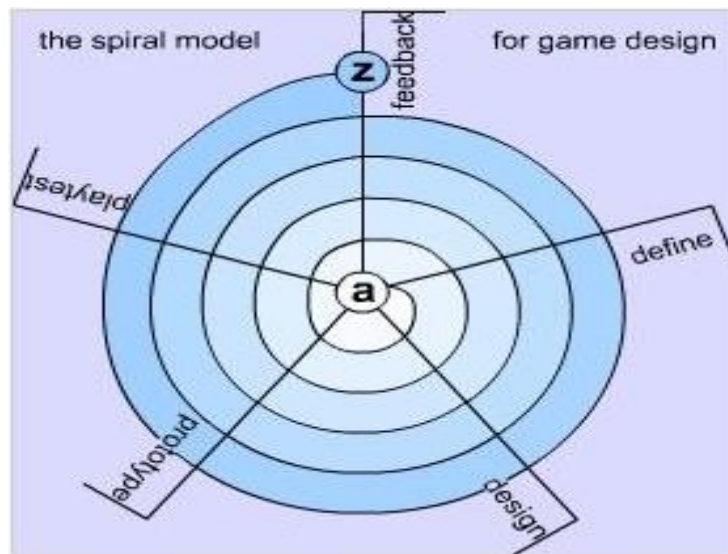


Figure 3-1-F1 Spiral Model for Game Development

Define Phase – Define the ideas and features to develop.

Design Phase – Sketch storyboard based on the ideas and features.

Prototype Phase – Build a working model and implement the features into it.

Playtest Phase – Perform solo playtest on the project for bugs and design flaws.

Feedback Phase – Evaluate the working model and features during the cycle then go back to first step (Define phase).

Chapter 3: Methodology

There are some reason why choosing Spiral model as the project development methodology:

- Spiral model contains of playtest phase on every prototype that been developed in order minimize the risk such as bugs and design flaws
- Spiral model able to build a prototype quickly
- Spiral model able to let developers add additional features and functions later on
- Spiral model allow developers to change the requirements easily and faster

Besides that, there will be several prototype undergoing throughout the project before complete.

Prototype 1: Modelling UTAR library and test on the integration with Unreal Engine 4.

Prototype 2: Modelling main characters and animate them with camera within the Unreal Engine 4.

Prototype 3: Coding the game related story, interact with the objects and etc. Then linking them together with the character.

Prototype 4: Test on integrating the game into the virtual tour location which is UTAR library.

Prototype 5: Final version of the project, complete the project with bug free.

Chapter 4: System Design

4.1 System Flowchart

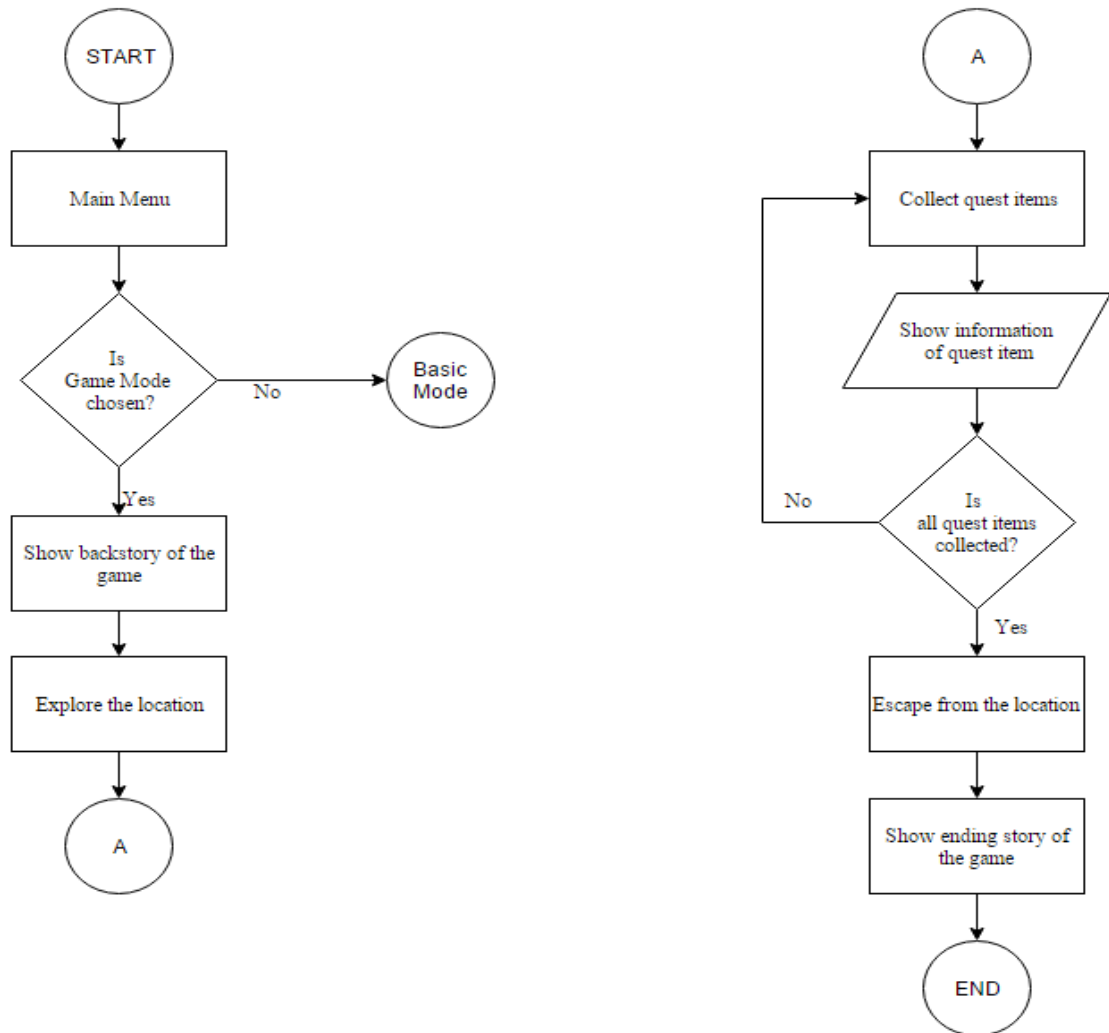


Figure 4-1-F1 Flow Chart of Project

Figure 4-1-F1 above shown the system flow of this project which that users will enter the game mode through the menu. Then, a backstory which is a story that tells what led up to game will be shown to users so that they won't be confuse in the beginning. After that, users are required to collect all the quest items while exploring the location. Once the quest item have been collected, it will show the information to users, let them understand more about the location. After collected all the quest items, users are required to escape from the location then a story will show to users as an ending of this project.

4.2 Storyboard



Figure 4-2-F1 Main Menu Screen

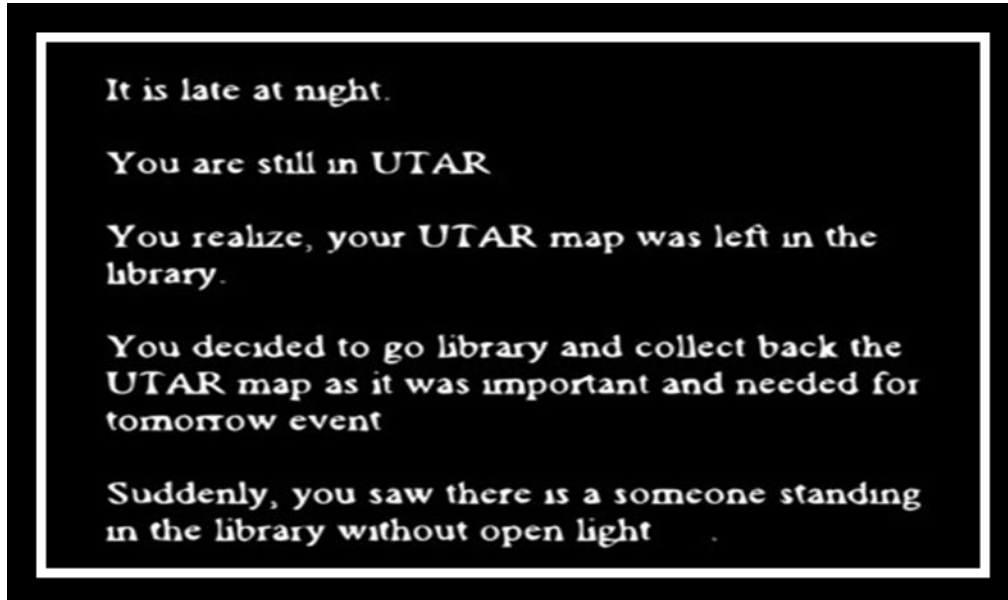


Figure 4-2-F2 Backstory before game start

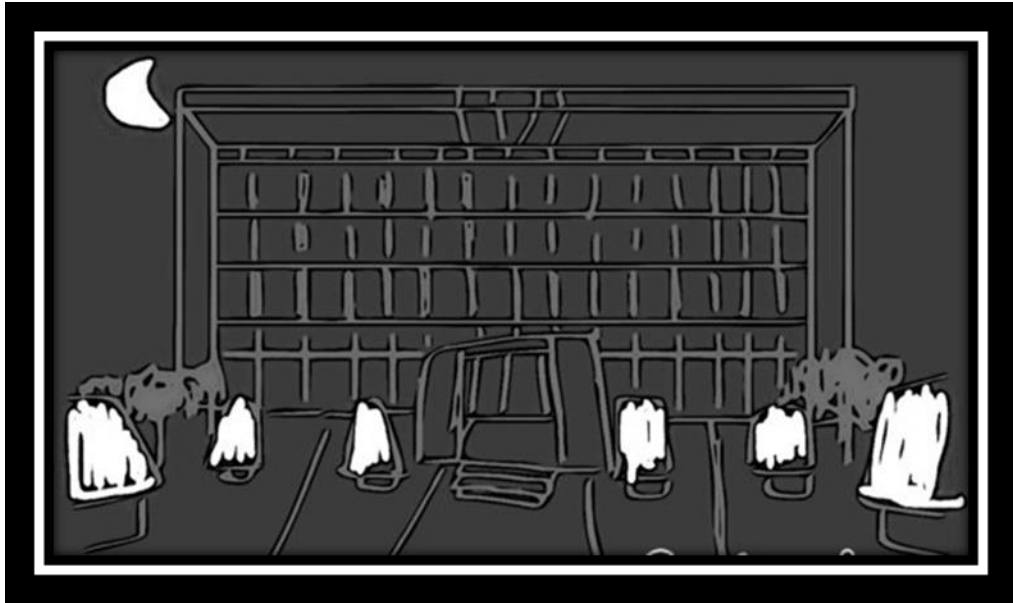


Figure 4-2-F3 Game start – in front library

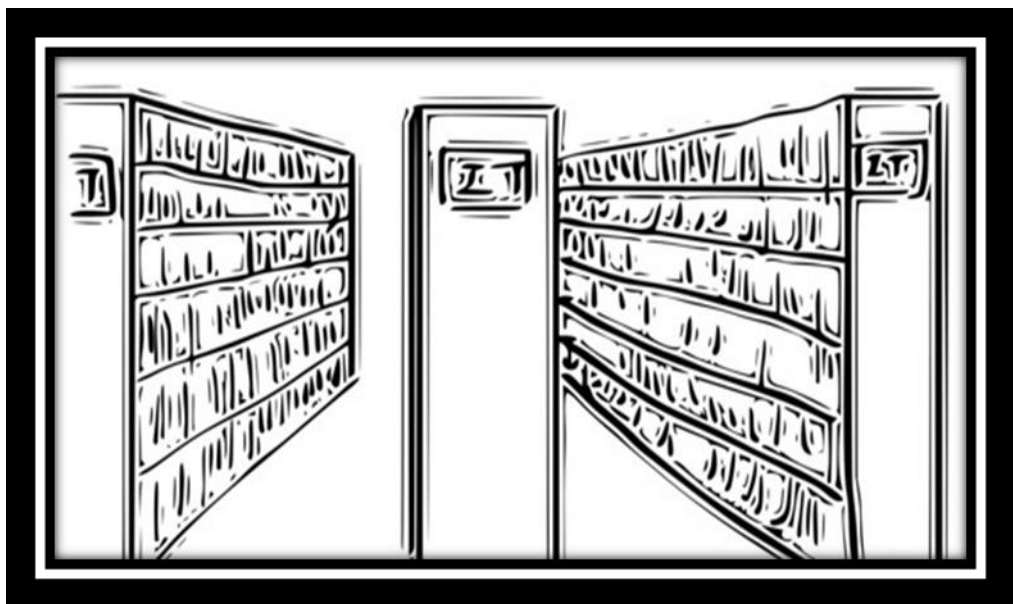


Figure 4-2-F4 Gameplay – exploring library

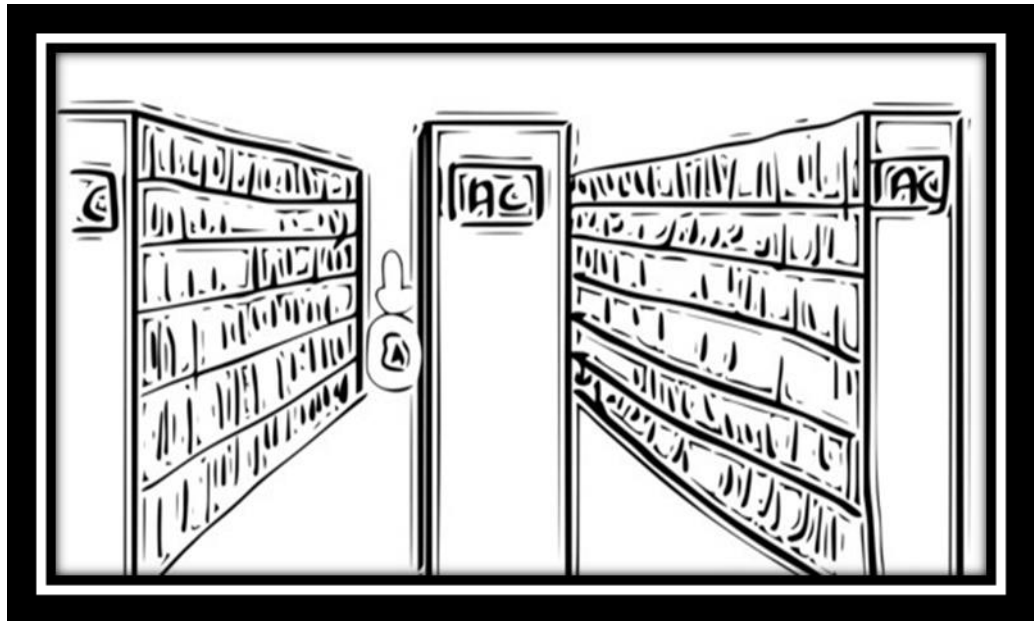


Figure 4-2-F5 Gameplay – collect quest item

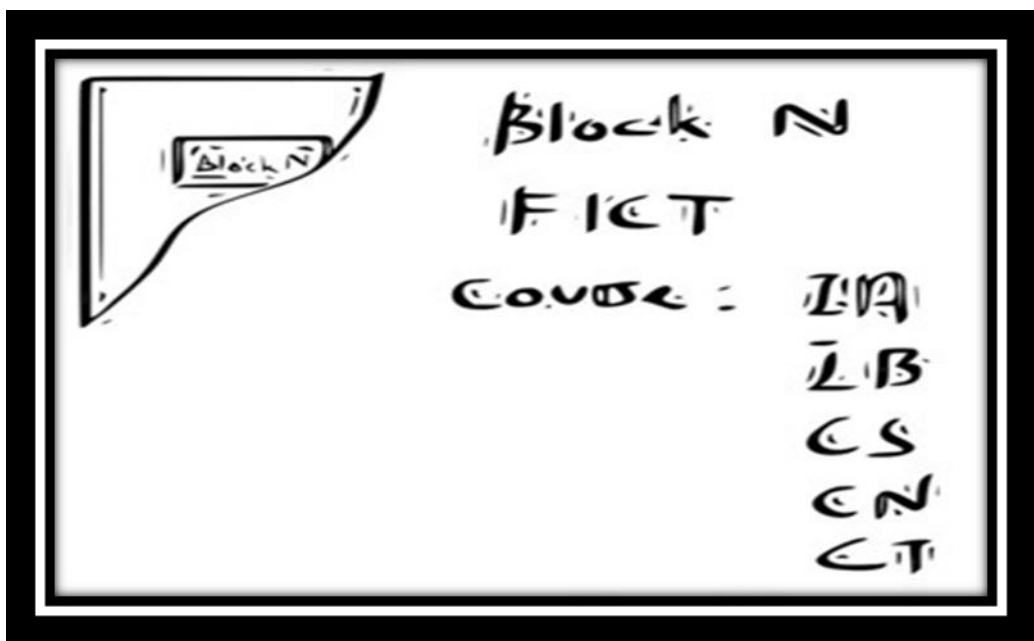


Figure 4-2-F6 Gameplay – quest item information

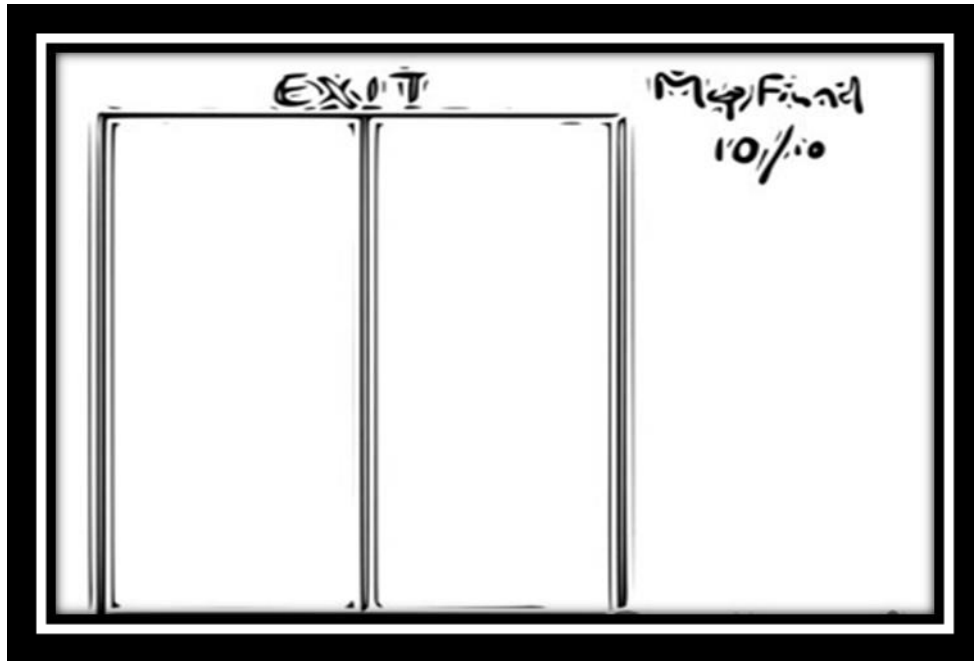


Figure 4-2-F7 Gameplay – escape after collected all quest item

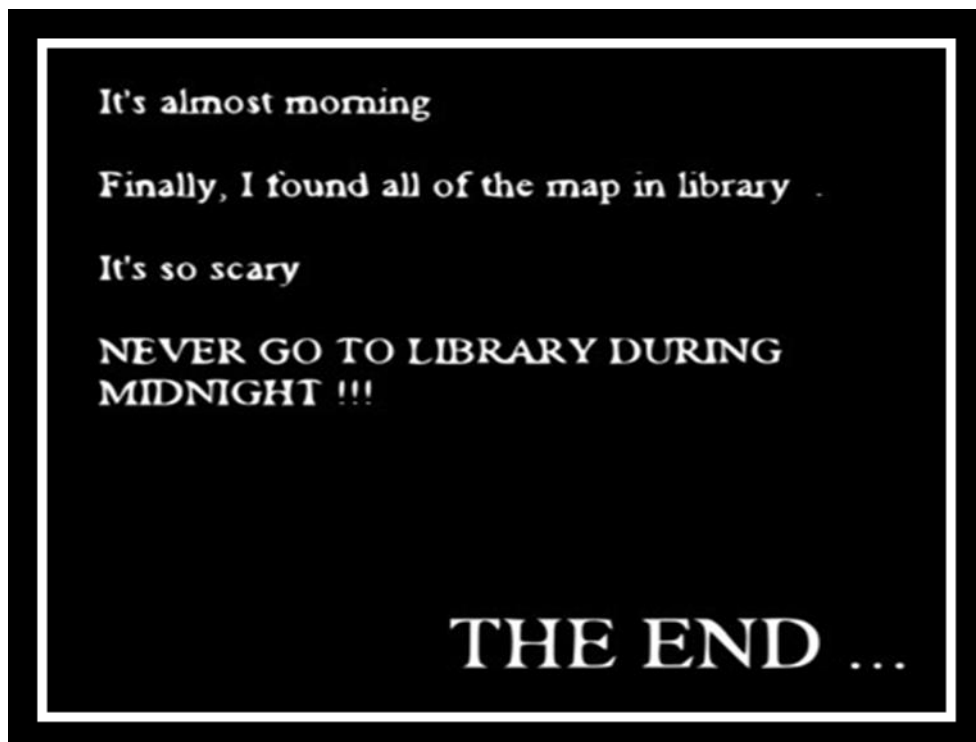


Figure 4-2-F8 Ending story after complete

Chapter 4: System Design

4.3 Timeline

4.3.1 FYP 1 Gantt Chart

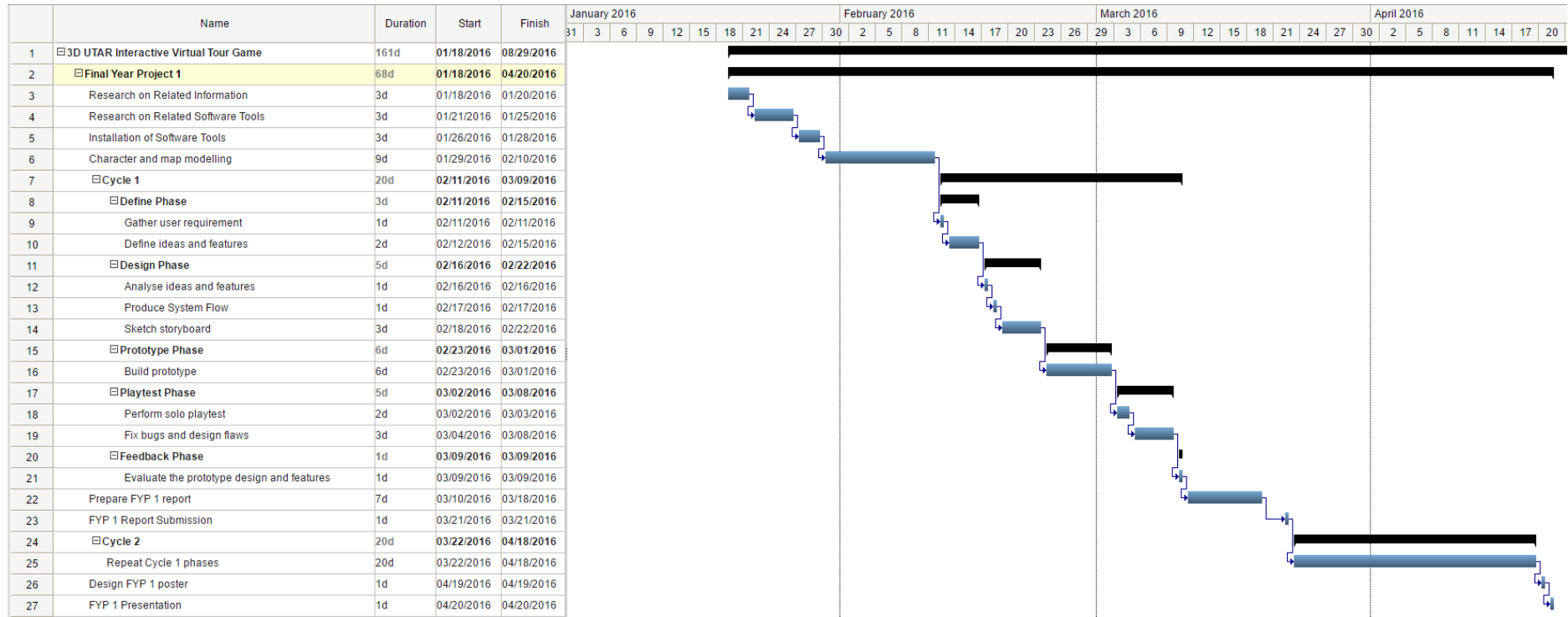


Figure 4-3-F1 FYP 1 Gantt Chart

Chapter 4: System Design

4.3.2 FYP 2 Gantt Chart

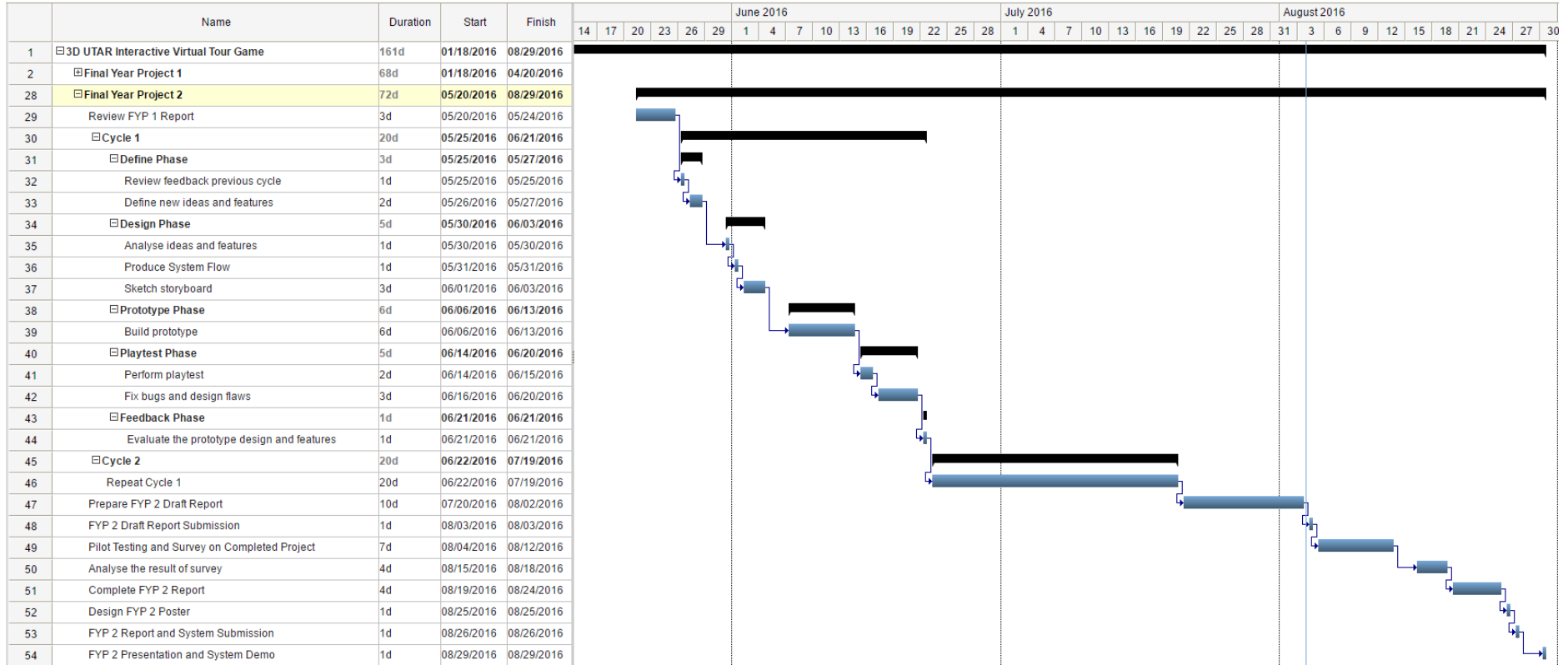


Figure 4-3-F2 FYP 2 Gantt Chart

Chapter 5: Implementation and Testing

5.1 Software used

5.1.1 Unreal Engine 4



Figure 5-1-F1 Unreal Engine 4 Logo

Unreal Engine 4 is game development tools from Epic Games for developers. The Unreal Engine technology can be used to achieve many systems whether making a mobile application or an open-world action game. Other than that, Unreal Engine 4 is suited to be used by students, Indie and even a large project teams. Most important thing for using Unreal Engine 4 is it is free to use. There is no limitation in the software, users can use every tools, features, platforms, source code and more that provided from the software. There are some useful functions provided in the software itself.

Useful Functions:

- Blueprints
 - Enable developer prototype and build a games, simulation and visualizations without programming.
- Tools
 - Allow developer to build every aspect of the project such as rendering, UI, animation, visual effects and etc.
- Source Code
 - Provide an existing complete editor source code which allow new developer to access it and customize the existing game, makes it easier to debug.

Chapter 5: Implementation and Testing

Installation Steps:

1. Go to <https://www.unrealengine.com/what-is-unreal-engine-4>
2. Click the Get Unreal button to proceed

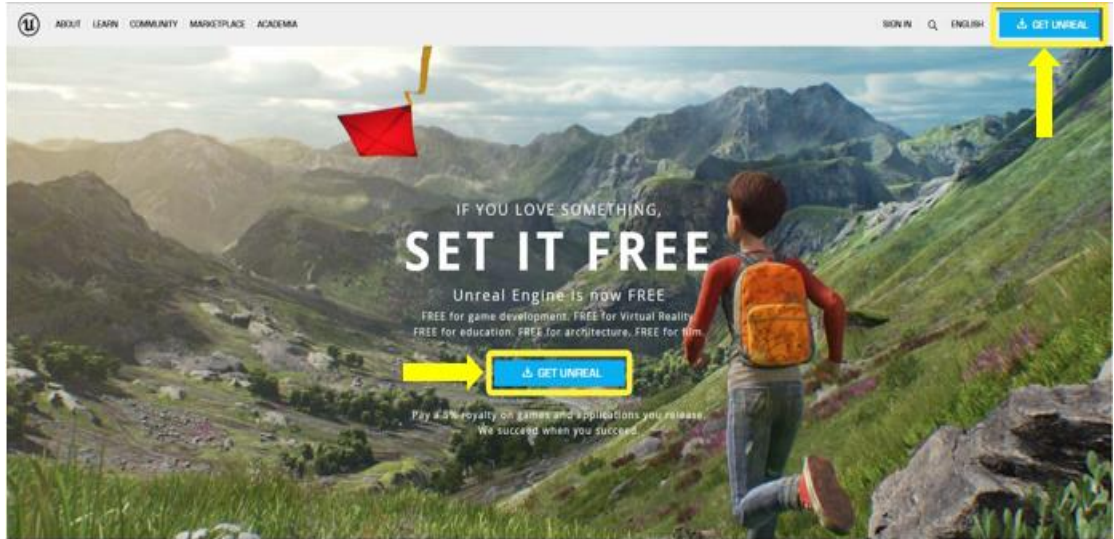


Figure 5-1-F2 Unreal Engine homepage

3. Sign in with existing Epic Game account or sign up new Epic Game account by filling up the form to proceed

Figure 5-1-F3 Sign up form of Epic Game Account

Chapter 5: Implementation and Testing

4. Read the End User License Agreement, tick and click Accept button to proceed

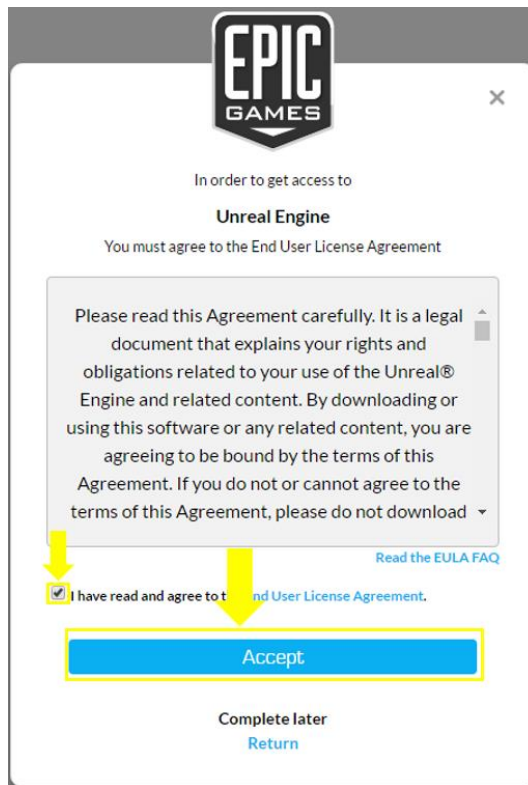


Figure 5-1-F4 EULA for sign up

5. Click Download button to download the installer

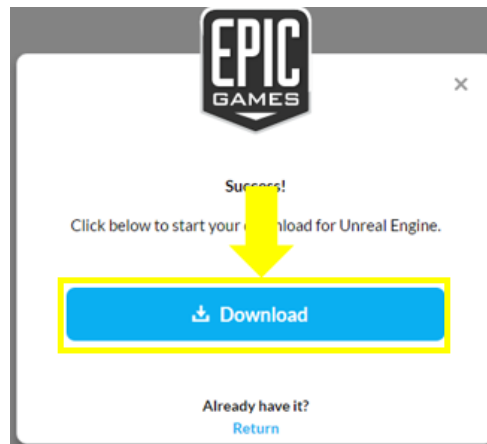


Figure 5-1-F5 Epic Game Launcher download page

Chapter 5: Implementation and Testing

6. Run the installer after download is complete



Figure 5-1-F6 Epic Game Launcher installer permission dialog

7. Click Install button after Epic Game Launcher Setup interface appears

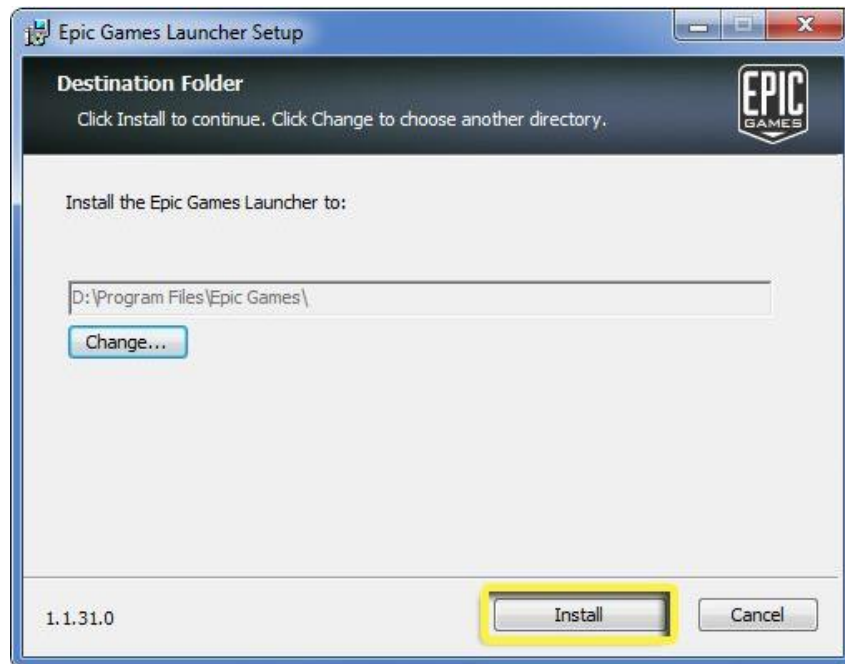


Figure 5-1-F7 Epic Game Launcher setup interface

Chapter 5: Implementation and Testing

8. After installed the Epic Game Launcher, launch and login with your Epic Game account



Figure 5-1-F8 Login page of Epic Game Launcher

9. Then, click the Unreal Engine tab inside the Epic Game Launcher

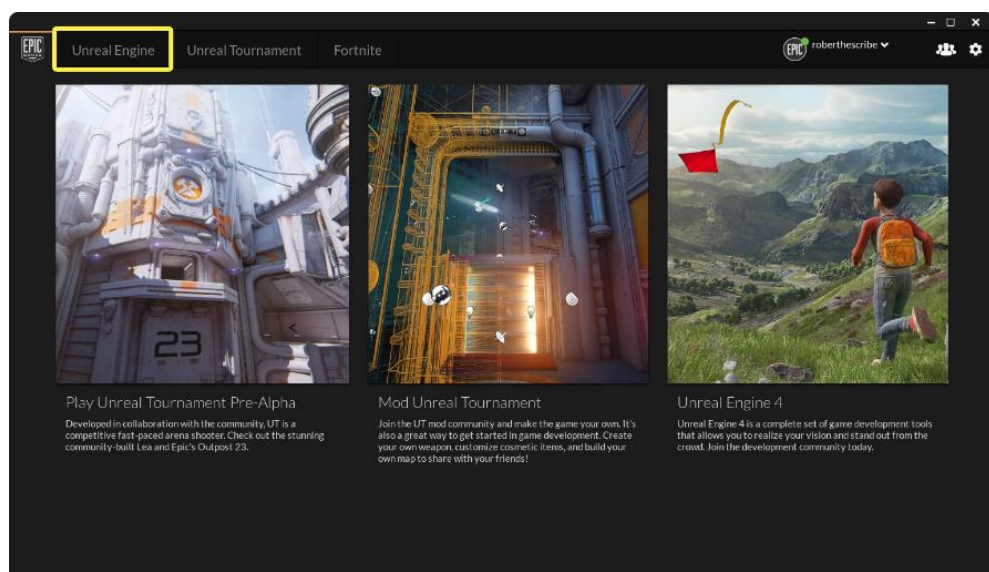


Figure 5-1-F9 Epic Game Launcher main menu

Chapter 5: Implementation and Testing

10. Then, click Install Engine to download latest version of Unreal Engine

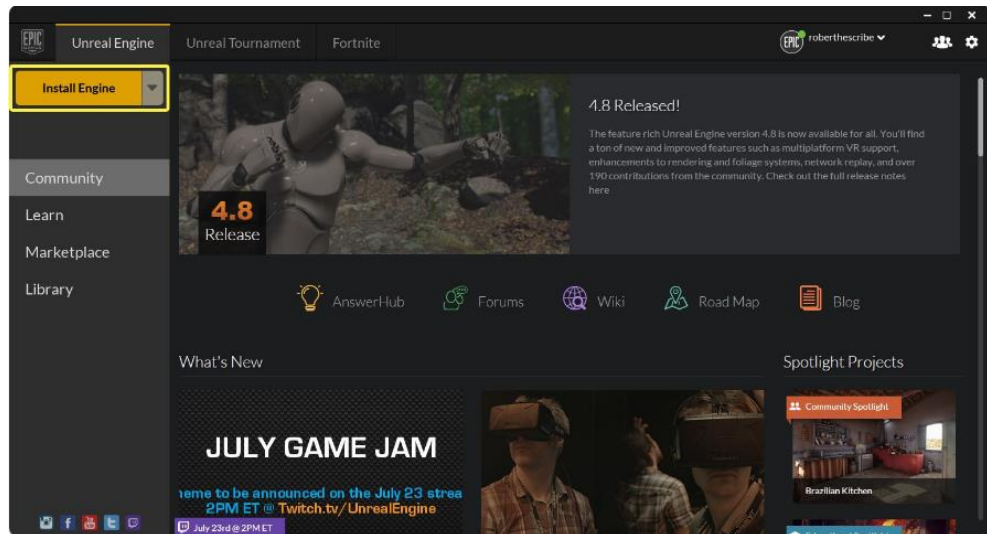


Figure 5-1-F10 Unreal Engine tab before download

11. Read the End User License Agreement, tick and click Accept button to proceed



Figure 5-1-F11 EULA for download Unreal Engine

Chapter 5: Implementation and Testing

12. After accept the EULA, it will start downloading the Unreal Engine and install after download is complete

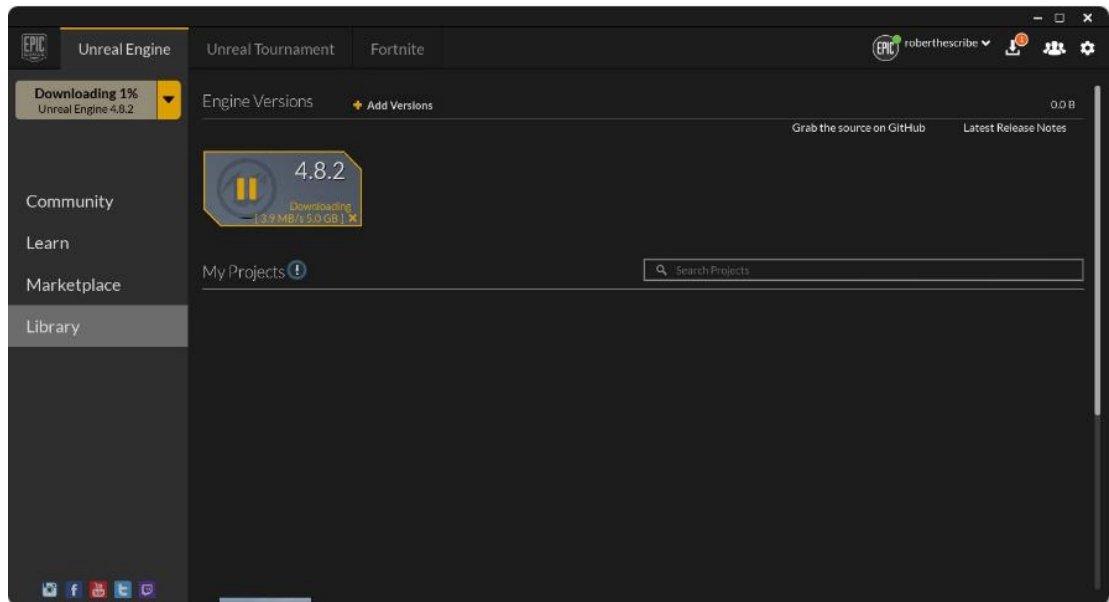


Figure 5-1-F12 Unreal Engine tab while downloading

13. After Unreal Engine is successfully downloaded and installed, you are able to click Launch to start the program now

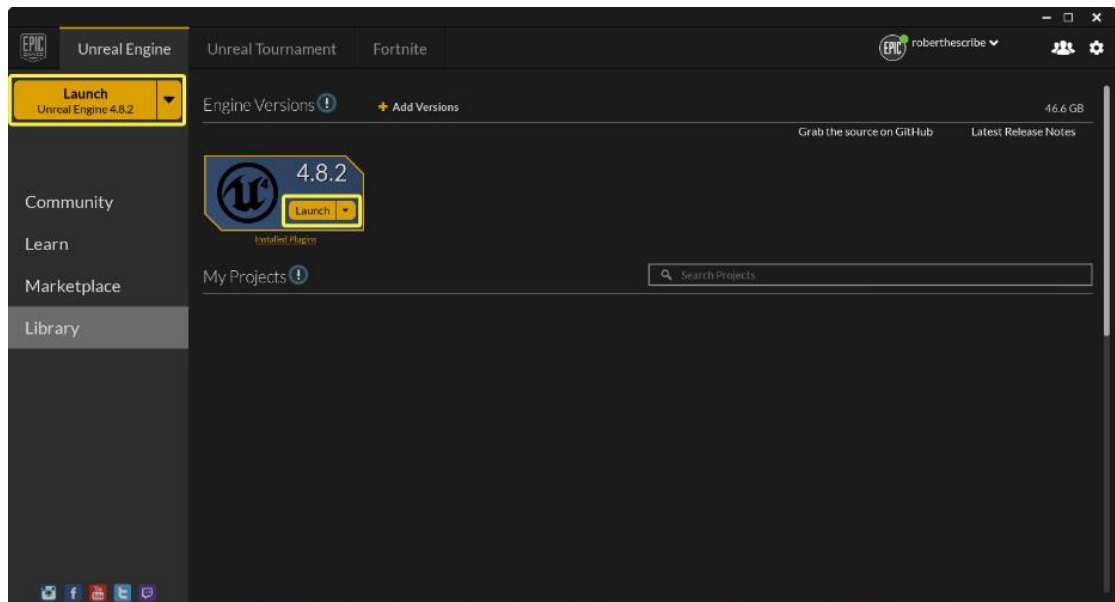


Figure 5-1-F13 Unreal Engine tab after complete download

Chapter 5: Implementation and Testing

5.1.2 Autodesk 3ds Max

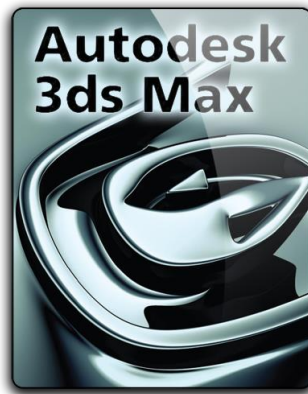


Figure 5-1-F14 Autodesk 3ds Max Logo

Autodesk 3ds Max is a professional 3D computer graphics program which provides 3D animations, modelling, rendering and etc. It has modelling capabilities that based around polygon modelling which developer can create a wide array of primitives like cubes, cones and etc. It also provides a flexible plugin architecture and can be used on Windows platform. The program does provide a lots of useful features to developer for modelling, texturing, and animation.

Useful Features:

- Character Studio
 - A plugin that integrated into 3DS Max that helps users to do 3D model animations.
- Texture editing
 - 3ds do offers many operations for creative texture such as tiling, mirroring, rotate, UV stretching and etc.
- General key framing
 - It has fast and intuitive controls for key framing which let users create animations with ease

Chapter 5: Implementation and Testing

Installation Steps:

1. Go to <http://www.autodesk.com/education/free-software/3ds-max>
2. You are required to sign in with existing Autodesk account or sign up new account in order to install Autodesk 3ds Max

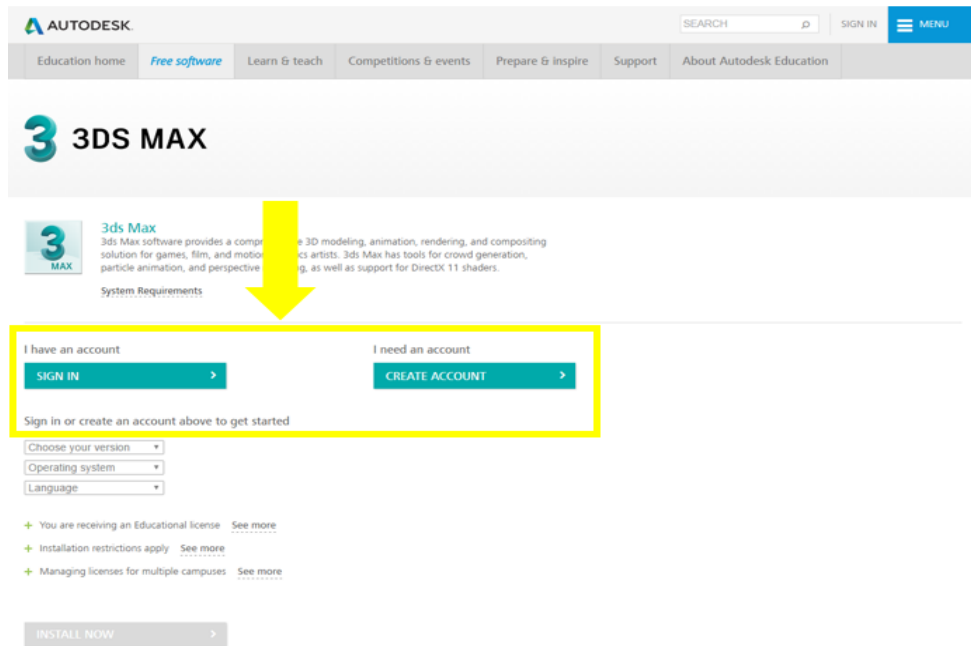


Figure 5-1-F15 Free Autodesk 3ds Max page before sign in

Chapter 5: Implementation and Testing

3. After sign in the Autodesk account, choose the software specification you preferred to get the serial number and product key and click Install Now

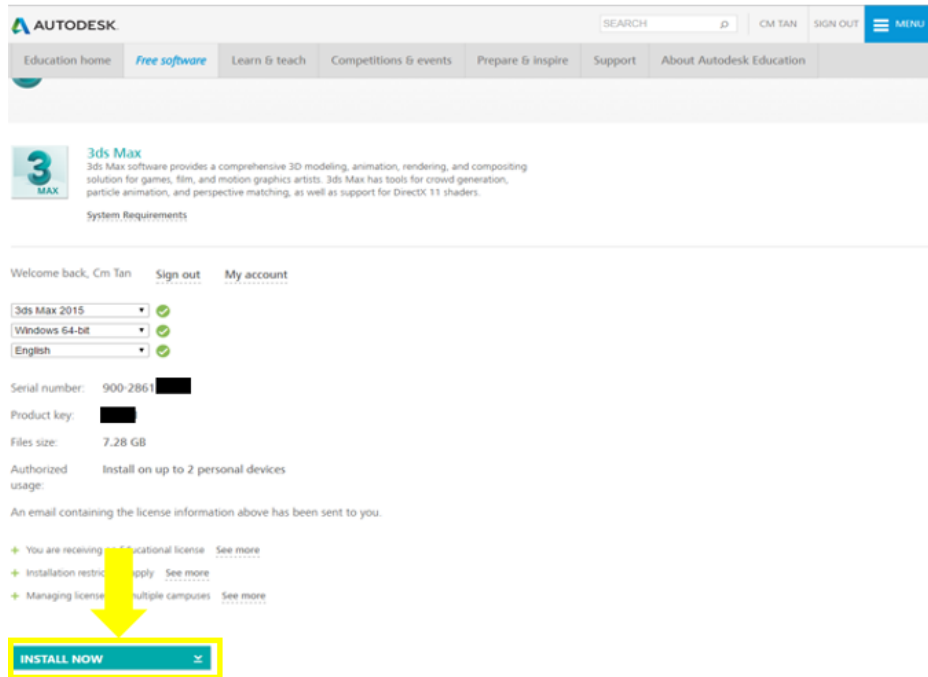


Figure 5-1-F16 Free Autodesk 3ds Max page after sign in

4. After finish download, run the file.
5. Then, click Install after the Autodesk 3ds Max 2015 setup page

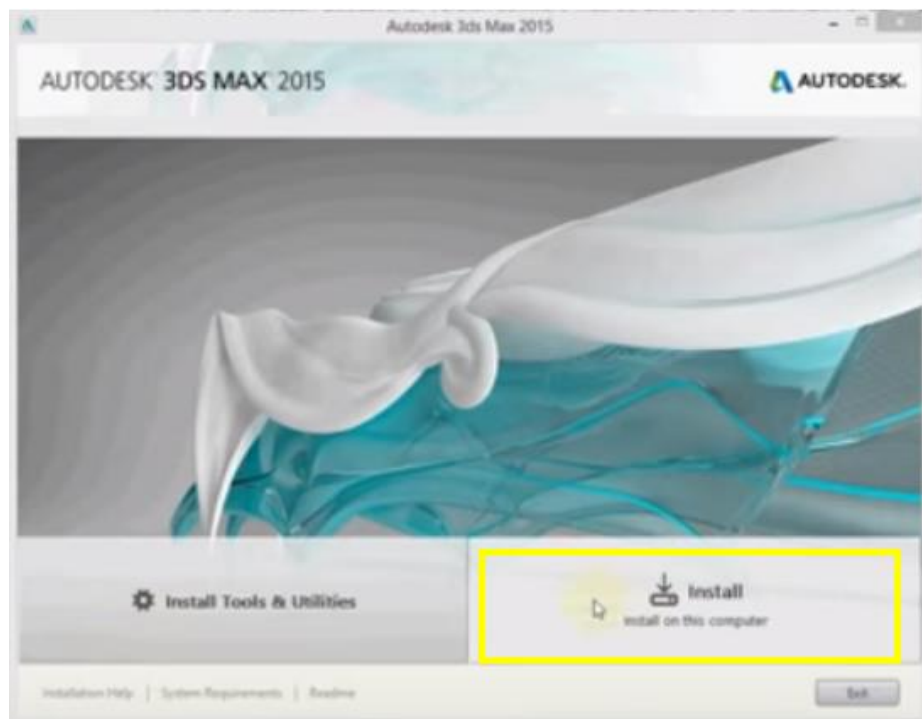


Figure 5-1-F17 Autodesk 3ds Max setup page

Chapter 5: Implementation and Testing

6. Then click Install and click Finish after it finish installing

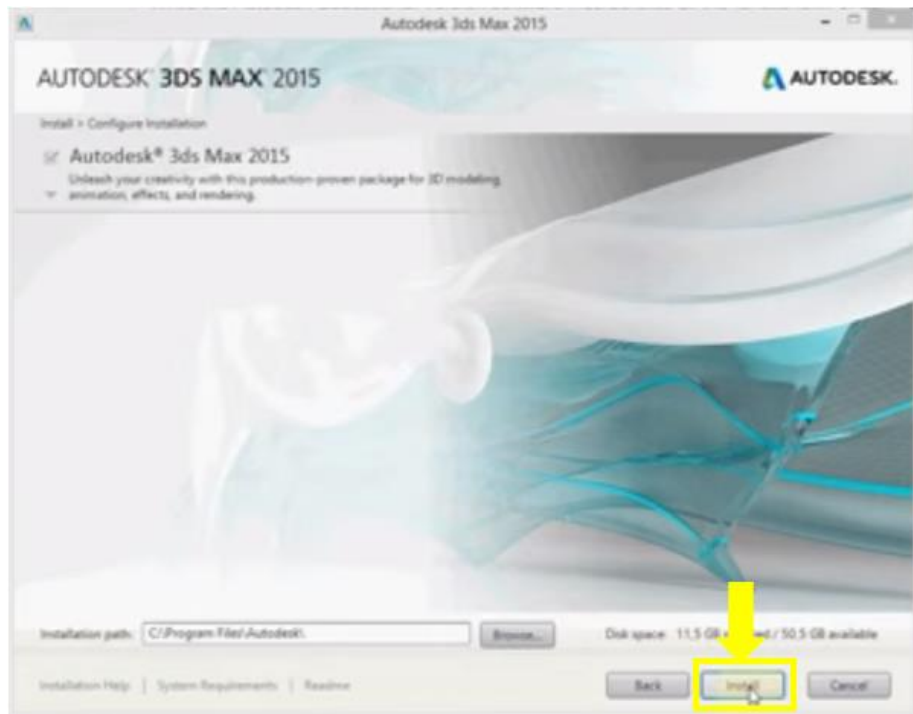


Figure 5-1-F18 Autodesk 3ds Max install page

7. Finally, Autodesk 3ds Max is done installed and able to run now

5.2 Hardware used

5.2.1 Leap Motion Device



Figure 5-2-F1 Leap Motion controller example

Leap Motion controller is motion sensor device that has only the size of an USB and designed using two monochromatic IR cameras and three infrared LEDs. It's about three inches long, an inch wide and less than a half-inch thick and have roughly one meter distance of semi-spherical observational area. Leap Motion controller software is comparing the 2D frames that generated by the two cameras that mentioned with using a “complex math” in a way to synthesizing the 3D position data. There are several pros and cons in this modern devices.

Pros	Cons
Fine-tuned motion control for both hand fingers at same time	No wireless connection provided
Simple, portable hardware	Limited selection of suited apps provided
SDK is provided for developer to code own gesture	Not yet alternative to a mouse or touchscreen

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Installation steps:

1. Get a Leap Motion device
2. Then, go to <https://www.leapmotion.com/setup>
3. Click Windows Download (Desktop) to download the Leap Motion setup, it also available for Mac and Linux

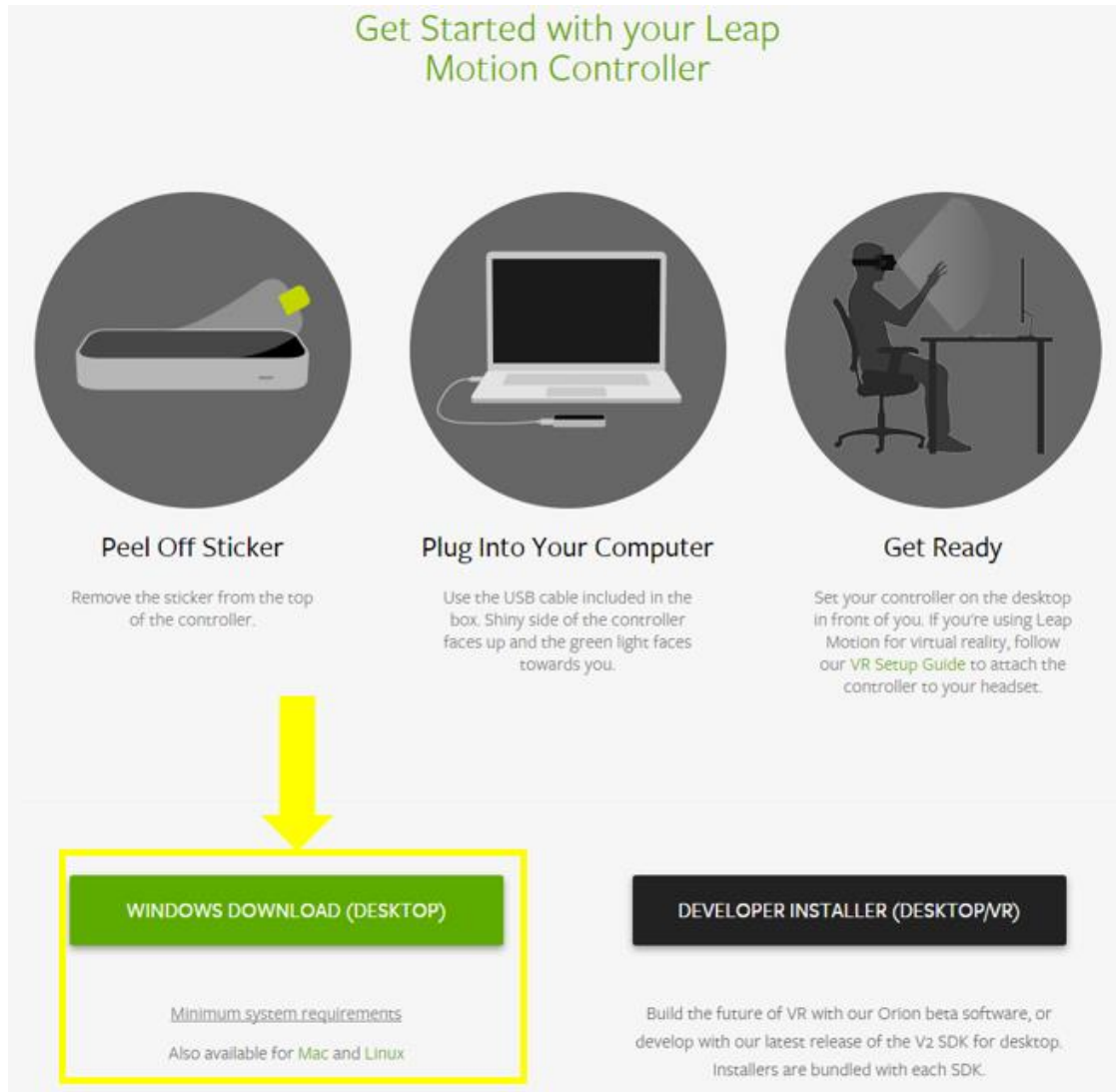


Figure 5-2-F2 Leap Motion download setup page

4. After download is finish, run and install the Leap Motion experience program.
5. Then, the Leap Motion device is ready to use now

5.3 Graphical User Interface (GUI)

5.3.1 Main Menu Interface



Figure 5-3-F1 Main Menu Interface

Main menu interface had been shown above as Figure 5-3-F1. The main menu mainly contains the game title, background picture with UTAR library and also four buttons provided for users which are:

First button: Start Game – Navigate user to the gameplay interface with starting story.

Second button: Instruction – Navigate user to instruction interface which user can check about the input control.

Third button: Option – Navigate user to option menu which able to change the input method and also the gameplay resolution.

Forth button: Quit Game – Close the game.

5.3.2 Instruction Interface

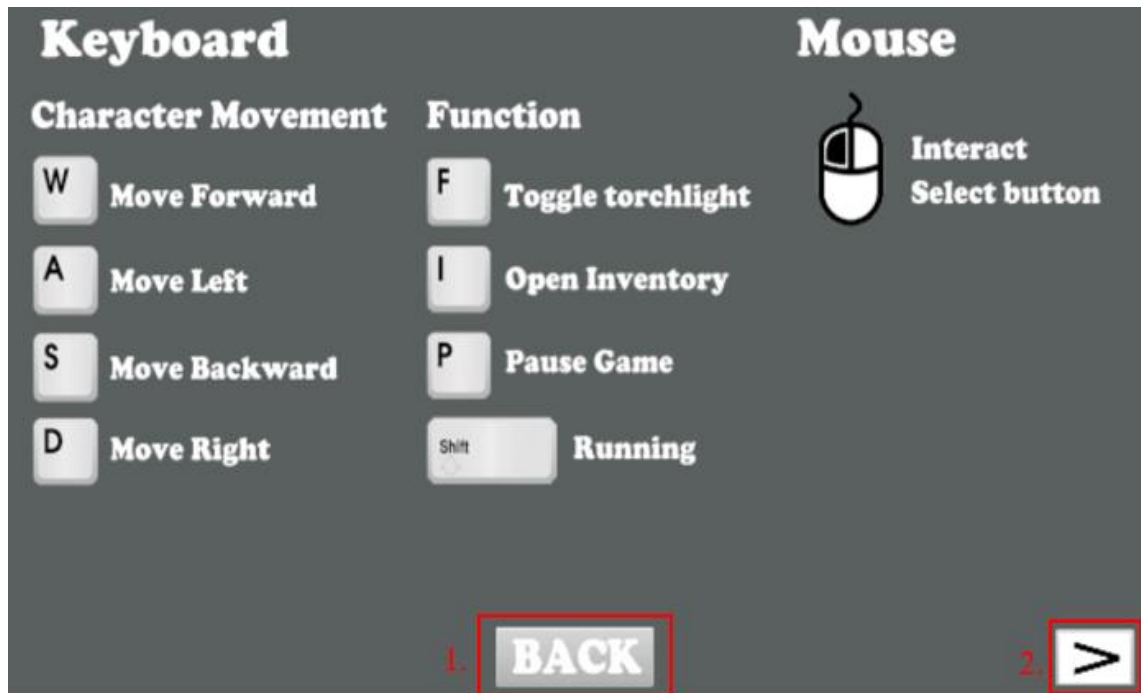


Figure 5-3-F2 Instruction Interface (Keyboard and Mouse)

Figure 5-3-F2 shown the project Instruction interface of all the in game keys control of keyboard and mouse. There are two buttons in the interface which are:

First button: Back – Allow user to go back the previous interface.

Second button: “>” – Navigate user to next page of Instruction interface.



Figure 5-3-F3 Instruction Interface (Leap Motion)

Figure 5-3-F3 shown the project Instruction interface of all the in game keys control of Leap Motion. There are two buttons in the interface which are:

First button: "<" – Navigate user to previous page of Instruction interface.

Second button: Back – Allow user to go back the previous interface.

5.3.3 Option Interface



Figure 5-3-F4 Option Interface (Keyboard & Mouse input chosen)



Figure 5-3-F5 Option Interface (Leap Motion input chosen)

Option interface shown above as Figure 5-3-F4. The interface contains of 6 buttons which three of them under Resolution option, two of them under Input Method option and last one allow user to go back main menu.

First part (Resolution option): User is allow to choose the game resolution with given option which are 640x480, 1280x720 and 1920x1080.

Second part (Input Method): User is allow to choose the game input method between keyboard and mouse or Leap Motion. Figure 5-3-F4 shown keyboard and mouse input chosen while Figure 5-3-F5 shown Leap Motion input chosen.

Third part: Back to Menu – Navigate user back to main menu.

5.3.4 Starting Story Interface



Figure 5-3-F6 Starting story 1

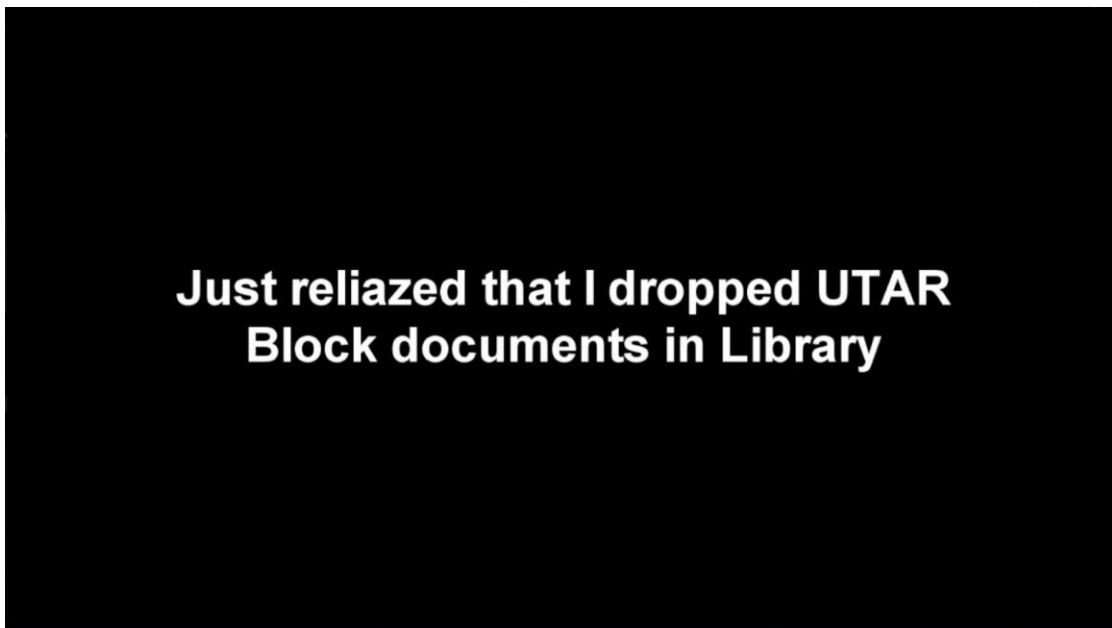


Figure 5-3-F7 Starting story 2

Figure 5-3-F6 and Figure 5-3-F7 shown the starting story that will play for user after user clicks Start Game button at Main Menu interface that mentioned above. This will help user to understand the flow of the game before playing.

5.3.5 Gameplay Interface

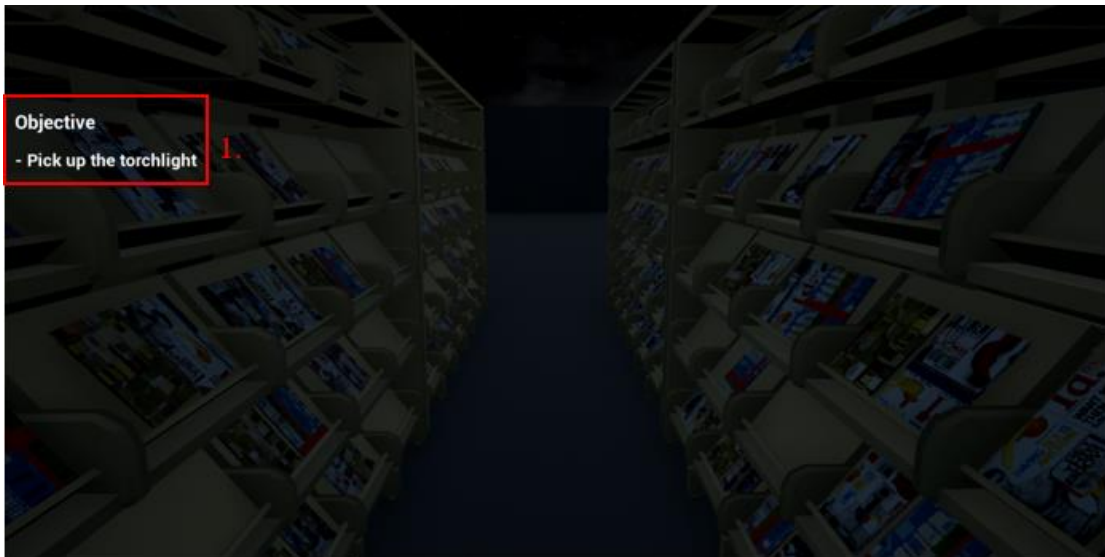


Figure 5-3-F8 Gameplay Interface with objective

Figure 5-3-F8 above shown the main gameplay interface after starting story finish. There will be an objective shown on the left side on the interface in order to let user know what is currently objective and how to complete the game. Every time user finish the current objective, the list will auto change to next objective.

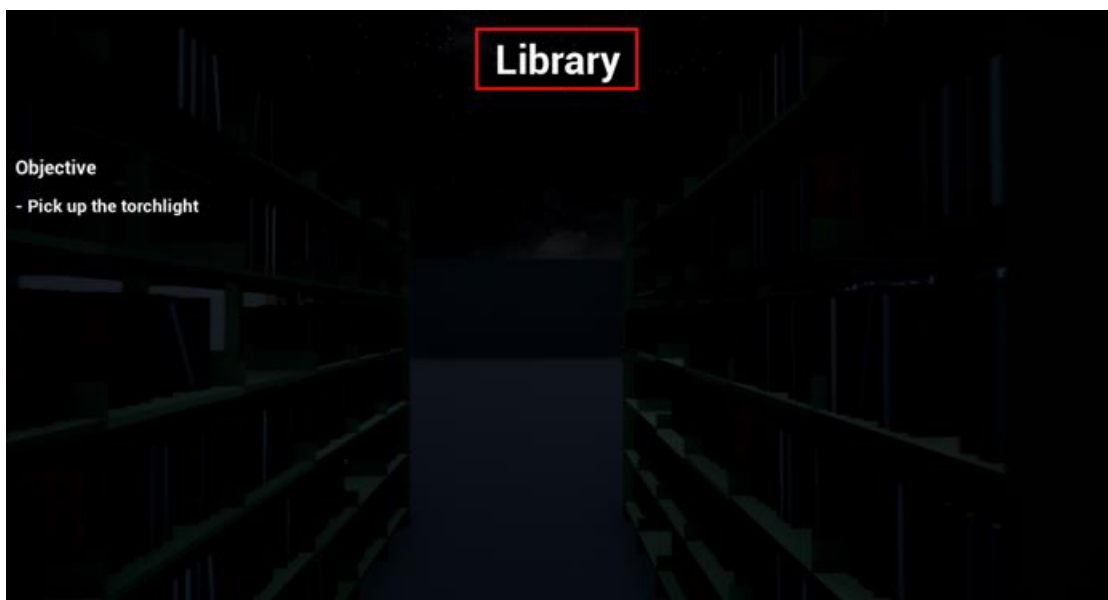


Figure 5-3-F9 Gameplay Interface with location name

Whenever user reach certain area of the virtual tour game, it will show the location name on top centre of the interface as shown in Figure 5-3-F9.

Chapter 5: Implementation and Testing



Figure 5-3-F10 Quest item with outline

Figure 5-3-F10 above shown the model with outline, it was the quest item that can pick up by the user to complete the objective. The outline will only show when user reach the certain range from the quest item.

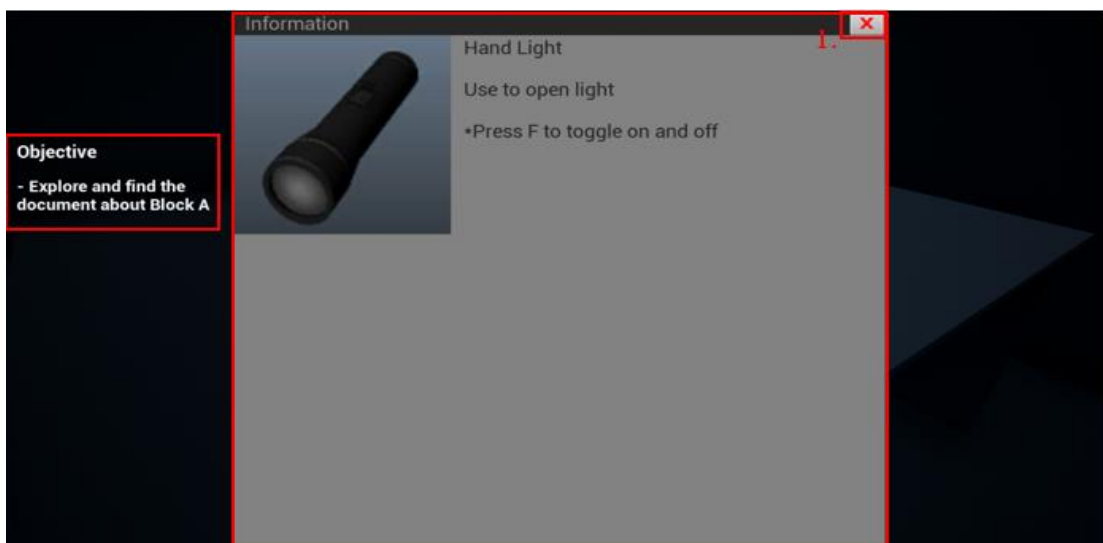


Figure 5-3-F11 Quest item information shown

After pick up the quest item, an information about the quest item will automatically show to user. Besides that, the objective will also change to next objective as mentioned above. There is a button on top right side of the information menu that allow user to close the information menu. Refer to Figure 5-3-F11 for the quest item information shown interface.

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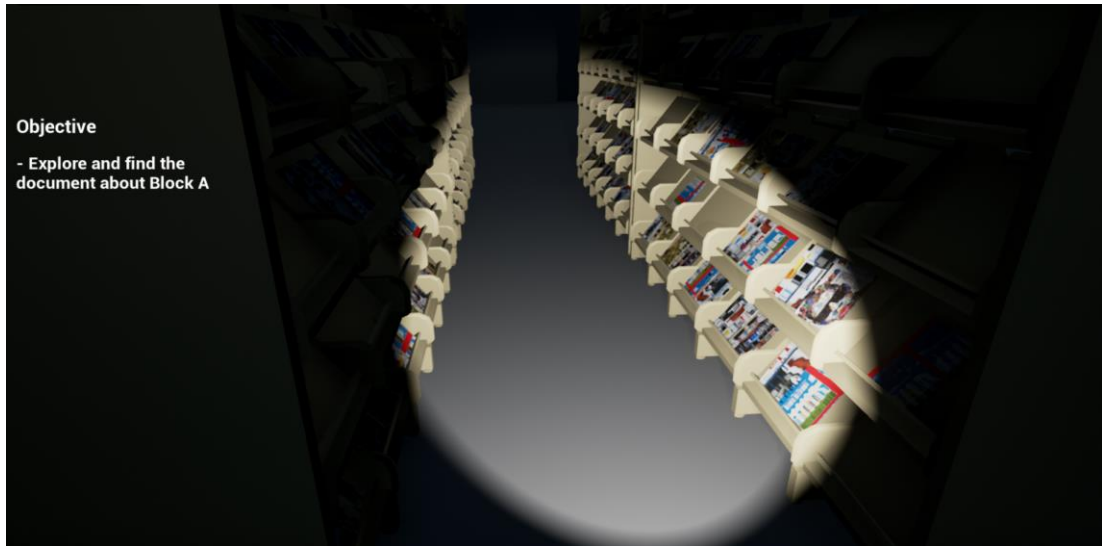


Figure 5-3-F12 Torchlight effect in gameplay

After user get the torchlight, user is allow to toggle the torchlight by pressing “F” key or swipe left hand palm to right or left with Leap Motion device. Figure 5-3-F12 above shown the torchlight effect in gameplay.



Figure 5-3-F13 Inventory menu

User allow to press “I” or swipe left hand palm up with Leap Motion device to open up the inventory menu. The inventory slot contains every quest item image that had been collected by the user. Every inventory slot that contains item are clickable to open action menu. The interface of inventory menu shown in Figure 5-3-F13.

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Figure 5-3-F14 Hover on quest item in inventory

Figure 5-3-F14 above shown colour change on the inventory slot whenever user hover mouse on the item.



Figure 5-3-F15 Action menu

An action menu will be show up whenever user click on the inventory slot that contains item which shown in Figure 5-3-F15. There are two function in action menu which are Details and Cancel. Inventory menu will be disable whenever action menu shown.

First button: Details – Allow user to read the item information again

Second Button: Cancel – Cancel action menu and navigate user back to inventory menu

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Figure 5-3-F16 Door in gameplay



Figure 5-3-F17 Open door in gameplay

Figure 5-3-F16 above shown one of the door in the gameplay. In the virtual tour game, there are doors that able to open by interact from user control. Figure 5-3-F17 shown the door opened when user interacted with it.

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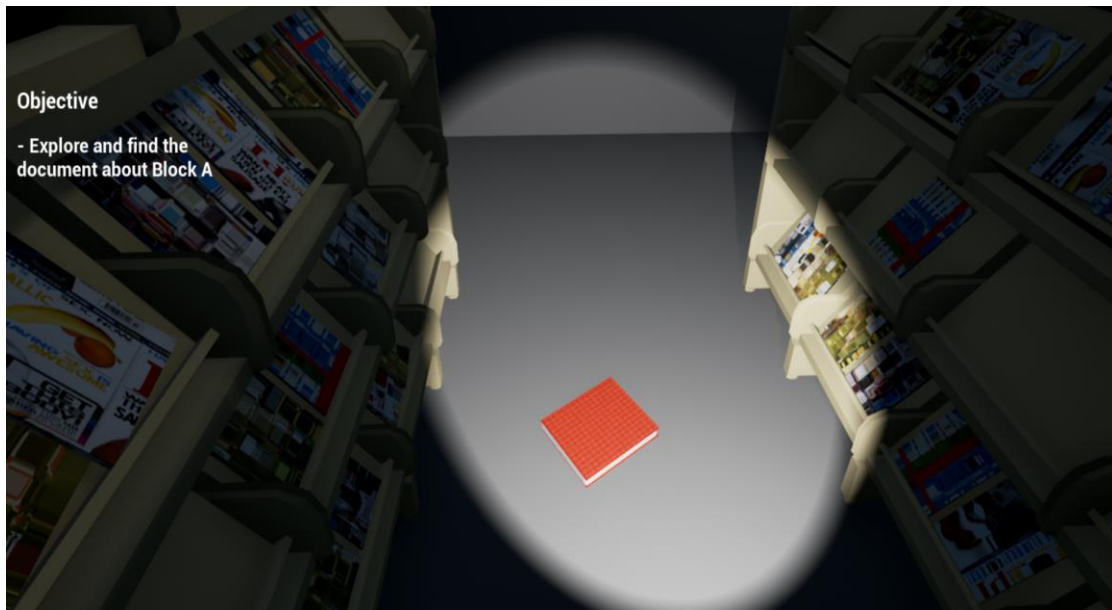


Figure 5-3-F18 Event triggered in gameplay

There are quite numbers of event implemented in virtual tour game. User will trigger them while exploring the virtual library and collecting quest item. The event will enhance the overall gameplay of the project. One of the event triggered in gameplay shown in Figure 5-3-F18.

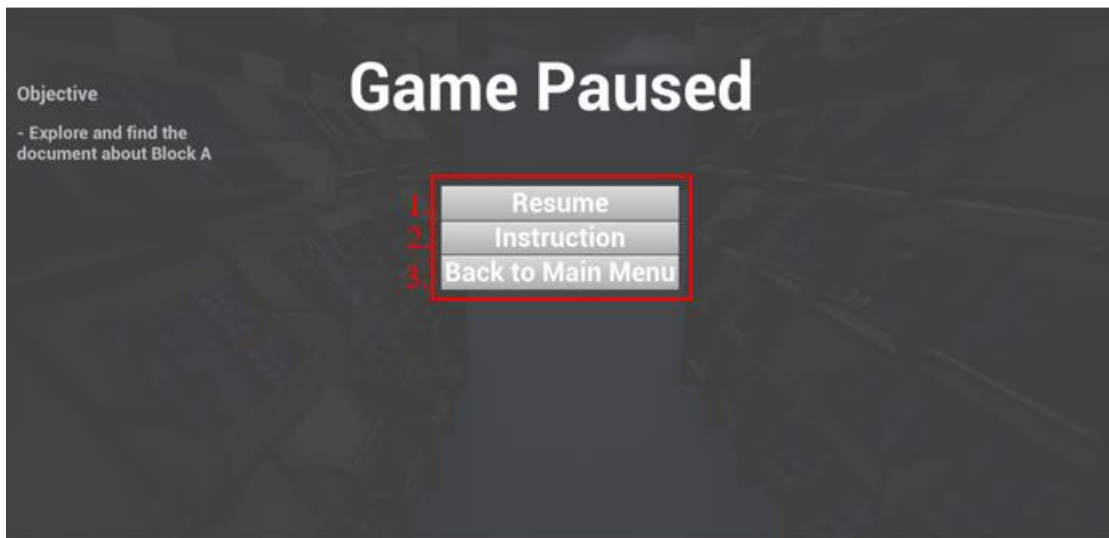


Figure 5-3-F19 Pause menu

Figure 5-3-F19 above shown the pause menu of the gameplay. There will be three option to let user choose in pause menu.

First button: Resume – Un-pause and continue the game

Second button: Instruction – Allow user to open the instruction menu again

Third button: Back to Main Menu – Allow user to quit the game and back to main menu



Figure 5-3-F20 Ending Story

Figure 5-3-F20 above shown the ending story after user complete the gameplay by collecting all the quest item and exit library.

Chapter 5: Implementation and Testing

5.4 Testing

5.4.1 Main Menu

Table 5-4-T1 Main menu testing result

No	Event	Expected Result	Result
1	Main menu start initially	Background music start playing	Pass
2	User hover the mouse over the buttons	Button background colour will change to light green	Pass
3	User clicks on the first (Start Game) button	Navigate to gameplay (Normal input or Leap Motion) based on option chosen by user	Pass
4	User clicks on the second (Instruction) button	Navigate to instruction menu	Pass
5	User clicks on the third (Option) button	Navigate to option menu	Pass
6	User clicks on the forth (Quit Game) button	Close the system	Pass

5.4.2 Instruction Menu

Table 5-4-T2 Instruction menu testing result

No	Event	Expected Result	Result
1	User clicks on the first (Back) button	Navigate to previous menu	Pass
2	User clicks on the second (>) button	Navigate to next page	Pass
3	User clicks on the second (<) button	Navigate to previous page	Pass

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5.4.3 Option Menu

Table 5-4-T3 Option menu testing result

No	Event	Expected Result	Result
1	Option menu open initially	Either Keyboard & Mouse or Leap Motion input must be in light green colour	Pass
2	User hover the mouse over the buttons under Resolution part	Button background colour will change to light green	Pass
3	User clicks on the first (640x480) button	Change the gameplay screen resolution to 640x480	Pass
4	User clicks on the second (1280x720) button	Change the gameplay screen resolution to 1280x720	Pass
5	User clicks on the third (1920x1080) button	Change the gameplay screen resolution to 1920x1080	Pass
6	User clicks on the forth (Back to Menu) button	Navigate to main menu	Pass
7	User clicks on the fifth (Keyboard & Mouse) button	Button background colour change to light green and set gameplay to normal input	Pass
8	User clicks on the sixth (Leap Motion) button	Button background colour change to light green and set gameplay to Leap Motion	Pass

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5.4.4 Normal Gameplay Main Input

Table 5-4-T4 Normal gameplay main input testing result

No	Event	Expected Result	Result
1	Gameplay start initially	Starting story video will play	Pass
2	After starting story stop playing	The gameplay camera will starting fade in	Pass
3	When camera starting to fade in	Game objective will show on the left side interface	Pass
4	User attempt to play game while camera fading in	Nothing will happen, user are not allow to play game while camera fading in	Pass
5	User attempt to play game after camera finish fade in	User must be able to play game without any function stop working	Pass
6	User move the mouse to any direction	Move the camera follow by the mouse direction	Pass
7	User left clicks	To open door and pick up quest item	Pass
8	User press “W” key	Character walk forward	Pass
9	User press “A” key	Character walk left	Pass
10	User press “S” key	Character walk backward	Pass
11	User press “D” key	Character walk right	Pass
12	User pressing “Shift” key together with either the “W”, “A”, “S” or “D” key	Character running follow by the key direction	Pass
13	User press “F” key	Character toggle the torchlight status	Pass
14	User attempt to press “F” key before getting torchlight	Nothing will happen, user are not able to toggle the light source without getting torchlight	Pass
15	User press “I” key	Open the inventory menu	Pass
16	User press “P” key	Navigate to pause menu	Pass

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17	User walk through “Trigger Box”	Begin certain event at the specific location	Pass
18	User attempt to play game using Leap Motion	Nothing will happen, currently in normal input gameplay mode	Pass

5.4.5 Normal Gameplay Pause Menu

Table 5-4-T5 Normal gameplay pause menu testing result

No	Event	Expected Result	Result
1	User attempt to play game while pausing	Nothing will happen, the game is paused	Pass
2	User clicks on the first (Resume) button	User are able to continue play the game again	Pass
3	User clicks on the second (Instruction) button	Navigate to instruction menu	Pass
4	User clicks on the third (Back to Main Menu) button	Navigate to main menu	Pass

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5.4.6 Normal Gameplay Inventory Menu

Table 5-4-T6 Normal gameplay inventory menu testing result

No	Event	Expected Result	Result
1	User press "I" key	Close everything in the inventory menu	Pass
2	User hover the mouse over the inventory slot that contain item	Inventory slot background colour change to light green	Pass
3	User attempt to hover the mouse over the inventory slot without item	Nothing will happen, inventory slot background colour only change when contains item	Pass
4	User clicks on the inventory slot	Action menu will be shown to user with two option: Details and Cancel	Pass
5	User attempt to clicks on the inventory slot without item	Nothing will happen, user must only able to click the slot contain with item	Pass
6	After pick up any quest item	Inventory menu will update the inventory slot with quest item image	Pass

5.4.7 Normal Gameplay Action Menu

Table 5-4-T7 Normal gameplay action menu testing result

No	Event	Expected Result	Result
1	User attempt to click anywhere on screen	Nothing happen, user are only able to click on action menu	Pass
2	User hover the mouse over the buttons	Buttons background colour change to light green	Pass
3	User clicks on the first (Details) button	Navigate to information menu	Pass
4	User clicks on the second (Cancel) button	Close the action menu	Pass

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5.4.8 Normal Gameplay Information Menu

Table 5-4-T8 Normal gameplay information menu testing result

No	Event	Expected Result	Result
1	User press “I” key	Close information menu and inventory menu together	Pass
2	User clicks on the “X” button on top right	Close information menu and back to inventory menu	Pass
3	After user clicks on Details button in Action Menu	Showing the item image and details on the information menu	Pass
4	Correctness test: Clicks on Block A quest item	Output: Block A image and details shown on the information menu	Pass

5.4.9 Leap Motion Gameplay Main Input

Table 5-4-T9 Leap Motion gameplay main input testing result

No	Event	Expected Result	Result
1	Gameplay start initially	Starting story video will play	Pass
2	After starting story stop playing	The gameplay camera will starting fade in	Pass
3	When camera starting to fade in	Game objective will show on the left side interface	Pass
4	User attempt to play game while camera fading in	Nothing will happen, user are not allow to play game while camera fading in	Pass
5	User attempt to play game after camera finish fade in	User must be able to play game without any function stop working	Pass
6	User move the right hand palm to any direction	Move the camera follow by right hand palm finger pointed direction	Pass

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7	User grab with right hand palm	To open door and pick up quest item	Pass
8	User pinch with left hand finger	Character walk forward	Pass
9	User grabbing with left hand palm	Character running forward	Pass
10	User swipe to left with left hand palm	Character turn on the torchlight	Pass
11	User swipe to right with left hand palm	Character turn off the torchlight	Pass
12	User attempt to swipe left or right with left hand palm before getting torchlight	Nothing will happen, user are not able to toggle the torchlight before getting it	Pass
13	User swipe up with left hand palm	Open the inventory menu	Pass
14	User swipe down with left hand palm	Close the inventory menu	Pass
16	User swipe up with right hand palm	Navigate to pause menu	Pass
17	User walk through “Trigger Box”	Begin certain event at the specific location	Pass
18	User attempt to play game using keyboard and mouse	Nothing will happen, currently in Leap Motion gameplay mode	Pass

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5.4.10 Leap Motion Gameplay Pause Menu

Table 5-4-T10 Leap Motion gameplay pause menu testing result

No	Event	Expected Result	Result
1	User attempt to play game while pausing	Nothing will happen, the game is paused	Pass
2	User swipe down or up with right hand palm	Button background will change to light green to acknowledge user which button had been chosen	Pass
3	User grab with right hand palm on "Resume" button	User are able to continue play the game again	Pass
4	User grab with right hand palm on "Instruction" button	Navigate to instruction menu	Pass
5	User grab with right hand palm on "Back to Main Menu" button	Navigate to main menu	Pass

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5.4.11 Leap Motion Gameplay Inventory Menu

Table 5-4-T11 Leap Motion gameplay inventory menu testing result

No	Event	Expected Result	Result
1	User swipe to right or left with right hand palm	Inventory slot background colour change to light green to acknowledge user which one had been chosen	Pass
2	User attempt to swipe to right with right hand palm whenever there is no item on next inventory slot	Nothing will happen, it will remain at current inventory slot	Pass
3	User grab with right hand palm	Action menu will be shown to user with two options: Details and Cancel	Pass
4	After pick up any quest item	Inventory menu will update the inventory slot with quest item image	Pass

5.4.12 Leap Motion Gameplay Action Menu

Table 5-4-T12 Leap Motion gameplay action menu testing result

No	Event	Expected Result	Result
1	User swipe down or up with right hand palm	Button background will change to light green to acknowledge user which button had been chosen	Pass
2	User grab with right hand palm on "Details" button	Navigate to information menu	Pass
3	User grab with right hand palm on "Cancel" button	Close the action menu	Pass

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5.4.13 Leap Motion Gameplay Information Menu

Table 5-4-T13 Leap Motion gameplay information menu testing result

No	Event	Expected Result	Result
1	User grab with right hand palm	Close information menu and back to inventory menu	Pass
2	After navigated from Action Menu	Showing the item image and details on the information menu	Pass
3	Correctness test: Clicks on Block A quest item	Output: Block A image and details shown on the information menu	Pass

Chapter 6: Conclusion

6.1 Conclusion

As a conclusion, the project will enable users to enjoy and understand the location through gameplay that integrated within virtual tour system. The existing virtual tour system nowadays are lack of attractiveness, lack of location information provided and most of them are image based which only allow users to have a look but not virtually explore.

By using this project, users can have fun and get the information while virtually explore the location through the gameplay. Besides that, the game element would enhance the attractiveness of the virtual tour system that can raise the awareness of the system. In addition, game element in virtual tour system could enrich the user experiences rather than a dull look in the image based system.

Lastly, the project will benefits the users and also the location as it will increase the popularity of the location and recognized by more people; users can virtually explore and find out the location more clearly at anywhere and anytime.

6.2 Discussion

As stated in chapter, the motivation behind this project is to innovate the virtual tour system that provide different experience and raise awareness of the user. According to the complete system, it provide constant interactivity between user and the system. Besides that, the elements in system such as audio, graphics, information and animation that can enhance the gameplay experience of user. Moreover, integrate the Leap Motion into system input are effectively increase the attractiveness of the system. Thus, this project have successfully meet its original objectives and is progressing towards in a good direction.

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6.3 Problem Faced

Several problems was faced during the entire process of developing process. Firstly, one of the major problem that is modelling everything of the UTAR library. It cause huge amount of time spend on visit UTAR library to record everything like chair, table, book rack, whole building architecture and etc. The second problem would be import the textured model into Unreal Engine 4. The whole model become black colour due to the light map UV problem of the model. At last, found a tutorial that teach to solve the light map UV problem which required to restructure all model and the mesh. The last problem is lack of information about integrating Leap Motion and Unreal Engine. Thus, need to spend a lot of time on research Leap Motion functions and link to Unreal Engine blueprint.

6.4 Future Work

This project can be further develop in virtual reality device to improve the reality of the location and enhance the users virtually explore experience. Besides that, different type of game element can be integrated to the virtual tour system as long as it's suitable. This can increase the attractiveness of the virtual tour system. Moreover, the project can be also developed in the mobile application as the mobile technology is a trend nowadays. Besides that, the maturity of mobile technology also allows users to develop the project more convenient and easy.

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