

Cheng Hoon Teng Temple Virtual Tourism Application

By

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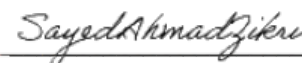
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ABSTRACT

This project is a Virtual Tourism Application Using AR for Tourist Attraction. This project involves in the field of Computer Science and Augmented Reality (AR). After Covid-19 Pandemic, the tourism industry in Malaysia has been affected since public are preferred to stay at home rather than travelling outside to decrease the risk of Covid-19 infection. Although Malaysia is a small country, but the geographic limitation between each state still occurred. Besides, most of the people nowadays have fulfil their life with work and sometimes they want to travel outside alone in order to enjoy their personal space but they feel afraid because do not have any past experiences. Most of the problem mentioned above can be solved through our application. The methodology used in this project is ADDIE Model (Analysis, Design, Development, Implementation, Evaluation) and discovery approach. Unity and Blender will be used as the software required for this project to build the 3D Model and combine those models to give users an impressive virtual travelling experience. Extensive research has been done in the literature review part in order to let developers know about the strength and weakness of each existing application. So that developers can based on this information to build a virtual tourism application which can help users to solve their recent facing problems from the existing application. As a result, the virtual tourism app successfully combines AR technology with tourism industry and it has demonstrated the feasibility of leveraging AR for transforming traditional tourism. Furthermore, the author also allows users to provide feedback to them for continuous improvement in the future. In conclusion, this project has shown the potential of cooperation between AR technology and traditional tourism which can bring different and unique travel experiences to users.

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LIST OF ABBREVIATIONS

<i>AR</i>	Augmented Reality
<i>VR</i>	Virtual Reality
<i>IOS</i>	iPhone Operating System
<i>3D</i>	Three-dimensional
<i>2D</i>	Two-dimensional
<i>APK</i>	Android Package
<i>UI</i>	User Interface
<i>IPA</i>	iOS AppStore Package
<i>NPC</i>	Non Player Character

CHAPTER 1

Project Background

1.1 Introduction

Nowadays, most of the people are emphasis on work-life balance. Different people will have different ways to achieve their balance. For example, some of them will select travelling to different tourist attractions to enjoy the beautiful view of different places in order to help them release their work-related stress. In order to have a good travelling experience, they need to do a good survey and preparation before travel to those tourist attractions.

There are many existence ways to get the information about those tourist attractions like through online travel websites (TripAdvisor, Lonely Planet, and Yelp) which can provide reviews, ratings and more specific information include operating hours, ticket prices, and special events for the travellers. Besides, travellers also can get the information through the social media like Facebook, Instagram, XiaoHongShu and others to know about their friends and other users feedback and recommendation about those tourist attractions. Moreover, travellers can also read the books, magazines or lectures located at the educational institutions and libraries to know about the history and significance of tourist attractions.

Although there is a lot of ways for travellers to obtain those tourist attractions information, but most of methods above will present the information in words and picture format which make travellers can't feel about the reality of that tourist attraction. Furthermore, travellers also not available to make deeper interaction with the tourist attraction like walking inside that place by using Virtual Reality Technology (VR) or Augmented Reality Technology (AR) which can help them feel more interesting and easier to explore different places.

The purpose of this project is to give a better virtual tourism experience for the travellers by using Augmented Reality Technology.

In this application, it doesn't have specific rules that needed to be followed. Travellers can feel free to explore the tourist attraction with whatever area they want to visit first without any limitations and make interaction with them. As a result, travellers can have a basic knowledge towards that tourist attraction and evaluate either that tourist attraction can fulfil their expectations or not.

1.2 Problem Statement and Motivation

COVID-19 Pandemic Influence

Malaysia has implemented a Movement Control Order (MCO) since March 18, 2020 and ended on January 3, 2022. This MCO has caused a huge impact towards economic of Malaysia especially for the tourism sector since the travel lover afraid of COVID-19 infection and decided to stay at home rather than travelling outside. [1] Nowadays, even though government has announced to end MCO and most of the public has finished second dose of vaccine, but some of them still select to stay at home instead of travel outside to decrease the possibility of COVID-19 infection. This phenomenon has caused them unavailable to release their working stress. By the implementation of AR, it can help those travelers can travel outside virtually by not step out from home.

Geographical limitation

Although Malaysia is a peaceful and small country but there still have some geographical limitation between each state. For example, citizens in Johor want to visit tourist attractions in Penang need to travel at least 600KM and citizens in west Malaysia want to visit tourist attractions located at east Malaysia need to pass through South China Sea. If the travelers only get the information about the tourist attraction through online, they might not able to fully assess either that place can fulfil their expectations or not. By the implementation of AR technology, it can give a basic understanding about the tourist attraction for the travelers by providing them a virtual environment with the combination of some related information like history, significance place etc.

Traveler feels confused when travelling alone.

Sometimes, travelers who like backpack travel alone might feel confused during their trip because they do not know where the most famous travel sight in that travel attraction is. For example, when travelling to Melaka, we known that the most significant sight is A’Famosa and the Stadthuys. By implementing AR technology, it can help to improve travelers’ communication and collaboration by including some useful features like AR avatars or virtual tourist guide which can provide some assistances for the travelers like suggesting them the activities that must be done in that tourism attraction, answering some common questions etc. which can give a better travel experience for the travelers.[2]

1.3 Target Audience

The target audience for this project is travel enthusiasts which are the individuals who have a strong passion to explore new tourist attractions. Those travel enthusiasts who could face some constraints like health, times or budget which caused them unable to physically travel can also achieve their goal through this application. The AR technology will be applied to present the views of the tourist attractions for those travel enthusiasts to help them still can desire a rich and immersive travel experience without step out from the comfort of their home and spending any money. Besides, our project also provided a novelty travelling method which is virtually travelling for the travel enthusiasts to help them making survey on those tourist attractions before visit to those places physically. AR supporting in virtual tourism are not so popular in Malaysia, so the author would like to develop a brand-new virtual tourism application in order to help travelers have better travel experience in travelling. With the help of interactive augmented reality aided, the author can present the view or scene at the tourist attraction, so travelers can visualize the view before making travelling decision.

1.4 Project Objective

To study the usage of augmented reality technologies in virtual tourism software development.

Augmented reality (AR) is a technology that used to give a better experience for the users by combining the object in real-world environment and object in virtual-world environment and it is done by computer-generated information. Generally, it will across multiple sensory modalities like visual, auditory, haptic, somatosensory, and olfactory. Undoubtedly, travelling is a good way for people to release their stress. But, in order to lower the risk of making wrong decision, users can walk through the tourist attraction virtually first before decided travelling to there. So, lets included AR module into the tourism to help user get a better experience and more chances to make a true decision for their travelling.

To develops an AR based software for Tourism Attraction (Cheng Hong Teng Temple).

Most of the new generation nowadays willing to spend their free time travel to tourism attraction which is more modern like Legoland, Universal Studio, Pulau Langkawi and etc compared to historical tourism attraction. It is because they feel

boring when travelling to tourism attractions which contain only traditional and historical elements like Cheng Hong Teng Temple. If these historical tourism attractions cannot inherit to next generation, it will be bad influence for us. By implementing Augmented Reality (AR) technology, we can try to make these places become more attractive and fun towards young generation through the interaction between real-world object and virtual-world objects.

To evaluate the effectiveness the AR based software can support the user for virtual tourism.

Nowadays, people preferred to stay at home rather than travel outside especially after Covid-19 pandemic. If the tourist attractions can be presented on electronic product, then most of the users can walk through them at their comfort from home without stepping out by using their mobile phone or computer.

1.5 Project Scope

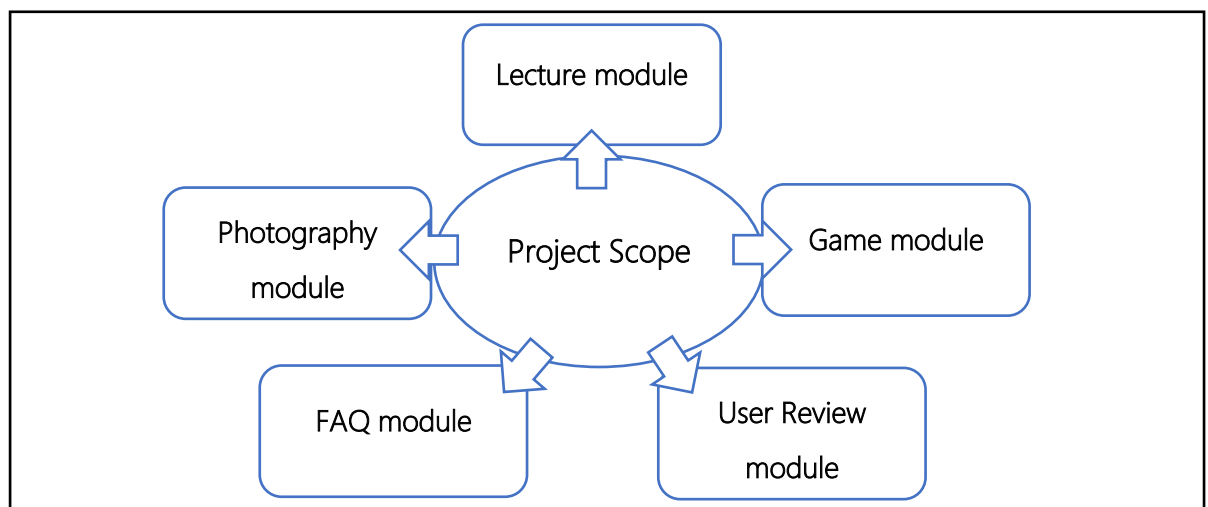


Figure 1.1 five project scope

1.5.1 Lecture Module

Lecture module is a module let users to have a self-learning about the history of the tourism attraction. In this module, it will present the information in different ways like text, picture, audio, video, and animation to help users easier to have a basic understanding about the history of the tourist attraction. This module will mainly design like a plug-in feature which will be popped out when users select them. This module also includes AR technology to show different 3D model of the building, so that users can feel more realistic during their tours.

1.5.2 Game Module

In this module, 3D modelling technology will be used to present the building and scene of tourism attractions. For example, it will build a 3D model of Malacca Cheng Hong Teng temple and users can walkthrough it through the model. Besides, it will also add some features like timeline features which can allow users to select the timeline to know about the changes of Cheng Hong Teng along the time.

1.5.3 User Review Module

In this module, it will provide a platform for users to upload their feedback about the travel experience for this tourism attraction. Besides, it will also look like a social platform. Communication between user and user can also be established through this module. User can comment and reply on each other's review. Users who already walkthrough the AR module and wanted to know about other users' feedback or review about this tourism attraction for further survey assessment to help them making decisions can come through this module.

1.5.4 FAQ Module

In this module, it will prepare some frequently ask questions (FAQ) for users to know more about Cheng Hoon Teng temple. These questions and answers will be set up based on various aspects such as the history, management, architecture, rituals, and cultural influence of Cheng Hoon Teng temple.

1.5.5 Photography Module

In this module, it will provide some photos about the scene or building of the tourism attraction. From these photos, users can get a more realistic view compared to 3D model. It is because sometimes the developers do not have the ability to restore the scene or building as well as originally. Users can also upload photos captured by them inside this module to let other users admire.

1.6 Impact, Significance and contribution

The Cheng Hoon Teng Temple Virtual Tourism Application could completely transform how people engage with and comprehend historical sites. The project breaks down geographical barriers by offering a digital platform for immersive exploration of the Cheng Hoon Teng temple, enabling people all around the world to appreciate the beauty and historical value of this location. This initiative not only promotes the harmony and tolerance between cultures but also encourage cultural awareness and appreciation.

This initiative aims to solve the issue of cultural sites being inaccessible to people who lack the resources or chance to visit them in person. This gap is filled by the Cheng Hoon Teng Temple Virtual Tourism Application, which provides an interesting and instructive virtual tour. From the comfort of their own homes, users may learn more about the temple's history, architecture, and cultural significance through different module provided in this project such as the game module, lecture module, AR Module etc.

The users should invest their time in this project because it provides a rare chance to see and discover one of Malaysia's most famous cultural sites. Users can extend their cultural perspectives, develop a deeper respect for variety, and help preserve historical sites for future generations by visiting the Cheng Hoon Teng temple via this cutting-edge virtual platform. Since the goal of this project is to advance cross-cultural dialogue and understanding, anyone looking for meaningful and rewarding experiences will find it to be both significant and highly desirable.

1.7 Background Information

An inventive combination of technology, tourism, and cultural heritage preservation can be found in the Cheng Hoon Teng Temple Virtual Tourism Application. Digital humanities, cultural studies, tourism management, and augmented reality (AR) technologies are some of the topics that this project intersects. Understanding the background and evolution of these overlapping disciplines is crucial to comprehending the significance and ramifications of this endeavour.

The area of digital humanities initially existence during the latter half of the 20th century because of advances in computing technology and an increasing desire to use computational approaches in humanities research. It includes a broad range of tasks, such as producing interactive instructional materials, digitizing cultural relics, and building digital archives. Scholars in the digital humanities aim to use technology to promote and ease the study of literature, history, cultural heritage, and other humanities subjects.

The long-standing effort of cultural heritage preservation derives from the understanding of how vital it is to protect and promote the world's rich cultural heritage for future generations. Cultural locations and artifacts are physically conserved, documented, and interpreted as part of traditional preservation efforts. Digital technologies, on the other hand, have completely changed the area by providing new methods and tools for virtual conservation and distribution. In order to ensure the long-term preservation of cultural heritage locations, objects, and records, efforts pertaining to digital preservation seek to digitize and produce digital replicas of these materials. This allows for their accessibility to a worldwide audience.

Through the addition of digital overlays and interactive components, augmented reality (AR) technology has become more and more popular in recent years as an effective tool for improving real-world experiences. Augmented Reality (AR) combines virtual content with the user's perspective of the actual world, making it harder to distinguish between the real world and physical world. Applications for AR technology can be found in a variety of sectors, including marketing, education, gaming, and tourism. Augmented Reality (AR) enhances users' comprehension and engagement with the subject matter by allowing them to experience historical sites and cultural landmarks in a more immersive and interactive way within the context of virtual tourism.

It is crucial for readers who are not familiar with these areas to understand historical developments and fundamental ideas in order to fully comprehend the importance of the Cheng Hoon Teng Temple Virtual Tourism Application. This project offers a unique way to experience and learn about cultural landmarks which

Chapter1

is Cheng Hoon Teng temple because it represents a fusion of digital humanities approach, cultural heritage preservation goals, and cutting-edge AR technology. In an increasingly interconnected world, this project seeks to promote cultural awareness, preservation, and cross-cultural understanding by utilizing digital tools and immersive experiences.

CHAPTER 2

Literature Review

2.1 Review on Similar Applications

2.1.1 Shrine Melbourne

“Shrine Melbourne” is an interactive and highly user-involvement tour product launched by the Shrine of Remembrance. Users can enjoy different types of panoramic views at different level floor which totally included 43 places like Devanha Boat, World War II Forecourt, Legacy Garden, the Sanctuary, Galleries of Remembrance, etc. through their smartphone, tablet, or computer from the comfort of their house. Besides, this product has captured nearly 1000 different scenic point to let users can visit through the Shrine of Remembrance freely without limitation. In past, users need to queue up for a long time in order to view the exhibition. But for now, users can get a closer look at the exhibition of the Shrine of Remembrance like imagining centaur, between tworlds, defending with pride, lust love loss, for kin and country and toys tales & tenacity through this application by using their cell phone without wasting time to line up. In addition, this product also included an user-friendly features which is known as “tags”. The function of this “tags” is it will embed the specific information to the relatively built 3D model to make user easier to get understanding about the history of that places. [3]



Figure 2.1 screenshot of the Shrine Melbourne

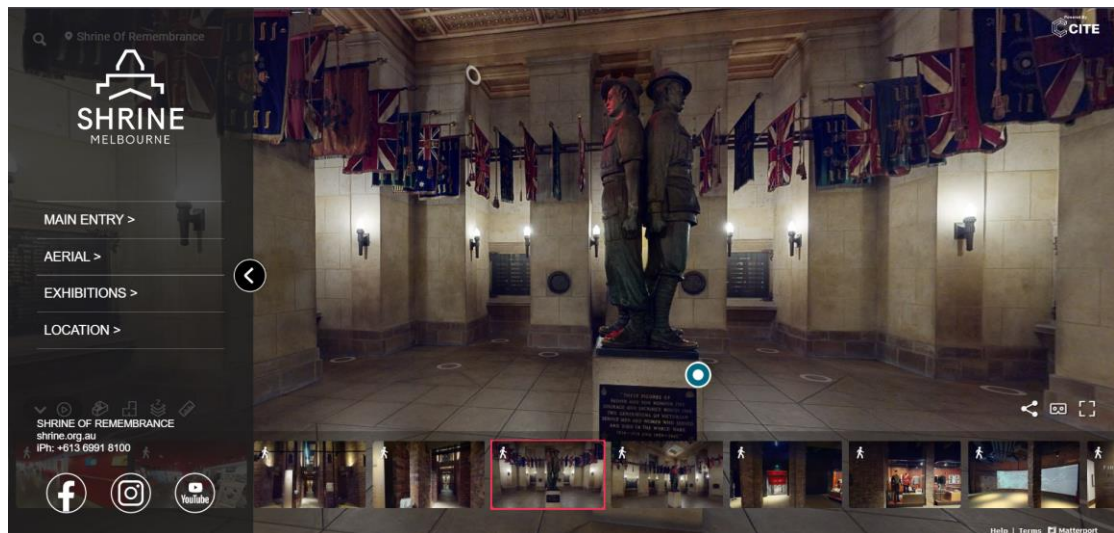


Figure 2.2 screenshot of the Shrine Melbourne

Strength: It has a simple user interface, users easy to get use on it without reading through any tutorial. Besides, it has restored the panoramic view of the Shrine of Remembrance well which can give an overview for the users who are interested to visit Shrine of Remembrance. In addition, it has provided different type of viewing mode like floor plan, dollhouse, or street view for users during their touring sessions. Some algorithms like Image capture, Image Stitching, point-to-point and etc. also have been applied to this application to make it seems more professional and competitive compared to other typical virtual tourism applications. By applying these algorithms, it has also provided more freedom for the users to explore the place. [3]

Weakness: Since the area of Shrine of Remembrance is too large (75 meters high and 40 meters width), so users might not be able to completely visit through the place without any assistance. It is recommended to plug in some features like AR virtual tour guide in order to help users can travel the place more efficiently and give them a basic understanding about the history of the place. [3]

2.1.2 Quan Jing Gu Gong



Figure 2.3 screenshot of the Quan Jing Gu Gong

“Quan Jing Gu Gong” is a virtual tourism application launched by the Gu Gong. Users can visit different inside and outside panoramic view of those 61 palaces like the Palace of Mental Cultivation, Palace of Compassion and Tranquillity, Hall of Martial Valor, Imperial Garden, and every inch of the Gu Gong which are nearly 1,000 scenic point has been captured through their mobile devices or computer without step out from home. In order to give users a better experience, “Quan Jing Gu Gong” also has included the exhibition function which is used to display the products of the 14 palaces in order to give users a better understanding about the history of Gu Gong. For example, ceramics hall in Wenhua Hall, painting and calligraphy hall in Wuying Hall, bronze museum in Chengqian Palace, Ouzhai ink edge - the National Palace Collection Xiaoshan Zhu's special exhibition of inscriptions, the National Palace Museum collection of jasperware and Manas exhibition of the Qing dynasty, etc. “Quan Jing Gu Gong” also embedded picture and text inside many places so that users can know about the history of each place more efficiently. [4]

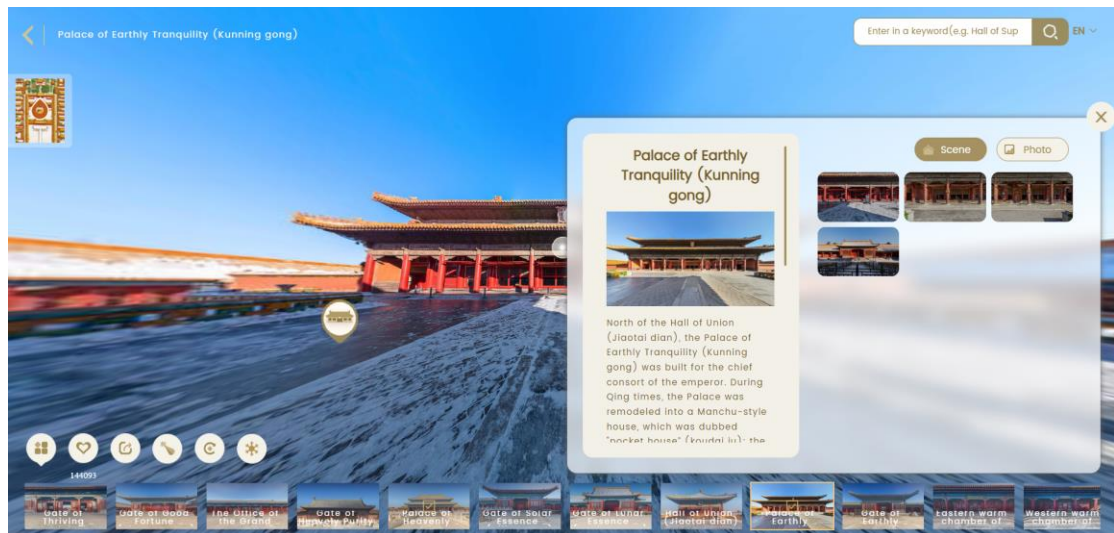


Figure 2.4 screenshot of the Quan Jing Gu Gong



Figure 2.5 screenshot of the Quan Jing Gu Gong

Strength: Although Gu Gong is a China Tourist Attractions, but it still has provided different type of language, so that users can select their preferred language during their touring session in order to help them get a better understanding on the history. Besides, “Quan Jing Gu Gong” also recreate the panoramic view well which can allow users feel they are really stay at Gu Gong. [4]

Weakness: Although users can rotate the page freely but the overall picture does not look 3D and it give users feel like looking at a photo but not in a 3D model of Gu Gong. [4]

CHAPTER 2



Figure 2.6 screenshot of the Quan Jing Gu Gong

2.1.3 CyArk

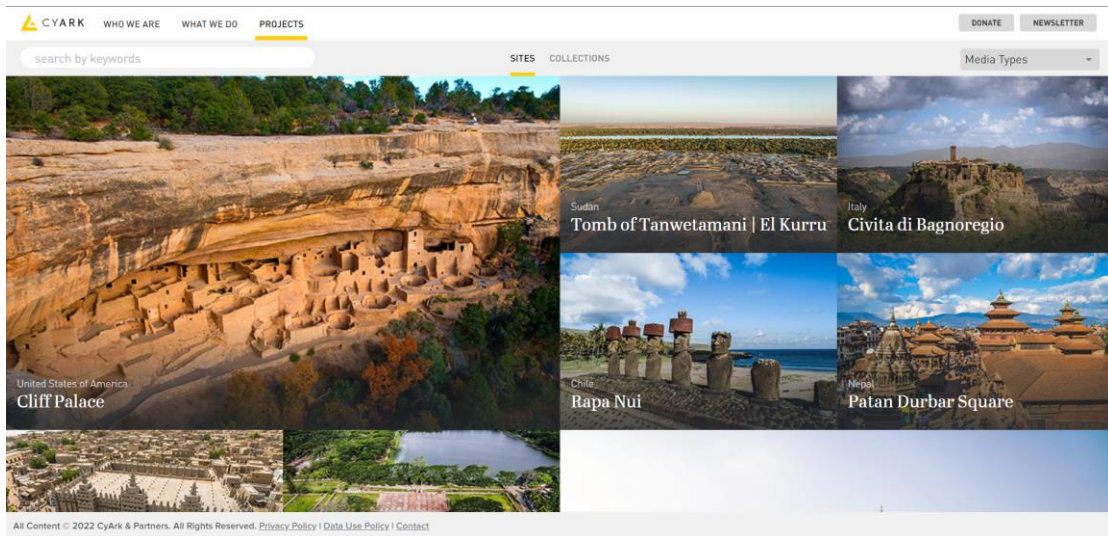


Figure 2.7 screenshot of the CyArk

CyArk (Cyber Archive) is a non-profit organization dedicated to the digital preservation of cultural heritage site around the world and strengthening linkage between each site. It was founded in 2003 and has over 200 sites in more than 40 countries with the cooperation with local partners. CyArk has applied cutting-edge technology like 3D laser scanning, photogrammetry etc. to document, archive, and share the world's most iconic and at-risk heritage site for future generations. The purpose of CyArk is to ensure these heritages and cultural treasures can be preserved well in digital format even though facing the problem of natural disasters or human conflicts and the passage of time. So that our next generation still can visit them in virtually. [5]

CHAPTER 2

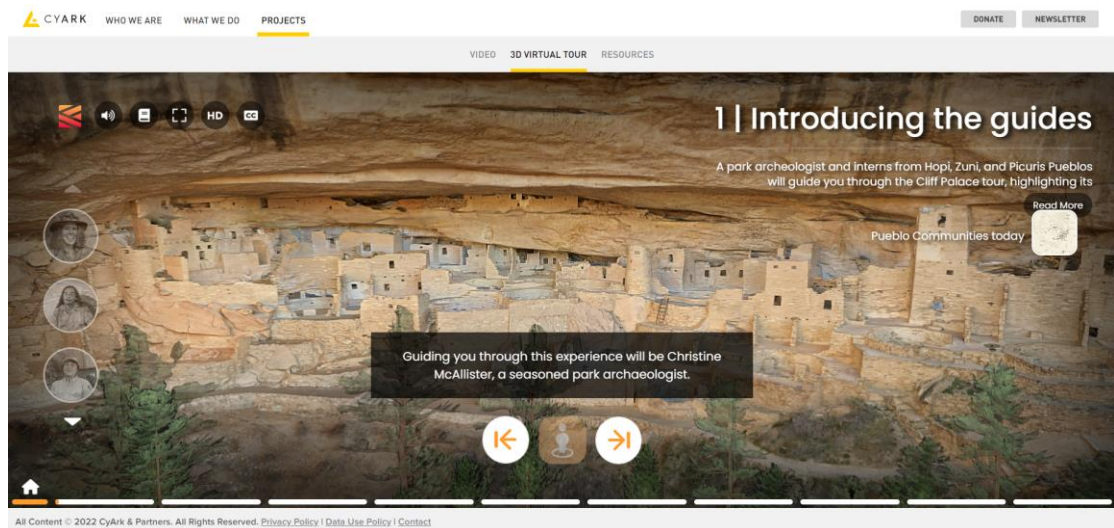


Figure 2.8 screenshot of the CyArk

Strength: CyArk has included many famous buildings and landmarks over the world and provide a highly freedom accessibility for users to travel through those tourist attractions. The 3D modelling technology applied inside CyArk is more advanced compared to others virtual tourism applications which allows users to observe the details of the buildings and landmarks from different angle. Besides, it has also plug in virtual tour guide feature which will guide users from scene to scene in audio format. [5]

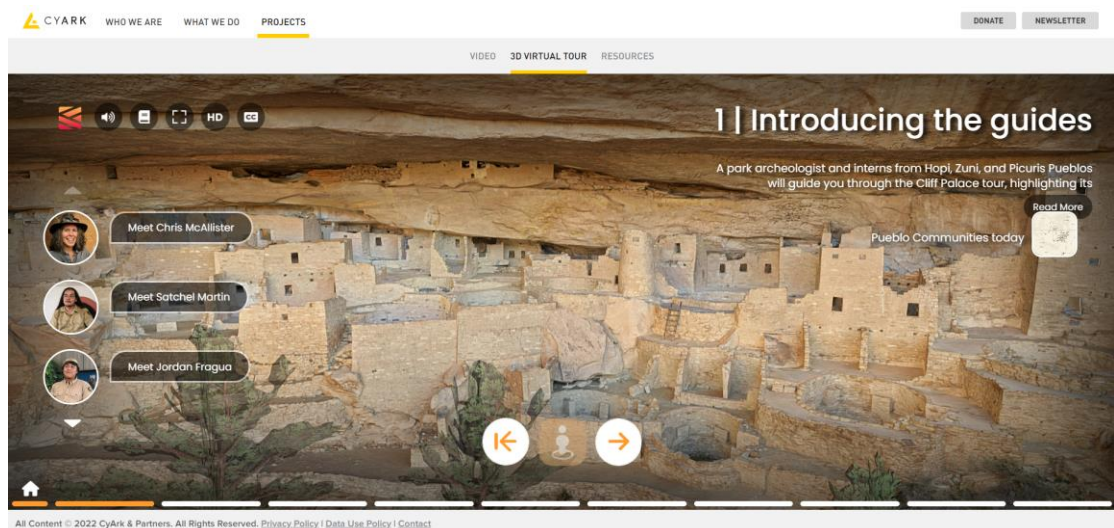


Figure 2.9 screenshot of the CyArk

CHAPTER 2

Weakness: Although users can view the buildings or landmarks from multiple angles, but users cannot walkthrough inside the building or landmarks by their own way like street view since the scene is originally set up by the developer team and users can only view different angle inside the specific scene. This might cause users cannot feel the ambitious of building and landmark when they are integrated with the local area.
[5]

2.1.4 Airpano

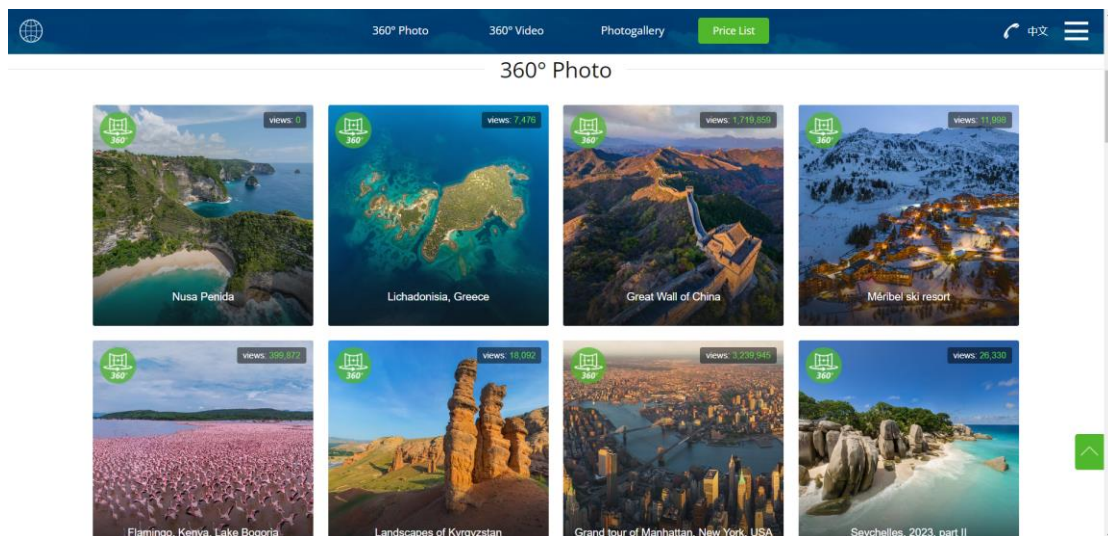


Figure 2.10 screenshot of the AirPano

AirPano is an AR virtual tourism app that allows users to explore different popular tourist attractions in 360-degree panoramic view. AirPano was developed by a group of Russian photographers and enthusiasts who have a strongly passion for aerial and panoramic photography. The mission of Airpano is to provide users an unique and immersive virtual tourist experience without step out from home. [6]

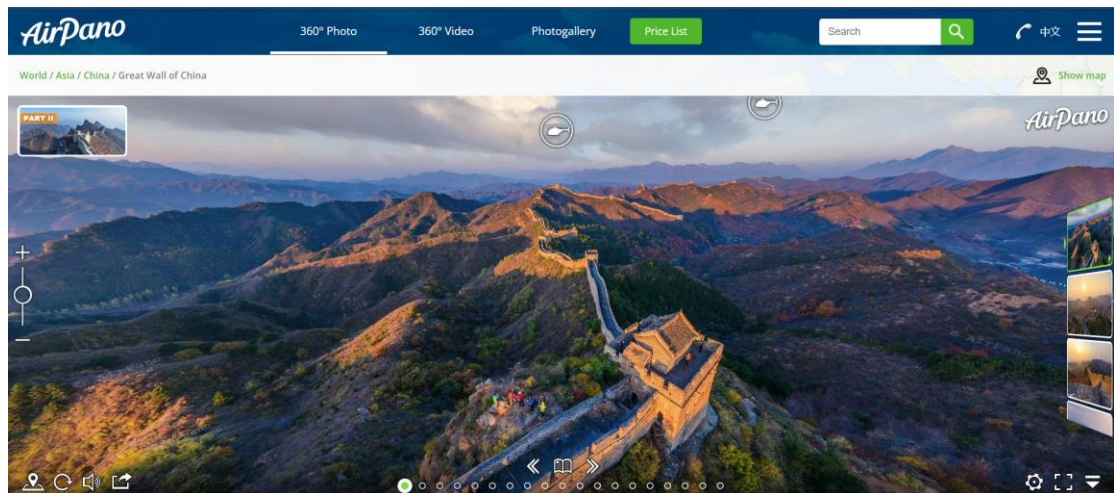


Figure 2.11 screenshot of the AirPano

Strength: Airpano has provided users a stunning visuals and high-resolution panoramic images by using some advanced aerial photography techniques like used of helicopters, drones, and other equipment to capture different bird's-eye view from unique perspective. It has provided two type of virtual travelling mode which is 360-degree photo or 360-degree video. Users who preferred to enjoy the view automatically can select 360-degree video and follow the pace of the video to explore the tourist attraction. In 360-degree photo, developers have also provided background music while touring session to make users feel that they are in the actual location. Below the virtual tour video and photo, some information about the history of those specific tourist attractions and some users reviews also provided to make users easier to do survey. [6]

Weakness: Although AirPano has provided many high-resolution and breathtaking aerial photography, but it is lack of the street view photo. So that it only can give an overview of the places for the users, but users cannot get in details for those places. Besides, when the users are rotate the panoramic view, it does not look like 3D and seems like watch at a normal photo. [6]

2.1.5 ARloopa

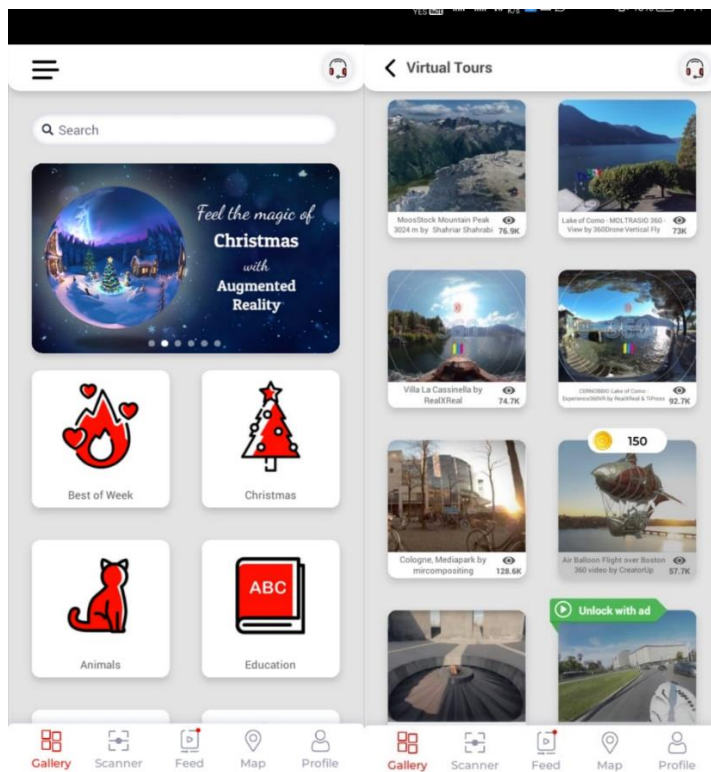


Figure 2.12 screenshot of the ARloopa

ARloopa is an AR platform that designed to enable users to develop and deploy AR experiences for various purposes. ARloopa's capabilities often include marker-based AR, markerless AR, and object recognition, allowing users to overlay digital content onto the physical world through the mobile device's camera. [7]



Figure 2.13 screenshot of the ARloopa

Strength: ARloopa is often designed to work across multiple platforms like iOS and Android which can give more convenience for the users. Besides, it has also provided a user-friendly interface. Users who do not have extensive technical training also can be easy to get use on it. It has a strong 3D modelling technique, users can walk inside the virtual places or elements through the built up 3D model. [7]

Weakness: ARloopa is a mobile platform application, so it might be a limitation for users who do not have access to smartphones or tablets. Besides, although it has a strong 3D modelling technique but for the virtual tour function inside it only show about the virtual place but not tourist attraction in real life. Since it is a mobile application, so users have some difficulty when they want to move around the 3D model compared to using computer. [7]

2.2 Summary of the Similar Applications (Comparison Tables)

Table2.1 comparison in function of different system.

	Platform	Content inside (specific/roughly)	Does clean surface required?	3D modelling Support(yes/no)	Degree of openness (freely/limited)
Shrine Melbourne [6]	Website-based	Specific	No	Yes	Freely
Quan Jing Gu Gong [7]	Website-based	Specific	No	Yes	Freely
Cyark [8]	Website-based	Specific	No	Yes	Limited
AirPano [9]	Website-based	Roughly	No	Yes	Limited
ARLoopa [10]	Mobile Platform (IOS and Android)	Roughly	Yes	Yes	Freely

2.3 Resolved Solution

The author found that some of the existing applications which are website-based is only convenience for computer users while mobile platforms application only user-friendly to mobile users. So, the author will try to develop the new virtual tourism application which are suitable for computers and also mobile devices users and it will detect either users are using computer or mobile devices. Based on their selected devices, the app will be presented in suitable interface.

Besides, the author also found that some of the existing virtual tourism applications have a detailed content while some of them only included roughly content. For those are specific, it normally only one place is available for users to tour only, for those which have roughly content can give a well overview about many places for users but cannot give them the detail. So, the solution is that author will give a simple overview and users can based on the selection given in the overview to explore more detailed information.

Lastly, author found that some of the website using AR module present their building does not access through the users' camera to present the scenes. The author would like to develop an application that can present the scene by using 3D modelling technique through users' camera to make them feel more realistic.

2.4 Discovery Approach

Discovery Learning is one of the learning models founded by Jerome Bruner in 1960s. This approach allows students to actively participate in the learning process rather than receive the knowledge passively. Teacher will give students to know about their objectives, but he/she will not tell students how to achieve the objectives. Students encouraged to ask questions, hypothesize, speculate, cooperate, and collaborate with each other in order to achieve the goals set by teachers. The role of teacher in this approach is as a facilitator which will only keep a close eye on kids to check whether they are on track or having any misconceptions or not and help them to discover principles by themselves. [8]

There are five principles of discovery learning method which are problem solving, learner management, Integrating and connecting, information analysis and interpretation, and failure and feedback.

Principle 1: Problem Solving

In first principle, instructors should guide and motivate students to discover solutions themselves creatively by combining their existing knowledge and new acquired knowledge. Learners will take an active role in this principle to generate new knowledge and solution by themselves instead of only get the information through the lectures and practices. [8]

Principle 2: Learner Management

It is a more flexible learning approach for the learner. It is because learners can manage their learning time at their own pace. Besides, they can also choose either they want to work alone or work together to achieve the goals. [8]

Principle 3: Integrating and connecting

Instructor will give a guideline for the students to know about how to combine their existing knowledge together with the new obtained knowledge. Based on this new combined knowledge, students will be encouraged to use it by connecting to the real-world situation. [8]

Principle 4: Information Analysis and Interpretation

Discovery learning is not just only collection of facts but also built on the idea. It is a process-oriented rather than content-oriented. Students are more encouraged to analyse and interpret the acquire information rather than just memorize it. [8]

Principle 5: Failure and feedback

During discovery learning, there is not 100% correct. Students are accepted to get failure during their learning process while instructor will play an important role in this session to give students feedback about their work in order to get a perfect final outcome. Learning is incomplete if without any error or failure. [8]

For this project, discovery approached is used because the author would like to let users explore by themselves. At the beginning, the author will provide some simple tutorial for the users to give them have a basic understanding about the operation of the program. Then, the author will let the users to use it freely. Users can start to explore any part that they are interested and slowly move to other parts based on their own pace. Eventually, users can connect all of the part together and know about the basic concept of that tourism attraction. By using this approach, it allows users to have fun during their exposure session and this is the things that author want to give the users.

2.5 Data Collection

2.5.1 Data Collection Method

I have use questionnaire as the methodology to collect my data from public. These data are collected in order clarify my ideas and planning before I start to develop my project. I have used google form to design my questionnaire and send it to 30 participants. The questions used for data collection can be referred to Appendix A.

2.5.2 Data Analysis

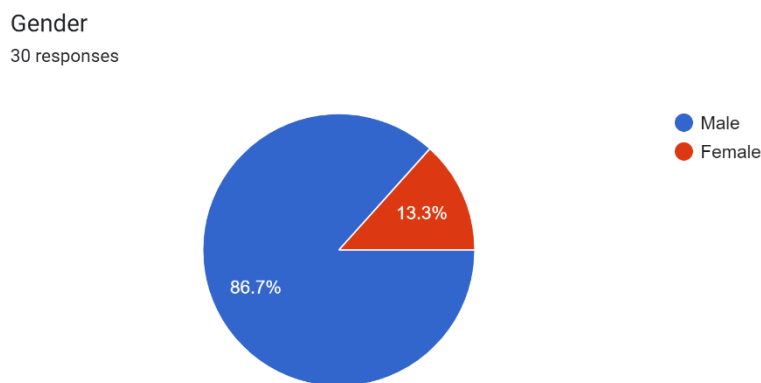


Figure 2.14 Gender

Based on the pie chart above, we know that out of 30 respondents, 86.7% (26 respondents) of them are Male and 13.3% (4 respondents) of them are female.

CHAPTER 2

Age
30 responses

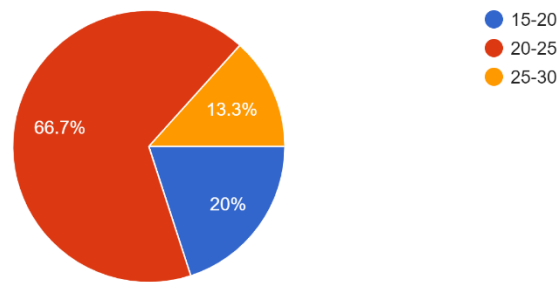


Figure 2.15 Age

Based on the data collected, we found that 66.7% of the respondents' (20 respondents) age are between 20 to 25. Besides, 20% of the respondents' (6 respondents) age are between 15 to 20 and 13.3% of them (4 respondents) are between 25 to 30.

Have you visited Cheng Hoon Teng Temple Before?
30 responses

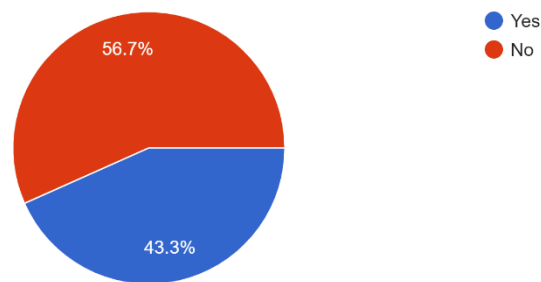


Figure 2.16 Have you visited Cheng Hoon Teng Temple before?

Based on the result, 13 out of 30 respondents which are 43.3% of them visited Cheng Hoon Teng Temple before while 56.7% of the respondents which are 17 of them have not visited Cheng Hoon Teng Temple before.

CHAPTER 2

Have you ever used any software to virtual tour some places before?
30 responses

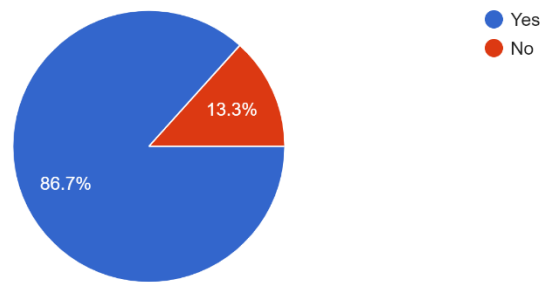


Figure 2.17 Have you ever used any software to virtual tour some places before?

Based on the pie chart above, we know that 86.7% of 30 respondents which are 26 of them have used software to virtual tour some places before. In other hand, there 13.3% of them have not used any software to do virtual tourism before.

Have you heard about Augmented Reality Technology before?
30 responses

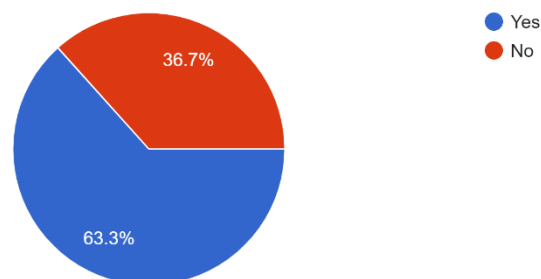


Figure 2.18 Have you heard about Augmented Reality Technology before?

From the data collected, we found that 63.3% of the respondents which are 19 out of 30 have heard about Augmented Reality Technology before while there are 36.7% of them which are 11 out of 30 have not heard about Augmented Reality Technology before.

CHAPTER 2

Do You have use any software that has implement Augmented Reality Technology Before?
30 responses

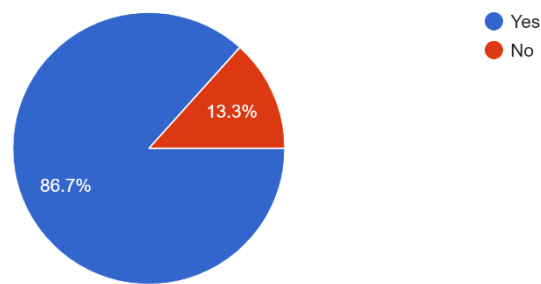


Figure 2.19 Do You have used any software that has implement Augmented Reality Technology before?

Based on the result, we know that 86.7% of the respondents which are 26 respondents have used some software that have implement Augmented Reality Technology before. But, it still have 13.3% of them which are 4 of them do not have any experience about using any software that has implemented Augmented Reality Technology before.

CHAPTER 2

Do you think that visit a place using Augment Reality Technology is a novelty idea? (5- Strongly Agree, 1- Strongly Disagree)

30 responses

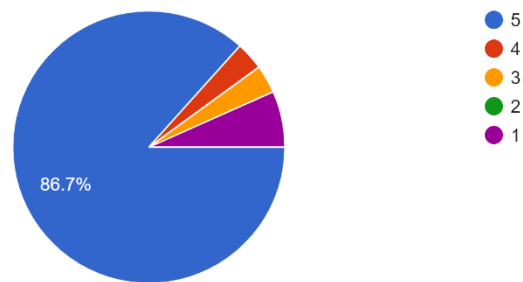


Figure 2.20 Do you think that visit a place using Augment Reality Technology is a novelty idea?

Based on the pie chart provided, we know that 86.7% of the respondents which are 26 out of 30 respondents strongly agree that using Augmented Reality Technology to visit a place is a novelty idea. There are 2 respondents which is 6.7% strongly disagree that using Augmented Reality Technology to visit a place is a novelty idea.

CHAPTER 2

Do you think that implement Augmented Reality Technology in tourism sector can solve geographic limitations? (5- Strongly Agree, 1- Strongly Disagree)

30 responses

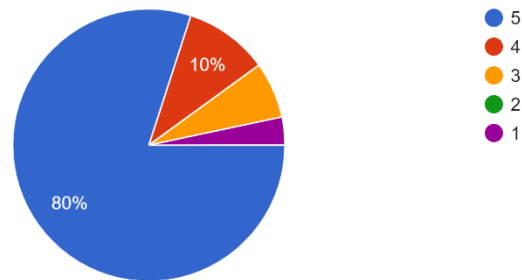


Figure 2.21 Do you think that implement Augmented Reality Technology in tourism sector can solve geographic limitations?

Based on the data collected, we found that 80% of the respondents which are 24 out of 30 strongly agree that implement Augmented Reality Technology in tourism sector can help to solve geographic limitations. 1 out of 30 respondents which is 3.3% strongly disagree that implement Augmented Reality Technology in tourism sector can solve geographic limitations.

CHAPTER 2

Do you think that virtual tour can give a simple overview about that tourist attraction for travelers?
(5- Strongly Agree, 1- Strongly Disagree)

30 responses

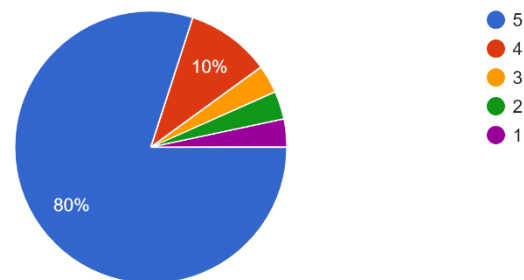


Figure 2.22 Do you think that virtual tour can give a simple overview about that tourist attraction for travelers?

Based on the pie chart provided, we know that 80% of the respondents which are 24 out of 30 respondents strongly agree that virtual tour can give a simple overview about that tourist attraction for travelers. In other hand, there is 1 out of 30 respondents which is 3.3% strongly disagree that virtual tour can give a simple overview about that tourist attraction for travelers.

CHAPTER 2

Do you think that implement a 2D/3D Game or quiz in a virtual tour application can help users learn about the history/information of that place in a delightful way?

30 responses

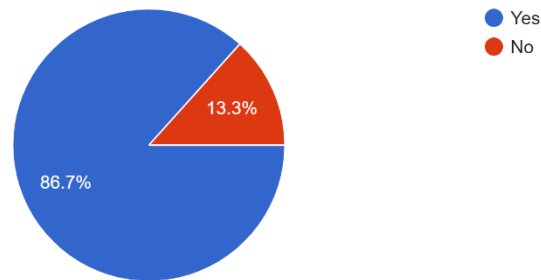


Figure 2.23 Do you think that implement a 2D/3D Game or quiz in a virtual tour application can help users learn about the history/information of that place in a delightful way?

Based on the results, we found that 26 out of 30 respondents which is 86.7% of them think that implement a 2D/3D Game or quiz in a virtual tour application can helps users learn about the history or information of that place in a delightful way. There are 4 respondents which is 13.3% of respondents think that implement a 2D/3D Game or quiz in a virtual tour application is a delightful way to let users learn about the history or information about that place.

CHAPTER 2

Would you always do some research about that tourist attraction through online before travels to the place physically?

30 responses

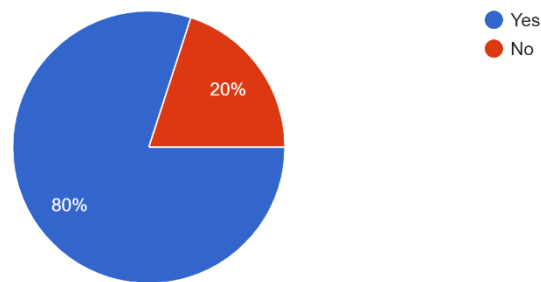


Figure 2.24 Would you always do some research about that tourist attraction through online before travels to the place physically?

Based on the pie chart above, we know that 80% of the respondents which are 24 respondents will do some research about that tourist attraction through online before travels to the place physically. 20% of respondents which are 6 of them will not do research about that tourist attraction through online before travels to the place physically.

2.5.3 Discussion

From the questionnaire result collected, we know that majority respondents for this questionnaire is male and their age is between 20 to 25. Besides, majority of the respondents which is 56.7% of them have not visited Cheng Hoon Teng temple before. Besides, majority of the respondents which is 26 out of 30 has used software to do virtual tourism before. In addition, 63.3% of the respondents have heard about Augmented Reality technology before and 86.7% of them have used applications which have implemented this technology. Moreover, 86.7% of the respondents agree that visit a place through Augmented Reality technology is a novelty idea nowadays and 80% of them also strongly agree that implementation of Augmented Reality in tourism sector can help some travellers to solve the geographical limitations. Furthermore, 80% of the respondents agree that users can get a simple overview about that tourist attraction through virtual tourism application which has implemented with Augmented Reality technology. 86.7% of the respondents also strongly agree that implement a 2D/3D game or quiz in a virtual tourism application is a delightful way to let users know about the history or information about that tourism attraction. Lastly, majority of the respondents which is 80% of them will do some online research before travelling to the tourism attraction physically.

CHAPTER 3

Proposed Method/Approach

3.1 Methodology

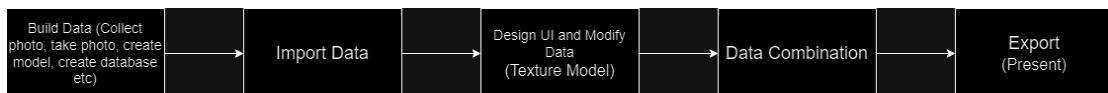


Figure 3.1 Methodology

First, we need to build data such as collect the tourism attraction photo, create a 3D Model for AR Module purpose and create a database server for storing user review and photo purpose. Then, we import these data into the system and start to design the system UI and modify the data. After UI designed and data being modified, we will combine data and UI together and export it out.

3.2 System Requirement

3.2.1 Software requirement

Blender

Blender is a powerful, free, and open-source 3D modelling software. It can be used for many kinds of features like modelling, animation, rendering, sculpting, texturing, compositing, and more. Furthermore, it is also supported for video editing and game production. Blender is developed by the Blender Foundation which has provided a strong toolset for artist, animators, game developers, and filmmakers.

Blender is also a cross-platform software which can works on Linux, Windows, and Macintosh Operating System. The user interface used on Blender is based on OpenGL, which ensures a consistent experience for the users. Blender has a vibrant and active community function which give a huge contribution to its development. The software is continuously updated by included more and more new features and improvements into it to make it become popular choice for both beginners and professionals in the 3D graphics and animation industry. [10]

Unity

Unity is a cross-platform game engine and development framework developed by Unity Technologies which can be used for the creation of interactive 2D, 3D, augmented reality (AR), and virtual reality (VR) experiences. Unity is a very user-friendly application because it provides plenty of documentation to teach users how to use it. Unity is selected because it is suitable used to develop the AR tourism module.

Usually, Unity will work together with Blender. Blender is used to create the content (3D modelling) while Unity is used to bring those models together to create an interactive augmented reality (AR) application. [11]

Table 3.1 Software requirement for each multimedia element

Multimedia Element	Software
Text	• Adobe Illustrator • Fontlab Studio • FontCreator • Fontbase
Graphic	• Adobe Illustrator • Adobe Photoshop • Adobe InDesign • Affinity Designer
Audio	• Adobe Audio • Youtube to mp3 converter • Audacity
Video	• Youtube to mp4 converter • Adobe Premiere Pro CC • Wondershare Filmora9
Animation	• 3D painter • Anime Studio • Animaker • Synfig

XAMAPP

XAMPP is an Apache distribution that is easy to install and absolutely free. It comes with MariaDB, PHP, and Perl. The XAMPP open-source software is designed to be extremely simple to use and install. XAMAPP is used as a database server purpose in this project to store the user review and images. [12]

VMWare

VMware is a virtualization and cloud computing software provider which is in Palo Alto, California. VMware is used as a macOS virtual machine in this project to build the project to iOS platform as Xcode only can be run on macOS. MacOS Sonoma version will be used during this development. [13]

Xcode

Xcode is a developer application to enable developer to develop, test, and distribute apps for all Apple platforms. Xcode is used to distribute this project to iOS, enabling it to run on both Android and iOS platforms. [14]

3.2.2 Hardware Requirement

Table 3.2 hardware requirements for the project

Hardware	Minimum Requirements	Optimum Requirements
OS	Window10	Window10/window 11
Processor	Intel Core i5-8400 AMD Ryzen 3 3300X	Intel Core i7-8700K AMD Ryzen 5 3600X
Memory	8GB RAM	12GB RAM
Graphics Card	Nvidia GeForce GTX 1060, 3GB AMD Radeon RX 580, 4GB	Nvidia GeForce GTX 1070, 8GB AMD Radeon RX Vega 56, 8GB
DirectX	DirectX 12 (Feature Level 12.0)	DirectX 12 (Feature Level 12.0)
Storage	60GB	60 GB

3.3 ADDIE Model

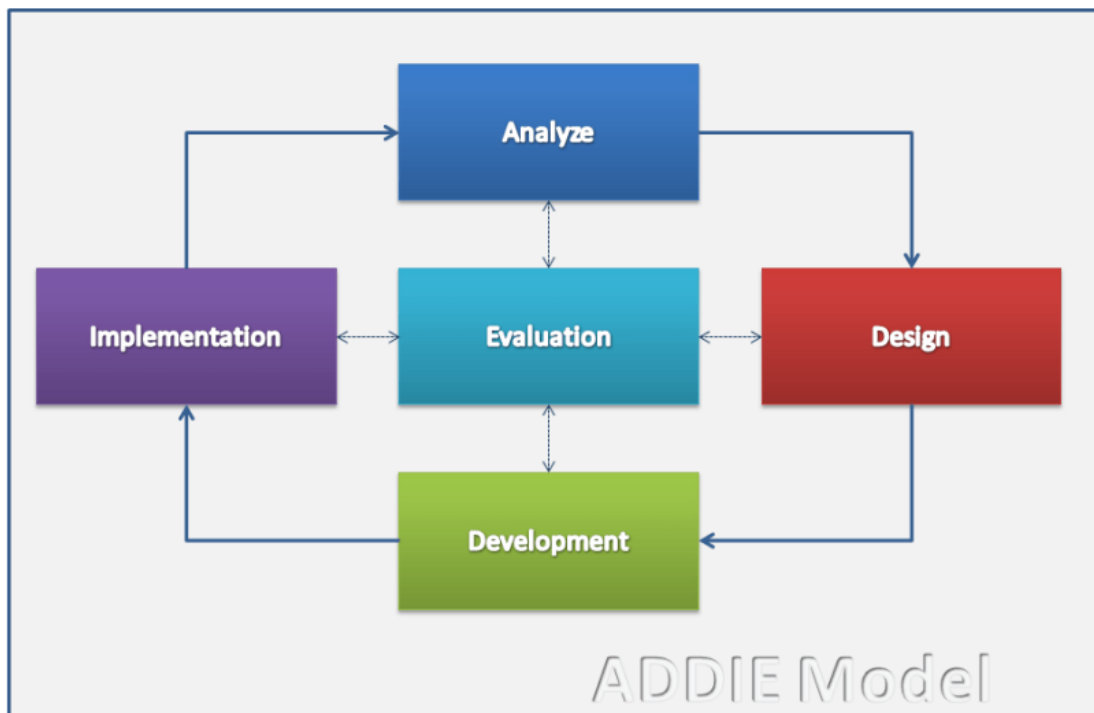


Figure 3.2 ADDIE Model [9]

The methodology that used for this project is ADDIE model. ADDIE model is one of the most popular methods as a framework in designing and developing a project. “ADDIE” stands for Analysis, Design, Development, Implementation and Evaluation. However, it does not force a strict linear progression through these steps. Developers can go through analyse phase then go to design phase, development phase and implementation phase. Lastly, in the evaluation phase, developers can move back to the previous phases for further improvement. ADDIE Model has been used widely because it provides a dynamic and flexible guideline for developer to build a project. Although ADDIE model does not force the users to follow the sequence, but the outcome of each phase will be the input of the subsequent phase. [9]

3.3.1 ADDIE model and activities

Analysis

Before started to develop a project, the developer is recommended to do some analysis about his/her current situation like knowledge, equipment, training etc. After walk through these, the developer should also do some research about the selected tourism attraction (Chong Hoon Teng Temple). It is because this action can bring many important decisions for the later phases.

In this phase, it is more focus on the documentation. Developers should do some literature review on the similar system or application in order to know about the existing features in the similar application, what is the review given by the users after using those features, what is the feeling when they are operate the application by themselves and etc. to get a basic understanding of how to develop an project in order to get the attraction from the users and how to help users solve their problems on existing systems/applications.

After evaluating multiple existing systems/applications and listing the strengths and weaknesses, they can give a primary idea about the project objectives, target audience, and have a basic concept about how to start developing the project.

Design

After finish analysis phase, it will come to the design phase. In this phase, author will base on all of the learnings from the previous phase and convert it to practical methods which included strategy, delivery methods, structure, duration, assessment, and feedback.

Besides, the authors will also sketch a prototype design for the selected users to test about the project interface and some of the functionality in this phase. Then, the author will also send a questionnaire to them to know about their feedback.

After that, the author will also create UML diagram like use case diagram and activity flow in this phase in order to prepare for the development phase.

Development

In this phase, developer will begin to develop the project. The project will be developed guided by the prototype. Each element in this phase will be developed to match the design phase.

During this phase, Unity and Blender will be chosen by the developer as the development tools. The five modules stated above will be developed subsequently which are lecture module, AR tourism module, user review module, cost estimation module, and photography module. Other than Unity and Blender, developers will also use other supporting software like Adobe Illustrator to design the interface. Some multimedia elements like text, animation, video will also be added to improve the user experience.

Implementation

During implementation phase, the nearly completed software will be produced. It is coded, installed, tested and supported. The developer will give users training on how to use it and give the target users to test it. If the target users found some weaknesses of the software, they can feedback to the developers and developers will revise the feedback content and do some improvements to solve the weaknesses.

Evaluation

In evaluation phase, it can be divided into two part which is formative and summative. Formative evaluation is presented in every phase while summative evaluation is designed for specific functionality which provides a standardized reference to the users when they are doing testing.

During evaluation phase, the author will implement continuous formative growth. Firstly, the developer will test all the capabilities then he/she will distribute the system to the users at the end of project II for testing purposes. It will include interface design testing, functionalities testing, unit testing, and system testing. Then the developer will collect their feedback through interview sessions to determine whether the deliverable system has met the objective. Different types of testing will be held in different module. For example, usability, content clarity and simplicity will be the focus point in interface design module while functionality will be the focus point in the application module.

CHAPTER 3

After receiving the project's final output, a summary report will be prepared by the author.

3.4 System Flow Diagram

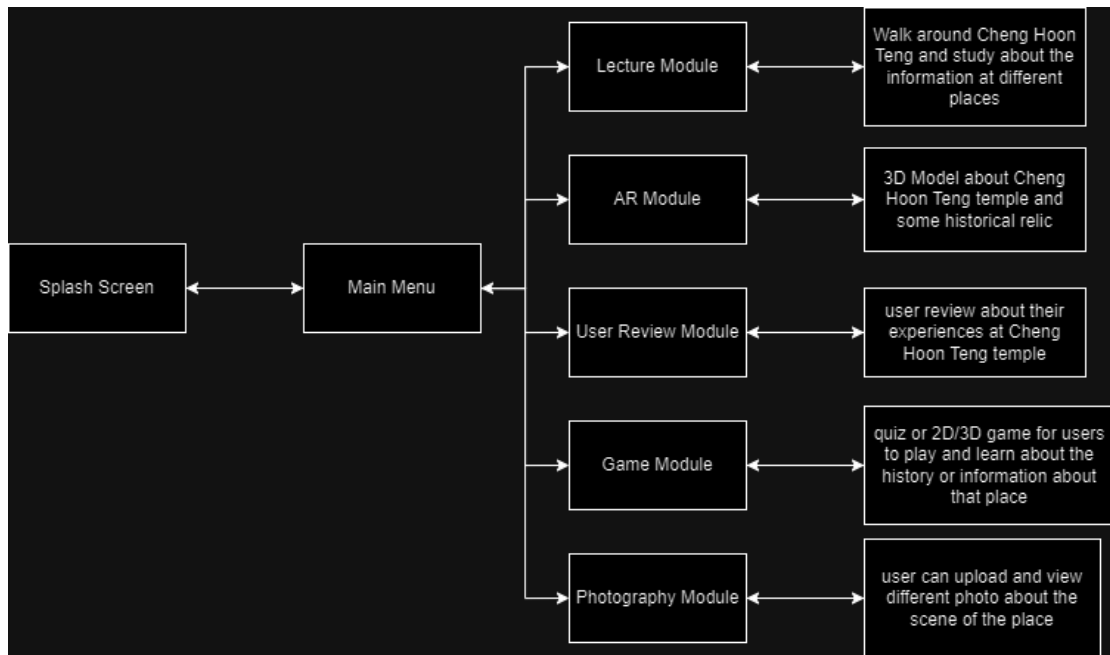


Figure 3.3 System Flow Diagram

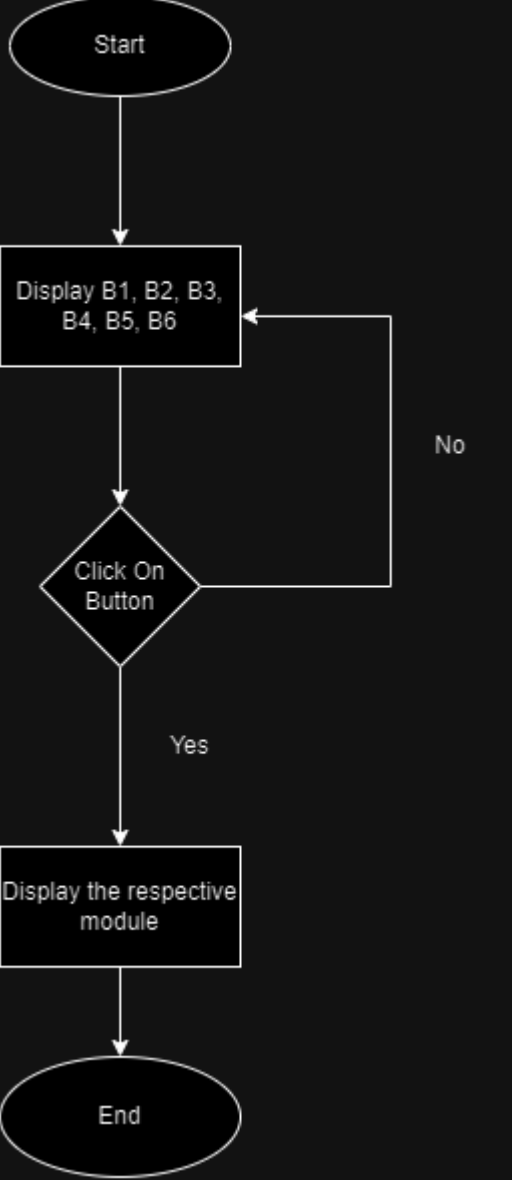
3.5 Storyboard Design

3.5.1 Main Menu



Figure 3.4 Main Menu

Table 3.3 The details for Main Menu

Instruction for Text, Graphic, Audio, Animation and Button	Flow diagram for Text, Graphic, Audio, Animation and Button
B1 is Lecture Module button. When users click on it, it will redirect to Lecture Module page. B2 is Game Module button. When users click on it, it will redirect to Game Module page. B3 is User Review Module button. When users click on it, it will redirect to User Review Module page. B4 is FAQ Module button. When users click on it, it will redirect to FAQ Module page. B5 is Photography Module button. When users click on it, it will redirect to Photography Module page. B6 is Quit button. When users click on it, the whole application will be closed.	 <pre> graph TD Start([Start]) --> DisplayButtons[Display B1, B2, B3, B4, B5, B6] DisplayButtons --> ClickButton{Click On Button} ClickButton -- Yes --> DisplayModule[Display the respective module] DisplayModule --> End([End]) ClickButton -- No --> DisplayButtons </pre>

3.5.2 Lecture Module

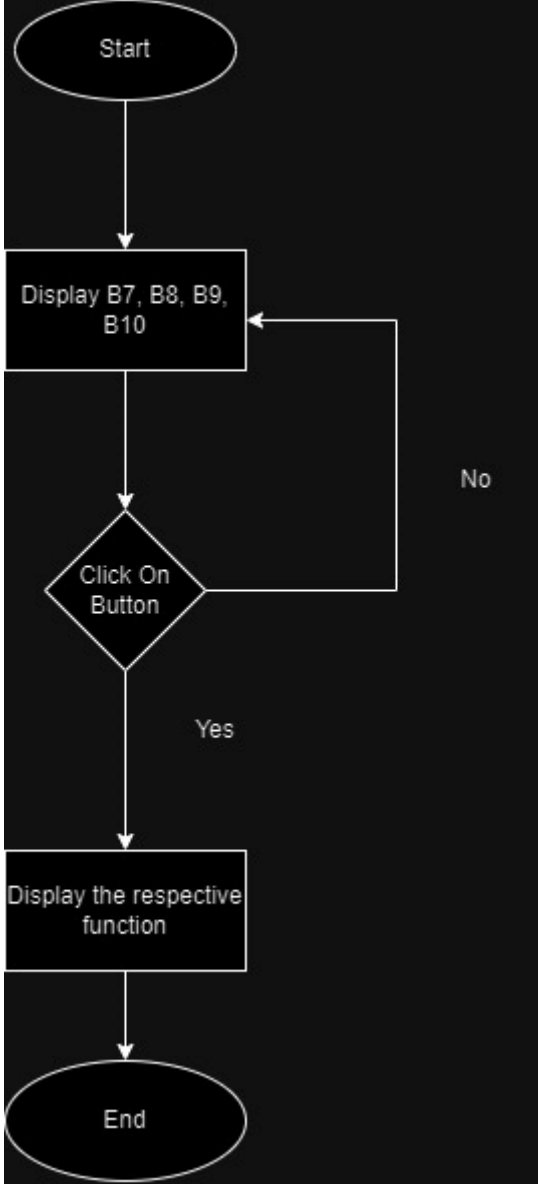


Figure 3.5 Lecture Module



Figure 3.6 Lecture Module

Table 3.4 The details for Lecture Module

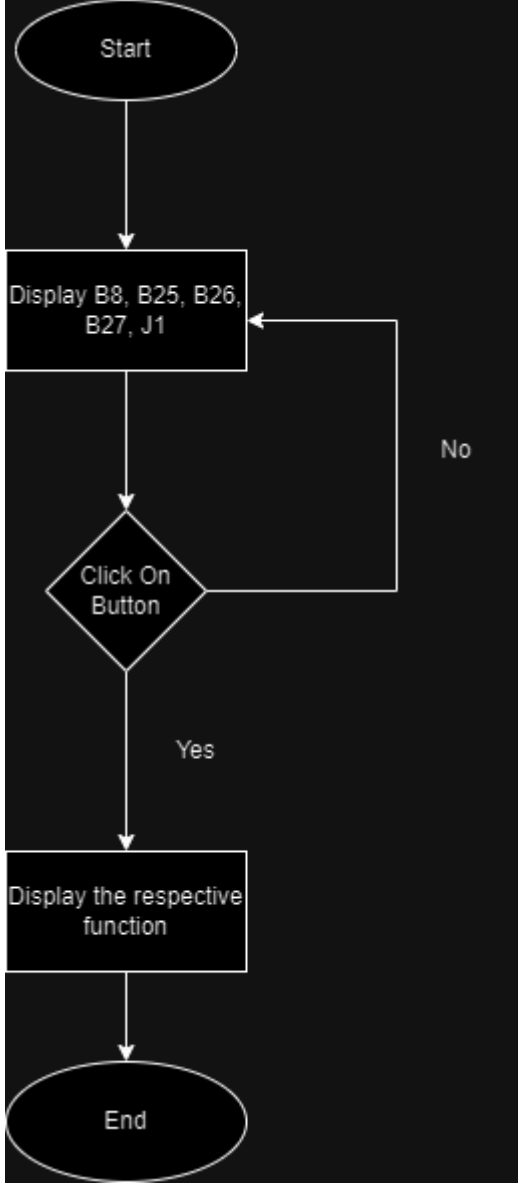
Instruction for Text, Graphic, Audio, Animation and Button	Flow diagram for Text, Graphic, Audio, Animation and Button
B7 is walk in button. After users click on it, it will bring users to move in further the scene. B8 is back button. After users click on it, it will bring users back to main menu. B9 is relative information button. After users click on it, it will pop out a window and show users about the related information. B10 is close button. After users click on it, it will close the information window.	 <pre> graph TD Start([Start]) --> Display[Display B7, B8, B9, B10] Display --> Click{Click On Button} Click -- No --> Display Click -- Yes --> Function[Display the respective function] Function --> End([End]) </pre>

3.5.3 Game Module



Figure 3.7 Game Module

Table 3.5 The details of Game Module

Instruction for Text, Graphic, Audio, Animation and Button	Flow diagram for Text, Graphic, Audio, Animation and Button
B8 is back button. After users click on it, it will bring users back to main menu. J1 is the joystick. User can use it to control the movement of the player from First Person Point of View. B25 is the time selection button. User can select either they want to visit Cheng Hoon Teng temple in which time such as day, evening or night. B26 is key button. User can open the door by click on this button when the player near the door. B27 is jump button. When user click on this button, the player will jump to cross over some obstacle such as stair or doorstep.	 <pre> graph TD Start([Start]) --> Display[Display B8, B25, B26, B27, J1] Display --> Click{Click On Button} Click -- No --> Display Click -- Yes --> Function[Display the respective function] Function --> End([End]) </pre>

3.5.4 User Review Module



Figure 3.8 User Review Module

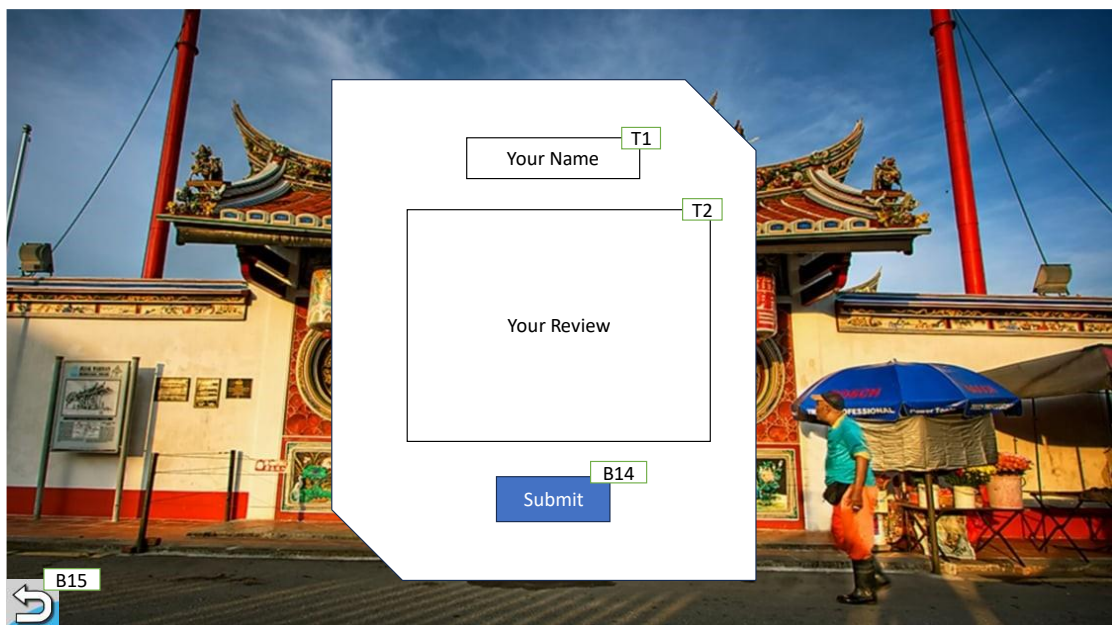
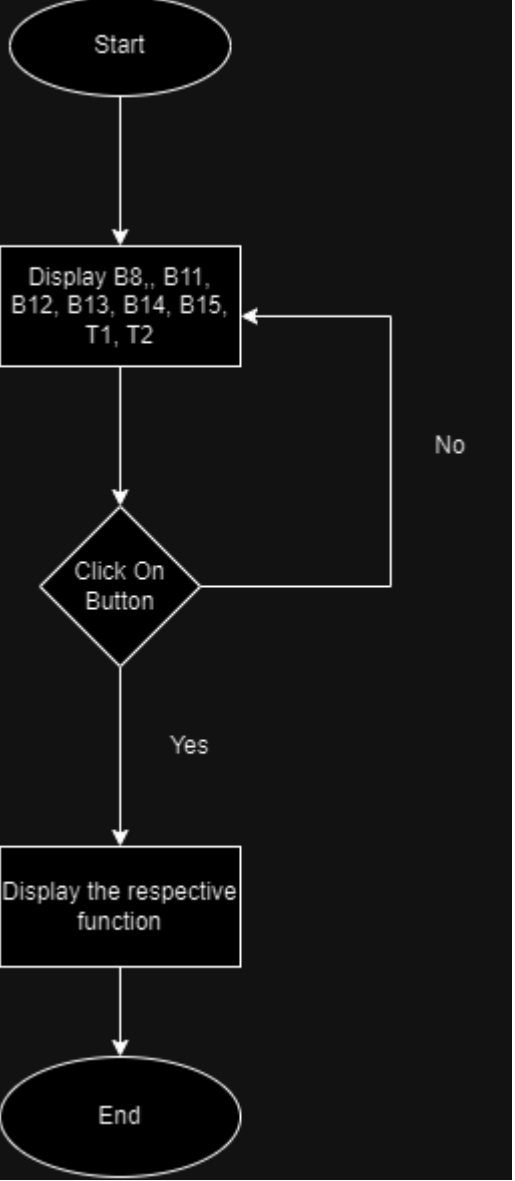


Figure 3.9 User Review Module

Table 3.6 The details of User Review Module

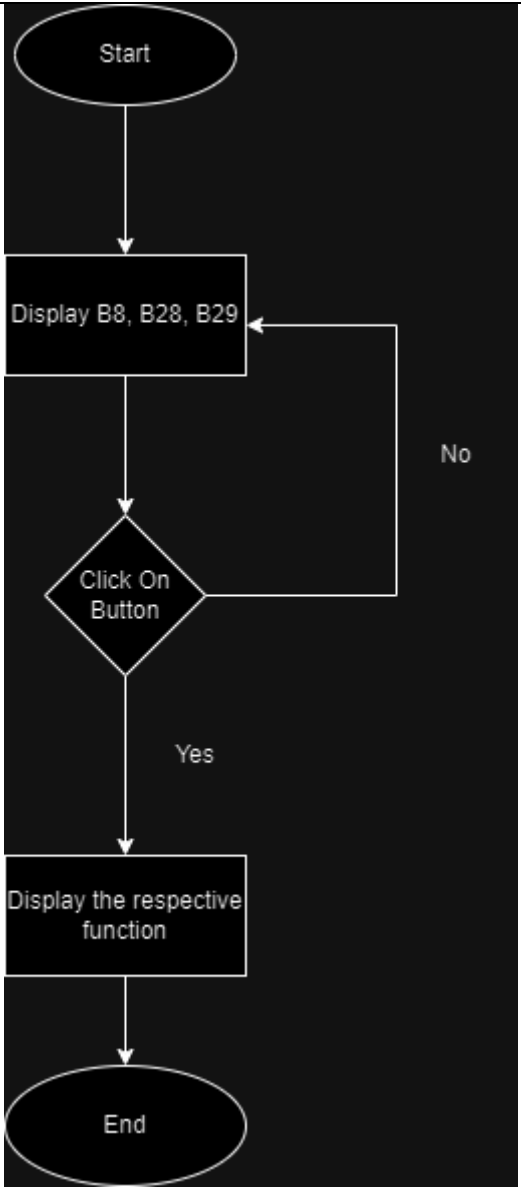
Instruction for Text, Graphic, Audio, Animation and Button	Flow diagram for Text, Graphic, Audio, Animation and Button
B8 is back button. After users click on it, it will bring users back to main menu. B11 is move left button. After users click on it, it will show more review at the left side for the users. B12 is move right button. After users click on it, it will show more review at the right side for the users. B13 is post review button. After users click on it, it will redirect users to the review writing page. T1 is name input. Users can input their name. T2 is review input. Users can write their review. B14 is submit button. Users can submit their review. B15 is back to user review module.	 <pre> graph TD Start([Start]) --> Display[Display B8., B11, B12, B13, B14, B15, T1, T2] Display --> Click{Click On Button} Click -- Yes --> Function[Display the respective function] Function --> End([End]) Click -- No --> Click </pre>

3.5.5 FAQ Module



Figure 3.10 FAQ Module

Table 3.7 The details of FAQ Module

Instruction for Text, Graphic, Audio, Animation and Button	Flow diagram for Text, Graphic, Audio, Animation and Button
B8 is back button. After users click on it, it will bring users back to main menu. B28 is move left button. After users click on it, it will show more FAQ at the left side for the users. B29 is move right button. After users click on it, it will show more review at the right side for the users	 <pre> graph TD Start([Start]) --> Display[Display B8, B28, B29] Display --> Click{Click On Button} Click -- Yes --> DisplayFunc[Display the respective function] DisplayFunc --> End([End]) Click -- No --> Display </pre>

3.5.6 Photography Module

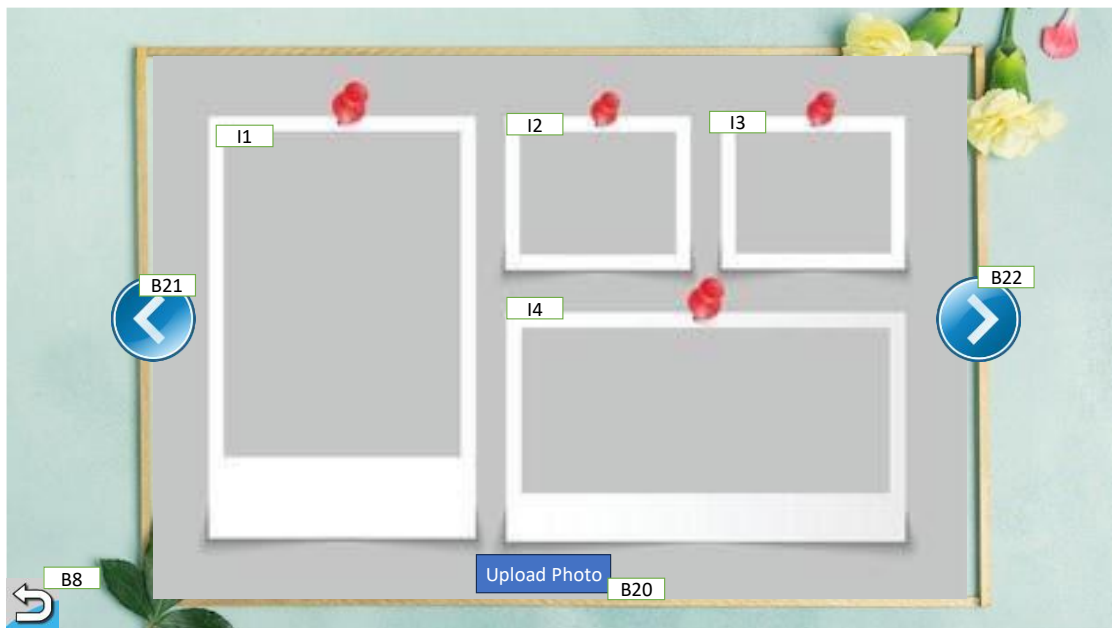
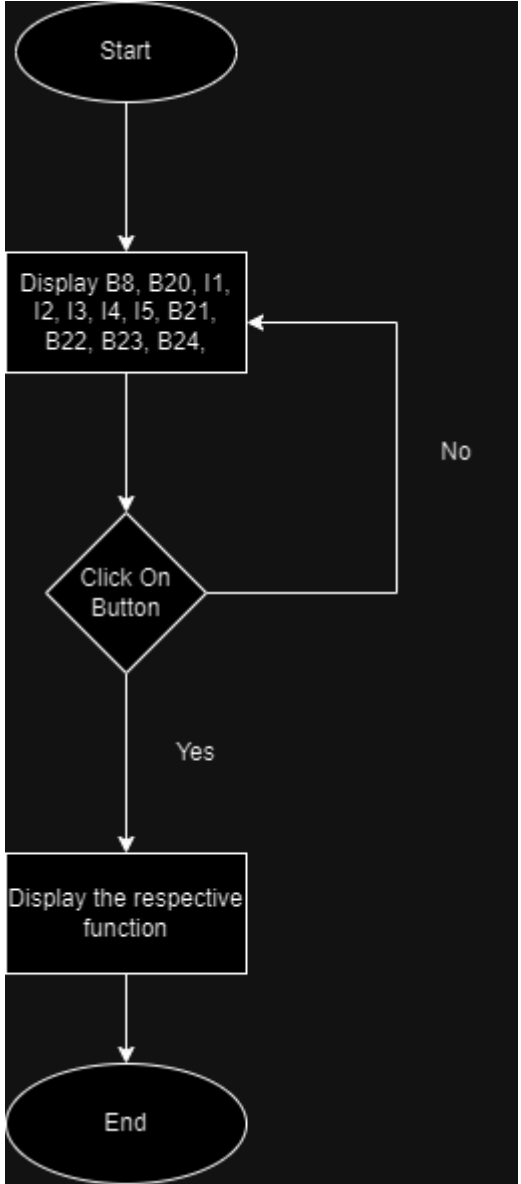


Figure 3.11 Photography Module



Figure 3.12 Photography Module

Table 3.8 The details of Photography Module

Instruction for Text, Graphic, Audio, Animation and Button	Flow diagram for Text, Graphic, Audio, Animation and Button
B8 is back button. After users click on it, it will bring users back to main menu. B20 is upload photo button. After users click on it, it will bring users to upload photo scene and users can upload their photo at that scene. I1 is show image 1. I2 is show image 1. I3 is show image 1. I4 is show image 1. B21 is the move left button. After user click on it, it will show more image at the left side to the users. B22 is the move right button. After user click on it, it will show more image at the right side to the users. B23 is submit button. After users have upload their image and click this button, it will submit the photo to database server. B24 is back button. After users click on it, it will bring users back to the photography module. I5 is the upload image place. Users can upload their images at here.	 <pre> graph TD Start([Start]) --> Display[Display B8, B20, I1, I2, I3, I4, I5, B21, B22, B23, B24] Display --> Click{Click On Button} Click -- Yes --> Function[Display the respective function] Function --> End([End]) Click -- No --> Click </pre>

3.6 System Design

3.6.1 Use Case Diagram and description

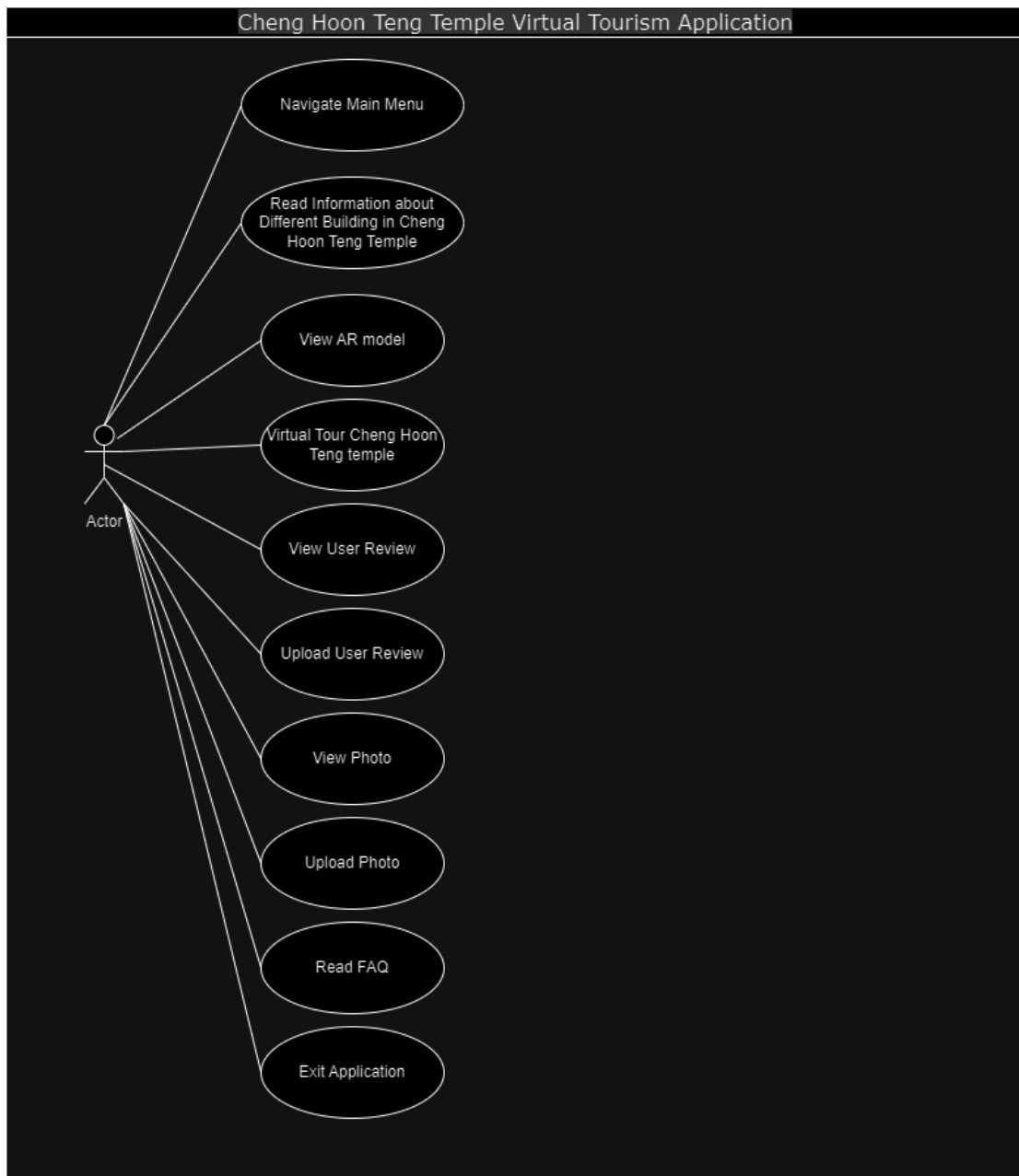


Figure 3.13 Use Case Diagram

Figure above show the use case diagram of Cheng Hoon Teng Temple Virtual Tourism Application. Users can navigate to main menu and select which action they want to proceed next. Firstly, users can read the information of different places through the lecture module. Then, the users also can view the AR model of different places by clicking on the button that show in the information panel. Besides, users can

virtually tour Cheng Hoon Teng temple in game module. In this module, users will act like a player and visit Cheng Hoon Teng temple in First Person Point of view (FPS) by controlling the player through on-screen joystick and button such as jump button and key button. In addition, users can view other users' review through selecting the user review module. In this module, users can also upload their personal review based on their experience. Furthermore, if the users have the chance to visit Cheng Hoon Teng temple physically, they can upload some photos taken by them to this application and let other users who are willing to visit this place to view. Moreover, this application also provides some general Frequently Asked Questions (FAQ) to help users solve their basic problems or have a better preparation when they are planning to visit Cheng Hoon Teng temple. Lastly, users can also select to exit the application through selecting the quit button in the main menu.

3.6.2 Activity Diagram and description

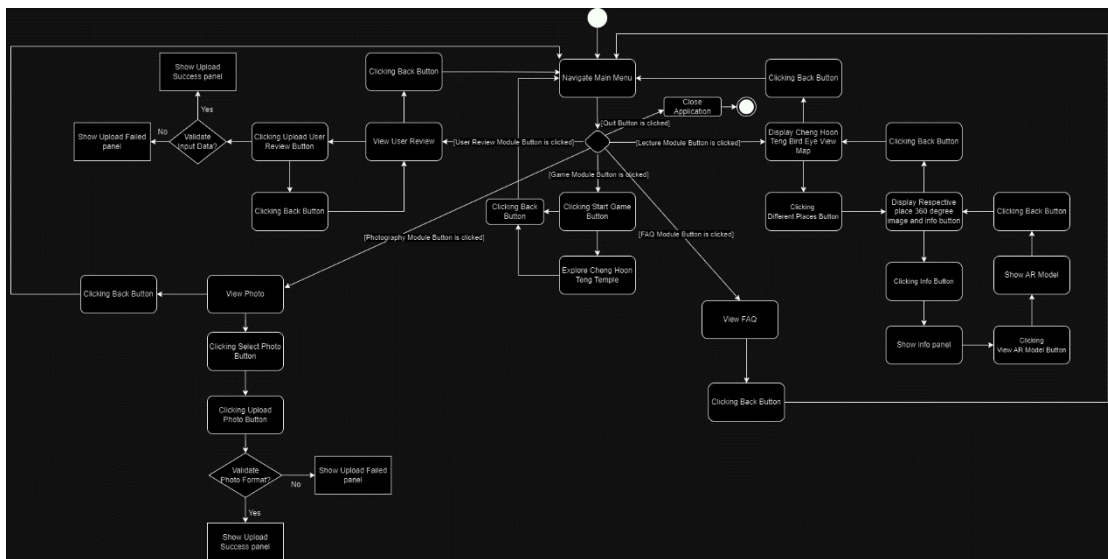


Figure 3.14 Activity Diagram

Figure 3.5 illustrates the activity diagram for the Cheng Hoon Teng Temple virtual tourism application. When users launch the application, they are directed to the main menu scene. From this scene, users can choose the module they wish to explore. If users select the lecture module, the system will present a bird's-eye view map of Cheng Hoon Teng. On this map, users can click on various buttons to visit specific locations such as the Jialan Palace, Main Hall, Tai Bo Gong Hall, and more. Once users click on these buttons, the system will navigate them to the corresponding

scene, where they can view a 360-degree photo of the location. Users can click on an embedded info button within the photo to access details about the place. In the information panel, there is also a view AR model button that allows users to see a 3D model of the location using their device's camera. Additionally, a back button is located at the bottom left of the screen, enabling users to return to the previous scene or the main menu.

Besides, users can click on the game module button to explore the Cheng Hoon Teng temple freely. After selecting this option, a start game button will appear. Once users clicked on it, they will be redirected into a 3D model environment of Cheng Hoon Teng, where they can explore the temple in a First-Person Point of View (FPS). In this environment, users can control the player using a joystick and jump button. They can also change the timeline by using the drop-down button located at the top left of the screen. As with other modules, a back button is available at the bottom left to allow users to return to the main menu.

In addition, users can also view and upload the user review by clicking the user review module button. After users click on this button, it will take users to review scene and users can read other users' reviews in this scene or they can also upload their reviews by clicking the upload review button. Once upload review button is clicked, they will be redirected to the upload scene and users can submit their reviews at here. Upon submission, the system will check the validation of the input data. For example, if the users do not enter any review and click submit button, the system will prompt an error message and ask users to retry again. If the input data is valid, the system will prompt out a success panel to inform users that their reviews have been successfully uploaded to the database. Users can click back button located at the bottom left of the screen to go back to the review scene to view their uploaded reviews. Same as other module, a back button is also located at the bottom left in the review scene to allow users to return to the main menu.

Similar with user review module, users can also view and upload some scene photo through clicking on the photography module button. Once users click on it, the system will show the photo that stored in the database for the users to view it. Users can also

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upload some photos related to Cheng Hoon Teng temple which are taken by them to the database in this module through clicking on the select photo button. Once the photo is selected, users can click on the upload button to upload it. Once upload button is clicked, the system will validate the format of the selected photo. In this project, the developer only allowed JPG and PNG to be uploaded. If users attempt to upload other format such as MP4 or MP3 format file, the system will prompt out an error message and ask users to try again. If the selected photo is valid, the system will show a success panel to inform users that their photos have been uploaded successfully. Consistently, users can click on the back button located at the bottom left of the screen to return to the main menu.

Furthermore, users can read some Frequently Asked Questions (FAQ) through clicking on the FAQ module button. Once users click on it, the system will show many FAQ and users can read it one by one. As usual, users can click on the back button located on the bottom left of the screen to go back to the main menu.

Lastly, users can exit the application by clicking on the quit button in the main menu.

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3.7 Project Planning

Project I

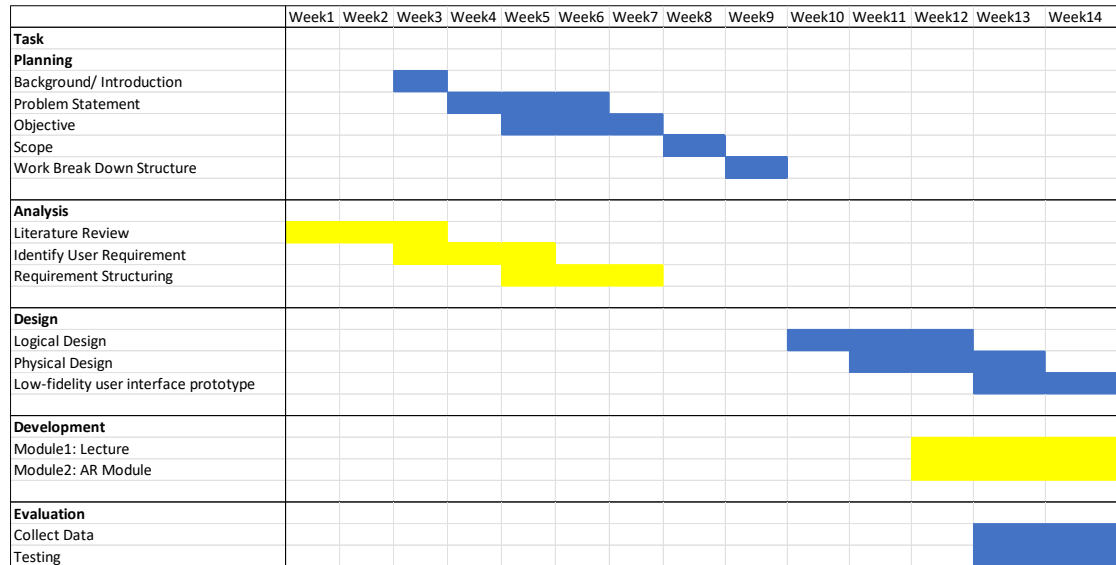


Figure 3.15 Gantt Chart for project I

Project II

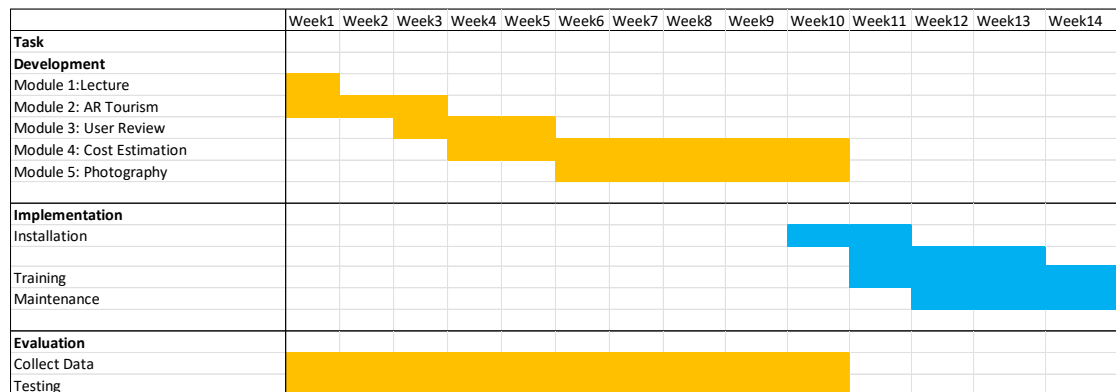


Figure 3.16 Gantt Chart for project II

CHAPTER 4

System Design

4.1 3D Modelling

Before started to develop the AR module, developer need to build up the 3D Model of different places in Cheng Hoon Teng temple. Since the developer is new to the Blender, so it has taken some times for the developer to learn about how to use Blender through watching tutorial on YouTube.

4.1.1 Main Gate Model

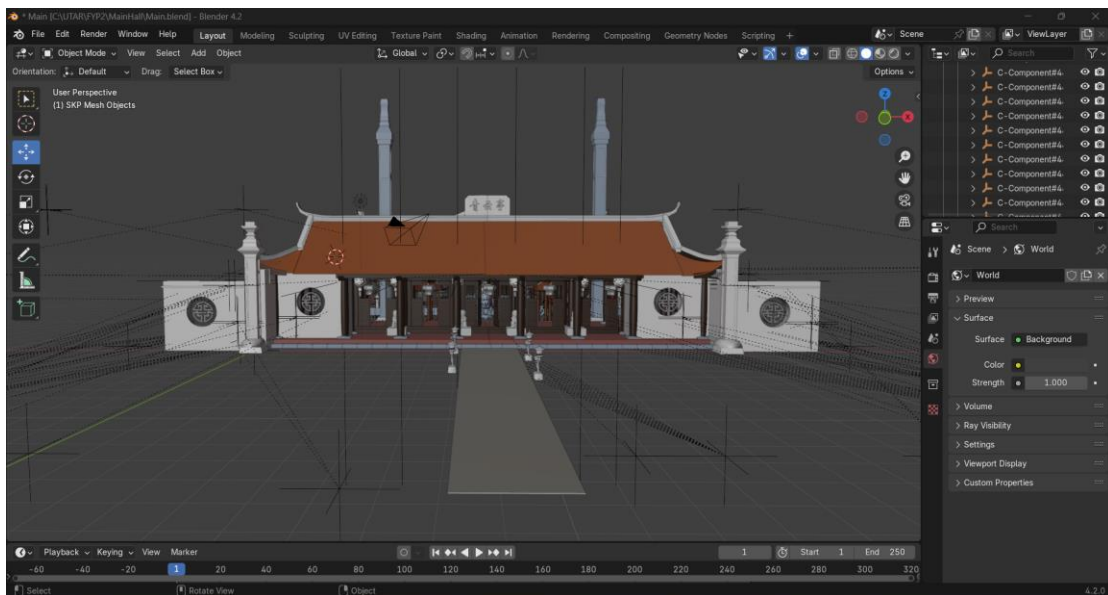


Figure 4.1 3D Model of Main Gate

The figure above shows the 3D model of the main gate of the Cheng Hoon Teng Temple.

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4.1.2 Main Hall Model



Figure 4.2 3D Model of Main Hall (Exterior)

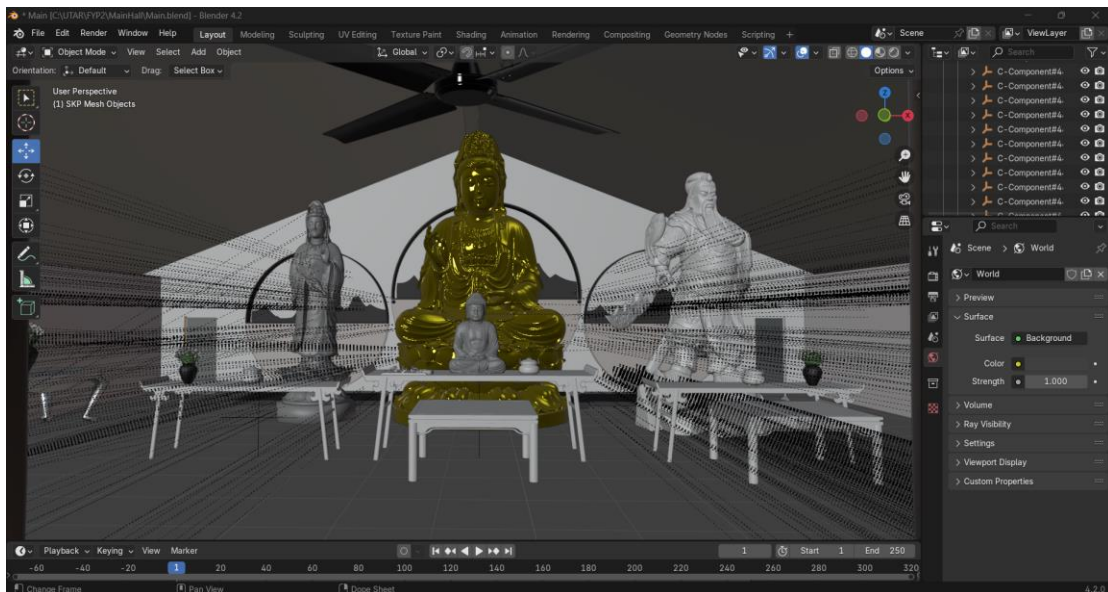


Figure 4.3 3D Model of Main Hall (Interior)

Figure 4.2 and figure 4.3 shows the 3D model about the exterior and interior of Main Hall in Cheng Hoon Teng temple. There are few buddha statues placed in main hall. These statues are built based on the actual statue locate at the Cheng Hoon Teng temple.

4.1.3 Kapitan Monument Room Model

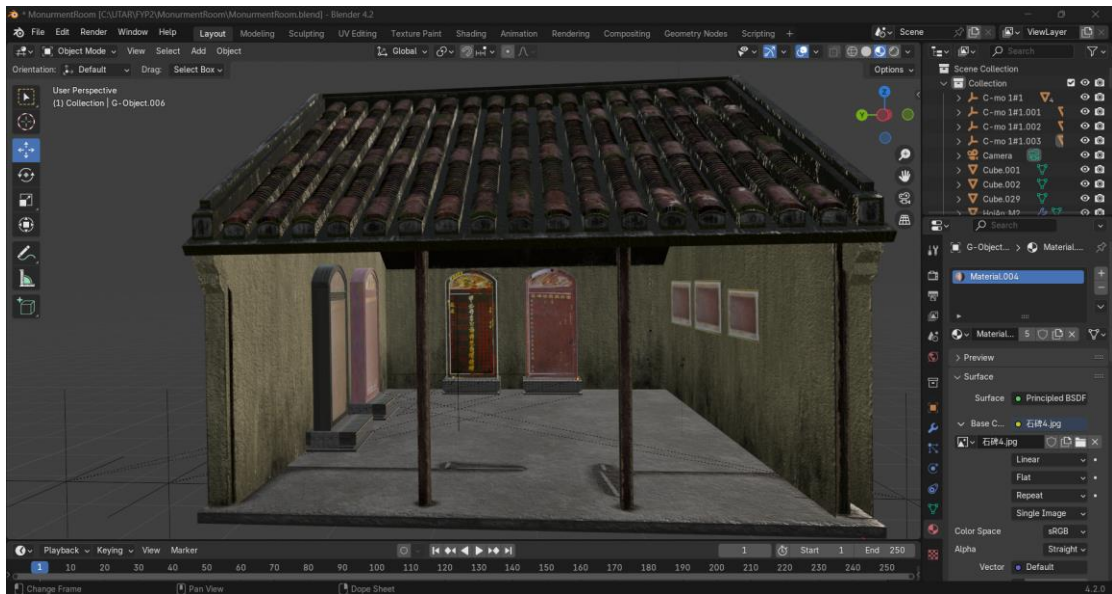


Figure 4.4 3D Model of Monument Room

The figure above shows the 3D Model of Kapitan Monument Room in Cheng Hoon Teng temple. There are four monuments in the room and each of it has written down different history about Cheng Hoon Teng temple. User can read about the history through them.

4.1.4 Jialan Palace Model

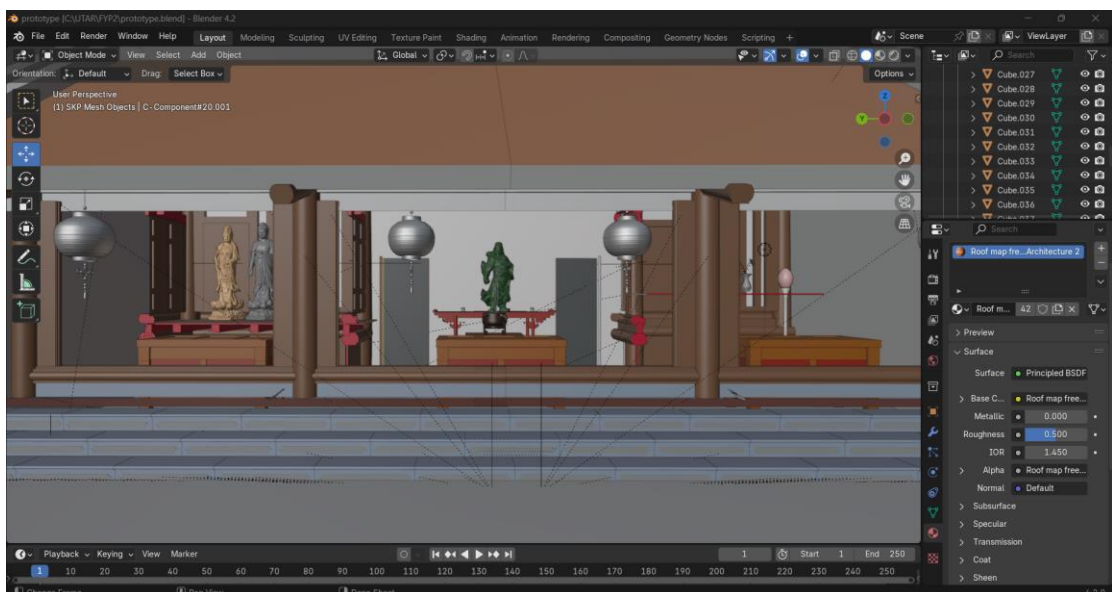


Figure 4.5 3D Model of Jialan Palace

Figure 4.5 shows the 3D Model of the Jialan Palace in Cheng Hoon Teng temple.

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4.1.5 Tiger Lord Hall Model

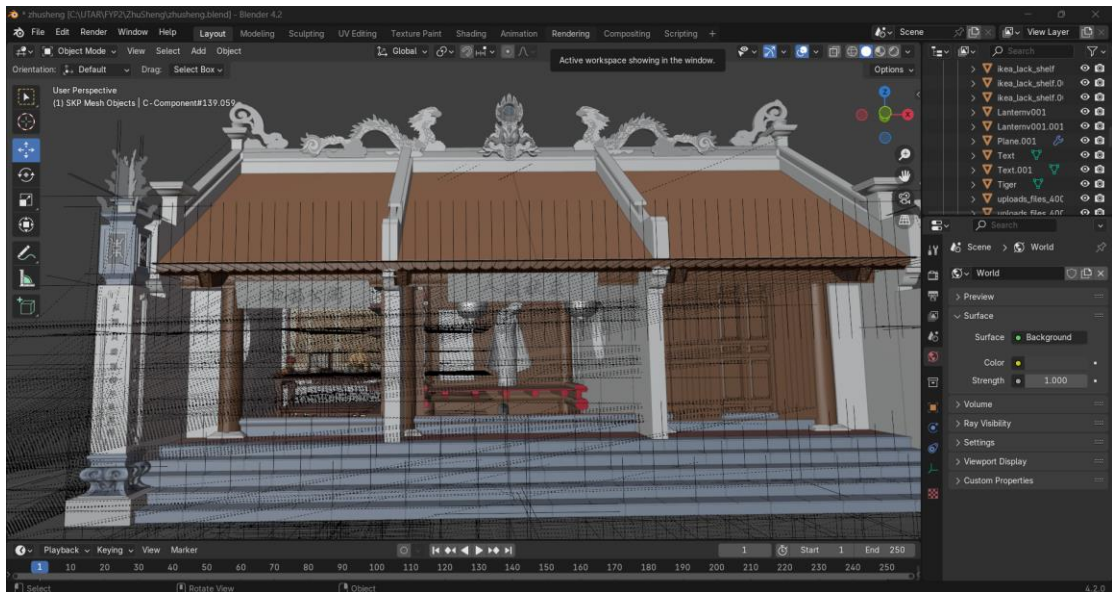


Figure 4.6 3D Model of Tiger Lord Hall

Figure 4.6 show the 3D model of tiger lord hall which is located at the middle part of the figure while the left side of the figure is the ancestral room. Tiger Lord statue is located at the bottom part in the tiger lord hall and the Goddess of Fertility (ZhuSheng NiangNiang) statue is located above the statue of tiger lord.

4.1.6 Li Jun Chang Portrait Room Model

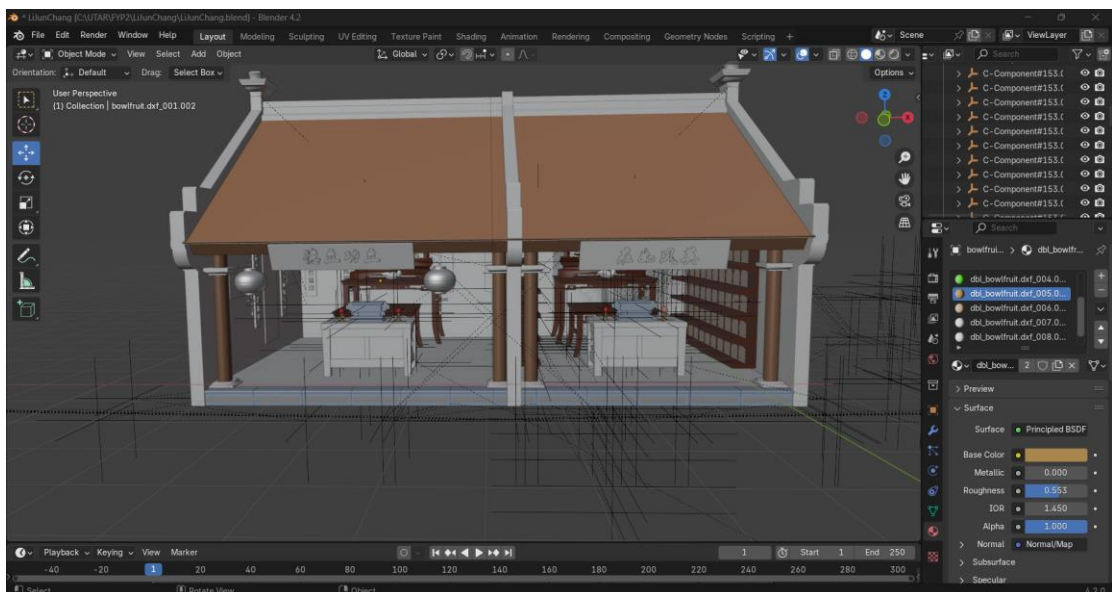


Figure 4.7 3D Model of Li Jun Chang Portrait Room

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Figure 4.7 show the Li Jun Chang Portrait Room 3D model. Li Jun Chang Portrait is located at the left side room in the figure while the right side room is the ancestral room.

4.1.7 Tai Bo Gong Hall Model

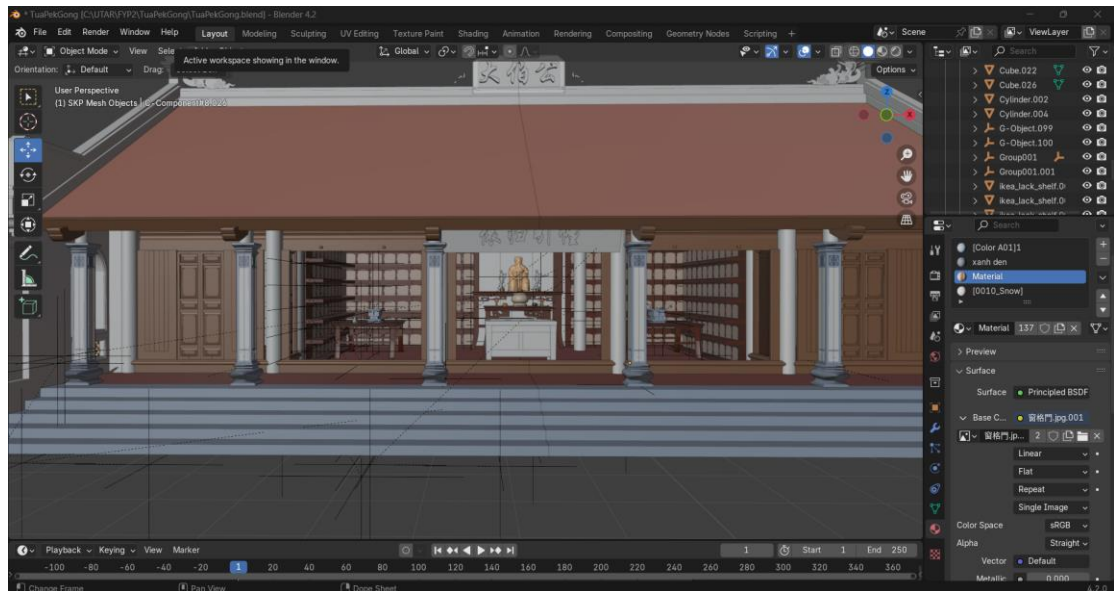


Figure 4.8 3D Model of Tai Bo Gong Hall

The figure above shows the 3D model of Tai Bo Gong Hall in Cheng Hoon Teng temple.

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4.1.8 History Museum Model

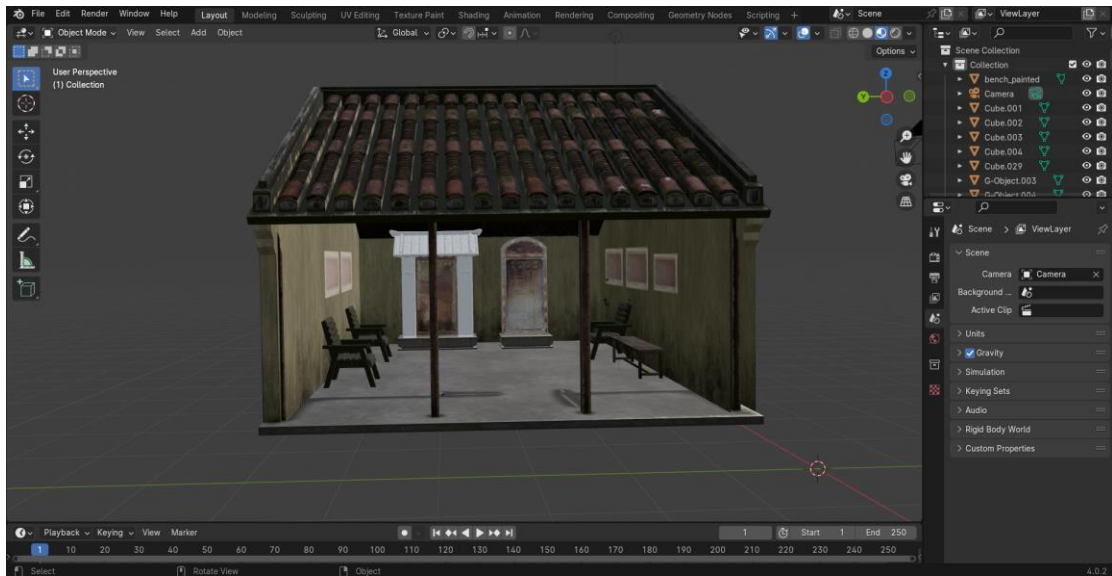


Figure 4.9 3D Model of History Museum

Figure 4.9 shows the 3D model of history museum located in Cheng Hoon Teng temple. Visitors can view the history event of Cheng Hoon Teng temple at here.

4.2 3D Rendering

After the developer has finished built up the 3D model of different places in Cheng Hoon Teng temple. The developer will start 3D rendering process. In this process, the developer will attach some 2D images on 3D model as texture so that the model will look more realistic.

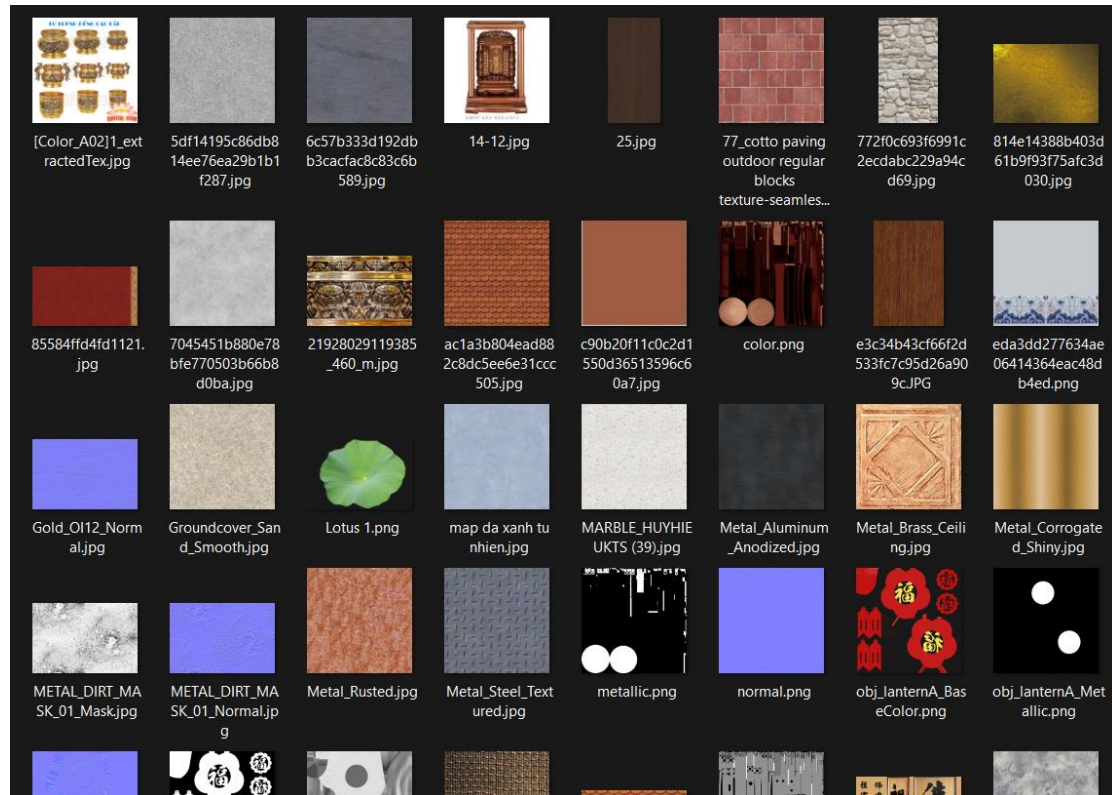


Figure 4.10 Texture of 3D Model

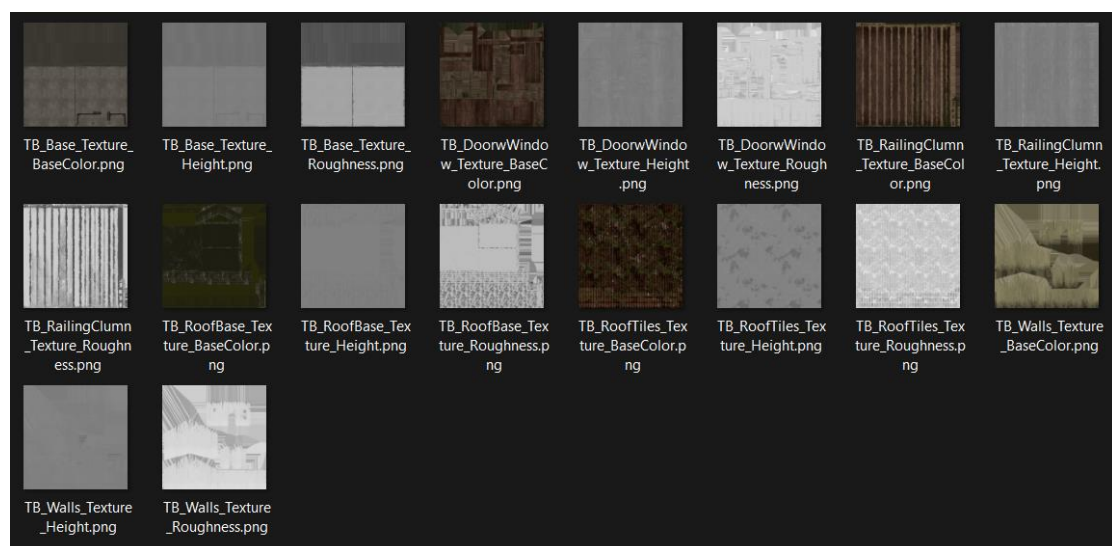


Figure 4.11 Texture of 3D Model

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Figure 4.11 and figure 4.10 show some texture examples that be used in this project. Most of these textures are download from online and apply them manually on to the 3D model.

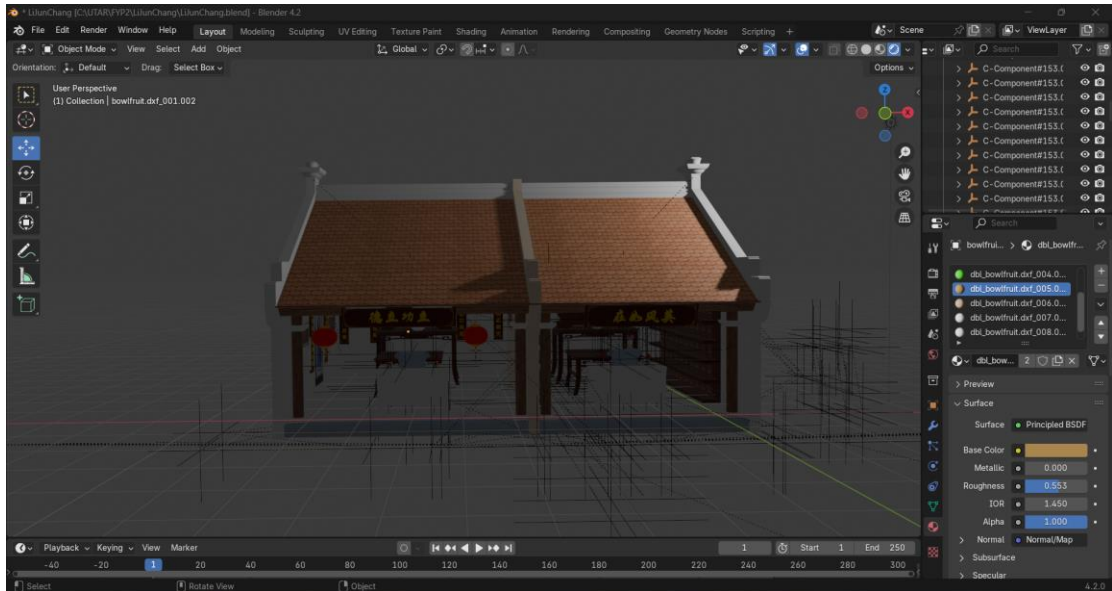


Figure 4.12 Li Jun Chang Portrait Room 3D Model with texture

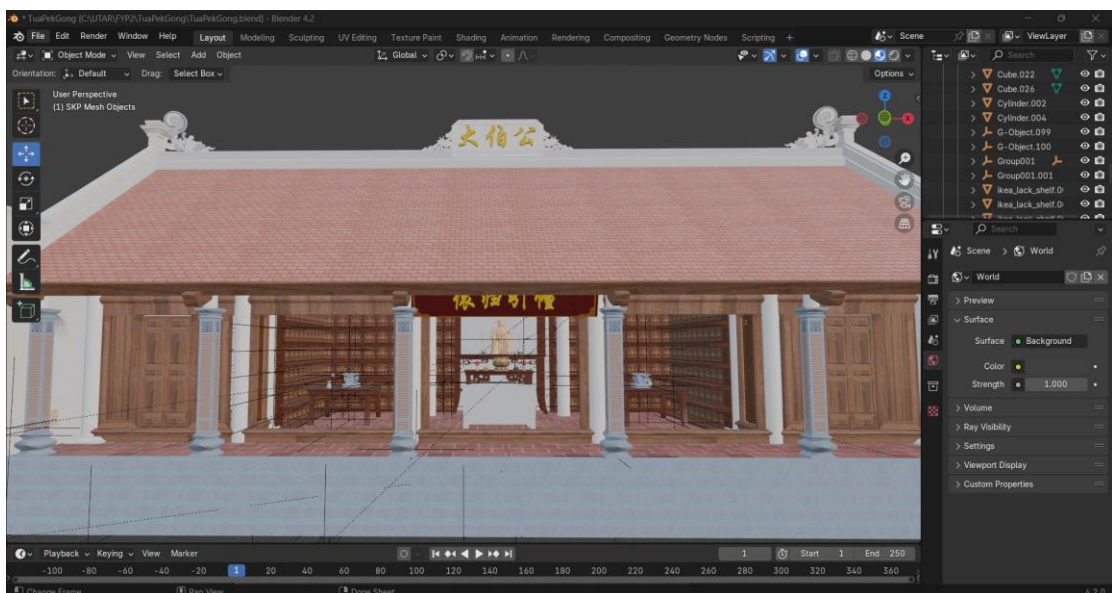


Figure 4.13 Tai Bo Gong Hall 3D Model with texture

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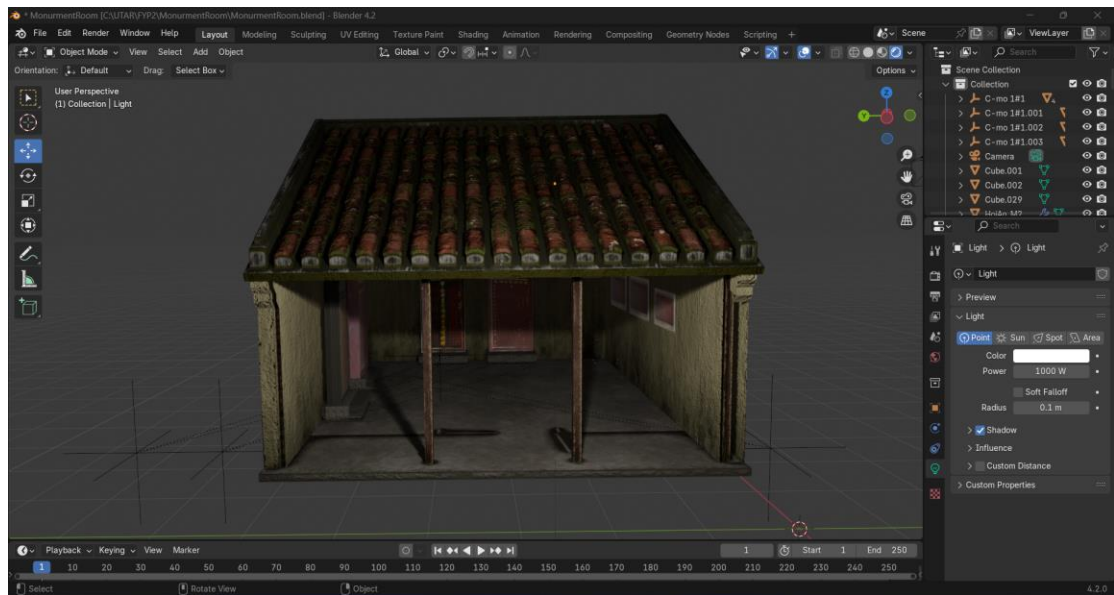


Figure 4.14 Monument Room 3D Model with texture

Figure 4.12, figure 4.13 and figure 4.14 shows some examples about 3D model buildings (with texture) which are in Cheng Hoon Teng temple.

4.3 Application Development in Unity

After all 3D models have been built successfully in Blender, the developer will start to develop virtual tourism application in Unity. There are five modules being developed in this project which are lecture module, game module, user review module, photography module and FAQ module. When users launched this application, a main menu scene will be shown and users can select which action they want to proceed next by clicking on the button display on the main menu.

4.3.1 Main Menu

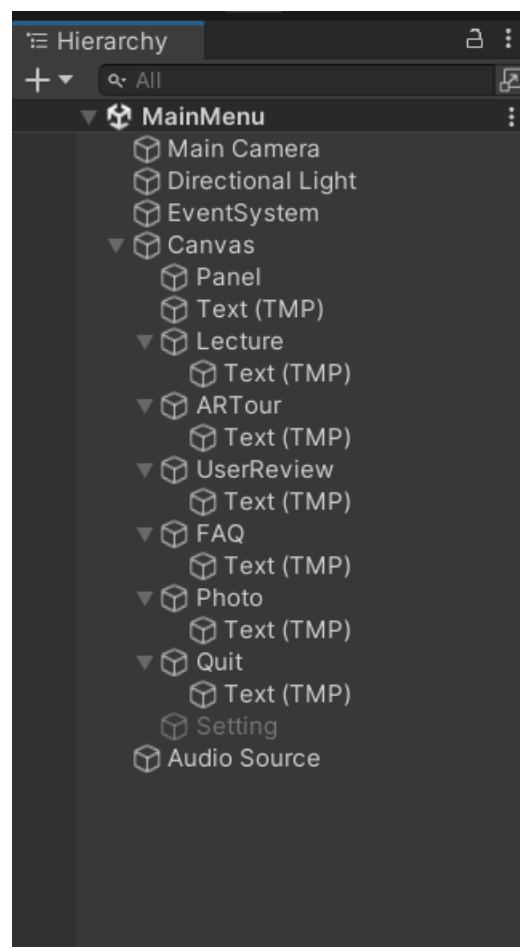
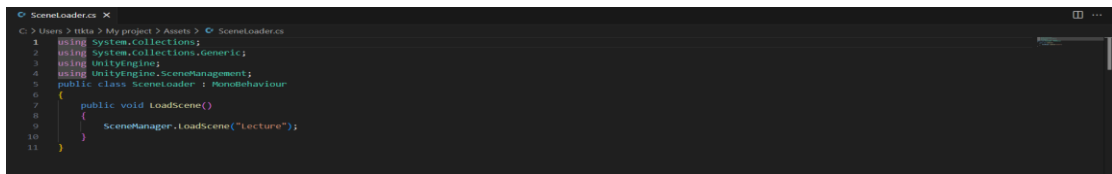


Figure 4.15 Hierarchy of Main Menu Scene

Figure above shows the hierarchy of Main Menu scene. The developer has created a canvas UI and each module button has been created within this UI. Each of the button will be linked to different module scene. It will transform users to different scene based on users' selection. Besides, users can also exit the application by clicking on the quit button. It also includes audio source as background music.



```

1 using System.Collections;
2 using System.Collections.Generic;
3 using UnityEngine;
4 using UnityEngine.SceneManagement;
5 public class SceneLoader : MonoBehaviour
6 {
7     public void LoadScene()
8     {
9         SceneManager.LoadScene("Lecture");
10    }
11 }

```

Figure 4.16 C# of scene loader

Figure 4.16 shows the C# code for scene loader manager which will be called when users clicked on the button to bring users to another scene. This figure only shows lecture scene as an example. The developer has written different scene loader C# code for each button.

4.3.2 Lecture Module

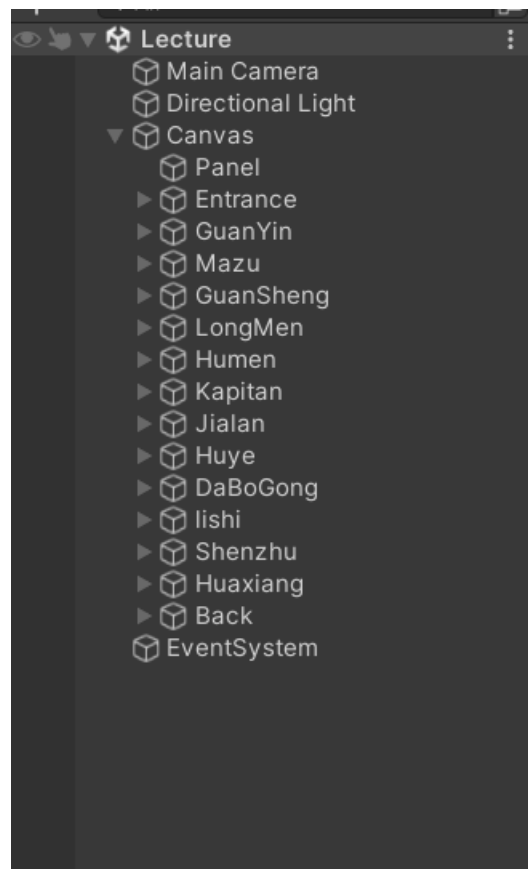


Figure 4.17 Hierarchy of Lecture Module

When users clicked on the lecture module button, they will be transformed to lecture scene. A bird eye view map will be displayed to the users and different places will have their respective button such as Jialan Palace, Tai Bo Gong Hall, Tiger Lord Hall etc. Users can click on these buttons to tour the place virtually by viewing their 360-degree photo.

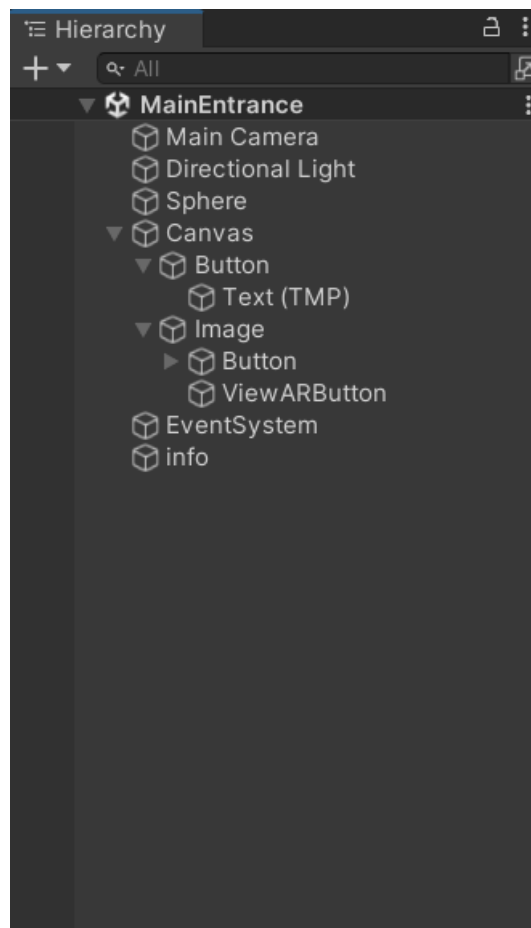
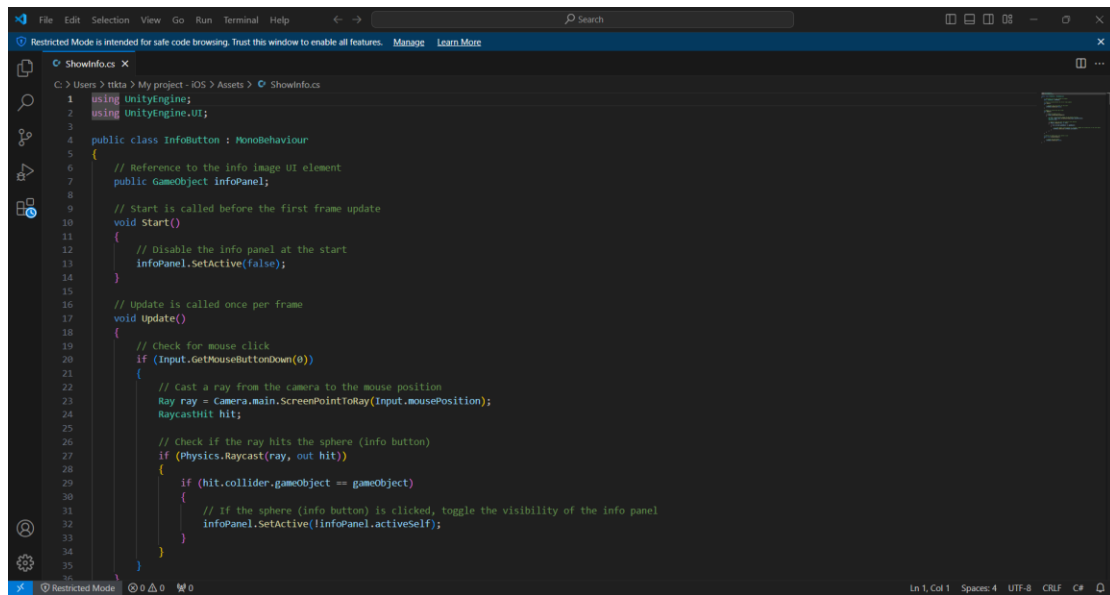


Figure 4.18 Hierarchy of Main Entrance

Figure 4.18 illustrates an example where users click on the main entrance button from the bird's-eye view map. The 360-degree photo is applied as the material of a sphere, with the main camera positioned inside the sphere. This setup creates an immersive experience, allowing users to feel as if they are inside the 360-degree photo, like Google Street View. An embedded info button is also provided, and users can click it to open the information panel, which is labeled as "image" in the hierarchy. Additionally, the close panel button, named "Button," and the view AR model button, named "ViewARButton," are placed as child objects of the info panel in the hierarchy.

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```
1 using UnityEngine;
2 using UnityEngine.UI;
3
4 public class InfoButton : MonoBehaviour
5 {
6     // Reference to the info image UI element
7     public GameObject infoPanel;
8
9     // Start is called before the first frame update
10    void Start()
11    {
12        // Disable the info panel at the start
13        infoPanel.SetActive(false);
14    }
15
16    // Update is called once per frame
17    void Update()
18    {
19        // Check for mouse click
20        if (Input.GetMouseButton(0))
21        {
22            // Cast a ray from the camera to the mouse position
23            Ray ray = Camera.main.ScreenPointToRay(Input.mousePosition);
24            RaycastHit hit;
25
26            // Check if the ray hits the sphere (info button)
27            if (Physics.Raycast(ray, out hit))
28            {
29                if (hit.collider.gameObject == gameObject)
30                {
31                    // If the sphere (info button) is clicked, toggle the visibility of the info panel
32                    infoPanel.SetActive(!infoPanel.activeSelf);
33                }
34            }
35        }
36    }
37 }
```

Figure 4.19 C# code for info button

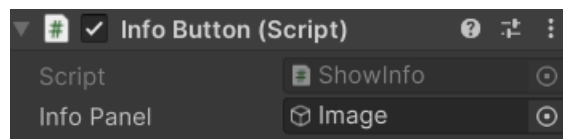


Figure 4.20 Info panel attachment

Figure 4.19 shows the C# code for calling the info panel out when the info button is being clicked by users and figure 4.20 shows the image is attached as info panel in the inspector to let Unity know which info panel is point to.

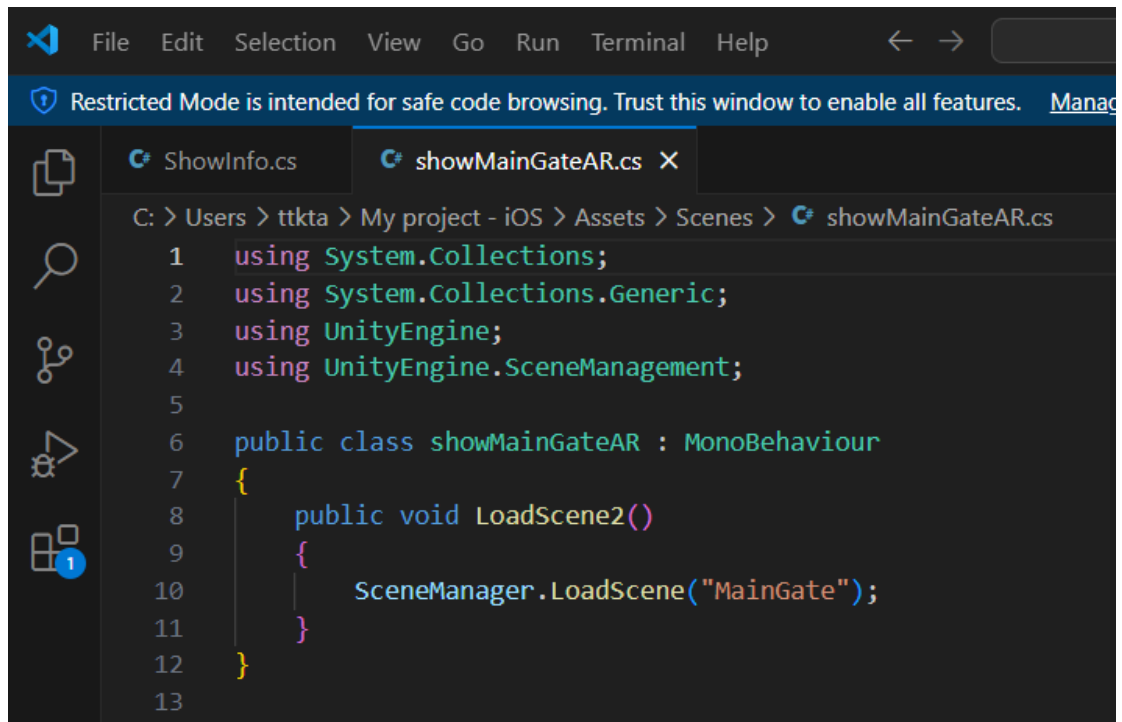


Figure 4.21 C# code for ViewARButton

Figure 4.21 shows the C# code to bring the users to the respective AR model scene after they clicked on the ViewARButton.

```

1  using System.Collections;
2  using System.Collections.Generic;
3  using UnityEngine;
4  using System;
5  public class VRCamera : MonoBehaviour
6  { // flag to keep track whether we are dragging or not
7      public bool isDragging = false;
8
9      // starting point of a camera movement
10     float startMouseX;
11     float startMouseY;
12
13     // Camera component
14     public Camera cam;
15     // Start is called before the first frame update
16     void Start()
17     {
18         // Get our camera component
19         cam = this.gameObject.GetComponent<Camera>();
20     }
21
22     // Update is called once per frame
23     void Update()
24     {
25
26         // if we press the left button and we haven't started dragging
27         if (Input.GetMouseButtonDown(0) && !isDragging)
28         {
29             // set the flag to true
30             isDragging = true;
31
32             // save the mouse starting position
33             startMouseX = Input.mousePosition.x;
34             startMouseY = Input.mousePosition.y;
35         }
36         // if we are not pressing the left btn, and we were dragging
37         else if (Input.GetMouseButtonUp(0) && isDragging)
38         {
39             // set the flag to false
40             isDragging = false;
41         }
42     }
43
44     void LateUpdate()
45     {
46         // Check if we are dragging
47         if (isDragging)
48         {
49             //Calculate current mouse position
50             float endMouseX = Input.mousePosition.x;
51             float endMouseY = Input.mousePosition.y;
52
53             //Difference (in screen coordinates)
54             float diffX = endMouseX - startMouseX;
55             float diffY = endMouseY - startMouseY;
56
57             //New center of the screen
58             float newCenterX = Screen.width / 2 + diffX;
59             float newCenterY = Screen.height / 2 + diffY;
60
61             //Get the world coordinate , this is where we want to look at
62             Vector3 LookHerePoint = cam.ScreenToWorldPoint(new Vector3(newCenterX, newCenterY, cam.nearClipPlane));
63
64             //Make our camera look at the "LookHerePoint"
65             transform.LookAt(LookHerePoint);
66
67             //starting position for the next call
68             startMouseX = endMouseX;
69             startMouseY = endMouseY;
70         }
71     }
72 }

```

Figure 4.22 C# code for Main Camera

Figure above shows the C# code to let the users can view around the place by dragging the screen of the devices.

Chapter 4

4.3.3 Game Module

After all of the 3D models have been successfully built up and rendered, the developer will export all these 3D model to FBX format and import them into Unity for further development.

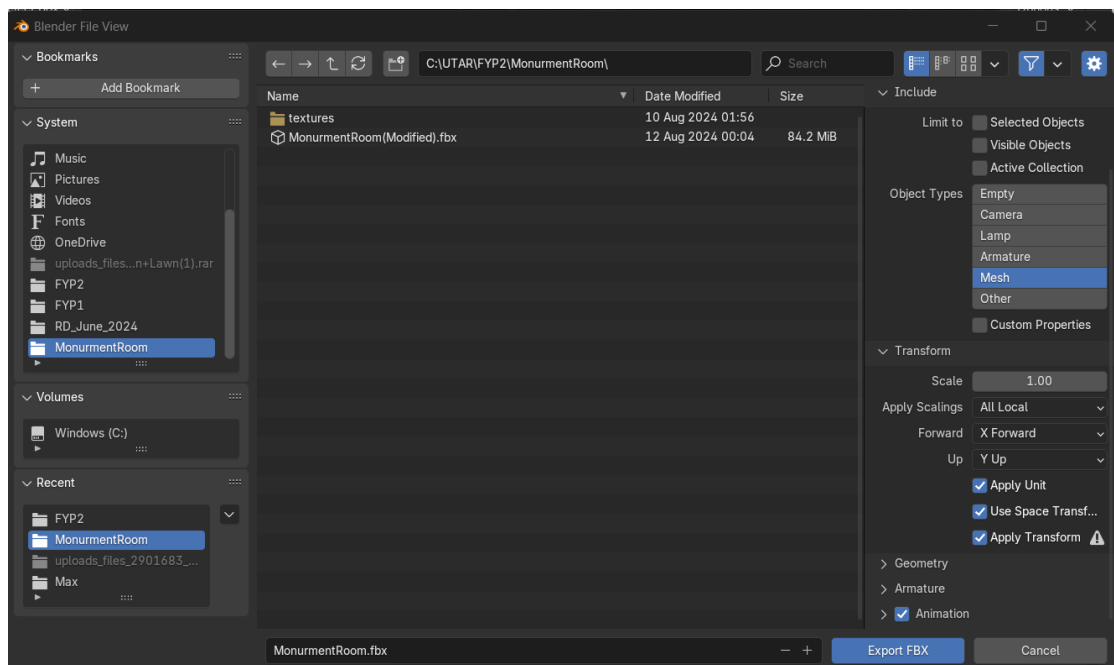


Figure 4.23 Configuration of export 3D Model from Blender

After all 3D model has been successfully exported, the developer will import them into unity.

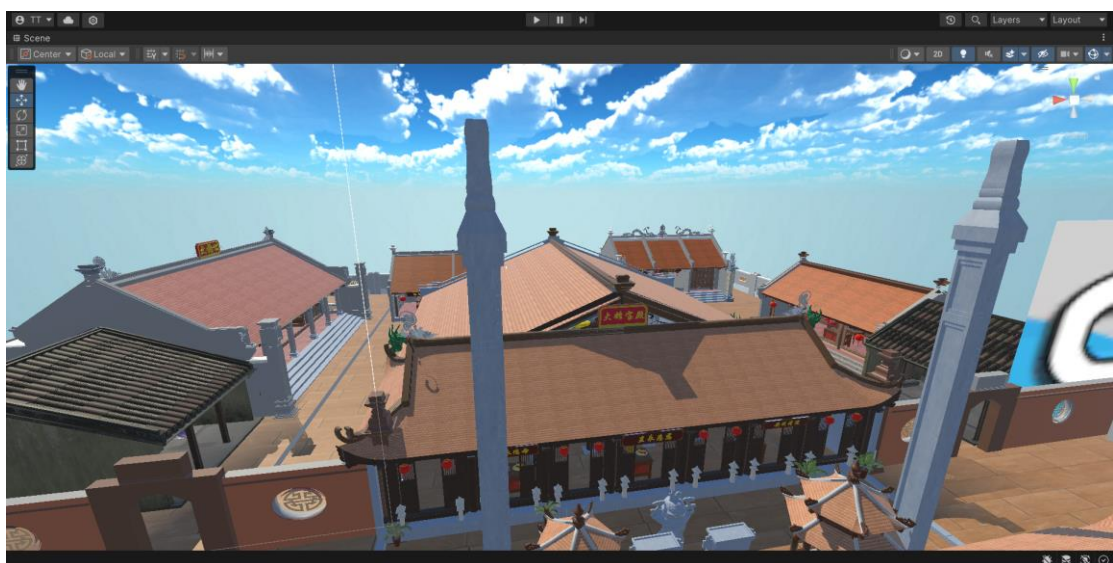


Figure 4.24 Completion import 3D Model to Unity

Chapter 4

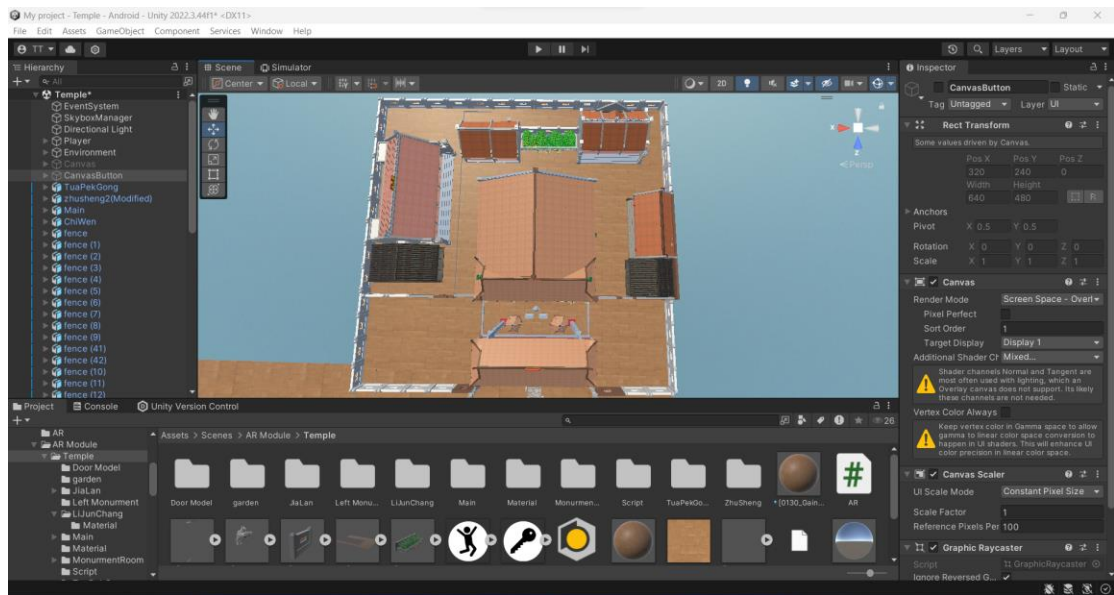


Figure 4.25 Bird eye view of overall 3D Model in Unity

Figure 4.24 and figure 4.25 show that the developer has successfully imported 3D model into unity and the view of 3D model in unity.

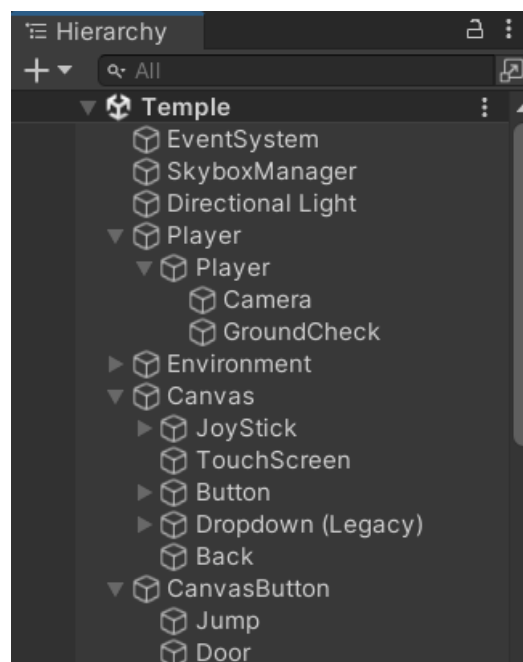
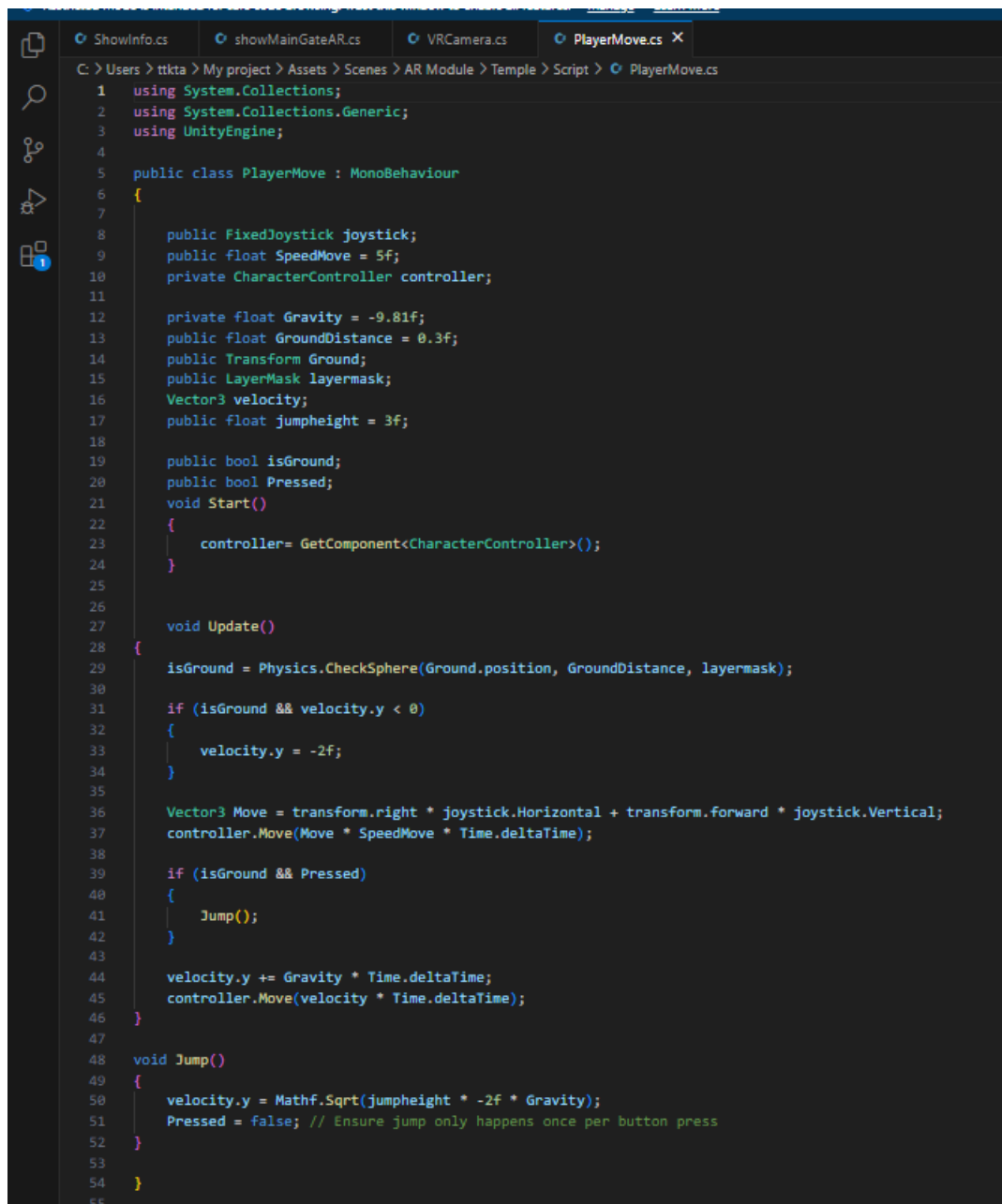


Figure 4.26 Hierarchy of Game module

Before users go into the 3D model environment, a start game scene will be shown out to let users clicked in order to activate the player's camera, joystick, jump and key button and drop-down timeline button which are placed within the canvas UI as shown in figure 4.26.

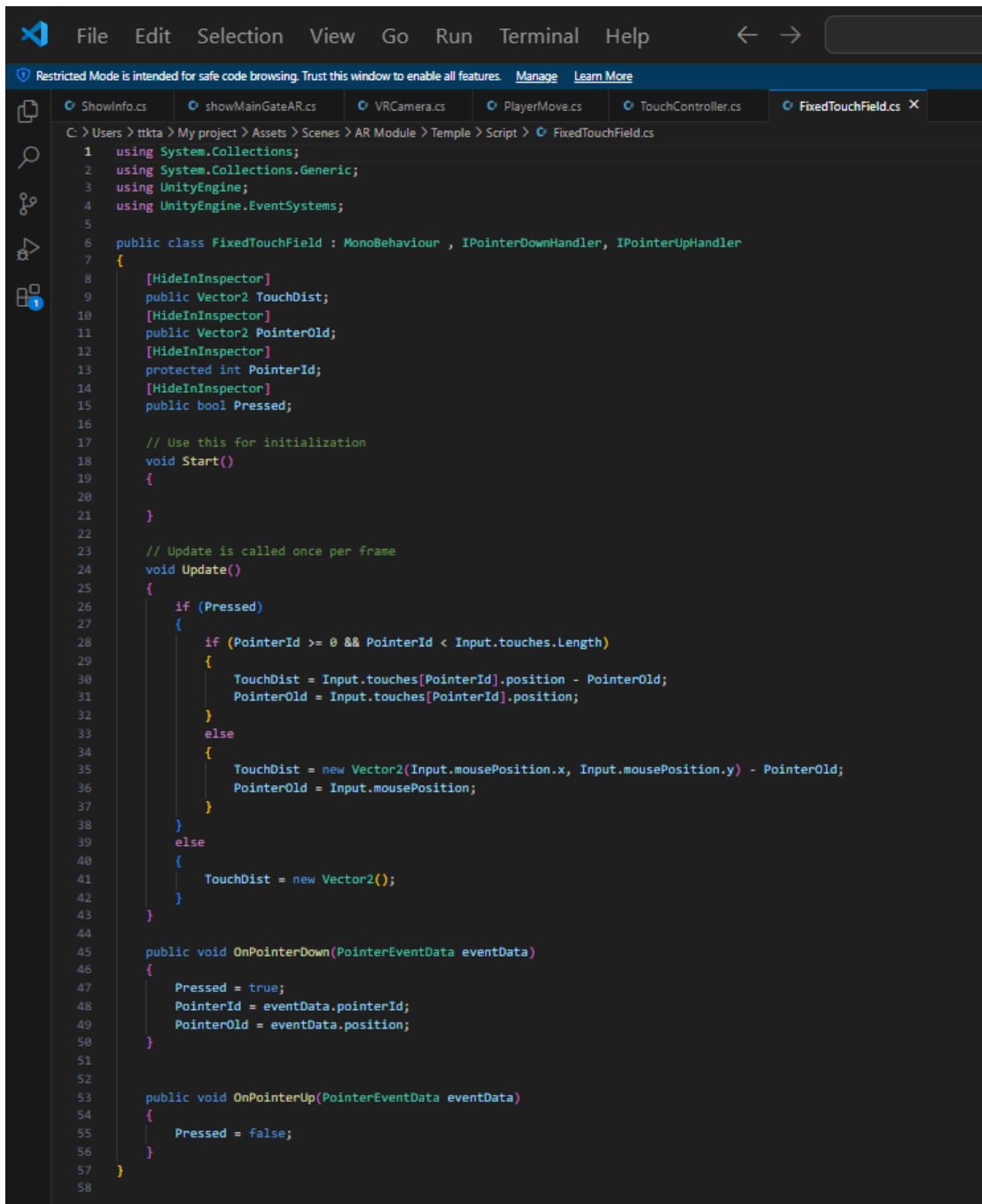


```

1  using System.Collections;
2  using System.Collections.Generic;
3  using UnityEngine;
4
5  public class PlayerMove : MonoBehaviour
6  {
7
8      public FixedJoystick joystick;
9      public float SpeedMove = 5f;
10     private CharacterController controller;
11
12     private float Gravity = -9.81f;
13     public float GroundDistance = 0.3f;
14     public Transform Ground;
15     public LayerMask layermask;
16     Vector3 velocity;
17     public float jumpheight = 3f;
18
19     public bool isGround;
20     public bool Pressed;
21     void Start()
22     {
23         controller = GetComponent<CharacterController>();
24     }
25
26
27     void Update()
28     {
29         isGround = Physics.CheckSphere(Ground.position, GroundDistance, layermask);
30
31         if (isGround && velocity.y < 0)
32         {
33             velocity.y = -2f;
34         }
35
36         Vector3 Move = transform.right * joystick.Horizontal + transform.forward * joystick.Vertical;
37         controller.Move(Move * SpeedMove * Time.deltaTime);
38
39         if (isGround && Pressed)
40         {
41             Jump();
42         }
43
44         velocity.y += Gravity * Time.deltaTime;
45         controller.Move(velocity * Time.deltaTime);
46     }
47
48     void Jump()
49     {
50         velocity.y = Mathf.Sqrt(jumpheight * -2f * Gravity);
51         Pressed = false; // Ensure jump only happens once per button press
52     }
53
54 }
55

```

Figure 4.27 C# code for control player movement



```

1  using System.Collections;
2  using System.Collections.Generic;
3  using UnityEngine;
4  using UnityEngine.EventSystems;
5
6  public class FixedTouchField : MonoBehaviour , IPointerDownHandler, IPointerUpHandler
7  {
8      [HideInInspector]
9      public Vector2 TouchDist;
10     [HideInInspector]
11     public Vector2 PointerOld;
12     [HideInInspector]
13     protected int PointerId;
14     [HideInInspector]
15     public bool Pressed;
16
17     // Use this for initialization
18     void Start()
19     {
20
21     }
22
23     // Update is called once per frame
24     void Update()
25     {
26         if (Pressed)
27         {
28             if (PointerId >= 0 && PointerId < Input.touches.Length)
29             {
30                 TouchDist = Input.touches[PointerId].position - PointerOld;
31                 PointerOld = Input.touches[PointerId].position;
32             }
33             else
34             {
35                 TouchDist = new Vector2(Input.mousePosition.x, Input.mousePosition.y) - PointerOld;
36                 PointerOld = Input.mousePosition;
37             }
38         }
39         else
40         {
41             TouchDist = new Vector2();
42         }
43     }
44
45     public void OnPointerDown(PointerEventData eventData)
46     {
47         Pressed = true;
48         PointerId = eventData.pointerId;
49         PointerOld = eventData.position;
50     }
51
52
53     public void OnPointerUp(PointerEventData eventData)
54     {
55         Pressed = false;
56     }
57 }
58

```

Figure 4.28 C# code for control player's camera

4.3.4 User Review Module

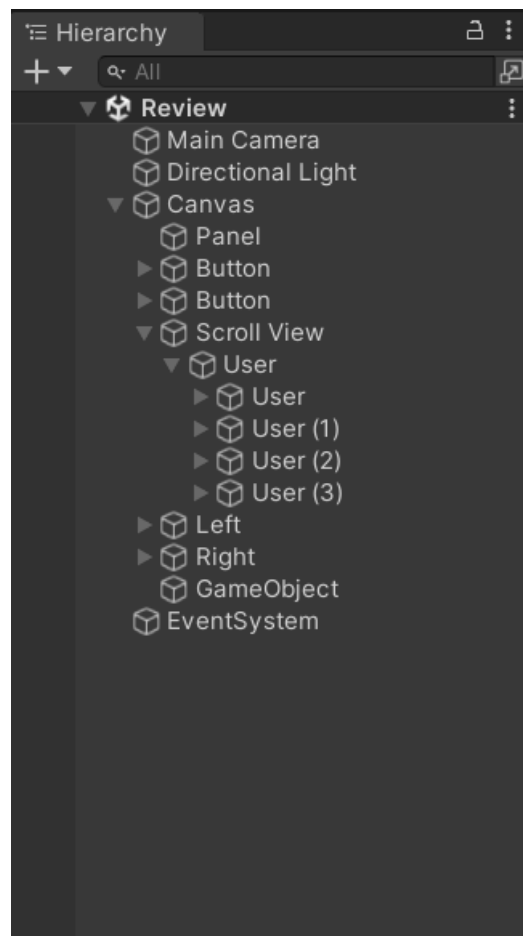
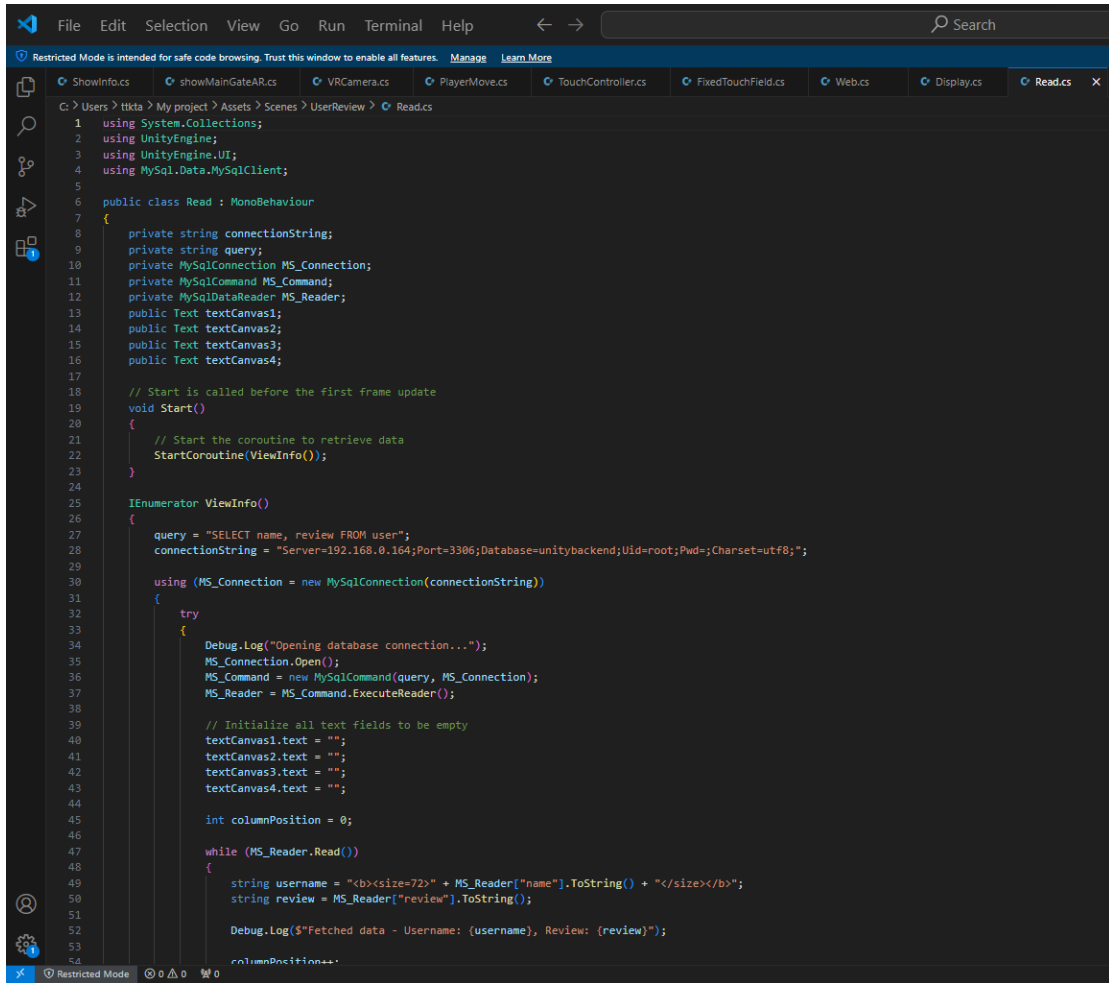


Figure 4.29 Hierarchy of user review module

Figure 4.29 depicts the hierarchy of the user review module. In this module, user reviews are displayed using a scroll view UI, with left and right buttons provided for users to navigate between reviews. A maximum of four of the latest user reviews will be shown at a time. These reviews are retrieved from the database server using a combination of PHP and C# scripts.

Chapter 4



```
1 using System.Collections;
2 using UnityEngine;
3 using UnityEngine.UI;
4 using MySql.Data.MySqlClient;
5
6 public class Read : MonoBehaviour
7 {
8     private string connectionString;
9     private string query;
10    private MySqlConnection MS_Connection;
11    private MySqlCommand MS_Command;
12    private MySqlDataReader MS_Reader;
13    public Text textCanvas1;
14    public Text textCanvas2;
15    public Text textCanvas3;
16    public Text textCanvas4;
17
18    // Start is called before the first frame update
19    void Start()
20    {
21        // Start the coroutine to retrieve data
22        StartCoroutine(ViewInfo());
23    }
24
25    IEnumerator ViewInfo()
26    {
27        query = "SELECT name, review FROM user";
28        connectionString = "Server=192.168.0.164;Port=3306;Database=unitybackend;Uid=root;Pwd=;Charset=utf8;";
29
30        using (MS_Connection = new MySqlConnection(connectionString))
31        {
32            try
33            {
34                Debug.Log("Opening database connection...");
35                MS_Connection.Open();
36                MS_Command = new MySqlCommand(query, MS_Connection);
37                MS_Reader = MS_Command.ExecuteReader();
38
39                // Initialize all text fields to be empty
40                textCanvas1.text = "";
41                textCanvas2.text = "";
42                textCanvas3.text = "";
43                textCanvas4.text = "";
44
45                int columnPosition = 0;
46
47                while (MS_Reader.Read())
48                {
49                    string username = "<b><size=72>" + MS_Reader["name"].ToString() + "</size></b>";
50                    string review = MS_Reader["review"].ToString();
51
52                    Debug.Log($"Fetched data - Username: {username}, Review: {review}");
53
54                    columnPosition++;
55                }
56            }
57            catch (Exception ex)
58            {
59                Debug.LogError(ex.Message);
60            }
61        }
62    }
63 }
```

Figure 4.30 C# code for reading user review

```

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string review = MS_Reader["review"].ToString();

Debug.Log($"Fetched data - Username: {username}, Review: {review}");

columnPosition++;
if (columnPosition == 1)
{
    textCanvas1.supportRichText = true;
    textCanvas1.text = username + ":\n" + review + "\n\n";
}
else if (columnPosition == 2)
{
    textCanvas2.supportRichText = true;
    textCanvas2.text = username + ":\n" + review + "\n\n";
}
else if (columnPosition == 3)
{
    textCanvas3.supportRichText = true;
    textCanvas3.text = username + ":\n" + review + "\n\n";
}
else if (columnPosition == 4)
{
    textCanvas4.supportRichText = true;
    textCanvas4.text = username + ":\n" + review + "\n\n";
}
else
{
    int textFieldIndex = (columnPosition - 1) % 4;
    switch (textFieldIndex)
    {
        case 0:
            textCanvas1.supportRichText = true;
            textCanvas1.text = username + ":\n" + review + "\n\n";
            break;
        case 1:
            textCanvas2.supportRichText = true;
            textCanvas2.text = username + ":\n" + review + "\n\n";
            break;
        case 2:
            textCanvas3.supportRichText = true;
            textCanvas3.text = username + ":\n" + review + "\n\n";
            break;
        case 3:
            textCanvas4.supportRichText = true;
            textCanvas4.text = username + ":\n" + review + "\n\n";
            break;
    }
}

if (columnPosition == 0)
{
    Debug.Log("No records found.");
}

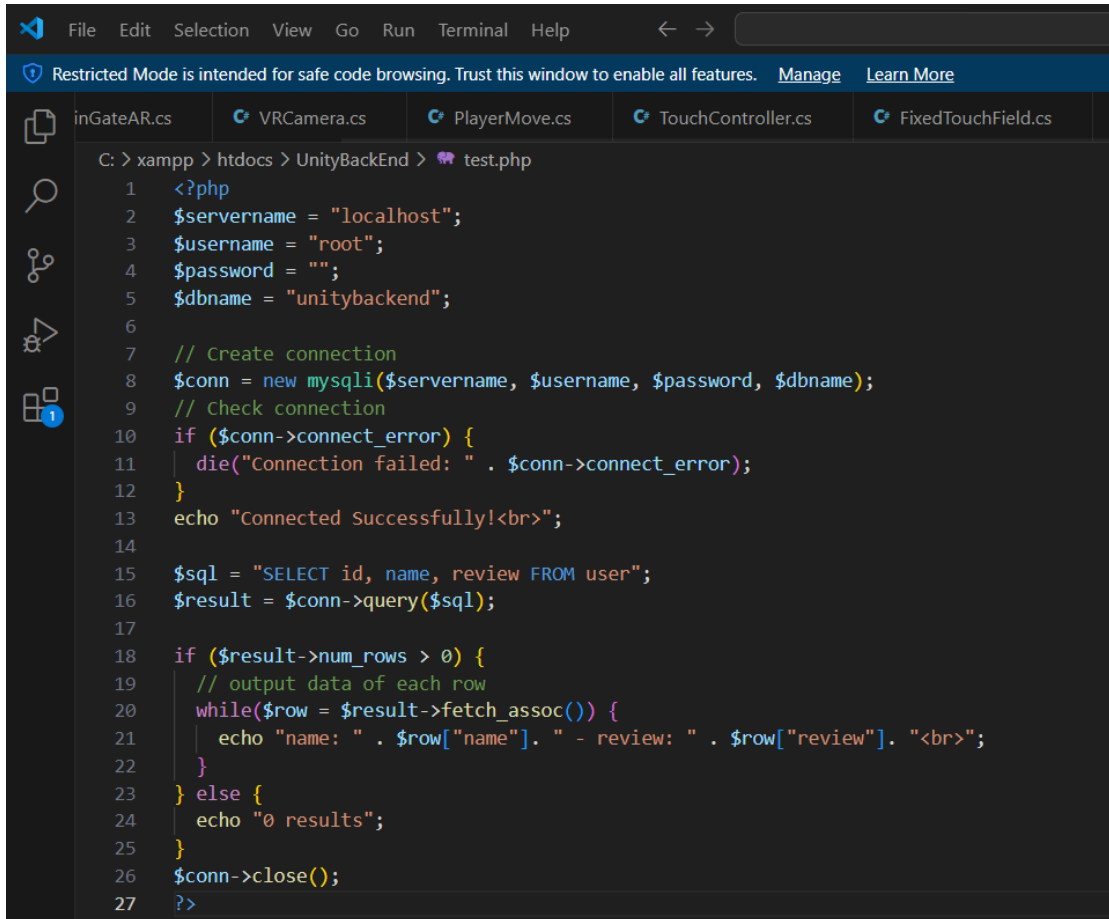
MS_Reader.Close();
}
catch (System.Exception ex)
{
    Debug.LogError("Error: " + ex.Message);
}
finally
{
    if (MS_Connection.State == System.Data.ConnectionState.Open)
    {
        MS_Connection.Close();
    }
}

yield return null;
}
}

```

Figure 4.31 C# code for reading user review

Figure 4.30 and figure 4.31 indicates how the developer reading the user review from database by using C# code.



The screenshot shows a code editor window with a dark theme. The top menu bar includes File, Edit, Selection, View, Go, Run, Terminal, and Help. Below the menu bar, a blue banner states: "Restricted Mode is intended for safe code browsing. Trust this window to enable all features. [Manage](#) [Learn More](#)". The editor displays several tabs: inGateAR.cs, VRCamera.cs, PlayerMove.cs, TouchController.cs, and FixedTouchField.cs. The active tab is test.php, which contains the following PHP code:

```

C: > xampp >htdocs > UnityBackEnd > test.php
1  <?php
2  $servername = "localhost";
3  $username = "root";
4  $password = "";
5  $dbname = "unitybackend";
6
7  // Create connection
8  $conn = new mysqli($servername, $username, $password, $dbname);
9  // Check connection
10 if ($conn->connect_error) {
11     die("Connection failed: " . $conn->connect_error);
12 }
13 echo "Connected Successfully!<br>";
14
15 $sql = "SELECT id, name, review FROM user";
16 $result = $conn->query($sql);
17
18 if ($result->num_rows > 0) {
19     // output data of each row
20     while($row = $result->fetch_assoc()) {
21         echo "name: " . $row["name"]. " - review: " . $row["review"]. "<br>";
22     }
23 } else {
24     echo "0 results";
25 }
26 $conn->close();
27 ?>

```

Figure 4.32 PHP code for retrieving user review

Figure 4.32 shows the PHP code about how the user review being retrieved from database.

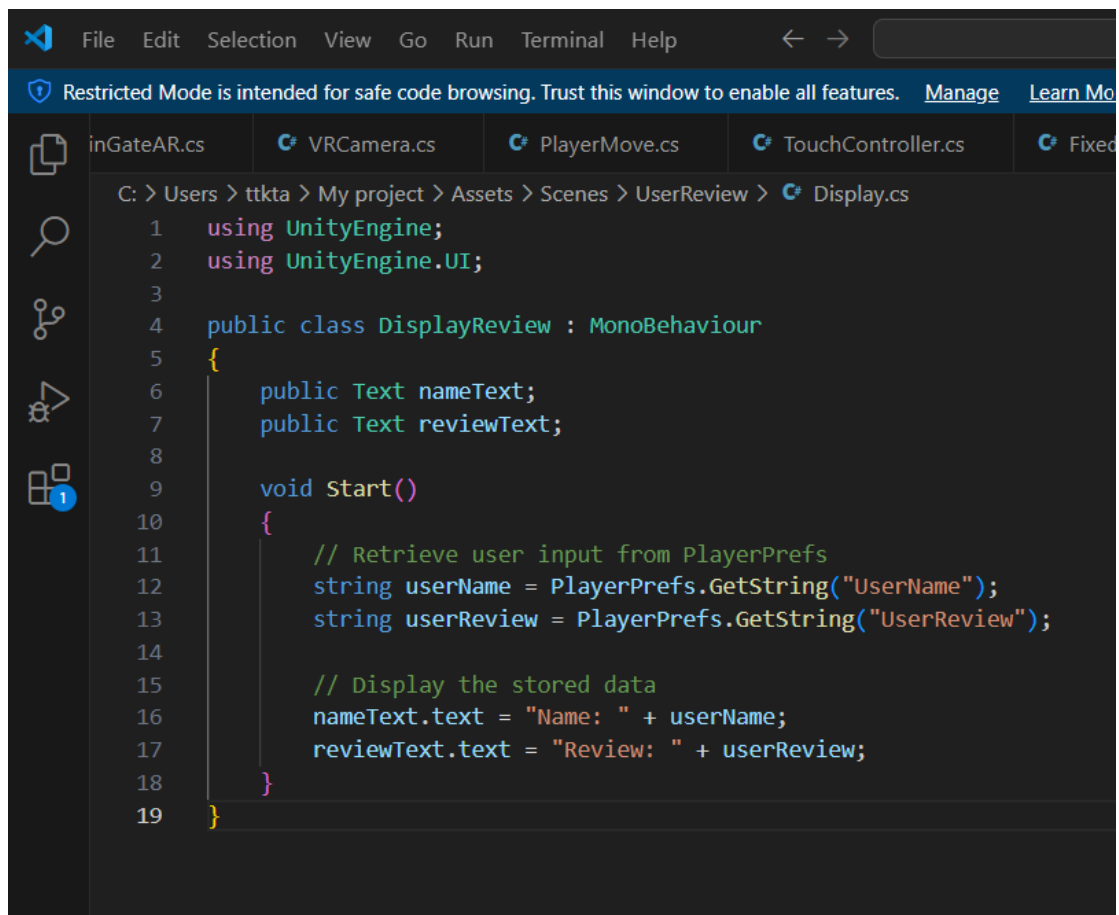


Figure 4.33 C# code for displaying user review

After retrieving user review successfully from database, figure 4.33 shows how the developer displays these records to the text UI in the Unity.

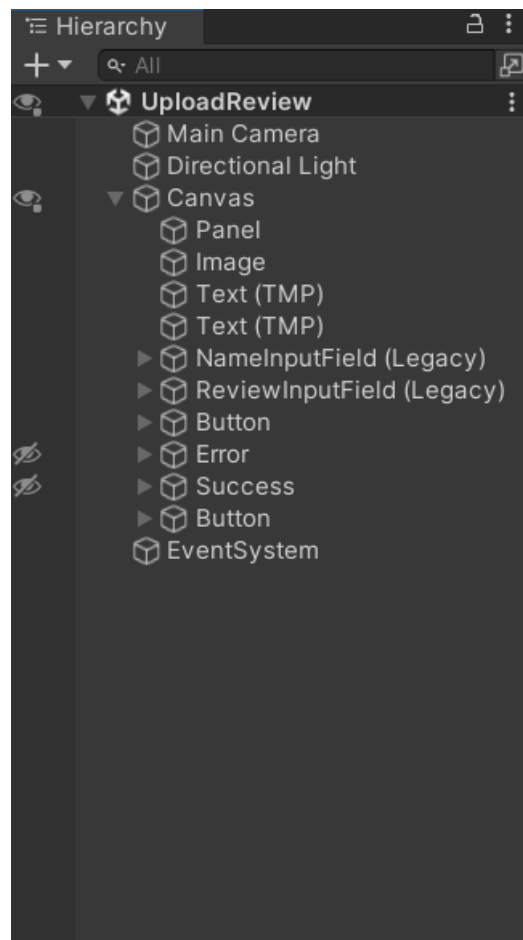


Figure 4.34 Hierarchy of upload review

Figure 4.34 illustrates the hierarchy of the upload review scene. In this scene, users can enter their name and review into designated input fields within the UI. After submitting by clicking the submit button, either a success or error panel will appear depending on the validation of the input data.

```

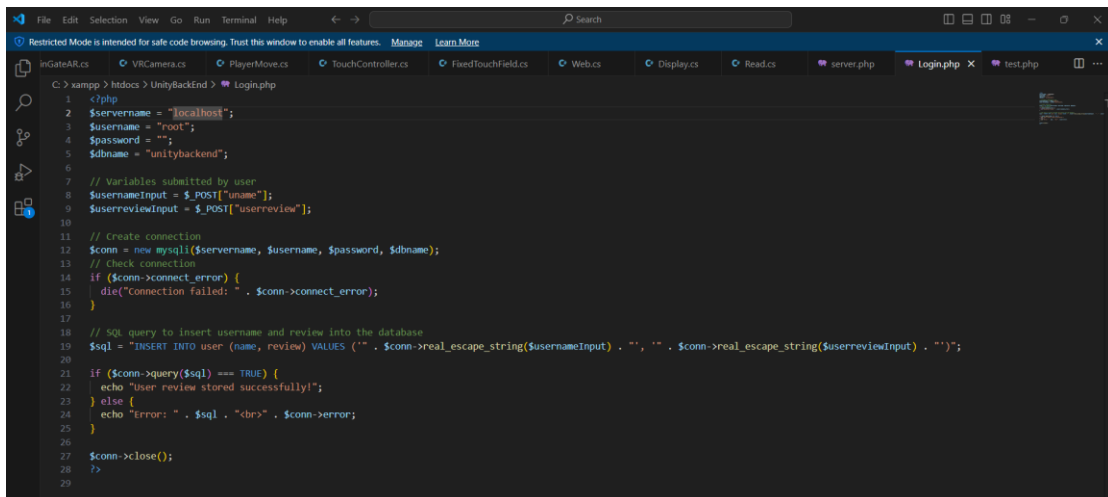
1  using System.Collections;
2  using UnityEngine;
3  using UnityEngine.Networking;
4  using UnityEngine.UI;
5
6  public class Web : MonoBehaviour
7  {
8      public InputField usernameInputField;
9      public InputField reviewInputField;
10     public Image successImage; // Assign this in the Unity Editor
11     public Image errorImage; // Assign this in the Unity Editor
12
13     void Start()
14     {
15         StartCoroutine(GetReview());
16     }
17
18     IEnumerator GetReview()
19     {
20         using (UnityWebRequest www = UnityWebRequest.Get("http://localhost/UnityBackend/test.php"))
21         {
22             yield return www.SendWebRequest();
23
24             if (www.result != UnityWebRequest.Result.Success)
25             {
26                 Debug.Log(www.error);
27             }
28             else
29             {
30                 Debug.Log(www.downloadHandler.text);
31             }
32         }
33     }
34
35     public void SubstReview()
36     {
37         string username = usernameInputField.text.Trim();
38         string review = reviewInputField.text.Trim();
39
40         if (string.IsNullOrEmpty(username) || string.IsNullOrEmpty(review))
41         {
42             Debug.LogError("Username or review is empty. Review not submitted.");
43             ShowErrorMessage();
44             return;
45         }
46
47         StartCoroutine(Review(username, review));
48     }
49
50     private void ShowSuccessImage()
51     {
52         successImage.gameObject.SetActive(true);
53         errorImage.gameObject.SetActive(false);
54     }
55
56     private void ShowErrorMessage()
57     {
58         errorImage.gameObject.SetActive(true);
59         successImage.gameObject.SetActive(false);
60     }
61
62     IEnumerator Review(string username, string review)
63     {
64         WebForm form = new WebForm();
65         form.AddField("uname", username);
66         form.AddField("userreview", review);
67
68         using (UnityWebRequest www = UnityWebRequest.Post("http://localhost/UnityBackend/login.php", form))
69         {
70             yield return www.SendWebRequest();
71
72             if (www.result != UnityWebRequest.Result.Success)
73             {
74                 Debug.LogError(www.error);
75                 ShowErrorMessage();
76             }
77             else
78             {
79                 Debug.Log("Response: " + www.downloadHandler.text);
80                 ShowSuccessImage();
81             }
82         }
83     }
84 }
85

```

Figure 4.35 C# code for upload user review

Figure 4.35 shows the C# code for upload user review.

Chapter 4

A screenshot of a code editor window showing a PHP script named 'Login.php'. The code is written in a dark-themed editor with line numbers on the left. The script starts with a PHP opening tag and sets database credentials: \$servername = 'localhost', \$username = 'root', \$password = '', and \$dbname = 'unitybackend'. It then retrieves user input from \$_POST for 'uname' and 'userreview'. A MySQL connection is established using mysqli. The script checks the connection and then executes an SQL query to insert the username and review into a table named 'user'. It checks if the query was successful and echoes a success message or an error message. Finally, it closes the database connection and ends the script with a closing PHP tag. The editor's top bar shows various tabs for different files, including 'Login.php' which is currently active.

```
1 <?php
2 $servername = "localhost";
3 $username = "root";
4 $password = "";
5 $dbname = "unitybackend";
6
7 // Variables submitted by user
8 $usernameInput = $_POST["uname"];
9 $userreviewInput = $_POST["userreview"];
10
11 // Create connection
12 $conn = new mysqli($servername, $username, $password, $dbname);
13 // Check connection
14 if ($conn->connect_error) {
15     die("Connection failed: " . $conn->connect_error);
16 }
17
18 // SQL query to insert username and review into the database
19 $sql = "INSERT INTO user (name, review) VALUES ('" . $conn->real_escape_string($usernameInput) . "', '" . $conn->real_escape_string($userreviewInput) . "')";
20
21 if ($conn->query($sql) === TRUE) {
22     echo "User review stored successfully!";
23 } else {
24     echo "Error: " . $sql . "<br>" . $conn->error;
25 }
26
27 $conn->close();
28 ?>
```

Figure 4.36 PHP code for upload user review

Figure 4.36 shows the PHP code for upload user review.

Since the developer is using XAMPP as the database server software, PHP is required to develop the server-side functionalities. However, as Unity primarily uses C# for development, the developer needs to integrate C# with PHP to enable communication between Unity and the server, ensuring that the server functions properly within the Unity environment.

4.3.5 Photography Module

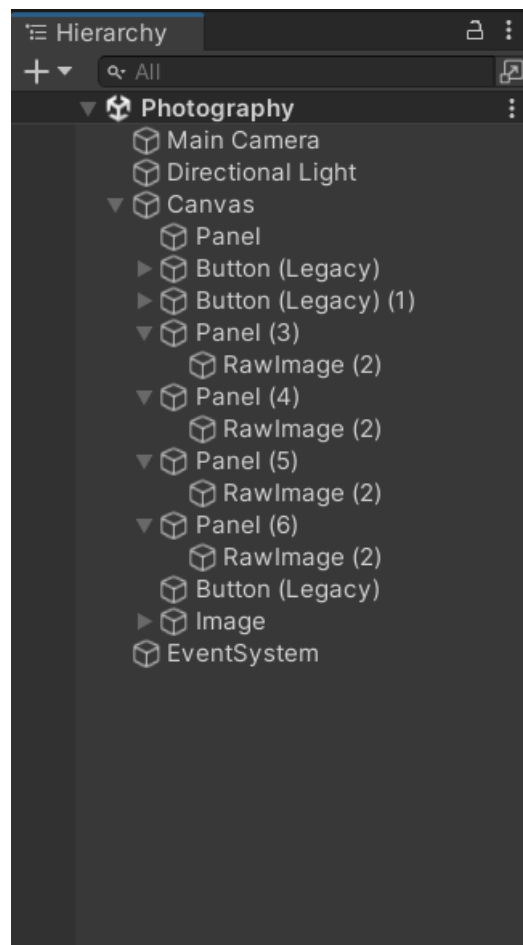


Figure 4.37 Hierarchy of photography module

Figure 4.37 displays the hierarchy of photography module. There are four images being displayed in this module. The number of the images being displayed can be controlled in the inspector.

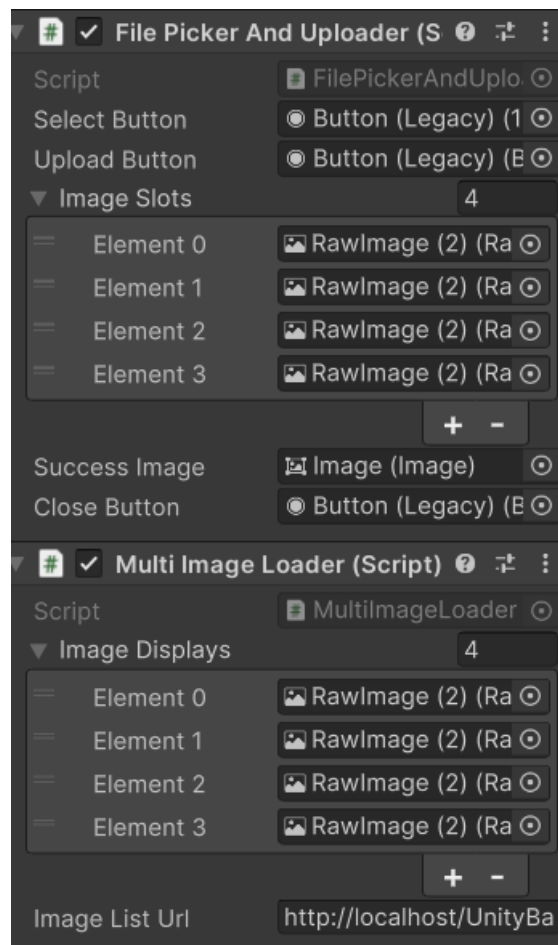


Figure 4.38 Image Controller

Figure 4.38 displays the image controller in the inspector. The developer can adjust the number of images by modifying the image slots and image display columns. After setting the number of images, the developer must attach the raw image elements to the corresponding columns. This ensures that the system knows which image should be displayed in each raw image UI element.

Similar to the user review module, the photography module is also connected to the database server via XAMPP. To ensure proper functionality, PHP is used for server-side operations, while C# handles the Unity-side integration. Both languages work together to ensure smooth communication between the database and Unity.

```

ShowInfo.cs showMainGateAR.cs VRCamera.cs PlayerMove.cs TouchController.cs FixedTouchField.cs Web
C:\Users> ttka > My project > Assets > Scenes > Photography > FilePickerAndUploader.cs
1  using UnityEngine;
2  using UnityEngine.UI;
3  using UnityEngine.Networking;
4  using System.Collections;
5  using System.IO;
6
7  public class FilePickerAndUploader : MonoBehaviour
8  {
9      public Button selectButton;
10     public Button uploadButton;
11     public RawImage[] imageSlots; // Array of RawImage elements (adjust size as needed)
12     public Image successImage; // Reference to the success image UI element
13     public Button closeButton; // Reference to the close button
14
15     private string[] selectedFilePaths;
16     private const int maxFileCount = 40; // Size increased by 10 times from 4
17     private const string serverUploadUrl = "http://localhost/UnityBackend/upload.php";
18
19     void Start()
20     {
21         selectButton.onClick.AddListener(PickFile);
22         uploadButton.onClick.AddListener(UploadFiles);
23         closeButton.onClick.AddListener(CloseSuccessImage);
24         successImage.enabled = false; // Hide the success image initially
25         closeButton.gameObject.SetActive(false); // Hide the close button initially
26         selectedFilePaths = new string[maxFileCount]; // Initialize the array with increased size
27     }
28
29     void PickFile()
30     {
31         NativeFilePicker.PickFile((path) =>
32         {
33             if (!string.IsNullOrEmpty(path))
34             {
35                 for (int i = 0; i < selectedFilePaths.Length; i++)
36                 {
37                     if (string.IsNullOrEmpty(selectedFilePaths[i]))
38                     {
39                         selectedFilePaths[i] = path;
40                         StartCoroutine(LoadImage(path, i));
41                         return; // Exit after assigning the image to the first available slot
42                     }
43                 }
44
45                 Debug.LogWarning("All file slots are occupied.");
46             }
47         });
48     }
49
50     IEnumerator LoadImage(string filePath, int slotIndex)
51     {
52         if (slotIndex < 0 || slotIndex >= selectedFilePaths.Length)
53         {
54             Debug.LogError("Slot index out of bounds!");
55             yield break;
56         }
57
58         Texture2D texture = new Texture2D(2, 2);
59         byte[] fileData = File.ReadAllBytes(filePath);
60         texture.LoadImage(fileData);
61
62         if (slotIndex < imageSlots.Length) // Ensure we do not exceed available UI slots
63         {
64             imageSlots[slotIndex].texture = texture;
65         }
66     }

```

Figure 4.39 C# code for file picker

```

8 {
9 {
10     yield return null;
11 }
12
13 void UploadFiles()
14 {
15     StartCoroutine(UploadFilesCoroutine());
16 }
17
18 IEnumerator UploadFilesCoroutine()
19 {
20     bool hasFiles = false;
21
22     for (int i = 0; i < selectedFilePaths.Length; i++)
23     {
24         if (!string.IsNullOrEmpty(selectedFilePaths[i]))
25         {
26             hasFiles = true;
27             string timestamp = System.DateTime.Now.ToString("yyyyMMddHHmmssfff");
28             string newFileName = timestamp + Path.GetExtension(selectedFilePaths[i]);
29             yield return StartCoroutine(UploadFileCoroutine(selectedFilePaths[i], newFileName));
30             selectedFilePaths[i] = null; // Clear the file path after uploading
31         }
32     }
33
34     if (!hasFiles)
35     {
36         Debug.LogError("No files to upload!");
37     }
38 }
39
40 IEnumerator UploadFileCoroutine(string filePath, string newFileName)
41 {
42     Debug.Log($"Starting upload for {newFileName}...");
43
44     byte[] fileData = File.ReadAllBytes(filePath);
45     WWWForm form = new WWWForm();
46     form.AddBinaryData("file", fileData, newFileName);
47
48     using (UnityWebRequest www = UnityWebRequest.Post(serverUploadUrl, form))
49     {
50         yield return www.SendWebRequest();
51
52         if (www.result != UnityWebRequest.Result.Success)
53         {
54             Debug.LogError($"Upload error for {newFileName}: {www.error}");
55         }
56         else
57         {
58             Debug.Log($"File {newFileName} uploaded successfully!");
59             ShowSuccessImage();
60         }
61     }
62 }
63
64 private void ShowSuccessImage()
65 {
66     Debug.Log("Showing success image..."); // Debug log to check method invocation
67     successImage.enabled = true; // Show the success image
68     closeButton.gameObject.SetActive(true); // Show the close button
69 }
70
71 private void CloseSuccessImage()
72 {
73     successImage.enabled = false; // Hide the success image
74     closeButton.gameObject.SetActive(false); // Hide the close button
75 }
76 }
77 }

```

Figure 4.40 C# code for file picker

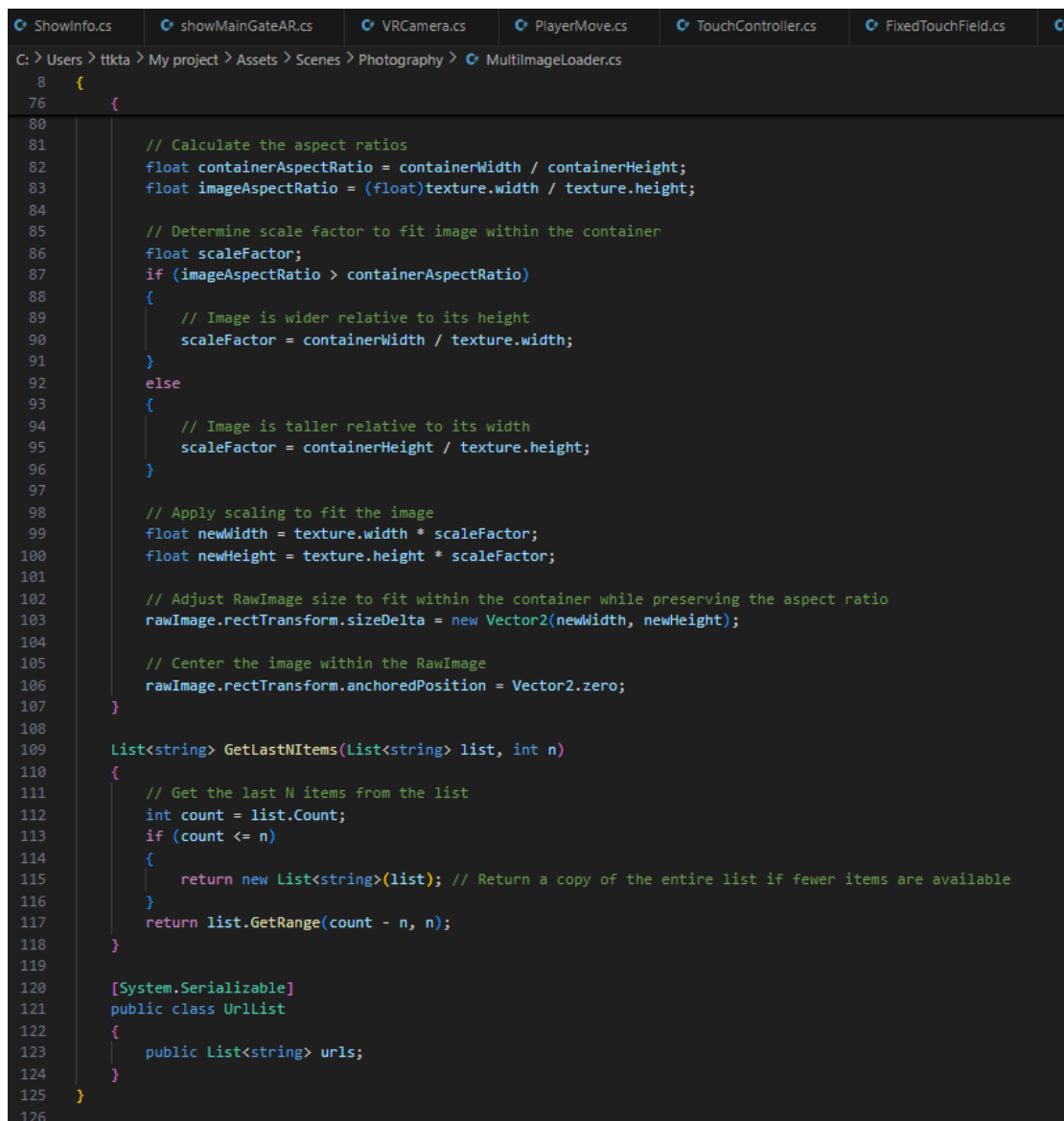
Figure 4.39 and figure 4.40 shows the C# code for file picker which can let users to select which image they want to upload to database through their devices' file explorer.

```

C:\Users> tkta > My project > Assets > Scenes > Photography > MultiImageLoader.cs
1 using System.Collections;
2 using System.Collections.Generic;
3 using UnityEngine;
4 using UnityEngine.Networking;
5 using UnityEngine.UI;
6
7 public class MultiImageLoader : MonoBehaviour
8 {
9     public RawImage[] imageDisplays; // The RawImage elements to display the images
10    public string imagelistUrl = "http://localhost/UnityBackEnd/list_images.php"; // URL to fetch image list
11
12    void Start()
13    {
14        StartCoroutine(GetImageUrls());
15    }
16
17    IEnumerator GetImageUrls()
18    {
19        using (UnityWebRequest uwr = UnityWebRequest.Get(imagelistUrl))
20        {
21            yield return uwr.SendWebRequest();
22
23            if (uwr.result == UnityWebRequest.Result.ConnectionError || uwr.result == UnityWebRequest.Result.ProtocolError)
24            {
25                Debug.LogError($"Error fetching image list: {uwr.error}");
26            }
27            else
28            {
29                // Parse JSON response
30                Urllist urllist = JsonUtility.FromJson<Urllist>(uwr.downloadHandler.text);
31                if (urllist != null && urllist.urls != null)
32                {
33                    // Process and display the last 4 images
34                    LoadImages(GetLastNItems(urllist.urls, 4));
35                }
36                else
37                {
38                    Debug.LogError("Error parsing JSON or URL list is null.");
39                }
40            }
41        }
42    }
43
44    void LoadImages(List<string> imageUrls)
45    {
46        // Limit to the first 4 images
47        int count = Mathf.Min(imageDisplays.Length, imageUrls.Count);
48
49        for (int i = 0; i < count; i++)
50        {
51            StartCoroutine(LoadImage(imageUrls[i], imageDisplays[i]));
52        }
53    }
54
55    IEnumerator LoadImage(string url, RawImage rawImage)
56    {
57        using (UnityWebRequest uwr = UnityWebRequestTexture.GetTexture(url))
58        {
59            yield return uwr.SendWebRequest();
60
61            if (uwr.result == UnityWebRequest.Result.ConnectionError || uwr.result == UnityWebRequest.Result.ProtocolError)
62            {
63                Debug.LogError($"Error fetching image: {uwr.error}");
64            }
65            else
66            {
67                Texture2D texture = DownloadHandlerTexture.GetContent(uwr);
68                rawImage.texture = texture;
69                // Fit image to RawImage while preserving original size within the frame
70                FitImageToRawImage(rawImage, texture);
71            }
72        }
73    }
74
75    void FitImageToRawImage(RawImage rawImage, Texture2D texture)
76    {
77        RectTransform rectTransform = rawImage.GetComponent<RectTransform>();
78        float containerWidth = rectTransform.rect.width;
79        float containerHeight = rectTransform.rect.height;

```

Figure 4.41 C# code for image loader



```

8  {
76  {
80
81      // Calculate the aspect ratios
82      float containerAspectRatio = containerWidth / containerHeight;
83      float imageAspectRatio = (float)texture.width / texture.height;
84
85      // Determine scale factor to fit image within the container
86      float scaleFactor;
87      if (imageAspectRatio > containerAspectRatio)
88      {
89          // Image is wider relative to its height
90          scaleFactor = containerWidth / texture.width;
91      }
92      else
93      {
94          // Image is taller relative to its width
95          scaleFactor = containerHeight / texture.height;
96      }
97
98      // Apply scaling to fit the image
99      float newWidth = texture.width * scaleFactor;
100     float newHeight = texture.height * scaleFactor;
101
102     // Adjust RawImage size to fit within the container while preserving the aspect ratio
103     rawImage.rectTransform.sizeDelta = new Vector2(newWidth, newHeight);
104
105     // Center the image within the RawImage
106     rawImage.rectTransform.anchoredPosition = Vector2.zero;
107 }
108
109 List<string> GetLastNItems(List<string> list, int n)
110 {
111     // Get the last N items from the list
112     int count = list.Count;
113     if (count <= n)
114     {
115         return new List<string>(list); // Return a copy of the entire list if fewer items are available
116     }
117     return list.GetRange(count - n, n);
118 }
119
120 [System.Serializable]
121 public class UrlList
122 {
123     public List<string> urls;
124 }
125 }
126

```

Figure 4.42 C# code for image loader

Figure 4.41 and figure 4.42 shows the C# code for image loader which will retrieve image from database.

```
C: > xampp > htdocs > UnityBackEnd > list_images.php
1  <?php
2  $directory = 'uploads/'; // Directory where images are stored
3  $images = array();
4
5  // Check if directory exists and is accessible
6  if (is_dir($directory)) {
7      if ($dh = opendir($directory)) {
8          while (($file = readdir($dh)) !== false) {
9              if (in_array(pathinfo($file, PATHINFO_EXTENSION), ['jpg', 'jpeg', 'png'])) {
10                 $images[] = 'http://localhost/UnityBackEnd/uploads/' . $file; // Adjust the URL as needed
11             }
12         }
13         closedir($dh);
14     }
15 }
16
17 header('Content-Type: application/json');
18 echo json_encode(array("urls" => $images));
19 ?>
20
```

Figure 4.43 PHP code for image upload

Figure above displays PHP code for image upload. The selected image will be uploaded to database server which directory is UnityBackEnd/uploads/.

4.3.6 FAQ Module

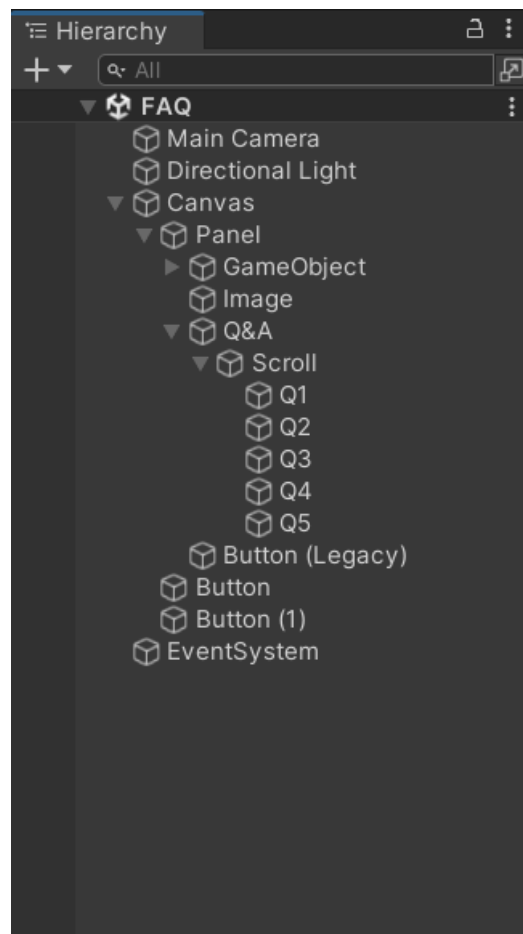


Figure 4.44 Hierarchy for FAQ module

Similar with the user review module, the FAQ module displays frequently asked questions (FAQ) in a scroll view UI. Users can click the left or right buttons to navigate the scroll view and view different questions.

Chapter 5

System Implementation

5.1 Software Setup

5.1.1 Unity

User can download Unity from Unity official website (<https://unity.com/>)

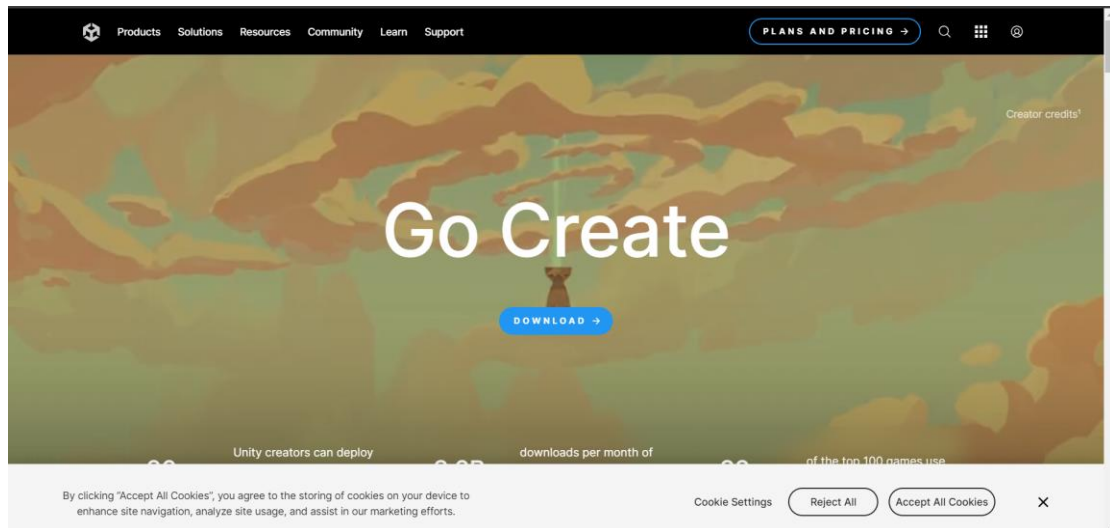


Figure 5.1 Download Page for Unity



Figure 5.2 User Interface for Unity

Chapter 5

5.1.2 Blender

User can download blender from Blender official website (<https://www.blender.org/>)

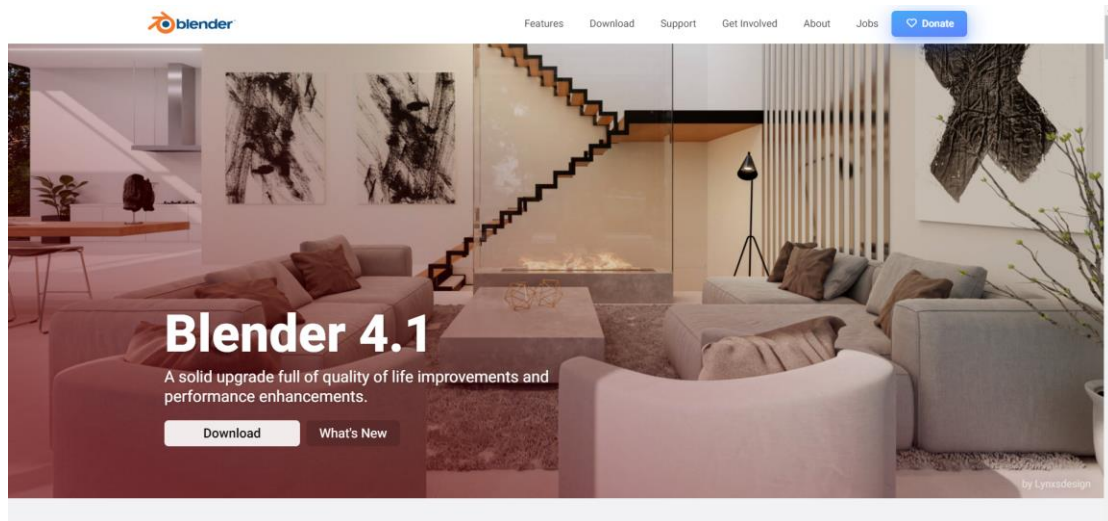


Figure 5.3 Download Page for Blender

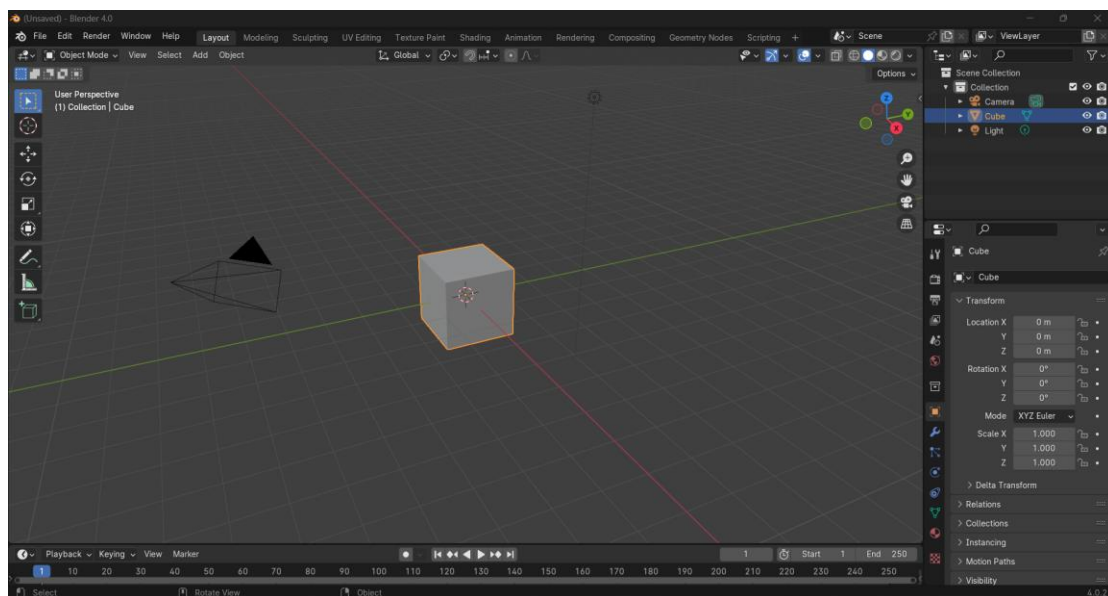


Figure 5.4 User Interface for Blender

5.1.3 XAMPP



Figure 5.5 Download Page for XAMPP

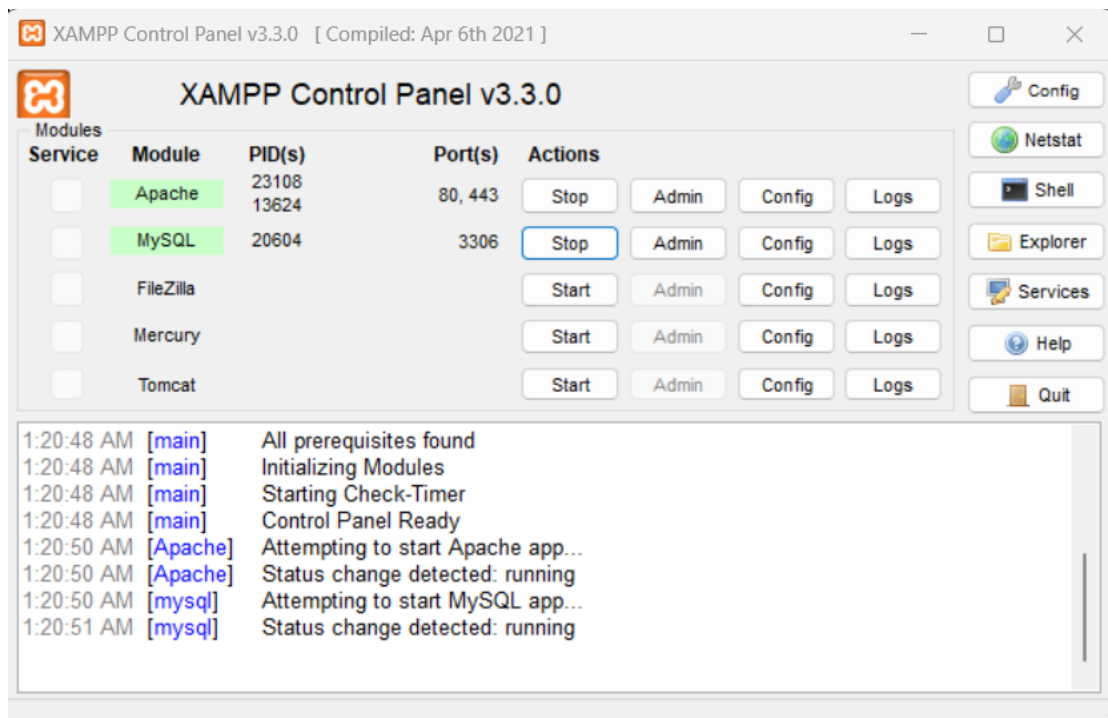


Figure 5.6 User Interface for XAMPP

Chapter 5

5.1.4 VMWare

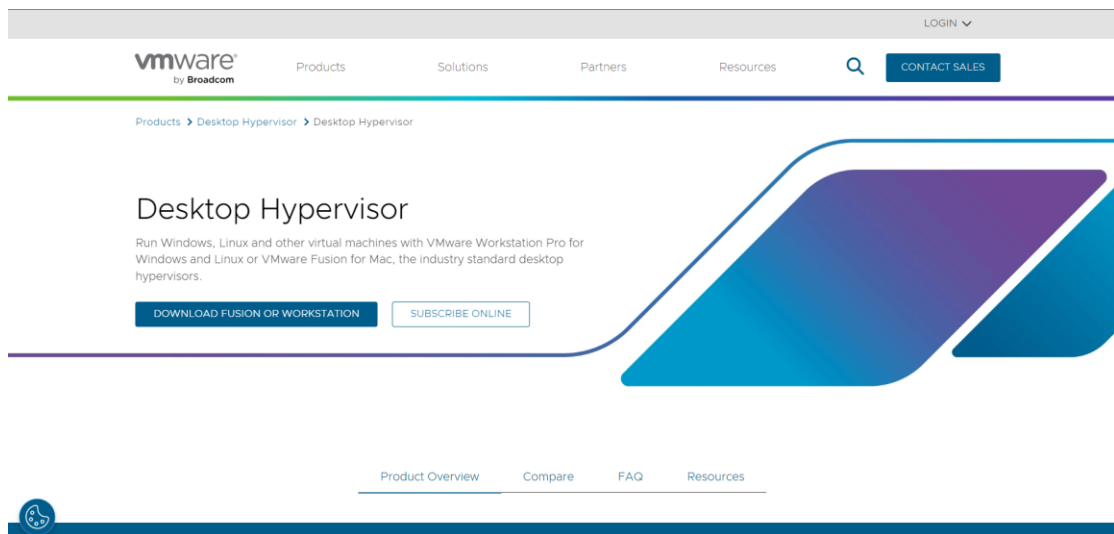


Figure 5.7 Download Page for VMWare workstation pro

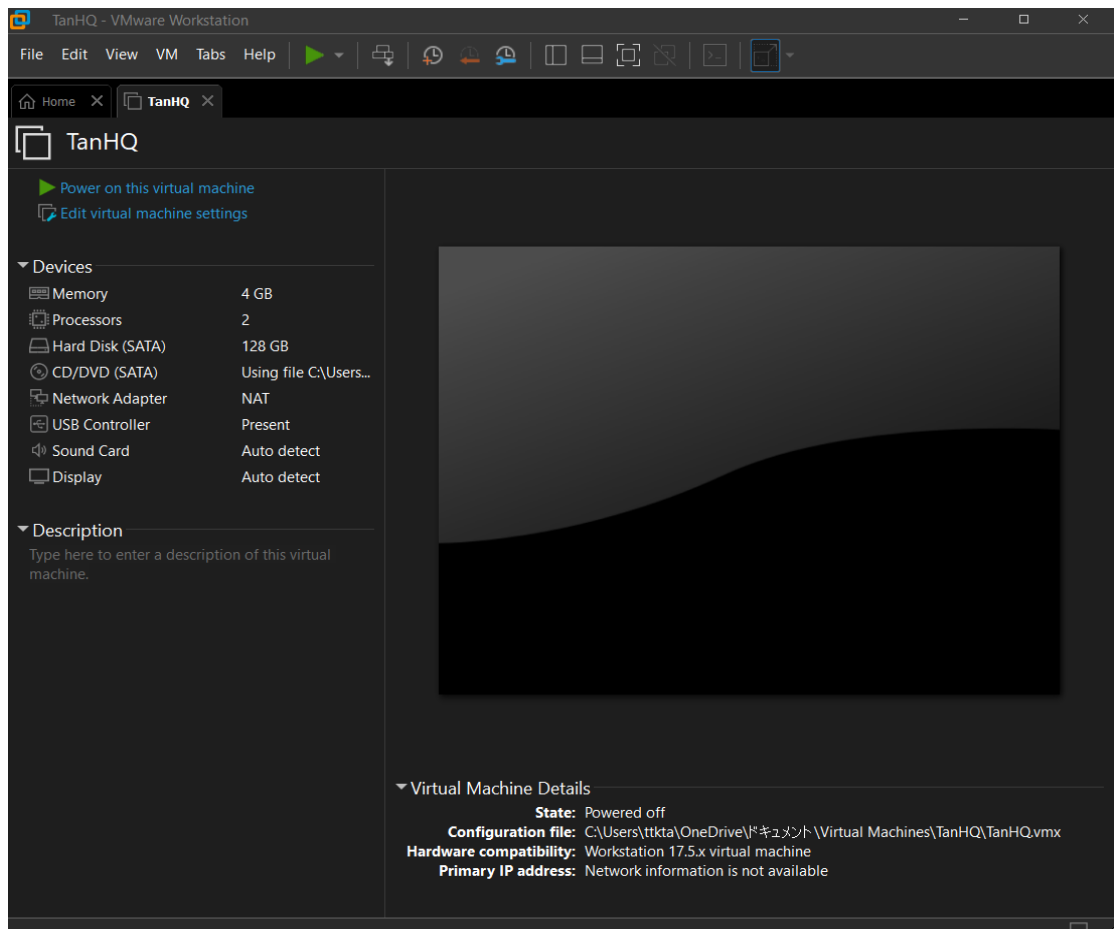


Figure 5.8 Configuration for VMWare workstation pro (MacOS Sonoma)

Chapter 5

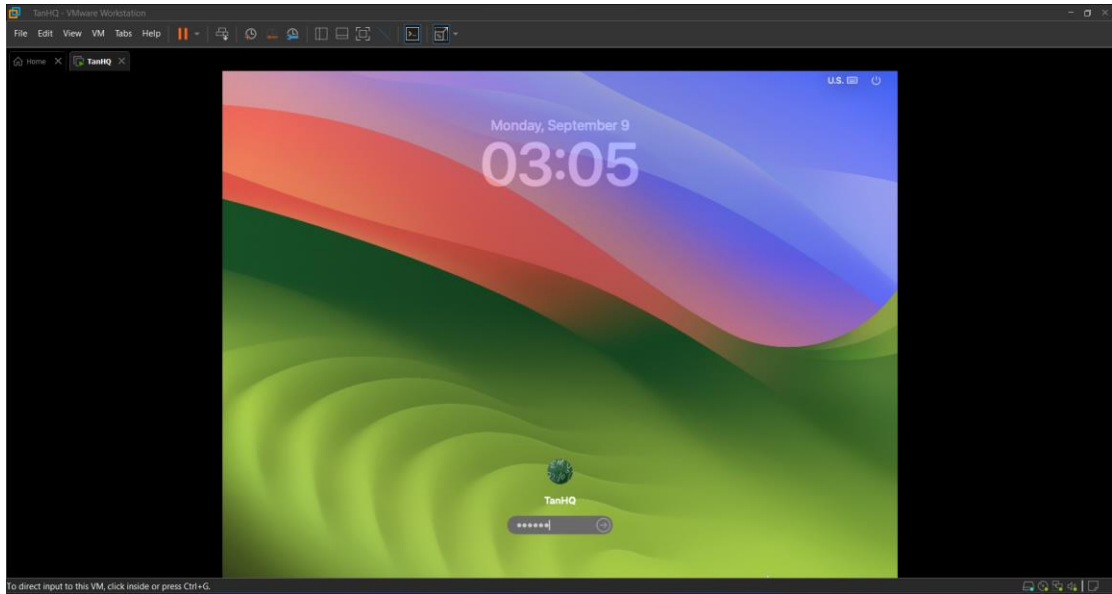


Figure 5.9 User Interface for VMWare workstation pro (MacOS Sonoma)

5.1.5 Xcode

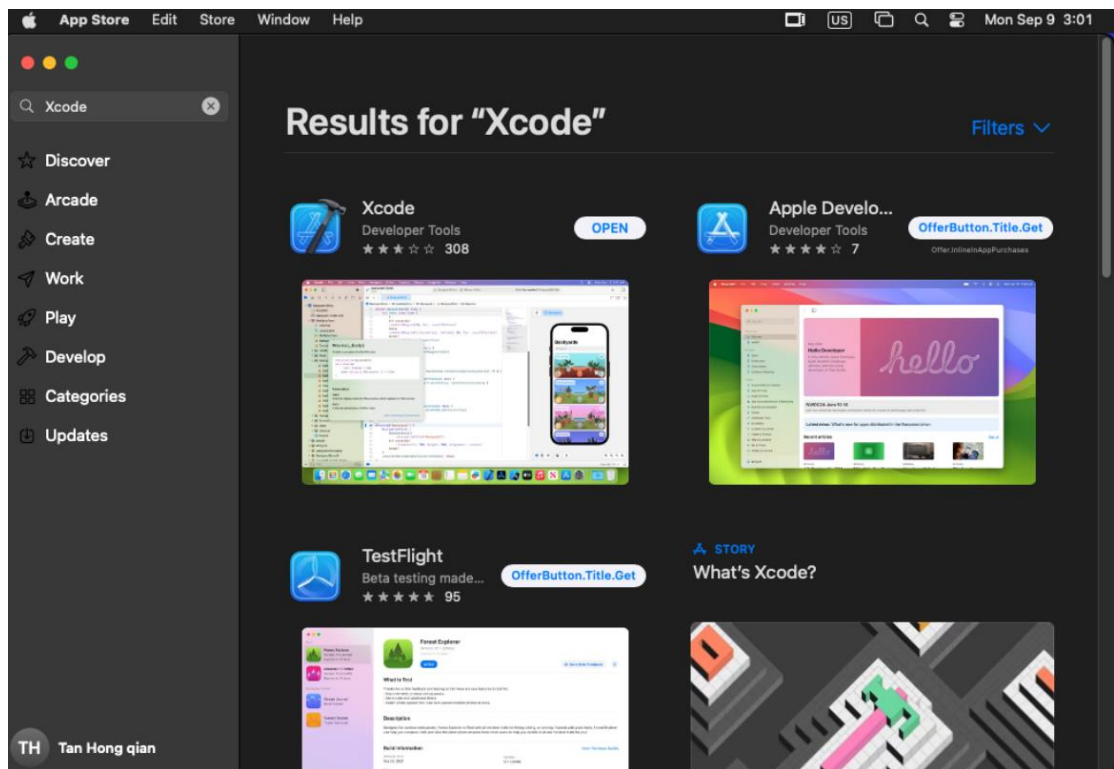


Figure 5.10 Xcode on App Store



Figure 5.11 User Interface for Xcode

Chapter 5

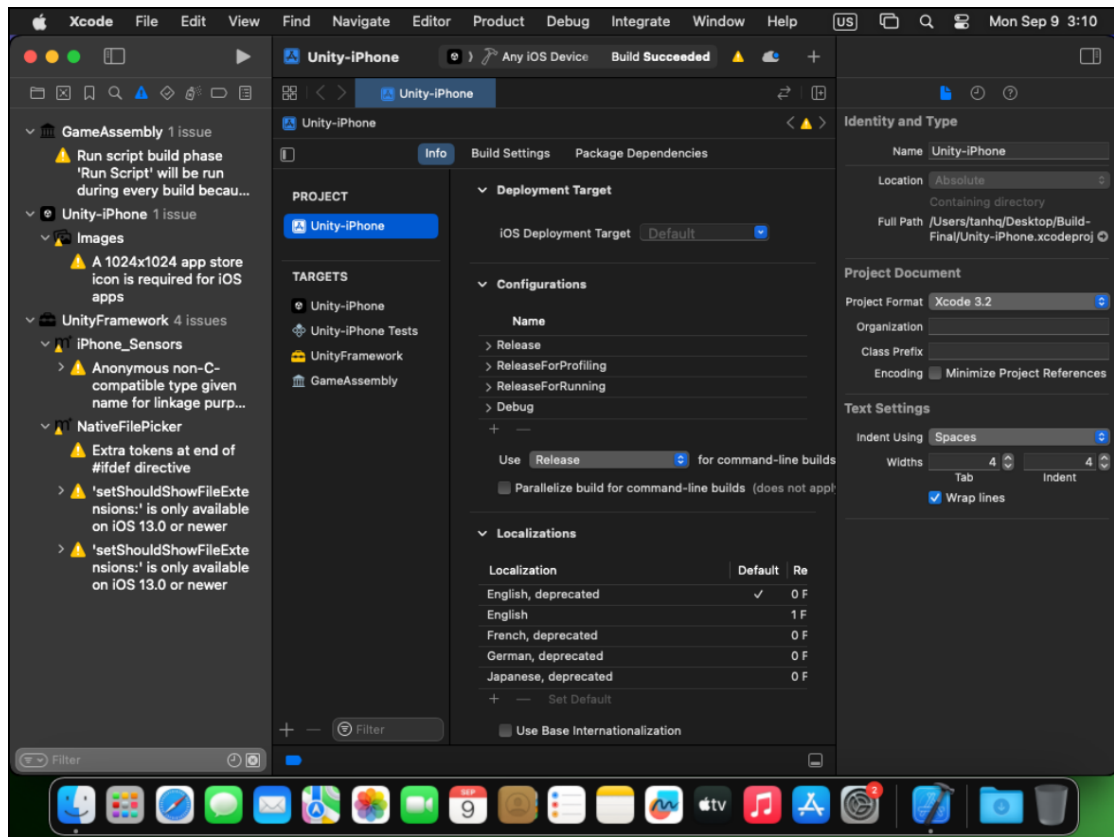


Figure 5.12 User Interface for Xcode

Chapter 5

5.2 Setting and Configuration

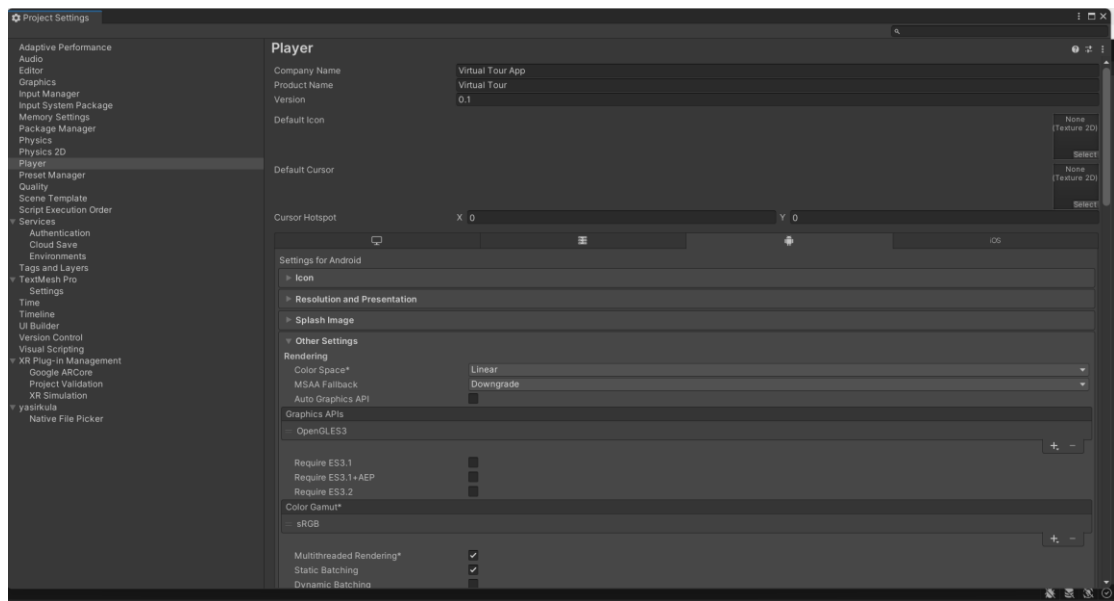


Figure 5.13 Project Settings – Player (Android)

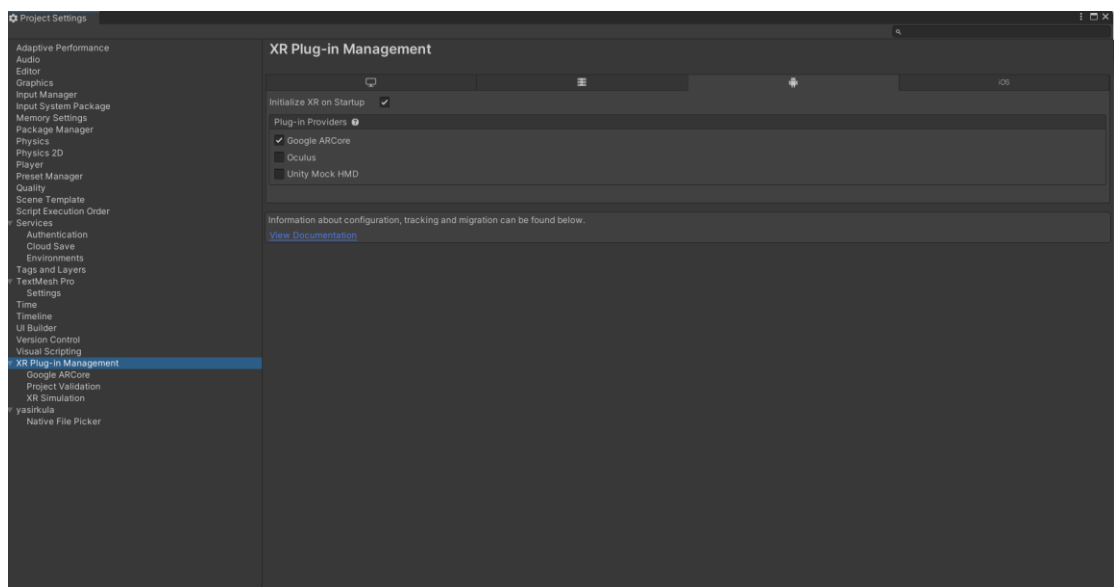


Figure 5.14 AR Settings in Android

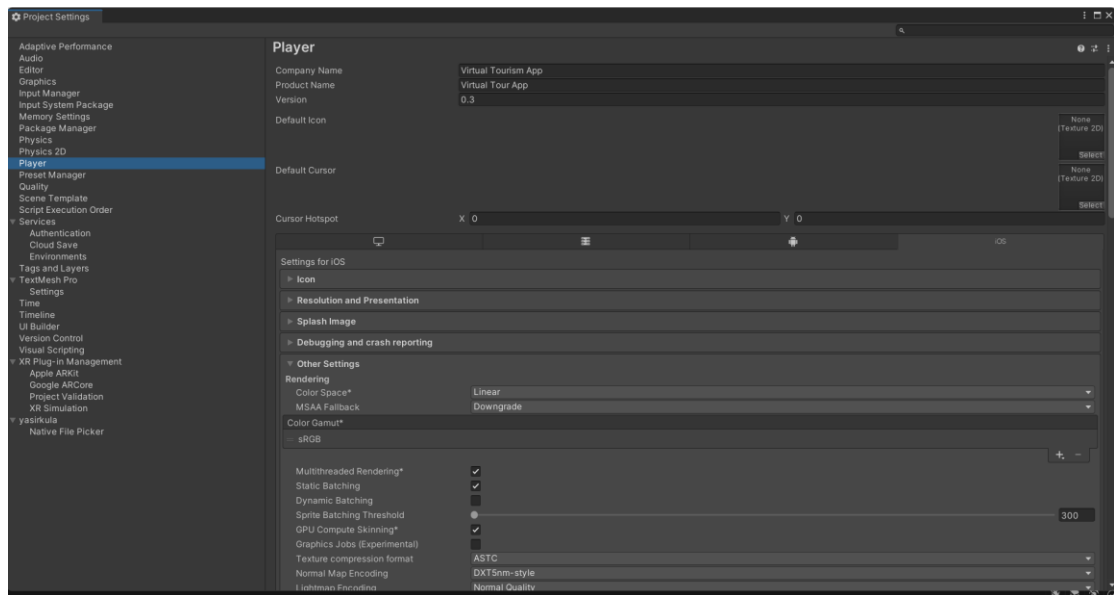


Figure 5.15 Project Settings – Player (iOS)

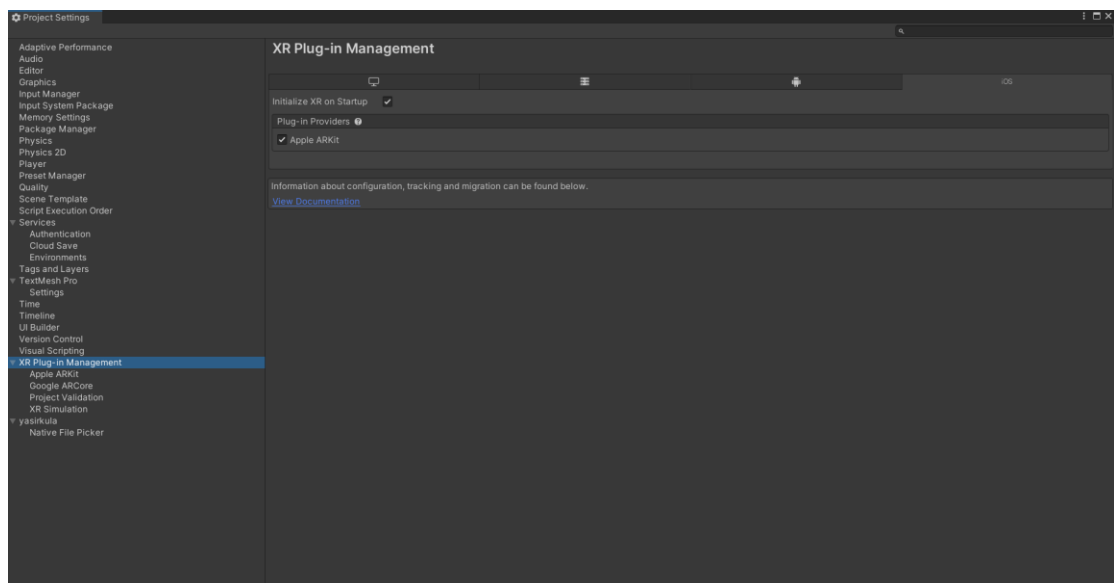


Figure 5.16 AR Settings in iOS

Figure 5.13, figure 5.14, figure 5.15 and figure 5.16 show the setting and configuration of project before it is exported. Figure 5.13 and figure 5.15 illustrate the player setting in Android and iOS platform respectively. These player settings have shown the configuration of application name, developer name, splash image etc. There are certain settings that must be checked before export the project out such as enable “Always allow download over HTTP” in “Other setting” section in order to ensure the built application can be connected to database server through HTTP protocol as it is set as not allowed as default.

Figure 5.14 and figure 5.16 display the AR settings in Android and iOS platform respectively. Developer must download the XR Plug-in management from Unity assets in order to activate this setting. In Android platform, Google ARCore service must be checked to enable devices' AR functionality being activated when users click on view AR model button. Similarly, Apple ARKit must be checked in iOS platform and developers must provide the camera description in player setting in order to inform users of the camera's intended use.

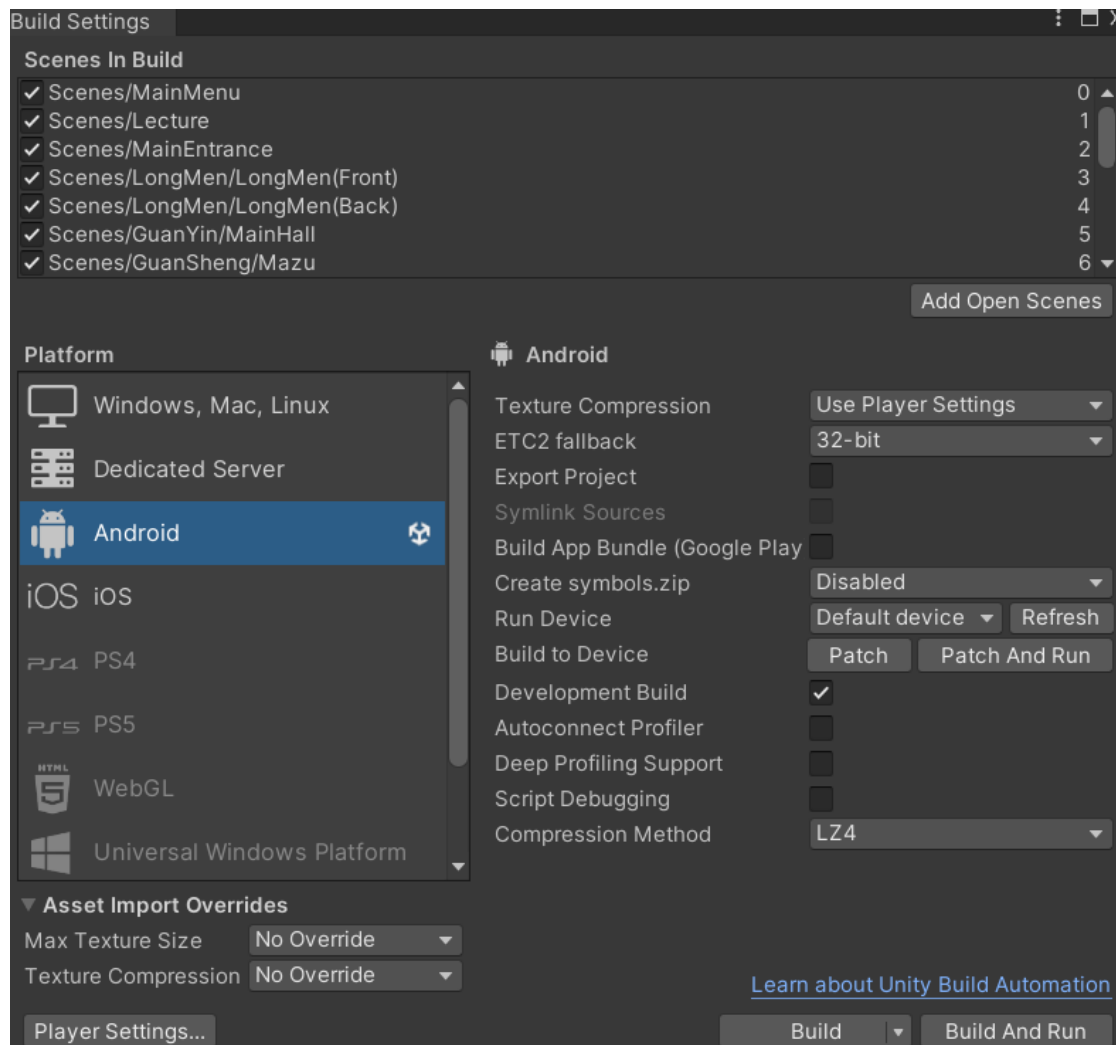


Figure 5.17 Build Setting in Android

The figure above displays the build settings of the project after configuring the necessary settings. Before building the project into an APK file, the developer must ensure that all scenes are checked in the "Scenes In Build" section. For the Android platform, the developer can simply click the build button to generate the APK file.

Chapter 5

Once the APK file is successfully built, it can be installed directly on Android devices, allowing users to enjoy the virtual tour immediately.

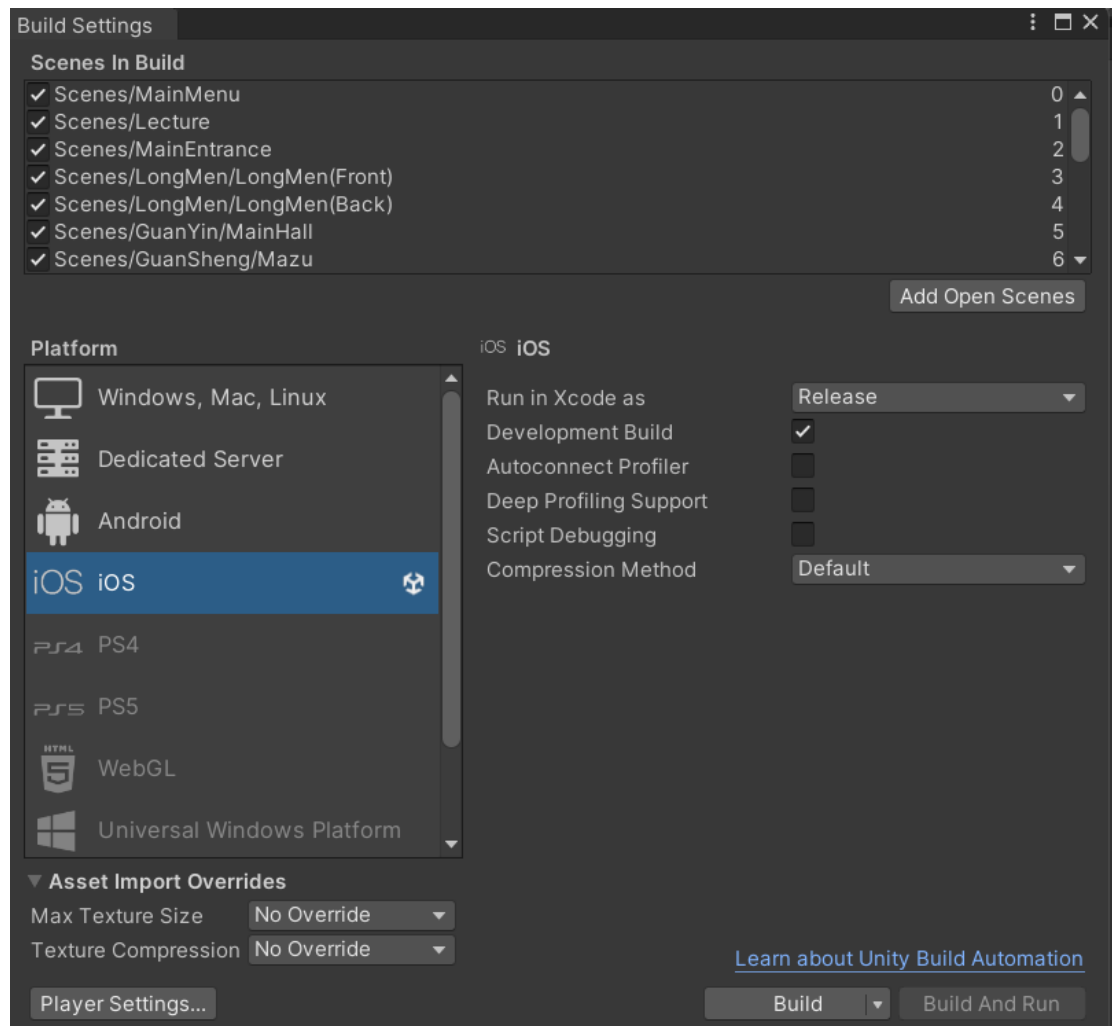


Figure 5.18 Build Setting in iOS

There are a few differences between the iOS and Android platforms. As shown in Figure 5.18, the developer must first switch the platform to iOS before clicking the build button. Once clicked, Unity will generate an Xcode project folder instead of an APK file directly. The developer must then open this project in Xcode and build the IPA file from there, which can subsequently be installed on iOS devices.

Chapter 5

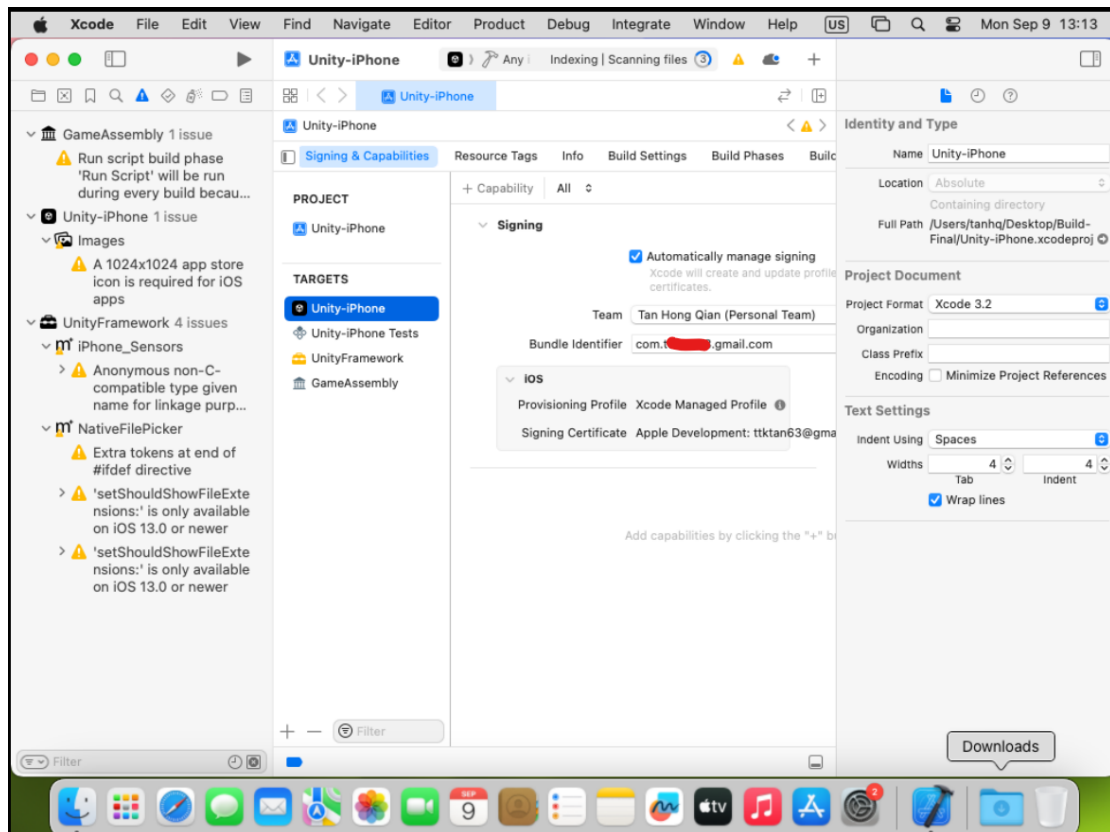


Figure 5.19 Setting in Xcode

In Xcode, the developer must sign using own Apple ID in order to build the application successfully.

CHAPTER 6

System Evaluation

6.1 Graphic User Interface

6.1.1 Main Menu



Figure 6.1 Main Menu



Figure 6.2 Main Menu

These are the Main Menu of the project. The above picture is in the design phase while the bottom picture is in the gaming phase which are running in a mobile phone simulator. When users start this project, they will first come to this main menu scene and background music will be started to play. Then, user can click on the module button in the main menu to redirect to different module scene. In addition, users can exit the application by clicking on the Quit button.

Chapter 6

6.1.2 Lecture Module

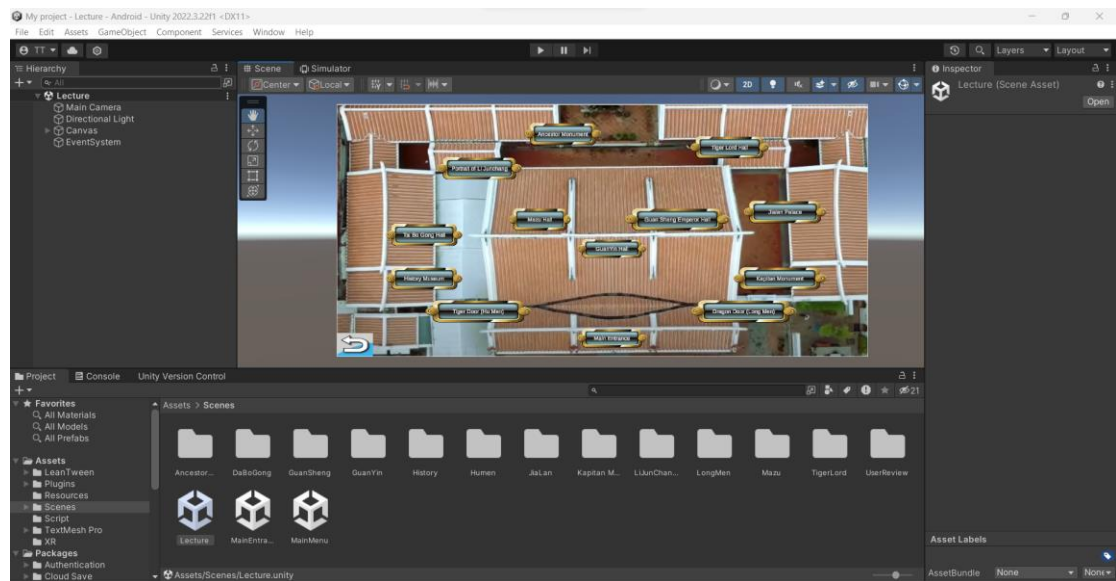


Figure 6.3 Lecture Module

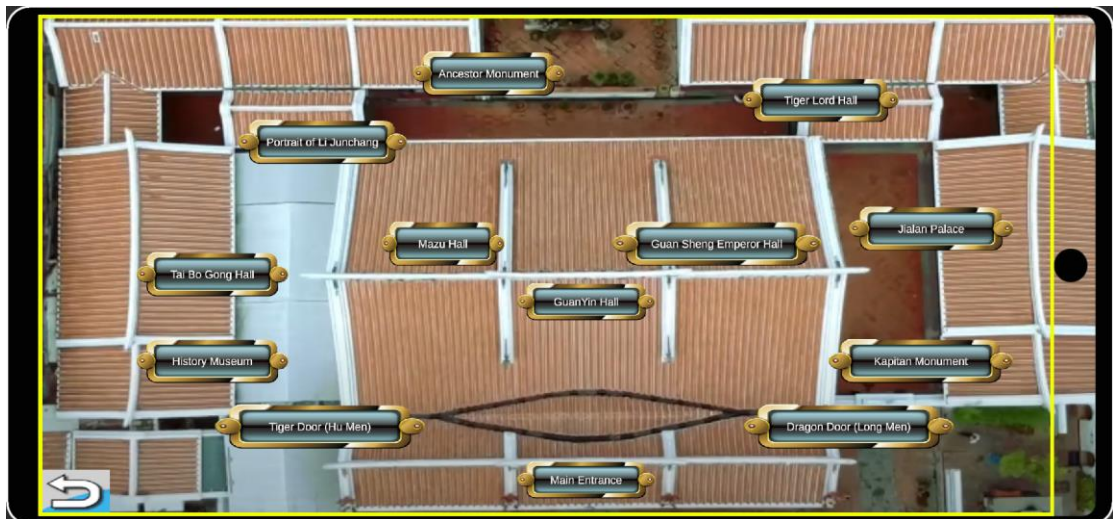


Figure 6.4 Lecture Module (Bird Eye View)

These are the Lecture Module. The above picture is in the design phase while the bottom image is in the gaming phase which is running in the mobile phone simulator. After users click on the Lecture Module button in the main menu, then users will be redirected to this Bird Eye View scene and users can click anywhere they want to visit at here. Then, users will be redirected to the selected place.

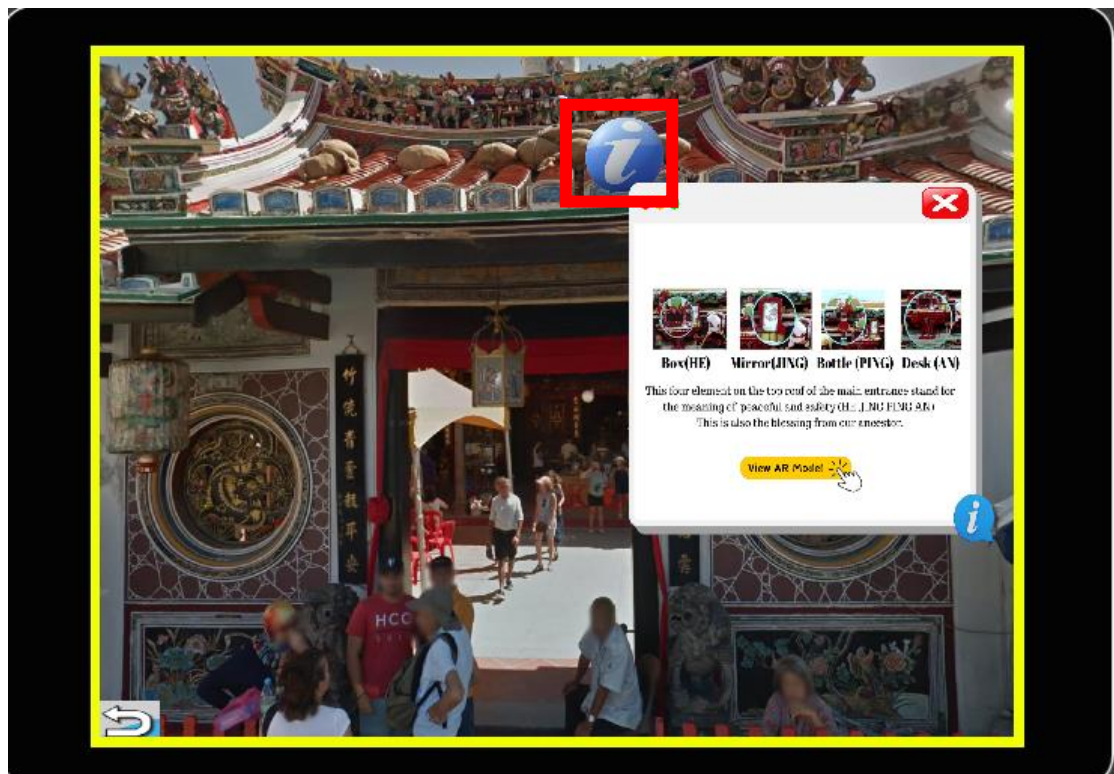


Figure 6.5 Lecture Module (Main Entrance)

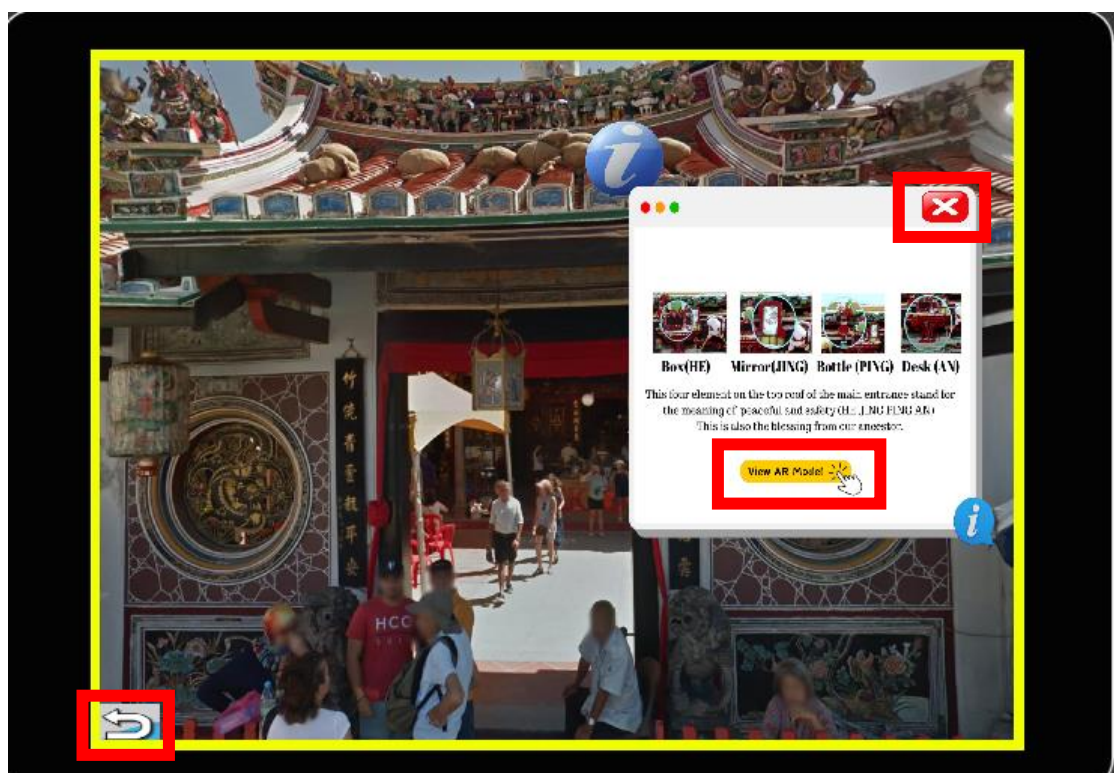


Figure 6.6 Lecture Module (Main Entrance - Info)

If users select Main Entrance, then it will be redirected to here and press the button with info picture texture which is stand for the information button to view more information about the places. After users press this info button, then an information panel will be popped out. Users can press the Red Cross Button at the top right of the info panel to close it. Users can back to the Bird Eye View scene by pressing the back button at the bottom left of the screen. Users can also move around their point of view by sliding the screen with their finger.



Figure 6.7 AR Module (Main Entrance)

Besides, users can enable the AR module to view the 3D model of the places through their devices' camera by clicking on the “View AR Model” button. After users click on this button, they will be redirected to the main entrance AR scene. Then, users can view around the 3D model by turning around their devices' camera. After finish viewing, users can also press the back button at the bottom left of the screen to return to the lecture module.



Figure 6.8 Lecture Module (Long Men)

If users select Long Men from Bird Eye View scene, then users will be redirected to this scene. Users can also view the information of this place by clicking the info button. Besides, there is also a green button at here. If users press on this green button, it will bring users to the nearest place. So that users no need to always back to the Bird Eye View Scene to transform to other places.

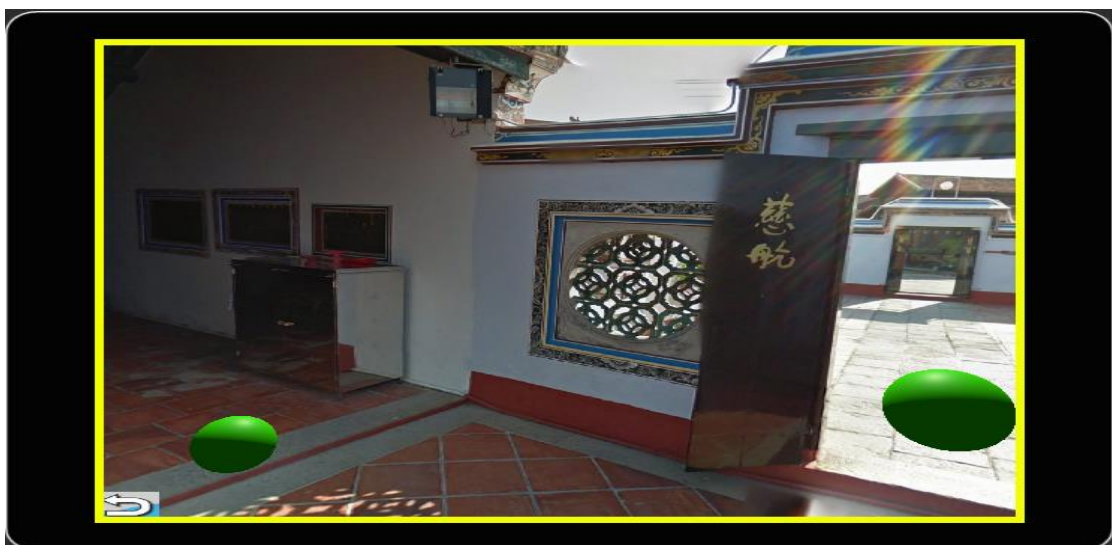


Figure 6.9 Lecture Module (Long Men-Backed)

Chapter 6

6.1.3 Game Module

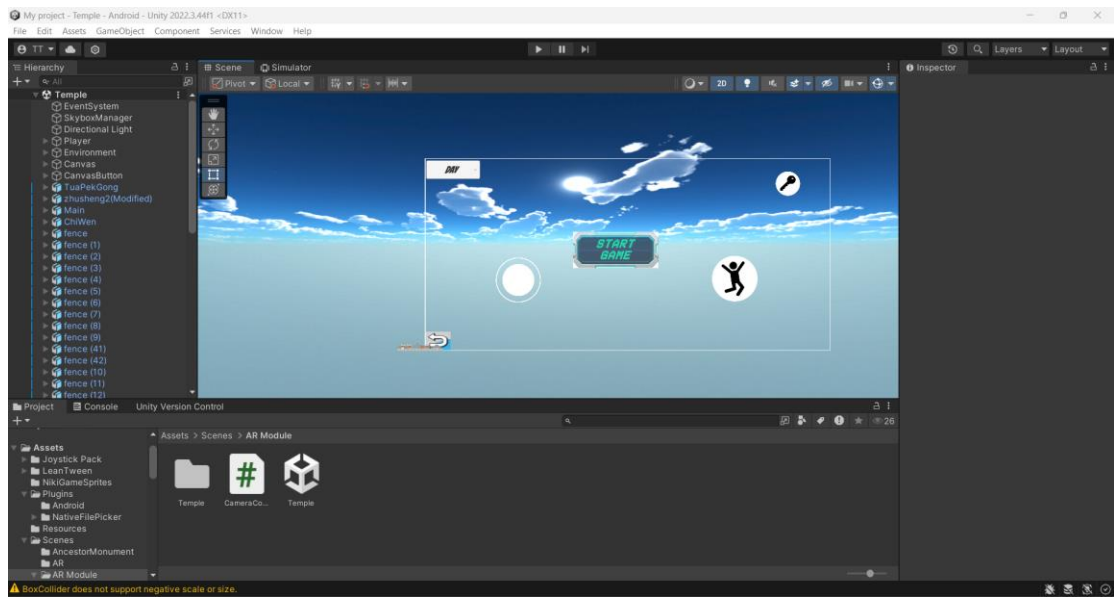


Figure 6.10 Game Module



Figure 6.11 Game Module

Figure 6.10 and figure 6.11 display the game module of this project. Figure 6.10 shows game module in design phase while figure 6.11 illustrates the game module running in game phase using phone simulator. When users click on the game module button from the main menu, they will be redirected to the scene same as figure 6.11. Then, users can click on the start game button at the centre to activate Cheng Hoon Teng 3D model, joystick, player's camera, jump and key button as figure shown below.

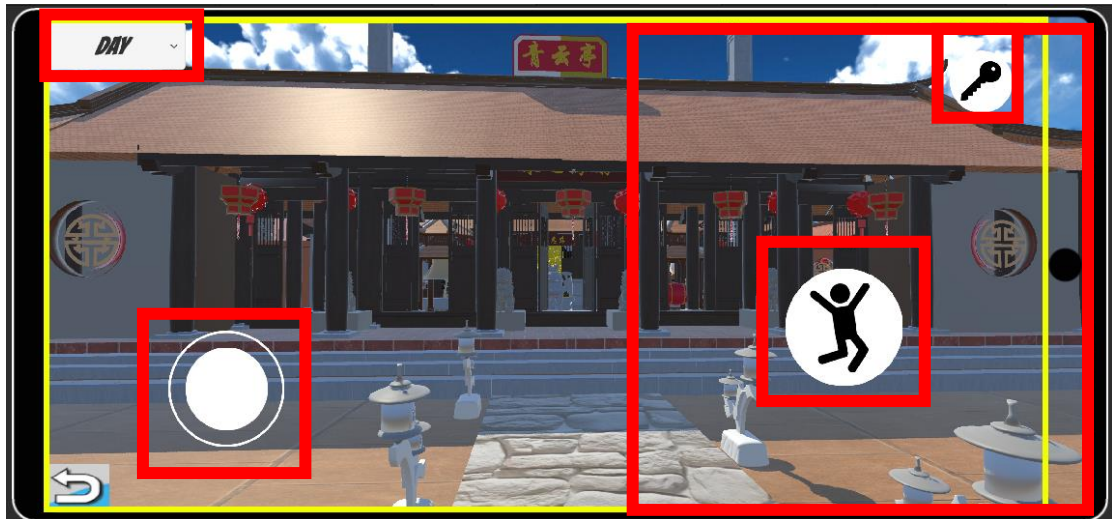


Figure 6.12 Game Module

After all elements have been loaded successfully, users can start to explore Cheng Hoon Teng temple virtually. Users will explore by First Person Point of View (FPS). Users can control the movement of the player by using the joystick and jump button. Besides, users can control the player's camera angle through dragging the right half screen. Users can also change the sky texture through the drop-down UI at the top left of the screen. If users have selected explore it at night, the light will be switched off and the shadow of all 3D model will be disabled too. Users can use key button at the top right corner to open specific door in the game module.

Chapter 6

6.1.4 User Review Module

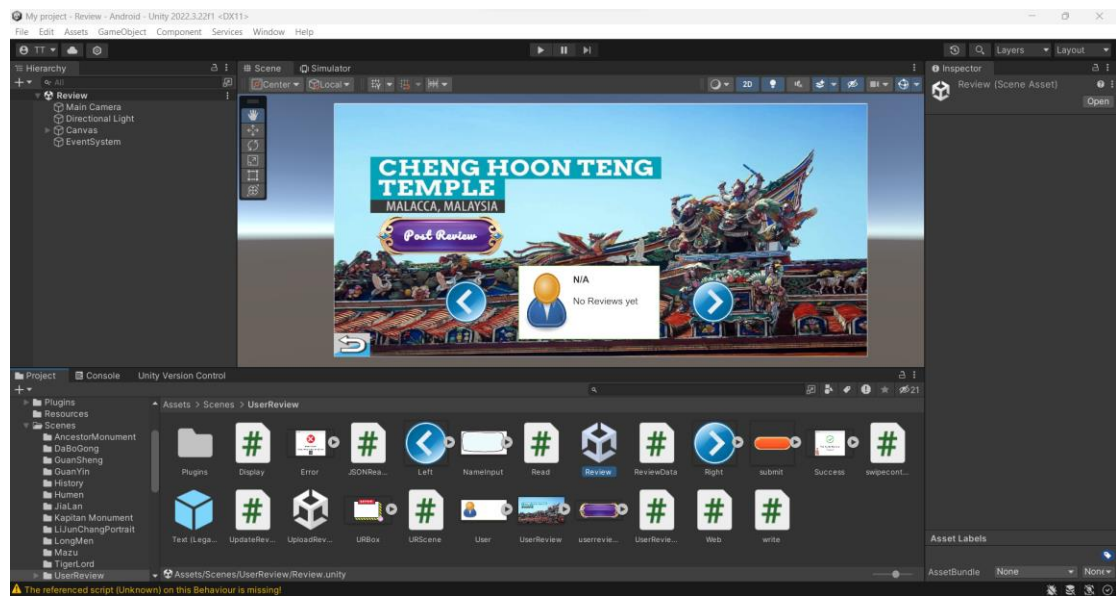


Figure 6.13 User Review Module



Figure 6.14 User Review Module (View Review)

These are the User Review Module. The above picture is in the design phase while the bottom image is under the gaming phase which is run in the mobile phone simulator.

After users click on the user review button on the main menu, then it will redirect users to this user review scene and user can see other users' review on this page.

Users can click on the Post Review button to post their review also.



Figure 6.15 User Review Module (Post Review)

After users press the Post Review button in the view review scene, then users will be redirected to this post review scene. In this scene, users can input their name and their review. After finish input, users can click on submit button and an upload success dialogue will be popped out to informed users that their review has been uploaded successfully.

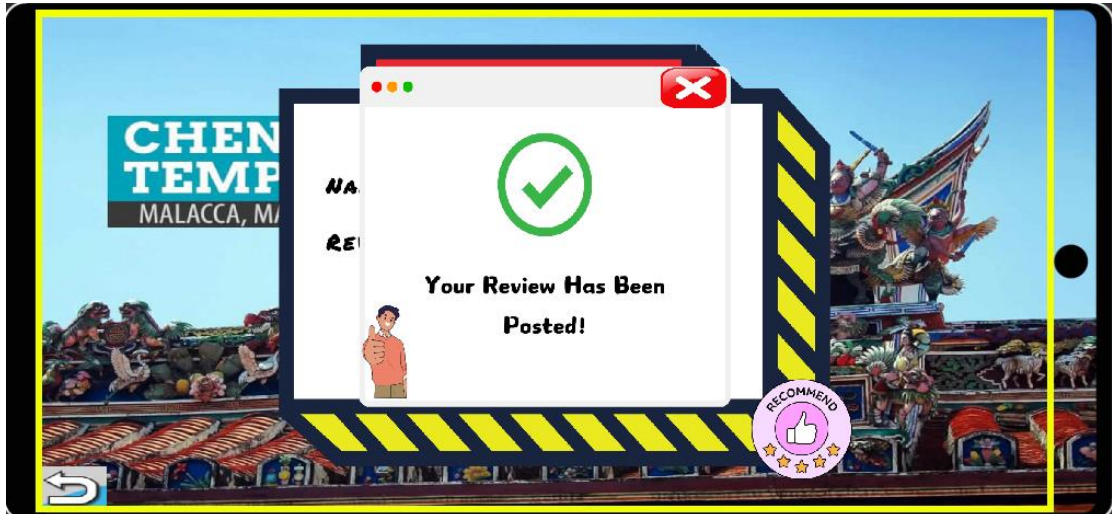


Figure 6.16 User Review Module (Upload Success)

If users do not input any data or miss up filling the information and click submit button, an error dialogue will be popped out to informed users fill in all the fields and this record will not be stored in the database.



Figure 6.17 User Review Module (Upload Error)

Users can click the back button at the bottom left of the screen to back to the view review scene to view their uploaded review.



Figure 6.18 User Review Module (After upload review)

6.1.5 Photography Module

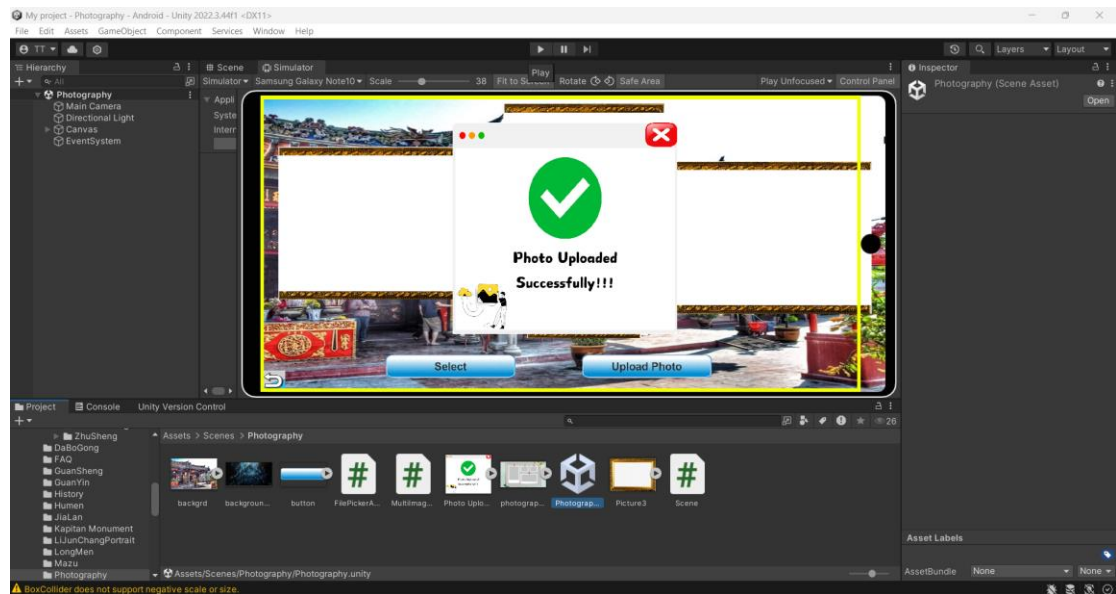


Figure 6.19 Photography Module

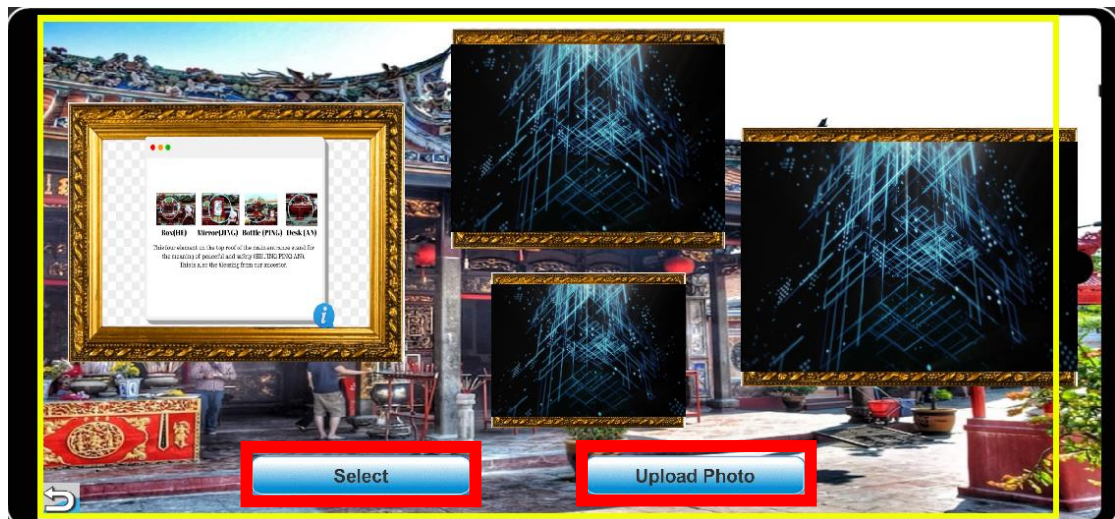


Figure 6.20 Photography Module

Figure 6.19 and figure 6.20 illustrates photography module of this project. The users will be redirected to this module after they clicked on the photography module button from main menu scene. Figure 6.19 shows the photography module in design phase while figure 6.20 displays the photography module in game scene with running in mobile simulator. After users reached this scene, they can view the photos uploaded by other users which are stored in the database. Besides, they can also click on the Select button to select some photos which are taken by them and related to Cheng

Hoon Teng from their devices' gallery and select Upload Photo button to upload it to the database server.

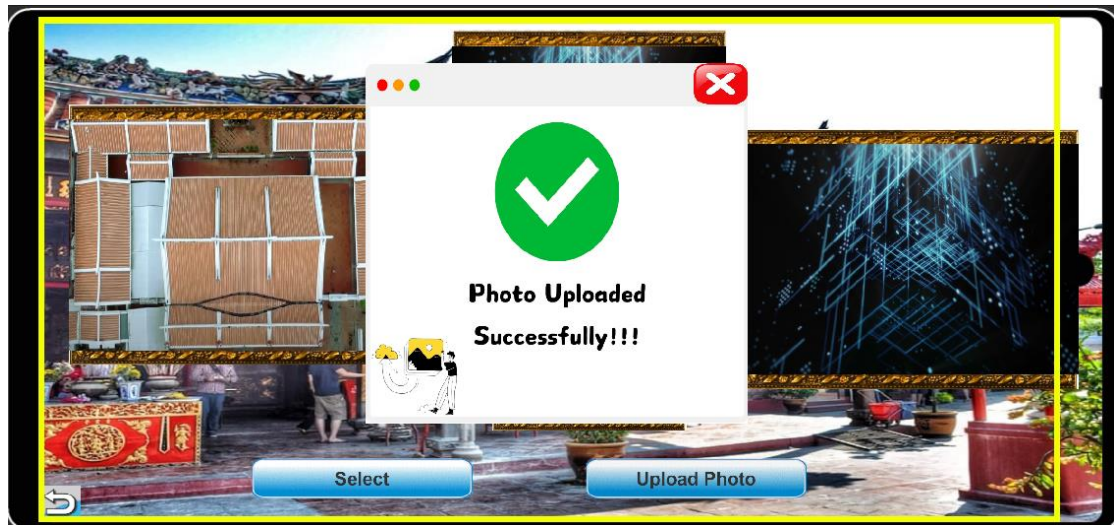


Figure 6.21 Photography Module (Upload Success)

If the selected image is uploaded successfully, the application will prompt an success panel to inform users that their images have been uploaded successfully.

6.1.6 FAQ Module

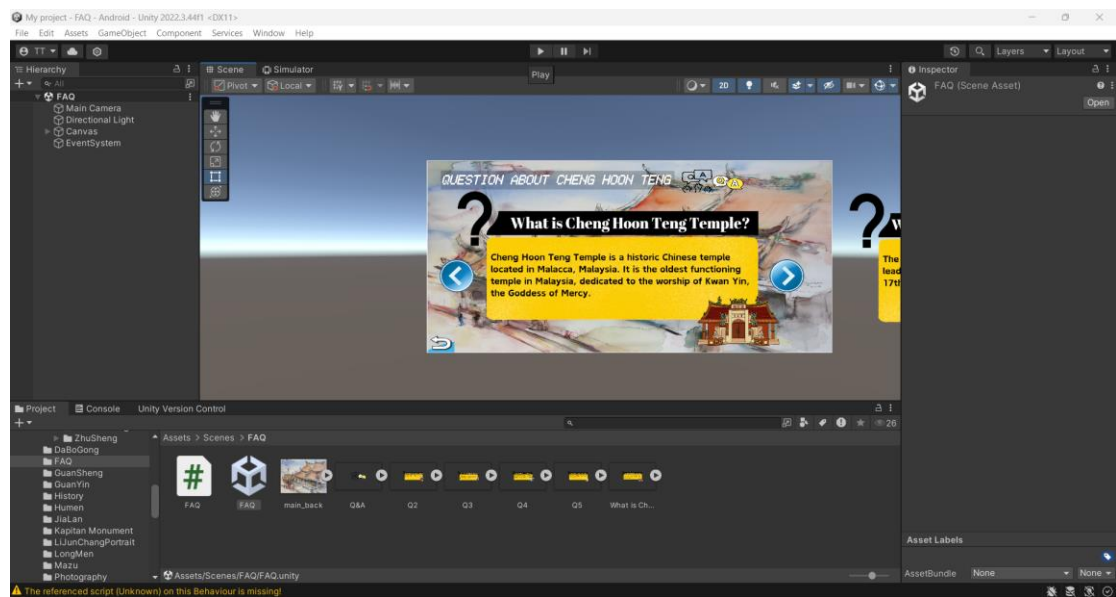


Figure 6.22 FAQ Module



Figure 6.23 FAQ Module

These two figures show the FAQ module of this project. The users can redirect to here by clicking on the FAQ module from main menu scene. The above figure shows the FAQ module in design phase while the below figure shows the FAQ module in game phase with running on mobile simulator. Users can click on the left and right arrow to view more FAQ in this module. There are only five FAQ design in this module as an example. The FAQ are placed in the scroll view UI.

6.2 System Testing

No	Test Case	Expected Output	Actual Output	Remark
1.	Launch application	Loads main menu scene and audio	Main menu scene and audio loaded successfully	PASS
2.	Click Lecture Module Button	Load Cheng Hoon Teng bird eye view map	Cheng Hoon Teng bird eye view map loaded correctly	PASS
3.	Click on main entrance button on maps	Load 360-degree photo of main entrance	360-degree photo of main entrance displayed successfully	PASS
4.	Drag the screen	Main camera angle will be changed	Change main camera angle correctly	PASS
5.	Click on the info button	Show information panel	Information panel loaded successfully	PASS
6.	Click the close button	Close information panel	Information panel being close successfully	PASS
7.	Click on the view AR model button	Load main entrance AR model scene	Main entrance AR model scene loaded successfully	PASS
8.	Click on the back button on AR scene	Load back main entrance 360-degree photo	Main entrance 360-degree photo being loaded correctly	PASS
9.	Click on the back button in 360-degree photo scene	Return to bird eye view map scene	Bird eye view map scene being loaded successfully.	PASS
10.	Click on the back button in bird eye view map	Return to main menu scene	Main menu scene loaded correctly.	PASS

No	Test Case	Expected Output	Actual Output	Remark
11.	Click on the Game module button	Load Start Game Scene	Start Game scene loaded successfully	PASS
12.	Click on the Start Game button	Load Cheng Hoon Teng 3D model environment, joystick and control button (Jump and key)	Cheng Hoon Teng 3D model environment, joystick and control button (Jump and key) displayed correctly.	PASS
13.	Select different timeline from drop-down menu	Skybox material will be changed based on selection	Skybox material change correctly based on selection.	PASS
14.	Using joystick and jump button	Player moves according to the instruction.	Player moves correctly.	PASS
15.	Click key button	Door opened successfully.	Door opened successfully.	PASS
16.	Click back button in game module	Back to main menu scene	Main menu scene being loaded successfully	PASS
17.	Click User Review Module button	Load user review scene	User review scene load successfully and user reviews retrieve and displays correctly	PASS
18.	Click upload review button	Load upload review scene	Upload review scene loaded correctly	PASS
19.	Submit user review	Prompt out panel and store review in database	User review stored in database successfully and	PASS

			prompt out respective panel	
No	Test Case	Expected Outcome	Actual Outcome	Remark
20.	Click back button in user review module	Back to main menu scene	Main menu scene loaded correctly	PASS
21.	Click photography module	Load photography scene	Photography scene loaded successfully and photo retrieve and displays correctly	PASS
22.	Click select button	Prompt out file explorer	File explorer prompt out successfully	PASS
23.	Click upload button	Prompt out respective panel and store image in database	Image stored successfully and panel prompt out correctly	PASS
24.	Click back button in photography module	Return to main menu scene	Main menu scene loaded successfully	PASS
25.	Click FAQ module button	Load FAQ scene	FAQ scene loaded correctly	PASS
26.	Click right button	Load more FAQ in the right	More FAQ located in the right of the scroll view being loaded correctly	PASS
27.	Click left button	Load more FAQ in the left	More FAQ located in the left of the scroll view being loaded correctly	PASS

28.	Click back button in FAQ module	Return to main menu scene	Main menu displays successfully	PASS
29.	Click Quit button	Exit application	Exit application successfully	PASS
30	Switch scene	Do not destroy background music	Background music continue being played	PASS

Table 6.1: Test Results of the Application

Table 6.1 summary the test case for the application. These testing have verified that all components within the application such as UI buttons, scenes, AR interaction etc. can work seamlessly.

6.3 Implementation Issue and Challenges

6.3.1 Database server

When I am running the application on Unity Desktop it can successfully connect to the database server to store and retrieve the user review. But when I publish the unity project to APK file and run in my phone, it become unable connect to the database server.

6.3.2 Devices unsupported ARCore service

When I build the project to APK file and install on my default android device and open AR module, it shows that my device is not supported ARCore service.

Unfortunately, this is a hardware limitation and cannot be resolved unless changing another device which is ARCore compatible. This is also a weakness of AR/VR application.

6.3.3 Apple Developer program payment issue

If the developer wants to export his projects to AppStore, the developer needs to pay an annual fee with 99USD to enrol in the developer program. After enrolling in this program only that the developer can distribute his application in AppStore. The temporary solution for this problem is signing the project using third-party tools which can build the project to IPA file and install it on iOS device. But these IPA files only valid for 7 days.

6.4 Objectives Evaluation

No	Field	Technology Used	Objectives	Justification
1.	AR	Unity	To develop an AR based software for Tourism Attraction (Cheng Hong Teng Temple). To evaluate the effectiveness the AR based software can support the user for virtual tourism.	Users can view the 3D model of the places through their devices' camera at home without stepping into the real tourism attraction.
2.	3D Modelling and Rendering	Blender	To develop an AR based software for Tourism Attraction (Cheng Hong Teng Temple).	3D Models that being used in AR and game module have been built in Blender and rendered it with image texture to make it looks more realistic and attract users' attraction.
3.	Application Development Platform	Unity	To develop an AR based software for Tourism Attraction (Cheng Hong Teng Temple). To evaluate the effectiveness the AR based software	This is a cross-platform project. Users can install it on both iOS and Android platform devices. They can just launch it and view the 3D models of the

			can support the user for virtual tourism.	temple through their devices' camera virtually without visiting to the actual place. This has make users more convenience.
--	--	--	---	--

Table 6.2: Objectives Evaluation

6.5 Application Result Evaluation

6.5.1 Data Collection Method

I used a questionnaire as the methodology to gather public evaluations of my application. The collected data provide valuable insights and ideas for future project improvements. To design the questionnaire, I utilized Google Forms and distributed it to 15 participants. The questions used for this data collection can be found in Appendix B.

6.5.2 Data Analysis

Gender
15 responses

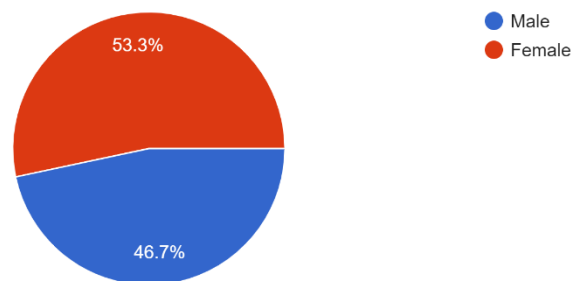


Figure 6.24 Gender

Based on the pie chart above, we know that out of 15 respondents, 46.7% (7 respondents) of them are Male and 53.3% (8 respondents) of them are female.

Age
15 responses

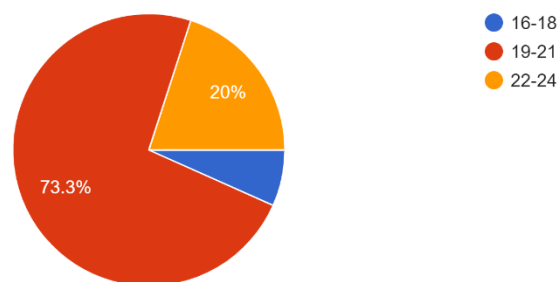


Figure 6.25 Age

Based on the pie chart above, we know that out of 15 respondents, 73.3% (11 respondents) of them are between 19 to 21 years old and 20% (3 respondents) of them

Chapter 6

are between 22 to 24 years old. While 6.7% (1 respondent) is between 16-18 years old.

How satisfied are you with the experience of exploring Cheng Hoon Teng temple in the lecture module?

15 responses

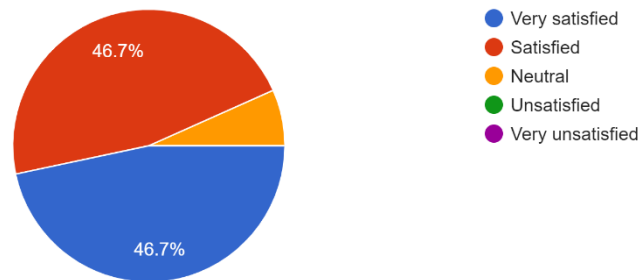


Figure 6.26 How satisfied are you with the experience of exploring Cheng Hoon Teng temple in the lecture module?

Based on the pie chart above, we know that out of 15 respondents, 46.7% (7 respondents) of them are very satisfied with lecture module and 46.7% (7 respondents) of them feel satisfied with lecture module. Only 1 out of 15 respondents (6.7%) feels neutral about lecture module. None of them feels unsatisfied or very unsatisfied.

How engaging was the game module, which allows you to explore Cheng Hoon Teng temple in First Person Point of View (FPS)?

15 responses

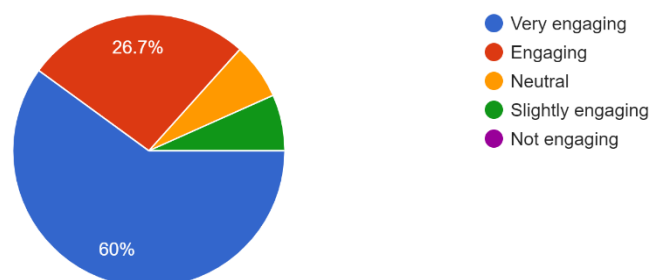


Figure 6.27 How engaging was the game module, which allows you to explore Cheng Hoon Teng temple in First Person Point of View (FPS)?

Chapter 6

Based on the pie chart above, we know that out of 15 respondents, 60.0% (9 respondents) of them are very engaging with game module and 26.7% (4 respondents) of them feel engaging with game module. 1 out of 15 respondents (6.7%) feels neutral about game module and 6.7% (1 respondent) feels slightly engaging with game module. None of them feels not engaging.

Which module you more preferred to be used in Cheng Hoon Teng exploration.
15 responses

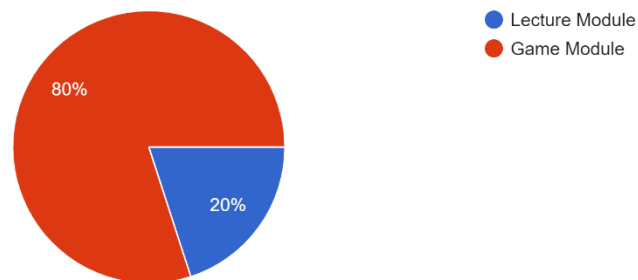


Figure 6.28 Which module you more preferred to be used in Cheng Hoon Teng exploration.

Based on the pie chart above, we know that out of 15 respondents, 80% (12 respondents) of them more prefer to use game module during exploration and 20% (3 respondents) of them are preferred lecture module.

How easy was it to view and upload reviews in the user review module?
15 responses

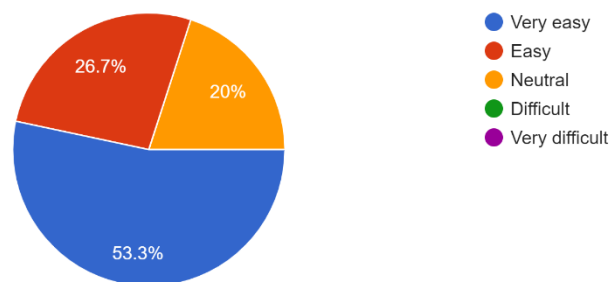


Figure 6.29 How easy was it to view and upload reviews in the user review module?

Based on the pie chart above, we know that out of 15 respondents, 53.3% (8 respondents) of them feels very easy to view and upload review. 26.7% of them (4

Chapter 6

respondents) feel that view and upload review in user review module is easy and 20% (3 respondents) of them are neutral.

How would you rate the functionality of viewing and uploading photos in the photography module?

15 responses

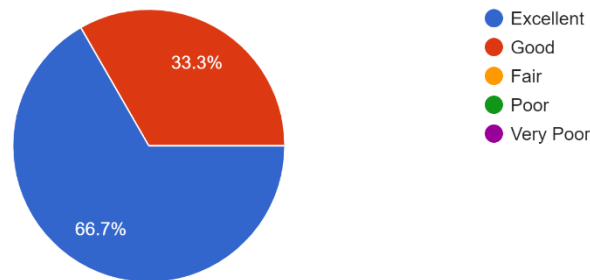


Figure 6.30 How would you rate the functionality of viewing and uploading photos in the photography module?

Based on the pie chart above, we know that out of 15 respondents, 66.7% (10 respondents) of them rate that photography module is excellent and 33.3% (5 respondents) of them feel good about photography module. None of them rate this module as fair, poor or very poor.

Did you find the FAQ module helpful for answering your questions about the application?

15 responses

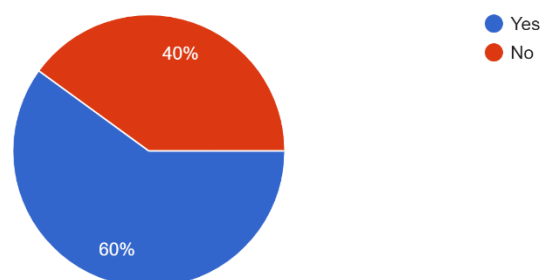


Figure 6.31 Did you find the FAQ module helpful for answering your questions about the application?

Based on the pie chart above, we know that out of 15 respondents, 60% (9 respondents) of them find the solution in FAQ module and 40% (6 respondents) of them can't find solution in FAQ module.

Chapter 6

How user-friendly is the overall interface of the Cheng Hoon Teng virtual tourism application?
15 responses

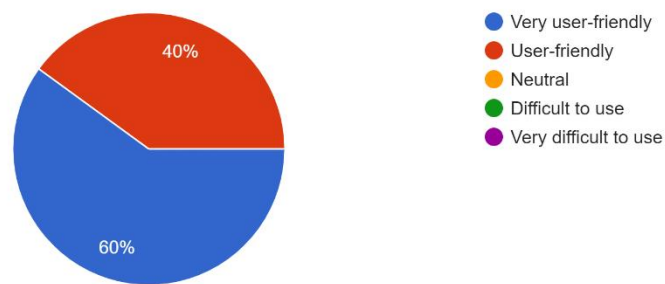


Figure 6.32 How user-friendly is the overall interface of the Cheng Hoon Teng virtual tourism application?

Based on the pie chart above, we know that out of 15 respondents, 60% (9 respondents) of them think that this application is very user-friendly and 40% (6 respondents) of them feels the UI design in this application is user friendly. None of them feels neutral or difficult/ very difficult to use.

How effective is the AR feature (e.g., viewing 3D models) in enhancing your virtual tour experience?
15 responses

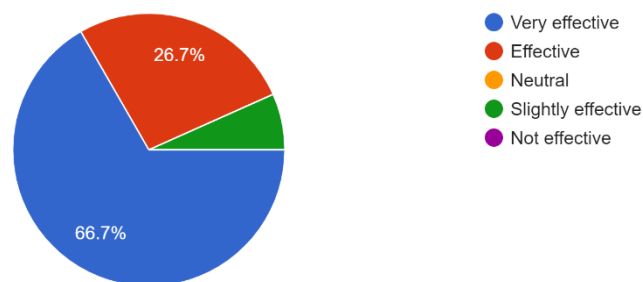


Figure 6.33 How effective is the AR feature (e.g., viewing 3D models) in enhancing your virtual tour experience?

Based on the pie chart above, we know that out of 15 respondents, 66.7% (10 respondents) of them think that AR features can very effectively enhance their virtual tour experience and 26.7% (4 respondents) of them feels that AR feature can effectively enhance their virtual tour experience. 6.7% of them (1 respondent) feels

Chapter 6

slight effective about AR features for enhancing his/her virtual tour experience. None of them nominate neutral or not effective.

How smooth was the performance of the application across different modules?

15 responses

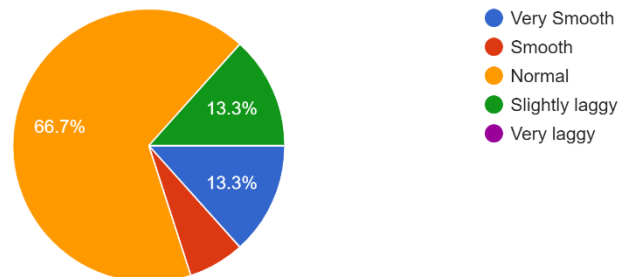


Figure 6.34 How smooth was the performance of the application across different modules?

Based on the pie chart above, we know that out of 15 respondents, 66.7% (10 respondents) of them feel normal performance speed of the application across different modules and 13.3% (2 respondents) of them feels very smooth and 13.3% (2 respondents) feels slight laggy when they are crossing different module in this application. 6.7% of them (1 respondent) feels smooth about the performance speed and none of them feels very laggy.

Can include some user manual
Can include a virtual tour guide
Can insert some NPC in game module
Include conservation function with NPC in game module
Rendered the 3D model with better texture
Insert some NPC in game module!! Make it looks more like a real game
explore the temple with third-person point of view
Combine AR with VR technology
Can rotate, transform AR model using provided UI such as slider
Make a more detailed 3D model
Insert some NPC that able to talk with player in game module
More animation
Users can control the running speed of the users
make the game module smoother
Add a tour guide

Table 6.3 What additional features or improvements would you like to see in future versions of the Cheng Hoon Teng virtual tourism application?

Table 6.3 shows the feedback from the public towards the additional features or improvements of the application.

6.5.3 Discussion

From the questionnaire result collected, we know that majority respondents for this questionnaire is female and their age is between 19 to 21. Besides, majority of the respondents which is 46.7% of them feel very satisfied or satisfied with the lecture module. Besides, majority of the respondents which is 9 out of 15 feel that explore Cheng Hoon Teng temple in First Person Point of View (FPS) is very engaging. In addition, 80% of the respondents more preferred to use game module during exploration. Moreover, 53.3% of the respondents agree that view and upload user review in user review module is very easy and 66.7% of them also rate that photography module is excellent. Furthermore, 60% of the respondents think that FAQ module is helpful for answering their questions. 60% of the respondents also strongly agree that the overall UI of Cheng Hoon Teng virtual tourism application is very user-friendly. Besides, 66.7 of the respondents think that AR feature is very effective in enhancing their virtual tour experience. Lastly, majority of the respondents which is 66.7% of them feel normal performance speed of the application across different modules.

CHAPTER 7

Conclusion

7.1 Conclusion

This project represents an innovative solution for geographical limitations to present and promote cultural heritage site like Cheng Hoon Teng to the worldwide. Individual who does not has an opportunity to visit this site in person can virtually tour this place through this application. This project has integrated virtual tourism and Augmented Reality technology which are aimed to create an unforgettable tourism experience for the users. By adding augmented reality (AR) technology, the virtual tour becomes more realistic and dynamic. Users can overlay interactive components, informational overlays, and digital reconstructions on top of their actual surroundings.

In a nutshell, the project has successfully showcased the potential of AR technology in the tourism industry. The developed Cheng Hoon Teng virtual tourism application serves as a solid foundation for future advancements in this field. By leveraging AR technology, the application provides users with a unique and engaging experience, enhancing their understanding and appreciation of the destination. Its potential to both promotes and educates about the location makes it a valuable contribution to the tourism sector.

7.2 Recommendation

Due to time constraints, this is an initial version of the Cheng Hoon Teng virtual tourism application. There are several improvements that can be made in the future. For instance, the developer could introduce NPCs in the game module to interact with players through conversations, providing guidance or act as a tour guide during exploration, rather than just allowing users to explore entirely on their own. Additionally, the application could be developed as an open-world game, incorporating mission-based features that enable users to learn more about the history of Cheng Hoon Teng Temple through these engaging tasks.

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APPENDIX

QUESTIONNAIRE SAMPLE (CHAPTER 2)

1. Gender
 - a. Male
 - b. Female
2. Age
 - a. 15-20
 - b. 20-25
 - c. 25-30
3. Have u visit Cheng Hoon Teng Temple Before?
 - a. Yes
 - b. No
4. Have you ever used any software to virtual tour some places before?
 - a. Yes
 - b. No
5. Have you heard about Augmented Reality Technology before?
 - a. Yes
 - b. No
6. Do You have use any software that has implement Augmented Reality Technology Before?
 - a. Yes
 - b. No
7. Do you think that visit a place using Augment Reality Technology is a novelty idea? (5- Strongly Agree, 1- Strongly Disagree)
 - a. 5
 - b. 4
 - c. 3
 - d. 2
 - e. 1

Appendix

8. Do you think that implement Augmented Reality Technology in tourism sector can solve geographic limitations? (5- Strongly Agree, 1- Strongly Disagree)
 - a. 5
 - b. 4
 - c. 3
 - d. 2
 - e. 1
9. Do you think that virtual tour can give a simple overview about that tourist attraction for travelers? (5- Strongly Agree, 1- Strongly Disagree)
 - a. 5
 - b. 4
 - c. 3
 - d. 2
 - e. 1
10. Do you think that implement a 2D/3D Game or quiz in a virtual tour application can help users learn about the history/information of that place in a delightful way?
 - a. Yes
 - b. No
11. Would you always do some research about that tourist attraction through online before travels to the place physically?
 - a. Yes
 - b. No

APPENDIX

QUESTIONNAIRE SAMPLE (CHAPTER 6)

1. Gender
 - a. Male
 - b. Female
2. Age
 - a. 16-18
 - b. 19-21
 - c. 22-24
3. How satisfied are you with the experience of exploring Cheng Hoon Teng temple in the lecture module?
 - a. Very satisfied
 - b. Satisfied
 - c. Neutral
 - d. Unsatisfied
 - e. Very unsatisfied
4. How engaging was the game module, which allows you to explore Cheng Hoon Teng temple in First Person Point of View (FPS)?
 - a. Very engaging
 - b. Engaging
 - c. Neutral
 - d. Slightly engaging
 - e. Not engaging
5. Which module you more preferred to be used in Cheng Hoon Teng exploration.
 - a. Lecture Module
 - b. Game Module
6. How easy was it to view and upload reviews in the user review module?
 - a. Very easy
 - b. Easy
 - c. Neutral
 - d. Difficult

Appendix

- e. Very difficult
- 7. How would you rate the functionality of viewing and uploading photos in the photography module?
 - a. Excellent
 - b. Good
 - c. Fair
 - d. Poor
 - e. Very Poor
- 8. Did you find the FAQ module helpful for answering your questions about the application?
 - a. Yes
 - b. No
- 9. How user-friendly is the overall interface of the Cheng Hoon Teng virtual tourism application?
 - a. Very user-friendly
 - b. User-friendly
 - c. Neutral
 - d. Difficult to use
 - e. Very difficult to use
- 10. How effective is the AR feature (e.g., viewing 3D models) in enhancing your virtual tour experience?
 - a. Very effective
 - b. Effective
 - c. Neutral
 - d. Slightly effective
 - e. Not effective
- 11. How smooth was the performance of the application across different modules?
 - a. Very Smooth
 - b. Smooth
 - c. Normal
 - d. Slightly laggy
 - e. Very laggy

Appendix

12. What additional features or improvements would you like to see in future versions of the Cheng Hoon Teng virtual tourism application?
 - a. (Open Ended Question)

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S1, 2024	Study week no.: 2
Student Name & ID: Tan Hong Qian 22ACB02321	
Supervisor: Dr Sayed Ahmad Zikri Bin Sayed Aluwee	
Project Title: Cheng Hoon Teng Temple Virtual Tourism Application	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Lecture Module, User Review Module

2. WORK TO BE DONE

Complete Photography Module

3. PROBLEMS ENCOUNTERED

It is hard to show the latest photo record from the database since all photo has different naming, so can't sort them according to time. But later then I found a solution which is renamed all of the file name according to the upload time, then this problem solved.

4. SELF EVALUATION OF THE PROGRESS

Sometimes need to think the solution out of the box.



Supervisor's signature



Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S1, 2024	Study week no.: 4
Student Name & ID: Tan Hong Qian 22ACB02321	
Supervisor: Dr Sayed Ahmad Zikri Bin Sayed Aluwee	
Project Title: Cheng Hoon Teng Temple Virtual Tourism Application	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Complete Lecture module, user review module, photography module

2. WORK TO BE DONE

Develop 3D model environment for Cheng Hoon Teng temple.

3. PROBLEMS ENCOUNTERED

New to Blender, still don't know how to use it very well.

4. SELF EVALUATION OF THE PROGRESS

Speed up the learning pace by watching the tutorial from YouTube.



Supervisor's signature



Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S1, 2024	Study week no.: 6
Student Name & ID: Tan Hong Qian 22ACB02321	
Supervisor: Dr Sayed Ahmad Zikri Bin Sayed Aluwee	
Project Title: Cheng Hoon Teng Temple Virtual Tourism Application	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Complete Lecture module, user review module, photography module, 3D model of Main Entrance, Main Hall, Monument Room and Jialan Palace

2. WORK TO BE DONE

Develop the rest 3D model for Cheng Hoon Teng temple.

3. PROBLEMS ENCOUNTERED

After completing the 3D model from Blender and import it to Unity, there is some texture problem. The model looks not same when imported in Unity compared to Blender.

4. SELF EVALUATION OF THE PROGRESS

Need to complete the work in more efficiency way.



Supervisor's signature



Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S1, 2024	Study week no.: 8
Student Name & ID: Tan Hong Qian 22ACB02321	
Supervisor: Dr Sayed Ahmad Zikri Bin Sayed Aluwee	
Project Title: Cheng Hoon Teng Temple Virtual Tourism Application	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Complete Lecture module, user review module, photography module, all 3D models

2. WORK TO BE DONE

Develop Game Module

3. PROBLEMS ENCOUNTERED

Lack of experience to build a game project. First time to use Unity to build a game.

4. SELF EVALUATION OF THE PROGRESS

Time management need to be improved to reached weekly project outcome.



Supervisor's signature



Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S1, 2024	Study week no.: 10
Student Name & ID: Tan Hong Qian 22ACB02321	
Supervisor: Dr Sayed Ahmad Zikri Bin Sayed Aluwee	
Project Title: Cheng Hoon Teng Temple Virtual Tourism Application	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Complete Lecture module, user review module, photography module, game module

2. WORK TO BE DONE

Develop the AR Module and combine it into Lecture Module

3. PROBLEMS ENCOUNTERED

My phone doesn't support for ARCore Service. Need to find other devices to check the project result. Finally, build the application on iOS platform. Since building project on iOS platform need to be run in Xcode which is only available in MacOS, then developer need to use the virtual machine and find the latest MacOS version by myself.

4. SELF EVALUATION OF THE PROGRESS

Check the device compatibility before trying to develop some application which required special technology.



Supervisor's signature



Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3S1, 2024	Study week no.: 12
Student Name & ID: Tan Hong Qian 22ACB02321	
Supervisor: Dr Sayed Ahmad Zikri Bin Sayed Aluwee	
Project Title: Cheng Hoon Teng Temple Virtual Tourism Application	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Complete Lecture module, user review module, photography module, game module, AR module

2. WORK TO BE DONE

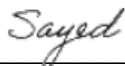
Develop the FAQ module and report

3. PROBLEMS ENCOUNTERED

When building the application on iOS platform, it is only valid for 7 days. After 7 days, the application need to be signed and installed on iOS devices again. Since I do not pay USD99 to enrol in the apple developer program.

4. SELF EVALUATION OF THE PROGRESS

Get more tutorial from YouTube to solve some problems which required payment.



Supervisor's signature



Student's signature

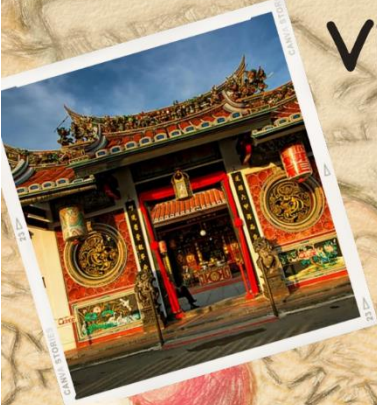
POSTER



UTAR
UNIVERSITI TUNKU ABDUL RAHMAN

UNIVERSITI TUNKU ABDUL RAHMAN

Cheng Hoon Teng Virtual Tour App





INTRODUCTION

Cheng Hoon Teng Virtual Tourism App is a mobile application that allow users to virtually visit Cheng Hoon Teng using their mobile phone without stepping out from home.



OBJECTIVE

- To study the usage of augmented reality technologies in virtual tourism software development.
- To develops an AR based software for Tourism Attraction (Cheng Hong Teng Temple).
- To evaluate the effectiveness the AR based software can support the user for virtual tourism.



METHODOLOGY

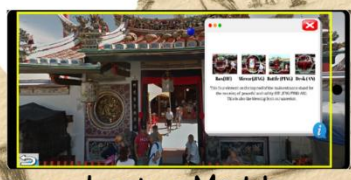
MAIN MENU

- 01 Lecture Module
- 02 Game Module
- 03 User Review Module
- 04 FAQ Module
- 05 Photography Module



PROJECT RESULT

Lecture Module



Game Module



Photography Module



User Review Module



FAQ Module



Project Developer
Tan Hong Qian

Supervisor
Dr Sayed Ahmad Zikri Bin Sayed Aluwee

Moderator
Cik Nor Fatiha Binti Subri

PLAGIARISM CHECK RESULT

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[H. Saito. "Super resolving texture mapping from multiple view images for 3D model construction", SMC 2000 Conference Proceedings, 2000 IEEE International Conference on Systems, Man and Cybernetics. "Cybernetics Evolving to Systems, Humans, Organizations, and their Complex Interactions" \(Cat. No.00CH37166\), 2000](#)

<1% match (publications)
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<1% match (publications)
[William R. Sherman. "VR Developer Gems", CRC Press, 2019](#)

Appendix

Universiti Tunku Abdul Rahman			
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Form Number: FM-IAD-005	Rev No.: 0	Effective Date: 01/10/2013	Page No.: 1 of 1



FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Full Name(s) of Candidate(s)	TAN HONG QIAN
ID Number(s)	22ACB02321
Programme / Course	BACHELOR OF INFORMATION SYSTEMS (HONOURS) INFORMATION SYSTEMS ENGINEERING
Title of Final Year Project	Cheng Hoon Teng Temple Virtual Tourism Application

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Number of individual sources listed of more than 3% similarity: <u>-</u>	
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Sayed Ahmad Zikri

Signature of Supervisor

Name: SAYED AHMAD ZIKRI BIN SAYED ALUWEE

Date: 15/09/2024

Signature of Co-Supervisor

Name: _____

Date: _____



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