

**The AR Based Digital Heritage Learning Application for Lenggong Valley using  
Constructivism Approach**

By

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## **ABSTRACT**

This proposed system is a system that will be useful for the learning of historical sites if the system has successfully been developed. This system is going to apply Augmented Reality (AR) technology which has the purpose to increase the interest of the user in the learning of historical sites. The structure of Lenggong Valley will be designed as a 3D model that allows the user to view the whole structure of the historical site virtually in this proposed system. The 3D structure of the historical site aims to allow the users to understand and learn about the historical site in a different way compared to the traditional way which is also known as visual learning so that the user can understand the historical site easily and thoroughly. This proposed system will be developed using ADDIE mode. Therefore, the Analyze, Design, Develop, Implement and Evaluate will be carried out consecutively to ensure the stages are being clearly defined and the implementation of effective training tools will be facilitated. The novelty of the system includes AR module which is used to create the 3D structure of Lenggong Valley, a virtual tour module that allows the user to visit Lenggong Valley virtually and an interactive map module that let the user visit the pinpoint location within Lenggong Valley. The developed software is tested using System Usability Scale (SUS) and the Post-Study System Usability Questionnaire (PSSUQ). The test is carried out to test the target audience's overall satisfaction towards the system. The average score of this system tested through SUS is 74.25 which mean that the system is perceived as usable by the target audience. However, the score tested by PSSUQ is lower than average as with the overall usability score of 2.225, System Usefulness score of 2.22833, Information Quality score of 2.66667 and the Interface Quality score of 2.111111. All the score is slightly lower than the average industry score set for PSSUQ which means that the system requires more improvement to increase the system usability.

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### **Chapter 1 Project Background**

#### **1.1 Introduction**

Lenggong Valley is located in Perak. Lenggong Valley is an important archaeological site where evidence of human settlement from the Paleolithic age was found. The important archaeological sites include Kota Tampan, Bukit Jawa at Kampung Gelok and Kampung Temelong. One of the most famous archaeological findings in Lenggong was the Perak Man. The name 'Perak Man' was given to the skeletal remains of a man who had thought to have lived about 11,000 years ago in the Lenggong Valley district of Hulu Perak. The Perak Man was found in 1991 in a cave called Gua Gunung Runtu, a few kilometers north of the town of Lenggong. It is also known as the oldest human skeleton found so far in Peninsular Malaysia [19].

The purpose of this project is to develop an AR based Digital Heritage Learning Application for Lenggong Valley using Constructivism Approach. The project aims to help students learn about the historical site in a different way. The AR allows the user to view and learn the structure of the historical sites in a different way. This project enables students to study the knowledge of the historical sites through visual learning instead of traditional learning styles. Visual learning can develop the student's interest to learn more about historical sites knowledge. It motivates the students throughout the learning process and saves the students from other distractions. Moreover, the visual study also eases the learning process with the help of video presentations for the students. Next, the visual study adds a fun element to studies. History can be boring at times. The visual study helps the students to improve their concentration levels during their study [20].

### **1.2 Background**

The project focuses on developing an AR-based digital heritage learning application for Lenggong Valley, which will enable students to learn about the historical site in a 3D environment. The Constructivism approach that emphasizes active and interactive learning will be used to develop the project. The project aims to help students develop their interest in historical sites and motivate them throughout the learning process by using visual learning. The project can be a valuable educational resource for students, researchers, and educators interested in learning about Lenggong Valley's rich history and cultural heritage.

### **1.3 Problem Statements and Motivation**

#### **Students are not interested in learning about the historical sites**

The study of historical sites can be boring [1], most students are not interested in studying more about the historical sites because there are too many words and it gets boring to read all the words let alone learn about them. The students may not even know what a historical site looks like when they first saw the picture of the historical sites from the book as it is hard to imagine the whole building from just some pictures provided in the book. Imagination allows students to assume roles for time being that provide students more understanding of their own personal vision [2].

#### **Students faced difficulties in visualizing the Historical Site**

Architectural visualization can be referred to as sketches, computational renderings, and drawings [3]. The design of the historical site can be challenging to visualize as the learning of history is a complex undertaking [4]. This is due to that when the student learns about the historical site through a book, they will need to visualize the design of the historical site themselves or with some pictures provided in the book. Therefore, students will be facing a lot of difficulties in understanding the structure of the historical site by just looking at some pictures or reading the description of the historical site in a book.

### **Lacks the AR Based Digital Heritage for historical sites**

Nowadays, Augmented Reality (AR) techniques have been widely used in different kind of fields. AR technology included two kinds of triggers which is GPS which is based on the location that provides the user's location to the AR applications and a camera which is for complex image recognition that is carried out by current smartphone cameras [5]. However, there is not much AR based digital heritage software for historical sites. This is due to that the technology is too new and is barely compatible with other software. This will complicate the unifying process while developing the overall technology [6].

### **1.4 Project Objectives**

#### **To study the usage of augmented reality (AR) technologies in historical sites studies**

Augmented reality (AR) is a real-time integration of digital information with the environment of the user. The user can receive more information or have natural environments aesthetically altered in some way by using augmented reality. The study of historical sites can be challenging, it involves not only the history of the sites, but also the need to know how to analyze the chronological relationships and patterns of the historical sites. The existence of interactive augmented reality can help present the theories or ideas behind it so that is easier for the student to visualize the image of the respective knowledge. Hence, when we apply AR technologies to historical studies, the user can have a better understanding of the ideas and especially the structure of the historical sites as the AR technologies are able to support visualization and engagement to the user.

### **To develops an AR based software for historical sites education**

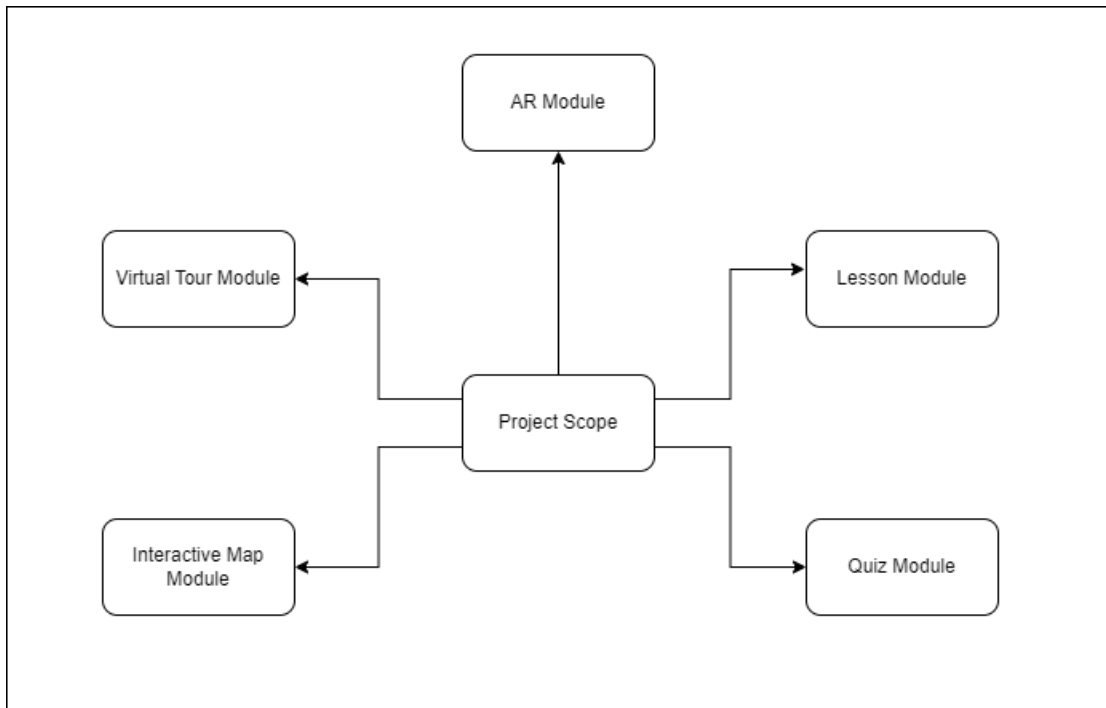
Augmented reality (AR) delivers visual elements, sound and other sensory to the user through a device such as a smartphone or smart glasses. It provides the user a seamless experience where digital information modifies the user's view of the actual environment, this information is layered onto the device. AR manages to blend in the digital and three-dimensional (3D) components with an individual's perception of the real world. A part of the natural world might be hidden or added to the superimposed information. Visual learning plays an important role in education. Visual learning is more appealing to students than reading plain text. The AR based software for historical sites education will aid the education field in increasing the student's interest in learning historical knowledge. This is due to that the software changes the knowledge in the form of words into a form of vision which is more appealing to the students as they can use their smart devices to scan the historical sites and obtain knowledge and the visualize structure of the historical sites.

### **To evaluate the effectiveness of AR software in historical sites studies towards students**

The traditional way of studying historical sites can be boring and demotivated as the students are required to memorize the knowledge of the historical sites without a proper image of the historical sites. The purpose of the AR software developed is to let the study of the historical site becomes easier and more fun. The software will help students to visualize the structure of the historical sites. This will ease the students to understand the knowledge provided regarding the historical sites. Visual learning is important and will be helpful for historical site studies which contain a lot of plain text. Hence, this will increase the interest of a student in learning about historical sites. This is due to that visual learning can help students to understand the site more easily and straightforwardly compare to trying to visualize the site themselves through the description from the textbooks.



## 1.5 Project Scope



*Figure 1.1: Project Scope*

### 1.5.1 Lesson Module

The lesson module is a proposed module to elaborate the information about Lenggong Valley to the user. The proposed module will be providing knowledge about the history of Lenggong Valley to the user to ensure the user understands the historical site of Lenggong Valley. The module includes many interactive features such as navigation buttons and will perform along with text, graphics, animation, audio and video. In short, the lesson module is to increase the understanding of the user of Lenggong Valley.

### **1.5.2 Quiz Module**

The quiz module is a proposed module to get to know the understanding level of the users of the knowledge of Lenggong Valley. The quiz modules will perform with the elements of text, graphics, animations and audio. The module will also include some interactive features. For instance, the user will have to drag to match the correct answer, multiple-choice questions and the navigation buttons such as previous and next will be provided. In a nutshell, the purpose of the proposed Quiz module is to test the level of understanding of the content of the user.

### **1.5.3 AR Module**

AR module is a proposed module that shows the historical site of Lenggong Valley in 3D mode. The 3D model of Lenggong Valley is shown to the user so that the user understands the structure of the historical site. The AR module will perform along with the elements of text, graphics and animation. The module also includes some interactive features such that the user can drag the 3D model to see the structure of the historical site from a different angle or zoom in and zoom out of the 3D model. In short, the motif of the AR module is to let the user understand the structure of Lenggong Valley to gain more interest in learning about historical sites.

### **1.5.4 Virtual Tour Module**

Virtual tour module is a proposed module that enables the user to visit the historical site through a 3D space. The tour module will guide the user to visit Lenggong Valley in a 3D Space. The user can view not only the structure of Lenggong Valley but also the surroundings of Lenggong Valley in the 3D space. The module consists of interactive features. For example, the user can navigate through the 3D spaces using the next and previous buttons and play, pause or stop the current tour using the multimedia controls. Thus, the purpose of the tour module is to allow the user to visit Lenggong Valley virtually.

### **1.5.5 Interactive Map Module**

The interactive maps module is a proposed module that let the user view the map of Lenggong Valley. The interactive map module shows the user a certain pinpoint data of Lenggong Valley on a map. The user is able to interact with the pinpoint to view the respective data of the particular point. The user can also go to the respective place through the interactive map module. The module consists of interactive features such as zooming in and out and panning around on the map. Therefore, the purpose of the interactive map module is to enable the user to view the structure of Lenggong Valley in the form of a map and go to the particular region in Lenggong Valley easily.

### **1.6 Contribution and Significance**

This project consists of some uniqueness of its own. First and foremost, the AR module is unique to the project as this project is mainly focused on creating a 3D model of the structure of Lenggong Valley. The purpose of this project is to increase the student's interest in learning about historical sites through Augmented Reality (AR). Hence, the AR module plays an important role in this project to produce the 3D model of the historical site and present it to the user. Next, there is the virtual tour module. The virtual tour module aims to allow the user to visit Lenggong Valley virtually. The student's interest in Lenggong Valley will increase as the visual information tends to attract more people compare to the text information. As not everyone is capable of went to the sites physically, the virtual tour will bring the user to Lenggong Valley to experience the historical sites and the surroundings of the historical sites. Furthermore, the interactive map module is also unique in this project. This is due to the interactive map allowing the user to visit the pinpoint places within Lenggong Valley easily. The pinpoint places on the interactive map will also show the summary of the information of the respective place to the user so that the user can learn the knowledge regarding the historical sites while interacting with the system.

### **1.7 Target Audience**

The target user of this project is the students. Students nowadays have lost interest in studying historical sites. This is because the students lack the motivation to invest the effort they need to learn [7]. The student is also having a hard time imagining the historical sites through the knowledge and pictures provided by the textbooks which causes the students hard to understand the historical sites. Hence, this project aims to increase the student's interest in learning the historical sites by bringing the knowledge to the students in a different way which is through Augmented Reality (AR). The student will be able to view the whole structure of the historical sites while they learn about them so that they were able to gain more understanding. Visual studies such as AR also drive the student's motivation to learn as it helps the students to overcome boredom and finds the motivation to perform better. Visual metaphors and images can create strong impressions in students. This is because of that human's process visual information and emotions in the same part of the brain. Emotional response and visual stimuli have a simple link that works together to generate memories. Hence, visual studies can help students to create lasting memories that help them to improve their studies [7].

## **Chapter 2 Literature Review**

### **2.1 Multimedia**

Multimedia is the integration of text, still and moving images, and sound by means of computer technology. The word Multimedia is the composed of two parts which is the prefix multi and the root media. “Multi” is a short form of multiple, which means “many” whereas Media is a means to distribute and represent information. Furthermore, multimedia is also defined as a form by using the computer system to present the combination the integration of multimedia elements which includes text, graphics, audio, video and animation that allow user to interact, navigate, create and communicate. Multimedia can be found in various forms of digital media, including websites, social media platforms, mobile applications, video games, and digital signage. The purpose of multimedia is to enhance the communication process by making the information more accessible and engaging to the audience.

#### **2.1.1 Linear Multimedia**

Linear multimedia refers to a type of multimedia that is designed to be presented in a sequential manner. It has a distinct beginning and end which goes on a logical flow from a starting point to a conclusion. The linear multimedia is usually for display purpose with not much interaction or distraction from the audience. This is due to that the linear multimedia does not provide features such as ability to select options and click on icons to the user to control the media displayed. Linear multimedia is also known as passive multimedia as the audience participation is not expected as the multimedia do not provide any control to the user. The main purpose of linear multimedia is for teaching, learning and publishing information to a group of people. For example, a PowerPoint lecture slides is used in a lecture class to provide information to the students.

### **2.1.2 Interactive Multimedia**

Interactive media is a type of multimedia with interactions that allows users to actively engage with the content they are consuming. The interactive multimedia is designed to provide an immersive and interactive experience by enabling users to control the flow of information and interact with the media in real-time. Interactivity empowers by the end users by allowing the user to control the content and the flow of information. The response of the computer depends on the response of the user. The purpose of the interactive multimedia is to encourage the participation and engagement, which can lead to a more memorable and effective learning experience [21]. Interactive multimedia is commonly used in educational, training and marketing applications, as it can provide a more engaging and effective way to communicate complex concepts and ideas.

## **2.2 Interactive Multimedia**

### **2.2.1 Benefits**

There are several benefits of interactive multimedia in different fields, including education, marketing and training. The interactive multimedia improved the engagement and motivation of the user by providing an immersive and engaging the experience to the user that can motivate learners to explore more and learn more. Furthermore, interactive multimedia provides learners a personalized learning experience as the learners are able to control their pace of training by providing feedback. Guidance, and support that is tailored to their needs and interests. Moreover, interactive multimedia can provide a real-world simulation. The interactive multimedia can simulate real-world scenarios that can help learners to practice and apply their knowledge in a safe and controlled environment.

### **2.2.2 Limitations**

While interactive media has several benefits, there are also some of the limitations that should be put into consideration. The interactive multimedia might not be accessible to all learners particularly to those with disabilities or those without access to high-speed internet or a specific device. The interactive multimedia could also be distracting and may lead to cognitive overload if not designed well. Then, there is the design and development costs of the interactive multimedia. The interactive multimedia can be expensive to design and develop, particularly for complex applications or simulations. Next, interactive multimedia has potential for information overload. This is due to that the interactive multimedia may be providing too much information, making it difficult for learners to process and retain the information effectively.

### **2.3 Applications of Multimedia**

Multimedia has a wide range of applications in various fields in our daily life including education, entertainment, marketing, and communication. Multimedia can be used in education and training to provide engaging and interactive learning experiences. It can be used to deliver online courses, eLearning modules, and simulations. For example, videos, animations, and simulations can be used to explain complex concepts or demonstrate a practical skill. Moreover, multimedia is used extensively in the entertainment industry, including the in movies, television shows, video games, and music. For examples, movies and TV shows use multimedia to create special effects and visual storytelling whereas video games use multimedia to create interactive and immersive experience for the players. Furthermore, multimedia is also used in marketing and advertising campaigns to create engaging and interactive content that can be used to attract and retain customers. For instance, video and animations can be used in social media campaigns to promote products and services. Last but not least, the multimedia can be used to enhance communication and collaboration in the various contexts including in business, healthcare, and social media. Interactive multimedia such as virtual reality can be used to create immersive and engaging experiences for remote teams or customers.

### **2.4 Multimedia in History Study**

Multimedia has played a significant role in revolutionizing the way we approach history study. The integration of different forms of media, including images, videos, audio, and interactive elements, has made history more accessible and engaging for learners of all ages. One of the earliest uses of multimedia in historical study was the introduction of the television documentary. Documentaries like “The World at War” and “Civilization” allowed viewers to see and hear history in a way that had not been possible before. These documentaries paved the way for other forms of multimedia, including historical reenactments, virtual tours of historical sites, and digital archives. Multimedia has also enabled historians and researchers to analyze and interpret historical events in new ways. For instance, the use of Geography Information Systems (GIS) has allowed historians to map and analyze historical events and locations in a new and innovative ways [22]. Digital archives and databases have also made it easier for researchers to access historical documents and artifacts, even if they are located in different parts of the world. Moreover, multimedia has made history study more accessible and engaging for learners of all ages. Interactive multimedia, such as games and simulations, have made it possible for learners to experience historical events in a way that goes beyond reading about them in a textbook. Videos, podcasts, and other forms of multimedia have also made it easier for learners to access historical content from anywhere in the world.

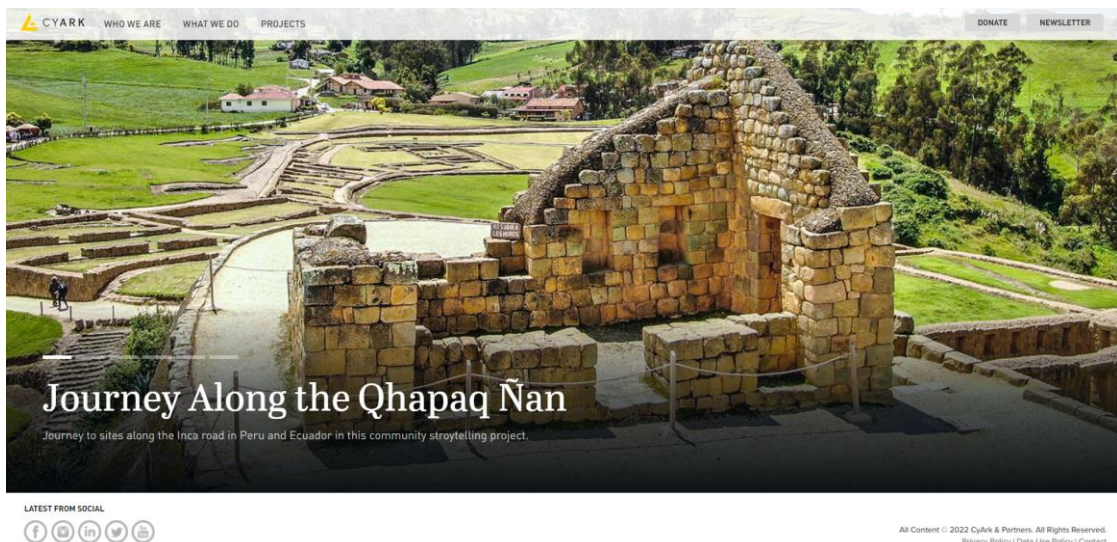


## CHAPTER 2

### 2.5 Comparison on Similar Multimedia Applications

#### 2.5.1 CyArk

CyArk is a nonprofit organization that is committed to empowering connections with historical places. CyArk was founded in 2003 and worked with local partners at more than 200 locations in more than 20 countries. CyArk was a pioneer in the application of 3D technologies to the protection and appreciation of cultural heritage. CyArk aims to introduce new audiences to heritage through digital documentation and the development of location-based web, mobile, and immersive experiences that stimulate thought, conversation, and imagination.

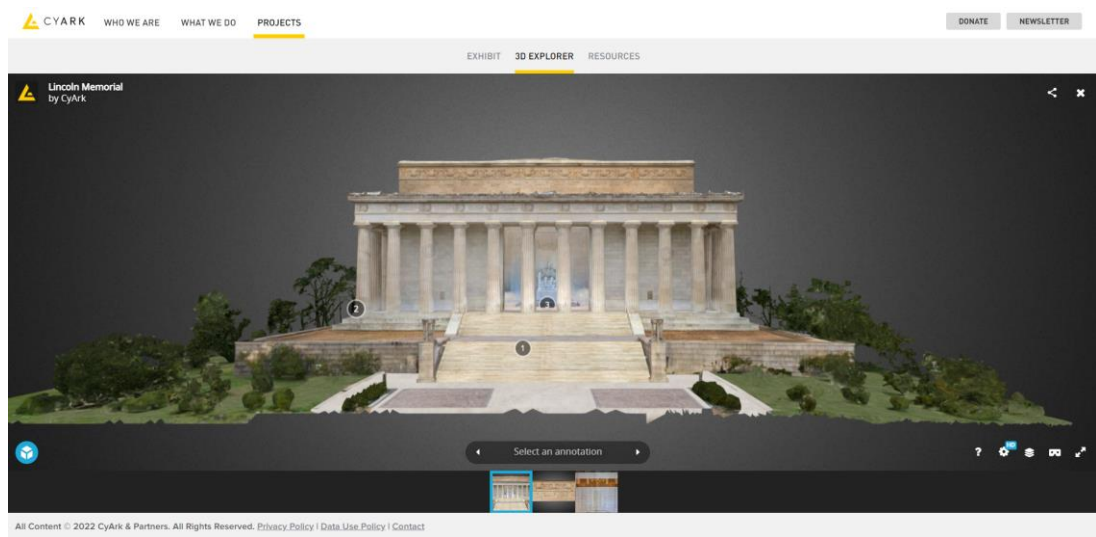


*Figure 2.1: Screenshot of CyArk Home Page*

Historic sites are important for creating and establishing cultural and community identity, but they are frequently undiscovered or out of reach for many people. CyArk strives to elevate new voices and broaden awareness of our past and our common human experience by establishing more equal and respectful access to places through digital technology.



*Figure 2.2: Screenshot of Lincoln Memorial by CyArk*



*Figure 2.3: Screenshot of Lincoln Memorial 3D Explorer by CyArk*

## CHAPTER 2

### Strengths

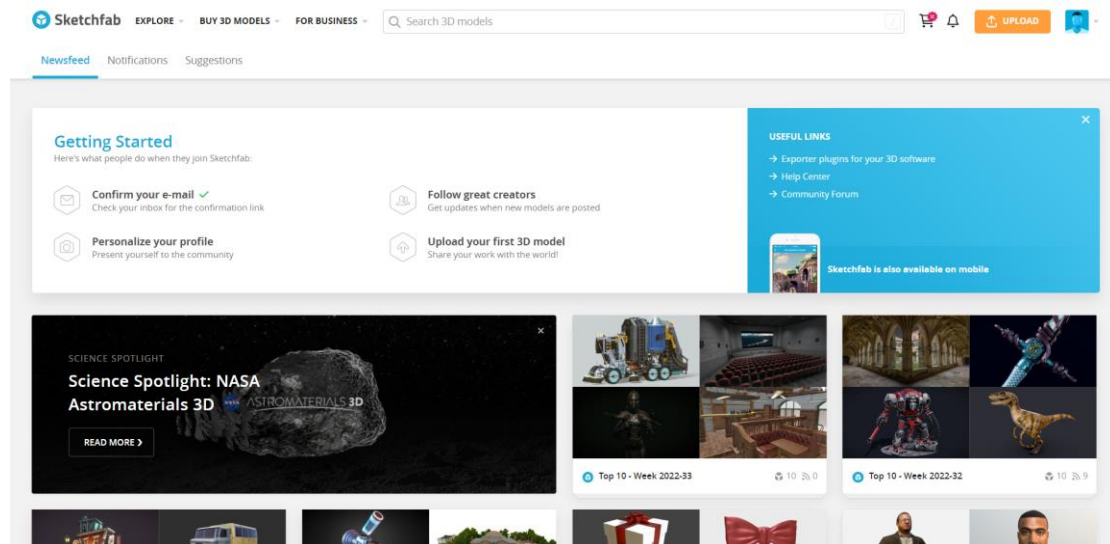
CyArk has several features such as Real 3D, Vignettes, Expert Narration and is Optimized for Web and Mobile. Real 3D features allow the user to experience the site in true immersive 3D with the freedom to explore an open environment. This feature allows the user to have a clear vision of what the site looks like without visiting the site. The vignette feature provides an additional hand-modeled scene that augmented the site model and brings the tour to life for the user. Expert Narration provides the user a tour with an expert guide that provides in-depth video or audio commentary at each of the tour stops. The user will be able to understand the site thoroughly while using the CyArk application as it will show the user about the specific knowledge of the site. CyArk application is also optimized for web and mobile. The tapestry tours of the application are designed for both web and mobile devices with adaptable UI elements that expand and contract with the available screen space. This feature is user friendly as the user can either access the application through computer devices or mobile devices at any time anywhere.

### Weaknesses

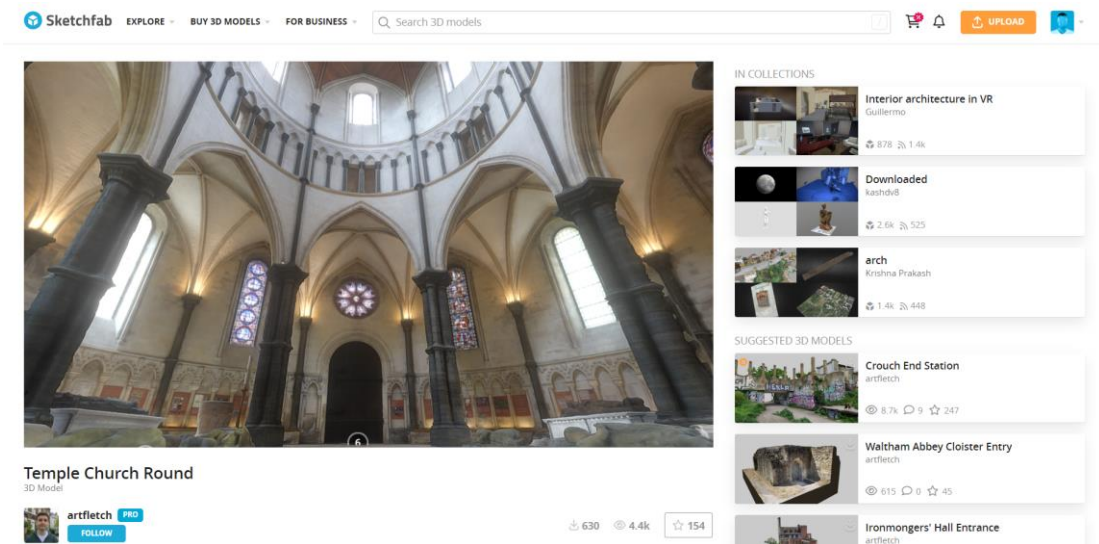
CyArk has different types of projects that are related to the different historical sit, 3D Explorer is available for most of the historical sites. However, there are still some historical sites that do not obtain the 3D Explorer features. This might affect the user experience as some of the specific historical sites required by the user do not have the 3D Explorer feature which causes the user unable to understand the respective site completely. Furthermore, CyArk should provide in-depth features for all their projects. This is due to that the in-depth feature provides historical knowledge about the respective historical sites. This feature can help the user to understand deeper about the historical sites while they are using CyArk to study the respective historical site.

### 2.5.2 SketchFab

SketchFab is a website that provides a platform for publishing, sharing, discovering, and selling 3D, VR, and AR content. It offers a viewer built on WebGL and WebXR that enables the user to show 3D on the web and is also viewable on any mobile browser, desktop browser or VR headset. SketchFab enables the users to move freely around or inside the 3D scene. The major products of SketchFab are a 3D, Virtual Reality (VR) and Augmented Reality (AR) model viewer. It allows the user to freely navigate around or inside the 3D environment by using the mouse, touch controls, VR or AR. The user will have access to 3D animations in addition to static 3D models.



*Figure 2.4: Screenshot of SketchFab Home Page*



*Figure 2.5: Screenshot of Temple Church Round published by artfletch in SketchFab*

## Strengths

SketchFab is a software that is easy to use. SketchFab makes it easy to upload, edit and share 3D online. The visualization quality of the uploaded 3D model is world-class and provides the user with VR and AR without any extra effort. This allows the user to bring their ideas to life with ease. It also supports the largest collection of files format and is significantly more lightweight than its closest contemporary. SketchFab also has very good functionality. The SketchFab API allows the user to create a very powerful and convincing product configurator. It provides a high visualization quality when producing 3D models. This provides the user with a fantastic platform to share their creative ideas and view. The user can share their creations and also receive feedback on their creation. SketchFab provides great customer support. It is easy for the user to set up for the user to experience the 3D configurator. The configurator allows the user to switch easily between different models, colors and rings to personalize the unit effectively and immediately.

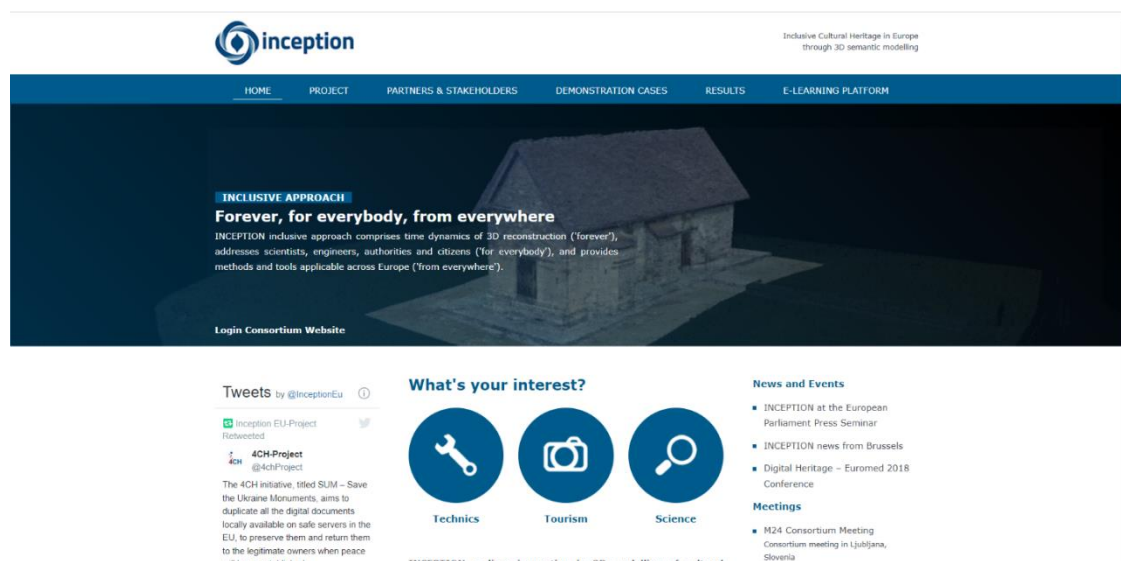
## CHAPTER 2

### Weaknesses

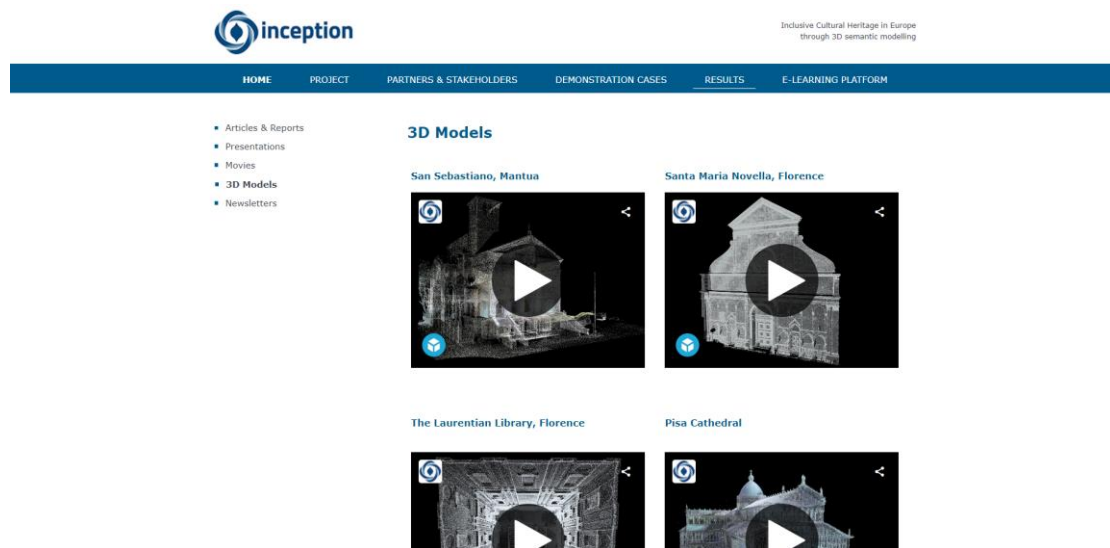
There are a few weaknesses that exist for the SketchFab software. Firstly, 3D modeling can be hard to capture the model's texture. The user will need more patience and practice to get as close as they can to capturing the model's texture. It also did not provide any way to animate textures. Next, the SketchFab separates the color configurator and mp4/jpg generator from the main SketchFab site despite having a great color configurator and mp4/jpg generator. It can be difficult for the user as they cannot access the color configurator and mp4/jpg generator as much as they like as it is not put as the main too in SketchFab. Furthermore, SketchFab does not have a very good organization capability of files. The user can only create a folder to organize files but without any ability to create a sub-folder within the folder This can be troublesome for some user such as fashion designers who would like to organize their files according to brand, gender, category and so on.

### 2.5.3 Inception

Inception models aim to increase the user awareness of European cultural resources and direct utilization for original and imaginative uses. The digital model is expected to become the representation and research needs to acknowledge the evolving role that reconstruction, reserve, and conservation currently play in the representation of heritage and its analysis. The 3D representations beyond existing levels of visual portrayals should facilitate information integration and linkage, shape-related analysis, and give the essential semantic information for in-depth study by the users and academics.



*Figure 2.6: Screenshot of Inception Home Page*



*Figure 2.7: Screenshot of 3D Models by Inception*

## Strengths

The 3D models produced by INCEPTION's methodology and tools will be simple to use for all user groups and compatible with a variety of hardware and applications. It creates a user-friendly augmented reality (VR and AR) platform based on open standards for building information models for cultural heritage (HBIM) that can be used on mobile devices. The combination of cutting-edge methodologies, protocols, processes, methods, and devices to better understand European Cultural Heritage through 3D models will result in new knowledge, cross-disciplinary collaboration, time and money savings in the creation and use of 3D digital models, market share growth, and social benefits. Remote access will be made possible by cutting-edge techniques and programs. The communication and collaboration among professionals, experts, and architects will also increase the operation fields in cultural heritage.



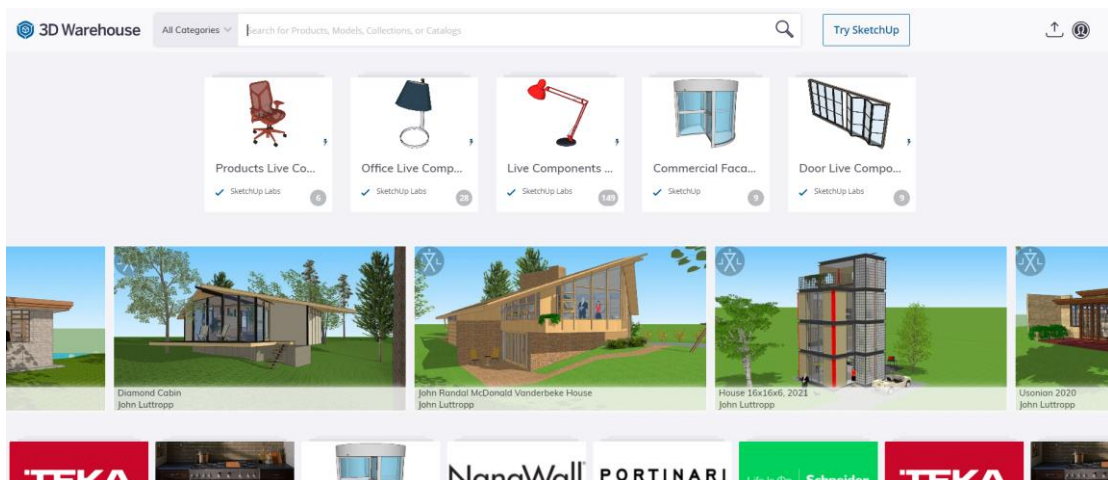
## CHAPTER 2

### Weaknesses

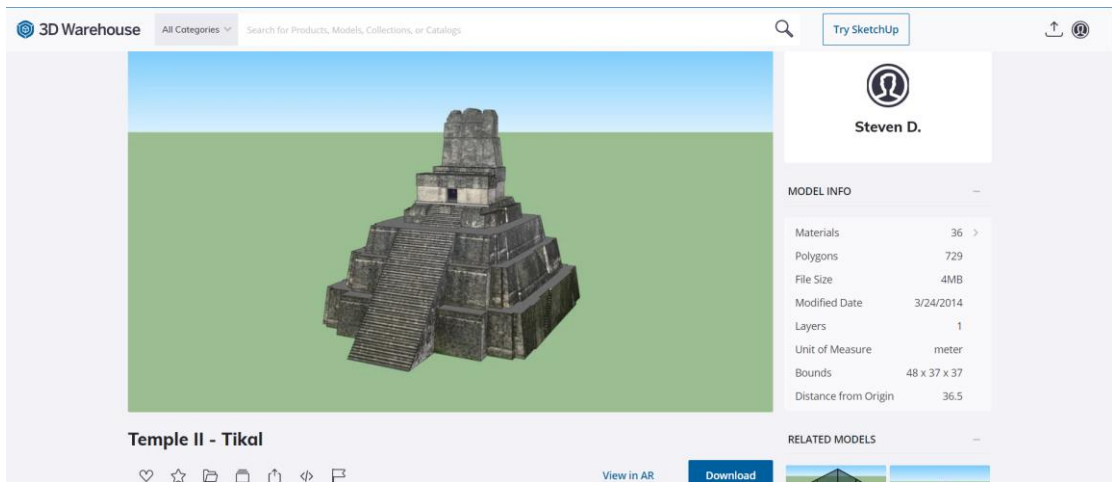
Inception produced 3D models but did not provide the respective knowledge about models. This might cause inconvenience to the user as the user need to search for the respective knowledge about the model to learn about the model. Besides, the 3D models provided by Inception do not have many choices. This might cause the user hard to find the models that they are looking for. Furthermore, the 3D models produced by Inception need to be accessed through another software. For instance, the 3D models by Inception require users to access the models through SketchFab. This might cause trouble to the user as the user will need to be going back and forth between two different software when they are looking for a 3D model in Inception.

### 2.5.4 SketchUp 3D Warehouse

SketchUp 3D Warehouse is an open library of 3D models that allows the user to download or upload 3D models. It shortens the 3D modeling time as the users can save time for designing by downloading the 3D models from the warehouse instead of designing the models from the scratch. SketchUp is a modeling CAD program for architectural, civil, interior design, mechanical design and landscape architecture drawings. It is a product of a California-based company Trimble Inc. that specializes in software, hardware and services that touch on a range of industries including Building and Construction, Agriculture, Geospatial and Transportation among others. SketchUp comes in 4 edition which consists of SketchUp Free, SketchUp Shop, SketchUp Pro and SketchUp Studio. SketchUp Free and SketchUp Shop are web-based and only accessed through the SketchUp website whereas the SketchUp Pro and SketchUp Studio require to download and to be used on the desktop.



*Figure 2.8: Screenshot of 3D Warehouse Home Page by SketchUp*



**Figure 2.9: Screenshot of 3D Model Temple II – Tikal by 3D Warehouse**

### Strengths

SketchUp is available in both Web-app and desktop apps. This can be convenient for the user as the user can work on any device and almost anywhere. There is also many versions offered by SketchUp which is great for different users that require different functions from the software. There is a lot of functions offered that do not require a lot of processing power to run. This means that the user does not require a high specification device to use the software. SketchUp is also very easy to learn and user friendly. Features such as customizable toolbars and large icons have made the application easier and more convenient even for a beginner user. The user can pick up the software and start using it at any time as the software is practical and simple to use. The software has everything that a user needs to create good modeling in 2D and 3D. The simplicity of the software allows users to reach an intermediate level of modeling skills in a short time. There are also a lot of tutorial resources available on the internet that provide the users with the techniques for using the software.

## CHAPTER 2

### Weaknesses

Web-app version of SketchUp is lagging and much slower compared to the desktop app version. The software starts lagging as the design details accumulate while using the browser. The user is limited to only creating simple models with the existing feature as the software does not handle the complex curves very well. When the models get large and extremely detailed, the certain model won't be able to run well within the program despite having a powerful computer. Next, the user requires some training to comprehend all the features provided by SketchUp as the software is so robust. SketchUp allows the user to play with lighting and textures but sometimes the tools are not enough for the user. They will need to look further into another program for more tools such as Blender. The software is very simplistic in models and rendering. It does not have a realistic texture. Most of the options are not visible to the user. Hence, the user might miss up on some of the important feature provided by Sketchup without any manual and video tutorials as many things that is simple cannot be done by the user as they are not offered.

### 2.5.5 The Panoramic Palace Museum

The Panoramic Palace Museum is a feature provided by the official website of the Palace Museum. This feature allows the user to virtually explore the ancient architectural compound of the 600-year-old Forbidden City. The user can explore the labyrinth of the hall, gardens and courtyards as well as learn about the story of every exhibit that the users are interested. This software can help the user to learn more about the history of the Forbidden City. The Forbidden City is a huge palace that was built in the 15<sup>th</sup> century and is extensively renovated later and restored during the Qing Dynasty in the 18<sup>th</sup> century. The palace consists of more than 9000 rooms and is spread over 250 acres.



*Figure 2.10: Screenshot of The Panoramic Palace Museum by Palace Museum*



*Figure 2.11: Screenshot of Tai He Palace by The Panoramic Palace Museum*

The respective knowledge about the Three Great Palace in Chinese

### Strengths

The Panoramic Palace Museum includes two different languages which is Chinese and English. This allows not only Chinese users able to obtain knowledge from the website but also any users that are interested in learning about the Forbidden City. The dual language provides users with another way to learn about the Forbidden City as there might be users who do not learn about the Chinese language. These users can enjoy this feature through the international language. The Panoramic Palace also provides the respective knowledge while the user is using the feature. For example, when the user is visiting Qian Qing Palace through the website, the respective knowledge about the Qian Qing Palace will also be shown beside the building. This enables the user to learn about the historical site while visiting them. This can also help users to learn about historical knowledge more easily as the user is able to learn while they are visiting the real Forbidden City virtually. Visual learning is always better than memorizing text from books.

## CHAPTER 2

### Weaknesses

The Panoramic Palace Museum features only have 2 languages as an option which are Chinese and English. This can also be considered a weakness for this feature as there may be a user that does not understand both languages provided. This feature can provide more types of different languages to allow more users to understand the knowledge provided more easily in their preferred language. Furthermore, some of the palace structure is incomplete in the Panoramic Palace Museum feature. Some of the structures such as Qian Qing Palace do not have the interior design structure provided to the user. This might affect the user's experience while using the feature as they cannot experience the complete structure of the historical site that they are interested in learning about. The incomplete structure might also affect users' understanding regarding the respective site as they did not get to see the complete structure of the site which helps them to understand more easily.

## 2.5.6 Summary of the Similar Applications (Comparison Tables)

*Table 2.1: Comparison of interface designs for different applications*

Components Applications	Ease of Use	Customer Support	Functionality	Interface Design	Interactivity
CyArk [8]	5	4	5	5	5
SketchFab [9]	4	4	4	4	4
Inception [10]	4	3	3	4	3
SketchUp 3D Warehouse [11]	3	4	3	3	4
The Panorama Palace Museum [12]	4	4	4	5	5
AR Based Digital Heritage Learning Application	5	3	4	5	5

1- Worst, 2-Poor, 3-Average, 4-Good, 5-Excellent



*Table 2.2: Comparison of media elements for different applications*

Media Elements \ Applications	Text	Graphics	Audio	Video	2D	3D	AR	VR
CyArk [8]	✓	✓	✓	✓	✓	✓	✓	✓
SketchFab [9]	✓	✓			✓	✓	✓	✓
Inception [10]	✓	✓			✓	✓	✓	
SketchUp 3D Warehouse [11]	✓	✓			✓	✓	✓	
The Panorama Palace Museum [12]	✓	✓	✓	✓	✓	✓	✓	✓
AR Based Digital Heritage Learning Application	✓	✓	✓	✓	✓	✓	✓	✓

### **2.6 Constructivism Approach**

Constructivism is an approach to learning where people construct their own knowledge instead of just passively perceiving the information [17]. People build their own representations and integrate new information into their pre-existing knowledge as they experience the world and reflect upon those experiences. The constructivism approach is important as it emphasizes student agency through self-guided exploration, reflection and evaluation. It promotes student agency and helps the students to develop advanced skills such as critical thinking, analysis, evaluation and creation. This approach also encourages the students reflect and evaluate their own work so that they can identify intermediary skills to acquire based on their own needs. The constructivism approach can be applied on the student by asking the students to construct their own definitions. The students will be provided with materials that allow them to build and illustrate their own definitions and concepts. Next, the students can also draw their own connections between their proposed concepts so that they can build expansive mental models that prompt them to questions and think out of the box. Furthermore, the students are also encouraged to reflect on their own progress to identify the skills they lack so that they can improve themselves. Students should be provided with time and space to be aware of their own knowledge and thinking so that their ownership increases [18].

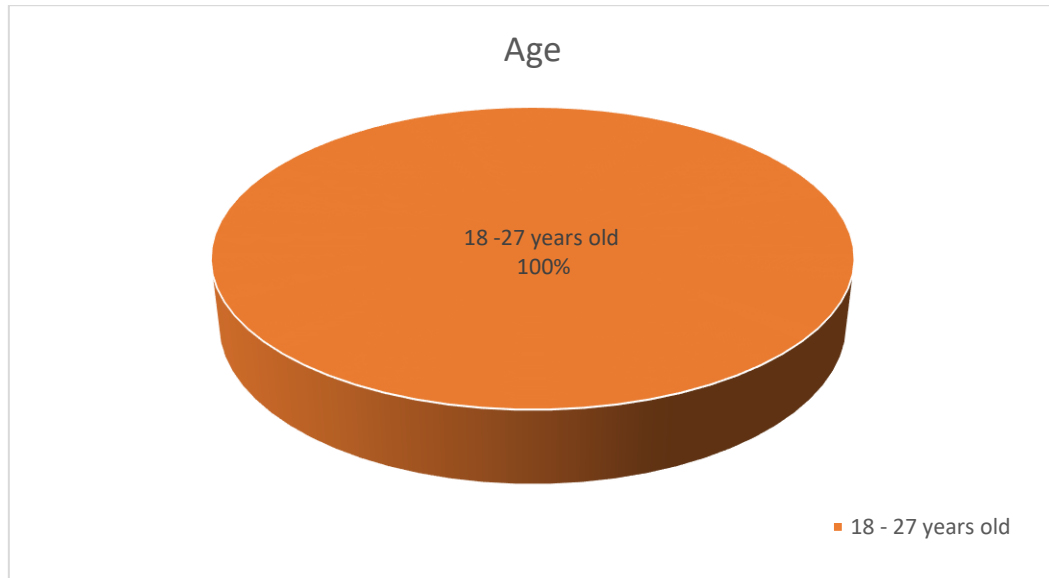
### **2.7 User Requirements Gathering**

#### **2.7.1 Survey Questionnaire**

The user requirements gathering is conducted through a survey questionnaire. The purpose of this user requirements gathering is to gain insight on identification of user preference in developing an AR Based Heritage Learning Application of their preferred choice. Survey questionnaire is selected for user requirement gathering as it is cost-efficient approach compared with a face-to-face questionnaire that is required to be delivered on site. Survey questionnaire also able to reach people quickly as it can be distributed to the respondent easily through email or texting. Next, the survey questionnaire also provide scalability as the target audience can be literally anywhere around the world. This is due to that the questionnaire can be distributed to the target audience easily by sending them a link to the questionnaire through internet. It is important to do user requirement gathering as the requirements are essential of any project. The requirements act as the foundation which all the projects should be built.

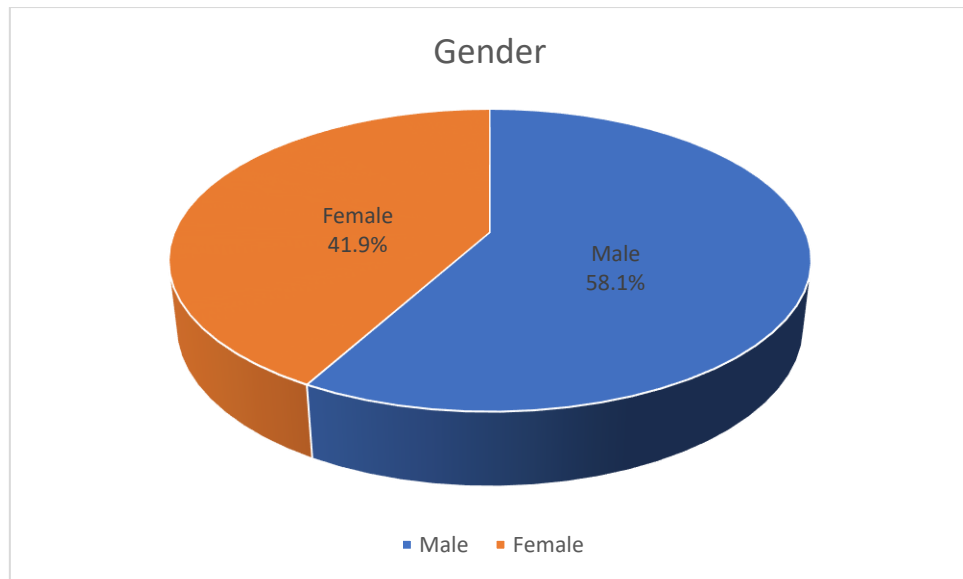
This survey questionnaire took 1 week to be prepared. There is a total of 25 questions for the questionnaire where the first 4 question is asking about the respondent's personal information, followed by 7 multiple choice questions, 12 Likert scale questions and 2 Open-ended questions. The questionnaire is being distributed to the respondent through Google Form where the link is being shared to the target audience through the internet and social applications. There is 31 sample collected for this questionnaire within 2 weeks and it took 3 days to complete the data analysis for the retrieved data. The data is being analyzed and represented in the form of Pie Chart and Bar Chart which is shown in the next section. The sample of the questionnaire is attached in Appendix.

**2.7.2 Data Collection and Analysis**



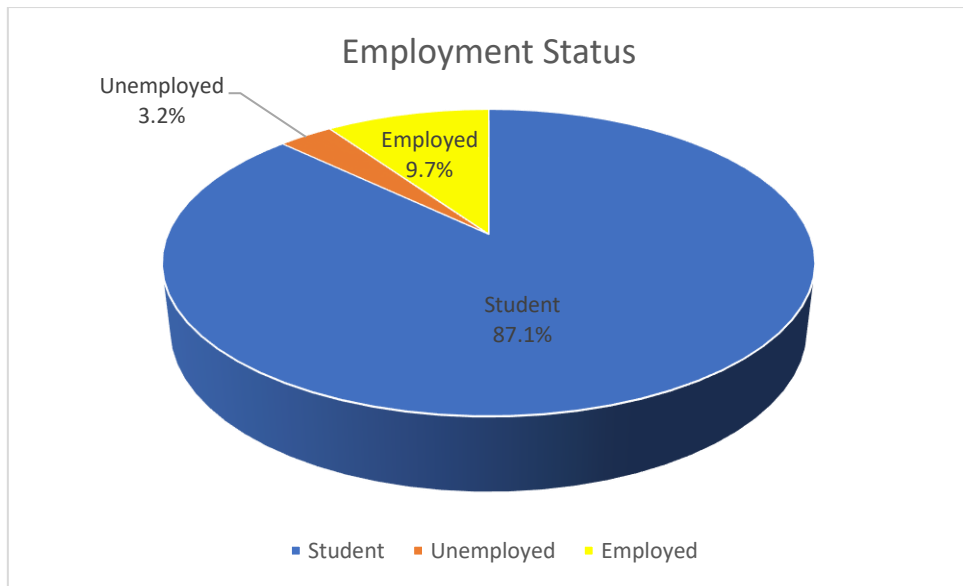
*Figure 2.12: Pie Chart for age of respondents*

There are 31 respondents for this survey. From the Pie Chart we can see that all our respondents are between the age of 18 – 27 years old.



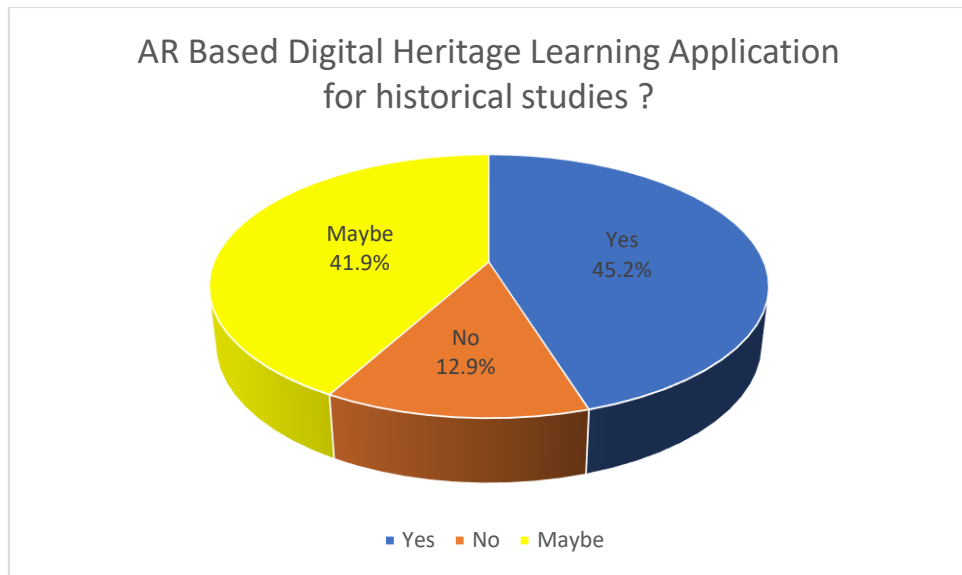
*Figure 2.13: Pie Chart for gender of respondents*

The collected data as shown in the Pie Chart above illustrate that there is 58.1% of male respondent among the 31 respondent and the rest of the 41.9% of the respondent is female.



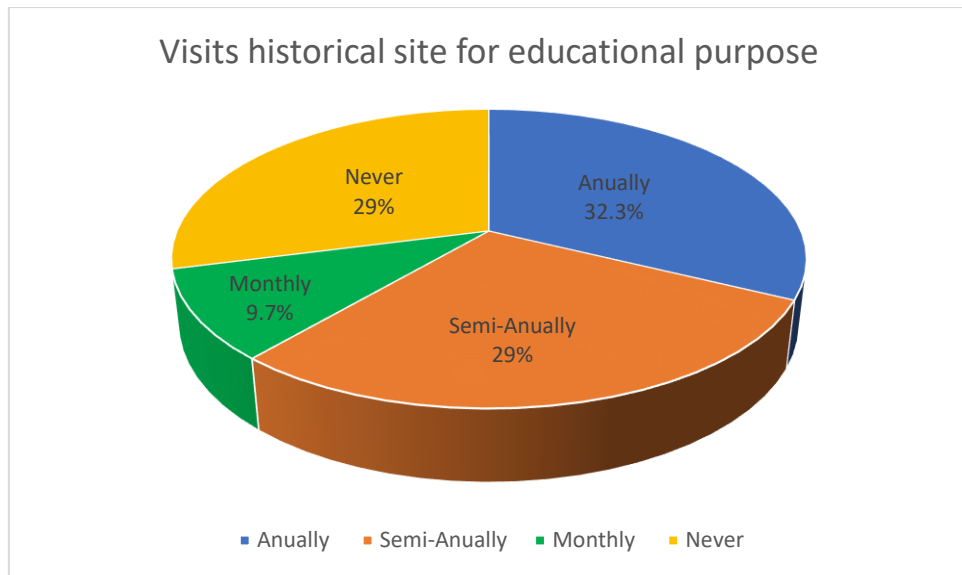
***Figure 2.14: Pie Chart for employment status of respondents***

The Pie Chart from the employment status shows that most of the respondents are student, which is 87.1% out of the 31 respondents. Next, there is 9.7% of the respondent has been employed and 3.2% of the respondent is unemployed.



***Figure 2.15: Pie Chart for respondent that would use AR Based Digital Heritage Learning Application for historical studies***

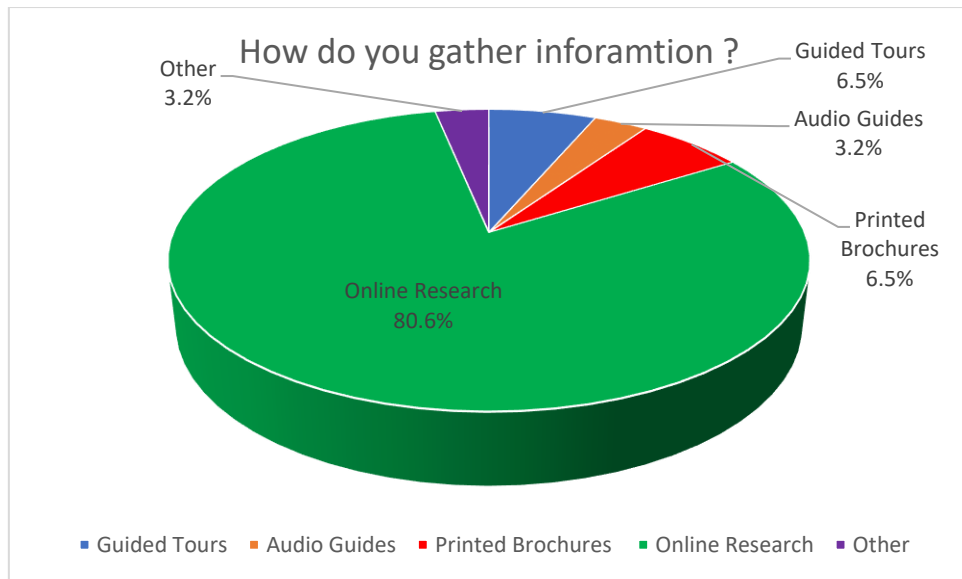
From the Pie Chart above show that most of the respondent which is 45.2% of the respondents would use the AR Based Digital Heritage Learning Application again for the historical study purposes and 41.9% of the respondents may use it and 12.9% of the user do not want to use the application again.



***Figure 2.16: Pie Chart for respondent that visits historical site for educational purpose***

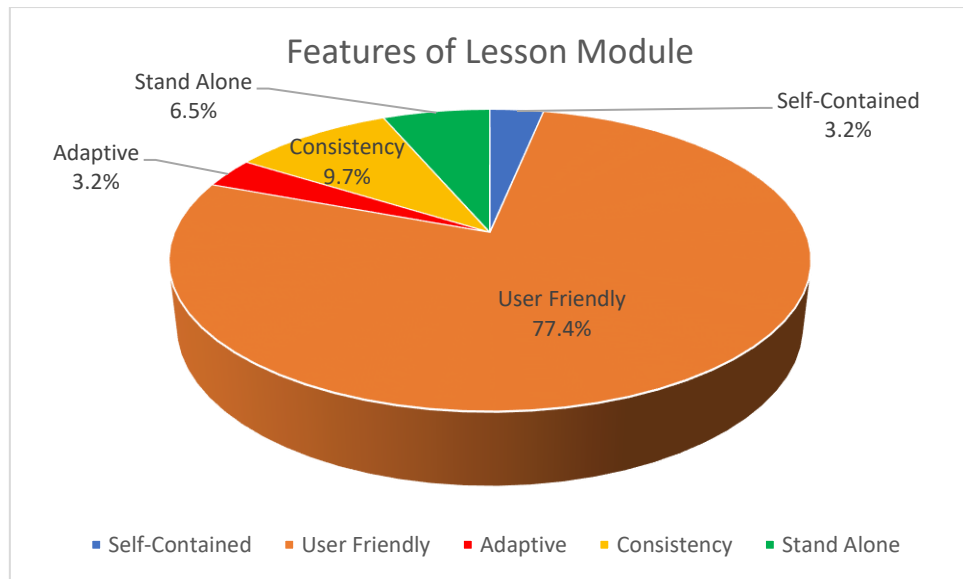
The evidence from the Pie Chart above shows that most of the respondents visits the historical sites for educational purposes annually. Then 29% of the respondent visits the historical sites for educational purposes semi-annually and 29% of them never visits to a historical site. There is only 9.7% of the respondent which visits the historical site monthly.





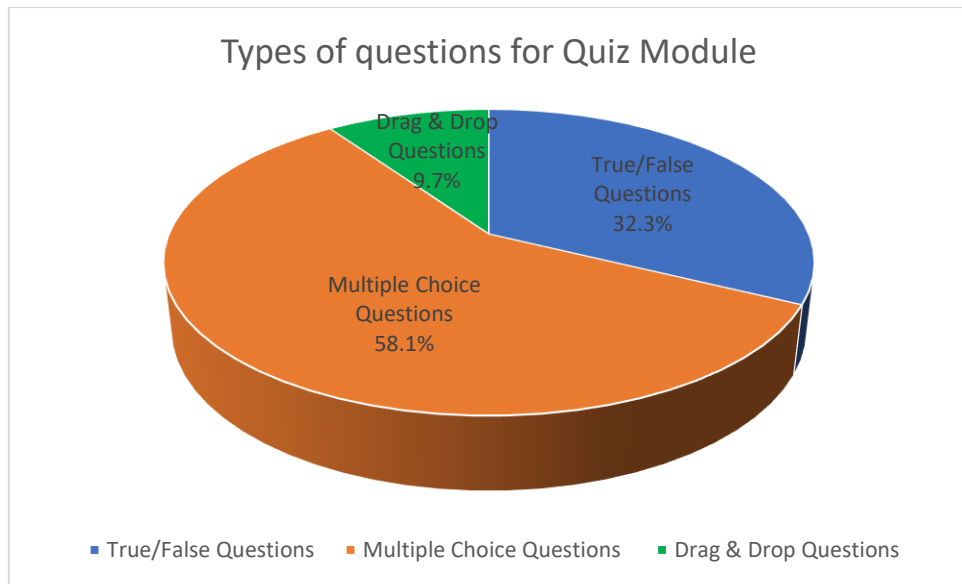
***Figure 2.17: Pie Chart for how respondent gather information***

From the Pie Chart above shows that most of the respondents which is 80.6% of them would use Online Research to gather information while visiting a historical site. There is only 6.5% of the respondent who chooses the Guided Tour method and the Printed Brochures method to gather information. Next, there is another 3.2% of the respondent who prefers Audio Guide and other information to gather the information.



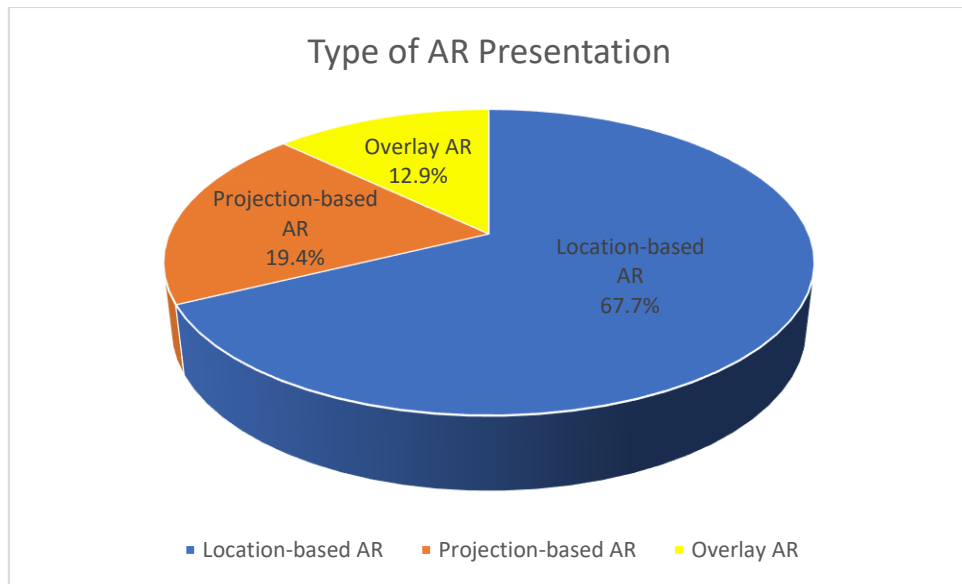
**Figure 2.18: Pie Chart for respondent's preferred feature of Lesson Module**

From the Pie Chart above shows that 77.4% of the respondent think that the Lesson Module should be mainly focus on the user-friendly feature. Next, there is only 9.7% of the respondent thinks that we should focus on the consistency of the Lesson Module, 6.5% of the respondent thinks that the stand alone feature of the Lesson Module should be focused on whereas there is 3.2% of the respondent think that we should focus on both self-contained feature and adaptive feature of the lesson module.



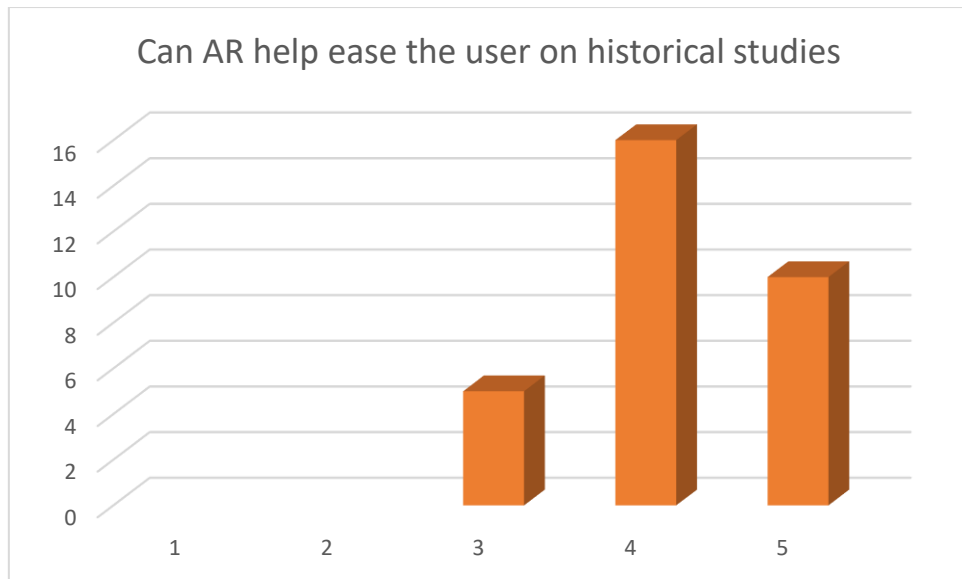
**Figure 2.19: Pie Chart for respondent's preferred type of questions for Quiz Module**

From the Pie Chart above shows that most of the respondent think that multiple choice questions would be suitable for the quiz module which is 58.1% of them. Next, there is 32.3% of the respondent choses true or false questions and 9.7% of the respondent choses drag and drag questions. There is no respondent that choses fill in the blank questions.



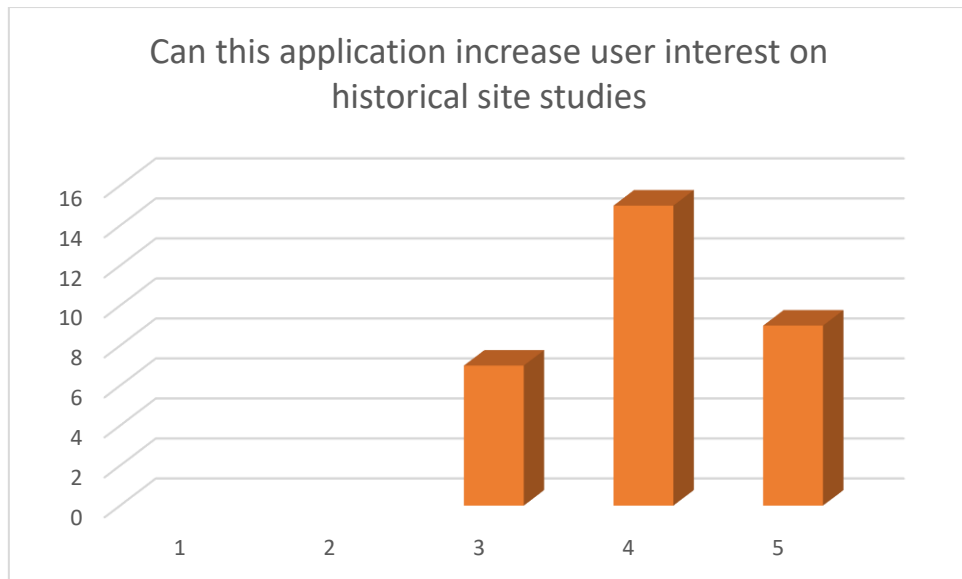
**Figure 2.20: Pie Chart for respondent's preferred type of AR Presentation**

From the Pie Chart above shows that 67.7% of the respondent that wish to see Location-based AR, 19.4% of the respondents wish to see Projection-based AR and 12.9% of the respondents wish to see Overlay AR. There is no respondent who wish to see the Contour-based AR.



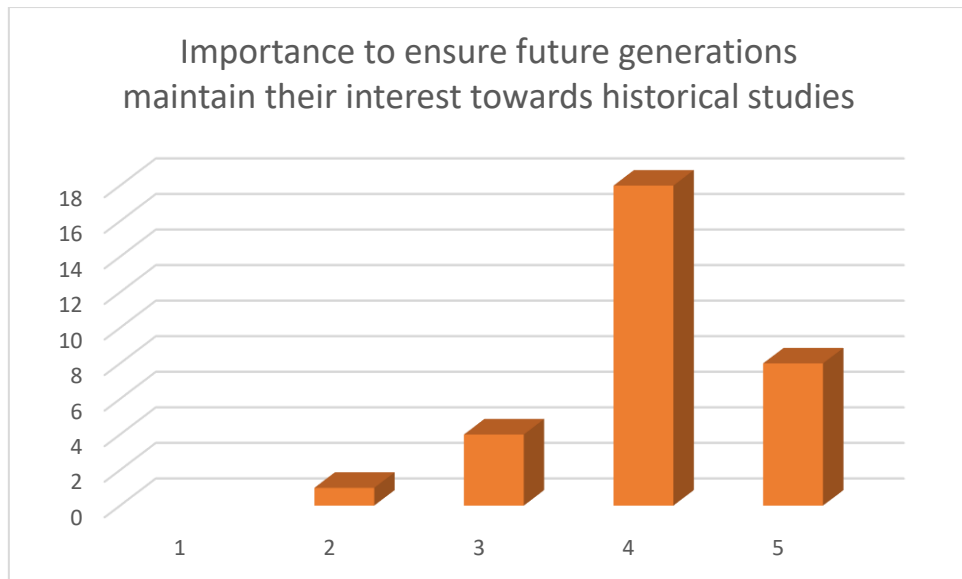
***Figure 2.21: Bar Chart for can AR help ease user on historical studies***

From the Bar Chart above shows that most of the respondent agree that AR can help ease to user on historical site studies which is 51.6% of them. Next, 32.3% of the respondent strongly agree that AR can help ease to user on historical site studies whereas 16.1% of them remain neutral.



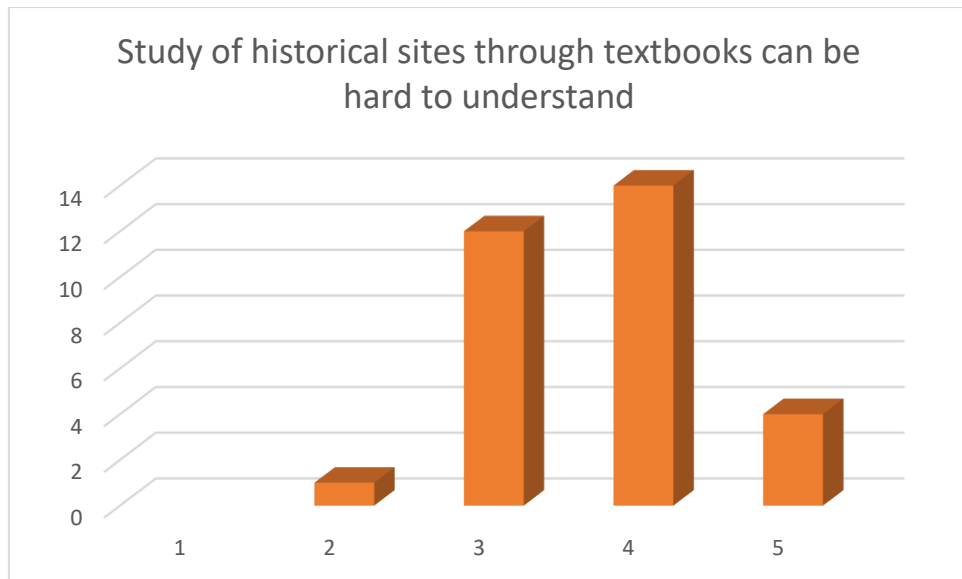
***Figure 2.22: Bar Chart for can this application increase user interest on historical site studies***

From the Bar Chart above shows that most of the respondent agree that this application increase the user's interest on historical site studies which is 48.4% of them whereas 29% of the respondent strongly agrees. Then, 22.6% of the respondent remain neutral towards this statement.



***Figure 2.23: Bar Chart for importance to ensure future generations maintain their interest towards historical studies***

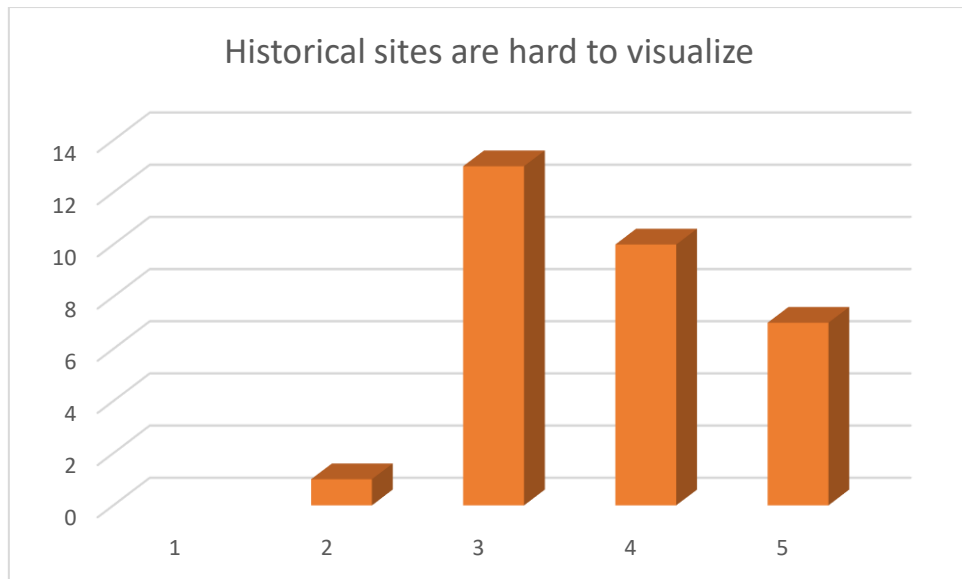
From the Bar Chart above shows that most of the respondent thinks that is important to ensure future generations maintain their interest towards historical sites studies which is 58.1% of them and 25.8% of them thinks that it is very important. 12.9% of the respondent remain neutral to this statement and 3.2% of them think that this statement is not so important.



***Figure 2.24: Bar Chart for study of historical sites through textbooks can be hard to understand***

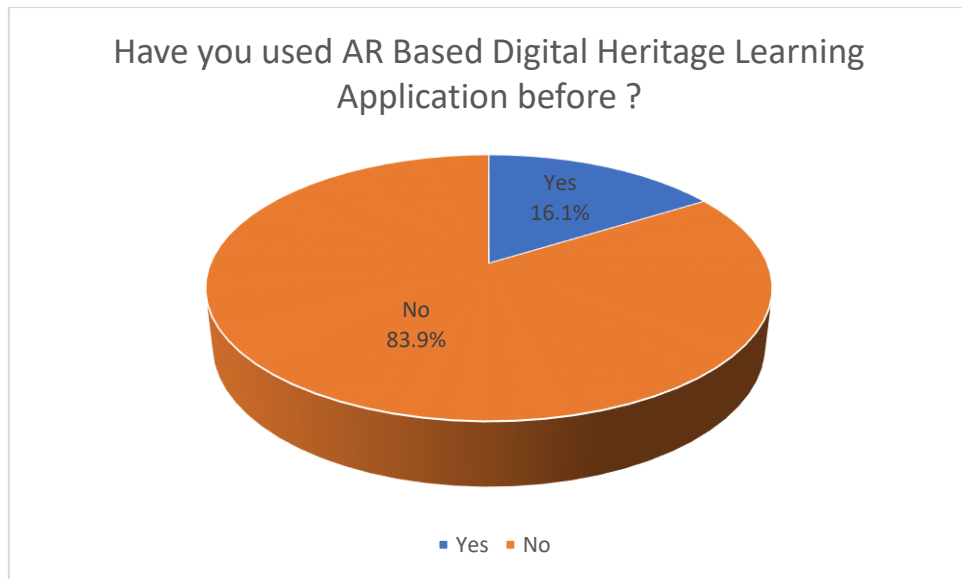
From the Bar Chart above shows that most of the respondent think that study of historical sites through textbooks can be hard to understand which is 45.2% of them and 12.9% of them thinks that it is very hard. 38.7% of the respondent remain neutral to this statement and 3.2% of them think that it is not so hard to study through textbook.





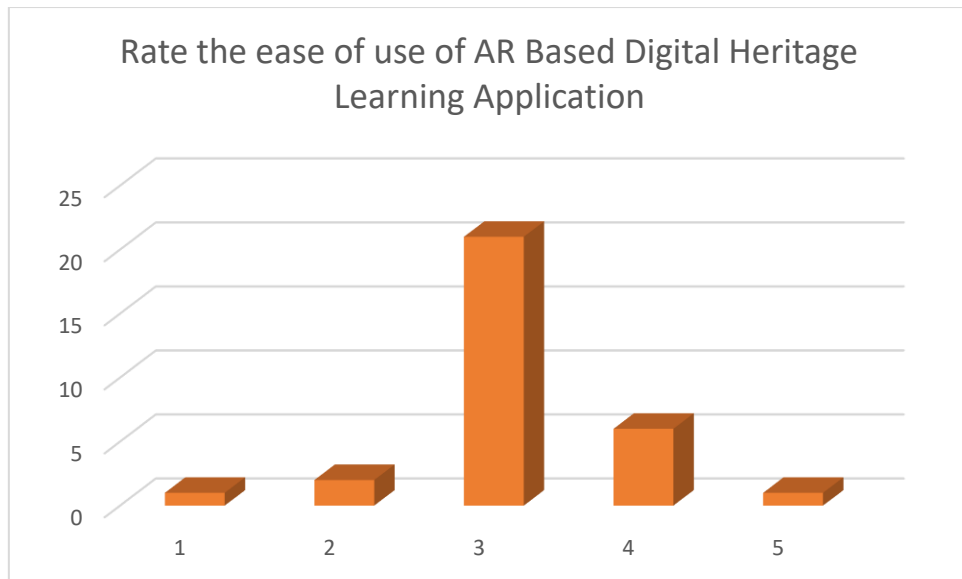
*Figure 2.25: Bar Chart for historical sites are hard to visualize*

The evidence of the Bar Chart above shows that most of the respondents which is 41.9% of them remain neutral about that the historical sites are hard to visualize by referring to the pictures provided in the textbook. 32.3% of the respondent think that it hard whereas 22.6% of the respondent think it is very hard. There is also 3.2% of the respondent think that is easy to visualize the historical sites by referring to the pictures provided in the textbook.



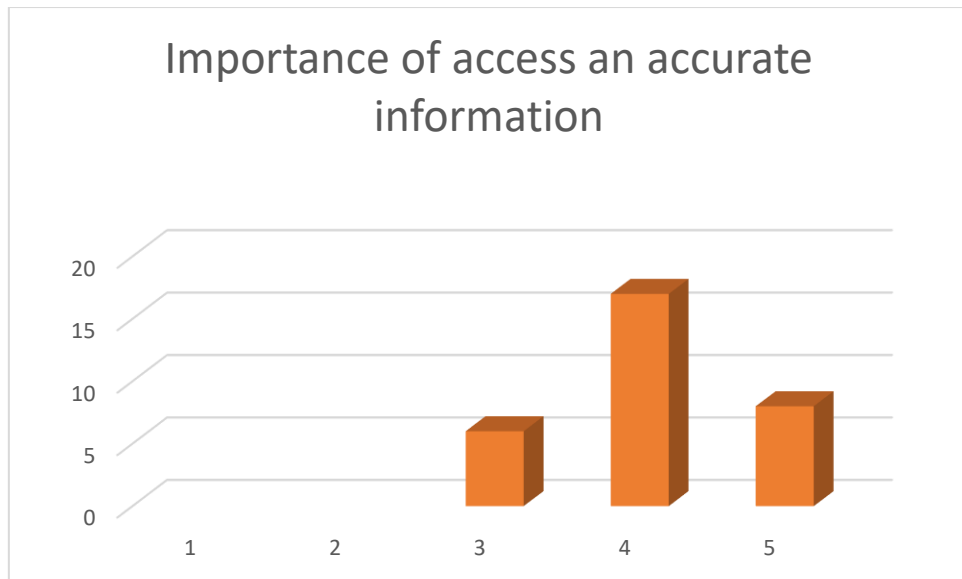
***Figure 2.26: Pie Chart for respondent that used AR Based Digital Heritage Learning Application before***

The Pie Chart above shows that there is 83.9% of the respondent never used any AR Based Digital Heritage Learning Application before. There is only 16.1% of the respondent that have experienced with AR Based Digital Heritage Learning Application.



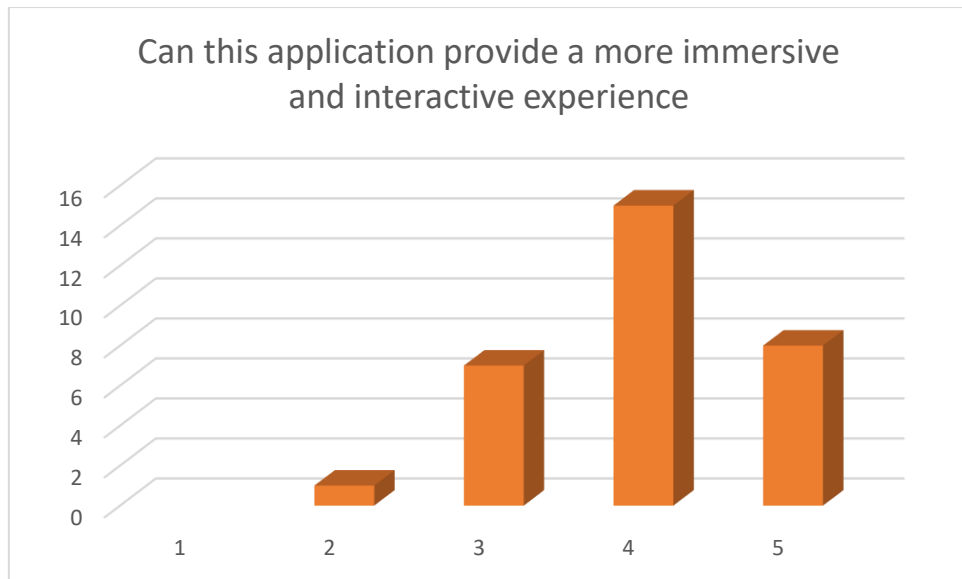
***Figure 2.27: Bar Chart for ease of use of AR Based Digital Heritage Learning Application***

The Bar Chart above shows that most of the respondents which is 67.7% of them remain neutral about the ease of use of the AR Based Digital Heritage Learning Application they used before. 19.4% of the respondent thinks that is easy to use the AR Based Digital Heritage Learning Application and 6.5% of them think it is hard to use the application. There is both 3.2% of the respondent who think that the AR Based Digital Heritage Learning Application they used is very easy and very hard.



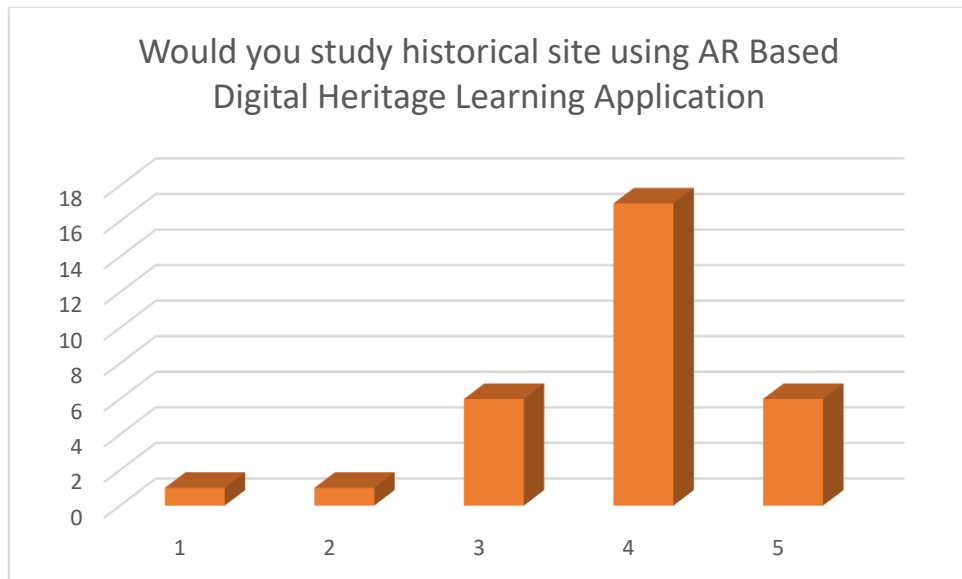
**Figure 2.28: Bar Chart for importance of access an accurate information**

The evidence from the Bar Chart above shows that 54.8% of the respondent think that is very important to have access to accurate information while visiting the historical sites whereas 25.8% of them think that is extremely important. 19.4% of the respondent remain neutral towards this statement.



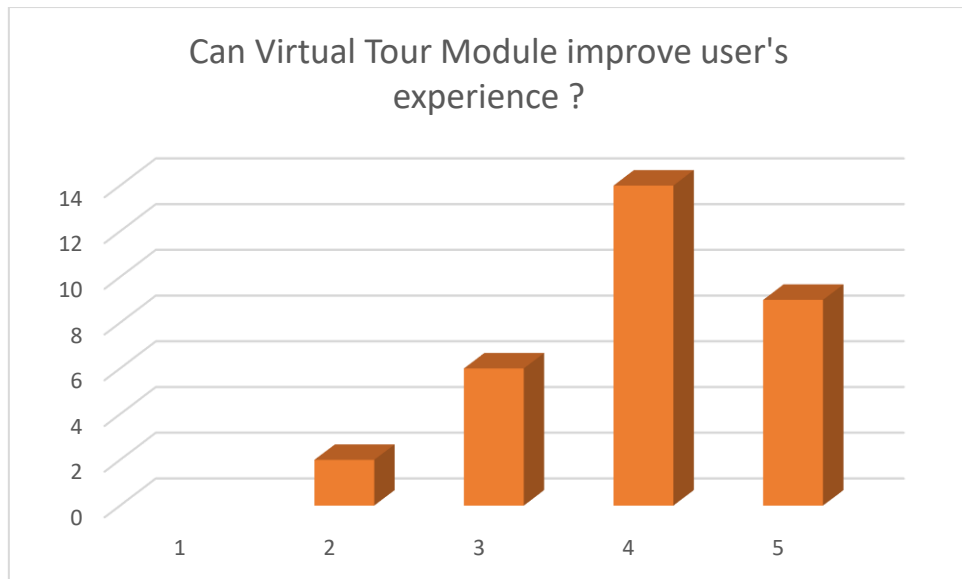
***Figure 2.29: Bar Chart for can the application provide a more immersive and interactive experience***

The Bar Chart above shows that most of the respondents which is 48.4% of them agree that AR Based Digital Heritage Learning Application can provide a more immersive and interactive experience compared to traditional methods of historical sites study and 25.8% of strongly agree. Next, there is 22.6% of the respondent remains neutral toward the statement and 3.2 % of the respondent disagree with the statement.



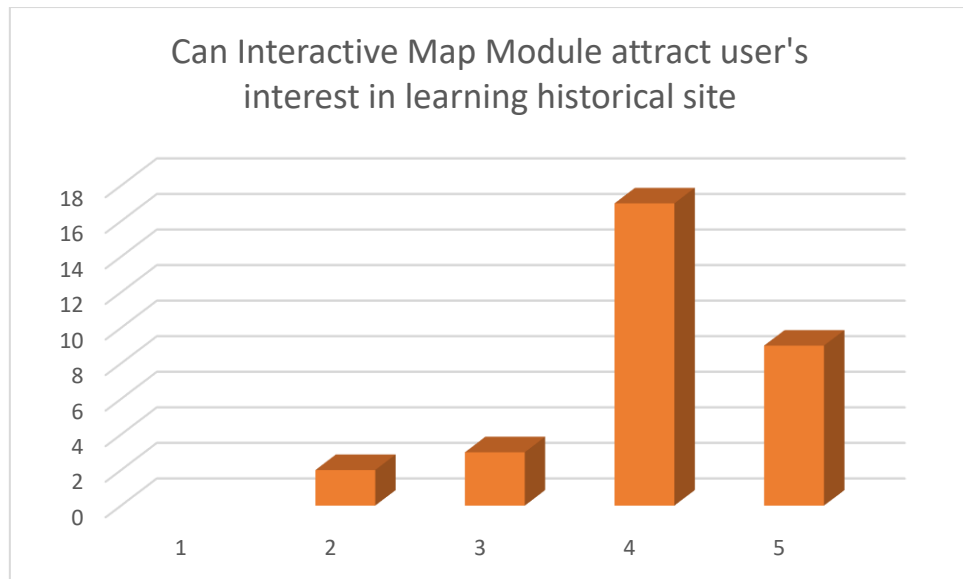
***Figure 2.30: Bar Chart for would respondent study historical site using AR Based Digital Heritage Learning Application***

The Bar Chart above shows that most of the respondent will most likely study the historical site using the AR Based Digital Heritage Learning Application. There is 19.4% of the respondent that are both very likely to use AR Based Digital Heritage Learning Application for historical studies and the respondent that remain neutral. Then, there is both 3.2% of the respondent thinks that they would be unlikely and very unlikely to use AR Based Digital Heritage Learning Application for historical studies.



*Figure 2.31: Bar Chart for can Virtual Tour Module improve user's experience*

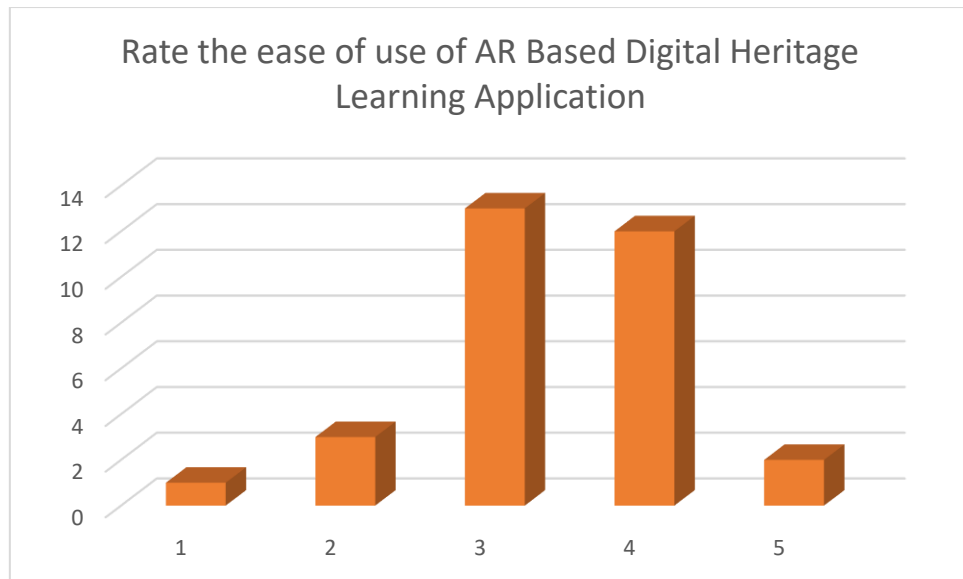
The evidence of the Bar Chart above shows that 45.2% of the respondent agrees that Virtual Tour Module can improve the user's experience for the AR Based Digital Heritage Learning Application and 29% of them strongly agrees. 19.4% of the respondent remain neutral toward this statement and 6.5% of them disagree with the statement.



**Figure 2.32: Bar Chart for can Interactive Map Module attract user's interest in learning historical site**

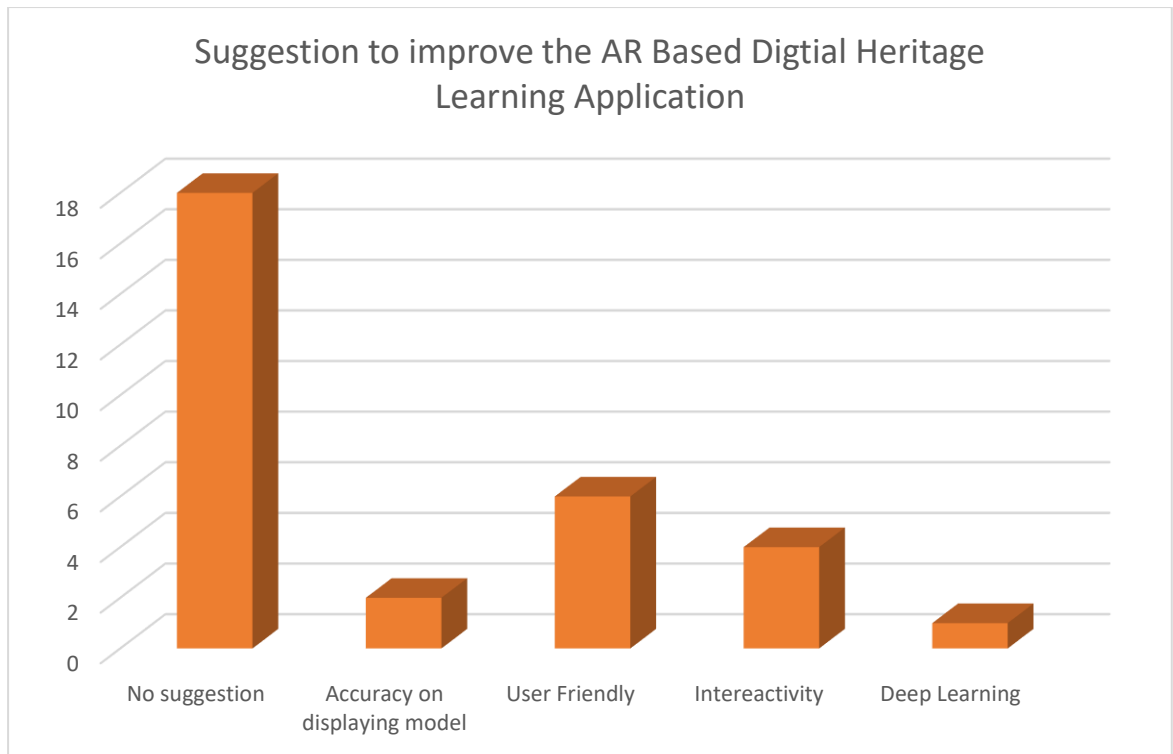
The Bar Chart above shows that there is 54.8% of the respondents agree that Interactive Map Module for AR Based Digital Heritage Learning Application could help attract the user's interest in learning historical site and 29% of them strongly agree. Then, there is 9.7% off the respondent remain neutral toward this statement and 6.5% of the disagree about the statement.





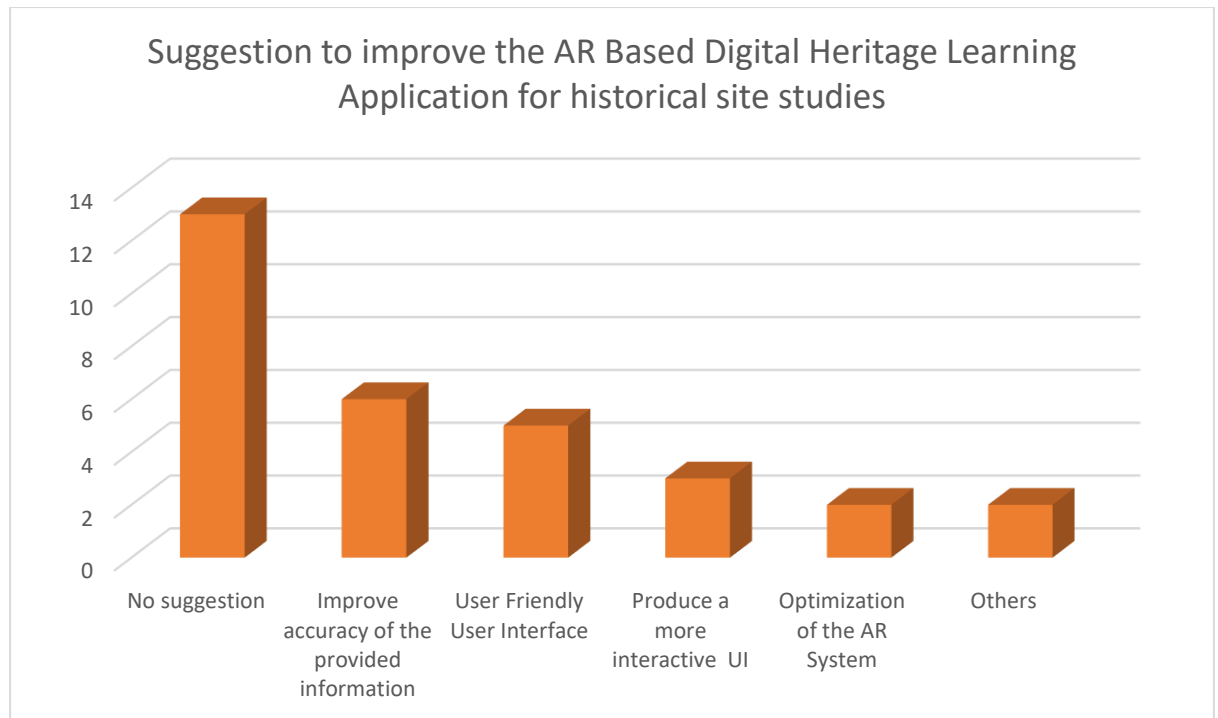
***Figure 2.33: Bar Chart for ease of use of AR Based Digital Heritage Learning Application***

The Bar Chart above shows most of the respondent which is 41.9% of them remain neutral about the AR Based Digital Heritage Learning Application that they have used before. 38.7% of the respondents think that is easy to use the AR Based Digital Heritage Learning Application they used before and 6.5% of them think it was very easy. Next, 9.7% of the respondent think it is hard to use the AR Based Digital Heritage Learning Application they used before and 3.2% of the respondent think it was very hard.



**Figure 2.34: Bar Chart for suggestion to improve AR Based Digital Heritage Learning Application**

The Bar Chart above shows that 41.9% of the respondents do not provide any suggestions for to improve the AR Based Digital Heritage Learning Application that they have used before. Next, there is 19.5% of the respondent think that the user friendliness of the application should be improved. Then, 12.9% of the respondent think that the interactivity of the application should be improved. 6.5% of the respondent think that the accuracy of the provided information need to be improved whereas the other 3.2% think that the application should be integrated with deep learning feature.



***Figure 2.35: Bar Chart for suggestion to improve AR Based Digital Heritage Learning Application for historical site studies***

The Bar Chart above shows that there is 41.9% of the respondent do not have any suggestion to improve the AR Based Digital Heritage Learning Application for historical site studies. Then, there is 19.3% of the respondents think that accuracy of the information provided by the application should be more accurate in bring out the respective information. Next, 16.1% if the respondents think that user friendliness of the application need to be improvised to provide user a better user experience. Then, 9.7% of the user think that the application needs to be produce with a more interactive user interface to attract more user to use the application. Lastly, there is 6.5% of the user which thinks that the AR system of the application should be optimized and another 6.5% of the respondent have other suggestions.

### 2.7.3 Discussion

From the survey we can see that this survey might only reflect the thoughts of those between age 18 – 27 years old. This might cause the survey to have limited scope as all our respondent are from the same age group. Moreover, most of the respondents rarely visits the historical sites for educational purpose. They would prefer to gather the required information by doing online research instead of visiting the historical sites themselves. Next, most of the respondents agree that AR Based Digital Heritage Learning Application can ease the user in studying historical site. They also agree that this application can increase user's interest towards historical sites studies. Then, most of the respondent think that it is very important to ensure that the future generations maintain their interest towards historical studies. They also think that historical sites can be hard to understand through textbooks.

However, from the survey we can see that most of the respondent is not familiar or do not have any experience with the AR Based Digital Heritage Learning Application as we can see most of them remain neutral when they were as to rate the ease of use of the AR Based Digital Heritage Learning Application they've used before. This is also due to that most of the respondent do not have any suggestions towards improvement for AR Based Digital Heritage Learning Application that they used before as they do not have any experience with the application. Most of the respondent agree that AR Based Digital Heritage Learning Application cab provide user a more immersive and interactive experience compared to the traditional methods of historical sites study and they would also likely use the AR Based Digital Heritage Learning Application for a historical sites study.

In a nutshell, this AR Based Digital Heritage Learning Application is built to raise the people's awareness towards AR and attract more people to study about the historical sites by providing another option of studying the historical site. This application aims to ensure that people maintain their interest toward the historical site studies.

## **Chapter 3 Methodology and System Design**

### **3.1 Overview**

In this Chapter the author is going to discuss about the system requirement for the project development. The software requirement and hardware requirement for this project are shown in the form of table. The author will also discuss about the methodology that he is going to use for this project which is the ADDIE model, and each phase of the ADDIE model will be discussed as in what the author is going to do in the respective phases of ADDIE model.

### **3.2 System Requirements**

#### **3.2.1 Software Requirements**

**Table 3.1: Table of Software Requirements**

<b>Multimedia Elements</b>		<b>Recommended Software</b>
Text		Microsoft Word, Window Notepad
Image / Graphic		Adobe Photoshop, Adobe Illustrator, CorelDRAW
Audio		Audacity, AudioDirector 365, AVS Audio Editor
Video		Filmora, Animaker, Coral VideoStudio
Animation	2D	OpenToonz, TupiTube, Syfig
	3D	Blender, Autodesk 3ds Max
Authoring Tools		Unity

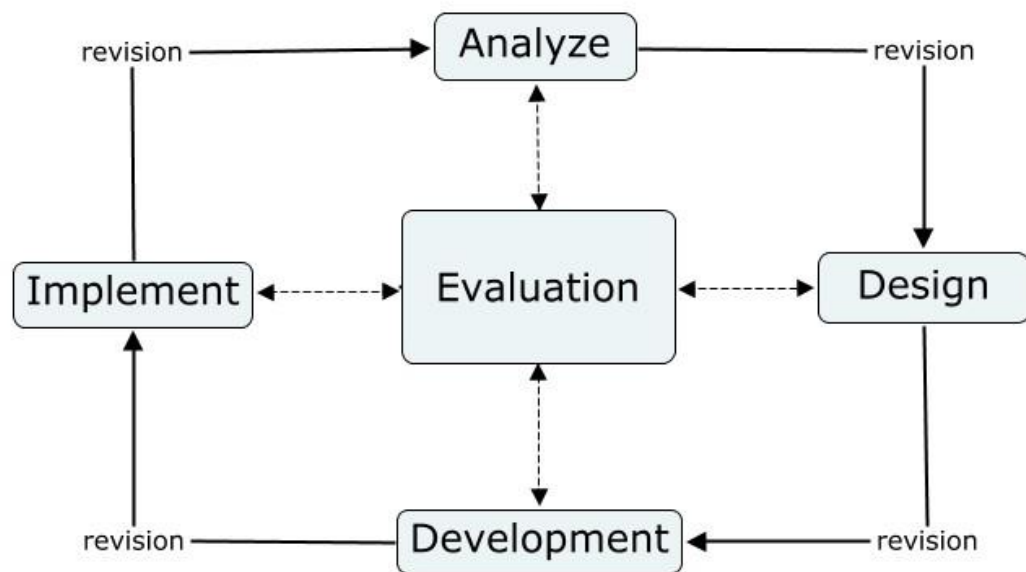
### 3.2.2 Hardware Requirements

**Table 3.2: Table of Hardware Requirements**

<b>Components</b>	<b>Minimum Requirement</b>	<b>Optimum Requirement</b>
Operating System	Window 10 (64bit)	Window 11 (64bit)
RAM Size	8GB RAM	16GB RAM
Processor	Intel Core i5-10300H	Intel Core i7-10870H
Free Disk Space	4GB	16GB
Graphic Card	NVIDIA GeForce GTX 1650Ti, 4GB GDDR6	NVIDIA GeForce RTX 3060, 6GB GDDR6

### 3.3 ADDIE Model

The AR based Digital Heritage Learning Application for Lenggong Valley using the Constructivism Approach project will apply the ADDIE Instructional Design (ID) method as the methodology. The ADDIE model is the generic process traditionally used by instructional designers and training developers [14]. This process helps the instructional designers and training developers to plan and create effective learning experiences [15]. ADDIE stands for Analyze, Design, Develop, Implement, and Evaluate. The sequence does not impose a strictly linear progression through the steps. Educators and instructional designers alike have used the ADDIE Instructional Design method as a framework in designing and developing educational and training programs for many years now. This is due to that educators, instructional designers and training developers find this approach very useful as it has stages that is being clearly defined and facilitate the implementation of effective training tools. The ADDIE Model has found wide acceptance and uses as an ID model [13].



*Figure 3.1: Phases of ADDIE Model [13]*

### 3.3.1 Analysis

The analysis phase undergoes a complete analysis of the instructional goal and objectives [13]. The instructional problem is also clarified in the analysis phase [14]. This phase ensures that the program matches the level of skill and intelligence that each participant shows. This ensures that their knowledge will not be duplicated so that they focus on the topics and lessons that the participant have yet to explore and study. In this phase, the instructor can distinguish between what the student already knows and what they should know after completing the course [13].

Activities:

In this phase, the proposal of the project is prepared. We need to define the problem statement, and project objectives and identify our target audience for this project. Next, we will do research on a similar existing system and a comparison of the strength and weaknesses of the existing system will also be done. Then, the similar existing reviewed system will also be compared with the proposed system. Furthermore, we will identify the required tools and technologies that are needed in the project.

### **3.3.2 Design**

The design phase determines all the goals, tools that are required to gauge performance, various tests, subject matter analysis, planning and resources [13]. This phase deals with learning objectives, content, subject matter analysis, exercise, lesson planning, assessment instruments used and media selection [14]. In the design phase, it is important to be specific and systematic to develop a logical and orderly approach [16]. This is because the approach is for the process of identification, development and evaluation of planned strategies that focus on the target attainment of the project's goals [13].

Activities:

In this phase, the architecture design, use case diagram, and diagram derivation will be planned to show how the system works.

### **3.3.3 Development**

The development phase starts with the production and testing of the methodology being used in the project [13]. The developers create and assemble the content assets from the data collected in the design phase [14]. The system analysts are responsible in collaborate and integrate different modes of technology whereas the system testers will work on the different procedures to identify errors and improvise the process [16]. The information collected from the previous two phases will be used to create a program that will relay what needs to be taught to the participant. The development phase is mainly about putting the planning and brainstorming from the previous two phases into action. Hence, these phases involve creating and testing of the learning outcomes [13].



## CHAPTER 3

Activities:

In this phase, coding will be done to develop the system. The 5 proposed modules of the system will also be developed during the development phase. The 3D model of Lenggong Valley will be designed in this phase. Then, the system will be tested to identify any possible errors and improve the outcomes.

### **3.3.4 Implementation**

The implementation phase refers to the continuous modification of the program to ensure maximum efficiency and that positive result are obtained [13]. This phase requires the transformation of the plan into action [16]. The IDs will strive to redesign, update, and edit the course curriculum, learning outcomes, method of delivery, and testing procedures to ensure that it can be delivered effectively [14]. The IDs and students work hand in hand to train on new tools so that the design can be evaluated continuously for further improvement. This phase provides much feedback from both IDs and participants, which allows them to be learned and addressed [13].

Activities:

In this phase, it will involve the physical implementation of the system according to the proposed modules. The produced system will undergo redesign, update, edit and testing procedures to ensure it can be delivered effectively. The produced system will be delivered to the target user to test and review. The feedback from the target user will be collected and analyzed.

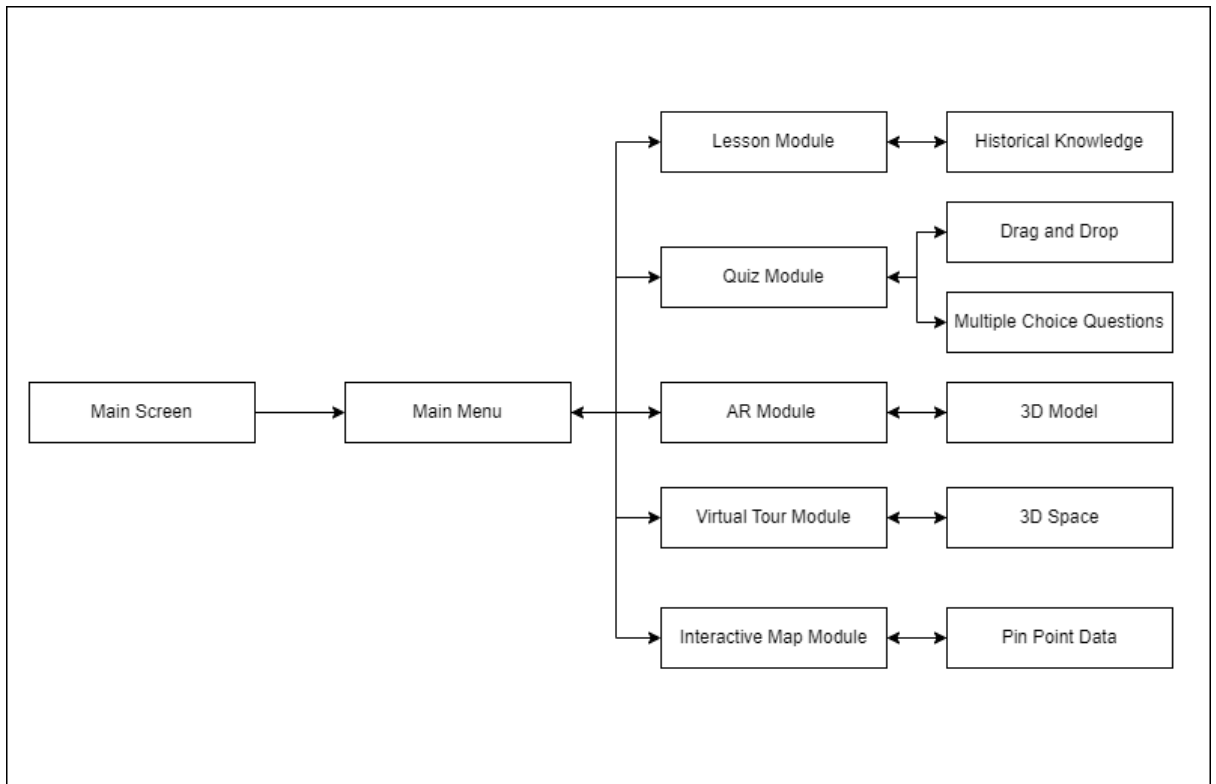
### **3.3.5 Evaluation**

The evaluation phase is the last stage of the ADDIE method. The Evaluation phase gathers important information to see if the project requires further improvising [15]. This is the stage where the project is subjected to final testing regarding what, how, why, and when of the things that were accomplished or not accomplished in the entire project [13]. This phase includes two parts which are Formative and Summative. Formative evaluation happens in each stage of the ADDIE process while the students and ID are conducting the study. Summative evaluation consists of tests designed for items and provides feedback from the user which happens at the end of the project [14]. The main purpose of the evaluation phase is to determine whether the goals have been met and to establish the requirement in moving forward to further the efficiency and success rate of the project [13].

#### Activities:

In this phase, the effectiveness of the project will be evaluated. The method to implement data collection and the system to analyze the feedback of the target user will be determined. The people who can receive the final output and also the person to prepare the report on the results of the evaluation will also be decided.

### 3.4 System Flow Diagram



*Figure 3.2: System Flow Diagram*

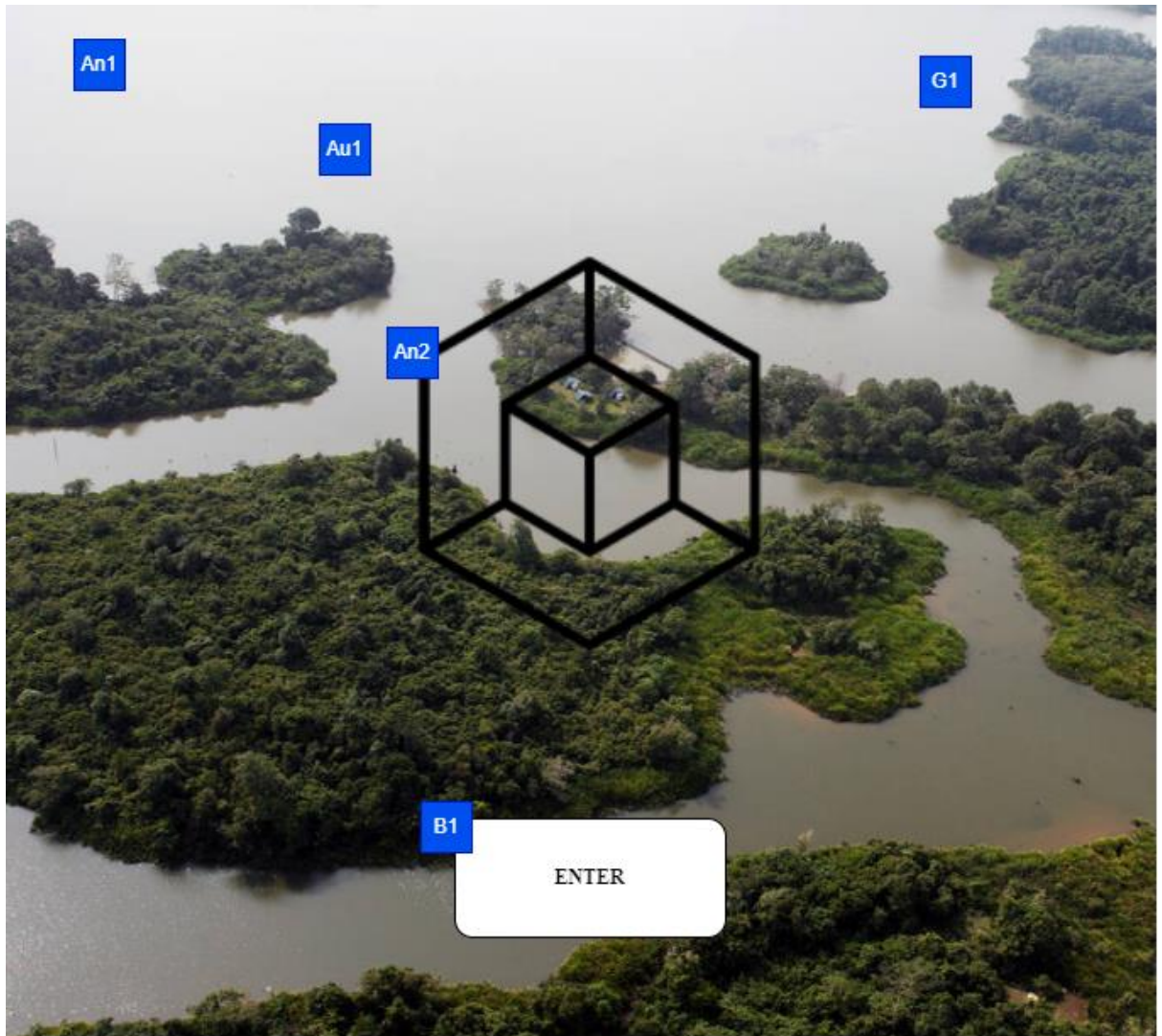
## CHAPTER 3

### 3.5 Storyboarding

#### Storyboard for Main Screen

#### Storyboard No: 1

Text(T), Graphics(G), Audio(Au), Animation(An), Button(B)



*Figure 3.3: Storyboard for Main Screen*

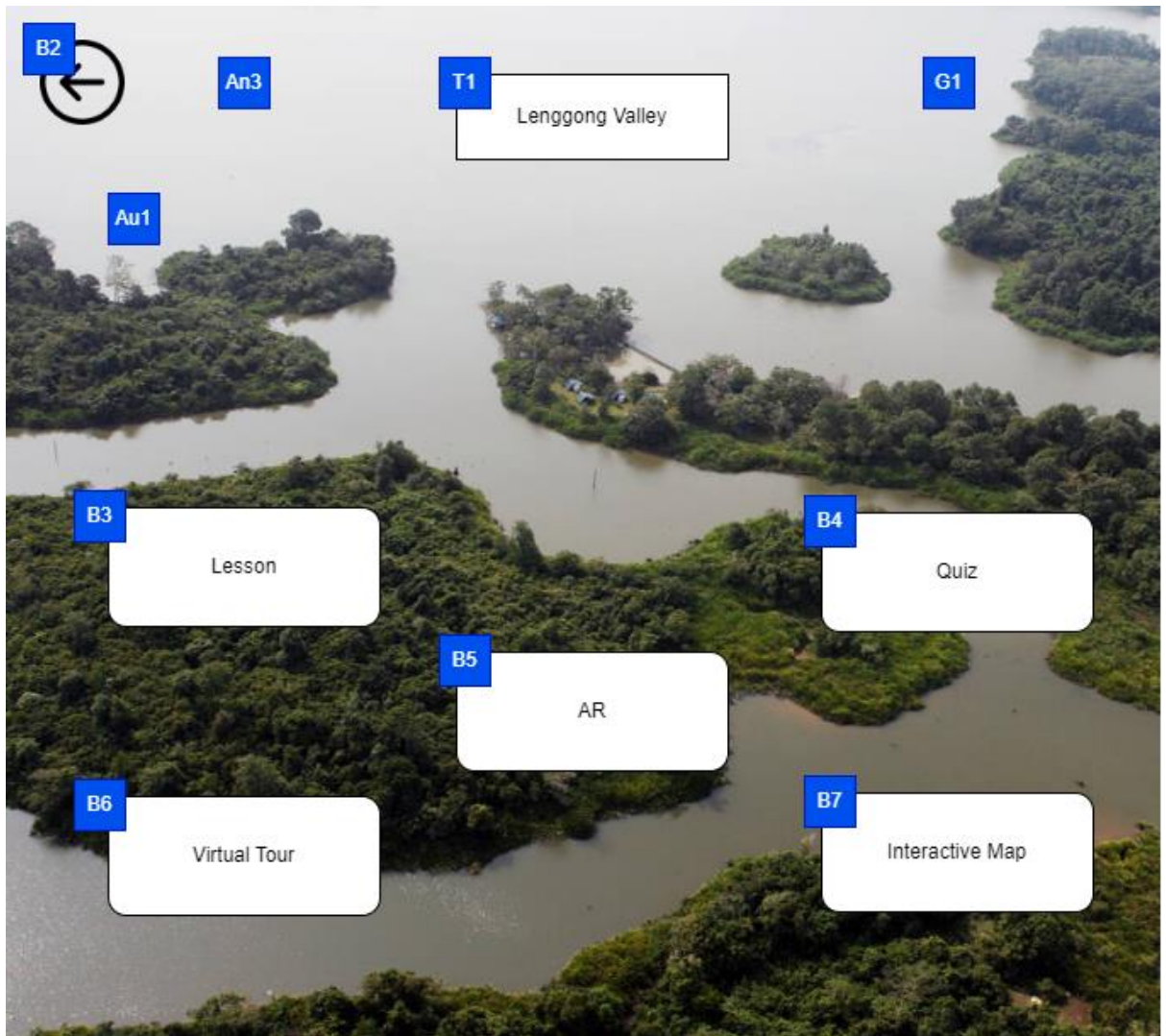
**Table 3.3: Storyboard Description for Main Screen**

Descriptions	Flow Diagram
<p><b>An1:</b> B1, G1, An2 will appear on the screen.</p> <p><b>An2:</b> A 3D Model animation appear on the screen.</p> <p><b>B1:</b> Graphic element serve as button, it can be clicked and proceed to the next frame.</p> <p><b>G1:</b> Background picture.</p> <p><b>Au1:</b> Background music of the software.</p>	<pre> graph TD     Start([Start]) --&gt; Display[Display, B1, G1, An1, An2, Au1]     Display --&gt; Click{Click On Button}     Click -- Yes --&gt; Show[Show the frame the user clicked]     Show --&gt; End([End])     Click -- No --&gt; Display     </pre>

**Storyboard for Main Menu**

**Storyboard No: 2**

**Text(T), Graphics(G), Audio(Au), Animation(An), Button(B)**



*Figure 3.4: Storyboard for Main Menu*

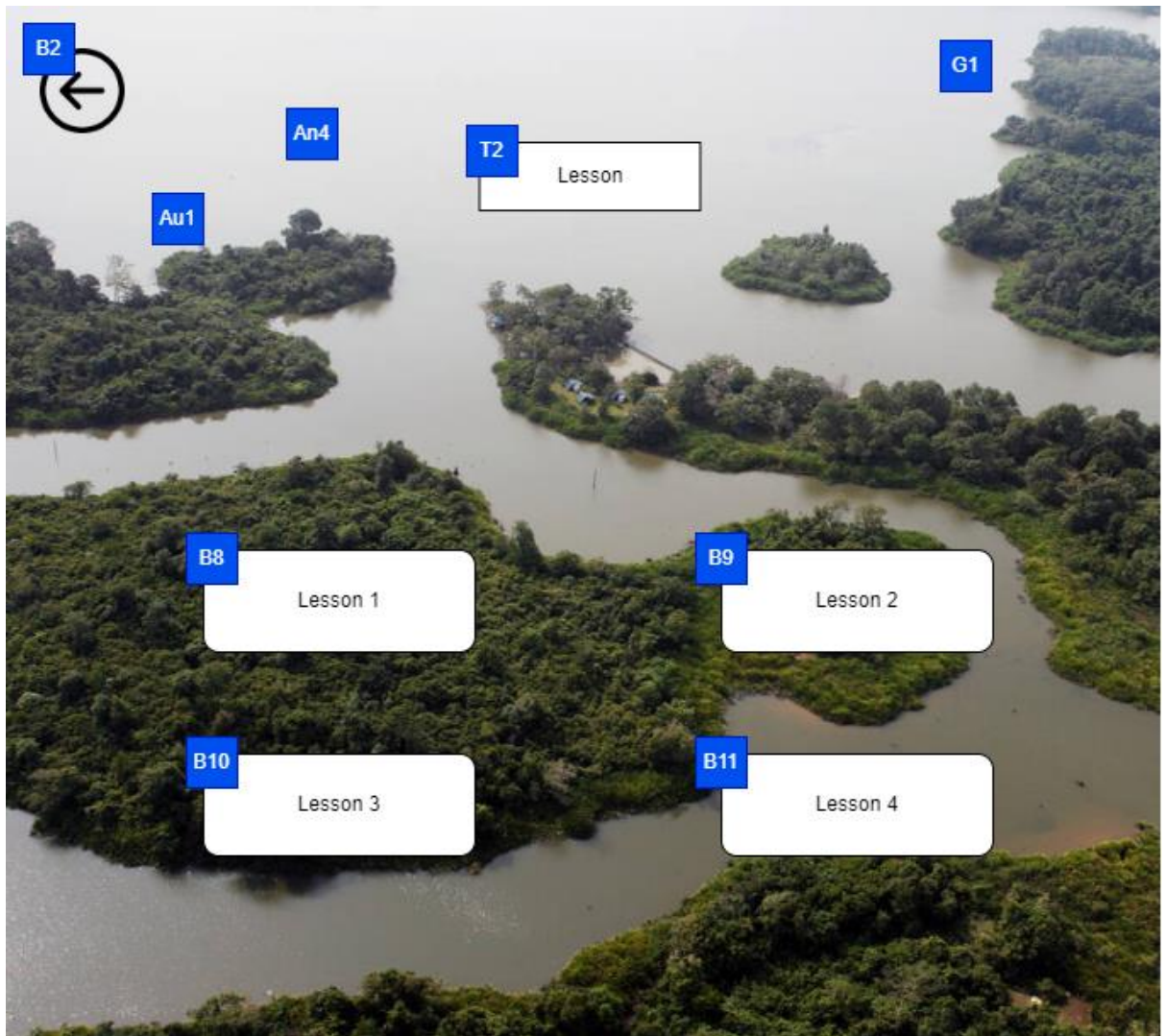
**Table 3.4: Storyboard Description for Main Menu**

Descriptions	Flow Diagram
<p><b>An3:</b> B2, B3 B4, B5, B6, B7, G1, Au1 will appear on the screen.</p> <p><b>T1:</b> Text element that serve the purpose to show the title.</p> <p><b>B2:</b> Graphic element serve as button, it can be clicked and proceed to the previous page. (Back)</p> <p><b>B3:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Lesson Module)</p> <p><b>B4:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Quiz Module)</p> <p><b>B5:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (AR Module)</p> <p><b>B6:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Virtual Tour Module)</p> <p><b>B7:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Interactive Map Module)</p> <p><b>G1:</b> Background picture.</p> <p><b>Au1:</b> Background music of the software.</p>	<pre> graph TD     Start([Start]) --&gt; Display[Display, An3, T1, B2, B3, B4, B5, B6, B7, G1, Au1]     Display --&gt; Click{Click On Button}     Click -- No --&gt; Display     Click -- Yes --&gt; Show[Show the frame the user clicked]     Show --&gt; End([End])     </pre>

**Storyboard for Lesson Module**

**Storyboard No: 3**

**Text(T), Graphics(G), Audio(Au), Animation(An), Button(B)**



*Figure 3.5: Storyboard for Lesson Module*



**Table 3.5: Storyboard Description for Lesson Module**

Descriptions	Flow Diagram
<p><b>An4:</b> B2, B8, B9, B10, T2, G1, Au1 will appear on the screen.</p> <p><b>T2:</b> Text element that serve the purpose to show the title.</p> <p><b>B2:</b> Graphic element serve as button, it can be clicked and proceed to the previous page. (Back)</p> <p><b>B8:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Lesson 1)</p> <p><b>B9:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Lesson 2)</p> <p><b>B10:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Lesson 3)</p> <p><b>B11:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Lesson 4)</p> <p><b>G1:</b> Background picture.</p> <p><b>Au1:</b> Background music of the software.</p>	<pre> graph TD     Start([Start]) --&gt; Display[Display, An4, T2, B1, B2, B3 B4, B5, B6, B7, B8, B9, B10, B11, G1, Au1]     Display --&gt; Click{Click On Button}     Click -- No --&gt; Display     Click -- Yes --&gt; Show[Show the frame the user clicked]     Show --&gt; End([End])     </pre>

CHAPTER 3

Storyboard for Quiz Module

Storyboard No: 4

Text(T), Graphics(G), Audio(Au), Animation(An), Button(B)

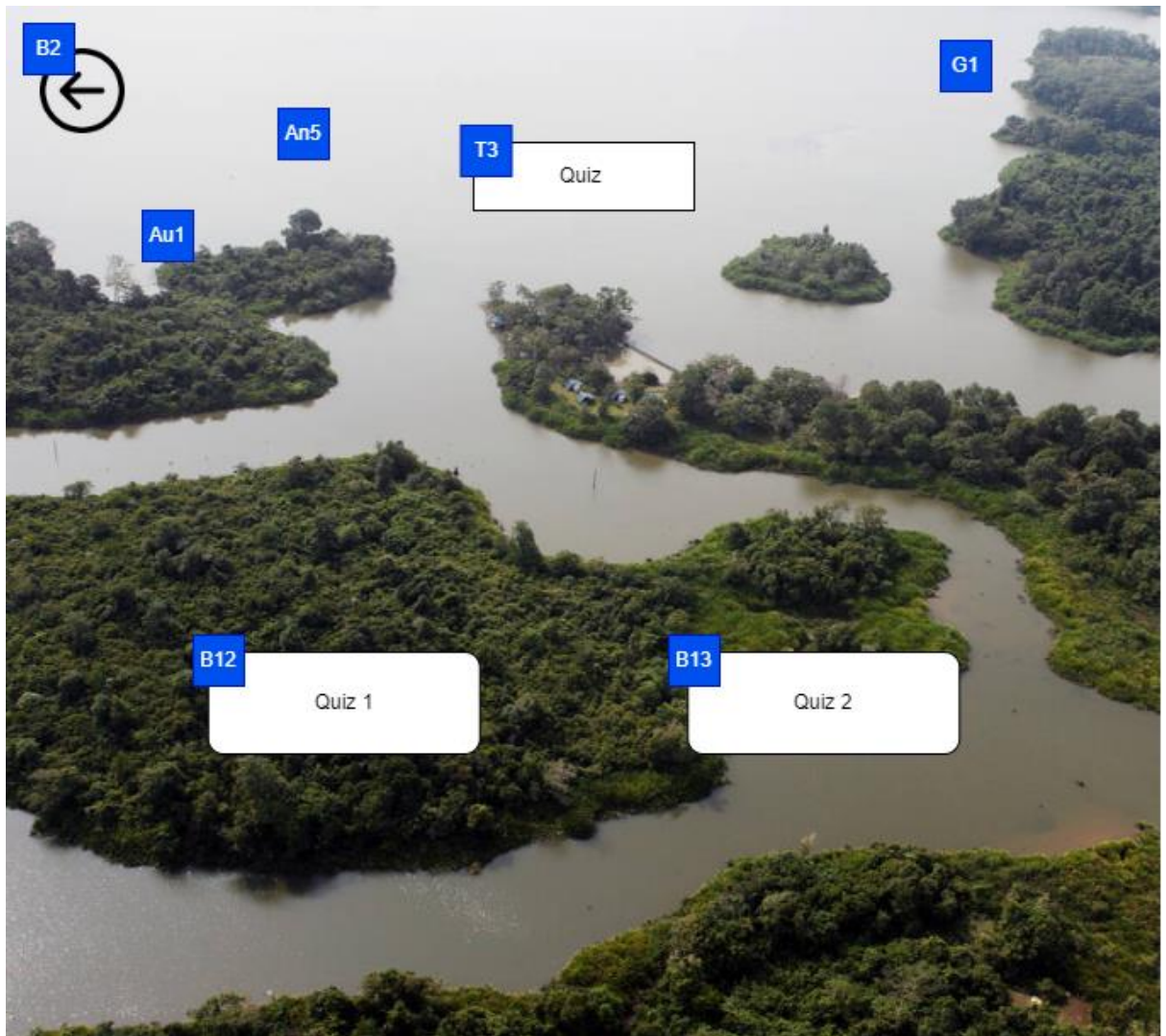


Figure 3.6: Storyboard for Quiz Module

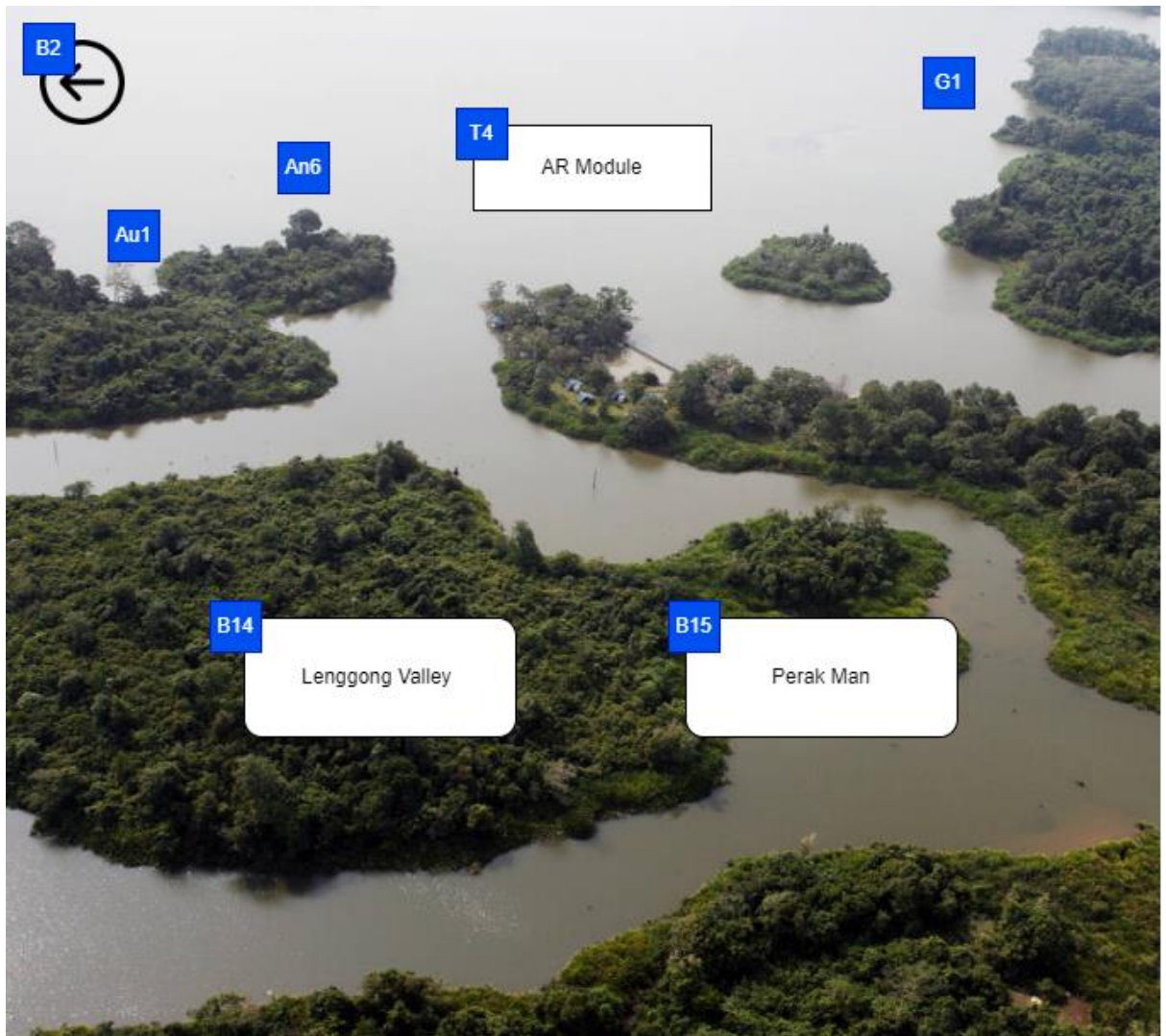
**Table 3.6: Storyboard Description for Quiz Module**

Descriptions	Flow Diagram
<p><b>An5:</b> B2, B12 B13, T3, G1, Au1 will appear on the screen.</p> <p><b>T3:</b> Text element that serve the purpose to show the title.</p> <p><b>B2:</b> Graphic element serve as button, it can be clicked and proceed to the previous page. (Back)</p> <p><b>B12:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Quiz 1)</p> <p><b>B13:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Quiz 2)</p> <p><b>G1:</b> Background picture.</p> <p><b>Au1:</b> Background music of the software.</p>	<pre> graph TD     Start([Start]) --&gt; Display[Display, An5, T3, B2, B12, B13, G1, Au1]     Display --&gt; Click{Click On Button}     Click -- No --&gt; Display     Click -- Yes --&gt; Show[Show the frame the user clicked]     Show --&gt; End([End])     </pre>

**Storyboard for AR Module**

**Storyboard No: 5**

**Text(T), Graphics(G), Audio(Au), Animation(An), Button(B)**



*Figure 3.7: Storyboard for AR Module*

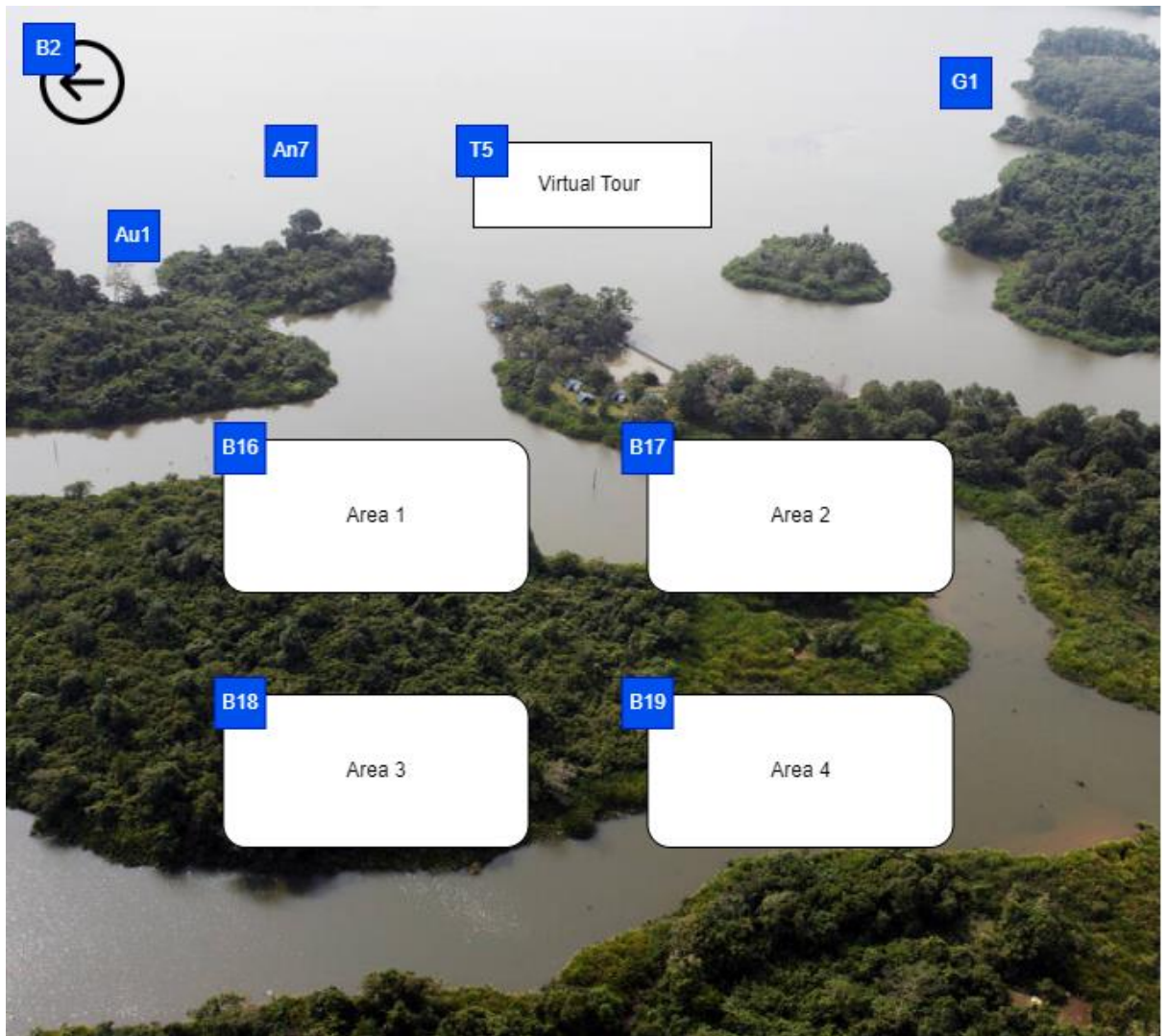
**Table 3.7: Storyboard Description for AR Module**

Descriptions	Flow Diagram
<p><b>An6:</b> B2, B14, B15, T4, G1, Au1 will appear on the screen.</p> <p><b>T4:</b> Text element that serve the purpose to show the title.</p> <p><b>B2:</b> Graphic element serve as button, it can be clicked and proceed to the previous page. (Back)</p> <p><b>B14:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Lenggong Valley)</p> <p><b>B15:</b> Graphic element serve as button, it can be clicked and proceed to the next frame. (Perak Man)</p> <p><b>G1:</b> Background picture.</p> <p><b>Au1:</b> Background music of the software.</p>	<pre> graph TD     Start([Start]) --&gt; Display[Display, An6, T4, B2, B14, B15, G1, Au1]     Display --&gt; Click{Click On Button}     Click -- No --&gt; Display     Click -- Yes --&gt; Show[Show the frame the user clicked]     Show --&gt; End([End])     </pre>

**Storyboard for Virtual Tour Module**

**Storyboard No: 6**

**Text(T), Graphics(G), Audio(Au), Animation(An), Button(B)**



*Figure 3.8: Storyboard for Virtual Tour Module*

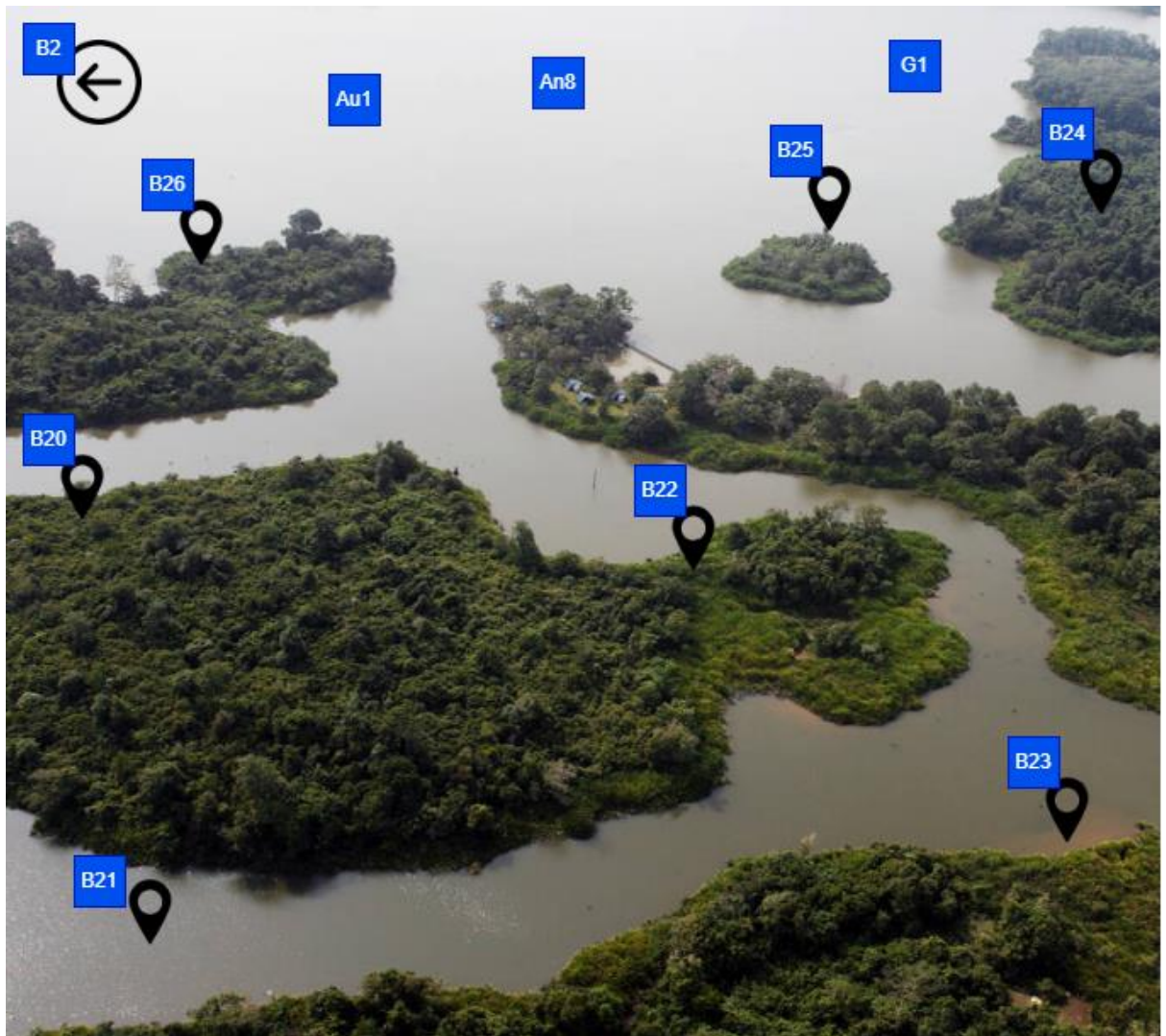
**Table 3.8: Storyboard Description for Virtual Tour Module**

Descriptions	Flow Diagram
<p><b>An7:</b> B2, B16, B17, B18, B19 T5, G1, Au1 will appear on the screen.</p> <p><b>T5:</b> Text element that serve the purpose to show the title.</p> <p><b>B2:</b> Graphic element serve as button, it can be clicked and proceed to the previous page. (Back)</p> <p><b>B16:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Area 1)</p> <p><b>B17:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Area 2)</p> <p><b>B18:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Area 3)</p> <p><b>B19:</b> Graphic element serve as button, it can be clicked and proceed to the next frame. (Area 4)</p> <p><b>G1:</b> Background picture.</p> <p><b>Au1:</b> Background music of the software.</p>	<pre> graph TD     Start([Start]) --&gt; Display[Display, An7, T5, B2, B16, B17, B18, B19, G1, Au1]     Display --&gt; Click{Click On Button}     Click -- No --&gt; Display     Click -- Yes --&gt; Show[Show the frame the user clicked]     Show --&gt; End([End])     </pre>

**Storyboard for Interactive Map Module**

**Storyboard No: 7**

**Text(T), Graphics(G), Audio(Au), Animation(An), Button(B)**



*Figure 3.9: Storyboard for Interactive Map Module*



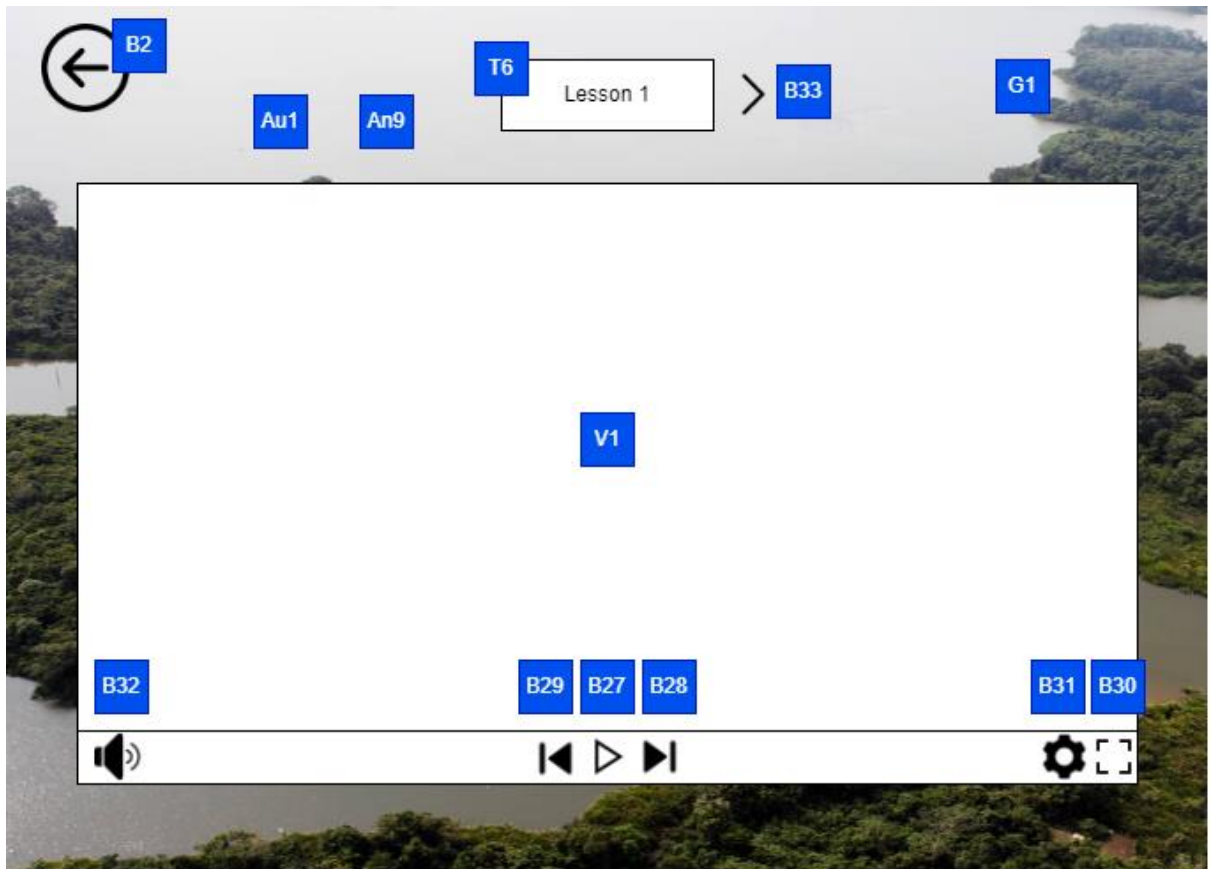
**Table 3.9: Storyboard Description for Interactive Map Module**

Descriptions	Flow Diagram
<p><b>An8:</b> B2, B20, B21, B22, B23, B24, B25, B26, G1, Au1 will appear on the screen.</p> <p><b>B2:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Back)</p> <p><b>B20:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Location 1)</p> <p><b>B21:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Location 2)</p> <p><b>B22:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Location 3)</p> <p><b>B23:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Location 4)</p> <p><b>B24:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Location 5)</p> <p><b>B25:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Location 6)</p> <p><b>B26:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Location 7)</p> <p><b>G1:</b> Background picture.</p> <p><b>Au1:</b> Background music of the software.</p>	<pre> graph TD     Start([Start]) --&gt; Display[Display, An8, B2, B20, B21, B22, B23, B24, B25, B26, G1, Au1]     Display --&gt; Click{Click On Button}     Click -- No --&gt; Display     Click -- Yes --&gt; Show[Show the frame the user clicked]     Show --&gt; End([End])     </pre>

**Storyboard for Lesson Module**

**Storyboard No: 8**

**Text(T), Graphics(G), Audio(Au), Video(V), Animation(An), Button(B)**



*Figure 3.10: Storyboard for Lesson Module*

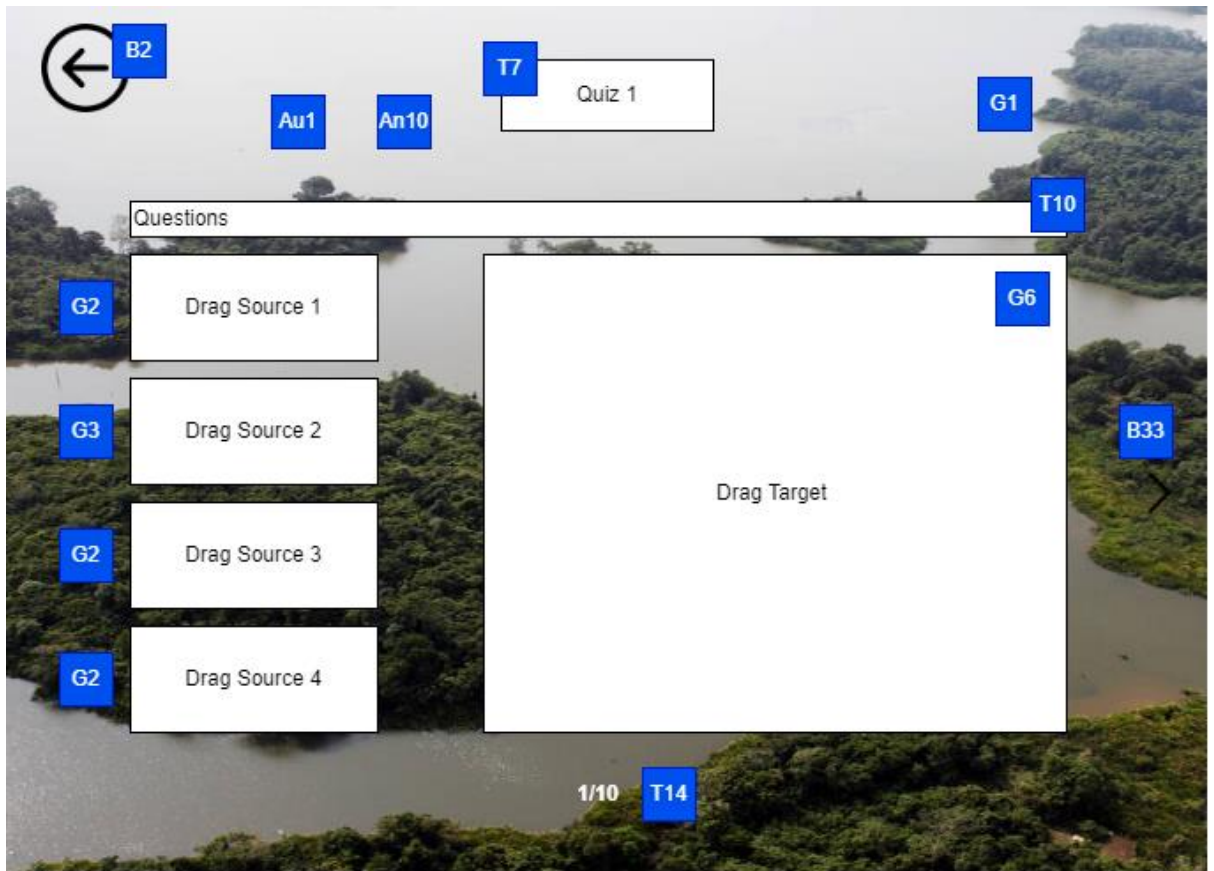
**Table 3.10: Storyboard Description for Lesson Module**

Descriptions	Flow Diagram
<p><b>An9:</b> B2, B27, B28, B29, B30, B31, B32, B33, G1, V1, Au1 will appear on the screen.</p> <p><b>B2:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Back)</p> <p><b>B33:</b> Graphic element serve as button, it can be clicked and play the video. (Play)</p> <p><b>B28:</b> Graphic element serve as button, it can be clicked and proceed to the next video. (Forward)</p> <p><b>B29:</b> Graphic element serve as button, it can be clicked and proceed to the previous video. (Previous)</p> <p><b>B30:</b> Graphic element serve as button, it can be clicked and make the video full screen. (Full Screen)</p> <p><b>B31:</b> Graphic element serve as button, it can be clicked and open the settings. (Settings)</p> <p><b>B32:</b> Graphic element serve as button, it can be clicked and open the volume bar (Volume)</p> <p><b>B33:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Next)</p> <p><b>G1:</b> Background picture.</p> <p><b>V1:</b> Video of the lesson.</p> <p><b>Au1:</b> Background music of the software.</p>	<pre> graph TD     Start([Start]) --&gt; Display[Display, An9, B2, B27, B28, B29, B30, B31, B32, B33, G1, V1, Au1]     Display --&gt; Click{Click On Button}     Click -- No --&gt; Display     Click -- Yes --&gt; Show[Show the frame the user clicked]     Show --&gt; End([End])     </pre>

### Storyboard for Quiz Module

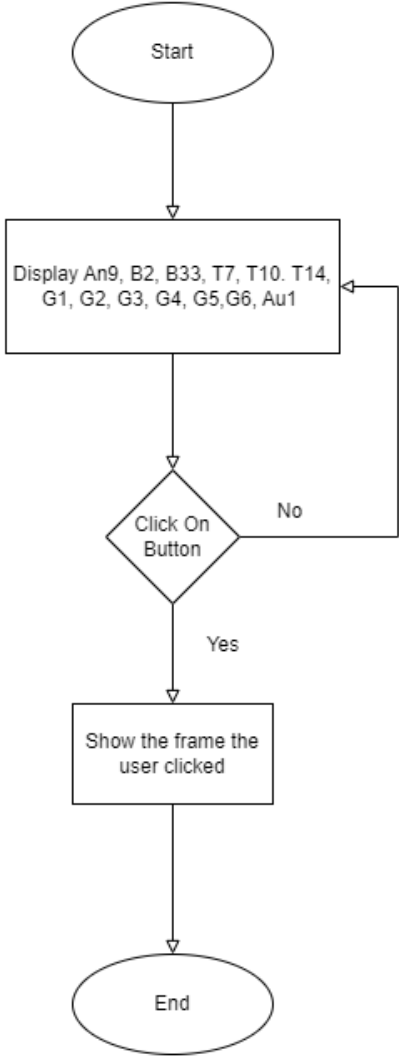
Storyboard No: 9

Text(T), Graphics(G), Audio(Au), Animation(An), Button(B)



*Figure 3.11: Storyboard for Quiz Module*

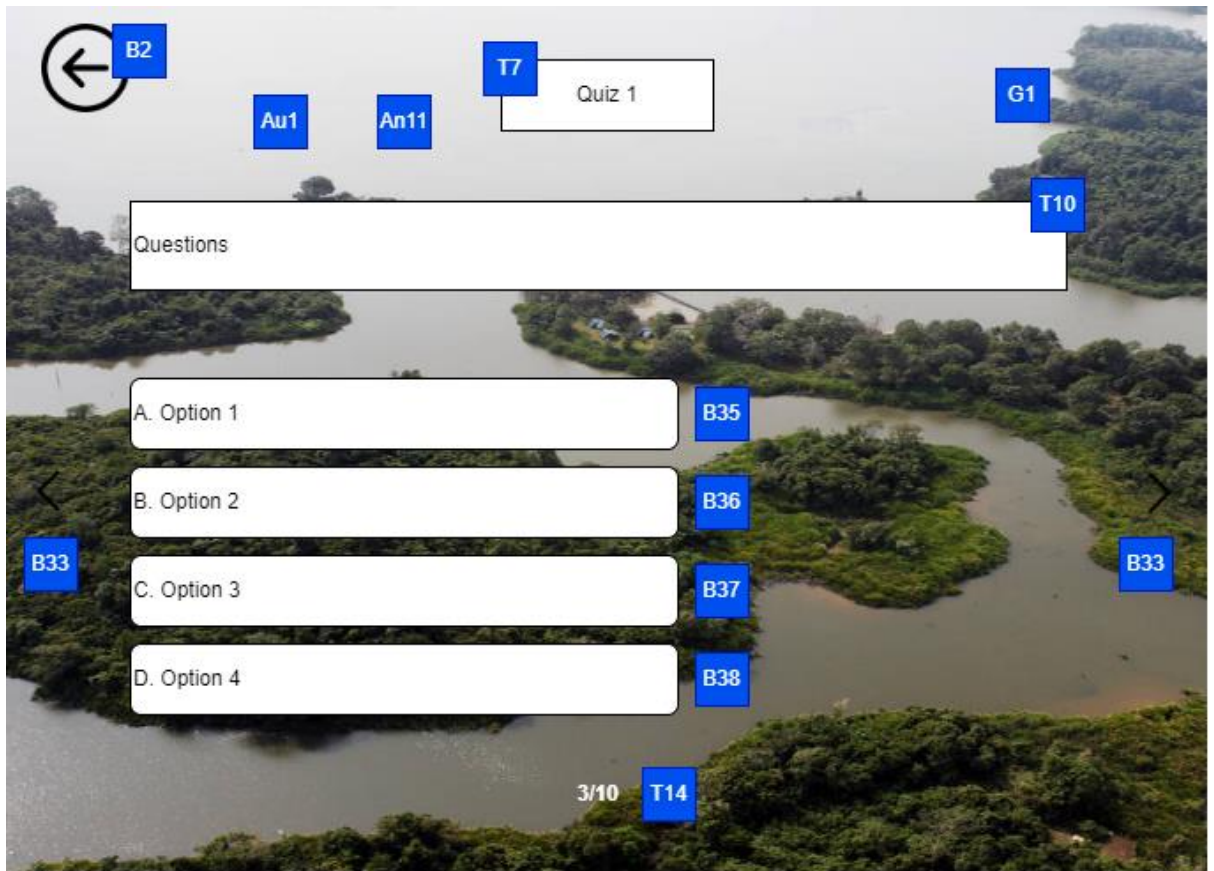
**Table 3.11: Storyboard Description for Quiz Module**

Descriptions	Flow Diagram
<p><b>An10:</b> B2, T7, T10, T14, G1, G2, G3, G4, G5, G6 Au1 will appear on the screen.</p> <p><b>B2:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Back)</p> <p><b>B33:</b> Graphic element serve as button, it can be clicked and proceed to the next or previous questions. (Next/Previous)</p> <p><b>T7:</b> Text element that serve the purpose to show the title.</p> <p><b>T10:</b> Text element that serve the purpose to show the questions.</p> <p><b>T14:</b> Text element that serve the purpose to show the question number.</p> <p><b>G1:</b> Background picture.</p> <p><b>G2:</b> Drag source 1.</p> <p><b>G3:</b> Drag source 2.</p> <p><b>G4:</b> Drag source 3.</p> <p><b>G5:</b> Drag source 4.</p> <p><b>G6:</b> Drag Target.</p> <p><b>Au1:</b> Background music of the software.</p>	 <pre> graph TD     Start([Start]) --&gt; Display[Display An9, B2, B33, T7, T10, T14, G1, G2, G3, G4, G5, G6, Au1]     Display --&gt; Click{Click On Button}     Click -- No --&gt; Display     Click -- Yes --&gt; Show[Show the frame the user clicked]     Show --&gt; End([End])     </pre> <p>The flow diagram illustrates the process flow for the quiz module. It begins with a 'Start' terminal, leading to a process box 'Display An9, B2, B33, T7, T10, T14, G1, G2, G3, G4, G5, G6, Au1'. This leads to a decision diamond 'Click On Button'. If the user clicks 'No', the flow loops back to the 'Display' process. If the user clicks 'Yes', the flow proceeds to a process box 'Show the frame the user clicked', which then leads to an 'End' terminal.</p>

**Storyboard for Quiz Module**

**Storyboard No: 10**

**Text(T), Graphics(G), Audio(Au), Animation(An), Button(B)**



*Figure 3.12: Storyboard for Quiz Module*

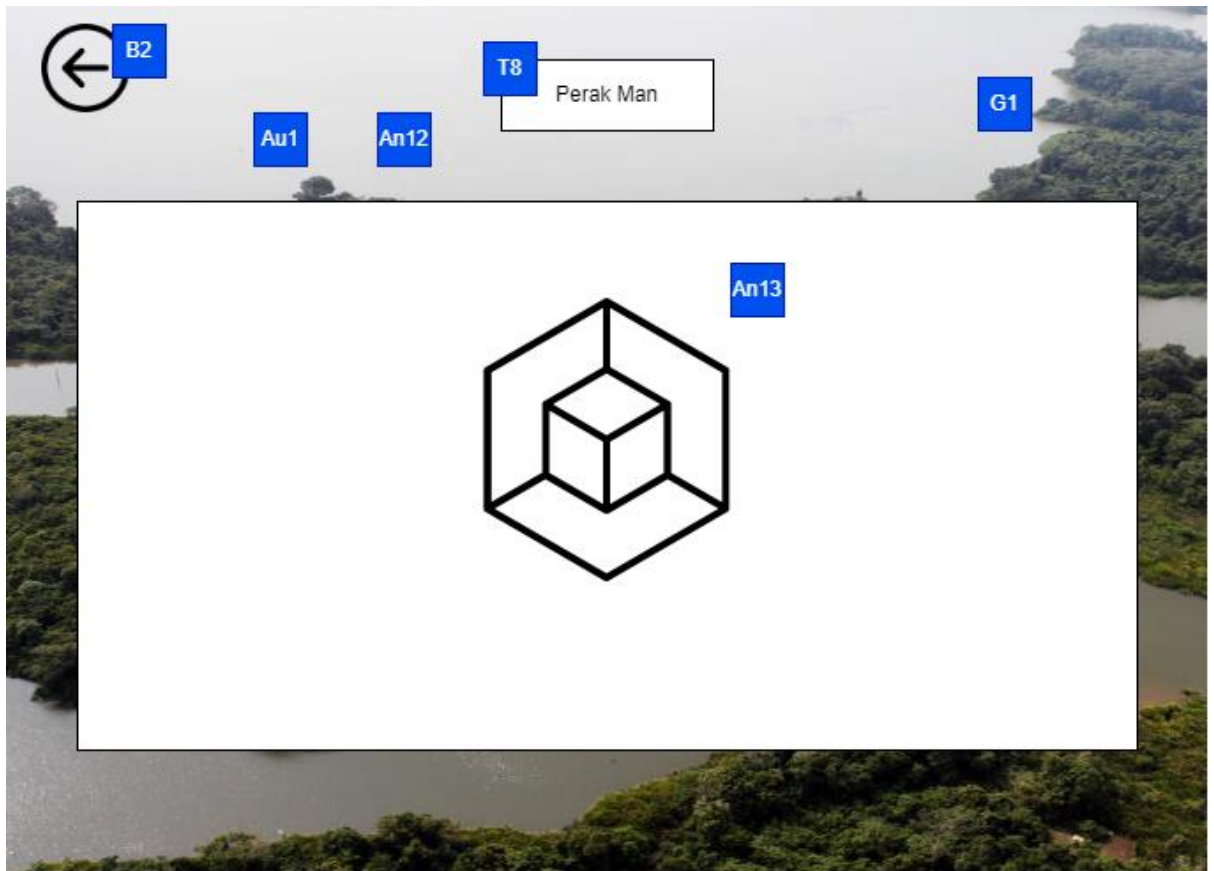
**Table 3.12: Storyboard Description for Quiz Module**

Descriptions	Flow Diagram
<p><b>An11:</b> B2, B33, B35, B36, B37, B38, T7, T10, T14, G1, Au1 will appear on the screen.</p> <p><b>B2:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Back)</p> <p><b>B33:</b> Graphic element serve as button, it can be clicked and proceed to the next or previous questions. (Next/Previous)</p> <p><b>B35:</b> Graphic element serve as button, it can be clicked to select the particular option (Option 1)</p> <p><b>B36:</b> Graphic element serve as button, it can be clicked to select the particular option (Option 2)</p> <p><b>B37:</b> Graphic element serve as button, it can be clicked to select the particular option (Option 3)</p> <p><b>B38:</b> Graphic element serve as button, it can be clicked to select the particular option (Option 4)</p> <p><b>T7:</b> Text element that serve the purpose to show the title.</p> <p><b>T10:</b> Text element that serve the purpose to show the questions.</p> <p><b>T14:</b> Text element that serve the purpose to show the question number.</p> <p><b>G1:</b> Background picture.</p> <p><b>Au1:</b> Background music of the software.</p>	<pre> graph TD     Start([Start]) --&gt; Display[Display An11, B2, B33, B35, B36, B37, B38, T7, T10, T14, G1, Au1]     Display --&gt; Click{Click On Button}     Click -- Yes --&gt; Show[Show the frame the user clicked]     Show --&gt; End([End])     Click -- No --&gt; Display     </pre>

**Storyboard for AR Module**

**Storyboard No: 11**

**Text(T), Graphics(G), Audio(Au), Animation(An), Button(B)**



*Figure 3.13: Storyboard for AR Module*



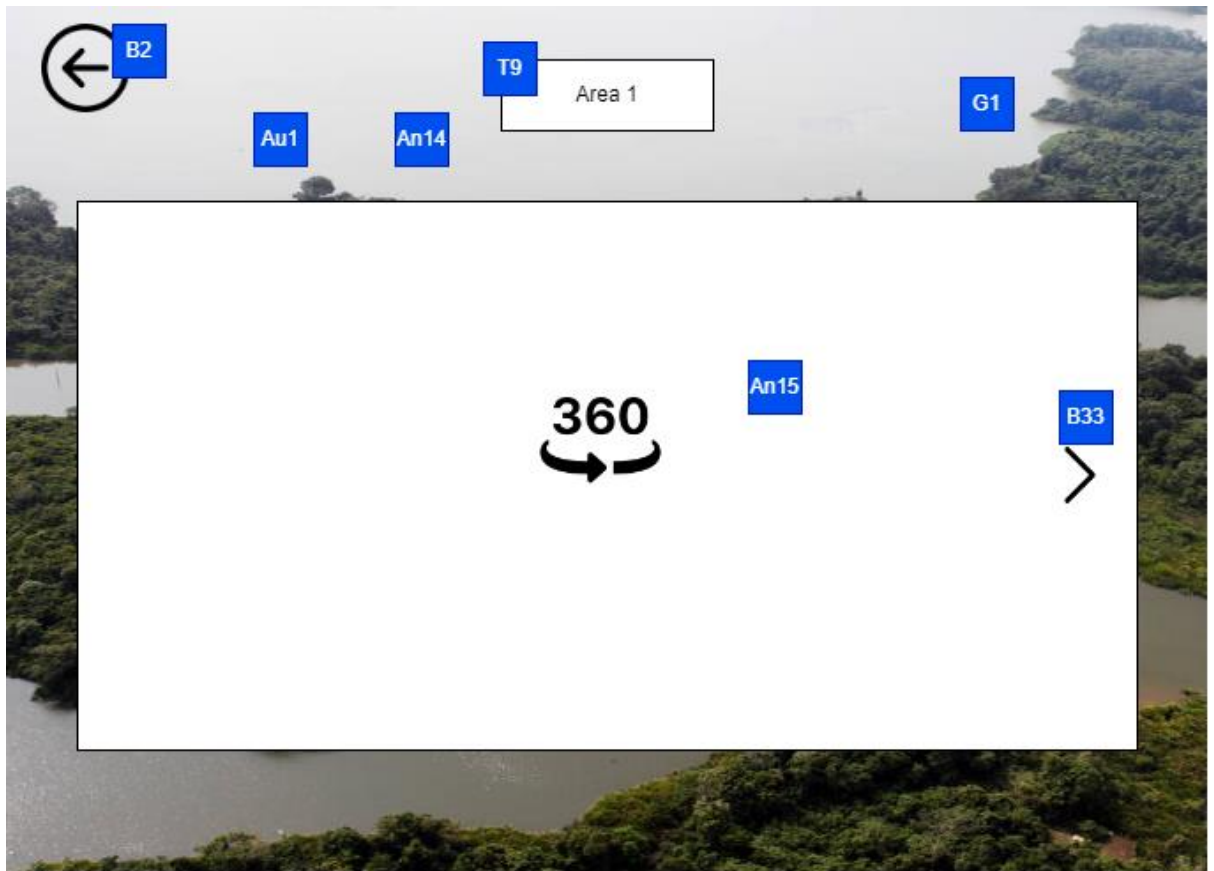
**Table 3.13: Storyboard Description for AR Module**

Descriptions	Flow Diagram
<p><b>An12:</b> B2, T8, G1, An13, Au1 will appear on the screen.</p> <p><b>An13:</b> A 3D Model animation appear on the screen.</p> <p><b>B2:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Back)</p> <p><b>G1:</b> Background picture.</p> <p><b>Au1:</b> Background music of the software.</p>	<pre> graph TD     Start([Start]) --&gt; Display[Display B2, T8, G1, An12, An13, Au1]     Display --&gt; Click{Click On Button}     Click -- No --&gt; Display     Click -- Yes --&gt; Show[Show the frame the user clicked]     Show --&gt; End([End])     </pre>

**Storyboard for Virtual Tour Module**

**Storyboard No: 12**

**Text(T), Graphics(G), Audio(Au), Animation(An), Button(B)**



*Figure 3.14: Storyboard for Virtual Tour Module*

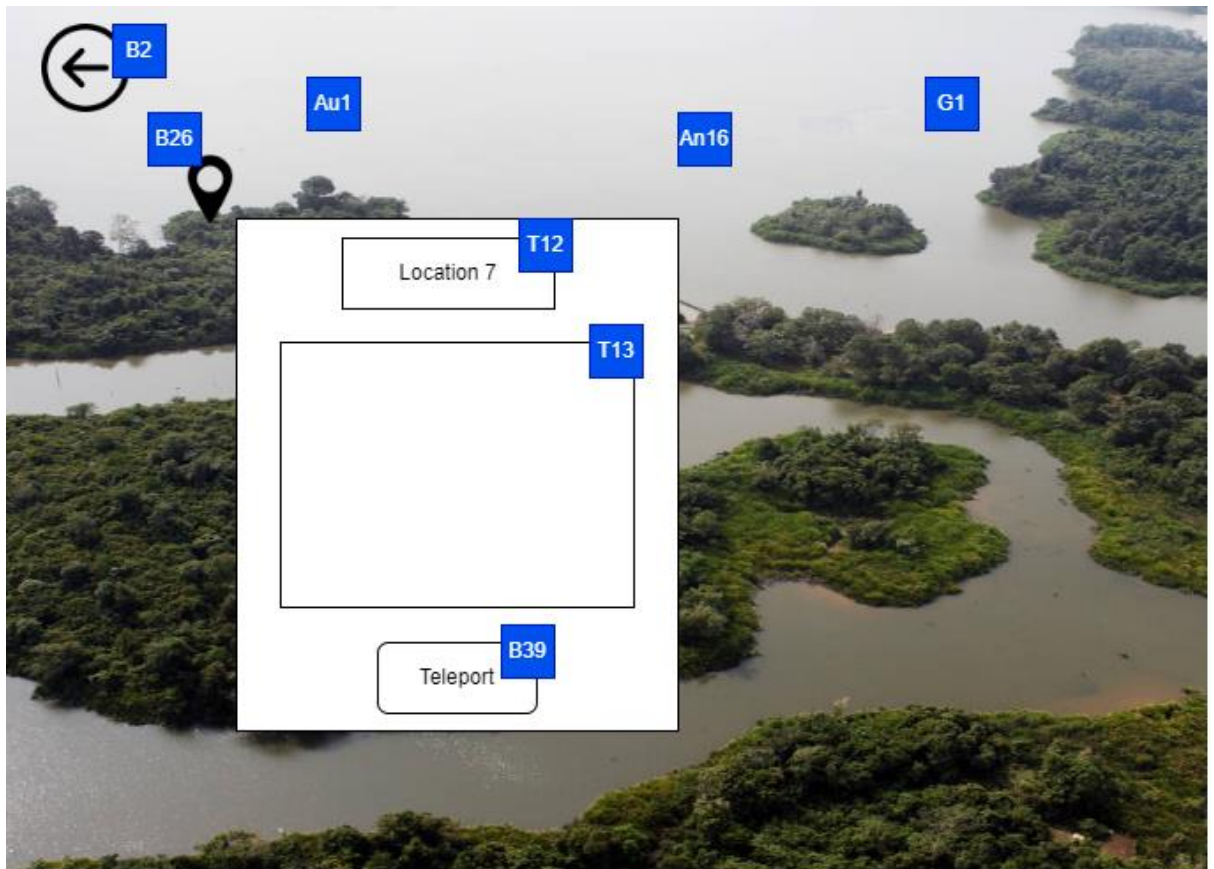
**Table 3.14: Storyboard Description for Virtual Tour Module**

Descriptions	Flow Diagram
<p><b>An14:</b> B2, B33, T9, G1, An15, Au1 will appear on the screen.</p> <p><b>An15:</b> A 3D virtual tour animation appear on the screen.</p> <p><b>B2:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Back)</p> <p><b>B33:</b> Graphic element serve as button, it can be clicked and proceed to the next or previous questions. (Next/Previous)</p> <p><b>G1:</b> Background picture.</p> <p><b>Au1:</b> Background music of the software.</p>	<pre> graph TD     Start([Start]) --&gt; Display[Display B2, B33, T9, G1, An14, An15, Au1]     Display --&gt; Click{Click On Button}     Click -- Yes --&gt; Show[Show the frame the user clicked]     Show --&gt; End([End])     Click -- No --&gt; Display     </pre>

**Storyboard for Interactive Map Module**

**Storyboard No: 13**

**Text(T), Graphics(G), Audio(Au), Animation(An), Button(B)**



*Figure 3.15: Storyboard for Interactive Map Module*

**Table 3.15: Storyboard Description for Interactive Map Module**

Descriptions	Flow Diagram
<p><b>An16:</b> B2, B26, B39, T12, T13, G1, Au1 will appear on the screen.</p> <p><b>B2:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Back)</p> <p><b>B26:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Location 7)</p> <p><b>B39:</b> Graphic element serve as button, it can be clicked and proceed to the next page. (Teleport)</p> <p><b>T12:</b> Text element that serve the purpose to show the selected location.</p> <p><b>T13:</b> Text element that serve the purpose to show the description of the selected location.</p> <p><b>G1:</b> Background picture.</p> <p><b>Au1:</b> Background music of the software.</p>	<pre> graph TD     Start([Start]) --&gt; Display[Display An16, B2, B26, B39, T12, T13, G1, Au1]     Display --&gt; Click{Click On Button}     Click -- No --&gt; Display     Click -- Yes --&gt; Show[Show the frame the user clicked]     Show --&gt; End([End])     </pre>

CHAPTER 3

3.6 Project Planning

3.6.1 Project 1

YEAR	2023																
MONTH	Jan	February					March					April					May
WEEK	1	1	2	3	4	5	5	6	7	8	9	9	10	11	12	13	14
Date	30 <sup>th</sup>	1 <sup>st</sup>	6 <sup>th</sup>	13 <sup>th</sup>	20 <sup>th</sup>	27 <sup>th</sup>	1 <sup>st</sup>	6 <sup>th</sup>	13 <sup>th</sup>	20 <sup>th</sup>	27 <sup>th</sup>	1 <sup>st</sup>	3 <sup>rd</sup>	10 <sup>th</sup>	17 <sup>th</sup>	24 <sup>th</sup>	1 <sup>st</sup>
Tasks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tasks	31 <sup>st</sup>	5 <sup>th</sup>	12 <sup>th</sup>	19 <sup>th</sup>	26 <sup>th</sup>	28 <sup>th</sup>	5 <sup>th</sup>	12 <sup>th</sup>	19 <sup>th</sup>	26 <sup>th</sup>	31 <sup>st</sup>	2 <sup>nd</sup>	9 <sup>th</sup>	16 <sup>th</sup>	23 <sup>rd</sup>	30 <sup>th</sup>	7 <sup>th</sup>
1.0 Analysis																	
Performing Literature Review																	
Identify Problem Statement																	
Identify Project Objectives																	
Identify Project Scope																	
Identify Methodology																	
Identify Development Tools																	
2.0 Design																	
Identify Architecture Design																	
Draw Use Case Diagram																	
Performing Diagram Derivation																	

CHAPTER 3

3.6.2 Project 2

YEAR	2023																	
MONTH	June			July						August				September				
WEEK	1	2	3	3	4	5	6	7	8	8	9	10	11	12	12	13	14	
Date	12 <sup>th</sup>	19 <sup>th</sup>	26 <sup>th</sup>	1 <sup>st</sup>	3 <sup>rd</sup>	10 <sup>th</sup>	17 <sup>th</sup>	24 <sup>th</sup>		1 <sup>st</sup>	7 <sup>th</sup>	14 <sup>th</sup>	21 <sup>st</sup>	28 <sup>th</sup>	1 <sup>st</sup>	4 <sup>th</sup>	11 <sup>th</sup>	
Tasks	-	-	-	-	-	-	-	-	31 <sup>st</sup>	-	-	-	-	-	-	-	-	
	18 <sup>th</sup>	25 <sup>th</sup>	30 <sup>th</sup>	2 <sup>nd</sup>	9 <sup>th</sup>	16 <sup>th</sup>	23 <sup>rd</sup>	30 <sup>th</sup>		6 <sup>th</sup>	13 <sup>th</sup>	20 <sup>th</sup>	27 <sup>th</sup>	31 <sup>st</sup>	3 <sup>rd</sup>	10 <sup>th</sup>	17 <sup>th</sup>	
3.0 Development																		
Develop First Module																		
Develop Second Module																		
Develop Third Module																		
Develop Fourth Module																		
Develop Fifth Module																		
Integrate Module																		
4.0 Implementation																		
Test system functionalities																		
Deliver system to target users																		
Collect analyze feedbacks form target users																		
5.0 Evaluation																		

CHAPTER 3

Evaluate project effectiveness																			
Determine analyzation method																			
Produce reports																			



## **Chapter 4 Development**

### **4.1 Overview**

In this Chapter the author is going to discuss about the development process of the project. The development process of the project is shown with some screenshots of the content interface of each module of the software. The author will discuss about each module that has been developed for the project and how the module has been designed using a specific software.

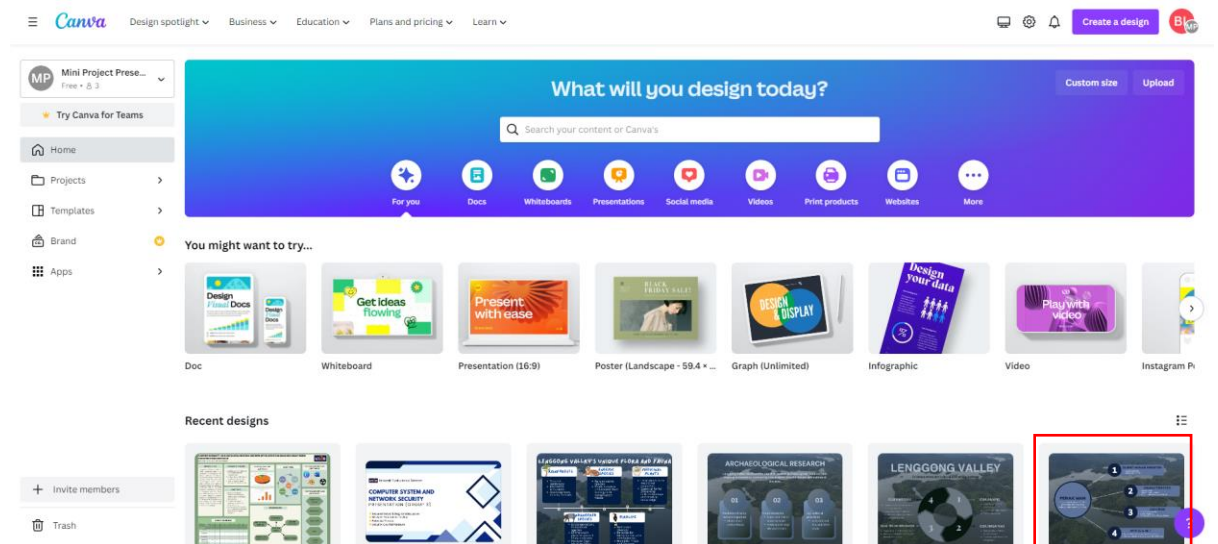
### **4.2 Development Process**

#### **4.2.1 Lesson Module**

The diagram for the lesson module is created using Canva which is an online graphic design tool. The Canva can be use to create social media posts, presentations, posters, videos, logos and more.

#### **Create Lesson Module Diagram**

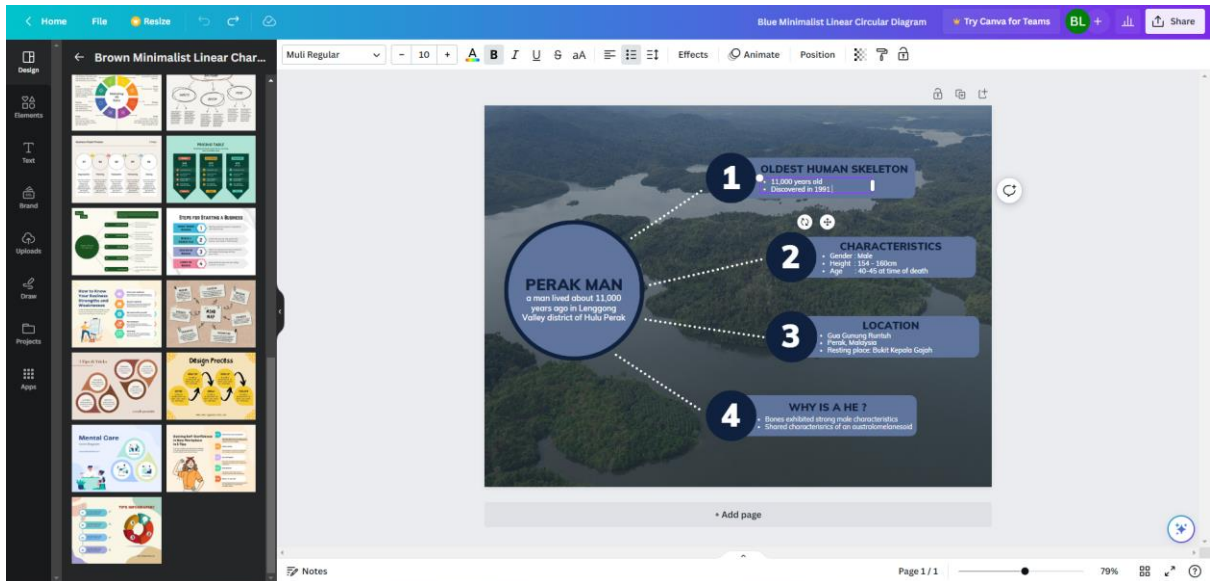
Choose a desired design for the diagram.



*Figure 4.1 Screenshot of Canvas*

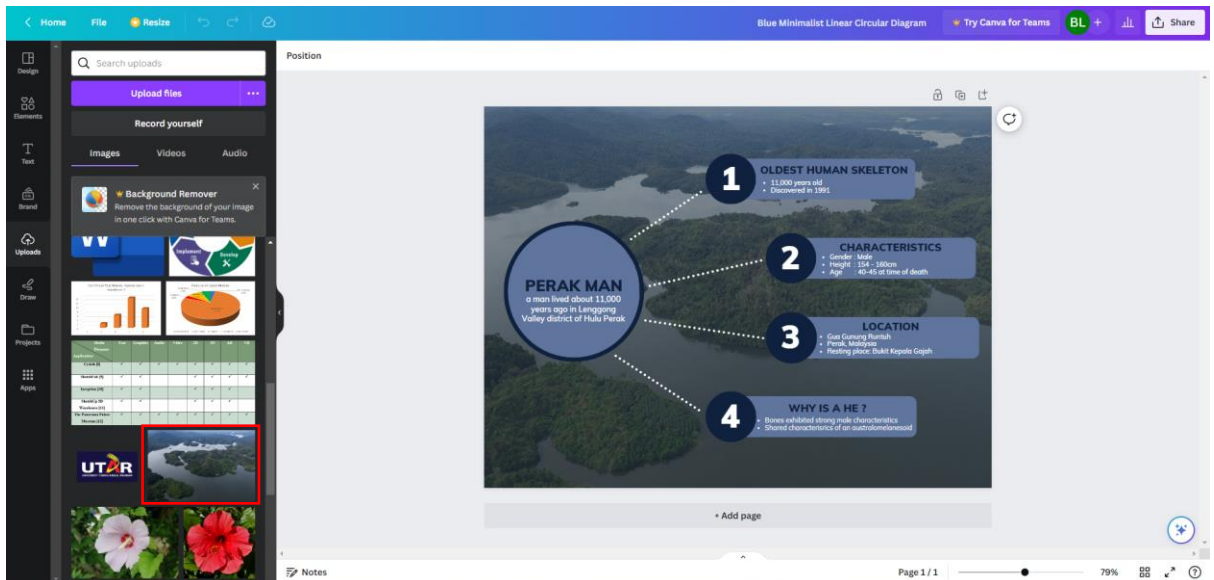
## CHAPTER 4

Edit the elements of the template to add in the information about the respective lesson.



*Figure 4.2 Screenshot of Edit Templates*

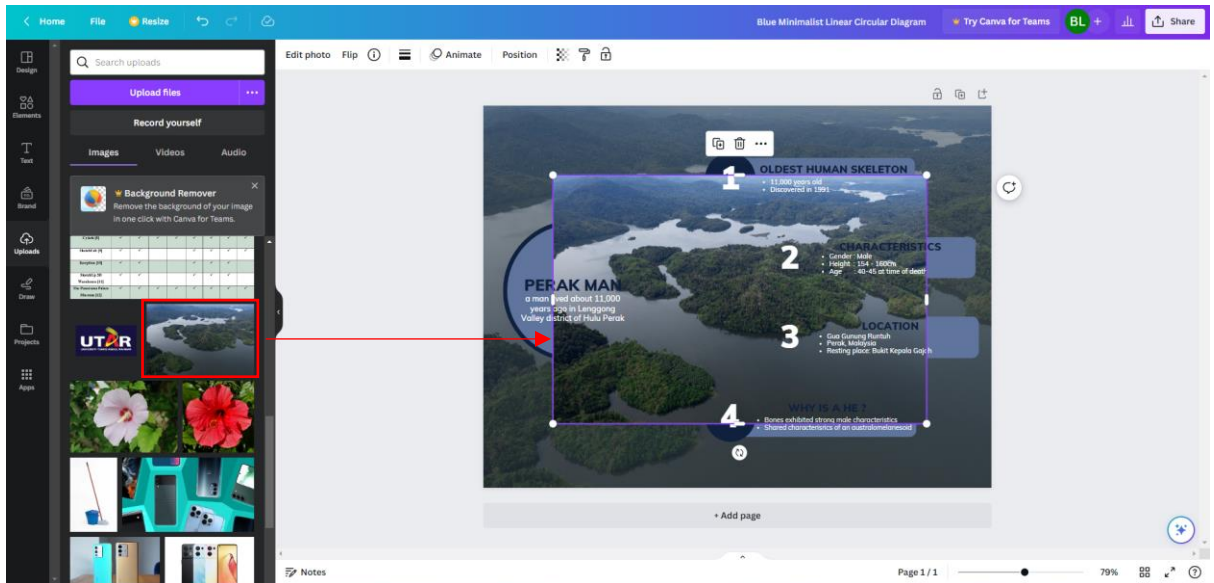
Upload a desired image to be set as the background of the template.



*Figure 4.3 Screenshot of Choosing Background*

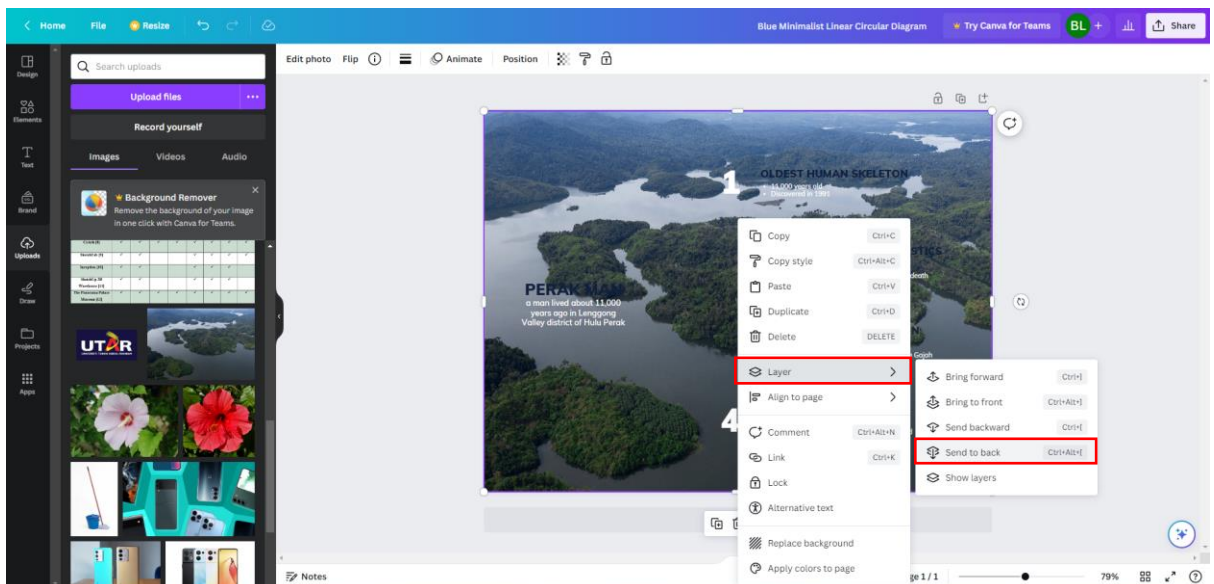
## CHAPTER 4

Drag and drop the image into the template and adjust the image to fit the size of the template.



*Figure 4.4 Screenshot of Drag and Drop Image into Template*

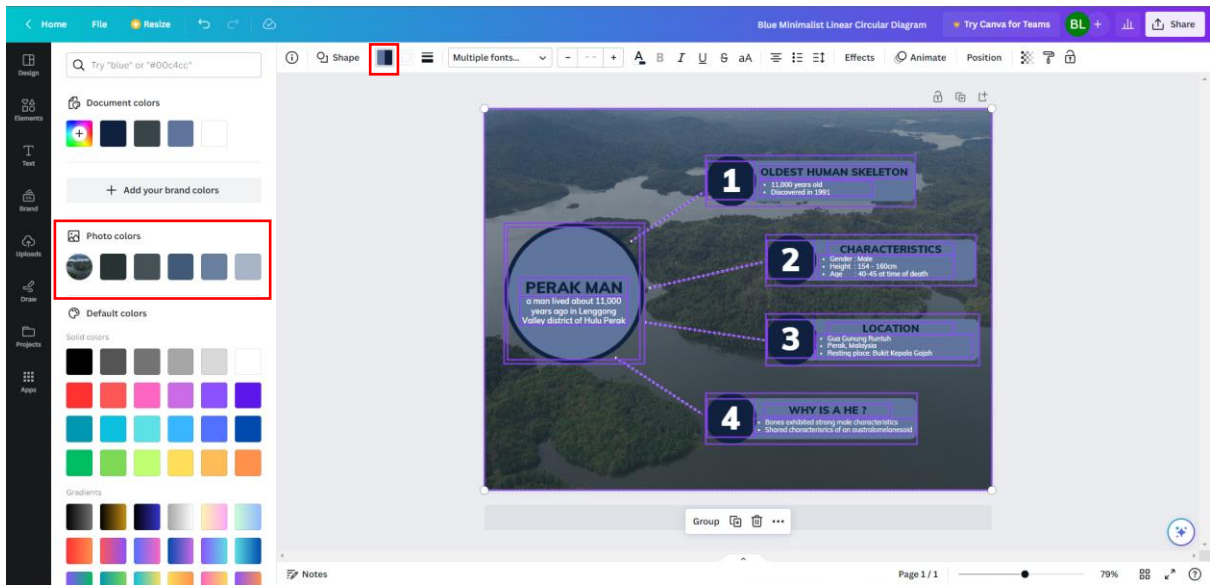
Click “Send to back” to set the image as a background.



*Figure 4.5 Screenshot of Send Image to Back*

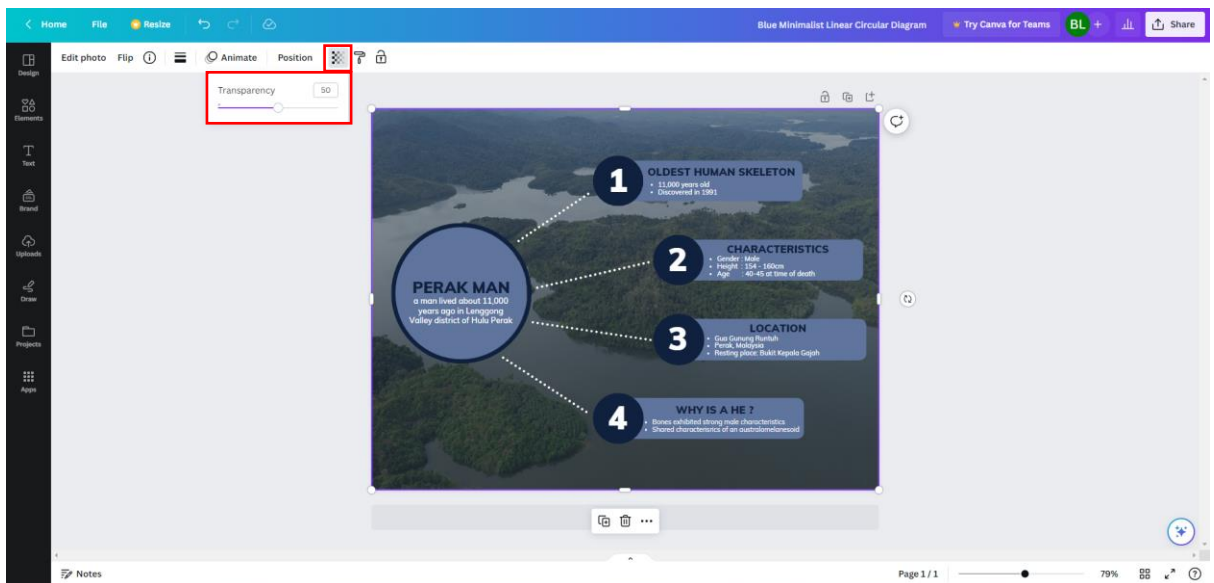
## CHAPTER 4

The theme color of the diagram is set according to the background color.



*Figure 4.6 Screenshot of Changing Theme Color*

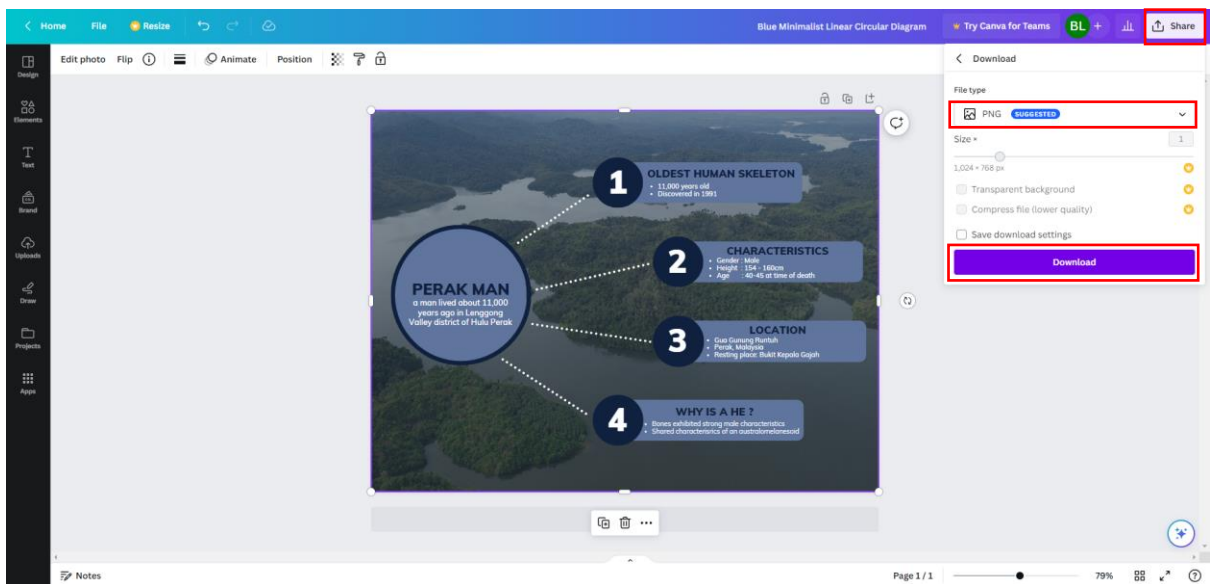
The transparency of the image is set to 50%



*Figure 4.7 Screenshot of Adjusting Transparency*

## CHAPTER 4

Save the diagram as PNG image.

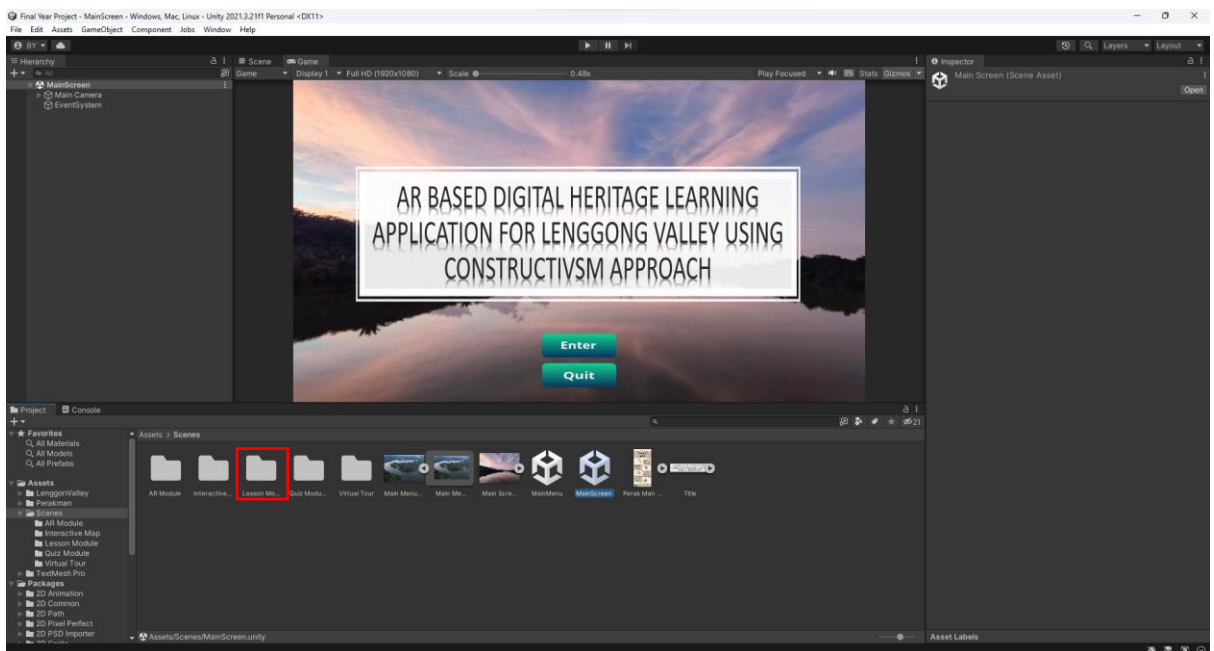


*Figure 4.8 Screenshot of Save Diagram*

### Create Lesson1

Next, open the Unity software.

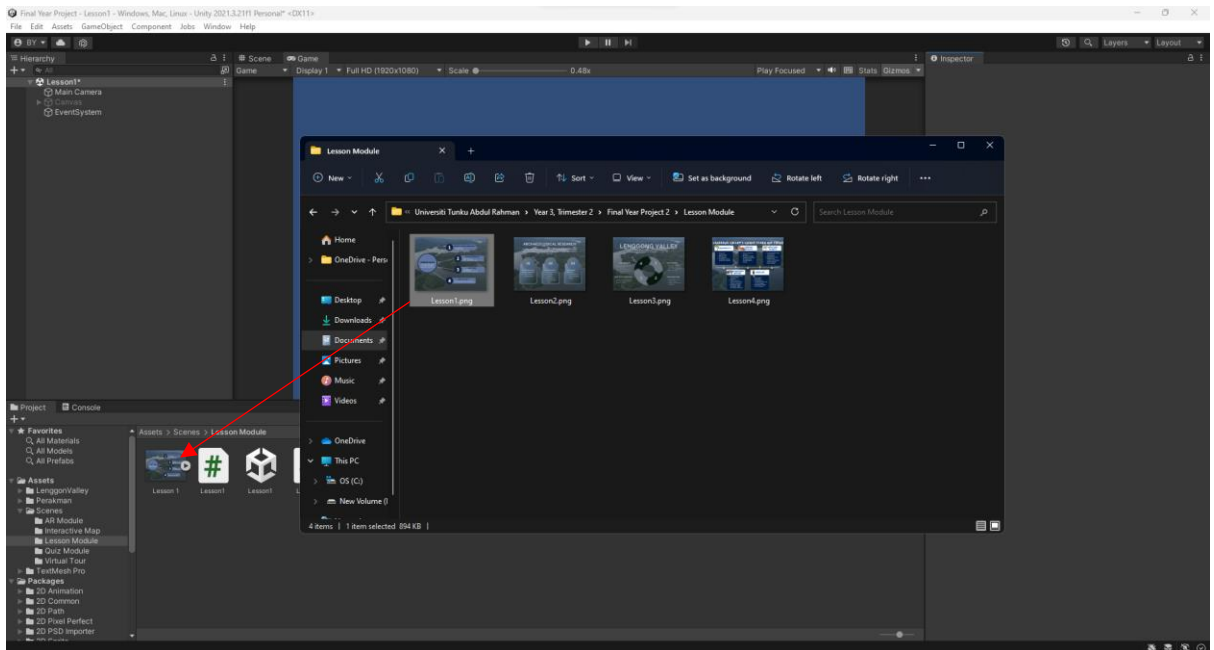
Create a folder in Scene for Lesson Module.



*Figure 4.9 Screenshot of Create New Folder for Lesson Module*

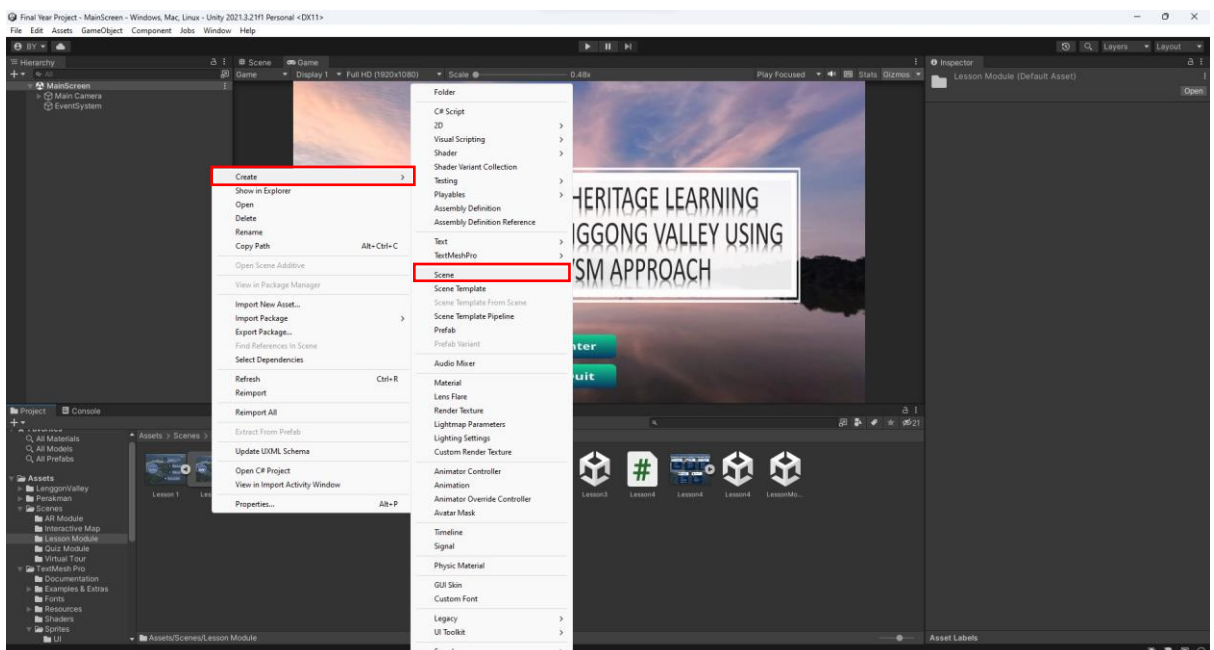
## CHAPTER 4

Drag and drop the images of the lesson diagram into Lesson Module folder.



*Figure 4.10 Screenshot of Drag and Drop Images*

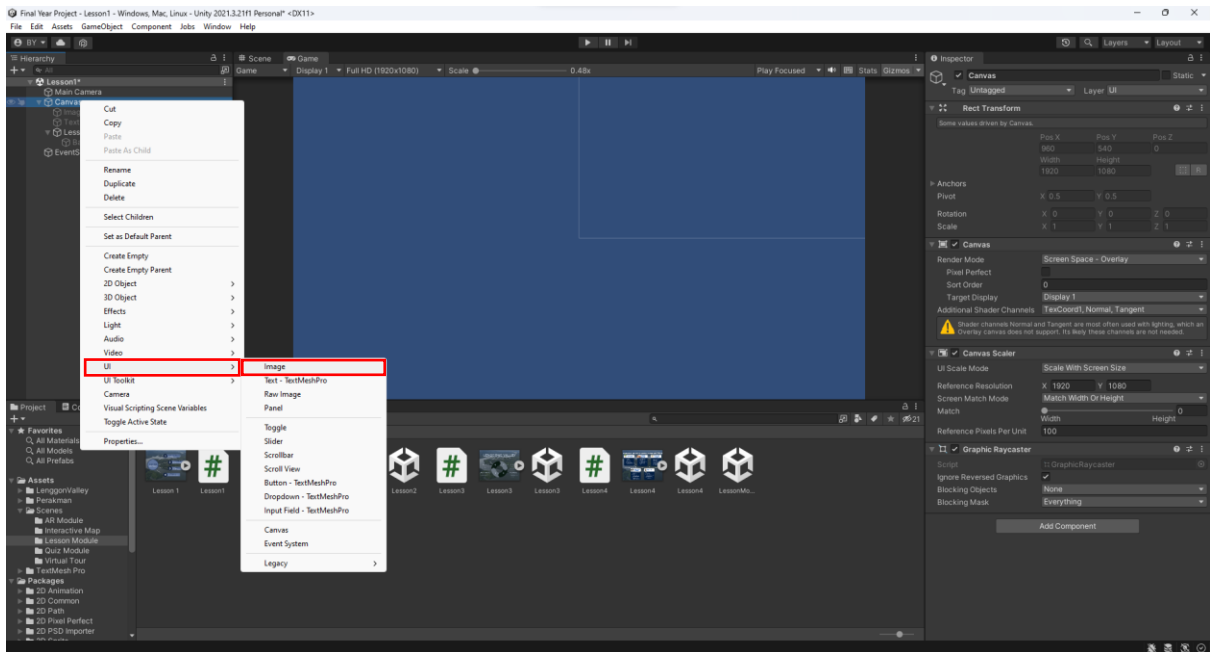
Create a new scene for Lesson1.



*Figure 4.11 Screenshot of Create New Scene for Lesson1*

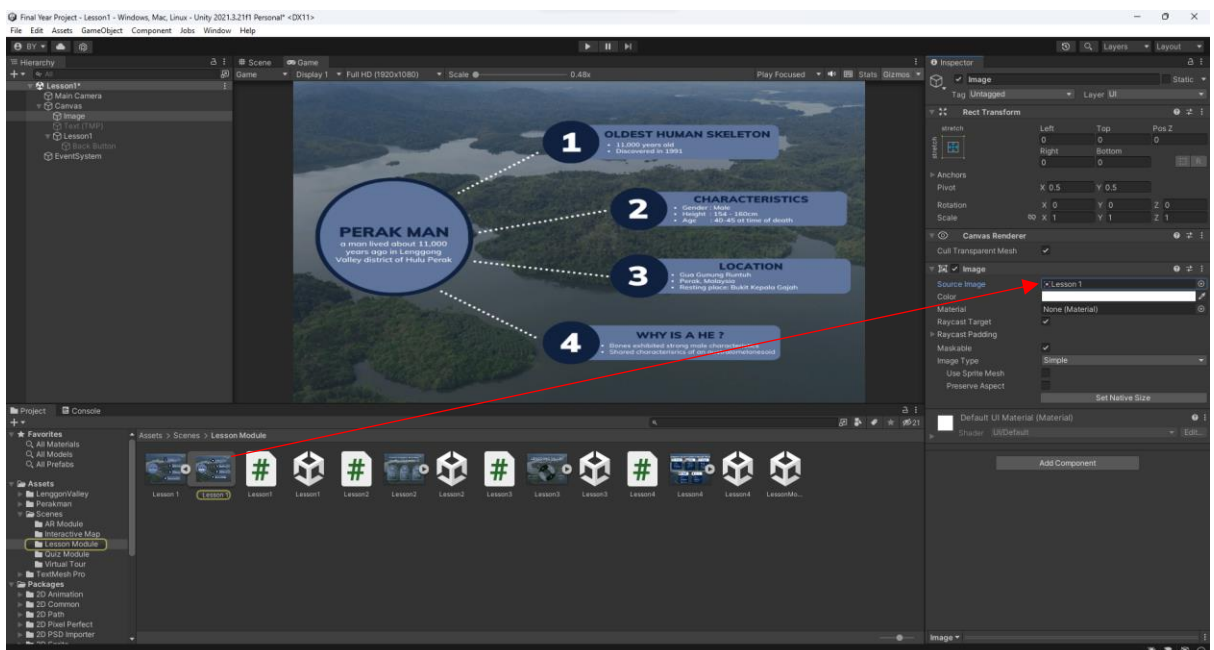
## CHAPTER 4

Right click on Canvas, select UI > Image to create an image element.



*Figure 4.12 Screenshot of Create Image Element*

Drag the diagram image into the Source Image of the Image created.



*Figure 4.13 Screenshot of Drag and Drop Image into the Source Image*

## CHAPTER 4

Right click on Canvas, select UI > Text – TextMeshPro to create a text element for title.

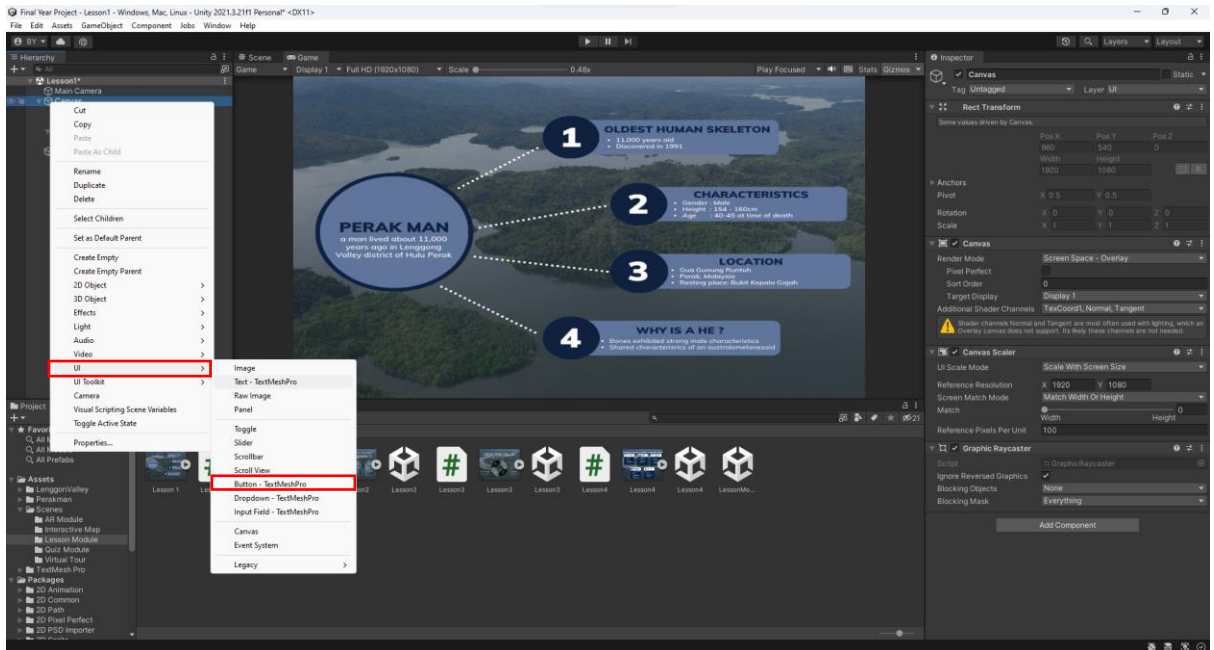


Figure 4.14 Screenshot of Create Text - TextMeshPro

Edit the Text Input to set the title of the content interface.

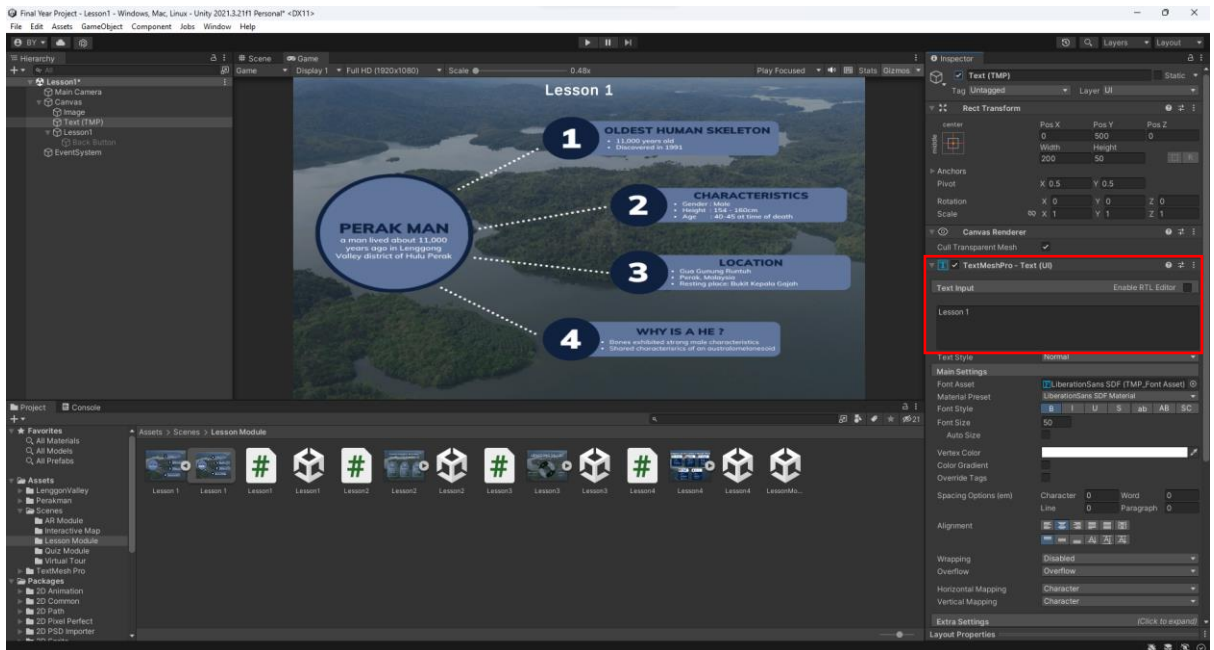


Figure 4.15 Screenshot of Edit Text Input



## CHAPTER 4

Adjust the position of the Title.

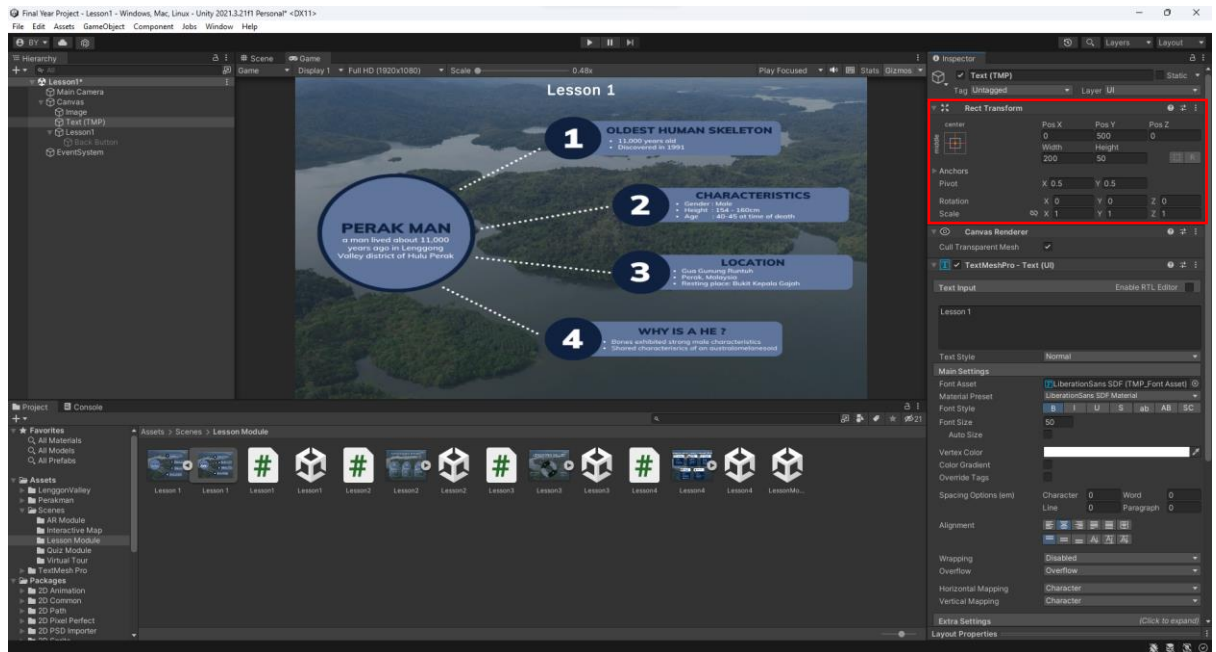


Figure 4.16 Screenshot of Adjust Title Position

Right click on Canvas, select UI > Button - TextMeshPro to create a Back Button.

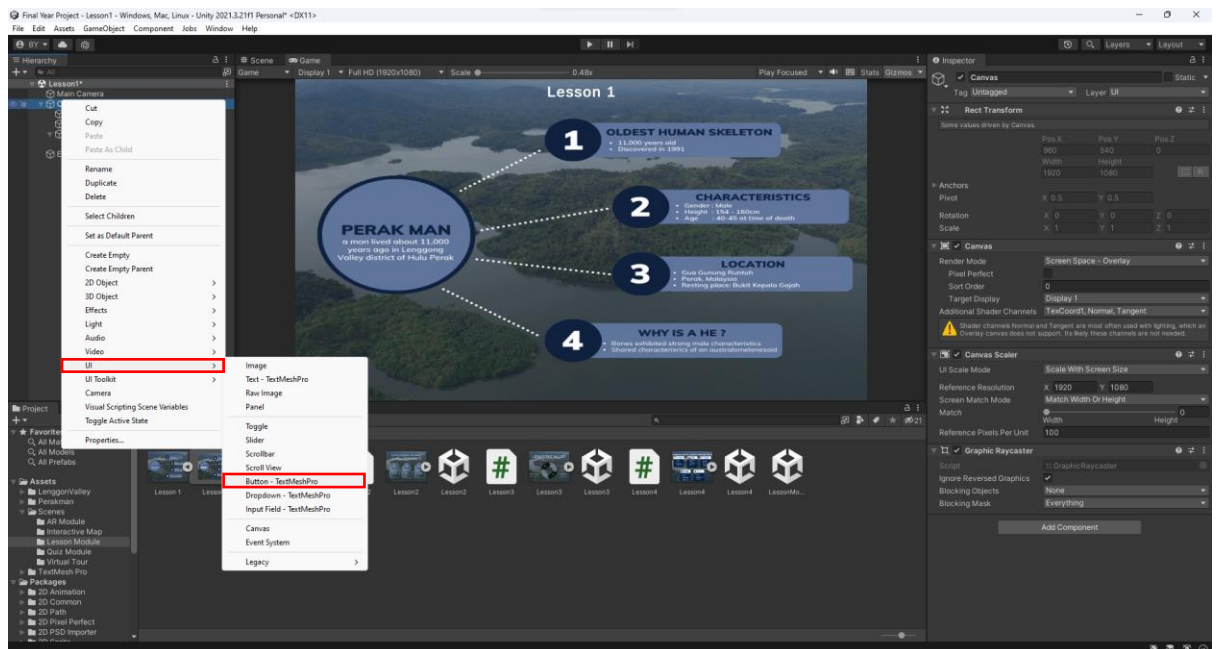
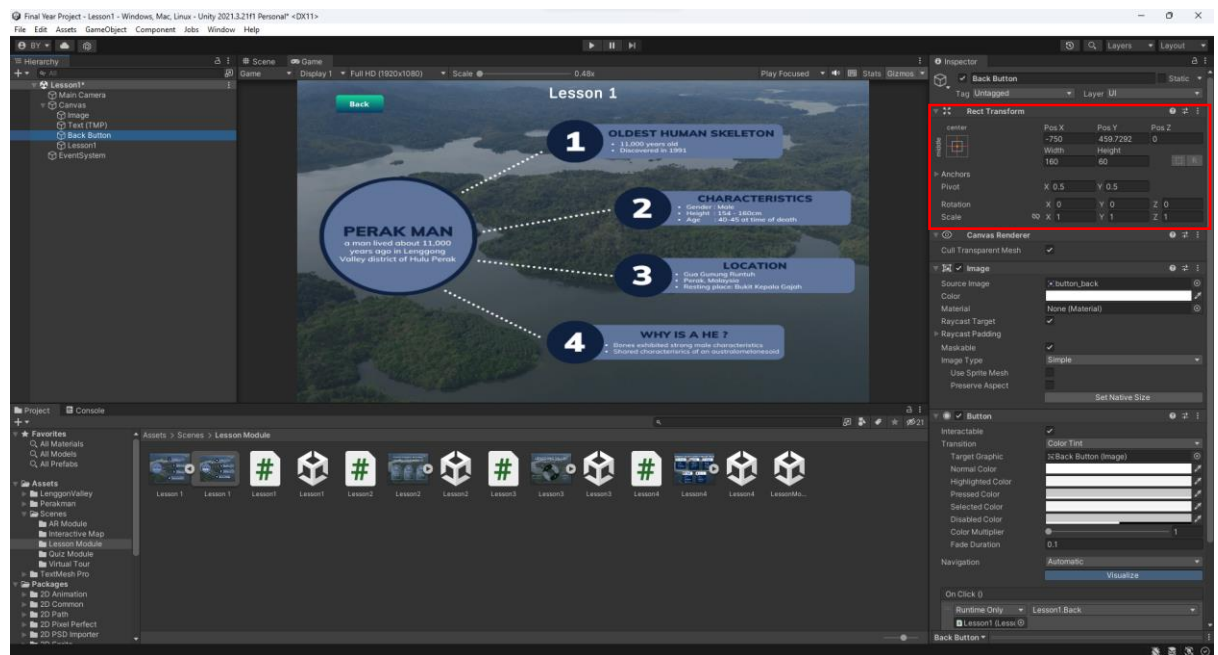


Figure 4.17 Screenshot of Create Button - TextMeshPro

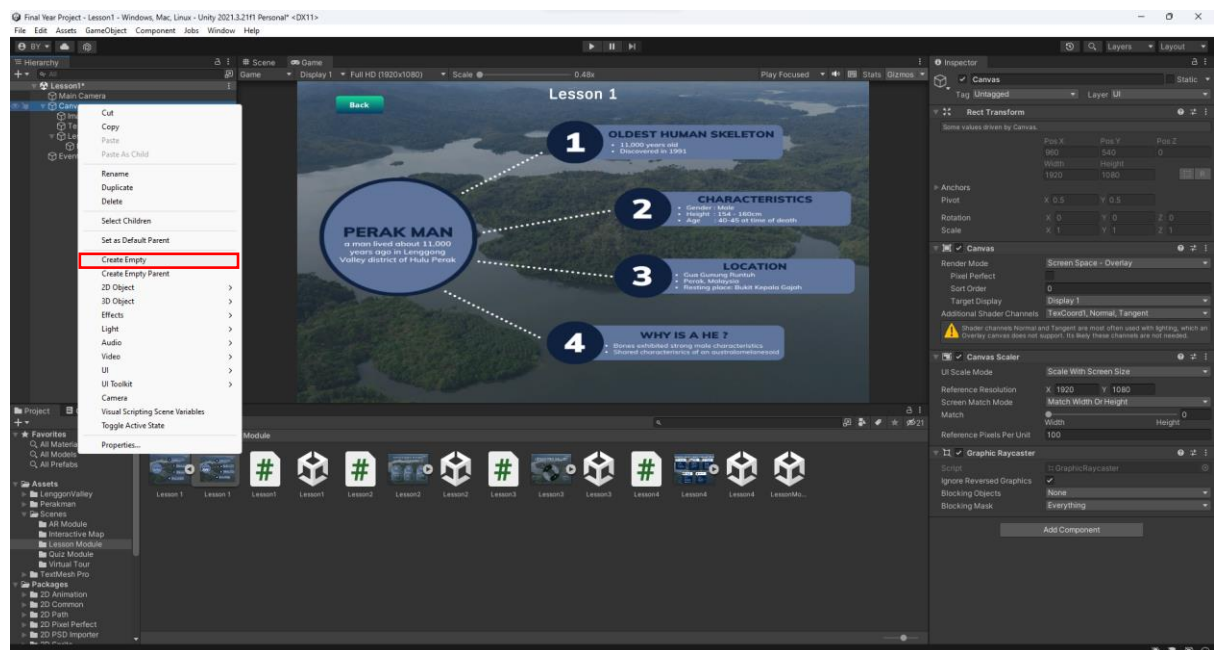
## CHAPTER 4

Adjust the position of the button and set the button width to 160 and height to 60.



*Figure 4.18 Screenshot of Adjust Button Position*

Right click on Canvas, select Create Empty Game Object and name as Lesson1.



*Figure 4.19 Screenshot of Create Empty Game Object*

## CHAPTER 4

Drag the Back Button into Lesson1 Game Object.

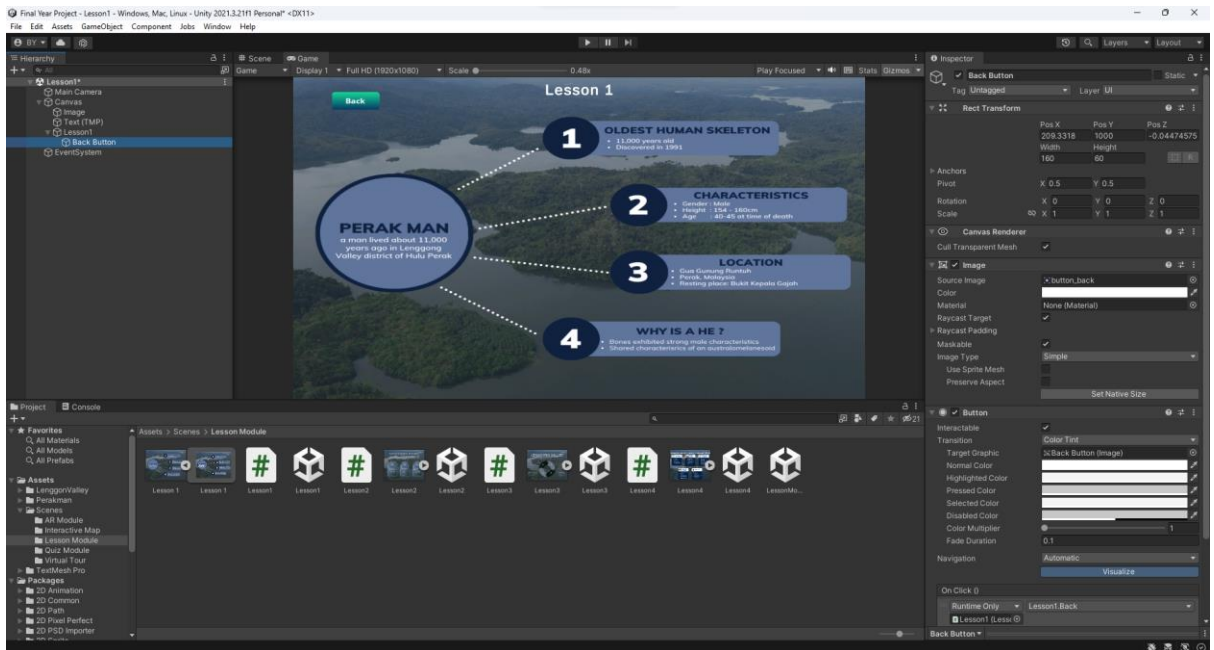


Figure 4.20 Screenshot of Drag and Drop Back Button

Remove Text(TMP) in the Back Button section to remove the default UI for the button.

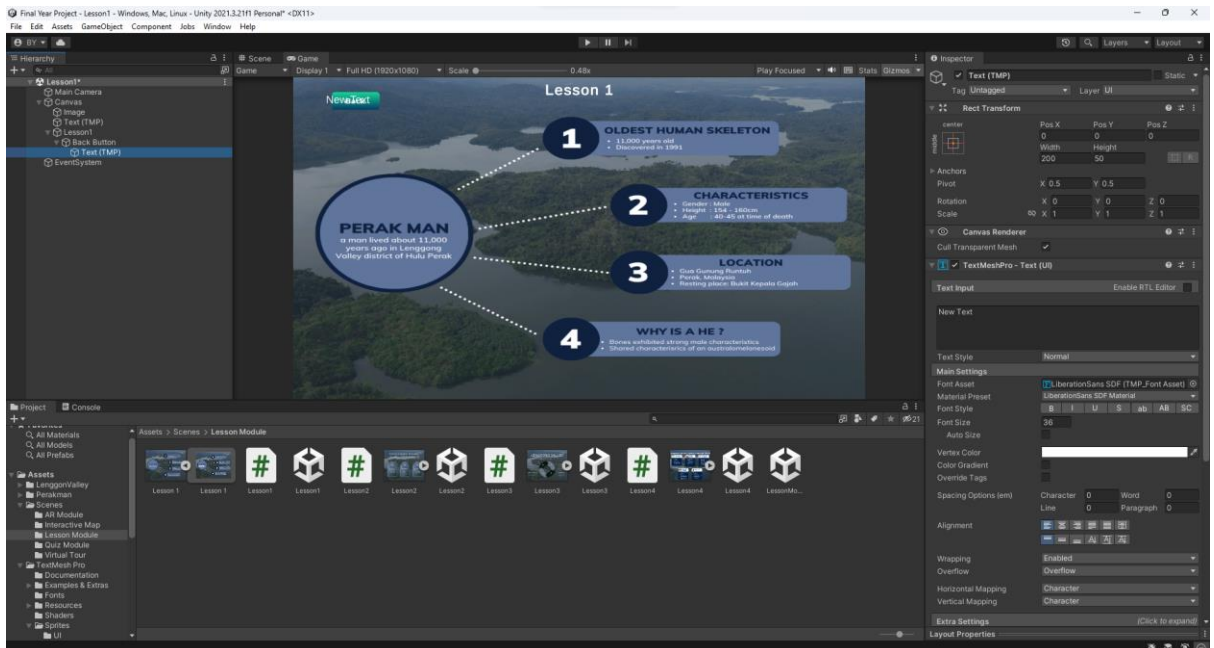


Figure 4.21 Screenshot of Remove Text(TMP) in Back Button

## CHAPTER 4

Create a UI folder in Assets > TestMeshPro > Sprites.

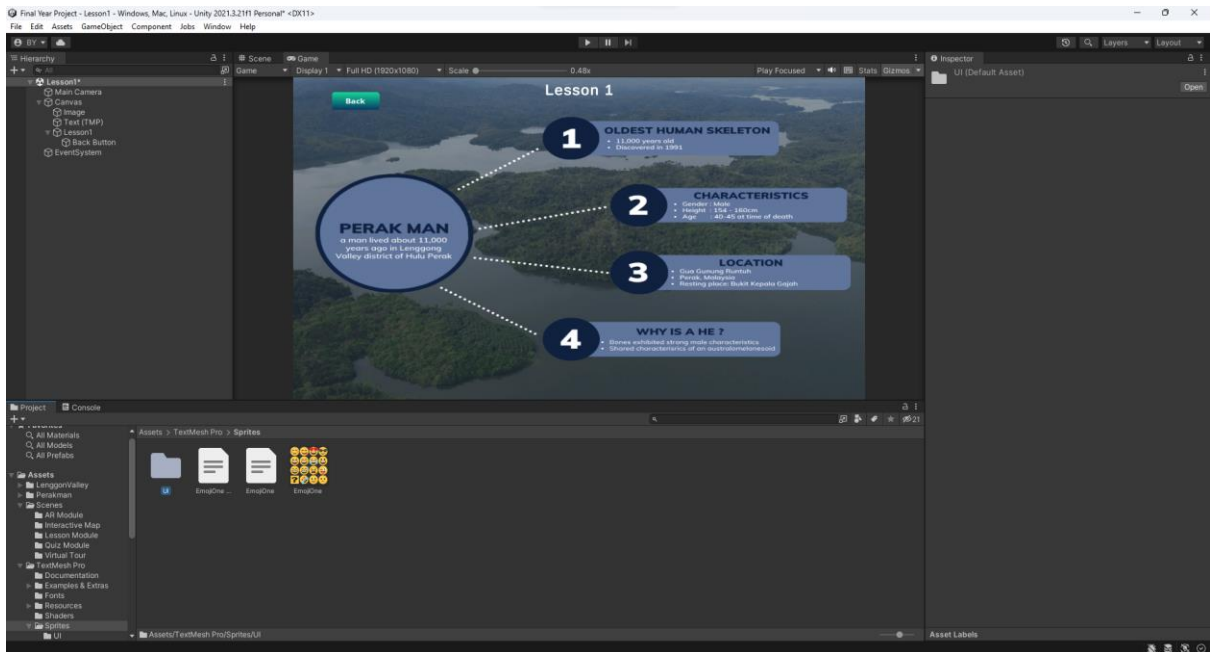


Figure 4.22 Screenshot of Create UI Folder

Drag all prepared UI buttons into the UI folder into Unity.

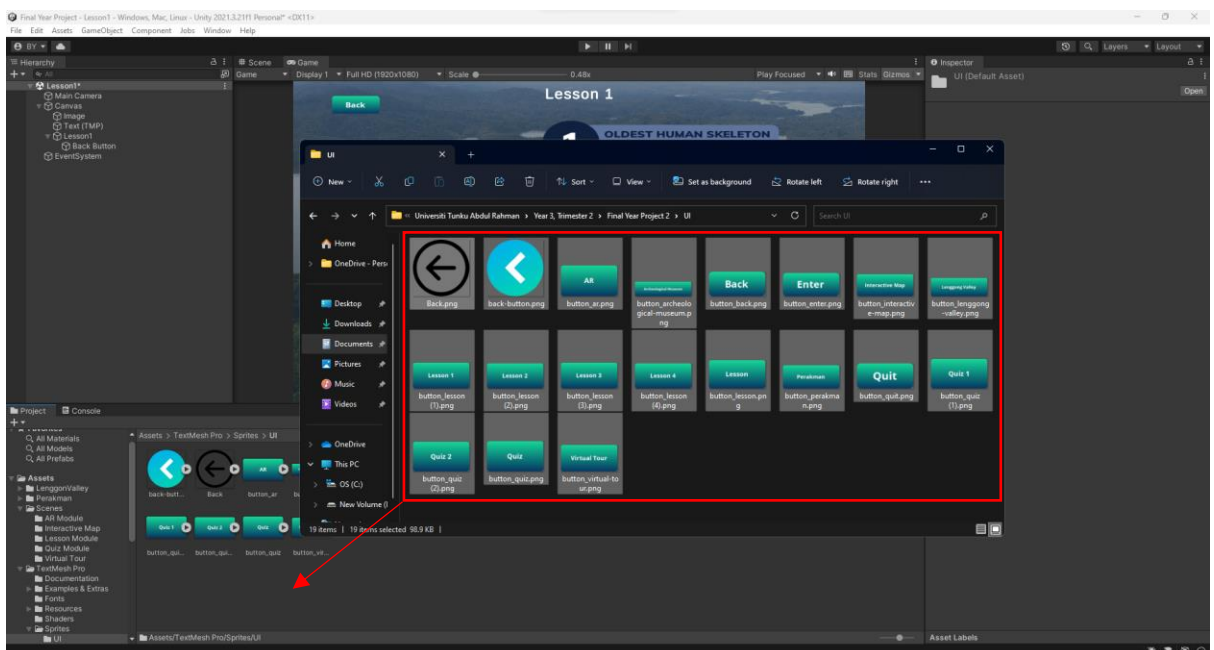
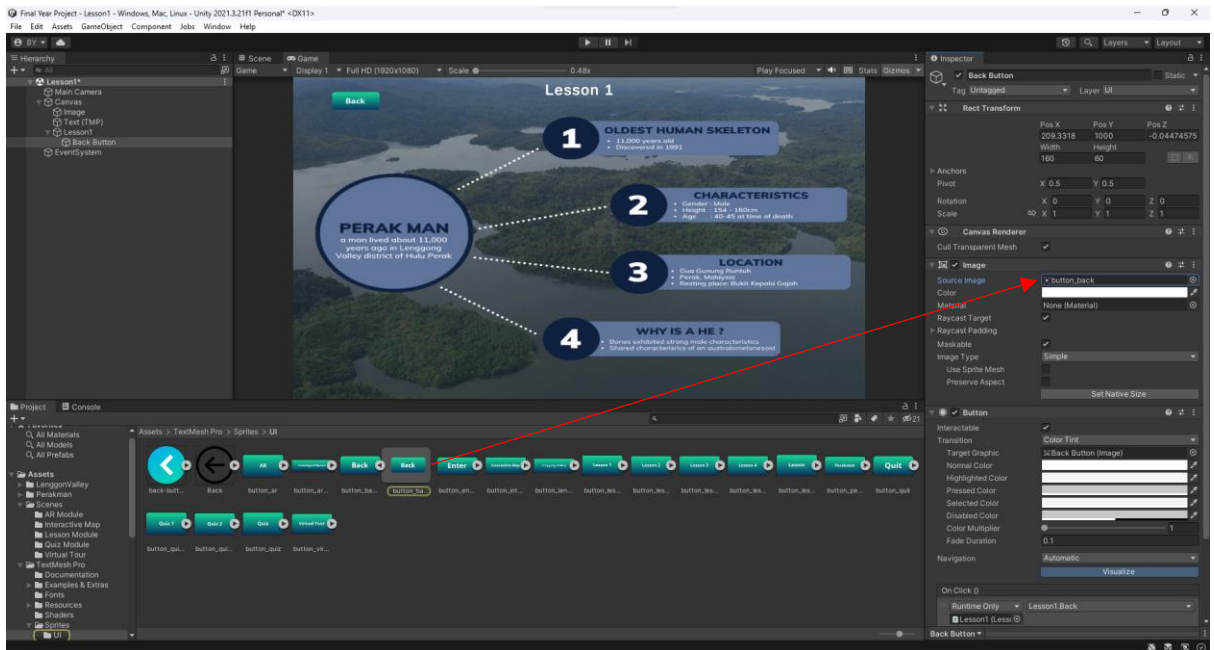


Figure 4.23 Screenshot of Drag and Drop UI buttons

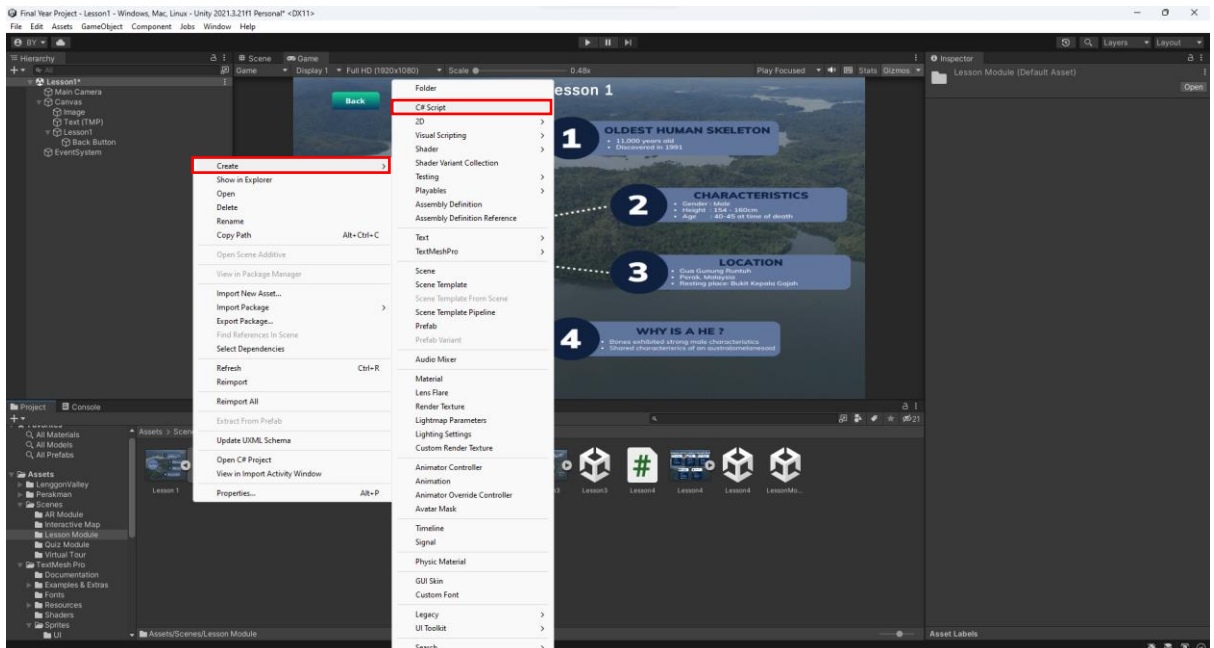
## CHAPTER 4

Drag and drop the UI of Back Button into the Source image of the button.



*Figure 4.24 Screenshot of Drag and Drop UI of Back Button into Source Image*

Right click select Create > C# Script to create a new C# Script and name it as Lesson1 in Lesson Module folder.



*Figure 4.25 Screenshot of Create New C# Script*

## CHAPTER 4

Drag and Drop the Lesson1 Module to Lesson1 GameObject.

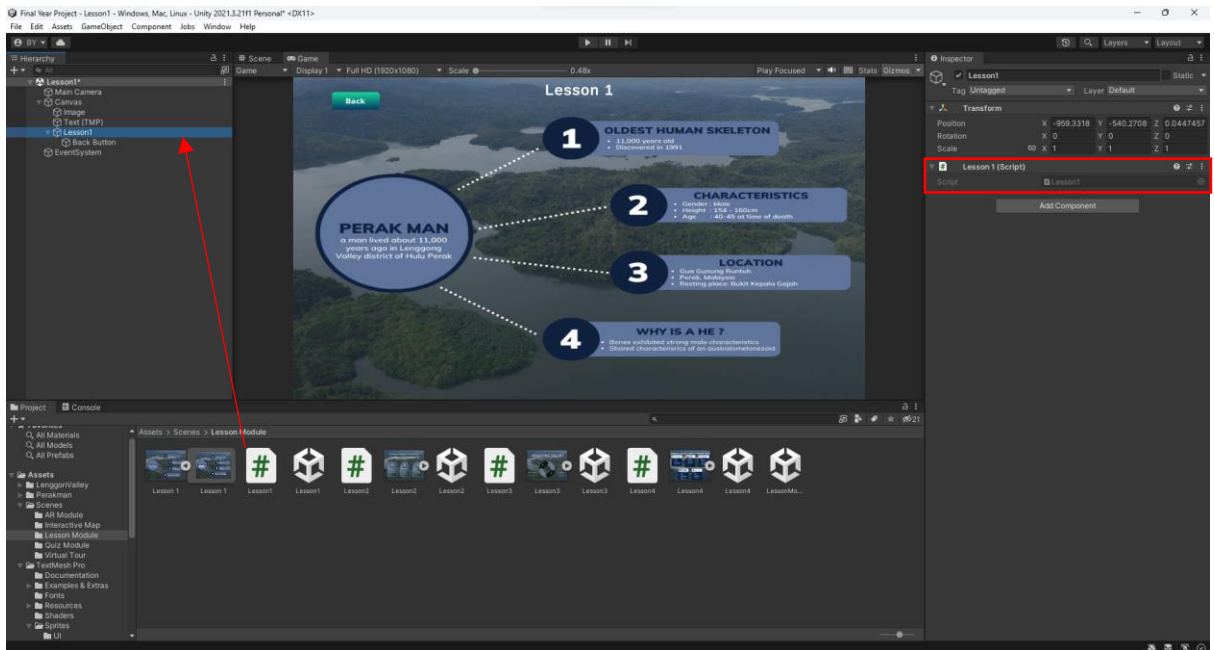


Figure 4.26 Screenshot of Drag and Drop Lesson1

Code the Lesson1 Script to create a Back function.

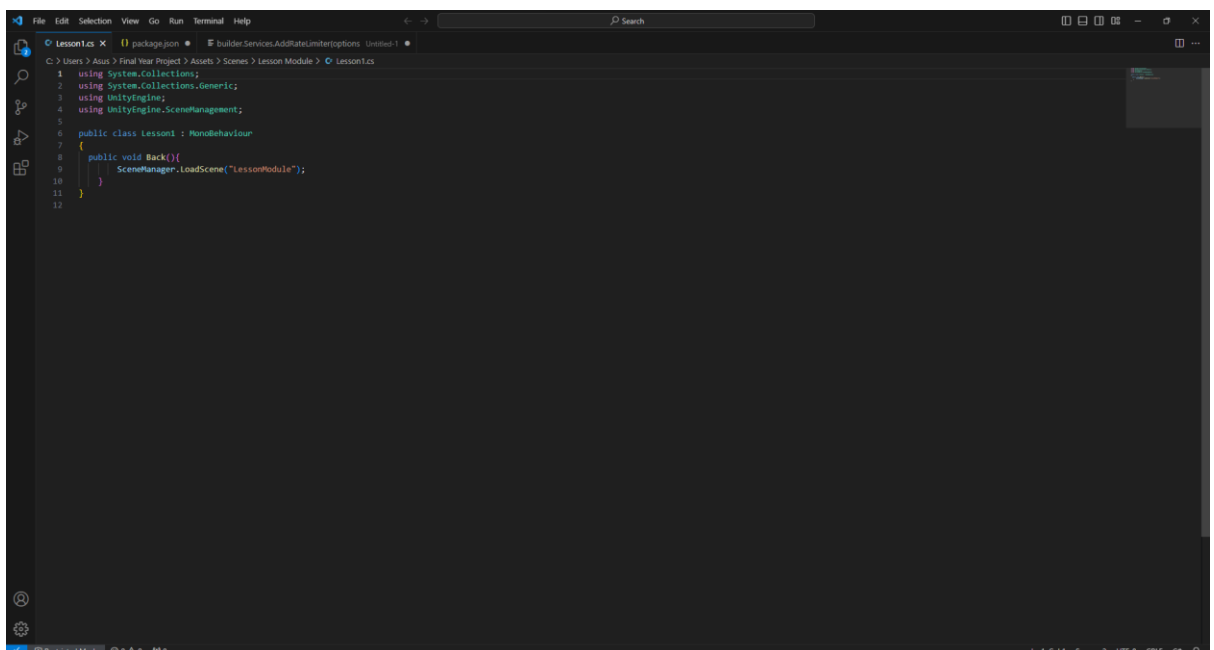


Figure 4.27 Screenshot of Code for Lesson1

## CHAPTER 4

Select the Back Button, Add an OnClick function and Drag and Drop the Lesson1 Game Object into the Object panel.

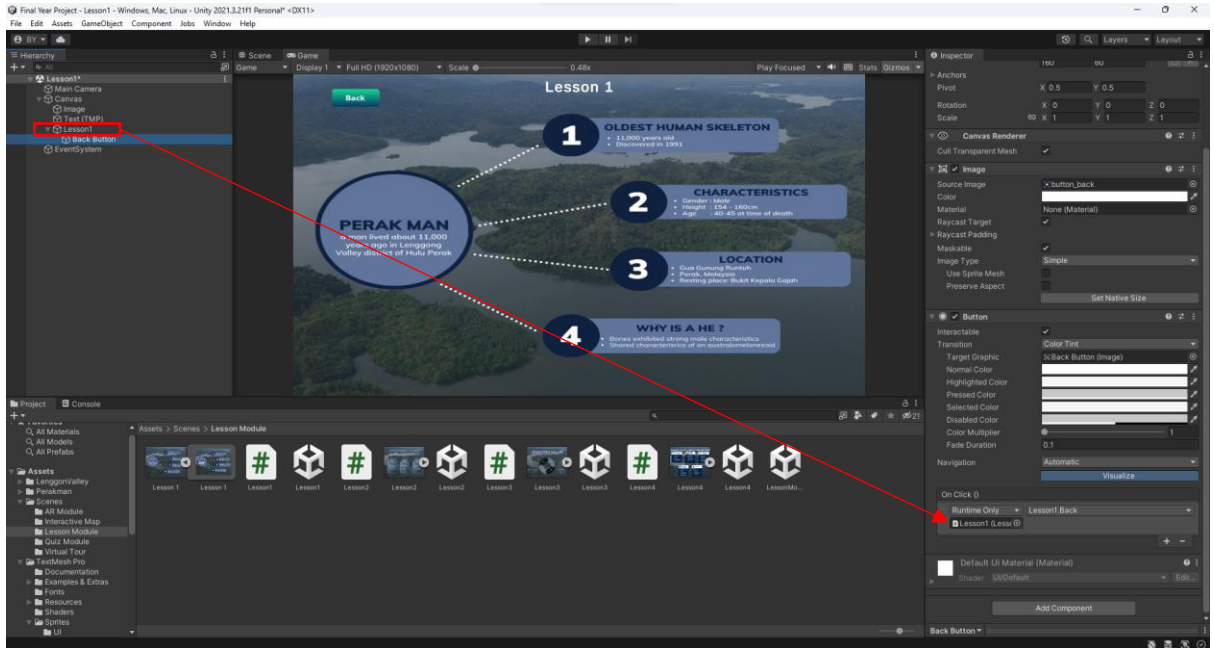


Figure 4.28 Screenshot of Drag and Drop Lesson1 into the Object panel

Next, select Lesson1 in the function panel, then Back() function.

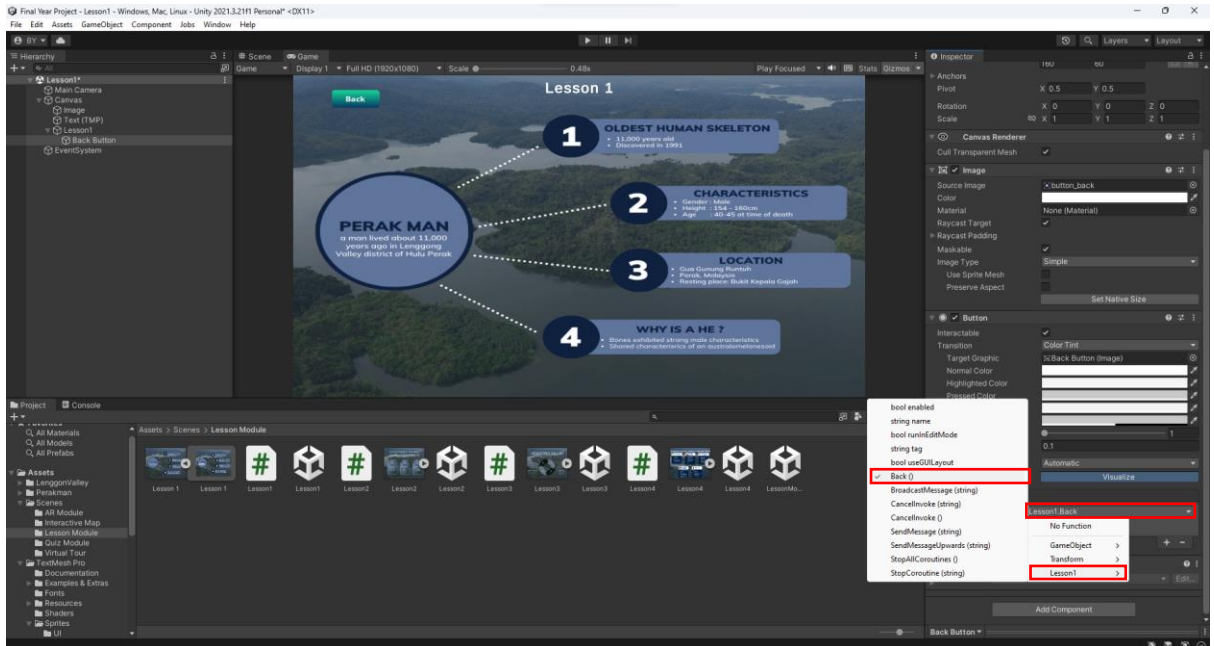
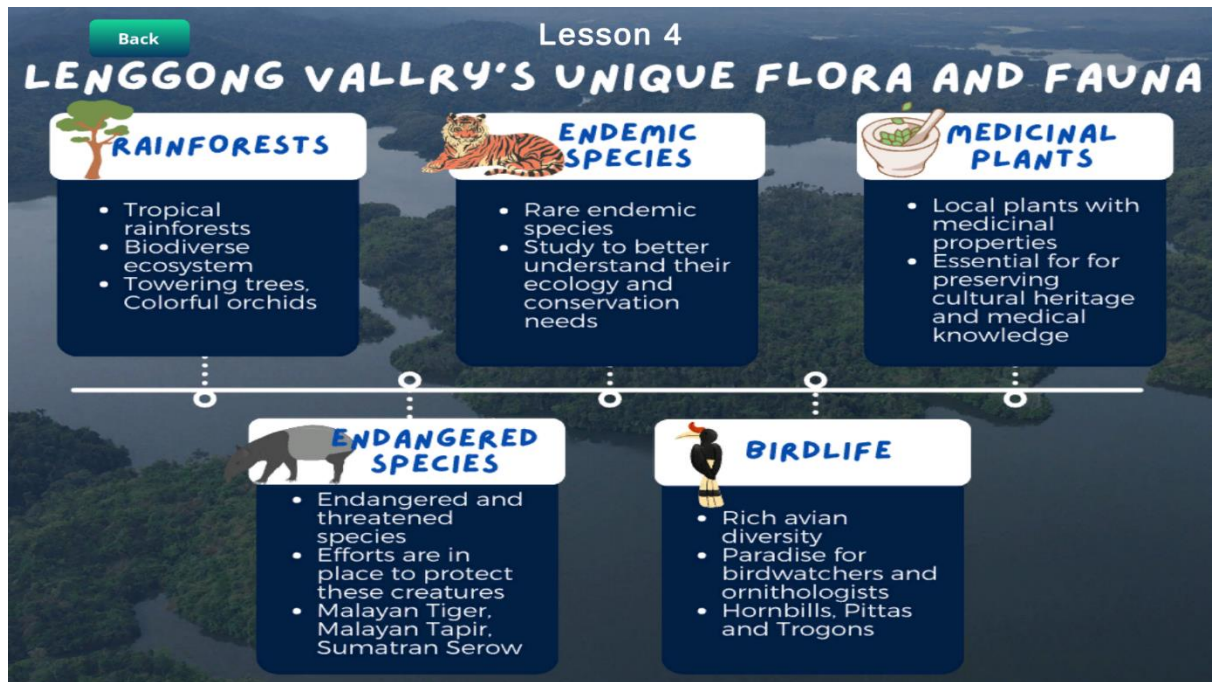


Figure 4.29 Screenshot of Setting Up Back Function



*Figure 4.30 Content Interface for Lesson Module*

The figure above shows the development of the Lesson Module interface. The module incorporates visually engaging diagrams and image to convey knowledge on specific topics relate to Lenggonng Valley. It not only informs but also captivates users with rich visuals. A Back button offers user-friendly navigation, allowing the users to return to the Lesson Module Menu anytime they want. There are total of four lessons provided to the users offering the users a substantial wealth of interesting facts and insight about Lenggonng Valley.

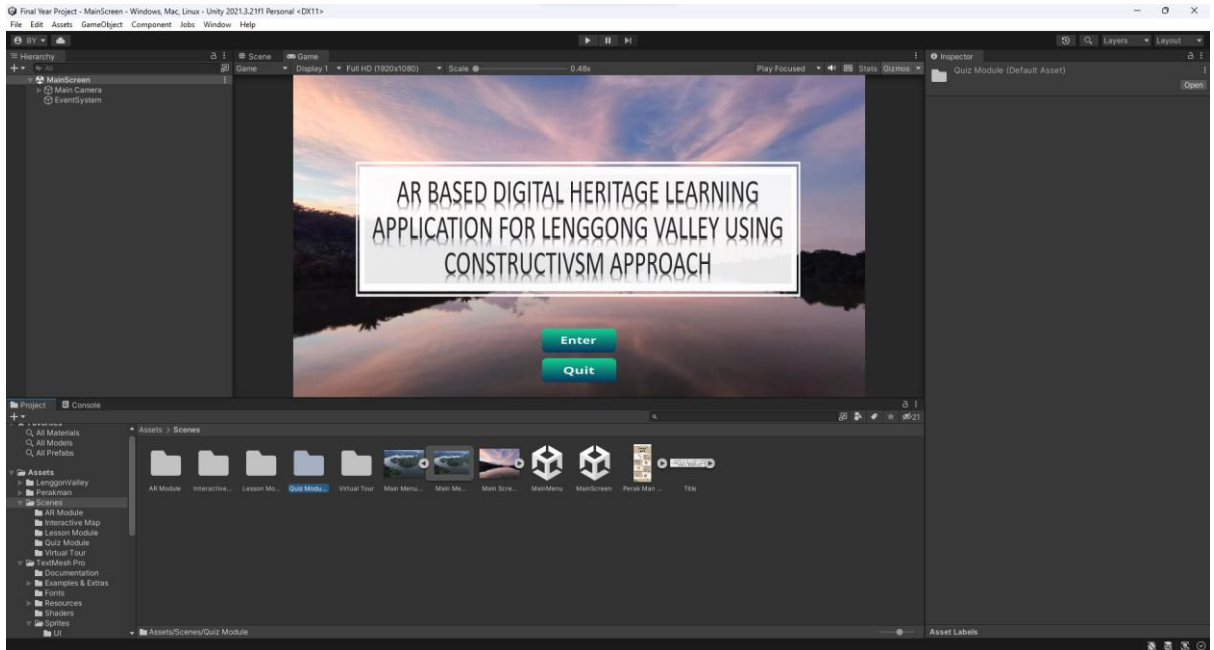


## CHAPTER 4

### 4.2.2 Quiz Module

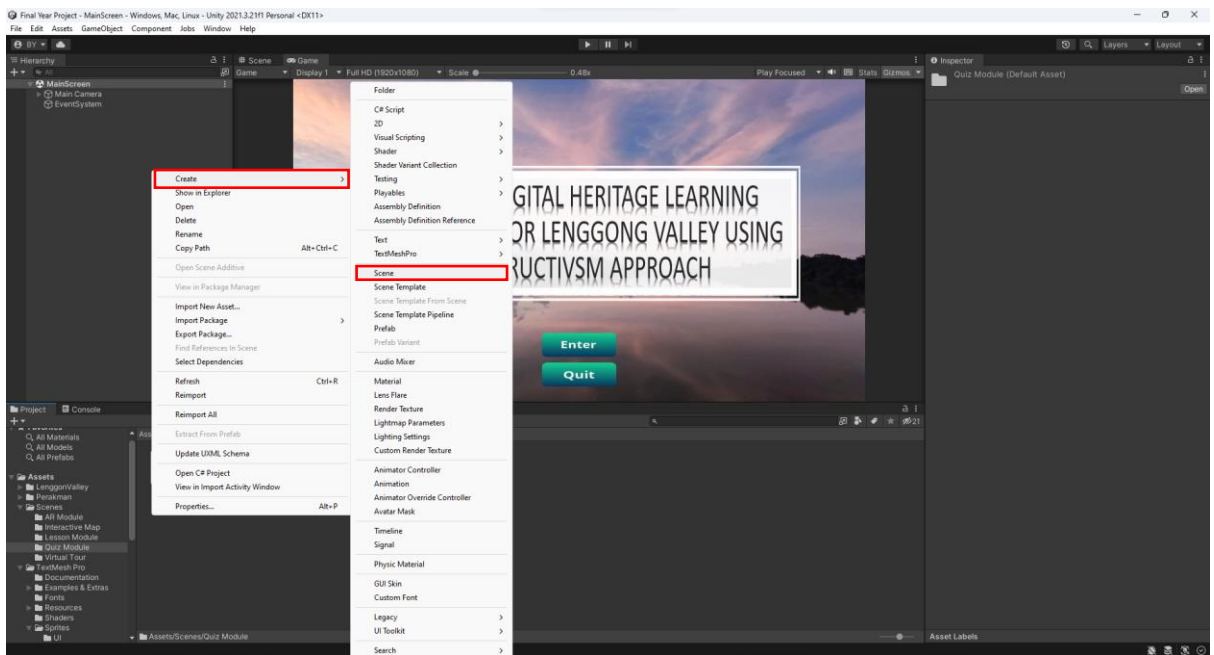
#### Create UI for Quiz1

Create a folder in Scene and name as Quiz Module.



*Figure 4.31 Screenshot of Create New Folder for Quiz Module*

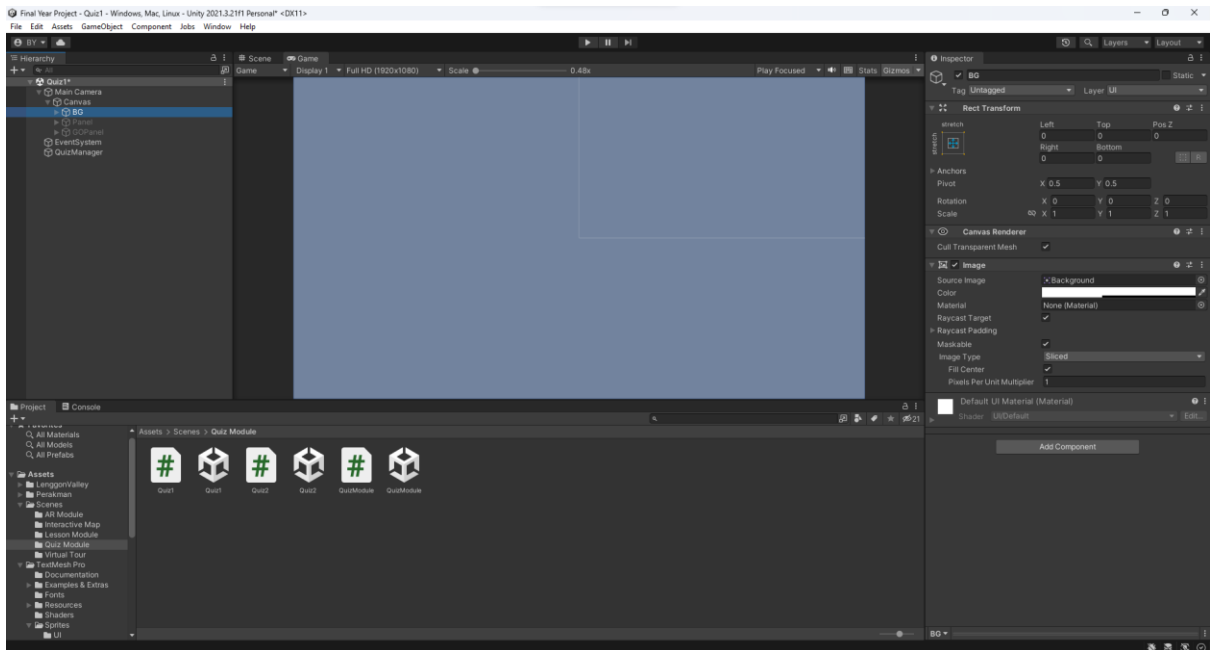
Create a new Scene in the Quiz Module folder.



*Figure 4.32 Screenshot of Create New Scene for Quiz1*

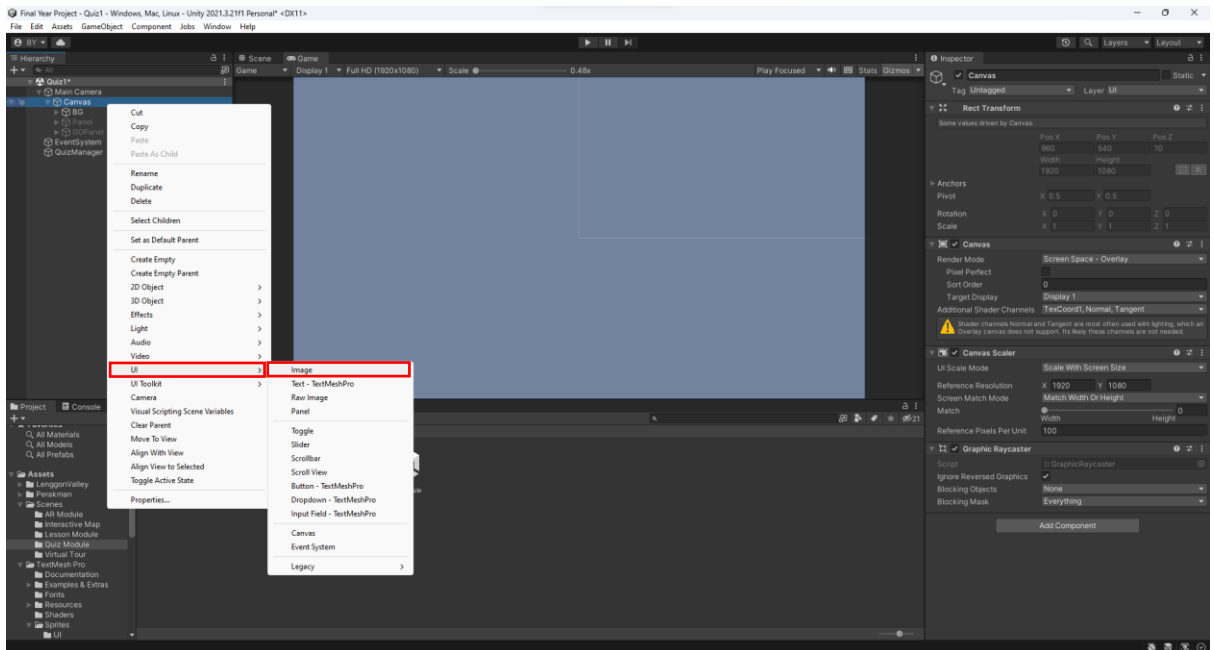
## CHAPTER 4

Create a new Game Object and name as BG.



*Figure 4.33 Screenshot of Create Game Object BG*

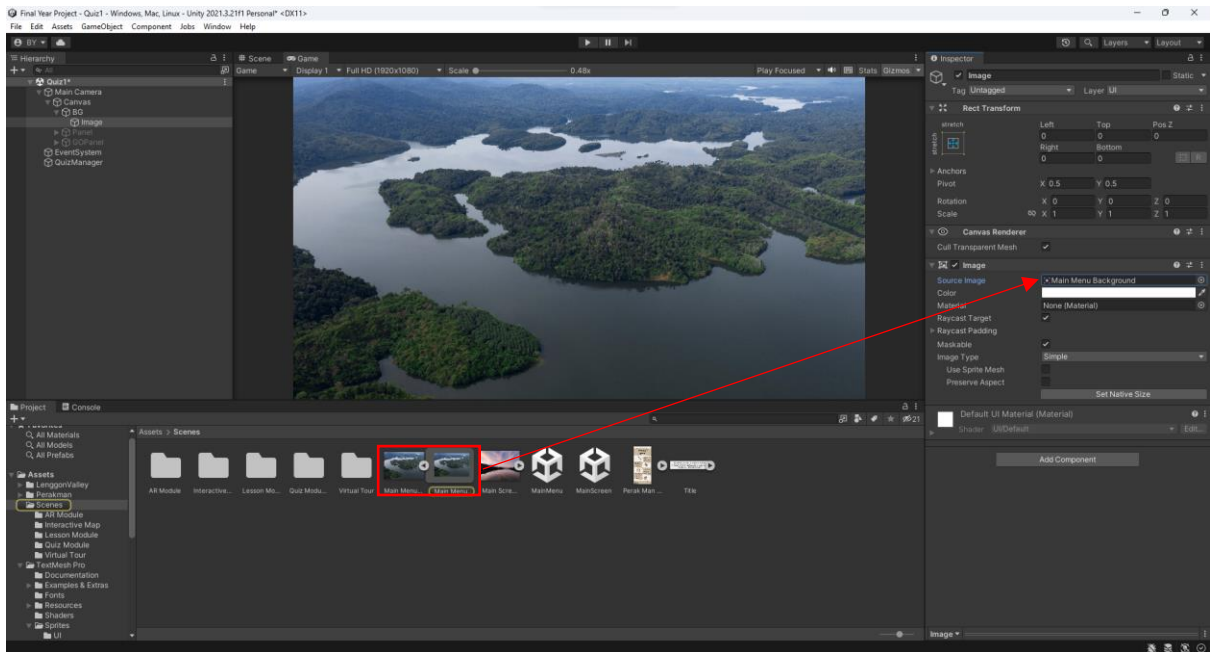
Right click on Canvas, select UI > Image to create an image element for the background. Drag the image element into the BG Game Object.



*Figure 4.34 Screenshot of Create Image Element*

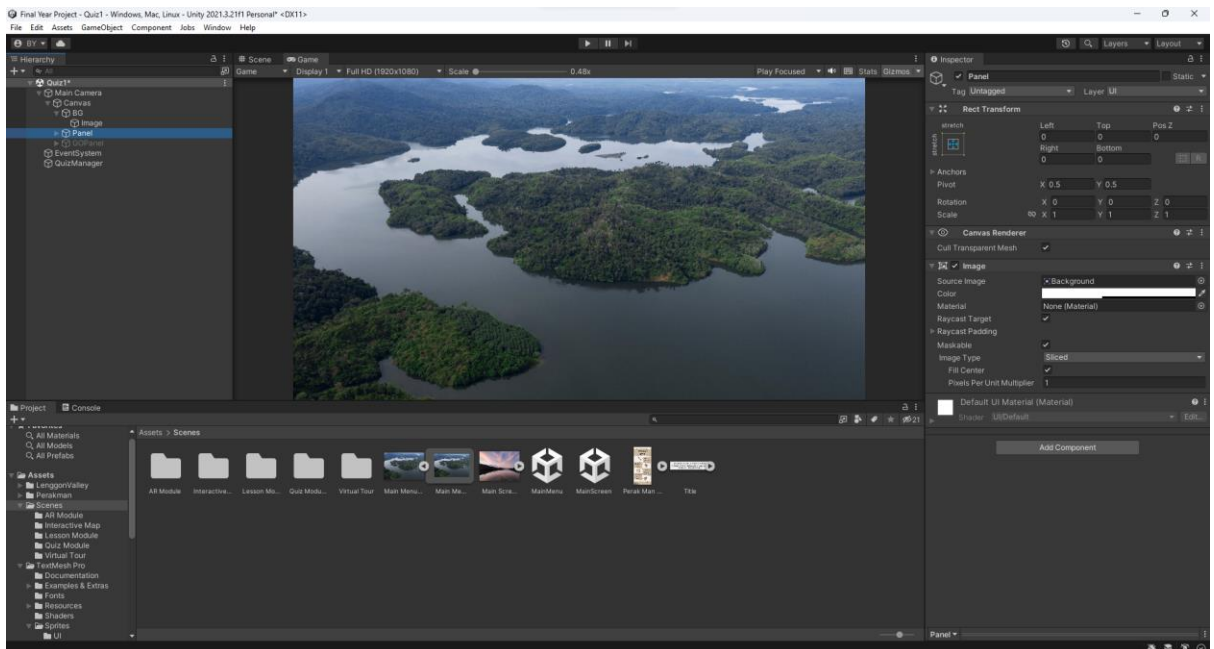
## CHAPTER 4

Drag the background image into the Source Image of the Image created.



*Figure 4.35 Screenshot of Drag and Drop Image into the Source Image*

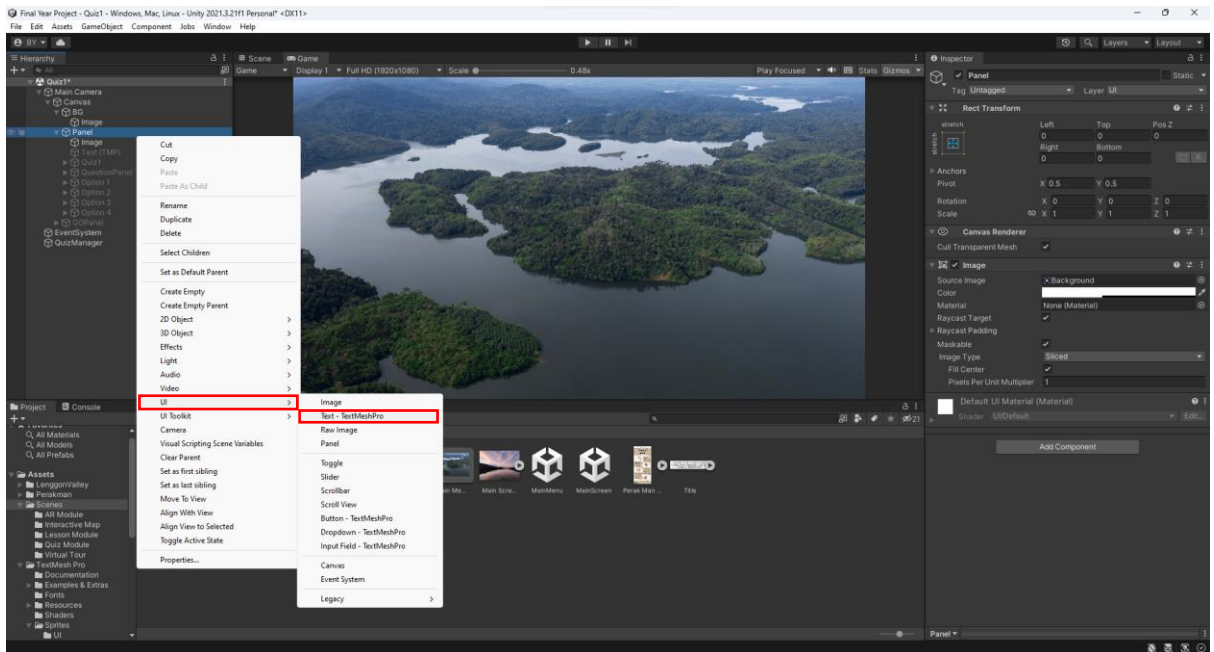
Create another Game Object and name as Panel.



*Figure 4.36 Screenshot of Create Game Object Panel*

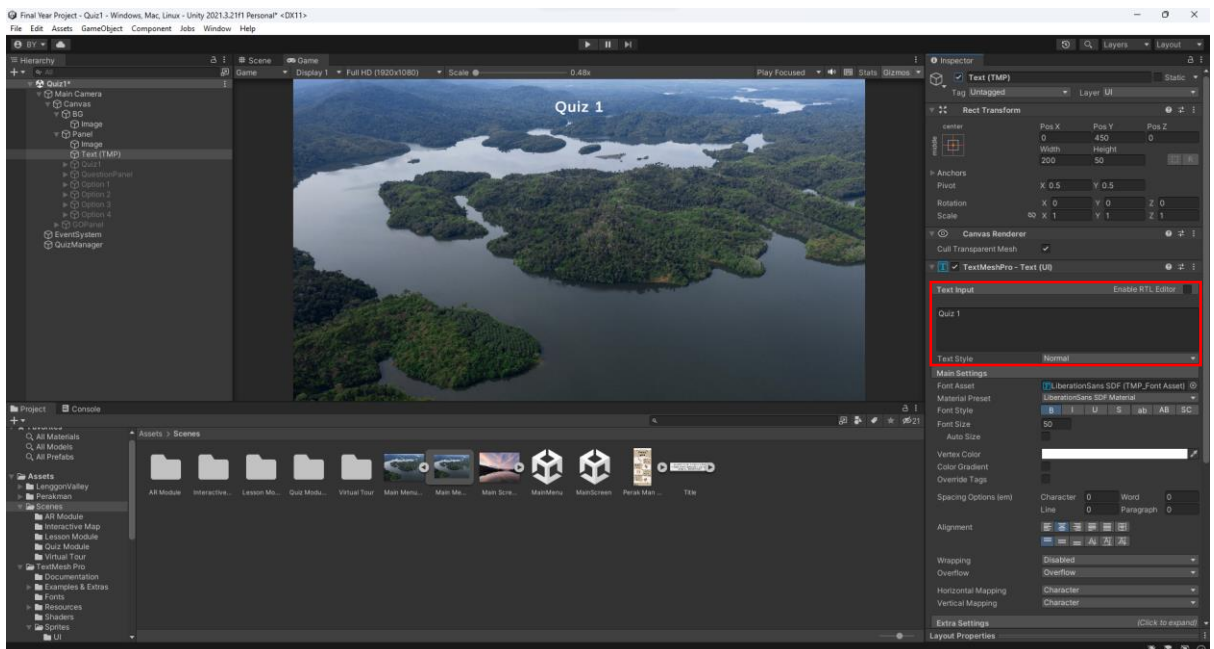
## CHAPTER 4

Right click on Panel, select UI > Text – TextMeshPro to create a text element for title.



*Figure 4.37 Screenshot of Create Text – TextMeshPro*

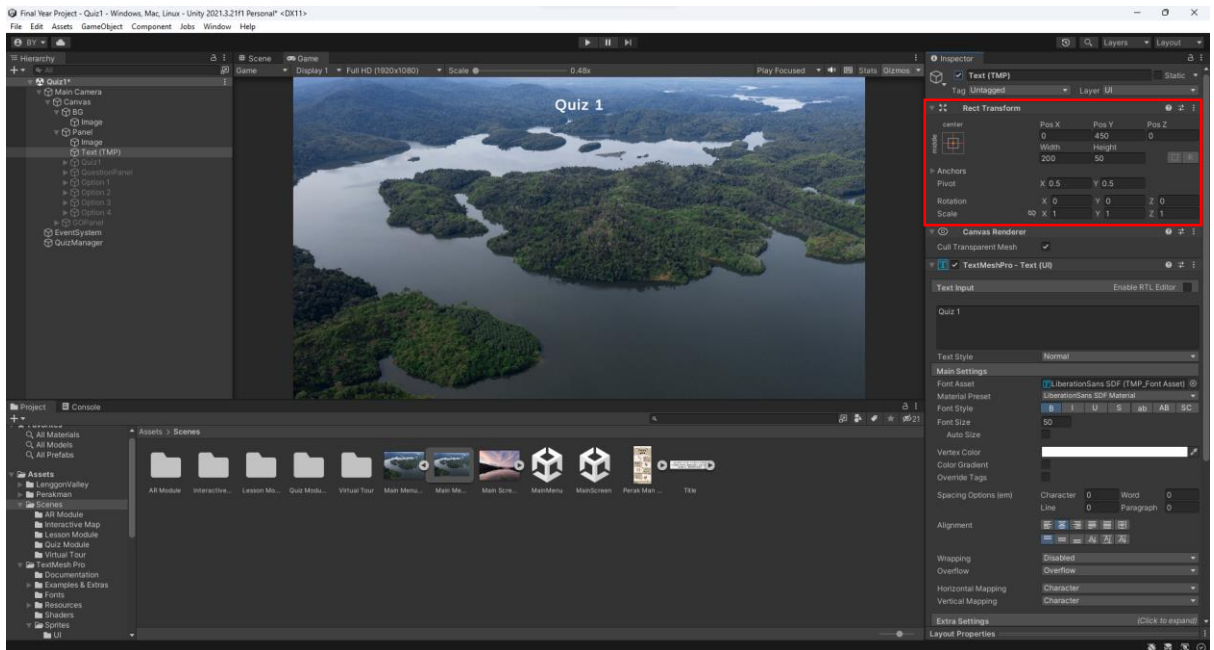
Edit the Text Input to set the title of the content interface.



*Figure 4.38 Screenshot of Edit Text Input*

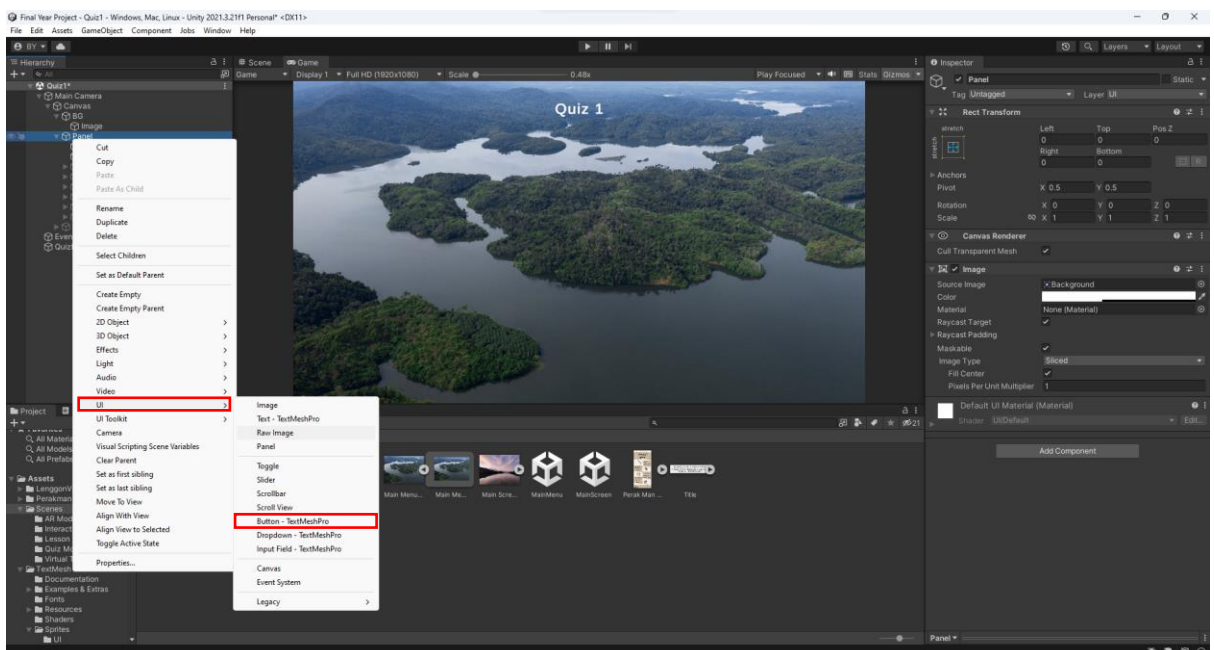
## CHAPTER 4

Adjust the position of the Title.



*Figure 4.39 Screenshot of Adjust Title Position*

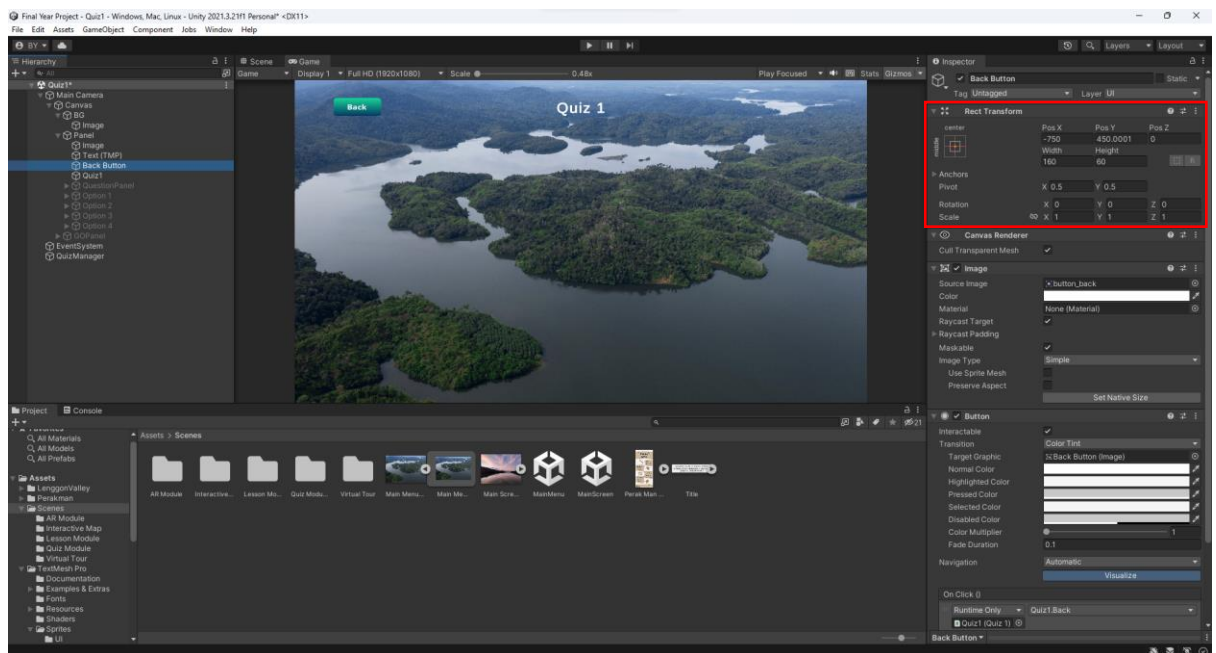
Right click on Canvas, select UI > Button - TextMeshPro to create a Back Button.



*Figure 4.40 Screenshot of Create Button - TextMeshPro*

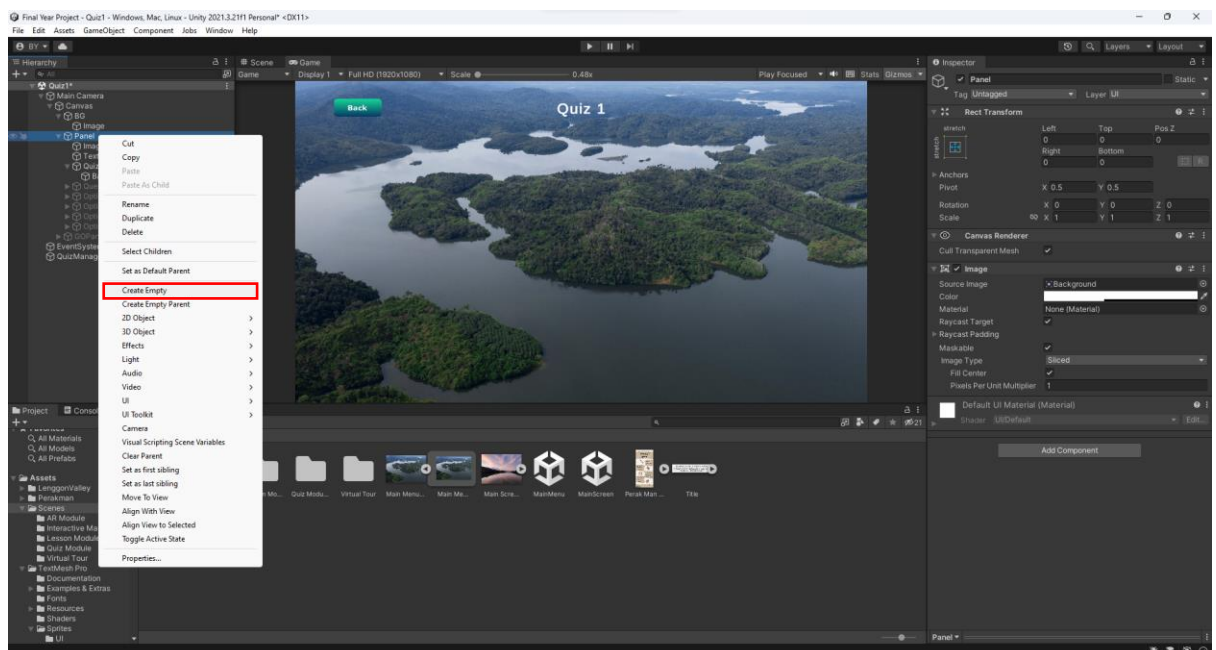
## CHAPTER 4

Adjust the position of the button and set the button width to 160 and height to 60.



*Figure 4.41 Screenshot of Adjust Button Position*

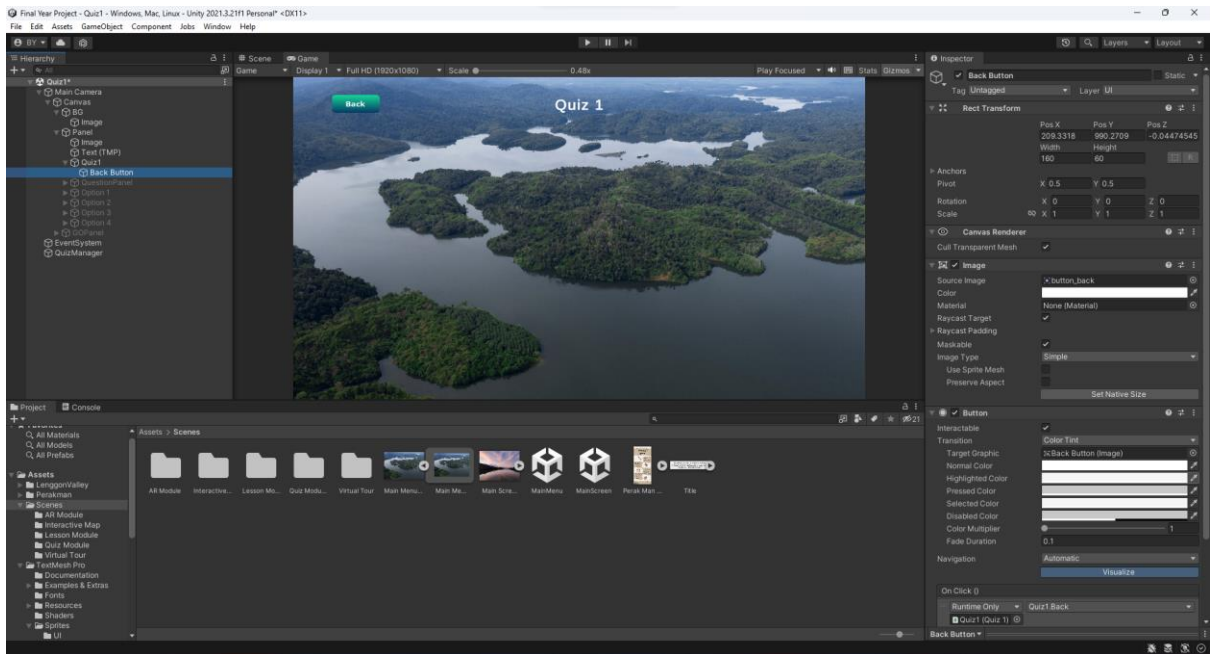
Right click on Canvas, select Create Empty Game Object and name as Quiz1.



*Figure 4.42 Screenshot of Create Empty Game Object*

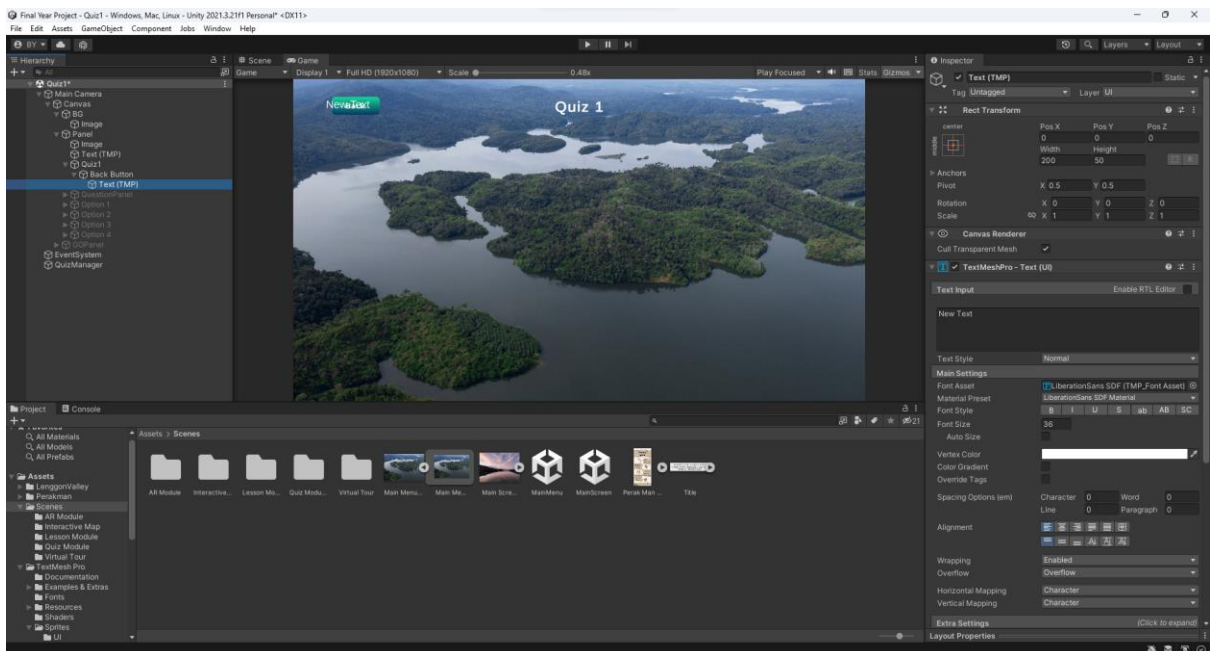
## CHAPTER 4

Drag the Back Button into Quiz1 Game Object.



*Figure 4.43 Screenshot of Drag and Drop Back Button*

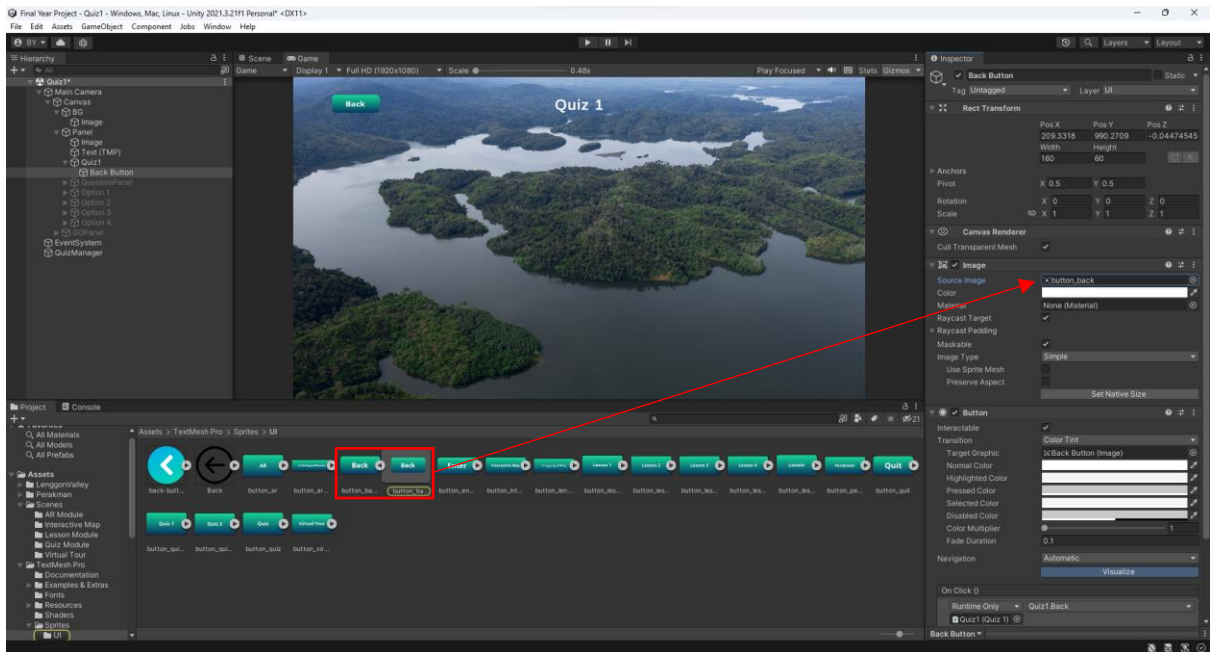
Remove Text(TMP) in the Back Button section to remove the default UI for the button.



*Figure 4.44 Screenshot of Remove Text(TMP) in Back Button*

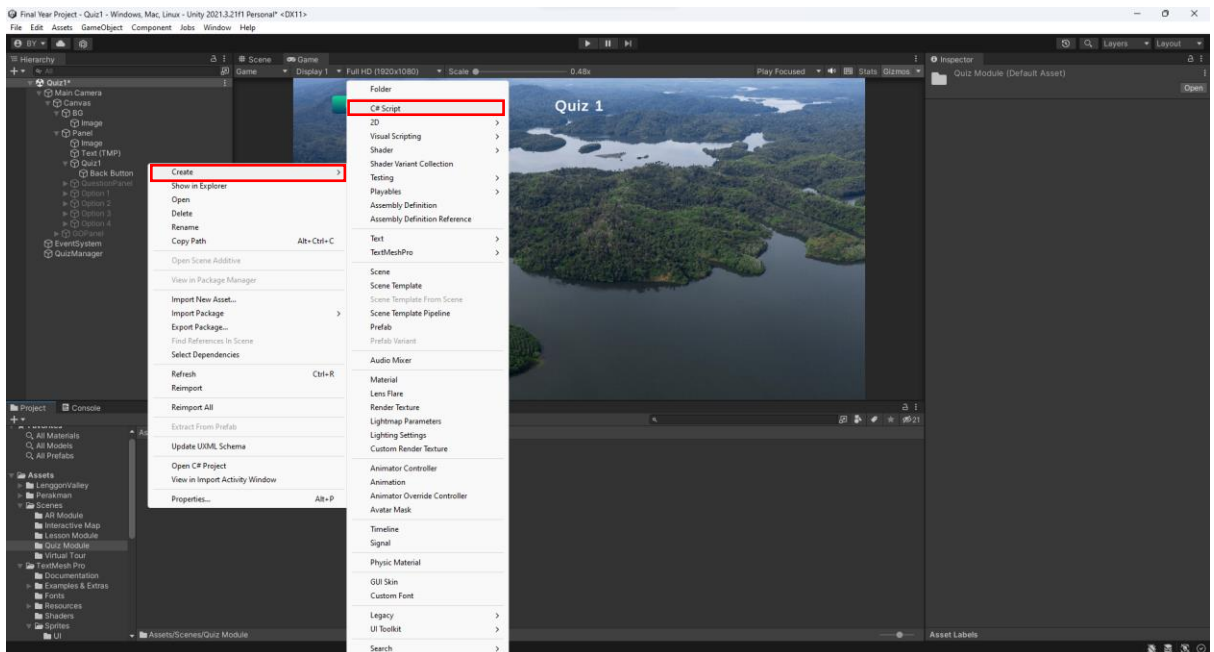
## CHAPTER 4

Drag and drop the UI of Back Button into the Source image of the button.



*Figure 4.45 Screenshot of Drag and Drop UI of Back Button into Source Image*

Right click select Create > C# Script to create a new C# Script and name it as Quiz1 in Quiz Module folder.

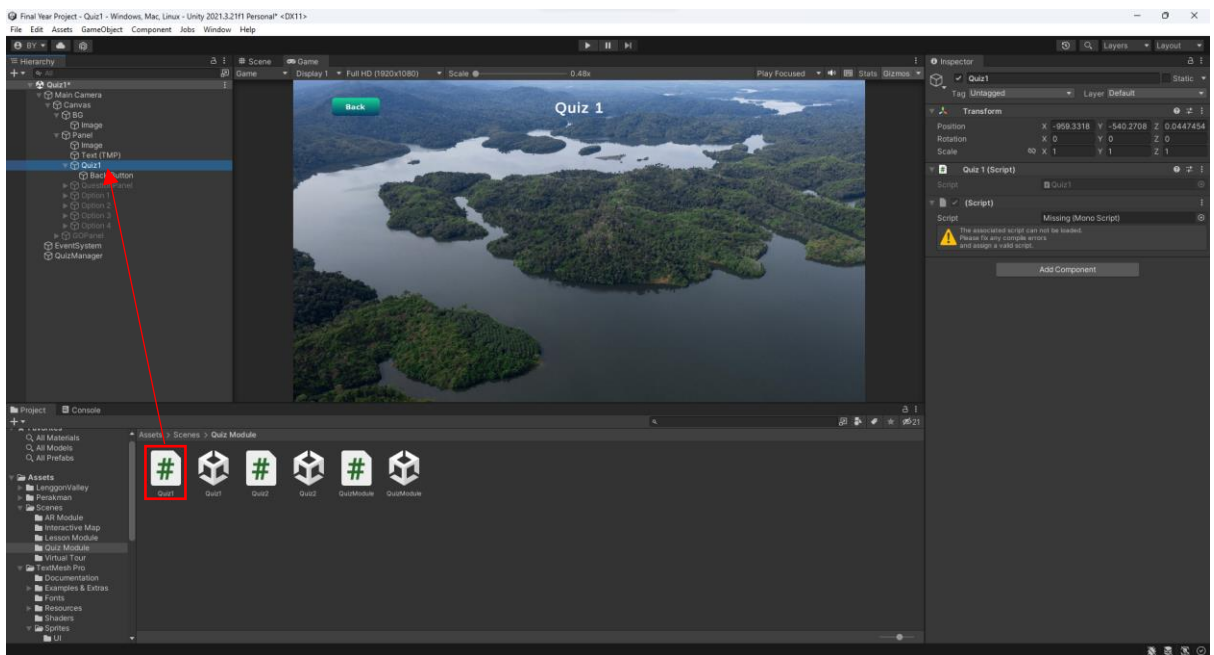


*Figure 4.46 Screenshot of Create New C# Script*



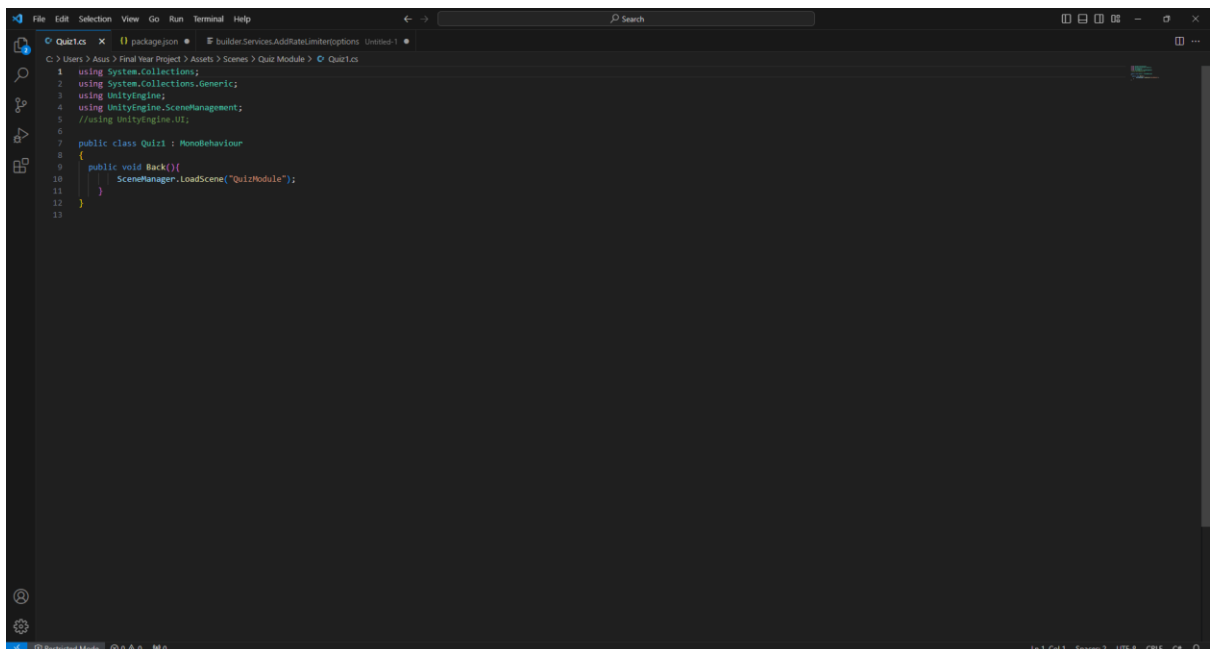
## CHAPTER 4

Drag and Drop the Quiz1 Script into Quiz1 Game Object.



*Figure 4.47 Screenshot of Drag and Drop Quiz1*

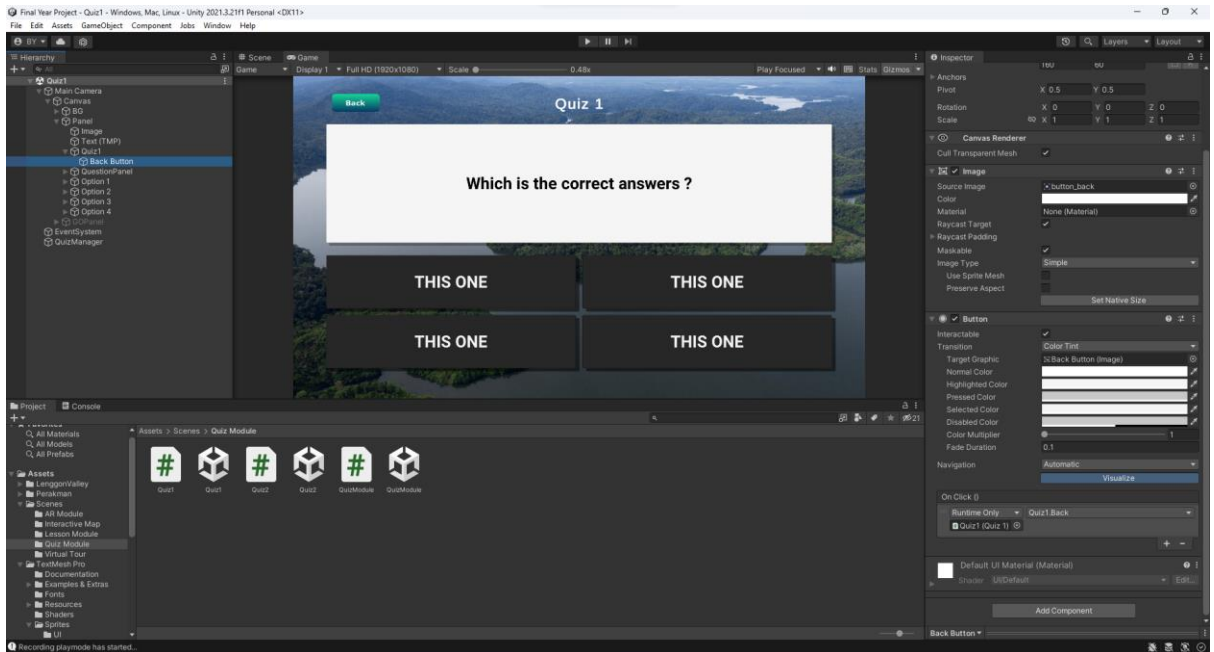
Code the Quiz1 Script for the back function.



*Figure 4.48 Screenshot of Code for Quiz1*

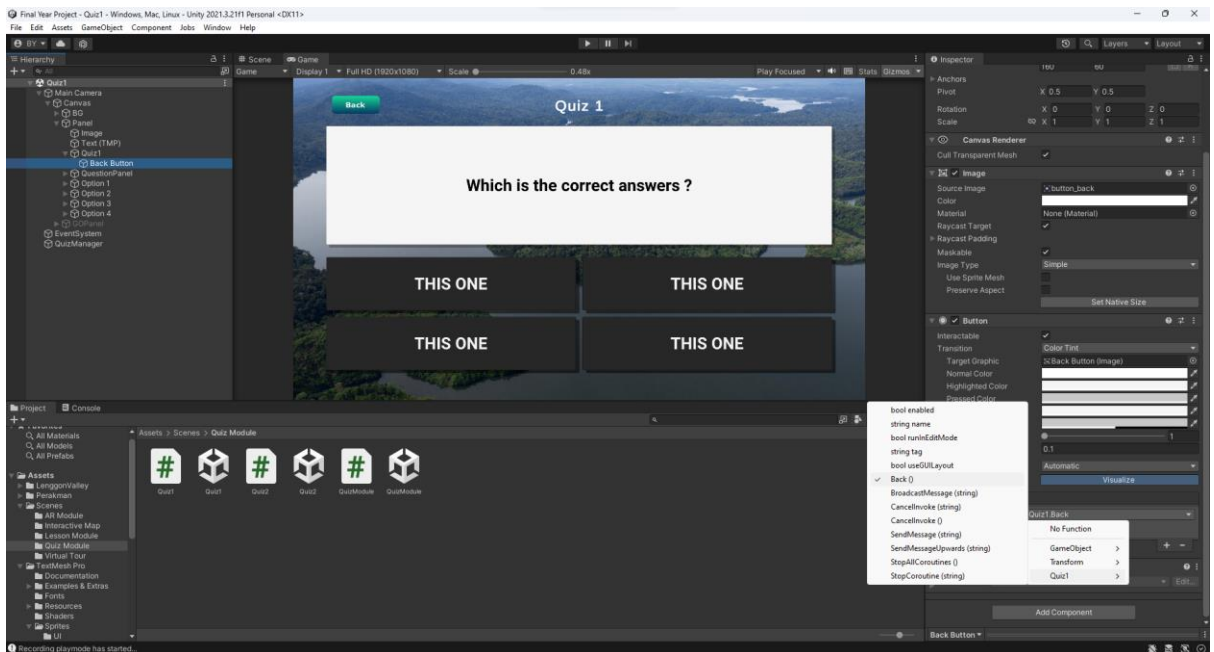
## CHAPTER 4

Select the Back Button, Add an OnClick function and Drag and Drop the Quiz1 Game Object into the Object panel.



*Figure 4.49 Screenshot of Drag and Drop Quiz1 into the Object panel*

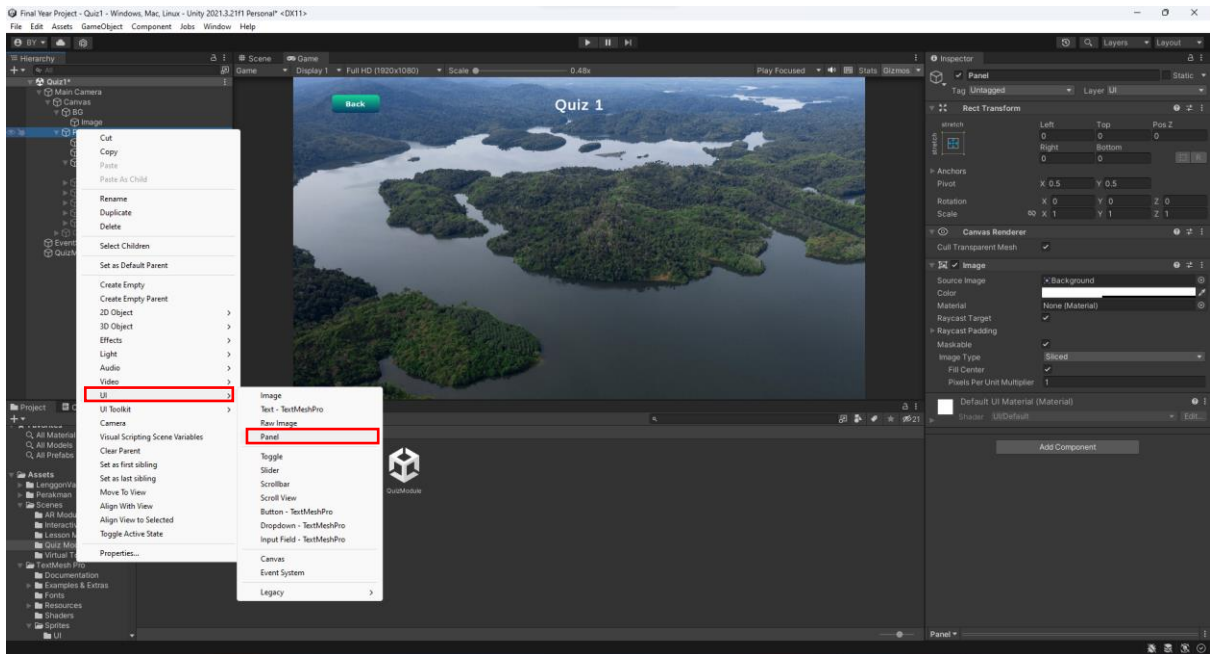
Next, select Quiz1 in the function panel, then Back() function.



*Figure 4.50 Screenshot of Setting Up Back Function*

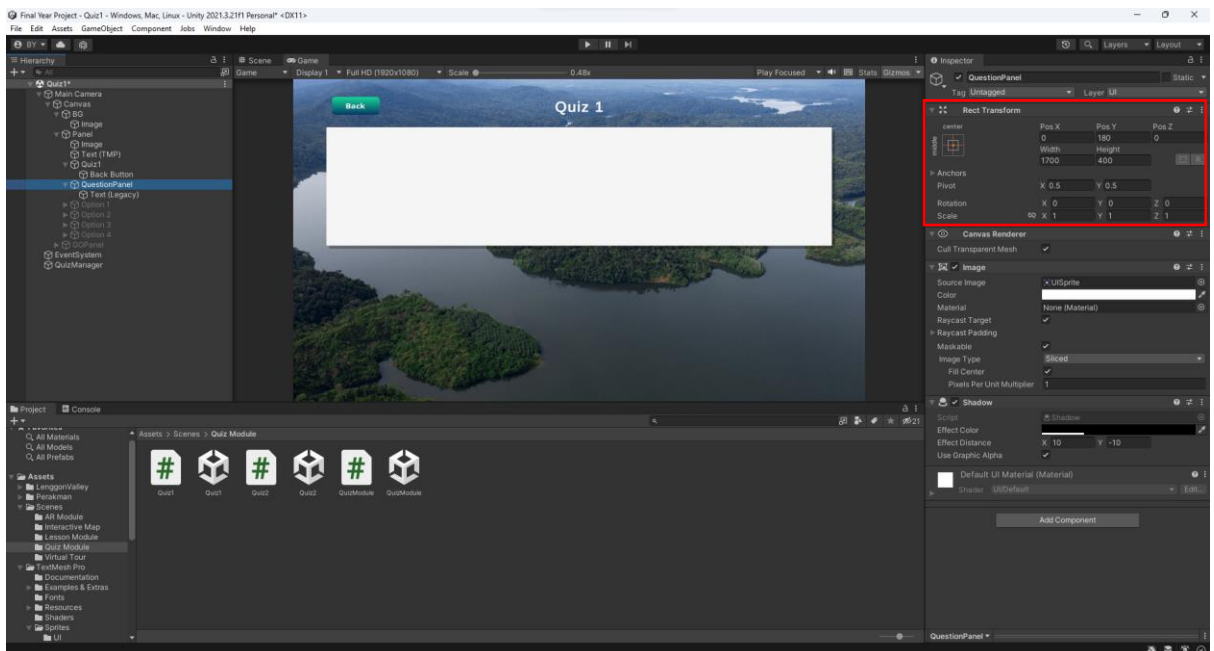
## CHAPTER 4

Right click on Panel, Create UI > Panel and name it as QuestionPanel.



*Figure 4.51 Screenshot of Create Question Panel*

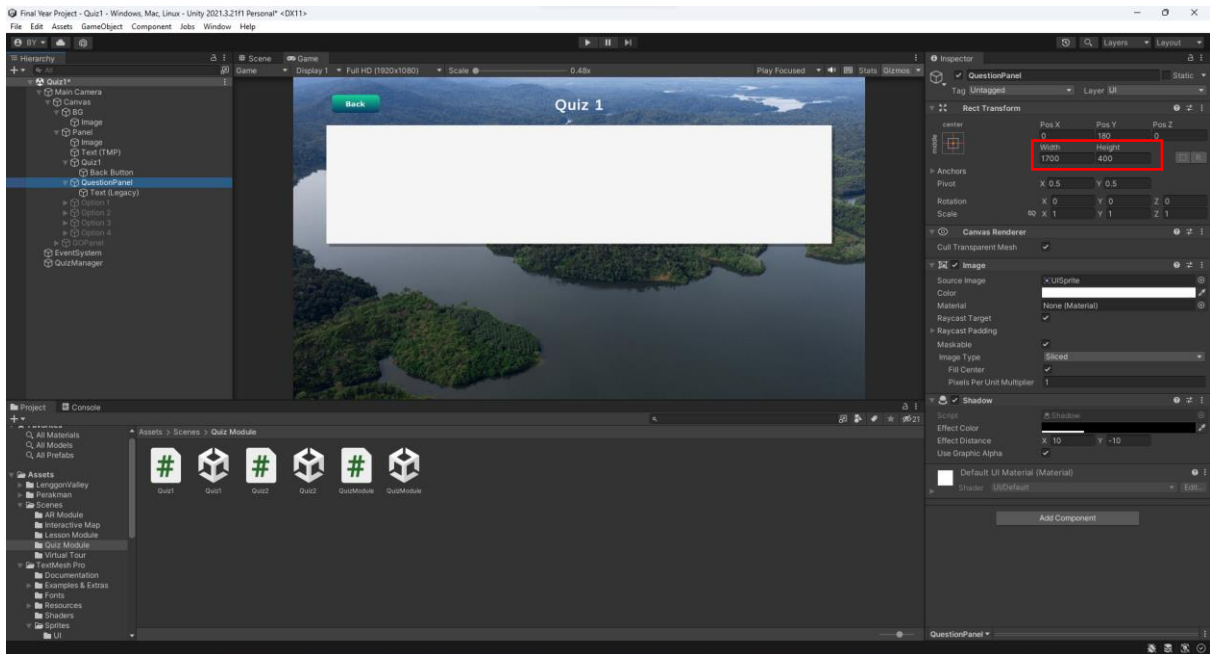
Adjust the position of the Question Panel.



*Figure 4.52 Screenshot of Adjust Panel Position*

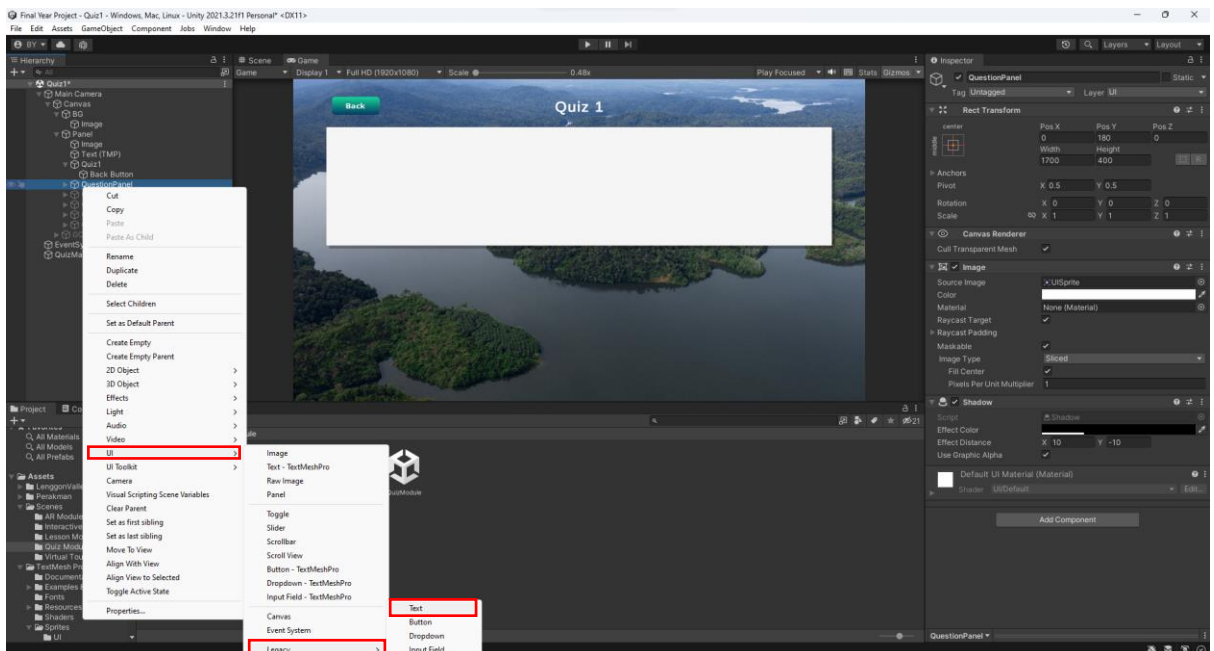
## CHAPTER 4

Set the panel width to 1700 and panel height to 400.



*Figure 4.53 Screenshot of Adjust Panel Size*

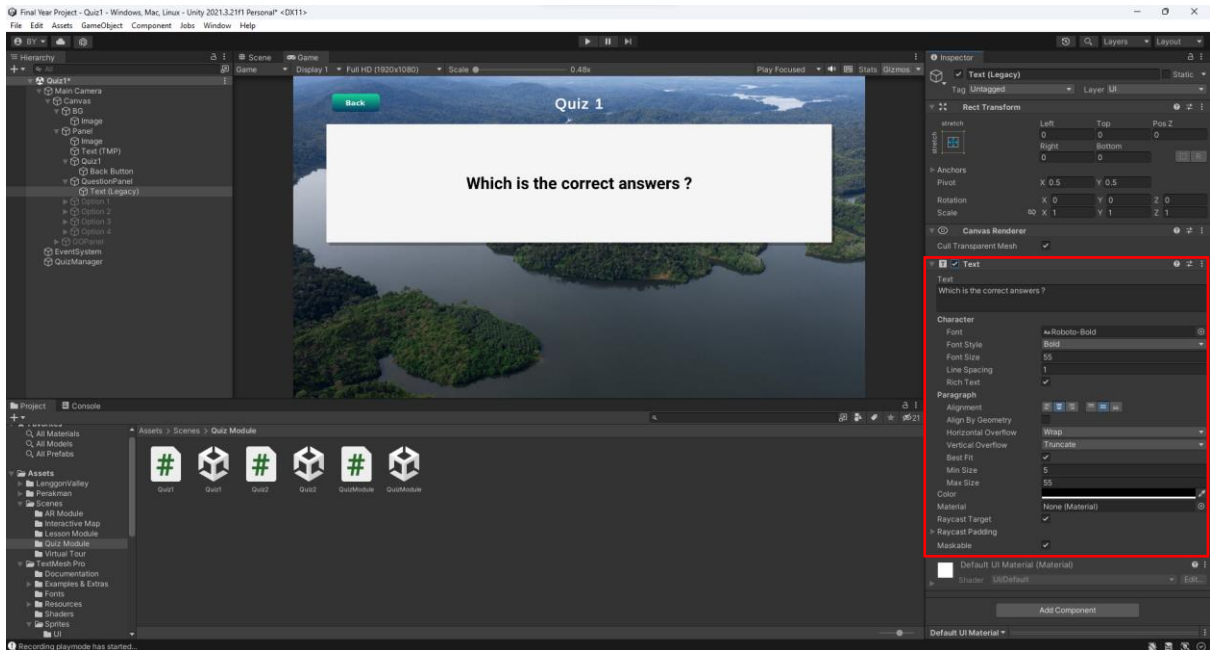
Right click on the QuestionPanel, Create UI > Legacy > Text.



*Figure 4.54 Screenshot of Create Text(Legacy)*

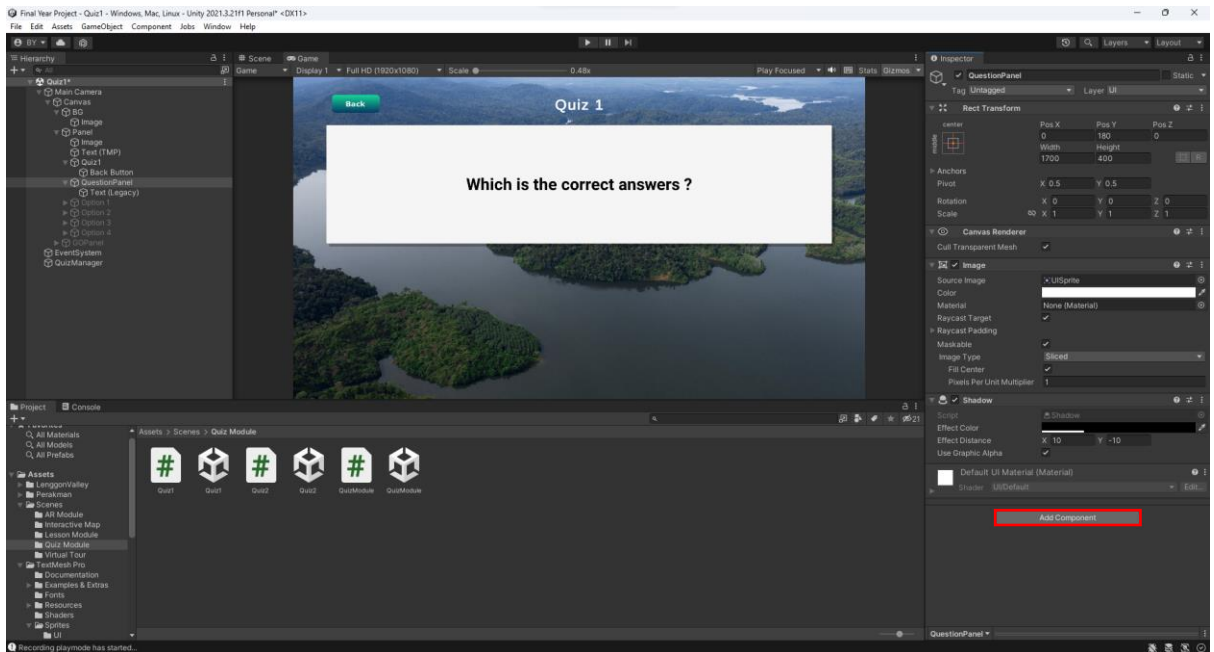
## CHAPTER 4

Edit the text in the Text(Legacy) into “ Which is the correct answers?” and set the Font to Roboto-Bold, set the Font Style to Bold and set the Font Size into 55.



*Figure 4.55 Screenshot of Edit Text*

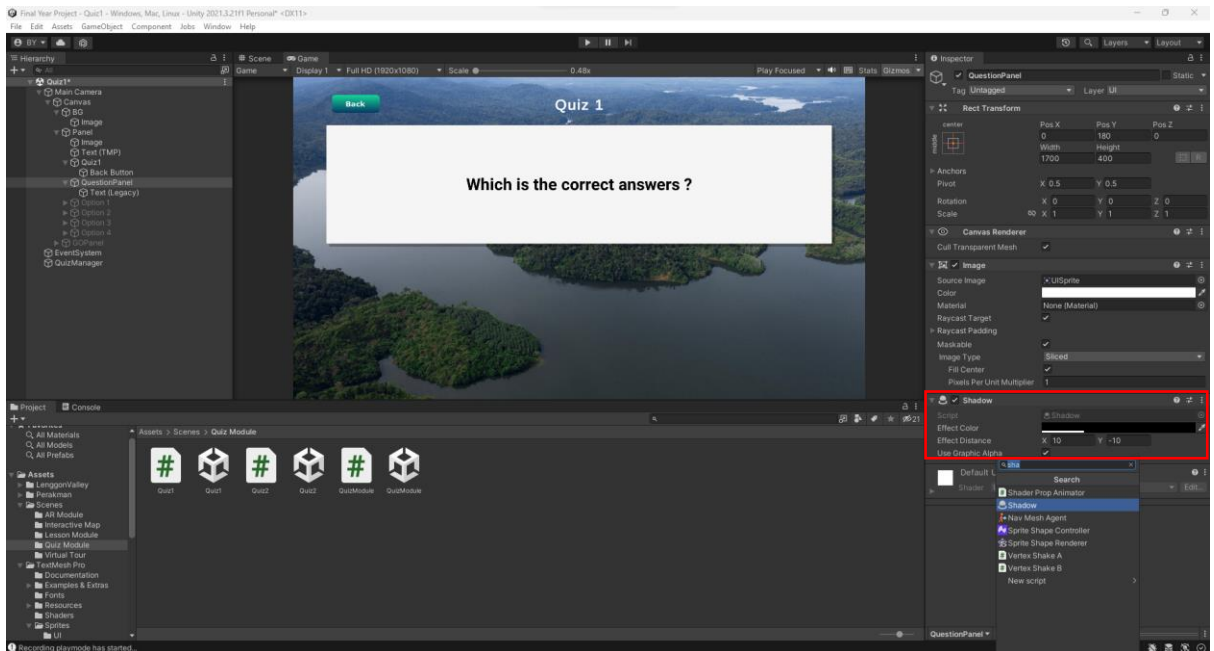
Select Add Component.



*Figure 4.56 Screenshot of Add Component*

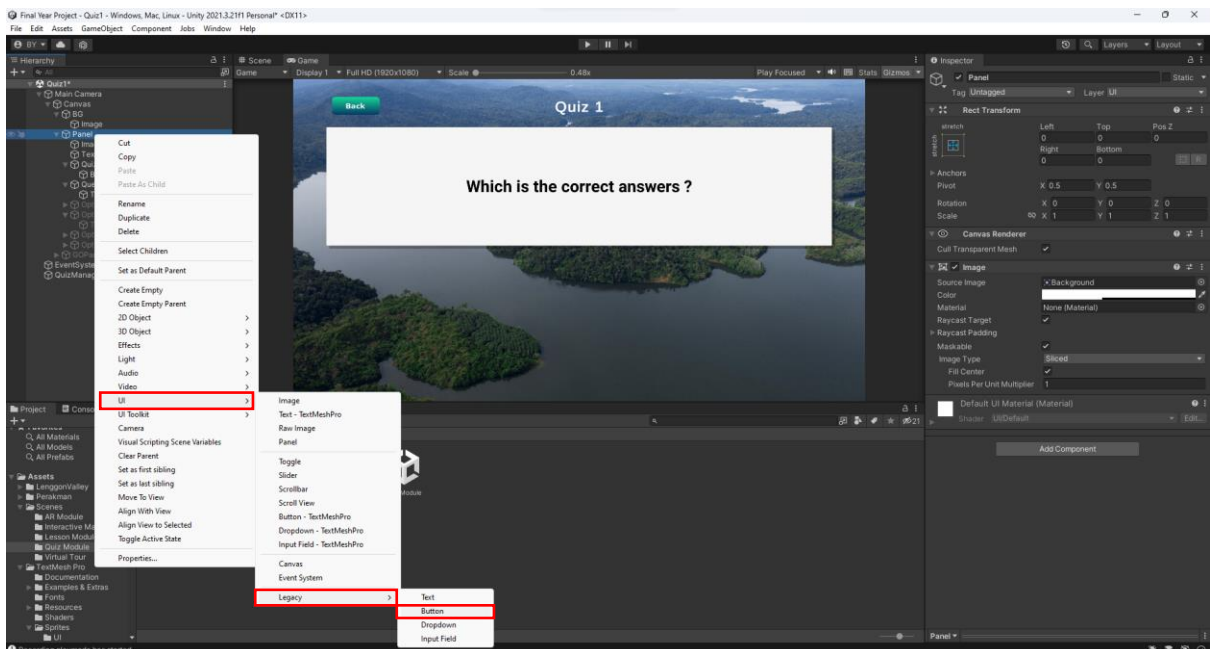
## CHAPTER 4

Select Shadow and set the Effect Distance X into 10 and Y into -10.



*Figure 4.57 Screenshot of Create Shadow Effect*

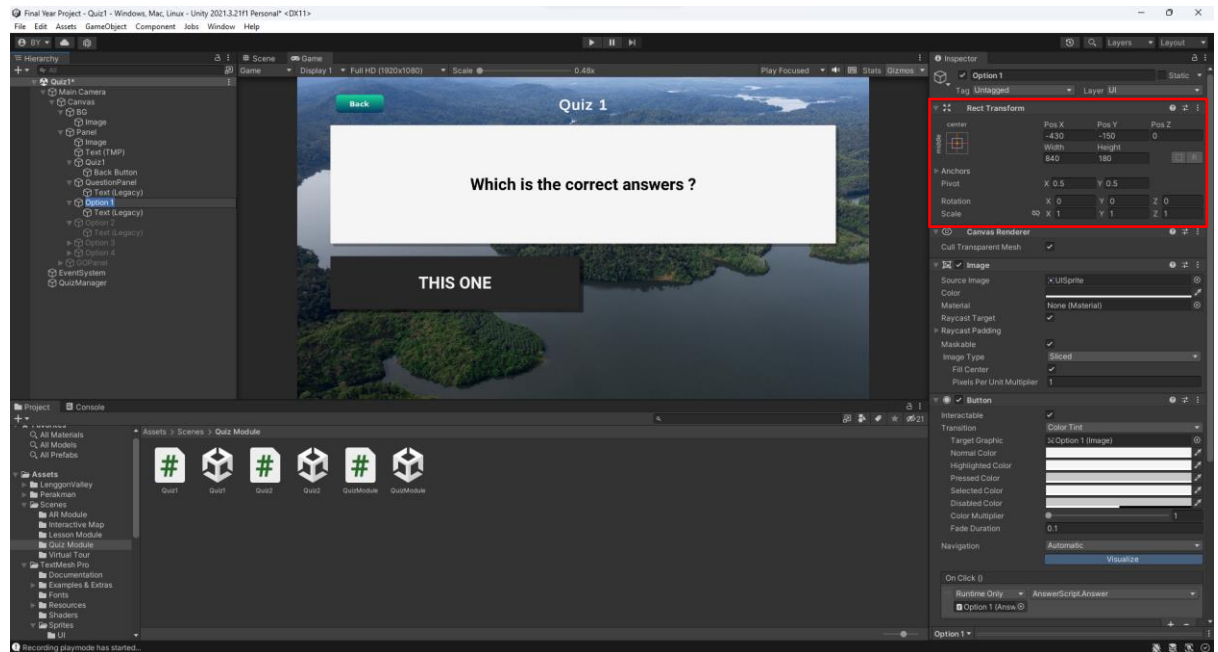
Right click on Panel, create UI > Legacy > Button and name it as Option1.



*Figure 4.58 Screenshot of Create Button(Legacy)*

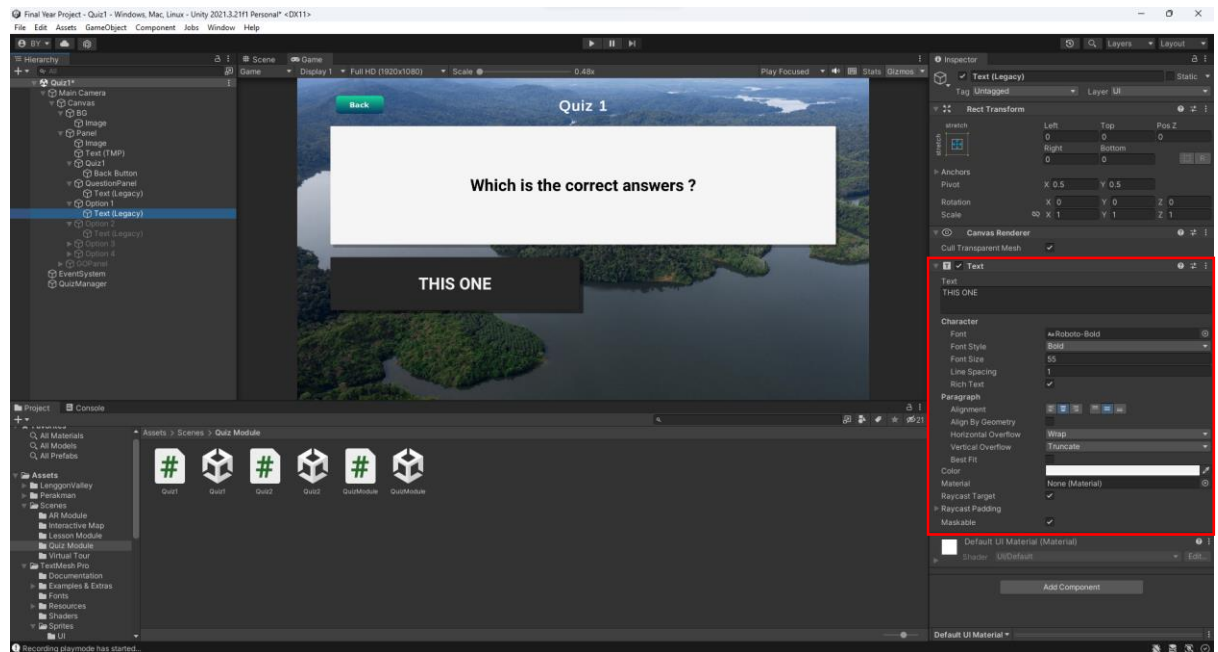
## CHAPTER 4

Adjust the position of the Option1.



*Figure 4.59 Screenshot of Adjust Button Position*

Edit the text in the Text(Legacy) into “ THIS ONE” and set the Font to Roboto-Bold, set the Font Style to Bold and set the Font Size into 55.



*Figure 4.60 Screenshot of Edit Button*

## CHAPTER 4

In Option1, select Add Component.

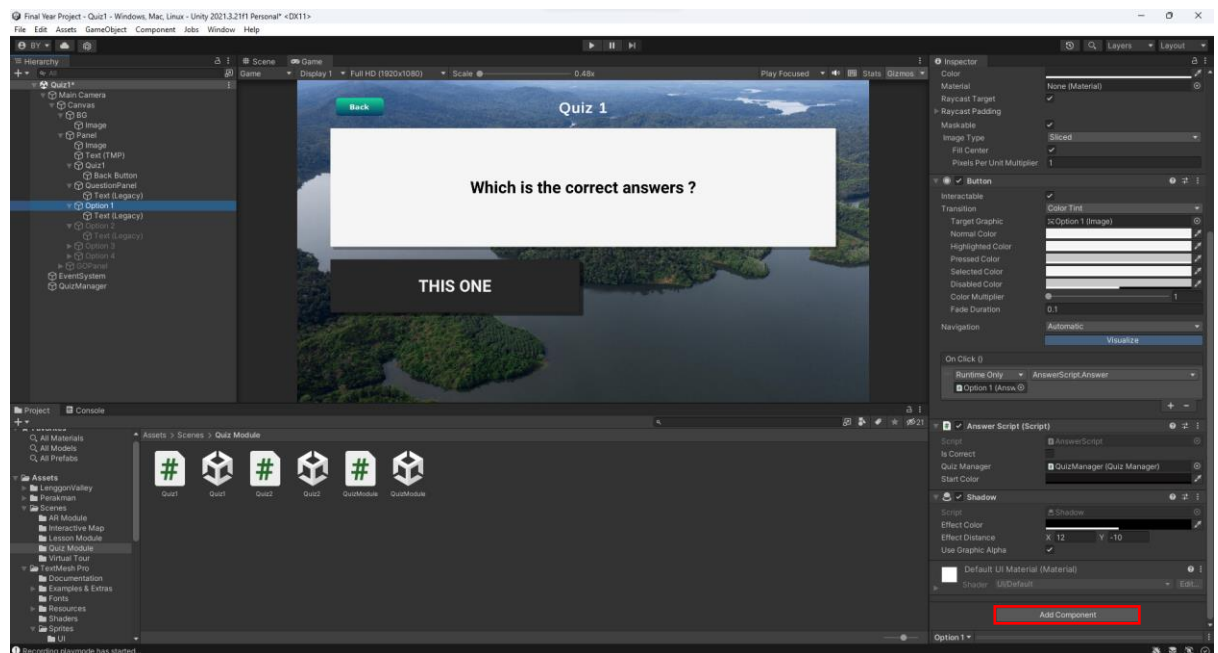


Figure 4.61 Screenshot of Add Component

Select Shadow and set the Effect Distance X to 12 and Y to -10.

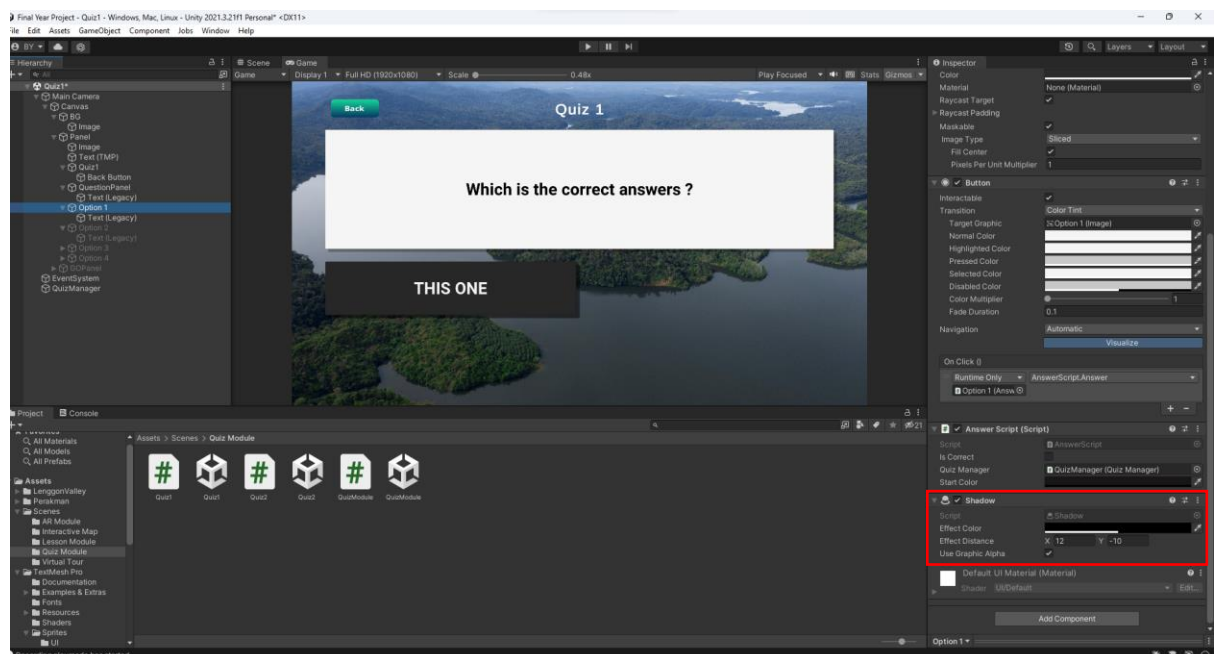
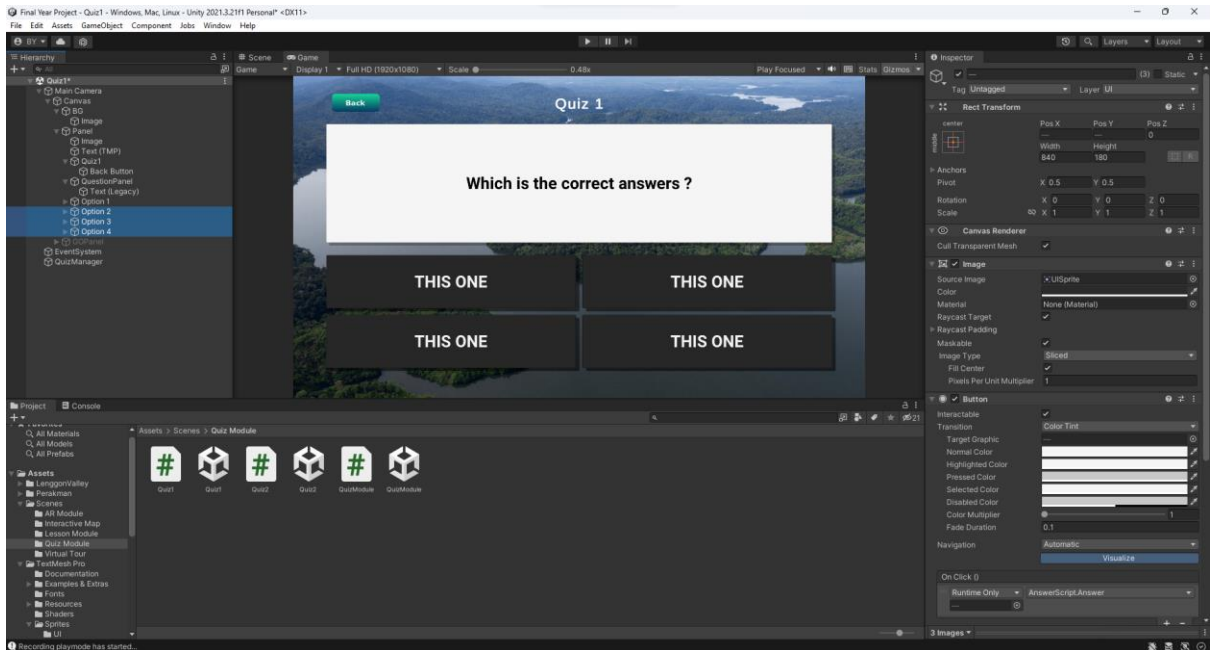


Figure 4.62 Screenshot of Create Shadow Effect



## CHAPTER 4

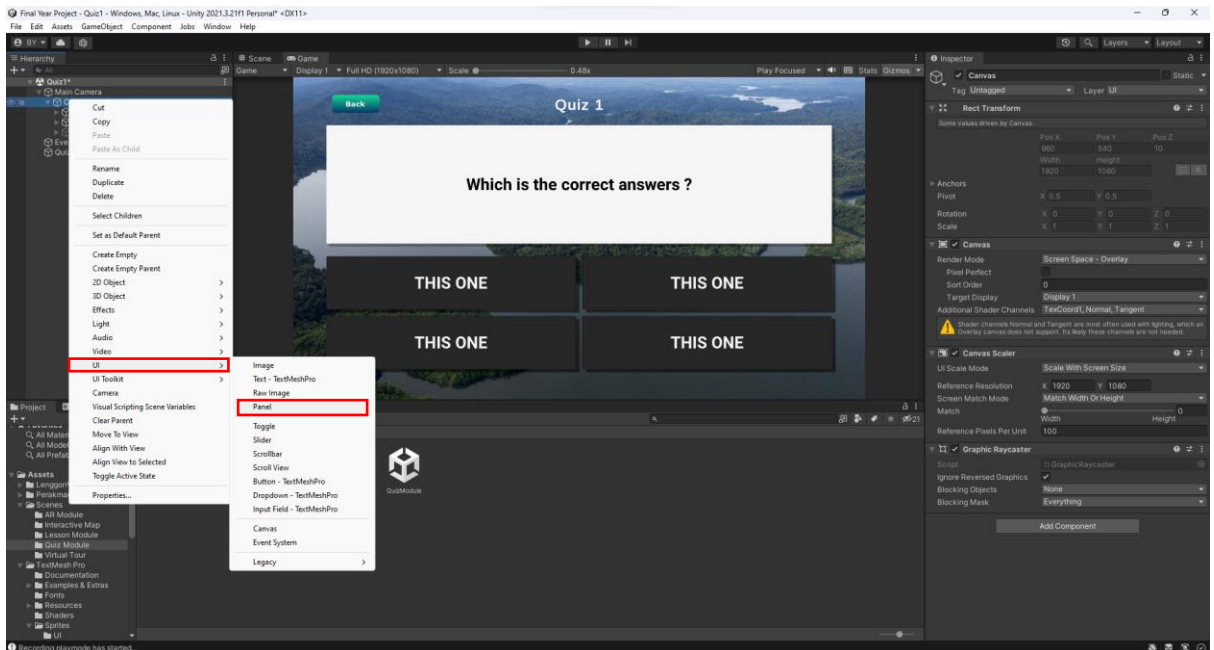
Duplicate Option1 into three buttons and name them as Option2, Option3, and Option4 and adjust the position of each button respectively.



*Figure 4.63 Screenshot of Duplicate Buttons*

### Create UI for Game Over Panel

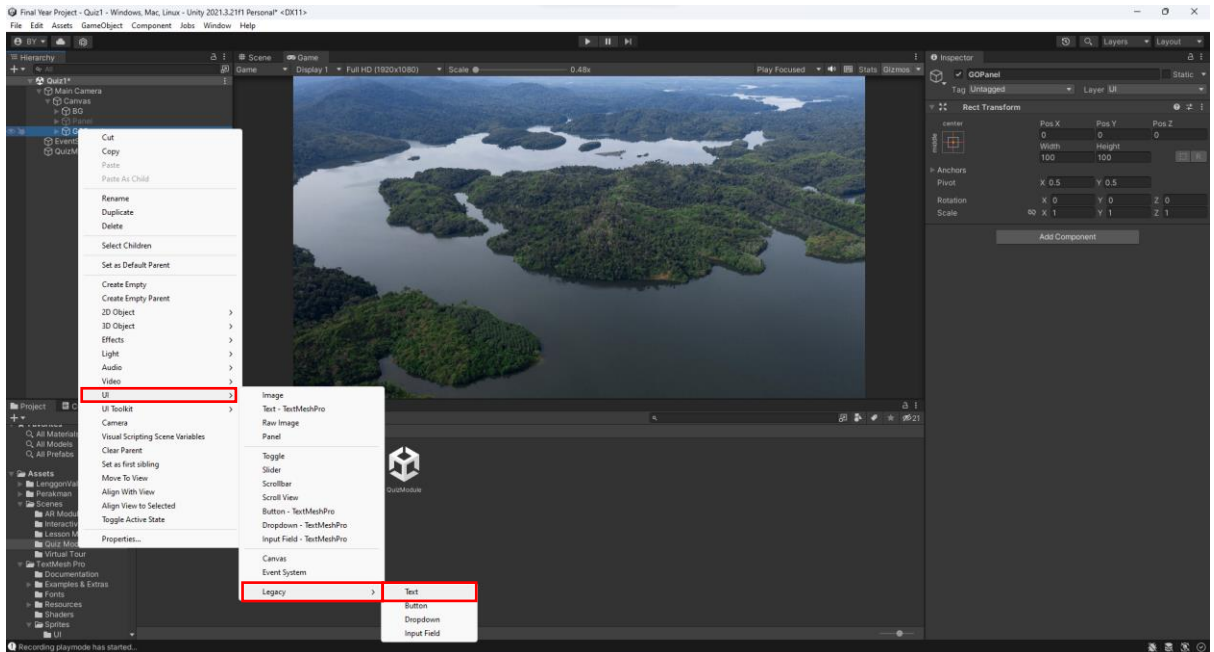
Right Click on Canvas, create UI > Panel and name it as GOPanel.



*Figure 4.64 Screenshot of Create GOPanel*

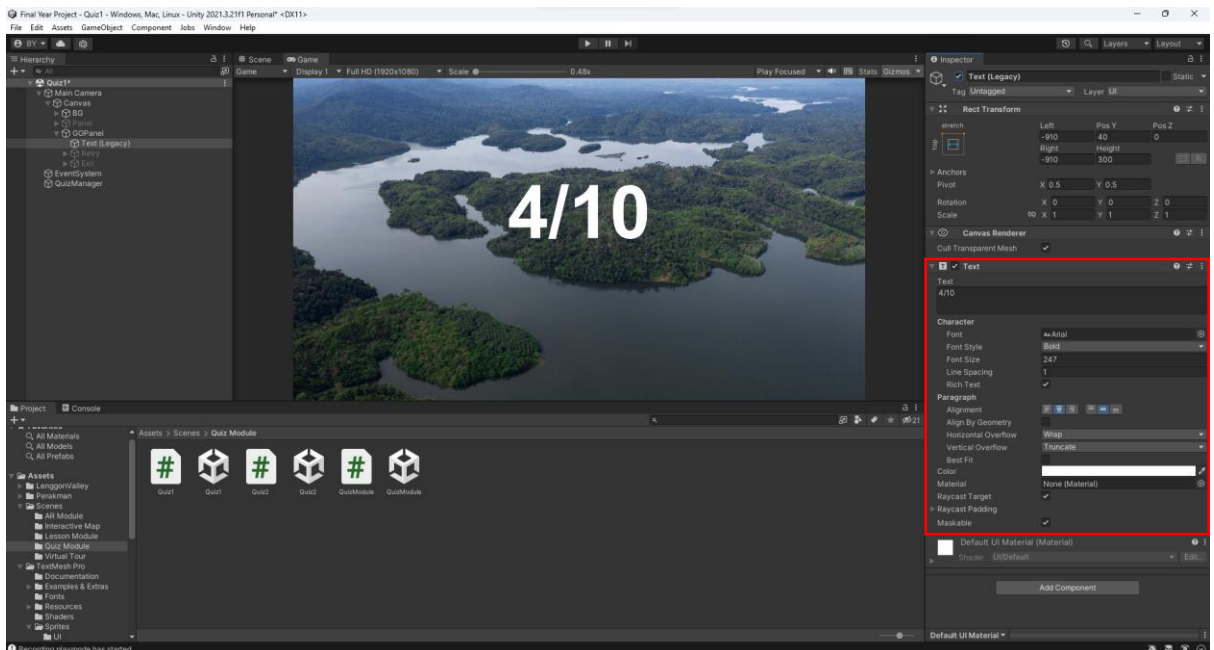
## CHAPTER 4

Right Click on GOPanel, create UI > Legacy > Text to create a text element to show score.



*Figure 4.65 Screenshot of Create Text(Legacy)*

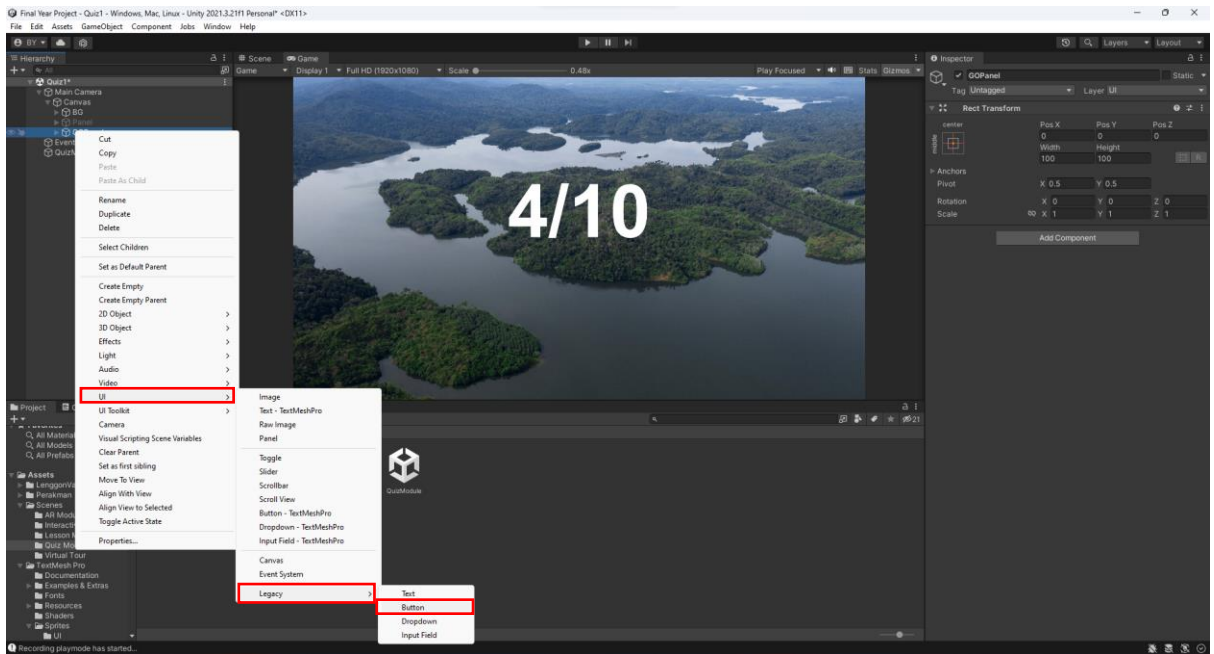
Adjust the position of the score and edit the default text for score into '4/10'.



*Figure 4.66 Screenshot of Edit Text*

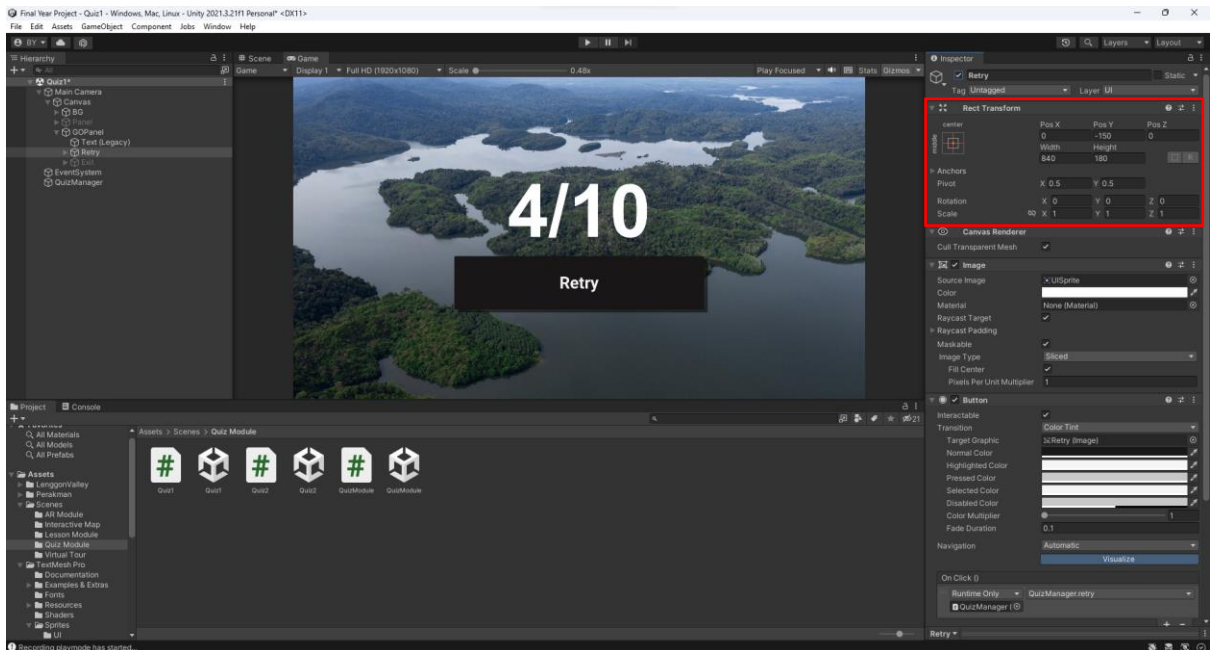
## CHAPTER 4

Right click on GOPanel, create UI > Legacy > Button and name the button as Retry.



*Figure 4.67 Screenshot of Create Button(Legacy)*

Adjust the position of the button and set the button width to 840 and button height to 180.



*Figure 4.68 Screenshot of Adjust Button Position*

## CHAPTER 4

In Retry button, edit the text in the Text(Legacy) into “ Retry” and set the Font to Roboto-Bold, set the Font Style to Bold and set the Font Size into 55.

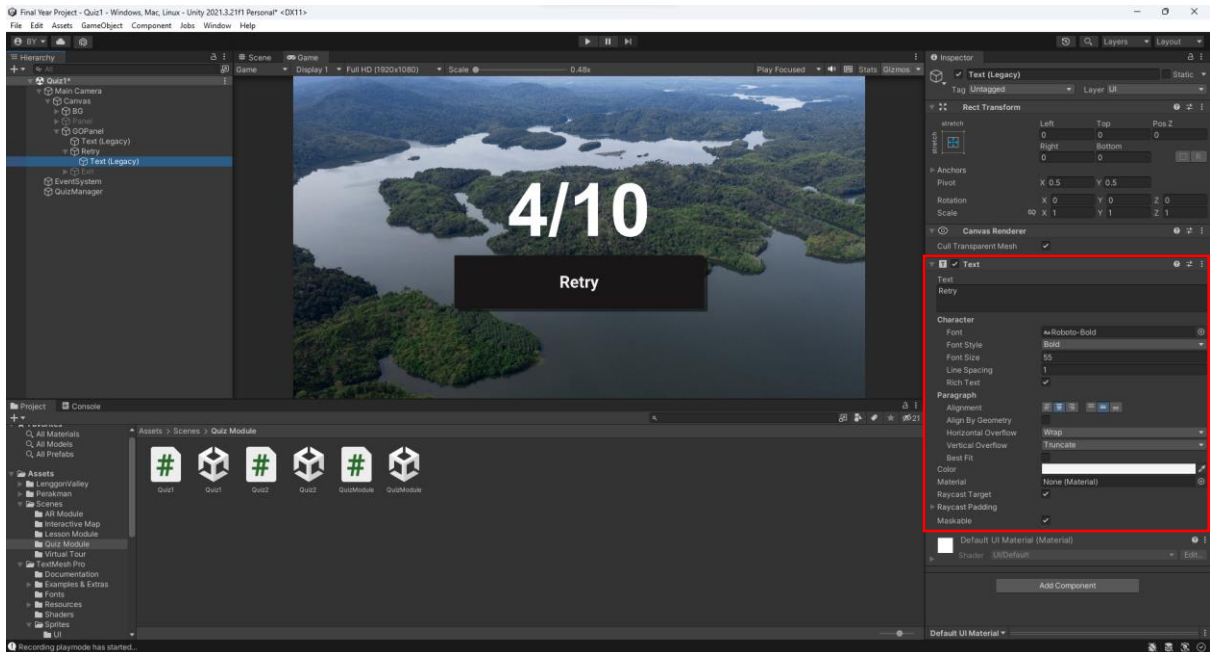


Figure 4.69 Screenshot of Edit Button

In Retry button, select Add Component.

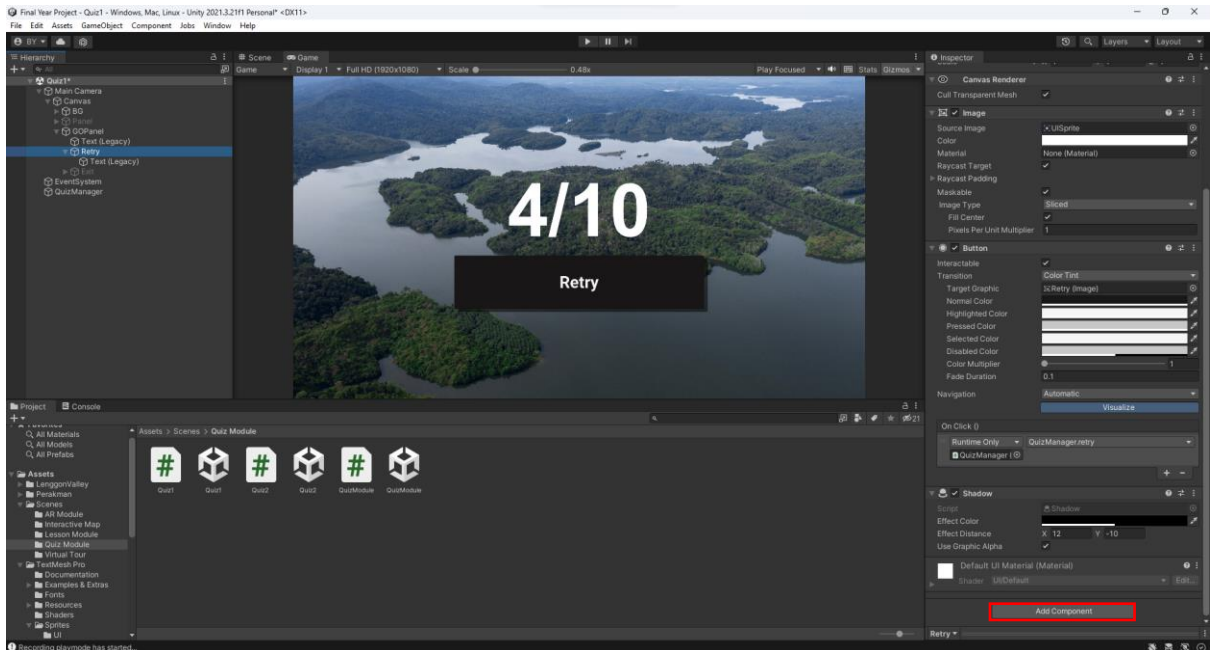


Figure 4.70 Screenshot of Add Component

## CHAPTER 4

### Select Shadow.

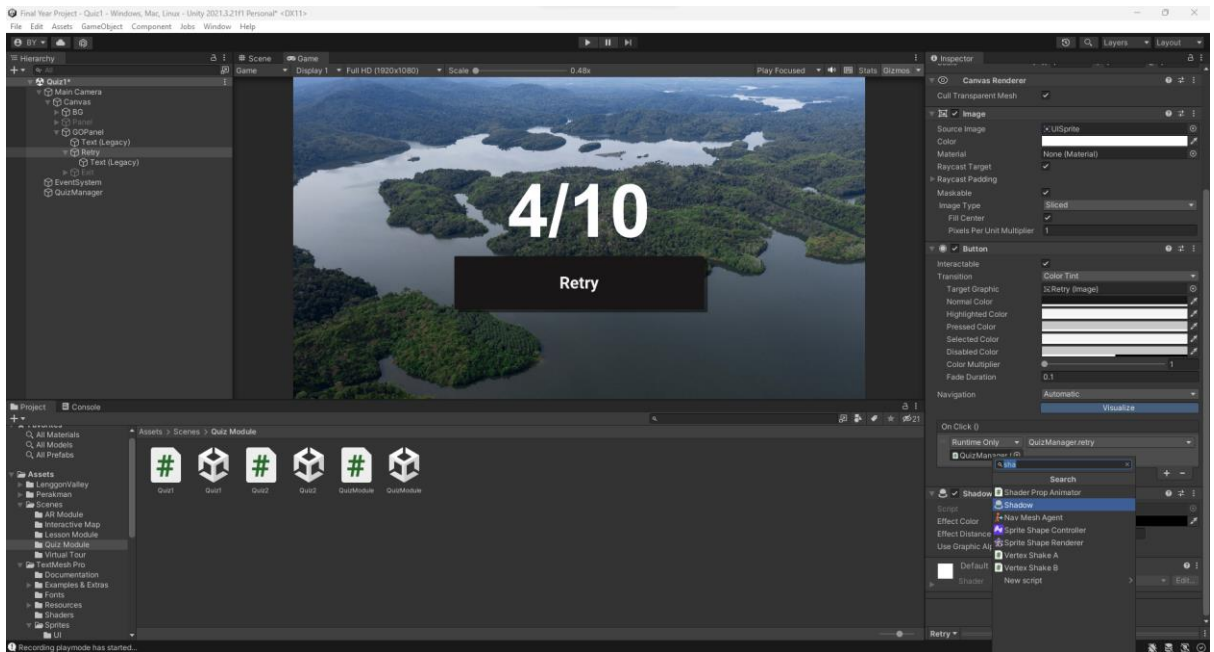


Figure 4.71 Screenshot of Select Shadow Component

Set the Effect Distance of X into 12 and Y into -10.

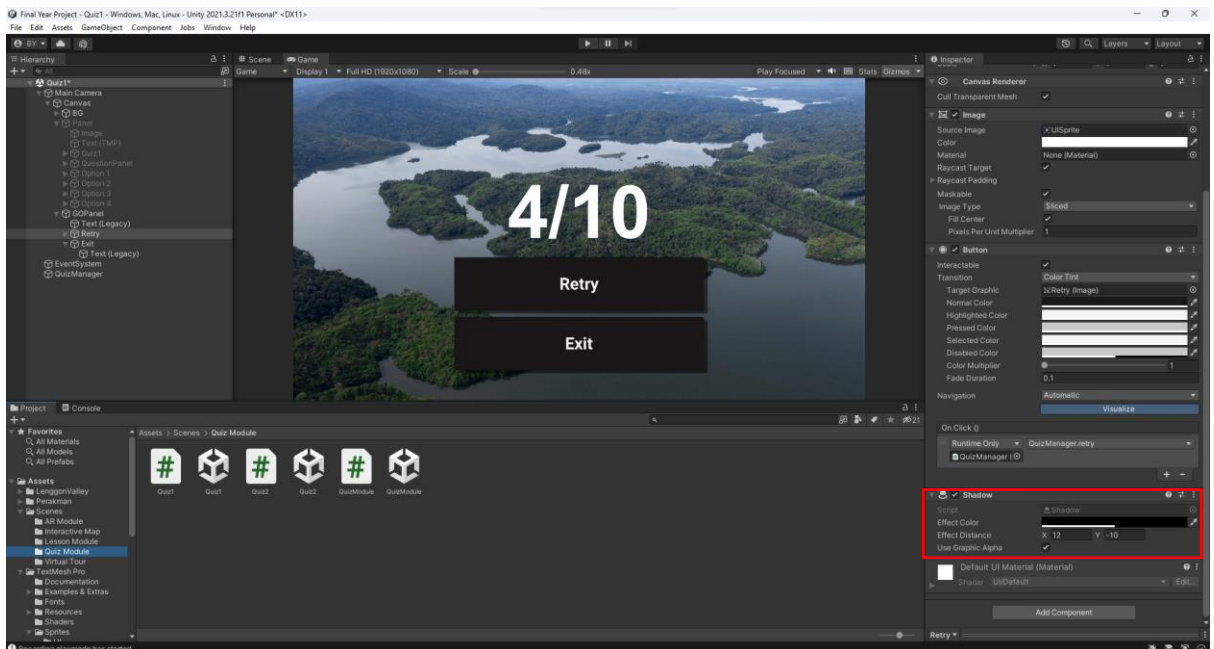
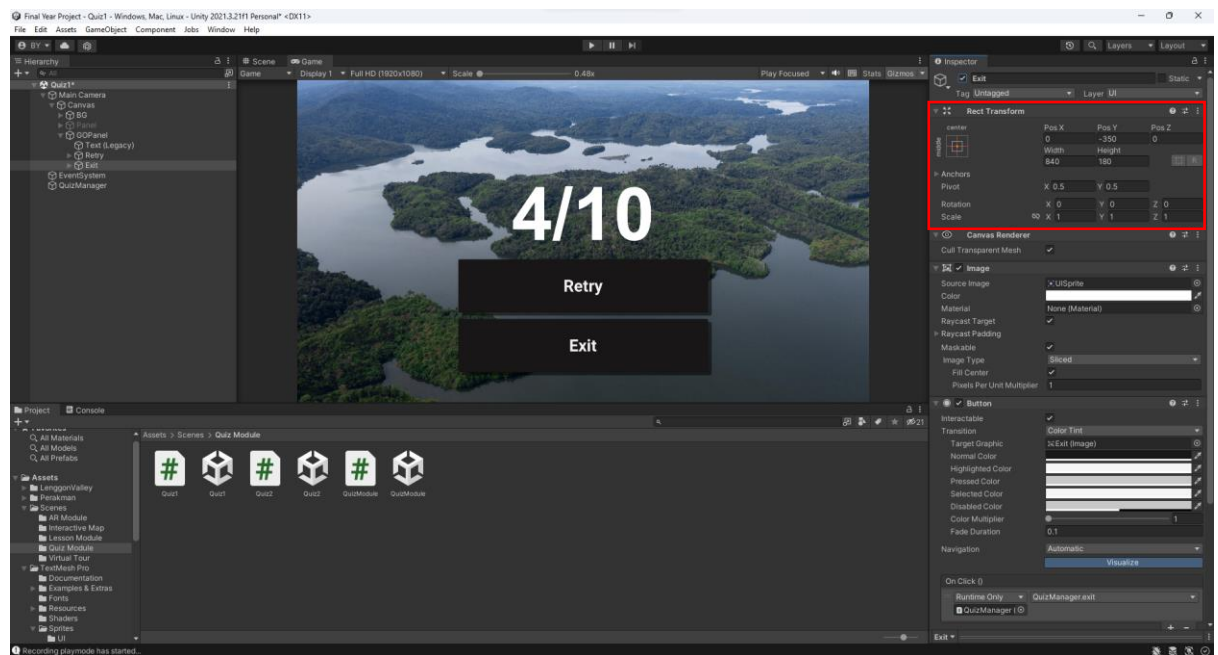


Figure 4.72 Screenshot of Create Shadow Effect

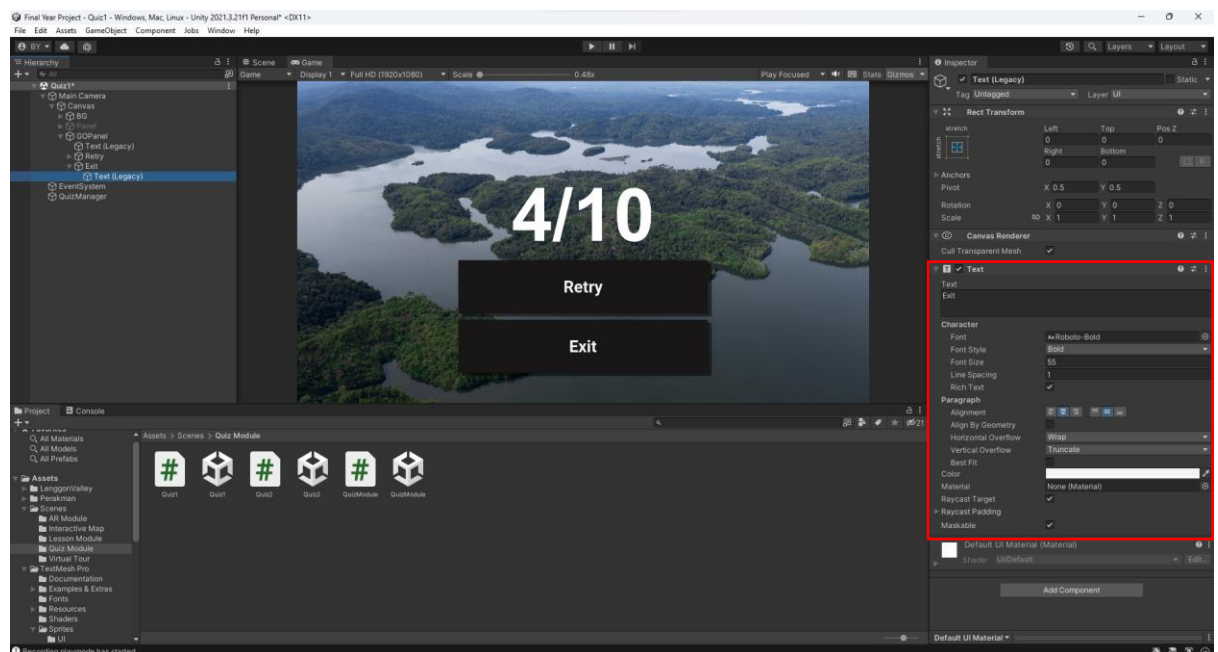
## CHAPTER 4

Duplicate the button and adjust the position of the button to create Exit button.



*Figure 4.73 Screenshot of Duplicate Buttons*

In Exit button, edit the text in the Text(Legacy) into “Exit”.

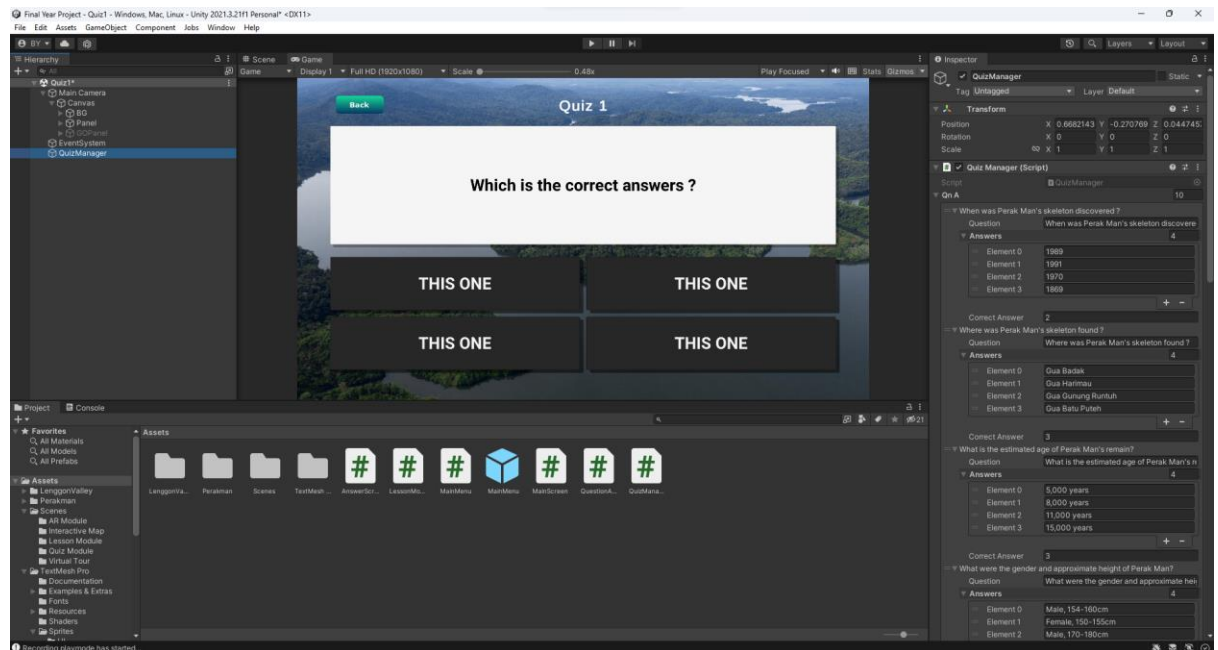


*Figure 4.74 Screenshot of Edit Button*

## CHAPTER 4

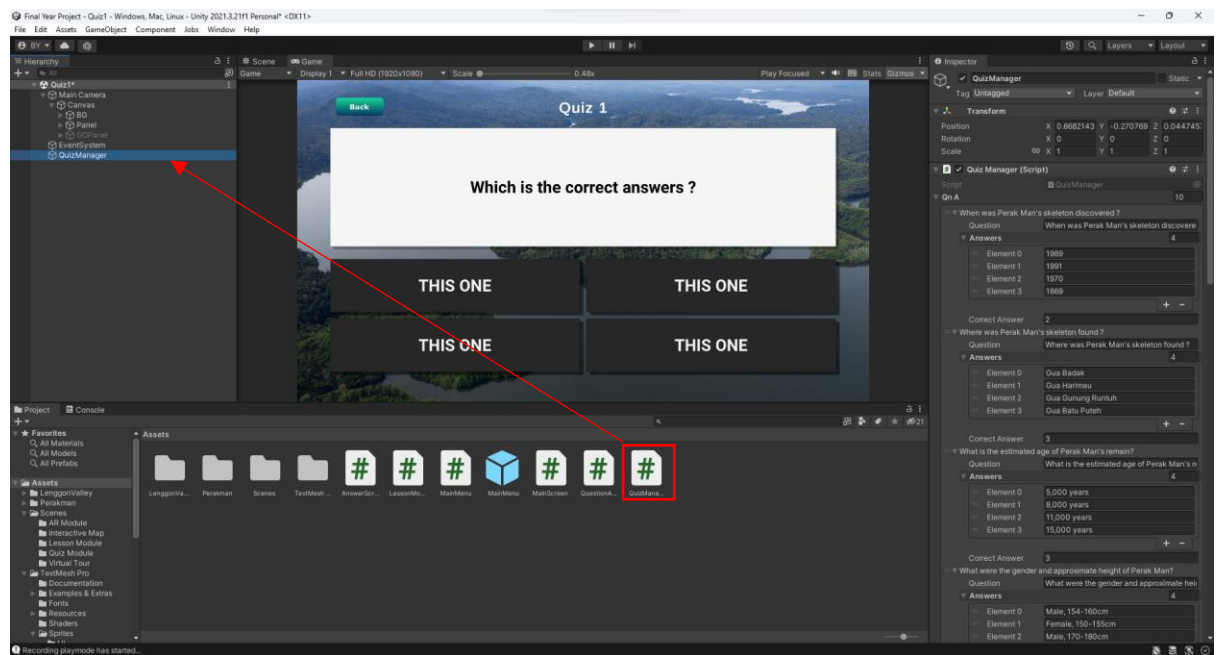
### Coding the Quiz Game

Create Empty Game Object and name it as QuizManager.



*Figure 4.75 Screenshot of Create Empty Game Object*

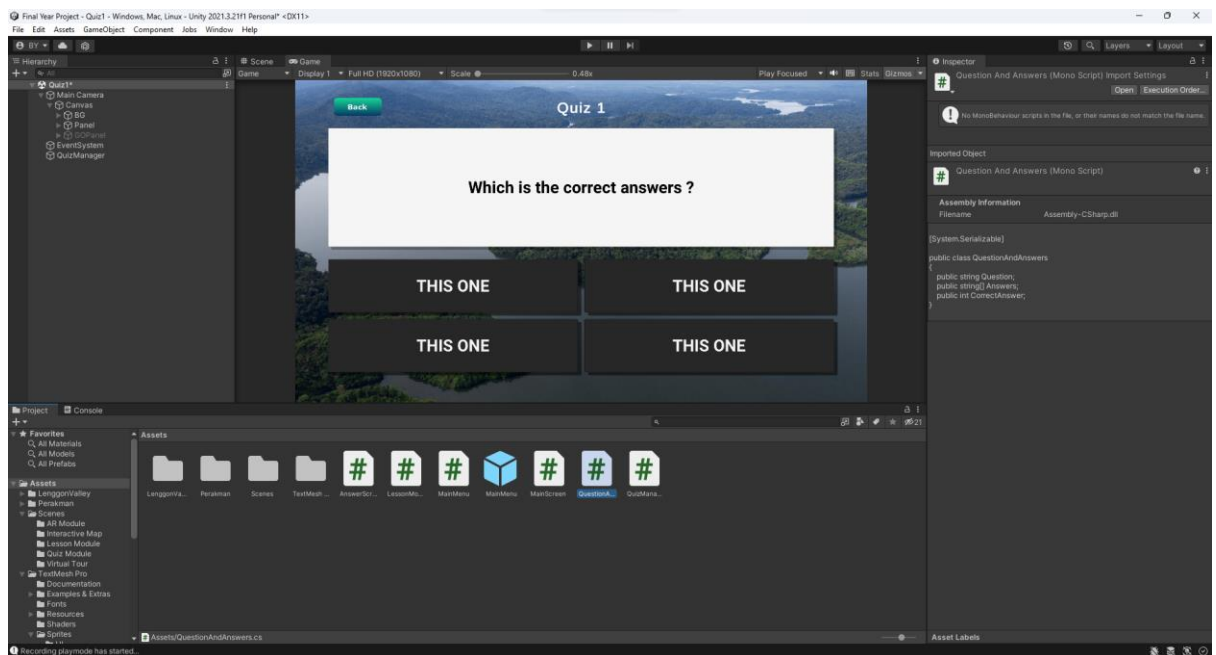
In Asset, create a new C# Script and name it as QuizManager. Then Drag and Drop the script into the QuizManager Game Object.



*Figure 4.76 Screenshot of Create C# Script QuizManager*

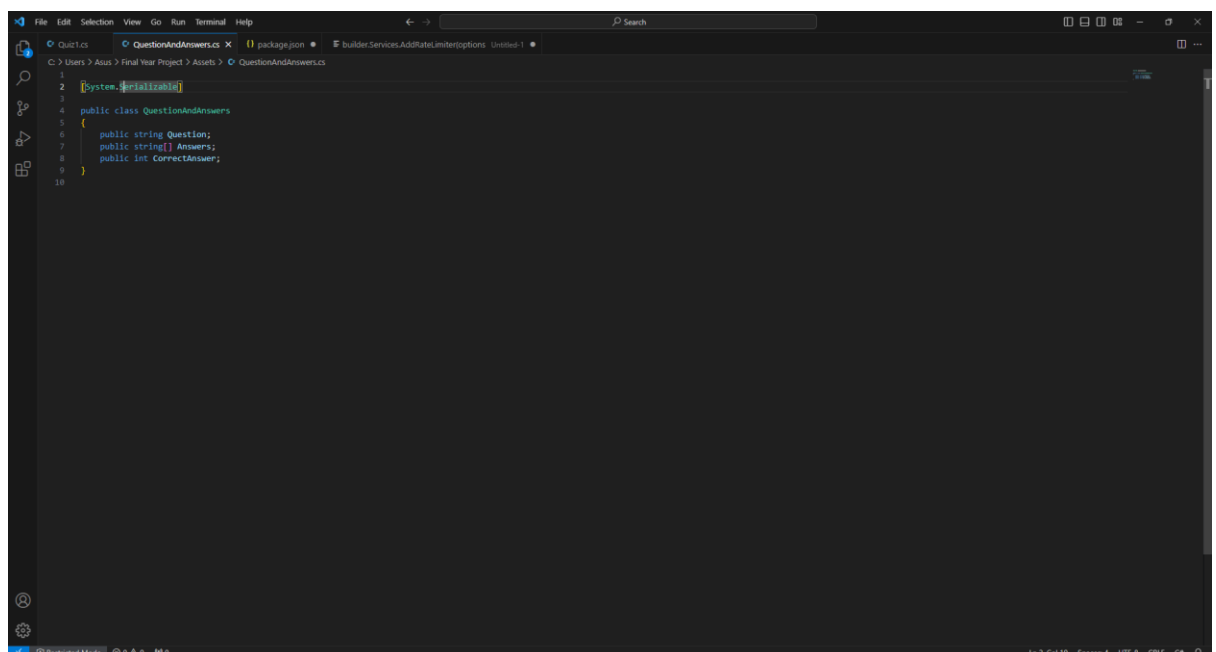
## CHAPTER 4

In Asset, create a new C# Script and name it as QuestionAndAnswers.



*Figure 4.77 Screenshot of Create C# Script QuestionsAndAnswers*

Codes for QuestionAndAnswers.

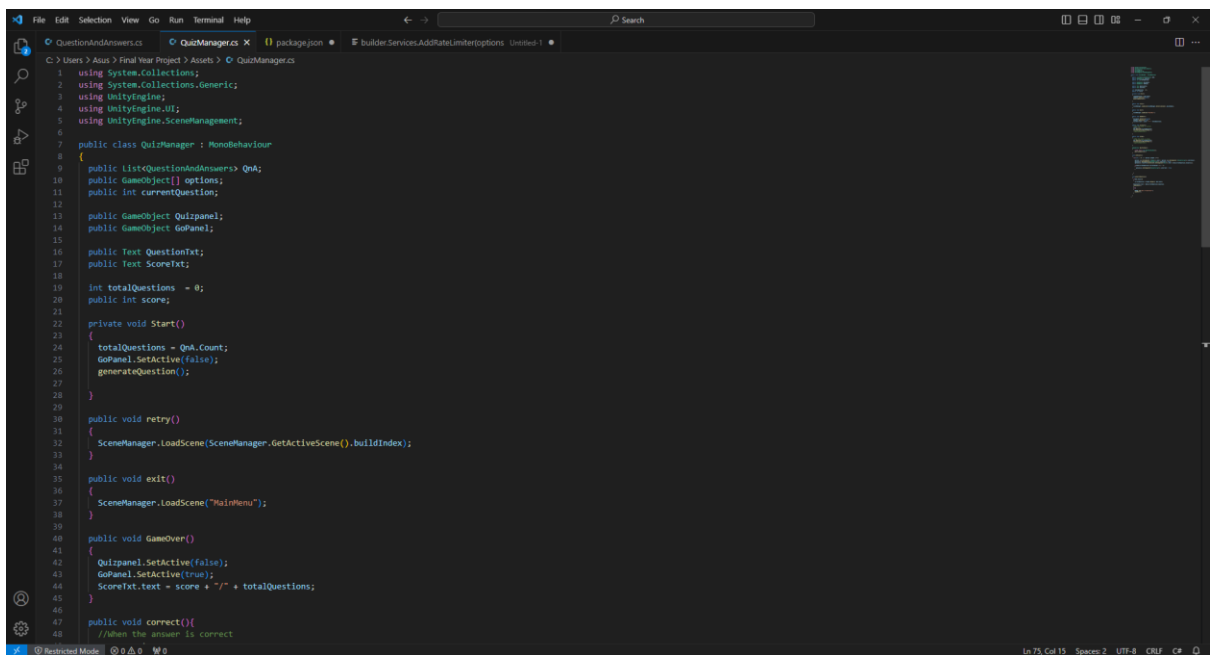


*Figure 4.78 Screenshot of Codes for QuestionsAndAnswers*



## CHAPTER 4

### Codes for QuizManager.



```
1 using System.Collections;
2 using System.Collections.Generic;
3 using UnityEngine;
4 using UnityEngine.UI;
5 using UnityEngine.SceneManagement;
6
7 public class QuizManager : MonoBehaviour
8 {
9     public List<QuestionAndAnswers> QnA;
10    public GameObject[] options;
11    public int currentQuestion;
12
13    public GameObject Quizpanel;
14    public GameObject GoPanel;
15    public Text QuestionTxt;
16    public Text ScoreTxt;
17
18    int totalQuestions = 0;
19    public int score;
20
21    private void Start()
22    {
23        totalQuestions = QnA.Count;
24        GoPanel.SetActive(false);
25        generateQuestion();
26    }
27
28
29
30
31    public void retry()
32    {
33        SceneManager.LoadScene(SceneManager.GetActiveScene().buildIndex);
34    }
35
36    public void exit()
37    {
38        SceneManager.LoadScene("MainMenu");
39    }
40
41    public void GameOver()
42    {
43        Quizpanel.SetActive(false);
44        GoPanel.SetActive(true);
45        ScoreTxt.text = score + "/" + totalQuestions;
46    }
47
48    public void correct()
49    {
50        //when the answer is correct
51    }
52 }
```

Figure 4.79 Screenshot of Codes for QuizManager

In Asset, create a new C# Script and name it as AnswerScript.

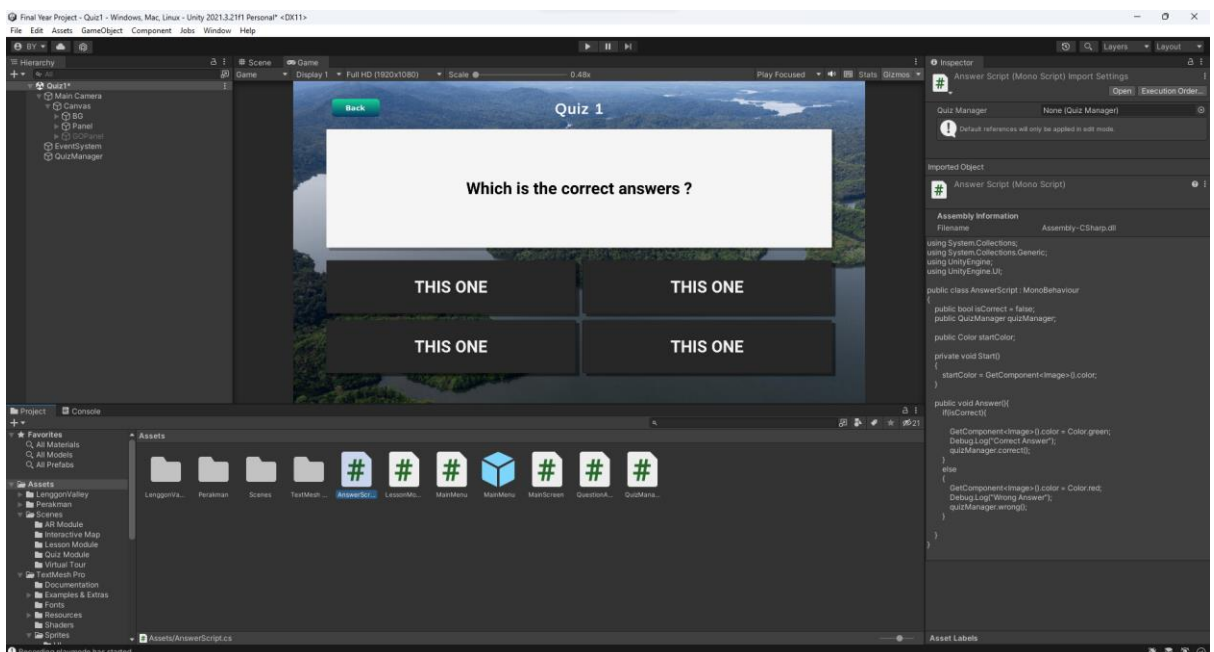
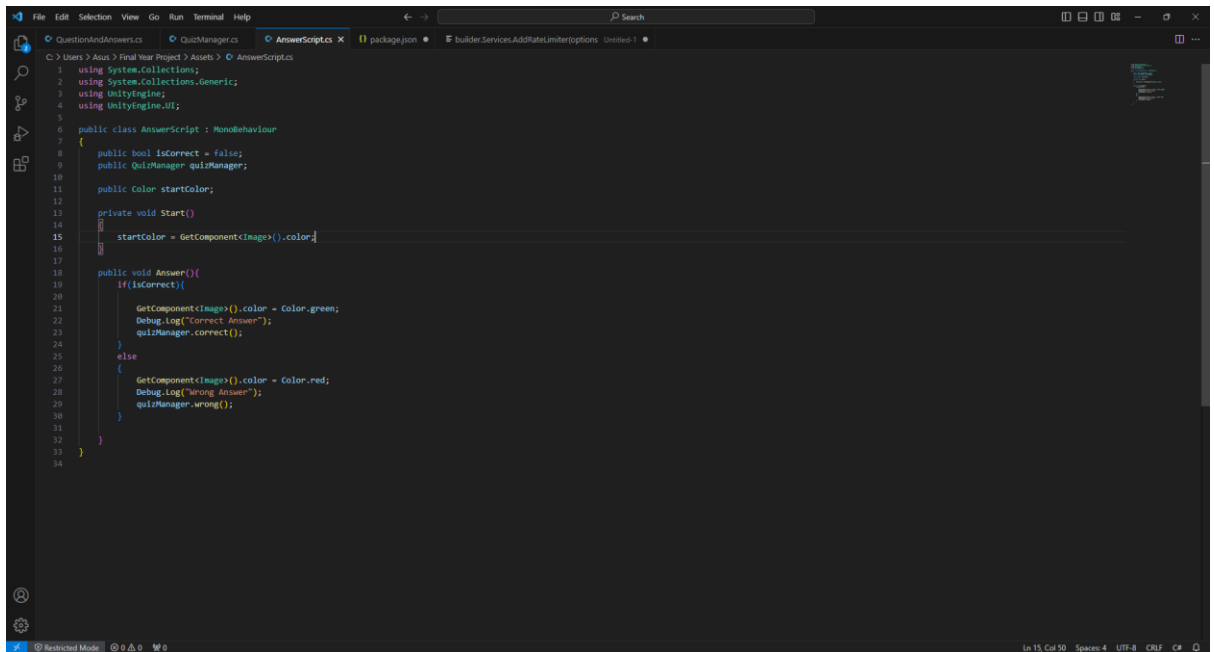


Figure 4.80 Screenshot of Create C# Script AnswerScript

## CHAPTER 4

### Codes for AnswerScript.



```
1 using System.Collections;
2 using System.Collections.Generic;
3 using UnityEngine;
4 using UnityEngine.UI;
5
6 public class AnswerScript : MonoBehaviour
7 {
8     public bool isCorrect = false;
9     public QuizManager quizManager;
10
11     public Color startColor;
12
13     private void Start()
14     {
15         startColor = GetComponent<Image>().color;
16     }
17
18     public void Answer(){
19         if(isCorrect){
20             GetComponent<Image>().color = Color.green;
21             Debug.Log("Correct Answer");
22             quizManager.correct();
23         }
24         else
25         {
26             GetComponent<Image>().color = Color.red;
27             Debug.Log("Wrong Answer");
28             quizManager.wrong();
29         }
30     }
31 }
32
33
34
```

Figure 4.81 Screenshot of Codes for AnswerScript

Select all Options button and Drag and drop AnswerScript into the Script, and Drag and drop QuizManager into Quiz Manager.

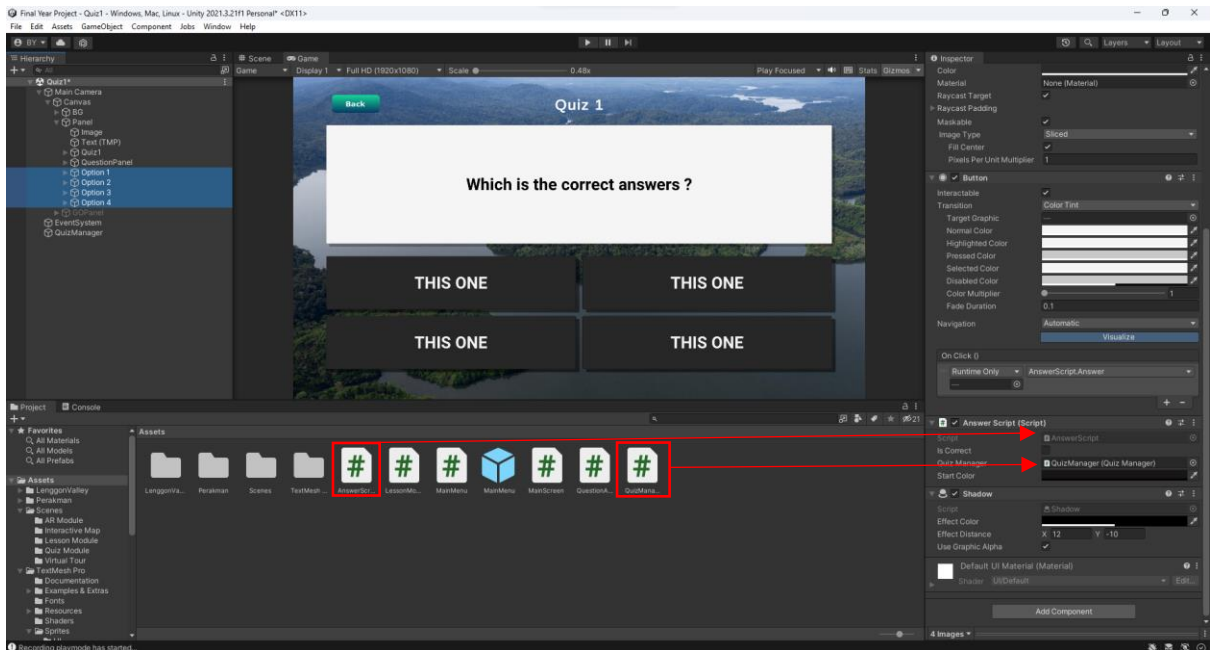
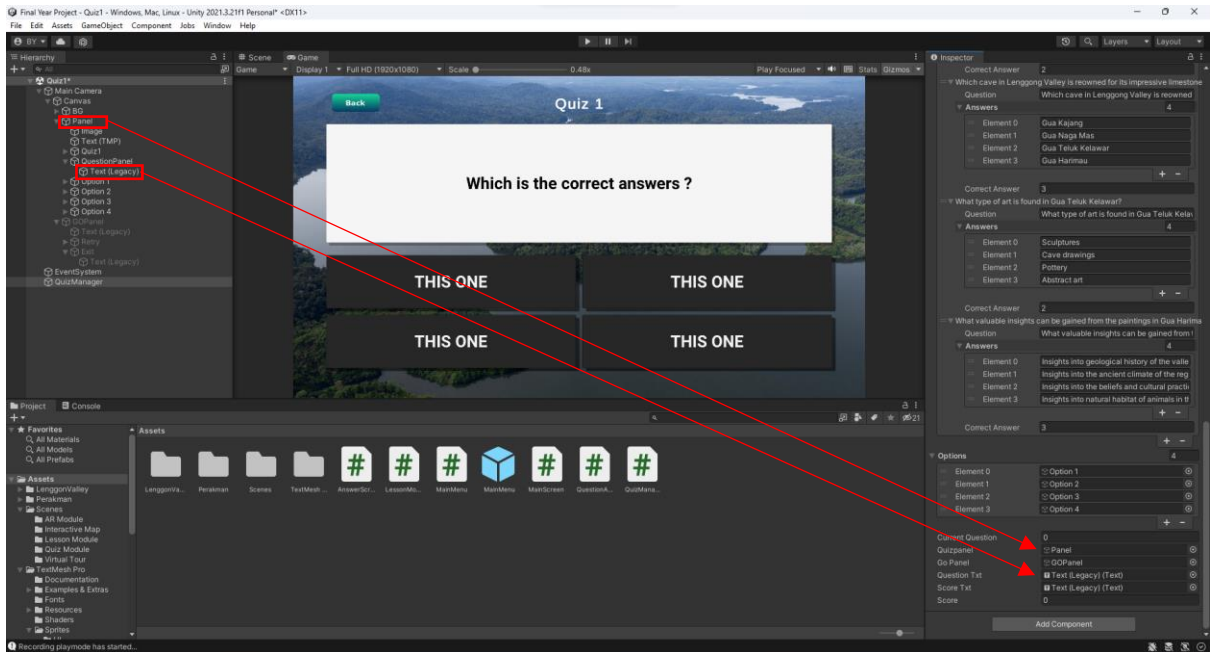


Figure 4.82 Screenshot of Drag and Drop Scripts

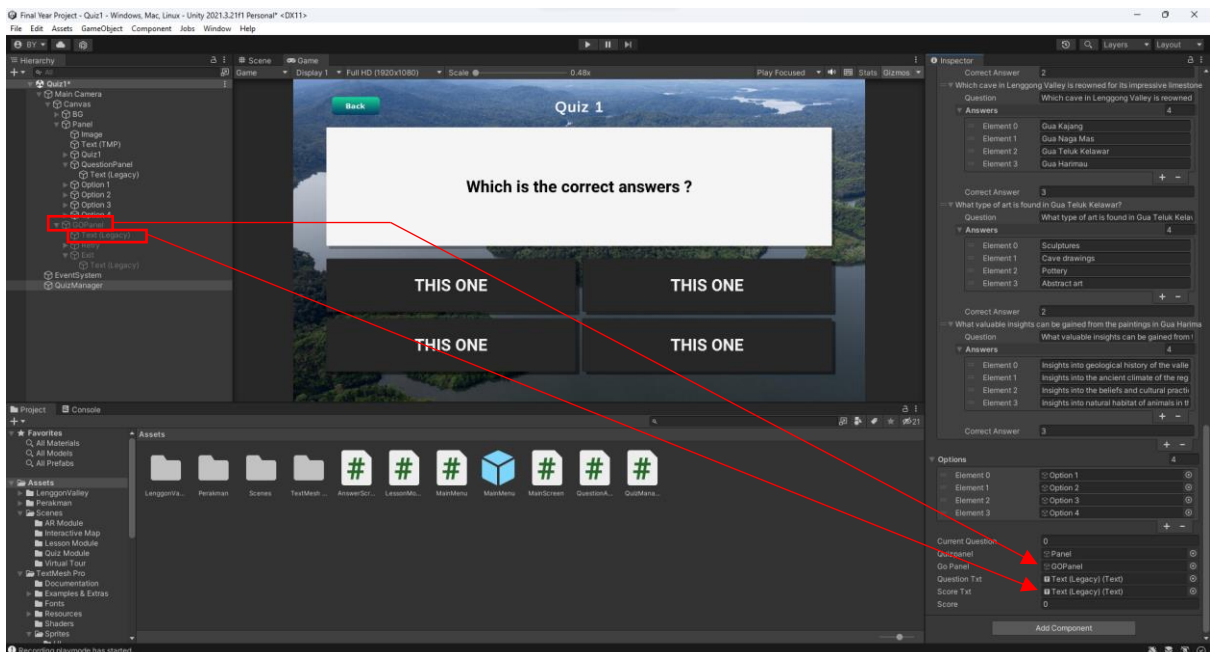
## CHAPTER 4

In QuizManager GameObject, drag and drop Panel into Question Panel and Text(Legacy) from QuestionPanel into Question Txt.



*Figure 4.83 Screenshot of Drag and Drop Game Objects*

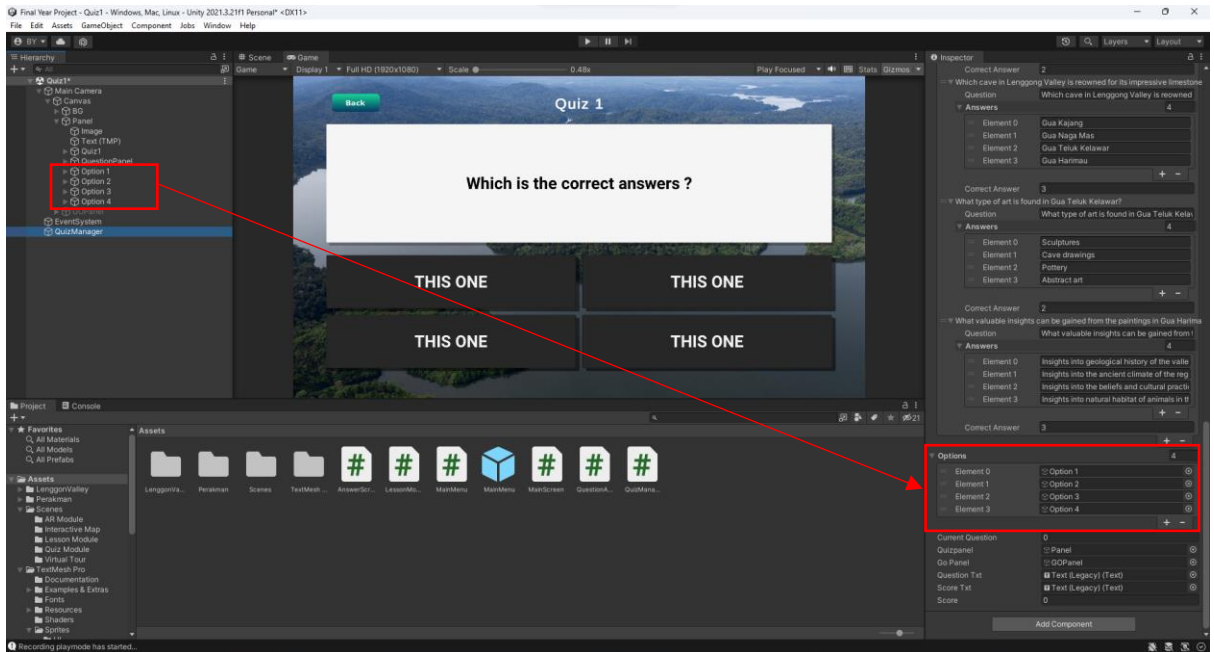
In QuizManager GameObject, drag and drop GOPanel into Go Panel and Text(Legacy) from GOPanel into Score.



*Figure 4.84 Screenshot of Drag and Drop Panels*

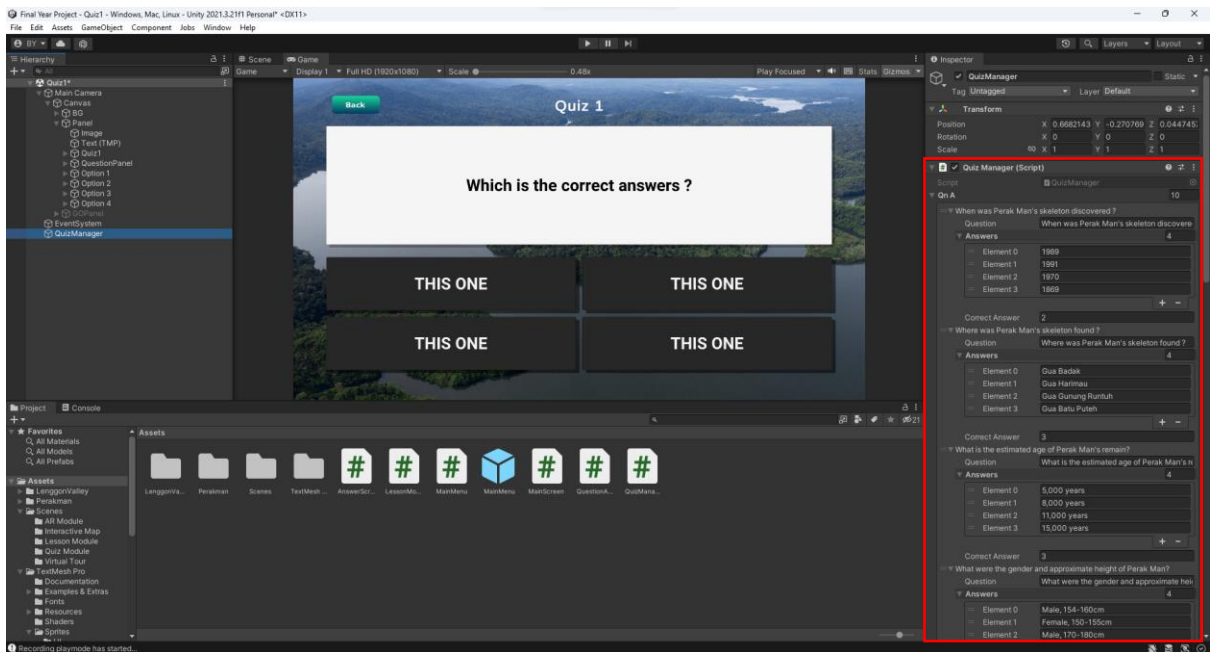
## CHAPTER 4

Set the size of Options element and drag Option 1 into Element0, Option 2 into Element1, Option 3 into Element2, and Option 4 into Element3.

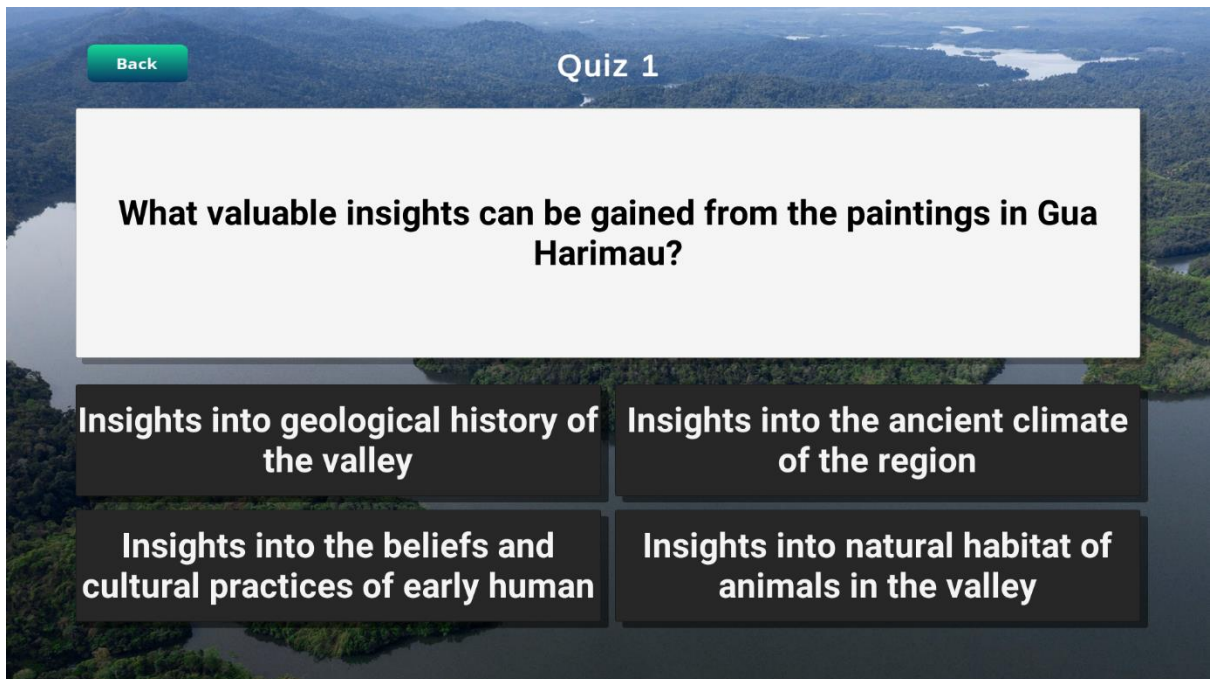


*Figure 4.85 Screenshot of Setting Up Option Buttons*

Set the size of QnA into 10 and set the questions and answers respectively.



*Figure 4.86 Screenshot of Setting Up Questions*



*Figure 4.87 Content Interface for Quiz Module*

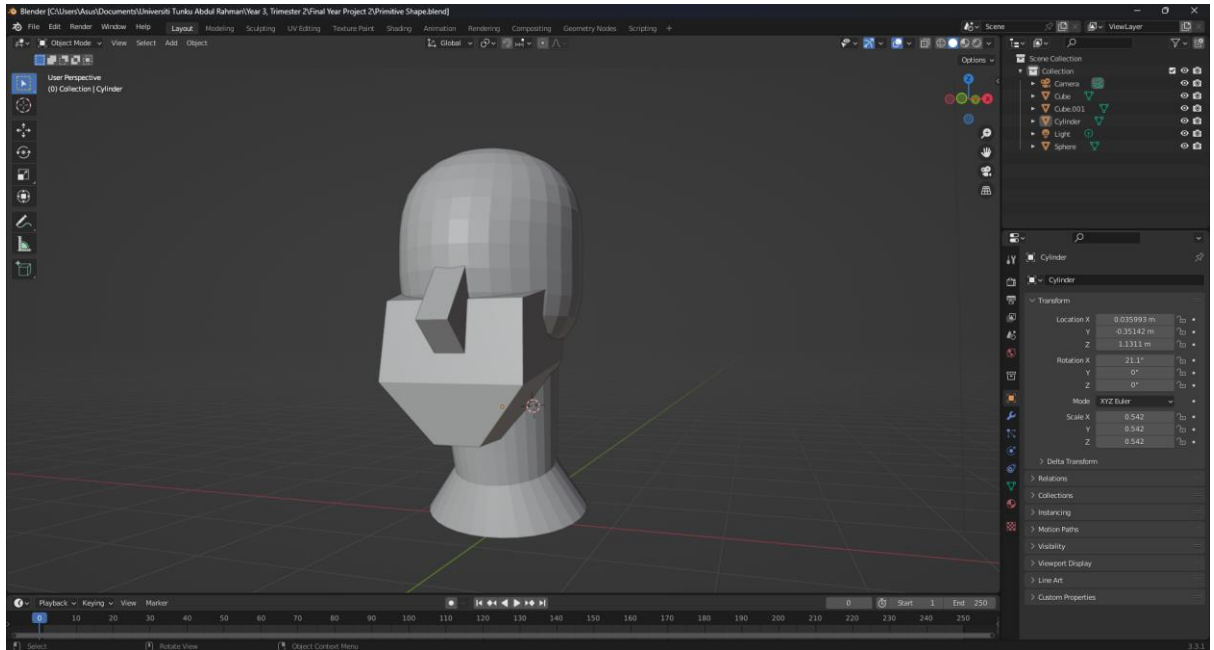
The figure above shows the development for the content interface of Quiz Module. The interface showing a multiple-choice question which consist of few Text element showing the title of the quiz and the questions and also the progress of the quiz that is being carried out. Four buttons will be provided in each question which represent for option for the answers. The user will be required to answer the question before they proceed to the next question. The Back button is provided to the user so that they could return to the Quiz Module Menu anytime they want. There is a total of two quiz provided in this system. All the questions from the quiz are related to the topic from the Lesson Modules. Hence, the users will be able to test their understanding on the knowledge they learned from the Lesson Module using the Quiz Module.

## CHAPTER 4

### 4.2.3 AR Module

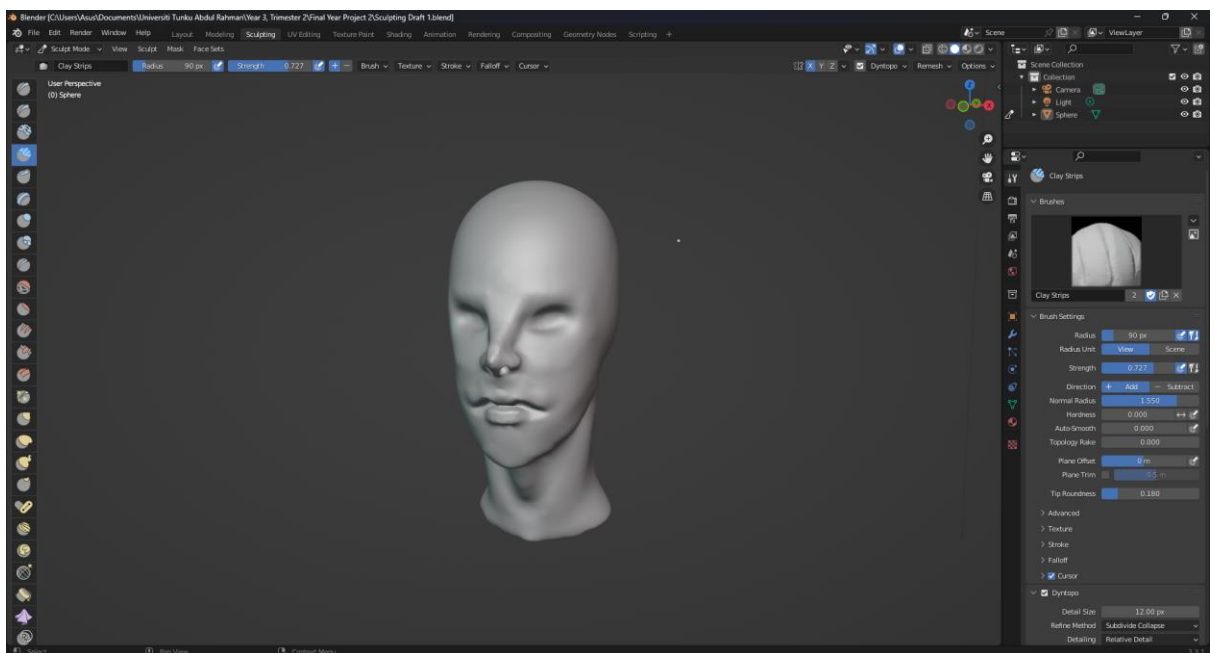
#### Sculpting 3D Model for Perak Man

##### First View



*Figure 4.88 Screenshot of First View of Perak Man*

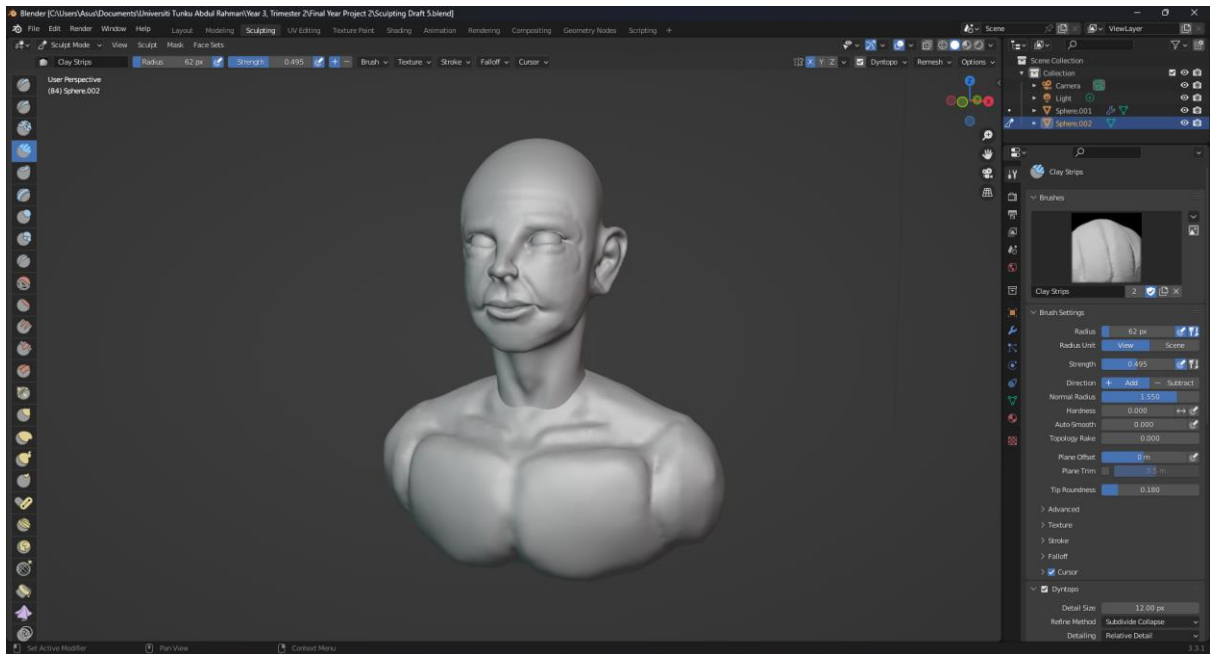
##### Second View



*Figure 4.89 Screenshot of Second View of Perak Man*

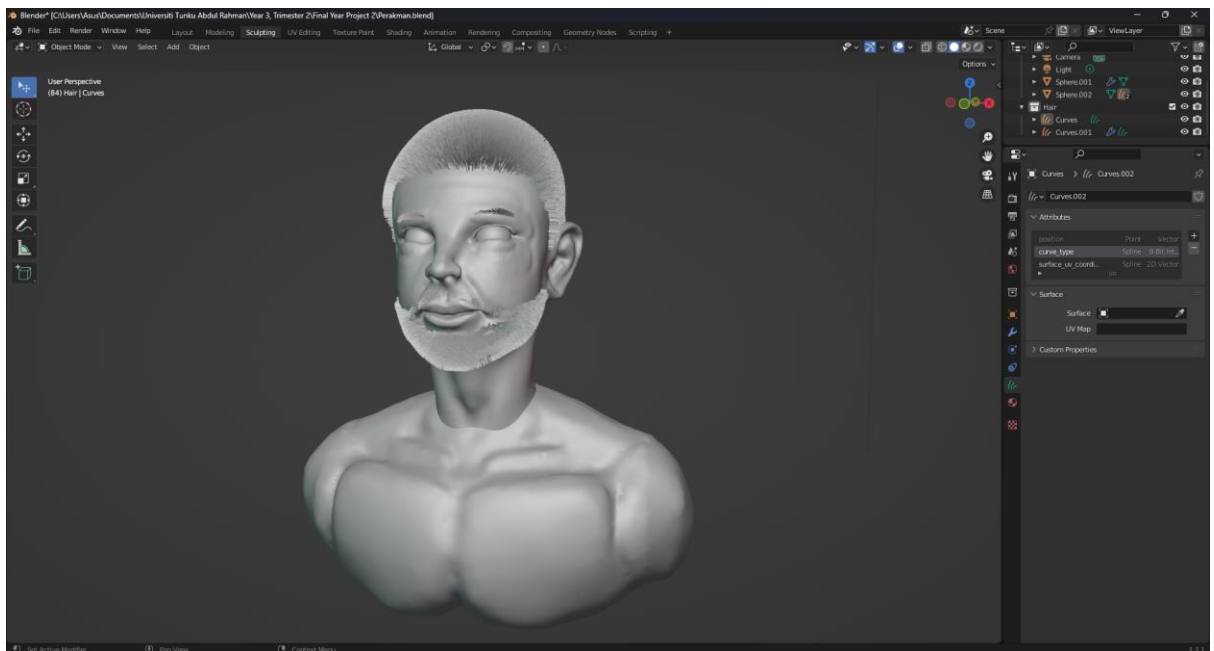
## CHAPTER 4

### Third View



*Figure 4.90 Screenshot of Third View of Perak Man*

### Fourth View



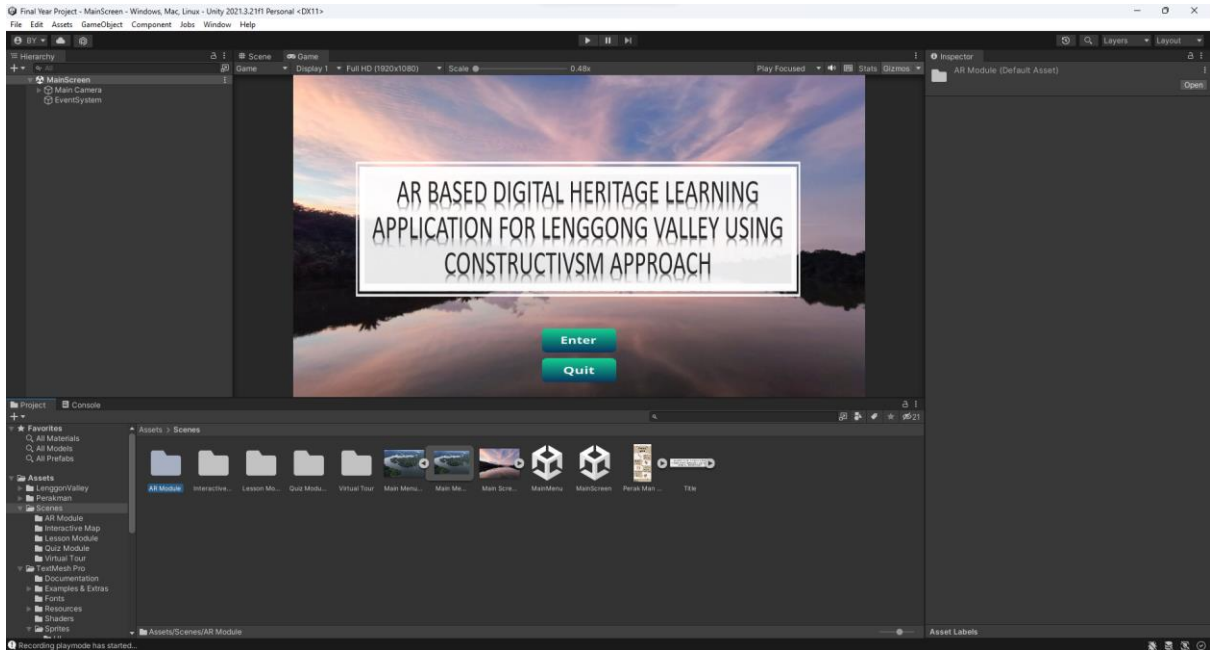
*Figure 4.91 Screenshot of Fourth View of Perak Man*

## CHAPTER 4

### Import the 3D Model into Unity

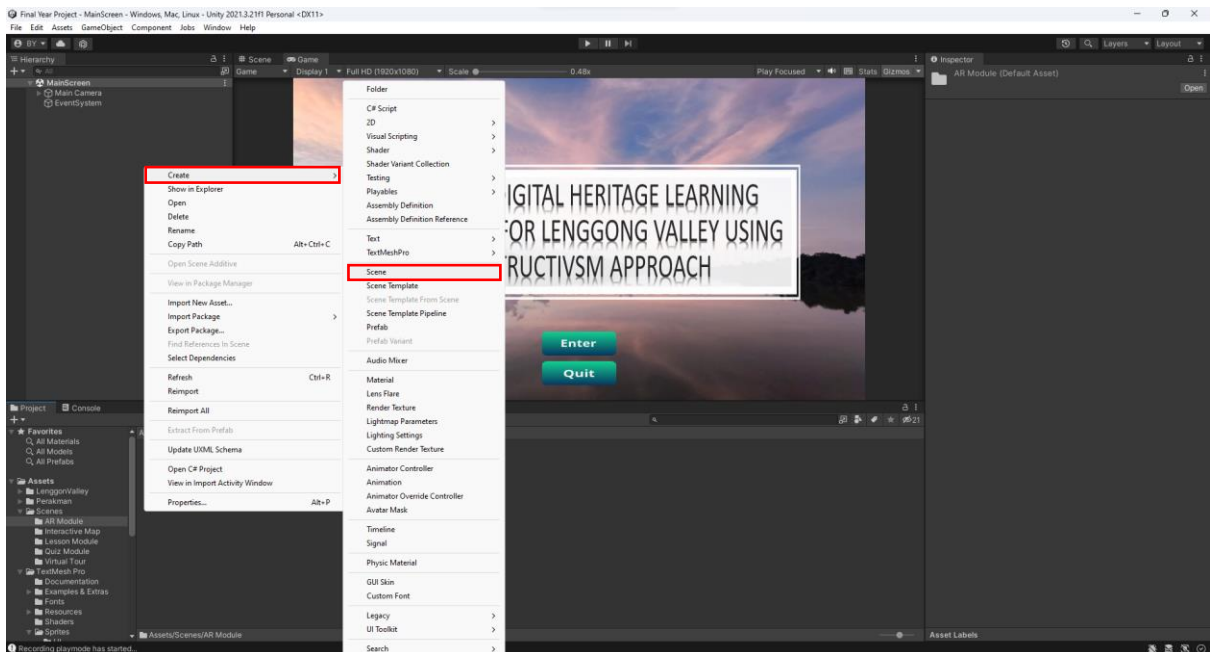
Next, go to Unity.

Create a new folder and name as AR Module.



*Figure 4.92 Screenshot of Create a New Folder for AR Module*

Create a new Scene in the AR Module folder.

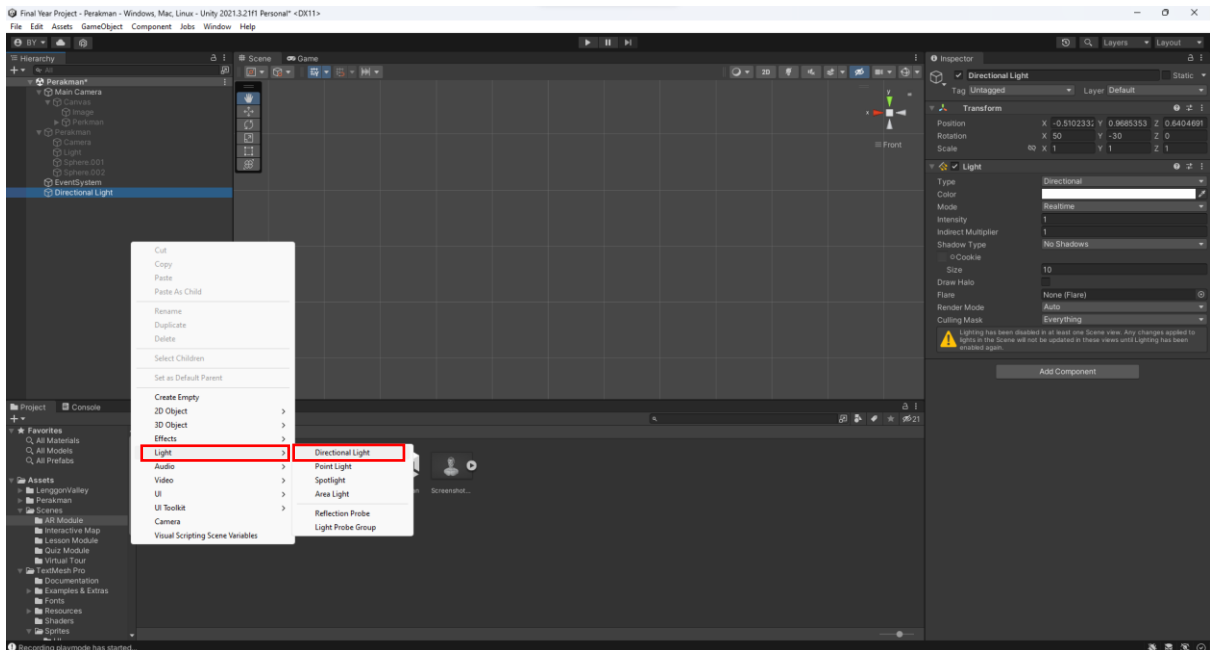


*Figure 4.93 Screenshot of Create a New Scene for Perakman*



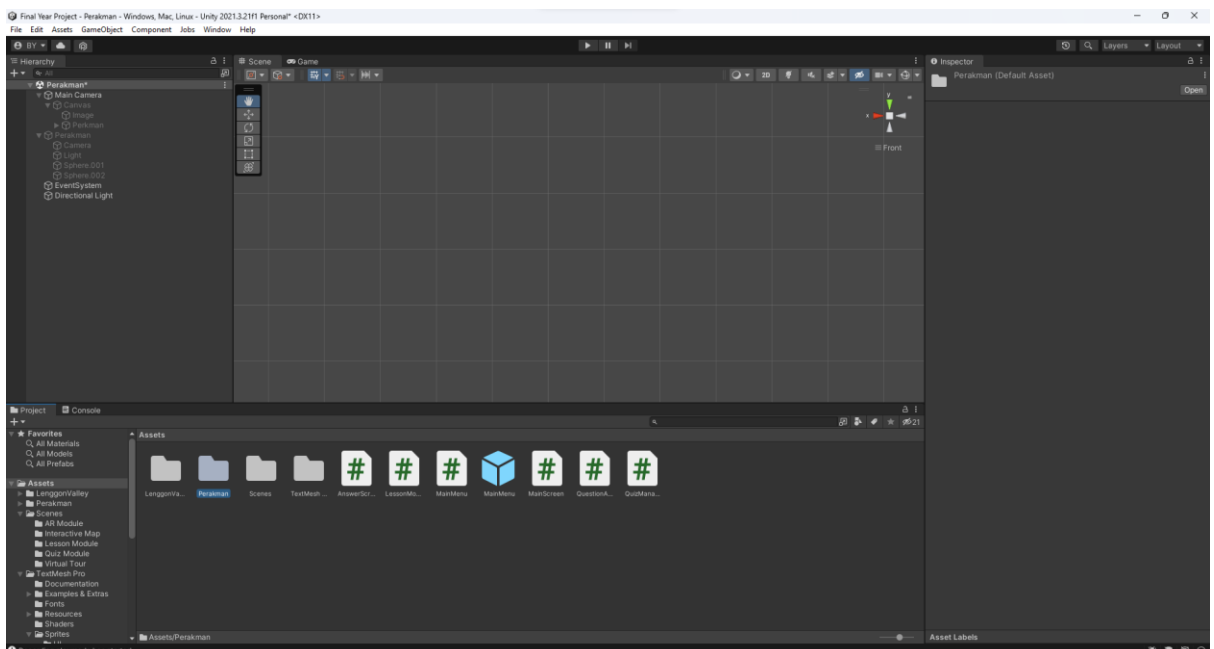
## CHAPTER 4

### Create Light > Directional Light



*Figure 4.94 Screenshot of Create a Directional Light*

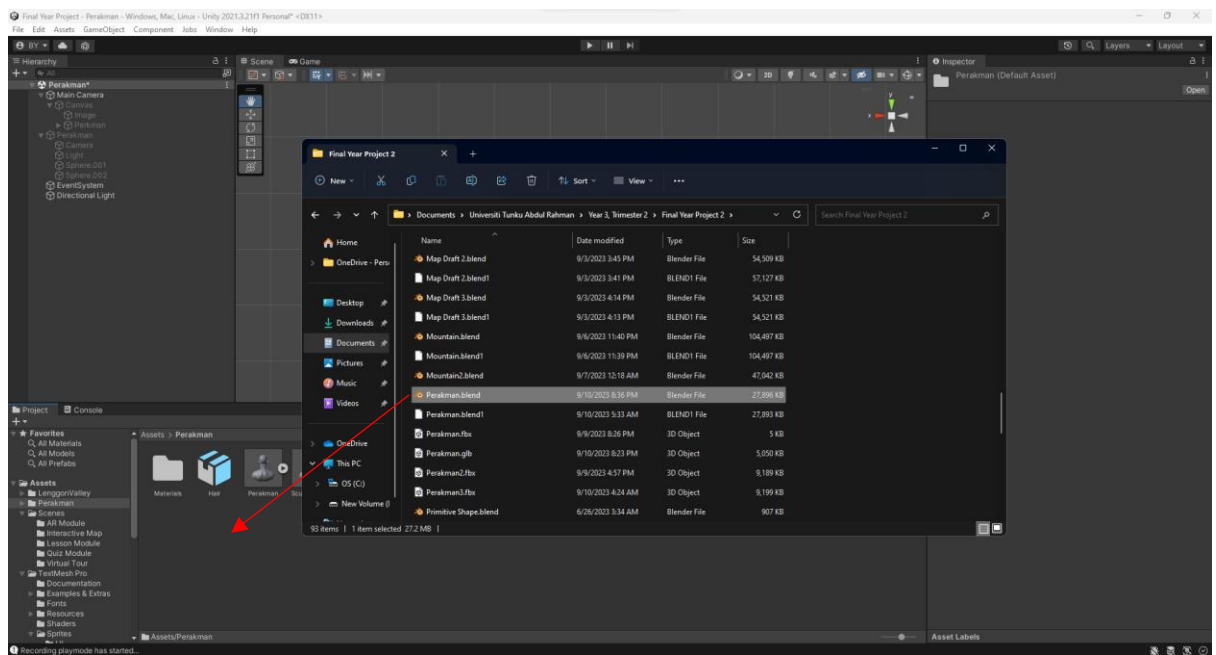
In Assets, create a folder and name as Perakman.



*Figure 4.95 Screenshot of Create a Folder for Perakman*

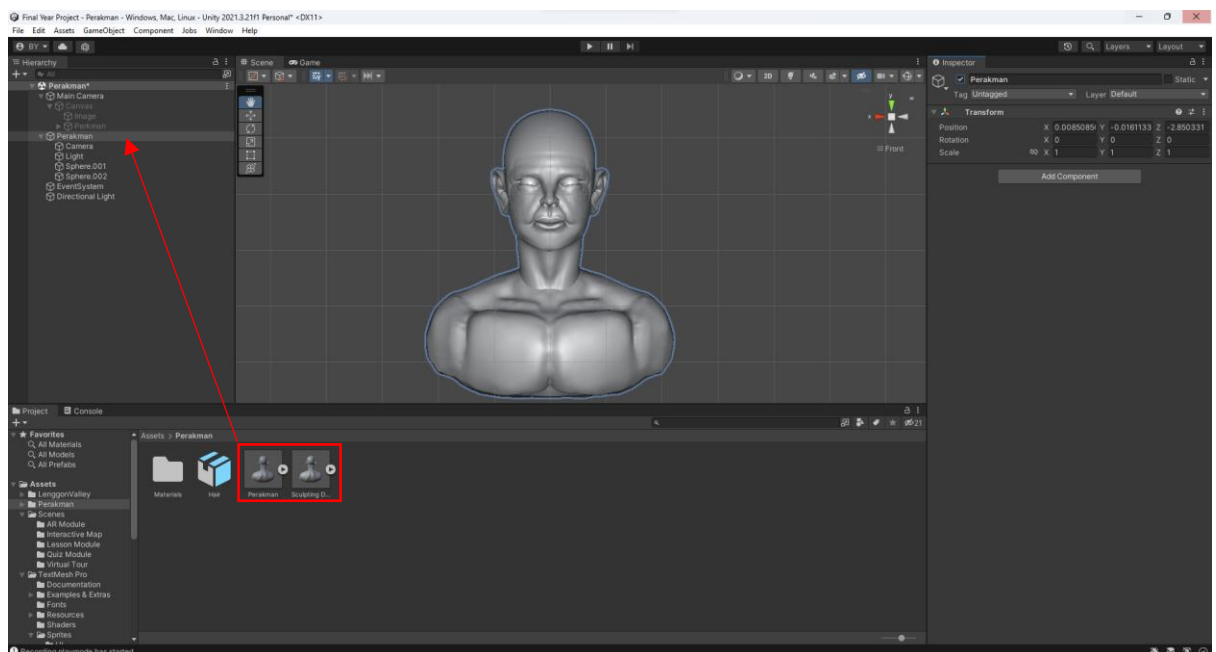
## CHAPTER 4

Drag and drop the Perakman blend file into the Perakman folder in Unity.



*Figure 4.96 Screenshot of Drag and Drop Perakman blend file*

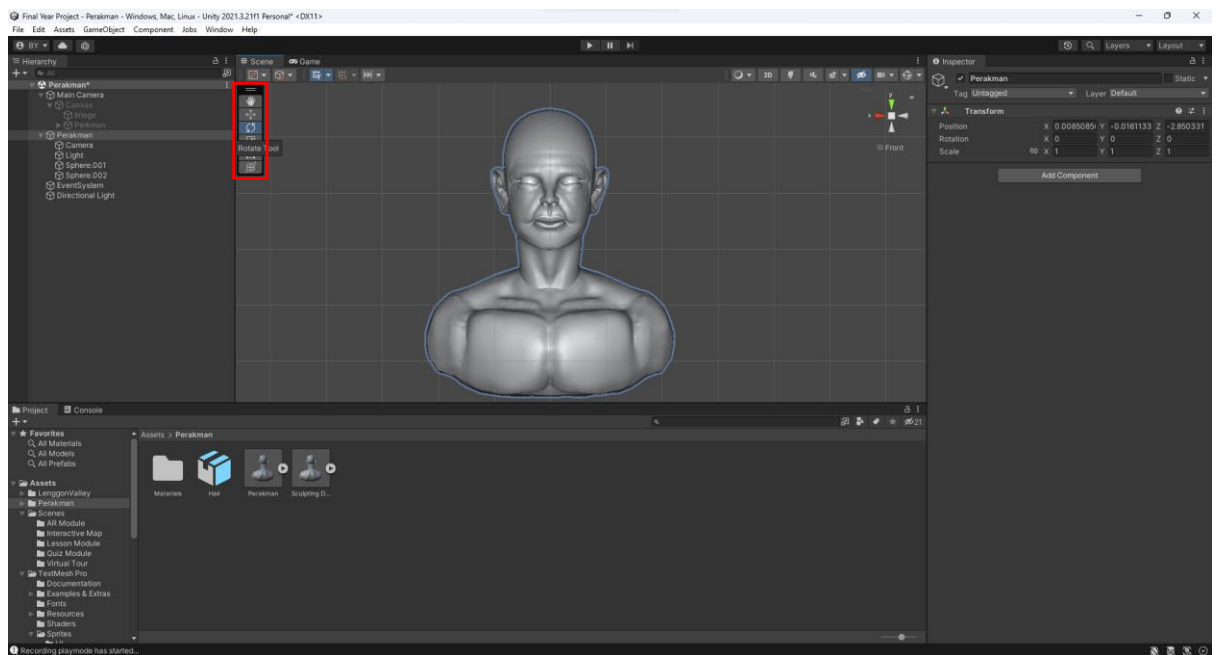
Drag and drop the Perakman blend file in the Unity to and add into the hierarchy.



*Figure 4.97 Screenshot of Drag and Drop Perakman blend file into Unity*

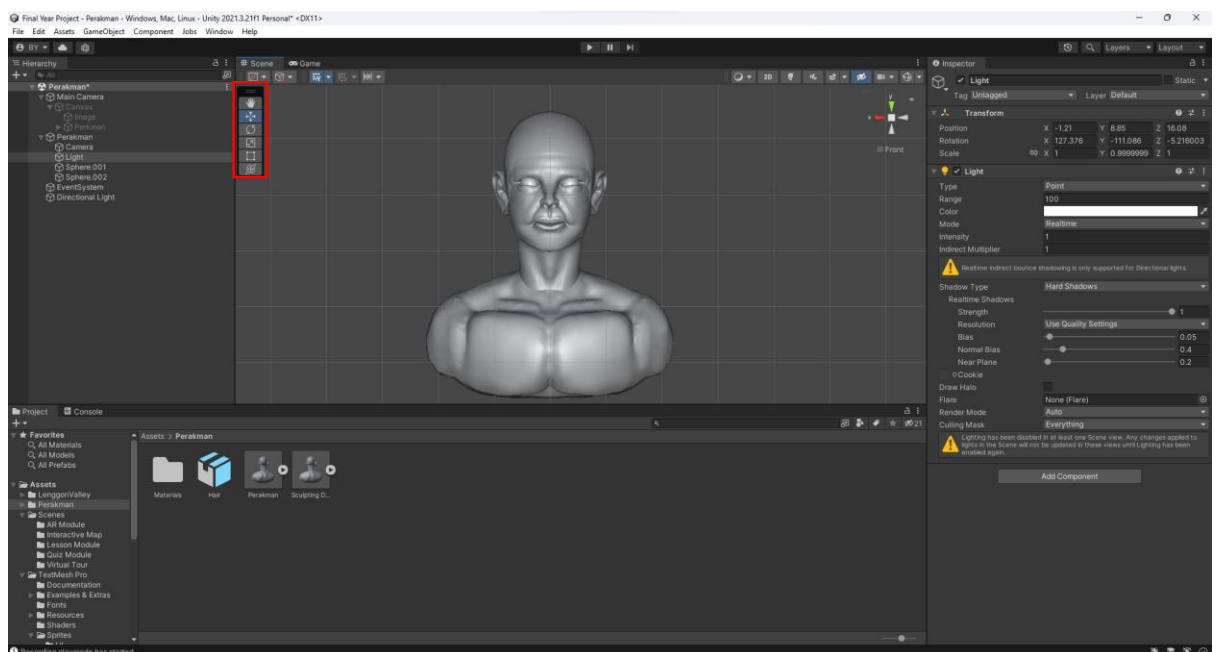
## CHAPTER 4

Adjust the position and size of the model with your own preferences.



*Figure 4.98 Screenshot of Adjust Position of Perakman*

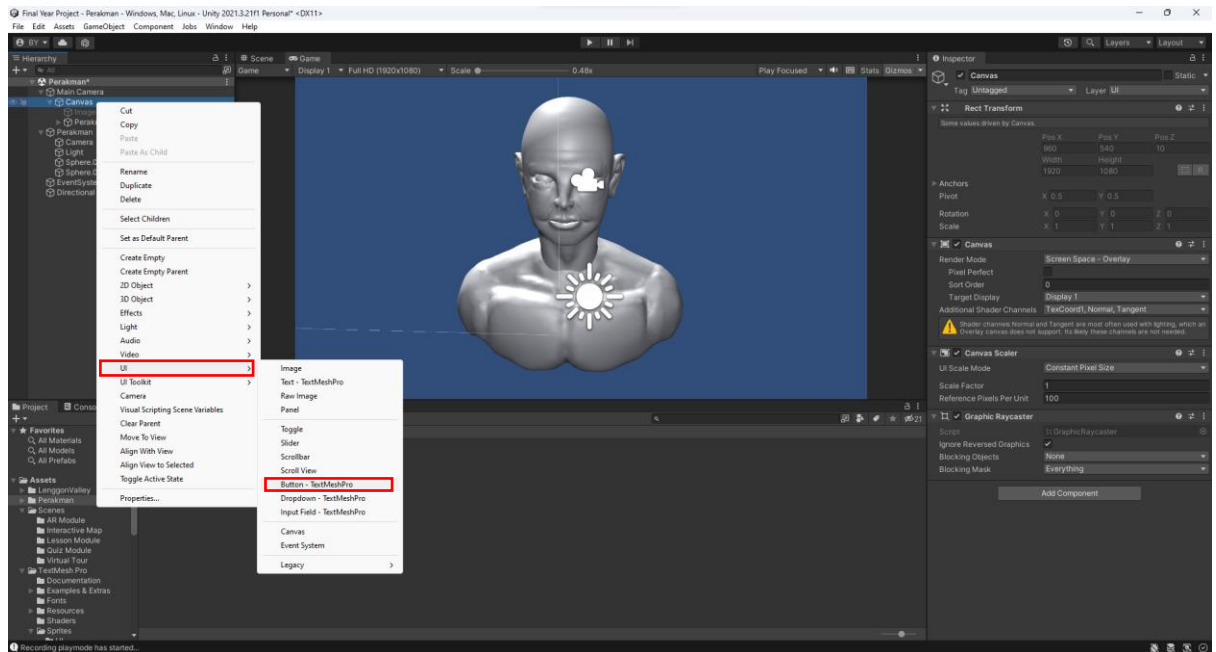
Adjust the direction of light, range and intensity of the light.



*Figure 4.99 Screenshot of Adjust Light of Perakman*

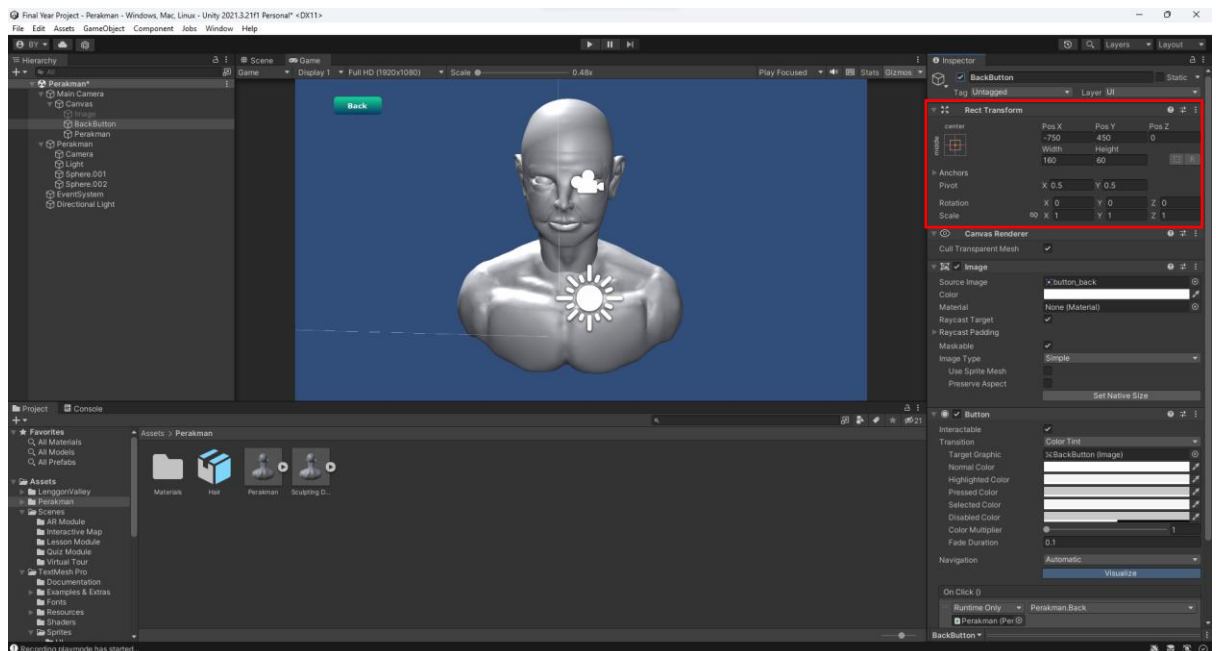
## CHAPTER 4

Right click on Canvas, select UI > Button - TextMeshPro to create a Back Button.



*Figure 4.100 Screenshot of Create Button - TextMeshPro*

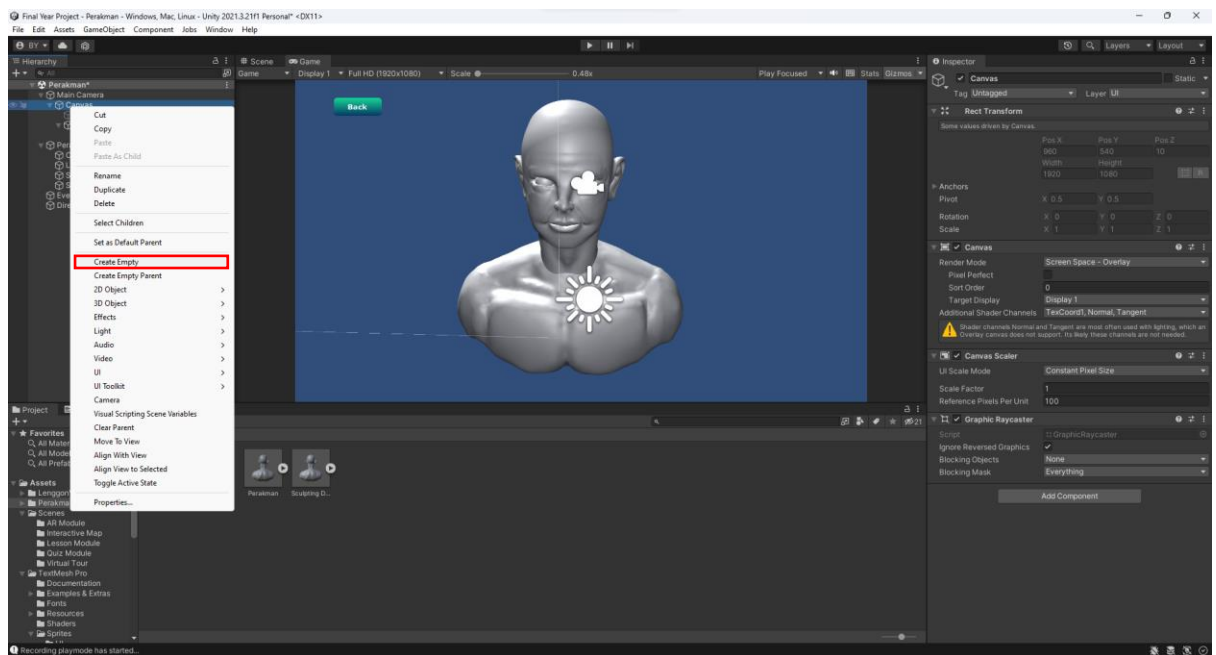
Adjust the position of the button and set the button width to 160 and height to 60.



*Figure 4.101 Screenshot of Adjust Position and Size of Button*

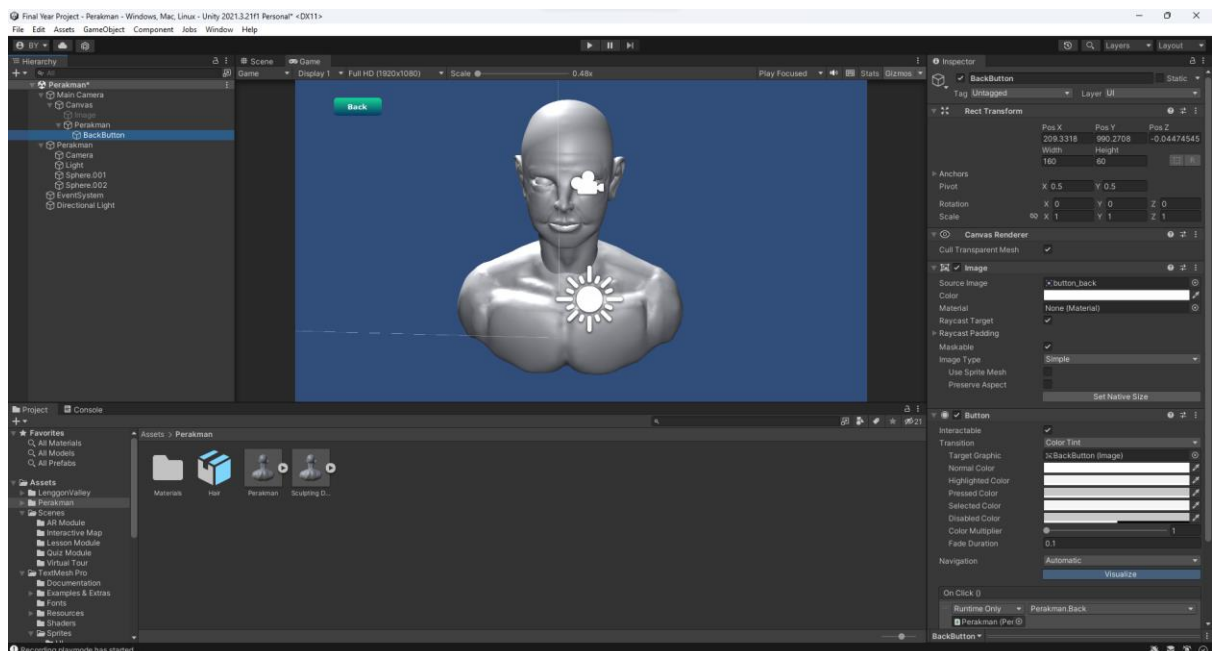
## CHAPTER 4

Right click on Canvas, select Create Empty Game Object and name as Perakman.



*Figure 4.102 Screenshot of Create Empty Game Object*

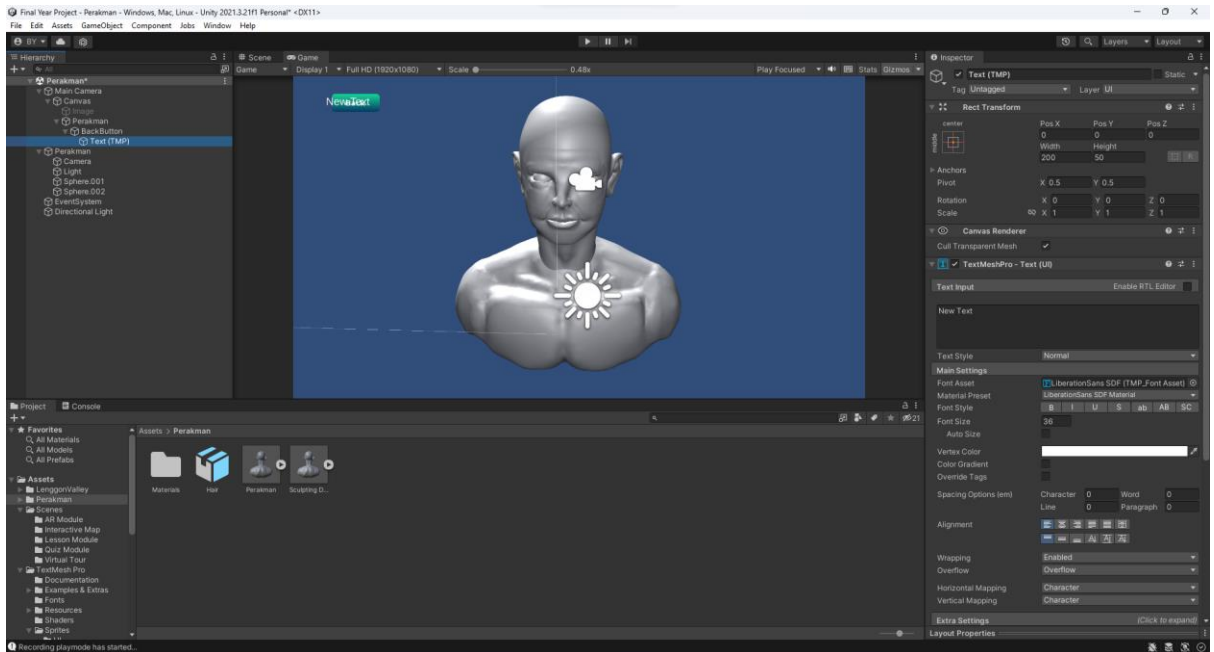
Drag the Back Button into Perakman Game Object.



*Figure 4.103 Screenshot of Drag and Drop the Back Button*

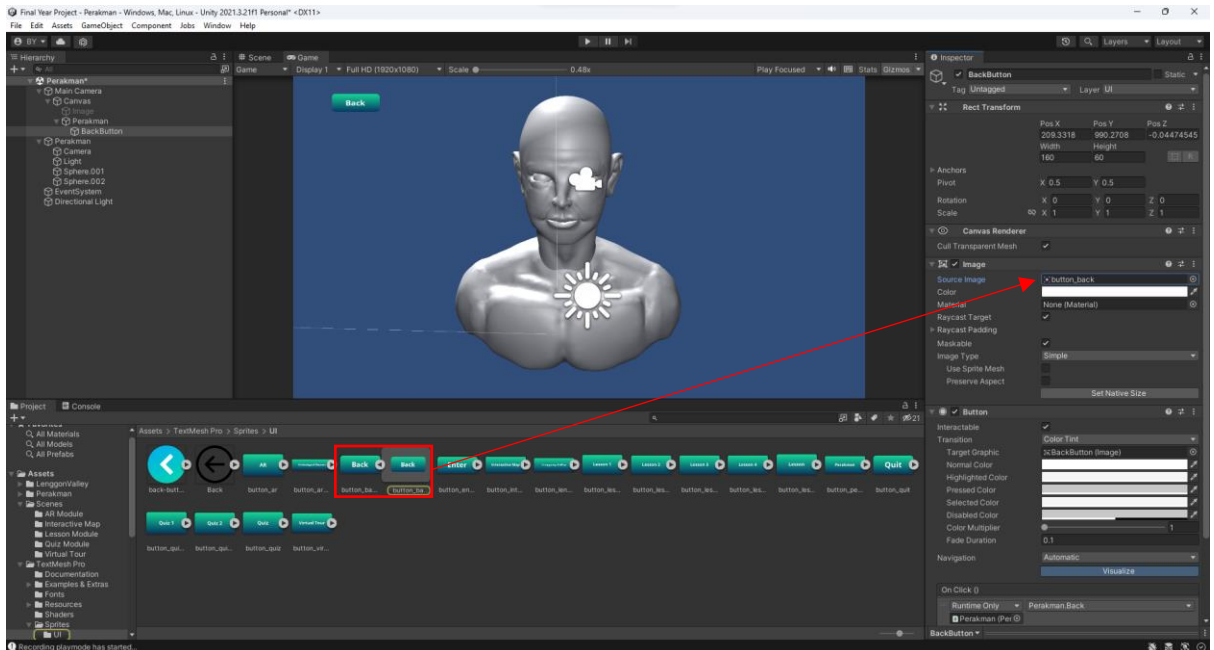
## CHAPTER 4

Remove Text(TMP) in the Back Button section to remove the default UI for the button.



*Figure 4.104 Screenshot of Remove Text(TMP)*

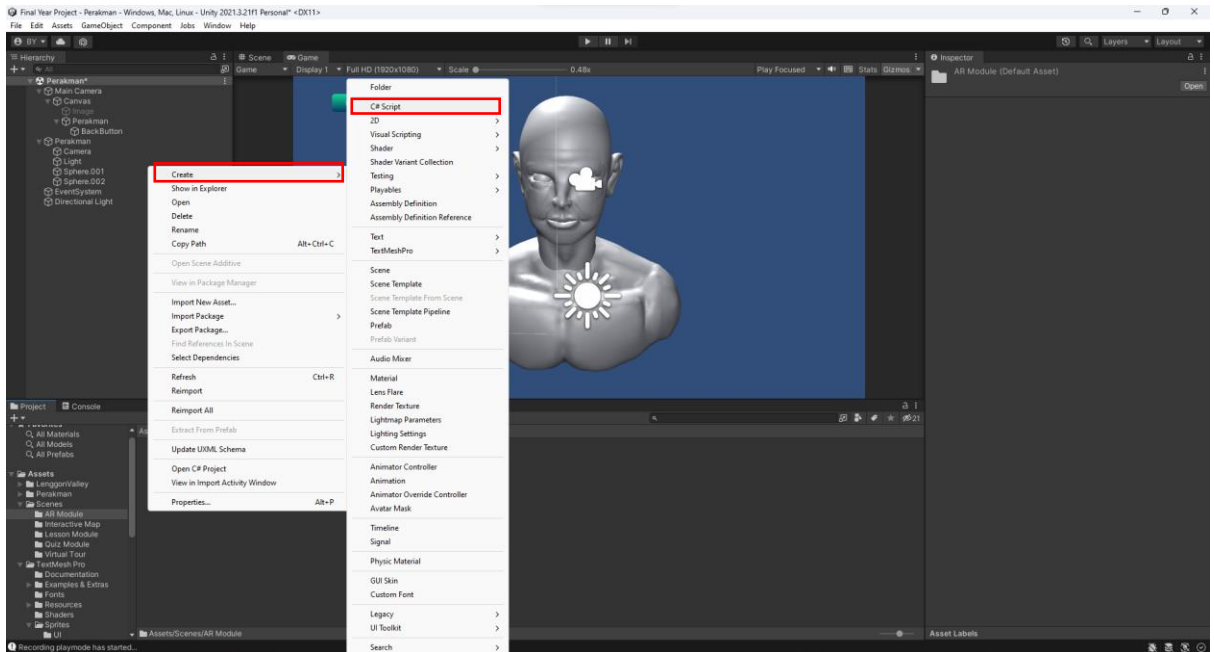
Drag and drop the UI of Back Button into the Source image of the button.



*Figure 4.105 Screenshot of Drag and Drop Button UI of Back Button*

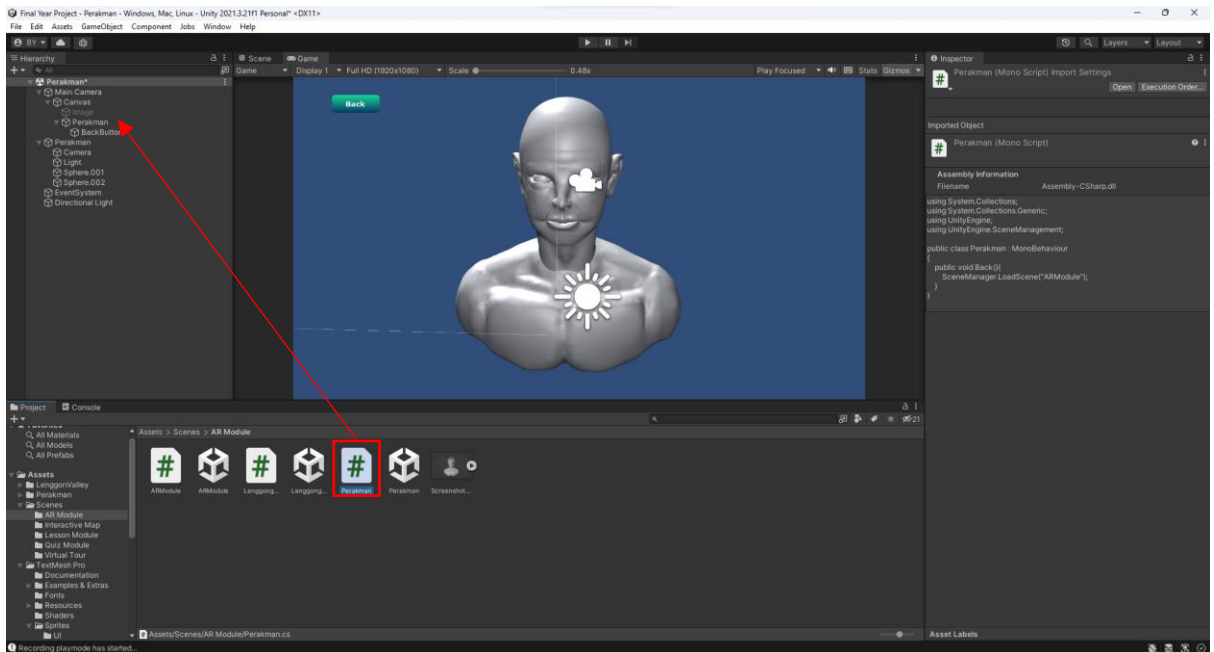
## CHAPTER 4

Right click select Create > C# Script to create a new C# Script and name it as Perakman in AR Module folder.



*Figure 4.106 Screenshot of Create C# Script*

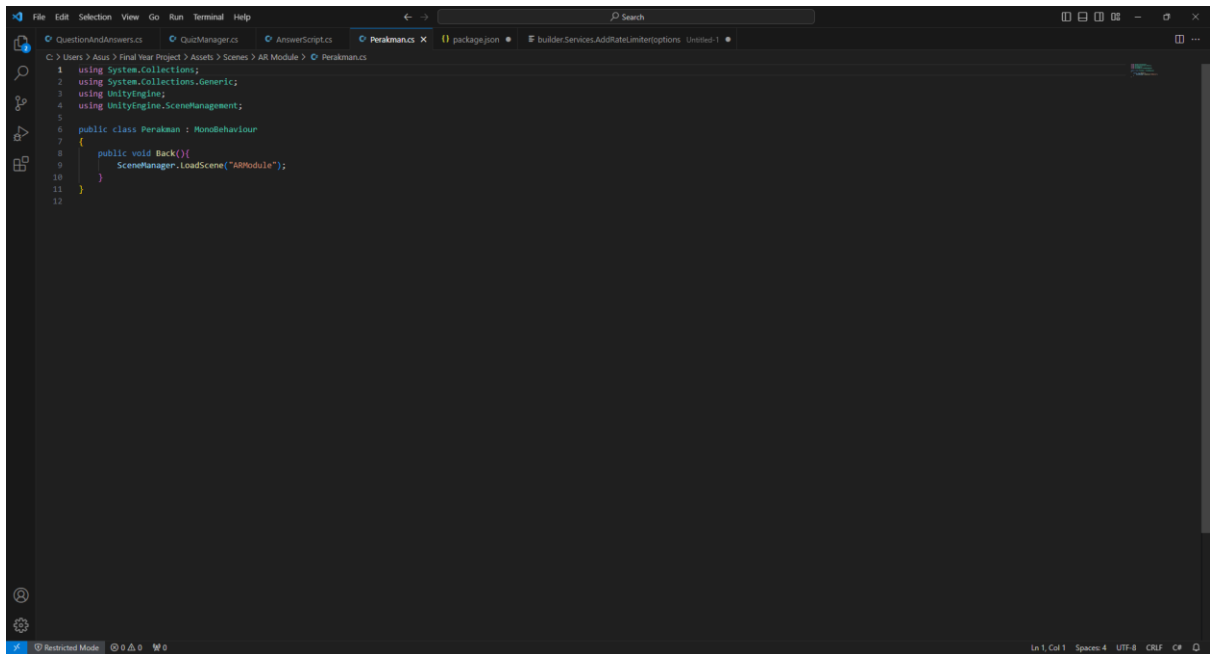
Drag and Drop the Perakman Module to Perakman Game Object.



*Figure 4.107 Screenshot of Drag and Drop Perakman*

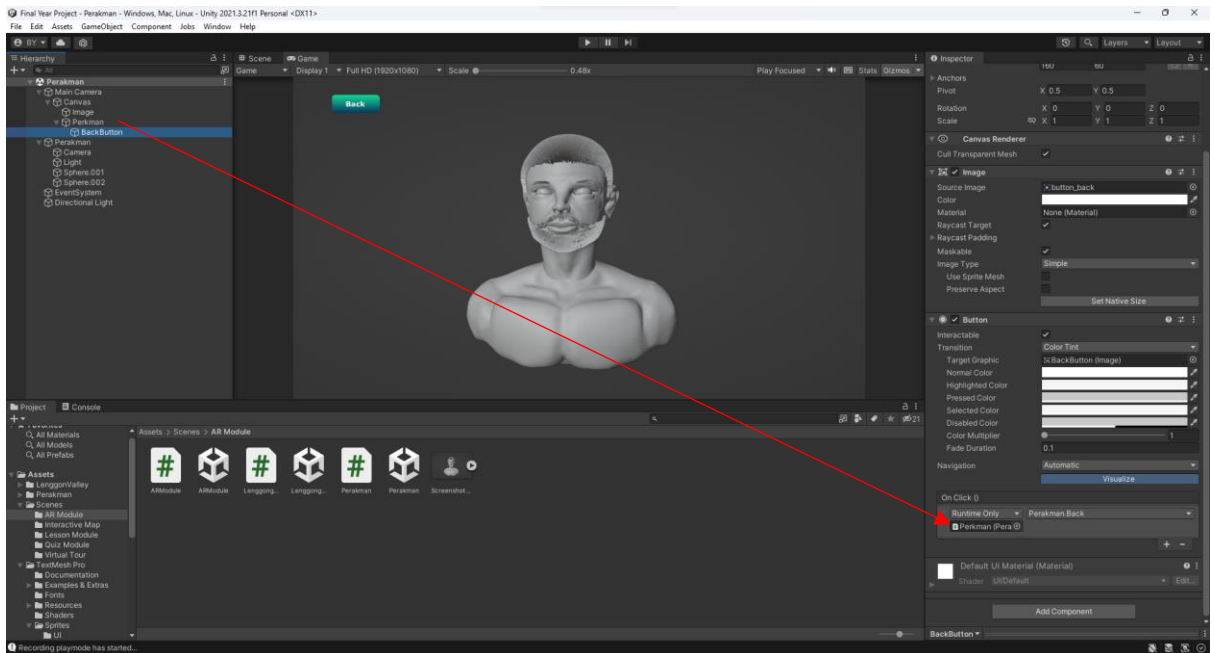
## CHAPTER 4

Code the Perakman Script and create a Back function.



*Figure 4.108 Screenshot of Code for Perakman Script*

Select the Back Button, Add an OnClick function and Drag and Drop the Perakman Game Object into the Object panel.

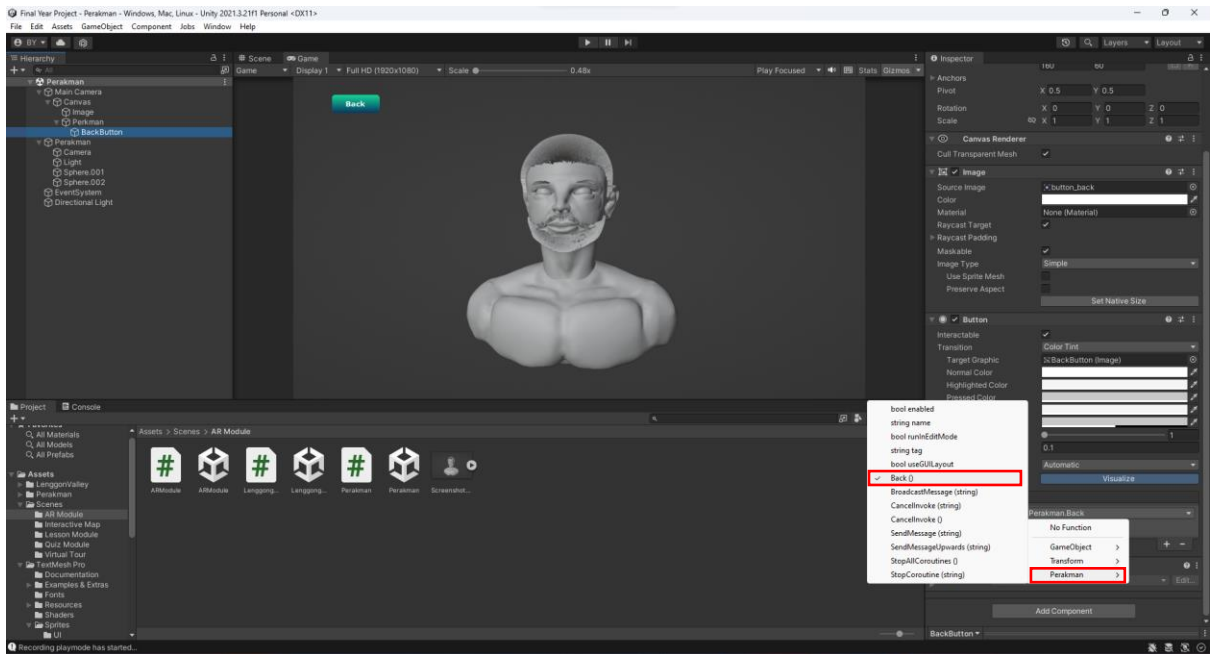


*Figure 4.109 Screenshot of Drag and Drop Perakman Game Object*



## CHAPTER 4

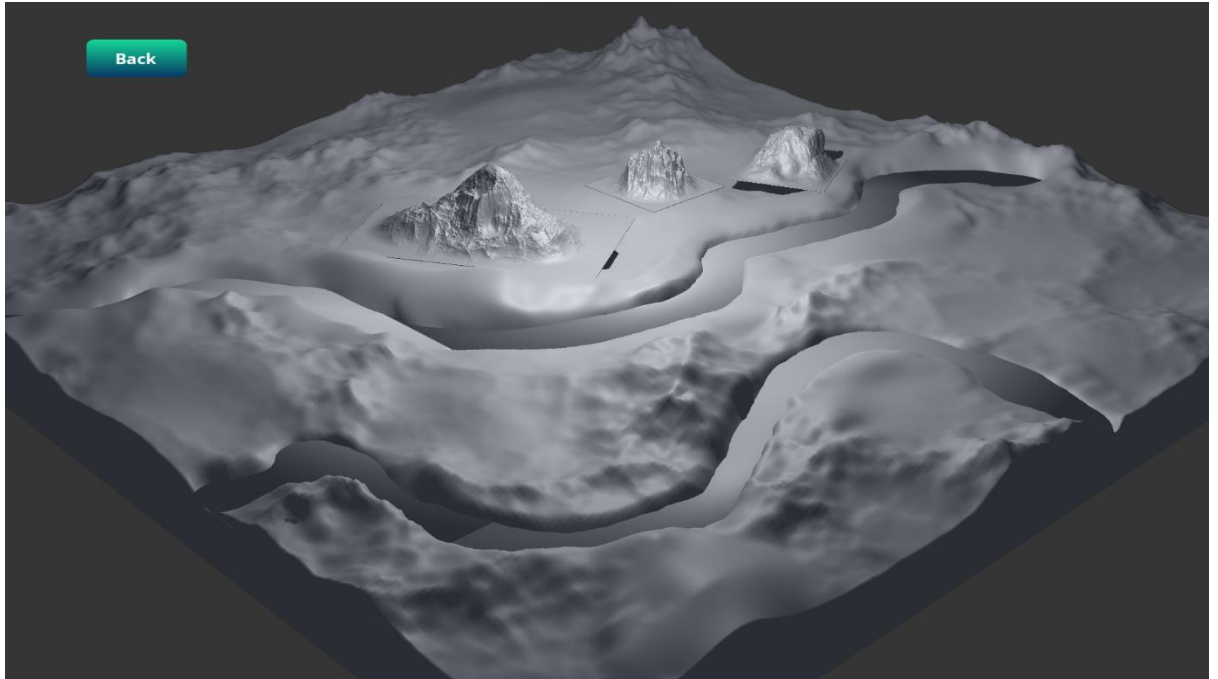
Next, select Perakman in the function panel, then Back() function.



*Figure 4.110 Screenshot of Setting Up Back Function*



*Figure 4.111 3D Model of Perak Man for AR Module*



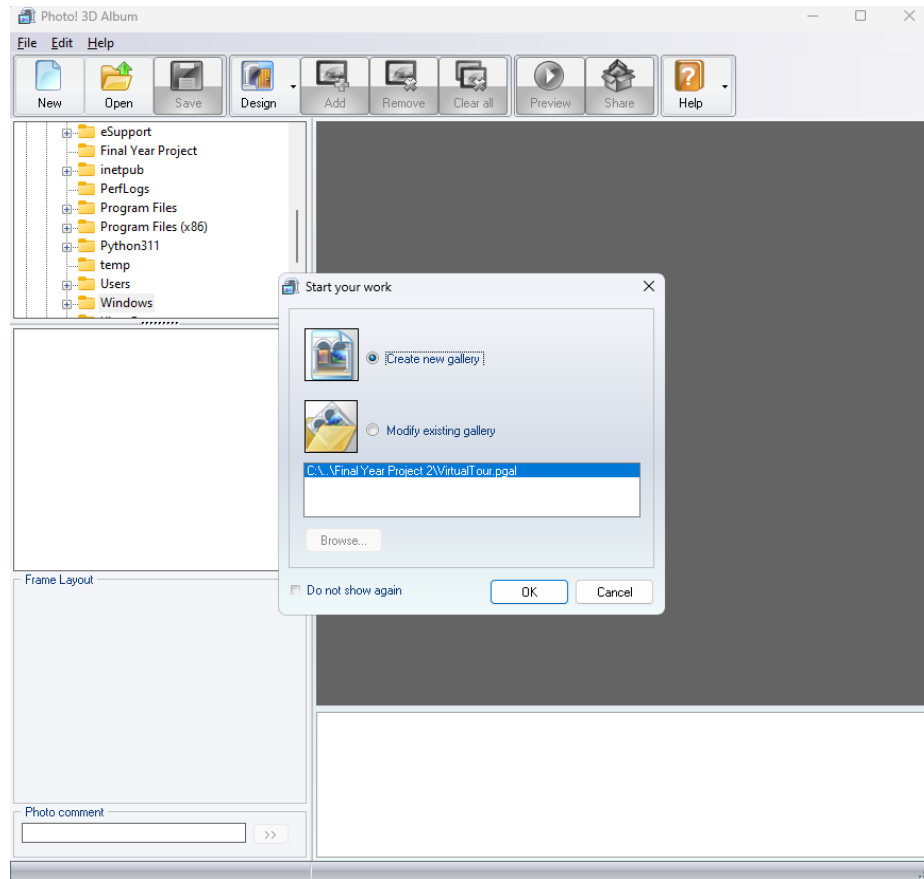
*Figure 4.112 3D Model of Lenggong Valley for AR Module*

The figure above shows 3D models that are required for the AR Module. The 3D model in the figure 4.3.1 above is a 3D model for Perak Man and 3D model in figure 4.3.2 is a 3D model for Lenggong Valley which will be the 3D models that will be included in the AR Module. The Perak Man model is a meticulous representation of the hypothetical face of Perak Man, while the Lenggong Valley models derives from satellite map data, showcasing the iconic landmarks such as Gua Gunung Runtuh, Gua Batu Puteh and Gua Badak. The 3D model is designed using the 3D Blender tools that allows the author to sculpt a realistic 3D model required for the AR Module.

## 4.2.4 Virtual Tour Module

### Create a Virtual Environment

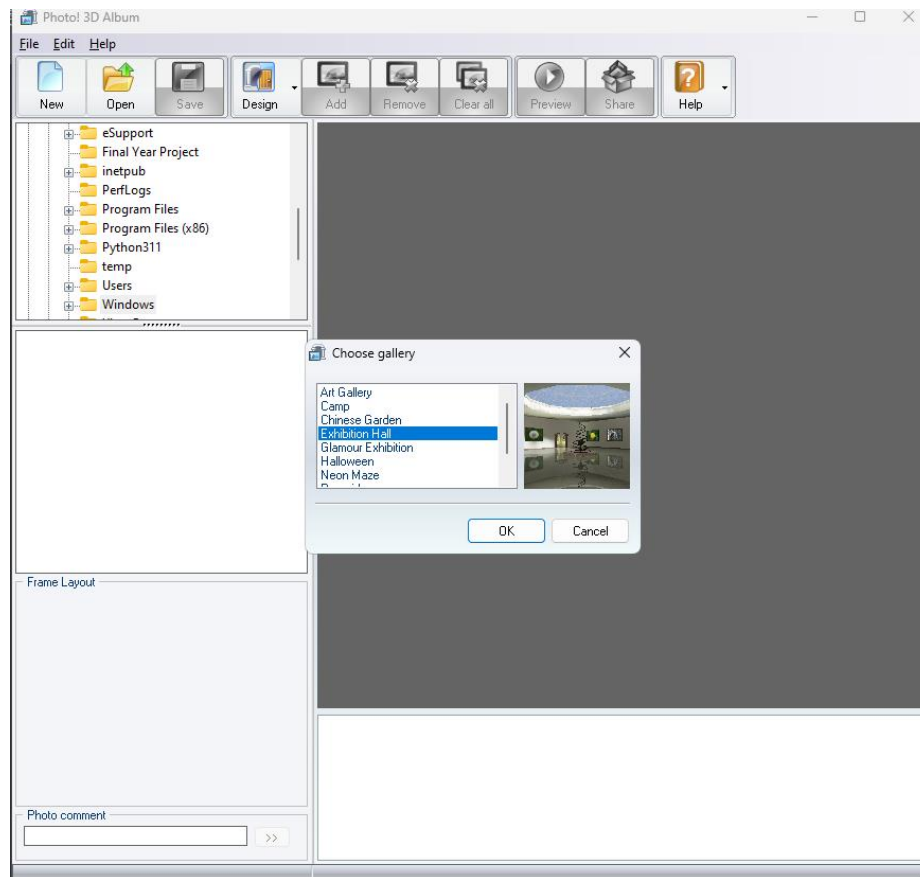
Open Photo! 3D Album software and create a new gallery.



*Figure 4.113 Screenshot for Create New Gallery*

## CHAPTER 4

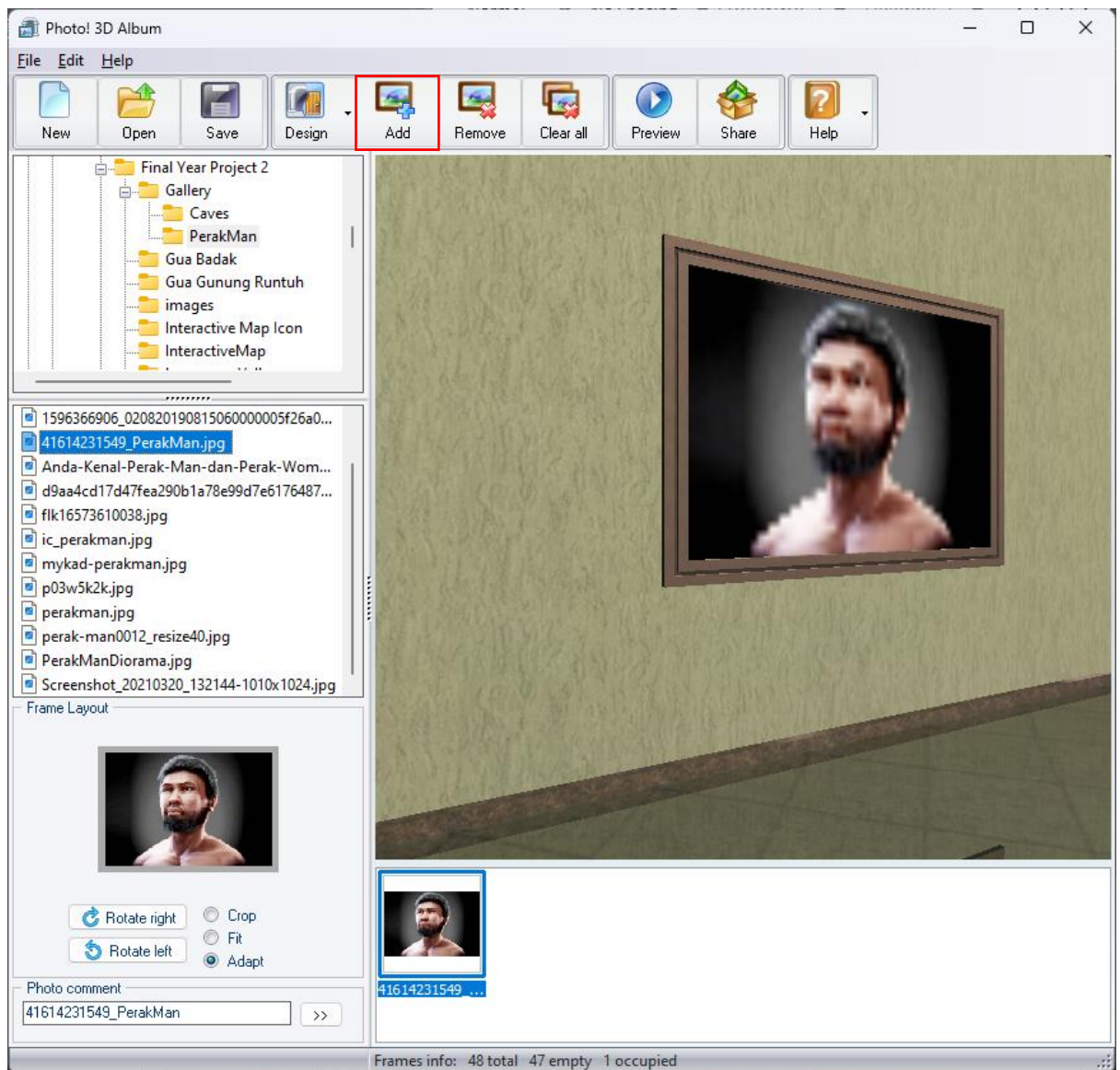
Choose the Exhibition Hall gallery template.



**Figure 4.114** Screenshot for Choose Gallery Template

## CHAPTER 4

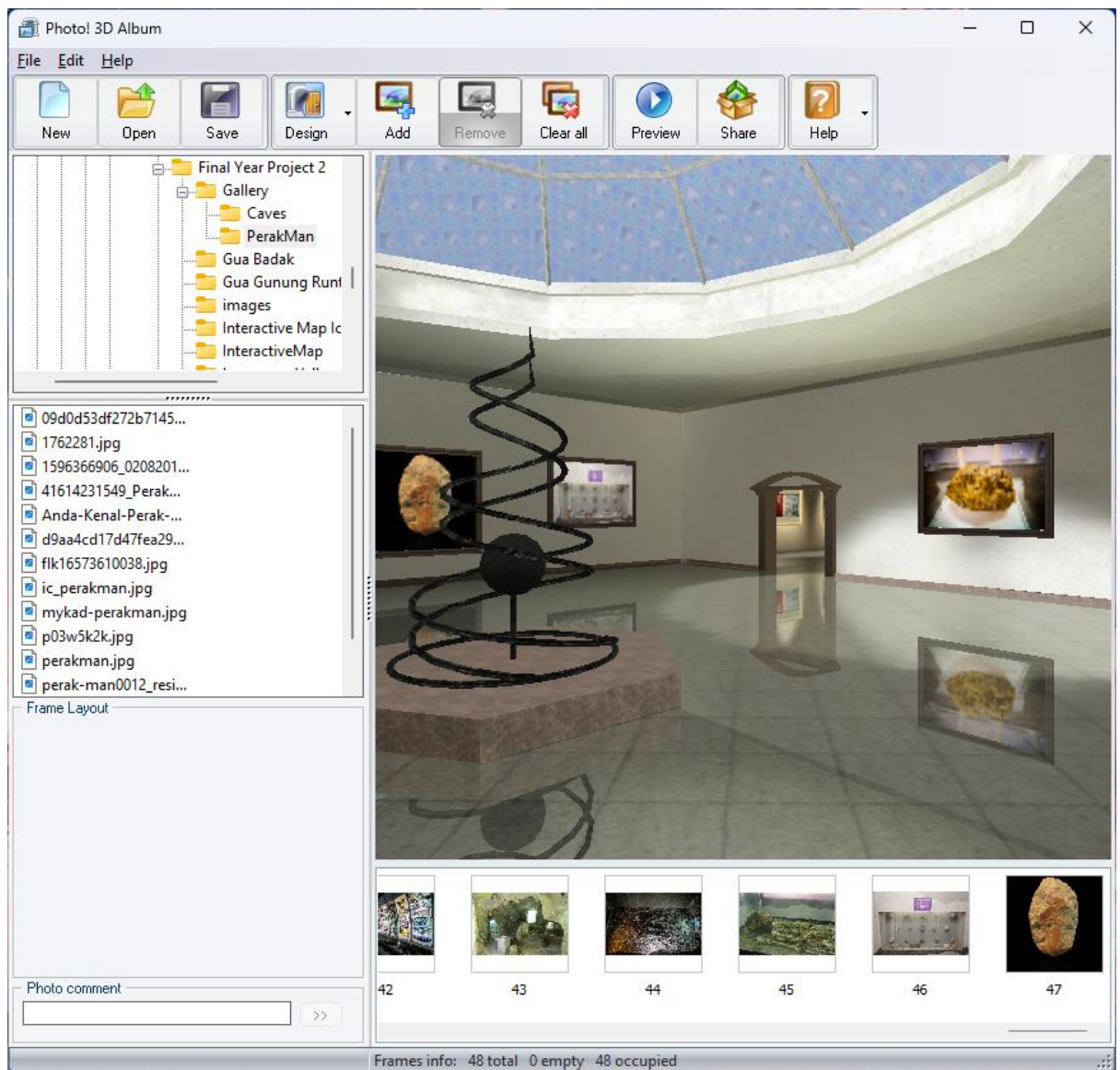
Select the relevant image from Files and Click the Add Button to add into the gallery.



*Figure 4.115 Screenshot for Add Image into Gallery*

## CHAPTER 4

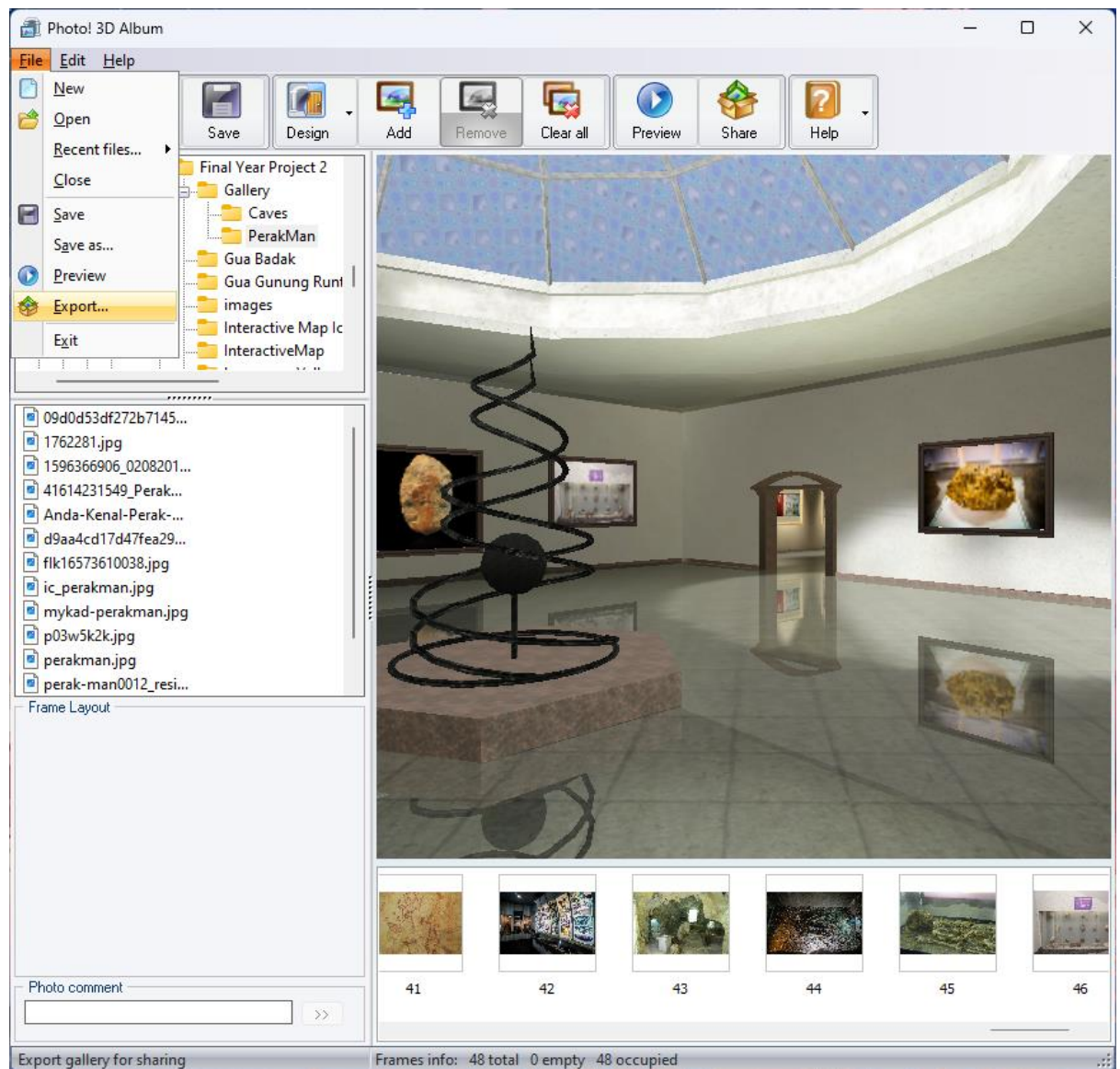
Add all relevant image into all photo gallery.



*Figure 4.116 Screenshot for Add All Image into Gallery*

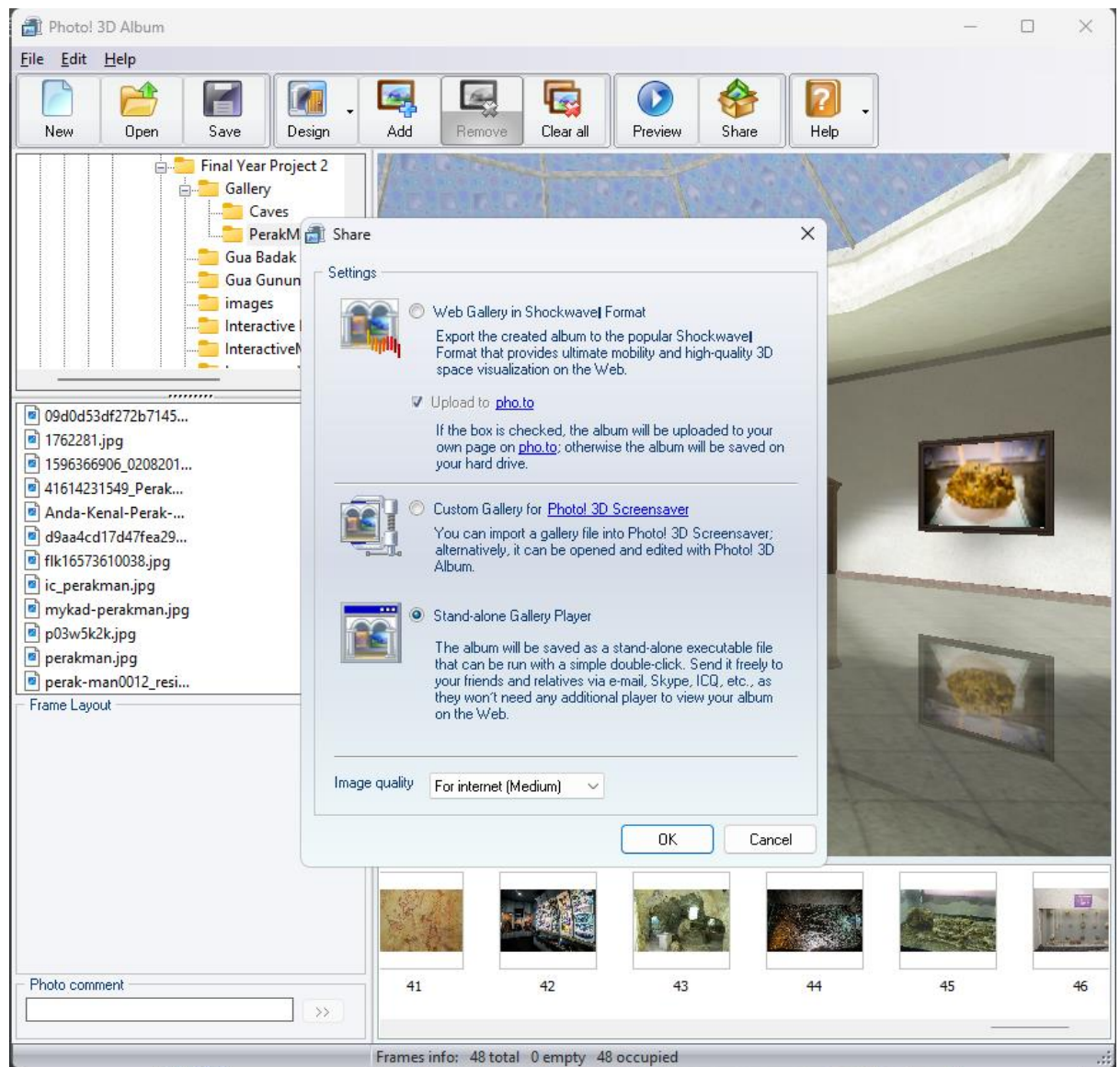
## CHAPTER 4

Export the Gallery.



*Figure 4.117 Screenshot for Export Gallery*

Choose Stand-alone Gallery Player which will export the file into an executable file.



**Figure 4.118** Screenshot for Choose Stand-alone Gallery Player

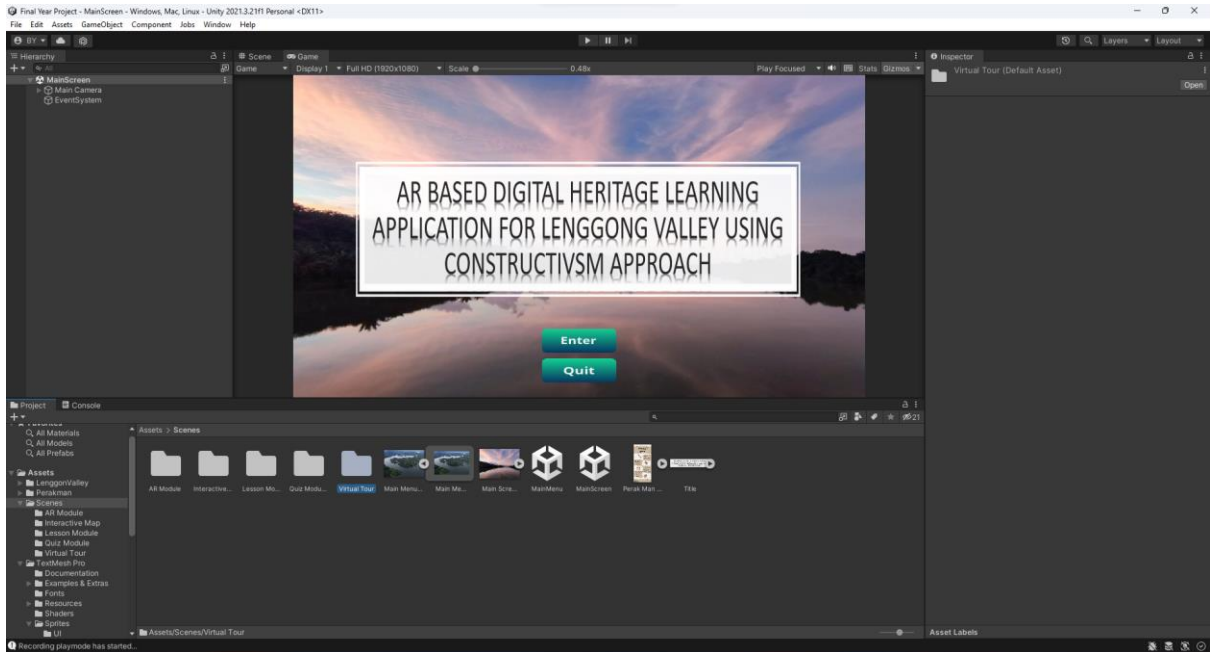


## CHAPTER 4

### Link the executable file with Unity

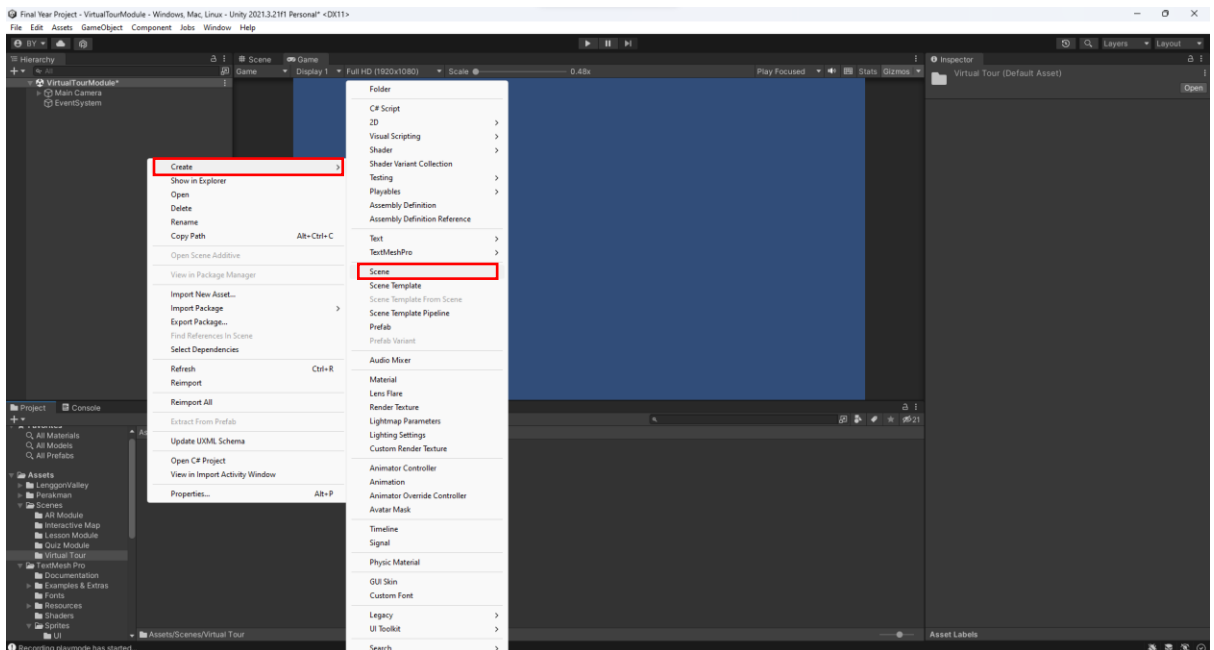
Open Unity.

Create a new folder and name it as Virtual Tour Module.



*Figure 4.119 Screenshot of Create a New Folder for Virtual Tour Module*

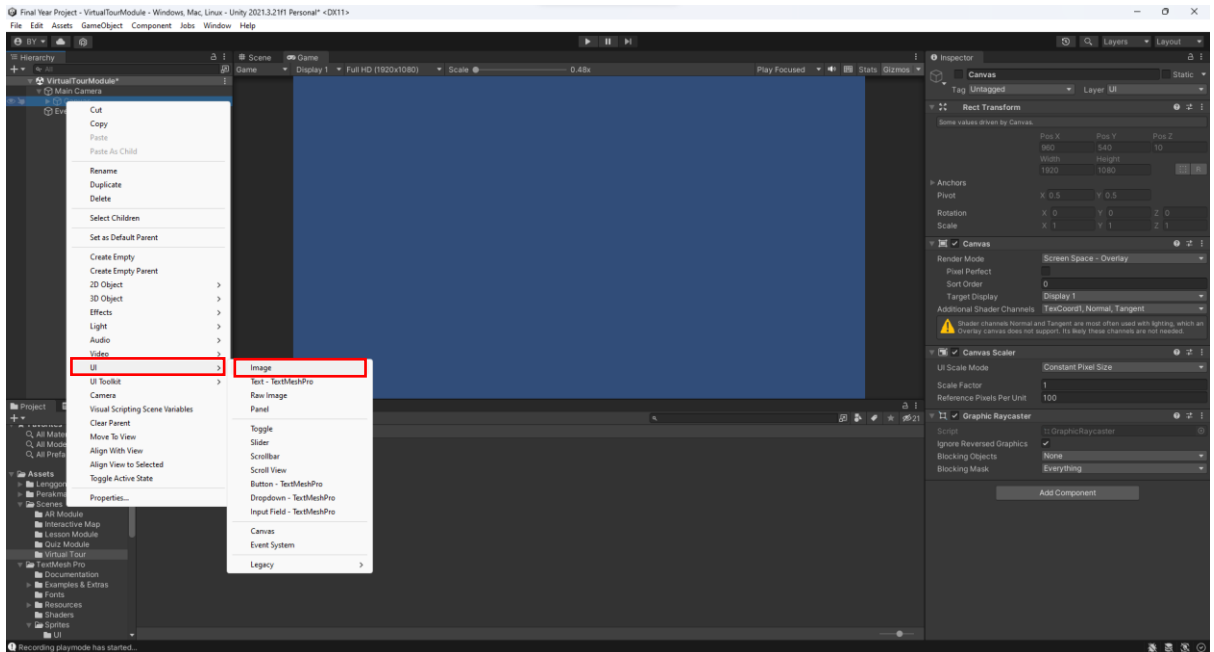
Create a new Scene in the Virtual Tour Module folder.



*Figure 4.120 Screenshot of Create a New Scene for Virtual Tour Module*

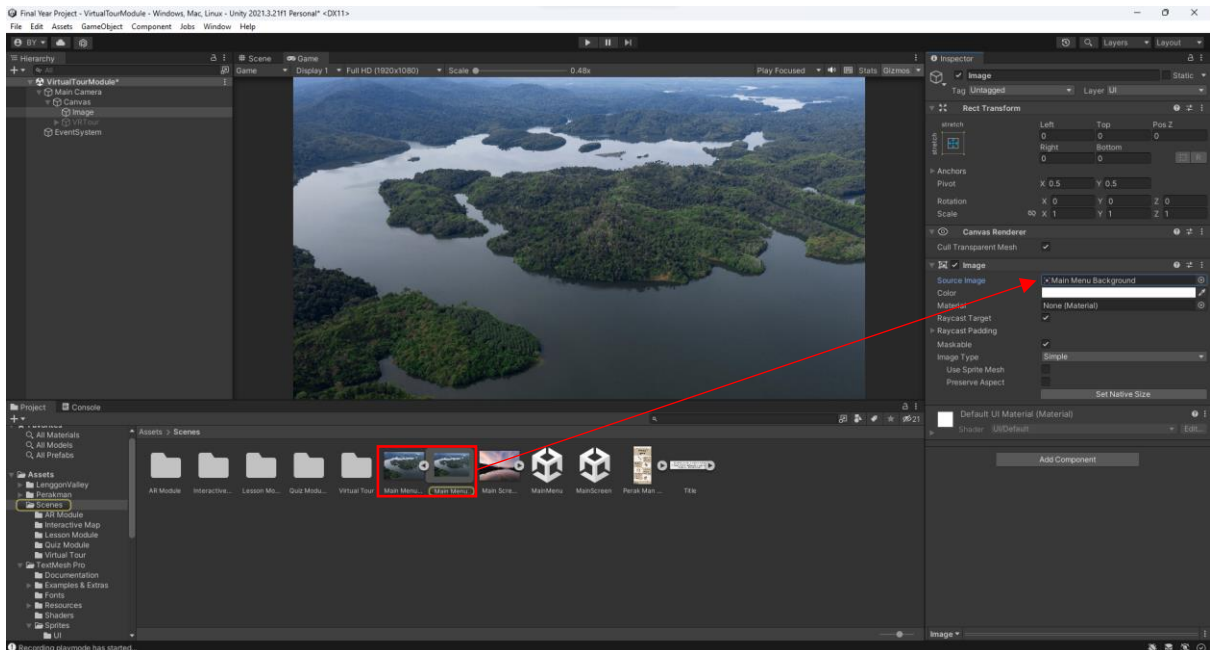
## CHAPTER 4

Right click on Canvas, select UI > Image to create an image element for the background.



*Figure 4.121 Screenshot of Create Image Element*

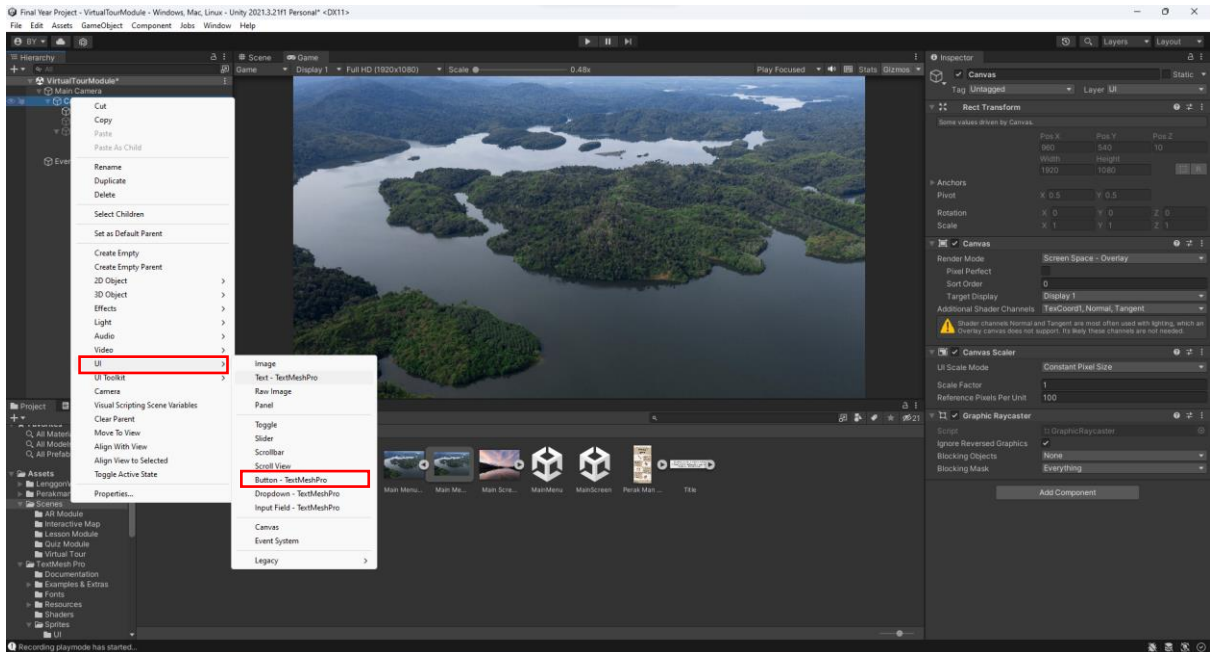
Drag the diagram image into the Source Image of the Image created.



*Figure 4.122 Screenshot of Drag and Drop Image into the Source Image*

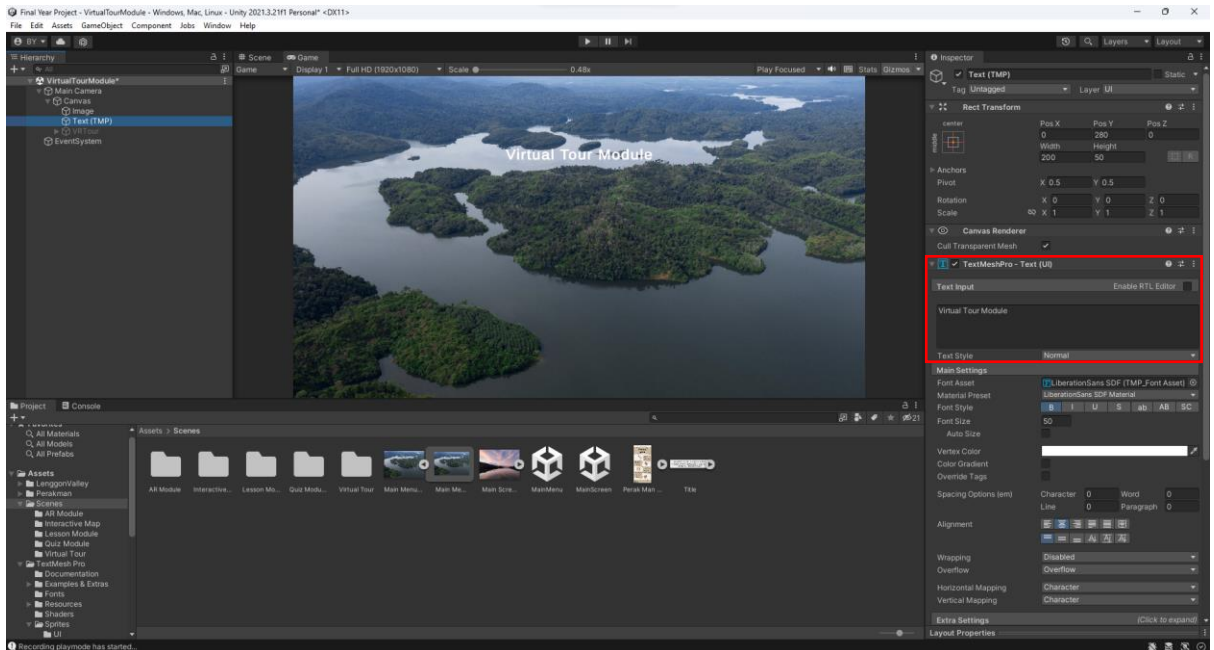
## CHAPTER 4

Right click on Canvas, select UI -> Text – TextMeshPro to create a text element for title.



*Figure 4.123 Screenshot of Create Text – TextMeshPro*

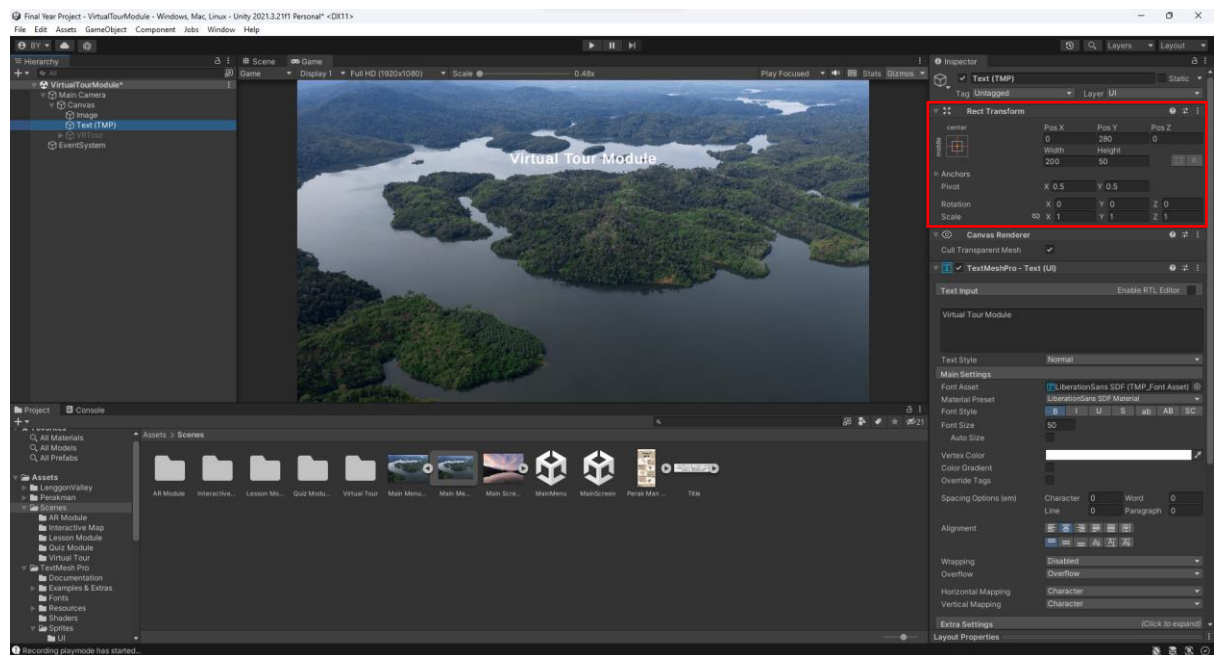
Edit the Text Input to set the title of the content interface.



*Figure 4.124 Screenshot of Edit Text Input*

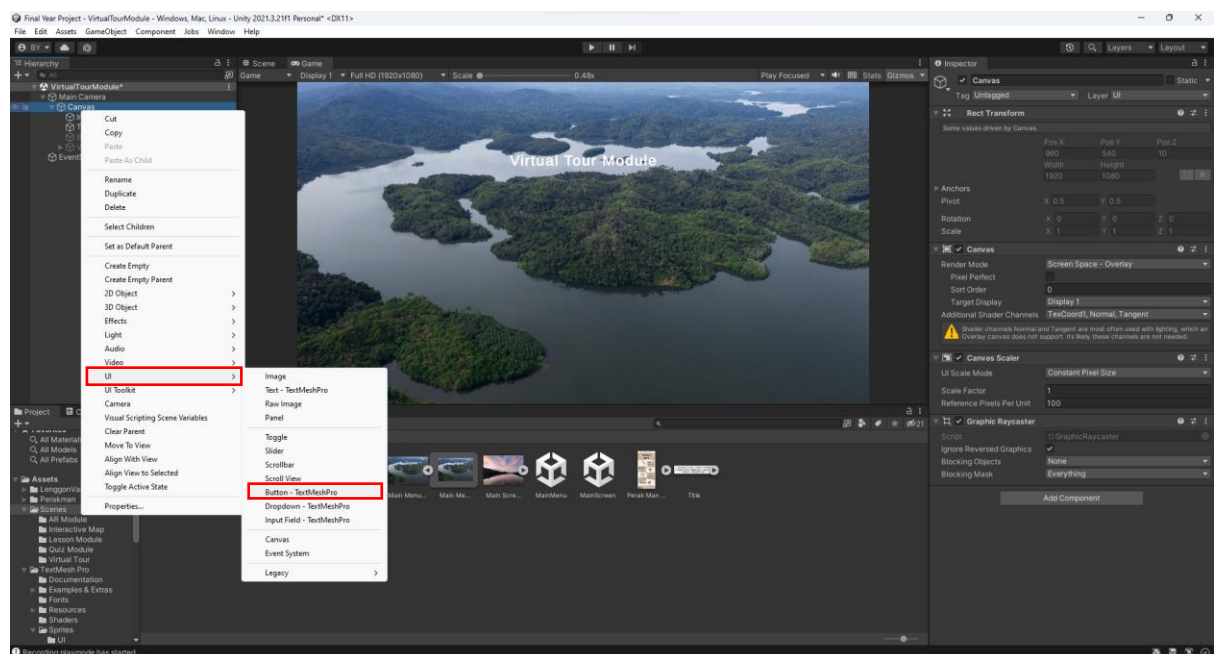
## CHAPTER 4

Adjust the position of the Title.



*Figure 4.125 Screenshot of Adjust Title Position*

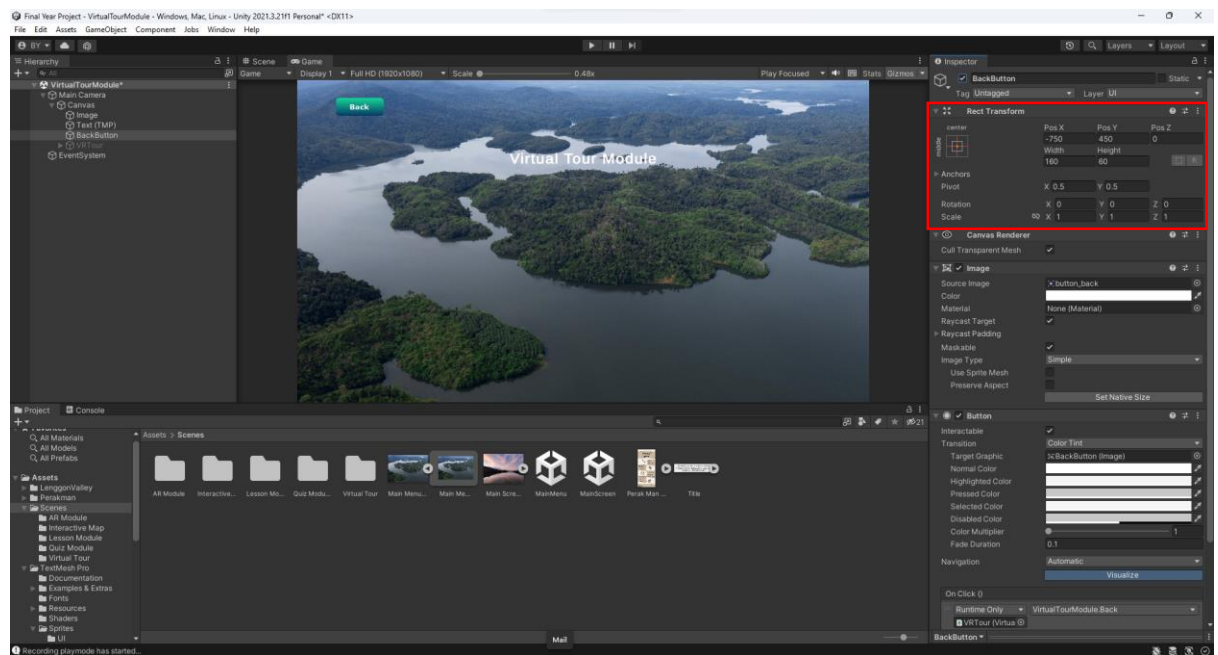
Right click on Canvas, select UI > Button - TextMeshPro to create a Back Button.



*Figure 4.126 Screenshot of Create Button - TextMeshPro*

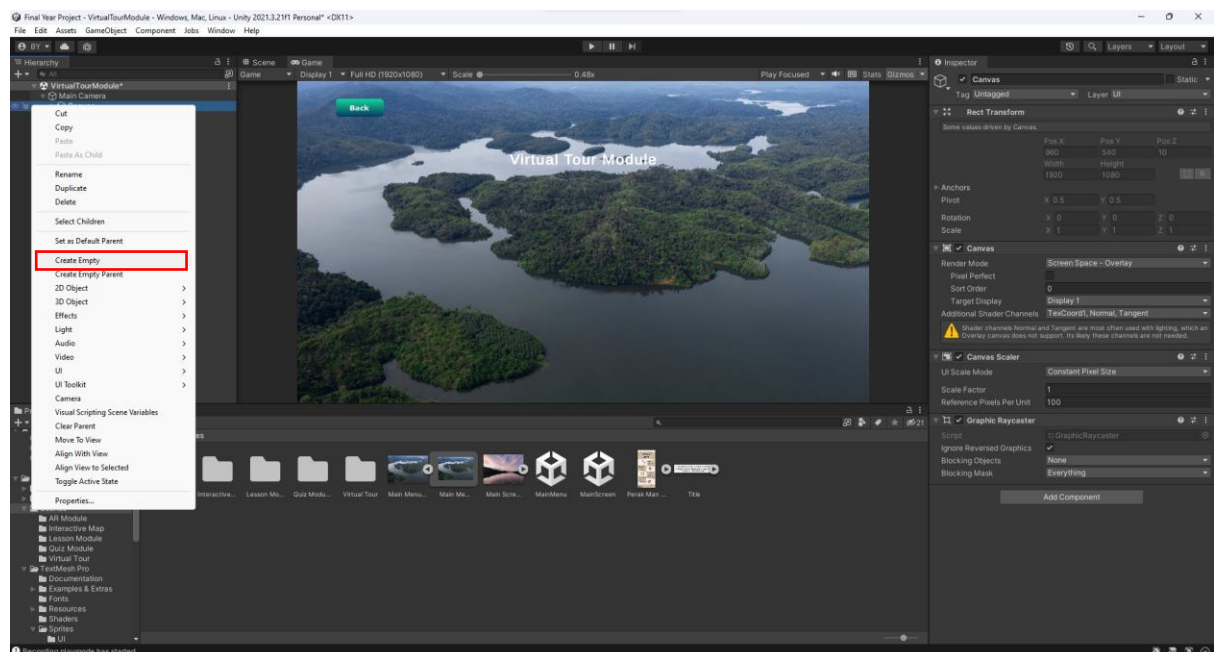
## CHAPTER 4

Adjust the position of the button and set the button width to 160 and height to 60.



*Figure 4.127 Screenshot of Adjust Button Position and Size*

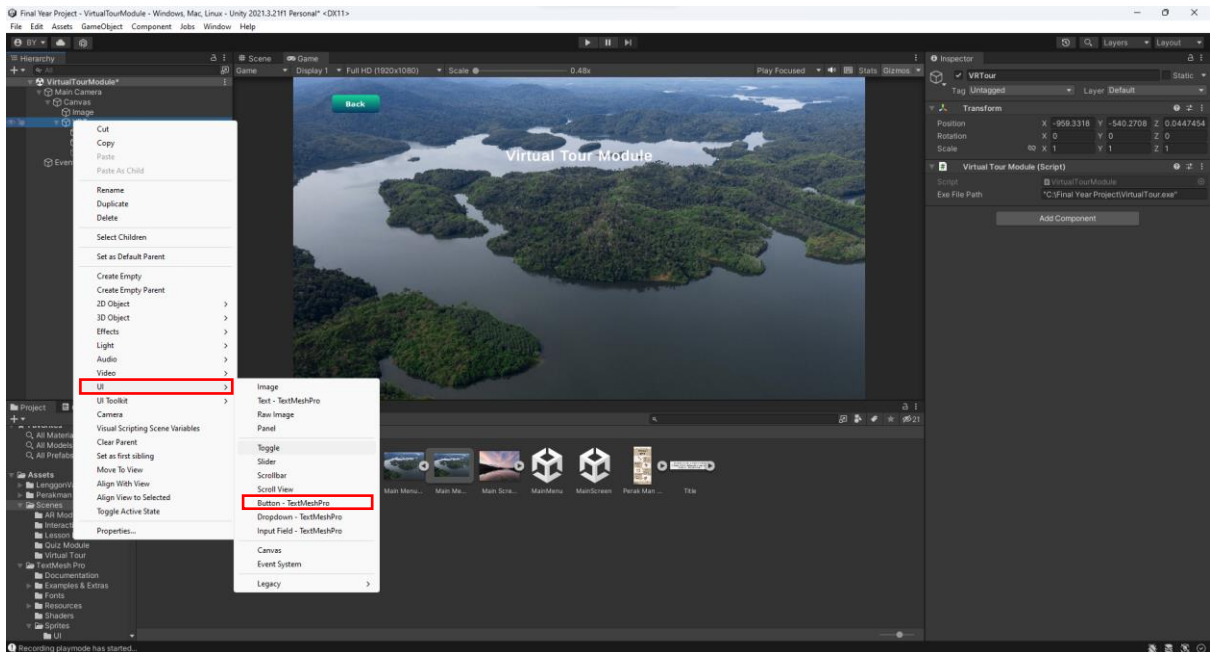
Right click on Canvas, select Create Empty Game Object and name as VRTour.



*Figure 4.128 Screenshot of Create Empty Game Object*

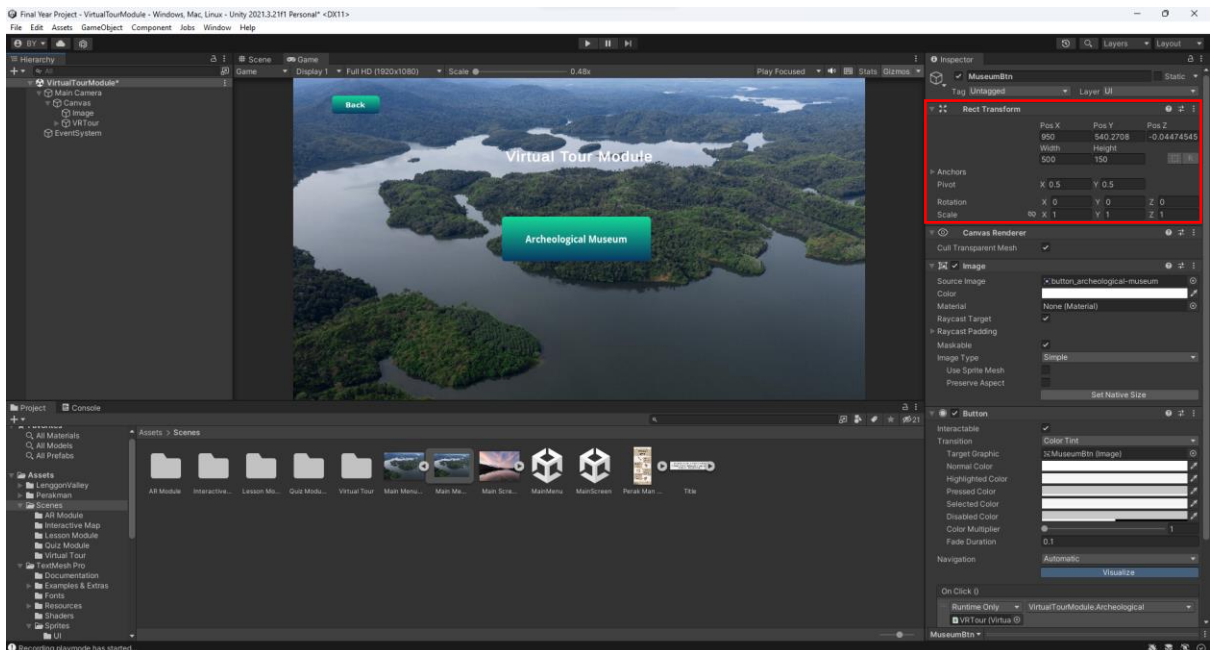
## CHAPTER 4

Right click on VRTour and create UI > Button(TextMeshPro)



*Figure 4.129 Screenshot of Create Button - TextMeshPro*

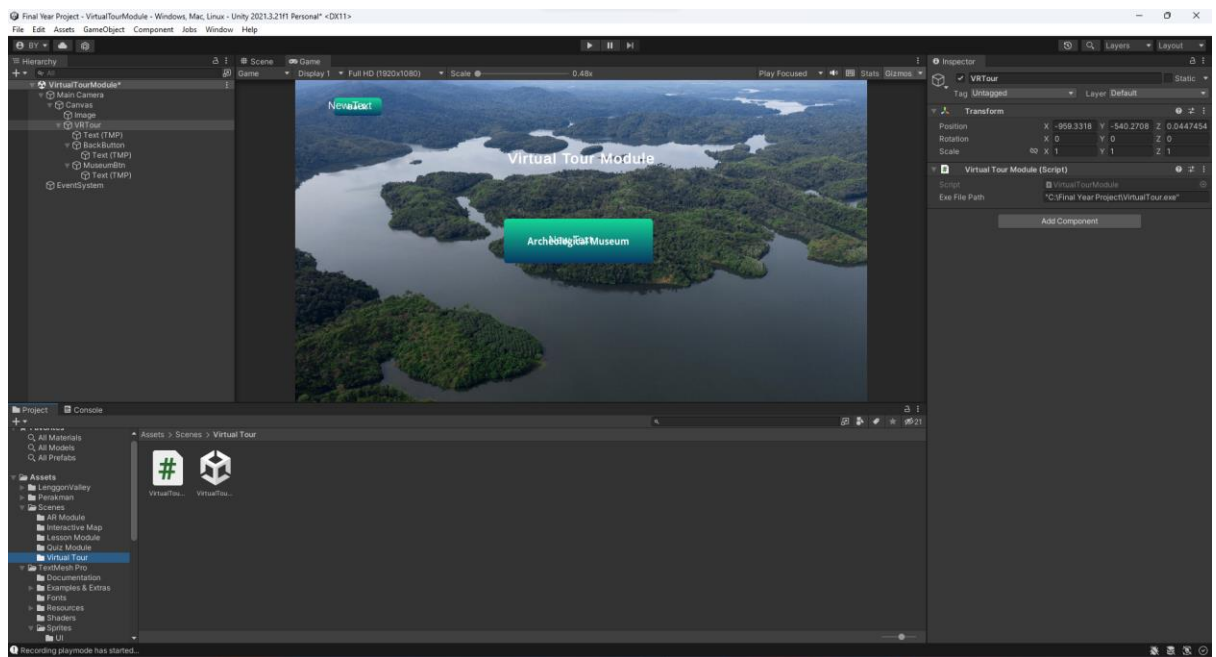
Adjust the position of the button and set the width of button to 500 and height of button to 150.



*Figure 4.130 Screenshot of Adjust Button Position and Size*

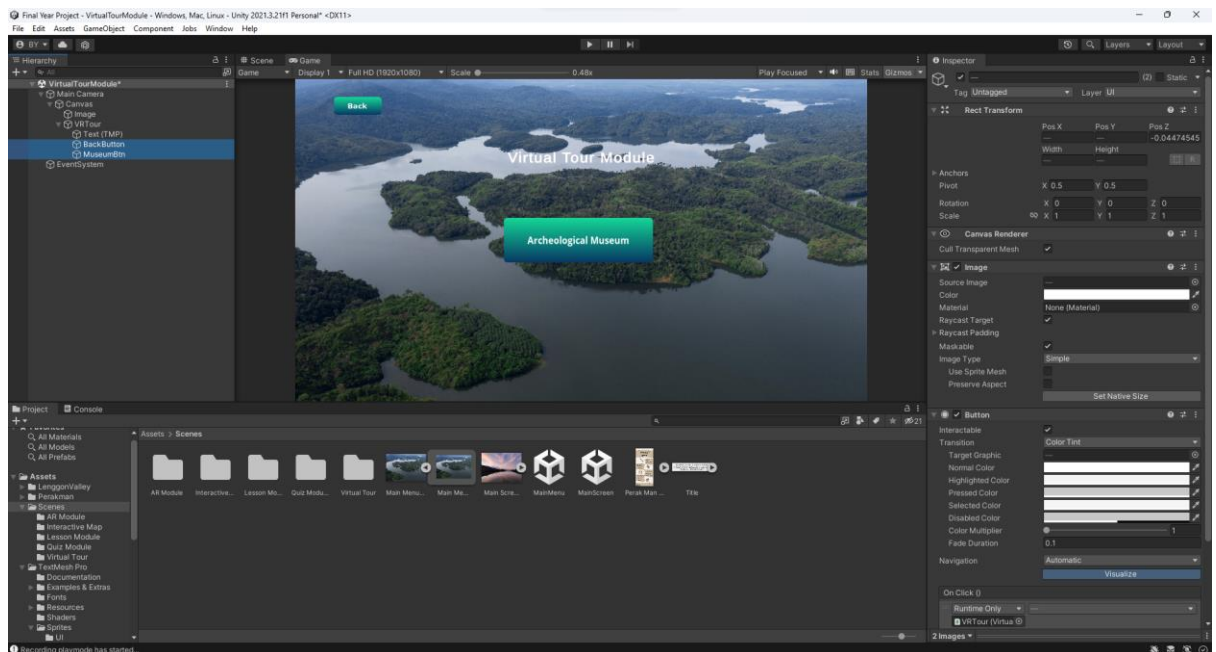
## CHAPTER 4

Drag the Back Button and MuseumBtn into VTModule Game Object.



*Figure 4.131 Screenshot of Drag and Drop Button into Game Object*

Remove Text(TMP) in the Back Button and MuseumBtn section to remove the default UI for the button.



*Figure 4.132 Screenshot of Remove Text(TMP)*

## CHAPTER 4

Drag and drop the UI of Back Button and MuseumBtn into the Source image of the button.

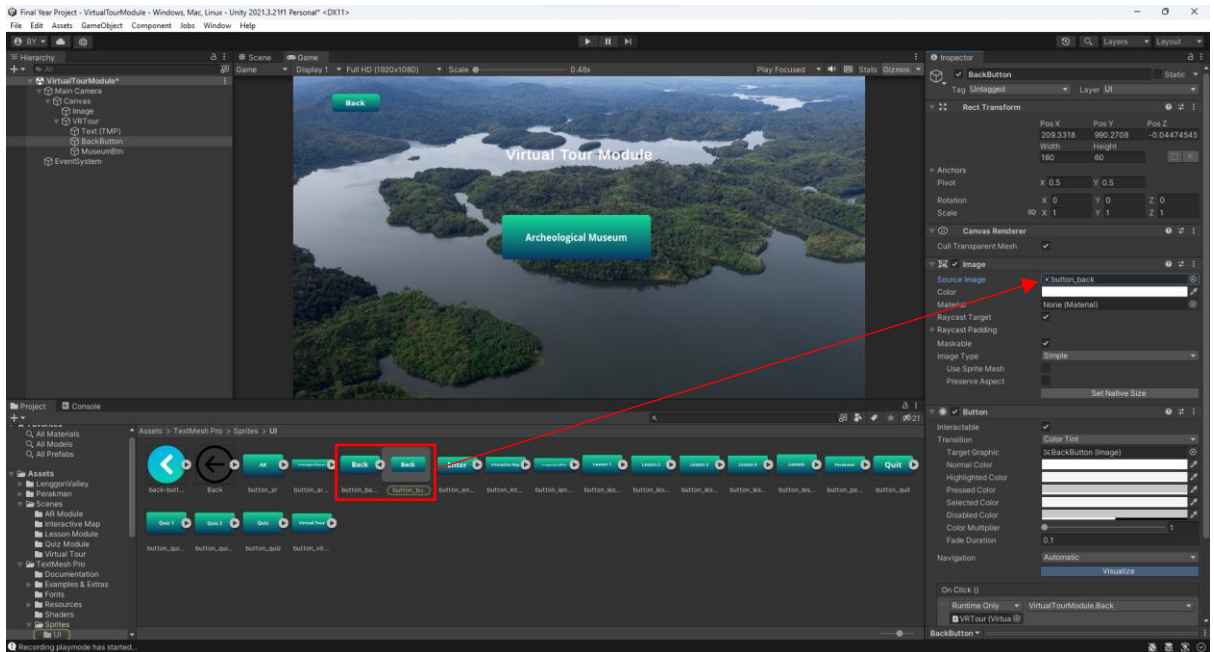


Figure 4.133 Screenshot of Drag and Drop Back Button UI

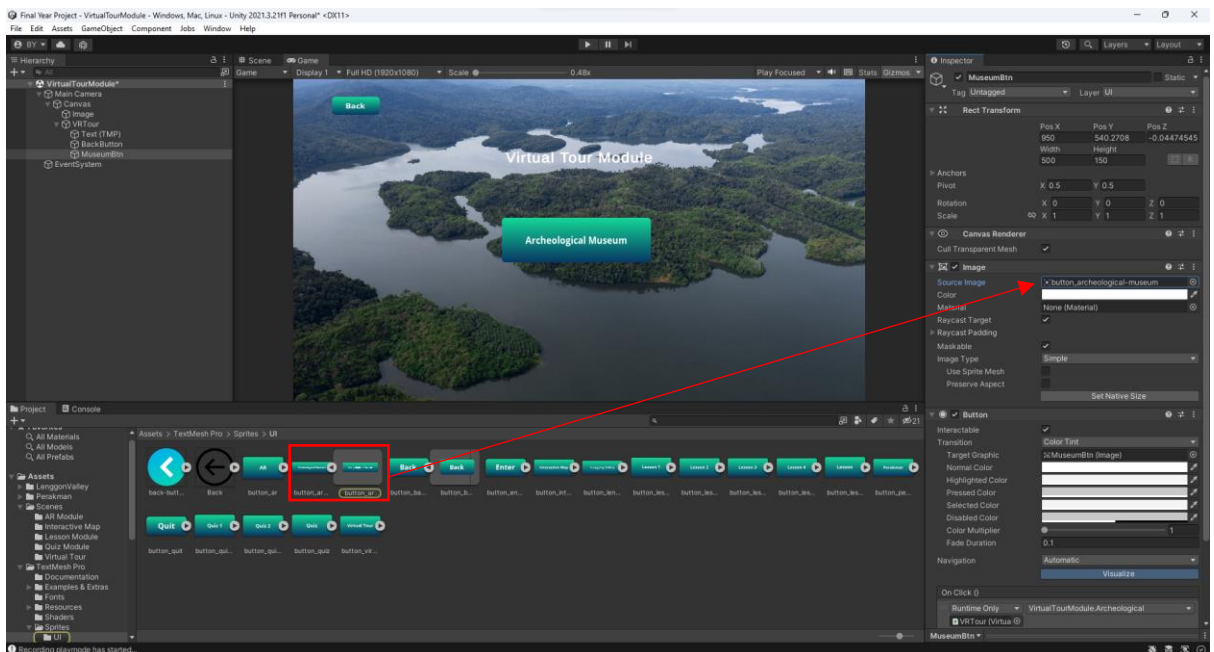
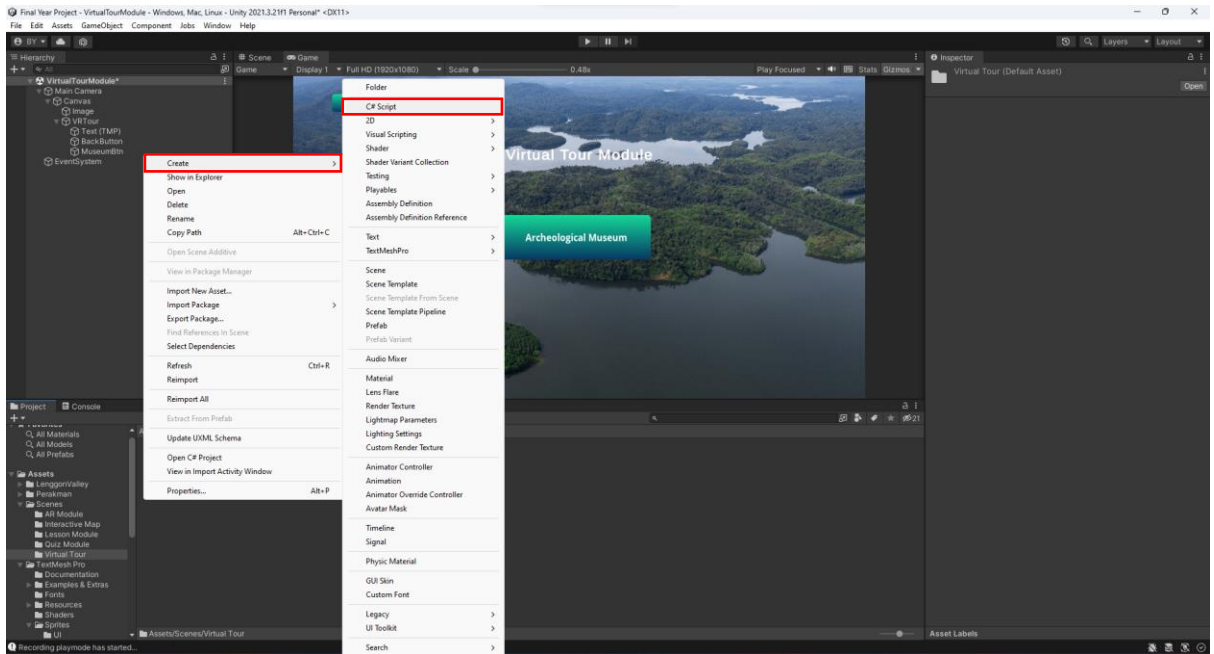


Figure 4.134 Screenshot of Drag and Drop Museum Button UI



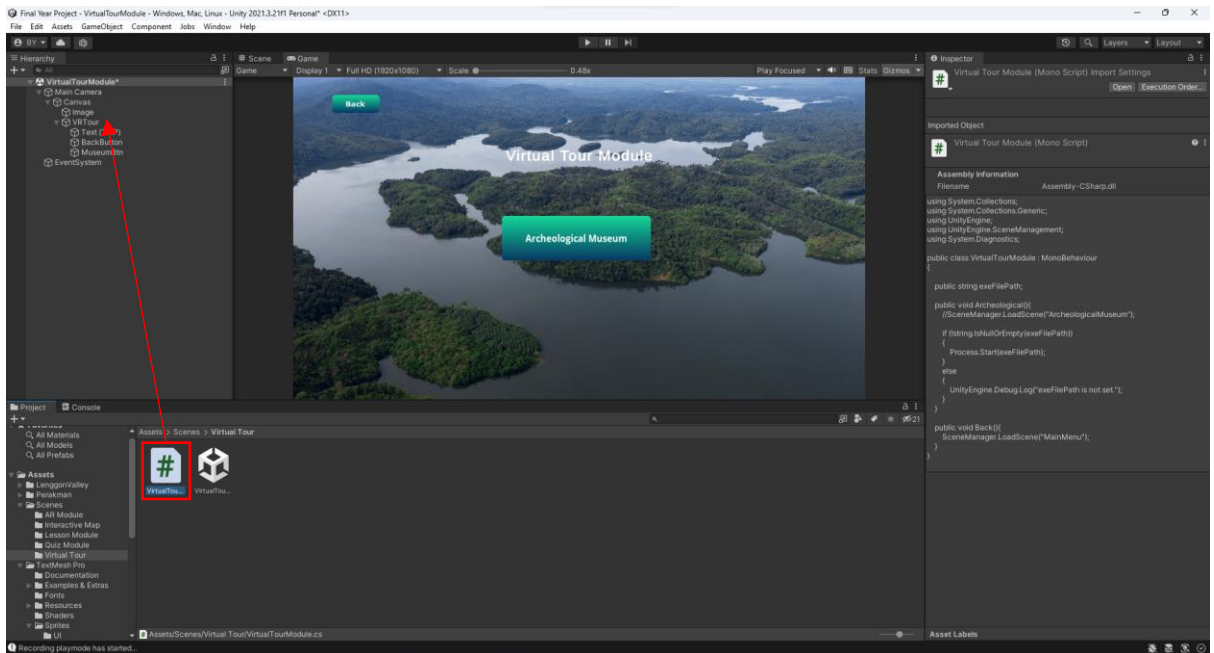
## CHAPTER 4

Right click select Create > C# Script to create a new C# Script and name it as VirtualTourModule in Virtual Tour folder.



*Figure 4.135 Screenshot of Create C# Script*

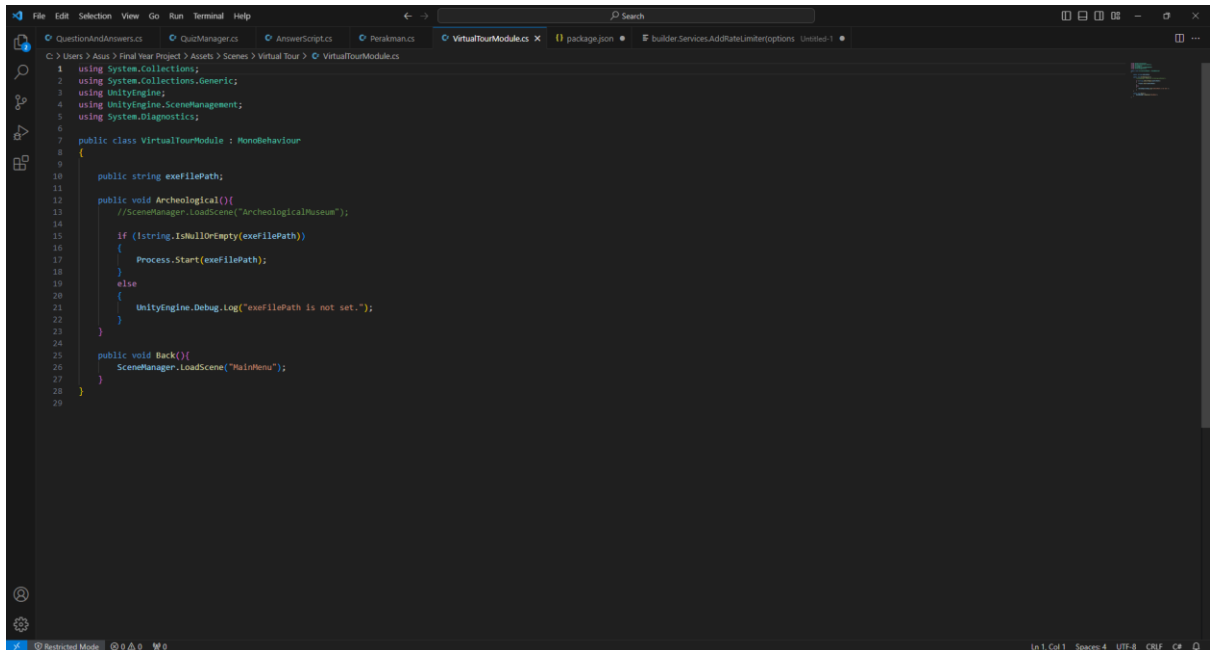
Drag and Drop the VirtualTourModule to VRTour Game Object.



*Figure 4.136 Screenshot of Drag and Drop Game Object*

## CHAPTER 4

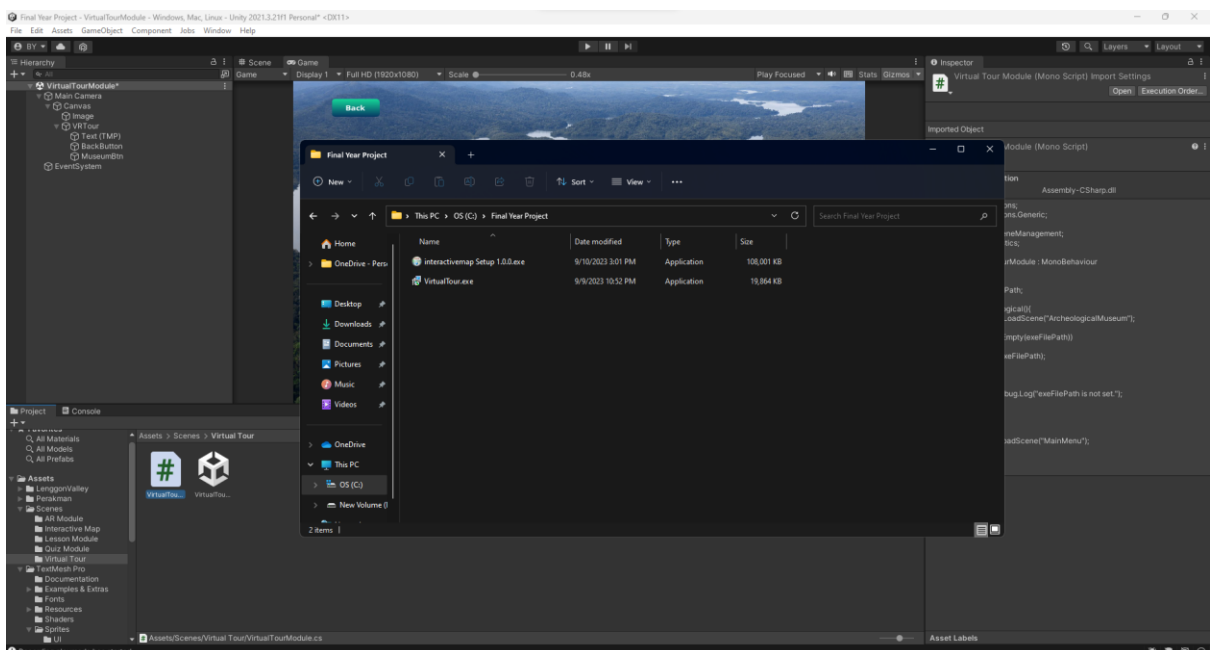
Code the VirtualTourModule Script and create a Back function and Archeological function that runs the executable file one the button click.



```
1 using System.Collections;
2 using System.Collections.Generic;
3 using UnityEngine;
4 using UnityEngine.SceneManagement;
5 using System.Diagnostics;
6
7 public class VirtualTourModule : MonoBehaviour
8 {
9
10     public string exeFilePath;
11
12     public void Archeological(){
13         //SceneManager.LoadScene("ArcheologicalMuseum");
14
15         if (!string.IsNullOrEmpty(exeFilePath))
16         {
17             Process.Start(exeFilePath);
18         }
19         else
20         {
21             UnityEngine.Debug.Log("exeFilePath is not set.");
22         }
23     }
24
25     public void Back(){
26         SceneManager.LoadScene("MainMenu");
27     }
28 }
29
```

*Figure 4.137 Screenshot of Codes for VirtualTourModule*

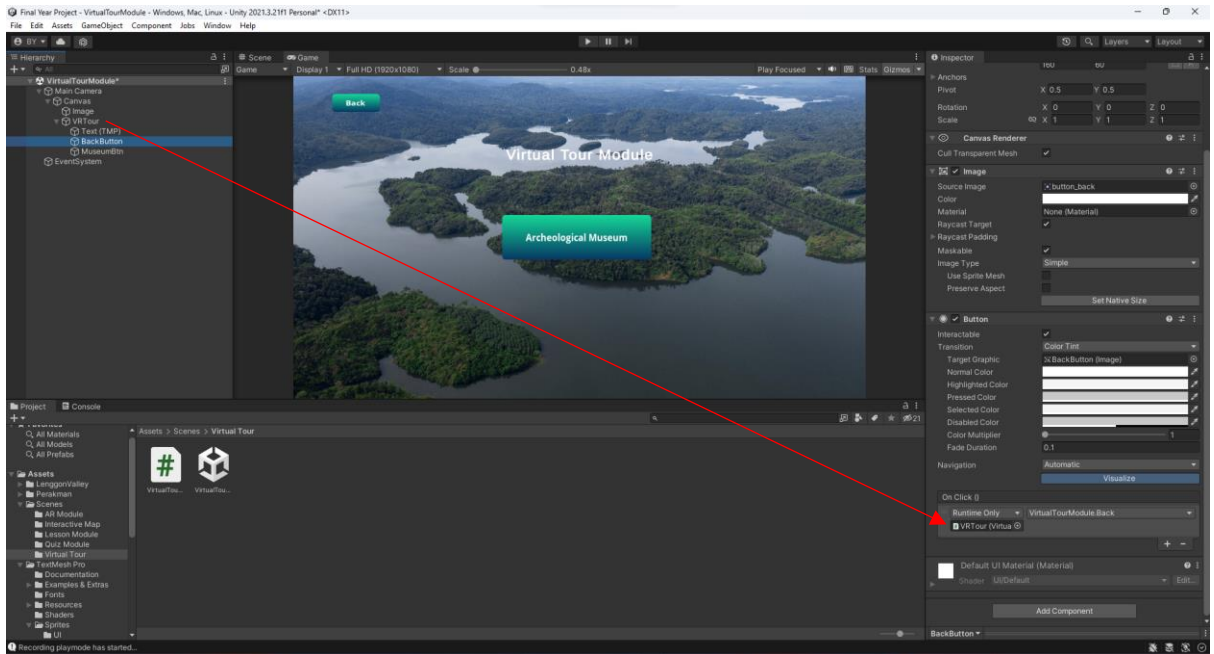
Create a Final Year Project folder in Local Disk C and paste the VirtualTour.exe in the folder.



*Figure 4.138 Screenshot of Create Final Year Project Folder*

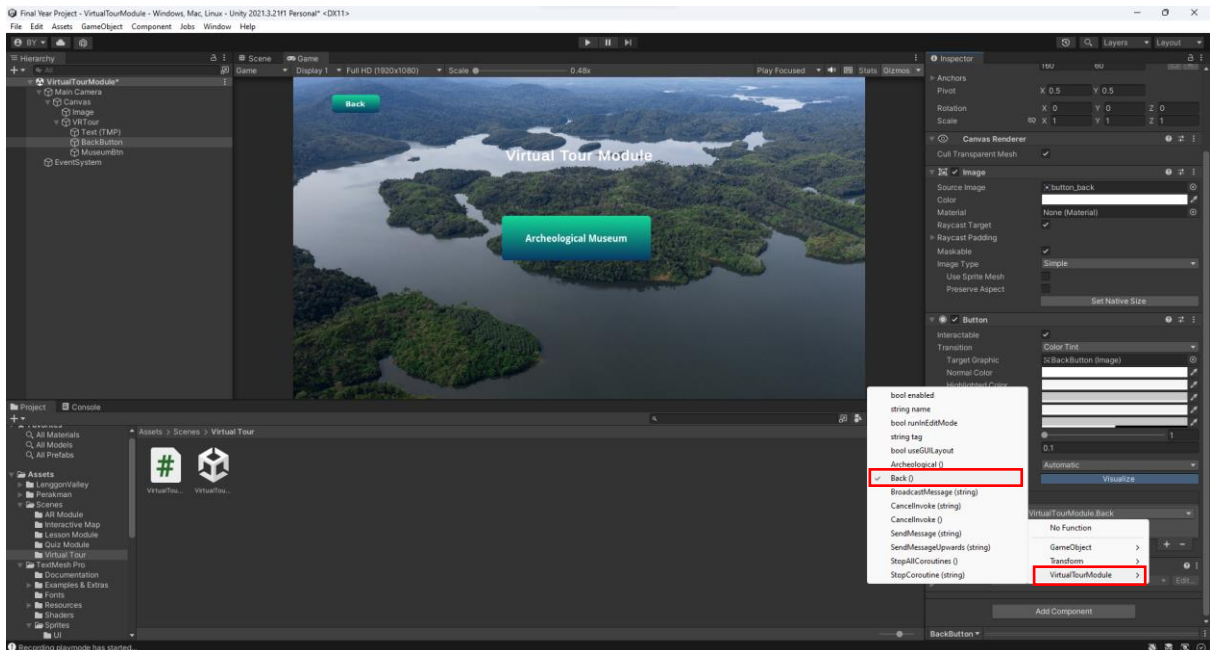
## CHAPTER 4

Select the Back Button, Add an OnClick function and Drag and Drop the VRTour Game Object into the Object panel.



*Figure 4.139 Screenshot of Drag and Drop VRTour Game Object*

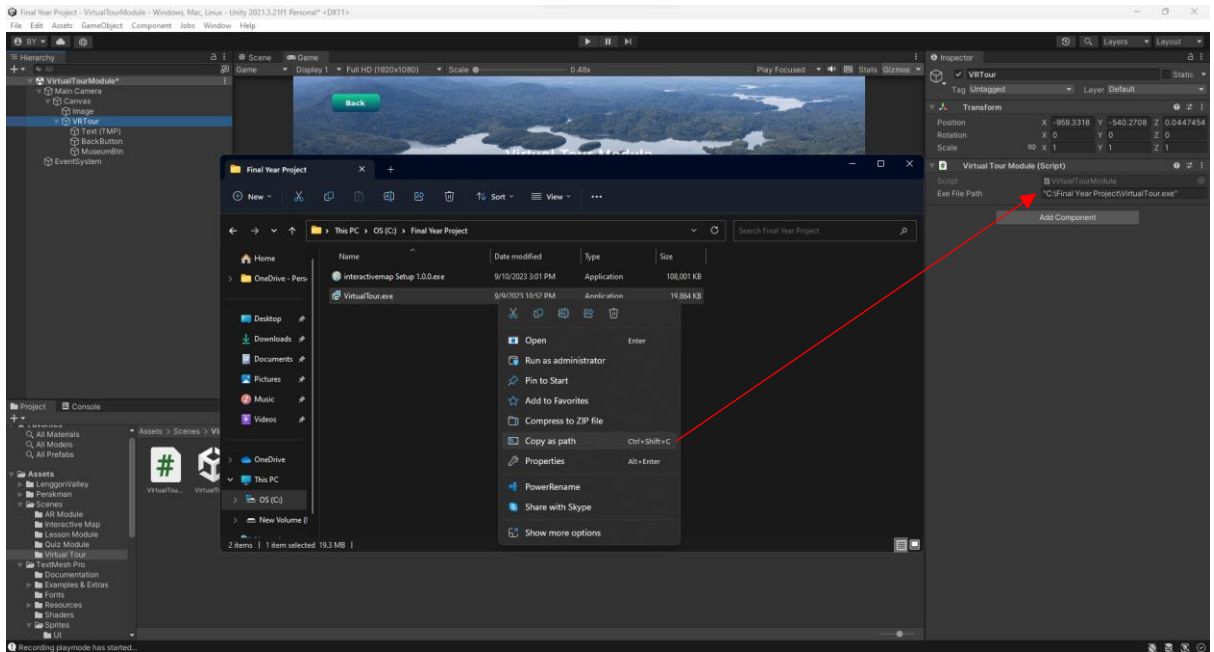
Next, select VirtualTourModule in the function panel, then Back() function.



*Figure 4.140 Screenshot of Setting Up of Back and Museum Button*

## CHAPTER 4

In VRTour Game Object, copy the path of VirtualTour.exe and drag into the Exe File Path in Unity to link the MuseumBtn to the VirtualTour.exe.



*Figure 4.141 Screenshot of Copy path of file directory*



*Figure 4.142 Content Interface for Virtual Tour Module*

The figure above shows the content interface of Virtual Tour Module. The interface is showing a virtual tour on Archeological Museum of Lenggong Valley. This module will take the users on a tour around the virtual museum and shows the users the artifacts related to Lenggong Valley such as the iconic skeleton of Perak Man. The module offers automated guided tours while also providing a free mode for independent exploration. The Virtual Tour Module is designed using a software known as Photo! 3D Album where the software helps the author to integrate the images into the virtual museum to create an engaging and informative virtual tour experience.

## CHAPTER 4

### 4.2.5 Interactive Map Module

#### Create a Map using Adobe Animate

##### First View

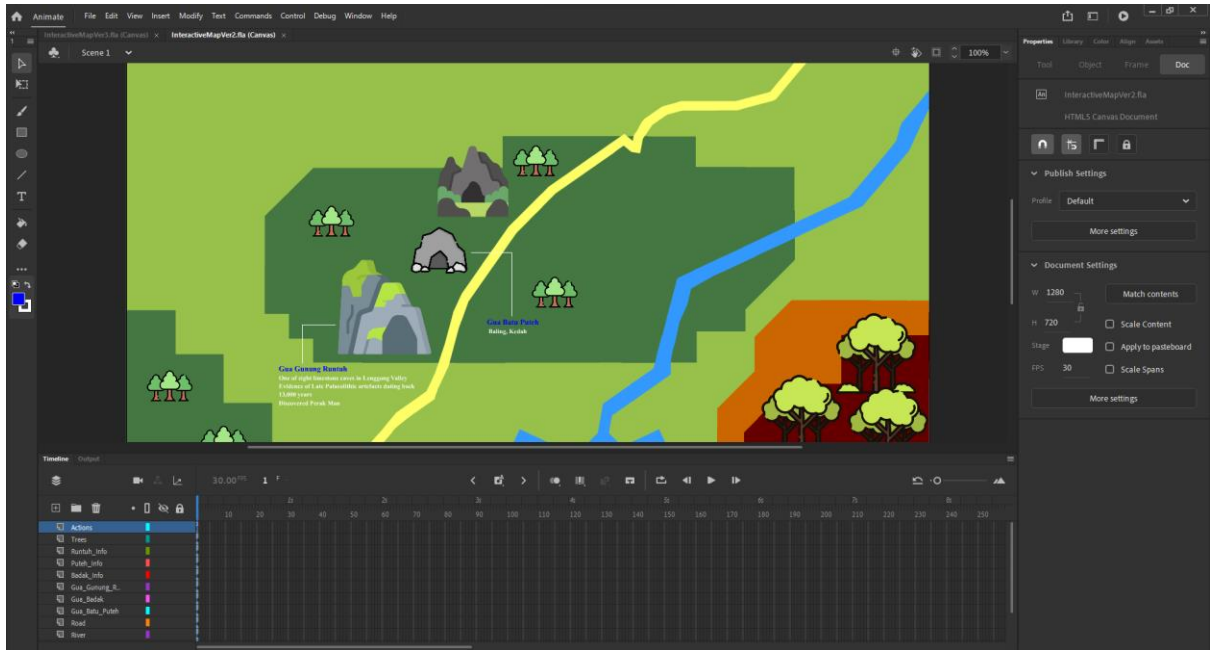


Figure 4.143 Screenshot of First View of Interactive Map

##### Second View

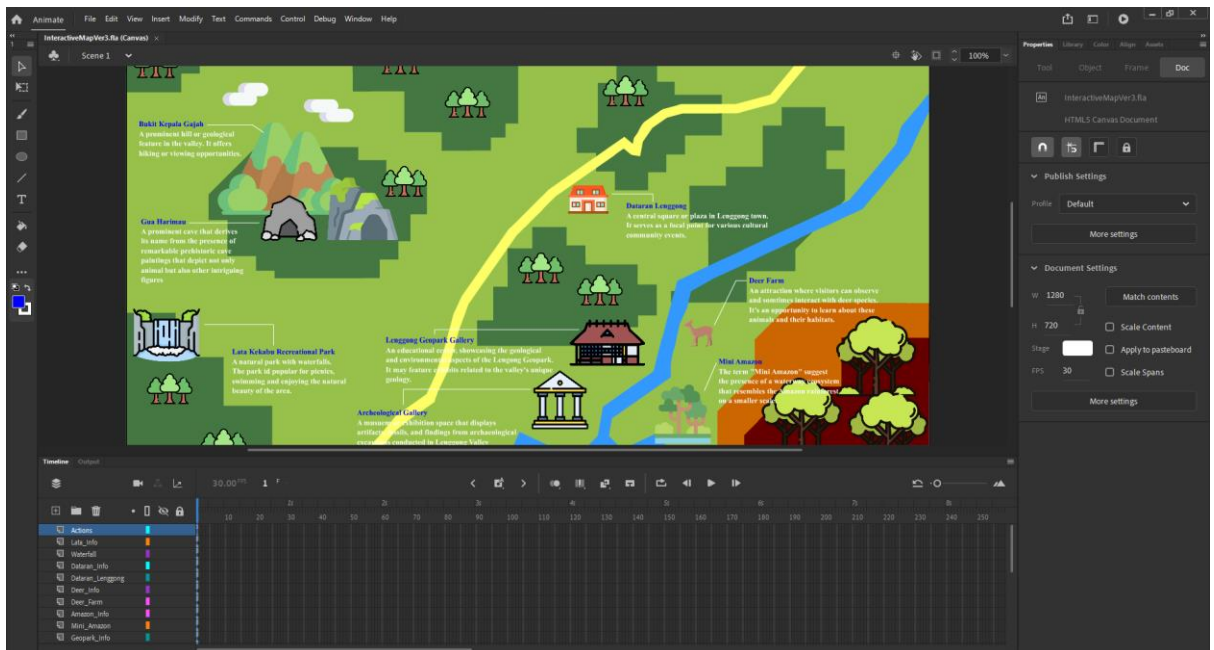
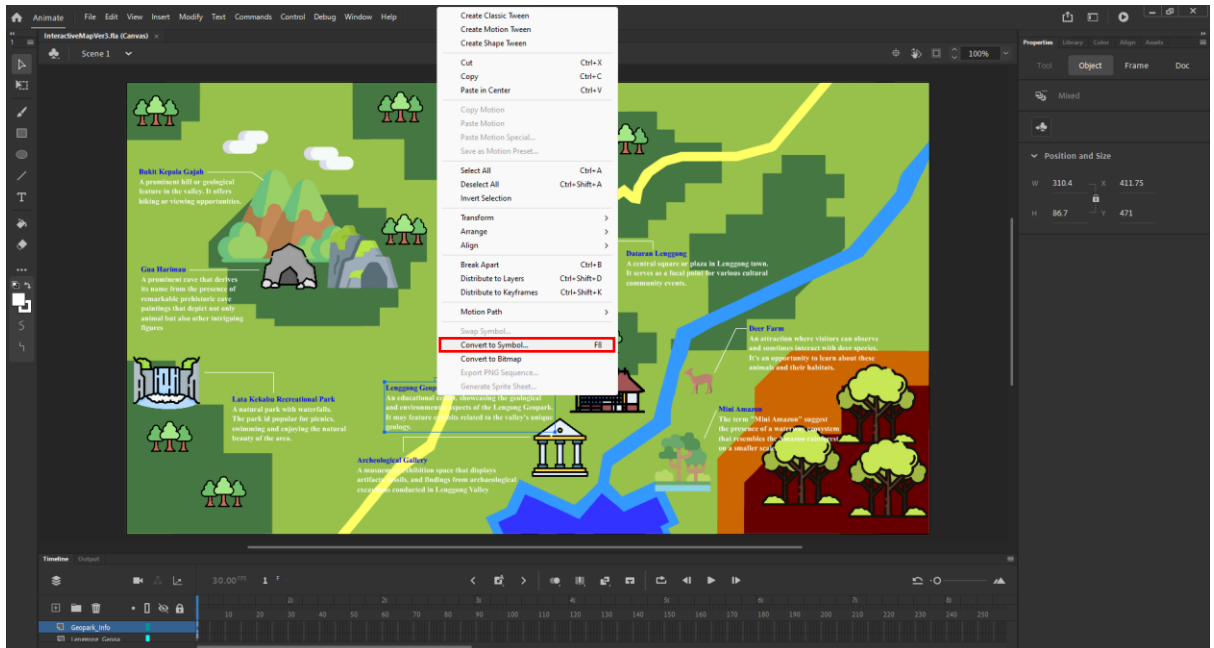


Figure 4.144 Screenshot of Second View of Interactive Map

## CHAPTER 4

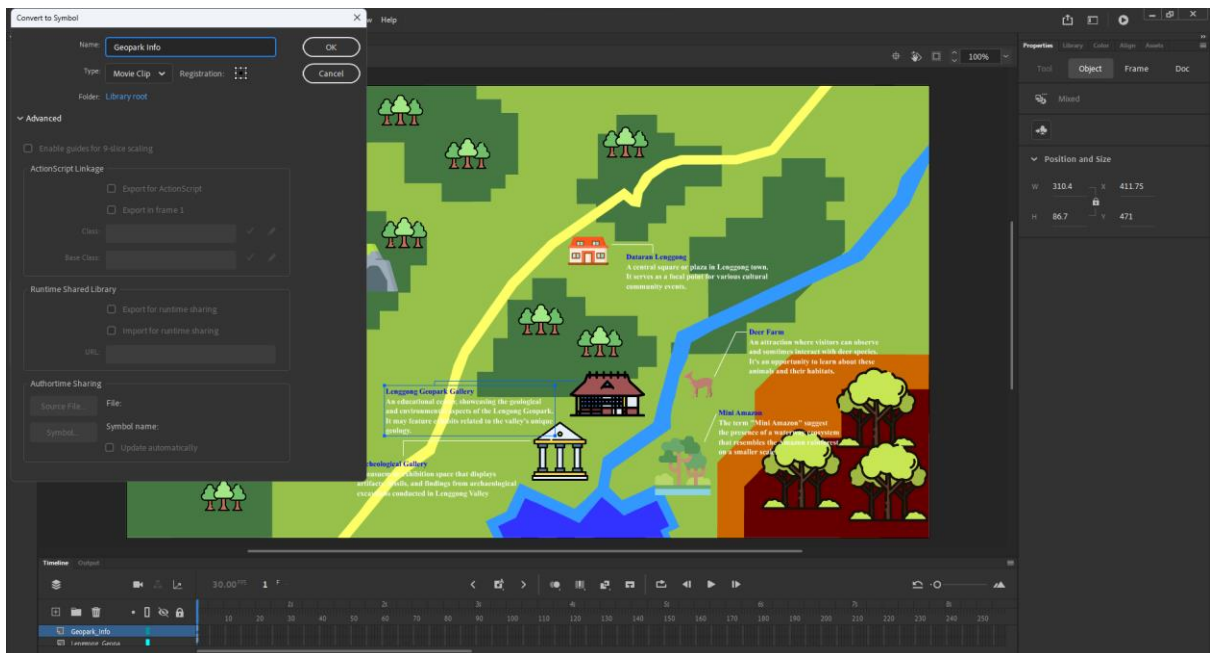
### Create Interactive Buttons

Select the landmark information, right click and select Convert to Symbol or press F8.



*Figure 4.145 Screenshot of Convert Icon into Symbol*

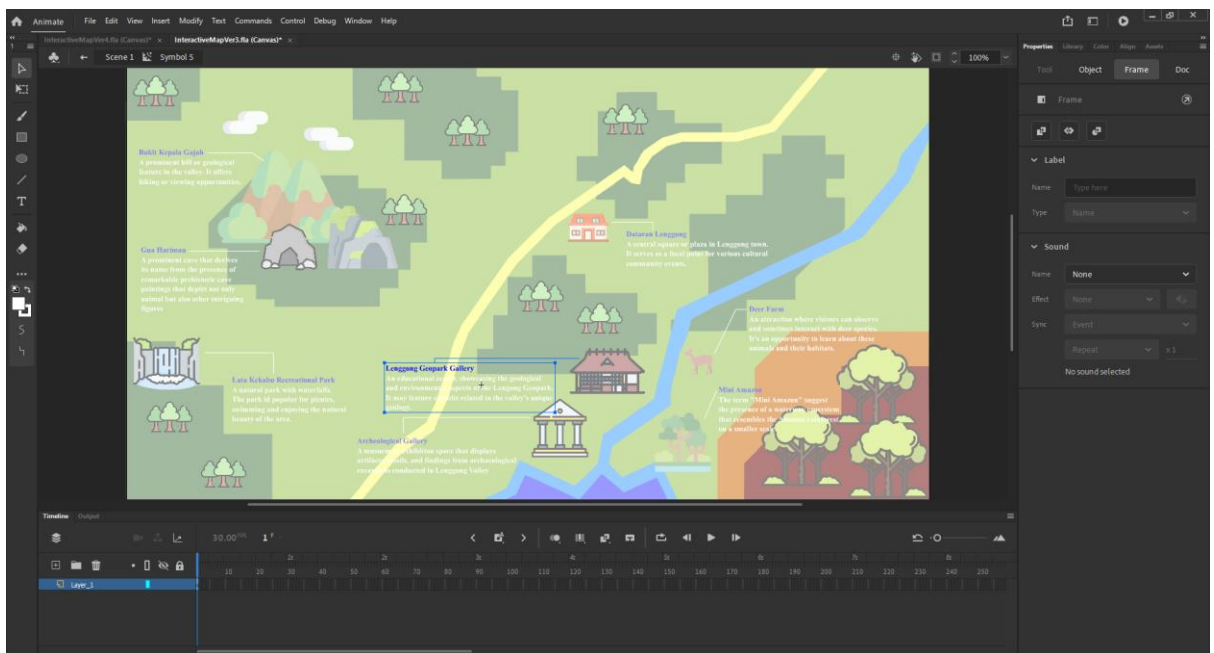
Every landmark information was converted into symbol with the type of symbol set to Movie Clip and the registration set to center. Ensure you have consistent naming on the symbol.



*Figure 4.146 Screenshot of Set Button Type*

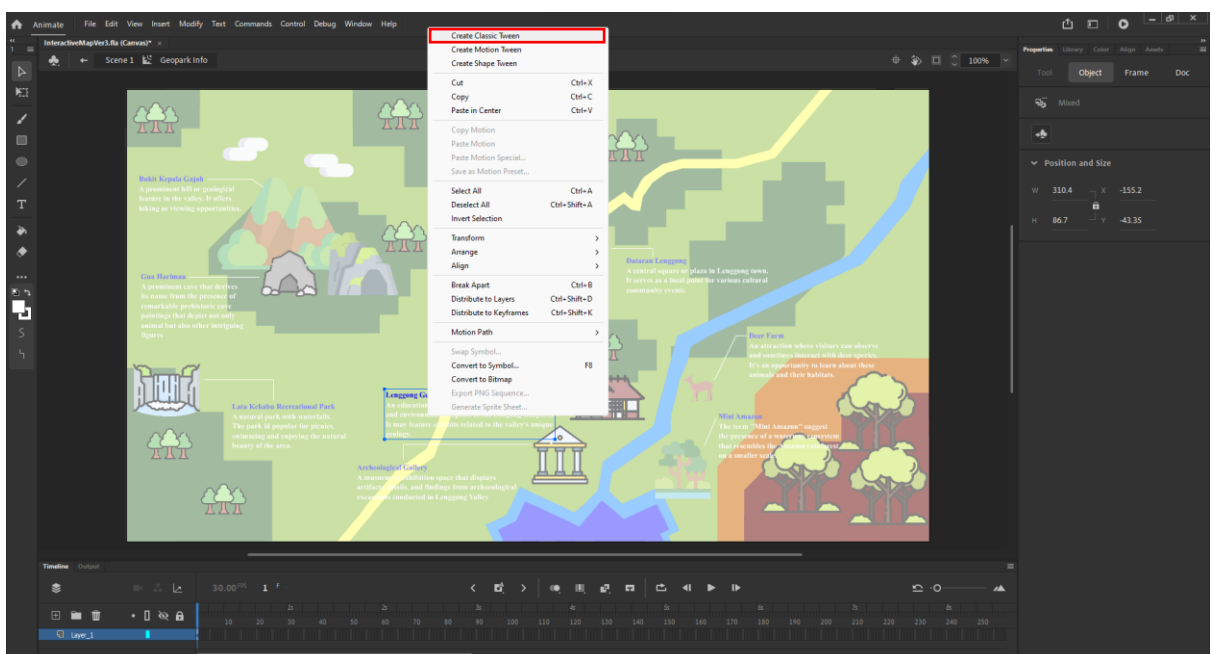
## CHAPTER 4

Next, double click the information to enter to its specific timeline.



*Figure 4.147 Screenshot of Enter Button Timeline*

Right click the symbol and select Create Classic Tween.

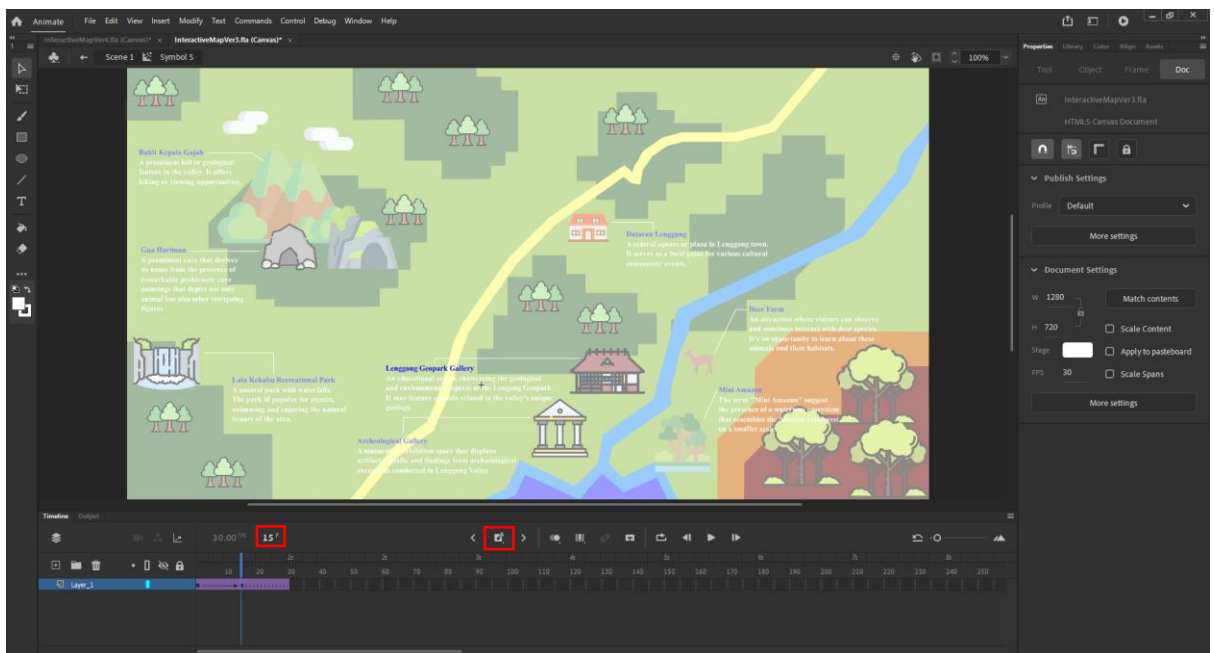


*Figure 4.148 Screenshot of Create Classic Tween*



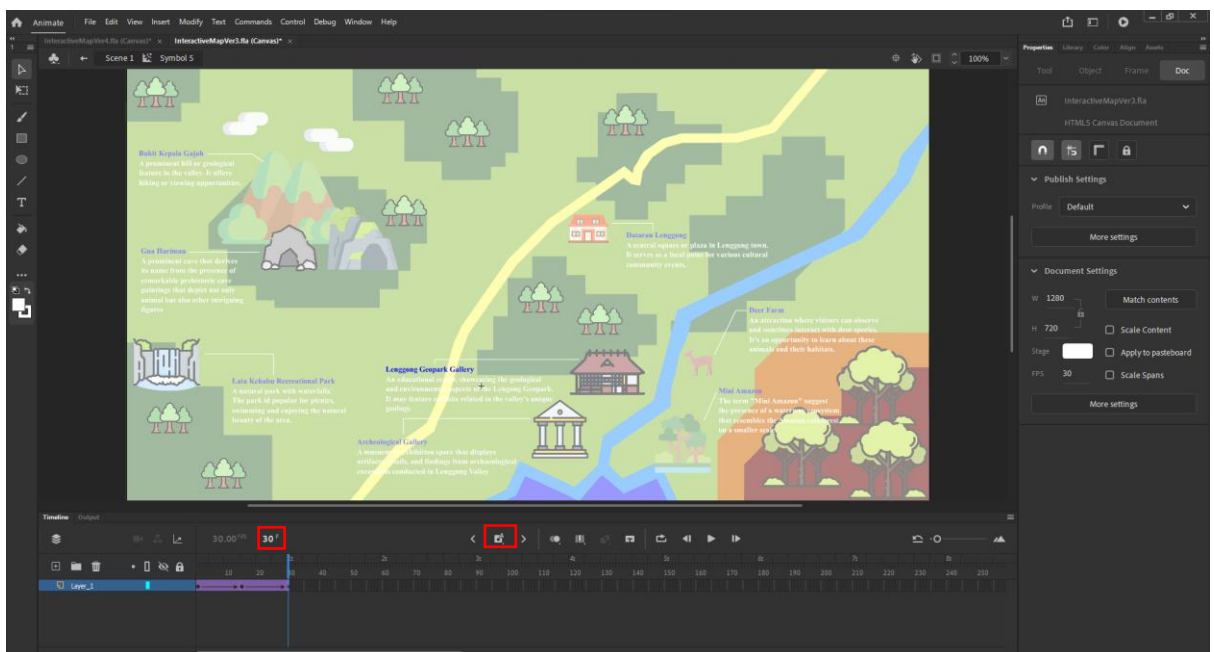
## CHAPTER 4

Drag the play head to 15 frame mark and press F6 to insert keyframe.



*Figure 4.149 Screenshot of Insert Keyframe*

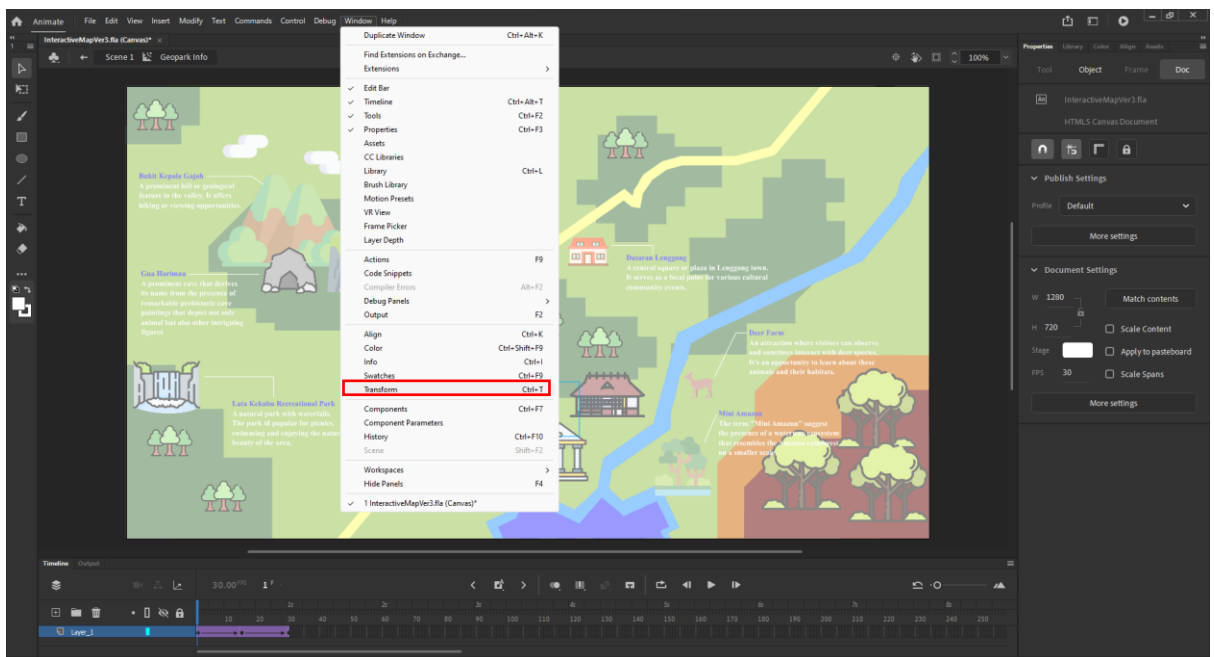
Then, drag the play head to 1s and press F6 to insert another keyframe.



*Figure 4.150 Screenshot of Insert Another Keyframe*

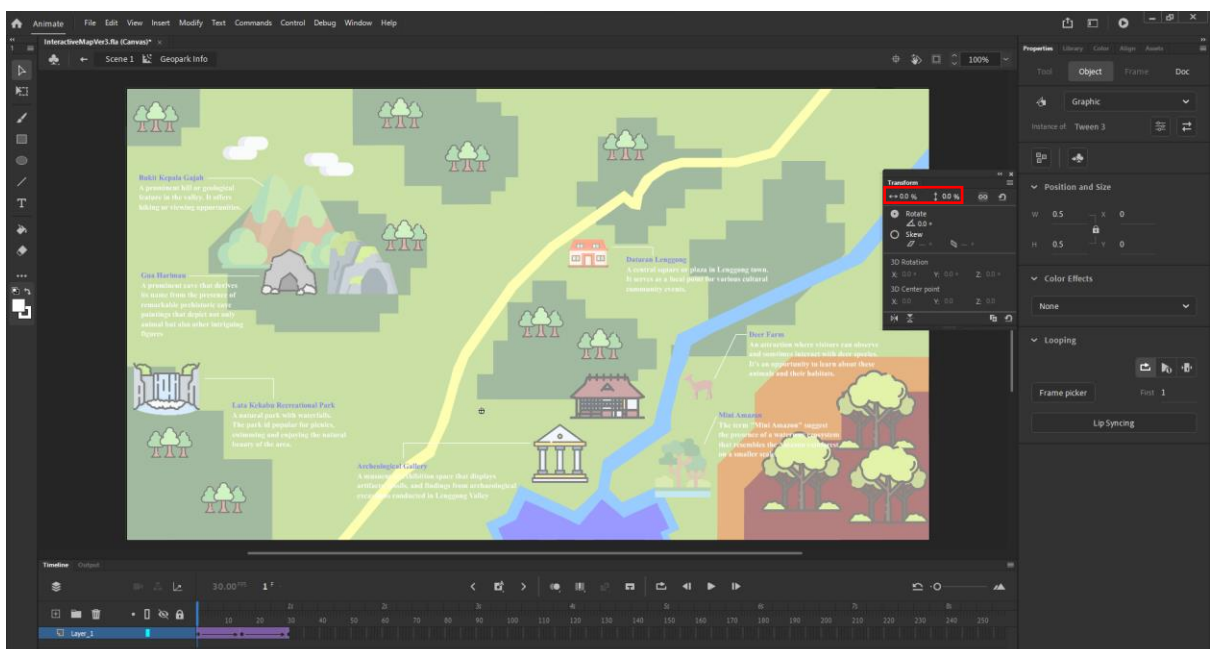
## CHAPTER 4

At the first frame, open the Transform Window.



**Figure 4.151 Screenshot of Open Transform Window**

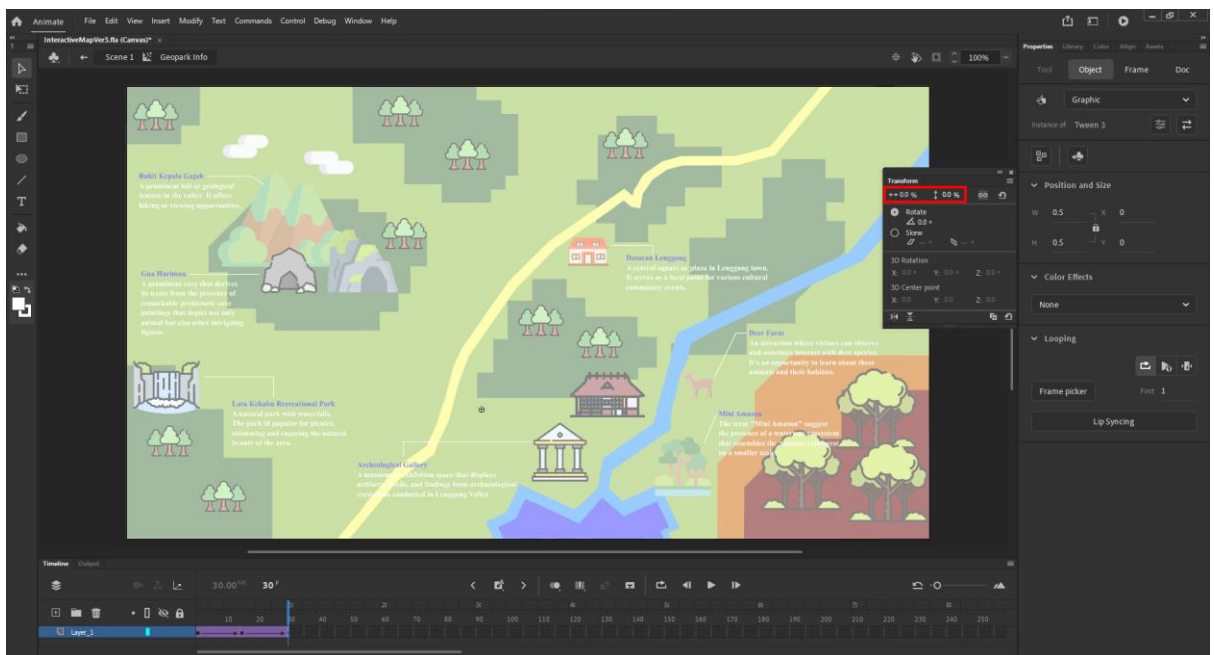
Set the scale width and scale height of the symbol on first frame into 0.0%.



**Figure 4.152 Screenshot of Set the Scale on First Frame**

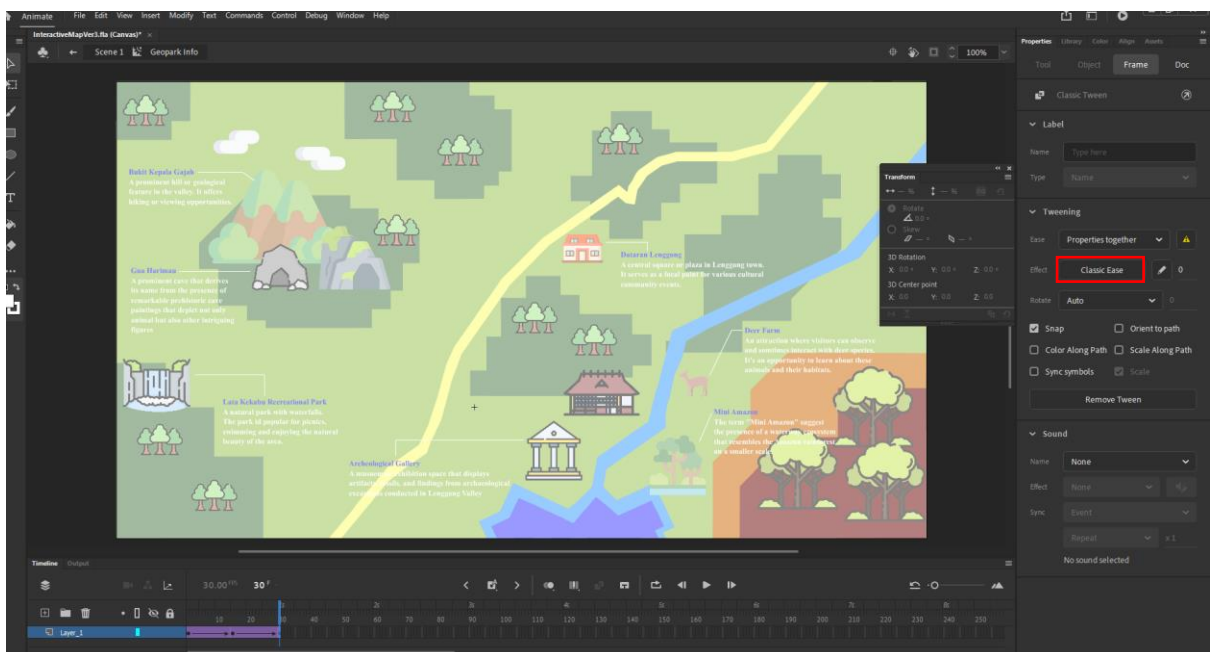
## CHAPTER 4

Repeat the same thing for the last frame.



*Figure 4.153 Screenshot of Set the Scale on Last Frame*

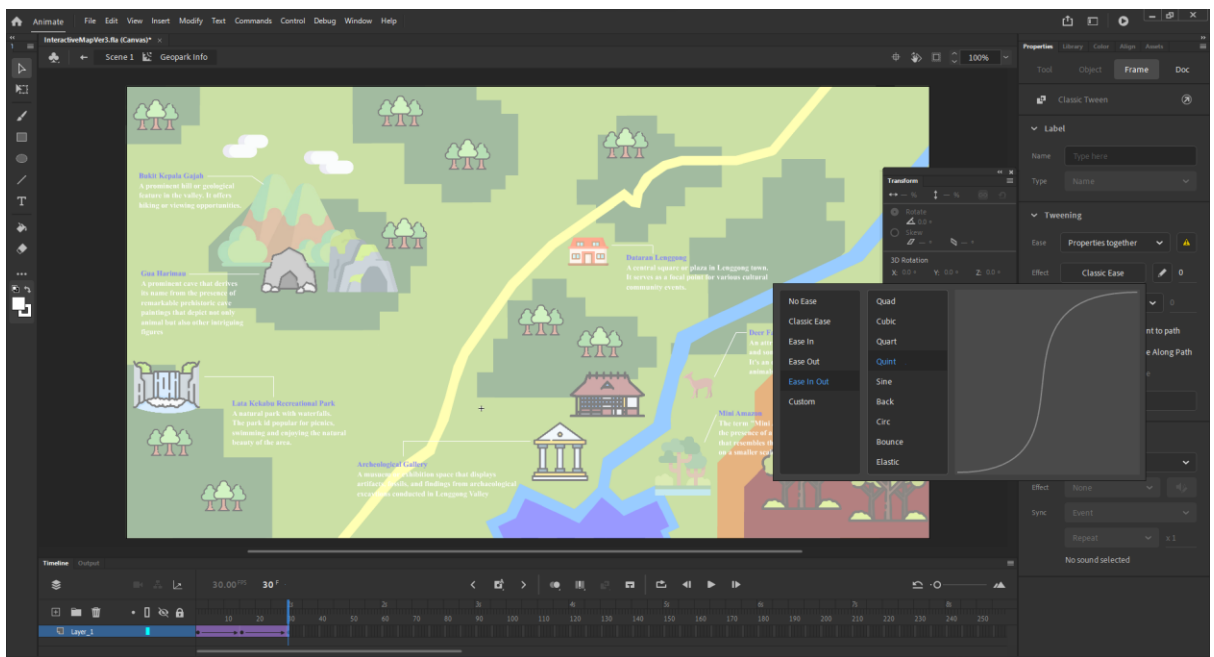
Next, on the Properties panel under Frame, select Classic Ease.



*Figure 4.154 Screenshot of Select Classic Ease*

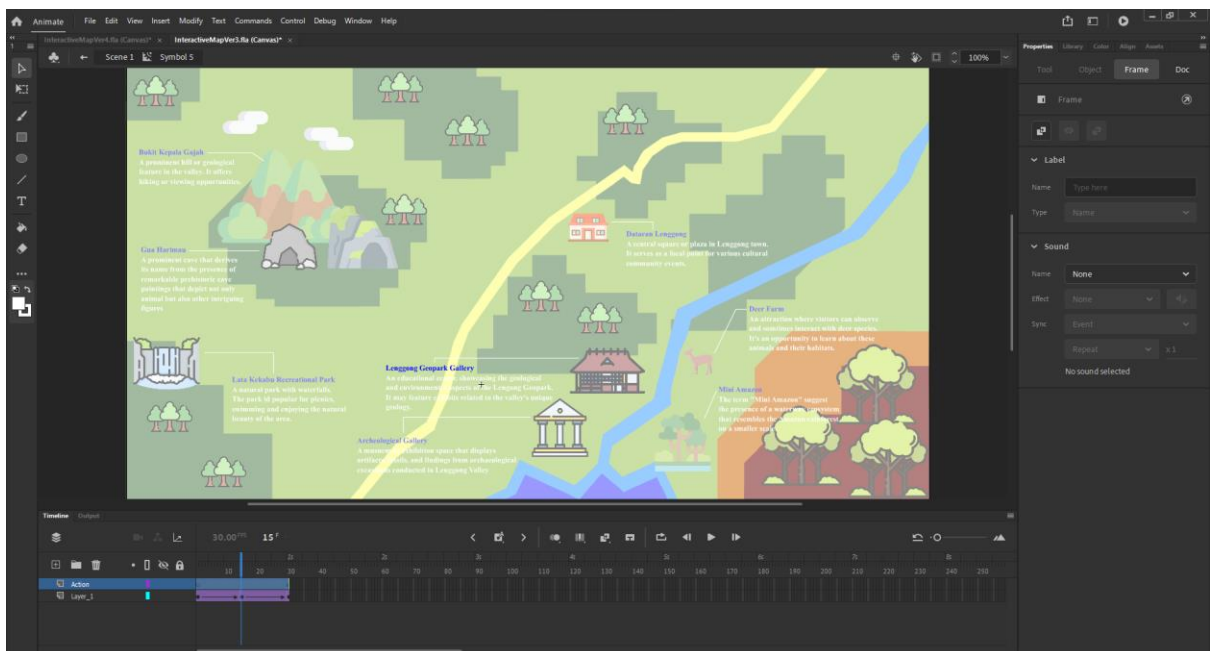
## CHAPTER 4

Change the effect into Ease In Out > Quint to make the animations cleaner.



*Figure 4.155 Screenshot of Change Effect*

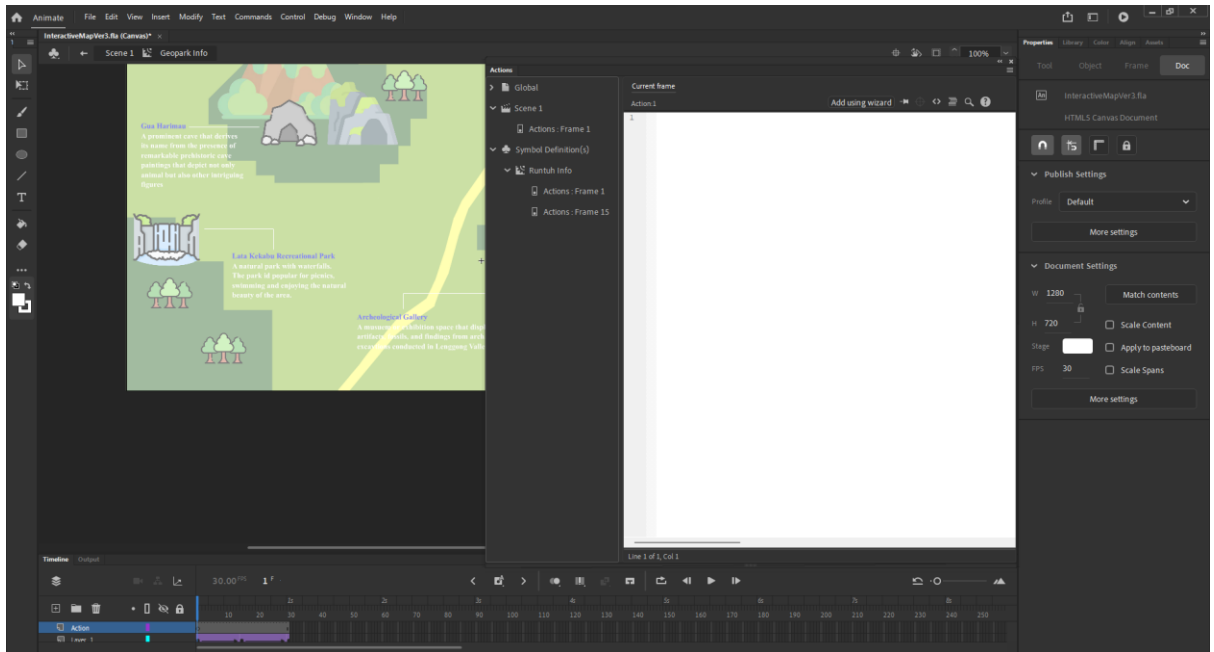
Add a new layer and name it as Action layer.



*Figure 4.156 Screenshot of Add New Layer*

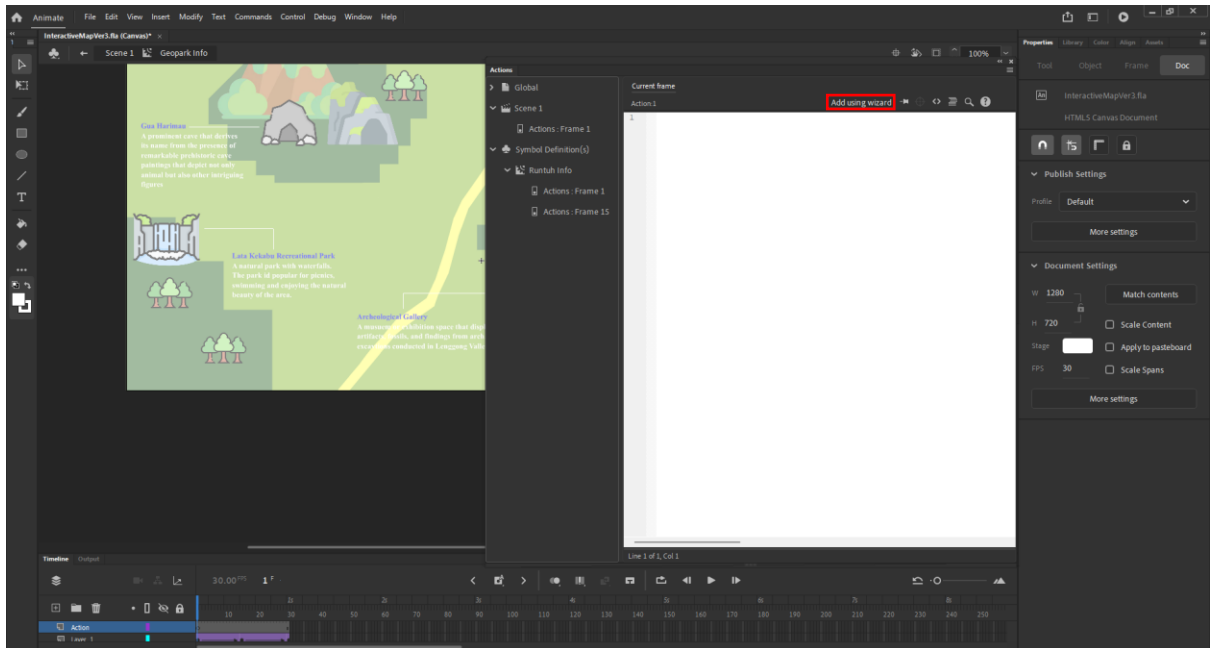
## CHAPTER 4

In the Action layer, drag the play head back to the first frame and open the Action Window.



*Figure 4.157 Screenshot of Open Action Window*

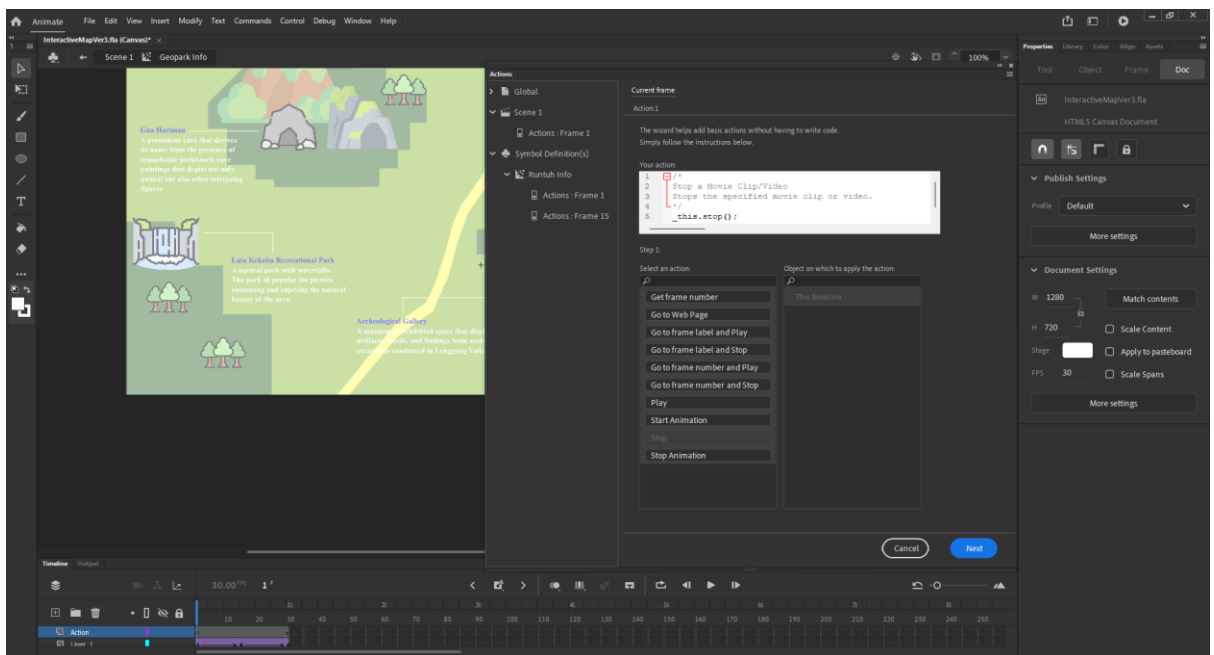
Select add using wizard.



*Figure 4.158 Screenshot of Add Using Wizard*

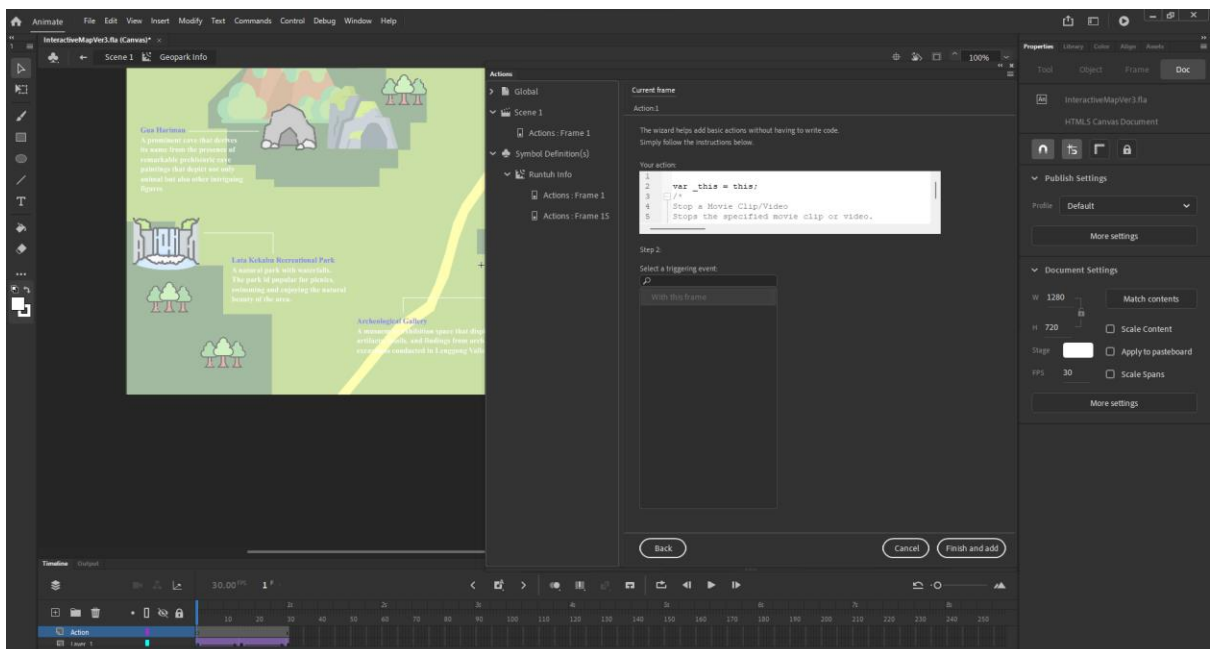
## CHAPTER 4

Select Stop > This Timeline to add a Stop action. Then select the Next button.



*Figure 4.159 Screenshot of Add Stop Action*

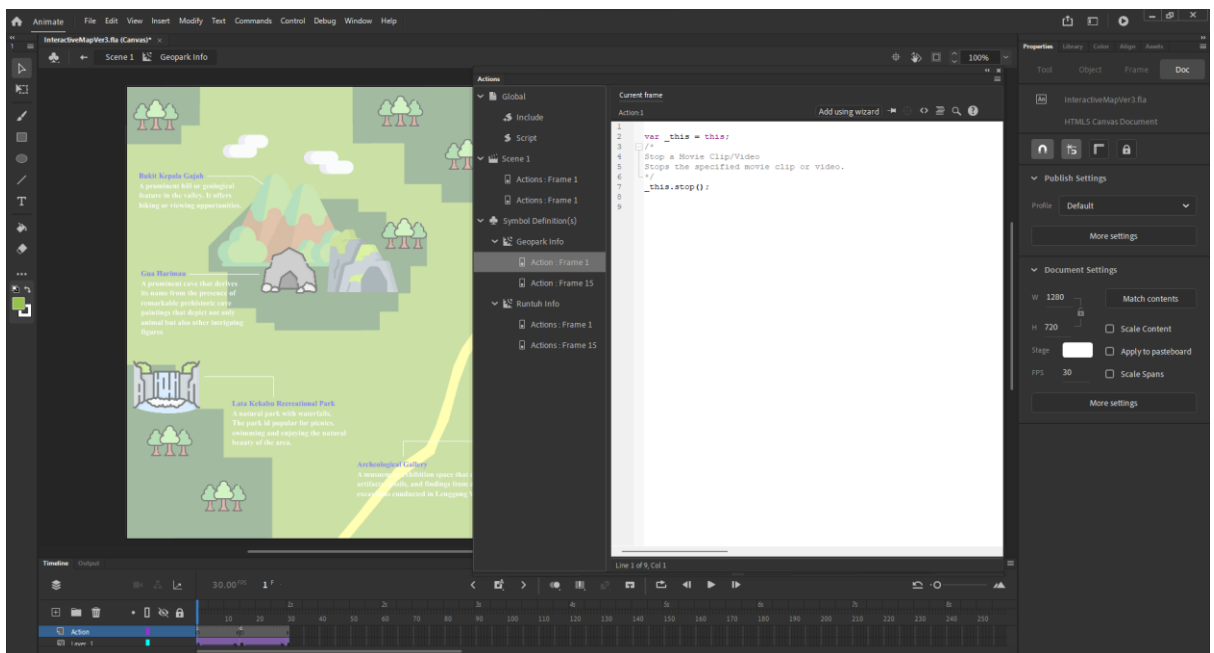
The triggering event is set to With this frame then select Finnish and Add.



*Figure 4.160 Screenshot of Set Triggering Event*

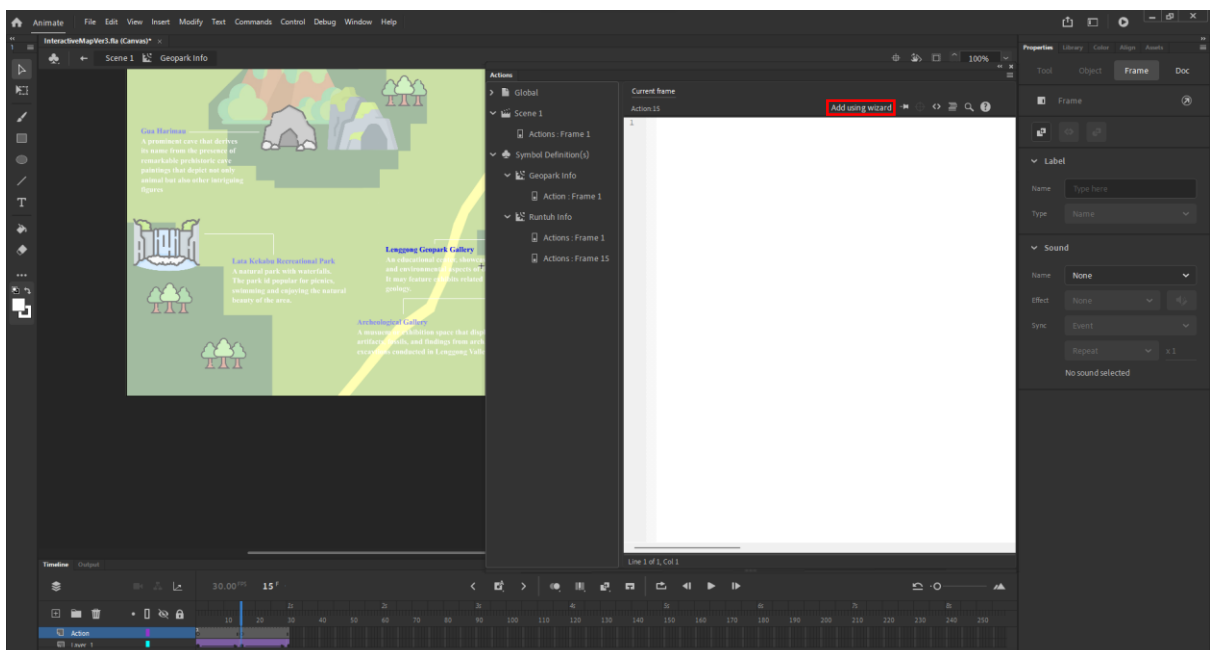
## CHAPTER 4

The little 'a' above the frame shows that the animation has been added.



**Figure 4.161 Screenshot of Shows Animation Added**

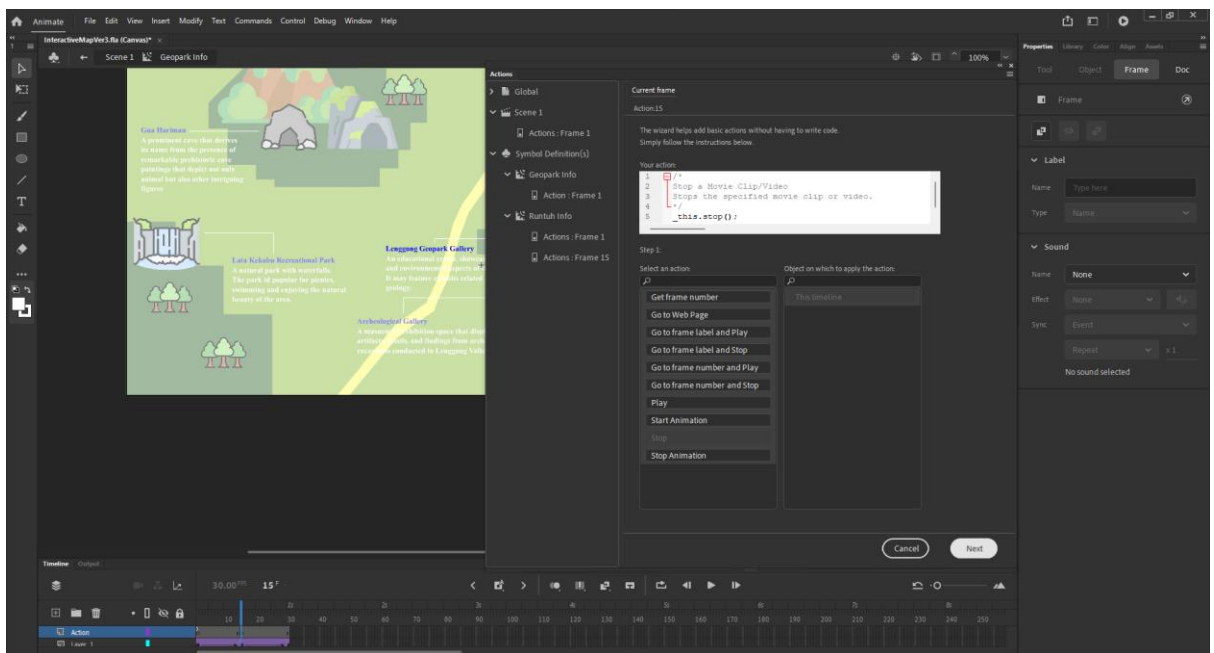
Repeat the same thing on the 15<sup>th</sup> frame mark. Drag the play head to the 15<sup>th</sup> frame. Click on the empty frame and press F6 to insert a keyframe. Then, select Add using wizard on the Animation window.



**Figure 4.162 Screenshot of Add Using Wizard**

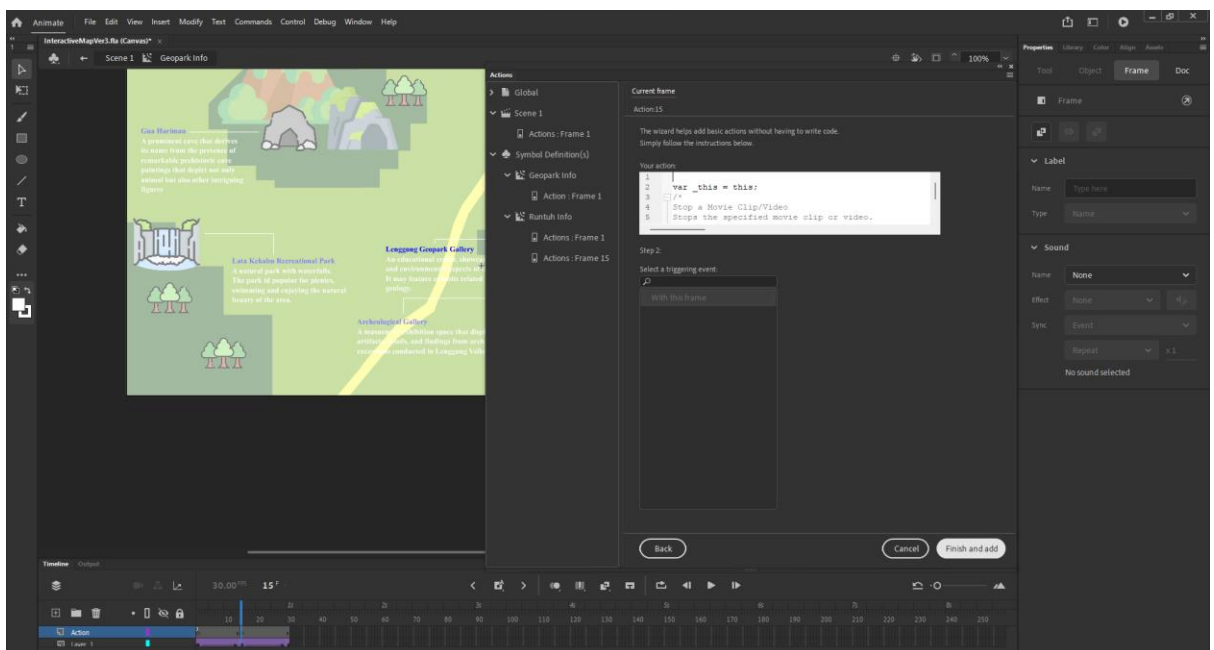
## CHAPTER 4

Select Stop > This Timeline to add a Stop action. Then select the Next button.



*Figure 4.163 Screenshot of Add Stop Action*

The triggering event is set to With this frame then select Finnish and Add.

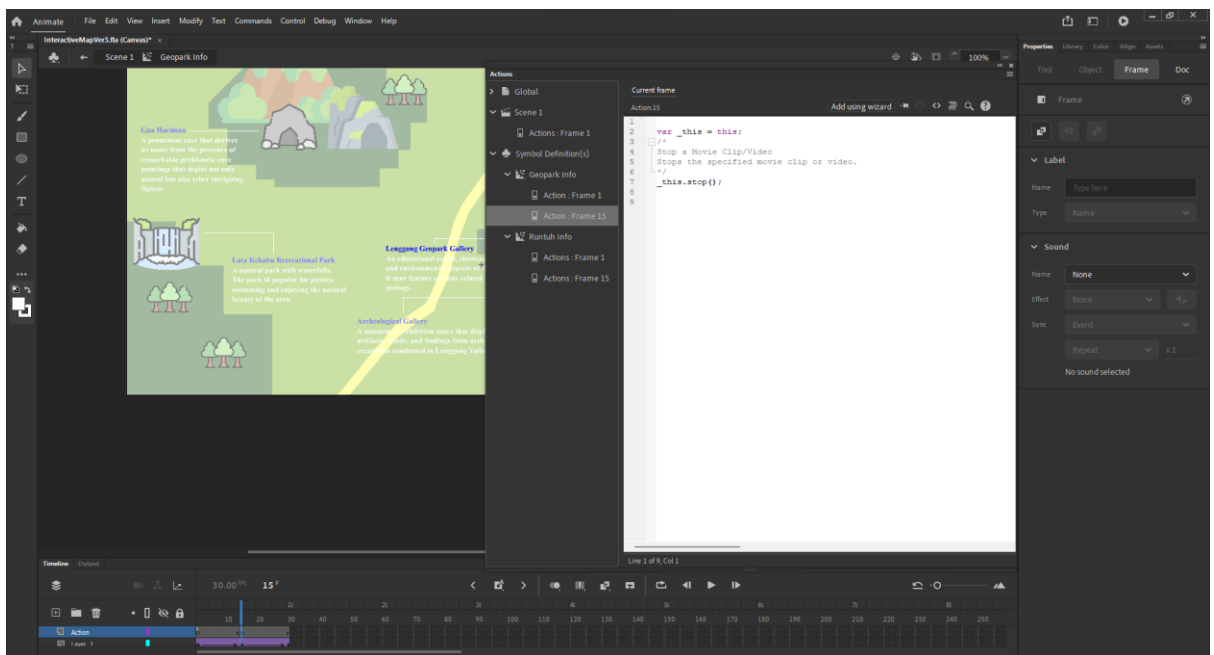


*Figure 4.164 Screenshot of Set Triggering Event*



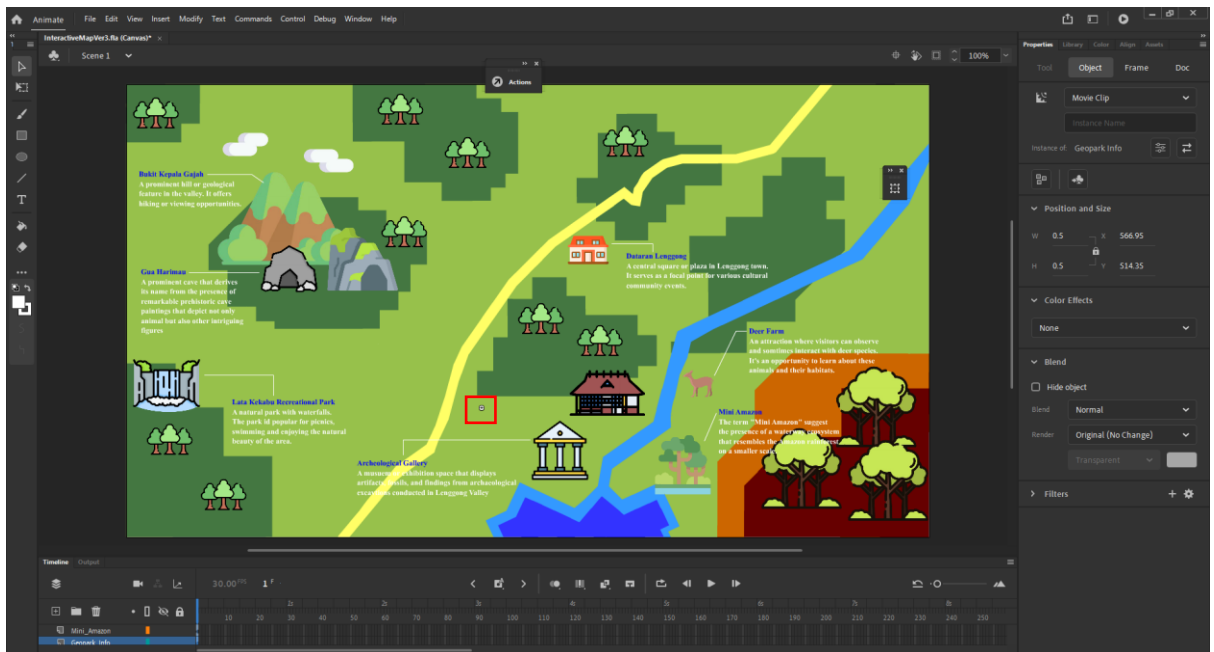
## CHAPTER 4

The little ‘a’ above the frame shows that the animation has been added.



**Figure 4.165 Screenshot of Shows Animation Added**

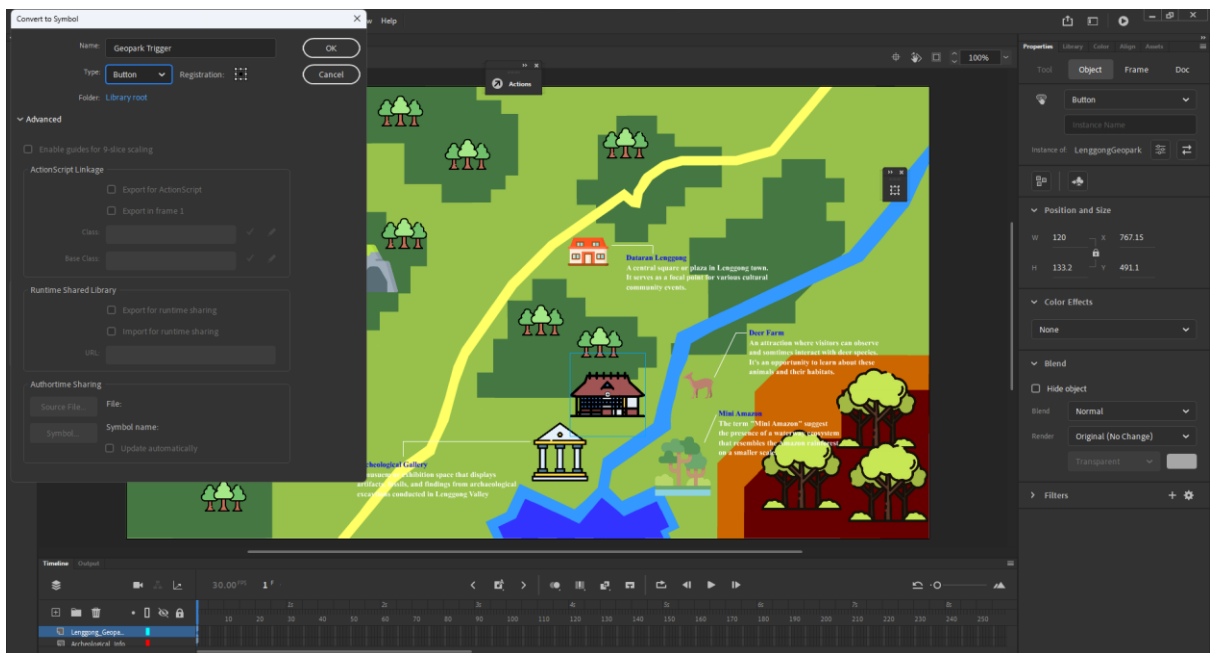
Go back to the main scene and the information symbol will not be visible as Stop actions is added.



**Figure 4.166 Screenshot of Symbol is Invisible**

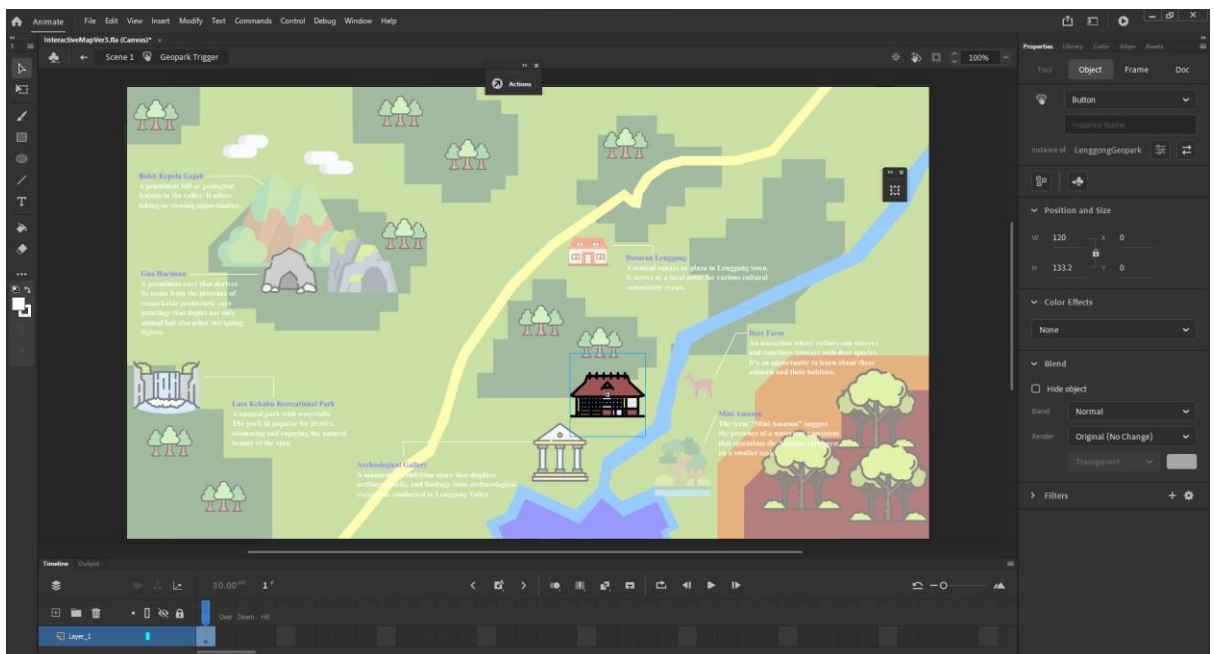
## CHAPTER 4

Next, each icon is converted into symbol and set the Type into Button.



*Figure 4.167 Screenshot of Set Button Type*

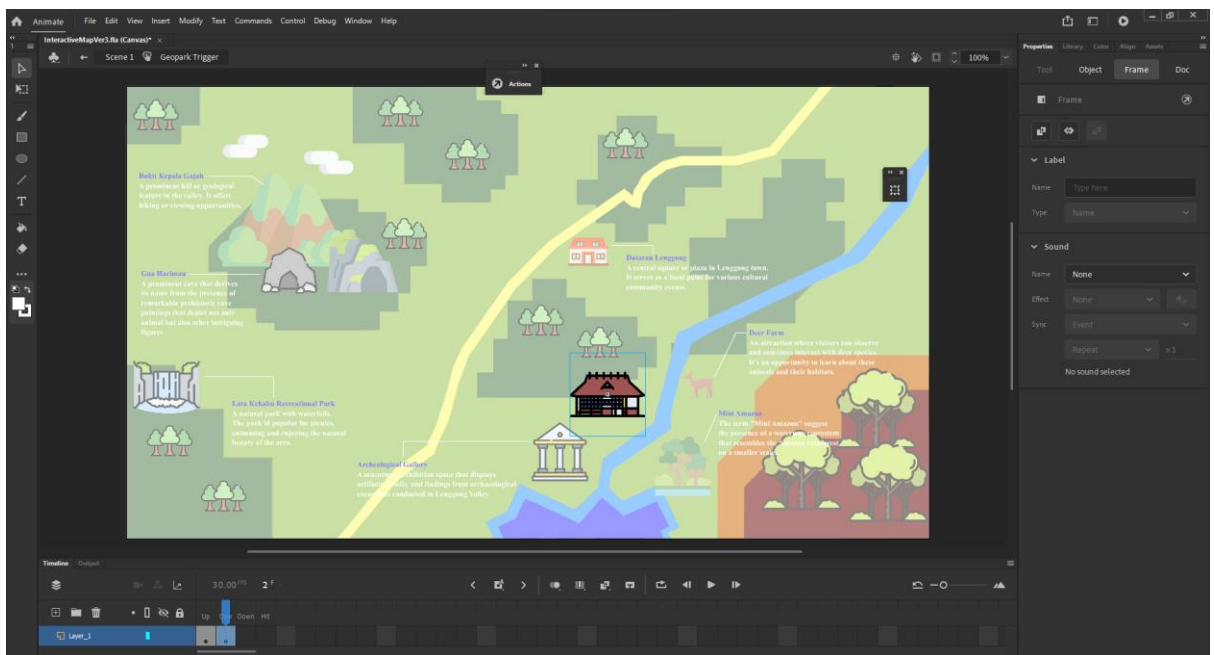
Then, double click on the icon to enter its specific timeline.



*Figure 4.168 Screenshot of Enter Button Timeline*

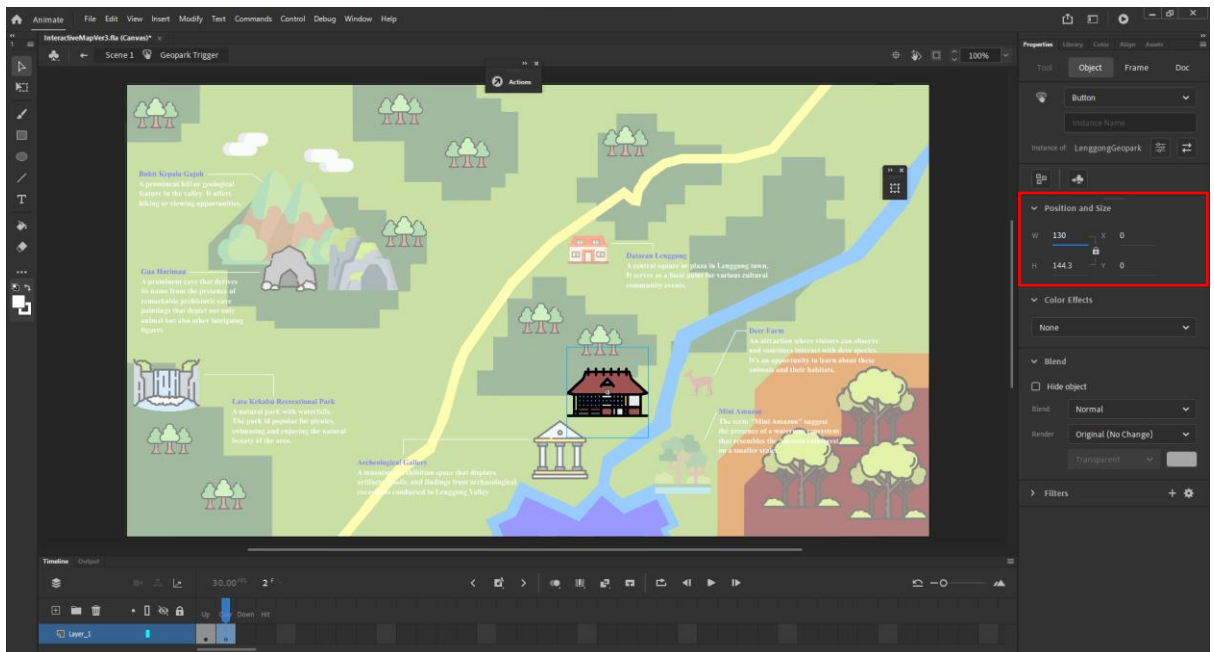
## CHAPTER 4

Click on Over, and press F6 to insert a keyframe.



*Figure 4.169 Screenshot of Insert Keyframe*

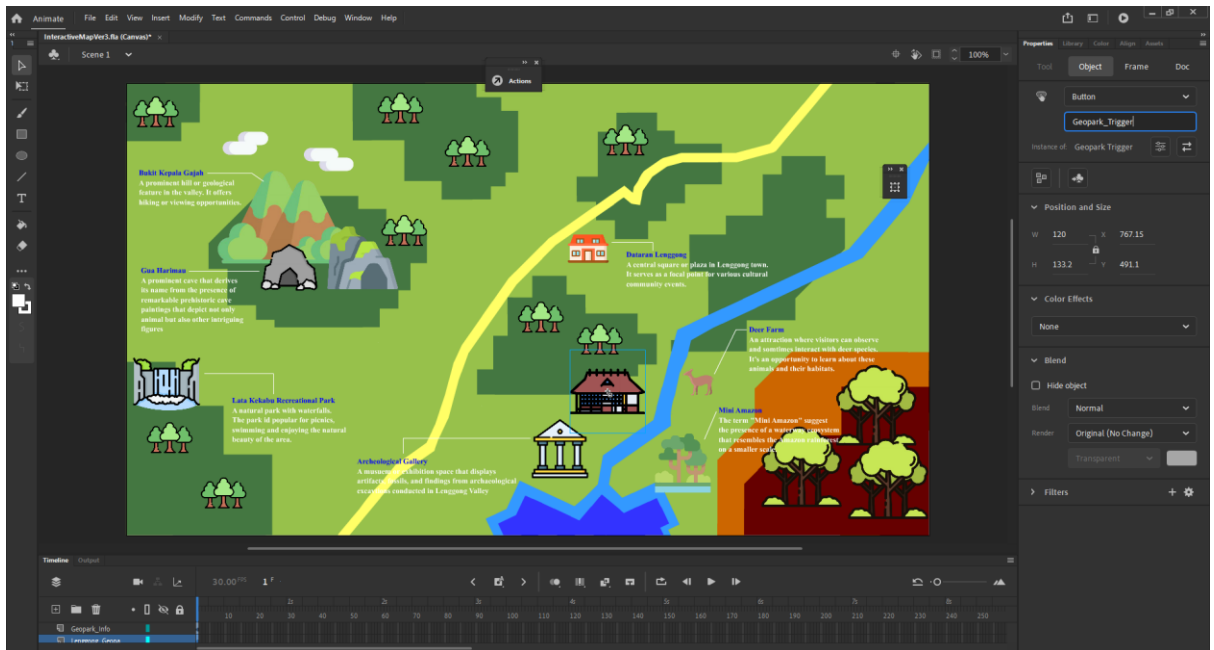
Go to Object > Position and Size, increase the scale width and scale height of the icon by 10 to create the hovering effect.



*Figure 4.170 Screenshot of Set Button Size in New Keyframe*

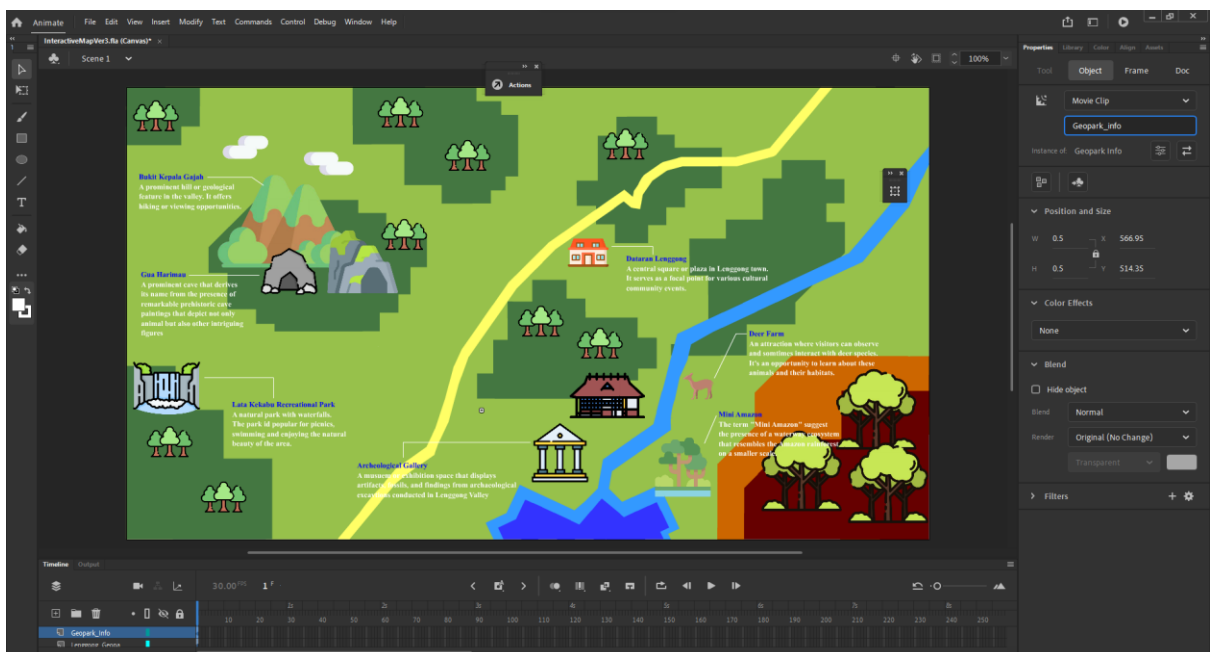
## CHAPTER 4

Go back to Main Scene, create instance name for the Icon Button.



*Figure 4.171 Screenshot of Create Instance for Icon Button*

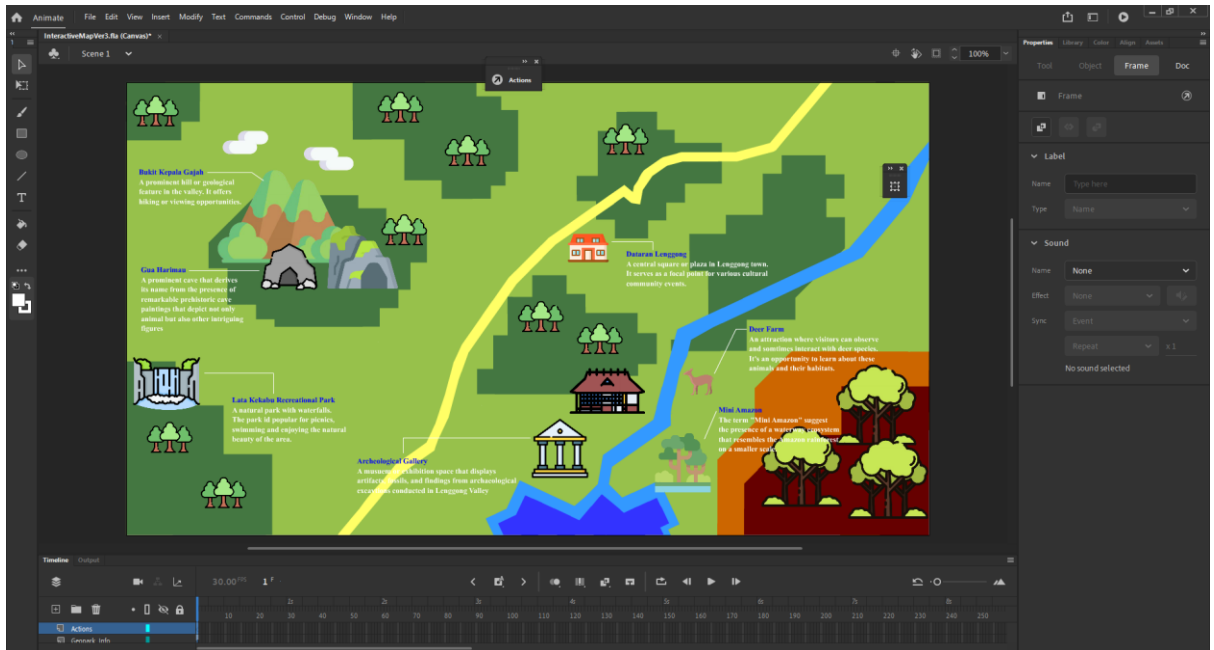
Create instance name for the landmark information.



*Figure 4.172 Screenshot of Create Instance for Landmark Information*

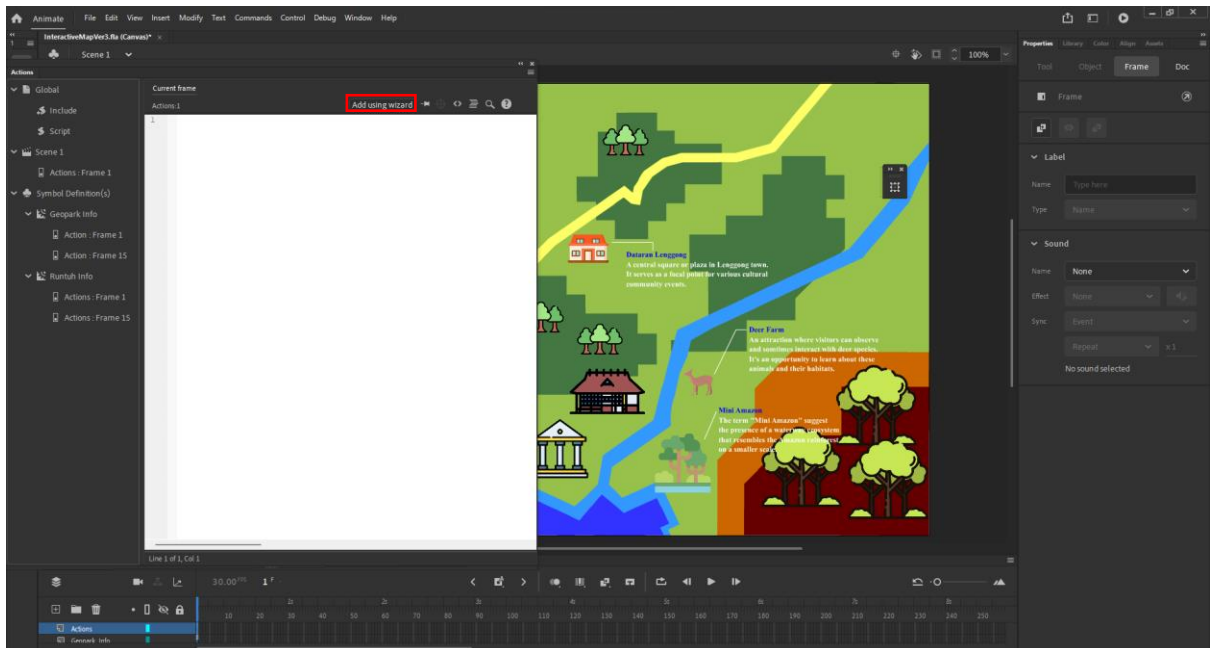
## CHAPTER 4

Create another layer in Main Scene and name it as Actions. Any actions in the interactive map will be done in this layer.



*Figure 4.173 Screenshot of Add New Layer in Main Scene*

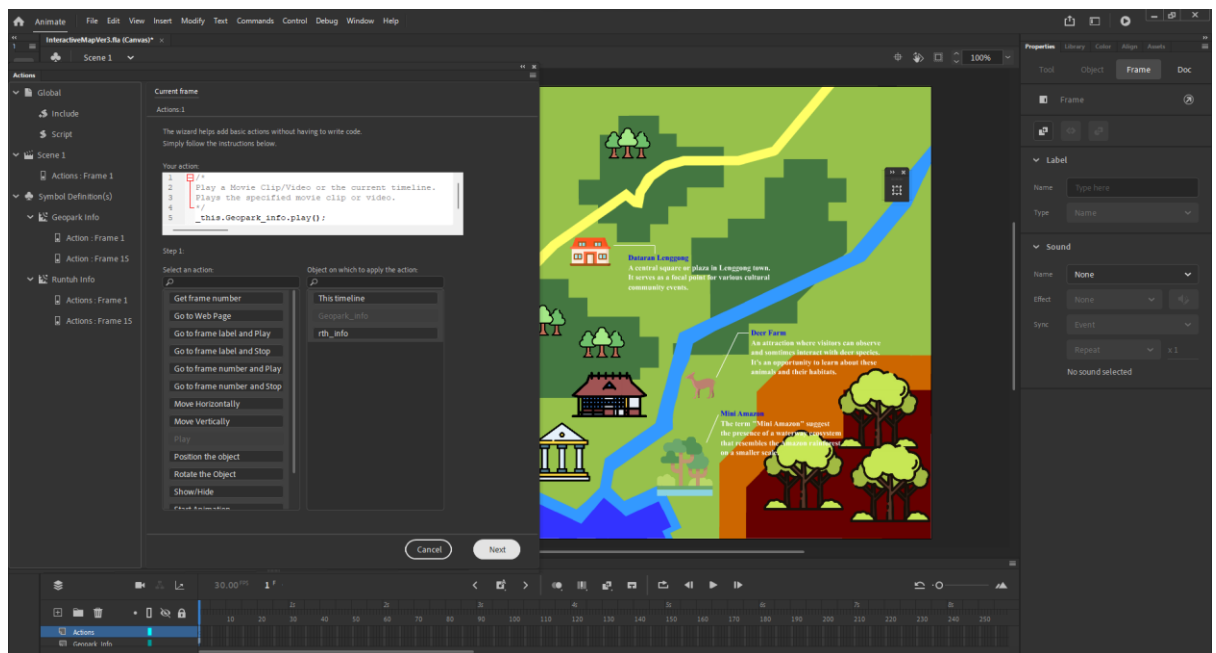
In the Actions layer, select Add Using Wizard in the Animation Window.



*Figure 4.174 Screenshot of Add Using Wizard*

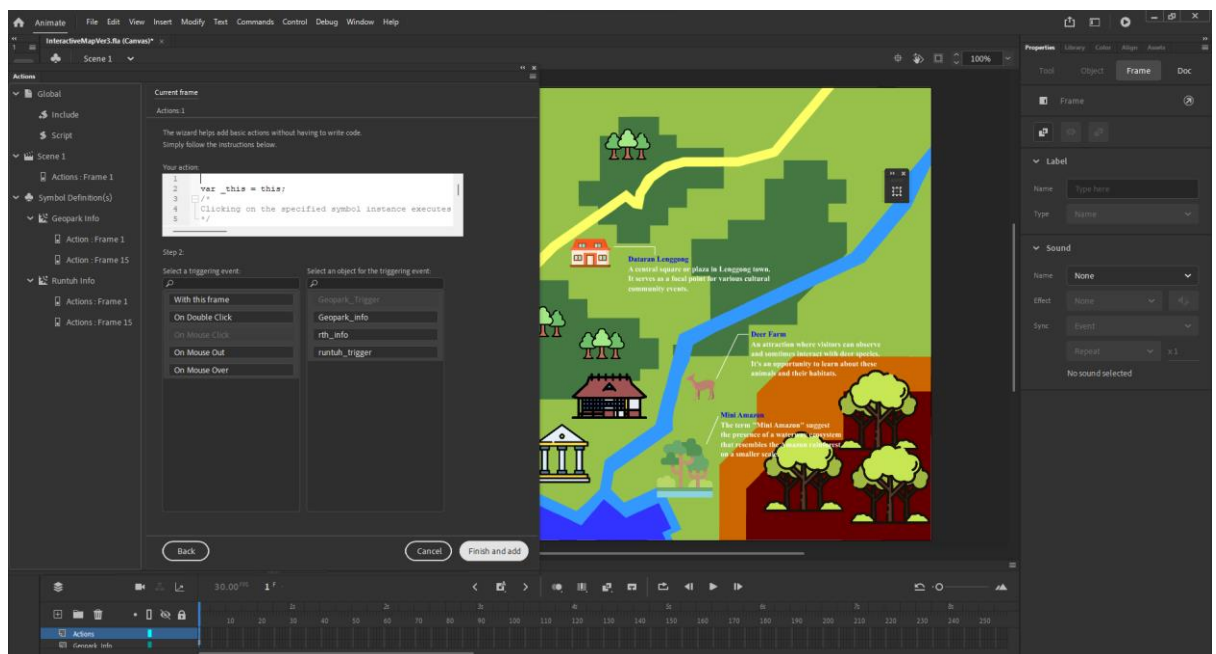
## CHAPTER 4

Click Play > Geopark\_info(based on the button you are setting) > Next.



*Figure 4.175 Screenshot of Add Play Action*

Click On Mouse Click > Geopark\_Trigger(based on the button you are setting) > Finnish and Add.

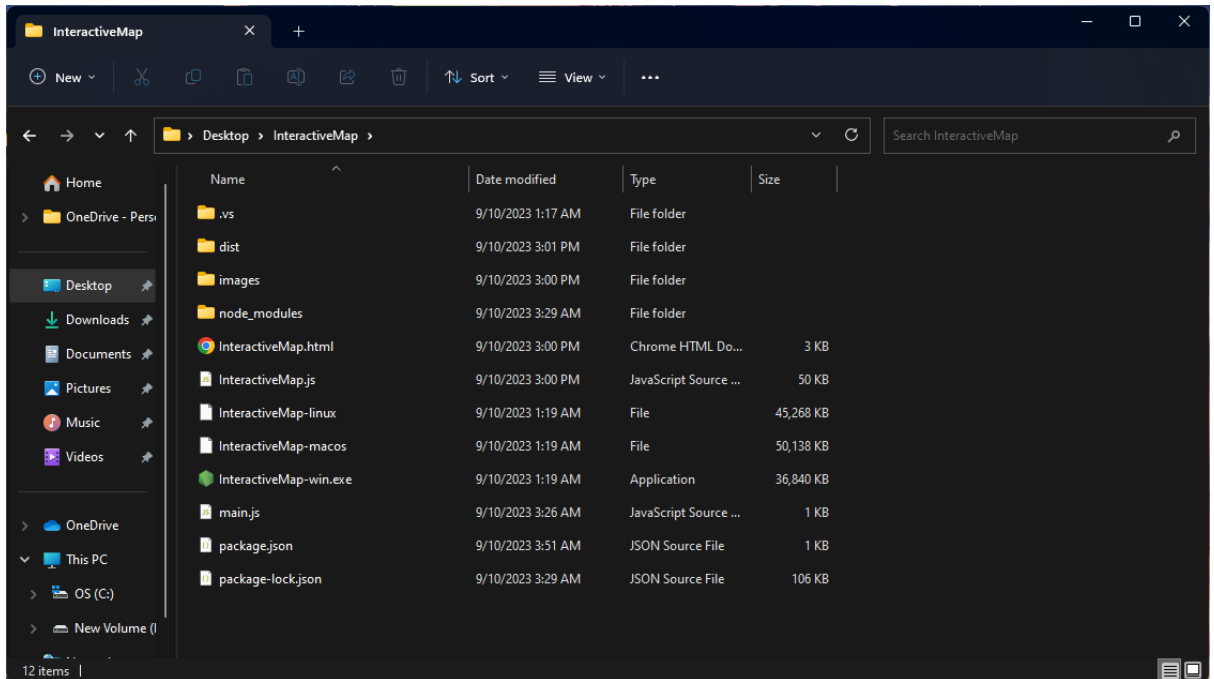


*Figure 4.176 Screenshot of Set Trigger*

Repeat the same method for all 9 landmarks to create the interactive buttons.

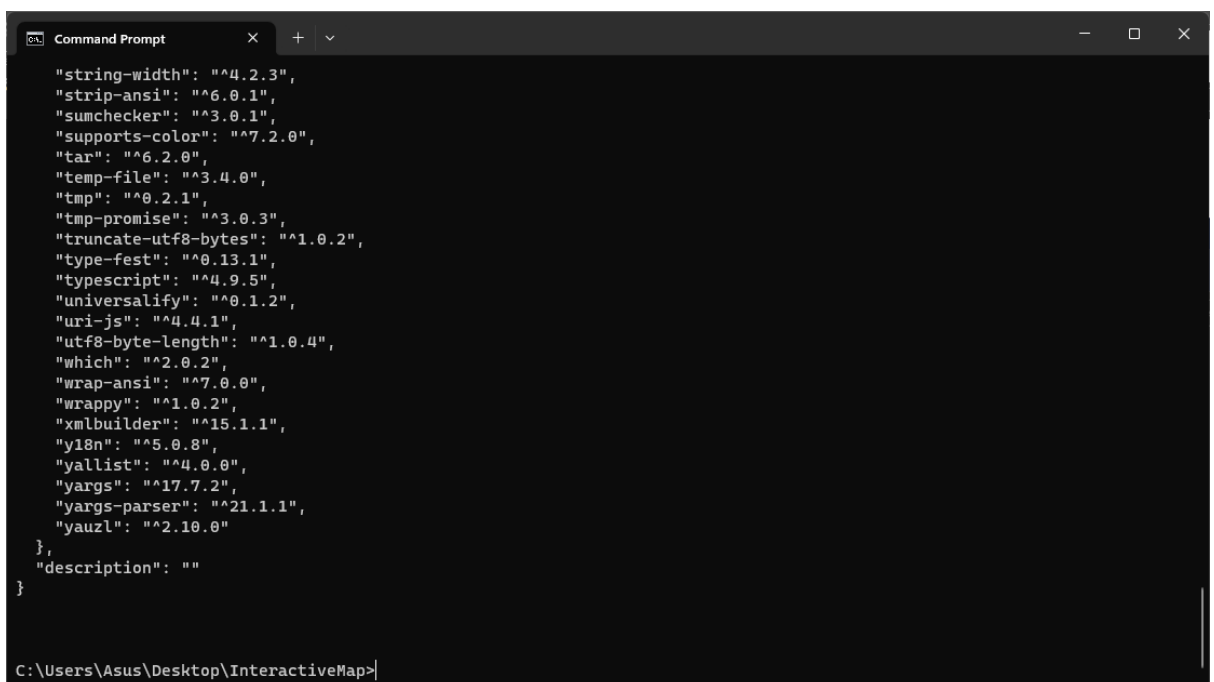
**Export the Interactive Map into executable file using Electron**

Create a new directory for the Electron Project.



*Figure 4.177 Screenshot of Directory for Electron Project*

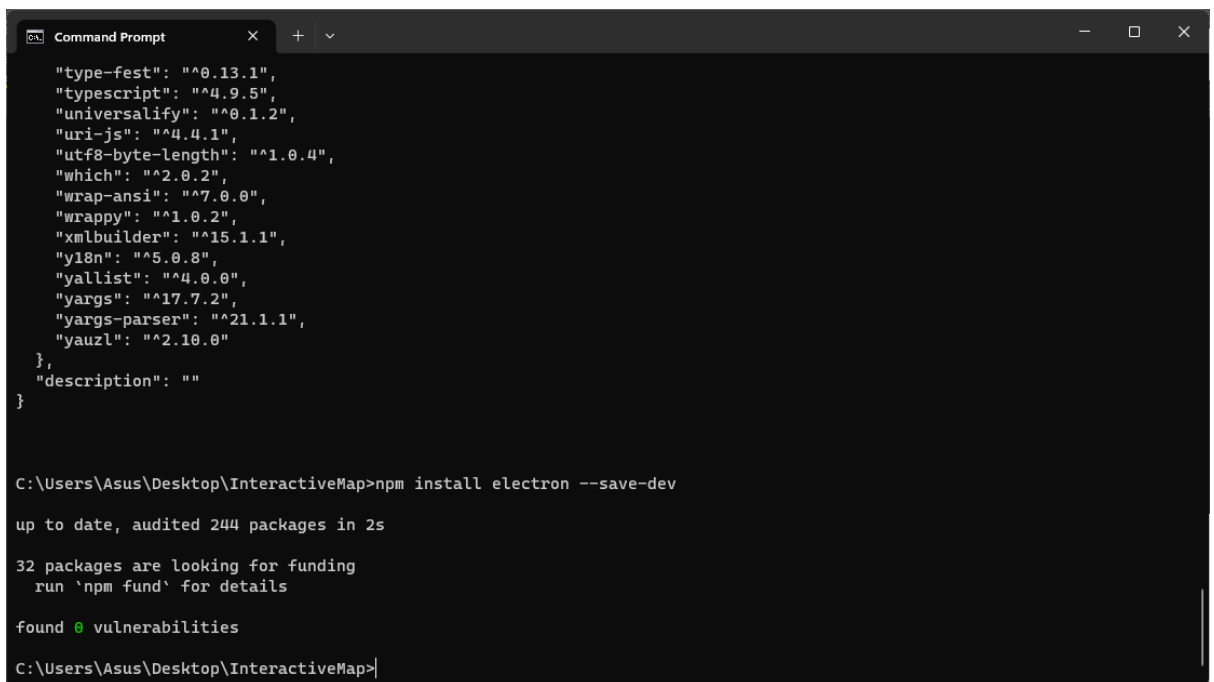
Open command prompt, navigate to the project directory and run the following command to create a 'package.json' file for the project.



*Figure 4.178 Screenshot of Create 'package.json'*

## CHAPTER 4

Install Electron.



```
Command Prompt
"gulp": "^3.9.1",
"gulp-uglify": "^3.0.1",
"typescript": "^4.9.5",
"universalify": "^0.1.2",
"uri-js": "^4.4.1",
"utf8-byte-length": "^1.0.4",
"which": "^2.0.2",
"wrap-ansi": "^7.0.0",
"wrappy": "^1.0.2",
"xmlbuilder": "^15.1.1",
"y18n": "^5.0.8",
"yallist": "^4.0.0",
"yargs": "^17.7.2",
"yargs-parser": "^21.1.1",
"yauzl": "^2.10.0"
},
"description": ""
}

C:\Users\Asus\Desktop\InteractiveMap>npm install electron --save-dev

up to date, audited 244 packages in 2s

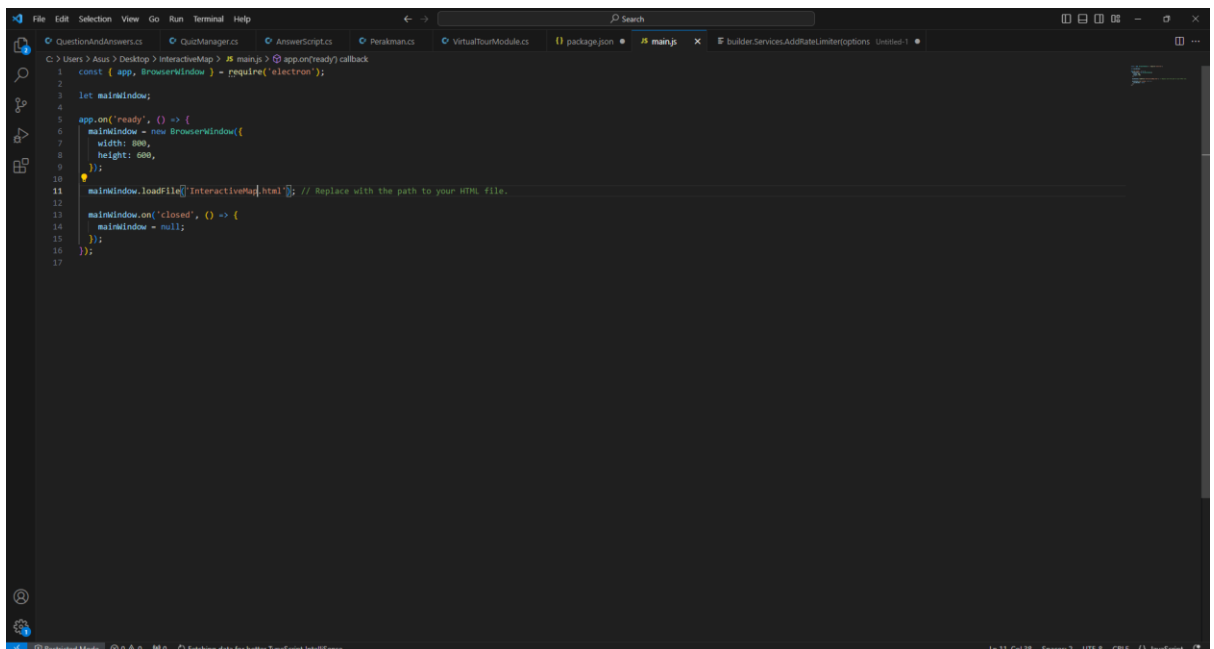
32 packages are looking for funding
  run `npm fund` for details

found 0 vulnerabilities

C:\Users\Asus\Desktop\InteractiveMap>
```

*Figure 4.179 Screenshot of Install Electron*

Create a JavaScript file main.js in the project directory.



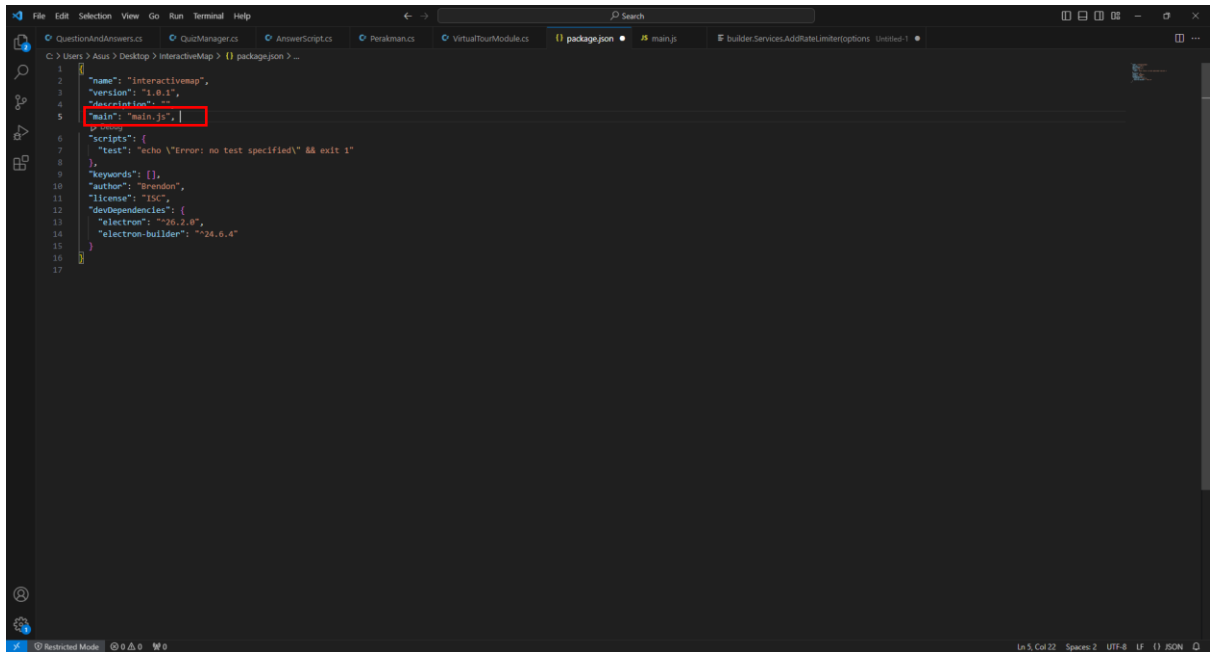
```
File Edit Selection View Go Run Terminal Help
QuestionAndAnswers.js QuizManagers.js AnswerScripts.js Perakman.js VirtualTourModule.js package.json main.js builder.Services.AddStateLimitOptions.1
1 const { app, BrowserWindow } = require('electron');
2
3 let mainWindow;
4
5 app.on('ready', () => {
6   mainWindow = new BrowserWindow({
7     width: 800,
8     height: 600,
9   });
10
11   mainWindow.loadFile('InteractiveMap.html'); // Replace with the path to your HTML file.
12
13   mainWindow.on('closed', () => {
14     mainWindow = null;
15   });
16 });
17
```

*Figure 4.180 Screenshot of Create JavaScript file main.js*



## CHAPTER 4

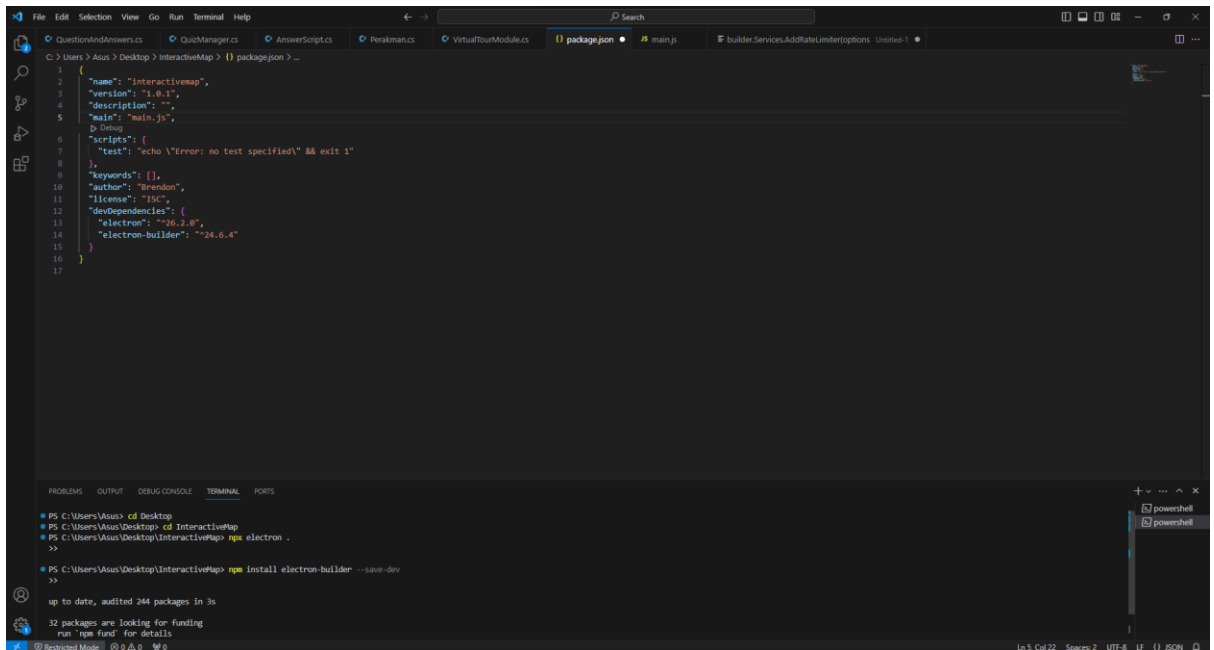
Edit the 'package.json' file and ensure the main.js is replace with the main JavaScript file.



```
1 {
2   "name": "interactivemap",
3   "version": "1.0.1",
4   "description": "",
5   "main": "main.js",
6   "scripts": {
7     "test": "echo \\\"Error: no test specified\\\" && exit 1"
8   },
9   "keywords": [],
10  "author": "Brendon",
11  "license": "ISC",
12  "devDependencies": {
13    "electron": "^26.2.0",
14    "electron-builder": "^24.6.4"
15  }
16 }
17
```

*Figure 4.181 Screenshot of Edit 'package.json' file*

Run the Electron App in the Visual Code terminal.



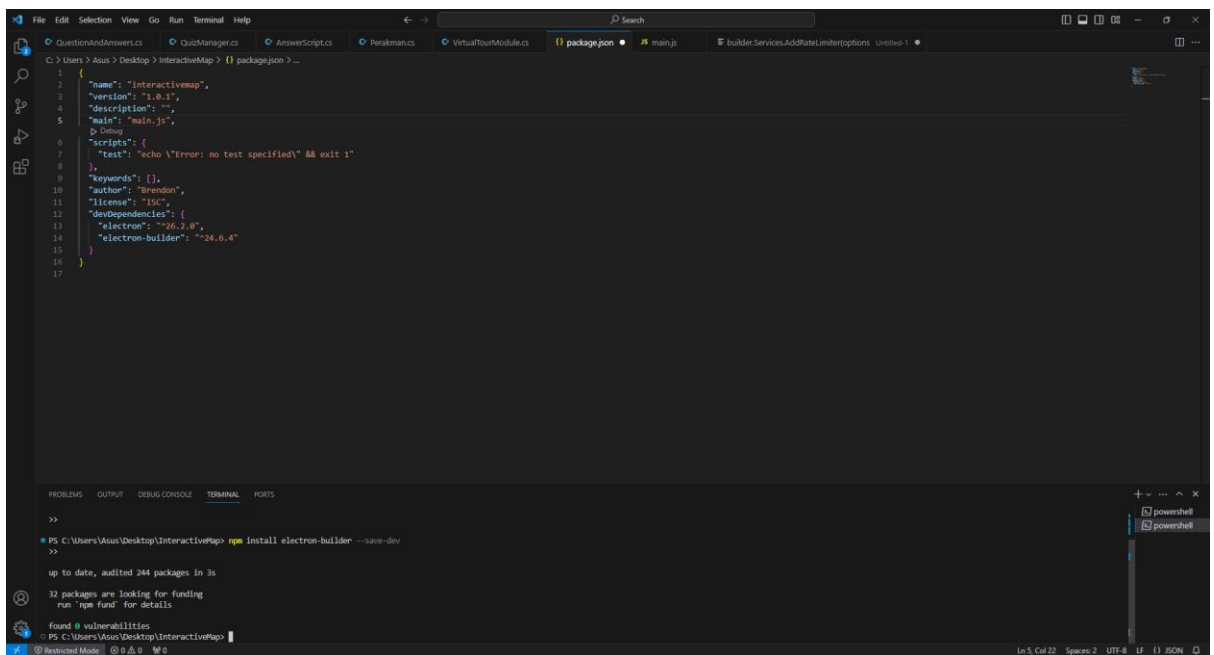
```
1 {
2   "name": "interactivemap",
3   "version": "1.0.1",
4   "description": "",
5   "main": "main.js",
6   "scripts": {
7     "test": "echo \\\"Error: no test specified\\\" && exit 1"
8   },
9   "keywords": [],
10  "author": "Brendon",
11  "license": "ISC",
12  "devDependencies": {
13    "electron": "^26.2.0",
14    "electron-builder": "^24.6.4"
15  }
16 }
17
```

```
PS C:\Users\Asus\Desktop> cd InteractiveMap
PS C:\Users\Asus\Desktop\InteractiveMap> npm install electron-builder --save-dev
up to date, audited 244 packages in 3s
32 packages are looking for funding
run 'npm fund' for details
```

*Figure 4.182 Screenshot of Run Electron App*

## CHAPTER 4

Package the Electron application as an executable file using the following commands.



```
1 {
2   "name": "interactivemap",
3   "version": "1.0.1",
4   "description": "",
5   "main": "main.js",
6   "scripts": {
7     "test": "echo \\\"Error: no test specified\\\" && exit 1"
8   },
9   "keywords": [],
10  "author": "Brendon",
11  "license": "ISC",
12  "devDependencies": {
13    "electron": "^26.2.0",
14    "electron-builder": "^24.0.4"
15  }
16 }
17
```

PS C:\Users\Aisul\Desktop\InteractiveMap> npm install electron-builder --save-dev

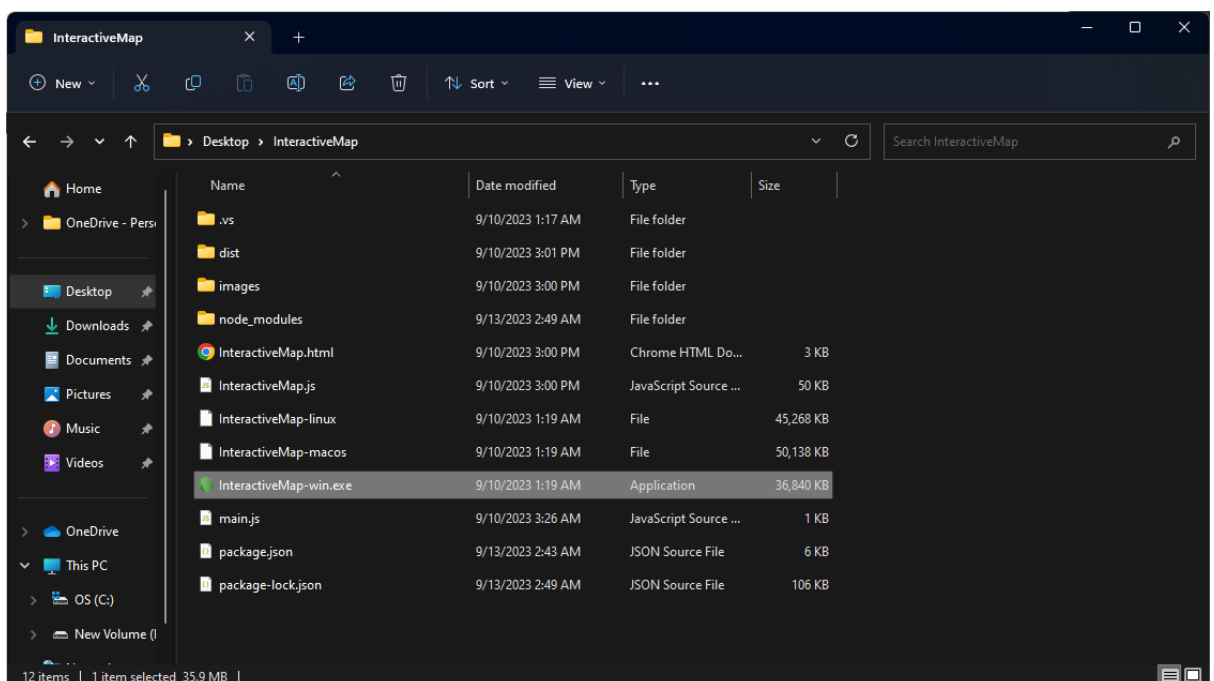
up to date, audited 244 packages in 3s

32 packages are looking for funding  
run `npm fund` for details

Found 0 vulnerabilities

*Figure 4.183 Screenshot of Package Electron Application*

The interactivemap.exe is created in the project directory.



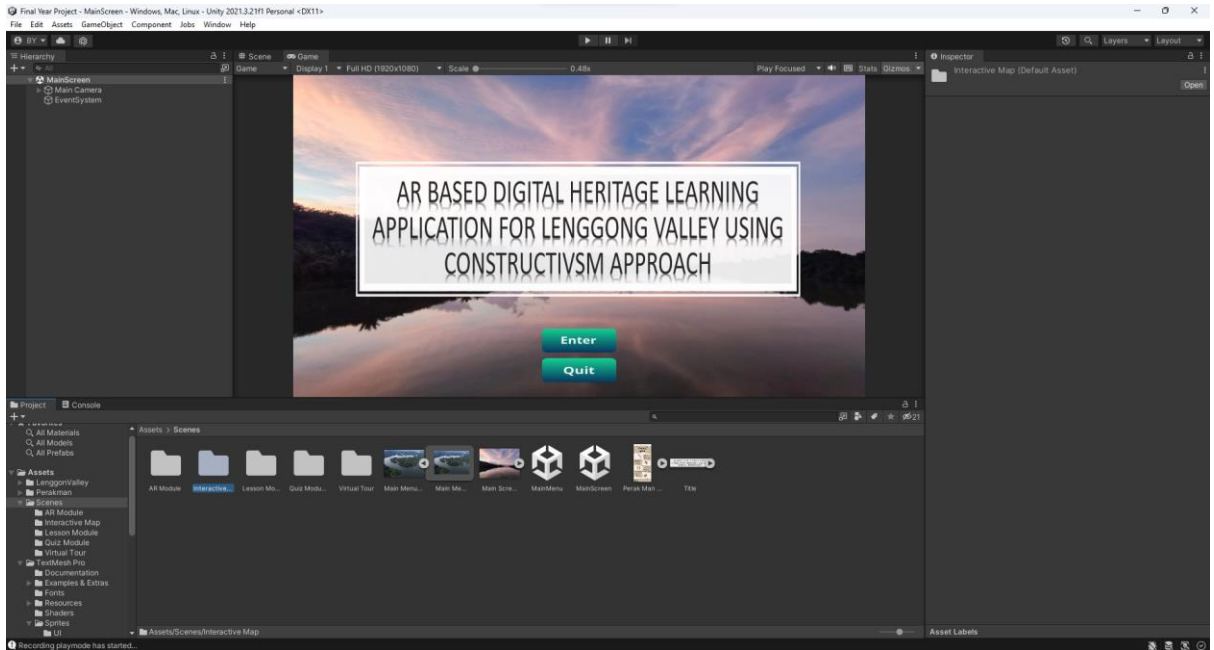
*Figure 4.184 Screenshot of interactivemap.exe Created*

## CHAPTER 4

Link the executable file with Unity.

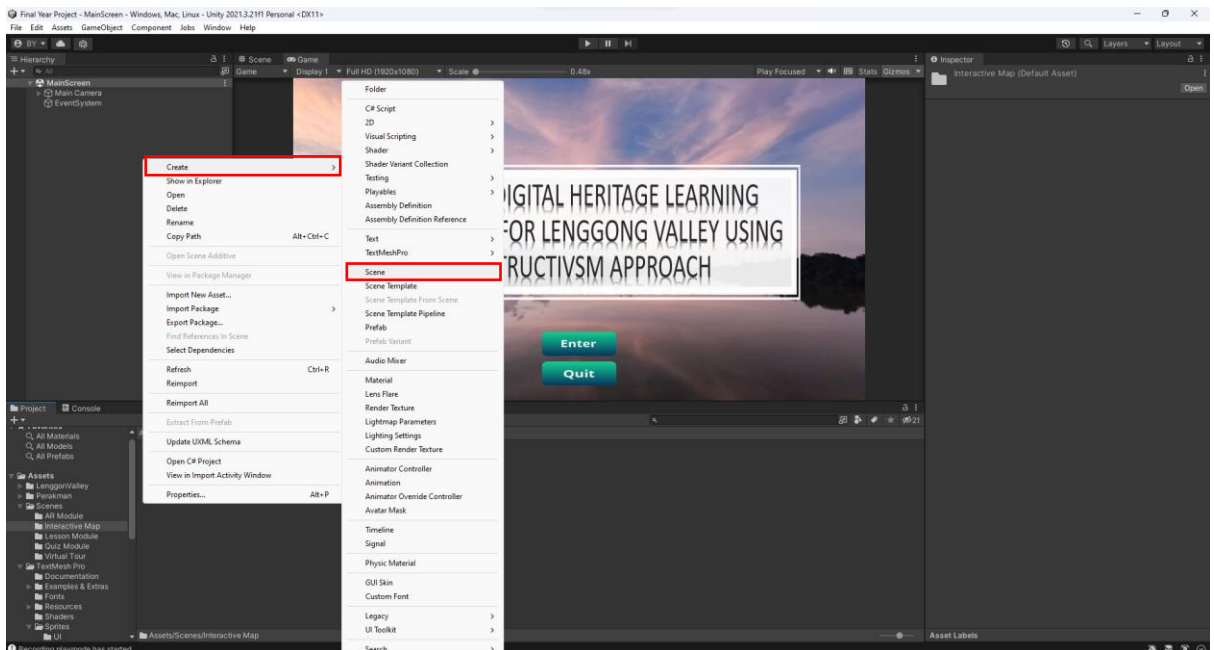
Open Unity.

Create a new folder and name as Interactive Map.



*Figure 4.185 Screenshot of Create a New Folder for Interactive Map Module*

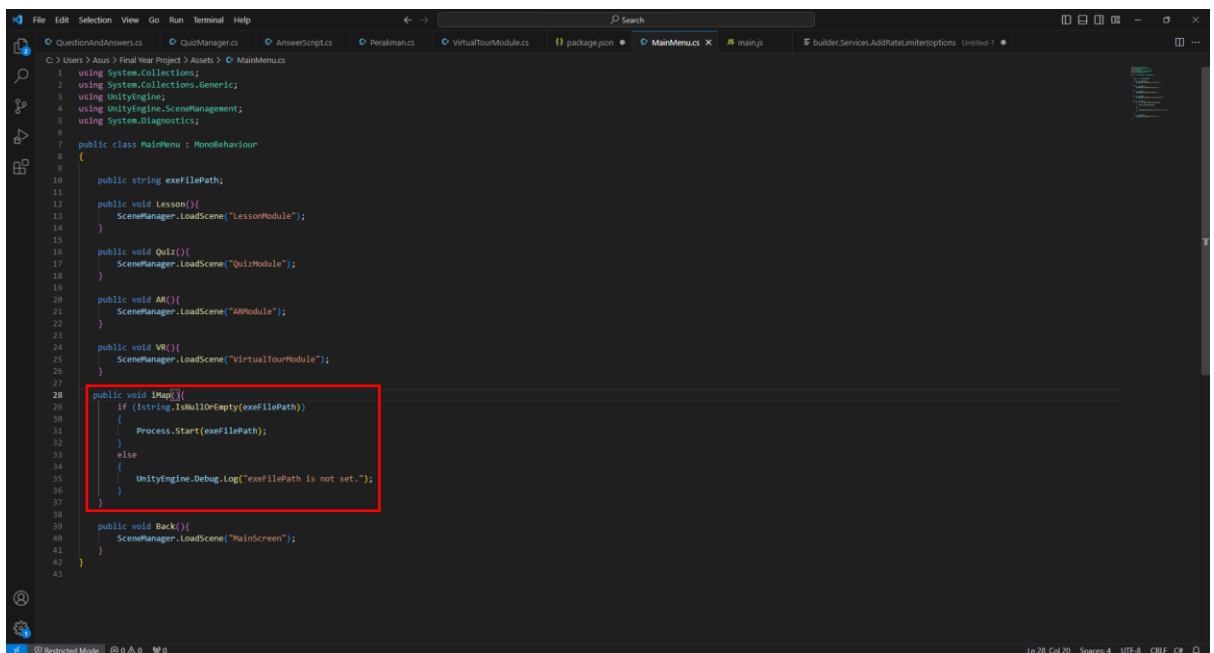
Create a new Scene in the Interactive Map folder.



*Figure 4.186 Screenshot of Create New Scene for Interactive Map*

## CHAPTER 4

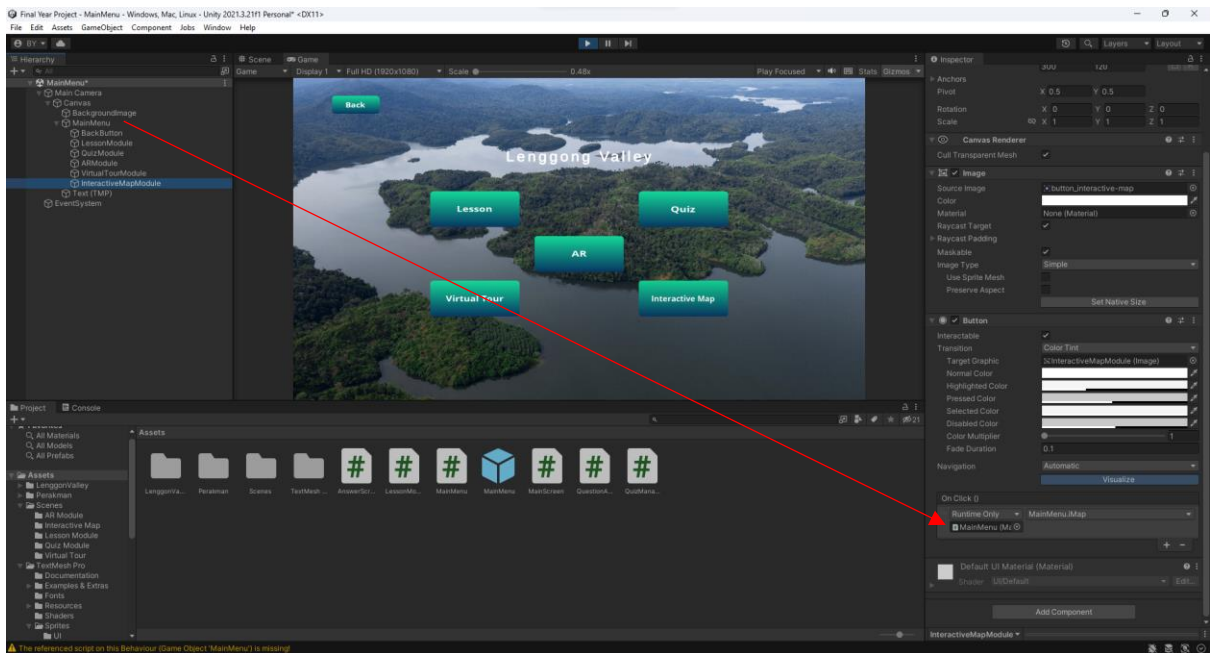
Go to the Main Menu C# Script in Assets. Code the iMap function.



```
1 using System.Collections;
2 using System.Collections.Generic;
3 using UnityEngine;
4 using UnityEngine.SceneManagement;
5 using System.Diagnostics;
6
7 public class MainMenu : MonoBehaviour
8 {
9
10     public string exeFilePath;
11
12     public void Lesson(){
13         SceneManager.LoadScene("LessonModule");
14     }
15
16     public void Quiz(){
17         SceneManager.LoadScene("QuizModule");
18     }
19
20     public void AR(){
21         SceneManager.LoadScene("ARModule");
22     }
23
24     public void VR(){
25         SceneManager.LoadScene("VirtualTourModule");
26     }
27
28     public void iMap(){
29         if (!string.IsNullOrEmpty(exeFilePath))
30         {
31             Process.Start(exeFilePath);
32         }
33         else
34         {
35             UnityEngine.Debug.Log("exeFilePath is not set.");
36         }
37     }
38
39     public void Back(){
40         SceneManager.LoadScene("MainScreen");
41     }
42 }
43
```

*Figure 4.187 Screenshot of Create iMap Function in Main Menu C# Script*

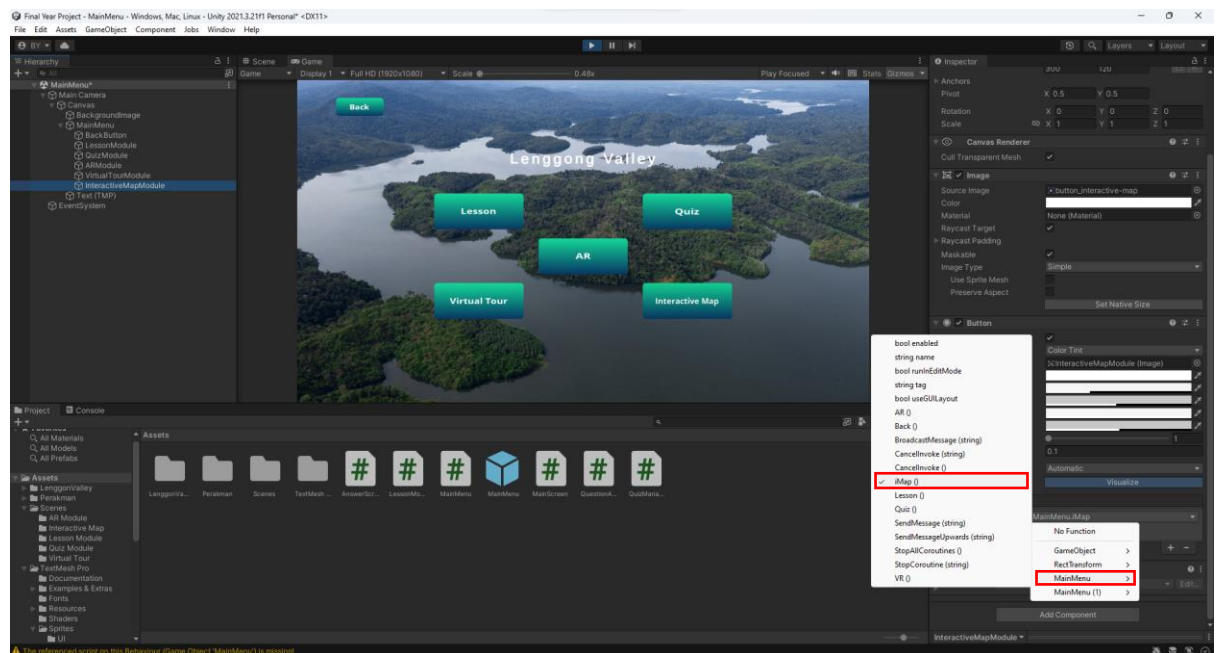
Select the InteractiveMapModule Button, Add an OnClick function and Drag and Drop the MainMenu Game Object into the Object panel.



*Figure 4.188 Screenshot of Drag and Drop Main Menu Game Object*

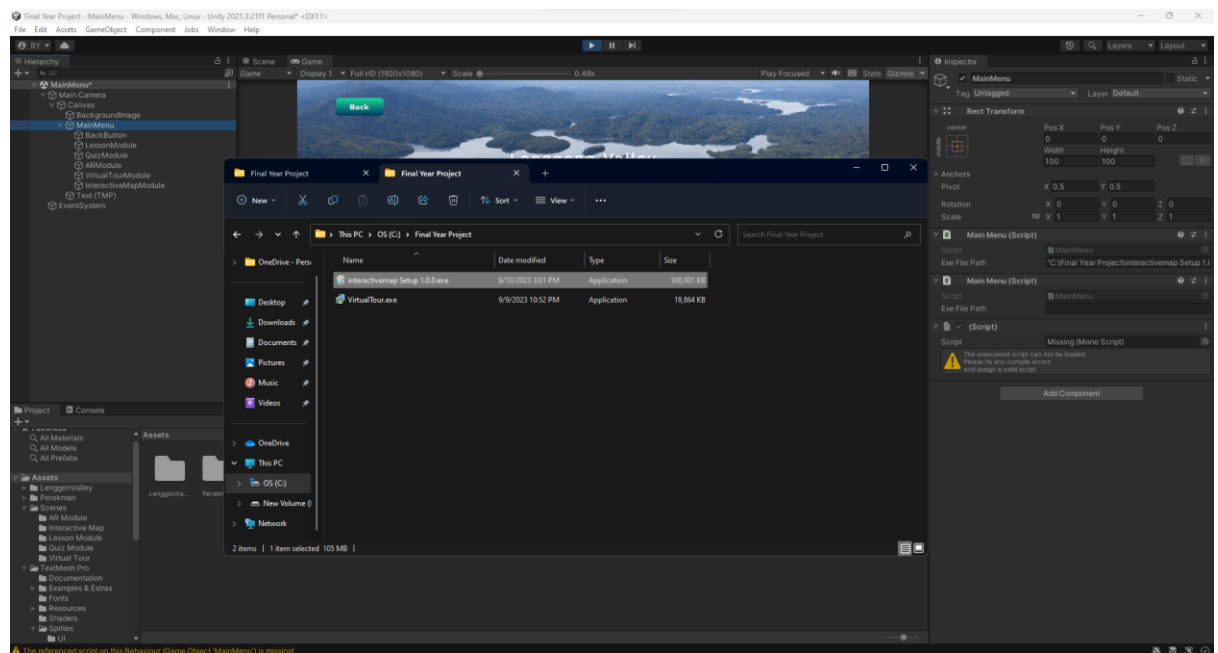
## CHAPTER 4

Next, select MainMenu in the function panel, then iMap() function.



*Figure 4.189 Screenshot of Setting Up Interactive Map Button*

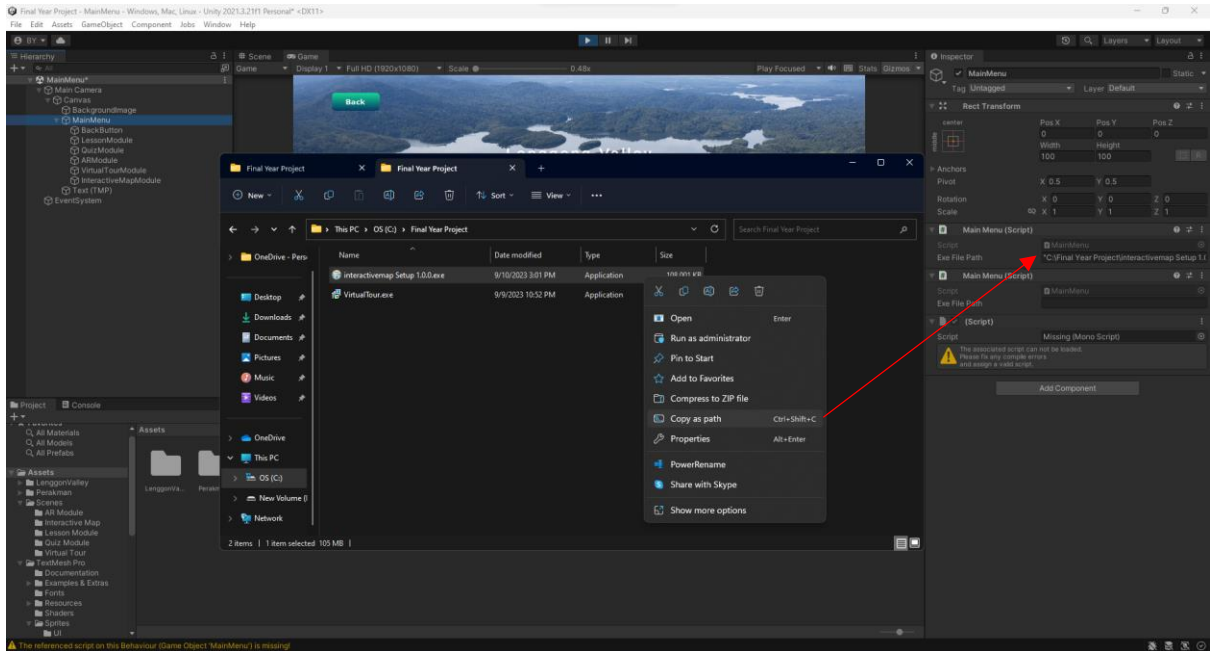
Create a Final Year Project folder in Local Disk C and paste the interactivemap Setup.exe in the folder.



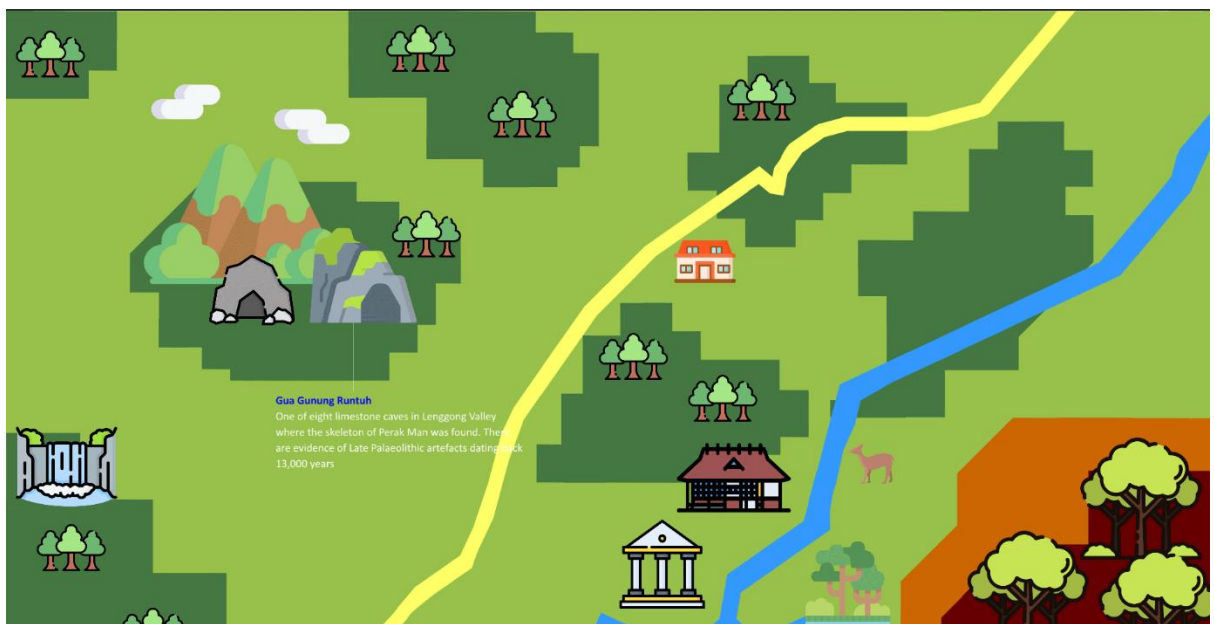
*Figure 4.190 Screenshot of Move interactivemap Setup.exe into Final Year Project*

## CHAPTER 4

In MainMenu Game Object, copy the path of interactivemap.exe and drag into the Exe File Path in Unity to link the InteractiveMapModule Button to the interactivemap Setup.exe.



*Figure 4.191 Screenshot of Copy path of file directory*



*Figure 4.192 Content interface for Interactive Map Module*

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The figure above shows the content for Interactive Map Module. The module presents an interactive map designed based on a satellite data of Lenggong Valley, featuring nine marked landmarks. Each landmark was set to be an interactive button, offering users insightful information when clicked. This will allow the users to learn about the relative landmark of Lenggong Valley. Adobe Animate is used to craft interactive elements, including captivating hovering effects and to ensure that detailed information about each landmark is readily accessible. This module enriches user's understanding of Lenggong Valley's key points of interest.

### 4.3 Conclusion

In a nutshell, the author has completed five modules for the project which is the Lesson Module, Quiz Module, AR Module, Virtual Tour Module and Interactive Map Module. The development process outlined a comprehensive and immersive learning experience designed to educate users about the fascinating Lenggong Valley. The system comprises various modules, each serving a unique purpose to engage and educate users effectively. The Lesson Module interface presents knowledge through diagrams and images, making the learning process visually appealing and engaging. Users have access to a wealth of interesting facts and information about Lenggong Valley with four lessons to explore. The Quiz Module complements the lessons, allowing users to test their understanding. The users can reinforce their knowledge while tracking their progress with multiple-choice questions related to the lesson content. Furthermore, the AR Module introduces a cutting-edge element by featuring 3D models of Perak Man and Lenggong Valley. These models are meticulously crafted using 3D Blender tools, enhancing the learning experience by bringing historical and geographical aspects to life. Moreover, the Virtual Tour Module provides an immersive experience by allowing the users to explore the Archeological Museum of Lenggong Valley. The users can view the artifacts in the museum in a virtual environment. Finally, the Interactive Map Module offers an informative journey through Lenggong Valley's landmarks. Users can click on landmarks to access relevant information by utilizing an interactive map based on a satellite image.

In summary, this multifaceted development process not only imparts knowledge but also fosters user engagement, interaction, and understanding of Lenggong Valley. The system provides a holistic and enriching educational experience for all users interested in this remarkable historical and geographical destination by combining visual elements, interactive features and immersive technologies.



## **Chapter 5 Testing, Results and Discussions**

### **5.1 Overview**

In this Chapter the author is going to discuss about the testing process of the project. The author will discuss about the method that are used for the testing of the project which is the System Usability Scale (SUS) and the Post-Study System Usability Questionnaire (PPSUQ). The author will show the result of the testing process of the project and discuss about the outcome of the testing process. The calculation of the score for SUS and PSSUQ will be conducted to determine the usability and overall satisfaction of the system.

### **5.2 Method of Testing**

The usability project is being tested using System Usability Scale (SUS) and Post-Study System Usability Questionnaire (PPSUQ). The final version of the project is being exported from Unity into an executable file and distributed to target audience to carry out usability testing for the system. Then, the tester will be asked to fill up the System Usability Scale survey form and Post-Study System Usability Questionnaire that are distributed through Google Form. There are 30 samples collected for this usability testing. The target audience are students and teenagers who are aged between 18 – 27 years old. The result of the System Usability Scale (SUS) and Post-Study System Usability Questionnaire will then be retrieved and carry out data analysis.

The System Usability Scale (SUS) is a widely used questionnaire-based tool for assessing the usability and user-friendliness of a wide range of products and services. This includes software applications, websites, and hardware devices. It was developed by John Brooke in 1986 and has since become a popular and reliable method for measuring usability. The SUS consists of a set of 10 standardized questions that users are required to answer after interacting with the product or system being evaluated. These questions are designed to gauge various aspects of the user experience, such as the ease of use, learnability, efficiency, and overall satisfaction. The questions are typically rated on a 5-point Likert scale, ranging from “Strongly Agree” to “Strongly Disagree.” The SUS can then be converted into SUS score, where the sum of the scores

for each question after converting the “Agree” responses to a positive score and the “Disagree” responses to a negative score, multiply the total by 2.5, and then calculate the average score. The resulting score is scale from 0 to 100 where higher scores indicating better usability [23]. The SUS scores are valuable for usability professionals and product designers as they provide a quantitative measure of usability, making it easier to identify areas that need improvement and track changes over time. SUS is a versatile tool and is often used in usability testing, user research, and product calculation to assess the user experience and prioritize design improvements.

The Post-Study System Usability Questionnaire (PSSUQ) is a questionnaire used to assess the usability and user satisfaction of a specific system or product after users have interacted with it. It was developed in 1992 by IBM to perform more in-depth system quality and user satisfaction research [24]. The PSSUQ is similar to SUS which is a standardized tool for evaluating the quality of the user experience. However, the PSSUQ provides a more detailed and system-specific assessment. The PSSUQ consists of 16 questions designed to capture user’s opinions and perception of various aspects of a system’s usability. These questions cover factors such as the system’s interface, ease of use, system capabilities, and overall satisfaction. Respondents typically rate their agreement with each statement on a 7-point Likert scale, ranging from “Strongly Agree” to “Strongly Disagree.” PSSUQ also have its own way of calculation. Firstly, the sum of the scores for each question is calculated, with reverse scored questions appropriately adjusted, and then calculate the average score. The resulting score can range from 1 to 7, with higher score indicating better usability and user satisfaction [25]. The PSSUQ is a valuable tool for gathering detailed feedback about a specific system or product’s usability and user experience. It can help designers and researchers identify specific strengths and weaknesses in a system and guide improvements to enhance overall usability and user satisfaction. The PSSUQ is commonly used in usability testing and user research to assess and improve the usability of software applications, websites, and other interactive systems.

### 5.3 Testing Analysis

The analysis of data for System Usability Scale (SUS) involves several steps to calculate the SUS score and interpret the results. Firstly, the responses from target audience will be collected. Next, for each odd number questions, subtract 1 from the score. For each even number questions, subtract their value from 5. Then, convert the scores to a scale of 10 to 100 by multiplying the score by 2.5. After that, calculate the average of the normalized scores where the resulting number is the final SUS score. The final SUS score can range from 0 to 100 with higher scores indicating better usability of the system. The SUS score alone can provide some insights into the system's usability but its often more valuable when compared to benchmarks or previous iterations of the system. The average SUS score is 68 where the system is good but could make more improvements. When the score is above 80.3 it means that people love the system and will recommend it to their friends. If the SUS score is below 51 it means that the system usability probably has serious problems that should be addressed [23].

The analysis of data for Post-Study System Usability Questionnaire (PSSUQ) consists of several steps to calculate the PSSUQ score and interpret the result. Firstly, the responses from target audience will be collected. Next, calculate the raw scores by summing up the scores for each of the 16 PSSUQ questions. The possible score ranges from 1 to 7. The possible range for the raw scores is from 16 to 112. Then, calculate the average of the raw scores. The resulting number is the final PSSUQ scores. The final PSSUQ score ranges from 16 to 112 where higher scores indicates better usability and user satisfaction. The PSSUQ score is same as the SUS score where the score alone can provide insights into the system's usability and user's satisfaction. However, it's often more valuable when compared to benchmarks or previous iterations of the system. The interpretation of the PSSUQ score can be further broken down into Overall score, SYSUSE score, INFOQUAL score and INTERQUAL score. The overall PSSUQ score represents the general evaluation of the system usability and system satisfaction. It is calculated by averaging the scores of all 16 questions in the PSSUQ. The System Usefulness score also known as SYSUSE score focuses on the perceived usefulness of the system. It is derived by averaging the scores of questions 1 to 6 which specifically

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related to the system's capabilities, meeting requirements and information organization. The Information Quality (INFOQUAL) Score assess the quality and clarity of the information provided by the system. It is calculated by averaging the scores of questions 7 to 12 which relate to error messages, confront using the system, and the ease of findings information. Interaction Quality (INTERQUAL) Score measures the quality of interactions with system. It is obtained by averaging the scores of questions 13 to 15 which cover the aspects like system complexity, ease of learning, flexibility, and overall satisfaction [25].

5.4 Results and Discussions

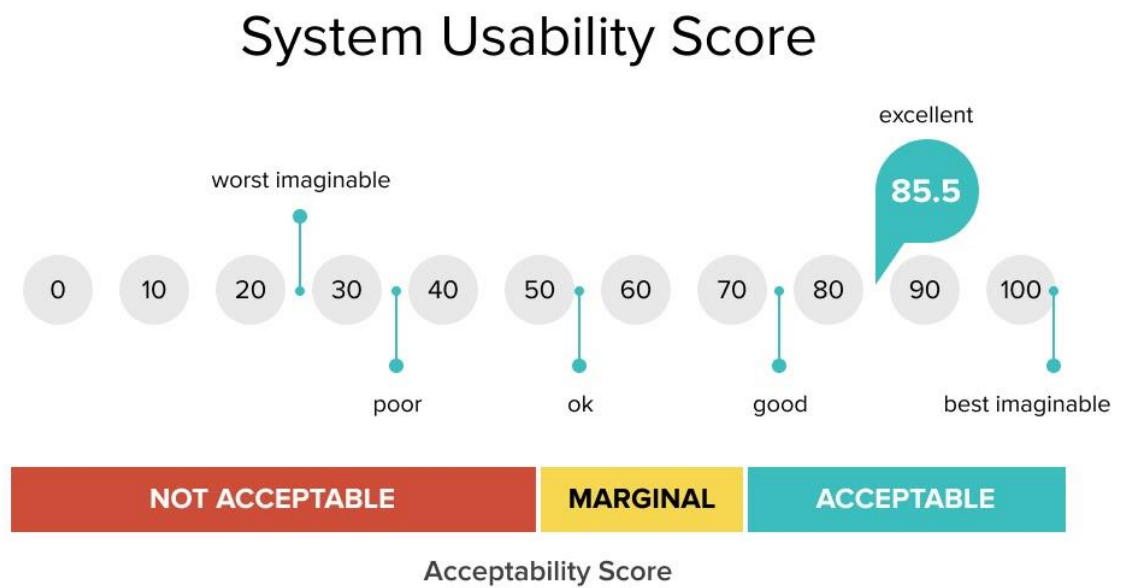


Figure 5.1 System Usability Score [26]

The average score of this system is 74.25

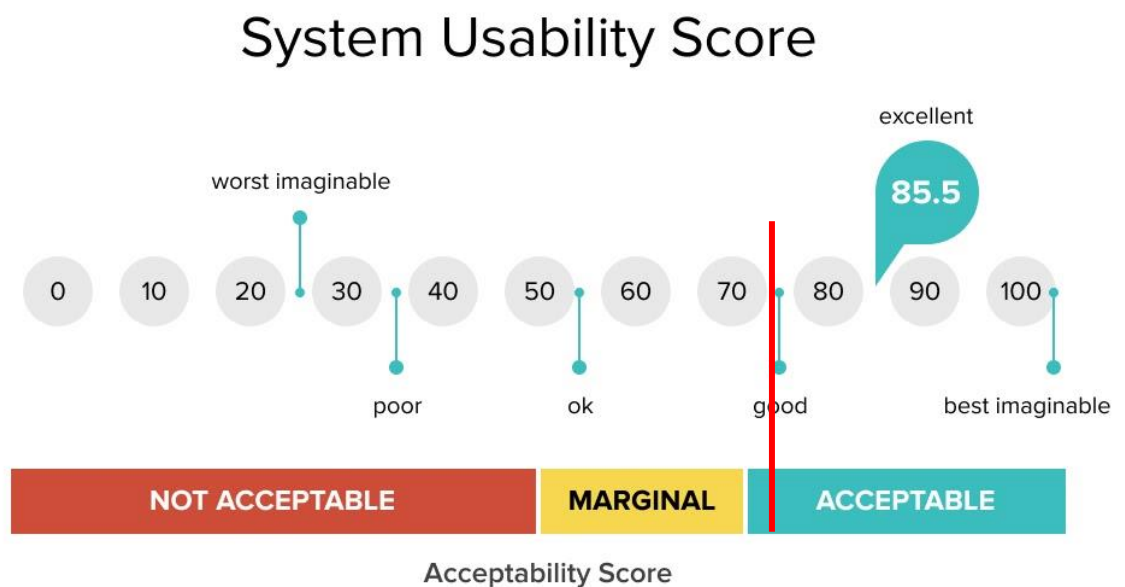


Figure 5.2 System Usability Score [26]

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The System Usability Scale score of this system is 74.25. From the figure above shows that 74.25 is a score close enough to be consider as good system. This mean that the system is above average and the system is perceived as usable by the target audience. However, improvements can be made to make the system better and increase the usability of the system and user's overall satisfaction. According to the industry standards, the average System Usability Score is 68 where if the score is under 68, there are probably some serious problems with the system [23]. When the score is between 68 and 80.3 means that the system is doing good but still have space for improvement. From the SUS questionnaire respondent, it is found that most of the respondent agree that the system was easy to use which shows that the system is user-friendly towards most of the respondent. However, some of the respondent did not agree that the system is well integrated. This might be cause by the issues of navigation to the Virtual Tour Module and Interactive Map Module in the system. The improvement that should be made to the system is the navigation of the system into Virtual Tour Module and Interactive Map Module as this can make some of the respondent think that the system is not well integrated and also found the system to be unnecessarily complex. In a nutshell, the overall of the findings is considered as good as most of the respondents are satisfied with the system. This means that most of the respondents agrees that the system has high usability.

**Table 5.1: PSSUQ Score**

Question 1 - 16	Question 1 - 6	Question 7 - 12	Question 13 - 16
Overall	SYSUSE (System Usefulness)	INFOQUAL (Information Quality)	INTERQUAL (Interface Quality)
2.82 (2.62 – 3.02)	2.80 (2.57 – 3.02)	3.02 (2.79 – 3.24)	2.49 (2.28 – 2.71)

The average score of the system:

**Table 5.2: PSSUQ Score of System**

Question 1 - 16	Question 1 - 6	Question 7 - 12	Question 13 - 16
Overall	SYSUSE (System Usefulness)	INFOQUAL (Information Quality)	INTERQUAL (Interface Quality)
2.225	2.28333	2.266667	2.111111

The overall usability score for the PSSUQ is 2.225, the System Usefulness score is 2.28333, the Information Quality for the system is 2.266667 and the Interface Quality of the system is 2.111111. The PSSUQ scores of the system is lower than the industry standard. This might be due to the usability issues of the system as there are a few users that are highly dissatisfied with various aspects of the system and this is clear that improvements are needed for the system. However, there might be misinterpretation of the questions or instructions to the respondent which can lead to biased responses. This is because that most of the respondent are satisfied with the system with some of them highly satisfied with the system. Hence, the system should be consider as above average in all aspects but improvements will be needed to increase or convinced more users about the overall usability of the system. From the response collected, there are only 2 respondents who is highly dissatisfied with the overall aspects of the system and with most of the respondents that are satisfied with the system. Therefore, the overall aspects

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of the system should be improved so that the system can be convenient and be used more efficiently by the users.

PSSUQ score summary table:

*Table 5.3: PSSUQ Score Summary Table*

PSSUQ Scale	Project Score	Industry Score
System Usefulness	2.28	2.80
Information Quality	2.27	3.02
Interface Quality	2.11	2.49
Overall Usability	2.22	2.82



### **Chapter 6 Conclusion**

#### **6.1 Overview**

In this chapter, the author will conclude about the progress of the project. The author will discuss about the research findings of the project on whether the researched objectives has been achieved throughout the project. The author will also discuss about the knowledge gained throughout the project. The author will then discuss about the limitations that currently exists in the system and what enhancement can be done in the future to overcome the limitations.

#### **6.2 Research Findings**

The first research objective is to study the usage of augmented reality (AR) technologies in historical sites studies. This research objective has been fully achieved as the 3D models Perak Man model and the Lenggong Valley model for the historical sites Lenggong Valley has been sculpted and successfully imported into the system. These models will be able to provide visualization support and engagement to the user. For example, the user can reference the model of Perak Man to get to know how Perak Man looks like instead of just imagine the looks of Perak Man from textbooks theories. The model itself would be able to let the user have a better understanding of the ideas and structures of the historical sites.

Moreover, the second research objective of this project is to develops an AR based software for historical sites education. This objective has been fully achieved as a complete AR based software for the historical sites education has been successfully developed using Unity. The software is able to blend in the digital and three-dimensional (3D) components with an individual's perception of the real world. The developed software is also able to aid the education field in increasing the student's interest in learning historical knowledge as the software provides interactive elements that increase the engagement of the user with the software that build that interest towards historical knowledge during their learning process.

Besides that, the third research objective which is to evaluate the effectiveness of AR software in historical sites towards students has been fully achieved too. This is due to that the AR software has been developed to make help the students visualize the structure of historical sites and build their interest towards historical knowledge. The developed software has been distributed to a group of target audiences aged between 18 – 27 years old to carry out system usability testing. The response of most of the target audiences are satisfied with the usability of the system which shows that the system is perceived as usable by the target audience.

### **6.3 Problems Faced**

One of problem faced while developing the project is that when developing the Quiz Module, the buttons of the answer options tend become transparent after running the game for one time or when the user enters the scene from the menu. This problem is later found out to be the problems from RGB settings. This is due to the value of the color intensity Blue was accidentally set to 0 during the set up of the buttons. This causes the color of the button tend to become invisible even though the author has set a default color on the button.

Next, another problem faced while developing the project was in AR Module. While exporting the 3D models from Blender into Unity, the hair of Perak Man model was unable to export successfully into Unity. This is because that the hair of Perak Man model was created using curves and the model must be converted into Mesh so that it can be exported out from Blender. Therefore, the hair of Perak Man was converted into Mesh so that it can be exported into Unity.

Then, the next problem the author faced while developing the project was in Interactive Map Module. While the author tries to export the interactive map from Adobe Animate software, the author realized that the function was not supported by Adobe Animate software. The author needs to find for another way to export the interactive map which is when the author found out about Electron and uses the electron-builder to export the interactive map from Adobe Animate software.

### **6.4 Knowledge Gained**

In this project, the author learned how to use Unity to develop a web-based application. The author learned about how to create a new scene in the project to create a new page for the application. The author also learns to create media elements such as text element and image element in the new scene to create a specific module. Next, the author learned how to create an interactive button in Unity. While creating the interactive button, the author is required to learn about C# programming language to code the interactive button. The author also creates a Quiz game in Unity using C# programming language.

Furthermore, the author learned how to use the Blender software to create and sculpt a 3D model. The author learned about the shortcuts while using Blender which allow the author to use the Blender software more effectively. The author learned about multiple types of brushes while sculpting for the 3D models. Different situation might require different brushes and the radius and force of the brush also requires adjustment in different kind of situation. The author also learns that there are different types of Add-ons in Blender preferences can be added into the Blender to help the author complete the 3D models more efficiently.

Moreover, the author learned about how to use Adobe Animate software to create an interactive map. The author learned about different kind of shortcuts which would assists the author in using the software more effectively. The author learns on how to convert an image into symbol to create hovering effects for the buttons. The author also learned about how to create animations using Adobe Animate which is crucial in creating an interactive map by adding animations into the content and create a Start and Stop motion for the content.

### 6.5 Limitations

One of the limitations found for the developed project is that the Lesson Module lacks interactivity with the user. The content in the Lesson Module is teaching the knowledge to the users in an easier way but it still lacks interactivity. This might cause the user to get boring while learning the knowledge in the Lesson Module. Interactivity elements such as gamified activities or simulations can boost a learner's motivation. In contrast, a lack of interactivity may lead to decrease in enthusiasm for the learning progress. Interactivity often involves scenarios and simulations that encourage learners to apply their knowledge in real-world context. Learners may struggle to transfer what they have learned to practical situations without these opportunities.

In addition, another limitation found for the developed project is that the Virtual Tour Module and Interactive Map Module is link to Unity using the directory path. This can be a problem while distributing the system to other user as not every user will have the same directory path. The author can ask the user to create the same directory on their own devices but this can be non-user friendly for the user as the user cannot use the software directly once they downloaded the software. This is due to that the user will need to set up the software navigation to the Virtual Tour Module and Interactive Map Module themselves. The user also need to download the Virtual Tour Module and Interactive Map Module separately which can be very troublesome for the user.

Furthermore, the Interactive Map modules lack animations in the map designs. This will cause limited visual engagement as animations can make a map visually engaging by adding dynamic elements such as moving objects, transitions, and effects. The map may appear static and less appealing to the users without these animations, potentially reducing their interest in exploring it. Lack of animation can also cause reduced contextual understanding as animations can help provide context and demonstrate processes or changes over time. For example, animated arrows can illustrate the flow of a river, or a time-lapse animation can show the evolution of a city. Users may struggle to grasp the context and dynamics of a mapped information without these animations.

### **6.6 Future Enhancement**

Future enhancement of the system can be making improvements by adding in more interactive elements into the Lesson Module. For example, the lesson content can be made into videos or increase more interactive elements so that it is easier for the user to learn. This can also encourage the user to learn about the knowledge provided from the module. This can help in increase engagement of the user while using the Lesson Module which motivates them into actively participate in the learning process. Interactivity can provide immediate feedback to the user allowing them to correct mistakes and learn from them in real-time. This helps the users to gauge their understanding and make necessary adjustments.

Next, the author should solve the limitation mentioned above which is the linking between Virtual Tour Module and Interactive Map Module. The author should try to find a method that can link or import both modules into Unity before exporting the Unity into an executable file so that the user can directly access to both modules in the system. This allows the system to be more user-friendly towards the user and increase the user satisfaction for the system. User-friendly system experience lower abandonment rates as the users are less likely to abandon the tasks or transactions due to frustration.

Furthermore, more animations can be added into the Interactive Map to make the module more interesting. For example, the author can animate the river flow inside the map and also animate the clouds moving around in the maps. Animations can make the map more visually appealing and engaging, capturing the user's attention and encouraging them to explore the map further. It can also be a powerful storytelling tool, guiding users through narratives by presenting information sequentially. This can be particularly useful for conveying historical events, ecological changes or urban development over time. Animations will allow the user to explore data in a more dynamic and engaging manner, enabling them to dive deeper into the content and make informed decisions based on the information presented.

## BIBLIOGRAPHY

### **Bibliography/Reference**

[1] Rum Tan, Top 5 Reasons Students HATE History – And what you can do to change that Available: <https://smiletutor.sg/top-5-reasons-students-hate-history-and-what-you-can-do-to-change-that/> [Accessed Aug 8, 2022]

[2] John Fines Imagination in History Teaching

Available: <https://www.mantleoftheexpert.com/blog-post/imagination-in-history-teaching/>

[Accessed Aug 10, 2022]

[3] Eduardo Souza, Visualizing the Invisible: Illustration Structural and Comfort Analyses

Available: <https://www.archdaily.com/941296/visualizing-the-invisible-illustrating-structural-and-comfort-analyses> [Accessed Aug 10, 2022]

[4] Bruce A. Van Sledright, Learning, Teaching of History

Available: <https://education.stateuniversity.com/pages/2048/History.html>

[Accessed: Aug 8, 2022]

[5] Manuel Charr, What can AR do to bring heritage sites to life?

Available: <https://www.museumnext.com/article/what-can-ar-do-to-bring-heritage-sites-to-life/>

[Accessed Aug 10, 2022]

## BIBLIOGRAPHY

[6] Daria Dubrova, Augmented Reality Issues – What You Need To Know

Available: <https://theappsolutions.com/blog/development/augmented-reality-challenges/#:~:text=Lack%20of%20Augmented%20Reality%20App%20Design%20%26%20Development%20Standards,-Standards%20are%20something&text=The%20reason%20is%20simple%20%2D%20it's,being%20around%20for%20a%20while.>) [Accessed Aug 10, 2022]

[7] Grove Eye Care, Why Visual Learning is Important in School

Available: <https://www.groveeyecare.com/blog/why-visual-learning-is-important-in-school.html#:~:text=According%20to%20the%20Visual%20Teaching,text%2C%20which%20is%20quite%20surprising.> [Accessed Aug 26, 2022]

[8] CyArk

Available: <https://www.cyark.org/> [Accessed Aug 17, 2022]

[9] Sketchfab

Available: <https://sketchfab.com/feed> [Accessed Aug 17, 2022]

[10] Inception

Available: <https://www.inception-project.eu/en> [Accessed Aug 17, 2022]

[11] SketchUp – 3D Warehouse

Available: <https://3dwarehouse.sketchup.com/?hl=en> [Accessed Aug 17, 2022]

[12] The Panoramic Palace Museum

Available: <https://pano.dpm.org.cn/> [Accessed Aug 17, 2022]

## BIBLIOGRAPHY

[13] Serhat Kurt, ADDIE Model: Instructional Design

Available: <https://educationaltechnology.net/the-addie-model-instructional-design/>

[Accessed Aug 25, 2022]

[14] Richard Culatta, ADDIE Model

Available: <https://www.instructionaldesign.org/models/addie/> [Accessed Aug 28, 2022]

[15] Andrew DeBell, What is the ADDIE Model of Instructional Design ?

Available: <https://waterbearlearning.com/addie-model-instructional-design/> [Accessed

Aug 28,2022]

[16] ISFET, ADDIE Model

Available: <https://www.isfet.org/pages/addie-model> [Accessed Aug 28, 2022]

[17] Saul McLeod, Constructivism as a theory for teaching and learning

Available: <https://www.simplypsychology.org/constructivism.html> [Accessed Aug 29,

2022]

[18] Grace Dover, The Benefits of Constructivist Learning Design

Available: <https://www.smartsparrow.com/2018/02/28/the-benefits-of-constructivist-learning-design/> [Accessed Aug 29, 2022]

[19] Malaysia Traveler, Lenggong Valley Archaeological Gallert & Gua Gunung Runtuh

Available: <https://www.malaysia-traveller.com/perak-man.html> [Accessed Aug 30, 2022]



## BIBLIOGRAPHY

[20] Anu\_V, Visual Learning Style for Students: Pros and Cons

Available: <https://www.embibe.com/exams/visual-learning-benefits-and-strategies-for-students-teachers/> [Accessed Aug 20, 2022]

[21] Rajeev Dhir, What Is Interactive Media ?

Available: <https://www.investopedia.com/terms/i/interactive-media.asp>

[Accessed April 18, 2023]

[22] Rachel Steenson FBCS, The history of Geographic Information System (GIS)

Available: <https://www.bcs.org/articles-opinion-and-research/the-history-of-geographic-information-systems-gis/> [Accessed April 18, 2023]

[23] Nathan Thomas, How To Use The System Usability Scale (SUS) To Evaluate the Usability Of Your Website

Available: <https://usabilitygeek.com/how-to-use-the-system-usability-scale-sus-to-evaluate-the-usability-of-your-website/> [Accessed September 12, 2023]

[24] The Trymata Blog, The PSSUQ and usability testing

Available: <https://trymata.com/blog/learn/pssuq/> [Accessed September 12, 2023]

[25] Will T, PSSUQ (Post-Study System Usability Questionnaire)

Available: [https://uiuxtrend.com/pssuq-post-study-system-usability-questionnaire/#:~:text=The%20PSSUQ%20\(Post%2DStudy%20System,System%20Usability%20Metrics\)%20in%201988.](https://uiuxtrend.com/pssuq-post-study-system-usability-questionnaire/#:~:text=The%20PSSUQ%20(Post%2DStudy%20System,System%20Usability%20Metrics)%20in%201988.) [Accessed September 12, 2023]

[26] Jacklyn Bunch, System Usability Scale

Available: <https://bunch-media.com/2021/03/29/system-usability-scale/>

[Accessed September 13, 2023]

## APPENDIX

### Questionnaire Sample

### AR Based Digital Heritage Learning Application Survey Form

---

Hello, I'm Year 3, Trimester 1 student from University Tunku Abdul Rahman (UTAR) currently working on my FYP 1.

The purpose of this survey is to gain insight on identification of user preference in developing an AR Based Digital Heritage Learning Application with your preferred choice.

Thank you for your time and participation 😊

(All responses will be anonymous and will be used for research purpose only)

---

1. Name \*

Short answer text

---

2. Age \*

< 18 years old

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### 2. Age \*

- < 18 years old
- 18 - 27 years old
- 28 - 37 years old
- 38 - 47 years old
- 48 - 57 years old
- > 58 years old

### 3. Gender \*

- Male
- Female
- Prefer Not To Say

### 4. Employment Status \*

- Student

## APPENDIX

### 4. Employment Status \*

- Student
- Unemployed
- Employed
- Self-Employed
- Other...

### 5. Would you use the AR Based Digital Heritage Learning Application again for historical study purposes? \*

- Yes
- No
- Maybe

### 6. How often do you visit historical sites for educational purposes? \*

- Anually
- Semi-Annually

## APPENDIX

6. How often do you visit historical sites for educational purposes? \*

- Anually
- Semi-Annually
- Monthly
- Never

7. How would you gather information while visiting a historical site? \*

- Guided Tours
- Audio Guides
- Printed Brochures
- Online Research
- Other

8. What features do you think that a Lesson Modules should possessed? \*

- Self-Contained

## APPENDIX

8. What features do you think that a Lesson Modules should possessed? \*

- Self-Contained
- User Friendly
- Adaptive
- Consistency
- Stand Alone

9. Which type of quiz questions do you think would be suitable for the Quiz Module? \*

- Fill in the Blank Questions
- True/False Questions
- Multiple Choice Questions
- Drag & Drop Questions

10. Which type of AR presentation do you wish to see being used on the AR Based Digital Heritage Learning Application? \*

## APPENDIX

10. Which type of AR presentation do you wish to see being used on the AR Based Digital Heritage Learning Application? \*

Location-based AR

Projection-based AR

Overlay AR

Contour-based AR

11. Given scale 1 to 5, do you think AR can help ease to user on historical site studies? \*

Poor      1      2      3      4      5      Excellent

12. Given scale 1 to 5, do you believe that this application increase user's interest on historical site studies? \*

Strongly Disagree      1      2      3      4      5      Strongly Agree

## APPENDIX

13. Do you think that is important to ensure future generations maintain their interest towards <sup>\*</sup> historical sites studies?

	1	2	3	4	5	
Not important	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremely important

14. Do you think the study of historical sites through textbooks can be hard to understand? <sup>\*</sup>

	1	2	3	4	5	
Very Easy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very Hard

15. Given scale 1 to 5, do you find that some of the historical sites are hard to visualize by <sup>\*</sup> referring to the pictures provided in the textbook?

	1	2	3	4	5	
Very Easy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very Hard



## APPENDIX

16. Have you used any AR Based Digital Heritage Learning Application before \*

Yes

No

17. How would you rate the ease of use of the AR Based Digital Heritage Learning Application you've used? \*

Poor      1      2      3      4      5      Excellent

18. How important do you think it is to have access to an accurate information while visiting the particular historical sites? \*

Not Important      1      2      3      4      5      Extremely Important

## APPENDIX

19. Do you think AR Based Digital Heritage Learning Applications can provide a more immersive and interactive experience compared to traditional methods of historical sites study? *						
	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

20. Given scale 1 to 5, how likely would you study historical site using the AR Based Digital Heritage Learning Application? *						
	1	2	3	4	5	
Extremely Unlikely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremely Likely

21. Given scale 1 to 5, do you agree that Virtual Tour Module can improve the user's experience for the AR Based Digital Heritage Learning Application? *						
	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

## APPENDIX

22. Given scale 1 to 5, do you agree that Interactive Map Module for AR Based Digital Heritage Learning Application could help attract user's interest in learning historical site? \*

Strongly Disagree      1      2      3      4      5      Strongly Agree

23. Given scale 1 to 5, how would rate the ease of use of an AR Based Digital Heritage Learning Application that you have used before? \*

Very Hard      1      2      3      4      5      Very Easy

24. What type of suggestion would you provide to improve the AR Based Digital Heritage Learning Application you've used? \*

Long answer text

.....

25. What is the suggestion that you will provide to improve the AR Based Digital Heritage Learning Application for studying historical sites? \*

Long answer text

.....

## System Usability Scale Survey Sample

### System Usability Scale (SUS)

Hello, I'm Year 3, Trimester 2 student from University Tunku Abdul Rahman (UTAR) currently working on my FYP 2.

The purpose of this survey is to gain insight on the usability of the system for AR Based Digital Heritage Learning Application.

The response are scale as below:

- 1 - Strongly Agree
- 2 - Agree
- 3 - Neutral
- 4 - Disagree
- 5 - Strongly Disagree

Thank you for your time and participation 😊

1. I think that I would like to use this system frequently. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

## APPENDIX

2. I found the system unnecessarily complex. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

3. I thought the system was easy to use. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

4. I think that I would need the support of a technical person to be able to use this system. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

5. I found the various functions in this system were well integrated. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

## APPENDIX

6. I thought there was too much inconsistency in this system. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

7. I would imagine that most people would learn to use this system very quickly. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

8. I found the system very cumbersome to use. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

9. I felt very confident using the system. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

## APPENDIX

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

8. I found the system very cumbersome to use. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

9. I felt very confident using the system. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

10. I needed to learn a lot of things before I could get going with this system. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

## Post-Study System Usability Questionnaire Sample

### Post-Study System Usability Questionnaire (PSSUQ)

Hello, I'm Year 3, Trimester 2 student from University Tunku Abdul Rahman (UTAR) currently working on my FYP 2.

The purpose of this survey is to gain insight on the usability of the system for AR Based Digital Heritage Learning Application.

The response are scale as below:

From **1 - Strongly Agree** to **7 - Strongly Disagree**

Thank you for your time and participation 😊

1. Overall, I am satisfied with how easy it is to use this system. \*

	1	2	3	4	5	6	7	
Strongly Agree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Disagree

2. It was simple to use this system. \*

1	2	3	4	5	6	7
---	---	---	---	---	---	---



## APPENDIX

2. It was simple to use this system. \*

	1	2	3	4	5	6	7	
Strongly Agree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Disagree

3. I was able to complete the tasks and scenarios quickly using this system. \*

	1	2	3	4	5	6	7	
Strongly Agree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Disagree

4. I felt comfortable using this system. \*

	1	2	3	4	5	6	7	
Strongly Agree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Disagree

5. It was easy to learn to use this system. \*

	1	2	3	4	5	6	7	
Strongly Agree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Disagree

## APPENDIX

6. I believe I could become productive quickly using this system. \*

	1	2	3	4	5	6	7	
Strongly Agree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Disagree

7. The system gave error messages that clearly told me how to fix problems. \*

	1	2	3	4	5	6	7	
Strongly Agree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Disagree

8. Whenever I made a mistake using the system, I could recover easily and quickly. \*

	1	2	3	4	5	6	7	
Strongly Agree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Disagree

9. The information (such as online help, on-screen messages, and other documentation) provided with this system was clear. \*

	1	2	3	4	5	6	7	
Strongly Agree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Disagree

## APPENDIX

10. It was easy to find the information I needed. \*

	1	2	3	4	5	6	7	
Strongly Agree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Disagree

11. The information was effective in helping me complete the tasks and scenarios. \*

	1	2	3	4	5	6	7	
Strongly Agree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Disagree

12. The organization of information on the system screens was clear. \*

	1	2	3	4	5	6	7	
Strongly Agree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Disagree

13. The interface of this system was pleasant. \*

	1	2	3	4	5	6	7	
Strongly Agree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Disagree

## APPENDIX

14. I liked using the interface of this system. \*

	1	2	3	4	5	6	7	
Strongly Agree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Disagree

15. This system has all the functions and capabilities I expect it to have. \*

	1	2	3	4	5	6	7	
Strongly Agree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Disagree

16. Overall, I am satisfied with this system. \*

	1	2	3	4	5	6	7	
Strongly Agree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Disagree

# FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: 2, 3	Study week no.: 1
Student Name & ID: Brendon Lee Chuin Yuen & 2100267	
Supervisor: Ts Dr Lee Chen Kang & Ts Saw Seow Hui	
Project Title: AR Based Digital Heritage Learning Application for Lenggong Valley Using Constructivism Approach	

## 1. WORK DONE

- Research on how to create a better human sculpture.

## 2. WORK TO BE DONE

- Complete the 3D sculpture for Perak Man.
- Create and sculpt a 3D human ears.

## 3. PROBLEMS ENCOUNTERED

- -

## 4. SELF EVALUATION OF THE PROGRESS

- Continue the project on a moderate progress.



Supervisor's signature



Student's signature

# FINAL YEAR PROJECT WEEKLY REPORT

*(Project II)*

<b>Trimester, Year: 2, 3</b>	<b>Study week no.: 2</b>
<b>Student Name &amp; ID: Brendon Lee Chuin Yuen &amp; 2100267</b>	
<b>Supervisor: Ts Dr Lee Chen Kang &amp; Ts Saw Seow Hui</b>	
<b>Project Title: AR Based Digital Heritage Learning Application for Lenggong Valley Using Constructivism Approach</b>	

## 1. WORK DONE

- Complete the basic 3D human sculpture for the head of Perak Man.
- Complete the 3D human ears sculpture.

## 2. WORK TO BE DONE

- Further modification on Perak Man model.
- Add on the hair and facial hair of Perak Man into the sculpture.

## 3. PROBLEMS ENCOUNTERED

- -

## 4. SELF EVALUATION OF THE PROGRESS

- Project is on a right path but with a slow progress.



Supervisor's signature



Student's signature

# FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: 2, 3	Study week no.: 3
Student Name & ID: Brendon Lee Chuin Yuen & 2100267	
Supervisor: Ts Dr Lee Chen Kang & Ts Saw Seow Hui	
Project Title: AR Based Digital Heritage Learning Application for Lenggong Valley Using Constructivism Approach	

## 1. WORK DONE

- Modification on Perak Man model.
- Discuss with supervisor on the area needed for the Lenggong Valley 3D model.

## 2. WORK TO BE DONE

- Further modification on Perak Man model.
- Add on the hair and facial hair of Perak Man into the sculpture.
- Research on creating a 3D model of a map terrain.

## 3. PROBLEMS ENCOUNTERED

- -

## 4. SELF EVALUATION OF THE PROGRESS

- Project is on a right path and but with slow progress progress.

Supervisor's signature

Student's signature

## FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

<b>Trimester, Year: 2, 3</b>	<b>Study week no.: 4</b>
<b>Student Name &amp; ID: Brendon Lee Chuin Yuen &amp; 2100267</b>	
<b>Supervisor: Ts Dr Lee Chen Kang &amp; Ts Saw Seow Hui</b>	
<b>Project Title: AR Based Digital Heritage Learning Application for Lenggong Valley Using Constructivism Approach</b>	

### 1. WORK DONE

- **Modification of Perak Man model.**
- **Research on creating a 3D model of a map terrain.**

### 2. WORK TO BE DONE

- **Add on the hair and facial hair of Perak Man into the sculpture.**
- **Research on creating hair on the human sculpture.**

### 3. PROBLEMS ENCOUNTERED

- **Unable to add on the hair due to UV Mapping of the model.**

### 4. SELF EVALUATION OF THE PROGRESS

- **Project is on a right path but with slow progress.**



Supervisor's signature



Student's signature



## FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

<b>Trimester, Year: 2, 3</b>	<b>Study week no.: 5</b>
<b>Student Name &amp; ID: Brendon Lee Chuin Yuen &amp; 2100267</b>	
<b>Supervisor: Ts Dr Lee Chen Kang &amp; Ts Saw Seow Hui</b>	
<b>Project Title: AR Based Digital Heritage Learning Application for Lenggong Valley Using Constructivism Approach</b>	

### 1. WORK DONE

- Completed the 3D model for Perak Man

### 2. WORK TO BE DONE

- Create the 3D model for Lenggong Valley

### 3. PROBLEMS ENCOUNTERED

- -

### 4. SELF EVALUATION OF THE PROGRESS

- Project is going smoothly and showing progress.



Supervisor's signature



Student's signature

## FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

<b>Trimester, Year: 2, 3</b>	<b>Study week no.: 6</b>
<b>Student Name &amp; ID: Brendon Lee Chuin Yuen &amp; 2100267</b>	
<b>Supervisor: Ts Dr Lee Chen Kang &amp; Ts Saw Seow Hui</b>	
<b>Project Title: AR Based Digital Heritage Learning Application for Lenggong Valley Using Constructivism Approach</b>	

### 1. WORK DONE

- 3D model for Lenggong Valley in progress.
- Further research conducted on how to create a better 3D model for map.
- Discuss with supervisor on the method of creating a Virtual Tour.

### 2. WORK TO BE DONE

- Complete the 3D model for Lenggong Valley.
- Research on method to create Virtual Tour.

### 3. PROBLEMS ENCOUNTERED

- -

### 4. SELF EVALUATION OF THE PROGRESS

- Progress on the right track but with slow progress.



Supervisor's signature



Student's signature

## FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

<b>Trimester, Year: 2, 3</b>	<b>Study week no.: 7</b>
<b>Student Name &amp; ID: Brendon Lee Chuin Yuen &amp; 2100267</b>	
<b>Supervisor: Ts Dr Lee Chen Kang &amp; Ts Saw Seow Hui</b>	
<b>Project Title: AR Based Digital Heritage Learning Application for Lenggong Valley Using Constructivism Approach</b>	

### 1. WORK DONE

- Created 3D model for Gua Badak one of the landmark in Lenggong Valley.
- Created 3D model for Gua Batu Puteh one of the landmark in Lenggong Valley.

### 2. WORK TO BE DONE

- Complete the 3D model for Lenggong Valley.
- Research on method to create Virtual Tour.

### 3. PROBLEMS ENCOUNTERED

- -

### 4. SELF EVALUATION OF THE PROGRESS

- Progress on the right track and showing satisfying result.



Supervisor's signature



Student's signature

## FINAL YEAR PROJECT WEEKLY REPORT

*(Project II)*

<b>Trimester, Year: 2, 3</b>	<b>Study week no.: 8</b>
<b>Student Name &amp; ID: Brendon Lee Chuin Yuen &amp; 2100267</b>	
<b>Supervisor: Ts Dr Lee Chen Kang &amp; Ts Saw Seow Hui</b>	
<b>Project Title: AR Based Digital Heritage Learning Application for Lenggong Valley Using Constructivism Approach</b>	

### 1. WORK DONE

- Created 3D model for Gua Gunung Runtuh one of the landmark in Lenggong Valley.
- Completed the 3D model for Lenggong Valley.

### 2. WORK TO BE DONE

- Start developing the Virtual Tour Module.
- Research on creating Interactive Map

### 3. PROBLEMS ENCOUNTERED

- -

### 4. SELF EVALUATION OF THE PROGRESS

- Progress on the right track and showing satisfying result.



Supervisor's signature



Student's signature

# FINAL YEAR PROJECT WEEKLY REPORT

*(Project II)*

<b>Trimester, Year: 2, 3</b>	<b>Study week no.: 9</b>
<b>Student Name &amp; ID: Brendon Lee Chuin Yuen &amp; 2100267</b>	
<b>Supervisor: Ts Dr Lee Chen Kang &amp; Ts Saw Seow Hui</b>	
<b>Project Title: AR Based Digital Heritage Learning Application for Lenggong Valley Using Constructivism Approach</b>	

## 1. WORK DONE

- **Prototype of Virtual Tour Module.**
- **Discussion with supervisor on how to obtain the resources needed.**

## 2. WORK TO BE DONE

- **Research on other methods for creating Virtual Tour.**
- **Research on creating Interactive Map.**
- **Start creating Interactive Map Module.**

## 3. PROBLEMS ENCOUNTERED

- **The Virtual Tour Module requires a high-resolution image of the area.**

## 4. SELF EVALUATION OF THE PROGRESS

- **Slow progress on the project due to the lack of resources.**



Supervisor's signature



Student's signature

# FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

<b>Trimester, Year: 2, 3</b>	<b>Study week no.: 10</b>
<b>Student Name &amp; ID: Brendon Lee Chuin Yuen &amp; 2100267</b>	
<b>Supervisor: Ts Dr Lee Chen Kang &amp; Ts Saw Seow Hui</b>	
<b>Project Title: AR Based Digital Heritage Learning Application for Lenggong Valley Using Constructivism Approach</b>	

## 1. WORK DONE

- **Research on creating Interactive Map.**

## 2. WORK TO BE DONE

- **Create Interactive Map Module.**
- **Complete the Lesson Module in Unity.**
- **Complete the Quiz Module in Unity.**

## 3. PROBLEMS ENCOUNTERED

- **Unfamiliar with the Adobe Animate software.**

## 4. SELF EVALUATION OF THE PROGRESS

- **Slow progress on the project due to the unfamiliarity with the software.**



Supervisor's signature



Student's signature

# FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

<b>Trimester, Year: 2, 3</b>	<b>Study week no.: 11</b>
<b>Student Name &amp; ID: Brendon Lee Chuin Yuen &amp; 2100267</b>	
<b>Supervisor: Ts Dr Lee Chen Kang &amp; Ts Saw Seow Hui</b>	
<b>Project Title: AR Based Digital Heritage Learning Application for Lenggong Valley Using Constructivism Approach</b>	

## 1. WORK DONE

- Completed Lesson Module.
- Completed the Quiz Module.
- Complete the Virtual Tour Module using another approach.
- Completed Interactive Map by adding animations and interactivity.

## 2. WORK TO BE DONE

- Conduct system usability testing.
- Prepare and distribute System Usability Scale survey.
- Prepare and distribute Post-Study System Usability Questionnaire.
- Design a UI for button and enhance the UI design of the software.
- Integrate the software and distribute them for testing purposes.

## 3. PROBLEMS ENCOUNTERED

- -

## 4. SELF EVALUATION OF THE PROGRESS

- Progress on the right track and showing satisfying result.



Supervisor's signature



Student's signature

# FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: 2, 3	Study week no.: 12
Student Name & ID: Brendon Lee Chuin Yuen & 2100267	
Supervisor: Ts Dr Lee Chen Kang & Ts Saw Seow Hui	
Project Title: AR Based Digital Heritage Learning Application for Lenggong Valley Using Constructivism Approach	

## 1. WORK DONE

- Enhance the UI design for the software.
- Integrated all modules into the software and distribute the software for testing purposes.
- Distributed the System Usability Scale survey.
- Distributed the Post-Study System Usability Questionnaire.

## 2. WORK TO BE DONE

- Retrieve the System Usability Scale Survey for data analysis.
- Retrieve Post-Study System Usability Questionnaire for data analysis.
- Start compiling the report.

## 3. PROBLEMS ENCOUNTERED

- -

## 4. SELF EVALUATION OF THE PROGRESS

- Progress on the right path with remarkable result.



Supervisor's signature



Student's signature



## FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: 2, 3	Study week no.: 13
Student Name & ID: Brendon Lee Chuin Yuen & 2100267	
Supervisor: Ts Dr Lee Chen Kang & Ts Saw Seow Hui	
Project Title: AR Based Digital Heritage Learning Application for Lenggong Valley Using Constructivism Approach	

### 1. WORK DONE

- Finalize and compile the report for FYP 2.

### 2. WORK TO BE DONE

- Continue enhancing the software for demonstrating purpose.

### 3. PROBLEMS ENCOUNTERED

- -

### 4. SELF EVALUATION OF THE PROGRESS

- Progress on the right path with remarkable result.



Supervisor's signature



Student's signature

Poster

## AUGMENTED REALITY (AR) BASED DIGITAL HERITAGE LEARNING APPLICATION FOR LENGGONG VALLEY USING CONSTRUCTIVISM APPROACH

**Introduction**

Lenggong Valley is located in Perak. Lenggong Valley is an important archaeological site where evidence of human settlement from the Paleolithic age was found. The important archaeological sites include Kota Tampan, Bukit Jawa at Kampung Gelok and Kampung Temelong. One of the most famous archaeological findings in Lenggong was the Perak Man which was found in 1991 in a cave called Gua Gunung Runtuh, a few kilometers north of the town of Lenggong. It is also known as the oldest human skeleton found so far in Peninsular Malaysia.

**Problem Statement**

- Students are not interested in learning about the historical sites
- Students faced difficulties in visualizing historical site
- Lacks AR Based Digital Heritage for historical sites

**Objectives**

- Study the usage of augmented reality (AR) technologies in historical sites studies
- Develop AR based software for historical sites education
- Evaluate the effectiveness of AR software in historical sites studies towards students

**Literature Review**

Media Elements	Text	Graphics	Audio	Video	2D	3D	AR	VR
CyArk [8]	✓	✓	✓	✓	✓	✓	✓	✓
SketchFab [9]	✓	✓			✓	✓	✓	✓
Inception [10]	✓	✓			✓	✓	✓	✓
SketchUp 3D Warehouse [11]	✓	✓			✓	✓	✓	✓
The Panoramas Palace Museum [12]	✓	✓	✓	✓	✓	✓	✓	✓



BRENDA LEE CHUIN YUEN  
21ACB00267

**User Requirement Gathering**

**Project Scope**

**ADDIE Model**

**Novelty**

- Increase students learning interest through AR
- Allow virtual visit to Lenggong Valley
- Provide interactivity and knowledge through interactive map



Perak Man



Interactive Map



Virtual Tour

**Technologies Involved (Software)**

**System Usability Score**

**Testing Results**

PSSUQ Scale	Project Score	Industry Score
System Usefulness	2.28	2.80
Information Quality	2.27	3.02
Interface Quality	2.11	2.49
Overall Usability	2.22	2.82

## PLAGIARISM CHECK RESULT

### FYP2 Report

#### ORIGINALITY REPORT

<b>5</b> %	%	<b>5</b> %	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

#### PRIMARY SOURCES

<b>1</b>	"Curriculum and Instructional Design - RRM", Global University, Springfield MO Publication	<b>2</b> %
<b>2</b>	"Foundation Flash 8", Springer Science and Business Media LLC, 2006 Publication	<b>&lt;1</b> %
<b>3</b>	Learn Unity 3D Programming with UnityScript, 2014. Publication	<b>&lt;1</b> %
<b>4</b>	Unity for Absolute Beginners, 2014. Publication	<b>&lt;1</b> %
<b>5</b>	Rakesh Baruah. "Virtual Reality with VRTK4", Springer Science and Business Media LLC, 2020 Publication	<b>&lt;1</b> %
<b>6</b>	Make a 2D Arcade Game in a Weekend, 2015. Publication	<b>&lt;1</b> %
<b>7</b>	"Cross Reality and Data Science in Engineering", Springer Science and Business Media LLC, 2021 Publication	<b>&lt;1</b> %

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| 8  | Soumik Rakshit, Aarthi Iyer, Sunil Retmin Raj.C, Shiloah Elizabeth.D, Aditya Vaidyanathan. "Augmented Reality For Education Based On Markerless Dynamic Rendering", 2023 International Conference on Networking and Communications (ICNWC), 2023<br><small>Publication</small> | <1 % |
| 9  | "Mixed Reality and Gamification for Cultural Heritage", Springer Science and Business Media LLC, 2017<br><small>Publication</small>  | <1 % |
| 10 | Lecture Notes in Computer Science, 2013.<br><small>Publication</small>   | <1 % |
| 11 | Hrshitva Patel. "Augmented Reality Pins facilitated through Geolocation", Cambridge University Press (CUP), 2022<br><small>Publication</small>   | <1 % |
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innovative teacher's quality maintenance",  
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**FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY**

<b>Full Name(s) of Candidate(s)</b>	Brendon Lee Chuin Yuen
<b>ID Number(s)</b>	2100267
<b>Programme / Course</b>	Bachelor of Computer Science
<b>Title of Final Year Project</b>	AR Based Digital Heritage Learning Application For Lenggong Valley Using Constructivism Approach

<b>Similarity</b>	<b>Supervisor's Comments (Compulsory if parameters of originality exceed the limits approved by UTAR)</b>
<b>Overall similarity index: <u>5</u> %</b>  <b>Similarity by source</b> Internet Sources: <u>N/A</u> % Publications: <u>5</u> % Student Papers: <u>N/A</u> %	The percentage meets the requirement.
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Signature of Supervisor

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Signature of Co-Supervisor

Name: Ts Saw Seow Hui

Name: \_\_\_\_\_

Date: 15/9/2023

Date: \_\_\_\_\_

## FYP 2 CHECKLIST



### UNIVERSITI TUNKU ABDUL RAHMAN

#### FACULTY OF INFORMATION & COMMUNICATION TECHNOLOGY (KAMPAR CAMPUS)

#### CHECKLIST FOR FYP2 THESIS SUBMISSION

Student Id	2100267
Student Name	Brendon Lee Chuin Yuen
Supervisor Name	Ts Saw Seow Hui & Ts Dr Lee Chen Kang

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√	Signed Report Status Declaration Form
√	Signed FYP Thesis Submission Form
√	Signed form of the Declaration of Originality
√	Acknowledgement
√	Abstract
√	Table of Contents
√	List of Figures (if applicable)
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