ITECH 7415 – MTECH PROJECT

Vic Health

Anti Vaping Virtual Reality Project

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Abstract

In this modern world, vaping is a serious problem which is not considered as big a problem as smoking. Vapes do not display warning signs like cigarette packages do. These vapes look cool and colourful, which appeals to the younger generation. Many people do not perceive them as being as harmful as cigarettes. To counter this problem, a solution has been created for young adults: a virtual reality application designed for Meta Quest 3. It is an engaging VR application that creates awareness among young adults about vaping. It provides an immersive experience of a vape world, showing how vaping can impact the human body without making users feel bored, while educating them. This application was created using the Unity Engine, assets from the Meta Asset Store, and custom 3D models created in Blender. It is able to provide a great, engaging, and immersive experience to raise awareness about vaping.

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Introduction

Vaping is a major concern in the modern world, and Australia is currently facing this issue severely. The use of vape products increased significantly, from 5.3% in 2019 to 21% in the year 2022-23 among young Australians aged 18 to 24. Additionally, one in every ten young adults uses a vape daily((ADF), 12 Jul 2024). The number of young Australians in this age bracket using high-capacity vapes (capable of over 3000 puffs) has doubled in two years, rising from 18.5% to 36.5%(Council, 6 May 2024). In countries like the United States of America, e-cigarettes are the most popular product among the youth (DISEASE & PREVENTION, October 17, 2024).

Nicotine is contained in most e-cigarettes, making these devices, or vapes, highly addictive. Parts of the adolescent brain responsible for controlling attention, learning, mood, and impulse control can be harmed by these highly addictive vapes(DISEASE & PREVENTION, October 17, 2024). The marketing and accessibility of these flavoured products, combined with social influences and the effects of nicotine, can encourage young adults to start or continue vaping(DISEASE & PREVENTION, October 17, 2024). A study by the Cancer Council found that in Australia, 79% of youth who vape report that it is "easy" for them to access vaping products. Moreover, 80% of Australian youth who regularly use vapes usually purchase them from brick-and-mortar shops(Council, 6 May 2024).

All these make a huge concern for Australian young adults. There is a lack of awareness among young people. To solve this problem, a virtual reality app named 'Beyond the Vape' has been created to raise awareness among Australian young adults aged 15 to 25 years. It was created for the clients VicHealth and Federation University Australia to use during Federation University Open Days and at Ballarat Community Health centres.

To create this VR application several software applications used like Unity engine, blender, Z-anatomy, Canva, C#. The primary device for this application was Meta Quest 3 for development and testing both. All the assets used in this project were either free open sourced or custom-made models. For the project management part, Agile methodology was used.

Reflection Video

The Journey of Beyond the Vape

https://www.youtube.com/watch?v=_mdgW6qob3Q

Duration 13.09 minutes

Problem Statement

Vaping is a big concern in Australia, especially among young people aged between 15 and 25. To address this issue, the government of Victoria's VicHealth wants to develop a virtual reality app to raise awareness about vaping among the youth. VicHealth aim to educate the young adults about the risks of vaping and the physical changes caused by it in their bodies: lungs, heart, and brain.

Solving this problem is crucial because it can change the youth's perspective and lead them to healthier lives, contributing to a better future generation for Australia.

Project Objectives

- **Objective 1**: Develop an immersive and interactive virtual reality experience by the end of Sprint 3.
- **Objective 2**: Enable users to engage with virtual objects related to vaping and its effects on the user's health.
- **Objective 3:** Create a virtual world and virtual store to allow users to engage with the application.
- **Objective 4:** Create an immersive virtual experience inside the user's body to show how vaping affects their internal organs.
- **Objective 5**: Create an immersive virtual demo tutorial on how to use the Meta Quest 3 headset so users can operate it without anyone's help.
- **Objective 6**: At the end of this experience, create an immersive scenario showing how users' lives can be better in a world without vaping.

Methodology

Creating the virtual reality application “Beyond the Vape” was not an easy journey. It took a great deal of effort, patience, and consistency to complete the project. Various approaches were taken, and numerous tools and applications were used. Meetings with clients, group work, and later solo work were all part of the process. A detailed description is provided below to explain everything.

Development Approach

The anti-vaping virtual reality project officially started on 30 July 2024. The project consisted of three sprints. At the beginning, the team was made up of three members: Product Owner and Developer Yash Raja, Product Developer and 3D Modeler Xinyu Zhang, and Scrum Master and Software Developer Tamim Hasan. The team worked together until the end of Sprint 1, after which it split into two groups, both working on the same project but on different versions. Version 2.0 was worked on by Tamim Hasan, who worked solo.

The agile methodology was chosen for the project. Daily scrum meetings were held by the Scrum Master on Microsoft Teams. Weekly meetings with clients were conducted until the project was completed. The agile approach was selected due to its iterative improvement of the product and the regular incorporation of feedback.

Sprint 1 began on 30 July 2024 and ended on 25 August 2024. During this sprint, approximately 200 hours were worked, with most of the time spent on research, learning about virtual reality, and creating a demonstration of the app.

Sprint 2 started later due to knee surgery, which took place on 4 September. Working solo, the sprint began on 4 October and concluded on 15 October. During this period, approximately 195 hours were worked. The focus was on learning Blender, the Unity engine, and designing and planning the app.

For the final sprint, approximately 200 hours were worked, starting on 16 October and ending on 29 October. Within this limited time, all software work was completed, and the app was prepared for its final demonstration in front of the audience and clients.

Research

Before commencing this project, thorough research was conducted. As virtual reality was a completely new field with minimal prior knowledge, everything had to be built from scratch. To gain a clear understanding of the problem and the project requirements, several meetings were attended with the clients. Additionally, various YouTube videos provided by the clients were reviewed to better grasp their vision.

The videos are as follows:

Smoking and your Brain - 3D Medical Animation || ABP © |

https://www.youtube.com/watch?v=Z-prS3Ag8uU

(Productions, 3 Oct 2017)

How Smoking Kills | https://www.youtube.com/watch?v=QDDnYcn-o8I

(Media, 10 Jun 2021)

Vaping Lawsuits and the Effects of Vaping in the Body |

https://www.youtube.com/watch?v=az2vsvLbHns

(Trial Exhibits, 1 Aug 2020)

Once the vision was understood, the team worked on the storyboard during the first sprint. The team aimed to determine what could be accomplished within the timeframe provided by the clients. Research was conducted on how to work with virtual reality. Focus was placed on gaining knowledge about the software and tools required for the project. The Unity engine and Unreal Engine were evaluated to decide the most suitable platform. After consulting with the supervisor, Mr. Evan Dekker, it was concluded that the Unity engine would be the best choice for the virtual reality app. Subsequently, more time was dedicated to learning how to work with the Unity engine. Multiple video and website platforms were visited in an effort to learn as quickly as possible.

Some YouTube videos that were particularly helpful are:

Learn VR Development in 3 Hours - Unity VR Tutorial Complete Course |

https://www.youtube.com/watch?v=YBQ_ps6e71k&t=10501s

(Tutorials, 26 Feb 2024)

How to Setup a VR Game in Unity - VR Rig & Animated Hands! |

https://www.youtube.com/watch?v=pI8l42F6ZVc

(Wolf, 18 Jan 2023)

Grab Objects in VR using Unity - Grab / Simple Interactables - XR Interaction Toolkit |

https://www.youtube.com/watch?v=FyhNnbZR28I

(Wolf, 17 Mar 2023)

2023 Unity VR Basics - Grabbing Objects |

https://www.youtube.com/watch?v=pNhrpdTLMl0

(Shrimp, 13 Jul 2023)

Unity Playmaker VR XR - Trigger Particles when object thrown |

https://www.youtube.com/watch?v=sBNpkZxHO60

(Studio, 9 Aug 2022)

During Sprint 2, an effort was made to understand how Blender works and begin creating custom models for the project. To learn Blender in a short amount of time, help was sought from YouTube, LinkedIn Learning, ChatGPT, and various websites to accelerate the learning process. Prior knowledge of software like Adobe and AutoCAD also contributed to learning Blender more quickly. One valuable resource found online was Z-Anatomy, which proved extremely helpful by saving time. As an open-source tool, its models were extracted and modified for use in the application. Without this resource, creating high-quality 3D models in such a short time with precision would have been nearly impossible.

Here are some useful videos for creating custom models using Blender:

How to create a blood flow in Blender 2.8? / Blender Tutorials |

https://www.youtube.com/watch?v=uBaPuDX1r9Y&t=244s

(Bionet, 17 Dec 2021)

Animated Blood Cells in a Vein - Blender Geometry Nodes 3.1 for Scientists Tutorial |

https://www.youtube.com/watch?v=7mU7dNE7hKI

(BlenderDude, 24 Apr 2022)

How to animate a camera inside a blood vessel in blender 2.8? |

https://www.youtube.com/watch?v=qWeLCVVJvHI

(Bionet, 14 Dec 2021)

To manage this project, knowledge was sought in roles such as Scrum Master, Scrum Meetings, and project management. Several courses were completed on LinkedIn Learning, and certifications were earned from organizations such as the Project Management Institute (PMI). These certifications strengthened the understanding of managing projects effectively and conducting Scrum Meetings proficiently. Additionally, effective use of Kanban boards and Jira software was learned.

Figure 1: LinkedIn Certificate for Product Management: Building a Product Roadmap

Figure 2: LinkedIn certificate for Managing Jira Projects: 1 - Introduction

Figure 3: LinkedIn certificate for Cert Prep: Scrum Master

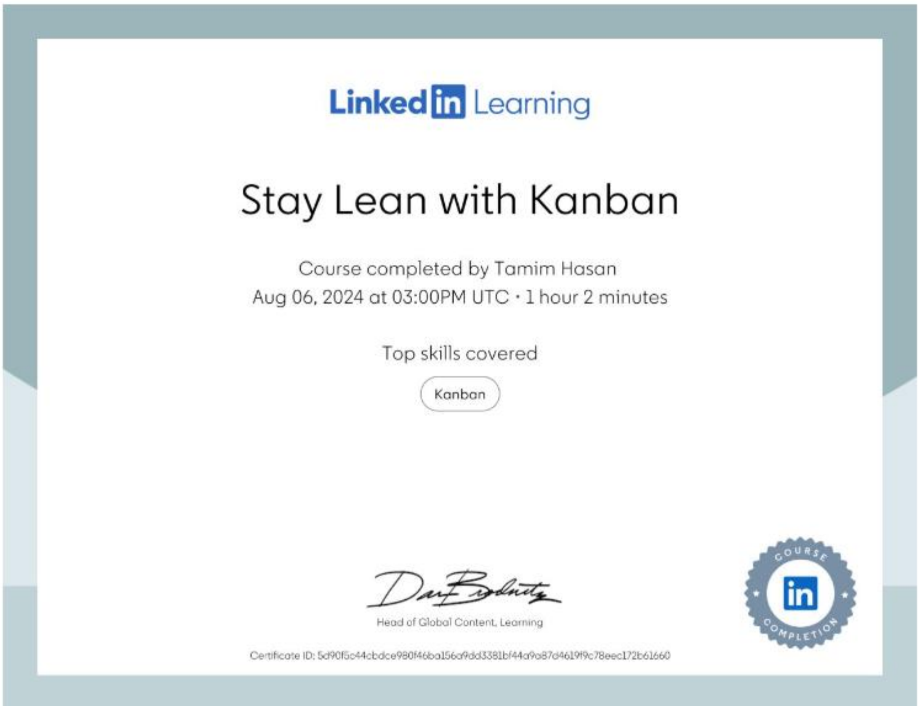

Figure 4: LinkedIn certificate for Stay Lean with Kanban

Figures 1 to 4 show different certificates earned for this project, which help in working on the project efficiently and also demonstrate dedication.

Prototyping

For this project, several 3D models were created to enhance the functionality of the 'Beyond the Vape' application. Custom 3D models were made, or free, open-source models were acquired online and edited to suit the app. One of the first 3D models, entirely custom-made, is a dome-shaped model created using Blender. It is designed to give the user the sensation of being inside their body. Additionally, with appropriate textures, colours, and animations, the model was made to feel as realistic as possible.

- **The Dome**

  The dome may seem very simple, but significant effort and patience are required to make it functional and realistic. Each texture and colour were carefully chosen to make the dome visually appealing. For the animation, Unity's animation engine was used. The scale and position were adjusted over time to make the user's body look and feel realistic while using the VR headset. Figures 5 to 7 show the 3D model of the dome.

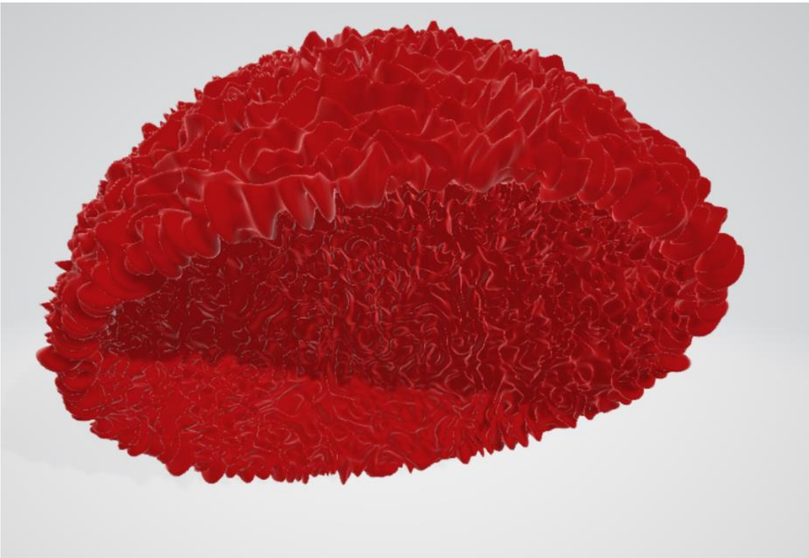

Figure 5: The Dome 1

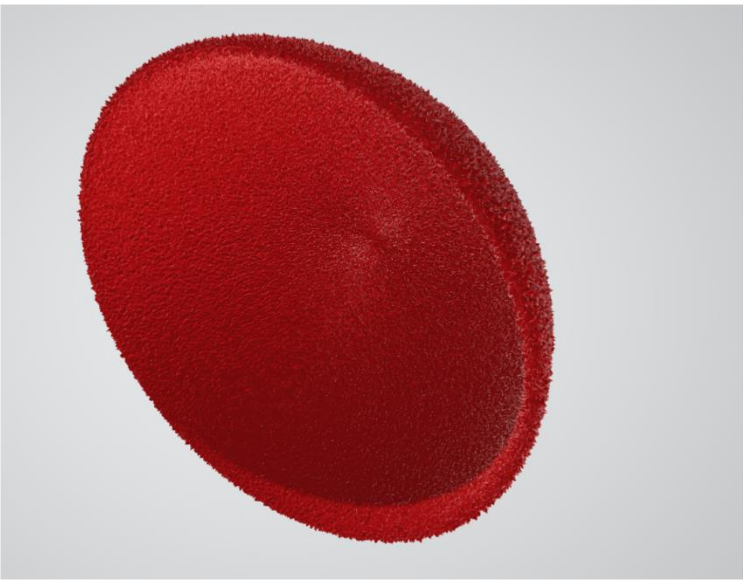

Figure 6: The Dome 2

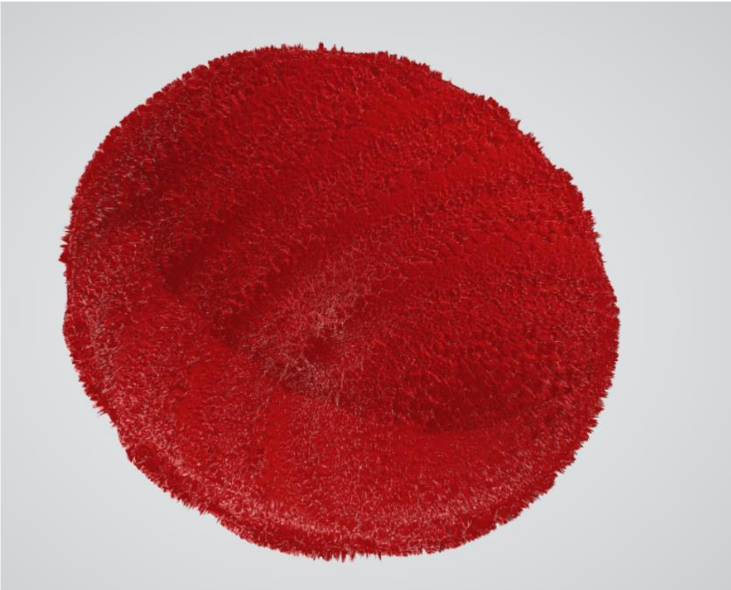

Figure 7: The Dome 3

Lungs:

The next section presents the 3D model of the lungs, which was one of the critical models for this project. The Z-anatomy 3D model was used to create the human lungs. The lungs were extracted from this model and modified for use in the app. To adapt the model, all textures and colours from the original were deleted, and new materials were created in the Unity engine. Efforts were made to show as much detail as possible of the lungs, altering the colours to depict the impact of vaping on the body. The goal was also to illustrate the effects on the trachea, bronchioles, and alveoli. Animation was employed to transition the colours from brown to dark brown to dark grey, symbolizing the harmful effects on the user's body. Figures 8 to 13 display the 3D model of the realistic human lungs.

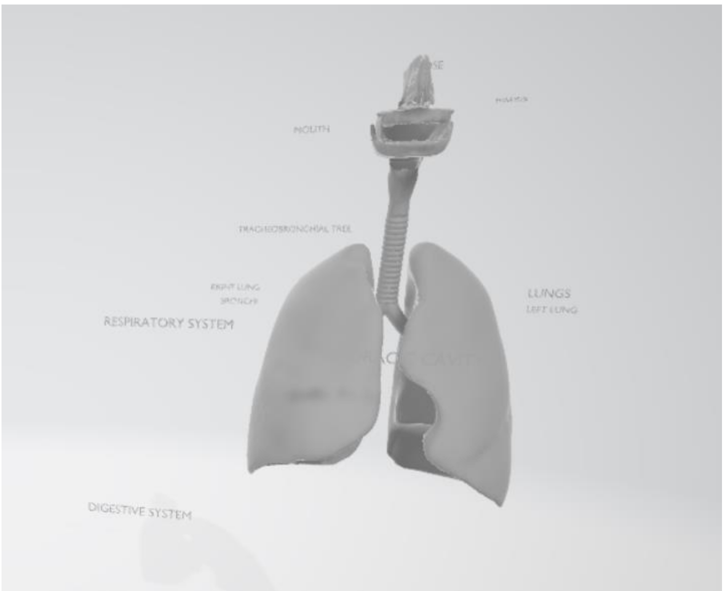

Figure 8: 3D Lungs 1

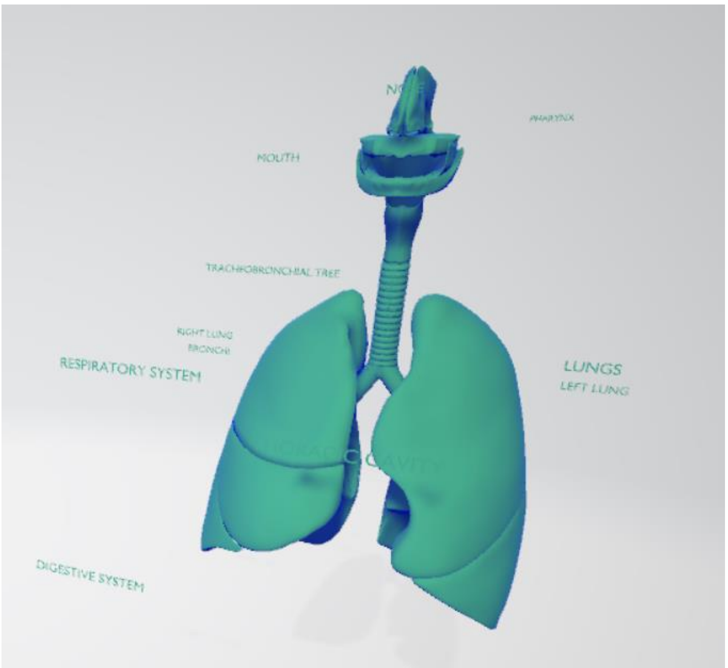

Figure 9: 3D Lungs 2

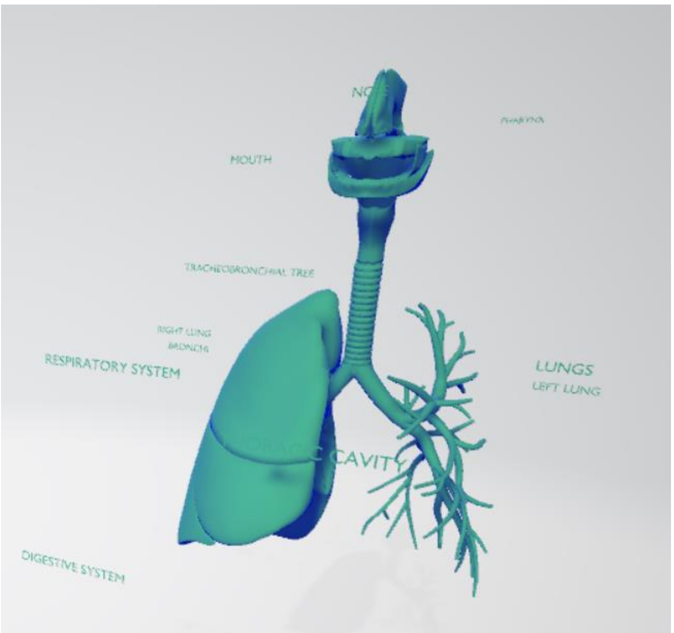

Figure 10: 3D Lungs 3

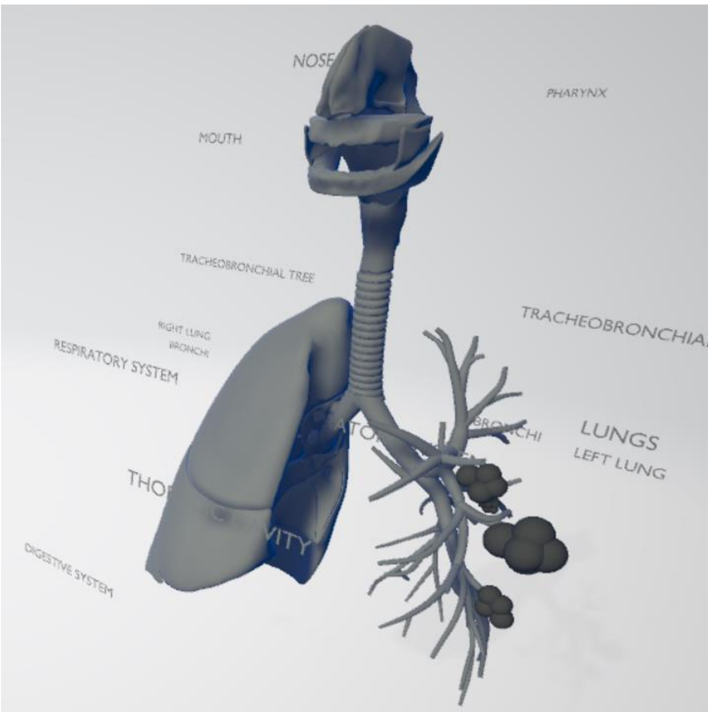

Figure 11: 3D Lungs 4

Figure 12: 3D Lungs 5

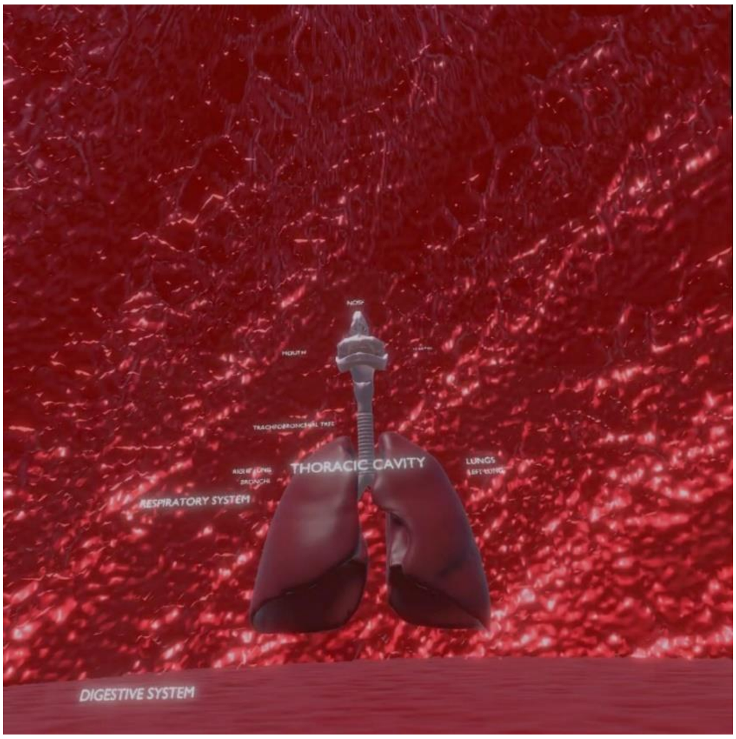

Figure 13: 3D Lungs 6

Heart:

The next important 3D model created for this project is the heart, which was modified from an extracted heart model sourced from the Z-Anatomy 3D models. Each part of the heart was meticulously extracted, and new materials and textures were created for use in the app. Extracting each part was not an easy task, with Blender being used for these modifications. A red colour was applied to represent a healthy heart, and animations were incorporated to demonstrate a transition over time, where the heart gradually turns very dark. Additionally, animations and sound effects were added to simulate a heartbeat, ranging from slow to fast. A faster heartbeat represents a weakened heart caused by the use of e-cigarettes or vapes. Figures 14 to 18 show the 3D model of the heart, extracted from Z-Anatomy and used in the application.

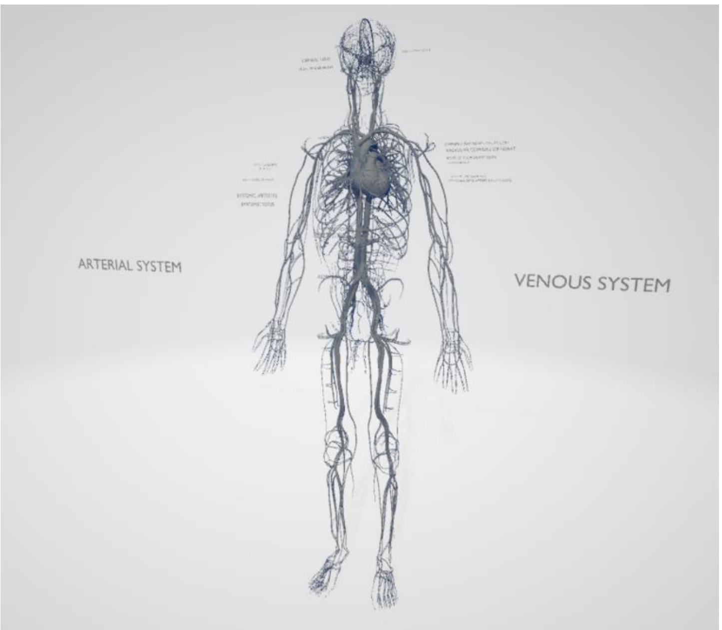

Figure 14: Heart 1

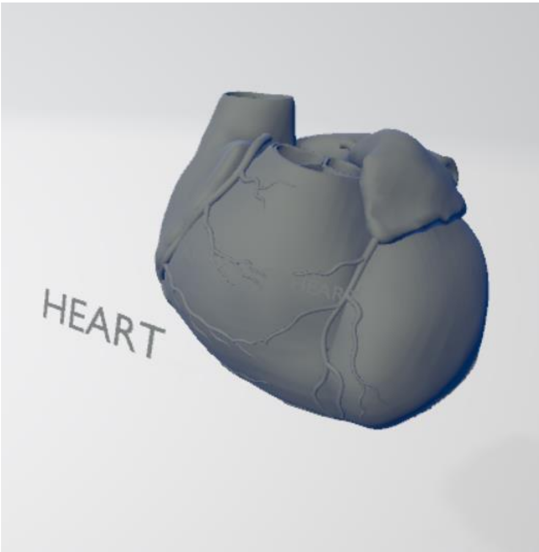

Figure 15: Heart 2

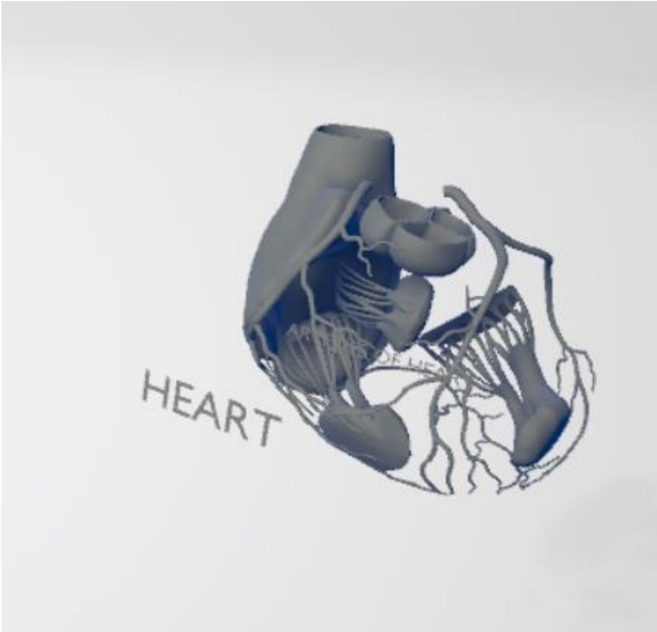

Figure 16: Heart 3

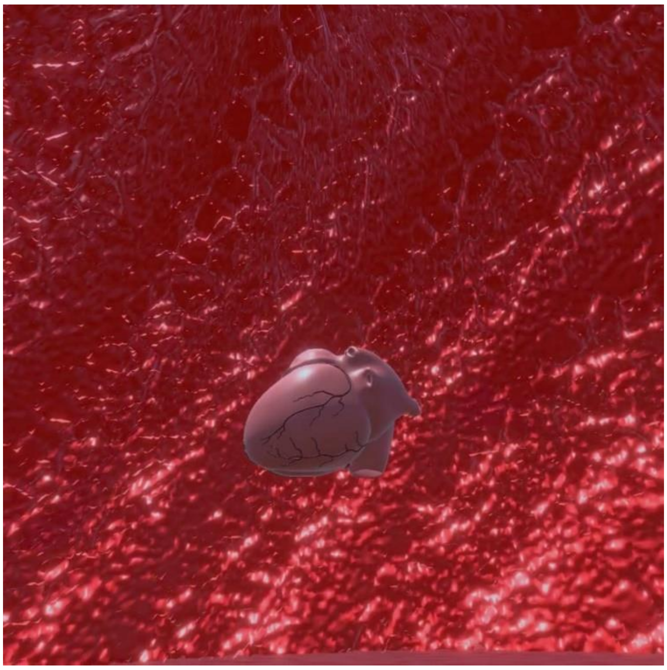

Figure 17: Heart 4

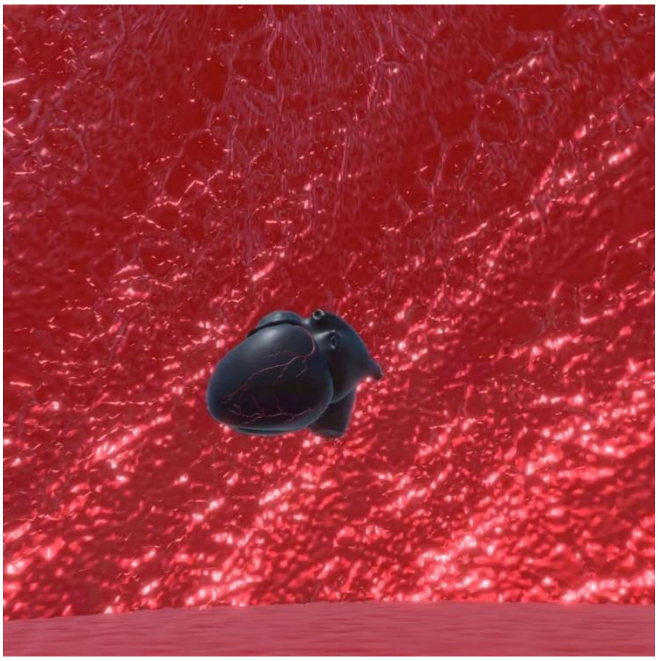

Figure 18: Heart 5

Brain:

The next and one of the most complex 3D models in this project is the human brain, which was modified from Z-Anatomy. This was the most challenging model to create. To develop it, the nervous system and sense organs were extracted from Z-Anatomy and modified to fit the project. The challenge with this model was its numerous parts, making it difficult for the Meta Quest headset to render. At one point, it seemed impossible to use this model, but after removing all the unnecessary elements for this version of the application, it was able to run on the Meta Quest 3 headset. Additionally, adding textures and materials to make it look and feel realistic was a tedious and complex task. The brain model contained at least 200+ elements, and each element required a colour and texture material.

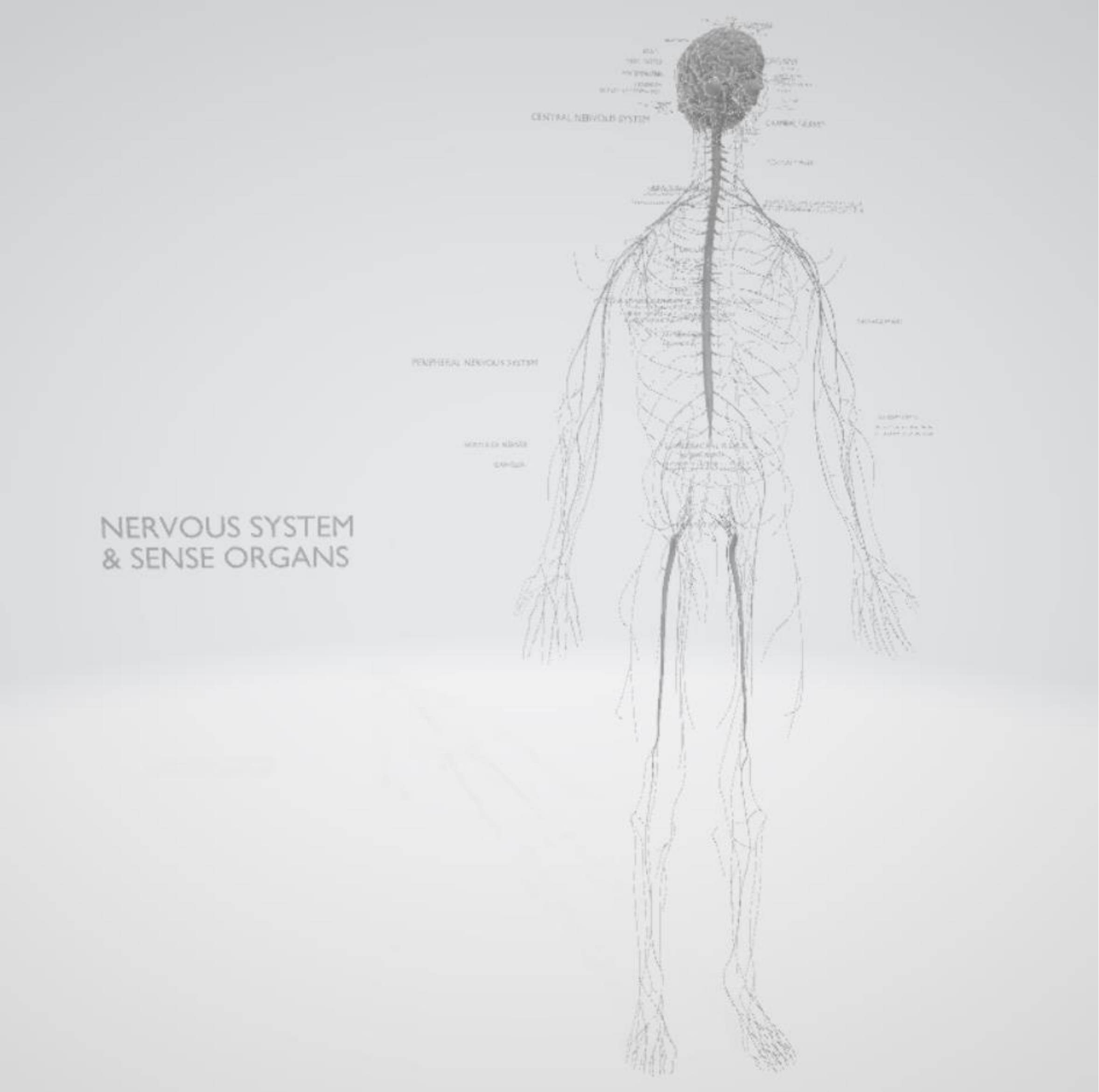

Figure 19: Nervous System 1

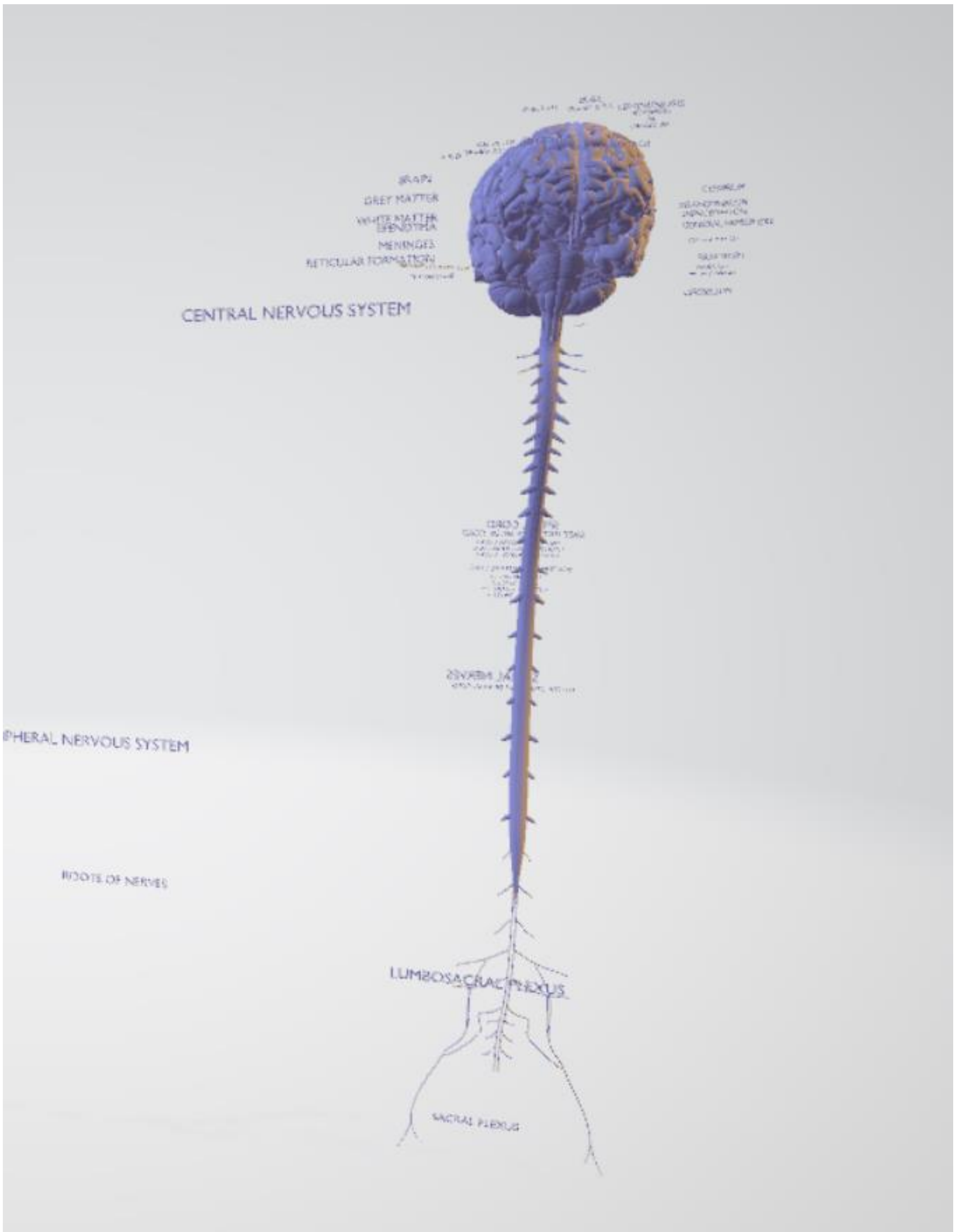

Figure 20: Nervous System 2

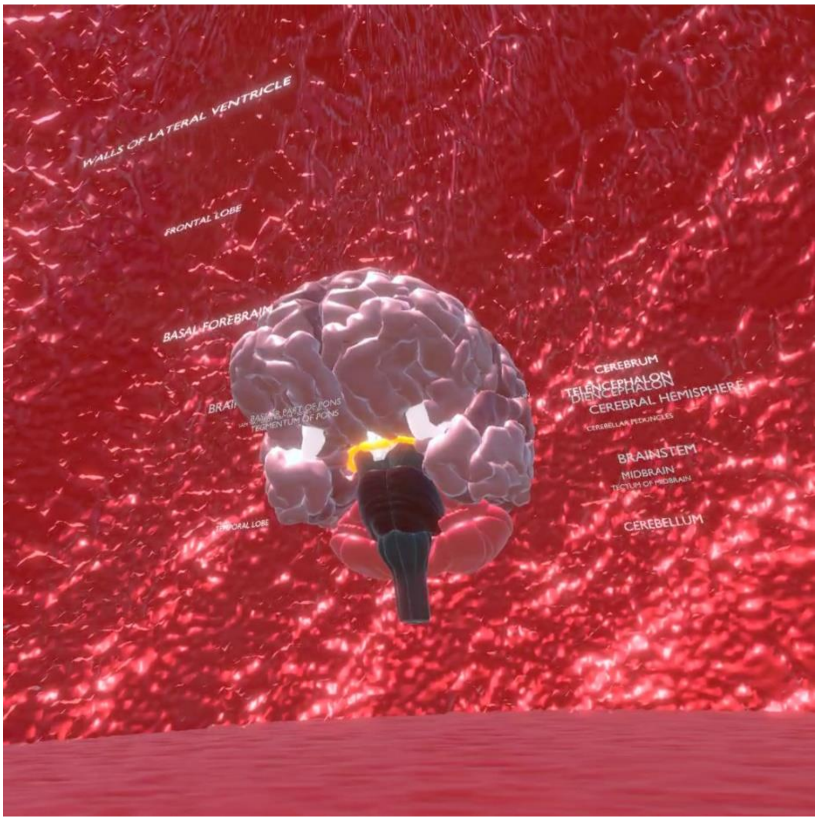

Figure 21: Nervous System 3

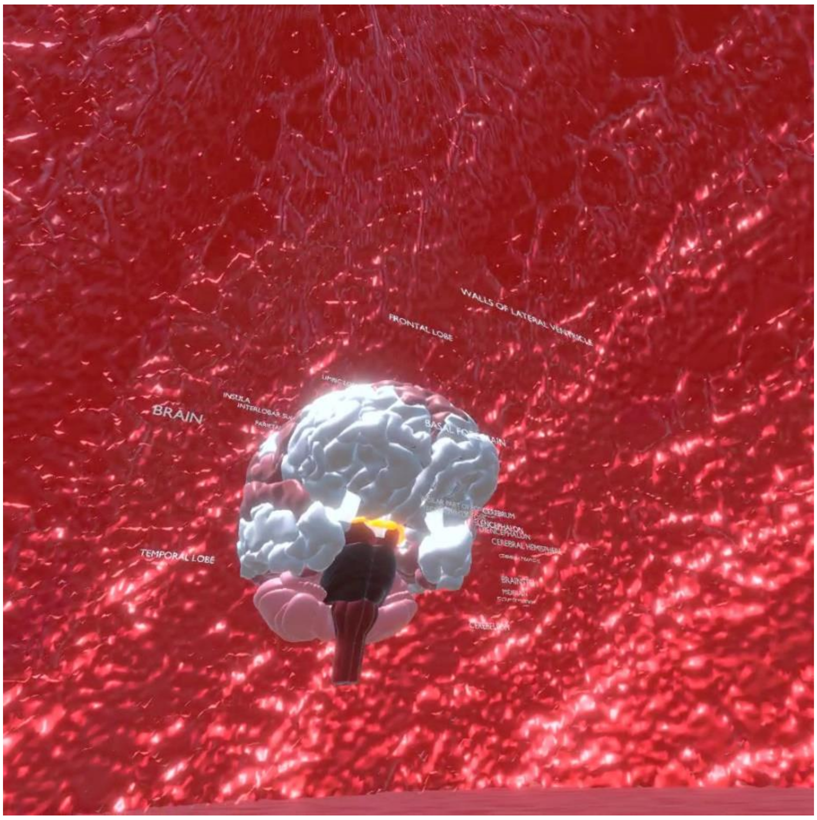

Figure 22: Nervous System 4

Vending Machine:

For this project, vending machines were a key component, as they allowed users to purchase vapes. The design of the vape vending machines utilized a 3D model sourced from Sketchfab.com, an online platform. The original model was a cola vending machine, which was modified to suit the needs of the project. The original design featured buttons, which were replaced with a TV screen that displays visuals such as available flavours and the toxins present in the vape, engaging the user. The vending machine was designed to feature four flavours and four toxins, with the text and visuals on the screen easily visible. A rack or table was added to the vending machine so that when a vape is ordered, it drops onto the rack or table. To make the vending machines visually appealing and fun, each was given a different colour. Figures 23 to 28 show the vending machine designs, from the original to the modified version.

Vending Machine 2 LOWPOLY | **https://sketchfab.com/3d-models/vending-machine-2-lowpoly-7fa48e74cde4415892b4ab87006abb8c**

(EFX, May 2nd, 2024)

Figure 23: Vending Machine 1

Figure 24: Vending Machine 2

Figure 25: Vending Machine 3

Figure 26: Vending Machine 4

Figure 27: Vending Machine 5

Figure 28: Vending Machine 6

Figure 29: The 3D vape model used in this project

Development Stages

For this project, there were three development stages:

a) concept design,

b) software development, and

c) software testing.

There were also three sprints in this project. Concept design was completed during Sprint 1, while the other two stages were present in all the sprints.

a) **Concept design**:

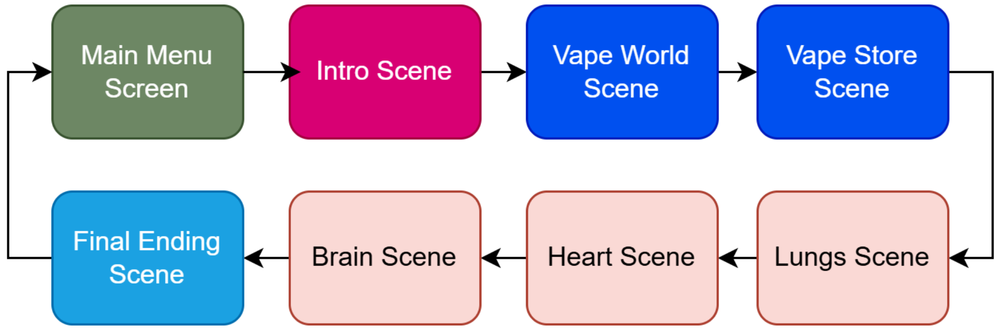

Figure 30: Concept Scene Design

During Sprint 1, the initial concept for the project was designed. At that time, there was no concept such as "Vape World" or "Vape Store." However, during Sprint 2, these ideas were incorporated.

In Sprint 1, the storyboard was created, where discussions with the clients covered their requirements and expectations for the project. Later, during the second phase, after receiving feedback and further discussions with the clients, the decision was made to proceed with the eight scenes outlined in Figure 29.

The first scene is the main menu, followed by the introduction, Vape World, Vape Store, lungs, heart, and brain scenes, and finally, the ending scene. These will be discussed in more detail in the section about scenes.

b) **Software development:**

The next stage is the software development phase. Throughout the sprints, the software development process progressed steadily. After completing all the research and the storyboard, work began on the main virtual reality software, which is the application. In the first sprint, the first application was built, marking the initial success in showcasing the work. This was also the first time working with the Unity engine. During that sprint, the tasks were divided into three parts. The responsibility was to work on the input system and virtual hands, and later, a virtual environment was incorporated. This work was done for the Federation University Open Day program, where the program was tested, and feedback was gathered from the audience and clients.

In the next two sprints, work was done completely solo. Since the development had to start from scratch, all work completed in the first sprint had to be recreated. In the second sprint, everything was replanned, and new scenes were incorporated to improve the application. During these stages, a significant amount of work had to be completed within a short time, which required working overtime.

In this software development project, eight major scenes were developed and incorporated into the final version of the app.

The eight scenes are:

1) Main Menu
2) Intro
3) Vape World
4) Vape Store
5) Lungs
6) Heart
7) Brain
8) Ending Scene

There are additional scenes, such as a laboratory scene, but due to the similarity of this concept to the work of former teammates, it was decided to exclude it from this version of the app. However, the app was designed in a way that allows the lab scene to be easily integrated in the future, should clients wish to include it.

1) Main Menu

Figures 30 to 32 show the appearance of the main menu in the application. When the Meta Quest 3 headset is worn, the name of the app, "BEYOND THE VAPE," is displayed in large letters. Below that, there are options to start the app or begin gameplay (referred to as "gameplay" in this case). An "About" section is also available. If the user selects this with the controllers, a brief description of the app will appear, detailing its purpose and features. Additionally, there is a "Quit" button to return to the Meta Quest 3 home screen. The main menu is displayed initially and reappears after the user completes the gameplay. A red gradient background colour and background music were chosen to create a lively atmosphere.

The sound effect in this main menu scene is by Luca Di Alessandro from Pixabay (Alessandro, March 20, 2023).

URL:

https://pixabay.com/users/lucadialessandro-25927643/?utm_source=link-attribution&utm_medium=referral&utm_campaign=music&utm_content=143276

Figure 31: Menu Screen 1

Figure 32: Menu Screen 2

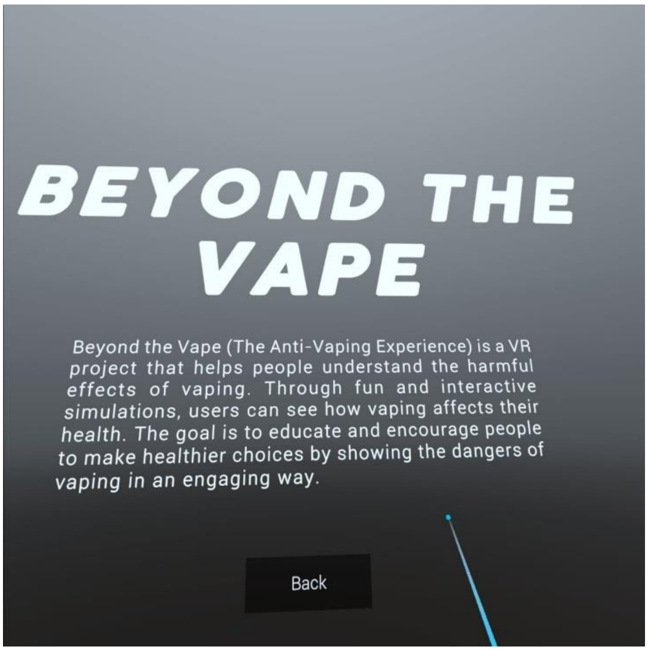

Figure 33: Menu Screen 3

2) Intro

The intro scene is a crucial part of this application. The reason for this is that, during the first sprint, feedback was received from both the audience and clients. It was noted that most people who tried the virtual reality headset had never used one before. As a result, they faced many difficulties or challenges when using the application.

Based on the feedback, this scene/gameplay was created to help users become familiar with the virtual reality headset. A complete demonstration tutorial was developed, where, upon wearing the headset, users see a large screen in front of them that shows how the headset works. To make the video tutorial engaging, music and a background score were added. Online software such as TTSMaker (https://ttsmaker.com/) was used, with a script that was written and modified using ChatGPT, to create a voice narration that serves as a guide for users. Additional screens were included to make it visually appealing. The videos used are from Canva Premium, and the proper licenses for all of them are held.

The Meta Quest 3 controllers 3D model were customized using the Meta XR package. The package included a controller model, but it did not resemble the Meta Quest 3 controllers. Since the free versions available online were unsuitable, the model was modified to make it more realistic. The controller appears larger and rotates on the user’s left side, providing a clearer understanding of its functionality, with voice narration offering guidance. To enhance the scene’s visual appeal, a terrain combining desert and soil elements was designed, resembling an outer space environment like Mars. A skybox with a large, animated circle, resembling a sun or star, was also added.

In Sprint 2, feedback was received regarding the start button, with users finding it difficult to locate and stand in the correct position to interact with it. To resolve this, a position was marked with large text reading "Stand Here," guiding users to the correct spot. A cube was also added to allow users to practice using the controllers. Figures 33 to 38 show different visuals of the intro scene.

Figure 34: Intro Scene 1

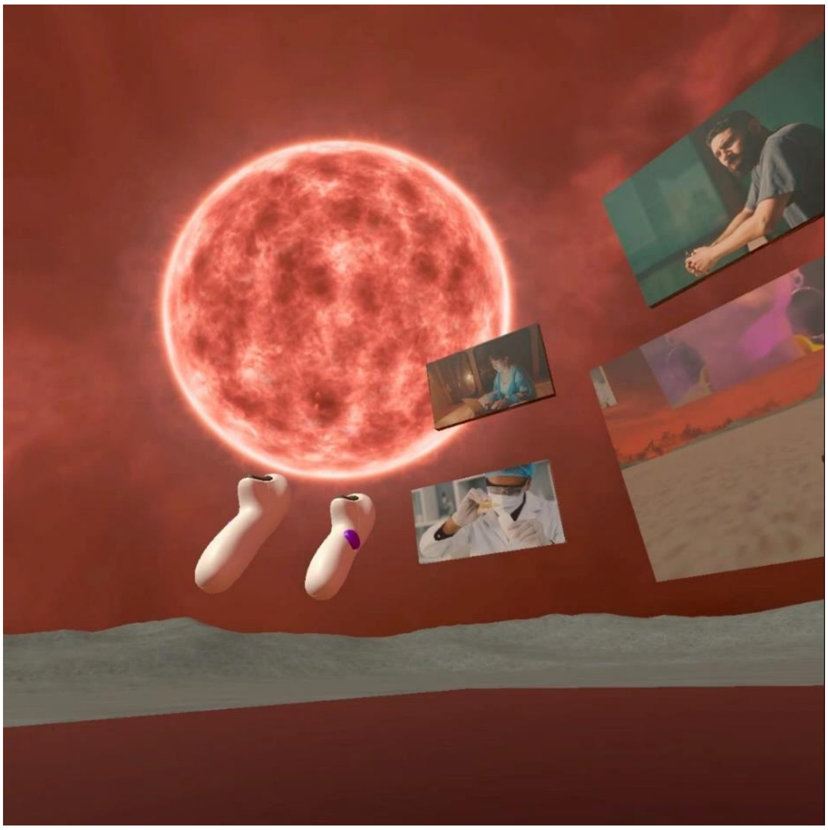

Figure 35: Intro Scene 2

Figure 36: Intro Scene 3

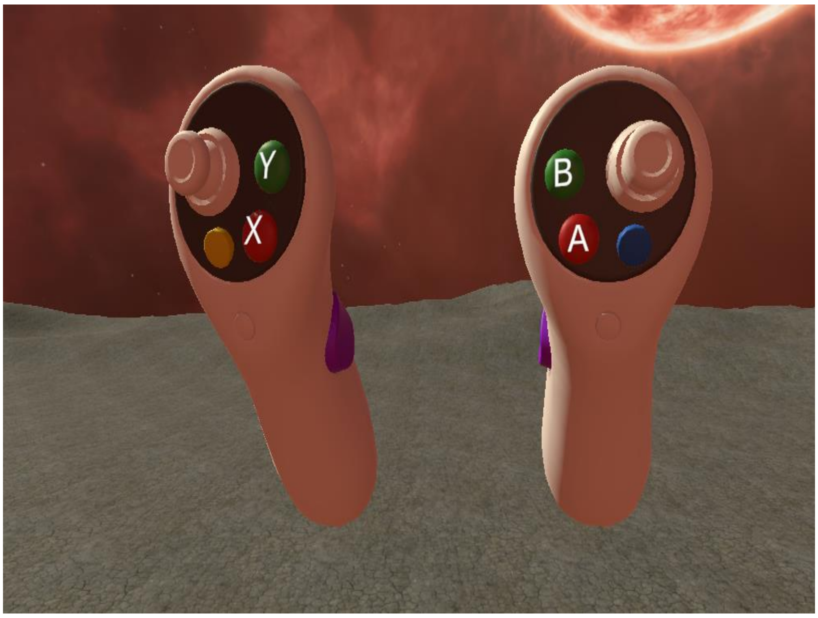

Figure 37: Intro Scene 4

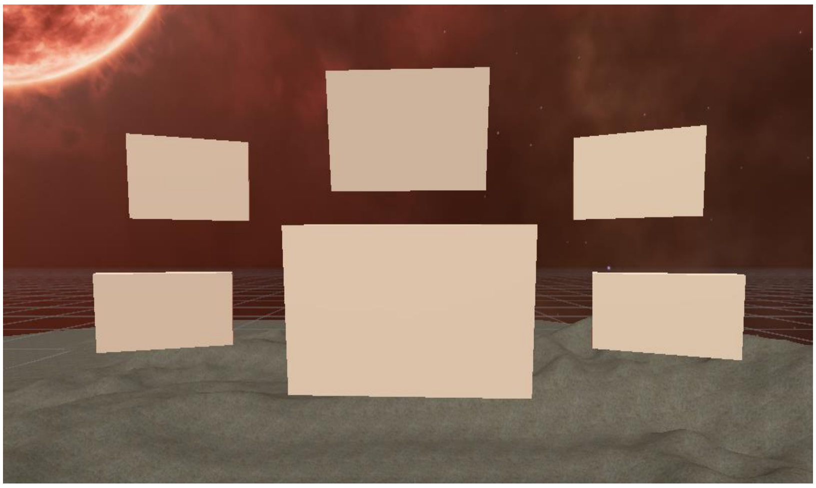

Figure 38: Intro Scene 5

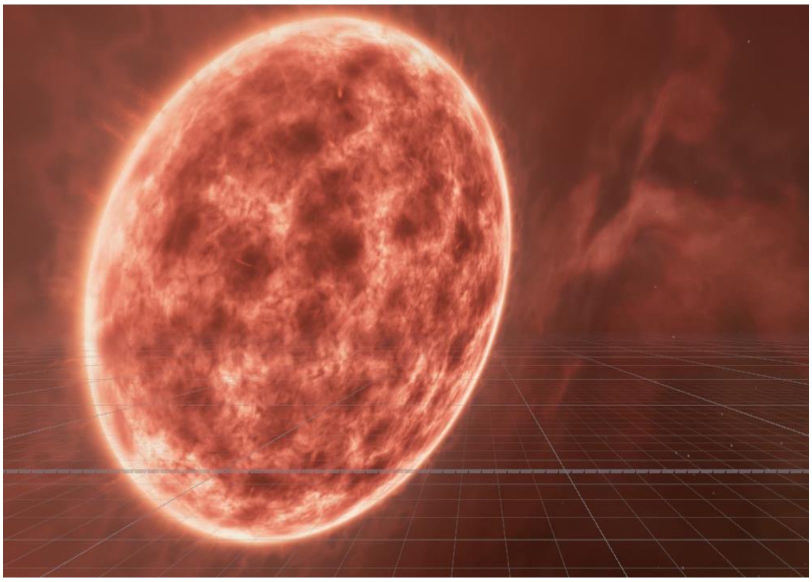

Figure 39: Intro Scene 6

3) Vape World

The concept of the vape world is crucial for this project to make the application more engaging for users. In today's world, where human attention spans are shorter, the focus was on creating an immersive and engaging experience that is both entertaining and educational. Another reason for this design was to help users become more comfortable with the virtual reality (VR) environment.

During testing in Sprint 2, it was observed that users were able to remember all the instructions. The vape world provides an opportunity for users to interact with objects and familiarize themselves with the virtual environment, which later helps them navigate important scenes, such as the lungs, brain, and heart, where the most educational content is located.

- To create the vape world, several 3D building models were included. These models were not created in-house; rather, free assets from online platforms were obtained and modified to suit the virtual environment. Within this virtual vape world, three main buildings were envisioned:
  a) the Vape Store,
  b) Vape Lab, and
  c) Vape Lounge.

  Currently, only the Vape Store has been implemented, though future work may include the addition of the other buildings. For instance, if clients request it, the laboratory concept developed by former team members could be incorporated into the vape world. The world was designed in a modular manner, which allows for the combination of both concepts if required in the future.

In the design of this city, particular attention was given to creating a colourful and visually appealing atmosphere. The materials of all buildings sourced from the asset store were altered to align with the aesthetic of the city. To further engage users, a walkway was created using multiple square shapes, which enables users to click and navigate to their desired locations, such as entering the Vape Store.

To create a nighttime atmosphere, skyboxes obtained from the asset store were utilized. Additionally, screens were added to display visuals, enhancing the futuristic ambiance. Background music was incorporated to capture users' attention, while voice narration was included to guide users, ensuring an intuitive and enjoyable gameplay experience.

Several other assets were integrated to enrich the appearance of the city and provide an immersive experience. Figures 39 to 52 illustrate the vape world and demonstrate the various assets employed in this scene of the anti-vaping project.

Assets Used in This Scene:
Jewellery shop
(SQUID, Oct 3, 2023)
https://assetstore.unity.com/packages/3d/environments/jewelry-shop-261543
Nain Buttons
(Metropolitan et al., May 11, 2024d)
https://assetstore.unity.com/packages/3d/environments/nain-buttons-282530
Dong-A Silk
(Metropolitan et al., May 11, 2024a)
https://assetstore.unity.com/packages/3d/environments/dong-a-silk-282534
Dotumal Women's Clothing

(Metropolitan et al., May 11, 2024b)
https://assetstore.unity.com/packages/3d/environments/dotumal-women-s-clothing-282529
Former Gwangju MBC Building
(Metropolitan et al., May 11, 2024c)
https://assetstore.unity.com/packages/3d/environments/former-gwangju-mbc-building-282526

Figure 40: Vape World 1

Figure 41: Vape World 2

Figure 42: Vape World 3

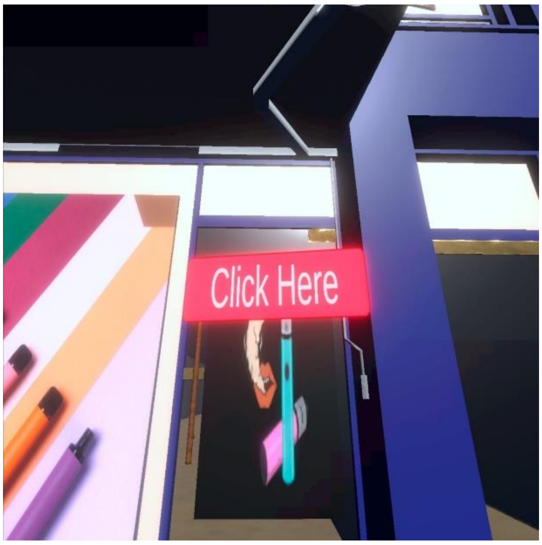

Figure 43: Vape World 4

Figure 44: Vape World 5

Figure 45: Asset used in the vape world 1

Figure 46: Asset used in the vape world 2

Figure 47: Asset used in the vape world 3

Figure 48: Asset used in the vape world 4

Figure 49: Asset used in the vape world 5

Figure 50: Asset used in the vape world 6

Figure 51: Asset used in the vape world 7

Figure 52: Asset used in the vape world 8

Figure 53: Asset used in the vape world 9

4) Vape Store

The vape store scene is the most important part of the application's gameplay, as it is where users interact the most with the virtual reality objects. After completing the vape world scene, users enter the vape store, where multiple vending machines are on display. All the vending machines are fully functional, and users can approach any of them to order their vape.

The functionality of the vending machines has already been discussed, so attention will now be directed to other aspects of the scene. Access to the vending machines is via a pathway with a similar square shape, as previously described in the vape world scene. The most challenging aspect of designing the vending machines and integrating them into this scene was ensuring perfect synchronization with the voice narration, so that users are not confused while ordering their vape.

New background music has been added to the scene, along with additional lighting elements to ensure that using the vending machines is comfortable for the user's eyes. Once users complete the task of ordering the vape, it will drop onto a rack attached to the vending machine. The vape can then be easily grabbed by the user with their controller, brought near their mouth, and inhaled.

Once the vape comes near the proximity sensor, smoke will be activated, and users will be able to see that the vape is functioning. One of the challenges was measuring the distance between the vape and the user's mouth or body to precisely activate the smoke using the proximity sensor of the Meta Quest 3. After inhaling the vape, the user is required to drop it onto the yellow square on the rack, which will then trigger the lungs scene. Figures 53 to 62 display various visuals of the vape store.

Figure 54: Vape Store 1

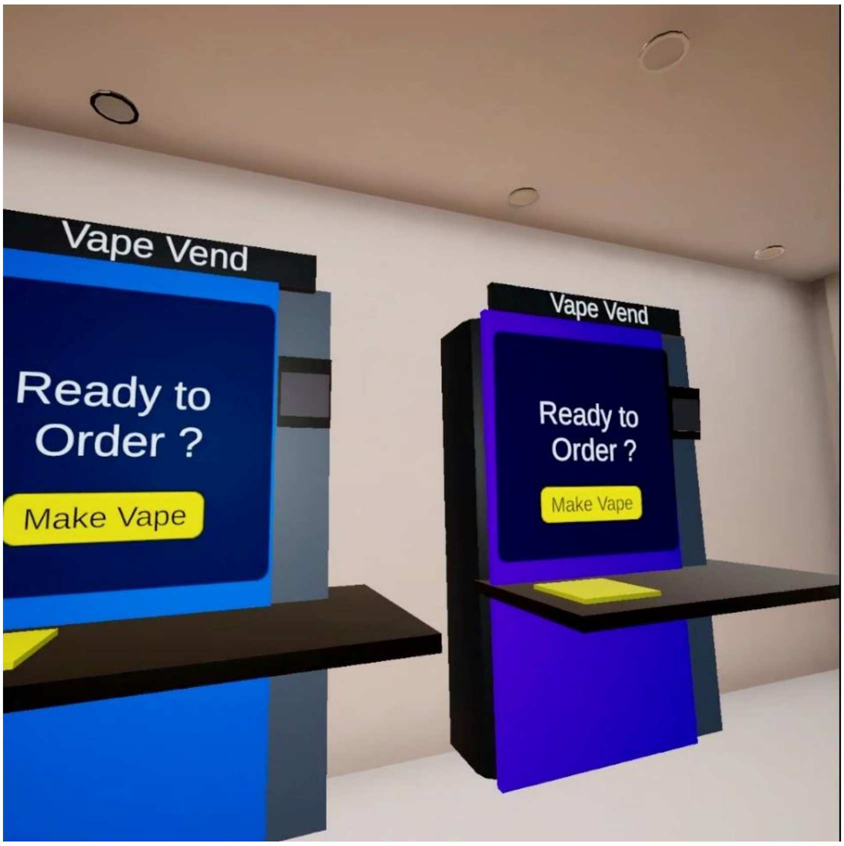

Figure 55: Vape Store 2

Figure 56: Vape Store 3

Figure 57: Vape Store 4

Figure 58: Vape Store 5

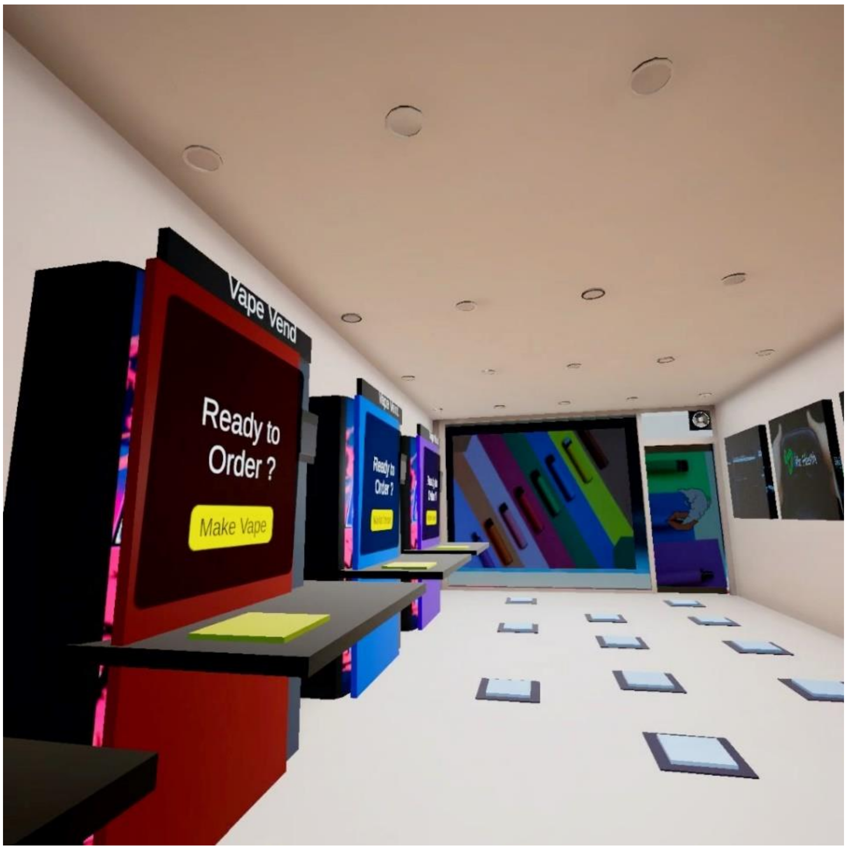

Figure 59: Vape Store 6

Figure 60: Vape Store 7

Figure 61: Vape Store 8

Figure 62: Vape Store 9

Figure 63: Vape Store 10

5) Lungs

Showing the human lungs, heart, and brain inside the human body and making the user feel as though they are inside their own body is a complex task. The lung scene is being developed first. To create the sensation of being inside the body, a dome-shaped structure has been created in Blender, with specific materials applied. By incorporating animations, a great visualization of the inside of the human body is achieved. When combined with background music of breathing in and out, an immersive experience is provided.

The most important element is the 3D lungs model. An attempt was made to find the best possible 3D model in the asset store for free, but none were suitable. Some models were found, but they were difficult to use to achieve the desired visuals. The Z-Anatomy 3D model, found on GitHub and their website platform (https://www.z-anatomy.com/), was discovered. However, this 3D model was not meant for virtual reality, requiring modifications to make it usable.

Because the model was highly detailed, containing thousands of elements of the human body, rendering it on the Meta Quest headset was difficult. Therefore, parts of the body were removed where possible without losing the impact of the application. The model was customized using Blender software and integrated into the scene, with animations added to enhance its visual appeal.

To reduce complexity for the user, interactions were not included. Instead, the scene was designed so the user could understand the educational content while also enjoying the experience. A timer was added to the scene and objects, transitioning to the next scene after a set period. Voice narration is a key element, as it provides a detailed description. To demonstrate the impact of vaping on the lungs, changes in lung colour were shown. Figures 63 to 69 illustrate the visuals of the lungs, heart, and brain scenes in the "Beyond the Vape" application.

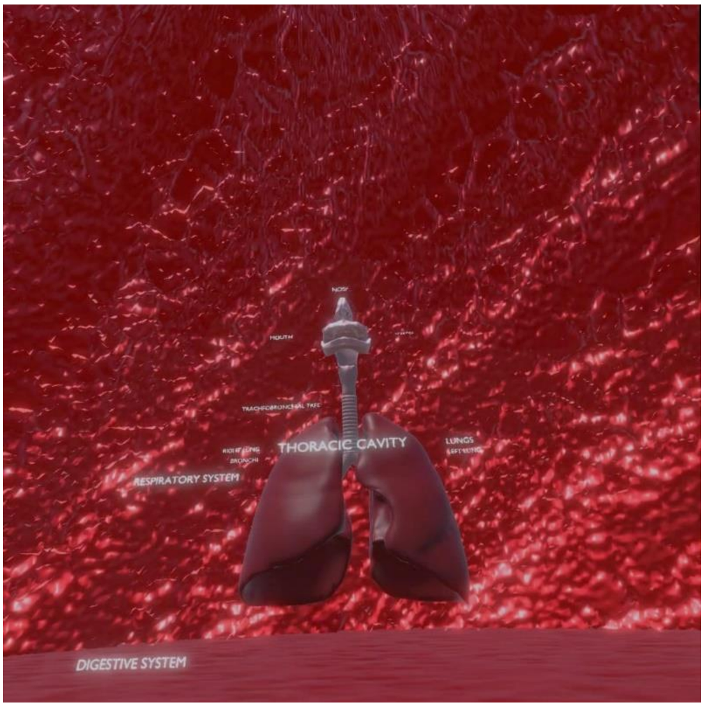

Figure 64:Lungs 1

Figure 65:Lungs 2

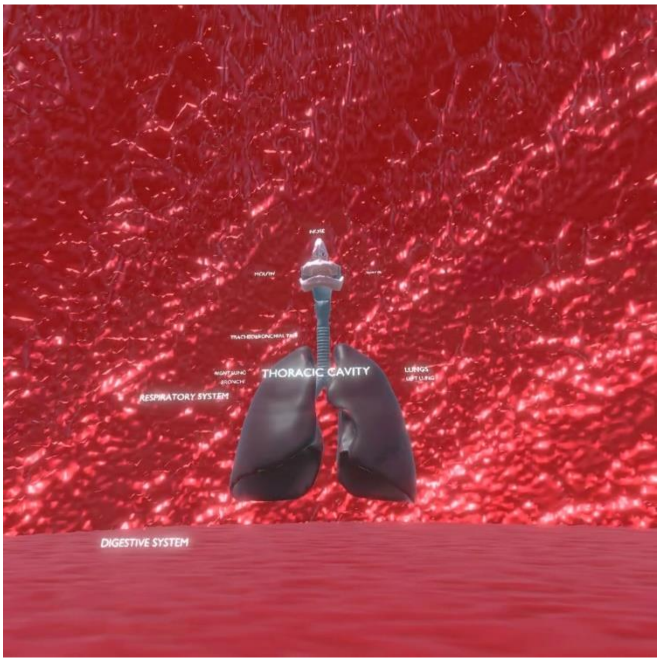

Figure 66:Lungs 3

6) Heart

The next scene inside the human body focuses on the heart. When planning the storyboard, discussions were held with the clients regarding how they wanted to portray the effects of vaping on the user's body. It was decided that the sequence should start with the lungs, followed by the heart, and then the brain—mimicking the natural progression of how vaping affects the body.

To create the heart scene, the same source used for the lungs, Z-Anatomy, was utilized. The same procedure was followed: extracting the 3D models from the source using Blender and customizing them to fit the application. The intention was to show detailed effects, such as blood flow and how vape particles travel through the body and impact the heart. However, due to time constraints, these effects were represented through animations, showing changes in the heartbeat pace. For example, the animation demonstrates the heart beating normally and then faster as it becomes affected by vaping.

Lerp Colour was used to gradually change the heart's colour over time, transitioning from light pink to dark grey, and finally to almost black, to illustrate the heart's deterioration. For sound engineering, a heartbeat sound was carefully selected from free online sources (Pixabay, October 12, 2022). After several attempts, the optimal sound was chosen to make the experience as realistic as possible. To simulate a faster heartbeat, the audio pitch was adjusted, enhancing the intensity to effectively convey the impact.

Figure 67: Heart 1

Figure 68: Heart 2

7) Brain

The brain scene is the final human body scene and one of the most impactful parts of the application. It is also the most complex part. The main issue encountered was the rendering problem. Z-Anatomy is an educational open-source tool designed for a wide range of audiences, providing knowledge both online and offline on a monitor screen. The problem arises when it is used in virtual reality, as it cannot render as smoothly as it does on a computer. It contains many elements; for instance, when animations are added, each element must be animated separately, which takes up a lot of space and causes the entire system to become buggy and stutter. As a result, almost all the elements of the 3D model had to be removed, and the focus was shifted to a more superficial level.

Each part of the nervous system is affected differently when vaping impacts it. Therefore, different materials needed to be applied to different parts of the nervous system. For example, it was necessary to determine which parts of the nervous system are affected first—whether it is the midbrain, medulla oblongata, cerebellum, cerebrum, hypothalamus, etc. This was complex, as additional research was required. Lerp colour was also used here to change colours.

Voice narration played a critical role in providing the educational content along with appropriate background music. Syncing the audio and video was also essential. The challenge in syncing the audio and visuals arose due to a rendering problem.

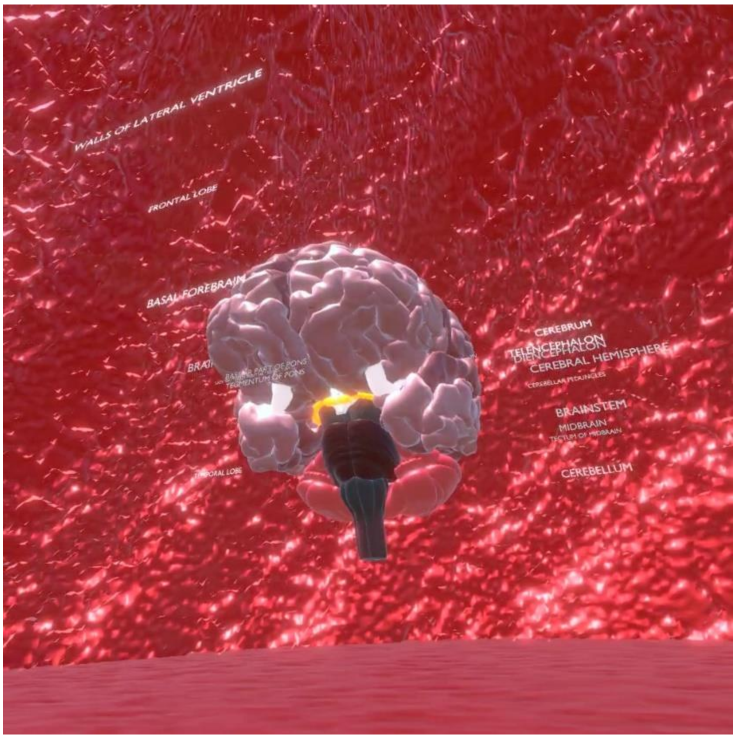

Figure 69: Brain 1

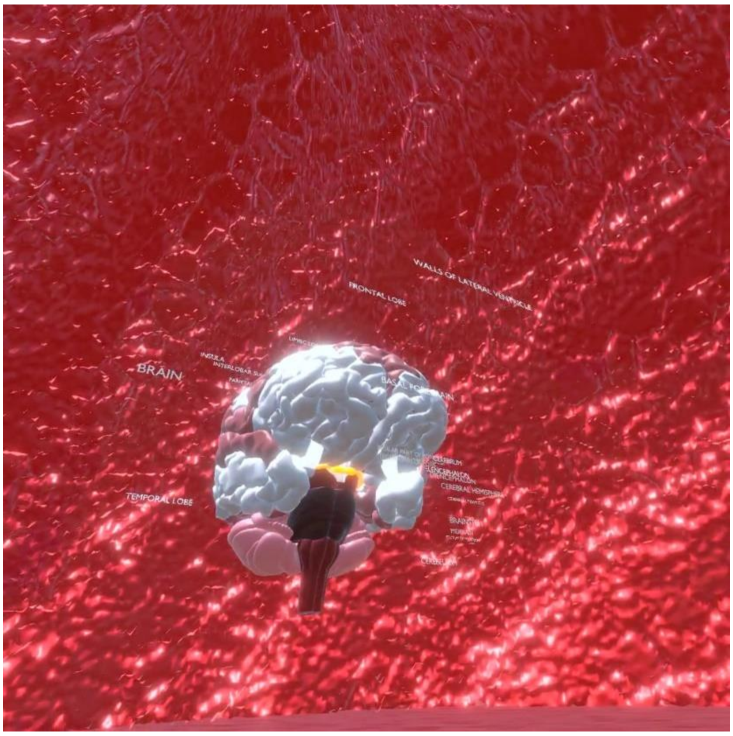

Figure 70: Brain 2

8) Ending Scene

The final scene of the Beyond the Vape application serves as the concluding part of the experience. The goal was to show how life could improve without vaping after the audience understands its impact on the body. Initially, this section was intended to be a meditation session, but it was later changed to a lighter scene, incorporating visuals, videos, and audio to demonstrate how life could be better without vaping. The purpose of this scene is to leave the audience with a positive mood.

A video was created using Canva specifically for this part, illustrating the wonderful life that awaits the viewer. All video content was sourced from Canva Premium and edited in accordance with the licensing conditions. For this final scene, a skybox was added to provide a relaxing and feel-good atmosphere. In front of the viewer, a large screen displays the video along with the tagline: "You have a wonderful life waiting; say no to vape."

On the screen to the right of the user, the website of VicHealth is visible, allowing users to visit the website (www.vichealth.vic.gov.au) later for helpful information once they complete the VR experience. Square-shaped pathways have been placed, enabling users to click on the shapes, walk around, and experience the positive environment. The environment has been designed with rocks to enhance its visual appeal, aiming to provide a feel-good immersive experience. Additionally, a menu has been included where users can return to the main menu screen to quit or replay the app.

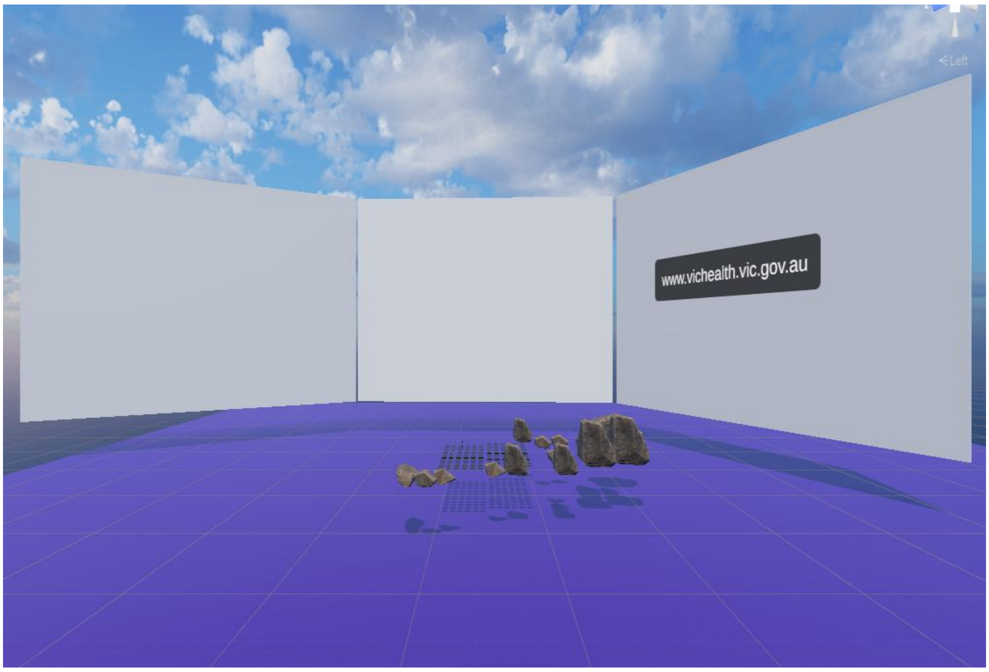

Figure 71: Final Scene 1

Figure 72: Final Scene 2

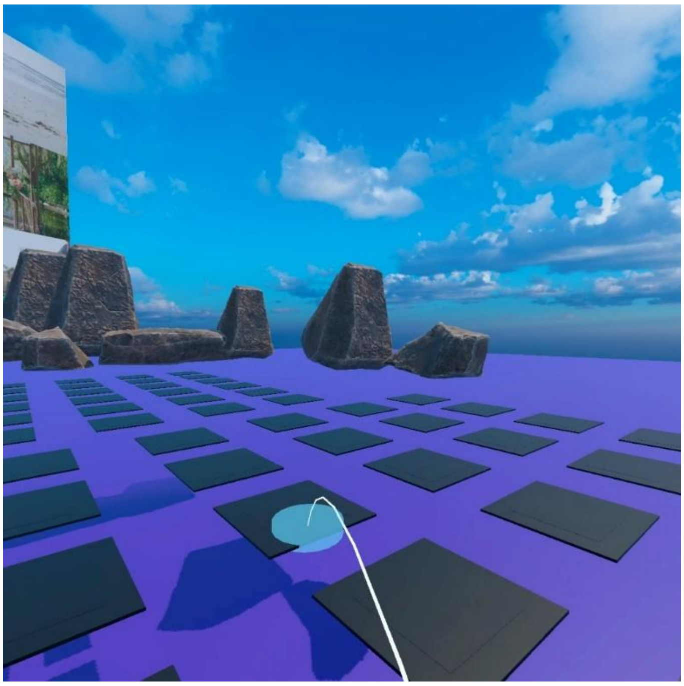

Figure 73: Final Scene 2

Figure 74: Final Scene 3

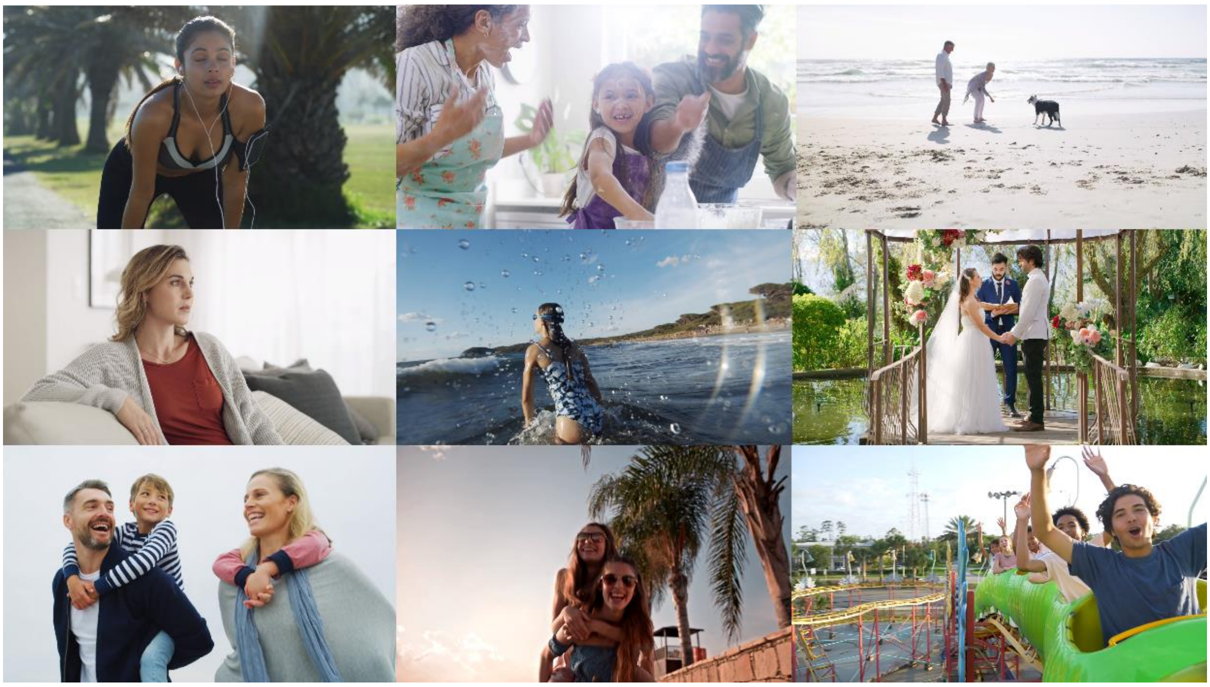

Figure 75: Final Scene Video

c) Software testing:

After the concept design and software development phase, the next step was software testing. For the application, testing was conducted during each sprint. In Sprint 1, extensive testing was carried out over three days at Federation University's Open Day and for two consecutive days at the Federation University

Fed-Wellbeing and VicHealth initiative program held on campus. This testing involved participants of various age groups, including university staff, students, and prospective students.

Before these events, several tests were conducted personally to ensure the application was functional. Testing proved to be a very hectic, tedious, and time-consuming task for a virtual reality developer, especially as access to a high-performance PC was not available. The laptop used lacked an external graphics card and had a low configuration, which significantly slowed the process. The entire project was developed on this laptop, resulting in prolonged testing times—times that could have been reduced by half if a better PC had been available.

Another challenge during testing was that the software was not supported by Meta Quest 3 due to the lack of an external or adequate graphics card. As a result, the application had to be manually tested using the VR headset, which, although time-consuming, ensured thorough testing.

In Sprint 2, parts of the application were tested with project peers and students living in university accommodations. Their feedback led to significant changes in the final sprint. Before demonstrating the final product, extensive testing of the final version was conducted with university students and staff. Further details will be discussed in the feedback section.

Interaction Design

Interaction design is essential in virtual reality projects as it is the main way users interact with objects and environments in the application. Several factors need to be considered to ensure that users do not experience motion sickness and that, when grabbing objects, they can feel the physics as they would in the real world. The goal is to ensure the experience feels as realistic as possible.

The main components required for users to move and see the visuals are:

a) XR Interaction Manager

b) XR Origin (XR Rig)

To ensure a realistic sense of height, the scale of the XR Rig was set to 1 on all axes. The tracking origin mode was set to "floor" to create the sensation that the user was walking on the ground. The Continuous Move Provider (Action-based) was used for movement, while the Snap Turn Provider (Action-based) allowed users to look left, right, or back. The Teleportation Provider was also implemented, enabling users to teleport along a predefined path designed in square shapes.

- A custom trigger object was added to activate specific actions when the user came near certain objects within a set distance. For example, when the user brought the vape close to their mouth, the trigger activated, displaying vape effects around them.
- Inside the camera offset, under the Main Camera object, a custom script called Camera Fade In (Script) was used to create a screen fade effect before the start of a new scene. The XR Controller allowed users to grab, throw, or click objects using the controller. The XR Direct Interactor enabled interaction with objects, and the XR Poke Interactor allowed users to interact with virtual buttons on the vending machine screen.
- The Ray Interactor was used for the right hand, enabling teleportation with the ray and allowing users to grab or click objects. For teleportation, a Reticle with

a reticle-shaped material was added to the Ray Interactor to enhance the user experience. All custom scripts throughout the project were written in C#.

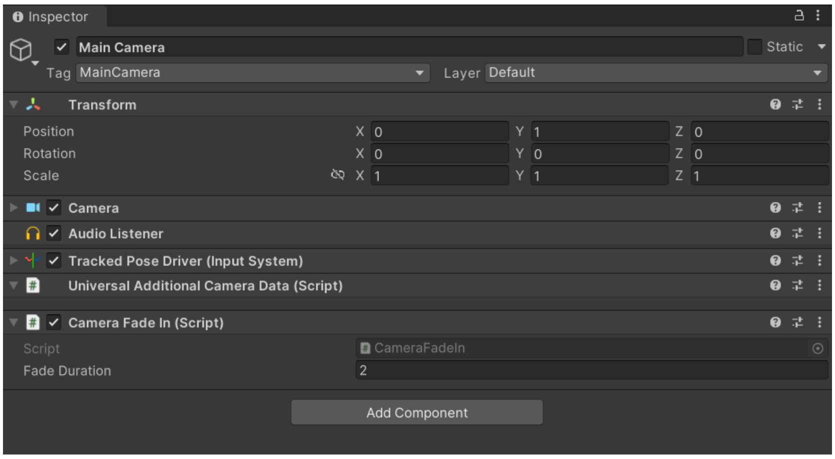

Figure 76: Inspector (Unity Engine) 1

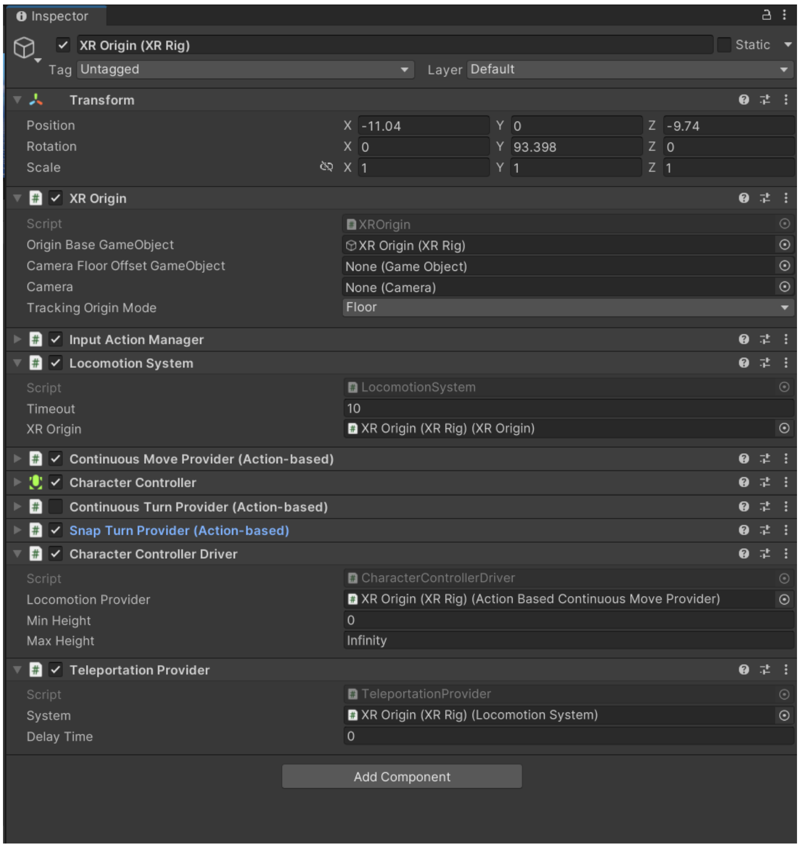

Figure 77: Inspector (Unity Engine) 2

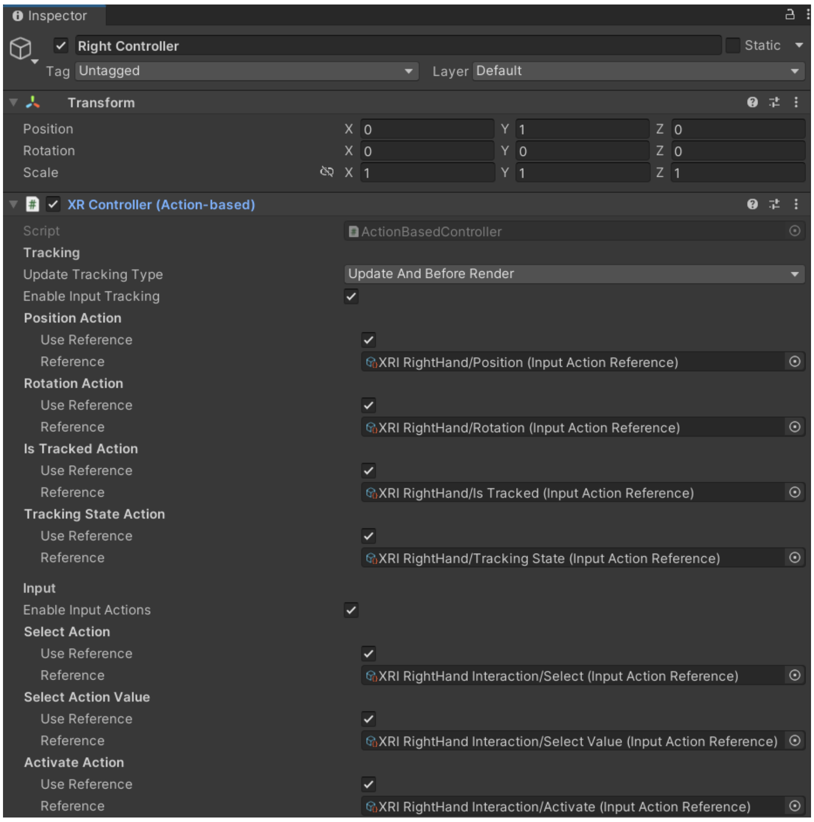

Figure 78: Inspector (Unity Engine) 3

Unity Engine Environment Setup

The setup of the Unity Engine was a crucial part; without proper setup, things would not work properly. Figures 78 to 81 show the build setup of the Unity Engine for this project.

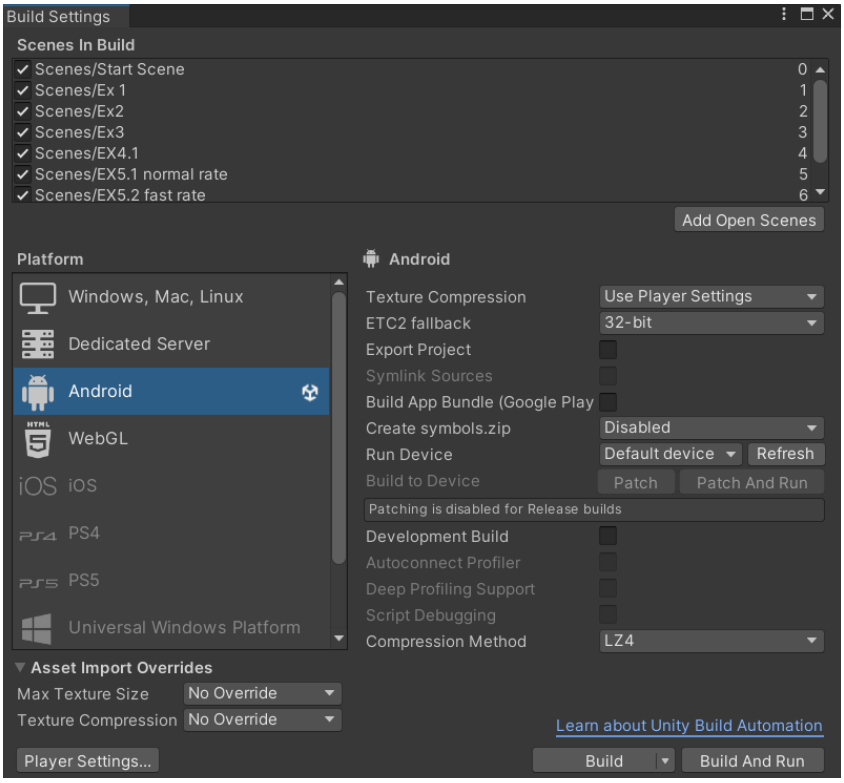

Figure 79: Build Settings 1

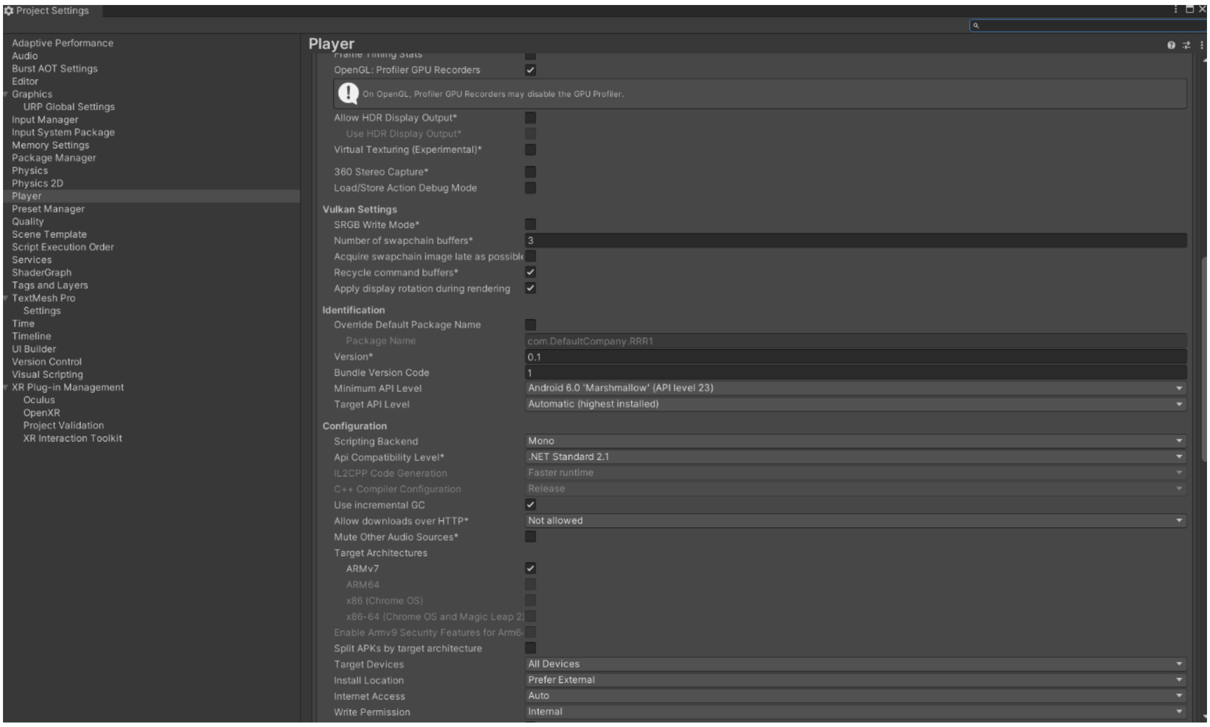

Figure 80: Build Settings 2

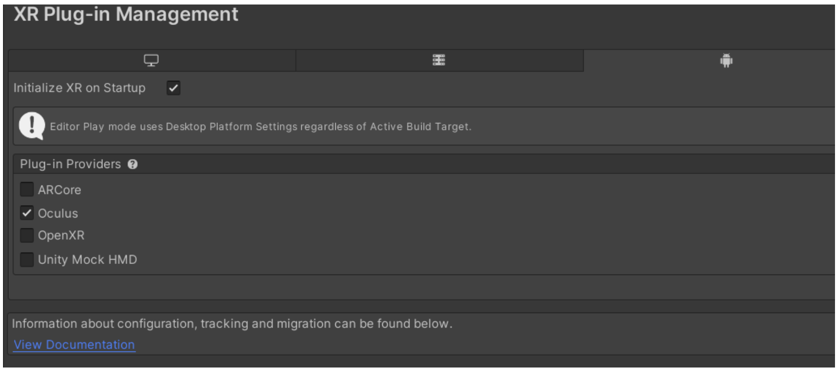

Figure 81: Build Settings 3

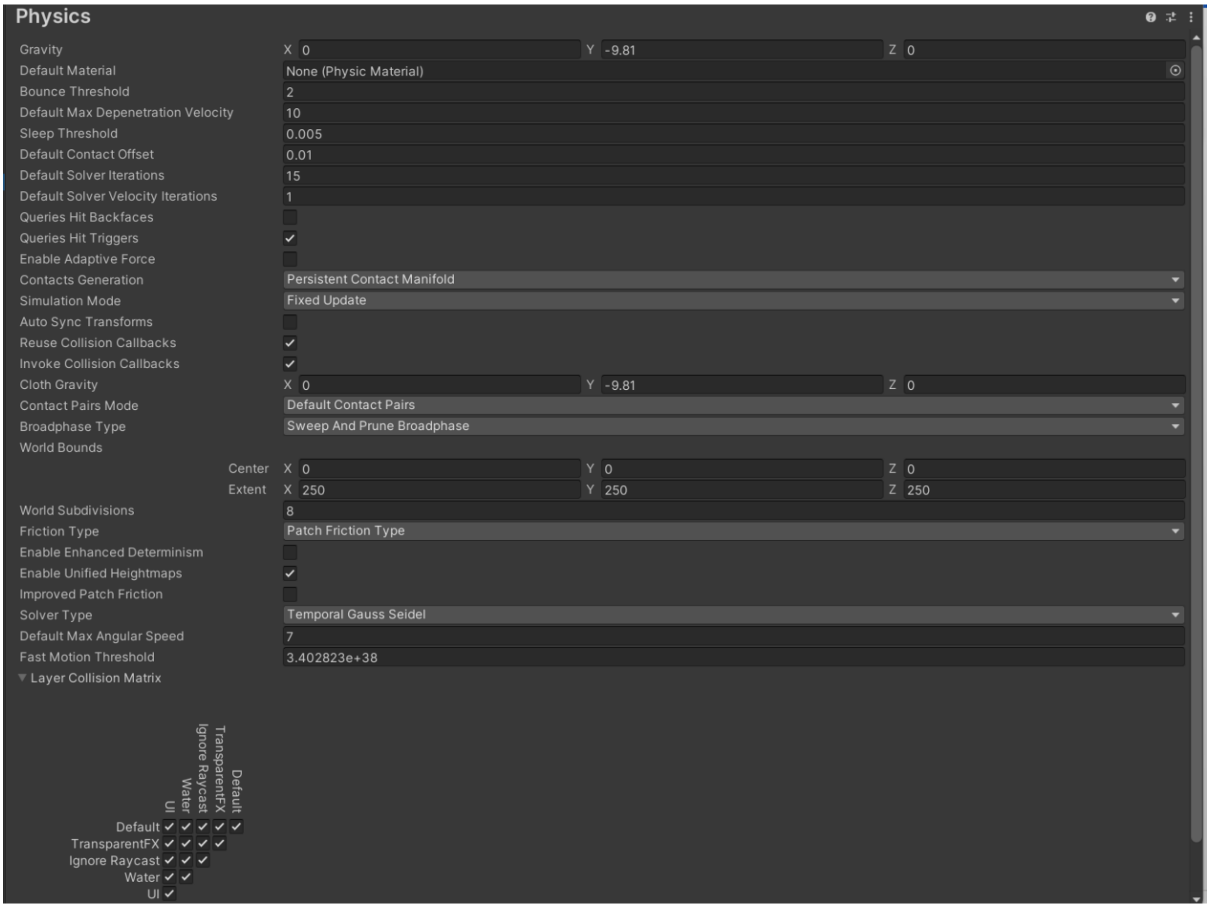

Figure 82: Build Settings 4

Collaboration

For the virtual reality project, a group of three members was formed: Yash Raja, Xinyu Zhang, and Tamim Hasan. Work was undertaken collaboratively during the first sprint. However, following Tamim's surgery, the group separated into two teams, each continuing to work on the same project with distinct versions and unique ideas. During

Sprints 2 and 3, all aspects of the project, including 3D modeling, creation of customized models, animation, sound engineering, scene creation, concept planning, and implementation, were handled independently.

Sprint 1

Name	Student ID	Role in the Project	Estimated Work Time
Yash Raja	30416705	Product Owner & Developer	240 Hours
Tamim Hasan	30432576	Scrum Master & Developer	200 Hours
Xinyu Zhang	30385231	3D Modeler & Developer	180 Hours

Table 1: Sprint 1

Sprint 2

Name	Student ID	Role in the Project	Estimated Work Time
Tamim Hasan	30432576	Scrum Master | 3D Modeler & Developer	195 Hours

Table 2: Sprint 2

Sprint 3

Name	Student ID	Role in the Project	Estimated Work Time
Tamim Hasan	30432576	Scrum Master | 3D Modeler & Developer	200 Hours

Table 3: Sprint 3

Software and Hardware

Hardware

The hardware used in this project are Yoga 7 141RL8 Laptop and Meta Quest 3 Virtual Reality Headset.

Specification of Yoga 7 141RL8

Chipset	13th Gen Intel(R) Core (TM) i7-1360P
Storage	WD PC SN740 SDDPMQD-512G-1101
Physical Memory	LPDDR5 16 GB
GPU	Intel(R) Iris(R) Xe Graphics

Table 4: Specification of Yoga 7 141RL8

Specification of Meta Quest 3

Chipset	Snapdragon XR2 Gen 2
Storage	128 GB
Physical Memory	DRAM 8 GB
Display Resolution	4K
Cost	AUD $799

Table 5: Specification of Meta Quest 3

The headset provided by Federation University Fed-Wellbeing, and I have returned it on 30th October 2024.

Software, Online Tools & Platform

There are multiple lists of software used in this virtual reality project.

Unity Engine	C#
Blender	Meta Asset Store
Canva Premium	Jira
Z-anatomy	Microsoft Excel
TTSMaker	Microsoft Teams
ChatGPT	Bitbucket

YouTube	LinkedIn Learning
Microsoft Visual Studio	Draw.io

Table 6: Software, Online Tools & Platform used in this project.

The main two software used in this project were Unity Engine and Blender. For Unity Engine, I used version 2022.3.42f1 LTS, and for Blender, I used version 4.2. Without these two, this project wouldn't have been possible. All the 3D model creation, modified 3D models, some of the animations, and material texturing were done using Blender. For the creation of all the scenes, scene design, primary animations, and background audio editing were done using Unity Engine. Canva Premium was used for acquiring all the videos used in this project and for video editing. Z-Anatomy was the main source of all the human organs' 3D models. TTSMaker is a text-to-speech tool that I used for voice narration at no cost.

C# programming language was used for coding. ChatGPT was crucial for the project because, although I know languages like Python, C, C++, Java, and PHP, I had never worked with C#. I created scripts in either Python or C++ and then used ChatGPT to convert them to C#. I also used ChatGPT to understand code and debug errors. Additionally, it helped me learn Unity Engine and Blender.

Microsoft Visual Studio was used to write all the C# scripts. The Meta Asset Store was the primary source for acquiring assets, but I also used online platforms like Sketchfab, TurboSquid, and Free3D.com. Jira was the platform used to manage this project, while Microsoft Excel and Jira were used to create the roadmap. For communication with the client, Microsoft Teams was used. LinkedIn Learning was very helpful for learning project management courses, which helped me complete this project. YouTube was the primary learning tool for quickly learning to work with virtual reality software.

Feedback

Client & Supervisor Feedback

Sprint 1

After the testing on Federation University's Open Day, I received constructive feedback regarding our app from the clients and supervisor. In the first sprint, they mentioned that the user interface was quite small for the menu screen to get a vape, making it difficult to read the text. The presentation of the toxin ingredients was complex and needed to be made more relatable to users. The toxins and flavours mentioned on the screen were in text format, and it was suggested to change them into graphical visuals, such as adding images.

Sprint 2

In Sprint 2, all the issues that arose in Sprint 1 were resolved. As a result, the clients and supervisor expressed their satisfaction with the work that had been done. In this sprint, it was suggested to add colour to the 3D models and to focus on the primary scenes first. Additionally, it was pointed out that the vending machines I created were not fully functional. Before the final product demonstration, all vending machines must be fully operational. Otherwise, I was advised to cancel the other vending machines and keep only one that works perfectly to create less confusion for users.

Sprint 3

In Sprint 3, all the issues that arose in Sprint 2 were resolved. The clients and supervisor were genuinely impressed with the work done and the level of detail I provided. All the promises were delivered by the end of this sprint. There was one piece of feedback regarding the brain scene: the animations needed to be changed because they could cause motion sickness. It was also suggested to change the lung positions in the lung scene. These changes can be implemented by future candidates.

User Feedback

Figures 83 to 87 show users experiencing Beyond the Vape, the application. I tested this application multiple times during all the sprints, and every time I received valuable constructive feedback from the users.

In the first sprint, the main issues reported by users were related to difficulties with using the headset. Most of them were new to virtual reality technology and had never used the headset before. They faced challenges in opening the app and locating the app logo in the Meta Quest app bar. Some were confused about how to use the controllers, requiring manual intervention and support. Another issue was motion sickness while trying to walk, as users didn't know where their desired location was. In the first sprint, the environment was too large, causing users to get lost and unable to find where they needed to be. Additionally, some users, who had prior VR experience, were not impressed with the graphical interface. Others complained that the environment felt scary. All of these issues were addressed and resolved in the second and third sprints.

In the second sprint, the primary issue was interaction with virtual world objects. Users suggested that the objects needed more colours because, at that time, I hadn't applied graphics to most of the scenes. Some users faced difficulties while standing in front of the vending machines, as they weren't sure where to stand to get the best experience. Despite these challenges, most users were mesmerized by what they saw and experienced.

By the final sprint, I tested the application extensively with many students and staff at the university. This time, they experienced the full version of the gameplay. They found improvements such as voice narration, enhanced graphics, and visuals, which provided a more engaging experience. A menu screen was added, so users no longer needed to locate the app logo in the taskbar. A proper introduction scene was included to teach users how to navigate the app. Additionally, the game environment was redesigned to prevent users from getting lost. Paths were restricted to certain footsteps, making it easier to find the desired destination. All scenes featured background music to enhance engagement, and the visuals were carefully designed for a polished experience.

Here is some feedback from the users:

"It was an amazing experience! I had never tried anything like this before. I would give it a 10/10 rating." – **Shihab Sharar Kuntol** (Master of Data Science Student)

"It's fantastic! Getting all that done in such a short time is impressive—you should be proud of yourself. The lungs scene was spooky but fun, and I loved the walking part. The text animation in the end scene could be clearer, but the final message came across really well." – **Kris Clancy** (Student Support Officer)

"Wow, this was amazing, never experienced before." – **Nanpir Hossain Nijhum** (Master of Renewable Energy)

Figure 83: User experiencing the app 1

Figure 84: User experiencing the app 2

Figure 85: User experiencing the app 3

Figure 86: User experiencing the app 4

Figure 87: User experiencing the app 5

Recommendations

This project has taken a lot of hard work and persistence. This project has much more potential than it currently shows. If initiatives are taken, this could be scaled to a grand level and could make a larger impact on the Victorian community. There are multiple suggestions I have for this application.

The first would be adding new scenes to the app with a story mode, similar to a proper PS5 game, which would engage users more effectively. There should be some angle in the story so that the user can relate to it emotionally. This way, after the experience, the impact can last for a long period of time. There should be more interactions in the Vape World, with more options and activities in the app. For example, the vape lounge and vape lab scenes could be made more impactful.

Currently, there is guidance provided by voice narration. Later, this could be improved by adding a character to guide the user, which would create more engagement. In this version, users can only sit in one position to use the app. If they stand, the app may not work properly, so this issue should be resolved. Some of the animations in the lung and brain scenes could cause motion sickness, which needs improvement.

Another significant suggestion is to visually show how smoke enters the body and how harmful toxic ingredients flow through the bloodstream. These visuals could enhance understanding. Additionally, we can include a character selection option for users. For example, before starting the main gameplay, users could choose their avatar—male, female, or non-binary. We could also show how vaping harms the female reproductive system or the male genital system. This scene could be impactful.

All the assets used in this version of the app were entirely free. In the app store, there are multiple high-quality assets that we could incorporate for better visuals. In this type of app, visuals and audio are the most important elements after the educational content. Therefore, improving the graphics is a must. Alternatively, in the future, high-quality 3D models can be created, though that would take significant time.

A meditation session could also be added, as the client initially wanted this in the first sprint but later changed the plan. We could revisit this idea. This app has so much potential and should be released in the app store. It could also be circulated in schools across Victoria or community hubs. VicHealth should take the initiative to support this.

VicHealth and Federation University Public Health Department are currently working on many research projects on vaping and trying to solve issues related to vaping. Prof. Dr. Muhammad Aziz Rahman is currently working on some of the research. Federation University should take the initiative and incorporate this application for research purposes.

This app is currently made only for the Meta Quest 3. It needs to be optimized for all Oculus Meta Quest headsets and, if possible, for all the virtual reality headsets available on the market. This would help raise awareness faster and make a bigger impact.

Conclusion

This project was truly impactful, especially if steps are taken to implement it in the community. It can make a significant impact on Victorian teenagers' lives and help create a vape-free generation in Australia. With the continuous support from the clients and supervisor, this app was successfully completed. Without their support, it would have been impossible. All the eight main scenes in this application are crucial to engaging the audience, providing them with an immersive experience, and educating them about vaping without making them feel bored. To solve a problem, we must understand the core issue. Once we identify the core issue, the problem can be easily solved. This app fulfills that role effectively. It is able to fulfill its promise of providing an 8-minute-long virtual experience. It aims to educate Australians aged 15 to 25 years and has the potential to make a significant difference in society.

References

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Appendices

Codes: Camera Fade In (Mono Script)

```
using UnityEngine;
using UnityEngine.UI;
using System.Collections;

public class CameraFadeIn : MonoBehaviour
{
    public float fadeDuration = 1.5f; // How long the fade lasts
    private Image fadeImage; // The image used to create the fade effect

    void Start()
    {
        // Create a black image that covers the entire screen for fading
        GameObject fadeObj = new GameObject("FadeImage");
        fadeObj.transform.SetParent(this.transform); // Make it a child of the
Main Camera

        Canvas canvas = fadeObj.AddComponent<Canvas>();
        canvas.renderMode = RenderMode.ScreenSpaceOverlay; // Overlay the image
on the screen
        fadeObj.AddComponent<CanvasScaler>();
        fadeObj.AddComponent<GraphicRaycaster>();

        // Create the black image
        fadeImage = fadeObj.AddComponent<Image>();
        fadeImage.color = Color.black;
        fadeImage.rectTransform.anchorMin = new Vector2(0, 0);
        fadeImage.rectTransform.anchorMax = new Vector2(1, 1);
        fadeImage.rectTransform.sizeDelta = new Vector2(0, 0);

        // Start the fade-in effect
        StartCoroutine(FadeIn());
    }

    IEnumerator FadeIn()
    {
        float elapsedTime = 0f;
        Color color = fadeImage.color;

        // Gradually fade from black to transparent
        while (elapsedTime < fadeDuration)
        {
            elapsedTime += Time.deltaTime;
            color.a = Mathf.Lerp(1f, 0f, elapsedTime / fadeDuration);
            fadeImage.color = color;
            yield return null;
        }

        // Make sure the image is fully transparent and deactivate it after the
fade
        fadeImage.color = new Color(color.r, color.g, color.b, 0f);
        fadeImage.gameObject.SetActive(false); // Disable the fade image once
fade-in is complete
    }
}
```

Codes: Enable After Delay (Mono Script)

```
using UnityEngine;
using System.Collections;

public class EnableAfterDelay : MonoBehaviour
{
    [SerializeField]
    private float delayTime; // Set this delay time in Unity Inspector

    // Start is called before the first frame update
    void Start()
    {
        // Initially disable the object, if it's active
        gameObject.SetActive(false);

        // Start the coroutine to enable the object after the delay
        StartCoroutine(EnableObjectAfterDelay());
    }

    // Coroutine to enable the object after the delay
    IEnumerator EnableObjectAfterDelay()
    {
        // Wait for the specified delay time
        yield return new WaitForSeconds(delayTime);

        // Enable the object
        gameObject.SetActive(true);
    }
}
```

Codes: Tele Sound (Mono Script)

```
using UnityEngine;
using UnityEngine.XR.Interaction.Toolkit;

public class TeleportSoundOnArea : MonoBehaviour
{
    public AudioSource teleportAudioSource;  // Reference to the AudioSource
component
    private TeleportationArea teleportationArea;  // Reference to the
TeleportationArea component

    void Start()
    {
        // Get the TeleportationArea component on the plane
        teleportationArea = GetComponent<TeleportationArea>();

        if (teleportationArea != null)
        {
            // Subscribe to the teleportation complete event
            teleportationArea.teleportationProvider.endLocomotion +=
OnTeleportComplete;
        }
    }

    // This is called when teleportation is complete
    private void OnTeleportComplete(LocomotionSystem locomotionSystem)
    {
```

```
        PlayTeleportSound();
    }

    // Play the teleport sound
    private void PlayTeleportSound()
    {
        if (teleportAudioSource != null)
        {
            teleportAudioSource.Play();
        }
    }

    private void OnDestroy()
    {
        // Unsubscribe from the event to avoid errors
        if (teleportationArea != null)
        {
            teleportationArea.teleportationProvider.endLocomotion -=
OnTeleportComplete;
        }
    }
}
```

Codes: Auto Scene Changer

```
using UnityEngine;
using UnityEngine.SceneManagement;

public class SceneChangerAuto : MonoBehaviour
{
    // Time after which the scene will change (in seconds)
    public float delayTime = 30f;

    void Start()
    {
        // Invoke the ChangeScene method after the specified delay
        Invoke("ChangeScene", delayTime);
    }

    // Method to change the scene
    void ChangeScene()
    {
        // Load the next scene in the build order
        int currentSceneIndex = SceneManager.GetActiveScene().buildIndex;
        SceneManager.LoadScene(currentSceneIndex + 1);
    }
}
```

Codes: Lerp

```
using UnityEngine;

public class LerpColor2 : MonoBehaviour
{
    MeshRenderer cubeMeshRenderer;

    [SerializeField]
    [Range(0f, 2f)]
    float lerpTime = 1f;  // You can set this between 0 and 2 seconds in the
Inspector or code
```

```
    [SerializeField]
    Color[] myColors;

    int colorIndex = 0;
    float t = 0f;
    int len;

    // Time delay before color transition starts
    float delayTimer = 28f; // Set the delay time to 28 seconds
    bool isColorChangeStarted = false;

    // Use this for initialization
    void Start()
    {
        cubeMeshRenderer = GetComponent<MeshRenderer>();
        len = myColors.Length;
    }

    // Update is called once per frame
    void Update()
    {
        // Countdown for delay
        if (delayTimer > 0)
        {
            delayTimer -= Time.deltaTime;
            return;  // Exit the function until delay is over
        }

        // Start color change after the delay
        if (!isColorChangeStarted)
        {
            isColorChangeStarted = true;
            t = 0f;  // Reset t to ensure smooth transition after delay
        }

        // Lerp color over the specified lerpTime
        cubeMeshRenderer.material.color = 
Color.Lerp(cubeMeshRenderer.material.color, myColors[colorIndex], t);
        t += Time.deltaTime / lerpTime;  // Increment t based on the lerpTime

        // If t has reached or exceeded 1, go to the next color
        if (t >= 1f)
        {
            t = 0f;
            colorIndex = (colorIndex + 1) % len; // Loop through colors
        }
    }
}
```

Codes: Connect Scenes

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;


public class NewBehaviourScript5 : MonoBehaviour
{
   public void GoToSceneMenu()
```

```
    {
        SceneManager.LoadScene("Start Scene");
    }
}
```

Codes: Time Destroy

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;


public class TimerDestroy : MonoBehaviour
{
    public float interval;

    // Use this for initialization
    void Start()
    {
        Destroy(gameObject, interval);
    }

    // Update is called once per frame
    void Update()
    {
    }
}
```