INTERACTIVE GAME FOR DEPRESSION INDIVIDUAL

By

KELVEN LING KIAN HAU

A REPORT

SUBMITTED TO

Universiti Tunku Abdul Rahman

in partial fulfillment of the requirements

for the degree of

BACHELOR OF INFORMATION SYSTEMS (HONOURS)

INFORMATION SYSTEM ENGINEERING

Faculty of Information and Communication Technology

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FACULTY/INSTITUTE* OF INFORMATION AND COMMUNICATION TECHNOLOGY

UNIVERSITI TUNKU ABDUL RAHMAN

Date: 20 April 2022

SUBMISSION OF FINAL YEAR PROJECT/DISSERTATION/THESIS

It is hereby certified that ___Kelven Ling Kian Hau___ (ID No: __18ACB03026__) has completed this final year project/ dissertation/ thesis* entitled "__Interactive Game for Depression Individual__ " under the supervision of __Dr Tong Dong Ling__ (Supervisor) from the Department of __Computer Science__ , Faculty/Institute* of __Information and Communication Technology__ .

I understand that University will upload softcopy of my final year project/ dissertation/ thesis* in pdf format into UTAR Institutional Repository, which may be made accessible to UTAR community and public.

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_Perak_____

Tong Dong Ling_____

Supervisor's name

Date: __20 April 2022__

Date: 21 Apr 2022_____

DECLARATION OF ORIGINALITY

I declare that this report entitled "**METHODOLOGY, CONCEPT AND DESIGN OF AN INTERACTIVE GAME FOR DEPRESSION INDIVIDUAL**" is my own work except as cited in the references. The report has not been accepted for any degree and is not being submitted concurrently in candidature for any degree or other award.

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Date   :   __20TH APRIL 2022__

ACKNOWLEDGEMENTS

ABSTRACT

This project is an interactive game for depression individual project for entertainment purposes. This project aims to enhance social acknowledgement and help depression individuals with depression through a game. Game is widely known for a large population of people. It can help spread the concept and knowledge about depression faster than any other media and in a fun way. In this project, agile methodology has been used in the process. As the game development process will have high uncertainty, agile methodology can play its role nicely during the development process in changing some of the design and requirements. Games with similar functionality and background have been reviewed in strengthen and improve the development and design of the game. This project will be developed using Unity 3D, a free license game engine. The game is a story-based game that delivers information and emotion through storytelling and helps depressed individuals face negative emotions more easily.

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List of Abbreviation

AI   *Artificial Intelligence*

AR   *Augmented Reality*

VR   *Virtual Reality*

CBT   *Cognitive Behavioral Therapy*

MMO   *Massively Multiplayer Online*

NFT   *Non-Fungible Tokens*

NPC   *Non-Player Character*

PHQ-9   *Patient Health Questionnaire - 9*

PS4   *PlayStation 4*

PS5   *PlayStation 5*

ROC   *Reach Out Central*

USA   *United States of America*

Chapter 1

1.1 Problem Statement

With the technology advancement, most information can be obtained easily through the internet. Research on mental illness carried out by the National Institute of Mental Health [1] on the USA population reported that almost half of the adolescents aged between 13 to 18 years old (Generation Z), approximately 49.5 % experiencing mental illness. The most common mental illness clarified is major depression [2]. It is not only affecting children and teenagers; it also affects adults.

The common issue among adolescents is reluctant to disclose depression to others. Feeling of shame and fear may be halted by individuals about what others will think about them when sharing their experiences or feelings [2]. The adolescents were afraid of being ignored and laughed at if they expressed their negative emotions.

Another issue is the lack of exposure to depression disease. Adolescents may not notice the relationship between negative emotions and mental illness due to the lack of knowledge about mental illness. Let them hard to detect if they have a mental illness. This issue also applies to adults.

The lack of public awareness of the severity of depression is also an issue. Public awareness plays an essential role in notifying if someone has a mental illness. The awareness should be trained among adolescents to increase the public awareness of the severity of depression.

1.2 Motivation

From the problems stated, it affects the adolescents and their future when facing mental illness. These problems motivate the author to develop a game to help individuals suffering from depression. Game is one of the most popular entertainments among all types of people. The game can become a medium for delivering the importance of mental health and spreading awareness of the severity of depression. It can also help individuals determine their mental status and provide correct precautions and actions.

1.3 Project Objective

In this project, some objective will need to achieve.

1. **To study the usage of Cognitive Behavioural Therapy in games.**

    Reviewing past research on cognitive behavioural therapy (CBT) can help decide the most suitable technique in CBT to use in the game.

2. **To design game mechanisms to deliver knowledge and apply cognitive behavioural techniques.**

    The game mechanism that fits this project will be developed. The method for delivering the knowledge and CBT technique will be designed and applied in this project.

3. **To develop a story-based adventure puzzle game to spread awareness of depression and identify the mental status of players.**

    A fully playable game will be developed for this project. The game's target is to help players determine their mental status and deliver knowledge and awareness about depression through the gameplay.

1.4 Project Scope

This project aims to develop an interactive game that can help deliver knowledge about depression and determine the players' current mental condition. Players can explore and collect collectable items and logs that provide information about depression. A short storyline will be developed in the proposed game, and a series of questions will be asked throughout the gameplay.

1.5 Impact, Significance, and Contribution

With the advancement of the game industry, games have become common entertainment among people. Treatment can be gamified and used to provide the patient with a more relaxed environment.

Many people, especially teenagers, are scared to express their mental status. This situation often happens among Asians and may destroy children's life in the future. This project mainly is to help those who scare

to seek help to confirm further and identify their mental status. The delivery of knowledge and awareness of mental health can also be done in games.

1.6 Background Information

Depression

Depression is a mental disorder that makes the patient feel depressed and lose interest in everything. Depression symptoms may include feelings of sadness, frustration, loss of interest, insomnia, excessive sleeping, and a change in appetite. Depression can lead to an inability to take care of his or her everyday responsibilities and lead to suicide [3].

Depression is different compared to sadness or grief [4]. However, it mainly causes the patient to feel stressed or sad for no reason and may continue experiencing such feelings for up to two weeks or longer. Many factors that increase the chance of depression, including genetic, environmental, psychological, or biochemical factors and depressed individuals can be found from age 15 to 44, including men and women [3].

There are three types of depression, major depression disorder, Dysthymia and Bipolar disorder [3]. In this project, major depression disorder is the target, also known as the most common depression suffered by the patient. Depression can be treated effectively by using either medication or some form of evidence-based psychotherapy [5]. Psychological treatment such as talk therapy helps patients learn how to cope or deal with these negative thoughts [3]. Many talk therapy such as cognitive behavioural therapy, psychotherapy or joining a support group can help with the patient's psychological health. Cognitive behavioural therapy (CBT) is effective in the treatment [4]. It mainly focuses on problem-solving in the present. It helps the patient recognize the negative thought and respond to challenges more positively. It also provides patients with the tool to live with and the ability to prevent or fight depression using the CBT technique in the future after curing.

Gamification in Health Treatment

Many technology devices started to advance in the last few years with more sophisticated computers, laptops and consoles such as Nintendo Switch, PS4, and PS5. With these devices, gaming has become more common. It has been played among people, from children to adults. Video games have been used strategically in the medical field and affect several issues in health among the patient [6]. Increases in motivation have been observed in the patient [6]. It motivates patients to continue the treatment when going through painful treatment such as chemotherapy and boringness. The essential feature of video games is their interactivity [7]. Video games are supposed to let the players interact with the NPC or other players in the multiplayer genre. Storylines or quests available in the games encourage players to actively involve themselves, motivating and encouraging players in different ways. Most relevant, SPARX, a fantasy video game developed for New Zealand Youth for depression, play an important role and example for others in attacking depression by using games. However, most video games developed for marketing purposes may not serve these benefits or advantages. Other psychological effects such as anxiety and additive may also happen with games. Video games addiction has been associated with several negative psychological issues, including depression, poor academic results, alcohol use problems, and conduct problems [8]. However, by understanding the cause of depression and how depressed individuals think, we can bring more countermeasure into the games. In SPARX, the quest system is designed to help depressed individuals cope with their negative thoughts and feelings. It also helps them improve their social skills with in-game society and helps build their confidence. With this example, we can know that helping depressed individuals cope with their negative feelings can help them feel better.

1.7 Report Organization

There are 7 chapters in this report. The first chapter introduces mainly provide the background information, objectives and scope of the project.

Chapter 2 review of the existing game that have similar functionality and background to the proposed game.

Chapter 3 describe the method used to develop the application and the timeline of the project. This chapter also shows the initial design of the game.

Chapter 4, system development will be explained to give insight to readers on how the proposed application is developed, the required software and the explanation of the main functionality of the application.

Chapter 5, tutorial on how the application can be installed on the computer and the screen shots of the application has been shown.

Chapter 6, system testing result will be reported, and the detail of the testing criteria are also explained.

Chapter 7 summarize the project by discuss on the future work and the limitation of the project.

Chapter 2 Literature Review

Interactive games can be in a large variety of categories. There are many interactive games available in the current market. The game's interactivity has been an essential aspect of the current gaming industry and development.

Many recent studies have focused on game-based digital interventions therapy to tackle mental illness. By learning different types of mental health approaches and comparing them with game-based digital interventions therapy, how the game can lead to and significantly affect the mental illness can be discovered.

Game-based interventions therapy has been found to have a high practical effect in finding the main barriers to engagement in the healthcare domain [9]. Positive game-playing experiences can trigger the release of hormones such as endorphins, even showing the effectiveness and the value of the game-based digital interventions in depression therapy. According to the research, the type of game used in intervention can be divided into psychoeducation, entertainment, virtual reality exposure therapy and exercising [9].

This literature review will review five games in terms of their game type and game-based digital interventions therapy.

2.1 Depression Quest
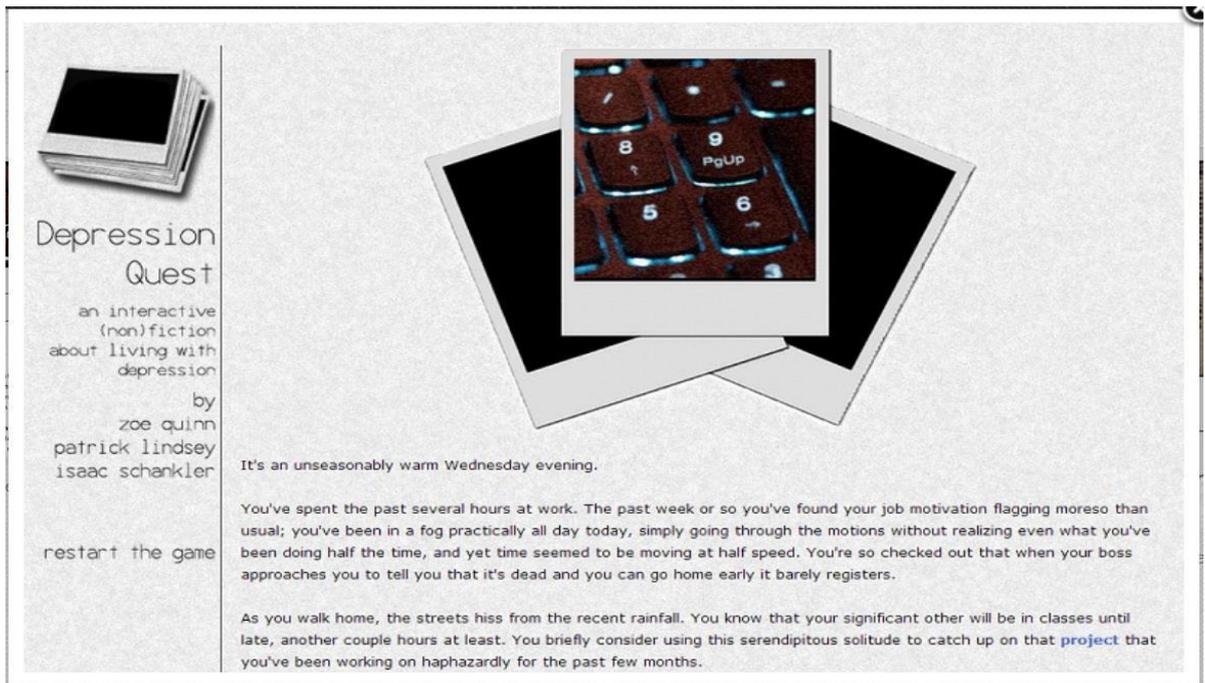
Figure 2.1 Game UI from Depression Quest

Depression Quest, developed by Zoe Quinn [10], is an interactive fiction game to alleviate the depression of the players by mimicking the daily activities of the depressed individual. In the gameplay, players are assumed to suffer from depression. Players need to manage their illness, relationship, job, and possible treatment for depression throughout the game. This game aims to show other patients with depression that they are not alone and show individuals who may not understand the illness depth of depression facing the patient [10].

This game intends to help players realize and understand how and what is depressed individual may be facing and give them a clearer picture of what depression is. Giving players a picture of depression makes the players more empathetic and helpful to sufferers [11].

The social impact brought by this game can be significant and effective as it helps us understand depression in the view of depressed individuals.

This game lets players experience the real situation, feeling, and mindset of a depressed individual and truly understand the act of a depressed individual.

Lewis [12] stated that the game mimics the exhaustion and listlessness that often accompany depression. The strange sensation of depressed individuals makes them know they are wrong but lack the strength to find a new path. This mechanism is why the game has a great social impact on the real encounter and experiences of the developer and writer, Quinn and Lindsey, who have been suffering from depression.
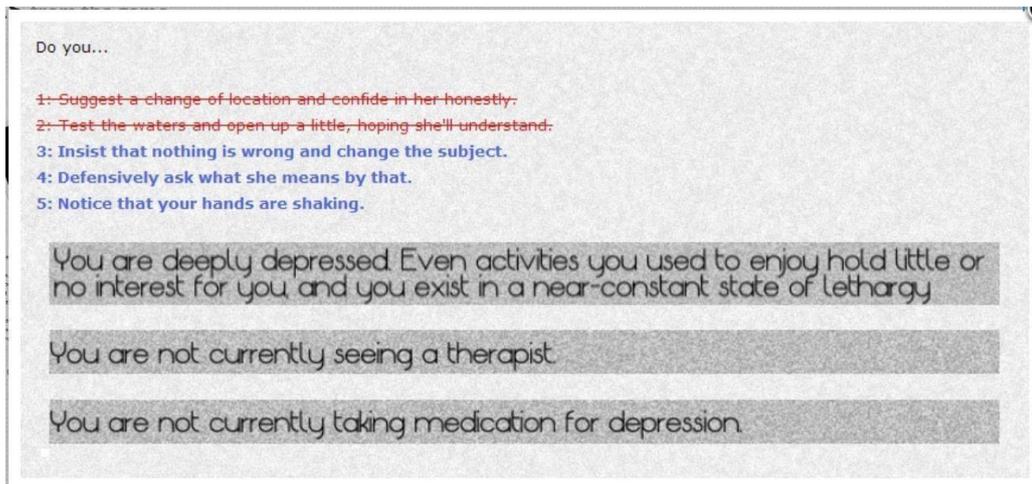
Figure 2.2 Option available for player and some is cross out.

This game has five different endings to demonstrate different choices made by the players. As the game assumes that players are suffering from severe depression, some choices have been crossed out at the initial stage of the game. For example, Figure 2.2 shows that players can only choose options 3, 4, and 5 while options 1 and 2 are crossed out. This game's mechanism has perfectly enacted the content of the depressed individual. It shows that depressed individuals' choices are more limited than regular people [11]. So, by using this mechanism, we can be aware that depression also can affect one daily life choices.

Players will not be attracted to play this game. Some players might love to play fictional novel-like games that require much reading. However, many prefer graphic, animation or video in-game scenes rather than text from the narrator. However, the game design using a text-like adventure requires players to read through the whole text to make choices.

Figure 2.3 Quote from David Foster Wallace in Depression Quest
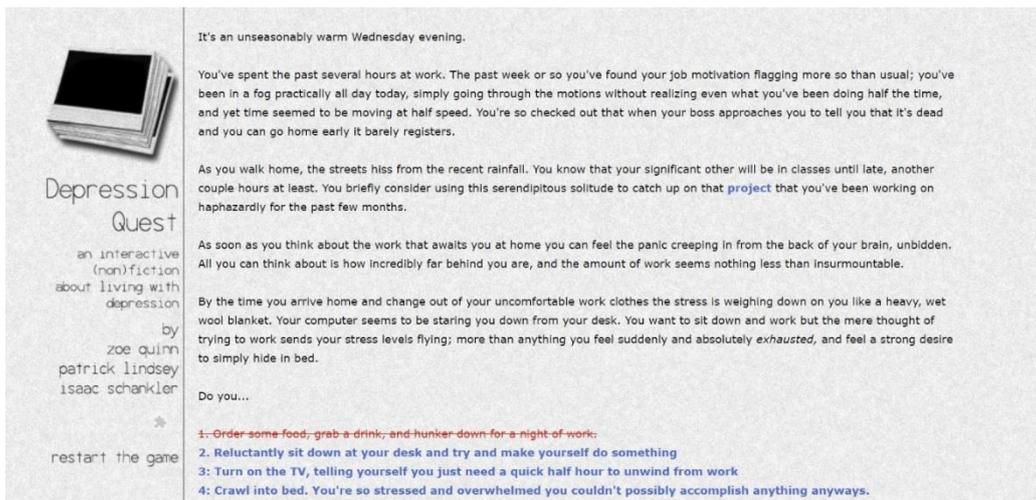
Figure 2.4 Novel of the game and option available

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2.2 Reach Out Central

Figure 2.5 Login screen from Reach Out Central

Reach Out Central (ROC) is funded by the Sony Foundation and BeyondBlue: The National Depression initiative [13]. It is a serious game that aims to improve the mental health and well-being of young people who have a mental illness. ROC is a single-player game played in a virtual world. When players log in, a short survey is conducted to measure the players' positive affect. The game has a mood score that will be affected by activities or actions made by players.

The game provides a story and real-life events for players to solve. The game aims to teach life skills such as communication, problem-solving and optimistic thinking [13].

With different choices players make, the different output is expected, such as increasing mood, gaining money or item and increasing friendship rating. The game shows critical themes such as depression, drug and alcohol, relationship problems, bullying, family relation, and financial management. The game one virtual day is equal to 1 actual day, which means players will need to note the game's time if they do not want to miss any in-game event or activity. This mechanism not only attracts players to the real-like virtual world but also trains the players' time management.

However, players will need to put extra effort into managing their time, including in-game activity. This issue led to extra stress and tiredness among players and made it hard to progress.

2.3 SPARX
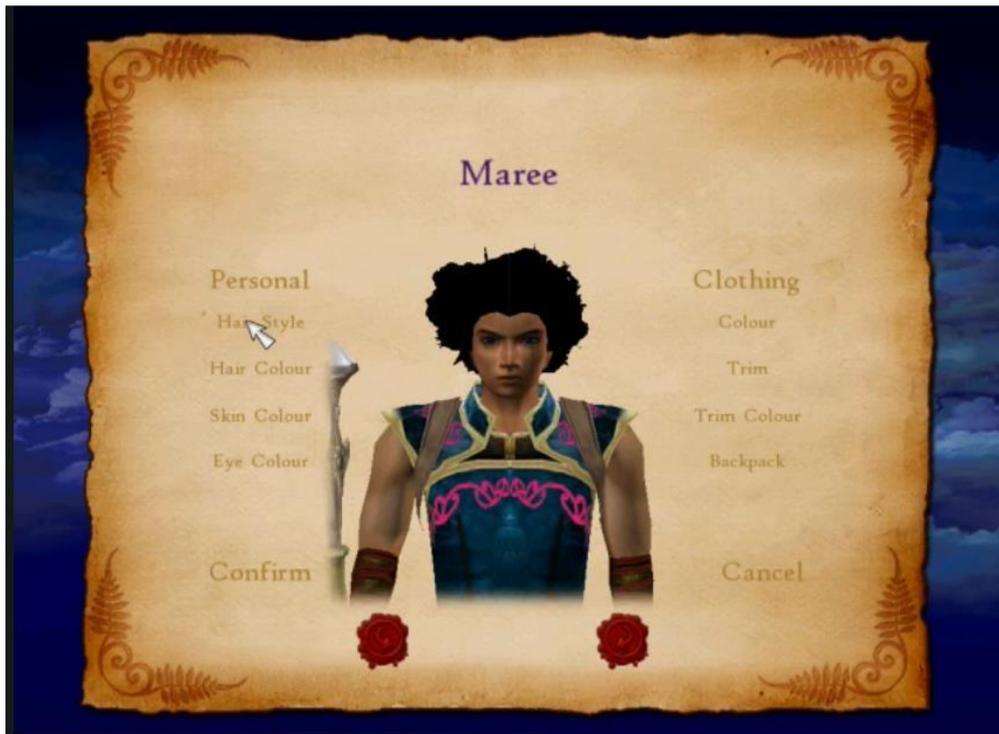
Figure 2.6 Character creation screen from SPARX.

SPARX was developed by a team of researchers and clinicians from the University of Auckland. The game is designed for young people aged 12-19 who may face or need help when feeling down, depressed, worried, and stressed [14]. SPARX's name comes with Smart, Positive, Active, Realistic and X-factor thoughts. The main idea they want is to deliver and help young people facing negative thoughts.

SPARX [14] uses multiple learning strategies, including fun and active learning methods, instead of learning from a book or talking to someone. This game also uses cognitive behavioural therapy (CBT), one of the main recommended treatments for young people with depression.

SPARX help the individual by designing all activities that will teach players a new skill to help them feel better and motivate them by giving a reward for each completed level. SPARX contain seven levels. All levels were designed by clinical and academic expectations from University Auckland based on CBT,

including psychoeducation, relaxation skills, problem-solving, activity scheduling, challenging, and replacing negative thought and social skills [15].

The massively Multiplayer Online (MMO) element found in SPARX is also one of its strengths in treating depression. MMO elements help depressed individuals by providing a virtual social network to build confidence and motivate them to communicate in the real world. A well-designed computer game has shown multiple benefits in affecting players, including increased social engagement [15]. The well maintained in-game social system can help depressed individuals build their confidence and increase their social engagement in real life.

Figure 2.7 User review for SPARX android version on PlayStore.

Although the game shows significant results in providing CBT for the patient, the game has been in poor performance with poor control and glitches that happen during the game. According to Figure 2.7, the most recent few comments on 2020 show that the game performance is terrible with a poor control system and bugs happening in the game.

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Figure 2.8 SPARX official registration website.

Other than the game's poor performance, the SPRAX is also only available to New Zealand residents, referring to Figure 2.8. Patients outside New Zealand who may suffer from depression cannot play this game even though they know they have been suffering from depression and need it.

2.4 Night In The Woods

Figure 2.9 Night In the Woods official website poster.

Night in the Woods, developed by Infinite Fall, is an adventure game focusing on exploration, story, and character [16]. Players play as Mae, who dropped out of college and returned to her hometown to find unexpected changes to the surroundings. The game's story tackles surprisingly heavy subjects such as mental illness, child abuse and death, and socio-political issues surrounding the game's town, including stereotypes and racism [17]. All the problems and subjects shown by the game can be found in every corner of the world.

Night in the Woods is about learning how to cope with mental illness [18]. The game's creator designs the character with a particular mental illness. Mae experiences depression and anxiety, her friend Gregg has bipolar disorder and Bea and Angus struggle with the consequences of abusive pasts. The game's creator intentionally left the character's mental health ambiguous to let the stories progress naturally [18]. This design help players understand and reflect on themselves if the players or somebody around them have the same characteristic.

The creator of the game wanted to develop a game about depression in the early development as the development team had experience depression in some way. They wanted to make a game about people who experience depression or mental illness to spread mental health awareness [18]. Night in the Woods is neither a cheerful game nor a depressing story about the

disillusionment of the suffering characters [17]. The game had carefully refined the characters and the complexity of sociocultural, political, and psychological issues that happen in the game. These topics show players what is happening in the current world, not only in the game.

Figure 2.10 Cut scene of adult and protagonist.

In the early of the gameplay, we need to keep Mae busy, and it allows Mae to meet everyone in the town. This gameplay mechanism is also Mae's coping mechanic [19]. It is a way that depressed individuals try to combat depressed feelings by keeping them busy and distracted from the feeling. It reflects the real-world situation of how depressed individuals have tried to combat depression.

However, the game explores many varieties of real problems from mental illness, religion, politics and sex. It was hard to determine if players would be able to receive the message in the way that the game tried to deliver in a veiled way.

2.5 Hellblade: Senua's Sacrifice

Figure 2.11 Hellblade: Senua's Sacrifice Game award poster.

Hellblade: Senua's Sacrifice is a dark fantasy action-adventure game developed by Ninja Theory [20]. It is a story about Senua, the protagonist who has psychosis, adventures to save her loved one from the goddess of death, Hela. Ninja Theory development team worked closely with a mental health professional, Fletcher, to achieve a realistic approach to psychosis suffering by Senua [21]. The game shows and uses many perspectives, such as vision and sound, to enhance and strengthen the psychosis feeling of the game.

In the development process, the Ninja Theory development team worked with mental health professionals, researchers, and individuals dealing with mental illness [22]. The development team attempts to make a game that allows players to experience symptoms like psychosis. Ninja Theory also attempts to combine approaches used by Depression Quest by placing the players in Senua's perspective and presenting them with what is psychosis [22].
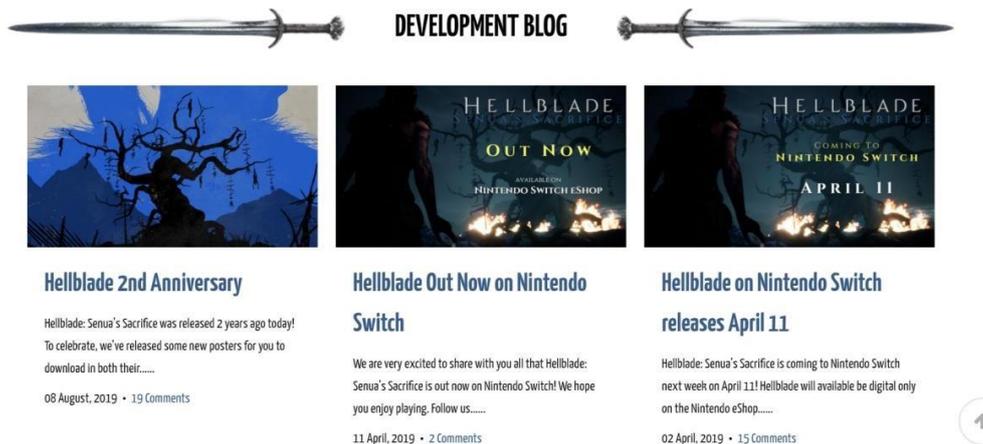
Figure 2.12 Hellblade development blog from official website.

Hellblade: Senua's Sacrifice is a triple 'A', "AAA" game. This type of game is
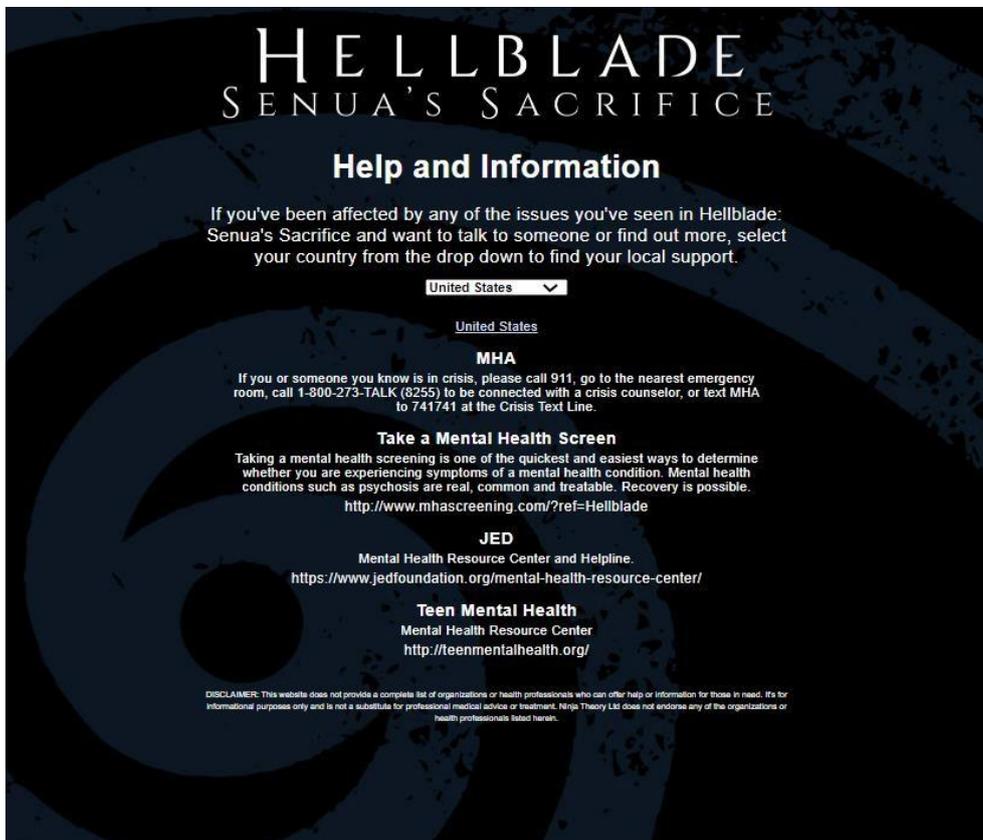
Figure 2.13 Hellblade mental support hotline from official website.

considered a high-quality game. Unlike the previously reviewed games, only more minor games are created by a smaller team with lower cost, also known as an indie game. It has also been a commercial game which may lead to profit

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after publishing the game. After the game was released, the development team released the development diary (refer to Figure 2.12) on developing and designing with a mental health expert in the game mechanism. The official website [20] also provides the user with more resources on mental illness and

Figure 2.14 Cut scene of hallucination happen in game.

able to seek help if the user face some of the mental illness (refer to Figure 2.13).

The game's sanity meter leads to hallucinations in the game, which is one of the psychosis symptoms (Figure 2.14). Through simulation of hallucinations, empathy and understanding of people with mental illness can increase [22].

The game has the strength of having a large and broad population in delivering the message and improving awareness of the mental illness. Hellblade presented a vehicle for awareness and destigmatizing mental illness [22]. The game develops with high-quality graphics and mechanics that can attract a variety of gamers, from young to adults and men to women. The game's detail is also one of the strengths, especially the audio and sound used. The players may hear an ongoing chorus of voices within Senua's mind. It is not only the mechanics that help players, but it also wanted to show what individuals suffer from psychosis or mental illness will face in real life.

Figure 2.15 Price of Hellblade on Steam

However, it is still a commercial game. The game costs RM56 for players to play on Steam (refer to Figure 2.15), considered expensive for students and low-

Figure 2.16 System requirement for Hellblade

wage individuals. The minimum system requirement of the game shows that a high specification device is required to play the game smoothly. Even the console that supports this game is not cheap in terms of price, such as Nintendo Switch (refer to Figure 2.16).

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2.6 Comparison Table

Games	*Intervention*			
	Psychoeducation	**entertainment**	**Virtual reality exposure therapy**	**exercising**
Depression Quest	✓			
Reach Out central	✓		✓	
SPARX	✓	✓		✓
Night in the Woods	✓	✓		
Hellblade: Senua's Sacrifice	✓	✓		

Table 2.1 Intervention comparison table

Chapter 3

3.1 Agile Development Methodology

The agile development methodology is a system development lifecycle that uses an iterative development process to develop software. In this project, this methodology will be chosen since agile development methodology can give better flexibility and the ability to reduce the risk of this project. It can also help improve and guarantee the project's quality as the software is developed in an incremental process. As game development consists of many risks that are unable to detect during the planning and design phases, many changes will be required to adopt into the project during the development process. The project has been divided into multiple small modules and developed one by one to ensure project quality.
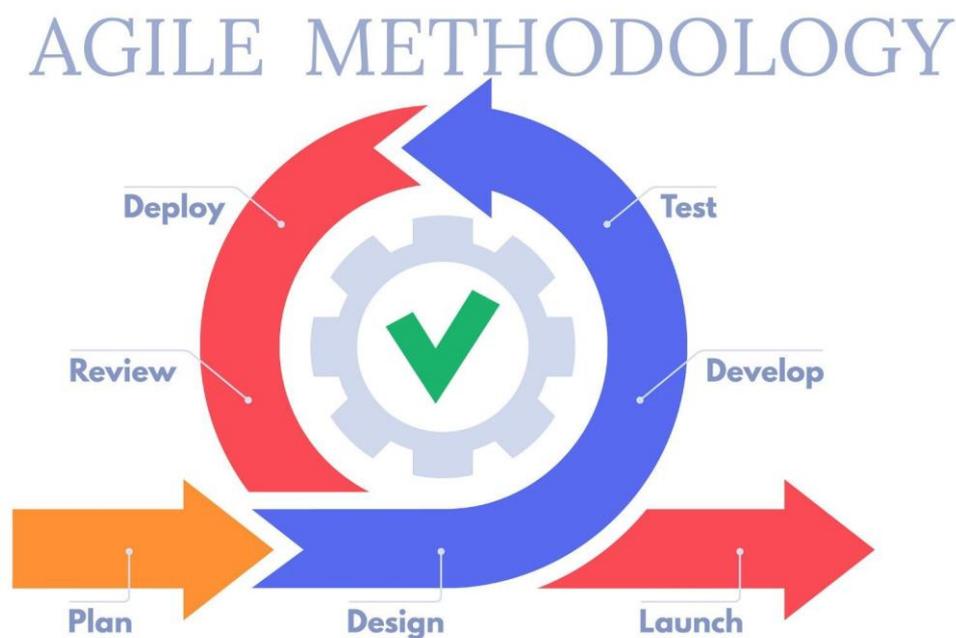
Figure 3.1 Agile Methodology Life Cycle [27]

In this project, a full prototype will be developed. The full prototype will be included all required functionality, Dialogue System, Responses System, Item Usage System, Timeline System, Audio System, Save System and Basic Interaction (Movement, Inventory, and user interface (UI)).

3.2 Software Development Tools

SOFTWARE	VERSION	DESCRIPTION
UNITY PERSONAL	2020.3.12F1	Unity Personal is a free version of Unity (Game Engine) for individuals, hobbyists, and small organizations with less than $100K of revenue or funds raised in last 12 months. This software is the main platform used to develop the game.
BLENDER	2.93.1	Blender is a free and open-source 3D creation software. It supported all the 3D pipelines and 2D pipelines. This software will be used to create the asset required for the game, such as maps and character models.
VISUAL STUDIO COMMUNITY 2022	17.1.1	Visual Studio Community is the free version of Visual Studio released by Microsoft. It is the main IDE for Unity. This software has been used as the script code editor to create and edit Unity Scripts.

Table 3.1 Software Requirement Table

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3.3 Hardware Development Tools

Computer Model: Lenovo Legion 15ACH6H 82JU00MKMJ

SYSTEM	INFORMATION
OPERATING SYSTEM	Windows 11 Home Single Language
PROCESSOR	AMD Ryzen 5 5600H
GPU	NVIDIA GeForce RTX 3060 Laptop (Dedicated) AMD Radeon™ Graphics (Integrated)
RAM	24.00GB
SYSTEM TYPE	64-bit operating system, x64-based processor

Table 3.2 Hardware Development Table.

3.4 Timeline

Task Name	Duration (Days)	Start	Finish
Phase 1 Planning	6	Mon, 24/1/22	Sun, 30/1/22
Project Timeline Schedule	2	Mon, 24/1/22	Wed, 26/1/22
FYP 1 Revision	3	Thu, 27/1/22	Sun, 30/1/22
Phase 2 Design & Development	59	Thu, 27/1/22	Sun, 27/3/22
Storyline Design	10	Thu, 27/1/22	Sun, 6/2/22
Puzzle Design	10	Thu, 27/1/22	Sun, 6/2/22
Log and Key Item Details	17	Thu, 27/1/22	Sun, 13/2/22
Asset Gathering and creation	41	Mon, 14/2/22	Sun, 27/3/22
Map Creation and Decoration	41	Mon, 14/2/22	Sun, 27/3/22
Game UI Recreation/Modification from FYP1	13	Mon, 21/2/22	Sun, 6/3/22
Game Basic Functionality Remodified	13	Tue, 22/2/22	Mon, 7/3/22
Interactable System Development	13	Wed, 23/2/22	Tue, 8/3/22
Dialogue System Development	13	Mon, 28/2/22	Sun, 13/3/22
Save System Development	13	Tue, 1/3/22	Mon, 14/3/22
Responses System Development	13	Mon, 7/3/22	Sun, 20/3/22
Unlockable System Development	13	Mon, 7/3/22	Sun, 20/3/22
Timeline System Development	13	Mon, 7/3/22	Sun, 20/3/22
Timeline Creation	13	Mon, 14/3/22	Sun, 27/3/22
Audio System Development	13	Mon, 14/3/22	Sun, 27/3/22
Phase 3 Testing	41	Mon, 21/2/22	Sun, 3/4/22
Prototype Testing Phase 1: Using Unity Editor	34	Mon, 21/2/22	Sun, 27/3/22
Prototype Testing Phase 1: Bug Fixing	34	Mon, 21/2/22	Sun, 27/3/22
Prototype Testing Phase 2: Standalone Testing	13	Mon, 21/3/22	Sun, 3/4/22
Prototype Testing Phase 2: Bug Fixing	13	Mon, 21/3/22	Sun, 3/4/22
Phase 4 Implementation and Documentation	25	Mon, 28/3/22	Fri, 22/4/22
Draft Documentation Preparation	13	Mon, 28/3/22	Sun, 10/4/22
FYP2 Presentation Slide Preparation	4	Fri, 15/4/22	Tue, 19/4/22
Final Report Submission	0	Fri, 22/4/22	Fri, 22/4/22
Phase 5 Review	0	Wed, 20/4/22	Wed, 20/4/22
FYP2 Presentation	0	Wed, 20/4/22	Wed, 20/4/22
FYP 2 Complete	88	Mon, 24/1/22	Fri, 22/4/22

The timeline spans weeks as follows:
Week 1 (24 January, 2022), Week 2 (31 January, 2022), Week 3 (7 February, 2022), Week 4 (14 February, 2022), Week 5 (21 February, 2022), Week 6 (28 February, 2022), Week 7 (7 March, 2022), Week 8 (14 March, 2022), Week 9 (21 March, 2022), Week 10 (28 March, 2022), Week 11 (4 April, 2022), Week 12 (11 April, 2022), Week 13 (18 April, 2022).

Figure 3.2 FYP2 Timeline

3.5 Overall Storyboard
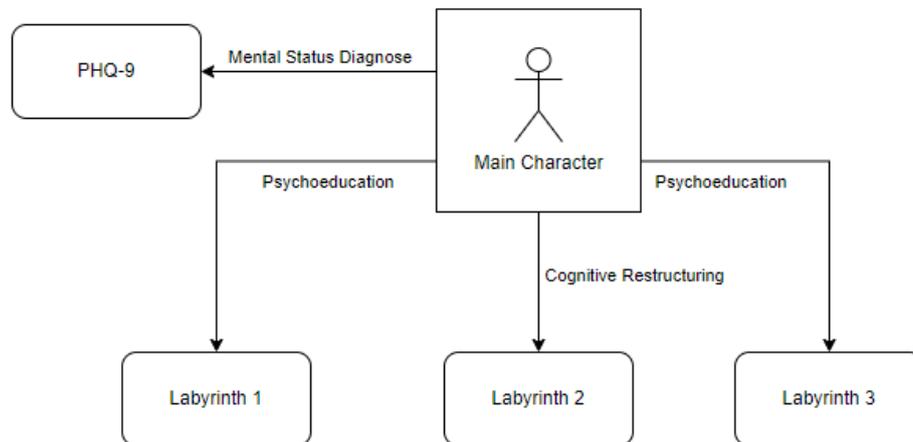
Figure 3.3 Overall Storyboarding

Figure 3.3 shows the overall storyboarding of the game. The game's main features are the Patient Health Questionnaire (PHQ-9) implementation and three labyrinths stage. The implementation of PHQ-9 is used to diagnose the player's current mental status. At the same time, the CBT technique is implemented in the labyrinths stage. Labyrinth 1 used psychoeducation to deliver the information about depression. Labyrinth 2 used cognitive restructuring to teach players alternative thinking skills. Labyrinth 3 used psychoeducation to deliver the information about the precautions and actions when facing depression.

3.6 System Design
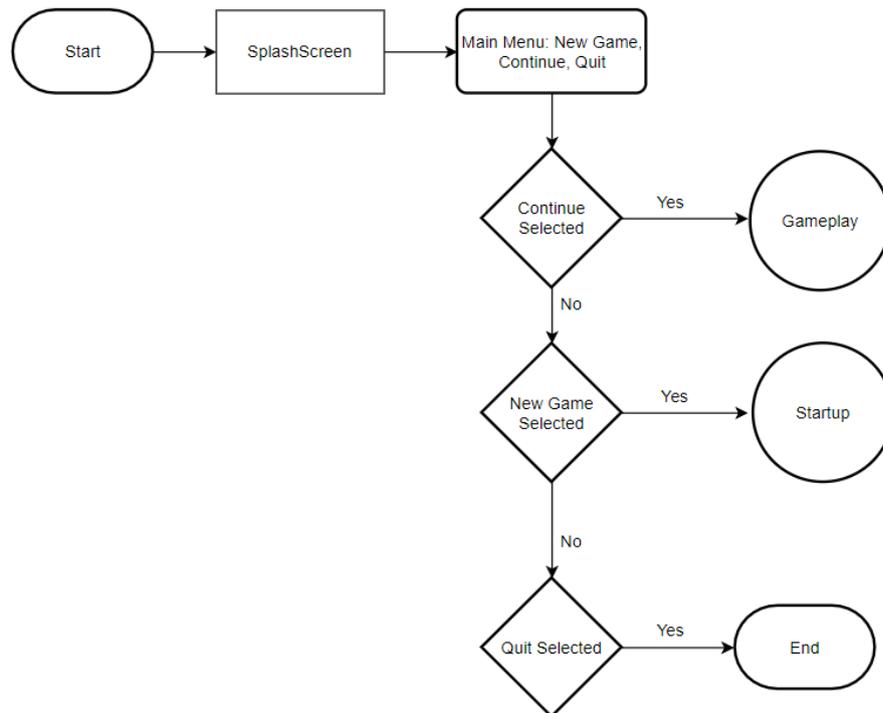
Figure 3.4 Main Menu Flowchart

Figure 3.4 shows the main menu flowchart of the game. When the players first open the game, a splash screen will be shown, redirecting players to the main menu. From the main menu, players can choose to continue to play the previous save or start a new game. If the players choose to continue with the saved, the players will be redirected to the gameplay. If the players choose to start a new game, the info is prompt for players through the start-up process.
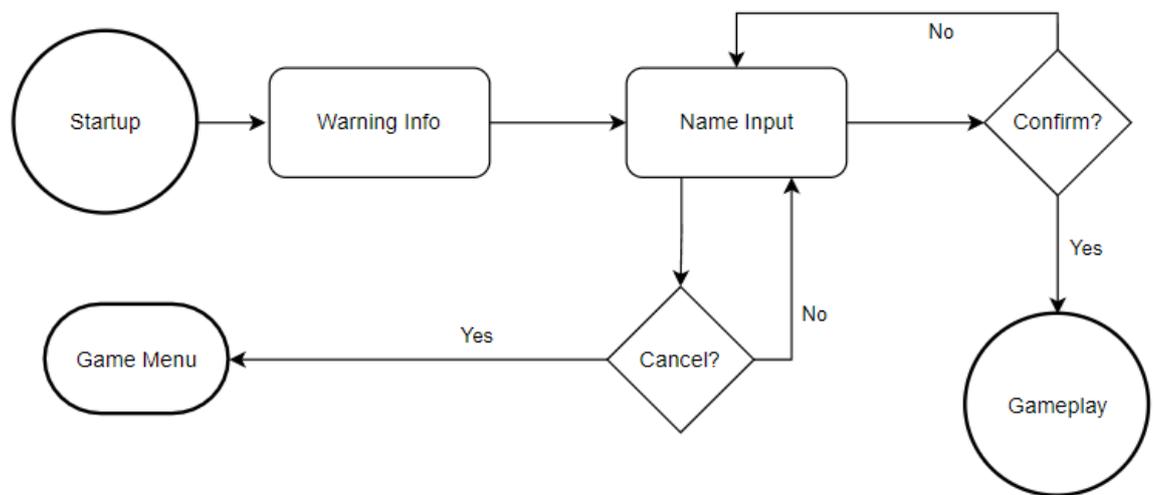
Figure 3.5 Start New Game Flow

Figure 3.5 shows the start-up flowchart continuous from Figure 3.4. In the start-up process, players will see warning info to inform players about the game and how to get the best result. After that, players will need to input their names for the game.
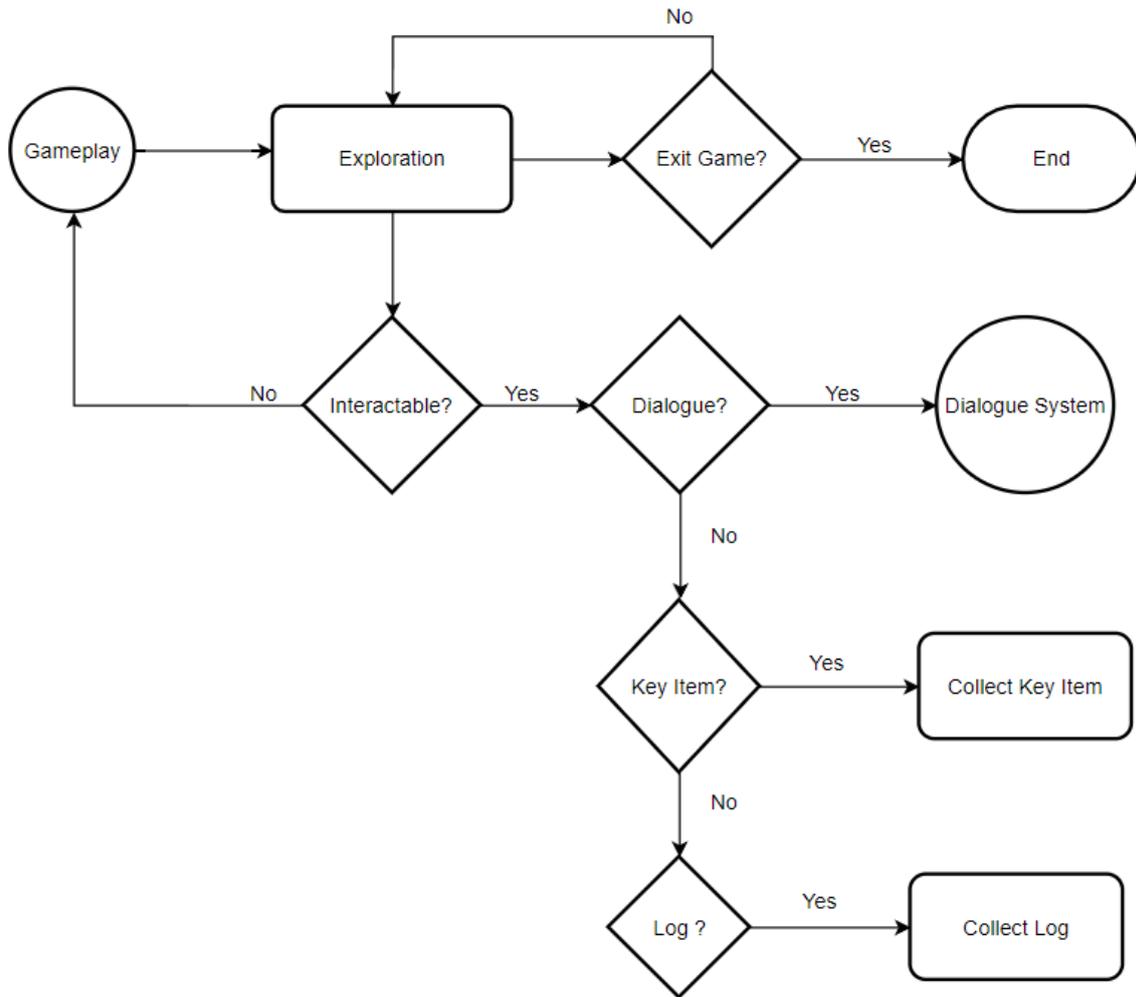
Figure 3.6 Gameplay flowchart

Figure 3.6 shows the Gameplay flowchart. During the gameplay session, players will be in exploration mode. When players interact with an object, the system will determine if the interactable is a dialogue, item, or log. The dialogue system will run if the object is a dialogue interactable. If the interactable is a key item or log, players will pick it up and store it in inventory.
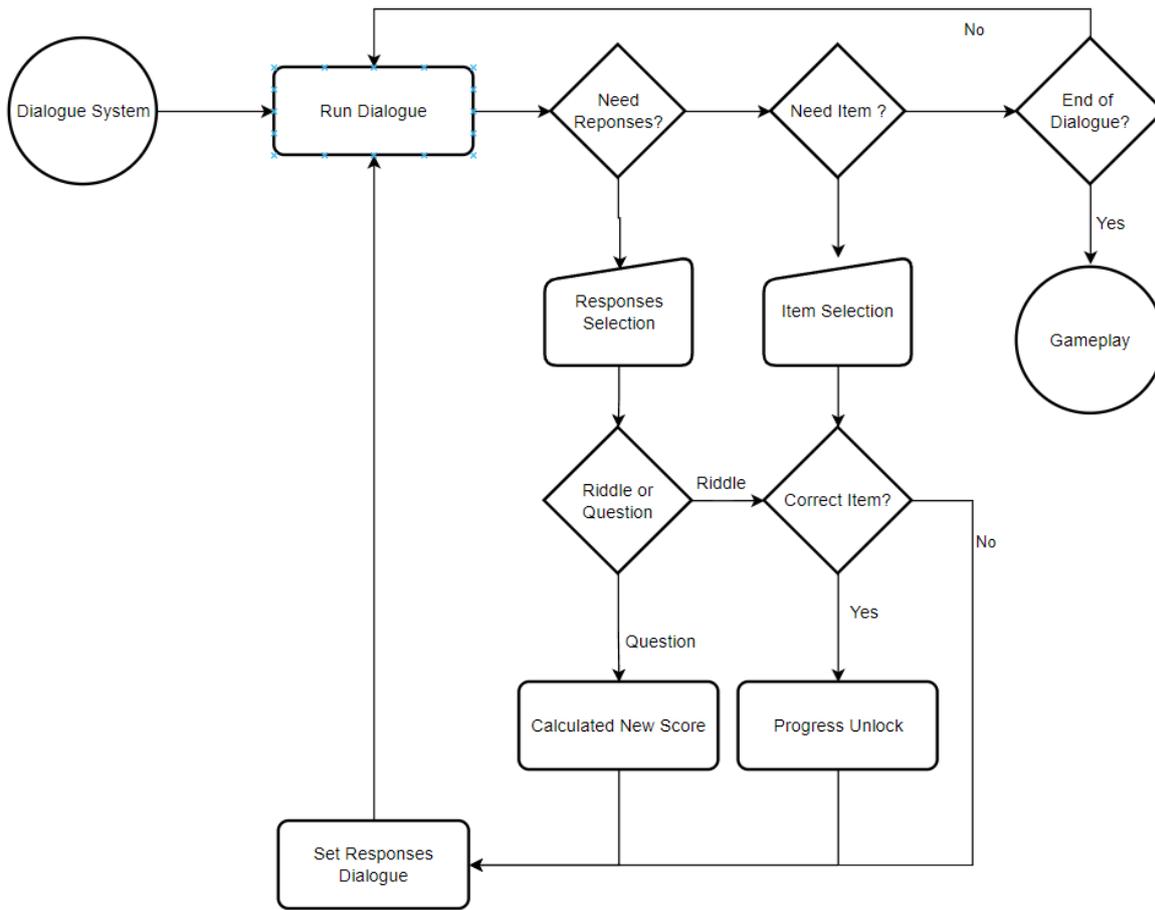
Figure 3.7 Dialogue System flowchart

Figure 3.7 shows the flowchart of the dialogue system. The dialogue system is the main system throughout the game. It is fundamental to responses and the item usage system. When the dialogue system is triggered, it will check if responses or item usage is needed. If no, it will continue to the following dialogue if the next dialogue exists. Multiple-choice is given when responses need. After the player's input, if the question is riddle type, it will check if the answer is correct. If it is correct, then it will unlock the progress defined. If the answer is incorrect, it will display the failed dialogue, and nothing will happen. If the responses type is question type, it will display relevant dialogue according to the choice given and calculated the new score for players.

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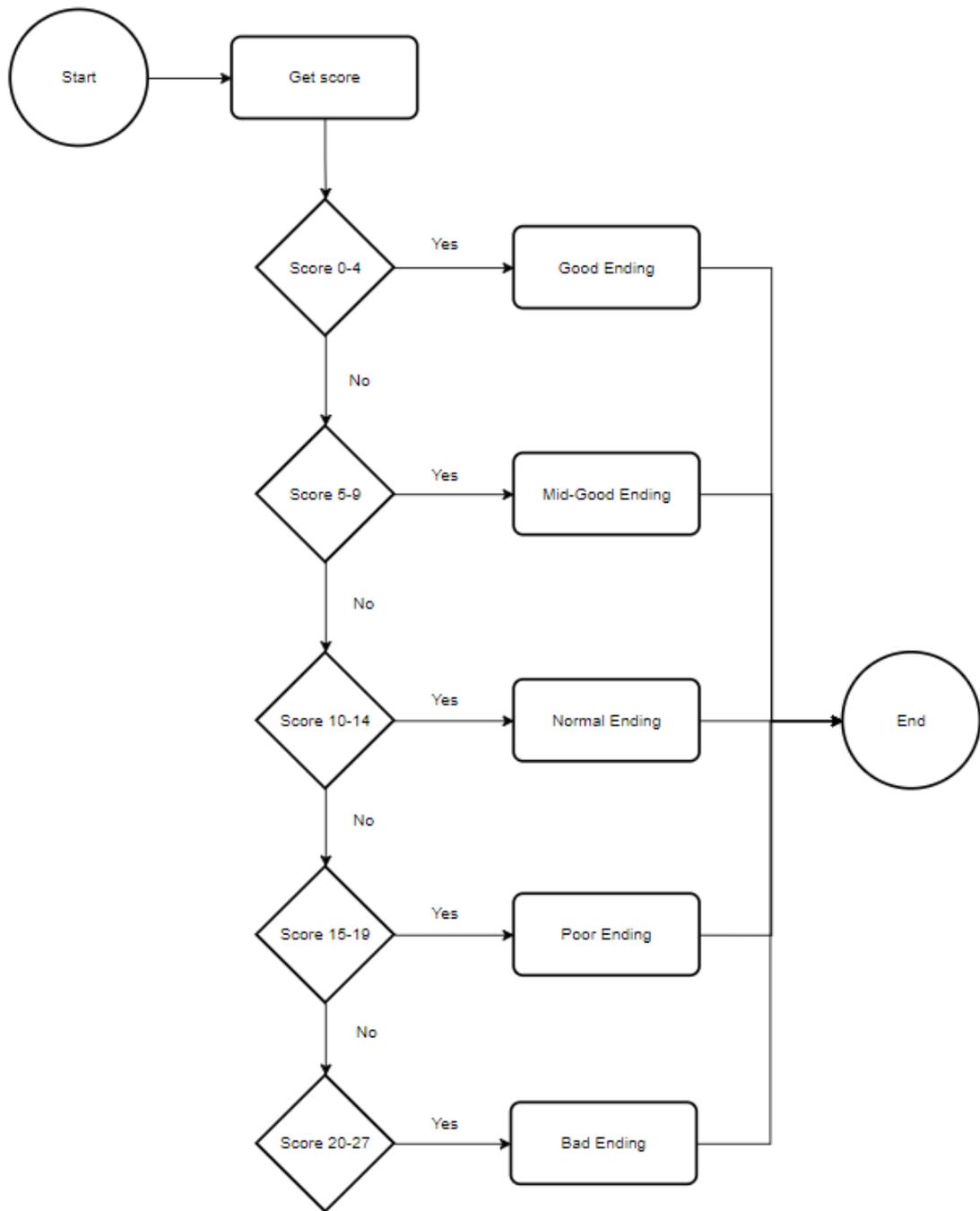
Figure 3.8 Ending flowchart

Figure 3.8 shows the ending flowchart of the game. When the players reach the end of the game, the game will display a relevant ending according to the score players get.

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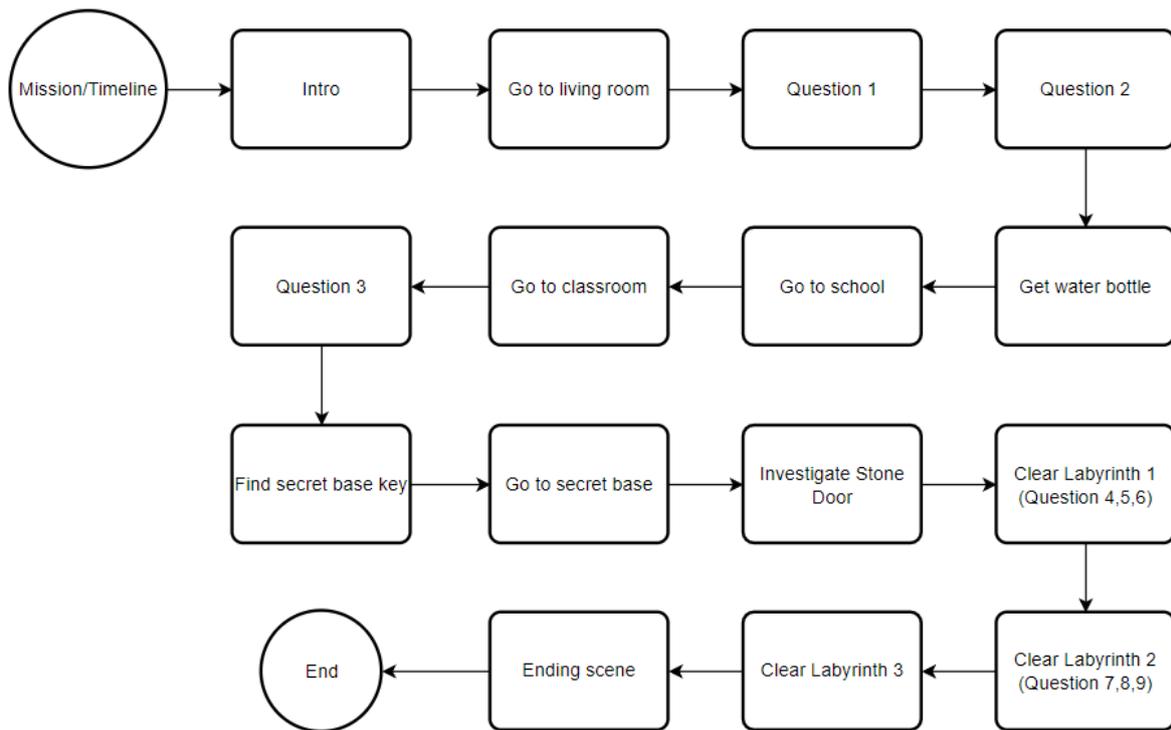
Figure 3.9 Mission/Timeline of the game

Figure 3.9 shows the mission or known as the timeline of the game. The game will progress according to the flow, which takes around 30 minutes to 45 minutes.

3.7 Storyboard

Storyboard Number	1
Page Name	**Main Menu**
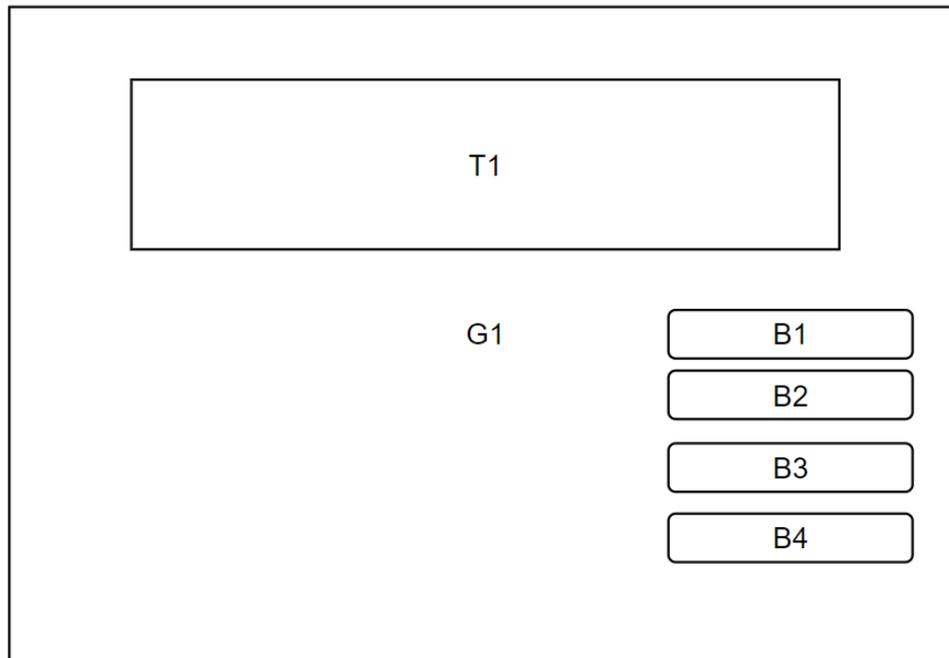
Label	Type	Description
T1	Text	Title of the game
G1	Graphic	A graphic element as the background of the main menu
B1	Button	A "Continue" button to let user to continue from the latest saved game.
B2	Button	A "New Game" button to let user to start new game.
B3	Button	A "Credit" button to let user view the credit of the game.
B4	Button	A "Quit" button to let user quit the game.

Storyboard Number	2
Page Name	Pop up
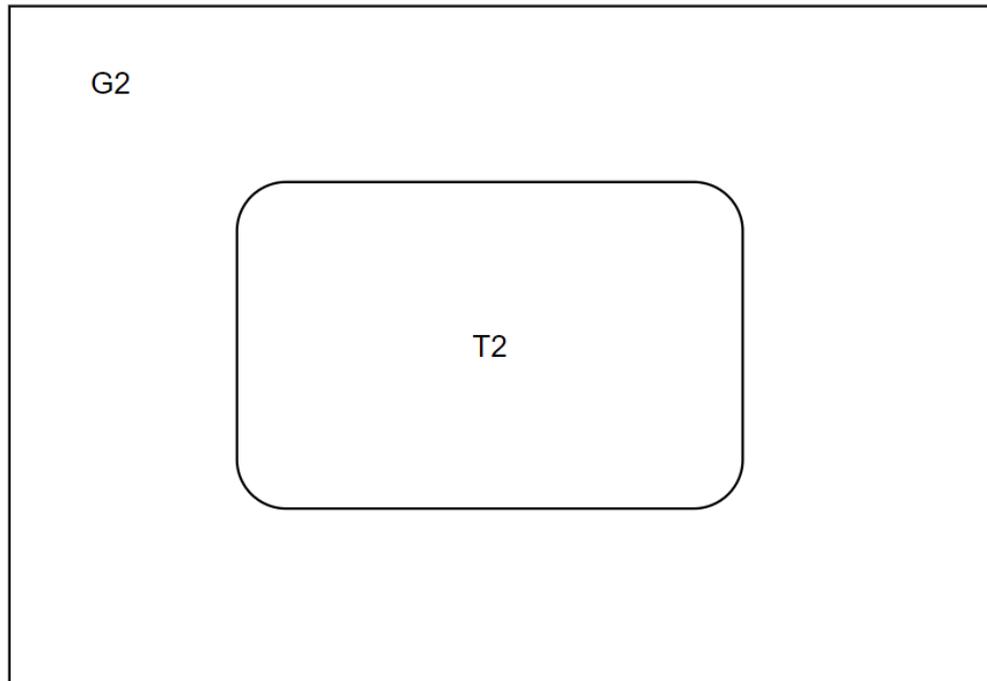
Label	Type	Description
T2	Text	Content of the Pop Up
G2	Graphic	A graphic element as the background.

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Storyboard Number	3
Page Name	**Gameplay UI**

G3

G4
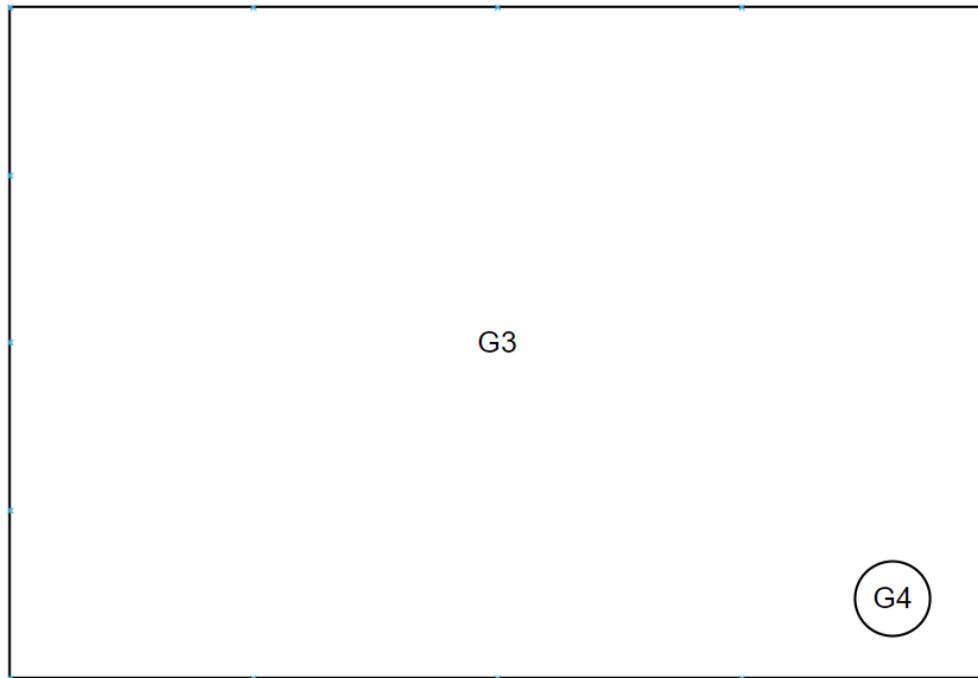
Label	Type	Description
G3	Graphic	Map level of the game.
G4	Graphic	Key Hint for Inventory

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Storyboard Number	4
Page Name	In-game menu 1
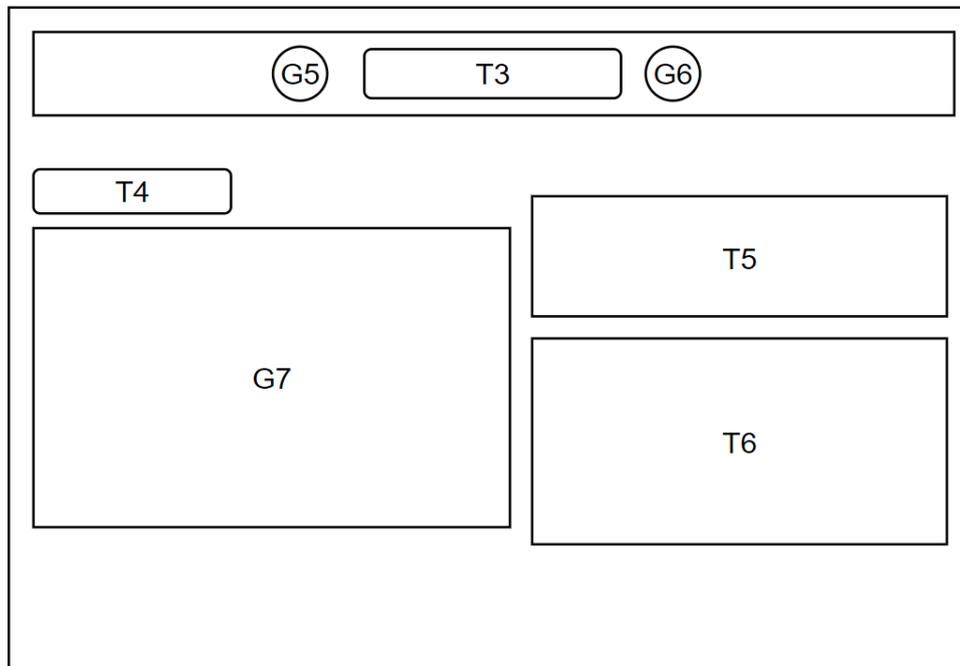
Label	Type	Description
T3	Text	Text content "Inventory"
T4	Text	Text content "Key Item"
T5	Text	Text content display current mission
T6	Text	Text content display the name and description of the key item
G5	Graphic	Graphic show the key hint to change tab.
G6	Graphic	Graphic show the key hint to change tab.
G7	Graphic	Graphic show the inventory item slot.

Storyboard Number	5
Page Name	**In-game menu 2**
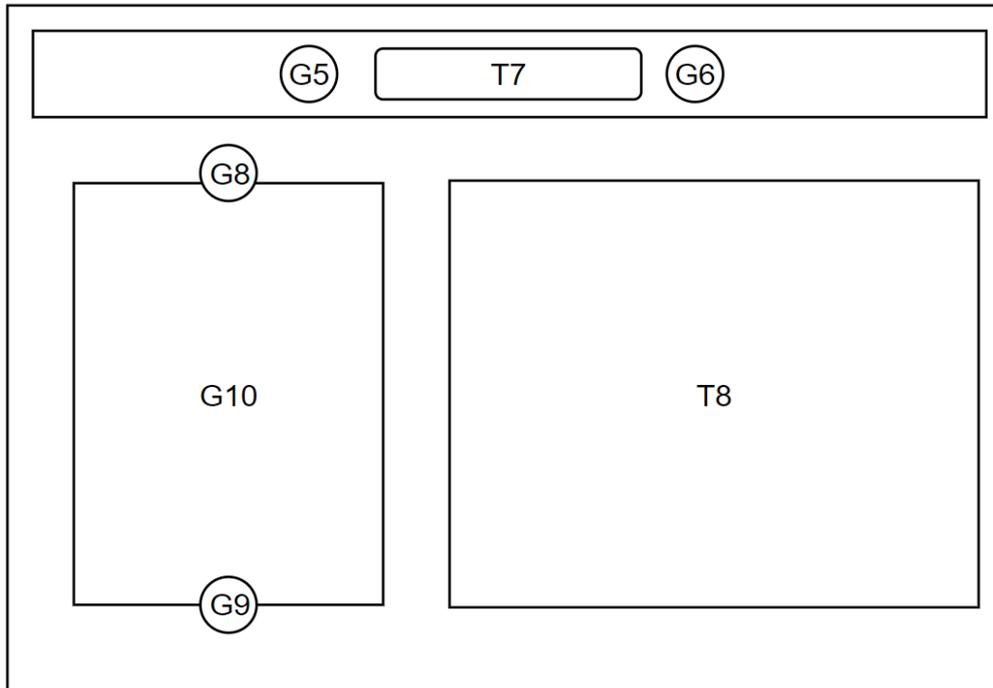
Label	Type	Description
T7	Text	Text context "Log"
T8	Text	Text contexts show the content of the logs.
G8	Graphic	Graphic show the key hint of the available log on top.
G9	Graphic	Graphic show the key hint of the available log on bottom.
G10	Graphic	Graphic show the inventory log item

Storyboard Number	6
Page Name	In-game menu 3
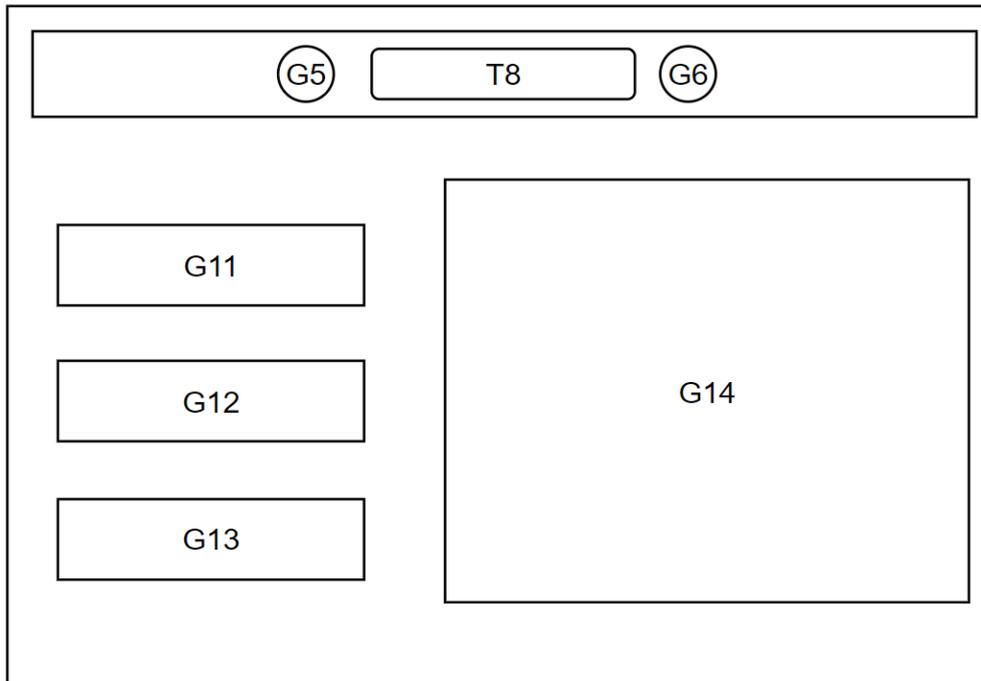
Label	Type	Description
T8	Text	Text content "System"
G11	Graphic	Graphic show the Save button
G12	Graphic	Graphic show the Credit button
G13	Graphic	Graphic show the Quit button
G14	Graphic	Graphic show the control manual of the game.

Chapter 4

4.1 3D Resource Gathering and Creation

For this project, some assets and resources are required to build the game. Most of the asset models are found online.
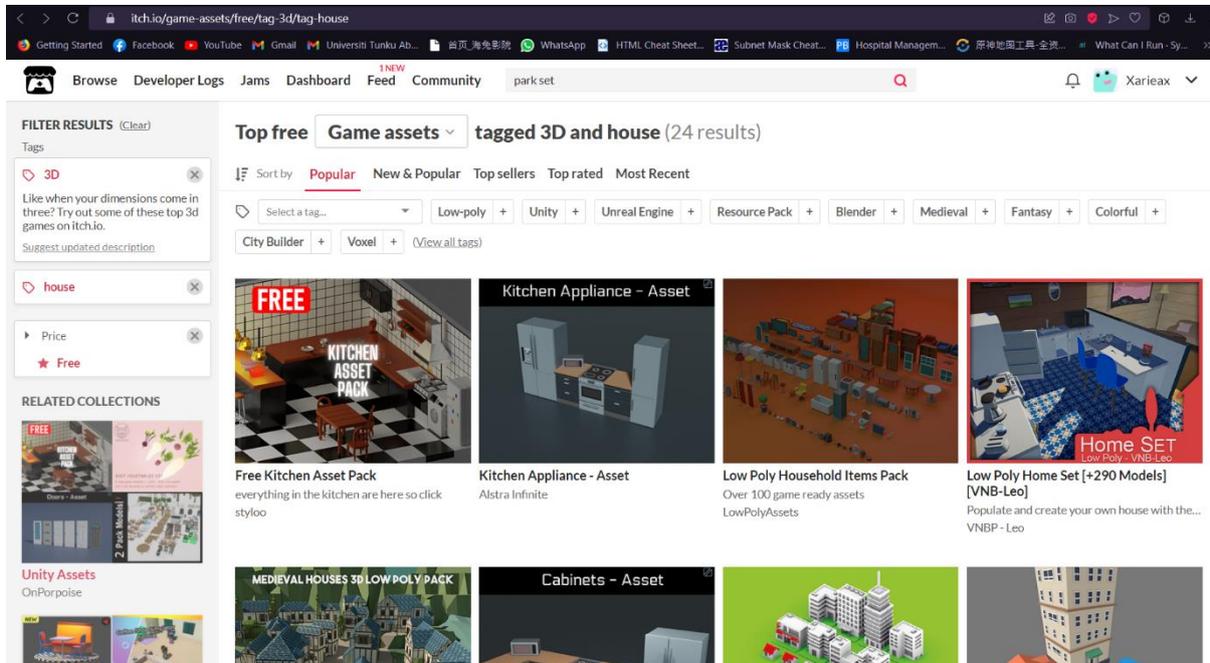
Figure 4.1 itch.io Website

Platform, itch.io is one of the game development platforms for the indie developer. Some of the resources are gathered from this platform.

Below is the list of gathered resources that have been used in the game.

NO	NAME	AUTHOR	WEBSITE
1	Free Medieval Houses 3D Low Poly Models	Free Game Asset (craftpix.net)	https://free-game-assets.itch.io/free-medieval-houses-3d-low-poly-models
2	KayKit: Dungeon Pack (1.0)	Kay Lousberg (www.kaylousberg.com)	https://kaylousberg.itch.io/kaykit-dungeon
3	KayKit: Medieval	Kay Lousberg	https://kaylousberg.itch.io/kaykit-medieval-builder-pack

	Builder Pack (1.0)	(www.kaylousberg. com)	
4	Low Poly Household Items	LowPolyAsset	https://edlunn03.itch.io/low-poly-household-item-pack
5	VNB Low Poly Park Set	VNBP-Leo (https://vnbp.itch.io)	https://vnbp.itch.io/low-poly-3d-park-set

Table 4.1 Credit List

Other than that, some 3D models have also been created through Blender, as not every model is available online.

In the game, a credit page was also included to credit all the authors for their amazing work and allow other users to use their work free for this project.

4.2 Project Development

4.2.1 Fundamental

In the game, players will have the ability to walk and interact with the interactable object. The game will have an isometric, top-down view for players (refer to Figure 4.2).

Figure 4.2 Gameplay scene example.

After creating a new project, delete the original camera object and create the isometric camera (refer to Figure 4.3).
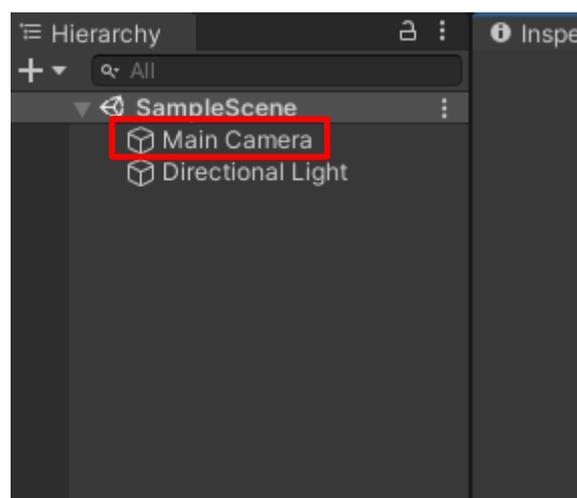
Figure 4.3 Camera Isometric Setting Guide 1

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4.2.2 Camera Isometric Setting

An isometric camera can be created by creating a new game object (refer to Figure 4.4). After creating the game object, set the rotation to x:30 and y:45 (refer to Figure 4.5).
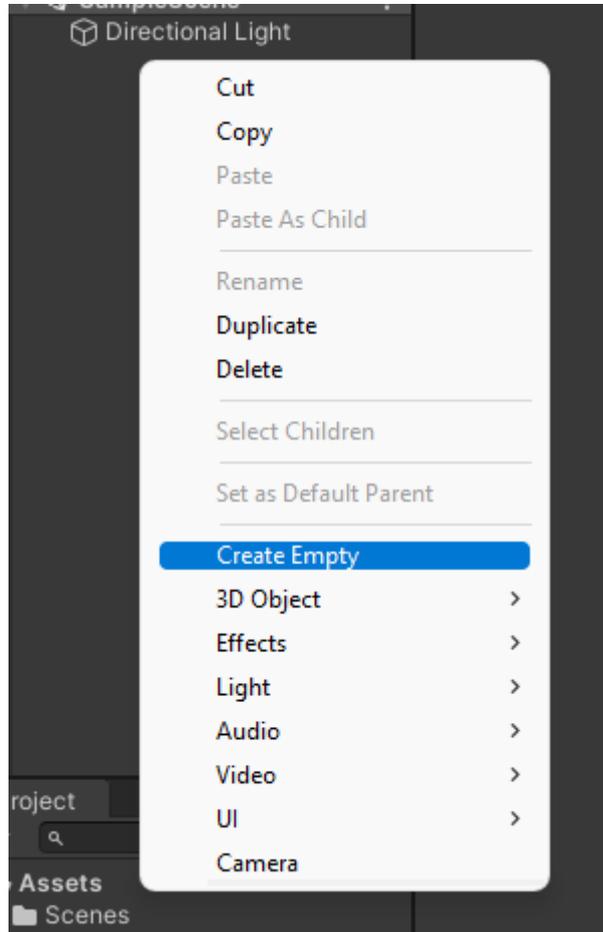
Figure 4.4 Camera Isometric Setting Guide 2
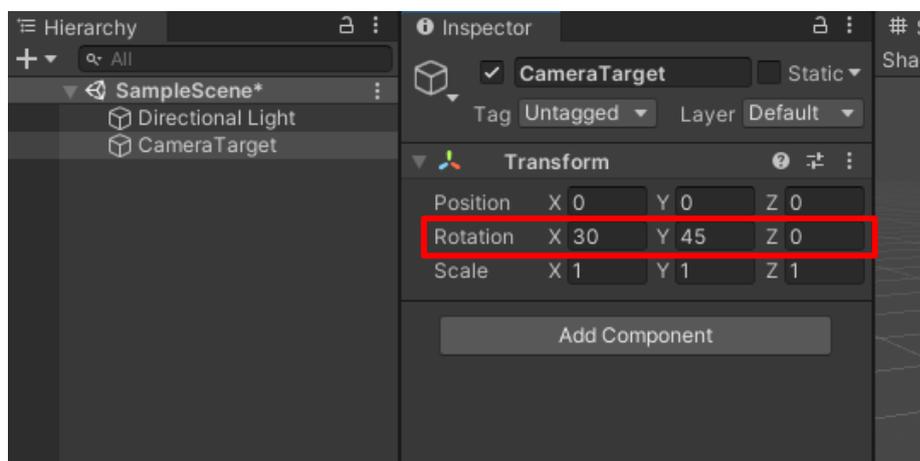
Figure 4.5 Camera Isometric Setting Guide 3
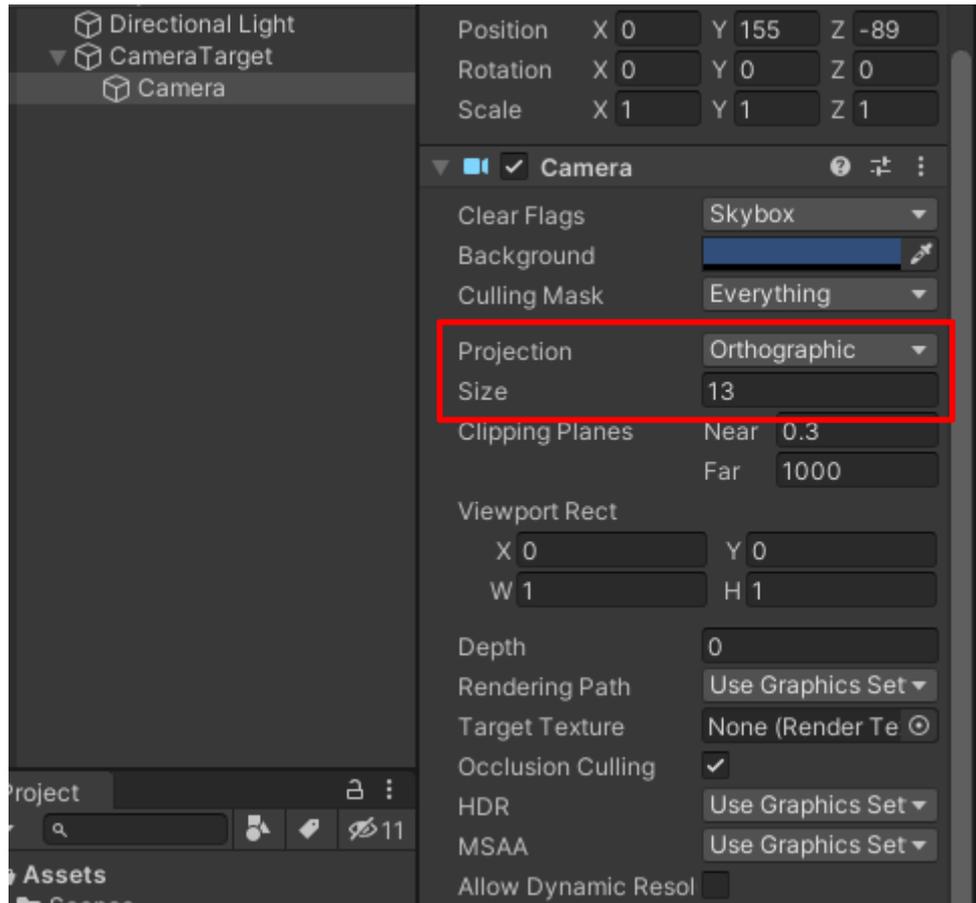
Figure 4.6 Camera Isometric Setting Guide 4

After creating the empty game object, create a new camera object under the Camara Target object (refer to Figure 4.6).

Set the camera setting to Projection> Orthographic and adjust the size accordingly (Figure 4.6). The camera is completely set, and now we can move on to the character movement.

4.2.3 Character Movement
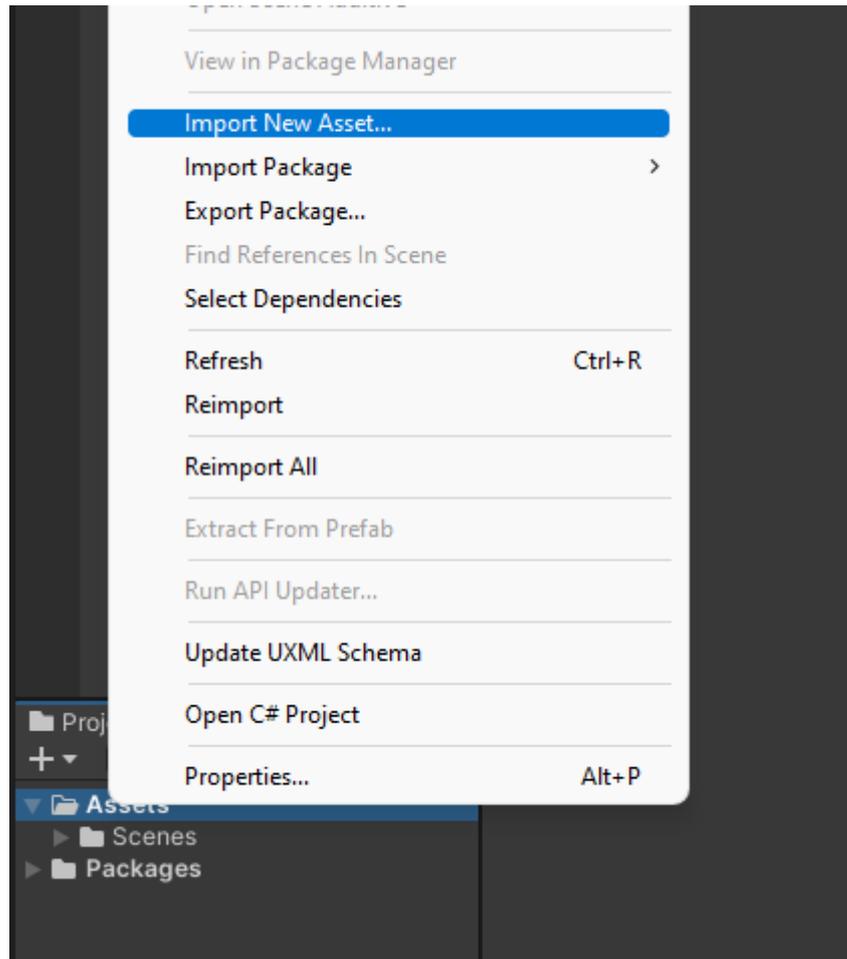
Figure 4.7 How to import Asset

Importing the necessary asset (refer to Figure 4.7) can be added to the hierarchy and start the development.
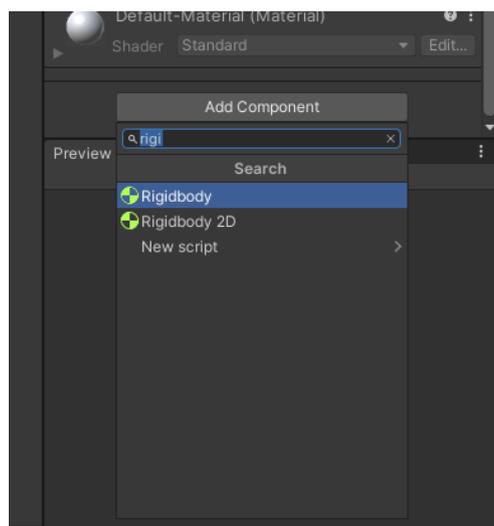
Figure 4.8 Add rigid body component

The player's game object with rigid body and box collider components is created (Figure 4.9).
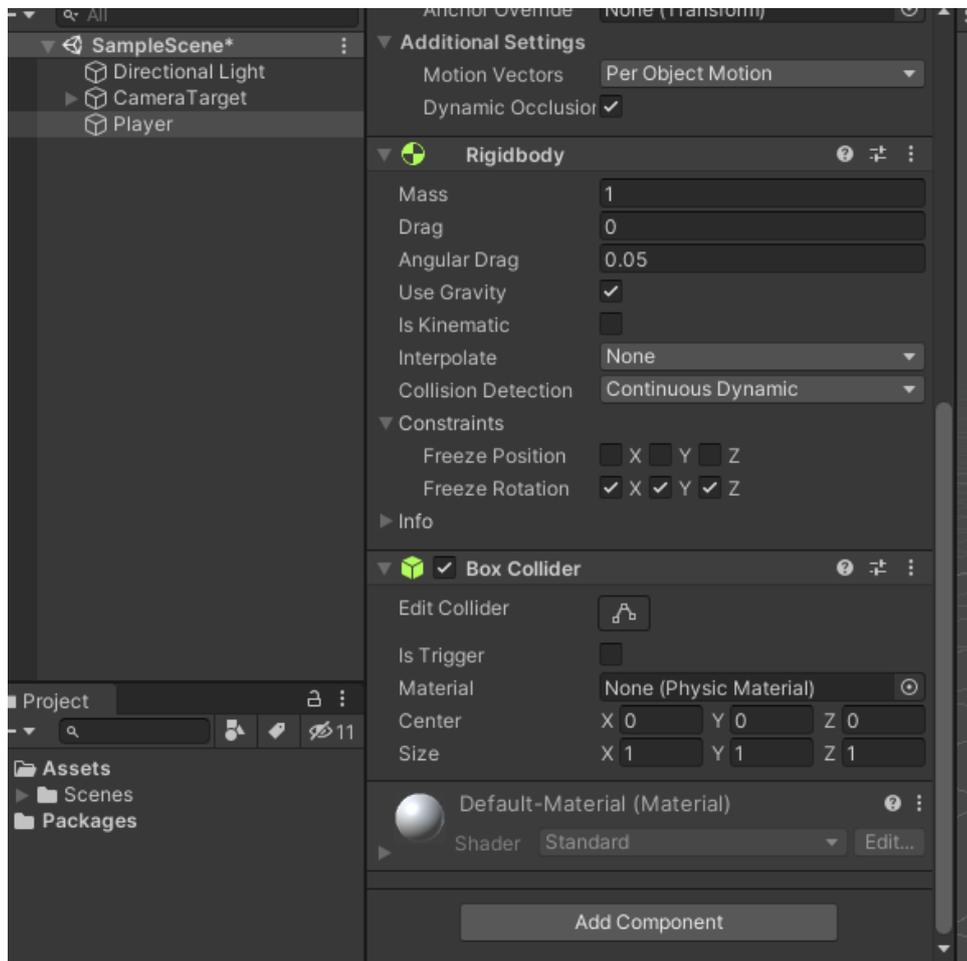
Figure 4.9 Player object Component.

Then create a "char Controller" script to the object.
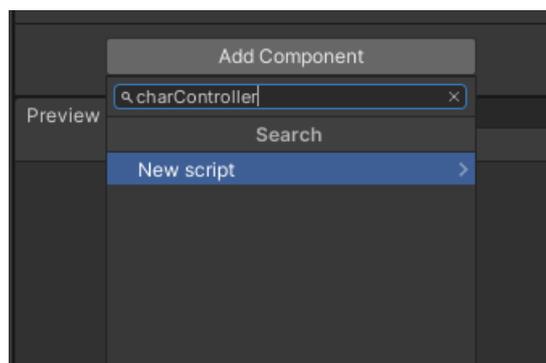
Figure 4.10 Add Component Guide

In Figure 4.11, necessary variable is being defined.

```
public float playerSpeed = 17.0f;
Rigidbody movementRigid;

//isometric movement
Vector3 forward, right;

public int wallColliderCount;

public Animator charAnimator;
```

Figure 4.11 charController script variable

```
 Unity Message | 0 references
void Start()
{
    ...
    //controller = GetComponent<CharacterController>();
    movementRigid = GetComponent<Rigidbody>();
    forward = Camera.main.transform.forward;
    forward.y = 0;
    forward = Vector3.Normalize(forward);
    right = Quaternion.Euler(new Vector3(0, 90, 0)) * forward;
    wallColliderCount = 0;
    charAnimator = GetComponent<Animator>();
}
```

Figure 4.12 Start function of charController script.

Multiple variables have been set in the start function (refer to Figure 4.12). These settings enable the players to move in isometric ways (red arrows refer to Figure 4.13) rather than follow the original axis (blue arrows refer to Figure 4.13).
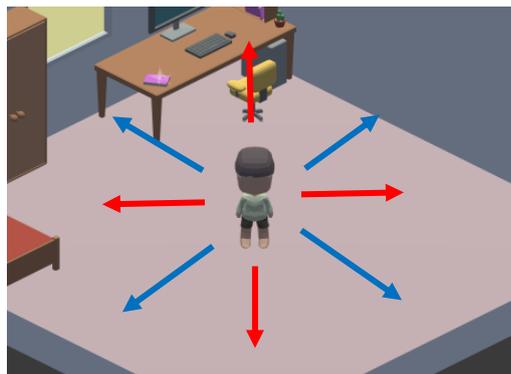
Figure 4.13 Player movement illustration

In the Fixed Update function (refer to Figure 4.14), the horizontal and vertical raw axis input, the arrow key, will be captured. The value got from the input will be calculated with an additional variable such as speed and time fixed delta time to get the smooth movement in the game from one position to another position.

```
⚑ Unity Message | 0 references
void FixedUpdate()
{

    //if(PlayerScript.instance.DialogueBox.GetComponent<DialogueUI>().isOpen) return;
    if (PlayerScript.instance.state != PlayerState.GAME) return;
    if (Input.GetButton("Horizontal") || Input.GetButton("Vertical"))
    {
        if(!PlayerScript.instance.audioManager.isPlaying("Walk"))
        {
            PlayerScript.instance.audioManager.Play("Walk");
        }
        charAnimator.SetBool("ToMove", true);
    }
    else
    {
        PlayerScript.instance.audioManager.Stop("Walk");
        charAnimator.SetBool("ToMove", false);
    }


    Vector3 move = new Vector3(Input.GetAxisRaw("Horizontal"), 0, Input.GetAxisRaw("Vertical"));
    Vector3 direction = new Vector3(0, 0, 0);
    direction.x = Input.GetAxisRaw("Horizontal");
    direction.z = Input.GetAxisRaw("Vertical");
    direction.Normalize();



    Vector3 upmovement = forward * playerSpeed * Time.fixedDeltaTime * direction.z;
    Vector3 rightmovement = right * playerSpeed * Time.fixedDeltaTime * direction.x;

    movementRigid.MovePosition(transform.position + upmovement + rightmovement);
    transform.LookAt(transform.position + upmovement + rightmovement);

}
```

Figure 4.14 Fixed Update function in char Controller script

```
Unity Message | 0 references
private void OnCollisionEnter(Collision collision)
{
    if (collision.gameObject.tag != "Land")
    {
        PlayerScript.instance.audioManager.Play("HitWall");
        wallColliderCount = 1;

    }
}

Unity Message | 0 references
private void OnCollisionStay(Collision collision)
{
    if (collision.gameObject.tag == "Land")
    {
        if (wallColliderCount == 0)
        {
            playerSpeed = 17f;
        }
        else
        {
            playerSpeed = 5f;
        }
    }

}

Unity Message | 0 references
private void OnCollisionExit(Collision collision)
{
    if (collision.gameObject.tag != "Land")
    {
        if (wallColliderCount > 0)
        {
            wallColliderCount--;
        }

    }
}
```

Figure 4.15 Wall Hit collision in char Controller script.

Figure 4.15 shows the functions to prevent the players from moving out of the map's boundary. This function also allows players to collide with the object on the map.

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4.2.4 Interaction

First, interactable object script has been created.

Figure 4.16 Interactable Enum ObjectType

The Enum object variable has been defined to define the type of the object, and multiple variables are being defined (Figure 4.16).

Figure 4.17 Start function of Interactable Object script

In Figure 4.17, the start function will check for the object status every time the object load. If the object exists in the current player's game statistics and disable the object accordingly.

```
if (type == ObjectType.Log)
{
    Debug.Log("Unlocked");
    PlayerScript.instance.logList[index].GetComponent<Log>().unlocked = true;
    dialogueSystem.dialogueOpen(this.gameObject.GetComponent<DialogueScript>().dialogue);
    keyHint.GetComponent<Image>().enabled = false;
    this.gameObject.SetActive(false);
}
else if (type == ObjectType.KeyItem)
{
    PlayerScript.instance.SlotList[index].GetComponent<KeyItem>().unlocked = true;
    dialogueSystem.dialogueOpen(this.gameObject.GetComponent<DialogueScript>().dialogue);
    keyHint.GetComponent<Image>().enabled = false;
    this.gameObject.SetActive(false);
    PlayerScript.instance.charController.wallColliderCount = 0;
    if (isMissionObject)
    {
        this.gameObject.GetComponent<MissionController>().recordMissionPass();
    }
}
else if (type == ObjectType.Dialogue)
{
    dialogueSystem.dialogueOpen(this.gameObject.GetComponent<DialogueScript>().dialogue);
}
else if (type == ObjectType.Unlockable)
{
    dialogueSystem.dialogueOpen(this.gameObject.GetComponent<DialogueScript>().dialogue);

    //keyHint.GetComponent<Image>().enabled = false;
```

Figure 1.18 Script shows how interactable check for it object type

In the update function (refer to Figure 4.18), key input will be captured to run the function. Then it will run the relevant script according to the object type.

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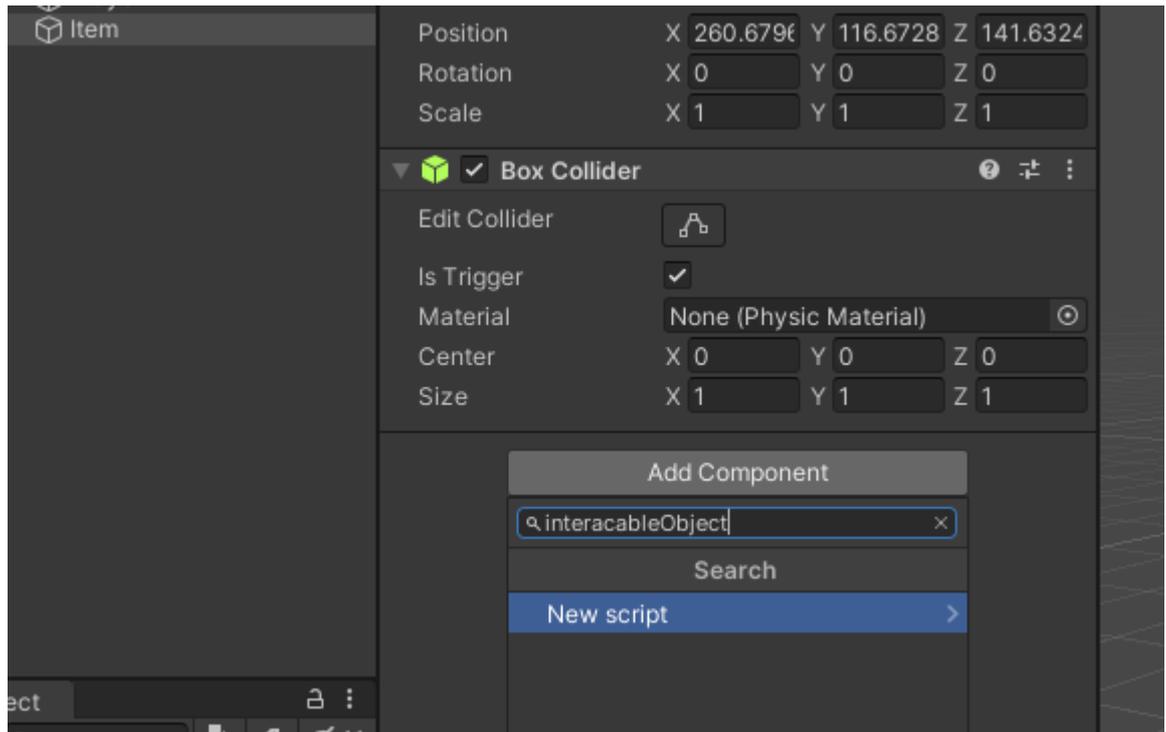
Figure 4.19 Add component Interactable Object script.

Each item will need a box collider or sphere collider and set the is triggered to true to enable the players to trigger it (Figure 4.19). The script used the "is trigger" setting to check if players are in range to interact with the item (refer to Figure 4.20).


```
Unity Message | 0 references
private void OnTriggerEnter(Collider other)
{
    if (other.tag == "Player")
    {
        interactable = true;
        //keyhint show

        keyHint.GetComponent<Image>().sprite = keyHint_Sprite;
        keyHint.GetComponent<Image>().enabled = true;

    }
}

Unity Message | 0 references
private void OnTriggerExit(Collider other)
{
    if (other.tag == "Player")
    {
        //keyhint hide
        keyHint.GetComponent<Image>().enabled = false;
        interactable = false;
```

Figure 4.20 Trigger function of Interactable Object script.

4.2.5 Map Change System
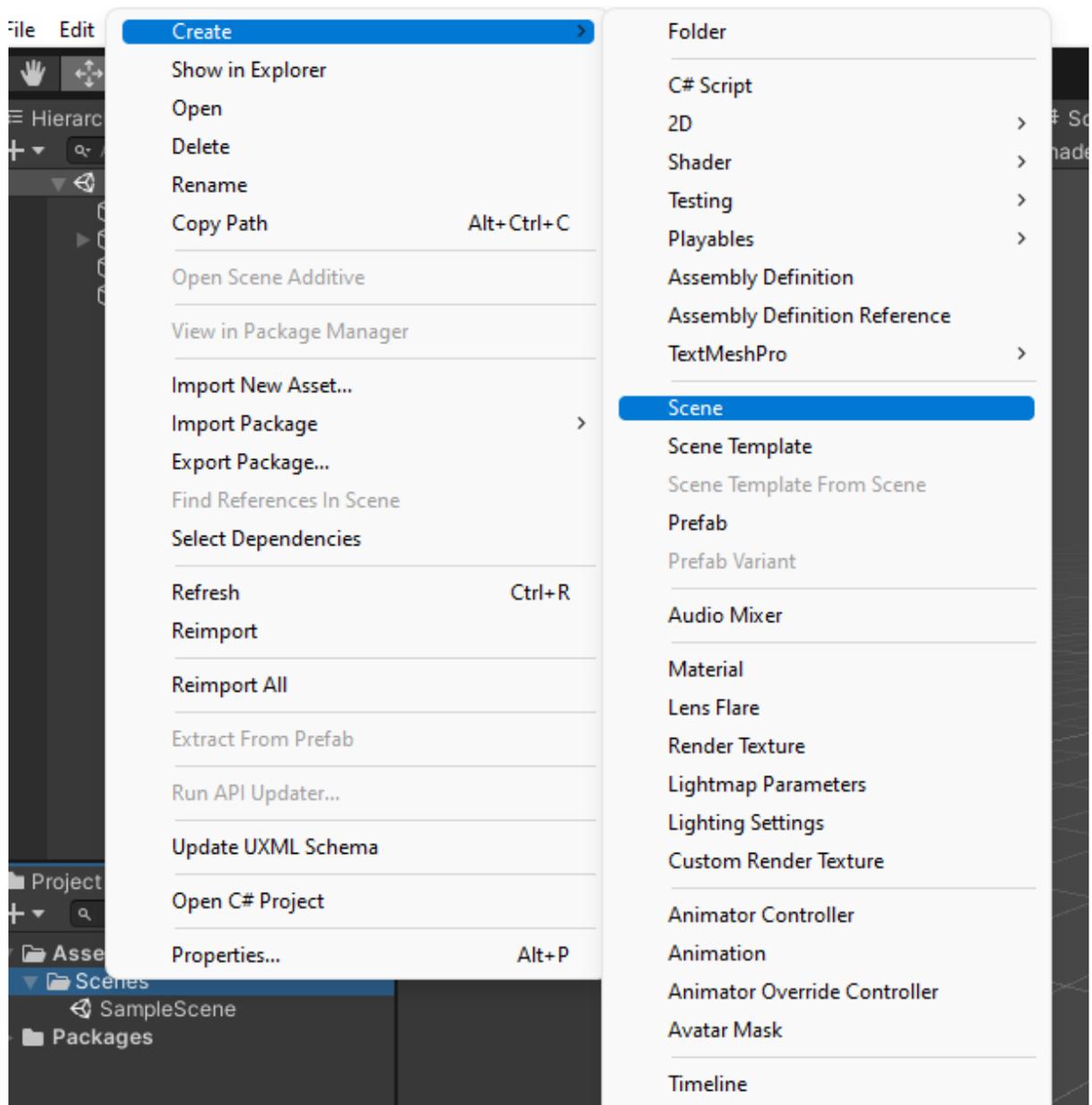
Figure 4.21 Scene Creation

Changing the map is the changing of the scene in Unity. Multiple scenes can be created and link it together using code. Figure 4.21 shows the process to create the scene in Unity.

To change scene, the scenes must be included in the build setting.

File > Build Setting.
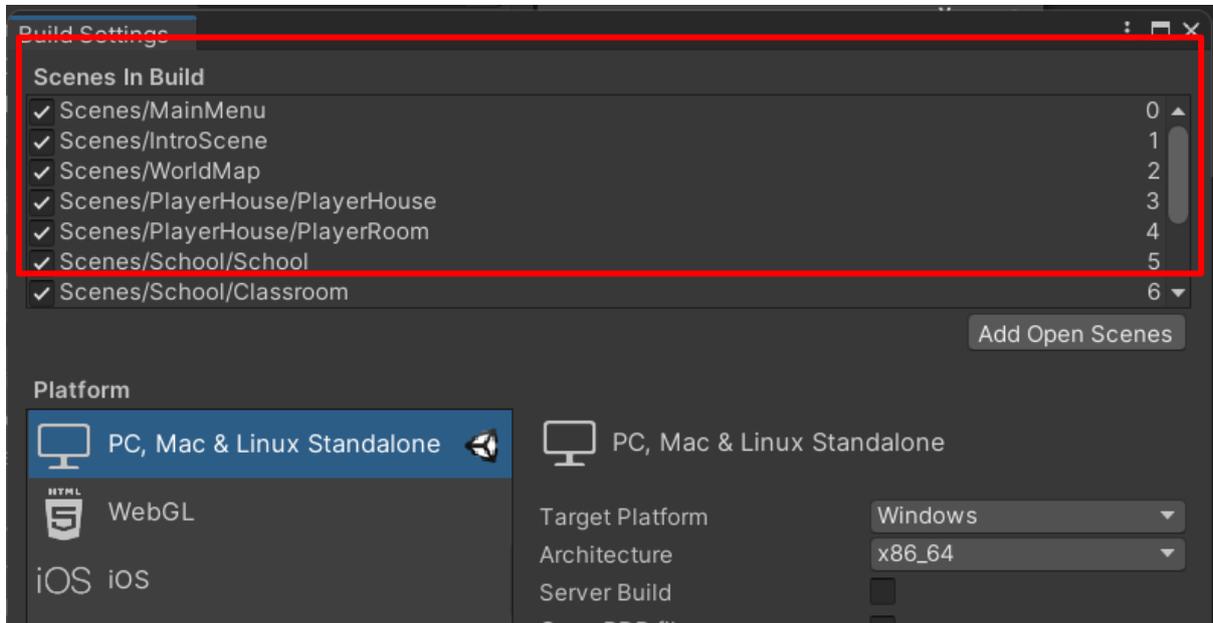
Figure 4.22 Scene Build Setting

The script will have the function to keep track of the players' input, same with the interactable object, then run the transition animation and load the target scene.

After including the scene in the build setting (refer to Figure 4.22), the map change script can be added to the object component where the place on the map wishes to transform players to a specific map.

```csharp
1 reference
void changeScene()
{
    if (!interactable) return;
    if (PlayerScript.instance.state != PlayerState.GAME) return;
    if (!unlocked) return;
    if (Input.GetKeyDown(KeyCode.X))
    {
        if (missionIndexToUnlock >= 0)
        {
            if (PlayerScript.instance.missionList[missionIndexToUnlock].missionPass == false)
            {
                dialogueSystem.dialogueOpen(missionDialogue);
            }
            else
            {
                PlayerScript.instance.audioManager.Play("Transition");
                loadNextMap();
            }
        }
        else
        {
            PlayerScript.instance.audioManager.Play("Transition");
            loadNextMap();
        }
    }
}
```

Figure 4.23 Change Scene Function

This function will save the current map information in the player's preferences which will be needed (Figure 4.24).

```csharp
3 references
public void loadNextMap()
{

    PlayerPrefs.SetString("toMap", toMap);
    PlayerPrefs.SetString("fromMap", fromMap);
    if (!animationScene)
    {
        charController.wallColliderCount = 0;
    }

    StartCoroutine(LoadMap(toMap));
}
```

Figure 4.24 Load Map Function

Start Coroutine function in unity to run animation like async, but it enables the control over the time and animation. The load map coroutine

54 | P a g e

will load the scene first, and after the scene is successfully loaded, it will transform players to the next scene (Figure 4.25).

```
2 references
IEnumerator LoadMap(string map)
{
    transition.SetBool("Start", true);
    if (!animationScene)
    {
        PlayerScript.instance.state = PlayerState.TRANSITION;
        yield return new WaitForSeconds(1f);
        PlayerScript.instance.audioManager.stopAll();
        if (ToBGM != string.Empty)
        {
            PlayerScript.instance.audioManager.Play(ToBGM);
        }
        else
        {
            PlayerScript.instance.audioManager.stopAll();
        }

    }
    if (map == "MainMenu")
    {
        StaticObjectScript.instance.GetComponent<StaticObjectScript>().destroyObject();
    }

    AsyncOperation operation = SceneManager.LoadSceneAsync(map);


    while (!operation.isDone)
    {
        yield return null;
    }
```

Figure 4.25 Load Map Coroutine.

Once players are in the next scene, all the door objects will run the script's Start function and find the position of players that should appear on that map by using the information stored in the player's preferences (refer to Figure 4.26).

```
if (PlayerPrefs.GetString("toMap") == fromMap && PlayerPrefs.GetString("fromMap") == toMap)
{
    if (locationTranfrom != null)
    {
        charController = GameObject.FindGameObjectWithTag("Player").GetComponent<CharController>();
        PlayerScript.instance.transform.position = locationTranfrom.position;
        PlayerScript.instance.resetPosition = locationTranfrom.position;
        charController.wallColliderCount = 0;
        keyHintUI.GetComponent<Image>().enabled = false;
    }


    //PlayerScript.instance.transform.eulerAngles = locationTranfrom.eulerAngles;
}
```

Figure 4.26 Find Location of player script.

4.2.6 Dialogue System

The dialogue system is the main core of the game, as all the functions are connected to the dialogue system. The dialogue system is not only used as the medium to transfer information to players like "Key item obtained" item or log is collected, but it also has the functionality to ask a question and get a response from players. Other than that, it also has an item usage system that lets players use a certain item in some scenarios. As many dialogues will be needed throughout the game, a scriptable object has been defined to make the process easier (refer to Figure 4.27).

```csharp
[Serializable]
[CreateAssetMenu(fileName = "Data", menuName = "ScriptableObjects/Dialogue", order = 1)]
Unity Script | 14 references
public class Dialogue : ScriptableObject
{
    public string characterName;

    [TextArea(5,20)]
    public List<string> dialogue;

    public bool needResponses;

    public bool needUnlockable;

    public bool gotNextTimeline;

    public List<Response> response;

    public Unlockable unlockable;

    public string nextTimeline;

    public Dialogue nextDialogue;

    public bool recordAsUnlock;
    public string recordString;


}
```

Figure 4.27 Dialogue System Script Variable.
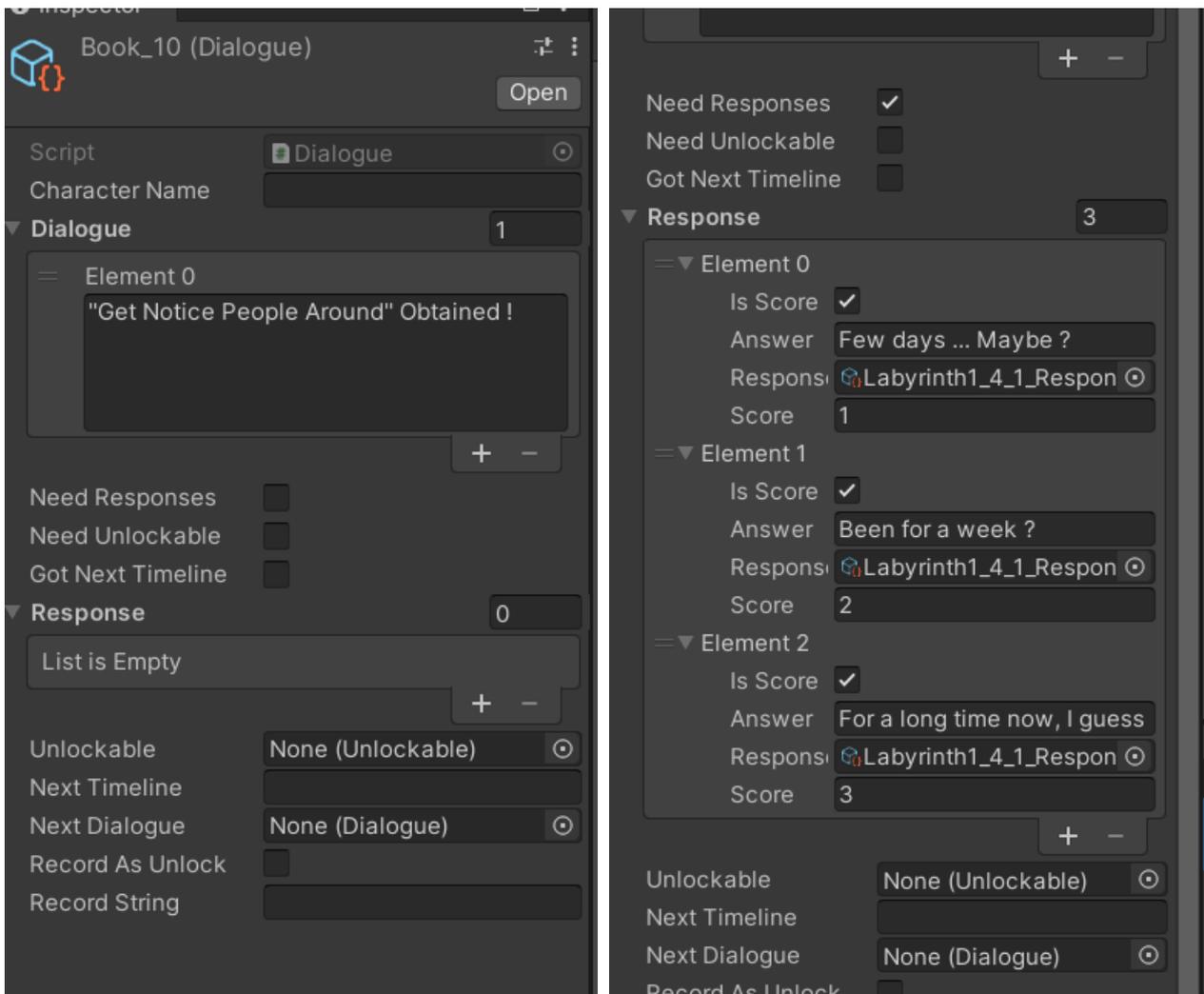
Figure 4.28 Dialogue Scriptable Object Class

All the dialogue assets are created with the class's own target, and how the dialogue will behave accordingly. Figure 4.28 shows the dialogue, and when the dialogue is required for responses, responses will be included as well.

```
13 references
public void dialogueOpen(Dialogue dialogue)
{
    if (interactUI.activeSelf)
    {
        StopAllCoroutines();
        dialogueClose();
    }
    try
    {
        PlayerScript.instance.state = PlayerState.DIALOGUE;
        if (PlayerScript.instance.audioManager.isPlaying("Walk"))
        {
            PlayerScript.instance.audioManager.Stop("Walk");
        }
    }
    catch { }


    interactUI.SetActive(true);
    try
    {
        freeUI.SetActive(false);
    }
    catch
    {

    }

    currentDialogue = dialogue;
    StartCoroutine(StepThroughDialogue(currentDialogue));
}
```

Figure 4.29 Dialogue Open function

The dialogue will open through the function "Dialogue open" to change the UI layout (refer to Figure 4.29). The function will open the dialogue UI and start the coroutine function, which will run through the dialogue until the dialogue is finished. The coroutine function "Step through dialogue" will get the dialogue and run through the dialogue. At the last of the dialogue, it will check for additional setting such as if this dialogue required responses or item usage, if the dialogue is linked to a timeline, or even linked to another dialogue.

```csharp
1 reference
private IEnumerator StepThroughDialogue(Dialogue dialogue)
{
    nextKeyHint.SetActive(false);
    if (dialogue.characterName != "Player")
    {
        textNameContainer.text = dialogue.characterName;
    }
    else
    {
        textNameContainer.text = PlayerScript.instance.playerName;
    }

    for (int i = 0; i < dialogue.dialogue.Count; i++)
    {
        textContainer.text = string.Empty;
        yield return new WaitForSeconds(0.3f);
        nextKeyHint.SetActive(false);
        string context = dialogue.dialogue[i];
        try
        {
            context = context.Replace("{playername}", PlayerScript.instance.playerName);
        }
        catch { }
        audioManager.Play("TypeWritterEffect");
        yield return typeWriter.Run(context, textContainer);
        audioManager.Stop("TypeWritterEffect");
        //if (i == dialogue.dialogue.Count - 1 && (dialogue.needResponses || dialogue.needUnlockable)) break;
        nextKeyHint.SetActive(true);
        yield return new WaitUntil(() => Input.GetKeyDown(KeyCode.X));
        audioManager.Play("Dialogue_Click");
        nextKeyHint.SetActive(false);
    }
}
```

Figure 4.30 Dialogue Text run Function

The step-through dialogue function (refer to Figure 4.30) will run the text through the typewriter effect script, which gives it the typewriter effect when the dialogue is in a run. The for loop will run until the end of the dialogue. After the loop, it will check if additional settings are required.

```
if (dialogue.needResponses)
{
    //build ans container;
    nextKeyHint.SetActive(false);
    responseContainerBuild(dialogue);
}
else if (dialogue.needUnlockable)
{
    nextKeyHint.SetActive(false);
    unlockableSystem.unlockableItemContainerBuild(dialogue);

}
else if (dialogue.gotNextTimeline)
{
    try
    {
        PlayerScript.instance.state = PlayerState.TIMELINE;
        if (PlayerScript.instance.audioManager.isPlaying("Walk"))
        {
            PlayerScript.instance.audioManager.Stop("Walk");
        }
    }
    catch { }


    interactUI.SetActive(false);
    dialogueClose();
    GameObject.Find(dialogue.nextTimeline).GetComponent<PlayableDirector>().Play();
}
else if (dialogue.nextDialogue != null)
{
    dialogueOpen(dialogue.nextDialogue);
}
else if (dialogue.recordAsUnlock)
{
    PlayerScript.instance.unlockableUnlock.Add(dialogue.recordString);
    GameObject.Find(dialogue.recordString).SetActive(false);
    dialogueClose();
}
else
{
    dialogueClose();
}
```

Figure 4.31 Dialogue Additional Event handler

When responses are required, it will run the response container build, which will dynamically build the selection of the response according to the dialogue scriptable object. If item usage is required, it will run the unlockable item container build, which will build according to the available item currently in the inventory (refer to Figure 4.31).

4.2.7 Save System

The save system is used to save the progress of the players. Although the game time is short, this functionality enables players to get away from the game when required. The save system will get all the required data from the player script (refer to Figure 4.32), which is a static variable that stores all the data of the game, such as collected logs, key items and unlocked doors or progress made so far.


```csharp
public class PlayerScript : MonoBehaviour
{
    // Start is called before the first frame update

    private List<string> alwaysUnlocked = new List<string>()
    {
        "DoorToWorldMap", "DoorToSchool", "DoorToWorld", "DoorToClassRoom","DoorToHouse","DoorToPlayerHouse","DoorToPlayerRoom"
    };

    public List<GameObject> logList = new List<GameObject>();
    public List<GameObject> SlotList = new List<GameObject>();

    public List<string> unlockableUnlock = new List<string>();
    public List<string> passTimeline = new List<string>();

    public List<Mission> missionList = new List<Mission>();

    public static PlayerScript instance;

    public string playerName;

    public int playerDepressionScore;

    public PlayerMentalState mentalState;

    public Dialogue endingDialogue;
    public Dialogue[] endingDialogueList;

    public PlayerState state;

    //public static List<KeyItem> ItemList = new List<KeyItem>();

    public CharController charController;
    //public MissionController missionController;

    public AudioManager audioManager;

    public Vector3 resetPosition;
```

Figure 4.32 Player script variable.

The save system will save all the data in the form of JSON. As JSON can only serialize basic data types such as string, integer, float, and Boolean, we need to divide the data required to save into basic data the JSON can understand. A Save Data class has been created to save the data required when writing it onto the JSON file.

```csharp
[System.Serializable]
24 references
public class SaveData
{
    //logUnlockList
    //only store unlocked index
    public List<int> logUnlock;

    //itemUnlockList
    //only store unlocked index
    public List<int> itemUnlock;

    //unlockableUnlock
    //store full list
    public List<string> unlockableUnlockList;

    //timelinelist
    //store full list
    public List<string> passTimeline;

    //passmissionindexlist
    //store pass index
    public List<int> passMissionList;


    //player info
    public string playerName;
    public int playerDepressionScore;

    //player location
    public float playerPositionX;
    public float playerPositionY;
    public float playerPositionZ;

    //player current scene;
    public string scene;

    public bool loadFromSave;
    public bool newGame;

    public static SaveData savedData = new SaveData();

}
```

Figure 4.33 Save Data Class

Figure 4.33 is the class created to save the data in the basic form such as integer and string. The Save System script will have the function to create the required Save Data variable before performing the write function.

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```
1 reference
SaveData createSaveData()
{
    SaveData data = new SaveData();

    //current log
    data.logUnlock = new List<int>();
    foreach(var item in PlayerScript.instance.logList)
    {
        if(item.GetComponent<Log>().unlocked)
        {
            data.logUnlock.Add(PlayerScript.instance.logList.IndexOf(item));
        }
    }
    //current item
    data.itemUnlock = new List<int>();
    foreach(var item in PlayerScript.instance.SlotList)
    {
        if(item.GetComponent<KeyItem>().unlocked)
        {
            data.itemUnlock.Add(PlayerScript.instance.SlotList.IndexOf(item));
        }
    }
    //current unlockable unlock
    data.unlockableUnlockList = new List<string>();
    data.unlockableUnlockList = PlayerScript.instance.unlockableUnlock;

    //current timeline
    data.passTimeline = new List<string>();
    data.passTimeline = PlayerScript.instance.passTimeline;

    //current passMission
    data.passMissionList = new List<int>();
    foreach(var item in PlayerScript.instance.missionList)
    {
        if(item.missionPass)
        {
            data.passMissionList.Add(PlayerScript.instance.missionList.IndexOf(item));
        }
    }
    //current playerinfo
    data.playerName = PlayerScript.instance.playerName;
    data.playerDepressionScore = PlayerScript.instance.playerDepressionScore;
    //location
    data.playerPositionX = PlayerScript.instance.gameObject.transform.position.x;
    data.playerPositionY = PlayerScript.instance.gameObject.transform.position.y;
    data.playerPositionZ = PlayerScript.instance.gameObject.transform.position.z;
    //current scene
    data.scene = SceneManager.GetActiveScene().name;

    return data;
}
```

Figure 4.34 Save Data Created Function.

The save data has been created through the function in Figure 4.34. After creating the save data variable, the save game function will perform the write function on the JSON file using the Stream Writer after converting the save data into JSON string format.

```
1 reference
public void saveGame()
{
    SaveData data = createSaveData();

    string jsonString = JsonUtility.ToJson(data);

    StreamWriter sw = new StreamWriter(Application.persistentDataPath + "/saveData.auraland");
    sw.Write(jsonString);
    sw.Close();

    Debug.Log("Save : " + Application.persistentDataPath + "/saveData.auraland");
}
```

Figure 4.35 Save Game Function

The save function will save the file in the application persistent Data Path where the application default is set (Figure 4.35). When players load the saved game, the load function (refer to Figure 4.36) is run and gets the file using the stream reader function and reloads the file string into the save data class. In the player script, if the game is loaded from the game, all the data will be loaded from the save data to its respective variable in the Start function (refer to Figure 4.37).

```
1 reference
public bool loadGame()
{
    if (File.Exists(Application.persistentDataPath + "/saveData.auraland"))
    {
        StreamReader sr = new StreamReader(Application.persistentDataPath + "/saveData.auraland");

        string jsonString = sr.ReadToEnd();

        sr.Close();

        SaveData data = JsonUtility.FromJson<SaveData>(jsonString);

        data.loadFromSave = true;

        SaveData.savedData = data;

        StartCoroutine(LoadMap(data.scene));

        return true;
    }
    else
    {
        return false;
    }
}
```

Figure 4.36 Load Game Function

```
if (SaveData.savedData.loadFromSave)
{
    //playerinfo
    Vector3 playerPosition = new Vector3(SaveData.savedData.playerPositionX, SaveData.savedData.playerPositionY, SaveData.savedData.playerPositionZ);
    instance.gameObject.transform.position = playerPosition;
    playerName = SaveData.savedData.playerName;
    playerDepressionScore = SaveData.savedData.playerDepressionScore;

    //log list
    logList.ForEach(x => x.GetComponent<Log>().unlocked = false);
    SaveData.savedData.logUnlock.ForEach(x => logList[x].GetComponent<Log>().unlocked = true);
    //keyitme list
    SlotList.ForEach(x => x.GetComponent<KeyItem>().unlocked = false);
    SaveData.savedData.itemUnlock.ForEach(x => SlotList[x].GetComponent<KeyItem>().unlocked = true);
    //unlockableunlock
    unlockableUnlock = SaveData.savedData.unlockableUnlockList;
    //timeline
    passTimeline = SaveData.savedData.passTimeline;
    //mission
    missionList.ForEach(x => x.missionPass = false);
    SaveData.savedData.passMissionList.ForEach(x => missionList[x].missionPass = true);
    //audio
    Scene x = SceneManager.GetActiveScene();
    if (x.name == "WorldMap")
    {
        audioManager.sceneBGM = "WorldMap_BGM";
    }
    else
    {
        audioManager.sceneBGM = "InDoor_BGM";
    }
}
```

Figure 4.37 Player Script Load Function

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4.2.8 Audio System

Audio is an essential aspect of a game that brings emotion and theme to the game. An audio system script has been created to control the audio played during the game. A list of the audio clip has been defined, and from the list, all the audio clips can be accessed by either using the index or name. The name will be used as the trigger to play the audio clip in this scenario. It is easier to access the audio using the name than memorizing the index when developing. A sound class has

```
9 references
public class Sound
{
    public string soundName;

    public AudioClip clip;

    public bool loop;

    [Range(0f,1f)]
    public float volume;


    [HideInInspector]
    public AudioSource source;


}
```

Figure 4.38 Sound Class

been created with the necessary variable defined to achieve the purpose. (refer to Figure 4.38).

Then, a list was created in the audio system to store all the sound available in the game. It is also easier and more flexible to manage if any new audio or sound effects are required to add to the game in future.

```csharp
// Unity Message | 0 references
private void Awake()
{
    foreach (Sound item in soundList)
    {
        item.source = gameObject.AddComponent<AudioSource>();
        item.source.clip = item.clip;
        item.source.volume = item.volume;
        item.source.loop = item.loop;
    }
}
```

Figure 4.39 Awake Function of Audio System Script

The Audio Source component will be added dynamically according to the list in the awake function (refer to Figure 4.39).

```csharp
88 references
public void Play(string name)
{
    Sound s = soundList.FirstOrDefault(x => x.soundName == name) as Sound;
    s.source.Play();
}

7 references
public void Stop(string name)
{
    Sound s = soundList.FirstOrDefault(x => x.soundName == name) as Sound;
    s.source.Stop();
}

2 references
public void stopAll()
{
    soundList.ForEach(x => x.source.Stop());
}

6 references
public bool isPlaying(string name)
{
    Sound s = soundList.FirstOrDefault(x => x.soundName == name) as Sound;
    if(s.source.isPlaying)
    {
        return true;
    }
    else
    {
        return false;
    }
}
```

Figure 4.40 Audio Control Functions

After that, multiple control functions like play, stop, stop all, and is Playing function are created to enable the usage of controlling the audio on the other script (refer to Figure 4.40). When sound or sound

effect is required during several actions, call the function from the required script and the sound will run according.

Figure 4.41 Audio System Usage

Figure 4.41 shows that the typewriter sound effect is triggered using the Play function and the name of the audio clip.

4.2.9 Game Build Setting

After the development, the game deployment and testing are done on the game. The game can be deployed from the build setting by building the game.

File > Build Setting > Players Setting
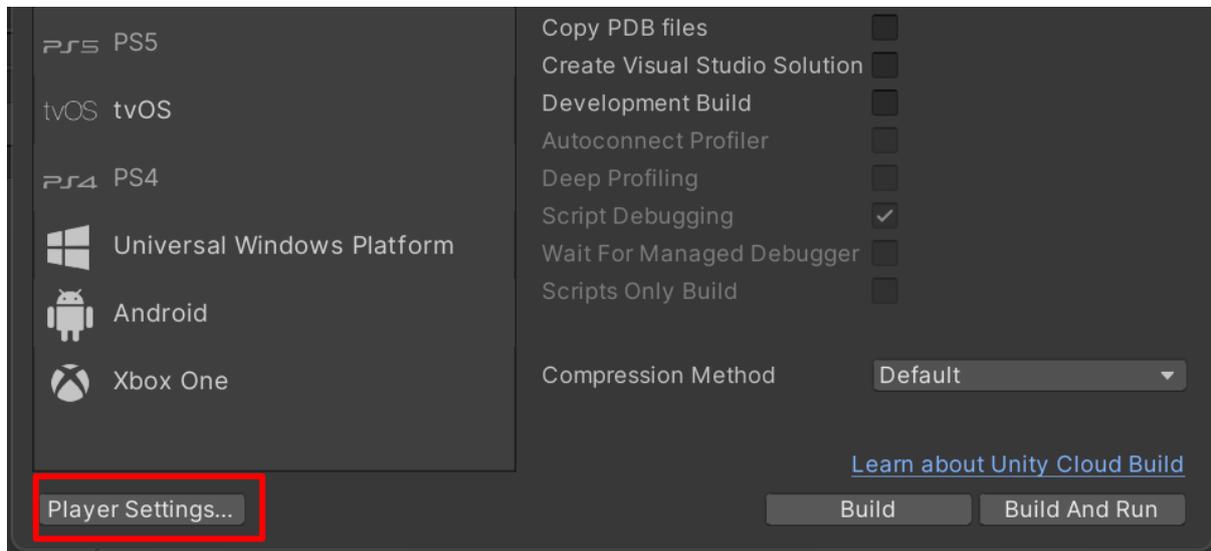
Figure 4.42 Build Setting > Player Setting.

Open the Players Setting (Figure 4.42) to further set the game's details, such as resolution, icon, and other additional settings.

Open the Resolution and Presentation tab after the basic setting is set to further tune the build. As figure 4.43 shows, Company Name, product name, version and icon can be set in the setting. For cursor, as this project will not require a cursor, so the cursor icon will not be set. In the resolution and presentation tab (refer to Figure 4.44), the type of screen mode and default resolution will be set as above.

After the setting is done, the game can be built into standalone software to play with.
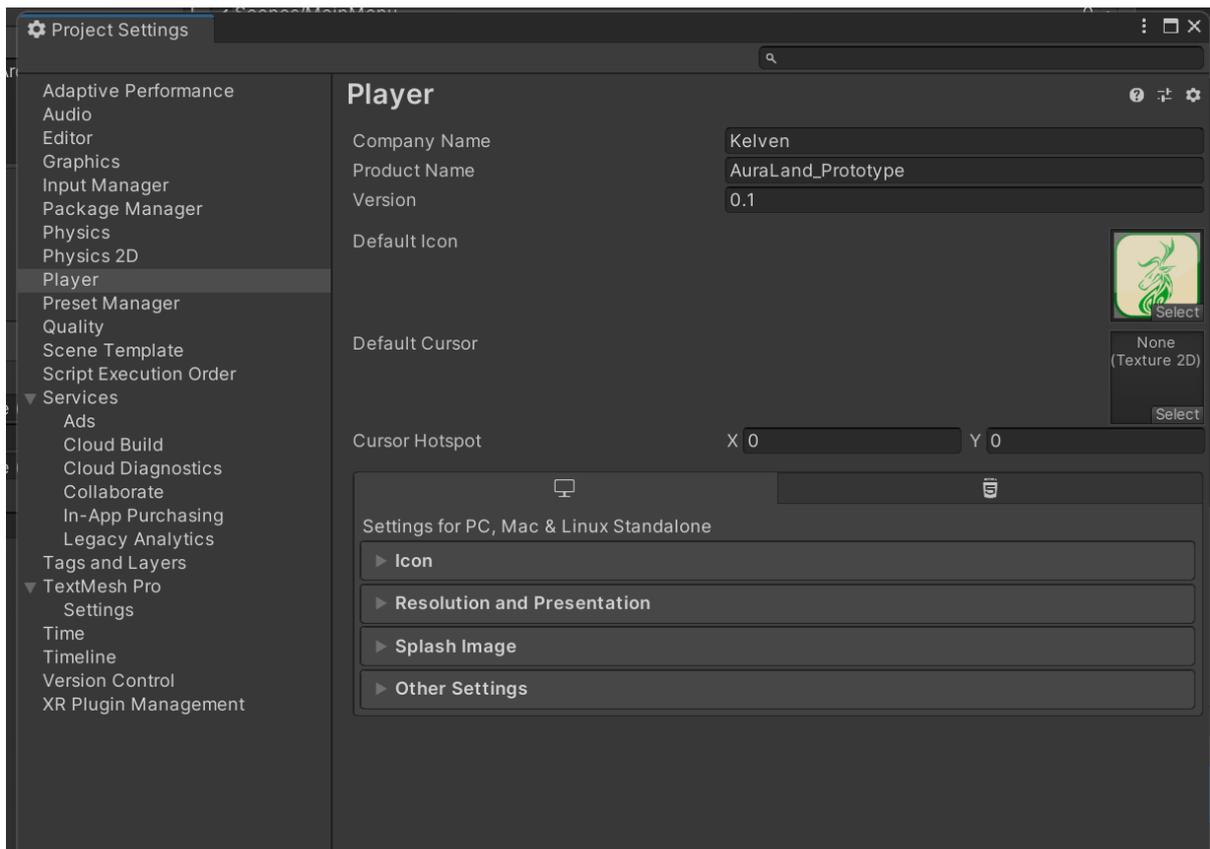
Figure 4.43 Player Setting

The build setting will be set as above for 64-bit system windows, and click build to build the game to the desired folder. (Figure 4.45).

The result is as Figure 4.46. The game can now open with the application (Red square). The folder can be compressed into a ZIP file and sent to others to play with the game by just uncompressing the file received.
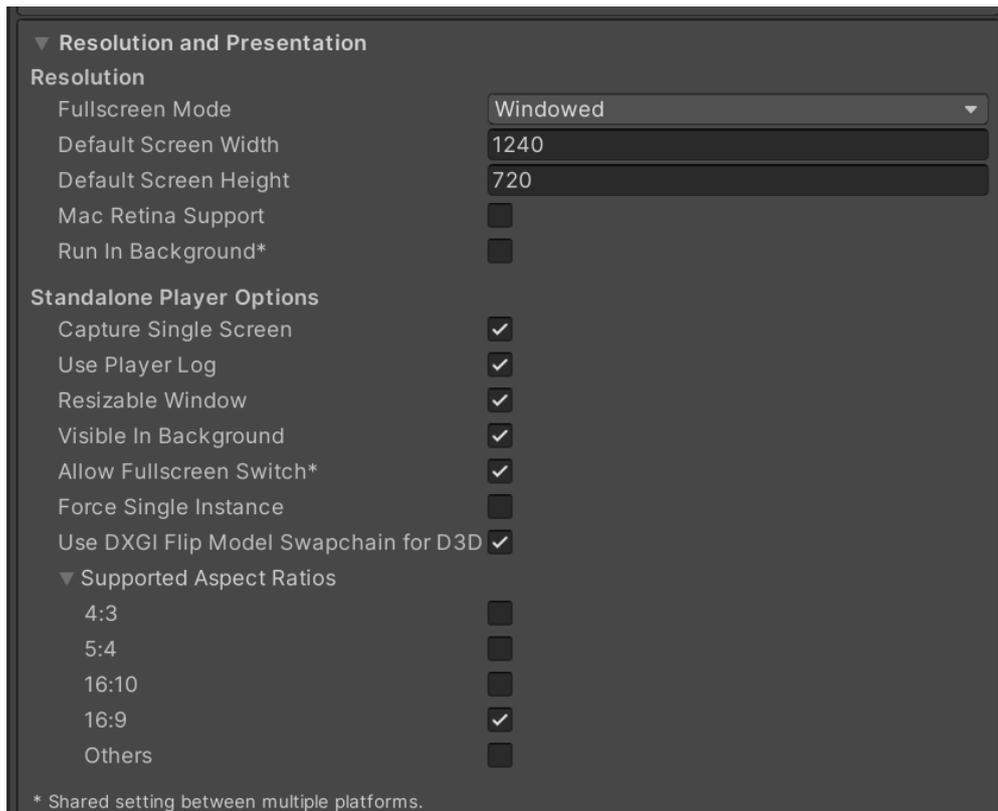
Figure 4.44 Resolution and Presentation
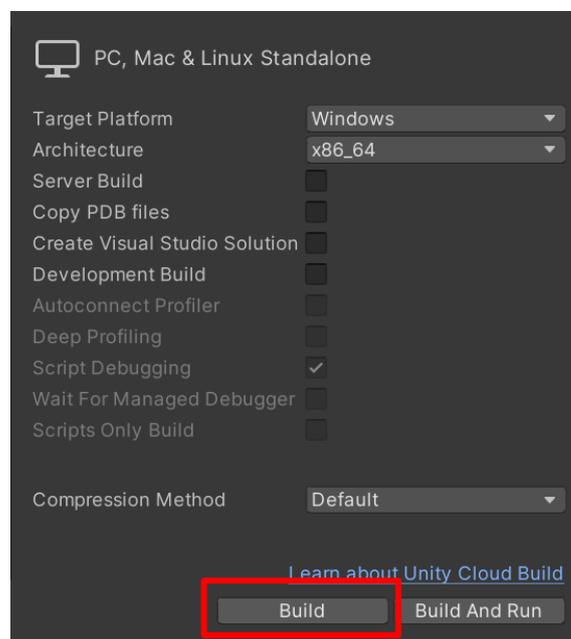
Figure 4.45 Standalone Setting Build

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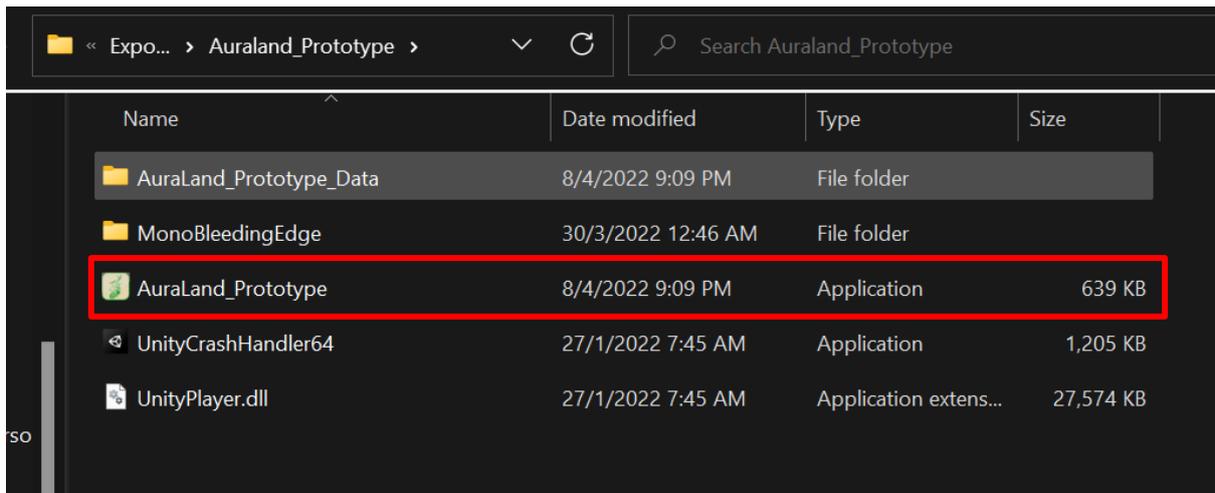
Figure 4.46 Final Output

Chapter 5

5.1 Hardware Set up

Below table show the minimum system requirement to play with the game.

SYSTEM	REQUIREMENT
WINDOWS	Windows 10, equivalent, or above
RAM	2GB ram, equivalent, or above
STORAGE	1 GB storage, equivalent, or above
GRAPHIC	AMD Radeon™ 530, equivalent, or above.

Table 5.1 Hardware Minimum Requirement.

5.2 Software Setup

The game will come in ZIP file.

Auraland_Prototype x64	30/3/2022 1:35 PM	Compressed (zipp...	56,099 KB

Figure 5.1 Game ZIP File

By unzip the compressed file, the game will be straight available to players to play with.
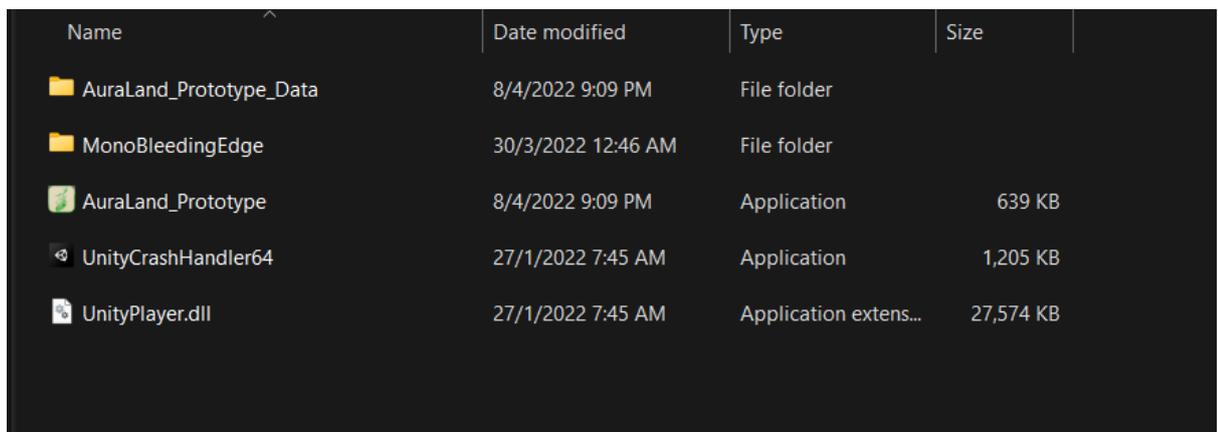
Name	Date modified	Type	Size
AuraLand_Prototype_Data	8/4/2022 9:09 PM	File folder	
MonoBleedingEdge	30/3/2022 12:46 AM	File folder	
AuraLand_Prototype	8/4/2022 9:09 PM	Application	639 KB
UnityCrashHandler64	27/1/2022 7:45 AM	Application	1,205 KB
UnityPlayer.dll	27/1/2022 7:45 AM	Application extens...	27,574 KB

Figure 5.2 Game UnZIP File

5.3 System Operation
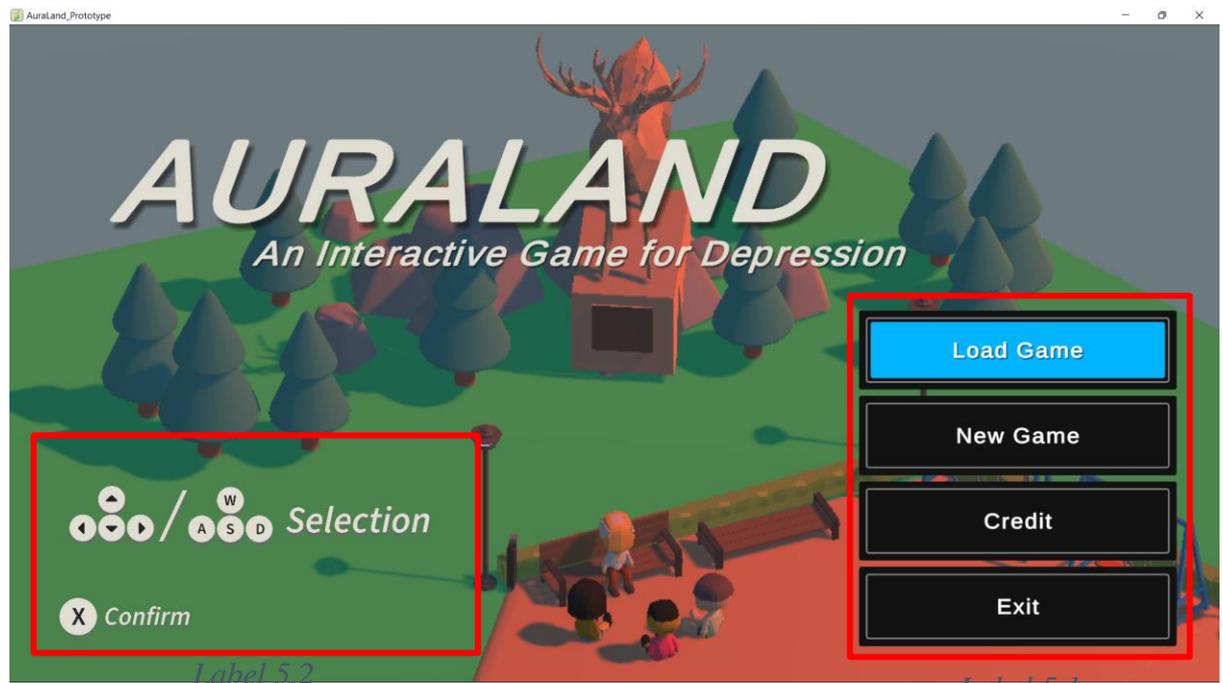
Figure 5.3 Game Main Menu

Figure 5.3 shows the main menu of the game. The main menu consists of several buttons to enable the players to load their desired function (Label 5.1). The left-hand side of the screen shows the key hint for controlling the main menu (Label 5.2).
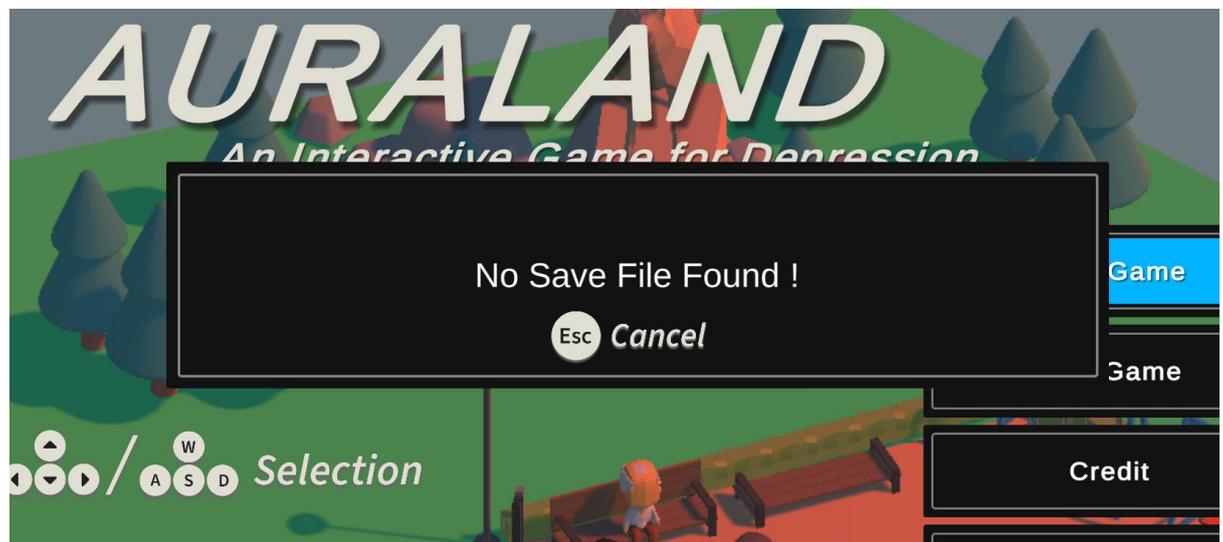
Figure 5.4 No Save File Warning

Figure 5.4 shows the "No Save File Found" if players select load game but no save game was found in the system.
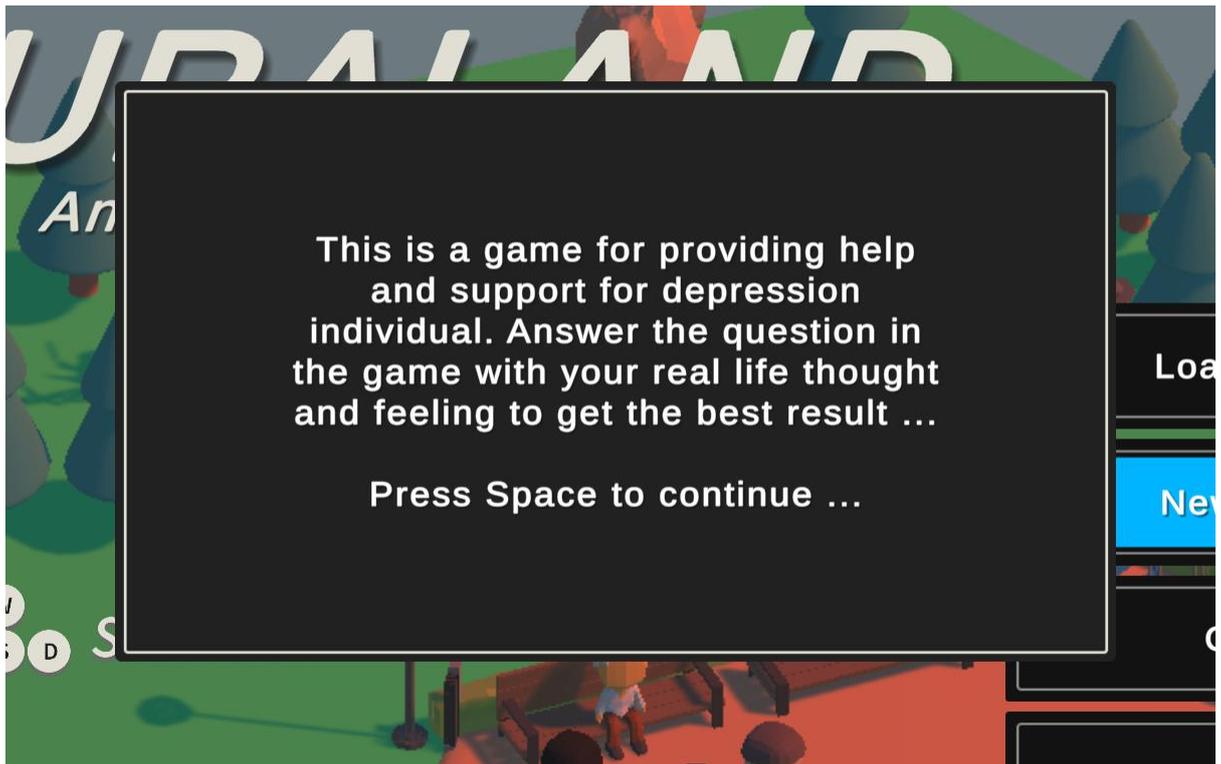
Figure 5.5 New Game Info Pop Up

 Figure 5.5 shows the information about the game when players click on the new game. This sign informs players what the game is and how to get the most accurate result. When players press on Space, it will continue to the name input for players (Figure 5.6).
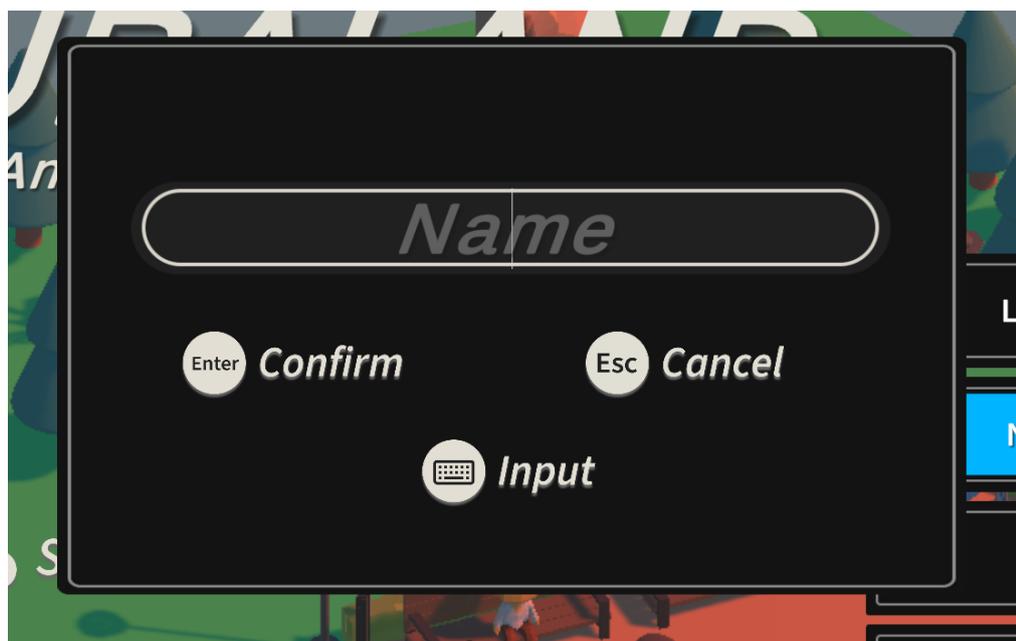
Figure 5.6 New Game Name Input
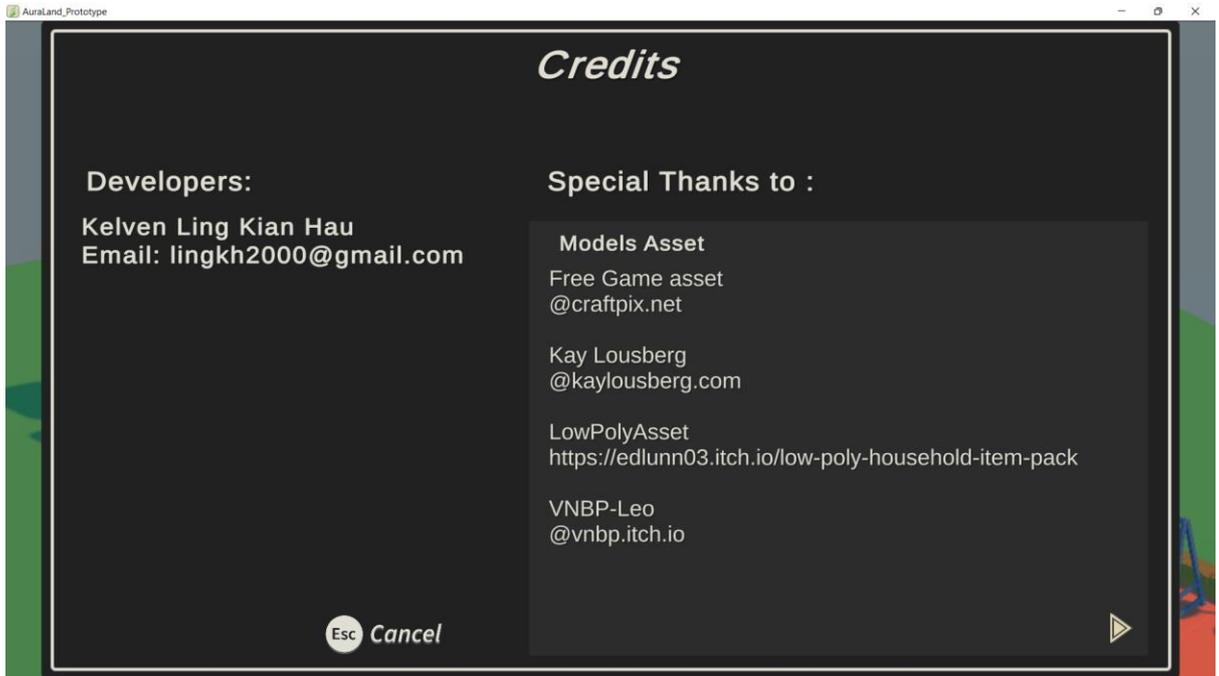
Figure 5.7 Main Menu Credit Page

Figure 5.7 shows the credit page in the authors' attribute that creates some of the assets used in the game. The first page is the model asset authors, the second page is the UI/Sprite authors, and the last page is the audio authors. Like the main menu control, players can control it using the arrow key.
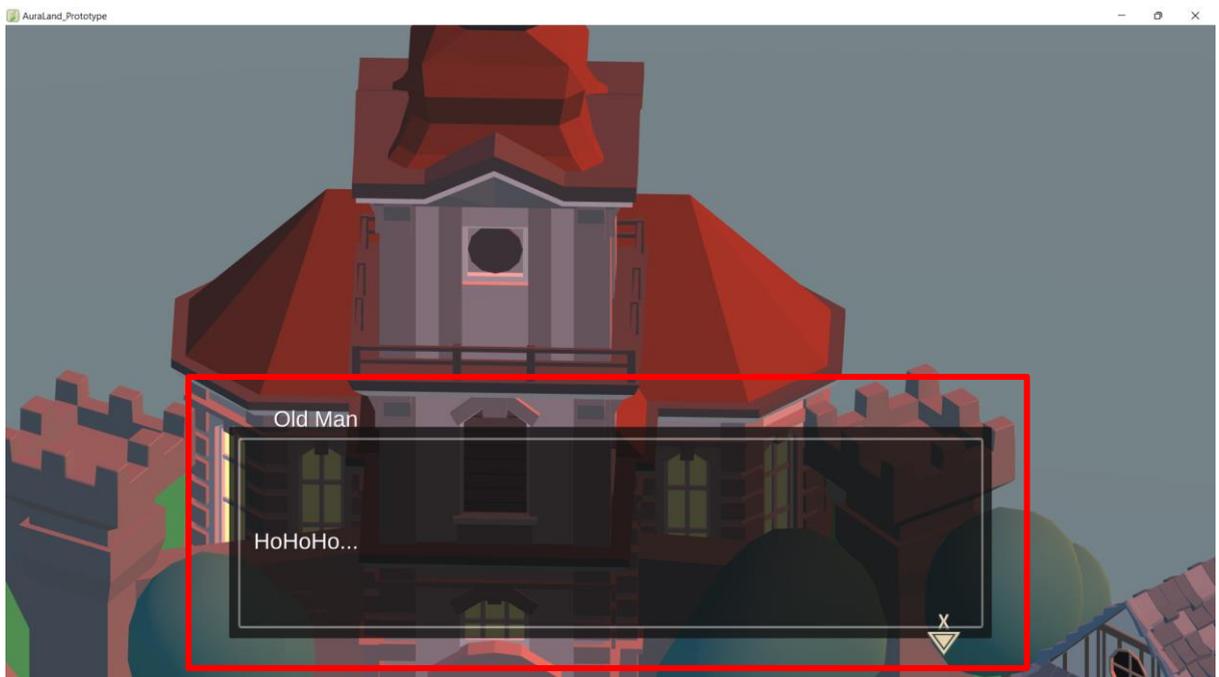
Figure 5.8 Dialogue Display

Figure 5.8 shows how the dialogue is displayed in the game. When the line of the dialogue is finished, key hint X at the corner of the dialogue box will appear. When players press on key X, the dialogue will continue to the following dialogue.
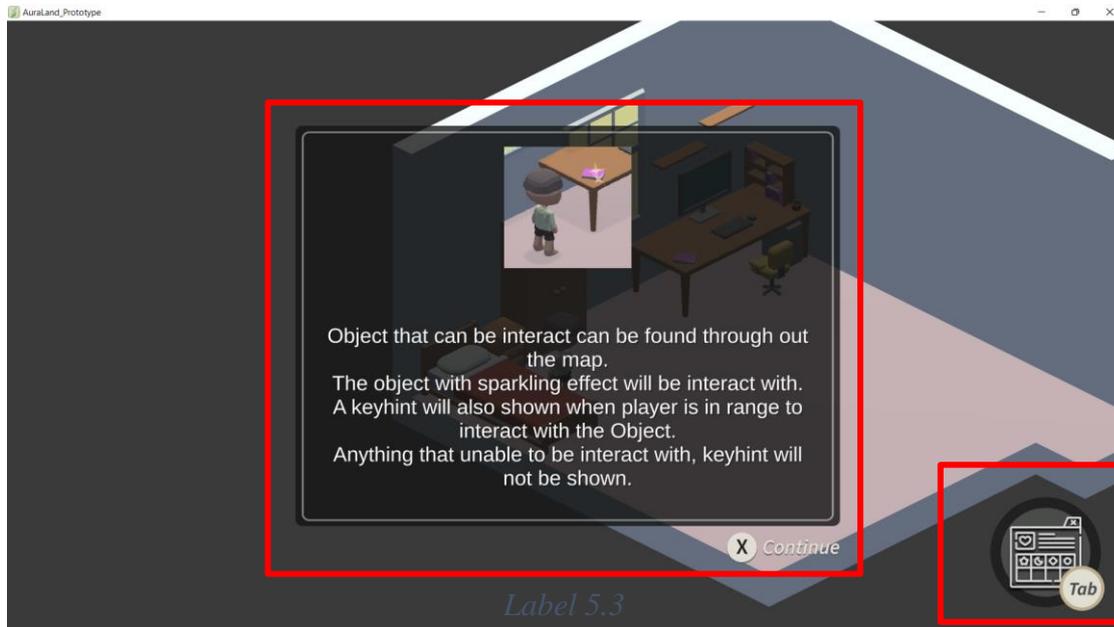
Figure 5.9 Starting of the Game

Figure 5.9 shows the popup dialogue (Label 5.3) that provides players with some necessary guide about the game. At the right bottom of the popup, show the key hint to close the popup and continue with the game. Label 5.4 is the key hint to let the players know that the key Tab has the function of accessing inventory.

Figure 5.10 shows the key hint "X" when players are near the interactable object.

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Figure 5.10 Key Hint
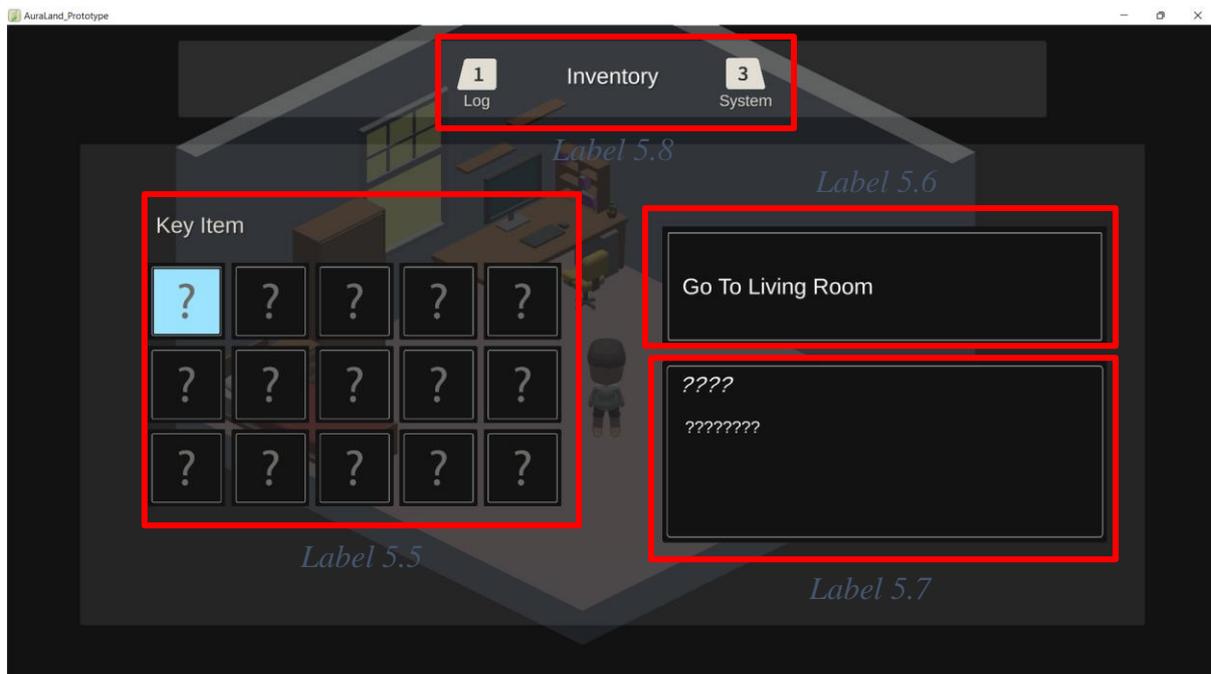
Figure 5.11 Inventory Menu

Figure 5.11 shows the inventory menu of the game. It has multiple slots for the key item (Label 5.5), the current mission notice (Label 5.6) and the description of the key item when the key item slot is selected (Label 5.7). Label 5.8 shows the key hint to access another tab of the menu. To the left is the log tab, and to the right is the system tab.

Figure 5.12 shows the Log tab menu. Label 5.9 shows the multiple selections for the log, and label 5.10 shows the context of the log selected.

Figure 5.12 Log Menu

Figure 5.13 shows the system menu, allowing players to save the game, view the credit page just like the main menu, and quit the game (Label 5.11). Label 5.12 shows the basic control of the game.
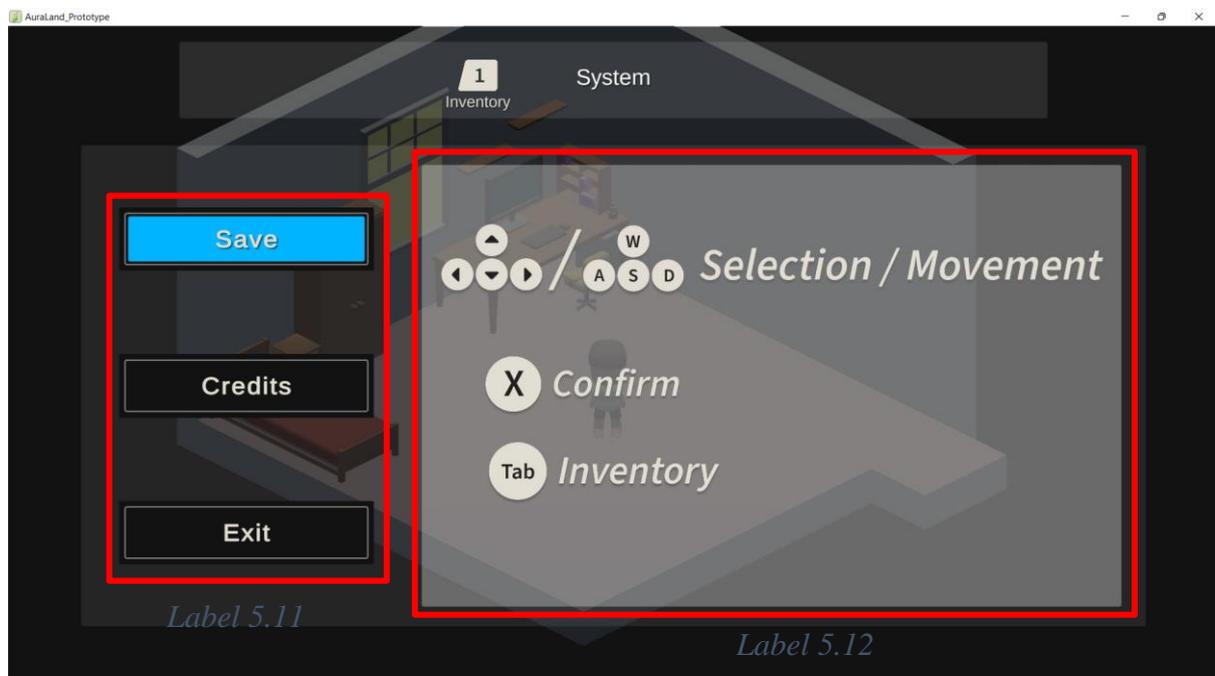
Figure 5.13 System Menu
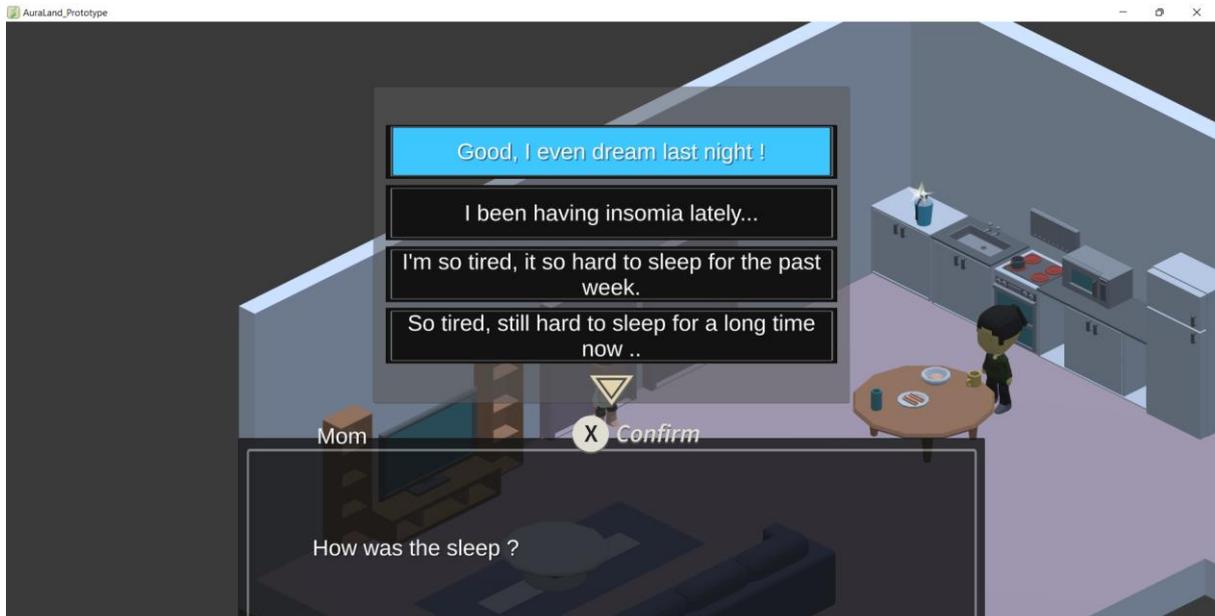
Figure 5.14 Responses Selection

Figure 5.14 shows the responses to the dialogue. Multiple answers will be provided to let the players choose from.

Figure 5.15 Item Selection

Figure 5.15 shows the item usage function. Items that players currently have will be shown in the selection menu.
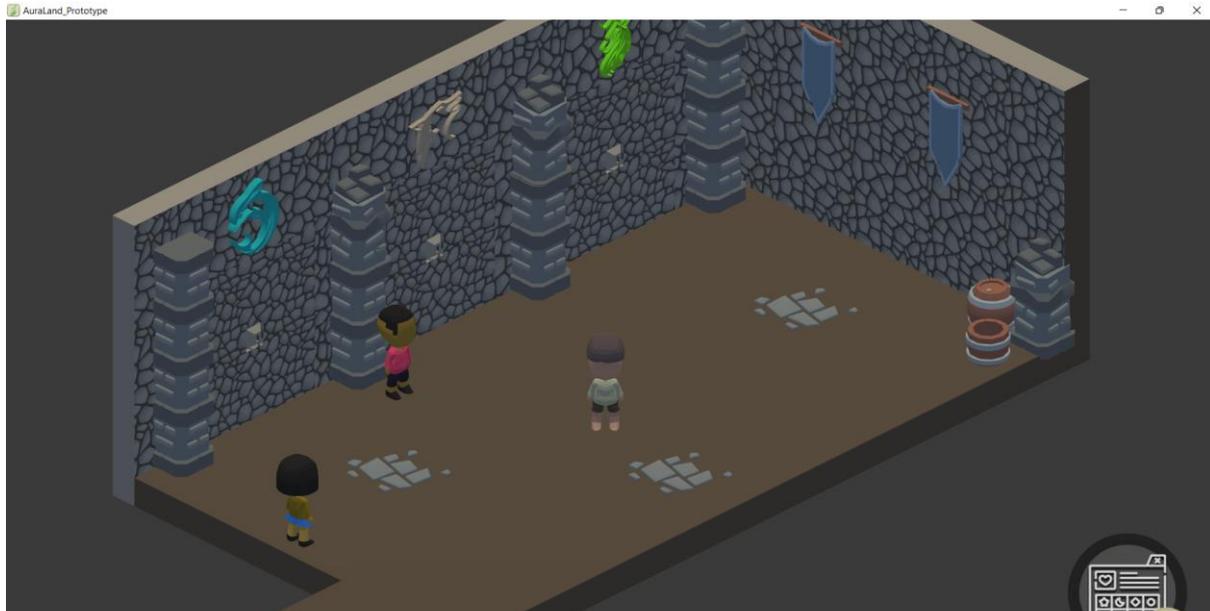
Figure 5.16 Labyrinth Chamber

Figure 5.16 shows the three entrances to the labyrinths. Each labyrinth provides different aspects of the CBT to help players.

Below is a table summarize the concept of the labyrinth.

LABYRINTH NO.	TOTEM SYMBOLIZE	CBT TECHNIQUE	DESCRIPTION
1	Dolphin	Pschoeducation	In this labyrinth, players will collect logs that consist of basic knowledge of depression, such as its symptoms, causes and other relevant information. In this labyrinth, several questions are also asked during the cutscene to further determine players mental status.
2	Wolf	Cognitive Restructuring	In this labyrinth, players would be able

			to collect many logs that consist of basic knowledge of CBT and some example of cognitive restructuring. Several questions have also been asked during the cutscene to further determine players' mental status in this labyrinth.
3	Deer	Pschoeducation	In this labyrinth, players would be able to collect additional information about depression, such as dealing with depression, suicide prevention, and recognizing depression. At the end of the labyrinth, players' mental status scores will be concluded, and relevant ending scenes and dialogue will run to end the game.

Table 2.2 Labyrinth Detail
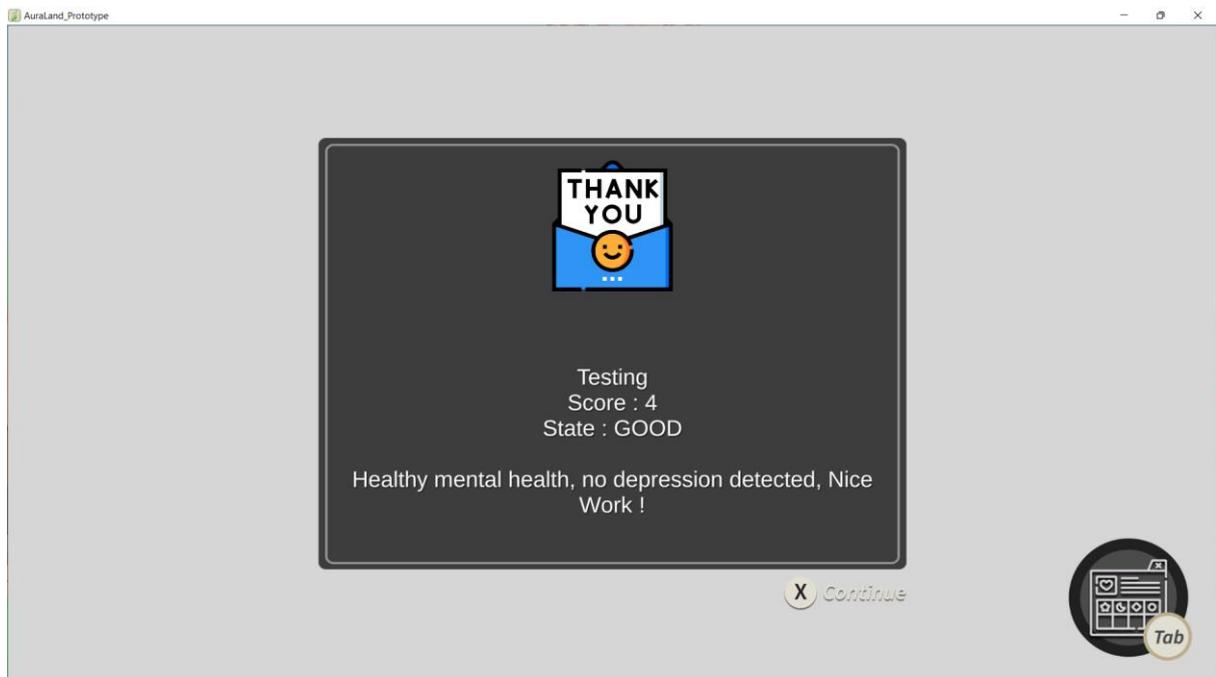
Figure 5.17 Ending Summarize.

Figure 5.17 shows the ending notice that summarizes the game, which shows the players' status and the suggestion given.

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Chapter 6

6.1 System Testing and Performance Metrics

Testing the game on overall functionality will be done to match the target scenarios. The table on the detail of the testing will be as below.

6.1.1 Main Menu

No	Event	Expected Result	Result
1	Main Menu – Load Game	No save file found pop up if no save game found.	Pass
		Load the save game from save file and all the data are imported correctly	Pass
2	Main Menu – New Game	Game Information pop up.	Pass
		Name Input of players	Pass
		Intro started successfully	Pass
		Game record correct name from Name Input	Pass
3	Main Menu – Credit	Credit Page pop up.	Pass
		Model, UI, Audio credit page change using arrow control key.	Pass
4	Main Menu – Quit	Quit the Game	Pass

Table 6.1 Main Menu Test Case

6.1.2 In Game Control

No	Event	Expected Result	Result
1	Character Movement	Character able to move in isometric direction.	Pass
		Character not able to move over the border of the map.	Fail
		When Character out of map, key input to reposition the character on the map.	Pass
2	Character Interaction	Character Key hint appear when near interactable object	Pass

3	Character Inventory Access	Character able to open inventory.	Pass
		Character able to change tab between Logs, Inventory, and System	Pass
		Character Inventory key item unlocked correctly	Pass
		Character Mission Notice display correctly	Pass
		Character Key item description display correctly	Pass
		Character Key item selection control correctly	Pass
		Character Log unlocked correctly	Pass
		Character Log content display correctly	Pass
		Character Log selection control correctly	Pass
		Character System Menu selection control correctly	Pass
		Character System control info display correctly	Pass
		Character System Save button save current game progress.	Pass
		Character System credit button show credit page.	Pass
		Character System Quit button exit the game.	Pass

Table 6.2 In Game Control Test

6.1.3 Map Transition Control

No	Event	Expected Result	Result
1	Map Change Transition.	Transition start	Pass
		Transition end	Pass
2	Map Change	Map change to correct map.	Pass
		Character reappears at correct location a new map	Pass

Table 6.3 Map Transition Test

6.1.4 Interactable Control

No	Event	Expected Result	Result
1	Character interacts with key item	Character Inventory unlocked respective item	Pass
2	Character interacts with Log	Character Log unlocked respective item	Pass
3	Character interact with Door/Map change object	Character Map change successful	Pass
4	Character normal dialogue	Players view all dialogue and continue with "X" key	Pass
5	Character responses dialogue	Players able to choose responses for the question ask	Pass
6	Character item usage dialogue	Players able to choose item used	Pass
		Players able to cancel item selection	Pass
7	Map unlockable change map object.	When players success trigger interactable object for map object change, the change run accordingly	Pass

Table 6.4 Interactable Object Test

6.1.5 Mission Control

No	Event	Expected Result	Result
1	Mission Progress correctly.	Progress according to timeline/cutscene correctly	Pass

Table 6.5 Mission Test

6.1.6 Timeline Control

No	Event	Expected Result	Result
1	Timeline track object assign.	Timeline track object assigned correctly	Pass
2	Timeline Play.	Timeline play in correct sequence.	Pass

Table 6.6 Timeline/CutScene Test

6.1.7 Audio Control

No	Even	Expected Result	Result
1	Audio List add clip	All audio clip used available in audio list with respective setting	Pass
2	Audio clip BGM play	Every map have it respective BGM played in background	Pass
3	Sound effect Play	Character walking effect	Pass
		Character hit walk effect	Pass
		Dialogue typewriter effect	Pass
		Dialogue confirm effect	Pass
		Dialogue Response selection control effect	Pass
		Dialogue Response confirm control effect	Pass
		Dialogue Item usage selection control effect	Pass
		Dialogue Item usage cancel control effect	Pass

		Dialogue Item usage confirm control effect	Pass
		Interactable hit sound effect	Pass
		Map change sound effect	Pass
		Inventory open effect	Pass
		Tab changing effect	Pass
		Inventory control and confirm effect	Pass

Table 6.7 Audio Test

6.2 Objectives Evaluation

Project objectives stated in Chapter 1 in this report are being evaluated.

1. **To study the usage of Cognitive Behavioural Therapy in game.**

   This objective has been achieved by reviewing multiple games and papers that consist of the CBT technique reported in Chapter 1 and Chapter 2.

2. **To design game mechanism to deliver knowledge and apply cognitive behavioural technique.**

   The developed game consists of a mechanism of exploring and collecting the log, which consists of knowledge of depression and other additional information such as CBT and precaution about depression. According to the log, the game riddle also asks to make sure players can read the log when unable to solve the riddle. Two CBT techniques have been applied in the game: psychoeducation and cognitive restructuring. Other techniques are not chosen because some of them are physical activities, and some need the therapist to provide more professional advice and monitoring. The detail of the game can be found in Appendix.

3. **To develop a story-based adventure puzzle game to spread the awareness of depression and identify the mental status of players.**

   Auraland has been developed. The game consists of all the functionality to ensure all the objectives are achieved and the game runs smoothly. The game has a storyline to let players achieve the mission. At the same time, PHQ-9 questions are redesigned and implemented in the game to collect and determine the mental status of players and provide suggestions to the players. The game also has three labyrinths to let players solve the labyrinth and meanwhile able to collect the logs.

In conclusion, the objectives stated in Chapter 1 have been considered achieved.

Chapter 7

7.1 Discussion

Video games play an important role in the current generation and society. Many industries have made their way into the games field. Other new opportunities have been created to further improve the game industry. Furthermore, with the rise of blockchain technology, non-fungible tokens (NFT) and the metaverse have a significant impact on the game industry, especially in augmented reality (AR) and virtual reality (VR) games. This advancement will be able to affect gamification in the health industry.

With the issues and objectives stated in this project, the expectation for the younger generation will increase with the new technology and technique introduced over time and the opportunities that lie before them. The problems stated will be in serious condition if the solution is not provided. Providing mental support through the game can be improved. It may become the new trend in the psychological field with the rise of metaverse technology to enable long-distance meeting experiences and virtual treatment.

The fundamental of CBT is psychoeducation. Suppose players do not understand depression and other relevant topics or knowledge. In that case, they will not be able to recognise the mental illness faced and the precaution and actions to be done. However, the game is restricted from some techniques that require expert monitoring, which decreases the game's flexibility.

7.2 Future recommendation

This project can be further improved by providing more functionality and flexibility to the project. The story design and puzzle design can be improved in the future by adding more topics in the story and other mental illness topics such as anxiety to the game.

Other than that, the graphics can be improved by having better 3d models, a better user interface, and details such as animation and voice. Besides that, functionality such as map navigation for a bigger area, more storyline

division and sub-storyline, interactable NPC, AI chatbot, real expert for suggestion and help can also be added to the game.

More functionality enables the game to provide more flexible help to players and spread more knowledge and awareness about mental health and other relevant topics.

7.3 Limitation and Challenges

In this project, some of the limitations are being noticed.

1. **Players' responses may not the same compared to real life.**

   As PHQ-9 questions will be asked throughout the game, players' responses are important to ensure the accuracy of the PHQ-9 result. As the game has its storyline, players may alter the storyline and answer the question according to the 'players' self and not the 'real' self. This issue may lead to inaccurate results at the end of the game.

2. **Players complete the game with brute force.**

   The puzzle and solution to solve the puzzle can be found across the game, such as Log content. However, players may not read the log and any description and brute force through the game by testing every answer or selection.

3. **The puzzle is simple.**

   The puzzle has been designed with a simple question. The low number of content leads to easy puzzle solving due to the project's time constraint.

4. **Storyline too simple.**

   The storyline of the game is short. It is a 30 – 45 minutes story and only a simple story design to fit in all the PHQ-9 questions and other relevant information required in the story.

7.4 Conclusion

Gamification in the health industry is an achievable achievement that will influence other industries and people. With the improvement in technology, this concept can further improve by adopting new technology.

In conclusion, the lack of knowledge and exposure to mental health is the main problem that current society faces. This issue led to other problems such as ignorance of mental illness and lack of confidence to express emotion. These issues motivate the author to perform this investigation and develop the game. The author is motivated to increase the knowledge and awareness of the importance of mental health in current society. At the same time, it helps depressed individuals determine their mental condition in an easy and relaxed way.

The objectives are achieved in this project, and the game runs as expected. Through the concepts found and designed during the development, the author believes that it can help increase the awareness and knowledge of players. This method is also suitable for all other games as learning through playing is the fastest way of learning and has been proven in other games of educational programs [7].

At last, this topic will become more mature as time passes with new technology introduction. It can become a tool for experts as the medium to aid patients during the treatment process or diagnosis process. It also can become a tool for patients to identify their current condition at a lower cost.

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Appendix
Weekly Report

FINAL YEAR PROJECT WEEKLY REPORT
(Project II)

Trimester, Year: Y3S3	Study week no.: 1, 2
Student Name & ID: Kelven Ling Kian Hau 18ACB03026	
Supervisor: Dr Tong Dong Ling	
Project Title: Interactive Game for Depression Individual.	

1. WORK DONE

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

- None.

2. WORK TO BE DONE

- Design Full storyline.
- Design Full Puzzle.
- Design on all book content and item content.
- PHQ-9 question design.

3. PROBLEMS ENCOUNTERED

- None.

4. SELF EVALUATION OF THE PROGRESS

- None.

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Supervisor's signature

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Student's signature

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FINAL YEAR PROJECT WEEKLY REPORT
(Project II)

Trimester, Year: Y3S3	Study week no.: 3, 4
Student Name & ID: Kelven Ling Kian Hau 18ACB03026	
Supervisor: Dr Tong Dong Ling	
Project Title: Interactive Game for Depression Individual.	

1. WORK DONE

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

- Full Storyline
- Full Puzzle Concept
- Partial required book and item.
- Partial PHQ-9 question used in game.

2. WORK TO BE DONE

- Gathering of resources and asset.
- Creation of resources and asset.
- Rest of required book and item content.
- Rest of PHQ-9 question used in game.

3. PROBLEMS ENCOUNTERED

- None.

4. SELF EVALUATION OF THE PROGRESS

- None.

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Supervisor's signature

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Student's signature

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FINAL YEAR PROJECT WEEKLY REPORT
(Project II)

Trimester, Year: Y3S3	Study week no.: 5, 6
Student Name & ID: Kelven Ling Kian Hau 18ACB03026	
Supervisor: Dr Tong Dong Ling	
Project Title: Interactive Game for Depression Individual.	

1. WORK DONE

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

- Full required book and item content.
- Full PHQ-9 question used in game.

2. WORK TO BE DONE

- Gathering of resources and asset.
- Creation of resources and asset.
- Map creation and Decoration.
- Game UI recreation/Modification from FYP1.
- Game basic function remodified.
- Interactable System development.
- Dialogue System development.

3. PROBLEMS ENCOUNTERED

- None.

4. SELF EVALUATION OF THE PROGRESS

- None.

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FINAL YEAR PROJECT WEEKLY REPORT
(Project II)

Trimester, Year: Y3S3	**Study week no.: 7, 8**
Student Name & ID: Kelven Ling Kian Hau 18ACB03026	
Supervisor: Dr Tong Dong Ling	
Project Title: Interactive Game for Depression Individual.	

1. WORK DONE

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

- Game UI recreation/Modification from FYP1.
- Game basic function remodified (map change, movement)
- Interactable System.
- Dialogue System.

2. WORK TO BE DONE

- Gathering of resources and asset.
- Creation of resources and asset.
- Map creation and Decoration.
- Responses System development.
- Unlockable System development.
- Timeline System development.
- Audio system development.
- Save System development.

3. PROBLEMS ENCOUNTERED

- None.

4. SELF EVALUATION OF THE PROGRESS

- None.

_____
Supervisor's signature

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FINAL YEAR PROJECT WEEKLY REPORT
(Project II)

Trimester, Year: Y3S3	**Study week no.: 9, 10**
Student Name & ID: Kelven Ling Kian Hau 18ACB03026	
Supervisor: Dr Tong Dong Ling	
Project Title: Interactive Game for Depression Individual.	

1. WORK DONE
[Please write the details of the work done in the last fortnight.]
-   Responses System.
-   Unlockable System.
-   Save System.
2. WORK TO BE DONE
-   Gathering of resources and asset.
-   Creation of resources and asset.
-   Map creation and Decoration.
-   Timeline System development.
-   Audio System development.
-   Game UI Asset Modification, add-on.
-   Test Play.
-   Final Tune of game.
3. PROBLEMS ENCOUNTERED
-   None.
4. SELF EVALUATION OF THE PROGRESS
-   None.

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Supervisor's signature

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Poster

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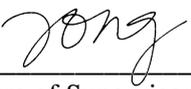| **Universiti Tunku Abdul Rahman**			
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  Name: _Tong Dong Ling_____   Name: _____

  Date: __21 Apr 2022_____   Date: _____

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