EDUCATIONAL MULTIPLAYER GAME FOR ENCOURAGE COMMUNICATION DURING COVID-19

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EDUCATIONAL MULTIPLAYER GAME FOR ENCOURAGE

COMMUNICATION DURING COVID-19

(Little Messenger)

LEE ZI XUAN

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ABSTRAK

Pada masa kini, pandemik COVID-19 banyak menjejaskan kehidupan manusia. Orang ramai akan sentiasa mengelakkan komunikasi yang tidak perlu dengan orang lain untuk mengurangkan risiko dijangkiti penyakit. Selepas masa yang lama, kemahiran komunikasi orang akan terjejas. Oleh itu, objektif projek ini adalah reka bentuk dan pembangunan permainan video yang boleh membantu orang ramai menggalakkan kemahiran komunikasi. Kemudian, nilaikan kefungsian dan pengalaman pengguna permainan yang dicadangkan. Tahap adalah reka bentuk dengan beberapa cabaran dan halangan yang memerlukan pemain bekerjasama untuk menyelesaikan masalah. Memandangkan aplikasi permainan video ini adalah reka bentuk untuk kanak-kanak bermain, oleh itu cabaran dalam permainan video tidak akan terlalu sukar dan kompleks. Permainan video ini dibangunkan mengikut model Agile. Model Agile mempunyai enam fasa iaitu merancang, mereka bentuk, membangunkan, menguji, melepaskan dan maklum balas. Permainan video ini dibangunkan dengan menggunakan Unity Engine, direka menggunakan Photoshop dan menggunakan muzik bebas royalti dari internet. Produk akhir dimuat naik ke Itch.io. Itch.io ialah halaman web yang membenarkan pengguna menerbitkan permainan video mereka ke tapak web. Pemain boleh memuat turun permainan video dari laman web. Ujian Penerimaan Pengguna (UAT) dijalankan untuk memastikan permainan video tiada ralat dan mencapai objektif projek. Keputusan ujian permainan video ini secara keseluruhannya positif untuk mencapai objektif. Keputusan ujian alfa menunjukkan fungsi permainan video dengan baik. Keputusan keseluruhan menunjukkan positif untuk ujian beta. Oleh itu, objektif projek ini tercapai.

ABSTRACT

Nowadays, COVID-19 pandemic affects people's lives a lot. People will always avoid unnecessary communication with others to reduce the risk of being infected by diseases. After a long time, people's communication skill will be affected. Hence, the objectives of this project is design and develop a video game that can help people encourage communication skill. Then, evaluate the functionality and user experience of the proposed game. The levels are design with some challenges and obstacles that required players work together to solve the problems. Since this game application is design for children to play, therefore the challenge will not too difficult and complex. The game is develop follow the Agile model. Agile model has six phase which are plan, design, develop, test, release and feedback. The game is develop by using Unity Engine, designed using Photoshop and using royalty free music from the internet. The final product is uploaded to the Itch.io. Itch.io is a webpage that allowed user publish their game to the website. Player can download the game from the website. User Acceptance Test (UAT) is conducted to ensure that the game is free from errors and achieved the project's objectives. The alpha test result show the game function well. The overall result show positive for the beta test. Therefore, the objectives of this project is achieved.

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LIST OF ABBREVIATIONS

2D	Two-Dimensional
3D	Three-Dimensional
BGM	Background Music
EXE	Windows Executable File
GDD	Game Design Document
PC	Personal Computer
SFX	Sound Effect
UAT	User Acceptance Test

CHAPTER 1

INTRODUCTION

1.1   Introduction

COVID-19 is in charge of the current outbreak of pneumonia that began at the beginning of December 2019 near Wuhan City, Hubei Province, China. COVID-19 is a new type of coronavirus that appeared in those years. Due to the transmission of this virus is airborne transmission, therefore close contact with infected people will have high risk of being infected by the COVID-19. From COVID-19 occurring until now, this disease has already become a part of our life and causes a lot of effect to people's lives. At the same time, video games have become familiar to everyone. An interesting storyline and gameplay can attract people to play the game. Therefore, video games can be one of the ways to deliver some moral values or help people to encourage communication especially for children.

During the early phase, all people have to follow the Movement Control Order (MCO) which is imposed by the Malaysian government. People have to face the COVID-19 lockdown. Some cannot even return to their hometown due to the prolonged lockdown but some of the people have to stay at their home for a long time. For the people that cannot go back to their hometown, communication with their family members becomes a challenge for them due to their family not familiar with communication channels, facilities problems or busy at work as the working time is different. They also might lose connection with their friends. This will make their social life become terrible. Furthermore, for the all family members been forced to stay at home for all day, it might occur conflicts between families members as the time together at home become longer compare before. Therefore, communication is important for them to avoid arguing and solve the conflict. Any fighting that happens in a family will cause a bad feeling to the

other family members, especially children who are still easily affected by the surrounding emotions.

To solve the issues, this project proposed a 2D multiplayer platform game to help them have communication while playing this game. The target of this project is to help the player to understand that communication plays a role in tying a relationship together. It is important because communication within others enables them to express their feelings, needs, wants and concerns to each other, especially now is COVID-19 pandemic era, where everyone is under pressure to survive. Therefore, this project will help people to encourage communication during the era of COVID-19 pandemic. Not only do adults have to improve their communication skill, children also have to be active in communication with others. Multiplayer games can help people to encourage communication easily as they can play the game together with their friends or family. When they play games together, they will discuss and enjoy the game together at the same time. This also can help them to tie relationships together.

1.2   Problem Statement

Nowadays, COVID-19 pandemic affects people's lives a lot as people have to follow the MCO and Standard Operating Procedures (SOP) to reduce the risk of being infected by the COVID-19 diseases. Therefore, video games are one of the forms of entertainment that allows people to spend their time during MCO. At the same time, video games can become a platform to help people to encourage communication.

During the early phase of lockdown, people were forced to stop all outdoor activity and work due to COVID-19. They can only chat with friends through social media. After a long time, people will lose connection with their friends. Social life will be affected and it causes people to become passive and feel loneliness. Therefore, communication is important for people during MCO. The proposed video game can be a platform to tie the relationship together when they are playing together.

Furthermore, the cases of conflict between husband and wife also increase during MCO. This is because the time spent together during MCO is higher than before. When together time increases, the risk of conflict will increase together as they might have different opinions for one thing and then argue will happen. When they cannot seek consensus, then fighting will always happen in their life. This situation of life not only causes man and wife to fall out, children also feel upset about that. This will give a bad impression to children. Therefore, communication between husband and wife is important. When conflict occurs, why not just sit down and calm down to discuss problems and find out a solution. It can be a good example for children to learn that communication is a good way to solve a lot of problems.

Moreover, children also cannot go to school during MCO. It means that their parents have to take care of them 24 hours all day. Imagine that their parents have to take care of their children all day, at the same time they might work from home or a lot of household work. Parents also have to be in charge of their children's education during MCO. They have to spend a lot of energy and attention on their children all day. It might cause parents to lose their patience with their children especially for the parents who always have day care services or hide nanny before. Shouting, yelling or screaming at

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children are not the ways to solve the problem. Parents have to learn to communicate with their children.

In conclusion, the video game in this project will deliver the awareness of cherishing family and health during COVID-19 pandemic. Parents and children can work together to defend the COVID-19 and stay healthy and happy in their life.

1.3   Objective

There are three objectives in this project which are:

1. To design a video game that can help people to encourage communication.

2. To develop a game that can help people to encourage communication.

3. To evaluate the functionality and user experience of the proposed game.

1.4   Scope

There are scopes in this project:

1. This game is designed for users who are 10 years old and above.

2. To create a storyline for telling the important of communication in family life.

3. This game is a multiplayer game to let the children can play with their family member.

4. To create 5 levels in the game where the difficulty will increase by the levels.

5. The maximum of player in a game room is 2 player.

1.5   Significance of Project

This project is beneficial to society as people, especially children, can encourage communication through a video game. From this project, people can know the importance of communication especially when conflict happens between people. Calm down and sit together and discuss the problems is one of the ways to solve problems. Violence and anger cannot give help in problem solving, it only makes the problems become more terrible. Therefore, communication skill plays an important role in people's lives. When the risk of conflict decreases and at the same time people already learn to solve problems through communication, then the atmosphere of society will become more harmonious and the relationship between people closer than before.

1.6   Report Organization

This thesis report contains five chapters. Chapter 1 is the introduction of the project. In this chapter will discuss the introduction of the proposed game, problem statement of the important of encourage communication during COVID-19, objectives of this project and scopes of the proposed game.

Chapter 2 discusses the literature review. Three different existing games which related to this project will be analysed in this chapter. The details of the games are also studied such as the method, techniques, hardware and software used from these games.

Chapter 3 discusses the methodology used to develop the game in this project. The technology used, method and flow of this project will be discussed and explained.

Chapter 4 showcases the implementation and development process of the project. The result and discussion are also included in this chapter.

Lastly, Chapter 5 is to conclude and summarize about this project including the limitations and future work that can be implemented to enhance and improve this project.

CHAPTER 2

LITERATURE REVIEW

2.1   Review of Existing Game

The three existing game that chosen to analyse are Overcooked 2, BatterBlock Theater, and It Takes Two. All the three game is multiplayer game as this project is target to develop a multiplayer game where focus on communication at the same time.

2.1.1   Overcooked 2

Overcooked 2 is a 3D fast-paced cooking simulation game developed by Team17 and Ghost Town Games and published by Team17 on August 7, 2018. This game is developed by using Unity as a game engine. This game can be played on the PC, Nintendo Switch and Play Station. The target systems for Overcooked 2 are Windows, macOS, Linux and PlayStation 4 and Playstation 5. The minimum requirement for a PC to install this game's operating system is Windows 7, macOS Sierra 10.12.6 or Ubuntu 16.04.01 and above.

Figure 2.1   Screenshot of Overcooked 2 Wallpaper

Overcooked 2 is not free to all, it has to pay RM 59.00 then can install it into PC and play but there is no in-app purchase in this game. When playing this game, network connection is required to connect to the server. This game supports 12 languages which are English, French, Italian, German, Spanish, Japanese, Simplified Chinese, Korean, Polish, Portuguese, Traditional Chinese and Russian. Overcooked 2 is available in Malaysia.

In this game, there are a total of 36 base levels, and around seven additional Kevin levels. It can be played in single player mode or multiplayer mode. It is interesting in single player mode as the player can control two characters by using the swap function. For the multiplayer mode, players can choose to either invite friends to play together or party with other unknown players. In multiplayer mode, the player only allowed control of one character. Players have to cooperate with teammates to win the game. In this game, players have to cook to satiate the zombie bread slices which are called Unbread to save the Onion Kingdom. To pass the level, players have to gain enough score through serving the Unbread. Players have to cook the dish according to the order list. Players can chop

the food, cook ingredients, combine them on a plate, serve dishes to the Unbread and also wash the dishes after serving.

Figure 2.2   Level in Overcooked 2

Based on the reviews from users on Steam, the advantages of Overcooked 2 are the level designs are creative, diverse, challenging, and great fun. The interest of gameplay attracts players to continue to play it. Furthermore, the environment will change level by level. Different environments will have different challenges waiting for the player. The type of recipes also have many types. Moreover, the cute design of the game also is one of the advantages for this game. Besides that, online multiplayer also has the advantages of this game as players can play with their friends.
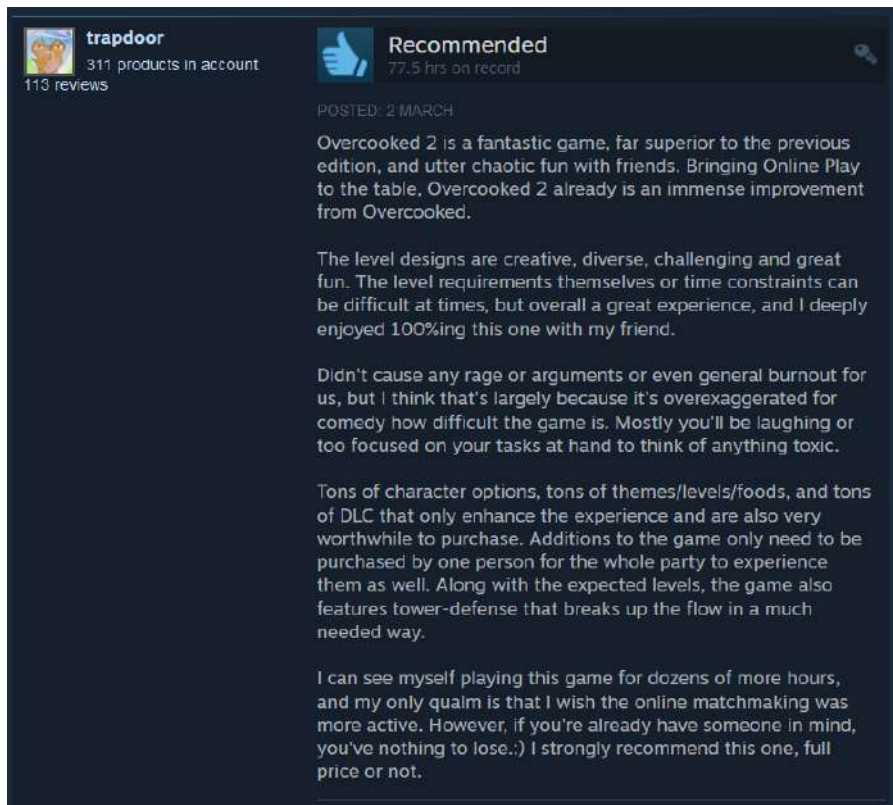
Figure 2.3   Positive Review of Overcooked 2 on Steam

Figure 2.4   Positive Review of Overcooked 2 on Steam

Based on the reviews from users on Steam, the disadvantages of Overcooked 2 are the multiplayer mode and lagging problems. This causes a bad experience to the player when playing Overcooked 2 with friends. The disappointing thing is this problem has already occurred for a long time but I haven't fixed it. Furthermore, some of the users comment that the levels are too difficult and complex. They have to replay many times to pass the levels but unfortunately replay a level too many times is not that appealing of a proposition.

Figure 2.5   Negative Review of Overcooked 2 on Steam

Figure 2.6   Negative Review of Overcooked 2 on Steam

The overall reviews of Overcooked 2 show that it is very positive which is rated by over 30000 players. It was still popular when it was released on Steam platform in 2018 until today.

Figure 2.7   Overcooked 2 Overall Rating on Steam

2.1.2 BattleBlock Theater

BattleBlock Theater is a 2D comedy platform game developed by The Behemoth and Big Timber Studio and published by Microsoft studios and The Behemoth. This game took 5 years to develop. The early playable version of this game was released in 2009 with a trailer of gameplay footage. This game can be played on PC, PlayStation, Xbox 360 and Xbox One. The target systems of BattleBlock Theater are Microsoft Windows and Mac OS X. the minimum requirement for operating systems is Windows XP or Mac OS X 10.7 Lion.

Figure 2.8   BattleBlock Theater

BattleBlock Theater has to pay RM 31.00 on Steam then only can install and start to play it but it does not have in-app purchase inside the game. The network connection is required when plating. The supported languages have 11 which are English, French, Italian, German, Spanish, Japanese, Korean, Portuguese, Simplified Chinese, Traditional Chinese and Russian but unfortunately, the audio only supports English. This game is available in Malaysia.

Figure 2.9   Level of BattleBlock Theater

In this game, there are over 450 levels provided to players to explore and it can be played in single player mode and multiplayer mode. For multiplayer mode, players can invite their friends to play together. To pass the level, players have to cooperate with their teammate. Some of the stages they have to work together to go to the next stage. Players can control a prisoner in game and they can control the character running, jumping, climbing, punching, pushing, and throwing a partner. There also have weapon can be used in game such as bomb, ice, poison, vacuum and so on.

Based on the reviews from users on Steam, the advantages of BattleBlock Theater are the puzzle levels will force the player to think and try to solve it in a limited time. Furthermore, the level design and music is amazing. Moreover, the art style and humour is the selling point of this game. The art style has a cartoonish vibe and the humour storyline gives a lot of fun to the player. The difficulty of this game is normal so it would be stressful to player.

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Figure 2.10   Positive Review of BattleBlock Theater on Steam

Figure 2.11   Positive Review of BattleBlock Theater on Steam

Based on the reviews from users on Steam, the disadvantages of BattleBlock Theater are that some of the players think that the gameplay is basic and boring. All the levels look virtually the same and the game mechanics are nothing interesting.

Figure 2.12   Negative Review of BattleBlock Theater on Steam

Figure 2.13   Negative Review of BattleBlock Theater on Steam

The overall reviews of BattleBlock Theater show that this game is overwhelmingly positive, rated by over 60000 players. But unfortunately, the most popular time for this game is in 2014 and until today it has become not so famous anymore.

Figure 2.14　BattleBlock Theater Overall Rating on Steam

2.1.3 It Takes Two

It Takes Two is a 3D action-adventure platform game developed by Hazelight Studios and published by Electronic Art on March 26, 2021. This game is developed by using Unreal Engine 4 as a game engine. It can be played on the PC and PlayStation. The target systems of this game are Microsoft Windows, PlayStation 4 and PlayStation 5. The minimum requirement for an operating system is Windows 8.1 and above.

Figure 2.15   It Takes Two

It Takes Two is not a free game, the price on steam is RM 159.00 but inside the game there is no in-app purchase. Furthermore, the network connection is required when playing this game as it is multiplayer mode. This game supports 12 languages for interface and subtitles which are English, French, Italian, German, Spanish, Japanese, Korean, Polish, Portuguese, Russian, Simplified Chinese and Traditional Chinese. Unfortunately, the audio only supports English. This game is available in Malaysia.

Figure 2.16   Level of It Takes Two

This game has an interesting storyline which is about the relationship between families. May and Cody, a married couple who always argue and conflict. Their daughter, Rose, is feeling sad. One day, May and Cody turned into dolls by a magic spell. To turn back to humans, they start their journey and along the journey, they save their fractured relationship and know the importance of communication. For the gameplay, players have to cooperate with teammates to complete all the tasks and challenges. The game is designed for split-screen cooperative multiplayer. Two players will have different views and they also have different duties in the game. Strategy is also needed in this game as the game won't give too many hints to players. Players have to discuss how to overcome the challenges and of course that teamwork is absolutely necessary for this game.

Based on the reviews from the users on Steam, the advantages of It Takes Two are an incredible teamwork oriented game. It makes players feel excited when they complete a task together and this can tie the relationship together at the same time. Furthermore, the music is amazing and the environment is perfect. This game is recommended to experience with friends and family. Moreover, unique gameplay mechanics that are never recycled. There are various mini-games scattered around the environment to let players explore. Besides that, the controls are tight and responsive, and the camera view is perfect.

Figure 2.17   Positive Review of It Takes Two on Steam

Recommended
0.0 hrs last two weeks / 21.8 hrs on record

Posted: 6 Apr, 2021 @ 6:13am
Updated: 26 Nov, 2021 @ 5:04am

Best neglectful parent simulator, ever.

I purchased this game specifically to play with my significant other. While we expected it to be good, It Takes Two, the sophomore effort from developer, Hazelight, impressed us so much, it is now the benchmark for which I will measure future co-op game experiences. We simply lost count of how many charming moments we encountered whilst playing.
I could go on and on, but, the selling points of this game are best experienced for yourself. Each painstakingly detailed level in this title offers you unique gameplay mechanics that are never recycled. Communication and cooperation are a must, as well as decent twitch response reflexes. Various mini-games are scattered around the environment, and give you a slight reprieve from your main objective, only to get your competitive juices flowing. (sore losers need not apply!)
Controls are tight and responsive, and the camera does a decent job of keeping track of the action. However, those who suffer from motion sickness may occasionally become disoriented or even nauseated due to the mandatory split screen.
Overall, this is a very high quality, one of a kind experience that could only be produced as a labor of love.
Pick this one up, play it with someone special, and let the hilarity ensue.

Highly recommended.

Figure 2.18   Positive Review of It Takes Two on Steam

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Based on the reviews from the users on Steam, the disadvantages of this game are some of the players think that the story inside the game is not that suitable and attract people. They are not satisfied with some of the part of the story.

Figure 2.19   Negative Review of It Takes Two on Steam

Figure 2.20   Negative Review of It Takes Two on Steam

The overall reviews for It Takes Two is overwhelmingly positive which is rated by over 80000 players. This review starts from March, 2021 until March, 2022 almost 1 years and it can reach high numbers of reviews.
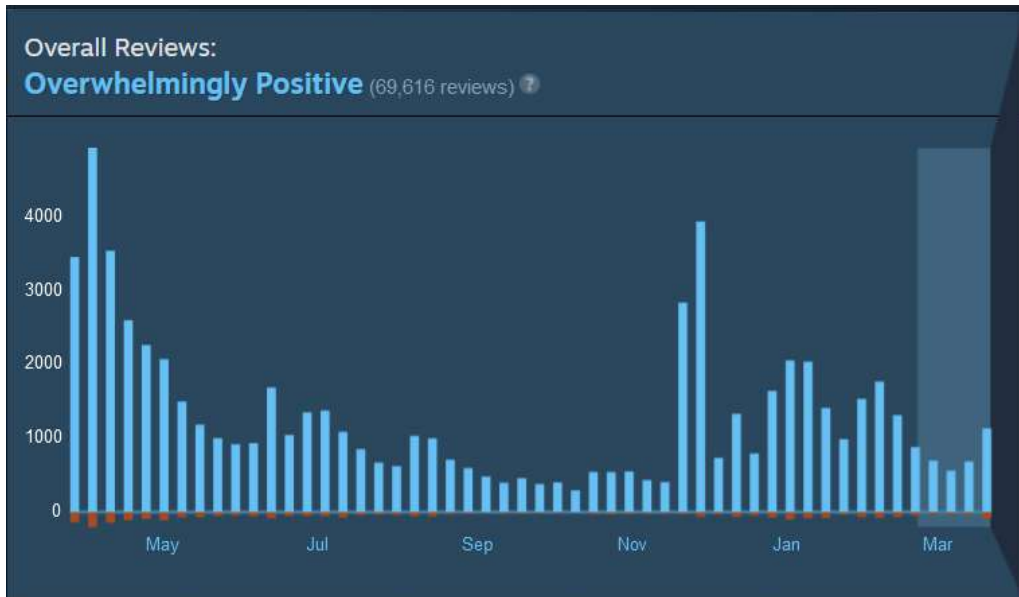
Figure 2.21   It Takes Two Overall Rating on Steam

2.2   Comparison of Three Existing Game

Table 2.1   Comparison of Three Existing Game

	Overcooked 2	**BattleBlock Theater**	**It Takes Two**
Platform	● PC ● Nintendo Switch ● PlayStation ● Xbox One	● PC ● PlayStation ● Xbox 360 ● Xbox One	● PC ● PlayStation
Target System	● PlayStation 4, 5 ● Windows ● macOS ● Linux	● Microsoft Windows ● Mac OS X	● Microsoft Windows ● PlayStation 4, 5
Operating System	● Windows 7 and above ● MacOS Sierra - 10.12.6 and above ● Ubuntu 16.04.01 and above	● Windows XP and above ● Mac OS X 10.7 – Lion and above	● Windows 8.1 and above
Game Engine	Unity	-	Unreal Engine 4
Price	RM 59.00	RM 31.00	RM 159.00
In-app purchase	No	No	No
Graphics	3D	2D	3D
Network Connection	Yes	Yes	Yes
Player Mode	● Single player Multiplayer	● Single player ● Multiplayer	● Multiplayer
Available in Malaysia	Yes	Yes	Yes

Advantages	● The level design is creative, diverse, challenging and fun. ● There are a lot of different environments prepared for players. ● Cute design of characters. ● Players can invite their friends to play together.	● Force players to think in the puzzle levels. ● Level design and music is suitable. ● The art style and humour is the selling point. ● The difficulty of the game is suitable for everyone.	● Teamwork oriented game. ● Music is amazing and attracts people. ● Environment modal is perfect ● Unique gameplay mechanics ● Controls are tight and responsive ● Camera view is smooth and prefect
Disadvantages	● The multiplayer mode has lagging problems. ● The levels are too difficult and complex.	● Gameplay not attract people ● All levels look virtually same ● Normal game mechanics	● The storyline of the game is not suitable and attracts people.

For the Overcooked 2, the level design is creative and challenging for the players. The challenges will be different for different environment. From this, the game will be more interesting and not getting boring after playing few levels as the challenges for players in each environment are different. While for the disadvantage of this game is the levels are too difficult and complex. The difficulty of the levels is too higher for the players. Furthermore, the Overcooked 2 only implement chat system for the Xbox One and PlayStation 4 platforms. For the other platforms such as Nintendo Switch and PC, the chat system did not implement into the game. The players only can communicate with each other's by using the third-party chat service such as Steam voice chat and Discord.

For the BattleBlock Theater, the puzzle levels are designed well as the levels force the players to think and solve the problems. From this, the players can encourage their problem solving skill while playing this game. Besides that, the difficulty of the challenges in the game is suitable for public. While for the disadvantage of BattleBlock Theater is the environments are look similar. Moreover, the keyboard chatting in-game is not supported in BattleBlock Theater. Players only can use the third-party chat service to communicate while playing game.

For the It Takes Two, the environment is the most engaging part of the game as it is 3D models and the models are smooth and prefect. The gameplay mechanics also unique as it is a teamwork oriented game. Moreover, It Takes Two also implement chat system in the game. The text message that send by the another player can be read aloud in voice chat. The incoming voice chat also can be displayed as text on the screen. While the disadvantage of this game is the storyline of the game cannot attract some of the people.

As conclusion, the similar of this three existing games are three of them are multiplayer game. Player have to work together to complete task in the game. Therefore, the communication skill is important for the player to assign tasks between them. Player can improve their communication skill while playing game. An important characteristic that can be drawn is that the game environment should be prepared with different types to attract the player in order to avoid similar game views throughout the game. Furthermore, the difficulty of challenging in game levels also need to be pay attention as the target user for this game is 10 years and above. Therefore, the difficulty should suitable for children. Moreover, the chat system is important as it used to communicate with other player. Chat system allows players to communicate when encountering problems or assigning tasks. Therefore, the chat system should implement in this game.

2.3   Multiplayer Video Game

Multiplayer video game is a video game that allows more than one person to play together in the same game environment at same time (Computer Hope, 2017). The

Internet is required to connect to the server. From this, the player's data can be synchronized and the system can get the needed data from the server.

As gaming and technology have increased, so too has its social aspects. This is because multiplayer video games can gather the players to play game at the same time. While playing games with other players, they can lead to more prosocial behaviours among children. Behaviour that is positive, helpful, and aimed toward social acceptance and friendship. The relationship between the players will be tie down especially for the cooperation game. Furthermore, playing multiplayer video game can promote teamwork and also build confidence. Teams and groups compete in multiplayer games. That implies that you are actually a member of a larger team when you play. In order to win the game, you must work together with your team. Both teamwork and confidence-building are encouraged by it. Sometimes, winning the game with a single play will boost your confidence.

Little Messenger, the game developed by this project is also a multiplayer game. The title of this project is help people encourage their communication skill while playing game. Therefore, the game was developed as a multiplayer game. Multiplayer game can help players to encourage communication. This is because players have to complete some tasks together in the game. Therefore, when designing the gameplay and levels in this project, focus on how to let the players work together to overcome the problem and complete the tasks. Communication is the needed skill in task distribution and teamwork which cannot be done in the single player mode. In single player mode, players only need to focus on their own character, while in the multiplayer mode players have to get teamwork with their partner and discuss with partner how to solve the problems.

2.4 Development Process Model

2.4.1 Waterfall Model
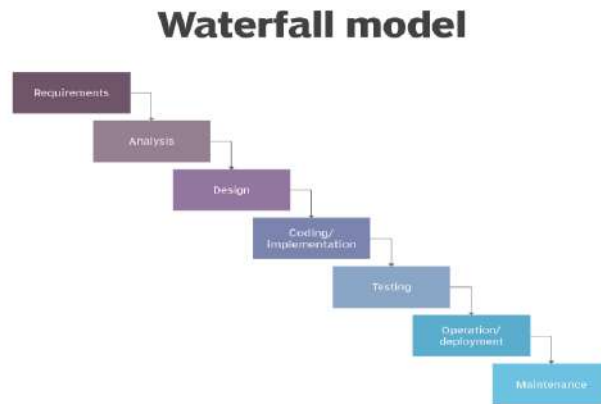
Figure 2.22   Waterfall Model

Waterfall model is one of the development process models introduced by Winston W. Royce in an article in 1970 (*Try QA*, 2021). There are seven phases in this model which are requirements, analysis, design, implementation, testing, deployment, and maintenance. In this model, the process is work from the top phases first which the requirements phase is. In this phase, developers have to collect the requirements from the stakeholders. After the requirements phase is fully complete then move to the next phase which is the analysis phase. In this phase, developers have to gather all the requirements and analyse them. When it comes to the design phase, developers have to design the game according to the requirements that were collected before. After that, developers can start coding to develop the game at the implementation phase. When the game is finished implementation, developers can start testing the game. Then, developers can deploy the game to the user or release it to market. Once the game is deployed, maintenance is needed to improve the performance of the game. The advantage of the waterfall model is it is easy to use as it easily understandable and explainable phases. It can be used to overcome many issues. Furthermore, developers can easily arrange the milestones. Unfortunately, this modal is not suitable for complex and object-oriented projects. It is also difficult to accommodate change requests once developers start to implement the game. Therefore, the waterfall model is not suitable for this project.

28
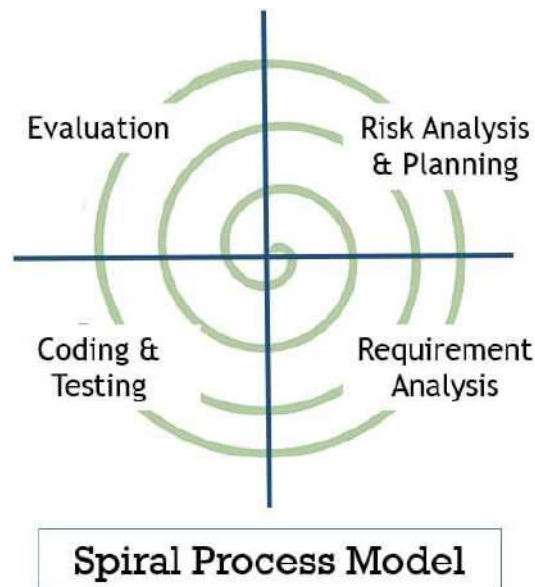
2.4.2 Spiral Model

Figure 2.23   Spiral Model

Spiral model is a development process model which was introduced by Barry Boehm. in this model, there are four phases which are risk analysis and planning phase, requirement analysis phase, coding and testing phase and evaluation phase. For the risk analysis and planning phase, developers will identify all the risks that are involved in the current iteration then minimize it and also state the objective of the project. After that, developers collect all the requirements from the stakeholders and analyse them. Then, developers can start to develop the coding part for the game. After finishing the coding part, developers will test all the functions in the game. The final phase is the evaluation phase. In this phase, developers will evaluate the game whether it achieved all the objectives or not. Developers also have to evaluate whether the planning is fully successful or not. The advantage of this model is that this model focuses on reducing risks that are involved in the project, therefore the project can be developed under a low risk. Furthermore, this model is suitable for a long term project. The customer requirements can be changed over the period but this project is not a long term project. Therefore, this model is not suitable for this project.

29
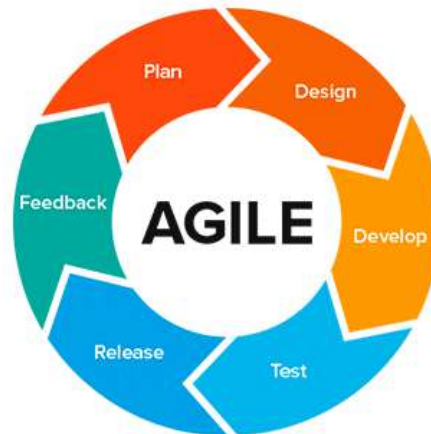
2.4.3   Agile Model

Figure 2.24   Agile Model

Agile model is one of the development process models which is a type of incremental model. In research from Dziuba (2022) this model is suitable for the project that requires speed and flexibility. In this modal, there are six phases which are plan, design, develop, test, release and feedback. In the first phase, plan phase, developers have to collect all requirements from stakeholders and it will become the initial documentation. Next, developers can start to design the game based on the requirements gathered before. After the design phase will be the development phase. During this phase, developers have to convert the design documentation into actual work through coding. Once the development process is done, developers have to test the game to ensure the game meets all technical requirements. After the testing phase, the game can be released to customers as demo or actual use. After all the previous phases are done, developers can get the review for the game from the customers and check if it is against the updated requirements. If stakeholders are not satisfied with the product, then developers can start iteration 2 until the stakeholders are satisfied with it. The advantage of the Agile model is it is allowed to change requirements even late. It gives a lot of flexibility to developers. Therefore, this development process model is suitable for this project.

CHAPTER 3

METHODOLOGY

3.1 Introduction

After analysis of the three game development models which are Waterfall model, Spiral model and Agile model, the more suitable development model for this project is Agile model as Spiral model is for long term project but this project is a short term project. For the Waterfall model, it is a risky model for mistakes, it does not allow change requirements when it comes to another phase. Therefore, the Agile model is the most suitable model for this project compared to the other two models.

There are six phases in the Agile model which are plan, design, develop, test, release and feedback. The advantage of the Agile model is it is allowed to change requirements even late. It gives a lot of flexibility to developers. This project is a short term project and it might have changes in requirements frequently. Therefore, this development process model is suitable for this project.

3.2 Plan

During this phase, developers have to brainstorm the ideas. State the issue that will discuss in this project and the objective of this project. The ideas are written down and it will be the requirements of this project. After that, the proposed requirements will be discussed by the developer and project supervisor. When the developer and project supervisor both agree with the requirements, then will move to the next phase which is the design phase. As this

project is a game development project, thus the design will be Game Design Document (GDD) which is the blueprint of the video game.

3.2.1 User Requirement

Functional Requirement

- The proposed game should allow the player to use the control key to move left and right.

- The proposed game should allow the player to control the character jump when pressing the jump key.

- The proposed game should allow player grab the object when pressing grab key.

- The proposed game should allow the player to damage the enemy to decrease the enemy's health bar by using shoot key.

- The proposed game must decrease the character's health bar when the character is damaged by enemy.

- The proposed game should allow player active the portal by using key.

- The proposed game should allow player go to next level through the portal.

- The proposed game should allow the player open the switch door when the switch is triggered.

- The proposed game must respawn the player at the starting point when the health bar of character becomes empty.

- The proposed game should pop out game over interface when the remaining time become empty.

- The proposed game should allow player to leave room when press quit button.

Non-Functional Requirement

- The proposed game only run on PC devices.

- The proposed game require Internet connect to the server.

- Any interaction between player and proposed game should not exceed 10 seconds.

3.2.2 Gantt Chart
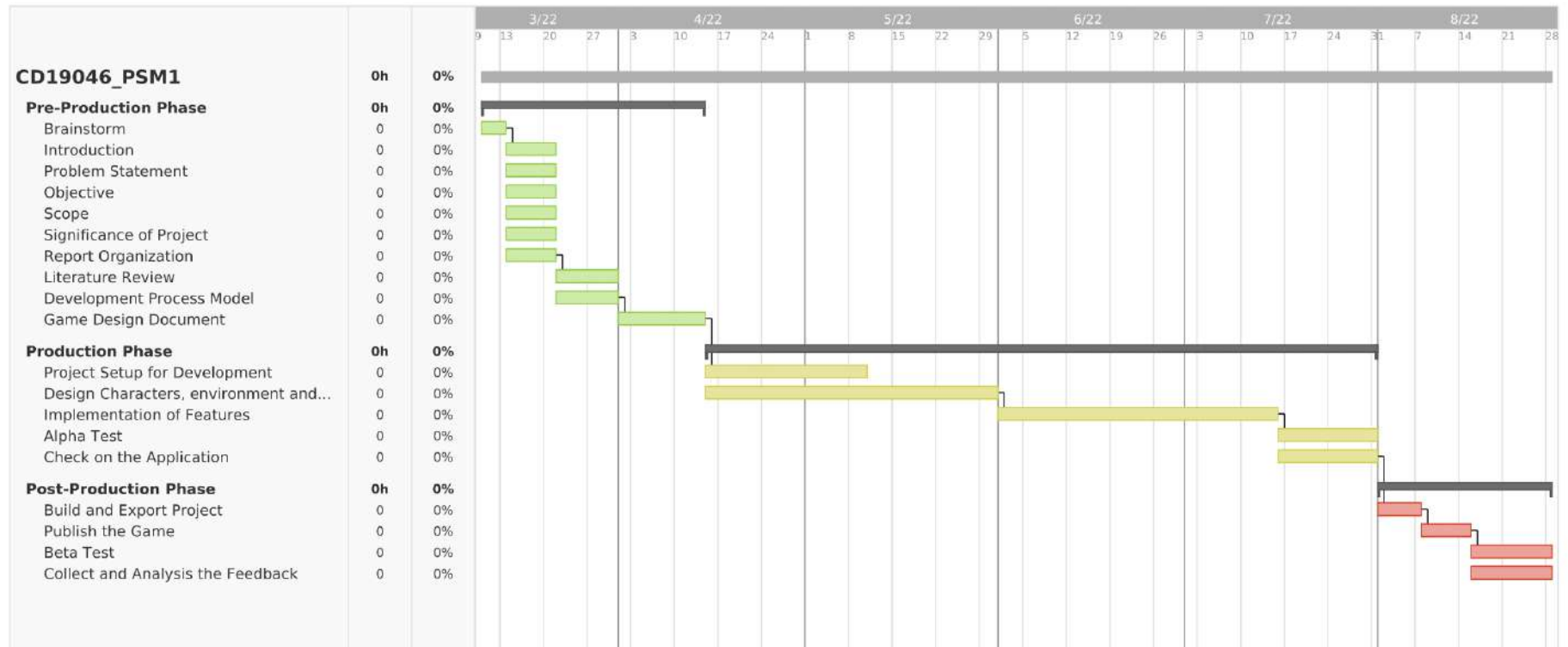
3.3   Game Design Document

3.3.1   Game Genre

The genre of the game application is a 2D multiplayer platformer game. The main game play is to control the character to have teamwork with party members to find out the exit door. There are a lot of obstacles and traps on the 2D plane that need players to work together to pass through it.

3.3.2   Game World

The game world of this game application is design in different environment which are grassland, desert, snow land, dark forest and sky. There will be some obstacles on the map. As the story background is during COVID-19 pandemic, therefore, the enemy will be the virus. The enemy will patrol around the map, players have to defeat them or pass through them to reach the goal point.

3.3.3   Storyline

During COVID-19 pandemic, people are facing communication problems when MCO. A lot of conflict happens between family and friends as they communicate less with each other. Therefore, the player will be a little messenger to help people to send their heart wishes to their lovely family or friends.

3.3.4   Level Design

The game consists of 5 levels. Players have to find the key that is located somewhere on the map to unlock the door and go to the next level. Along the journey, players will meet a lot of obstacles. Some of the obstacles need the players to work together to solve it and pass through it. The players also will meet the enemy in the game. The number of enemies will

increase level by level. Furthermore, there are some traps on the map. Once the players get into the trap, then the character will be transported to the starting point. Players have to find out the key again. If the remaining time becomes zero, then the players will game over. Therefore, players have to go into the exit door in the limited time. All the players have to go into the door then the remaining time will stop counting.
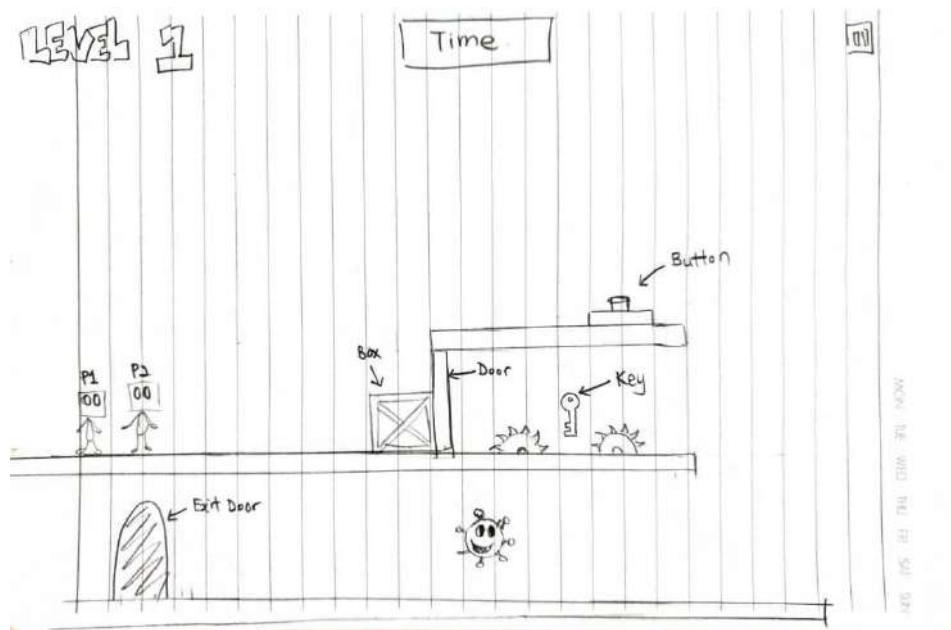
Figure 3.1   Simple Level Design

3.3.5 Game Mechanics

3.3.5.1 Main Character

The main character of this game is a little messenger who helps the people to send their voice and heartfelt wishes to their important people. The main character is designed in a simple vector art. The hat and the bag represent the messenger element.
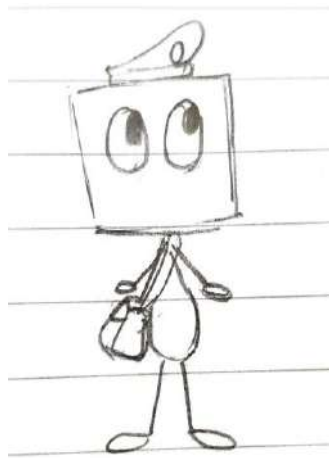
Figure 3.2   Main Character Concept Art

3.3.5.2   Enemy

In this game, there are two types of enemies which are boss monster and normal monster. The normal monster will portal around the map while the boss monster will only occur at the final level. Both monsters are design based on the virus as the background of this game is during COVID-19.

Figure 3.3   Boss Monster Concept Art
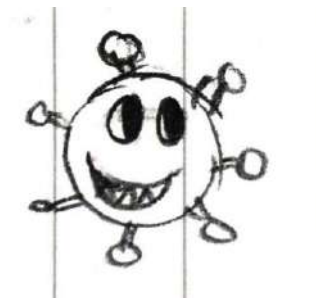
Figure 3.4   Monster Concept Art

3.3.5.3   Player Rules

- The player can control the main character to move in this level.

- The player can shoot at the enemy to damage them.

- The player can grab the box in the game.

- The player needs to find out the key to open the exit door to pass to the next level.

- The player will be transported by system to the starting point when the player gets damaged by an enemy or traps.

3.3.5.4   Player Control

Players can use arrow keys or WASD keys to move the main character in 4 directions, left, right, up, and down. The up button also can be used to jump in the game. Furthermore, the left click of the mouse can be used to throw the paper airplane bomb to attack the enemy while the right click of the mouse can be used to grab items in the game.

3.3.5.5   Reward and Punishment

Reward

- If the player get the time bonus in the game, then the remaining time will increase a little bit in the level.

Punishment

- If a player gets damaged by an enemy or traps, then the system will transport the player to the starting point at the level.

- Player will game over if times up and the player did not pass through the portal.

3.3.5.6   Victory Condition

Players have to find out the key to unlock the exit door. All players reach the exit door to pass to the next level in the limit time.

3.3.5.7   Challenges

Players need to communicate well when facing the obstacles to distribute tasks. The obstacles need their teamwork to overcome the problems and pass through it together. Furthermore, all the players need to reach the exit door. If only one player reaches there, the remaining time will continue counting.

3.3.6 Storyboard

PAGE TITLE: Intro Story	STORYBOARD NUMBER: 1.0
	ELEMENTS: FONT: - SOUND EFFECT (SFX): - MUSIC: (sad BGM) ANIMATION: -
DESCRIPTION: This is the scene 1 of intro story. A little girl is chatting with his grandma.	

PAGE TITLE: Intro Story	STORYBOARD NUMBER: 1.1
	ELEMENTS: FONT: - SOUND EFFECT (SFX): - MUSIC: (sad BGM) ANIMATION: -
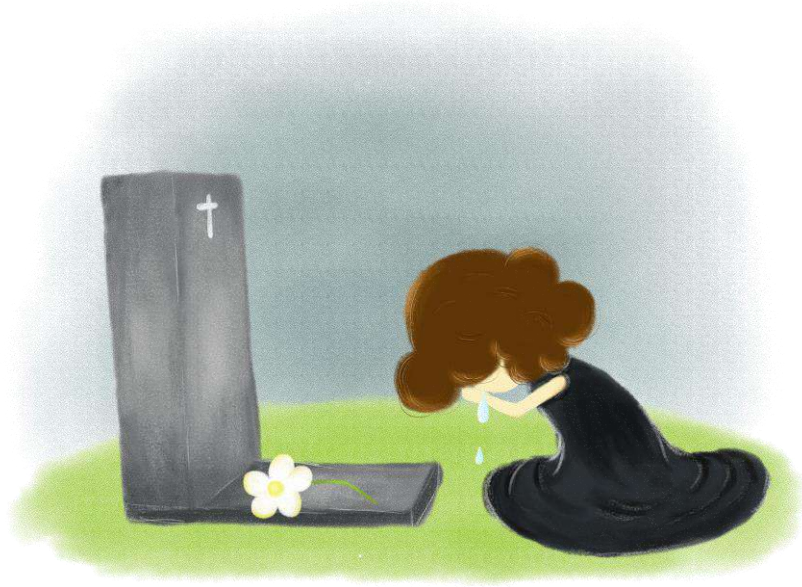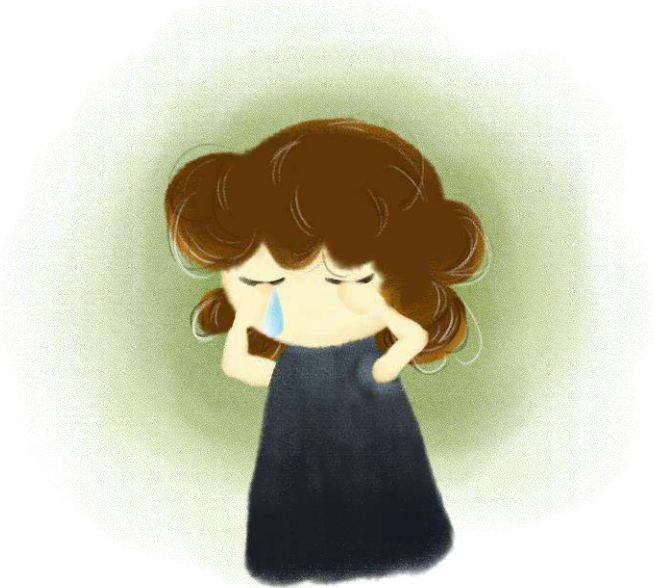
DESCRIPTION:

This is the scene 2 of intro story. Little girl is crying in front of her grandma's grave.

PAGE TITLE: Intro Story	STORYBOARD NUMBER: 1.2
	ELEMENTS: FONT: - SOUND EFFECT (SFX): - MUSIC: (sad BGM) ANIMATION: -

DESCRIPTION:

This is the scene 3 of intro story. Little girl is crying.

PAGE TITLE: Intro Story	STORYBOARD NUMBER: 1.3
	ELEMENTS: FONT: - SOUND EFFECT (SFX): - MUSIC: (sad BGM) ANIMATION: -
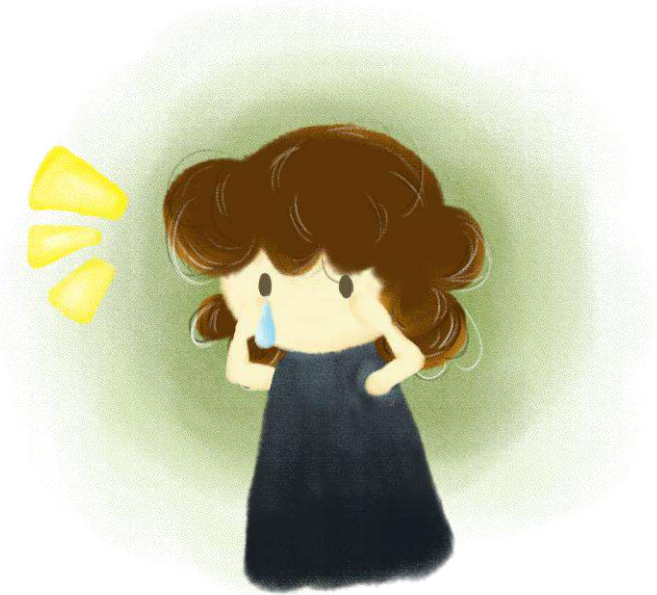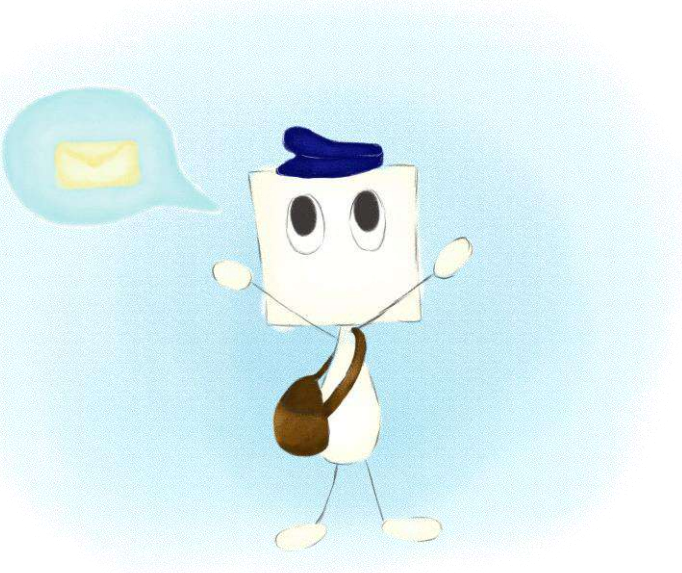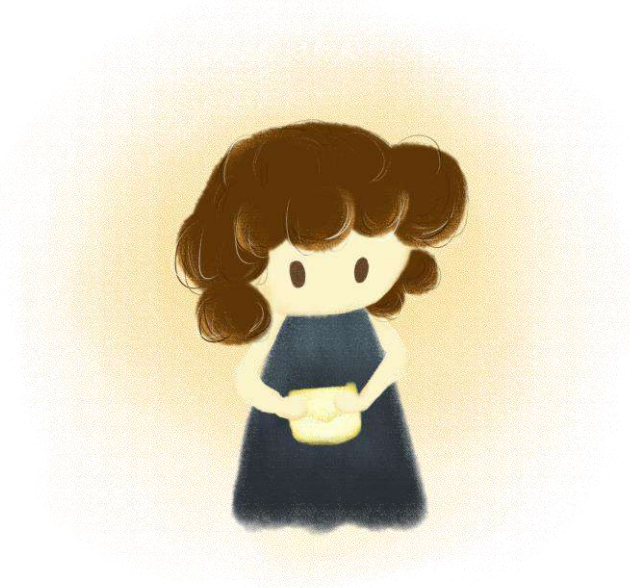
DESCRIPTION:

This is the scene 4 of intro story. Little girl hear some sound and look around.
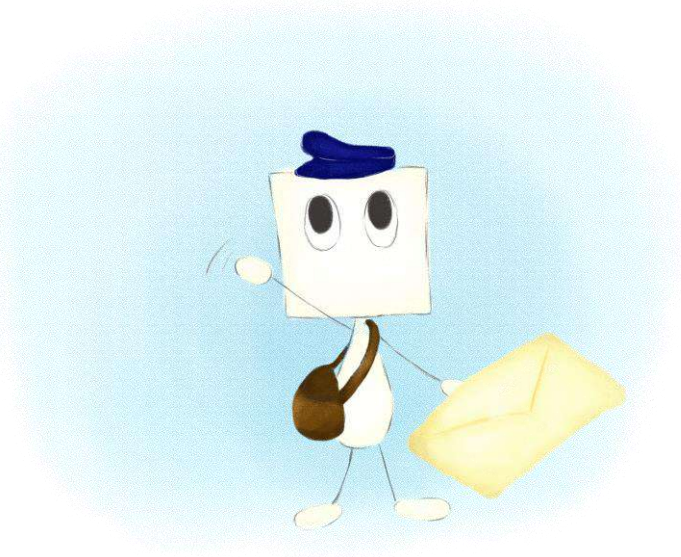
PAGE TITLE: Intro Story	STORYBOARD NUMBER: 1.4
	ELEMENTS: FONT: - SOUND EFFECT (SFX): - MUSIC: (sad BGM) ANIMATION: -

DESCRIPTION:

This is the scene 5 of intro story. Little Messenger hide behind the grave.

PAGE TITLE: Intro Story	STORYBOARD NUMBER: 1.5
	ELEMENTS: FONT: - SOUND EFFECT (SFX): - MUSIC: (sad BGM) ANIMATION: -

DESCRIPTION:

This is the scene 6 of intro story. Little Messenger want to help little girl to deliver the last letter to her grandma.

PAGE TITLE: Intro Story	STORYBOARD NUMBER: 1.6
	ELEMENTS: FONT: - SOUND EFFECT (SFX): - MUSIC: (sad BGM) ANIMATION: -

DESCRIPTION:

This is the scene 7 of intro story. Little girl hold a letter.

PAGE TITLE: Intro Story	STORYBOARD NUMBER: 1.7
	ELEMENTS: FONT: - SOUND EFFECT (SFX): - MUSIC: (sad BGM) ANIMATION: -

DESCRIPTION:

This is the scene 8 of intro story. Little girl give the letter to Little Messenger.

PAGE TITLE: Intro Story	STORYBOARD NUMBER: 1.8
	ELEMENTS: FONT: - SOUND EFFECT (SFX): - MUSIC: (sad BGM) ANIMATION: -

DESCRIPTION:

This is the scene 9 of intro story. Little Messenger say goodbye to the little girl.

PAGE TITLE: Intro Story	STORYBOARD NUMBER: 1.9
	ELEMENTS: FONT: - SOUND EFFECT (SFX): - MUSIC: (sad BGM) ANIMATION: -
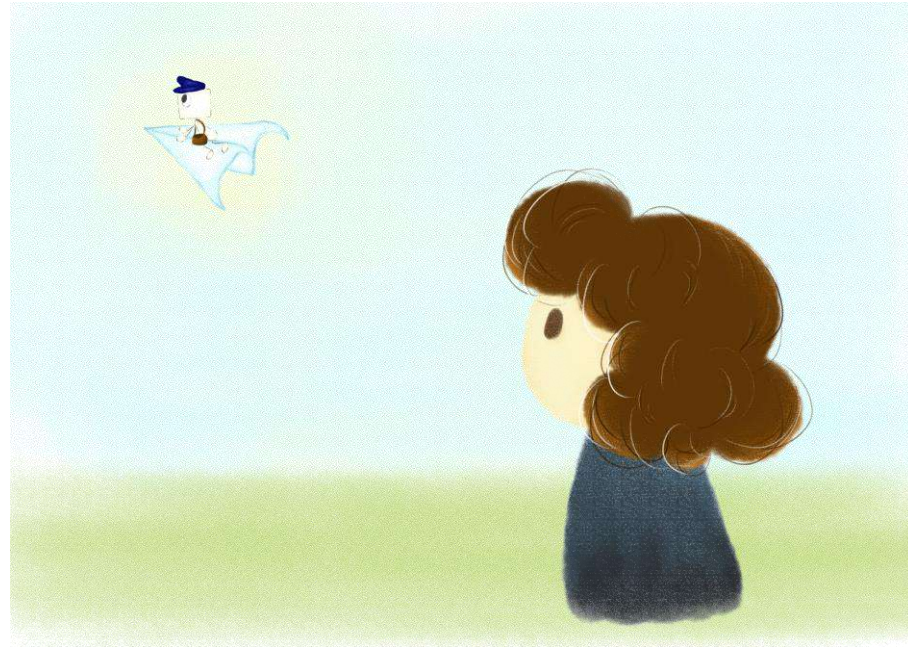
DESCRIPTION:

This is the scene 10 of intro story. Little Messenger fly into the sky and start the journey.

PAGE TITLE: Main Menu	STORYBOARD NUMBER: 2.0
	ELEMENTS: FONT: JazzCreateBubble for button and game title SOUND EFFECT (SFX): • Game Button Sfx 1 – hover • Game Button Sfx 2 –clicked MUSIC: (funny BGM) ANIMATION: -

DESCRIPTION:

This scene is the main menu scene. This scene contains four main buttons, which are tutorial mode, create game room, join game room and exit button. If click on the tutorial mode button, then will switch to storyboard 4.0.When clicking on the create game room button or join game room button, then will switch to storyboard 2.1. If the player clicks on the exit button, then will quit the game application.

PAGE TITLE: Username	STORYBOARD NUMBER: 2.1
	ELEMENTS: FONT: JazzCreateBubble SOUND EFFECT (SFX): - Game Button Sfx 1 – hover - Game Button Sfx 2 –clicked MUSIC: (funny BGM) ANIMATION: -
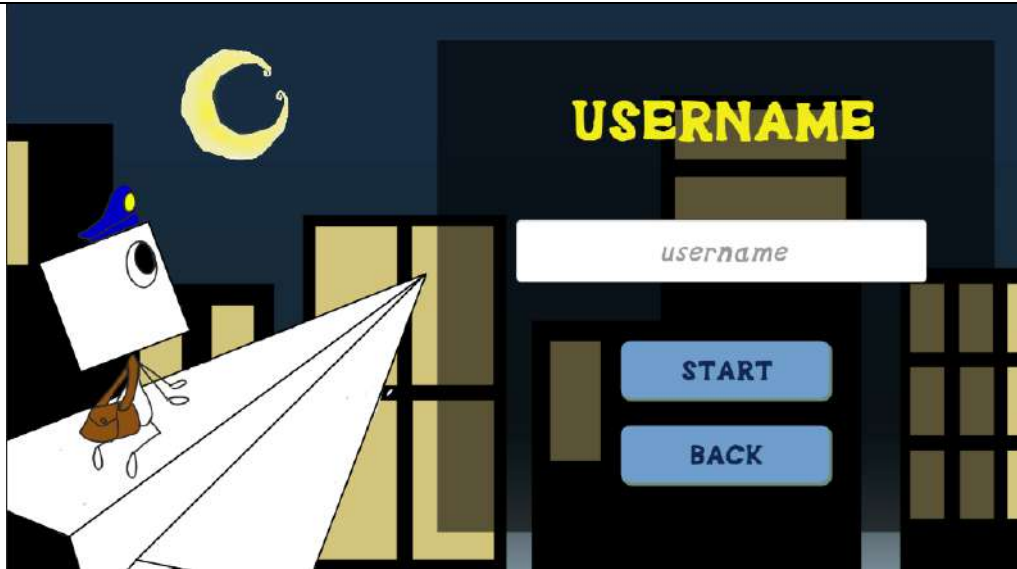
DESCRIPTION:

This scene is the username interface. Players can enter their username in the text box. The back button is back to the Main Menu scene as shown in storyboard 2.0. After enter username, click the start game button then will switch to another scene. If player click create game room button before, then will switch to storyboard 2.3. If the player click join game room before, then will switch to storyboard 2.4.

PAGE TITLE: Create Room Code	STORYBOARD NUMBER: 2.3
	ELEMENTS: FONT: JazzCreateBubble SOUND EFFECT (SFX): Game Button Sfx 1 – hover Game Button Sfx 2 –clicked MUSIC: (funny BGM) ANIMATION: -

DESCRIPTION:
This scene is the create room code scene. Players can enter a room code inside the text box. The system will create a room with the room code as id in the server. The back button is back to the Main Menu scene as shown in storyboard 2.0. After enter game room code, click the create room button then will switch to storyboard 4.1.

PAGE TITLE: Join Room	STORYBOARD NUMBER:2.4
	ELEMENTS: FONT: JazzCreateBubble SOUND EFFECT (SFX): Game Button Sfx 1 – hover Game Button Sfx 2 –clicked MUSIC: (funny BGM) ANIMATION: -

DESCRIPTION:

This scene is the join room scene. Players can enter a room code inside the text box which already create before to join the targeted room. The back button is back to the Main Menu scene as shown in storyboard 2.0. After enter game room code, click the join room button then will switch to storyboard 4.1.

PAGE TITLE: Game Mechanics – Multiplayer Mode	STORYBOARD NUMBER: 3.0
	ELEMENTS: FONT: - SOUND EFFECT (SFX): - ASSEST REQUIRED: Main Character MUSIC: - ANIMATION: Idle animation
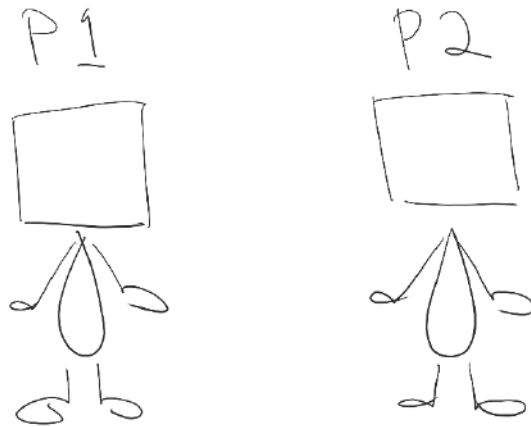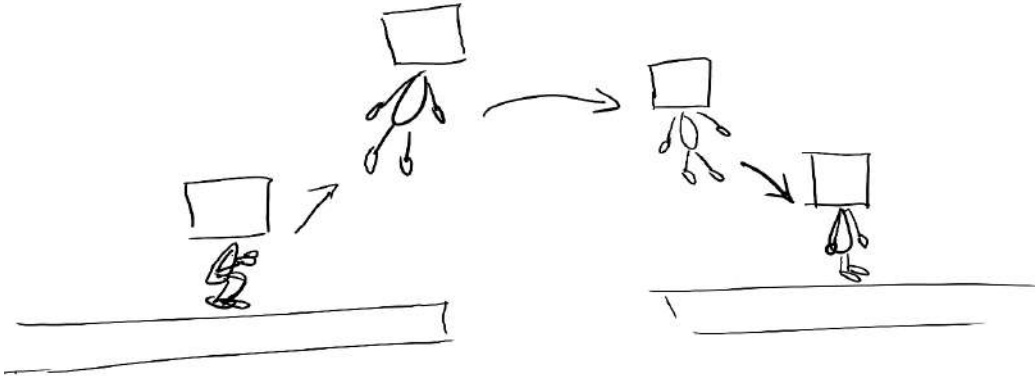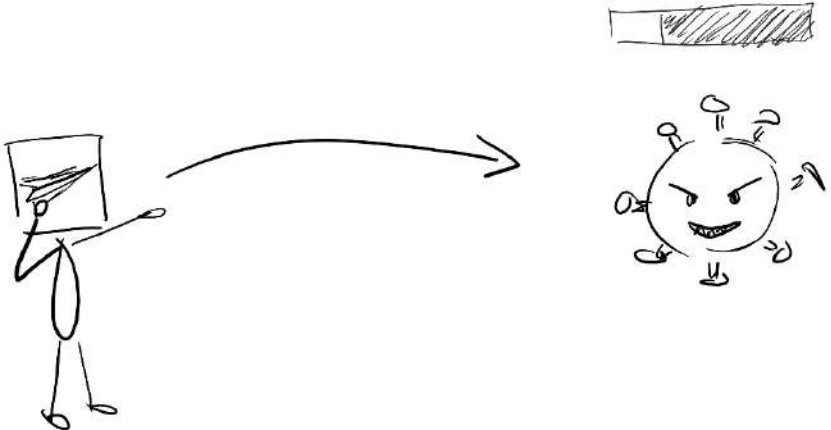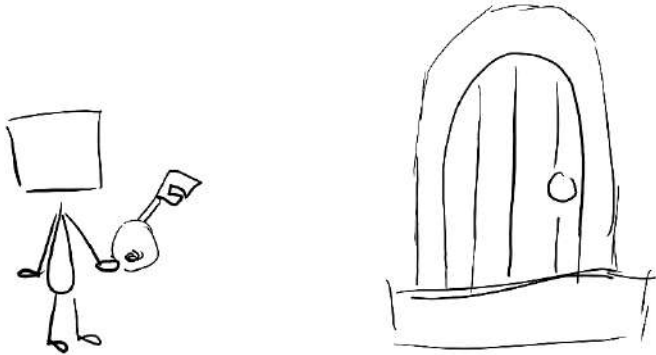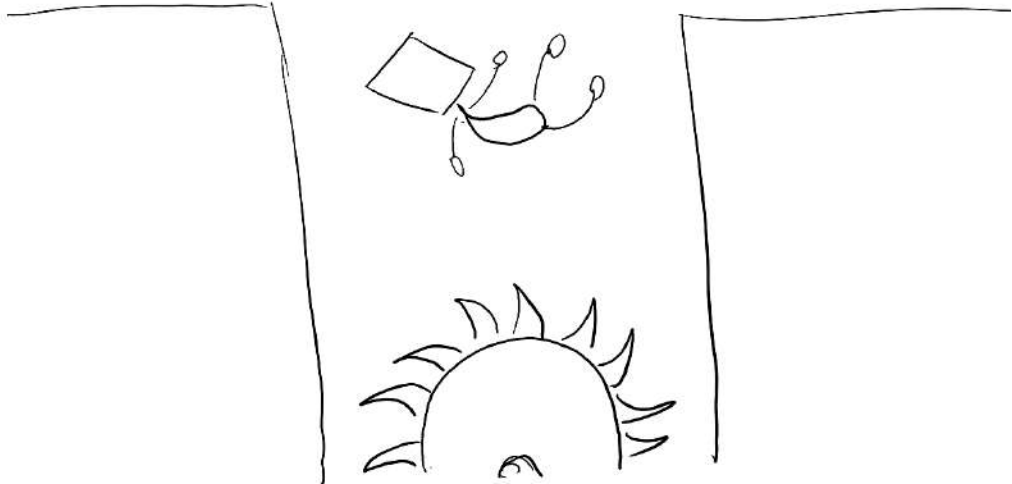
DESCRIPTION:

This game is a multiplayer game. The number of players needed to start a game is two.

PAGE TITLE: Game Mechanics – Movement	STORYBOARD NUMBER: 3.1
	ELEMENTS: FONT: - SOUND EFFECT (SFX): jumping SFX ASSEST REQUIRED: Main Character, Platforms MUSIC: - ANIMATION: Walking animation, Jumping animation

DESCRIPTION:
The character can jump around the platforms with keyboard controls. The animations will be implemented when the character is walking and jumping.

PAGE TITLE: Game Mechanics – Throw paper airplane to attack	STORYBOARD NUMBER: 3.2
	ELEMENTS: FONT: - SOUND EFFECT (SFX): shooting SFX, damage SFX ASSEST REQUIRED: Main Character, Enemy MUSIC: - ANIMATION: Throwing paper airplane animation, Explode animation

DESCRIPTION:
The character can throw paper airplanes to the enemy to attack them. When the paper airplane touches the enemy, it will explode and damage the enemy's health bar.

PAGE TITLE: Game Mechanics – Reaching the end of the level	STORYBOARD NUMBER: 3.3
	ELEMENTS: FONT: - SOUND EFFECT (SFX): - ASSEST REQUIRED: Main Character, key, door MUSIC: - ANIMATION: Door open animation

DESCRIPTION:
The door needs the key to unlock, then the character can pass through the door to go to the next level.

PAGE TITLE: Game Mechanics – Falling into the trap	STORYBOARD NUMBER: 3.4
	ELEMENTS: FONT: - SOUND EFFECT (SFX): damage SFX ASSEST REQUIRED: Main Character, trap MUSIC: - ANIMATION: Death animation,

DESCRIPTION:
When the character falls into the trap, then the character will die and the player will be transported to the starting point by the system.

PAGE TITLE: Game Mechanics – Teleporters	STORYBOARD NUMBER: 3.5
	ELEMENTS: FONT: - SOUND EFFECT (SFX): teleport SFX, teleporter SFX ASSEST REQUIRED: Main Character, teleporters MUSIC: (funny BGM) ANIMATION: teleport animation
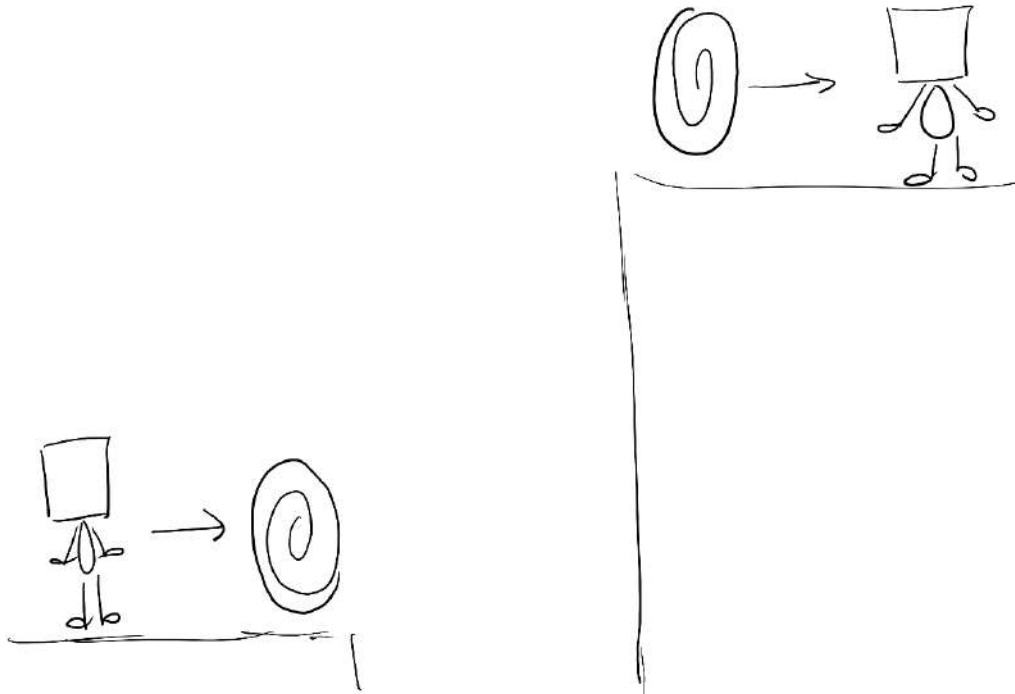
DESCRIPTION:
When the character jumps into the teleporter, then the character will be teleported to another place.

PAGE TITLE: Game Mechanics – Trigger switch to open the door	STORYBOARD NUMBER: 3.6
	ELEMENTS: FONT: - SOUND EFFECT (SFX): - ASSEST REQUIRED: Main Character, switch, door MUSIC: - ANIMATION: door open animation
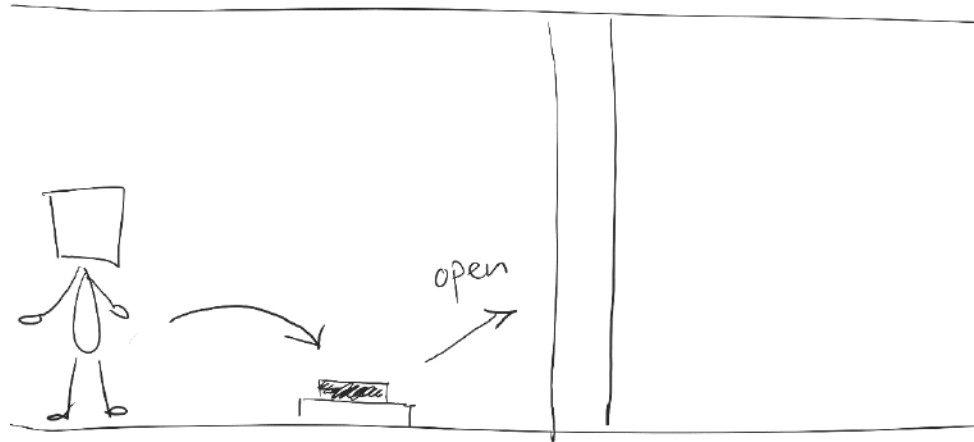
DESCRIPTION:
When the character triggers the switch, then the door will open to let the character pass through.

PAGE TITLE: Game Mechanics – Health item	STORYBOARD NUMBER: 3.7
	ELEMENTS: FONT: - SOUND EFFECT (SFX): heal SFX ASSEST REQUIRED: Main Character, health item MUSIC: ANIMATION: -

DESCRIPTION:

The character can collect the health item to get heal. After collect the health item, the health amount of character will increase.

PAGE TITLE: Game Mechanics – Game Over	STORYBOARD NUMBER: 3.8
Time: 0:00 Game Over Replay Back to Menu	**ELEMENTS:** FONT: JazzCreateBubble SOUND EFFECT (SFX): Game Button Sfx 1 – hover Game Button Sfx 2 –clicked MUSIC: ANIMATION: -

DESCRIPTION:
When the remaining time is zero, then the game over scene will pop out. Players can choose to replay the level or back to the main menu as shown in storyboard 2.0.

PAGE TITLE: Game Mechanics – Start Panel	STORYBOARD NUMBER: 3.9
	ELEMENTS: FONT: JazzCreateBubble SOUND EFFECT (SFX): Game Button Sfx 1 – hover Game Button Sfx 2 –clicked MUSIC: ANIMATION: -

DESCRIPTION:

When player clicks the start button, the character will spawn at the starting point.

PAGE TITLE: Game Mechanics – Pause Menu	STORYBOARD NUMBER: 3.10
	ELEMENTS: FONT: JazzCreateBubble SOUND EFFECT (SFX): Game Button Sfx 1 – hover Game Button Sfx 2 –clicked MUSIC: ANIMATION: -
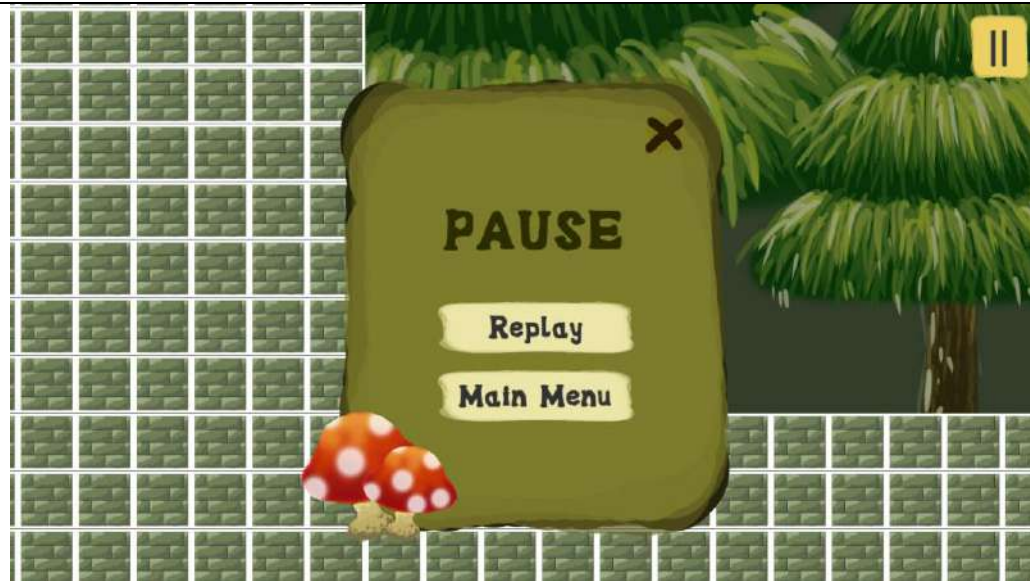
DESCRIPTION:

When player clicks the pause menu button or press ESC key, the pause menu panel will pop out.

PAGE TITLE: Game Mechanics – Tutorial Level	STORYBOARD NUMBER: 4.0
	ELEMENTS: FONT: JazzCreateBubble SOUND EFFECT (SFX): - MUSIC: (funny BGM) ANIMATION: -

DESCRIPTION:
The tutorial level will teach the player about the gameplay and how to control the character in the game.

PAGE TITLE: Game Mechanics – Level 1	STORYBOARD NUMBER: 4.1
	ELEMENTS: FONT: JazzCreateBubble SOUND EFFECT (SFX): - MUSIC: (funny BGM) ANIMATION: -
DESCRIPTION: The environment of level 1 is forest.	
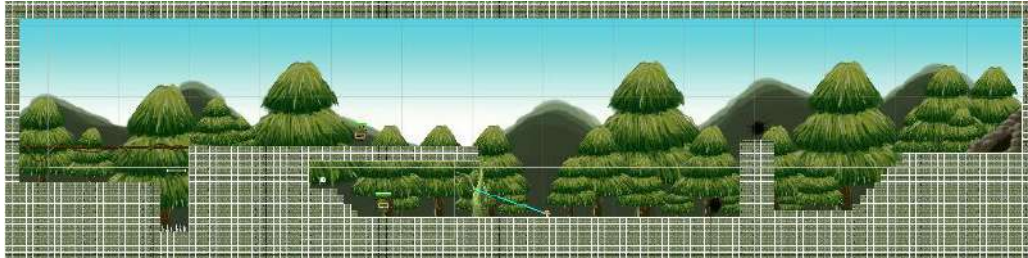
PAGE TITLE: Game Mechanics – Level 2	STORYBOARD NUMBER: 4.2
	ELEMENTS: FONT: JazzCreateBubble SOUND EFFECT (SFX): - MUSIC: (funny BGM) ANIMATION: -

DESCRIPTION:

The environment of level 2 is forest.

PAGE TITLE: Game Mechanics – Level 3	STORYBOARD NUMBER: 4.3
	ELEMENTS: FONT: JazzCreateBubble SOUND EFFECT (SFX): - MUSIC: (horror BGM) ANIMATION: -

DESCRIPTION:
The environment of level 3 night grave.

PAGE TITLE: Game Mechanics – Level 4	STORYBOARD NUMBER: 4.4
	ELEMENTS: FONT: JazzCreateBubble SOUND EFFECT (SFX): - MUSIC: (horror BGM) ANIMATION: fog moving animation
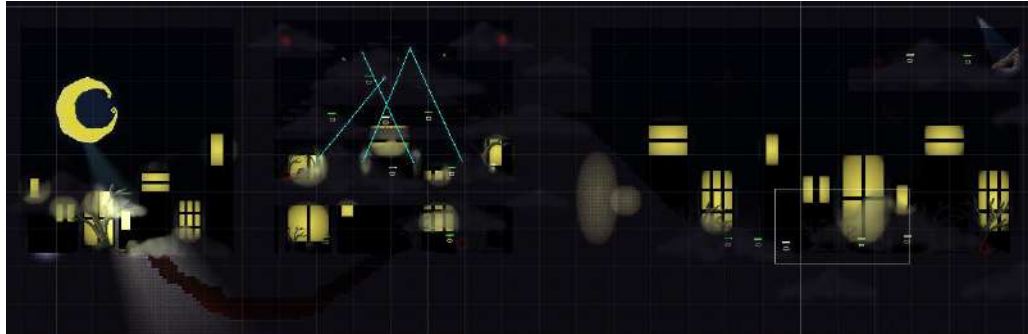
DESCRIPTION:
The environment of level 4 is night grave.

PAGE TITLE: Game Mechanics – Level 5	STORYBOARD NUMBER: 4.5
	ELEMENTS: FONT: JazzCreateBubble SOUND EFFECT (SFX): - MUSIC: (chill and relax BGM) ANIMATION: cloud moving animation

DESCRIPTION:

The environment of level 5 is in the heaven.

3.3.7 Flowchart
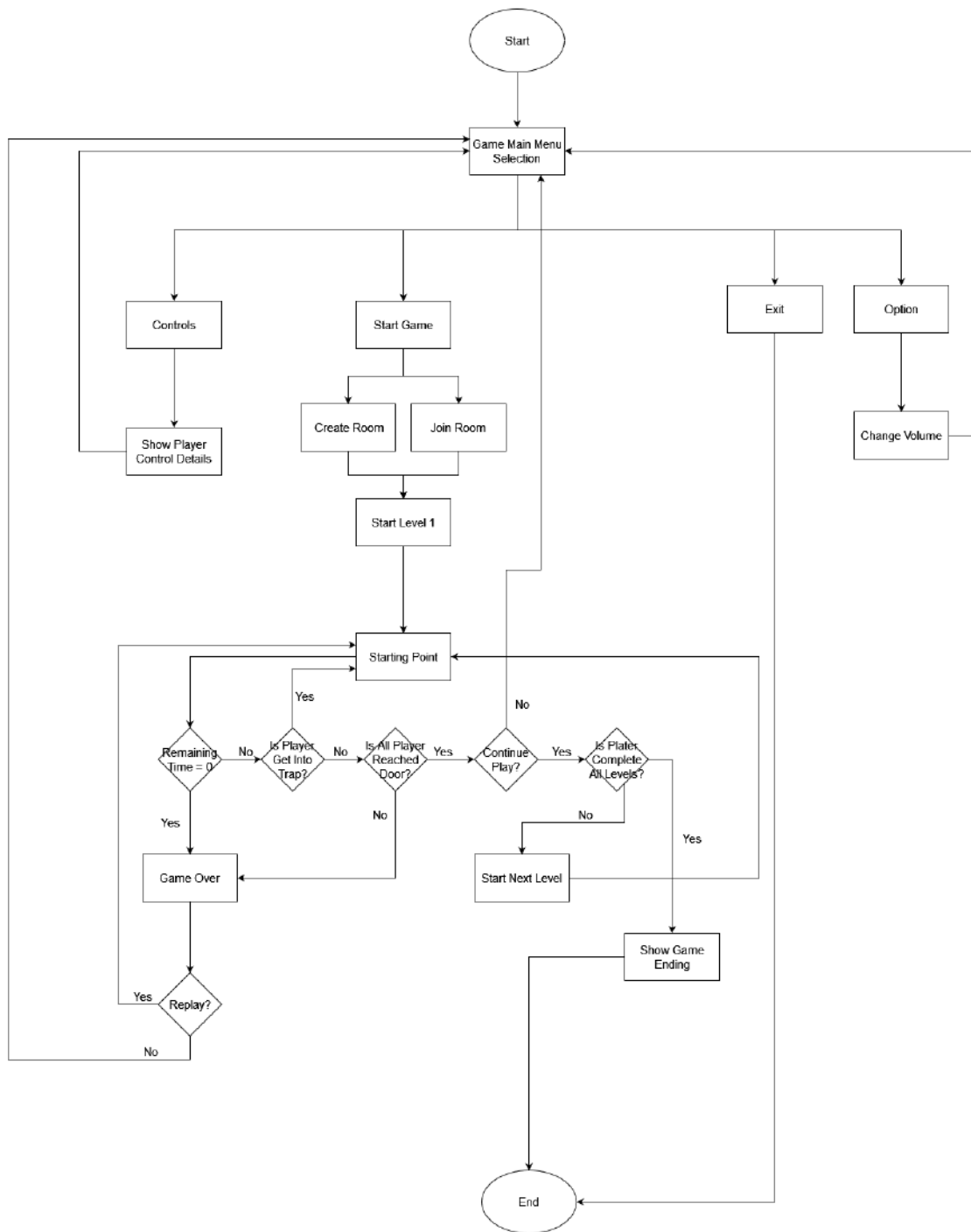
Figure 3.5   Overall Flowchart

3.3.8 Game Technology

The game that was proposed in this project will be developed by using Unity Engine. Unity Engine is a free-to-use software which is famous for developing 2D or 3D games. This game requires network connection when playing as it is a multiplayer game. Network connection is used to connect to the server to link with the other player.

Table 3.1   List of Software Used in Project

No	Software	Description
1.	Adobe Photoshop CC 2019	Adobe Photoshop is used to design the characters, background, interface and storyboard.
2.	Unity	Unity is used to create and develop the game.
3.	Visual Studio 2019	An Integrated development environment (IDE) that is used in Unity for scripting.
4.	Microsoft Word 2016	Microsoft Word 2016 is used for report writing and documentation

Table 3.2   List of Hardware Used in Project

No	Hardware	Description
1.	Laptops	Laptop is used for development game and documentation of the project.
2.	Pen Tablet	Pen tablet is used to design the character and create the character and item assets.

3.4   Develop

After the design phase, the developer can start to develop the game. Unity is used to develop the game function. For the coding part, Visual Studio is used as the scripting tool to code and implement into Unity. While the game asset, Adobe Photoshop is used to create all the assets. Then, implement the assets into the unity. After the development of the game function is complete, then use the Adobe Audition to create the sound effect

and background music of the game then implement it into Unity. After that, developers can build the game application and move to the next phase which is the testing phase.

3.5   Test

During this phase, User Acceptance Testing (UAT) will be conducted to do the project test. There are two parts of the test, which are the Alpha test and Beta test. Alpha test is about functionality test of the game application and Beta test is user feedback. The Alpha test will identify the error of the game before release to the public. Only the developers can conduct the test. While the Beta test will need to collect the user feedback after playing games.

3.5.1   Alpha Test

Alpha test is used to make sure the game is free from error. This test will ask about the functionality of game and the testing form will give to the tester to fill in. The testing form of Alpha test can be refer at APPENDIX A.

3.5.2   Beta Test

1. What is the respondent's gender?

2. How old are the respondent?

3. What is the respondent highest education level?

4. Does Little Messenger can run on PC device?

5. Does respondent think Little Messenger gameplay is fun and interesting?

6. Does respondent think Little Messenger is easy to understand?

7. Does respondent think Little Messenger is suitable for children to play?

8. Does respondent think Little Messenger is too difficult for children to play?

9. Does Little Messenger have a lot of bugs and glitches?

10. Does Little Messenger interact with player not exceed 10 seconds?

11. Does the instruction given in the tutorial level is clear and understandable?

12. Does Little Messenger encourage respondent's communication skill while play game?

3.6   Release

During this phase, the video game will be released to the public. Users can download the video game on their PC and play it with friends.

3.7   Feedback

The feedback of the user will gather in this phase and analysis all the feedback. From the feedback, make a conclusion and plan for the next development process to improve the game.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

This chapter is discuses about the development and implementation process of the propose game. The game interfaces, character design, development of setup and coding will be discussed. The result of testing also will be discussed at this chapter.

4.2 Project Setup

Table 4.1   Software to Setup during Development

Software	Description
Unity Engine	A game engine that used for game development. The version of Unity Engine that used in this project is 2021.3.11f1.
Adobe Photoshop CC 2019	Adobe Photoshop is used to design the characters, background, interface and storyboard.
Visual Studio 2019	An Integrated development environment (IDE) that is used in Unity for scripting.

Table 4.2   Essential Unity Packages Installed

Packages	Description
Photon Unity Networking 2	Photon Unity Networking (PUN) is a Unity package for multiplayer games. Flexible matchmaking gets players into rooms where objects can be synced over the network.
2D Tilemap Editor	2D Tilemap Editor is a package that contains editor functionalities for editing Tilemaps.
2D Sprite	Use Unity Sprite Editor Window to create and edit Sprite asset properties like pivot, borders and Physics shape.
LeanTween	LeanTween is an efficient tween engine that offers a many of the same features as the other tween engines (and more!) while having much less overhead.
Universal Renderer Pipeline (URP)	A prebuilt Scriptable Render Pipeline made by Unity which provides artist-friendly workflows that let users quickly create optimized graphics across a range of platforms.

4.3   Results

4.3.1   Game Interfaces and Character Design

The main menu of this game consists of four buttons which are tutorial mode button, create game room button, join game room button and exit button. The background of main menu is design by using Adobe Photoshop. The game style will be design in 2D vector art.

Figure 4.1   Main Menu Interface

The enter username interface allowed the player enter their favourite username. When join into the game, the username will show on the top of the character.
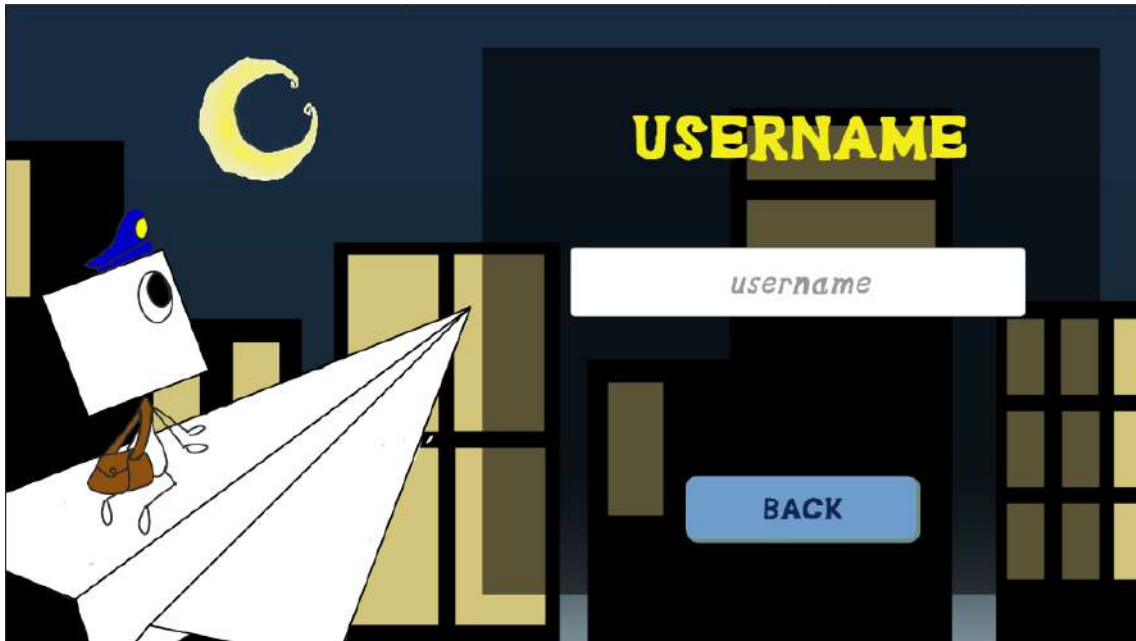
Figure 4.2   Enter Username Interface

Create game room interface allowed player to create a visual room based on the code. After create room, then will start the level 1.
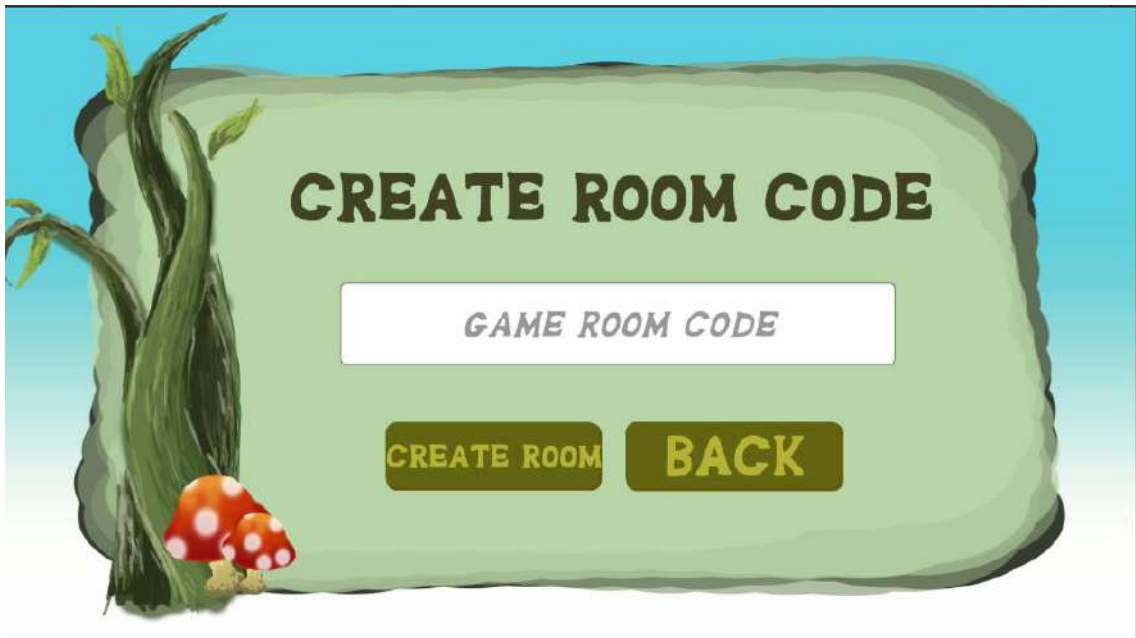
Figure 4.3   Create Game Room Interface

The join game room interface allowed the player join to a created game room based on the game code that create before. From this, the player can join to the game with another player.

Figure 4.4   Join Game Room Interface

This is the player interface in the game. at the top left show the remaining time to complete mission and escape from this level. While for the top right is the pause menu button which will pop out pause menu when click on it. Next is the chat room local at the bottom left in the interface. Player can use this chat room to make conversation with their partner. All the player in this room can view the chat.

Figure 4.5   Player Interface

The start game interface will pop out when player enter the level. When player click the start button, then the system will spawn the character at the starting point.

Figure 4.6   Start Game Interface

The pause menu interface have two button which are resume game button and main menu button. The resume game button will allowed the player close the pause menu interface and continue the game. While the main menu button allowed the player leave the game room and back to the main menu scene.
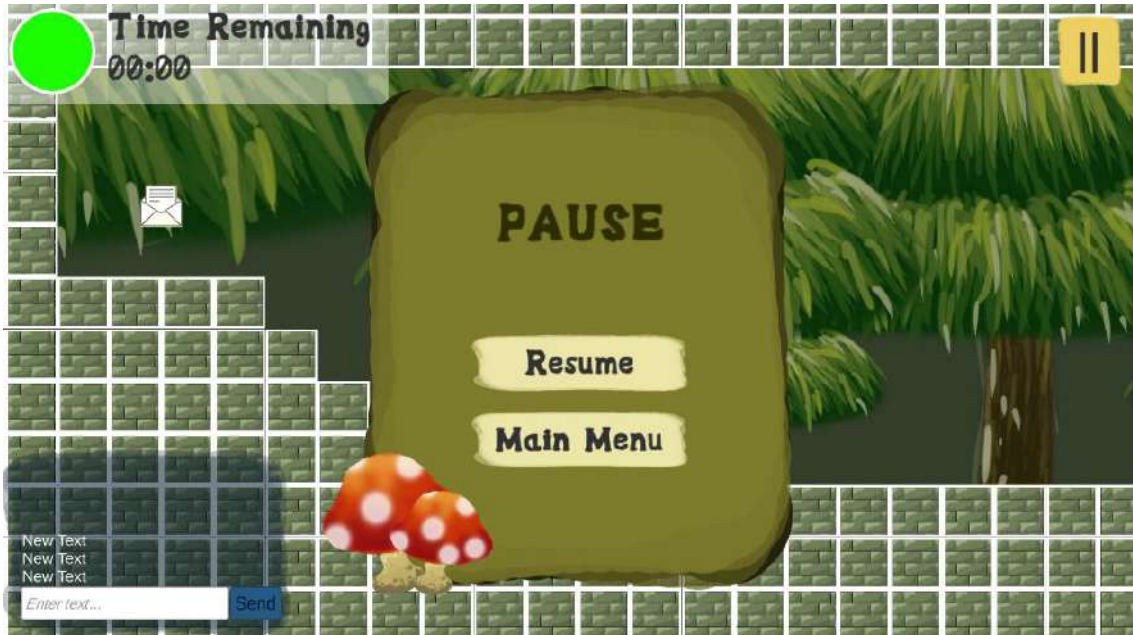
Figure 4.7   Pause Menu

The game over interface consists of two types which are room master's game over interface and client's game over interface. For the room master, they can select either replay the level or leave the room and back to main menu. While for the client, they only can wait for the room master decide to replay level or back to main menu.

Figure 4.8   Room Master's Game Over Interface
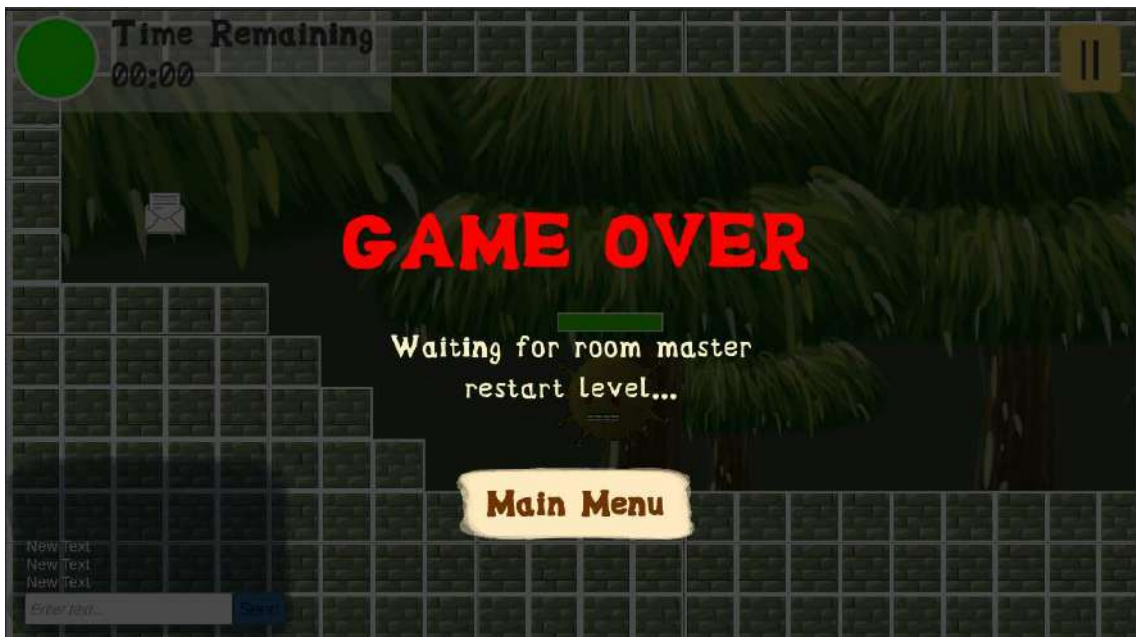
Figure 4.9   Client's Game Over Interface

There are a few character that designed to use in this game which includes the little messenger as the player, bacteria as the normal enemy, big bacteria as the final boss and a grandma as the final level NPC. All of this characters are design by using Adobe Photoshop.
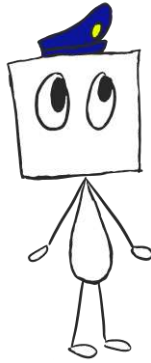
Figure 4.10   Little Messenger (player)
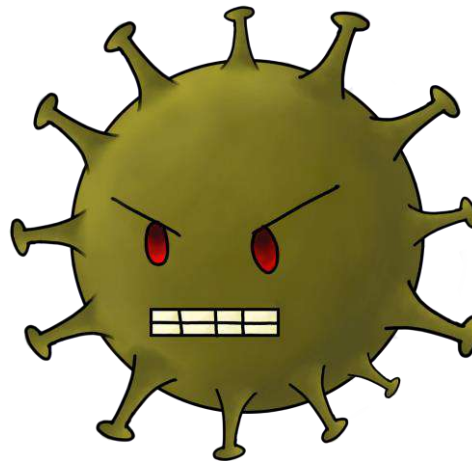
Figure 4.11   Bacteria (enemy)

Figure 4.12   Big Bacteria (Final Boss)

Figure 4.13   Grandma (NPC)

4.3.2   Environment

Little Messenger develop in side-view scrolling when player is playing. There are three type of game environment which are jungle, grave night and also heaven. The ground of environment is built by using Tilemap Palette in Unity. Tilemap Palette provide an easy way to build the ground quickly in a short time. The collider also can implement in the square tiles easily to ensure the character can walk on the ground.
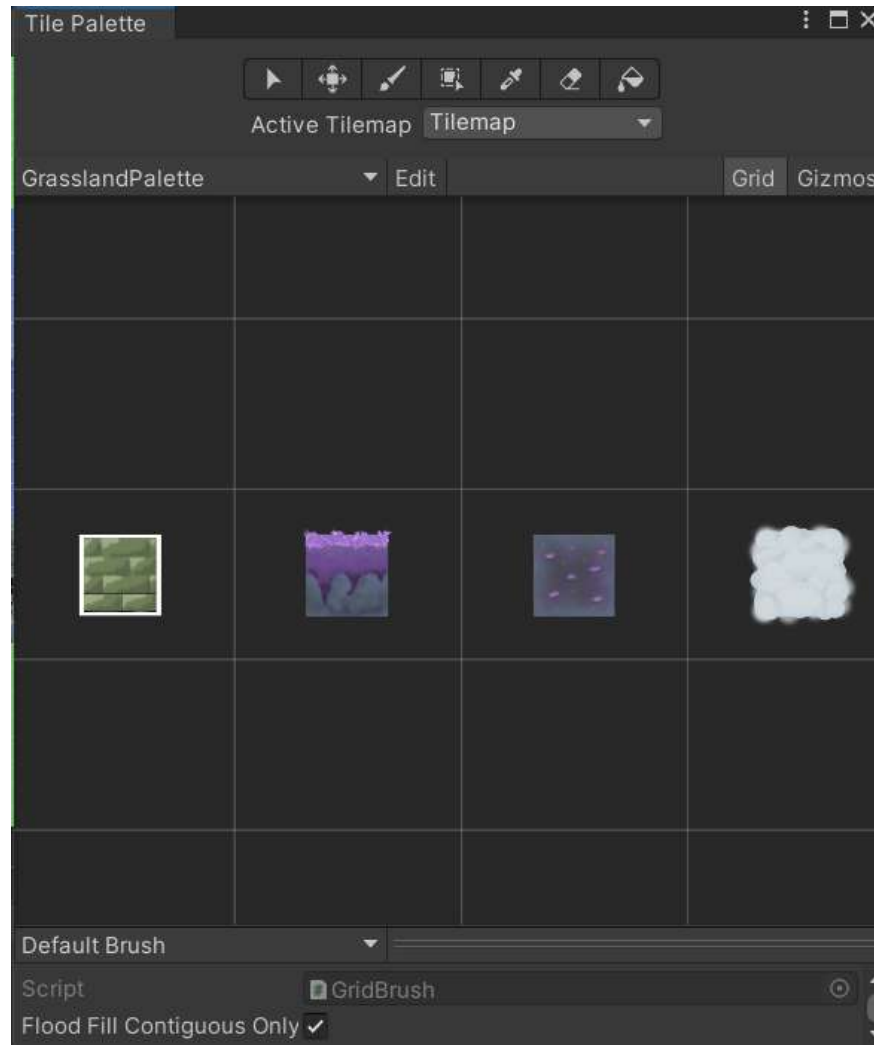
Figure 4.14   Tile Palette in Unity
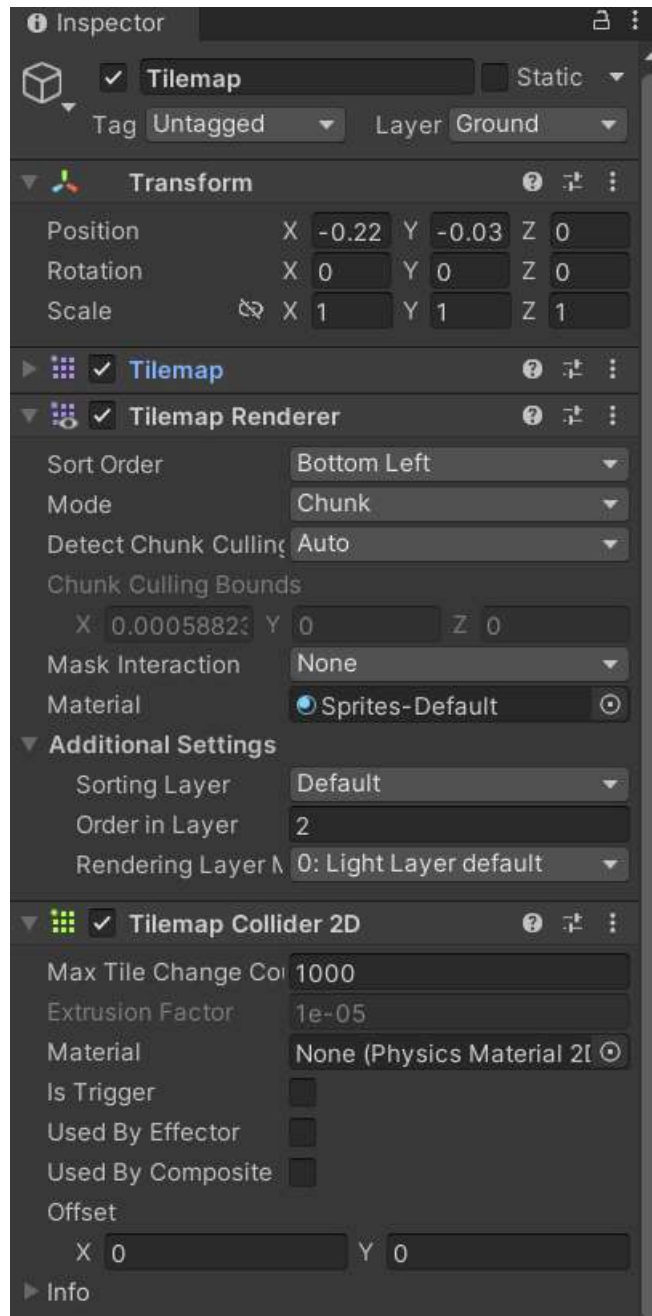
Figure 4.15   Inspector of Tilemap

There are three type of environment used in this game which are jungle, grave night and also heaven. For the jungle, the theme colour is green and brown. While for the grave night, the theme colour is dark purple and grey to present the mystery and horror of this level. The fog features also implement in the level 4 which is the grave night to make the environment looks more dangerous. Moreover, the colour theme that used in

heaven are bright blue and pink. This two colour present warm and peaceful atmosphere for the environment. All the assets are drawing by using Adobe Photoshop.

Figure 4.16   Jungle

Figure 4.17   Grave Night
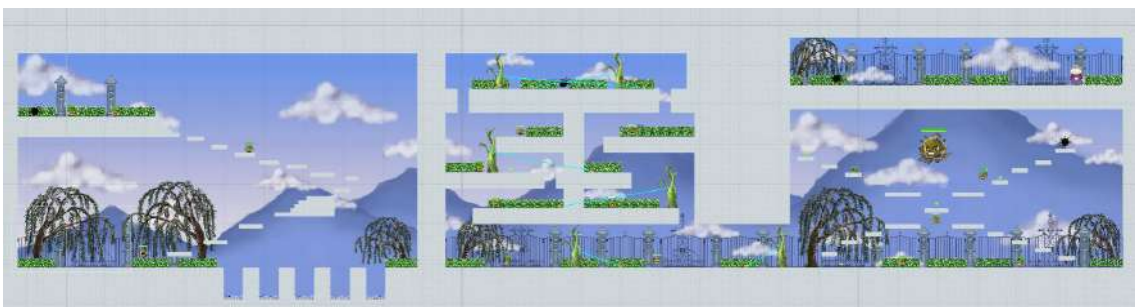
Figure 4.18   Heaven

4.3.3 Animation

There are some simple animation implement in this game. First of all is the vine become smaller when it had been triggered. This animation is develop by using sprite. The animation will be played when the switch is trigger. The sprite will change between each other follow the sequence. Same goes to the mushroom switch which used to trigger the vine to become smaller. When the player stand on the mushroom, the mushroom will become flat.

Figure 4.19   Sprite of Vine (door)

Figure 4.20   Sprite of Mushroom (switch)

Furthermore, the cloud also have a simple moving animation. The position of the cloud will change frame by frame in the game. While for the animation of enemy is rotation and scale. The enemy will rotate frame by frame when moving and also the size of body will change.

Figure 4.21   Cloud

Figure 4.22   Enemy

Moreover, the little messenger have idle, walk and jump animation. 2D sprite is used to create bones for the character. From this, the animation of character can be created easily compare to draw image frame by frame.
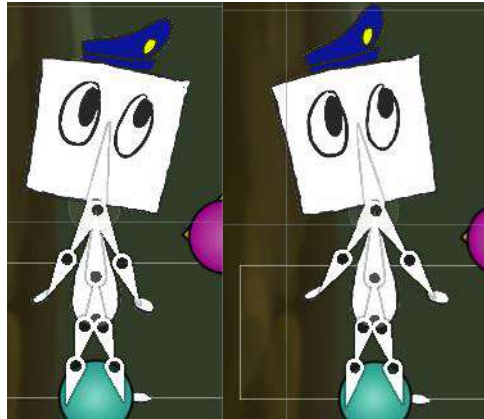
Figure 4.23   Idle Animation (little messenger)
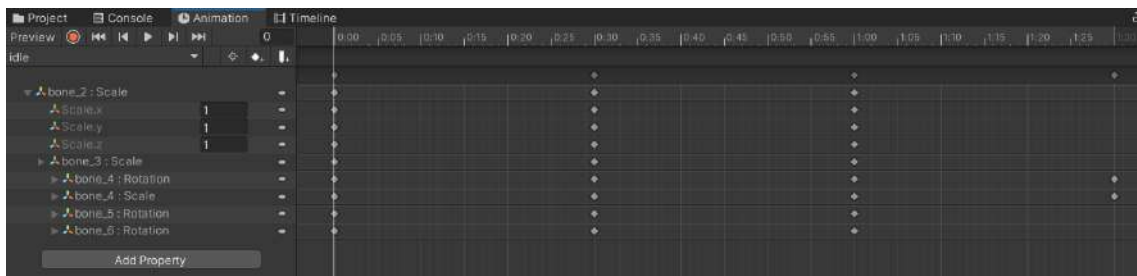
Figure 4.24   Dopesheet of Idel Animation
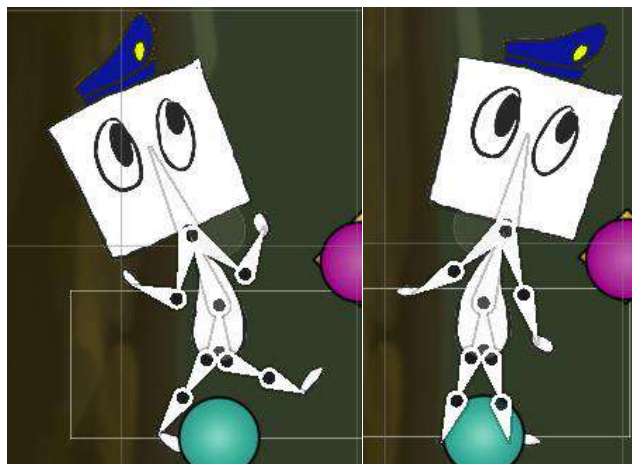
Figure 4.25   Jump Animation (Little Messenger)
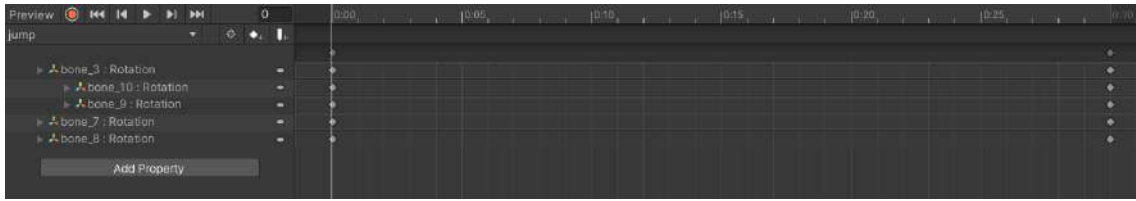
Figure 4.26   Dopesheet of Jump Animation
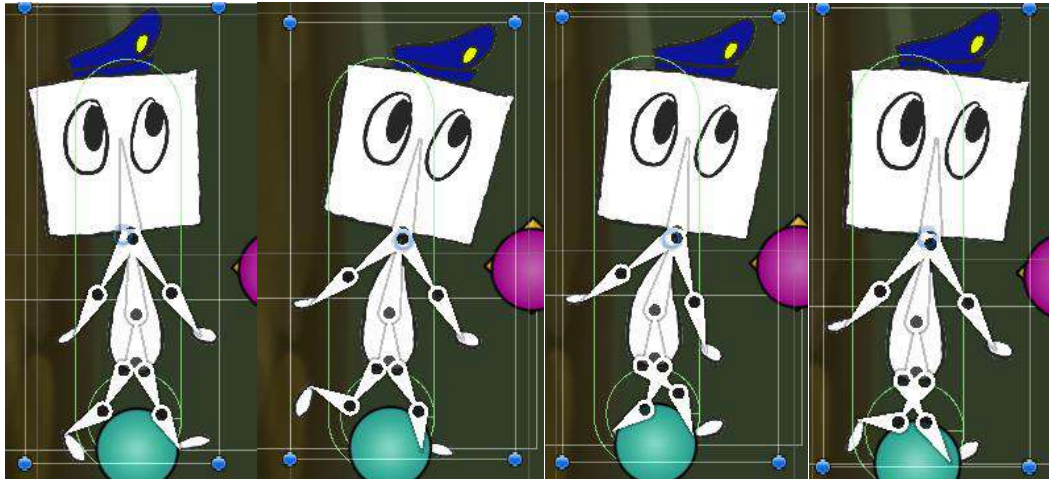
Figure 4.27   Walk Animation (Little Messenger)
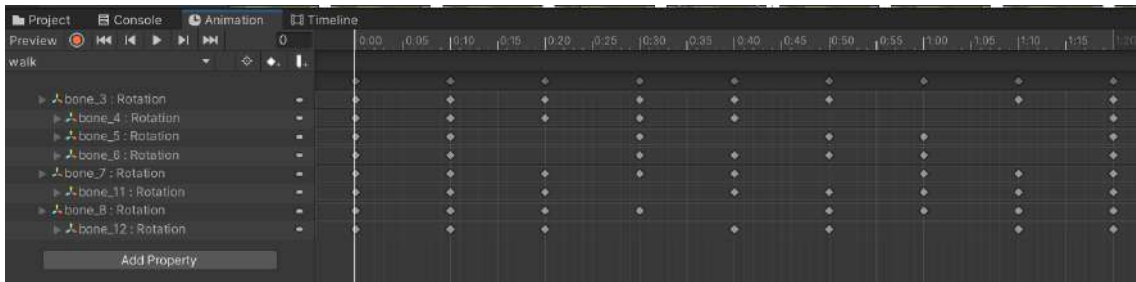
Figure 4.28   Dopesheet of Walk Animation

4.3.4　Photon Unity Network

The most important features in this game is the Photon Unity Networking 2 (PUN 2) which is a free Unity package for multiplayer games. PUN 2 used to easily add multiplayer to the games and launch them globally. Therefore, this game require internet to connect the PUN 2 network.

Figure 4.29　Photon Unity Networking (PUN 2) in Unity Asset Store

4.3.4.1　Network Connection

First of all, the system will connect to the Photon Network. Once it is done, then will automatically join the player into a lobby. After join the lobby, then player can select either create a game room or join a game room.

```
private void Awake()
{
    Debug.Log("Connecting to Master");
    PhotonNetwork.ConnectUsingSettings();
}


// Start is called before the first frame update
private void Start()
{
    MainPageCanvas.SetActive(true);
}

public override void OnConnectedToMaster()
{
    Debug.Log("Connected to Master");
    PhotonNetwork.JoinLobby();
}
```

Figure 4.30　　Script of Network Connection

4.3.4.2　Spawn Player

After player create or join a game room and start the game, the system will spawn the character at the starting point with the player's username.

```
public void SpawnPlayer()
{

    float randomValue = Random.Range(-0.1f, 0.1f);

    GameObject myPlayerGO = (GameObject)PhotonNetwork.Instantiate(PlayerPrefab.name, new Vector2(this.transform.position.x * randomValue, this.transform.position.y), Quaternion.identity, 0);
    GameCanvas.SetActive(false);
    SceneCamera.SetActive(false);

    ((MonoBehaviour)myPlayerGO.GetComponent("PlayerMovement")).enabled = true;
    myPlayerGO.transform.Find("PlayerCam").gameObject.SetActive(true);

}
```

Figure 4.31　　Script of Spawn Player

Below is the script that used to show the player's username. The colour of username for player view will be default colour while the partner's username will be different colour.

```
if(photonView.isMine)
{
    PlayerCamera.SetActive(true);
    PlayerNameText.text = PhotonNetwork.playerName;
}
else
{
    PlayerNameText.text = photonView.owner.name;
    PlayerNameText.color = Color.cyan;
}
```

Figure 4.32   Script of Username

Figure 4.33   Game View of Username

4.3.4.3   Respawn Player

Below script is used to respawn the character when the player is dead in the game. The character will respawn at the starting point after 5 seconds. After respawn, the player's health will full fill.

```csharp
public void EnableRespawn()
{
    TimerAmount = 5f;
    RunSpawnTimer = true;

    RespawnMenu.SetActive(true);
}

private void StartRespawn()
{
    TimerAmount -= Time.deltaTime;
    RespawnTimerText.text = "Respawning in " + TimerAmount.ToString("F0");

    if (TimerAmount <= 0)
    {
        LocalPlayer.GetComponent<PhotonView>().RPC("Respawn", PhotonTargets.AllBuffered);
        LocalPlayer.GetComponent<Health>().EnableInput();
        RespawnLocation();
        RespawnMenu.SetActive(false);
        RunSpawnTimer = false;




    }
}
```

Figure 4.34   Script of Respawn Player

4.3.5   Player System

4.3.5.1   Player Movement

One of the important feature in this game is player movement. This allowed the player can control their character to move horizontally and vertically in the game by using the WASD keys on keyboard. The A and D keys is used to move to left and right while the W key is used to jump.
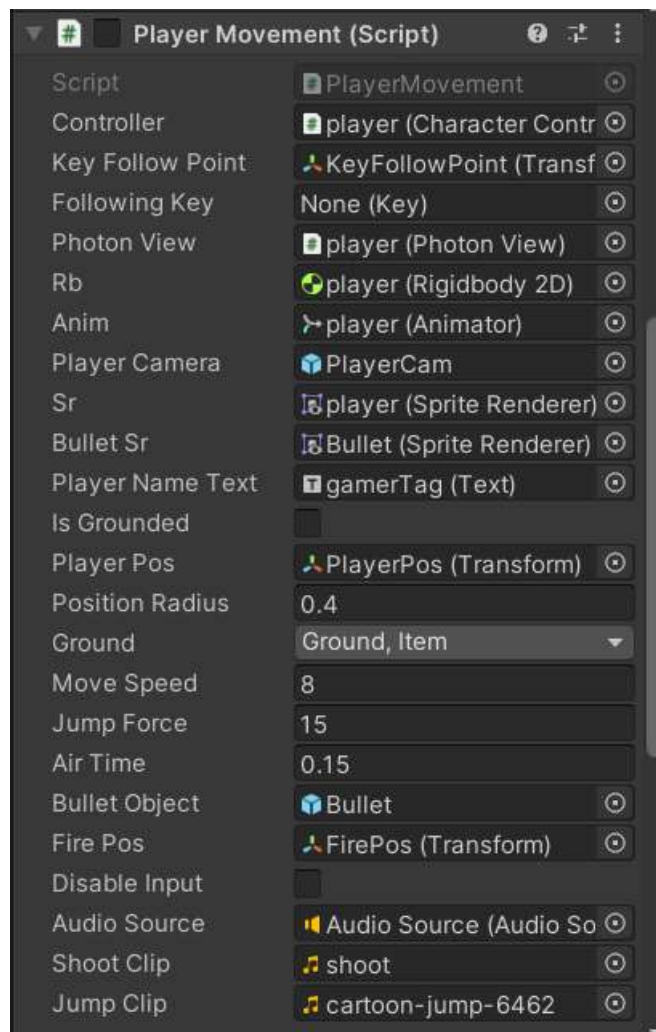
Figure 4.35   Inspector of Player Movement

Below image is the script which allow the player move in the game. When the player press "A" or "D" key, the system will get the input to classify left or right. After that, the position of the character will change in horizontal.

```
var move = new Vector3(Input.GetAxisRaw("Horizontal"), 0);
transform.position += move * MoveSpeed * Time.deltaTime;

IsGrounded = Physics2D.OverlapCircle(playerPos.position, positionRadius, ground);
```

Figure 4.36   Script of Player Movement

The below image shows the jump script which will control the character to jump. When the player press W key, the system will check whether the character is in the air or not. If the character is in air, then cannot jump again.

```
if(IsGrounded == true && Input.GetKeyDown(KeyCode.W))
{
    inAir = true;
    airTimeCount = airTime;
    rb.velocity = Vector2.up * JumpForce;

}

if(Input.GetKey(KeyCode.W) && inAir==true)
{
    if (airTimeCount > 0)
    {
        rb.velocity = Vector2.up * JumpForce;
        airTimeCount -= Time.deltaTime;
    }
    else
    {
        inAir = false;
    }
```

Figure 4.37   Script of Jump

4.3.5.2   Shooting

Another feature in this game is shooting system. As there are enemy in the game, therefore the shooting system can help the player survive in game. The player can control the character shoot a bullet to the enemy by using the right click of the mouse. A bullet can cause 10 damage to the enemy.
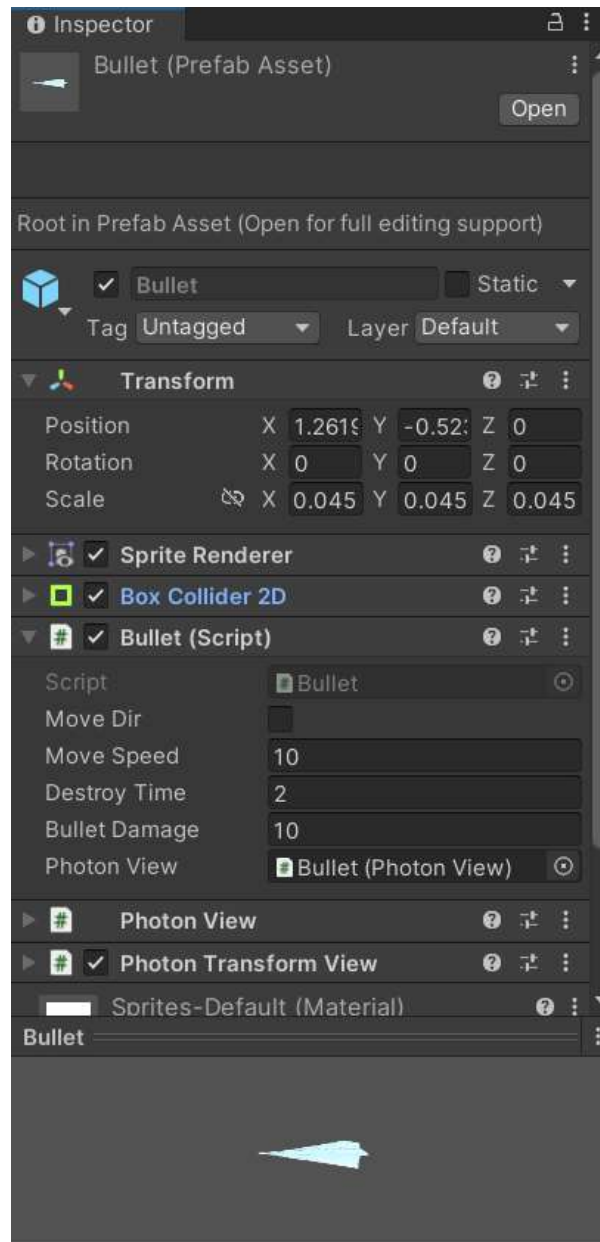
Figure 4.38   Inspector of Bullet

The below image show the script of the shooting. When the player right click of the mouse, the bullet will be created at the position set before and shoot to in front of the character.

Figure 4.39   Script of Shooting

Below is the image of bullet script which used to damage the enemy. The bullet will detect the game component which tag as enemy to reduce its health bar. The interesting is the bullet also can damage the player's partner which will cause the health bar decrease.


```
private void OnTriggerEnter2D(Collider2D collision)
{
    if(!photonView.isMine)
    {
        return;
    }

    PhotonView target = collision.gameObject.GetComponent <PhotonView>();

    if (target != null && (!target.isMine || target.isSceneView))
    {
        if (target.tag == "Player")
        {
            target.RPC("ReduceHealth", PhotonTargets.AllBuffered, BulletDamage);
        }

        if (target.tag == "Enemy")
        {
            target.RPC("ReduceEnemyHealth", PhotonTargets.AllBuffered, BulletDamage);
        }

        this.GetComponent<PhotonView>().RPC("DestroyObject", PhotonTargets.AllBuffered);
    }

}
```

Figure 4.40   Script of Bullet

Figure 4.41   Game View of Shooting

4.3.5.3   Player Health System

A health system can let the player feeling nervous while playing game. This is because, once the health bar empty, the player will respawn at the starting point and the timer will count down continuous. Therefore, health system is implemented in this game. The below image show the health script of the player. The health amount can be set at the inspector.
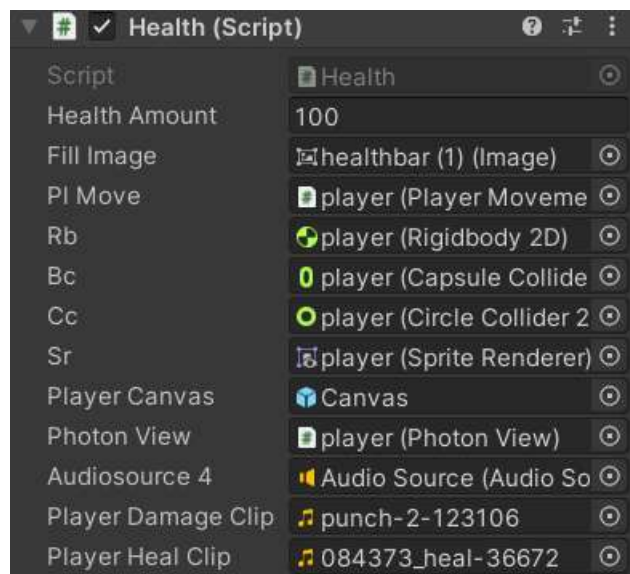
Figure 4.42   Inspector of Player's Health

When the player attack by the enemy or accidentally touch the trap in the game, the health amount of character will decrease. The below script is the modify health function. The damage amount will can be set once call this function such as damage by bullet or enemy.

```
private void ModifyHealth(float amount)
{
    if (photonView.isMine)
    {
        HealthAmount -= amount;
        FillImage.fillAmount -= amount;

    }
    else
    {
        HealthAmount -= amount;
        FillImage.fillAmount -= amount;
    }

    CheckHealth();
}
```

Figure 4.43   Script of Modify Health

For the check health function, it used to check the player's health amount. If the health amount of character is less than or equal to 0, then will call the dead function. Display health bar features also in this function which will calculate the percentage of character health's amount. The colour health bar will change from green to red when the percentage of health amount decrease.

```
private void CheckHealth()
{
    FillImage.fillAmount = HealthAmount / 100f;

    if(photonView.isMine && HealthAmount <= 0)
    {
        GameManager.Instance.EnableRespawn();
        plMove.DisableInput = true;
        this.GetComponent<PhotonView>().RPC("Dead", PhotonTargets.AllBuffered);
    }
}
```

Figure 4.44   Script of Check Player's Health Amount

```
void ColorChange()
{
    Color healthColor = Color.Lerp(Color.red, Color.green, (HealthAmount / 100f));
    FillImage.color = healthColor;
}
```

Figure 4.45   Script of Health Bar Colour Change

Once the player's health empty, means the character is death then the dead function will been call. Below is the dead function that used to disabled the sprite and collider of the character. The gravity of player also become zero.

```
[PunRPC]
private void Dead()
{
    rb.gravityScale = 0;
    bc.enabled = false;
    sr.enabled = false;

    PlayerCanvas.SetActive(false);
}
```

Figure 4.46   Script of Dead Function

4.3.6   Enemy System

4.3.6.1   Enemy's Waypoints

In this game, enemy is the one of the challenge for player to pass through the level. The enemies local at somewhere of the map. The enemy will petrol from a setting point to another setting point through the waypoints function. The number of waypoints can be increase in the inspector. In this game, each of the enemy only have three waypoints.
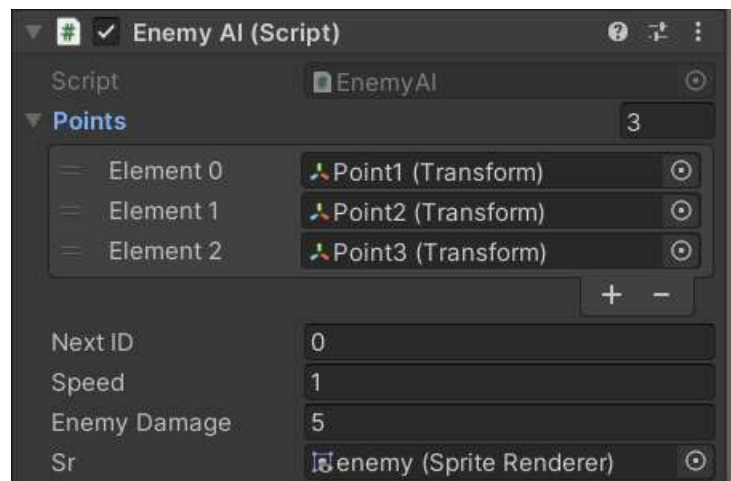
Figure 4.47   Inspector of Enemy

The position of the waypoints can be set. The enemy will move to the waypoints based on the sequences. The below image show the waypoints which is the green diamond that set for the enemy portal.
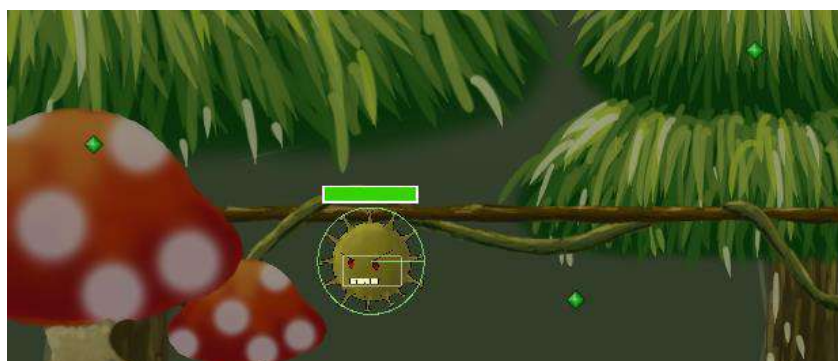
Figure 4.48   Enemy's Waypoints

The below script is the portal function for the enemy. The enemy will move from a point to another point. Each of the waypoints have its own ID. The waypoint will set as goal point. The enemy will move to the point by using Move towards function. After that, the goal point will change after the Move towards function.

```
void MoveToNextPoint()
{
    //Get the next Point transform
    Transform goalPoint = points[nextID];
    //Flip the enemy transform to look into the point's direction
    if (goalPoint.transform.position.x > transform.position.x)
    {
        sr.flipX = true;
    }

    else
    {
        sr.flipX = false;
    }

    //Move the enemy towards the goal point
    transform.position = Vector2.MoveTowards(transform.position, goalPoint.position, speed * Time.deltaTime);
    //Check the distance between enemy and goal point to trigger next point
    if (Vector2.Distance(transform.position, goalPoint.position) < 0.2f)
    {
        //Check if we are at the end of the line (make the change -1)
        if (nextID == points.Count - 1)
            idChangeValue = -1;
        //Check if we are at the start of the line (make the change +1)
        if (nextID == 0)
            idChangeValue = 1;
        //Apply the change on the nextID
        nextID += idChangeValue;
    }
}
```

Figure 4.49   Script of Waypoints

4.3.6.2   Enemy damage

An enemy should have ability to give damage to player. Therefore, a reduce health function implement into enemy. The enemy will only give damage to the player who touch the collider of the enemy. The collider will detect the game component which tag as "Player" and then call the reduce health function.

```
private void OnTriggerEnter2D(Collider2D collision)
{
    PhotonView target = collision.gameObject.GetComponent<PhotonView>();

    if (target.tag == "Player")
    {
        target.RPC("ReduceHealth", PhotonTargets.AllBuffered, EnemyDamage);
    }

}
```

Figure 4.50   Script of Enemy Damage

4.3.6.3   Enemy's Health System

Each of the enemy also have its own health bar. The total health amount can be set in the inspector. The rigidbody, collider and sprite of the enemy also have to be assigned into the inspector.
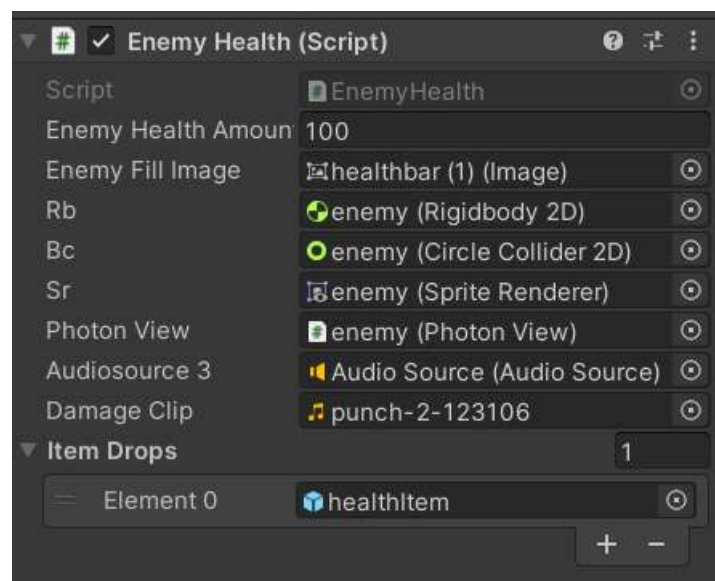
Figure 4.51   Inspector of Enemy's Health

If the enemy is attacked by player, then the health bar of enemy will be decrease. When the health amount of enemy less than or equal to 0, then will call the dead function which will destroy the game object.

```
private void CheckHealth()
{
    EnemyFillImage.fillAmount = EnemyHealthAmount / 100f;

    if (photonView.isMine && EnemyHealthAmount <= 0)
    {
        this.GetComponent<PhotonView>().RPC("Dead", PhotonTargets.AllBuffered);
    }
}

[PunRPC]
private void Dead()
{
    rb.gravityScale = 0;
    bc.enabled = false;
    sr.enabled = false;
    Destroy(this.gameObject);
}



private void ModifyHealth(float Eamount)
{
    if (photonView.isMine)
    {
        EnemyHealthAmount -= Eamount;
        EnemyFillImage.fillAmount -= Eamount;

    }
    else
    {
        EnemyHealthAmount -= Eamount;
        EnemyFillImage.fillAmount -= Eamount;
    }

    CheckHealth();
}
```

Figure 4.52   Script of Enemy's Modify Health
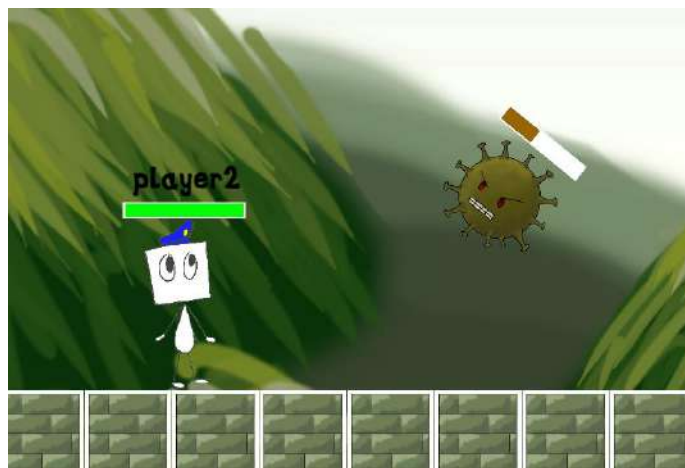
Figure 4.53   Damaged Enemy in Game View

4.3.6.4　Drop Item

When the enemy kill by the player, a health item will appear as the drop item of enemy. The position of drop item will near to the enemy's position. In the script, the item drop function will instantiate the items based on the enemy's position.

```
[PunRPC]
private void ItemDrop()
{
    for (int i = 0; i < itemDrops.Length; i++)
    {
        Instantiate(itemDrops[i], transform.position + new Vector3(0, 1, 0), Quaternion.identity);
    }
}
```

Figure 4.54　　Script of Item Drop

The item drop function will be called when the enemy health amount become zero.

```
private void CheckHealth()
{
    EnemyFillImage.fillAmount = EnemyHealthAmount / 100f;

    if (photonView.IsMine && EnemyHealthAmount <= 0)
    {
        this.GetComponent<PhotonView>().RPC("Dead", RpcTarget.All);
        this.GetComponent<PhotonView>().RPC("ItemDrop", RpcTarget.All);

    }
}
```

Figure 4.55　　Script of enemy's health

When the player collect the health item, the current health amount of player will increase. The collider of the health item will detect the game object which tag as "Player" to call increase health function.

```
private void OnTriggerEnter2D(Collider2D collision)
{
    PhotonView target = collision.gameObject.GetComponent<PhotonView>();

    if(target.tag == "Player")
    {
        target.RPC("IncreaseHealth", RpcTarget.All, HealAmount);
        Destroy(gameObject);
    }

}
```

Figure 4.56   Script of Item Drop
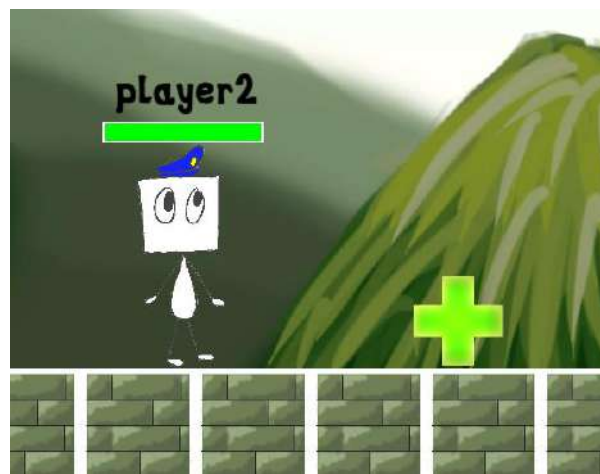
Figure 4.57   Health Item in Game View

4.3.6.5   Pathfinding

In level 5, a final boss will as the last challenge for the players. The final boss implement pathfinding system to allow the final boss to track the player. The player's position will be set as the final boss target's position every frame.

```
void Start()
{
    player = GameObject.FindGameObjectWithTag("Player");
    target.position = player.transform.position;
}

/// <summary>Updates the AI's destination every frame</summary>
void Update () {
    player = GameObject.FindGameObjectWithTag("Player");
    target.position = player.transform.position;

    if (target != null && ai != null) ai.destination = target.position;
}
```

Figure 4.58   Script of AI Destination Setter

The area that allowed final boss to track player can be set at the pathfinder's inspector. The final boss will only move in the area. In the area, the obstacle can be scanned to avoid the final boss crash with the obstacle. The shortest path will be calculated and then the final boss will follow the path to chase the player.
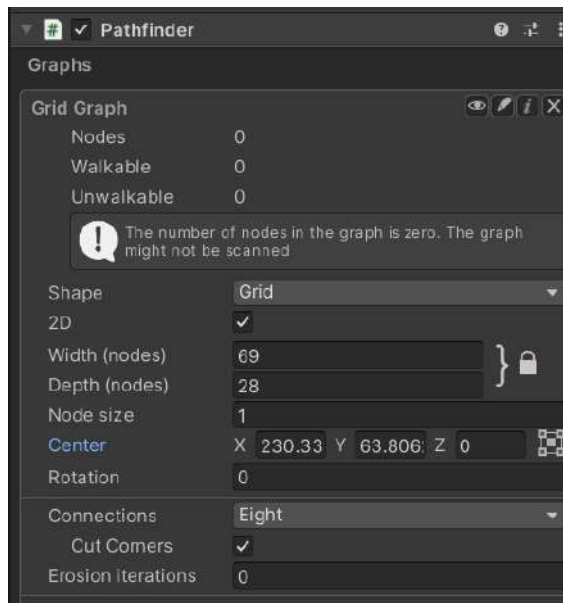
Figure 4.59   Pathfinder of Inspector

Figure 4.60   Moving Area of Final Boss

Figure 4.61   Calculated Path between Final Boss and Player

4.3.6.6   Enemy shoot

The final boss will automatically shoot to the player when it detect the player. The distance between the final boss and player will be calculated every frame. When the distance between player and final boss less than 30, than the final boss will shoot to the player every 2 seconds.

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

    player = GameObject.FindGameObjectWithTag("Player");
    float distance = Vector2.Distance(transform.position, player.transform.position);
    Debug.Log(distance);

    if(distance < 30)
    {
        timer += Time.deltaTime;

        if(timer > 2)
        {
            timer = 0;
            shoot();
        }
    }

}

void shoot()
{
    Instantiate(bullet, bulletPos.position, Quaternion.identity);
}
```

Figure 4.62   Script of Enemy Shooting
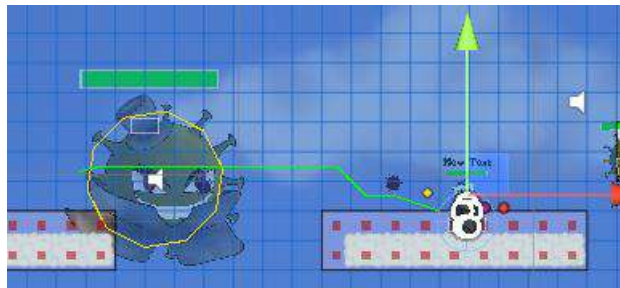
Figure 4.63   Enemy Shoot to Player in Game View

When the bullet's collider touch the game object which tag as player then will call the reduce health function. From this, the player's health amount will decrease.
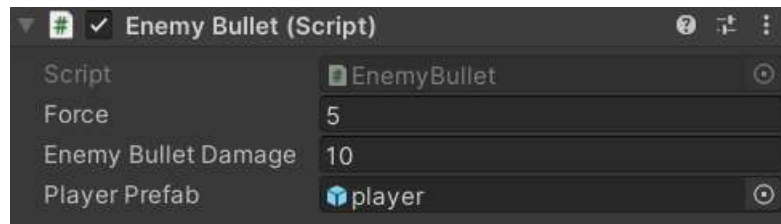
Figure 4.64   Enemy Bullet Inspector

```csharp
// Update is called once per frame
void Update()
{
    player = GameObject.FindGameObjectWithTag("Player");

    timer += Time.deltaTime;

    if(timer > 10)
    {
        Destroy(gameObject);
    }
}

private void OnTriggerEnter2D(Collider2D collision)
{
    PhotonView target = collision.gameObject.GetComponent<PhotonView>();
    if(target.tag == "Player")
    {
        Destroy(gameObject);
        target.RPC("ReduceHealth", RpcTarget.All, EnemyBulletDamage);
    }
}
```

Figure 4.65   Script of Enemy Bullet

4.3.7   Switch and Door

One of the mechanic that implement in this game is the switch door features. When the player trigger the switch, the door will open at the same time. Each door will have its own door trigger as the child of the door. When the door trigger of the door drag into the array of the switch's inspector, the door and the switch will be linked.

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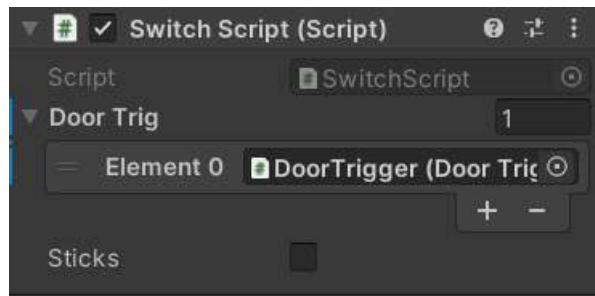
Figure 4.66   Inspector of Switch

When the door trigger is trigger by the switch, the open door animation will be played.

```
void OnTriggerStay2D()
{
    anim.SetBool("goDown", true);

    foreach (DoorTrigger trigger in doorTrig)
    {

        trigger.Toggle(true);

    }

}

void OnTriggerExit2D()
{
    if (sticks)
        return;

    anim.SetBool("goDown", false);

    foreach (DoorTrigger trigger in doorTrig)
    {

        trigger.Toggle(false);

    }

}
```

Figure 4.67   Script of Door Trigger

Figure 4.68   Switch and Door in Game View

4.3.8   Teleporter

Teleporter is one of the mechanic that implement in this game. The teleporter allowed the player teleport from a location to another location. The destination of the teleport place can be set at the inspector. The destination of the teleporter is the position of another teleporter that set in the teleporter's inspector.
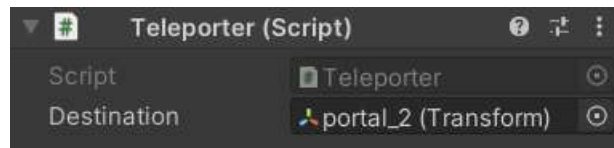
Figure 4.69   Inspector of Teleporter

When the player press E key in front of the teleporter, the player's position will change to another teleporter's position.

```csharp
void Update()
{
    if (Input.GetKeyDown(KeyCode.E))
    {
        if (currentTeleporter != null)
        {
            transform.position = currentTeleporter.GetComponent<Teleporter>().GetDestination().position;
        }
    }
}
```

Figure 4.70   Script of Player Teleporter

Figure 4.71   Teleporter in Game View

4.3.9   Chat Box

There are some obstacles that require players work together to pass through it. Therefore, a chat box implement in the game to allow players communicate when they are playing game. The players can send message via chat box. Both players can view the message in the content box at the same time. When the player click the submit button or press Enter key, the message will show in the chat content panel.

```csharp
public void SendChat(string msg)
{
    string NewMessage = PhotonNetwork.NickName + ": " + msg;
    _photon.RPC("RPC_AddNewMessage", RpcTarget.All, NewMessage);
}

public void SubmitChat()
{
    string blankCheck = ChatInput.text;
    blankCheck = Regex.Replace(blankCheck, @"\s", "");

    if (blankCheck == "")
    {
        ChatInput.ActivateInputField();
        ChatInput.text = "";
        return;
    }

    SendChat(ChatInput.text);
    ChatInput.ActivateInputField();
    ChatInput.text = "";
}
```

Figure 4.72   Script of Chat Manager

```csharp
public void BuildChatContents()
{
    string NewContents = "";
    foreach (string s in _messages)
    {
        NewContents += s + "\n";
    }
    ChatContent.text = NewContents;
}

void Update()
{
    timer += 1*Time.deltaTime;

    if (Input.GetKey(KeyCode.KeypadEnter) || Input.GetKey(KeyCode.Return))
    {
        SubmitChat();
    }

    if (PhotonNetwork.InRoom)
    {
        ChatContent.maxVisibleLines = _maximumMessages;
        if (_messages.Count > _maximumMessages)
        {
            _messages.RemoveAt(0);
        }
        if (_buildDelay < Time.time)
        {
            BuildChatContents();
            _buildDelay = Time.time + 0.5f;
        }
    }
    else if (_messages.Count > 0)
    {
        _messages.Clear();
        ChatContent.text = "";
    }
    if (timer > 10)
    {
        _messages.RemoveAt(0);
    }
}//Update
```

Figure 4.73   Script of Chat Manager

Figure 4.74   Chat Box in Game View

4.3.10 Timer System

The timer system also implement in this game. The remaining time for each level will be different as the difficulty of the levels are different. The remaining time will count down every frame. The remaining time will show at the top left in the game view. When the remaining time become zero, then the players will game over.

```csharp
private void FixedUpdate()
{
    DisplayTime(timer);
    lerpSpeed = 3f * Time.deltaTime;

    if(timer <= 0)
    {
        if (PhotonNetwork.IsMasterClient)
        {
            GameOverCanvas.SetActive(true);

        }
        else
        {
            GameOverCanvas_client.SetActive(true);
        }
    }

    if (exitDoor.isVictory)
    {
        return;
    }

    if(!PhotonNetwork.IsMasterClient)
    {
        return;
    }

    timer -= Time.fixedDeltaTime;


}
```

Figure 4.75   Script of Timer

Below script is used to synchronize the remaining time for player's game view. The remaining time of the master player will be the standard remaining time in whole game.

```
public void OnPhotonSerializeView(PhotonStream stream, PhotonMessageInfo info)
{
    if(stream.IsWriting && PhotonNetwork.IsMasterClient)
    {
        stream.SendNext(timer);
    }
    else if (stream.IsReading)
    {
        timer = (float)stream.ReceiveNext();
        textTimer.text = timer.ToString("F1");
    }

}
```

Figure 4.76   Script of Timer

The remaining time will show in text view and also image view. When the remaining time decrease, the fill of the image will also decrease at the same time. The colour of the fill image will also change from green to red when the remaining time decrease.

```
public void DisplayTime(float timeToDisplay)
{
    if (timeToDisplay < 0)
    {
        timeToDisplay = 0;
    }

    float minutes = Mathf.FloorToInt(timeToDisplay / 60);
    float seconds = Mathf.FloorToInt(timeToDisplay % 60);


    textTimer.text = string.Format("{0:00}:{1:00}", minutes, seconds);
    TimerFill.fillAmount = Mathf.Lerp(TimerFill.fillAmount, timeToDisplay / default_timer_time, lerpSpeed);
    Color timeColor = Color.Lerp(Color.red, Color.green, (timeToDisplay / default_timer_time));
    TimerFill.color = timeColor;
}
```

Figure 4.77   Script of Timer

Figure 4.78   Timer in Game View

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4.3.11 Exit Door

The goal of the players every levels is get the letter as the key to active the exit door. When the player brings the letter to the exit door, the key will disappear and the waiting to open condition of the exit door will change to true. After the waiting to open condition change to true, the door open condition will become true. Then the master player can press E key to load next level. When the master player load to next scene, the client player will load to the scene at the same time. Both game view will be synchronize.

```csharp
// Update is called once per frame
void Update()
{
    PlayerMovement thePlayer = FindObjectOfType<PlayerMovement>();

    if (waitingToOpen)
    {
        if (Vector3.Distance(thePlayer.followingKey.transform.position, transform.position) < 0.1f)
        {
            waitingToOpen = false;
            doorOpen = true;
            theSR.sprite = doorOpenSprite;

            thePlayer.followingKey.gameObject.SetActive(false);
            thePlayer.followingKey = null;

        }
    }


    if (doorOpen && Input.GetKeyDown(KeyCode.E))
    {

        if (PhotonNetwork.IsMasterClient)
        {
            isVictory = true;
            PhotonNetwork.AutomaticallySyncScene = true;

            PhotonNetwork.LoadLevel(nextLevel);
            Destroy(this);
        }

    }
```

Figure 4.79   Script of Exit Door

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```
private void OnTriggerEnter2D(Collider2D collision)
{
    PlayerMovement thePlayer = FindObjectOfType<PlayerMovement>();

    PhotonView target = collision.gameObject.GetComponent<PhotonView>();

    if (target.tag == "Player")
    {
        if (thePlayer.followingKey != null)
        {
            thePlayer.followingKey.followTarget = transform;
            waitingToOpen = true;
        }

    }
}
```

Figure 4.80   Script of Exit Door
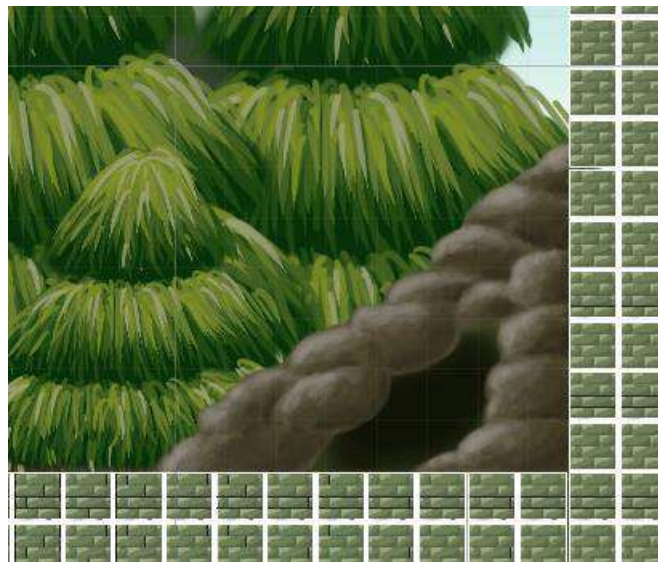
Figure 4.81   Exit Door in Game View

4.3.12 Dialogue System

A dialogue system can help the player to understand the game. In this game, dialogue system implement in intro story and also the tutorial mode. In tutorial mode, the game play can be easily taught to the player. There are two script used in this system which are dialogue manager and dialogue trigger. The messages and actor that would like

to show in the dialogue box can be modify in the dialogue trigger's inspector. While the dialogue manager is used to display the messages that set in the dialogue trigger's inspector. The display message function is used to change the default text to a previously set message. For the next message function is used to call again the display message function and also check the end of the dialogue. The next message function will be called when player press space bar.
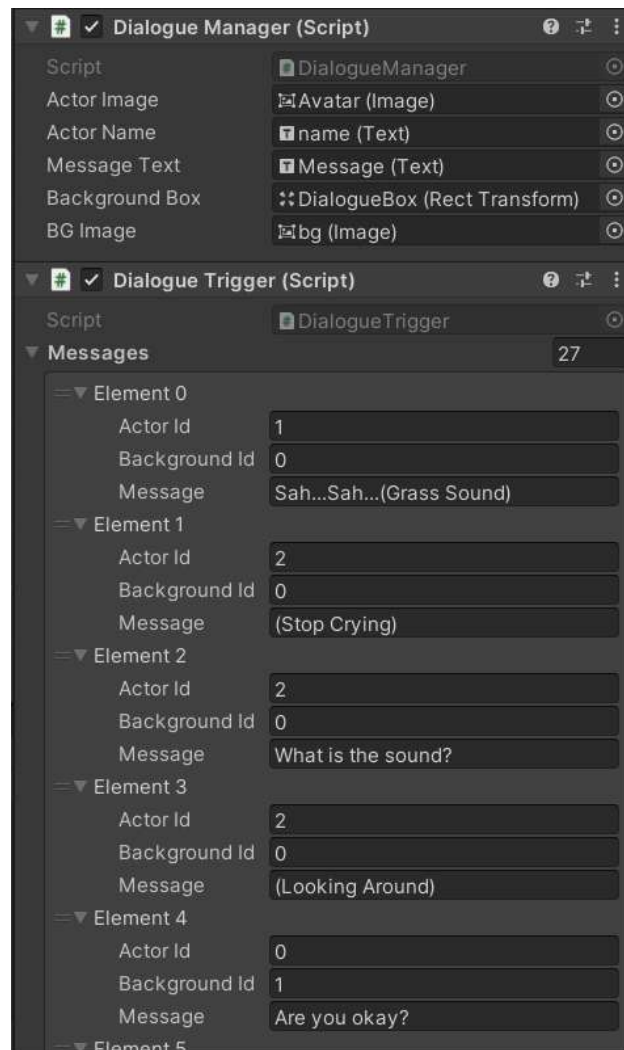
Figure 4.82   Dialogue System's Inspector

```
public void OpenDialogue(Message[] messages, Actor[] actors, Background[] backgrounds)
{
    currentMessages = messages;
    currentActors = actors;
    activeMessage = 0;

    currentBackgrounds = backgrounds;

    isActive = true;

    Debug.Log("Started conversation! Loaded messages: " + messages.Length);
    DisplayMessage();
    backgroundBox.LeanScale(Vector3.one, 0.5f).setEaseInOutExpo();

}
```

Figure 4.83   Script of Dialogue Manager

```
void DisplayMessage()
{
    Message messageToDisplay = currentMessages[activeMessage];
    messageText.text = messageToDisplay.message;

    Actor actorToDisplay =currentActors[messageToDisplay.actorId];
    actorName.text = actorToDisplay.name;
    actorImage.sprite = actorToDisplay.sprite;

    Background backgroundToDisplay =currentBackgrounds[messageToDisplay.backgroundId];
    BGImage.sprite = backgroundToDisplay.sprite;

    AnimateTextColor();
}

public void NextMessage()
{
    activeMessage++;
    if(activeMessage < currentMessages.Length)
    {
        DisplayMessage();
    }
    else
    {
        Debug.Log("Conversation eneded!");
        backgroundBox.LeanScale(Vector3.zero, 0.5f).setEaseInOutExpo();
        isActive = false;
        SceneManager.LoadScene("Menu");

    }

}
```

Figure 4.84   Script of Dialogue Manager

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Figure 4.85   Dialogue in Game View

4.4   Discussion

In this section, the result of project tests will be discussed. The User Acceptance Test (UAT) is conducted to do the game testing phase. From this, the game application can perform without bug and fulfil the objectives and requirements after release to public. There are two test will conduct which are Alpha test and Beta test. The Alpha test is focus on the functionality of the game application while the Beta test is focus on the usability of the game application.

4.4.1   Alpha Test

In the Alpha test, the functionality of the game application will be focused. All the game mechanics and buttons will be test targets. In this test, 10 testers will involve to conduct the test. The exe files and also the functionality form will be provided to the testers. After the testers fill in the form, the result will be analysed. The below table will be the conclusion of Alpha test. The tutorial mode button in the main menu scene does not function well. Therefore, the bug will be fix before move to Beta test. The result form of Alpha test can be refer at APPENDIX A.

Table 4.3   Test Case of Intro Story

Test Case 1: Intro Story				
No.	Functionality	Pre-Condition	Expected Outcome	Result (√ / ×)
1.	Animation play	Starting game	Able to view the animation	√
2.	Dialogue appears	Animation ends playing	Dialogue box pop out	√
3.	Dialogue change	Press space bar	Next dialogue will be loaded	√
4.	Background music	Starting game	Background music will be played	√
5.	Load to Main Menu	Dialogue ends	Main menu scene will be loaded	√

Table 4.4   Test Case of Main Menu

Test Case 2: Main Menu

No.	Functionality	Pre-Condition	Expected Outcome	Result (√ / ×)
1.	Go to tutorial mode scene	Click on the tutorial mode button	The tutorial scene will be loaded	×
2.	Go to create game room scene	Click on the create game room button	The create username panel will pop out	√
3.	Go to join game room scene	Click on the join game room button	The create username panel will pop out	√
4.	Quit the game application	Click on the exit button	The game will be closed	√
5.	Tutorial mode button click sound	Click on the tutorial mode button	Button click sound will be played	√
6.	Create game room button click sound	Click on the create game room button	Button click sound will be played	√
7.	Join game room click sound	Click on the join game room button	Button click sound will be played	√
8.	Exit button click sound	Click on the exit button	Button click sound will be played	√
9.	Background music	Load to main menu scene	Background music will be played	√

Table 4.5   Test Case of Create Username

Test Case 3: Create Username

No.	Functionality	Pre-Condition	Expected Outcome	Result (√ / ×)
1.	Get player's username	Enter Username in text box	The username will show in game level.	√
2.	Go to create game room scene	Click on the start button and previously click the create game room button	The create game room panel will pop out.	√
3.	Go to join game room scene	Click on the start button and previously click the join game room button	The join game room panel will pop out.	√

4.	Back to main menu	Click on the back button	The main menu will pop out.	√
5.	Start button click sound	Click on the start button	Button click sound will be played	√
6.	Back button click sound	Click on the start button	Button click sound will be played	√
7.	Background music	Load to main menu scene	Background music will be played	√

Table 4.6   Test Case of Create Game Room

Test Case 4: Create Game Room				
No.	**Functionality**	**Pre-Condition**	**Expected Outcome**	**Result (√ / ×)**
1.	Get room code	Enter new room code in text box	The room code will uploaded to the server	√
2.	Load to level 1	Click on the create room button	Level 1 will be loaded	√
3.	Back to main menu	Click on the back button	The main menu will pop out	√
4.	Create room button click sound	Click on the create room button	Button click sound will be played	√
5.	Back button click sound	Click on the start button	Button click sound will be played	√
6.	Background music	Load to main menu scene	Background music will be played	√

Table 4.7   Test Case of Join Game Room

Test Case 5: Join Game Room				
No.	**Functionality**	**Pre-Condition**	**Expected Outcome**	**Result (√ / ×)**
1.	Get room code	Enter room code that have already been created in text box	The room code will uploaded to the server	√
2.	Load to level 1	Click on the join room button	Join with room's master into level 1	√

3.	Back to main menu	Click on the back button	The main menu will pop out	√
4.	Join room button click sound	Click on the join room button	Button click sound will be played	√
5.	Back button click sound	Click on the start button	Button click sound will be played	√
6.	Background music	Load to main menu scene	Background music will be played	√

Table 4.8   Test Case of Tutorial Mode

Test Case 6: Tutorial Mode				
No.	**Functionality**	**Pre-Condition**	**Expected Outcome**	**Result (√ / ×)**
1.	Start game panel	Loaded to tutorial mode scene	The start game panel pop out	√
2.	Spawn player	Click the start button in the start game panel	System spawn the player at the starting point	√
3.	Dialogue system triggered	Click the start button in the start game panel	Dialogue box appear	√
4.	Dialogue change	Press space bar	Next dialogue will be loaded	√
5.	Dialogue box close	Dialogue finish	Dialogue box disappear	√
6.	Dialogue system triggered	Player near to the mushroom	Dialogue box appear	√
7.	Dialogue system triggered	Player near to the enemy	Dialogue box appear	√
8.	Dialogue system triggered	Player near to the teleporter	Dialogue box appear	√
9.	Dialogue system triggered	Player near to the letter	Dialogue box appear	√
10.	Dialogue system triggered	Player near to the exit door	Dialogue box appear	√

11.	Characters can move left and right.	Press the A/D keys or left/right keys.	The characters move either left or right.	√
12.	Characters can jump.	Press the W key.	The characters jump smoothly.	√
13.	Plater are able to shoot.	Player right click the mouse.	The character is shooting.	√
14.	Player able to damage enemy by shooting.	Bullet hit the enemy	The enemy's health bar decrease	√
15.	Heath item drop	Enemy die	Health item appear where enemy die	√
16.	Health item heal the player	Player get the health item	Player's health amount increase	√
17.	Enemy able to damage to player.	Enemy touch the player.	Health bar of character decreases.	√
18.	Player are able to teleport to another place by using teleporter.	Player must stand in front of the teleporter and press E key.	The character teleport to the other place.	√
19.	The vine door open	Player trigger the mushroom	The vine door open and allow character pass through.	√
20.	The letter follow one of the player.	The player collected the letter.	The letter follow behind the player.	√
21.	The letter activate the exit door.	The player bring the letter to the exit door.	The exit door activated.	√
22.	Tutorial complete panel	Exit door is activated	Tutorial complete panel pop out	√
23.	Player respawn at starting point	The character's health bar empty.	Respawn player at the starting point after 5 seconds.	√
24.	Count down remaining time	Start the level	The remaining time decrease	√
25.	Player game over.	The remaining time become zero.	Game over panel pop out.	√
26.	Pause menu	Press ESC key or click the pause menu button	Pause menu panel pop out	√

27.	Replay level	Room's master click on the replay button	Loading scene will be loaded and then load to the tutorial mode scene	√
28.	Back to main menu	Click on the main menu button	Player leave the room and will be loaded to main menu scene	√
29.	Close panel button in pause menu	Click the close button	Pause menu panel will be deactivate	√
30.	Jump sound effect	Press the W key.	Jump sound effect will be played	√
31.	Shoot sound effect	Player right click the mouse.	Shoot sound effect will be played	√
32.	Health item collected sound effect	Player collect the health item	Heal sound effect will be played	√
33.	Get damage sound effect	Player or enemy get damage	Get damage sound effect will be played	√
34.	Teleporter sound effect	Player get close to teleporter	Teleporter sound effect will be played	√
35.	Teleport sound effect	Player must stand in front of the teleporter and press E key.	Teleport sound effect will be played	√
36.	Complete tutorial panel pop out sound effect	Player active the exit door	Mission complete sound will be played	√
37.	Pause menu button click sound	Click on the pause menu button	Button click sound will be played	√
38.	Replay button click sound for pause menu panel	Click on the replay button for pause menu panel	Button click sound will be played	√
39.	Main menu button click sound for pause menu panel	Click on the main menu button pause menu panel	Button click sound will be played	√
40.	Start button click sound for start game panel	Click on the start menu button for start game panel	Button click sound will be played	√
41.	Close button click sound for pause menu panel	Click on the close button for pause menu panel	Button click sound will be played	√
42.	Replay button click sound for game over panel	Click on the replay menu button for game over panel	Button click sound will be played	√

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No.	Functionality	Pre-Condition	Expected Outcome	Result (√ / ×)
43.	Main menu button click sound for game over panel	Click on the main menu button fro game over panel	Button click sound will be played	√
44.	Background music	Start level	Background music will be played	√

Table 4.9   Test Case of Level 1

Test Case 7: Level 1				
No.	**Functionality**	**Pre-Condition**	**Expected Outcome**	**Result (√ / ×)**
1.	Start game panel	Loaded to level 1 scene	The start game panel pop out	√
2.	Spawn player	Click the start button in the start game panel	System spawn the player at the starting point	√
3.	Player's username show on the top of the character	System spawn the player at the starting point	The username is the same as the username entered by the player before	√
4.	Both players in same scene	Two players join in the same room	Two character with their own username appear in the level	√
5.	Characters can move left and right.	Press the A/D keys or left/right keys.	The characters move either left or right.	√
6.	Characters can jump.	Press the W key or the up key.	The characters jump smoothly.	√
7.	Player are able to shoot.	Player right click the mouse.	The character is shooting.	√
8.	Player able to damage enemy by shooting.	Bullet hit the enemy	The enemy's health bar decrease	√
9.	Heath item drop	Enemy die	Health item appear where enemy die	√
10.	Health item heal the player	Player get the health item	Player's health amount increase	√
11.	Enemy able to damage to player.	Enemy touch the player.	Health bar of character decreases.	√
12.	Player are able to teleport to another	Player must stand in front of the	The character teleport to the other place.	√

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		teleporter and press E key.		
	place by using teleporter.			
13.	The vine door open	Player trigger the mushroom	The vine door open and allow character pass through.	√
14.	The letter follow one of the player.	The player collected the letter.	The letter follow behind the player.	√
15.	The letter activate the exit door.	The player bring the letter to the exit door.	The exit door activated.	√
16.	Player move to level 2.	Reach the activated exit door and press the E key.	Both player loaded to level 2.	√
17.	Player respawn at starting point	The character's health bar empty.	Respawn player at the starting point after 5 seconds.	√
18.	Count down remaining time	Start the level	The remaining time decrease	√
19.	Player game over.	The remaining time become zero.	Game over panel pop out.	√
20.	Pause menu	Press ESC key or click the pause menu button	Pause menu panel pop out	√
21.	Player's health bars are synced in both player views	Player get damage	The amount and colour of health bars are same in both player views	√
22.	Replay level	Room's master click on the replay button	Loading scene will be loaded and then load to the level 1	√
23.	Back to main menu	Click on the main menu button	Player leave the room and will be loaded to main menu scene	√
24.	Close panel button in pause menu	Click the close button	Pause menu panel will be deactivate	√
25.	Chat room	Player types in the text box and click the send button	The message show in the chat room panel and both players can view the message	√
26.	Jump sound effect	Press the W key.	Jump sound effect will be played	√
27.	Shoot sound effect	Player right click the mouse.	Shoot sound effect will be played	√
28.	Health item collected sound effect	Player collect the health item	Heal sound effect will be played	√

29.	Get damage sound effect	Player or enemy get damage	Get damage sound effect will be played	√
30.	Teleporter sound effect	Player get close to teleporter	Teleporter sound effect will be played	√
31.	Teleport sound effect	Player must stand in front of the teleporter and press E key.	Teleport sound effect will be played	√
32.	Pause menu button click sound	Click on the pause menu button	Button click sound will be played	√
33.	Replay button click sound for pause menu panel	Click on the replay button for pause menu panel	Button click sound will be played	√
34.	Main menu button click sound for pause menu panel	Click on the main menu button pause menu panel	Button click sound will be played	√
35.	Start button click sound for start game panel	Click on the start menu button for start game panel	Button click sound will be played	√
36.	Close button click sound for pause menu panel	Click on the close button for pause menu panel	Button click sound will be played	√
37.	Replay button click sound for game over panel	Click on the replay menu button for game over panel	Button click sound will be played	√
38.	Main menu button click sound for game over panel	Click on the main menu button fro game over panel	Button click sound will be played	√
39.	Background music	Start level 1	Background music will be played	√

Table 4.10   Test Case of Level 2

Test Case 8: Level 2				
No.	Functionality	Pre-Condition	Expected Outcome	Result (√ / ×)
1.	Start game panel	Loaded to level 2 scene	The start game panel pop out	√
2.	Spawn player	Click the start button in the start game panel	System spawn the player at the starting point	√
3.	Player's username show on the top of the character	System spawn the player at the starting point	The username is the same as the username	√

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			entered by the player before	
4.	Both players in same scene	Two players join in the same room	Two character with their own username appear in the level	√
5.	Characters can move left and right.	Press the A/D keys or left/right keys.	The characters move either left or right.	√
6.	Characters can jump.	Press the W key or the up key.	The characters jump smoothly.	√
7.	Player are able to shoot.	Player right click the mouse.	The character is shooting.	√
8.	Player able to damage enemy by shooting.	Bullet hit the enemy	The enemy's health bar decrease	√
9.	Heath item drop	Enemy die	Health item appear where enemy die	√
10.	Health item heal the player	Player get the health item	Player's health amount increase	√
11.	Enemy able to damage to player.	Enemy touch the player.	Health bar of character decreases.	√
12.	Traps able to damage to player.	Player touch the trap.	Health bar of character decreases.	√
13.	Player are able to teleport to another place by using teleporter.	Player must stand in front of the teleporter and press E key.	The character teleport to the other place.	√
14.	The vine door open	Player trigger the mushroom	The vine door open and allow character pass through.	√
15.	The letter follow one of the player.	The player collected the letter.	The letter follow behind the player.	√
16.	The letter activate the exit door.	The player bring the letter to the exit door.	The exit door activated.	√
17.	Player move to level 3.	Reach the activated exit door and press the E key.	Both player loaded to level 3.	√
18.	Player respawn at starting point	The character's health bar empty.	Respawn player at the starting point after 5 seconds.	√

19.	Count down remaining time	Start the level	The remaining time decrease	√
20.	Player game over.	The remaining time become zero.	Game over panel pop out.	√
21.	Pause menu	Press ESC key or click the pause menu button	Pause menu panel pop out	√
22.	Player's health bars are synced in both player views	Player get damage	The amount and colour of health bars are same in both player views	√
23.	Replay level	Room's master click on the replay button	Loading scene will be loaded and then load to the level 2	√
24.	Back to main menu	Click on the main menu button	Player leave the room and will be loaded to main menu scene	√
25.	Close panel button in pause menu	Click the close button	Pause menu panel will be deactivate	√
26.	Chat room	Player types in the text box and click the send button	The message show in the chat room panel and both players can view the message	√
27.	Jump sound effect	Press the W key.	Jump sound effect will be played	√
28.	Shoot sound effect	Player right click the mouse.	Shoot sound effect will be played	√
29.	Health item collected sound effect	Player collect the health item	Heal sound effect will be played	√
30.	Get damage sound effect	Player or enemy get damage	Get damage sound effect will be played	√
31.	Teleporter sound effect	Player get close to teleporter	Teleporter sound effect will be played	√
32.	Teleport sound effect	Player must stand in front of the teleporter and press E key.	Teleport sound effect will be played	√
33.	Pause menu button click sound	Click on the pause menu button	Button click sound will be played	√
34.	Replay button click sound for pause menu panel	Click on the replay button for pause menu panel	Button click sound will be played	√

35.	Main menu button click sound for pause menu panel	Click on the main menu button pause menu panel	Button click sound will be played	√
36.	Start button click sound for start game panel	Click on the start menu button for start game panel	Button click sound will be played	√
37.	Close button click sound for pause menu panel	Click on the close button for pause menu panel	Button click sound will be played	√
38.	Replay button click sound for game over panel	Click on the replay menu button for game over panel	Button click sound will be played	√
39.	Main menu button click sound for game over panel	Click on the main menu button fro game over panel	Button click sound will be played	√
40.	Background music	Start level 2	Background music will be played	√

Table 4.11   Test Case of Level 3

Test Case 9: Level 3				
No.	**Functionality**	**Pre-Condition**	**Expected Outcome**	**Result (√ / ×)**
1.	Start game panel	Loaded to level 3 scene	The start game panel pop out	√
2.	Spawn player	Click the start button in the start game panel	System spawn the player at the starting point	√
3.	Player's username show on the top of the character	System spawn the player at the starting point	The username is the same as the username entered by the player before	√
4.	Both players in same scene	Two players join in the same room	Two character with their own username appear in the level	√
5.	Characters can move left and right.	Press the A/D keys or left/right keys.	The characters move either left or right.	√
6.	Characters can jump.	Press the W key or the up key.	The characters jump smoothly.	√
7.	Player are able to shoot.	Player right click the mouse.	The character is shooting.	√
8.	Player able to damage enemy by shooting.	Bullet hit the enemy	The enemy's health bar decrease	√

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9.	Heath item drop	Enemy die	Health item appear where enemy die	√
10.	Health item heal the player	Player get the health item	Player's health amount increase	√
11.	Enemy able to damage to player.	Enemy touch the player.	Health bar of character decreases.	√
12.	Player are able to teleport to another place by using teleporter.	Player must stand in front of the teleporter and press E key.	The character teleport to the other place.	√
13.	The vine door open	Player trigger the mushroom	The vine door open and allow character pass through.	√
14.	The letter follow one of the player.	The player collected the letter.	The letter follow behind the player.	√
15.	The letter activate the exit door.	The player bring the letter to the exit door.	The exit door activated.	√
16.	Player move to level 4.	Reach the activated exit door and press the E key.	Both player loaded to level 4.	√
17.	Player respawn at starting point	The character's health bar empty.	Respawn player at the starting point after 5 seconds.	√
18.	Count down remaining time	Start the level	The remaining time decrease	√
19.	Player game over.	The remaining time become zero.	Game over panel pop out.	√
20.	Pause menu	Press ESC key or click the pause menu button	Pause menu panel pop out	√
21.	Player's health bars are synced in both player views	Player get damage	The amount and colour of health bars are same in both player views	√
22.	Replay level	Room's master click on the replay button	Loading scene will be loaded and then load to the level 3	√
23.	Back to main menu	Click on the main menu button	Player leave the room and will be loaded to main menu scene	√
24.	Close panel button in pause menu	Click the close button	Pause menu panel will be deactivate	√

25.	Chat room	Player types in the text box and click the send button	The message show in the chat room panel and both players can view the message	√
26.	Jump sound effect	Press the W key.	Jump sound effect will be played	√
27.	Shoot sound effect	Player right click the mouse.	Shoot sound effect will be played	√
28.	Health item collected sound effect	Player collect the health item	Heal sound effect will be played	√
29.	Get damage sound effect	Player or enemy get damage	Get damage sound effect will be played	√
30.	Teleporter sound effect	Player get close to teleporter	Teleporter sound effect will be played	√
31.	Teleport sound effect	Player must stand in front of the teleporter and press E key.	Teleport sound effect will be played	√
32.	Pause menu button click sound	Click on the pause menu button	Button click sound will be played	√
33.	Replay button click sound for pause menu panel	Click on the replay button for pause menu panel	Button click sound will be played	√
34.	Main menu button click sound for pause menu panel	Click on the main menu button pause menu panel	Button click sound will be played	√
35.	Start button click sound for start game panel	Click on the start menu button for start game panel	Button click sound will be played	√
36.	Close button click sound for pause menu panel	Click on the close button for pause menu panel	Button click sound will be played	√
37.	Replay button click sound for game over panel	Click on the replay menu button for game over panel	Button click sound will be played	√
38.	Main menu button click sound for game over panel	Click on the main menu button fro game over panel	Button click sound will be played	√
39.	Background music	Start level 3	Background music will be played	√

Table 4.12   Test Case of Level 4

No.	Functionality	Pre-Condition	Expected Outcome	Result (√ / ×)
Test Case 10: Level 4				
1.	Start game panel	Loaded to level 4 scene	The start game panel pop out	√
2.	Spawn player	Click the start button in the start game panel	System spawn the player at the starting point	√
3.	Player's username show on the top of the character	System spawn the player at the starting point	The username is the same as the username entered by the player before	√
4.	Both players in same scene	Two players join in the same room	Two character with their own username appear in the level	√
5.	Characters can move left and right.	Press the A/D keys or left/right keys.	The characters move either left or right.	√
6.	Characters can jump.	Press the W key or the up key.	The characters jump smoothly.	√
7.	Player are able to shoot.	Player right click the mouse.	The character is shooting.	√
8.	Player able to damage enemy by shooting.	Bullet hit the enemy	The enemy's health bar decrease	√
9.	Heath item drop	Enemy die	Health item appear where enemy die	√
10.	Health item heal the player	Player get the health item	Player's health amount increase	√
11.	Enemy able to damage to player.	Enemy touch the player.	Health bar of character decreases.	√
12.	Player are able to teleport to another place by using teleporter.	Player must stand in front of the teleporter and press E key.	The character teleport to the other place.	√
13.	The vine door open	Player trigger the mushroom	The vine door open and allow character pass through.	√
14.	The letter follow one of the player.	The player collected the letter.	The letter follow behind the player.	√

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15.	The letter activate the exit door.	The player bring the letter to the exit door.	The exit door activated.	√
16.	Player move to level 5.	Reach the activated exit door and press the E key.	Both player loaded to level 5.	√
17.	Player respawn at starting point	The character's health bar empty.	Respawn player at the starting point after 5 seconds.	√
18.	Count down remaining time	Start the level	The remaining time decrease	√
19.	Player game over.	The remaining time become zero.	Game over panel pop out.	√
20.	Pause menu	Press ESC key or click the pause menu button	Pause menu panel pop out	√
21.	Player's health bars are synced in both player views	Player get damage	The amount and colour of health bars are same in both player views	√
22.	Replay level	Room's master click on the replay button	Loading scene will be loaded and then load to the level 4	√
23.	Back to main menu	Click on the main menu button	Player leave the room and will be loaded to main menu scene	√
24.	Close panel button in pause menu	Click the close button	Pause menu panel will be deactivate	√
25.	Chat room	Player types in the text box and click the send button	The message show in the chat room panel and both players can view the message	√
26.	Jump sound effect	Press the W key.	Jump sound effect will be played	√
27.	Shoot sound effect	Player right click the mouse.	Shoot sound effect will be played	√
28.	Health item collected sound effect	Player collect the health item	Heal sound effect will be played	√
29.	Get damage sound effect	Player or enemy get damage	Get damage sound effect will be played	√
30.	Teleporter sound effect	Player get close to teleporter	Teleporter sound effect will be played	√

31.	Teleport sound effect	Player must stand in front of the teleporter and press E key.	Teleport sound effect will be played	√
32.	Pause menu button click sound	Click on the pause menu button	Button click sound will be played	√
33.	Replay button click sound for pause menu panel	Click on the replay button for pause menu panel	Button click sound will be played	√
34.	Main menu button click sound for pause menu panel	Click on the main menu button pause menu panel	Button click sound will be played	√
35.	Start button click sound for start game panel	Click on the start menu button for start game panel	Button click sound will be played	√
36.	Close button click sound for pause menu panel	Click on the close button for pause menu panel	Button click sound will be played	√
37.	Replay button click sound for game over panel	Click on the replay menu button for game over panel	Button click sound will be played	√
38.	Main menu button click sound for game over panel	Click on the main menu button fro game over panel	Button click sound will be played	√
39.	Background music	Start level 4	Background music will be played	√

Table 4.13   Test Case of Level 5

Test Case 11: Level 5				
No.	Functionality	Pre-Condition	Expected Outcome	Result (√ / ×)
1.	Start game panel	Loaded to level 5 scene	The start game panel pop out	√
2.	Spawn player	Click the start button in the start game panel	System spawn the player at the starting point	√
3.	Player's username show on the top of the character	System spawn player at the starting point	The username is the same as the username entered by the player before	√
4.	Both players in same scene	Two players join in the same room	Two character with their own username appear in the level	√

5.	Characters can move left and right.	Press the A/D keys or left/right keys.	The characters move either left or right.	√
6.	Characters can jump.	Press the W key or the up key.	The characters jump smoothly.	√
7.	Player are able to shoot.	Player right click the mouse.	The character is shooting.	√
8.	Player able to damage enemy by shooting.	Bullet hit the enemy	The enemy's health bar decrease	√
9.	Heath item drop	Enemy die	Health item appear where enemy die	√
10.	Health item heal the player	Player get the health item	Player's health amount increase	√
11.	Enemy able to damage to player.	Enemy touch the player.	Health bar of character decreases.	√
12.	Final boss chase player	Player get close to the final boss	Final boss follow the player	√
13.	Final boss shoot to player	Player get close to the final boss	Bullet move to player's position	√
14.	Letter as drop item	Final boss die	Letter appear where final boss die	√
15.	Traps able to damage to player.	Player touch the trap.	Health bar of character decreases.	√
16.	Player are able to teleport to another place by using teleporter.	Player must stand in front of the teleporter and press E key.	The character teleport to the other place.	√
17.	The vine door open	Player trigger the mushroom	The vine door open and allow character pass through.	√
18.	The letter follow one of the player.	The player collected the letter.	The letter follow behind the player.	√
19.	The letter activate the exit door.	The player bring the letter to the exit door.	The exit door activated.	√
20.	Complete mission panel pop out	Reach the activated exit door and press the E key.	Complete mission panel will be pop out.	√

21.	Player respawn at starting point	The character's health bar empty.	Respawn player at the starting point after 5 seconds.	√
22.	Count down remaining time	Start the level	The remaining time decrease	√
23.	Player game over.	The remaining time become zero.	Game over panel pop out.	√
24.	Pause menu	Press ESC key or click the pause menu button	Pause menu panel pop out	√
25.	Player's health bars are synced in both player views	Player get damage	The amount and colour of health bars are same in both player views	√
26.	Replay level	Room's master click on the replay button	Loading scene will be loaded and then load to the level 5	√
27.	Back to main menu	Click on the main menu button	Player leave the room and will be loaded to main menu scene	√
28.	Close panel button in pause menu	Click the close button	Pause menu panel will be deactivate	√
29.	Chat room	Player types in the text box and click the send button	The message show in the chat room panel and both players can view the message	√
30.	Jump sound effect	Press the W key.	Jump sound effect will be played	√
31.	Shoot sound effect	Player right click the mouse.	Shoot sound effect will be played	√
32.	Health item collected sound effect	Player collect the health item	Heal sound effect will be played	√
33.	Get damage sound effect	Player or enemy get damage	Get damage sound effect will be played	√
34.	Teleporter sound effect	Player get close to teleporter	Teleporter sound effect will be played	√
35.	Teleport sound effect	Player must stand in front of the teleporter and press E key.	Teleport sound effect will be played	√
36.	Pause menu button click sound	Click on the pause menu button	Button click sound will be played	√

37.	Replay button click sound for pause menu panel	Click on the replay button for pause menu panel	Button click sound will be played	√
38.	Main menu button click sound for pause menu panel	Click on the main menu button pause menu panel	Button click sound will be played	√
39.	Start button click sound for start game panel	Click on the start menu button for start game panel	Button click sound will be played	√
40.	Close button click sound for pause menu panel	Click on the close button for pause menu panel	Button click sound will be played	√
41.	Replay button click sound for game over panel	Click on the replay menu button for game over panel	Button click sound will be played	√
42.	Main menu button click sound for game over panel	Click on the main menu button fro game over panel	Button click sound will be played	√
43.	Background music	Start level 5	Background music will be played	√

4.4.2 Beta Test

In Beta test, Little Messenger is uploaded to a webpage that allow user publish game application which is Itch.io. The game can be accessed by anyone who view the project's webpage. The user can download Little Messenger via the webpage. The feedback form link is given in the description of the project. The total number of respondents in Beta test is 23 persons. There are 12 questions will be ask in the feedback form.

1. What is the respondent's gender?
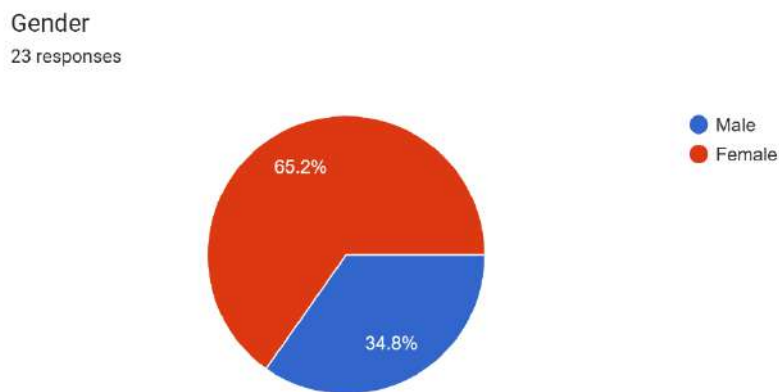
Figure 4.86   Pie Chart – Gender

From the result, there are 8 males (34.8%) and 15 females (65.2%) fill in the feedback form. Most of the respondents are female.

2. How old are the respondent?

Age
23 responses
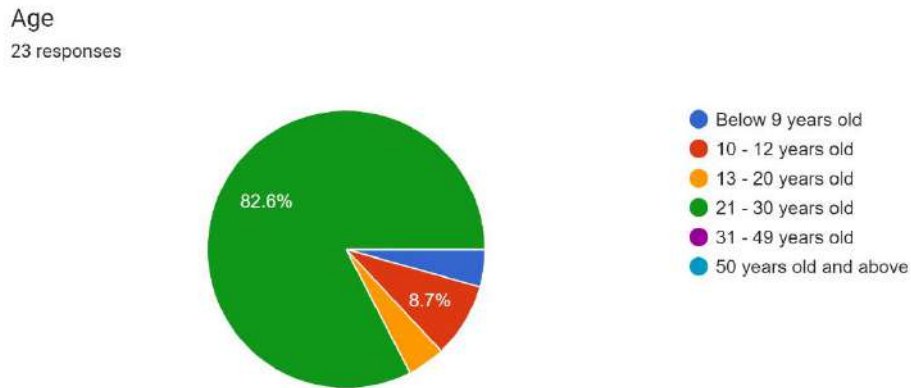
Figure 4.87   Pie Chart – Age

Most of the respondents are aged between 21 to 30 years old which has 19 respondents (82.6%). There are only 2 respondents (8.7 %) are aged between 10 to 12 years old. For the respondents who aged between 13 to 20 years old and below 9 years old only have 1 person (4.3%) for each range.

3. What is the respondent highest education level?

Education level
23 responses
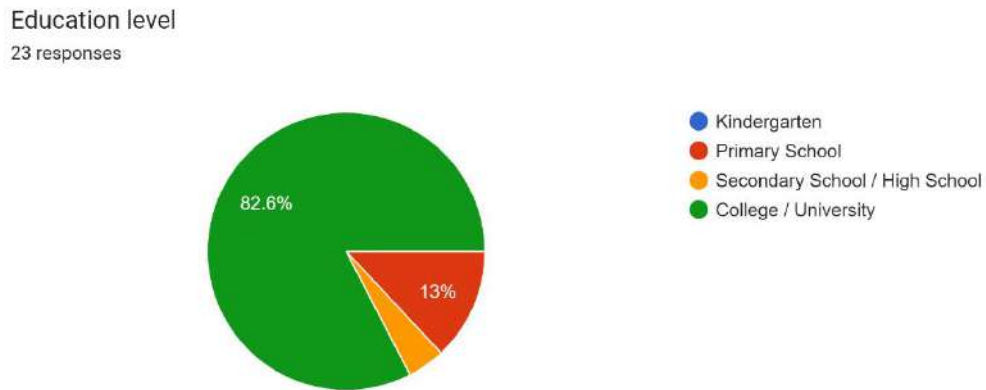
Figure 4.88   Pie Chart – Education Level

Most of the respondents are at least studying in college or university, which takes up 19 respondents (82.6%) of the 23 total respondents. Besides, there are 3 respondents (13%) are studying in primary school and 1 respondent (4.3%) is studying in secondary school or high school.

4. Does Little Messenger can run on PC device?

Does Little Messenger can run on PC devices?
23 responses

Yes
No

100%
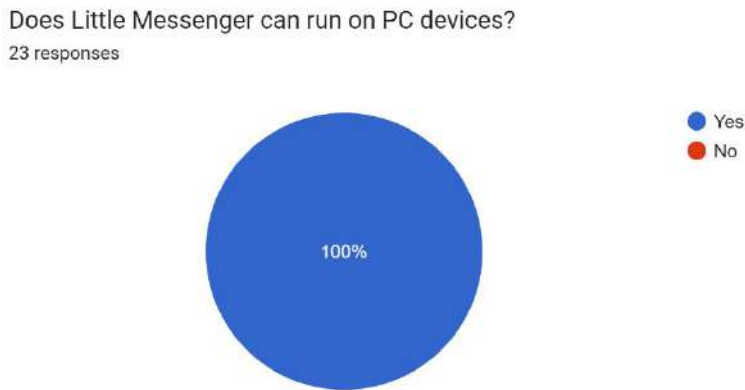
Figure 4.89   Pie Chart – Ability of Game Application Run On Device

All of the respondents successful run the game application on PC device.

5. Does respondent think Little Messenger gameplay is fun and interesting?

Do you think Little Messenger gameplay is fun and interesting?
23 responses

0 (0%)   0 (0%)   1 (4.3%)   6 (26.1%)   16 (69.6%)
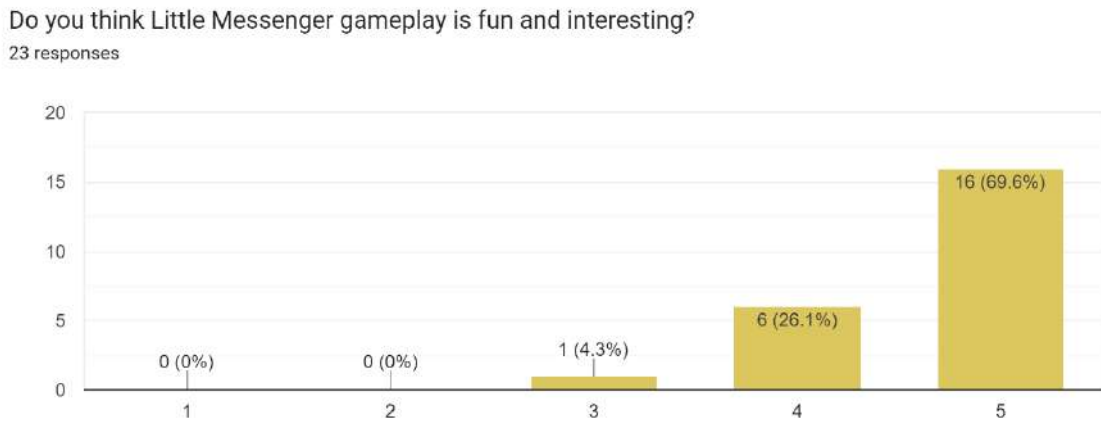
Figure 4.90   Bar Chart – Feelings towards Little Messenger

Most of the respondents (69.6%) strongly agree that the gameplay of Little Messenger is fun and interesting. Besides that, there are 6 respondents (26.1%) agreed and 1 respondent (4.3%) held a neutral opinion.

6. Does respondent think Little Messenger is easy to understand?

Do you think Little Messenger is easy to understand?
23 responses
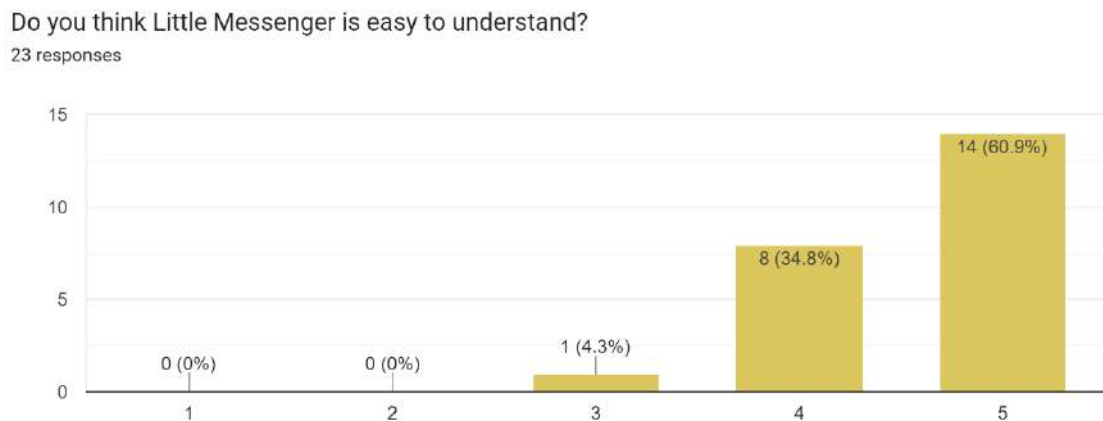
Figure 4.91   Bar Chart – General Understanding towards Little Messenger

There are 14 respondents (60.9%) strongly agree and 8 respondents (34.8%) agree that Little Messenger is easy to understand. However, there are 1 respondents (4.3%) held a neutral opinion.

7. Does respondent think Little Messenger is suitable for children to play?

Do you think Little Messenger is suitable for children to play?
23 responses
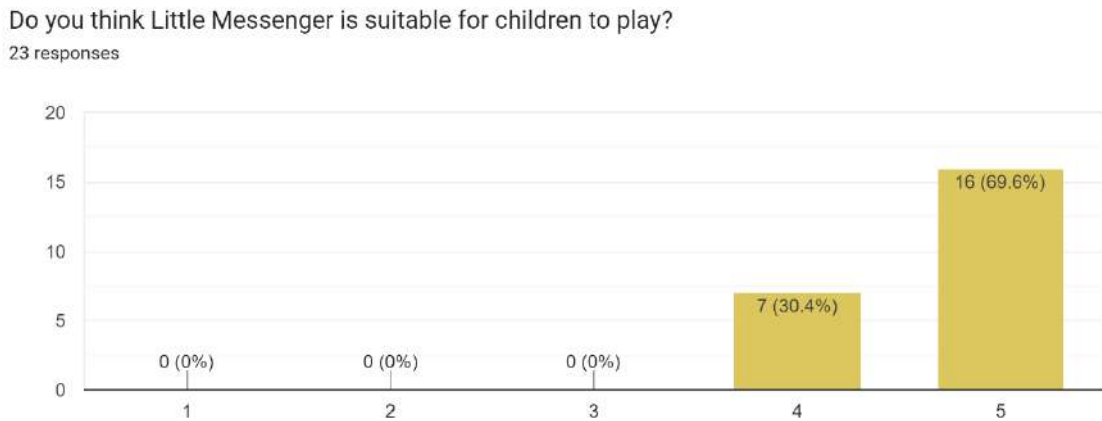
Figure 4.92   Bar Chart – Suitability of Little Messenger for Children to Play

There are 16 respondents (69.6%) stated that they strongly agree that Little Messenger is suitable for children to play. There are 7 respondents (30.4%) agree on it.

8. Does respondent think Little Messenger is too difficult for children to play?

Do you think Little Messenger is too difficult for children to play?
23 responses
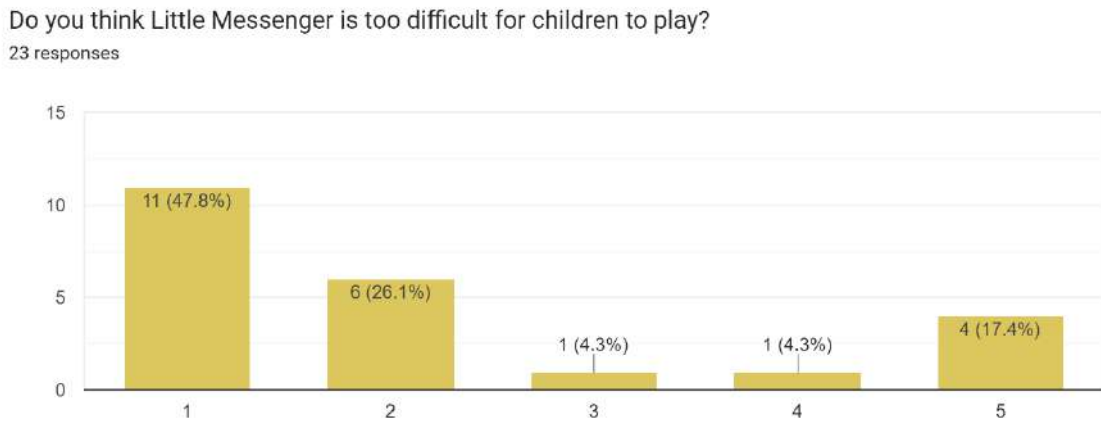
Figure 4.93   Bar Chart - Difficulty of Little Messenger for Children

There are 11 respondents (47.8%) strongly disagree and 6 respondents (26.1%) disagree that Little Messenger is too difficult for children to play. However, there are 4 respondents (17.4%) strongly agree that Little Messenger is too difficult for children to play. There are also 1 respondent (4.3 %) agree on it and held a neutral opinion.

9. Does Little Messenger have a lot of bugs and glitches?

Does Little Messenger have a lot of bugs and glitches?
23 responses
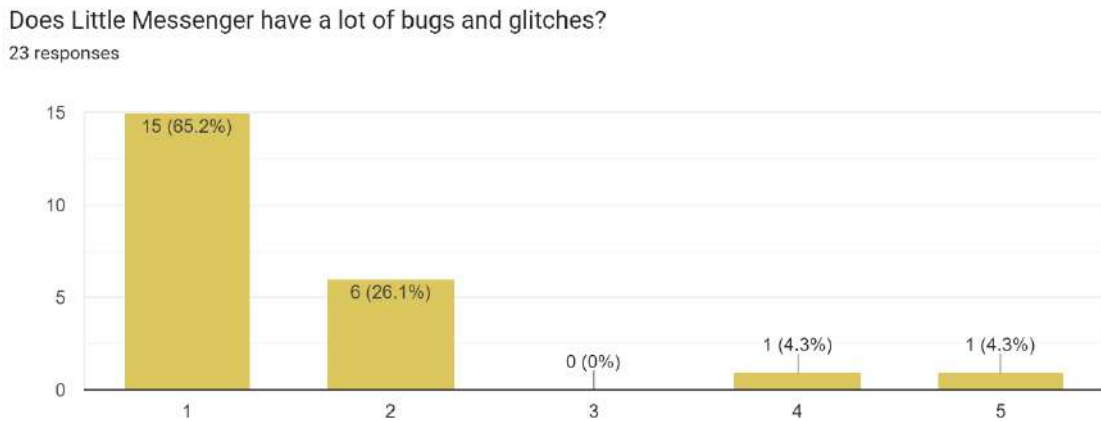
Figure 4.94   Bar Chart – Bug and Glitches in Little Messenger

There are 15 respondents (65.2%) strongly disagree and 6 respondents (26.1%) disagree that Little Messenger have a lot of bugs and glitches. However, there are 1 respondents (4.3%) strongly agree and agree on it.

10. Does Little Messenger interact with player not exceed 10 seconds?

Does Little Messenger interact with player not exceed 10 seconds?
23 responses
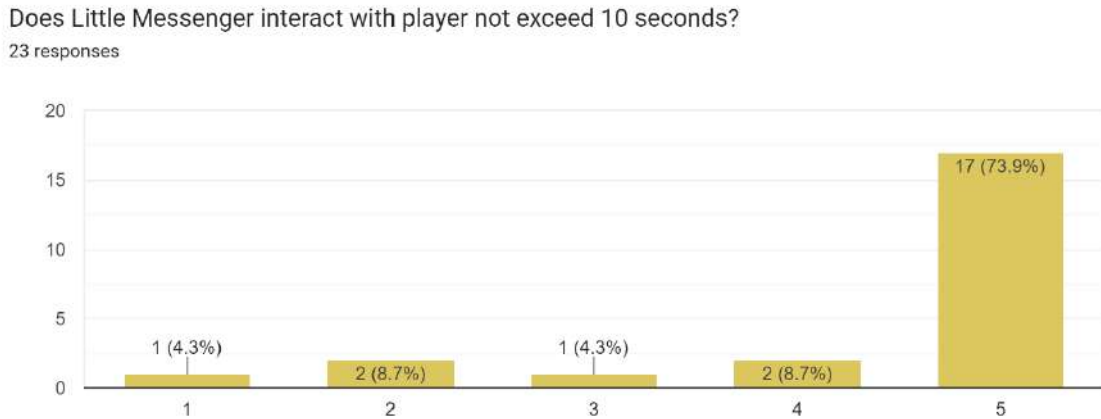
Figure 4.95   Bar Chart - Response Time of Little Messenger to Respondent

Most of the respondents (73.9%) strongly agree that response time for Little Messenger interact with player not exceed 10 seconds. Moreover, there are 2 respondents (8.7 %) agree and disagree on it. There are also 1 respondent (4.3%) strongly disagree on it and held a neutral opinion.

11. Does the instruction given in the tutorial level is clear and understandable?

Does the instruction given in the tutorial level is clear and understandable?
23 responses
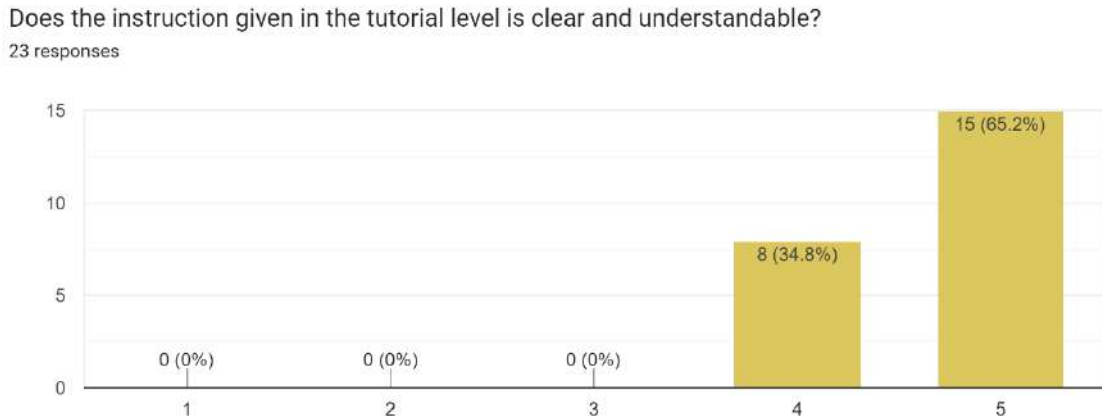
Figure 4.96   Bar Chart – Understandable for Tutorial level

There are 15 respondents (65.2%) strongly agree that the instruction given in the tutorial level is clear and understandable. In addition, there are 8 respondents (34.8%) agree on it.

12. Does Little Messenger encourage respondent's communication skill while play game?

Does Little Messenger encourage your communication skill when you are playing?
23 responses
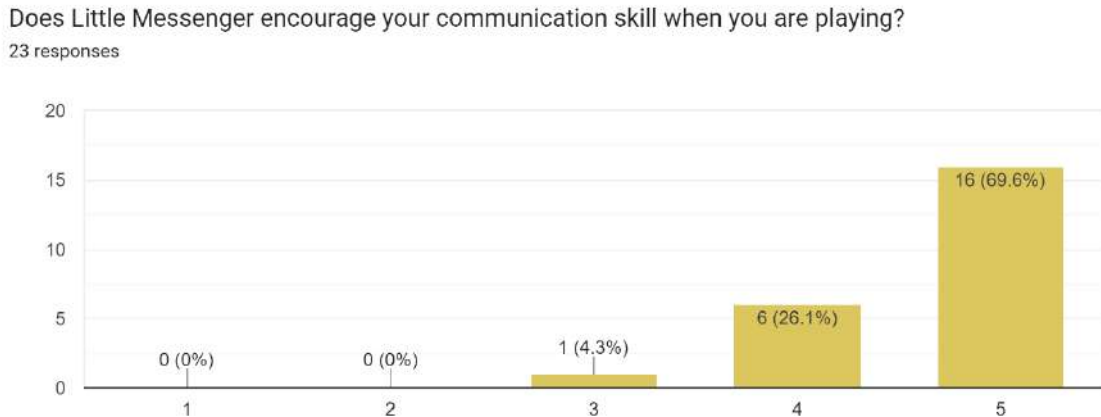
Figure 4.97   Bar Chart – Goal Achievement for Little Messenger

There are 16 respondents strongly agree and 6 respondents agree that Little Messenger can encourage communication skill while play the game. However, there are 1 respondent (4.3%) held a neutral opinion.

4.4.3   Test Analysis

From the Beta test result, it can be confirmed that Little Messenger can run normally on PC devices. Furthermore, the result from question 5 and 6 stated that most of the respondents think that Little Messenger is fun and easy to understand. However, there are still have some respondents held a neutral opinion. Therefore, the gameplay still have space to do improvement to make the game more simple and interesting.

Moreover, from question 7, all the respondents stated that Little Messenger is suitable for children to play. However, in question 8 there are some respondents think that Little Messenger is too difficult for children to play. Even majority people disagree for this, but still have respondents agree with this. Hence, the difficulty of Little

Messenger should be decrease to make sure the difficulty of game suitable for all children.

Besides that, most of the respondents stated that Little messenger did not have a lot of bugs and glitches when they are playing. This situation is well aware by the developer as there are some weird interactions between different entities, but since it does not post a major setback in the system, so it was ignored for higher priorities features. In addition, most of the respondents agree that the response time for Little Messenger interact between with player no exceed 10 seconds. Some of the respondents disagree on it. The response time of Little Messenger can be affected by internet speed and devices' speed.

Next is the question 11, all the respondents agree that the instruction given in the tutorial level is clear and understand. Lastly is the question 12, most of the respondents stated that Little Messenger can encourage communication skill when play the game. However, there are 1 respondents held a neutral opinion. Hence, the interaction between players in game might add more in future to ensure both players always communicate with each other. In conclusion, based on the result, Little Messenger game application reaches its objective to encourage communication.

CHAPTER 5

CONCLUSION

5.1   Objective Revisited

In this chapter, the objective of this project will be reviewed. The three objective of this project are

1. To design a video game that can help people to encourage communication.

2. To develop a game that can help people to encourage communication.

3. To evaluate the functionality and user experience of the proposed game.

While completing this project, a lot of time were spend to research about network for multiplayer game. Photon Unity Network is the final decision for this project. After a long learning journey, Little Messenger was successfully developed by using Unity and Photon Unity Network. Chat room system was implemented in this video game to allow players can have communication while playing game. From this, the objectives had successfully met.

5.2   Limitation

There are some limitation and challenges while develop Little Messenger and also post launch of the game.

1. At begin, developer's laptop hard to support the development process. Therefore, the workflow was low efficient.

2. The tutorial for develop multiplayer game is rare. Therefore, this is the big challenges for modify the single player code to multiplayer code.

3. Before upgrade to Photon Unity Network 2, the Photon Unity Network Classic has lagging problem and unstable. Fortunately, Photon Unity Network 2 was founded even it take some times to study again.

4. When testing game mechanics, two windows are needed to ensure the mechanics are work in different view. Therefore, build application is required to test every game mechanics.

5. Due to time constraint, some of the game mechanics were dropped from the plan.

5.3   Future Work

There are a lot of improvements can be done in future to make the game become prefect. First of all, a lobby can be implemented before start the level. The lobby is used to gather the players before start the game. When the number of player is enough then can move to level 1 together.

Furthermore, the number of levels can added more, as can more environments. When the number of levels reach a certain number, the levels can divided based on environment's type. An environment selection option can be added in the main menu.

Moreover, the varieties of enemy can become more to avoid the game being too boring. The enemy's attack methods can become more such as weapon type can have different. The type of obstacles in the game also can have more to give new challenge to the players.

Lastly, the storyline can improve to more details and completeness. More stories can be added to the game and divided into different chapters, allowing the player to enjoy the game and the story at the same time. NPC and Easter eggs can added into game. From this, the player may be interested in exploring the level again and again.

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NAME: YONG RONG SEE

Test Case 1: Intro Story				
No.	**Functionality**	**Pre-Condition**	**Expected Outcome**	**Result (√ / ×)**
1.	Animation play	Starting game	Able to view the animation	√
2.	Dialogue appears	Animation ends playing	Dialogue box pop out	√
3.	Dialogue change	Press space bar	Next dialogue will be loaded	√
4.	Background music	Starting game	Background music will be played	√
5.	Load to Main Menu	Dialogue ends	Main menu scene will be loaded	√

Test Case 2: Main Menu				
No.	**Functionality**	**Pre-Condition**	**Expected Outcome**	**Result (√ / ×)**
1.	Go to tutorial mode scene	Click on the tutorial mode button	The tutorial scene will be loaded	√
2.	Go to create game room scene	Click on the create game room button	The create username panel will pop out	√
3.	Go to join game room scene	Click on the join game room button	The create username panel will pop out	√
4.	Quit the game application	Click on the exit button	The game will be closed	√
5.	Tutorial mode button click sound	Click on the tutorial mode button	Button click sound will be played	√
6.	Create game room button click sound	Click on the create game room button	Button click sound will be played	√
7.	Join game room click sound	Click on the join game room button	Button click sound will be played	√
8.	Exit button click sound	Click on the exit button	Button click sound will be played	√
9.	Background music	Load to main menu scene	Background music will be played	√

Test Case 3: Create Username				
No.	**Functionality**	**Pre-Condition**	**Expected Outcome**	Result (√ / ×)
1.	Get player's username	Enter Username in text box	The username will show in game level.	√
2.	Go to create game room scene	Click on the start button and previously click the create game room button	The create game room panel will pop out.	√
3.	Go to join game room scene	Click on the start button and previously click the join game room button	The join game room panel will pop out.	√
4.	Back to main menu	Click on the back button	The main menu will pop out.	√
5.	Start button click sound	Click on the start button	Button click sound will be played	√
6.	Back button click sound	Click on the start button	Button click sound will be played	√
7.	Background music	Load to main menu scene	Background music will be played	√

Test Case 4: Create Game Room				
No.	**Functionality**	**Pre-Condition**	**Expected Outcome**	Result (√ / ×)
1.	Get room code	Enter new room code in text box	The room code will uploaded to the server	√
2.	Load to level 1	Click on the create room button	Level 1 will be loaded	√
3.	Back to main menu	Click on the back button	The main menu will pop out	√
4.	Create room button click sound	Click on the create room button	Button click sound will be played	√
5.	Back button click sound	Click on the start button	Button click sound will be played	√
6.	Background music	Load to main menu scene	Background music will be played	√

Test Case 5: Join Game Room

No.	Functionality	Pre-Condition	Expected Outcome	Result (√ / ×)
1.	Get room code	Enter room code that have already been created in text box	The room code will uploaded to the server	√
2.	Load to level 1	Click on the join room button	Join with room's master into level 1	√
3.	Back to main menu	Click on the back button	The main menu will pop out	√
4.	Join room button click sound	Click on the join room button	Button click sound will be played	√
5.	Back button click sound	Click on the start button	Button click sound will be played	√
6.	Background music	Load to main menu scene	Background music will be played	√

Test Case 6: Tutorial Mode

No.	Functionality	Pre-Condition	Expected Outcome	Result (√ / ×)
1.	Start game panel	Loaded to tutorial mode scene	The start game panel pop out	√
2.	Spawn player	Click the start button in the start game panel	System spawn the player at the starting point	√
3.	Dialogue system triggered	Click the start button in the start game panel	Dialogue box appear	√
4.	Dialogue change	Press space bar	Next dialogue will be loaded	√
5.	Dialogue box close	Dialogue finish	Dialogue box disappear	√
6.	Dialogue system triggered	Player near to the mushroom	Dialogue box appear	√
7.	Dialogue system triggered	Player near to the enemy	Dialogue box appear	√
8.	Dialogue system triggered	Player near to the teleporter	Dialogue box appear	√
9.	Dialogue system triggered	Player near to the letter	Dialogue box appear	√

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10.	Dialogue system triggered	Player near to the exit door	Dialogue box appear	√
11.	Characters can move left and right.	Press the A/D keys or left/right keys.	The characters move either left or right.	√
12.	Characters can jump.	Press the W key.	The characters jump smoothly.	√
13.	Player are able to shoot.	Player right click the mouse.	The character is shooting.	√
14.	Player able to damage the enemy by shooting.	Bullet hit the enemy	The enemy's health bar decrease	√
15.	Heath item drop	Enemy die	Health item appear where enemy die	√
16.	Health item heal the player	Player get the health item	Player's health amount increase	√
17.	Enemy able to damage the player.	Enemy touch the player.	Health bar of character decreases.	√
18.	Player are able to teleport to another place by using teleporters.	Player must stand in front of the teleporter and press the E key.	The character teleports to another place.	√
19.	The vine door open	Player trigger the mushroom	The vine door opens and allows the player to pass through.	√
20.	The letter follows one of the player.	The player collected the letter.	The letter follows behind the player.	√
21.	The letter activates the exit door.	The player brings the letter to the exit door.	The exit door activated.	√
22.	Tutorial complete panel	Exit door is activated	Tutorial complete panel pop out	√
23.	Player respawn at starting point	The character's health bar is empty.	Respawn player at the starting point after 5 seconds.	√
24.	Countdown remaining time	Start the level	The remaining time decrease	√

25.	Player game over.	The remaining time becomes zero.	Game over panel pop out.	√
26.	Pause menu	Press ESC key or click the pause menu button	Pause menu panel pop out	√
27.	Replay level	Room's master click on the replay button	Loading scene will be loaded and then load to the tutorial mode scene	√
28.	Back to main menu	Click on the main menu button	Player leave the room and will be loaded to main menu scene	√
29.	Close panel button in pause menu	Click the close button	Pause menu panel will be deactivate	√
30.	Jump sound effect	Press the W key.	Jump sound effect will be played	√
31.	Shoot sound effect	Player right click the mouse.	Shoot sound effect will be played	√
32.	Health item collected sound effect	Player collect the health item	Heal sound effect will be played	√
33.	Get damage sound effect	Player or enemy get damage	Get damage sound effect will be played	√
34.	Teleporter sound effect	Player get close to teleporter	Teleporter sound effect will be played	√
35.	Teleport sound effect	Player must stand in front of the teleporter and press the E key.	Teleport sound effect will be played	√
36.	Complete tutorial panel pop out sound effect	Player active the exit door	Mission complete sound will be played	√
37.	Pause menu button click sound	Click on the pause menu button	Button click sound will be played	√
38.	Replay button click sound for pause menu panel	Click on the replay button for pause menu panel	Button click sound will be played	√

39.	Main menu button click sound for pause menu panel	Click on the main menu button pause menu panel	Button click sound will be played	√
40.	Start button click sound for start game panel	Click on the start menu button for start game panel	Button click sound will be played	√
41.	Close button click sound for pause menu panel	Click on the close button for pause menu panel	Button click sound will be played	√
42.	Replay button click sound for game over panel	Click on the replay menu button for game over panel	Button click sound will be played	√
43.	Main menu button click sound for game over panel	Click on the main menu button fro game over panel	Button click sound will be played	√
44.	Background music	Start level	Background music will be played	√

Test Case 7: Level 1				
No.	Functionality	Pre-Condition	Expected Outcome	Result (√ / ×)
1.	Start game panel	Loaded to level 1 scene	The start game panel pop out	√
2.	Spawn player	Click the start button in the start game panel	System spawn the player at the starting point	√
3.	Player's username show on the top of the character	System spawn the player at the starting point	The username is the same as the username entered by the player before	√
4.	Both players in same scene	Two players join in the same room	Two character with their own username appear in the level	√
5.	Characters can move left and right.	Press the A/D keys or left/right keys.	The characters move either left or right.	√
6.	Characters can jump.	Press the W key or the up key.	The characters jump smoothly.	√

7.	Player are able to shoot.	Player right click the mouse.	The character is shooting.	√
8.	Player able to damage the enemy by shooting.	Bullet hit the enemy	The enemy's health bar decrease	√
9.	Heath item drop	Enemy die	Health item appear where enemy die	√
10.	Health item heal the player	Player get the health item	Player's health amount increase	√
11.	Enemy able to damage the player.	Enemy touch the player.	Health bar of character decreases.	√
12.	Player are able to teleport to another place by using teleporters.	Player must stand in front of the teleporter and press the E key.	The character teleports to another place.	√
13.	The vine door open	Player trigger the mushroom	The vine door opens and allows the player to pass through.	√
14.	The letter follows one of the player.	The player collected the letter.	The letter follows behind the player.	√
15.	The letter activates the exit door.	The player brings the letter to the exit door.	The exit door activated.	√
16.	Player move to level 2.	Reach the activated exit door and press the E key.	Both players loaded to level 2.	√
17.	Player respawn at starting point	The character's health bar is empty.	Respawn player at the starting point after 5 seconds.	√
18.	Countdown remaining time	Start the level	The remaining time decrease	√
19.	Player game over.	The remaining time becomes zero.	Game over panel pop out.	√
20.	Pause menu	Press ESC key or click the pause menu button	Pause menu panel pop out	√
21.	Player's health bars are synced in both player views	Player get damage	The amount and colour of health bars are same in both player views	√
22.	Replay level	Room's master click on the replay button	Loading scene will be loaded and then load to the level 1	√

23.	Back to main menu	Click on the main menu button	Player leave the room and will be loaded to main menu scene	√
24.	Close panel button in pause menu	Click the close button	Pause menu panel will be deactivate	√
25.	Chat room	Player types in the text box and click the send button	The message show in the chat room panel and both players can view the message	√
26.	Jump sound effect	Press the W key.	Jump sound effect will be played	√
27.	Shoot sound effect	Player right click the mouse.	Shoot sound effect will be played	√
28.	Health item collected sound effect	Player collect the health item	Heal sound effect will be played	√
29.	Get damage sound effect	Player or enemy get damage	Get damage sound effect will be played	√
30.	Teleporter sound effect	Player get close to teleporter	Teleporter sound effect will be played	√
31.	Teleport sound effect	Player must stand in front of the teleporter and press the E key.	Teleport sound effect will be played	√
32.	Pause menu button click sound	Click on the pause menu button	Button click sound will be played	√
33.	Replay button click sound for pause menu panel	Click on the replay button for pause menu panel	Button click sound will be played	√
34.	Main menu button click sound for pause menu panel	Click on the main menu button pause menu panel	Button click sound will be played	√
35.	Start button click sound for start game panel	Click on the start menu button for start game panel	Button click sound will be played	√
36.	Close button click sound for pause menu panel	Click on the close button for pause menu panel	Button click sound will be played	√
37.	Replay button click sound for game over panel	Click on the replay menu button for game over panel	Button click sound will be played	√

38.	Main menu button click sound for game over panel	Click on the main menu button for game over panel	Button click sound will be played	√
39.	Background music	Start level 1	Background music will be played	√

Test Case 8: Level 2				
No.	**Functionality**	**Pre-Condition**	**Expected Outcome**	Result (√ / ×)
1.	Start game panel	Loaded to level 2 scene	The start game panel pop out	√
2.	Spawn player	Click the start button in the start game panel	System spawn the player at the starting point	√
3.	Player's username show on the top of the character	System spawn the player at the starting point	The username is the same as the username entered by the player before	√
4.	Both players in same scene	Two players join in the same room	Two character with their own username appear in the level	√
5.	Characters can move left and right.	Press the A/D keys or left/right keys.	The characters move either left or right.	√
6.	Characters can jump.	Press the W key or the up key.	The characters jump smoothly.	√
7.	Player are able to shoot.	Player right click the mouse.	The character is shooting.	√
8.	Player able to damage the enemy by shooting.	Bullet hit the enemy	The enemy's health bar decrease	√
9.	Heath item drop	Enemy die	Health item appear where enemy die	√
10.	Health item heal the player	Player get the health item	Player's health amount increase	√
11.	Enemy able to damage to player.	Enemy touch the player.	Health bar of character decreases.	√
12.	Traps able to damage to player.	Player touch the trap.	Health bar of character decreases.	√
13.	Player are able to teleport to another place by using teleporters.	Player must stand in front of the teleporter and press the E key.	The character teleports to another place.	√

14.	The vine door open	Player trigger the mushroom	The vine door opens and allows the player to pass through.	√
15.	The letter follows one of the player.	The player collected the letter.	The letter follows behind the player.	√
16.	The letter activates the exit door.	The player brings the letter to the exit door.	The exit door activated.	√
17.	Player move to level 3.	Reach the activated exit door and press the E key.	Both players loaded to level 3.	√
18.	Player respawn at starting point	The character's health bar is empty.	Respawn player at the starting point after 5 seconds.	√
19.	Countdown remaining time	Start the level	The remaining time decrease	√
20.	Player game over.	The remaining time becomes zero.	Game over panel pop out.	√
21.	Pause menu	Press ESC key or click the pause menu button	Pause menu panel pop out	√
22.	Player's health bars are synced in both player views	Player get damage	The amount and colour of health bars are same in both player views	√
23.	Replay level	Room's master click on the replay button	Loading scene will be loaded and then load to the level 2	√
24.	Back to main menu	Click on the main menu button	Player leave the room and will be loaded to main menu scene	√
25.	Close panel button in pause menu	Click the close button	Pause menu panel will be deactivate	√
26.	Chat room	Player types in the text box and click the send button	The message show in the chat room panel and both players can view the message	√
27.	Jump sound effect	Press the W key.	Jump sound effect will be played	√
28.	Shoot sound effect	Player right click the mouse.	Shoot sound effect will be played	√
29.	Health item collected sound effect	Player collect the health item	Heal sound effect will be played	√
30.	Get damage sound effect	Player or enemy get damage	Get damage sound effect will be played	√

31.	Teleporter sound effect	Player get close to teleporter	Teleporter sound effect will be played	√
32.	Teleport sound effect	Player must stand in front of the teleporter and press the E key.	Teleport sound effect will be played	√
33.	Pause menu button click sound	Click on the pause menu button	Button click sound will be played	√
34.	Replay button click sound for pause menu panel	Click on the replay button for pause menu panel	Button click sound will be played	√
35.	Main menu button click sound for pause menu panel	Click on the main menu button pause menu panel	Button click sound will be played	√
36.	Start button click sound for start game panel	Click on the start menu button for start game panel	Button click sound will be played	√
37.	Close button click sound for pause menu panel	Click on the close button for pause menu panel	Button click sound will be played	√
38.	Replay button click sound for game over panel	Click on the replay menu button for game over panel	Button click sound will be played	√
39.	Main menu button click sound for game over panel	Click on the main menu button for game over panel	Button click sound will be played	√
40.	Background music	Start level 2	Background music will be played	√

Test Case 9: Level 3				
No.	Functionality	Pre-Condition	Expected Outcome	Result (√ / ×)
1.	Start game panel	Loaded to level 3 scene	The start game panel pop out	√
2.	Spawn player	Click the start button in the start game panel	System spawn the player at the starting point	√
3.	Player's username show on the top of the character	System spawn the player at the starting point	The username is the same as the username entered by the player before	√
4.	Both players in same scene	Two players join in the same room	Two character with their own username appear in the level	√

5.	Characters can move left and right.	Press the A/D keys or left/right keys.	The characters move either left or right.	√
6.	Characters can jump.	Press the W key or the up key.	The characters jump smoothly.	√
7.	Player are able to shoot.	Player right click the mouse.	The character is shooting.	√
8.	Player able to damage the enemy by shooting.	Bullet hit the enemy	The enemy's health bar decrease	√
9.	Heath item drop	Enemy die	Health item appear where enemy die	√
10.	Health item heal the player	Player get the health item	Player's health amount increase	√
11.	Enemy able to damage the player.	Enemy touch the player.	Health bar of character decreases.	√
12.	Player are able to teleport to another place by using teleporters.	Player must stand in front of the teleporter and press the E key.	The character teleports to another place.	√
13.	The vine door open	Player trigger the mushroom	The vine door opens and allows the player to pass through.	√
14.	The letter follows one of the player.	The player collected the letter.	The letter follows behind the player.	√
15.	The letter activates the exit door.	The player brings the letter to the exit door.	The exit door activated.	√
16.	Player move to level 4.	Reach the activated exit door and press the E key.	Both players loaded to level 4.	√
17.	Player respawn at starting point	The character's health bar is empty.	Respawn player at the starting point after 5 seconds.	√
18.	Countdown remaining time	Start the level	The remaining time decrease	√
19.	Player game over.	The remaining time becomes zero.	Game over panel pop out.	√
20.	Pause menu	Press ESC key or click the pause menu button	Pause menu panel pop out	√
21.	Player's health bars are synced in both player views	Player get damage	The amount and colour of health bars are same in both player views	√
22.	Replay level	Room's master click on the replay button	Loading scene will be loaded and then load to the level 3	√
23.	Back to main menu	Click on the main menu button	Player leave the room and will be loaded to main menu scene	√
24.	Close panel button in pause menu	Click the close button	Pause menu panel will be deactivate	√

25.	Chat room	Player types in the text box and click the send button	The message show in the chat room panel and both players can view the message	√
26.	Jump sound effect	Press the W key.	Jump sound effect will be played	√
27.	Shoot sound effect	Player right click the mouse.	Shoot sound effect will be played	√
28.	Health item collected sound effect	Player collect the health item	Heal sound effect will be played	√
29.	Get damage sound effect	Player or enemy get damage	Get damage sound effect will be played	√
30.	Teleporter sound effect	Player get close to teleporter	Teleporter sound effect will be played	√
31.	Teleport sound effect	Player must stand in front of the teleporter and press the E key.	Teleport sound effect will be played	√
32.	Pause menu button click sound	Click on the pause menu button	Button click sound will be played	√
33.	Replay button click sound for pause menu panel	Click on the replay button for pause menu panel	Button click sound will be played	√
34.	Main menu button click sound for pause menu panel	Click on the main menu button pause menu panel	Button click sound will be played	√
35.	Start button click sound for start game panel	Click on the start menu button for start game panel	Button click sound will be played	√
36.	Close button click sound for pause menu panel	Click on the close button for pause menu panel	Button click sound will be played	√
37.	Replay button click sound for game over panel	Click on the replay menu button for game over panel	Button click sound will be played	√
38.	Main menu button click sound for game over panel	Click on the main menu button for game over panel	Button click sound will be played	√
39.	Background music	Start level 3	Background music will be played	√

Test Case 10: Level 4				
No.	Functionality	Pre-Condition	Expected Outcome	Result (√ / ×)
1.	Start game panel	Loaded to level 4 scene	The start game panel pop out	√

2.	Spawn player	Click the start button in the start game panel	System spawn the player at the starting point	√
3.	Player's username show on the top of the character	System spawn the player at the starting point	The username is the same as the username entered by the player before	√
4.	Both players in same scene	Two players join in the same room	Two character with their own username appear in the level	√
5.	Characters can move left and right.	Press the A/D keys or left/right keys.	The characters move either left or right.	√
6.	Characters can jump.	Press the W key or the up key.	The characters jump smoothly.	√
7.	Player are able to shoot.	Player right click the mouse.	The character is shooting.	√
8.	Player able to damage the enemy by shooting.	Bullet hit the enemy	The enemy's health bar decrease	√
9.	Heath item drop	Enemy die	Health item appear where enemy die	√
10.	Health item heal the player	Player get the health item	Player's health amount increase	√
11.	Enemy able to damage the player.	Enemy touch the player.	Health bar of character decreases.	√
12.	Player are able to teleport to another place by using teleporter.	Player must stand in front of the teleporter and press E key.	The character teleports to another place.	√
13.	The vine door open	Player trigger the mushroom	The vine door opens and allows the player to pass through.	√
14.	The letter follows one of the player.	The player collected the letter.	The letter follows behind the player.	√
15.	The letter activates the exit door.	The player brings the letter to the exit door.	The exit door activated.	√
16.	Player move to level 5.	Reach the activated exit door and press the E key.	Both players loaded to level 5.	√
17.	Player respawn at starting point	The character's health bar is empty.	Respawn player at the starting point after 5 seconds.	√
18.	Countdown remaining time	Start the level	The remaining time decrease	√

19.	Player game over.	The remaining time becomes zero.	Game over panel pop out.	√
20.	Pause menu	Press ESC key or click the pause menu button	Pause menu panel pop out	√
21.	Player's health bars are synced in both player views	Player get damage	The amount and colour of health bars are same in both player views	√
22.	Replay level	Room's master click on the replay button	Loading scene will be loaded and then load to the level 4	√
23.	Back to main menu	Click on the main menu button	Player leave the room and will be loaded to main menu scene	√
24.	Close panel button in pause menu	Click the close button	Pause menu panel will be deactivate	√
25.	Chat room	Player types in the text box and click the send button	The message show in the chat room panel and both players can view the message	√
26.	Jump sound effect	Press the W key.	Jump sound effect will be played	√
27.	Shoot sound effect	Player right click the mouse.	Shoot sound effect will be played	√
28.	Health item collected sound effect	Player collect the health item	Heal sound effect will be played	√
29.	Get damage sound effect	Player or enemy get damage	Get damage sound effect will be played	√
30.	Teleporter sound effect	Player get close to teleporter	Teleporter sound effect will be played	√
31.	Teleport sound effect	Player must stand in front of the teleporter and press the E key.	Teleport sound effect will be played	√
32.	Pause menu button click sound	Click on the pause menu button	Button click sound will be played	√
33.	Replay button click sound for pause menu panel	Click on the replay button for pause menu panel	Button click sound will be played	√
34.	Main menu button click sound for pause menu panel	Click on the main menu button pause menu panel	Button click sound will be played	√

35.	Start button click sound for start game panel	Click on the start menu button for start game panel	Button click sound will be played	√
36.	Close button click sound for pause menu panel	Click on the close button for pause menu panel	Button click sound will be played	√
37.	Replay button click sound for game over panel	Click on the replay menu button for game over panel	Button click sound will be played	√
38.	Main menu button click sound for game over panel	Click on the main menu button for game over panel	Button click sound will be played	√
39.	Background music	Start level 4	Background music will be played	√

Test Case 11: Level 5				
No.	**Functionality**	**Pre-Condition**	**Expected Outcome**	Result (√ / ×)
1.	Start game panel	Loaded to level 5 scene	The start game panel pop out	√
2.	Spawn player	Click the start button in the start game panel	System spawn the player at the starting point	√
3.	Player's username show on the top of the character	System spawn the player at the starting point	The username is the same as the username entered by the player before	√
4.	Both players in same scene	Two players join in the same room	Two character with their own username appear in the level	√
5.	Characters can move left and right.	Press the A/D keys or left/right keys.	The characters move either left or right.	√
6.	Characters can jump.	Press the W key or the up key.	The characters jump smoothly.	√
7.	Player are able to shoot.	Player right click the mouse.	The character is shooting.	√
8.	Player able to damage the enemy by shooting.	Bullet hit the enemy	The enemy's health bar decrease	√

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9.	Heath item drop	Enemy die	Health item appear where enemy die	√
10.	Health item heal the player	Player get the health item	Player's health amount increase	√
11.	Enemy able to damage the player.	Enemy touch the player.	Health bar of character decreases.	√
12.	Final boss chase player	Player get close to the final boss	Final boss follow the player	√
13.	Final boss shoot to player	Player get close to the final boss	Bullet move to player's position	√
14.	Letter as drop item	Final boss die	Letter appear where final boss die	√
15.	Traps able to damage to player.	Player touch the trap.	Health bar of character decreases.	√
16.	Player are able to teleport to another place by using teleporters.	Player must stand in front of the teleporter and press the E key.	The character teleports to another place.	√
17.	The vine door open	Player trigger the mushroom	The vine door opens and allows the player to pass through.	√
18.	The letter follows one of the player.	The player collected the letter.	The letter follows behind the player.	√
19.	The letter activates the exit door.	The player brings the letter to the exit door.	The exit door activated.	√
20.	Complete mission panel pop out	Reach the activated exit door and press the E key.	Complete mission panel will pop out.	√
21.	Player respawn at starting point	The character's health bar is empty.	Respawn player at the starting point after 5 seconds.	√
22.	Countdown remaining time	Start the level	The remaining time decrease	√
23.	Player game over.	The remaining time becomes zero.	Game over panel pop out.	√

24.	Pause menu	Press ESC key or click the pause menu button	Pause menu panel pop out	√
25.	Player's health bars are synced in both player views	Player get damage	The amount and colour of health bars are same in both player views	√
26.	Replay level	Room's master click on the replay button	Loading scene will be loaded and then load to the level 5	√
27.	Back to main menu	Click on the main menu button	Player leave the room and will be loaded to main menu scene	√
28.	Close panel button in pause menu	Click the close button	Pause menu panel will be deactivate	√
29.	Chat room	Player types in the text box and click the send button	The message show in the chat room panel and both players can view the message	√
30.	Jump sound effect	Press the W key.	Jump sound effect will be played	√
31.	Shoot sound effect	Player right click the mouse.	Shoot sound effect will be played	√
32.	Health item collected sound effect	Player collect the health item	Heal sound effect will be played	√
33.	Get damage sound effect	Player or enemy get damage	Get damage sound effect will be played	√
34.	Teleporter sound effect	Player get close to teleporter	Teleporter sound effect will be played	√
35.	Teleport sound effect	Player must stand in front of the teleporter and press the E key.	Teleport sound effect will be played	√
36.	Pause menu button click sound	Click on the pause menu button	Button click sound will be played	√

37.	Replay button click sound for pause menu panel	Click on the replay button for pause menu panel	Button click sound will be played	√
38.	Main menu button click sound for pause menu panel	Click on the main menu button pause menu panel	Button click sound will be played	√
39.	Start button click sound for start game panel	Click on the start menu button for start game panel	Button click sound will be played	√
40.	Close button click sound for pause menu panel	Click on the close button for pause menu panel	Button click sound will be played	√
41.	Replay button click sound for game over panel	Click on the replay menu button for game over panel	Button click sound will be played	√
42.	Main menu button click sound for game over panel	Click on the main menu button for game over panel	Button click sound will be played	√
43.	Background music	Start level 5	Background music will be played	√

APPENDIX B
USER ACCEPTANCE FORM

Education level *

○ Kindergarten

○ Primary School

○ Secondary School / High School

○ College / University

After section 1   Continue to next section   ▾

Section 2 of 2

GAME SURVEY QUESTION   ⌄   ⋮

Description (optional)

Does Little Messenger can run on PC devices? *

○ Yes

○ No

Do you think Little Messenger gameplay is fun and interesting? *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Do you think Little Messenger is easy to understand? *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

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Do you think Little Messenger is suitable for children to play? *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Do you think Little Messenger is too difficult for children to play? *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Does Little Messenger have a lot of bugs and glitches? *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Does Little Messenger interact with player not exceed 10 seconds? *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Does the instruction given in the tutorial level is clear and understandable? *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Does Little Messenger encourage your communication skill when you are playing?

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

What is your comment(s) or any improvement suggestion for this game ?

Long-answer text