ENVIRONMENTAL AWARENESS ON WATER POLLUTION THROUGH 2D GAME APPLICATION

(DORIS)

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BACHELOR OF COMPUTER SCIENCE

(GRAPHIC & MULTIMEDIA TECHNOLOGY)

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ENVIRONMENTAL AWARENESS ON WATER POLLUTION THROUGH 2D
GAME APPLICATION (DORIS)

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Thesis submitted in fulfillment of the requirements

for the award of the

Bachelor of Computer Science

(Graphics and Multimedia Technology) with Honors

Faculty of Computing

UNIVERSITI MALAYSIA PAHANG

JANUARY 2023

ACKNOWLEDGEMENTS

ABSTRAK

Pencemaran air adalah masalah global. Memahami kepentingan menjaga alam sekitar kita daripada pencemaran air adalah sangat penting. Malangnya, kebanyakan orang masih mengambil sedikit atau tiada tindakan untuk mengelakkan atau mengurangkan kesan pencemaran air. Ini mungkin disebabkan maklumat tentang masalah pencemaran air tidak dikomunikasikan dengan baik kepada awam sehingga menyebabkan kurangnya kesedaran awam tentang masalah pencemaran air. Ramai orang tidak tahu bagaimana untuk mencegah pencemaran dan sukar untuk kita melihat kesan sebenar pencemaran air. Untuk menyelesaikan masalah ini, aplikasi permainan video dicadangkan untuk dibangunkan bagi meningkatkan kesedaran awam tentang isu pencemaran air. Metodologi yang digunakan dalam projek ini ialah model ADDIE, yang dapat membantu pembangunan projek lebih teratur. Permainan video ini dibangunkan menggunakan Unity Engine, direka menggunakan Photoshop, dan menggunakan muzik bebas royalti dari internet. Permainan video yang berasaskan platform menyediakan pemain dengan cara yang lebih menarik untuk berinteraksi dan menyampaikan kandungan. Permainan yang ringkas membolehkan pemain menumpukan lebih pada kandungan yang dihantar dan mencapai matlamat projek ini. Produk akhir dimuat naik ke itch.io yang mana pemain boleh memuat turun permainan dari itch.io ke dalam PC mereka untuk dimainkan. Selepas projek siap, akan ada penguji bermain untuk menilai projek menggunakan Ujian Penerimaan Pengguna (UAT). Keputusan menunjukkan permainan ini berfungsi dengan baik dan bebas daripada ralat. Maklum balas keseluruhan adalah positif, ia juga menunjukkan permainan ini telah mencapai objektifnya.

ABSTRACT

Water pollution is a global problem. It is important to better understand the importance of keeping our environment from water pollution. Unfortunately, most people still take little or no action to avoid or reduce the effect of water pollution. This may be because information on water pollution problems is not well communicated to the public, resulting in a lack of clear public awareness of water pollution problems. People don't know how to prevent pollution and it is difficult for people to see the actual impact of water pollution. To solve this problem, game applications is developed to enhance the public awareness about water pollution issues. The methodology adopted in this project is the ADDIE model, which makes the project development more organized. The game is developed using Unity Engine, designed using Photoshop, and using royalty free music from the internet. Platform-based games provide players with more engaging ways to interact and deliver content. The simple gameplay allows players to focus more on the delivered content and achieve the goals of this project. The final product is upload to itch.io which the player can download the game from itch.io into their PC to play. After the project is completed, there will be play testers to evaluate the project using the User Acceptance Test (UAT). The results show the game is well function and free from errors. The overall responses are positive, it also shows this game has achieved its objectives.

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LIST OF ABBREVIATIONS

ADDIE	Analyse, Design, Development, Implementation and Evaluation
EXE	Windows Executable File
UI	User Interface
GUI	Graphical User Interface
UAT	User Acceptance Test
2D	Two-Dimensional
3D	Three-Dimensional
PC	Personal computer
FPS	First Person Shooter
TPS	Third Person Shooter
RPG	Role-playing Game
GDD	Game Design Document

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter will be discussing the background story of development of the proposed game with the problem statement, objective and scope.

1.2 Background of Project

Environmental awareness is understanding the vulnerability of our environment and the importance of protecting it. Raising environmental awareness is an easy way to protect the natural environment and participate in creating a brighter future for our earth (Pachamama, n.d.). There are several problems that will cause environmental pollution.

Water pollution occurs when dirty, harmful substances enter clean water. Water pollution on earth is mainly caused by human discharge of a large number of harmful substances into water bodies in industry, agriculture and daily life. Untreated industrial wastewater is discharged into nearby rivers. Farmland sewage is overused with harmful fertilizers, pesticides, and herbicides in agriculture to keep insects, worms and other animals out. These fertilizers further seep into groundwater and mix with water bodies, and may contaminate most potable waters near farmland. Furthermore, many cargo ships transport tankers from one location to another. Due to issues during the trip, there may be oil spills that contaminate the water. Like most single-use plastics, oil can settle on top of water and cause long-term damage to humans and animals (Pachamama, n.d.). Also, people dump household waste near the water.

The contribution of the factories not only causes water pollution, but also the cause of air pollution. This is because the gasses emitted by factory operations contribute to air pollution. The increasing number of factory construction exacerbates the air pollution issues.

To educate the public about the importance of keeping our environment from pollution, we need to have some approach. Conventional approaches are usually through videos, public campaigns, schools and books. These approaches sometimes failed to achieve the objective, which is to ensure the public to be aware of the pollution and the effects it might bring to the environment. There are some other more recent approaches, such as introducing games to let the public gain understanding of pollution and interactively educate the public on how to prevent more damages from happening to the environment.

This project will mainly focus on the issues of water pollution which is the most common pollution problem facing the world today. Hence, the purpose of this report is to propose an idea which is to apply an educational game in the process of enhancing awareness of water pollution.

1.3   Problem Statements

Water pollution is a growing problem everywhere. Although our planet constantly hints at the importance of extreme drought for water and makes us understand its necessity, most people still take little or no action to achieve environmentally sustainable lifestyles. There are some possible factors that cause this problem.

Firstly, the information about the water pollution issues is not well conveyed to the public, cause the public lacks a clear understanding of water pollution problems. Traditional methods are usually through videos, public events, schools and books. These methods sometimes fail to communicate well to the public about water pollution problems since today's young people are rarely interested in books; schools do not guarantee that the information can be fully conveyed; most of the people are busy with work and have no time to participate in public activities.

Secondly, people having difficulty to see the actual affect if the water pollution really happened. Water pollution is often less visible and thus are ignored. Citizens tend to focus on issues they can see and experience. Water pollution is usually less pronounced than air pollution. Sewage pipes are often buried underground and discharge sewage into large bodies of water. This means that citizens are less likely to notice water contamination in their daily encounters, with only bad smells and odd colours in the water leading to complaints (Dolšak & Prakash, 2016).

Lastly, people do not know how to prevent pollution. There are some people who are aware and concerned about the pollution issues but do not know what the right action should do to improve the environment.

Therefore, this project aims to apply a game approach to solve the problem in raising public awareness of water pollution.

1.4   Objective

There are three objectives in this project which are:

1. To study the existing educational game that can help the public in enhancing awareness of water pollution issues.
2. To design and develop an educational game by embedding the interactive learning module for water pollution issues.
3. To evaluate the functionality of the game prototype in enhancing the public's awareness of water pollution issues.

1.5   Scope

Table 1.1   Project scope

Target User	Primary students (Age between 9 to 12 years old)	
Topic	Water Pollution Issues and Awareness	
Purpose	To enhance the primary student's awareness on water pollution issues.	
Language	English	
Development Tools and Software	Sketchbook	Used for game content design
	Unity Engine	Used for game development.
	Visual Studio	Used for C# coding in Unity.
	Microsoft Word	Used for report documentation.
	Draw.io	Use to draw use case diagram, context diagram, and plot graph.
Technology	• 2D graphic design and multimedia elements such as text, sound, and animation. • The game will be design and develop by using Sketchbook, Adobe Photoshop, and Unity. • Programming language C# used for game function scripting.	

1.6   Significance of Project

In the process of playing the game, players will gain a better understanding about the impact of water pollution to the ecology. This project guides players to think about the water pollution issues affecting our life and environment. Through the interaction and dialogue between the characters in the game, it reveals the impact of future water pollution on our current environment and even our earth. Through the combination of gaming and storytelling, we can understand the consequences of water pollution in a more attractive way.

1.7   Report Organization

This thesis consists of five chapters. Chapter one discusses the introduction to the project. This chapter included the introduction of the proposed game, problems statement, objectives, scope, and significance of this project.

Chapter 2 is about literature review. This chapter includes the research and the comparisons of game features such as gameplay, genre, advantages and disadvantages of the game.

Chapter 3 is analysed about the methodology that will be used in this project. The software development model, game design, game contain and testing will be discussed in this chapter.

Chapter 4 is about the result and discussion of this project. This chapter will explain the game user interface and game functionality of this project. The testing results and discussion are also included in this chapter.

Lastly, Chapter 5 is about the conclusion and summary about this project. It includes the objectives to revisit, the limitations and the future work that can be implemented to improve this project.

CHAPTER 2

LITERATURE REVIEW

2.1   Introduction

There are many educational games that provide environmental education on different environmental issues. This chapter will be discussing the details and information on these games, analysing the comparison between these games. The games that are selected are in different genres but focus on environmental issues.

2.2   Water Pollution

Water pollution occurs when harmful substances, usually chemicals or microorganisms contaminate streams, rivers, lakes, oceans, aquifers or other bodies of water, reducing water quality and making it toxic to humans or the environment (Denchak, 2014). There are many causes of water pollution such as rapid urban development, improper sewage treatment, fertilizer runoff, oil spill, chemical waste dumping, radioactive waste discharge, and so on.

Water pollution will reduce potable water. Due to the pollution of water resources, many water sources have been destroyed and should not be used. In addition, water pollution is a threat to aquatic life. Aquatic organisms are at risk due to water pollution. We're hearing about whales, sharks and many other aquatic creatures finding huge amounts of plastic in their stomachs. Due to the increase in oil spills and plastic pollution, the balance of aquatic ecosystems has become unbalanced, leading to a series of adverse reactions. Furthermore, when harmful substances in water sources penetrate

our food sources, such as fish and crops, it can lead us to the ingestion of toxic substances.

We must take responsibility for today's water pollution problem. Fortunately, there are some simple ways to prevent water pollution (Denchak, 2014):

i. Minimize plastic consumption and reuse or recycle plastic as much as possible.

ii. Properly dispose of chemical cleaners, oils, and non-biodegradable items to prevent them from running down the drain.

iii. Try to avoid pesticides and herbicides.

2.3 Game

2.3.1 Introduction to Game

According to Kramer (2000), a game is any activity that is performed for the purpose of entertainment. In this definition, every activity that brings joy is a game. For example, people dance, play musical instruments, perform plays, play with dolls and model trains. In most cases, the rules and components define the game. Everything in the rules is part of the game, and the rules are the boundary and core of the game. While there are rules to the game, playing the game is voluntary and cannot be imposed on the player. Whoever plays the game voluntarily follows the rules.

As technology developed, games were brought into the virtual world. Games nowadays can be played through different media, such as PC games, console games, mobile games, and so on. Same as traditional games, these games are designed to entertain players through a series of rules, objectives, rewards, and sometimes competition-based methods.

There is many software that can be used to develop a video game, such as Unity and Unreal Engine. Some software is commercial and some is free. The programming language used depends on the game development engine itself, for example, Unity uses

C# for the scripting, and Unreal Engine uses C++. To make the Graphical User Interface (GUI) more interesting, additional tools are required, such as Adobe Photoshop, 3D modelling software, scripting software, etc.

2.3.2 Type of Games

The video games are basically divided into 2-Dimensional or 3-Dimension. The variety of game genres is growing, especially as game developers mix and fuse different genres in new and unexpected ways. For example: Sandbox, First Person Shooter (FPS), Third Person Shooter (TPS), Stimulation, Puzzle, Platform, Survival and horror, Role-playing (RPG), and so on (Pavlovic, 2020).

Sandbox is often associated with open environments and non-linear gameplay. In these games, players often have fewer specific goals and narrative paths to pursue. Rather than defeating bosses and saving princesses, you may be faced with various missions that can be accomplished in many different ways. This draws players into a more immersive experience, encouraging experimentation with mechanics that may be unfamiliar.

Shooters are another long-standing genre that developed several early offshoots and expanded into two main subgenres: first-person shooters (FPS) and third-person shooters (TPS). The key difference is the perspective. FPS simulates a typical human perspective, basically showing what your character in the game sees in the game. TPS pulls the camera back and shows your entire character and surroundings. There are now many shooter games that allow players to switch between first-person and third-person perspectives.

Puzzle games emphasize game mechanics, require critical thinking and problem solving. Platformer games involve running, climbing and jumping as players explore and pass challenging levels. Platformer with side view and simple controls.

2.3.3   Process to Develop Game

According to Stefyn (2019), The game development process is the process of building a video game from concept to completion; Much like a production line, the game development pipeline helps organize the flow of work so that everyone knows what they need to deliver and when. The process of game development basically has divided into three stages: pre-production, production, and post-production.

Pre-production is where the project begins, something like the planning stage. In pre-production, developers will need to define what the game is about, why it was made, how it was made, and the requirements that needed. Game Design Document (GDD) needs to prepare in order to help everyone understand and participate in the larger vision of the project.

Production is the longest stage in the pipeline. It is where the game really starts to take shape. The story is refined, assets (characters, creatures, props, and environments) are created, game rules are set, levels and worlds are built, code is written, and more. However, the original idea doesn't always translate well in reality, so the game is constantly being tested and refined as the work is done.

Once production is complete and the game has been released, then come to post-production. Even though the game is released, the game development process will continue, such as maintenance (fixing bugs, creating patches) to check if there is any improvement.

2.4   Existing Game Research

2.4.1   Plasticity

"Plasticity" is a free-to-play puzzle platform game on Steam. The game was released on 24 May 2019 and it was developed by students from the renowned USC Games Program. The game is about the future world full of plastic, leaving behind dead lands, flooded cities, and large areas of garbage. In the game, players will play the role as Noah, who leaves home in search of a better life, she need to make various choices in order to save the world which full of plastic. It is an independent work with a simple

style but worth thinking about, the game guides players to think about the trash we throw away and the plastic we recycle through the art of storytelling and player interactions in real time. (Plasticity Game, 2019)

Figure 2.1   Screenshot of Plasticity

The operation of the game is very simple. The player only needs to use the keyboard up, down, left and right to move the character. There is not much text description on the screen, and only short text descriptions will be available under some cutscenes. Based on the different choices and actions that player make, will lead to different ending of the game.
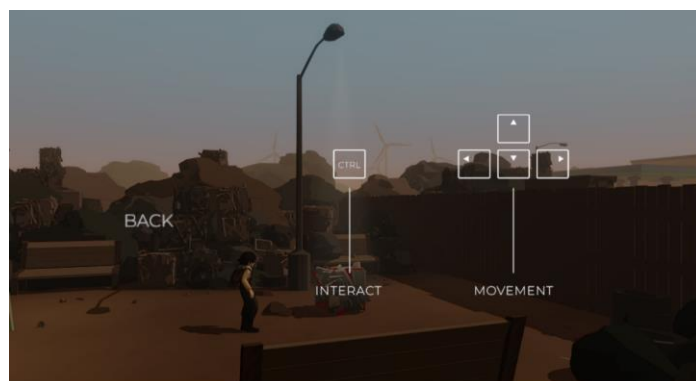
Figure 2.2   Screenshot of Plasticity

Figure 2.3   Screenshot of Plasticity

The gameplay of "Plasticity" is actually not high. The focus of this game is to present the atmosphere of environmental pollution in the year 2140, and to express the worldview faced by Noah through simple text narration. The scenes in the game are full of garbage and waste produced by modern civilization. Even the sea is polluted, not to mention that it is difficult for creatures to survive. In this game, the harm caused by plastic particles to the human body is also mentioned.

Based on the reviews from Steam, "Plasticity" was rated by 602 players, and the overall reviews are positive. Players like the game concept that brings out through the simple narration of the story, it makes people thought-provoking about our environment. These reviews prove that if the story is interesting enough, even the use of simple gameplay can entice people to play. The gameplay is also short, around 20 - 40 minutes, which doesn't take up too much of the player's time.

Figure 2.4   Overall Rating on Steam

Figure 2.5　　　Positive Review on Steam
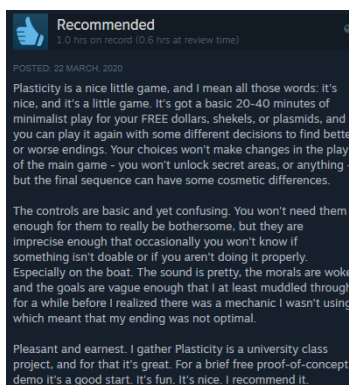
Figure 2.6　　　Positive Review on Steam

Though the concept of the game is highly praised by many players, the game also has a few flaws. Based on the negative reviews, the player interaction control is stiff and has some bugs that make it difficult to control and affect the game experience. The game also cannot save progress, if the player quit halfway through, the game will start over.

Figure 2.7　　　Negative Review on Steam

2.4.2   World Rescue

"World Rescue" is a research-based narrative video game inspired by the United Nations Sustainable Development Goals, a collaboration between ZU Digital and the UNESCO Mahatma Gandhi Institute for Peace Education (MGIEP) (UNESCO MGIEP, n.d.). Players will meet five young heroes in Kenya, Norway, Brazil, India and China as they solve global problems - such as disease, deforestation, drought and pollution (Games4Sustainability, 2018).

In the game, the player can play as five characters. One character will be unlocked after the player clears the level of the previous character. Also, when the player completes one mini-game, the next mini-game will unlock. Each character will represent a different country and the related global issues. Hence, the player needs to play the role of one of the characters to solve the problem through the gameplay of diverse minigames. The overall gameplay of the game is drag and drop the feature on the touchscreen mobile.
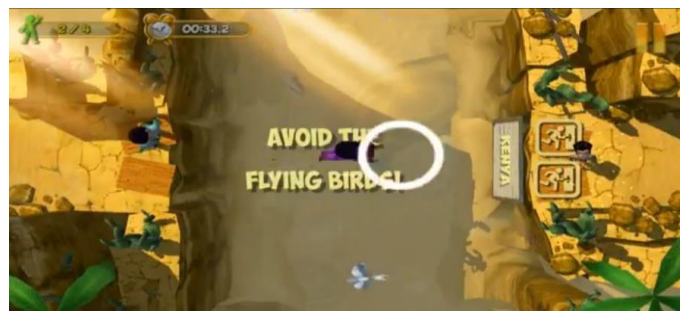
Figure 2.8   Screenshot of World Rescue

Figure 2.9   Screenshot of World Rescue

Figure 2.10   Screenshot of World Rescue

"World Rescue" received a 4.0 overall rating on the Google Play Store rated by 159 users, which is an overall positive rating. Based on the reviews, the players praised that the game is fun and a wonderful game for learning world issues. The player also suggests the game can be played with children to let the children know about world issues.
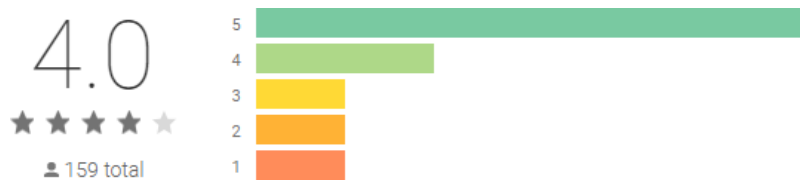
Figure 2.11   Overall Rating on Google Play Store

Figure 2.12   Positive review on Google Play Store

2.4.3 Bleached Az

"Bleached Az" is a mobile arcade game from Chaos Theory and We Are Rad based on the 2008 Australian popular cartoon Beached Az. The game is filled with confrontation and humor, designed to advance social and environmental goals. Players have to save desperate corals from the dangers of plastic pollution and overfishing. The game promotes ocean health awareness and motivates players to actively contribute to environmental protection, and also aims to raise awareness of the adverse effects of climate change through an in-game carbon uptake meter (Tamayao, 2021). In the game has brought out today's environmental problems, such as coral bleaching, pollution and overfishing.

Figure 2.13   Screenshot of Bleached Az

"Bleached Az" is testing the player's hand speed and accuracy to protect the fishes and corals. The gameplay of this game is the player needs to chop and cut through plastic, hooks, trawl nets and crown of thorns starfish to protect the inhabitants of the Great Barrier Reef. If the player does not cut through the hooks, and trawl nets, they will successfully catch the fish and the player will be deducted points. Players will also be deducted points if they accidentally cut through the fish or the corals. If the player does not protect the corals from the plastic, hooks, trawl nets and crown of thorns starfish, the corals will bleach and die, and the game is over and will show the score that player gets. At the end of the game, the interface will also show a little knowledge at the below. There are also leaderboards in the game, so the players will have the motivation to get higher scores.
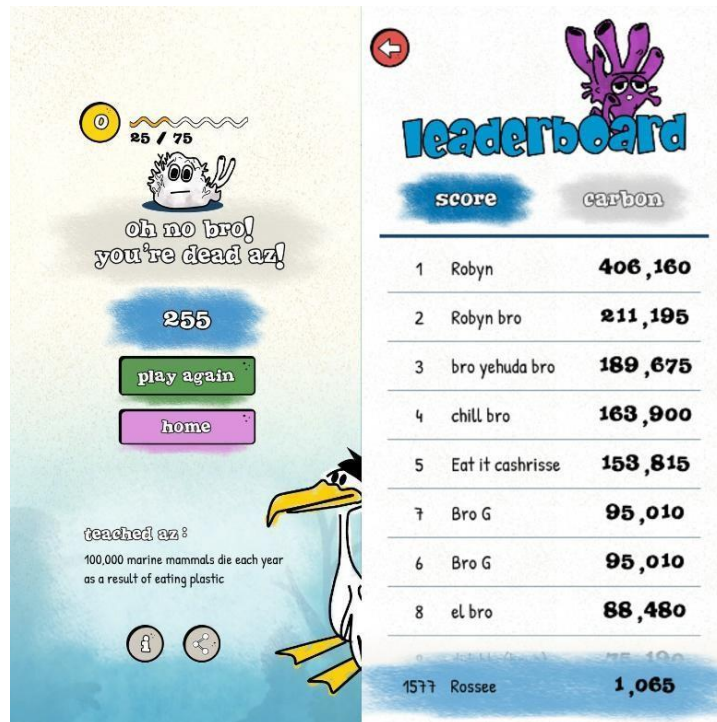
Figure 2.14   Screenshot of Bleached Az

Based on the review of the players on the Google Play Store, players like games with fun elements especially the game is dealing with world issues with funny way.
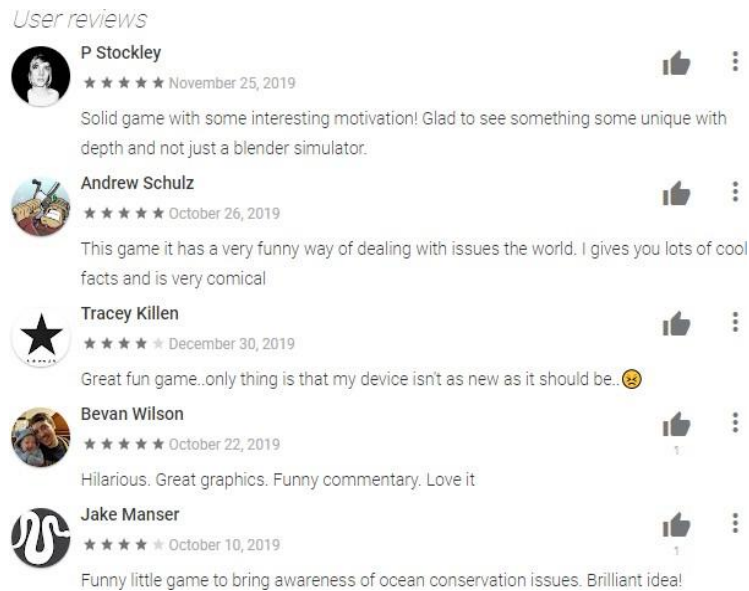
Figure 2.15   Positive review on Google Play Store

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2.5   Comparison of Existing Game

2.5.1   Analysis of comparison on existing games

Table 2.1   Comparison of Three Existing games

Features	Plasticity	World Rescue	Bleached Az
Game genre	Puzzle Platformer, Educational	Minigames, Role-playing game	Arcade
Topic	Waste Management and Recycling	Global management	Ocean pollution and climate change
Platform	PC (Windows & Mac)	Mobile (Android & IOS)	Mobile (Android & IOS)
Operating system	Windows 7 or later (64 bits OS required) Mac OS X 10.0 or later	Android 4.1 and up. iOS 9.0 or later.	Android 4.1 and up. iOS 9.0 or later.
Graphic	3D	3D	2D
Price	Free	Free	Free
In-app purchase	No	Yes	Yes
Network access	No	No	No
Player mode	Single player	Single player	Single player
Advantages	Free A storytelling game that delivers the message of waste pollution to players. Simple gameplay	Free Has great educational value Fun game to learn world issues. Suitable for parents to play with their children Simple gameplay	Free Deliver the world issues message in a humorous & funny way. Hilarious dialogue Simple gameplay
Disadvantages	The control is stiff and buggy. Progress of the game cannot be saved.	-	-

From Table 2.1, comparisons can be made between each attribute of all three games. We can see that all the three games are different genres. Plasticity is a puzzle platformer educational game, World Rescue is a role-playing minigames, while Bleached Az is an arcade mobile game. Three of the games are related to the topic of environmental issues. World Rescue and Bleached Az are only available on mobile (Android and iOS) played by a higher version which requires at least Android 4.1 or above and iOS 9.0 or later. On the other hand, Plasticity can only play on PC (Windows

and Mac) which requires version Windows 7 or later and Mac OS X 10 or later. Plasticity and World Rescue are 3D games while Bleached Az is a 2D game. All of the three games are free to play, however, only Plasticity has no in-app purchase while the other two have in-app purchases. All of the three games are single player mode. They also do not require network connection while playing. All of the three games have an overall positive review because the games have a great educational value since the games deliver the message about environmental issues in their own way. Plus, the gameplay of the three games is simple.

2.5.2   Relevance of Comparison With Project Title

Based on the research, the three games have delivered the message regarding the environmental issues whether in interesting storytelling or in a funny way to enhance public awareness of environmental issues. The project will have an interesting storyline to guide players to raise the public awareness of environmental protection. Besides that, the graphic of the proposed game will be in 2D graphic which will be designed in children's illustration book style. Similar to Bleached Az, the design is the hand-draw style to attract the people to play the game.

2.6   Chapter Summary

This chapter has explained about the analysis of three existing games, the comparisons of these three games and the relevance of the three games with this project.

CHAPTER 3

METHODOLOGY

3.1   Introduction

Methodology is a process of a project development to divide the development into the phase, for example, design phase, development phase, implementation phase, evaluation phase, and so on. It is used to describe how the life cycle of a project is or also can say how you are going to work in the project. The suitable methodology is important in a project development to make sure the project is managed effectively. There is common methodology used in project development, for example, Waterfall model, Agile model, RAD model, and Analyze, Design, Develop, Implement, and Evaluate (ADDIE) model.

3.2   Methodology - ADDIE Model

The methodology that was used in this project is the ADDIE model. ADDIE model provides a structured framework that helps to ensure that the developer creates effective products such as those designed to transfer knowledge to one or more individuals (Vulpen, 2022). ADDIE stands for five phases, that are Analysis, Design, Development, Implementation, and Evaluation. Figure 3.1 shows the ADDIE model.

Figure 3.1   ADDIE Model

In the Analysis phase, the developer has to identify the problem or current issues, and how the proposed game can help to solve that problem. The developer also needs to identify the target audiences, the purpose of the game that they want to develop, and how the game will fulfil the requirements.

In the Design phase, developers need to identify the methodology that will be used in the project. Then, the developer will start to design the content and the storyboard of the game, making sure the game is fulfilling the requirements. The developer also has to identify the tools or hardware that were used to develop the proposed game.

In the Development phase, the developer has started to develop the content design which can include the character design, user interface design, game objects audio, animation and so on. The developer will need to ensure that the content can be used and can be implemented into the system.

Next in the Implementation phase, the developer needs to integrate all the design, and make sure the system can work. This phase will need continuous modification of the system to ensure the maximum efficiency until it gets the positive result. This is where the developer has to work hard to redesign, update the system. Implementation phase is the most of the actual work done here.

In the Evaluation phase, the system will ensure whether it can work properly, no bug and has achieved the purpose. In this phase, the system will get a lot of feedback from the user for further improvement.

The reason for choosing ADDIE model as the methodology of this project is that ADDIE model is suitable for multimedia system development. In addition, it allows developers to evaluate projects at each stage, which can reduce more errors.

3.3 Development of The Project Using Addie Model

As this project will be developed by using the ADDIE model, this subtopic will discuss the task to be done using the ADDIE model. Figure 3.2 shows the tasks distribution using the ADDIE Model.
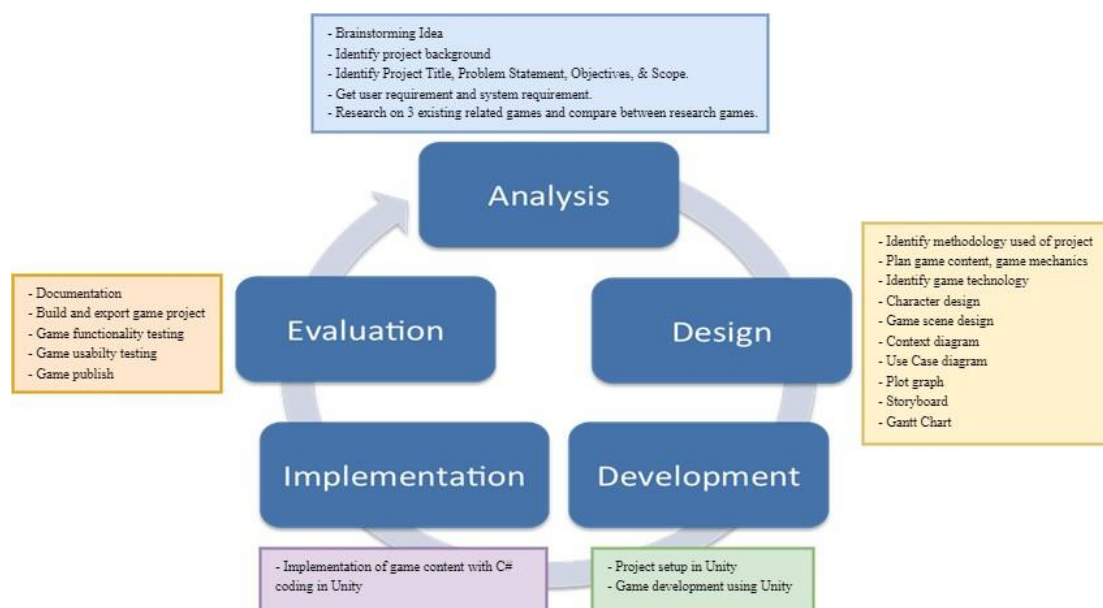
Figure 3.2   Proposed frameworks based on ADDIE model

3.3.1 Analysis Phase

Analysis phase in this project started by brainstorming ideas. The problem of environmental awareness issues is identified and found the solution to solve those problems. The objectives also have been identified by listing out the goal of the project. The focus area of the project also has been discussed in scope. In addition, literature review also has been done by the research and comparison about three existing games that resembles this project. Besides, there are some questions that can help the developers create the plan to develop the project by using technique 5W1H which are Who, What, When, Where, Why, and How.

There are some samples of the questions:

1. Who is the primary target user for the project?

2. What are the learning outcomes you aim to achieve?

3. When will the project be complete?

4. Where the project be used?

5. Why is the project developed?

6. How to achieve the requirement?
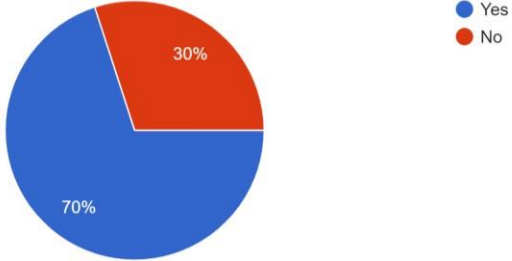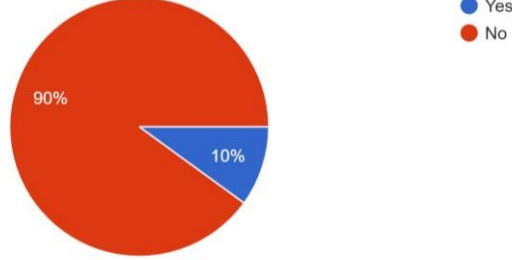
3.3.1.1 Identify Target User
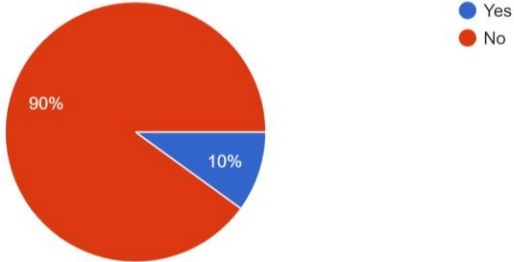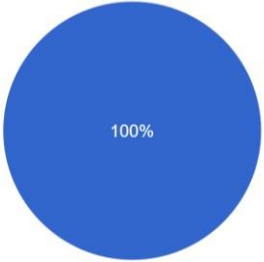
The target user of this project is for the primary students with the age between 7 to 12 years old which are the students from Standard 1 to Standard 6.

3.3.1.2 User requirement

In order to obtain user requirements for the proposed project, a survey was carried out using Google Forms. The survey aims to obtain opinions and expectations regarding the project. There are six questions open for public. The survey has received ten responses. Please refer to **APPENDIX A** for the survey form. Figures below shows the responses from the ten respondents.

Table 3.1   User Requirements

No.	Question	Responses
1.	Have you ever followed with interest to the topic of water pollution?	10 responses ● Yes ● No 30% 70%
2.	Have you ever heard about any 2D game application related to Water Pollution?	10 responses ● Yes ● No 90% 10%

3.	Have you ever played any 2D game application related to Water Pollution?	10 responses ● Yes ● No 90% 10%		
4.	Do you think that 2D game application is needed to the primary students for enhance their awareness of Water Pollution?	10 responses ● Yes ● No 100%		
5.	Do you think that 2D game application can help to enhance the primary students' awareness of Water Pollution? Why?	1.	Yes, learn through game will not as boring as just reading the textbook	
		2.	Yes. Student can learn the topic of water pollution in a fun and interesting way.	
		3.	Yes, learning with game will be more interesting and attractive.	
		4.	yes, students will be more understanding	
		5.	yes, learning in the fun way should be easy to let them understand	

		6.	yes, it may increase the students' interest in learning the water pollution topic
		7.	Yes. game will make them learning with more fun
		8.	yes. the students will be more interested to learn
		9.	yes, students will be more attractive to image compare to words.
		10.	yes. it is easy for the students to learn by using the game
6.	What is your expectation about the 2D Game Application that will be develop for primary student for enhance their awareness of Water Pollution?	1.	Not so much difficulty, suitable for primary students
		2.	Has the interactive gaming.
		3.	the game must be fun
		4.	maybe can have some information about the causes of the water pollution
		5.	i expect the game will be fun and interesting
		6.	easy to play
		7.	can have some interesting elements
		8.	interesting storytelling
		9.	fun gameplay
		10.	gameplay that related to water pollution topic, example collect the trash from the river something like that

3.3.1.3   System requirement

3.3.1.3.1   Functional Requirements

1. The game application can be download and installed to the PC.
2. The game application should allow players to start and exit the game.
3. The user should be able to play the game level by level.
4. The player should be able to return to the main menu.
5. The player should be able to pause the game.
6. The player should be able to control the hook to grab the rubbish.
7. The level should be able to restart when the player loses.
8. The game should use simple English to have better understanding.

3.3.1.3.2   Non-functional Requirements

1. The game shall deliver information about water pollution issues.
2. The game should not be too difficult for the player to prevent them lose patience playing the game.
3. This game should be achievable by players.
4. The game should be more engaging to play than reading from the article.
5. It should not take more than five seconds to load into the game.
6. The average time between a click to a button in the game must be less than one seconds.
7. The game must run on the PC.

3.3.2   Design Phase

In the Design phase, methodology that is suitable for this project is identified. The game content, game mechanics are identified. The design of the game content such as character, game environment, levels, game play, and others are designed in this phase. The flowchart and the storyboard of the game is also identified in this phase.

3.3.2.1   Game Content

This proposed game, **DORIS** is telling about the main character, Doris is going an adventure to clean the rubbish that's been thrown into the river and the sea.

3.3.2.1.1   Game Genre

The genre of this proposed game, **DORIS** is an educational game with 2D cartoon style puzzle based, in which the player needs to control the rope and hook in the right angle to hook the rubbish, to get the scores and hit the target scores within the time.

3.3.2.1.2   Game World

The game takes place in a world that facing the problem of water pollution. The levels will be designed in water environment such as river, and sea. The perspective view of this game is side-on, which means the player will view the game from the side. The player can control the rope and hook to extend the rope to grab the rubbish.

3.3.2.1.3   Character

DORIS game application will only have one character which is the Main Character, Doris. Doris will be going on an adventure to clean the river and ocean that are full of rubbish. The player will not be able to control the main character but to control her fish rod which are rope and hook to grab the rubbish.

3.3.2.1.4   Game Control

The game control of **DORIS** game application is the mouse and keyboard, right mouse button to grab the rubbish, and spacebar key to navigate the dialogue.

Table 3.2   Game controls

Control key	Function
	For extend the rope to grab the rubbish.
Space	Navigate the dialogue.

3.3.2.1.5   Level Design

The game consists of 5 levels. The levels will be designed in a different environment which will give the images about the impact of water pollution such as the environment which the rubbish is throw into the river, and the undersea full of garbage. In the levels, will have the collectable items which are rubbish that can be hook by the player, each level will be add the different rubbish level by level. Each level will be set the target score, which increase level by level. Each level will also be set the timer.

3.3.2.2   Game Mechanics

3.3.2.2.1   Player Rules

The player rule for **DORIS** game is the player needs to control the rope and hook to grab the rubbish which under the river and the sea, to gain the score. The hook controlled by the player will constantly change the angle. When the player feel that the angle of the hook is pointing to the position of the rubbish, press the left mouse button on the screen to grab the rubbish. By reach the target score within the time, the player can be pass and go to next level.

3.3.2.2.2 Reward and Punishment

The reward for **DORIS** game is the player can get the score and pass the level. The punishment of the game is the player will be deducted score when hook the fish. When the player does not reach the target score within the time, the level will restart.

3.3.2.2.3 Victory Condition

The player needs to reach the target score within the time to pass the level and go to next level.

3.3.2.2.4 Challenges

The player needs to reach the target score within the level, to avoid replay the level or game over. Moreover, there will have the fish swimming around as the obstacle to disturb the player. In addition, the plastic rubbish will also drift in the water instead of static in the water like the other rubbish. The player needs to avoid the fish, and look carefully where the hook points to the rubbish and grab the rubbish. Although the game is simple, the player needs to master a certain rhythm and find the best time to throw the hook out to catch the enough rubbish within the stipulated time to pass the level.

3.3.2.3 Game Technology

The DORIS game is a single-player game. It only be access in PC platform and does not require an internet connection, which means the player can access this game offline once its download. The game can play with a mouse and keyboard. The graphics used in this game is in 2D. the audio is used for background music and sound effect such as collect item sound, button click sound, and other.

3.3.2.4 Context Diagram

Context diagram shows how the user interact with this game and the relationships between them. F below shows the context diagram of **DORIS** game.
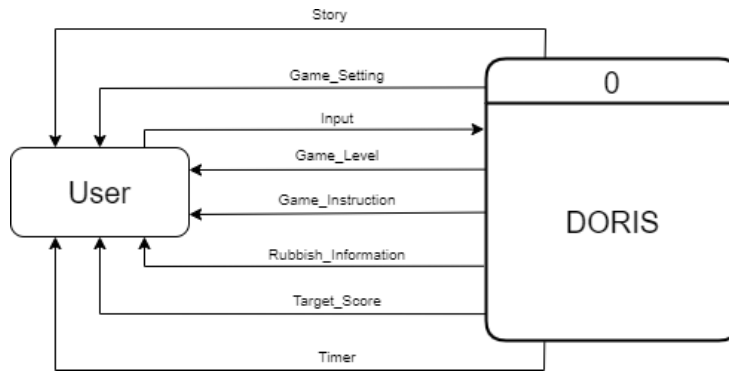
Figure 3.3   Context Diagram of the proposed project

3.3.2.5   Use Case Diagram

Use Case diagram shows the interaction between the player and the game, where it consists three modules: Setting, Gameplay, and Information. F below shows the use case diagram of **DORIS** game.
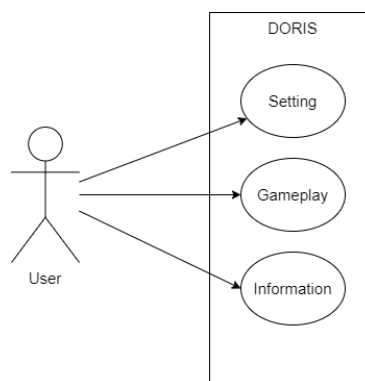
Figure 3.4   Use Case Diagram of the proposed project

3.3.2.6   Gantt Chart

Please refer to **APPENDIX B**. This Gantt chart shows the task distribution with the period given based on the ADDIE model.

3.3.2.7   Plot Graph

Please refer to **APPENDIX C**. This flowchart shows the overall flow of the whole game.

3.3.2.8   Storyboard

Please refer to **APPENDIX D**. This flowchart shows the overall flow of the whole game.

3.3.3   Development Phase

The Development phase will be started by develop the game object based on the storyboarding in the design phase. The game object will be created by using various software such as Adobe Photoshop, Sketchbook, and others. The project setup will be started to implementing the game object by using Unity.

3.3.3.1   Hardware Requirements

Table 3.3   Hardware requirements

Hardware	Laptop (VivoBook_ASUSLaptop X421EAYB_K413EA)
Storage	244 GB
Display	Full HD 1920 x 1080 pixels
CPU	Intel® Core™ i5-1135G7
GPU	Intel® Iris® Xe Graphics
RAM	8 GB
Purpose	- Design and develop the game - Report documentation
Quantity	1

3.3.3.2   Software Requirements

Table 3.4   Software requirements

Software		Purpose
	Sketchbook	Used for game content design
	Unity Engine	Used for game development. The version used for this project is 2021.3.16f1.

	Visual Studio	Used for C# coding in Unity.
	Microsoft Word	Used for report documentation.
	Draw.io	Use to draw use case diagram, context diagram, and plot graph.
	Itch.io	Use to publish the game.

3.3.4   Implementation Phase

In Implementation phase, the game function will be implemented into Unity by coding using C# Language in Visual Studio. All the scripting will be done in this phase in order to ensure the game function works well.

3.3.5   Evaluation Phase

In Evaluation Phase, Acceptance Test (UAT) will be tested by respondents and will be recorded to identify the game function is working well and evaluate the user's experience. In UAT have Alpha testing and Beta testing. Alpha testing perform by the tester to ensure the functionality of the application. Beta testing is performed by the public who are not part of development team based on the users' environment to ensure the quality of the application and ready to publish.

3.4   Chapter Summary

In this chapter, ADDIE model has been decided as the methodology used for the project. Tasks are assigned based on the ADDIE model framework and proposed into Gantt chart. Game flow is presented in the form of diagrams such as plot graph, use case diagrams, and context diagrams. The design of the game is also presented in the storyboard and scene design. In addition, this chapter plans for game content, game mechanics, and game technology.

CHAPTER 4

IMPLEMENTATION, RESULT AND DISCUSSION

4.1   Introduction

This chapter consists of the details of the process of development and implementation process, testing, result and of the game project. The project is developed and implemented by the Unity application for PC platform, and it is suitable for the people in age range 10-30 to enhance their awareness of water pollution. In the development phase, is including the design of the project such as main menu scene, game level scene, and others. Then, it will continue by the implementation phase. In this phase, will show the scripts of the game implementation include scene changing, score counting, and others. The User Acceptance Test (UAT) form also will be discussed.

4.2   Development of The Game

In this section, the development of the game will be discussed. To start developing a game, all the software required is installed. The designing of the graphic and multimedia content is also important. Those content will create a special visual experience to the player by designing the art assets and align with the game design. Therefore, this section will discuss the game design such as game scene, game UI, characters, game assets and other elements in the project.

4.2.1 Game Assets

The game assets such as background, character, props, and UI elements are design by using a free drawing software, Sketchbook. Some buttons are design by using draw.io website. The fonts used in game are download from website DaFont; the audio and music used are download from the royalty-free website Pixabay; and icons used are downloaded websites Flaticon.

4.2.2 Game Title

The game title is a simple design like a cartoon style. The font of the game title is used Wash Your Hand font which is download from the free font website DaFont. As this project is a game with topic about water pollution and the main character's adventure, so the title will be given the name of the main character, "**DORIS**", which is also represent the meaning "*gift of the ocean*" from Greek. The game title will put in the main menu scene of the game.

Figure 4.1   Game title – DORIS

4.2.3 Game Buttons

There are two types of buttons in the game, text style and icon style. The buttons for the Main Menu are displayed in text, as shown in Figure 4.2. The font of the text button is used Thousand Sunny font which is download from the free font website DaFont, and import into Unity. For the other buttons are design in icon and circular box. The icons are download from website Flaticon, and redesign to the buttons look by using online website draw.io, as shown in Figure 4.3. Each button will represent its functions as well. For Close button is design by using Sketchbook as shown in Figure 4.4.

Figure 4.2   Example of Buttons design in Main Menu
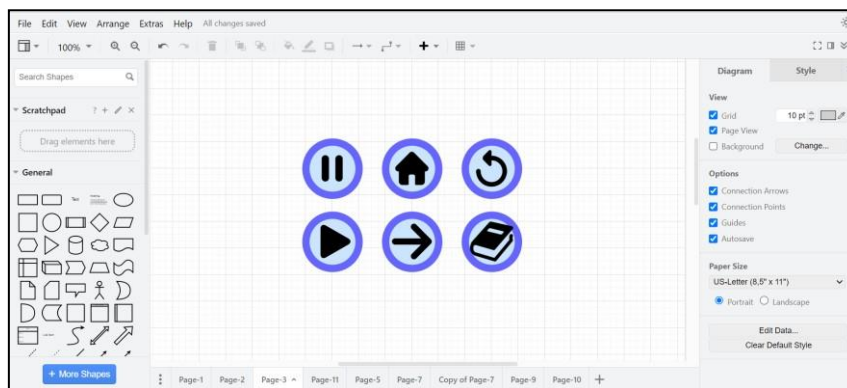
Figure 4.3   Example of Buttons design of DORIS game
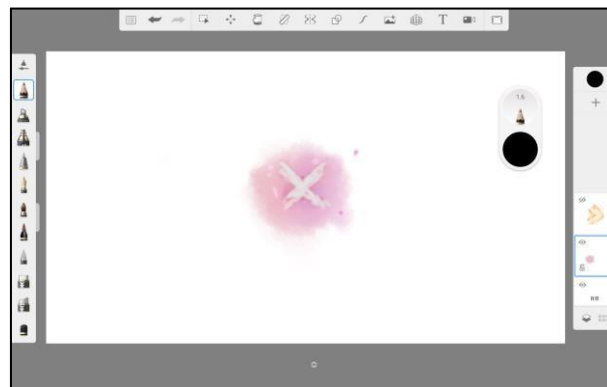
Figure 4.4   Example Close Button of DORIS game

4.2.4   Background

There are several backgrounds need to design for used in the game. The background of the Main Menu is using Sketchbook to design. In the background is the main character, a little girl name Doris, boating on the sea. As shown in the Figure 4.5, the ocean where the boat rowed is clear and blue, because in this story, she will clean

up the garbage that cause the pollution. The background of Level 1 and Level 2 are set in a town with the bridge on the river, and the river is dirty, and there are garbage floating on the river as shown as Figure 4.6. The background of Level 3 and Level 4 are set on the sea, the sea is dirty, and there is garbage under the sea as shown as Figure 4.7. The background of Level 5 is set under the sea as shown as Figure 4.8.

Figure 4.5   Main Menu background

Figure 4.6   Level 1 and Level 2 background

Figure 4.7   Level 4 and Level 4 background

Figure 4.8   Level 5 background

4.2.5   Character

A little girl, Doris is represented as the main character of the story in the game as shown in Figure 4.9. She will go on an adventure with a fishing rod to clean up the trash in the water. On the journey, she will clean up the rubbish in the river or ocean by using her fishing rod. The main character is design by using Sketchbook. Basically, the player will not able to control her, but mainly to control her fishing rod.

Figure 4.9   Main Character of the game – Doris

4.2.6 Rope and Hook

Rope and Hook are the parts of the fishing rod that Doris carries with her. Rope and hook are the main objects that the player needs to control in the game as shown as Figure 4.10. Rope and hook will be using at Level 1 until Level 4; while for environment of Level 5 will be under the sea, the character will be taking a submarine, so the rope and hook will be change to Pole and Grapple as shown as Figure 4.11. The Rope and Hook, and Pole and Grapple will swing left and right, player needs to click the right mouse button at the appropriate time, then the rope will stretch to grab the rubbish.
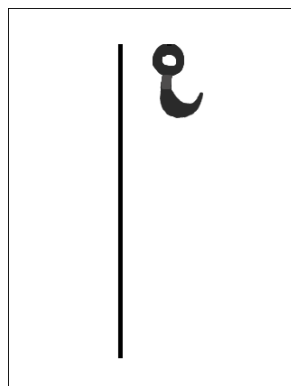
Figure 4.10   Rope and Hook.
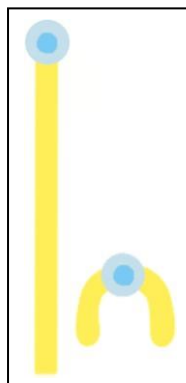
Figure 4.11   Pole and Grapple.

4.2.7   Collectable items - Rubbish

The collectable items in the game are the rubbish. When the player successfully grabs the rubbish up, the player will be adding the points. There are many types of rubbish, such as Apple core, Tin, Can, Milk bottle, Milk tea bottle, Plastic bottle, and Plastic bag as shown in Figure 4.12. From less harmful to more harmful, each type of rubbish will represent its own point. From less harmful to more harmful rubbish to the water source, the points will also increase accordingly.

Figure 4.12   The collectable items in the game.

4.2.8   Garbage Information Panel

When the player hooks a certain type of rubbish for the first time, it will pop out an information panel about that garbage. The player can know the negative impact brings by that garbage to the ocean.

Figure 4.13   Example Information Panel of Apple core.

Figure 4.14   Example Information Panel of Milk bottle.

Figure 4.15   Example Information Panel of Tin.

Figure 4.16   Example Information Panel of Can.

Figure 4.17   Example Information Panel of Milk tea bottle.

Figure 4.18   Example Information Panel of Plastic bottle.

Figure 4.19   Example Information Panel of Plastic bag.

4.2.9 Obstacles - Fish

The obstacles in the game are design as the fish as shown in Figure 4.20. Fish will move within a range, act as obstacles to the player in the game. The player needs to be careful not to catch fish, otherwise points will be deducted. Each fish will be deducted 5 points.
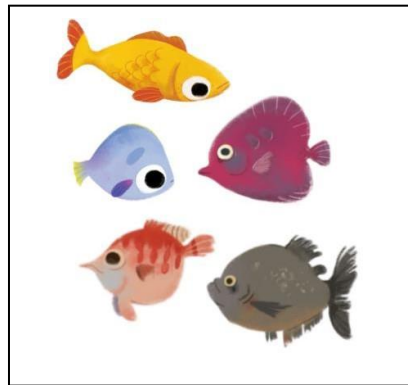
Figure 4.20   Example of the obstacles in the game.

4.2.10 Setup

Software that used to set up the project is Unity, and Visual Studio. Unity is a game engine that can develop games. Visual Studio is used to scripting the game functions in the project. A new project is created in Unity 2D to develop the DORIS game application as shown in Figure 4.21.
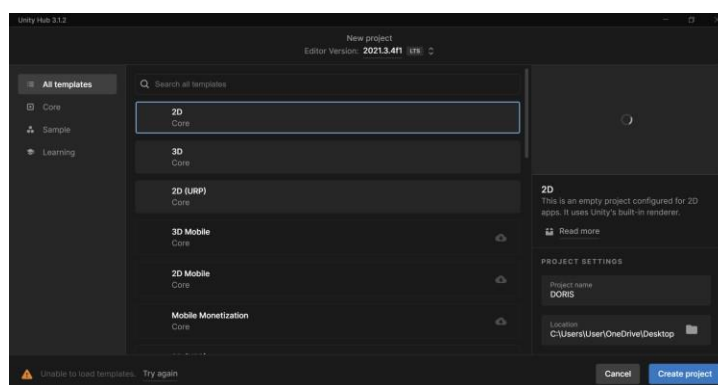
Figure 4.21   Setup new project in Unity

4.2.11 Intro Story

An intro story will start when the player accesses the game. The intro story backgrounds used in the game are design by using Sketchbook as show in Figure 4.22 and Figure 4.23, and Figure 4.24. The intro story will be display frame by frame, the animation is created by using Unity Timeline as shown in Figure 4.25.

Figure 4.22   Scene of Intro story
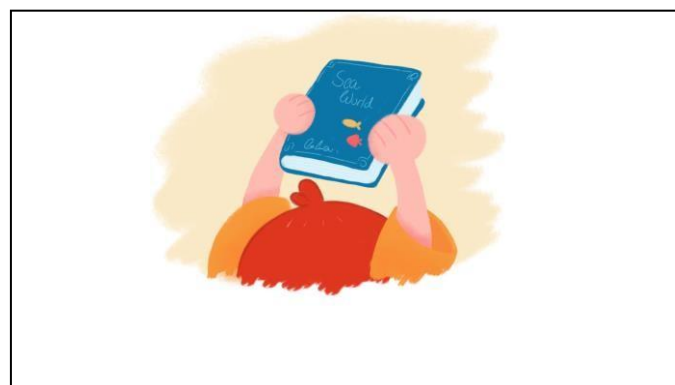
Figure 4.23   Background of Intro story
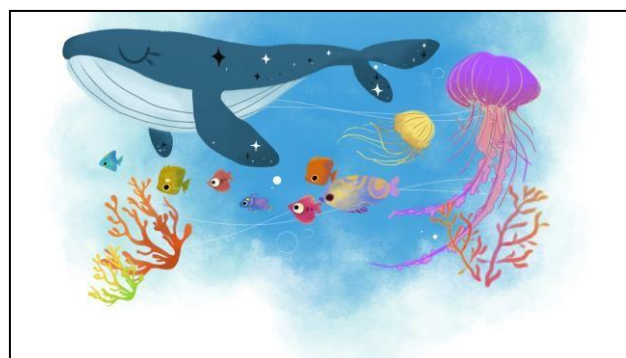
Figure 4.24   Background of Intro story
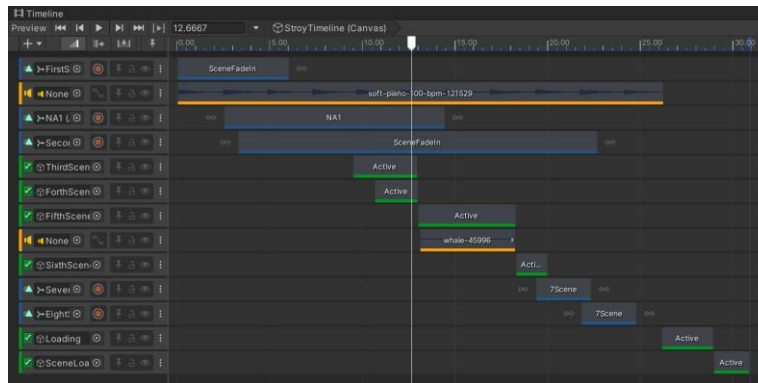
Figure 4.25   Timeline of Intro story

4.2.12 Main Menu Scene

The main menu of the **DORIS** game application is shown in Figure 4.26. It has the game title and four buttons which are PLAY button, HOW TO PLAY button, SETTING button, and QUIT button.

The PLAY button will navigate the player to the first level. The SETTINGS button navigates the player to the setting panel which is shown in Figure 4.27. The player is able to adjust the background music and the sound effect of the game by moving the slider.

The HOW TO PLAY Button is used to navigate the player to the Information Panel as shown in Figure 4.28, Figure 4.29, and Figure 4.30. It used to navigate the player getting to know about the ways to control the game. Player can swipe to the left or click the three dot buttons below to view the next page of instruction.

The QUIT button will navigate the player to open the confirmation panel as shown in Figure 4.31, it used to prevent the player's error. The panel have two buttons: Yes Button and No Button. Yes Button will allow the player to quit the game, while No Button will navigate the player go back to Main Menu.

Figure 4.26   Main Menu
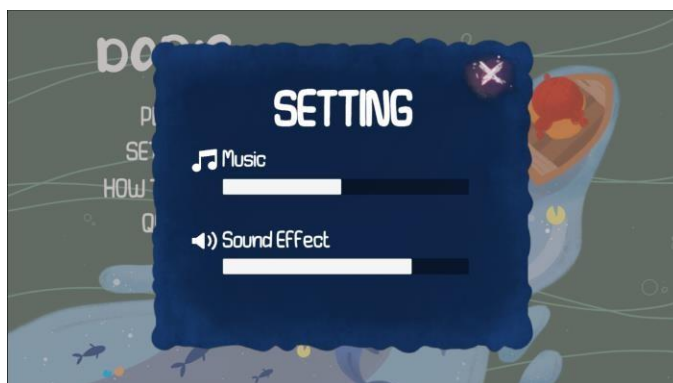
Figure 4.27   SETTINGS Panel

Figure 4.28   HOW TO PLAY Panel – Page 1

Figure 4.29   HOW TO PLAY Panel – Page 2

Figure 4.30   HOW TO PLAY Panel – Page 3
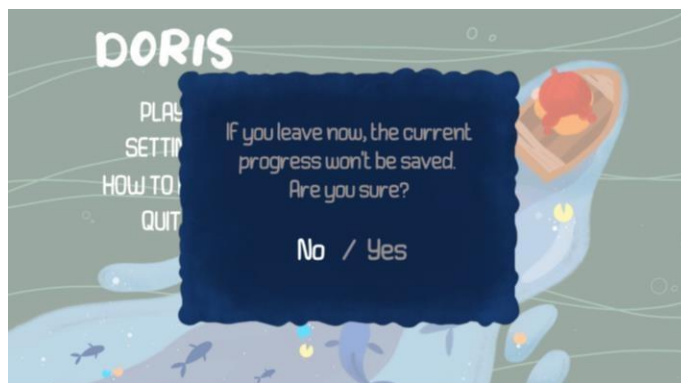
Figure 4.31   QUIT Panel

4.2.13 Dialogue

The dialogue will show in the Intro story and Game Tutorial as shown in Figure 4.33 and Figure 4.34. The player can press the Spacebar on the keyboard to load the next dialogue. The dialogue consists the character's image, the character's name, and the messages. The dialogue UI are design by using Sketchbook as shown as Figure 4.32.
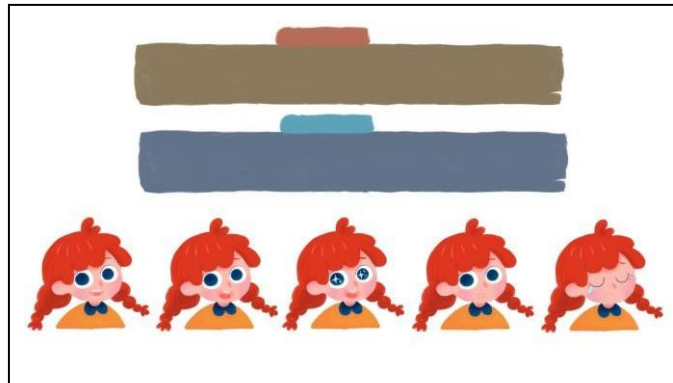
Figure 4.32   Dialogue UI design of the game

Figure 4.33   Example dialogue in Intro story

Figure 4.34   Example dialogue in Game turorial

4.2.14 Level Scene

There are five levels in this game. The levels have the different game environment. The different between the level is the target score that the player needs to hit and the counter timer. With the increase of level, some new game mechanics will be add-on in the later level such as adding obstacles, new type of collectable items (rubbish) will also be added inside. The score that the player gain will be brings to the next level, and at the end the player will be able to view the total score by all the level that they gain.

4.2.14.1   Level 1

The level 1 Scene is in a town full of trash as shown in Figure 4.35. Doris will clean up the rubbish that has accumulated under the bridge. The player needs to press the right mouse button when the rope is swinging at the right corner to grab the rubbish up. In Level 1, the rubbish that the player needs to hook are Apple core, Tin, and Milk bottle. The target score in Level 1 is 1000 and the time limit is 30 seconds. Hence, the player needs to grab the rubbish to hit the target score in 30 seconds.

Figure 4.35   Example Level 1 scene

4.2.14.2   Level 2

The background of Level 2 is same with Level 1. In the Level 2, the player needs to press the right mouse button when the rope is swinging at the right corner to grab the garbage up. In Level 2, the new rubbish, Can is added. The target score in Level 2 is 2000 and the time limit is 50 seconds. Hence, the player needs to grab the garbage to hit the target score in 50 seconds.

Figure 4.36   Example Level 2 scene

4.2.14.3   Level 3

The level 3 Scene is on the sea. The sea is dirty and full of rubbish. She needs to clean up the garbage. The player needs to press the right mouse button when the rope is swinging at the right corner to grab the garbage up. In Level 3, the new rubbish, Milk tea bottle is added. The target score in Level 3 is 5000 and the time limit is 50 seconds. Hence, the player needs to grab the garbage to hit the target score in 50 seconds.

Figure 4.37   Example Level 3 Scene

4.2.14.4   Level 4

The background of Level 2 is same with Level 3. The player needs to press the right mouse button when the rope is swinging at the right corner to grab the garbage up. In Level 4, the new rubbish, Plastic bottle is added, unlike other rubbish, the Plastic bottle will move around. In this level also will have the fish swimming around as the obstacles. Players must be careful not to catch the fish, otherwise the player will lose five points. The target score in Level 4 is 7000 and the time limit is 60 seconds. Hence, the player needs to grab the garbage to hit the target score in 60 seconds.

Figure 4.38   Example Level 4 Scene

4.2.14.5   Level 5

The Level 5 Scene is under the sea. The player needs to press the right mouse button when the rope is swinging at the right corner to grab the garbage up. In Level 4, the new rubbish, Plastic bag is added, same as Plastic bottle, the Plastic bag will move around. In this level also will have the fish swimming around as the obstacles. Players

must be careful not to catch the fish, otherwise the player will lose five points. The target score in Level 5 is 10000 and the time limit is 60 seconds. Hence, the player needs to grab the garbage to hit the target score in 60 seconds.

Figure 4.39   Example Level 5 Scene

4.2.15 Win Game

The win game panel will appear after the player hit the target score. The panel will show the score that the player has gain in the level. There are three buttons in the win game panel which are Next Button, and Replay Button as shown in Figure 4.40.

Figure 4.40   Win Game Panel.

4.2.16 Game Over

The game over panel will appear after the player fail to reach the target points within the time. Game over panel consist the Replay Button as shown in Figure 4.41. The Replay Button allows the player replay that level of the game.
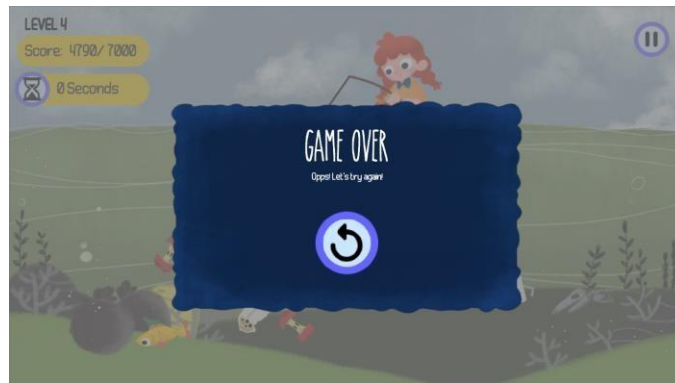
Figure 4.41　　Game Over Panel

4.2.17　Pause Game

The Paused Panel will be pop out when the player presses the Pause Button at the top right in the game. When the game is paused, the game will be stop temporarily until player resume the game. The paused panel consists of Music Slider and Sound Effect Slider, which allow player to adjust the sound volume of the game. There are also three buttons which are Resume Button, Replay Button, and Home Button as shown in Figure 4.42. It used to navigate the player to stop the game temporarily.

Figure 4.42　　Paused Panel

4.3　　Implementation of The Game

In the implementation phase, scripting is to make sure the functionality and effectiveness of the game. Hence, this section will discuss the implementation of the game which scripting and integrating all the game functions and components such as rope and hook management, switching levels or scenes, calculating the score and others.

4.3.1 Rope Management

In Figure 4.43, *RopeState* method is to get the states of the rope which are *Swing* for default state, *Extension* for stretch to grab the item, and *Takeback* for retract the rope. This method used to identify the state of the rope whether the rope is swinging in default mode, or extend when player press the right mouse button to grab the rubbish, or takeback when it hooks the rubbish.

```
public enum RopeState
{
    Swing,
    Extension,
    Takeback
}
```

Figure 4.43   The rope states

In the update method as shown in Figure 4.44, the rope will be swinging in default, *Input.GetMouseButtonDown(1)* means the action for click right mouse button. When the player clicks right mouse button, the rope will extend to grab the rubbish (*ropeState = RopeState.Extension*). When the rope is about to extend, it will call the *Extension()* method; while when the rope is about to takeback, it will call the *Takeback()* method.

```
public void Update()
{
    if(ropeState == RopeState.Swing)
    {
        Swinging();

        if (Input.GetMouseButtonDown(1))
        {
            ropeState = RopeState.Extension;
            RopeScaleSpeed = 1;
        }
    }
    else if(ropeState == RopeState.Extension)
    {
        Extension();
    }
    else if(ropeState == RopeState.Takeback)
    {
        Takeback();
    }
}
```

Figure 4.44   The rope action

4.3.2 Hook Management

To achieve the action of the hook can grab the rubbish, firstly the rubbish and the hook must be attaching the collider as shown in Figure 4.45. The ***HookManagement*** script is used to manage the hook operation.
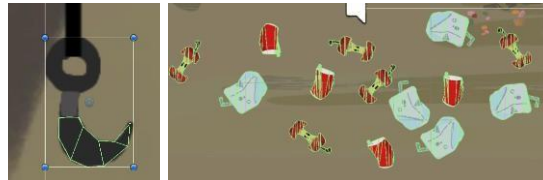
Figure 4.45   Collider in Hook and Rubbish object


```
public void OnTriggerEnter2D(Collider2D collision)
{
    ropeManager.ropeState = RopeState.Takeback;
    collision.transform.parent = transform;

    transform.GetComponent<PolygonCollider2D>().enabled = false;
    collision.GetComponent<PolygonCollider2D>().enabled = false;

    if (collision.transform.tag == "Plasticbag")
    {
        hookObjectPoint = collision.GetComponent<Plastic>().point;
        canAddScore = true;

        hookObjectQty = collision.GetComponent<Plastic>().quantity;
        canAddPlasticbagQty = true;
```

Figure 4.46   HookManagement script

When the hook is triggering the collider with the rubbish items, the rope will take back to the default position, then it will add the score. Hence, ***OnTriggerEnter2D()*** method is used to manage the trigger collider of the hook and rubbish. As shown in Figure 4.46, If the hook is collider with the object with the tag of "***Plasticbag***", it will need to add the already set score. Since the score is set in another script (***Plastic*** script), it will need to link with the Plastic script and get the score value by using ***GetComponent<Plastic>().point,*** same with calling the quantity of plastic bag. For the other rubbish are also use the same function.

4.3.3 Game Manager

In this game has the timer. In Figure 4.47,*Temptimer -= Time.deltaTime* is the function to decrease the time by seconds; *timer.text = Temptimer.ToString("0") + " Seconds"* is the function to display the time text on the game UI as shown in Figure 4.48.

```
void Update()
{
    Temptimer -= Time.deltaTime;
    timer.text = Temptimer.ToString("0") + " Seconds";

    if (Temptimer <= 0 && !isWin)
    {
        Temptimer = 0;
        LoseUI.SetActive(true);
        Time.timeScale = 0f;
    }
}
```

Figure 4.47   Timer script

Figure 4.48   Timer in game UI

When the player hooks the rubbish, the score will be added. When the player hit the target score, Win UI panel will pop out, and play the win sound effect. Hence, in the AddScore() method, *ShowFloatingText()* function is used to display the floating text score added when the player grabbed the rubbish as shown as Figure 4.50. *scoreSO.Value += value* is to get the score and *ScoreText.text = scoreSO.Value.ToString()* is to display the score in the game UI as shown in Figure 4.51. *currentScore += value* is used to get the player's current score, this is for the later restart game to reset that level score, which means the score accumulated by the player in the previous level will be minus the score obtained in this level when the player restarts this level, the coding as shown in Figure 4.52 and it is same function to use in calculate quantity of the rubbish that the player grabbed.

55

```
1 reference
public void AddScore(float value)
{
    ShowFloatingText("+" + value.ToString());

    scoreSO.Value += value;
    ScoreText.text = scoreSO.Value.ToString();

    currentScore += value;

    if (scoreSO.Value >= TargetScore)
    {
        isWin = true;
        WinUI.SetActive(true);
        scoreSO.Value += value;
        ResultScoreText.text = scoreSO.Value.ToString();
        PlayWinSound();
        Time.timeScale = 0f;
    }
}
```

Figure 4.49   Add score script

Figure 4.50   Floating text in game

Figure 4.51   Score display in game UI

Figure 4.52 shows the *NextLevel()* method used to load between scene such as next level scene, *Replay()* method used to regenerate the current scene. Figure 4.53 shows the *ResumeGame()* used to continue to the game, *PauseGame()* used to pause the game, *Home()* used to load to the Main Menu scene, and *PlayWinSound()* used to play the victory sound effect when player is win the game.

```
public void NextLevel()
{
    SceneManager.LoadScene(nextLevel);
}

0 references
public void Replay()
{
    SceneManager.LoadScene(replayLevel);
    scoreSO.Value = scoreSO.Value - currentScore;
    appleSO.Value = appleSO.Value - currentApple;
    tinSO.Value = tinSO.Value - currentTin;
    canSO.Value = canSO.Value - currentCan;
    milkbottleSO.Value = milkbottleSO.Value - currentMilkbottle;
    milkteabottleSO.Value = milkteabottleSO.Value - currentMilkteabottle;
    plasticbottleSO.Value = plasticbottleSO.Value - currentPlasticbottle;
    plasticbagSO.Value = plasticbagSO.Value - currentPlasticbag;
}
```

Figure 4.52   Replay level script

```
public void ResumeGame()
{
    PauseMenuUI.SetActive(false);
    Time.timeScale = 1f;
    isPaused = false;
}

1 reference
public void PauseGame()
{
    PauseMenuUI.SetActive(true);
    Time.timeScale = 0f;
    isPaused = true;
}

0 references
public void Home()
{
    Time.timeScale = 1f;
    SceneManager.LoadScene("Main menu");
}

1 reference
public void PlayWinSound()
{
    winSound.Play();
}
```

Figure 4.53   Resume game, Pause game, Go to main menu, and play win sound effect method

4.4   Testing

The User Acceptance Test (UAT) is conducted in the evaluation phase. This is an important phase to ensure the **DORIS** game application is no bug, perform well, and fulfil the objectives or requirements of the game application. Therefore, the types of UAT used to test the game application are alpha testing and beta testing. Both of the tests are used to test the functionality and usability of the game application.

4.4.1   Alpha Testing (Functionality Testing)

Alpha Testing is one of the types of UAT. It performed to identify all the possible errors and ensure the quality of the game application before release to the end users. There are two testers were selected for alpha testing. For alpha testing, 15 testers included 10 young people and 5 primary school children will be provided with functionality form, and exe files. They will test the functionality of the game and fill in the functionality testing form. Please refer to the **APPENDIX E** for the example of the functionality testing form.

4.4.2   Beta Testing (Usability Testing)

Beta Testing is one of the types of UAT. It is performed by the real users or public who are not part of an organization based on the user's environment to focus on the quality of the game application and ready to publish. It also helps in decision making to invest further in improvising future products or the same product. Hence, the game application will be published on the itch.io website which the player can download the **DORIS** game application exe file and the Google Form is attached with the itch.io link. Please refer to the **APPENDIX F** for the example of the usability testing form. The link of the itch.io website for the game published: https://rossee0813.itch.io/doris

4.5   Result and Discussion

The results will be discussed after the UAT testing is performed to evaluate the functionality and usability of **DORIS** game application. The result of the functionality with 15 testers and usability testing through the Google Form with 20 respondents will be made. For the alpha testing (functionality test), the result obtained from 15 testers which are 10 from young people and 5 from primary school children marking all the input in the DORIS game application is well functioning. Please refer to the **APPENDIX E**.

In addition, the beta testing (usability testing) from the 20 respondents will be conducted by using the Google Form. The form consists of 10 questions which include

2 multiple choices for gender and age, 7 multiple choices for the degree of agreement of the game application and last question which is for the respondents comment or improvement suggestions for this game application.

From the result, there are 5 males (25%) and 15 females (75%) fill in the survey form as shown in Figure 4.54. Most of the respondents are aged between 21 to 30 years old which has 17 respondents (85%) as shown in Figure 4.55. Also, there are 2 respondents (10%) that are aged between 13 to 20 years old, 1 respondent (5%) is aged 31 to 49 years old.
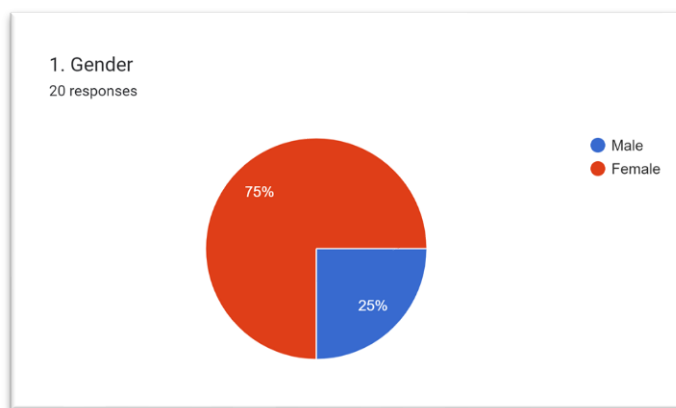
Figure 4.54   Pie Chart - Gender
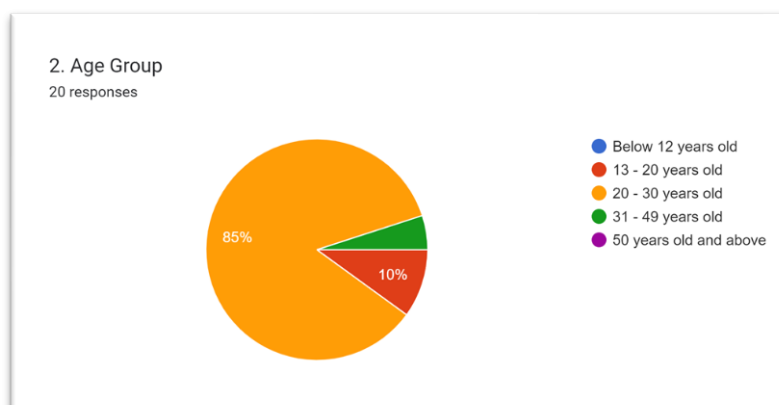
Figure 4.55   Pie Chart – Age

Table 4.1   Degrees of Agreement by 20 Respondents

No	Statement	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
1.	It is easy to use and enjoy to playing this game.	1	0	0	5	14
2.	It is well functioning when playing this game	1	0	0	4	15
3.	The instruction given in the game is clear and understandable	1	0	0	5	14
4.	The user interface design is suitable for this game	1	0	0	4	15
5.	The game is suitable to implement in primary school	1	0	0	5	14
6.	It can gain the knowledge of Water Pollution issues after playing the game	1	0	0	6	13
7.	It can enhance the awareness of the Water Pollution	1	0	0	6	13
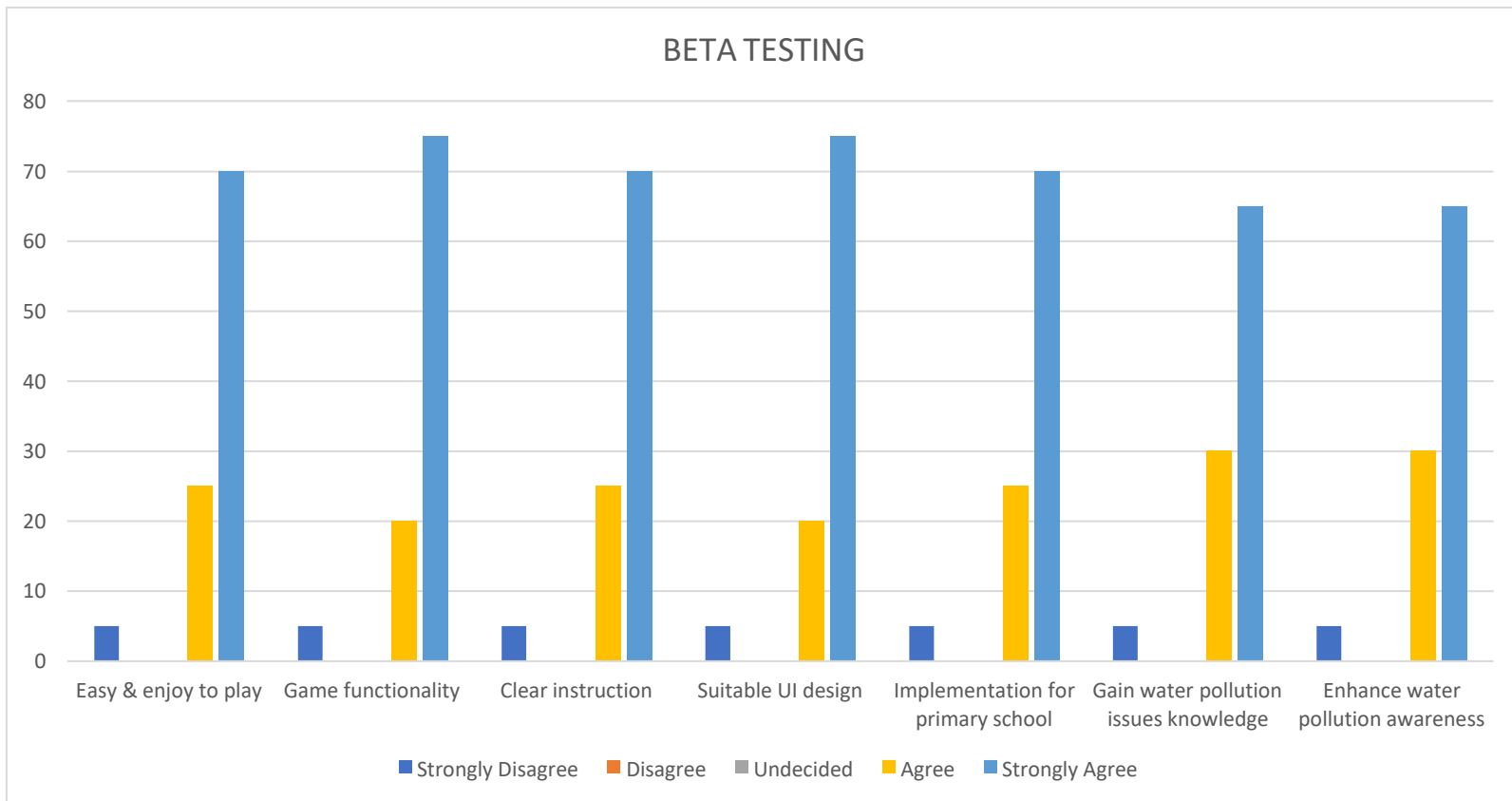
Figure 4.56   Bar Chart - Degrees of Agreement Percentage

There are 20 respondents who responded to the usability survey of the DORIS game application. From the result as shown in Table 4.1 and Figure 4.56, there are 14 respondents (70%) strongly agreed that the game is easy to use and enjoy to play; 5 respondents (25%) agreed; while 1 respondent (5%) disagreed. There are 15 respondents (75%) strongly agreed that the game is well functioning; 4 respondents (20%) agreed; while 1 respondent (5%) disagreed. There are 14 respondents (70%) strongly agreed that the instruction given in the game is clear and understandable; 5 respondents (25%) agreed; while 1 respondent (5%) disagreed. In addition, there are 15 respondents (75%) strongly agreed that the user interface design is suitable for this game; 4 respondents (20%) agreed; while 1 respondent (5%) disagreed. Furthermore, there are 14 respondents (70%) strongly agreed that The game is suitable to implement in primary school; 5 respondents (25%) agreed; while 1 respondent (5%) disagreed. Besides, there are 13 respondents (65%) strongly agreed that it can gain the knowledge of Water Pollution issues after playing the game; 6 respondents (30%) agreed; while 1 respondent (5%) disagreed. There are 13 respondents (65%) strongly agreed that it can enhance the awareness of the Water Pollution; 6 respondents (30%) agreed; while 1 respondent (5%) disagreed.

There are also some of the comments and suggestions that given by the respondents, included increase the level challenging and difficulty, add more levels, have more language to choose, add some props, and describe more about the information of rubbish, which as shown in Figure 4.57.

Figure 4.57   Comments Given by the Respondents

In conclusion, based on the result, **DORIS** game application reaches its objective to improve the learning the water pollution issues with more interesting and easier to understand. It also helps to enhance the awareness of water pollution among the primary school children.

4.6   Chapter Summary

This chapter has discussed the design phase, implementation phase and evaluation phase of the project. The design of the scenes, backgrounds, game objects, and others are explained in this chapter. Besides, scripting and implementing of all of the components in the development phase to the implementation phase of the game also explained in this chapter. The scripting for this game application also has been explained. In the evaluation phase, there are two types of the UAT testing which are alpha testing and beta testing. Both of the testing is performed to test the functionality and usability of the application to make sure the effectiveness and also fulfil the requirement of the application, and the result has been discussed in this chapter.

Hence, through the results of the tests from the testers and respondents, the overall of the responses are positive and it also shows this game has achieved its objectives.

CHAPTER 5

CONCLUSION

5.1   Introduction

DORIS game application is an educational game that discuss the topic of water pollution. It is a 2D educational game with water pollution topic to help enhancing awareness of water pollution for primary school students. This game application is a cartoon-style puzzle game, the player needs to control the hook to catch rubbish, and they can pass the level after reaching a certain number of points. Through playing the game, it is hoped that the player can behave easier to enhancing the awareness of water pollution as well as can help to get more understanding and fun while learning the topic of water pollution.

After the evaluation phase that is done by UAT, it shows all the buttons in this application worked well in alpha testing and the results obtained from the respondents in beta testing is the positive response as overall. This game achieved its objective by helps to enhance the awareness of the water pollution. Nevertheless, according to the responses from the 20 respondents, objectives of this application were achieved with limitations. Hence, in this chapter will be discussed about the project constraints, strengths and weaknesses as well as future work for improving the application.

5.2   Project Constraints

There are some constraints that have been faced during the implementation of the game application.

- Time Management

The main constraint is the time management. All the design, development and implementation of the game must be completed within the specific time. During this period, it may need to face the problems that take a lot of time to solve at each stage. Therefore, there are no more features to be added to the game due to limited time.

- Hardware Requirement

DORIS game application is only available for the PC platform only. Therefore, it limits the use of players who prefer with mobile devices or online platform.

- Testing

For the game testing, it is hard to find the testers aged between 7 – 12 years old due to school holidays. Therefore, the primary school teachers are founded as testers through online communication, while the feedback get from public as volunteers to fill in the survey form.

- User

The target user of this game application is the primary school students which are aged between 7 – 12 years old. Considering this, the game can't be too complicated, especially the used of English words. It is a bit difficult thinking for the simple word to replace the complex words since some word doesn't have the replacement. Therefore, needs to changing the sentences to the better easy understand without lose the meaning.

5.3   Strengths and Weaknesses of The Game

Table 5.1   Strengths and Weaknesses

Strengths	Weaknesses
The game application is offline internet access; hence, it does no need any network encouragement.	This game application is only available on PC platform.
The game application helps to enhances the awareness of water pollution.	It is single language, only English used in this game.
The game application is free, it doesn't need any purchase.	The game application cannot be updated automatically, it needs to reinstall with the updated EXE file.

5.4   Future Works

Based on the feedback given by the 20 respondents in the Beta Testing and the others, there are some enhancements can be done for future improvement of the **DORIS** game application.

As the language used in **DORIS** game application is only in English version, it can be improved by implement multilanguage in the game, such as Chinese, Malay, or Tamil versions. So, the players can switch between the language that they know, and also increase the opportunity for them to learn additional languages.

Besides, the game can be added more features or improve some features. For instance, for the Rubbish Information can be add more detail description on how to dispose of garbage. Moreover, it also can be added some props such as the prop that can speed up retracting hooks, and etc. In addition, the animation can be implemented in the rubbish (the items which the player needs to grab) in the level by make it move like floating in water. Furthermore, the game also can be improved by adding more level and also make it more challenging.

Last but not least, the game application can be improving the platform used. The game can also be developed by supporting the mobile devices for both Android and iOS platform, and also online platform to increase the number of players to access in this game application. For supporting mobile platform, the game can be access in anytime and anyplace. For supporting online platform, there is no need to download the game as well as it can save the memory space of the PC or mobile.

5.5   Conclusion

In conclusion, the educational game will make the learning fun and easier. Hence, **DORIS** game application is an educational game with 2D game-based to help the primary student to enhance their awareness of water pollution. In addition, the platform of this game is a PC platform, it can only be download and install into the PC. The players also can achieve knowledge about the water pollution topic by learning through playing the **DORIS** game application. Moreover, this game application still has improvements to make it more usable and interactive in the future.

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PSM - 2D Game to Enhance Awareness of Water Pollution

Good day everyone,

am Yong Rong See, a final year student from Faculty of Computing with Bachelor of Computer Science (Graphic & Multimedia Technology) in University Malaysia Pahang (UMP). I would like to take a survey on the effectiveness of the 2D game application for the primary school students. Please kindly fill in the form to assist me to complete this survey. Your response is greatly appreciated. Thank you!

*Required

Have you ever follow with interest to the topic of water pollution? *

◯ Yes

◯ No

Have you ever heard about any 2D game application related to Water Pollution? *

○ Yes

○ No

Have you ever play any 2D game application related to Water Pollution? *

○ Yes

○ No

Do you think that 2D game application is needed to the primary students for enhance their awareness of Water Pollution? *

○ Yes

○ No

Do you think that 2D game application can help to enhance the primary students' awareness of Water Pollution? Why? *

Your answer

What is your expectation about the 2D Game Application that will be develop for primary student for enhance their awareness of Water Pollution ? *

Your answer

Submit   Clear form

APPENDIX B
GANTT CHART
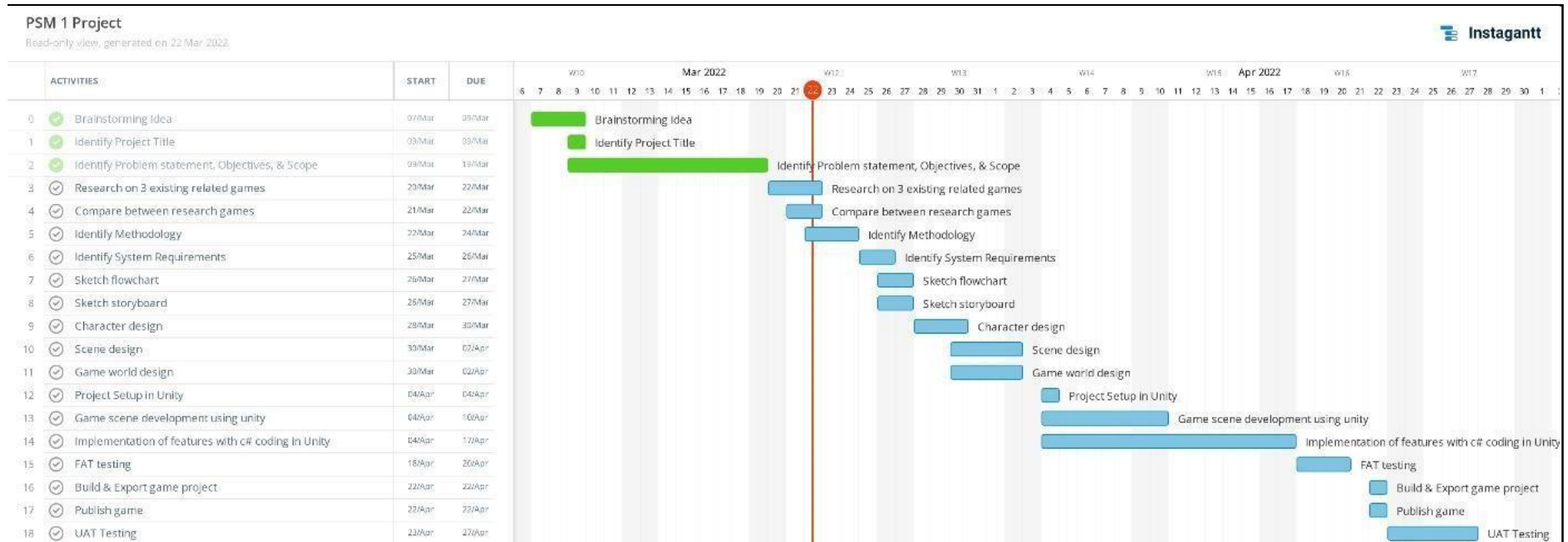
APPENDIX C
PLOT GRAPH
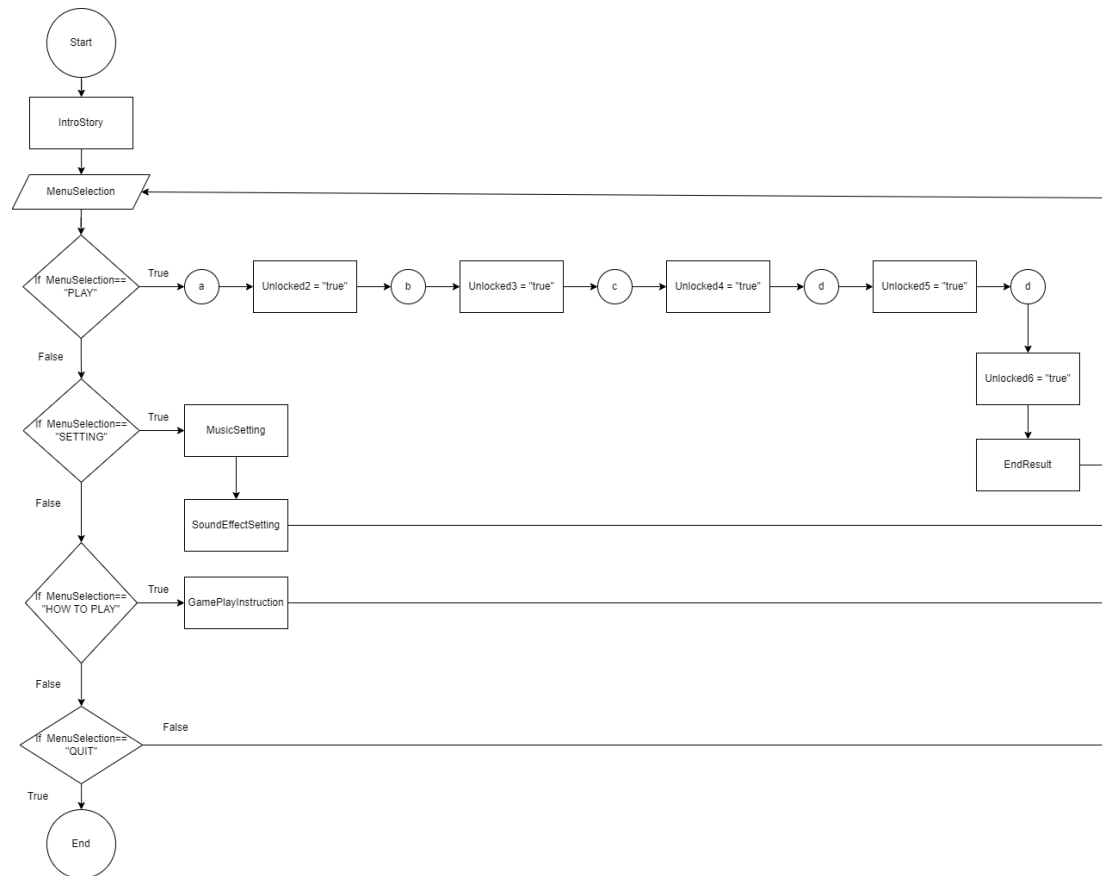
Level 1 Overall Plot Graph for DORIS Game Application
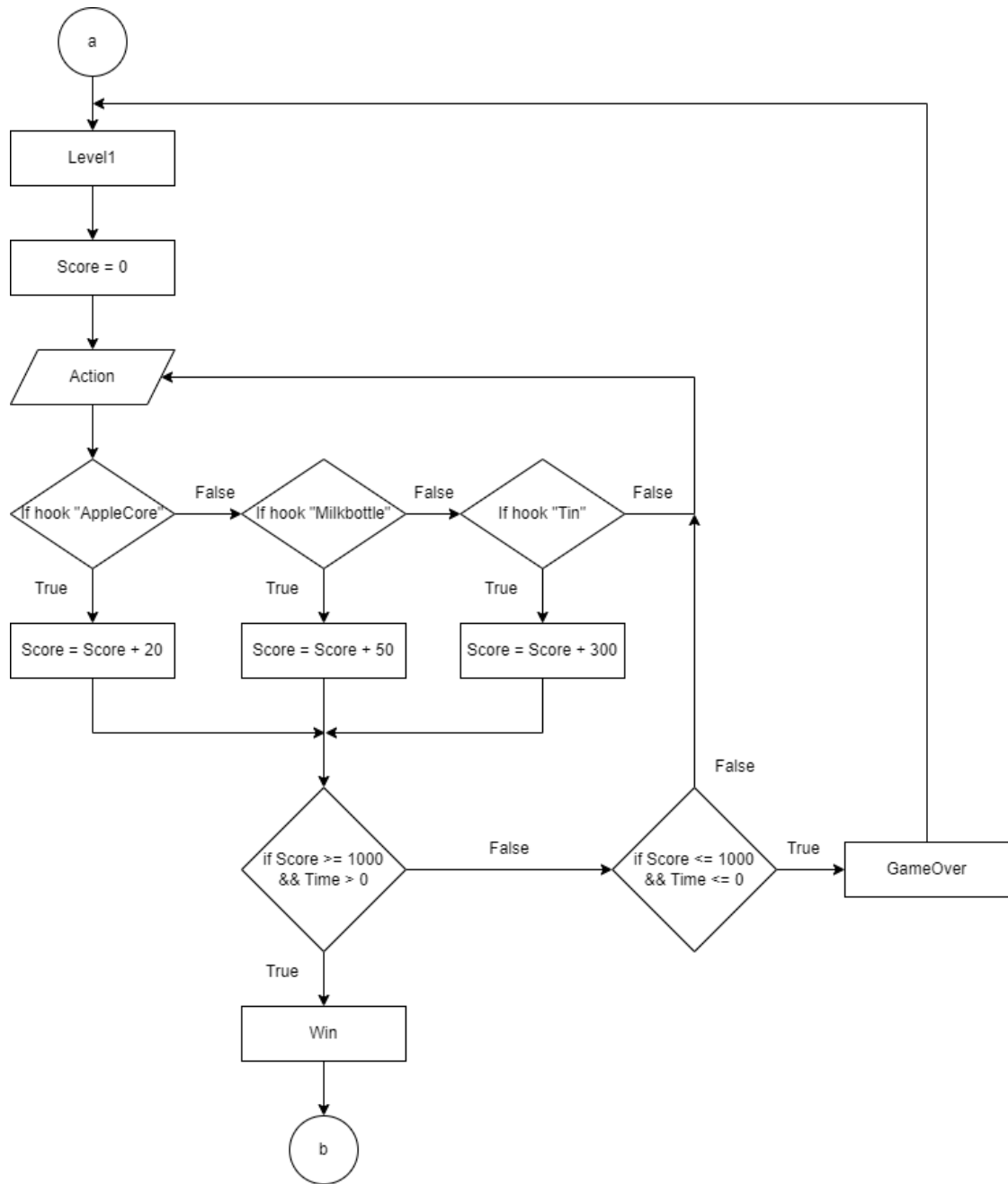
Level 1 Plot Graph for DORIS Game Application

```
                    ( b )
                      |
                      v
              +----------------+
              |     Level2     |
              +----------------+
                      |
                      v
              +----------------+
              | Score >= 1000  |
              +----------------+
                      |
                      v
              /  Action  /<-------------------------------------------+
                      |                                               |
                      v                                               |
           /\          False    /\         False   /\        False   /\    False
          /  \  -------------> /  \  ------------> /  \ ----------> /  \ ------>
         / If \              / If   \            / If   \         / If  \
         | hook|             | hook  |           | hook  |        | hook |
         |"Can"|             |"Apple |           |"Milk  |        | "Tin"|
          \  /               | Core" |           | bottle"|        \  /
           \/                 \    /              \    /            \/
            |                   \/                  \/               |
          True                  True               True           True
            |                    |                  |               |
            v                    v                  v               v
  +------------------+  +------------------+  +-----------------+  +------------------+
  |Score = Score + 500|  |Score = Score + 20|  |Score = Score + 50|  |Score = Score + 300|
  +------------------+  +------------------+  +-----------------+  +------------------+
            |                    |                  |               |
            +--------------------+------------------+---------------+
                                 |
                                 v
                          /\
                         /  \         False
                        / if   \  ------------>    /\                     +-----------+
                        |Score >=|               /  \      True          |           |
                        | 2000   |              / if   \ -------------->  | GameOver  |
                        |&&Time >0|             |Score <=|                |           |
                         \    /                 | 2000   |                +-----------+
                          \  /                  |&&Time <=0|
                           \/                    \    /  False
                           |                      \  /
                         True                      \/
                           |
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                    |      Win       |
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                           |
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```

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    │  Level3   │
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    ┌───────────────┐
    │ Score >= 2000 │
    └───────────────┘
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     ╱───────────╲
    │   Action    │◄──────────────────────────────────────┐
     ╲───────────╱                                         │
          │                                                │
          ▼                                                │
    ◇ If hook      False  ◇ If hook  False  ◇ If hook  False  ◇ If hook  False  ◇ If hook  False
    "MilkteaBottle" ────►  "Can"    ────►  "AppleCore" ──►  "Milkbottle" ──►  "Tin"  ──────┘
          │                   │                │                │                │
        True               True             True             True             True
          ▼                   ▼                ▼                ▼                ▼
 ┌──────────────────┐ ┌──────────────────┐ ┌─────────────────┐ ┌─────────────────┐ ┌──────────────────┐
 │Score = Score + 800│ │Score = Score + 500│ │Score = Score + 20│ │Score = Score + 50│ │Score = Score + 300│
 └──────────────────┘ └──────────────────┘ └─────────────────┘ └─────────────────┘ └──────────────────┘
          │                   │                │                │                │
          └───────────────────┴────────────────┴────────────────┴────────────────┘
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                                               ▼
                                    ◇ if Score >= 5000      False      ◇ if Score <= 5000    True   ┌──────────┐
                                      && Time > 0      ──────────────►   && Time <= 0     ────────► │ GameOver │
                                               │                                │                    └──────────┘
                                             True                            False
                                               ▼                                │
                                         ┌──────────┐                           │
                                         │   Win    │                           │
                                         └──────────┘                           │
                                               │
                                               ▼
                                            ( d )
```

76

```
          ( e )
            |
            v
     +------------+
     |   Level5   |
     +------------+
            |
            v
     +------------+
     | Score >= 7000 |
     +------------+
            |
            v
      /-----------/
     /  Action   /<-------------------------------------------------------------------+
    /-----------/                                                                      |
            |                                                                          |
            v                                                                          |
   <If hook  >  False  <If hook    >  False  <If hook    >  False  <If hook >  False  <If hook    >  False  <If hook    >  False  <If hook >  False  <If hook >  False
   <"PlasticBag">----->  <"PlasticBottle">--> <"MilkteaBottle">---> <"Can"  >------->  <"AppleCore">----->  <"Milkbottle">---->  <"Tin"   >------->  <"Fish"  >------->
            |                   |                   |                   |                   |                   |                   |                   |
         True                True                True                True                True                True                True                True
            v                   v                   v                   v                   v                   v                   v                   v
   +----------------+  +----------------+  +---------------+  +---------------+  +---------------+  +---------------+  +---------------+  +---------------+
   | Score = Score  |  | Score = Score  |  | Score = Score |  | Score = Score |  | Score = Score |  | Score = Score |  | Score = Score |  | Score = Score |
   |     + 1300     |  |     + 1000     |  |     + 800     |  |     + 500     |  |     + 20      |  |     + 50      |  |     + 300     |  |     - 5       |
   +----------------+  +----------------+  +---------------+  +---------------+  +---------------+  +---------------+  +---------------+  +---------------+
```

If Score >= 12000 && Time > 0

If Score <= 12000 && Time <= 0

False

True

False

True

GameOver

Win

78

FRAME 01 (Intro Story Part 1)					
PROJECT TITLE	:	DORIS	**SCENE**	:	IntroStory_1
DISPLAY SCREEN					

DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is the first scene of intro story. The scene is the main character, Doris is reading a book. This book is about describing the beautiful ocean world.
RESOLUTION	:	1920 x 1080 pixels	
FONT	:	N/A	

FONT STYLE	:	N/A	- The scene will show with the fade in animation. The animation is made by Unity.
FONT SIZE	:	N/A	
FONT COLOR	:	N/A	- The background music of this scene is soft and relaxing.
LINE SPACING	:	N/A	
TEXTURES	:	N/A	
GRAPHIC	:	2D	**ACTION/NAVIGATION**
BACKGROUND	:	Black background with a little girl reading book illustration	N/A
AUDIO	:	N/A	
MUSIC	:	soft-piano-100-bpm-121529.mp3 [Source: https://pixabay.com/music/]	
VIDEO	:	N/A	
ANIMATION	:	Fade in	
BUTTON	:	N/A	
SCRIPT	:	N/A	
PREVIOUS SCENE	:	N/A	

FRAME 02 (Intro Story Part 1)					
PROJECT TITLE	:	DORIS	**SCENE**	:	IntroStory_1
DISPLAY SCREEN					

Naration Sentence

DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is the second scene of intro story. It is a transition to the world of storybooks. A prologue to describe the ocean will appear.
RESOLUTION	:	1920 x 1080 pixels	
FONT	:	Wash Your Hand [Source: https://www.dafont.com/wash-your-hand.font]	- The scene will show with the fade in animation and exit with fade out animation. The animation is made by Unity.
FONT STYLE	:	Normal	
FONT SIZE	:	80	- The background music of this scene is soft and relaxing.

FONT COLOR	:	White	
LINE SPACING	:	N/A	
TEXTURES	:	N/A	
GRAPHIC	:	2D	**ACTION/NAVIGATION**
BACKGROUND	:	Ocean watercolour background	
AUDIO	:	N/A	N/A
MUSIC	:	soft-piano-100-bpm-121529.mp3 [Source: https://pixabay.com/music/]	
VIDEO	:	N/A	
ANIMATION	:	Fade in, Fade out	
BUTTON	:	N/A	
SCRIPT	:	N/A	
PREVIOUS SCENE	:	IntroStory_1 (First scene)	

FRAME 03 (Intro Story Part 1)					
PROJECT TITLE	:	DORIS	**SCENE**	:	IntroStory_1
DISPLAY SCREEN					

DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is the third scene of intro story. This scene is to show the wonderful marine life in the sea. The scene will show the colourful fish and beautiful jellyfish.
RESOLUTION	:	1920 x 1080 pixels	
FONT	:	N/A	- The background music of this scene is soft and relaxing.
FONT STYLE	:	N/A	
FONT SIZE	:	N/A	

FONT COLOR	:	N/A	
LINE SPACING	:	N/A	
TEXTURES	:	N/A	
GRAPHIC	:	2D	**ACTION/NAVIGATION**
BACKGROUND	:	Black background with fish and jellyfish illustration	N/A
AUDIO	:	N/A	
MUSIC	:	soft-piano-100-bpm-121529.mp3 [Source: https://pixabay.com/music/]	
VIDEO	:	N/A	
ANIMATION	:	N/A	
BUTTON	:	N/A	
SCRIPT	:	N/A	
PREVIOUS SCENE	:	IntroStory_1 (Second scene)	

FRAME 04 (Intro Story Part 1)					
PROJECT TITLE	:	DORIS	**SCENE**	:	IntroStory_1
DISPLAY SCREEN					

DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is the fourth scene of intro story. The scene will show the beautiful whales.
RESOLUTION	:	1920 x 1080 pixels	
FONT	:	N/A	- The scene will display the whale sound effect.
FONT STYLE	:	N/A	- The background music of this scene is soft and relaxing.
FONT SIZE	:	N/A	

			ACTION/NAVIGATION
FONT COLOR	:	N/A	
LINE SPACING	:	N/A	
TEXTURES	:	N/A	
GRAPHIC	:	2D	
BACKGROUND	:	Black background with whales' illustration	N/A
AUDIO	:	whale-45996.mp3 [Source: https://pixabay.com/music/]	
MUSIC	:	soft-piano-100-bpm-121529.mp3 [Source: https://pixabay.com/music/]	
VIDEO	:	N/A	
ANIMATION	:	N/A	
BUTTON	:	N/A	
SCRIPT	:	N/A	
PREVIOUS SCENE	:	IntroStory_1 (Third scene)	

FRAME 05 (Intro Story Part 1)						
PROJECT TITLE	:	DORIS		**SCENE**	:	IntroStory_1
DISPLAY SCREEN						

DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is the fifth scene of intro story. The scene is transition from storybook world to the little girl reading a book. The little girl yearns for the sea world in the storybook.
RESOLUTION	:	1920 x 1080 pixels	
FONT	:	N/A	
FONT STYLE	:	N/A	
FONT SIZE	:	N/A	- The background music of this scene is soft and relaxing.

FONT COLOR	:	N/A		
LINE SPACING	:	N/A		
TEXTURES	:	N/A		
GRAPHIC	:	2D	**ACTION/NAVIGATION**	
BACKGROUND	:	Black background with a girl illustration		
AUDIO	:	N/A	N/A	
MUSIC	:	soft-piano-100-bpm-121529.mp3 [Source: https://pixabay.com/music/]		
VIDEO	:	N/A		
ANIMATION	:	N/A		
BUTTON	:	N/A		
SCRIPT	:	N/A		
PREVIOUS SCENE	:	IntroStory_1 (Fourth scene)		

FRAME 06 (Intro Story Part 1)					
PROJECT TITLE	:	DORIS	**SCENE**	:	IntroStory_1
DISPLAY SCREEN					
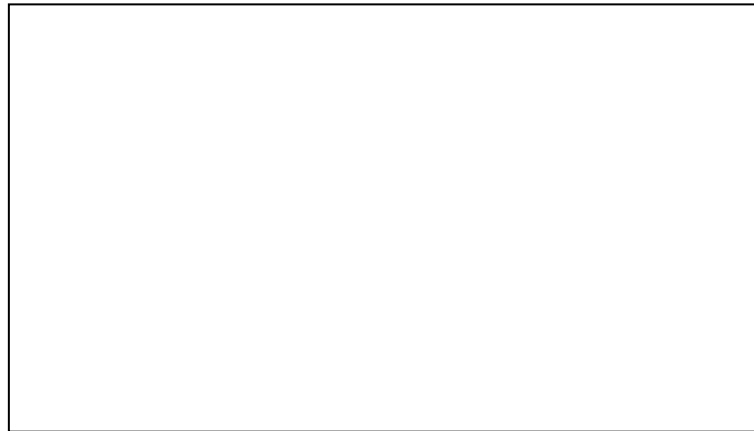
DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is the sixth scene of intro story. The little girl suddenly realize that the world now is unlike the storybook. - The background music of this scene is soft and relaxing.
RESOLUTION	:	1920 x 1080 pixels	
FONT	:	N/A	
FONT STYLE	:	N/A	
FONT SIZE	:	N/A	

				ACTION/NAVIGATION
FONT COLOR	:	N/A		
LINE SPACING	:	N/A		
TEXTURES	:	N/A		
GRAPHIC	:	2D		
BACKGROUND	:	Black background with a girl illustration		
AUDIO	:	N/A	N/A	
MUSIC	:	soft-piano-100-bpm-121529.mp3 [Source: https://pixabay.com/music/]		
VIDEO	:	N/A		
ANIMATION	:	N/A		
BUTTON	:	N/A		
SCRIPT	:	N/A		
PREVIOUS SCENE	:	IntroStory_1 (Fifth scene)		

FRAME 07 (Intro Story Part 1)					
PROJECT TITLE	:	DORIS	**SCENE**	:	IntroStory_1
DISPLAY SCREEN					
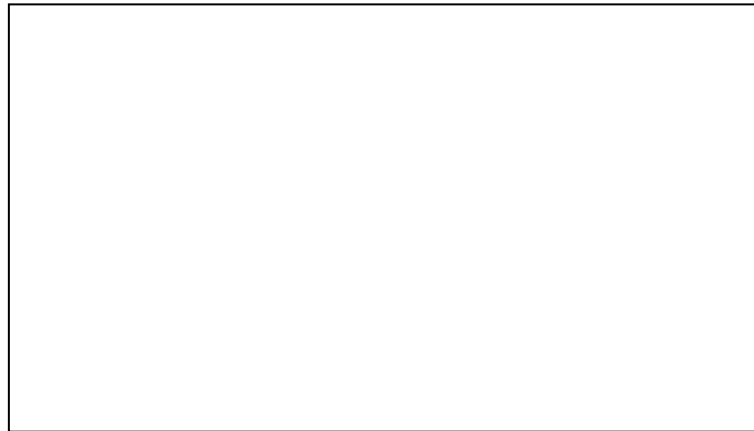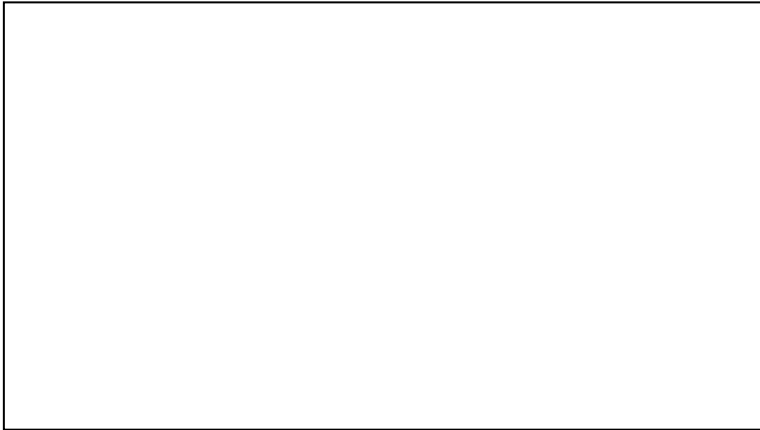
DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is the seven scene of intro story. Little girl looking out at the world through the window
RESOLUTION	:	1920 x 1080 pixels	
FONT	:	N/A	- The background music of this scene is soft and relaxing.
FONT STYLE	:	N/A	
FONT SIZE	:	N/A	

FONT COLOR	:	N/A		
LINE SPACING	:	N/A		
TEXTURES	:	N/A		
GRAPHIC	:	2D	ACTION/NAVIGATION	
BACKGROUND	:	Black background with a girl looking to the window illustration	N/A	
AUDIO	:	N/A		
MUSIC	:	soft-piano-100-bpm-121529.mp3 [Source: https://pixabay.com/music/]		
VIDEO	:	N/A		
ANIMATION	:	N/A		
BUTTON	:	N/A		
SCRIPT	:	N/A		
PREVIOUS SCENE	:	IntroStory_1 (Sixth scene)		

FRAME 08 (Loading Scene)					
PROJECT TITLE	:	DORIS	**SCENE**	:	IntroStory_1
DISPLAY SCREEN					

DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is the loading scene of the game.
RESOLUTION	:	1920 x 1080 pixels	- Loading screens are an important part of any video game, they help the player take a breath before loading the next level and allow the game to load all the necessary assets for the next level.
FONT	:	Wash Your Hand [Source: https://www.dafont.com/wash-your-hand.font]	

FONT STYLE	:	Normal	-	The loading screen contain the main character image of the game and the text "Loading…".
FONT SIZE	:	100		
FONT COLOR	:	White		
LINE SPACING	:	N/A		
TEXTURES	:	N/A		
GRAPHIC	:	2D	**ACTION/NAVIGATION**	
BACKGROUND	:	Black background with a girl illustration		
AUDIO	:	N/A	N/A	
MUSIC	:	N/A		
VIDEO	:	N/A		
ANIMATION	:	N/A		
BUTTON	:	N/A		
SCRIPT	:	N/A		
PREVIOUS SCENE	:	IntroStory_1 (Seventh scene)		

FRAME 09 (Intro Story Part 2)					
PROJECT TITLE	:	DORIS	**SCENE**	:	IntroStory_2
DISPLAY SCREEN					
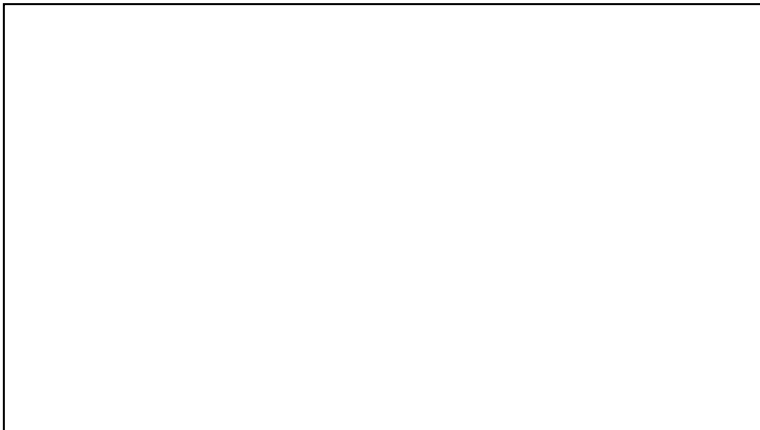
DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is the part two of intro story. This scene will start the dialogue with the main character. The main character will introduce herself, and then telling what is happening in the world right now. She said the world is now full of water pollution, what is causing the pollution, and the
RESOLUTION	:	1920 x 1080 pixels	
FONT	:	ThousandSunny-Regular [Source: https://www.dafont.com/thousand-snny.font]	
FONT STYLE	:	Normal (Dialogue text)	

		Italic (Hint text for navigate to next dialogue line)	effect of the pollution. She will also tell that she is going on an adventure to clean up the rubbish.
FONT SIZE	:	40 (Dialogue text) 30 (Hint text for navigate to next dialogue line)	- In this scene, will have the dialogue elements. The background will change depends on the dialogue sentences.
FONT COLOR	:	White (Dialogue) Orange (Hint text for navigate to next dialogue line)	- There is the ease in animation when the dialogue is start. - Under the dialogue box will have the hint text to navigate the player to press spacebar to load next sentence.
LINE SPACING	:	1	
TEXTURES	:	N/A	
GRAPHIC	:	2D	**ACTION/NAVIGATION**
BACKGROUND	:	Black background Illustration of the girl holding a storybook Blue ocean with marine life background Dirty ocean with rubbish	- The spacebar key used to trigger the next sentence of the dialogue.
AUDIO	:	N/A	
MUSIC	:	N/A	
VIDEO	:	N/A	
ANIMATION	:	Ease in	
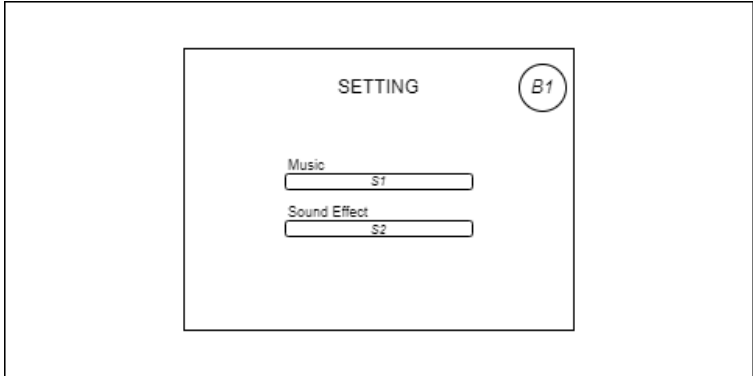
BUTTON	:	N/A
SCRIPT	:	DialogueManager
		DialogueTrigger
PREVIOUS SCENE	:	IntroStory_1 (Loading scene)

FRAME 10 (Main Menu)					
PROJECT TITLE	:	DORIS	**SCENE**	:	Main menu
DISPLAY SCREEN					

DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is a main menu scene for the **DORIS** game. The players can access all the buttons in the game.
RESOLUTION	:	1920 x 1080 pixels	
FONT	:	Wash Your Hand (Game Title) ThousandSunny-Regular (Buttons) [Source: https://www.dafont.com/thousand-sunny.font)	- The game title is **DORIS**, which type in unity. The font used is download from the font website. - The game background design is a girl (main character) boating on the sea which made by the software Sketchbook. The output of the background is in Portable Graphics Format (PNG) file format.
FONT STYLE	:	Normal	
FONT SIZE	:	150 (Game Title) 80 (Buttons)	- The game button design is the font style which type in unity, and using the free font download from the font website.
FONT COLOR	:	White	
LINE SPACING	:	N/A	
TEXTURES	:	N/A	- The animation of the buttons is made by using Unity. When the button is hover, it will be showing the scaling animation.
GRAPHIC	:	2D	**ACTION/NAVIGATION**
BACKGROUND	:	Illustration of a girl boating on the sea	- The SETTINGS Button used to navigate the player able to open the setting panel and adjust the game sound or background music.
AUDIO	:	lclick-13694.mp3 (Button Click Sound Effect)	

		[Source: https://pixabay.com/music/]	
MUSIC	:	waves-and-tears-sad-piano-music-with-calm-ocean-waves-8164.mp3 [Source: https://pixabay.com/music/)	- The PLAY Button used to navigate the player to the beginner guide to give the information on how to play the game. After finish the guide, the game will navigate the player to access the Level 1.
VIDEO	:	N/A	- The HOW TO PLAY Button used to navigate the player able to know or understand how to play and control this game.
ANIMATION	:	Scaling Animation for Buttons (Hover)	
BUTTON	:	B1 – PLAY B2 – SETTINGS B3 – HOW TO PLAY B4 - QUIT	- The QUIT Button used to navigate the player able to exit the game and also will display the confirmation message to prevent the player's error.
SCRIPT	:	MainMenu AudioManager Swipe ResetGameValue	
PREVIOUS SCENE	:	IntroStory_2	

FRAME 11 (Settings)					
PROJECT TITLE	:	DORIS	**SCENE**	:	Main menu
DISPLAY SCREEN					

DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is the setting of the game. It used to adjust the volume of the sound and music in the **DORIS** game.
RESOLUTION	:	1920 x 1080 pixels	
FONT	:	ThousandSunny-Regular [Source: https://www.dafont.com/thousand-sunny.font)	- The volume of sound and music are adjusted by using slider.
FONT STYLE	:	Bold (Title)	

		Normal	
FONT SIZE	:	150 (Title) 70	
FONT COLOR	:	White	
LINE SPACING	:	N/A	
TEXTURES	:	N/A	
GRAPHIC	:	2D	
BACKGROUND	:	Dark blue background	
AUDIO	:	click-21156.mp3 (Button Click Sound Effect) [Source: https://pixabay.com/music/]	
MUSIC	:	waves-and-tears-sad-piano-music-with-calm-ocean-waves-8164.mp3 [Source: https://pixabay.com/music/)	
VIDEO	:	N/A	
ANIMATION	:	Scaling Animation for Buttons	

- The setting panel background design uses a dark blue background which is designed in Sketchbook. The output of the background designs is in PNG file format.
- The close buttons design in the close icon which is designed in Sketchbook. The output of the game buttons design is in PNG file format.
- The animation of the buttons is made by using Unity. When the button is hover, it will be showing the scaling animation.

ACTION/NAVIGATION

- The Sound slider used to adjust the sound effect of the game.
- The Music slider used to adjust the music of the game.
- The Close Button used to navigate the player able to close the setting panel and return to the main menu of the game.

BUTTON/SLIDER	:	B1 – Close Button	
		S1 – Music Slider	
		S2 – Sound effect Slider	
SCRIPT	:	AudioManager	
PREVIOUS SCENE	:	Main menu (SETTINGS Button)	

FRAME 12 (How to play)					
PROJECT TITLE	:	DORIS	**SCENE**	:	Main menu
DISPLAY SCREEN					
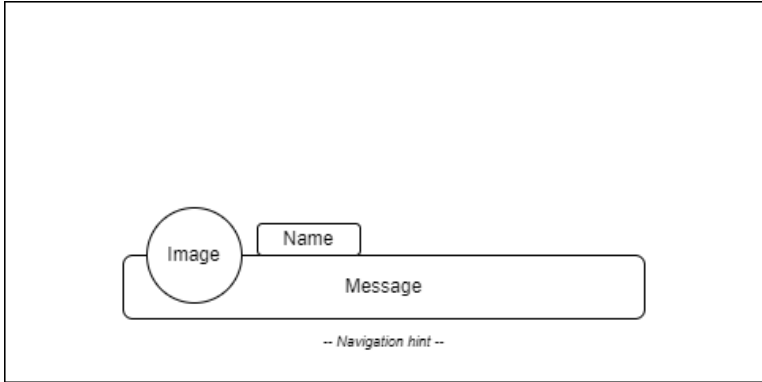
DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is the instruction on how to play of the game. It is used to guide the player about the control of the game. The player can access all the buttons in the game.
RESOLUTION	:	1920 x 1080 pixels	
FONT	:	ThousandSunny-Regular [Source: https://www.dafont.com/thousand-sunny.font)	- The title and heading typed in Unity. The font used is download from the font website.
FONT STYLE	:	Bold (Title) Normal (Instruction)	- The game background designs use a light beige brown background overlay with a dark blue background which is designed in Sketchbook. The output of the game background designs is in PNG file format.
FONT SIZE	:	100 (Title) 50 (Instruction)	
FONT COLOR	:	Dark blue (Title) White	- The close buttons design in the close icon which is designed in Sketchbook. The output of the game buttons design is in PNG file format.
LINE SPACING	:	1	- The animation of the close buttons is made by using Unity. When the button is hover, it will be showing the scaling animation.
TEXTURES	:	N/A	- The dot buttons design used a circle which design by Sketchbook. The output of the game buttons design is in PNG file format.

GRAPHIC	:	2D	ACTION/NAVIGATION
BACKGROUND	:	Light beige brown background overlay with a dark blue background	- The Close Button used to navigate the player able to close the setting panel and return to the main menu of the game. - The dot button used to navigate the player to the next page of instruction. - The player also can swipe to the left on the screen to view the next page of instruction.
AUDIO	:	click-21156.mp3 (Close Button Click Sound Effect) [Source: https://pixabay.com/music/]	
MUSIC	:	waves-and-tears-sad-piano-music-with-calm-ocean-waves-8164.mp3 [Source: https://pixabay.com/music/)	
VIDEO	:	N/A	
ANIMATION	:	Scaling Animation for Close Buttons	
BUTTON/SLIDER	:	B1 – Close Button B2 – Dot Button 1 B3 – Dot Button 2 B4 – Dot Button 2	
SCRIPT	:	Swipe	
PREVIOUS SCENE	:	Main menu (HOW TO PLAY Button)	

FRAME 13 (Quit)					
PROJECT TITLE	:	DORIS	**SCENE**	:	Main menu

DISPLAY SCREEN
If you leave now, the current progress won't be saved. Are you sure? No / Yes

DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is a confirmation message for quitting **DORIS** game to prevent the player's error. The player can access all the buttons in the game.
RESOLUTION	:	1920 x 1080 pixels	
FONT	:	ThousandSunny-Regular [Source: https://www.dafont.com/thousand-sunny.font)	- The description typed by using Unity, the font used is downloaded from free font website.
FONT STYLE	:	Normal	
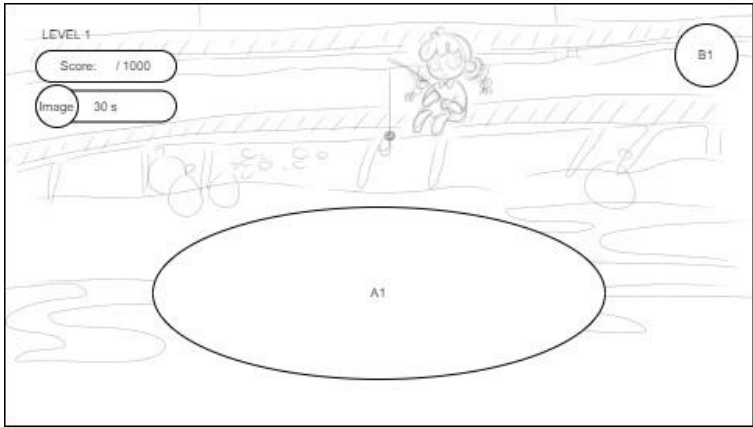
FONT SIZE	:	80	- The game background designs use a dark blue background which is designed in Sketchbook. The output of the background designs is in PNG file format.
FONT COLOR	:	Grey	
LINE SPACING	:	1	
TEXTURES	:	N/A	- The game buttons design in font style, the font used downloaded from free font website.
GRAPHIC	:	2D	**ACTION/NAVIGATION**
BACKGROUND	:	Dark blue background	- Yes Button used to navigate the player able to exit the game.
AUDIO	:	click-21156.mp3 (Close Button Click Sound Effect) [Source: https://pixabay.com/music/]	- No Button used to navigate the player able to return to the main menu of the game.
MUSIC	:	waves-and-tears-sad-piano-music-with-calm-ocean-waves-8164.mp3 [Source: https://pixabay.com/music/)	
VIDEO	:	N/A	
ANIMATION	:	N/A	
BUTTON/SLIDER	:	B1 – No Button B2 – Yes Button	
SCRIPT	:	MainMenu	
PREVIOUS SCENE	:	Main menu (QUIT Button)	

FRAME 14 (Beginner Guide)					
PROJECT TITLE	:	DORIS	**SCENE**	:	BeginnerGuide
DISPLAY SCREEN					

DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is the gameplay tutorial. This scene will start the
RESOLUTION	:	1920 x 1080 pixels	dialogue with the main character. The main character
FONT	:	ThousandSunny-Regular	will explain the gameplay of the **DORIS** game.
		[Source: https://www.dafont.com/thousand-	- In this scene, will have the dialogue elements. The
		sunny.font]	background will change depends on the dialogue
FONT STYLE	:	Normal (Dialogue text)	sentences.

	:	Italic (Hint text for navigate to next dialogue line)	- There is the ease in animation when the dialogue is start.
FONT SIZE	:	40 (Dialogue text) 30 (Hint text for navigate to next dialogue line)	- Under the dialogue box will have the hint text to navigate the player to press spacebar to load next sentence.
FONT COLOR	:	White (Dialogue) Orange (Hint text for navigate to next dialogue line)	
LINE SPACING	:	1	
TEXTURES	:	N/A	
GRAPHIC	:	2D	**ACTION/NAVIGATION**
BACKGROUND	:	Tutorial backgrounds	- The spacebar key used to trigger the next sentence of the dialogue.
AUDIO	:	pop-94319.mp3 (Dialogue pop out sound effect) [Source: https://pixabay.com/music/]	
MUSIC	:	best-adventure-ever-122726.mp3 [Source: https://pixabay.com/music/]	
VIDEO	:	N/A	
ANIMATION	:	N/A	
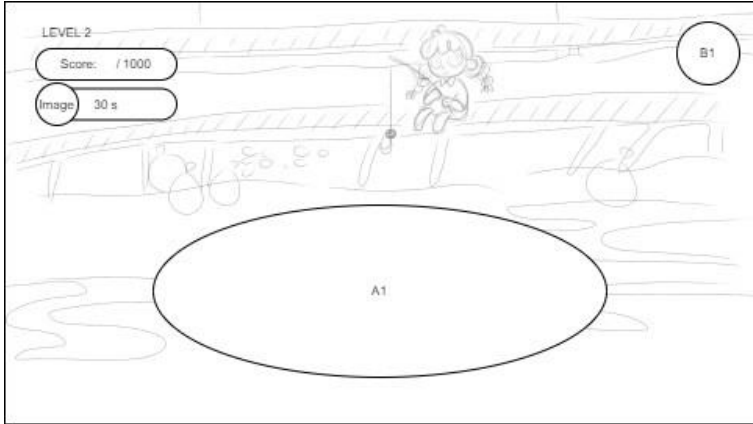
BUTTON/SLIDER	:	N/A
SCRIPT	:	DialogueManager DialogueTrigger
PREVIOUS SCENE	:	Main menu (PLAY Button)

FRAME 15 (Level 1)					
PROJECT TITLE	:	DORIS	**SCENE**	:	Level 1
DISPLAY SCREEN					

DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is a level 1 scene for the **DORIS** game.
RESOLUTION	:	1920 x 1080 pixels	- The game buttons design uses a circular box which is designed in Adobe Photoshop. The output of the game buttons design is in PNG file format.
FONT	:	ThousandSunny-Regular [Source: https://www.dafont.com/thousand-sunny.font]	- The game background is a town with a bridge on the river full of garbage.
FONT STYLE	:	Normal	- The gameplay is controlled by using the mouse.
FONT SIZE	:	50	- A1 refer to the rubbish area that contain the rubbish which needs the player to hook them up.
FONT COLOR	:	White (Level 1 text) Black (Score & time)	
LINE SPACING	:	N/A	
TEXTURES	:	N/A	
GRAPHIC	:	2D	**ACTION/NAVIGATION**
BACKGROUND	:	Town with a bridge on the river full of garbage	- Right mouse button used to navigate the player able to hook the rubbish.
AUDIO	:	Alert.mp3 (hook rubbish sound effect) mixkit-ethereal-fairy-win-sound-2019.mp3 (Game win sound effect)	- The Pause Button used to navigate the player to stop the game temporarily.

		lclick-13694.mp3 (Button click sound effect)
		click-21156.mp3 (Close button click sound effect)
MUSIC	:	game-comedy-interesting-playful-sweet-bright-childish-music-57040.mp3 [Source: https://pixabay.com/music/]
VIDEO	:	N/A
ANIMATION	:	Rope swinging animation
BUTTON/SLIDER	:	B1 – Pause Button
SCRIPT	:	GameManager AudioManager AudioSetting AchievementSystem RopeManager HookManager ScoreItem (Rubbish)
PREVIOUS SCENE	:	BeginnerGuide Level 1 (Pause Button > Replay Button)
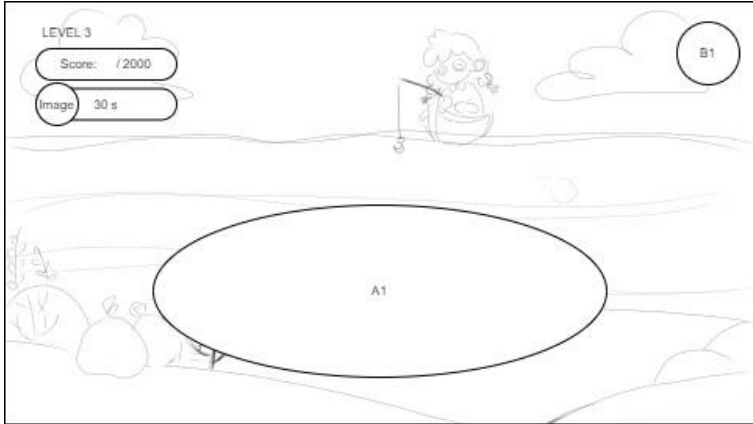
FRAME 16 (Level 2)					
PROJECT TITLE	:	DORIS	**SCENE**	:	Level 2
DISPLAY SCREEN					

DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is a level 2 scene for the **DORIS** game.
RESOLUTION	:	1920 x 1080 pixels	- The game buttons design uses a circular box which is designed in Adobe Photoshop. The output of the game buttons design is in PNG file format.
FONT	:	ThousandSunny-Regular [Source: https://www.dafont.com/thousand-sunny.font]	

FONT STYLE	:	Normal
FONT SIZE	:	50
FONT COLOR	:	White (Level 1 text)
		Black (Score & time)
LINE SPACING	:	N/A
TEXTURES	:	N/A
GRAPHIC	:	2D
BACKGROUND	:	Town with a bridge on the river full of garbage
AUDIO	:	Alert.mp3 (hook rubbish sound effect) mixkit-ethereal-fairy-win-sound-2019.mp3 (Game win sound effect) lclick-13694.mp3 (Button click sound effect) click-21156.mp3 (Close button click sound effect)
MUSIC	:	game-comedy-interesting-playful-sweet-bright-childish-music-57040.mp3 [Source: https://pixabay.com/music/]

- The game background is a town with a bridge on the river full of garbage.
- The gameplay is controlled by using the mouse.
- A1 refer to the rubbish area that contain the rubbish which needs the player to hook them up.

ACTION/NAVIGATION

- Right mouse button used to navigate the player able to hook the rubbish.
- The Pause Button used to navigate the player to stop the game temporarily.

VIDEO	:	N/A
ANIMATION	:	Rope swinging animation
BUTTON/SLIDER	:	B1 – Pause Button
SCRIPT	:	GameManager
		AudioManager
		AudioSetting
		AchievementSystem
		RopeManager
		HookManager
		ScoreItem (Rubbish)
PREVIOUS SCENE	:	Level 1 (Next Button)
		Level 2 (Pause Button > Replay Button)

FRAME 17 (Level 3)					
PROJECT TITLE	:	DORIS	**SCENE**	:	Level 3
DISPLAY SCREEN					

DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is a level 3 scene for the **DORIS** game.
RESOLUTION	:	1920 x 1080 pixels	- The game buttons design uses a circular box which is designed in Adobe Photoshop. The output of the game buttons design is in PNG file format.
FONT	:	ThousandSunny-Regular [Source: https://www.dafont.com/thousand-sunny.font]	

FONT STYLE	:	Normal	The game background is on the sea and the sea is full of rubbish.
FONT SIZE	:	50	
FONT COLOR	:	White (Level 1 text) Black (Score & time)	- The gameplay is controlled by using the mouse. - A1 refer to the rubbish area that contain the rubbish which needs the player to hook them up.
LINE SPACING	:	N/A	
TEXTURES	:	N/A	
GRAPHIC	:	2D	**ACTION/NAVIGATION**
BACKGROUND	:	On the sea with full of rubbish	- Right mouse button used to navigate the player able to hook the rubbish.
AUDIO	:	Alert.mp3 (hook rubbish sound effect) mixkit-ethereal-fairy-win-sound-2019.mp3 (Game win sound effect) lclick-13694.mp3 (Button click sound effect) click-21156.mp3 (Close button click sound effect)	- The Pause Button used to navigate the player to stop the game temporarily.
MUSIC	:	game-comedy-interesting-playful-sweet-bright-childish-music-57040.mp3 [Source: https://pixabay.com/music/]	
VIDEO	:	N/A	

ANIMATION	:	Rope swinging animation
BUTTON/SLIDER	:	B1 – Pause Button
SCRIPT	:	GameManager
		AudioManager
		AudioSetting
		AchievementSystem
		RopeManager
		HookManager
		ScoreItem (Rubbish)
PREVIOUS SCENE	:	Level 2 (Next Button)
		Level 3 (Pause Button > Replay Button)

FRAME 18 (Game Tutorial Part 2)					
PROJECT TITLE	:	DORIS	**SCENE**	:	MiddleGuide
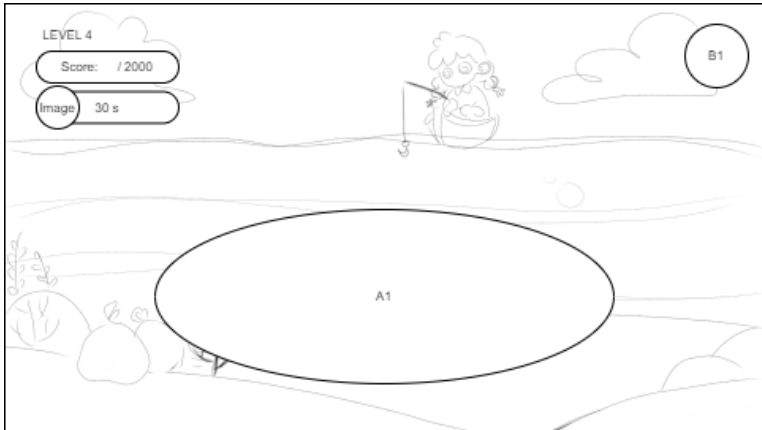
DISPLAY SCREEN

DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is the gameplay tutorial part 2 which will introduce the new game mechanics of the Level 4 and Level 5. This scene will start the dialogue with the main character. The main character will explain the gameplay of the **DORIS** game.
RESOLUTION	:	1920 x 1080 pixels	
FONT	:	ThousandSunny-Regular [Source: https://www.dafont.com/thousand-sunny.font]	
FONT STYLE	:	Normal (Dialogue text)	

		Italic (Hint text for navigate to next dialogue line)	- In this scene, will have the dialogue elements. The background will change depends on the dialogue sentences.
FONT SIZE	:	40 (Dialogue text) 30 (Hint text for navigate to next dialogue line)	- There is the ease in animation when the dialogue is start.
FONT COLOR	:	White (Dialogue) Orange (Hint text for navigate to next dialogue line)	- Under the dialogue box will have the hint text to navigate the player to press spacebar to load next sentence.
LINE SPACING	:	1	
TEXTURES	:	N/A	
GRAPHIC	:	2D	**ACTION/NAVIGATION**
BACKGROUND	:	Tutorial backgrounds	- The spacebar key used to trigger the next sentence of the dialogue.
AUDIO	:	N/A	
MUSIC	:	game-comedy-interesting-playful-sweet-bright-childish-music-57040.mp3 [Source: https://pixabay.com/music/]	
VIDEO	:	N/A	
ANIMATION	:	N/A	
BUTTON/SLIDER	:	N/A	

SCRIPT	:	DialogueManager	
		DialogueTrigger	
PREVIOUS SCENE	:	Level 3 (Win game > Next Button)	

FRAME 19 (Level 4)					
PROJECT TITLE	:	DORIS	SCENE	:	Level 4
DISPLAY SCREEN					

DESCRIPTIONS	NOTES

SCREEN SIZE	:	16:9 ratio	- This is a level 3 scene for the **DORIS** game.
RESOLUTION	:	1920 x 1080 pixels	- The game buttons design uses a circular box which is designed in Adobe Photoshop. The output of the game buttons design is in PNG file format.
FONT	:	ThousandSunny-Regular [Source: https://www.dafont.com/thousand-sunny.font]	
FONT STYLE	:	Normal	- The game background is on the sea and the sea is full of rubbish.
FONT SIZE	:	50	- The gameplay is controlled by using the mouse.
FONT COLOR	:	White (Level 1 text) Black (Score & time)	- A1 refer to the rubbish area that contain the rubbish which needs the player to hook them up.
LINE SPACING	:	N/A	
TEXTURES	:	N/A	
GRAPHIC	:	2D	**ACTION/NAVIGATION**
BACKGROUND	:	On the sea with full of rubbish	- Right mouse button used to navigate the player able to hook the rubbish.
AUDIO	:	Alert.mp3 (hook rubbish sound effect) mixkit-ethereal-fairy-win-sound-2019.mp3 (Game win sound effect) lclick-13694.mp3 (Button click sound effect)	- The Pause Button used to navigate the player to stop the game temporarily.

		click-21156.mp3 (Close button click sound effect)
		[Source: https://pixabay.com/music/]
MUSIC	:	game-comedy-interesting-playful-sweet-bright-childish-music-57040.mp3
		[Source: https://pixabay.com/music/]
VIDEO	:	N/A
ANIMATION	:	Rope swinging animation
BUTTON/SLIDER	:	B1 – Pause Button
SCRIPT	:	GameManager
		AudioManager
		AudioSetting
		AchievementSystem
		RopeManager
		HookManager
		ScoreItem (Rubbish)
PREVIOUS SCENE	:	MiddleGuide
		Level 2 (Pause Button > Replay Button)

FRAME 20 (Level 5)					
PROJECT TITLE	:	DORIS	**SCENE**	:	Level 5
DISPLAY SCREEN					

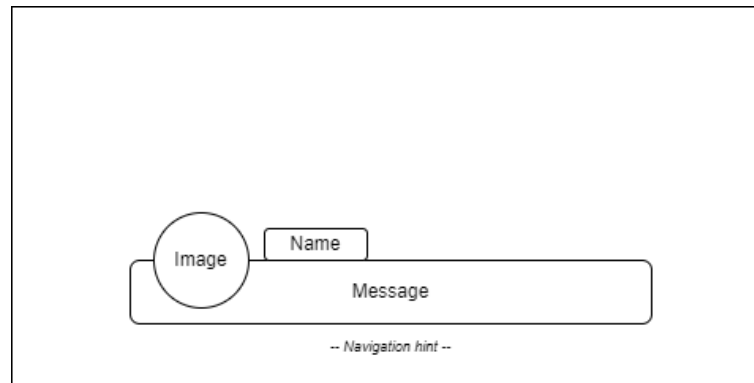| DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is a level 3 scene for the **DORIS** game.
RESOLUTION	:	1920 x 1080 pixels	- The game buttons design uses a circular box which is designed in Adobe Photoshop. The output of the game buttons design is in PNG file format.
FONT	:	ThousandSunny-Regular [Source: https://www.dafont.com/thousand-sunny.font]	
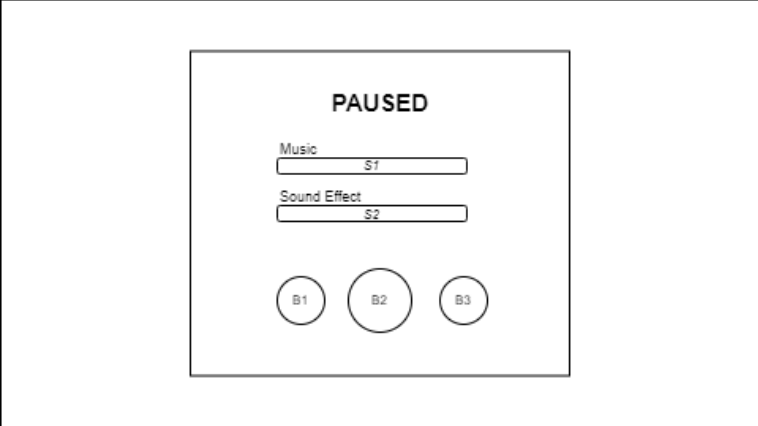
FONT STYLE	:	Normal	- The game background is under the sea and the sea is full of rubbish.
FONT SIZE	:	50	
FONT COLOR	:	White (Level 5 text) Black (Score & time)	- The gameplay is controlled by using the mouse. - A1 refer to the rubbish area that contain the rubbish which needs the player to hook them up.
LINE SPACING	:	N/A	
TEXTURES	:	N/A	
GRAPHIC	:	2D	**ACTION/NAVIGATION**
BACKGROUND	:	Under the sea with full of rubbish	- Right mouse button used to navigate the player able to hook the rubbish.
AUDIO	:	Alert.mp3 (hook rubbish sound effect) mixkit-ethereal-fairy-win-sound-2019.mp3 (Game win sound effect) lclick-13694.mp3 (Button click sound effect) click-21156.mp3 (Close button click sound effect) [Source: https://pixabay.com/music/]	- The Pause Button used to navigate the player to stop the game temporarily.
MUSIC	:	game-comedy-interesting-playful-sweet-bright-childish-music-57040.mp3 [Source: https://pixabay.com/music/]	

VIDEO	:	N/A
ANIMATION	:	Rope swinging animation
BUTTON/SLIDER	:	B1 – Pause Button
SCRIPT	:	GameManager
		AudioManager
		AudioSetting
		AchievementSystem
		RopeManager
		HookManager
		ScoreItem (Rubbish)
PREVIOUS SCENE	:	Level 1 (Next Button)
		Level 2 (Pause Button > Replay Button)

FRAME 21 (Rubbish Information)					
PROJECT TITLE	:	DORIS	**SCENE**	:	Level 1, Level 2, Level 3, Level 4, Level 5
DISPLAY SCREEN					

DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is a rubbish information of the **DORIS** game. The information panel will pop out when the player first time hook the certain type of rubbish.
RESOLUTION	:	1920 x 1080 pixels	
FONT	:	The Skinny (Rubbish name) ThousandSunny-Regular (Description)	

		[Source: https://www.dafont.com/thousand-sunny.font]	- The game background is designs in light beige brown and dark blue background which is designed in Sketchbook.
FONT STYLE	:	Normal	
FONT SIZE	:	80 (Rubbish name) 50 (Description)	- The close buttons design in cross icon which is designed in Sketchbook. The output of the game buttons design is in PNG file format.
FONT COLOR	:	White	
LINE SPACING	:	N/A	
TEXTURES	:	N/A	
GRAPHIC	:	2D	**ACTION/NAVIGATION**
BACKGROUND	:	Light beige brown and dark blue background	- The Close Button used to navigate the player to close the panel and continue the game.
AUDIO	:	lclick-13694.mp3 (Button click sound effect when open the panel) click-21156.mp3 (Button click sound effect when close the panel) [Source: https://pixabay.com/music/]	
MUSIC	:	game-comedy-interesting-playful-sweet-bright-childish-music-57040 .mp3(Level 1 – Level 3)	

		BG audio.mp3 (Level 4, Level 5)
		[Source: https://pixabay.com/music/]
VIDEO	:	N/A
ANIMATION	:	N/A
BUTTON/SLIDER	:	B1 – Close Button
SCRIPT	:	AchievementSystem
PREVIOUS SCENE	:	Level 1 (First time hook the rubbish)
		Level 2 (First time hook the rubbish)
		Level 3 (First time hook the rubbish)
		Level 4 (First time hook the rubbish)
		Level 5 (First time hook the rubbish)

-

FRAME 22 (Pause)					
PROJECT TITLE	:	DORIS	**SCENE**	:	Level 1, Level 2, Level 3, Level 4, Level 5
DISPLAY SCREEN					

DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is a pause menu of the **DORIS** game.
RESOLUTION	:	1920 x 1080 pixels	

FONT	:	ThousandSunny-Regular [Source: https://www.dafont.com/thousand-sunny.font]	- The game background is designs in dark blue background which is designed in Sketchbook. - The game buttons design in circular box which is designed in Adobe Photoshop. The output of the game buttons design is in PNG file format.
FONT STYLE	:	Normal	
FONT SIZE	:	100 (Title) 70 (Label)	
FONT COLOR	:	White	
LINE SPACING	:	N/A	
TEXTURES	:	N/A	
GRAPHIC	:	2D	**ACTION/NAVIGATION**
BACKGROUND	:	Dark blue background	- The Replay Button used to navigate the player to replay the particular level of the game.
AUDIO	:	lclick-13694.mp3 (Button click sound effect when open the panel) click-21156.mp3 (Button click sound effect when close the panel) [Source: https://pixabay.com/music/]	- The Resume Button used to navigate the player to return or continue to the game. - The Home Button is used to navigate the player to go to Main menu. - The Sound slider used to adjust the sound effect of the game.
MUSIC	:	game-comedy-interesting-playful-sweet-bright-childish-music-57040 .mp3(Level 1 – Level 3)	- The Music slider used to adjust the music of the game.

		BG audio.mp3 (Level 4, Level 5)	
		[Source: https://pixabay.com/music/]	
VIDEO	:	N/A	
ANIMATION	:	N/A	
BUTTON/SLIDER	:	B1 – Replay Button	
		B2 – Resume Button	
		B3 – Home Button	
		S1 – Music Slider	
		S2 – Sound Effect Slider	
SCRIPT	:	MainMenu	
		AudioManager	
		AudioSetting	
PREVIOUS SCENE	:	Level 1 (Pause Button)	
		Level 2 (Pause Button)	
		Level 3 (Pause Button)	
		Level 4 (Pause Button)	
		Level 5 (Pause Button)	

FRAME 23 (Win)					
PROJECT TITLE	:	DORIS	**SCENE**	:	Level 1, Level 2, Level 3, Level 4, Level 5

DISPLAY SCREEN
CONGRATULATIONS! You have complete the level Score: 0 B1 B2

DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is an example of the win of the **DORIS** game.
RESOLUTION	:	1920 x 1080 pixels	- The game background is designs in dark blue background which is designed in Sketchbook.
FONT	:	ThousandSunny-Regular	

		[Source: https://www.dafont.com/thousand-sunny.font]	- The game buttons design in circular box which is designed in Adobe Photoshop. The output of the game buttons design is in PNG file format.
FONT STYLE	:	Normal	
FONT SIZE	:	100 (Title) 30 (Description) 50 (Score)	
FONT COLOR	:	White	
LINE SPACING	:	N/A	
TEXTURES	:	N/A	
GRAPHIC	:	2D	**ACTION/NAVIGATION**
BACKGROUND	:	Dark blue background	- The Replay Button used to navigate the player to replay the particular level of the game.
AUDIO	:	click-21156.mp3 (Button click sound effect) mixkit-ethereal-fairy-win-sound-2019 (Win sound effect) [Source: https://pixabay.com/music/]	- The Next Button used to navigate the player to go to next level or next scene.
MUSIC	:	game-comedy-interesting-playful-sweet-bright-childish-music-57040 .mp3(Level 1 – Level 3)	

		BG audio.mp3 (Level 4, Level 5)
		[Source: https://pixabay.com/music/]
VIDEO	:	N/A
ANIMATION	:	N/A
BUTTON/SLIDER	:	B1 – Replay Button
		B2 – Next Button
SCRIPT	:	MainMenu
PREVIOUS SCENE	:	Level 1 (Hit target score)
		Level 2 (Hit target score)
		Level 3 (Hit target score)
		Level 4 (Hit target score)
		Level 5 (Hit target score)

FRAME 24 (Game Over)					
PROJECT TITLE	:	DORIS	**SCENE**	:	Level 1, Level 2, Level 3, Level 4, Level 5
DISPLAY SCREEN					

GAME OVER

Opps! Let's try again.

B1

DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is an example of the game over of the **DORIS** game.
RESOLUTION	:	1920 x 1080 pixels	
FONT	:	ThousandSunny-Regular	

		[Source: https://www.dafont.com/thousand-sunny.font]	- The game background is designs in dark blue background which is designed in Sketchbook.
FONT STYLE	:	Normal	- The game buttons design in circular box which is designed in Adobe Photoshop. The output of the game buttons design is in PNG file format.
FONT SIZE	:	100 (Title) 30 (Description)	
FONT COLOR	:	White	
LINE SPACING	:	N/A	
TEXTURES	:	N/A	
GRAPHIC	:	2D	**ACTION/NAVIGATION**
BACKGROUND	:	Dark blue background	- The Replay Button used to navigate the player to replay the particular level of the game.
AUDIO	:	click-21156.mp3 (Button click sound effect) [Source: https://pixabay.com/music/]	
MUSIC	:	game-comedy-interesting-playful-sweet-bright-childish-music-57040 .mp3(Level 1 – Level 3) BG audio.mp3 (Level 4, Level 5) [Source: https://pixabay.com/music/]	
VIDEO	:	N/A	

ANIMATION	:	N/A
BUTTON/SLIDER	:	B1 – Replay Button
SCRIPT	:	MainMenu
PREVIOUS SCENE	:	Level 1 (Hit target score)
		Level 2 (Hit target score)
		Level 3 (Hit target score)
		Level 4 (Hit target score)
		Level 5 (Hit target score)

FRAME 25 (End Result)					
PROJECT TITLE	:	DORIS	**SCENE**	:	EndResult

DISPLAY SCREEN

	DESCRIPTIONS		NOTES
SCREEN SIZE	:	16:9 ratio	- This scene is the final scene of the game. This scene will display the total score that the player has gain. This scene will also display quantity of each rubbish that the player has hook.
RESOLUTION	:	1920 x 1080 pixels	
FONT	:	ThousandSunny-Regular [Source: https://www.dafont.com/thousand-sunny.font]	

FONT STYLE	:	Normal	- The game background design is the ocean watercolour background which design by the software Sketchbook. The output of the background is in Portable Graphics Format (PNG) file format.
FONT SIZE	:	100 (Title & Total score) 70 (Header) 50 (Rubbish quantity)	
FONT COLOR	:	White (Title, Total score, & Header) Dark blue (Rubbish quantity)	- The game button is design in circular box which design by Adobe Photoshop.
LINE SPACING	:	N/A	
TEXTURES	:	N/A	
GRAPHIC	:	2D	**ACTION/NAVIGATION**
BACKGROUND	:	Ocean watercolour background	- The Home Button is used to navigate the player to go to Main menu.
AUDIO	:	winfantasia-6912 (Congratulations sound effect) lclick-13694.mp3 (Button click sound effect) click-21156.mp3 (Close button click sound effect)	- The Rubbish Information Button is used to navigate the player to open the information panel. The panel is about the rubbish and the effect of those rubbish.
MUSIC	:	N/A	
VIDEO	:	N/A	
ANIMATION	:	N/A	

BUTTON/SLIDER	:	B1 – Home Button
		B2 – Rubbish Information Button
SCRIPT	:	EndResult
PREVIOUS SCENE	:	Level 5 (Win game > Next Button)

FRAME 26 (Rubbish Information Book)					
PROJECT TITLE	:	DORIS	SCENE	:	EndResult
DISPLAY SCREEN					

DESCRIPTIONS			NOTES
SCREEN SIZE	:	16:9 ratio	- This is a rubbish information book of the **DORIS** game.
RESOLUTION	:	1920 x 1080 pixels	- The game background is designs in light beige brown and dark blue background which is designed in Sketchbook.
FONT	:	The Skinny (Rubbish name) ThousandSunny-Regular (Description) [Source: https://www.dafont.com/thousand-sunny.font]	- The close buttons design in cross icon which is designed in Sketchbook. The output of the game buttons design is in PNG file format.
FONT STYLE	:	Normal	
FONT SIZE	:	100 (Rubbish name) 50 (Description)	- The Rubbish Button (B2 – B8) is design in rectangular box with related rubbish image which is design in Sketchbook. The output of the game buttons design is in PNG file format.
FONT COLOR	:	Dark (Rubbish name) White (Description)	
LINE SPACING	:	N/A	
TEXTURES	:	N/A	
GRAPHIC	:	2D	**ACTION/NAVIGATION**
BACKGROUND	:	Light beige brown and dark blue background	- The Close Button used to navigate the player to close the panel and continue the game.
AUDIO	:	lclick-13694.mp3 (Button click sound effect when open the panel)	

		click-21156.mp3 (Button click sound effect when close the panel) [Source: https://pixabay.com/music/]	- The Rubbish A, B, C, D, E, F, and G Buttons used to navigate the player to view the related rubbish information.
MUSIC	:	N/A	
VIDEO	:	N/A	
ANIMATION	:	N/A	
BUTTON/SLIDER	:	B1 – Close Button B2 – Rubbish A Button B3 – Rubbish B Button B4 – Rubbish C Button B5 – Rubbish D Button B6 – Rubbish E Button B7 – Rubbish F Button B8 – Rubbish G Button	
SCRIPT	:	N/A	
PREVIOUS SCENE	:	EndResult (Rubbish Information Button)	

APPENDIX E
ALPHA TESTING (FUNCTIONALITY TESTING)

USER ACCEPTANCE TEST (UAT) – ALPHA TESTING

This is the functionality testing form for DORIS 2D PC game application, used to test the functionality of the game. This functionality testing is divided into 10 sections: A, B, C, D, E, F, G, H, I, and J. Please tick (√) or cross (×) on the checkbox given.

Please refer to the link to download the game:

https://drive.google.com/drive/folders/1dROKhIpNVENQEpNEKyr1CShKrExDn6QM?usp=sharing

Section A – Intro Story

No	Event	Functionality	Expected Result	Result Pass (√)	Fail (×)
Intro Story Part 1					
1.	Access the game	Story start	Able to view the story	√	
2.	Background music start	Background music start	Able to hear the background music	√	
3.	Show loading screen	Loading screen display	Able to load loading screen	√	
Intro Story Part 2					
1.	Dialogue appears	Dialogue start	Able to view the dialogue	√	
2.	Press spacebar	Load next dialogue or next scene	Able to load next dialogue or next scene	√	

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Section B – Main Menu

No	Event	Functionality	Expected Result	Result Pass (√)	Fail (×)
1.	Background music start	Play Background music	Able to play background music	√	
2.	Hover on buttons	Scaling the button	Button will be scaling when hover on the buttons	√	
3.	Click the SETTING button	To show Setting Panel	Setting Panel appear	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
4.	Click the HOW TO PLAY button	To show Game Guide Panel	Game Guide appear	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
5.	Click QUIT button	To show quit message panel	Quit message panel appear	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
6.	Click PLAY button	To access Game Tutorial	Able to access Game Tutorial scene	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Setting Panel					
1.	Setting Panel appeared	Show two sliders and three buttons	Able to adjust all the sliders and press all the buttons	√	
2.	Adjust music volume slider	Turn down/turn up the music	Able to turn down/turn up the music	√	

				√	
3.	Adjust sound volume slider	Turn down/turn up the sound effect of the game	Able to turn down/turn up the sound effect of the game	√	
4.	Press close button	To close the Setting Panel/Go back to Main Menu	Able to close the Setting Panel/Go back to Main Menu	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Game Guide Panel					
1.	How To Play Panel appeared	Show the game tutorials	Able to swipe the screen to the left to show the other instruction.	√	
2.	Press close button	Close HOW TO PLAY Panel/ Go back to Main Menu	Able to close the HOW TO PLAY Panel/Go back to Main Menu	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Quit message panel					
1.	Quit message panel appeared	Show quit confirmation message, No button, and Yes button.	Able to view quit confirmation message, and can press No button, and Yes button.	√	
2.	Press No button	To close the message panel and go back to Main Menu	Able to go back to Main Menu	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
3.	Press Yes button	To quit the game	Able to quit the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	

Section C – Game Tutorial Part 1

No	Event	Functionality	Expected Result	Result Pass (√)	Fail (×)
1.	Background music start	Play background music	Able to play background music	√	
2.	Dialogue appears	Dialogue start	Able to view the dialogue	√	
3.	Press spacebar	Load next dialogue	Able to load next dialogue	√	
	If Last sentence				
4.	Press spacebar	Load Level 1	Able to access Level 1	√	

Section D – Level 1

No	Event	Functionality	Expected Result	Result Pass (√)	Fail (×)
1.	Background music start	Play background music	Able to play background music	√	
2.	Press right mouse button	To extend the rope	Able to extend the rope	√	
		Play rope extend sound effect	Able to play rope extend sound effect	√	
3.	Press Pause button	To show Paused panel and stop the game	Able to show Paused Panel and stop the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
4.	Extend the rope	To hook the rubbish	Able to hook the rubbish and take back the rubbish up	√	
5.	Take back rubbish	Rubbish disappears	Rubbish will disappear and get points.	√	

		Show the points get	Able to show the added point	√	
Hook the *Apple Core*					
1.	Get 50 points	To add 50 points	Able to add 50 points	√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
	First time hook the Apple Core				
3.	Apple core Information Panel appeared	To show the Apple Core information.	Able to view the Apple Core information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 1 and continue the game	Able to return to Level 1 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Hook the *Tin*					
1.	Get 300 points	To add 300 points	Able to add 300points	√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
	First time hook the Tin				
3.	Tin Information Panel appeared	To show the Tin information.	Able to view the Tin information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 1 and continue the game	Able to return to Level 1 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	

Hook the *Milk Bottle*				
1.	Get 100 points	To add 100 points	Able to add 100 points	√
2.	Play sound effect	Play sound effect	Able to play sound effect	√
	First time hook the Milk Bottle			
3.	Milk Bottle Information Panel appeared	To show the Milk Bottle information.	Able to view the Milk Bottle information	√
4.	Press Close button	Close the Information Panel/ Go back to Level 1 and continue the game	Able to return to Level 1 and continue the game	√
		Display button click sound	Able to hear button click sound when click the buttons.	√
Paused Panel				
1.	Pause Panel appeared	To show two sliders and three buttons	Able to adjust all the sliders and press all the buttons	√
2.	Adjust music volume slider	Turn down/turn up the music	Able to turn down/turn up the music	√
3.	Adjust sound volume slider	Turn down/turn up the sound effect of the game	Able to turn down/turn up the sound effect of the game	√
4.	Press home button	To show confirmation message panel	Confirmation message panel appear	√
		Display button click sound	Able to hear button click sound when click the buttons.	√
5.	Press replay button	To start over Level 1	Able to start over Level 1	√
		Display button click sound	Able to hear button click sound when click the buttons.	√

6.	Press resume button	To continue the game	Able to continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Confirmation message panel					
1.	Confirmation message panel appeared	Show confirmation message, No button, and Yes button.	Able to view confirmation message, and can press No button, and Yes button.	√	
2.	Press No button	To close the message panel and go back to Paused Panel	Able to go back to Paused Panel	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
3.	Press Yes button	To go back to Main Menu	Able to go back to Main Menu	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Win					
1.	Play win sound effect	Play win sound effect	Able to play win sound effect	√	
2.	Press replay button	To start over Level 1	Able to start over Level 1	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
3.	Press next button	To go to Level 2	Able to access Level 2	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Game Over					

No	Event	Functionality	Expected Result	Pass (√)	Fail (×)
1.	Press replay button	To start over Level 1	Able to start over Level 1	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	

Section E – Level 2

No	Event	Functionality	Expected Result	Result Pass (√)	Result Fail (×)
1.	Background music start	Play background music	Able to play background music	√	
2.	Press right mouse button	To extend the rope	Able to extend the rope	√	
		Play rope extend sound effect	Able to play rope extend sound effect	√	
3.	Press Pause button	To show Paused panel and stop the game	Able to show Paused Panel and stop the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
4.	Extend the rope	To hook the rubbish	Able to hook the rubbish and take back the rubbish up	√	
5.	Take back rubbish	Rubbish disappears	Rubbish will disappear and get points.	√	
		Show the points get	Able to show the added point	√	
Hook the *Apple Core*					
1.	Get 50 points	To add 50 points	Able to add 50 points	√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
	First time hook the *Apple Core*				

				√	
3.	Apple core Information Panel appeared	To show the Apple Core information.	Able to view the Apple Core information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 2 and continue the game	Able to return to Level 2 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Hook the *Tin*					
1.	Get 300 points	To add 50 points	Able to add 300 points	√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
	First time hook the *Tin*				
3.	Tin Information Panel appeared	To show the Tin information.	Able to view the Tin information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 2 and continue the game	Able to return to Level 2 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Hook the *Milk Bottle*					
1.	Get 100 points	To add 100 points	Able to add 100 points	√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
	First time hook the *Milk Bottle*				

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				√	
3.	Milk Bottle Information Panel appeared	To show the Milk Bottle information.	Able to view the Milk Bottle information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 2 and continue the game	Able to return to Level 2 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	

Hook the *Can*

1.	Get 500 points	To add 500 points	Able to add 500 points	√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	

	First time hook the *Can*				
3.	Can Information Panel appear	To show the Can information.	Able to view the Can information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 2 and continue the game	Able to return to Level 2 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	

Paused Panel

1.	Pause Panel appeared	To show two sliders and three buttons	Able to adjust all the sliders and press all the buttons	√	
2.	Adjust music volume slider	Turn down/turn up the music	Able to turn down/turn up the music	√	
3.	Adjust sound volume slider	Turn down/turn up the sound effect of the game	Able to turn down/turn up the sound effect of the game	√	

		To show confirmation message panel	Confirmation message panel appear	√	
4.	Press home button	Display button click sound	Able to hear button click sound when click the buttons.	√	
5.	Press replay button	To start over Level 2	Able to start over Level 2	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
6.	Press resume button	To continue the game	Able to continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Confirmation message panel					
1.	Confirmation message panel appeared	Show confirmation message, No button, and Yes button.	Able to view confirmation message, and can press No button, and Yes button.	√	
2.	Press No button	To close the message panel and go back to Paused Panel	Able to go back to Paused Panel	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
3.	Press Yes button	To go back to Main Menu	Able to go back to Main Menu	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Win					
1.	Play win sound effect	Play win sound effect	Able to play win sound effect	√	
2.	Press replay button	To start over Level 2	Able to start over Level 2	√	

		Display button click sound	Able to hear button click sound when click the buttons.	√	
3.	Press next button	To go to Level 3	Able to access Level 3	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Game Over					
1.	Press replay button	To start over Level 2	Able to start over Level 2	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	

Section F– Level 3

No	Event	Functionality	Expected Result	Result	
				Pass (√)	Fail (×)
1.	Background music start	Play background music	Able to play background music	√	
2.	Press right mouse button	To extend the rope	Able to extend the rope	√	
		Play rope extend sound effect	Able to play rope extend sound effect	√	
3.	Press Pause button	To show Paused panel and stop the game	Able to show Paused Panel and stop the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
4.	Extend the rope	To hook the rubbish	Able to hook the rubbish and take back the rubbish up	√	
5.	Take back rubbish	Rubbish disappears	Rubbish will disappear and get points.	√	
		Show the points get	Able to show the added point	√	

Hook the *Apple Core*					
1.	Get 50 points	To add 50 points	Able to add 50 points	√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
	First time hook the *Apple Core*				
3.	Apple core Information Panel appeared	To show the Apple Core information.	Able to view the Apple Core information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 3 and continue the game	Able to return to Level 3 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Hook the *Tin*					
1.	Get 300 points	To add 300 points	Able to add 300 points	√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
	First time hook the *Tin*				
3.	Tin Information Panel appeared	To show the Tin information.	Able to view the Tin information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 3 and continue the game	Able to return to Level 3 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Hook the *Milk Bottle*					

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1.	Get 100 points	To add 100 points	Able to add 100 points	√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
	First time hook the *Milk Bottle*				
3.	Milk Bottle Information Panel appeared	To show the Milk Bottle information.	Able to view the Milk Bottle information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 3 and continue the game	Able to return to Level 3 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Hook the *Can*					
1.	Get 500 points	To add 500 points	Able to add 500 points	√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
	First time hook the *Can*				
3.	Can Information Panel appear.	To show the Can information.	Able to view the Can information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 3 and continue the game	Able to return to Level 3 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Hook the *Milk tea bottle*					
1.	Get 800 points	To add 800 points	Able to add 800 points	√	

2.	Play sound effect	Play sound effect	Able to play sound effect	√	
	First time hook the *Milk tea bottle*				
3.	Milk tea bottle Information Panel appeared	To show the Milk tea bottle information.	Able to view the Milk tea bottle information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 3 and continue the game	Able to return to Level 3 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Paused Panel					
1.	Pause Panel appeared	To show two sliders and three buttons	Able to adjust all the sliders and press all the buttons	√	
2.	Adjust music volume slider	Turn down/turn up the music	Able to turn down/turn up the music	√	
3.	Adjust sound volume slider	Turn down/turn up the sound effect of the game	Able to turn down/turn up the sound effect of the game	√	
4.	Press home button	To show confirmation message panel	Confirmation message panel appear	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
5.	Press replay button	To start over Level 3	Able to start over Level 3	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
6.	Press resume button	To continue the game	Able to continue the game	√	

		Display button click sound	Able to hear button click sound when click the buttons.	√	
Confirmation message panel					
1.	Confirmation message panel appeared	Show confirmation message, No button, and Yes button.	Able to view confirmation message, and can press No button, and Yes button.	√	
2.	Press No button	To close the message panel and go back to Paused Panel	Able to go back to Paused Panel	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
3.	Press Yes button	To go back to Main Menu	Able to go back to Main Menu	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Win					
1.	Play win sound effect	Play win sound effect	Able to play win sound effect	√	
2.	Press replay button	To start over Level 3	Able to start over Level 3	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
3.	Press next button	To go to Game tutorial of Level 4 and Level 5	Able to access Game tutorial of Level 4 and Level 5	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Game Over					
1.	Press replay button	To start over Level 3	Able to start over Level 3	√	

		Display button click sound	Able to hear button click sound when click the buttons.	√	

Section G – Game Tutorial Part 2

No	Event	Functionality	Expected Result	Result Pass (√)	Fail (×)
1.	Background music start	Play background music	Able to play background music	√	
2.	Dialogue appears	Dialogue start	Able to view the dialogue	√	
3.	Press spacebar	Show next dialogue	Able to show next dialogue	√	
	Last sentence				
4.	Press spacebar	Load Level 4	Able to access Level 4	√	

Section H – Level 4

No	Event	Functionality	Expected Result	Result Pass (√)	Fail (×)
1.	Background music start	Play background music	Able to play background music	√	
2.	Press right mouse button	To extend the rope	Able to extend the rope	√	
		Play rope extend sound effect	Able to play rope extend sound effect	√	
3.	Press Pause button	To show Paused panel and stop the game	Able to show Paused Panel and stop the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	

4.	Extend the rope	To hook the rubbish	Able to hook the rubbish and take back the rubbish up	√	
		To hook the fish	Able to hook the fish and take back the fish up	√	
5.	Take back rubbish	Rubbish disappears	Rubbish will disappear and get points.	√	
		Show the points get	Able to show the added point	√	
	Take back fish	Fish disappears	Fish will disappear and deduct the points.	√	
		Show the points deducted	Able to show the deducted point	√	
Hook the *Apple Core*					
1.	Get 50 points	To add 50 points	Able to add 50 points	√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
	First time hook the *Apple Core*				
3.	Apple core Information Panel appeared	To show the Apple Core information.	Able to view the Apple Core information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 4 and continue the game	Able to return to Level 4 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Hook the *Tin*					
1.	Get 300 points	To add 300 points	Able to add 300 points	√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
	First time hook the *Tin*				

				√	
3.	Tin Information Panel appeared	To show the Tin information.	Able to view the Tin information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 4 and continue the game	Able to return to Level 4 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Hook the *Milk Bottle*					
1.	Get 100 points	To add 100 points	Able to add 100 points	√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
	First time hook the *Milk Bottle*				
3.	Milk Bottle Information Panel appeared	To show the Milk Bottle information.	Able to view the Milk Bottle information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 4 and continue the game	Able to return to Level 4 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Hook the *Can*					
1.	Get 500 points	To add 500 points	Able to add 500 points	√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
	First time hook the *Can*				

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3.	Can Information Panel appear.	To show the Can information.	Able to view the Can information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 4 and continue the game	Able to return to Level 4 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Hook the *Milk tea bottle*					
1.	Get 800 points	To add 800 points	Able to add 800 points	√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
	First time hook the *Milk tea bottle*				
3.	Milk tea bottle Information Panel appeared	To show the Milk tea bottle information.	Able to view the Milk tea bottle information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 4 and continue the game	Able to return to Level 4 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Hook the *Plastic bottle*					
1.	Get 1000 points	To add 1000 points	Able to add 1000 points	√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
	First time hook the *Plastic bottle*				

				√	
3.	Plastic bottle Information Panel appeared	To show the Plastic bottle information.	Able to view the Plastic bottle information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 4 and continue the game	Able to return to Level 4 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Hook the *Fish*					
1.	Deduct 5 points	To deduct 5 points	Able to deduct 5 points	√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
Paused Panel					
1.	Pause Panel appeared	To show two sliders and three buttons	Able to adjust all the sliders and press all the buttons	√	
2.	Adjust music volume slider	Turn down/turn up the music	Able to turn down/turn up the music	√	
3.	Adjust sound volume slider	Turn down/turn up the sound effect of the game	Able to turn down/turn up the sound effect of the game	√	
4.	Press home button	To show confirmation message panel	Confirmation message panel appear	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
5.	Press replay button	To start over Level 4	Able to start over Level 4	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
6.	Press resume button	To continue the game	Able to continue the game	√	

		Display button click sound	Able to hear button click sound when click the buttons.	√	
Confirmation message panel					
1.	Confirmation message panel appeared	Show confirmation message, No button, and Yes button.	Able to view confirmation message, and can press No button, and Yes button.	√	
2.	Press No button	To close the message panel and go back to Paused Panel	Able to go back to Paused Panel	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
3.	Press Yes button	To go back to Main Menu	Able to go back to Main Menu	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Win					
1.	Play win sound effect	Play win sound effect	Able to play win sound effect	√	
2.	Press replay button	To start over Level 4	Able to start over Level 4	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
3.	Press next button	To go to Level 5	Able to access Level 5	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Game Over					
1.	Press replay button	To start over Level 4	Able to start over Level 4	√	

		Display button click sound	Able to hear button click sound when click the buttons.	√	

Section I – Level 5

No	Event	Functionality	Expected Result	Result Pass (√)	Fail (×)
1.	Background music start	Play background music	Able to play background music	√	
2.	Press right mouse button	To extend the rope	Able to extend the rope	√	
		Play rope extend sound effect	Able to play rope extend sound effect	√	
3.	Press Pause button	To show Paused panel and stop the game	Able to show Paused Panel and stop the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
4.	Extend the rope	To hook the rubbish	Able to hook the rubbish and take back the rubbish up	√	
		To hook the fish	Able to hook the fish and take back the fish up	√	
5.	Take back rubbish	Rubbish disappears	Rubbish will disappear and get points.	√	
		Show the points get	Able to show the added point	√	
	Take back fish	Fish disappears	Fish will disappear and deduct the points.	√	
		Show the points deducted	Able to show the deducted point	√	
Hook the *Apple Core*					
1.	Get 50 points	To add 50 points	Able to add 50 points	√	

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	2.	Play sound effect	Play sound effect	Able to play sound effect	√	
		First time hook the *Apple Core*				
	3.	Apple core Information Panel appeared	To show the Apple Core information.	Able to view the Apple Core information	√	
	4.	Press Close button	Close the Information Panel/ Go back to Level 5 and continue the game	Able to return to Level 5 and continue the game	√	
			Display button click sound	Able to hear button click sound when click the buttons.	√	
Hook the *Tin*						
	1.	Get 300 points	To add 300 points	Able to add 300 points	√	
	2.	Play sound effect	Play sound effect	Able to play sound effect	√	
		First time hook the *Tin*				
	3.	Tin Information Panel appeared	To show the Tin information.	Able to view the Tin information	√	
	4.	Press Close button	Close the Information Panel/ Go back to Level 5 and continue the game	Able to return to Level 5 and continue the game	√	
			Display button click sound	Able to hear button click sound when click the buttons.	√	
Hook the *Milk Bottle*						
	1.	Get 100 points	To add 100 points	Able to add 100 points	√	

				√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
	First time hook the *Milk Bottle*				
3.	Milk Bottle Information Panel appeared	To show the Milk Bottle information.	Able to view the Milk Bottle information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 5 and continue the game	Able to return to Level 5 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Hook the *Can*					
1.	Get 500 points	To add 500 points	Able to add 500 points	√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
	First time hook the *Can*				
3.	Can Information Panel appeared.	To show the Can information.	Able to view the Can information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 5 and continue the game	Able to return to Level 5 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Hook the *Milk tea bottle*					
1.	Get 800 points	To add 800 points	Able to add 800 points	√	

				√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
	First time hook the *Milk tea bottle*				
3.	Milk tea bottle Information Panel appeared	To show the Milk tea bottle information.	Able to view the Milk tea bottle information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 5 and continue the game	Able to return to Level 5 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Hook the *Plastic bottle*					
1.	Get 1000 points	To add 1000 points	Able to add 1000 points	√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
	First time hook the *Plastic bottle*				
3.	Plastic bottle Information Panel appeared	To show the Plastic bottle information.	Able to view the Plastic bottle information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 5 and continue the game	Able to return to Level 5 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Hook the *Plastic bag*					
1.	Get 1300 points	To add 1300 points	Able to add 1300 points	√	

				√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
	First time hook the *Plastic bag*				
3.	Plastic bag Information Panel appeared	To show the Plastic bag information.	Able to view the Plastic bag information	√	
4.	Press Close button	Close the Information Panel/ Go back to Level 5 and continue the game	Able to return to Level 5 and continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Hook the *Fish*					
1.	Deduct 5 points	To deduct 5 points	Able to deduct 5 points	√	
2.	Play sound effect	Play sound effect	Able to play sound effect	√	
Paused Panel					
1.	Pause Panel appeared	To show two sliders and three buttons	Able to adjust all the sliders and press all the buttons	√	
2.	Adjust music volume slider	Turn down/turn up the music	Able to turn down/turn up the music	√	
3.	Adjust sound volume slider	Turn down/turn up the sound effect of the game	Able to turn down/turn up the sound effect of the game	√	
4.	Press home button	To show confirmation message panel	Confirmation message panel appear	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
5.	Press replay button	To start over Level 5	Able to start over Level 5	√	

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		Display button click sound	Able to hear button click sound when click the buttons.	√	
6.	Press resume button	To continue the game	Able to continue the game	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Confirmation message panel					
1.	Confirmation message panel appeared	Show confirmation message, No button, and Yes button.	Able to view confirmation message, and can press No button, and Yes button.	√	
2.	Press No button	To close the message panel and go back to Paused Panel	Able to go back to Paused Panel	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
3.	Press Yes button	To go back to Main Menu	Able to go back to Main Menu	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Win					
1.	Play win sound effect	Play win sound effect	Able to play win sound effect	√	
2.	Press replay button	To start over Level 5	Able to start over Level 5	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
3.	Press next button	To go to End result scene	Able to access End result scene	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
Game Over					
1.	Press replay button	To start over Level 5	Able to start over Level 4	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	

Section J – End Result

No	Event	Functionality	Expected Result	Pass (√)	Fail (×)
1.	Background music start	Play background music	Able to play background music	√	
2.	Display total score	To display total score	Able to display total score	√	
3.	Display Apple core total quantity	To display Apple core total quantity	Able to display Apple core total quantity.	√	
4.	Display Tin total quantity	To display Tin total quantity	Able to display Tin total quantity.	√	
5.	Display Can total quantity	To display Can total quantity	Able to display Can total quantity	√	
6.	Display Milk bottle total quantity	To display Milk bottle total quantity	Able to display Milk bottle total quantity	√	
7.	Display Milk tea bottle total quantity	To display Milk tea bottle total quantity	Able to display Milk tea bottle total quantity	√	
8.	Display Plastic bottle total quantity	To display Plastic bottle total quantity	Able to display Plastic bottle total quantity	√	
9.	Display Plastic bag total quantity	To display Plastic bag total quantity	Able to display Plastic bag total quantity	√	
10.	Press Book Button	To show rubbish information panel	Rubbish information panel appear	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	
11.	Press Home Button	To go back to Main Menu	Able to go back to Main Menu	√	
		Display button click sound	Able to hear button click sound when click the buttons.	√	

Rubbish Informational Panel				
1.	Rubbish Informational Panel appear	To show rubbish information	Able to show rubbish information	√
2.	Press Apple core image button	To show Apple core information	Able to show Apple core information	√
3.	Press Tin image button	To show Tin information	Able to show Tin information	√
4.	Press Can image button	To show Can information	Able to show Can information	√
5.	Press Milk bottle image button	To show Milk bottle information	Able to show Milk bottle information	√
6.	Press Milk tea bottle image button	To show Milk tea bottle information	Able to show Milk tea bottle information	√
7.	Press Plastic bottle image button	To show Plastic bottle information	Able to show Plastic bottle information	√
8.	Press Plastic bag image button	To show Plastic bag information	Able to show Plastic bag information	√
9.	Press Close button	To close the Rubbish Information Panel	Able to close the Rubbish Information Panel	√
		Display button click sound	Able to hear button click sound when click the buttons.	√

NAME: Goh Mei Kei

AGE: 24

Final Year Project - Usability Testing of DORIS Game Application

Hi and good day, I am Yong Rong See, a final year student from Faculty of Computing with Bachelor of Computer Science (Graphic & Multimedia Technology) in University Malaysia Pahang. Currently I am doing my Final Year Project on the title of ENVIRONMENTAL AWARENESS ON WATER POLLUTION THROUGH 2D GAME APPLICATION (DORIS). I would like to conduct an usability testing of the DORIS Game Application for the primary student (7 - 12 years old).

This form will be divided to 2 part :
Part A: Profile
Part B: Survey

Kindly fill in the form to help me in complete this usablilty testing. Thank you for your time and patience, your response is greatly appreciated!

DORIS game application is a PC-based game application. You can download the game from the link given below:
https://rossee0813.itch.io/doris

1. Gender *

◯ Male

◯ Female

2. Age Group *

◯ Below 12 years old

◯ 13 - 20 years old

◯ 20 - 30 years old

◯ 31 - 49 years old

◯ 50 years old and above

There are some question regarding the DORIS game application. *
Please choose your degrees of agreement and disagreement.

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
It is easy to use and enjoy to playing this game.	○	○	○	○	○
It is well functioning when playing this game	○	○	○	○	○
The instruction given in the game is clear and understandable	○	○	○	○	○
The user interface design is suitable for this game	○	○	○	○	○
The game is suitable to implement in primary school	○	○	○	○	○
It can gain the knowledge of Water Pollution issues after playing the game	○	○	○	○	○
It can enhance the awareness of the Water Pollution	○	○	○	○	○

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

Your answer