THINK SAFE: A ROAD SAFETY AWARENESS THROUGH 3D ROLE PLAYING GAME

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This report is submitted in partial fulfilment of the requirements for the Bachelor of Information Technology (Game Technology) With Honours.

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
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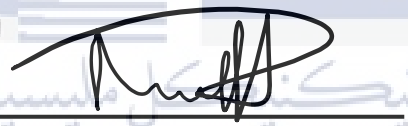
DECLARATION

I hereby declare that this project entitled
THINK SAFE: A ROAD SAFETY AWARENESS THROUGH 3D ROLE PLAYING GAME
is written by me and is my own effort and that no part has been plagiarized without citations.

STUDENT:  Date: 29/6/2021

(MOHD NAJIB BIN ABD HALIM)

I hereby declare that I have read this project report and found this project report is sufficient in term of the scope and quality for the award of Bachelor of Information Technology (Game Technology) with Honours.

SUPERVISOR: *M.HaziqLim* Date: 03/09/2021

(DR. MUHAMMAD HAZIQ LIM BIN ABDULLAH)

DEDICATION

Praise to Almighty Allah S.W.T

To my supervisor, Ts. Dr. Muhammad Haziq Lim Bin Abdullah who always giving so much motivation and attention in term of guiding me throughout the project development process and report writing

To my beloved parents, wife and son, thank you for understanding and great support of encouragement and motivation through the time

Finally, not to forget to Universiti Teknikal Malaysia Melaka that giving such a great opportunity for me to enhance my skills and resources to make this project possible

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Grateful to Almighty Allah S.W.T and His bless for giving me strength and ability to complete the project in time provided with great satisfaction

I would like to thank my supervisor, Ts. Dr. Muhammad Haziq Lim Bin Abdullah, my sincerely gratitude to him for guiding me through the development process of this project from report writing to the game development phase. Not to forget great dedication and attention by him giving motivation to keep the working momentum were on pace.

Furthermore, a huge appreciation to my beloved parents, wife and son for understanding and great support when come to words of encouragement and motivation through the tough time.

Finally, not to forget to Universiti Teknikal Malaysia Melaka that giving such a great opportunity for me to enhance my skills and resources to make this project possible.

ABSTRACT

This project was focusing on the development of the Role-Playing Game genre that are inspired from Road Safety Awareness program conducted by related authorities in road safety in purposes as alternative way to teach people especially children about road safety through video game. This project starts with finding problem that relevant to game development. The problem is the children with basic of road safety without experience of scenario on the road is unsuitable for being safe in the road, road safety awareness approach is still not effective because children not able to gain useful knowledge and children still get negative effects because some approaching method maybe not reach to the expectations and can be harmful for them if it makes a false sense of safety and overconfident. Furthermore, schools with road safety learning programme still use a traditional way (say and write) without hands on method and suitable timing, there are young people are not interested with so much theoretical learning and there are still insufficient of materials provided to family and teachers in order to teach students. In fact, children may search a right road safety awareness program outside by using web-based application, but it is still differed with road rules and environment in Malaysia if children want to use the application as medium for learning road safety. This project aims to determine the improvement of knowledge about traffic rules and conditions after children play, to introduce a new alternative road safety teaching method, to transfer knowledge about road safety to children aged seven to twelve years old, to analyse the factors that can influence learning through playful learning and presents a new alternative

teaching method for road safety education. The project uses the Game Development Life Cycle model as a methodology that consists of four phases such as start-up phase, pre-production phase, production phase and testing phase before turning into a gold master release. Through a literature review, developer found four findings which are 3D RPG game can visualize virtual environment to trigger players reaction, the game design can be effectiveness tool for children learning, the game approach can improve road safety awareness advocation and the game can trigger behaviours and experience of learning. In conclusion this game was developed to approach younger generation with a new way to learn the road safety rules, code of conduct and safely practise in virtual mode as well as become support system of current children road safety awareness learning program especially for children. The significance of this project is aimed to teach children about traffic safety, realize their familiarity with road rules and conditions after play the game. Moreover, it will introduce a new alternative method of road safety education. Hence, it will support children learning through fun games and on the same time to provide teaching methods for the effectiveness of traffic education in the program evaluation results.

ABSTRAK

Projek ini bertumpukan kepada pembangunan permainan video dalam bentuk RPG yang diinspirasikan dari program Kesedaran Keselamatan Jalan Raya yang telah diaturkan oleh pihak berkuasa keselamatan jalan bertujuan sebagai jalan alternatig untuk mendidik orang ramai terutama kanak – kanak menerusi permainan video. Projek ini bermula dengan pencarian isu yang berkaitan dengan pembangunan permainan ini. Isunya ialah kanak-kanak dengan asas keselamatan jalan raya tanpa pengalaman berhadapan senario di jalan raya adalah tidak sesuai dan selamat semasa berada di jalan raya, pendekatan kesedaran keselamatan jalan raya masih tidak berkesan kerana kanak-kanak kurang memperoleh pengetahuan yang berguna dan kanak-kanak masih mendapat kesan negatif kerana beberapa kaedah pendekatan mungkin tidak menepati jangkaan dan boleh memudaratkan mereka sekiranya mempunyai kesedaran keselamatan dan keyakinan diri yang salah. Tambahan pula, program pembelajaran keselamatan jalan raya di sekolah masih menggunakan cara tradisional (lisan dan tulis) tanpa kaedah dan masa yang sesuai, kanak – kanak dan juga orang muda tidak berminat dengan pembelajaran teori yang begitu banyak dan masih tiada bahan yang mencukupi untuk ibu bapa dan guru untuk mengajar pelajar berkaitan keselamatan jalan raya. Sebenarnya, kanak-kanak mungkin mencari program kesedaran keselamatan jalan raya yang betul di luar dengan menggunakan aplikasi berasaskan web, tetapi masih berbeza dengan peraturan jalan raya dan persekitaran di Malaysia jika anak-anak ingin menggunakan aplikasi tersebut sebagai media untuk mempelajari keselamatan jalan raya. Projek ini bertujuan untuk meningkatkan pengetahuan mengenai

peraturan dan keadaan lalu lintas kepada kanak-kanak selepas bermain, memperkenalkan kaedah alternatif yang baru bagi pembelajaran keselamatan jalan raya, mendedahkan pengetahuan mengenai keselamatan jalan raya kepada kanak-kanak berumur tujuh hingga dua belas tahun, menganalisis faktor-faktor yang dapat mempengaruhi pembelajaran melalui pengalaman bermain dan menyampaikan kaedah pengajaran alternatif yang baru untuk pendidikan keselamatan jalan raya. Projek ini menggunakan model Kitaran Hayat Pembangungan Pemainan sebagai metodologi yang terdiri daripada empat fasa seperti fasa permulaan, fasa pra-produksi, fasa pengeluaran dan fasa pengujian sebelum bertukar menjadi produk akhir. Melalui ulasan literatur, pembangun mendapat empat penemuan iaitu permainan 3D RPG dapat memvisualisasikan persekitaran maya untuk mencetuskan reaksi pemain, reka bentuk permainan dapat menjadi alat keberkesanan untuk pembelajaran anak-anak, pendekatan permainan dapat meningkatkan advokasi kesedaran keselamatan jalan raya dan permainan dapat mencetuskan tingkah laku dan pengalaman belajar. Kesimpulannya, permainan video ini dibangunkan untuk mendekati generasi muda dengan cara yang baru dalam mempelajari peraturan keselamatan jalan raya, kod aturan dan praktis selamat dalam mod virtual serta menjadi sistem sokongan kepada program pendidikan kesedaran keselamatan jalan raya yang sedia ada khususnya kepada kanak – kanak. Kepentingan projek ini adalah bertujuan untuk mengajar kanak-kanak mengenai keselamatan lalu lintas, menyedarkan mereka dengan membiasakan peraturan dan keadaan jalan raya setelah bermain dengan permainan ini. Selain itu, ia juga dapat memperkenalkan kaedah alternatif baru dalam pendidikan keselamatan jalan raya. Oleh itu, ia dapat menyokong pembelajaran kanak-kanak melalui permainan yang menyeronokkan dan pada masa yang sama menyediakan kaedah pengajaran untuk menilai keberkesanan program pendidikan lalu lintas.

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LIST OF ABBREVIATIONS

RPG	Role Playing Game
JKJR	Jabatan Keselamatan Jalan Raya
MIROS	Malaysian Institute of Road Institute
KPM	Kementerian Pelajaran Malaysia
UI	User Interface
GUI	Graphical User Interface
GDLC	Game Development Life Cycle
NPC	Non-Playable Character
VFX	Visual Effects

LIST OF ATTACHMENTS

CHAPTER I

INTRODUCTION

1.1 Project Background

Road Safety Awareness campaign has been held several years in Malaysia. In search of program effectiveness instead of criticism for road safety awareness program delivering system, this will open a new chance to develop a 3D RPG interactive game to ensure the road safety awareness program is relevant for now. This game projects combines role-playing game (RPG) genre in game-based learning. This project is purposes to create road safety awareness to communities especially children because it is suitable interactive media to learn road awareness and traffic rules. Plus, it will clearly show road surroundings and able to help them familiarize with the surroundings. Although road safety awareness application or game is existing and can be played by anyone still it has a constraint and different environment. Hence, this project can be a catalyst for road safety awareness program enhancement in Malaysia.

1.2 Problem Statement

Road Safety Awareness is a campaign for people to understand about road safety. Every country including Malaysia has implemented this campaign in such way like forum, seminars, training and get a support from public & private sector to organize it. Despite of all effort and approach to make road safety awareness program reach at target people especially for children, there are still have constraints and issues on it. There has a factor why this project is dedicated to this age group, kids with a basic of road safety without experience of scenario on the road is unsuitable for being safe in the road. Moreover, road safety awareness approach is still not effective because children not able to gain useful knowledge without stimulation and motivation. Hence, children still get negative effects because some approaching method maybe not reach to the expectations and can be harmful for them if it makes a false sense of safety and overconfident. In fact, schools with road safety learning programme still use a traditional way (say and write) without hands on method and suitable timing. In addition, there are young people are not interested with so much theoretical learning and there are still insufficient of materials provided to family and teachers in order to teach students. In another way, children may search a right road safety awareness program outside by using web-based application, but it is still differed with road rules and environment in Malaysia if children want to use the application as medium for learning road safety.

1.3 Objectives

The main objectives of this project are:

i. To investigate the game elements of 3D role playing for Road Safety Awareness.
ii. To develop 3D role playing game based on identified elements.
iii. To evaluate children awareness towards road safety through 3D role playing game.

1.4 Scope

The game development is more on educational game oriented. So, it needed to focus on children group target age between 7 to 10 years old. The platform suggestion of this project is through Web (online) and PC Windows. This is because it widely uses, easy installation and flexibility. It also used as a testing environment for collecting data for qualitative and quantitative analysis. For game genre, it will focus on how RPG game design can blend together with game-based learning and create interaction.

1.5 Project Significance

The project is aimed to teach children about traffic safety, realize their familiarity with road rules and conditions after play the game. Moreover, it will introduce a new alternative method of road safety education. Hence, it will support children learning through fun games and on the same time to provide teaching methods for the effectiveness of traffic education in the program evaluation results. In addition, it will create stimulating environment through social stories and digital stories to educate children about road safety awareness. Therefore, the aim is to assist primary school students in learning and teaching methods and implement transportation education. Besides that, it also to evaluate the main characteristics of traffic training evaluation plan, the impact criteria used and the characteristics of the potentially effective programme. Moreover, it can help developer to analyse the factors that affect learning through play learning in game, and to investigate whether first-person game interactions are more immersive than third-person games to be implemented in this 3D RPG game.

Therefore, the expected results of this project are to achieve all game development goals which is to investigate the game elements of 3D role playing for road safety awareness. Moreover, it will develop 3D role playing game based on identified elements. Besides that, it will evaluate children awareness towards road safety through 3D role playing game.

Overall, this project is expecting to help people especially children adapt virtual road environment and road scenario in their real life. Hence, children have ability to explore, learn and decide what the right action and teach them to obey the traffic rules and regulation. In addition, it will help and enhance road safety awareness program in Malaysia with effective solution to ensure the program still relevant to run. Besides that, it will show an ability of RPG game genre collaborate with game-based learning especially in road safety awareness and how this collaboration can be a best combination through 3D game development.

1.6 Summary

In the conclusion, overall idea for this project assembles on this chapter. The purposes, target audience and problem are a basic discovery to kick start for next chapter. This is to ensure all idea is in line with the objective of this project. As matter of facts, it will define a learning and play experience factor to suit with the project requirements and at the same time help developer have a deeper understanding of the characteristics and limitations of different teaching strategies.

Therefore, the development of project methodology and the process of project development will be explained in the next chapter.

CHAPTER II

LITERATURE REVIEW & PROJECT METHODOLOGY

2.1 Introduction

This chapter will discuss about past literature related to proposed project. It is a requirement to guide developer design a game based on literature review and get overview about road safety awareness approach, a game design useful in learning and related theories.

2.2 Domain

The domain for this project is 3D Role Playing Game. The design and development of the game would combine 3D RPG Game with learning base element. Hence, the project will indirectly become as a medium to deliver awareness of road safety. Serious game in 3D RPG game have possibility to create as if virtual environment without need to assist player in real situation. In fact, the game with AI driven would enhance traffic situation in order to immerse player based on road situation in real life.

RPG game genre widely become popular genre today. This game genre shows behavioural shape regarding to characteristics of the game character. While the character is a person, it can be followed by children in positive aspect without destroy the fun. As mentioned before in article written by Vinogradovaa and Ivanova (2016), when design and develop RPG game for children, a plots and contents is fixed and only can change the characteristic by recurrence plots.

By using the literature review, a developer found four (4) findings which are:

i. 3D RPG game can visualize virtual environment to trigger players reaction.

A 3D Role Playing Game (RPG) game-based learning is one of the alternative ways to visualize real scenario without compromise on safety. M. Ariffin et al (2004) stated that simulating virtual environment scene can be benefited in terms of reducing risk and cost rather than conducting in real situation. In addition, game have ability to visualise player in realistic environment and trigger reaction when some scenario on the road is happen (Herold et al, 2019). Hence, a game should be typical, varied, broad in knowledge, and able to reflect the cultural characteristics of the times. (Wang et al, 2019).

As matter of facts, a character in 3D RPG game is to visualise children itself. Dennisova and Cairns (2018) stated that game with third-person perspective allows players to watch the actions of the protagonist without making the player feel that they are really a character. For example, characters in the games must meet the needs of educational goals, convey certain educational information, and serve the goals. (Wang et al, 2019). Moreover, it is being stated the characters in the game must meet the cognitive level of the learner in order to be accepted and loved by the learner. Therefore, it is important to allow player discover open world in virtual environment game without to practise on real environment. Hence, the characters visualise inside this game project can shaping a nature of children itself to be disciplined and always careful when they are on the road.

ii. 3D RPG game design can effectiveness tool for children learning

A 3D RPG game with learning based preferably designed with a right gamification concept can be effectiveness for children learning. Wang et. al

(2009) stated that role playing games are a great way for children to grow, communicate and enjoy learning. In fact, the game is not only a teaching tool but also a tool that promotes the negotiation process and the understanding of complex systems. (Manuela and Daniel, 2010).

As matter of facts, based on guideline written by Ministry of Transport and Ministry of Education (2006), without effective traffic education for children, it is difficult to implement other preventive measures to achieve the desired goals. For instance, this program with such good intentions of road traffic training, still get criticized for lack of evidence of effectiveness, partly because of the training methods implemented by the program. (Jamaludin et al, 2016). Hence, a gamification can improve the learning curve that to achieve safer road behaviour in line to broader advanced media education concepts. (Gounaridou et al, 2021). As a result, it is handy tools for children to broader the learning despite of current system still being used today. Hence, it can wider to use as a support system for current road safety awareness programme today.

iii. 3D RPG game approach can improve road safety awareness advocation.

A 3D RPG game is a role game that can guide the player to reach the target. The game approach is similar with road safety awareness advocation approach in where people will undergo through the programme to reach the target. Despite of a large number of road safety educational programs out there however, the number of programs that will result from a thorough evaluation and the book is quite limited. (Dragutinovic and Twisk, 2006). Indeed, the learning module needs to be revised and improved over time, leading to advances in information technology, globalization, and emerging road safety issues. (Malaysian Road Safety Department, 2018).

Therefore, it is undeniable that some following application regarding to road safety awareness advocation can be explored by children, however Abdul Rawi et al (2014) mentioned that most application are based on countries whose regulations and environment are different from Malaysia. As matter of facts, wake up from situation above, Husin and Mohd Fouzi (2018) stated that games can be used as an alternative way for children to better understand road safety. Moreover, the 3D RPG

game to be developed must be attractive to children, and most importantly, it contains components that allow children to gain new knowledge about road safety.

iv. 3D RPG game can trigger behaviours and experience of learning

A 3D RPG game has ability to trigger reactions by player and gained experience to complete the learning journey. Besides that, as mentioned by Dennisova and Cairns (2015), the game providing a comprehensive model of stimulus and response theories for predicting behavioural learning. In addition, it is a summary of key comments that explain the nature of rules violation and help players identify errors and misconduct. (Gounaridou et al, 2021). For example, chance is given to players during the game. The idea behind chance is to allow children to learn from their mistake an improve. (Husin and Mohd Fauzi, 2018).

Besides that, Herold et al (2019) stated that with multiple scenarios developed can generate moral or other arguments for children's pedestrian decision. In fact, the continuous and real time slowness of each game can create openings for reflection. (Marsh, 2016). Therefore, the game offers greater experience learning and obtained player behaviour results when going through the game.

2.3 Existing System

When focusing the domain of this project, a developer would be finding several games related to this project. In fact, most of the road safety awareness program and application are strategy & puzzle genre and a little bit of first or third-person view / role playing game can be related to this project also become as a reference.

Game analyses are required when compare an existing game to define various of operations performed by games while study the game relationship inside and outside. As stated on Figure 2.1, there are three existing game that can be compared and analyse. This project will focus on important dimension of the game including gameplay, game mechanic, game genre, game design and others.

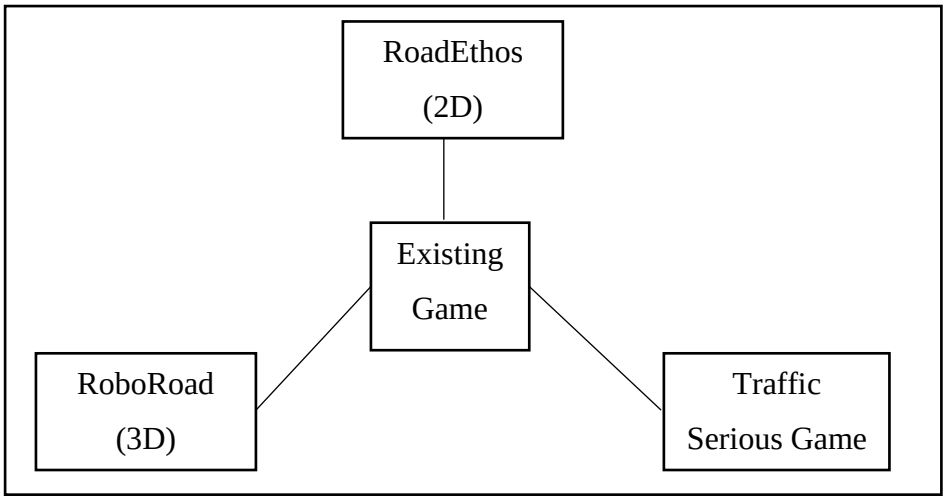


Figure 2.1: Comparison between three existing games

2.3.1 Comparison of Existing System

i. RoboRoad

As shown in Figure 2.2 below, RoboRoad is an interactive educational game that aim for children to learn and improve their traffic skills as well as to adopt this knowledge in real world. RoboRoad is a robot character that assign missions and help player facing different difficulties and challenge. It also as assistant for player too.

Figure 2.2: RoboRoad (Source: http://m3c.web.auth.gr/roboroad/)

This game only applicable for Greece country road rules and may differ with Malaysia road rules and guideline. Perhaps the concept would be taken as a basis to develop this game with additional features.

Game Play:

a. When the game begins, the player starts exploring the city, searching for the yellow arrow.
b. While wandering around, several events and accidents occur, for which the player should make crucial decisions.
c. Every traffic violation, minor or major, led the player directly to a "Game Over" screen and back to the starting point of the same stage compulsorily.

ii. 3D Traffic Serious Game Prototype

As shown in Figure 2.3 below, this game prototypes are made by researcher to stimulates the logical and spatial reasoning of children in the area of road safety education. In this game, player can choose to be as pedestrian role, driver role and spectator role. For pedestrian role, player allowed to explore the city with avatar and learning to respect traffic signals and use zebra crossing to cross the streets. For driver role, player will drove a car with average speed and need to obey traffic rules such as speed limit, safe distances when on the road, respect for traffic lights and others. For spectator role, only for quick tour of the city and does not reflect to rules and regulation.

Figure 2.3: 3D Traffic Serious Game Prototype (Source: Google)

Game play:

a. In Pedestrian mode, the player is allowed to travel through the city with an avatar and learn to respect traffic signals and cross the streets through the zebra crossing. Just free roam without any points deduction if making a mistake.

b. In Driver mode, the player will drive a vehicle through a city and be required to obey traffic signs, speed limit and drive in the correct lane. If they fail to do so, player points will be deducted according to the mistakes they make.

iii. Road Ethos

As shown in Figure 2.4 below, Road Ethos is 2D game-based learning design and develop by researcher to sensitise children towards road safety through ethical reasoning. This game use technology (Scratch platform, Arduino sensor and 3D printed brakes & steering(controls)). The game will interact with Arduino sensor to detect brakes and steering motion by player than send signal back to reflect the desired and undesired action.

Figure 2.4: Road Ethos (source: Google)

Game play:

a. The game starts with a blue instruction screen which asks the participant to reach home safely with road ethics in mind.

b. This is followed by the scenario where a red car comes in front of the participants' car, and simultaneously, the ambulance siren starts ringing from the back.

c. The participant will select either Action 1 or Action 2. After select the option, game will playback gameplay and effect after take Action 1 or Action 2

d. If choose desired action, player will continue to a next situation instead of undesired action, game play will pause, and a game will recap what action player selected and effects after wrongly choose the action.

2.4 Project Methodology

This project development will definitely use a Game Development Life Cycle model as shown in Figure 2.5 as a guideline to ensure 3D RPG game is deliver in better quality based on criteria at each of the phase.

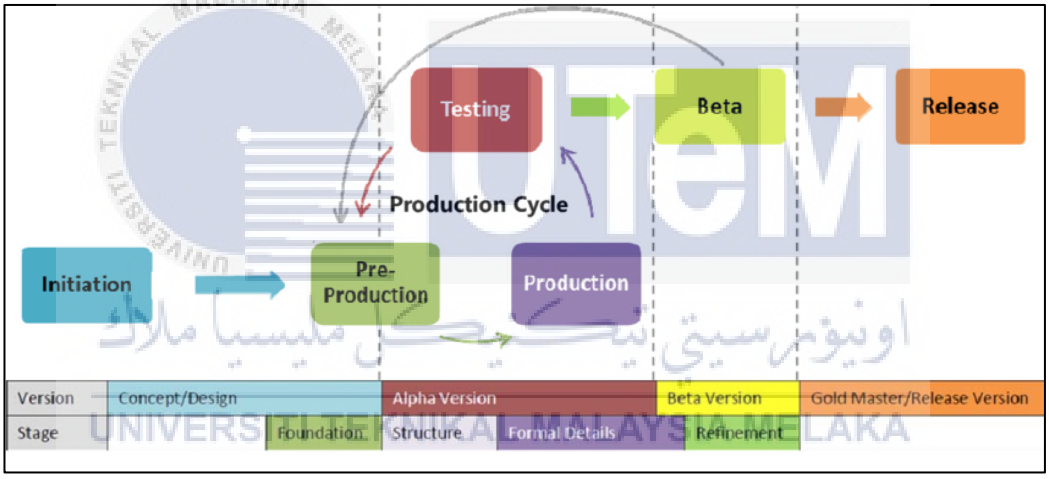


Figure 2.5: Game Development Life Cycle Model (Source: https://personanonymous.wordpress.com/2013/07/17/a-guidelines-of-game-development-life-cycle-v2-0/)

There are four (4) phases in GDLC model, and the details are:

i. Initiation Phase

Initiation phase is to define concept and design process of the game project through brainstorming an idea and determine the kind of game, genre, gameplay, character, goals and rules and others will be run on this phase.

ii. Pre-Production Phase

Once getting the game foundation from initiation phase, in this phase developer will planning game project scheduling, enhance the gameplay in terms of game framework and fun factor, determine the game mechanic and rules and make sure development progress stay on track.

iii. Production Phase

A massive game development process will begin in this phase. All game assets, levels, user interfaces / experiences and source code will build and linking each other. Hence, the developer had to ensure all game components playable and functioning well including gameplay, game mechanic, rules, features and absolutely the whole game is complete.

iv. Testing Phase

Developer will check bugs, glitch, gameplay issues that maybe encounter when running game and fixed the issues in this phase. This is to ensure all game features, mechanics, concept and other game element tested and everything is going well. In Beta phase, preliminary test will be held on this phase with third party involvement such as publisher, game reviewer, potential buyer and related person. It is to define a bug and getting feedbacks from user of current game build.

Release Phase is the final phase, where all the important phase above is success and gold master version will release to marketplace and project are dismissed.

2.5 Project Requirement

Game development will require appropriate software and hardware to ease the project development.

2.5.1 Software Requirement

- Unity 2020.2.7f1
- Maya 2020
- Adobe Illustrator CC 2018

2.5.2 Hardware Requirement

- PC Workstation
- Speaker / Headset
- Internet

2.6 Project Schedules and Milestones

Figure 2.6 as shown below is a Project Schedules for game development and Table 2.1 describe a Project Milestone planning.

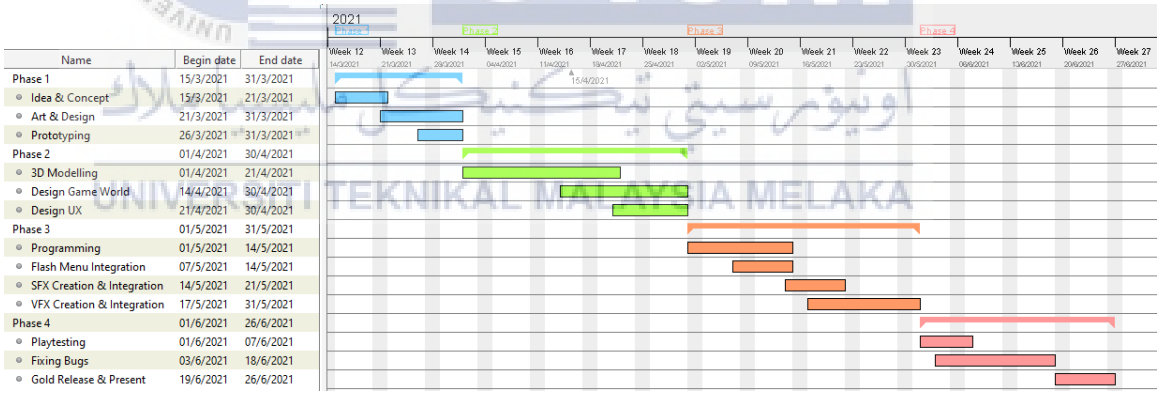


Figure 2.6: Project Schedules

Table 2.1: Project Milestones

Key Milestones	Start Date	End Date
Phase 1	15 March 2021	31 March 2021
Phase 2	1 April 2021	30 April 2021
Phase 3	1 May 2021	31 May 2021
Phase 4	1 June 2021	25 June 2021

2.7 Summary

In conclusion, game development process must focus on domain of the game. This is to ensure an objective and aim of the project is accomplished. In addition, game development foundation and game concept can be determined by comparing the existing game that purposes to identify and enhance gameplay, game elements, game mechanics and related in a step to build a better game. Plus, it will guide developer to build the game based on requirement and GDLC model exactly.

CHAPTER III

ANALYSIS

3.1 Introduction

Designing role playing game together with game-based learning require developer to analysis the problem and requirement based on comparison of existing games. In this chapter, it will sort out the pro and cons of existing games, evaluate the finding and matching the ideas found from comparison then produce a nice game project. Hence, comparison is a better way to make a great game and as a reference for the next game development.

3.2 Problem Analysis

Based on heuristic evaluation when comparing the example game founded origin of the game is from different country. Every country has a road rules and regulation, and it may differ with Malaysia. As example the game use left handling car beside of right handling in Malaysia. Next, the example game combine

pedestrian and driver role together in one game. From the other side it is a good combination but for target age group for children it was not necessary.

3.3 Requirement Analysis

3.3.1 Project Requirement

There are three existing games related to this project and has been compared. The summary of information of the existing game are illustrated in Table 3.1 below.

Table 3.1: Comparison of Existing Game

Dimension	Existing Game		
	RoboRoad	**Serious Traffic**	**Road Ethos**
Gameplay	When the game begins, the player starts exploring the city, searching for the yellow arrow. While wandering around, several events and accidents occur, for which the user should make crucial decisions. Every traffic violation, minor or major led the player directly to a "Game Over" screen and back to the starting point of the same stage compulsorily	Player can select Pedestrian / Driver role: i. In Pedestrian mode, the player is allowed to travel through the city with an avatar and learn to respect traffic signals and cross the streets through the zebra crossing. Just free roam without any points deduction if making a mistake. ii. In Driver mode, the player will drive a vehicle through a city and required to obey traffic signs, speed limit and drive at the correct lane. If they failed to do so, player points will deduct according to rule violation they made	The game starts with a blue instruction screen which asks the participant to reach home safely with road ethics in mind. This is followed by the scenario where a red car comes in front of the participants' car, and simultaneously, the ambulance siren starts ringing from the back. The player would select either Action 1 or Action 2. After select the option, game will playback gameplay and effect after take Action 1 or Action 2
Skills	Improve computer literacy and digital skills	Improve development of cognitive skills that strengthen the internal learning process within children	Improve ethical reasoning when facing the scenarios on the road and how to act with the condition.
Game Element	Rules: Players must choose the right option when on pedestrian and driver mode. Penalty will be given to the player if they select a wrong decision. Technology: A.I: Vehicle self-	Rules: When players drive in the city, the player must ensure the car is in the right direction on the road, obey traffic signals and control the car speed to avoid collision with other cars or pedestrians. Points will be deducted if doing mistakes spoken above.	Rules: Players are required to choose the desired action when they get into road scenarios. If action is correct, it will allow the player to next scenarios. If incorrect action, game will be pause and play the effect cause by player selection

	movement, traffic control, path finding Audio: Background & Notification Video: Instructional video related to the traffic code violation Animation: Vehicle movement, people walking Level: Only 1 level in this game (Pedestrian / Driver)	Technology: A.I: Finite States Machine use in automatic cars to react with driving, ready to stop and stop condition, Navigation system use pathfinding for NPC. Animation: Vehicle movement, walking NPC's. Level: Only 1 level in this game (Pedestrian / Driver)	Technology: Graphics: Use Paint software to create perspective in Scratch game platform Device: 3D printed steering wheel, brake / acceleration pedal and Arduino sensor. Level: Only 1 level in this game. (Driver)
Game Mechanic	RoboRoad informs the user that the adventure has been completed successfully while also an option for continuing to the next mission is offered. Yellow arrow spot is marking places to start mission and red arrow is destination Reward and mission accomplishment screen will appear once the adventure is completed successfully.	Information regarding the score is updated when the user commits a violation of three possible cases: a) Not respecting the traffic light, subtracts 180 points. b) Exceed the speed limit, subtract 60 points. c) Drive in a street in the opposite direction, subtract 120 points. The speed control of the car is done by the arrows up and down (accelerate / brake) and left to right to drive.	Use a steering wheel to maneuverer cars control and brake /acceleration pedal to move the car or slow the car. Both of device is 3D printed Use an Arduino sensor to detect a 3D printed steering wheel and brake / acceleration pedal interaction and translate into action on Scratch game platform.
Game Design	Space Open and free roam. Player in a virtual city environment. Components Avatar: Robot Blocks: Building, Sidewalk, Trees Goals Reach destination in time safely without penalty Mechanics 1)The player is able to choose the game mode. 2)Red arrow that denotes the final destination 3)A countdown timer is also shown at the top-right corner 4)When a wrong choice is made, crucial feedback about the correct answer is given and option Continue will appear to the player to get back on gameplay.	Space Open and free roam. Player in a virtual city environment Components Avatar: Character, NPC Blocks: Buildings, Sidewalks, Trees Goals Drive a vehicle wisely without point deduction Mechanics 1) Velocity Control: The speed limit signs determine the speed reached by the car in each sector of the city. 2) Respect for Traffic Lights: The transition from one operating state to another is defined by the fulfilment of conditions.	Space Limited and show scenarios only. Players is in driver side view perspective Components Avatar: Animal Goals Desired action is the best step in the game. Mechanics 1)Design of multiple scenarios on the road which could elicit the ethical/other reasoning, for the decisions made by the novice driver. 2) A perspective replay of the scenarios from the other stakeholders' point of view, to make the driver reflect on their decision. .

As shown in Table 3.1, the trend of existing game is focus on pedestrian and driver role. The gameplay, mechanic & game element are almost same but limited in certain areas. In addition, let see the overall flowchart of existing game. Looking on existing game called RoboRoad overall flowchart as shown in Figure 3.1, it explains how player interaction in the game.

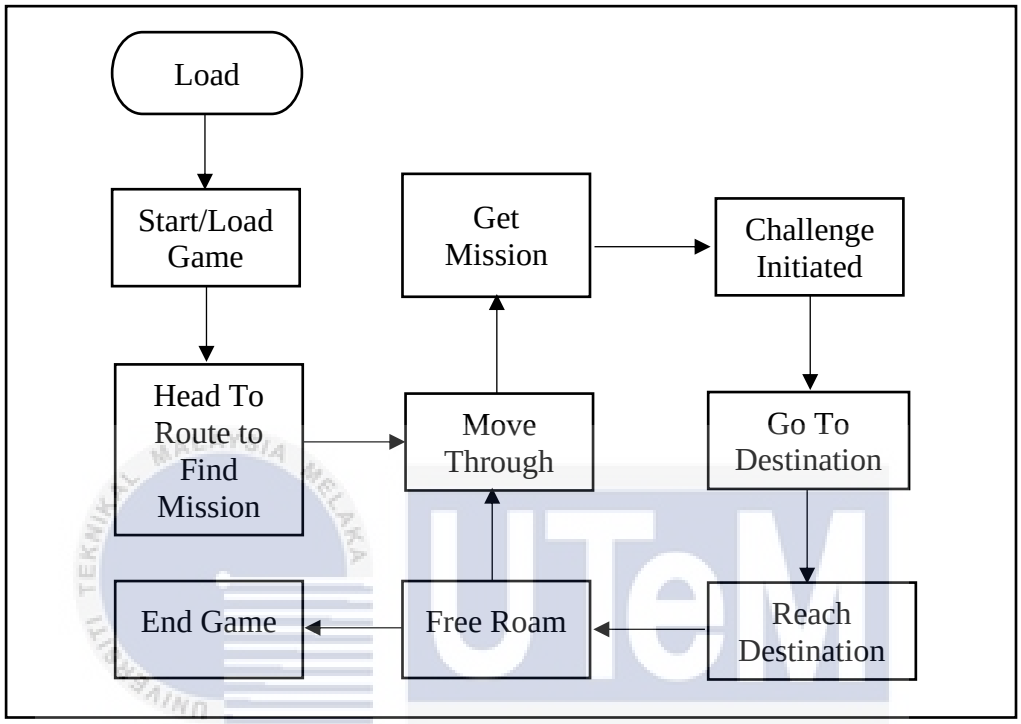


Figure 3.1: Flowchart of RoboRoad

Next as shown in Figure 3.2 is the flowchart of 3D Traffic Serious Game. This figure describes about the game flow.

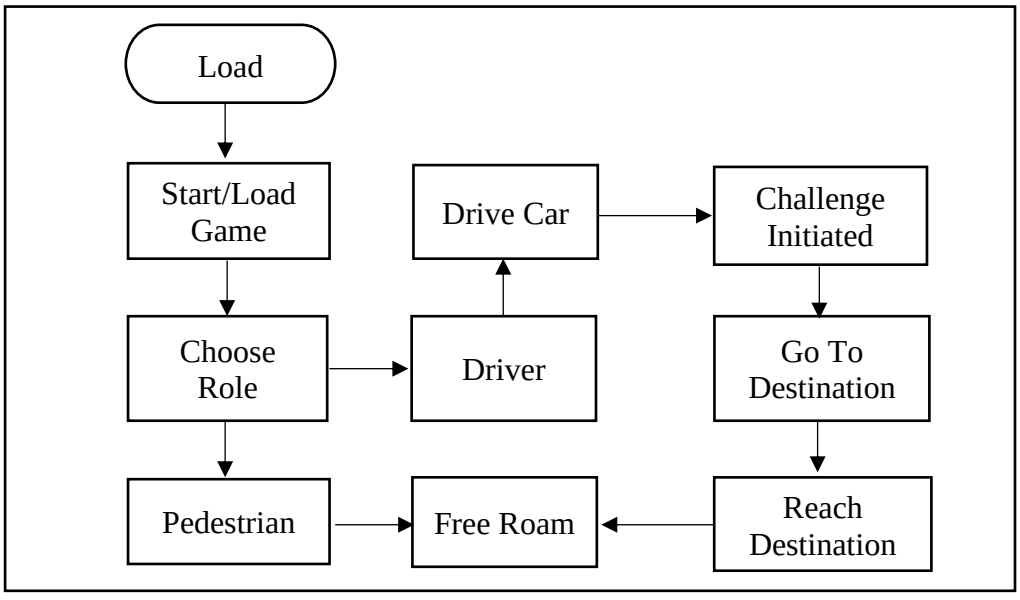


Figure 3.2: Flowchart of 3D Traffic Serious Game

Next as shown in Figure 3.3 is the flowchart of Road Ethos. This figure describes about the game flow.

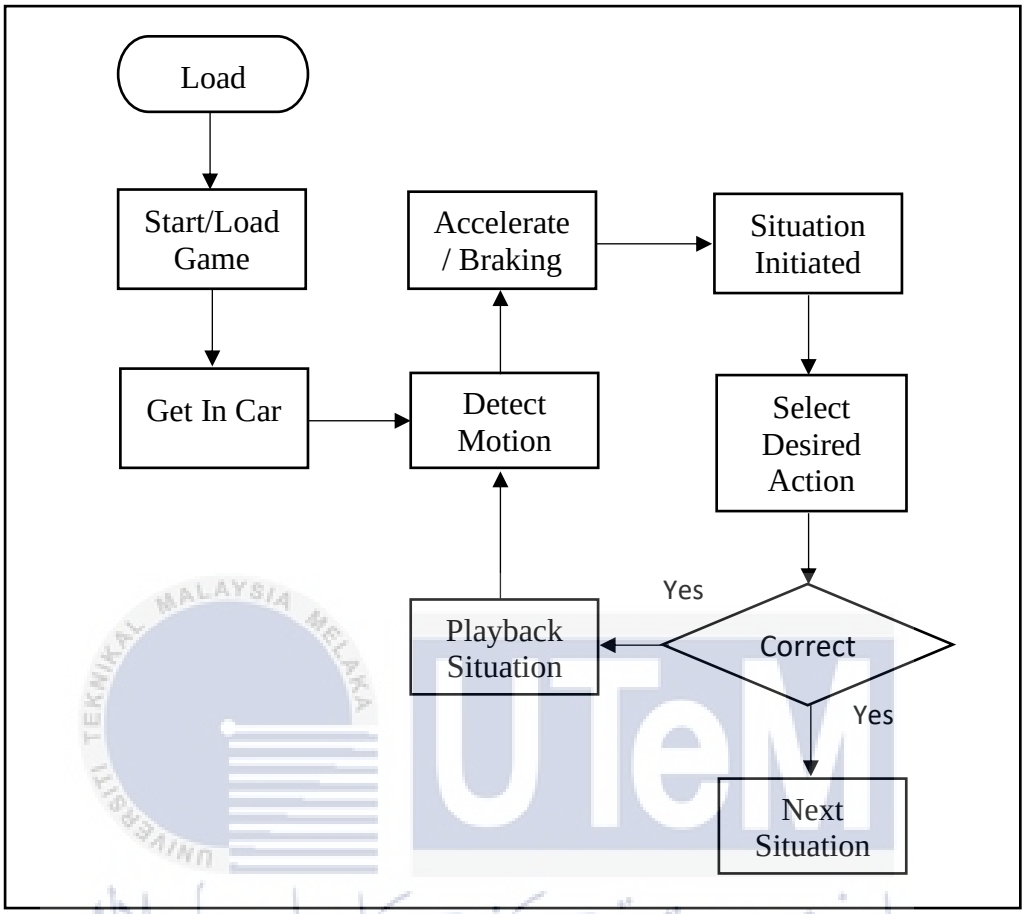


Figure 3.3: Flowchart of Road Ethos

As shown above, it is the flowchart of three existing games that develop related to road safety awareness. This is because to analyse how the 3D game approach works on children learning and how player will interact with the game in order to give a guideline to the development process of this project

Therefore, in developing this project, there are several ways in collecting data in order to help project development process. First of all, data has been collected through analysed the 3D RPG game research paper which four findings were found which can visualize virtual environment to trigger players reaction, can effectiveness in children learning, helping improve the road safety education approach and trigger behaviours and experience in children learning.

Through the analysis, it obvious stated that 3D RPG game has widely used in other field and one of it is gaming industry. Next is making a direct observation, observation was taken from a few of children playing a 3D RPG game and how the react on it. Last but not least is by making a survey toward the market demand and also for the focus group as it is important in knowing the current situation and the player's interest about game. In fact, an open-ended interview with the focus group also helping in collecting the data for development's need.

3.2.2 Software Requirement

In this project, software that would be used is Unity 2020 as the game engine in developing the whole project. Besides that, Maya 2020, Adobe Illustrator CC 2018 and Adobo Mixamo Rigging process are also needed in this project development as it is the software that would be used to design and create game asset and also user interface.

3.2.3 Hardware Requirement

For the whole project development, a personal computer is needed in order to develop this project with internet connection is needed through this project development due to fact that to access asset store in Unity need an internet connection.

3.4 Summary

In this chapter, developer shall do an analysis by comparing related game and list out the fact founded and be as foundation of this project. Hence, it will guide developer to stay on track in this project.

CHAPTER IV

DESIGN

4.1 Introduction

When designing a 3D RPG game in learning oriented, there are few factors to consider about how the game works, mechanics, physical interaction and player experience. In fact, it will blend together with idea to deliver entertaining interactive experience for player.

Hence, in this chapter, the whole design will be explain including the storyboard, the flowchart and others as it would give the overall look of this project to create a game that can facilitate interaction between players for stimulating the children's physical.

4.2 Proposed Design

In the analysis chapter before, developer has identified a proposed design of the project based on finding from heuristic evaluation. As shown in Table 4.1 is a proposed design for the project.

Table 4.1: Proposed Designed for Project

Dimension	**Proposed Design**
Gameplay	Player can select character role provided on the game and guide them to travel through city and complete a task given without ignoring traffic rules. While moving through city, some event may occur, and player should make a right decision. Player will hand over the package at every checkpoint and get an instruction for the next checkpoint. every checkpoint will have an indicator to ease player search a place. Every traffic violation, player will get a summon and to continue the game, player need to redeem a reward. If no rewards to trade it will be led player directly to Game Over screen and back to the starting point on the same stage.
Skills	Computer literacy, cognitive skills and ethical reasoning.
Game Element	**Rules:** Player must obey the traffic rules in a journey to complete a current level. A summon will be given to player if select a wrong decision. Player is free to choose any roads in a way to spot indicator. But it must do in time given of every check point. Its time is running out, the current level will game over and need to start again from beginning at the same level. **Technology:** AI: Vehicle self-movement, traffic control, path finding Audio: Background music and notification sound Animation: Vehicle movement & character movement **Level:** Consists of 3 level (Tutorial Level, Level Two and Level Three). Each level will on the city setting and have a different timer to complete the level. Also, it has multiple checkpoints to player find to complete a task.

Game Mechanic	Player need to complete each level with minimal summon or without traffic violation to unlock next level. This game progression will be determined by summon gain because of traffic violation and rewards player get. The spot indicator will show the next destination player to travel. Every successful checkpoint in time given, player will get a rewards and accomplishment screen will appear.
Game Design	Space: Open and free roam. Player is free to choose any road in virtual environment Components Avatar: Character Blocks: Building, trees, sidewalk, vehicles. Goals: Complete each level in time given without traffic violation. Gain so much rewards as a backup if get a summon to escape and continue the game. Mechanics 1) A spot indicator visible in blinking views that denotes the checkpoint 2) A countdown timer displays the time left on a way to checkpoint. 3) If choose a wrong decision, player get a feedback of what traffic violation they do it and option Continue with rewards exchange in time given is displayed. If time out, current game will end. 4) Players carry a package from current checkpoint to next checkpoint. If package successfully receive at designated location, the rewards

4.3 System Architecture

This section will describe about game logic for whole project and explain the overview of the game.

i. Character Selection

As shown in Figure 4.1, player can choose character they want to play with it. In the game, there has two characters which is Adi and Sara. After input the nick name selecting the character, game scene will automatically visible.

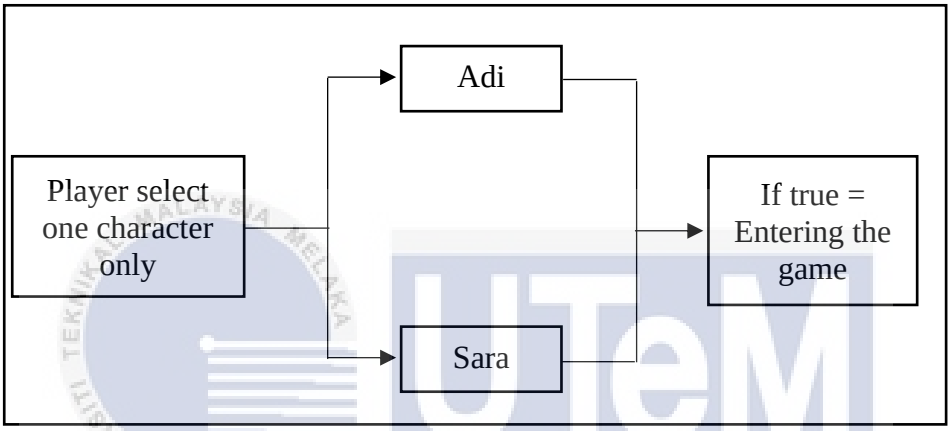


Figure 4.1: Character Selection

ii. Player Interaction

As shown in Figure 4.2, player can interact with NPC to do conversation and get a task, mouse over the object to highlight and select the appropriate object or item to store in inventory.

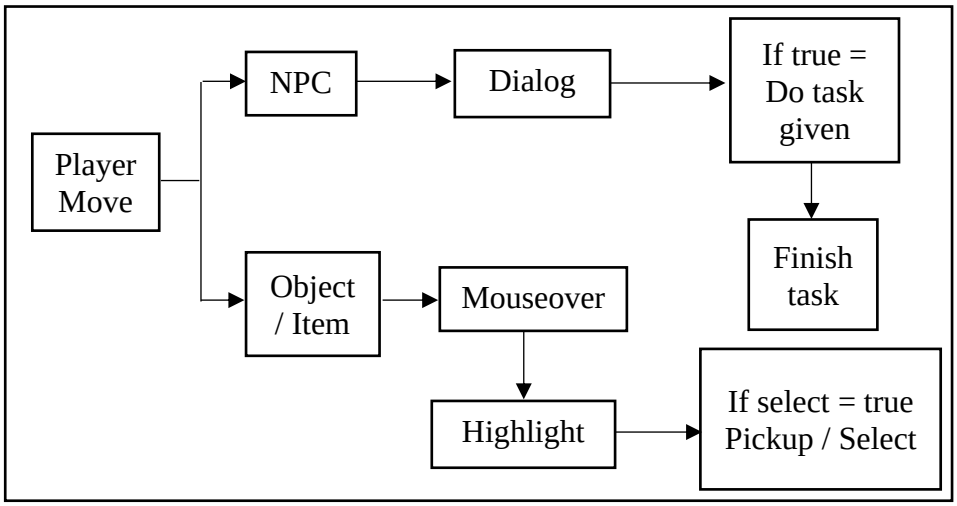


Figure 4.2: Player Interaction

iii. Collider Interaction

The game logic shown in Figure 4.3 describe the collider logic. If player hit with the collider, it can trigger event or effect after it.

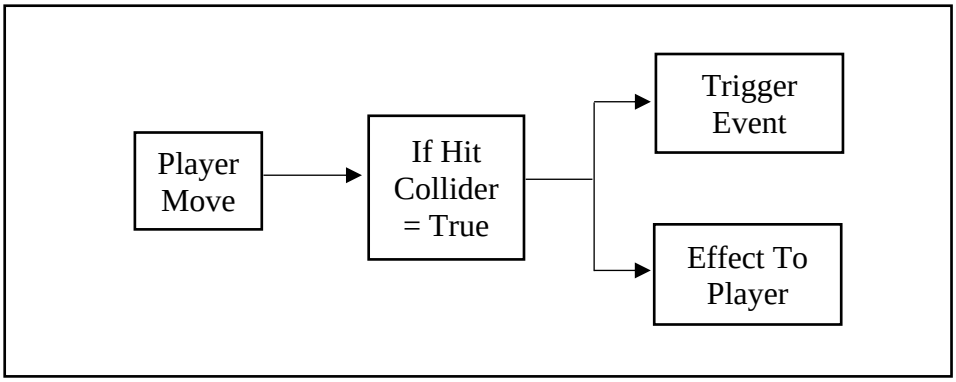


Figure 4.3: Collider Interaction

iv. Button Navigation

The game logic shown in Figure 4.4 describe the button navigation. If player click at any button and if the function is true, the button can navigate to other scene or display dialogue text.

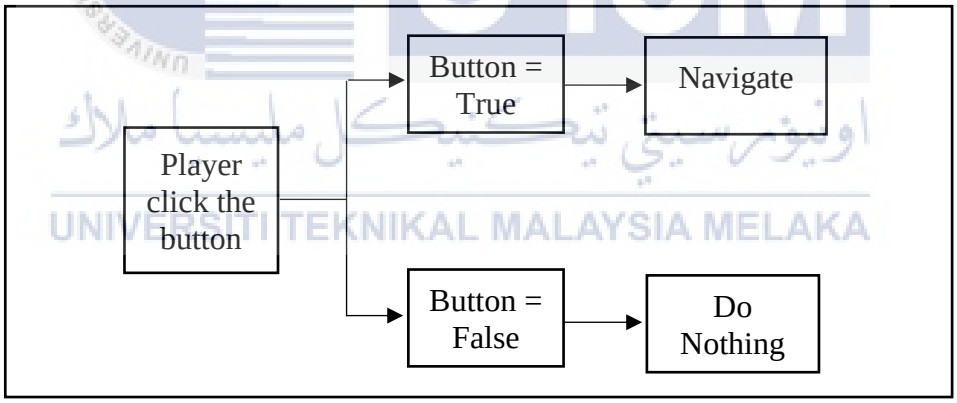


Figure 4.4: Button Navigation

4.4 Preliminary Design

The detail of the game will be described in this section by storyboard and the game progress until end.

4.4.1 Storyboard Design

Figures 4.5 and 4.6 as shown below describe the storyboard of Think Safe Level Tutorial. This level consists of tutorial and task for player to explore.

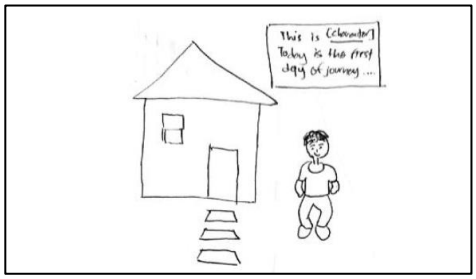
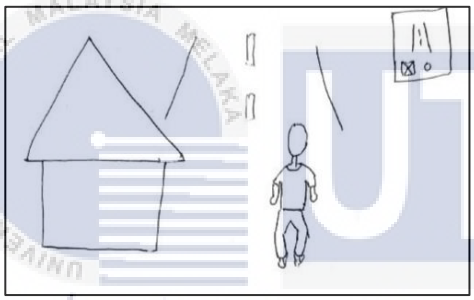
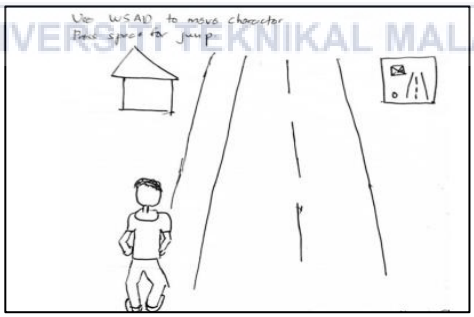
Seq.	Sketch	Description
1		The game started with character selection is stand in front of his/her house
2		Then, a main camera will change to third person camera position that focuses to character and a view.
3		A movement tutorial notification will appear at HUD. Player can move any direction in front of the house.
4		A tutorial notification of using the change view feature will appear at HUD. Player can use this change view feature to look left and right when need to cross the road.

Figure 4.5: Storyboard Level Tutorial (i)

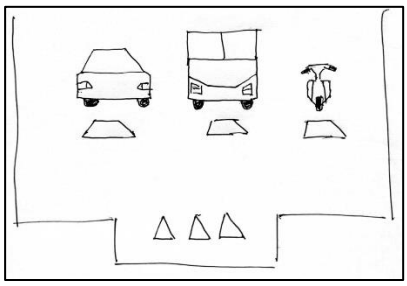
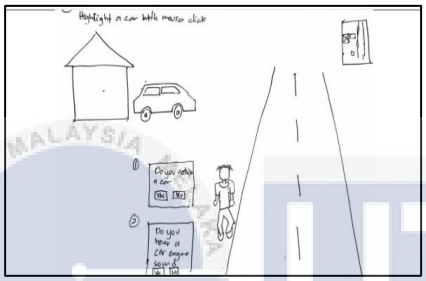
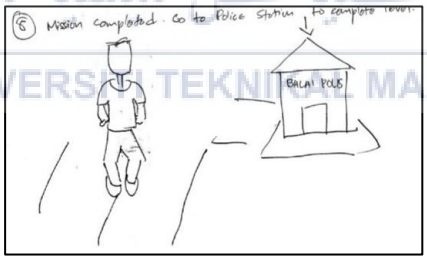
Seq.	Sketch	Description
5		First task for children is identify vehicle based on cone colour related to type of vehicle. Player will use left mouse to drag cone at a box in front of vehicle.
6		The level will start on this point. Player walk along through neighbours house and do the first task. The task is to identify vehicle that park at house and highlight which one of the vehicles is going out. Player need to avoid clashed with the vehicle. If get clashed with vehicle, a reminder will appear on screen.
8		After completing a task, a notification will appear and tells player to reach at police station End of tutorial level

Figure 4.6: Storyboard Level Tutorial (ii)

Figures 4.7, 4.8 and 4.9 as shown below describe the storyboard of Think Safe level two. This level consists of more task than level tutorial to explore by player and a place where the road rules enforce.

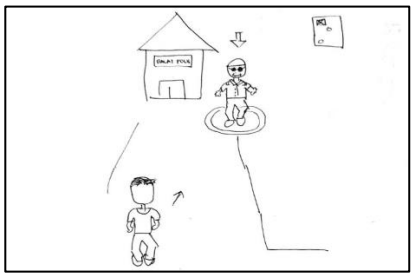
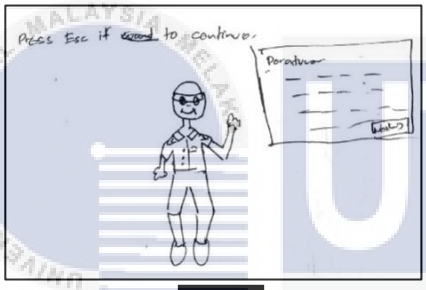
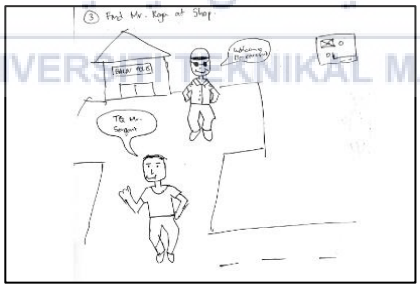
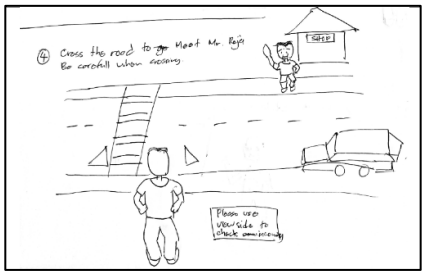
Seq.	Sketch	Description
1		Level two begins at the Police Station. Player need to find Mr. Sergeant for the next task.
2		Mr. Sergeant also explain the road rules and regulation by dialogue box. Player can scroll the dialogue to see the rules & regulation or push Esc button to continue the task.
3		After complete information explained by Mr. Sergeant, a notification tells the player to find Mr. Raja at shop.
4		Players need to cross the road to meet NPC (Mr. Lim) for the next task. In this level, side view feature is important to use by player when crossing the road.

Figure 4.7: Storyboard Level Two (i)

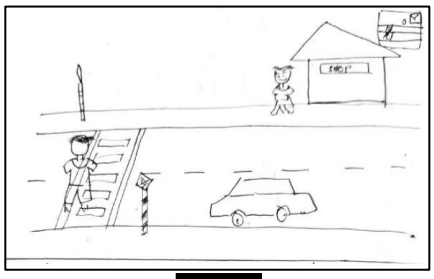
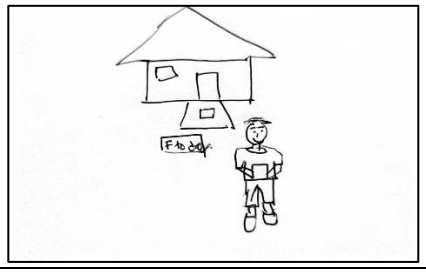
Seq.	Sketch	Description
3		Player cross the road safely to Mr. Raja shop by using pedestrian cross. Then, meet the Mr. Raja for next task.
4		Player meet Mr. Lim and give a task to completed. Player can accept or decline the task. But, player is require to complete three task that eligible for the next level. Player can meet another NPC to get the task.
5		If player accept the task, player will pickup an item to deliver. A command use key to pickup will appear at screen.
6		Player will drop at designated place to drop the item. A command use key to drop will appear at screen

Figure 4.8: Storyboard Level Two (ii)

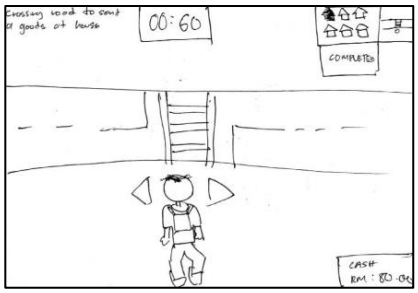
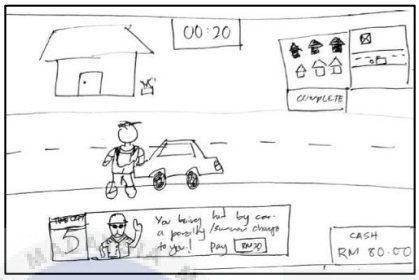
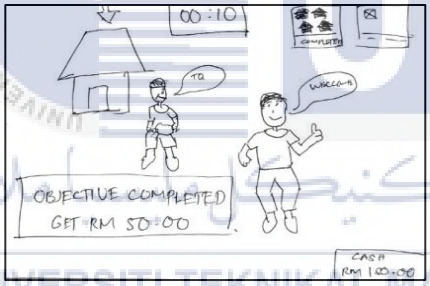
Seq.	Sketch	Description
7		The timer start counting when player pickup the item. The player shall practice all safety procedure and be rewarded upon do the practise. Player need to send a goods to customer at random place. Once finish, player get rewarded.
8		Every traffic violation will be fined or summon by police traffic. Players can withdraw the available money as a trade to pay the summon in time given. If fail to do so, player need start from beginning level.
9		After finished the task, player will be rewarded and add on with bonus cash. Players need to ensure all task complete before return to house.

Figure 4.9: Storyboard Level Two (iii)

All figures illustrated before is the storyboard of the game. It covers level tutorial and level two progress. For a level three, the storyboard is the same concept, but the difference is a riding a bicycle instead of pedestrian situation. First of all, player will see a main menu screen then when hit Let's Play button, the character selection will be appeared, and player will choose suitable character that he or she want to be. In level tutorial player will complete the task to complete a current level then the stats screen will appear to show current money and rewards gained. Level two button will unlock to proceed the next level. In level two & three, player continue the task given by NPC and must obey the traffic rules and avoid being hit by vehicle. If got a summon or hit by

vehicle it requires player to withdraw the available money to continue the game by the time given and if not enough money or not click a continue button in time given, the game will over, and screen stats will appear to player restart a current level.

4.4.2 Description of Player Character

In this section, it describes a player are able to select their character they wanted to be before entering the game scene. Therefore, there are two characters that player can choose as shown below. The two characters is Adi and Sara shown in Figure 4.10 has been chosen by developer because it is close to children environment and gender of player. Hence, these characters were designed to attract the interest and attention of children.

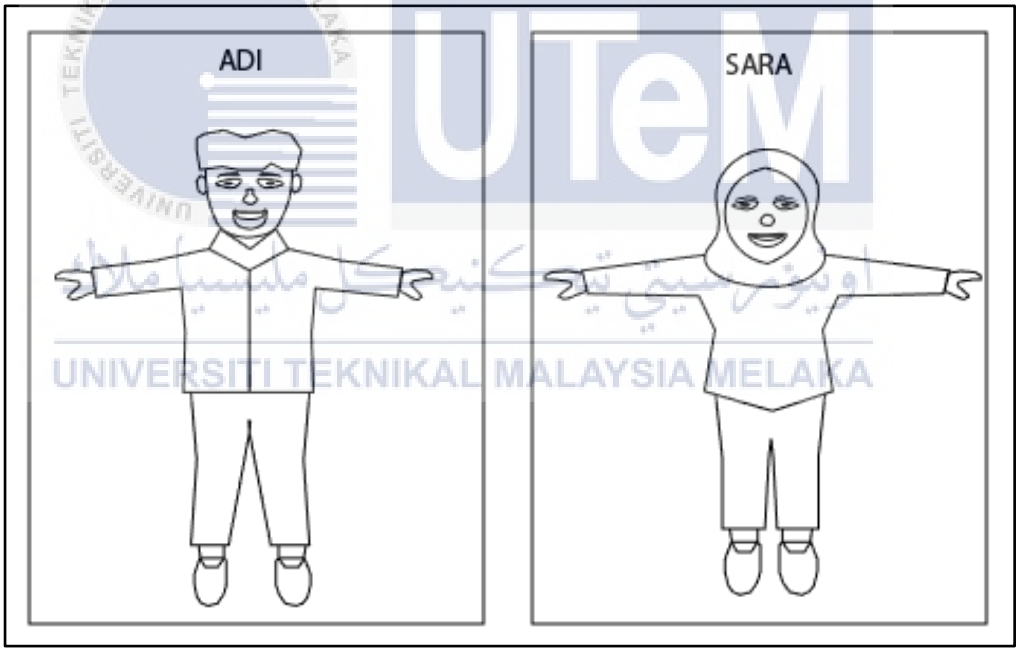


Figure 4.10: Player Character

4.5 User Interface Design

i. Navigational Design

As shown in Figure 4.11, it describes the overview how the game work. The user interface starts with main menu screen contains a Let's Play, Setting, Stats and Exit Game. If player want to play, they can hit Let's Play button, followed by level selection screen where the New Game and unlock Level sits and at this screen, a new player can start a New Game or a recent player can select unlock Level to continue. After select a New Game button, Character Selection user interface will appear and at this screen, player can fill the Nickname in input text then select character Adi or Sara to start a tutorial level. When complete a tutorial level, a Level Finished splash screen will appear to show the game information, stats and Level Two button will unlock if fulfil the level requirement. In this screen also display Play Again button to restart current level and Main Menu button to going back Main Menu.

If player want to see a game stat at Main Menu screen, player can click Stats button to show the player position rank with reward scores. Players are able to Reset current scores to empty the rank list or click Back button to return Main Menu screen. If player want to change a game setting, player can click at Setting button. In this Setting user interface, player is able to control Sound, Display and Controller. Player can use slider to increase and decrease the Audio & Display resolution to an appropriate setting. Player also can click the Default button to enable default setting, Apply button to save current setting or Cancel to return back at Main Menu screen.

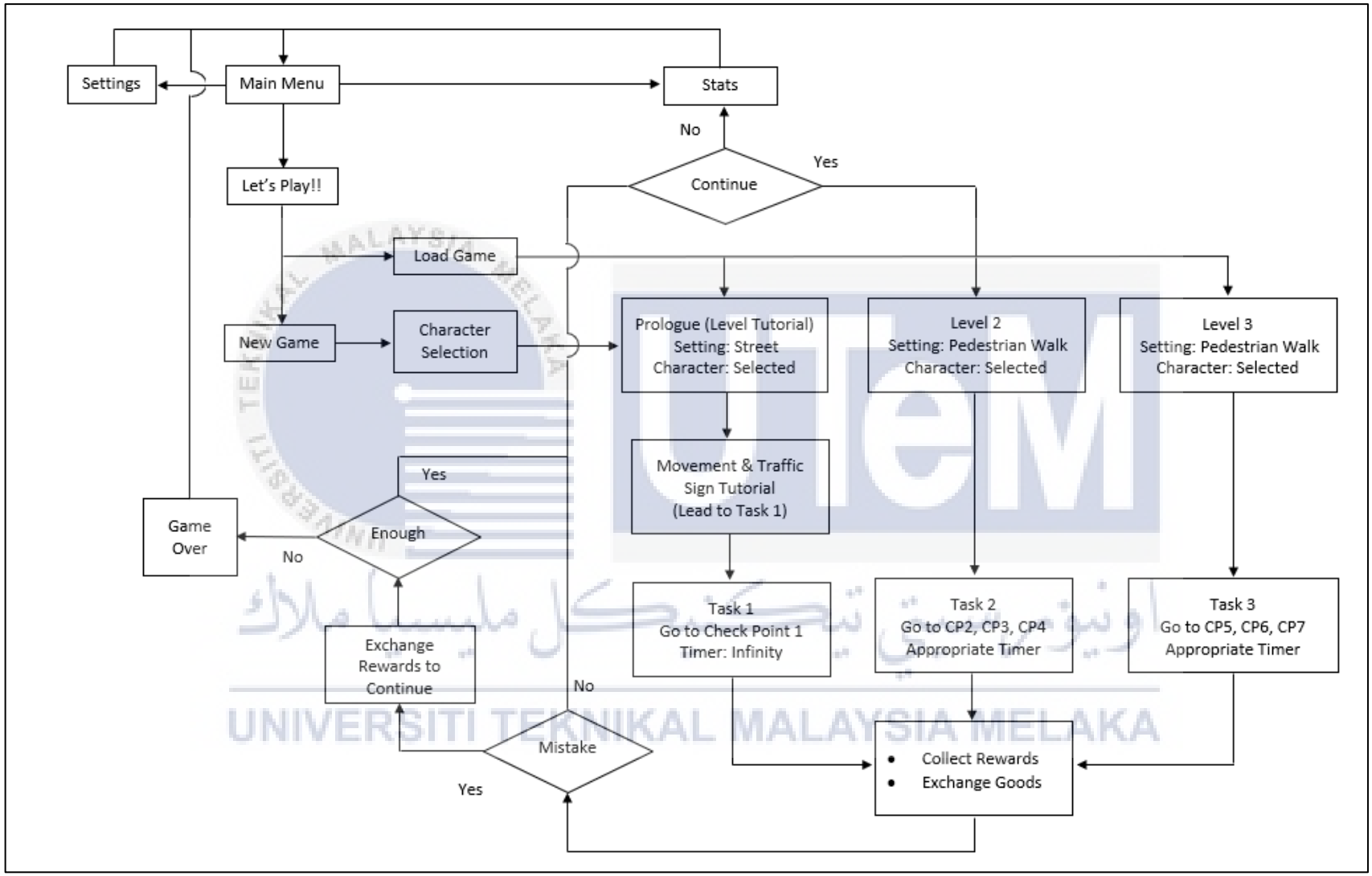


Figure 4.11: Game Flowboard

ii. Input Design

As shown in Figure 4.12, it describes about input design for this project. Some of button design on this project are design accordingly to specified target, especially children. Therefore, it purposes to attract children interest and attention by use graphic at button instead of using text.

Figure 4.12: Input Design

iii. Output Design

As shown below in Figure 4.13 is the design of Splash screen. This screen was designed to allow game loading before Main Menu screen appear.

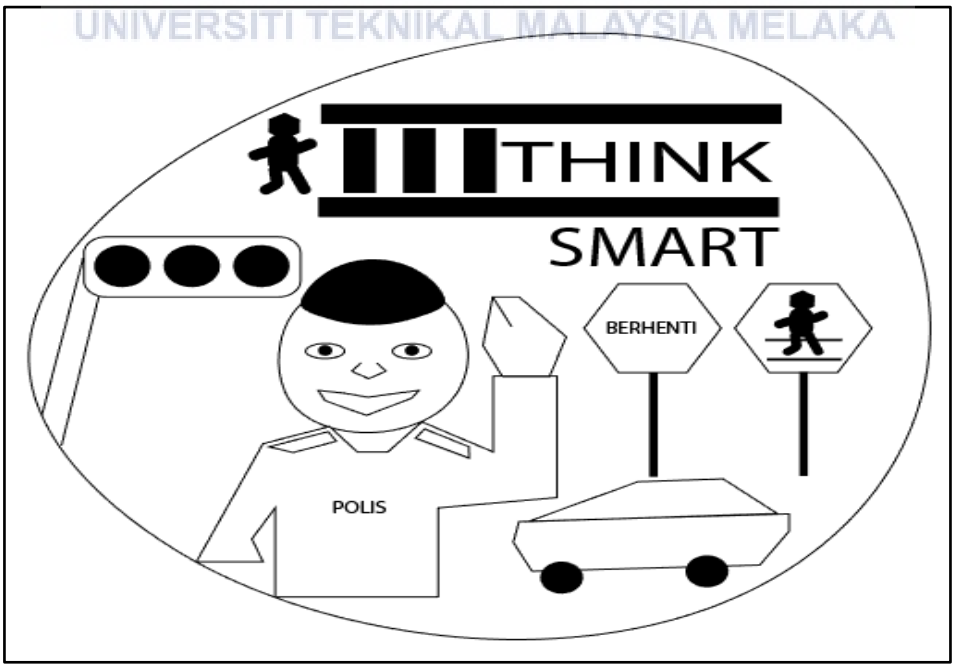


Figure 4.13: Splash Screen

As shown below in Figure 4.14 is the design of main menu screen. The screen design is a home of the game where four button is located which is let's play button, setting button, stats button and exit button.

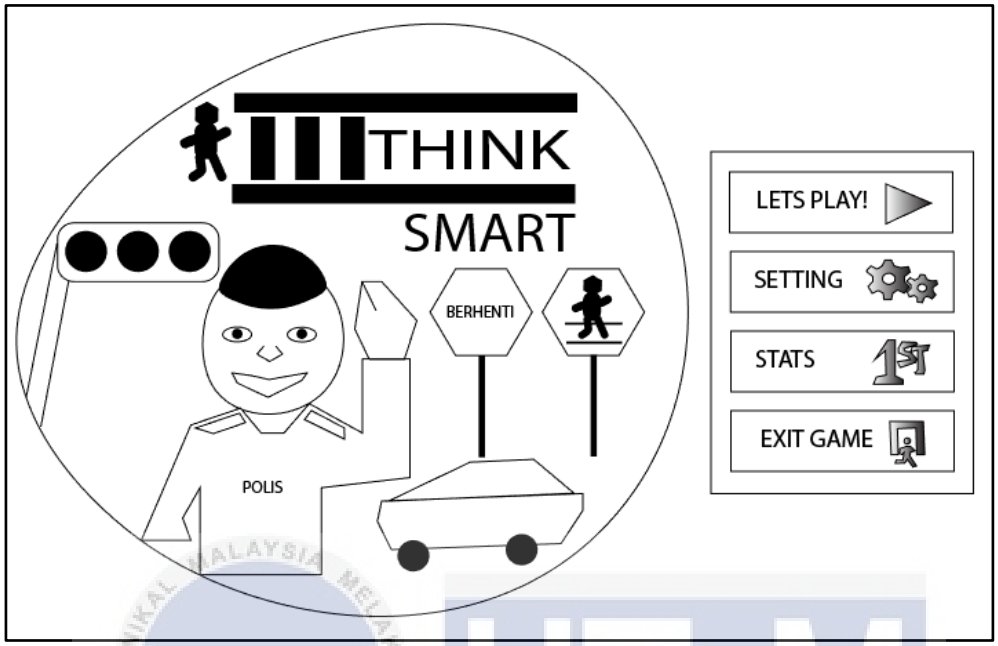


Figure 4.14: Main Menu Screen

As shown below in Figure 4.15 is the design of player character selection screen. The player can choose one character button from two-character button. In this screen also have Nickname input text to be inserted by player. If no nickname inserted, as a default it sets a nickname as Player 1. If player want to back at main menu screen, they can click at home button.

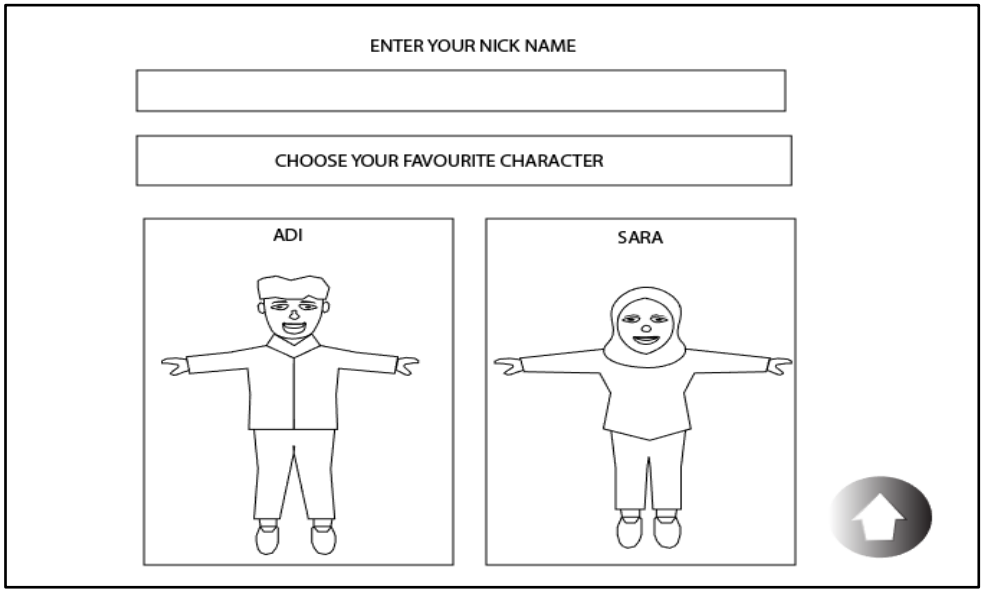


Figure 4.15: Character Selection Screen

As shown below in Figure 4.16 is the design of game play screen. Player required to walk through street and road, get to NPC and interact then avoid traffic violation in order to complete current level. Player can pause the game play by press Escape button on keyboard and can choose to continue the game, restart current level, change setting or exit game. If exit button game clicked, it will be going back to main menu screen.

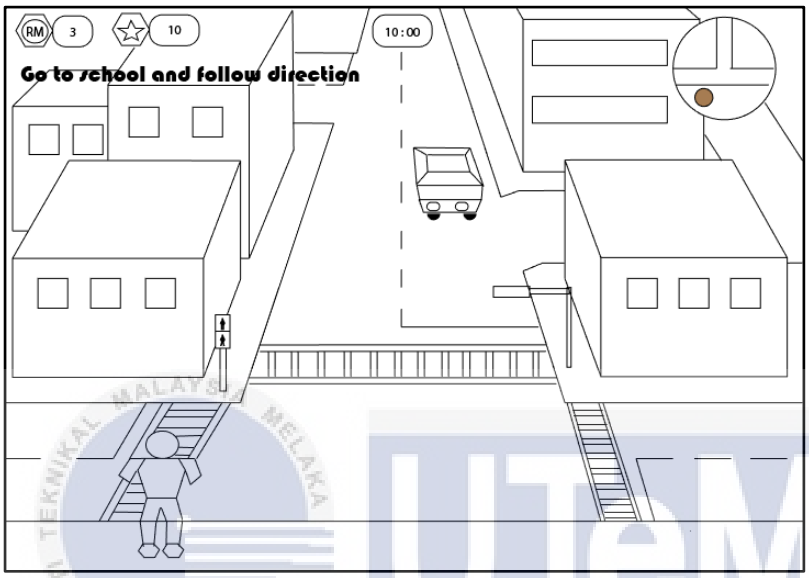


Figure 4.16: Game Play Screen

As shown below in Figure 4.17 is the design of Level Finished screen. Player can view level stat, button level unlocks to continue next level, button play again to restart current level and main menu button to return main menu screen

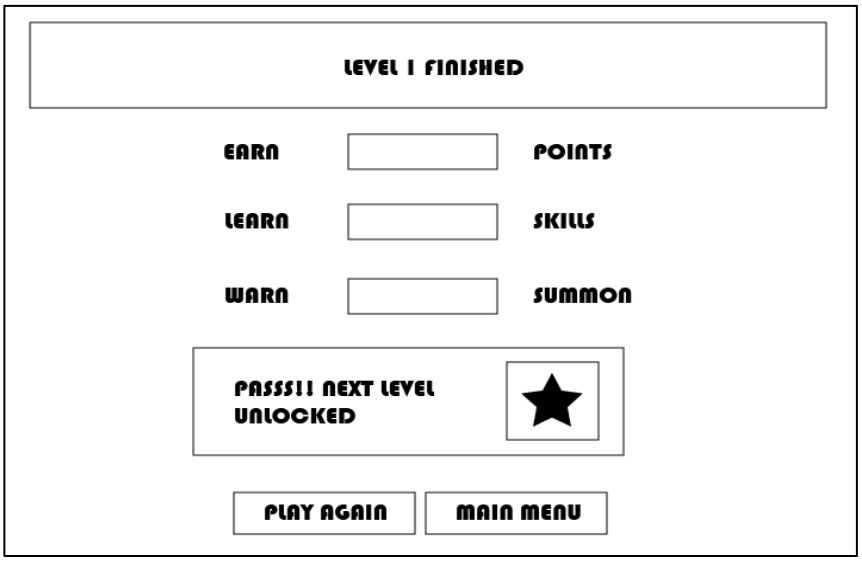


Figure 4.17: Level Finished Screen

As shown below in Figure 4.18 is the design of Game Over screen. Player cannot continue the current level and need to restart at starting level. The screen will appear when player not enough money to continue the game or not click continue button in given time. In this screen, there has a three button which is home (main menu), stats (show the stats) and restart (restart current level)

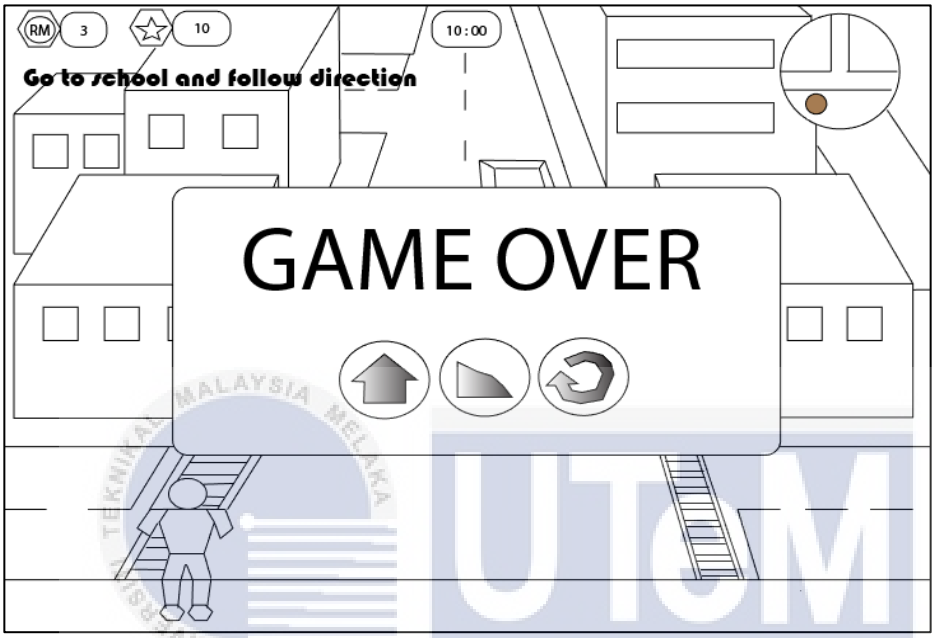


Figure 4.18: Game Over Screen

iv. Metaphors

The game theme in this project is children in learning oriented. The purpose is to create a children world space in virtual environment manner to expose the player experience and at the same time guide them follow the road rules and regulation. It also to give their own imagination towards the character and capture the children attention.

v. Templated Design

In this project, after player select the character, they want to be, the game scene will display the head unit display (HUD) on the top of screen. In this HUD, player can see a money and reward collection, general information, mini map and timer. Therefore, player need to move through the street and road to find NPC. Moreover, the screen will use mouse pointing to flashing selected object when player mouse over the selected object.

vi. Uploading files

After completing the game project, it will be exported to Windows version and Web version. Hence, for the Windows version, the executable file (EXE) will be created in order to install the game in Windows PC platform and for the Web version it will deploy in WebGL and share it on Unity Connect.

4.6 Summary

In conclusion for this chapter, designing the game is most important part in this chapter that purposes to show overall look of this project. In addition, this chapter also help catch up with player's need and focuses to game demand for children. Therefore, it guides the developer to develop this project very well.

CHAPTER V

IMPLEMENTATION

5.1 Introduction

In this phase, the real production begins. This is important part of game development where the ideas and design transform to digital manner and takes more time in schedule of project development. As well as we know, use of resources are high during this phase.

Therefore, all design from previous chapter will be implemented in this chapter. Hence, the purpose of this chapter is to ensure that this project, which contains all the code, modules, components, and libraries, is complete so that there are no errors when testing with the target audience. In general, this chapter explains the details of the deployment phase, including creating media, code and others.

5.2 Media Creation

i. Texts production

The text element in this game is used to describe the game title, characters name title, information or warning message, timer and score counter. The font size of each text depends on the function of the text. As for the game name, the text is centered on the game screen and the font is larger than normal. Figure 5.1 is an example of text use in the game.

Figure 5.1: Example of Text Use in The Game

ii. Graphics production

The graphic production in this project mostly using Adobe Illustrator software and all graphics is common produce in vector. Moreover, the character, NPC and objects or building in 3D model created using Maya 2020 software and imported from outside. Figure 5.2 is an example of graphics and 3D model in the game.

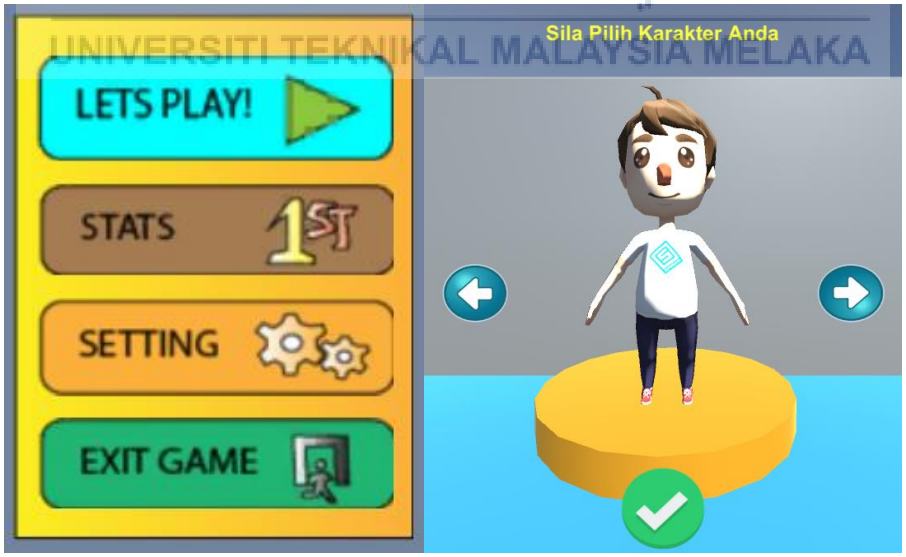


Figure 5.2: Example of Graphics & 3D Model in The Game

iii. Audio production

The audio used in this project is the music background, hit sound and engine car starting sound. The audio is downloaded from free royalty audio source site such as bensound.com and YouTube. It will go through editing process by using Audacity software and then converted into wav file. Then the audio imported to Unity and used for the whole project. As a shown below is the list of audios used in this project:

a. Music background
b. Hit sound
c. Car engine sound.

5.3 Media Integration

As shown in Figure 5.3, this is an example of media integration in this project. Therefore, media integration is very important in the game development process because it can improve the user experience of when playing games.

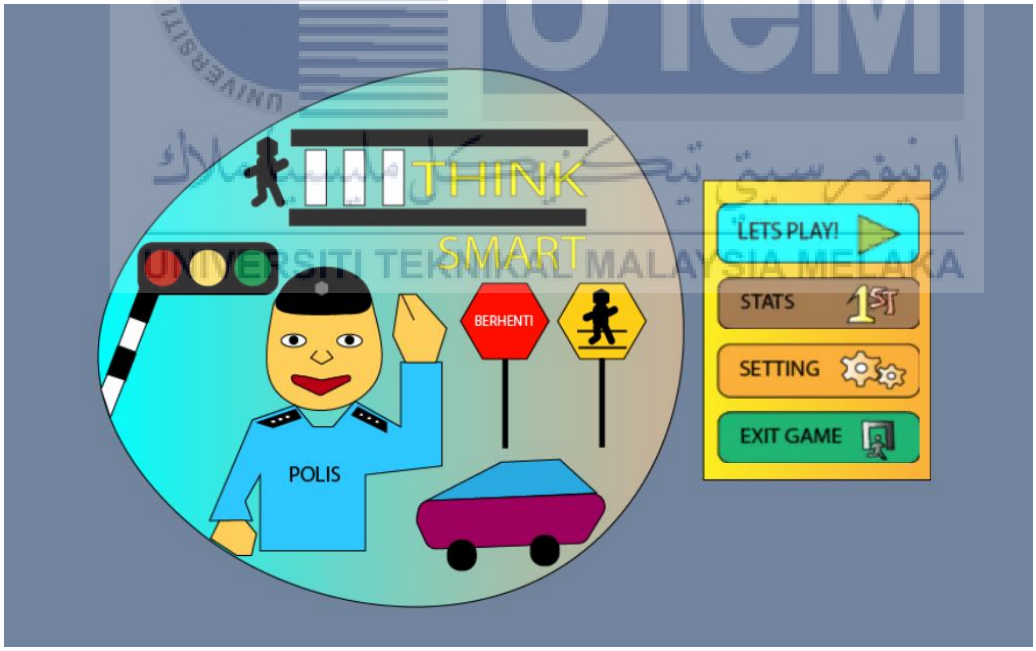


Figure 5.3 Example of Media Integration in Main Menu

First of all, in order to combine all elements including text, graphics, and sound in full-screen mode, the developer designed every scene required for the project, and then proposed a suitable theme for the game. This is to ensure fun

element suits with the theme and as a useful guideline for developer decided the correct theme.

Besides that, music background starts when Main Menu screen appeared and then followed by next music background when new level starts. Sound effect used in this game is mostly used in the level scene especially to get sense of awareness by children such as car engine start audio (aware for car movement) and hit sound (if being hit by vehicle)

5.4. Product Configuration Management

Product configuration management in developing a game is very important due it is a process for establishing and maintaining the consistency, performance and functionality of the game. Therefore, the project has gone through several stages of product customization to ensure that the project works as expected and is identified and recorded in sufficient detail to support its planned life cycle. Hence, this section will elaborate all the details about the game engine being used, plug in libraries, and others.

First, this whole project was developed by using Unity version 2020.3.1f. As shown in Figure 5.4, since this version has a lot of improvements rather than the previous version especially in latency reduction using view or controller late latching for quest on Vulcan and scripting documentation improvement for Application.isPlaying.

Figure 5.4: Game Engine Used to Develop Think Safe

Besides that, it also fixed occlusion culling glitches that occurred when transitioning between two baked occlusion areas and the camera was close to the clipping plane. This Unity software is most stable version ever build from previous version.

After finished developing the game, to enable the game played on web browser, developer requires to install WebGL publisher that can obtain from Unity Package Manager as shown in Figure 5.5 below before exporting the game to the Unity Connect platform.

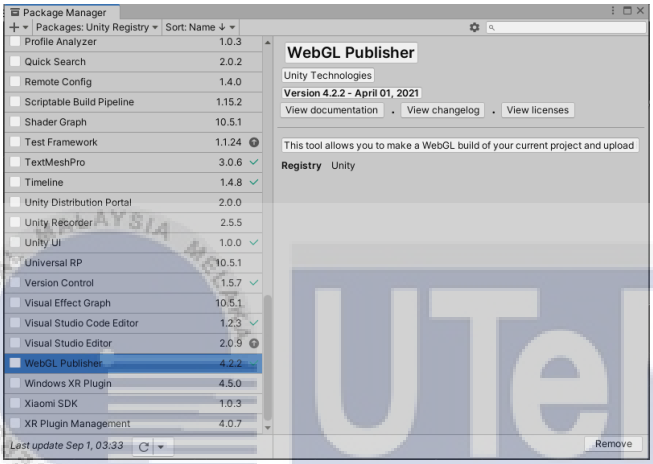


Figure 5.5: WebGL Publisher

Once the WebGL publisher ready, developer shall edit the identifier in Project Settings and export the game as usual by using Build Settings as shown in Figure 5.6.

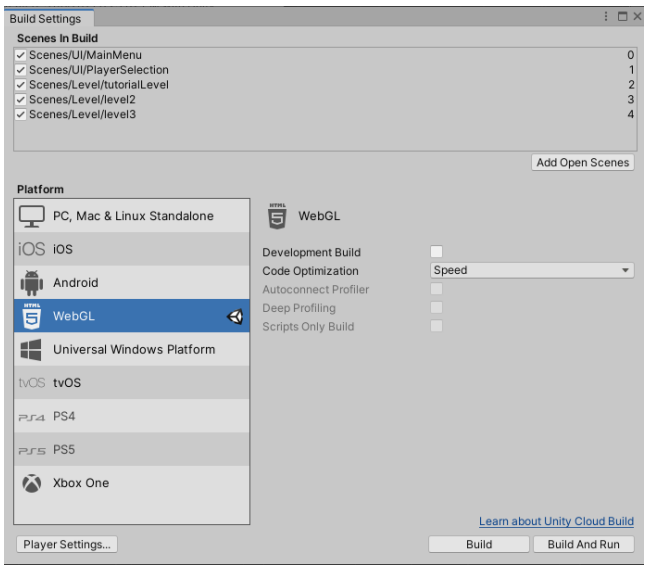


Figure 5.6: Building a WebGL File

After done building a WebGL file, the last step is to publish the content to Unity Play platform by using WebGL publishing tools as shown in Figure 5.7

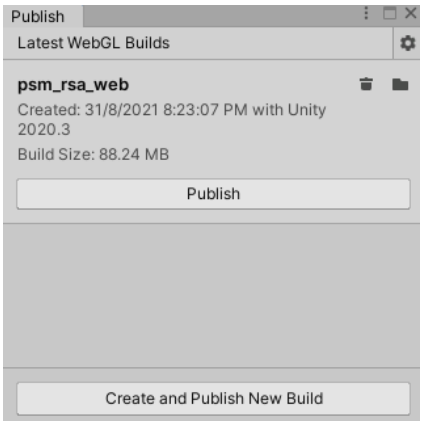


Figure 5.7: Publish to Unity Play Platform

5.5 Implementation Status

As shown in Figure 5.8 is the process of creation and developing the game. Thus, in this section this process will be elaborate more including how each phase be done and how longer each phase take time to be done.

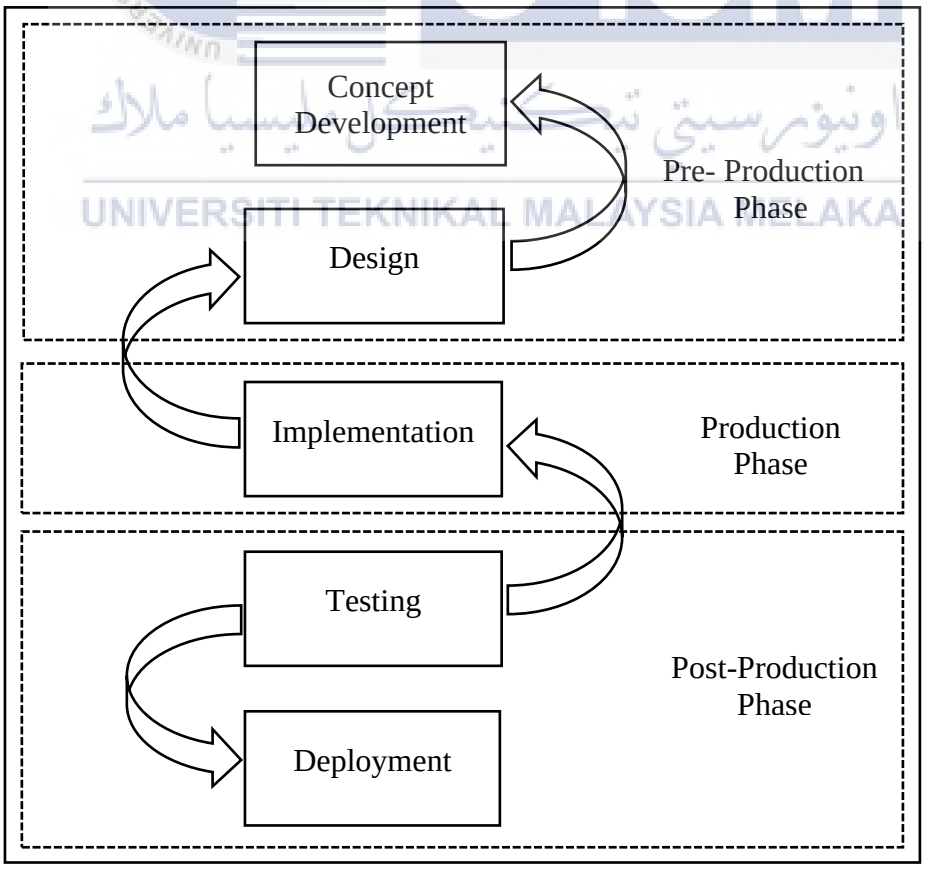


Figure 5.8: Process of Game Creation

As shown in Figure 5.9, this is the implementation status for the whole project. Overall, it took 7 months to complete this project. At the first stage which is concept development and design took almost 2 months due to brainstorming the idea and define the game mechanic, game rules and as well the game play of the game. At first, this project was designed for children with special needs and the aimed of this game is to test the attention span among the children however changed it to stimulating physical play of children due to the first target user are difficult to find.

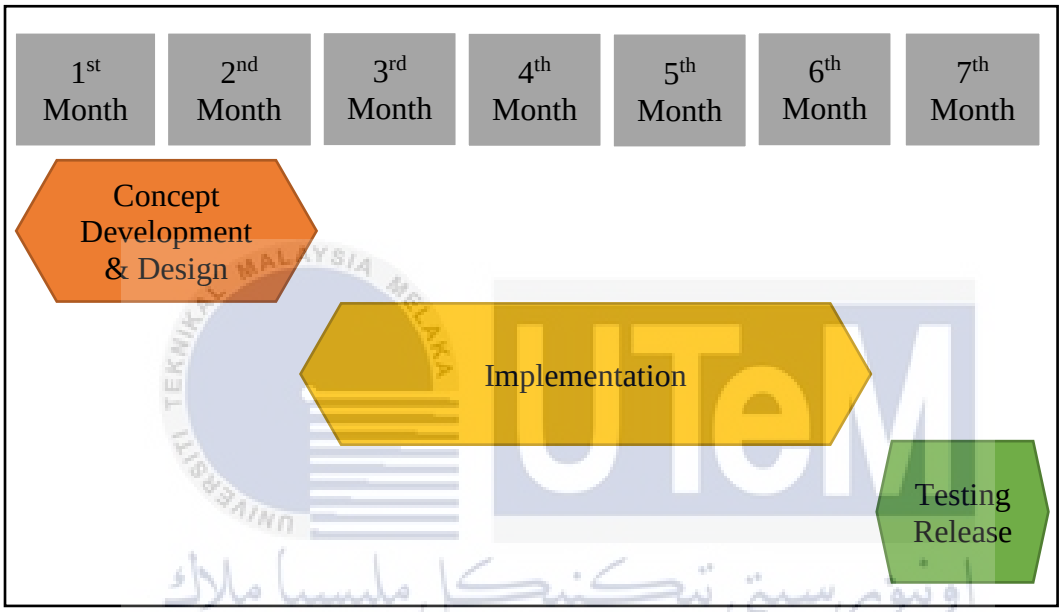


Figure 5.9: Implementation Status of Think Safe

Besides that, implementation phase took almost 4 months due to implement everything was design in the game engine and also this phase required a longer time due to programme the AI technology in the game and also to ensure everything were being coded well. Meanwhile, testing phase took almost 1 month because this project's usability testing was divided into three categories and each category undergoes its own phase according to the usability testing plan had been make and also the availability of test participant. Hence, the data will be analysed and the game project will be release.

5.6 Summary

Overall, this chapter is related to the previous chapter which is design. However, in this chapter is explaining about how to implement and to create the design in the software such as Adobe Illustrator, Audacity and Unity. Thus, this chapter is very important in making sure that the project will complete within the dateline including the code, graphic, sound and others. Hence, the usability testing of the game will be explained in the next chapter including the testing plan, procedure and also the data analysis.

CHAPTER VI

TESTING

6.1 Introduction

Every game development that follows the Game Development Life Cycle will undergo the testing phases to evaluate usability of this game, bug feedback or any sign of glitch that occur in this game. However, during this project, we are going to be concentrate on usability test which implies a method utilized in user-centered interaction design to evaluate a product by testing it on users. In addition, the purpose of this usability test is to identify any usability problems, collect qualitative and quantitative data, and determine the participant's satisfaction with 3D RPG game.

Therefore, this chapter details the test plan and methods used during the usability testing being performed.

6.2 Test Plan

Test plan is necessary thing in usability test which state activity to undergo, the testing environment that will be conducted, the number of participants involved, duration of testing and more (as in Table 6.1). Therefore, the details for planning a usability test are explained in this section.

During this usability test in pandemic situation, there will be one person only to conduct the test via online method.

Table 6.1: Usability Testing Plan for Think Safe

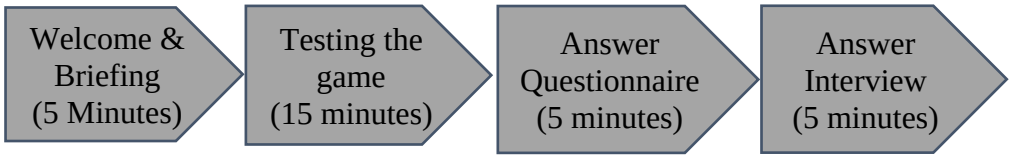
Developer: Mohd Najib Bin Abd Halim

Objectives	Participant	Equipment
To test the usability and suitability of "3D RPG Game for Road Safety Awareness" for age 7 - 11	Minimum 12 participant i. 6 children aged 7 to 9 (male / female) ii. 6 children aged 10 to 11 (male / female)	A PC / Laptop which have internet connection and compatible internet browser

Product Tested: 3D RPG Game for Road Safety Awareness

Test Task & Duration	Location & Dates
Duration: 15 minutes per person Task: i. Play the game ii. Answer the questionnaire iii. Answer the interview	13 to 19 August 2021 at various places (own places)

Procedure



Test Schedule	
Pre-testing	i. Setting up host of game to use for testing ii. Ensure connection to host stable iii. Tells the participant to power up their PC / Laptop with internet connection & browser is ready
Testing	i. Give gratitude to participants to run the game ii. Explains briefly to participant what they are asked to do iii. Give a URL host link to participant accessed it by internet browser iv. Participants are able to start playing the game.
Post-testing	a) Give instruction to participant who answering the questionnaire b) Give a URL link of questionnaire site c) Participant start answering questionnaire d) Participant answering the interview e) Thank them for able to complete the test. f) Collect all data

As shown above, it is the usability test plan for the entire project that explains the elements required to run the test, the purpose of the test, the time and place, equipment, participants, and others.

However, there will be minor changes to the date and venues depending on the attendee's availability.

6.2.1 Test Organisation

During this usability test in pandemic situation, there will be one person only to conduct the test via online method. Thus, this test consists of single stages and will be carried out only between children.

This is because to grant the person in charge regulate the check conducted smoothly.

6.2.2 Test Environment

As mentioned above, this usability test single phases and is performed based on the readiness of the test participants thru online. Therefore, the test participants are come from selected parents who have children aged 7 to 12 years old from various places.

The test was conducted through online using Google Meet medium where it has ability to give briefing, monitoring everything that player have done during the play testing and interviewing participant.

6.2.3 Test Schedule

The testing will be carried out in single stages and conducted only among children. However, the test procedure remains the same for each participant and each test participant has 15 or 20 minutes to try the usability test. Therefore, the test procedure for usability test as listed below.

i. Pre-testing session:

Facilitator will prepare the materials needed during the testing session:

a. Setting up host of game to use for testing (Unity Play)
b. Ensure connection to host stable
c. Tells the participant to power up their PC / Laptop with internet connection & browser is ready
d. Create a Google Meet session and share a code to joined it.

ii. Testing session:

a. Give gratitude to participants to run the game
b. Explains briefly to participant what they are asked to do
c. Give a URL host link to participant accessed it by internet browser.
d. Participants are able to start playing the game.

e. Monitor participant through PC / Laptop camera and screen sharing via Google Meet and record everything by OBS software.
f. Facilitator will record everything needed for the observation data.

iii. Post-testing session:
a. Give instruction to participant who answering the questionnaire
b. Give a URL link of questionnaire site
c. Participant start answering questionnaire
d. Participant answering the interview
e. Thank them for able to complete the test.
f. Collect all data

6.3 Test Strategy

There are several methods of performing usability tests. In this test, it only used single method during usability testing which is retrospective probing. Essentially, retrospective probing requires the facilitator to wait until the session is complete and then question the thoughts and actions of the participants. In addition, post-test questionnaires and interview are essential step to get effective data collection to ensure that participants have a difference in their thoughts after taking the test. In addition, the moderator should take notes, almost anything the participant has made as detailed as possible, as it will make analysis easier.

Therefore, the strategy of the usability test is to observe the participant and also to do the questionnaire and interview after the test to collect the qualitative and quantitative data.

6.4 Test Design

In this section, it will explain the specification required to test usability, including what to test, the characteristics of the test item under test, and how to successfully test the features.

6.4.1 Test Description

The usability test usually takes 15 to 20 minutes to complete among single categories of play tester which is children group. It is designed to evaluate the usability of 3D RPG game. In addition, this test is also used to obtain information about the product, to make recommendations for future improvements and to determine the satisfaction of the user with the product.

Therefore, there are several expected results in this test to facilitate the analysis which is:

i. How the game can visualize virtual environment to trigger players reaction.
ii. How the game approach can improve player knowledge of road safety awareness education
iii. How the game can trigger participant behaviours and improve their action when on the road.

6.4.2 Test Implementation

i. Places

Due to the pandemic situation, there has a limitation for developer to organise the test in one place because doing assembly is prohibited. Despite of the ban, there has an alternative way to implement the test and we choose Google Meet as shown in Figure 6.1 to handle the test through online method.

Figure 6.1: Google Meet Platform

The reason why we use the Google Meet, it is compatible for developer to monitor, record the activities and communicate with play tester. Hence, it also accessible from play tester device that have stable internet connection.

ii. Questionnaire

There has a various way to implement the survey questionnaire in post-test and Google Form is mostly popular platform to do this. But, for children on age 7 to 9, using Smiling Meter Scale to measure the weakness and strength for every question is so hard for them. Due to this age group, we take initiative to use smiley scale as shown in Figure 6.2 to measure the weakness and strength.

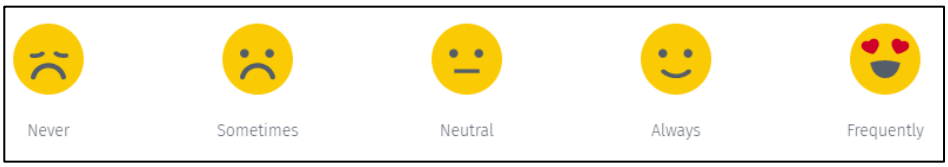


Figure 6.2: Smiley Meter Scale

However, Google Form are not offering smiley meter scale and as alternative, we choose to use QuestionPro (www.questionpro.com) as a questionnaire medium because it has capability to use smiley meter. Hence, using smiley scale is the best way to attract the children answering the questionnaire and it is enjoyable for them.

6.4.2 Test Data

i. Participant's demographic

The category is 12 children aged 7 to 12 years old with basics of computer literation and computer game experience as shown in Table 6.2.

Table 6.2: Total Children Based on Age Group

Age	Count
7	3
8	2
9	1
10	1
11	2
12	3

From the total count of children, we split the group by male & female gender as shown in Table 6.3.

Table 6.3: Total Children Based on Gender

Male	Female
5	7

6.5 Test Results and Analysis

In this section, it will analyse the data get from questionnaire and interview results. Developer chooses descriptive statistic and thematic analysis as analysis technique.

6.5.1 Demography

As this game is focused on children, game experience data is used to see how they are known about the game, platform that they preferred, game that they are like to play and the frequency of playing the game.

i. Game Experience

Data from the first questionnaire as shown in Figure 6.3 describe the highest participant prefer to play on Laptop platform at 47.37%, followed by Smartphone platform at 26.32%, Computer at 21.05% and the lowest is Smart TV at 5.26%

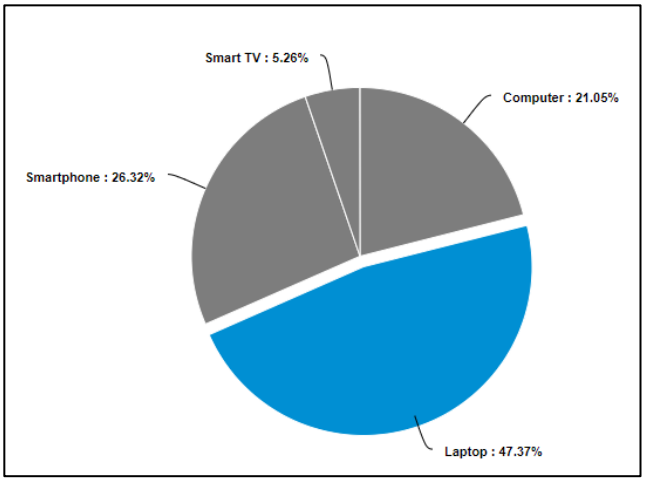


Figure 6.3: Participant Prefer to Play on Platform

Data from the second questionnaire as shown in Figure 6.4 describe the game genre that participant like to play

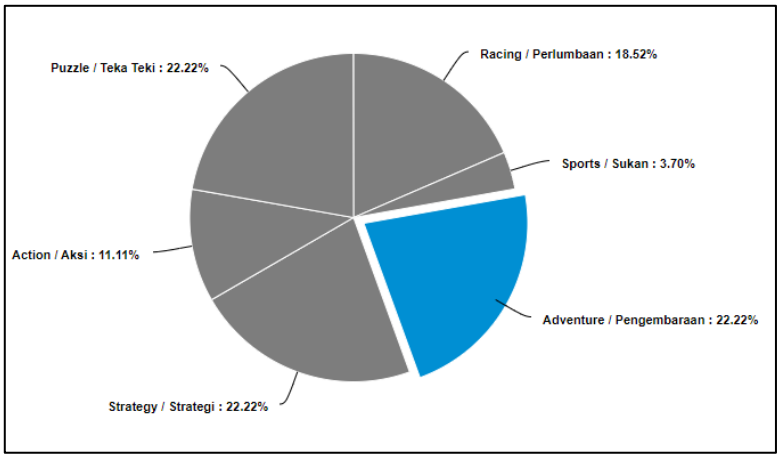


Figure 6.4: Game Genre Participant Like to Play

ii. Game Frequency

Data from third question in questionnaire as shown in Figure 6.5 and its descriptive statistic data in Table 6.4 shows the frequency of playing games. Scale number 5 is the highest (Mode = 4) with 4 participants answered that they frequently play the game. On average, participants frequently playing score is 3.91 (Mean = 3.91) which means participant frequently play the game are not to the part that they frequently play game all time. The median of participants frequency is 4 (Median = 4)

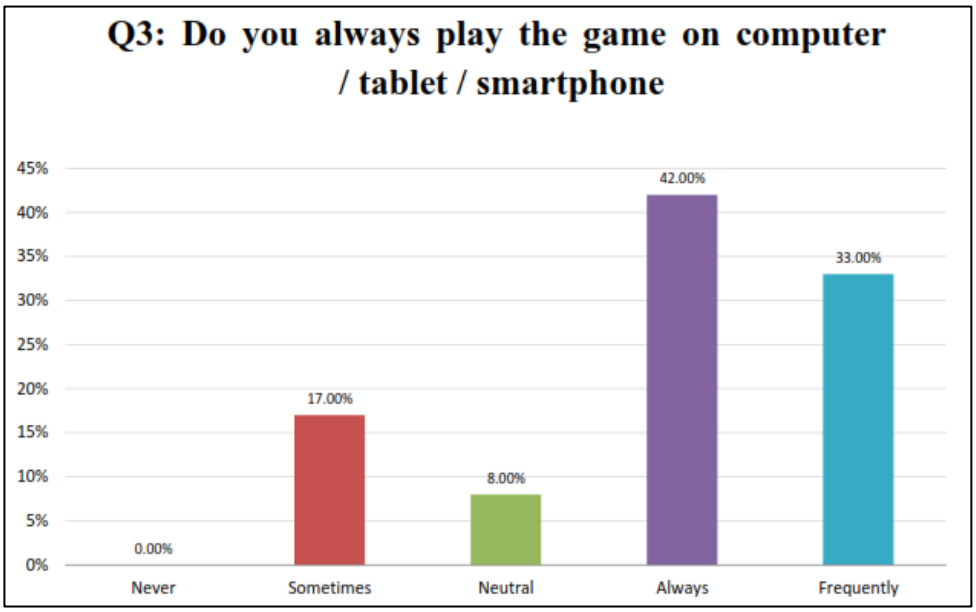


Figure 6.5: Scale of Playing Game Frequency

Table 6.4: Descriptive Statistics of Question 3

	Data
Mean	3.91
Median	4
Mode	4

6.5.2 Experience

As this game focused on level experience when they need to complete each stage without fail, data from question 4 in questionnaire is shown in Figure 6.6 and its descriptive statistic in Table 6.5. Scale number 4 is the highest (Mode = 4) with 5 participants that they felt very easy to complete each level. On average, participants completion score is 4.25 (Mean = 4.25) which means participants experience in the fame are not to the part that they cannot complete at all as they complete all stage. The median of participant experience is 4 (Median = 4).

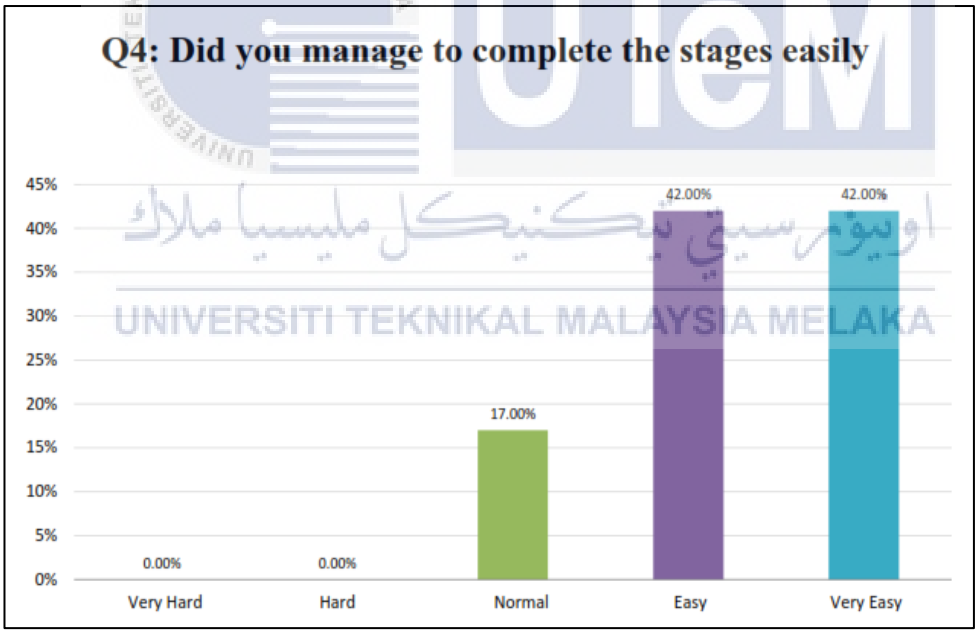


Figure 6.6: Scale of Level Completion

Table 6.5: Descriptive Statistics of Question 4

	Data
Mean	4.25
Median	4
Mode	4

For the question 5, the data from questionnaire as shown in Figure 6.7 and the descriptive statistic are shown in Table 6.6. Scale number 5 is the highest (Mode = 5) with 6 participants stated that they felt very fun on each level and the data in bar chart shows scale 4 are equally same. On average, the feel of level enjoyment is 4.25 (Mean = 4.25).

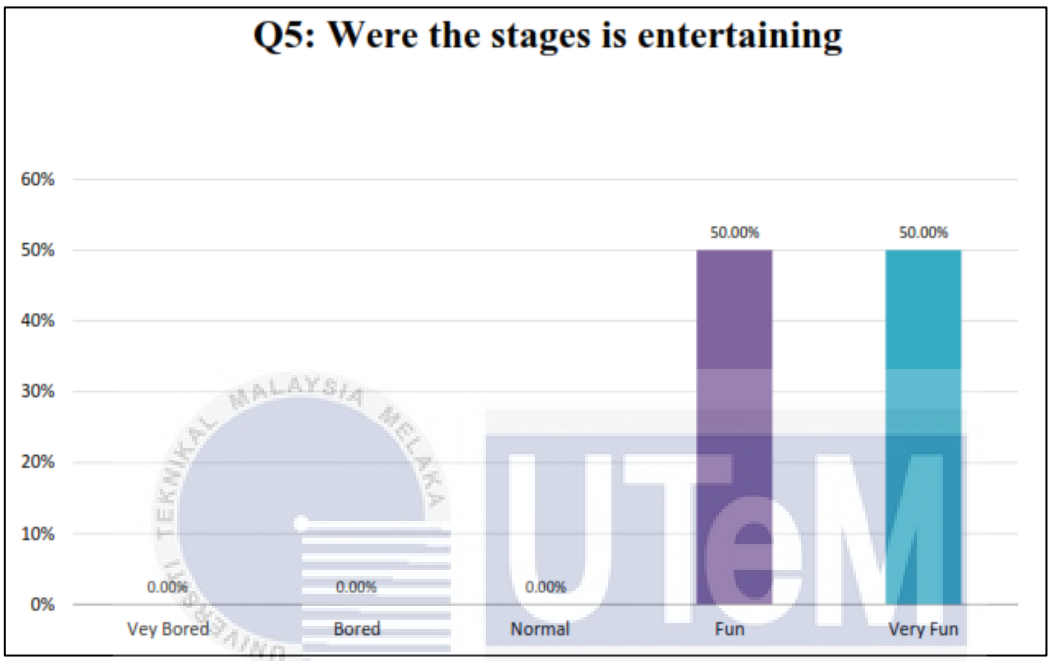


Figure 6.7: Scale of Entertaining Stages

Table 6.6: Descriptive Statistics of Question 5

	Data
Mean	4.25
Median	4
Mode	5

For the question 6, the data from questionnaire as shown in Figure 6.8 and the descriptive statistics are shown in Table 6.7. Scale number 5 is the highest (Mode = 5) with 5 participants admit that they feel easy to control character movement around in the game. On average, the feel of movement score is 4 (Mean = 4) and it suggested that all participants feel easy to move around.

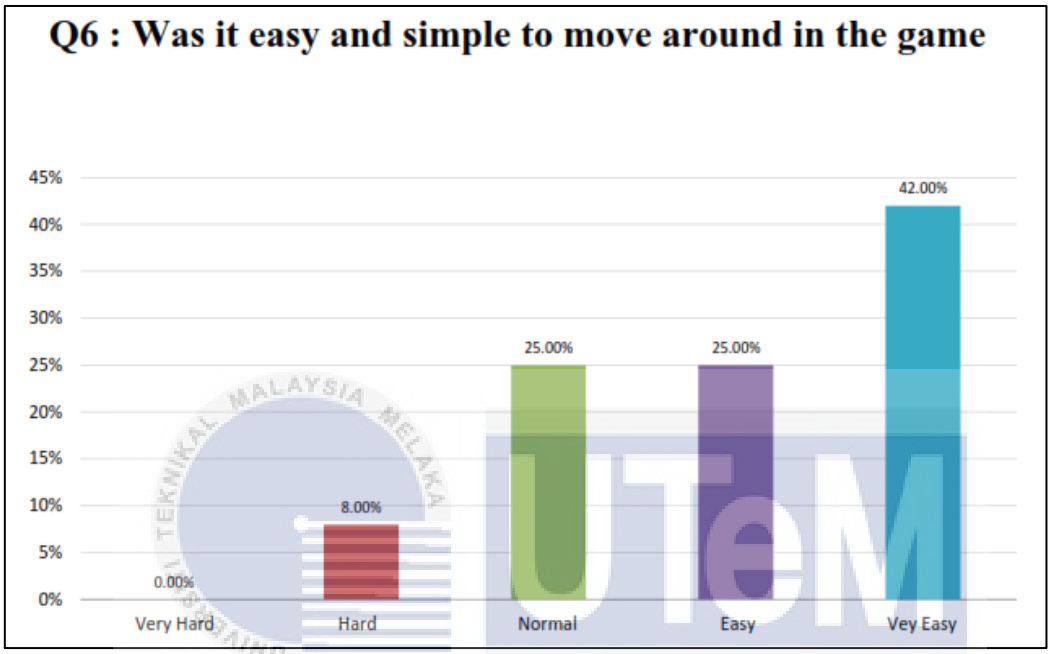


Figure 6.8: Scale of Movement Control

Table 6.7: Descriptive Statistics of Question 6

	Data
Mean	4
Median	4
Mode	5

For the question 7, the data from questionnaire as shown in Figure 6.9 and the descriptive statistics are shown in Table 6.8. Scale number 5 is the highest (Mode = 5) with 7 participants admit that they feel not bored to playing this game. On average, the feel of not bored score is 4.58 (Mean = 4.58) and it suggested that all participants feel this game is not so bored.

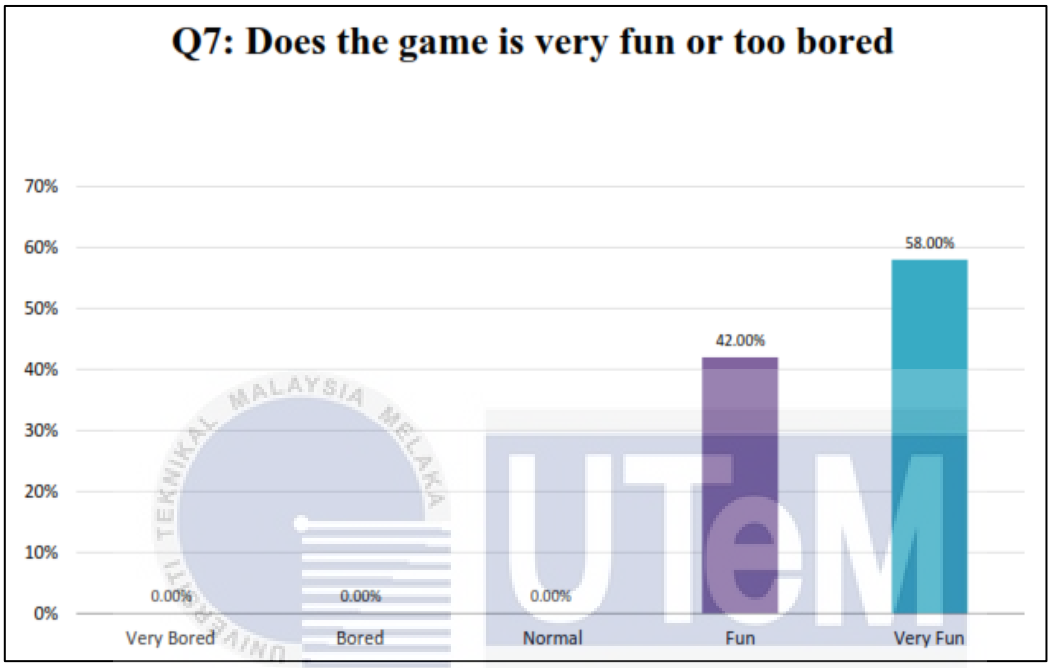


Figure 6.9: Scale of Game Enjoyment

Table 6.8: Descriptive Statistics of Question 7

	Data
Mean	4.58
Median	4
Mode	5

For the question 8, the data from questionnaire as shown in Figure 6.10 and the descriptive statistics are shown in Table 6.9. Scale number 5 is the highest (Mode = 5) with 10 participants admit that they feel interested to this game after playing. On average, the feel of interested score is 4.66 (Mean = 4.66) and it suggested that all participants feel this game is interested to play.

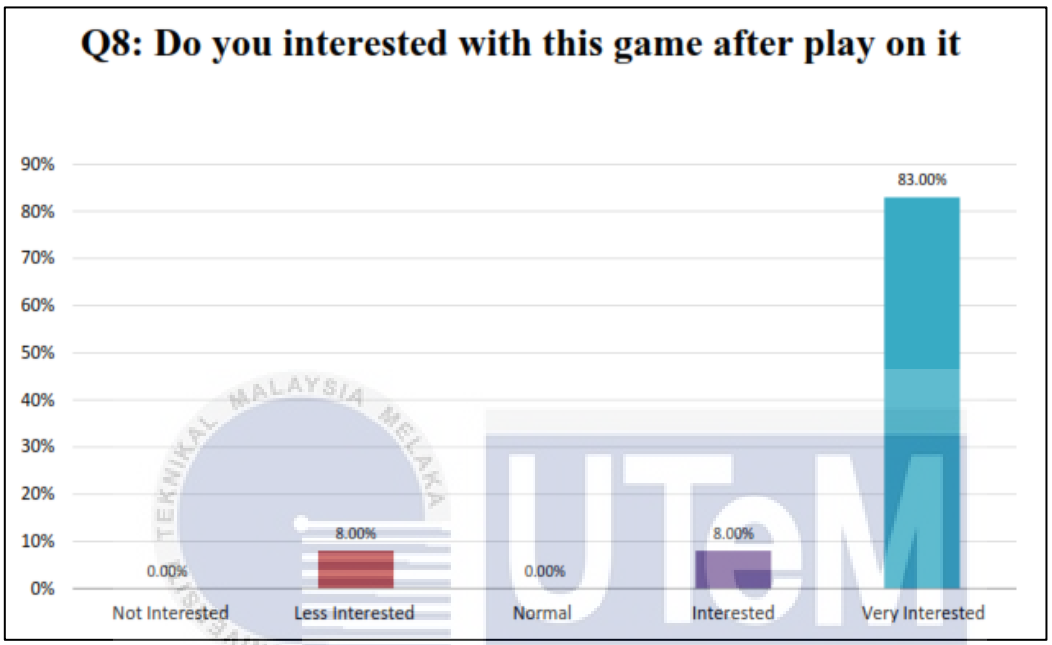


Figure 6.10: Scale of Game Interest

Table 6.9: Descriptive Statistics of Question 8

	Data
Mean	4.66
Median	5
Mode	5

For the question 9, the data from questionnaire as shown in Figure 6.11 and the descriptive statistics are shown in Table 6.10. Scale number 5 is the highest (Mode = 5) with 6 participants admit that they feel view of the game world are very same with actual environment. On average, the feel of interested score is 4.33 (Mean = 4.33) and it suggested that participants feel the game world view in this game is same with actual environment outside.

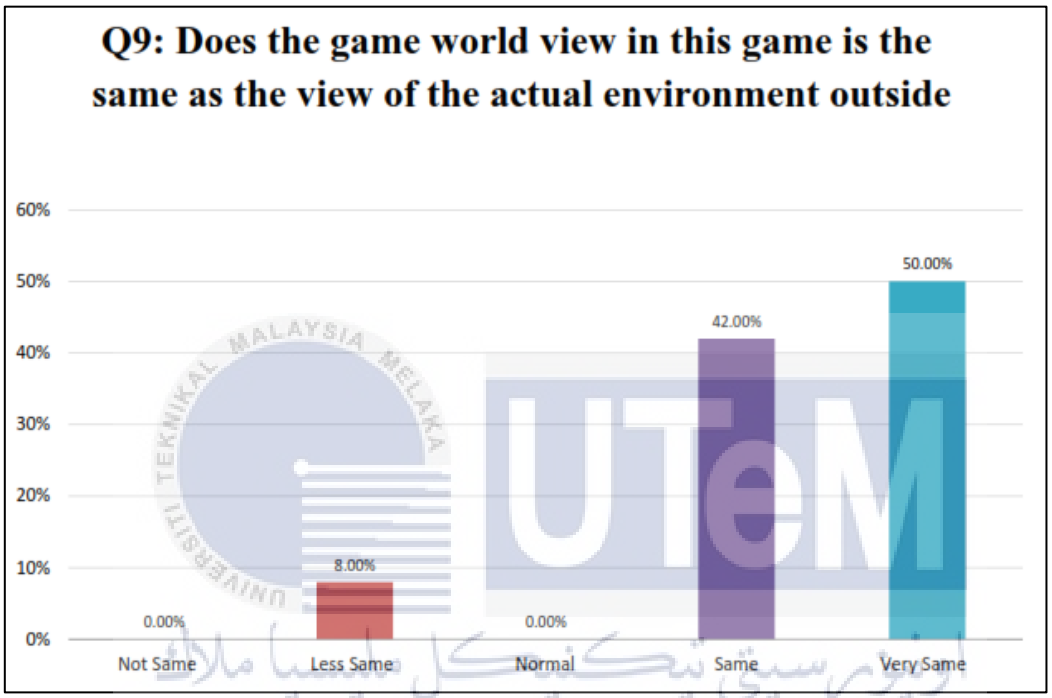


Figure 6.11: Person View Rating

Table 6.10: Descriptive Statistics of Question 9

	Data
Mean	4.33
Median	4.5
Mode	5

Earn Experience

During the observation, player mostly like on all level because the visual environment in this game can triggers their reaction. Participant N stated, "*kena berhenti dulu sebelum melintas, tengok kiri dan kanan (must stop before crossing, look left and right side)"* when they want to practise road crossing. According to that, we can see that they are know what to do after facing with condition in visual environment. As shown in Figure 6.12 below indicate the participant reaction when they need to cross the road

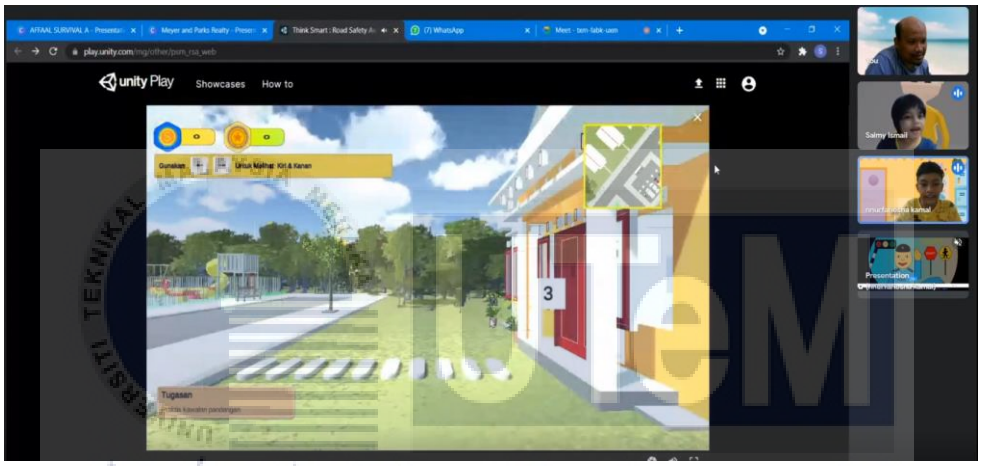


Figure 6.12: Participant Reaction When They Want to Crossing Road

Through observation, when suddenly car reverse while they walk on sidewalk, participant A react to step back behind and wait until the car return to parking bay. When we asked why participant do it, they stated "*kalau kereta bergerak dan kita jalan, nanti kena langgar mati (if car moving out and we walk, if being hit can caused death)*. According to that, we can see that they ready to face with unexpectedly condition and remember the cause if they still want to walk. As shown in Figure 6.13 indicate the participant reaction when the car suddenly reverses from the carpark.

Figure 6.13: Participant Reaction When Car Is Moving Out

6.5.3 Awareness

As this game focused on awareness of road safety when they finish the game, data from question 10 in questionnaire is shown in Figure 6.14. This figure shows all of 12 participants will be careful when on the road after playing this game

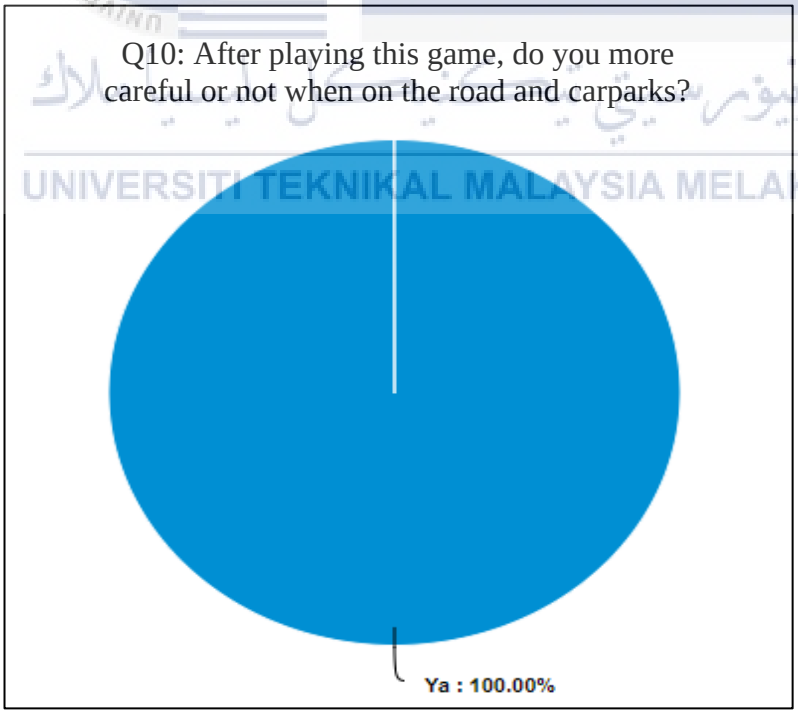


Figure 6.14: Pie Chart of Question 10

For the question 11, the data from questionnaire as shown in Figure 6.15 and the descriptive statistics are shown in Table 6.11. Scale number 5 is the highest (Mode = 5) with 6 participants admit that they understand why this game is developed. On average, the feel of understanding score is 4.5 (Mean = 4.5) and it suggested that all participants feel this game is understanding why it is developed.

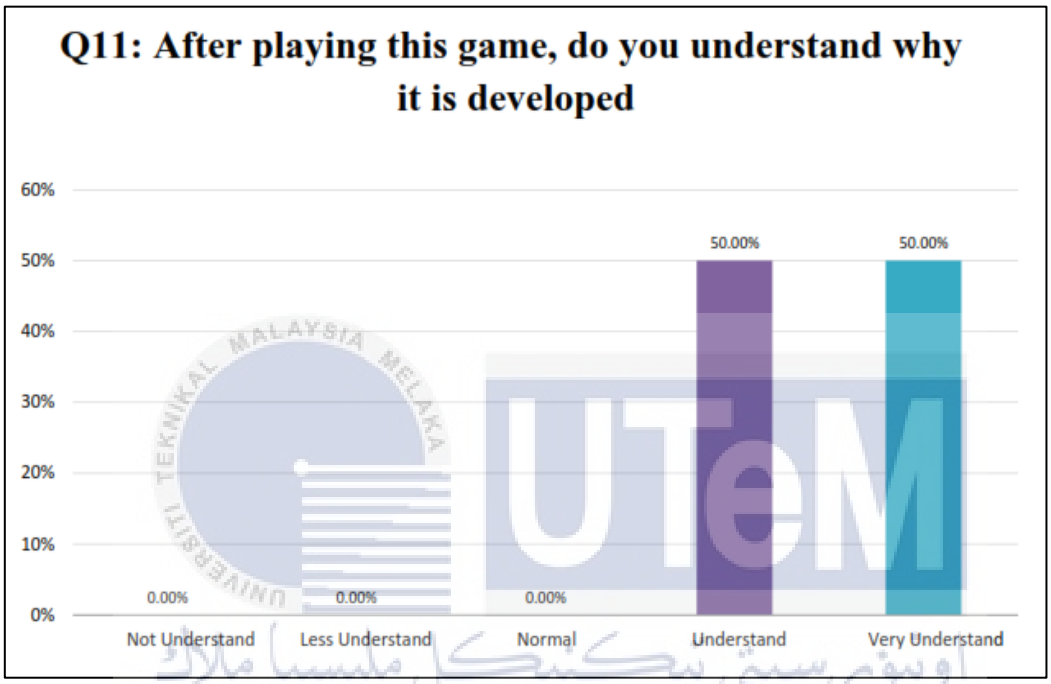


Figure 6.15: Scale of Game Development Understanding

Table 6.11: Descriptive Statistics of Question 11

	Data
Mean	4.5
Median	4.5
Mode	5

For the question 12, the data from questionnaire as shown in Figure 6.16 and the descriptive statistics are shown in Table 6.12. Scale number 5 is the highest (Mode = 5) with 9 participants admit that they comprehend every instruction easily. On average, the feel of understanding score is 4.75 (Mean = 4.75) and it suggested that all participants feel this game comprehend every instruction easily.

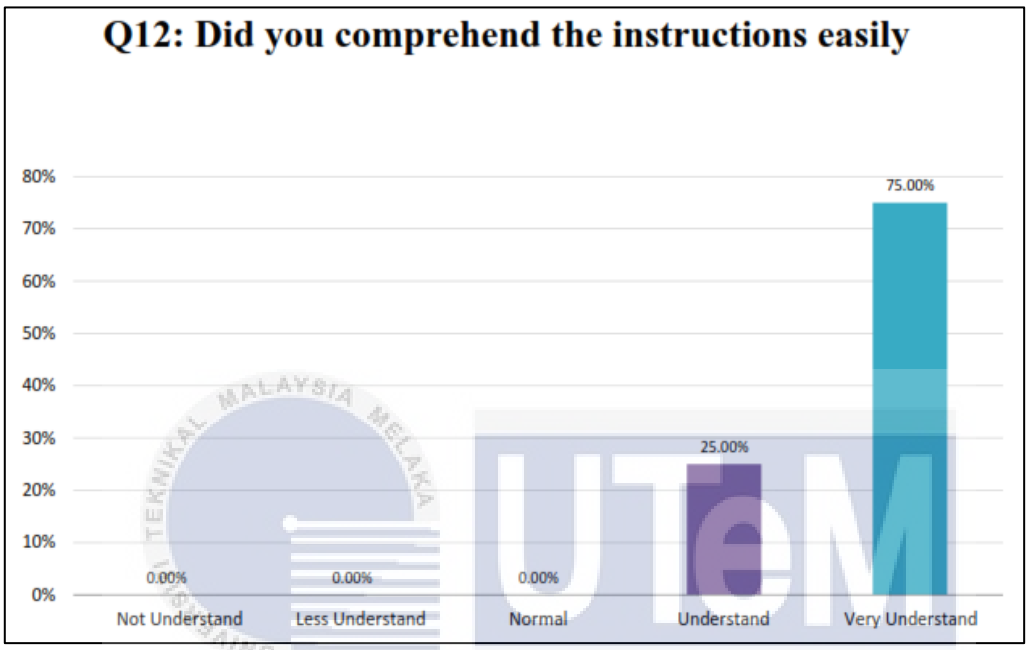


Figure 6.16: Scale of Instruction Understanding

Table 6.12: Descriptive Statistics of Question 12

	Data
Mean	4.75
Median	5
Mode	5

Create Awareness

During the interview session, participant was required to justify their answer regarding to what they have learn when play this game. Participant A stated "*sebelum nak berjalan belakang kereta kena tengok dulu dia nak bergerak ke tak (Before want to walk behind the car, we must firstly check if that car wants to move or not).* According to that, we can see there can follow instruction and aware

with condition near them. As shown in Figure 6.17, the participant tells developer about awareness they get when playing this game.

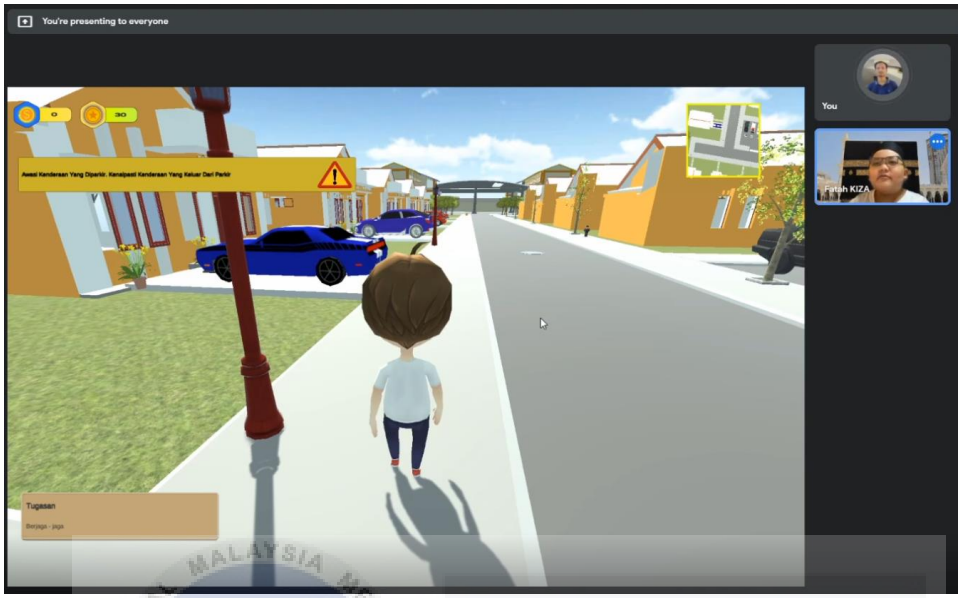


Figure 6.17: Player F Awareness

We asked the participant if this game suggested as an alternative for road safety textbook during the class, participant M stated, "*saya suka, sebab buku tak nampak sangat keadaan sebenar (I'm like it because the book not see real situation)".* According to that, we can see this game have capability and practical to practice and create awareness to them. As shown in Figure 6.18, the participant tells developer about these games as an alternative for road safety textbook.

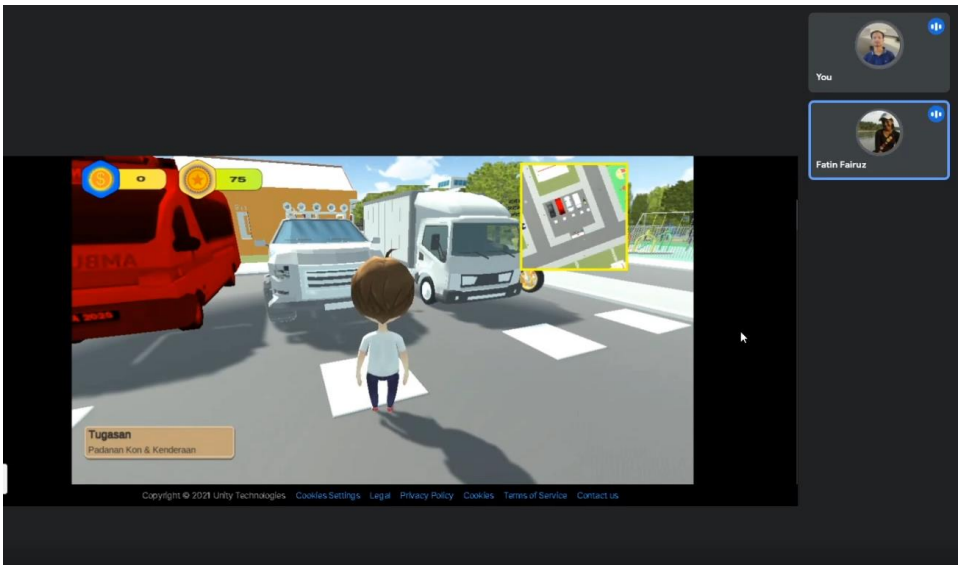


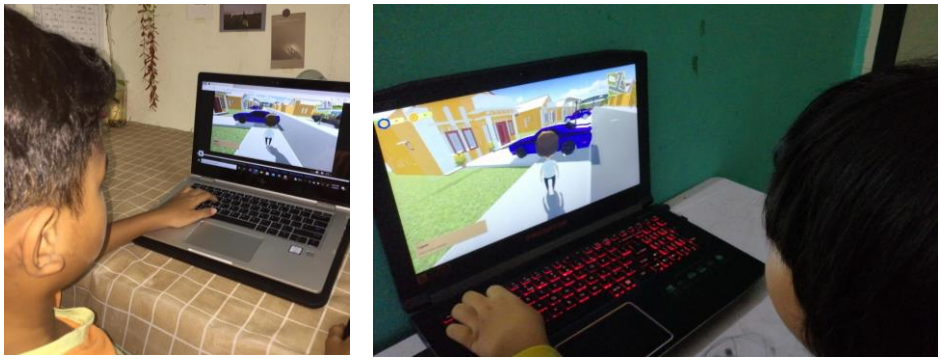
Figure 6.18: Player M Awareness

6.5.4 Findings

i. 3D RPG game can visualize virtual environment to trigger players reaction.

This project is about to find how does virtual environment can trigger players reaction and it is being validate in the post test where 100% of the participants said the environment in this game is seems like same with local environment outside such as road, buildings, flyover and ramps. By observation, we found that when they move the characters through sidewalks that have a vehicle suddenly moving out from parking, they seem to reverse a character back before being hit by a vehicle. Also, when they want to cross the road, they practise the left, right and left view to see the incoming vehicles before it safe to cross the roads instead of using zebra crossing.

As shown below, there are two examples in Figure 6.19 where the participants react to vehicles engine sound, they carefully walking and when the vehicle suddenly reverse, they step back and wait until the vehicle is entering the park again. Hence, this conclude that virtual environment in 3D RPG game can triggers players reaction. Regarding to test result in experience manner we can justify this project enables to triggers player reaction. The findings support Herold et al, (2019). They demonstrated that game have ability to visualise player in realistic environment and trigger reaction when some scenario on the road is happen.



Participants wait until the vehicle is clear from the sidewalks

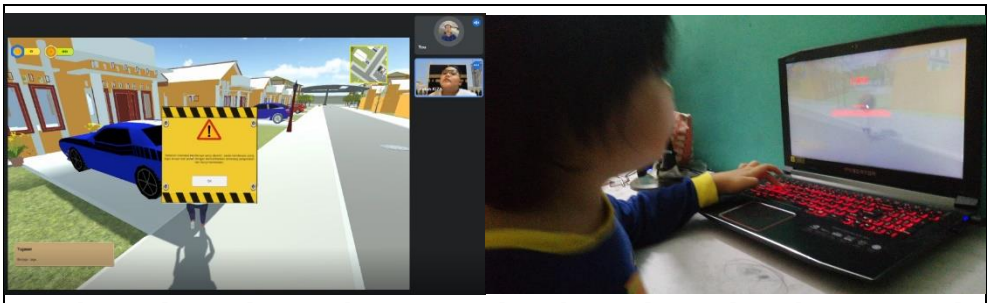
Figure 6.19 Examples of Test Participants Reaction

Besides the data shows the test participants are mostly agree that virtual environment in this game almost same with outside environment. Hence the data of virtual environment were observed and recorded.

ii. 3D RPG game approach can improve player knowledge of road safety awareness education

In this project, we need to find out that 3D RPG game can improve player knowledge of road safety awareness and it is proof that they have learn something after playing this game. Through the data collected in the post test, we found that 100% of test participant will be careful when they need to walk along the road. During observation, we get feedback from player that they have learned a step to do road crossing, always careful when approaching the nearest vehicle and use only sidewalk to walk along main road because it is dangerous to walk on the main road.

In Figure 6.20, there are two example of testing player knowledge of road safety education which is (a) is about being careful when passing the vehicle parking and (b) is about use the sidewalk is safe rather that use a main road to walk. Player is able to fix their mistake when a reminder given and more caution for the next parking vehicle and player simultaneously get back on the sidewalk if they take a long time on the main road. Besides that, we can justify that this project can improve player knowledge of road safety awareness education.



a) Players learn about to be caution with reversing vehicles when being hit by car and get noticed about always wise the environment before walking

b) Players learn about how to avoid walking on the main road by reminder alert to walk on the sidewalk before time out or being hit by a car.

Figure 6.20: Example of Testing Player Knowledge of Road Safety

This finding support Hussin and Mohd Fauzi (2018). They demonstrated when chance is given to players during the game, it will allow children to learn from their mistake an improve.

iii. 3D RPG game design can be effectiveness tool for children learning

Besides that, we found that every game design is the important point to make the player are fun playing this game without compromise a learning process. This fact validates with data collected during observation and we hear they said that this game is fun, enjoyable and few of them are agree if this game is suggested to be as an alternative for existing textbook.

Through observation, we found for the participant that feel not interested is because of some element control on this game is not suit with them and will take action to fix the element. Besides that, we can justify that this project with good game design will attract players to play and interested with it. This finding supports Wang et. al (2009) that stated that role playing games are a great way for children to grow, communicate and enjoy learning.

6.6 Summary

In general, this chapter focuses on how usability testing is done and through data analysis we obtain three findings which are 3D RPG game can visualize virtual environment to trigger players reaction, can improve player knowledge of road safety awareness education and can be effectiveness tool for children learning. In addition, in this chapter, it will help developer to find out how good the product it is and measures the participants like the products.

As matter of fact, during this testing phase, it can also help the developer get a lot of feedback for future improvements.

CHAPTER VII

PROJECT CONCLUSION

7.1 Introduction

In game development, the project development process is important because it will encourage developer to early planning, coverage and assessment of the needs, goals, objectives, problems and impacts of the project. It also can be determined before significant resources are used. Thus, in the previous chapters, developer can identify the advantages and disadvantages of this project, as well as suggestions for further development.

Thus, this section will shed light on the main result of the work, its main contribution to this area and other aspects.

7.2 Project Summarization

The goal of this project is designing a 3D RPG game that can teach children about traffic safety with fun element without compromise the safety. Thus, it complies with three objectives when developing this project which is to investigate the game elements of 3D role playing for road safety awareness, to develop 3D role playing game based on identified elements and to evaluate children awareness towards road safety through 3D role playing game.

Thus, through the development of the project, all goals were achieved with supported by usability testing that conducted to children. In addition, the data was analysed and through analysis, it can define a finding which the 3D RPG game can help children learn and get awareness when they are on the road.

Therefore, through this project, we can conclude that 3D RPG Game can visualize virtual environment to trigger players reaction and furthermore it can improve player knowledge of road safety awareness education. However, we admit this project also have weaknesses such as control element, text notification too small and platform limitation.

7.3 Project Contribution

This project is contributed to Faculty of Information and Communication Technology of Universiti Teknikal Malaysia Melaka.

7.4 Project Limitation

During this project development, there has a few limitations encountered for developer to handle with it such as lacks AI knowledge that involves traffic management algorithm (traffic lights and car controls), insufficient time to fix all bugs of some functions that developer has to change the gameplay and finding the right models of building to make the game environment is suits with local environment.

7.5 Future Works

During usability testing, developer found a constraint that play tester face when playing the game. Furthermore, a lot of improvement could be made in future works involving gameplay improvement such as waypoint system, interaction system, dialog enhancement and scoring system. Moreover, it also needs to wider the game platform that it can be play not only in PC but also suits with mobile platform such as Android & Apple.

7.6 Summary

In conclusion, the game is still needing a lot of improvement and to achieve the game industries standard, more hard work to do to improve the game. Therefore, it is necessary to improve the gameplay as well as the plot of the game in order to make the game more valuable.

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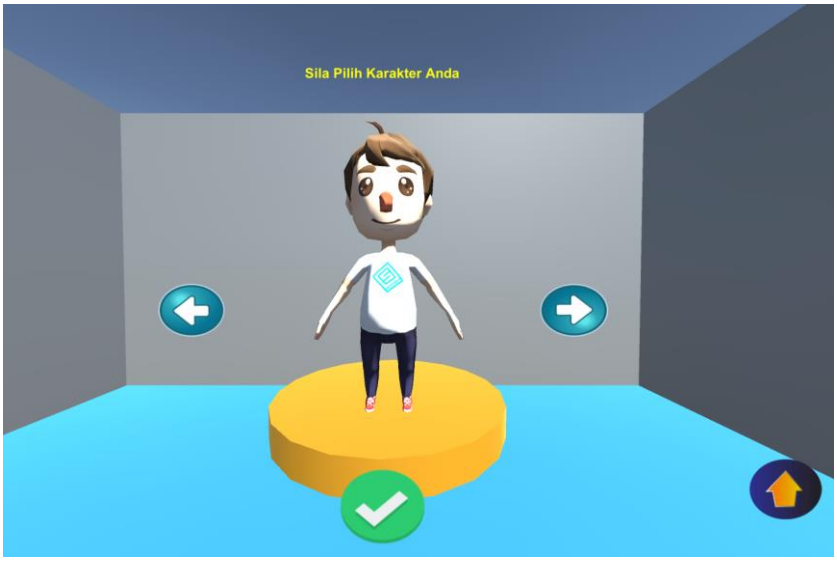
APPENDIX

Asset

Main Menu



Character Selection

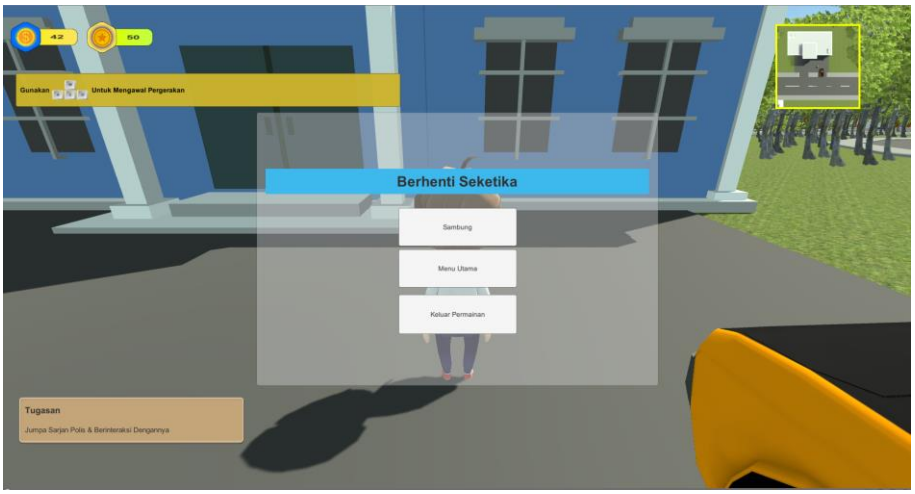
Tutorial Level

Match Vehicle

Identified Danger

Car AI control

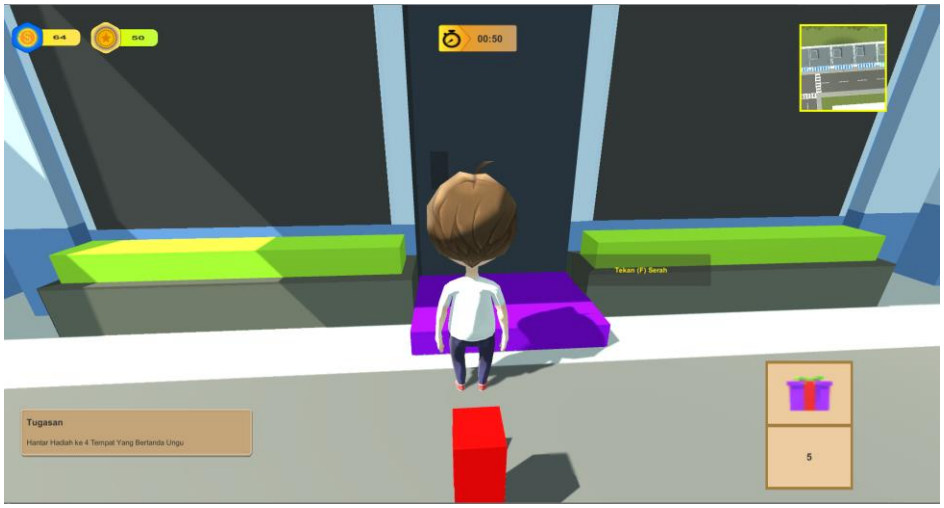
Level Complete



Pause Menu

Dialog System

Quest System



Inventory System

Zebra Crossing Practise

Summon Notification & Trade In

Pedestrian Flyover

Timer, Left Right View Counter

Road Warning Reminder

Source Code

```
using UnityEngine;
using UnityEngine.UI;
using UnityEngine.SceneManagement;

public class GameManager : MonoBehaviour
{
    public GameObject WarningWindow;
    public GameObject TimeOutWindow;
    public GameObject pauseMenuUI;

    public static bool gameIsPaused = false;
    public bool isCrash = false;
    public bool isCollide = false;
    public bool timeOut = false;
    public bool isContinue = false;
    public static bool isTutorialLevel = false;
    public static bool isLevelTwo = false;
    public static bool isLevelThree = false;
    private string currentLevel;
    public int moneyToPaySummon;
    public int monetToPayTimeOut;
    public float timeToAdd;
    private Timer timer;
    private TimeOut timeOuta;
    private ScoreManager scoreManager;
    private SimpleSampleCharacterControl simpleSampleCharacterControl;
    private ObjectiveManager objectiveManager;
    private ItemController itemController;

    void Awake()
    {
        timer = GameObject.FindObjectOfType<Timer>();

        Scene scene = SceneManager.GetActiveScene();
        currentLevel = scene.name;
        Debug.Log("Current Level : " + currentLevel);
    }

    void Update()
    {
        if (Input.GetKeyDown(KeyCode.Escape))
        {
            if(gameIsPaused)
            {
                Resume();
            } else
            {
                Pause();
            }
        }

        SetLevel();

    }

    public void Resume()
    {
        pauseMenuUI.gameObject.SetActive(false);
        Time.timeScale = 1f;
        gameIsPaused = false;
    }


    void Pause()
    {
        pauseMenuUI.gameObject.SetActive(true);
        Time.timeScale = 0f;
        gameIsPaused = true;
    }

    public void Home()
    {
        Debug.Log("Back to home");
        SceneManager.LoadScene("MainMenu");

    }

    public void QuitGame()
    {
        Debug.Log("Quitting game....");
        Application.Quit();
    }
```

```
    public void LoadLevel2()
    {

        SceneManager.LoadScene("level2");
        Time.timeScale = 1f;
        PlayerPrefs.GetInt("CurrentPlayerScore");
        PlayerPrefs.GetInt("CurrentPlayerPoints");
    }

    public void LoadLevel3()
    {
        SceneManager.LoadScene("level3");
        Time.timeScale = 1f;
        PlayerPrefs.GetInt("CurrentPlayerScore");
        PlayerPrefs.GetInt("CurrentPlayerPoints");
    }

    public void ResumePlay()
    {
        WarningWindow.gameObject.SetActive(false);
        Time.timeScale = 1.0f;
        Debug.Log("Game is resume");
    }

    public void RestartLevelTutorial()
    {
        SceneManager.LoadScene("tutorialLevel");
        Time.timeScale = 1.0f;
        PlayerPrefs.SetInt("CurrentPlayerScore", 0);
        PlayerPrefs.SetInt("CurrentPlayerPoints", 0);
    }

    public void RestartLevelTwo()
    {
        SceneManager.LoadScene("tutorialLevel");
        Time.timeScale = 1.0f;
        PlayerPrefs.SetInt("CurrentPlayerScore", 0);
        PlayerPrefs.SetInt("CurrentPlayerPoints", 0);
    }

    public void RestartLevelThree()
    {
        SceneManager.LoadScene("level3");
        Time.timeScale = 1.0f;
        PlayerPrefs.SetInt("CurrentPlayerScore", 0);
        PlayerPrefs.SetInt("CurrentPlayerPoints", 0);
    }

    public void MainMenu()
    {
        SceneManager.LoadScene("MainMenu");
    }

    public void DisplayWarningWindow()
    {
        isCrash = true;

        if(isCrash)
        {
            WarningWindow.gameObject.SetActive(true);
        }
    }

    public void HitByCar()
    {
        if(isCollide)

            scoreManager = GameObject.FindObjectOfType<ScoreManager>();
            scoreManager.summons++;

            simpleSampleCharacterControl =
GameObject.FindObjectOfType<SimpleSampleCharacterControl>();
            simpleSampleCharacterControl.hitByCars = true;

            WarningWindow.gameObject.SetActive(true);
            timeOuta = GameObject.FindObjectOfType<TimeOut>();
            timeOuta.startCount = true;
    }

    public void TimesOut ()
    {
        if (timeOut)
        {
            simpleSampleCharacterControl =
GameObject.FindObjectOfType<SimpleSampleCharacterControl>();
            simpleSampleCharacterControl.isTimeOut = true;
```

```
            TimeOutWindow.gameObject.SetActive(true);
            timeOuta = GameObject.FindObjectOfType<TimeOut>();
            timeOuta.startCount = true;
        }
    }


    public void ContinueGameSummon()
    {
        scoreManager = GameObject.FindObjectOfType<ScoreManager>();

        if(ScoreManager.money <= 0)
        {
            return;
        }

        if(ScoreManager.money >= moneyToPaySummon)
        {
            ScoreManager.TradeMoneyToResume(moneyToPaySummon);

            Debug.Log("Already pay summon and continue");
            WarningWindow.gameObject.SetActive(false);

            simpleSampleCharacterControl =
GameObject.FindObjectOfType<SimpleSampleCharacterControl>();
            simpleSampleCharacterControl.isTimeOut = false;
        }
    }

    public void ContinueGameTimeOut()
    {
        scoreManager = GameObject.FindObjectOfType<ScoreManager>();

        if(ScoreManager.money <= 0)
        {
            return;
        }

        if(ScoreManager.money >= monetToPayTimeOut)
        {
            ScoreManager.TradeMoneyToResume(monetToPayTimeOut);

            timer = GameObject.FindObjectOfType<Timer>();
            timer.ExtraTime(timeToAdd);
            timeOut = false;
            timeOuta.startCount = false;

            Debug.Log("Already pay money to earn extra time");
            TimeOutWindow.gameObject.SetActive(false);
        }

    }

    void SetLevel()
    {
        if(currentLevel == "tutorialLevel")
        {
            isTutorialLevel = true;
        }

        if(currentLevel == "level2")
        {
            isLevelTwo = true;
        }

        if(currentLevel == "level3")
        {
            isLevelThree = true;
        }
    }

}
```

Game Manager Script

```
using UnityEngine;
using UnityEngine.UI;


public class ScoreManager : MonoBehaviour
{
    public Text MoneyCount;
    public Text RewardCount;

    public Text currentMoney;
    public Text currentReward;
    public Text currentSummons;

    public bool isLevelTutorial = false;
    public bool isLevelTwo = false;
    public bool isLevelThree = false;

    public static int money;
    public static int reward;
    public int summons = 0;


    public static int addReward = 1;


    // Start is called before the first frame update
    void Start()
    {
        money = PlayerPrefs.GetInt("CurrentPlayerScore");
        reward = PlayerPrefs.GetInt("CurrentPlayerPoints");
    }

    // Update is called once per frame
    void Update()
    {
        if (money < 0)
        {
            money = 0;
            MoneyCount.text = "" + money.ToString();
        }

        MoneyCount.text = money.ToString();
        RewardCount.text = reward.ToString();
    }

    public static void AddMoney (int moneyToAdd)
    {
        if(GameManager.isTutorialLevel)
        {
            money += 3;
            PlayerPrefs.SetInt("CurrentPlayerScore", money);
            Debug.Log("money count :" + money);
        }

        if(GameManager.isLevelTwo)
        {
            money = moneyToAdd + PlayerPrefs.GetInt("CurrentPlayerScore",
money);
            Debug.Log("money count :" + money);
        }


        if(GameManager.isLevelThree)
        {
            money = moneyToAdd + PlayerPrefs.GetInt("CurrentPlayerScore",
money);
            Debug.Log("money count :" + money);
        }

    }


    public static void AddReward (int rewardToAdd)
    {
         if(GameManager.isTutorialLevel)
         {
            reward += 5;
            PlayerPrefs.SetInt("CurrentPlayerPoints", reward);
            Debug.Log("reward count :" + reward);
         }

         if(GameManager.isLevelTwo)
         {
             reward = rewardToAdd + PlayerPrefs.GetInt("CurrentPlayerPoints",
reward);
             PlayerPrefs.SetInt("CurrentPlayerPoints", reward);
             Debug.Log("reward count :" + reward);
```

```
        }

        if(GameManager.isLevelThree)
        {
            reward = rewardToAdd + PlayerPrefs.GetInt("CurrentPlayerPoints",
reward);
            Debug.Log("reward count :" + reward);
        }

    }


    public static void TradeMoneyToResume (int tradeMoney)
    {
        if(tradeMoney > 0)
        {
            money = money -= tradeMoney;
            Debug.Log("Money trades : " + money);
            PlayerPrefs.SetInt("CurrentPlayerPoints", money);
        }
    }


    public void LoadCurrentPoints()
    {
        currentMoney.text = money.ToString();
        currentReward.text = reward.ToString();

        if(!isLevelTutorial)
        currentSummons.text = summons.ToString();
    }

}
```

Score Manager Script

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

public class spawnScript : MonoBehaviour {

        public Transform[] spawnPoints;
        public float spawnTime = 1.5f;
        public GameObject[] coins;
        public List<Transform> possibleSpawns = new List<Transform> ();

        // Use this for initialization
        void Start ()
        {
                //fill possible spawn
                for(int i = 0; i < spawnPoints.Length; i++)
                {
                        possibleSpawns.Add (spawnPoints [i]);
                }
                //start spawning
                InvokeRepeating ("SpawnItems", spawnTime, spawnTime);
        }

        void SpawnItems()
        {
                if(possibleSpawns.Count>0)
                {
                        int spawnIndex = Random.Range (0, possibleSpawns.Count);
                        int spawnObject = Random.Range (0, coins.Length);

                        GameObject NewCoins = Instantiate (coins[spawnObject],
possibleSpawns [spawnIndex].position, possibleSpawns [spawnIndex].rotation) as
GameObject;
//                      NewCoins.GetComponent<destroyScript>().mySpawnPoint =
possibleSpawns[spawnIndex];

                        possibleSpawns.RemoveAt(spawnIndex);
                }
        }
}
```

Spawn Item Script

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

public class CarEngine : MonoBehaviour
{
    public Transform path;
    public float maxSteerAngle = 45f;
    public float turnSpeed = 5f;
    public WheelCollider wheelFL;
    public WheelCollider wheelFR;
    public WheelCollider wheelRL;
    public WheelCollider wheelRR;

    public float maxMotorTorque = 80f;
    public float maxBrakeTorque = 150f;
    public float currentSpeed;
    public float maximumSpeed;
    public Vector3 centerOfMass;
    public bool isBraking;
    public bool isNear = false;
    public Texture2D textureNormal;
    public Texture2D textureBraking;
    public Renderer carRenderer;

/*
    [Header("Sensors")]
    public float sensorLength = 5f;
    public float frontSensorPosition = 0.5f;
    public float sideSensorPosition = 0.5f;
    public float frontSideSensorPosition = 0.2f;
*/
    private List<Transform> nodes;
    private int currentNode = 0;
    private float targetSteerAngle = 0;

    private void Start () {
        GetComponent<Rigidbody>().centerOfMass = centerOfMass;
        Transform[] pathTransforms =
path.GetComponentsInChildren<Transform>();
        nodes = new List<Transform>();

        for (int i = 0; i < pathTransforms.Length; i++) {
            if (pathTransforms[i] != path.transform) {
                nodes.Add(pathTransforms[i]);
            }
        }
    }

/*
    private void Sensors()
    {
        RaycastHit hit;
        Vector3 sensorStartPos = transform.position;
        sensorStartPos.z += frontSensorPosition;

        //sensor depan

        if (Physics.Raycast(sensorStartPos, transform.forward, out hit,
sensorLength))
        {

        }
        Debug.DrawLine(sensorStartPos, hit.point);

        //sensor depan kanan
        sensorStartPos.x += frontSideSensorPosition;
        if (Physics.Raycast(sensorStartPos, transform.forward, out hit,
sensorLength))
        {

        }
        Debug.DrawLine(sensorStartPos, hit.point);

        //sensor depan kiri
        sensorStartPos.x -= 2 * frontSideSensorPosition;
        if (Physics.Raycast(sensorStartPos, transform.forward, out hit,
sensorLength))
        {

        }
        Debug.DrawLine(sensorStartPos, hit.point);

    }
```

```
    */

    private void FixedUpdate () {
      //  Sensors();

        ApplySteer();
        Drive();
        CheckWaypointDistance();
        Braking();

    }

    private void ApplySteer() {
        Vector3 relativeVector =
transform.InverseTransformPoint(nodes[currentNode].position);
    //    print(relativeVector);

        float newSteer = (relativeVector.x / relativeVector.magnitude) *
maxSteerAngle;
        wheelFL.steerAngle = newSteer;
        wheelFR.steerAngle = newSteer;

    }

    private void Drive() {
        currentSpeed = 2 * Mathf.PI * wheelFL.radius * wheelFL.rpm * 60 /
1000;

       // wheelFL.motorTorque = maxMotorTorque;
      //  wheelFR.motorTorque = maxMotorTorque;

        if (currentSpeed < maximumSpeed && !isBraking){
            wheelFL.motorTorque = maxMotorTorque;
            wheelFR.motorTorque = maxMotorTorque;
        } else {
            wheelFL.motorTorque = 0;
            wheelFR.motorTorque = 0;
        }
    }

    private void CheckWaypointDistance() {
        if(Vector3.Distance(transform.position, nodes[currentNode].position) <
1f) {
            if(currentNode == nodes.Count - 1) {
                currentNode = 0;
            } else {
                currentNode++;
            }
            }
        }

        private void Braking()
        {
            if (isBraking) {
                carRenderer.material.mainTexture = textureBraking;
                wheelRL.brakeTorque = maxBrakeTorque;
                wheelRR.brakeTorque = maxBrakeTorque;

            } else {
                carRenderer.material.mainTexture = textureNormal;
                wheelRL.brakeTorque = 0;
                wheelRR.brakeTorque = 0;
            }

        }

        private void LerpToSteerAngle() {
            wheelFL.steerAngle = Mathf.Lerp(wheelFL.steerAngle,
targetSteerAngle, Time.deltaTime * turnSpeed);
            wheelFR.steerAngle = Mathf.Lerp(wheelFR.steerAngle,
targetSteerAngle, Time.deltaTime * turnSpeed);
        }

    }
```

Car AI Script

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

public class DialogueManager : MonoBehaviour
{
    private DialogueTrigger dp;
 //   public Animator animator;
    public Text nameText;
    public Text dialogueText;
    public static bool endMessage = false;
    private Queue<string> sentences;
    void Start()
    {
        sentences = new Queue<string>();
    }

    public void StartDialogue (Dialogue dialogue)
    {
     //   animator.SetBool("IsOpen", true);
        nameText.text = dialogue.name;

        sentences.Clear();

        foreach (string sentence in dialogue.sentences)
        {
            sentences.Enqueue(sentence);
        }

        DisplayNextSentences();
    }

    public void DisplayNextSentences()
    {
        if (sentences.Count == 0)
        {
            EndDialogue();
            return;
        }

        string sentence = sentences.Dequeue();
      // dialogueText.text = sentence;
        StopAllCoroutines();
        StartCoroutine(TypeSentence(sentence));
    }

    IEnumerator TypeSentence (string sentence)
    {
        dialogueText.text = "";
        foreach (char letter in sentence.ToCharArray())
        {
            dialogueText.text += letter;
            yield return null;

        }
    }

    void EndDialogue()
    {
        endMessage = true;
        Debug.Log("End of conversation");
        dp.disableButton();

      //  animator.SetBool("IsOpen", false);
    }


}
```

Dialog Manager Script

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

public class npcInteract : MonoBehaviour
{
    public GameObject toolTip;
    public GameObject dialogWindow;
    public GameObject playerWindow;
    public GameObject objectiveWindow;

    public Text NotifyInteract;
    public bool objectiveComplete = false;
    [SerializeField] float delay = 5f;

    private QuestGiver questGiver;
    private DialogueTrigger dialogueTrigger;
    private ObjectiveManager objectiveManager;
    private ItemController itemController;


    bool checkIsPolice = false;
    bool checkIsNpc = false;

    void Awake()
    {
        dialogueTrigger = GameObject.FindObjectOfType<DialogueTrigger>();
    }

    void OnTriggerEnter(Collider col)
    {
        if(col.gameObject.CompareTag("police"))
        {
            toolTip.SetActive(true);
            checkIsPolice = true;
            NotifyInteract.text = "Tekan E (Interaksi)";
        }

        if(col.gameObject.CompareTag("NPC"))
        {
            toolTip.SetActive(true);
            checkIsNpc = true;
            NotifyInteract.text = "Tekan E (Interaksi)";
        }
    }

    void OnTriggerExit(Collider col)
    {
        if(col.gameObject.CompareTag("police"))
        {
            NotifyInteract.text = " ";
            toolTip.SetActive(false);
            checkIsPolice = false;
        }

        if(col.gameObject.CompareTag("NPC"))
        {
            NotifyInteract.text = " ";
            toolTip.SetActive(false);
            checkIsNpc = false;
        }
    }
    void Update()
    {

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

             toolTip.SetActive(false);

             if(checkIsPolice)
             {
                dialogWindow.gameObject.SetActive(true);
                dialogueTrigger.TriggerDialogue();
             }

             if(checkIsNpc)
             {
                 objectiveManager =
GameObject.FindObjectOfType<ObjectiveManager>();
                 objectiveManager.task2Finish = true;
                 questGiver = GameObject.FindObjectOfType<QuestGiver>();
                 playerWindow.gameObject.SetActive(true);
                 questGiver.loadQuest = true;

             }
        }
```

```
        if(objectiveComplete)
        {
            objectiveWindow.gameObject.SetActive(true);
            CloseWindow();
        }
    }


    void CloseWindow()
    {
         StartCoroutine(DelayDeactivate(delay));

    }

    IEnumerator DelayDeactivate(float _delay)
    {
        yield return new WaitForSeconds(_delay);
        objectiveWindow.gameObject.SetActive(true);
    }

}
```

NPC Interaction Script

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

public class PlayerController : MonoBehaviour
{

    public Animator anim;
    private Rigidbody rb;
    public LayerMask layerMask;
    public bool grounded;


    // Start is called before the first frame update
    void Start()
    {
        this.rb = GetComponent<Rigidbody>();

    }

    // Update is called once per frame
    void Update()
    {
        Grounded();
        Jump();
        Move();
    }

    private void Jump()
    {
        if(Input.GetKeyDown(KeyCode.Space) && this.grounded)
        {
            this.rb.AddForce(Vector3.up * 4, ForceMode.Impulse);
        }
    }

    private void Grounded()
    {
        if(Physics.CheckSphere(this.transform.position + Vector3.down, 0.2f,
layerMask))
        {
            this.grounded = true;

        }
        else
        {
            this.grounded = false;
        }
        this.anim.SetBool("jump", this.grounded);
    }

    private void Move()
    {
        float verticalAxis = Input.GetAxis("Vertical");
        float horizontalAxis = Input.GetAxis("Horizontal");

        Vector3 movement = this.transform.forward * verticalAxis +
this.transform.right * horizontalAxis;
        movement.Normalize();
```

```
        this.transform.position += movement * 0.07f;

        this.anim.SetFloat("vertical", verticalAxis);
        this.anim.SetFloat("horizontal", horizontalAxis);

    }
}
```

Player Controller Script

```
using UnityEngine;
using UnityEngine.SceneManagement;

public class playerSelection : MonoBehaviour
{
    private GameObject[] characterList;
    private int index;

    private void Start()
    {
        index = PlayerPrefs.GetInt("CharacterSelected");

        characterList = new GameObject[transform.childCount];

            // Fill the array with our models
            for (int i = 0; i < transform.childCount; i++)
                characterList[i] = transform.GetChild(i).gameObject;

            // toggle off their renderer
            foreach (GameObject go in characterList)
                    go.SetActive(false);

            // toggle in the selected character
            if (characterList[index])
                characterList[index].SetActive(true);

    }

    public void ToggleLeft()
    {
        // Toggle off the current model
        characterList[index].SetActive(false);


        index--;
        if(index < 0)
            index = characterList.Length - 1;

        // Toggle on the new model
        characterList[index].SetActive(true);

    }

    public void ToggleRight()
    {
        // Toggle off the current model
        characterList[index].SetActive(false);


        index++;
        if(index == characterList.Length)
            index = 0;

        // Toggle on the new model
        characterList[index].SetActive(true);

    }

    public void Confirm()
    {
        PlayerPrefs.SetInt("CharacterSelected", index);
        PlayerPrefs.SetInt("CurrentPlayerScore", 0);
        PlayerPrefs.SetInt("CurrentPlayerPoints", 0);
        SceneManager.LoadScene("tutorialLevel");
    }

    public void Home()
    {
        SceneManager.LoadScene("MainMenu");
    }

}
```

Character Selection Script

```
using UnityEngine;
using UnityEngine.UI;

public class ToggleCam : MonoBehaviour
{
    private ObjectiveManager objManager;
    private ScoreManager scoreManager;

    public GameObject leftCam;
    public GameObject rightCam;
    public GameObject mainCam;

    bool isTriggered = false;
    bool setChecked = false;
    bool leftRoadSide = false;

    public Text viewCount;
    public int setView;
    private int rightView;
    private int leftView ;
    private int reward;
    private static int totalView = 0;
    private static int countView = 0;

    void Awake()
    {
        objManager = GameObject.FindObjectOfType<ObjectiveManager>();
    }

    void OnTriggerEnter(Collider col)
    {
        if (col.gameObject.CompareTag("ColView"))
        {

            isTriggered = true;
            Debug.Log("is triggered");
        }
    }

    void OnTriggerExit(Collider col)
    {
        if (col.gameObject.CompareTag("ColView"))
        {
            isTriggered = false;
            Debug.Log("not triggered");
            totalView = 0;
            rightView = 0;
            leftView = 0;
            viewCount.text = totalView.ToString();
        }
    }


    void Update ()
    {

        if (Input.GetButtonDown("right") && isTriggered)
        {
            rightView += 1;
            Debug.Log("Count :" + rightView);
            LookCount();


            leftCam.SetActive(false);
            rightCam.SetActive(true);
            mainCam.SetActive(false);

        } else

        if (Input.GetButtonUp("right"))
        {
            leftCam.SetActive(false);
            rightCam.SetActive(false);
            mainCam.SetActive(true);
        } else

        if (Input.GetButtonDown("left") && isTriggered)
        {
            leftView += 1;
            Debug.Log("Count : " + leftView);
            LookCount();

            leftCam.SetActive(true);
            rightCam.SetActive(true);
            mainCam.SetActive(false);
        } else
```

```
        if (Input.GetButtonUp("left"))
        {
            leftCam.SetActive(false);
            rightCam.SetActive(false);
            mainCam.SetActive(true);
        }

    }

    public void LookLeft ()
    {
            leftCam.SetActive(true);
    }


   public void LookRight ()
    {
         rightCam.SetActive(true);
    }

    public void LookCount()
    {
        totalView = leftView + rightView;

        viewCount.text = totalView.ToString();

        if(totalView >= 3)
        {
        SetCountView();
        ResetCount();
        }

    }

    public void ResetCount()
    {
        if(isTriggered == false)
        {
            totalView = 0;
            rightView = 0;
            leftView = 0;

        }

        viewCount.text = totalView.ToString();
    }

    public void SetCountView()
    {
        countView++;
        Debug.Log("Count view =" + countView);

        if(countView >= setView)
        {
            Debug.Log("passing value");
            setChecked = true;
            objManager.task1Finish = true;
            AddReward(reward);

        }
    }

    public void AddReward(int rewardToAdd)
    {
        reward = rewardToAdd += 10;
        ScoreManager.AddReward(reward);
    }


}
```

Toggle Cam Script (For Left Right Practise)