VRtualize in Simulation and Training

By

Farah Wahidah binti Kamarudin
16243

A dissertation submitted to the
Information and Communication Technology Program
Universiti Teknologi PETRONAS
In partial fulfillment of the requirement for the
BACHELOR (Hons) OF TECHNOLOGY
(BUSINESS INFORMATION SYSTEM)

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CERTIFICATION OF APPROVAL

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Approved by,

_____
(ASSOC PROF DR WAN FATIMAH BT WAN AHAMD)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK

MAY 2015

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

_____

FARAH WAHIDAH BT KAMARUDIN

ABSTRACT

Road safety education is considered one of the most important basic skills that need to be taught on children with the correct best practical way since they are small. However, many programs, do not consider the practical skills of the road-crossing task, the functional and behavioral factors that may put some children at increased risk, and the most beneficial methods to transfer knowledge to improved behavior in modern, real-world environments. Therefore, to address this issue, VRtualize, a Virtual Reality in Simulation and Training will be programmed. VRtualize will train children on how to cross the road using the correct method and will create awareness on the importance of road safety. This program is giving the real experience to cross the road while the children do not expose to the road danger. It will use the Unity as the platform to create the program using C# language. The program will be using 3D effect using the Google Oculus to give the real experience being on real road. Children need to undergo three levels which are first the road with car passing, second road, practice to cross using zebra cross and last cross practice is using pedestrian bridge. The Rapid Application Development (RAD) methodology is used for this project. Surveys and interviews are the sources to collect data about this project.

ACKNOWLEDGEMENT

Alhamdullillah and gratitude to the almighty one for his mercy and guidance in giving me full strength to complete this project. I am using this opportunity to express my gratitude to everyone who supported me throughout the course of this final year project.

Firstly, I would like to express my sincere gratitude to my supervisor, Associate Professor Dr Wan Fatimah binti Wan Ahmad for the continuous support of completing my final year project for her motivations, immense knowledge and also patience with my bad attitudes. Her guidance helped me in all the time throughout completing this project. Without her support, I may not able to finish the project and completing the course successfully.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Road safety education is considered important to teach children on using the correct way to cross the road. Many programs, however, do not consider the practical skills of the road-crossing task, the functional and behavioral factors that may put some children at increased risk, and the most beneficial methods to transfer knowledge to improved behavior in modern, real-world environments. A targeted and practical training program using a simulated road environment has been developed using Virtual Reality. The beneficial effects were greater for younger children, females, children with less well developed perceptual, attention and cognitive skills, and those with little traffic exposure.

This research discusses the use of the simulated training program using Virtual Reality, a novel and safe way, to improve road crossing decisions. The children will experience by themselves the real environment of crossing the road while they do not have to go to the actual road. It is suggested that improvements can be made to child pedestrian education by providing tailored and practical programs that target the component skills of road-crossing decisions and improve essential skills through intensive training and feedback on known risk factors by using this VRtualize application.

1.2 Problem Statement

There are lots of program and initiative of creating the awareness of road safety that has been implemented worldwide. For example, campaign, talk on road safety, road safety's exhibition and many more. However, none of the programs is implementing the real road crossing environment.

1.2.1 Develop a prototype to help children crossing the road

A real road environment is needed in order to do the prototype. However, there are several concerns regarding the prototype. To create a real road environment, all the detail aspect of the real road is taken care of. To make the environment more realistic and lively, an environment of a city is developed. As for this application, there will be three types of roads which will be explained further on the next topic.

1.3 Objectives

There are several objectives that have been identified as follows:

i. To identify the suitable theories and method for simulation in virtual reality.
ii. To develop prototype for simulation.
iii. To conduct the user acceptance test.

1.4 Scope of Study

In order to test the prototype there are several scopes that need to be consider which are the Google Oculus rift, the three levels of the game and user's behaviors.

1.4.1 Google Oculus rift

Google Oculus rift is one of the important scopes on this project. This is because Google Oculus rift is the tools that giving the user the feeling of the real environment of the virtual reality. There are more tools that can be considered, but this project is using Google Oculus rift since people increasingly interested with this application. This Google Oculus rift will play the application that has been developed in Unity platform.

1.4.2 Three levels

There will be three levels in this game. User need to pass all levels in order to finish the game. There are three types of road obstacle which are first, level one, a busy road. There will be vehicles passing by the road. The second road's obstacle is pedestrian bridge. User need to use the pedestrian bridge to cross the road. Last is level three which there is zebra cross. The user needs to cross the road using zebra cross and reach their home. Then the game will finish.

1.4.3 User's behavior

User behavior is when the user uses the application. This user behavior is study to know how user interacts with the application. So, if the user behavior is different from what is expected, there must be something wrong with the project. Since this project is using lots of body movement, the user behavior is considering one of the important scopes of this project.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This research is focusing on accidents involving pedestrians. According to a research on Chilalert (2015), 107 children were killed and more than 5000 seriously injured as they crossed the road. Also 191 children were killed in all road accidents. This is showing how dangerous the roads are to our children. So a good safety precaution from the early stage is important to them.

2.2 Road accidents involving pedestrians

Road accidents are increasing in number of deaths and injuries each year. This research is giving an overview of the number of pedestrians killed or seriously injured on the roads each year, and which types of road user are most at risk (e.g. cyclists, pedestrians, etc). Road accidents different from other kinds because it is the third of accidental deaths among 0-14 year olds and over half of accidental deaths for 5-14 year olds.

2.2.1 Causes of road accidents

Some of the causes of road accidents are first the driver. The driver might be tired, sleepy and feeling emotional but still driving on the road. This cause harm to other road's user and of course in fact they should not drive at all. Next causes might be from the condition of the roads. When it is raining day, driver should drive slowly since the road is slippery. And the sight also might not clear. They might not seen people crossing the road. Last, some of the cause is the user themselves. They might have lack of awareness on how to cross the road safely.

They do not use proper way to cross the road. For example they should first turn their head to left then right and again back to left but they do not do it. So this also might contribute to the causes of the road accidents.

2.2.2 Statistics of road accidents

The table below shows the statistic of general road accidents in Malaysia. While the population and vehicle registered is increasing, the road accident is also increasing. This statistic show how lack Malaysian people is with the awareness to prevent the road accidents.

Table 2.1 General Road Accident Data in Malaysia (1995 – 2012)

Year	Population	Vehicles Registered	Vehicle Involved	Road Accidents	Road Casualties	Road Deaths
1999	22,711,900	9,929,951	390,674	223,166	52,937	5,794
2000	23,263,600	10,598,804	441,386	250,429	50,200	6,035
2001	23,795,300	11,302,545	483,351	265,175	50,473	5,849
2002	24,526,500	12,068,144	507,995	279,711	49,552	5,891
2003	25,048,300	12,819,248	555,634	298,653	52,741	6,286
2004	25,580,000	13,828,889	596,533	326,815	54,091	6,228
2005	26,130,000	15,026,660	581,136	328,264	47,012	6,200
2006	26,640,000	15,790,732	635,024	341,252	35,425	6,287
2007	27,170,000	16,813,943	668,173	363,319	33,999	6,282
2008	27,730,000	17,971,901	671,078	373,071	32,274	6,527
2009	28,310,000	19,016,782	705,623	397,330	31,417	6,745
2010	28,910,000	20,188,565	760,433	414,421	28,269	6,872
2011	29,000,000	21,401,269	817,151	449,040	25,570	6,877
2012	29,300,000	22,702,221	777,817	462,423	24,439	6,917

Source : Road Transport of Department Malaysia – 2012

2.3 Current Approaches

There are a numbers of available safety road programs for children that already implemented in the world. Most of the programs are actually to train people to cross the road safely and create awareness on road safety.

2.3.1 PETRONAS Street Smart

This program is actually one of the community service programs by PETRONAS. This program has begin on 2001 with their goals to educate the public, engage with them, especially school children age range zero to twelve years old. They address the road safety issues through focusing on science awareness and education.

These are some of the offerings and programs that they have done. First is visit to primary and secondary school. They have spent about two hours science and road safety educational program. This program consists of ice breaking, safety show hands on workshop and quizzes. Next a three days and two nights camp for both primary and secondary students. On this camp, they learn modules that based on road safety and workshop involving indoor and outdoor.

Figure 2.1 Some of the activities done by PETRONAS Street Smart. (Source: www.petronasstreetsmart.com.my)

2.3.2 Child Passenger Safety Tips by NHTSA

NHTSA is stand for National Highway Traffic Safety Administration. By implementing "Highway Safety Program Guidelines No.14" they have come out with a numbers of programs. Some of the program are multidisciplinary involvement, communication program and outreach program.

Multidisciplinary program is a program that support and coordinated activity for pedestrians and bicyclist safety at both state and local levels. Some of the communities that will be involved are state pedestrian or bicycle coordinators, law enforcement and public safety, education and many more. Then communication program is a program that contain comprehensive component to support program and policy efforts. This program will address coordination with traffic engineering and law enforcement efforts. The materials should be culturally relevant and multilingual as appropriate and should contain issues for example proper street-crossing behavior and rules of the road.

Next is the outreach program. This program is by encouraging each state to involve in pedestrian and bicycle safety education and also involving the individuals and organizations outside the traditional highway safety community. Vulnerable road users for example older pedestrians, young children should be focused by this outreach program.

Figure 2.2 Road safety program initiated by NHTSA. (Source : http://www.nhtsa.gov/nhtsa/everyoneisapedestrian/index.html)

2.3.3 Assorted Info by Children's National Medical Center.

Figure 2.3 The strategies for keeping children safe on road initiative by Safe Kids Worldwide. (Source : http://www.safekids.org/sites/default/files/documents/who_nmh_nvi_15.3_eng.pdf)

In order to overcome the road accidents, Children's National Medical Center has come out with a program called Safe Kids Worldwide. There are lots of program that they have done and one of them is they come out with ten strategies for keeping children safe on the road.

Some of the strategies is first, controlling speed. Speed has been the contribute factor around one-third of all fatal road traffic crashes. So to reduce speed, first by setting and enforcing speed limits of each road and set maximum speed limit on road that have high concentrations of pedestrians. Second, reducing drinking and driving. So, they need to setting and enforcing BAC limits of 0.05 g/dl or less for all drivers and lower BAC limits of 0.02 g/dl or less for young drivers. And third is using helmets for bicyclists and motorcyclists. A law on this should be enforced that is mandating and enforcing motorcycle helmet laws that stipulate the type and fit of motorcycle helmets by age group.

2.3.4 Program by Jabatan Keselamatan Jalan Raya (JKJR)

Jabatan Keselamatan Jalan Raya (JKJR) is a road safety department in Malaysia. Their roles and functions in Malaysia are to plan, formulate, implement and coordinate road safety policies/plan/regulations. They also coordinate road safety programmes involving other agencies and coordinate and implement road safety campaigns at national level to educate road users.

2.3.4.1 Road safety lessons for preschooler.

This is one of the program initiate by JKJR. They will visit preschooler to impart road safety knowledge to the young children. This program will involved year one to year six students while the form one to form three students will learning about road safety at school. This is a good initiative since road safety should be acknowledge at early age.

They also have plan for year 2014 to 2010 at the plan has been approved. The plan is about enforcing government and non-government organizations to spread the message of road safety. They also will collaborate among the enforcement agencies instead of the present practice where each agency had the own programme.

THURSDAY, JANUARY 29, 2015

Road safety lessons for preschoolers

IPOH: Beginning this year, the Road Safety Department will visit kindergartens to impart road safety knowledge to young children.

Perak director Laila Mazwin Zakaria said this was one of numerous strategies that had been drawn up to ensure safer roads.

"We have obtained approval from the National Unity Department to go into kindergartens," she told the *New Straits Times* here yesterday.

At present, only Year One to Year Six pupils and Form One to Form Three students are learning about road safety in schools.

Laila said this was part of five strategies drawn up under the department's six-year road safety plan to make our roads safer.

The plan, from 2014 to 2020, was approved by the cabinet.

"Under the plan, enforcement agencies and non-governmental organisations will be roped in to spread the message of road safety."

Laila said there would be closer collaboration among the enforcement agencies instead of the present practice where each agency had its own programme.

Figure 2.2 Article on 'The Star' about the road safety lesson for preschooler program (Retrieved from 'The Star')

2.3.4.2 "Ops Didik"

Ops Didik is focusing on students. They are exchanging the old helmet with a new helmet free of charge at chosen school. They focus on student since they realize that most risky of the incident is involving students. The target of this program is students ages between 16 to 25 years old that are students from secondary school and universities students. This program has got collaboration with police that checking the motorcycle during giving the helmet.

Ops Didik sasar pelajar

JKJR beri penerangan mengenai keselamatan jalan raya, tukar 30 topi keledar

ISMANIZA AHMAD

IPOH - Jabatan Keselamatan Jalan Raya (JKJR) Negeri mengadakan Ops Didik di sekolah terpilih untuk membuat pemeriksaan terhadap pelajar yang menunggang motosikal ke sekolah.

Pengarah JKJR Negeri, Laila Mazwin Zakaria berkata, operasi berkenaan dijalankan kerana pelajar adalah golongan yang paling tinggi berisiko terlibat dalam kemalangan.

Menurutnya, daripada kajian dilakukan sasaran bagi program itu adalah mereka yang berusia 16 hingga 25 tahun iaitu pelajar sekolah menengah dan Institusi Pengajian Tinggi.

"Program tersebut turut mendapat kerjasama polis yang memeriksa motosikal pelajar ketika operasi dijalankan.

"Selain memberi risalah mengenai keselamatan jalan raya, kami turut menukar topi keledar pelajar yang lusuh atau lama, memberikan jaket keselamatan selain memasangkan pelekat pemantul cahaya," katanya selepas menjayakan Ops Didik di SMK Anderson baru-baru ini.

Hadir sama, Ahli Jawatankuasa Persatuan Keruja (bekas pelajar) SMK Anderson, Abdul Wahhid Abdul Wahab.

Laila Mazwin berkata, topi keledar yang melebihi tempoh lima tahun perlu ditukar bagi memastikan keselamatan kepala jika berlaku kemalangan.

Beliau berkata, tidak ramai mengetahui hal itu malah memandang remah kerana topi keledar berkenaan masih dalam keadaan baik untuk digunakan.

"Kita sasarkan 30 topi keledar ditukarkan selain memberi kesedaran kepada

Laila Mazwin memakaikan topi keledar baharu pada pelajar, C Suwarnaraj, 17 dalam Ops Didik yang berlangsung di SMK Anderson.

Pihak polis turut membantu memeriksa motosikal pelajar pada program berkenaan.

Figure 2.3 Article on 'Ops Didik Sasar Pelajar". (Retrieved from 'Berita Harian')

2.4 Potential Solutions

Virtual reality (VR) is a term that applies to computer-simulated environments that can simulate physical presence in places in the real world, as well as in imaginary worlds. Most current virtual reality environments are primarily visual experiences, displayed either on a computer screen or through special stereoscopic displays, but some simulations include additional sensory information, such as sound through speakers or headphones. Some advanced, haptic systems now include tactile information, generally known as force feedback, in medical and gaming applications. Furthermore, virtual reality covers remote communication environments which provide virtual presence of users with the concepts of telepresence and telexistence or a virtual artifact (VA) either through the use of standard input devices such as a keyboard and mouse, or through multimodal devices such as a wired glove, the Polhemus, and omnidirectional treadmills.

Figure 2.4 Multimodal devices - wired glove and omnidirectional treadmills.

As for the solution of this problem, a Virtual Reality in simulation and training application is created. This is a simulation on how to train children to cross the road. This application is focusing on children since the road awareness is needed to be aware on early stage. So this application will be used by children and they will experience themselves the actual way to cross the road using Virtual Reality.

2.4.1 Virtual Reality in Simulation and Training

Figure 2.5 Google Oculus rift.

This research is using platform Google Oculus rift. The Rift looks like a pair of ski Google. Inside are two lenses, one for each eye and it is pointing at a single LCD display. The screen delivers two separate images, one to each eye, so user will get stereoscopic 3-D. There are sensors in the Google--accelerometer, gyroscope that are keyed into PC games. When user turning their head, the vision moves just about perfectly with it--360 degrees around, plus all the way up and all the way down.

2.5 Existing System

Many people are familiar with the term 'virtual reality' but are unsure about the uses of this technology. Gaming is an obvious virtual reality application as are virtual worlds but there are a whole host of uses for virtual reality – some of which are more challenging or unusual than others.

There are many more uses of Virtual Reality than first realized which range from academic research through to engineering, design, business, the arts and entertainment. But irrespective of the use, virtual reality produces a set of data which is then used to develop new models, training methods, communication and interaction. In many ways the possibilities are endless.

2.6 Virtual Reality in Educations

For this research, this virtual reality is focusing in educations since this application will be developed to train children on how to cross the roads. Education is another area which has adopted virtual reality for teaching and learning situations. The advantage of this is that it enables large groups of students to interact with each other as well as within a three dimensional environment. It is able to present complex data in an accessible way to students which is both fun and easy to learn. Plus these students can interact with the objects in that environment in order to discover more about them.

2.6.1 Astronomy

Astronomy students can learn about the solar system and how it works by physical engagement with the objects within. They can move planets, see around stars and track the progress of a comet. This also enables them to see how abstract concepts work in a three dimensional environment which makes them easier to understand and retain. This is useful for students who have a particular learning style, e.g. creative or those who find it easier to learn using symbols, colors and textures.

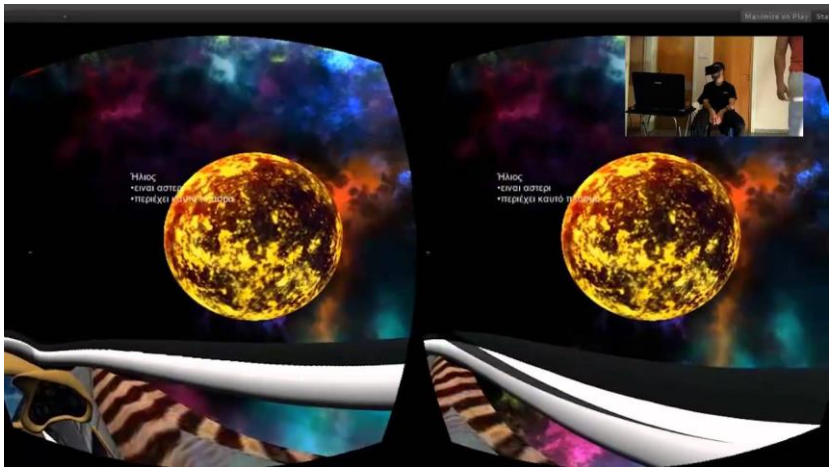

Figure 2.6 Virtual Reality in astronomy. (Source : http://i.ytimg.com/vi/G4oIeEHbtZk/maxresdefault.jpg)

2.6.2 Medicine

One ideal learning scenario is medicine: virtual reality can be used to develop surgery simulations or three dimensional images of the human body which the students can explore. This has been used in medical schools both in the UK and abroad. The use of virtual reality in medicine is discussed in a series of separate articles in the virtual reality and health care section.

Figure 2.7 Virtual Reality in medicine. (Source: http://healthysimulation.com/wp-content/uploads/2015/03/simx-medical-simulation.jpg)

2.6.3 History

For a history teacher, they make their students to have the opportunity to explore a historic building or era in time such as Ancient Greece. They will be able to walk around a Greek city, e.g. Athens, and explore various aspects, often by using touch via the data glove. This is a great way of learning about day to day life in Ancient Greece which brings it to life in a way that books or online media are unable to.

2.6 Summary

Based on the existing systems discussed by the author in the previous few pages, the summary of all those three systems is provided in the table below.

Table 2.3 Summary of existing virtual reality in educations.

Students involve	Learn about	Advantages	Disadvantages
Astronomy	Solar system	Enables them to see how abstract concepts work in a three dimensional environment	Only suitable for creative imaginations students
Medicine	Surgery simulations	Explore three-dimensions of human body	Students might not serious because they know that it is only a 3D human body
History	Explore historic building, walk around a Greek city	Brings it to live	Not enough information on Greek city

Based on this, none of the current virtual reality in education system is applicable for road safety. The first approach is on astronomy which students learn about the solar system. The second approach is in medicine which students learn about surgery simulations. The last system is in histories which students explore historic building, and walk around a Greek city. Therefore, it can be concluded that Virtual Reality in Simulations and Training is a totally new approach and has a huge potential to help the government in controlling road accidents cases in Malaysia.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter will be explaining about the methodologies used in this project. This chapter consists of System Development Life Cycle (SDLC) methodology and the research methodology used to collect the information. For development methodology, the Rapid Application Development (RAD) is used while for research methodology, there are several methods that had been used that are interview and questionnaire.

3.2 Development Methodology

The Rapid Application Development (RAD) Methodology is use for this project. This methodology is actually has a task list and work breakdown structure that is designed for speed. One of the valid reasons to use this methodology is due to time constraint to complete the project. There are only 28 weeks to develop the product from scratch which is equivalent to seven months. Besides that, this methodology is very suitable to be applied in this project due to the focused and narrow scope of study, the need of uncomplicated data, an individual project instead of a large team project, few decision makers and also the existing of technology components in place.

This project is broken down into four main phases which are the requirement gathering, prototyping, testing and deployment of product.

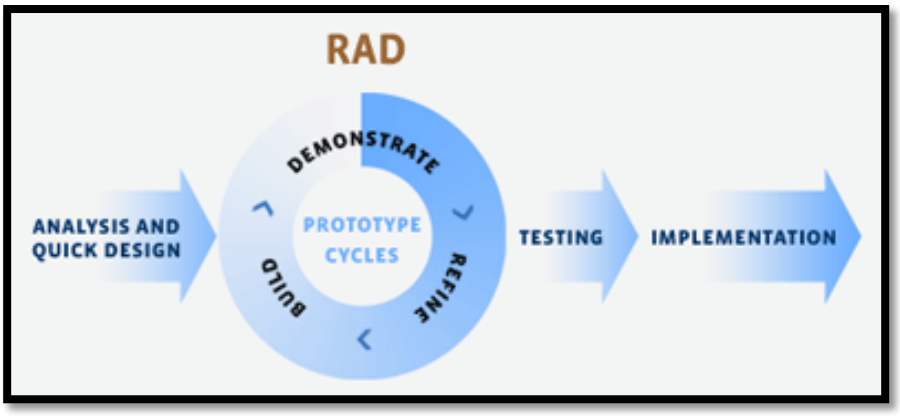

Figure 3.1: Rapid Application Development (RAD) Methodology.

3.2.1 Requirement Planning

During the second week, the supervisor of the project is assign that is Associate Professor Dr Wan Fatimah binti Wan Ahmad. In the third week, the final project title is been submitted as agreed by the supervisor. A planning of schedule for the tasks to be done is then developed to ensure that the project can keep on the right track and the complete within the timeframe given. The Gantt chart and key milestones are provided in Table 3.1 in the following page for reference.

During this planning phase, all the requirements of the product are identified. An interview is conducted at Suria KLCC, Kuala Lumpur. The aim of the interview is to collect as many data and information possible related to road safety awareness to control accidents when crossing the road. For data collection, the author used several different methods such as interview, survey, questionnaire and observation.

Critical analysis has been done on journals, research papers and other reliable sources in order to identify the current existing systems and applications for road safety. This is useful especially to identify either the current project is similar with existing ones, an improved version or a totally new approach to solve the problem. Responds from the public people through surveys and questionnaires are also being reviewed to generate hypothesis on the level of public awareness.

Table 3.1 Gantt chart for FYP1 and FYP2.

Task	Duration in week	Week																											
		FYP 1														FYP 2													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Requirement Planning																													
Identification of Problems	1																												
Study on Project Background	1																												
Define Objectives of Project	1																												
Define Scope and Limitation	1																												
Preliminary Research	1																												
Literature Review	2																												
Tools	2																												
Proposal Submission	1																												
Prototyping																													
Designing the Architecture	2																												
Construct Activity Diagram	2																												
Submission of Interim Report	1																												
Project Proposal Defence	1																												
Build VRtualize	5																												
Testing																													
Survey	2																												
Improvement on Prototype	5																												
Pre Sedex	1																												
Submission of Technical Report	1																												
Submission of Dissertation Report	1																												
Sedex	1																												
NRIC	2																												
Viva	1																												
Project Submission	1																												

3.3 Body Movement

Body movement is one of the methods used in this project. User need to move their head when they use this application to see their surroundings. They can turn their head left and right, up and down to see the virtual environment in the application. This will make they feel as they are on the real place.

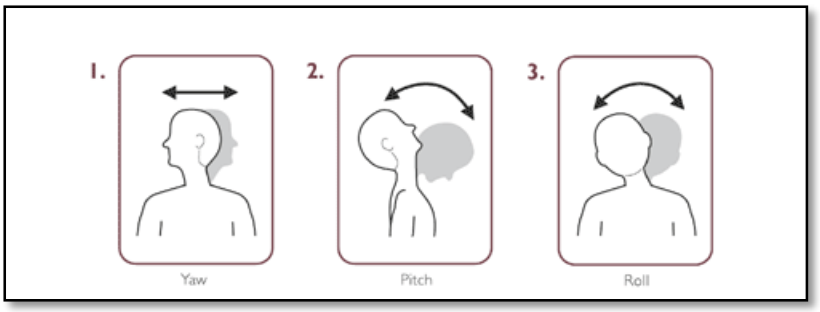

Figure 3.2 Head movements.

As user feel they are on their road, automatically the other part of the body will play their role as they are on the real road. For example their leg will walk as they moving in the game. But in this application, user will walk using up and down arrow on keyboard.

3.4 Research Methodology

Several different methods have been used as the research methodology in order to gather more data and information related to the accidents involving children when crossing the road and the potential solutions. Interview and survey are used as the methodology approaches. The sources of information will be the government officers and the local community.

3.4.1 Interview

On 24th March 2015, a number of interviews are conducted involving a number of parents and children. The place of interview is at Suria KLCC since there is having an event name F1 Open Day.

There are a number of 55 respondents interested to be interviewed. All the information is recorded. Some of the question that has been asked was, how they train their children to cross the road and at what age they give their permission to their children to cross the road by themselves. The aim of this interview are to know more about how actually parents train their children crossing the road, whether by parent themselves or from other parties for example from school.

Also, there are a number of children has been interviewed. Some of the questions are regarding if they have ever cross the road by themselves and how they learn to cross the road. The aims for this interview are to know the behavior of children crossing the road. By this information, the previous information that had been gathered from the internet is corrected and verified.

3.4.2 Questionnaire

A survey had been conducted by distributing questionnaires to respondents. 55 respondents involved in this survey and 9 of them are male while the other 44 respondents are female. The range age is from five years old and above.

From the set of questionnaires, the aim is to analyze the knowledge of Virtual Reality, road safety and their knowledge to cross the road. Some of the questions tested their understanding and knowledge about Virtual Reality and road safety.

Figure 3.3 User trying Google Oculus rift.

3.4 Tools

To develop the prototype, based on some discussions with the supervisor and also all the findings there are several different tools that will be used to meet the requirements of the project that are Google Oculus rift and the platform to create the application that is Unity.

3.4.1 Google Oculus Rift

The Google Oculus rift will be use for this project. By using Virtual Reality it will give the real experience to the user on crossing the road.

Figure 3.4 Google by Oculus.

3.4.2 Unity

Figure 3.5 The Unity logo.

Unity is a platform where all the games are create. It can create multiplatform 2D or 3D games and interactive experiences. So as for this project also will be used 3D environment to create the application. It is using C# language as to code the application.

3.5 Proposed Framework

For a general overview on how the whole system of VRtualize will work, an activity diagram is provided to illustrate the sequences of activities or responses.

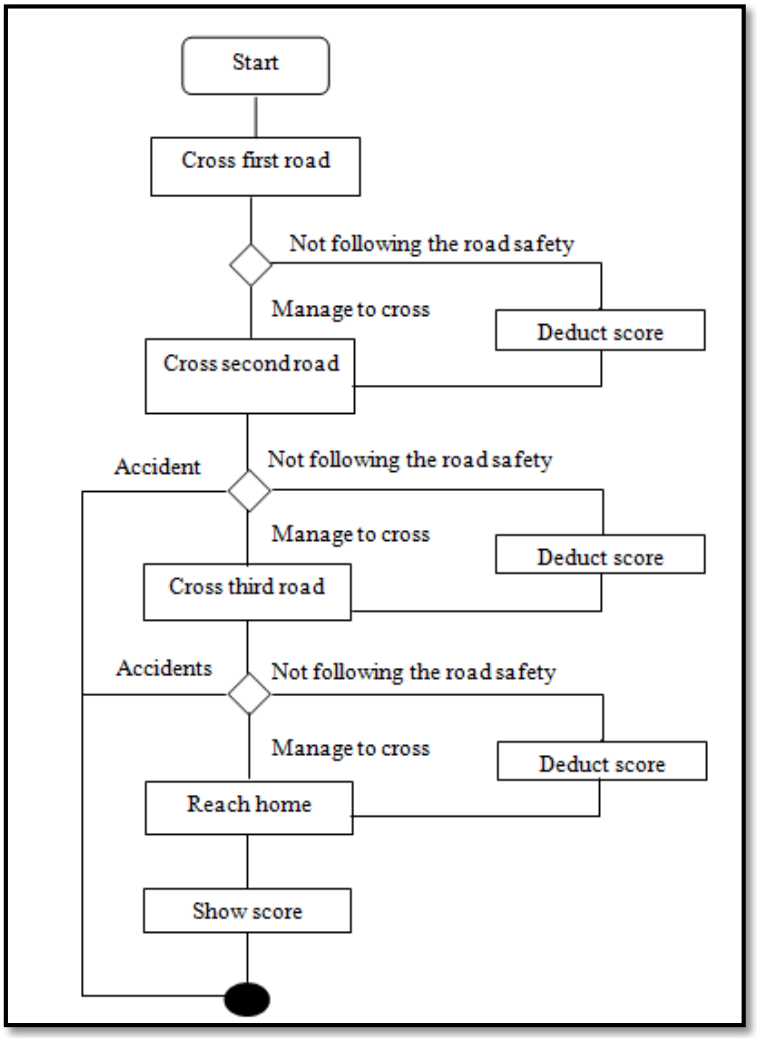

Figure 3.6 Activity Diagram

First the user needs to cross the first road. If the user cross the road safely and follow all the road safety, then he can proceed to the next road. If not, his mark will be deducted. Then, on the second road, again the user needs to follow the road safety rules. There is pedestrian bridge on the road. If the user cross do not use the bridge, mark will be deducted. On the last road, there is zebra crossing. Again, if he does not follow the road safety, the score will be deducted and if he got hit by car, the game will be terminated.

3.6 Storyboard

Below is the story board for VRtualize application.

3.6.1 First level

On the first level, user need to cross the road that have vehicles passing. User need to stand beside the road and turn his head left, right then left to see if there are vehicles coming. When the road is safe, user can cross road properly. For following all the road safety rules, he will be given 20 marks. And if he do not survey the traffic first, the mark will be deducted.

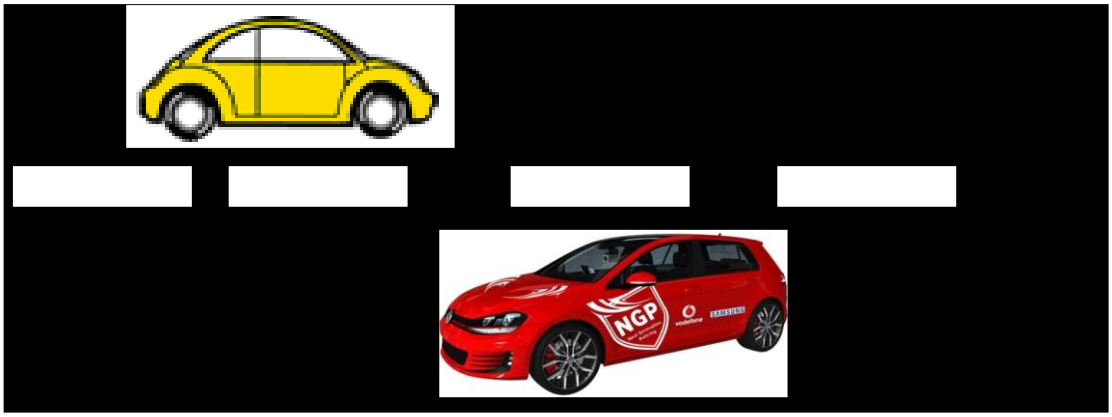

Figure 3.7 First level

3.6.2 Second Level

On this level, there is a pedestrian bridge on the road. User need to cross the road using the bridge. If he not uses the bridge, then there will be no mark given.

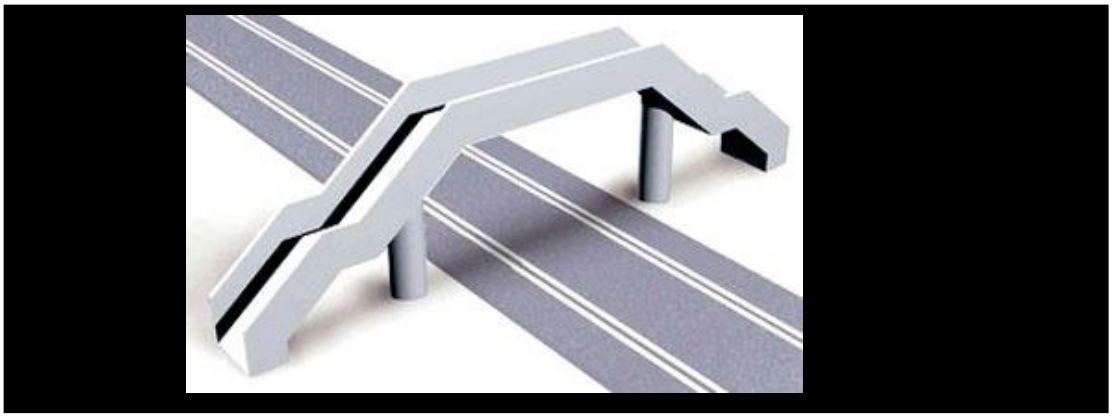

Figure 3.8 Second level.

3.6.3 Third level

On this road, there is zebra crossing. To cross the road, user needs to use the zebra crossing. If he not uses it, mark will not be given.

Figure 3.9 Third level.

3.6 Summary

This chapter contains the development methodology used for this project which is the Rapid Application Development (RAD) method. This method has four main stages that are the requirement planning, prototyping phase (develop, demonstrate and refine), testing phase and deployment phase. The Gantt chart is provided for reference.

The tools used for this project are Google Oculus rift and Unity platform to create the application. The other method use is body movement. The user needs to use their body in this application for moving. For research methodology, the author used interview and questionnaires to collect data. The system flow of VRtualize is illustrated using the activity diagram.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter is discussing about the results and discussions of this project. The results are collected by doing interview and survey in order to help improve the project. The first early prototype for the project is discussed further on this topic and also the final prototype which has been improved from the first prototype.

4.2 Qualitative Results of Interview

A research has been done at Suria KLCC during F1 Open Day on 24th March 2015. The main purpose of this research is to gather information on the current way of crossing the road, how they learn to cross the road and their knowledge on Virtual Reality. The respondents are interview with the same set of questions. They are 10 respondents for interview and 55 respondents for survey questions. Below is the summary of the result of the interview.

Table 4.1 Summary of interview session.

Respondents	Age	Sex	How do they learn to cross the roads
Respondent 1	10	Male	By teachers.
Respondent 2	23	Female	Learn by parent action when cross the road.
Respondent 3	32	Male	Learn at school.
Respondent 4	12	Male	Teachers teach at school.
Respondent 5	15	Male	Parent teaches.
Respondent 6	8	Female	Never cross road alone.
Respondent 7	20	Male	By teachers.
Respondent 8	31	Female	Watch the television ads.
Respondent 9	16	Male	By parents.
Respondent 10	19	Male	Learn at school.

From the interview it shows that, most of the respondents learn how to cross the road at school. Then there also some of the respondent being teaches by their parent and watch the television ads on how to cross the road. One of the respondent never cross the road alone since she is still small and her parent do not allow it.

4.3 Survey on VRtualize

An interview is conducted on the visitors. The initial survey was conducted on 55 visitor of F1 Open Day at Suria KLCC. They need to answer question after they test the VRtualize application to know the knowledge on Virtual Reality and their feeling when using it. Studying their knowledge of Virtual Reality give helps to add useful features to VRtualize. The question is divided into three sections that are demographic information, knowledge on virtual reality and usability of VRtualize.

Figure 4.1 The survey form's header. (Source: https://docs.google.com/forms/d/1iZ_g0I_RWwLpYCdruYYiKXrDams_uF7NF4kV7SN0asE/viewform)

4.3.1 Section A

The first section, section A, is about demographic information of respondents. A total of two questions are asked in this section that is about their gender and age. They need to mark their gender and choose their age range. The respondent need to be age more than 5 years old to test the application since it is not good for very small kids since it might hurt their eye.

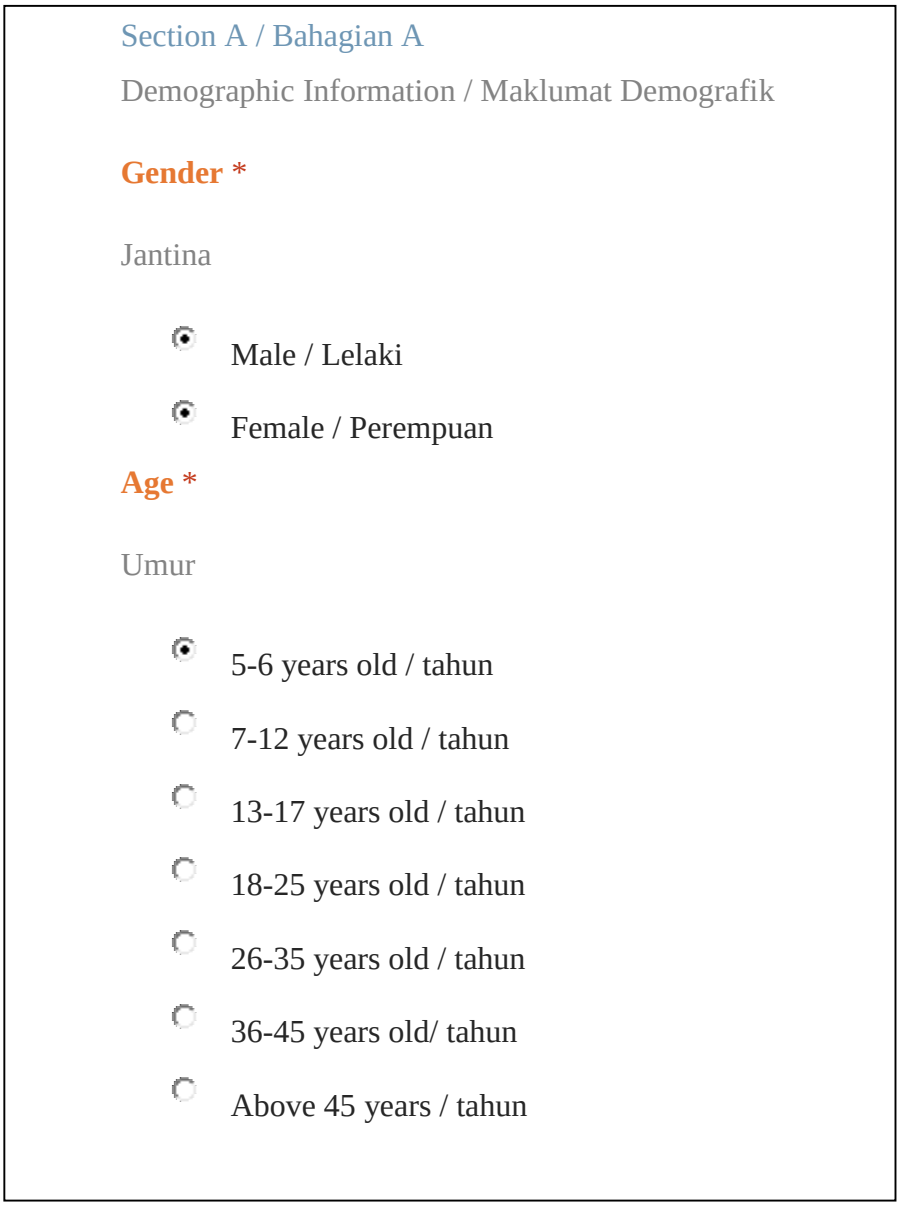

Figure 4.2 The first section of survey form.

From the result, total of 55 respondents have answer the survey and 9 (16%) of them are females and 46 (84%) are males.

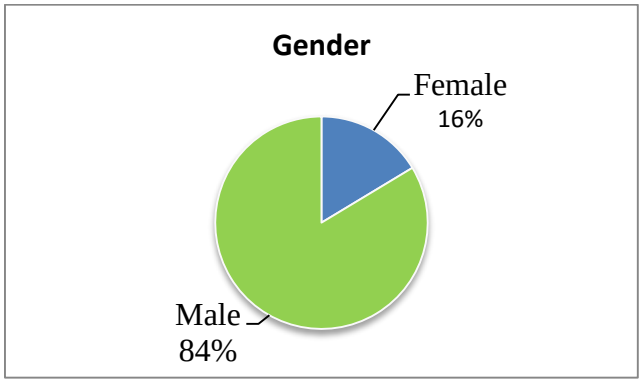

Figure 4.2 Percentage on gender of the respondents.

The second question on this first section is about age. One of the respondents is age range between 13 to 17 years old. Most of the respondents that are 27 of them as range between 18 to 25 years old follow. 17 of them are range between 26 to 35 years old follow by 7 respondents' age range between 36 to 45 years old and the rest is 2 respondent ages between seven to 12 years old and 1 respondent is above 45 years old.

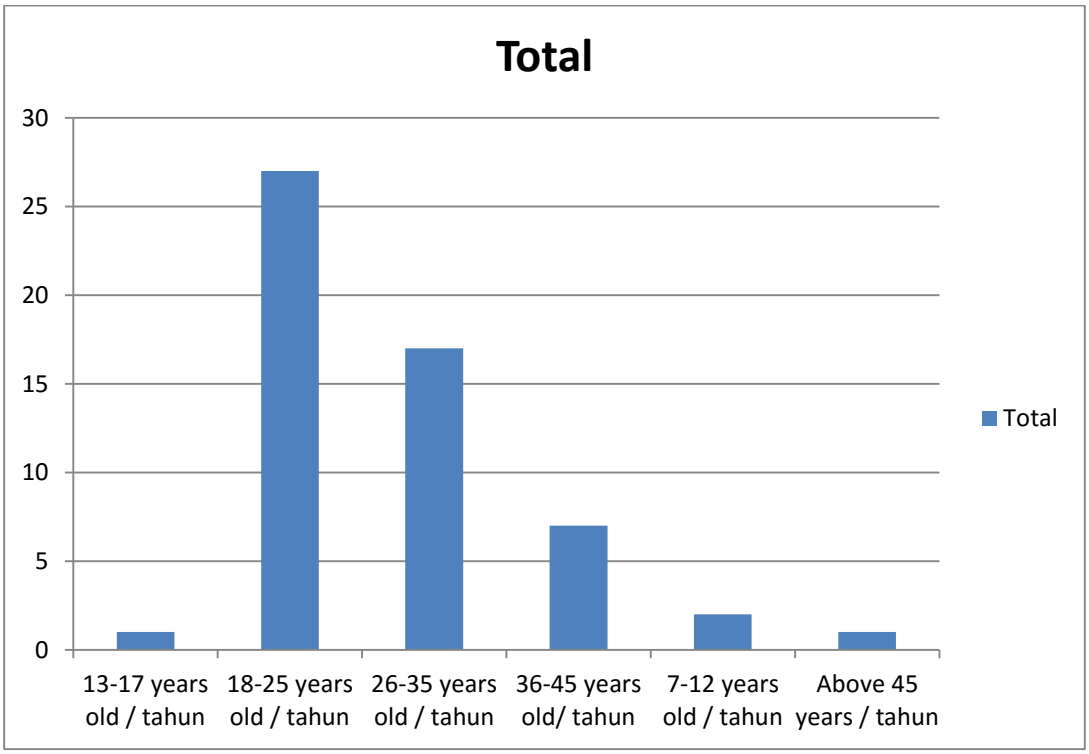

Figure 4.3 Age of respondents.

4.3.2 Section B

The second section is about the respondent knowledge on virtual reality.

Section B / Bahagian B

Knowledge on Virtual Reality / Pengetahuan Tentang Virtual Maya.
1=Strongly disagree / Sangat tidak setuju 2=Disagree / Tidak Setuju 3=Neutral / Neutral 4=Agree / Setuju 5=Strongly Agree / Sangat Setuju

I heard about Virtual Reality before. *

Saya pernah mendengar tentang Virtual maya sebelum ini.

1 2 3 4 5

I have used Virtual Reality to teach/learn. *

Saya pernah menggunakan Virtual Maya untuk menagjar/belajar.

1 2 3 4 5

I agree that Vitual Reality can be used to teach/learn. *

Saya setuju Virtual Maya boleh digunakan untuk mengajar/belajar.

1 2 3 4 5

I believe that Virtual Reality can increase children interest towards learning how to cross the road properly. *

Saya percaya bahawa Virtual Maya dapat meningkatkan minat kanak-kanak untuk belajar melintas jalan dnegan betul.

1 2 3 4 5

Figure 4.4 The second section for the survey.

Below are the questions and the total of respondents' answer. The answer is range between one to five which is from totally disagree to totally agree.

Table 4.2 The question asked for section B.

No	Question	Totally Disagree	Disagree	Neutral	Agree	Totally Agree
1	I heard about Virtual Reality before.	9	2	8	15	21
2	I have used Virtual Reality to teach/learn.	16	8	14	10	7
3	I agree that Virtual Reality can be used to teach/learn.	3	3	4	10	35
4	I believe that Virtual Reality can increase children interest towards learning how to cross the road properly.	2	3	0	20	30

The first question is asking about if they ever heard about virtual reality before. Most of the respondents' answers totally agree which means that most of the respondent is aware about virtual reality technology. The second question is about if they ever use virtual reality before to teach or learn. Most of them totally disagree with the statement. This shows that most of the respondents know about virtual reality but never try them yet.

The third question is about whether they agree that virtual reality can be use to teach or learn. Most of them totally agree with the statement. This means they

really interested to know more about virtual reality. The last question of this section is about whether they believe that virtual reality can increase children interest towards learning how to cross the road properly. Most of them totally agree with the statement. This shows that they alert on how children really interested toward technology nowadays.

4.3.3 Section C

Section C / Bahagian C

Usability of VRtualize / Kepenggunaan VRtualize 1=Strongly disagree / Sangat tidak setuju 2=Disagree / Tidak Setuju 3=Neutral / Neutral 4=Agree / Setuju 5=Strongly Agree / Sangat Setuju

The user interfaces are consistent. *

Antaramuka adalah konsisten

1	2	3	4	5
○	○	○	○	○

The application has user friendly features. *

Aplikasi mempunyai ciri mudah pengguna.

1	2	3	4	5
○	○	○	◉	○

The graphics used are attractive. *

Grafik yang digunakan adalah menarik.

1	2	3	4	5
○	○	○	○	○

Color schemes used are attractive and suitable for children.. *

Skema warna yang digunakan adalah menarik dan sesuai untuk kanak-kanak

1	2	3	4	5
○	○	○	○	○

Figure 4.5 Section C for survey questions.

There are seven questions asked in this section. Below are the questions and total number of respondents' answer for those questions.

Table 4.3 The questions asked for section C.

No	Question	Totally Disagree	Disagree	Neutral	Agree	Totally Agree
1	The user interfaces are consistent.	2	3	12	22	16
2	The application has user friendly features.	3	2	8	25	17
3	The graphics used are attractive.	1	5	12	19	18
4	Color schemes used are attractive and suitable for children..	3	8	7	22	15
5	VRtualize is easy to use and suitable for children.	1	5	9	19	21
6	Audio used are clear and understandable	2	9	17	17	10
7	I will use VRtualize for learn/teach children on how to cross the road.	6	0	4	26	19

The first question is regarding the user interface of the application whether it is consistent or not. Most of them agree that the interface is consistent. The second question is about user friendly features. 25 of them agree that the application do have the user friendly features. Next question is about the graphics used. 19 of them agree and 18 of them totally agree that the graphic is attractive. 22 of the respondents agree that the color schemes used are attractive. 21 of them totally agree that VRtualize is easy to use and suitable for children. Next question is about audio. 17 of the respondents are neutral about that statement. This is because during the interview there is some technical error on the speaker so respondent cannot really hear the audio well. Las question is about

whether they will use VRtualize for learn or teach. Most of them agree that they will use the application.

4.4 Prototype Design

There will be three types of road which consist of three levels. In order to finish the game, user need to cross all three roads.

4.4.1 First prototype design

This is the early prototype design. There will be three roads. The first road has no car passing. User need to cross the road. The second road is consisting of light traffic. There will be vehicles passing the road but only a small number. User need to follow road safety rules then cross the road. The third road is having a heavy traffic. Same as level two, user need to cross the road and follow the road safety rules. Then, the end point is the user's home.

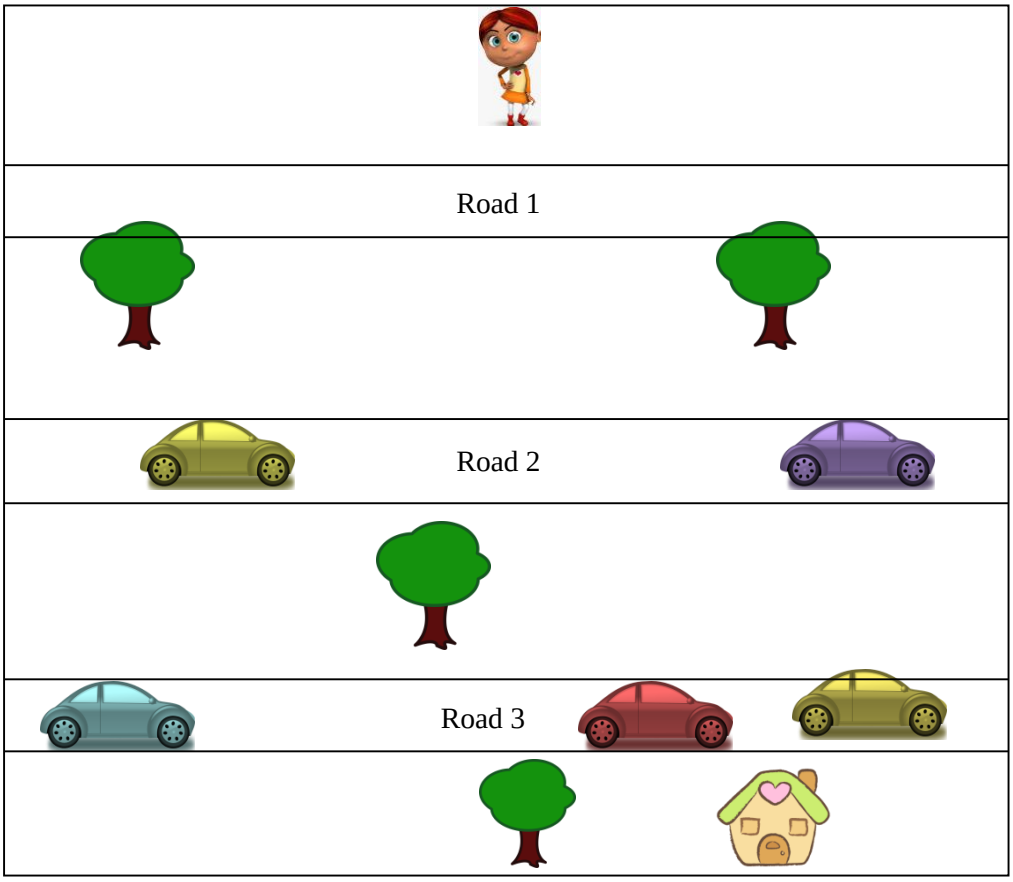

Figure 4.6 Potential designs of VRtualize.

4.4.2 Finalize prototype design

After improving the early design of the application, the final prototype design is created. There will be three roads but the obstacle is improved. For the first road, there will be light traffic. User need to cross the road and using the correct method of road crossing. If user not following the rules, mark will be deducted. User need to turn their head left, right then left as following the correct method of road crossing to see if there is any vehicle passing. If they got hit by vehicles, automatically the game will end. This is because they have involving in accident.

Figure 4.7 First roads with light traffic.

Then the second road will have pedestrian bridge. Pedestrian bridge is used to visually link between two distinct areas. This bridge let the user cross the bridge safely without slowing down the traffic. User need to cross the road using pedestrian bridge. If user does not use it, they cross the road under the bridge, mark will be deducted.

Figure 4.8 Pedestrian bridges on second road.

Last road obstacle is zebra cross. User need to cross the last road using zebra cross. Zebra-crossing consists of an alternating pattern of black and white stripes, which can be considered as a group of consecutive edges. They also need to follow the correct method of road crossing. If user does not use the zebra crossing, mark will be deducted.

Figure 4.9 Zebra cross on third road.

After finish all the three roads crossing, user need to go to the house as it last check point which will end the game as the aim for the game is reaching user's home. There will be a score board at the end of the game. The score board will show the total marks that the user collected throughout the game.

4.5 Summary

This chapter briefly explained on the outcomes of the survey and interview that was carried out. A survey and interview has been done involving ten peoples from different age on how they learn to cross the road. Results of the survey is recorded and analyze. This interview is done with ten peoples at Suria KLCC during F1 Open Day.

Then a survey on user acceptance test is recorded. The respondents need to fill in the survey form after they try the VRtualize application. The survey question is consist of three sections which are demographic information, knowledge on virtual reality and the VRtualize usability. A total number of 55 respondents is recorded.

Next, the first draft of the prototype has been done. On the first draft, there will be three types of road which the first road has no vehicle passing, second road with light traffic and last road with heavy traffic. User need to follow all the road safety rules. If there is any accidents happen, the game will be terminated. Then, after some research, the road obstacles are improved. The first road is having vehicles passing. The second road, user need to cross using pedestrian bridge and last road using zebra crossing.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

Despite the importance of knowing the correct way to cross the road, failure to adhere to the road rules is becoming common not even only children, but all people from various ages. This phenomenon, in some circumstances can result in life threatening consequences and at some point may cause death and accidents. There are lots of programs and activities that already implemented to create the awareness about the road safety but none of the programs is really practicing the real practical way on crossing the road. In order to solve the problem, VRtualize is created.

VRtualize is created through Unity platform using C# language. Google Oculus rift is used to give the virtual reality environment. VRtualize is giving the real experience on crossing the road while user does not really have to be on road. This is a perfect simulation for a child who is having his first time on road alone. They do not expose to the real road danger while having fun attempting to cross the road on their own.

5.2 Achieved Objectives

Throughout this project, all the objective of the project is achieved through below activities.

5.2.1 Objective 1- To identify the suitable theories and method for simulation in virtual reality.

This objective has been achieved through interviews and surveys. A field visit has been done on to research on the problems faced by the children. A research has been conducted on 24th April 2015 at Suria KLCC during F1 Open Day to study their behavior on crossing the road. Besides, a survey on 55 respondents on visitor of F1 Open Day has been carried out to seek their opinion on the Virtual Reality and the awareness of road safety.

5.2.2 Objective 2 – To develop prototype for simulation.

A prototype on VRtualize in simulation and training is created. The prototype is developing using Unity platform by creating a 3D environment and the coding is using C# language. This prototype is developed for about two months.

5.2.3 Objective 3 - To conduct the user acceptance test.

After finish creating the prototype, a user acceptance test is conducted to see how user response on the product. As mentioned before, the test is involving people from different ages even this project is design specifically for children. This is because, adults opinion is also important in order to improve the project.

5.3 Recommendations

Below are some recommendations to improve this project.

5.3.1 Having more realistic environment

It is better to have the environment exactly like what Malaysia has for example creating a city like Kuala Lumpur, having the KLCC tower. It makes the environment more realistic and lively. Since the time is limited, only simple environment is created for this project.

5.3.2 Use Samsung gear instead of Google Oculus rift

Samsung gear function is exactly the same as Google Oculus rift. But the advantages of using Samsung gear instead on Google Oculus rift is because the application of Samsung gear is created through mobile application. Mobile is more convenient for people to buy since it is a need nowadays for each of us. So, all people can easily having the application through mobile rather than buying the Google Oculus rift.

5.4 Summary

All the objectives for this project are achieved. The first objective is achieved by identifying all the suitable theories and method for simulation in virtual reality. The second objective is achieved by developing the prototype of the simulation. Last objective is achieved through conducting user acceptance test on the project which involving people from various ages.

To improve the project in coming future, some recommendations are given. The first recommendation is about creating the environment exactly like what Malaysia have. For example create the famous tower at Malaysia that is KLCC tower. This will make the application more realistic and lively. The second recommendation is about using Samsung gear instead of Google Oculus rift since it is more affordable for normal people.

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