TO DESIGN AND IMPLEMENTATION OF AUGMENTED REALITY APPLICATION FOR RAPIDKL

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This report is submitted in partial fulfilment of the requirements for the

Bachelor of [Computer Science (Interactive Media)] with Honours.

FACULTY OF INFORMATION AND COMMUNICATION
TECHNOLOGY UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021

DECLARATION

I hereby declare that this project report entitled

[The development LRT and MRT RapidKL by using Augmented Reality

is written by me and is my own effort and that no part has been plagiarized

without citations.

STUDENT : nazira Date : 31/8/2021

(NOORIN NAZIRA BINTI RUSAN).

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 [Computer Science (Interactive Media)] with Honours.

SUPERVISOR : _____ Date : 31/8/2021

(DR ULKA CHANDINI PENDIT)

DEDICATION

This final project is wholeheartedly dedicated to my beloved parents, who have been my source of inspiration, gave me strength when I thought of giving up, support and help whenever and wherever I need.

In addition, to my supervisor, who always committed, endless support and guide me while the progress of this final project.

To my evaluator, who gives a feedback and advice on this final year project.

Lastly, to all my beloved friends who always there to help me through anything and shared their words of advice and encouragement to finish my final year project.

ACKNOWLEDGEMENTS

Bismillahirahmanirahim,

In the name of Allah, thank you for the guidance, strength and giving me a healthy life. Alhamdulillah, with his permission I am able to finish and completed my final year project.

I would like to express my sincere gratitude to my parents, for their contribution on financial, endless moral support and all the guidance and advice to help me on this project.

Secondly, thank you to my supervisor Dr Ulka Chandini Pendit, who always guide me all along the way to develop this project, for always encourage me in my progress and for being a very kind and thoughtful supervisor. Thank you for all of your help and advices in the making of this final year project.

To wrap things up, I dedicated this final year project to all my friends who always give a hand and their support during the development of this projects.

Thank you.

ABSTRACT

Malaysia has many different public transports. LRT and MRT are the most popular public transport in Malaysia. LRT and MRT is a train that link from one place to others place. LRT and MRT simplify user affairs without having to face traffic jam especially when go and back form works and public holiday. This project for promoting LRT and MRT for user and tourists. In this project, have information about LRT and MRT RapidKL using Augmented Reality (AR). The users need to download the Augmented Reality application and scan the RapidKl card so the popup of Augmented Reality will display. This project to study about the LRT and MRT transportation using Augmented Reality. Next, to develop the augmented reality application for LRT and MRT RapidKL and to evaluate the effectiveness of Augmented RapidKL based on usability. The application is expected to successfully develop the application that use an augmented reality feature as a platform for promote LRT and MRT RapidKL.

ABSTRAK

Malaysia mempunyai pelbagai pengangkutan awam yang berbeza. LRT dan MRT antara pengangkutan awam yang paling popular di Malaysia. LRT dan MRT adalah kereta api yang menghubungkan dari satu tempat ke tempat lain. LRT dan MRT juga mempermudahkan urusan pengguna tanpa perlu menghadapi kesesakan jalan raya terutama ketika pergi dan balik kerja dan cuti umum. Projek ini untuk mempromosikan LRT dan MRT untuk pengguna dan pelancong. Dalam projek ini, mendapatkan maklumat mengenai LRT dan MRT RapidKL dengan menggunakan Augmented Reality (AR). Pengguna perlu memuat turun aplikasi Augmented Reality dan mengimbas kad RapidKl sehingga pop timbul Augmented Reality akan dipaparkan. Projek ini untuk mengkaji mengenai pengangkutan LRT dan MRT menggunakan Augmented Reality. Seterusnya, untuk mengembangkan aplikasi augmented reality untuk LRT dan MRT RapidKL dan untuk menilai keberkesanan Augmented RapidKL berdasarkan kebolehgunaan. Aplikasi ini diharapkan dapat berjaya mengembangkan aplikasi yang menggunakan ciri-ciri augmented reality sebagai platform untuk mempromosikan LRT dan MRT RapidKL.

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FYP - - Final Year Project

AR - - Augmented Reality

LRT - - Light Rail Transit

MRT - - Mass Rail Transit

CHAPTER 1:
INTRODUCTION

1.1 Project Background

In retail or sales (for example, an online fashion shop), augmented reality has been widely employed as a virtual product demo tool, giving you to virtually visualise the clothes you want to buy. In the sector of industry training, augmented reality technology can give virtual products to be studied in place of the physical product. Augmented reality provides extra information about the product while also improving subject visualisation. Malaysia is a developing country that has public transportation. RapidKL is a brand name used by Prasarana Malaysia companies to represent to public transportation services in the Kuala Lumpur and Klang Valley areas.

Users may move faster, reduce traffic congestion, especially when heading to and from work, and reduce air pollution caused by car and motor smoke with this LRT and MRT RapidKL. Understanding and researching the LRT and MRT RapidKL to users and tourists through augmented reality technology is one approach to accomplish this (AR). As a result, with Marker-Based Augmented Reality, an AR application is created to visualise the information of the LRT and MRT transit stations based on Android.

Many companies have switched to a computerised working system in this information technology age. Augmented Reality (AR), which is part of computer science, is the less field than its counterparts. Augmented Reality (AR) is an interactive experience of a real-world environment in which computer-generated elements complement the real-world ones. The purpose of this study is to look into the relevance

and importance of Augmented Reality in assisting users in using and launching LRT and MRT RapidKL as a public transportation system.

This application has several objectives, which is to study about the LRT and MRT transportation using Augmented Reality and also to develop the augmented reality application for LRT and MRT RapidKL. Aside from that, is to evaluate the effectiveness of Augmented RapidKL based on usability. Next, the project's expected outcome is the successful development of an application that uses an augmented reality feature as a platform to promote LRT and MRT RapidKL so that tourists are more aware of their use and people have a better understanding of LRT and MRT.

1.2 Problem Statement

Malaysia provides a variety of public transportation options, including LRT, MRT, bus, and taxi. People prefer to use public transportation to get there from one location to another, especially in cities where traffic is unpredictable and has become an issue. In certain places, the local government prevents private vehicles from entering the city centre, encouraging residents to take public transportation instead to avoid traffic jams and pollution. The problem now is that users and tourists are having difficulty finding the interactive map. In addition, there is no AR application for RapidKL. Lack of AR application for RapidKL (Ng, C., & Ramasamy, C. , 2018). And also, lack of interactive maps for RapidKL to be use by user (siti nurbaya binti karim, 2016).

When users or tourists visit a train station these days, they are given a board with a map but no interactive content. As a result, no one wants to see the map. Those applications, in general, provide information on LRT and MRT rail station maps.

1.3 Objectives

The objectives of this project are:

a) To study about the LRT and MRT transportation using Augmented Reality.

b) To develop the augmented reality application for LRT and MRT RapidKL.

c) To evaluate the effectiveness of Augmented RapidKL based on usability.

1.4 Scope

The scopes in developing this project are :

1. Module/content:

There are several module will be used in this application. The features on part of the LRT RapidKL will be displayed such as

a) Introduction
b) RapidKL map
c) Information

2. Target Audiance :

This Augmented Reality application is targeting for public and tourists.

3. Software and Requirement:

I. Software components :

- Unity 2019
- Vuforia Engine
- Operating System : Windows 10
- Aurasma Studio

II. Hardware components :

- *WINDOWS-R77FH7H*
- Processor: Intel® Core ™ i3. 6006U CPU @ 2.00GHz 1.99GHz
- 64-BIT Operating System, x64-based processor
- 4.00 GB Installed RAM

1.5 Project Significant

The purpose of the project is to provide an interactive new experience for the audience in understanding RapidKL through Augmented Reality. Following that, it will be quite helpful to everyone. Users will gain a better knowledge of what augmented reality is as a result of the initiative. As a result, the new Augmented Reality technology can be developed or upgraded.

1.6 Conclusion

The aim of this project is to create a standalone application that can display the LRT and MRT train station maps to the public so that they may better understand LRT and MRT. Using Augmented Reality technology, the application was created and constructed. The problem statements explain the situation as it is now and why this initiative is necessary. In the problem statement, the objective are mentioned clearly. The objectives must be realistic and reasonable. The research interests explain the basic target customer, system, and usability.

CHAPTER 2:
LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 Introduction

A writing audit is a study of useful materials on a specific topic. It provides a flow diagram, identifying relevant hypotheses, methodologies, and holes in the current investigation. It keeps track of the best in class on the subject or point you're discussing. Make a reference to Harvey. A library dedicated to Andruss (2019) It should provide a speculative foundation for the research and helps in the selection of assessment options. The writing evaluation considers previous subject matter experts' contributions and, as a result, assures the reader that the examination has been thoroughly organised.

Methodology is a set of procedures, processes, cycles, and frameworks that are utilised to attain a goal. The strategy is a broad investigative framework that sets out how assessment will be carried out and, among other things, how the procedures will be carried out. These procedures described in the theory show techniques or strategies for data variety or how to resolve a given result. Despite how much effort is put to the nature and types of cycles to be maintained in a particular system or to achieve a purpose, theory does not provide definitive strategies.

2.2 Facts and findings

The basic concept of Augmented Reality in terms of definition, as well as several problems related to Augmented Reality, will be discussed in Chapter 2. (AR). This

section will also look into the movement business's potential as well as the strategy for boosting the movement business division. In this section, some existing AR SDKs with coordinated effort features will be analysed and remembered for the relationship cycle.

2.3 Domain

The domain of this project is Augmented Reality in LRT and MRT RapidKL, and users can learn about LRT and MRT RapidKL and understand the map by using this application. By utilising this software, users will gain a better understanding of the LRT and MRT.

2.3.1 Augmented Reality

Augmented Reality is a work of art that splits the difference between what is real and what is generated by a computer. Temporary Augmented reality is accustomed to combining a direct and circumstantial view of the physical world with Computer tangible information, such as a 3D model or sound. When the increase is completed in a continuous manner, As the increase is completed regularly, Augmented Reality can genuinely improve the view of reality through intuitive and carefully collected data, resulting in the creation of new and stunning experiences. Augmented Reality gradually resolves any problems that exist in the real and virtual worlds. In comparison to virtual reality (VR), augmented reality (AR) creates a completely fake situation that replicates the present situation (Straits Times, 16 February 2016).

2.3.2 Type of Augmented Reality

There are several platforms that can be used in AR to view the output which is Marker Based Augmented Reality, Marker-less Based Augmented Reality, Projection Based Augmented Reality and Superimposition Based Augmented Reality.

2.3.2.1 Marker Based Augmented Reality

Image Recognition or Recognition based AR are two other names for Marker-Based AR. After focusing on object recognition, this type of AR provides us with additional knowledge about the object. It recognises the object in front of the camera and displays data about it on the screen. The object is recognised using a marker, such as a QR Code or a flyer, which replaces the marker on the screen with a 3D version of the corresponding object. As a result, the user will examine the object more closely and from different perspectives. Additionally, the user will rotate the 3D imagery while rotating the marker.

Figure 2.1: Marker Based Augmented Reality
(researchgate.net,2019 September)

2.3.2.2 Marker-less Based Augmented Reality

Markerless augmented reality (AR) is a software application that overlays virtual 3D content onto a scene and holds it to a fixed point in space without requiring prior knowledge of the user's environment. Markerless augmented reality (AR) combines digital data with real-

time, real-world inputs that are registered to a physical space. To register 3D graphics in the real world, the technology integrates software, audio, and video graphics with the cameras, gyroscope, accelerometer, haptic sensors, and location services of a smartphone or headset. Without any previous knowledge of the world, markerless AR detects objects or different views of a scene, such as walls or intersection points. The visual effect that combines computer graphics with real-world imagery is also associated with the technology. The accuracy of markerless AR image analysis has improved thanks to the advancement of simultaneous localization and mapping technologies (SLAM). The SLAM markerless image tracking system scans the environment and generates maps of where virtual 3D objects should be placed. The objects do not move as the user runs, and the user does not have to search new files.

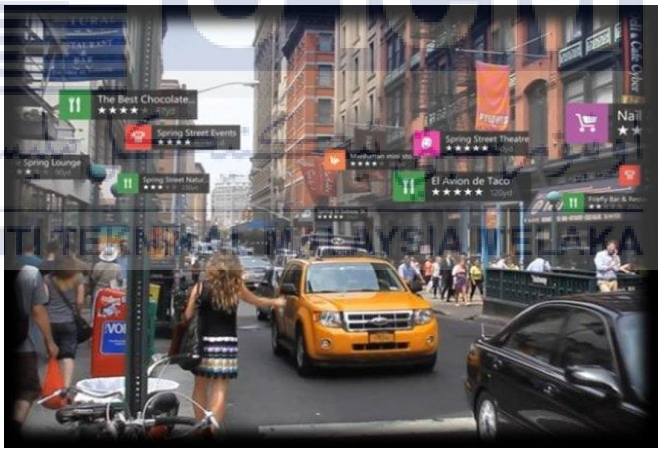

Figure 2.2: Markerless Based Augmented Reality (researchgate.net,2019 September)

2.3.2.3 Projection Based Augmented Reality

Projection-based augmented reality, also known as spatial augmented reality (SAR), functions similarly to a movie

projection in that it projects artificial light onto a real surface. There is no need for screens or headphones. Projection-based augmented reality is typically used at a larger scale, such as at a meeting or exhibition. It can be interactive and 3D, thanks to the use of sensors. This form of AR is useful for displaying large objects such as cars and can also be used in the market testing process to gather input on various models.

Figure 2.3: Projection Based Augmented Reality (researchgate.net,2019 September)

2.3.2.4 Superimposition Based Augmented Reality

Object detection is used in superimposition-based augmented reality. The augmented image partially or completely replaces the original image. In the medical sector, this form of AR is typically used to superimpose an X-ray onto a patient's body. It can also be used to make a historical tour more interesting. You might, for example, use superimposition-based AR to demonstrate how a statue or structure appeared years ago, visually describing how it has aged and why that is important.

Figure 2.4: Superimposition Based Augmented Reality (augmented-minds.com,2020, July 7)

2.3.3 Augmented Reality Application

Augmented Reality Apps are software applications that integrate advanced visual (as well as sound and other types of) content into the user's real-world environment. AR programming may be used for a variety of tasks such as planning, jobs, and customer applications in a variety of industries, including open defence, medical care, travel, gas and oil, and marketing. Many applications of Augmented Reality technology are used in everyday life to increase the user experience and understanding of something. In another application, augmented reality was used to display logical data using the client's camera. For example, a user may open the camera application and point their phone at a marker material, and data about the structure will pop up. This application has some flexibility in that it provides video support and precise innovations in addition to providing custom critical exercises such as SMS, call, email, and web-based media interfacing.

Figure 2.5: Example of Augmented Reality Application (play.google.com, November 9, 2017)

2.3.4 Usage of Augmented Reality in Tourism

Tourists may use mobile AR applications for a variety of purposes, including searching for information, sharing or exchanging information and helpful tips, and making feedback on a place or destination with a wide network. As a result, other users, in this case tourists, will communicate with one another and share their experiences (Russell, 2012). Furthermore, by tailoring their needs and changing the settings of the applications they are using on demand, mobile AR applications can help tourists avoid information overload or irrelevant information. It is useful for visitors because there is a lot of knowledge available about historical sites and museum exhibits, and it can be difficult to find the information they need. As a result, museums, heritage sites, cities, and tourist professionals in general can organise and transmit information in layers or provide information on demand, i.e. based on the specific needs of tourists, such as their preferences, age, occupation, and information level. As a result, tailoring their visit to their preferences can increase their enjoyment of the trip and make it a memorable experience (Carmigniani et al, Berryman, 2012).

Transportation is one sector where AR has been shown to be used rather than in hotels or restaurants. Tourists will get a lot of needed assistance with AR after travelling through a new world. Navigation is also made simpler for pedestrians as well as those on the move thanks to augmented displays. Via appropriate AR applications, users will be able to find the correct path to their desired destination using directional arrows and virtual ways. Buses in many locations have digital screens attached to the backs of the seats that can be scanned using an AR application to provide passengers with interactive content (Wilson, 2014b).

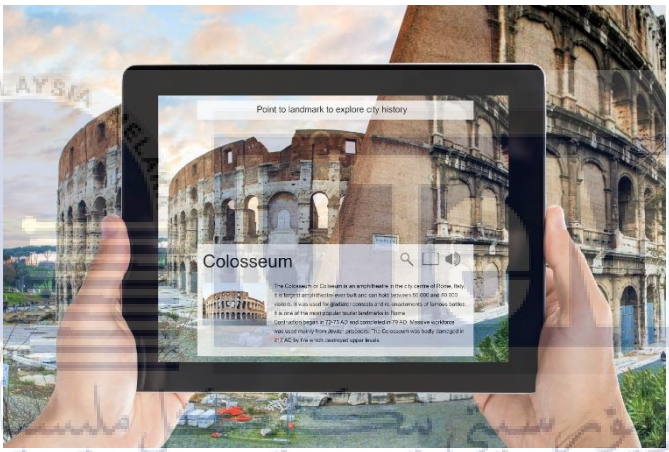

Figure 2.6: Example of Augmented Reality in Tourism (searchabledesign.com,2020 Diecember 7)

2.4 Existing System

The existing system for project references comes from a subject matter expert (SME) who has a number of ideas that will be useful in this project.

2.4.1 Mobile Application of RapidKL

This project mobile application is built for Klang Valley users and tourists who use public transportation especially for train users. It makes it easier for users

to schedule their journeys along Rapid KL's routes and networks. This mobile application can be found on google play and app store.

Figure 2.7 Display for the main page of mobile application

Figure 2.8 Example of first page for mobile application

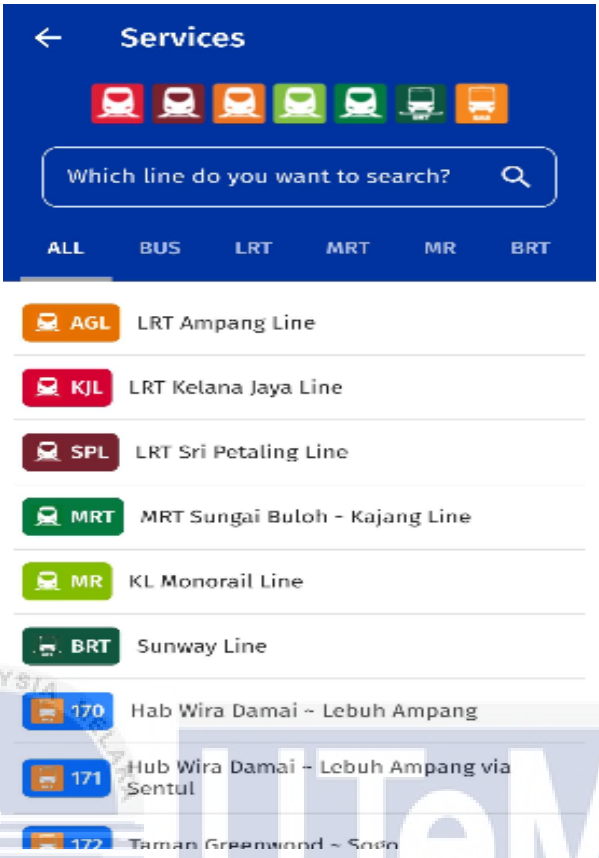

Figure 2.9 Example of services page for mobile application

2.4.2 Comparison between existing system

Table 2.1 shows the existing system which have been taken as the reference in this project. Comparison between the existing system and proposed system have been made in this table.

Table 2.1 Summary and Comparison of Reviewed System and Proposed Project

Existing System	**Mobile Application for RapidKL**	**Augmented Reality for Train Station of LRT RapidKL**
Target user	Public	User and tourists

Platform	Mobile Application	Augmented Reality
Software	Android Studio, APK	Unity, Vuforia SDK, Blender
Language	English	English/Malay
Price	Free	Free
User Interface	Yes	Yes
Ease of use	No	Yes
Audio	None	Background music
Feature	- Services status - Journey planner - Arrival time - Fare calculator	- Information about RapidKL - Visualize train station routes
Related Technology	Mobile Application	Augmented Reality
Strength	- Can calculate fare. - Can estimate arrival time. - Has maps function.	- AR technology provide rapid rescue, evacuation simulation and guidance. - Very high performance. - Good graphical design.
Weakness	- Easy to lack when loading the application - The time when the train arrives with the actual is not the same	

2.5 Project Methodology

Before starting the LRT and MRT RapidKL Augmented Reality development process, careful preparation is required to ensure effective outcomes. The agile approach combines iterative and incremental process models, focusing on process adaptability and customer satisfaction through rapid delivery of working software. Agile methods divide a project into small, incremental steps. Iterations of these builds are available. Each iteration lasts anywhere from one to three weeks. Every iteration incorporates cross-functional teams working on multiple topics at the same time.

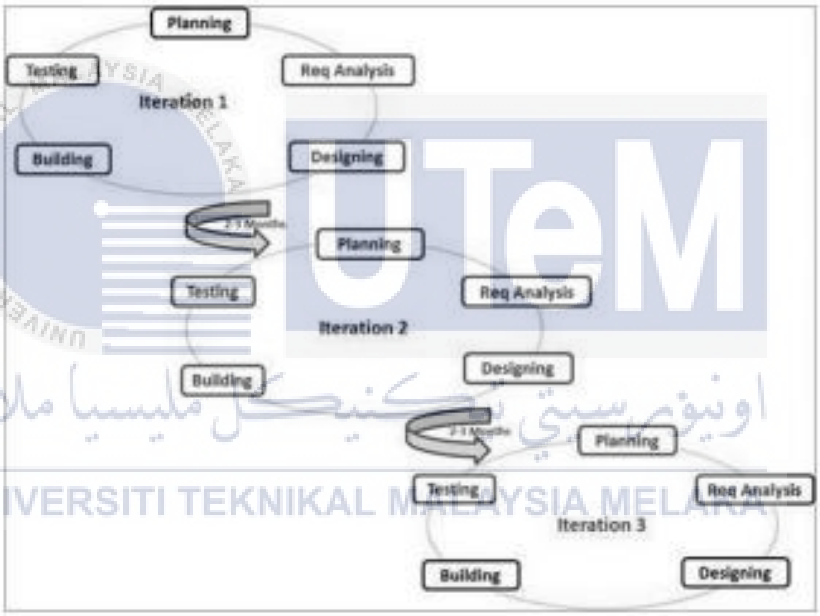

Figure 2.10 Agile Model (Quora.com)

2.6 Project Requirements

The project requirements are the software and hardware needs that must be used to ensure the project's success. It provides a greats AR that need to be finish on the time by using the tools that needed.

2.6.1 Hardware Requirement

The device used in this project were LAPTOP which is WINDOWS-R77FH7H and contains Intel® Core ™ i3. 6006U CPU @ 2.00GHz 1.99GHz of processor, 64-BIT Windows 10 Operating System and 4.00 GB RAM.

2.6.2 Software Requirement

Unity, Blender and Vuforia are the main platform of building application for this project.

2.6.2.1 Vuforia 7 Engine

Vuforia is an Augmented Reality Software Development Kit (SDK) for mobile devices that enables the creation of Augmented Reality applications. It uses Computer Vision technology to recognize and 22 track planar images (Image Targets) and simple 3D objects, such as boxes, in real-time.

2.6.2.2 Unity 2019.2.5.f1

Unity is a cross-platform game engine developed by Unity Technologies, which is primarily used to develop both three dimensional and two-dimensional video games and simulations for computers, consoles, and mobile devices.

2.6.2.3 Blender

Blender is the free and open source 3D creation suite. It supports the entirety of the 3D pipeline - modeling, rigging, animation, simulation,

rendering, compositing and motion tracking, video editing and 2D animation pipeline.

2.7 Conclusion

To conclude, Augmented Reality provides a competitive economic opportunity in current period of modern innovation globally. AR improves commitment and teamwork while also making the client experience more enjoyable. According to study, augmented reality appears to boost the perceived worth of items and companies. This section details the present systems in the area segment, as well as the various types of Augmented Reality. The three stages of the project illustrated are pre-production, production, and post-production. The purpose of project requirements is to ensure that the project is executed effectively. The next chapter, Chapter 3, goes deep into need analysis, including venture prerequisites, programming prerequisites, and equipment prerequisites. To ensure that this application can scale quickly and that no complications arise during development, a different form of requirement is being used. In Chapter 3, we'll talk about how we're going to grow this business by expressing how we're going to achieve our objectives. What is the best way to put the application's plan together.

CHAPTER 3:

ANALYSIS

3.1 Introduction

In the great majority of current strategies, the analysis stage is critical. Essentially, investigation requires an analysis of the problem in the investigation techniques used, as well as research objective, properties, and the conveyance level. This section will go over the problem and the task's prerequisite investigation. The cycle of critical thought is the way to figure out how to lessen the differences, just as the way to recognizing issues is the way to characterizing comparisons.

3.2 Current Scenario Analysis

The current scenario of LRT and MRT in pervious chapter is different. The analysis of the current system is a successful method for increasing the knowledge of how the current system works. Most of the existing system for LRT and MRT is using website and mobile application.

3.2.1 Comparing Existing Augmented Reality

There is an application for the LRT and MRT RapidKL Train Station that has comparative capability for Augmented Reality. Nonetheless, it has qualities that differentiate them. The flowchart for the current system is shown below.

3.2.1.1 Mobile Application for RapidKL

The scenario entails creating a work area application that can assist users in using public transportation. Fare calculator, service status, arrival time, and journey planner are all available data in this app.

3.3 Requirement Analysis

Requirement analysis is a method of describing the needs that contributed to the creation of the project. The analysis includes the project requirements, software requirements, hardware requirements, and other requirements

3.3.1 Project Requirement

The system to be developed is evaluated in the project specifications. It will specify the actions, procedures, or other requirements that the project must achieve. It will be evaluated based on the requirements gathered and the project's basic methodology. This project's requirements will include a clear understanding of the tasks that must be completed.

3.3.1.1 Requirement Gathering

Requirements gathering is probably the most important activity to be performed in delivering and information solution. There are two categories of requirement gathering which are qualitative and

quantitative. Qualitative assessments use words or relative values to express risk, cost, and impact. A quality assessment is appropriate when there is not enough time, money and data to perform a quantitative assessment. Usually, the qualitative assessment is used in questionnaire or interview. The questionnaire will be conducted for public user and tourists. All of the project functionality, proposed interaction and the analysis of raw data and sources will be discussed in requirement gathering. The specific technique used when developed this project also be analyzed. The analysis result will be contributed to the augmented reality development.

3.3.2 Software Requirement

Unity, Vuforia Engine and Adobe Illustrator are the principles foundation of building application for this undertaking.

3.3.2.1 Vuforia 7 Engine

Vuforia is an Augmented Reality Software Development Kit (SDK) for mobile devices that enables the creation of Augmented Reality applications. It uses Computer Vision technology to recognize and 22 track planar images (Image Targets) and simple 3D objects, such as boxes, in real-time.

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Unity is a cross-platform game engine developed by Unity Technologies, which is primarily used to develop both three dimensional and two-dimensional video games and simulations for computers, consoles, and mobile devices.

3.3.2.3 Blender

Blender is the free and open source 3D creation suite. It supports the entirety of the 3D pipeline—modeling, rigging, animation, simulation, rendering, compositing and motion tracking, video editing and 2D animation pipeline.

3.3.2.4 Adobe Illustrator

Adobe Illustrator is the industry-standard vector graphics software that's used by millions of designers and artists to create everything from gorgeous web and mobile graphics to logos, icons, book illustrations, product packaging and billboards.

3.3.2.5 Microsoft Word 2016

Microsoft word is used to make the documentation and proposal. All the documentation part will be done in Microsoft Word. It has been used to type, edit, and makeup all the format that needs in the project documentation.

3.3.3 Hardware Requirement

Hardware has an important part in the development of the application. It will provide as a support to the software. The software determines which hardware to use, it will be chosen. Hardware is important because it will be the platform and the functionality will determine the fastest to deliver the project. Below is the list of the hardware, its specification and the function.

3.3.3.1 Laptop

The device used in this project were LAPTOP which is WINDOWS-R77FH7H and contains Intel® Core ™ i3. 6006U CPU @ 2.00GHz 1.99GHz of processor, 64-BIT Windows 10 Operating System and 4.00 GB RAM. It is chosen to support the software used and develop the project.

3.3.3.2 Mobile Device

To support the augmented reality application, the mobile device's operating system must be Android 7.0 or higher, as well as OpenGL ES 3.2. In addition, the AR virtual object can be scanned and accessed using a mobile device with a camera. The application is run on a mobile device.

3.4 Project Schedule and Milestone

This section will explain the venture's timeline and success. The task is completed in one semester, which lasts fourteen (14) weeks. The task's timeline and completion must be carefully planned in order to ensure that the task meets its objectives. This project's timetable and milestones are shown in the table below.

Activity Description	**Duration (Working days only)**	**Start Date**	**End Date**
1. Brainstorming	**7 days**	**29/1/21**	**14/1/21**
1.1 Select project title	4 days	29/1/21	1/2/21
1.2 Find the information related the title	3 days	2/1/21	4/2/21
2. Proposal	**13 days**	**5/2/21**	**17/2/21**

3. Project Preparation	**13 days**	**18/2/21**	**2/3/21**
3.1 Install the needed software	4 days	18/2/21	21/2/21
3.2 Learn how to use the software	9 days	22/2/21	2/3/21
3.1. Analysis	**14 days**	**3/3/21**	**16/3/21**
3.1.1 Describe project background	2 days	3/3/21	4/3/21
3.1.2 Identify target user	1 days	5/3/21	5/3/21
3.1.3 Identify project significance	1 days	6/3/21	6/3/21
3.1.4 Define literature review	5 days	7/3/21	11/3/21
3.1.5 Identify project methodology	2 days	12/3/21	13/3/21
3.1.6 Analysis project requirement	2 days	14/3/21	15/3/21
3.1.7 Review project plan	1 days	16/3/21	16/3/21
4. Designing	**77 days**	**17/3/21**	**1/6/21**
4.1 Design 2D object	15 days	17/3/21	31/3/21
4.2 Modelling 2D object	15 days	1/4/21	15/4/21
5. Testing	**47 days**	**16/4/21**	**1/6/21**
5.1 Develop scene	15 days	16/4/21	30/4/21
5.2 Integrate object into Unity	16 days	1/5/21	16/5/21
5.3 Develop user interaction	16 days	17/5/21	1/6/21
5. Testing	**7 days**	**2/6/21**	**8/6/21**
6. Development	**7 days**	**9/6/21**	**15/6/21**
6.1 Edit scenes	4 days	9/6/21	12/6/21

6.2 Improve the interface	3 days	13/6/21	15/6/21
PSM 2			
7. Development	**28 days**	**16/6/21**	**13/7/21**
8. Implementation	**21 days**	**14/7/21**	**4/8/21**
9. Testing	**21 days**	**5/8/21**	**25/8/21**
9.1 Testing	11 days	5/8/21	15/8/21
9.2 Evaluate	5 days	16/8/21	20/8/21
9.3 Publish	5 days	21/8/21	25/8/21
10. Documentation	**6 days**	**26/8/21**	**1/9/21**
11. Final Preparation	**5 days**	**2/9/21**	**6/9/21**

Table 3.1: Project Schedule and Milestone

3.5 Conclusion

This section describes all of the analysis that has been completed before to start the next stage, design the analysis and design requirement for current and the system that will be developed is being explained. In general, this stage is used to evaluate the client's needs and the important of addressing, improving, and implementing changes that needs. Developers can learn what users want and what functions should be added to the application by doing a requirement analysis. Instances, hardware and software is the requirement needed to be carried out, to improve the development experience. With the milestones and project schedule, the project can be run on time. In next chapter, the project design will be discussed with the project progression.

CHAPTER 4:

DESIGN

4.1 Introduction

This chapter explains on the findings of the review throughout this chapter. The design step includes several progressions in terms of learning goals, assessment apparatuses, preparation, and workouts. The developer will create and structure the application during the design phase. It is based on the project's concept and concept. The developer will gain a basic outline on what to add to the project interface by sketching the idea, layout, and design. In this chapter, we'll go over the process of creating this design application in greater detail.

4.2 System Architecture

The architecture of the system giving the briefly explanation for the overall application. In this Augmented Reality, there are several parts to form the system architecture. The “LRT and MRT RapidKL Augmented Reality” application is a marker-based augmented reality application. The RapidKL card functions as the application's marker. The user must scan the card with their phone camera, and after that the detection marker will render an AR Batik from the Vuforia Engine database based on the marker ID. The application will process the visual rendering and load the 3D models after the user allows permission to use the camera. Then, the user are able

to rotate, change the colour, hear the audio and zoom the 3D models that have been loaded. The purpose of 3D models is to put the application's content into action. In addition, some buttons will be included in the application to improve the user experience. The AR LRT and MRT may be seen and interact with on the phone screen.

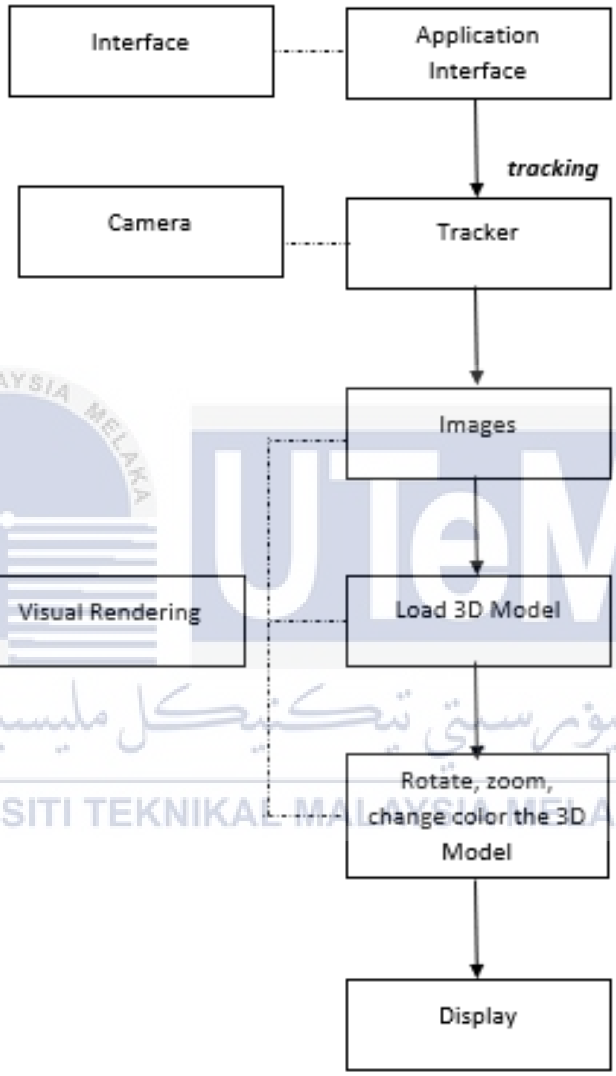


Figure 4.1: The System Architecture of Augmented Reality

4.2.1 Marker For Card RapidKL

Figure below are the logo designed as marker for this project. The usage of the marker for this project is for able user or audience to scan the poster and experience the augmented reality technology.

Figure 4.2: Marker 1 for Card RapidKL

4.3 Preliminary Design

The preliminary design is an architectural design of the application at a high level. User interface design is one of the most significant elements for developers to implement interface design, and there will be an explanation of interactive storyboards, user interface design, navigation design, logo design, and card design.

4.3.1 Interactive Storyboard

This LRT application's interactive storyboard will be separated into various parts. At beginning, users can view the application's cover and navigate to the main menu by clicking the AR as shown in Image 1. The user can then select a module to see from the main menu list, as shown in Image 2. Introduction, RapidKL Map, and Gallery are the three components included in this application. The application will navigate the user to the module function menu when the user selects the module from the main menu list, as shown in Image

1. The user will access the mobile application and scan the RapidKL card. The 3D model will display on the screen once the marker has been tracked. The user can access features such as augmented reality (AR) by selecting the AR logo in the top left corner of the screen and seeing the model in AR Marker-Based mode. The model can then rotate and zoom to better observe the information, and the user can exit the AR environment by clicking the back button. Labeling is also available for users in this application. The user can view the labelling of information on the model by clicking the label icon, as shown in Image 3. There are various pictures of tourist attractions near the RapidKL station in the Gallery module.

	
Scene 1	Scene 2

	
Scene 3	Scene 4
	
Scene 5	Scene 6

	
Scene 7	Scene 8

Figure 4.3 Storyboard of LRT RapidKL AR

4.4 User Interface Design

The user interface serves as a medium though that the client can interact with the extended reality. It is important because the majority of the excellent extended reality application is dependent on the number of clients who can see how to use the augmented reality application. As a result, the approach to user interface design must be legitimate in order to make communication between the client and the expanded reality attractive. Navigation design, logo design, card design, and 3d model design are the four important elements of a user interface.

4.4.1 Navigation Design

The goal of navigation design is to build a system that users can easily interact with and use. The navigation design can make it easier for users to navigate the system. The flowchart for navigation design is shown below.

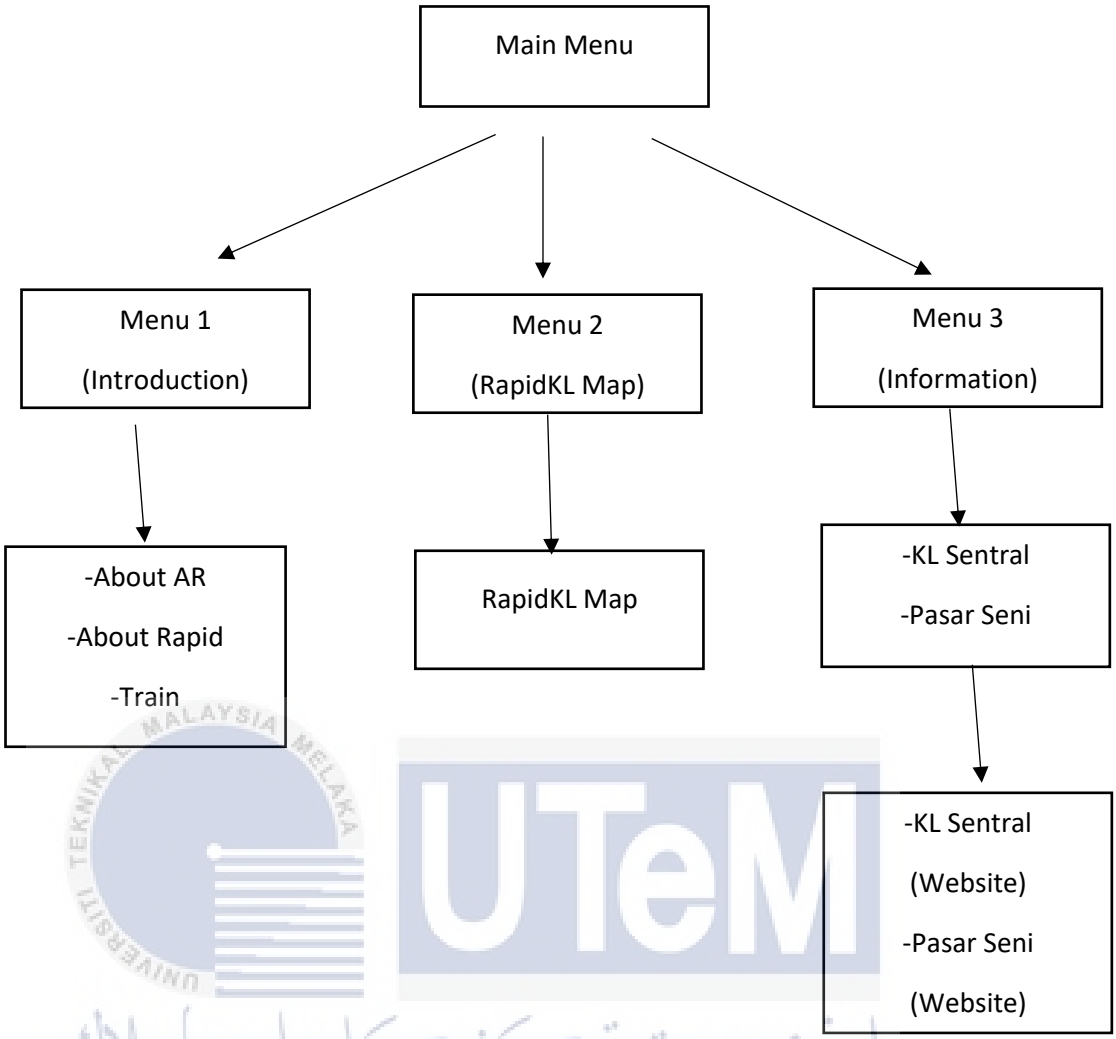


Figure 4.4 Flowchart for navigation design

4.4.2 Logo Design

The logo of this mobile application has been designed by including the pattern of LRT train in Augmented Reality.

Figure 4.5 The logo for the RapidKL mobile application

4.4.3 Card Design

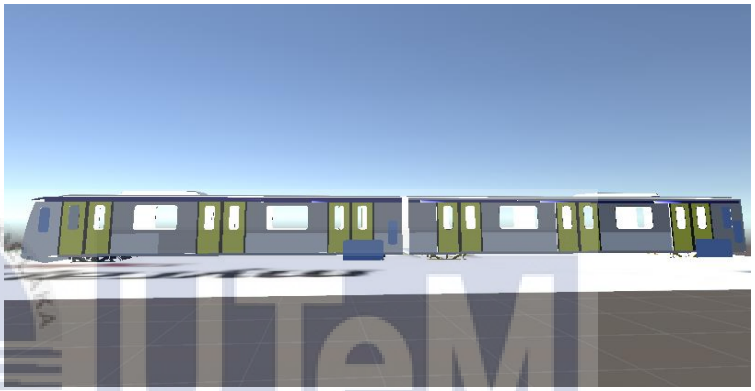
The card acts as a marker for the Augmented Reality RapidKL mobile application in this project. Tourism is one of the themes on the card for this application.

Figure 4.6 Card Design

4.4.4 Three-Dimensional Model Design

3D model is the process of developing any surface of an object. For this application, 3D model to visualize the train.

Table 4.1 3D Modelling Design

Object	3D Model
TRAIN	

4.4.5 Metaphor

This application's design is based on the illustrate image. There is only one theme in this application's design. Tourism was chosen as the theme.

4.4.6 Template Design

This application interface does not have a defined template. The design was made by according to the guidelines that had been established. Furthermore, the templates for this poster were developed only by the developer.

4.5 Conclusion

The design phase is critical for developers because it is during this phase that they will receive the idea for the application's design. Following that, the application will be

developed using the storyboard drawing as a guide. In terms of user interface design, the navigation design helps the user in following the system's flow. Finally, the system design will develop from this step. The next chapter will discuss the project's implementation phase, which includes the process and activities of implementation as well as the project's progress.

CHAPTER 5:
IMPLEMENTATION

5.1 Introduction

In this chapter, we will go over the whole process of creating media. Realistic, video, and collaboration are all part of the media development process. This stage also shows the cycle for creating all of the media that was previously recorded. Furthermore, all media components will be applied to Augmented Reality. The delivery control strategy as well as the earth arrangement will be explored in this section. The point is that the input into the module, the item adaption, and the path to completing this project are all important. While doing the item arrangement on the board, there is some control to be taken. The next section explains about media creation.

5.2 Media Creation

Media creation refer to content production in any communication, entertainment, or information industry. Insight into the era of substance, text, animation, and realistic, games, sound, and video segments will be achieved by media creation. Whatever procedure and technique that the parts expected to experience could be recorded even more conclusively and clearly across the cycle will be accounted for. To make the final useful item, the whole part will be collected.

5.2.1 Production of Text

One of the most important interactive media components in this project is text. Text is being used to deliver information to the crowd in order for them to understand what this project is all about. Text is an important medium for conveying content for description, instruction, and objectivity. The language and sentences used in this effort are simple and plain, with the purpose of improving the crowd's understanding. In this project, the font that has been use for the button is Rockwell Extra Bold and Arial for the description of the application.

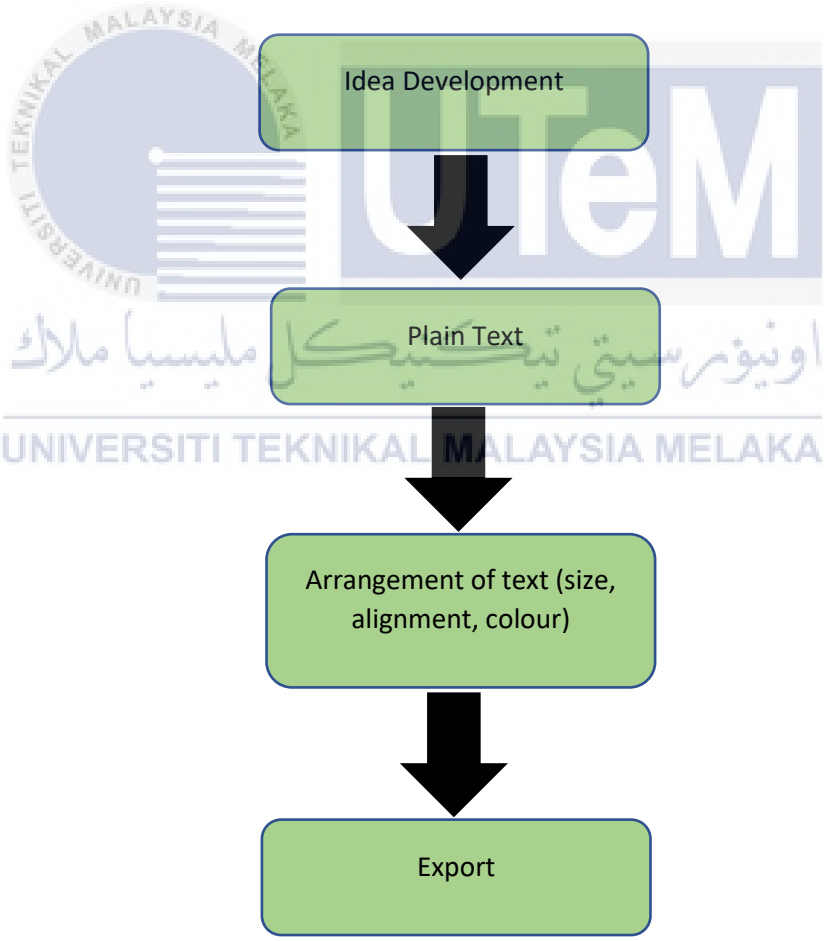


Figure 5.1 The process of the Elements

5.2.2 Production of Graphics

This graphic is the visual picture or configuration that creates. It's critical to make this AR RapidKL project even more interesting and fascinating. This project is 2D realistic throughout the entire project, which was created with Adobe Illustrator. The first cycle involves the development of the idea and structure for a number of reasons, such as the instructional board, target banner, and increased reality content. To ensure that the structure of this project is interesting and practical, an innovative work sketch was created. Following the completion of the development sketch, the sketch will be copied in Adobe Illustrator in a vector-based arrangement to digitalize the structure, with only minor changes and alterations made in Adobe Illustrator to complete the plan. Following the alteration of measure, the structure will be traded according to their objectives, whether for printing or activity vector resource. The graphic component for the guidance application, and vector resource for substance transportation is given. In Adobe Illustrator and Adobe Photoshop, the shading, textual style, and realistic elements will be adjusted and changed. The graphic manufacturing process is explained in Figures 5.2 below.

Figure 5.2 Production of Graphic for Vector Asset

Figure 5.3 Example of graphic

5.2.3 Production of Audio

Audio production is the term used to describe all stages of production. Sound design, sound editing, audio mixing, and eventually the introduction of effects are all parts of the audio production process. Audacity is used to create the audio for this project. The first step is to record the audio by using the audacity software. After that, all of the sounds exported into Unity.

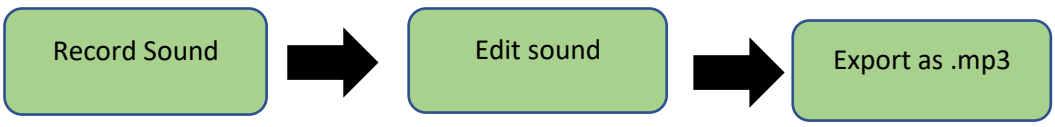


Figure 5.4 Production of Audio

5.2.4 Production of Animation

The objective of using animation is to attract in the audience and make the information more understandable to them. The use of animation movement is a purpose to attract people in and provide information to the audience. An successful application of animation is that it may effectively integrate the audience and simplify complex responses. Besides from that, it can help deliverables become more memorable. Unity and Blender were used to create the animation for this project. The first step is to generate an idea and create a storyboard. The object will be designed in Blender in vector base format after the storyboard has been sketched. After that, all of the assets are ready to be exported into Unity for animation process.

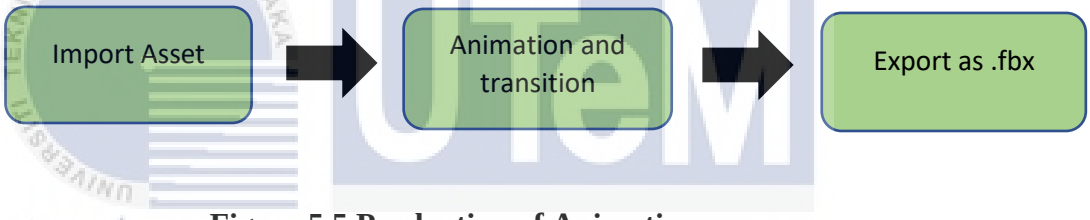


Figure 5.5 Production of Animation

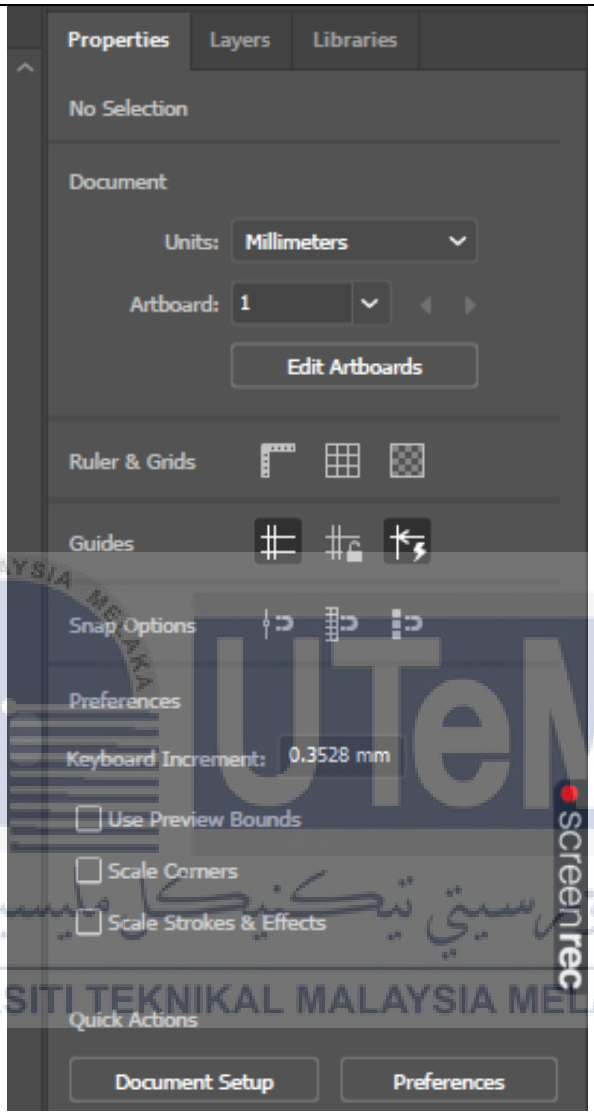
Figure 5.6 Example of Animation

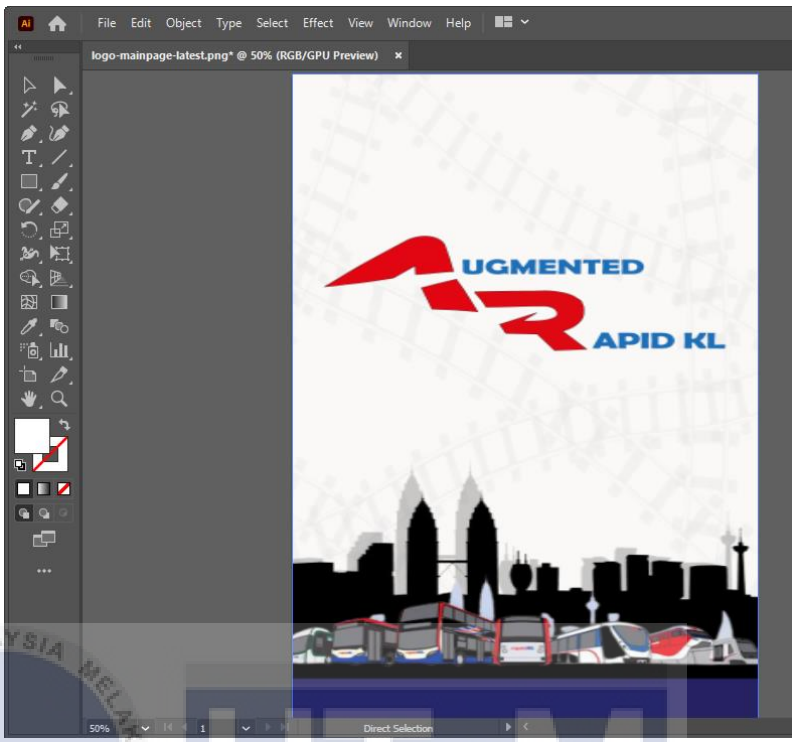
5.3 Media Integration

Unity and the Vuforia Engine are used to create all of the Augmented Reality contents. Before it can be published, 3D modelling must be imported and setup in Unity. The target image that was uploaded into Vuforia for setup purposes. In Unity, all target image used the same configuration. After all of the steps have been completed, this application will be exported as an .apk file that can be installed on a smartphone. As a result, the user can run and use it.

5.4 Product Configuration Management

Product configuration management refers to the process of setting up an item to achieve the good output. It also contained adaption control and information on how to set up design conditions.

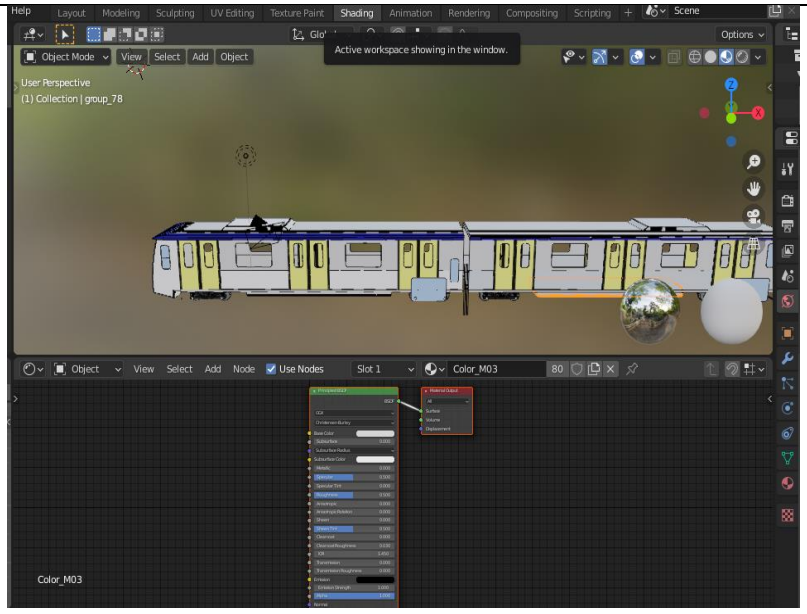
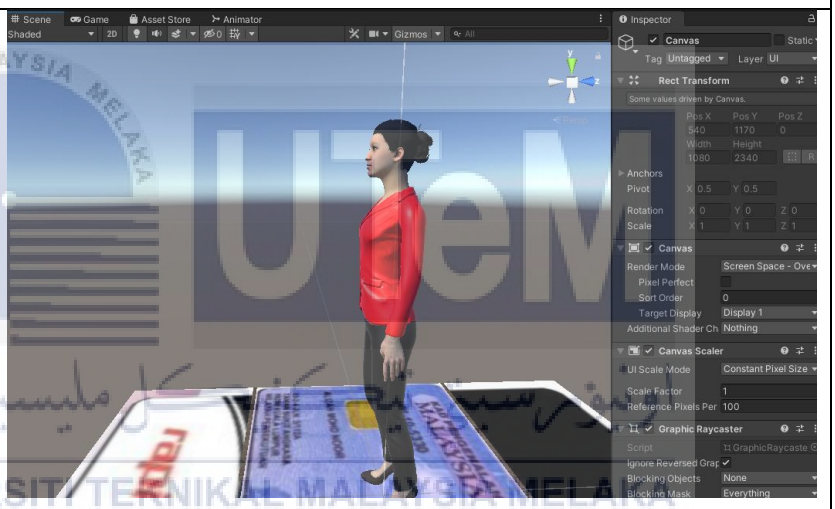
Application Software	Example
Adobe Illustrator	 **Property Setting**

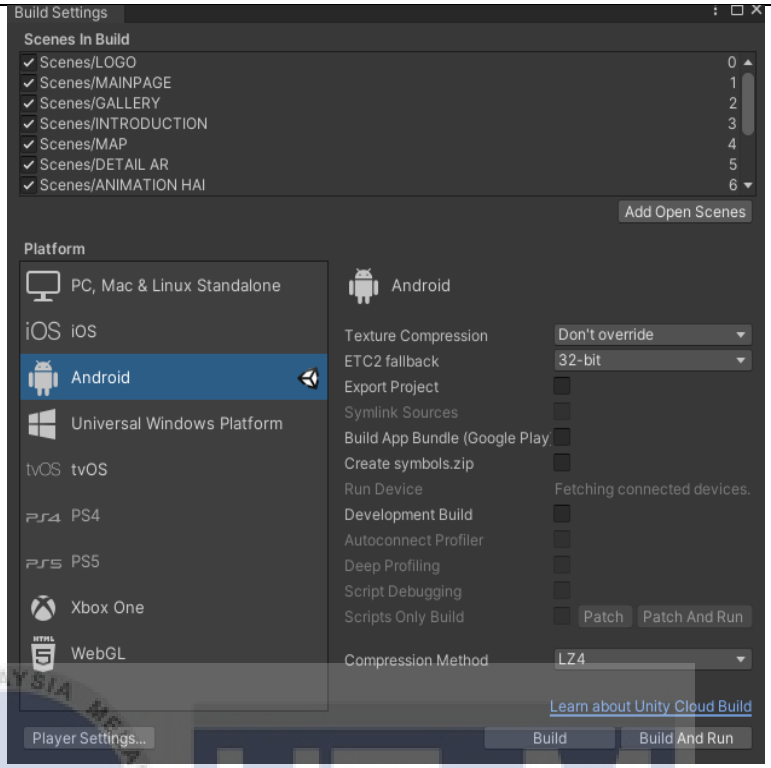


Designing Logo

Blender

Train model

	
Unity	
	Sample Scene



Build Setting

Table 5.1 Environment Setup

5.4.1 Configuration environment Setup

The setting required in the software used to build and create the substance that clarified by the configuration environment setup. To create Augmented Reality content, various software such as Adobe Illustrator, Adobe Photoshop, Unity, and Vuforia Engine have been used to create all of the content included in this project. Before beginning any development or activity, a few designs should be prepared. This arrangement is necessary to ensure that the final product is true to form and run smoothly. This project's setup configuration is shown in Tables 5.1.

5.4.2 Version Control Procedure

During the implementation phase, requirement needs it is one of the contributors to the project's developments. The changes are done based on the project supervisor's feedback from the previous project. Table 5.2 shows version control procedure.

Version	Module	Modification
Ver1	Logo	Change the logo design
Ver1.1	Logo	Change the logo colour
Ver1.2	Logo	Change the logo font
Ver1.3	Logo	Change the logo concept (public transport concept)
Ver1.4	AR Rapid	Add module (information)
Ver1.5	About AR	Add sound (explanation about AR)
Ver1.6	About AR	Change character design (use RapidKL uniform)
Ver1.7	Graphic	Add new image target (old version rapidKL card, identity card)
Ver1.8	Final touch up	Improve augmented reality interaction

Table 5.2 Version Control Procedure

5.5 Implementation Process Status

The progress of the implementation process is used to show the development progress during time. This progress must be recorded so that the version and details of the progress can be observed. This project's implementation status is shown in Table 5.3.

Component/Module	Description	Status
Module 1 (Research and Explore)	Collecting information about the project, include the media elements that will be used	Completed
Module 2 (Create Development Plan)	Sketching the concept and storyboard as a guideline	Completed
Module 3 (Design content)	Process of designing all media elements in the project	Completed
Module 4 (Development of multimedia element)	Combine of all multimedia element include the text, graphic, animations, sound and interaction.	Completed
Module 5 (Implementation of Augmented Reality)	Process of combining necessary elements to create the end product.	Completed

Table 5.3 Status of component implementation

5.6 Conclusion

This section contains information about the media component that is used to create the final result during the execution step. It also ensured that the application progress was based on the most efficient way for coordinate the quantity and status of each module, which was based on a Gantt Chart. It explains the text, animation, video, and graphics creation processes, as well as media integration, configuration management, and implementation status. In the next section, you will find some requirements for case

framework testing, item quality, sample target users, creator, and partner and colleagues.

CHAPTER 6:

TESTING

6.1 Introduction

Testing is a stage that must be completed after the implementation stage is completed. The testing stage will explain how to test and evaluate the project's output after it has finished. It is critical to conduct this testing and evaluation so that actual data can be analyse and compared to ensure that the objective in Chapter 1 is achieved. Before the project can be approved, all of its functions must be tested to ensure that it will run smoothly and according to plan. The testing phase's goal is to find that the project's objective has been achieved or not. This chapter also explains the test user, test schedule, and test strategy for collecting and analysing real data. The success of this project is determined by the project's objectives.

6.2 Test Plan

Test user, test schedule, and test strategy are the three sections of the test plan. The whole test plan for this testing stage will be quickly clarified in this section. This is a strategy for getting the testing stage in to a good beginning. The test plan is important since it will cover the most important issue in testing in order to ensure that it will persuade the user to complete the current task's objectives. The developer should decide on the proper test with the objective of creating it function for the objective user. In the test plan, all of the item testing range, the project that

will be tested, the time, and also all of the people who will be testing the project will be recorded.

6.2.1 Test User

The number of participants in the testing, as well as the tester for this project, will be included by the test user. The testing step for this Design and Implementation of Augmented Reality Application for RapidKL includes three different groups of users who will run the test: multimedia experts, subject matter experts, and the real target user.

Multimedia expert, target user, and subject matter expert are the three types of users who must be deal with. The types of testing will be put to the test by three different types of users. The function will be tested by multimedia experts, while user acceptance testing will be done by the project's target user. Also, subject matter experts will focus on the product's content and information.

6.2.1.1 Multimedia Expert

There were 3 multimedia expert who tested this project. This is due to the fact that the application first must run before it can be delivered to the user. They were people who have experience in Multimedia Industry for more than a year. This test is done at the end of the development process and before the product is released. They will test the application's usability, including the interface, interactivity, design, multimedia integration, and content arrangements in the project.

Testing	Multimedia Expert
Profession	**Position**: Graphic Designer **Company**: KAAMI studio **No of respondent**: 3 respondents
General information	Working experience from below 1 year – 3 years and above
No of respondent	3 respondents

Table 6.1 Test User for testing

6.2.1.2 Public

Target audience of this project is the public. They were 32 respondents who involved in testing. They tested the application's based on their understanding of the project and acceptance of it.

Testing	Target User
Profession	Public
General information	Age from below 18 years old and above 30 years old
No of respondent	32 respondents

Table 6.1 Test User for testing

6.2.1.3 Subject Matter Expert

Someone who has a full understanding of a RapidKL and can assist in improve the product or solve a specific issue. Individual that works at RapidKL transport was picked to go through the test. They will test the project and give feedback.

Testing	Subject Matter Expert
Profession	**Status**: Staff **No of respondent:** 3 respondents
General information	Staff
No of respondent	3 respondents

Table 6.1 Test User for testing

6.2.2 Test Schedule

After a demonstration of how to use the AR RapidKL mobile application that has been proposed, a user test on the application function is done. Because of the virus Covid19, the test environment is conduct via online in regards with the government's standard operating procedure. The testing was scheduled from 19/08/2021 to 29/08/2021. It was done in 10 days. The AR RapidKL .apk file has been be provided to the user for testing and evaluation through a questionnaire using the Google form provided as a record of the test results. Throughout all of the testing, an Android smartphone running Android 7.0 Nougat or above is required.

Tester	Number of Tester	Testing Date	Platform
Multimedia Expert	3 respondents	19/08/2021 – 29/08/2021	Online (Google Form)
Public	32 respondents	19/08/2021 – 29/08/2021	Online (Google Form)
Subject Matter Expert	3 respondents	19/08/2021 – 29/08/2021	Online (Google Form)

Table 6.2 Test schedule for testing

6.3 Test Strategy

To achieve project's goals, it is important to set up the correct test strategy. The test strategy will explain how the testing will be done and directed, as well as the sort of testing that will be done based on the item. Multimedia expert, subject matter expert, and target user tests are three different types of tests that perform at different levels. It is performed in order to obtain feedback from a real user in order to reduce the risk of product failure and improve the quality of the final product. It's the last test before the final product is released to the public. The purpose of user acceptance testing is to see if the target user of this project understands and accepts the application. Respondents are required to test the application and answer a questionnaire about project's effectiveness. Testing has a specific goal, and the test strategy must be well-planned to ensure that the goals are achieved. Every tester will be focused on a specific test type. There were sections in the questionnaire, includes the effectiveness of project, the usability of the product, the flexibility and the accessibility of project. There are five score levels on this question going from one to five which from strongly disagree to strongly agree.

1	2	3	4	5
STRONGLY DISAGREE	DISAGREE	AVERAGE	AGREE	STRONGLY AGREE

Table 6.3 Scoring details for User Testing

6.4 Test Implementation

Test implementation will explain how the testing will be done to a specific target user. The test strategy is used to conduct the related part between the test description and the test data. During test implementation, the designer must ensure that all requirements are done before beginning the testing session, which is based on the test purpose, so that the developer is ready to gather the expected results from the testing.

6.4.1 Test Description

During the testing, a survey was distributed to the specific target user for testing. There are 32 complete respondents that have selected randomly and want to take part in the testing phase. After the developer provides them with a clear explanation of the project, each respondent will do their own testing. At that moment, each respondent is required to complete a questionnaire created by the developer.

6.4.2 Test Data

Once the testing session is completed, the evaluation will be recorded. All of the test results are recorded to be evaluated. The goal of both functionality testing and user acceptance testing is to see if the project achieves the goal stated in the first chapter. The results of all the tests are gathered and analysed. To determine the average ranking of each question, the average ranking of each question was evaluated. Based on the question, each question has a different level of satisfaction.

No	Tester	Number of respondent
1	Multimedia Expert	3 respondents
2	Public	32 respondents
3	Subject Matter Expert	3 respondents

Table 6.4 Test data for user testing

No		Strongly disagree	Disagree	Average	Agree	Strongly agree
	a. Learnability					
1.	The content of the Augmented Reality is easy to understand.				1	2
2.	The instructions stated in the				1	2

	application are clear to guide the user to use the application.					
	b. Effectiveness					
1.	Integration of multimedia elements in the content helps user to receive the information effectively.				2	1
2.	The content arrangements make the delivery of information more effective.				1	2
3.	The information able to give an impact to the user.				1	2
	c. Ease of use					
1.	This application is easy to use?				1	2
2.	User can use this Augmented Reality anywhere?				2	1
3.	Readability of text is clear and easy to understand.				1	2
	d. Flexibility					
1.	The content of the Augmented Reality for the user gain knowledge about RapidKL?				1	2
	e. Accessibility					

1.	The interface design in this application is attractive.				2	1
2.	The colors used in this application is attractive.			1	1	1
3.	The font and graphic used in this application is attractive and easy to understand.				2	1

Table 6.5 Results of Functionality Testing for multimedia expert

a) Usability of project

No	Questions	Satisfaction level (1=Strongly disagree 5=Strongly agree)					Average
		1	2	3	4	5	
1.	Does the instructions stated in the application are clear to guide the user to use the application.				8	24	4.75
2.	Do the colour use in this application is suitable.		1	1	6	24	4.66
3.	Do the image and graphic use in this application helps you to understand better about this application.				8	24	4.75

b) Effectiveness of the content

No	Questions	Satisfaction level (1=Strongly disagree 5=Strongly agree)					Average
		1	2	3	4	5	
1.	Do you understand what is this application about.				10	22	4.69
2.	Do you understand every content showed in this application.			1	6	25	4.75
3.	Does this application give you any new knowledge about RapidKL that you didn't know before.		1	2	8	21	4.51
4.	In your opinion, do you think this method (Augmented Reality) is more effective to use in a campaign better than old method (eg: poster, billboard, etc).			1	8	23	4.69

c) Usability of product

No	Questions	Satisfaction level (1=Strongly disagree 5=Strongly agree)					Average
		1	2	3	4	5	
1.	I think that the incorporation of RapidKL into Augmented Reality would encourage more interest in it.			2	6	24	4.63
2.	I would be more interested in RapidKL after using this application			3	7	22	4.56

Table 6.6 Result of User Acceptance Testing for target user

a) The content

No	Question	Yes	No
1.	Does the instructions stated in the application are clear to guide the user to use the application.	3	
2.	This Augmented Reality tell about RapidKL.	3	
3.	Does the arrangement of map are correctly.	3	
4.	Using an Augmented Reality is more convenient compare to personal computer for learning.	3	
5.	The Augmented Reality is more effective in learning about RapidKL on a mobile device anywhere and at anytime.	3	
6.	The integration off all learning content with Augmented Reality is more effective than the current teaching method.	3	

b) the effectiveness

No		**Strongly disagree**	**Disagree**	**Average**	**Agree**	**Strongly agree**
1.	This RapidKL Augmented Reality application is convenient to use.					3
2.	This RapidKL Augmented Reality application able to attract your attention.					3
3.	The Augmented Reality is effective in understand RapidKL on mobile device at anywhere and anytime.					3

4.	Using an Augmented Reality is more convenient compare to a computer for learning.				1	2
5.	The intergration of learning content with augmented reality technology is more effective than the current method.					3

Table 6.7 Results of Content Testing for Subject Matter Expert

6.5 Test result and analysis

Figures and charts will be shown in this analysis depending on the outcomes of the overview and testing measure. This is a diagram displaying the assessment testing that has been done. A few charts have been created based on the information received from the testing results to describe the assessment's result.

6.5.1 Multimedia Expert

Three responses were tested, including a multimedia expert which is graphic designer. Questionnaires have been used after users have tested the product to verify its usefulness and functionality. The multimedia expert is asked to evaluate the achievement of the mobile application's multimedia elements, such as content, audio, video, and interface design, and also the product overall. The collected data will be analysed and displayed into a graph.

6.5.1.1 Learnability

The results of questions 1, and 2 are shown in the graph below. According to the results, multimedia experts strongly agree that this application has a high

level of learnability. The focus of the question is on the information in guidelines, and content in the AR application.

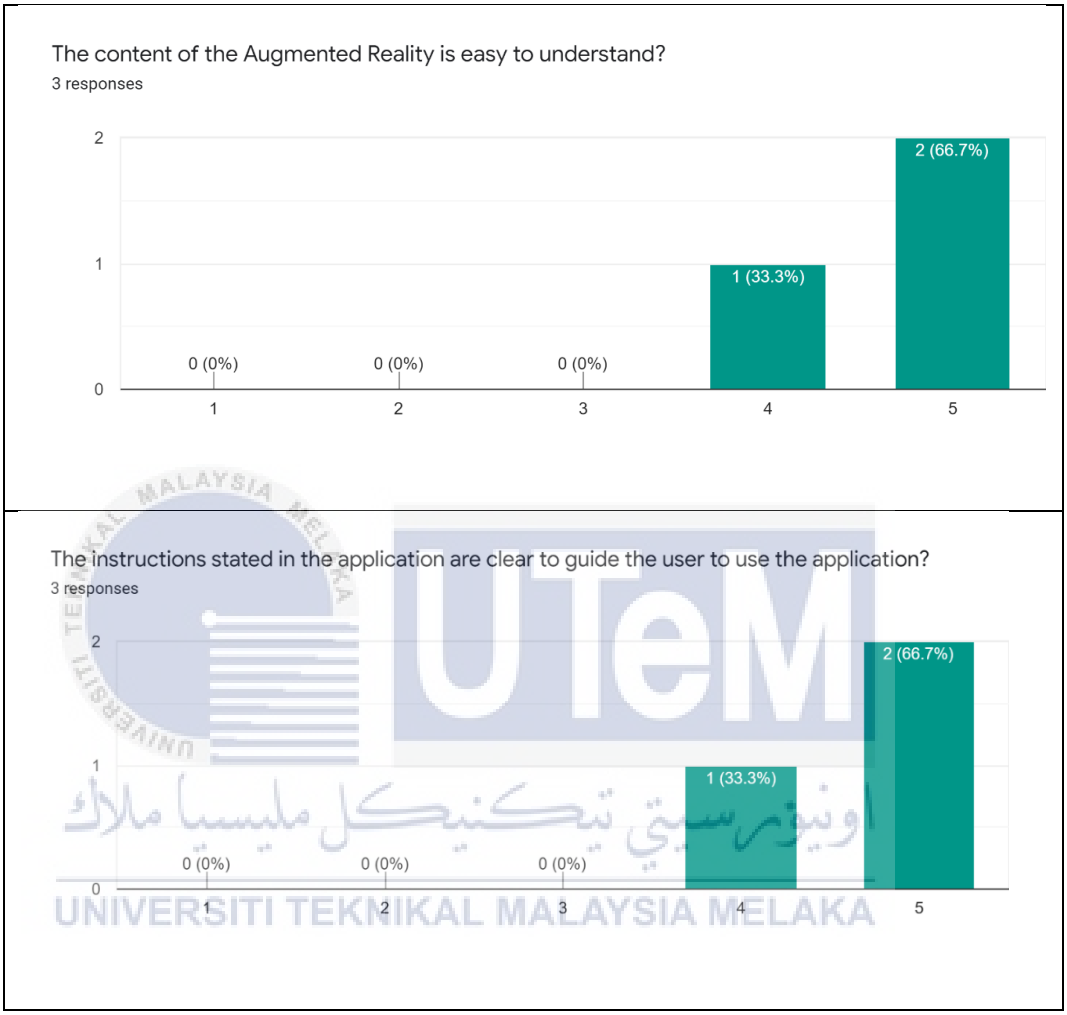


Table 6.8 Graph of learnability for multimedia expert

6.5.1.2 Effectiveness

The results of questions 3, 4, and 5 are shown in the graph below. According to the results, multimedia experts strongly agree that this application has a high level of effectiveness of this application is efficient. The question is focus of media components in delivering the material and effect on the user.

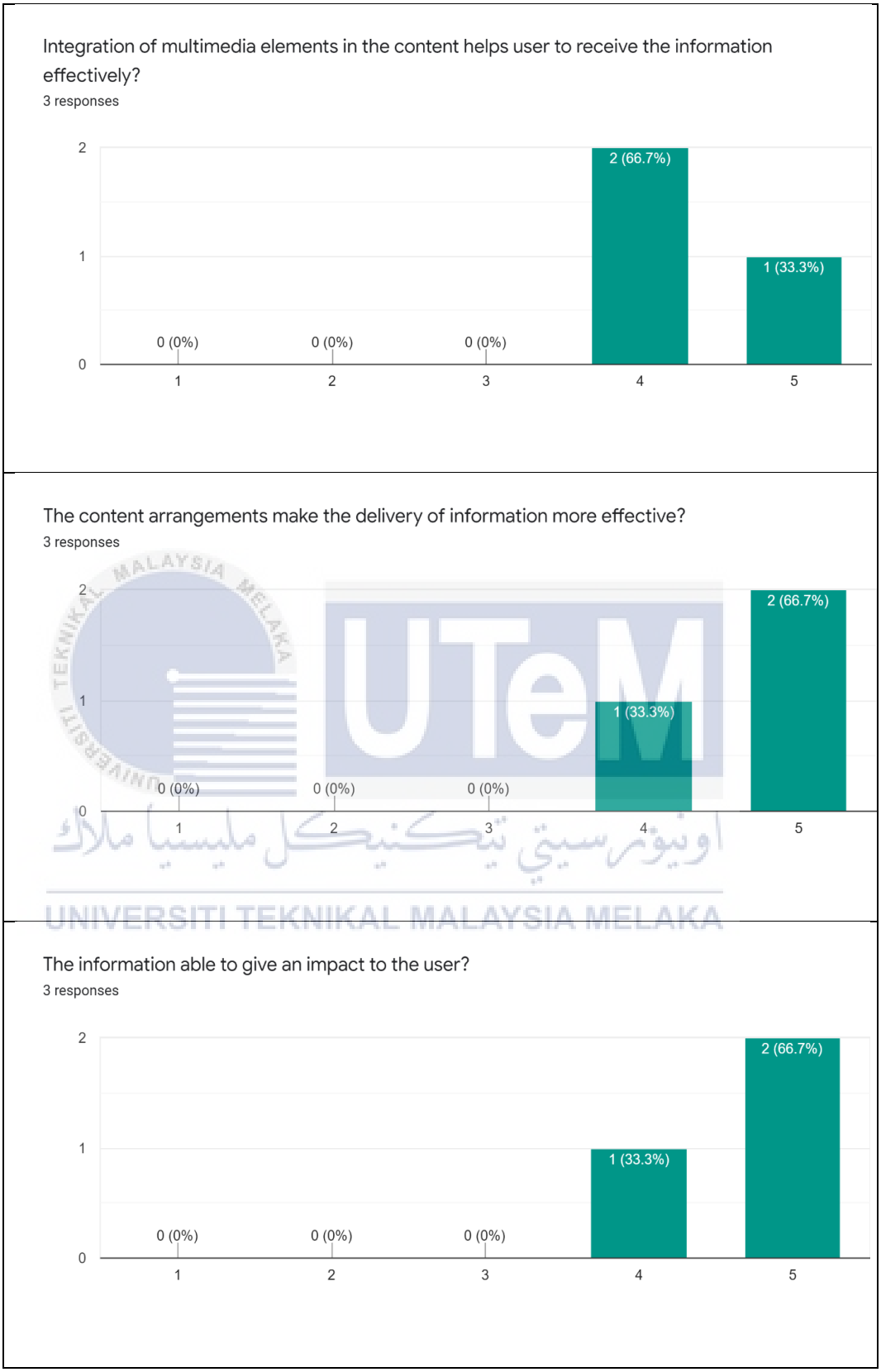
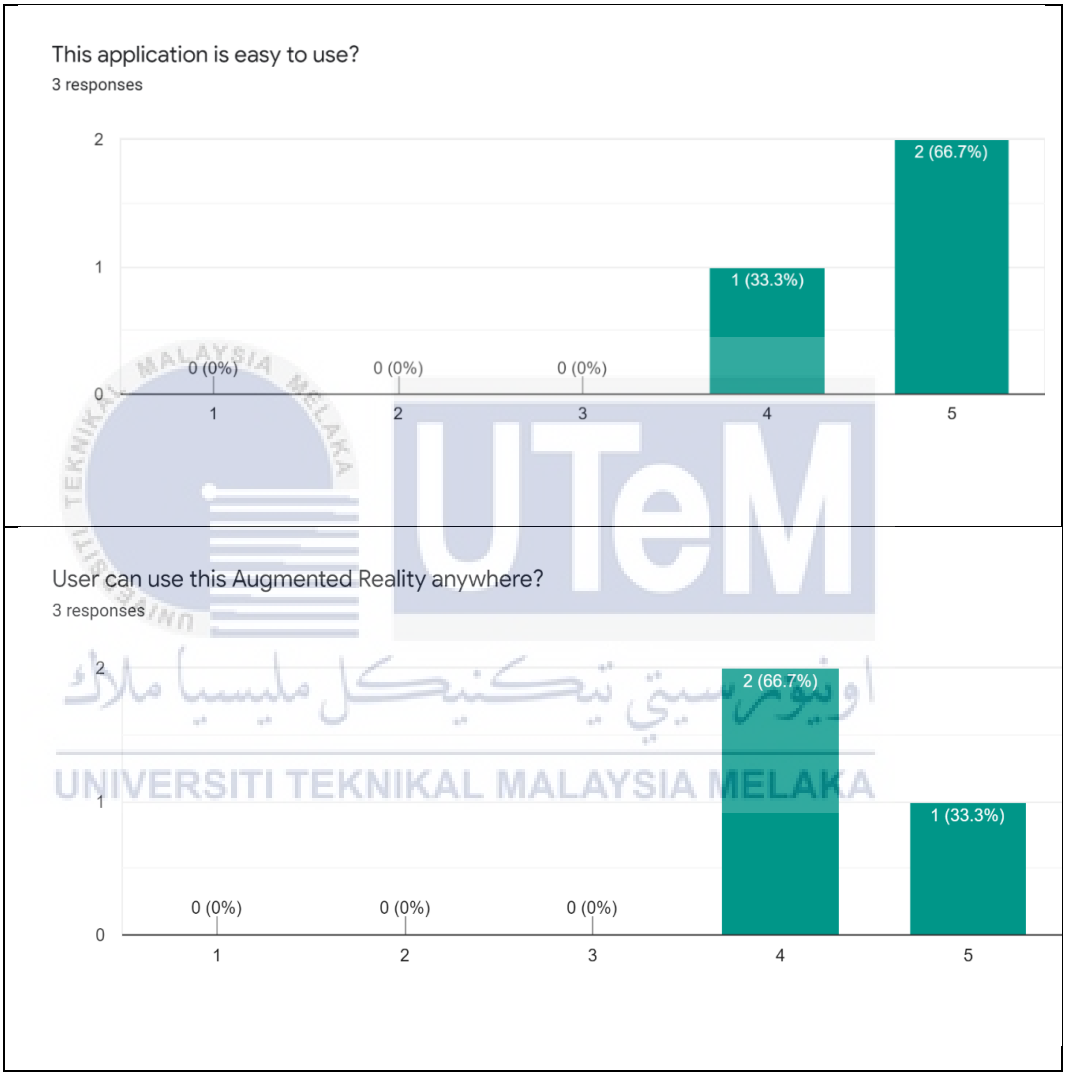


Table 6.9 Graph of effectiveness for multimedia expert

6.5.1.3 Ease of use

The results of questions 6, 7, and 8 are shown in the graph below. According to the results, multimedia experts strongly agree that this application has ease of use. The question is focus on ease of using the AR and explain of font.



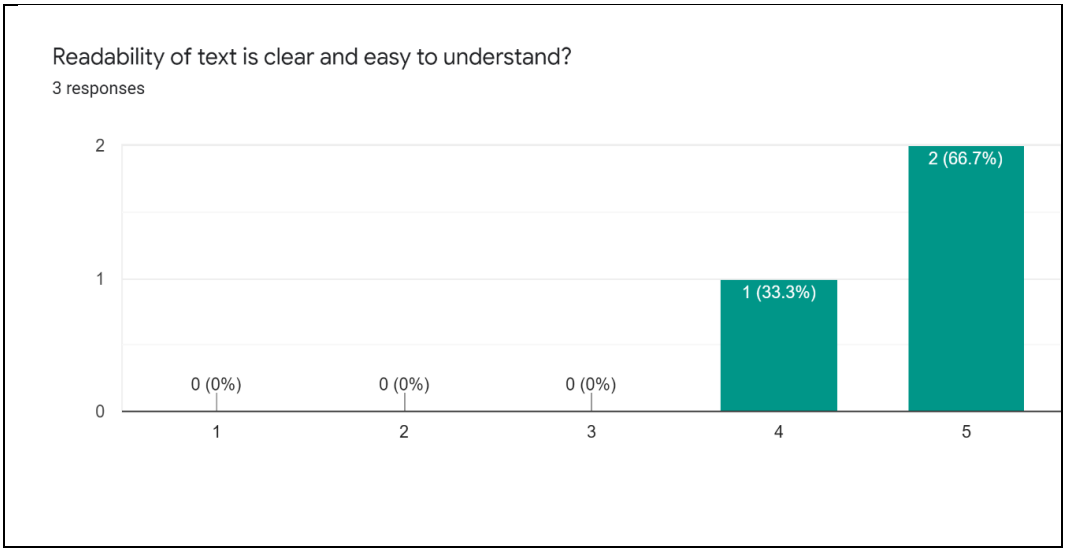


Table 6.10 Graph of ease of use for multimedia expert

6.5.1.4 Flexibility

The results of questions 9 is shown in the graph below. According to the results, multimedia expert agree that the level of flexibility of this application is good. The question is focus on the information of Augmented Reality.

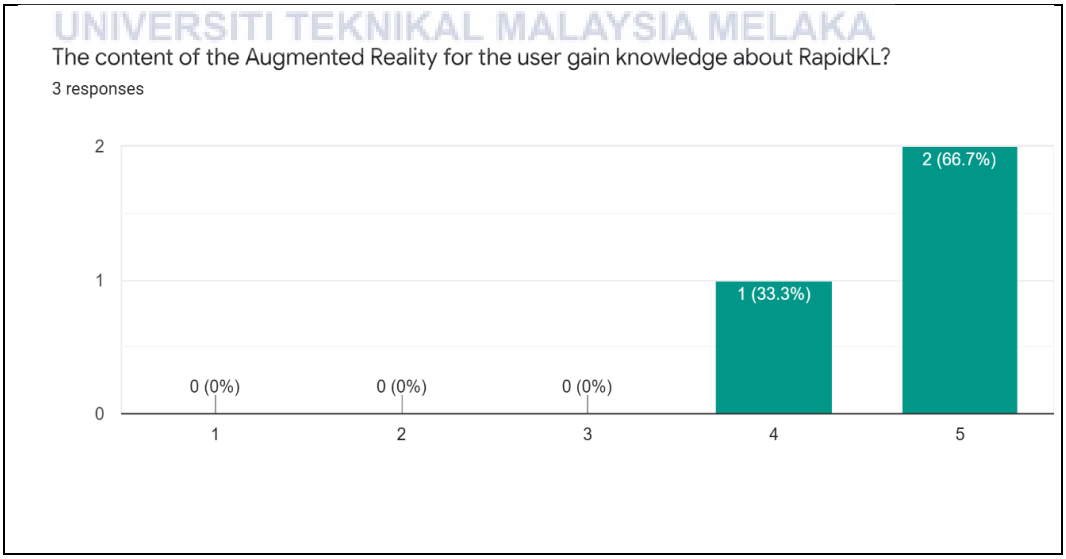
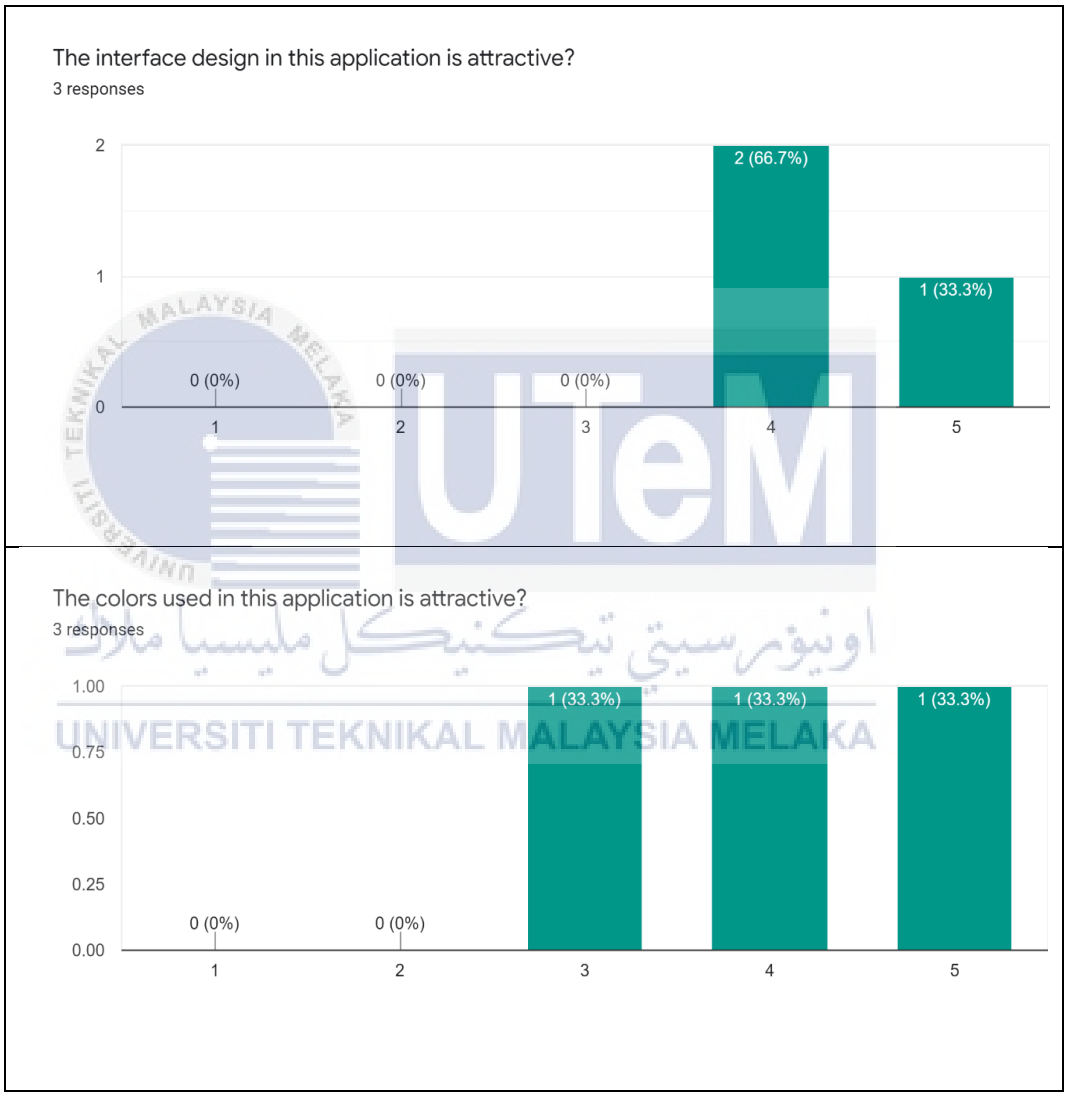


Table 6.11 Graph of flexibility for multimedia expert

6.5.1.5 Accessibility

The results of questions 10, 11, and 12 are shown in the graph below. According to the results, multimedia expert agree that the level of accessibility of this project is very good. The question is focus on the interface design of application include colour, font and graphic.



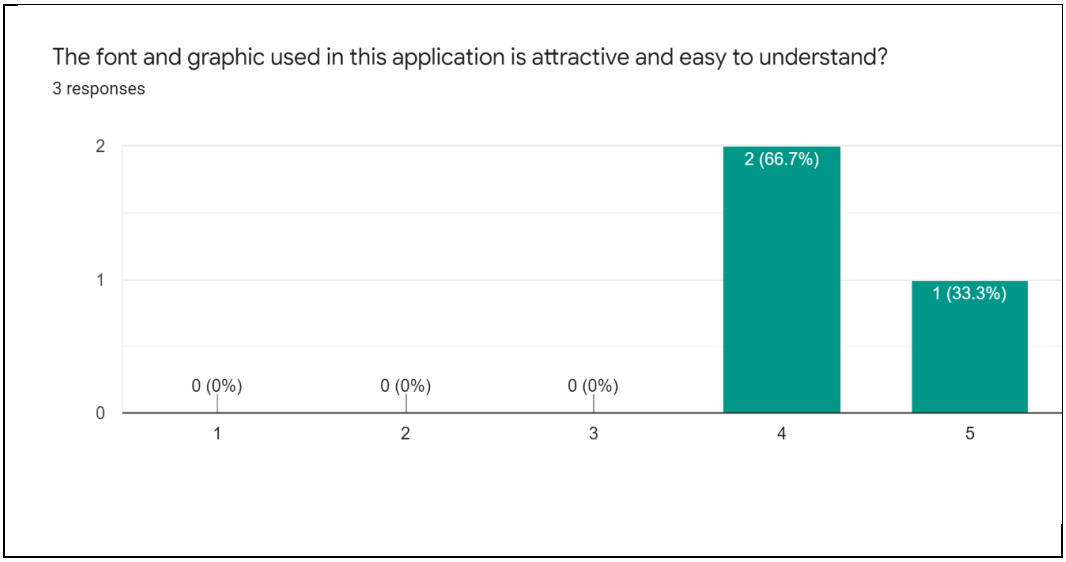


Table 6.12 Graph of accessibility for multimedia expert

6.5.2 Target User

This application testing was done by 32 respondents which is public users that use RapidKL transport. The application tested are included the questions of demography, usefulness, and ease of use.

The graph down below shows the results of demographics testing section. The average rating of each questions is clearly graphed. Based on the graph, the tester believe that the application is good to use.

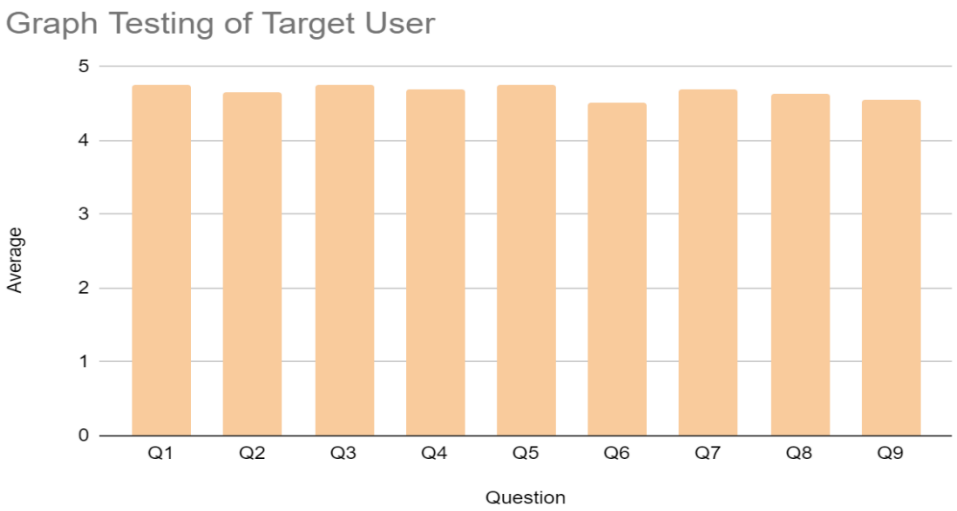


Figure 6.1 Graph testing of target user

The survey is distributed to the respondent after developer AR's demonstration is finished. The gender of the user chosen to test this AR application is shown in the diagram below. From of 32 respondents, 12 respondents are Male and the rest 20 respondents are female.

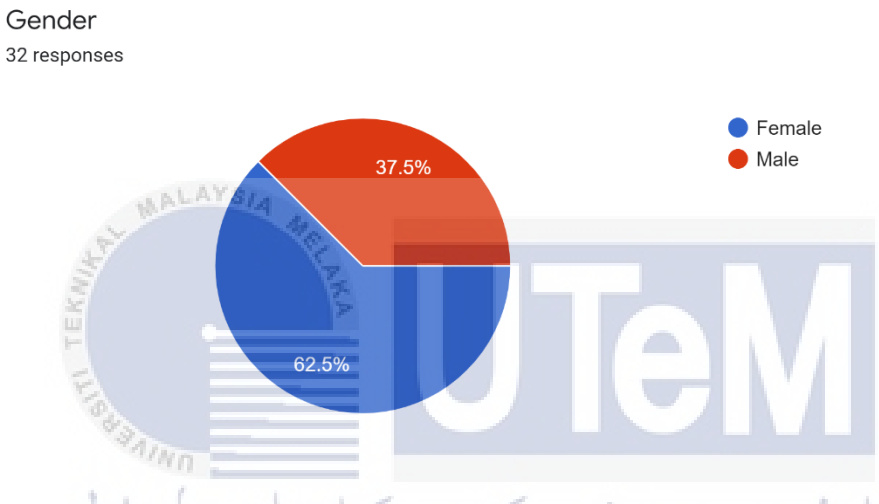


Figure 6.2 Result of gender for target user

Then, the age of the user, with 16 respondents mostly at around 19-30 years of age (50%), 9 respondents is from 24-28 years old (28.1%), 6 respondents is from 29 years old and above (18.8%) and the 1 respondent with fewer percentage is below 18 years old (3.1%).

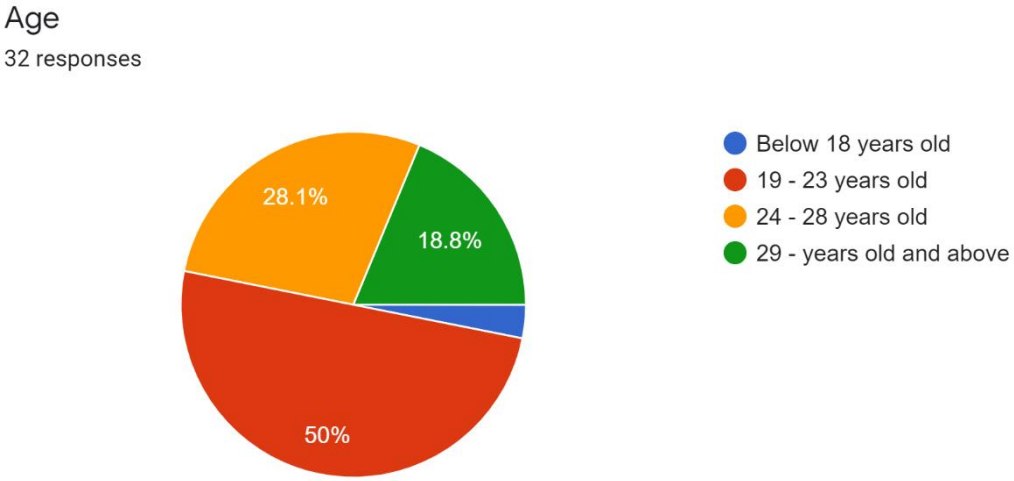


Figure 6.3 Result of age for target user

Then, the other general information to be collected is about status, with 19 respondents mostly are student (59.4%), 12 respondents is employer (37.5%) and 1 respondent is employee (3.1%).

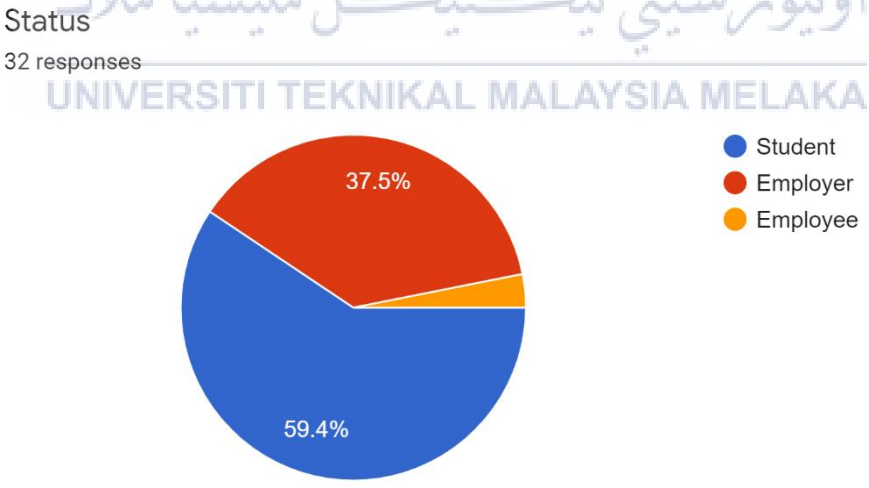
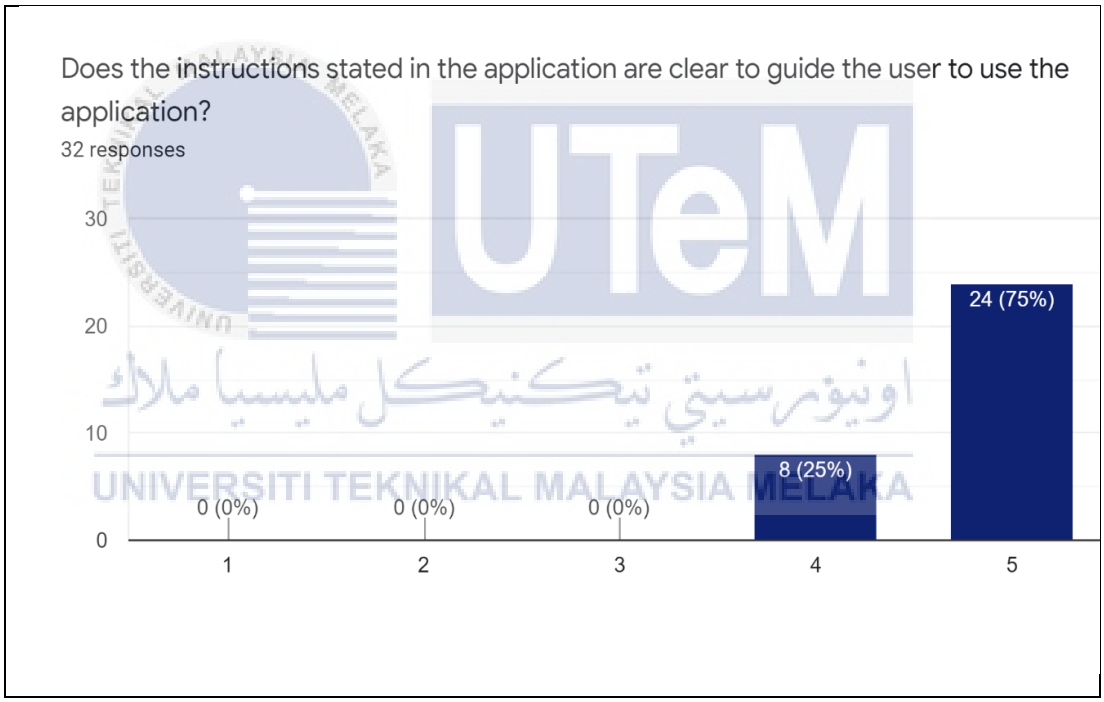


Figure 6.4 Result of status for target user

6.5.2.1 Usability of product

There are 3 questions in Section A which is focused on the usability of the product which is instruction layout, use of colour, and use of graphic and image. Figure below show the results of Section A. In conclusion, most respondents are satisfied with the interface design. According to the questionnaire results, can be seen that it's not a problem with the good and straightforward design to understand interactive design that most respondent feel to use the application. They agreed that colour, fonts and graphics are simple to comprehend.



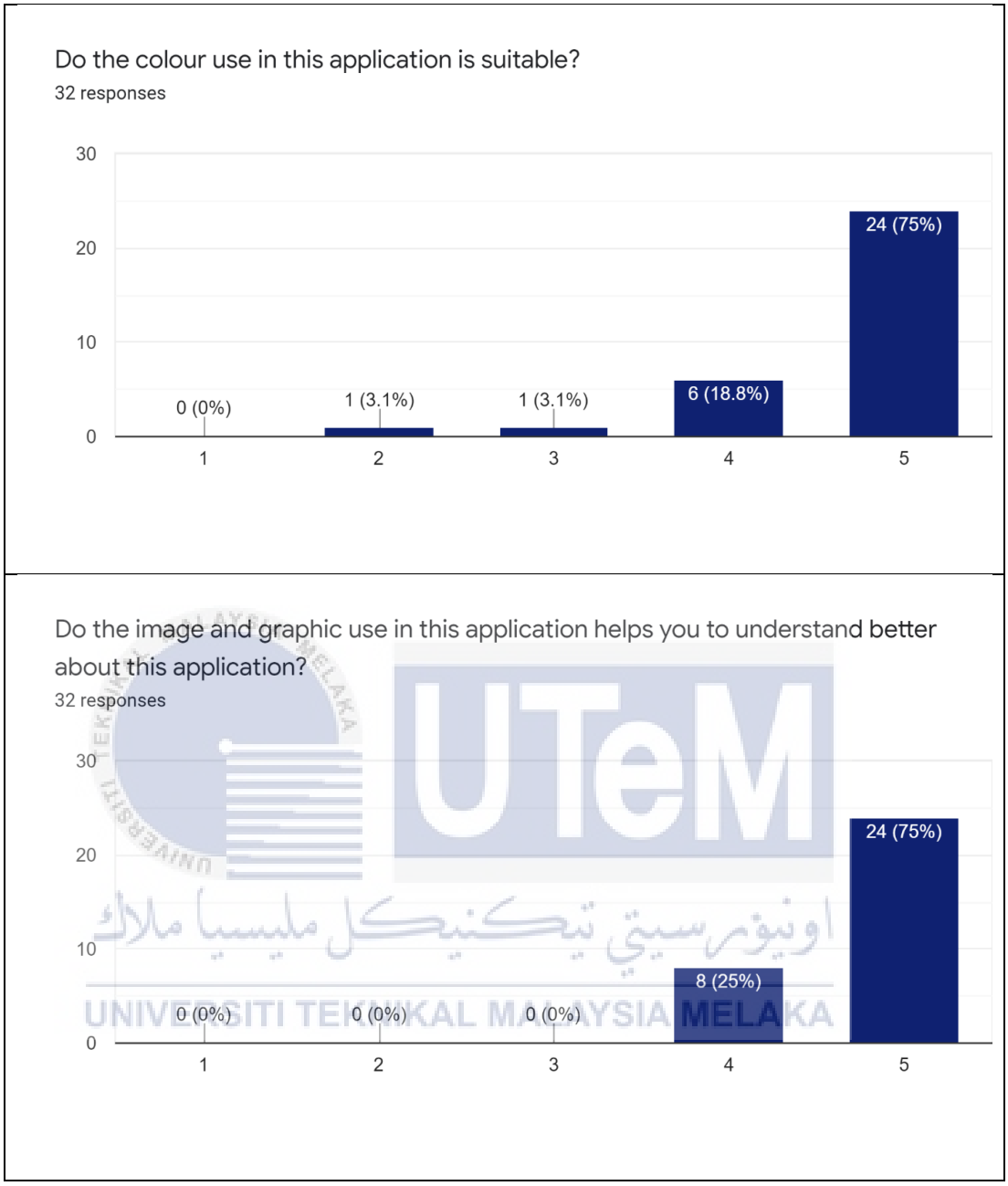
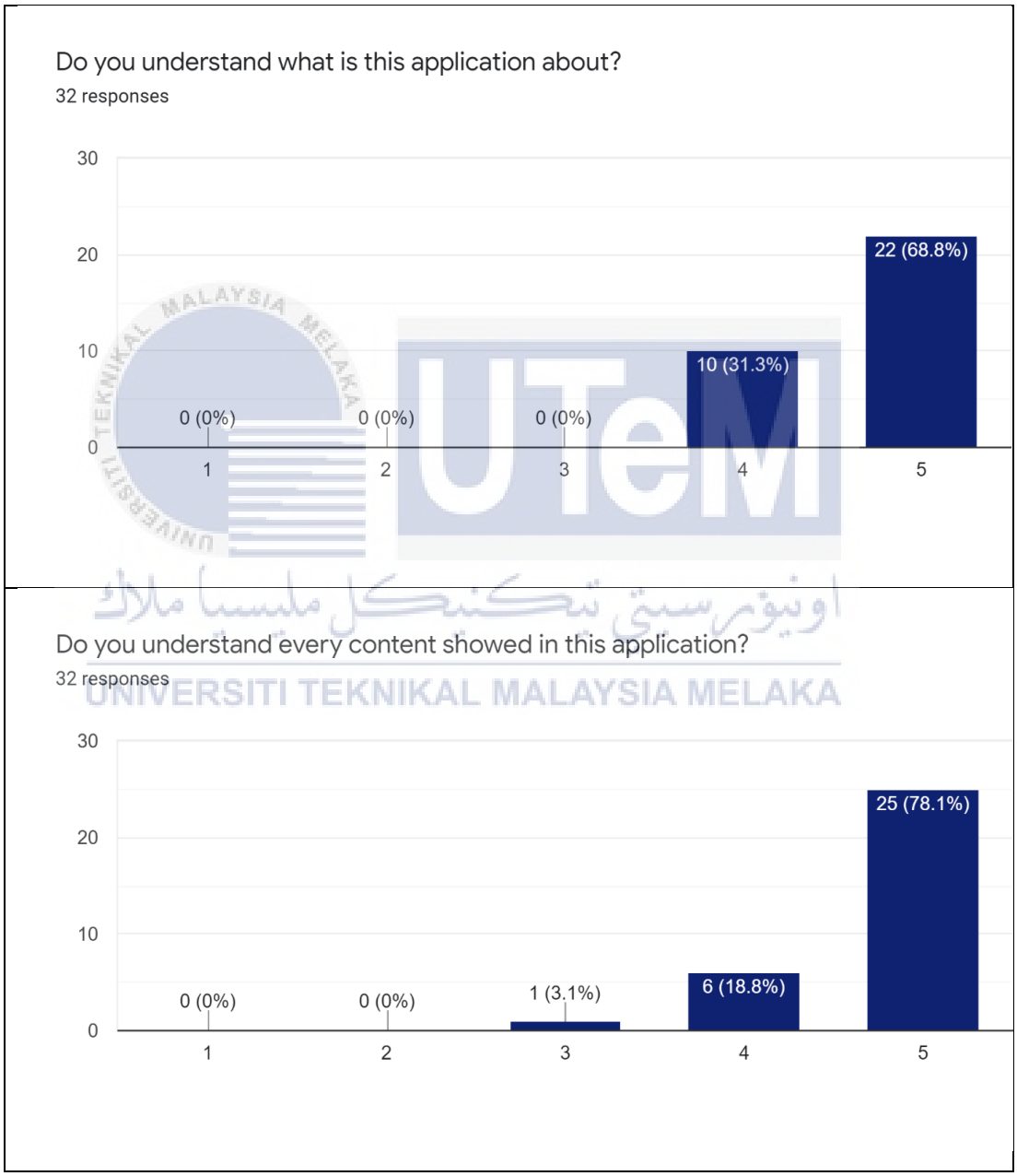


Table 6.13 Graph of usability of product for target user

6.5.2.2 Effectiveness of product

The respondents in Section B of the questionnaire, which is about the project's effectiveness, should answer 4 questions. This shows that the product is very effective, and the integration of multimedia elements helps the user in the

delivery of content and information. Since this is a mobile application, almost all of the respondents say that understanding RapidKL on a mobile device anywhere and at any time is very effective. Moreover, because this AR application is focused on RapidKL, the data shows that respondents agree that this application can gain their interest in knowing about RapidKL.



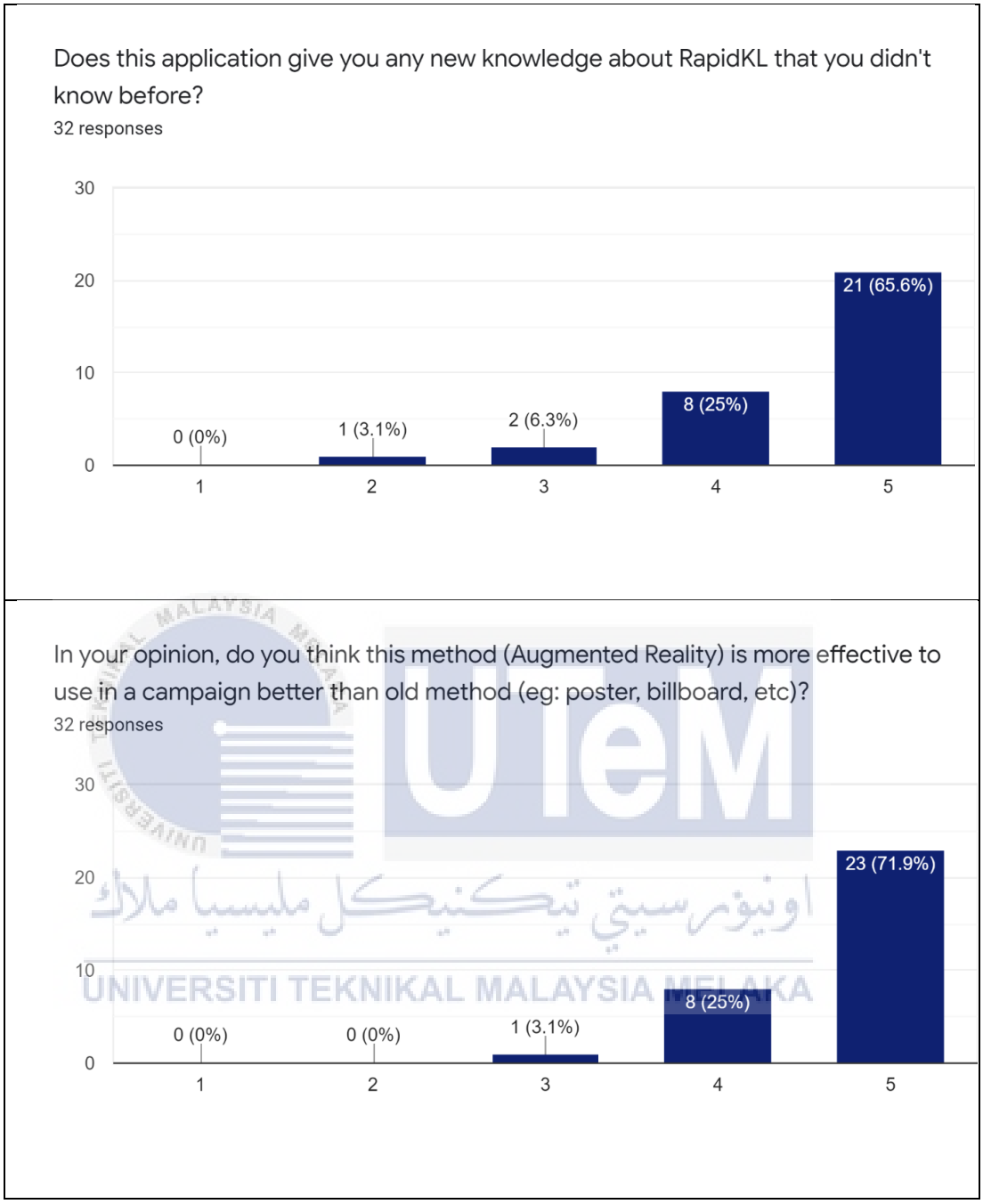


Table 6.14 Graph of effectiveness of product for target user

6.5.2.3 Flexibility

There are 2 questions that respondents must answer in the questionnaire for Section C which is about the flexibility of the application. The question is focused on the interest in RapidKL.

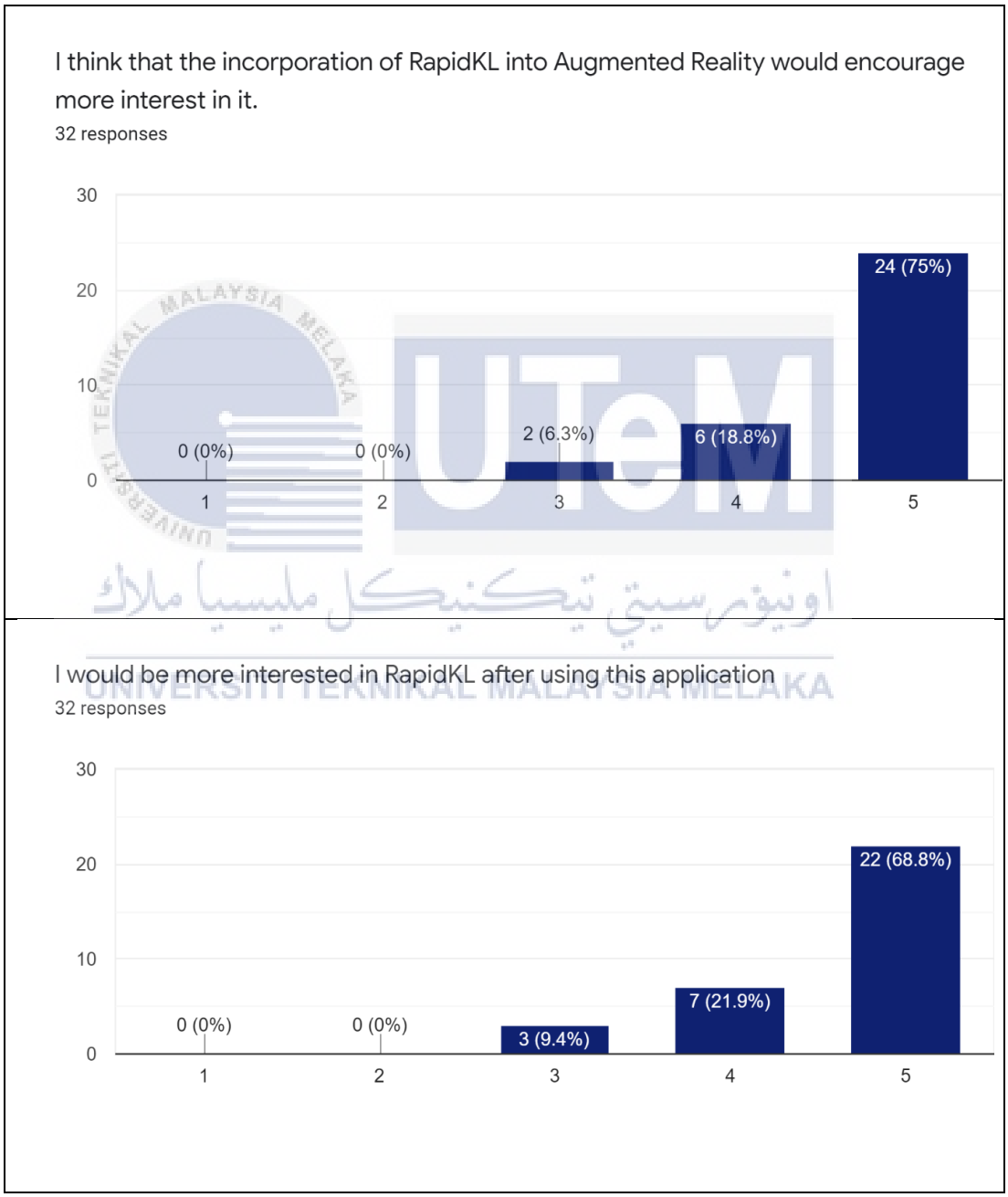


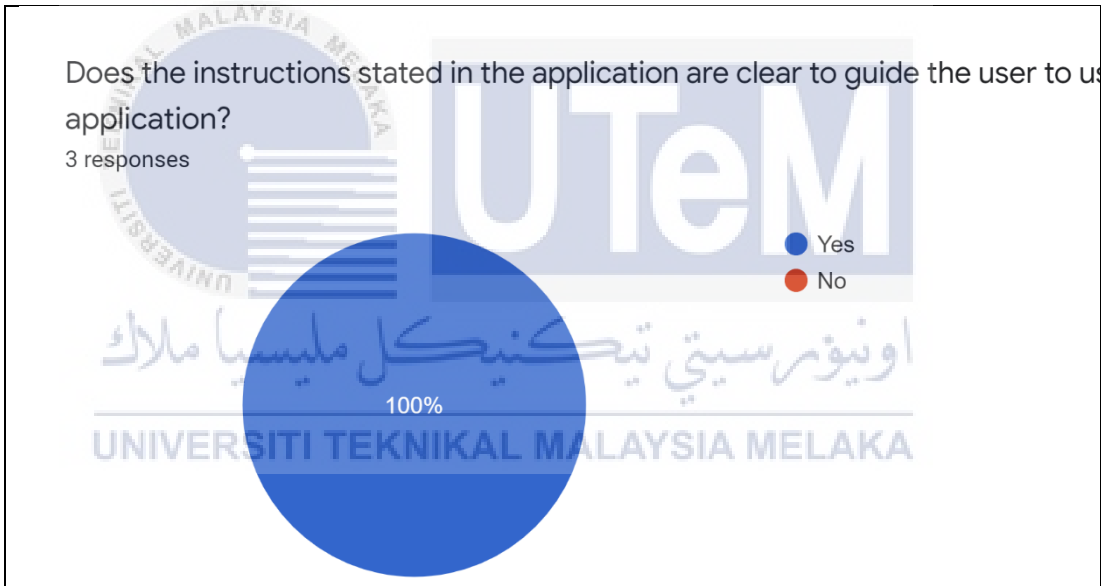
Table 6.15 Graph of flexibility of product for target user

6.5.3 Subject Matter Expert

The subject expert for this project are users that always use the RapidKL transport. They are asked to evaluate the effectiveness in conveying RapidKL information of using new method that is Augmented Reality.

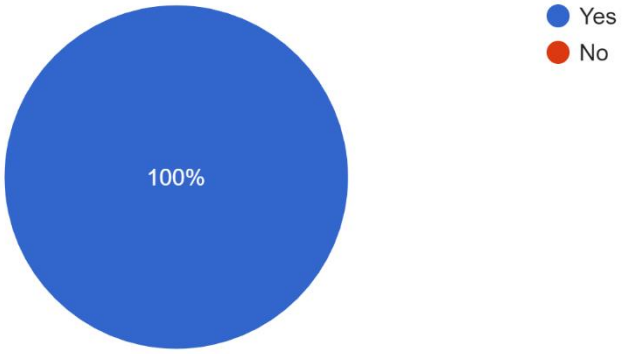
6.5.3.1 Content of project

Graph below shows the result from questionnaire in Section A. 3 respondents from user that always use RapidKL they have answer yes for this question which is focused on content and information about RapidKL.



Does the arrangement of map are correctly?

3 responses



Using an Augmented Reality is more convenient compare to personal computer f learning?

3 responses

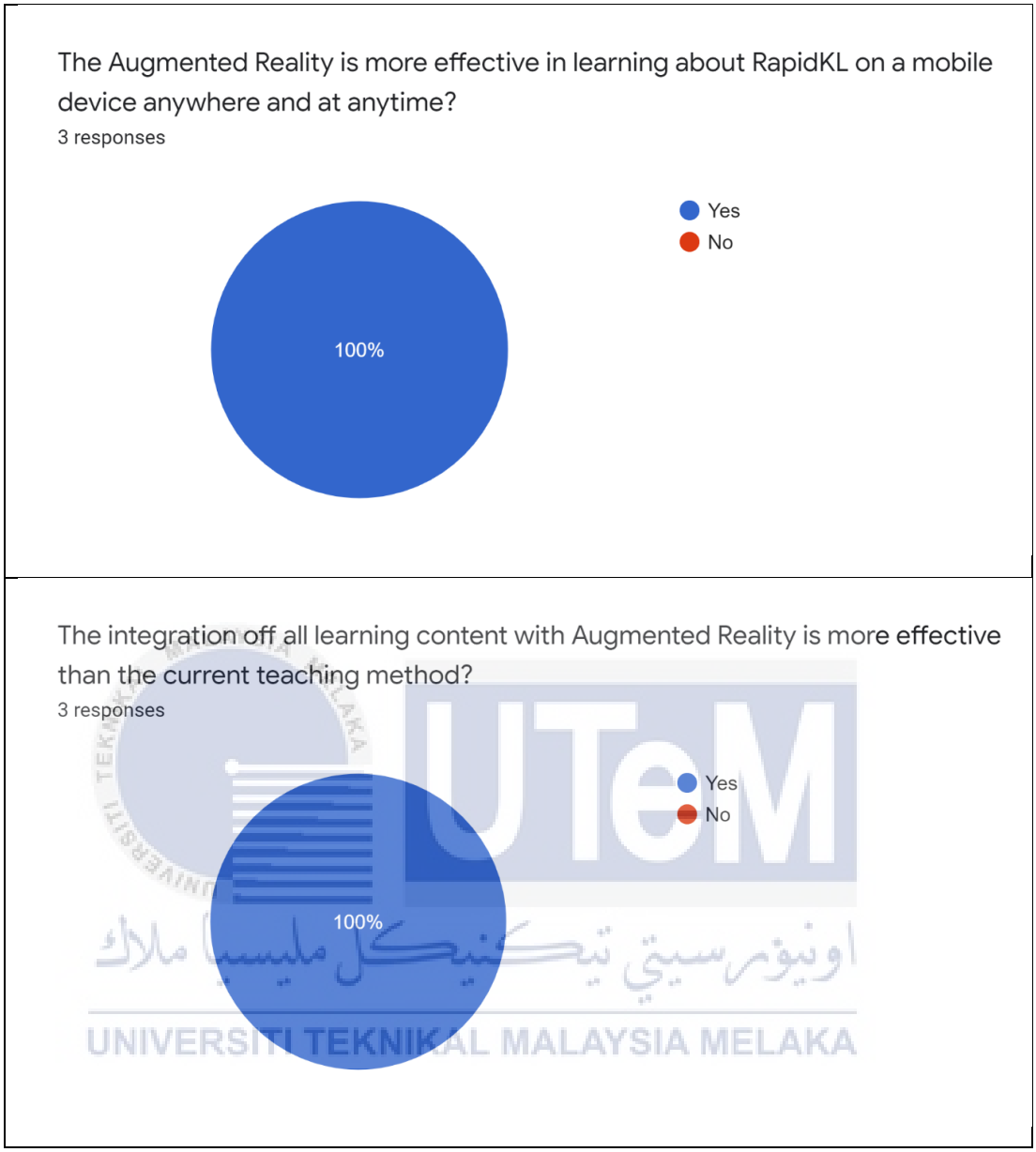
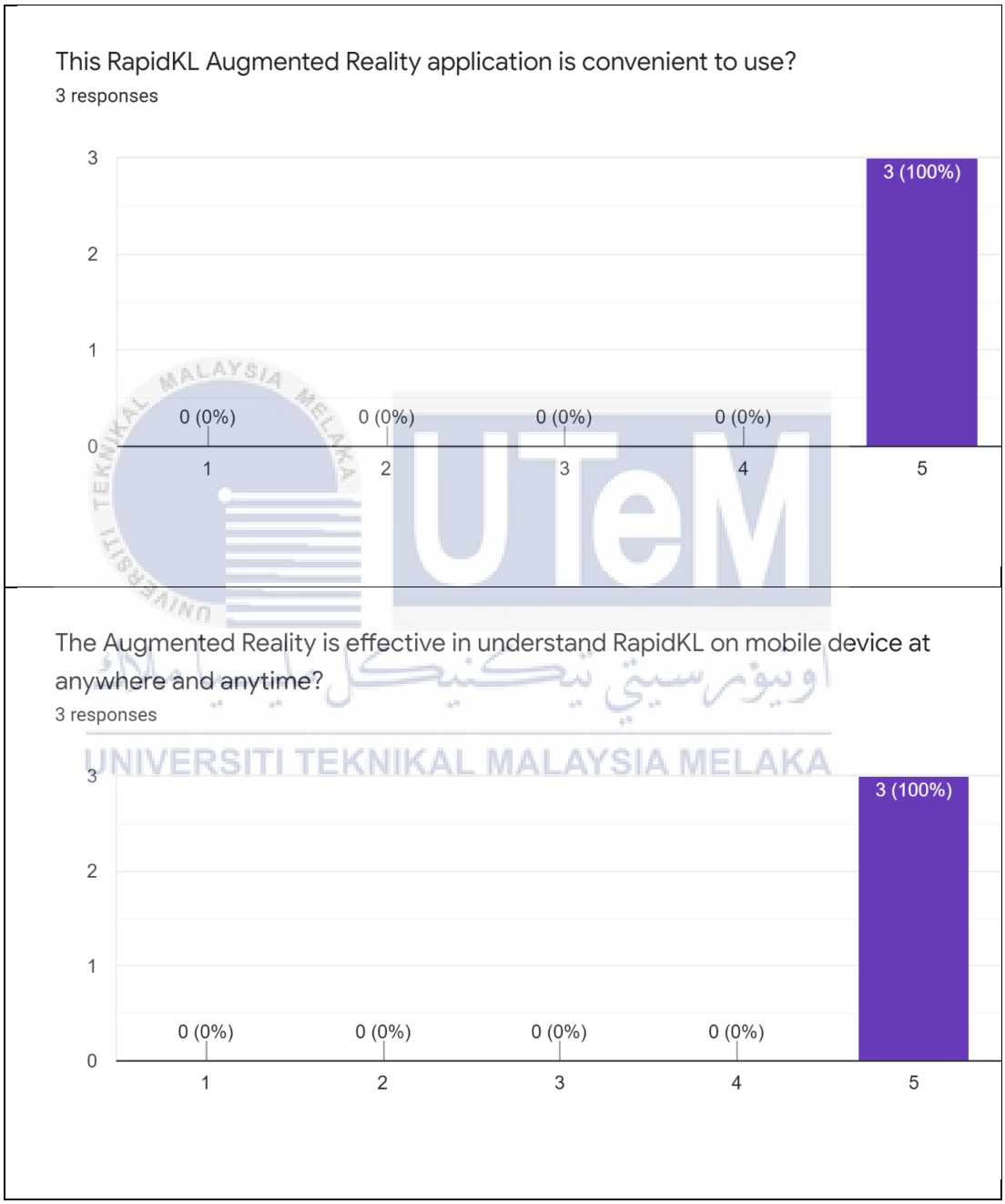


Table 6.16 Graph of content of project for subject matter expert

6.5.3.2 Usability of project

The subject matter experts agreed, based on the charts below, that this application is ready to stand out for them and is attractive to be used. Experts has found that this application can be used to study RapidKL on a mobile phone at anytime and in anywhere, making it incredibly useful and serviceable. However, in terms of being helpful to use, the subject matter

experts absolutely agree that it is beneficial to use the application RapidKL by applying Augmented Reality. The same may be said for the effect that this application has on their understanding of RapidKL.



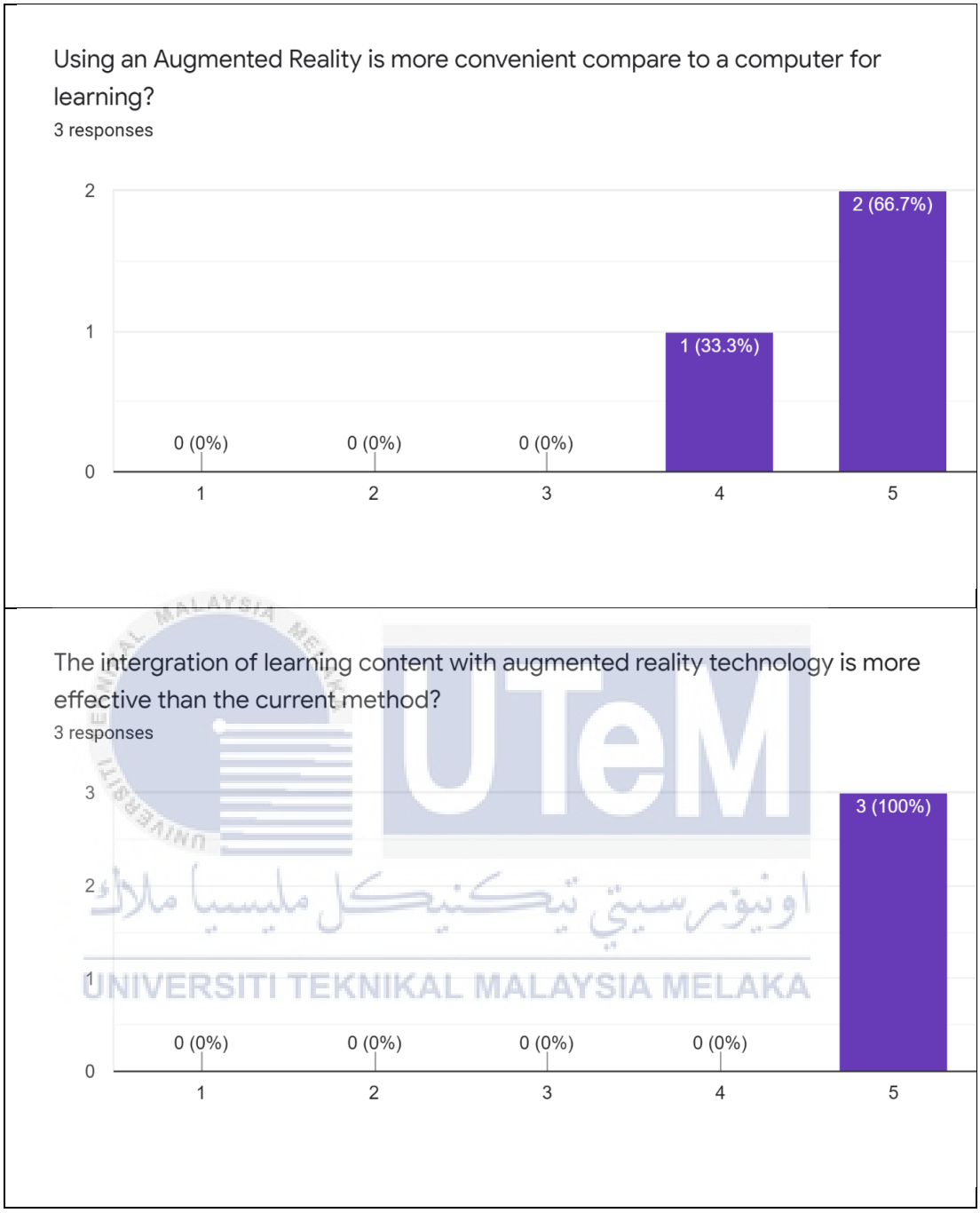


Table 6.17 Graph of usability of project for subject matter expert

6.6 Analysis Testing

By analysing the information collected from randomly selected respondents, it will be possible to define whether the project's goals have been achieved as a result of the

survey. Questionnaires and evaluations are used to collect data such as feedback, comments, and understanding. The graph analysis below displays the respondent reaction based on the feedback form provided during the testing session.

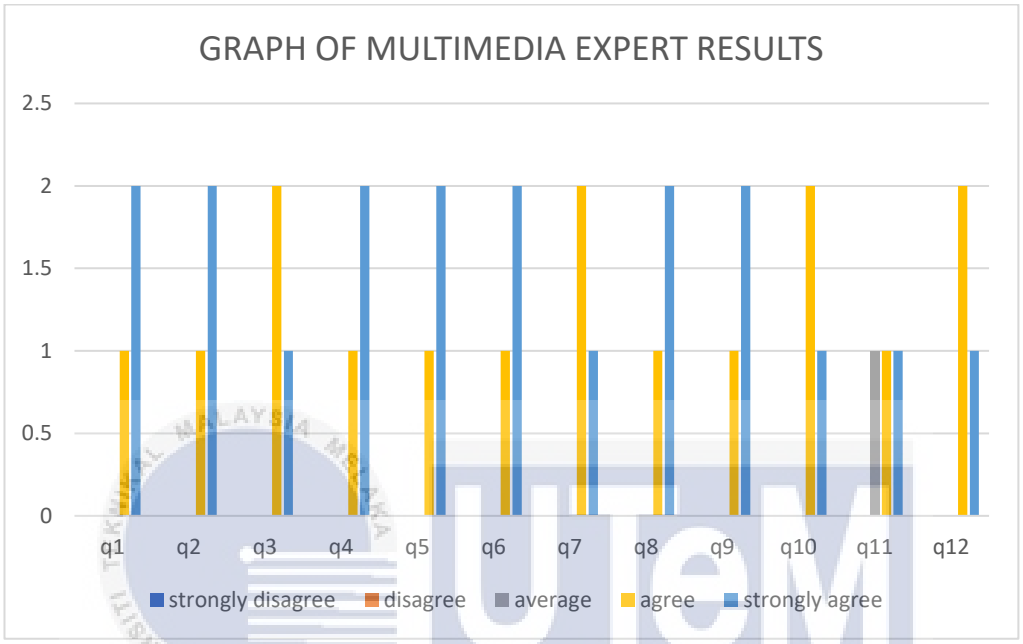


Figure 6.5 Graph of Multimedia Expert Results

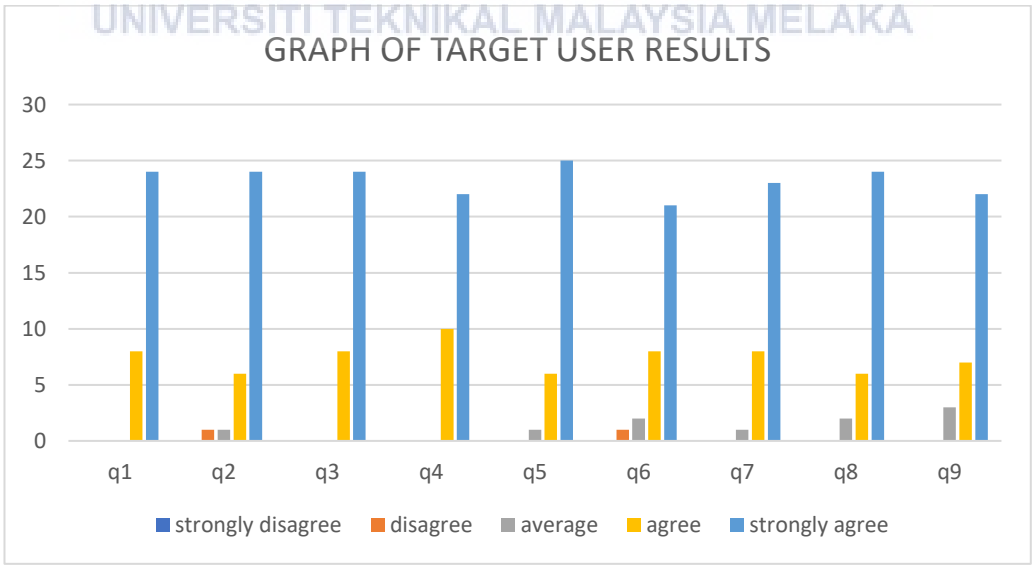


Figure 6.6 Graph of Target User Results

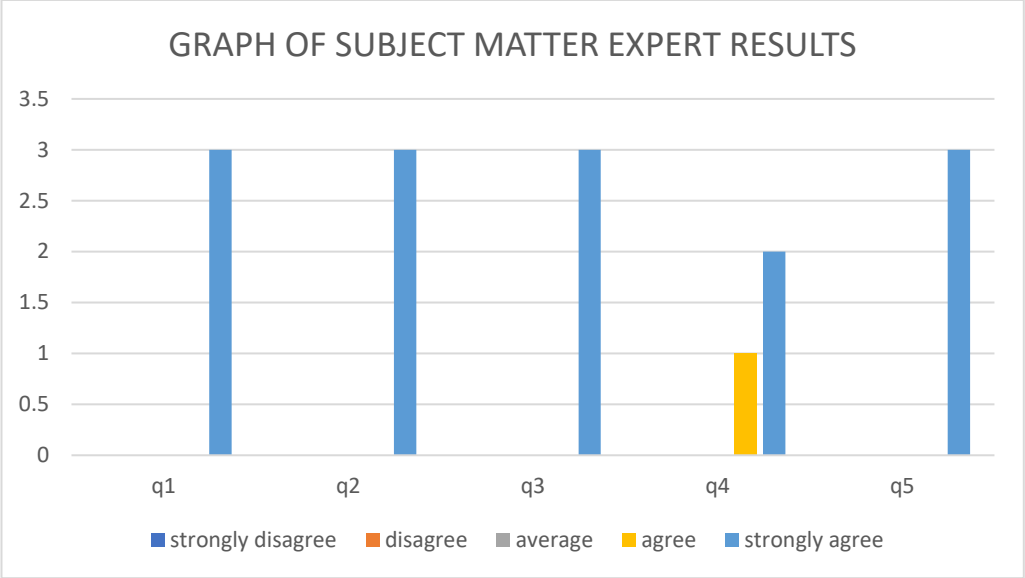


Figure 6.7 Graph of Subject Matter Expert Results

6.7 Conclusion

In conclusion, the application is successfully function. In Chapter 3, the components of the AR already discussed and used in the aspect of comparing to existing Augmented Reality. The result of the questions has been shown in figures and tables. The purpose of using a questionnaire is to see if the product's goal has been achieved. The summaries based on the questionnaire have clearly shown that the components which are applied to the AR have been successfully completed. Finally, it describes the survey's suggestion and feedback from the testing. To ensure that this project achieves the purpose stated in chapter 1, it is important to gain user feedbacks. From the feedback that got from the testing, some upgrades can be made for better application in future.

CHAPTER 7:
PROJECT CONCLUSION

7.1 Observation on weakness and strength

As a new technology Augmented Reality, each application developed has strengths and weaknesses. However, the strengths and weaknesses of this product may be an advantage for better clarification in order to build a good product. The user can only experience Augmented Reality using a smartphone, and it is only available for Android users.

7.1.1 Weakness

7.1.1.1 Less Augmented Reality interaction

There is less interaction with user in this application such as interactive animation and the button.

7.1.1.2 Less information about RapidKL

There is less details and information about RapidKL, for example information about LRT transit places. So, user will get more information about other places.

7.1.2 Strength

7.1.2.1 Interactive design of application

This Augmented Reality application uses an attractive design to help users gain a better understanding of RapidKL. For easily studying RapidKL information on the internet, Augmented Reality is an alternative method that can turn into an interesting and fulfilling technique of teaching.

7.1.2.2 Combination of multimedia element

The achievement of new media innovation can be simply transferred with Augmented Reality. It will provide a good user experience by include graphics, text, and audio from the users and the device. According to the test results, the application instruction is straightforward and easy to understand by the tester.

7.1.2.3 Utilizing the use of smartphone

By using this application, user do not need to use additional devices such as controller to engage with innovation of technology, by using their mobile user can experience AR.

7.2 Proposition for improvement

This section will explain a realistic recommendation to upgrade and improve the application's functionality and execution. A recommendation for development will be the important aspect in order to overcome the application's constraint and weakness. The tester who used the application during the testing stage provided the recommendation and suggestion for this project 's development. A few improvement

suggestions have been identified in order to improve the application's performance in the future.

7.2.1 Build in Ios user

Nowadays, many user's smartphone is change from android to Ios, therefore the development of an application that can achieve market demand is necessary.

7.2.2 Upload an application to google play store

Develop a stand-alone application for this AR so that users can access it and install it directly from the Google Play Store. As a result, the user can use the Augmented Reality application at any time and in any place.

7.2.3 Add a few function

Based on survey result, will add some function for this application. Such as estimate time and price for the train.

7.3 Project Contribution

The technology of augmented reality has been used to interact user, transform certain things and enables more simple way of interaction. This project contributes with the university. With AR technology, it is possible to get users to try out RapidKL. The attractive graphical element on the interface design was used in this project to attract people to participate in this application. The combination of graphical elements and animation ensures that the content is delivered to the user effectively.

7.4 Conclusion

In conclusion, this AR RapidKL project is successfully developed and run for user. The comparison of existing system and project requirements are attached with AR application in the literature review chapter. The storyboard and user interface design are designed in detail in design stage to ensure the project runs smoothly. Augmented Reality has a great impact on the user's potential to experience in the reality. Based on the survey feedback, the improvement will be made to make it more user friendly for users. Finally, Augmented Reality RapidKL has provided an effective method of promoting RapidKL transportation while fulfilling its requirements. This augmented reality application is needed to help users in improving and understanding how to use RapidKL transportation.

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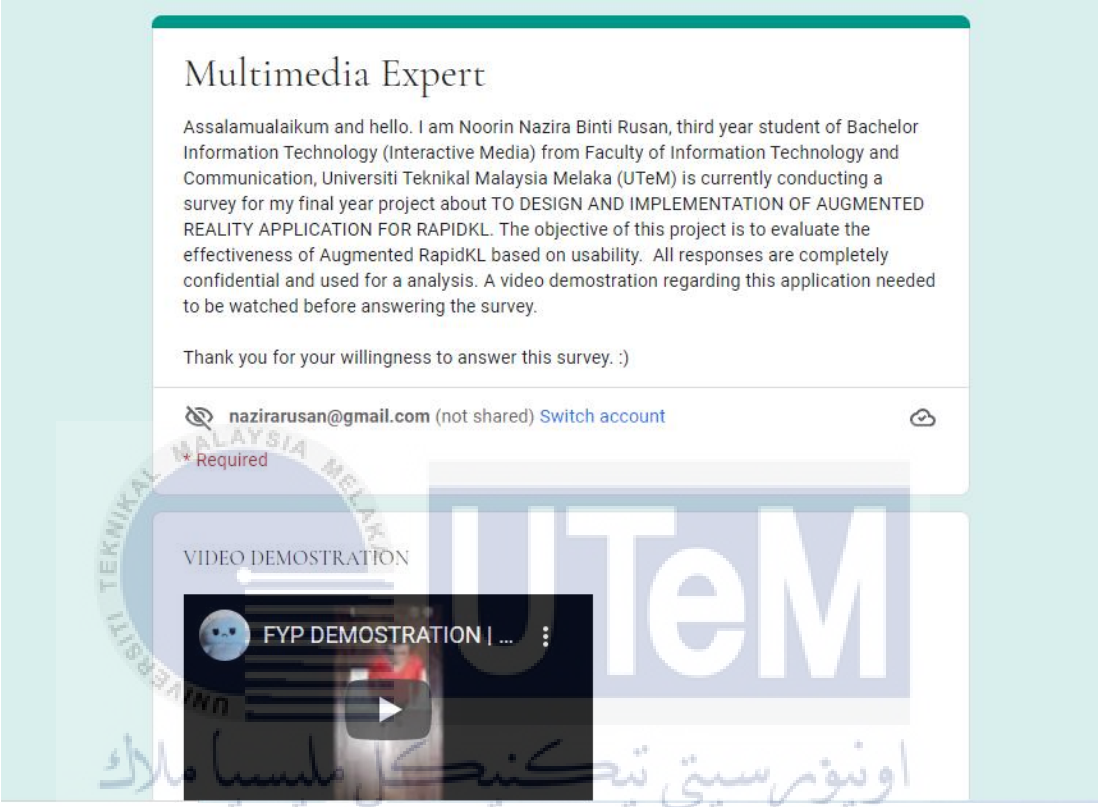
APPENDIX

MULTIMEDIA EXPERT (GOOGLE FORM QUESTIONNAIRE)



Name *

Your answer

Gender *

- Female
- Male

Position *

- Graphic designer
- Animator
- Web/Application developer
- Other:

Experience in this field? *

- Below 1 year
- 1 - 3 years
- More than 3 year

The content of the Augmented Reality is easy to understand? *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

The instructions stated in the application are clear to guide the user to use the application? *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

Integration of multimedia elements in the content helps user to receive the information effectively? *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

The content arrangements make the delivery of information more effective? *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

The information able to give an impact to the user? *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

This application is easy to use? *

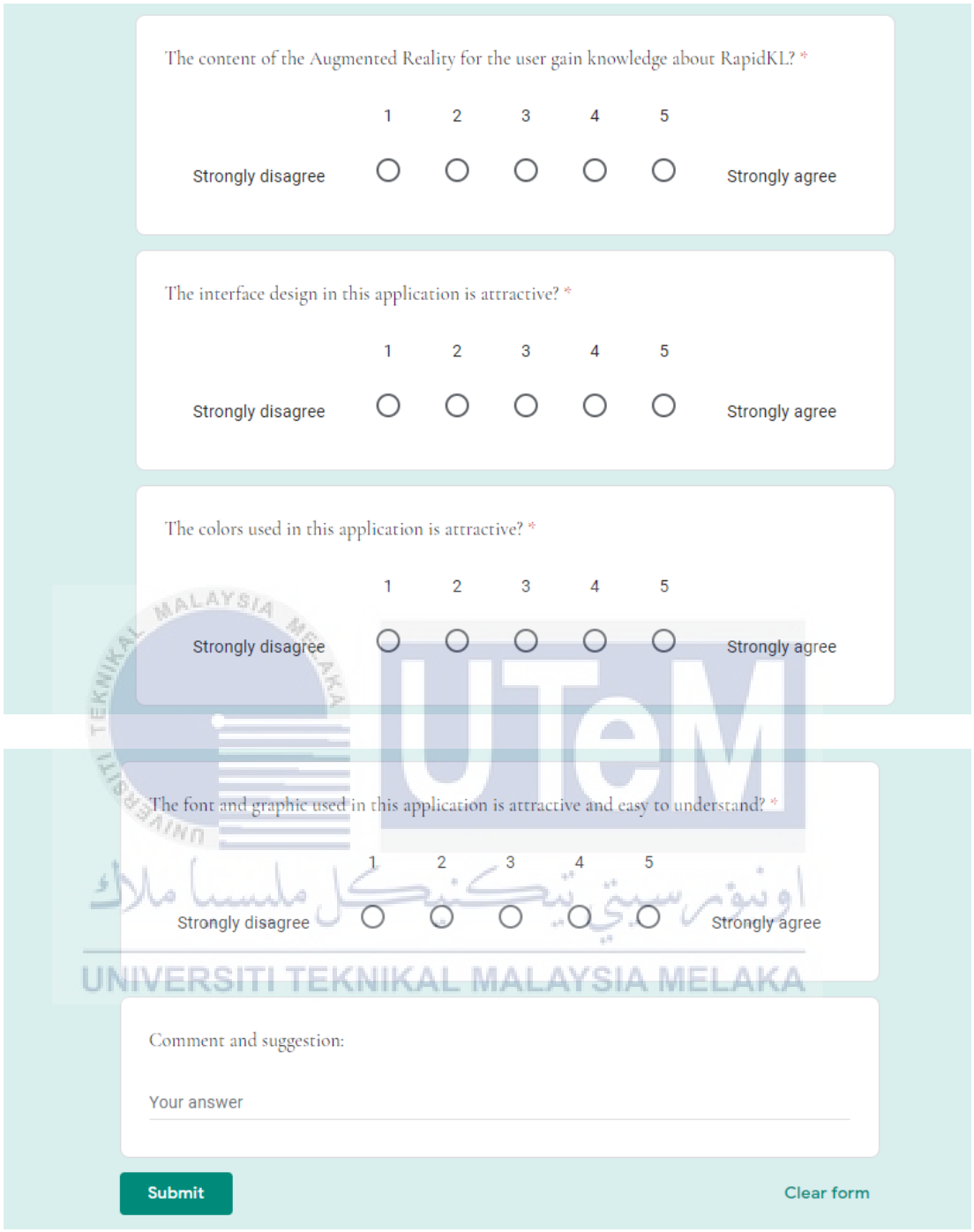
	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

User can use this Augmented Reality anywhere? *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

Readability of text is clear and easy to understand? *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree



TARGET USER (GOOGLE FORM QUESTIONNAIRE)

User Survey

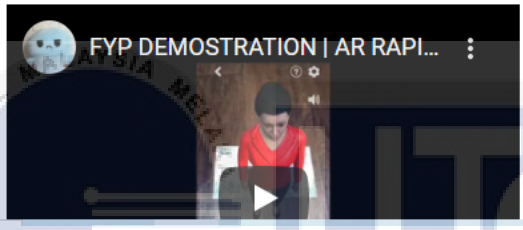
Assalamualaikum and hello. I am Noorin Nazira Binti Rusan, third year student of Bachelor Information Technology (Interactive Media) from Faculty of Information Technology and Communication, Universiti Teknikal Malaysia Melaka (UTeM) is currently conducting a survey for my final year project about TO DESIGN AND IMPLEMENTATION OF AUGMENTED REALITY APPLICATION FOR RAPIDKL. The objective of this project is to evaluate the effectiveness of Augmented RapidKL based on usability. All responses are completely confidential and used for a analysis. A video demostration regarding this application needed to be watched before answering the survey.

Thank you for your willingness to answer this survey. :)

nazirarusan@gmail.com (not shared) Switch account

* Required

VIDEO DEMOSTRATION



Gender *

- Female
- Male

Age *

- Below 18 years old
- 19 - 23 years old
- 24 - 28 years old
- 29 - years old and above

Status *

- Student
- Employer
- Other:

Does the instructions stated in the application are clear to guide the user to use the application? *

	1	2	3	4	5	
strongly disagree	○	○	○	○	○	strongly agree

Do the colour use in this application is suitable? *

	1	2	3	4	5	
strongly disagree	○	○	○	○	○	strongly agree

Do the image and graphic use in this application helps you to understand better about this application? *

	1	2	3	4	5	
strongly disagree	○	○	○	○	○	strongly agree

Do you understand what is this application about? *

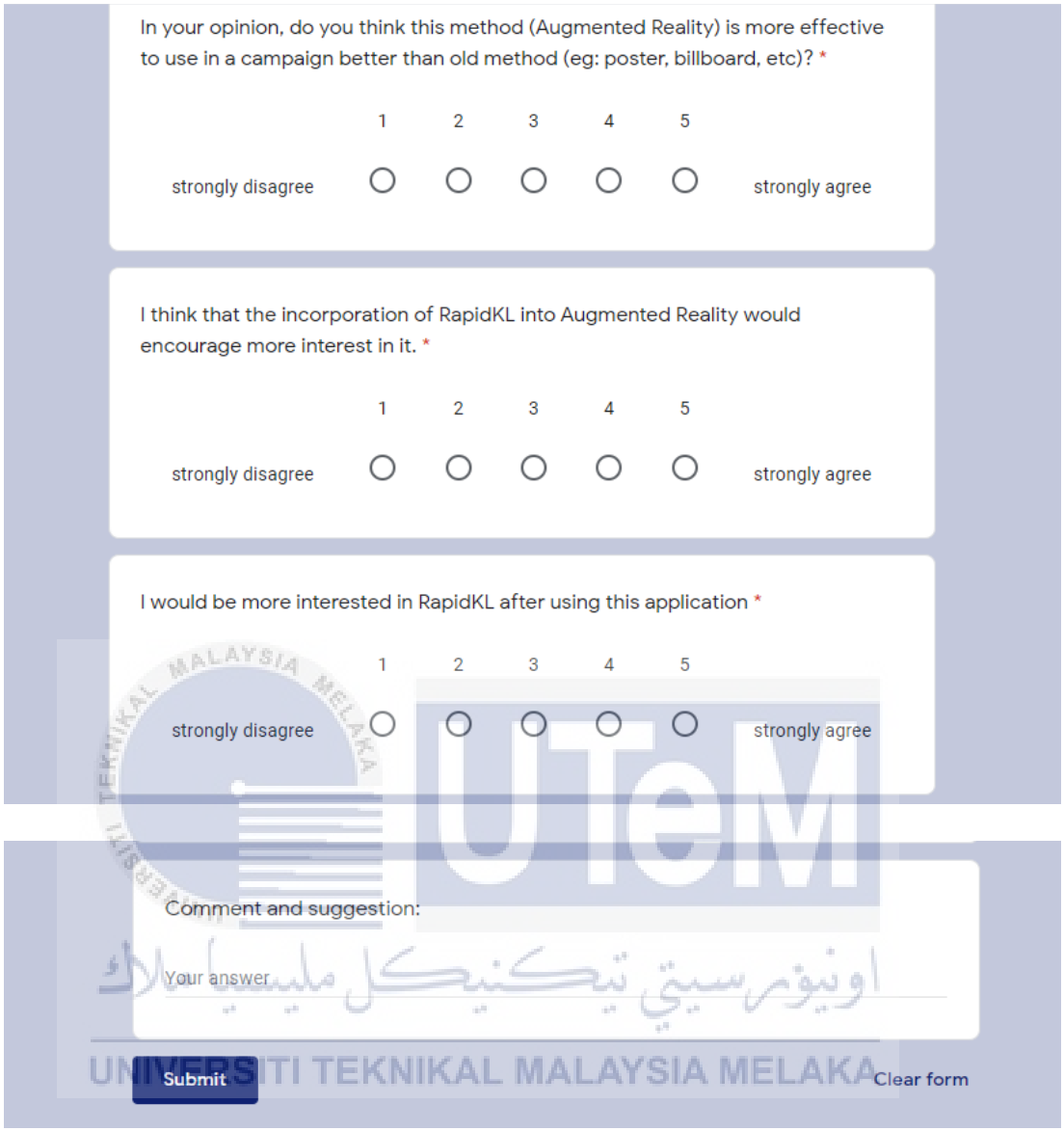
	1	2	3	4	5	
strongly disagree	○	○	○	○	○	strongly agree

Do you understand every content showed in this application? *

	1	2	3	4	5	
strongly disagree	○	○	○	○	○	strongly agree

Does this application give you any new knowledge about RapidKL that you didn't know before? *

	1	2	3	4	5	
strongly disagree	○	○	○	○	○	strongly agree



SUBJECT MATTER EXPERT (GOOGLE FORM QUESTIONNAIRE)

Subject Matter Expert Survey

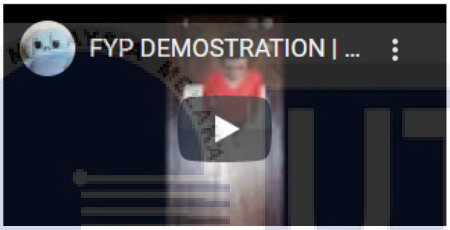
Assalamualaikum and hello. I am Noorin Nazira Binti Rusan, third year student of Bachelor Information Technology (Interactive Media) from Faculty of Information Technology and Communication, Universiti Teknikal Malaysia Melaka (UTeM) is currently conducting a survey for my final year project about TO DESIGN AND IMPLEMENTATION OF AUGMENTED REALITY APPLICATION FOR RAPIDKL. The objective of this project is to evaluate the effectiveness of Augmented RapidKL based on usability. All responses are completely confidential and used for a analysis. A video demostration regarding this application needed to be watched before answering the survey.

Thank you for your willingness to answer this survey. :)

nazirarusan@gmail.com (not shared) Switch account

* Required

VIDEO DEMOSTRATION



Please watch video first before answer the question.

Name *

Your answer

Gender *

- Male
- Female

Age *

- Below 18 years old
- 19 - 23 years old
- 24 - 28 years old
- 29 - years old and above

Status *

- Student
- Employer
- Other:

How often do you use RapidKL ? *

- Never
- Sometimes
- Always

Do you use *

- LRT
- MRT
- KTM

- KTM
- BUS
- MONORAIL
- Other:

Does the instructions stated in the application are clear to guide the user to use the application? *

- Yes
- No

This Augmented Reality tells about RapidKL? *

- Yes
- No

Does the arrangement of map are correctly? *

- Yes
- No

Using an Augmented Reality is more convenient compare to personal computer for learning? *

- Yes
- No

The Augmented Reality is more effective in learning about RapidKL on a mobile device anywhere and at anytime? *

- Yes
- No

The integration off all learning content with Augmented Reality is more effective than the current teaching method? *

- Yes
- No

This RapidKL Augmented Reality application is convenient to use? *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

This RapidKL Augmented Reality application able to attract your attention? *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

The Augmented Reality is effective in understand RapidKL on mobile device at anywhere and anytime? *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

Using an Augmented Reality is more convenient compare to a computer for learning? *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

The intergration of learning content with augmented reality technology is more effective than the current method? *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree