HUSNA HOMESTAY JEMENTAH: THE DEVELOPMENT OF AUGMENTED REALITY BUSINESS CARD

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This report is submitted in partial fulfillment of the requirements for the Bachelor of Computer Science (Interactive Media) with Honours.

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DECLARATION

I hereby declare that this project report entitled

HUSNA HOMESTAY JEMENTAH: THE DEVELOPMENT OF AUGMENTED REALITY BUSINESS CARD

is written by me and is my own effort and that no part has been plagiarized without citations.

STUDENT : MOHD NAZMI BIN YUSOF Date : 25 JUNE 2021

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

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DEDICATION

To all those who have supported, encouraged, challenged and inspire me especially to my beloved parents, honourable lectures for all their guidance, love and attention which has make it possible for me to make it up to this point.

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ABSTRACT

The primarily idea for this project is to introduce the technology of Mobile Phone Augmented Reality (AR) for Husna Homestay Jementah and develop it into an application for business card. AR technology is rather easier to introduce to the public by using Mobile Phone as compared to any other devices and a growing trend among companied involved in mobile computing and business application in particular. While AR also increases the engagement and interaction and provides a richer user experience. Thus, this project will bring up the basic idea of Mobile Phone AR technology and its application on a physical Business Card. Using a typical business card imprinted with as a marker that assists in the marker tracking and identification process, and AR virtual business card will be displayed on the Mobile Phone upon application execution. The project is aimed to increase and expand the brand of Husna Homestay Jementah by using AR technology and expected it be able stand out from the rest.

ABSTRAK

Idea utama untuk projek ini adalah memperkenalkan teknologi Mobile Phone Augmented Reality (AR) untuk Husna Homestay Jementah dan mengembangkannya menjadi aplikasi untuk kad nama. Teknologi AR lebih mudah diperkenalkan kepada umum dengan menggunakan Telefon bimbit berbanding dengan peranti lain dan trend yang semakin meningkat di kalangan pengiring yang terlibat dalam pengkomputeran mudah alih dan aplikasi perniagaan khususnya. Sementara AR juga meningkatkan interaksi dan interaksi dan memberikan pengalaman pengguna yang lebih kaya. Oleh itu, projek ini akan memunculkan idea asas teknologi AR Telefon Bimbit dan aplikasinya pada Kad Perniagaan fizikal. Menggunakan kad nama khas yang dicetak sebagai penanda yang membantu proses pengesanan dan pengenalpastian penanda, dan kad perniagaan maya AR akan dipaparkan di Telefon bimbit semasa pelaksanaan aplikasi. Projek ini bertujuan untuk meningkatkan dan mengembangkan jenama Husna Homestay Jementah dengan menggunakan teknologi AR dan diharapkan dapat menonjol dari yang lain.

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CHAPTER 1: INTRODUCTION

1.1 Introduction

An Augmented Reality (AR) technology, is a growing area that lets the user experience the real world which originally comes from the Virtual Reality (VR) technology, yet vary form VR where removes the user from that real-world experience, replacing it with a completely simulated one. Despite the technology of mobile phone AR is still in an immature state, the number of smart phone usage which implementing this technology is gradually increasing and this trend tells that the mobile phone AR technology is going to become a new broad area.

By applying the mobile phone AR technology into a business, it brings many benefits such as providing a new experience to a person and can increase consumer engagement. With the application of this technology, it can also affect the interests of the users who see the advertisement and they will get engaged to examine it. Therefore, an AR application will be use to enhance the brand of Husna Homestay Jementah and hopefully will have a very positive impact.

Existing business card is static and cannot convey interactive information about the business. The main objective of this project is to develop a mobile phone AR business card application for Husna Homestay Jementah in which the owners can include much more interactive information about their accommodation services. The use of this application will give users a new experience while cutting cost of advertisement and increase viewer's understanding by providing others information.

1.2 Problem Statement

As we all know, a typical business card is made of paper and has a small size that often includes the name of the giver, company name or even their business name and others related information such as address, phone numbers and other information. However, with the sophistication of today's technology, many have turned to the use of new technologies such as using augmented reality technology.

Now days, it is clear that the use of paper business cards is no longer relevant because with the ability of AR technology, it can help many things including being used in marketing purposes in various sectors. Therefore, with the use of AR technology it is expected to help solve some problems. From observations made around my surrounding area which is Jementah, Johor, accommodation that provides Muslim-friendly accommodation is not easy to find, especially on accommodation booking sites such as booking.com, agoda and airbnb.

This is because, homestay operators near the area, especially Husna Homestay Jementah are still using the old method where reservations are made through phone calls or text messages. However, bookers or prospective residents cannot see the environment of this homestay and information related to this home stay. Apart from that, Husna Homestay Jementah also only runs small accommodation and has no provision to advertise their businesses. It is hoped that with the development of this system, it will to some extent be able to expand the brand of Husna Homestay Jementah and be able to attract more visitors.

1.3 Objective

There are three objectives that are needed to be achieved. The objectives are as follows:

I. To determine the appropriate AR sdk software for developing an Augmented Reality Business Card.

II. To develop an interactive augmented reality business card for Husna Homestay Jementah that includes interactive information such as contact information, social links, video,3D model and sounds.

III. To evaluate the acceptance of the Augmented Reality business card prototype.

1.4 Scope

I. The project only covers the enhancement and development of business card by using Mobile Phone AR technology for Husna Homestay Jementah.

II. The target user for this project are open for general and is targeting for public.

1.5 Project Significant

This project serves as a medium of cooperation with a homestay entrepreneur, Husna Homestay Jementah, by helping to develop an augmented reality business card application to further enhance marketing and advertising for this homestay.

The expected result of this project is the production of a smartphone application that uses augmented reality technology as the main framework where in the main system, users can access various interactive multimedia element regarding this homestay. Among them is that users can access information on homestay in more detail with features such as video players that display the homestay area as well as interior space and more.

1.6 Conclusion

From this project, the expectation is to develop a stand -alone application that can further enhance the advertising services of Husna Homestay Jementah. The application is mainly developed by using Augmented Reality technology as the main framework. Through the development of this system which has a variety of interactive media it is also able to help users to better understand the field of augmented reality. The introduction, problem statement, objectives, scope, significant project and expected output are included in this chapter to demonstrate a general understanding about the project. In the next chapter 2 will be discussing the literature related to the project topic.

CHAPTER 2: LITERATURE REVIEW AND PROJECT METHADOLOGY

2.1 Introduction

This chapter discusses augmented reality, mobile phone augmented reality, and software for augmented reality. Not only that, but several existent augmented business card examples will be discussed as well. The application of mobile phone AR in the application of physical business cards will be covered at the end of this chapter.

A methodology is an organised set of tactics, practises, processes, and systems that are utilised to achieve a goal. The procedure is the entire investigation system that maps out how investigation will be carried out and, among other things, identifies the strategies that will be used. These philosophical strategies define the ways or methods of gathering knowledge, or how a specific outcome is to be determined. Despite the fact that much thought is paid to the nature and types of cycles to be followed in a specific methodology or to achieve a goal, philosophy does not specify explicit approaches.

2.2 Domain

The domain of this project is based on the Augmented Reality in Business card. Through this application, user can gain the new experience on using a business card by using augmented reality. With this application, user can also get many new information regarding the homestay.

Augmented Reality technology is a basic idea which superimposes graphics, audio and other sense enhancements over real world environment in real time. Augmented Reality is also the workmanship innovation that limit

between what is genuine and what is PC created. Term Augmented Reality is accustomed to compositing an immediate and roundabout perspective on the physical world with PC produced tangible information 3D model or sound. At the point when the increase is completed continuously, the utilization of Augmented Reality can genuinely improve the view of reality through intuitive and carefully data, and result in the formation of new novel stunning encounters. Augmented Reality overcomes any issues between the genuine and virtual universes progressively. In contrast to augmented reality (VR), AR makes an absolutely fake condition that actualize the current condition.

2.2.1 Type of Augmented Reality

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

2.2.1.1 Marker Based Augmented Reality

After focusing on object detection, this type of AR gives us with more information about the thing. It recognises and displays information about the thing in front of the camera on the screen. The object is recognised using a marker, such as a QR Code or flyer, which replaces the marker on the screen with a 3D replica of the related object. As a result, the user can examine the object in more depth and from multiple perspectives. Aside from that, the user can spin the 3D images while rotating the marker.

Figure 2.1: Marker Based Augmented Reality

2.2.1.2 Marker-less Based Augmented Reality

One of the most widely used applications is markerless augmented reality. It's also known as Location-based AR because of the ease with which the highlights in cell phones that provide area identification may be accessed. Aside from that, it encourages customers to look for interesting places in their current location. This method works by analysing data from the portable's GPS, sophisticated compass, and accelerometer while anticipating the client's centering point. This AR is linked to a page that displays area info about the items that can be viewed from the user's camera.

Figure 2.2: Marker Based Augmented Reality

2.2.1.3 Projection Based Augmented Reality

Projection-based AR is engaging and intuitive where light is blown onto a surface and the collaboration is finished by contacting the extended surface with hand. The far reaching employments of projection-based AR methods can be utilized to make misdirection about the position, direction, and profundity of an article. Another case of Projection Based Augmented Reality laser plasma innovation that venture multi-dimensional image in reality

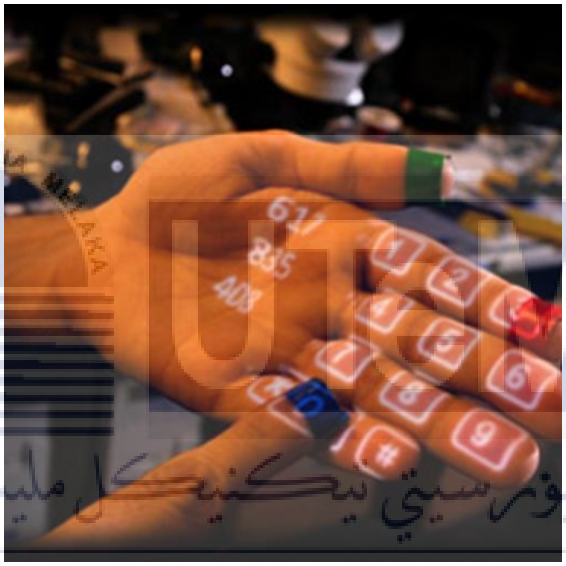


Figure 2.3: Projection Based Augmented Reality

2.2.1.4 Projection Based Augmented Reality

Superimposition Based Augmented Reality are the ability to recognize the object as the object replacement cannot be done if it cannot determine what the original object is. This AR provides a replacement view of the object in focus. This is done by replacing the entire or partial view with an augmented view of the object. A strong consumer-facing example of superimposition based augmented reality could be found in the Ikea augmented reality furniture catalogue where user just need to download the apps and place virtual furniture to get the one that match with their house.

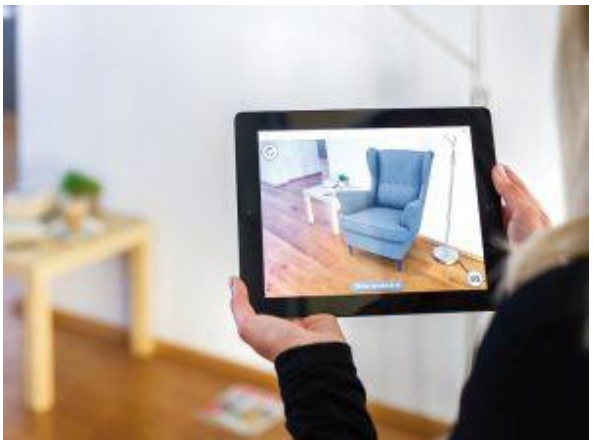


Figure 2.4: Superimposition Based Augmented Reality

In conclusion, AR technology offers many potential applications in various fields not only in marketing including maintenance and construction, military, instant information as well as gaming. There are hundreds of potential applications for such a technology, gaming and entertainment being the most obvious ones.

2.2.2 AR SDK's Software

An SDK stands for software development kit or devkit for short. It is a set of software tools and programs used by developers to create applications for specific platforms, For this it is only focussing on Augmented Reality SDK's. There are several AR SDK's that can be used such Vuforia Engine, ARKit, ARCore, Unity Composer, and HP Reveal. These SDK are all serve the same purposes which is to perform the non-trivial task of fusing digital content and information with the real world. It is responsible for many component of the applications, which are currently available, including content rendering, AT tracking, and scene recognition.

2.2.2.1.1 Vuforia Engine

Vuforia is a mobile-centric, immersive augmented reality SDK that allows enterprises and app developers to easily create high-fidelity, mobile-centric AR experiences. The Vuforia SDK uses computer vision to recognise and track image targets and 3D objects in real time. Businesses and AR development companies can use this feature to orient and put virtual objects, such as 3D models and other material, in relation to the real-world environment. An AR-enabled smartphone or tablet can then overlay 3D models and digital information on top of the real-world picture and display them in relation to the environment.

The Vuforia augmented reality SDK can handle a wide range of 3D and 2D targets, including 3D multi-target setups, markerless picture targets, and VuMark fiducial markers. Localized occlusion detection utilising virtual buttons, the ability to construct and calibrate target sets at runtime, and runtime target image selection are all included in the Vuforia SDK.

Vuforia is an extension of the Unity game engine that provides APIs (application programming interfaces) in Java, C++ and Objective C++, and.NET. With this in mind, the Vuforia SDK can support both native iOS and Android development as well as the creation of AR apps and prototypes in Unity that can be quickly converted across all platforms. This is an excellent choice for companies and brands looking to create apps that work on both iOS and Android while minimising commercial and technical risk. This means that AR apps may be produced in the shortest amount of time for the largest number of target mobile devices.

2.2.2.2 ARKit

The ARKit SDK works in the same manner that most AR SDKs do, by allowing digital information and 3D objects to be merged with the real world, but it offers a largely unprecedented level of accessibility in terms of the number of devices it supports.

ARKit uses VIO (Visual Inertial Odometry) to monitor the surrounding world with seamless levels of accuracy on any device with an Apple A9, A10, or A11 processor. VIO allows the ARKit to merge Core Motion data with camera sensor data, allowing developers to create applications that can identify horizontal and vertical planes (floors and tables) (walls). This allows the ARKit to precisely analyse the dynamics and make-up of a scene, as well as put 3D objects and overlay digital content in a context-relevant manner (for example, because ARKit understands the difference between a floor and a table, it knows to place a bottle of wine on the table, rather than the floor). If you're working on an AR project with ARKit, we've put together a checklist of the most important things to keep in mind.

Developers and organisations can use third-party 3D engines like Unity, Unreal Engine, and SceneKit to create apps that use ARKit and its accompanying optimizations.

2.2.2.3 ARCore

Google's augmented reality SDK is known as ARCore. It allows marketers and developers to get AR apps up and running on compatible Google smartphones and tablets, similar to ARKit. One of ARCore's most remarkable advantages is that it also works with iOS devices, giving developers unprecedented access to users on both platforms. The entire ARCore product is based on two main components: real-time tracking and position calculation, as well as the integration of virtual items with the real-world environment. This allows businesses and marketers to create rich and immersive AR experiences for mobile devices, allowing 3D objects, text, and digital information to be placed directly in the real-world environment. Developers can use ARCore for free, and it works with a variety of Android (and iOS) devices and tablets.

2.2.2.4 Wikitude

The Wikitude SDK was created with one goal in mind when it was first released: to allow AR developers to construct location-centric augmented reality experiences using the Wikitude World Browser app. In 2012, Wikitude repositioned their main technology offering by releasing the Wikitude SDK, which included geolocation, tracking, and picture recognition capabilities built right into the core platform.

The Wikitude SDK has become the company's main product, promising developers the capacity to create immersive mobile AR experiences in the shortest time feasible. Wikitude SDK now features 3D model rendering, location-based AR, and video overlay functionality. SLAM (simultaneous localization and mapping) technology was recently released by the corporation, which allows for seamless object tracking and recognition as well as markerless instantaneous tracking.

Wikitude SDK supports a variety of platforms and is now available for Windows, iOS, Android, and a variety of HUDs (heads up displays). Wikitude is the first SDK to focus solely on a location-based approach to generating augmented reality apps for cross-platform mobile AR development and smart eyewear devices, according to the company.

2.2.2.5 EasyAR

The EasyAR SDK is available in two pricing bundles for organisations and developers: EasyAR SDK Basic and EasyAR SDK Pro. Developers should expect improved APIs, workflow, and compatibility with the basic package. The Pro package is totally new, and it comes with additional features not found in the standard package. The basic package is free for developers who want to create AR apps, and it supports the Java API for Android, Swift API for iOS, and Windows OS. Video playback, transparent video playback, QR code scanning, and complete Unity integration are some of the extra capabilities offered by the base package.

The EasyAR Pro package includes all of the functionality found in the free package on the platform's basic edition, as well as SLAM, 3D object tracking, screen recording, and simultaneous detection and tracking of various types of objects.

The EasyAR Pro package's fundamental feature set revolves around the following: SLAM (which includes Monocular real-time 6 DOF camera posture tracking and full mobile compatibility), 3D-object tracking (which can recognise and track a common 3D object with texturing in real-time), and screen recording (provides a simple and efficient way of recording AR content) Planar image tracking (the ability to monitor and identify planar pictures in real time), a concise API that connects with all major mobile AR platforms and content, and interaction support to present the most attractive AR content with additional capabilities are all available. The EasyAR website is jam-packed with resources to help you get your AR app up and running as quickly as possible, including extensive support, Q&A, and community information.

Table 2.0 Comparison of AR SDK's Software available

AR SDK	Vuforia Engine	ARKit	ARCore	Wikitude	EasyAR
Licenese	OS, Free	OS,Comm. SDK	OS, Free	Free Trial version, Paid version	Basic free version, Pro paid version
Platform	Android, iOS, Windows	Android, iOS, Linux, OSX, Windows	Android	Android, iOS	Android, iOS, MacOS, Windows
Marker	-Frame markers -Image target	Square Marker, Multiple Marker Tracking	Image target	Image target	-Image target -Object target

	-Text target				
2D Object	✓			✓	✓
3D Object	✓		✓	✓	✓
Benefits	-Enable to maintain tracking even when the target is out of view and view them from greater distance. -Cloud Database allows storing thousands of image targets. -3D animation can be overlain on screen.	-Multiple platform AR app development possible. -Only AR SDK which is available as open source, through which many new AR frameworks developed.	- Works with Unity 3D and Unreal Engine. -Google ARCore is a steady part of the corresponding operation system Android.	-Easy portability of AR apps from one platform to another. -Can be programmed using basic HTML5, JS and CSS.	-Provide a cloud recognition service solution to help developers manage up to 100k image targets online. -Users can create several cloud database and each space is secure and separated from others.
Limitation	Device database can support 100 image targets.	-Less accuracy in tracking markers even when camera and	-Just prioritize android. -It slows down for large scale virtual objects.	-Doesn't track 3D model which limits it use to only 2D tracking.	-Extra features only be accessible after purchasing

		marker are still. -It itself doesn't support location based AR.	-Human body detection is not great.	-Target image to track need to be of solid colors to be recognized.	the pro versions.

2.2.3 Preferred AR SDK's Software

Before creating an AR application, it is important to answer an important and difficult question which is what SDK should be chosen. This question should be taken seriously because the quality of the apps is depend on it. After a little bit of research and observation I have considered to choose Vuforia as my AR SDK. This is because Vuforia SDK sits near the top of AR lists with a good reason and it also a free to use. It offers a range of products for developing AR experiences, including Vuforia engine, Studio and Chalk. While the software also supports the creation of both marker-based and marker-less AR which are essentials to this project that involved image tracking marker-based AR.

The platform that is supported are Android, iOS, UWP and Unity Editor. One of the main features of Vuforia which I think is important for this project is its superior real-time image recognition as this project will involve in developing an AR Business Card where to have a reliable image tracking feature is a must and. Vuforia offers two ways of data storage for image targets where one is local (Device Database) and cloud (Cloud Recognition Database). The second reasons that I choose using Vuforia Engine is it is simple to develop with Unity. Combination Unity and Vuforia makes a great standalone application with more control over interface design while the overlays can be load quickly too. As this project is being developed by Unity it is the best option to use Vuforia that has been featured and used a lot by developers. In conclusion, Vuforia is a powerful platform to create an app with AR compared to others and it is perfect for Unity developer. With Vuforia and Unity it makes any application development much easier.

2.3 Related Existing System

There are few existing system found regarding digital business card that use a similar approach which are Near Field Communication (NFC) Business Card, QR Code Business Card. These are system that is used for the project references that contain several ideas that will contribute ideas to this project.

1. Near Field Communication (NFC) Business Card

NFC stands for "Near Field Communication," and it facilitates short-range communication between compatible devices, as the name implies. This necessitates the use of at least one sending device and one receiving device. The NFC standard can be used by a variety of devices and is classified as either passive or active. Tags and other small transmitters that are passive NFC devices can convey information to other NFC devices without requiring their own power source. They can't link to other passive components and can't analyse information supplied from other sources. On the interior of your card, an NFC business card is like having a third side. When the card is touched to an NFC capable phone, a little microchip implanted in the card instructs the smartphone what to do. People can tell the NFC chip what to do, so the business card can do more than just tell people who you are, what you do, and how to contact you. Assume you've just delivered your business card to a potential client. You inform him about the NFC chip, and he later recalls having the card. He taps it against his phone and the data you want him to see appears on his phone almost quickly.

Figure 2.5: Example of NFC Business Card

2. QR Code Business Card

The QR code is one of the most widely used types of scannable barcodes in the world. These amusing-looking codes may be printed on almost anything and read rapidly by smartphones, acting as scannable buttons or links that connect the physical and digital worlds. QR codes are utilised in a variety of places and forms, including stickers, posters, and business cards. Scannable QR codes on business cards often lead to a website with more information about the product or service. They can be scanned with almost any smartphone.

Figure 2.6: Example of QR Code Business Card

2.3.1 Comparison of Existing System

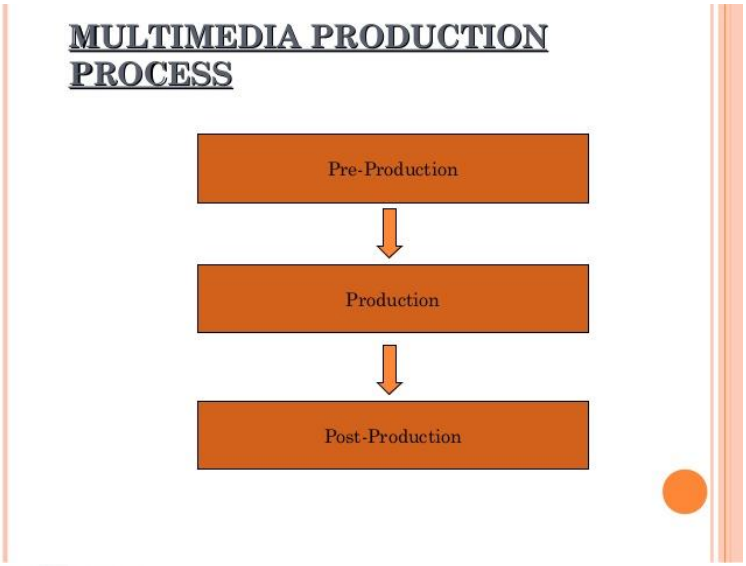
Table 2.1 shows the two existing system which have been taken as the reference in this project. Comparison between the current system and proposed system have been made in this table.

Table 2.1 Comparison of Reviewed System and Proposed Project

Technology	NFC Business Card	QR Business Card	Augmented Reality Business Card
Cost	Expensive	Less expensive	Free
Interaction	Yes	No	Yes
Easy of use	No	Yes	Yes
Audio	None	Yes	Yes
Strength	-Instance feedback -Read with single tap -Convenient and more secure.	-Simple and easy -All smartphone can scan QR Code -Not require physical contact	-Good graphical design. -Speedy performance -Simple and sleek
Weakness	-Expensive -Require a tag and reader device . -Relies on distance. -Device compatibality	-Not provide simpler customer experience. -Adding landing page for QR code may be unnecessary for some business.	-Might have less privacy -Need certain requirement of hardware and software resourses.

2.4 Project Methodology

This project will be develop using Multimedia Production Process. The three main phases of the process of multimedia production are Pre-Production, Production and Post-Production, and each phase has its own sub-phase. The analysis phase and the design phase occur during the pre-production phase, while the development and test phases consist of production phases. In analysis phase we try to figure out what are the information that need and can be added in the application so that every next phase can be run accordingly. Two major activities are going to be carried out in analysis which is requirement gathering and interview. After that, in design phase where all the idea and design of the interface takes place. The interface of the business card need to be simple while maintaining its feature and informative as it can to make sure that everyone can use the application despite different age. The selection of colour, font, theme, logo, graphic design are all to be discussed and analyzed in this phase. In design phase of Pre-Production stage, project requirement is identified and understand. Project requirement, the technology to be used, analysis of the existing system and lack of the current system are part of the requirements. Every multimedia element used in this project will be determined and project flow charts and storyboards created. The Production stage begin with the build and implementation of the storyboard into a multimedia creation. In this phase, all required hardware was set up, assets were exported to unit, coding and so on. The interface of the system will be created in this section. The next phase is the Production phase in which the testing takes place. The main aim in the trial phase is to ensure that the product works the way it should work. When the application building has finished, it would be tested to be installed. Each modulles will be tested. The phases of Post-Production consist of the test result and analysis from the project. During the evaluation, few users are selected by chance to test the product on the presentation and efficiency of the product. This testing will be conducted utilising the acceptance testing questionnaire, which will be discussed in further detail in chapter Testing. The project is ready for further user release when the product passes the evaluation phase.



2.5 Project Requirement

Project Requirement is a specification of project needed that can includes function, behaviour and qualities of the project. The most requirement that needed for this project is hardware and software to ensure the project's success. Hardware and software are important assets to develop a system. The hardware and software must be identified so that the system can be developed and tested without any conflict in both terms. It provides a great AR that need to be finish on the time by using the tools that needed.

2.5.1 Software Requirements

Software requirement is a listing of what software programs or hardware device are required to operate the system. The software used have been determined before development process to ensure a smooth progress.

I. Vuforia 8 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.

II. Unity 2018.4.35f1

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.

III. Adobe Illustrator

Adobe Illustrator is a professional vector-based design and drawing program. Used as part of a larger design workflow, Illustrator allows for the creation of everything from single design elements to entire compositions. Designers use Illustrator to create posters, symbols, logos, patterns, icons, etc.

IV. Adobe Premier Pro

Adobe Premiere Pro is a video editing program that is part of the Adobe Creative Cloud software collection, as well as Adobe CS6 – or Adobe Creative Suite. Premiere Pro is used to edit videos, including movies, and is quickly becoming the go-to program for filmmakers all over the world, both amateur and pro.

V. Microsoft Visual Studio Community 2017

Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. It is used to develop computer programs, as well as websites, web apps, web services and mobile apps. Visual Studio uses Microsoft software development platforms such as Windows API, Windows Forms, Windows Presentation Foundation, Windows Store and Microsoft Silverlight. It can produce both native code and managed code.

2.5.2 Hardware Requirements

Hardware requirements are the hardware devices needed to construct a the system. The device used in this project were Asus Strix laptop. Listed below are the specification hardware used in this project.

I. Laptop (64-bit Operating System)
II. Hard Disk Drive
III. Processor (Intel® Core™ i5-9200U CPU)
IV. RAM (Installed 12.0 GB space of RAM)
V. Windows 10 Operating System

2.6 Conclusion

In conclusion, Augmented Reality has a few types and way to implement it into development. It also has a market opportunity where it can contend in this time of modern innovation globalization. Observation has indicated that AR expands the apparent estimation of items and brands. This part clarifies pretty much all the survey of existing frameworks and portrays the sorts of Augmented Reality in area segment. The undertaking being depict in 3 different ways of arranging stage which is pre-production, production, and post-production. Project requirements additionally happen so as to ensure the undertaking being conduct effectively.

Next segment, which is chapter 3, will address more detail on analysis where the necessity examination and how the strategy of this application will be assemble and how to built up this venture. The information gained will be used in the project and the designer must make sure to meet the software and hardware requirement of this project.

CHAPTER 3: ANALYSIS

3.1 Introduction

In the vast majority of extant strategies, the analysis stage is critical. Essentially, inquiry necessitates an examination of the problem in the investigation approaches used, as well as preliminary research, assets, and the conveyance stage. This section will go over the problem and the task's prerequisite inquiry. The cycle of critical thinking is the means to figure out how to minimise the distinctions, just as the way to recognise issues is the way to characterise contrasts.

Functional, non-functional, and other needs are all part of the requirement analysis process. Many of the requirements that will be covered in the development phase, as well as their thorough applications, will be mentioned. In the creation of the system, hardware and software requirements are critical. If the requirements are not clearly stated, the system will have a difficulty and will not function properly in the real world.

3.2 Requirement Analysis

Requirement analysis is a method for identifying the desires that lead to the creation of the project's requirements.

3.2.1 Project Requirement

The system to be developed is examined in the project requirements. It will specify the actions, processes, or other requirements that the project must meet. It will be evaluated based on the requirements gathered and the project's specific technique. This project's requirements will provide a clear understanding of the tasks that must be completed.

Requirement Gathering

Gathering requirements is arguably the most important step in the data transmission and organisation process. Qualitative and quantitative requirements collecting are the two types of requirements gathering. When there isn't enough time, money, or data to undertake a quantitative assessment, a quality assessment is the best option. In most cases, a qualitative assessment is conducted during an interview. The interview will be held with Husna Homestay Jementah owner. The technique used to construct this project will also be examined. The findings of the analysis will be used to further the field of augmented reality.

Interview

This research method uses through observation and interview at the homestay. The homestay is located at Jementah, Johor. From the interview that has been made with the owner of the homestay, Puan Nurul Husna Syuhaidah Binti Yusof and Nurul Hizam Bin Muzakir who has been involved in homestay involvement for 2 years now. Starting as a rental house, the house has now evolved into a homestay due to a demand for rent on a day-to-day basis. They do not consider turning the house into a homestay because the owner does not live in the region and no one will be able to check that the procedure is followed once the occupant has left. However, they chose to appoint workers who will be in charge of all procedures and

will be able to monitor the services that have been provided thus far. To make the homestay more pleasant and user-friendly, additional equipment and furniture are being installed. The owner is also concerned about the tenants, who only allow Muslims and are concerned about maintaining a clean environment in order to make this homestay Muslim-friendly.

Table 3.1 Content Verification Form

Component	Details
Owner Name :	Nurul Husna Syuhaidah Binti Yusof
Homestay Name :	Husna Homestay Jementah
Venue :	Lot 3100, Jalan Belakang Sekolah Agama, 85200, Jementah, Segamat, Johor
Email :	Ansuh8@gmail.com
No Tel :	019-7348434
Date	13/4/2021

3.2.2 Software Requirement

The primary building elements for this project are Unity, Vuforia Engine, Adobe Illustrator, Adobe Premiere Pro, and Microsoft Visual Studio Community.

Table 3.2: Software used throughout development

No.	Software	Usage
1.	Unity Version 2018	-To design the card interface. -To develop the AR experience for the card.
2.	Vuforia Engine	-To served and add advanced computer vision functionality to create AR experiences.
3.	Adobe Illustrator	-To create and edit the card design. -To designing the homestay logo -To create some of the logo inside the AR
4.	Adobe Premiere Pro	-To create a promotional video about the homestay and for AR card content
5.	Microsoft Visual Studio Community 2017	-To create the scrip and programming purposes to create interaction of UI & UX

3.2.3 Hardware Requirement

Hardware plays a significant role in the development of the application. It will serve as a supplement to the software. The programme determines which hardware to utilise. It will be chosen if the hardware has the ability to handle the software requirements. Hardware is critical since it will serve as the basis for the project, and its functionality will dictate how quickly it can be completed. The hardware, as well as its specifications and functions, are listed below.

3.2.3.1 Laptop

The laptop model ASUS STRIX DESKTOP-5AUHPKF was utilised in this project, and it has a GeForce GTX 16 Series Graphic Card, a 6 COMPUTE CORE processor, a 64-BIT Windows 10 Operating System, and 12.00 GB RAM. It was chosen to support and develop the project's software.

3.2.3.2 Mobile Device

To enable the augmented reality application, the mobile device's operating system must be Android 5.0 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 executed on a mobile device.

3.3 Project Schedule and Milestones

This section will explain the venture's timeline and success. The task is completed in one semester, which lasts fourteen (14) weeks. The assignment's scheduling 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.

Table 3.3: Description of Project Schedule and Milestone

Activity Description	Duration (Working days only)	Start Date	End Date
1. Brainstorming	**7 days**	**1/3/21**	**8/3/21**
1.1 Select project title	4 days	1/3/21	5/3/21
1.2 Find the information related the title	3 days	6/3/21	9/3/21
2. Proposal	**11 days**	**15/3/21**	**26/3/21**
3. Project Preparation	**13 days**	**27/3/21**	**9/4/21**
3.1 Install the needed software	4 days	10/4/21	14/4/21
3.2 Learn how to use the software	9 days	15/4/21	24/4/21
3.1 Analysis	**14 days**	**25/4/21**	**9/5/21**
3.1.1 Describe project background	2 days	10/5/21	12/5/21
3.1.2 Identify target user	1 day	13/5/21	14/5/21
3.1.3 Identify project significance	1 day	15/5/21	16/5/21
3.1.4 Define literature review	5 days	17/5/21	22/5/21
3.1.5 Identify project methodology	2 days	23/5/21	25/5/21
3.1.6 Analysis project requirement	2 days	26/5/21	28/5/21
3.1.7 Review project plan	2 days	29/5/21	31/5/21
4. Development	**71 days**	**29/3/21**	**7/6/21**
4.1 Develop scene	15 days	30/3/21	7/4/21
4.2 Create video	7 days	8/4/21	15/4/21
4.3 Integrate multimedia element into Unity	15 days	16/4/21	1/5/21
4.4 Develop user interaction	35 days	2/5/21	7/6/21
5. Testing	**10 days**	**8/6/21**	**18/6/21**
6. Development	**7 days**	**19/6/21**	**26/6/21**
6.1 Edit scenes	4 days	27/6/21	1/7/21
6.2 Improve interface	3 days	2/7/21	5/7/21
PSM 2			
7. Development	**57 days**	**27/6/21**	**22/8/21**
8. Testing	**10 days**	**23/8/21**	**2/9/21**

8.1 Testing	5 days	23/8/ 21	28/8/21
8.2 Evaluate	3 days	29/8/21	1/9/21
8.3 Publish	1 day	1/9/21	2/9/21
9. Documentation	**10 days**	**23/8/21**	**2/9/21**
10. Final Preparation	**16 days**	**3/9/21**	**19/9/21**
10.1 Submit project report	1 day	3/9/21	3/9/21
10.2 Present final project	1 day	3/9/21	3/9/21
10.3 Make correction project report	8 days	4/9/21	12/9/21
10.4 Finalize project report	8 days	4/9/21	12/9/21
10.5 Submit final project report	6 days	13/9/21	18/9/21
10.6 Project complete	1 day	19/9/21	19/9/21

3.4 Conclusion

This chapter summarises all of the investigations and discusses the research that has been conducted prior to the start of the next stage, as well as the structure of the inquiry and plan that will be established. This stage is used to assess the client's demand and the necessity to solve it, as well as to build a solution based on that need. Developers can learn what users desire and what functions should be added to the app by doing a requirement analysis. To improve the development experience, instances, hardware, and software are the requirements that must be met. The project can be completed on time thanks to the milestones and project timeline. The project design will be addressed in the next chapter, along with the project's progress.

CHAPTER 4: DESIGN

4.1 Introduction

This chapter elaborates on the findings of the review conducted in the previous chapter. The design step includes several advancements 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 premise. The developer will acquire a basic outline on what to add to the project interface by sketching the idea, layout, and design. In the next chapter, we'll go over the process of creating this design application in greater detail.

4.2 System Architecture

The system architecture provides a high-level overview of the total application. The system architecture of Augmented Reality is made up of numerous pieces. The application "Husna Homestay Jementah Augmented Reality Business Card" is a marker-based AR app. The Husna Homestay's image card serves as the application's identifier. The user must scan the flyers with their phone camera, and the detection marker will then render a Husna Homestay Jementah AR card from the Vuforia Engine database based on the marker ID. The application will process the visual rendering and load the scene after the user grants permission to access the camera. After then, the user can interact with the card. There are a total of 5 planes that can be interacted with. To improve the user experience and usefulness of the card, a few buttons will be included in the application, and users will be able to use them to further enrich their experience by clicking on them, which will guide them to launch specific applications based on the icons presented. There are also promotional video playback tools, which allow users to interact with the app to play and pause videos. The Husna

Homestay Jementah AR card may be viewed and interacted with on the phone screen. Finally, a 3D model that replicates the homestay representation is also available.

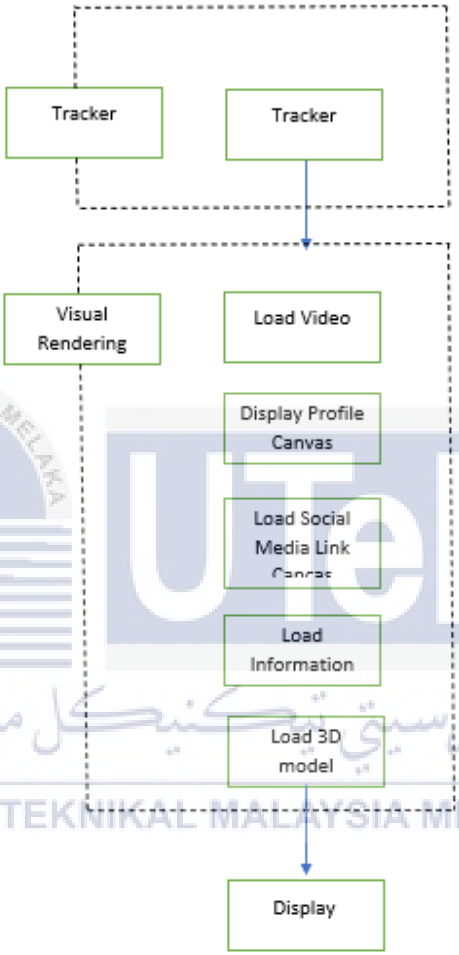


Figure 4.1: The System Architecture of Augmented Reality

4.2.1 Marker Card for Husna Homestay Jementah AR

The card image created as a marker for this project is shown below. For this project, the marker will be used to allow users or audiences to scan the card image and experience augmented reality technology.

Figure 4.2: Marker Card for Husna Homestay Jementah AR

4.3 Preliminary Design

The preliminary design is an architectural design of the application at a high level. The interactive storyboard, user interface design, video playback design, navigation design, logo design, and card are some of the most significant aspects for developers to consider while implementing the interface design.

4.3.1 Storyboard Design

This Husna Homestay application's storyboard will be separated into several parts. To begin, the user can view the application's cover or scan marker interface, which they must scan. The user is then presented with an interface that allows them to see which module canvas they wish to interact with on the main page. Image card target, Promotional Video playback canvas, Intro canvas, Social media link canvas, and Information canvas are among the 5 modules canvas and 1 3D model included in this programme. The user will open the mobile app and scan the target card image. Once the marker has been identified and tracked, a menu will appear on the screen, displaying all of the application's functions. The user can choose whether to play or pause the promotional video. The user can then open all of the social media applications available by clicking the icon, such as Whatsapp, Facebook, Instagram, and Position, where the user will be shown the location of the homestay inside the programme to open and redirect it to the Husna Homestay AR social media platform. This will provide the user with more information about the homestay, as well as the ability to contact the owner via Whatsapp or make a reservation through the social media site. Lastly, this AR also have a scrollable section which represent the score review breakdown and nearby places around the homestay.

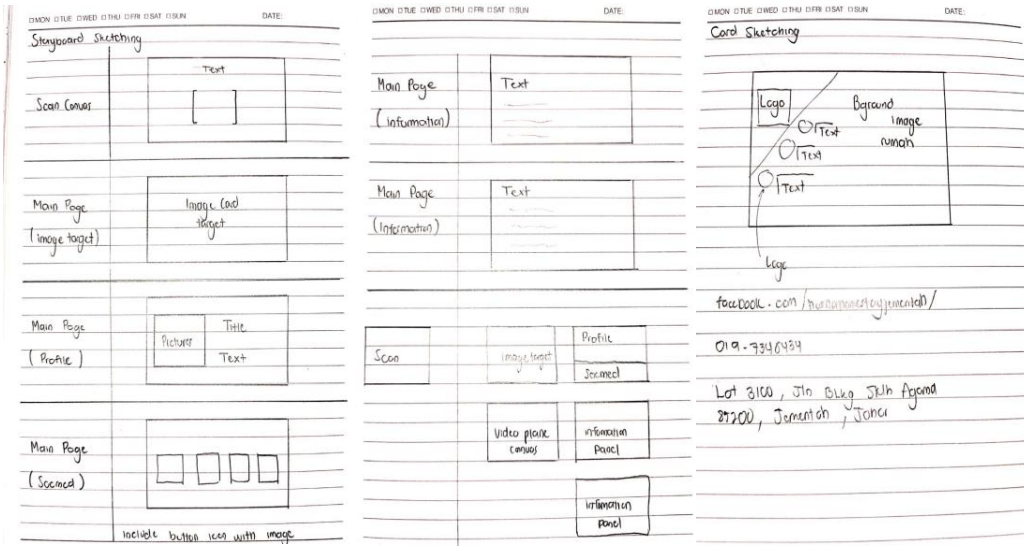


Figure 4.3 Storyboard of Husna Homestay AR

4.4 User Interface Design

The user interface serves as a channel for the client to interact with the expanded reality. It is vital because the majority of the excellent augmented reality application is dependent on the amount of clients who can see how to use the augmented reality application. As a result, the approach to user interface design must be appropriate in order to make communication between the client and the enhanced reality attractive. Navigation design, Logo design, Card design, and information are the three main components of a user interface.

4.4.1 Navigation Design

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

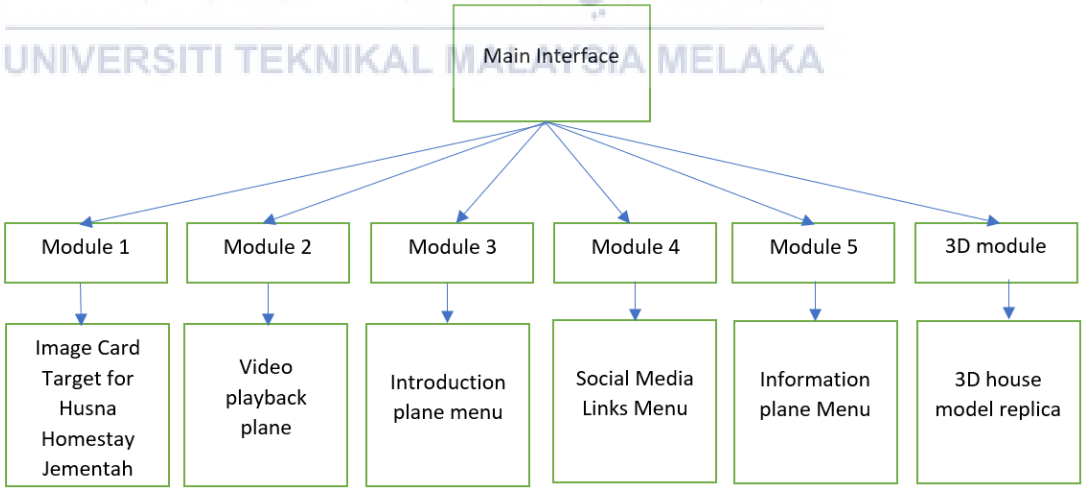


Figure 4.4 Flowchart for navigation design

4.4.2 Logo Design

The logo of this mobile application and card has been designed by including the pattern of Husna Homestay Jementah in Augmented Reality.

Figure 4.5 The logo for the Husna Homestay AR mobile application

4.4.3 Card Design

The card image serves as a marker for the Husna Homestay Augmented Reality mobile application in this project. This application's card features a subject of accommodation. In the card, there is some information about the homestay design that is related to the topic.

Figure 4.6 Card Design

4.4.4 Metaphors

This application's design is based on the illustrate image. The design of this application has only one theme. The theme chosen was a homestay/accommodation.

4.4.5 Template Design

This application's UI is not based on a template. The design was made by following to the defined requirements. The card's template was produced by the developer itself.

4.5 Conclusion

Finally, the design phase is critical for developers because it is at this step that they will receive the idea for the application's design. When it comes to user interface design, the navigation design makes it easier for people to use the system. Finally, the system design will be develop from this step. The project's implementation, which includes the method and activities of implementation as well as the project's progress, will be covered in Chapter Five.

CHAPTER 5: IMPLEMENTATION

5.1 Introduction

The way to actualizing and making the sight components into this Augmented Reality will be explained throughout this implementation stage. In this section, we'll go over the entire process of creating media. Realistic, video, liveliness, and collaboration are all part of the media development process. This stage also reveals the cycle for creating all of the media that was previously recorded. At that point, all media components will be sorted and applied to Augmented Reality. The rendition control strategy as well as the earth arrangement will be studied in this section. The point is that the insight into the module, the item's adaption, and the path to completing this project are all important. While doing the item setup on the board, some control must be taken.

5.2 Media Creation

The creation of substance in any sphere of correspondence, diversion, or data is referred to as media creation. Whatever procedure and approach that the parts expected to experience could be recorded even more conclusively and clearly throughout the cycle will be accounted for. To make the final usable item, the full part will be acquired.

5.2.1 Production of Text

One of the most prominent 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 depth. The language and sentences used in this effort are straightforward and plain, with the purpose of improving the crowd's understanding.

The entire content used in this project is written in the Signed Distance Field (SDF) font style. Different types of SDF fonts are used in the letters to make them more simple and apparent for everyone, and each word is important to see in this task. This also allowed for smooth high-resolution that could function under the same "layout guidelines," resulting in a significant gain in readability and comfort. SDF fonts retain a distance value that may be converted into display pixels later at any resolution using a custom graphics shader, rather than individual display pixels of a text glpyh. Unlike normal pixel fonts, which become pixelated at higher resolutions, SDF text may leverage those distance values to provide fine detail at QHD and higher resolutions. It will also produce the greatest results on mobile device screens. There are three different types of SDF font styles used in this project: Aurach Heavy SDF, Bangers SDF, and Anton SDF

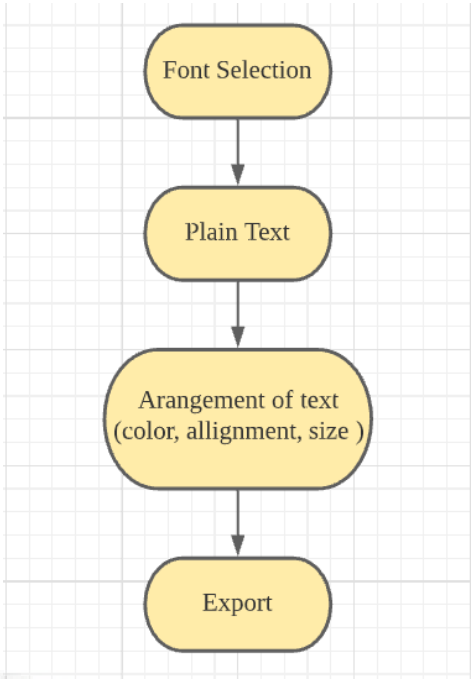


Figure 5.1 The process of the Elements

5.2.2 Production of Graphic

This venture's graphic is the visual image or configuration it creates. It is important to make this project even more interesting and fascinating. For the guidance application, image target card, and vector resource for the substance, the graphic component is provided. In Adobe Illustrator, the textual style and realistic elements will be adjusted. This project is 2D realistic throughout the entire project, which was created using Adobe Illustrator. To ensure that the structure of this project is interesting and realistic, an innovative work sketch was created. Following the completion of the development sketch, the sketch will be duplicated 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. The graphic manufacturing process is described in Figures 5.2 and 5.3 below.

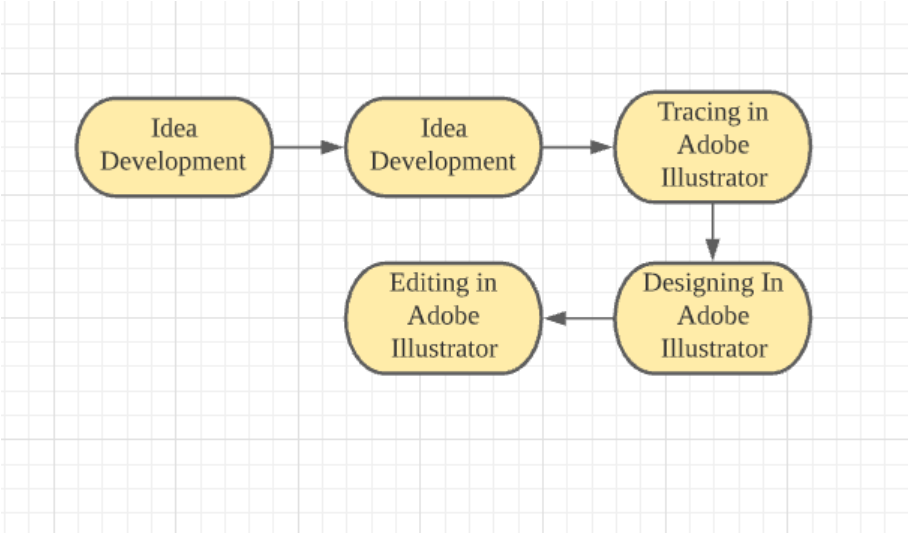


Figure 5.2 Production of Graphic for Card

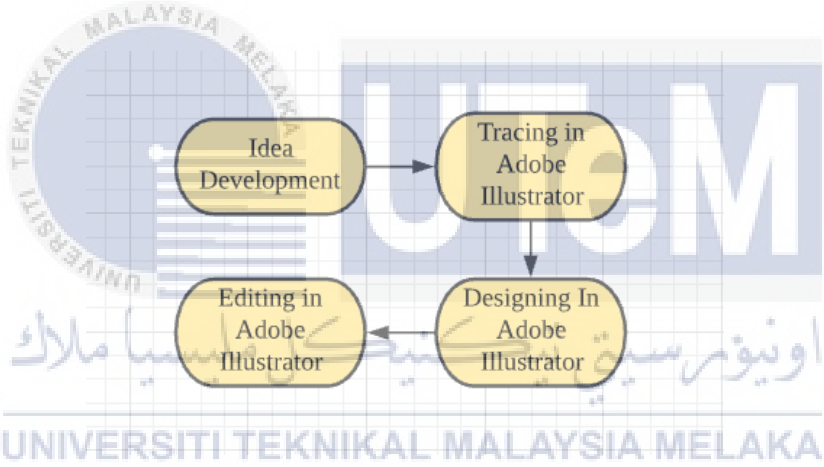


Figure 5.3 Production of Graphic for Icons and Vectors Asset

5.2.3 Production of video

The objective of using video is to draw in the audience while visualising and delivering information to them. The use of video is a good way to attract users and delivering information to the audience. Aside from that, it can help deliverables become more memorable. Pre-production, production, and post-production are the three primary stages of video production. In the pre-production phases, the storyboard has been made to enable in visualizing the

video will be shot. The production phase includes the actual filming of the video according to a defined timeline. Finally, all of the parts are edited and combined in post production to make the final video. All of the video production was done entirely in Adobe Premier Pro, and it was exported in various quality levels to ensure that it could be imported into Unity.

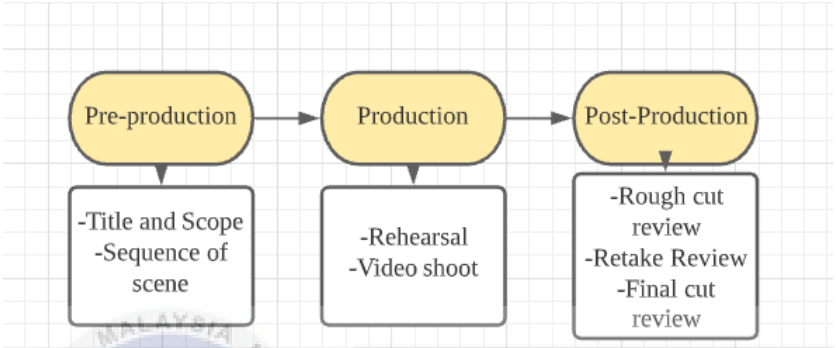


Figure 5.4 Production of Video

5.3 Media Integration

All of the Augmented Reality content element is integrated in Unity and Vuforia Engine. Importing the image of the target card into Vuforia for setup purposes. In Unity, the target card has the same setup. 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.

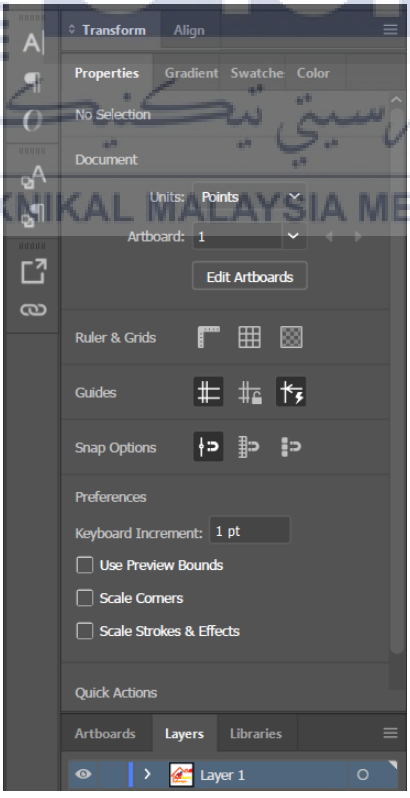
5.4 Product configuration management

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

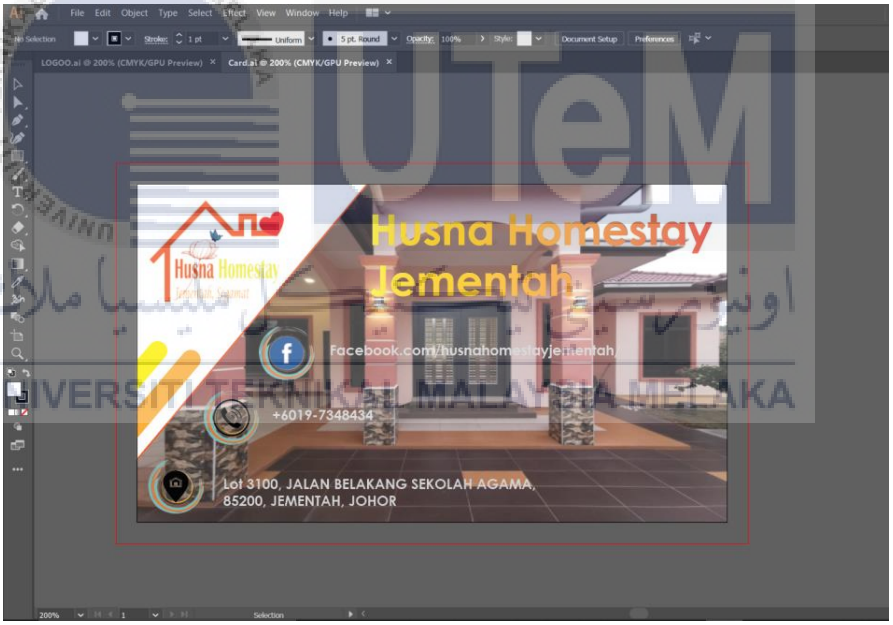
5.4.1 Configuration environment Setup

The setting necessary in the programme used to build and create the substance is clarified by the configuration environment setup. To create Augmented Reality content, several software such as Adobe Illustrator, Adobe Premier Pro, Unity, and Vuforia Engine were 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 functions properly. This project's setup settings is shown in Tables 5.1.

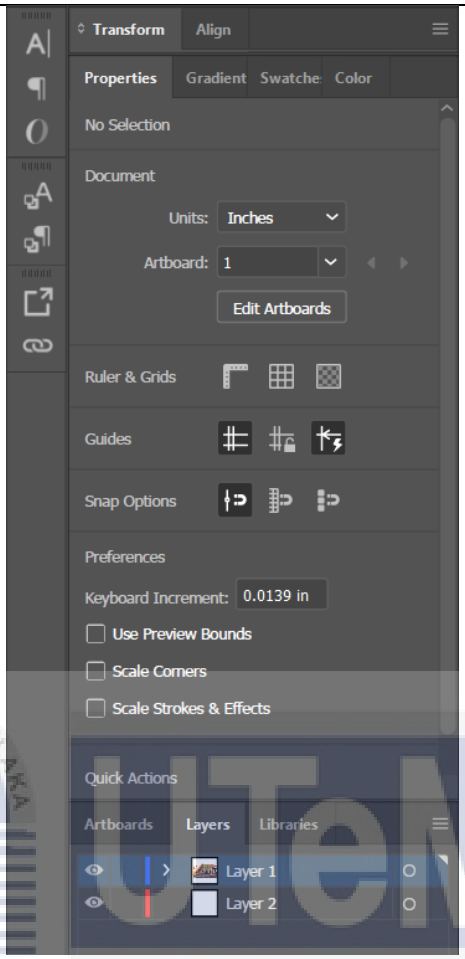
Table 5.1 Environment Setup

Application Software	Setting
Adobe Illustrator	 **Properties Setting**

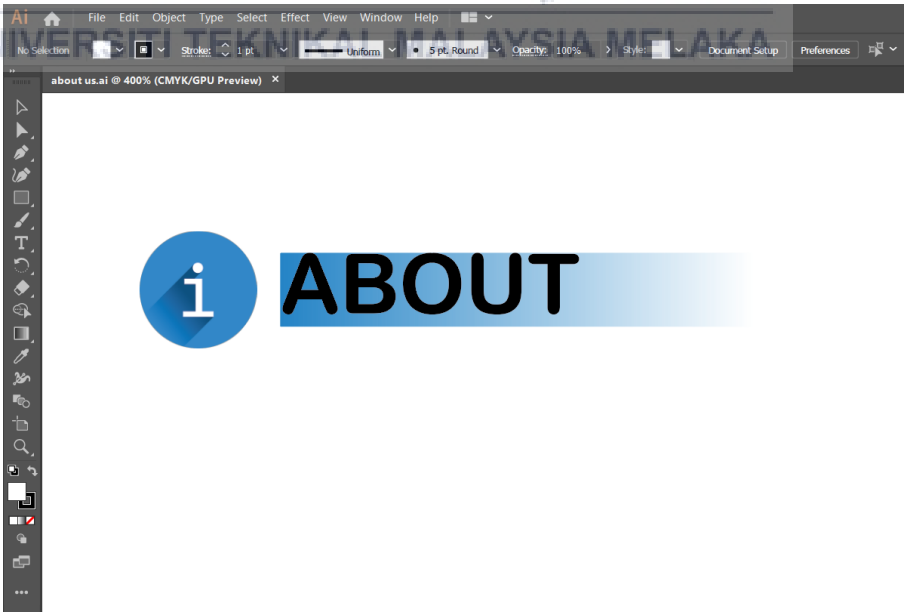
Designing Logo



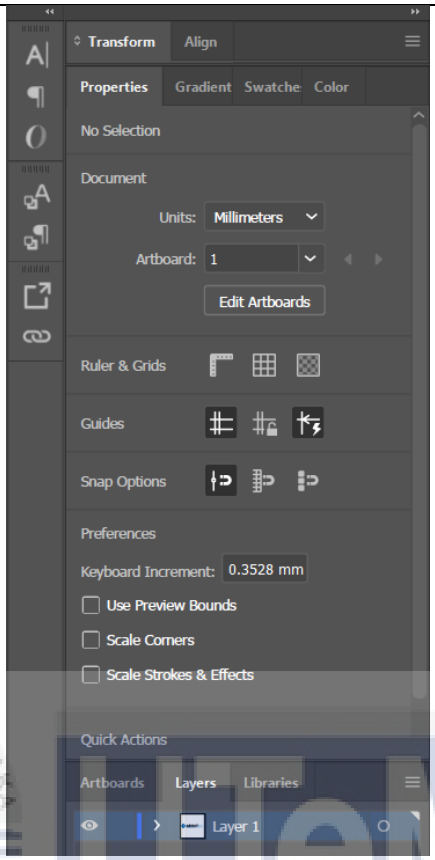
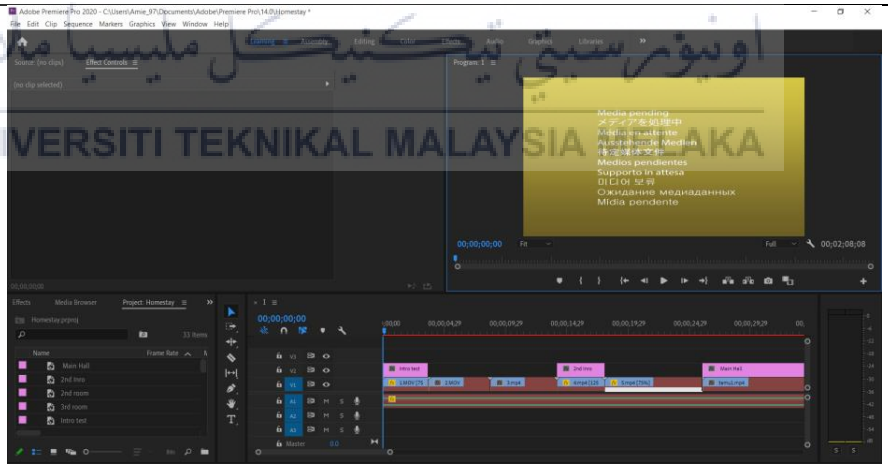
Designing Image target card

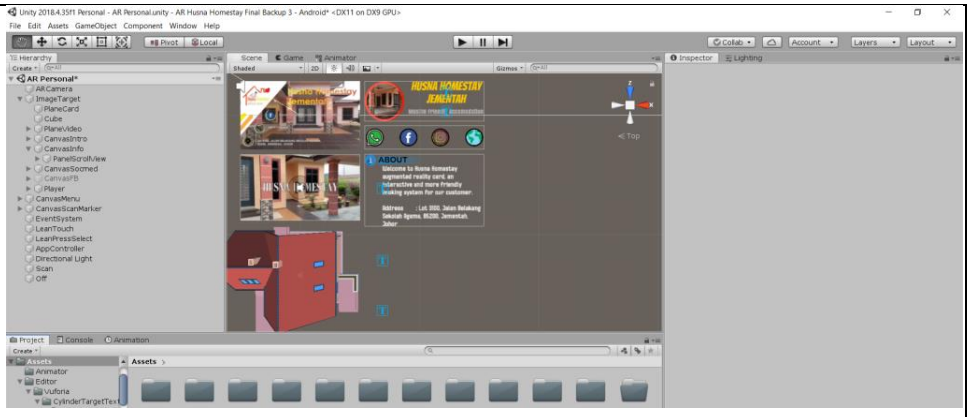
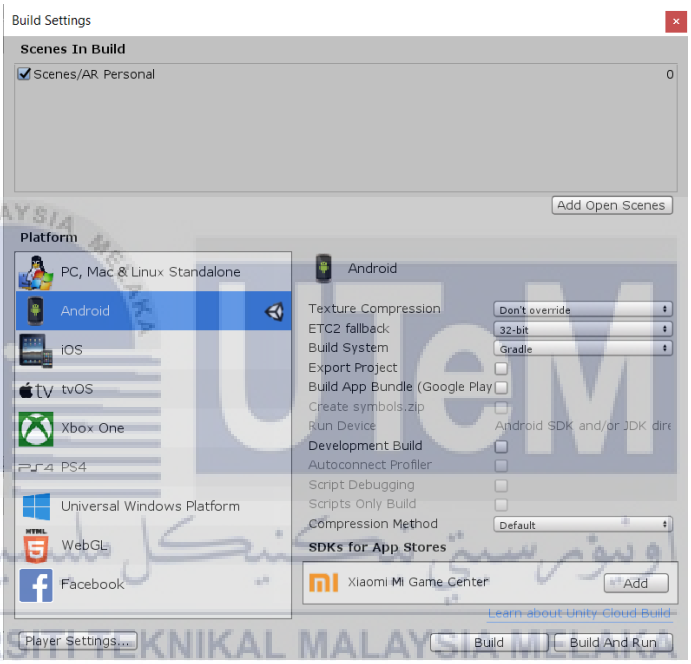


Properties Setting



Designing Icons

	 **Properties Setting**
Premier Pro	 **Creating the promotional video**

Unity	 **Sample Scene**  **Build Setting**

5.5 Implementation Status

Implementation process status is use to show the development progress from time to time. This progress need to be record to now the version and the details of progress that been made. Table 5.4 shows implementation status for this project.

Table 5.2 Status of component implementation

Component/Module	Description	Status
Module 1 (Research and Explore)	Gathering information related with this project include the media elements to be applied	Completed
Module 2 (Create Development Plan)	Sketching the design concept as a guideline	Completed
Module 3 (Design content)	Process of designing all media elements in the project.	Completed
Module 4 (Development of multimedia element)	Combination of all multimedia element such as text, graphic, and interaction	Completed
Module 5 (Implementation of Augmented Reality)	Process of combining essential elements to produce the end product.	Completed

5.6 Conclusion

In conclusion, the implementation phase is important for developing this application. The overall production for the graphic has been discussed in this chapter. The media integration has shown the process of developing the scene and the role of each software used in this project. The following section is where all the testing will be made. There are a few necessities in the following section for cases framework testing, item quality, example target clients, maker, and partner and colleagues. In light of the outcome, it will decide the improvement required later on. The next chapter will be discussing about the testing and the evaluation of this project that has been carried out.

CHAPTER 6: TESTING

6.1 Introduction

After the installation stage has been completed, testing must be conducted. After the project has completed all of the cycle and process development stages, the testing stage will explain how to test and analyze the project's output. This testing and assessment must be completed in order to ensure that authentic data can be measured and compared in order to ensure that the aim set forward in Chapter 1 can be met. All of the venture's features must be tested before it can be approved to verify that it will run smoothly and according to plan. The purpose of the testing phase is to see if the project's goal has been met or not. The test user, test schedule, and test method for gathering and analysing real data are also discussed in this chapter. The project's objectives will determine the project's success.

The three types of users who must be dealt with are multimedia experts, target users, and subject matter experts. Three different categories of users will put both types of testing to the test. Multimedia experts will test the functionality, while the project's target user will conduct user acceptance testing. Furthermore, subject matter specialists will focus on the product's content and details and also the acceptance test.

An Augmented Reality platform must keep up with evolving of technology in this era of technical advancement and innovation. Advanced technologies mobile devices such as smartphones should be fully utilised because new technology can be an incentive to a Homestay promotion campaign.

6.2 Test Plan

Test user, test schedule, and test strategy are the three sections of the test plan. The full test plan for this testing stage will be promptly clarified in this section. This is a strategy for getting the testing stage off to a good start. The test plan is fundamental since it will address the most important issue in testing in order to ensure that it will persuade the user to complete the current task's goal. The developer and designer should decide on the proper test with the purpose of making it work for the objective user. All of the item testing ranges, the project that will be tested, the time that will be tested, and all of the people who will be testing the project will be recorded and archived in the test plan. It is crucial and critical to ensure that the project stream is on track and that everything is going according to plan.

To detect a flaw in a product, a test plan must be prepared as a strategy for inspecting and testing the product before it is put into full operation. Before a product to be completely operational, it must work to its full potential, smoothly, effectively, and efficiently during testing. To ensure the effectiveness of the testing phase, all details regarding the testing module, testing aspects that must be considered, who will execute the test, and the duration of the testing will be clearly described in the test plan.

The entire significant aspect for testing will be distinguished, such as the test environment and platform for testing, to ensure that the testing runs smoothly. The rules for completing the testing will be the test strategy. The selection of users to test the project is vital since their feedback will be invaluable in improving and updating the project.

6.2.1 Test User

The number of participants in the testing, as well as the tester for this project, will be shown by the test user. For the development of Husna Homestay Jementah Augmented Reality Business Card, the Multimedia Expert, Subject Matter Expert, and the actual Target User are the three unique groups of users who will conduct the test during the testing stage.

6.2.1.1 Multimedia Expert

A multimedia specialist is someone who is knowledgeable and experienced in the fields of multimedia and information technology. The project will be tested by two people. This is due to the fact that the application must first run before it can be delivered to the user. This test is done at the end of the development process and before the product is released. A demonstration with the subject matter expert will be conducted through an online session where the developer will test the application and every functionality will be tested within the session with the multimedia expert. A functionality test docx will be handed over to the multimedia expert beforehand to be marked while presenting.

6.2.1.2 Public

This category will include both male and female individuals. This project's primary target audience is the general public. They will be 35 respondents who will be random and will test the product independently. They tested depending on their grasp of the project and acceptance of it. It is carried out in order to gather input 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 finished product is made available to the public. The goal of user acceptability testing is to see if the intended user of this project understands and uses the programme. The respondents must test the application and complete a questionnaire focusing on the project's effectiveness and substance.

6.2.1.3 Subject Matter Expert

An expert in the homestay industry can assist with improving the product or overcoming specific challenges. The proprietor of a homestay was chosen to take the test.They will independently test the product and provide feedback on the app. For AR Business Card Husna Homestay Jementah, this testing is being done by the Husna Homestay owner and other homestay owner to see if the information or content in the application is appropriate.

Table 6.1 Test User for testing

Testing	**Multimedia Expert**	**Target User**	**Subject Matter Exper**
Profession	A) **Name:** Mohammad Syafiq Bin Enchek Muda **Position:** Software Developer B) **Name:** Abdul Hanna Bin Yusop **Position:** Software Engineer	Public	A) **Name:** Yusof Bin Omar **Position:** Owner of Husna Homestay Jementah B) **Name:** Rasul bin Makrup **Position:** Owner of AR Homestay C) **Name:**

			Khairul Anuar Bin Daud **Position:** Owner of Khairul Ruzaini Homestay Bandaraya Melaka D) **Name:** Mohizan Bin Mokhtar **Position:** Owner of Niza Homestay E) **Name:** Muzakir bin Diyanti **Position:** Owner of Yam Homestay
General Information	Have experience in multimedia and IT field more than 3 years	Wide range of age groups from age 19-30 and 30 years and above.	Working experience from below 1 year – 3 years and above
No of respondent	2 respondents	35 respondents	5 respondents

6.2.3 Test Environment

The test environment will be conducted online in accordance with the government's standard operating procedure. The user will be given the AR Husna Homestay Jementah .apk file to test and evaluate using the Google form provided as a record of the test results. A smartphone running Android 4.4 KitKat or higher, as well as an FHD display and a camera, are necessary for all testing. The smartphone is required for the AR Husna Homestay Jementah apk application to be installed. The hardware configuration to test the system will be described in the Table 6.2 below.

Table 6.2 Hardware Configuration

Hardware	**Purpose**
Smartphone	- Device to test the system. - Device to answer the Google Form questionnaire.
Internet connection	- Required to answer the Google Form questionnaire.

The public user were informed about the project's goal, what they may expect from the system, and what they need do for the post-test phase prior to the testing period. After testing the system, a Google Form questionnaire was created for users to fill out.

6.2.3 Test Schedule

If there is no time management for testing, running tests among testers is challenging. After a demonstration on how to use the AR Husna Homestay Jementah mobile application that has been suggested to the experts, a user test on the application's functioning will be conducted.

Table 6.3 Test schedule for testing

Tester	Number of Tester	Testing Date	Testing Vanue	Platform
Multimedia Expert	2 people	23/8/2021	Anywhere	Meeting Platform
Public	35 respondent	24/8/2021-28/8/2021	Anywhere	Google form
Subject Matter Expert	5 respondent	24/8/2021-28/8/2021	Anywhere	Google form

6.3 Test Strategy

It is critical to establish the proper test strategy in order to meet the project's objectives. The test strategy will detail how the testing will be conducted and directed, as well as the type of testing that will be conducted based on the item. Multimedia expert, subject matter expert, and target user tests are three different types of tests that occur at different stages of the process. Testing has a specific goal, and the test approach must be well-planned to ensure that the goals are met. Each tester will be assigned to a specific test type. On this question, they can score themselves on a scale of one to five, ranging from strongly disagreeing to highly agreeing. The scoring data of the questionnaire were shown in Table 6.3.

Table 6.4 Scoring details for User testing

1	2	3	4	5
STRONGLY DISAGREE	**DISAGREE**	***NEUTRAL***	**AGREE**	**STRONGLY AGREE**

6.3.1 Classes of Tests

There are three tests carried out which is unit testing, functionality testing and user acceptance testing. Each is described below.

i. Unit Testing

This test is conducted by the AR Husna Homestay Jementah developer. This is to ensure that systems run without fail. Since the beginning of development, this test has been performed on a regular basis.

ii. Functionality Testing

This test ensures that AR Husna Homestay Jementah is working appropriately. The test was conducted by two different developer. Both of the developers are not affiliated with AR Husna Homestay Jementah, although they have created apps, website and mobile app. The test are conducted once and everything has been tested out to ensure that it was working properly.

iii. User Acceptance Testing

After the AR Husna Homestay Jementah has been successfully deployed, the end users conduct a User Acceptance Test to assess their acceptance of the system.

6.4 Test Implementation

Test implementation is the process of developing and structuring a test system, creating test data, and, in some cases, preparing test hardness and composing automated test content. During the testing phase, test implementation will specify how the testing will be applied to a certain target user. The test strategy is used to conduct the associated part between the test description and the test data. During test

implementation, the designer must ensure that all necessities are handled before beginning the testing session, which is based on the test purpose, so that the developer is prepared 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 35 complete respondents that were chosen at random and eagerly to participate in the testing phase. After the developer provides them with a clear explanation of the project, each respondent will conduct their own testing. They must test out all of the available features. At that moment, each respondent is required to complete a poll created by the developer. The questionnaire are provided in Appendix C.

6.4.2 Test Data

Once the testing session is over, the evaluation will be recorded. All of the test results are documented so that they can be evaluated. The goal of both functionality testing and user acceptance testing is to see if the project achieves the goal specified in the first chapter. The results of all the tests are gathered and examined. To determine the average rating of each question, the average ranking of each question was examined. Based on the question, each question has a distinct level of satisfaction.

Table 6.5 Test data for user testing

No	Tester	Number of respondent
1	Multimedia Expert	2 people
2	Public Target User	35 people
3	Subject Matter Expert	5 people

Figure 6.1 Questionnaire for User Acceptance Test

Figure 6.2 Questionnaire for Subject Matter Expert Acceptance Test

6.5 Test Results and Analysis

Diagrams and charts will be shown in this analysis based on the results of the overview and testing measure. The assessment testing that was done is represented in this diagram. A few charts have been created based on the information obtained from the testing results to summarise the assessment's outcome.

6.5.1 Target User

The survey is distributed to the respondent after the demonstration is finished. Real data from real users is used in both functionality and user acceptance testing. Appendix C contains the results of the functioning test. Figure 6.3 depicts the User Acceptance Test questionnaire distributed via Google Form.

A total of 35 people responded to each question. The data for User Acceptance is organised into categories as shown below.

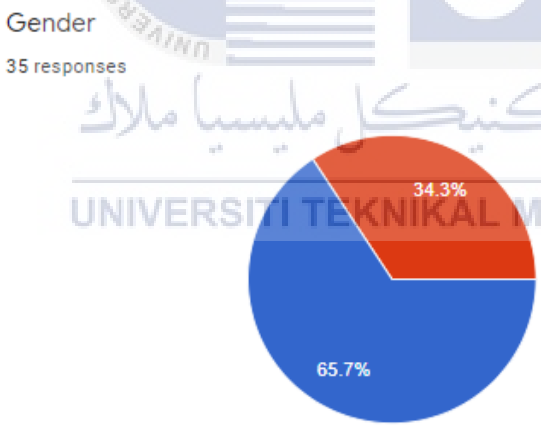


Figure 6.3 Data for Gender

The diagram shows the gender of selected user for testing this AR application. From 35 respondents, 23 respondents are Male and the rest 12 respondents are female.

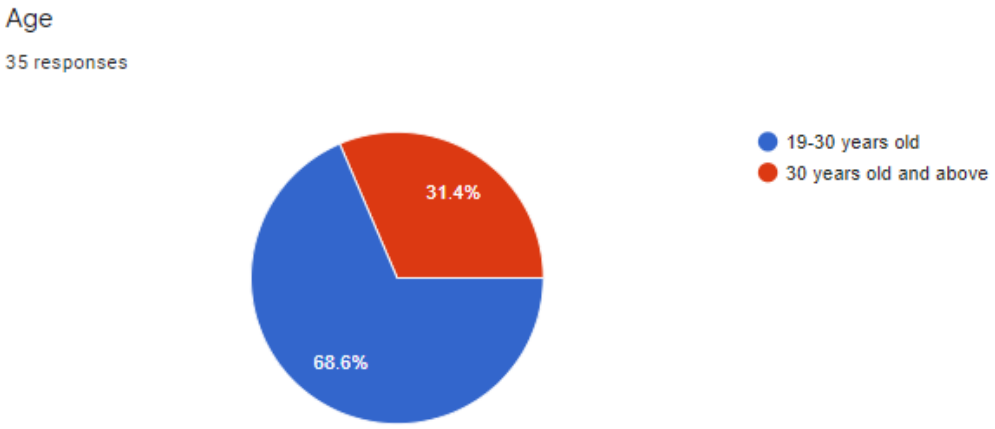


Figure 6.4 Data of age for target user

Other general information to be collected is about age, with 24 respondents mostly at around 19-30 years old (68.6%), while the rest 11 respondents is 30 years old and above (31.4%).

Next, data collected based on four categories based on user acceptance towards AR Husna Homestay Jementah. The score 1 to 5 is identified as:

1- Strongly Disagree
2- Disagree
3- Neutral
4- Agree
5- Strongly Agree

i. Perceived Ease of Use

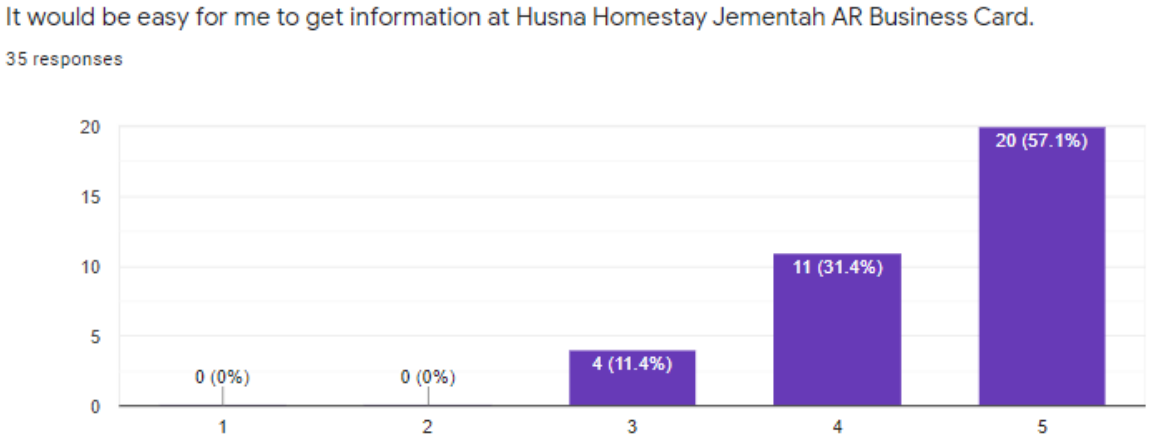


Figure 6.5 Data for getting information

Based on Figure 6.5, data shows that 20 people strongly agree, 11 agree and 4 neutral that getting information on AR Husna Homestay Jementah will be easy for them.

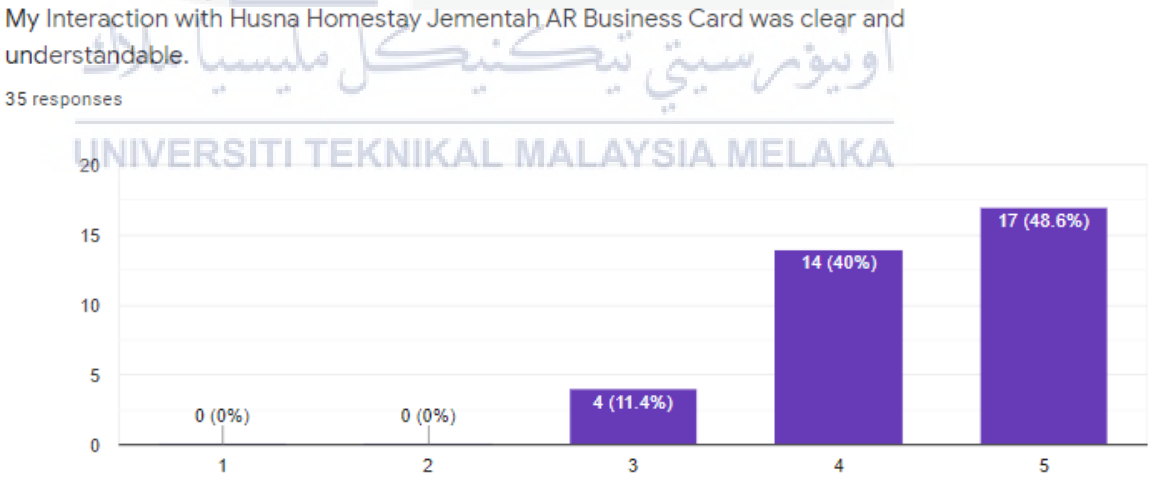


Figure 6.6 Data for clear interaction

Based on Figure 6.6, data shows 17 strongly agree, 14 agree and 4 neutral that they has clear interaction with AR Husna Homestay Jementah.

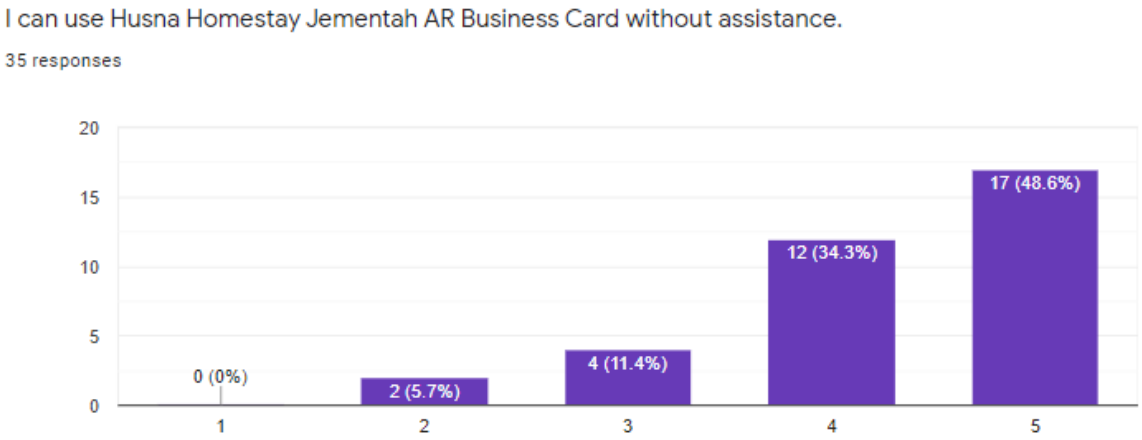


Figure 6.7 Data for using without assistance

Based on Figure 6.7, data shows 17 strongly agree, 12 agree, 4 neutral that they can use AR Husna Homestay Jementah without assistant. The constraints that lowers the score 2 respondents are unable to operate the system without the help of an assistant.

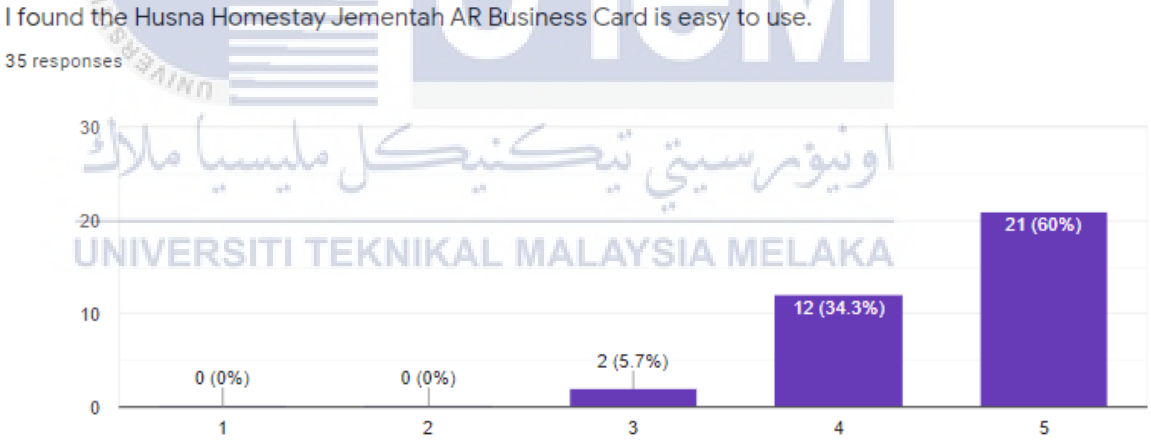


Figure 6.8 Data for ease to use

Based on Figure 6.8, data shows 21 people strongly agree, 12 agree, and 2 neutral that AR Husna Homestay was easy to use.

ii. Perceived Usefulness

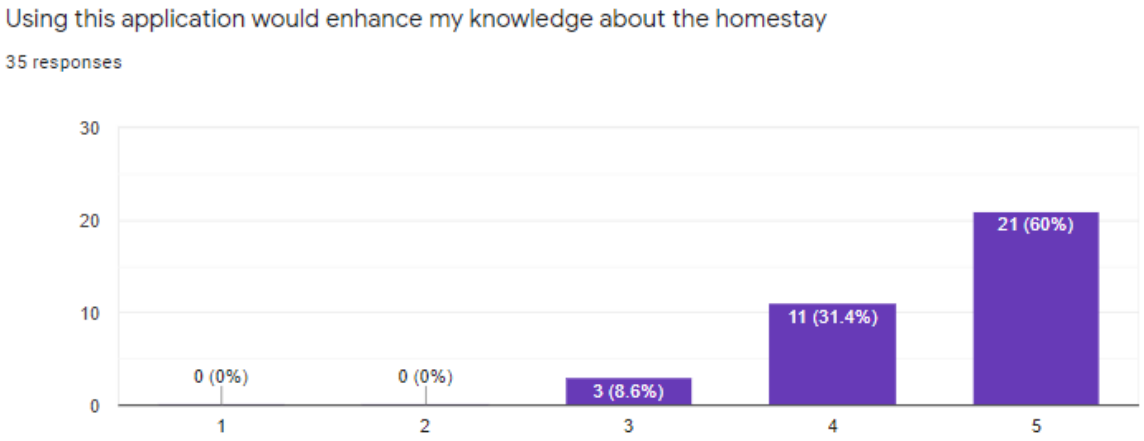


Figure 6.9 Data for enhance knowledge

Based on Figure 6.9, data shows 21 people strongly agree, 11 agree, and 3 neutral that AR Husna Homestay will enhance their knowledge about the homestay.

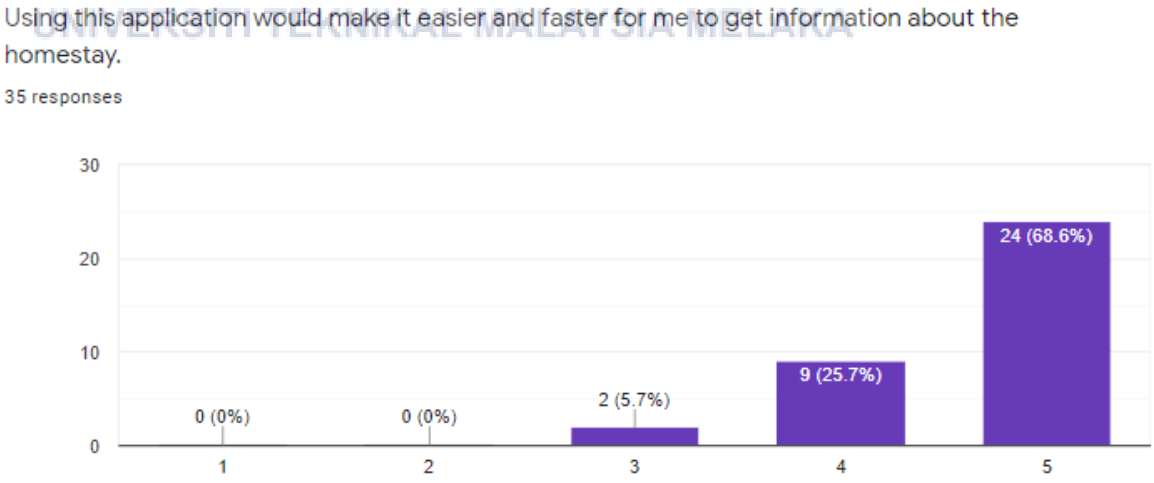


Figure 6.10 Data for easier and faster getting information

Figure 6.10 shows 24 people strongly agree, 9 agree, and 2 neutral that AR Husna Homestay would make them easier and faster getting information about the homestay.

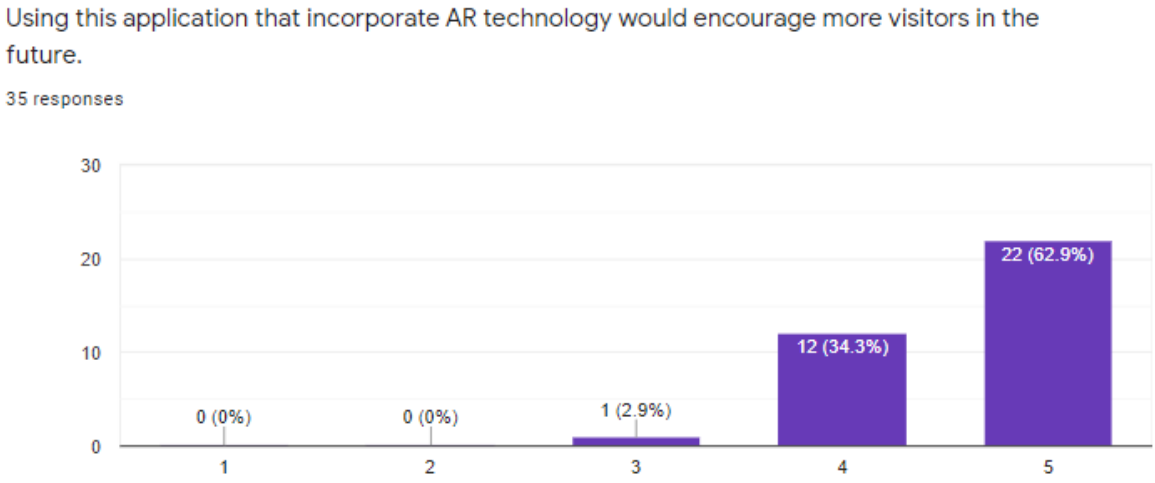


Figure 6.11 Data for encourage more visitor

Figure 611 shows that 22 people strongly agree, 12 agree, and 1 neutral that incorporate of AR technology would encourage more visitors in the future. This shows as evidence that users are more than ready to accept new ideas in marketing techniques in the future.

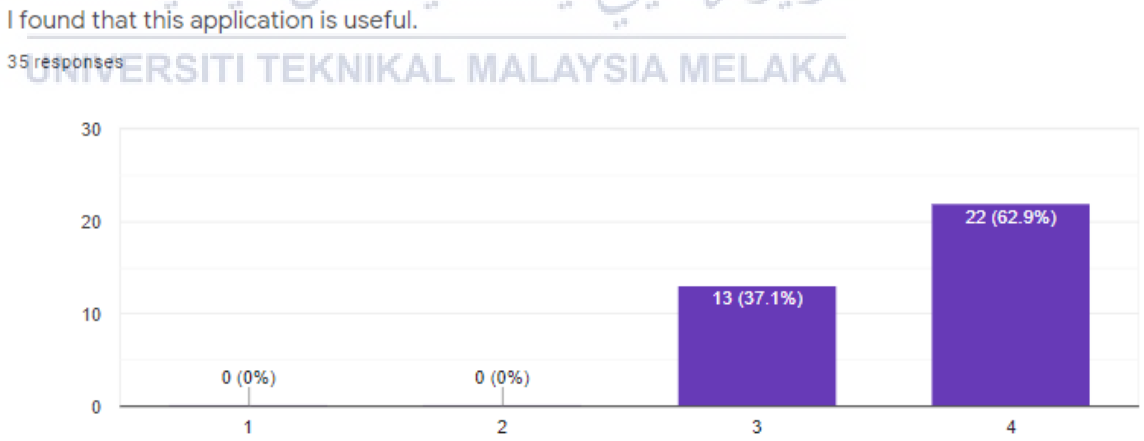


Figure 6.12 Data for useful of application

From Figure 6.12 shows the data of 22 respondent is strongly agree, 9 and the rest 13 are neutral that finds this application were useful.

iii. Attitude Towards using

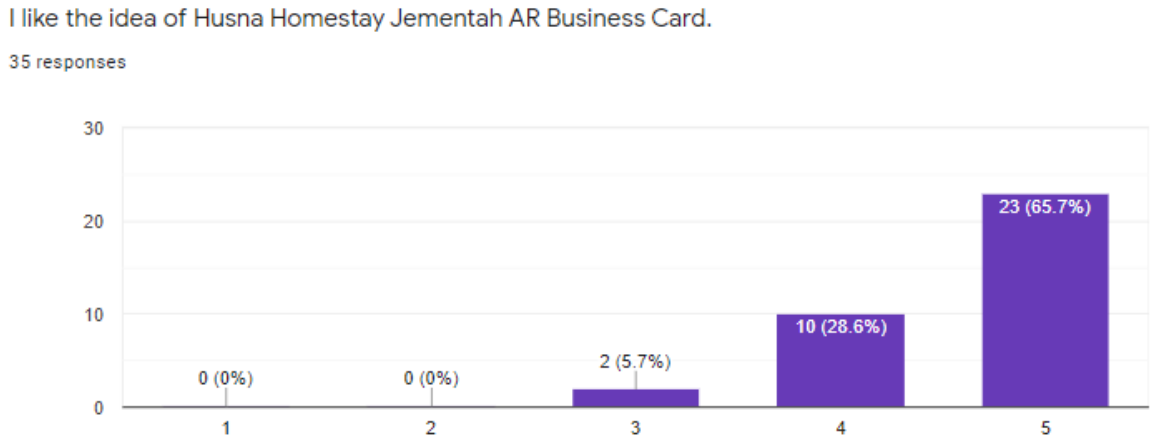


Figure 6.13 Data for idea liking

Based on Figure 6.13 the data showed 23 respondent strongly agree, 10 agree and only 2 people neutral that they like the idea of AR Husna Homestay Jementah.

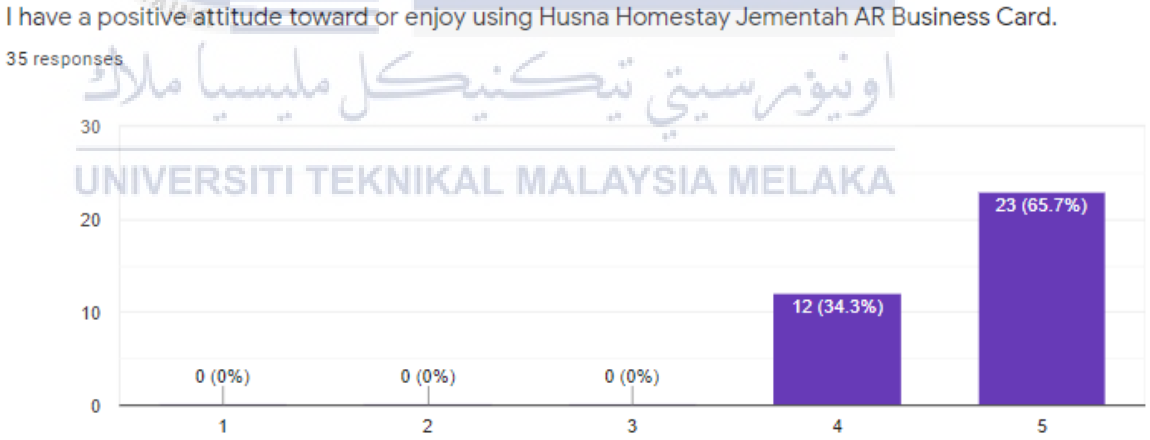


Figure 6.14 Data for positive attitude

Based on Figure 6.14 data shows that 23 people are strongly agree and 12 agree that they have positive attitude toward using the application.

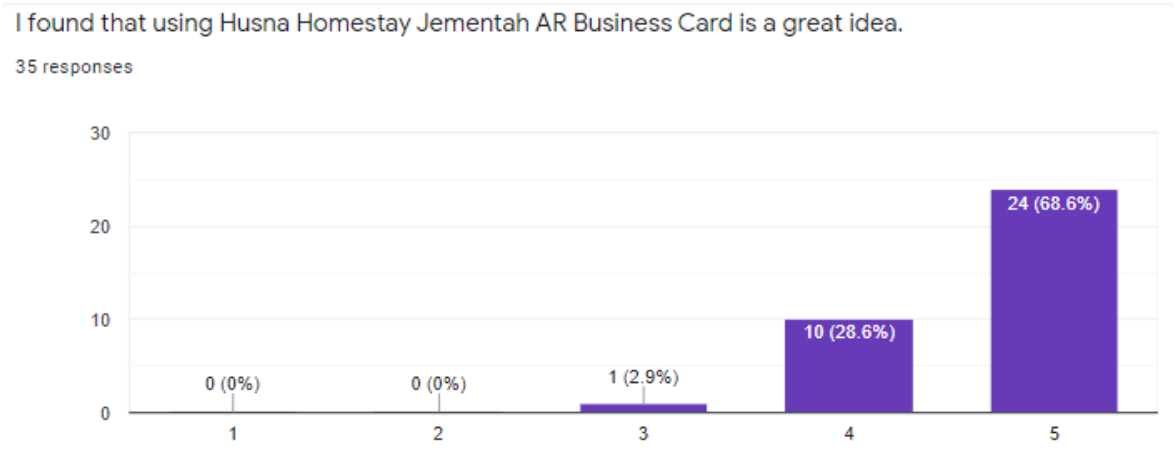


Figure 6.15 Data for using application is a great idea

Based on Figure 6.15, the data shows that 24 people are strongly agree, 10 agree and 1 neutral that using AR Husna Homestay Jementah application is a great idea.

iv. Intention to Use

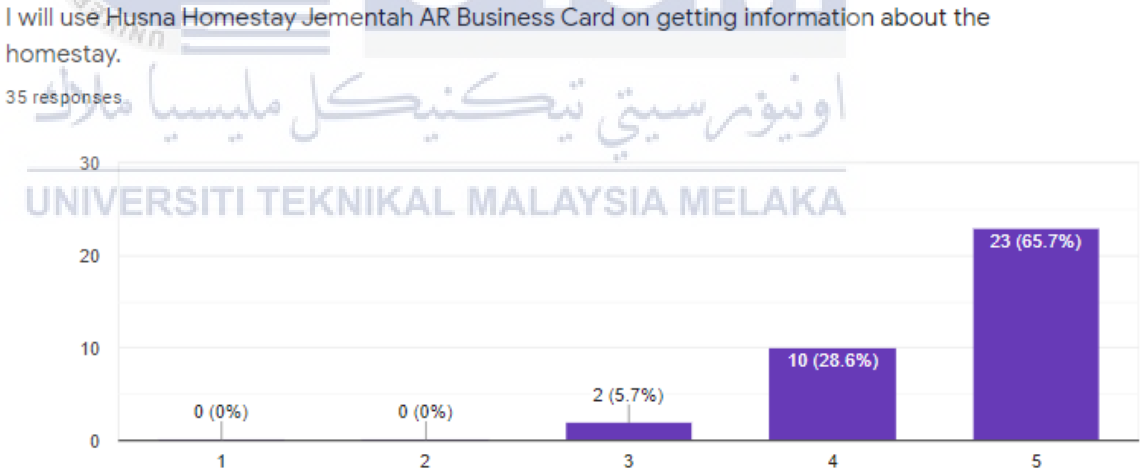


Figure 6.16 Data for intent to get information

Based on Figure 6.16, data shows that 23 are strongly agree, 10 agree and 2 neutral that they will use this application to get information about Husna Husna Jementah homestay.

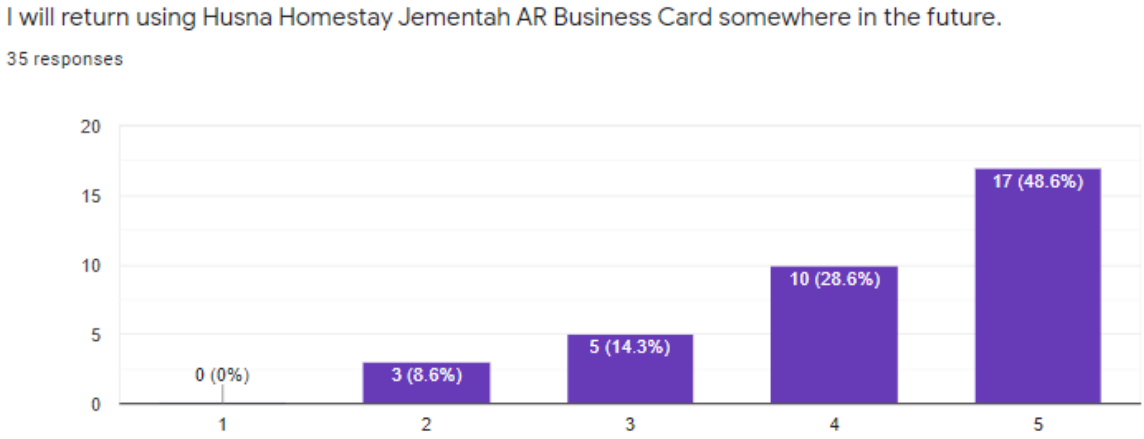


Figure 6.17 Data for return of using

From the Figure 6.17, data shows that 17 people strongly agree, 10 is agree, 5 neutral that they will return using the application. There were 3 people who disagree to go back to using the application,

6.5.1 Subject Matter Expert

The subject expert for this application is the Husna Homestay Jementah owner itself and some other around homestay owners. They are asked to evaluate the acceptance of using AR Husna Homestay Jementah application.

Figure 6.18 depicts the Subject Matter Expert Acceptance Test questionnaire distributed via Google Form.

A total of 5 people responded to each question. The data for Subject Matter Expert Acceptance is organised into categories as shown below.

Figure 6.18 Data for Respondent Name

Figure 6.19 Data for Homestay Name

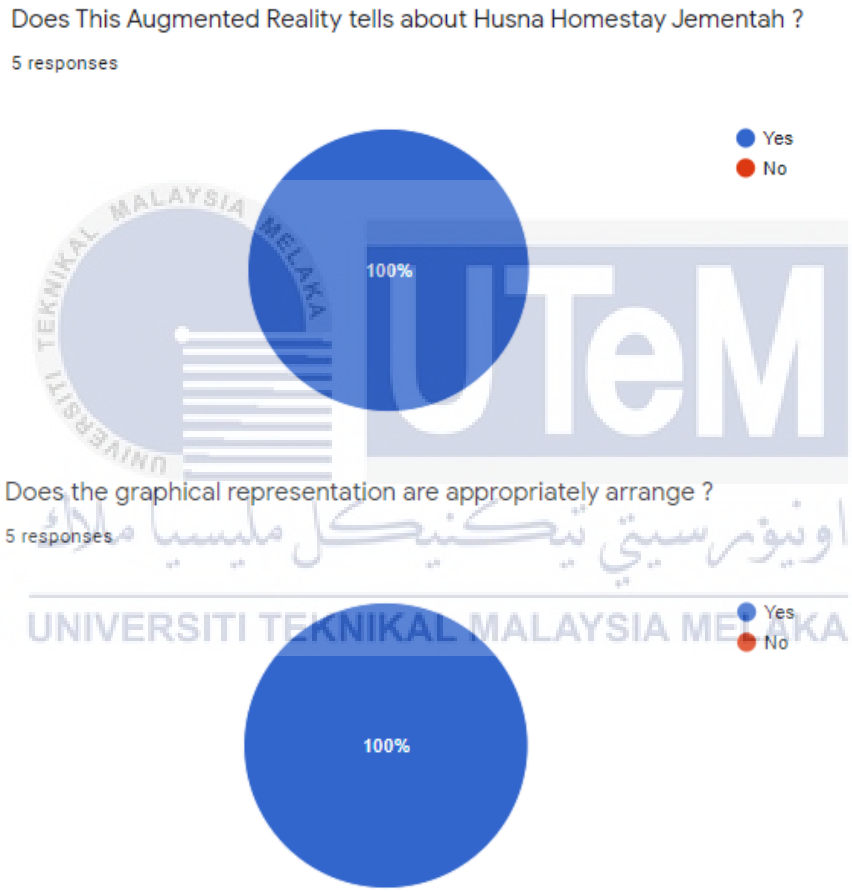
Next, data collected based on four categories based on user acceptance towards AR Husna Homestay Jementah. The score 1 to 5 is identified as:

1- Strongly Disagree
2- Disagree
3- Neutral
4- Agree
5- Strongly Agree

i. The Product Content

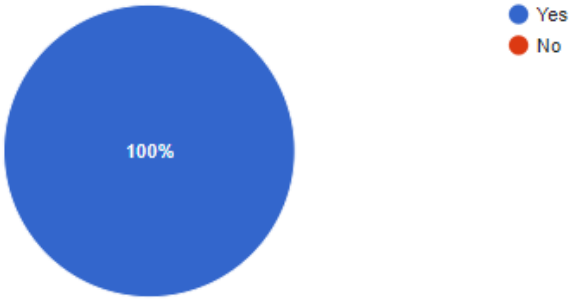
The graph below shows the result from Part A section questionnaire. All of the respondent have answered yes (100%) for this question which focused on the content and information about AR Husna Homestay Jementah application.

Figure 6.20 Graph of content of project for subject matter expert



Does the multimedia element (video) is helpful to deliver the information about the homestay ?

5 responses

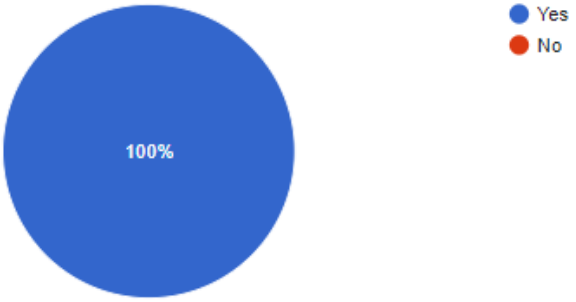


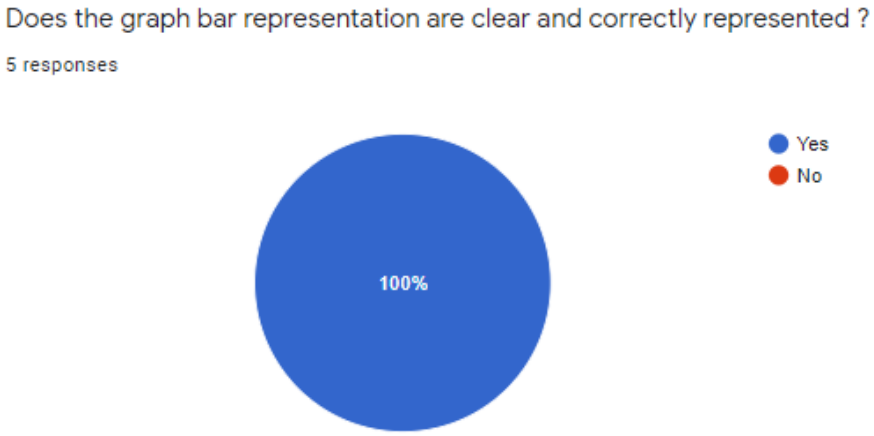
Does the multimedia element (3D model) helpful to visualize the house representation ?

5 responses

Does the social links provided direct to the appropriate website ?

5 responses





ii. The Product Acceptance

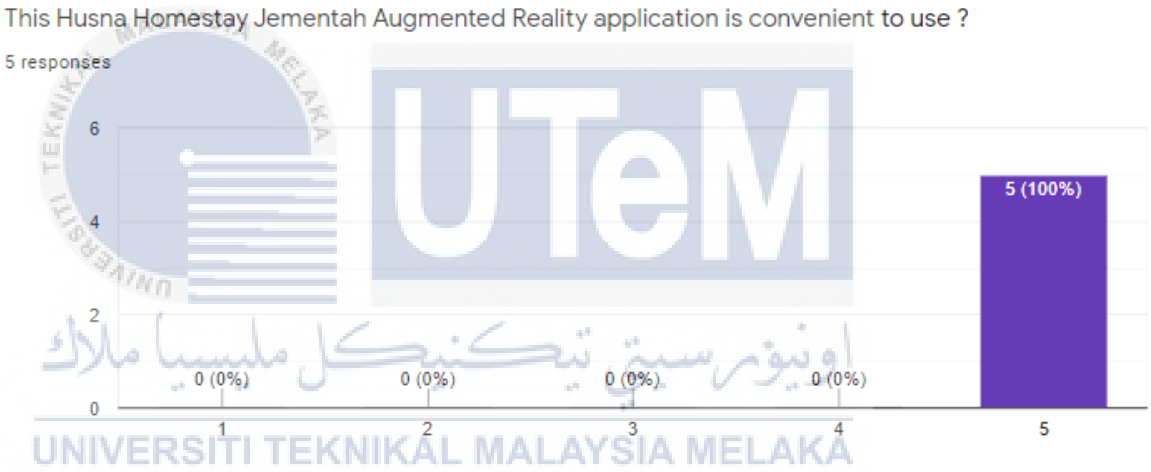


Figure 6.21 Data for convenient of use

From the Figure 6.21, data shows that 5 people strongly agree that the application is convenient to use.

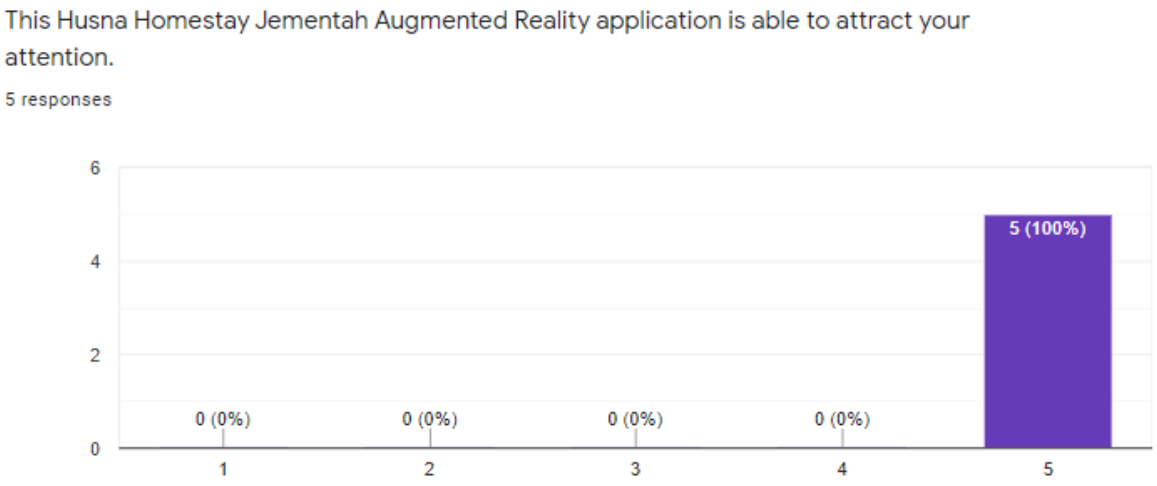


Figure 6.22 Data for attract the attention

From the Figure 6.22, data shows that 5 people strongly agree that the application is able to attract their attention.

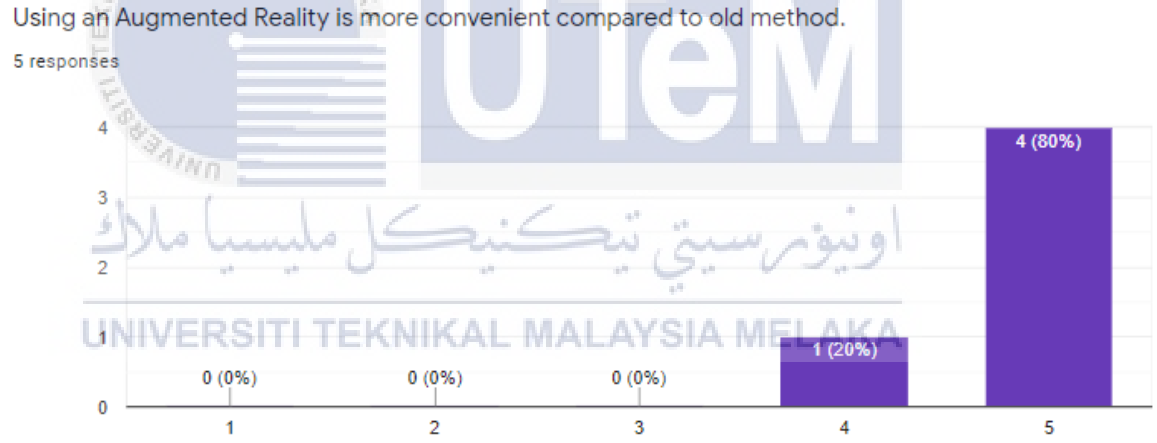


Figure 6.23 Data for convenient comparison

From the Figure 6.22, data shows that 4 people strongly agree while 1 agree using the application is more convenient compared to old method.

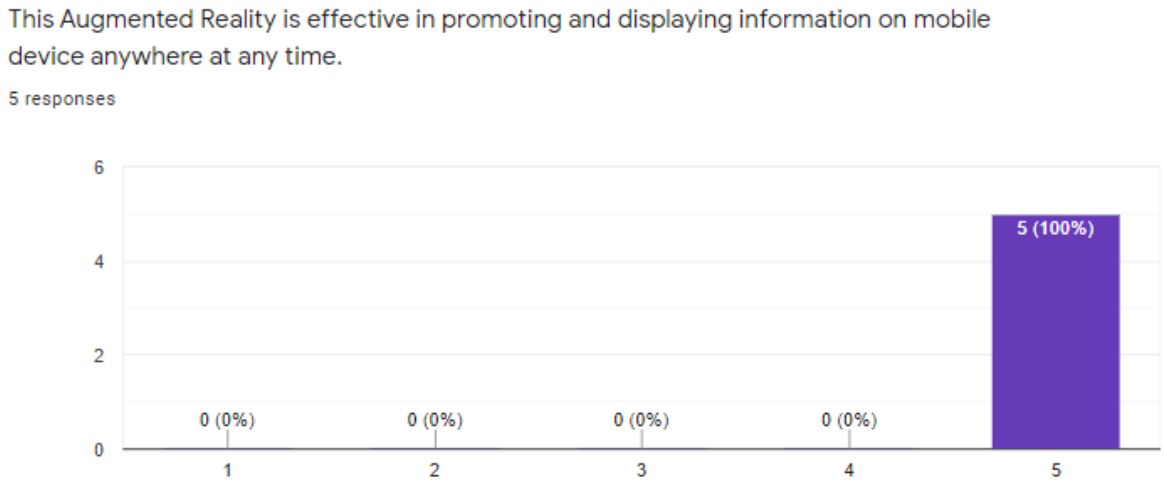


Figure 6.24 Data for convenient comparison

Based on Figure 6.24, 5 people are strongly agree that using Augmented Reality is more effective in promoting and displaying information on mobile device.

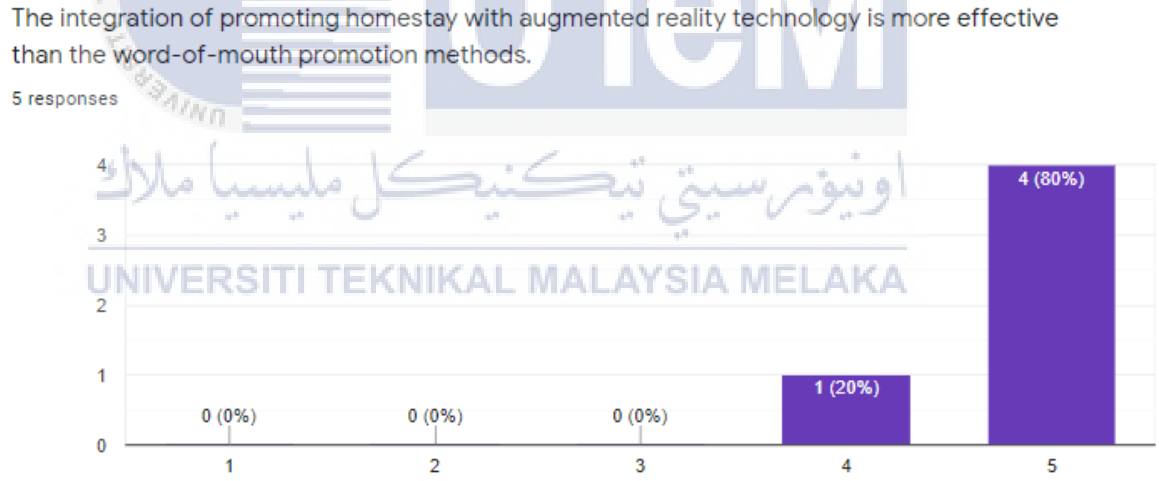


Figure 6.25 Data for convenient comparison

Figure 6.25 shows data that 4 people strongly agree that integration of promoting homestay with Augmented Reality technology is more effective while the other 1 respondent are just agree.

The public target user responses suggested that they are highly interested in the AR Husna Homestay Jementah application and think it is a fantastic idea. Subject expert respondents also gave a good response to the use of this application with some suggestions that may be improved to further improve the usability of this application in the future.

6.6 Analysis Testing

For target user acceptance, most of the user is satisfied and strongly agree with the application with some suggestion that can be improved for better user experience.

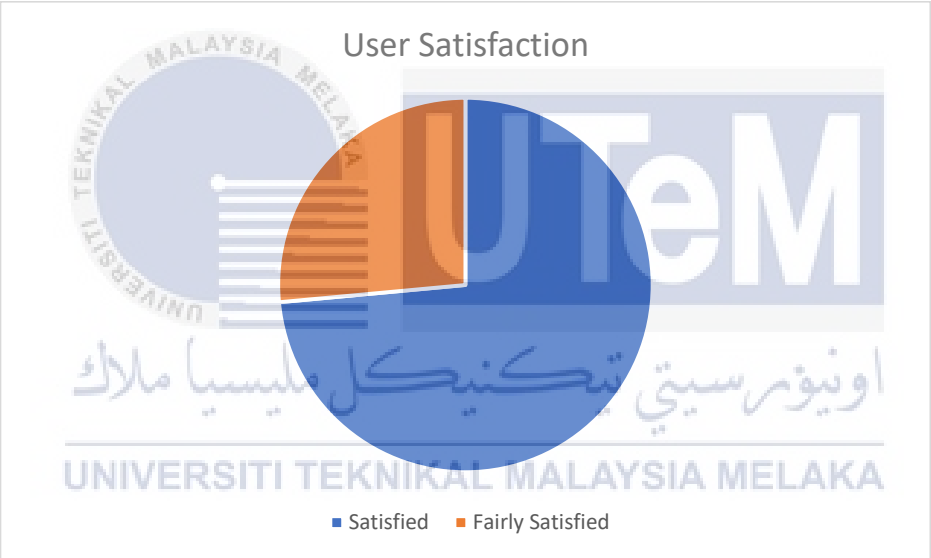


Figure 6.26 Target User Satisfaction Chart

For multimedia expert acceptance, most of the them is strongly agree with the application. Figure 6.27 below shows a chart reflecting their response towards the application. In conclusion, most of the respondents find the AR Husna Homestay Jementah application to be useful and enjoy using it.

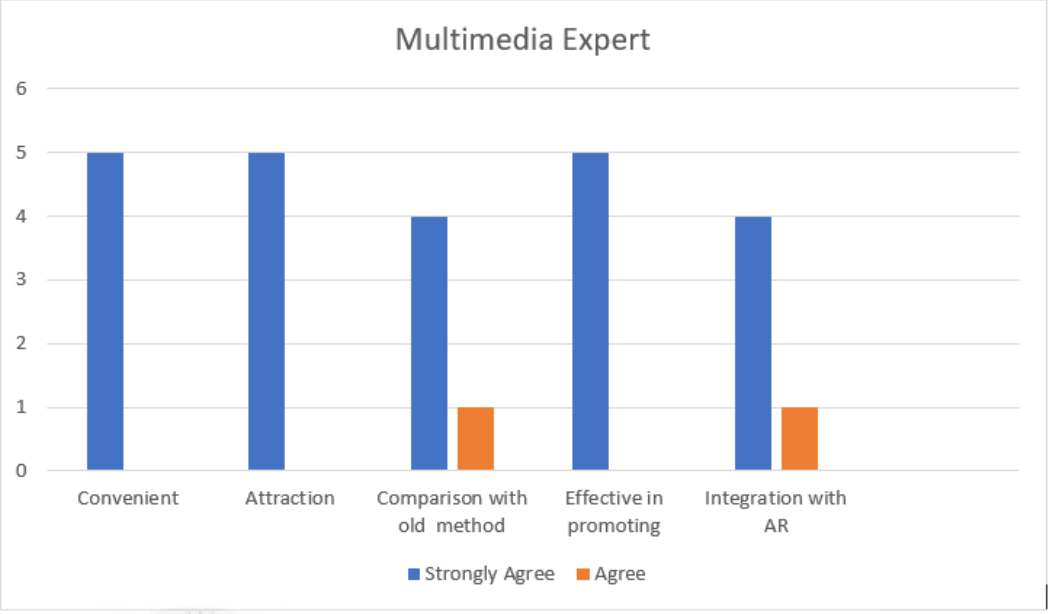


Figure 6.27 Multimedia Expert

6.7 Conclusion

To finish up, the application has been successfully implemented. In Chapter 3, the components of the AR were examined and implemented in the context of comparing it to existing AR. The questions' outcomes have been grouped into diagrams and tables. This section discusses how to conduct a test. The purpose of using a survey is to see if the product's aim has been met. The outlines based on the questionnaire have clearly revealed that the components that are applied to the AR have been successfully completed. We can assume that AR will be beneficial for a lot of purposes especially in term of promoting business. Based on the results from the testing, a few improvements can be done to improve the application. The following part will look at the project's shortcomings, quality, and completion.

CHAPTER 7: CONCLUSION

7.1 Observation on weakness and strength

The last chapter analyzes the advantages and disadvantages of this augmented reality project . This project has realized the advantages and disadvantages of the product since the testing stage. Some weaknesses in this product require to improvise improvements to this AR application in the future. In addition, from this project, the contribution of Augmented Reality to Husna Homestay will be explained.

Every application that has been developed has its advantages and disadvantages, such as utilizing the method using a new technology called Augmented Reality. On the contrary, the advantages and disadvantages of this product can be used to better clarify the advantages of creating a good product. The limitation of this application is that users can only use mobile devices to experience augmented reality, and it can be used by Android users. In addition, there were no gallery and only depends on a single video which showing all the information about the interior as well as exterior of the homestay.

7.1.1 Weakness

7.1.1.1 No additional details provided

Except from the video provided which showing most the interior and exterior on the homestay there were no gallery or pictures provided where user can better understand the homestay.

7.1.1.2 Language limitation

One of the weaknesses of the application is the language is only limited to only one which is English meanwhile all of the users are Malaysian and might be more comfortable with Bahasa Malaysia.

7.1.1.3 Somewhat difficult to use application

Since this application is primarily based totally on AR marker-based, user might need to print and preview the image target card or have another device by their side earlier than to experience and use of the application. Without the image target card, the AR application cannot be functioning.

7.1.2 Strength

7.1.2.1 Combination multimedia element

The enjoyment of new media innovation can be intuitively transferred through Augmented Reality and can be stand out feature from others. It can provide a positive and new experience for users who never try Augmented Reality yet by combining, text, bar, music, video, and some user-device interactivity. According to the test results, the application directive is straightforward and easy to grasp by the tester.

7.1.2.2 Interactive design of application

This Augmented Reality application feature an appealing design and giving new experience to help future visitors learns and getting more information about Husna Homestay accommodation instead than communicate directly with homestay owner or search on the internet to get further details. AR can be used as an alternative tool that can be engaging and fulfilling manner of promoting.

7.1.2.3 Using only smartphone

Users do not need extra peripherals or hardware to engage with innovation technology using this application; all they need is their smartphone to experience AR that they can percieved on their own.

7.2 Propositions for Improvement

This segment will clarify a fair recommendation to upgrade and improve the application's capabilities and execution. A recommendation for development will be the major subject in order to overcome the application's constraint and weakness. The tester who used the programme throughout the testing stage provided the recommendation for this project's development.

Based on the weaknesses and strengths of the system, an improvement that can be made to AR Husna Homestay Jementah is to add a new Bahasa Malaysia option so that the system can be used more comfortable by most Malaysian users and aged past 40 that may have difficulty in understanding English. Next, many smartphone users has now switching from Android operating system to iOS operating system, so it is necessary develop an application that can meet market needs in the future. Moreover, a proposition to develop a stand-alone application specifically for this AR enable user to use the application and install it directly from Google Play Store. Therefore, users can get the application and use it more easily.

7.3 Project Contribution

Many industries have used augmented reality for a variety of reasons and goals including promoting travel and hospitality industry marketing. Augmented reality technology has been used to engage people and modify diverse objects, allowing for a more intuitive way of interaction. This project helps to promote Husna Homestay by creating a buzz around the homestay brand . It has the potential to improve and enhance the status of the homestay itself by promoting it effectively. With the integration of Augmented Reality technology, it is possible to attract more customers to stay and spend the night in this homestay after having received exposure about the homestay through the application. This project has leverage a visually appealing interface design, digital image target card, and bar representation to nearby interesting places to visits to attract people to come. The mix of graphical elements allows the content and information to be delivered to the audience effectively.

7.4 Conclusion

To summarise, Augmented Reality application has been successfully developed and run for user. The comparison of existing system and project requirements are linked with AR application in literature review chapter. The storyboard and user interface design are sketched throughout the design stage to make sure that the project run smoothly. Augmented Reality has a wonderful effect on the user's ability to experience enlightening scenes in the real world. Although there were some obstacles encountered, the application was successfully completed. There is still a need for improvement in order to make this application more user-friendly.

In conclusion, AR Husna Homestay Jementah have provided a capable and beneficial way of promoting their accommodation and meets its requirements. The user should be able to obtain the information provide in the application more easily and effectively. The availability and efficiency of this system are all advantages. In short, this system can help customers in understanding and obtaining information while promoting Husna Homestay Jementah accommodation brand.

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APPENDIX A: INTERVIEW PHOTO

APPENDIX B: QUESTIONNAIRE

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

HUSNA HOMESTAY JEMENTAH: THE DEVELOPMENT OF AUGMENTED REALITY BUSINESS CARD

QUESTIONNAIRE

Assalamualaikum and hello. I am Mohd Nazmi Bin Yusof, student of 3 BITM from Faculty of Information Technology and Communication. I want to conduct a survey about about **Husna Homestay Jementah: The Development Of Augmented Reality Business Card**. The objective of this survey is to evaluate the acceptance of using Augmented Reality Husna Homestay Jementah business card from various perspective. Thank you for your willingness to answer this survey.

Personal Information

Please tick ()yes or no in the table below.

Gender

- Male
- Female

Age

- 19-30 years old
- 30 years old and above

Part A – USER TESTING

Direction: Please rate the following question according to the following scale:

1	2	3	4	5
STRONGLY DISAGREE	**DISAGREE**	***NEUTRAL***	**AGREE**	**STRONGLY AGREE**

A) Perceived Ease of Use

No	Question	1	2	3	4	5
1	It would be easy for me to get information at Husna Homestay Jementah AR Business Card.					
2	My Interaction with Husna Homestay Jementah AR Business Card was clear and understandable.					
3	I can use Husna Homestay Jementah AR Business Card without assistance.					
4	I found the Husna Homestay Jementah AR Business Card is easy to use.					

B) Perceived Usefullness

No	Question	1	2	3	4	5
1	Using this application would enhance my knowledge about the homestay					
2	Using this application would make it easier and faster for me to get information about the homestay.					
3	Using this application that incorporate AR technology would encourage more visitors in the future.					
4	I found that this application is useful.					

C) Attitiude Towards Using

No	Question	1	2	3	4	5
1	I like the idea of Husna Homestay Jementah AR Business Card.					
2	I have a positive attitude toward or enjoy using Husna Homestay Jementah AR Business Card.					
3	I found that using Husna Homestay Jementah AR Business Card is a great idea.					

D) Intention To Use

No	Question	1	2	3	4	5
1	I will use Husna Homestay Jementah AR Business Card on getting information about the homestay.					
2	I will return using Husna Homestay Jementah AR Business Card somewhere in the future.					

Part C – Comment and suggestion

I have tested the product and answer the questionnaires:

.....

Name:

Date:

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

HUSNA HOMESTAY JEMENTAH: THE DEVELOPMENT OF AUGMENTED REALITY BUSINESS CARD

QUESTIONNAIRE

[TO BE COMPLETED BY HOMESTAY OWNER]

Assalamualaikum and hello. I am Mohd Nazmi Bin Yusof, student of 3 BITM from Faculty of Information Technology and Communication. I want to conduct a survey about about **Husna Homestay Jementah: The Development Of Augmented Reality Business Card**. The objective of this survey is to evaluate the acceptance of using Augmented Reality Husna Homestay Jementah business card from various perspective. Thank you for your willingness to answer this survey.

Part A – The Product Content

Please provide your answer in the table below.

Name:

Homestay Name:

Please tick () yes or no in the table below.

1. Does this Augmented Reality tells about Husna Homestay Jementah ?
   - Yes
   - No
2. Does the graphical representation are appropriately arrange ?
   - Yes
   - No
3. Does the multimedia element (video) is helpful to deliver the information about the homestay ?
   - Yes
   - No
4. Does the multimedia element (3D model) helpful to visualize the house representation ?
   - Yes
   - No
5. Does the social links provided direct to the appropriate website ?
   - Yes
   - No
6. Does the graph bar representation are clear and correctly represented ?

- o Yes
- o No

Part B – The Product Acceptance

Direction: Please rate the following question according to the following scale:

1	2	3	4	5
STRONGLY DISAGREE	DISAGREE	*NEUTRAL*	AGREE	STRONGLY AGREE

No	Question	1	2	3	4	5
1	This Husna Homestay Jementah Augmented Reality application is convenient to use ?					
2	This Husna Homestay Jementah Augmented Reality application is able to attract your attention.					
3	Using an Augmented Reality is more convenient compared to old method.					
4	This Augmented Reality is effective in promoting and displaying information on mobile device anywhere at any time.					
5	The integration of promoting homestay with augmented reality technology is more effective than the word-of-mouth promotion methods.					

Part C – Comment and suggestion

I have tested the product and answer the questionnaires:

.....

Name:

Date:

APPENDIX C: FUNCTIONALITY TEST

Functionality Test 1

System: AR Husna Homestay Jementah Business Card

System Developer: ABDUL HANNAN BIN YUSOP (SOFTWARE ENGINEER)

Date: 23 August 2021

No.	ID	Input (Question)	Expected Output (Answer)	Output (OK/Failed)
1	initiate.app	How to open the app?	Click the app icon	OK
2	open.camera	Does the app start the camera?	The camera opened	OK
3	image.target	Does the app recognize the image target ?	The app recognize the image target	OK
4	scan.card	Does the interface show up?	The interface appear normally	OK
5	alignment.interface	Does the interface align correctly ?	The interface align correctly	OK
5	play.video	Does the play button work ?	The play button functioning	OK
6	pause.video	Does the video pause when click ?	The video is paused	OK
7	whatsapp.button	Will it redirect user to open whatsapp ?	The button opened whatsapp when pressed	OK
8	facebook.button	Will it open Facebook and direct it to Husna Homestay FB page ?	The button opened Facebook and directed to Husna Homestay FB page	OK

9	instagram.button	Will it open Instagram and direct it to Husna Homestay Instagram page ?	The button opened Instagram and directed to Husna Homestay Instagram page	OK
10	direction.button	Will it open internet browser and shows the exact direction of the homestay ?	The button opened browser and will show google maps direction to the homestay	OK
11	panel.scroll	Does the text section is scrollable?	The text is scrollable when scrolled	OK
12	3d.model	Does the 3D model shows appropriately	The 3D model showed appropriately	OK
13	exit	Does the exit button function ?	The exit button closed the app	OK

Functionality Test 2

System: AR Husna Homestay Jementah business card

System Developer: Mohammad Syafiq Bin Enchek Muda (Software Developer)

Date: 23 August 2021

No.	ID	Input (Question)	Expected Output (Answer)	Output (OK/Failed)
1	initiate.app	How to open the app?	Click the app icon	OK
2	open.camera	Does the app start the camera?	The camera opened	OK
3	image.target	Does the app recognize the image target ?	The app recognize the image target	OK
4	scan.card	Does the interface show up?	The interface appear normally	OK
5	alignment.interface	Does the interface align correctly ?	The interface align correctly	OK
5	play.video	Does the play button work ?	The play button functioning	OK
6	pause.video	Does the video pause when click ?	The video is paused	OK
7	whatsapp.button	Will it redirect user to open whatsapp ?	The button opened whatsapp when pressed	OK
8	facebook.button	Will it open Facebook and direct it to Husna Homestay FB page ?	The button opened Facebook and directed to Husna Homestay FB page	OK
9	instagram.button	Will it open Instagram and direct it to Husna Homestay Instagram page ?	The button opened Instagram and directed to Husna Homestay Instagram page	OK

10	direction.button	Will it open internet browser and shows the exact direction of the homestay ?	The button opened browser and will show google maps direction to the homestay	OK
11	panel.scroll	Does the text section is scrollable?	The text is scrollable when scrolled	OK
12	3d.model	Does the 3D model shows appropriately	The 3D model showed appropriately	OK
13	exit	Does the exit button function ?	The exit button closed the app	OK