# THE DEVELOPMENT OF WEDDING DRESS FITTING USING AUGMENTED REALITY BY TRACKING SHOULDER'S MEASUREMENT

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# THE DEVELOPMENT OF WEDDING DRESS FITTING USING AUGMENTED REALITY

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

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
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# DECLARATION

I hereby declare that this project report entitled

[THE DEVELOPMENT OF WEDDING DRESS FITTING USING AUGMENTED REALITY

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

STUDENT : _____ *zhendi* _____ Date : 4 SEPT 2021

(KHOR ZHEN DI)



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 (Media Interactive)] with Honours.

SUPERVISOR : _____ Date : 12 SEPT 2021

(MDM NORAZLIN BT MOHAMMED)

**DEDICATION**

To my beloved family members, friends and supervisor who supported me all this while.

## ACKNOWLEDGEMENTS

I would like to thank Mdm Norazlin binti Mohammed for giving assistant to complete this project successfully. She gave me an opportunity to develop Augmented Reality application that I never learn before.

I would also like to thank my family that giving me support and motivation throughout my project.

Lastly, I appreciate to my friends who helped me in solving problems and remind me about my schedule in developing my project.

# ABSTRACT

LaFame Dressing Room is a marker-less based Augmented Reality application that enable user to try on the wedding dress of LaFame Bridal Mansion in virtually. In this era, the technology of Augmented Reality is widely use in the field of games, education and so on. Choosing a weeding dress is a must for a bride before wedding day. A bride always need long time to choose and try the wedding gown. Furthermore, the pandemic of Covid-19 cause brides cannot go out from home easily. This application with the features of 3D model wedding gown and virtual fitting room can help brides to know about the details of dress and how it looks on the brides. In this project, open source software like Android Studio and Blender will be used to develop Augmented Reality application.

# ABSTRAK

LaFame Dressing Room adalah satu applikasi yang mempunyai AR marker-less yang membolehkan pengguna pakai gaun perkahwinan LAFame Bridal Mansion secara maya. Dalam era globalisasi kini, teknologi AR telah digunakan dalam bidang permainan, edukasi dan lain-lain lagi. Pengantian memang akan memilih gaun perkhawinan sebelum berkahwin. Pengantin biasanya menggunakan banyak masa untuk memilih dan memakai gaun. Tambahan pula, pandemic Covid-19 menyebabkan pengantin tidak boleh keluar dari rumah. Applikasi ini yang mempunyai fungsi 3D gaun model dan bilik pemasangan maya dapat membantu pengantin untuk tahu perincian gaun dan dapat tengok kesan gaun atas pengantin. Projek ini menggunakan perisian seperti Android Studio dan Blender untuk membangunkan applikasi AR.

# TABLE OF CONTENTS

**PAGE**

# LIST OF TABLES

**PAGE**

# LIST OF FIGURES

**PAGE**

# LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| **FYP** | **-** | **Final Year Project** |
| **FTMK** | **-** | **Fakulti Teknologi Maklumat dan Komunikasi** |
| **UTeM** | **-** | **Universiti Teknikal Malaysia Melaka** |

# LIST OF ATTACHMENTS

# CHAPTER 1: INTRODUCTION

## 1.1 Introduction

In this era of advance technology, Augmented Reality (AR) is booming and it relates to various of field for entertainment, learning, business and so on. AR is an enhanced version of the real physical world that is achieved using digital visual elements, sound, or other sensory stimuli delivered via technology. In 2020, there is a statistic showing 83.1 million consumers will use AR monthly in United States only. This shows people can easily and willing to get in touch with AR application such as the filters in Instagram. The picture that captured will combine the real image with overlaid elements.



"Try before you buy" is the important strategy before a buyer decides to buy a thing. As 74% out of 2005 consumers think that try out the goods before paying would remove a major drawback to online shopping (Klarna,2018). Retail industry like IKEA knows that and provides an application, IKEA place AR, to enable user preview and try the furniture virtually at home before buying it. In order to improve AR immersion of user, human body detection technology is merged into AR technology to let the user interact with virtual elements in the application with body movement. For example, since 2018, iOS 12 or later got the feature of Memoji which will mirror the user's facial expression and body movement in real-time by using the face detection and body detection technology. Tracking body movement can be done by capturing the specific points of user's body and joints.

Tracking shoulder's measurement technology is also used in AR fitting room to allow users pick out the clothing and try them all out virtually. The demand for

virtual fitting room increases during the Covid-19 pandemic as people prefer online shopping (Global report,2019). The proposed AR fitting wedding dress is aimed to study how AR tracking shoulder's measurement and superimpose the wedding dress based on the user's shoulder measurement. Wearing a wedding gown is a complicated process and it is impossible to try all the wedding dress in the physical store. With shoulder tracking technology, it will detect moving the joint part of shoulder and know a human is detected to do the following operation. The sensor node will send the data of user's shoulder measurement that be captured to let the virtual wedding dress fits on the correct position with correct size in real-time. Trying all the wedding dress is not dream for girls anymore.

## 1.2 Problem Statement

The first problem statement is the steps of wearing a wedding gown are complicated. Wearing a wedding gown usually need one professional staff to help the brides to try it on. If the bride wants to try many styles of wedding gown, that is a lot of work for the staff and bride as they are exhausted to wear and take off the gown. This is also cause to the next problem.



Next, the second problem statement is brides need a long time to choose perfect gowns that actually suit them. Although the wedding gown designer will give the advice and suggestions to the bride, it still uses lot of time for trying the wedding dresses. It may use less time, if the bride has her own choice before she goes to the physical wedding gown store to try it.

The last problem is the bride cannot actually see and feel all the design of the dresses. For the wedding exhibition, people can only see limited dresses or see the wedding gowns through the catalog only. The bride has to book another suitable time to go to the physical store to see all the dresses.

## 1.3 Objectives

This project embarks on the following objectives:

1. To study AR tracking shoulder's measurement for wedding dress fitting.

2. To develop an interactive AR application that help user to choose their wedding dress through mobile platform.

3. To evaluate the usability of AR technology in the field of the fashion of wedding dress.

## 1.4 Scope

This project is suitable for all the girls especially the brides. The wedding dresses in augmented reality form show on the user's body. This application will be developed in mobile applications because everyone uses mobile phones. Users can use the application whenever they want. Besides, this application is in English version that most people know the language.



## 1.5 Project Significant

Users have to download the application on their mobile phone to use it at any time. The application will detect the joint position of user's shoulder while the users need to pick the wedding dress to fit on their body. An Augmented Reality(AR) application will be developed to see how the wedding dress looks on a bride. Users can save the choosing time of wedding dress without going through too many complicated wearing times. It becomes a reference for brides to choose which style of wedding dress looks good on her before she goes to the physical store to try for it. The bride can try all the wedding dresses with AR application if she wants.

## 1.6 Conclusion

In conclusion, this chapter briefly introduces and explains about what and why this project is going to develop. The problems that are faced by the brides are stated and these are the problems that hoped to be solved in this project. In the next chapter, literature review and project methodology will be explained.

# CHAPTER 2: LITERATURE REVIEW AND PROJECT METHODOLOGY

## 2.1 Introduction

In this chapter, the Augmented Reality in fitting the wedding dress and the existing system of fitting clothes will be discussed. Although Augmented Reality technology is not the latest technology, it is still trending as it integrates virtual objects to our real environment. Our life can become better with Augmented Reality technology as it can give us references before we buy a thing.



## 2.2 Domain

In this part, the concept of visualization, augmented reality definition and concept, types of augmented reality and augmented reality application will be discussed.

### 2.2.1 Visualization

There are 3 criteria that need to fulfill for visualization. Firstly, producing an image that contains the information for visualize. Next, visual based on data, visualization transform from invisible to visible. Lastly, it must be readable and recognizable to provide a learning way about the data.

### 2.2.2 Augmented Reality Concept

Augmented reality is using the existing real-world environment and puts virtual object on the top of it to give a better experience. Virtual reality creates its own cyber environment, but augmented reality adds to the existing world. Augmented reality can highlight specific features of the physical world to make people more understand about those features.

### 2.2.3 Types of Augmented Reality

Augmented reality is mainly categorized into 4 types: marker-based, marker-less AR, Superimposition Based AR, and projection-based AR.

#### 2.2.3.1 Marker-based AR

Marker-based AR or Image Recognition AR always provide us more information of a specific objects. The device's camera is used to detect the maker and a 3D version of corresponding object will replace the marker on the screen. It also allows user to rotate the 3D imagery to view more detail.



**Figure 2.1 Example of marker-based AR**

**(El Filali, Yassir & Salah-ddine, Krit. (2019). AUGMENTED REALITY TYPES AND POPULAR USE CASES. 8. 91-97.)**

### 2.2.3.2 Marker-less AR

Marker-less AR is widely used in developing of AR application. It is also location based AR as it provide location detection. It usually works by reading data from mobile's GPS, accelerator and digital compass to know the location of the user. Marker-less AR do not need identifying any maker to see the 3D content. This technology will combine computer graphics with real-world imagery to produce visual effect.


**Figure 2.2 Example for Marker-less AR**

**(Everything You Need to Know to Build Location-Based AR App (Updated). (2020, April 18). Retrieved September 08, 2020, from https://blog.vakoms.com/everything-you-need-to-knowto-build-location based-ar-app/)**



### 2.2.3.3 Superimposition Based AR

This AR gives a replacement look of the object in focus. The augmented view of the object will replace the entire or partial view. Objects recognition will play important role to do the replacement.


**Figure 2.3 Example of Superimposition Based AR**

**(3 DIFFERENT TYPES OF AR EXPLAINED: MARKER-BASED, MARKERLESS & LOCATION)( August 14, 2018 from https://www.blippar.com/blog/2018/08/14/marker-based-markerless-or-location-based-ar-different-types-of-ar)**



#### 2.2.3.4 Projection-Based Augmented Reality

This AR use the projection of light on a surface and the interaction is done by touching projected surface. It can use to create the position of deception, orientation and depth of an object. Different objects and their structure are taking consider to study in-depth. The computer image is projected to create a realistic looking object

**Figure 2.4 4 Example of projection-based AR**

**(An example of projection-based AR in Geograpgy class, (2019, Feb), Shushan Poghosyan)**



### 2.2.4 **Augmented Reality Application**

Augmented Reality Applications are software applications which integrate the digital visual content into the user's real-world environment. AR software has various uses like training, work and consumer applications in various industries including public safety, healthcare, tourism, gas and oil, and marketing. AR applications display in optical projection systems, monitors, handheld devices etc.

#### **2.2.4.1 Augmented Reality in Learning**

With the AR technology, learning will become easier and more interesting to student compared to the learning of information from the books. The benefit of applying this technology into education is to enhance the students' learning achievement (Chang et al, 2015). AR technology gives virtual examples and adds gaming elements to support textbook materials that help students better remember the information. AR in education covers Paleontology, Chemistry, history and science and so on.

#### 2.2.4.2 Augmented Reality in Gaming

Augmented reality is said as the future of gaming and its value is expected to reach almost $285 billion by 2023 (Nitin Garg, 2019). AR technology in gaming field builds a strong relationship with the audience and the branded characters. The technology provides better and more ways of interaction to the players. The most successful example for the entertainment industry is Pokémon Go and it makes the brands to discover the market value of AR to build the deeper bonds between characters and audience.

#### 2.2.4.3 Augmented reality for medical education and training

Medical students are most probably the future doctors, they needs to know human body very well as they may saving life or killing life in accidentally. With AR technology, medical students are allowed to learn anatomy in depth with human body models. Brian Mullins, Founder and CEO at DAQRI said it is no longer to learn to do surgeon from books but learn the process in almost real-life scenario. With the stimulations, medical students are provided more training opportunities as they can practice surgeries on virtual patients. Human Anatomy Atlas provides more than 10,000 anatomical models and information in seven languages. There are 3D models of body that allow students to rotate and interact.



## 2.3 Existing System

#### 2.3.1.1 Uniqlo AR Fitting Room App by Christine Le

Christine Le, Maral Habeshian, Matt Phan, Jade Vasun developed an Uniqlo AR Fitting Room application but it is not affiliated with Uniqlo. It is an application that allow user to try on anything currently in Uniqlo store from the mobile app. First, the user can pick whatever clothes that be provided and press ‘Try UniqAR’ to try the

garments virtually. It will model out a model after the user key in their height, weight, detail size like their bust, waist, hip etc. It provides some belly shape and hip shape for user to choose to model out the body shape of user. The user can personalize the avatar by taking a selfie that acts as the face of the avatar. User even can choose the skin color to make the model looks more similar to the reality of user. After all details are filled up, it will show a model wearing the clothes with front view and back view. The color option of the clothes will be provided, user can choose which color is more suitable on him/her. This application provides social sharing, add to wish list and add to cart.

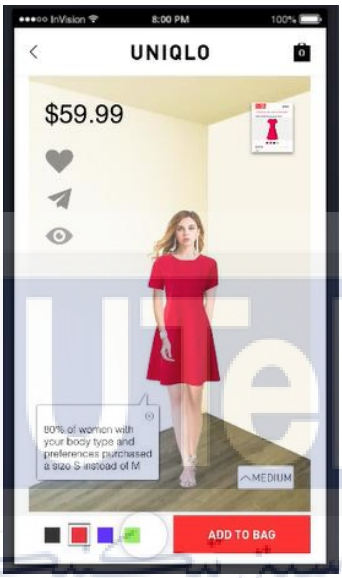


**Figure 2.5 Screenshot of the Uniqlo AR Fitting Room App**

**(Uniqlo AR Fitting Room App Retrieved from https://www.christinele.info/uniqlo-case-study)**

#### 2.3.1.2 Visualook Virtual Fitting Room

It is a 3D virtual fitting room that user can create own look with actual garments from the partner brands. It can be shared on social networks to ask for friend's opinion. Entering the measurements like height, weight, chest, age to modify the avatar. It is a 3D avatar with the outfit so that the user can rotate 360 degree to look at the details. The clothes on the avatar looks totally same with the clothes wore on the model.

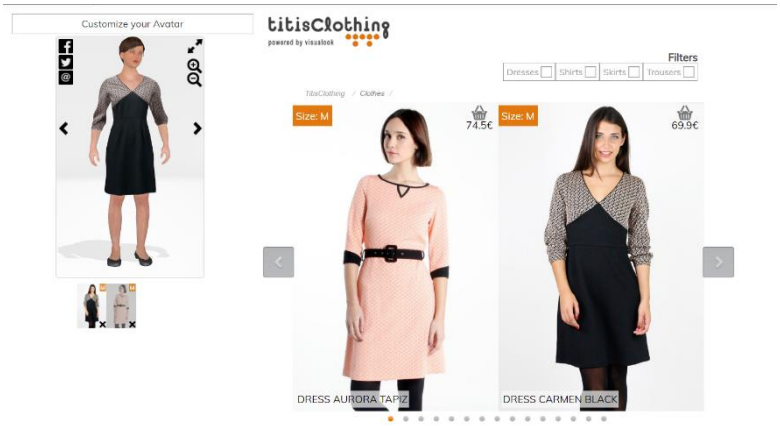


**Figure 2.6 Screenshot of the Visualook Virtual Fitting Room**

**(Visualook Virtual Fitting Room Retrieved from http://visualook.com/en/)**

### 2.3.1.3 Webcam Social Shopper(WSS)

The Webcam Social Shopper (WSS) is debuted by Zugara for retailers worldwide in 2009. The WSS software offers an advanced product visualization way to help online shoppers to try clothing on virtually by turning camera into a real-time interactive mirror. It will superimpose the static 2D image of virtual garments on top of user body. The software enables users to use hand motions to interact with the software content without using of keyboard or mouse. Users can browse various options of the garment by just moving arms above head as motion capture system is used.


**Figure 2.7 Screenshot of the Webcam Social Shopper**

**(Webcam Social Shopper Retrieved from http://webcamsocialshopper.com/)**

### 2.3.1.4 Suzanne Harward Virtual View Mobile App

Suzanne Harward Virtual View mobile app is available in iOS and Android system. This application allows brides to see all of Suzanne Harward's collections with life size fashion models in their home with almost realistic. User can visualize the dresses in 360 degrees of full detail to see how they fit on a model. Director of Marketing at INHAABIT ,Jason Yim believed that this application is an exciting new way to experience fashion.


**Figure 2.8 Screenshot of Suzanne Harward Virtual View Mobile App**

**(Say Yes to the Dress With Augmented Reality Retrieved from Say Yes to the Dress With Augmented Reality | INHAABIT)**

### 2.3.2 Comparison of Existing System

**Table 2.1 Comparison between 3 different existing system**

| | **Uniqlo AR Fitting Room App** | **Visualook Virtual Fitting Room** | **Webcam Social Shopper** | **Suzanne Harward Virtual View Mobile App** |
|---|---|---|---|---|
| **Avatar** | Virtual 2D Avatar | Virtual 3D Avatar | Real-time user | Model |
| **Present of garments** | Static image with front & back view | 3D model | 2D Static image with front view only | Model wearing the dress(video) |
| **Platform** | mobile | Tablet & mobile | Web & kiosk | mobile |
| **Technology** | Superimposition based AR on 3D model | 3D virtual fitting room | Real-time superimposition-based AR | Marker-less AR with person model |

| | | | | |
|---|---|---|---|---|
| **Strengths** | -User can see the garments from different view<br>-can share it to social media | -360 degree of 3D modelling<br>-can share it to social media | -use motion capture system for user input<br>-can share it to social media | -view dress on user with 360 degree details<br>-compare multiple outfits |
| **Weaknesses** | -difference between virtual avatar with real human | -difference between virtual avatar with real human | -garments not actually fit user's body<br>-static virtual garment | -difference between model with the user |

From the comparison in the table above, every application has its strengths and weaknesses. With virtual avatar like Visualook Virtual Fitting Room, user can see the detail of garments easily but cannot know is it actually look good on user. On the other hand like WSS, user can see the garment straight away wearing on the body in real-time but knowing less details on the clothes. They all have the same objective which is giving a reference to the user before they buy a garment.



## 2.4 Project Methodology

The methodology of Multimedia Development Life Cycle (MDLC) is used in the development of project. It contains 5 phases, which are define, planning, implementation, construction, and evaluation.

*a) Define*

This is the phase for brainstorming the idea. After the domain is chose, the topic of research needs to be selected. The aim in this phase is thinking the ideas to solve a particular problem faced by target user.

*b) Planning*

Analyzing the scope and requirements of the projects are the main tasks in this phase. This is to analyze the objectives and problem statement of the project. Project requirements like hardware and software requirements need to be identified to accomplish the project. The background and method used for this project will be introduce in the proposal.

*c) Implementation*

The software systems that needed to develop this project are downloaded while the hardware requirement is prepared in this phase.

*d) Construction*

Adding AR elements that are created with AR software to the application. In this stage, technical testing will be done to ensure there are no serious bugs before having the presentation and demonstration. Subsequent alterations are allowed when there are any bugs exist.

*e) Evaluation*

The target user will evaluate the project in this stage. Feedback is collected from the user to improve the application. Documentation for the whole development project also will be prepared in this stage.



## 2.5 Project Requirement

### 2.5.1 Software Requirement

*I. Tensorflow lite*

An opensource software library for machine learning. Its machine learning models can perform classification, regression, detection and any other machine learning algorithms. It also provides Python and C APIs. It supports running the models on mobile platform.

*II. Open source computer vision (OpenCV)*

OpenCV is a library of programming functions that mainly aimed at real-time vision. It provides hundreds of computer vision algorithms for computer vision application.

*III. Android Studio*

A tool for developing applications in Android platform. It provides strong features and vary version of emulators to run the app without actual device.

*IV. Adobe photoshop CC 2018*

A raster graphics editor that developed and published by Adobe Inc for Windows and macOS. It is widely used for image editing, retouching, creating image compositions and supports masks, and several color models including RGB, CMYK, duotone etc.



### 2.5.2 Hardware Requirement

The hardware requirement for developing this project are laptop and smartphone. The specification of hardware used are stated below.

*I. Laptop: ACER N16Q2*

**Table 2.2 Specification of laptop**

| | |
|---|---|
| **System Type** | 64-bit Operating System |
| **Processor** | Intel(R) Core(TM) 5-6200U CPU @ 2.3GHz |
| **Graphics Card** | NVIDIA GeForce 940MX |
| **RAM** | 4 GB DDR4 |
| **Operating System** | Microsoft Windows 10 Pro |

*II. Smartphone: Huawei Nova 3i*

**Table 2.3 Specification of mobile phone**

| | |
|---|---|
| **CPU** | Hisilicon Kirin 710 |
| **Android version** | 9.0 |
| **RAM** | 4GB |

### 2.5.3 Software Requirement for Documentation

*I. Microsoft Word*

A graphical word processing program that allows user to type and save documents.

*II. Microsoft PowerPoint*

An application software that used to present data and information by using text, diagrams. It also have animations and transitional effect in slides that help to explain the idea or topic in front of audience easily and practically.



## 2.6 Conclusion

The use of Augmented reality technology is trending to develop a virtual fitting room. The AR concepts is introduced in this chapter. The existing system for virtual fitting room is listed and compared with each other. The system requirement for developing this project is stated too. For the next chapter, the analysis of the project will be made.

# CHAPTER 3: ANALYSIS

## 3.1 Introduction

In this chapter, a further study in analyzing current scenario and requirements will be carried out to understand more about the project. The flowchart is used to analyze the approach of current scenario while questionnaire and interview are used to collect requirements from public. Furthermore, the requirements of hardware and software will be stated to assist in the development of this project. The project schedule and milestone are included to ensure the project develop completely on time.



## 3.2 Current Scenario Analysis

In the Chapter 2, the current scenario of Virtual Fitting Room(VFR) is clearly explain. This can come into some conclusion of there are many attempts to help the user to see and try the clothes virtually. However, there are still got the potential to use the AR technology in VFR for fitting wedding dress.

This project is inspired by Suzanne Harward Virtual View Mobile App which introduced in previous chapter. The main aim of Suzanne Harward Virtual View Mobile App is to let the user see the dresses on a model at home. This objective is similar to this project but the weakness of Suzanne Harward Virtual View Mobile App is unable to look the dress fits on the user. The user can only view how the wedding dress looks on the pre-set model. The project will be improved in this part based on the project referred.

## 3.3 Requirement Analysis

The requirements of the project like project requirements, software requirements, hardware requirements and other requirements are be analyzed.

### 3.3.1 Project Requirement – Analysis of system to be developed

It is important to know the project requirement in one project. The analysis of the system to be developed can be done through the requirements gathering and specific techniques.

#### 3.3.1.1 Requirement Gathering

There are two categories in requirement gathering which are qualitative and quantitative. For the qualitative method, the interview assessment is conducted with one of the shop owners of LaFame Bridal Mansion, Max. The quantitative assessment, questionnaire is distributed to the girls that going to marry or just married. The project functionality proposed interaction and the analyze of raw data or sources will also be discussed. Furthermore, the specific technique used in this project will be explained.



*a) Interview*

This project is fully supported by Max Goh, one of the shop owners of LaFame Bridal Mansion as he said user may feel hesitated to choose the wedding dress out of so many choices in a section of 2 hours. He mentioned that if this application is successfully developed, it can help the users to have a look and try before they come to the physical store and it helps the staff saving some time to introduce the gown.

*b) Questionnaire*

Google Form is used to collect feedback from the public. There are 11 question in the questionnaire and 30 respondents answered the Google Form. The 30 respondent are all the girls as they are the main user for this application.

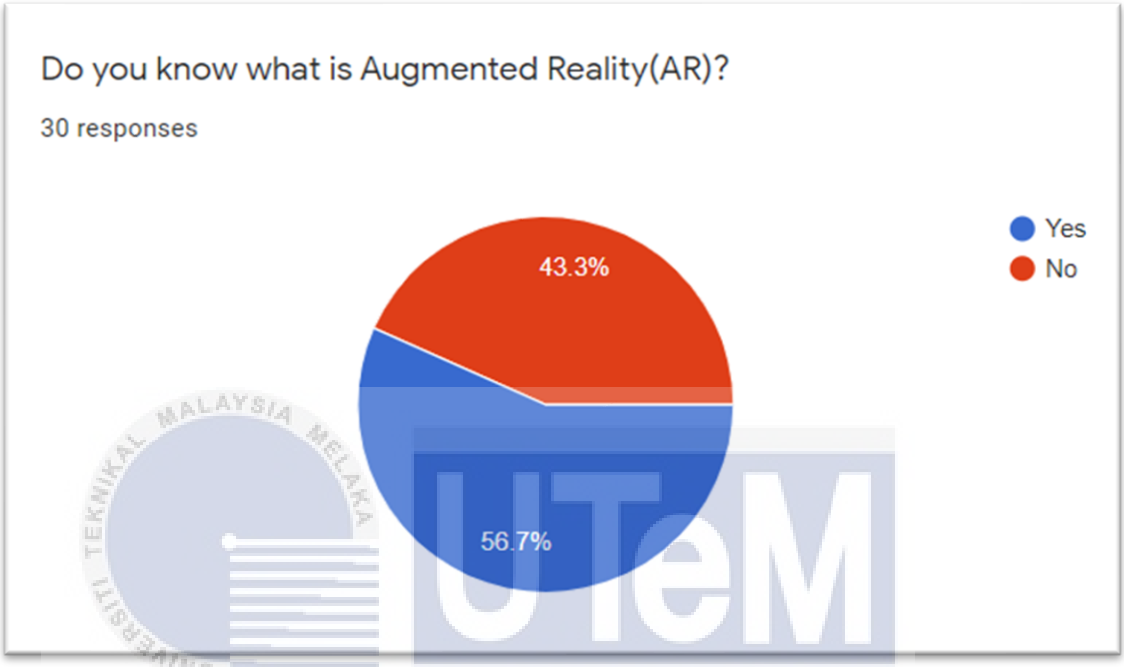


**Figure 3.1 The knowledge of Augmented Reality**



Figure 3.1 shows that half of the respondents (56.7%) know what Augmented Reality is, while 43.3% people do not have the concept of AR. This seems that AR field is still a strange field for some people.

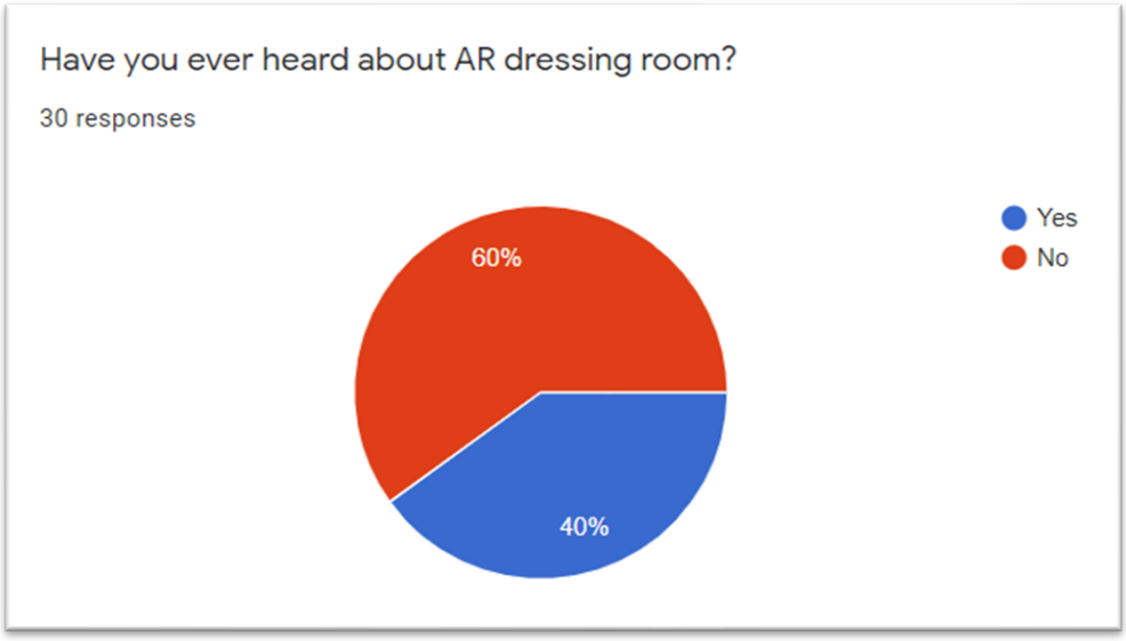


**Figure 3.2 Knowledge of AR dressing room**

From the figure above, only 40% respondents heard about AR dressing room before. There are as many as 60% do not know about AR dressing room.



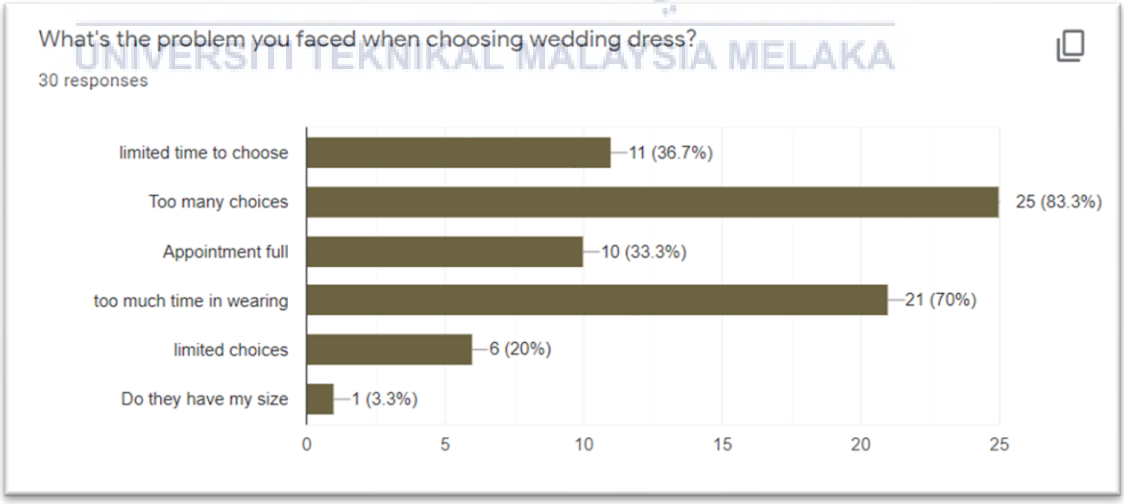


**Figure 3.3 Problem faced when choosing wedding dress**

The biggest problem that faced by 25 respondents (83.3%) is the shop provide too many choices of wedding dress. The second problem of using too much time in

wearing wedding dress is faced by 70% respondents. There are 10 people facing the problem of appointment full while 11 people (35.7%) said that limited time to choose the wedding dress. 20% of respondents faced the problem of limited choices and 1 person worries about the size of wedding dress.

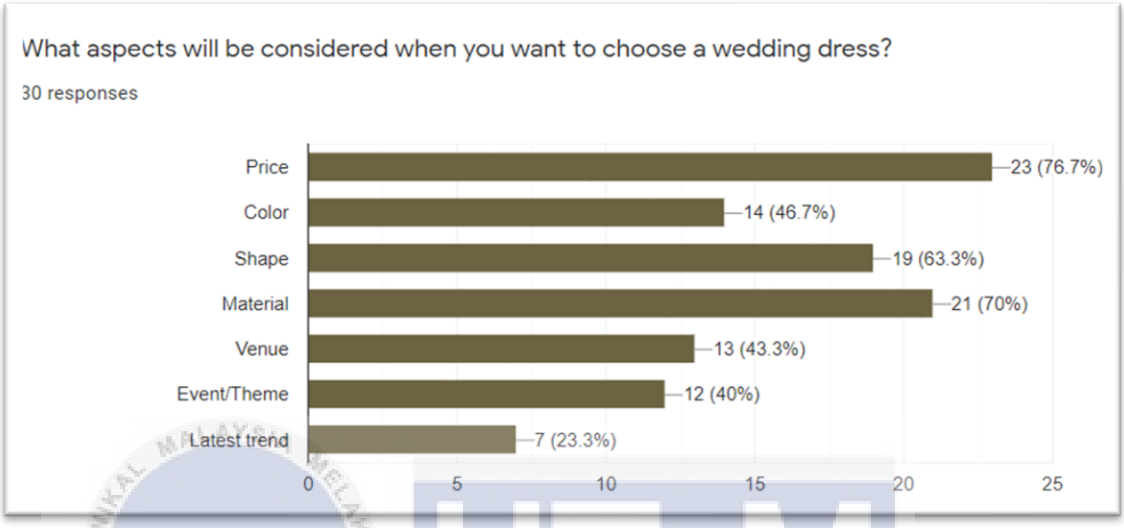


**Figure 3.4 Aspects considered to choose a wedding dress**

From the figure 3.4, the most important aspect that be considered to choose a wedding dress is the price, which selected by 23(76.7%) respondents. There are 70% respondents take the material of the wedding dress as the consideration to choose a wedding dress while 63.3% choose the shape of the wedding dress. The aspects of color, venue, event or theme also the aspects that take into consideration by 46.7%, 43.3% and 40% of respondents. The less important aspects that take consideration by the respondents is the latest trend which choose by 7 respondents only. This can conclude that people is more focus on the wedding dress that is affordable and comfortable.

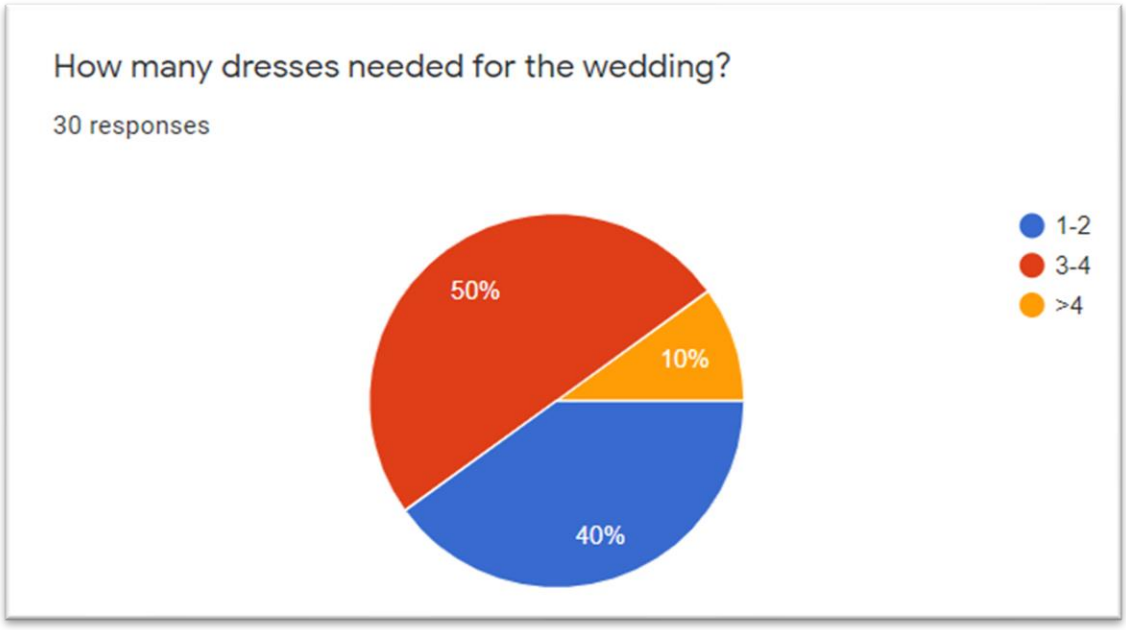


**Figure 3.5 Quantity of dresses chose**

In Figure 3.5, it shows 50% respondents chose 3-4 pieces of wedding dresses for their wedding while 40% respondents chose 1-2 pieces wedding dresses. Only small amount of 10% respondents chose more than 4 pieces of wedding dresses.



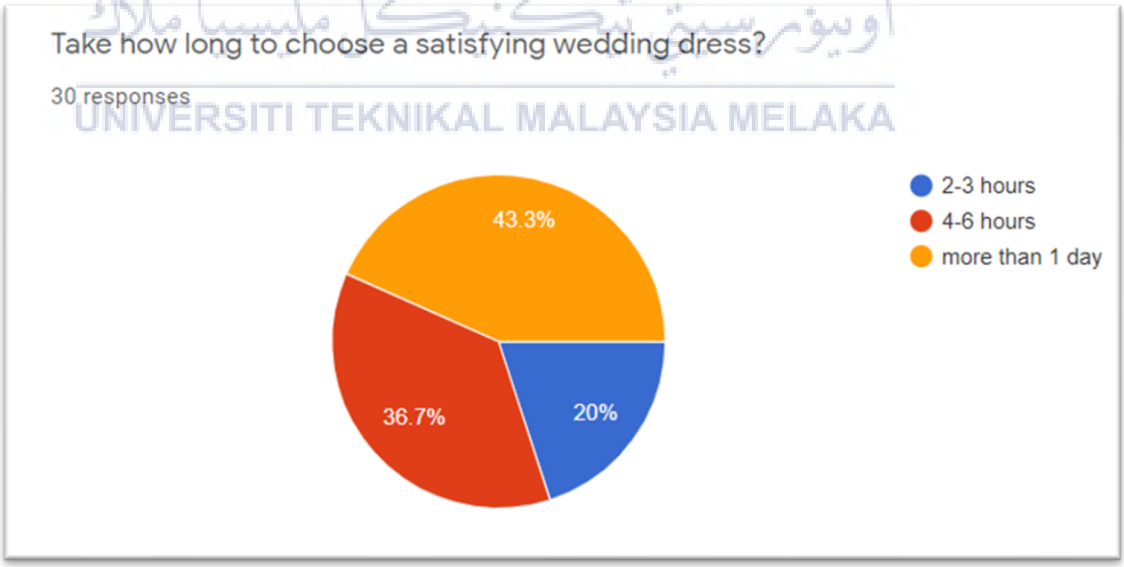


**Figure 3.6 Time spent to choose a satisfy wedding dress**

There are 43.3% respondents spent more than 1 day to actually choose a wedding dress that they satisfy. 36.7% respondents spent 4-6 hours to choose while only 20% respondents can choose a satisfying wedding dress in 2-3 hours.

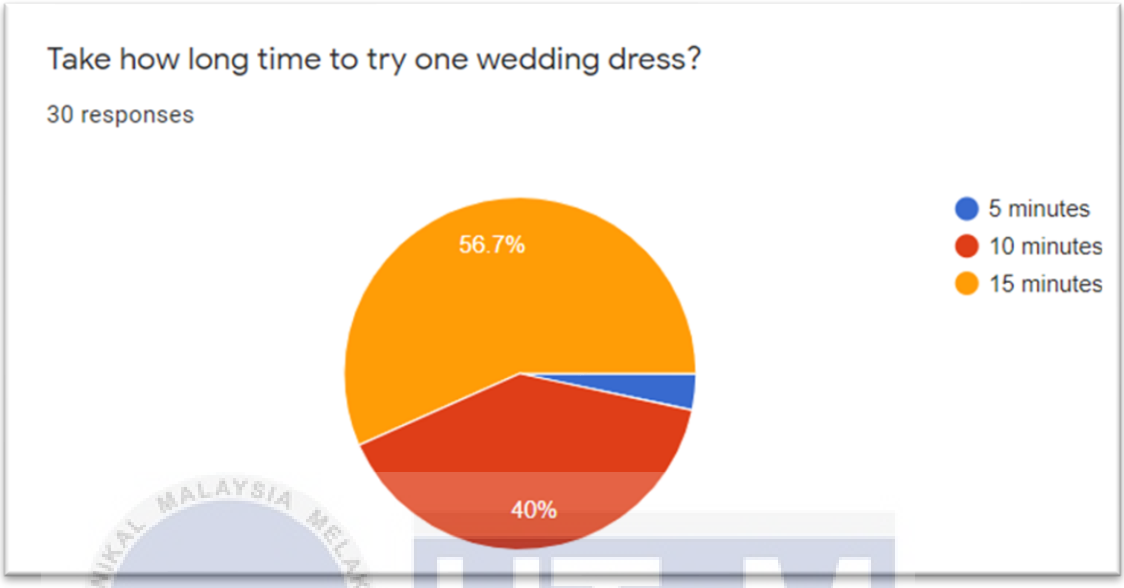


**Figure 3.7 Time spent to wear a wedding dress**

From Figure 3.7, only 1 respondent used 5 minutes to wear a wedding dress. There are 56.7% respondents used 15 minutes while 40% respondents used 10 minutes to wear into a wedding dress. This shows that wearing a wedding dress still need some time to fit in.

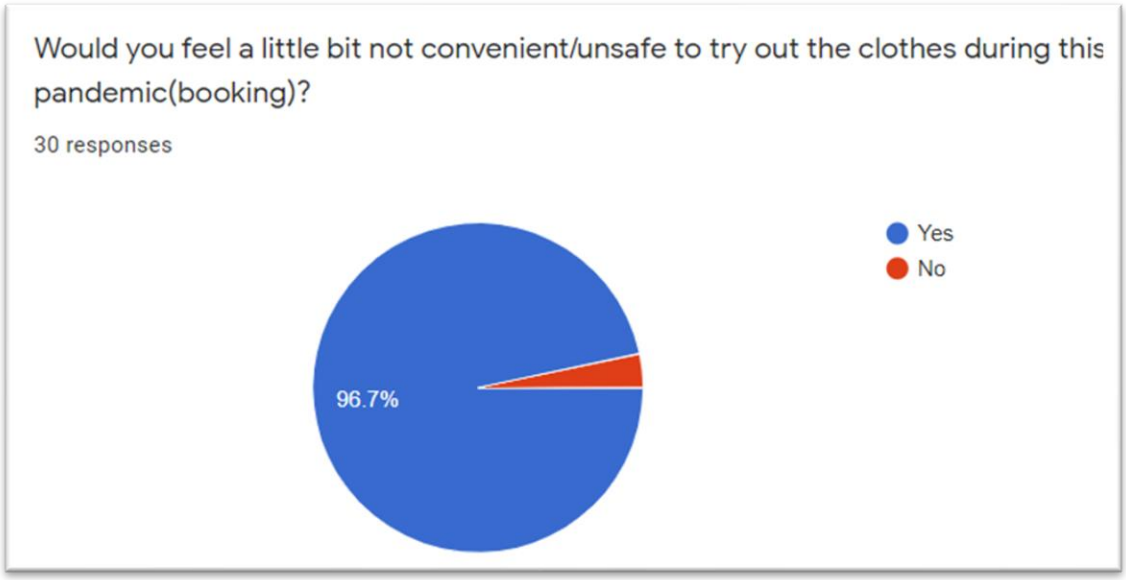


**Figure 3.8 Feeling of respondent**

There are as many as 96.7% respondents feel unsafe to try out the wedding dress during the Cobid-19 pandemic. Only one person feels safe and convenient to try out the wedding dress in physical store.



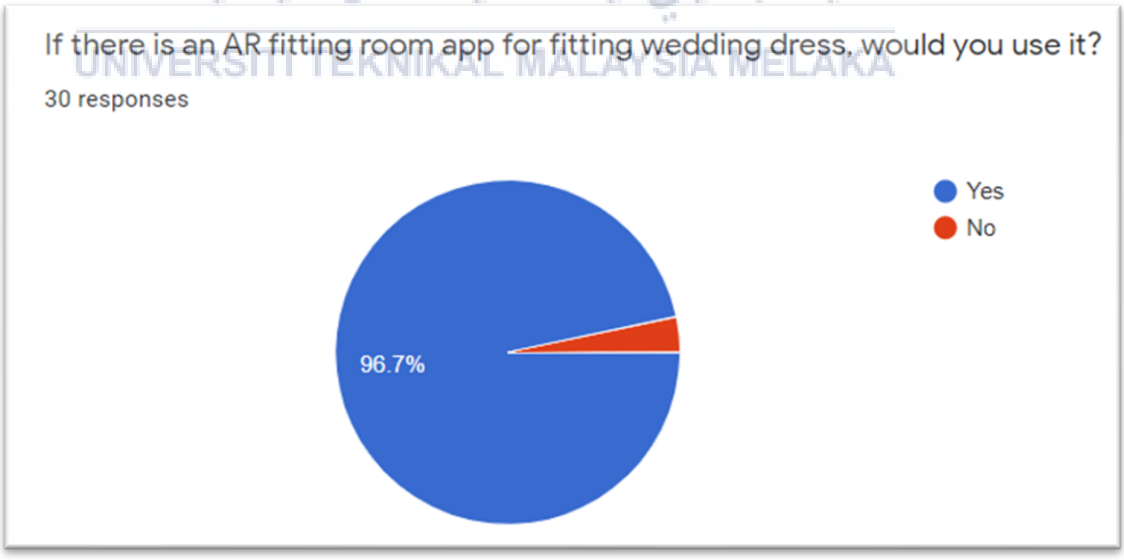


**Figure 3.9 Willingness to use the application**

29 out of 30 respondents (96.7%) willing to use the AR fitting room application to fit wedding dress while 1 person (3.3%) unwilling to use it.

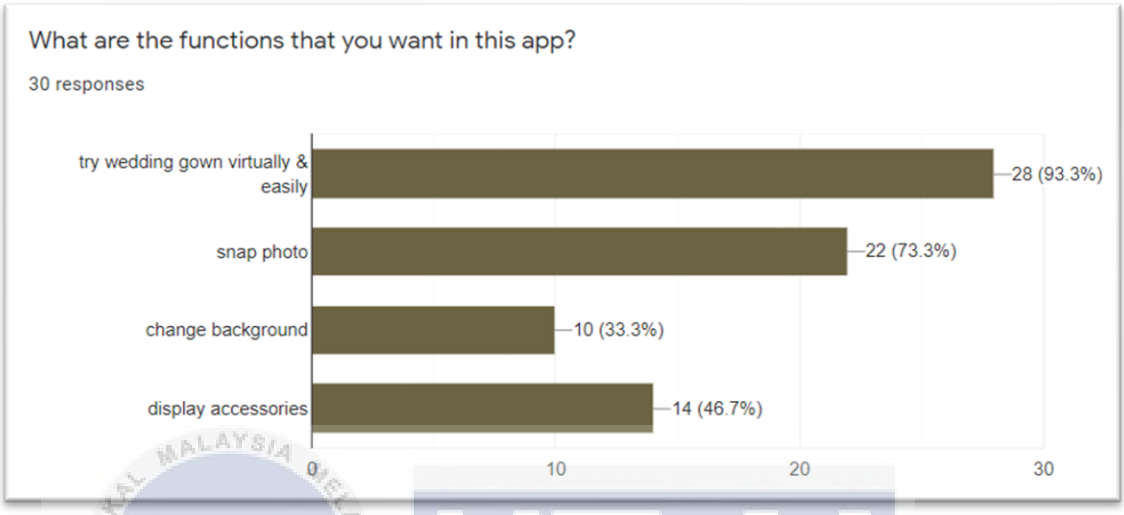


**Figure 3.10 Functions of the application**

From the figure above, 93.3% respondents want the function of wearing wedding dress virtually. 73.3% respondents want to snap the photo and 46.7% want to have a look of the accessories while 33.3% respondents want the changing of background.



*c) Project Functionality*

This project allows user to wear the wedding dress of LaFame Bridal Mansion with AR technology. It will show the details of the dresses and snap the photo of the user wearing the dress.

*d) User Interaction*

In this project, user can view the 3d model of the dresses to know about the dresses design and material. User can move, rotate, zoom in and out the 3d model.

*e) Analysis of Raw Data/Source*

There are many references and sources that were searched and referred to in the process of developing the project. The image of the wedding dress will get from LaFame Bridal Mansion to get the high quality of picture.

### 3.3.2 **Software requirement**

The selection of software used is quite important as it can affect the process of development. The chosen of software is based on the suitableness and the effectiveness. The software used are divide into two types, which are software for development, and the software for documentation.

#### **3.3.2.1 Software Development Requirement**

*I. Tensorflow lite*

An open source software library for machine learning.



*II. Open source computer vision (OpenCV)*

OpenCV is a library of programming functions that mainly aimed at real-time vision.

*III. Android studio*

A tool for developing applications by combining all the elements.

*IV. Adobe photoshop CC 2018*

A raster graphics editor to edit the image.

#### 3.3.2.2 Software Documentation Requirement

*I. Microsoft Word*

A word processor developed that used for documentation work.

*II. Microsoft PowerPoint*

A presentation program that used for the project presentation.

### 3.3.3 Hardware requirement

A computer is used to develop the application and a mobile phone is used to test the application.

### 3.3.4 Other Requirement

*a) Google form*

A tool for collecting information from users via customized survey or quiz. In this project, it used to collect the feedback from the public.



## 3.4 Project Schedule and Milestone

**Table 3.1 Project Milestone**

| Activity | Duration(Day) | Start Date | End Date |
|---|---|---|---|
| **1.0 Define** | | | |
| Meeting with supervisor to discuss the tile of project | 1 | 5 Mac 2021 | 5 Mac 2021 |
| Brainstorming idea about project | 1 | 6 Mac 2021 | 6 Mac 2021 |
| **2.0 Planning** | | | |
| Prepare of proposal | 2 | 7 Mac 2021 | 8 Mac 2021 |
| **3.0 Implementation** | | | |
| Installation of required software | 6 | 9 Mac 2021 | 14 Mac 2021 |
| **4.0 Construction** | | | |
| Development of project | 90 | 15 Mac 2021 | 18 June 2021 |
| Prepare for each chapter in report | 90 | 15 Mac 2021 | 18 June 2021 |

| | | | |
|---|---|---|---|
| Meeting with supervisor every week | Minimum 7 days | - | - |
| **5.0 Evaluation** | | | |
| Testing and publishing | 5 | 20 June 2021 | 25 June 2021 |
| Demo the progress to supervisor | Minimum 4 times across the development | - | - |

Project schedule and milestone is the starting before developing a project. It can make sure the project progress is following the timetable set to let the project complete on time.

## 3.5 Conclusion

In conclusion, this chapter has provided the analysis of the project requirements to know the needs of the public. The project schedule and milestone are stated to make sure the project complete within the duration. Design of the project will be discussed in the next chapter.

# CHAPTER 4: DESIGN

## 4.1 Introduction

The preliminary design and other design details for the project will be defined in this chapter. This chapter includes three parts, which are system architecture, preliminary design and user interface design.

## 4.2 System Architecture

The architecture of the system gives explanation of how the overall system works. First, the user will choose type and shape of the wedding dress. The application will ask for the permission of camera so that the camera will detect user's shoulder to superimpose the wedding dress on the user's body. The user can take photo to see the result of wedding dress fit on her.



## 4.3 Preliminary Design

### 4.3.1 Interactive Storyboard

The storyboard of the AR wedding dress fitting room is drafted using Balsamiq Mockup. Figure 4.1 will let users choose the type of dress that they want to find. After choosing the type, they will choose for the shape of the wedding dress and the design they want(Figure 4.2 & Figure 4.3). Detail of dress will be shown and a button provided to let user 'try it'. User will able to try the wedding dress in virtually like Figure 4.5 and even capture the photo.


**Figure 4.1**


**Figure 4.2**

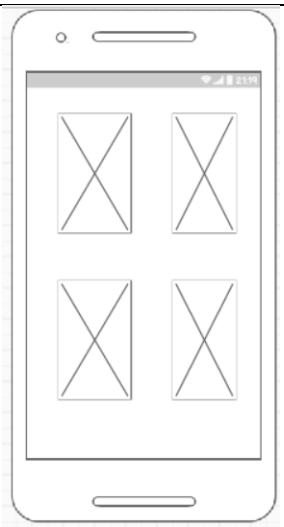

**Figure 4.3**


**Figure 4.4**

**Figure 4.5**



## 4.4 User interface Design

### 4.4.1 Navigation Design

It is to guide the action of the user to use the application in correct way. It is also a reminder for user to take the next action.

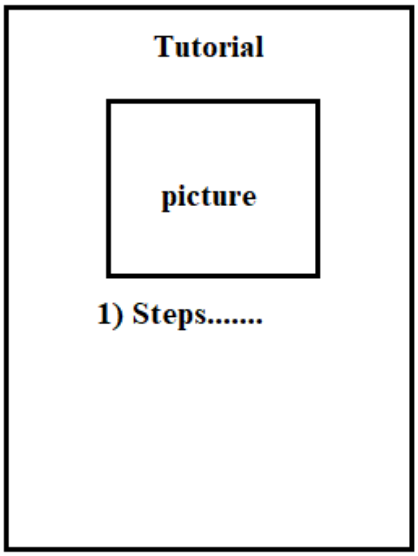


**Figure 4.6 Demo of Navigation Design**

### 4.4.2 Logo

Logo of application will be using the existing logo of LaFame Bridal Mansion as it represents the shop. Black color is used as the background color to make the logo simple and elegant.




**Figure 4.7 Logo**

## 4.5 Conclusion

As a conclusion, this chapter is discussing the system architecture, preliminary designs and user interface design in details. These are to enhance the user experience and the quality of the final product. In the next chapter, the project implementation will be discussed.

# CHAPTER 5: IMPLEMENTATION

## 5.1 Introduction

In this chapter, the activities that carried out during the implementation phase will be discussed. The expected output also will be included in this chapter. The list of activities that need to be completed in this implementation phase are media creation, media integration, product configuration management and implementation status.



## 5.2 Media Creation

Media creation include some elements like text, graphics and three-dimensional(3D) model. Specification of each media creation will be mentioned later.

### 5.2.1 Text Production

The first element of media creation is production of text of the information. In the table below, the font and font size are stated down. The text font used are the built in font in Android Studio.

**Table 5.1 Specification of production of text**

| **Home** | | | | |
|---|---|---|---|---|
| **Type of text** | **Fonts** | **Format** | **Size** | **Color** |
| Title | aclonica | Bold | 16 | black |

| | | | | |
|---|---|---|---|---|
| Description | aclonica | normal | 14 | grey |
| **Product Card** | | | | |
| Naming | serif | normal | 12 | black |
| **Product detail** | | | | |
| Description | serif | normal | 14 | black |
| **Camera** | | | | |
| Tutorial | serif | normal | 14 | black |

### 5.2.2 Graphic Production

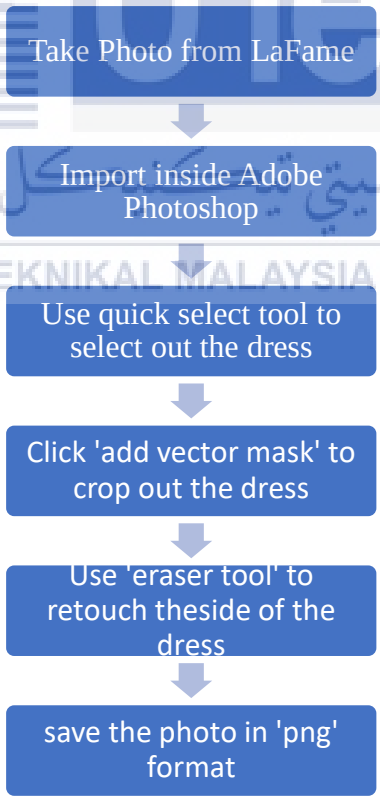


**Figure 5.1 Flowchart of production text**

The second element of media creation is production of graphic in the using of tutorial, picture display, logo and virtual fitting dress. The images of the wedding gown are provided by the staff of LaFame Bridal Mansion. Adobe Premiere Pro CC is used to crop out the dress part and save as file format of '.png'. The images of the introduction for the shop are taken from the website of LaFame. Images for explanation in tutorial are get from the 'Google' as the hand gestures is known by public.

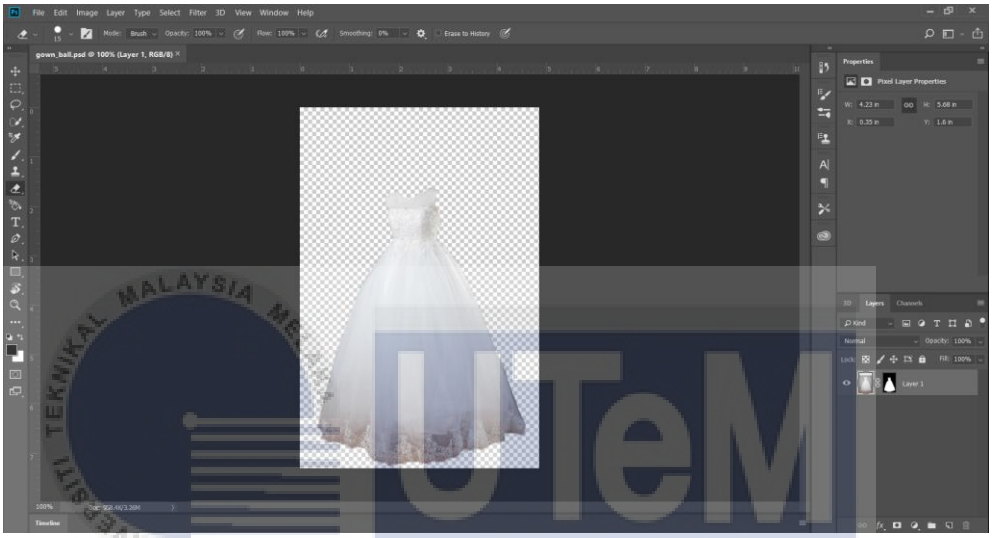

**Figure 5.2 Cropping of dress in Adobe Photoshop**

### 5.2.3 Three-dimensional(3D) model production

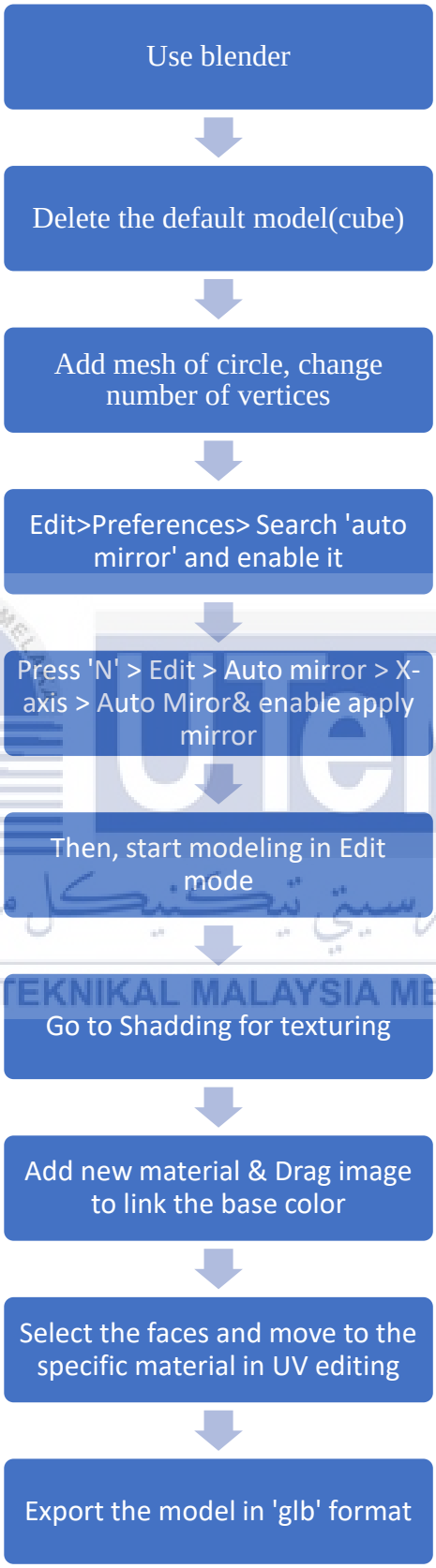




**Figure 5.3 Flowchart of 3D model production**

The last element of media creation is the production of three-dimensional model. The 3D model is used to let user know about the design of the wedding gown and the material used for the gown. The models with the labels are all created using Blender. The texturing process is done to modify the appearance of the real dress. Those models are exported in glb model to import into Android Studio to use.

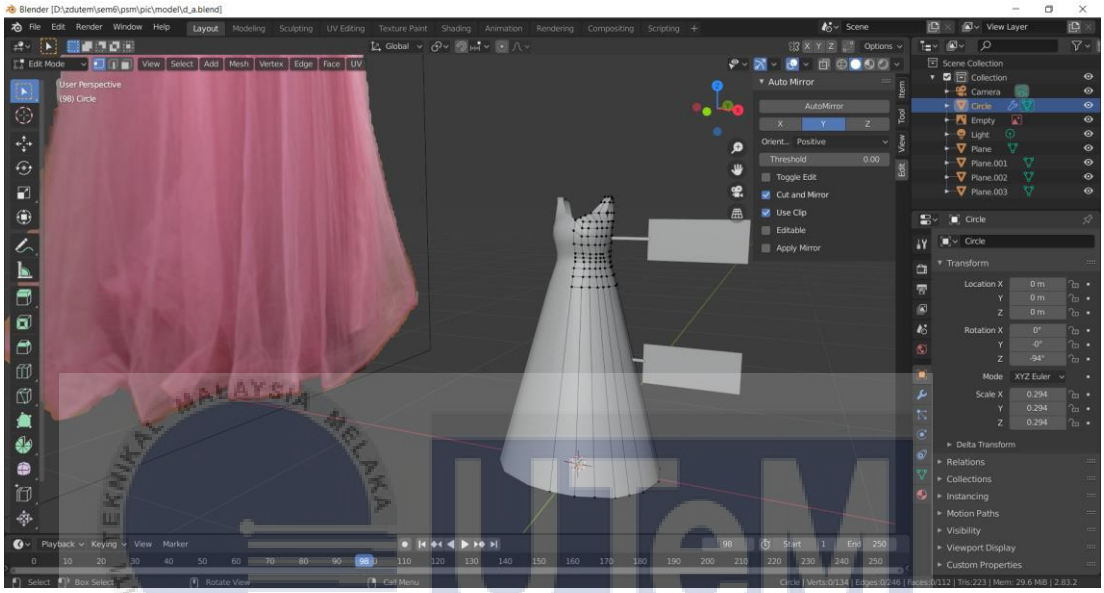

**Figure 5.4 Modeling in Blender**



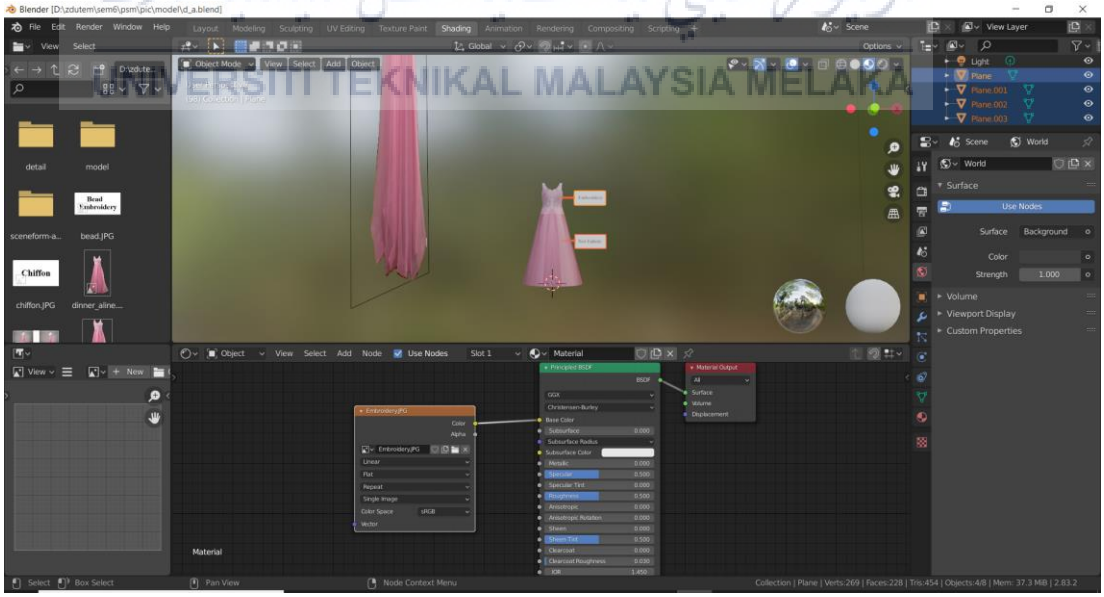

**Figure 5.5 Texturing method**

## 5.3 Media Integration

Media integration will combine all the media creation element by software and impose become one application. The software used to develop the application is Android Studio (64-bit).

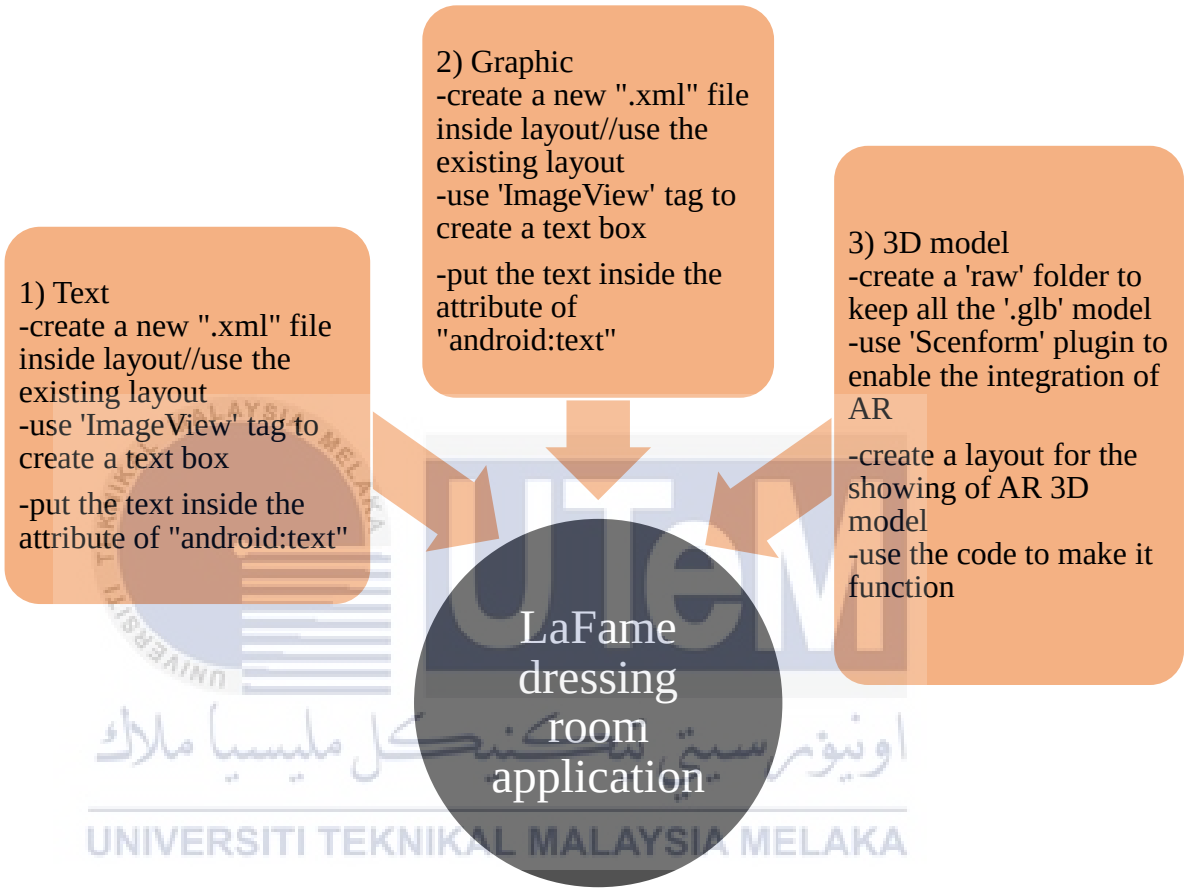


**Figure 5.6 Chart of media integration**

File and material used will be keep properly inside its folder. Right click the folder >> New >> Then create whatever file that needed.

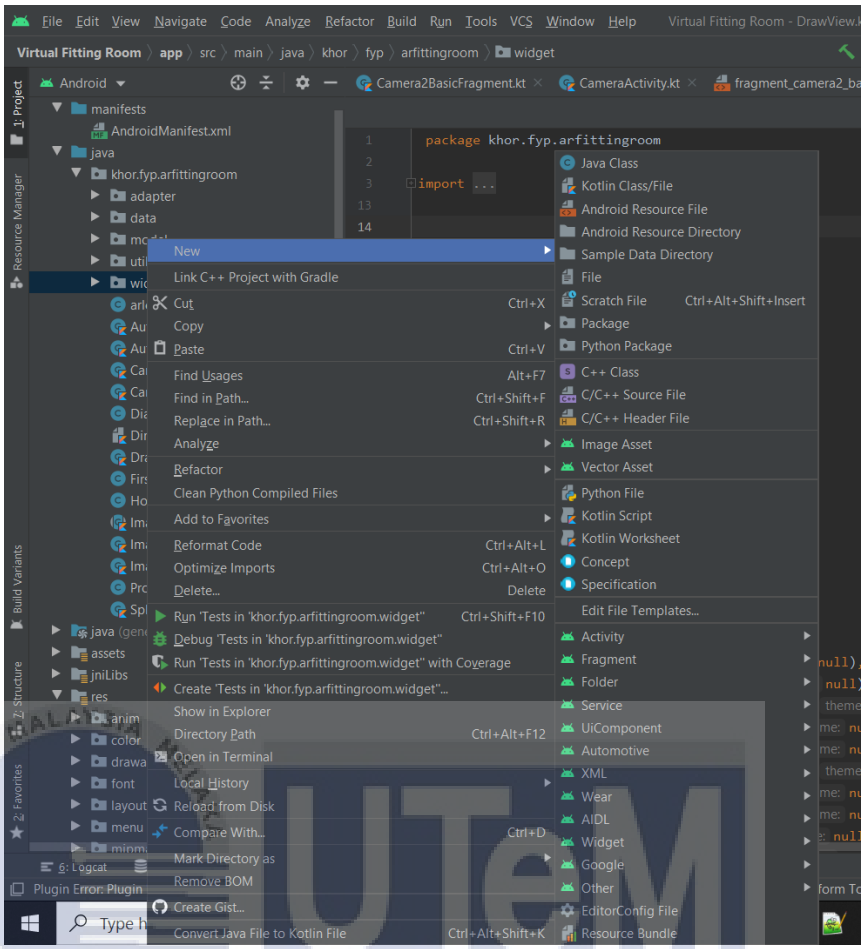


**Figure 5.7 Project files and right click properties**

First, create and design a layout (xml) for user interface like home page. Use the tag like <Relative Layout>, <ImageView>, <TextView> to create containers, image and text. Integrate other layout yu using <include layout>. Then, link the layout with the Java file or Kotlin file to make the buttons work.

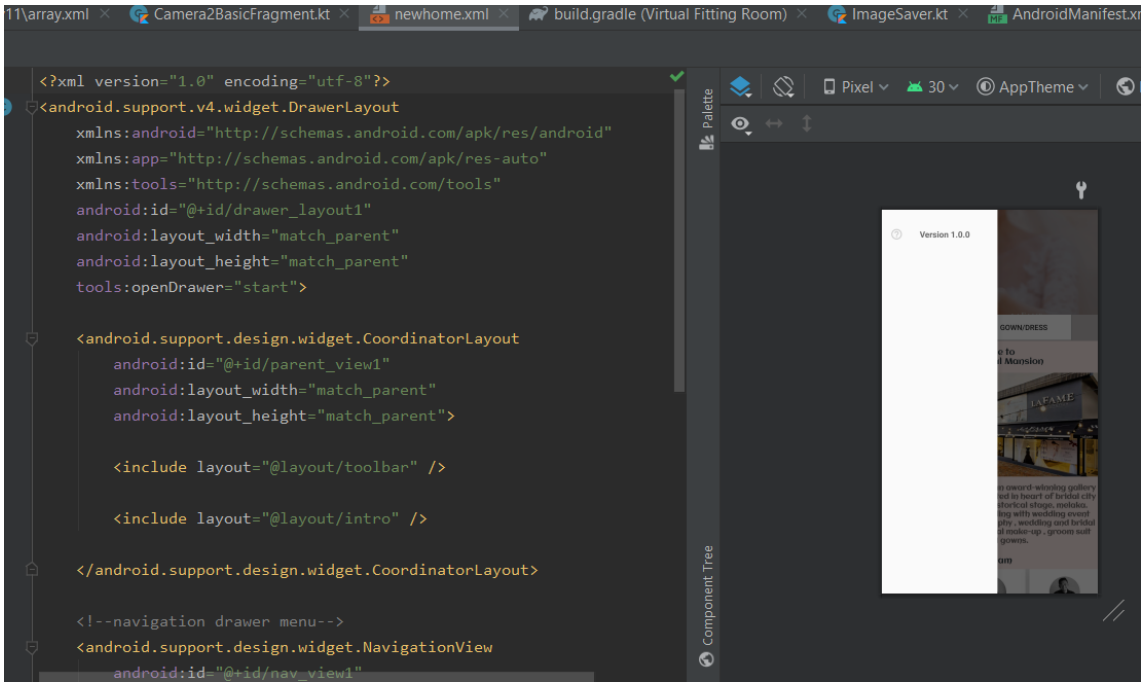


**Figure 5.8 Layout design for home (newhome.xml)**

There is also palette that ease the designing of the interface and the attributes can be assign on the right hand side.

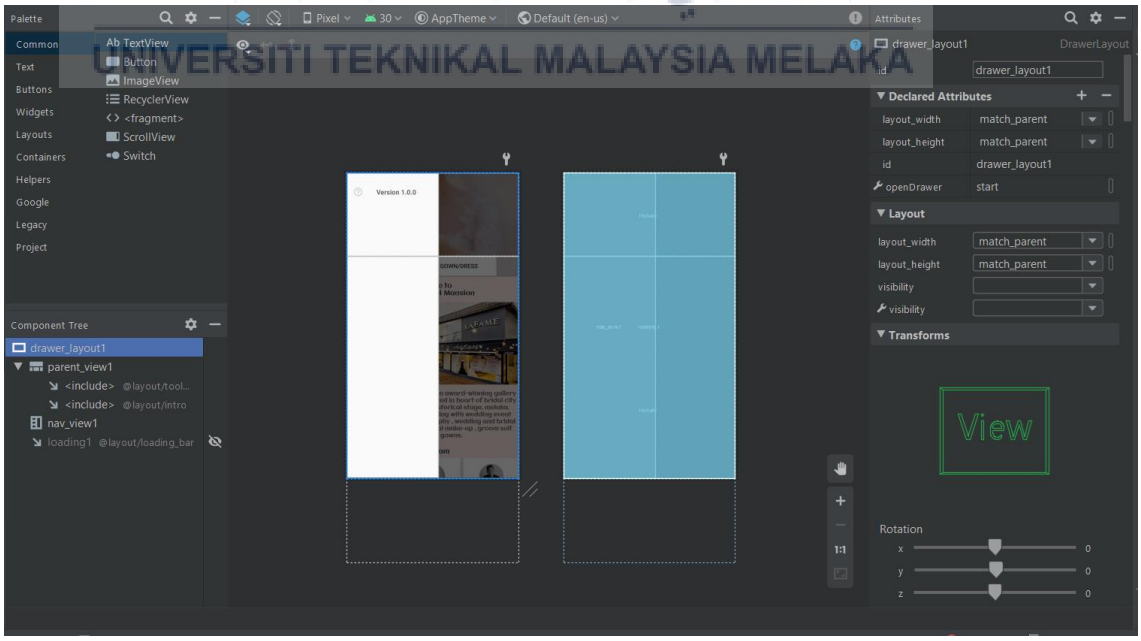


**Figure 5.9 Use of palette design**

```
@Override
protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.newhome);

    parent_view = findViewById(R.id.parent_view1);
    loadingBar = (View) findViewById(R.id.loading1);
    homebutton=findViewById(R.id.homebutton);
    wedbut=findViewById(R.id.wedbutton);
    wedbut.setOnClickListener(new View.OnClickListener() {
        @Override
        public void onClick(View view) {
            Intent i = new Intent(getApplicationContext(), Home.class);
            startActivity(i);
        }
    });
    initToolbar();
    initNavigationMenu();
```

**Figure 5.10 Java code for linking the functions to the layout (first.java)**



Gradle script is the settings for the library and the project. Using of plugin, sdk version can be changed in these files. The minimum sdk for this project is 24 and the target sdk is 26.

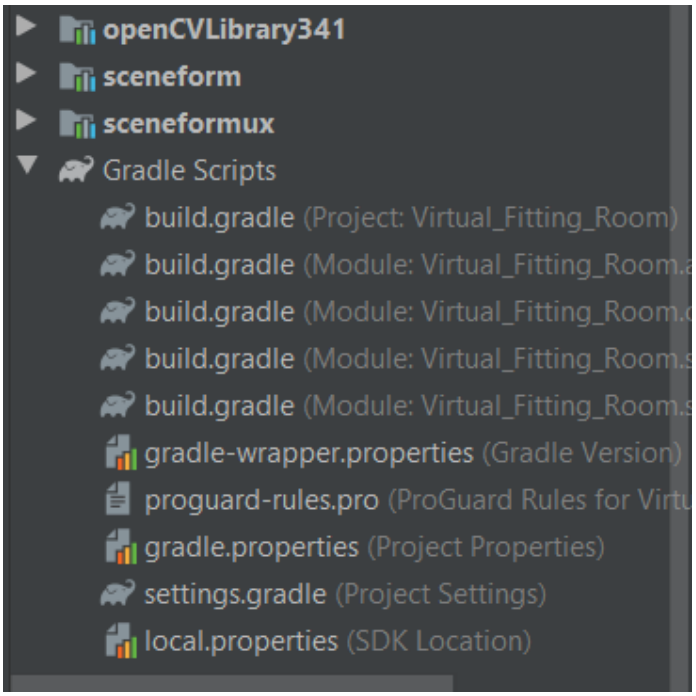


**Figure 5.11 Libraries and Gradle Script**

The '.glb' 3D model store inside raw folder. Next, coding below are called out to take the '.glb' model file to make as the AR 3D model.




**Figure 5.12 Raw folder with 'glb' format model**

```
// ArFragment is linked up with its respective id used in the activity_main.xml
arCam = (ArFragment) getSupportFragmentManager().findFragmentById(R.id.arCameraArea);
arCam.setOnTapArPlaneListener((hitResult, plane, motionEvent) -> {
    clickNo++;
    // the 3d model comes to the scene only
    // when clickNo is one that means once
    if (clickNo == 1) {
        Anchor anchor = hitResult.createAnchor();
        ModelRenderable.builder() ModelRenderable.Builder
                .setSource( context: this, R.raw.g_a)
                .setIsFilamentGltf(true)
                .build() CompletableFuture<ModelRenderable>
                .thenAccept(modelRenderable -> addModel(anchor, modelRenderable)) CompletableFuture<Void>
                .exceptionally(throwable -> {
                    AlertDialog.Builder builder = new AlertDialog.Builder( context: this);
                    builder.setMessage("Something is not right" + throwable.getMessage()).show();
                    return null;
                });
    }
});
```

**Figure 5.13 Code for the function of AR 3D model**

The human body is tracked to know the measurement of the human and resize the virtual dress to fit on the user.

```
bm = BitmapFactory.decodeResource(context.getResources(), R.drawable.gown_mer_try)

val scale = shoudlerW/bm!!.width * 4.5

mat.reset()
mat.postScale(scale.toFloat(), scale.toFloat());
mat.postTranslate( dx: mDrawPoint[1].x - (bm!!.width*scale.toFloat()/2), dy: mDrawPoint[1].y - 100*scale.toFloat())
```

**Figure 5.14 Code for superimpose the dress on human**

## 5.4 Product Configuration Management

This part will explain how to setup the application in the mobile. In Android Studio, the process of exporting the mobile application is called ‘Build’. However, there are some configurations required to do before building the application. This case is specified with the using of Huawei nova3i (Android 9.0) to run the application. The configuration steps are stated below.

Step 1:

Use the USB cable to connect Huawei device with the laptop. Select the option of “Transfer File” in the notification bar of mobile. Go to Setting >> System >> About Phone, tap on Build Number for 7 times to activate develop mode. Then, back to option menu and switch on the Developer Option to turn on the “USB Debugging” function.

Step2:

Save the current project progress. Next, just press the play button or press Build>> Build project. Then, the application will straight away install in the mobile. Furthermore, the apk file can get through Build >> Build Bundle(apk). Transfer the apk file to mobile device and install it.

### 5.4.1 Version Control

The version control integration of the project can be enable by just click VCS>>Enable Version Control. Then, choose ‘git’ as the version control system. Lastly, press ‘commit’ and tick the files that wanted to commit.

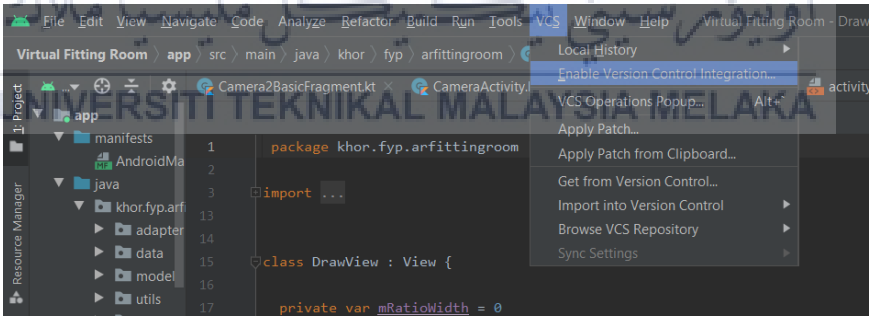


**Figure 5.15 Enable of Version Control**

## 5.5 Implementation Status

The implementation status will be explained based on the activities in Gantt Chart and milestone. This table is let developer keep track of the working progress

**Table 5.2 Project Schedule**

| Task | Expected Date complete | Actual Date completed | Status |
|---|---|---|---|
| 1.0 Project Assign | 5 Mac 2021 | 5 Mac 2021 | On-time |
| 2.0 Project Planning | 7 Mac 2021 | 7 Mac 2021 | On-time |
| 3.0 Project Design | | | |
| Storyline & Project flow | 15 Mac 2021 | 15 Mac 2021 | On-time |
| Storyboard | 20 Mac 2021 | 22 Mac 2021 | Delay(prepare more detail storyboard) |
| 4.0 Project Implementation and Development | | | |
| Image Cropping | 25 Mac 2021 | 25 Mac 2021 | On-time |
| Development Phase 1 | 6 April 2021 | 10 April 2021 | Delay(material not enough) |
| Development Phase 2 | 20 April 2021 | 22 April 2021 | Delay(Phase 1 delay) |
| Modelling | 27 April 2021 | 27 April 2021 | On-time |
| Texturing | 30 April 2021 | 29 April 2021 | In-time |
| Labelling | 4 May 2021 | 2 May 2021 | On-time |

| | | | |
|---|---|---|---|
| Development Phase 3 | 16 Jun 2021 | 21 Jun 2021 | Delay(camera function have not complete) |
| Exporting | 18 Jun 2021 | 21 Jun 2021 | Delay(Phase 3 delay) |
| PSM 1 report | 23 Jun 2021 | 22 Jun 2021 | In-time |
| 5.0 Project Testing and Maintaining | | | |
| Project Testing | 20 July 2021 | 25 Aug 2021 | On-time |
| Project improvement | 19 July 2021 | 2 Aug 2021 | In-time |
| Presentation | 30 Aug 2021 | 5 Sept 2021 | In-time |

## 5.6 Conclusion

This chapter had discussed all the phases in implementation stage. The implementation phase is a very important phase as it determines the product quality. This phase takes longer time compared with other as many resources and material need to prepare before start. In the next chapter, testing of the application will be discussed.

# CHAPTER 6: TESTING

## 6.1 Introduction

In this chapter, the testing phase of the project will be detailing. The test plan consists of test user, test environment, and test schedule. After the test implementation, the test results and test analysis will be stated out.

The testing phase are to determine whether the application achieve the objectives of the project and try the effectiveness of the application.



## 6.2 Testing Plan

### 6.2.1 Test User

The test user for this project are the founders of LaFame Bridal Mansion(client) and their customer (end user). For client, the test is to evaluate the correctness of the content and fulfill the functions needed while for the end user, they need to test the application to provide real-time review and suggestion based on their user experience.

### 6.2.2 Test Environment

Due to the Covid-19 pandemic, the test environment will be conducted through online social media application which is ‘WhatsApp’. The .apk file and end user questionnaire form will be sent to the staff of LaFame Bridal Mansion to collect 30

feedbacks from their customer. The client testing questionnaire will also be sent to the founders of LaFame Bridal Mansionto get theier suggestion. The testing will use the Android system smartphone for installation and the testing process.

### 6.2.3 **Test Schedule**

The testing duration consumes a whole day as the .apk file and the questionnaire will be sent out in the morning. Client and end user feel free to test around the application and give their opinion within the day. The client and user can carry out testing whenever they free in that day.

### 6.2.4 **Test Script and Design**

Test Script is a set of instructions that performed to test the application. First, the .apk file of the application will be sent to 3 clients and 30 users. Then, the usability form will also be sent to all the respondents to get their user experience. The respondents are given a whole day to test run the application and fill the usability testing form after they experienced it.



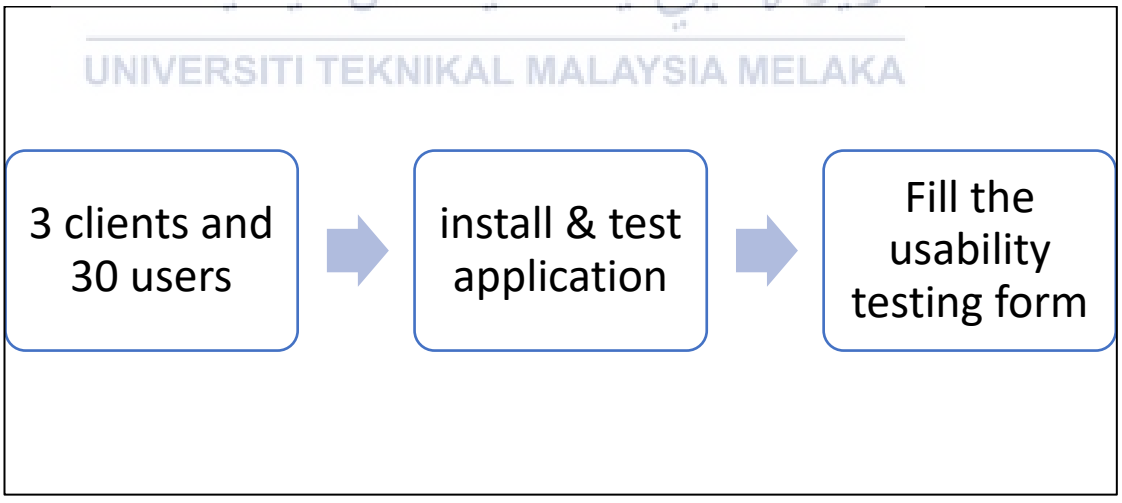


**Figure 6.1 Test Design**

## 6.3 Test Strategy

### 6.3.1 Usability Test

The client aims to determine whether the AR technology is suitable in the fashion of wedding dress. Besides, it is to verify the accuracy of the content provided. The client and the end user need to review based on the learnability, efficiency, memorability, errors and satisfaction. There is scale of strongly disagree, disagree, agree and strongly agree.

**Table 6.1 Usability test for Client**

| | | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|---|
| Learnability | | | | | |
| 1 | The information given are all correct | | | | |
| 2 | The description of dresses is correct | | | | |
| 3 | This system has all the functions that expected to have | | | | |
| 4 | This application helps to introduce the wedding dress | | | | |
| 5 | The model dress looks exactly like the real dress | | | | |
| Efficiency | | | | | |
| 1 | Categorizing the wedding dress with shape is clear and easy | | | | |
| 2 | AR 3D model gives details about the wedding dress clearly | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 3 | The wedding dress fitting is easy to use | | | | |
| 4 | This application can help customer to choose their wedding dress | | | | |
| Memorability | | | | | |
| 1 | The tutorial given is clear, understandable and easy to memorize | | | | |
| 2 | The interface design(button, graphic, color) of this system reach my expectation | | | | |
| 3 | The logo button used is simple and memorable | | | | |
| Error | | | | | |
| 1 | The tutorial gives good instruction | | | | |
| 2 | The recovering from error is easy(back) | | | | |
| Satisfaction | | | | | |
| 1 | Overall, the system works well | | | | |
| 2 | The application helps customer in the future | | | | |
| 3 | The application reduces the work of introducing the wedding dress | | | | |
| Feedback: | | | | | |

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**Table 6.2 Usability test for End User**

| | | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|---|
| Learnability | | | | | |
| 1 | The information of LaFame Bridal Mansion is clear and informative | | | | |
| 2 | The material, shape, looks of the dress is easy to know when using AR 3D model | | | | |
| 3 | The AR 3D model gives more details of the wedding dress | | | | |
| 4 | The description of the wedding dress is understandable | | | | |
| 5 | The tutorial given is clear and understandable | | | | |
| Efficiency | | | | | |
| 1 | Searching the wedding dress through its shape is easy | | | | |
| 2 | Comparing the difference of the wedding dress is easy using the application | | | | |
| 3 | AR 3D model gives more details than a traditional catalog book | | | | |
| 4 | The system helps to see how nicely the dress fits on | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 5 | This system has all the functions and capabilities | | | | |
| 6 | Choosing wedding dress become easier after using the application | | | | |
| Memorability | | | | | |
| 1 | The system is easy to learn to use | | | | |
| 2 | The interface(button, graphic, color) of this system is pleasant | | | | |
| 3 | The meaning of the button is well-known(logo) | | | | |
| Error | | | | | |
| 1 | The tutorial gives good instruction | | | | |
| 2 | The recovering from error is easy(back) | | | | |
| 3 | The running of the application is smooth | | | | |
| Satisfaction | | | | | |
| 1 | This application is easy to use | | | | |
| 2 | The AR 3D model is simple to use | | | | |
| 3 | The AR 3D model performs the fashion of wedding dress well | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 4 | The fitting room works well | | | | |
| 5 | Overall, I am satisfied with this system | | | | |
| Feedback: | | | | | |

## 6.4 Test Implementation

### 6.4.1 Test Description

The targeted individual for the client is founder and the person that work at the wedding field which know about the fashion well. The client will follow the test script that can guide them to test the application. After the use of mobile application, they will be given the client test Google form that consist of some questions. The questions are divided into several parts which are learnability, efficiency, memorability, error and satisfaction. The client can review each question with the scale of strongly disagree, disagree, agree or strongly agree.

The end user testing will be conducted among 30 customers of LaFame Bridal Mansion or the girls who going to marry. The .apk file need to be installed and run before giving their feedback through the Google form about the using of the LaFame Dressing Room Application. The test script will give the instruction to them to run the application. The questions are divided like the client test Google form. The end user can review it based on their user experience.



### 6.4.2 Test Data

The data for this project is real life data. All data are collected from founders and 30 customers of LaFame Bridal Mansion. The table below will show the test data that collected from the respondents.

#### 6.4.2.1 Usability Test for Client

**Table 6.3 Details of clients**

| No | Name | Position |
|---|---|---|
| 1 | Paul Kong | Managing Director |
| 2 | Max Goh | Operation Director |
| 3 | Sk Yong | Business Development Director |

**Table 6.4 Test data for Client**

| Question | Responds from clients | | | |
|---|---|---|---|---|
| | Strongly Disagree | Disagree | Agree | Strongly Agree |
| Learnability | | | | |
| 1 | 0 | 0 | 0 | 3 |
| 2 | 0 | 0 | 1 | 2 |
| 3 | 0 | 0 | 3 | 0 |
| 4 | 0 | 0 | 1 | 2 |
| 5 | 0 | 0 | 2 | 1 |
| Efficiency | | | | |
| 1 | 0 | 0 | 1 | 2 |
| 2 | 0 | 0 | 2 | 1 |
| 3 | 0 | 1 | 1 | 1 |
| 4 | 0 | 0 | 2 | 1 |
| Memorability | | | | |
| 1 | 0 | 0 | 3 | 0 |
| 2 | 0 | 0 | 1 | 2 |
| 3 | 0 | 0 | 0 | 3 |
| Error | | | | |

| | | | | |
|---|---|---|---|---|
| 1 | 0 | 0 | 2 | 1 |
| 2 | 0 | 0 | 3 | 0 |
| Satisfaction | | | | |
| 1 | 0 | 0 | 1 | 2 |
| 2 | 0 | 0 | 0 | 3 |
| 3 | 0 | 0 | 1 | 2 |

### 6.4.2.2 Usability Test for End User

**Table 6.5 Test data for End user**

| Question | Responds from 30 End User | | | |
|---|---|---|---|---|
| | Strongly Disagree | Disagree | Agree | Strongly Agree |
| Learnability | | | | |
| 1 | 0 | 0 | 15 | 15 |
| 2 | 0 | 0 | 13 | 17 |
| 3 | 0 | 0 | 15 | 15 |
| 4 | 0 | 0 | 13 | 17 |
| 5 | 0 | 0 | 12 | 18 |
| Efficiency | | | | |
| 1 | 0 | 0 | 18 | 12 |

| | | | | |
|---|---|---|---|---|
| 2 | 0 | 0 | 17 | 13 |
| 3 | 0 | 0 | 11 | 19 |
| 4 | 0 | 0 | 14 | 16 |
| 5 | 0 | 0 | 18 | 12 |
| 6 | 0 | 0 | 15 | 15 |
| Memorability | | | | |
| 1 | 0 | 0 | 15 | 15 |
| 2 | 0 | 0 | 17 | 13 |
| 3 | 0 | 0 | 7 | 23 |
| Error | | | | |
| 1 | 0 | 0 | 13 | 17 |
| 2 | 0 | 2 | 16 | 12 |
| 3 | 0 | 0 | 15 | 15 |
| Satisfaction | | | | |
| 1 | 0 | 0 | 12 | 18 |
| 2 | 0 | 0 | 14 | 16 |
| 3 | 0 | 0 | 11 | 19 |
| 4 | 0 | 1 | 11 | 18 |
| 5 | 0 | 0 | 15 | 15 |

## 6.5 Test Results and Analysis

### 6.5.1 Usability Test for Client

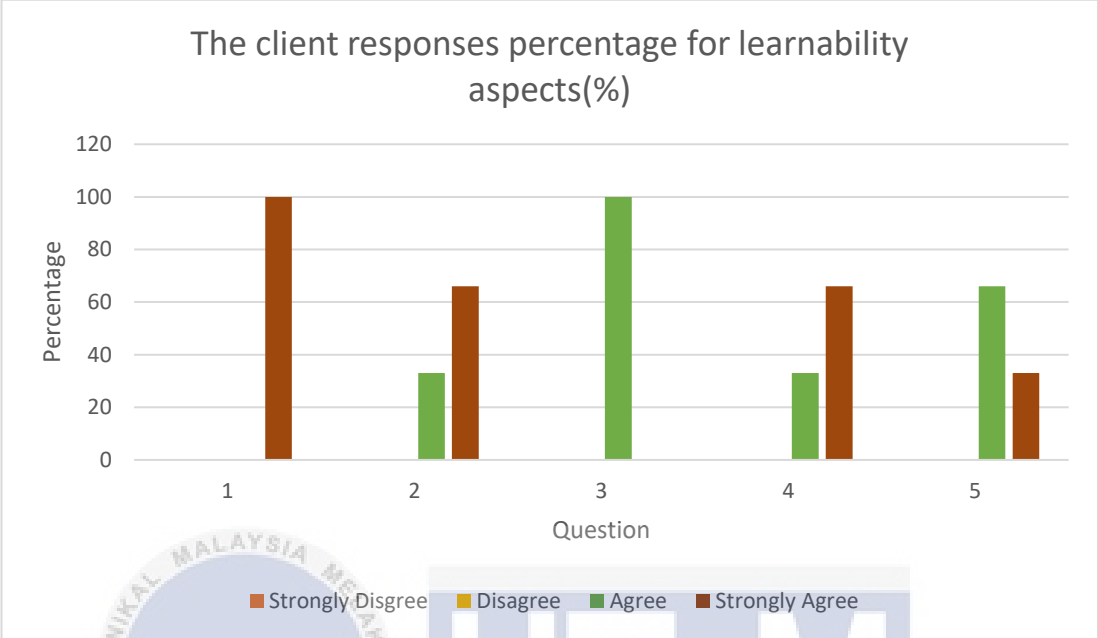


**Figure 6.2 Graph of the client responses for learnability aspects**



**Table 6.6 The client responses percentage for learnability aspects**

| Question | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 100% |
| 2 | 0 | 0 | 33% | 66% |
| 3 | 0 | 0 | 100% | 0 |
| 4 | 0 | 0 | 33% | 66% |
| 5 | 0 | 0 | 66% | 33% |

Based on the Figure 6.2 and Table 6.6, it shows the result analysis of 3 client in the form of graph and percentage for the learnability section. There are 5 questions in this section. For the first question, is to make sure the information given are all correct. All of the clients are strongly agreed that the information given in this application are the information that they provided. Then, the next question is about the description for the dresses are correct. 33% of clients are agreed and 66% of clients are strongly agreed with this statement. Furthermore, the question of whether the features that they wanted are in the application. All of the clients are agreed that this application contains the functional features that they needed. The fourth question is regarding to the application helps to introduce the wedding dress. 33% of clients are agreed and 66% of clients are strongly agreed with the statement. Last question in this part is the 3D model looks exactly like the real dress. 66% of client are agreed and 33% of client are strongly agreed that the models are follow the real dress to model out. Positive reviews in this part shows that the information given in this application is correct.

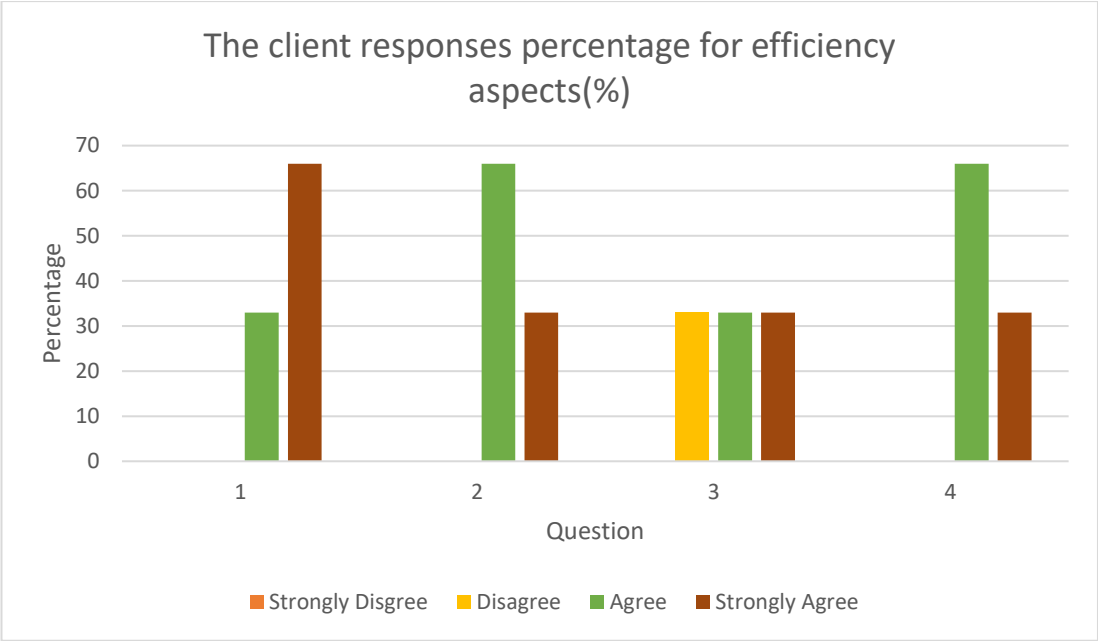


**Figure 6.3 Graph of the client responses percentage for efficiency aspects**

**Table 6.7 The client responses percentage for efficiency aspects**

| Question | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| 1 | 0 | 0 | 33% | 66% |
| 2 | 0 | 0 | 66% | 33% |
| 3 | 0 | 33% | 33% | 33% |
| 4 | 0 | 0 | 66% | 33% |

Based on the Figure 6.3 and Table 6.7, it shows the result analysis of 3 client in the form of graph and percentage for the efficiency section. It consists of 4 questions in this part. The question asked whether categorizing the wedding dress with the shape is clear and simple. 33% of clients are agreed and 66% of clients are strongly agreed that the categorization is correct and ease the searching of dress. Next, the question is about the details given in the AR 3D model is clear enough. 66% of clients are agreed and 33% of clients are strongly agreed that the AR 3D model can give enough details of wedding dress to the customer. This includes the material, shape and appearance of the wedding dress. Then, the third question is the ease of using wedding dress fitting room. 2 out of 3 clients give positive responses while 1 client are disagreed that the working of wedding dress fitting is simple to control and use. For the fourth question, it is asking whether the application can help the customer to choose their wedding dress. 66% of clients are agreed and 33% of clients are strongly agreed that this application can help the customer to decide which wedding dress they want to try out in their physical store. This can conclude that the efficiency of the application is quite high as the clients had test the working of application and gave quite high reviews.

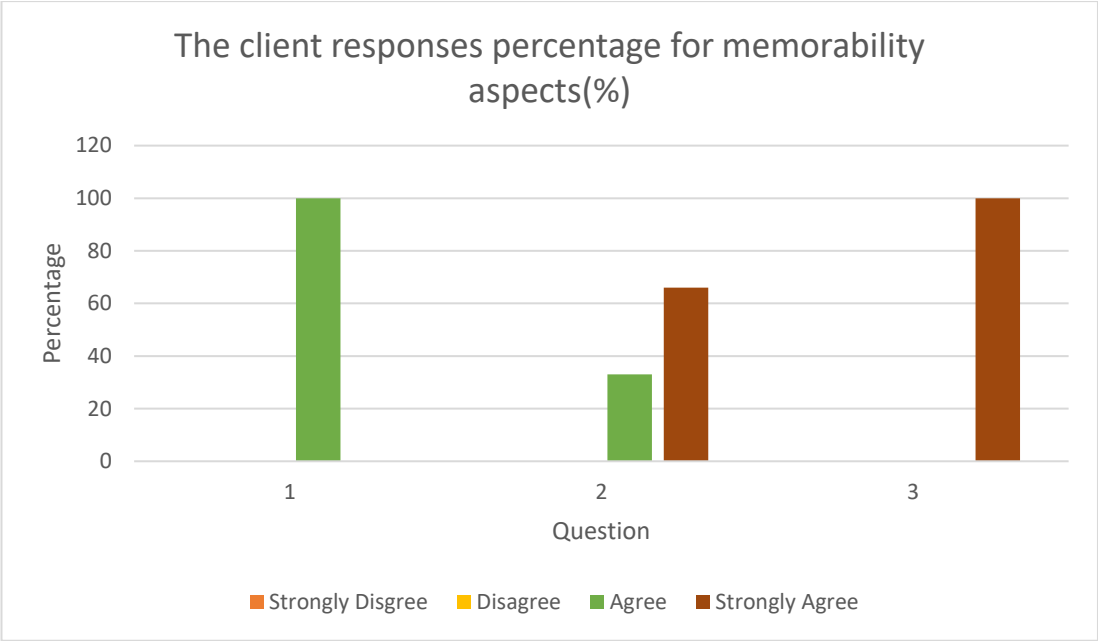


**Figure 6.4 Graph of the client responses percentage for memorability aspects**

**Table 6.8 The client responses percentage for memorability aspects**

| Question | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| 1 | 0 | 0 | 100% | 0 |
| 2 | 0 | 0 | 33% | 66% |
| 3 | 0 | 0 | 0 | 100% |

Based on the Figure 6.4 and Table 6.8, it shows the result analysis of 3 client in the form of graph and percentage for the memorability section. In this section, there are 3 simple questions. For the first question, it is regarding to the understandable, memorable of the tutorial. 100% of clients are agreed that the tutorial is clear and easy to understand. This means that they can recognize the hand gesture which they need to use in AR 3D model through the tutorial. Next, the question asked whether the interface design reach client's expectations. 33% of clients agreed and 66% of clients are strongly agreed that the design is pleasant to be memorized. The last question for memorability part is about the understandable of the button. 100% of clients are strongly agreed that they know the functionality of every button. The logo used for the button is easy to understand and need not put much effort to memorize their meaning. The interface of the application is simple to let them memorize, they are still able to know how it use for the next time.

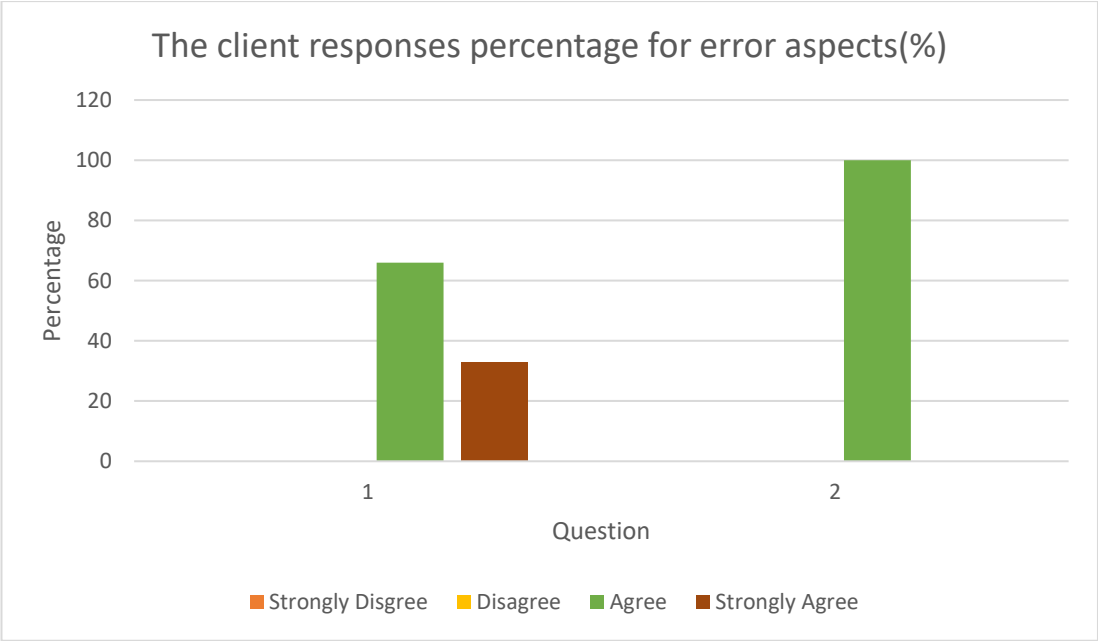


**Figure 6.5 Graph of the client responses percentage for error aspects**

**Table 6.9 The client responses percentage for error aspects**

| Question | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| 1 | 0 | 0 | 66% | 33% |
| 2 | 0 | 0 | 100% | 0% |

Based on the Figure 6.5 and Table 6.9, it shows the result analysis of 3 client in the form of graph and percentage for the error section. There are only 2 questions in this section. This section will test on the prevention of error and error recovering. The first question is whether the tutorial gives good instruction. 66% of clients are agreed and 33% of clients are strongly agreed that the tutorial guide the usage of the 3D AR model. Good instruction can prevent clients from making mistakes. The next question is regarding to the error recovery by pressing back button. 100% of client are agreed that back button can solve the problem they met. In this part, the reviews are all in positive responses because they might not have problem when they are running the application.

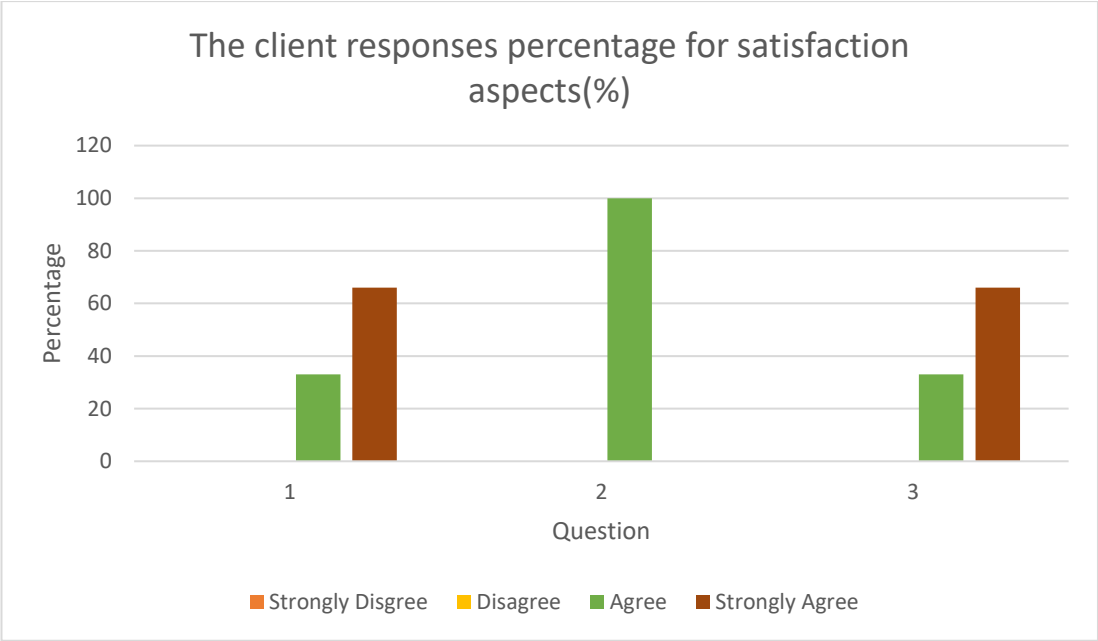


**Figure 6.6 Graph of the client responses percentage for satisfaction aspects**

**Table 6.10 The client responses percentage for satisfaction aspects**

| Question | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| 1 | 0 | 0 | 33% | 66% |
| 2 | 0 | 0 | 100% | 0 |
| 3 | 0 | 0 | 33% | 66% |

Based on the Figure 6.6 and Table 6.10, it shows the result analysis of 3 client in the form of graph and percentage for the satisfaction section. This part consists of 3 questions. In question 1, it asked the satisfaction of client toward the overall application. 33% of the clients are agreed and 66% of clients are strongly agreed that they are satisfied with this application. Then, the second question is asking whether the application would help customers choosing their in the future. All clients are agreed that this application can help customers to decide their wedding dress. The last question in this part is whether the introduction task of wedding dress can be reduced with the use of this application. 33% of clients are agreed and 66 % of client are strongly agreed with this statement. The feedback in this section is almost positive, it seems the application has reached their expectations and they are satisfied with the features that provided by this application.

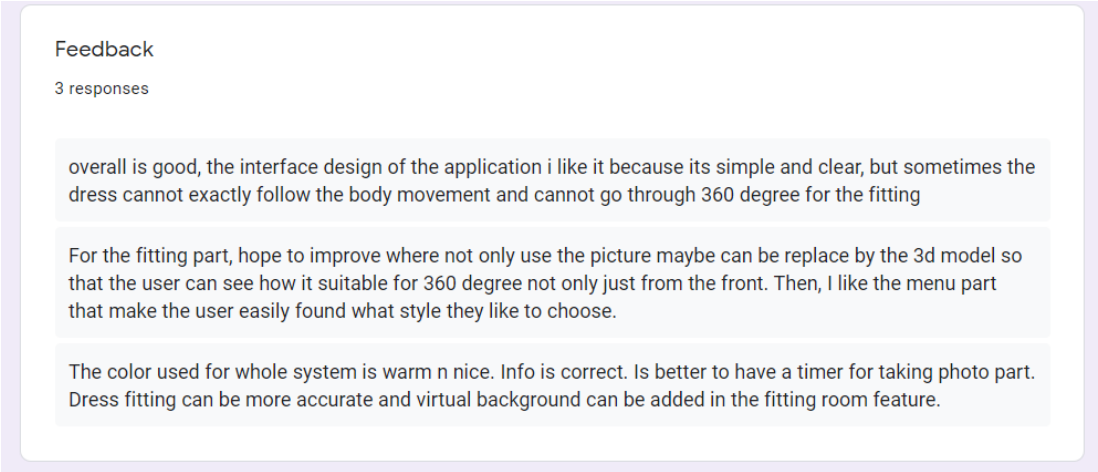


**Figure 6.7 Feedback of clients**

In the last part of questionnaire form, it has a feedback section for the respondents to give some opinions or suggestions. Some positive feedbacks and some suggestion that can be adapted are given in this part. They praised the aesthetic of the application as they felt comfortable with the color used. They seem satisfied with the application but they also gave some suggestion to improve this application. The suggestion like 360 degree of fitting, fitting with 3D model and adding timer will discussed as the improvement in the next chapter.

### 6.5.2 **Usability Test for End User**

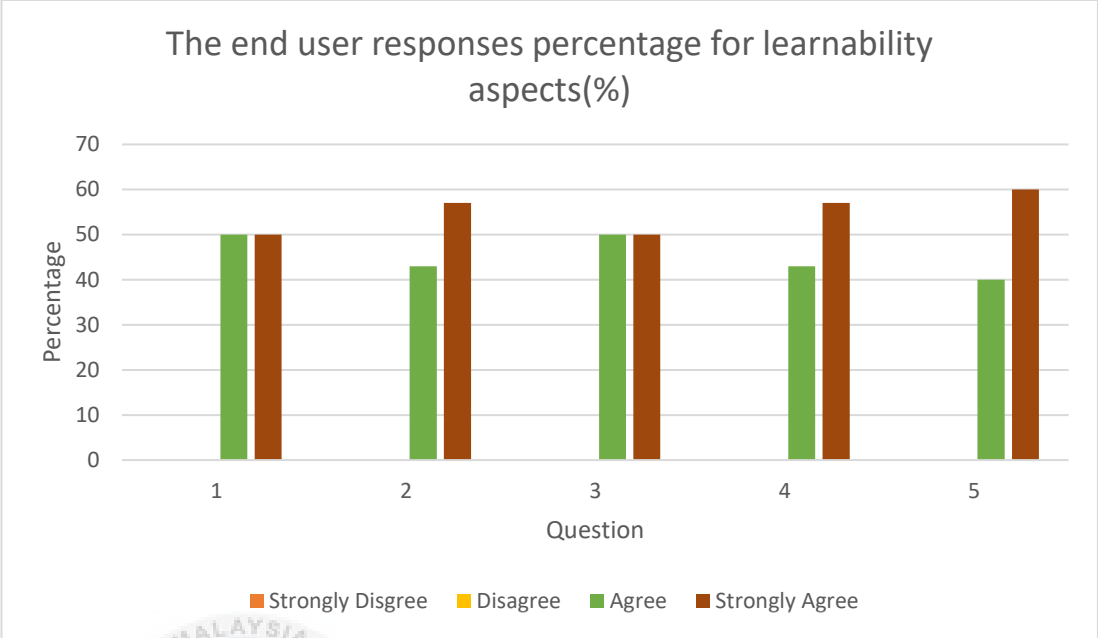


**Figure 6.8 Graph of the end user responses percentage for learnability aspects**

**Table 6.11 The end user responses percentage for learnability aspects**

| Question | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| 1 | 0 | 0 | 50% | 50% |
| 2 | 0 | 0 | 43% | 57% |
| 3 | 0 | 0 | 50% | 50% |
| 4 | 0 | 0 | 43% | 57% |
| 5 | 0 | 0 | 40% | 60% |

Based on the Figure 6.8 and Table 6.11, it shows the result analysis of 30 end user in the form of graph and percentage for the learnability section. There are 5 questions in this section. For the first question, it is asking whether the information provided is clear and informative. Half of them agreed with this statement while the other half strongly agreed with it. The second question is about user can know the material, shape and looks of the dress easily through AR 3D model. There are 57% respondents are strongly agreed and 43% respondents are agreed that AR 3D model helps them to know the appearance of dress. Next, the third question is regarding to AR 3D model gives more details of wedding dress. 50% of them are agreed and another 50% of respondents strongly agreed that they can get more information when using the AR 3D model. For the fourth question, it is about whether the description of the wedding dress is understandable. 13 out of 30 respondents (43%) feel agreed and 57% respondent strongly agreed that they are understand to the content of the description. The last question in this learnability section is whether the tutorial given is clear and understandable. 40% of respondents agreed and 60% of respondent strongly agreed with this statement. This might because the graphic using in the tutorial make them easier to understand about it. Most of the respondents gave positive feedback as the information provided is clear enough, understandable and ease their learning of wedding dress with this application.

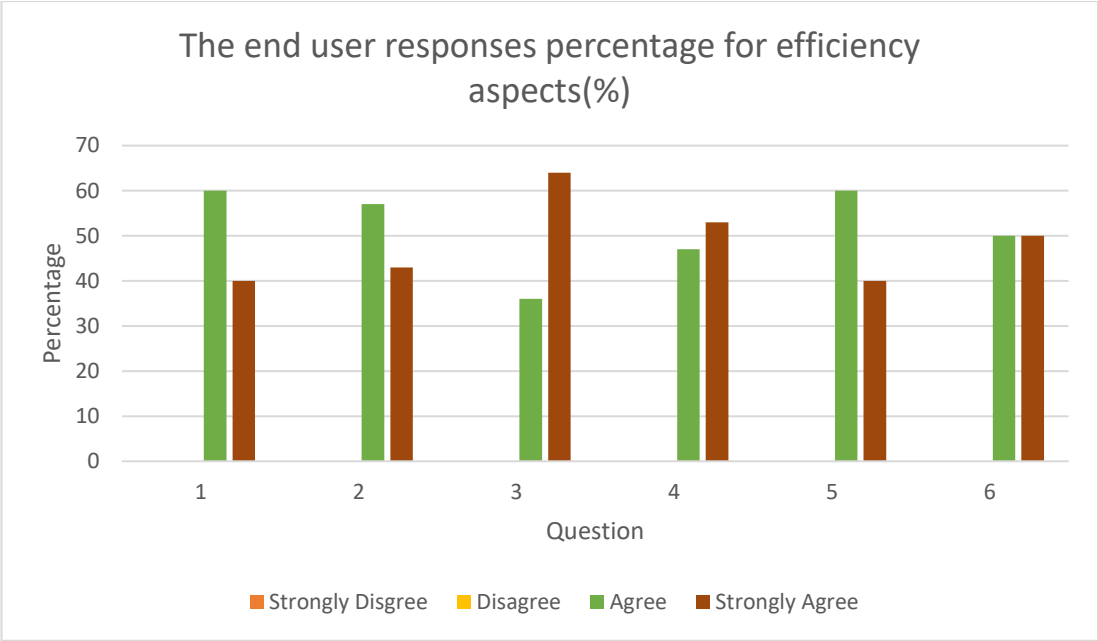


**Figure 6.9 Graph of the end user responses percentage for efficiency aspects**

**Table 6.12 The end user responses percentage for efficiency aspects**

| Question | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| 1 | 0 | 0 | 60% | 40% |
| 2 | 0 | 0 | 57% | 43% |
| 3 | 0 | 0 | 36% | 64% |
| 4 | 0 | 0 | 47% | 53% |
| 5 | 0 | 0 | 60% | 40% |
| 6 | 0 | 0 | 50% | 50% |

Figure 6.9 and Table 6.12 show the result analysis of 30 respondents in the form of graph and percentage for the efficiency section. This section consists of 6 questions. In the first question, it mentioned whether the searching method of wedding dress by its shape is an easy way. More than half of the respondents which is 60% of them are agreed and 40% of the respondents are strongly agreeing that they can simply search the wedding dress with the categories of shape. Then, second question is regarding the efficiency of comparing the difference among all the dresses is easy. 57% of the respondents are agreed while 43% of the respondents strongly agreed that they can know the difference of the wedding dress with the information provided. The third question is AR 3D model gives more details than traditional catalog book. 36% out of 100% are agreed and 64% of the respondents are strongly agreed with the AR 3D model is more efficient in delivering the dresses details than traditional catalog book. For the fourth question, it is about the system helps to see how nicely the dress fits on the user. 14 out of 30 which up to 47% respondents are agreed and 16 respondents (53%) are strongly agreed with the statement. Next question, it is regarding whether the application contain all the functions and capabilities that user wants. 60% respondents are agreed and 40% respondents are strongly agreed that this application contain all the features that they wanted and needed. The last question is it is easy to choose the wedding dress with the use of this application. Half of the respondents are agreed and another half respondents are strongly agreed the application helps them in the choosing of wedding dress. In this section, positive feedback shows the efficiency of LaFame Dressing Room is quite high.

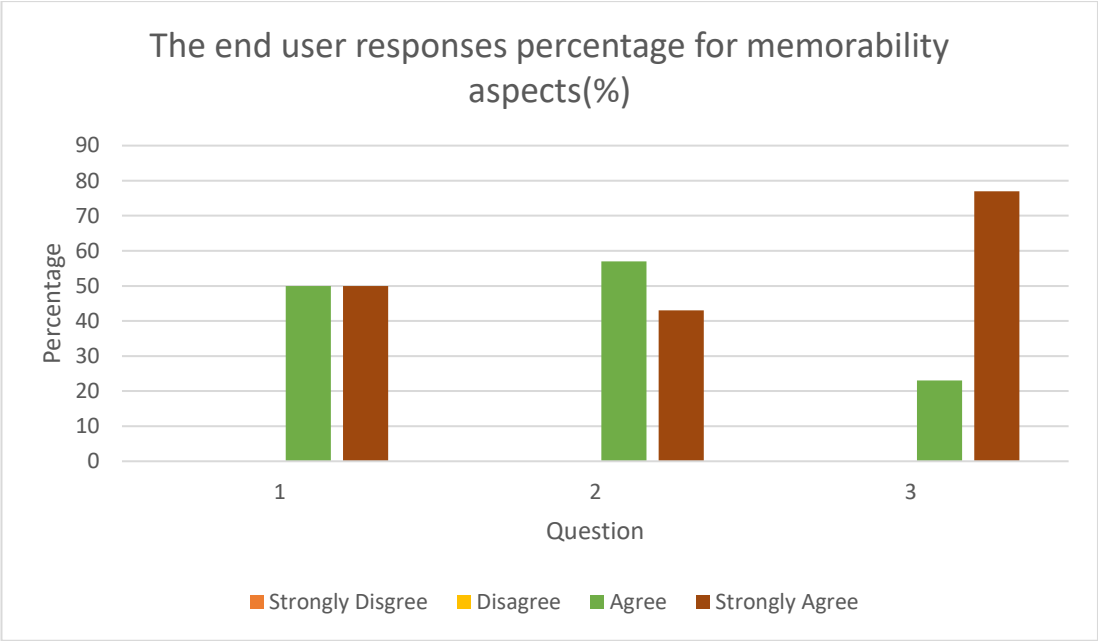


**Figure 6.10 Graph of the end user responses percentage for memorability aspects**

**Table 6.13 The end user responses percentage for memorability aspects**

| Question | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| 1 | 0 | 0 | 50% | 50% |
| 2 | 0 | 0 | 57% | 43% |
| 3 | 0 | 0 | 23% | 77% |

Based on the Figure 6.10 and Table 6.13, it shows the result analysis of 30 respondents in the form of graph and percentage for the memorability section. There are only 3 questions in this section. For the first question, it asked whether the system is easy to learn to use. All of the respondent gives positive feedback as 50% of agreed and 50% of strongly agreed. The application might be memorable to them because it is easy to use. Then, the second question is regarding the pleasant of the interface. 57% respondents are agreed and 43% respondents are strongly agreed that the color used, graphics and so on are nice and pleasing. The third question is whether the logo used for the button is well-known. Up to 77% respondents are strongly agreed and 23% agreed with the statement. This might conclude as the logo used is well-known and need not to be memorized when clicking those buttons.

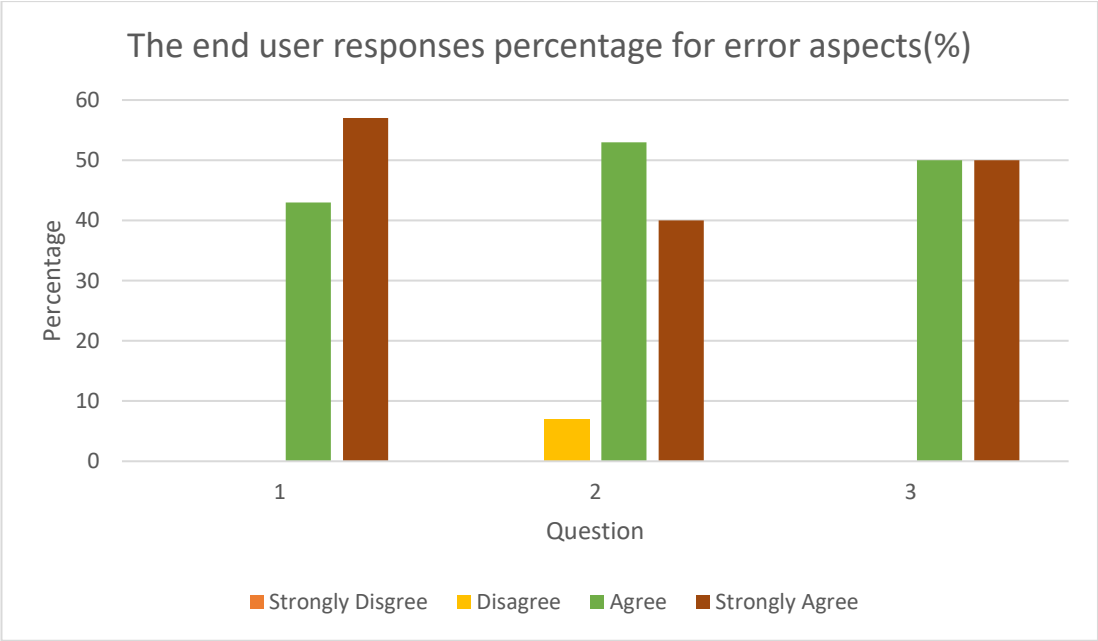


**Figure 6.11 Graph of the end user responses percentage for error aspects**

**Table 6.14 The end user responses percentage for error aspects**

| Question | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| 1 | 0 | 0 | 43% | 57% |
| 2 | 0 | 7% | 53% | 40% |
| 3 | 0 | 0 | 50% | 50% |

Based on the Figure 6.11 and Table 6.14 above, it shows the result analysis of 30 respondents in the form of graph and percentage for the error section. This section contains 3 questions. First question, it is to confirm whether the tutorial gives good instruction. 43% of respondents are agreed and 57% of respondents are strongly agreed that the tutorial provides good instruction. This might prevent user from making mistakes. Next, the second question is regarding to the easy of the recovery from error. There are 93% of respondents are agreed or strongly agreed but 7% of respondents disagree with the easiness of error recovering. This might because of they have some errors that cannot be solve by returning to the previous page. Last question of this section is asking about whether the running of the application is smooth. 50% respondents are agreed and another half of 30 respondents are strongly agreed. It seems like most of them do not have big problem when they run the application.

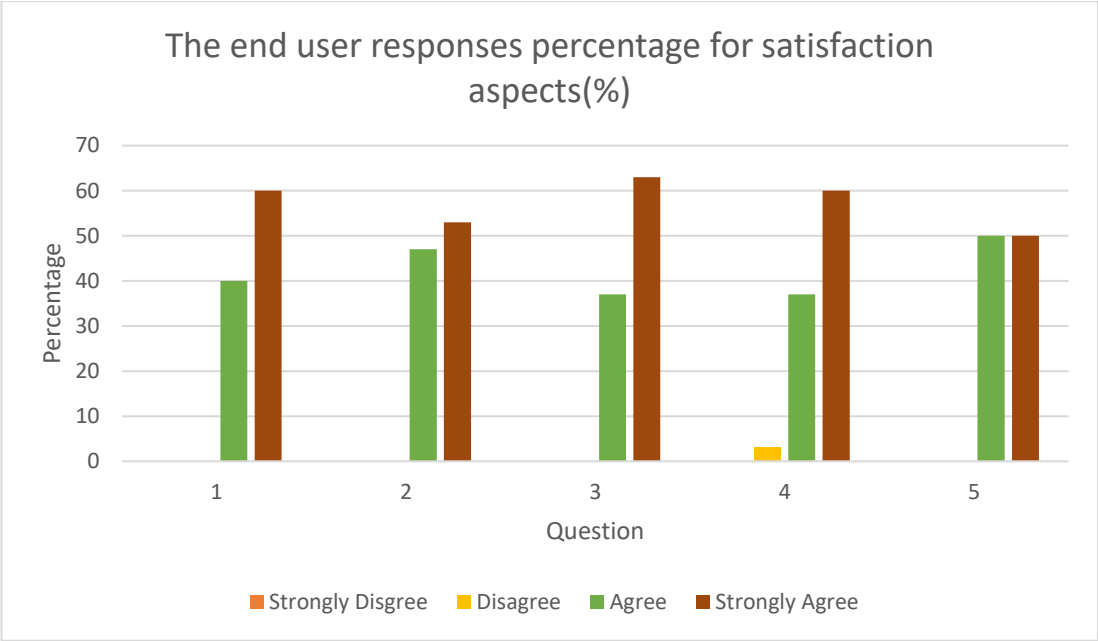


**Figure 6.12 Graph of the end user responses percentage for satisfaction aspects**

**Table 6.15 The end user responses percentage for satisfaction aspects**

| Question | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| 1 | 0 | 0 | 40% | 60% |
| 2 | 0 | 0 | 47% | 53% |
| 3 | 0 | 0 | 37% | 63% |
| 4 | 0 | 3% | 37% | 60% |
| 5 | 0 | 0 | 50% | 50% |

Based on the Figure 6.12 and Table 6.15 above, it shows the result analysis of 30 respondents in the form of graph and percentage for the satisfaction section. For the last section, there are 5 questions. For the first question, it is about whether the application is easy to use. 12 out of 30 respondents (40%) are agreed and 60% of respondents are strongly agreed. Then, the second question is regarding to the ease to use of AR 3D model. There are 47% respondents are agreed and 53% respondents are strongly agreed that it is easy to use the AR 3D model. Third question is about the well performs of the fashion of wedding dress. 37% of respondents agreed and 63% are strongly agreed that this application can well present the wedding dress. Furthermore, the fourth question is mentioning the well working of fitting room. The responses for this question are no totally positive feedback. 37% of respondent are agreed and 60 % of respondents are strongly agreed while there is one respondent who are disagreed with well-functioning of the fitting room. This might because of the graphic of the dresses not so high in quality or the dress do not fit accurate on the user. The last question is asking whether they are satisfied with the overall application. Half of the respondents are agreed and another 50 % respondents are strongly agreed that they are satisfied with this application. Although there are some negative feedbacks in the fitting room features, the running of overall application is still not bad and most of the user seem willing to use the application.

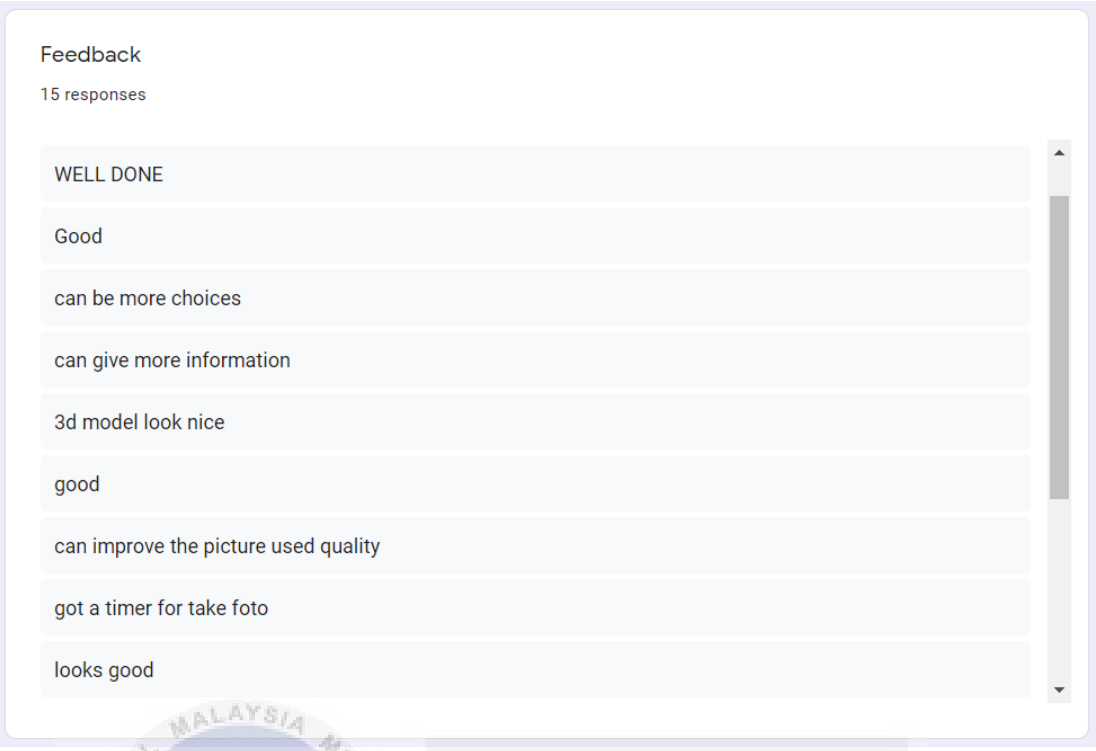


**Figure 6.13 Feedback from end user**

In the last part of questionnaire form got a feedback section for the respondents to give some opinions or suggestions. This question is setting as optional and only 15 respondents respond to it. There are some positive feedbacks and some suggestion that can be adapted. Most of them are satisfied with the application and at the same time they had gave some suggestion to improve this application. Respondents reviewed that they would like to have more choices of wedding dress and more information about the dress.

## 6.6 Conclusion

The aims of testing are to test the functionality and usability of AR technology in the fashion field of wedding dress. The usability testing for client and end users are successfully conducted. From the testing, it has proved that AR technology works well in the wedding dress fashion application. Furthermore, it also proved that fitting wedding dress by tracking shoulder's measurement can give reference to the brides and girls.

# CHAPTER 7: CONCLUSION

## 7.1 Observation on Weakness and Strengths

Not to deny, every application has its own strengths and weaknesses include this LaFame Dressing Room Application. The weakness and strengths of this application are identified in the previous testing phase.

### 7.1.1 Weaknesses

Some weaknesses have found in this project. First weakness is the application cannot be run by all smartphone systems. The application is designed for android user which is running Android 9.0. Besides, there are no timer for capturing photo and user need to find other friend to take photo. The user unable to take photo with her own as she need to have a distance with the smartphone camera.



Besides, the choices of wedding dress are too limited. Due to the time given for this project is just a few months, only 7 wedding dresses are available in the application. Furthermore, the graphics used for the dress fitting are not in high quality and the angle of the graphic not exactly from in front. It causes some distortion to fit the dress on user.

### 7.1.2 Strengths

The strengths of this project must also be stated out. The greatest strength of this project is AR 3D model technology used to let user have more information about

the wedding dress. Users can rotate, zoom in and out the model to see the design of the dresses in 360 degrees. The fabrics used for the dress are also labelled out in the model. Besides, it also has the AR technology in tracking shoulder's measurement to let the wedding dress superimpose on user body. It shows how the wedding dress fits on user. Users can choose the wedding dress according to its shape, appearance, design and material.

Furthermore, the application is convenient to be installed on Android system smartphones. After installation, users can just use the application whenever and wherever they are. This is because, the application can be used without the internet connection. Moreover, the aesthetic of the application is simple and nice. The color used is warm and the logo used for the button is welly known.

## 7.2 Prepositions for improvement

Improvement is always a way to solve the weakness. First, the application should be implemented in more platform like iOS and higher version of Android system. Thus, the user can run the application on any platform they want. However, the use of Android Studio can only produce android applications. Then, a timer can be added in the fitting room capturing feature.



Besides, the choices of the dresses can be increased after the Covid-19 pandemic as LaFame Bridal Mansion is not operating during this pandemic. Taking high quality photos make dress fitting looks more realistic. The using of 360-degree 3D AR dress fitting would become better reference to the brides as it can be viewed in 360 degreed and more realistic than just a picture. However, it is not easy to have, due to the limited time, cost, resource and knowledge.

For the usability testing form, the evaluator suggested to identify the question clearly for each aspect. The using of words should be more accurate and straight to the point. This can let respondent less confuse and giving the right feedback for every question.

## 7.3 Project Contribution

LaFame Dressing Room provides a free application that can help the bride to have a look of the wedding dress. The brides can choose the wedding dress that they want to try before they make appointment to go to the physical store. This using of AR 3D model in this application provides more details than just a 2D picture or a catalogue book. This application has helped the staff of LaFame Bridal Mansion saving some time on the introduction of wedding dress.

## 7.4 Conclusion

As a conclusion, the main purpose of LaFame Bridal Mansion had achieved based on the goals that had defined in each chapter. The using of AR technology in the field of the fashion of wedding dress did help the brides to know about the wedding dress and choose their wedding dress. However, there are still got place to improve it become a better application. The project is successfully completed on time.

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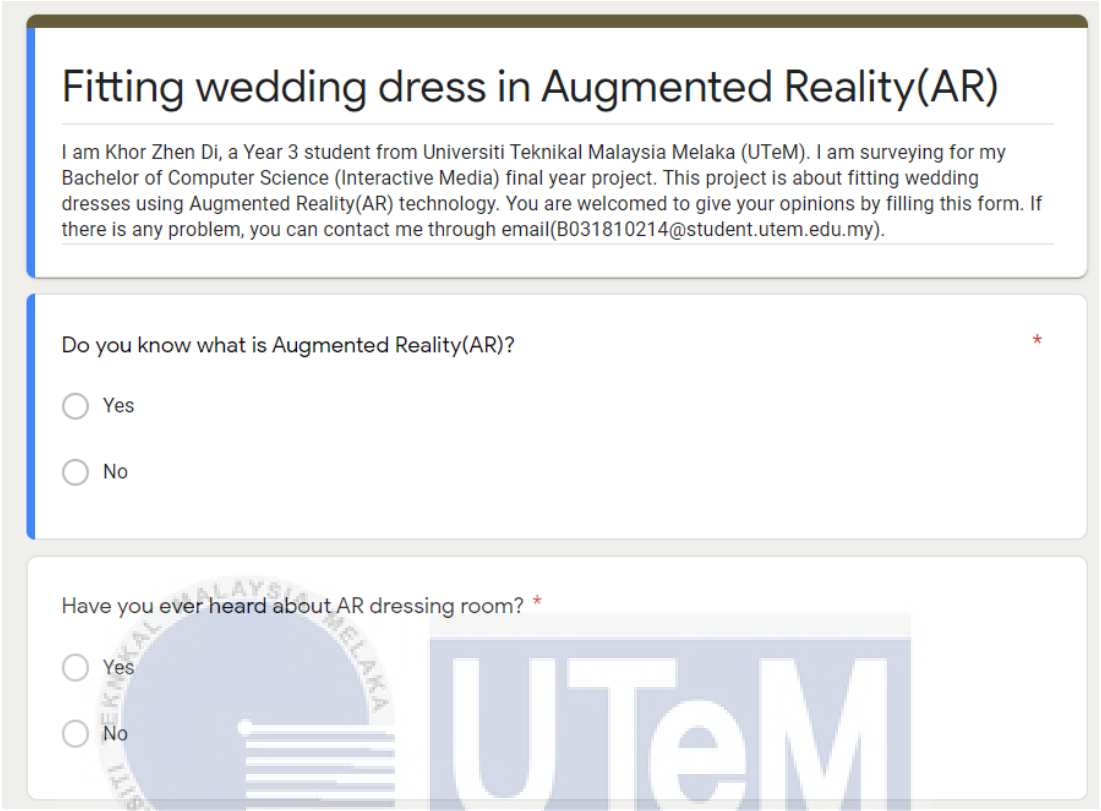
**APPENDIX A**



Fitting wedding dress in Augmented Reality(AR)

I am Khor Zhen Di, a Year 3 student from Universiti Teknikal Malaysia Melaka (UTeM). I am surveying for my Bachelor of Computer Science (Interactive Media) final year project. This project is about fitting wedding dresses using Augmented Reality(AR) technology. You are welcomed to give your opinions by filling this form. If there is any problem, you can contact me through email(B031810214@student.utem.edu.my).

Do you know what is Augmented Reality(AR)? *

- Yes
- No

Have you ever heard about AR dressing room? *

- Yes
- No

What's the problem you faced when choosing wedding dress? *

- [ ] limited time to choose
- [ ] Too many choices
- [ ] Appointment full
- [ ] too much time in wearing
- [ ] limited choices
- [ ] Other...

What aspects will be considered when you want to choose a wedding dress? *

- [ ] Price
- [ ] Color
- [ ] Shape
- [ ] Material
- [ ] Venue
- [ ] Event/Theme
- [ ] Latest trend
- [ ] Other...

What kind of resource that you refer to choose a wedding dress? *

- [ ] Catalog
- [ ] Magazine
- [ ] Online website
- [ ] Physical store
- [ ] Friend introduce
- [ ] Other...

How many dresses needed for the wedding? *

- ( ) 1-2
- ( ) 3-4
- ( ) >4

Take how long to choose a satisfying wedding dress? *

- ( ) 2-3 hours
- ( ) 4-6 hours
- ( ) more than 1 day

Take how long time to try one wedding dress? *

- 5 minutes
- 10 minutes
- 15 minutes

Would you feel a little bit not convenient/unsafe to try out the clothes during this pandemic(booking)? *

- Yes
- No

If there is an AR fitting room app for fitting wedding dress, would you use it? *

- Yes
- No

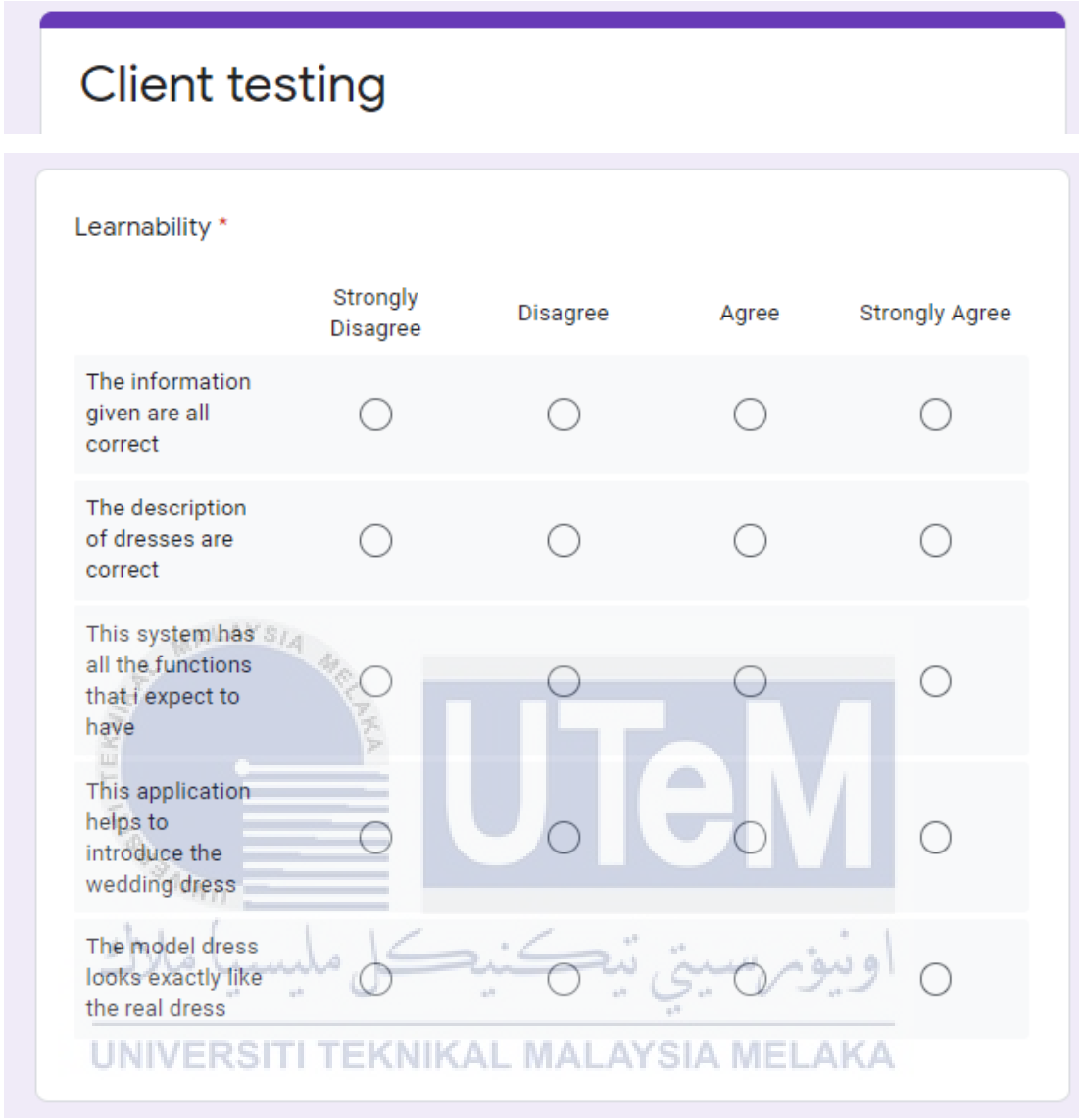
What are the functions that you want in this app? *

- [ ] try wedding gown virtually & easily
- [ ] snap photo
- [ ] change background
- [ ] display accessories
- [ ] Other...

**APPENDIX B**

| No | Name | Position | Working Experience/ Achievements |
|---|---|---|---|
| 1 | Paul Kong  | Managing Director | -2019 Vice President at Wedding Professionals Association of Malaysia<br><br>-2019 Tallypress Top10 Photographer<br><br>-2015 Tallypress Top10 Photographer<br><br>-Founder of LaFame 2016 |
| 2 | Max Goh  | Operation Director | Working at LaFame since 2018<br><br>-Photographer of LaFame |
| 3 | Sk Yong  | Business Development Director | Working at LaFame since 2018<br><br>-Photographer of LaFame |

**APPENDIX C**



Client testing

Learnability *

| | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| The information given are all correct | ○ | ○ | ○ | ○ |
| The description of dresses are correct | ○ | ○ | ○ | ○ |
| This system has all the functions that i expect to have | ○ | ○ | ○ | ○ |
| This application helps to introduce the wedding dress | ○ | ○ | ○ | ○ |
| The model dress looks exactly like the real dress | ○ | ○ | ○ | ○ |

Efficiency *

| | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| Categorizing the wedding dress with shape is clear and easy | ○ | ○ | ○ | ○ |
| AR 3D model gives details about the wedding dress clearly | ○ | ○ | ○ | ○ |
| The wedding dress fitting is easy to use | ○ | ○ | ○ | ○ |
| This application can help customer to choose their wedding dress | ○ | ○ | ○ | ○ |

Memorability *

| | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| The tutorial given is clear, understandable and easy to memorize | ◯ | ◯ | ◯ | ◯ |
| The interface design(button, graphic, color) of this system reach my expectation | ◯ | ◯ | ◯ | ◯ |
| The logo button used is simple and memorable | ◯ | ◯ | ◯ | ◯ |

Errors *

| | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| The tutorial gives good instruction | ◯ | ◯ | ◯ | ◯ |
| The recovering from error is easy(back) | ◯ | ◯ | ◯ | ◯ |

Satisfaction *

| | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| Overall, the system works well | ◯ | ◯ | ◯ | ◯ |
| The application helps customer choosing their wedding dress in the future | ◯ | ◯ | ◯ | ◯ |
| The application reduces the work of introducing the wedding dress | ◯ | ◯ | ◯ | ◯ |

Feedback *

Your answer

**APPENDIX D**

## Usability Testing User

Learnability *

| | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| The information of LaFame Bridal Mansion is clear and informative | ○ | ○ | ○ | ○ |
| The material, shape, looks of the dress is easy to know when using AR 3D model | ○ | ○ | ○ | ○ |
| The AR 3D model gives more details of the wedding dress | ○ | ○ | ○ | ○ |
| The description of the wedding dress is understanable | ○ | ○ | ○ | ○ |
| The tutorial given is clear and understandable | ○ | ○ | ○ | ○ |

Efficiency *

| | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| Searching the wedding dress through its shape is easy | ○ | ○ | ○ | ○ |
| Comparing the difference of the wedding dress is easy using the application | ○ | ○ | ○ | ○ |
| AR 3D model gives more details than a traditional catalog book | ○ | ○ | ○ | ○ |
| The system helps to see how the dress fits on | ○ | ○ | ○ | ○ |
| This system has all the functions and capabilities | ○ | ○ | ○ | ○ |
| Choosing wedding dress become easier after using the application | ○ | ○ | ○ | ○ |

Memorability *

| | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| The system is easy to learn to use | ◯ | ◯ | ◯ | ◯ |
| The interface(button, graphic, color) of this system is pleasant | ◯ | ◯ | ◯ | ◯ |
| The meaning of the button is well-known(logo) | ◯ | ◯ | ◯ | ◯ |

Errors *

| | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| The tutorial gives good instruction | ◯ | ◯ | ◯ | ◯ |
| The recovering from error is easy(back) | ◯ | ◯ | ◯ | ◯ |
| The running of the application is smooth | ◯ | ◯ | ◯ | ◯ |

Satisfaction *

| | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| This application is easy to use | ◯ | ◯ | ◯ | ◯ |
| The AR 3D model is simple to use | ◯ | ◯ | ◯ | ◯ |
| The AR 3D model performs the fashion of wedding dress well | ◯ | ◯ | ◯ | ◯ |
| The fitting room works well | ◯ | ◯ | ◯ | ◯ |
| Overall, I am satisfied with this system | ◯ | ◯ | ◯ | ◯ |

Feedback

Your answer