AUGMENTED REALITY FOR ANIMAL CLASSIFICATION IN MOBILE APPLICATION FOR FORM 2 STUDENT

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

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DEDICATION

To my beloved parents and family, thank you for your support and encouragement with my studies.

To my supervisor, Mrs. Norazlin Mohammed, thank you for guidance from start until the project is complete.

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First of all, I am very grateful that I was able to complete the Final Year Project. Many trials and challenges I faced during this project, but all of it will I make it a very valuable experience for me.

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ABSTRACT

Animal classification or also known as animal taxonomy is the grouping or classifying of things into a framework or tree structure. The animal classification is divided by two which is vertebrate and invertebrate. The vertebrate is divided by five classes which are reptiles, mammals, amphibians, birds and fish while invertebrate is an animal without a backbones. In order to help these student learns about the classification of animal, the animal classification in mobile application is introduced and developed to give more information about the classification in details. This application will be develop in three-dimensional (3D) model. There are also other way for people to get information nowadays which is from the internet. This is because they tends to think that by using internet they can save their time and get the information they need quickly. From this observation, a responsive web is needed for developing this project as they are functioning as other platform for user to get information and material about the animal. This mobile application and the responsive web will be a help to students in improving learning process about Animal Classification.

ABSTRAK

Pengelasan haiwan atau juga dikenali sebagai taksonomi haiwan adalah mengumpul atau mengelaskan perkara ke dalam struktur rangka kerja atau pokok. Pengelasan haiwan dibahagikan oleh dua iaitu vertebrate dan invertebrate. Vertebrate yang dibahagikan kepada lima kelas iaitu Reptilia, Mamalia, Amfibia, Burung dan Ikan manakala invertebrate adalah haiwan tanpa tulang belakang. Untuk membantu pelajar-pelajar ini belajar tentang pengelasan haiwan, aplikasi mudah alih mengenai pengelasan haiwan diperkenalkan dan dibangunkan untuk memberi maklumat lanjut mengenai pengelasan maklumat. Aplikasi ini akan dibangunkan dalam bentuk tiga dimensi (3D) model. Terdapat juga cara lain untuk orang ramai untuk mendapatkan maklumat pada masa kini iaitu dari internet. Ini adalah kerana mereka cenderung untuk berfikir bahawa dengan menggunakan internet mereka dapat menjimatkan masa mereka dan mendapatkan maklumat yang mereka perlukan dengan cepat. Daripada pemerhatian ini, web responsif juga diperlukan untuk membangunkan projek ini kerana mereka akan berfungsi sebagai platform lain bagi pengguna untuk mendapatkan maklumat dan bahan-bahan mengenai haiwan. Aplikasi mudah alih ini dan web responsif akan menjadi bantuan kepada pelajar-pelajar untuk meningkatkan proses pembelajaran tentang pengelasan haiwan.

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LIST OF ABBREVIATIONS

3D	-	**Three-Dimensional**
AR	-	**Augmented Reality**
API	-	**Application Programming Interface**
SDK	-	**Software Development Kit**
VR	-	**Virtual reality**
2D	-	**Two-Dimensional**
WWW	-	**World Wide Web**
PHP	-	**Hypertext Preprocessor**
HTML	-	**Hypertext Markup Language**
OS	-	**Operating System**
JDK	-	**Java Development Kit**
ID	-	**Identification**
FBX	-	**Filmbox**
PNG	-	**Portable Network Graphics**
CSS	-	**Cascading Style Sheets**
BITM	-	**Bachelor of Science Computer (Interactive Media)**
UTeM	-	**Universiti Teknikal Malaysia Melaka**
UAT	-	**User Acceptance Testing**

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CHAPTER 1

INTRODUCTION

1.1 Project Background

Animal classification or also known as animal taxonomy is the grouping or classifying of things into a framework or tree structure. The animal classification is divided by two which is vertebrate and invertebrate. The vertebrate is divided by five classes which are reptiles, mammals, amphibians, birds and fish while invertebrate is an animal without a backbones. They are divided into many classes such as insects, protozoa and flatworms.

Nowadays, with the upgrading technologies, people have started to learn and play with the technology named Augmented Reality. This technology provided a live direct or indirect view of a physical, real-world environment whose elements are augmented by computer-generated. In order to help these student learns about the classification of animal, the animal classification in mobile application is introduced and developed to give more information about the classification in details. This application will be develop in three-dimensional (3D) model and it will be moving like a real animal so that the student can interact with the application.

There are also other way for people to get information nowadays which is from the internet. This is because they tends to think that by using internet they can save their time and get the information they need quickly. From this observation, a responsive web is needed for developing this project as they are functioning as other platform for user to get information and material about the animal.

1.2 Problem Background

Nowadays, many student had difficulty in making the distinction between vertebrates and invertebrates. Because there are a lot of classes, the student are still confusing about animal classification and they do not know what are the animal class belongs to.

Besides, the student also do not have other alternative to learn about the animal classification. They only can learn it in the school with their teacher or with their parents. They also do not have a clear image about the animal classification.

Next, there is no interactivity while these student learns about the animal. It will make them feels boring and tends to find other things that will make them happy. It also will make them lose focus while learning because they do not get the information clearly.

So, with the upgrading technology, it could help student in learning more in animal classification using augmented reality in mobile application. This mobile application and responsive web also will give a new way for the student to study and learn about animal classification and they will interact, learning and having fun at the same time.

1.3 Objectives

i. To develop an augmented reality in mobile application for student to learn and interact about animal classification.
ii. To develop a responsive web that would help students to learn more about animal and its specification.
iii. To evaluate the effectiveness of the application and responsive web in student learning compare to textbook.

1.4 Project Scopes

This project is designed to the student age 14 years old. This is because the student will start their learning on animal classification within the year. In secondary school, this topic will be teaching by their teachers but the content of this topic is not detailed much to give the initial image to the students about the animal and its classification.

Besides, this project will be focused in mobile device and a responsive web. The responsive web is created to give other way to the users to get their information about the animal. This web also will provide link for user to get the application and its material for learning. The tool that will be using to create the responsive web is Adobe Dreamweaver CS6 and the language that will be used is PHP and HTML. The platform that is chosen to develop this project is Android platform and it must have a minimum features such as Android version 2.3, Application Programming Interface (API) and a phone camera. This project will be applied by using Augmented Reality, hence identification marker type is chosen and will be implemented in a card. The identification marker type that is chosen is a marker based. This is because it will ease the user to identify when use the application.

Next, there will be 6 animal and its classification include in this project. This is because there are many class of animal and this project is develop to test whether augmented reality in mobile application would be a help to student for learning about animal classification. Therefore, the classes will be chosen randomly in order to let the student learn about the animal classes.

1.5 Project Significant

This mobile application is suitable for student to learn about animal classification in an entertaining ways. This ways of learning is easy understandable and useable. The student will be able to interact with the animal model while they learning. This mobile application will help to deliver the information about animal classes to the student as they are designed to student age 14 years old.

With this application, the student do not have to wait for the teacher or their parents to teach them. They can learn it by themselves. This application also will bring benefits for the teachers as they can get new ways to teach their students and the users because they can save times when using the application.

1.6 Expected Outputs

Expected result for this project is the output product of this project is develop using augmented reality in mobile application. This application is made for secondary school student which is Form 2. The student should be able to use the mobile application and learn about the animal classification perfectly. Besides, the application should be successfully installed in any Android device and working properly when scanning the identification marker. The responsive web should be working properly by showing proper information and include usable link for user to download the material and application for this project.

For the first time user, they will have to download the application from the responsive web created and installed it in their Android device. The identification marker of the animal will be given in a link that can find and download it in the responsive web.

When the device scan the identification marker for classification and animal, there will have a (3d/2d) model overlap the marker. There are also classification of the animal and also there is more facts about animal and its specification in the responsive web.

After the mobile application is finished to develop, the product will be testing and conduct among the student and to know whether this mobile application can solve the problem faced by the student.

1.7 Conclusion

This project aims to develop an Augmented Reality for Android mobile application which names Animal Classification that implement identification marker to deliver the facts or information to the student.

For the next chapter, the activities will be developed is literature review and project methodology. The literature review will discuss the technology and technique that being applied on. While the project methodology will be discussed to identified the method that used to develop this project. Project schedule and milestones of this project will provide and explain in the next chapter in order to ensure the progress of this project is develop according to its schedule.

CHAPTER II

LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1. Introduction

In this chapter, literature review and project methodology are discussed for developing this Animal Classification mobile application and responsive web. For this project, the source that are used are basically from reference book, journal, article and internet. The literature review will be done searching articles and journals about what student faces when they classify the animal class, reference book (textbook) about animal details and its class, and collect information about the technology and content that will be implemented in the application and web through the internet.

Besides, a project methodology is needed in order to complete this project. It is important to follow as it is used as framework that give developers instruction on what they have to do. The project methodology that is used in developing the application is based on ADDIE Model. It is because this model is suitable for the concept of the project which is learning. Every stage and process that is in the production will be discuss in detailed to create a plan and structure of the process of developing application for developers to develop the application and follow it. Next, the requirements that is needed is software and hardware. It is needed in order to develop and complete this project are listed and the features of the requirements are explained in detailed. Milestone and schedule of the project are included in the chapter as it is used to demonstrate the whole progression of the project and duration. This milestone will give the developer to keep on track with the schedule.

2.2. Domain

Facts and findings for this project include the meaning of AR, what is the benefit of AR and responsive web in education and know the existing mobile application of animal classification.

2.2.1. Animal Classification

Scientist arranged creature differing qualities in a settled chain of importance of gatherings inside gatherings as indicated by developmental relationship as uncovered by requested examples in their sharing of homologous components. This order is known as a characteristic framework since it reflects relationship that exist among creature in nature.

Scientific classification otherwise called order is a part of the more extensive study of systematics which investigations of variety among creature populace is utilized to uncover their transformative relationship. Linnaeus was a Swedish botanist at the University of Uppsala. He partitioned the set of all animals into species and gave every one an unmistakable name. He gathered species into general, general into requests, and requests into classes.

The developmental hypothesis into creature scientific categorization has changed the part from one of arrangement to one of systematizations. Characterization means the development of classes, groupings of living being that have a typical components. The movement of a taxonomist who's gathering of species speak to units of normal transformative drop is systematization not grouping.

2.2.2. Augmented Reality

A system that supplements the real world with virtual (computer-generated) objects that appear coexist in the same space as the real world [1]. It combines real and virtual objects in real environment, runs interactively and aligns real and virtual object with each other. AR interfaces allow user to see the real world at the same time as virtual imagery attached to the

Real locations and objects [2]. Augmented reality is characterized by the incorporation of artificial or virtual elements into physical worlds as shown by the live feed of the camera, in real time [3].

Concept of AR is related to Virtual Reality (VR). VR's concept is to create an entirely artificial environment which generated in 3D by digital technologies that allow users to experience and interact through their sense of vision. AR is implements an interactive experience but aims to supplement the real world [4]. It is an advanced technology that allows computer generated virtual imagery information which must be registered in 3D and overlaid onto a live direct or indirect real-world environment in real time. In other words, AR is bridges the gap between the real and virtual world in a seamless way [5].

2.2.2.1. Marker-Based in AR

There are different type of AR markers which is image that can be detected by a camera and used with software as the location for virtual assets placed in a scene. Most are black and white, though colors can be used as long as the contract between them can be properly recognized by a camera. The simplest augmented marker can consist of one or more basic shape made up of black squares against white background [6].

A camera is used with AR software to detect augmented reality marker or identification marker as the location for virtual objects [7]. There are limitation on the type of this identification marker that can be used based on the software that recognizes them. The simplest type of identification marker are black and white images that consist of two-dimensional (2D) barcodes [8].

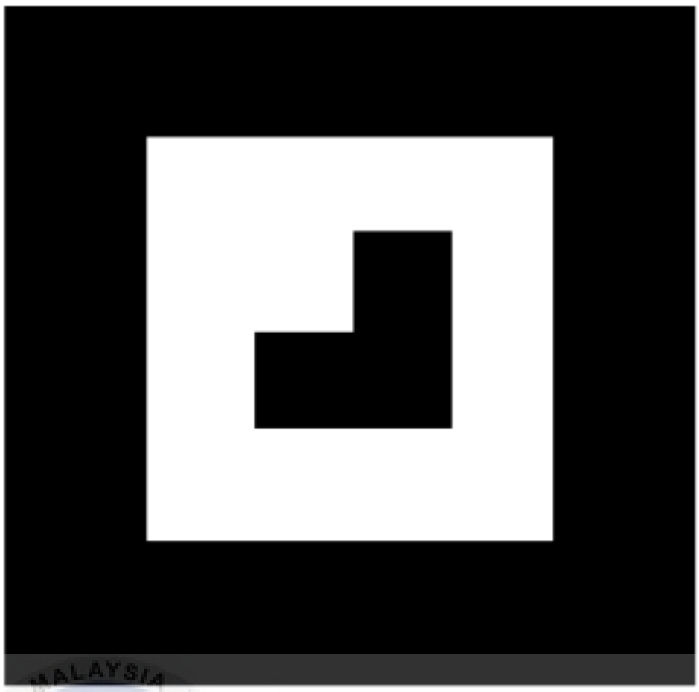


Figure 2.1. Simple augmented marker

2.2.3. Responsive Web Design

Responsive web is capable of reshaping itself depending on various screen sizes and resolutions from largest screen sizes to smallest on mobile device [9]. Thus, user will be exposed to the best experience with content visual display on the device or platform that they are viewing it on. This is more significant when users are studying in instructional web design automatically change page layout, resize the image or crop them proportionally [10].

Responsive web enables users the best practices while surfing on a website through multi-device world such as smartphones, tablets, laptop besides desktops [11].

2.2.4. Existing system

2.2.4.1. Science Textbook

Science teaching as a main subject in schools have long been recognized to have a significant impact. The students cannot focusing in class. They will not involve themselves in any activities that the teacher have been prepared [1]. They do not have any idea or their opinion.

The students will lose focus if their teacher is teaching without give a visualization on what they are learning. The students will be more active if their teacher gave them a pictures of the topic that they will be learning. The content from the textbook is not attractive enough to make the process of learning effective.

2.2.4.2. Animal 4D++

The application of Animal 4D++ are the first flash card that are being developed by Octagon Studio to be commercialized for education to user and attract them to knowing more about animal. The marker of the application comes with 26 picture cards of animal which sorted alphabetically from A-Z. This application can be installed on the device or gadget with the base Operating System (OS) Android and IOS (Apple).

Figure 2.2. logo of Animal 4D++ (Retrieve from : http://www.kartu4dimensi.com/)

Animal 4D++ is a very attractive as a medium of education because it contains a lot of interactions such as the animation of the animal itself, it gives the user to feel that the animal is really alive on their devices. Besides, this application also gives the user information about the animal, explained about their biological facts and they also provides other interaction which is the animal will find and move from their card to find and eat the food given.

Figure 2.3. show the interface of the Animal 4D++
(Retrieve from : http://www.kartu4dimensi.com/)

When the application is running, the application will access to the camera device or gadget as a scanner marker and a scan are used to display the 3D animated animal with its sounds and a narrator character and the type of the animal. The narrator features is only available for Animal 4D++ application. This application also can scan more than one card at a time. The animation of animal is eating their food is limited to only few of the animal.

Animal 4D++ can be used as a medium of education as an introduction of type of animal and letters alphabetically and it is equipped with information form or appearance of animal. This application also can be a medium of communication and interaction between parents and children as an entertainment media. But this application do not provide any classification which it is a very important education for user.

Figure 2.4. Flash Card used to scan the animal.
(Retrieve from : http://www.kartu4dimensi.com/)

2.2.4.3. ZooKazam

There are existing mobile application that have animal classification that are available in App Store or Google Play Store which allow user to download and see the animal through their device. ZooKazam is a first augmented reality educational application that do not required a printed marker. It provides children, teachers and parents a new way to learn by bringing animals to life within their existing surroundings using realistic 3D animation.

(a) ZooKazam marker 1

(b) ZooKazam marker 2

(c) ZooKazam marker 3

Figure 2.5 ZooKazam Marker used in mobile application (Retrieve from : http://www.zookazam.com/)

Zookazam provides education on animal classification, including dinosaurs, birds, mammals, insects, amphibians, invertebrates and reptiles, as well as the size, weight, habitat, diet, lifespan and population status of each individual species.

(a) Details about animal

(b) Resizable 3D model

Figure 2.6 Content in Zookazam mobile application (Retrieve from : http://www.zookazam.com/)

However, the Zookazam application does not provide fact about animal classification in detailed. It only give user the animal and its class in the same space. The classification in this application acts as a menu for user to choose which animal they want to play with.

Figure 2.7 Menu interface in ZooKazam mobile application (Retrieve from : http://www.zookazam.com/)

2.2.5. Comparison of the existing system

Table 2.1. Comparison of the existing system

Existing System	Science Textbook	Animal 4D++	ZooKazam
Technology used	Paper-based	AR	AR
Tracking Method	None	Use flash card	Provided image tracker but can create new tracker.
Platform	None	Android, iOS	Android, iOS
Content creation	Graphic image	3D model, audio	3D model, audio
Additional features	None	Have interaction for the animal to eat	Have weather changer and information about animal in graphics

Advantage	• Classification of animal is explained in detailed.	• Have interaction and animation • Flash card is alphabetically	• Have interaction in changing the weather. • Have information about the animal in graphics.
Disadvantage	• Do not have any interaction, animation • Less attractive to the students.	• The classification of the animal is combine with its specification.	• Do not have animation.

2.3. Project Methodology

This project used ADDIE model to complete the content of the project. In the Analysis phase, defining, developing and understanding user's need is important as it will decide what the desired outcome are user want. The Design phase is to identify specific learning, topic content, and presentation method to be used to complete the project. In Development phase, the production of the material used for learning is created. Implementation delivers the material by presenting the developed product to the user and Evaluation is needed to know the effectiveness of the product to the user in learning.

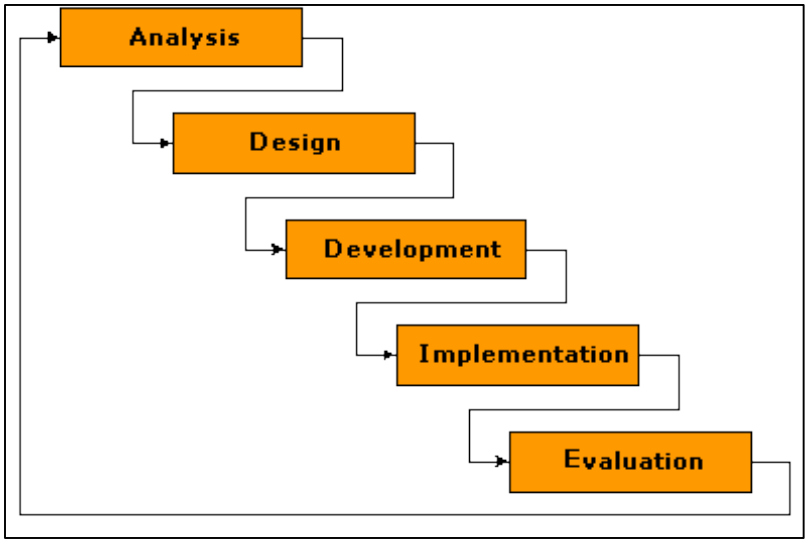


Figure 2.8 ADDIE Model

2.3.1. ADDIE Model process

The ADDIE model is an instructional design process which contains of five phase: Analysis, Design, Development, Implementation and Evaluation. The detailed about the phase are explain in detailed.

2.3.1.1. Analysis

It is first stage in the model. In this stage, the user's requirements is need to be gathered, defining the problem face by user and find what is the suitable system that is need to be built with its functionality and purpose. All requirement of the project to be developed are listed in this phase. After the requirements are gathered, a proposal of the project is proposed.

2.3.1.2. Design

The second stage in the model is design which it is used to create all related to the design activities in the project such as flow chart of the project. Besides, this stage is also the stage where the developer designing how the project will be but this stage will start only after the first stage are approved. As for this project, the design that needed are the responsive web for animal classification and the interface of the product.

2.3.1.3. Development

This stage is the main production and assembly of the material that were developed in the design phase. It is important to have elements, time schedules and deadlines. In this project, the model of the animal, the facts about the animal classifications, audio, video that is needed in the project is created, collected, developed and ready to be tested. After all the material is done, it will be imported to be developed.

2.3.1.4. Implementation

The implementation stage is where the developed product is actually put into action, and the final product, developed based on what user's need and the error discovered while testing is presented to the user. This project will be tested on different user and multiple version of Android mobile device to see if it is compatibles with the device.

2.3.1.5. Evaluation

In the last stage which Evaluation, selected user which is student age 14 years old will answer the questionnaire prepared and they will try the product which is the mobile application and the responsive web that was developed. The data from the questionnaire are collected from the user.

2.4. Project Requirement

Project requirements are discussed about what are the software and hardware requirement that is used in order to complete the project and produce the final product.

2.4.1. Software Requirement

The software requirements is divided into two section which is development tools and documentation tools. All the tools that is used in this project is listed in detailed.

2.4.1.1. Development tools

i. Unity 3D

ii. Vuforia SDK

iii. Autodesk Maya 2014

iv. Adobe Illustator CS6

v. Adobe Photoshop CS6

vi. Notepad ++

2.4.1.2. Documentation Tools

i. Microsoft Word 2013

ii. Microsoft Project 2010

iii. Microsoft Visio 2010

iv. Microsoft PowerPoint 2013

2.4.2. Hardware Requirement

i. Laptop

ii. Android smartphone

2.4.3. Other Requirement

i. Printer

2.5. Project Schedule and Milestone

Project schedule is very import in every project because developer will have to follow the schedule to keep on track with the dateline given. This is because to ensure that the process of developing the final product is being develop according to the time planned and to make sure the product is complete in time. Table 2.2 shows the project milestone and the Gantt chart will be place in the Appendix A.

Table 2.2 Project Milestone

No	Activity	Start Date	End Date
1.	**Proposal Submission and Correction**	12/22/2015	12/31/2015
2.	**Analysis**	02/22/2016	03/02/2016
	2.1 Gathering requirement	02/22/2016	02/24/2016
	2.2 Analyze project objective	02/25/2016	02/27/2016
	2.3 Select target platform	02/28/2016	03/02/2017
3.	**Design**	03/03/2016	03/22/2016
	3.1 Design project architecure	03/03/2016	03/05/2016
	3.2 Design project content	03/06/2016	03/15/2016
	3.3 Design graphics	03/06/2016	03/22/2016
4.	**Development**	03/23/2016	04/11/2016
	4.1 Android SDK Development Tools installation	03/23/2016	03/25/2016
	4.2 Unity 3D installation	03/26/2016	03/28/2016
	4.3 Configuration of project tools	03/29/2015	04/11/2016
5.	**Implementation**	04/12/2016	04/23/2016
	5.1 Implementation project content with application	04/12/2016	04/18/2016
	5.2 Run application	04/19/2016	04/23/2016
6.	**Evalution & Testing**	04/24/2016	05/04/2016
	6.1 Test the application	04/24/2016	04/27/2016
	6.2 Refine the application	05/01/2016	05/04/2016
7.	**Project demo & PSM report**	04/04/2016	05/27/2016
8.	**Final presentation**	05/30/2016	06/03/2016
9.	**Project submission**	06/06/2016	06/10/2016

2.6. Conclusion

This chapter is discussing about the literature review and methodology used for this project. The literature review id done by gathering and analyzing the technology which found from Internet, journal and reference books.

Besides, ADDIE model is chosen as project methodology for this project because it is suitable for learning. It has 5 phases which is Analyze, Design, Develop, Implement and Evaluation. All phase are listed and discussed in detailed. There are also list of software and hardware requirement that is used for developing this project and it has been explained in detailed. Milestone is provided as a guide to complete this project successfully.

Lastly, the next chapter will be discussing about analysis. It will analyze the product by identify the functionality and how it will be done. Thus, next chapter will includes all user requirement, functional requirements, non-requirements and system architecture of this project.

CHAPTETR III

ANALYSIS

3.1. Introduction

This chapter will discussing and identifying the requirement for the project to be completed. In this chapter, the solution for every problem or issues that the previous system had will be stated and explained. This chapter will be discussing about two things which current scenario analysis and requirement analysis. The current scenario analysis will be about previous or existing system flow in order to determine the problem in the system. Besides, the requirement analysis will be describe about ways in gathering information.

3.2. Current Scenario Analysis

Current scenario analysis is needed to identify what are the architecture involves in making the existing system that stated in the previous chapter. The types of AR SDK's that is used in the existing system will be identified and explain in detailed. The flow of the existing system also will be include in this chapter for better understanding the technology that they use to develop the system.

3.2.1. Analysis of Science Textbook

Science textbook is a main material used in the school for students to learn about Animal Classification. The textbook provided all information needed by the student but there are no interaction between student and the textbook. The information provided are in paragraph which makes students less reading the information. The images provided in the textbook do not give any attraction to students. The flow process for the textbook is provided in the Figure 3.1.

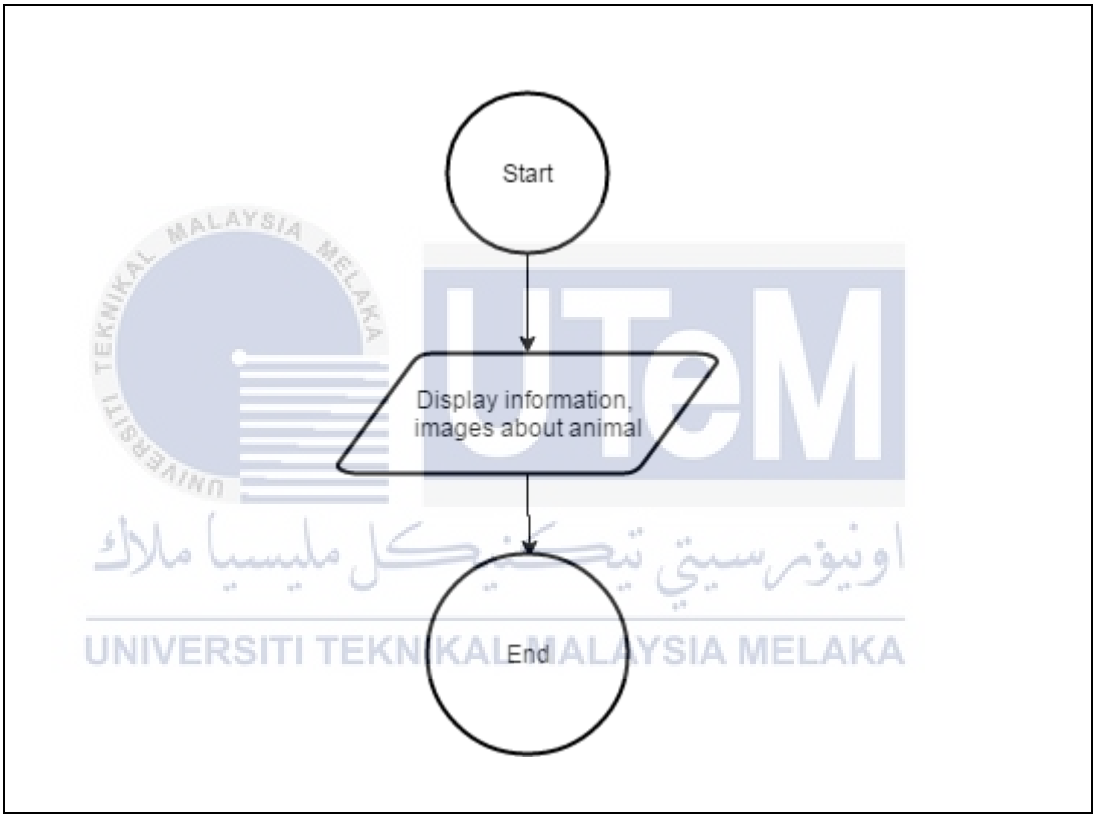


Figure 3.1 Flow process for Textbook

3.2.2. Analysis of Animal 4D++

Animal 4D++ is an augmented reality mobile application that is developed by Octagon Studio for Android and iOS user. This application using Vuforia to creating the application. This application provides interaction and also animation for user to play with. The interaction that they provided is the animal gets to eat and moving from their card to other card. This

application also have 26 card which is arranged alphabetically so that the user can learn not only about animal but also learn about alphabet.

This application needs to be downloaded in goggle play store and they need to buy the flash card to play with the application. The application contain many option which is VR mode, interaction mode and tools. The VR mode is can be used with goggle cupboard. The function of providing the VR mode is to give the user an extra attraction so they can watch the animal as if the animal becomes alive. They also provides tools which contain capture image, swapping camera and rotating camera to ease user while using the application. The flow process of the mobile application is provided in Figure 3.2.

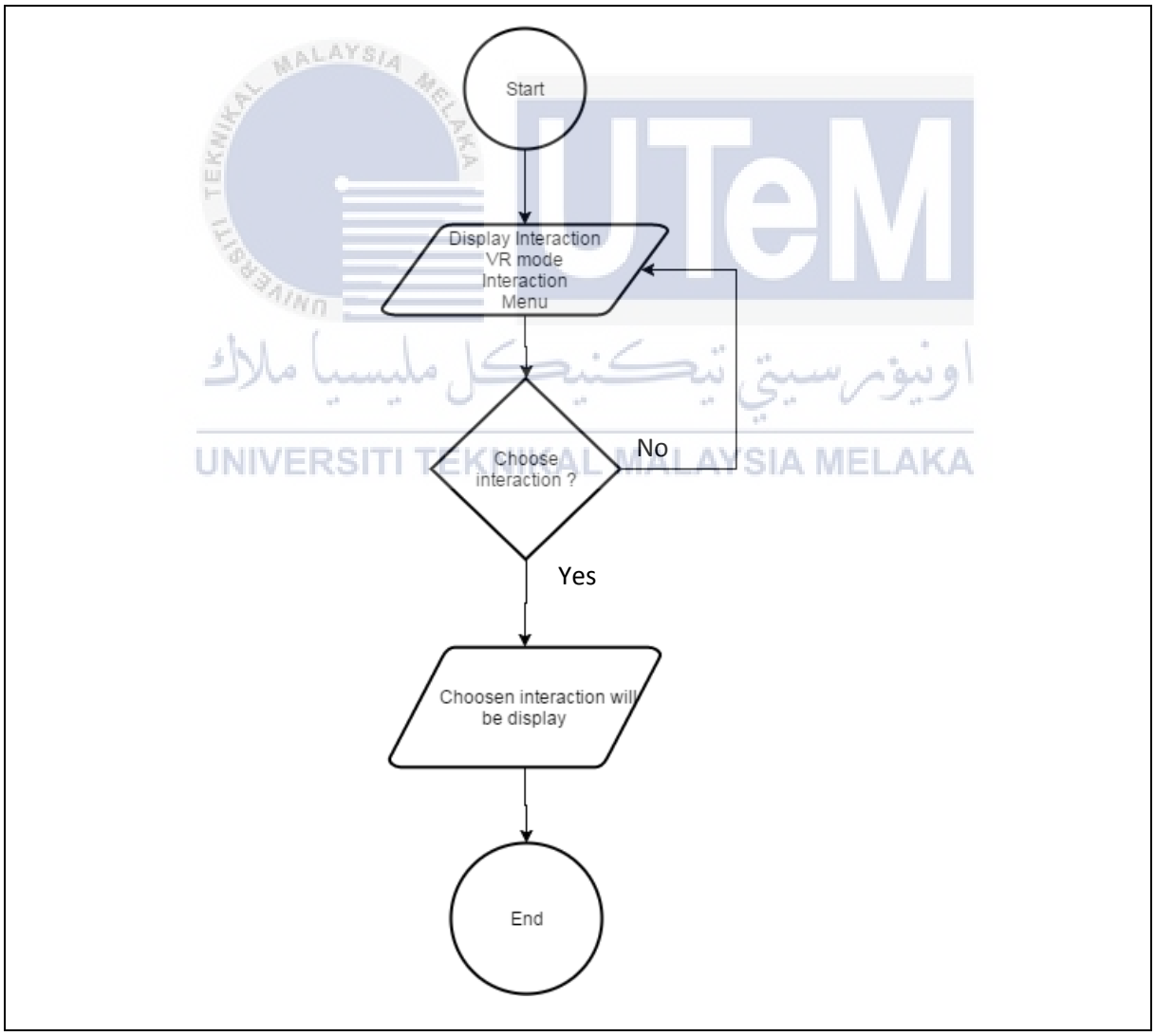


Figure 3.2 Flow process for Animal 4D++

3.2.3. Analysis of ZooKazam

ZooKazam is an augmented reality mobile application for iOS and Android platform. This mobile application used Vuforia to implement AR technique. ZooKazam provides many interaction to play with the application. It has many animal with different classes. When user choose the animal, the application will download the chosen animal. This application comes with marker that user need to download to display the animal. It provide three marker which an image of grass, the logo of their application and the back of the dollar bill. The bigger the marker printed the larger the animal will be displayed. However, ZooKazam have upgrading their application where user can make their own marker. Just take a picture and set it as their main marker, the animal will be displayed.

This mobile application do not have option. On the first interface of the application, there are list of classification of the animal. When user choose the desire animal, they will be downloaded and displayed on its marker. Besides, there are interaction provides for user to play with the animal such as weather condition and fisheye. User also can take a picture of the animal and save it in their mobile. The flow of process of this mobile application is provided in Figure 3.3.

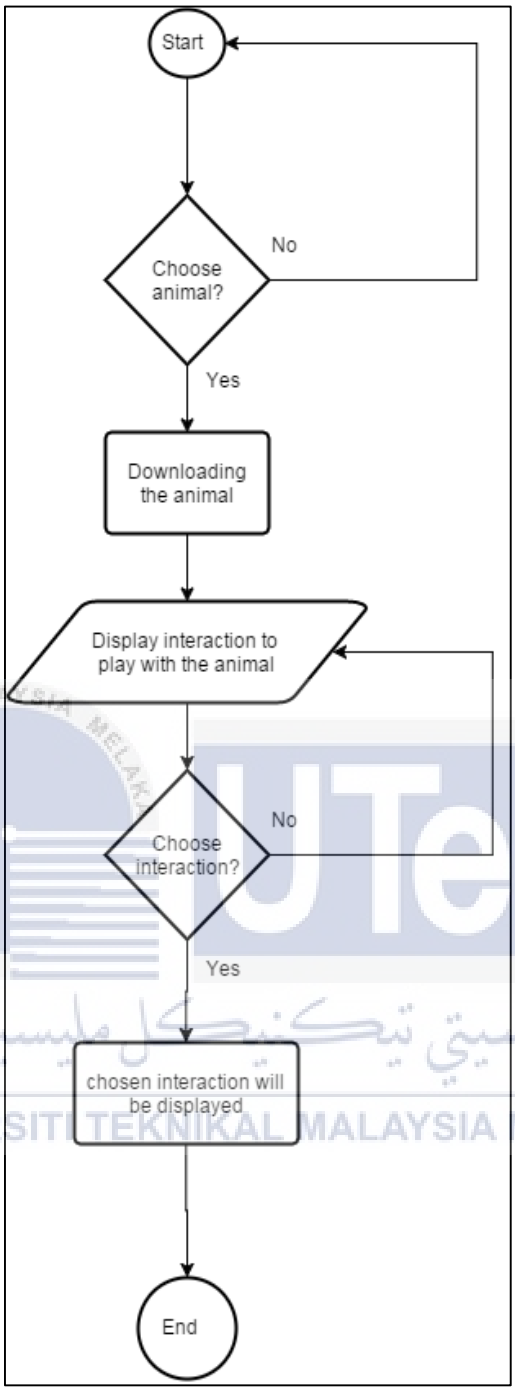


Figure 3.3. The flow of process of ZooKazam mobile application

3.3. Requirements Analysis

In this section, there are some categories in the project analysis that is need to be explained which need analysis, user analysis, technical analysis, resource analysis and requirement analysis.

3.3.1. Project Analysis

The project analysis will help to determine the problem faced by the existing mobile application. The problem are listed in the Table 3.1.

Table 3.1. Problems of the existing system

Existing mobile application	Problems
Science Textbook	• Do not have interaction. • Do not have visualization, audio, animation. • The content of the animal and its classification is too little.
Animal 4D++	• User need to buy the flash card in order to play with the application. • The classification of the animal is combined with the specification. • User need to have higher OS to use the application.
ZooKazam	• User need to download the animal before they want to display the animal. • The fact about animal classification is written in the first interface under its classification. • User need to focus when they want to listen to the explanation provided about animal.

	• User need to have higher OS to have a better interaction with the animal.

With the problem listed in the table, this project aims to develop a new augmented reality mobile application to improve the problem in the existing system.

3.3.1.1. Need Analysis

From the table 3.1, it is concluded that user need to download the animal before they want to display and interact with them which require user to have internet to download all the animal. Hence, money is needed to use this application. When user download the animal, it will take space in their memory phone. Therefore, a mobile application to let user use it without any worry will be develop.

Besides, this mobile application comes with a responsive web. This web is used to provide identification marker and mobile application for user. This web also contain information about animal in an entertainment way for user to explore. For marker based, there will be six different image represent the animal and a classification marker for the animal. When user download and start the application, they can choose the marker and put it on top of the classification marker. An animal will be displayed. There will be buttons for user to interact with such as information button and moving button. The information button is a button when user click on it, the information about the animal will be displayed and the moving button is used when user want to class the animal. When user click on the moving button, the animal will be moving to its class. This makes the mobile application interesting and entertainment.

3.3.1.2. User Analysis

This project will be develop for Android platform only. The user need to possess an Android device to be able to install and interact with it. The reason for developing this mobile application is because this application will be used for testing only. The other reason is, the user

that will be using this application is a student age 14 years old and they tends to use Android over iOS because of the difference price of the device. Next, there are questionnaire distributed to teenagers student specifically student with age 14 years old. All the information will be explained in section 3.3.1.4 Requirement Gathering.

3.3.1.3. Resource Analysis

There are six animal that will be provide in the augmented reality mobile application. The 3D models of animal are modelled not according to real life animal as it is used for testing only. Besides, the fact about the animal is collected through textbook, notes and official zoo websites.

3.3.1.4. Requirement Gathering

Requirement gathering is done to find out better solution for developing mobile application. Questionnaire method is make and distribute to users and it is used to gathering requirement from user.

The questionnaire consist of 16 questions which were separated into 4 parts. Part A is about student's profile, Part B is about smartphones and augmented reality, Part C and D covers the issues of animal classification. The example of the questionnaire will be at the Appendix B.

The questionnaire is distributed to 20 students, age 14 years old (Form 2) at Sekolah Menengah Kebangsaan Wakaf Bharu, Kelantan. There are short briefing about Augmented Reality and explanation for the questionnaire before the question is distributed.

The data from the questionnaire have been collected and the results were analyzed and displayed in pie chart form. The result obtained was calculated in percentage to give a clear statistical view.

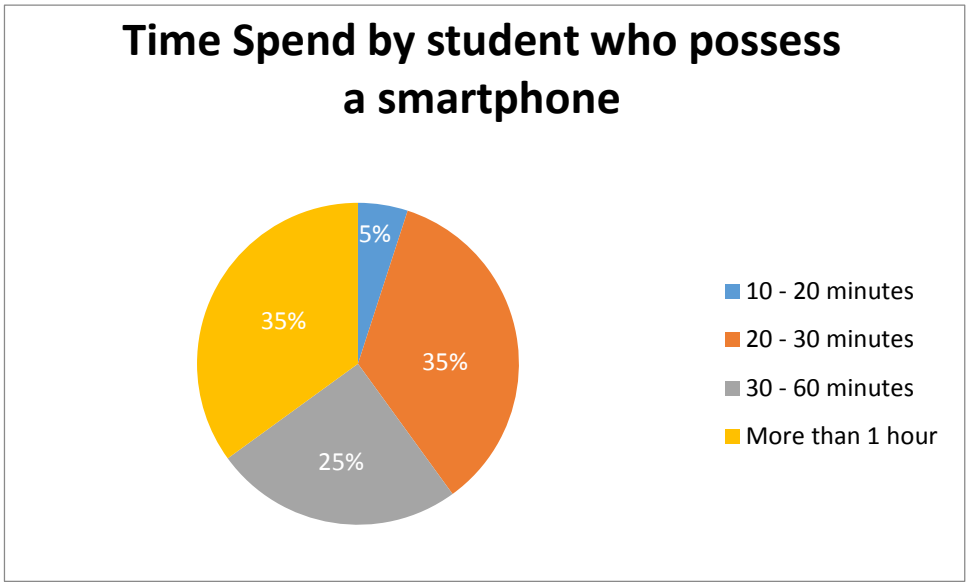


Figure 3.4 Statistic of time spent by student who possess a smartphone.

As shown in Figure 3.4, the results showed that 100% of the students at the school nowadays possess a smartphones. There are 35% students who spent their time with their smartphones for about 20 to 30 minutes and above 1 hours. This results shows that the students nowadays are already used to the image of smartphones.

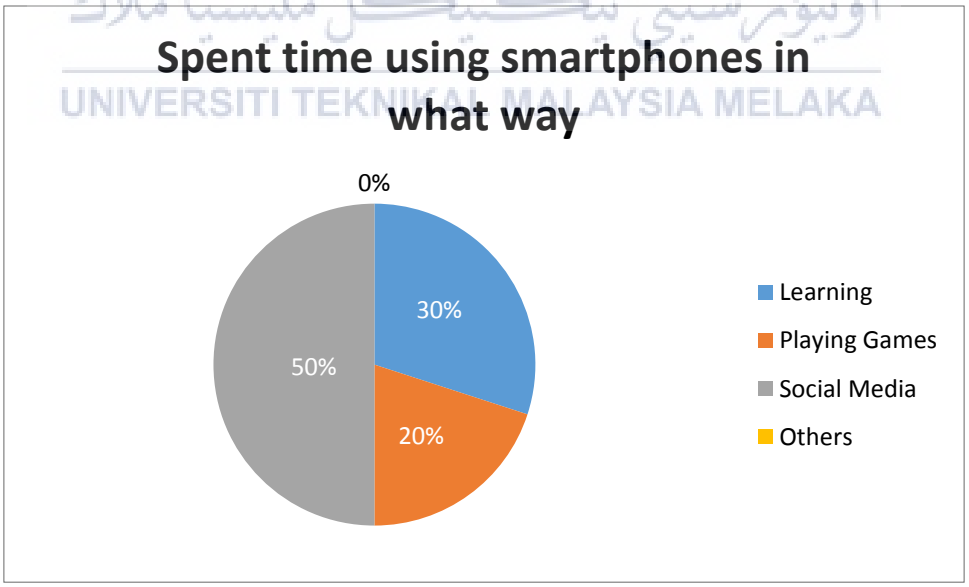


Figure 3.5 Statistic of time spent using smartphones in what way

Figure 3.5. Shows that students who possess a smartphones are using their smartphones in different use. 50% of the students use their smartphones to access their social

media. From this, we can conclude that these students spent time for hours only to access their social media. 30% of the students says that they use smartphones for learning. From this result, there is a possibility that the student find their information about their learning in the internet by using smartphones.

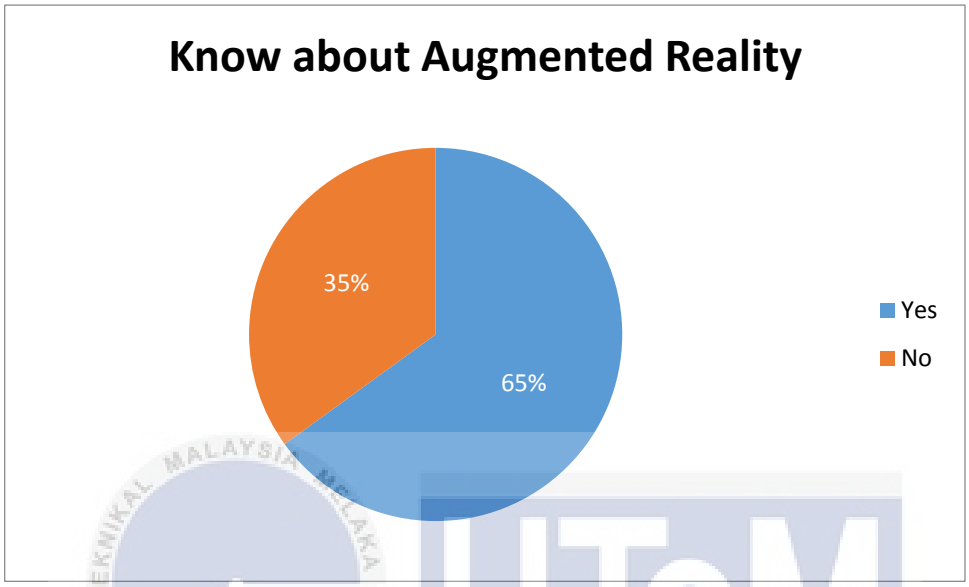


Figure 3.6 Statistic of whether student knows about what is Augmented Reality

Figure 3.6 is a statistic about whether student know what is augmented reality is. From the results, 60% of the student is already aware of augmented reality. This can conclude that these student might have seen or use augmented reality while 35% of the student do not know about augmented reality. So, this is the opportunity to introduce to them what is augmented reality while they can interact with it.

In part C, the questionnaire is about the animal classification, this is where we can know whether these students know about the animal classification, where did they learn or get the information about the animal.

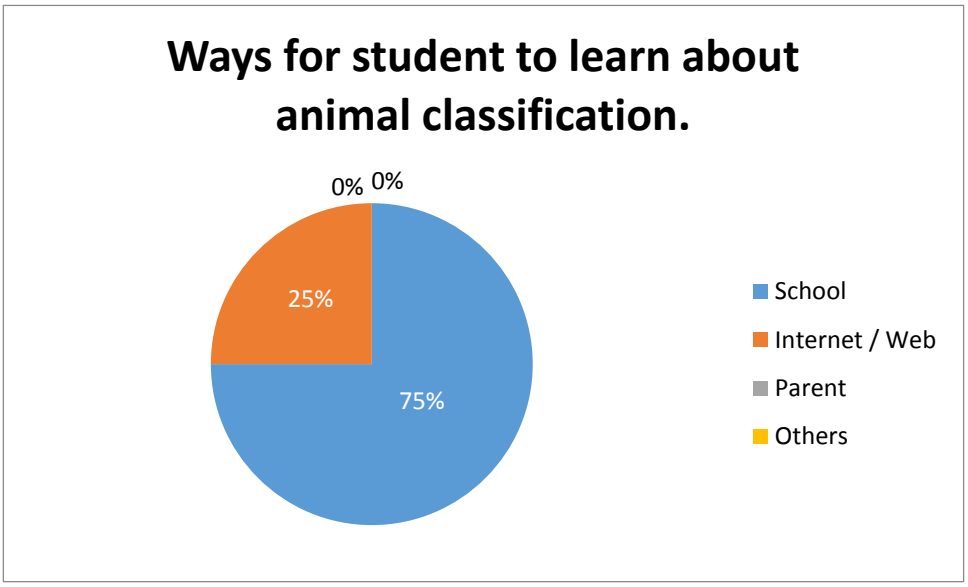


Figure 3.7 Statistic of ways for student to learn about animal classification

This figure shows that all the student know about animal classification. This is because they have learned it in the school from their teacher. There is 75% students said that they learn about animal classification from school and their teachers but the other 25% students said that they learn about animal classification through the internet. this can conclude that the students are not only learn in the school but they learn from other source. From this, the responsive web that will be develop will be suitable platform for these student to learn more about animal and its classification.

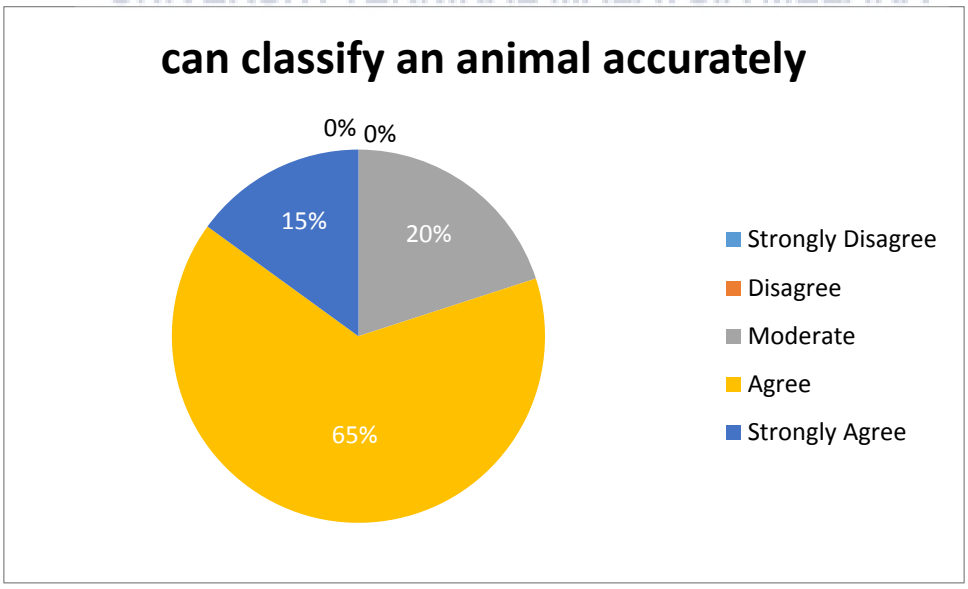


Figure 3.8 Statistic of student who can classify an animal accurately

Based on Figure 3.8, 65% of the student agree that they can classify an animal accurately, 20% of them can moderately classify the animal and 15% of the student cannot classify the animal accurately. This can conclude that not all of the student can classify the animal classification. So, with this new augmented mobile application will be a chance for them to learn and understand about the animal and its classification.

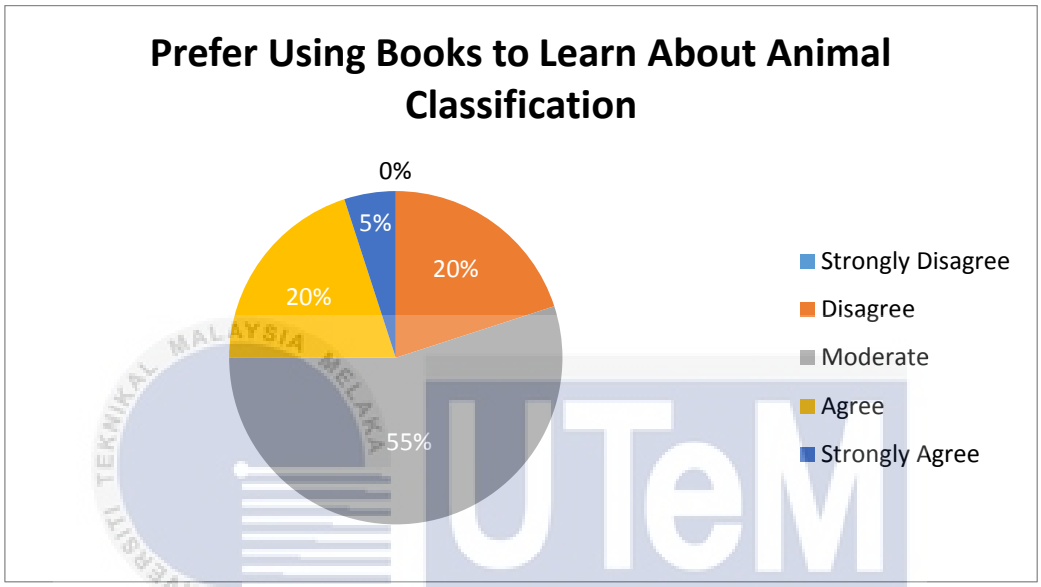


Figure 3.9 Statistic of student who prefer using books to learn about animal classification.

Figure 3.9 shows the statistical of student who prefer using books to learn about animal classification. This is to know that if they can accept the new way of learning without using books but using other source to learn. 55% of them are moderately prefer using book to learn. This can conclude that these student are likely to accept if there is a new way to learn besides using books in class. 5% of them are strongly disagree to use books to learn.

3.3.2. Software Requirement

i. Unity 3D

Unity 3D is cross-platform 3D development engine that is commonly used to creates games. It is notable for its ability to target games to multiple platforms. It also allows specification of texture compression and resolution setting for each platform the game engine support. This unity is used in the project where all the interaction in the mobile application will be included using unity.

ii. Vuforia SDK

Vuforia is a software that enables application to see. Developers can add advance computer vision functionality very easily to any application, thus allowing it to recognize images and objects, or reconstruct environments in the real world. In this project, vuforia is used to support the marker based that is going to be developed for the animal classification.

iii. Autodesk Maya 2014

Autodesk Maya is an industry leading 3D animation software application developed by Autodesk that enable developer to create three-dimensional (3D) cinematic animation. As for this project, Maya is used to create model of animals in 3D.

iv. Adobe Illustator CS6

Adobe Illustrator is used in creating interface for the mobile application and the responsive web such as buttons, image of the content that is in the web and logo.

v. Adobe Photoshop CS6

Adobe Photoshop is also used in creating interface for the mobile application and the responsive web such as buttons, image of the content that is in the web and logo.

vi. Notepad ++

Notepad ++ is used to create responsive web by using HTML language as main language. It is also used to connect to the database if there is any database that is used to complete this project.

vii. Microsoft Word 2013

Used to prepare the documentation of proposal, whole report and questionnaire.

viii. Microsoft Project 2010

Used to prepare Gantt chart for the project in the proposal and report.

ix. Microsoft Visio 2010

Used to draw flow chart of project's progress.

x. Microsoft PowerPoint 2013

Used to prepare slides for final presentation.

3.3.3. Hardware Requirement

i. Laptop

Used to install the requirement software for this project to complete, create a 3D model animation, editing and design the interface of the responsive web and the mobile application.

ii. Android smartphone

Used to install final product of this project and test the application for desired output.

3.3.4. Other Requirement

i. Printer

Used to print all material needed for this project which is proposal, report, questionnaire and identification marker.

3.4. Conclusion

As a conclusion for this chapter, there are parts that have been discussed which current scenario analysis and requirement analysis. This chapter also discussing about the design of the mobile application that will be developed. The requirement analysis are explained which there are information needed to complete this project. From the questionnaire collected, there are several information that can get to develop this application.

For the next chapter, the next phase that will be explained is the design phase. The design phase is need to design the architecture and the flow process of the new augmented reality mobile application. The user interface of the mobile application will also be provided and explained in detailed in the next chapter.

CHAPTER IV

DESIGN

4.1 Introduction

In this section, system architecture, preliminary design and user interface design will be will be expressed and clarify. The Animal Classification mobile application is develop for teenager student which age is 14 years old. Thus, the design of the interface and content of both mobile application and responsive web will be discuss based on the student's need. Besides, the preliminary design is made to produce the identification marker for the mobile application.

4.2 System Architecture

System architecture is a reaction to the reasonable and commonsense troubles of the depiction and the configuration of complex framework. In this anticipate, the primary stage that used to build up this mobile application is Java Development Kit (JDK) for java engineer. This anticipate are utilizing two SDKs to create which Android SDK and Vuforia which is focused for Android cell phones to apply AR innovation. Vuforia is picked in this anticipate in light of the fact that it is free and simple to utilize.

Other than that, the AR mobile application use marker-based application. Subsequently, without the ID marker, the students will not have the capacity to utilize this mobile application because the identification marker are provided in the responsive web. The students have to

download the identification marker and the mobile application provided in the responsive web to be able to use the application.

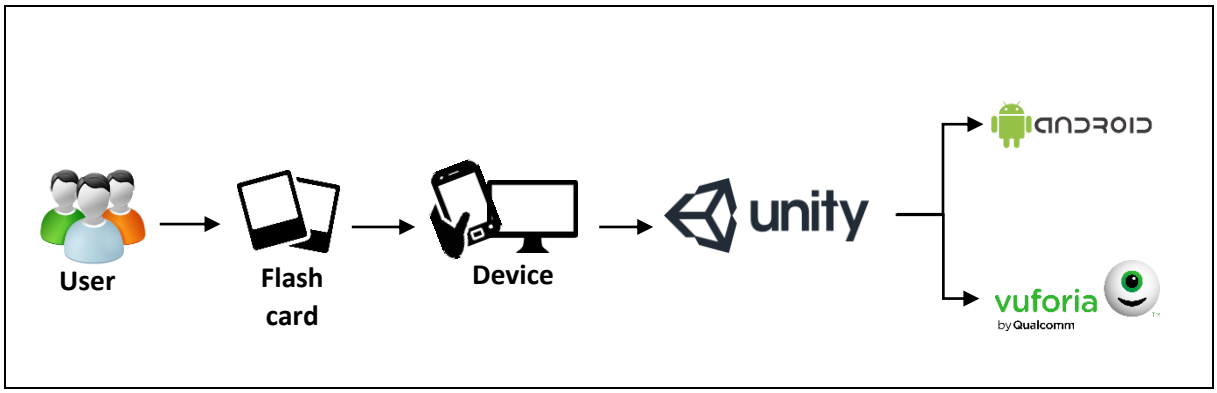


Figure 4.1 System Architecture

1.3 Preliminary Design

Preliminary design is the first phase of the design process. It contain the sketch of the entire framework. Early design phase is imperative for developer when developing the mobile application to guarantee the mobile application will be create in the correct ways and contain every one of the prerequisites required. In this stage, there are few plans are required such as flow of the system which mobile application and responsive web and the storyboard design.

4.3.1 Flow Chart

The general flow of the whole system are shown in flow chart. The flowchart is utilized as a direction for developer to develop this system. Table 4.1 show the function of the mobile application in every interface. Figure 421 (a) show the flow of the main interface of the Animal Classification and Figure 4.2 (b) shows the flow of the detection of each marker of the Animal Classification.

Table 4.1. Shows the functionality of button in mobile application.

Interface	Button	Functionality
Main interface of the Animal Classification mobile application.	Button “Start”	Let user to enter the AR environment.
	Button “How to Use”	Let user to enter the how to use interface. The manual on how to use the application is given.
	Button “exit”	Let user to exit the application
Interface on How to use	Button “Back”	Let user to enter the main interface of the mobile application.
AR environment.	Button “Information”	Let user to view the information of the animal.
	Button “Classify”	Let user to view the classification of the animal.

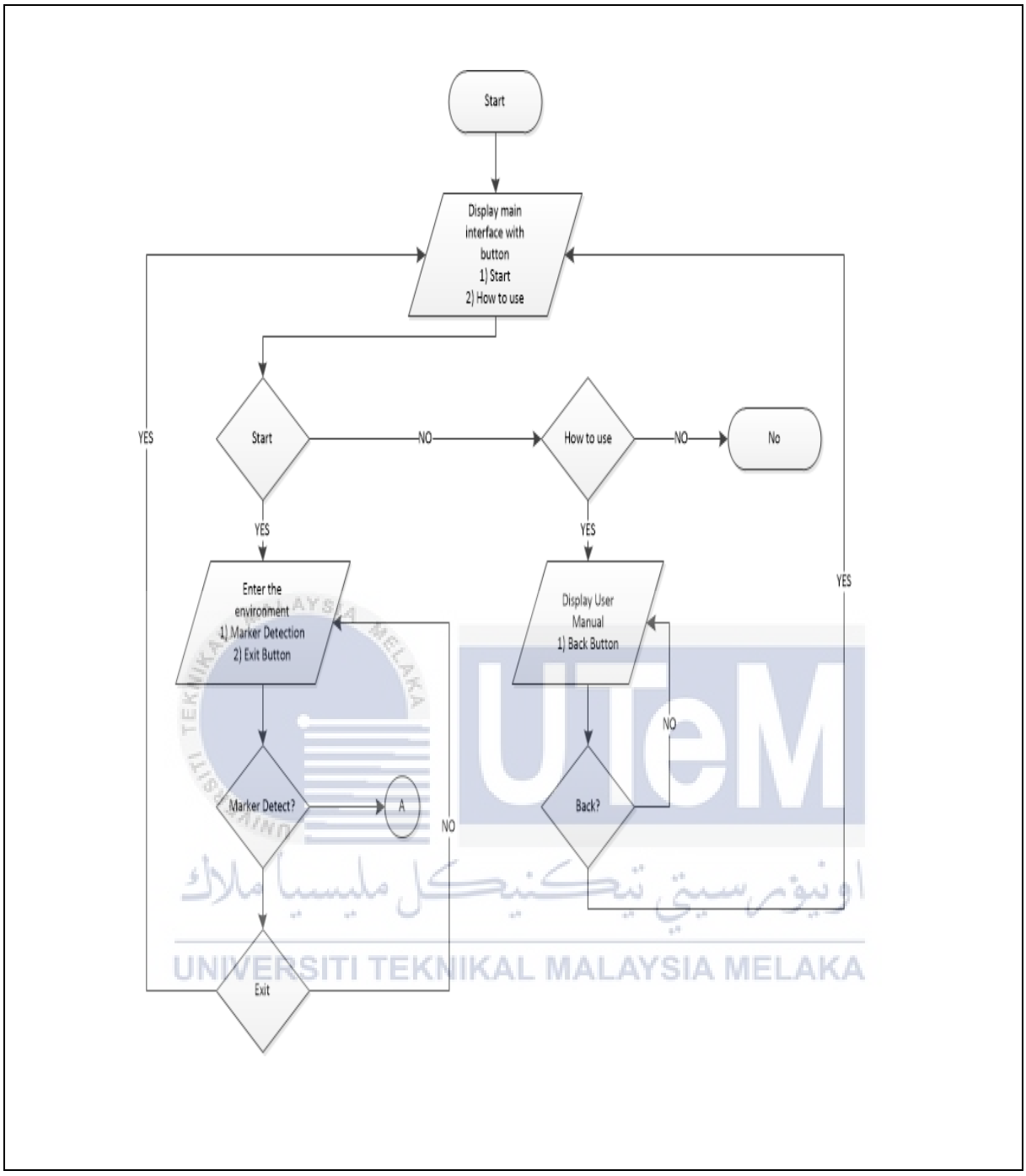


Figure 4.2 (a) Flow of main interface of Animal Classification mobile application

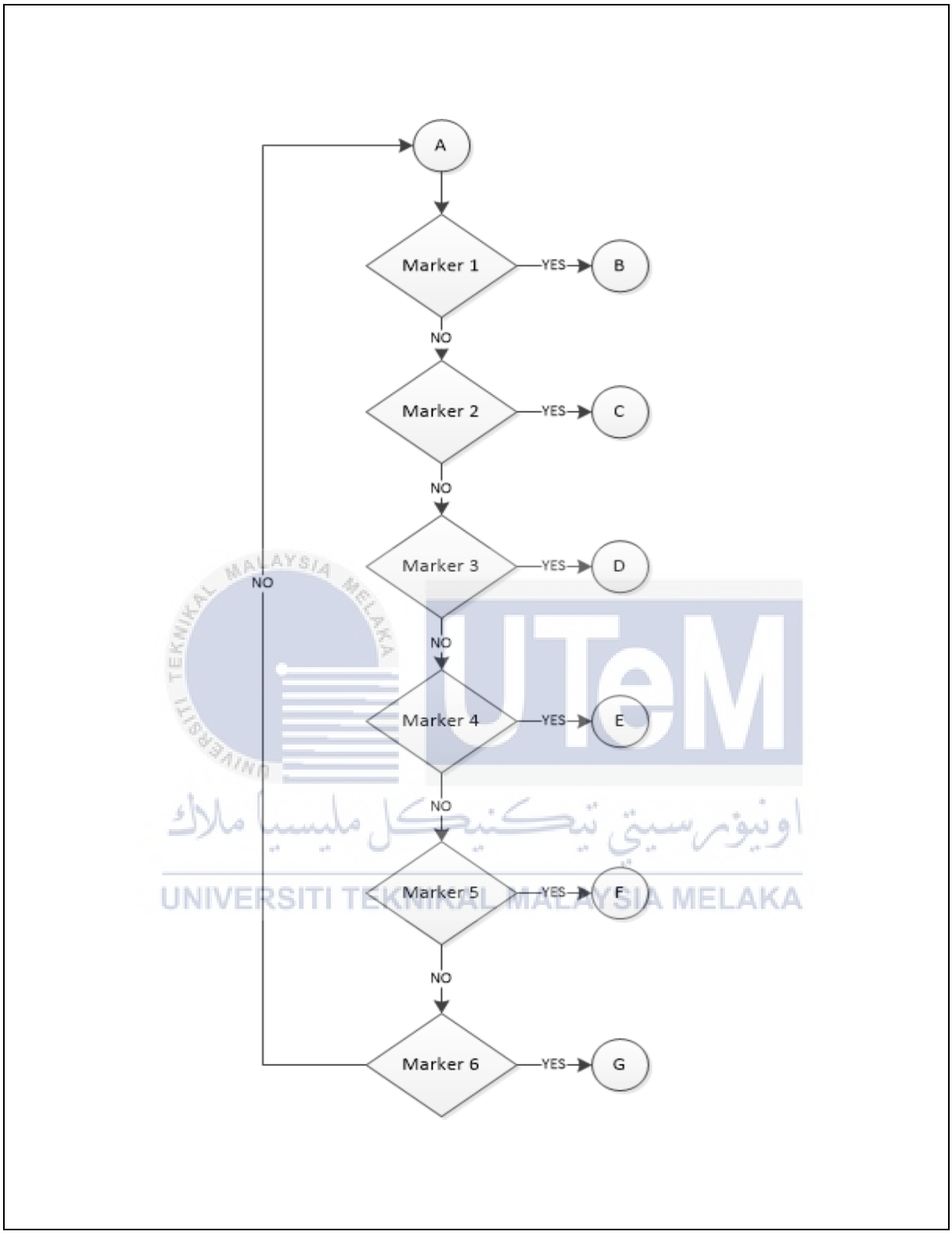


Figure 4.2 (b) flow of the detection of each marker of Animal Classification

4.3.2 Storyboard Design

Storyboard design is graphic organizers as representations or pictures showed in sequence for the purpose of pre-visualizing the flow of the mobile application. Thus, storyboard will be produced for developer to illustrate the general of the final product will look be. Please refer to Appendix C for the storyboard design of the mobile application.

4.4 User Interface Design

In this section, the design of the identification marker, navigation design, input output design and icon design are provided.

4.4.1 Identification marker and responsive web design

For this application, the identification marker are design using Adobe Illustrator CS6 with the size of 21.17cm x 14.11 cm. This identification marker is used to detecting the 3D model of animals. This identification is design in cartoon mode because it used to attract student. As for the web responsive design, the content in the web are design using both Adobe Photoshop CS6 and Adobe Illustrator CS6 to design the icon of the marker, and Adobe Flash CS6 is used to make another platform for user to know more about the animal and its class.

Figure 4.3 and Figure 4.4 shows the image of the identification marker to be used in the application and viewed in the responsive web.

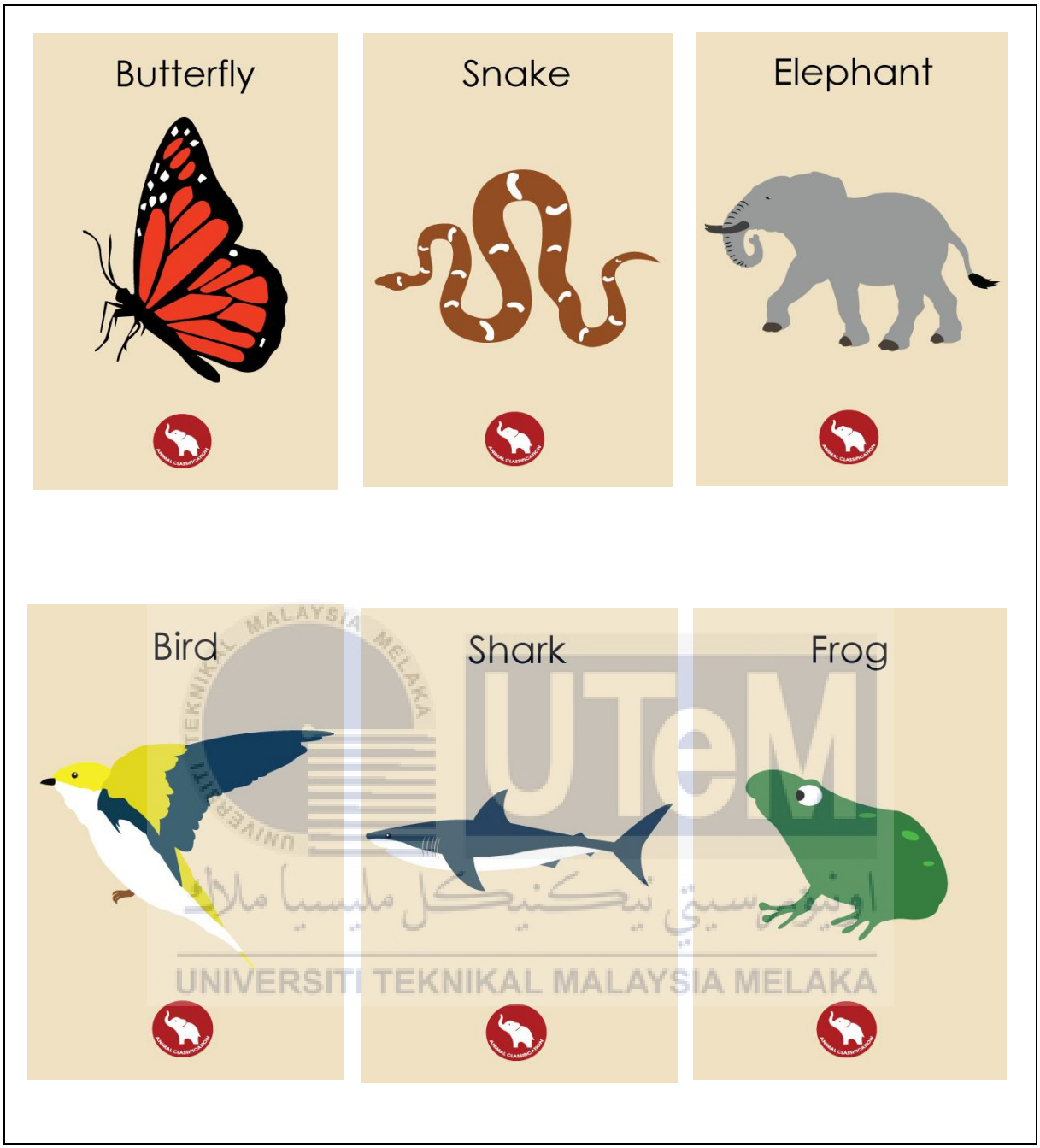


Figure 4.3 Identification marker design

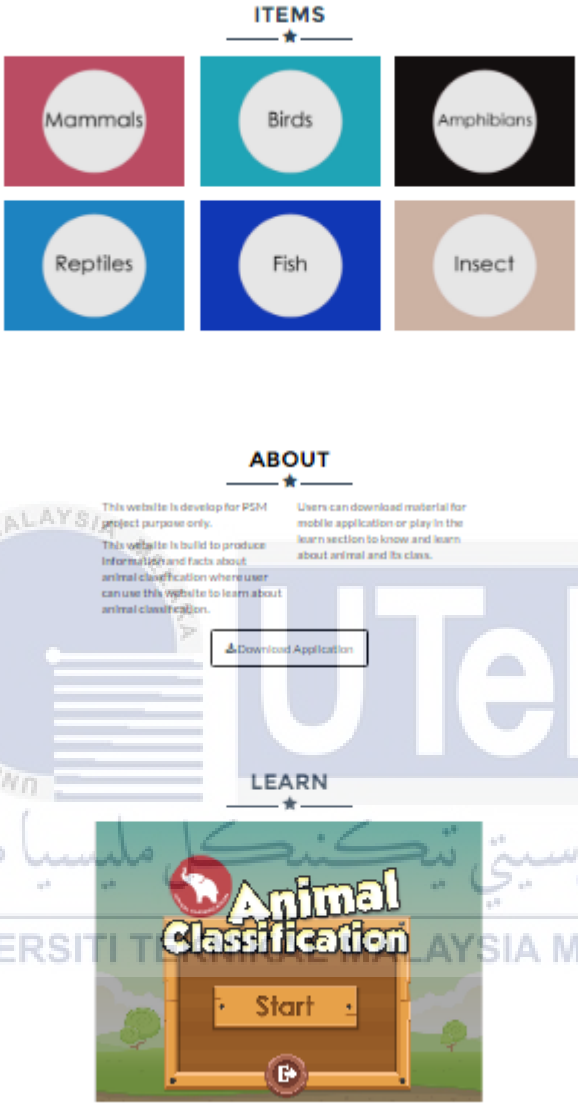


Figure 4.4 Responsive Web design.

4.4.2 Icon Design

Any application has its own logo to give the distinction to the user. Accordingly, this project will also design a logo to represent the Animal Classification application and responsive web. This logo will be included in the mobile application as it will become as an icon to the mobile application and also in the menu interface of the mobile application.

Figure 4.5. Icon Design

The idea of using elephant as a main logo is because this animal is attractive and different from other animal. Elephants have customarily been presumed for having an especially solid and long memory. So, as a charm for student to have long memory as elephant, this logo is created. From the icon design, white color is used because the main background of this logo is red.

4.4.3 Navigation

Navigation design is a fundamental flow that gives a sensible flow of the whole system. This mobile application which provides interactivity for user to get to the data. Figure 4.6 shows the navigation of the Animal Classification mobile application and Figure 4.7 shows the navigation of the Responsive Web of Animal Classification.

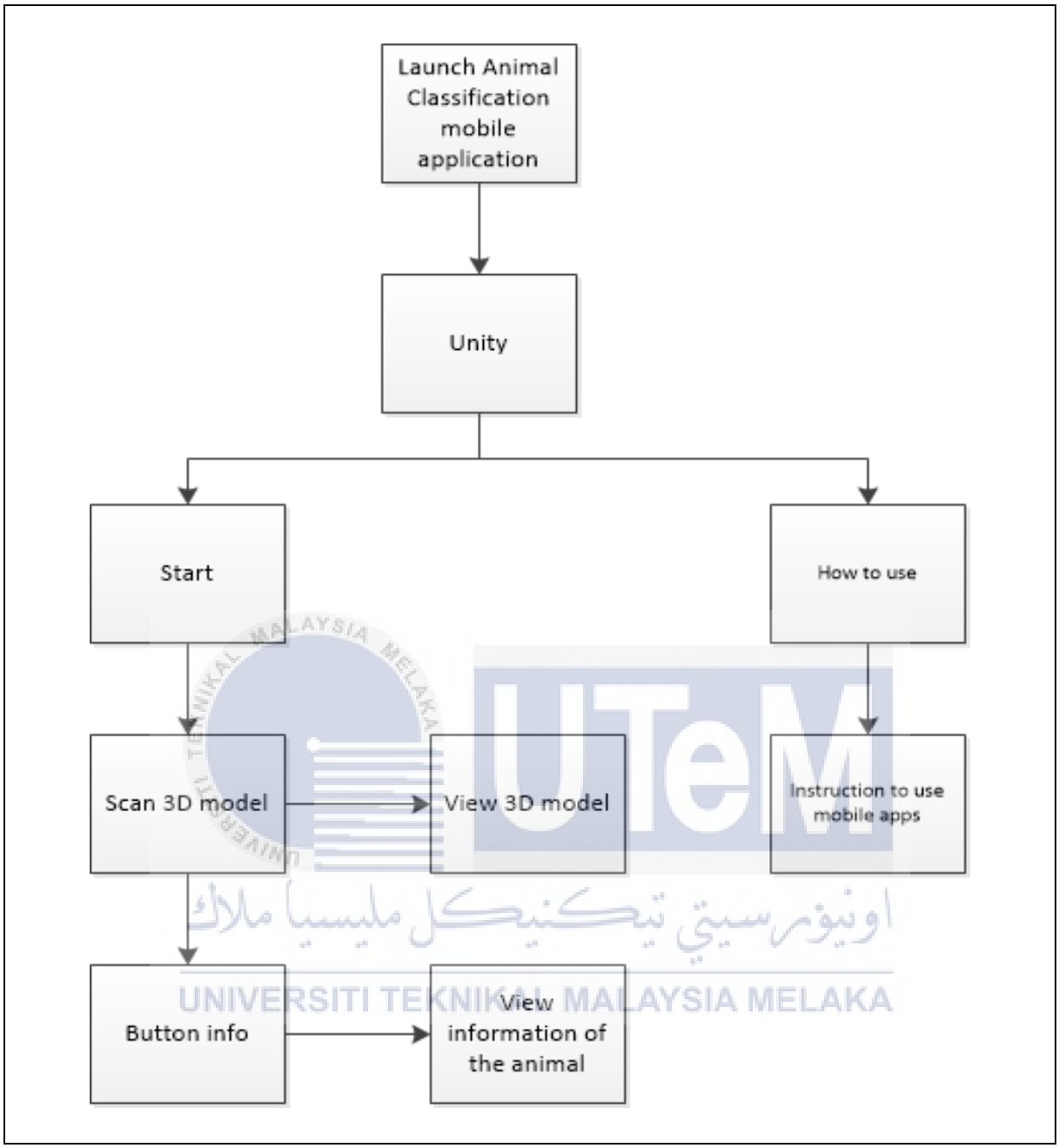


Figure 4.6. The navigation of the Animal Classification mobile application

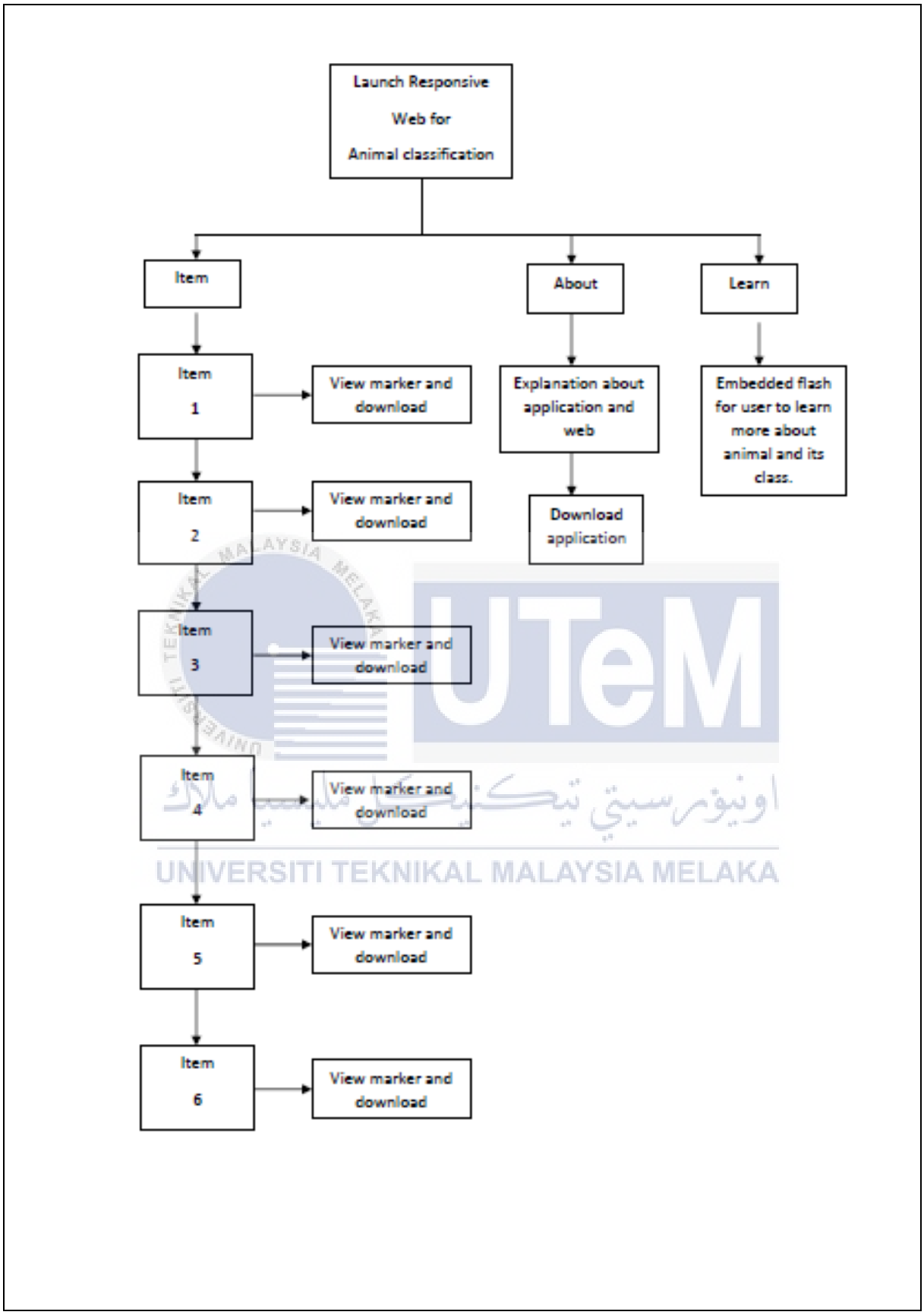
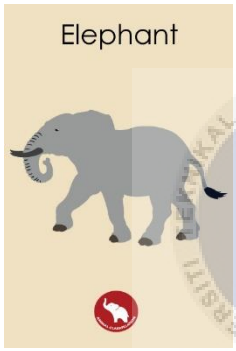
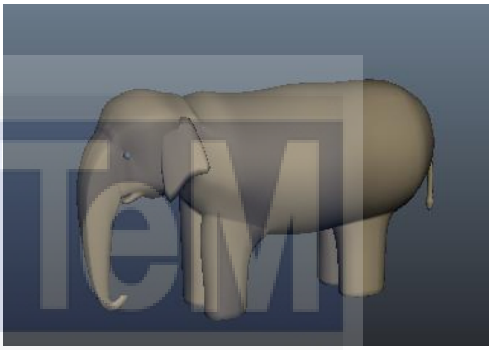
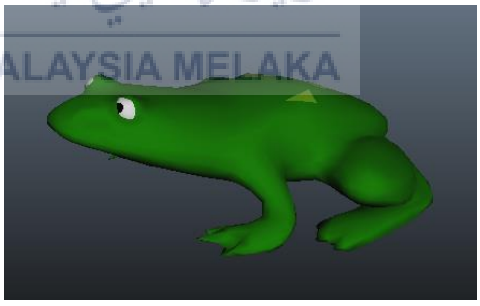


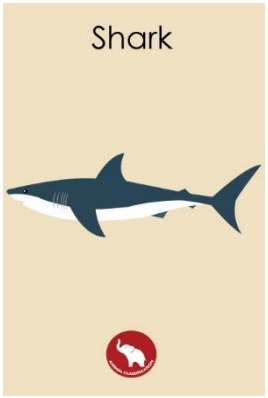
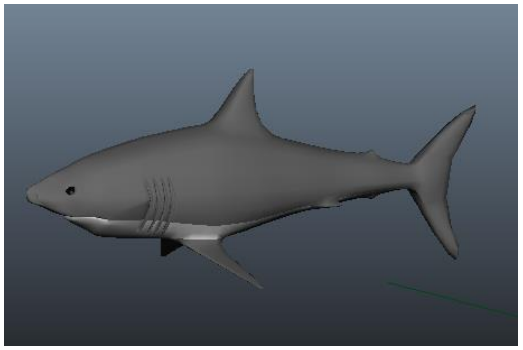
Figure 4.7. The navigation of the Responsive Web of Animal Classification.

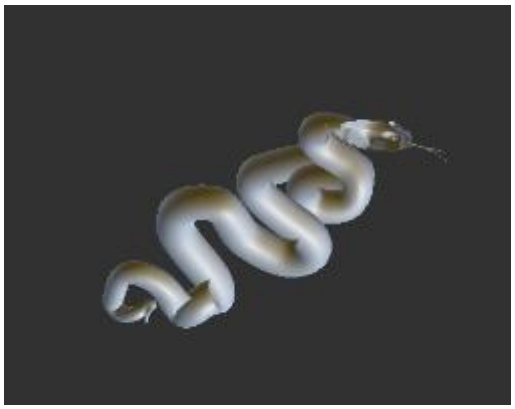
4.4.4 Input and Output Design

For this mobile application, the ID marker is required and it is given by the developer. The identification marker is an image of the animal in 2d cartoon in colors to give attraction to the user. Table 4.2 shows the input and output design of identification marker Animal Classification mobile application. As for the input and output design of the responsive web and the application, please refer to Appendix D.

Table 4.2. Input and Output design of Animal Classification

Input Marker	Output	
		
		

4.5 Conclusion

This part clarified about the configuration that is utilized to build up the versatile application and the responsive web, the framework design, stream of the framework and distinguishing proof marker. In addition, the flow chart was talked about to see the flow procedure of the system that will be create.

For the following part, execution stage will be talk about and clarify. The procedure or exercises will be incorporated. The exercises that will be given is media integration, media creation and configuration management.

CHAPTER V

IMPLEMENTATION

5.1 Introduction

During implementation phase, it manages the issues of quality of the media creation. The activities that will incorporate into this part are the media creation, media integration, product configuration management and the implementation status. Media creation is all about the substance creation for the system and media integration is decide the procedure of incorporating the created content. Next, product configuration management will examine about the arrangement setup of the system and lastly explain the progress of the development status of the system.

5.2 Media Creation

The media creation process focusing about the text production, graphics production and animation production. The detailed about all graphics, text and animation used to developed the system will be listed and explain.

5.2.1 Production of Text

The use of text in the system is to let the user to understand what developer are trying to show about the system. The system have to have the “look and feel” so that the user can feel

comfortable and enjoying the mobile application and the responsive web. Table 5.1 shows the details of the production of text in mobile application and responsive web.

Table 5.1. Details of the production of text for whole system.

Material	Type of text	Font Color
ID marker • Animal name	San Serif : Century Gothic	Black

Interface of Animal Classification mobile application
• Main Menu
  • Button START
  • Button HOW TO USE
  • Button EXIT
• Interface of HOW TO USE
  • Content
• AR Interface
  • Button INFORMATION
  • Button CLASSIFY
	
	San Serif : Century Gothic Bold
	San Serif : Century Gothic Bold
	San Serif : Century Gothic Bold
	
	San Serif : Century Gothic
	
	San Serif : Century Gothic
	San Serif : Century Gothic
		
		Black
		Black
		Black
		
		White
		
		Black
		Black

Resource in Animal Classification • 3D model information • 3D model classification	 San Serif : Century Gothic Bold San Serif : Century Gothic Bold	 White Blue
Responsive Web • Button • Title	 San Serif : Awesome font Bold San Serif : Awesome font Bold	 White Black

In order to developing the mobile application, there is other process that have been made for production of text which the 3D text for the classification of the animal. This process have been made in Autodesk Maya 2014 and the text are exported to FBX file. Figure 5. 1 shows the process in creating the 3D text.

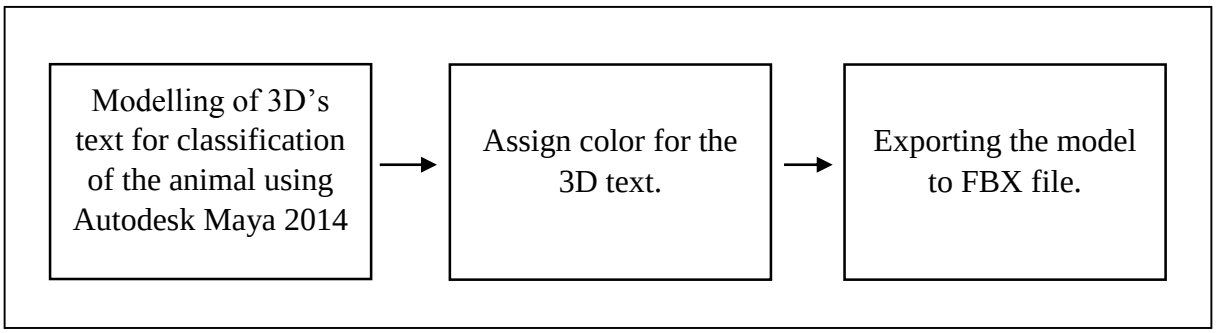


Figure 5.1. Process of creating 3D text for classification of the animal.

5.2.2 Production of Graphic

In order to make another platform for student to learn about animal classification, there is a lot of using image to be included in the platform. So, Adobe Photoshop CS6 and Adobe Illustrator CS6 is used to create all the 2D animal to be included in the platform. All of the image created are saved in the PNG file format to give transparent background for the image. The button in the platform are created using Adobe Flash CS6.

The image of identification marker and responsive web and button in the mobile application are also created using Adobe Photoshop CS6 and Adobe Illustrator CS6. After all of the image is done created, it will be export to PNG file and will be applied in the mobile application and responsive web.

3d modeling can also be included in the production of graphics. The modeling created are the animal for AR mobile application. The model of the animal are created using Autodesk Maya 2014. The animal modeling created are Shark, Elephant, Snake, Butterfly, Frog and Bird.

After finish modeling the animal, it will be exported to FBX file and imported to Unity to be applied to AR mobile application.

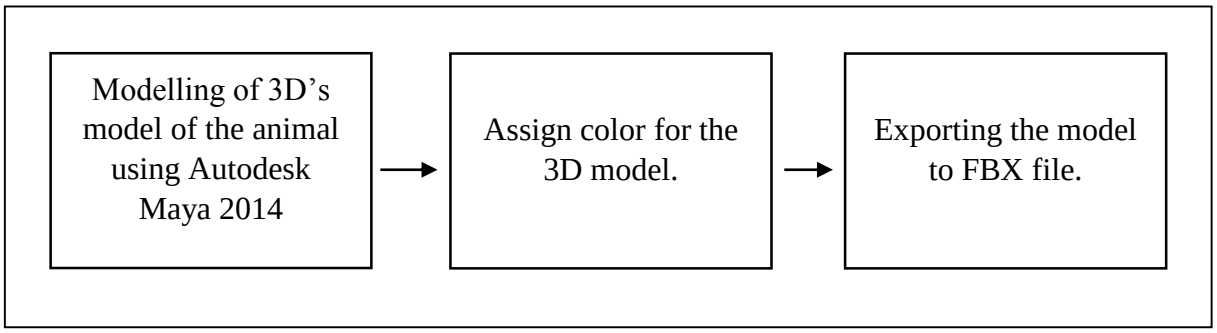


Figure 5.2. Process of creating 3D model of the animal.

5.2.3 Production of Animation

There will be a simple animation for the animal when the ID marker is scan in the mobile application. There are also animation when user click on the Classify button. The animation will be created in Autodesk Maya 2014 and will be exported to unity to be applied in the AR mobile application.

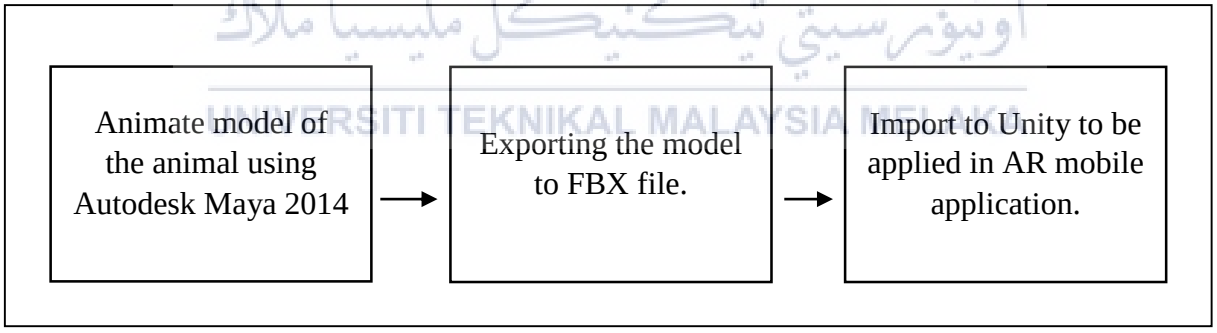


Figure 5.3. Process of creating animation for the animal

5.3 Media Integration

In this project, the developer are using Unity and Vuforia to developing the mobile application. All of graphics that have been made will be imported in Unity to be applied in the AR mobile application. Vuforia act as database to keep all the image target to be imported to

Unity. As for the responsive web, the developer use HTML and CSS to make the web. A little bit of using Bootstrap to make the web responsive.

Firstly, all the component such as 3D model, 3D text are imported to unity and they are saved in the Assets folder which is shown in Figure 5.4. The component to make the other platform for user to learn about animal is imported in Adobe Flash CS6 as shown in Figure 5.5.

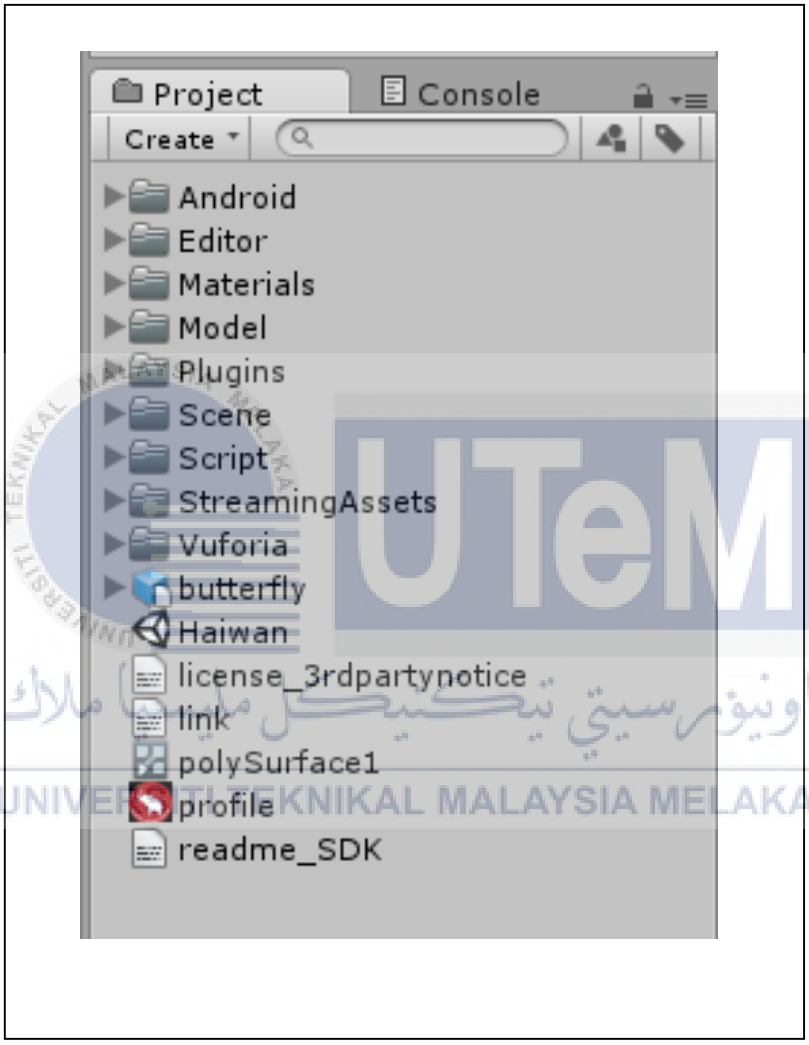


Figure 5.4. Component imported in Unity

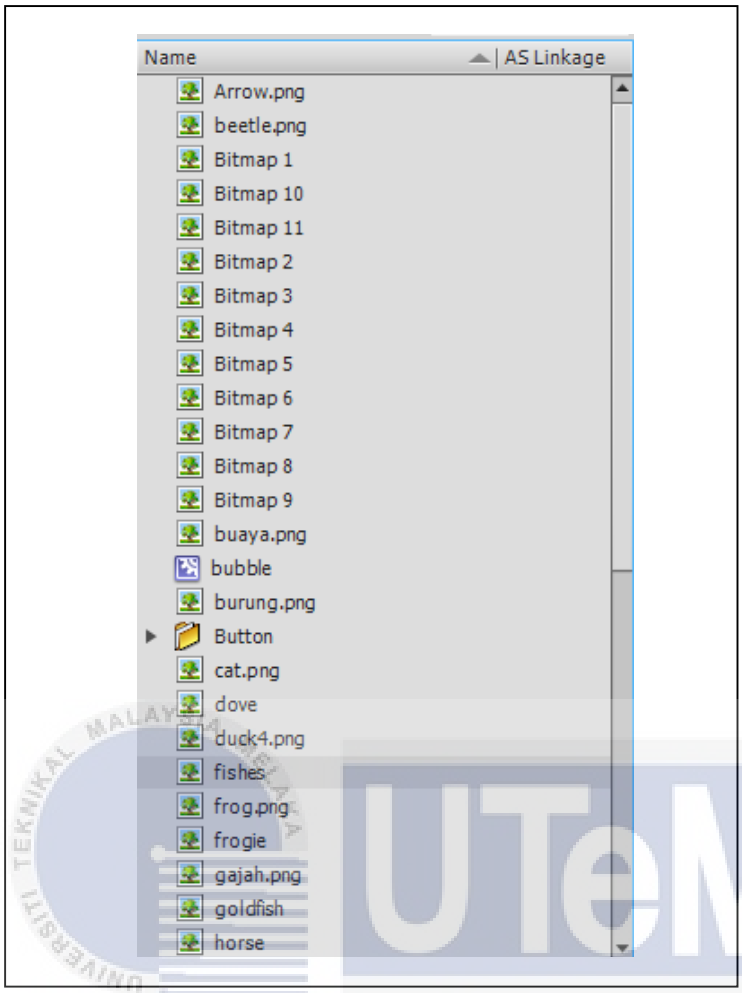


Figure 5.5. Component in Adobe Flash CS6

Other than that, the component for responsive web such the identification for the marker and the mobile application is imported using Notepad ++. The link to download the mobile application and the identification marker are included using hyperlink. The tag that allow hyperlink in HTML is <a>. Figure 5.6 shows the scripting to including ID marker and mobile application to the HTML.

```
<a href="/1. PSM 1/Web/Responsive Web/img/portfolio/shark.png" download>Download Link</a>
<a href="/1. PSM 1/Web/Responsive Web/img/portfolio/Animal_v2.apk" class="btn btn-lg btn-outline" download>
```

Figure 5.6. Scripting to including ID marker and mobile application to HTML

5.4 Product Configuration Management

In this section, all of the configuration environment setup and version control will be listed and explain in detail. The configuration setup are about how the process of design and configure or installation need by the software for mobile application while the version control is about managing the version update for the mobile application.

5.4.1 Configuration Environment Setup

There are many developing tools that is used in order to complete this project such as Unity3D, Vuforia, and Android SDK that will be discuss and explain in detail.

5.4.1.1 Installation of Unity 3D

These are steps to installing Unity 3D.

1. Go to the Unity3D official website and download the software UnityDownloadAssistant-5.3.1f1.
2. Double click to install the software. [Refer to figure 5.7]

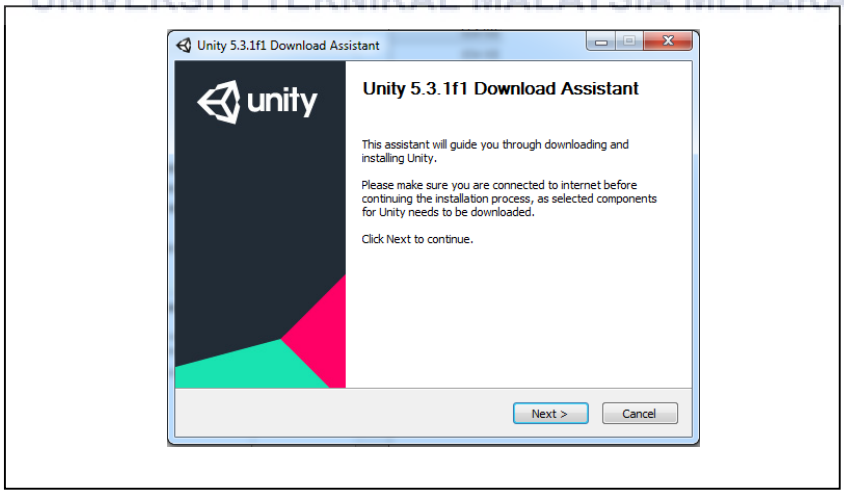


Figure 5.7. Steps to install Unity3D

5.4.1.2 Configuring Vuforia

The steps to configuring Vuforia to keep all the image target in their database are listed below.

1. Go to the Vuforia official website, sign up or register as a member to download and use the Vuforia SDK for Unity for free [refer to Figure 5.8]
2. After download the SDK, import it to Unity to make AR mobile application [Refer to Figure 5.9]
3. Go to the Developer > License Manager to get license key to use Vuforia in Unity3D [Refer to Figure 5.10]
4. Go to the Developer > Target Manager to import the ID marker and download the database from Vuforia to be imported in Unity3D and acts as image target for the ID marker. [Refer to Figure 5.11]

Figure 5.8. Vuforia SDK for Unity

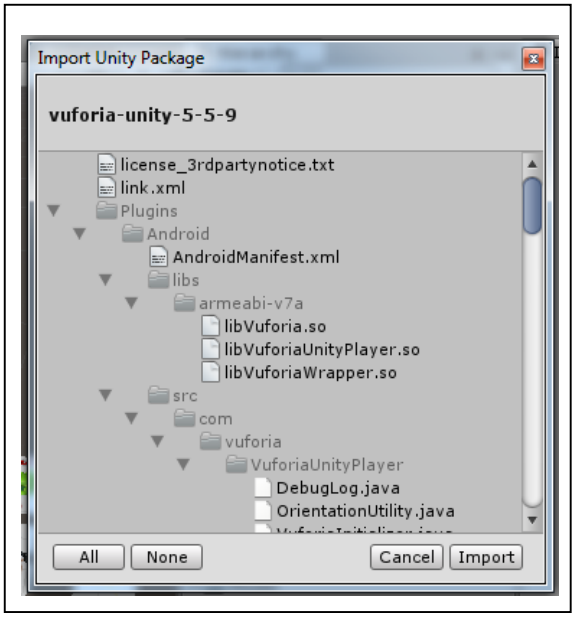


Figure 5.9. Import Vuforia to Unity3D

Figure 5.10. License key to be use in Unity3D

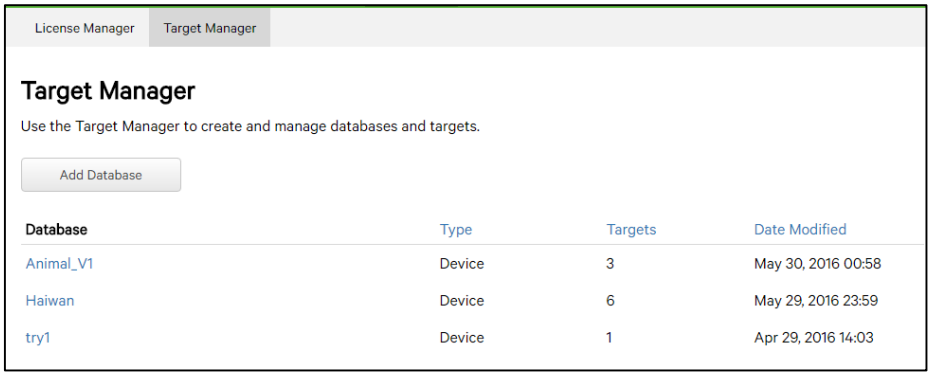


Figure 5.11. Target Manager for Unity3D

5.4.1.3 Configuring Android SDK

The steps of configuring and installing Android SDK are listed below.

1. Go to the http://freewareupdate.com/download-android-sdk/ to download the Android SDK. [refer to Figure 5.12]
2. Using the Android SDK Manager, install the needed component to developing AR mobile application. [Refer to Figure 5.13]
3. After installing, using Unity to configure Android setting to build the mobile application for Android [Refer to Figure 5.14 and Figure 5.15]

Figure 5.12. Android SDK

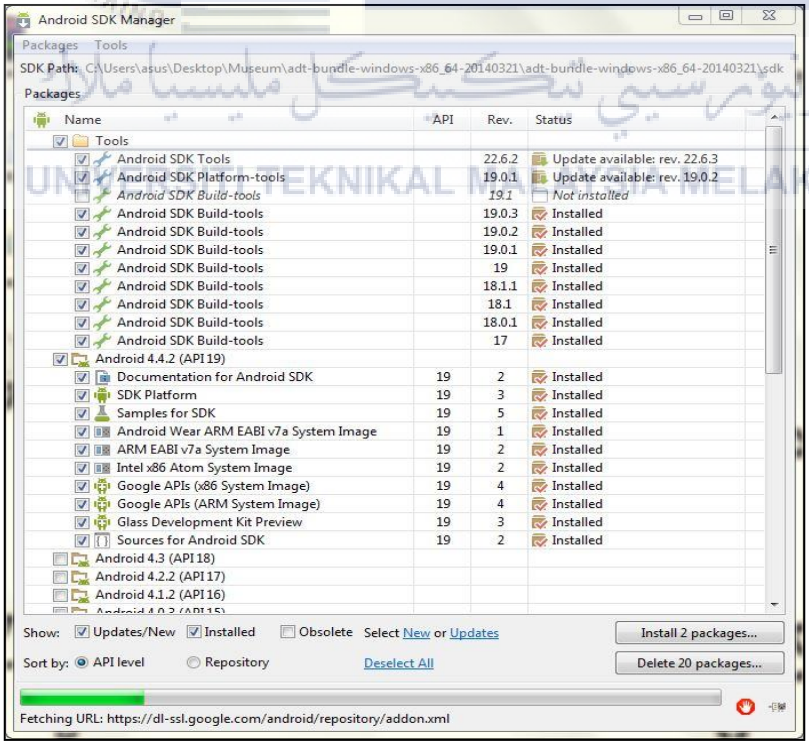


Figure 5.13. Android SDK Manager to download all component needed

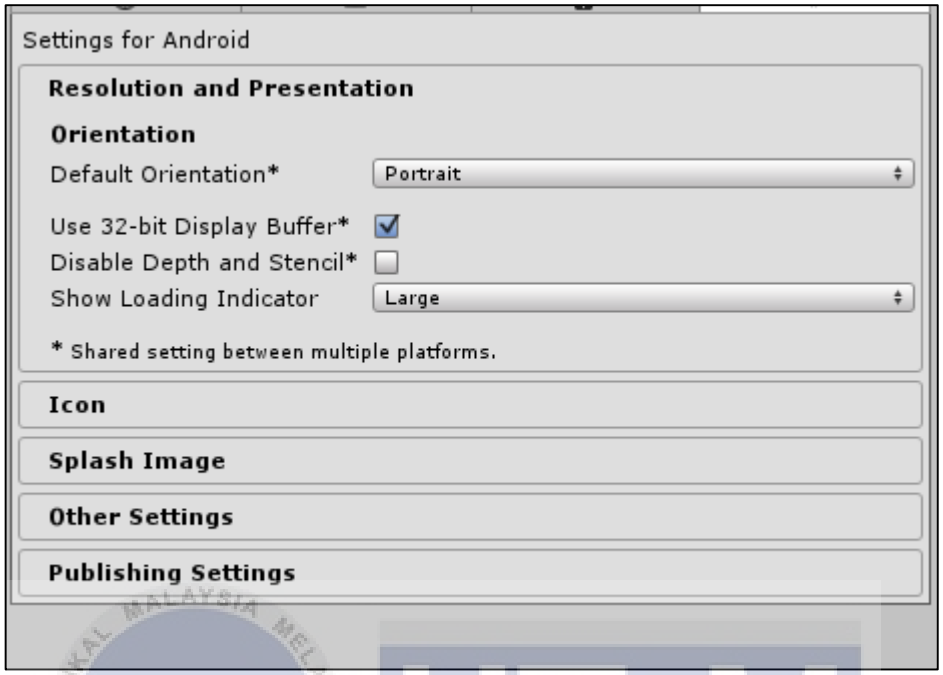


Figure 5.14 Setting for Android

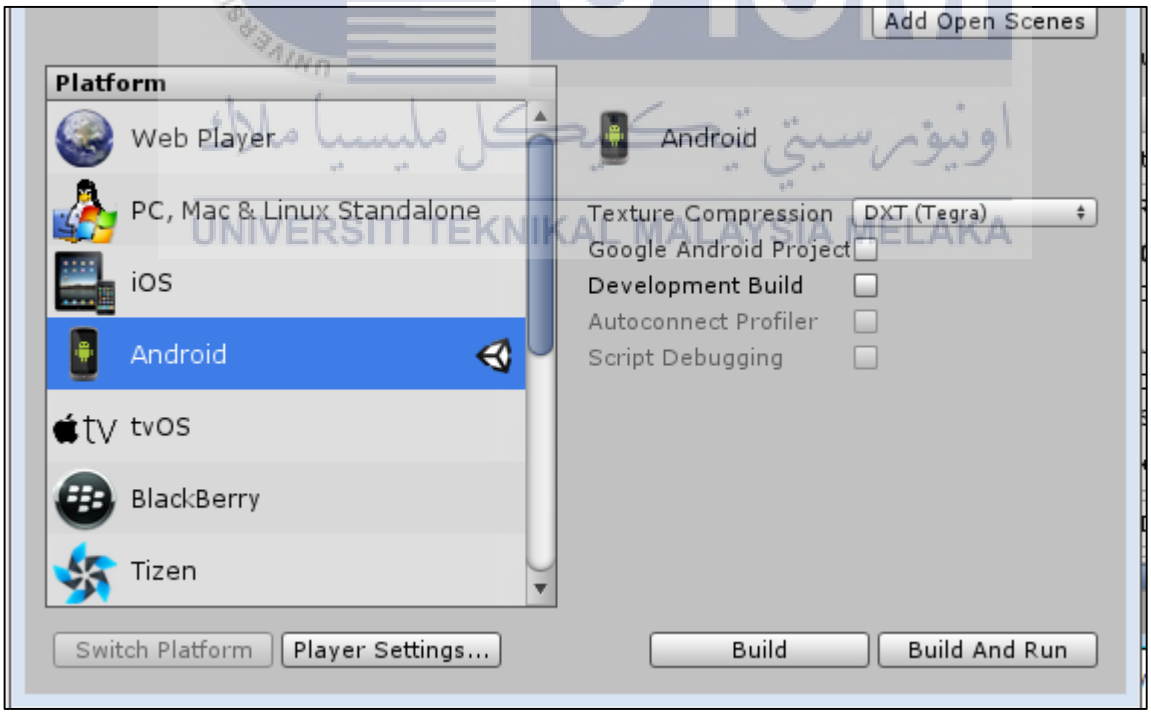


Figure 5.15 Build mobile application

5.4.2 Version Control Procedures

For the version control procedures, there are two versions that need to be considered for developing the mobile application which is alpha and beta version.

5.4.2.1 Alpha Version

During the development of the mobile application, there are several version for alpha testing. The version are listed in Table 5.2 and explain in detailed.

Table 5.2. Version Control and Description for Alpha Version

Versions	Description
Version 1.0	Complete one of the 3D animal modeling which is "Shark". Import to Unity.
Version 2.0	Import Vuforia to Unity. Import image target
Version 3.0	Import 3D model to the image target and scan using webcam
Version 4.0	Import Android SDK to Unity3D
Version 5.0	Build the android and import to the device
Version 6.0	Complete modeling all the 3D animal model
Version 7.0	Importing the image target from vuforia and import to Unity
Version 8.0	Sorted the 3D animal based on their image target and build

5.4.2.2 Beta Version

A few changes have been made to the mobile application after alpha version. The detail about changes are listed in table 5.3.

Table 5.3 Version Control and Description for Beta Version

Version	Description
Version 1.0	Adding Menu interface to the mobile application.
Version 2.0	Adding button to the image target
Version 3.0	Adding animal info and classification
Version 4.0	Adding animation to classification
Version 5.0	Adding explanation to the classification

5.5 Implementation Status

Implementation status are needed to be explain about the development of the mobile application. The implementation status for each task is listed below in Table 5.4.

Table 5.4 Implementation status

Task	Start Date	End Date	Statue
Analysis			
Gather Requirement	22/02/2016	25/02/2016	On Time
Set Project Goal	26/02/2016	29/02/2016	On Time
Select Target Platform	01/03/2016	04/03/2016	On Time
Design			
Design the software architecture	05/03/2016	08/03/2016	On Time
Design 3D model	10/03/2016	14/03/2016	Delayed
Design Graphics	15/03/2016	21/03/2016	Delayed
Development			
Installing Development Tools	22/03/2016	28/03/2016	Delayed
Configuration of Project Tools	04/03/2016	11/04/2016	Delayed
Implementation			
Integrate the application	13/04/2016	20/04/2016	Delayed
Run the application	21/04/2016	27/04/2016	Delayed

5.6 Conclusion

The implementation phase is about describing the detailed about production of text, graphics and text. The configuration management are also explained in detailed on how to configure all the development tools that is required to build the augmented reality mobile application. Lastly, the implementation status is describe for all task that being done in the project.

As for the next chapter, the Animal Classification mobile application and responsive web are ready to be tested by the user which is student age 14 years old. Next, all of the activity in the testing phase will be explained as it is about to testing and detect any error in the mobile application. This phase also will collect data about the third objective in this project which is to test the effectiveness of augmented reality mobile application and responsive web compare to the old way of learning which is textbook.

CHAPTER VI

TESTING

6.1 Introduction

The final phase of this project development is testing. The purpose of this phase is to determine to what degree the task had effectively accomplished the objectives and ready to exchange the data to the intended interest group.

This project will be conducted in two ways, which is black box testing and user acceptance testing. Black box testing will test for the functionality of the mobile application, while user acceptance testing is about how target users feel about the application. This section clarifies how this testing procedure is arranged and executed. The outcome gathered from users is examined to see the testing expected result.

6.2 Test Plan

Before any testing is conducted, a proper planning need to be done to ensure that when the testing is conducted, it will be done smoothly to collect data. It will be used to verify and ensure that the mobile application achieved its objectives and other requirements.

6.2.1 Test organization

Test organization is needed to clarify the person or user who are involve in the testing phase of this project. The user that are typically involve in the testing are developer, project supervisor, evaluator and students. Table 6.1 shows the details of the test organization.

Table 6.1 The detail of the test organization

Criteria	Alpha Version	Beta Version
Profession	BITM second and third year	Secondary school student (Form 2)
Responsibility	Respondents are responsible to test all functionality of the mobile application and web including the interface design, content, interactivity and functionality of AR	Responsibility to testing mobile application. Responsibility to do activities Responsibility to answer questionnaire.
Age (years old)	20 and above	14
Gender	Male : 0 Female : 6 persons	Male : 5 persons Female : 17 persons
Total of respondents	6	22

6.2.2 Test Environment

Test environment is about planning on how to setup the location of the testing will be conducted. Besides, the testing will be needed to use several smartphones with Android operating system. Table 6.2 explained the details of the test environment for the testing phase for this project.

Table 6.2 Test environment

Testing	Alpha Version	Beta Version
Profession	BITM second and third year student	Secondary school student (Form 2)
Location	UTeM, Melaka	Sekolah Menengah Kebangsaan Tun Sardon, Rengit, Johor
Hardware	- Two smartphones with Android platform - Two laptop	
Others	- Flash card	

Testing activities are captured using a smartphones to capture all the activities and testing that have been carried out. Figure 6.1 displays the layout of classroom when conducting the testing.

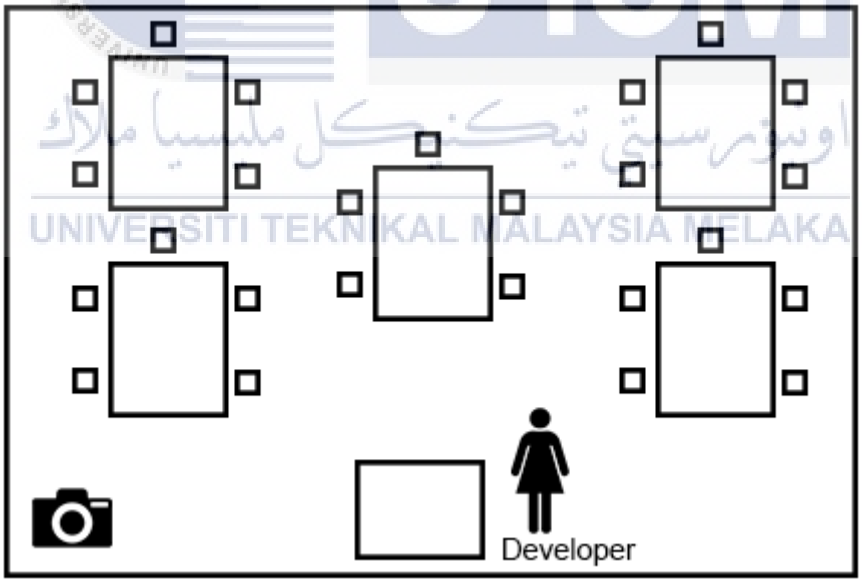


Figure 6.1. Layout of classroom

6.2.3 Test Schedule

Test schedule arrange the duration of the testing that is conducted. Table 6.3 shows the details of test schedule. A test script is provided as a guidelines to carry out the testing, please refer to Appendix F and Appendix H.

Table 6.3 Test Schedule

Testing	Alpha Version	Beta Version
Profession	Multimedia Developer	Secondary students
Total of participants	6	22
Date	2nd August 2016	4th August 2016
Number of participant per session	1	5 (4 or 5 student per section)
Total time spent (minutes)	10 minutes	90 minutes

6.3 Test Strategy

Test strategy is a rule to the testing plan where it is a technique that chose to do the test plan. In this project, the test strategy that chosen for this testing phase is black-box testing.

Black box testing is a testing method that examines the functionality of an application without looking its internal structures or workings. This method is attempts to find errors such as incorrect or missing features, interface errors, behavior or performance errors as well as initialization and termination errors. This testing will be carried out by following the testing form which is prepared to test specific functions of this mobile application. Although there have different types for black-box testing, functional testing and integration testing will be chosen for this project.

The product will be tested based on alpha version and beta version. Functional testing and integration testing will be carried out for alpha version while User Acceptance Testing (UAT) is prepared for beta version. A set of questionnaire will prepared for each testing. Tester need to answer the questions in the testing form by giving the rating as shown in the table below.

Table 6.4 Test rate indicate and description

Description	Rate of score
Strongly disagree	1
Disagree	2
Not sure	3
Agree	4
Strongly Agree	5

i. Alpha Version

Functionality testing is a testing process used within mobile application in which software is tested to ensure that it meets all the requirements. Functional testing is a way of checking software to ensure that it contain all the required functionality that is specified within its functional requirements.

The questionnaire that prepare for both designed based on for criteria which is visual clarity, navigation and interaction, content and functionality of AR. Refer the questionnaire in Appendix G and Appendix I.

ii. Beta Version

User Acceptance Testing consists of a process of verifying a solution works for target user. It is to ensure that the solution will work for the target user. The testing is carried out to test whether the target will accepts the solution that is provided.

User Acceptance Testing is carried out based on the test script and a set of User Acceptance Testing questionnaire to allow them to use the Animal Classification mobile application and answer the question provided. The questions are designed based on four principals which are visual clarity, navigation and interactivity, content and functionality of AR and content as well as effectiveness.

6.4 Test Design

Test design discussed the test description and test data for the testing phase. In this section, test description and test data will be focused on black box testing and User Acceptance Testing.

6.4.1 Test Description

Test description is a part where the case status description for alpha version was measured and expected result for the beta version.

i. Alpha Version

Table 6.5 show the aspect that are tested for functional testing respectively.

Table 6.5 List of question for functional testing

No	Module
PART A : VISUAL CLARITY	
1.	Application interface layout well organized.
2.	The text on the screen easier to read.
3.	Use appropriate colors and web applications
4.	Label the buttons are easy to understand clearly.
5.	The use of the icons on the buttons are easy to understand
PART B : NAVIGATION AND INTERACTIVITY	
1.	The interface is clear and concise navigation
2.	Interface “How To Use” is easy to understand.
3.	The use of the buttons quickly and smoothly.
4.	Exit interface is clear and easy to understand.
PART C : CONTENT AND INFORMATION	

1.	The information provided in the application is sufficient.
2.	The information provided in the application is clearly presented.
3.	Animation easy to understand.
4.	Animation provided interesting.
5.	The images used in the web interesting.
PART D : INTEGRATION AND USE OF AR	
1.	The use of AR in the application is interesting
2.	Content displayed clearly.
3.	The use of color on the AR does not interfere.
4.	The use of AR can draw attention to the model and content of the application.

ii. Beta Version

Table 6.6 shows the module and description of expected result for beta testing. For more detail of complete questionnaire of User Acceptance Testing, please refer to Appendix I.

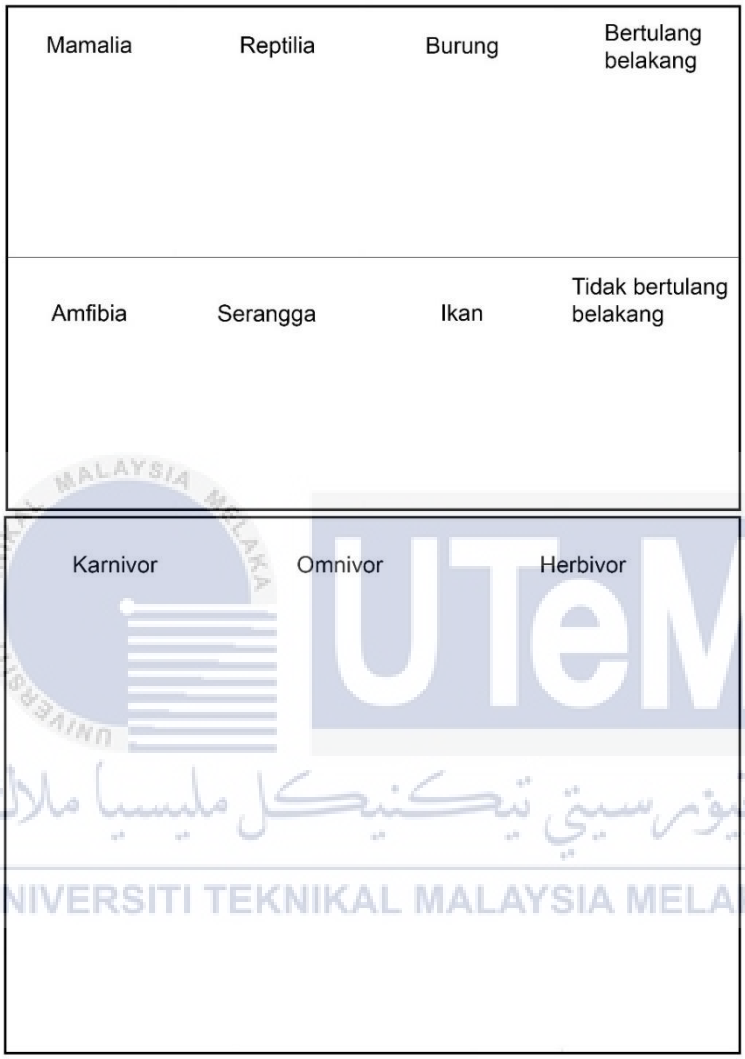
Table 6.6 List of question for User Acceptance Testing

No	Module
PART A : VISUAL CLARITY	
1.	The colors used is suitable
2.	Appropriate paper size and type
3.	Animal models provided interesting
4.	The images used interesting.
PART C : CONTENT AND INFORMATION	
1.	The information provided is easily understood.
2.	Information is clearly presented.
3.	Content provided to attract attention.
4.	Easy to get information.
5.	The information provided is easily understood.

PART D : EFFECTIVENESS PRE-TEST

**** Question will be given based on the post-test**

***Please choose the right answer based on the answer that will be given**



PART D : EFFECTIVENESS POST-TEST

1.	What is the classification of animals for sharks? A. Amphibians B. Reptiles C. Mammals D. Fish
2.	What is the classification of food for the frog? A. Carnivores B. Herbivore

	C. Omnivorous
3.	What animal species of mammals? A. Elephant B. Shark C. Frogs D. Bird
4.	What are the foods eaten by carnivores? A. Meat B. Plants C. Both
5.	What is the classification of food for the Elephants? A. Omnivorous B. Carnivores C. Herbivore
6.	What is the classification of animals for butterflies? A. Insects B. Mammals C. Reptiles D. Bird
7.	What is the classification of beetles? A. Vertebrates B. Invertebrates
8.	What are the animals that are Invertebrate? A. Cattle B. Snakes C. Worm D. Tapir
9.	What animal has the same classification of animals with snakes? A. Sea turtles B. Starfish C. Gold Fish D. Toad

6.4.2 Test Data

Test data is about collecting results from all testing that is carried out. The result of black box testing and User Acceptance Testing that are collected are attached in Appendix J.

6.5 Test Results and Analysis

This section will display the test result that were collected from the testing. From overall test result, the application developed has meets the intended user requirement. The result output were divided into mode, mean and median.

6.5.1 Test Results

i. Alpha Version

The result of functional testing from BITM second and third year students are shown in Table 6.7.

Table 6.7 Result of functional testing

No	Module	Median	Mode
PART A : VISUAL CLARITY			
1.	Application interface layout well organized.	5	5
2.	The text on the screen easier to read.	5	5
3.	Use appropriate colors and web applications	5	5
4.	Label the buttons are easy to understand clearly.	5	5
5.	The use of the icons on the buttons are easy to understand	5	5
PART B : NAVIGATION AND INTERACTIVITY			
1.	The interface is clear and concise navigation	5	5
2.	Interface “How To Use” is easy to understand.	5	5

3.	The use of the buttons quickly and smoothly.	4	4
4.	Exit interface is clear and easy to understand.	5	5
PART C : CONTENT AND INFORMATION			
1.	The information provided in the application is sufficient.	5	5
2.	The information provided in the application is clearly presented.	4.5	5
3.	Animation easy to understand.	5	5
4.	Animation provided interesting.	4	4
5.	The images used in the web interesting.	4	4
PART D : INTEGRATION AND USE OF AR			
1.	The use of AR in the application is interesting	5	5
2.	Content displayed clearly.	5	5
3.	The use of color on the AR does not interfere.	5	5
4.	The use of AR can draw attention to the model and content of the application.	5	5

ii. Beta Version.

There are two types of test results in beta testing. Table below shows the result of 22 testers which is Form 2 students.

Table 6.8 Result of User Acceptance Testing

Textbook		**Module**	**Application/Web**	
Median	**Mode**		**Median**	**Mode**
PART A : VISUAL CLARITY				
4	4	The colors used is suitable	5	5
4	3	Appropriate font size and type	5	5
3	4	Animal models provided interesting	4	4
4	4	The images used interesting.	4	4
PART C : CONTENT AND INFORMATION				

4	4	The information provided is easily understood.	5	5
4	4,5	Information is clearly presented.	5	5
5	5	Content provided to attract attention.	5	5
4	4	Easy to get information.	5	5

PART D : EFFECTIVENESS

		Answer correct	**Answer wrong**
Pre-Test			
1.	What is the classification of animals for sharks?	17	5
2.	What is the classification of food for the frog?	15	7
3.	What animal species of mammals?	19	3
4.	What are the foods eaten by carnivores?	19	3
5.	What is the classification of food for the Elephants?	18	4
6.	What is the classification of animals for butterflies?	22	0
7.	What is the classification of beetles?	15	7
8.	What are the animals that are Invertebrate?	18	4
9.	What animal has the same classification of animals with snakes?	12	10
Post-Test			
1.	What is the classification of animals for sharks?	22	0
2.	What is the classification of food for the frog?	22	0
3.	What animal species of mammals?	22	0
4.	What are the foods eaten by carnivores?	22	0
5.	What is the classification of food for the Elephants?	22	0
6.	What is the classification of animals for butterflies?	22	0
7.	What is the classification of beetles?	18	4
8.	What are the animals that are Invertebrate?	22	0
9.	What animal has the same classification of animals with snakes?	22	0

Table 6.9 Result of marks to the quiz for pre-test and post-test.

Student	Pre-test Mark		Post-test Mark	
	(9/9)	(%)	(9/9)	(%)
1	6	67	9	100
2	7	78	9	100
3	7	78	9	100
4	5	56	8	89
5	7	78	9	100
6	7	78	9	100
7	7	78	9	100
8	5	56	9	100
9	7	78	8	89
10	7	78	9	100
11	7	78	9	100
12	8	89	9	100
13	7	78	9	100
14	9	100	9	100
15	7	78	9	100
16	6	67	8	89
17	9	100	9	100
18	7	78	9	100
19	7	78	8	89
20	8	89	9	100
21	7	78	9	100
22	7	78	9	100

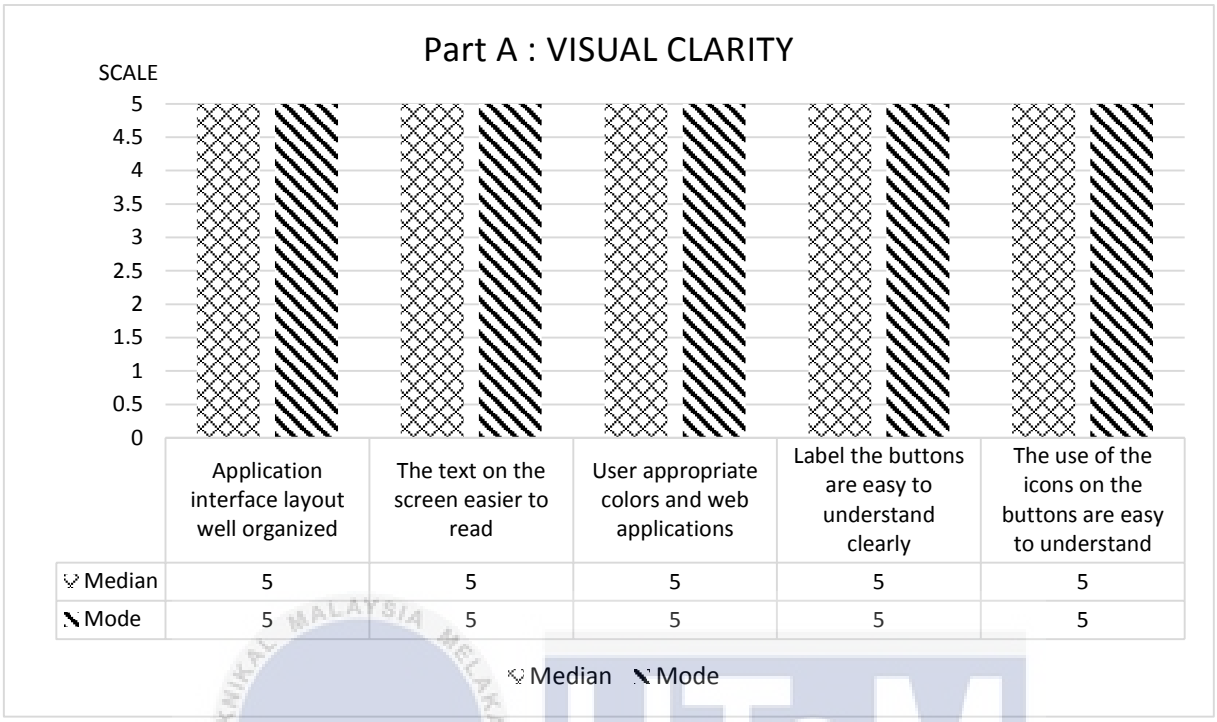
6.5.2 Analysis Results

This section is to analyze the results that collected and summarized in the testing. The data will be charted into bar chart and evaluated according to its results.

i. Results for Alpha Version

There are two sections of testing are analyzed in Alpha version which is functional testing to show the information gathered from the testers. After analyze the result collected, a summary of the result for alpha version is concluded.

A. Results of Functional Testing



	Application interface layout well organized	The text on the screen easier to read	User appropriate colors and web applications	Label the buttons are easy to understand clearly	The use of the icons on the buttons are easy to understand
Median	5	5	5	5	5
Mode	5	5	5	5	5

Figure 6.2. Statistic of visual clarity for functional testing

Figure 6.2 shows the result of questionnaire for visual clarity. The graph shows that the student agree with all aspect of the visual clarity. All aspect have reached 5 which is it is the highest range. Thus, it can be proven that the visual clarity of Animal Classification mobile application and Responsive web is acceptable by them.

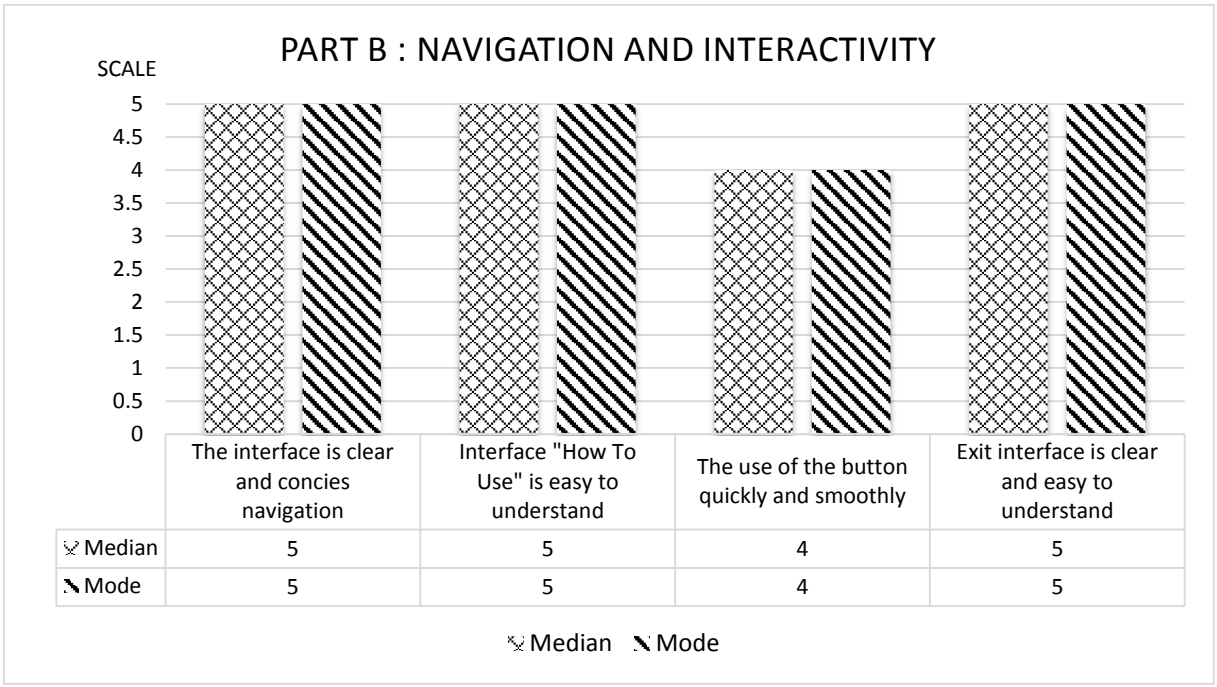


Figure 6.3. Statistic of navigation and interactivity for functional testing

Figure 6.3 shows that the result for navigation and interactivity. This questionnaire is related to the time taken by application to respond when navigating and controlling the menu. From the graph, it shows that all of the aspect reached highest rate except for the use of button quickly and smoothly achieve 4.

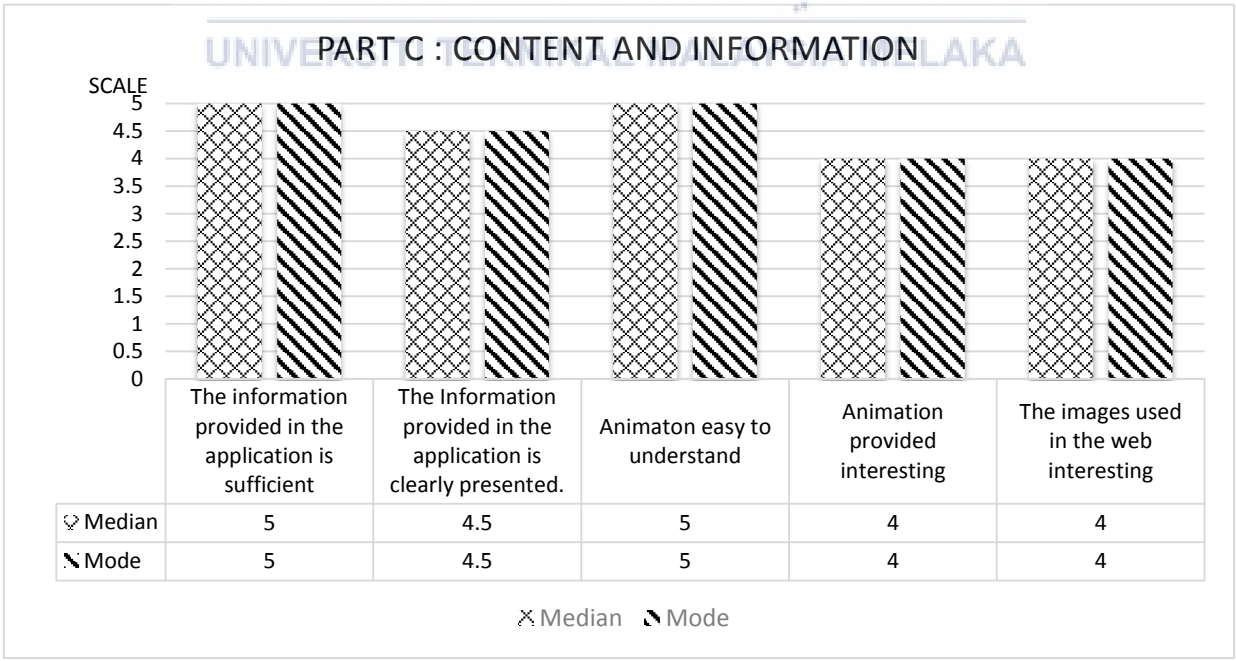


Figure 6.4. Statistic of content of Animal Classification for functional testing

Figure 6.4. Shows the content of the Animal Classification mobile application and Responsive Web which is 3D model, classification and information in both platform. This graph will determine whether the information provided is useful for user. All aspect are achieved 4 and above proving that the information is enough for user to learn and interact.

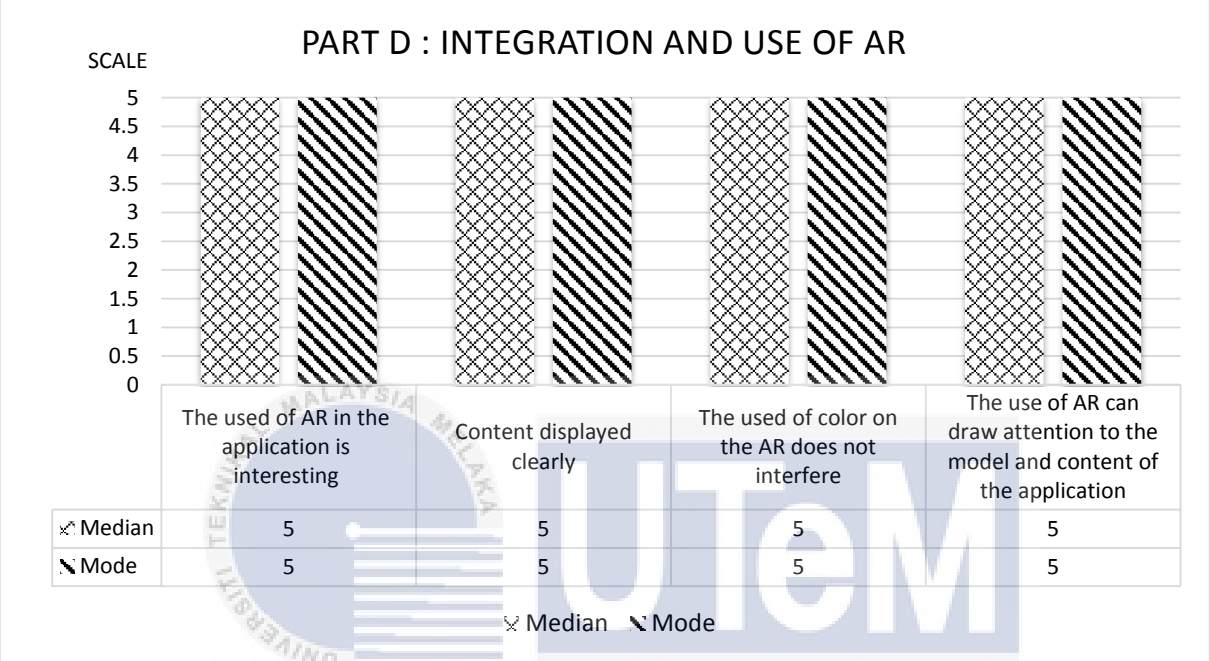


Figure 6.5. Statistic of use of AR for functional testing

Figure 6.5, demonstrate the result of functionality of AR. The criteria are evaluated by Multimedia developer. The range of the aspect are all achieved the highest rate which is 5.

B. Summary of Testing for Alpha Version

From the result, four aspect which is visual clarity, navigation and interactivity, functionality of AR and its content are all achieved 4 and above which can conclude that the developer are agree and happy with the functionality provided in Animal Classification mobile application and also Responsive Web.

ii. Results of Beta Version

User Acceptance Testing is used in Beta version. The result of the testing will be presented in bar graph. After the result is analyses, a summary will be concluded in detail.

A. Results of User Acceptance Testing

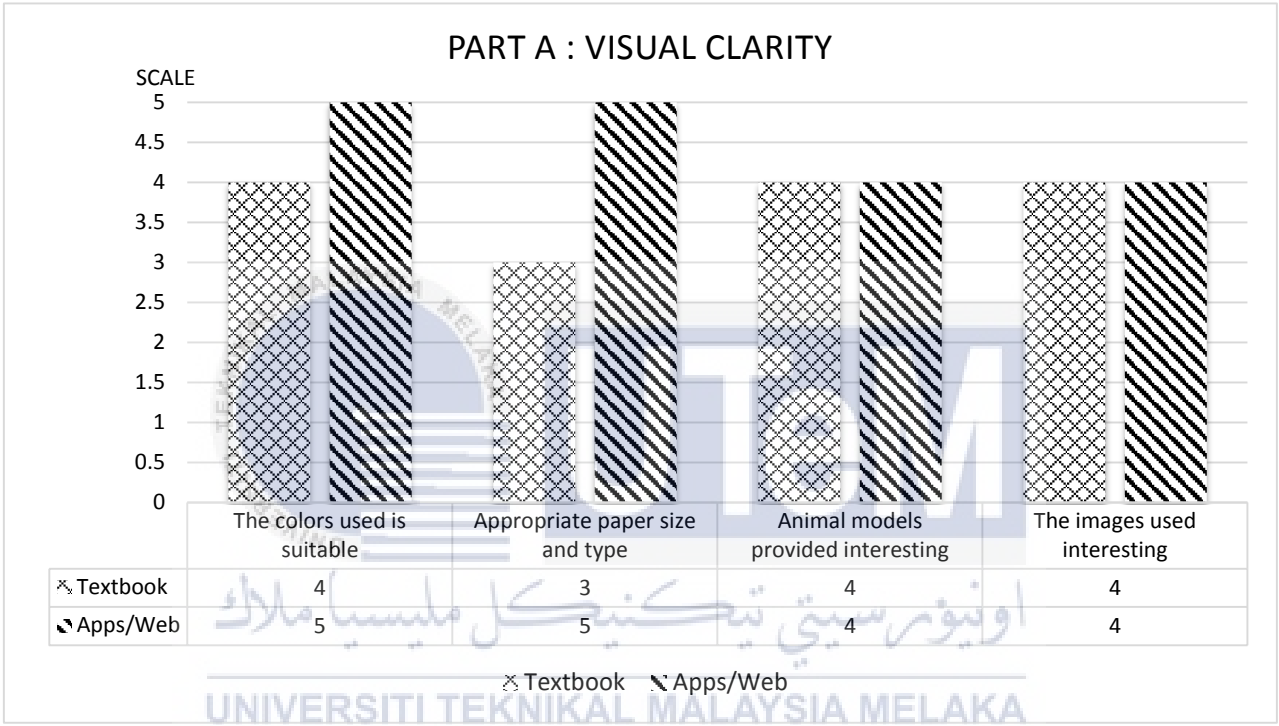


Figure 6.6. Statistic of Visual Clarity for UAT

Figure 6.6. Shows the result for question for visual clarity for textbook and application. From the graph, it is clearly shows that all student agree with the aspect that are provided in the question as all the aspect achieved 4 and above. From the result above, it can be concluded that the students can get to use to Animal Classification mobile application and Web Responsive.

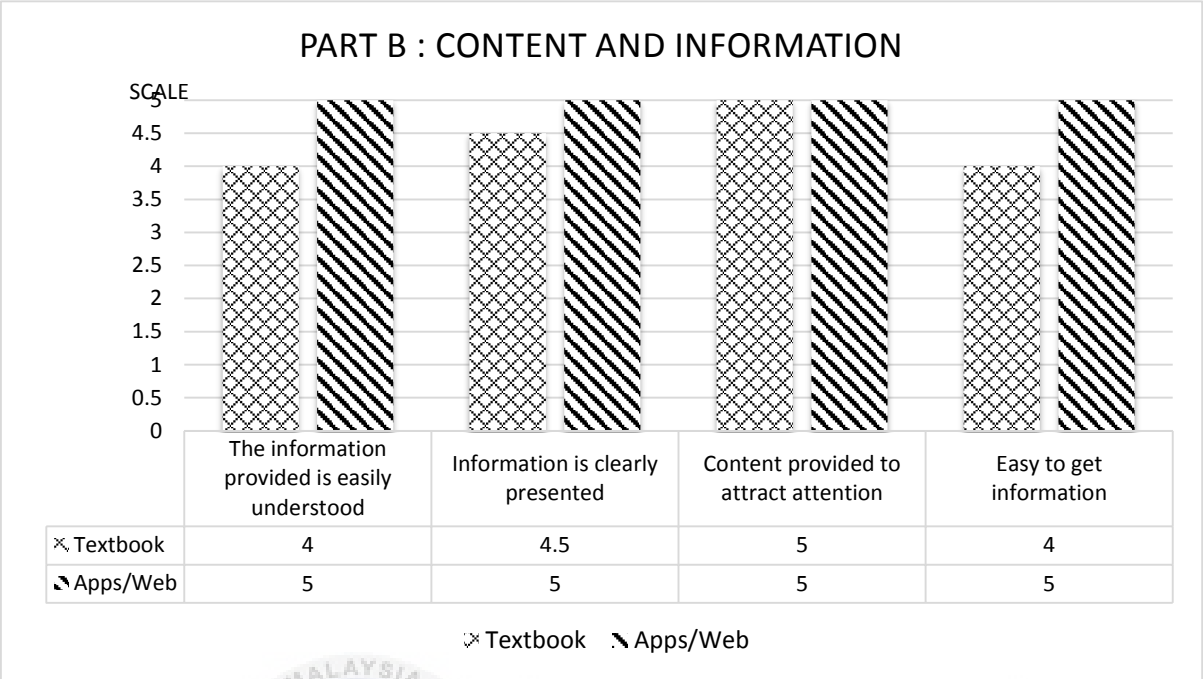


Figure 6.7. Statistic of functionality of AR and content for UAT

Figure 6.8. Explained the principle of functionality of AR and its content that are provided in the mobile application and Responsive Web. All aspect are achieved highest rate which is 5. From the result, it can conclude that the students are agree with the functionality and the content in AR. From result also, it can also be conclude that all the student can understand the information provided in the mobile application and Responsive Web.

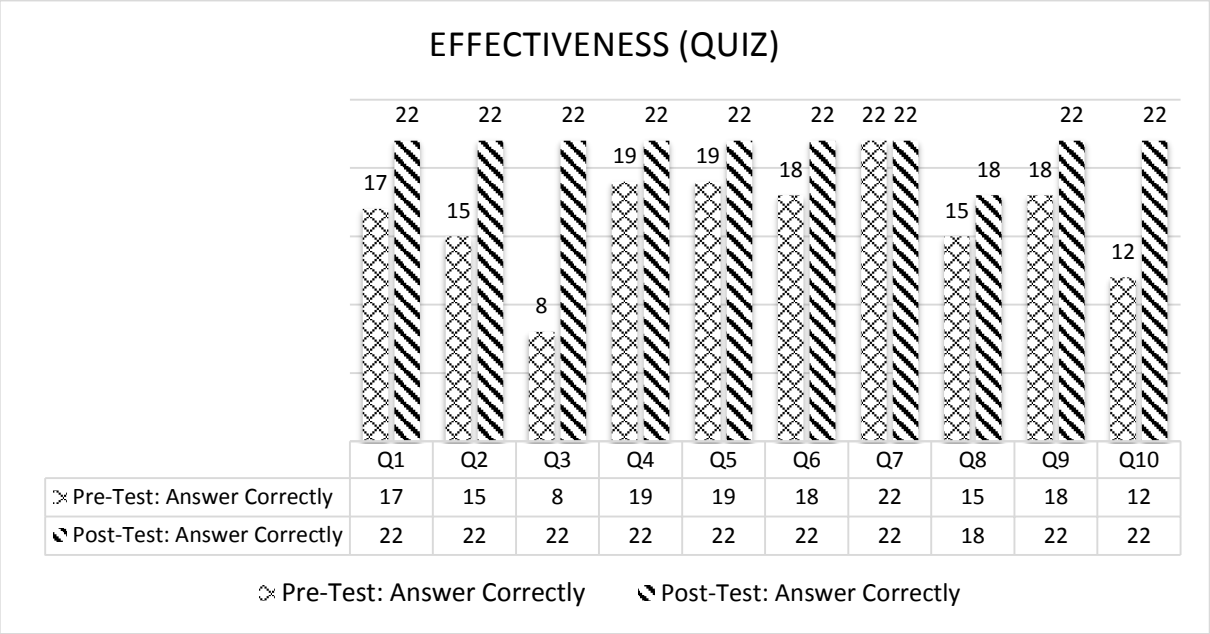
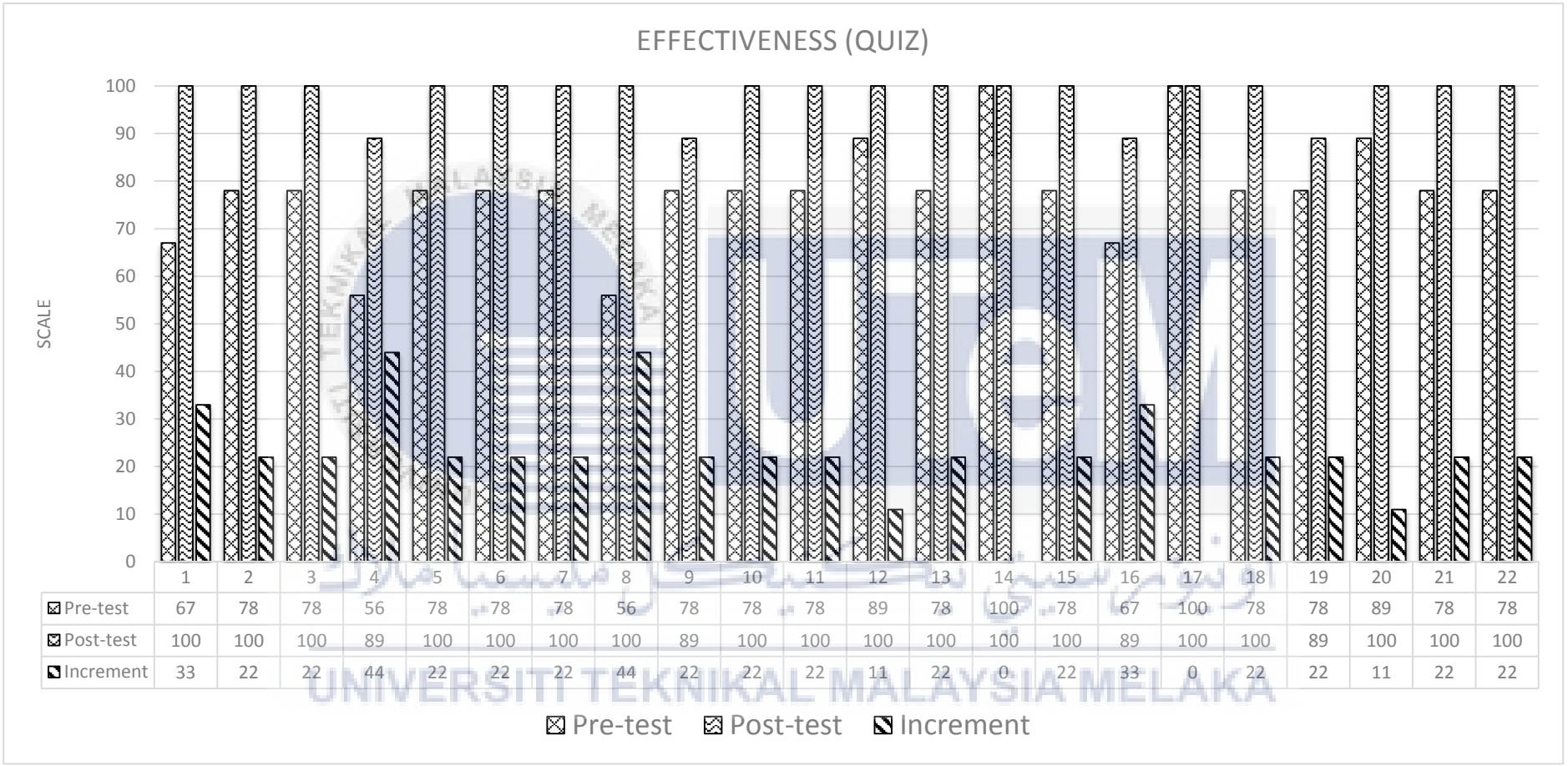


Figure 6.8 Statistic of effectiveness for UAT

Delivering knowledge to students needs to have effectiveness as it is important to determine whether the product created is useful for the user or not. There are ten question prepared for students and the result collected are demonstrate in Figure 6.9 .From the results, it is clearly shows the difference of in number in using old ways of learning and use Animal Classification mobile application.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Pre-test	67	78	78	56	78	78	78	56	78	78	78	89	78	100	78	67	100	78	78	89	78	78
Post-test	100	100	100	89	100	100	100	100	89	100	100	100	100	100	100	89	100	100	89	100	100	100
Increment	33	22	22	44	22	22	22	44	22	22	22	11	22	0	22	33	0	22	22	11	22	22

Figure 6.9 Statistic of marks to the quiz for pre-test and post-test.

Figure 6.9 explained about the marks that the students get. There is a difference as for increment between pre-test and post-test. This can be proven that the application and web are helping students in learning about Animal Classification.

B. Summary of Testing Result for Beta Version

From the principals which visual clarity, navigation and interactivity, functionality of AR and its content including the effectiveness of the mobile application and responsive web, it is clearly shows that this product is suitable and able to deliver knowledge to the user. As the summary, the objective which is mentioned in Chapter 1 is achieved.

6.6 Conclusion

As a conclusion, the testing process that has been carried out smoothly and successfully at Sekolah Menengah Kebangsaan Tun Sardon, Rengit, Johor. From the data collected, it shows that the product is able to work with AR for target users and it is able to deliver the knowledge for the students. Besides, the content that are delivered to them is easy to understand and attractive.

But, the use of AR in Malaysia is still minimum and the awareness of AR in Malaysia is low. Next, the strengths and weakness, improvements of the product will be discussed in detail in the next chapter.

CHAPTER VII

PROJECT CONCLUSION

7.1 Observation on Strengths and Weakness

Animal Classification is a mobile application build for Android user and developed using Vuforia SDK. For this Animal Classification mobile application, there are a few strengths and weakness that need to be explained.

7.1.1 Strengths

The strengths of this mobile application are listed as following.

i. Easy to use to get information.
   This mobile application provides a simple interaction such as animation to attract them in using the mobile application and easily get all information about animal.

ii. The information provided is easily understood and clearly presented.
   This mobile application gives information in an easy form so that user can understand the information easily.

iii. It is easy to use as children are aware the use of mobile.
   This mobile application is easy to use as it do not contain any complicated menu for user and the user can easily understand and easily use the application.

7.1.2. Weakness

There are several weakness in this Animal Classification mobile application and Responsive Web. The weakness is:

i. 3D model do not have any movement

Different from previous system, this mobile application do not provide any animation as there are some problem with the texture of the animal when importing in Unity 3D.

ii. Estimated time for button to respond is not smoothly

The provided button which is used to get into AR scene is not smooth and it do not have any loading sign to inform user.

iii. 3D model overlapped

Animal classification mobile application have problem when scanning a few image target as when user scan the image, there will be other 3D model overlapping each other.

iv. Image target cannot be scan at a same time

This is because when user try to scan all image at once, the button provided on the image target will not come out.

7.2. Proposition for improvement and future work

By the strengths and weakness listed above, there have to be some improvements need to be done to improving Animal Classification mobile application.

Firstly, the texture of the animal need to be improve as the 3D model used in this mobile application only use solid color as a texture. Besides, developer also can add some movements to the animal to make the models look real.

The developer also can make the animal interact with each other to make the mobile application looks more interesting. As for the responsive web, the developer need to finds domain to publish the websites for user to use the web as platform to learn about animals.

The developer need to overcome the problem in animal overlapping each other and the buttons when user scanning image target at once so that this mobile application can be used by everyone

Lastly, for future work, the developer can make interactivity between flash cards so that it can be more interactive. Besides, the developer also can add sound to make it more interesting and add animation to the animal to attract user. Find domain to publish the responsive web for Animal Classification

7.3. Contribution

This project will be beneficial for student age 14 years old who want to get more knowledge about animal. They can look at the animal in a easiest way which is the mobile application and responsive web. They also be able to understand all the information provided either in mobile application and responsive web. This mobile application can substitute textbook as student will have more attention to this mobile application compare looking at the textbook.

By developing this mobile application, it creates a medium to deliver knowledge to the students without having any problems. This application is developed based on early analysis in secondary school. All related information that have been gathered become guides for developer to develop this mobile application and responsive web.

7.4. Conclusion

The idea of the Animal Classification have becomes real in a few month, based on the result of the testing shows that students can easily get knowledge about animal by using this Animal Classification mobile application and responsive web. It can be concluded that all objective stated in Chapter one have been achieved although there might be some improvement need to improve the quality of this project.

REFERENCES

Trowbridge, John E., and Joel J. Mintzes. "Students' Alternative Conceptions of Animals and Animal Classification." School Science and Mathematics 85.4 (1985): 304-16.

Yen, Chiung-Fen, Tsung-Wei Yao, and Yu-Chih Chiu. "Alternative Conceptions in Animal Classification Focusing on Amphibians and Reptiles: A Cross-Age Study." Int J Sci Math

Educ International Journal of Science and Mathematics Education 2.2 (2004): 159-74.

" Billinghurst, Mark, "Augmented Reality in Education", December 2002.
"ERIC - Turkish High School Students' Ideas about Invertebrates: General Characteristics and Classification, International Journal of Environmental and Science Education, 2013."

APPENDICES

APPENDIX A **PROJECT GANTT CHART**

APPENDIX B **SAMPLE QUESTIONNAIRE**

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APPENDIX D **MOBILE APPLICATION AND OUTPUT DESIGN**

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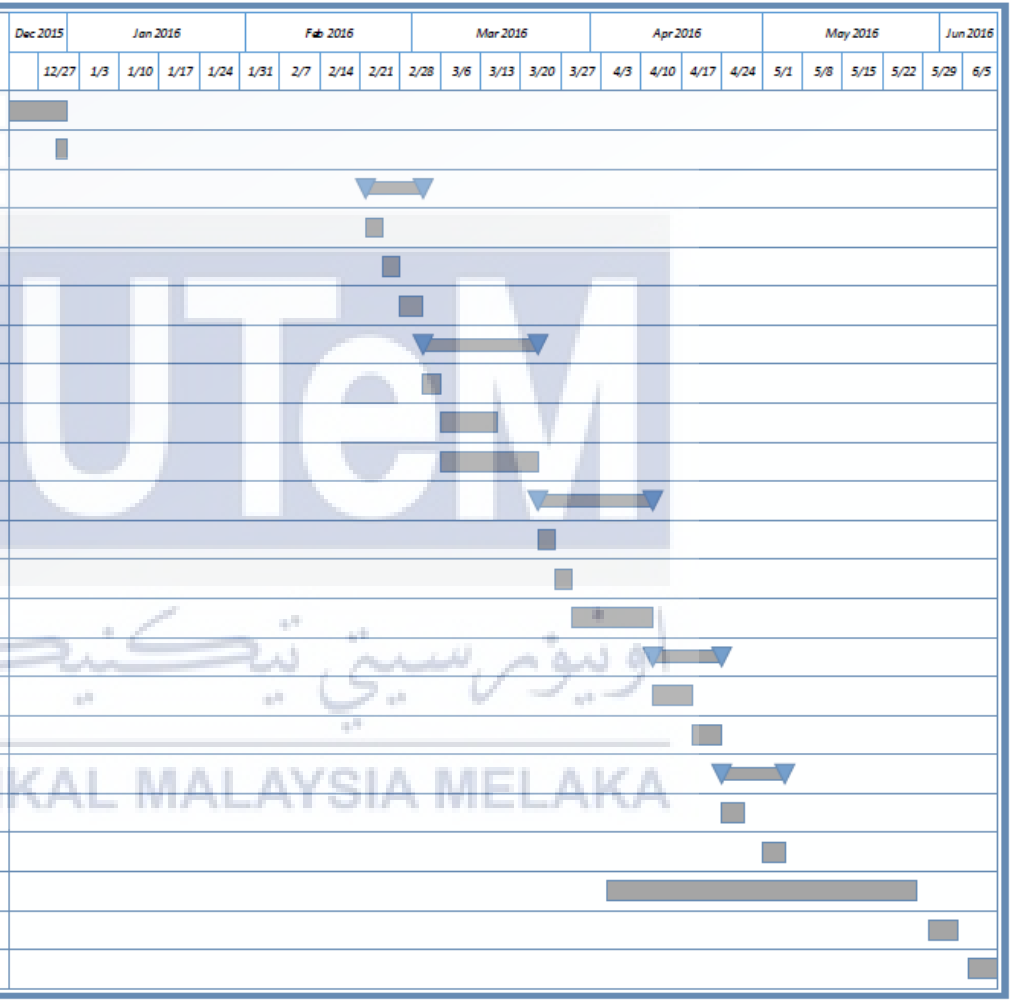
APPENDIX A

PROJECT GANTT CHART

No	Activity	Start	Finish	Duration
1	Proposal Submission	12/22/2015	12/31/2015	10d
2	Proposal correction	12/30/2015	12/31/2015	2d
3	Anaysis	2/22/2016	3/2/2016	10d
4	Gathering requirements	2/22/2016	2/24/2016	3d
5	Analyze project objective	2/25/2016	2/27/2016	3d
6	Select target platform	2/28/2016	3/2/2016	4d
7	Design	3/3/2016	3/22/2016	20d
8	Design project architecture	3/3/2016	3/5/2016	3d
9	Design project content	3/6/2016	3/15/2016	10d
10	Design graphics	3/6/2016	3/22/2016	17d
11	Development	3/23/2016	4/11/2016	20d
12	Android SDK development tools installation	3/23/2016	3/25/2016	3d
13	Unity 3D installation	3/26/2016	3/28/2016	3d
14	Configuration of project tools	3/29/2016	4/11/2016	14d
15	Implementation	4/12/2016	4/23/2016	12d
16	Implement project content with application	4/12/2016	4/18/2016	7d
17	Run application	4/19/2016	4/23/2016	5d
18	Evaluation & testing	4/24/2016	5/4/2016	11d
19	Test the application	4/24/2016	4/27/2016	4d
20	Refine the application	5/1/2016	5/4/2016	4d
21	Project demo & PSM report	4/4/2016	5/27/2016	54d
22	Final presentation	5/30/2016	6/3/2016	5d
23	Project submission	6/6/2016	6/10/2016	5d



APPENDIX B

SAMPLE QUESTIONNAIRE

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

AUGMENTED REALITY FOR ANIMAL CLASSIFICATION IN MOBILE APPLICATION

BORANG SOAL SELIDIK

Borang kaji selidik ini dijalankan bertujuan untuk mengenalpasti tahap pengetahuan pelajar tentang pengkelasan haiwan. Diharapkan respondan dapat memberikan kerjasama dengan menjawab semua soalan yang dikemukakan agar kajian ini dapat dihasilkan dengan sebaiknya.

Adalah dimaklumkan juga bahawa maklumat yang diperoleh adalah SULIT dan hanya digunakan sebagai data ilmiah sahaja. Kesudian anda untuk memberi kerjasama dalam menjawab soal selidik ini didahului dengan ucapan terima kasih.

NUR ATHIRAH BINTI AZMI
Pelajar tahun akhir
Fakulti Teknologi Maklumat dan Komunikasi
Universiti Teknikal Malaysia Melaka (UTeM)

BAHAGIAN A

1. Jantina

- [x] Lelaki
- [ ] Perempuan

2. Kaum

- [x] Melayu
- [ ] Cina
- [ ] India
- [ ] Lain - lain

BAHAGIAN B

4. Adakah anda mempunyai telefon pintar?

- [x] Ya
- [ ] Tidak

5. Berapa lamakah anda menghabiskan masa bersama telefon pintar anda?

- [ ] 10 - 20 minit
- [ ] 20 - 30 minit
- [ ] 30 - 60 minit
- [x] lebih dari 1 jam

6. Anda menghabiskan masa menggunakan telefon pintar anda untuk :

- [ ] Belajar
- [ ] Bermain permainan aplikasi
- [x] Media Sosial
- [ ] Lain - lain

7. Adakah anda tahu apa itu Augmented Reality (AR)?

- [ ] Ya
- [x] Tidak

8. Jika ya, adakah anda pernah menggunakan aplikasi AR dalam telefon pintar anda?

- [ ] Ya
- [x] Tidak

BAHAGIAN C

9. Adakah anda tahu apa itu pengkelasan haiwan?

- [x] Ya
- [ ] Tidak

10. Jika ya, anda belajar mengenai pengkelasan haiwan melalui :

- [x] Sekolah
- [ ] Internet/Web
- [ ] IbuBapa
- [ ] Lain - lain

11. Adakah anda pernah menggunakan aplikasi tentang pengkelasan

- [ ] Ya
- [x] Tidak

12. Apakah pengkelasan haiwan bagi seekor lembu?

- [ ] Reptilia
- [x] Mamalia
- [ ] Amfibia
- [ ] Burung
- [ ] Ikan

13. Apakah ciri - ciri pengkelasan bagi Reptilia?

- [x] Mempunyai kulit bersisik dan kering
- [ ] Mempunyai kulit yang lembap
- [ ] Dilitupi kulit bersisik berlendir
- [ ] Badan dilitupi dengan rambut atau bulu

BAHAGIAN D

14. Anda dapat mengelaskan haiwan dengan tepat.

	1	2	3	4	5	
Tidak Setuju	○	○	✓	○	○	Sangat Setuju

15. Anda suka belajar mengenai pengkelasan haiwan menggunakan buku.

	1	2	3	4	5	
Tidak Setuju	○	✓	○	○	○	Sangat Setuju

16. Alternatif lain untuk belajar mengenai pengkelasan haiwan perlu dibangunkan.

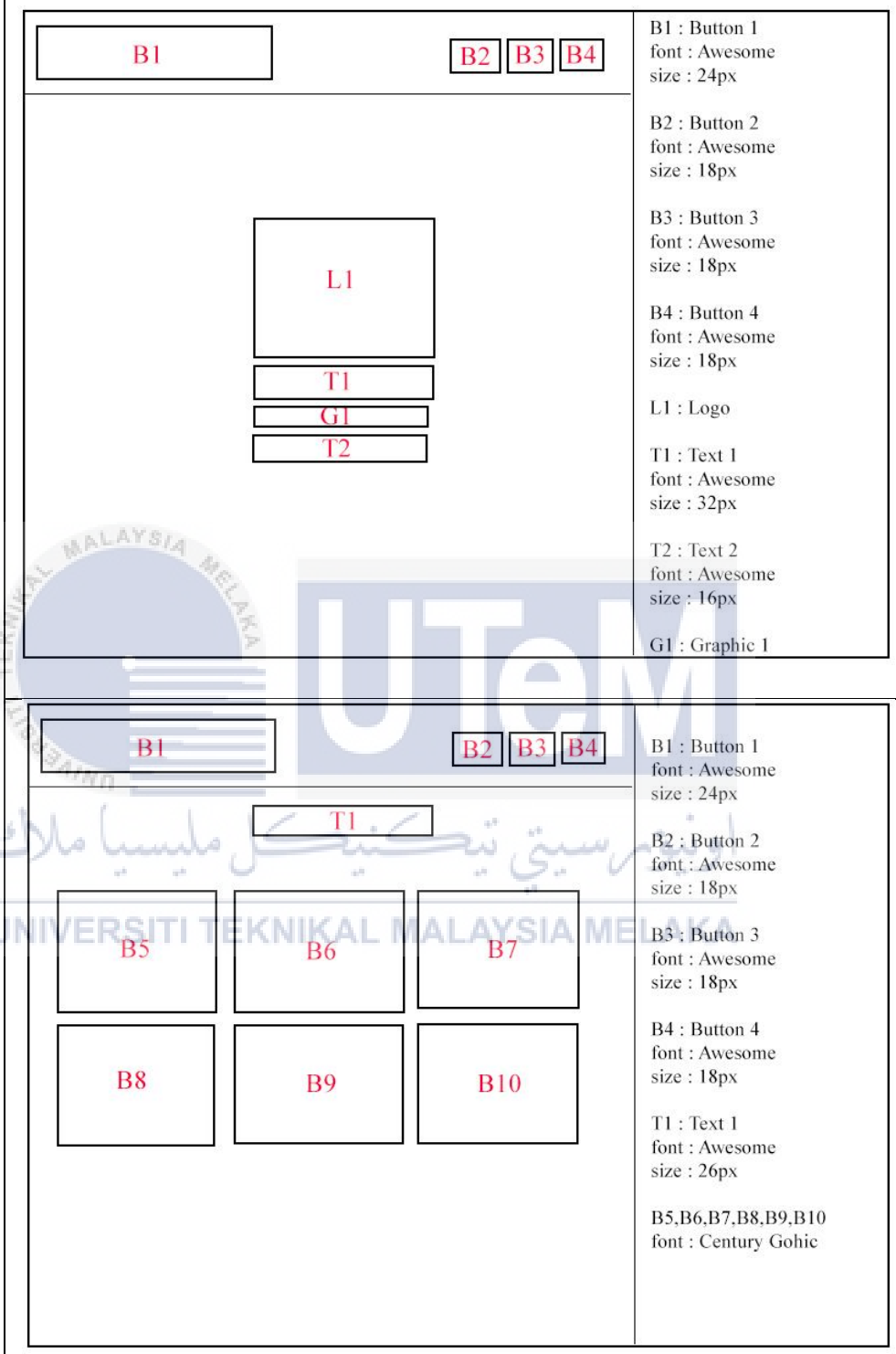
	1	2	3	4	5	
Tidak Setuju	○	○	✓	○	○	Sangat Setuju

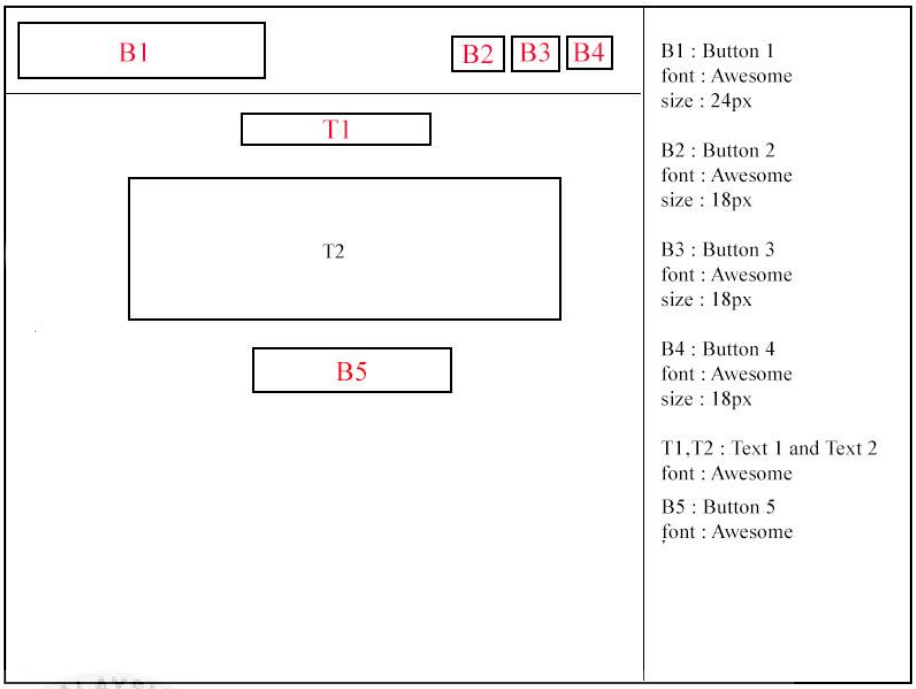
17. Aplikasi AR dapat membantu anda belajar tentang pengkelasan haiwan.

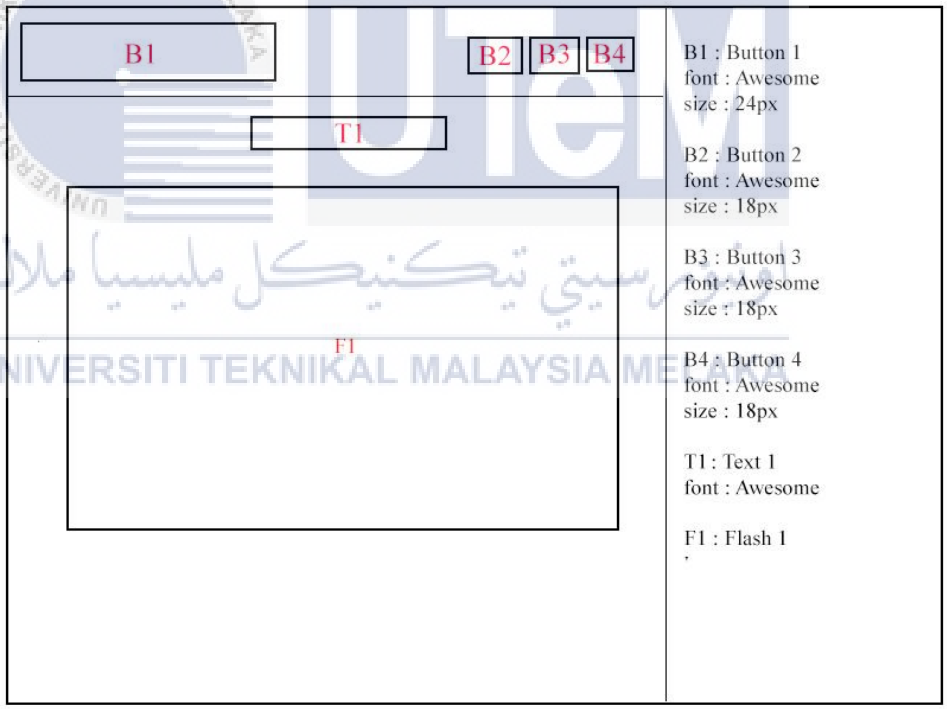
	1	2	3	4	5	
Tidak Setuju	○	✓	○	○	○	Sangat Setuju

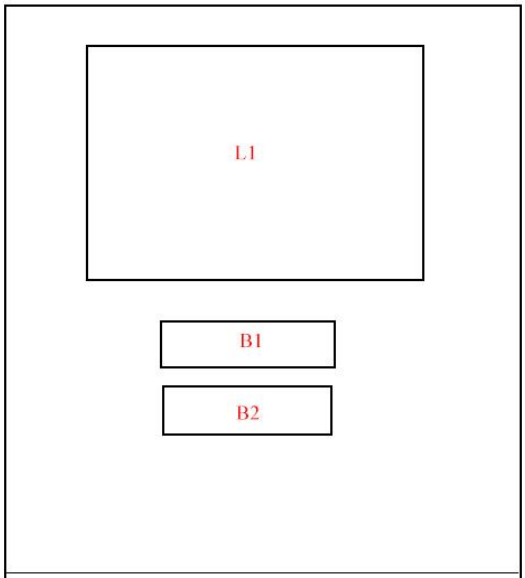
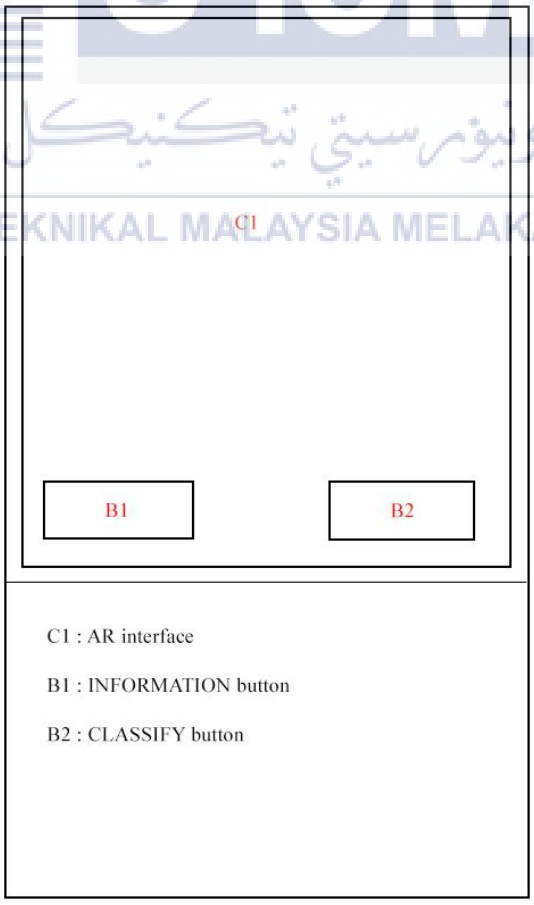
APPENDIX C

STODYBOARD DESIGN

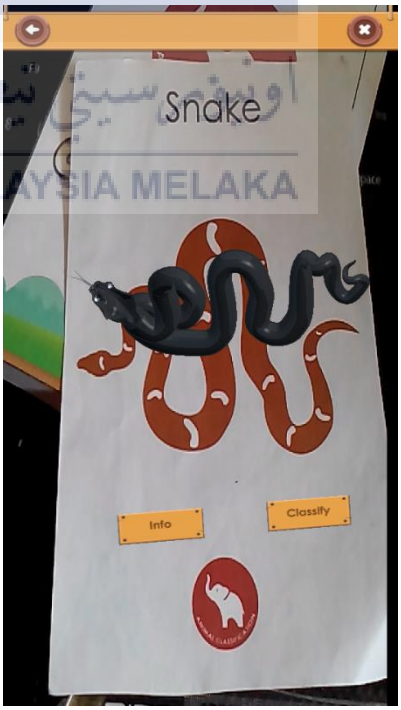
Interface	Storyboard design
Responsive Web	





Mobile Application	 LI : Logo B1 : START button B2 : HOW TO USE button  C1 : AR interface B1 : INFORMATION button B2 : CLASSIFY button

APPENDIX D
MOBILE APPLICATION OUTPUT DESIGN



APPENDIX E
RESPONSIVE WEB INPUT AND OUTPUT DESIGN

Input Design	Output Design
	

APPENDIX F
TEST SCRIPT

TEST SCRIPT ALPHA TESTING.

Details :

1. 6 tester for testing.
2. Time taken to finish testing around 1 hour.

Instruction :

1. Give introduction to students about the project.
2. Let user use the mobile application to navigate.
3. Pass functional testing paper to let them fill the answer.
4. Testing is finish.

APPENDIX G

QUESTIONNAIRE ALPHA TESTING

TITLE : **AUGMENTED REALITY FOR ANIMAL CLASSIFICATION IN MOBILE APPLICATION FOR FORM 2 STUDENT** **BLACK-BOX**

Please circle (O) on the basis of your observations on the application developed.

Strongly Disagree	**Disagree**	**Not Sure**	**Agree**	**Strongly Agree**
1	**2**	**3**	**4**	**5**

SECTION A : FUNCTIONAL TESTING

No	**Module**	**Scale**				
PART A : VISUAL CLARITY						
1.	Application interface layout well organized.	1	2	3	4	5
2.	The text on the screen easier to read.	1	2	3	4	5
3.	Use appropriate colors and web applications	1	2	3	4	5
4.	Label the buttons are easy to understand clearly.	1	2	3	4	5

5.	The use of the icons on the buttons are easy to understand	1	2	3	4	5
PART B : NAVIGATION AND INTERACTIVITY						
1.	The interface is clear and concise navigation	1	2	3	4	5
2.	Interface “How To Use” is easy to understand.	1	2	3	4	5
3.	The use of the buttons quickly and smoothly.	1	2	3	4	5
4.	Exit interface is clear and easy to understand.	1	2	3	4	5
PART C : CONTENT AND INFORMATION						
1.	The information provided in the application is sufficient.	1	2	3	4	5
2.	The information provided in the application is clearly presented.	1	2	3	4	5
3.	Animation easy to understand.	1	2	3	4	5
4.	Animation provided interesting.	1	2	3	4	5
5.	The images used in the web interesting.	1	2	3	4	5
PART D : INTERGRATION AND USE AR						
1.	The use of AR in the application is interesting	1	2	3	4	5
2.	Content displayed clearly.	1	2	3	4	5
3.	The use of color on the AR does not interfere.	1	2	3	4	5
4.	The use of AR can draw attention to the model and content of the application.	1	2	3	4	5

APPENDIX H
TEST SCRIPT

TEST SCRIPT BETA TESTING.

Details :

1. 22 tester for testing.
2. Pre testing : All student will make activity given.
3. Post testing : 4 and 5 tester per section, divided into 5 group.
4. Time taken for pre testing is 20 minutes.
5. Time taken for second testing is 10 minutes per cycle.
6. Time taken to finish testing around 1 hour and half.

Instruction :

1. Give introduction to students about the project.
2. Read textbook (Chapter 2)
3. Pass the first activity sheet.
4. Check answer and collect answer sheet.
5. Pass second activity sheet.
6. Check answer and collect answer sheet.
7. Briefing about what student should do for the second testing.
8. Let student use the mobile application to navigate.
9. Pass question paper and let them answer. [Questionnaire 2].
10. Pass UAT paper to let them fill the answer.
11. Testing is finish.

APPENDIX I
QUESTIONNAIRE BETA TESTING

TITLE :
AUGMENTED REALITY FOR ANIMAL CLASSIFICATION IN MOBILE APPLICATION FOR FORM 2 STUDENT

PART A : USER ACCEPTANCE TESTING

Please circle (O) on the basis of your observations on the application developed.

Strongly Disagree	**Disagree**	**Not Sure**	**Agree**	**Strongly Agree**
1	**2**	**3**	**4**	**5**

Buku Teks						**Aplikasi/Web**				
VISUAL CLARITY										
1	2	3	4	5	The colors used is suitable	1	2	3	4	5
1	2	3	4	5	Appropriate paper size and type	1	2	3	4	5
1	2	3	4	5	Animal models provided interesting	1	2	3	4	5
1	2	3	4	5	The images used interesting.	1	2	3	4	5
CONTENT AND INFORMATION										
1	2	3	4	5	The information provided is easily understood.	1	2	3	4	5
1	2	3	4	5	Information is clearly presented.	1	2	3	4	5
1	2	3	4	5	Content provided to attract attention.	1	2	3	4	5
1	2	3	4	5	Easy to get information.	1	2	3	4	5

PART D : EFFECTIVENESS (QUIZ) PRE-TEST
**** Question will be given based on the post-test**
***Please choose the right answer based on the answer that will be given**

Mamalia	Reptilia	Burung	Bertulang belakang
Amfibia	Serangga	Ikan	Tidak bertulang belakang

Karnivor	Omnivor	Herbivor

EFFECTIVENESS (QUIZ) POST TEST	
1.	What is the classification of animals for sharks? A. Amphibians B. Reptiles C. Mammals D. Fish
2.	What is the classification of food for the frog? A. Carnivores B. Herbivore C. Omnivorous
3.	What animal species of mammals?

	A. Elephant B. Shark C. Frogs D. Bird
4.	What are the foods eaten by carnivores? A. Meat B. Plants C. Both
5.	What is the classification of food for the Elephants? A. Omnivorous B. Carnivores C. Herbivore
6.	What is the classification of animals for butterflies? A. Insects B. Mammals C. Reptiles D. Bird
7.	What is the classification of beetles? A. Vertebrates B. Invertebrates
8.	What are the animals that are Invertebrate? A. Cattle B. Snakes C. Worm D. Tapir
9.	What animal has the same classification of animals with snakes? A. Sea turtles B. Starfish C. Gold Fish D. Toad