PICTURE DICTIONARY INSIDE HOUSE WITH AUGEMENTED REALITY

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BACHELOR OF INFORMATION TECHNOLOGY (INFORMATICS MEDIA) WITH HONOURS
UNIVERSITI SULTAN ZAINAL ABIDIN

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DECEMBER 2018
DECLARATION

I hereby declare that this report is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Sultan Zainal Abidin or other institutions.

________________________________
Name : Muhammad Nur Athari bin Shafiee

Date   : 23rd December 2018
CONFIRMATION

This is to confirm that:

The research conducted and the writing of this report was under my supervision.

________________________________
Name : Dr Ismahafezi bin Ismail

Tarikh : 23rd December 2018
DEDICATION

In the Name of Allah, the Most Gracious and the Most Merciful.

Alhamdulillah, I thank God for His grace and grace, I can prepare and complete this report successfully.

First of all, I would like to thank my supervisor, Dr Ismahafezi bin Ismail because with guidance, the advice and the thoughtful ideas given me the opportunity to prepare this report successfully.

In addition, my gratitude is also to my colleagues who share ideas, opinions, knowledge and reminders. They helped me answer every question that was important to me in completing this report.

Thanks also to my beloved mother and father always encouraged me and motivated me to prepare for this report.

I would like to take the opportunity to thank all lecturers of the Informatics and Computing Faculty for their attention, guidance, and advice in helping and sharing ideas and opinions in making this report successful.

May Allah SWT bless to all the efforts that have been given in completing this report.

Thank you.
ABSTRACT

The Picture Dictionary Inside House with Augmented Reality was developed to student primary school to manage learning more efficiently. Existing learning methods more efficiently. Existing learning methods are changed by AR technologies and using smartphones. This app may be able to help student to learn the type of objects more interactive and engaging. Additionally, this app uses interactive 3-dimensional objects, sound and display info so that students are interested in using this application. The ADDIE method is divided into five main sections, namely the beginning of the analysis phases, design phases, development phases, implementation phases and evaluation phases. The use of the ADDIE method ensures that the development of the system runs smoothly and according to planning.
ABSTRAK

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<td>Argumented Reality</td>
</tr>
<tr>
<td>3D</td>
<td>Three dimensional</td>
</tr>
<tr>
<td>FYP</td>
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CHAPTER I

INTRODUCTION

1.1 Introduction

This section is the introduction to the report for developed system. It will provide a basic overview of the whole system. This chapter presents about the project background, problem statement objectives, scope and project planning. Background of the system discuss about basic information about this system. Problem statements discuss about related issues of the system. Objectives state all main goal of this system. The scope shows who are using the system and what the user can do.

1.2 Background

Augmented Reality (AR) is a type of interactive, reality based display environment that takes the capabilities of computer generated display, sound, text and effects to enhance the user’s real-world experience. Augmented reality combines real and computer-based scenes and images to deliver a unified but enhanced view of the world. Augmented reality has many different implementation models and applications, but its primary objective is to provide a rich audiovisual experience. AR
works by employing computerized simulation and techniques such as image and
speech recognition, animation, head-mounted and hand-held devices and powered
display environments to add a virtual display on top of real images and surroundings.

The picture dictionary is a book containing illustrative objects with words to help develop a child's mind to recognize objects and pronounce words appropriately. This book is suitable for primary school students as the reference for learning. The children over 2 years also can read this book. This book also has interesting and colorful pictures for children. This book usually has 3 languages, namely Malay, English, and Arabic. There are theme titles such as classroom, animal kingdom, vehicle, food, and others.

For this application, I develop the application using the AR technology in Picture Dictionary. This book only focused object inside the house such as living room, bedroom, kitchen, toilet, and surau.

1.3 Problem Statement

Currently, students nowadays are currently too much open with the technology so they may not interest too much for reading the picture dictionary beside they will feel bored with it. Besides that, the student should learning to speaking a word in picture dictionary. Unfortunately, the dictionary cannot be dealt with this problem because this way of education doesn't have a sound that can give attraction to them. It will difficult to them if no has teaching them to speak correctly word of an object in picture dictionary.
1.4 Objectives

There are several goals in this project:

1. To study the technology augmented reality can use in dictionary picture.
2. To design and develop dictionary picture that enable users can learning with augmented reality.
3. To evaluate function augmented reality of dictionary picture.

1.5 Scopes

The scope will be explained about the actor who will involve in this system and what function involved in this system. The main scopes of the system:

i. Admin

The admin can make maintenance on the application and update a new version. Besides that, the admin able to view the responses to the feedback which comes from the users.

ii. User (Student)

This interactive picture dictionary is invented especially for student primary school around age 7-12 years old. The students can use this dictionary picture using AR Technology to learn about object inside house with an interesting way. They also can experience to see virtual object appear in real-world with the animation.
1.6 Activities, Milestones (Gantt Chart)

<table>
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<td>4</td>
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<td>5</td>
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<td>7</td>
<td>8</td>
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<tr>
<td>Submit draft of report to supervisor</td>
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<td>15</td>
<td></td>
</tr>
<tr>
<td>Correction Report</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Final Report Submission</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
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</tbody>
</table>

Table 1.1 Gantt Chart
1.7 Limitation of work

There are several limitations and constraints that occurred throughout the development of this picture dictionary. These problems and limitations in conducting this study are the users need a smartphone for start playing the augmented reality. Besides that, the application need android version. The method of application is marked based mobile AR.

1.8 Expected Result

The expected result following the development of the proposed project are the user can choose any picture of object for pop up 3D animation. Augmented reality with good interface in this application. User able press button sound for pop up a word with 2 option language such as Malay or English.

1.9 Conclusion

With the technological advances of today’s increasingly fast-growing, it is hoped that this project will help to learn for a student to get gain knowledge. I hope this picture dictionary can get more published in markets shop.
CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A literature review is a process of identifying; evaluating and summarizing the existing body of a complete research that done by a researcher. It can be guideline to develop a new product so that the new product can provide a better functionality compared to the existing product. Besides, the research comparison between the current product and the new developed product is done to overcome the weakness of the current product.

2.2 Explanation Technology Timeline

Mobile Augmented Reality has largely evolved over the last decade, as well as the interpretation itself of what is Mobile Augmented Reality (Arth, Clemens & Grasset, Raphael & Gruber, Lukas & Langlotz, Tobias & Mulloni, Alessandro & Wagner, 2015). The first instance of Mobile AR can certainly be associated with the development of wearable AR, in a sense of experiencing AR during locomotion (mobile as a motion). With the transformation and miniaturization of physical devices and displays, the concept of mobile AR evolved towards the notion of "mobile
device", aka AR on a mobile device. In this history of mobile AR we considered both definitions and the evolution of the term over time.

The year 1968 is the first creates the augmented reality system by Ivan Sutherland. It also the first virtual reality system. It uses an optical see-through head-mounted display that is tracked by one of two different 6DOF trackers: a mechanical tracker and an ultrasonic tracker. Due to the limited processing power of computers at that time, only very simple wireframe drawings could be displayed in real time. In 1974, Myron Krueger built an artificial reality laboratory called the Videoplace. The Videoplace combined projects with video cameras the emitted onscreen silhouettes, surrounding users in an interactive environment.

In 1999, Hirokazu Kato and Mark Billinghurst present AR Toolkit, an open-source software library that uses video tracking on overlay computer graphics on a video camera. The AR Toolkit is still used widely to compliment many augmented reality experiences. Tobias Höllerer develop a mobile AR system that overlays models of earlier buildings. This was the first mobile AR system to use RTK GPS and an inertial-magnetic orientation tracker. He present a mobile augmented reality system that includes indoor user interfaces (desktop, AR tabletop and head-worn VR) to interact with the outdoor user. While outdoor users experiences a first person spatialized multimedia presentation via a head-mounted display, indoor users can get an overview of the outdoor scene. In 2000, Sharp Corporation releases the first commercial camera phone to public. The official name of the phone is J-SHO4. The phones camera has a resolution of 0.1 megapixels. In year 2009, print media tries out AR for the first time. Esquire Magazine prompts readers to scan the cover to make Robert Downey Jr come alive on the page. In 2014, Google announces shipment of Google Glass device for consumers, thus starting the trend of wearable AR.
2.3 Related techniques

Related techniques refer techniques of Augmented Reality already existing and used until now. This is example of techniques:

2.3.1 Marker based

![Figure 2.1 Marker based](image)

The digital world is anchored to the real world. Marker based Image recognition is an imperative component of augmented reality systems. By use of identifying visual markers already embedded within the system, physical world objects are detected for superimposition of virtual elements. (Sanni Silatanen, 2012). Therefore, the device must first recognise which page user looking at from the live camera view. This can be achieved by placing a distinctive picture or shape on the page. That picture will be recognised and the animation can start immediately, tracked to the appropriate place on the page. The user can also move the physical book around and see the virtual world “stick” to the real surface of the page. The distinctive picture that can be recognised by the device, the marker. A marker can be anything, as long as it has enough unique visual points.
2.3.2 Markerless

Figure 2.2 Markerless

Markerless augmented reality technique allows the use of any and all parts of the physical environment as the target or base for the placement of superimposed virtual objects. (Sato, Yusuke & Fukuda, Tomohiro & Yabuki, Nobuyoshi & Michikawa, Takashi & Motamedi, Ali, 2016). Markerless AR depends on the natural features of a surrounding rather than the fiducially identifying markers. Some Markerless systems have the ability to extract and store information and characteristics about the environments they are used on for later usage. When used in smartphones and other digital devices, the Markerless AR system typically makes use of the GPS feature in-built in the device in order to locate and interact with the available augmented reality resources.
2.4 Related Product

Related products refer a system already existing and used until now. This is example of system:

2.4.1 Picture Dictionary

![Picture Dictionary](image1)

Figure 2.3 Picture Dictionary

The picture dictionary is a book containing illustrative objects with words to help develop a child's mind to recognize objects and pronounce words appropriately. This books it suitable for primary school students as the reference for learning.

2.4.2 Kamus Bergambar Bestari AR 3D

![Kamus Bergambar Bestari AR 3D](image2)

Figure 2.4 Kamus Bergambar Bestari AR 3D
Kamus Bergambar Bestari AR 3D is the first picture dictionary in Malaysia. This book consists of 16 major themes covering daily themes. Illustration and pictures are colorful, clear and interesting. There is AR for selected entries. It also 70 titles are relevant to leaning needs. This product prepares free install application can augmented reality. Unfortunately, only 30 pages from 200 pages can active augmented reality.

2.4.3 E Book Ku

E Book Ku is an electronic book can display sound when the user presses a button. Like picture dictionary, this book also show a visual picture with following a theme tittle. This book contains 3 languages such as Malay, English and Arabic. This book has a learning teach Islamic education. The weaknesses this product is unclear sound to hear because it has small speaker.
2.4.4 Discovery Kids Teach & Talk Exploration Laptop

Discovery Kids Teach & Talk Exploration is a laptop for learning introductory spelling, math, music, geography and more. It only for English language. The users use a keyboard for select a menu to start and mouse is not function this device. It contains more than 60 challenging games and fun activities for kids. The screen will display in pixel art.

2.4.5 The Internet Picture Dictionary

The Internet Picture Dictionary is a website similar picture dictionary book but with display sound and animation. This website is not following a tittle theme but following alphabet A-Z.
### 2.5 Comparison table of existing product

<table>
<thead>
<tr>
<th>Product</th>
<th>Platform</th>
<th>Function</th>
<th>Method</th>
<th>Advantage</th>
<th>Drawback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picture Dictionary</td>
<td>• Printed book</td>
<td>• Help build vocabulary</td>
<td>• None</td>
<td>• Easily to read</td>
<td>• Design not interactive</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Has good illustrator picture</td>
<td>• No sound interaction</td>
</tr>
<tr>
<td>Kamus Bergambar Bestari</td>
<td>• Printed book</td>
<td>• Help build vocabulary</td>
<td>• Marker based Method</td>
<td>• Easily to read</td>
<td>• Only 30 pages can active AR</td>
</tr>
<tr>
<td></td>
<td>• Android/IOS phone</td>
<td>• Creative learning with 3D Augmented Reality</td>
<td></td>
<td>• Interactive animation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Sound interaction</td>
<td></td>
</tr>
<tr>
<td>E Book Ku</td>
<td>• Android/IOS phone</td>
<td>• Help build vocabulary</td>
<td>• None</td>
<td>• Easily to read</td>
<td>• Unclear sound</td>
</tr>
<tr>
<td></td>
<td>• Device</td>
<td>• Display sound</td>
<td></td>
<td>• It contains quiz</td>
<td></td>
</tr>
<tr>
<td>Discovery Kids Teach &amp; Talk Exploration</td>
<td>• Device</td>
<td>• Display animation and sound</td>
<td>• None</td>
<td>• It contains games and quizzes</td>
<td>• Low quality animation because pixel art</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Help build vocabulary</td>
<td></td>
<td></td>
<td>• Low quality design</td>
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<td></td>
<td></td>
<td>• Has quiz game</td>
<td></td>
<td></td>
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<td>The Internet Picture Dictionary</td>
<td>• Android phone, OS window, / tablets / PCs / notebook</td>
<td>• Help build vocabulary</td>
<td>• HTML JavaScript PHP</td>
<td>• Easily to read</td>
<td>• Not animation</td>
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<tr>
<td></td>
<td></td>
<td>• Can Interactive button</td>
<td></td>
<td>• Has click link button</td>
<td>• Only English language</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Low quality design</td>
</tr>
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</table>

Table 2.1 Comparison table of existing product

The Table 2.1 describes about comparison of the existing product with platform, function, method, advantage and drawback. This table we will know comparison each of product.
### 2.6 Comparison table of the existing products with 5 element of multimedia

<table>
<thead>
<tr>
<th>Product</th>
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<th>Image</th>
<th>Video</th>
<th>Audio</th>
<th>Animation</th>
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<tr>
<td>Picture Dictionary</td>
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<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kamus Bergambar</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
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<td>Bestari AR 3D</td>
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<tr>
<td>E Book Ku</td>
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<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

Table 2.2 Comparison table of the existing products with 5 element of multimedia

The Table 2.2 describes about comparison of the existing product with 5 element of multimedia such as Text, Image, Video, Audio and Animation. This table we will know comparison each of product.
2.7 Conclusion

In this whole chapter, this chapter discusses a product that uses a picture dictionary to develop an augmented reality. This chapter also discussed the technique used in the new system and the technique used in the previous research articles and journal. The comparison with the previous research is done so that the right choice will be selected.
CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter will explain the details of methodology being used in this project. The project methodology should systematically solve all the problems arise in the system analysis to make sure this project complete and working well. It is an important step of development since it will guide researcher through software development. After system has been completely developed. It should be tested for make sure all the objective of the project achieved.

3.2 Methodology Model

The model that I will use this system is ADDIE model. The ADDIE model is important understand if a developer want to develop a successful project. The ADDIE model has five phase acronyms is Analysis, Design, Development, Implementation, and Evaluation. ADDIE is an extremely effective tool in training development that addresses instruction. Most employees have a significant amount of information to learn in order to become more proficient at their jobs. Therefore, the ADDIE model should be helpful for many in planning a course of action that would lead to the
successful implementation of a project. When dealing with projects that involve instruction or steps, the approach fits nicely. In order to ensure effective learning outcomes from augmented reality (AR) education development, careful planning are required before the development process begins. ADDIE Instructional Design Model is used in this mobile AR application development methodology. The ADDIE model for instructional system design (ISD) is a basic model that can be applied to any kind of learning solution. The ADDIE model has five steps processes which is analysis, design, development, implementation, and evaluation.

3.2.1 Analysis phase

The Analysis phase is the foundation for all other phases of instructional design. During this phase, it must define the problem, identify the source of the problem and determine possible solutions. The phase may include specific research techniques such as needs analysis, job analysis and task analysis. The outputs of this phase often include the instructional goals, and a list of tasks to be instructed. These

![ADDIE Model](image)
outputs will be the inputs for the Design phase. In this phase, analysis phase need to
develop the mobile AR application. The analysis phase involves are requirement
analysis, task analysis and instructional analysis. Then, the activities involves are
identifying the problem statement, the goals and objectives of the mobile AR
application. This is very important because to developed the users need, existing
knowledge and any other relevant characteristics and also the content of mobile AR
application. All information gathered was used to develop goals and objective of
developing mobile AR application.
Figure 3.2 Analysis Phase

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3.2.2 Design phase

The design phase deals with learning objectives, assessment instruments, exercises, content, subject matter analysis, and lesson planning and media selection. The design phase should be systematic and specific. Systematic means a logical, orderly method of identifying, developing and evaluating a set of planned strategies targeted for attaining the project’s goals. Specific means each element of the instructional design plan needs to be executed with attention to details. The developer need make storyboard book design and application for create a visual map of application. This can help the developer shape the vision and flow of application.

i. Storyboard book design

![Storyboard book design](image)

Figure 3.3 Storyboard book design
## ii. Storyboard application

<table>
<thead>
<tr>
<th>Home Page</th>
<th>Tutorial Page</th>
<th>Credit Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Home Page" /></td>
<td><img src="image2" alt="Tutorial Page" /></td>
<td><img src="image3" alt="Credit Page" /></td>
</tr>
<tr>
<td>User need to click button start to play.</td>
<td>Show that explain how to use this application.</td>
<td>This page describes the developer this application.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AR Camera (Before)</th>
<th>AR Camera (After)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4" alt="AR Camera (Before)" /></td>
<td><img src="image5" alt="AR Camera (After)" /></td>
</tr>
<tr>
<td>The user need click button scan to start, AR camera will open and the object will automatically pop out on the screen.</td>
<td>When user touch the button, the sound will display.</td>
</tr>
</tbody>
</table>

Figure 3.4 Storyboard application
3.3.3 Development phase

The Development phase builds on both the Analysis and Design phase. The purpose of this phase is to generate the lesson plans and lesson materials. This phase will develop the instruction, all media that will be used in the instruction, and any supporting documentation. This may include hardware and software. During the development phase, the actual course materials are created. A successful development phase uses the information collected in the analysis phase and the decisions made in the design phase. The Development phase is the actual production and assembly of the materials that were developed in the design phase. At this point it is important to include whoever is responsible for which elements, time schedules, and deadlines. In this phase, all steps in development of the project are collected, prepared, created and ready to be tested. In the development phase, instructional designers and developers create and assemble content assets blueprinted in the design phase. In this phase, the designers create storyboards and graphics. The project is reviewed and revised according to feedback.
i. Create Marker

Figure 3.5 Create Marker

This is the first step before start build 3d animation models. I must create markers using Adobe Photoshop CS64. On the picture there are pictures of object and also two languages such as Malay and English. So, the users are willing to scan images or markers on the picture and the 3D animation models automatically pop out on the phone screen.

ii. Modeling 3D

Figure 3.6 Modeling 3D
Figure 3.6 show the developer making the process of modeling 3D animation models using Autodesk Maya software. The image of the table show as reference to create 3D animation.

iii. Texturing 3D

![Texturing 3D](image)

Figure 3.7 Texturing 3D

Figure 3.7 shows the next process in animating 3d characters which is texturing. Texturing is the next phase involved while creating 3d animation. It includes creating a texture from the base, editing an existing texture for reuse. Shading intensity is to be decided during the texturing phase and textures are developed like maps and then assigned to a particular scene or model. After finish modeling the models, the developer needs to find the right texture to wrap the models.

iv. Rendering

![Rendering](image)

Figure 3.8 Rendering
Figure 3.8 shows the next process in animating 3d characters which is rendering. Rendering is the final step in the animating 3d character process. Rendering is the process of creating an image or sequence of images from a scene. During rendering, Maya generates a two-dimensional image, or series of images, from a specific view of a three-dimensional scene, and saves it as an image file.

v. Create marker use Vuforia

Figure 3.9 Create marker use Vuforia

The figure 3.9 show that Vuforia is able to recognize and track targets by analyzing the contrast based features of the target that are visible to camera. The developer can improve the performance of a target by improving the visibility of these features through adjustments to the target's design, its rendering and scale, and how it's printed. The star rating of a target ranges between 1 and 5 stars; although targets with low rating (1 or 2 stars) can usually detect and track well. For best results, the developer should aim for targets with 4 or 5 stars.
vi. Building environment AR use 3D Unity

The Figure 3.10 shows the unity 3D software. The developer need to setup the Unity 3D before start using it. This is the platform where to begin build AR experiences. Next, developer need to create project and create the scenes which is Navigation, Camera & Light, 3D Object, Physics, Material and Scripts.

3.3.4 Implementation phases

The Implementation phase refers to the actual delivery of the instruction, whether it's classroom-based, lab-based, or computer-based. The purpose of this phase is the effective and efficient delivery of instruction. This phase must promote the students 'understanding of material, support the students' mastery of objectives, and ensure the students' transfer of knowledge from the instructional setting to the job.

i) Test Run Project

The developer test runs the project herself. This is to ensure that the project can be used and is running accordingly.
ii) **User Test Run**

Developer give to the user to test the project and give the feedback before the presenting the final product. Criticisms and constructive feedback is taken to be implemented later on.

### 3.3.5 Evaluation phases

This phase measures the effectiveness and efficiency of the instruction. Evaluation should actually occur throughout the entire instructional design process—within phases, between phases, and after implementation. Evaluation phases may be formative or summative.

i) **Debug**

a) **Identify Errors**

   After done test run, errors that were found by the users should be identified. Example, glitches and mistakes should be brought to light for developer to improve the project while also implementing the feedback by the alpha and beta testers.

b) **Find solutions**

   If once errors have been identified, solutions the error must be done to solve.

ii) **Final product**

a) **Presentation**

   The system is ready to be presented and launched for a large audience to use.
3.4 Framework Design

Figure 3.11 Framework Design

Figure 3.11 above shows the framework design of Picture Dictionary Inside House. User able to choose any button in this application. The users need scan any image object for display 3D object and also press button for display language sound. For Admin, Admin able to update the application for make new design. Admin also able view the response feedback. The 3DUnity used to create the Virtual Reality application and overall project and modelling 3D objects. The Vuforia use to create augmented reality. The Vuforia detects and tracks the features that are naturally found in the image itself by comparing these natural features against a known target resource database. Once the Image Target is detected, Vuforia Engine will track the image as long as it is at least partially in the camera’s field of view. For the best results, you should aim for targets with 4 or 5 starts.
3.5 Hardware and Software Requirement

This section will show that the all hardware and software that involve in the development process. All of these elements are important in the process of development of the system. List of hardware and software are shown as below:

3.5.1 Hardware requirement

i. Laptop ACER
   - To create the sketches for the characters, background and create scripts or documents related to “Mercy”. Also used for on the go coding and 3D modelling.
   - Processor : Intel Core i5-2450M CPU @ 2.50GHz
   - Operating System : Windows 10 Pro – 64 bit
   - Memory : 8GB RAM

ii. WACOM Tablet
   - For drawing and digital painting on the Laptop or PC. Also used to design merchandise.

iii. Pen drive
   - To store the backup file
   - Storage : 32GB

iv. Printer Canon MP287
   - To print out the documentation
   - To print picture dictionary

vi. Android Mobile Phone: Huawei nova 2 lite
   - Used to run and testing the application
3.5.2 Software requirement

i. Unity3D
   - Used to create the Virtual Reality app and overall project and modelling 3D object

ii. Autodesk Maya
   - Used to create 3D character models

iii. Vuforia
   - To create augmented reality
   - Detects and tracks the features of images. For best result, aim for target with 4 or 5 stars.

3.6 Conclusion

Methodology is very important in a system development. It helps to make sure the system develop correctly from phases to phases. In this system, Iterative and Incremental Model had been chosen as a guide to build system. It also helps to ensure all the objectives can be achieved. Besides, this chapter also explains the hardware and software requirements for this system.
Reference

