TABLE OF CONTENTS

ABSTRACT

Augmented reality (AR) and virtual reality (VR) are becoming a part of everyday life with the advance of other technologies such as computer vision systems, sensing technologies, graphics, mobile computing, and others. Their primary goal is to help users achieve their goals effectively and efficiently with satisfaction.

This project surveys the field of Augmented Reality and Virtual Reality among new intake students or guests in Information Communication & Technology (ICT) Department of Ungku Omar Polytechnic (PUO), in which 3-D virtual objects are integrated into a 3-D real environment in real time. It describes the architectural visualization applications of ICT Department building in 3-D model. This project also describes the 3 mode of displaying the view of the location of the classroom and laboratory.

This project is to help in understanding the advanced navigation tools we are developing, it begins with a brief introduction to our project and to the augmented reality and virtual reality technology upon which this project are built.

So this project summarizes current efforts to overcome the problems. Future directions and areas requiring further research are discussed. This project provides a starting point for anyone interested in researching or using Augmented Reality and Virtual Reality.

1. PROJET PLAN

1.1 Introduction

Augmented reality (AR) is a technology that works on computer vision based recognition algorithms to augment sound, video, graphics and other sensor based inputs on real world objects using the camera of your device. It is a good way to render real world information and present it in an interactive way so that virtual elements become part of the real world.

Augmented reality is the integration of digital information with the user's environment in real time. It uses the existing environment and overlays new information on top of it. It provides a simple and immediate user interface to an electronically enhanced physical world. Augmented reality (AR) aims to present information that is directly registered to the physical environment. AR goes beyond mobile computing in that it bridges the gap between virtual world and real world, both spatially and cognitively. With AR, the digital information appears to become part of the real world, at least in the user's perception.

Augmented reality also may be more useful than virtual reality because it takes into account the real world and allows users to see what a project will look like on a specific site. Originally, the immersive augmented reality experiences were used in entertainment and game businesses, but now other business industries are also getting interested about AR's possibilities for example in knowledge sharing, educating, managing the information flood and organizing distant meetings. Augmented reality has a lot of potential in gathering and sharing tacit knowledge.

Virtual reality (VR) is a computer-generated scenario that simulates experience. The immersive environment can be similar to the real world or it can be fantastical, creating an experience not possible in our physical reality. Augmented reality systems may also be considered a form of VR that layers virtual information over a live camera feed into a headset, or through a smartphone or tablet device.

Current VR technology most commonly uses virtual reality headsets or multi-projected environments, sometimes in combination with physical environments or props, to generate realistic images, sounds and other sensations that simulate a user's physical presence in a virtual or imaginary environment. A person using virtual reality equipment is able to "look around" the artificial world, move around in it, and interact with virtual features or items. The effect is commonly created by VR headsets consisting of a head-mounted display with a small screen in front of the eyes, but can also be created through specially designed rooms with multiple large screens.

VR systems that include transmission of vibrations and other sensations to the user through a game controller or other devices are known as haptic systems. This tactile information is generally known as force feedback in medical, video gaming and military training applications.

By realizing the potential of AR and VR technology, we came up with an idea by implementing AR and VR technology into our own project, PintARVR. PintARVR will be use AR and VR technology to display information of location and a 3D model of a building which help users to identify or recognize the structure, place and surrounding of the specific area. In this project, we limited the scope location to our own ICT department building.

1.2 Objectives of Project

i. To develop an alternative solution for student to find the location through virtual reality environment, real-time environment and 3D models.

ii. To specify information about the surrounding building of the classroom becomes more interactive and digitally manipulable.

iii. To provide a modern way of a combination between virtual and real objects to make the picture of the location of classroom more clear and precise to the student.

1.3 Scope of Project

a. Specific method used

System:
PintARVR development will be an application compatible on Android devices only. To use PintARVR, you will be needed:

i.SmartPhone (Android Device)

Latest smart Mobile phone is more than with camera, GPS. Most important default inbuilt sensor like voice, location, camera sensor which are inbuilt in max all smart phone.

Minimum requirement:

- 1GB RAM
- Android 4.4 (Kit Kat) and higher
- Fully working back-camera

ii.Google Cardboard VR (Optional)

b. Target Group
   - Student of ICT's Department
   - Guests or visitors

1.4 Methodology of Project

Methodologies in general are defined as a guideline to solve problem with the specific component such as phase, tasks, methods and technique. It can also be defined as a systematic method that can be used in a single development designed to solve the problem.

There are various type of models that can be used in the development system such as Iterative Model, V-Model, Spiral Model and others. In order to implementing this project, the most suitable methodology is Agile Model which is commonly used in system development life cycle (SDLC).

System development life cycle is a structured analysis technique that is used to plan and manage the development system process. System development life cycle is a complete development process which is includes six phases where the initial phase is planning and end with the support phase. SDLC approach with more appropriate to the system that will be developed.

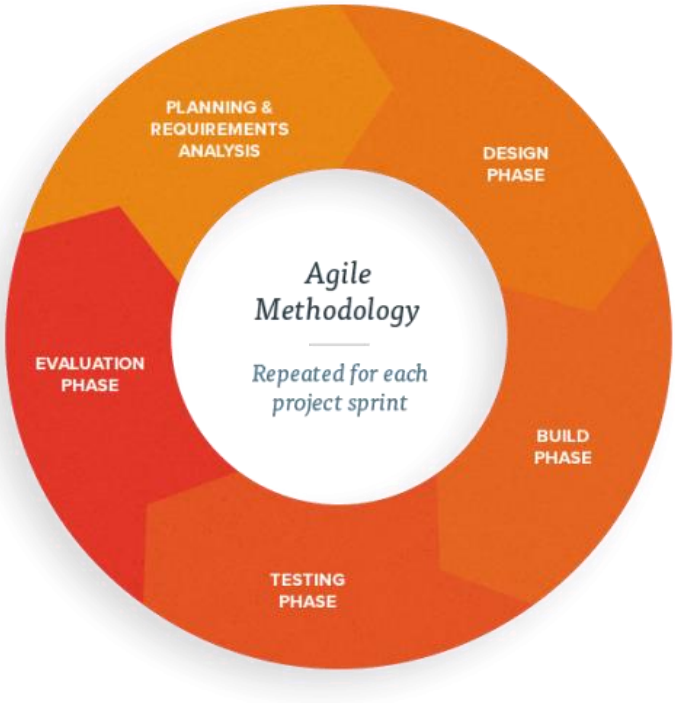

Figure 1.4.1 : Agile Model

Software Development Life Cycle or SDLC is the life cycle literally of the development of a system or software. This life cycle details all the processes that a system undergoes while it is being designed. Beside that, the software development life cycle (SDLC) is the process of creating or altering a systems, and the models and methodologies that people use to develop these system.

i. Planning & Requirement Analysis Phase

This is the early planning phase for the development of this AR and VR's application. In this phase, various item of the planning process has been made such as planning application title, the type of application to be develop and the scope of this project. Besides that, the Gantt chart also has been prepared. This scheduling plan was carried out aiming to serve as a guide to system developers to perform system development in accordance with the specified time. All requirement for the AR and VR's application has collected. Some of the activities or task performed in this phase was carried out to gather information based on the need of requirement. Finally the information that gathered is analyzed and implemented in the project.

ii. Design Phase

Before launch the application, the importance things to do is understand what is the computer programs that need to be developed and the extent of system interoperability when fully developed. During this phase, the conception of the AR and VR's application has been sketched. The design is built and the layout such as software uses like SketchUp as a 3D modeling computer program. An image target for AR is use to be scan by smartphone devices and need to be design in non-repeat pattern. Image target can be print or display on any devices screen.

iii. Build Phase

This phase is the most importance in the development of the AR and VR's application where the programs, algorithms and flow chart of the system was designed to create actual working functionality of the application. In this phase, the actual coding will be written. The application use C# as a programming language. Besides that, the information that had been gathered in analysis phase and design phase will be implemented as a whole.

iv. Testing Phase

Testing and implementation phase is the phase where the completed application need to be tested first to ensure all the application`s function can run smoothly. The inspection on the AR and VR's application should be done in detail to make the system free from any errors. Application are debug and test on smartphone devices. When the application already launched, scan the image target and the 3D model of the building will appear on the screen.

v. Evaluation Phase

The evaluation phase is the last phase in completing the AR and VR's application. All the completed paper work and entire system will be presented to the supervisors for review. Implementation compared to the initial requirements of project. Adjustment made as required based on testing and client feedback. Once it had evaluated by the supervisor, the project will be given approval certification.

Generally, methodology give a guideline what have to do in developing the system. It also describes every step in the project life cycle in depth, so developers know exactly which tasks to complete, when and how. The methodology that will be used in system development life cycle (SDLC) for the AR and VR's application which has six phases of development, starting with planning phase, analysis, design, testing and support phase. All the phases in methodology are related with each other because, if one of the phases in the methodology cannot be done or completed on time, the next task or phase will be affected.

1. 5 Project Gantt Chart

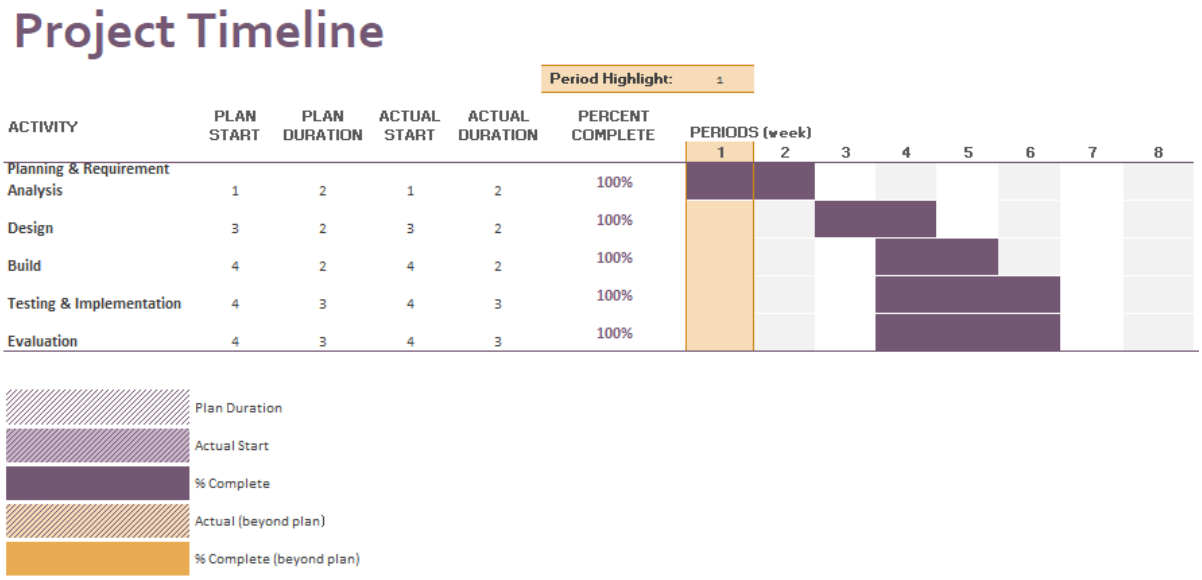

Figure 1.5.1 : Gantt Chart

Phase	Description
Planning & Requirement Analysis	- Application title - The type of application to be develop - The scope of this project - The Gantt chart - All requirement for the AR and VR's application is collected - Gather information based on the need of requirement - Analyzed the information and implemented in the project
Design	- Develop the computer programs that is needed. - Concept of PintARVR is sketched. - Built the design. - Image target is design in non-repeat pattern.
Build	- The programs, algorithms and flow chart of the system is designed. - Write the actual coding. - Implement all the information that had been gathered in analysis phase.
Testing	- Test the complete application - Ensure all the function of application run smoothly
Evaluation	- The completed paper work and entire system is presented to the supervisors - Adjustment made as required based on testing and client feedback.

Figure 1.5.2 : Table of Description of the process in Gantt Chart

2. REQUIREMENT SPECIFICATION

2.1 Functional Requirement

2.1.1 Download mobile apps

- User should be able to download PintARVR apps from PintARVR website.

2.1.2 Choose Mode

- There are three mode available that can be choose by user

2.1.3 Virtual Reality mode

- User can use virtual reality mode with virtual reality device such as Google VR Cardboard

2.1.4 Augmented Reality mode

- User can use augmented reality mode and scan image target that can be obtain from PintARVR website.

2.1.5 3D Tour mode

- User can control view and movement by using control button on the screen interface

2.2 Non-Functional Requirement

2.2.1 Performance

- Mode can be access instantly after selected

- Scanning image target for augmented reality fast and accurate.

2.2.2 Environmental

- Augmented reality can be used without even use of paper for image target.

2.2.3 Availability

- PintARVR available 24/7 even when it is not connected to the internet.

- PintARVR website can be access with 99% uptime.

2.3 Hardware and Software Requirement

Hardware	Minimum Requirement
Laptop	Intel i5 Processor, 4 GB RAM
Smartphone	Android (4.4 or higher)
VR Cardbox	Two lenses

Figure 2.3.1 : Hardware Requirement

Software	Minimum Requirement
SketchUp	Intel i5 Processor, 4GB RAM
Unity	
Java SDK	JDK 1.8.0
Vuforia SDK	Latest version
Google VR SDK	

Figure 2.3.2 : Software Requirement

2.4 System Configuration

2.4.1 Install Unity

Make sure that the Android Build Support component is selected during installation.

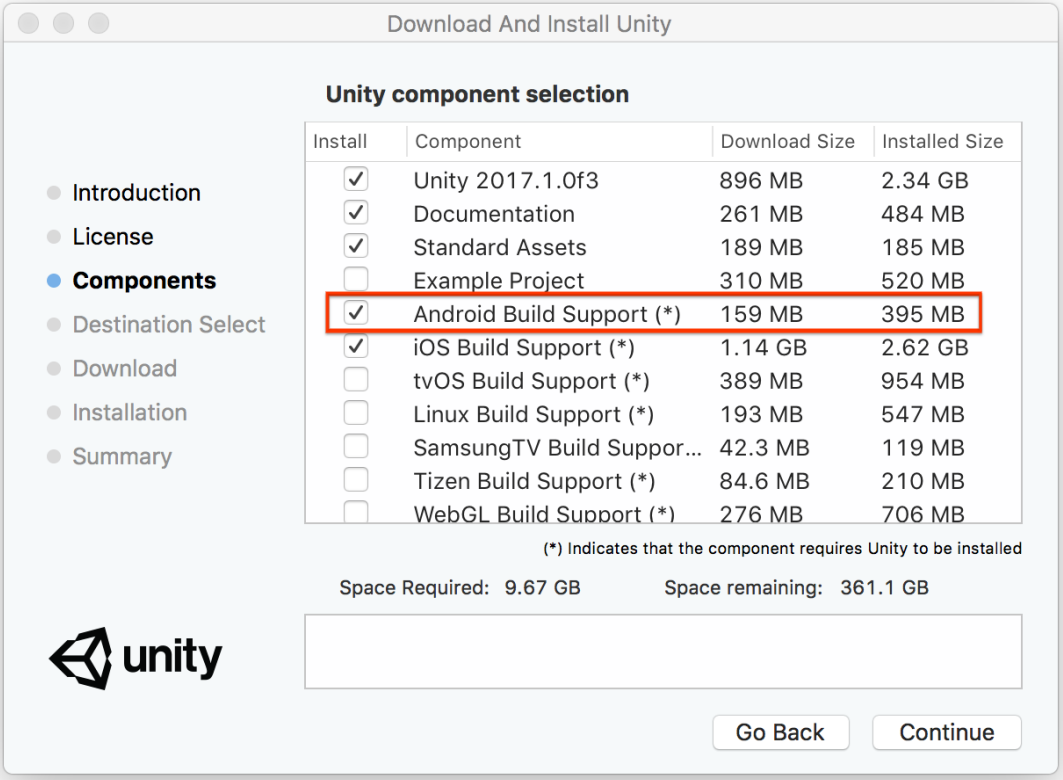

Figure 2.4.1.1 : Unity installer interface

2.4.2 Install Java JDK

The installation process starts. Click the Install button to accept the license terms and to continue with the installation

Figure 2.4.2.1 : Installer JAVA

A few brief dialogs confirm the last steps of the installation process; click Close on the last dialog. This will complete Java installation process.

Figure 2.4.2.2 : Installer JAVA after completion

2.4.3 Import Vuforia SDK Package and Google Cardboard VR SDK Package for Unity

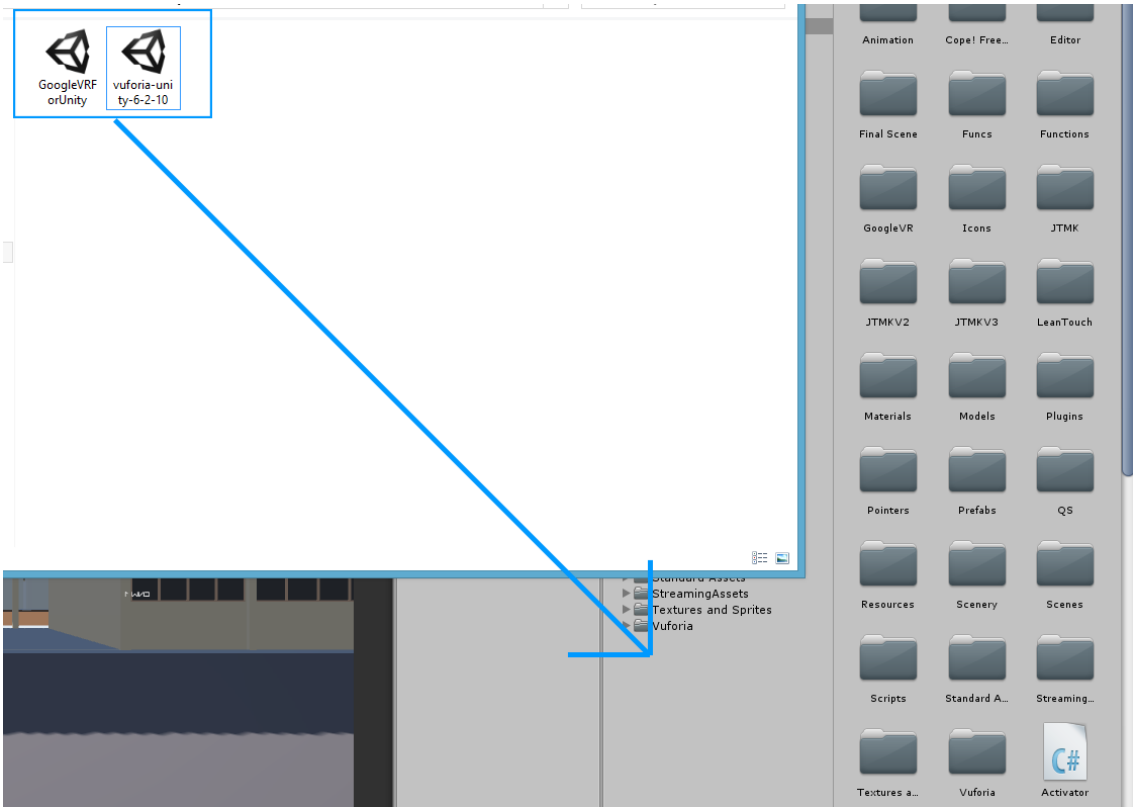

Figure 2.4.3.1 : Import Vuforia SDK

3. FINAL DESIGN

3.1 Logical Design

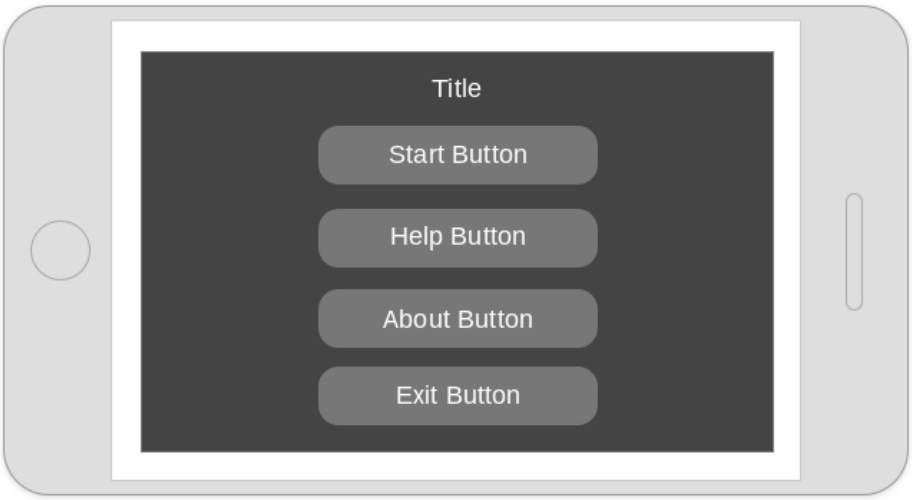

Figure 3.1.1 : Main Menu

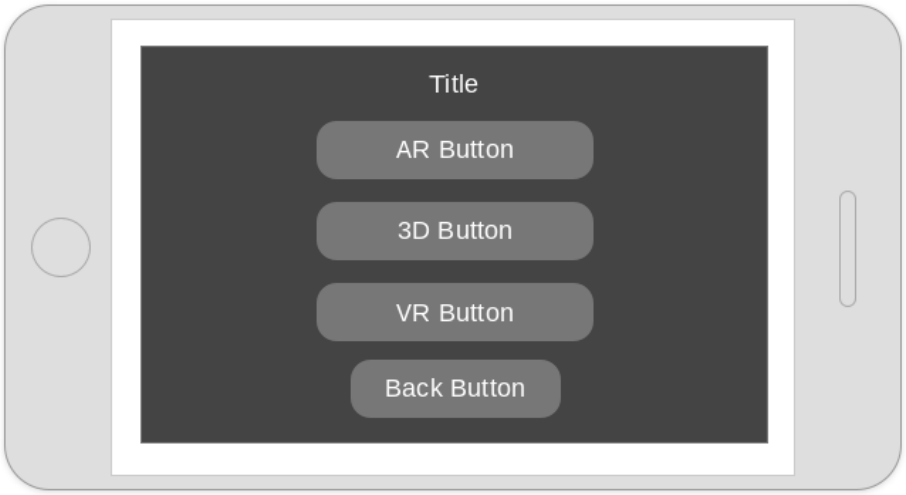

Figure 3.1.2 : Selection Mode Menu

Figure 3.1.3 : Help and About Panel

Figure 3.1.4 : Augmented Reality Interface 1

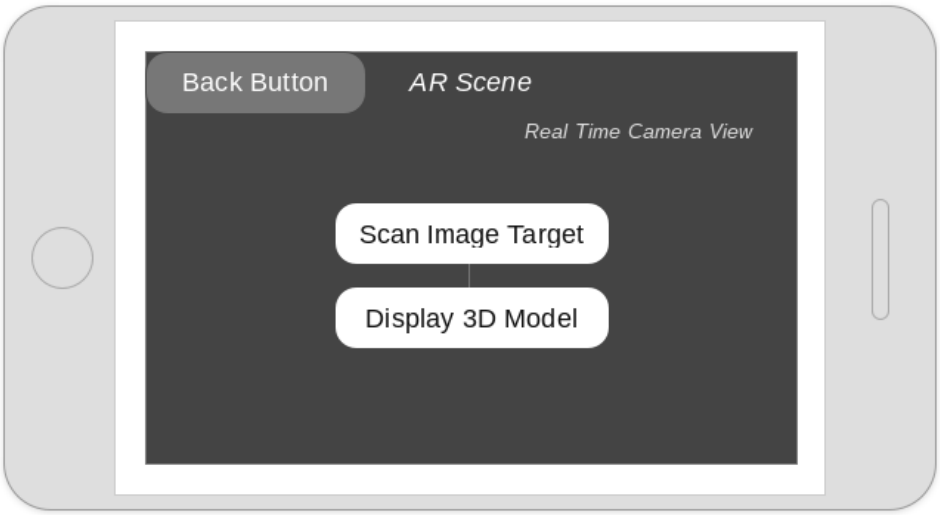

Figure 3.1.5 : Augmented Reality Interface 2

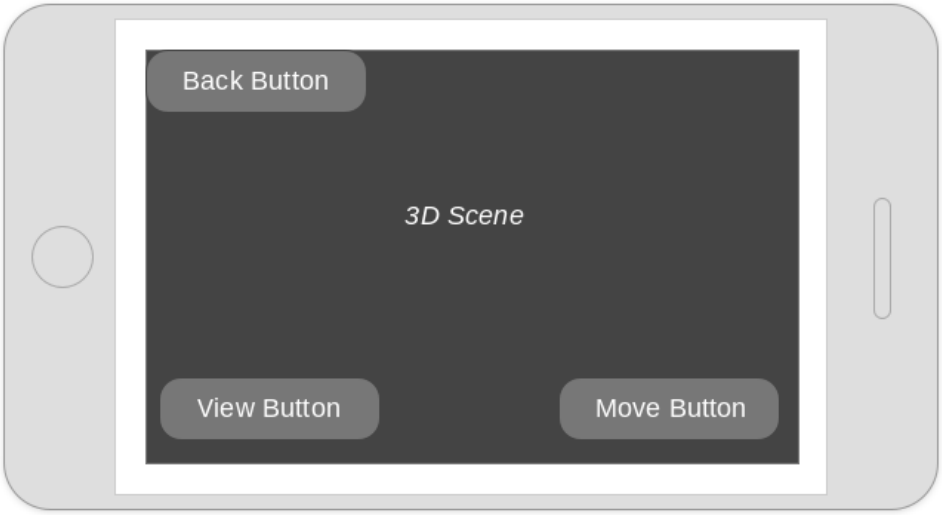

Figure 3.1.6 : 3D Tour Interface

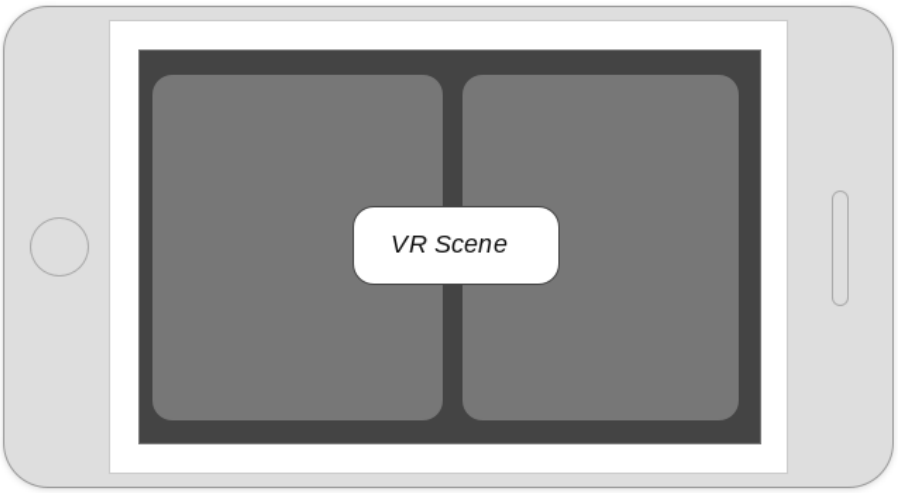

Figure 3.1.7 : Virtual Reality Interface

3.2 Physical Design

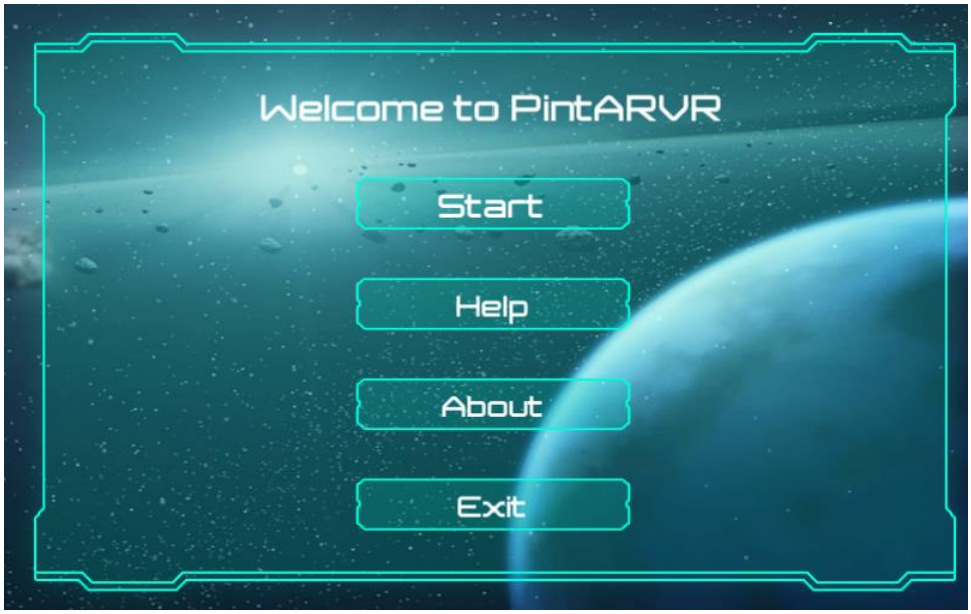

Figure 3.2.1 : Main Menu Interface

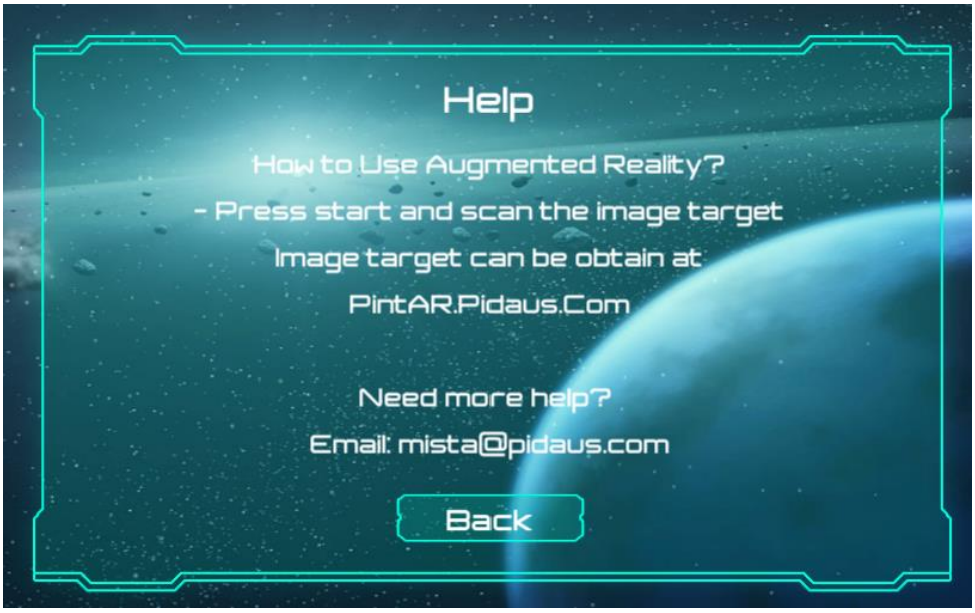

Figure 3.2.2 : Help Panel

Figure 3.2.3 : About Panel

Figure 3.2.4 : Selection Menu Panel

Figure 3.2.5 : 3D Tour Interface

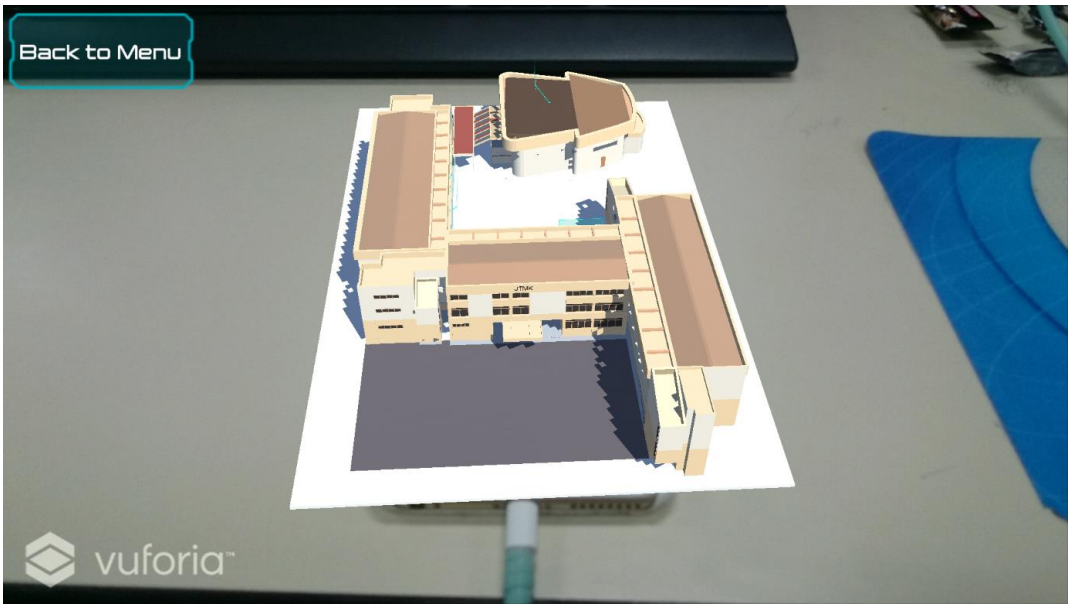

Figure 3.2.6 : Augmented Reality Interface

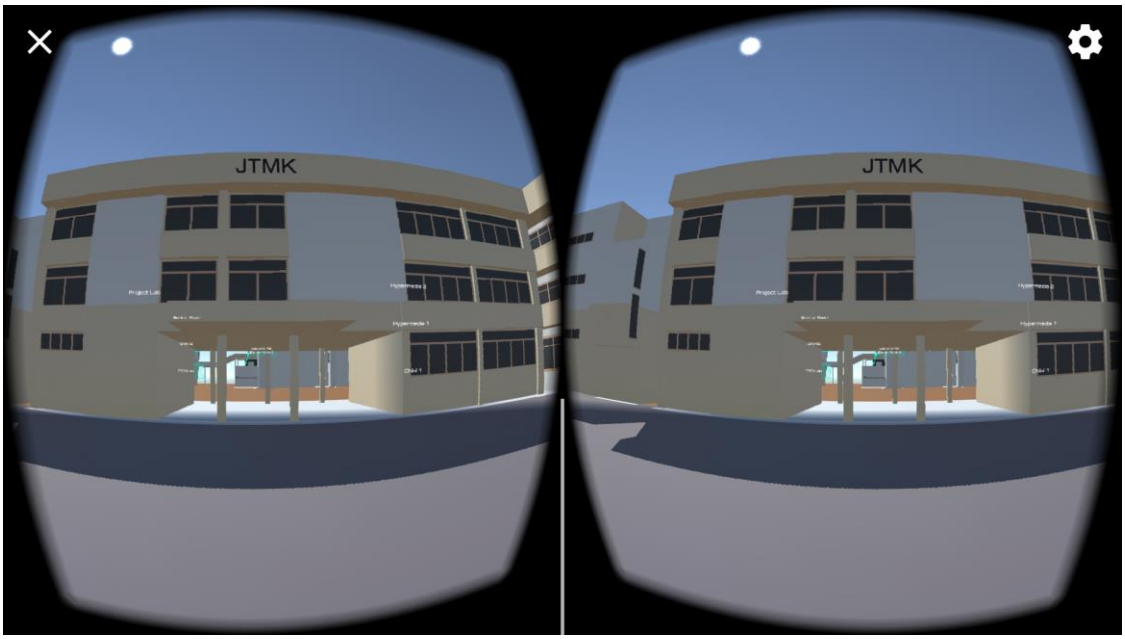

Figure 3.2.7 : Virtual Reality Interface

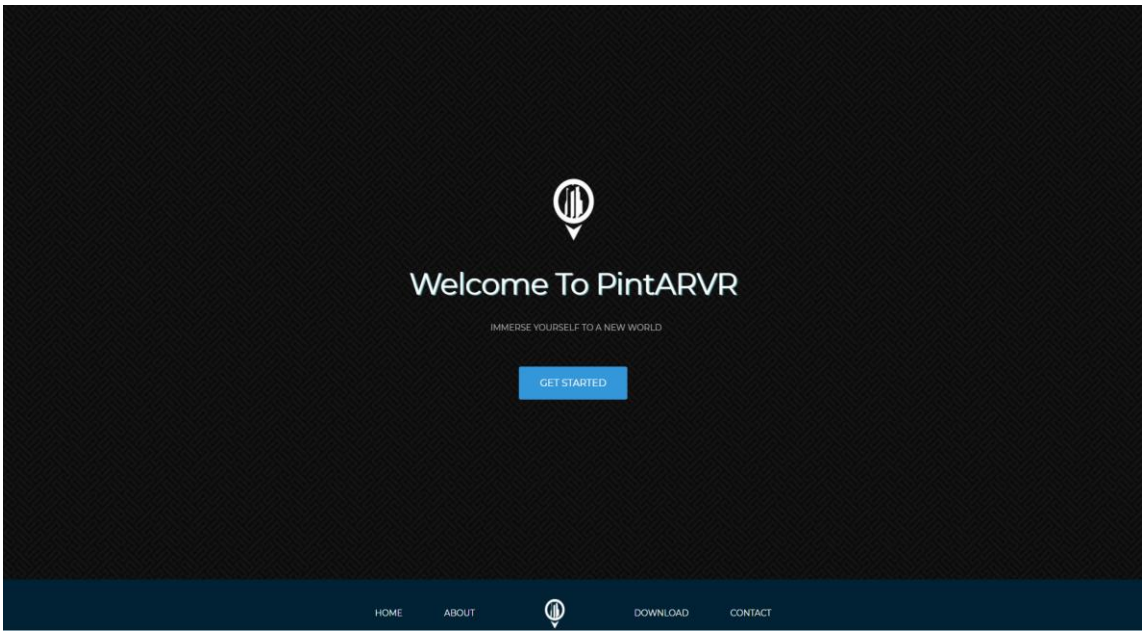

Figure 3.2.8 : PintARVR Website

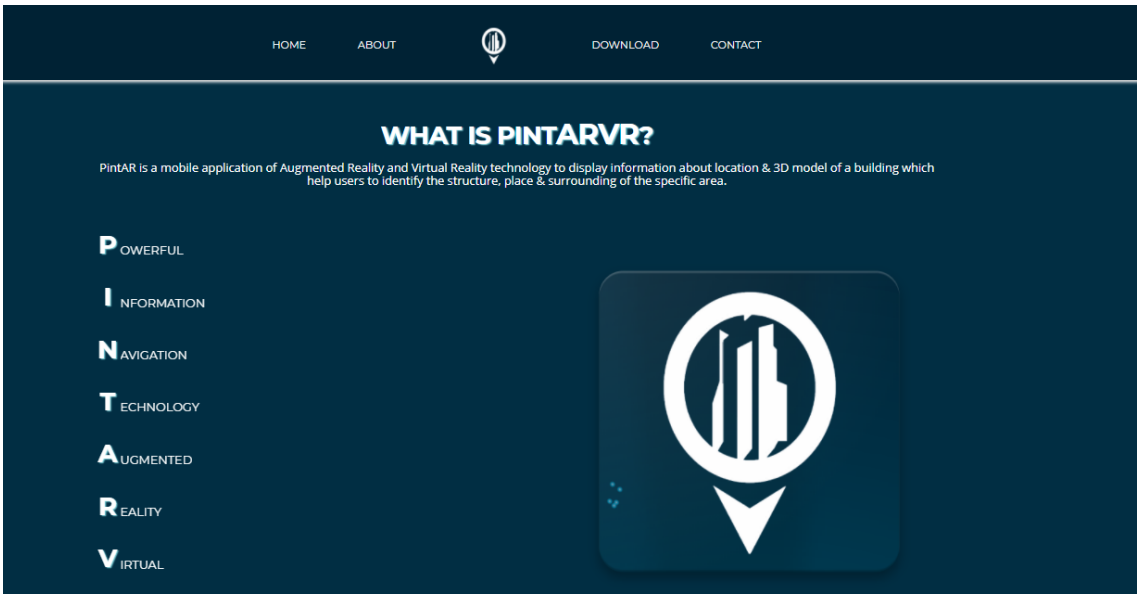

Figure 3.2.9 : PintARVR Home page

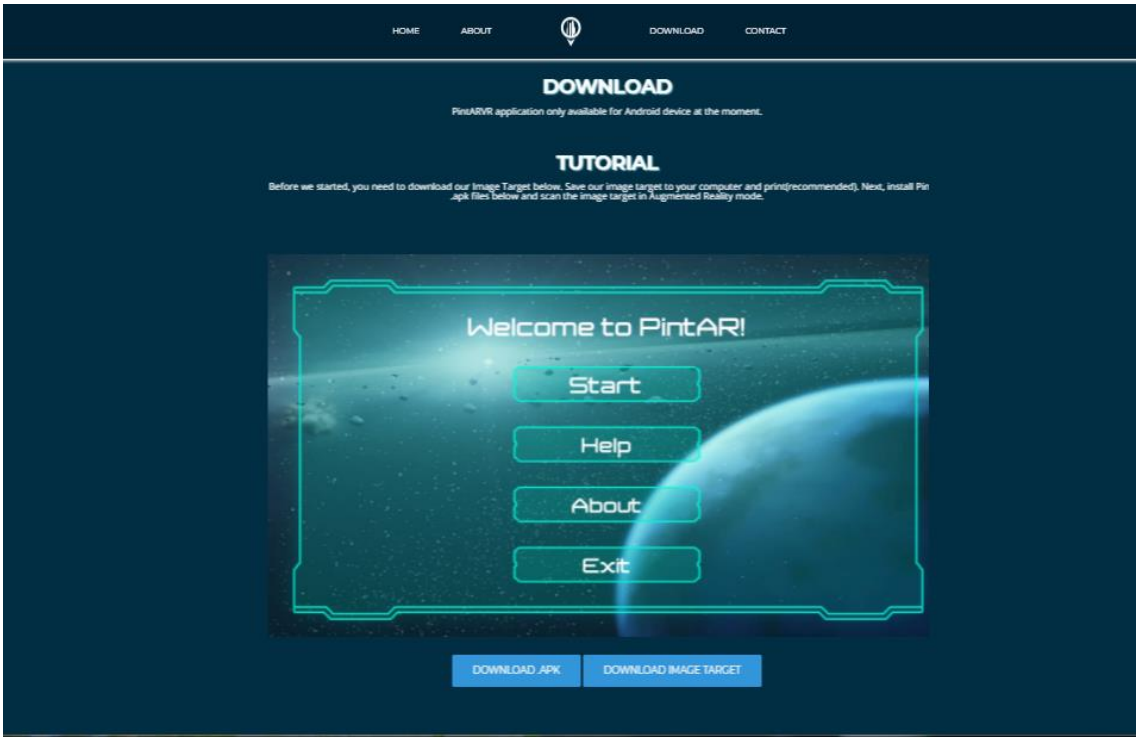

Figure 3.2.10 : PintARVR Download page

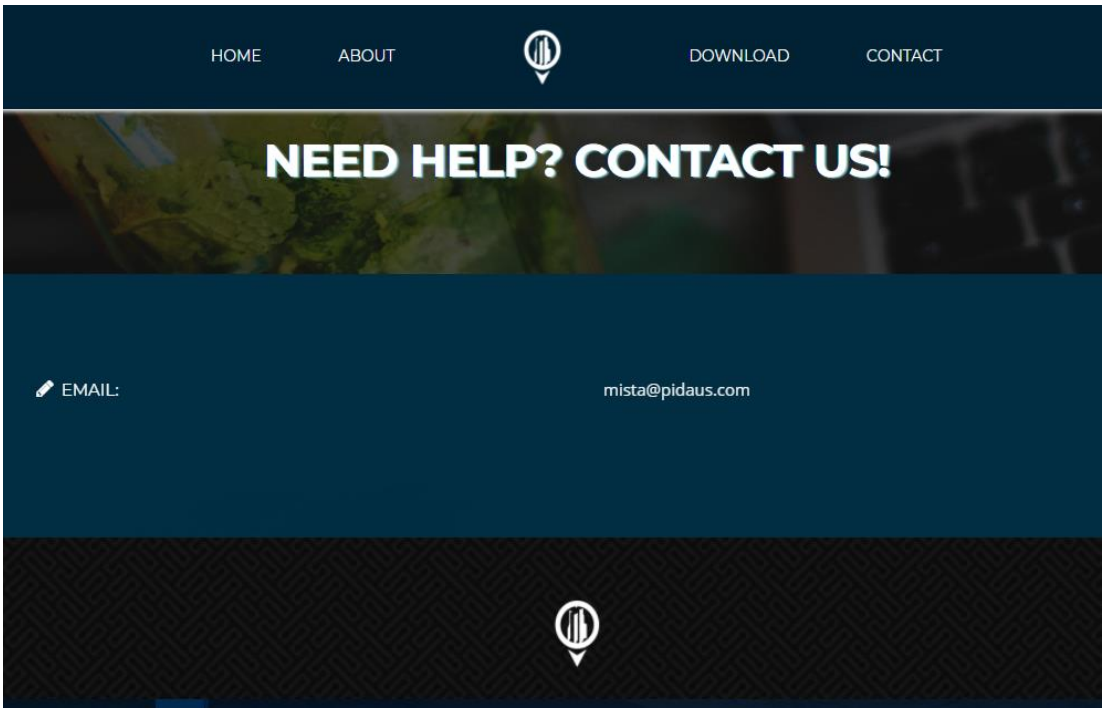

Figure 3.2.11 : PintARVR Contact page

4. TEST AND DESCRIPTION RESULTS

4.1 Unit Testing Plan

UNIT TESTING PLAN (UTP)						
No.	**Test Case Name**	**Test Procedure**	**Pre condition**	**Expected Result**	**Tester**	**Result (Pass/Failure)**
1.	Download mobile application in PintARVR website.	User required to download the application in website	User need to download PintARVR apps from PintARVR website.	The application can successful install in the mobile phone	Firdaus	Pass
2.	Choose Mode	User required to choose three mode as augmented reality, 3D mode or virtual reality mode.	User need to choose only one mode in each time.	The chose mode button function well.	Firdaus	Pass
3.	Virtual Reality mode	User required to look a little towards the bottom to move forward and look slightly upward to stop from moving.	User need to use the virtual reality device such as Google VR Cardboard.	Look around in 360-degree.	Firdaus	Pass
4.	Augmented Reality mode	User required to scan image target to explore the ar.	User need to scan image target that can be obtain from PintARVR website.	The system rotation and zoom function well.	Firdaus	Pass
5.	Movement control button in 3D tour mode	User is required to move the controller	User need to choose the 3D tour mode before use it.	Movement control button	Firdaus	Pass

				function well.		
6.	View control button in 3D tour mode	User required to control view and movement by using control button on the screen interface	User need to move forward and view to look around.	View control function well.	Firdaus	Pass

Figure 4.1.1 : Table of Unit Testing

4.2 Integration Testing Plan

INTEGRATION TESTING PLAN (ITP)						
No	**Test Case Name**	**Test Procedure**	**Pre condition**	**Expected Result**	**Tester**	**Result (Pass/Failure)**
1.	Augmented reality mode	User is required to scan image target to explore the augmented reality.	User need to scan image target that can be obtain from PintARVR website.	User will rotate and zoom to look around.	Firdaus	Pass
2.	3D tour mode	User required to control view and movement by using control button on the screen interface	User need to choose the 3D tour mode before use it.	User will control to view and move.	Firdaus	Pass
3.	Virtual reality mode	User required to look a little towards the bottom to move forward and look slightly upward to stop from moving.	User need to use the virtual reality device such as Google VR Cardboard.	User will move forward and view look around.	Firdaus	Pass

Figure 4.2.1 : Table of Integration Testing

5. MAJOR FINDINGS AND DISCUSSIONS

Application that has been developed, will then be reviewed in implementation and testing phase and some of the advantages and disadvantages of the system identified.

5.1 Advantages of PintARVR

The main purpose of PintARVR is to help target groups in ICT department's identify or recognize the structure of the building and the exact class location. Below are the advantages of the application:

- Reduce time and energy of a user to go and look for the classroom and laboratory by themselves. It provides additional information in real time in a defined position or in a specific environment.
- Eliminates the need for a human teacher. An example, most of the new intake students will ask the senior or lecturer to tell and show them the place of the classroom. While PintARVR can be immersive and informative.
- Help users better understand perspectives other than their own

5.2 Disadvantages of PintARVR

The disadvantages of the application has been identified in this PintARVR. Below are the disadvantages:

- Minimal social interaction. Where, users will have less communications with other senior or lecturer in asking to guide them to the location.
- The battery life of a device, which should be extended to allow users make the most from the technology in daily use.

6. CONCLUSIONS AND RECOMMENDATIONS

In conclusion, augmented reality (AR) and virtual reality (VR) has evolved from pipe dream to a substantial reality in just within a century. Besides, with PintARVR it will improve the quality, efficiency, and productivity of experiences of the target groups in ICT's Department. This is because PintARVR can be used as an interactive style of 3D virtualization information.

To achieve the main purpose of the development of PintARVR's application, which is to build an application or platform of an Augmented Reality for real-time visualization of architectural models and a Virtual Reality for more enjoyable and realistic environment. Each advantage and disadvantage that are detected during the implementation phase will be studied so that the developers can find ways for improvements to the existing application to meet requirement which need in the future.

There are some recommendations for improvements in the future works:

- Guide them through each modes and phases of the experience so that it can be executed successfully.
- Ensure that there is adequate lighting.
- Sit down when executing the experience, for their comfort and physical safety.

7. REFERENCES

Aukstakalnis, S. (2017). *Practical augmented reality : a guide to the technologies, applications, and human factors for AR and VR*. Boston: Addison-Wesley.

Bailenson, J. (2018). *Experience on demand : what virtual reality is, how it works, and what it can do*. New York: W.W. Norton & Company.

Challoner., Kidd, B. & Barton, E. (2017). *Virtual reality*. New York, New York: DK Publishing.

Hackl, C. & Wolfe, S. (2017). *Marketing new realities : an introduction to virtual reality & augmented reality marketing, branding, & communications*. Lexington, KY: manufacturer not identified.

Kipper, G. & Rampolla, J. (2012). *Augmented reality : an emerging technologies guide to AR*. Waltham, MA: Syngress.

Lanham, M. (2017). *Augmented reality game development : create your own augmented reality games from scratch with Unity 5*. Birmingham, UK: Packt Publishing.

Linowes, J. & Babilinski, K. (2017). *Augmented reality for developers : build practical augmented reality applications with Unity, ARCore, ARKit, and Vuforia*. Birmingham, UK: Packt Publishing.

Linowes, J. (2015). *Unity virtual reality projects : explore the world of virtual reality by building immersive and fun VR projects using Unity 3D*. Birmingham, UK: Packt Publishing.

Sood, R. (2012). *Pro Android augmented reality*. Berkeley, CA: Apress.