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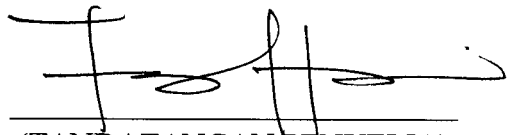
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AUGMENTED UTEM

LEE PEI PEI

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

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
UNIVERSITI TEKNIKAL MALAYSIA MELAKA
2010

DECLARATION

I hereby declare that this project report entitled

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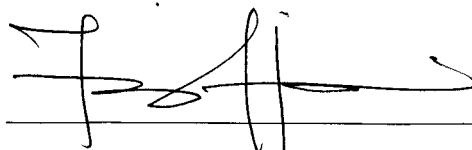
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DEDICATION

I sincerely dedicated this project to my beloved parents, friends and my supervisor, Dr. Syariffanor binti Hisham. Without their supports and patience, the completion of my project would not have been possible. Million thanks for the understanding and guidance given throughout the completion of my project.

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First of all, I would like to thank my supervisor, Dr. Syariffanor binti Hisham for her guidance and assistance in developing my final year project. She has spending her time to give me some comments and ideas. In addition, she helped me by explaining the correct way to write the documentation. I sincerely thank to my friends for their help and support in carrying out this project. Last but not least, I would like to take this opportunity to express my gratitude to my beloved family for their continuous support.

ABSTRACT

Augmented reality (AR) is a current technology which can create a virtual object in the real world environment by using the recording device. The basic components used in AR are tracking marker, computer and web camera and it involves the processes of capturing, computing and rendering. The purpose of this project is to develop an AR application which can introduce Universiti Teknikal Malaysia Melaka (UTeM) buildings and map to the visitors. In order to create the application, the UTeM buildings and map are modeled into 3D graphic models. The AR application is developed by using open source library. In this project, FLARToolkit is selected to create the AR application. The project methodology used in this project is System Development Life Cycle (SDLC). Therefore, the product developed will be undergoes planning, design, development and implementation processes. This AR application can be utilized with UTeM logo maker, web camera as the display device and a personal computer for application processing. The application allows user to select the 3D graphical buildings based on their interest. In short, this paper is intended to provide a general idea of open source AR development process and apply it in developing an AR application which is named as Augmented UTeM.

ABSTRAK

Augmented reality (AR) merupakan teknologi terkini yang digunakan untuk menghasilkan objek maya dalam persekitaran nyata. Komponen yang diperlukan dalam menghasilkan teknologi tersebut adalah penanda, komputer dan web kamera. Proses yang terlibat termasuk proses pengambilan, pengkomputeran dan penghasilan. Projek ini bertujuan untuk membangunkan suatu aplikasi *AR* yang dapat memperkenalkan bangunan dan peta Universiti Teknikal Malaysia Melaka (UTeM) kepada para pengguna. Bagi menghasilkan aplikasi tersebut, bangunan dan peta UTeM perlu ditransformasikan kepada model tiga dimensi. Aplikasi *AR* tersebut akan dibangunkan dengan menggunakan *open source library*. Dalam projek ini, FLARToolkit telah dipilih sebagai salah satu daripada *open source library* untuk menghasilkan aplikasi tersebut. Metodologi yang digunakan dalam projek ini adalah *System Development Life Cycle (SDLC)*. Oleh itu, produk yang dibangunkan akan melalui proses yang terdapat dalam *SDLC*. Aplikasi yang dibangunkan dapat berfungsi dengan hanya menggunakan logo UTeM sebagai penanda, web kamera, dan juga komputer. Aplikasi tersebut membolehkan pengguna memilih model tiga dimensi yang dikehendaki sebagai objek maya. Tujuan penyelidikan projek ini adalah untuk menghasilkan suatu aplikasi *AR* bernama Augmented UTeM dengan mengemukakan konsep dan proses yang perlu difahami dalam menghasilkan aplikasi tersebut.

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LIST OF ABBREVIATIONS

AR	-	Augmented Reality
UTeM	-	Universiti Teknikal Malaysia Melaka
3D	-	Three Dimensions
2D	-	Two Dimensions
VR	-	Virtual Reality
MR	-	Mixed Reality
GNU	-	General Public License
HIT	-	Human Interface Technology
HMD	-	Head Mounted Display
PDA	-	Personal Digital Assistant
LCD	-	Liquid Crystal Display
RV	-	Reality-Virtuality
FTMK	-	Fakulti Teknologi Maklumat dan Komunikasi
CD	-	Compact Disc
GUI	-	Graphical User Interface
SDLC	-	Systems Development Life Cycle

CHAPTER I

INTRODUCTION

1.1 Project Background

In the world of technology, the interaction between human and computer increase significantly. Computer graphic have become the important and sophisticated element in our life. Nowadays, the interaction between computer and human are more powerful when the object in the screen or computer display can be integrated and displayed in the real-world environment. At the same time, virtual object can interact with human in the real environment.

Augmented reality is the existing current technology which can create a simulative and interactive human experience. AR occurs when the virtual objects are added to the real-world by some recording devices such as web camera in the real time. This technology is getting popular and it is used in many platforms such as web and mobile applications. This project is using AR technology as the main domain.

In this project, an application which introduces UTeM main campus areas will be developed by integrated AR technology. This product will give an overview in UTeM campus main areas to the user in AR.

1.2 Problem Statement

AR is not a new technology but it is not widely use in our country compared to virtual reality. Virtual reality is the current popular technology which is only use to stimulate the environment of the real world. Hence, virtual reality does not combine a real environment with virtual objects.

Current available map model in our country is using the architecture model which is a physical object. Therefore, it will be hardly for the user to bring to any location. Besides, user may not be able to use the architecture model whenever they need it.

1.3 Objective

- To study the open source AR development process and apply in the project application. AR technology can be developed in different types of development environment. Hence, different types of tools can be used to develop AR. In this project, FLARToolkit will be used as the tool for develops an AR application.
- To design a 3D graphics map with the buildings. The 3D objects will be design in Autodesk Maya 2009 and also will be built by using the helper classes for flash 3D engines. The 3D graphic map consists of four buildings in UTeM.
- To develop an augmented application which will integrate with a 3D graphic map. AR application can be produced by integrates the development toolkits with 3D graphic models.

1.4 Scope

This project is to build a virtual UTeM main campus map in a 3D object. Few building and areas in the main campus will be illustrated in the augmented application. User may view and control the map in AR world. The information of the selected areas in the map will be displayed to the user. The target audiences of this product are undergraduate UTeM students, UTeM lecturers, and the visitors who want to know more about UTeM main campus areas. In this project, the application to be developed is standalone based application.

1.5 Project Significance

UTeM visitor, staff, and undergraduate student will be benefits from the application. One of the contributions of successfully developed application is to allow the benefit group views and understands UTeM main areas map and at the same time provide the building information. The users may use the product in the interactive way and hence increase their interest to know more about UTeM main buildings and areas. Benefit group may experience AR technology with the 3D maps in their pace. They may use the map anytime and anywhere they need it with just a laptop, marker and web camera.

1.6 Conclusion

The expectation from this project is to develop a standalone application which can introduce UTeM campus main areas to the users. The application is developed by using AR technology and 3D graphics models. Next topic will discuss about literature review and project methodology.

CHAPTER II

LITERATURE REVIEW & PROJECT METHODOLOGY

2.1 Introduction

This chapter is to discuss about the literature review and project methodology of the domain augmented reality. The literature review of this chapter is to study related augmented reality application and the development tools used. Besides, the processes and constraints of develop an augmented reality application also will be explained later in this chapter.

2.2 Domain

Augmented reality is another immersive technology which is different from virtual reality (VR). Augmented reality does not create a simulation of a physical real world. Instead, it combines the real environment and virtual object. Azuma (1997) in his paper “A Survey of Augmented Reality” defined that AR system should have the following three characteristics:

- Combines reality and virtual objects
- Interactive in real time
- Build with 3D objects

However, there are some relationship between AR and VR. The relationship of AR and VR is shown in the diagram below.

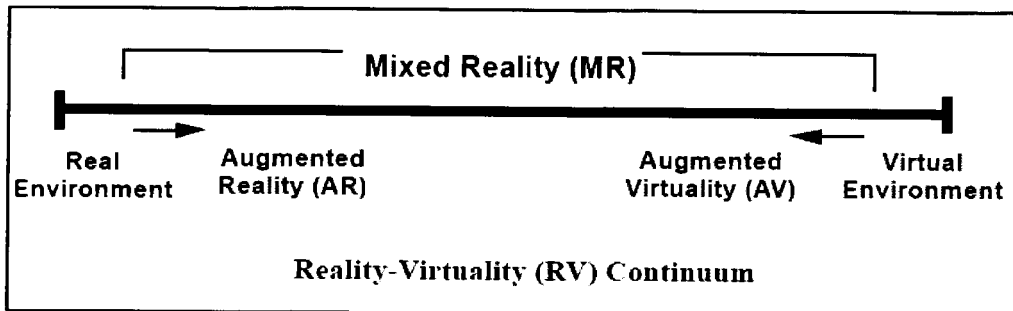


Figure 2.1: Simplified Representation of a RV Continuum (Milgram *et al.*, 1994)

The diagram shows that there are two ends on the continuum. The left of the continuum defines the real environment which consists of real objects. In contrast, the right side of the continuum represents virtual environment. The virtual environment includes conventional computer graphic simulations in monitor based or immersive form. Mixed reality (MR) environment happened when real and virtual objects are gathered together in a single display which is place between the two ends of the continuum. Therefore, AR is in the form of MR environment.

According to Mohamad Said and Ismail (2007), “Augmented reality or also known as AR is not a new technology. They specified that the technology has existed for almost 40 years ago after Ivan Sutherland introduced the first virtual reality application.” Nowadays, the application of augmented reality is significant increasing in many fields. ARToolKit is a software library freeware originally developed by DR. Hirokazu Kato at HIT Lab, University of Washington in year 1999. It is use for non-commercial use and it register under the GNU General Public License. Another Java ported version of ARToolKit is FLARToolKit. FLARToolKit is use to develop AR application in flash environment.

AR can be used to enhance environment information by overlay some of the real environment with virtual object. Therefore, users can interact with virtual object in the real environment and at the same time users can gain some meaningful information. The possibility of replace some of the real world with virtual object

makes augmented reality a potential technology use in large number of applications including education, architecture, entertainment, training, and medical field.

Head mounted display (HMD) provides users more immersive experience and seems to be important display hardware in augmented reality application. However, an augmented reality application can be implemented with basic hardware such as web camera, laptop and desktop. The basic components used in ARToolKit are tracking marker, computer and web camera and it involves the processes of capturing, computing and rendering.

In order to create an ARToolKit or FLARToolKit application, a tracking marker with black square graphic will save as pattern file in a computer. The image processes started by using a web camera to capture real environment video frame in real time. After that, the computer software will search through each video frame to find the tracking marker which is the black square. Once the black square is found, the position of the camera relative to the black square is calculated and a visual object is drawn follow the marker position. The visual graphic is drawn on the top of each video frame. Finally, user will have an immersive experience by viewing through the computer screen as they can see the virtual object exists in the video display.

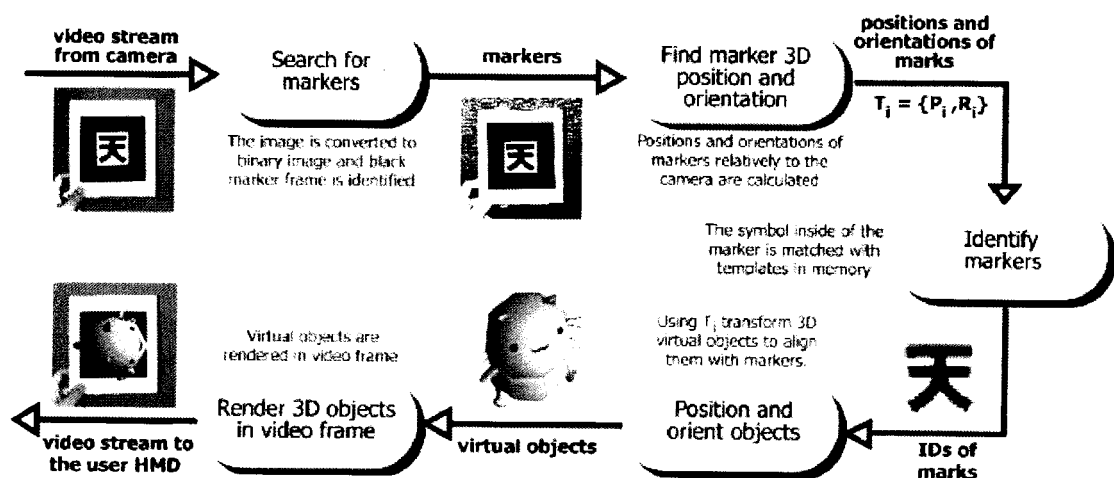


Figure 2.2: ARToolKit Image Processing (Kato *et al.*, 2000)