BORANG PENGESAHAN STATUS TESIS^

JUDUL: WALKTHROUGH APPLICATION FOR FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY'S BUILDING AND PLANNER FOR THE FACILITIES

SESI PENGAJIAN: 2005

Saya REDZUAN BIN JARIS
(HURUF BESAR)

mengaku membenarkan tesis (PSM/Sarjana/Doktor Falsafah) ini disimpan di Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dengan syarat-syarat kegunaan seperti berikut:

1. Tesis adalah hakmilik Kolej Universiti Teknikal Kebangsaan Malaysia.
2. Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dibenarkan membuat salinan tesis ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. ** Sila tandakan (/)

_____ SULIT (Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

_____ TERHAD (Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

/ TIDAK TERHAD

(TANDATANGAN PENULIS)

Alamat tetap : NO 28, JALAN RAMBUTAN, TAMAN DAKIO, 86200 SIMPANG RENGGAM, JOHOR

Tarikh : 25/11/05

(TANDATANGAN PENYELIA)

PN. RUSNIDA BINTI ROMLI
Nama Penyelia

Tarikh : 23/11/05

CATATAN: ** Jika tesis ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa.
^ Tesis dimaksudkan sebagai Laporan Projek Sarjana Muda (PSM)

WALKTHROUGH APPLICATION OF FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY'S BUILDING IN THE MAIN CAMPUS AND PLANNER FOR THE FACILITIES INSIDE THE BUILDING

REDZUAN BIN JARIS

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

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
KOLEJ UNIVERSITI TEKNIKAL KEBANGSAAN MALAYSIA
2005

DECLARATION

I hereby declare that this project report entitled

Walkthrough Application of Faculty of Information and Communication Technology's Building in the main campus and Planner Application for the facilities inside the building

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

STUDENT : _____ **Date:** 25/11/05

(REDZUAN BIN JARIS)

SUPERVISOR : _____ **Date:** 23/11/05

(PUAN RUSNIDA BINTI ROMLI)

ACKNOWLEDGEMENT

Alhamdulilah, my praise and thanks to God because with His help and permission I acquire the good health and knowledge, gratitude to all those who have helped in making my PSM 1 (Projek Sarjana Muda) stint such a rewarding and enriching experience.

I want to express my deepest thanks to my supervisor Cik Rusnida Binti Romli for all the information, assist and experienced shared that will guide me to develop this project. Special thanks also give to En. Hafiz Zakaria and En. Shaarizan for their briefing about the BITM PSM during the seminar. Their explaination and guidance are really important in preparing the report for PSM 1.

Then, to my beloved parents, Pn. Ramlah Bt. Yusop and En. Jaris Bin Minin for all their moral support and advices that will keep me believes in myself and trust the inner potential of mine. To the entire BITM lecturers thank you. Without your thought, it is impossible for me to fulfill this project proposal. Last but not least to my entire fellow friends, I wish you all, best of luck.

"Thank you"

Abstract

The use of computers in society provides obvious benefits and some drawbacks. `Virtual Reality', a new method of interacting with any computer, is presented and its advantages and disadvantages are considered. The human aspects of computing and computers as a form of escapism are developed. Virtual Reality can be partitioned into three categories, non-immersive virtual reality, semi-immersive virtual reality, and full immersive virtual reality. From the categories of virtual reality, non-immersive virtual reality has been chose for this project. A non-immersive virtual reality walkthrough application will be built. This walkthrough application will focus on the Faculty of Information and Communication Technology, Kolej Universiti Teknikal Kebangsaan Malaysia, for its future building that will be built in the permanent campus. It needs to be visualized although it has no being developed yet. The propose of the Walkthrough Application of this building is to help the administration of the faculty and other parties to experience the true intent of the proposed building design in more realistic way, which is in Virtual Environment. The administration of the faculty will fine that the walkthrough application will help them in promoting the facilities of the faculty for example in an Education Exhibition. Beside the walkthrough application, the project that will be built also enable the administration to plan on how to facilitate office furniture in that building. In doing so, the walkthrough application will be added with extra feature which is office planner. This extra feature is going to be combined with the walkthrough application and differ it from other existing application.

Abstrak

Kegunaan komputer dalam masyarakat memberikan faedah yang begitu banyak. 'Reality Maya', satu kaedah baru untuk berinteraksi dengan komputer dipersembahkan dan kelebihan serta kekurangannya akan diambil kira. Aspek kemanusiaan perkomputeran dan komputer dalam bentuk yang lain dari kenyataan kebiasaan akan dibangunkan. Realiti Maya boleh dipecahkan kepada tiga kategori, realiti maya tidak imersif, realiti maya separa imersif, dan realiti maya imersif sepenuhnya. Daripada kategori yang telah dinyatakan, realiti maya tidak imersif telah dipilih untuk projek ini. Satu 'Walkthrough' realiti maya tidak imersif akan dibina. Aplikasi 'Walkthrough' ini akan menumpukan kepada bangunan Fakulti Teknologi Maklumat dan Komunikasi, Kolej Universiti Teknikal Kebangsaan Malaysia di kampus tetap yang masih dalam pembinaan. Tujuan aplikasi 'Walkthrough' ini adalah untuk membantu pentadbiran fakulti dan pihak lain untuk merasai pengalaman bentuk sebenar bangunan yang akan dibina nanti dengan cara yang lebih realistik, iaitu 'Virtual Environment'. Aplikasi ini dapat membantu pihak fakulti dalam mempromosikan fakulti itu sendiri kepada pihak luar walaupun bangunan di kampus tetap masih belum siap. Di samping itu, ia dapat membantu pihak pentadbiran dalam usaha untuk menyusun kelengkapan di bangunan itu dengan adanya 'Office Planner' juga membezakannya dengan aplikasi yang lain.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

PSM	-	**Projek Sarjana Muda**
KUTKM	-	**Kolej Universiti Teknikal Kebangsaan Malaysia**
VR	-	**Virtual Reality**
VE	-	**Virtual Environment**
EON	-	**Interactive 3D and Virtual Reality Software from EON Reality, Inc**
VRML	-	**Virtual Reality Modeling Language**
OpenGL	-	**Programming interface mainly for 3D Applications**
API	-	**Application program interface**
CAD	-	**Computer Aided-Design**
3ds	-	**3D Studio Max**
IFIP	-	**International Federation for Information Processing**
MIT	-	**Massachusetts institute of technology**
PLM	-	**Product Life Cycle**
ArchiCAD	-	**Building design software**
MDM	-	**Multimedia Design Model**
CSG	-	**Constructive Solid Geometry**
NURMS	-	**Non-Uniformal Rational MeshSmooth**
DXF	-	**Data Exchange File**

CHAPTER I

INTRODUCTION

1.1 Project Background

KUTKM's permanent campus is currently under construction on a 725-acre site at Bukit Senandung I and II, Mukim Durian Tunggal in the district of Alor Gajah. The ground breaking ceremony of the new campus was officiated by the then Prime Minister Tun Dr. Mahathir Mohamad on 25th January 2002. The RM600 million campus is being constrcuted in two stages by a consortium comprising of Kumpulan Melaka Berhad, Putera Perdana & Cobrain (KKPC).

The first phase of the permanent campus development costing is expected to be completed in 2005. The permanent campus is expected to be fully constructed by 2010. Among the faculties' building that has not been completed yet is the building of Faculty of Information and Communication Technology. It is hard for others to witness or imagine the building that has not being built yet, so this project is developed to overcome the problem. It will accommodate unanticipated questions on specific areas of proposed developments, in this case the building of Faculty of Information and Communication Technology. Now all parties can experience the true intent of the proposed building design before any on-site work is started.

Beside that the administration of the building can plan on how to facilitate the building for example with office furniture using the Office Planner which also will be developed. The walkthrough will start from outside the building and will continue into the faculty's building and for beginnings it will only focus on ground floor. The interactions of the user to this walkthrough are via keyboard or mouse and it is design to suite desktop presentation. The virtual reality that is going to be built is also a non-immersive.

There is no project yet has been built to represent the faculty's building and this "Walkthrough Application of Faculty of Information and Communication Technology's Building in the main campus at Durian Tunggal and Planner Application for the facilities inside the building" is developed as a pioneer in representing the faculty's building in Virtual Environment. The main purpose of this project are to develop a virtual walkthrough using EON technology rather than using VRML or C++ programming language with OpenGL library and the subject of this project is the building of the Faculty of Information and Communication Technology of Kolej Universiti Teknikal Kebangsaan Malaysia.

1.2 Problem Statement(s)

This project is performed due to some of the problems that have been discovered, and the way to solve the problem is by developing this project. Described below are the problems that have encountered that caused the development of this project and how they will be solved with the implement of the project.

Firstly the subject or the model that will be used in this walkthrough application is the building of the Faculty of Information and Communication Technology, Kolej Univesiti Teknikal Kebangsaan Malaysia. The development of the faculty's building in the main campus is not completed yet. The only source to the building is according to

the plan. Only person with the knowledge of architecture can read the plan and imagine the proposed building before it being completed. It is hard for other parties especially the administrator of the faculty to see or imagine their future building and to plan on how to facilitate the building with its furniture. So this proposed walkthrough application will help the administrator to complete their task on planning the coordination of the office furniture long before the development of the real building will be completed. In this project, user can walk through the proposed building in a non-immersive virtual reality, using desktop and interaction using keyboard or mouse. Beside that, user also can plan on arranging office furniture using the Office Planner that also going to be developed. It will give the new experience to the user on viewing the proposed development of the building as well as planning the facilities or furniture coordination which has not being developed before.

There are three techniques for building 3D models. The first technique is by using scripting language, e.g., Virtual Reality Modeling Language or (VRML). The second technique is by using Virtual Reality (VR) authoring tools which additional tools that can perform such task for example Cosmo World from SGI. The third technique is by using conversion program such as CAD or Computer-Aided Design. Every technique has its own advantages and disadvantages. The most common problem occur, is the polygon reduction. Many of the models that create with the help of 3D modeling tools, as well as some models converted from CAD or 3ds Max software can be very complex. These models may consist many hundred thousand polygons and are practically useless for processing in real-time visualization. Reducing the polygons can help in reaching the optimal balance between the necessary details level and the size of 3D models and decrease the real-time visualization processing. This project is using the third technique which is the conversion program by using 3ds Max. The problem occurs is tried to be solve by using new software which is EON Reality from EON technology to construct the virtual environment. For the 3D models of the faculty's building, they will be design in 3D Studio Max and will be converted and imported into the VR authoring tool which is EON Reality. By using this method, it makes a major contribution to the reconstruction of virtual environments where lots of modeling intense will be reduced.

When it is completed, it also can be placed on a desktop at the lobby of the faculty's building to educate the visitor about safety precaution on the building.

1.3 Objective(s)

Like many other projects, this project is developed to achieve certain objectives that are very important to make sure the project will be meaningful and will benefit to others. In this case the project is hopefully help the administration of the Faculty of Information and Communication Technology to visualize the faculty's building. The project also will contribute in educational value especially in 3D modeling and Virtual Reality, as the one of the element in developing the project is doing research on 3D modeling and polygon reduction to help for processing in real-time visualization. The objectives are:

- To provide a tool for exploring a non-completed building(ground floor only).
- To provide an Office Planner, in planning the facilities inside the building(ground floor only).
- To study the polygon reduction on 3D model by using the EON Reality software.

i. To provide a tool for exploring a non-completed building(ground floor only)

The Walkthrough Project aims at providing a tool in which virtual buildings, Designed but not yet constructed, can be explored by "walking through" them in the same way that simulated airplanes "fly" over virtual terrain. The object is not training, as it is with flight simulators, but visualization to permit the architect to "prototype" a building and to iterate with the client on the detailed desire data for

it. In this case the client is the administration of the Faculty of Information and Communication Technology Kolej Universiti Teknikal Kebangsaan Malaysia. As a starter the detail of building will only be in the ground floor only.

ii. To provide an Office Planner, in planning the office facilities inside the building(ground floor only)

The Walkthrough Project is also developed with an Office Planner which can be done using the EON Reality software. The planner will help the administration of the faculty to create a whole new virtual office plan. This is important to the administration to make an early planning even before the actual building is completed. So they can save a lot of time on planning the office coordination. This is function also is going to be in the first floor only.

iii. To study the polygon reduction on 3D model by using the EON Reality software

This project is develop in other words to implement a research on polygon reduction, in this case by using the new software which is EON Reality with its own polygon reducer. The original creation of polygon models is still a difficult task that often consumes a tremendous amount of time. Polygon reduction is very important so that the processing of real-time visualization can be performed lower time and to maintain a good frame rate in 3D interactive programs by rendering objects using fewer polygons.

1.4 Scopes

This project is a non-immersive Virtual Reality, in addition to the immersive variety so far described Virtual Reality also comes in a so-called "non-immersive" form. Here the visual aspects of the computer generated VR environment are presented not through helmet mounted displays but on a conventional computer monitor or projected

onto a screen. In a non-immersive system, the person is outside the VE, looking (or listening) in and seeing it as a scale model. The person controls his/her movement within the environment by means of a joy stick or other control device such as keyboard or using mouse. In this project user, via a window as mentioned before can walk through and explore the building's 3D model in real-time. The 3D model will represent the actual environment and location of the Faculty of Information and Communication building which its development is still in progress. The target users of this system are:

- Administration of Faculty of Information and Communication Technology.
- Administration of Kolej Universiti Teknikal Kebangsaan Malaysia.
- Students of Faculty of Information and Communication Technology.
- Organization or individuals which interested in Faculty of Information and Communication Technology.

This walkthrough system will give the user a new experienced to the actual scene of the Faculty of Information and Communication Technology building using virtual reality concept. However this walkthrough system still has its weakness, where all users must have a basic knowledge to use the computer or desktop system which will be the input device for the Virtual Reality walkthrough. As a new walk through application also, still lot of improvement can be done to the modeled and the environment inside the walk through application. The walkthrough application will only gives detail in the ground floor only. So as a further development, works will focus on other floor. The navigations in the walkthrough application are also restricted to the movements that can be developed in EON Reality software.

1.5 Project Significance

Every project has its own significance. This project, with its own significance, will give benefits to the end user of the Walkthrough Application. As for the administration of Faculty of Communication and Technology, they will have a great tool in helping them to explore the building long before the development is being completed. It will allows them to navigate from the outside environment of the building and move to the inside area or space to see the architectural design. In other aspect, the Office Planner will help the administration to design the office plan with the 3D model facilities without spending a lot of time. Compare when planning on the real building which is not even completed yet and acquire a lot of time arranging the real furniture, using the Office Planner is much better. As it is big building the walkthrough application for starting, will focus on the ground floor only. The rest of the building will not as detail as the ground floor.

To those who want to search for laboratory or lecturer rooms, the Walkthrough Application will guide them to the places or rooms they want to go because the walkthrough itself enable the user to navigate through and around the faculty's building when user use the input device.

This project as stated earlier will be developed for desktop system and is a non-immersive Virtual Reality. This method or ways to develop the Virtual Reality Walkthrough is much cheaper rather than developing an immersive Virtual Reality. This is because there are no expensive hardware needed for example the data glove or the head mounted display which cost thousand. These hardware are usually used for immersive Virtual Reality, and give the sense to the eye or hand as reflection to the virtual environment. For this kind of walkthrough application, its better to develop a non-immersive Virtual Reality, because cheaper budget is needed, furthermore the project is a new creation, and as a benchmark to move in developing an immersive Virtual reality.

1.6 Conclusion

The "Walkthrough Application of Faculty of Information and Communication Technology's Building in the main campus at Durian Tunggal and Planner Application for the facilities inside the building" is a newly create project that need to a lot of research and guidance from existing project or at least which involve Walkthrough Application in Virtual Reality.

Derived from the problems that have been identified, this project is developed to overcome all the problems that being stated earlier. The focus is on producing a Walkthrough Application that can help the Faculty of Information and Communication Technology in promoting its propose building as well as planning its office. Beside that, as a tour guide for the visitor who visit the building. In other words the Walkthrough Application is hopefully will benefits to the intended user and accomplish the expected result as stated in the scope of the project.

The project also will be developed using new software which is EON Reality and certain aspect are very important here such as whether the software can hold a lot of polygons or not and whether it can perform polygon reduction on 3D models to ease the rendering process of the Virtual reality Application. The decision to build a non-immersive Virtual Reality is made because to suit with the outcome of the project that will be running on desktop systems or can be inserted to a CD.

In the next chapter, the contents are mostly on the literature review of the project, which will support the concept of the development of the project with words and statements on previous or existing project. Also will be describe are the methodology, project requirement and the schedule and milestones of the project.

CHAPTER II

Literature Review and Project Methodology

2.1 Introduction

In most research or projects literature review is the most important part in the paperwork. For this project's report this part also plays a crucial role in adding value to all those papers that have been read, where explanations on how the many apparent ideas of others gathered from many disparate sources have led up to and have contributed to the research problem. Here, in this literature review, certain factors will be high lighted to support the reason for the development of this project and the value that will be uncovered by doing the research problem.

This chapter will contain the description about Virtual Reality, Walkthrough System and Office Planner. Also describe here in this chapter is about immersive Virtual Reality and non-immersive Virtual Reality. Furthermore is about the EON software and what it can do in reducing polygons of 3D models and how crucial is polygon reduction in Virtual Reality. Then, the selected approach or methodology used in developing this project which describes the activities that will be done in every stage are also going to be explained in this chapter.