3D VIRTUAL SEIT (BLOCK A)
SECOND, THIRD AND FOURTH FLOOR

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DECLARATION

The materials in this thesis are original except for quotations, excerpts, summaries and references, which have dully acknowledged.

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ABSTRAK

3D VIRTUAL SEIT
(BLOCK A — SECOND, THIRD AND FOURTH FLOOR)

Tujuan utama projek ini adalah untuk membina satu sistem yang bertajuk 3D Virtual School of Engineering and Information Technology (SEIT) – Blok A. Sistem ini membenarkan sesiapa yang berminat untuk mengetahui lebih lanjut mengenai Sekolah Kejuruteraan dan Teknologi Maklumat (SKTM) serta struktur bangunannya. Sistem ini membenarkan para penguna melihat SKTM – blok A yang berada dalam Universiti Malaysia Sabah dalam 3 dimensi dengan lebih teliti dan realiti. Para pengguna boleh melihat dan mengelilingi SKTM melalui Internet dan berpeluang melihat dengan lebih teliti. Sistem ini dibina dengan menggunakan perisian Virtual Reality Modeling Language (VRML) dan 3D Studio Max. Sistem ini boleh dilihat dengan menggunakan Cortona VRML Client. Animasi dalam sistem ini dibina menggunakan VRML skrip. Laporan ini menerangkan penghasilan tingkat dua, tiga dan empat dalam bangunan SKTM. Sistem ini boleh dikembangkan lagi pada masa depan dengan menambahkan blok-blok lain yang berada dalam SKTM, atau lebih-lebih lagi seluruh universiti.

ABSTRACT

3D VIRTUAL SEIT
(BLOCK A — SECOND, THIRD AND FOURTH FLOOR)

The main objective of this final year project is to create a virtual 3D of School of Engineering and Information Technology (SEIT) – Block A in University Malaysia Sabah. The system provide a basis for a school-wide virtual tour, with the 3D represented graphic. Users can have a better view of SEIT in a virtual reality, without coming to SEIT in person. The system was created using Virtual Reality Modeling Language (VRML) and 3D Studio Max. The system can be viewed with Cortona VRML Client and the animation behavior of the system was controlled in VRML script. This report explains the development for the second, third and fourth floor of block A SEIT. The system can be improved in the future by adding other block in the SEIT or even the whole university.

LIST OF ABBREVIATIONS

2D	Two Dimensions
3D	Three-Dimensional
AIFC	Audio Interchange Format File with Compression
AIFF	Audio Interchange File Format
API	Application Programming Interface
AU	Audio Units
AVI	Audio Video Interleave
BMP	Bitmap File
CAD	Computer-Aided Design
CD-ROM	Compact Disc Read-Only Memory
EAI	External Authoring Interface
ENGIT	Engineering and Information Technology
fps	Frames Per Second
FTP	File Transfer Protocol
GIF	Graphics Interchange Format
GUI	Graphical User Interface
HTML	Hypertext Markup Languages
HUD	Head Up Display
IICM	Institute for Information Processing and Computer-Supported New Media
ISO	International Organization for Standardization
JPEG	Joint Photographic Experts Group
Kbps	Kilobit Per Second
LOD	Levels of Detail
MIDI	Musical Iinstrument Digital Interface
MPEG	Moving Picture Experts Group
MPEG-4	Moving Picture Experts Group-Four
NTU	Nanyang Technological University
NURBS	Non-Uniform Rational B-Spline
PC	Personal Computer

PNG	Portable Network Graphic
RAS	Random Audio Sequencer
RGB	Red Green Blue
SEIT	School of Engineering and Information System
SGI	Silicon Graphics, Inc
SIM	Systems in Motion
T&L	Textures & Lighting
TCP/IP	Transmission Control Protocol/Internet Protocol
UCLA	University of California, Los Angeles,
UMS	University Malaysia Sabah
UMSINTEC	University Malaysia Sabah Information Technology
URL	Uniform Resource Locator
UV	Ultraviolet
VRML	Virtual Reality Modeling Language
VRMLview,	Virtual Reality Modeling Language view
VRwave	Virtual Reality Wave
WAV	Wave

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The project is all about letting people from all around the world that are interested in getting to know more of School of Engineering and Information System (SEIT), University Malaysia Sabah (UMS) when visiting the university's website. The idea is to let people knowing more and better about SEIT in a quicker, more interesting and realistic way in the form of three-dimensional (3D) representation instead of in the static form of pictures and text.

People can get the chance to look into SEIT more clearly in a virtual way. They can get inside the building to get a closer look at the building, with this way they can see clearly enough the whole building including outside and inside of the building. Inside the building, people can see the inside structure of the building. They have the chance to see things inside include the lecturer's room, tutorial room, laboratory, and even toilet.

In this 21st century, with the mass storage capability and computing power, representation in 3D format is more appealing and realistic. 3D representation is applied in various field including games, movies, modeling, simulations, terrain mapping and so on. This inspired the idea of doing the project in 3D. The project is called as 3D virtual SEIT (Block A). Compared with the one currently available in SEIT with only 2D surface in the form of pictures and text, a 3D system is more interesting.

1.2 Problem Background

Basically there are two normal ways to get to know about SEIT and how SEIT looked like. One way is though SEIT website and find out about SEIT with the system of navigating in the form of 2D map. Another way is simply come to SEIT.

SEIT is located in University Malaysia Sabah (UMS), one of the local universities in Malaysia in Kota Kinabalu, Sabah. Some people come to know UMS when there is an education fair, or through UMS website.

Normally people who are interested in knowing and coming to SEIT are the new students of UMS and perhaps the parent. Students interested in getting know SEIT because SEIT may become their studying institution in the future. Parent getting to know SEIT to get a clear vision on the place, whether it is a good place to study.

Normally people will browse to the SEIT website in order to know SEIT. It is a easiest way compared to the others. Information about SEIT easily be obtain in the website.

1.3 Problem Statement

In SEIT, the previous system of navigating is in the form of 2D map with legend. The main problem with the 2D map is that the map cannot represent the 3D reality view of SEIT.

The project is done by only provide information about SEIT in text and pictures. Sometimes with only words, the information provided cannot reach and achieve thel objectives or send out the correct massage. Words cannot give a reality vision of SEIT to people. People sometimes get confused with what they read as people always tend to believe on the things they saw with their own eyes rather than the things that they can only read in words.

The previous system does have some pictures to support the text written. With these photos or pictures, it can let people to have a look of the campus. But this is not enough, picture is a just a picture, nothing special or interesting enough. A picture does not have any movement or motion; it does not look interesting enough.

With the 3D virtual SEIT, people can have a look of SEIT in a realistic way. They can have the chance to ready look into SEIT in the system, this way people can have a better view of SEIT using the system. People can go around SEIT, going in any direction using their keyboard. They can go in and out or up and down in any direction in SEIT by just pressing the arrow key in the keypad.

Another way to look clearly in SEIT is to come to SEIT but this is a problem for some people. For those who live far away from SEIT, is very difficult for them to come to SEIT. This takes time, and even money. Usually most of the people who are interested in SEIT are student, but it would be a problem to come to SEIT, especially for those who live far away for SEIT. With the project - 3D VIRTUAL SEIT (BLOCK A), now they don't

have to come to SEIT in order to know SEIT. Simple and easy, just go online to the SEIT website, SEIT will be there to be seen.

1.4 Objectives

1. Develop a 3D virtual SEIT using VRML v2.0 and 3D studio max v7.0.
2. To visually represent the area of SEIT Block A in 3D representation.
3. To provide alternative way of touring in SEIT.

1.5 Project Scopes

Scopes of this project include

- Covering only Block A of SEIT

  This project covers only Block A of SEIT, so School of Food Science and Nutrient is not include. But still it will be seen in the project, but none information about it will be included. In this report, only second, third and fourth floor will be covered.

- Online based

  This outcome of this project can be putting into the school's website and need to be view with VRML viewer or plug-in.

- VRML v2.0 and 3D studio max v7.0

  VRML v2.0 is an acronym for the Virtual Reality Modeling Language. Basically, it is a 3D interchange format that provides a specification for the description of three-dimensional space, a scene corresponding to reality or completely imaginary and conceptual (McAndless, *et al*, 1996). While 3D studio max v7.0 is tool used to draw the 3D graphic in the project.

1.6 Organization of the Report

Chapter 1 briefly discussed on outlines the project by giving introduction of the project. This chapter will also discuss on the problem statement and problem background of the project. The objectives and scope will also be mentioned. Finally chapter 1 included an

organization of the report that briefly explaining on the content to be covered for each chapter of the report.

Chapter 2 is on literature review. This chapter reviews on the tools and technologies for virtual reality prototyping, technologies for 3D graphics development, technologies for VRML browsers and existing systems that looks similar to the project. Comparison made on the existing systems by comparing on the functions.

Chapter 3 is on methodology. The chapter reports approaches and overall framework taken in building up the project. Methodology also contains the techniques use to applied in the design and implementation of the project. This chapter also contains the approaches used and the software and hardware specifications.

Chapter 4 is on system analysis and design. The chapter is discussing on system design, user interface design, drawing the building blueprints, and related algorithms of the project. Class diagram will be included.

Chapter 5 is discussing on the implementation of the program. This is where the interfaces and also the guidelines on using the program are being show. Screenshots are included as well, and also type of testing performed and testing results.

Chapter 6 is on the testing phase. A few type of testing can be done such as testing on functionality, structural, contents and others.

Chapter 7 is on conclusion and future works. This chapter summarizes the project and results obtained. The limitations and recommendations of the project for future works are included and mentioned.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter consists of several sections. The first section is tools and technologies for virtual reality prototyping. This section describes the tools and technologies for virtual reality prototyping like Open Inventor, VRML and Java, Java3D, WorldToolKit and WorldUp, CYBELIUS TouchMore! and CyberToolBox. This section also discusses about the advantages and limitations for each tools and technologies. The second section describes the technologies for 3D graphics development. The 3D graphic software are Alias Maya, Discreet 3D Studio Max, Autodesk AutoCAD, NewTek Lightwave 3D. It also discusses about the features for the 3D graphic software. The third section is technologies for VRML browsers. In this section, it describes the technologies for VRML browsers like CASUS Presenter, Community Place, Cosmo Player, Cortona VRML Client, VRMLview, VRware, WorldView and Blaxxun Contact. This section also discusses about the features for the VRML browsers. The fourth section describes the 2-dimension and 3-dimension techniques with the advantages and limitations of the 2D and 3D techniques. The last section reviews on the existing systems that look similar to the project. Comparison are made on the existing systems by comparing on the function of each existing systems, tools and technologies for virtual reality prototyping, technologies for 3D graphics development and technologies for VRML browsers. This section also describes the history of each existing systems.

2.2 Tools and Technologies for Virtual Reality Prototyping

There are varieties of technologies that are normally applied for the development of 3D graphics. Those technologies include Open Investor, Virtual Reality Modeling Language (VRML) and Java, Java3D, WorldToolKit and WorldUp, CYBELIUS TouchMore!, and CyberToolBox. The background, functions, advantages and disadvantages of those technologies are compared.

2.2.1 Open Inventor

Open Inventor is available for several platforms, most notably for Silicon Graphics workstations, which was originally developed, and also for PC. Open Inventor and other products based on it are represented by Template Graphics Software. Open Inventor is a library of objects and methods used for creating interactive graphic applications. It defines a file format and an application programming interface (API) for 3D. The basic idea is to create 3D objects and to store these objects as a hierarchical tree in a scene database. These objects are called nodes and they represent geometries, materials, translations and behavior of 3D objects (Wernecke, 1994).

The behavior of nodes is written in them and it is possible to create functional 3D models by extending these nodes. Since Open Inventor is a C++-based class library, extending means that functional nodes are created by deriving existing nodes and adding or replacing methods in them. By using Open Inventor, it is possible to create a virtual reality prototyping environment the supports heterogeneous virtual reality prototypes (Wernecke, 1994).

One of the benefits of Open inventor are that enables the use of various virtual reality input devices, including stereo viewing, haptic rendering and data gloves. In addition, Open Inventor has its specific file format; while the latest versions support also VRML97. The extendibility of Open Inventor can be regarded as a further benefit (Harri Kyllonen, 1999).

Open Inventor has some weaknesses. One of them is being the authoring tools, which are not very good. The Open Inventor file format is not very well supported, either. To be able to use the files by means of another system, the files have to be converted, possibly even several times. Furthermore, Open Inventor and C++-based virtual reality prototypes are highly platform and operating system dependent. Integration with Java applications and APIs has proven difficult and problematic. Thus Open Inventor is not suitable for Internet use. Finally, the license fees are also not likely to make Open Inventor a more tempting choice (Harri Kyllonen, 1999).

REFERENCES

"3D Studio Max" in http://www-personal.umich.edu/~emdanat/Tutorials/3DSMax/. Accessed on 5/9/2005.

"About Blaxxun Contact" in http://developer.base.com/html/. Accessed on 13/9/2005.

"Basic Concepts" in http://courses.home.att.net/autolisp/aconcept.htm. Accessed on 1/8/2005.

"Bringing 2D Interfaces into 3D Worlds" in http://people.cs.vt.edu/~bowman/3dui.org/course_notes/siggraph2001/2dto3d.pdf. Accessed on 25/8/2005.

"Cortona VRML Client-Complete Web3D viewer" in http://www.parallelgraphics.com/products/cortona/. Accessed on 13/8/2005.

"Creating an Interactive 3D Product Using VRML" in http://www.virtualrealms.com.au/vrml/tute01/tutorial.htm. Accessed on 11/9/2005.

"External authoring interface" in http://www.web3d.org/x3d/specifications/vrml/ISO-IEC-14772-IS-VRML97WithAmendment1/. Accessed on 5/9/2005.

"Functional specification and UTF-8 encoding" in http://www.web3d.org/x3d/specifications/vrml/ISO-IEC-14772-IS-VRML97WithAmendment1/. Accessed on 25/8/2005.

"Image Viewers, Conversions, and Manipulation" in http://ceu.fi.udc.es/SAL/E/5/VRMLVIEW.html. Accessed on 27/9/2005.

"LightWave's Future: The Development Model" in http://www.newtek.com/lightwave/lwfuturedev.php. Accessed on 27/9/2005.

"On-line UCLA Virtual Campus" in http://oldcda.design.ucla.edu/CAAD/worlds.html. Accessed on 11/9/2005.

"Previous work on the navigation controls" in http://faculty.uaeu.ac.ae/~hazem/chapt2.doc. Accessed on 25/8/2005.

"The Maya Family" in http://www.alias.com/glb/eng/products-services/family_details.jsp?familyId=3900009. Accessed on 27/9/2005.

"VRML Browsers" in http://www.agocg.ac.uk/train/vrml2rep/part1/guide2.htm#heading16. Accessed on 3/9/2005.

Arno Schäfer. 1997. *A Java-based VRML 2.0-Browser: CASUS Presenter*. Thesis Institution of Computer Graphic.

Carey R & Bell G. 1997. *The Annotated VRML2.0 Reference Manual*. Reading: Addison-Wesley Publishing Company.

Eckel B. 1998. *Thinking in Java*. New Jersey: Prentice Hall Incorporated.

Fabiana Saldanha Tamiosso, Alberto Barbosa Raposo & Leo Pini Magalhes. 1998. *Building Interactive Animations using VRML and Java*. Thesis University of Waterloo.

Harri Kyllonen. 1999. *Framework for Developing VRML-Based Virtual Prototypes*. Thesis University of Oulu.

Lin Jia Wen, Teo Hwee Seong & Tan Pee Loon. 2004. *Virtual Campus of NTU*. Thesis University of Nanyang Technological.

Ming Kwong Ti, Chiang Oon Tan & Chong Hang Ieong. 1997. *Virtual Campus-The University of New South Wales*. Thesis University of New South Wales.

Rodger Lea, Kouichi Matsuda & Ken Miyashita. 1996. Java for 3D and VRML Worlds. Indianapolis: New Rider Publishing.

Rushforth K, Deering M & Sowizral H. 1997. *The Java 3D API Specification*. Reading: Addison-Wesley Publishing Company.

Wernecke J. 1994. *The Inventor Mentor: programming Object-oriented 3D graphics with Open Inventor*. Reading: Addison-Wesley Publishing Company.