

**3D VISUALIZATION OF CPU COMPONENTS:
A DESKTOP VR APPLICATION**

A thesis submitted to the Graduate School in partial fulfilment of the requirements
for the degree Master of Science (Information Technology);
Universiti Utara Malaysia

By

Suzana Zambri

© Suzana Zambri, 2003. All rights reserved



Sekolah Siswazah
(Graduate School)
Universiti Utara Malaysia

PERAKUAN KERJA KERTAS PROJEK
(Certification of Project Paper)

Saya, yang bertandatangan, memperakukan bahawa
(I, the undersigned, certify that)

SUZANA BINTI ZAMBRI

calon untuk Ijazah Sarjana Sains (Teknologi Maklumat)
(candidate for the degree of)

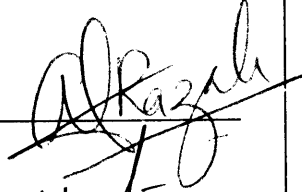
telah mengemukakan kertas projek yang bertajuk
(has presented his/her project paper of the following title)

3D VISUALIZATION OF CPU COMPONENTS : A DESKTOP VR APPLICATION

seperti yang tercatat di muka surat tajuk dan kulit kertas projek
(as it appears on the title page and front cover of project paper)

bahawa kertas projek tersebut boleh diterima dari segi bentuk serta kandungan dan meliputi bidang ilmu dengan memuaskan.
(that the project paper acceptable in form and content and that a satisfactory knowledge of the field is covered by the project paper);

Nama : Assoc. Prof. Dr. Abdul Razak Yaakub
(Name) (Penyelia Utama/Principal Supervisor)

Tandatangan : 
(Signature)

Nama : Encik Rusliizam Daud
(Name) (Penyelia Kedua/Second Supervisor)

Tandatangan : 
(Signature)

Tarikh : 8/6/2003
(Date)

**GRADUATE SCHOOL
UNIVERSITI UTARA MALAYSIA**

PERMISSION TO USE

In presenting this thesis in partial fulfilment of the requirements for a post graduate degree from the Universiti Utara Malaysia, I agree that the University Library may make it freely available for inspection. I further agree that permission for copying of this thesis in any manner, in whole or in part, for scholarly purposes may be granted by my supervisors or, in their absence, by the Dean of the Graduate School. It is understood that any copying or publication or use of this thesis or parts thereof for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to Universiti Utara Malaysia for any scholarly use which may be made of any material from my thesis.

Requests for permission to copy or to make other use of material in this thesis in whole or in part should be addressed to:

**Dean of Graduate School
Universiti Utara Malaysia
06010 UUM Sintok
Kedah Darul Aman**

ABSTRAK

Potensi teknik reality maya seperti *Desktop VR* dan visualisasi tiga dimensi semakin meningkat dalam bidang pendidikan. Dengan kemajuan sistem *computer-aided design*, menggantikan model fizikal dengan model digital adalah tidak mustahil. Pada masa kini, berlaku masalah dalam menyediakan peluang secara praktikal dalam menyampaikan subjek-subjek teknikal. Objektif kajian ini adalah untuk memperkenalkan konsep *Desktop VR* bagi mengatasi masalah ini dan mengkaji potensi-potensi yang sedia ada bagi perisian AutoCAD2000, 3DStudio MAX R3.1 dan Cortona VRML Player dalam menghasilkan kesan visualisasi tiga dimensi. Dalam kajian ini, satu aplikasi *Desktop VR* akan dibangunkan. Satu permodelan Unit Pemprosesan Utama (CPU) tiga dimensi akan dibangunkan bertujuan memberi pemahaman kepada pengguna mengenai komponen-komponen di dalam CPU. Metodologi yang digunakan ialah Kitar Hayat Pembangunan Sistem (SDLC). Daripada kajian ini, didapati ia mampu meningkatkan perasaan ingin tahu individu. Ciri-ciri perisian yang digunakan juga dikenalpasti. Visualisasi tiga dimensi yang dimodelkan dan dilakar akan membantu pengguna memahami kaedah memasang komponen-komponen CPU secara teknikal. Adalah diharapkan teknologi reality maya akan diperluaskan dalam bidang pendidikan.

ABSTRACT

There has been a steady increase in the potential for virtual reality techniques such as Desktop VR and three dimensional (3D) visualization for many education applications. With the development of computer-aided design systems, it has become possible to supplement or replace physical models with digital models. Currently, it is difficult to provide hands-on practical that are important for many of the technical-based subjects. The objective of this project is to introduce the concept of Desktop VR and to investigate the potential of using AutoCAD2000, 3DStudio MAX R3 and Cortona 3D Studio Max in three dimensional visualisation effects. This project will develop a Desktop VR application. A three dimensional modeling of Central Processing Unit (CPU) components is developed as a mean to educate people on CPU components. The methodology used in developing the three dimensional visualization model is System Development Life Cycle (SDLC). From this project, it is found that the three dimensional visualization of CPU can stimulate a person's curiosity. The features of the software(s) that are being used in this project are identified. The three dimensional visualization which been modeled and drawn will allow students to understand the technical method of CPU assembly. It is hoped form this project, VR technology can be associated with education field in future.

ACKNOWLEDGEMENTS

I would like to thank :

My supervisors, Ass. Prof. Dr. Abdul Razak Yaakub and Encik Ruslizam Daud for their guidance, constructive ideas and comments;

The lectures who have taught me in this programme;

My parents, Haji Zambri Mohamad Noor and Hajah Rahmah Abdul Rahman for their motivation, support and love that has helped me in completing this thesis. Not forgetting my brothers, Nizar Zambri, Razman Zambri and Syazali Zambri for their understanding.

My good friend, Justtina John for always by my side through thick and thin,

My friends, Mohd Fuad Latip, Tan Teck Eng, Syahida Hassan, Salwa Muda, Siti Faeizah Mohd Ali, Azliza Mohd Ali, Wan Noraini Abdul Latif, Irene Yong, Kamaliah Khamis for the ideas and never ending support,

And finally, for the individuals who have given me help throughout my university year.

TABLE OF CONTENTS

	PAGE
PERMISSION TO USE	i
ABSTRAK	ii
ABSTRACT	iii
ACKNOWLEDGEMENTS	iv
TABLE OF CONTENTS	v
LIST OF FIGURES	viii
LIST OF ABBREVIATIONS	x
LIST OF APPENDICES	xi
CHAPTER ONE : INTRODUCTION	
1.1 Introduction	1
1.2 Problem Statement	4
1.3 Objectives	5
1.4 Hardware and Software Requirements	5
1.5 Scope of Work	8
1.6 Expected Result	9
1.7 Summary	9

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction	10
2.2 Three Dimensional Visualization	11
2.3 Application in Three Dimensional Visualization	12
2.3.1 Assembly Process Visualization in Feature-Based Design For Assembly	12
2.3.2 Three-Dimensional Modeling of Complex Environment	15
2.3.3 Three-Dimensional Visualization on PDA	17
2.3.4 Engineering Design	21
2.4 Virtual Reality in Education	22
2.4.1 Puzzle World	26
2.4.2 Tree World	28
2.4.3 Distributed VR	28

CHAPTER THREE : METHODOLOGY

3.1 Introduction	30
3.2 Extrusions: 2-1/2D	33
3.3 Surface Generation	35
3.4 Solid Modeling	37
3.5 Model Display	37
3.6 Animation	38

3.7 Summary	40
CHAPTER FOUR : FINDINGS	
4.1 Findings	41
CHAPTER FIVE : DISCUSSION	
5.1 Discussion of Findings	52
CHAPTER SIX : CONCLUSION	
6.1 Conclusion	55
6.2 Limitations	57
6.3 Recommendation	58
REFERENCES	59
BIBLIOGRAPHY	64

LIST OF FIGURES

Number	Title	Page
Figure 2.1	The relationship of interface between VR and IMM	23
Figure 2.2	An interpretation of Thurman & Matoon's 3D Virtual Reality Classification	24
Figure 3.1	System Development Life Cycle	31
Figure 3.2	Development of 3D Visualization of CPU Components	32
Figure 3.3	An outline of CPU	34
Figure 3.4	3D shape of CPU	34
Figure 3.5	The components are being positioned	35
Figure 3.6	Generated Surfaces	36
Figure 3.7	CPU components in rendered display	38
Figure 3.8	Animation Toolbar	39
Figure 3.9	Time Configuration Window	39
Figure 4.1	Front view	42
Figure 4.2	Right view	43
Figure 4.3	Left view	43
Figure 4.4	Top view	44
Figure 4.5	Bottom view	44

Figure 4.6	Layers	45
Figure 4.7	Model in Layout panel	45
Figure 4.8	Four Different View	46
Figure 4.9	Four Different View in Closer Look	47
Figure 4.10	Top View	48
Figure 4.11	User View	48
Figure 4.12	Perspective View	49
Figure 4.13	Animation in Process	49
Figure 4.14	MAXScript Listener Window	50
Figure 4.15	Cortona VRML Player Window	51

LIST OF ABBREVIATIONS

CAD	Computer aided design
CD ROM	Compact disc read only memory
CPU	Computer processing unit
DFA	Design for assembly
HITL	Human Interface Technology Lab
HMD	Head mounted display
IIM	Interactive Multimedia
MOO	Multiple Object-Oriented
MUD	Multiple user dungeons (or dimensions)
PDA	Personal digital assistant
SDLC	System Development Life Cycle
VR	Virtual reality
VRML	Virtual reality modeling language
WoW	Window on World
3AV	Three dimensional assembly visualization
3D	Three dimensional

LIST OF APPENDICES

Number	Title	Page
Appendix 1	MAX Script	65
Appendix 2	History of AutoCAD Release	70
Appendix 3	The Computer Visualization and Forensic Illustration FAQ	113
Appendix 4	Virtual Reality: A Historical Perspective	118

CHAPTER 1

INTRODUCTION

1.1 Introduction

Educating current and future generation of students in this world to live in an information society is a critical issue. In Malaysian environment, it is compounded by recognizing the need to provide life-long education and to support the market of the workforce for the implementation of Multimedia Super Corridor Mission. Virtual reality (VR) technology has been widely proposed as a major technological advance that can offer significant support for such education.

There has been a steady increase in the potential for virtual reality techniques for many education applications. Numerous researchers such as Roussos, M. (1997) and Winn, W. (1993) have noted the potential of using virtual reality as an education tool. It is a powerful tool that provides a far more stimulating learning environment and will have profound impact on future shape of education (Jen Chen, C & Chee Siong, T., 1998).

The contents of
the thesis is for
internal user
only

REFERENCES

- Ames A., Nadeau D., & Moreland J. (1997). *VRML 2.0 sourcebook 2nd ed.* USA : John Wiley & Sons, Inc.
- Andreason, M., M., Kahler, S., Lund, T.,(1988,). *Design for assembly, 2nd ed.*. Springer :Verlag
- Bricken, W. (1990). *Learning in virtual reality*. Seattle: Human Interface Technology Laboratory Technical Report HITL-M-90-5.
- Bricken, M., & Byrne, C.M. (1993). Summer students in virtual reality: a pilot study on educational applications of virtual reality technology. In A. Wexelblat (Ed.), *Virtual reality applications and explorations*. Cambridge, MA: Academic Press Professional
- Cunningham, J.J. & Dixon, J.R. (1988). Designing with features: the origin of features.. *Proceedings ASME International Computers in Engineering Conference and Exhibition*, San Francisco: CA, pp. 237-43.
- Duarte J.P. and Simondetti A. (1997). Basic grammars and rapid prototyping, EG-SEA-AI Workshop '97, applications of artificial intelligence in structural engineering. *Proceedings of the Fourth International Conference on Rapid Prototyping*.
- Furness, T.A. (1989). *Configuring virtual space for the super cockpit*. Seattle: Human Interface Technology Laboratory Technical Report HITL-M-89-1

- Heim, M. (1993). *The metaphysics of virtual reality*. New York: Oxford University Press.
- Hedberg, J. & Alexander, S. (1994). Virtual reality in education: Defining researchable issues. *Educational Media International*, Vol. 31(4), pp. 214-220
- Jen Chen, C and Chee Siong, T. (1998). Design issues of desktop virtual reality educational applications. In H.M Khalid (ed). *Proceedings of VR 98 Conference*, Kuala Lumpur, Malaysia :Asean Academic Press Ltd, pp. 63-77
- Johnson, A, Hoffman, R., Osborn, J., Hebert, M. (1999). A system for semi-automatic modeling of complex environments. *IEEE proceedings of the International Conference On 3D Digital Imaging and Modeling (3DIM'97)*, pp. 213- 220
- Kim, C. & O'Grady, P. (1996). A representation formalism for feature-based design. *Computer-Aided Design*, Vol. 28 (6), pp. 451-60
- Lavroff, N. (1992). *The virtual reality playhouse*. Corte Madera, CA: Waite Group Press.
- Loeffler, C. E. & Anderson, T. (eds) (1994). *The Virtual Reality Casebook*. Van Nostrand Reinhold. New York.
- O'Grady, P., Kim, C., Kim, Y.(1996). Feature based design of electronics assemblies. *International Journal of Production Research*. Vol. 34(5), pp. 1307-1310.
- O'Grady, P., Oh, J-S., Mittal, R.(1996). Issues in feature-based design for assembly, *Engineering Design and Automation*. Vol.2(3), pp. 187-202.

- O'Grady, & P., Liang, W., Y. (1999). An object oriented approach to design with modules, *Computer Integrated Manufacturing Systems*. Vol.11(4), pp. 167-283
- Osberg & Kimberly M.(1995) virtual reality and education: where imagination and experience meet. *VR in the Schools* Vol. 1(2), pp. 1-3.
- Pratt, M.J., (1988), Synthesis of an optimal approach to form feature modeling, *Computers in Engineering*, Vol 1(2), pp.63-74.
- Pena-Mora F., Dwivedi G.H.(2002) .Multiple device collaborative and real time analysis system for project management in civil engineering. *Journal of Computing in Civil Engineering*,
- Roussos, M. (1997). MSc. Thesis Issues *.In the design and evaluation of a virtual reality learning environment*. University of Illinois, USA
- Shah, J.J., (1989). Philosophical development of form feature concept", *Proceedings of the NSF Engineering Design Research Conference, University of Massachusetts*, pp.317-32.
- Shah, J.J., (1991) Assessment of features technology. *Computer-Aided Design*, Vol. 23 (5), pp 331 43.
- Smith R. P. and Heim J. A. (1999), Virtual facility layout design: the value of an interactive three-dimensional representation. In Taylor & Francis (ed). *International Journal of Production Research*). Vol.37(17), pp. 3941-3957
- Stone, R (2001). Virtual reality for interactive training: an industrial practitioner's viewpoint. *International Journal of Human Computer Studies* Vol. 55 (4), pp. 699-711.

- Thurman, R. A. & Mattoon, J. S. (1994). Virtual reality: toward fundamental improvements in simulation-based training. *Educational Technology*. pp.56-64.
- Turoff, M.(1995).Designing a virtual classroom, *Proc. 1995 International Conference on computer assisted instruction..*
- Traub, D. (1994). The promise of virtual reality for learning. In Loeffler, C. E. & Anderson, T. (eds), *The Virtual Reality Casebook*. New York : Van Nostrand Reinhold.
- Tufte, Edward R.(1997). *Visual explanations*. Connecticut: Graphics Press.
- Whitten, J. & Bentley, L. (1998). *System analysis and design methods 4th ed.*USA : McGraw Hill
- Wilson, J.R., Cobb, S.V.G., D'Cruz, M.D., & Eastgate, R.M., (1996). *Virtual Reality for Industrial Application: Opportunities and Limitations*. Nottingham.: Nottingham University Press.
- Winn, W. (1993). Technical report *.A conceptual basis for educational applications of virtual reality*. University of Washington, USA
- Arc second pocketCAD. Available at <http://www.pocketcad.com> (13th January,2003)
- ATI imageon 100 .Available at <http://www.ati.com/technology/hardware/imageon100/index.html> (4th February,2003)
- Blaxxun. Available at <http://www.blaxxun.com/> (4th February, 2003)
- Gove, J. (1996). *VR and history - some findings and thoughts*. *VR in the schools*, 2(1), <http://eastnet.educ.ecu.edu/vr/vrits/2-1grove.htm> (19th December, 2002)

IBM microdrive. Available at <http://www.storage.ibm.com/hdd/micro/index.htm> (23rd December, 2002)

Loeffler, C. E. (1993). Distributed virtual reality: Applications for education, entertainment and industry. *Teletronikk*, 4. Available at http://www.nta.no/teletronikk/tema/nr4_93.html (19th Hanuary, 2003)

OQO corporation. Available at <http://www.oqo.com/> (9th March, 2003)

Scott, M. A. (1999). *Virtual reality as a tool for education*. <http://www.milleniumwave.com>

Pesce, M., Kennard, P. & Parisi, A. (1995). Cyberspace. <http://vrml.wired.com/concepts/>

Pocket Cortona, <http://www.parallelgraphics.com/products/cortonace/>

Potka, J. (1994). *Immersive tutoring systems: Virtual reality and education and training*. <http://alex.immersion.army.mil/>