3D VISUALIZATION OF CPU COMPONENTS:

A DESKTOP VR APPLICATION

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ABSTRAK

Potensi teknik reality maya seperti *Desktop VR* dan visualisasi tiga dimensi semakin meningkat dalam bidang pendidikan. Dengan kemajuan sistem *computer-uided design,,* menggantikan model fizikal dengan model digital adalah tidak mustahil. Pada masa kini, berlaku masalah dalam menyediakan pel uang secara praktikal dalam menyampaikan subj ek-subj ek teknikal. Obj ektif 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 Dekstop 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.

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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

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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 vitual 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. Conerence 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*. Notingham.: 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. *Telektronikk*, 4. Available at http://www.nta.no/telektronikk/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/

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