



Faculty of Cognitive Sciences and Human Development

**THE DEVELOPMENT OF A VIRTUAL REALITY (VR)-BASED  
SYSTEM FOR LEARNING BASIC PHOTOCOPYING  
PROCEDURES**

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QA  
76.76  
H94  
I755  
2009

Bachelor of Science (Honours)  
Cognitive Sciences  
2009

## BORANG PENGESAHAN STATUS TESIS

Gred: *K*

JUDUL : The Development of a Virtual Reality (VR)-based System for Learning Basic Photocopying Procedures

SESI PENGAJIAN : 2008/2009

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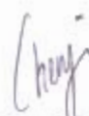
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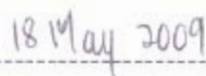
The project entitled 'The Development of a Virtual Reality (VR)-based System for Learning Basic Photocopying Procedures' was prepared by Ling Siew Hui and submitted to the Faculty of Cognitive Sciences and Human Development in partial fulfillment of the requirements for a Bachelor of Science with Honours (Cognitive Science)

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FOR LEARNING BASIC PHOTOCOPYING PROCEDURES**

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This project is submitted in partial fulfilment of the requirements for a  
Bachelor of Science with Honours  
(Cognitive Science)

Faculty of Cognitive Sciences and Human Development  
UNIVERSITI MALAYSIA SARAWAK  
(2009)

### Statement of Originality

The work described in this Final Year Project, entitled  
**“The Development Of A Virtual Reality (VR)-Based System  
For Learning Basic Photocopying Procedures”**  
is to the best of the author’s knowledge that of the author except  
where due reference is made.

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## ACKNOWLEDGEMENT

A special thank goes to my final year project supervisor Associate Professor Dr. Chen Chwen Jen. I greatly appreciate the dedication, comments, valuable time, and thoughtful ideas that she shared with me. My highest gratitude also dedicated to my final year project partner, Ting Lee Yi for making this project successful. Besides, I am also grateful to my seniors for their assistance and guide during the development of this project. Last but not least, I would like to thank my family members, friends and other who give me encouragement and moral support that lead to the completion of this project.

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## **ABSTRACT**

### **THE DEVELOPMENT OF A VIRTUAL REALITY (VR)-BASED SYSTEM FOR LEARNING BASIC PHOTOCOPYING PROCEDURES**

Ling Siew Hui

This project aims to develop a virtual reality (VR)-based system for learning basic photocopying procedures. The main purpose of this learning tool is to assist learners especially novice photocopier users to learn the basic photocopying procedures. This learning tool provides both demonstration and practice to the learners. Learners can interact actively with the virtual photocopier available in the virtual learning environment to construct their knowledge and understanding of the photocopying procedures. Developmental tools that were used in developing the learning tool are Rhinoceros 3.0, Internet Scene Assembler, Macromedia Dreamweaver 8 and Adobe Photoshop 7.0. Finally, some recommendations and future work are suggested to improve the learning tool.

## **ABSTRAK**

### **PEMBANGUNAN SISTEM BERDASARKAN REALITI MAYA UNTUK PEMBELAJARAN LANGKAH-LANGKAH ASAS FOTOKOPI**

*Ling Siew Hui*

*Projek ini bertujuan untuk membangunkan satu sistem berdasarkan realiti maya untuk pembelajaran langkah-langkah asas fotokopi. Tujuan utama sistem pembelajaran ini adalah untuk membantu pengguna terutamanya pengguna yang tidak berpengalaman dalam mesin fotokopi untuk mempelajari langkah-langkah asas fotokopi. Sistem ini mempunyai dua bahagian iaitu bahagian demonstrasi dan bahagian latihan. Pengguna-pengguna boleh berinteraksi secara aktif dengan mesin fotokopi maya di dalam persekitaran pembelajaran maya untuk membina pengetahuan dan pemahaman mereka terhadap langkah-langkah fotokopi. Perisian yang digunakan untuk membangunkan alat pembelajaran ini adalah Rhinoceros 3.0, Internet Scene Assembler, Macromedia Dreamweaver 8 dan Adobe Photoshop 7.0. Akhir sekali, beberapa cadangan dan kajian masa hadapan juga telah dikemukakan untuk memperbaiki sistem pembelajaran berkenaan.*

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.0 Overview**

This chapter introduces virtual reality and its applications as a tool for training. It also states the problem statement, the aims, the objectives and significance of this project.

#### **1.1 Background of the Study**

Virtual reality (VR) can be described as a computer generated three-dimensional (3D) environment which enables the users to immerse themselves in that 3D environment, and allow them to navigate through the environment and interact with the objects in real time within that environment by means of one or more control devices and involve one or more of their physical senses (Ausburn & Ausburn, 2004). VR is a 3D user interface in which the user can perform actions and experience their consequences. Unlike animation which only allows the user to replay set sequence where the user as a passive viewer, VR user can move around freely and interact with

the virtual object in a virtual environment where the user as an active participant (Balducelli & Louka, n.d).

The two keywords in the field of virtual reality are presence and immersion (Balducelli & Louka, n.d). A person can feel the presence in a virtual environment that similar to the real environment when he or she immerse into a computer generated environment (Balducelli & Louka, n.d). The presence is achieved if the virtual environment makes the person experience if he or she is really present at the real environment whereas the degree of immersion depends on what computer hardware are being used (Balducelli & Louka, n.d). There are three different kinds of VR system, which can be categorized by the hardware and software used.

The first type is desktop VR system. According to Backman *et al.* (1999) desktop VR system is by far the most common and least expensive compare to the other form of VR which typically consists of a standard desktop computer. This type of VR system produces less immersion feeling to the user. Mouse is usually used as input device in desktop VR system to select and manipulate objects as well as to choose menu options (Balducelli & Louka, n.d). Computer screen which is the output device is used as display medium and the user views the virtual environment on the computer screen (5DT, 2008). The user must look the screen the whole time in order to experience the virtual environment (5DT, 2008).

The second type is semi-immersive VR system, which typically consists of 3D graphics cards and software which can support stereoscopic display by using desktop display or suitable projector. When stereoscopic display is applied, the user needs to wear special glasses so that he or she can view the virtual environment with an enhanced sense of depth (Balducelli & Louka, n.d). This type of VR system gives the user a slight feeling of immersion (Backman *et al.*, 1999).



The third type is immersive VR system, which typically consists of head-mounted display or multi-screen projection that allow the users to be completely isolated from the outside world and thus, the user can focus entirely on the virtual environment (Backman *et al.*, 1999). This type of VR system is expensive compared to other forms of VR system (Backman *et al.*, 1999). This is because the VR hardware used, such as 3D input devices, data gloves and output devices, head-mounted display that are used to support full immersion are relatively expensive.

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A desktop VR system is chosen for use in this project. This is because it does not require complex technical skills or expensive hardware and software (Ausburn & Ausburn, 2004). The desktop VR technology such as mouse-controlled that uses to navigate in a 3D environment is easy to use and much more affordable in an educational setting compared to the immersive VR technology (Ausburn & Ausburn, 2004). Besides, the users can perform tasks in a comfortable condition in desktop VR system (Chen, 1998). This is because they do not need to wear the heavy immersive device such as head-mounted display and data-gloves.

### **1.1.1 VR Systems for Training Machine Operation**

VR is currently used to train the operators of various kinds of equipment (Wang *et al.*, 2004). This is because initial training in a virtual environment can reduce the expense, danger, and problems of monitoring and control associated with training in the real life situation (Wang *et al.*, 2004).

VR-based system is ideal for training the users that perform the tasks in dangerous or hazardous environments (5DT, 2008). The users can practice the procedures in VR-based system under a safe and control environment before operating the real machinery in real environment. If the users do not have enough skills or knowledge about the machine operation, they can get hurt, or they can damage the equipment or waste the work piece (Huesca & Noguez, 2008).

VR-based system is also a convenient tool to train the users for the operation of expensive equipment (5DT, 2008). This can safeguard the expensive equipment. Besides that, VR-based system is also used to train the users on operation of equipment with high running cost (5DT, 2008). This can save fuel and electricity.

### **1.1.2 VR Training Applications**

There are several applications conducted regarding VR training. VR-based Training System (VRST) for Computer Numeric Control (CNC) milling machine operations is developed at the Hong Kong University of Science and Technology. The goal is to teach the trainees on operating the machine manually so that after the virtual training the user can handle a simple part in the real machine (Lin *et al.*, 1997).

VTW is a virtual training workshop in ultra-precision machining. It is for training of engineering workers to get the theoretical know-how, practical skills and

the problem troubleshooting techniques on the usage of ultra-precision machining which are not affordable in conventional training workshop (Lee *et al.*, 2002).

LaSiTo is a lathe simulated virtual laboratory for engineering students to practice and carry out experiments where their instructors and equipment are not always available. The lathe simulated virtual laboratory is combining the virtual laboratories with the intelligent tutoring system. It gives the students knowledge and skills to use safely a lathe (Huesca & Noguez, 2008).

## **1.2 Problem Statement**

Photocopier is now widely used by everyone and at everywhere. However, photocopier is more frequently used by the officers or workers for their own personal use, public use or company use. The officers and workers who often use photocopier know how to operate photocopier better. The problem that they faced when they first operated the photocopier now is also the problem that other novice users faced.

For the novice users or the users who seldom use photocopier, they will spend longer time in operating the system because they need to explore on the system before they are able to get their desired copies. Wastage on materials such as paper and ink can happen in the process if they are not familiar with the system. Some even fail to get their desired copies after a number of trials.

Some of the users will seek for help from experienced workers. Lengthy explanations and guidance will usually be given by the experienced user. However, this method is time consuming and ineffective.

### **1.3 Aim**

To overcome the problems, a prototype of VR-based system for learning basic photocopier operations is developed in this project to allow users to acquire the basic knowledge of how to operate a photocopier as in the real photocopier.

#### **1.3.1 General Objective**

The main objective of this project is to develop a virtual reality (VR)-based system for training photocopier operation procedure.

#### **1.3.2 Specific Objectives**

The specific objectives of this project are:

- To identify a suitable instructional model to guide the design of the VR-based training system.
- To design the training system based on the identified instructional model.
- To create 3D components of the photocopier machine.
- To integrate the 3D components of the photocopier machine into a 3D environment.
- To incorporate the 3D environment onto the web interface.

### **1.4 Significance of Study**

VR-based system is a system that develops a training environment which mimics the real world training where the users can enhance their skills by constructing knowledge on the operation of photocopier through active and interactive process. In VR-based system, the users are allowed to explore and

navigate freely through the virtual environment and at the same time interact with the objects in the virtual environment.

VR-based system is more economical for the beginners to do their practices compared to the real machine. This is because VR-based system can be distributed via the World Wide Web or on CD and the user can install it in the affordable desktop personal computer which uses conventional input devices such as mouse and keyboard

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.0 Overview**

This chapter discusses the benefits of using VR in training machine operation and gives detail explanation of VR applications for training. The instructional design model which is chosen to guide the design of the learning environment is also discussed in this chapter.

#### **2.1 Virtual Reality in Training Machine Operation**

VR-based system is ideal for training the users that perform the tasks in dangerous or hazardous environments (5DT, 2008). The users can practice the procedures in VR-based system under a safe and control environment before operating the real machinery in real environment. If the users do not have enough skills or knowledge about the machine operation, they can be hurt, or they can damage the equipment or waste the work piece (Huesca & Noguez, 2008).

VR-based system is also a convenient tool to train the users for the operation of expensive equipment (5DT, 2008). This can safeguard the expensive equipment. Besides that, VR-based system is also used to train the users for operation of equipment with high running cost (5DT, 2008). This can save fuel, electricity and the wear of the equipment.

VR-based system enables the users to practice different and more type of machine requirements within the same allocated training time (SIMTech, 2007). With this additional preparation, the users would have a short learning cycle when they start use the real machine. In addition, this can dramatically reduce the cost of delivering training because of decreasing learning time (Wang *et al.*, 2004).

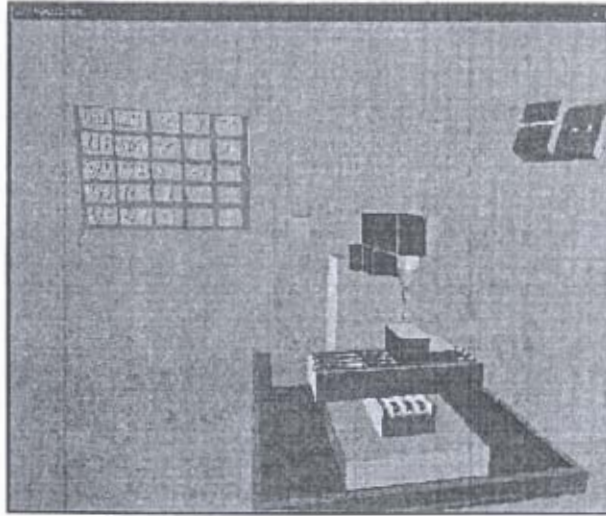
Apart from this, the users can enhance their skills. This is because in VR-based training the users are active and can continually practice compared to traditional training technologies such as book and video (Balducelli & Louka, n.d). Through the practice, the users can continually construct and refine the correct mental solution of the problem that the users faced (Rafi *et al.*, 2008). VR can also bring the equipment and actual working conditions to the users for unlimited access in any location (Wang *et al.*, 2004).

## **2.2 Sample VR Training Applications**

### **2.2.1 VR-based Training System for CNC Milling Machine**

This VRTS is consists of three components that are CNC milling machine, control panels and work piece. The goal of this VRTS is to allow the users to get the same experience of basic knowledge on how to operate CNC milling machine through practice in a virtual CNC milling machine as in the real machine (Lin *et al.*,

1997). The three-axis CNC milling machine model, work piece and a control panel is shown in Figure 2.1.



**Figure 2.1:** The three-axis CNC milling machine model, work piece and a control panel

There are two types of virtual learning in this system, which are guided training and self-learning. In the guided training mode, the user is restricted to follow the system instruction to perform the task given. In the self-learning mode, the user uses the knowledge and experience learnt in the guided training mode to operate the system. The system would not give the hint on what need to do next unlike the guided training mode, but the system would record the mistakes of operation made by the user (Lin *et al.*, 1997).

This VRTS is a semi-immersive VR system. CrystalEyes glasses and Emitter are used to get stereoscopic effect while the device control for Cyberglove and mouse is used for the user-system interaction in the VRTS (Lin *et al.*, 1997).