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

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Paper Presented at the Prosiding Seminar Pencapaian Penyelidikan KUTKM (REACH 2006)
18 – 20 Disember 2006, Holiday Inn Resort, Batu Feringgi, Pulau Pinang

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

# Walkthrough Application of Faculty of Information and Communications Technology's Building in The Main Campus and Planner for The Facilities Inside The Building

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*ABSTRACT*

*This paper suggests an alternative of visualizing non-existing information of permanent Fakulti Teknologi Maklumat dan Komunikasi's building (henceforth as FTMK) to the administrative personnel and other users. The main objective of this project is to develop a virtual walkthrough that could assist FTMK's administration in visualizing and planning the layout of the permanent campus of FTMK in Durian Tunggal, which is expected to be completed by the year 2008, into three-dimensional (3D) model. In order to achieve it, a walkthrough non-immersive virtual environment of the building is constructed which allows the user to navigate and interact with the area. As it could be used as office planner, the walkthrough application will suggest some layout for lab, lecture hall, administration area and lecturer's room. This walkthrough application could also aid FTMK's staffs, students and communities to view the design of the building hence promoting FTMK and KUTKM.*

*KEYWORDS*

*Virtual Reality, Walkthrough, 3 dimensional (3D) modelling*

## 1. INTRODUCTION

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 constructed 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 2008. Among the faculties' building that has not been completed is the building of Faculty of Information and Communications Technology. It is hard for others to visualise 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 Communications Technology.

For the development purposes, the department of Development and Assets Management had the complete plan and layout of the buildings. However, only a person with architectural background can understand the plan and visualise the proposed building before it is being completed. It is hard for others especially the administrator of the faculty to see or imagine their future building and to plan on how to facilitate the building with its furnishing.

Therefore virtual reality had been seen as an alternative way to visualise the information and could offers new experiences to the user on viewing the proposed development. Virtual reality is well suited to helping users learn to navigate or walk through unfamiliar or complex surroundings. A number of studies have shown that navigation in virtual reality models of complex buildings generalizes to actual buildings [1]. Researchers in Japan are developing a system to train guards for power plants in navigating them around. In this application, the VR training takes place before workers have been assigned to the site, when the workers are as yet unfamiliar with the look and layout of an actual plant [2].

Learning to navigate and function in unfamiliar environments is one of several applications that are emerging for individuals with disabilities. Few cases showing the usage of computer simulation with disabilities people [6],[7],[8] have provides evidence that it could actually train and help them to improve their quality of life. All these cases and quotation prove that using walkthrough application can be used to educate and trained user about the emergency exit in the same time will safe the time and cost to conduct it if done in real world.

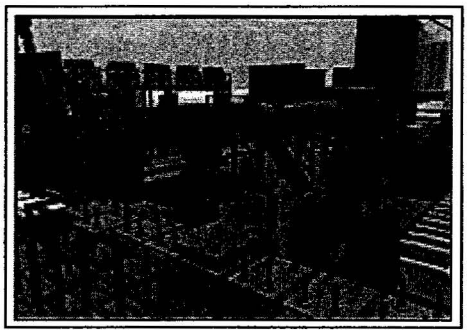

***Fig. 1 Walkthrough Application of Assembly Training and Simulation***

The idea of the ultimate virtual environment by [3] states that VR should be indistinguishable from "real" reality. A real environment includes both simple and complex objects. However according to [4], [5] it is almost impossible to include all of it in a virtual environment because of a few aspects such as required time and the complexity of the development process. Therefore only minimal "things" or information will be included in the VR without impeding the representation of the real environment. The techniques that are implemented for this project will include the use of texture mapping to enhance the display fidelity, the use of authoring using novel approach and the incorporation of games peripheral to maximize the interactivity experiences.

## RESEARCH METHODOLOGY

Methodologies used in this project are as follow:

a) Revision of related and latest literature in the area of 3D modelling.
b) Data capture and collection of the project's resources including CAD drawings and the schedules of the development's phases.
c) Identify the specification and the processes of the proposed techniques.
d) Investigation of suitable software, programming language and tools for the research.
e) The development of the prototype walkthrough simulation of the proposed building model.

## DEVELOPMENT

### 1 MODELLING TECHNIQUES

Based on the literature review, there are three techniques for building 3D models. The first technique is by sing scripting language, e.g., Virtual Reality Modelling Language (VRML). VRML is an open, extensible, dustry-standard scene description language for 3D scenes over the Internet. The second technique is by using irtual Reality authoring tools which usually come with its own modeller and browser but still support VRML. n example of it is Cosmo World from SGI. However, this kind of tool has it own disadvantages where this uthoring tool works independently and the modellers are not user friendly in terms of precision and movements.

The third technique is by using conversion program such as modelling the virtual terrain or building using DS Max. The use of this kind of programs will decrease the troublesome to learn individual VR packages. This ethod makes a major contribution to the reconstruction of the virtual environments where lots of modelling tense will be reduced. For this project the modelling had been done using 3DS Max. It includes creating the bjects meshes, texture mapping using images in order to enhance the display quality and the use of different meras to represent different angles of views.

### 2 DEVELOPMENT PROCESS

This walkthrough application is fully depends on the user who is using it. There is no time constraint or task be fulfilled. It is up to the user to navigate and move around the virtual environment and upon arriving at rtain venue, the user can arrange the office furniture to the specific area. The flow of the walkthrough pplication is as in Figure 2 below.

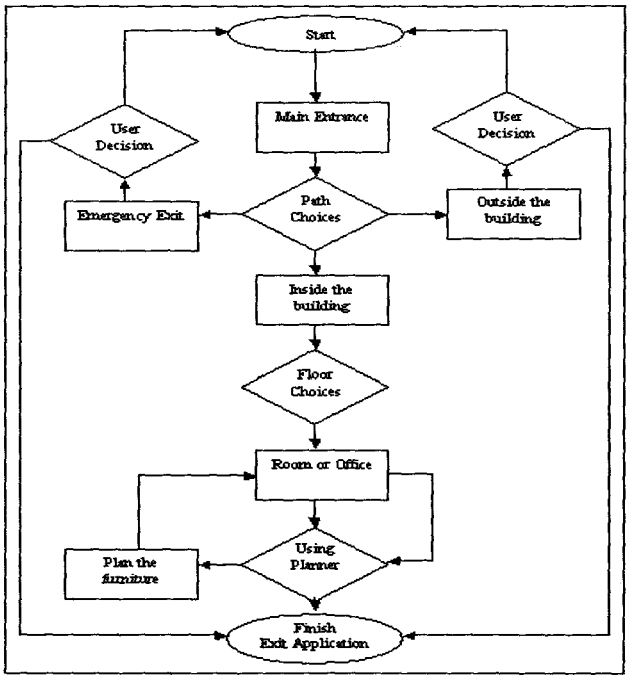


***Fig. 2 Flow Diagram of the Walkthrough Application***

As walkthrough requires computational power in terms of the interactivity, the type of virtual environment for this application is non-immersive virtual environment. Non-immersive virtual environment is a pc-based VR, which give a limited sense of immersion to the viewer with higher quality of display resolution and lower lag or "jerky" effect [4]. The development process involves three different tools; AutoCAD, 3DS Max and EON Studio as the integration platform of the walkthrough application. The processes start from gathering information of the plan, reconstruct the 3D model from the 2D plan and applying material to the model, as in Figure 3.

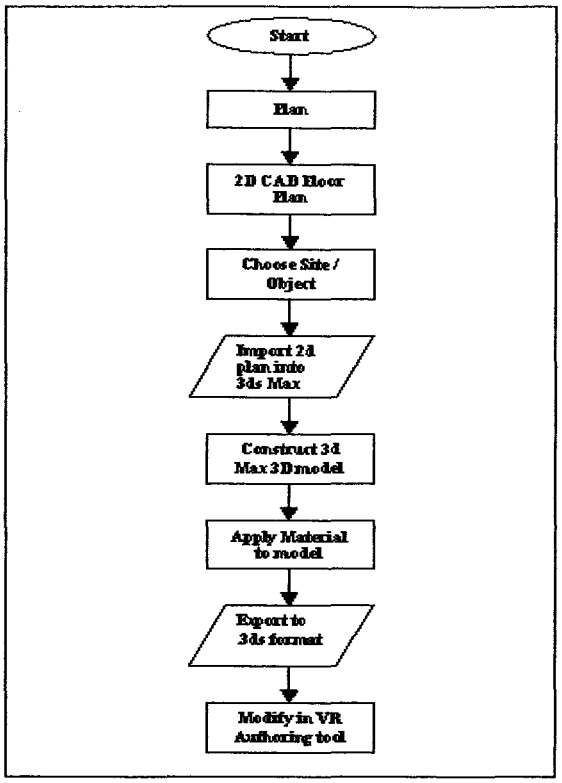


*Fig. 3 The Diagram of 3D model Construction Process*

### 3.2.1 WALL, WINDOW AND DOOR EXTRUSION

As the first steps of the VR construction, the information should be gathered on the actual site of the building by taking the snapshot of the building or take the measurement of the building. However, in this project the actual building is not yet been completed so the information came mainly from the blueprint of the building. In other words it came from the floor plan and the elevations of the building done by the architect. Basically the resources of the plan are in soft copies so the only approach that has been used in constructing the 3D model is by using 3DS Max. Extrusion technique had been used in modelling the walls where 3D objects are created from 2D shapes by pushing up the 2D shapes through a path or assigning a specific height to them.

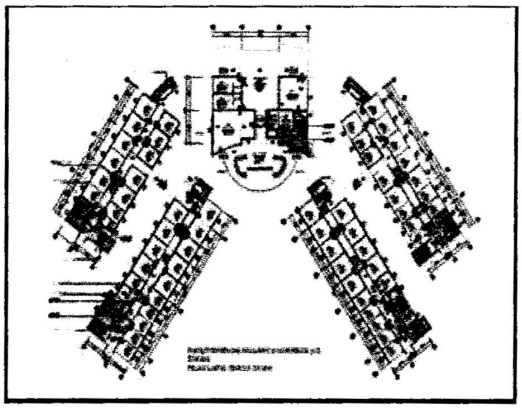

*Fig. 4 CAD Drawing of the Faculty Building as the raw data*

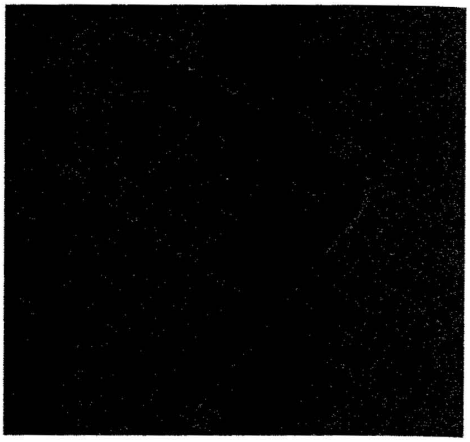

*Fig. 5 Example of 3D wall model*

Windows and door can also be extruded in 3DS Max. 3DS max supplies a number of parametric windows and door objects that can be placed into wall openings to add realism to an architectural model. These objects let you control details like trim and panel fill in your model. Using these windows and door objects will resulting in decreasing the use of Boolean operation for example *UNION* and *SUBSTRACT* operation to cut through the wall to place the doors or windows.

### 3.2.2 TEXTURE MAPPING

According to [9], texture mapping is a method of adding realism to a computer-generated graphic. An image (the texture) is added (mapped) to a simpler shape or primitive object that is generated in the scene, like a decal pasted to a flat surface. This reduces the amount of computing needed to create the shapes and textures in the scene. There are two methods in choosing texture material used in this project. The first one and that has been implemented is using the existing materials available from the 3DS Max materials library itself. The second one is by capturing the image using digital camera where the images are saved as bitmap file in the 3DS Max material library.

In this project texture mapping is first used in building the windows and the doors. The original windows and doors objects are just simple solid primitive objects (Figure 6). After applying the material to both of them the result is as the example below with a transparent glass (Figure 7).

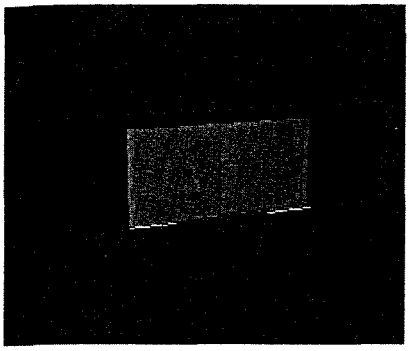

*Fig. 6 Before texture mapping*

*Fig. 7 After texture mapping*

After the modelling process, the models in 3DS Max are converted to 3ds. file format. This is to insure the compatibility of the modelling to be imported into EON Studio, the VR authoring tool. In EON Studio, the models can be assigned or arranged inside the intended virtual environment, and interactivity can be applied as well as the additional behaviour of the model. For example the door can be opened or closed or switch on and off the lights.

Using EON Studio user can imports 3D objects from modelling tools such as 3D Studio or LightWave, or from CAD systems such as ArchiCAD, Pro/ENGINEER, or AutoCAD. It has the ability to modify the scale, colour, texture, reflective, and other properties of the imported objects. All the objects in the imported file, as well as any lights and views that were already defined become "nodes" in EON Studio and get placed in a "simulation tree" where they can be rearranged [10].

Objects also can be embedded with behaviours such as movement, collision detection, disassembly, and reassembly, which can be triggered by pressing keys. Lights can be programmed to turn on and off. Beside that sound and video files attached to objects can be activated when simulation begins. In most cases, these effects are associated with an object by dragging and dropping predefined EON nodes into the simulation tree under the node that represents the object. There are a large number of these predefined nodes such as Walk, Path, Light, MouseDrag, KeyMove, Texture, MultimediaStream, and so on which are straightforward to apply. A scripting language is available to add more advanced effects. It can be deployed over the Internet or distributed as a stand-alone program on a CD when the application complete. Figure 8 shows the EON simulations of the building.

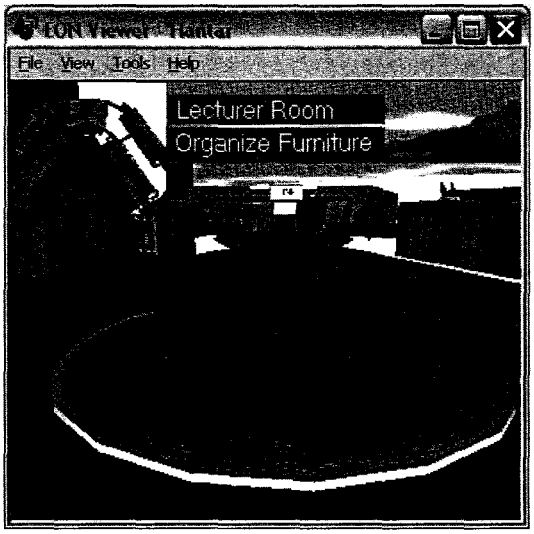


***Fig. 8 The completed walkthrough application of the building***

In order to enhance the user experience with the application, a game peripheral CyMouse is used to allow the user to navigate the simulation using head movement. CyMouse need to be integrated with conventional mouse.

## 4. RESULT AND DISCUSSION

For this research, two types of testing had been carried out to verify the technical and usability of the walkthrough application; technical testing and user acceptance testing. The technical test was done through out the development process by the developers. The test is mainly about the capability of the software used in the development and the suitable platform for the end product. The sizes of the models' files with their physical are also being tested so that it will not be too large. On the other hand, the user acceptance test was done with the normal user who represents the intended user of this simulation. The test is mainly concern with the deliverability of the simulation such as the ease of the navigation and also to investigate the run-time performance.

| No. | Classes of Test | Lecturer | Interactive Media Student | Other Course Student |
|---|---|---|---|---|
| 1 | Run-time performance Test | Average, can be improved | Average | Satisfying |
| 2 | Object Interaction Test | Satisfying | Satisfying | Average, can be improved |
| 3 | Button Functionality Test | Average, need to be improved | Average | Good |
| 4 | Integration Test | Good | Good | Good |

Table 1 Test Results

Throughout the research and development, there are a few problems had been identified. The problems will give whether benefits or contribute to the limitation and weakness to the project. "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 Virtual Reality simulation project base on the FTMK's building at the permanent campus. VR simulation will give the user a new kind of experience when it comes to visualization and guidance. Unlike looking at a map, this project will enable the user to interact with the visualization in front of them. Now user can select an object and move it to other place. This is an example of the furniture planner. Beside that, it is easier for user who does not has any experience in AutoCad 2D plan to view the intended building that has not been built. As 2D plan is hard to understand, this project is an alternative way for those who do not understand to read a plan.

However, this project still has its own weakness and it limitation in the way it can perform. This is due to the constraint that cannot be overcome such as time constraint. Because of this, only the ground floor of the building was built and all the furniture and the models are not rendered with realistic effect. Beside the simulation do not run smoothly as it supposed to be. User will experience some lagging during the simulation. This is due to the hardware capabilities.

## 5. CONCLUSION

This project has indirectly affects the user of the simulation. In virtual reality simulation, the important aspect is to develop a model that pictured the real building with the right measurements and that is the most vital factor to be considered when this project is about to be viewed to the public. VR simulation is an alternative medium to visualize the building that has not completed. This is to help other people with no experience in 2D plan to view the building. Before, only those with the knowledge in AutoCAD 2D plan can imagine the building, but now the administrative personnel and other people could visualise the building by using the VR simulation. In general it helps the admin to plan the interior layout of FTMK's building and indirectly be able to promote

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