3D Office Walkthrough

by

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Dissertation submitted in partial fulfillment of

the requirements for the

Bachelor of Technology (Hons)

(Information Communication Technology)

JUN 2006

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CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
Information Communication Technology Programme
Universiti Teknologi PETRONAS
in partial fulfillment of the requirement for the
BACHELOR OF TECHNOLOGY (Hons)
(INFORMATION COMMUNICATION TECHNOLOGY)

Approved by,

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JUN 2006

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

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ACKNOWLEDGEMENTS

ABSTRACT

3D Office Walkthrough application is developed with the main objective to enhance existing 2D traditional map, hence provide user with better visualization and realistic means of information. 3D approaches overcome 2D traditional approaches by providing objects with significant rendering, lighting and modeling which gives a "true depth" and "feel" of the model. 3D environment simulates the natural surroundings for human beings in which they are accustomed to orient themselves. A 3D view that represents a walkthrough in the scene provides the user with much better orientation about the space than would information in 2D form. 3D walkthrough application overcomes the problem faced by recipients of 2D map where users usually extract the necessary information and interpret it based on their previous experience, background and knowledge, thus create misunderstanding of the content. The scope of 3D Office Walkthrough application will concentrate on creating 3D primitive objects of typical office arrangements and developing a walkthrough scene of the office. In this paper, author has provided review on VR desktop implementation, how 3D approach is significant in offering better graphical representation and what walkthrough application is meant to be. Process activities include 4 phases of development which are identified problems identification and requirement analysis, concept design, application development and the last phase would be testing and evaluation.

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CHAPTER 1

INTRODUCTION

1.1   Background of Study

In the late 1980s, embryonic Virtual Reality (VR) systems became commercially available, and the worldwide publicity VR systems attracted caught everyone's attention and imagination. Virtual reality is a simulation in which computer graphics is used to create a realistic-looking world. In other words, VR is a high-end user-computer interface that involves real-time simulation and interactions through multiple sensorial channels.

The potential of VR technology for supporting education and training is widely recognized. Several programs designed to introduce large numbers of students and teachers to the technology have been established, a number of academic institutions have developed research programs to investigate key issues, and some public schools are evaluating the technology. At large companies and organizations, many have implemented VR technology to train and instruct employees in various areas. In organizations, one classic application of VR is to train people to cope with situations that would be expensive or dangerous if experienced for real.

3D computer graphics are works of graphic art that were created with the aid of digital computers and specialized 3D software. In general, the term may also refer to the process of creating such graphics, or the field of study of 3D computer graphic techniques and its related technology.3D computer graphics are different from 2D computer graphics in that a three-dimensional representation of geometric data is stored in the computer for the purposes of performing calculations and rendering 2D images.

In general, the art of 3D modeling, which prepares geometric data for 3D computer graphics, is similar to sculpting or photography, while the art of 2D graphics is analogous to painting. However, 3D computer graphics relies on many of the same algorithms as 2D computer graphics. In computer graphics software, this distinction is occasionally blurred; some 2D applications use 3D techniques to achieve certain effects such as lighting, while some primarily 3D applications make use of 2D visual techniques. 2D graphics is a subset of 3D graphics.

The focus of this project is to provide a 3D visualization in a virtual environment of typical office setup. The system visualization permits the user to experience the real working place and by applying a window on world system in the virtual environment using desktop VR, user is presented with an interactive application where they could undergo the safety training.

The study of this project will also focus on implementation of 3D office walkthrough application. In general, 3D Walkthrough allows a person to walk through the project in 3D on the computer.

1.2 Problem Statement

The major problem that motivated author to develop the project is the fact that 2D representation possesses limitations to allow full understanding of delivered information. Currently, the common method for representing and distributing information about a construction facility is via two-dimensional (2D) drawings and relevant specifications. Recipients of 2D drawings and specifications will extract the necessary information and interpret it based on their previous experience, background and knowledge. When we look at typical 2D representation of an office, we seldom able to understand the structure at first look. We have to go through few times before we can really grab what the drawings are all about. The plainness of this type of drawing confines the user to remember the structure precisely.

The goal of having map is to ensure the recipients will understand and remember it but it seems to be difficult because of lack of accurate information the 2D maps hold. In addition, what makes the author to come up with such project is because the technology of 3D object is identified as one of the solutions to overcome 2D representations by giving more interesting and understandable depiction.

1.2.1 Problem Identification

- Existing 2D drawings have the components expressed in lines, but the depth and actual shape of objects cannot be represented thus increases the difficulty to recipient to understand the arrangement.
- In 2D drawings and representation, the objects visualization limited on only 2 faces and fix angle.

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- Plainness of the existing 2D drawings might lead to a misunderstanding of the map because each recipient might have different interpreting on how the office will look like.

- Recipients of 2D drawings and specifications will extract the necessary information and interpret it based on their previous experience, background and knowledge. The interpretation might not match with what the drawing is meant to deliver.

- 2D map limits users' ability to remember and memorize the arrangement and office structure especially big construction space, which might causes problem of being lost and confused.

1.2.2   Significant of the Project

- This project meant to provide 3D visualization of typical office arrangements
- 3D visualization offers the viewers better graphical representations in 3 dimensional formats.
- The actual shapes and angle of each object are properly presented in 3D visualization.
- 3D walkthrough application allows users to explore the environment and gives more understanding of the office arrangements
- 3D walkthrough application overcomes 2D representations motionless drawing with environment exploration.

1.3 Objectives and Scope of Study

The primary objective of this project is to fulfill the University Technology of PETRONAS (UTP) requirement upon completion of Information and Communication Technology (ICT) course. As for the 3D Office walkthrough application itself, the objectives are as the following:

- To replace the existing 2D map representation with 3D walkthrough application
- To help user in obtaining more information with precise facts in moving application
- To provide with interesting and effective means of office map
- To develop 3D office environment and walkthrough application

1.3.1 Relevance of the Project

The development of 3D Office walkthrough application has several characteristic which determine its relevance. It is stated above in the problem statement section that the existing 2D map drawing contribute to misunderstanding because of its limitation to represent the real arrangement of the office. Because users tend interpret the map based on their own knowledge, each will have different point of view. Therefore, by implementing this application, it will allow the user to have the view of the real arrangement of the office. Everyone who uses the application will have the same interpretation and same view regardless their level of knowledge and experience. Since the typical 2D map only provide information of the layout in line and 2 faces object, this system is designed to enhance the object visualization with 3D representation.

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The relevance of this project also measured by its capability to offer user with a camera view to allow user experiencing the application like they are in the room. The project is also economical since the hardware used for application deliverable is a standard computer which is affordable by many organizations. The walkthrough application will assist the user to understand the office structure easily and precisely and not only for the benefit of adults, but the simplicity the project has would make it applicable even for children and old folks.

1.3.2   Feasibility of Project within Scope and Time Frame

Virtual reality system is new knowledge to author, with only one semester of learning the course theoretically, the implementation is a part where has to learn by herself. Therefore, most of the development time will be concentrated on understanding the underlying concept of 3D technology and identifying what is the most appropriate approach to develop the application. Down to the fact of time constraint faced, author had to narrow down the scope of study so that the project can be completed within the time frame give and at the same time meet with FYP standard. Office was the main subject of development because the structure is enough to represent typical building structure.

The aim is to provide a walkthrough application and to ensure the project really meet with FYP requirement; the product should be able to give 3D visualization of an office arrangement and allow the user to experience the walkthrough application themselves. In order to meet the objectives of the project, the application should posses the characteristic of the ability to overcome limitation hold by existing 2D

map. The challenges including, to demonstrate realism in the environment itself, that is the objects should replicate the real world office setup as well the lighting and camera setup. The walkthrough application is to be developed as such it would make the user feels as if they are really in the office.

CHAPTER 2

LITERATURE REVIEW

2.1 Desktop-VR

2.1.1 Definition of Desktop-VR

Desktop VR [1] is the use of animated interactive 3D graphics to build virtual worlds with desktop displays and without head tracking. Desktop VR focuses on mouse, joystick, or space/sensorball-controlled navigation through a 3D environment on a graphics monitor under computer control.

2.1.2 Types of Desktop-VR

There are two broad types of desktop VR [2]; these are referred to as panoramic and object. Panoramic VR wraps the photos into a single cylindrical image with the viewer looking out from the inside. Object VR is the type of format that is of interest to us. This type of VR uses a series of still photos taken at regular intervals around an object. The software then treats them rather like a flip book animation creating the illusion of a 3D object which the user manipulates through a mouse or keyboard.

2.1.3 Significance of Desktop-VR

[4]The design point for the VR-Desktop is to provide VR systems that will meet a wider range of potential users closer to "where they are" in terms of 1) existing computing skills and work methods, 2) budgets and 3) physical proximity. In short, VR-Desktop is meant to make it as easy, cost effective and convenient as possible for everyday computer users (as well as potential VR lab administrators) to realize whatever benefits "big screen VR" can bring to their respective disciplines and organizations. Continuing improvements in the

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price/performance of desktop graphics systems and related technology have made these goals reasonable, as evidenced by recent commercial and academic development efforts.

Desktop VR began in the entertainment industry, making its first appearance in video arcade games. Made possible by the development of sophisticated computer graphics and animation technology, screen-based environments that were realistic, flexible, interactive, and easily controlled by users opened major new possibilities for what has been termed unwired or unencumbered VR [5]. Early in their development, advanced computer graphics were predicted, quite accurately, to make VR a reality for everyone at very low cost and with relative technical ease [6].Today the wide-spread availability of sophisticated computer graphics software and reasonably priced consumer computers with high-end graphics hardware components have placed the world of virtual reality on everyone's desktop:

[7]Desktop virtual reality systems can be distributed easily via the World Wide Web or on CD and users need little skill to install or use them. Generally, all that is needed to allow this type of virtual reality to run on a standard computer is a single piece of software in the form of a viewer.

[3] Desktop VR applications are far less expensive and technically daunting than their immersive predecessors and are beginning to make inroads into industry training and development.

[8] In practical terms, desktop VR is more suitable for widespread use than immersive VR technology. Considering both the hardware and software requirements, desktop VR is quite a mature technology. It is affordable in that a

basic level of technology can be achieved on most existing personal computers at either no cost or some minimal software cost. The expected availability of increasing numbers of virtual worlds over the Web is likely to promote its use.

2.1.4 Limitations and Disadvantages of Desktop-VR

Instructional design issues create another set of challenges for VR environments. [9]Weak instructional design, along with the latency problems associated with technical limitations, can result in inadequate sense of presence in a virtual environment to adequately maintain the necessary sense of immersion and reality to allow virtual training to transfer to the real world. A study concluded that a VR designer's understanding of a task, cognitive task analysis technique, and skill in translating these to a sound instructional design are critical in the success of a VR environment.

A major review of VR in engineering education also stressed the importance of solid instructional design, cautioning that the design must overcome the potential problems of overly complex navigation control, inconsistent or negating look and feel, and incompatibility between what an instructor wants students to focus on and what students may choose for themselves.

2.2 2D Vs 3D

Computer vision is concerned with inferring information about the three-dimensional (3D) world from two-dimensional (2D) images. The human visual system is adept at discerning quantities such as depth and motion, helping us interacts with our environment without needing to come into direct contact with it [10].

Realism and details in virtual environments are achieved through the process of adding 3D qualities such as shadows, colors and shade variances. The criterion that makes virtual reality closer to reality is the ability to allow "immediate, direct, and more intuitive control over a three-dimensional design". [11]

2D Based Approaches. The two-dimensionally based approaches create a new presentation or view by spatially adjusting a given two-dimensional layout to another two-dimensional layout. A 2D transformation function performs adjustments in and/or the resulting pattern of magnification and compression is the derivative of the transformation function. The reverse, determining the transformation function from the magnification function is non-trivial in 2D. .[12]

3D Based Approaches. The three dimensional based approaches are quite different algorithmically. The plane or surface that holds the two-dimensional representation is manipulated in three dimensions, then viewed through single point perspective projection. The transformation function results from the combination of the manipulation of the surface and the perspective projection of it. In a perspective framework the two-dimensional surface is placed on the x,y plane parallel to the view plane at a distance along the z axis from the viewpoint which defines unit magnification. Single point perspective projection in this orientation preserves angles, proximity, and parallelism on all x,y planes and has visual realism from the perspective foreshortening in z. The scale or magnification factor of planes parallel to the view plane is a function of the distance from the viewpoint.[12]

The primary difference between 2D and 3D technology is apparent in the amount of time designers spend on these tasks when they use the respective tools. Unlike 2D drafting tools, 3D modeling technology provides lifelike representation of a design,

from structural composition and the way parts fit and move together, to the performance impact of characteristics such as size, thickness, and weight. [13]

When engineers can see the sum of the parts in 3D, they can see issues and opportunities without ever having to spend time creating documentation. Rather than starting a new product concept with meticulous 2D technical drawings of elements that might not function as planned, 3D design technology quickly shows whether a design idea is viable. This difference amounts to business advantage for companies that otherwise might have to retrace all manufacturing processes in search of an answer – or build physical prototypes of products that don't function as desired. [13]

Interactive 3D modeling seems to be the next logical step in enhancing the current teaching techniques given that it addresses the third dimension that is missing in 2D views and drawings. Adding the third dimension to viewing an assembly gives it a unique position in space and clarifies many of the details associated with its components, including connectivity issues. Interactive 3D tools also allow manipulating the 3D view, which adds flexibility of viewing. Using these tools, the 3D model can be rotated around any axis, and panned or zoomed in any direction.

Realistic rendering of the components representing the various materials is possible, which gives a "true depth" and "feel" of the model. Texture mapping and dynamic lighting can create a realistic simulation of the structure and enhance the 3D object. With 3D viewing tools, users are able to position and recognize the object with relation to others in the scene, enabling a better and more complete visualization and instigating an interactive process. It is even possible to mimic the sequence of construction. This enables better and complete visualization of the model, as

compared to 2D drawings, since all 3dimensions are visible simultaneously allowing the users to make correlations between components.[14]

In terms of education and learning purposes, if 3D objects can be presented on the web and can be interactively changed / navigated, it will be beneficial for the students' conceptual understanding on the domain topics. Nothing can be more convincing to a student than being able to walk-through a virtual model of a transparent concrete beam with all the reinforcement details. With a walkthrough, things can be discovered, added or corrected before the actual construction begins. A walk-through is an excellent way to show students the reinforcement details. [15] Same condition applied when organizations want to their employees to fully understand certain systems and process, it can be effectively achieved through 3D application.

3D environment simulates the natural surroundings for human beings in which they are accustomed to orient themselves. A 3D view that represents a walkthrough in the scene, providing the user with much better orientation about the space than would information in 2D form. Currently there exist several technologies that allow for the generation of 3D views on a computer screen. The user can freely move in the 3D scene and choose an appropriate view to the scene, and thus gets a good notion about the 3D environment investigated. The most popular techniques are QuickTime VR and various 3D modeling techniques based on the use of VRML or some other technique, e.g. techniques based on the use of 3D Studio etc. [16]

2.3 Virtual Walkthrough

In a virtual walkthrough application, a viewer could explore a specific place of interest without having to travel physically. The place of interest is usually modeled as a virtual environment, containing a vast number of virtual objects. Sample

applications of this sort include virtual museum, virtual library, and virtual university. [17]

One purpose of the virtual walkthrough is to increase the opportunities for exploration, manipulation of objects, experimentation with possible and practical movements, and comprehension of what is real and not real. This is done, using symbolic elements within artificial situations. This is medium-independent, allowing interaction with objects rather than with the medium. In fact, the change from interactive buttons to handling objects directly makes users believe that the simulation of the learning process could depend on the way the characteristics of an object are represented.[18]

The walkthrough application allows users and all participants to feel as though they are there, walking through space, able to move up stairs, peering out windows etc. This application is also able to give them a real scale of the facility, space, and furnishing. [14]

There are several ways to solve the walkthrough generation. The simplest one is to pre-compute animations for all possible paths. This approach is useful only for relatively small buildings. Another possibility is on-line generation, but this is computationally expensive. A combination of both methods is also possible. The generated data is also stored in the cache memory and may be reused. [16]

The development of real-time walkthrough application can provide the owner of a project the ability to freely inspect the virtual facility prior to complete design or construction and can better set realistic expectations on the final product, rather than just viewing representations in the forms of 2D drawings, static image rendering or fixed-path animation. The walkthrough application allows users and all participants to feel as though they are there, walking through space, able to move up stairs,

peering out windows etc. This application is also able to give them a real scale of the facility, space, and furnishing. [19]

Virtual walkthroughs can allow participants to perform design/construction review tasks collaboratively, while locally present, or remotely connected. Collaboration among participants from the initial design stage is important because critical decisions can be made as many and as early as possible to lessen disputes, delays, cost overrun etc. at later stages. [20] Visualization of the desired end product in a virtual environment with real-time walkthrough capabilities will also allow for such collaboration among project participants and will assist each party to decide on the means and methods of achieving the project goal. [19]

Walkthrough system is also seen as an effective option to aiding learning process. A learning walk-through system is based on the process of navigating within a virtual environment. Using this kind of learning tool, searching for information is substituted for motor action so that the participant keeps control over what s/he wants to explore and manipulate, looking for the object or elements of it within the walk-through system. Learning situations often prevent the observer from having an opportunity to be an active participant. This restriction comes from the design and the concomitant conditions of knowledge transmission inherent in the particular sequence of learning, including certain learning organizers (verbal instructions, demonstrations, simulations, examples, questions, etc.). In contrast, a virtual environment is designed without a specified sequence, and there are no external verbal external interventions (for the moment, at least). Moreover, the lack of linearity within the virtual experience leads to important changes. [18] Presently, most walkthrough systems do not allow the user to click on an object in order to activate an animation link. Selecting an internal command doesn't allow the recall of any external links.

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CHAPTER 3

METHODOLOGY

3.1 Procedure Identification

The project is developed using incremental model. The model suggest that the model is designed, implemented and tested as a series of incremental builds until the product is finished. As for the development of 3D Office walkthrough application, the development process activities are done from phase to phase incrementally.

The model allows application specification, concept, design and implementation stages to be broken down into sequences of increment which, each of the stage will be developed one after another. One of the reasons to choose this type of design model is because the incremental process can reduce the risk of project failure by encountering problems at each stage of development rather than testing the application at the end of the development process. Therefore the likelihood to have a successful product delivery is high.

Specifically, for this particular project, 4 primary phases are identified problems identification and requirement analysis, concept design, application development and the last phase would be testing and evaluation.
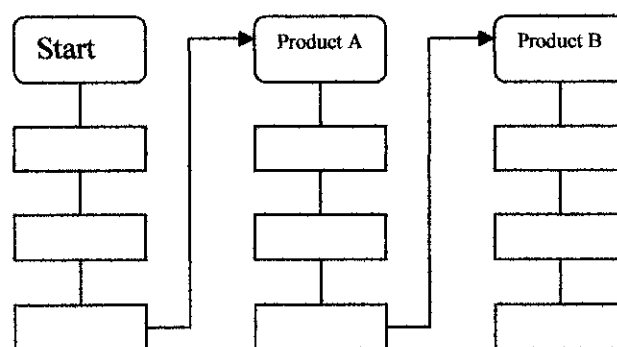

Fig. 3.1: Incremental model of 3D Office process activities

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3.1.1 Phase I: Problem Identification & Requirement Analysis

The motivation to develop this project is from the fact of problems users have to face with existing 2D map. Problems are identified through questionnaires, research and observations. Author found the encouragement to develop the project mainly because of the limitation a 2D drawing has that bound recipient's ability in understanding and imagining the subject. The next step in this particular phase is to study and define the requirements of the application.

The requirements are derived from the identified problems and should well-defined in order to ensure the project meets the stated objectives. The author first task is to understand the limitation of 2D map and how a 3D object is visualized in order to come with precise application requirement. The requirements are specified and determined so that it would not only meeting the project objectives but also should be within the scope of study author had earlier established.
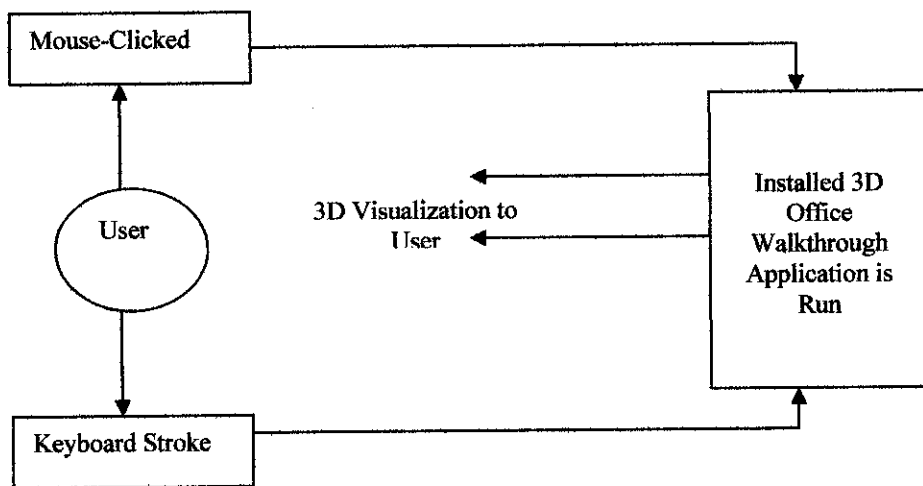

Fig. 3.2: System architecture for 3D Office Walkthrough Application

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Figure 2 shows how the application architecture will look alike. This application involves direct interaction between user and the application. Being differ from many systems architecture, this application does not require any database or other engine since it is designed to execute on its own from user's command. In this application, the user is interacting with the application through keyboard and mouse.

When the application architecture is identified, the next step is to prepare functional requirement of 3D Office Walkthrough. The functional requirement is derived from background of study the author chose to concentrate with regard of problem statement stated earlier in this document.

Functional requirement defines define the internal workings of the software: that is, the calculations, technical details, data manipulation and processing, and other specific functionality that show how the use cases are to be satisfied [21]. In other words, functional requirement specifies specific behaviors of the system of application. As for this application, the functional requirement should indicate what the component and function the application has to perform. 3D Office Walkthrough application has to achieve the following functional requirements;

- *Provide 3D environment of a typical office setup*

  The application should be able to visualize a 3D environment of a typical office setup. This includes basic objects like tables, cubicles, chairs and doors. The environment should be in 3-dimensional form.

- *Provide the environment with realistic lighting and camera path*

  Once the environment is built in 3-dimensional form, the environment should possess realistic lighting that reflects objects to increase realism of 3D

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environment. The camera is positioned as if the viewer is in the room and has a view range of normal human eyes should possess.

- *Provide walkthrough function*

  The application should be able to provide the user with a walkthrough application. Walkthrough here specifies the ability of the application to allow user to view the tour guide as a walking person in the environment. The walkthrough should allow the user to explore the entire office space, including each cubicle and each room.

- *Provide playback of the walkthrough application*

  The application should allow repetition of the walkthrough scenes in accordance with user preferences. One time exploration might not sufficient enough to let the user remember the office layout. Therefore the application should have the ability to allow user to view the application few times

3.1.2 Phase II: Concept Design

3.1.2.1 Layout Design

The second phase of the 3D Office Walkthrough application is the concept design phase, which is executed when requirement analysis phase is completed. From all the information derived from the analysis done from the first stage, now it's time to develop the product. Concept design phase is an essential stage, where at this level ideas are generated on how the scene should look alike.

Storyboarding, conceptual design and object design are truly essential to any successful 3D project.[22]It is important to come up with relevant and precise concept design hence the development in the next phase is smoothen. Not only the design has to be precise, but the design is expected to meet with user basic knowledge and logic. This is essential because the ultimate objective of developing this prototype is to allow user to remember the office arrangements. At this phase, the objective is to provide 2D scene of a typical office environment. The output should feature the layout of the office, how the furniture is being arranged as well as the walking path of the office. The purpose of developing this scene is to help me to get the first visualization on how the setting is going to be when it is being implemented in 3D environment. The basic 2D map drawing is done using Microsoft Visio. However, the 2D map drawing is served as guideline to author how the office environment is going to be created. As for the software, I used 3D Home Architecture software.
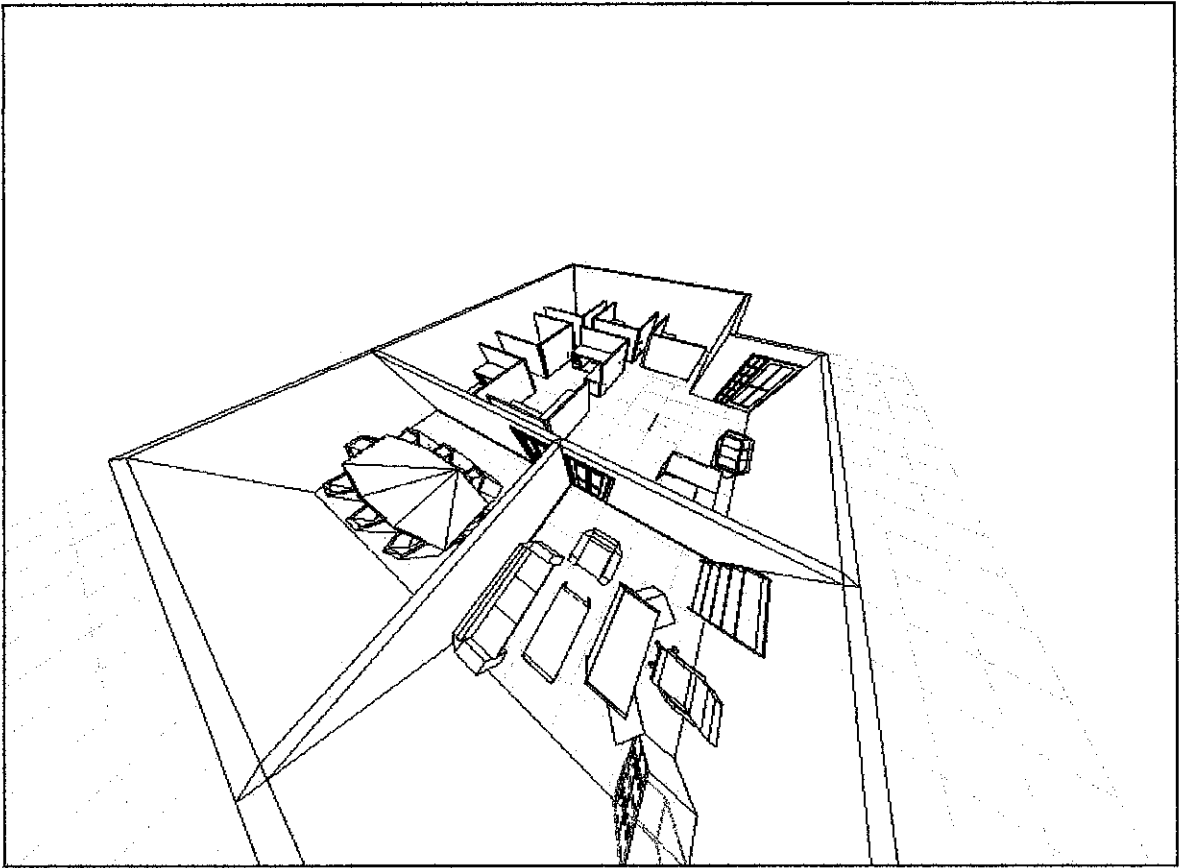
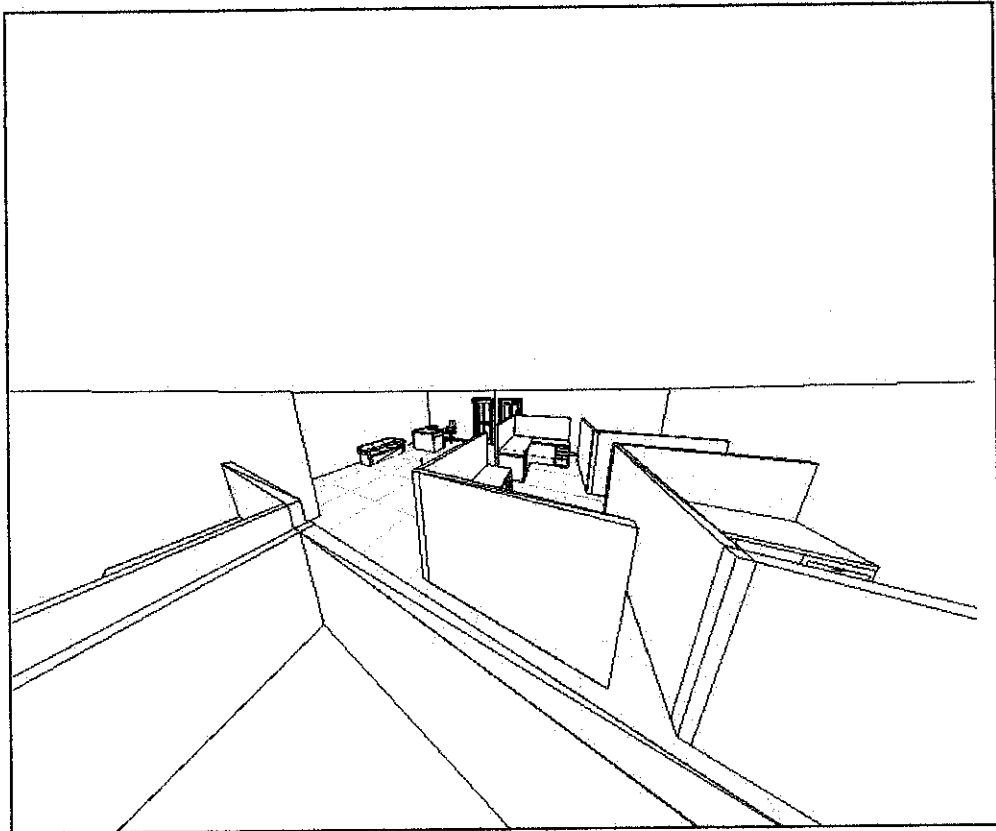*Fig. 3.3: Bird's Eye View Of 3D Office Layout*

Fig. 3.4: Side View of 3D Office Layout

3.1.3 Phase III: Application Development

3.1.3.1 Model Construction phase

The challenge starts here, at this phase where the 2D scene is being converted to 3D. Using software called Maya 6, each object in the scene is developed from scratch. Modeling is the process of building the characters, props and environments in the scenes. Objects are constructed from 3D geometrical surfaces to allow rotation and viewable from all angles. One of the biggest advantages of using 3D over more traditional 2D techniques for animation is that the 3D objects need to be built only

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once while a character or object created in 2D needs to be re-created for every frame of the animation.

As for the modeling part, author has chosen to model the object using polygon modeling rather than organic modeling. A polygonal model is a group of points in 3D that are connected to form squares or triangles. The reason behind selecting this method is because polygon modeling allows detailed modeling and easy branch model. It is easy to model objects with rigid surface and hard edges. Polygon modeling uses simple toolsets and polygonal models are recognized by almost any 3D animation program.
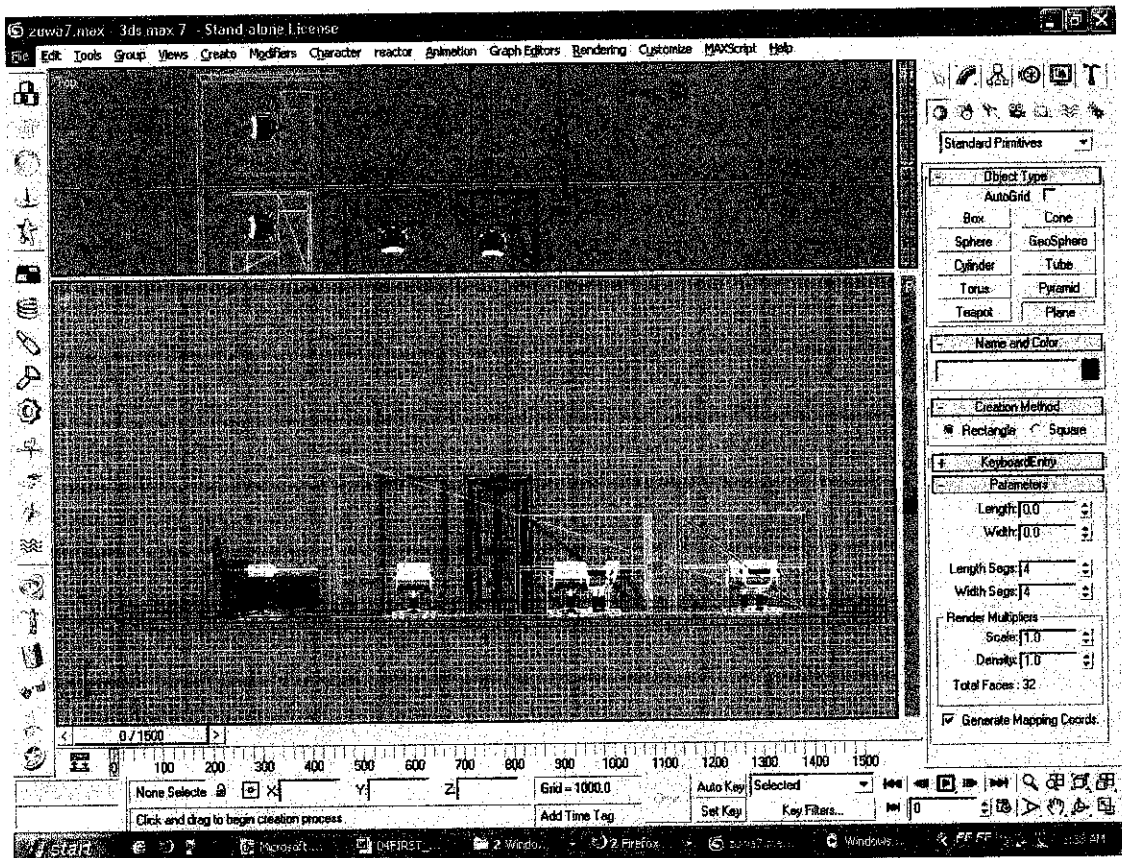

Fig. 3.5: 3D Office Objects Modeling

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3.1.3.2 Rendering Setup phase

At this phase, when all of the primitive objects are designed, it is time to put the attributes that make all the objects look 3D. This include, with lights and surface materials. In addition, camera is set at this phase, for the moment, the scene is viewable from the bird's eye view. At the next stage, the walkthrough path will be developed.

3.1.3.3 Animation Setup and Key Frames

At animation setup and key frames, the task is to ensure that camera path should be a continuous loop and must include a clear view of office area. At this stage, the walk-through path is created. In order to have the camera view tracks smoothly through the scene, the camera, camera path and dolly motion are adjusted.
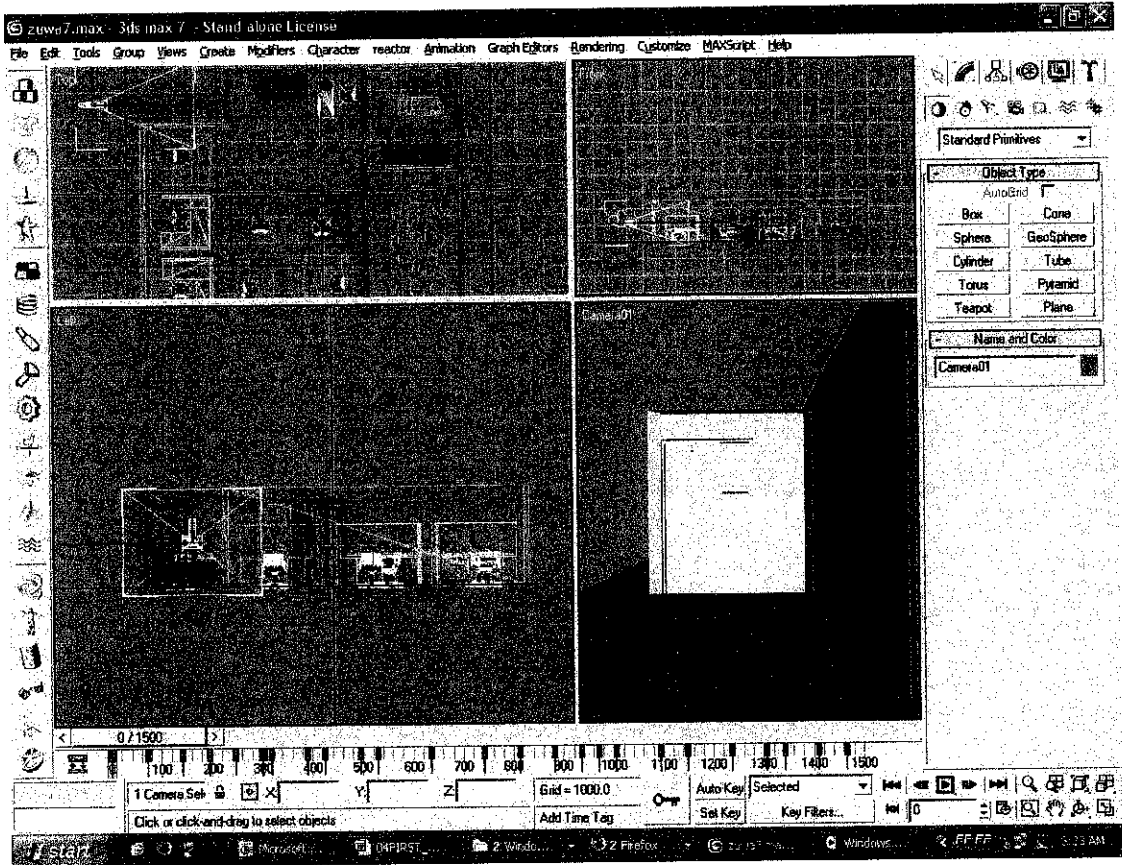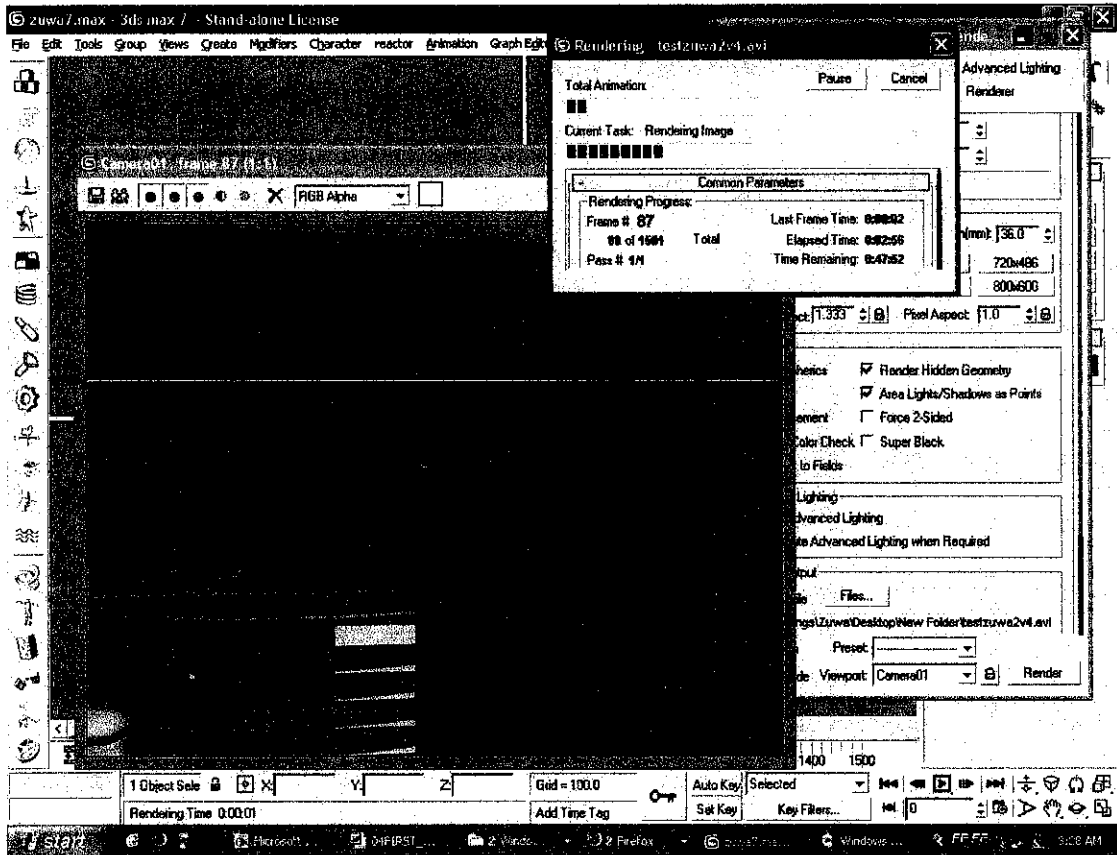
Fig. 3.6: 3D Office Key Frame and Camera Path

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Fig. 3.7: 3D Office Final Rendering

3.1.4   Phase IV: Testing and Evaluation

At this stage, as the final stage, the application is tested by several target users. The main objective is to identify whether the application developed is meeting with all the objectives the project had stated. The purpose of testing also to judge the functional requirements the application should possess. At the development level, at each sub-phase, testing is conducted to check if there is any flaw of the 3D scene, especially during modeling and key-framing stages. It is important to have testing conducted at each sub-phase so that every defect is detected earlier and can be corrected immediately. To wait until the entire application done to conduct is risky since it might encounter many problems and it is difficult to alter do modification when all the sub functions are already integrated. The acceptance test on the other hand, is executed at the end of the development to see if the application can be used by the user and meet with requirements.

3.2   Tools Required

In order to have the project successfully developed, the usage of appropriate software and hardware is important. The following are the software and hardware involve in the application development:

3.2.1. Software

- *Microsoft Visio*

  Microsoft Vision is used to sketch the initial 2D drawing of office layout

- *3D Home Architecture*

  To convert 2D drawing into 3D concept to obtain the physical setup of the 3D scene and as guideline how the 3D models should be modeled.

- *3D Studio Max 7*

  3D Studio Max 7 is most used software in this project development. Using this software the activities of creating 3D objects are done. Starting with modeling, setting camera path, develop walkthrough functions, rendering and animation, this is the software that contributes to these processes.

- *Windows Media Player*

  This software is used to allow playback of the rendered video. The rendered video is in the .avi format.

3.2.2. Hardware

- *Computer with CPU 1.8Ghz and 1G of RAM*

  In order to have smooth development, a fine computer is needed since the process of modeling and rendering require lot of cpu and memory usage. The graphic card installed also has to be compatible with high specification to ensure good graphical display for the application.

- *Display Monitor*

  Display monitor is used as the output device.

CHAPTER 4

RESULTS AND DISCUSSION

4.1   Questionnaires on walkthrough application

Questions	Answers (according to number of respondents)	
	Yes	No
1 Do you know what 3D walkthrough application is?	6	4
2 Have you ever experience any of this application?	5	5
3 Do you find walkthrough application interesting? (from 5 respondents who said yes to Q2)	4	1
4 Do you think walkthrough application should be widely use in daily activities? (from 5 respondents who said yes to Q2)	4	1

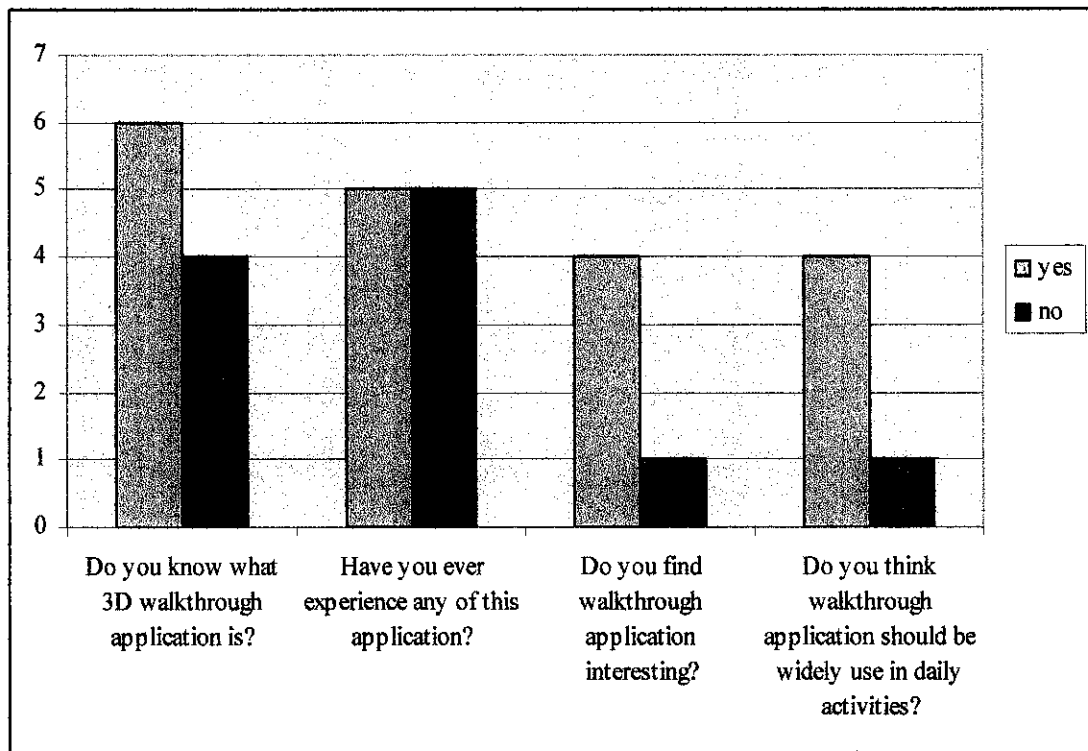*Table 4.1: Table of Questionnaires Results*

Figure 4.1: Bar Chart Represents Questionnaires Results

The figure above shows the result of a survey conducted on 10 respondents. Author had conducted a survey to a group of target users on their awareness of walkthrough application. Based on the information obtained, half of the respondents never experience any interaction or view walkthrough application. What author can figure out from the feedback, the 3D walkthrough application hasn't arrived to many people's knowledge especially people who have low educational background. Despite the fact that 3D technology has existed long enough, many people still don't recognize its potential and usage. As for those who have experience a walkthrough application, 80% of them found that this application is very interesting approach of exploration. They gave feedback on the reliability of walkthrough application to attract people's attention to use them is based on the fact that 3D provides better visualization and realism

environment to the respondents. The only respondent that found that 3D walkthrough application is not interesting is because 3D walkthrough application can only be view from computers and monitor displays, which make it harder to be available at many places. However, another four respondents agreed on implementing 3D walkthrough application in daily activities to aid for better information delivery and to smooth processes.

4.2 Time comparison between reading map and viewing walkthrough application

Author made comparison between 2 main activities; reading a 2D map and viewing walkthrough application. The comparison is measuring time taken to do both activities in order to identify which is faster. Five different subjects tested the activities. The results are as the following:

Word	Time taken to read/view (min)	
	2D map	Walkthrough
Subject A	5	2
Subject B	3	2
Subject C	5	2
Subject D	4	2
Subject E	3	2

Table 4.2: Comparison between time taken to read/view 2D map and 3D Walkthrough

Figure above shows the result from test made to compare time taken by user to read/view an office layout from two sources; 2D map and 3D walkthrough application. Overall, from the results, it clearly demonstrates how 3D walkthrough application gives better delivery than 2D map in terms of time taken to view and understand the office arrangements. Feedback from the test conducted stated that, all the subjects took more time to understand traditional 2D map compare to 3D walkthrough application. Candidates feel to gain more understanding using 3D walkthrough application based on 2 major factors:

Factor 1: 2D map lacking of graphical representation

When asked why candidates tend to spend more time on 2D map, the feedback recorded that this traditional approach limits user's ability to imagine and visualize the real arrangement of the office. The ability to present only 2 face of object limits 2D map to give good graphical representation to user. User find it is difficult to understand and harder to remember. 2D map is too plain that it is not very interesting means of information. 3D on the other hand, allows user to see real shape of objects, which increases the possibility to remember the arrangement better than 2D map.

Factor 2: 3D walkthrough provides realistic presentation

In 3D, objects are addressed with third dimensional that is not present in 2D drawing and allows better viewing, validating and understanding of the office structure. In 3D view scene, the objects created represent its actual shape and increase the opportunities for exploration. . The walkthrough application allows users and all participants to feel as though they are there, walking through space of the office. Candidates tend to comprehend the structure better than 2D map has to offer.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The development of 3D Office Walkthrough application is aimed to become effective replacement of existing 2D map. Now with 3D technology, in walkthrough application, 3D walkthrough application overcomes the problem faced by recipients of 2D map where users usually extract the necessary information and interpret it based on their previous experience, background and knowledge, thus create misunderstanding of the content. The application allows user to explore and to feel as if they are in the scene themselves. This application is also able to give them a real scale of the facility, space, and furnishing Since the typical 2D map only provide information of the layout in line and 2 faces object, this system is designed to enhance the object visualization with 3D representation. The walkthrough application will assist the user to understand the office structure easily and precisely and not only for the benefit of adults, but the simplicity the project has would make it applicable even for children and old folks

5.2 Recommendations

Additional enhancement of 3D Office Walkthrough application are as follows :

1. Develop an application where user has the ability to move the objects around and change their locations.

2. Include speech functions as tour guide to enhance user-friendliness of the application.

3. Make the application available in the network instead of run in a standalone computer by implementing distributed walkthrough system

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APPENDICES

APPENDIX A: GANTT CHART

ID		Task Name	Duration	Start	Finish
1		**Project Identification and Planning**	**35 days**	**Mon 7/25/05**	**Fri 9/9/05**
2		Define project title	5 days	Mon 7/25/05	Fri 7/29/05
3		Initiate proposal	5 days	Mon 8/1/05	Fri 8/5/05
4		Project title approval	5 days	Mon 8/8/05	Fri 8/12/05
5		Obtain supervisor's consultation	5 days	Mon 8/15/05	Fri 8/19/05
6		Information gathering	10 days	Mon 8/22/05	Fri 9/2/05
7		Preliminary report submission	5 days	Mon 9/5/05	Fri 9/9/05
8		**Data Analysis**	**35 days**	**Mon 9/12/05**	**Fri 10/28/05**
9		Requirements analysis	5 days	Mon 9/12/05	Fri 9/16/05
10		Research on the 3D Modeling	20 days	Mon 9/19/05	Fri 10/14/05
11		Identify project's requirement	5 days	Mon 10/17/05	Fri 10/21/05
12		Identify phases involved	5 days	Mon 10/24/05	Fri 10/28/05
13		Submission of interim report	5 days	Mon 10/31/05	Fri 11/4/05
14		Oral presentation FYP Part A	1 day	Mon 12/5/05	Mon 12/5/05
15		**Project Design**	**45 days**	**Mon 10/31/05**	**Fri 12/30/05**
16		Design initial layout	25 days	Mon 10/31/05	Fri 12/2/05
17		Design 3D environment	10 days	Mon 12/5/05	Fri 12/16/05
18		Design 3D modeling & rendering	10 days	Mon 12/19/05	Fri 12/30/05
19		Submission of progress report	5 days	Mon 3/6/06	Fri 3/10/06
20		**Implementation**	**85 days**	**Mon 1/2/06**	**Fri 4/28/06**
21		Modeling	25 days	Mon 1/2/06	Fri 2/3/06
22		Rendering	10 days	Mon 2/6/06	Fri 2/17/06
23		Animation & Keyfram Setting	30 days	Mon 2/20/06	Fri 3/31/06
24		Conduct project test	20 days	Mon 4/3/06	Fri 4/28/06
25		Submission of Dissertation Final Draft	5 days	Mon 5/8/06	Fri 5/12/06
26		Oral Presentation	1 day	Mon 4/24/06	Mon 4/24/06
27		Submission of Project Dissertation	10 days	Mon 5/8/06	Fri 5/19/06
28		Oral Presentation with External Examiners	5 days	Mon 6/5/06	Fri 6/9/06

Project: duration fyp
Date: Tue 6/20/06

Task		Milestone	External Tasks
Split		Summary	External Milestone
Progress		Project Summary	Deadline