Online 3D Housing Showroom

by

Khairul Azwan Bin Badari

Dissertation submitted in partial fulfillment of
the requirements for the
Bachelor of Technology (Hons)
(Information System)

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CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
Information System Programme
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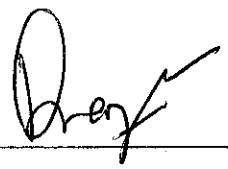
Approved by,

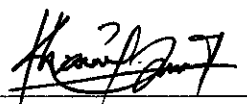


(Anang Hudaya Muhamad Amin)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
DECEMBER 2004

CERTIFICATION OF ORIGINALITY

This is to verify 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.



KHAIRUL AZWAN BIN BADARI

ABSTRACT

Online virtual housing showroom is developed for the housing estate developers to promote and advertise their houses effectively. By using this method, they do not have to build a model house for the potential buyers to evaluate their housing project. They can promote their housing by publishing it in the internet and at the same time giving the user the same experience as visiting the site. Currently, the potential buyers have to visit the site to see and evaluate the house offered by the developers. The needs to visit the site lead to time consuming for the potential buyers. They have to spend their time to visit a few sites in order to see and evaluate the houses before making the decision. There are a lot of websites offered to promote the housing estate; however, they did not have an ability to explore the house itself. The potential buyers still have to visit the site in order to have a closer look of the house. The approach taken for handling this project will be divided into two parts; 3D model development and website development. The modeling stage will developed a model house that will be able to view thoroughly inside and outside the house. The model will be integrated with web page developed to create online housing showroom. As conclusion, the application is beneficial for both housing estate developers and potential buyers because it helps the buyers save their time and cost to make purchasing decision and offers the housing estate developers an interactive promotion strategy for their housing project.

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ABBREVIATIONS AND NOMENCLATURES

VRML - Virtual Reality Modeling Language

GUI - Graphical User Interface

UV - Ultra Violet

3D - Three Dimensional

NURBS - Non - Uniform Rational Basis Spline

NURMS - Non - Uniform Rational Mesh Smooth

CHAPTER 1

INTRODUCTION

1.1 Background of Study

This online virtual housing showroom is a 3D web based application which aim to help the housing estate developers to promote and advertise their housing projects. Besides, it helps the potential buyers to fly by the model of the housing developed such as interior and panoramic view. The user will have a thorough view of the house build and lead them to make better decision. The 3D model of the project is developed by using 3D Studio Max software and the website of the application is developed by using Macromedia Dreamweaver software.

1.2 Problem Statement

The websites offered on the internet does not provide virtual view of the house to the user except plan layout view and model house together with other relevant information regarding the house and company. The potential buyers interested to make a purchase still have to visit the site to get a closer view of the house. This condition will lead to time consuming for the buyers since they have to visit a few sites before making any decision. This project is different with the existing website because it will provide virtual housing showroom to the potential buyers where they can explore and see the house like they are on site.

1.3 Objectives

The objective of the project is to provide an interactive website for the potential buyer to view and make purchasing decision. It is aim to save the time and cost of the potential buyer to find and visit a few housing estates before making any purchasing decision. Beside that, the housing estate developers can promote their housing more effectively. Therefore, it is necessary to develop the application due to needs of the current society to make their life easier and faster.

1.4 Scope of Study

The scope of study for this project is divided into three parts; 3D modeling, website development and Virtual Reality Modeling Language (VRML).

- **Designing 3D model**
  Create a 3D house model to be viewed online in VRML environment. The model created is a simple and basic Malaysian house.

- **Designing a website to animate the model through online**
  Create a simple housing estate developer website to promote the model house. The web will act as the showroom. The website and application should be easy to use and does not require too much time to learn how to use it.

- **Using VRML to enable the virtual reality environment**
  The research involves the tools used to convert the model into VRML format that enable to be viewed through online. The use of VRML will provide interactivity and realism while surfing the website, especially exploring the model.

CHAPTER 2

LITERATURE REVIEW AND THEORY

2.1 3D Modeling

3D modeling is the main part of the overall project. The creation of the housing model is time consuming and needs a lot of time to create the model that reflect to the real house developed.

The software used to develop this model is 3D Studio Max. 3D Studio Max is a modeling or animation software package developed by DISCREET Inc. It uses an open architecture to encourage program additions and features. These features allow 3DsMax to continuously evolve to suit the needs of the individuals using it. The model created has to consider the size of it since it will be viewed over the internet that depending on the connection speeds.

2.2 Website Design

The internet is one of the significant communication developments. It can be used to promote and make the product more exciting and popular. The development of the website needs to be attractive and able to satisfy the user for navigation and view the virtual house. There are a lot of factors that has to be taken into consideration such as platform used, visual effect including text and placement coordination, embedding media, supporting application and internet service provider. The software used to create the website for this project is Macromedia Dreamweaver.

According to CTF Webmeister (Cheshire Technology Forum), we should understand why we need the website and the purpose of creating a website. The second thing is to determine what kind of image or graphic that we need to include in the design. Other than

that are color and text used where it should be legible because the text is used to explain what the website is all about.

2.3 Virtual Reality Modeling Language

VRML is stand for Virtual Reality Modeling Language. It was designed to create a more "friendly" environment for the World Wide Web. VRML incorporates 3-D shapes, colors, textures, and sounds to produce a "virtual world" that a user could walk and fly through. VRML is an interpreted language. Therefore, commands written in text are interpreted by the browser and displayed on the user's monitor. Many of these worlds can be found on the web today. The current specification, VRML 97, supports JAVA, sound, animation, and JavaScript. It allows the world to be dynamic.

There are two version of VRML; version 1.0 and the latest is version 2.0. The major difference that VRML 2.0 has is that it is more interactive and more realistic. VRML 1.0 had static worlds, that is, no interaction and the shapes have no movement. VRML 2.0 enhances this by adding JAVA and JavaScript support, as well as sound and animation. Now instead of just looking at an unexciting house, we can see the windows flutter, the doors open and also cars entering and exiting the garage. VRML 2.0 was such a major leap from 1.0 that a whole new language had to be created.

To write VRML, we need a simple text editor. However, this can become cumbersome, so we can look into a 3D modeling tool. In addition to an editor, we need a VRML 2 browser or plug-in. Most plug-in are for Netscape Navigator and Internet Explorer. The plug-in for these browsers is Cortona VRML.

VRML Script grew out of the need for a lightweight script language in VRML. It is a subset of the JavaScript language, with VRML data types supported as JavaScript built-in objects. It has many advantages over other script languages such as:

- Scripts can be included in source form, inline rather than in a separate URL.

- All VRML 2.0 data types are supported directly.
- Receiving eventIns is handled with separate functions to ease development and to speed processing.
- Sending eventOuts is done with simple assignment.
- The full set of JavaScript string methods and properties are available. Scalar values automatically convert to strings when concatenated. This makes construction of URLs and VRML strings easier.
- Constructors are available for most data types to ease creation and conversion of data.

This kind of format is widely used in the website by the graphic designer to show their art work where the user can navigate and study their model over the internet. However, there is no application like that I have developed yet. The main theory of this application is to integrate the model created in modeling software with the website by using this kind of format.

2.4 Online Housing Showroom

The current housing estate company's websites developed do not have the online showroom where they can show their housing project online to the potential buyer. From what I have found in the internet, they only provide the picture of their housing project and the image of the model house and also the layout plan of the house. The website used is only for promotion where the potential buyers still have to visit the site in order to evaluate and see the house before making any purchasing decision.

CHAPTER 3

METHODOLOGY AND PROJECT WORK

3.1 Procedure Identification

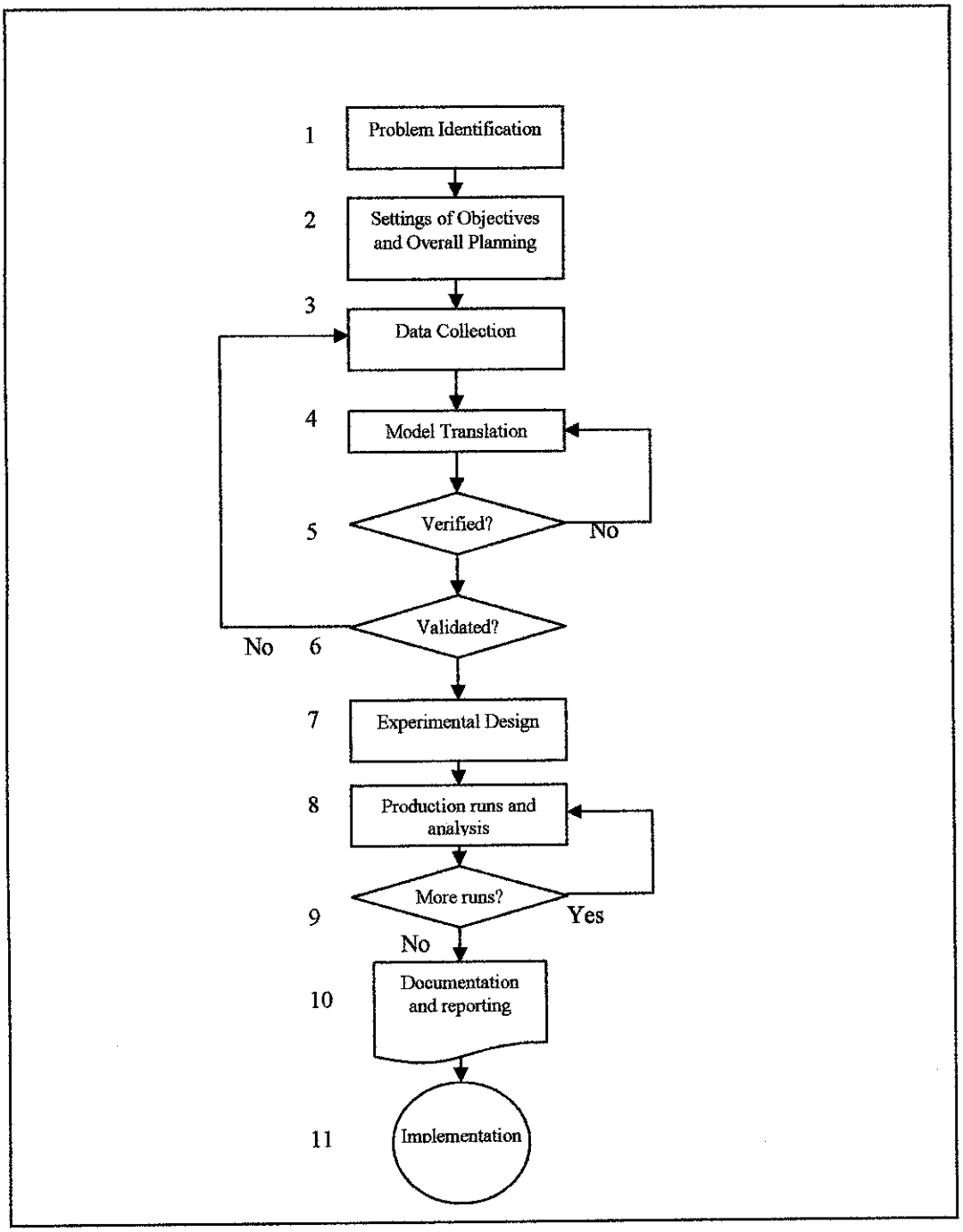

Figure 3.1: Steps in design modeling

Based on the figure 1, below are the steps which have been refined as to design the model in handling the project:

1) Problem Identification

The problem or objective of the simulation must be clearly understood including identifying and analyzing the requirements of the client and user. It is to determine the need and relevancy of the project. The formulation of the simulation must be agreed upon by client and also research studies that have been conducted. The problem will be needed to be formulated again if the simulation does not follow the requirements while it is in the study progress.

2) Settings of Objectives and Overall Planning

Another way to state this step is by "preparing a proposal". The objectives indicate the question which needs to be answered by the simulation that is to be conducted. The project plan will include a statement of the various scenarios that will be investigated for the simulation of the house developed. The plans will indicate in terms of time that is required, personnel that will be employed, hardware and software requirements to be run and to conduct analysis, stages in the investigation, output at each stage, cost of the study and billing procedures.

3) Data Collection

A schedule of the data requirement would be requested from the client. In the best of circumstances, the client have been collecting the kind of data needed and can submit these data to the designer. The data gathered here will be on the architecture of the house, including size and specification and also the concept of the house developed. Beside that, the data collected including the information of the company and project developed.

4) Model Translation

The data collected in step three will be converted and coded into computer-recognizable form, an operational model. This step is designing and creating the model house. This is done by using the 3D Studio Max software for making 3D models. In this model the data collection will be integrated to create the model in 3 dimensional forms.

5) Verified

Verification concerns with the operational model. Is it performing properly? Even with small textbook-sized models, it is quite possible that it may have verification difficulties. The models are orders of magnitude smaller than real models.

The verification is advisable to be a perpetuated process. It is ill advisable to wait until the entire model is completed to begin the verification process. An interactive run controller, or debugger, is highly encouraged as an aid to the verification process. The verification will take into account the house model and the stimulus gathered from the model conceptualization and the data collection phase. The verification loop will continue until the model is verified by the client.

6) Validated

Validation is the determination that the conceptual model is an accurate representation of the real house model. This validation step will investigate the model created which will be separated into two parts; the model conceptualization and the data collected. An accurate representation of the system is examined to both elements as to ascertain their credibility and if one or both is not validated the process will turn back to steps three and four. This loop will continue until both elements of the system are validated by the supervisor of the project.

7) Experimental Design

For each scenario that is to be simulated, decisions need to be made concerning the length of the simulation run, the number of runs (also called replications), and the manner initialization, as required by the clients. This experimental design will lead to the overall house design model.

8) Production Runs and Analysis

Production runs and their subsequent analysis are used to estimate measures of performance for the scenarios that are being simulated. The operation of the analysis will enable a more comprehensive and accurate representation.

9) More Runs

Based on the analysis of runs that have been completed, additional runs need to be determined. If any additional scenarios are needed to be simulated it will be simulated until it gives an accurate representation of the model to be simulated. In this step the more runs of simulation conducted the more accurate the model representation. If the simulation design model does not adhere to the requirements it will go back to experimental design.

10) Documentation and Reporting

Documentation is necessary for numerous reasons. If the simulation model is going to be used again by the same or different analysts, it may be necessary to understand how the simulation model operates. This will stimulate confidence in the simulation model so that the client can make decisions based on the analysis.

11) Implementation

The implementation is when the simulation is completed. The documentation in step ten stands on its merit and is just additional information that the client uses to make a decision. The model will be integrated with the web through VRML.

3.2 Software and Tools

The tools and equipment needed to create this system are basically divided into two main sections which are the hardware and software. The hardware needed is a multimedia computer that is capable to do multimedia works with minimum interruption and lagging problem. The software used to develop this project is 3D software which is 3D Studio Max for modeling and Macromedia Dreamweaver MX which was used to design the website.

Here are the hardware requirements needed for this project:

- Pentium IV 1.6 GHz or higher
- 256 Mb RAM or higher
- 600 Mb freespace
- GForce 2 graphic card or higher

3.2.1 3D Studio Max

3D Studio Max is the first and only fully integrated 3D graphics creation suite allowing modeling, animation, rendering, post-production, real-time interactive 3D and game creation and playback with cross-platform compatibility which is all in one tidy and easily used.

Here are some of the features available in this software:

Modeling:

- A range of 3D object types including polygonal meshes, NURBS surface, NURMS surface, Bezier patch and subdivision surface modeling.
- 'Smooth proxy' style subdivision surfaces.
- Multi spline shape.
- Editing functions such as extrude, spin, screw, warp, subdivide, noise, smooth
- Soft selection editing tools for organic modeling.
- Rendering and extruding shapes.
- Additional modeling method with standard primitive.
- Modeling with modifier such as object and sub-object.

Animation:

- Keyframe animation with track bar and auto key mode.
- Armature deformation with forward and inverse kinematics, auto skinning. and interactive 3D paint for vertex weighting.
- Allows trajectories to visualize the position transforms.
- Non-linear animation mixer with automated walk cycles along paths.
- Vertex key framing for morphing with controlling sliders.
- Character animation pose editor
- Animation lattice deformation.
- Audio playback, mixing and editing support for sound synchronization.
- Scripting access for custom and procedural animation effects.

Real-time 3D/Game Creation

- Graphical editor for defining interactive behavior without programming.
- Collision detection and dynamics simulation.
- Scripting for sophisticated control and fully defined advanced game logic.
- Supports all OpenGL™ lighting modes, including transparencies, Animated and reflection-mapped textures.
- Playback of games and interactive 3D content without compiling or preprocessing.
- Multi-layering of Scenes for overlay interfaces.

Rendering

- Very fast inbuilt renderer including direct X and OpenGL.
- Over sampling, motion blur, post-production effects, fields, non-square pixels.
- Environment maps, halos, lens flares and fog.
- Various surface shades and materials.
- Edge rendering for shading.
- Export scripts available for external renderer.
- UV texture editor with various mesh unwrap modes.
- Export into various kind of format.
- Anti aliasing control and motion blur.
- Support special effect such as light, space warp and particles.

Interface

- Flexible user configurable window layout.
- Powerful object-oriented data system.
- Anti-aliased fonts with international translation support.
- Windows for animation curves and keyframes, flyout, snap control, material and curve editor, viewport with perspective view, quad menu, MAXscript mini-listener, create and modify panel, autogrid, image UV editing, file selection and file management, modifier and transform.

- Inbuilt text editor for annotations and editing scripts.
- Consistent interface across multiple platforms.

Supported Platforms

- Windows 95, 98, 2000, XP, ME, NT (i386)
- Mac OS X
- Linux i386
- Linux PPC
- FreeBSD 4.2 (i386)
- SGI Irix 6.5
- Sun Solaris 2.8

3.2.2 Macromedia Dreamweaver MX

The software is an easier tool used to design the website which makes the ordinary and repetitive tasks of coding easier. Besides, it allows complete control over the code. The software takes advantages of the latest Web technology and HTML standards with backward compatibility and designer's work flow.

Here are some features available in this software:

Enhance Layout

The feature available is redesigned workspace. Panels are now docked together and, if the Windows-only MDI mode is used, documents appear in a single window. The redesigned look and feel matches other Macromedia products in the MX line: Fireworks, Flash, and FreeHand. This common user interface smoothes out the workflows and aids productivity.

The software also restores the underlying architecture of how documents and sites work together and made it far easier to work with different types of Web documents. The New Document feature now allows to pick from 36 different standard formats can add our own. It also includes a wide variety of basic page layouts, from text-based pages to product catalogs.

Code Editing

Dreamweaver revitalized its coding architecture by tying each page type to a customizable set of tags known as a tag library. This enhancement gives users the power to create HTML, XHTML, ASP, ColdFusion, XML pages, and more with equal ease. It also provides an easy-to-use editor for managing existing tag libraries and adding new ones.

Two other new features are geared to ramp up code production. The Snippets panel keeps commonly used blocks of code within easy reach and can add our own code and manage the categories. The tag inspector serves double-duty by first exposing all the page elements in a collapsible tree structure, and second by allowing all the attributes of any selected element to be directly edited.

Powerful CSS Support

- CSS rule inspector
- CSS layout visualization
- CSS based page properties
- CSS based text property inspector
- Improved CSS rendering and panel

Supported Platforms

- Windows 98, 2000, XP, ME, NT
- Mac OS 9.1 or Mac OS 10.1 or higher

CHAPTER 4

RESULT AND DISCUSSION

4.1 The House Model

4.1.1 Modeling

The 3D house model created in this application is according to self specification and concept. This is because the model created is not for any company and it is as a sample to promote the application developed.

The model is developed by using 3D Studio Max. The figure below shown the views of the house created so far. The model house created has three rooms, two toilets, a living room and a kitchen.

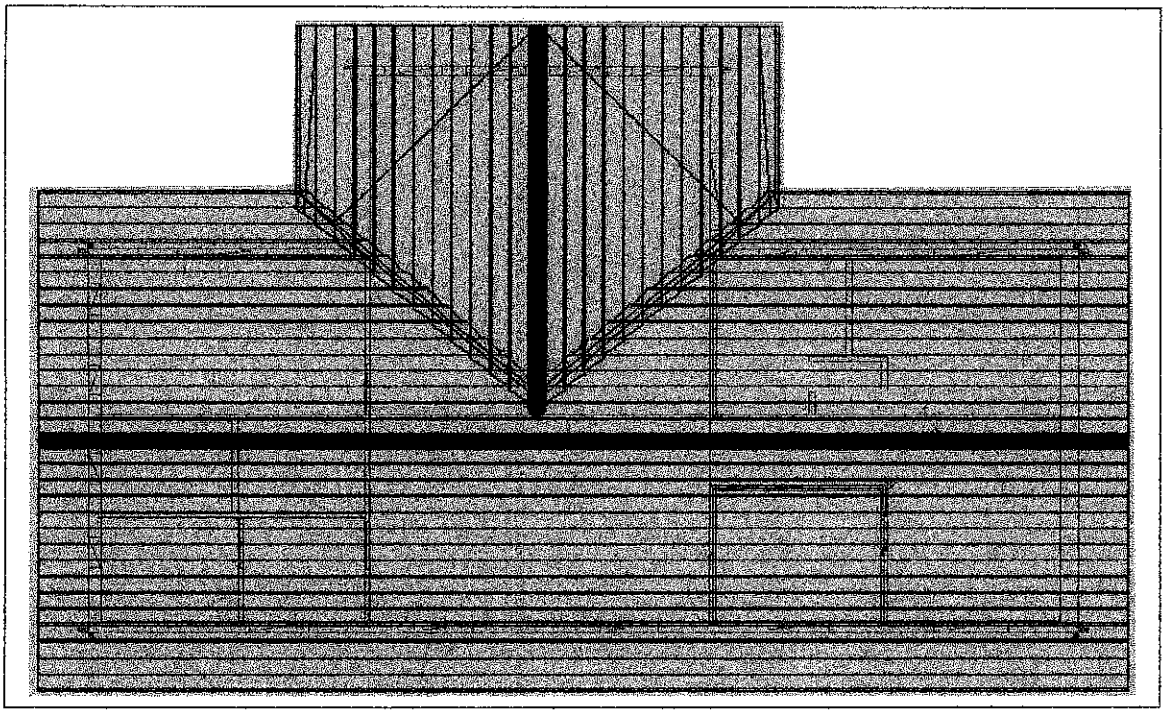

Figure 4.1: Top view of the model

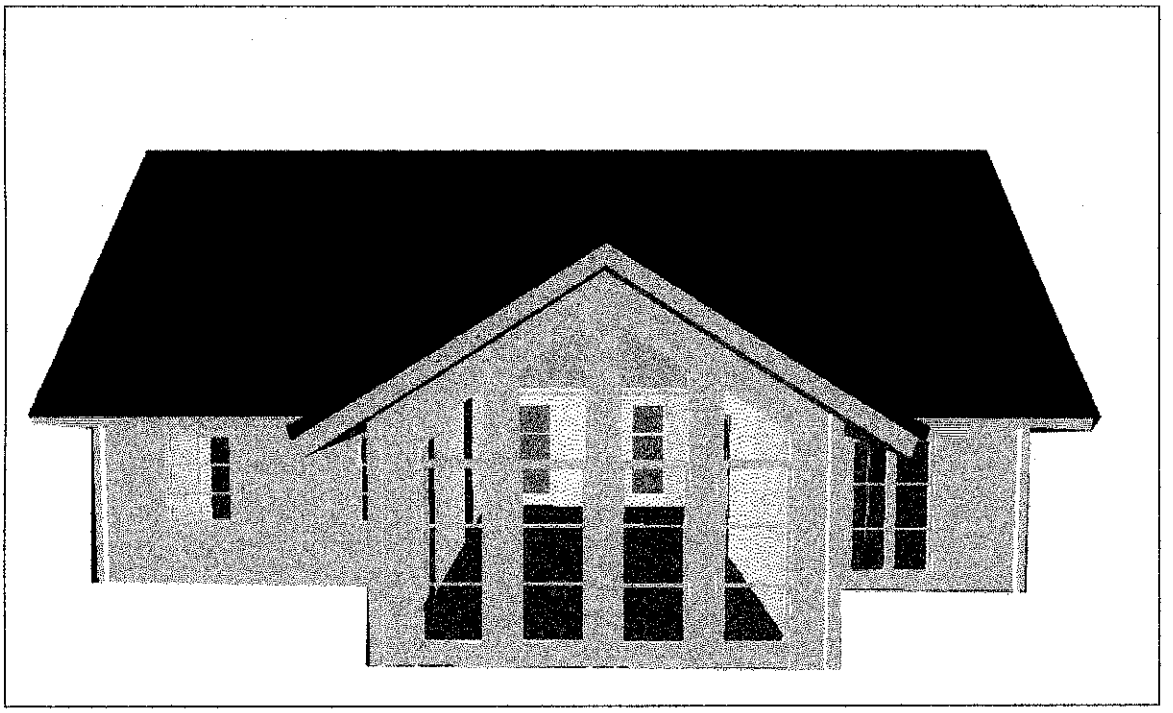

Figure 4.2: Front view of the model

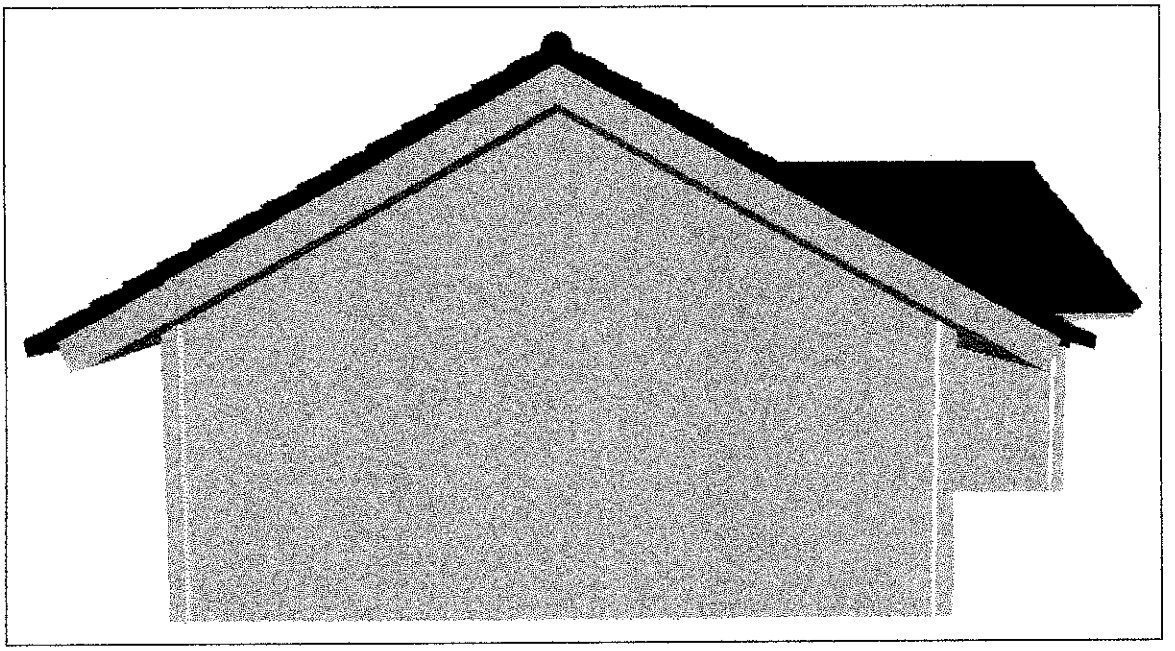

Figure 4.3: Left side view of the model

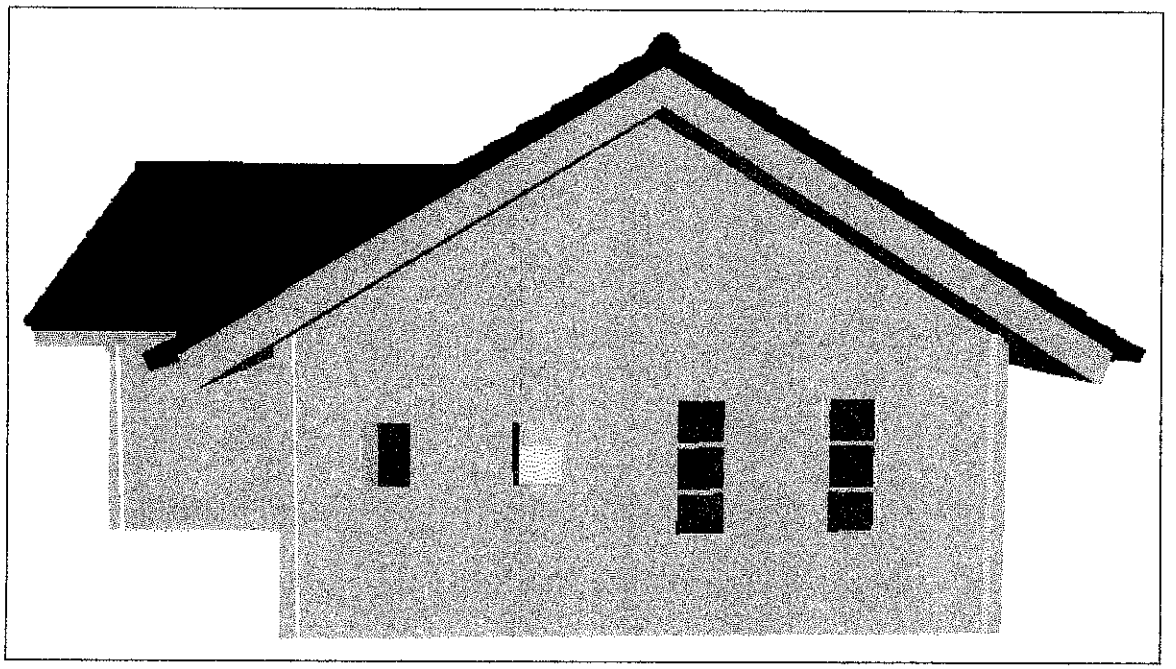

Figure 4.4: Right side view of the model

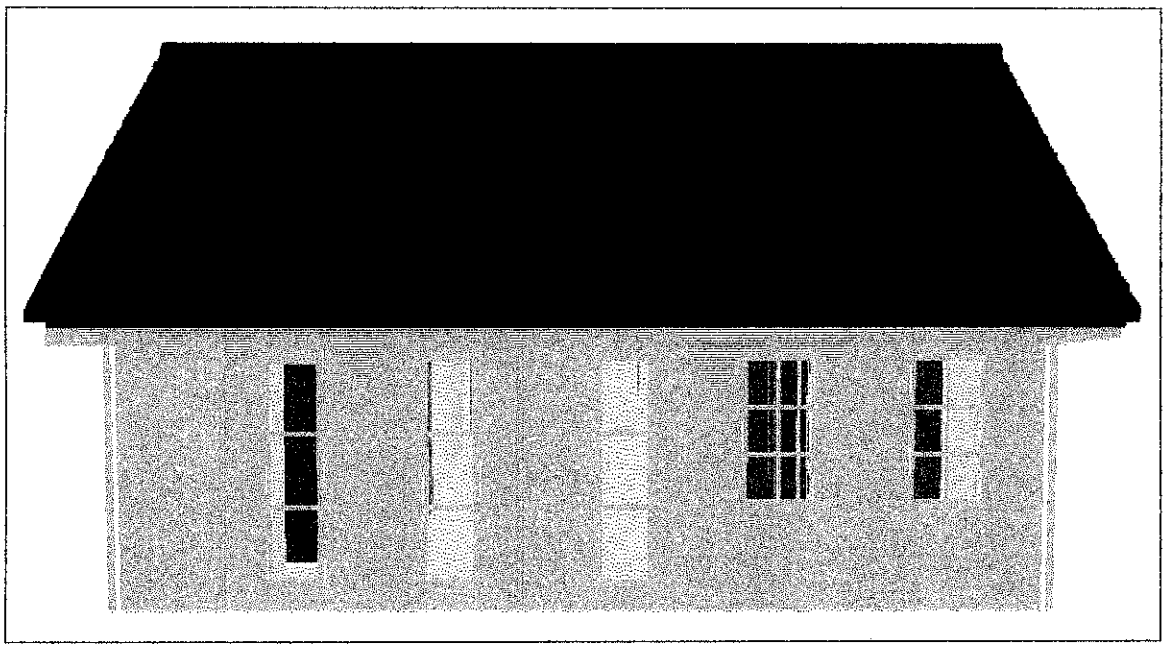

Figure 4.5: Back view of the model

The modeling process of the house begins with analysis and imagination. The real images will be studied and imagine what the model would look like. After that, the idea will be translated into the model by using various types of object model. There are three main categories of the modeling technique; Mesh, Bezier Patch and NURBS. Each type has its own strength and weakness. These three techniques were used in this project to produce the model because each object has its priority in terms of object details and textures.

Mesh Modeling

This type of model is referred to as a polygon or poly model and sometimes it called wire mesh. The main characteristic of mesh model is that it has no true curvature where it is composed entirely of perfectly flat surfaces called polygons or faces. The polygons are built from straight lines called edges while its end is called vertex.

The approximation of curvature is determined by the number of polygons. Meaning that, the more polygons appear in an object, the higher mesh density or mesh resolution of the object and it will give more realism of the object created. However, the increase in density of a mesh object will increase the render time. Therefore, it is important to know the intended use of the model before building the model.

With mesh model, each vertex, edge and polygon is explicitly. This kind of technique is suitable for hard surfaces such as architecture. It is necessary to exert precise, low level control over individual vertices and faces.

Bezier Patch Modeling

The advantage of this modeling technique is that it is easy to achieve naturalistic curvature. The curves of these objects are controlled by a small number of control vertices (CV). The manipulation of CV can define the contours of the model.

This kind of technique is suitable for character modeling because it is easy to change the density of the model. The complexity of the surface can be altered instantly by using a parameter. However, this technique may slow down viewport interactivity compared to similar mesh object because the render process may take longer to calculate the semi parametric nature of the object.

NURBS Modeling

NURBS technique is the most challenging and complex form of modeling. NURBS is stands for Non – Uniform Rational Basis Spline. It has more functionality than other technique because the object's surface can be trimmed and blended.

This technique is suitable for automotive and industrial designer to produce complex surfaces with smooth curves. The NURBS object is only suitable for rounded surfaces. Because of it advantages over rounded surface, this kind of technique was used to design the toilet bowl and the sink.

After the object model is created, the shape can be changed with modifiers. It can control the effect of the object will have. There are two basic levels of manipulating the modifiers; object and sub-object. The object modifier is used to transform the geometric object to achieve different effects while sub-object modifier is used to bend or taper the object. Another useful modifier for shape is bevel. This modifier extrudes an object and also creates an outline of the shape. It can be used to create a 3D object with angled edges and produce curved surfaces. The angle of the bevel is controlled by the extrusion distance and the outline parameter.

4.1.2 Material

Materials are the paint or texture to put on the models. All of the surfaces properties of renderable objects such as color, bumpiness, shininess and transparency are defined by materials. Materials to be used are created, edited and assigned in the material editor of the software. Material is the whole host of the attributes which controls how the objects will rendered. There are four levels of creating the material; types, shading algorithm, parameters and maps.

Each material type has its own specific function and purpose such as cartoon style, complex layering and composite. Shading algorithm is the process of rendering geometry so that it responds to simulated light in environment to achieve a certain look such as plastic, glass and metal surfaces. The parameter is used with shading algorithm to control the ambient, diffuse, glossiness, opacity and specular of the materials. The map or called texture map is used to vary the material parameters across the surface of the object. It will place a pattern or image on the object to simulate changes in color.

4.1.3 Camera and Light

Camera is the element used in this project to navigate the house. A camera is used to set up a particular view and it can be placed and moved like any other object in the scene. There are two types of cameras, target and free. A target camera is a look-at point where it will always pointed at its target object while free camera does not have target. Each camera has a focal length and field of view associated with it. Focal length is the distance from the center of the lens glass to the film while field of view is the angle that can be viewed with the camera's lens. This two parameters combine together to produce different perspective effects. As the focal length increases, the field of view decreases and the perspective tends to flatten out and vice versa.

There are several types of light that can be used for this project. The main types of standard lights are omni, spot and direct. Omni is the simplest type where it sheds light on objects in all direction and it is used as general illumination of the scene. The spot light shines in one direction that creating a cone of light that gets wider as farther from the light source. Meanwhile, the direct light only casts a parallel rays that project a cylindrical beam which will not diverge over distance. This type of light is used to simulate very distant light source such as the sun.

The choice of lighting depends on whether the scene simulates natural or artificial illumination. Naturally lit scenes, such as daylight or moonlight, get their most important illumination from a single light source. Artificially lit scenes, on the other hand, often have multiple light sources of similar intensity. In this software, both kinds of scenes require multiple secondary light sources for effective illumination.

4.1.4 Rendering

The final process of creating a 3D model is rendering to make a movie. Basic rendering in 3Ds Max is very easy to use; however, there are a lot of tools can be used to customize the rendering according to our preference. In this software, we can use rendering parameters in render scene dialog to control the aspect such as time output, output size, file type and compression.

The time output section can control the number and range of frames to be rendered. We can choose either single or active time segment or range. The output size section determines the resolution of the rendered image. The image resolution used for this project is 640 x 480. The rendered image can be saved in various kind of format. The type chosen can affect the size of the output file. Animation formats such as Microsoft (.avi) and Apple QuickTime (.mov) are generally used for test rendering. For final production, the images are usually rendered in .TGA format because it is the most widely supported file type for video. However, .AVI and .MOV formats are suitable to display

over Internet because these format use lossy compression technique to discard information to save disk space.

The finished product model is converted into VRML format (.wrl) by using export option in the software. To view the converted format, we need a plug-in for Internet Explorer called Cortona VRML. The browser will automatically read the format and display the model where we can navigate and fly by the model.

4.2 Website Development

4.2.1 Website Design

The website for this project is designed by using Macromedia Dreamweaver MX. The website for this project is simple and contains the information of the company and to linking with VRML environment. The first step to develop a website is to gather bas much information about the company of the housing estate. The information needed such as the housing project that is developed, the company background, contact information, the house model and its specification, the product and house details and services offered.

After all the information is gathered, the website was developed by starting the layout of the main page. The main page is the doorway or entrance for the whole content of the website. It is mainly consists of the history and background of the company. There are a few buttons to link to another page to view the other content of it including the showroom where the user will be brought into VRML environment. The model created is integrated into the web page. The VRML environment is a separate Internet browser which it has its own default layout. The browser has a few buttons used to navigate and explore the model which will be explained later.

Figure 4.6 below shows the main page of the website developed by using Macromedia Dreamweaver. The main page shows the name of the company and their background including the services offered and their reputation among the housing estate developers.

There are four buttons to assist the navigation of the website which are; About Us, Project, Showroom and Contact Us.

The Project button will open the Housing Project Development page as shown in figure 4.7. The page tells the overall project development and the advantages of that project. This is where the company will promote their housing project to the potential buyers.

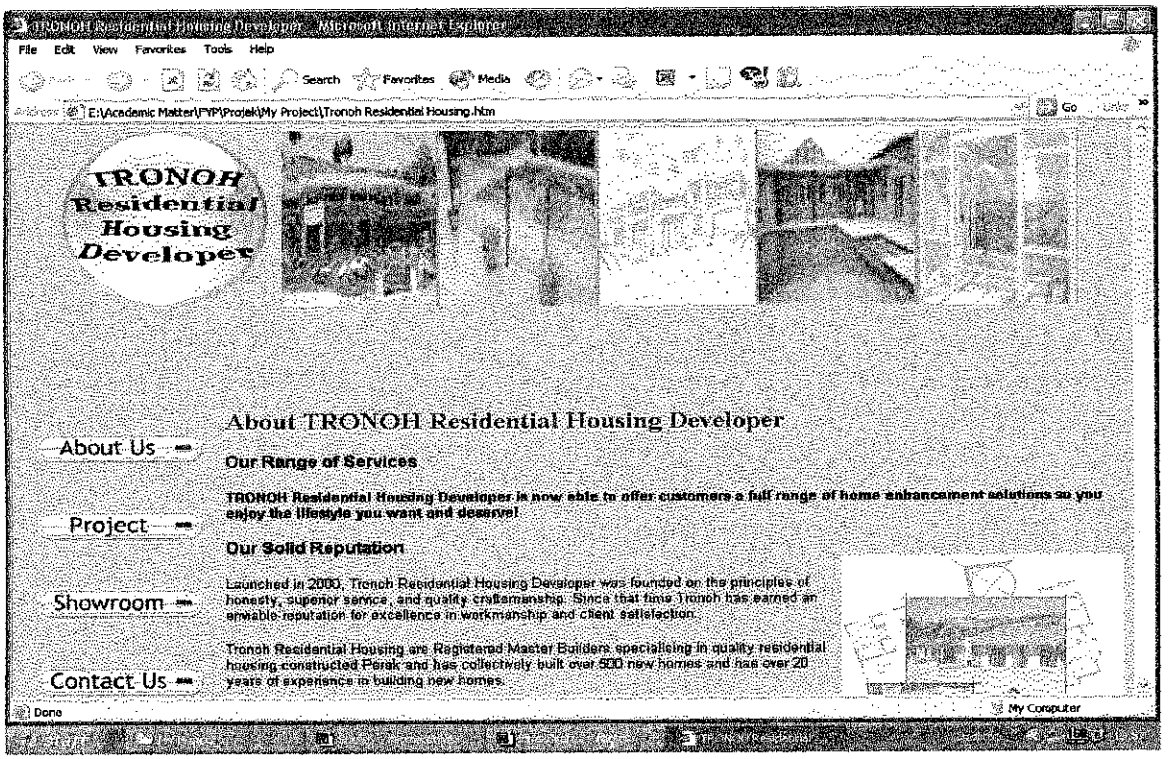

Figure 4.6: The main page of the website.

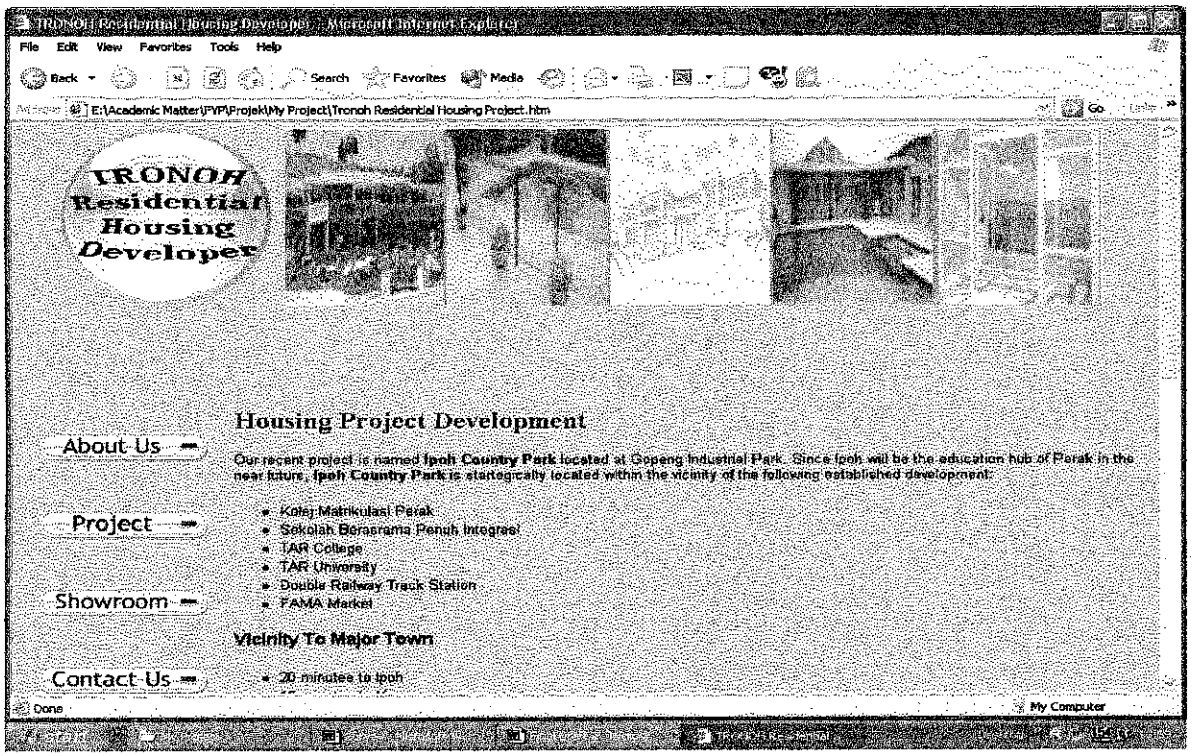

Figure 4.7: The housing project development page

Meanwhile, the Showroom button will link to the 3D model of the house where it will open a VRML browser and loading the image file.

4.2.2 Model Navigation

The figure below (figure 4.8) is the Internet Explorer browser that showing the house model in VRML format. The browser is linked with the button in the main web page and it will automatically load the model to be viewed. The layout of the browser shown is the default layout when viewing the model in this kind of format.

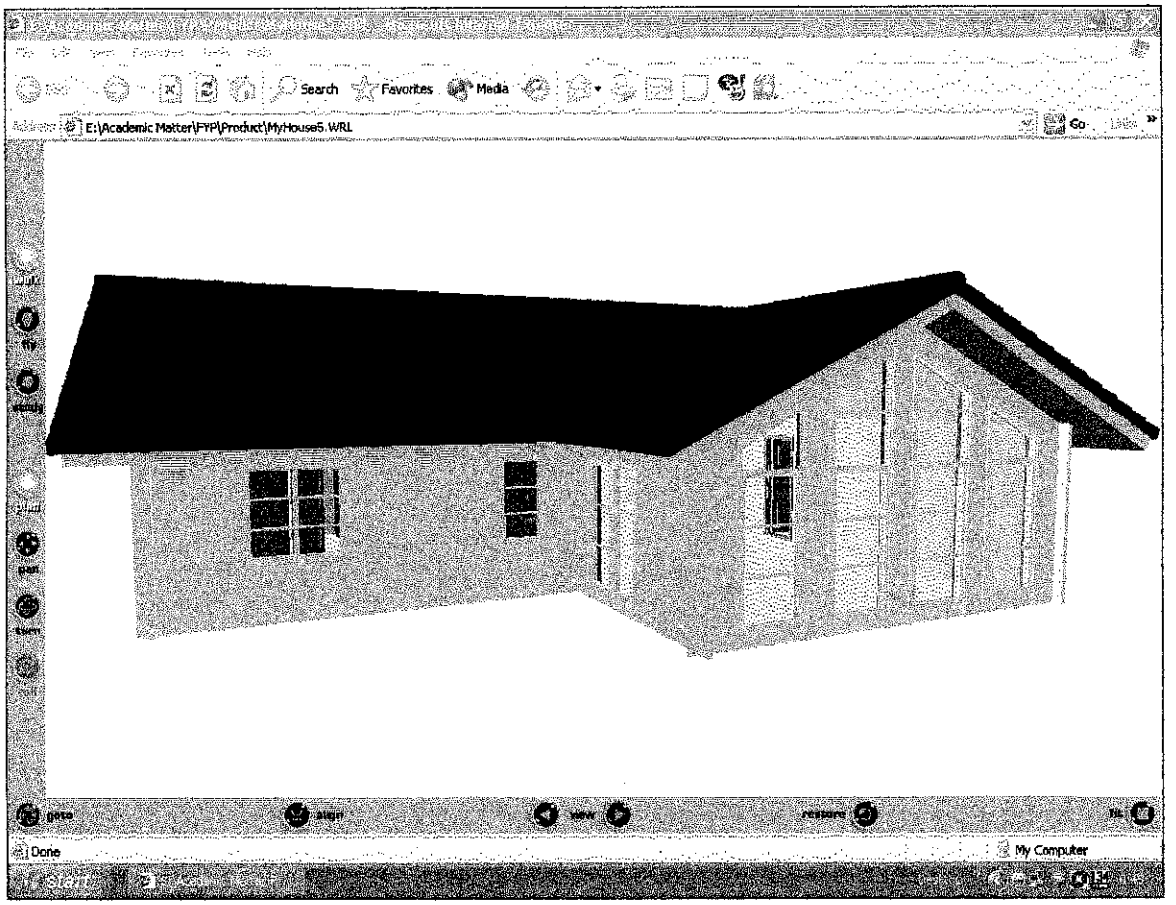

Figure 4.8: Virtual reality navigation screen

Moving through a 3D space in VRML environment is similar to moving a camera. Think of a video camera that captures images in the real world and converts them into electronic signals for viewing on a screen; it has a position and orientation, and these are independent attributes. This concept assumes that there is a real person viewing and interacting with the VRML environment.

We can place any number of viewpoints or cameras where the user might wish to view the world. This viewpoint is done during development stage of the model in 3D Studio Max. However, only one viewpoint may be active at a time. By using this environment, we can go into the model and look around of it.

There are a few buttons on the interface in order to assist the navigation. On the left side of the window, there are seven buttons to navigate the model, which are:

i. Walk - walk into the model (forward, backward, right, left)
ii. Fly - Fly by the model
iii. Study - Rotate the house at the same axis
iv. Plan - Use with fly button
v. Pan - Use with walk button
vi. Turn - Use with study button
vii. Roll - Use with study button

On the bottom of the window, there are six buttons to reset the model to its original form during navigation. The buttons are:

i. Goto - Use to go to the next model.
ii. Align - To position the camera's horizontal and longitudinal axes parallel to the scene horizontal plane.
iii. View (two Buttons) - choose viewpoints from the pop-up menu.
iv. Restore- return to the loaded world's original active viewpoint.
v. Fit - view fully visible scene in the window.

4.3 User Response

According to the random survey conducted, the user response towards the application is fairly positive. There were 20 users involved in this evaluation by using a set of questionnaire as included in appendices section.

Below is the result for Section A of the survey;

	Score				
Category	**1**	**2**	**3**	**4**	**5**
Interface	0	0	10	6	4
Content/Information	0	0	0	13	7
Control/Navigation	0	0	0	15	5
Interactivity	0	0	6	10	4
Realism	0	2	16	2	0

Table 4.1: The result of user response (Section A)

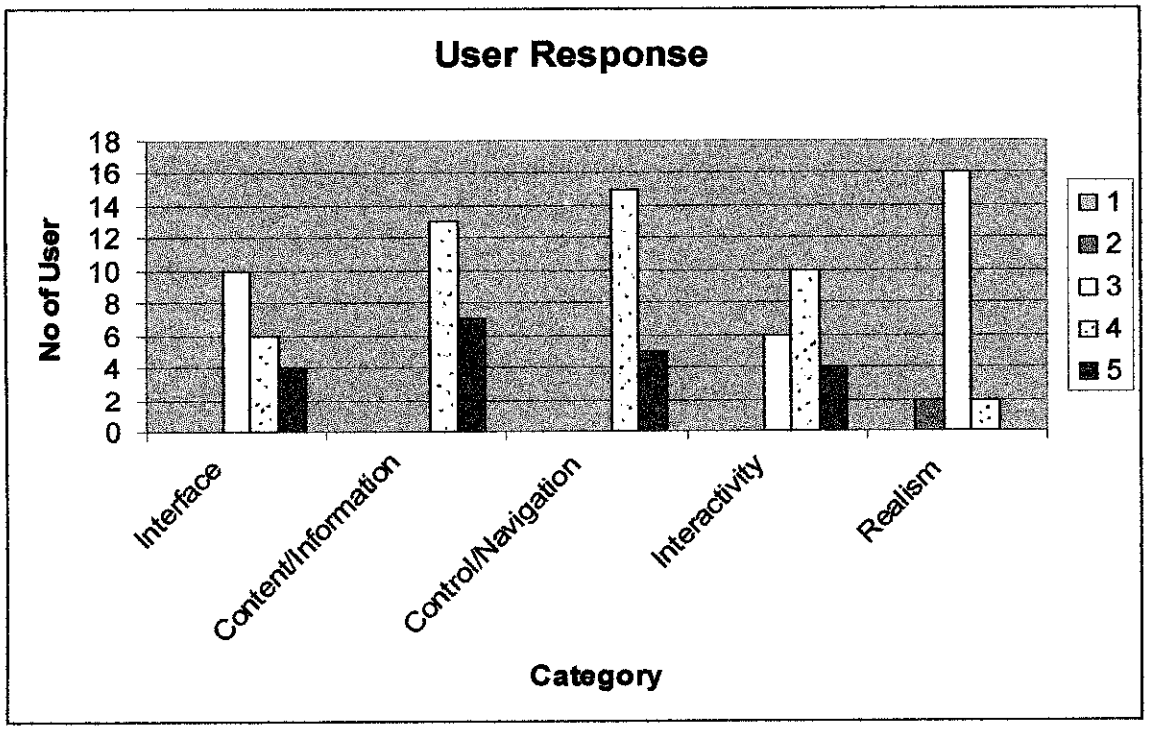

Figure 4.9: User response graph (Section A)

Table 4.1 shows the result of the survey with 20 respondents for Section A. From the table, it shows that the interface of the website and realism of the house model are only average and needs to be enhanced to attract the potential buyer. However, the users were satisfied with other categories where more than 50% of the respondents give score 4 out of 5.

	Response	
Question	Yes	No
A	15	5
B	10	10
C	17	3
D	17	3

Table 4.2: The result of user response (Section B)

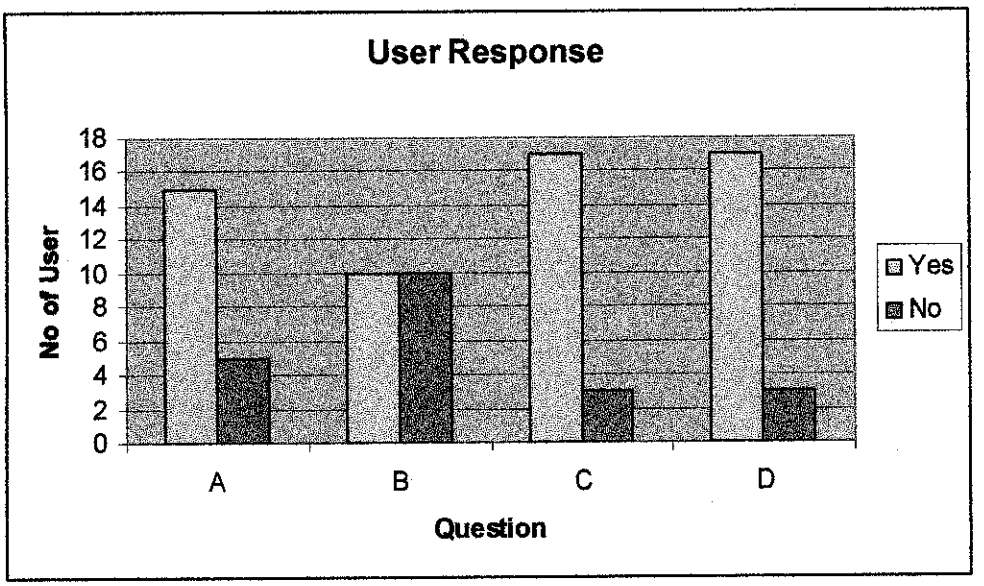

Figure 4.10: User response graph (Section B)

Table 4.1 shows the result of the survey with 20 respondents for Section B. From the result, it shows that the users were agreed that the application is useful for them in order to make their housing purchasing decision. The users also found that the application is easy to use and the browser environment used was user friendly.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

This application, 3D online housing showroom, is beneficial both to the housing estate developers and potential buyers because it helps the buyers to make purchasing decision and offers the housing estate developers to promote their housing project in an interactive way. This project may attract the attention of the housing estate developer since it offers a lot of advantages especially the cost which is much cheaper than developing the real model.

The 3D Studio Max software is very powerful that can create 3D model as detail as possible compare to the real one. This software has a lot of features to do this which has been explained in detail chapter three.

The virtual reality can be viewed online by using VRML. The model that converted into this format will be interpreted by the internet browser and displayed on the monitor. The environment used to navigate the model is very user friendly and easy to use. The model exploration is interactive and the users will feel like they were at the sites.

5.2 Recommendation

The application can be further enhanced by offering online purchasing or booking system where it allows the user to make reservation for their preferred house. By doing so, the potential buyers do not have to go to the developer's company in order to make their reservation.

Beside that, it can be further enhanced by offering more interactive user centered design. The feature that might be included into the application is interior design for the company that might be interested to expend their services. The feature recommended might be some kind of after sales service where the buyer might want to renovate or decorate their house. The feature will allow the user to modify and illustrate the model house according to their preferences. They can place the furniture, decorate and painting the wall and modify the size of the rooms. These enhancements may be costlier and is harder to conceive but it will be beneficial to both the commercial sector and the community itself.

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APPENDICES

ONLINE 3D HOUSING SHOWROOM.

The survey is to get the user respond regarding the application as an alternative rather than visiting the project site for housing purchasing decision.

Please answer the question below:

Section A

Interface	1	2	3	4	5
Content/Information	1	2	3	4	5
Control/Navigation	1	2	3	4	5
Interactivity	1	2	3	4	5
Realism	1	2	3	4	5

(1 = Poor and 5 = Excellent)

Section B

A) Is the application helps in your decision making? Yes No

B) Do you still need to visit the site after using this application? Yes No

C) Do you find the application is easy to use? Yes No

D) Do you think the application is user friendly? Yes No

APPENDIX A: GANTT CHART- WORK PLAN FOR FINAL YEAR PROJECT, JULY 2004

No.	Section 1.01 Detail/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Selection of Project Title - Title of FYP: **Online 3D Housing Showroom**														
2	Preliminary Research Work - Introduction - Objective - Methodology - Literature review ▪ Internet source ▪ Journals ▪ Books - Project Process Flow Chart - Suggestions and Scope of Study														
3	Submission of Preliminary Report (Initial Proposal)														
4	Project Work - Reference/Literature - Tools and Software Identification - Familiarization with necessary tools and software will be used during the projects														
5	Submission of Progress Report														

No.	Section 1.02 Detail/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
6	Project Work Continue - System Design														
7	Submission of Dissertation Final Draft														
8	Oral Presentation														
9	Submission of Project Dissertation														

Legend: **Work Plan**

Submission Date