CERTIFICATION OF APPROVAL

2 ½ Dimensional (2½ D) Web-Based Virtual Walkthrough (VW) of Chancellor Hall (CH) and Undercroft of Universiti Teknologi PETRONAS (UTP)

By

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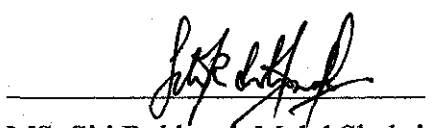
Approved by,



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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 person.

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ABSTRACT

This project will focus on the development of a 2 ½ D Virtual Walkthrough of Chancellor Hall and Undercroft of UTP. The virtual walkthrough is developed in 2 ½ dimensional in order to reduce the size of the virtual walkthrough. Besides that, the virtual walkthrough is available on the Internet so that it can be easily obtainable and accessible by people. The existing visualization of both CH and Undercroft of UTP does not offer sufficient illustration. The insufficiency leads to the issue of getting lost among individuals whom is coming for the first time to UTP. The insufficiency also can lead to dissatisfaction particularly among the potential sponsors of an event when the location provided which is where the event been held does not meet their expectation. Therefore, this project is meant to provide a virtual visualization to mainly the individuals who have never been to the CH and Undercroft of UTP due to distance constraint. Besides that, this project aims to provide an easy understanding and initial direction on how to move from one location to another location as well as the facilities within CH and Undercroft of UTP by providing a better illustration than the existing visualization.

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CHAPTER 1
INTRODUCTION

1.1 Background of Study

Virtual Walkthrough (VW) is one of the most common behaviors exist in virtual environment. VW can be developed to explore a building particularly the areas inside the building. Then, Chancellor Hall (CH) and Undercroft is part of the new academic buildings in Universiti Teknologi PETRONAS (UTP). Various activities particularly important events have been held at CH and Undercroft. Most of the activities and events held typically engage UTP's community which is its staff and students. Nevertheless, there are numerous activities and events that engage external individuals or organizations as well. For instance, UTP Convocation Ceremony is UTP's annual event and its audience is ranging from UTP's chancellor; UTP's staff; UTP's students; students' parents, relatives and parents; and so forth.

VW of CH and Undercroft of UTP is developed in order to provide a much better illustration of the building to the targeted audience which are the external individuals or organizations. The development of this VW will be focusing on illustrating the interior design particularly the areas inside the CH and Undercroft of UTP. Besides that, the VW offers user control in order to give hands-on experience to the end-user. With hands-on experience, user will be able to understand and memorize the area easily. In addition, the virtual walkthrough is in 2 ½ Dimensional and can be accessed using Computer which has Internet connection. Then, illustration on examples of exhibition is included on the virtual walkthrough of Chancellor Hall. With this development, it is anticipated that the targeted audience will be able to see, know, understand and memorize each area inside the CH and Undercroft of UTP easily and effectively.

1.2 Problem Statement

Various events or activities have been held at Chancellor Hall (CH) and Undercroft of UTP. Most of the events or activities held there usually involved non-UTP community too.

The attendees of the events are navigated from one location to another location in CH and Undercroft of UTP by the organizing committees or a sign. Nevertheless, there are possibilities of being lost because the attendees might overlook the sign or do not understand the sign provided. Being lost of direction is not appealing or likable as time is wasted, causes postponement to do next activities and can lead to depression. This kind of situation is also happening during any events held in CH and/or Undercroft of UTP such as to the parents during UTP Convocation Ceremony or the new students of UTP during their Orientation Week.

Then, sponsors of most events in UTP are companies from around Malaysia. For instance, Technology, Education and Career (TEC), which functions similar to a career fair, is one of the events held annually at these two areas. Companies from various industries in Malaysia, mainly those related to engineering and IT are invited to participate in this event. Besides that, exhibition is held at the areas in front of the CH during TEC. Sponsors are provided with the 2D plan of booth arrangements before the exhibition. Booth size is told verbally, via written word or 2D image. During the exhibition, sponsors might not feel satisfied particularly when the characteristics of the booth provided do not meet their expectation. Dissatisfaction may lead to loss of potential sponsor to the event and other events that is going to be held in UTP in the future.

1.3 Objectives

The objectives of this project are:

- To develop a 2 ½ Dimensional virtual walkthrough of Chancellor Hall and Undercroft of UTP which can be used by individuals, whom are coming to UTP, to learn on how to move from one location to another location in Chancellor Hall and Undercroft of UTP which will contribute to solve the issue of getting lost while they travel for the first time at Chancellor Hall and Undercroft of UTP.

- To develop a 2 ½ Dimensional virtual walkthrough of Chancellor Hall and Undercroft of UTP which can be used to provide a better visualization of the two areas - comparing to the current available representation - for the individuals whom have never been to UTP.

1.4 Scope of Study

- To develop a virtual walkthrough that enable user control in order to give hands-on experience to the user and so that the user is able to understand and memorize the areas easily.

- To use computer as the output device for this virtual walkthrough as it is more convenient for the user because most people nowadays owned a computer.

- To make the virtual walkthrough available and accessible at the Internet so that it can be obtained easily by the targeted audience.

- To include illustration on example of booth arrangement during selected Exhibition held at the area in front of CH which can be used by any organization committee of any event in UTP as a sample to be shown to the potential sponsor of their event.

- To develop 3D graphic models using Google SketchUp that illustrate selected areas and facilities inside Chancellor Hall and Undercroft of UTP.

- To develop 2D graphic images using Paint and Picasa that will be used to illustrate selected areas and facilities inside Chancellor Hall and Undercroft of UTP and as signs in order to inform where the location and facility is and what is the name of the venue.

CHAPTER 2
LITERATURE REVIEW

2.1 Definition of Virtual Walkthrough (VW)

According to Arns and Cruz-Neira (2004), walkthrough is one of the most frequent activities being carried out in virtual environment. Besides that, Elmqvist and Tudoreanu (2007) describe virtual walkthrough as one of the functions used in virtual world to imitate reality in order to provide understanding about a place. Then, Chim, et al., (1998) stated that with VW application, people can explore a specific place of interest that is made as a virtual environment without having to travel it physically. Rutenbeck (2006) provides a more specific definition of VW on his book. According to Rutenbeck (2006), VW is also called virtual tour. He also added that VW is a software-based technique using virtual reality applications that enable user to appear as "walking through" a physical environment that has been made to a virtual environment. Therefore, we can conclude that virtual walkthrough or virtual tour is an application that allow user to explore a physical place on virtual environment.

2.2 Virtual Walkthrough (VW) and its Application around the World

The advance on technological development is one of the factors that contribute to enormous development of 3D virtual environment among worldwide community [8]. For instance, Hong Kong is one of the countries which have carried out various research programs as well as developments related to Computer Graphics

including development of VW for architecture [18]. At other countries, VW on architecture are mostly developed to illustrate cultural heritage, museums, historical monument, and cultural archaeological sites [5] [9]. Moreover, recently - which is on March 2011, Google launched its Google Art Project Tuesday wherein they are going to create a 3D VW of 17 museums wherein the selected museums are some of the most prestigious museums in the world [13].

In Malaysia, VW is widely used among hospitality industry such as hotel, apartment or restaurant. For instance, Archiseed is a 3D visualization company which has developed 3D Architecture Walkthrough for Pick & Brew, one of the restaurants at One Utama, Petaling Jaya as well as for Nura Wellness, a wellness center located at Kuala Lumpur [2]. For education sector in Malaysia, most universities, colleges or schools are using 2D images and recorded videos such as their university's corporate video to illustrate their campus. However, there are some universities that have developed their own campus VW. For instance, EduWorldGroup has built a 3D VW or virtual tour of Taylor's University campus [7]. Then, some of the students of University of Technology PETRONAS (UTP) done projects related to 3D and virtual walkthrough of UTP campus. For instance, Norul Huda M.S (2001) developed a walkthrough for UTP new campus that allow exploration of some of the main locations in UTP.

To conclude, the usage of virtual walkthrough application on architecture within education sector in Malaysia is unusual and still new. However, the development of virtual walkthrough for architecture is still achievable as it is frequent and prominent at other countries.

2.3 Chancellor Hall (CH) and Undercroft of University of Technology PETRONAS (UTP)

As stated by Arns and Cruz-Neira (2004), VW of architecture allow people to explore and understand the layout and features of a building. This project will be focusing on developing a VW of CH and Undercroft of UTP. As taken from a review report written by Hanif K, CH of UTP is the other half of the UTP's Chancellor Complex that has a 3,000-seat auditorium with five tribunes, retractable and loose seating and an excellent acoustic performance. As part of chancellor complex, CH has contributes in providing exceptional conference facilities for other institutions to use and allows the learning of technology to be linked with access to cultural offerings such as music and art [12]. Whereas Undercroft comprises of seminar rooms, exhibition areas, VIP suite, Green Room and other facilities such as prayer room and storages. Seminar rooms usually are a place where examinations and other events such as award ceremony or talk are held.

2.4 Creating a Virtual Walkthrough (VW)

According to Hooi, et al. (2007), virtual environment for VW can be created using 3D graphics model or digital photos (image-based approach). However, Hooi, et al. (2007) and Arif, W.N., et al. (2009) claimed that developing a virtual walkthrough using image-based approach required superior photography capturing techniques and special photography tools in order to create better images so that a more realistic virtual environment can be developed. Besides that, Rambli, et al. stated that developing a virtual walkthrough using image-based approach resulted in huge size of virtual walkthrough [13]. Hence, huge size of virtual walkthrough as a result of image-based approach, non-existence of special photography tools as well as lack of photography skills are the reasons why image-based approach is not selected to develop the virtual walkthrough.

Nevertheless, the size of the VW developed using 3D graphics model will be large too. To reduce the size of the virtual walkthrough, the virtual walkthrough is developed based on 2 ½ dimensional concept – instead of developing the virtual walkthrough fully in 3D. 2 ½ D is a concept introduced by Ware (2001). 2 ½ D concept encourages 2 ½ attitude which is combining 3D and 2D elements in developing a virtual walkthrough. According to Ware (2001), 3D elements are more suitable to construct objects while 2D elements are more appropriate on tasks associated with reading, entering and editing text. Ware (2001) also added that it is easier for user to identify, analyze and remember diagrams and objects with 3D components. Consequently, the virtual walkthrough of Chancellor Hall and Undercroft of UTP is going to utilize 3D elements more than 2D elements as it provide better illustration in visualizing the real world. Then, 3D elements are to be used on developing diagrams and objects whereas 2D elements are to be used on developing text such as door sign.

2.5 Virtual Walkthrough (VW) and its Output Device

Head-mounted displays (HMD), mobile and computer are some of the output devices available that can be used to display virtual walkthrough [16].

Pausch, Proffiitt and Williams claimed that HMD provides a stronger sense of immersion than desktop PC. However, Robertson, et al. (1997), claimed that current HMD bring various limitations which reduce the level of immersion. Based on the study conducted by Arns and Cruz-Neira (2004), HMD has small peripheral view and that resulted in more collisions occurred when using HMD to carry out virtual walkthrough. Besides that, based on study conducted by Elmqvist and Tudoreanu

(2007), people tends to spend more time on the virtual walkthrough while using computer rather than while using HMD. Elmqvist and Tudoreanu claimed that people get tired more easily while using HMD which causes them to shorten the time spent exploring the virtual walkthrough and such situation contributes to the failure to achieve the objective of the virtual walkthrough. Moreover, Norul Huda M.S (2001) stated that most people are not familiar with HMD which resulted in a decrease in level of user immersion during the virtual walkthrough. Hence, HMD is not selected to be output device for the virtual walkthrough.

Besides that, many studies have been conducted to encourage the usage of mobile devices to be one of the possible output devices on displaying the virtual environment recently. However, Hwang, et al. (2007), claimed that most current mobile devices are not sufficiently equipped as it has limited display channels such as small visual display size and freedom-of-view (FOV). As a result, according to Hwang, et al. (2007), mobile devices provide a very small amount of immersion to user.

According to Lapointe & Savard (2009), most virtual walkthroughs are performed on computer due to its availability. Besides that, nowadays, most people owned a computer and its price is not expensive if ones want to purchase it – in contrast to HMD. Other than that, according to Bastanlar, et al. (2008), web-based virtual walkthrough will be able to reach a larger number of audiences and allow people to view the place of interest from their computer screen at any location in the world. Hence, computer with an Internet connection is selected as an output device to display the virtual walkthrough so that the virtual walkthrough can easily be accessed by most people from around the world.

As a conclusion, the VW of CH and Undercroft of UTP is

:

- To be developed in 2 ½ D concept in order to come out with a smaller size of VW than VW which is developed using image-based approach or VW which is developed in 3D only.

- Using computer as its output device because most people owned a computer and it is not expensive to purchase a computer.

- To be available via the Internet in order to reach audience from around the world.

CHAPTER 3
METHODOLOGY

3.1 System Methodology

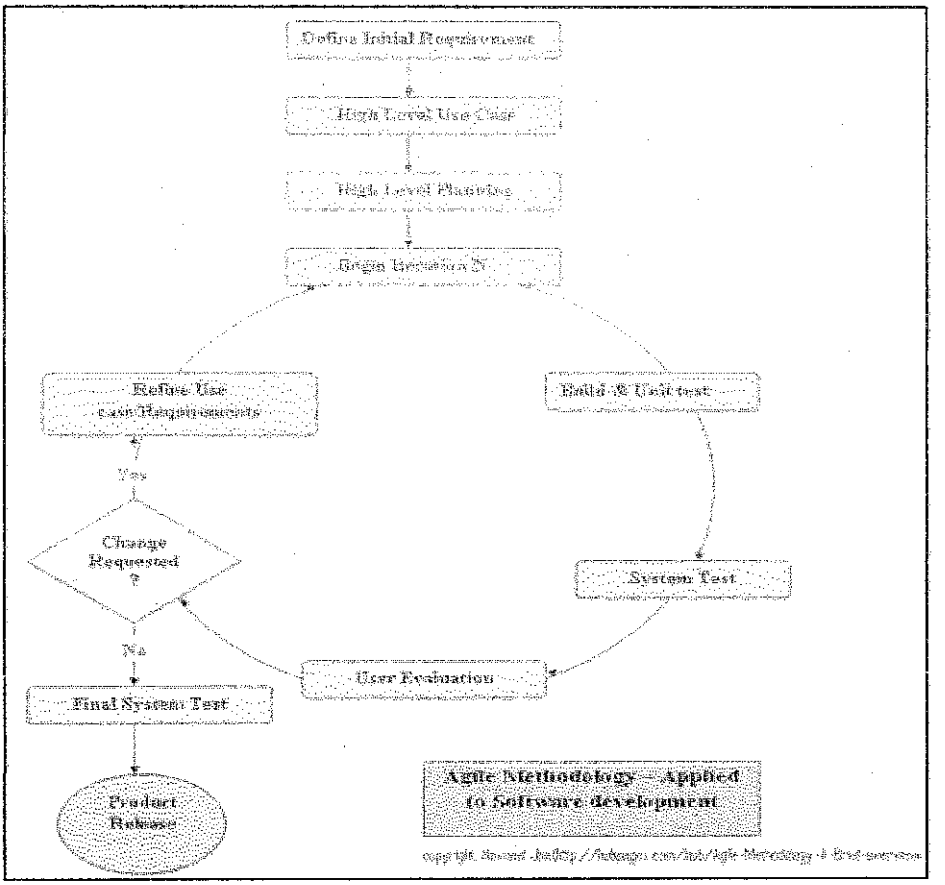

Figure 1.0: Model of Agile Methodology

The possibilities of changes to occur at any phases throughout the development process are very high. The changes may happen due to:

- Change in user requirement.

  There are possibilities wherein not all requirements are identified by the developer or the end-user on the early phase of the development such as during the planning phase. Developer or user might change the requirements

at any phase during the development process. In worst case scenario, developer or user also might decide to change the requirement while testing the system which is when the system is already complete.

- Change in system requirement.

  There are possibilities wherein the developer might change the system requirement at any development phase. For instance, the developer figures out that there are certain elements in the system cannot be made or designed or developed by using the current software. Moreover, the elements are very crucial that it must be available or included in the system developed. As a result, the developer needs to look for other software that can fulfill all elements needed and the developer have to redevelop the system.

In order to minimize the risk of facing negative impact due to the changes, it is important for the system to be flexible to any changes during its development particularly before the implementation or final release of the system.

3.1.1 Agile Methodology

Agile methodology focuses on iterative and incremental work cycles during developing the product wherein the process of building, testing and user evaluation is being repeated until the end user is satisfied with the product developed. Next, with agile methodology, the whole big picture is being cut down to pieces and the pieces will be combined when the time is right. After that, the pieces that are known as a prototype can be tested by user and is improved based on the suggested changes.

For that reason, agile methodology is very high in flexibility to changing requirements. Hence, there are slightly less risk of facing negative impact when there are changes occurred throughout the development phases.

Besides that, there is constant communication between the end user and developer which can contribute to better understanding between both end user and developer. As a result, a feasible system can be created.

Therefore, agile methodology is chosen as a method to be used in developing the virtual walkthrough because of its flexibility and adaptability to changes as well as the ability of having a constant communication with the end user that can resulted in a system that meet at least most of the users' requirements and satisfy the users' needs.

3.2 System Development Life Cycle

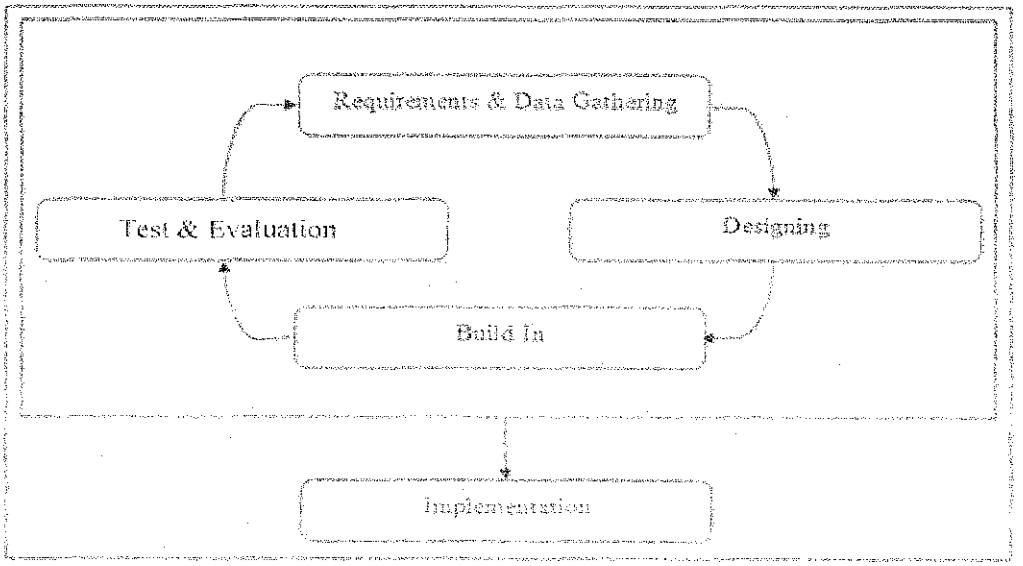

Figure 1.1: System Development Life Cycle

As shown at Figure 1.1, there are five phases in the SDLC:

Phase 1: Requirements & Data Gathering

On this phase, all user requirements are identified and gathered wherein developer acquire what user wants in the system as well as how the user wants the system to be. Next, studies are conducted in order to get more information on how to fulfill all the requirements. Then, actions are carried out in order to get all the data needed to develop the system. Besides that, system requirements are identified which is by identifying what kind of hardware and software needed to develop the system. Next, studies are conducted in order to look for the most suitable or potential hardware and software to be used to develop the virtual walkthrough. Once the suitable hardware and software are identified, actions are carried out which is to get the hardware and to look for the software's installer.

For instance, 3D graphics model of Undercroft of UTP need to be developed. Developer need to figure out on what data need to be obtained and what software or hardware needed to develop the model. Data needed to develop the graphics model is the floor plan and images of Undercroft. Floor plan of Undercroft is needed in order to know the interior design of Undercroft such as amount of rooms and hallways at Undercroft as well as the size of the each room. Figure 1.2 shows one of the original plans of Undercroft:

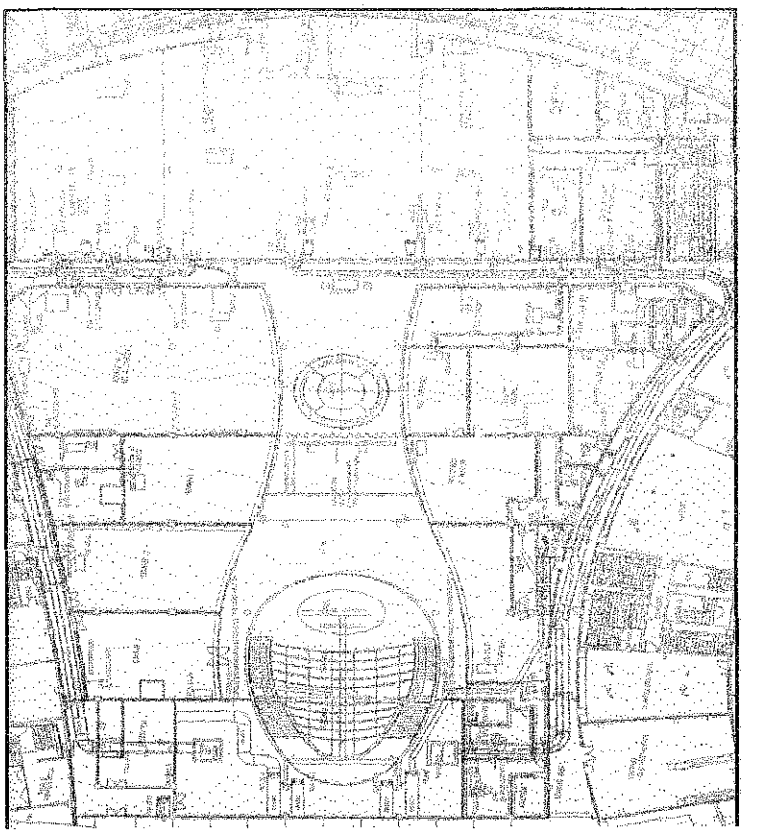

Figure 1.2: Floor plan of Undercroft

Then, images of Undercroft is needed in order to further understand the floor plan particularly on identifying which one is a room and which one is a hallway. Moreover, hardware needed is desktop PC with enough storage while software need to be installed is Google SketchUp, a tool that will be used to develop 3D graphic models.

Phase 2: Modeling & Designing

On this phase, the model is developed component by component. Then, all the components will be combined to become another one big component. Besides that, selected graphics for selected parts of the system also will be modeled separately. For instance, initially, only the selected areas at Undercroft is being created and designed wherein each area is considered as a component. Figure 1.3 shows components developed for Undercroft:

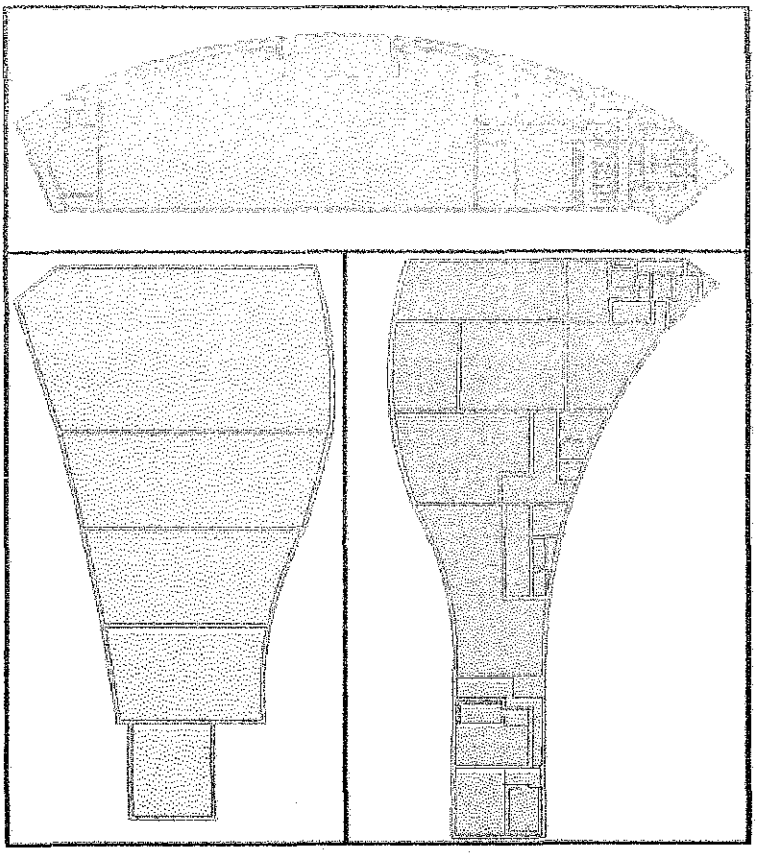

Figure 1.3: Components developed for Undercroft

Next, all of these components are combined and resulted in another one big component. Figure 1.4 shows the one big component of Undercroft:

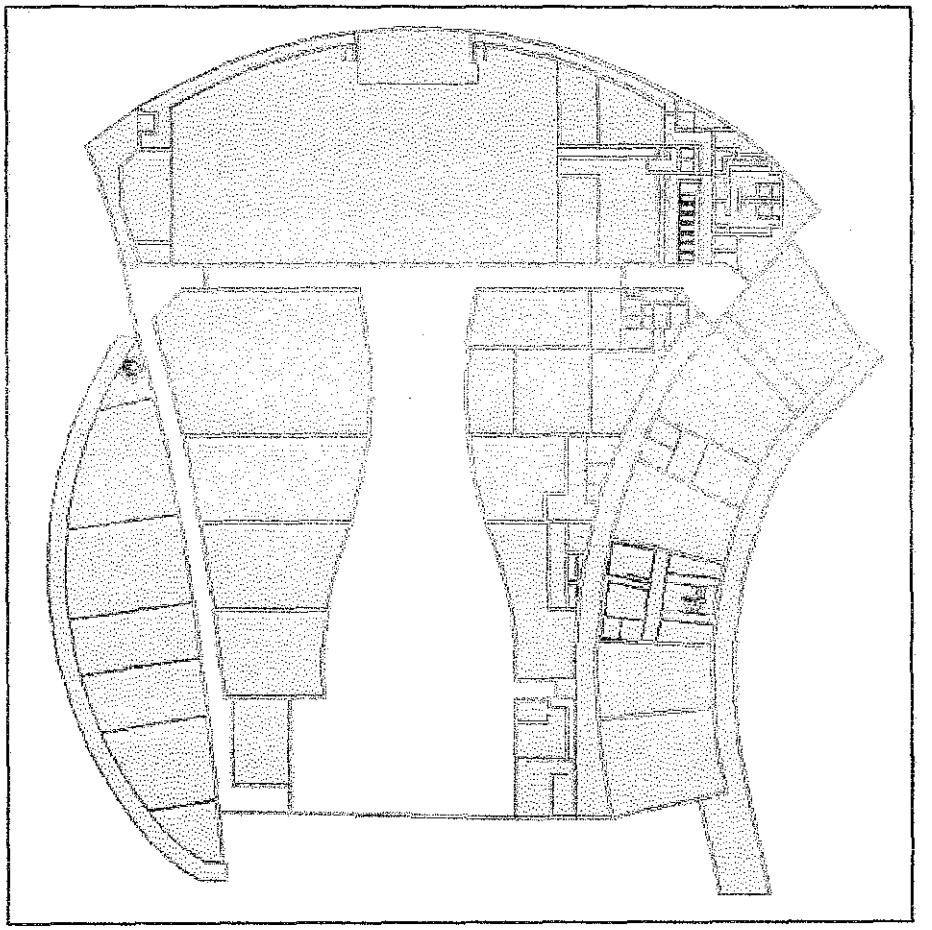

Figure 1.4: One big component of Undercroft

Then, the big component which was only a 2D plan is developed onto 3D. Figure 1.5 shows Undercroft model in 3D:

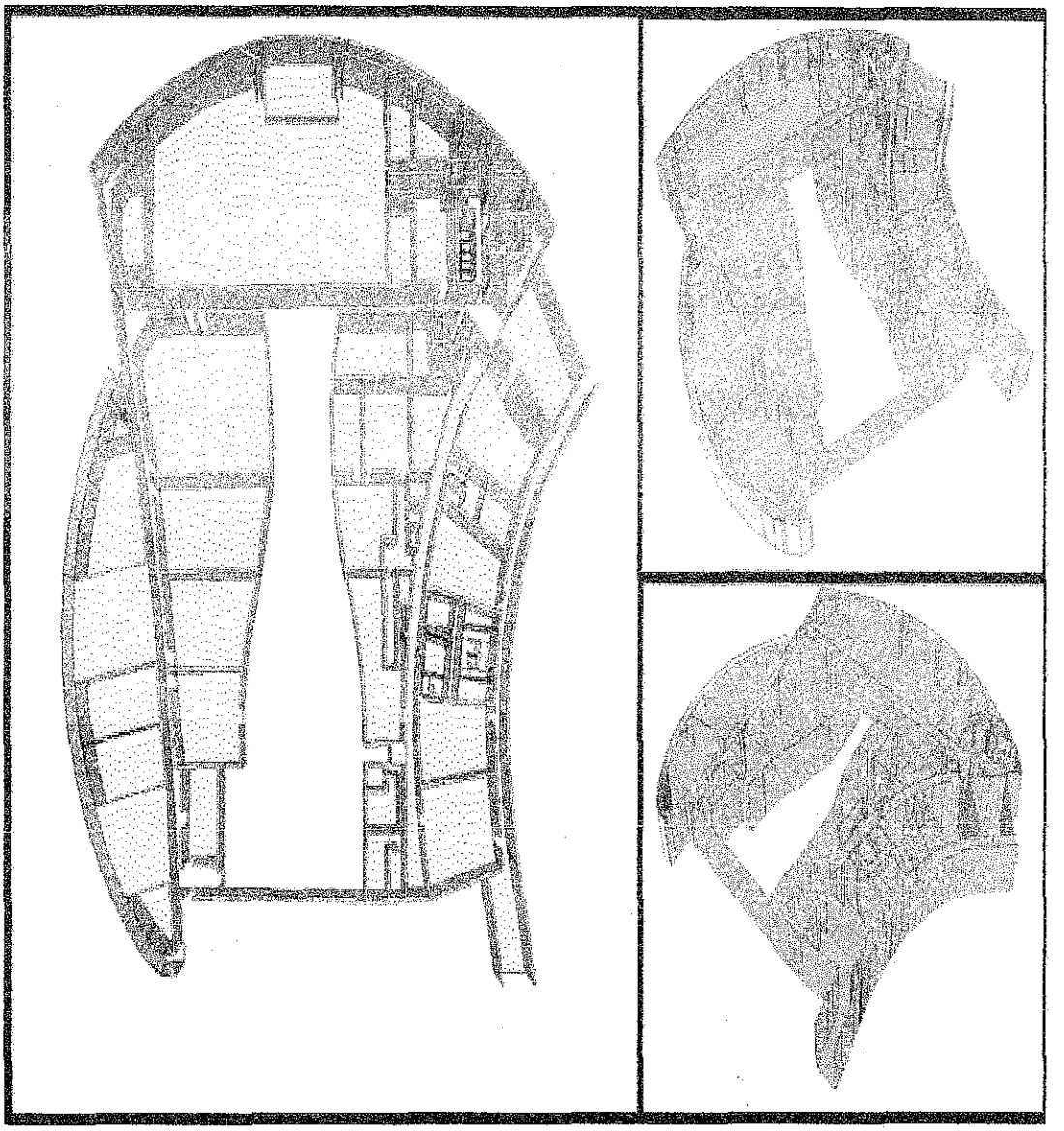

Figure 1.5: Undercroft model in 3D

After that, all 2D graphics are created and designed using Paint whereas all 2D images and some of the 2D graphic is created or edited using Picasa 3. Figure 1.6 is examples of 2D graphic created by Paint:

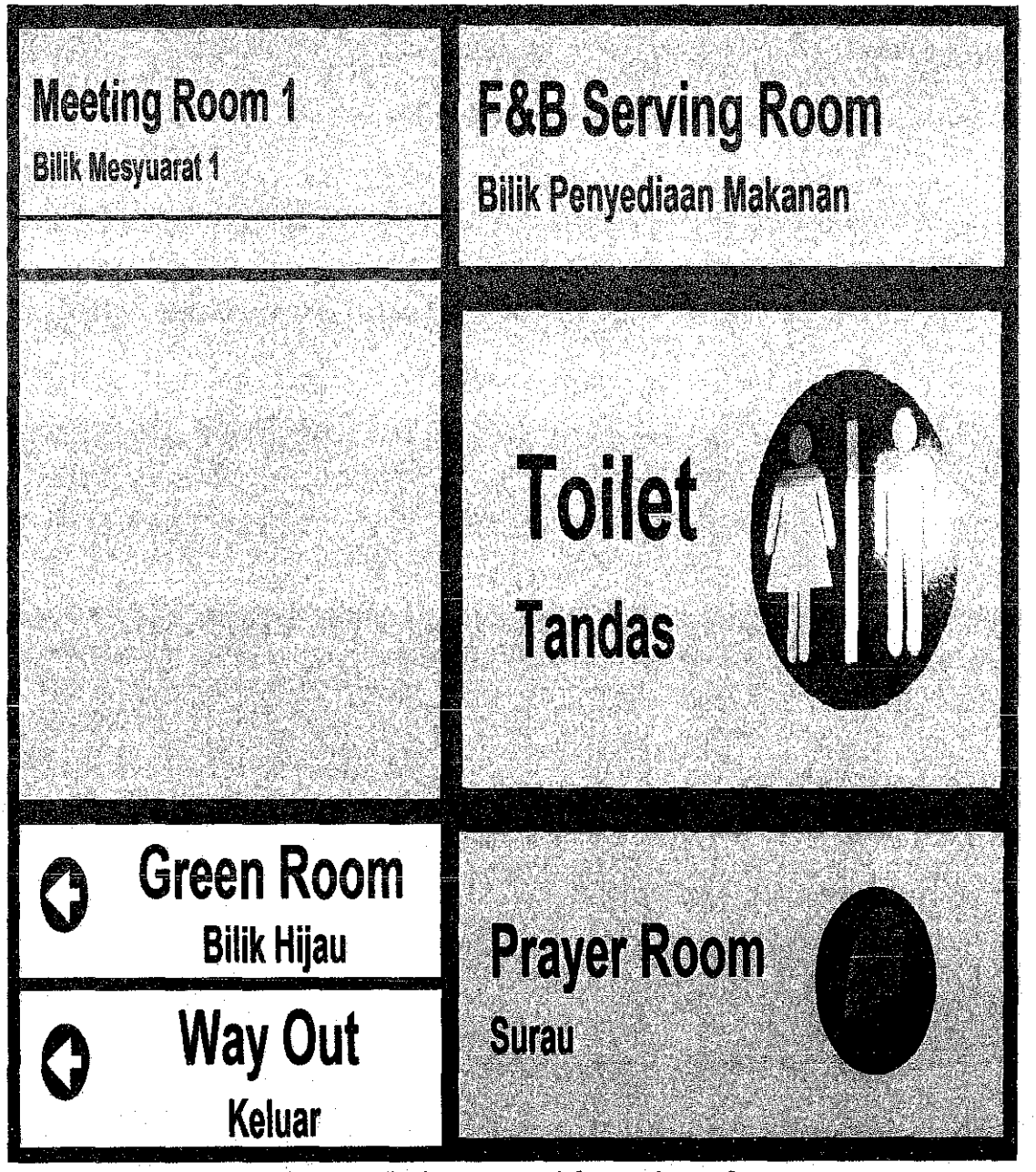

Figure 1.6: Signs created for Undercroft

Phase 3: Build in

On this phase, all the parts developed from Modeling and Designing phase are combined. Before the 2D graphics and images are included or attached at the developed 3D graphic model, the 3D graphic model is going to be painted using the Paint Tool available on Google SketchUp. Figure 1.7 shows a fully painted Undercroft model:

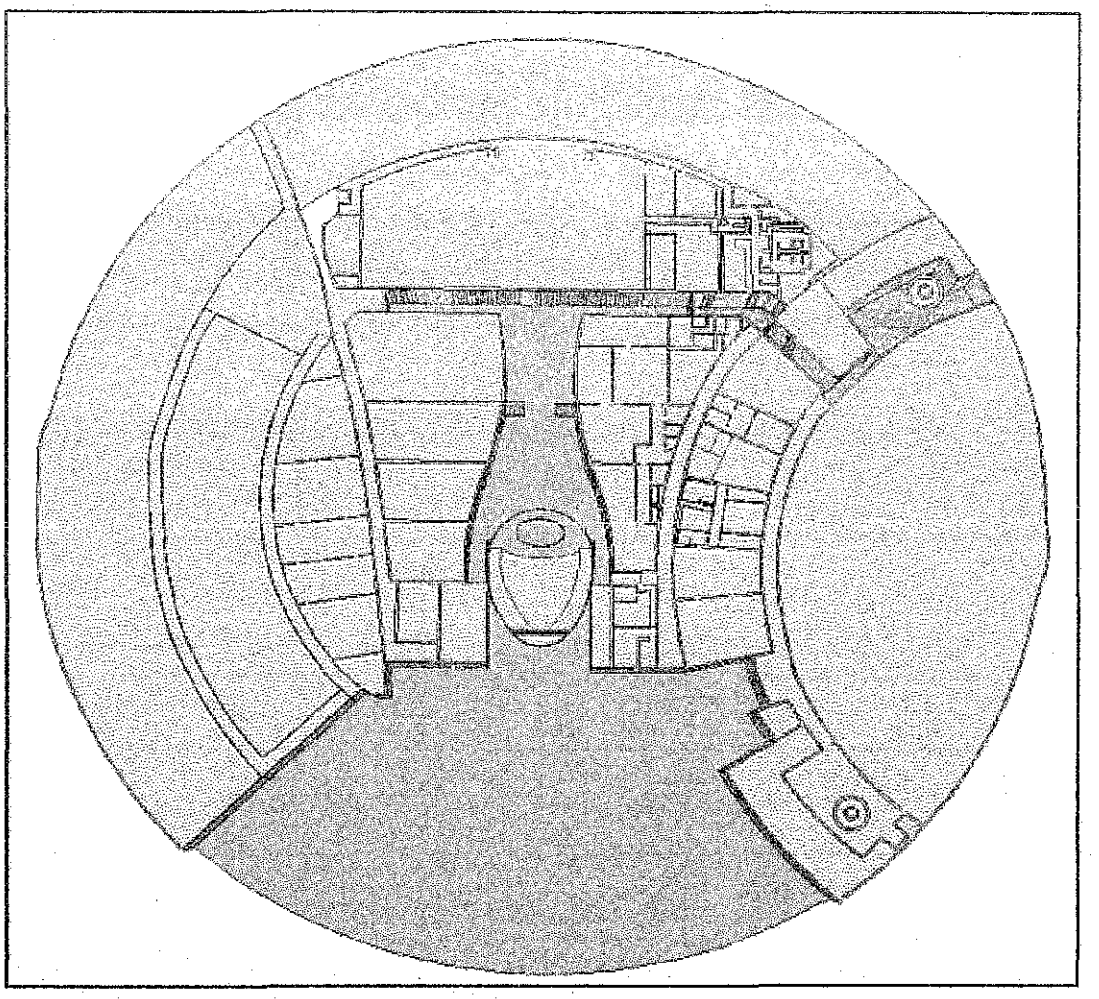

Figure 1.7: Undercroft model fully painted

Then, all the 2D graphics and images are included or attached at the developed 3D graphic models. Figure 1.8 shows example on the 2D graphics created formerly is attached to the 3D model of Undercroft:

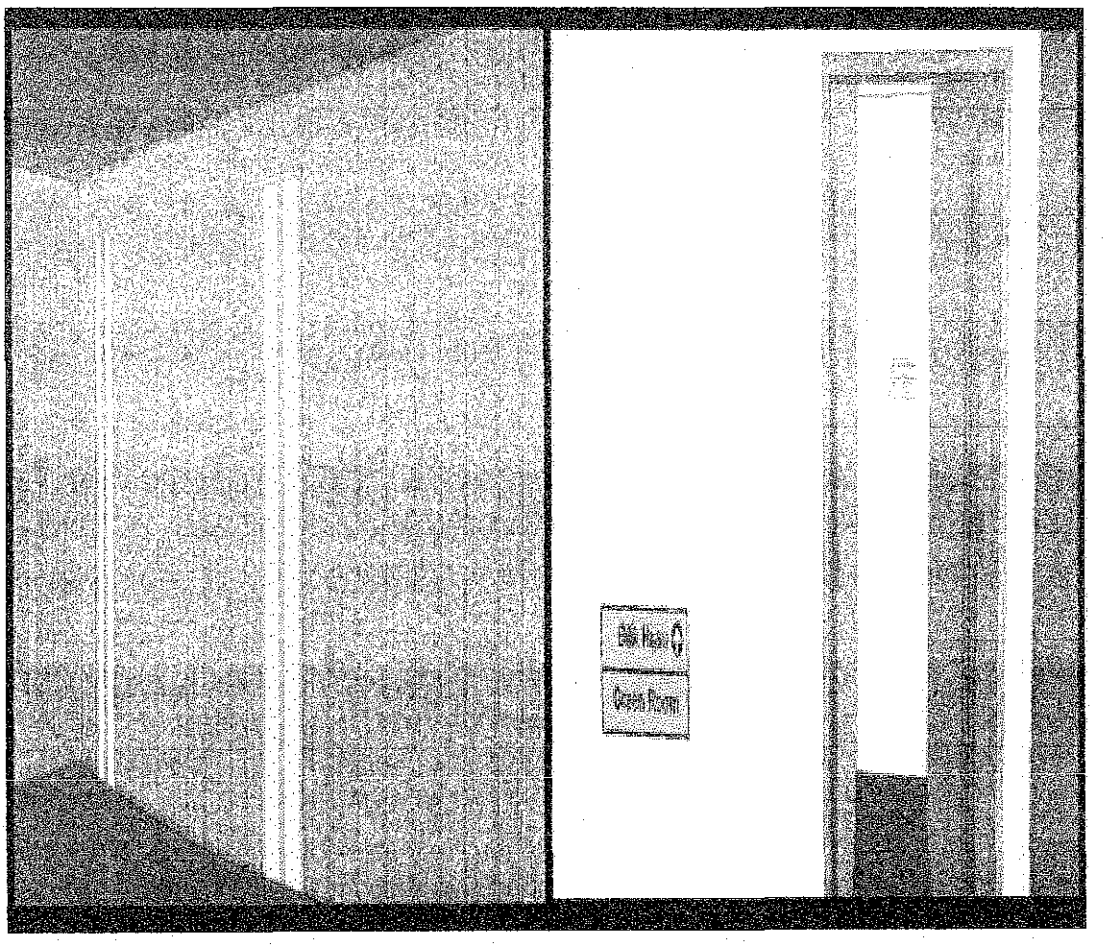

Figure 1.8: 2D Graphics attached to the 3D model of Undercroft

Phase 4: Test & Evaluate

On this phase, the prototype of virtual walkthrough is being tested initially by the developer. During testing, developer will identify whether there is any error with the prototype. Developer will primarily check for missing components, prototype can run smoothly or not and the size of the prototype is acceptable or not. Next, user will conduct testing on the prototype. User will primarily check on how well the prototype meets the user's requirements. Then, from the information obtained during testing, both developer and user will evaluate the prototype based on the performance standards and guides that are developed earlier.

When either developer or user think that the prototype does not meet their satisfaction and changes or improvement need to be done for the prototype, the iterative phase in order to do changes and improvement on the prototype followed. However, when both developer and user think that the prototype is acceptable and importantly, meets the user's requirements, the iterative phase in order to do other parts for the virtual walkthrough followed.

- **Iteration Phase: Editing the prototype**

  For this iteration part, phase 1, phase 2, phase 3 and phase 4 is being repeated in order to make changes and improvement on the developed prototype. For instance, developer figured out that the prototype developed cannot run smoothly. Hence, developer finds a solution to solve the problem in order to make the prototype run smoothly. Once developer finishes making changes and improvement on the prototype, the developer test the prototype again in order to check whether the prototype can run smoothly or not.

Besides that, user does not find the prototype is attractive and interactive enough. Hence, both developer and user find a solution in order to make the prototype more attractive and interactive. Once developer finishes making changes and improvement on the prototype, the developer and user test the prototype again in order to check whether the prototype attractive and interactive enough or not.

- **Iteration Phase: Developing other prototype**

For this iteration part, phase 1, phase 2, phase 3 and phase 4 is being repeated in order to develop more prototype which is the parts of virtual walkthrough of Chancellor Hall and Undercroft of UTP. For instance, initially developer only developed virtual walkthrough of selected areas of Undercroft. For the second prototype, developer develops the remaining areas of Undercroft. For the third prototype, developer develops selected areas of Chancellor Hall. For the fourth prototype, developer develops the remaining areas of Chancellor Hall. Once all the prototypes are completely built, the merging phase followed.

- **Merging Phase: Combine all prototypes**

On this phase, all prototypes are being merged and a complete virtual environment of Chancellor Hall and Undercroft of UTP is built. Next, other additional component such as sound effect is added into the virtual environment. The combination of all prototypes with the other additional component is considered a complete virtual walkthrough of Chancellor Hall and Undercroft of UTP. A complete virtual walkthrough of Chancellor Hall and Undercroft of UTP contain virtual environment of Chancellor Hall and Undercroft of UTP that offer user control as well as other additional components such as sound effect.

Then, phase 4 (Test and evaluate phase) followed. The complete virtual walkthrough of Chancellor Hall and Undercroft of UTP is tested to check whether there is any error with the complete virtual walkthrough. For instance, after merging all the prototypes, developer figure out that the size of the virtual walkthrough exceeds the targeted size of virtual walkthrough that should be developed. Hence, the iterative phase in order to do changes and improvement on the prototype followed.

Besides that, the complete system is evaluated in order to check on how well the complete system meets the user requirements. For instance, after merging all the prototypes, user proposed that some of the function on the virtual walkthrough is not significant and should be removed from the system. Hence, the iterative phase in order to do changes and improvement on the prototype followed.

The implementation phase followed only when both developer and user are satisfied with the complete virtual walkthrough of Chancellor Hall and Undercroft of UTP.

Phase 5: Implementation

On this phase, a complete virtual walkthrough of Chancellor Hall and Undercroft of UTP is already fully built wherein the user is satisfy with the virtual walkthrough developed and further changes or improvement are less likely required by user. Next, the virtual walkthrough is made into a web-based where there are two options to achieve it:

1. Buy a server and a domain which is needed to be used to developed a website
2. Search for a service on the Internet that allow virtual walkthrough to be created and shared on the Internet

While trying to make the virtual walkthrough to be available and can be shared on the Internet, the developer also need to identify whether user need to install certain software or plug-ins in the beginning before they will be able to use the virtual walkthrough. Besides that, developer needs to find out about the virtual walkthrough compatibility with each browser which is available currently. Some browser might be not really suitable to be used to view the virtual walkthrough. Then, developer need to identify which browser is the best to be used in order to view and play with the virtual walkthrough. Developer will also provide information particularly about the requirements that the user need to have or fulfill in order to install plugin and to view and play the virtual walkthrough. For instance, user needs to install DirectX in order to be able to install the plugin. Next, user needs to have a graphic card in order to play the virtual walkthrough. Failure to meet the requirements will result in; the user cannot view or play the virtual walkthrough.

3.3 System Requirements

Below is the software that will be used to complete this project:

- Google SketchUp 8
  - To create and design 3D graphic models of Chancellor Hall and Undercroft of UTP

- Picasa 3
  - To edit images in term on its lighting, able to add text, that will be used with 3D graphics models in order to make the models look real and interesting

- Paint
  - To edit images that will be used with 3D graphics models in order to make the models look real and interesting
  - To create 2D graphic models which are text that will be used as a sign to inform the user about what is the venue and where the location is.

- 3DVIA Player Plugin
  - To view the virtual walkthrough on web browser.

3.4 Storyline of Virtual Walkthrough

Two storylines or scenes are developed for the virtual walkthrough of CH and Undercroft of UTP.

Below are the storyline for the virtual walkthrough:

1. Start.
2. On the web browser, user are provided with a link to two options:
    - Travel Chancellor Hall and exhibition area
    - Travel Undercroft

3.4.1 Travel Chancellor Hall and Exhibition Area

1. User is walking around the middle area of Chancellor Complex where user can see an exhibition held in the middle of Chancellor Complex. (Chancellor Complex is in 2D) (Booth is in 3D)

- Technology, Education & Career (TEC) and Engineering Design Exhibition (EDX) are one of the annual events of UTP that was held at Chancellor Complex of UTP. Both events have exhibition. Then, exhibition held during both events which are during TEC as well as during EDX have the largest quantity of booth in contrast to other events that also held an exhibition at the middle area of the Chancellor Complex of UTP.

- By showing the sample of booth arrangement during both events, user particularly the potential sponsor will be able to know the maximum number of booths can be accommodated at the middle area of Chancellor Complex of UTP.

- Figures below shows the samples of floor plan for booth arrangement during selected exhibition:

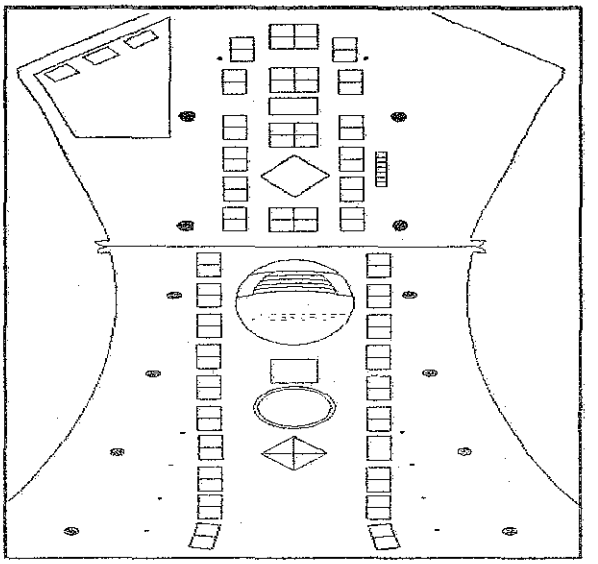

Figure 1.9: Sample of booth arrangement during Technology, Education & Career 2010 (TEC X)

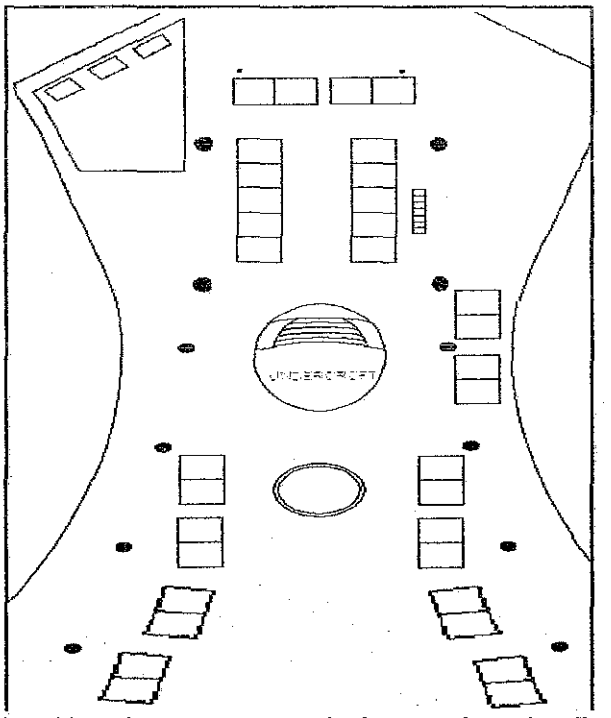

Figure 2.0: Sample of booth arrangement during Engineering Design Exhibition (EDX)

2. User is walking into Chancellor Hall using or through the middle door. (The Chancellor Hall is in 2D)
3. User enters the Chancellor Hall and arrives near the stage. (The Chancellor Hall and the stage is in 2D)
4. User is shown the stage, seating, and view of Chancellor Hall from right-side view, left-side view and upper-side of all areas inside the Chancellor Hall. (The stage, seating and views of Chancellor Hall is in 2D)

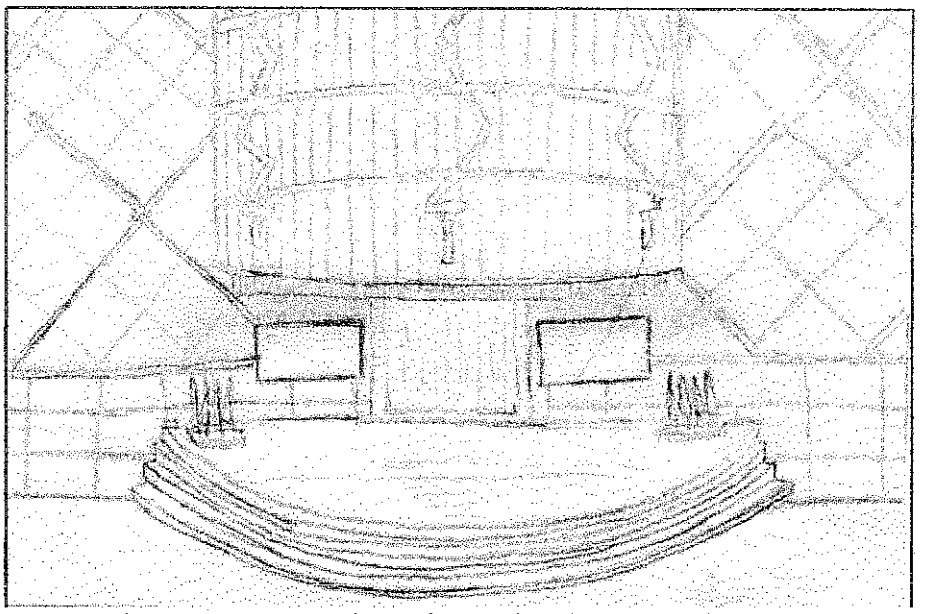

Figure 2.1: Front-view of stage inside Chancellor Hall

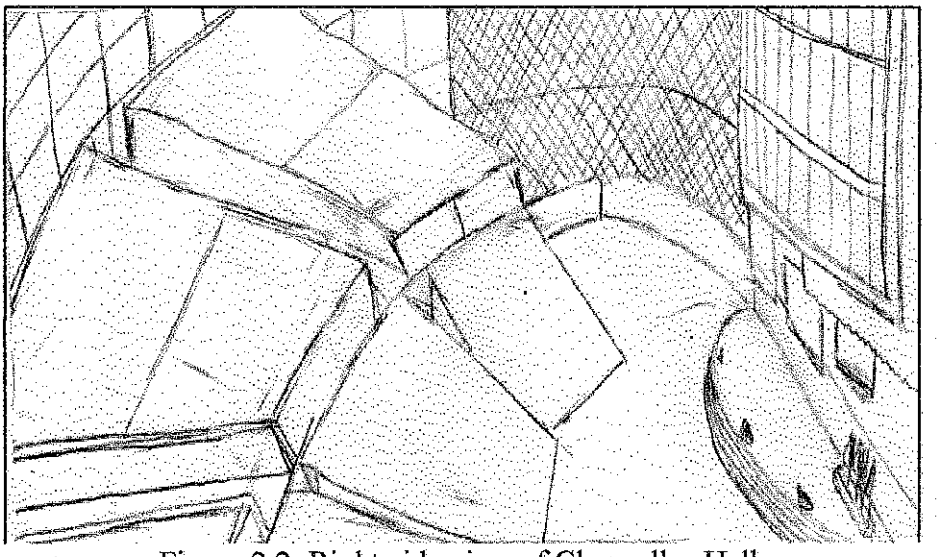

Figure 2.2: Right-side view of Chancellor Hall

5. User is walking out of the Chancellor Hall. (The Chancellor Hall is in 2D)
6. User stopped in the middle area of Chancellor Complex. (The Chancellor Complex is in 2D)
7. End.

3.4.2 Travel Undercroft

1. User travels in the Undercroft which starts from the seminar rooms until the end of the path which is the lobby. (Undercroft is in 3D)
2. User travels in the Undercroft which starts from the lobby until the end of the path the stair. (Undercroft is in 3D)
3. User exits the walkthrough.
4. End.

CHAPTER 4
RESULT AND DISCUSSION

4.1 Snapshots of Prototype

A blog is created in order to be used as a temporary platform on making the virtual walkthrough available and accessible via Internet. This blog can be found at http://i11739.blogspot.com. Figure 2.3 shows the snapshot of the homepage of the blog:

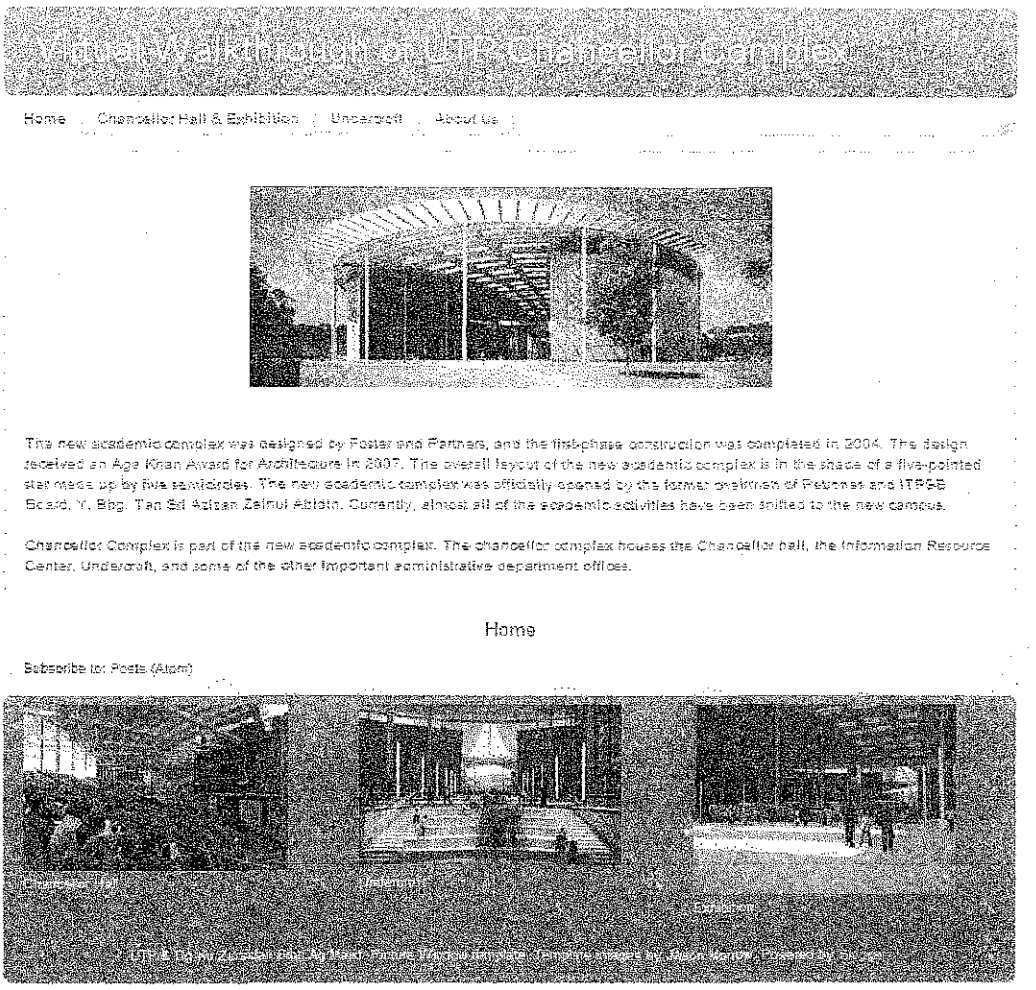

Figure 2.3: Homepage of the blog

The blog consists of the main page or homepage as well as two other tabs; one tab for Chancellor Hall and Exhibition while another one tab for Undercroft. The homepage consist of brief introduction about Chancellor Complex (Chancellor Hall and Undercroft is part of Chancellor Complex). Besides that, there are pictures of Chancellor Hall, Undercroft and samples of booth on the bottom of the page. The pictures linked to its own respective tab; picture of Chancellor Hall and picture of exhibition linked to the tab named Chancellor Hall & Exhibition whereas picture of Undercroft linked to the tab named Undercroft. Then, each tab consists of brief information about the scene, virtual walkthrough of the scene and short video of the scene. Figure 2.4 shows the snapshot of Chancellor Hall and Exhibition Tab:

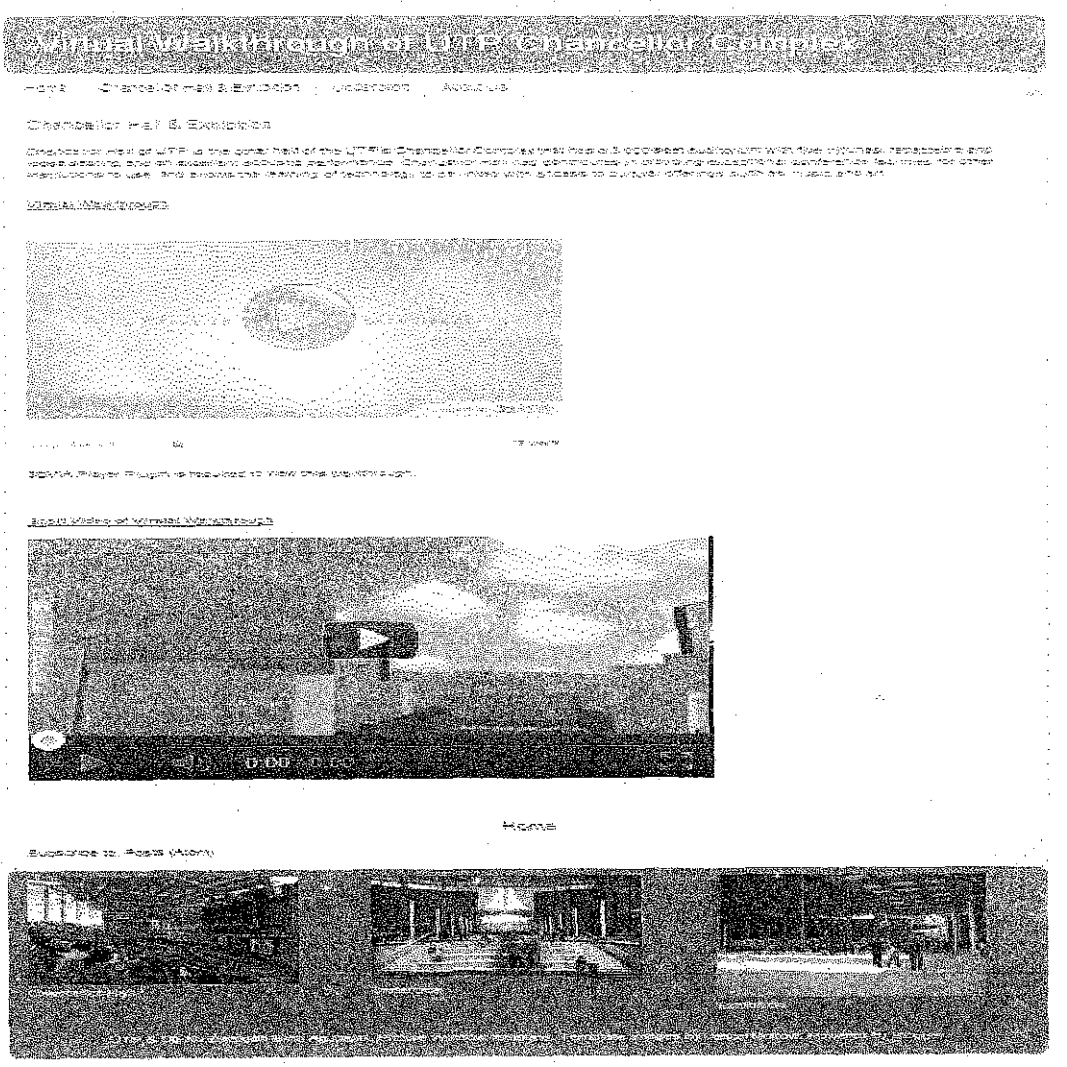

Figure 2.4: Snapshot of Chancellor Hall and Exhibition Tab

Figure 2.5 shows the snapshot of Undercroft Tab:

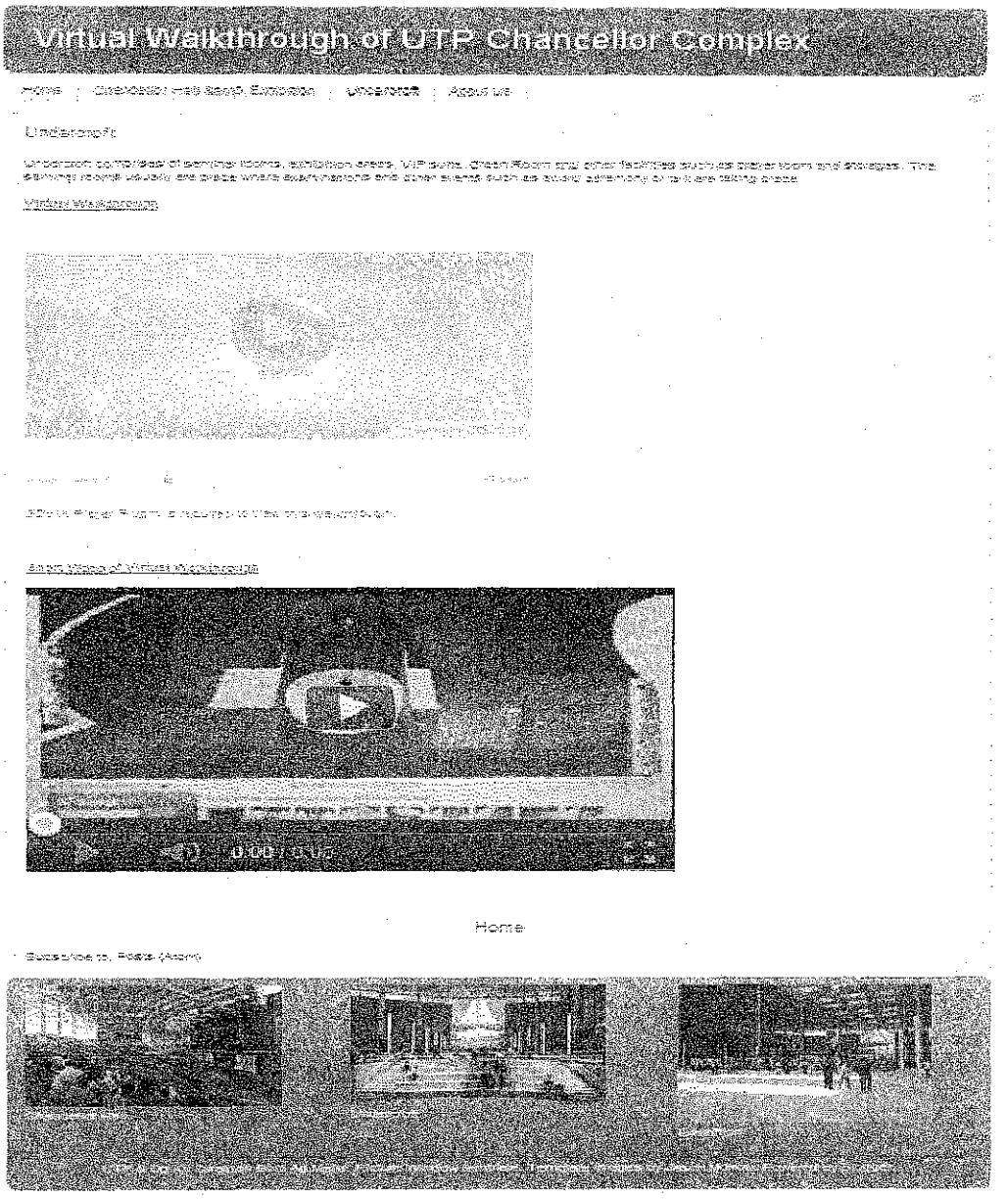

Figure 2.5: Snapshot of Undercroft Tab

Figure 2.6 shows the snapshots on virtual walkthrough of Chancellor Hall and Exhibition:

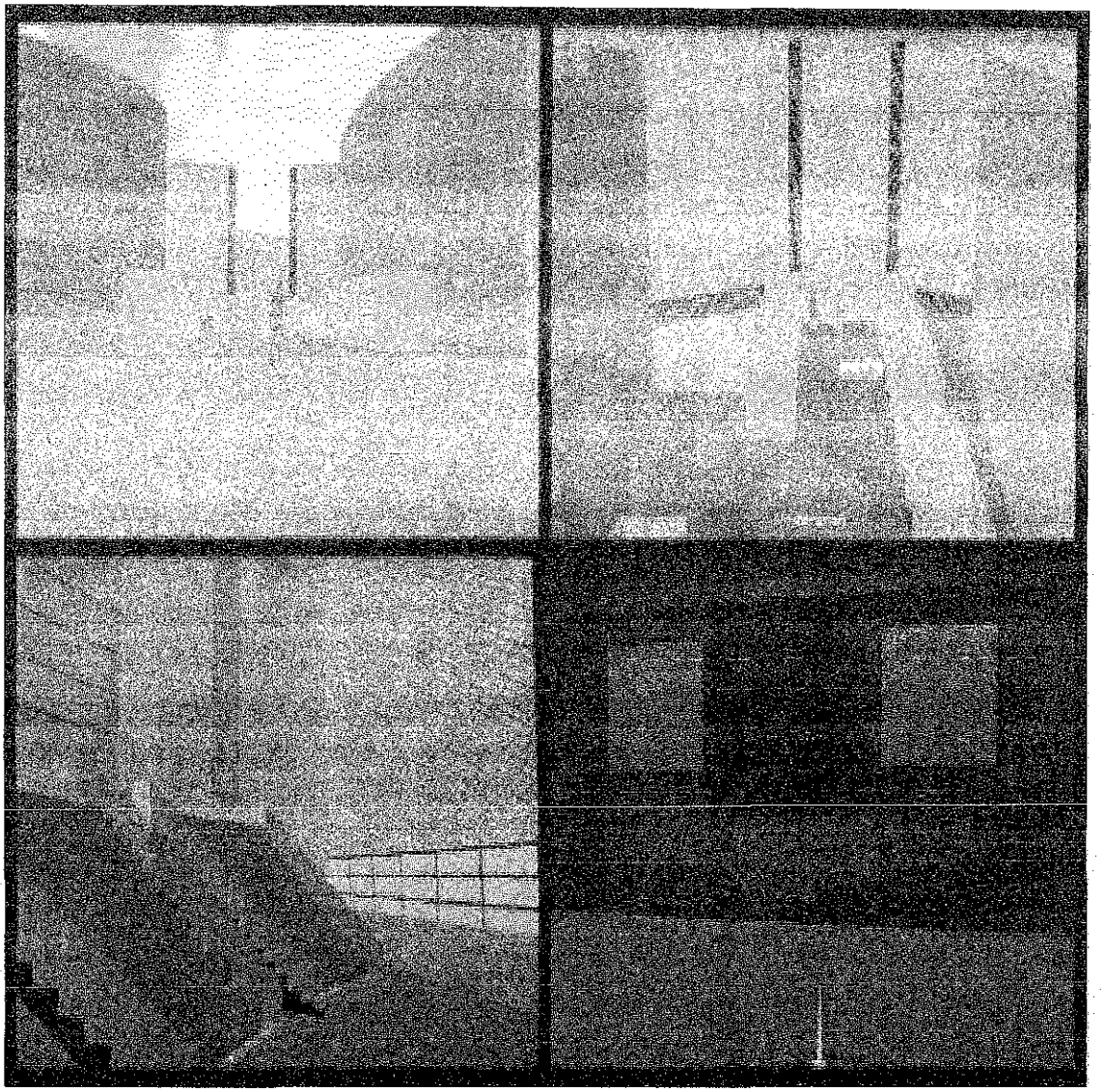

Figure 2.6: Snapshots on virtual walkthrough of Chancellor Hall and Exhibition

Figure 2.7 shows the snapshots on virtual walkthrough of Undercroft:

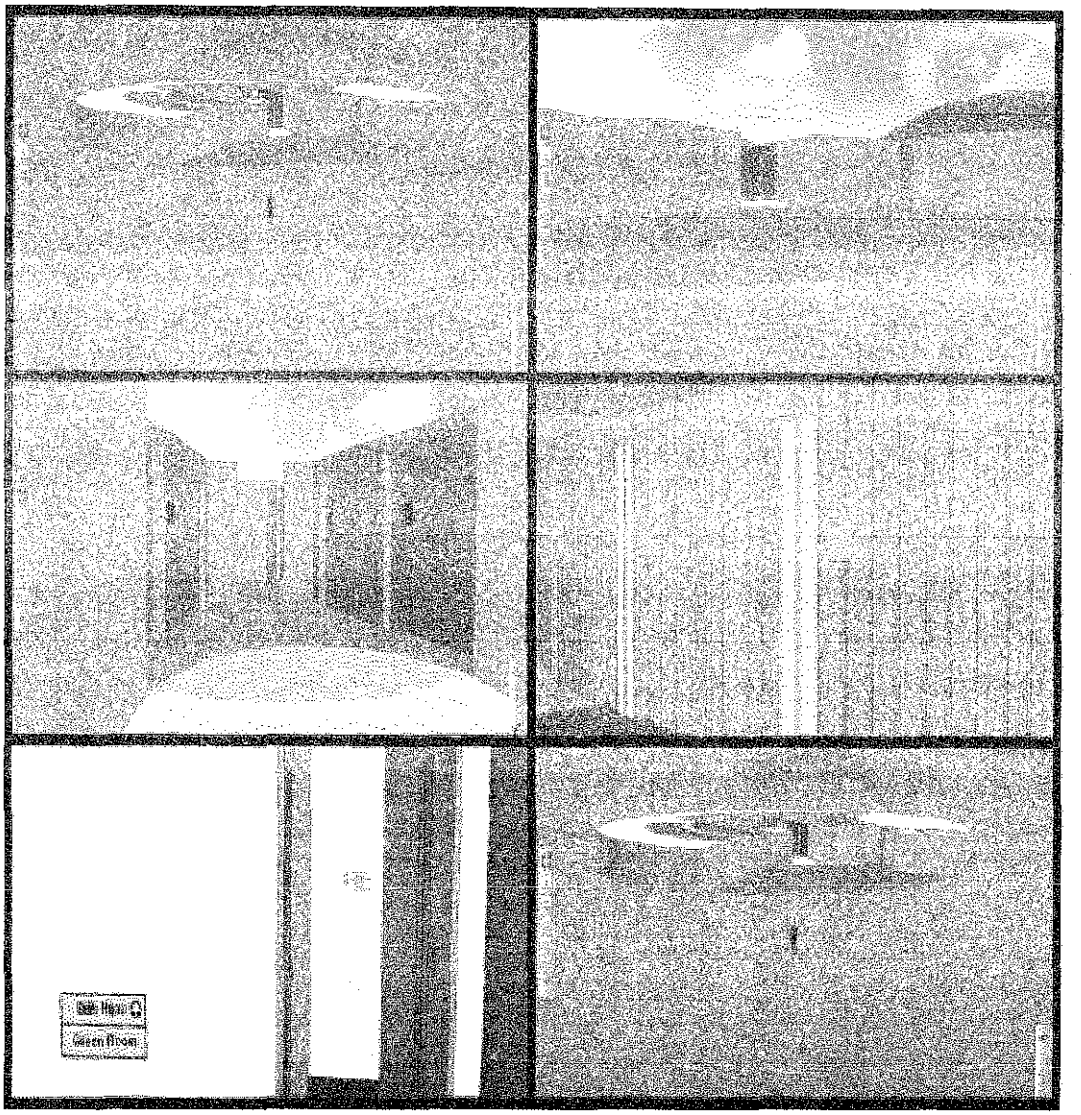

Figure 2.7: Snapshots on virtual walkthrough of Undercroft

Under the embedded virtual walkthrough, a statement informing what are the requirements needed in order to play the virtual walkthrough is included. Then, similar to the homepage, there are pictures of Chancellor Hall, Undercroft and samples of booth on the bottom of the page. The pictures linked to its own respective tab.

4.2 Building the Model

The models are developed by referring to the floor plan obtained from UTP's Maintenance Department. Two methods are used to develop the models. The methods are:

1. Developed the model by taking measurements of the area of the model such as size of room and size of path. Measurements are taken from the floor plan of the model. Then, by using the measurements taken, model are developed component by component. Hence, the final model is a combination of components.
2. Developed the model by using the image of the floor plan of the model. Digital image of the floor plan is imported to Google SketchUp and developer can draw the model based on the image. The final model developed is one component only.

Table below shows comparison between using method 1 and method 2 to develop the model:

	Method 1	**Method 2**
Duration needed to develop model	Take more time	Take lesser time
Accuracy of location measurement	More accurate	Less accurate
Size of final model	Smaller	Bigger
Others	Quite difficult to combine the components	

Table 1.0: Comparison between Method 1 and Method 2 on developing 3D Model

4.3 Creating the Virtual Walkthrough

3DVIA.com (www.3dvia.com) provides services that allow anyone to create and publish 3D applications and experiences. One of the services offered by 3DVIA.com is 3DVIA Scenes. Generally, 3DVIA Scenes allow anyone to build online games, applications and virtual worlds that do not required any programming. Then, one of the services offered by 3DVIA Scenes is to create 3D walkthrough which can be shared to people around the world.

Steps to create the walkthrough using 3DVIA.com are:

1. Create an account on 3DVIA.com. Registration is free.
2. Upload the model (in *.kmz* format) to 3DVIA.
3. Create a scene.
4. Select the scene background. In this project, grassy field is selected to be the default background for each scene created.
5. Select avatar for the scene. Avatar selected is the default avatar for each scene created.
6. Upload the model which was uploaded formerly to the scene.
7. Scene is completed.

Other models such as tree and human (static avatar) can be added onto the scene too in order to make the scene more attractive.

4.4 Issues on Creating the Virtual Walkthrough

There are some issues need to be taken into account while creating the virtual walkthrough on 3DVIA.com. The issues are:

1. The model of the architecture for instance model of Undercroft which is uploaded onto the platform, 3DVIA.com site must be in.kmz format. Uploading other type of format resulted in the textures of the model to disappear wherein the model appears in its default color which is gray.

2. Internet connection is needed to create the scene as the scene is created on 3DVIA.com site. Then, it is crucial to have an Internet connection with a good speed to create the scene or else the creation of the scene will be delayed. It is because the scene is created on 3DVIA.com site. Besides that, since the scene is in 3D, high speed internet connection is needed to deal with the 3D graphics.

3. Developer need to be aware that once the model once the model is uploaded onto the 3DVIA.com, the line of drawing of the model will disappear. Some user might find the model in which missing line of drawing as less attractive. Hence, developer might want to make the line of drawing bolder in order to avoid it from missing.

4.5 Viewing the Virtual Walkthrough

In order to view the virtual walkthrough, user need to:

1. Install 3DVIA Player Plugin. Then, the minimum system requirements need to be achieved in order to install this plugin are:

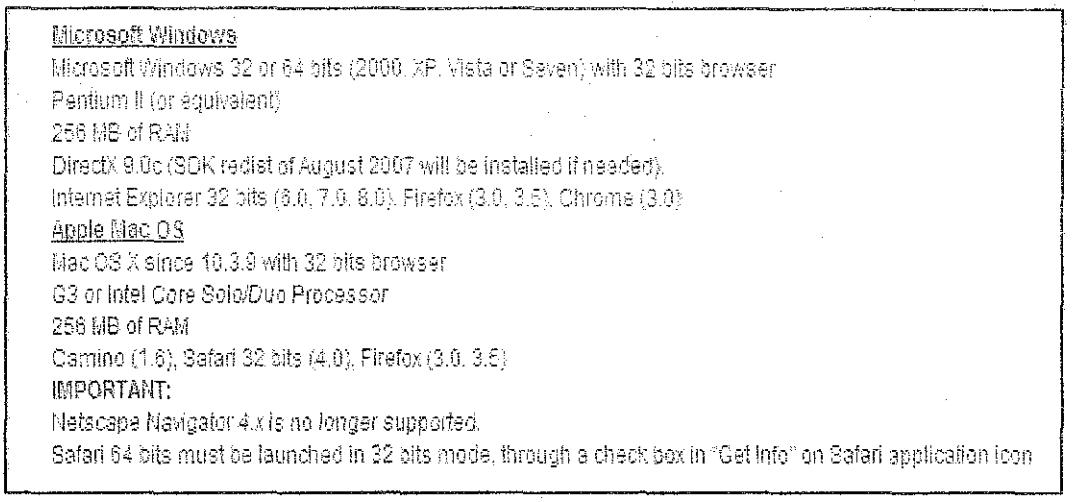

Figure 2.8: Minimum system requirements to install 3DVIA Player plugin

Failure to install 3DVIA Player Plugin can be because of the Internet Security (firewall/proxy) Settings wherein the network administrator do not allow .exe/.xpi file to be downloaded.

2. The computer needs to have a graphics card. Although 3DVIA Player Plugin already been successfully installed but the computer do not have a graphics card, user still cannot view the virtual walkthrough.

4.6 Playing the Virtual Walkthrough

In order to play the virtual walkthrough, user need to:

1. Have a computer mouse with at least two buttons and a scroll wheel as can be seen on the Figure 2.9:

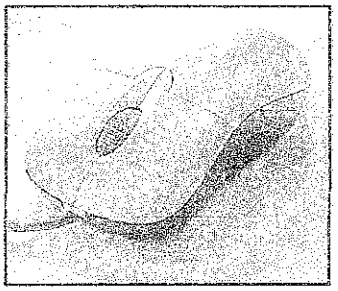

Figure 2.9: Computer mouse with two buttons and a scroll wheel

The mouse is used to make the avatar walk, zoom in and zoom out. The keyboard can be use too. However, only four keys can be used (see figure below) and it only can be used to move the avatar. Using keyboard, user cannot zoom in and zoom out the scene. Figure 3.0 shows the instructions on how to play the virtual walkthrough using computer mouse and keyboard:

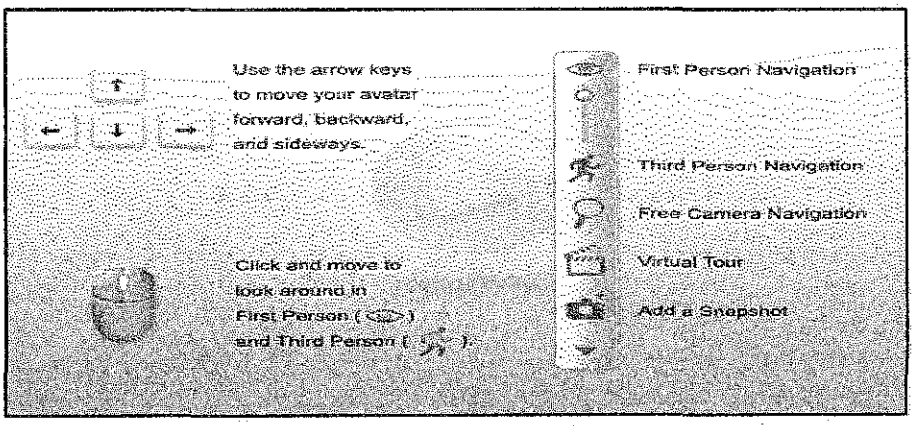

Figure 3.0: Instructions on how to play the virtual walkthrough

CHAPTER 5
CONCLUSION

Virtual walkthrough of Chancellor Hall and Undercroft of UTP enable user to explore the place virtually without having to travel the place physically. Individual whom has never been UTP can get an illustration on both Chancellor Hall and Undercroft of UTP. While individual who is coming to UTP can gain pre-visit information particularly on how to travel within Chancellor Hall and Undercroft of UTP.

Next, the difference between embedding the virtual walkthrough on the website with sharing the installer of the virtual walkthrough is that, by embedding the virtual walkthrough on the website, it is easier for the developer to provide updated version of the virtual walkthrough to the user. Once the developer updates the application on the website's server, all users automatically get to use the updated and improved version of the virtual walkthrough. The developer also can guarantee that all users are using the updated and improved version of virtual walkthrough.

Besides that, virtual walkthrough is not necessarily has to be developed completely in 3D. It is best that virtual walkthrough developed in 2 ½ dimensional where some of the advantages of 3D virtual walkthrough and at the same time some of the advantages of 2D virtual walkthrough can be obtained. Importantly, the size of 2 ½ dimensional virtual walkthrough application is smaller than 3D virtual walkthrough application yet more interesting and attractive than 2D virtual walkthrough application.

Then, an interactive virtual walkthrough is vital. An interactive virtual walkthrough can be made by enabling user control on the application wherein user has control while travelling around Chancellor Hall and Undercroft. User control offer user a hands-on experience which can assist user to easily understand and remember the areas at both Chancellor Hall and Undercroft of UTP.

Other than that, the virtual environment developed for walkthrough need to be more attractive. More models need to be added to the scene such as trees, road, other buildings and so forth – instead of putting the building model only in the walkthrough.

To conclude, various and numerous matter should be taken into account while developing a virtual walkthrough application. The virtual walkthrough need to be developed in a manner that can attract user to use it. In addition, the virtual walkthrough need to be developed so that it can retain the user interest on using the application.

CHAPTER 6
RECOMMENDATIONS

Firstly, object or model which its function is similar to landmark need to be added onto the virtual walkthrough. In the real world, most people are able to memorize on how to go from one location to another location by using a landmark. For instance, in order to go to Chancellor Complex from UTP main gate, UTP mosque is the landmark. From the landmark, user remembers that he or she needs to take the left path in order to go to UTP Chancellor Complex.

After travelling the place virtually, when the user wants to travel the area or building physically, it will be easier for them to link or associate the virtual environment and the real world with the existence of the landmark. However, it is very important for the landmark to be easily recognizable or else the situation will be similar to not having landmark at all.

Nevertheless, it will not be easy to identify a suitable object to be used as a landmark for architecture or within a building. For this project, it is possible to identify a landmark for Chancellor Hall and the area in front of Chancellor Hall. However, it is quite difficult to identify suitable landmark for Undercroft since the Undercroft are fill with rooms only. Therefore, interactive guidance or navigation needs to be made available on the virtual walkthrough.

A pop-out message box can be used as interactive guidance. For instance, when the user is standing in front of Chancellor Hall main door, a pop-out message

box will appear which is to inform the user what is the name of the location and give suggestion to user about what user can do or where user can go after that.

It is important to have the function mentioned above or else the virtual walkthrough will be ineffective. The targeted audience has never been to UTP. Therefore, they do not know what the name of the location or object is. The pop-out message box can provide more information about the location to the user.

Besides that, it is better to have a text-based message which can be shown using the pop-out message box instead of audio-based message which is voice of a person speaking giving instructions. One of the limitations of audio-based message is, user cannot understand or cannot catch the instructions spoken by the instructor due to wrong pronunciation, instructor's pronunciation is not clear and instructor's voice is not clear enough

By using text-based message, no problem caused by unclear pronunciation or unclear voice will arise. User only needs to read the instructions given and what developer needs to do is to provide a message with no grammar error, short and easy to understand. A message with grammar error will cause negative image among user to the developer and the developer's institution – for this project, it is UTP. A long message will discourage user to read the message. A very hard to understand message will resulted in, the intended message failed to be delivered to the user.

Other than that, user should be given an option to enable or disable the pop-out message box. Some user might not need to have the function. For instance, UTP students might want to disable the pop-out message box as they already know and recognize the area or object. They only need to identify the name of the room by looking at the door sign; they do not need the pop-out message box.

Next, user should be given an option to close the pop-out message box. It is not suitable to make the pop-out message box to appear on certain time duration only. It is for the reason that different people take different time duration to read. Besides that, user will not find it comfortable to see the pop-out message box keep on appearing on the virtual walkthrough screen and will only disappear when the next message box with new message appear.

As a conclusion, more research need to be conducted in order to know how to make an easily recognize landmark, which object within the architecture need to be used as a landmark and how to enable pop-out message box function on the virtual walkthrough. It is because, no matter what, developer needs to ensure that the objective of the virtual walkthrough is achieved as well as good experience is given to the user while the user uses the virtual walkthrough.

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