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Virtual Environment Navigation Using an Image-Based Approach

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Abstract – this paper investigates and illustrates the potential of using panorama virtual reality to enhance web-based library instruction. The project presents that panorama virtual reality (VR) could be a powerful tool when comparing conventional tour and virtual tour. VR tour into as a whole can became a more useful medium that allows navigating, viewing, reading, hearing and remote access. This paper describes the implement processes and the lessons learned throughout the development process regarding the application stage of prototype development using various software: VR Worx Panorama, VR Worx Scene, PhotoVista Panorama, Reality Studio and Ulead COOL 360. The discussion includes an overview of comparison between panorama VR and other VR tools. Adding to this is the result of survey, which was done with the objective of comparing the virtual reality panorama with the conventional technique in delivered guided tour information.

Keywords: panorama virtual reality, library and guided tour.

1. INTRODUCTION

Communication or method to give correct and impressive information is an issue as well as challenge to improve quality of service. Information can be obtained from various media. The problem is how to get the realistic view at an affordable price and at the right time easily.

As new information medium of 21st century, virtual reality (VR) will replace the majority of passive entertainment activities like reading books, watching movies and listening to the music. In fact all of them will be unified in one big virtually multimedia system [6]. VR also is the best among printed media and video/film for its immersive, interactivity and information intensity [2]. According to Whyte [13], VR has the potential to be a powerful medium for architectural design and communication. As a result, VR is a medium in visualization and complex information presentation.

In this paper, we will focus on visual information in the delivery of guided tour information. This paper discusses the development process regarding the application stage of prototype development. The prototype build is the virtual representation of the Sultanah Bahiyah Library of Universiti Utara Malaysia. The research also suggests the use of panorama virtual reality as an alternative medium to convey library tour information. It was found that the

user is able to obtain visualize information, when they used the prototype system.

1.1 Panorama Virtual Reality

Panorama-based virtual reality is an extension of computer graphics and VR [15]. Panorama VR can be categorized as a desktop virtual reality. VR can be defined as "telepresence", or the "projection of a human mind to a remote site" [5]. The idea of the ultimate virtual environment by Sutherland (1965) [11], states that VR should be indistinguishable from "real" reality.

In 1994, Apple is the first to develop panorama VR or panoramic view with their product name QuickTime VR (QTVR) technology. Since then, many others panoramic techniques package and technologies were introduced by different developers in the market such as iMove, Spin Panorama, Ulead, VR Worx etc.

2. DIFFERENCES BETWEEN PANORAMA VR AND OTHER VR TOOLS

VR panorama techniques were chosen because it produces high quality images. It is also quite easy to produce the data, no requirement of expensive hardware or software [9,15], easier for the user to navigate in it, provides better user control, can be viewed on standard monitors and need less computer power and bandwidth size than a real 3D visualization [3].

Compared to other VR models, the panorama model may have limited attributes of immersion or interactivity [15], such as motion in some local places such as opening a door.

Panorama VR also is a solution to the static environment. The advantage of image based modeling and rendering is that the tedious 3 dimension (3D) modeling state is avoided and traded by a number of pre-computed images or photographs. On the other hand, since the complexity of image-based operations is independent of the scene complexity, rendering from images is usually faster than rendering complex geometry models [4].

The image-based method also provides a solution to the levels of detail problem in most 3D VR display systems. Ideally, an object should be displayed in less detail when it is farther away and in more detail when it is close to the observer. However, automatically changing the level of detail is very difficult for most polygon-based objects. Differences with the images – based method automatically provides the appropriate level of detail. The images are view of a scene from a

range of location. As the viewpoint moves from one location to another within the range, the image associated with the new location is retrieved. In this way, the scene is always displayed at the appropriate level of detail [3].

Generally, panorama VR is more suitable for a simple application, which does no require many data manipulations and interactions such as virtual tour, advertisement and promotion. The best example is walkthrough virtual Graz city project (http://vrgraz.com).

3. DEVELOPMENT OF THE PANORAMA VR TOUR

The image-based method has three major categories of walkthrough techniques; inside-out view, outside-in view and walk into views [4]. In this paper, we concentrate only at inside-out view. It is a panorama VR concept. Panorama VR is a photo that displays a wide view along the horizon [7]. It consists of a series of sequential photographs, which are presented so that the view of the surrounding world or the object can be controlled [10]. It creates an illusion that one is standing at the center of the panorama and sees the surrounding with a maximum view of 360^0 or less.

Development of the panorama VR process involved six steps:

3.1 Planning
Planning is a process to determine panorama specifications, storyboard, production timeline, budget user experience, location and equipment. In this case, we choose Sultanah Bahiyah Library for location to created panorama VR and the pictures was taken in semester's holiday.

3.2 Photographing images and digitalizing images
Firstly, to produce a panorama of the building environment, the required surrounding images of the building were captured using a high-resolution digital camera. When capturing the images, to ensure each image is continuous, the photos need to have an overlap of 20% to 50% [7] between adjacent images. However, QTVR online [1] decides 50% overlap between adjacent images during image capture is the best. The goal of image overlap between adjacent images is to create a smooth blend of color values between images during stitching process development [1,10]. This is especially important part in outdoor scenes, where colors can change dramatically as user pan into or away from the sun [1].

From our experiences, we found that in order to produce panorama VR, overlapping between images also depends on the types of panorama VR software that is used. For example, PhotoVista needs overlapping image between 20% until 70% [7]. While Ulead COOL 360 needs minimum overlapping image by 15% [12] and VR Worx Panorama receives minimum overlapping images between 10% until 14%.

When images were captured, tripod was used to ensure that the photo is clear and sharp at the angle.

The camera is rotated after each shot until the camera goes through a complete circle. In our prototype, a full circle usually consists of 11-18 individual photos.

From our study and experience, we have found that for 35 millimeters photography, a lens in the 15-18 millimeters range is the best.

3.3 Stitching Images
PhotoVista Studio Edition, Ulead COOL 360 and VR Worx Panorama software were used to stitch the images. Stitch is the process of blending a series of photographs, taken in a circular view, into one seamless panoramic image, which is automatically generated. These images were than systematically stitched and aligned to provide a 360° panoramic view [16].

There are three main differences between Ulead COOL 360, VR Worx Panorama and PhotoVista. Stitching images through Ulead COOL 360 and PhotoVista is easier than through VR Worx. The differences between this software are described at Table 1.

After performing full stitch, PhotoVista automatically creates an IVR file to play the panorama. Ulead COOL 360 and VR Worx panorama produce QTVR movie files.

The success of the stitching process depends on the overlapping between images as discussed previously. It also depends on experiences and expertise in capturing the pictures as well as the position of camera.

3.4 Build Virtual Tour by Linking Panorama VR
Two sofwares were used to build virtual tour. It is Reality Studio and VR Worx Scene. Reality Studio and VR Worx Scene allow us to build Web sites with interactive 3D objects, 360° panoramas, zoom able images, animation and more. It is a complete set of tools for Web designers who want to build compelling Web content. It is easy to create photo-realistic, fully immersive experiences.

Developer can be export or add panorama VR from Ulead COOL 360 and VR Worx Panorama to VR Worx Scene and PhotoVista to Reality Studio.

Within each panorama, key spots were defined through Reality Studio or VR Worx Scene to provide the illusion of being able to go from one location to another. User can click hotspots to play sounds and movies or open panoramas. Viewer is able to visualize realistic images since the panorama was based on a real picture.

3.5 Comprise and Resize Panorama VR
After that, panorama VR file was comprised to minimum the file of panorama VR. In case, *Ulead* COOL 360 file size is too big and we comprise it at VR Worx. It supports Ulead COOL files because it was produces the same output file. While, Reality Studio automatically comprises it file and save it as IVR file.

TABLE 1
Differences Specification of Panorama VR and Linking Panorama VR Software

Subject	PhotoVista v2.02	Ulead COOL 360 v1.0	Reality Studio v1.0	VR Worx v2.0
Producer	Live Picture, 1996. In 1999, MGI Software acquires Live Picture.	Ulead System Inc. GmbH, Mac 1996.	Live Picture, 1996. In 1999, MGI Software acquires Live Picture.	VR Toolbox, Inc. 1999.
Function	Build panorama VR.	Build panorama VR.	Build virtual tour by linking panorama VR. Example: Add panorama from PhotoVista.	VR Worx Panorama for build panorama VR; VR Worx Scene for build virtual tour.
Web Pages	http://www.mgisoft.com/products/webtools/panorama/index_flash.asp	http://imagemechanic2.ulead.com/cool360/runme.htm	http://www.mgisoft.com/products/webtools/reality/index.asp	http://www.vrtoolbox.com/VRtoolbox.html
Price	US 49.95.	US 39.95.	US 189.00.	US 299.99.
Platforms	Windows and Macintosh 7.5.	Windows.	Windows.	Windows and Macintosh.
Format File Input	bmp, jpeg, pic and gif	bmp, jpg, tif, pcd (read only), png and upj.	jpeg, gif, bmp, FlashPix - fpx, ivr, wml, QuickTime (mov), wav, midi and video Window (avi).	pict, bmp, jpeg, psd, png, tif, QuickTime Image (qtif), MacPaint (pntg),sgi, tga and QuickTime (mov).
Format File Output	bmp, jpeg, ric and ivr (qtvr for Macintosh).	mov (QuickTime and format VR), uvr, bmp, jpg, tif, png and upj.	MGI Image Worlds (ivr).	MacPaint (pntg), psd, pict, png, bmp, sgi, jpeg, tga, QuickTime Image (qtif), tiff and mov (QuickTime and QuickTime VR).
Overlapping images	20% to 50%.	Minimum 15%.	Nil.	VR Worx Panorama: Recommended: 10% to 35%.
Hotspot	Nil.		Yes.	Yes - in VR Worx Scene.

3.6 Publish on the Web

The process continues with publishing on the web. Through Reality Studio, user can be export panorama from PhotoVista to Java Applet Target to publish on the web. Reality Studio exports IVR and HTML files, along with the associated files necessary to play the world in the Live Picture Viewer plug-in or Java applet in a Web page. However, it still have problem at Netscape Navigator. Users need to add "i-world/i-vrml" into embed src line in html source code to ensure that the plug in will load with all browser.

Through VR Worx Panorama and Ulead COOL 360, we used VR Worx Scene to publish it on the web as a QTVR movie file. The plug in is free and available at
http://www.apple.com/quicktime/download/.

At the end of the process, FrontPage and Dream weaver 4.0 was used to make-up the web with others information.

Besides, panorama VR can be linked with other application used Active-X function. From what we know at the moment, only movie file format (QTVR) and wrl file format can be linked to others application like Macromedia Director and Visual Basic.

4. LIBRARY SERVICES SURVEY

A library is known as the main information center. The uniqueness of a library depends on the ability of the library staff in selecting the material needed by library users and organize them in such a way that they will be easier accessible in addition of archiving them.

Meanwhile, the main objective of a library is to provide its customers the best service.

4.1 Library Services Today

According to Wilson [14] at the moment, client of library want: (a) What they want, they want it like materials readily available; (b) books; (c) longer opening hours; (d) staff assistance and training. In this survey, case 4 is highlighted. Looking at the future, Morales [8] states that the library at the future will focus on helping users to access information both remotely and indepently. That is the motivation to provide an alternative tool for librarian in library tour or visual information service.

Currently, the use of signboards is the common methods used in libraries to provide information regarding books and their placement. Other methods include the use of pamphlets, homepages or the librarian. However, there are still questions on: "The more effective way of information delivery for a library tour?" According to Xiao [15], there exist three medias for library tour: (a) Physical tour; (b) Virtual web tour; (c) Panorama and Virtual Reality Web Authoring Technology. Xiao [15] concluded in his survey that the delivery of information using VR panoramic technology could be effective for library tour. Then, try to look our survey at prototype location.

4.2 Survey the Potential Virtual Guided Tour

The survey period was form 17th to 30th of September 2001. The venue was the Auditorium of Sultanah Bahiyah Library and Computer Laboratory of

Information Technology Department, Universiti Utara Malaysia. 42 respondents that have Sultanah Bahiyah Library membership were selected randomly to answer the questionnaire.

We found that panorama VR has the potential to be a communication tool particularly to be used in virtual guided tour system compared to the conventional methods using oral, signboard or printed media in library, see Fig. 1. In addition, it is easier to use, understand and remember; provides greater flexibility and clearer information; and more attractive compared to the conventional techniques. However, this technique is not to replace the conventional information delivering techniques, which is being practiced by the library. It just provides an alternative technique to conveying information for library user to make it more attractive and easier to comprehend and to increase the quality of information service.
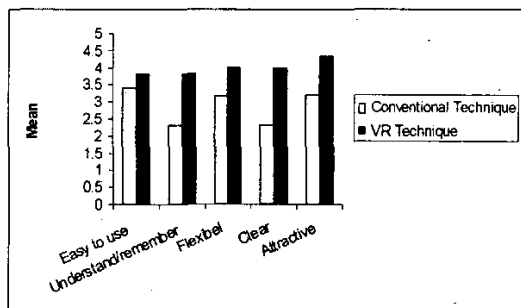

Fig. 1. Mean User Satisfactions Using Conventional and VR Technique in Delivery Information

5. CONCLUSION AND FUTURE WORK

From previous studies, and also from our survey used panorama imaging technique, it can be concluded that visual presentation is an effective way to communication tool particularly to be used in library tours. Other area which can be benefit by using panorama representation on their website i.e. virtual tour in tourism industry, promotion and marketing, exhibition and other information focusing in visualization. For future work, more research regarding potential used of VR in the library can be carried out. A combination between cataloging search (OPAC) and visualization used VR technology can also be experimented.

6. ACKNOWLEDGEMENT

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