Realidad virtual como herramienta para interactuar en línea

Virtual reality as a tool for online interaction

Salvador Hernández Mendoza
Universidad Tecnológica deTulancingo
salvador.hernandez.mendoza@hotmail.com

Dante Peña Rojas
Universidad Tecnológica de Tulancingo
dantuno_82@hotmail.com

Resumen

En el presente proyecto se desarrolla un Recorrido Virtual Interactivo de "La Catedral Metropolitana de Tulancingo", con el objetivo de proveer una herramienta para fomentar el desarrollo turístico de la región, además de apoyar al rescate cultural, a través de herramientas que permitan la interacción con otras personas en el mismo escenario empleando Avatares y chat como medio de comunicación, para ofrecer una experiencia enriquecida a los usuarios. Además de estas técnicas de desarrollo se trabaja con la generación de imágenes estereoscópicas como medio para visualizar los escenarios con efecto de inmersión, al igual que los que se pueden ver en la salas de cine

El proyecto tiene como característica esencial que utiliza software libre y técnicas de visualización 3D de bajo costo, además es posible alojar el proyecto en un servidor web y acceder a él desde cualquier parte del mundo, utilizando una conexión a Internet. Las técnicas aplicadas pueden ser utilizadas como herramientas en presentaciones y/o conferencias, demostraciones de prototipos, así como también en simulaciones.

Palabras Clave: Realidad Virtual, Interacción, Visualización 3D, Educación, Imágenes Estereoscópicas, Internet.

Abstract

This project develops an interactive Virtual Tour of "The Metropolitan Cathedral of Tulancingo", with the aim of providing a tool to promote the tourist development of the region, as well as supporting the cultural rescue, through tools that allow interaction with other people in the same scenario using avatars and chat as means of communication, to provide an enriched user experience. In addition to these development techniques working with the generation of stereoscopic images as a means to visualize the scenarios with effect of immersion, as well as that you can see in the theaters.

The project is the essential feature that uses free software and low cost 3D visualization techniques, furthermore it is possible to stay the project on a web server and access it from anywhere in the world, for using an Internet connection. The applied techniques can be used as tools in presentations or lectures, demos, prototypes, as well as simulations.

Key Words: Virtual reality, interaction, 3D visualization, education, stereoscopic images, Internet

Fecha recepción: Noviembre 2013 **Fecha aceptación:** Enero 2014

Introduction

Currently the terms virtual reality or technologies 3D and dip seem to be very new, however, are old. There are a large number of meanings describing them, all with something in common.

One of the more specific meanings of virtual reality is: "computer system used to create an artificial world in which the user has the impression of being in that world, as well as the ability to navigate and manipulate objects in it". Ref. 1.

Nowadays you can find many applications with 3D technology, highlighting different areas of medicine, education, e-commerce, military, architecture, leisure and entertainment (see annex 1). The latter is having a strong impact within society, while it is a true revolution in the immersive 3D digital models of inspection; increasingly, applications in the fields of design and development of projects in different fields.

Of the foregoing, we began work on the development of a collaborative virtual environment to publicize the Metropolitan Cathedral of Tulancingo, Hidalgo, in order to integrate the technologies of the information culture, to make it entertaining and in this way to publicize to the world the architectural riches of the region.

To carry out the foregoing, required the development of an application that was called "Environment Collaborative Virtual in Cathedral", which is a 3D modeling that represents the infrastructure of the Cathedral, showing a large number of details that are created the closest to reality. This application makes use of Anaglyph 3D visualization technique to give the user the feeling of immersion in the virtual world, at the same time this tour also has the characteristic to be able to interact within the same through an avatar, as well as also show to the world through a web page of the Metropolitan Cathedral in Tulancingo.

This project aims to encourage people to explore new creative ways to raise awareness of the importance of reconstruction of historical monuments alternatives, as well as to increase the cultural level of each of the individuals by means of a tool that makes use virtual reality and 3D visualization techniques. Similarly, this application is intended to be an option that benefits tourism chains, for users interested in visiting and get more information about that place.

This research has revealed that all the information technologies used can fully reconstruct scenarios that existed several years ago, where the user could take a tour of a virtual world and which would be released including the various human cultures art and monuments, as well as recreate scenarios in which future architectural projects shown, for example, eat-ts, buildings, businesses, industrial plants and so on.

Somehow with these tools could also redo spaces where the different stages of a process of evolution display, and raising awareness of the past, present and future of an architectural monument, living being, object, among others; in order to expose more interactive way the modifica-tions and adjustments at different times.

2. DEVELOPMENT

3D technological tools exist to support in psychological, educational, investigational therapies, simulació-tions, such as 360 ° tours and virtual tours. Thanks to the research of the latter arises the idea of creating the "Virtual Collaborative Environment in Cathedral".

The project was born from the interest to know more about the significance of one of the most matter-tes buildings that comprise the state of Hidalgo, which is known as the Metropolitan Cathedral of Tulancingo; eva-ation and research were directed to operate the development of a "Collaborative Environment Vir-tual Cathedral" to show the chronological sequence of more interactive and interesting way to various users.

It seeks to propose a virtual guide service quality, coverage and accessibility that it will help to spread the culture of the region and also support tourism chains. This project aims to create a con-ness-raising within society about the importance of different historical buildings in the region.

The municipality of Tulancingo de Bravo is the second largest within the state of Hidalgo, because her ex-tension of more than 150, 000 thousand inhabitants and possessing great commercial, which once had large textiles, handicrafts boom and dairy . Writers and chroniclers of history in the state have recognized the historical and cultural significance of one of the oldest municipalities in Mexico, as it has ancestral remains as Huapalcalco site, birthplace of the Toltec culture; however, many of these monuments are not many people recognize that they deny the value to society.

Currently, Tulancingo Hidalgo has many attractions and places full of history, which the perso-nas visit to enrich their cultural heritage, but in a situation of economic crisis, people do not travel as much as they did before the expenses generated by .

It should be mentioned that it is difficult to know what they were really some archaeological remains when they are underground or in ruins, and to assess some proposals on construction of stores, factories, buildings, houses, and so on.

There are ways to inform users certain places, such as images, photographs, leaflets, brochures, postcards and videos. These tools are sometimes too limited to show detail each of the places, plus some of them generate pollution as they are papers that in some circum-stances are thrown. Another disadvantage of these tools is that the information is displayed unattractive and interesting for the user.

2.1 Theoretical Framework

Virtual reality is an interface or system that displays real-time synthetic environments, this is divided into two: immersed virtual reality and virtual reality is not immersed.

Immersed virtual reality is what allows perceiving be within the arti-ficialmente, with the help of various devices generated three-dimensional virtual environment. The non-immersed virtual reality, also known as virtual reality desktop resembles surfing the Internet, where one computer is used, because it does not require the use of other devices.

The basis for achieving infiltration these virtual worlds, is modeled in 3D as well as incorporating animation, sounds, models and 3D visualization techniques, using specific software. At present there is a wide variety of tools for this process. Following are some. For some 3D modeling programs they are:

Autodesk 3Ds Max (formerly 3D Studio Max), which is a program for creating 3D graphics and animation developed by Autodesk.

3ds Max is one of the most used programs 3D animation is paid and does not have a free version. Ref. 2 Autodesk AutoCAD is a program of computer-aided design for drawing in two and three dimensions. He is currently developed and marketed by Autodesk. Ref. 3.

Autodesk Maya (aka Maya) is a computer program dedicated to the development of 3D graphics, special effects and animation. The program is a trial version, if you want to use all compo-nents

should purchase the paid version. Ref. 4.

Blender is a 3D modeling program supported by various tools, multiplatform. It develops as Software free, with source code available under the GNU GPL, download and use its free. Ref. 5.

Annex 2 a comparative table of the characteristics, advantages and disadvantages of the programs for development of 3D modeling discussed above is shown. According to the comparison made on programs for development of 3D modeling, it was determined that about its characteristics, advantages and disadvantages, Blender is a viable option for the development of the modeling required for this project option.

To incorporate animation, sounds and 3D models are called (game engine). A brief description of some.

A game engine refers to a series of programming routines that allow the representation of a sawdeojuego. Also it provides a rendering of 2D and 3D graphics, which includes collision detection, sound, scripting, animation, artificial intelligence, networking, streaming, memory management and scene graph.
Unreal is a game engine developed by Epic Games also in other genres such as role-pers games and third-person perspective. It is written in C ++. Ref. 6.

Unreal Engine also offers several additional tools helpful for designers and artists.

The latest version of this engine is the Unreal Engine 3 technology is designed to:

- DirectX 9 de Microsoft (for Windows XP/Windows Vista de 32/64-bit y Xbox 360).
- DirectX 10 (for Windows Vista 32/64-bit).
- OpenGL (for plataformas Linux, Mac OS X de 32/64-bit y PlayStation 3).

Microsoft XNA (is a set of tools with a managed execution environment and provided by Microsoft that facilitates the development and management of computer games. Ref. 7.

Unity is an integrated authoring tools for creating 3D video games or other interactive conte-nests such as architectural visualizations in real time system. Ref. 8 This program is used for internet games, play3, PC and mobile iPhone, Android mobile systems, this with the help of a plugin. Unity has a free version that can be downloaded from the Internet and another that is a PRO version which has a cost. It contains other additional features that help in the made-ness of a video game. See Appendix 3.

According to the comparison made about programs for integration, animation, interaction and immersion in the virtual world created, it was determined that about its characteristics, advantages and disadvantages, Unity is a viable option since it has the essential characteristics for optimal development of the project.

At this time, undoubtedly the virtual reality (VR) has revolutionized and has been increasing in the world in its various spheres, beyond the computer, since this technique is also widely used in medical, educational, spatial environments and a long list of scientific activities. Ref. 9. Its main objective is to immerse the user in a simulated artificial world by computer, bringing realistic feelings in the world that presents itself. One of the qualities denoted in the RV is the three-dimensionality; the tri-dimensional immersive feeling is achieved by projecting stereoscopic graphics, creating an image for the left eye and one image for the right eye of the user.

Regarding the graphics projection it is said that two types of stereo systems that combine images to give users a single image with a sense of depth exist primarily: stereo systems active and passive stereo systems.

Active stereo systems are providing a higher quality in design and usually have a high cost. They are sequential systems, in which for each eye images alternate in rapid succession (typically 120

Hz.). In such systems active glasses are used.

The most common passive systems use a set of stereo two projectors with polarizing filters. The glasses do not have any electronic component, but that embody similar filters projectors. The graphs can be generated by a computer or two semi-independent computer synchronized. Ref. 10.
3D (blocking or image sequence) display can be done in two different ways: using active stereo or passive stereo vision.

Techniques, more typical passive stereoscopic display are: the anaglyph technique, polarization, eclipse or active closure and Infitec, which are described briefly below.

Technique anaglyph described as a system for binocular visualization is based on images of two di-dimensions suitable to cause a three dimensional effect, which is conducted with the use of filters of different colors for each eye, each color filter absorbs the part of the image of the same color, ie red red filter lens for an eye image, making this not see the other image of a different color. Thus each eye sees the outline of the opposite color image and position, causing the brain to interpret a single image with depth. This method, its low cost, is mainly used in publications, as well as computer monitors and cinema.

The polarization technique does not require changing the colors in the image but rather refers to having two images with different polarization filter. These are projected onto a screen and lenses with a filter for each eye to match the screen do the work to get the two images to our brain. In this technique must be used silver compound (or aluminum) screens to maintain the polarization of the projected light and the circular polarization is used. Another disadvantage is the frames per second; the film does not allow as many frames per second. However in this digital screens it has improved.

Infitec is a technique that performs quality stereo separation without ghosting known as ghost. Infitec stereo separation is useful for high contrast images; in this technique, the user has complete freedom of movement and the angle of display is independent. Infitec makes a good separation of image-tions, regardless of display technology being used, resulting in greater uniformity, which

does not happen with the polarization technique. The main disadvantage is that it requires more Infitec brightness over other methods. Ref. 11.

Another improved method for modernity is "eclipse" or "active close", where some LCD glasses open and close at the same frequency for each image (right or left). Opening-lock note and can not perfectly see a 3D movie without changing color or polarization. The problem is you have to be in perfect sync with the screening of the film forcing the system to be connected somehow. Ref. 12.

Moreover, as already mentioned, there is also the technique of active stereoscopic display which is one of the most used so far, which is characterized by specific demands on hardware and technology to the projector.

For stereoscopic vision switching technique uses active glasses, commonly called glasses with mutation-known as shutterglasses. These glasses consist switching liquid crystal lenses are able to darken completely and do not let the light, quickly alternating the opening and closing of the LCD. This feature, along with the alternate projection of images, allowing each eye sees a different image, thus the 3D illusion.

Switching glasses are a more expensive option than those presented above; also they require synchronization with the display device and therefore require additional hardware. However, they are those that produce better results. Ref. 13.
It was determined using the passive stereo system with anaglyph 3D visualization technique for this project because it turns out to be 80% more economical, feasible and accessible than others at this time. As described above-mind, to use the system and its active stereo 3D visualization techniques are needed materials and high cost devices.

It is intended that this project has the feature to give the user the feeling of immersion, and Anaglyph technique is suitable for this process therefore was seeking a tool that will help show how dumb anaglyph created virtual (3D glasses, see Appendix 4).

According to the investigation, the following list highlights programs for carrying anaglyph effect described.

3. Results

An investigation into how many people know the term virtual reality was made. Annex 5 is given to know the amount in percentage of the general population who knows the term virtual reality, which is 66.7%, while 33.3% of the population does not know the term according to statistics were performed Nacional level. This was done in order to determine whether the application will be understandable to the various users.

Having developed the modeling of the Metropolitan Cathedral of Tulancingo textures placed to provide a real effect on the modeled objects. See Annex 6.

These modeled were exported to Unity 3D, also known as the game engine, to join the pieces and drop modeling the interaction between the user and virtual world, using the keyboard to explore the virtual world. See Annex 7.

It is intended that this application is a web server and display the various users via a web page, for which an executable was created from Unity Web. He began conducting an investigation to ha-collar tool that would serve to link the virtual avatar with modeling. Having found an application that could support this process, a series of tests were run, which are described below:

The executable generated by Unity 3D was placed on a Web server with the help developer Cathedral website. See Appendix 8.

A collaborative environment to incorporate the virtual tour you need to gather the Cathedral virtual modeling the application containing the elements that give the movement and incorporation of several avatars.

The application that was placed in network reported that only allows 33 users to connect simultaneously. See Annex 9. It is noteworthy that on the application managed to place an immersive effect, in order to make the user feel the sensation of being inside the virtual world to do a comparison between the various methods that help was made to This process is performed.

It was determined using the passive stereo system with anaglyph 3D visualization technique for this project because it turns out to be 80% more economical, feasible and accessible than others at this time. As described above-mind, to use the system and its active stereo 3D visualization techniques are needed materials and devices are expensive. This is mentioned in the theoretical framework as previous research. A table where the pictures are compared with the executable application modeled virtual path, in order to demonstrate that modeling was done as close to the actual structure was performed.

4. CONCLUSION

From the above work it was noted that development of this kind of tours a major limi-tant for processing is the time to be devoted to the design and modeling of each of the parties to con-form route, all this in mind that the goal is to offer the user an experience closer to reality. Other equally important factors are the software tools, such as: software for 3D modeling, software for retouching images, and the game engine that integrates all these components, in this case tools are used whose license is free , and they replaced perfectly professional tools whose license cost exceeded the resources that were available.

On the other hand, the experience gained in the project can see new applications and uses a combination of these tools, which may well be future projects such as the creation of "virtual" classrooms, where you actually PUE-da see and interact with others peers through his "Avatars" in much the same way as is done in the classroom, while this concept may seem like science fiction elements necessary to carry out already have: Software 3D modeling, management realistic textures, game engine to integrate the elements and, finally, a protocol for connecting to the same stage and interact with it from anywhere using In-ternet. The tools are there, and the uses and

applications depend on the ingenuity and creativity of the developers.

Bibliography

Definición de realidad virtual, [en línea], Ed. 2010, [Citado 26/Enero/2011], Formato HTML, Disponible en Internet: http://usuarios.multimania.es/artofmusic/the_matrix_vr/definicion_vr.html

Autodesk, [en línea], Ed. Copyright 2011, 2011, [Citado 01/Febrero/2011], Formato HTML, Disponible en Internet: http://usa.autodesk.com/adsk/servlet/pc/index?siteID=123112&id=135832396

KSH_Alone en 3D y Render, Software, renderati el blog con profundidad, altura, anchura [en línea], Ed. 2010, 2007, 2011, [Citado 01/Febrero/2011], Formato HTML, Disponible en Internet: http://www.renderati. com/render/%C2%BFque-es-blender/

Graciela Marker., informatica-hoy, [en línea], Ed. 2010, www.informatica-hoy.com.ar, 2007, 2010, [Citado 22/Enero/2011], Formato HTML, Disponible en Internet: http://www.informatica-hoy.com.ar/realidad-vir-tual/Realidad-Virtual-Su-historia-y-sus-variantes.php

Iris Noemí Ramírez García., INSTITUTO POLITÉCNICO NACIONAL, [en línea], Ed. 2008, México, D.F., 2008, [Citado 12/Enero/2011], Formato PDF, Disponible en Internet: http://itzamna.bnct. ipn.mx:8080/dspace/bitstream/123456789/4028/1/SISTDEVISION.pdf

Iris Noemí Ramírez García., INSTITUTO POLITÉCNICO NACIONAL, [en línea], Ed. 2008, México, D.F., 2008, [Citado 12/Enero/2011], Formato PDF, Disponible en Internet: http://itzamna.bnct. ipn.mx:8080/dspace/bitstream/123456789/4028/1/SISTDEVISION.pdf

Fabio Baccaglioni, Argentina., "tecnogeek", tecnología al alcance de todos, [en línea], Publicado 18de marzo de2010, Argentina, 2005, 2010, [Citado 28/Enero/2011], Formato HTML, Disponible en Internet: http:// www.tecnogeek.com/verpost.php?id_noticia=1143

Iris Noemí Ramírez García., INSTITUTO POLITÉCNICO NACIONAL, [en línea], Ed. 2008, México, D.F., 2008, [Citado 12/Enero/2011], Formato PDF, Disponible en Internet: http://itzamna.bnct. ipn.mx:8080/dspace/bitstream/123456789/4028/1/SISTDEVISION.pdf

6. ATTACHMENTS

Annex 1. Table showing the main applications and common areas has been applied virtual reality.

Aplicaciones de la realidad virtual	Áreas principales en las que se aplica
Medicina	Simuladores para formación
	Tratamientos psicológicos de fobias
	Cirugía
Educación	Herramientas educativas y Teleducación
Marketing y Comercio electrónico	Venta de productos
	Probador Virtual
Militar	Simuladores de Vuelo
	Entrenamiento militar
Arquitectura	Visitas virtuales
Industria	Monumentos históricos
	Diseño de plantas industriales
	Simulaciones de las etapas del proceso productivo
Ocio y Entretenimiento	Juegos electrónicos
	Instalaciones virtuales

Annex 2: Comparison of development programs for 3D modeling.

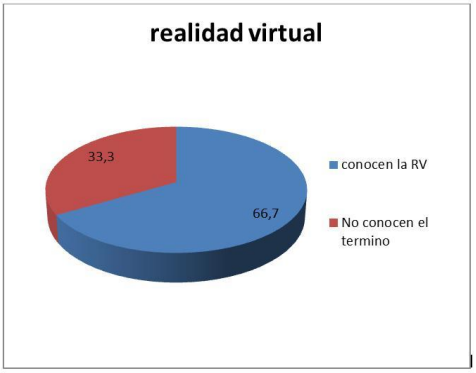
Nombre del software	Sistema operativo compatibles	Tutoriales y documentación	Animación	Modelado	Efectos visuales	Renderización	Herramientas de pintura y texturas	Representación de aspecto sombreado	La posibilidad de programar	Importa y exporta de múltiples formatos 3D	Gratuito.	En español
Autodesk 3ds Max	Windows (2000, XP o Vista)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗
Autodesk AutoCAD	Microsoft Windows, Mac OS X	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓
Autodesk Maya	Mac OS ® X, Windows32 - y 64 bits, y Linux de 64 bits	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗
Blender	windows XP, Vista 32 y 64 bits, Linux 32 y 64 bits, MacOS, solaris, etc	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Annex 3: Comparison of game engines.

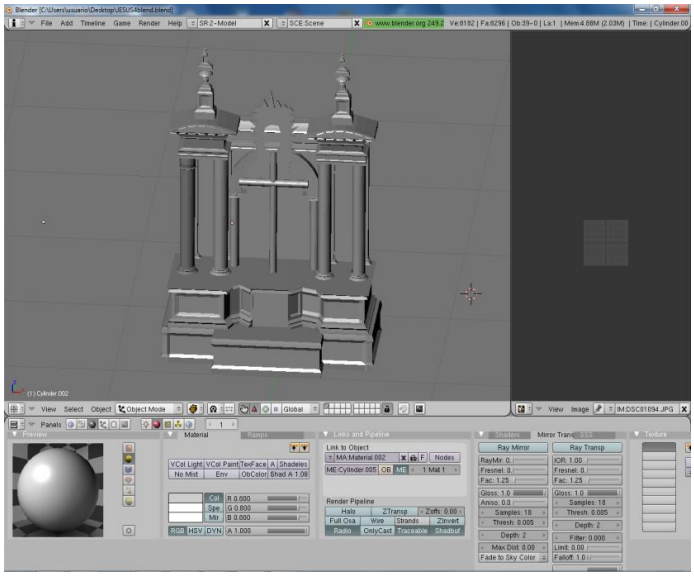
Nombre del software	Sistema operativo compatibles	Tutoriales y documentación	Crea aplicaciones soportadas en Internet Explorer, Firefox, Safari, Mozilla, Netscape, Opera, Google Chrome.	Renderización	Herramientas de iluminación y textura	La posibilidad de programar	Importa y exporta de múltiples formatos 3D (3ds Max , Maya , Blender , Cinema 4D , y Cheetah3D)	Gratuito.	En español
Unreal	Multiplataforma	✓	✓	✓	✓	✓	✓	✗	✗
XNA de Microsoft	Microsoft Windows , Xbox 360 , Zune , teléfono de Windows 7	✓	✓	✓	✓	✓	✓	✗	✗
Unity	Windows, Mac OS X	✓	✓	✓	✓	✓	✓	✓	✓

Annex 4: 3D anaglyph glasses.

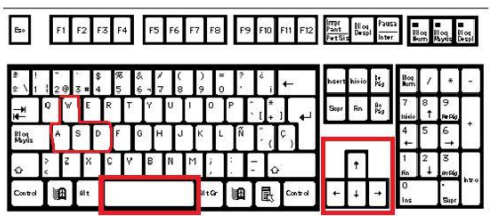
Annex 5. Percentage of people who know the term virtual reality.



Annex 6. Modeling



Annex 7: Virtual Tour using the keyboard.



Annex 8. View main cathedral.

Annex 9: Application network showing avatar in the virtual world of Cathedral.