

Virtual Reality Environment Proposal, CIMAT-Quantum, Zacatecas, Mexico

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Abstract

Nowadays, the use of virtual tours through virtual reality allows for the creation of a recreation of the real world where the user can interact to know different places. In this work, we present the virtual tour of the technology park Quantum Knowledge City in Zacatecas, Mexico. The objective of this application developed under the video game engine Unity3D is to have a means of dissemination that interactively, through 360 images and virtual representations, offers a user experience in which you can learn about the facilities that make up the technological part, get information about the turn of the established companies, in addition to the research of the research centers located in Quantum.

Keywords

Virtual Reality, Virtual tourism, Education

1. Introduction

Nowadays, technology allows for quite interactive representations of places or points of interest for people to get to know using technology. This type of virtual tourism has the advantage that people through devices such as smartphones, computers, and other devices can interact with real-life representations so that they can experience a complete immersion safely and playfully [1].

In recent years, virtual reality has become a means to promote the economic development of various locations. This in turn brings with it several advantages such as the generation of information services, mechanisms for supply and demand of services, and sustainable development [2].

Virtual tourism has had a considerable increase; in the United States alone it is estimated to be worth five billion dollars and it is projected that by 2027 it could exceed 24 billion dollars [3].

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The increase in virtual tourism strategies may be due to the events of a globalized world such as the COVID-19 pandemic, which has drastically changed the way people today use technology to obtain information in various fields, such as work, education, entertainment, and tourism. In this way, virtual tourism is constantly innovating to offer customers experiences in which new technologies and services are integrated [4].

This work presents the proposal for virtual tourism CIMAT-Quantum, City of Knowledge, Zacatecas, Mexico. The purpose of this proposal is to have a virtual environment in which people can get to know the Quantum technological complex, and the different companies, governmental institutions, and public research centers located within it. The purpose of this technological complex is to establish collaboration networks between governmental agencies, educational institutions, private initiatives, society, and environmental protection [5].

In particular, this proposal is oriented to the Centro de Investigación en Matemáticas (CIMAT) which is a public research center integrated into the Sistema de Centros Públicos CONACYT, dedicated to the generation, transmission, and application of specialized knowledge in the areas of mathematics, statistics, and computational sciences [6].

2. Related work

Virtual environments provide a window into experiences abstracted from reality. In the field of tourism these environments can have several applications, such as, in planning and management, marketing and information exchange, entertainment, educational content and accessibility [7]. From a sustainable point of view, virtual environments offer people to have experiences at low cost, with the possibility to access risky and protected places, to have access to remote and difficult to access places, as well as to witness representations of places that in real life are impossible to access [8, 9, 10]. The following are some examples:

- Historical recreations [11, 12]: allows visitors to experience reliable representations of historical sites, learn about and identify characters from history, and witness scenes from history.
- Tourism from home [13]: allows visitors to make trips from home to places such as museums, cities, and presentation sites, from the comfort of a computer or mobile device.
- Accessibility [14]: have access to remote and restricted locations, such as pyramids, government-protected areas, and other constructions.
- Impossible places [15]: allows users to experience from their devices representations of places and events that are difficult to witness in real life, such as the planets, the surface of the moon, witnessing an eclipse, etc.
- Opportunity for disabled tourists [16]: virtual experiences allow users with physical disabilities to carry out tourist activities through technology.
- Sustainability [17]: allows virtual tourism to avoid the deterioration of the environment and at the same time promote the conservation of natural reserves and environments at possible risk.

3. Quantum, Knowledge City

Quantum is a scientific and technological complex that houses private and government research centers to promote the knowledge economy, the training of specialized human resources, and entrepreneurship (see Figure 1) [18].



Figure 1: Quantum, Knowledge City, Zacatecas, Mexico [18].

The new government and private institutions are being added all the time. Currently, we can find within Quantum [19]:

- Metallurgical Research Center.
- Center for Research in Mathematics, Zacatecas Unit.
- Center for Technological Development and Innovation in Telecommunications and Information Technologies for Mining in the State of Zacatecas of the company Lasec Telecomunicaciones S.A.P.I de C.V.
- Innovation Center for the Development of Solutions with Information Technologies, Communications and Software Engineering, Compulogic company.
- Laboratory for Drilling and Rock Support Research.

4. Problem outline

Nowadays, governments and institutions, through the media and technology, are looking for ways to publicize their daily work and promote the benefits and applications of science and technology to students, teachers, and the general public through outreach.

It is important to make known nationally and even internationally what is being done in the sense of scientific development and establish new connections for collaboration. Therefore, everyday strategies are employed through the use of technology in which marketing and promotional experiences can be offered to attract tourists and thus generate new collaboration and business.

In this sense, the use of virtual environments is proposed as a support for dissemination and attraction of new students and researchers to the Mathematics Research Center at Quantum so that they can get to know the graduate programs, professors, facilities, and part of the academic and student life that takes place in this research center.

5. Virtual Environment CIMAT-Quantum

This section presents the proposal of the virtual environment CIMAT-Quantum (see Figure 2), this virtual environment has the purpose of being a window to the outside world to show the Quantum complex to the public.



Figure 2: CIMAT, Zacatecas, Mexico [20].

In this virtual environment, the Center for Research in Mathematics (CIMAT), Zacatecas unit is presented as a first instance. The objective is to provide the user with an immersive experience through CIMAT's facilities, to learn about its undergraduate programs, to get to know the academic and student life within the research center and to provide the user with recreational activities related to the topics carried out at the CIMAT.

For the development of this virtual environment, the steps proposed by Seipel [21] for the development of a virtual environment were taken into account. Each of them is described below.

5.1. Content

The virtual environment starts with a selection of predefined avatars, once the avatar is selected, the user can be moved to the main scenario (see Figure 3). In this scenario, it is intended to show the CIMAT facilities, interact with the professors and perform playful activities within the facilities. In addition, it is possible to tour the entire Quantum complex and learn information about the institutions and companies.

5.2. Objects and Dynamics

For the design of the virtual environment, the Low Poly [22] art type was selected (see Figure 4). This type of art was selected because it is very cartoon-like and visually appealing. Within the virtual environment, there are static 3D models (buildings, some, trees, cars, etc.). These 3D models usually have minimal interaction with the user. On the other hand, dynamic objects are

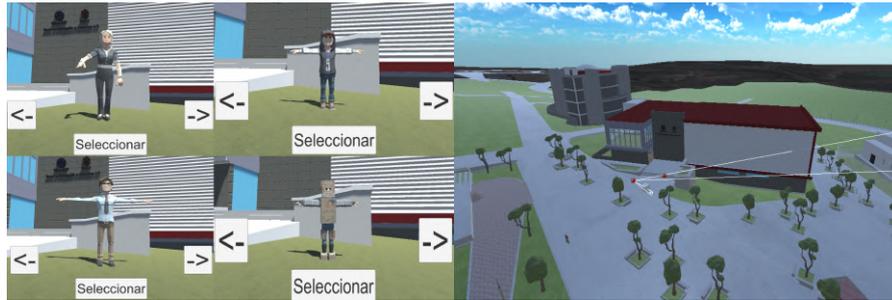


Figure 3: (left) Avatar selection. (right) Main scenario.

those that within the scene will allow the user to perform various actions or interact to perform specified tasks. An example of this is the 360 icons that rotate to show the user the 3D images of Quantum.



Figure 4: (left) Character in Low Poly art. (right) Interactive icon to show 360° images.

5.3. System Implementation

For the implementation of the system, the Unity3D video game engine was used, which allows the compilation of the application on various platforms such as Web, Windows, Mac, and Mobile, among others. Field work was also carried out to take 360° photographs with the Ricoh Theta SC2 camera at various points of the Quantum complex and thus incorporate them into the project so that the user can see them. The 3D models of the buildings and facilities were designed using the Sketchup tool [23] and corrections were made using the Blender tool [24] for their import into the Unity scenario. In Figure 5, a view of the project in Unity and an example of the compiled platform for Web browser are presented.

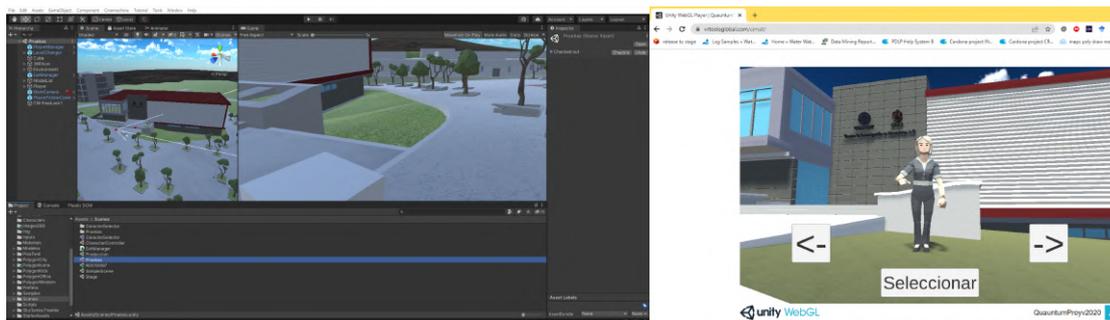


Figure 5: WebGL platform implementation example.

6. Conclusions and Future Work

This work presents the proposal of the virtual environment CIMAT-Quantum, which is proposed as a window to publicize the scientific and academic work being done within CIMAT and also as a means of dissemination of the Quantum technological complex, City of Knowledge, Zacatecas, Mexico.

This work presents an excerpt of the stages that make up its design and development, also emphasizes the interest in having sustainable tourism mechanisms, through the use of technology, and that this tourism can reach a greater number of visitors and thus promote the linkage and business in the region.

The future work is vast, as we continue to work on the design and implementation of various interactive activities within the virtual environment so that users can have a better immersive experience. We are working on a robust design that allows the interaction of several users using different platforms such as mobile devices, virtual reality, and pc platforms. From the user experience point of view, we worked on the design of mechanisms to evaluate the user experience to obtain feedback and make improvements to the system.

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