

Implementation of augmented reality to spread tourism in San Martín Texmelucan, Puebla

Implementación de realidad aumentada para difundir el turismo en San Martín Texmelucan, Puebla

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Abstract

Augmented reality (AR) is a technology that has been gaining greater presence in different sectors, among which we find education, marketing, training, tourism, among others. Augmented reality can be consumed in two ways, one is by creating an application that is installed on a smartphone or tablet and the second is through web environments (Web AR). Through the use of a web platform, a tour is developed through the tourist places named below in the township of San Martín Texmelucan Puebla, Mexico: Iglesia El Carmen, Antigua fábrica textil El Carmen, Parroquia de San Martín Obispo de Tours, Monumento a la Unificación Obrera, Complejo Cultural Texmeluquense and Antigua estación Ferroviaria. Within the AR Web, it allows you to see the locations, the map and show the route to follow to reach the tourist place. When you reach the destination, within a pre-established radius, you will be able to see information and an image or video representative of the place. For the development, the following steps were followed: determining the tourist places, collecting relevant information about each place (description, images, latitude and longitude), creating the scene and content, testing and adjusting the scene, and finally sharing the link.

Augmented reality, Mobile application, Tourism

Resumen

La realidad aumentada (RA) es una tecnología que ha ido adquiriendo mayor presencia en diferentes sectores, entre los cuales encontramos educación, marketing, capacitación, turismo, entre otros. La realidad aumentada puede ser consumida de dos maneras, una es creado una aplicación que se instale en un teléfono inteligente o tableta y la segunda, mediante entornos web (Web AR). Mediante la utilización de una plataforma web se desarrolla un recorrido por los lugares turísticos que a continuación se nombran del municipio de San Martín Texmelucan Puebla, México: Iglesia El Carmen, Antigua fábrica textil El Carmen, Parroquia de San Martín Obispo de Tours, Monumento a la Unificación Obrera, Complejo Cultural Texmeluquense y Antigua estación Ferroviaria. Dentro de la Web AR, permite ver las localizaciones, el mapa y mostrar la ruta a seguir para llegar al lugar turístico. Cuando se llegue al destino, dentro de un radio preestablecido, se podrá observar información y una imagen o video representativo del lugar. Para el desarrollo se siguieron los siguientes pasos: determinación de los lugares turísticos, recabar información relevante de cada lugar (descripción, imágenes, latitud y longitud), creación de la escena y contenido, prueba y ajuste de escena, y finalmente compartir el enlace.

Aplicación web, Realidad aumentada, Turismo

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Introduction

Tourism is an activity that promotes sources of income to a certain area. In a blog of the CESUMA University (n.d.) tourism is established as "an activity that consists of the temporary displacement of people to places other than their usual place of residence with the aim of enjoying leisure, cultural, educational, business experiences, among others". So we want to promote tourist sites in the region of San Martín Texmelucan, Puebla, so that tourists can get to know the attractions in the area, among the attractions are: Parish of San Martín Bishop of Tours, Ex Franciscan Convent, Church of Carmen, Ex hacienda of San Cristóbal Polaxtla, among others.

To achieve this, Augmented Reality (AR) techniques will be implemented, which consists of a technological resource that offers interactive experiences to the user based on the combination of the virtual and physical dimensions, with the use of digital devices (Grapsas. 2019). Augmented reality can be consumed from a mobile phone, either by installing a previously made application or it can be consumed from a web environment, also known as Web AR. AR can be classified into the following types: AR on markers, AR with image tracking, geolocalised AR, AR on surfaces, AR on objects Face Tracking, Body Tracking and AR in open spaces (González. S.f.).

The project consists of using Web AR applied to the main tourist attractions of St. Martín, using the Onirix platform, which allows the creation of projects and scenes, in each scene will be an attraction, showing a general description and a representative image. The platform uses Google Maps to show the way to the chosen destination, as well as being able to choose between the different points of interest, and when a certain distance is reached, the phone will start to vibrate to indicate that the destination has been reached.

The development stage was divided into 3 parts: the first one is to choose the places to be implemented, obtaining a description, image, latitude and longitude; the second stage is to implement in the Onirix platform the scenes of the chosen places; the third part is to carry out the tests in the tourist places.

Theoretical framework

Augmented reality is a computational technique that allows humans to interact between the real world and the digital world through a device such as a tablet or smartphone. Augmented Reality (AR) is a technology that allows virtual elements to be superimposed on our vision of reality (Iberdrola. 2023).

The main types of augmented reality classified are:

Augmented Reality based on markers: this type of augmented reality depends on an external visual element to know where to place the digital asset that will be seen through the viewer.

Markerless Augmented Reality: there is no need to place visual clues in the surrounding material environment; the software is already capable of identifying shapes and patterns in real time and places its virtual assets on these elements, having generated a three-dimensional map of the location in its memory system.

Projection-based Augmented Reality: the digital asset added by augmented reality remains immobile and tied to a specific location in a place.

Augmented Reality location-based

Location and user movement detection technologies are used to represent a zoom in or out of the digital asset, which appears in the person's field of view if they are in the right place at the right time.

Overlay-based

Augmented Reality: this technology superimposes visual information on a physical element, for example, by making different parts of it coloured in a different way.

Contour-based

Augmented Reality: the contours of the elements captured by the camera are highlighted, making it easier for the human eye to distinguish between different aspects of its surroundings (Filtroo. 2022).

For the realisation of this project, location-based AR or geolocated AR is used, in which technology is used to detect the location and movement of people, this is achieved by receiving information from the Global Positioning System (GPS).

The Onirix platform handles Web AR and geolocation, defining Web AR as the consumption of this type of technology - referring to augmented reality - and AR experiences from a mobile web browser. With the emergence of augmented reality for the web (also known as AR in web), essentially thanks to the huge evolution of mobile web browsers, we now have a next level of access to this technology. It is therefore much easier to create web pages with augmented reality (Onirix, 2022).

Methodology

As mentioned, the parts of the project are site selection, implementation of AR on the platform and testing.

Choice of places: we investigated which are the tourist places in the municipality of San Martín Texmelucan, among them are: Antique Railway Station, Parish of San Martín Obispo, Parish of San Rafael Arcángel, Ex-Convent of Santa María Magdalena, Temple of Nuestra Señora de la Asunción, Monument to the Workers Unification, Church of El Carmen, Antique Textile Factory "El Carmen", Ex Hacienda de San Cristóbal Polaxtla, Archaeological Zone "Los cerritos de tepatlaxco", Zócalo de San Martín, among others.

After having seen all the places, the most emblematic ones were selected, leaving the following in the first phase: El Carmen Church, Old Textile Factory "El Carmen", Parish of San Martín Obispo de Tours, Texmeluquense Cultural Complex, Old Railway Station and Monument to the Workers Unification (Hombres Fuertes).

The main sites were then visited to obtain descriptions, photographs and coordinates (latitude and longitude). Table 1 shows the name of the site and its geographical coordinates.

Place	Latitude	Length
El Carmen Church	19.29304	-98.44337
Former textile factory "El Carmen".	19.29231	-98.44291
Parish Church of San Martín Obispo de Tours	19.28288	-98.43499
Texmeluquense Cultural Complex	19.28342	-98.43714
Former Railway Station	19.28278	-98.43872
Monument to the Workers Unification	19.28674	-98.44041

Table 1 Details of the locations

Figure 1 shows the main façade of the Iglesia del Carmen, located in the colonia of the same name.



Figure 1 Façade of the El Carmen Church

Implementation of AR in the platform: after having collected the necessary information of each place, we proceeded to place the data in the Onirix platform, for this, the first thing is to create the project: Tourism San Martín Texmelucan, Puebla; the creation is shown in figure 2.:

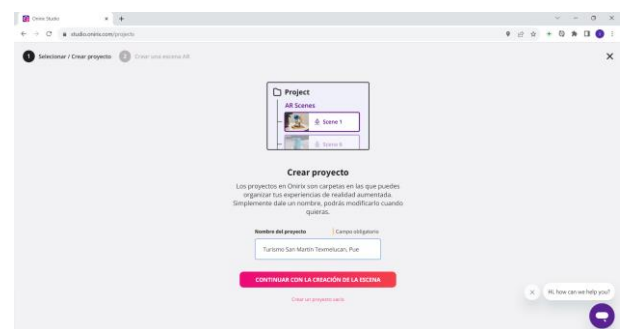


Figure 2 Creation of the project

After the creation of the project, the type of scene the project will have is requested, which can be either image tracking (markers) or surface tracking.

A marker provides the Augmented Reality (AR) application itself with a visual cue or trigger on where to position the AR content. A marker can be an image, a logo, or any kind of 2D object that can be distinguished and recognised by the camera. Some AR applications, instead of using a traditional 2D marker, can detect surfaces and use them as markers (Onirix. n.d.).

The best option in this case is surface tracking, because when the tourist arrives at the marked area, he/she only has to identify a surface such as the floor or wall of the place and it will display the information. Unlike image tracking, it is not necessary to see a static image to display the information, as the image may or may not be there or even be deteriorated by different types of conditions. Figure 3 shows the choice of Tracking type.:

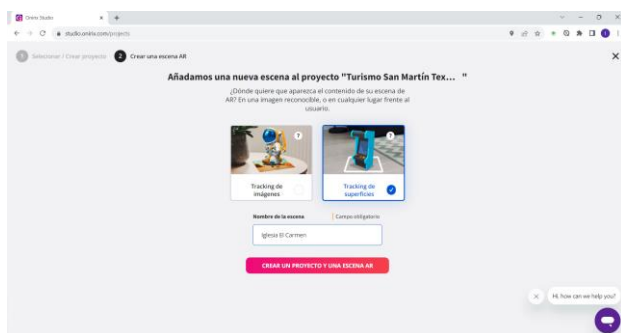


Figure 3 Tracking of surfaces

It is important to indicate to the project that it should be a "Geolocated project", with the intention of indicating the points of interest and then tracing the georoute from the user's location. The georoute can be defined as a line drawn between two geographically located points. That is, the path followed to get from point A to point B. (Ubiquo. 2023). Figure 4 shows the data of the place to be established, the required data are: Title, description, image, coordinates (latitude, longitude and elevation) and activation radius, which is a margin that is assigned to send an alert when near the area.

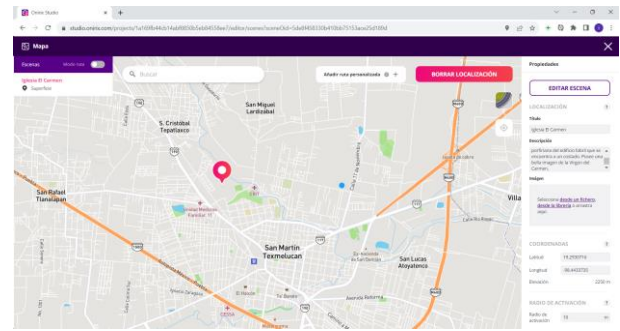


Figure 4 Location of the point of interest

When you have finished adding all the scenes to the project, you will be able to see the suggested route of the places to visit, the project will show the numbering as the scenes are added to the project. Figure 5 shows the route mode of the project.

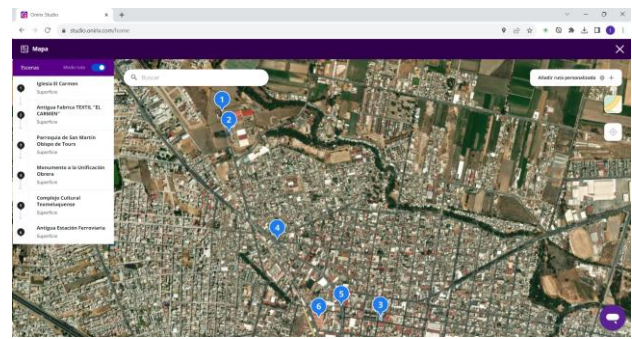


Figure 5 Route mode

Testing: Finally, the link was shared with 50 people who interacted with the project by executing it from their mobile phones; the people had to be at a random point in the city and choose a place to visit. Figure 6 shows the execution of the shared link, in which the location of the tourist and a marker with the places to visit are indicated.

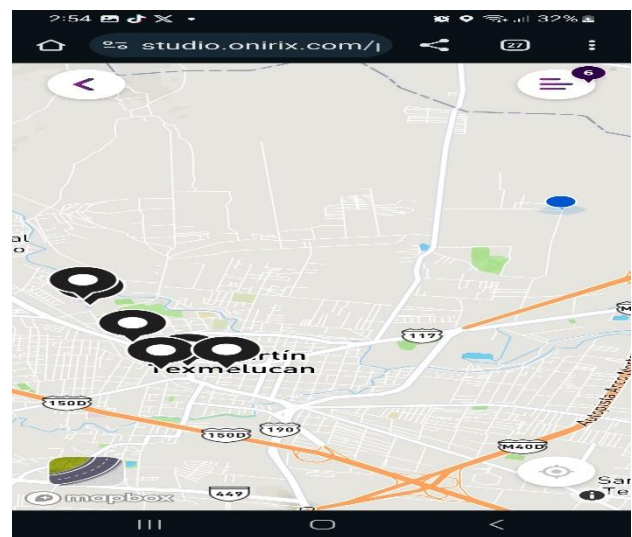


Figure 6 link executed on the mobile phone

The upper right panel shows the available locations and then the options View on map and Route. The first option shows the location of the attraction, while the second shows the route to follow from the place where the tourist is located to the destination. Figure 7 shows the route option that goes from the origin to the chosen destination.

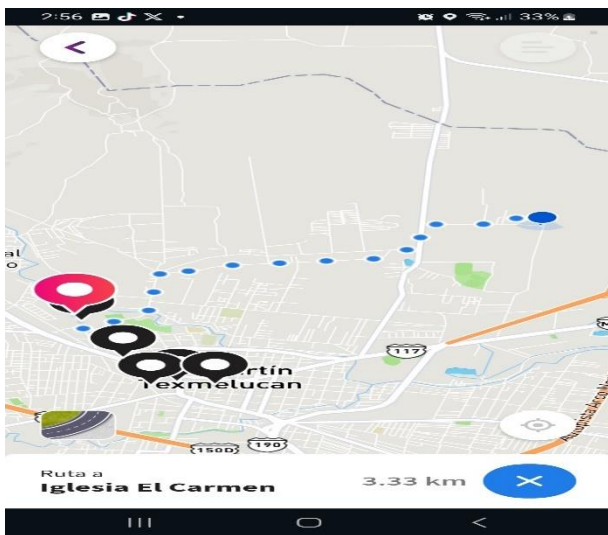


Figure 7 Route from origin to destination

Finally, upon arrival at the destination, the project sends a vibration as a warning signal that it can see the augmented reality mode, it must detect a surface to display the content, shown in Figure 8 the content of one of the tourist sites of San Martín Texmelucan.



Figure 8 Augmented reality description of the chosen location

Results

At the end of the project stages, a series of 5 questions were asked to each user to see the feasibility and efficiency of the project, giving favourable results. The graphs of the questions asked are shown below.

Question 1: How easy is the project to use? 96% of people answered that it was easy and 4% indicated that it was complicated to understand. Figure 9 shows the resulting graph.

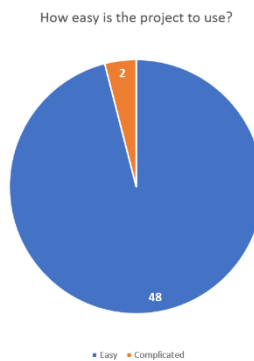


Figure 9 Graph of question 1

Question 2: Did the project help you to get to know tourist sites in Sint Maarten? 84% said yes and the remaining 16% said no.

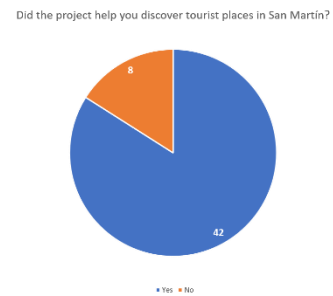


Figure 10 Graph of question 2

Question 3: Would you recommend using this project to visit tourist sites in Sint Maarten? 100% said yes and the remaining 0% said no.

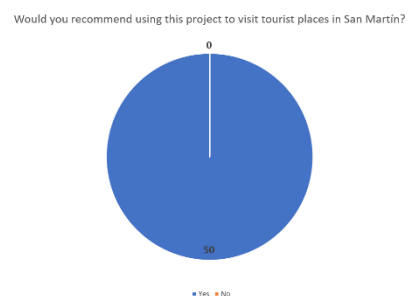


Figure 11 Graph of question 3

Question 4: Did you find the augmented reality content appealing? 84% said yes and the remaining 16% said no.

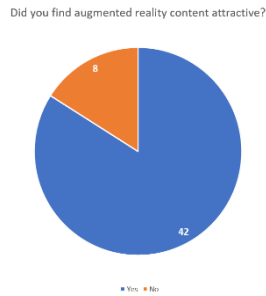


Figure 12 Question 4 graph

Question 5: Did your mobile device display all the augmented reality content? 84% said yes and the remaining 16% said no.

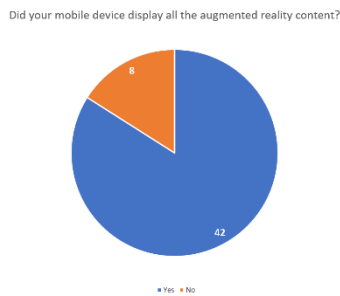


Figure 13 Graph of question 5

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Conclusions

With the implementation of this project it is expected that both tourists and residents will have a better guide to different destinations in the municipality, allowing them to get clear and precise indications, saving time and travel costs, as well as having a historical review and images of the place they want to see. As future work, three-dimensional objects can be designed to show them areas that they would not be able to see with the naked eye or that are deteriorated. In the region there are more places to visit, so it

could be implemented in collaboration with the secretary of tourism of the municipality.

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