

## Augmented Reality App for tourism promotion in the Triangle of the Sun of the State of Guerrero

### Aplicación de Realidad Aumentada para promoción turística en el Triángulo del Sol del Estado de Guerrero

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#### Abstract

To show information about the three main tourist destinations in the state of Guerrero: “Acapulco de Juárez”, “Ixtatapa-Zihuatanejo” and “Taxco de Alarcón” to users using an application for devices with Android Operating System with Augmented Reality, a promotional video reproduced by recognizing the target of the city and showing information like activities or attractions of each of these destinations; these images will be on a poster located at different terminals within the Mexican Republic and the state of Guerrero, thus achieving greater impact and interest in national users.

**Augmented Reality, Triangle of the Sun, Tourism**

#### Resumen

Mostrar información sobre los tres destinos turísticos principales del estado de Guerrero que son: Acapulco de Juárez, Ixtatapa-Zihuatanejo y Taxco de Alarcón, hacia a los usuarios haciendo uso de una aplicación para dispositivos con Sistema Operativo Android con Realidad Aumentada, un video promocional que se reproduzca al reconocer el target de la ciudad y muestre información como actividades o atracciones de cada uno de estos destinos, estas imágenes estarán en un cartel ubicado en las diferentes terminales dentro de la República Mexicana y del estado de Guerrero, y así lograr un mayor impacto e interés en los usuarios mayor atracción turística por parte de usuarios Nacionales.

**Realidad Aumentada, Triangulo del Sol, Turismo**

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## Introduction

The relationship which existed in the twentieth century between education and technology has become close since the twenty-first century; making it easier for students to learn by using today's technologies, such as laptops, wireless transmission devices, like GoogleCast, smartphones, and even tablets.

In addition, the development of mobile applications aimed at various educational areas, such as: Sexual and Reproductive Education, Languages, Mathematics, Economics and Tourism, etc., are aimed at promoting and improving cognitive learning through the use of augmented reality; even cultural heritage sites have made use of this tool (Urueta, 2017).

The problem that exists when visiting certain sites is bad promotion in diverse means of information like social networks. This research proposes an application of augmented reality in the area of Economy and Tourism to promote the tourist attractions of the Sun Triangle of the state of Guerrero as an alternative to the different conventional forms of tourism promotion.

## 1.1 Concepts and definitions

### 1.1.1 Augmented Reality

Augmented reality (AR) is a variation of virtual environments (VE) or virtual reality as it is commonly called.

VE technologies completely immerse the user in a synthetic environment; while immersed, the user cannot see the real world around them. In contrast, AR allows the user to see the real world with virtual objects that are superimposed or in composition with an image of the real world, obtained through a screen, using 3D models or other computer generated information. That is, augmented reality supplements reality rather than completely replacing it (Azuma, 1997).

According to the aforementioned, AR possesses the following three characteristics (Espinosa, 2015):

1. Combines the real and the virtual
2. Interactive and real time
3. Registered in 3D

### 1.1.2 Levels of augmented reality

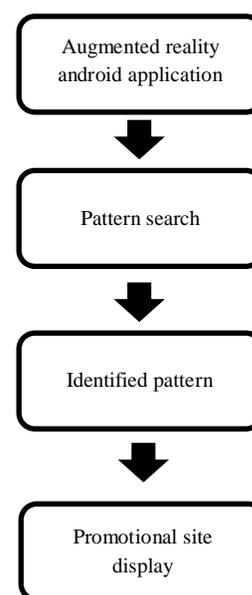
There are different levels of augmented reality, numbered from 0 to 3; these are (Fitzgerald, 2009):

- Level 0: Hyperlinks in the physical world. By reading a barcode or QR, hyperlinks are made to other content such as websites, there is no 3D registration or bookmark tracking.
- Level 1: Augmented reality based on markers. In this level, the activators are markers, these are black and white images, generally square, with simple and asymmetrical drawings that portrays a virtual object which overlaps with the real image when scanned.
- Level 2: Augmented reality without markers. The activators are images, objects or GPS locations by which POI (points of interest) are superimposed on real-world images.

## Methodology

### 2.1 Application development

Through a mobile device with Android operating system version 4.4+, the user can view a 30-minute promotional short video of a place within the Sun Triangle, allowing and encouraging visitors to go to that place, through the interest caused by the video. The general operation is presented in the following Figure:



**Figure 1** General operation

To carry out the visualization of the video, three images that are unique to said tourist place were edited as shown in Figure 2.A and Figure 3.A, to make use of them in the application. The edited images were subjected to an editing process to be able to attract more public attention as shown in Figure 2.B.

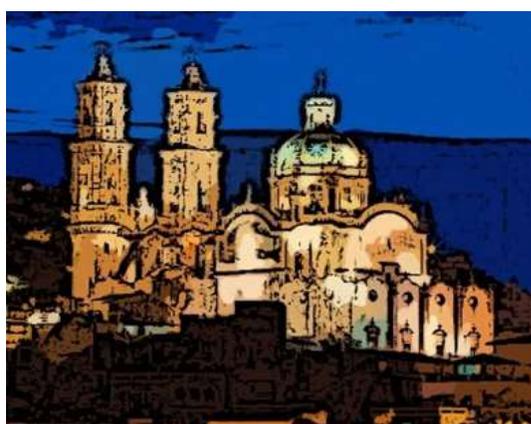


**Figure 2.A** Raw Image

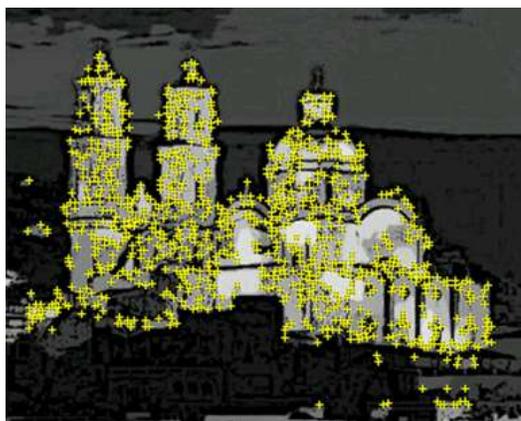


**Figure 2.B** Edited image of the tourist place

From the edited images, with the Vuforia tool, they were subjected to a process for pattern identification, obtaining the "target" as shown in Figure 3-B.



**Figure 3.A** Image of the tourist place



**Figure 3.B** Image with detected patterns

A challenge faced in the development of the application was the selection of the massive tourist information on these selected destinations; however, videos of shorter duration and with more striking content were selected, as shown in Figure 4. Another challenge is the lack of platforms as official repositories of tourism material, which is why we opted to embed the video within the application, greatly increasing the size of it.

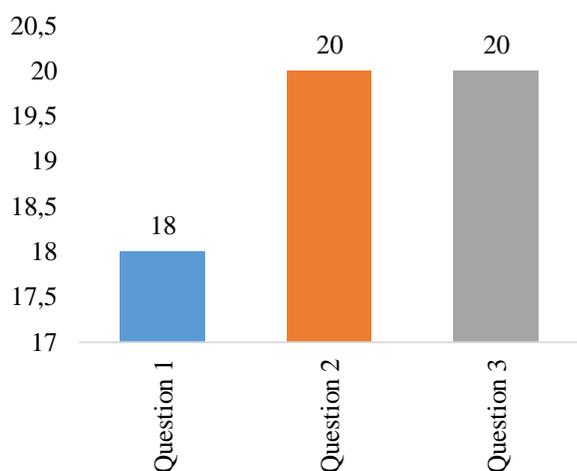


**Figure 4** Application execution

## 2.2 App Evaluation

After the creation of the application, 30 people were randomly selected in the Palmas terminal in Cuernavaca and 30 people in the Iguala terminal in Guerrero, addressing the issue of activities that can be carried out in these tourist spots through Augmented Reality, in addition to having a mobile device with Android 4.4+.

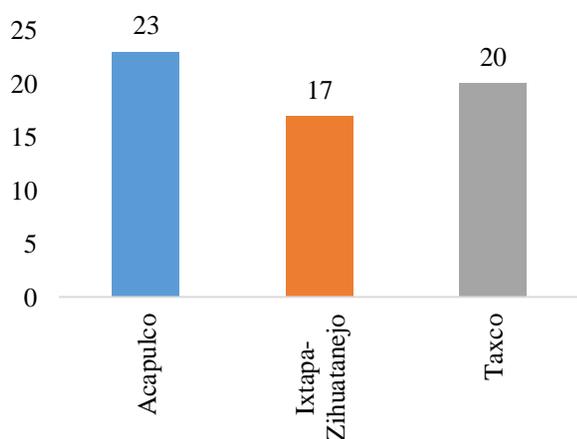
Half of them had the application installed (Group A) and the other half, not (Group B) and had a verbal presentation. Following the use of the application or verbal explanation, a brief questionnaire was made (see Appendix). The results are shown below.



**Figure 5** Questions about the application

Additionally, from question 4, points could be obtained to improve the application; these include the following: being able to use it with iOS devices and reducing the size of the application.

In the case of question 5, the holiday destination of each user after having used the application or listened to the talk is shown in Figure 6.



**Figure 6** Holiday destination chosen by respondents

## Results

In this paper, an augmented reality application was developed for Android devices which show activities and places in a tourist destination within the Sun Triangle in the state of Guerrero.

## Conclusions

The application had a high level of acceptance by the users; however, it can improve substantially due to the comments provided by users.

There was a greater interest in traveling and knowing the activities and places shown in the video after using the application.

It is also possible to conclude that, with the help of digital technology, tourism promotion can be improved, this proposal can be expanded by creating an official state repository with this information.

## Future Work

Compatible devices will be extended so that the application can also work with an iOS system.

The development of new tourism promotion materials in the Sun Triangle will continue; it is also expected to reduce the size of the application through the use of video streaming, with which it is expected to focus more attention on the promotion and therefore increase of tourism within the state of Guerrero.

## References

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**APPENDIX**

Questionnaire used in the investigation

Instructions and considerations.

- Read carefully before choosing an answer.
  - If the application was not installed on your device, answer only question 5
1. Do you think the application is engaging?
    - a) Yes
    - b) No
  2. Do you think that the application can influence the visit of said tourist place?
    - a) Yes
    - b) No
  3. Would you recommend the use of the application?
    - a) Yes
    - b) No
  4. What would you like to include in the application?
  5. Select one place you would like to visit on your next holiday.
    - a) Acapulco
    - b) Ixtapa – Zihuatanejo
    - c) Taxco