An Augmented Tourist Guide of a World Heritage City

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Abstract. In this paper, we introduce the design and implementation of a tourist guide, using augmented reality technology, for visiting two of the most important routes in a World Heritage city. To produce this application, we used the augmented reality library, HumanAR, developed by our research group and created with the aim of integrating the applications we have developed. The application guides the user on a route across the town with a video of 3D animations of historic buildings along the way. The most symbolic buildings of the city are pictured and modelled on a walking tour across the historic site, designed to develop an interest in cultural tourism, keeping in mind the impact that this tourism may have on World Heritage cities.

Keywords: Augmented reality, world heritage, tourist guide.

1 Introduction

Augmented reality applications allow the introduction of additional information to our real view of the world, making it possible to superimpose virtual objects over real images captured by a camera. It's a technology that improves the experience of communication as well as that of human computer interaction. The AR environments have the following characteristics: they combine real and virtual environments; they are interactive in real-time; they are registered in four dimensions (three dimensional space and time), where virtual objects can be stationary or animated; there is interactivity between the object and the real world and abstract concepts can be made visible, in order to enhance the user's understanding.

These characteristics seem appropriate for producing a tourist route guide of the historic town of San Cristobal de La Laguna. In this paper, we justify the need for using such technological actions in the culture and tourism field and describe the completed application.

2   Justification

There are many applications and benefits from using augmented and virtual reality technologies in activities related to historic heritage [1][2].

The augmented reality applications have several advantages over virtual reality environments including:

- The combination of real information and virtual elements, providing great realism over perceived information, avoiding the abstraction caused by virtual environments.
- The main added value of an augmented reality application is not based on the quality of their virtual models but on the viewing of dynamic information that is attractive and interactive in real time (images, videos, animations, 3D models, audio and text).
- The knowledge and tracking of the user's position eases the orientation and location of the places and elements of interest.
- The digital information is introduced in the real context, mixed with actual information captured by the senses and correctly referenced, respecting the user's position and point of view.

In the last few years, there has been rising interest in cultural tourism and its impact is huge on World Heritage cities [3] that are involved in creating tourist attractions. Through cultural activities and entertainment to promote the artistic and cultural heritage of the city, they seek to attract more tourists. This is the case in the city of San Cristobal de La Laguna (Tenerife, Spain), with its interesting past, historic buildings and street layout, making it a suitable town for trying to attract more tourists.

Tourist strategies show that a tourist who remembers his visit with enjoyment may return home and tell all his relatives and friends what a wonderful time he had. [4]. Bearing in mind that AR technology is growing, we may be able to create that enjoyment for the tourist, whilst viewing the places he will be visiting through AR. This may be the first approach to this technology for many of them and as we may already know, every time we experience it, we are often impressed.

On their arrival in the city, tourists will visit the tourist information office to gather information about the places they would like to visit. We have developed an AR application as an attraction for tourists, where they will be able to witness the city map becoming live on screen when it's using the computer's webcam, augmenting information already being viewed as 3D animations, with a musical background.

In this way, tourists may be able to know the path or route they may follow for getting to the buildings and other places shown in the guide. This could enable them to remember where there are places of interest to go on their visit.

3   Aim

It's necessary to keep in mind that tourism's purpose is to enhance new urban recovery processes [5]. In the case of the Canary Islands (Spain) and especially of San

Cristobal de La Laguna, tourism is one of the pillars of the economy and necessary for the future development of the town.

One of the key factors is the city's plain layout which has enabled the development of walking routes across it, improving the creation of commercial and private activities. This has brought about social and economic improvements for the city, including important developments on the political side.

The objective that made us create this tourist guide through augmented reality technology was the profile of tourists of this town. These include;

— Young visitors who travel as couples or with their families.
— Visitors of medium-high academic and cultural level.
— Visitors of medium-high economic possibilities
— Travel's motivation which is usually by recommendation
— Interests of visitors who know something about the city's culture, history and architecture.

The town was declared a UNESCO World Heritage city in 1999, which has led to some modernization, in keeping with the canary architecture and preserving its characteristic historical and cultural heritage. Alongside this, the rehabilitation, restoration and conservation of the town's most emblematic buildings, qualified by UNESCO as 'Cultural Interest sites', have led to considerable investment.

4   Work Description

As a starting point, a town map has been created where two routes have been drawn, one in red across the city centre and another in blue, around the town's outskirts.

Fig. 1. Map of the historic La Laguna city with HumanAR markers. Implemented with Augmented Reality.

In the city there are several symbolic buildings, but over each proposed walking tour, the ones included in the Historic Building special protection plan have been underlined. Photographs of the buildings were taken and processed through image recognition software to obtain the correct perspectives.

Fig. 2. Buildings of interest along the red route

Fig. 3. Buildings of interest along the blue route

The red route walking tour proposes visiting seven points of interest whilst the blue route proposes visiting four. A Macromedia Flash animation was developed, where a virtual camera follows the path of the route until an interest point is reached, where a building's image rises perpendicularly over the plane, creating the sensation of fake 3D. A text tag shows the building's name and then the building fades while the line keeps its path, until the next point of interest, where the procedure repeats itself. When the seven points of interest on the red route are finished, the blue route starts. The multimedia element created has been an *.avi format video.

5 AR System: Software Library

Although there are several public libraries with AR capabilities, we have worked together with researchers of the Labhuman institute (www.labhuman.com) to create a software library called HumanAR, in order to assist the integration of Augmented Reality into our applications. HumanAR uses computer vision techniques to calculate the real camera viewpoint, relative to a real world marker, which calculates the integration of three-dimensional objects codified by the camera and captured by itself, in real time. When the marker enters the scene picked up by the camera, the fusion of the real world with the virtual object is shown on the screen. This requires the application to relate the two worlds (real and virtual) in a single system of

co-ordinates. The key technical issues for the development of the AR library are; marker detection, camera calibration, calculation of marker position and orientation, and augmentation of virtual objects. More details about this library can be found by consulting Martin-Gutierrez et al. [6]. The graphics engine used to display three-dimensional models or video files was Game Studio A8.

6   Conclusions and Future Works

We regard augmented reality technology as a great potential tool for spreading and enhancing the value of Cultural Heritage, as it does not replace reality but improves its contents. It has established itself as a useful resource for the recovery and knowledge of heritage, because of its ability to add elements to an object's real view, offering different versions of it. Tourists have been impressed by the AR application we have developed. During its use, they paid attention to the virtual information and, after completion of the virtual tour, they were perfectly oriented for paying a visit to the city. We intend developing an application for describing the routes through smartphones, as well as introducing new functionalities over every point of interest, such as augmented audio, graphic and textual information, as well as interactive games, with all of them related to the town's history and culture.

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