Virtual Tours and Serious Game for Promoting Educational Tourism Using Non-Intrusive Human-Computer Interfaces

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INTRODUCTION

As we become an increasingly visual society, a way to maintain heritage and promote culture and knowledge about cities and museums is adopting new visualization and human computer interaction technologies. Technological approaches taking advantage of Virtual Reality (VR) and Augmented Reality (AR) are being adopted inside museums to attract attention of the visitors on the most different topics (Walczak, Cellary, & White, 2006). Complexity of these displays is increasing day by day, while the technologies behind the scene are becoming more common and affordable. Actually, the growing expansion of these technologies makes it possible to somehow take museums information directly to homes using low-cost Virtual Reality devices (Mortara et al., 2013). In this article we will explore the development of such a system. The system is employed to promote the city of Valladolid in Spain from architecture, historic, geographic or artistic perspectives. Under this point of view, the system can be considered as a tool for remote Educational Tourism.

Educational tourism by itself is one of the trends that have higher growth in recent years (Donaldson & Gatsinzi, 2005). Despite the concept of travel for education and learning is a complicated area to delimit (Smith & Jenner, 1997), tourists are beginning to give more importance to new ways for discovering tourist destinations, and so the possibilities of learning grow significantly. On certain occasions, the learning activities at the destination are performed as annexed to the travel aim, but other times, the purpose of the trip is the learning itself. The most traditional way to know any city is through brochures provided by the Tourism and Information Office. In this way these offices can foster a more attractive way to learn about the different aspects of the city. Other approaches include traditional city books and multimedia DVD videos offering very limited user interaction possibilities.

Augmented and Virtual Reality technologies can be used to improve the user experience a step further in the learning process (Zhigeng, Cheok, Yang, Zhu, & Shi, 2006). Nowadays, the first one is used mainly while the visitor is in the travel destination. More and more AR mobile applications are available to get additional

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information from historical places. These applications usually use the mobile devices GPS signal information to show augmented reality layers containing text, pictures, videos or audio explanations of a place. While AR is a very convenient approach when the visitor has travelled to a place, VR solutions are preferred when the user is far away, may be sitting in front of a display at a museum. VR enables the possibility of not only visiting and knowing places nearby, but also to visit other cities and historical spaces even from the users' homes. This approach offers also a great opportunity to people who cannot travel to a destination for different reasons such as illness, old age or high travel costs among others. Using a low-cost system as the one described in this article, these populations could experience travelling and educational tourism learning even from their own homes, using a game console or a PC together with proper visualization and interaction devices.

The advent of commercially available gaming consoles and multi-touch devices has resulted in an enormous growth of the gaming market. New devices have brought new ways of interaction based on natural gestures. Some of these gaming consoles include peripherals that can track the user movements using infrared technology or capture the environment to generate virtual experiences. Besides, the great availability of new gaming technologies comes together with an increasing interest in not only playful aspect of games, but their utility in areas such as education, health, art or training among others. Those games and videogames belong to a new category of games called Serious Games (Zyda, 2005): learning tools that pursue educational objectives, allowing players to get a set of knowledge and skills predominantly practical.

In the system presented in this article, we propose combining gaming and VR techniques to develop a Serious Game for Virtual City Tours and Educational Tourism. This Serious Game offers a different, fun and enjoyable way to learn or review different aspects of a city such as history, geography, sports or art and literature. The system can be used inside a museum, at schools or even at home. Besides, the system can be used in case the students, foreigners or other people are not able to visit the real places, but also as a perfect complement to an educational tourism visit. In that scenario, the system can be used to remember their experiences and also to test or complement the knowledge that they received.

BACKGROUND

In this section the state-of-art technologies that can be employed to develop a Virtual City Tour system like the one presented are introduced. The description of these technologies includes 3D design applications, game engines and multimodal user interfaces, paying special attention to non-intrusive devices such as Microsoft® Kinect Camera.

3D Design Programs

Three-dimensional design is a large field with application to many areas, including design, engineering or architecture. Recreation of real objects into 3D models is also very useful for multimedia and 3D animation, which is the approach taken in this article. Depending on the specific sector of application, one can choose among different software to address specific design requirements. Some of the first 3D design applications were Maya (Maya 3D design program), Autodesk 3D Studio (3DS) Max (3D Studio Max design program), Lightwave (Lightwave 3D design program) or Softimage (Softimage 3D design program). Nowadays it is possible to find some competitive free proposals such as Blender (Blender 3D design program) or SketchUp (SketchUp 3D design program). Each one has its advantages and disadvantages, but with any of them the quality and final appearance of the recreated models depend in a high degree on the knowledge and creativity of the user. Generating a 3D model or scene comprises the steps of: modeling, shading, texturing, animation and rendering. Blender, 3DS Max and SketchUp are able to export objects and scenes to an external rendering engine. In Blender and 3DS Max it is also possible character animation and the former allows applying sculpting and painting techniques. Blender is one of the most featured 3D design programs, despite of being completely free.

Game Engines

Games and interactive graphics applications are getting more and more interest everyday. The overall business volume of the game industry has surpassed the cinema and music industry and many enterprises are emerging around the world. The newer generation