International Journal of Creative Interfaces and Computer Graphics
Volume 9 • Issue 1 • January-June 2018

Leveraging Pervasive Games for Tourism:
An Augmented Reality Perspective

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ABSTRACT

Creating an augmented reality (AR) urban tourism application presents several interactivity challenges on how to convey an engaging multimedia experience on-site. This article describes a methodology for fast prototyping of multimedia mobile applications dedicated to urban tourism storytelling with special focus on AR techniques. Following the lessons learned in previous applications the systematic creation of location-based augmented reality (LBAR) applications is explored in this article. The goal is to create serious games for tourism that follow a main narrative but where the story can automatically adapt itself to the current location of the player, assimilate possible detours and allow posterior out-of-location playback. Adaptable stories can use dynamic information from map sources such as points of interest (POI), elevation or virtual buildings. The article discusses and presents solutions for media acquisition, interactive storytelling, game-design interface and multi-disciplinary coordination for mobile app development.

KEYWORDS

Augmented Reality, Location-Based Games, Mobile Applications, Tourism Applications

INTRODUCTION

The implementation of context-aware mobile AR applications into tourism provides many benefits for the tourist experience. These apps can be used to enhance visitor learning in cultural heritage sites (Lombardo & Damiano, 2012) or advance the interaction between the visitor and tourist artifacts (Kim & Schliesser, 2007) and often assume the form of games. Games have the power to create more engagement with the tourist destination through storytelling (Paay et al., 2008; Stenros, Holopainen, Waern, Montola, & Ollila, 2011) playfulness and mobile learning. These stories may be fictional or based on historical events.

The demand for the fast creation of such games is increasing, with a large demand for changing new content to be delivered at a high pace. This requires new approaches for multimedia content creation beyond traditional field research. This includes using geo-location utilities and frameworks (Jacob & Coelho, 2011; Matyas et al., 2008) to gather points of interest (POI) or mining social networks (Papadopoulos, Kompatsiaris, Vakali, & Spyridonos, 2011) in order to get collaborative feedback from other tourists or visitors.

DOI: 10.4018/IJCICG.2018010101

The use of mobile applications for mobile devices is rapidly growing and has become apparent for the world's largest industry – travel and tourism. With more than $6 trillion direct and indirect economic impact of the industry, tourism has a huge market to facilitate innovation. Tourists use mobile devices before (Gretzel, Fesenmaier, Lee, & Tussyadiah, 2011), during and after their holidays to retrieve geographic information (Tussyadiah & Zach, 2012), to mediate tourist sites (Kennedy-Eden & Gretzel, 2012) or to share experiences in social networks. Falling roaming charges will facilitate further increasing usage of these applications abroad. The nature of tourism is to create extraordinary experiences (Pine & Gilmore, 1999), thus there is a constant search for innovative tools and new technologies to enhance the tourist experience.

Smartphones, with the latest GPS-technology and built-in camera, enable players to use the real world as the playground and take gameplay outside into the real world. While the quantity and quality of mobile devices are increasing, mobile gaming attracts a wide range of user groups playing in different contexts (Carrigy, Naliuka, Paterson, & Haahr, 2010).

Recent advancements provide more people than ever access to hardware and new mobile game experiences (Wetzel, Blum, Broll, & Oppermann, 2011).

Mobile gaming is lately evolving in travel and tourism opening new forms of creating enhanced experiences for tourists. Location-based (Jacob & Coelho, 2011; Weber & Dickinson, 2018), Augmented Reality (AR) (R Nóbrega, Cabral, Jacucci, & Coelho, 2015), Pervasive or Serious Games (Marsh, 2011) open the possibility to create deep, personalized and interactive experiences tourists are striving for by actively engaging the tourist with places and people throughout gameplay. This creates a deeper understanding and distinct experiences for the tourist with his immediate environment applying playful and gameful concepts.

To gain an understanding of tourists' requirements for such games, the following research question was taken into consideration: how to tell a story in the city with a multimedia system, making the user discover important locations in the city, understand its history and provide an autonomous and, at the same time, social interaction to create engaging tourist experiences.

An important requirement is to create a fast prototype using a multidisciplinary team in a short amount of time following an iterative design process.

The game framework is based on a mobile multimedia system, which features a storytelling game that uses the real city as a game board (Ferreira, Alves, & Quico, 2014). Technologically this requires the use of mobile devices, using location-based games to move the user from place to place (Jacob & Coelho, 2011), augmented reality (AR) to immerse the player in the urban environment with in loco information (Takeuchi & Perlin, 2012; Wagner, Reitmayr, Mulloni, Drummond, & Schmalstieg, 2010) and multimedia capabilities to display a story through videos, images, texts and games (Ferreira et al., 2014). The media sources for these stories and games should contain static and dynamic elements (Papadopoulos et al., 2011). The main story media sources consist of an extensive background research of the desired tourism destination. The multimedia location and AR based games will take advantage of external dynamic sources such as freely available geo-referenced information like maps, social travel websites or online collaborative tourism recommendation systems.

In this article, we are presenting the result of a fast prototyping approach, which led to the creation of a full multimedia experience in less than one month using a multi-disciplinary team. The design concept of an urban adventure game for tourists takes advantage of internal and external media sources to improve the storytelling strategy. As a proof-of-concept, two location-based games designed for tourism in the city of Porto, Portugal are presented. These games, are based on the previously presented Unlocking Porto (Rui Nóbrega et al., 2017), which takes advantage of location-based technologies, augmented reality and mobile 3D graphics (Rui Nóbrega & Correia, 2017) as depicted in Figure 1. In the end, several considerations are drawn covering the lessons learnt and future directions. This paper is an extension of a previously developed work (Rui Nóbrega et al., 2017).