MOBILE EDUTAINMENT IN THE CITY

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ABSTRACT

Touring around a City can sometimes be frustrating rather than an enjoyable experience. The scope of the Virtual Mobile City Guide (VMCG) is to create a mobile application which aims to provide the user with tools normally used by tourists while travelling and provides them with factual information about the city. The VMCG is a mash up of different APIs implemented in the Android platform which together with an information infrastructure provides the user with information about different attractions and guidance around the city in question. While providing the user with the traditional map view by making use of the Google maps API, the VMCG also employs the Wikitude® API to provide the user with an innovative approach to navigating through cities. This view uses augmented reality to indicate the location of attractions and displays information in the same augmented reality. The VMCG also has a built in recommendation engine which suggests attractions to the user depending on the attractions which the user is visiting during the tour and tailor information in order to cater for a learning experience while the user travels around the city in question.

KEYWORDS

Mobile Technology, Tourism, Android, Location Based Service, Augmented Reality, Educational

1. INTRODUCTION

A visitor in a city engaged in a learning experience requires different forms of guidance and assistance, whether or not the city is known to the person and according to the learning quest undertaken. Normally these take the form of maps and guidebooks which are generally utilised in printed form. Another item attributed to tourists is the camera which people use to try to save the moment and share it later with their friends or relatives back home. Tourists or visitors of cities usually also ask other fellow perambulators about different attractions or places of interest or perhaps suggestions about which attraction is in reality nicer or more recommended to visit.

The Virtual Mobile City Guide (VMCG) combines all of these features together and adds even more educational and entertaining functions. The VMCG makes use of various APIs which together with an information infrastructure provides the user with information about different attractions and guidance around the said attractions. The information provided includes a Map system which makes use of the Google maps API, the VMCG also employs the Wikitude® API to provide the user with an innovative augmented reality system to indicate the location of attractions and display related information.

From an administrative point of view, the VMCG allows various cities to adopt the same framework but providing the application with a different profile of the city in question. This would allow the users to use the same interface while having information relevant to the city they are visiting at that point in time. The VMCG also offers the capability of suggesting different attractions depending on the likings of the user. For the sake of practicality, the VMCG also allows the user to use the mobile device as a camera and organise the photographs taken while using the application in a dedicated directory.

2. BACKGROUND

When on holiday, tourists face a number of problems according to Brown and Chalmers [Brown and Chalmers, 2003]. These include the “What to do” problem. Brown and Chalmers explain that with difference to work, there is not well defined goal which must be reached by the end of the holiday. The tourists face an

"open-ended" list of options since tourism entails a choice from various activities such as commercial activities, social activities and so on. The "how" problem outlines the situation in which tourists may find themselves and eventually being exploited since most of them are not accustomed to the local ways and means. Brown and Chalmers say that an issue in this case is the cultural norms possible minor clashes when the difference of the culture of the tourist and that of the place being visited clash. The tourist needs to be equipped with knowledge about how to get something from place which is being visited to avoid exploitation [Brown and Chalmers, 2003]. The "Where" problem is about finding the location of particular things be it attractions, monuments, etc. Apart from the different attractions located all over the place, tourists are also restricted with the time at hand. Brown and Chalmers emphasise that tourists "need to avoid spending too much time travelling between places" [Brown and Chalmers, 2003].

The following existing systems were explored prior to designing the VMCG. These were namely the CRUMPET application [Schmidt-Belz *et al*, 2003], the GUIDE application which was implemented in Lancaster [Chevest, Keith *et al*, 1999] and the Italian case study of a system implemented at Locri [Cutrí *et al*, 2008]. These will help us understand various issues tackled in previous parts of this review and observe how touristic problems were tackled and solved.

3. TECHNICAL INFORMATION

The two techniques important to create the VMCG are augmented reality and localization.

3.1 Augmented Reality

Azuma *et al* [Azuma *et al*, 2001] refer to augmented reality as the reality-virtuality continuum which was originally presented by Milgram *et al* in 1994 [Milgram *et al*, 1994]. It normally refers to the addition of virtual elements to the real world and is different variation of Virtual Environments [Azuma, 1997]. Unlike virtual reality, the user can still see elements of the real world while using an AR system. As we see in [Azuma, 1997], the characteristics of an augmented reality system are the combination of real and virtual worlds, interaction within the environments in real time and a 3-dimensional representation of both environments for the alignment of real and virtual objects.The VMCG uses a video-based AR system to provide the user with a "*window on the world*" and thus the user will not be totally immersed since one is not necessarily in the real place were the events are situated [Milgram *et al*, 1994]. Piekarski refers to this technique as "*video combined displays*" [Piekarski, 2004]. In practice, this technique uses cameras which feed the real image in the computer simultaneously with the graphical image to be imposed [Piekarski, 2004]. In their 2001 survey, Azuma *et al* describe this class as a "*flat panel LCD that uses an unattached camera to provide video see-through-based augmentations*" and also serve as a "*window which shows the real object with an AR overlay*" [Azuma *et al*, 2001]. In 2009, Nokia claimed that they are engaged in numerous research projects in the field of mixed reality where they also said that mobile phones "*can be used to connect the physical world with the vast amounts of online information*" [NRC, 2009].

3.2 Localisation

Localisation services refer to the faculty of identifying the location of a particular device around the globe [Zhang and Kosecka, 2005]. Virrantaus *et al* also go into further depth in defining the concept of a location based service as having the "*ability to dynamically determine and transmit the location of persons...by the means of their terminal*" [Virrantaus *et al.*, 2001]. Steiniger *et al* also define localisation as the process of having the mobile device exploiting its position in order to provide the user with information [Steiniger *et al*, 2006]. They explore the relation of Geographic Information Systems (GIS) and the concept of a localised service or location-based service [Steiniger *et al*, 2006]. Their philosophy is based on the principle of Virrantaus *et al*. It is further extended by asking short questions which clearly define the concept [Steiniger *et al*, 2006]: *"where am I?" "What is nearby?"* and *"How can I go to?"* Schmidt-Belz et al express it in a lower level of abstraction and put these questions into the context of a tourist on a tour. [Schmidt-Belz *et al*, 2003] Further list the components which make up a location based service [Steiniger *et al*, 2006]. These are

the mobile device itself, the communication network, the position component which in this case is the GPS, the service and application provider and the data and content provider.

Another approach in localisation is that of recognising the environment and buildings such as the work of Bres and Tellez [Bres and Tellez, 2008] based their work on SIFT technique [Lowe, 1999]. Chung *et al* explore sketch-based representation and spectral graph matching [Chung *et al*, 2009]. These techniques generally involve an intense computational effort in order to cater for the difficulties described by Bres and Tellez and mitigate them accordingly. On the other hand, the technique which employs geographic information is a lighter approach. When compared to the former technique, the disadvantage of this method is that it requires a continuous visibility so that the device can be tracked by satellites in order to receive the respective GPS coordinates.

4. METHODOLOGY

The VMCG is an application which runs on the Android platform. Our choice was made based on the fact that Burnette [Burnette, 2009] claims that the Android platform is special when compared with others since it is truly open source and free. Deep inside, it is a component-based architecture which was inspired by internet mash-ups. The VMCG is made up of a thin user interface which is easy. These aim to solve the tourist problems as described by Brown and Chalmers. One of the main features is the listing of attractions which shows the events presented as a list. When an event is selected, a new screen is displayed with all the information about that particular event together with a map view. This information is not hardcoded, in fact it can be edited by modifying the <city>.xml initialisation document. Furthermore, the user would learn about the attraction by being physically in the places in question while, being provided with background information.

Another feature found in the system is the map view which is a module that provides the user with a map interface. This makes use of the Google Maps API which is conveniently available in the Android platform since both technologies form part of the Google family. The Camera View feature was included in this project to assist the user when looking for a particular object. This module gives the user the possibility of making use of augmented reality in order to locate objects while looking around through the mobile device. The Wikitude® API was used to develop this module and the result is shown in Figure 1. In this example, the annotations are superimposed upon the video and serve as virtual cues. One can notice up to four types of annotations:

The green speech bubbles are known as virtual graffiti. These annotations differ from all the others since they were created by a user rather than automatically by the system or by the administrator of the site. In actual fact, they are geo-tagged annotations shared by friends of the user. The scope of these graffiti is widespread since they can be used to share comments, recommendations, or even educational information. In fact they can be easily used by teachers when taking children around different places.

Points of Interest (POI) are markers identifying a particular location in a map. Their scope is to inform the tourists about the particular place. The square has a series of stars which are used to represent the quality of the attraction as rated by people in social networking sites. No stars inform the tourists that the attraction is not worth the visit. The circles are a representation of the queue length. Three circles indicate very long queues whereas no circles indicate no queues. The VMCG manages to combine real world information with virtual navigation by making use of several cameras installed in various locations around the city which are used to measure queue lengths automatically. This information is analysed by the system and shown in those tags as circles. The square on top of the label is an indication of direction. The red tags indicate a Virtual advert which is a sort of billboard showcasing adverts. These adverts can be placed on walls, floating in the air, etc virtually anywhere in the city. These boxes are normally paid by shop owners in order to promote a product or a promotion. The lifetime of the advert is defined by the amount of money which the owner pays in order to erect the virtual adverts. The light blue box indicates a Quiz box. These are used to define geo-located quizzes. In the system they have been used to create a treasure hunt which takes the person from one place of the City to another. Apart from being entertaining, they also help the user appreciate the different elements of the city in an innovative and educational way.

The VMCG is offers recommendations based upon an algorithm which runs while the application is being used. The system has to rank attractions based upon user preferences so that the final list reflects the user

model as much as possible. This feature assists the user while tackling the "what to do" problem. While providing the tourists with suggestions, this feature can be also used to present buildings and attractions which fall in a particular category, say historical era. A training option is also offered to allow the user fine tune the user model guiding the suggestions. This feature ensures the relevance of the recommendations and would then encourage the users to use recommendations features of the VMCG. Another feature offered by the VMCG is to allow users to use the camera of the mobile device and take photographs while using the application. These photos are geo-tagged and are later used to help the tourists during the post-visit phase of the trip.

Figure 1. Using the AR system in VMCG (Source: Authors)

5. EVALUTATION

The system's evaluation is based upon the market research process as described by Kotler *et al* [Kotler, 1996]. Selected stakeholders were chosen and various in depth interviews were conducted with them. These interviews were mainly based upon open-ended questions in order to allow the stakeholders to expand further on the subject. Most of them found the application very useful and they're very much in favour of such systems because of the entertaining and educational aspect of the application. The fact that the experience was richer meant that visitors can learn much more than by going through the normal tours since they would be exploring the city at their own pace and not based upon the speed of a tourist guide. Apart from these, shorter interviews were conducted with random tourists in the city of Valletta. In this part of the research, the process was conducted as follows. First the personal, touristic and technical profiles of the forty-two respondents were investigated. Then, a demonstration of the VMCG was given and questions were asked about the application. By doing so, tourists had the possibility of actually using the system in a real environment. The interviewees came from 12 different nationalities and their average age was about 49 years old. The results obtained from those interviewed were very encouraging since the majority of the respondents found the VMCG easy to use. They also think that the tools provided by the system are enough to tour the city in an effective way and without the use of a guide or any other person in a similar role. It was clear from the interviews that all those people who already owned a smart phone and were accustomed to installing apps would immediately install the VMCG as soon as it is available for download.

6. CONCLUSION AND FUTURE WORK

The evaluation clearly showed that a mash-up application designed to assist tourists during their visit was welcomed by most of the respondents. In fact most of them claimed that the application had some very promising prospects. The exercise also showed that even though the Android platform is one of the youngest systems available, it is adequate for the task. However, since there is a dominance of the iPhone market, it is also desirable to create a version for the iPhone. Even though great effort was placed in the design of the graphical user interface (GUI), different interaction modes such as audio should be sought since different people have different needs. The GUI should also be developed to cater for accessibility and usability aspects by allowing varying text size among other possible adjustments. The fact that a person can adapt the interface through various customizations makes the entire experience more pleasurable. It is also important to provide more connections between the VMCG and the social networking sites. In so doing, an update provided by a user within a social context would be easier to achieve. This can be seen from the star systems which we have in the annotations which were welcomed by the users testing the system.

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