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An Augmented Reality Model to Support Tourist Experience in Albania

ANA DHËMBI
Department of Informatics, Faculty of Natural Sciences
University of Tirana, Albania
PETER DARRAGJATI
Department of Political Science, Southern Connecticut State University

Abstract:

Augmented Reality (AR) applications have become an essential part of technological development in many areas including the tourism industry. This modern and powerful tool during the past few years has shown a great potential to engage tourists in new ways of perceiving reality, through the easy adaption of a wide range of opportunities that traditional tourism could not provide.

This paper presents the process of design and implementation of an Android application using Augmented Reality tools. This is a model designed for the tourism sector in Albania. The proposed model is designed to present tourists with multimedial information about points of interest (PoI) in the surrounding environment. The proposed platform uses GPS and mobile sensors to retrieve user orientation and location to further enhance the panorama by multimedial personalized information from various APIs.

This is an interactive model designed for touch screens and enabled devices. During this study, we have experimented with some of the best AR tools and hold an intense interest in using open-source libraries.

Albania is a culturally rich country so the integration of AR applications in tourism is not only assisting visitors to independently explore their destinations but is also contributing to the development of city-wide small businesses and other tourism subsectors.

Keywords: Augmented Reality, Tourism Industry, Android Applications, AR Tools, GPS, Google Maps, OSM, Wikipedia, Open-Source, Albania.

1. INTRODUCTION

Cultural tourism is increasingly relying on modern technologies to guarantee an enhanced visitor experience (Pallud and Monod, 2010). AR applications have emerged in many fields and in tourism as well. The development of this technology has altered the perceptual experience of tourism (Dhëmbi, 2021).

Albania is characterized by its rich archaeological and cultural heritage, ancient relics from Illyrian, Hellenic, Roman, and Medieval periods can be found throughout the country. Albanian Ministry of Culture ratified the convention with The United Nations Educational, Scientific and Cultural Organization (UNESCO) in 1989, to protect and create sustainable cultural heritage resources. According to Hillsdon in 2017, Albania is the 25th most visited country in Europe.

Tourism is constantly developing and has always been a key factor for Albanian economic activity, and this is reflected in government decisions, numerous country destinations, and the increasing number of tourists over the years (Invest in Albania, 2019).

In order to bring innovation to a country's cultural heritage, offering a renewed tourist experience, integrating the latest technologies will increase the competitiveness of the site. While one of the best technologies to enhance the user experience is AR, it is important to enrich points of interest (PoI) by offering improved information availability without interrupting the physical space. This will allow visitors to explore preferred PoI and get view-based information (Moorhouse, Tom Dieck and Jung, 2016).

Mobile-enabled AR in tourism will help users have immediate access to location-based information while discovering a new destination (Yovcheva et al., 2014), and by so being the creator of their own experiences (Neuhofer et al., 2015).

Albania is new to the tourism industry, yet offers a variety of beautiful destinations, and has an ever-expanding number of visitors each year. Emerging AR techniques in this sector will benefit the

development of the country and bring a new standard to all spheres of tourism.

The presented model is dedicated to foreign tourists, by providing them with real-time data about destinations, distances, specific filters, and data about the tourism subcategory they are interested in.

This paper is organized as follows: Section 1, analyzes tourism in Albania based on previous year's statistics. Section 2 presents the general idea of the AR model, AR overview, a short analysis and design of the AR model. Section 3 discusses several aspects of the implemented model. The final section (Section 4) concludes with the main issues that are solved using the proposed model.

2. TOURISM EXPERIENCE IN ALBANIA

Albania is a small country located at the heart of "Old Europe." The territory is geographically located at the crossroads of three continents and is 28,748km². It is the home of roughly 2.9 million people, with its capital Tirana being populated by some 860,000 residents (INSTAT, 2018).

Tourism is one of Albania's main sources of revenue. The county relies on tourism as a means of generating income for the sustainment of its cultural heritage sites, environment, and of course the thousands of personnel employed in said sector. Between the years 2013 to 2017 Albania saw a 12% increase in foreign tourists and an increase of expenditure by foreign tourists of 8.5%. At the same time period, some 621,000 tourists visited cultural monuments (INSTAT, 2018).

In the aforementioned four-year period, some 21 million foreign individuals entered Albania. Of that figure, the vast majority of visitors are from European countries and makeup around 92.4% of the total visitors. Most of the visitors arrive from the surrounding countries through land routes about 84%, countries such as Kosovo, Greece, Montenegro, and Macedonia making up the vast bulk of yearly arrivals (Albanian Ministry of Interior Affairs and INSTAT, 2018).

Over 51% of the tourists that enter Albania are between the ages of 15-44, making them fully proficient in the use of mobile technology. Some 98.7% of all visitors arrive due to personal needs, such as vacation, religion, or medical. On average most foreign visitors

stay some 4.2 nights in Albania and spend around 63 euros a day, around 75% arrive by personal vehicle, and roughly 79% of them stay at hotels. A free application easily downloadable and accessible would greatly enhance and ease a tourist's outings (INSTAT, 2018).

Between the years 2013 and 2017 an estimated 2.4 million tourists visited cultural sites such as fortresses, museums, archeological excavations, and other monuments. Tourist visits to cultural sites consecutively grew by an average of 19.5% each year, with 2017 marking an increase of 20.6% in comparison to the previous year (INSTAT, 2018).

Given a large number of individuals interested in cultural sites, the availability of a free application could further awareness of historical site locations and ease wayfinding for tourists, thus greatly simplifying a tourist's decisions as to what to visit and how to get there. Additionally, extra content through the use of Augmented Reality would greatly supplement an individual's excursions.

3. THE AUGMENTED REALITY MODEL

a. AR Overview

There are many definitions of AR, and they all rely on the same theory "give a rich perspective by applying virtual content over physical reality and make users feel virtual is part of the real perception". According to Milgram Augmented Reality is a mix of real and virtual environments (Milgram P., 1994) (Figure 1).

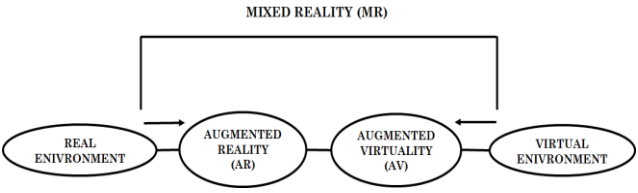

Figure 1 Reality-Virtuality (RV) Continuum

Some definitions of AR conclude that a virtual object must be a three-dimensional model type. Instead, the majority of definitions in AR are broader and more inclusive than the previous notion. The broader and more inclusive definition of AR also incorporates 2-dimensional objects such as images, texts, and sometimes they go even further by adding to this category other multimedial data such as video and audio.

These systems supplement true reality and whilst separating the virtual from the actual is relatively straightforward, at times a magnitude of confusion can still affect the user. In such circumstances, the individual might for a moment forget to differentiate between the two realities and simply see them as a single actuality.

b. Model Design

This software is developed using the Google Android Platform (GAP). GAP is a mobile operating system that offers the possibility to adapt software and is at the disposal of many other tools for mobile devices (Parsons, 2012). Application development in this platform is made via Android SDK, and it holds all the necessary APIs to manage the device. Android is designed for mobile devices, the API integrates elements like the sensors, the camera, and the signal transmitter. So, Android as a development platform can produce powerful agents that help users with useful information about their surroundings. Information given is composed of points of interest (PoI) and other data found within a specific radius.

This system will aid visitors to have a better understanding of available venues around them, and the correct bearings they should take to reach their preferred location. System data and system functionalities will address one of the main questions tourists are confronted with inside Albania, that question being "Where am I?".

The main objectives of this project are:

- Using geographical information from third parties, such as Google Maps, and other services.
- Organizing this information in categories or layers.
- Making it available for tourists, having the ability to search through.
- Visualizing data in real-time through a camera window.

Obtaining and storing information about locations and orientation is difficult in Albania, due to a weak road signs system. The AR model overcomes this problem by using the tourist device location information. Also providing information about location-based surroundings requires knowledge about camera alignment, which is received by compass and GPS, as integrated parts of intelligent devices (smartphones).

The diagram presented below (Figure 2), describes the main user activity, starting with the use of the device camera, defining information about camera orientation, and user location as preconditions to search about PoI's using different data sources.

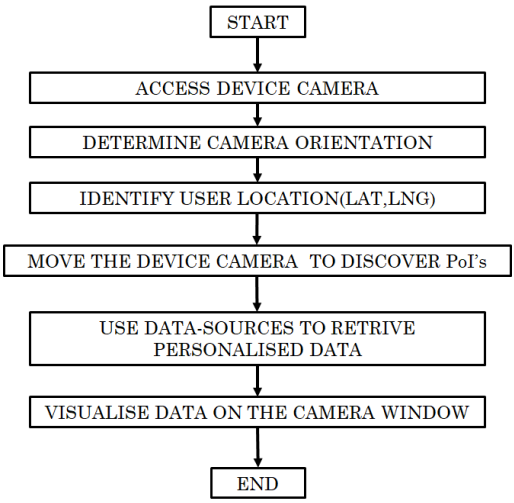

Figure 2: User Main Activity on the AR Model

The AR model depends on the device camera and map service. The visualized data on the camera window is basic (name, distance, and object orientation), by doing so each PoI is identified easily and will occupy less space on the camera window. Information presented on the camera about PoI distance is in meters, so the user can access the chosen destination by walking. PoI orientation on the camera window is defined using a marker and the device radar. Users can have full detailed information about each PoI, by clicking on the element. This information is related to the address, contact, and other general descriptive information about PoI.

In Figure 3, are displayed some of the aforementioned elements contained in the UI-designed AR model.

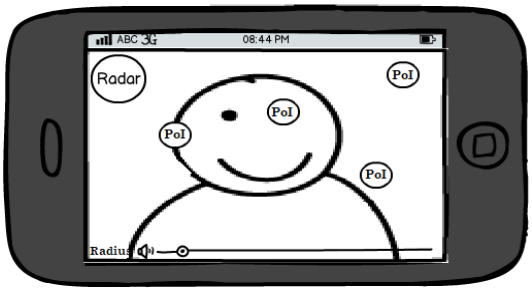

Figure 3: Distributed PoI's on the camera window.

4. MODEL IMPLEMENTATION

Identifying a group of components in this project enabled the possibility of creating a system architecture. Starting from the Search Component, visitors use this component to receive data presented through a Model Component. Models are produced by two different components such as data sources and sensor data. Sensors Component generate data about user location and orientation, while data sources are used to find the location-based information. The Model Component uses Markers, PoI's, and lists to organize geographical data for users. Data Sources Component is connected to Model Component as it downloads and processes a variety of sources like Google Places, Google Photos, Wiki to enhance the experience. Every model provided is created to be visualized for the end-user. So, the Visualization Component uses the camera window, the map, or the list-view as presenters.

The diagram presented in Figure 4, describes the system architecture based on the components identified.

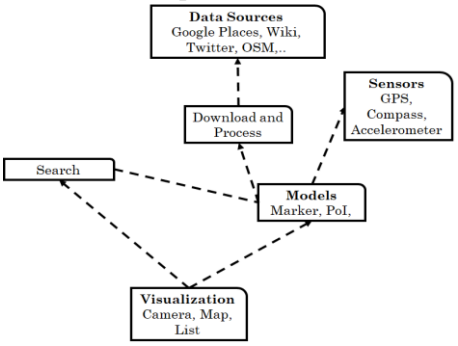

Figure 4: Components Diagram

The main data source for an Android platform is Google Maps API. The implemented application uses Google to load the map and its data from the server, to show the user's current location, to populate it with data from other data sources.

Open street maps (OSM) API is used to enrich the group of available places provided to the user (Dhëmbi, 2017). For experimental purposes, Panoramio, Wikipedia, Twitter are some of the data sources tested to update users with the latest data about locations, statuses, and photos.

To conclude, a dedicated source is implemented to generate data based on the request. The Application server uses Google Places to provide results based on user location (Lat, Lng) and radius in meters.

The most important sensors working as application information providers are orientation and location based. In this project, to retrieve user location GPS or network is used, in addition to the compass for user orientation.

GPS and network support each other in the user location information. GPS is more precise than network information, but the latter is faster and generates information even within buildings.

Once the first position updates are received, the application starts uploading data from all data sources.

Figure 5 shows the time interval in which the application is listening for location updates.

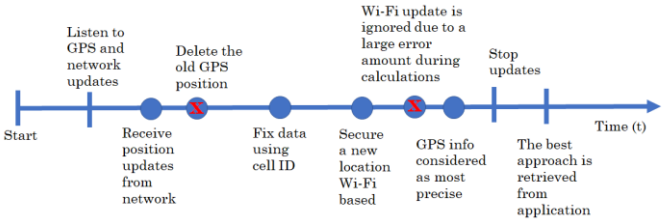

Figure 5: Time Intervals Application Listens for Location Updates

As mentioned above, the application's main user activity is positioning the PoI on the camera window. Figure 6 demonstrates how PoI's are placed over the real-time display.

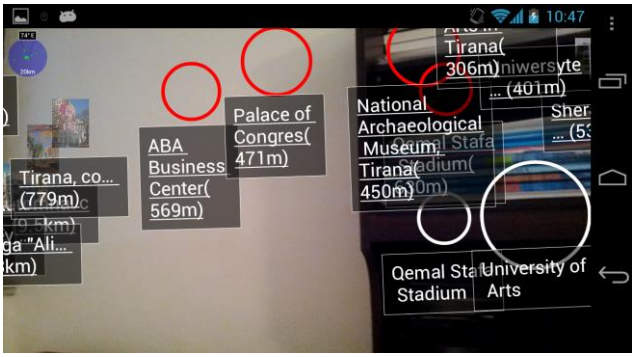

Figure 6: Searching for PoI's.

5. CONCLUSIONS

This paper presented an Augmented Reality application using the Android Platform. Application is focused on foreign tourists in Albania and tries to solve problems related to their location and disposition. Implemented software uses and displays information from several servers by placing them on the camera window and helping users to reach their destination.

During the application tests by several users, it was considered easy and practical to use. Users were able to familiarize themselves with the app in a short period of time, approximately within 15 minutes. They were delighted by the information presented in the application and were most eager to use it.

However, problems were encountered in time. The initial solution was implemented using the Mixare AR Library. Alas, today this library no longer offers support, so we have re-implemented it using a new and more reliable tool such as ARCore. As part of the Google Cloud Platform (GCP), ARCore has shown to be effective in providing the same level of functionalities as the initial version, by connecting it with other suitable data sources such as Google Maps API, Google Place API, Google Search, Photos, etc.

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