

Travelex: Augmented Reality using Google GeoFences

Mixed Reality Class
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Abstract—The tourism is a growing market and every company or local business involved on this are looking for attracting more and more tourists to their destinations.

This paper explains the use of Google Geofences for providing real-time notifications to tourists who holds a smartphone in a touristic destination. The notifications provides information about the near places and some recommendations about the interesting places to visit. The Travelex mobile application is planned to improve the tourists' experience with the ability of knowing what are the most visited places and at the same time it will be providing a way for posting feedback and share with others.

I. INTRODUCTION

With the enormous boom of powerful smart devices like smartphones, wearables and more recently the Google Glasses, the Augmented Reality (AR) is becoming the new trend topic in the world. This combination of virtual and physical world information has not been utilized at all in the Tourism field.

Augmented Reality (AR) is providing an extension of key visual and non-visual elements that are improving user experience in her/his interaction with the technology.

Geo-fencing is a technique for defining a virtual perimeter or real-world geographical area. A geo-fence could be dynamically generated as in a radius around a store or point location. Or a geo-fence can be a predefined set of boundaries, like school attendance zones or neighborhood boundaries.

Custom-digitized geofences have been in use since 2004 for multiple online mapping applications since their development by Dr. Vinay Rawlani at the University of Missouri-Columbia.

When the location-aware device of a location-based service (LBS) user enters or exits a geo-fence, the device receives a generated notification. This notification might contain information about the location of the device. The geofence notice might be sent to a mobile telephone or an email account.

With an increasing popularity of mobile advertising, geofencing has been employed to distribute location specific ads to customers on their mobile devices. This paper explains how we implemented the Google GeoFences API for locating a tourist and provide him/her automatic alerts of the near places that may be interesting to visit.

A. AR trends

There are many opportunities where Augmented Reality can be applied and achieve interesting benefits. Talking about the Tourism sector, it has been generating a very lucrative approach for many corporations. For example, hotels are always looking for improving the user experience, for that there are a solution for enabling virtual tours to hotel guests as an entertainment.

Also, If we talk about education, there are some investigations in the museums and ancient cities that are providing Augmented Reality for simulating un-existing scenarios or re-creating an specific environment as it was many years ago.

B. Related Projects

Regarding projects that are allowing a better user experience with the use of Augmented Reality, there are many approaches around the world. Some of them combine the Virtual and Augmented Reality in order to provide altered landscapes and in some case it's providing a new virtual environment that is based in the focused one but in its recreated version of many years ago.

The PRISMA[7] project is an example of this AR applications. The main objective of PRISMA is the implementation of augmented binoculars, that combine the needs of tourists in real environments and Augmented Reality technologies. The use of these technologies will allow the users retrieving personalized and interactive multimodal information about monuments and historical buildings of a city.

If we focus in technologies that are being used for Geofencing, the Gimbal[5] project provides geofencing, secure proximity beacons, location-based messaging, analytics and consumer privacy controls.

1) *Research*: First of all we wanted to focus on the best practices of Augmented Reality that is applied to Tourism[8]:

- 1) An Enhanced Booking Experience
- 2) Museum Interactivity
- 3) AR Browsers in the Destination
- 4) Responsive Experience Through Gaming
- 5) Services in the Restaurant
- 6) Re-living Historic Life and Events
- 7) The Hotel Experience
- 8) Transportation
- 9) Accessibility and Translation
- 10) Participative Destination Management

The Travelex application has been designed to satisfy most of the best practices for AR applications in Tourism. It is improving the user experience at least in the last 3 points because it will provide assistance on finding the best places to visit.

According to the Secretary of Tourism in Mexico, in the last 5 years, there has been a considerable economic growth in tourism sector. Below the 2014 key results[6]:

- Income of foreign exchange from international visitors: 12,037.9 millions of USD (+17.4%)
- Arrival of international visitors: 21,112.8 thousands of people (+18.2%)
- Medium spending per international tourist inside the country: 861.7 (+10.5%)

The shown percentage is the comparison with the last year (2013). It means that there is a big opportunity to grow in the Tourism sector with the enablement the Augmented Reality technologies in order to attract more tourist to visit mexican amazing destinations.

C. Hardware Requirements

Nowadays that smartphones are being used by a 63.5% of the 4.55 billion of mobile phone users[1], it's a great opportunity to introduce mobile applications that take advantage of mobile technology like 3G/4G and GPS.

In order to run the Travelex application, it's necessary to have a smartphone with the following specs:

- Operative System: Android (15 to latest versions)
- GPS enabled
- Internet connectivity (WiFi or 3G/4G)

1) *Justification*: Given the current number of Android based smartphones (52.1%)[2], it's a good start point for this application to be released.

It's also easier to implement the Google Geofences on an Android phone because the code can more natively implemented.

D. Programming Techniques

Android is an Operative System is mainly based in Java programming language. The Travelex application was fully developed on Java with the implementation of RESTful calls for the Google Geofencing API and some SQL queries for the database interaction.

Below are the required development tools and frameworks:

- Programming Language: Java
- Database: SQLite
- API: RESTful with Google Geofences
- Frameworks: Google Geofences, Android SDK
- IDE: Android Studio

1) *Justification*: The above technologies where chosen because there is a vast amount of documentation and there is a big community of developers that could help us in case of a show stopper may appear in the progress of the project.

2) *Technologies Comparisons*: When choosing the mobile Operative System for implementing the first release of Travelex, we choose Android because is the mobile OS that is being more used and it is the one that has the more accesible prices for smartphones. Windows and iOS based phones would be the next target for a future release.

Google Geofences vs Gimbal

The Google Geofences provides more documentation and free access for starting developing a POC Android application. Gimbal seems to provide more features that at this moment are not relevant to the project and it also cost more money to implement.

II. OUR WORK

The Travelex project approach at this moment was just a Proof of Concept (POC) with a few of testing locations where we are getting automatic notifications when an user is walking near there. The experiments were done in the TEC Campus Guadalajara area.

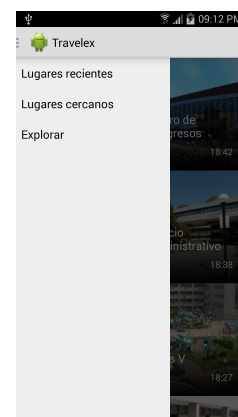


Fig. 1. Travelex Main Menu View

A. Identifying places of Interest

Based on the top 10 touristic places in Mexico shown in the TripAdvisor website[3]:

- Playa del Carmen
- Puerto Vallarta
- Mexico City
- Cabo San Lucas
- Zihuatanejo
- Tulum
- Oaxaca
- San Miguel de Allende
- Puerto Escondido
- Acapulco

In order to provide the first proof of concept (POC), we started in our city; Guadalajara, which is also a touristic city.

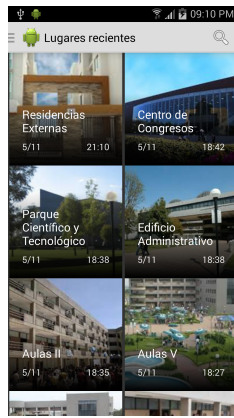


Fig. 2. Recent Places View

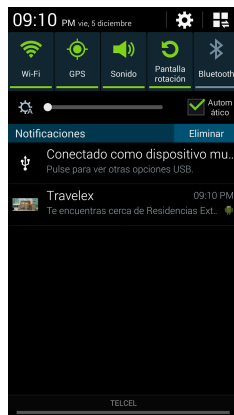


Fig. 3. Recent Places View

B. Google Geofences Implementation

A geofence defines a region of interest. For example, this may be a polygon outside of which a particular set of

entities is not expected to stray. Geofences apply to particular collections.

Each geofence has a number of properties [4]:

- ID: An opaque string used to refer to the geofence in calls to various methods. The ID for a geofence is assigned by the API at creation time.
- Name: A user-defined string describing the geofence.
- Collection IDs: Zero or more IDs of collections to which the geofence applies.
- Polygon: A polygon specifying the geofence's region. Crumbs recorded for entities belonging to one of the geofence's collections that fall within this polygon make the geofence active. This is required.

For the Travelex first approach the work-flow consists in the following 4 steps:

- The application opens the SQLite database file where it obtains the pre-defined GeoFences
- GeoFences information is sent to Google Geofencing API through a RESTful API to be created and monitored
- A BroadcastReceiver service is started to receive transactions from Google API when it identifies when the users is near to a registered touristic place.
- The BroadcastReceiver service is started every time the phone is booted in order to let the Google API the phone's current location

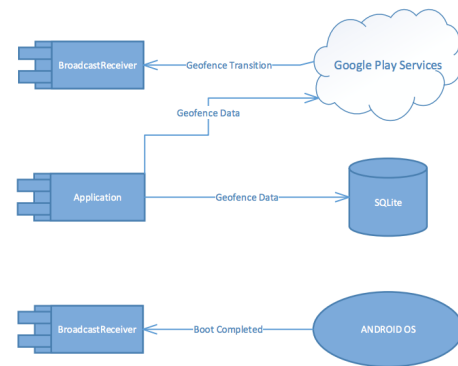


Fig. 4. Travelex Data-Flow Diagram

NOTE: In our first testing approach, geofences were pre-defined and loaded at installation time in the SQLite database file.

C. Project Schedule

1) *Personnel Needs*: At the beginning of this project it can be started with a 10 people team, because it would start as a proof of concept for an specific city. Once the project get the acceptance from the users, it will be escalated to more than 20 people where we will have teams of developers, testers,

designers, infrastructure operators and support.

Below are the number of human resources for the first release of the project:

- 1 Software Architect
- 3 Android Developers
- 3 User Interface Designers
- 3 Testers

Activity	Start	Weeks
Requirements and Analysis	0	4
Design	2	4
Development	5	12
Alpha Release Testing	17	2
Beta Release Testing	18	3
First Release	24	1
Bug Reporting and Fixing	17	8

Fig. 5. Table of Project Schedule (on weeks)

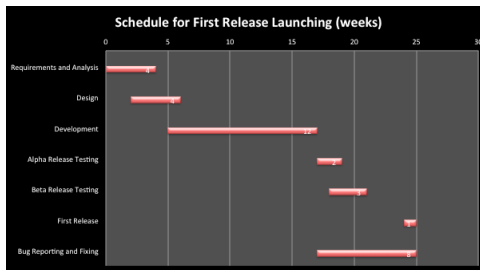


Fig. 6. Gantt Diagram of Project Schedule

D. Impact of the project

The impact of this project can be separated in 2 principal beneficiary sectors:

1. Economic

- Local businesses get more tourists on their destinations
- More job opportunities due to the demand of more services for tourists that are coming every vacation season

2. Social

- Local culture is diffused around the world
- Being role model in technology that is applied to improve the tourism
- Tourists will feel comfortable because there's a virtual assistant that will be there for directions to amazing places to visit

III. CONCLUSION

Here are the Adrian's Conclusions
Adrian Garcia Betancourt

Here are the Obed's conclusions
Obed N Munoz Reynoso

IV. FUTURE WORK

As we start with a proof of concept, below we define the opportunity areas where we could improve the Travelex Application in order to make a greater impact on the implementation of Augmented Reality in Tourism Sector:

- Adding more touristic places
- Enabling Explore capability that could let the users find more interesting places that are not necessary near to him/her.
- Enabling 'Near Places' capability
- Adding feedback mechanism for letting users rate the destinations

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