

Project Achievements



Crumbs, Places and Augmented reality in Social Networks

The CRUMBS project creates a platform to organize information in a social network based on users interacting with their physical environment while wandering around. This means that users and also other interested parties (merchants, institutions,...) will produce/consume rich multimedia social content “stuck” in different places (geo-localized) by using their mobile phones as a mixer between the real world captured by the mobile camera and the aforementioned content through Augmented Reality (AR) Technology.

Main focus

The Crumbs concept is central to the application. A “Crumb” is an extended Point of Interest (POI). It represents a trace left consciously by a person using a smartphone and the CRUMBS application. Besides including any information needed, the Crumb has a category and a subcategory, may be tagged, commented, or rated by the user who created it or by anyone who is allowed by him to do it.

The project focuses on precise geo-location -including indoor locations- and augmented reality based on location. The Crumbs are shown either over the camera view (Augmented Reality) or the map view. A combined approach for precise geo-location, using computer vision and

GPS, based on matching silhouettes has been successfully demonstrated even under changing light conditions. Indoor location is based on WiFi signal fingerprint. Both silhouette matching and WiFi fingerprinting require no special markers.

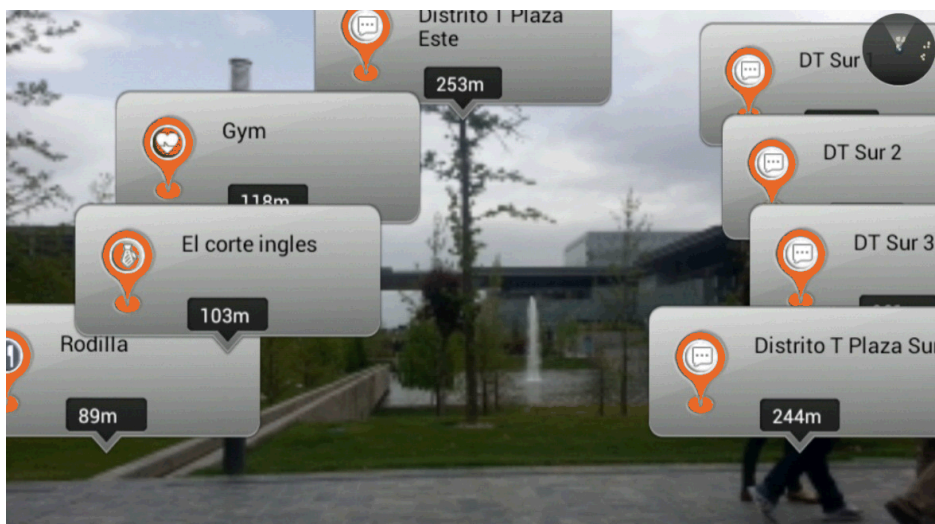
An innovative approach for recommendation has been implemented. The user is recommended based on several sources which may stand alone or combined between them: similarity to other users – users visiting similar places-, demographic characteristics (age, sex, city of residence), and explicit interests.

Approach

There was a feeling that existing tourism applications and geo-localized social networks like Foursquare could be improved using AR (Augmented Reality) and better geo-location approaches. The state of the art was analyzed, and user insights were researched giving birth to the CRUMBS idea.

The CRUMBS application consists of a back-end supporting the social network and the Crumbs data and a mobile app holding the intelligence and taking care for the presentation in the smartphone.

The Back-end is made up by ReST (Representational State Transfer) services (Services with an interface using the http protocol) which are called from the mobile



CRUMBS

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Fundación Vicomtech, Spain

Metaio, Germany

Polidea, Poland

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Project Websites

www.celticplus.eu/projects/celtic-projects/callcall7/CRUMBS/crumbs-default.asp
<http://crumbs.tid.es/>

app. These services perform their job in turn by accessing the social Database.

The mobile app was developed for Android systems. A plugin for AR based on the Junaio product (developed by Metaio) was tailored to integrate it into the app and to optimize its performance.

New location providers were added to the mobile app extending Android's Location Manager. The providers were WiFi Fingerprinting, Inertial Navigation and Silhouette matching.

Finally user tests were carried out in order to validate the approach and to point out future improvements which could be used to turn the application into one or several products.

Achieved results

1. Augmented Reality visualization: Navigation, Silhouette matching:

The Augmented Reality view was integrated into the CRUMBS architecture and the CRUMBS mobile client application. In addition to that the AR visualization had to be flexible/programmable and easy to be extended. As a result, the Augmented Reality Experience Language (AREL) was developed.

Also the researched approaches for the silhouette initialization/snap-in and Instant 3D-Tracking have been successful, especially within changing light-conditions (summer/winter, morning/

afternoon) which is a major challenge for computer vision based approaches in outdoor scenarios. Still the approach can be improved in the future regarding e.g. overall performance and robustness.

2. Positioning: Indoor positioning (WiFi Fingerprinting, Inertial positioning):

The main objective for the project was to implement a mechanism that would establish the location and orientation of the user's smartphone in the most efficient way and in the widest range of situations. The most difficult of these scenarios is when the user is not outdoors due to the lack of a GPS signal. This was achieved by CRUMBS by implementing WiFi Fingerprinting as an indoor positioning technique.

The work in the project has delivered a new geolocation library for the Android platform to integrate the location and orientation data derived from several location sources (including satellite, WiFi fingerprinting, Inertial Navigation – offset from an initial position based on measurements of acceleration sensors and gyroscopes, although this technique was not successful due to the inaccuracy of the existing sensors -, Image processing) and provides the most accurate location to the mobile application.

Android implementations were developed and integrated with the geolocation library for aforementioned location sources.

3. Crowdsourcing: The Crumbs

and the Recommendation system:

The users create a Crumb by simply pressing for a second on the smartphone screen. The users may share (read only / modify) the Crumb with any other user or only with friends. Users may comment and rate the Crumb. Users may challenge other users proposing them to guess a particular Crumb. Crumbs maybe posted to well-known social networks (Facebook, Twitter, LinkedIn, Foursquare).

A Recommendation system has been defined and successfully implemented. The system considers the users' demographic information, their explicit preferences, ratings and tags to generate user models, infer user preferences, and calculate similarities between users. These user models are applied by a hybrid recommendation service combining a content-based and a collaborative filtering algorithm to generate a list of CRUMBS to be recommended.

Impact

The CRUMBS Project has developed an initial prototype which shows that the concept could give ground to a wide array of applications. To mention some:

- ◆ Trip planner: The Crumbs could be marked on the map according to a plan previously devised by the user.
- ◆ Museum/Exhibition guide: Using the indoor location providers the user could find his location inside a building and spot the main Points of Interest.
- ◆ Commercial advertising: Commercial establishments could publish their Crumbs according to a category framework. Also events (concerts, conferences, etc...) could be published using the expiration date feature provided.
- ◆ Tourist guide: Tourism institutions could publish Crumbs in the application which could also be enriched by the users.

The former application types could be packed into one single application: i.e.: Trip planner or Tourist Guide. The only limitation being an excessive amount of information slowing down the application or making the screen unreadable – this issue is partially solved through the use of caching which allows the application to work partially offline.

About Celtic

Celtic is a European research and development programme, designed to strengthen Europe's competitiveness in telecommunications through short and medium term collaborative R&D projects. Celtic is currently the only European R&D programme fully dedicated to end-to-end telecommunication solutions.

Timeframe: 8 years, from 2004 to 2011

Clusterbudget: in the range of 1 billion euro, shared between governments and private participants

Participants: small, medium and large companies from telecommunications industry, universities, research institutes, and local authorities from all 35 Eureka countries.

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