An Ubiquitous Mobile Multimedia System for Events Agenda

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Abstract— The current growth of mobile devices enabled with GPS receptors, cameras, accelerometers, and Internet access offers new opportunities for new mobile ubiquitous multimedia applications. Such applications help local communities to share resources using geo-location, interactive mapping, augmented reality, and several data representations. This paper presents CityEvents, a mobile solution that provides real-time awareness-based information of local events and news. The presented ubiquitous system is a simple and easy to use event guide, providing location-awareness and content-awareness ordering data to the user. The proposal was evaluated and demonstrated in iPhone devices and it is ready for use.

Keywords— Mobile computing; Ubiquitous computing; Mobility; Web services; Multimedia applications; iPhone.

I. INTRODUCTION

Mobile devices offer opportunities for a better and fast growing globally connected society with online social networks, blogs, and Web pages, among others. These new approaches improved user-access to information through mobile communication. The research community along the years is studying and developing new technologies, new services, and new applications to enable ubiquitous environments based on mobile technology [1]. Mobile devices improved communication efficiency, therefore enhancing user-experience [2].

Geo-location applications are becoming very useful due to an anytime and anywhere fully connectivity. With them, Internet goes a step beyond; nowadays, with mobile devices, it is easier to have access to all range of contents regardless of where people are, e.g. trains, cars, restaurants, or public places. This means that users may perform a set of operations, like checking emails, messaging, read news, or even watching a television program without logging in a local wireless network.

The advent of mobile devices with location-aware and context-aware technologies, such as smartphones, cellphones, and tablets is changing people's daily lives. Features like, pinpointing locations on a map updated in real-time or finding user preferred information's in the surroundings. The number of applications that use global positioning system (GPS) services and new features are growing everyday [3].

Smartphones with GPS capability can be used as a personal navigator. There are various mobile navigation techniques to determine the location used on mobile multimedia applications [4]. Due to its portability and the vast range of applications, smart mobile devices are being appointed as the future when it comes to access multimedia content over the Internet. By adopting these techniques and concepts it is possible to develop intelligent mobile multimedia applications.

The ubiquitous collaboration between mobile device and Web services is another approach of intelligent applications. That brings out the best of the two worlds, the server-side resources and the client-side context and location [5]. The application is centered on what the user wants to see, where and how he/she wants to see it, giving the context and content-awareness. The information and context of the events on native applications have a better visualization to the user, contributing to a satisfying exploration of cultural and information events [6]. This paper presents CityEvents, a mobile application that follows location, context, and content-awareness approaches. It also shows events categorized by type, location, and preference, using an algorithm sensitive to the user’s behavior. The events may be shown in two distinct ways, on a table or on a map, including the user current GPS location. In order to attribute a score to each event, to determine user’s preferences, the algorithm uses context and location awareness technology. The algorithm will provide tools that allow users to receive information taking into account his/her profile settings, in an automatous and transparent way. Using the location awareness module, based on GPS location, CityEvents will highlight (or high-score) the user-preferred information. The algorithm is capable to adapt to the current context without explicit user intervention.

The main contribution of this paper is an application which scores the events based on user’s settings. The events are sorted by the user’s preferences and shown them on a map if relevant. The user can also be alerted if his/her location is close to a high-scored event.

The remainder of the paper is organized as follows. Section II elaborates on the related work, addressing several projects and applications about the topic. Section III describes the CityEvents application while Section IV focuses on the application demonstration and validation.
Finally, Section V concludes the paper and point directions for future work.

II. RELATED WORK

The exponential growth of people using mobile devices leads to a constant improvement of smart communications. Nowadays, mobile devices are getting smaller, faster, with a longer battery lifetime, and a greater processing power. With these improvements, it is increasingly common to find all type of multimedia content (audio, video, and images) available through a variety of mobile applications. This section introduces the concept of ubiquitous mobile computing and describes several projects and applications developed for mobile devices in the last years, which were considered in the development of the CityEvents application.

In the early 90’s Marc Weiser [7, 8] introduced his vision of ubiquitous computing. He presented a concept of a man-technology interaction with a complete abstraction of the user. However, Weiser’s vision faces several problems when considering the lack of technological support, that at the time of its creation was not available as may be found today [8]. A good example of ubiquitous technology is the Internet. Users use Internet only interested in information and services and not in the inherent technology. Users are connected everyday to several Internet access points without knowledge of protocol and network architecture used on a mobile device [9].

An important aspect of mobile devices is their portability and mobility. With the advent of wireless communication in mobile phones, smartphones, and tablets, ubiquitous computing has evolved as well. They take advantage of their portability to have wireless connectivity almost everywhere [10]. In mobile computing there are still some technological hurdles to overcome, such as the variation on the quality of a wireless network, local access limitation, and energy constraints. These problems affect the user and also the computing experience directly [6].

Taking into account the available literature and mobile applications, several multimedia mobile applications that influence the construction of the proposed system are described below.

An application that allows users to obtain all the information about culture events in France, created by i-Marginal is called CultureClic [11]. With this application it is possible to check out an event location, access museums data sheets, and find out cultural events near the user’s location.

Topsee is a mobile application that allows users to be fully updated with information about all the places in London [12]. It is possible to have an easy access to them, including restaurants, latest top shows, and culture events in the city.

A mobile application with the information about the Serralves foundation, called Serralves, is presented in [13]. With this application, users may have access to a constant updated schedule of activities (e.g., music and dance exhibitions, seminars, and conferences) with information about the event’s day, time, and location.

FCGulbenkien is an application developed for iPhone and Android, which allows users to access all type of information (exhibitions, concerts, events) about the Fundação Calouste Gulbenkien activities. It also gives access to news, contacts, schedules of each activity, and even online ticket purchase [14].

An application for iPhone, called N4MD – News for Mobile Devices, is presented in [15]. This is an application to visualize the weekly news produced on the Urbi et Orbi newspaper of the University of Beira Interior, Portugal. The application N4MD runs natively on the iPhone devices and it is now similar to hundreds of newspapers and magazines available for mobile devices.

The main differences between CityEvents and the above mentioned approaches and applications are the following: i) ordering events according to user's interests, based on the previously accessed events; ii) selecting the events list by restraining the categories; iii) events geo-localized on a map; and iv) giving more relevance to the events near the user’s location.

The proposed system, called CityEvents, gathers contributions from the above-presented mobile multimedia applications, creating a more complete and comprehensive proposal in the context of mobile and ubiquitous computing.

III. SYSTEM REQUIREMENTS, SPECIFICATIONS, AND DESIGN

This section discusses the requirements of the CityEvents proposal, the system architecture, the used technologies, and its development.

A. System Architecture

CityEvents is based on a mobile ubiquitous application with multimedia contents that allows users to obtain useful informations about culture events. It may be used in a region, in a city, or even in a country, for larger events with national impact and interest. The current implementation it’s optimized for local events in an area of 50-100.000 people.

The proposed system obtains data from a remote database with real-time updates through a Web service. That service supplies all the data on an eXtensible Markup Language (XML) file.

The user can choose a cultural event and see all the corresponding detailed information, as well as the event location on a map. It can also be easily found on a map with the available events by clicking on pin locations to access detailed information.

Figure 1 presents the CityEvents system architecture. The mobile application gets the data from a CityEvents server; at the moment the reply is not optimized for bigger areas, being a single XML file, real-time updated, for all the requests. Proper optimizations should be made if the application will run on a country/region-scale. The server collects information programmatically by getting localized feeds from safe
sources, or providing localization-enabled backend for specific groups of interest (Culture, Sport, etc.). The user will have full access to all events through a list and a visual map, as well as aware-enabled data sections or data orderings, depending on distance to the event and/or the relevance for the user.

For this first implementation, simple parameters are used to provide combined location and content-awareness. Events are ordered (and filtered in number) considering Euclidean distance from the GPS position to the event-position and the relevance to the user expressed in percentage of events seen for a specific category. Future improvements can be done in these algorithms to express the “likelihood” of the events, as defined in Section V.

The Web service created to perform the communication among clients and server uses Simple Object Access protocol (SOAP) messages over Hypertext Transfer Protocol (HTTP). The information between clients and the server is exchanged using an XML file.

C. Software Platform

This section shows the software platform of CityEvents and their main functionalities. Figure 2 illustrates the communication among clients and the CityEvents server. Initially, the application sends a SOAP request to the server, asking for all the available upcoming events. With this request the server creates an organized XML file containing all the upcoming stored events. The application receives the XML file and parses all data, filling the local mobile database. When this operation ends, the information is displayed on the screen. The data contained in the file includes a title, a brief summary, the corresponding image URL (uniform resource locator), a place, date, date of publication, and its author. When the user chooses an event, the application gets all the corresponding multimedia content sending an HTTP request. As soon as the multimedia content of that event is received, it is displayed on the mobile device.

In CityEvents, users may choose which categories want to view. With this feature, the application sends a new request to the server that returns a new XML file with it, performing a similar set of the above-mentioned operations.

B. Used Technologies

Based on the nature of the proposed system and the available technologies and mobile devices, iPhone was chosen for the real deployment and demonstration of the proposed system. The native application CityEvents targets iPhone, a mobile device with iOS operating system, which is a software stack for mobile devices that contains an operating system, middleware, and main applications provided by Apple. The major solution for application development was Objective-C, using the Xcode, which integrates the development environment for creating applications for iPhone. Xcode includes the Xcode IDE, Instruments, iOS Simulator, and the latest Mac OS X and iOS SDKs [16-17].

Figure 1. Illustration of the system architecture.

Figure 2. Communication between clients and the CityEvents server.

IV. SYSTEM DEMONSTRATION AND VALIDATION

CityEvents system includes a user-friendly layout using the user-interaction capabilities of the iPhone. The user-interface is shown along the CityEvents system demonstration presented in this section. Figure 3 shows the Home window of the application. This window displays several information (e.g. title, image, and a brief summary) about the week event, which is the most important category for the user. By clicking on the event image, the application leads the user to the detail page of the event. This feature
allows users to know which event is considered the main event of the week, without the need to search for it. On the next tab bar, called **Events**, a list of events is shown to the user as presented on Figure 4. Displaying a list of events sorted by the user’s preferences.

At the bottom of this tab, the user can see the number of events available in the list. In the specific case shown in Figure 4, the user may choose from a range of 361 events.

When an event of the list is selected, all the event details are shown to the user. Figure 5 presents example of an **Event Details** window. As may be seen in Figure 5a), the details include the event title (at the top), a brief summary, an image with the corresponding caption, the event date, the publication date, and the author of the post. At the end of the view the user is able to see the description of the event (Figure 5b). When the description field is bigger than the available window area, the user is allowed to scroll the text in order to read it.

At the Settings tab (Figure 6a), the user may choose to see a specific category of events. This is made using a filter available at this tab bar. Figure 6a) also presents the list of the available categories to the user. Figure 6b) shows the result when the user chooses a category. The application will fetch only the user’s choice and the information of these events. With this feature, CityEvents implements a cognitively distinct group of users.

Figure 3. Home window.

![CityEvents](image)

**CityEvents**

Information about culture events and local news.

**Featured Event**

**CityEvents** is a mobile app that provides information about cultural events and local news.

**METALLICA CONFIRMED AT**

After a spectacular concert at the Rock in Rio...

**Britney Spears in Pavilhão Atlântico - Lisbon**

Britney Spears says her latest tour will delight fans as it is "one of the most entertaining shows she’s ever done."

**Events**

- **Britney Spears in Pavilhão Atlântico - Lisbon**
- **METALLICA CONFIRMED AT**
- **Britney Spears in Pavilhão Atlântico - Lisbon**
- **London Students Develop**
- **The Future of Mobile App**
- **Top 10 Free iPhone**
- **The Creative Source for Creative People**

**Figure 4. List of all available events.**

**Figure 5. Example of an event detail.**

**Event Details**

**Britney Spears has promised fans her ‘Femme Fatale’ tour is one of her most entertaining shows yet. The American singer Britney Spears will perform on 09 November at the Atlantic Pavilion in Lisbon, where he will present the album ‘Femme Fatale’, said the prosecutor Everything is New. The only time that Britney Spears was performed in Portugal in 2004. Rock in Rio Festival in Lisbon, a night of floating, but the actress eventually criticized for allegedly made "playback". The Criminal singer who will kick off the series of concerts in St Petersburg, Russia, on September 22 and finish in Lisbon, Portugal on November 9 is delighted with her group of backing dancers and says people will also be entertained by her ‘six or seven costume changes’. Britney is proud of her ‘Femme Fatale’ theme and credits her “amazing team” with helping her choose which songs from her impressive back.

**Figure 6. List of categories and corresponding events.**

**Settings**

- **Nature**
- **WorkShop**
- **Concerts**

**Events**

- **METALLICA CONFIRMED AT**
- **Britney Spears in Pavilhão Atlântico - Lisbon**
- **London Students Develop**
- **The Future of Mobile App**
- **Top 10 Free iPhone**
- **The Creative Source for Creative People**

**Figure 7. Shows the Map tab presenting a map**

Figure 7 shows the **Map** tab presenting a map with the localization of a specific event. In this tab it is also shown all the available events, using pinpoints that represent the event geolocation. The nearby event is represented by a blue pinpoint. The user location is also shown on the map and is...
represented by a red pin. When a mark is clicked, the user can read the title and a brief description of the event.

The CityEvents system was evaluated and performed as expected. The application was deployed in a real device and it is ready for use.

Figure 7. Example of an event location in a map.

V. CONCLUSIONS AND FUTURE WORK

This paper proposed a ubiquitous location, context, and content-aware mobile application, called CityEvents. It describes a mobile multimedia system for displaying geolocated cultural events. It provides the needed information to the user in an easy and intuitive way, catching the user’s interests and trying to suggest nearby events presented in a visual map that offers detailed information on request. A list of events ordered by interest is also available.

The amount of data transferred between the client and the server is taken into account and is reduced by caching mechanisms, and a proper compression system on the server-side. The client will only make requests to the server if needed, in background threads in order to improve the user experience. The solution has been demonstrated in iPhone.

For future work, several improvements are to be kept under consideration: i) a list of favorite events for the user may be created, joining data from location and content analysis with advanced algorithms; ii) contents may be improved with more multimedia elements, such as, video, photo slideshow and audio. The mobile application can also be deployed in other mobile platforms, such as Android or Windows mobile.

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