Location Based Services for Mobile Commerce Applications

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FOREWORD

We warmly welcome you to ICE-B 2007 - the *International Conference on E-business*, which is held, this year, in Barcelona, Spain. This conference reflects a continuing effort to increase the dissemination of recent research results among professionals who work on the e-business field. ICE-B is integrated as one of the modules of the ICETE joint conference.

The major goal of ICETE is to bring together researchers, engineers and practitioners interested in information and communication technologies, including e-business, wireless networks and information systems, security and cryptography, signal processing and multimedia applications. These are the main knowledge areas that define the four component conferences, namely: ICE-B, WINSYS, SECRYPT and SIGMAP, which together form the ICETE joint conference.

In the program for this joint conference, we have included keynote lectures, tutorials, papers, and posters to present the widest possible view on these technical areas. With these tracks, we expect to appeal to a global audience of the engineers, scientists, business practitioners and policy experts, interested in the research topics of ICETE. All tracks focus on research related to real world applications and rely on contributions not only from Academia, but also from the industry, with different solutions for end-user applications and enabling technologies, in a diversity of communication environments. The proceedings demonstrate a number of new and innovative solutions for e-business and telecommunication, and demonstrate the vitality of these research areas.

ICETE has received 418 papers in total, with contributions from more than 60 different countries, from all continents, which really shows the success and global dimension of ICETE 2007. To evaluate each submission, a double blind paper evaluation method was used: each paper was reviewed by at least two experts from the International Program Committee, in a double-blind review process, and most papers had 3 reviews or more. In the end, 175 papers were selected for oral presentation and publication, corresponding to a 41% acceptance ratio. Of these only 62 were accepted as full papers (15% of submissions) and 113 as short papers. Additionally, 99 papers were accepted for poster presentation. These acceptance ratios demonstrate that ICETE 2007 strives to achieve a high quality standard which we will keep and enhance in order to ensure the success of next year conference, to be held in Barcelona/Spain. Furthermore, a short list of about thirty papers will be selected to appear in a book that will be published by Springer.

We would like to emphasize that ICETE 2007 includes several outstanding keynote lectures in areas which are very relevant, nowadays. These talks are presented by distinguished researchers who are internationally renowned experts in all ICETE areas, and contribute to heighten the overall quality of the Conference.

A successful conference involves more than paper presentations; it is also a meeting place, where ideas about new research projects and other ventures are discussed and debated. Therefore, a social event including a conference diner/banquet has been planned for the evening of July 29 in order to promote this kind of social networking.

We would like to express our thanks, first of all, to all authors including those whose papers were not included in the program. Next, we would like to thank all the members of the program committee and reviewers, who helped us with their expertise, dedication and time. We would also like to thank the invited speakers for their invaluable contribution, sharing their vision and knowledge. Naturally, a word of appreciation for the work of the secretariat and all other members of the organizing committee, whose diligence in dealing with all organizational issues were essential and required a collaborative effort of a dedicated and highly capable team.

We hope that you will find these proceedings interesting and a helpful reference in the future for all those who need to address the areas of e-business and telecommunications.

Enjoy the program and your stay in Barcelona.

Joaquim Filipe
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LOCATION BASED SERVICES FOR MOBILE COMMERCE APPLICATIONS

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Abstract: Mobile setting considerations provide valuable issues regarding flexible mobile applications. In this paper, we indicate the advantages of an m-commerce application capable to provide users with useful information (e.g. historical buildings, shops, hotels) according to their location. First, the application creates a basic profile of the current user (type of information the user is mainly interested in). Then, in addition with the location awareness of the user's position the application provides only useful information according to the user's whereabouts. When the user is alerted that he is in close proximity of one place that he is interested in, he has the option to access more info about it (streaming video or photo and text). The application is implemented using the Java Micro Edition (Java ME) platform and is mainly making use of the Location API, which provides information about the device's present physical location and orientation. The customized information is stored online and is accessed only when user needs it.

1 INTRODUCTION

In a more and more dynamic and competitive business environment where innovation and quality servicing is crucial there has to be revolutionary ways to serve customer needs tailored only to their interests. The best way to attract the customer's attention is to personalize the services you provide by offering a product or service that your customer definitely wants. The evolution of mobile commerce (m-commerce) nowadays has come to built on this key strategy. M-commerce stands for electronic commerce made through mobile devices. It is currently mainly used for the sale of mobile phone ring-tones and games, while other services include the sending of textual information (such as football scores, weather reports, emergency news, etc. via SMS. Additional examples of m-commerce applications are information-on-demand systems such as news services or stock tickers, banking and stock brokerage applications, using not only SMS, but also mobile Internet access services (WAP or iMode). In addition, as 3G/UMTS services roll out it is increasingly used to enable payment for location-based services such as image content (maps, photos, etc.), as well as video and audio content, including full length music tracks (Elliot et al., 2004).

In m-commerce applications a beneficial subject is to be able to track a user's location. By knowing the user's location and by using a simple profile of his needs you can offer him a product or a service that he probably won't refuse (Ververidis et al., 2006).

2 LOCATION BASED SERVICES

The term Location Based Services (LBS) refers to services that utilize geographical data. The goal is to deliver information and services on location. LBS offer personalized services to users, who possess mobile devices, tailored to their present location in the right time needed. LBS answer three questions: Where am I? What's around me? How do I get there?

At this point it is important to emphasize the differentiation between LBS and Geographical Information Systems (GIS). Certainly, there are many similarities between them due to the nature of their functionality. Both of them manipulate data with positional references and make use of spatial analysis functions. Whereas LBS were born quite recently by the evolution of public mobile devices, GIS have been developed during several decades on the basis of professional geographic data

applications. GIS can be seen as professional systems intended for experienced users, which require extensive computing resources. In contrast, LBS are developed as limited services for large non-professional user groups (LBSZone, 2006). In addition, LBS applications operate with the restrictions of mobile computational power, small displays or battery run time of the mobile device.

2.1 Mobile Commerce

M-commerce is the buying and selling of goods and services through wireless handheld devices such as cellular telephone and personal digital assistants (PDAs). Known as next-generation e-commerce, m-commerce enables transactions by accessing the Internet without needing to find a place to plug in, via mobile phone networks.

Corporations are now using m-commerce to expand everything from services to marketing and advertisement. The benefits of M-Commerce among others include cost savings, and new business opportunities. As content delivery over wireless devices becomes faster, more secure, and scalable, there is wide speculation that m-commerce will surpass wireline e-commerce as the method of choice for digital commerce transactions.

2.2 Location Based Services in M-Commerce Applications

2.2.1 Advantages

The geographic intelligence delivers a new dimension to wireless businesses through LBS. The level of detail, accuracy and currency opens up a broad scope of potential applications, enabling you to tailor your technology and services to the exact location of your customers. The insurgence of high-bandwidth networks has significantly enhanced the potential of LBS, generating a potentially significant return on infrastructure investment with the delivery of personalized data (Georgiadis et al., 2005).

Possible use case scenarios for LBS in m-commerce applications have a very wide target group (Elliot et al., 2004). The following, are among the most promising: entertainment (searching and advertising of entertainment centers, such as bars, clubs, etc. in close proximity of the user), information (the user can get information about historical buildings/sites, museums or the weather for his current position), services (information about hospitals, hotels, etc.) and shopping (inform the user about special offers in nearby shops or guide the user to a specific store in a big mall).

2.2.2 Disadvantages

Location based applications can bring many benefits to business processes. But poorly used or mismanaged, they can become a major area of concern (Spinney, 2004). One major concern is the monitoring of users (without their consent) and the invasion of their privacy. Other problems that could appear from the misuse of LBS and the illegal knowledge of the user's whereabouts are the following: embarrassment (one customer's knowledge of another's location may lead to embarrassing situations), harassment (location information can be used to harass or attack a user), service denial (a health insurance firm might deny a claim if it learned that a user visited a high-risk area) and legal restrictions (some countries regulate the use of personal data).

M-Commerce and, generally, the use of mobile devices for more sensitive operations is fairly new and in a "primitive" stage, especially the LBS. But even with these drawbacks if the application and the carrier in question are trustworthy the user doesn't have to worry about privacy issues. For these and other reasons, users must know when their location is given to an application (Giaglis, 2004).

2.2.3 Requirements

Mobile computing environment has certain features that impose restrictions. The properties of mobile networks are: (relatively) low bandwidth, strong bandwidth variability, long latency, unpredictable disconnections and communication autonomy. The properties of mobile terminals are: small and low-resolution displays, limited input capabilities, limited computing power, limited power and small memory size (Ververidis et al., 2006). The practical conditions, when and where the mobile devices are used, brings also additional restrictions.

LBS are intended mainly for traveling people as a tool providing support in making decisions about where to go. Therefore, wrong information may mean wrong decisions, lost time and, as a result, anger of the client in the best case and a court examination in a worse case. A location based service consists of roughly two phases, determining the position of the customer and providing service or contents based on the position. For the location method at least the following requirements can be listed (Nokia, 2002):

- The method should provide good accuracy subject to the requirements of the application and the respective cost.

- The location method should not generate too much signaling load within the mobile network.
- The location method should have a minimum impact on the mobile network in terms of complexity and cost.
- Consumer privacy must be ensured, by, e.g., providing means for the consumer to turn off the locating feature of the terminal.

3 THE JAVA MICRO EDITON (JAVA ME) PLATFORM

Considering all of the aforementioned subjects we believe it's mandatory at this point to illustrate an application implicating a scenario which makes use of some of the benefits that LBS may offer to end users and the market. We have thus effected an application which makes use of Java Micro Edition (Java ME) platform and the Location API (JSR 179).

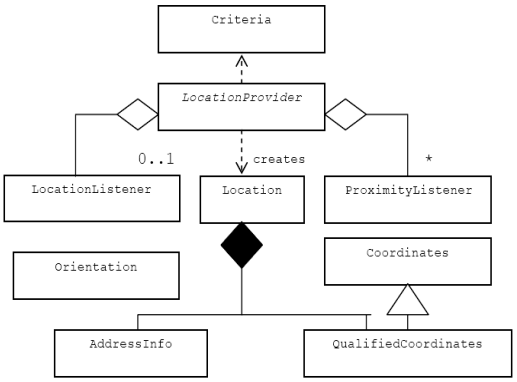

Figure 1: Location API UML diagram.

Java ME combines a resource-constrained Java Virtual Machine (JVM) and a set of Java APIs for developing applications for mobile devices. These APIs cannot run on a traditional JVM, due to the limited size of mobile devices in regards to memory and resource availability, so Java ME defines a limited version of the JVM as well.

Java ME can be divided into three parts: a configuration, a profile, and optional packages. A configuration contains the JVM (not the traditional JVM, but the cut-down version) and some class libraries; a profile builds on top of these base class libraries by providing a useful set of APIs; and optional packages. The most popular profile and configuration that Sun provides are the Mobile Information Device Profile (MIDP) and Connected Limited Device Configuration (CLDC), respectively. As the name suggests, CLDC is for devices with limited configurations; for example, devices that have only 128 to 512KB of memory available for Java applications. Consequently, the JVM that it provides is very limited and supports only a small number of traditional Java classes (Tauber, 2001).

3.1 Location API Java Specification Request (JSR 179)

We will briefly describe some major classes and definitions, in order to facilitate the conception of the logical construction of location based applications using the Java Specification Request (JSR) 179. This extract has been taken from the Location API JSR 179 (JCP, 2007).

Figure 2: A demonstrative profile settings form (frmOptions).

The Location API for Java ME specification defines an optional package, javax.microedition.location, which enables developers to write wireless location-based applications and services for resource-limited devices like mobile phones, and can be implemented with any common location method. The compact and generic Java ME location APIs provide mobile applications with information about the device's present physical location and orientation (compass direction), and support the creation and use of databases of known landmarks, stored in the device.

JSR 179 requires the Connected Device Configuration (CDC) or version 1.1 of the CLDC. CLDC 1.0 isn't adequate because it doesn't support floating-point numbers, which the API uses to represent coordinates and other measurements. The Location API doesn't depend on any particular profile; it can be used with MIDP or the Personal Profile.

In the following lines we will give you a brief introduction to some classes and means of the location API. The javax.microedition.location package contains the basic classes needed to request and get a location result.

```
Criteria c = new Criteria();
c.setHorizontalAccuracy(1000);
c.setVerticalAccuracy(1000);
c.setPreferredPowerConsumption(Criteria.NO_REQUIREMENT);
//***Create LocationProvider***
lp = LocationProvider.getInstance(c);
//***Create Location Variable***
loc = lp.getLocation(1000);
//***Create Qualified Coordinates Variable***
qc = loc.getQualifiedCoordinates();
//Creates the LocationListener (updates every 7 sec)
lp.setLocationListener(this, 7, 1, -1);
```

Figure 3: Creating the necessary objects for LBS (code detail).

The LocationProvider class is a module able of determining the location of the device. The implementation can make use of any possible location methods. We can also combine the methods in various ways to get the optimal result.

The application specifies criteria for selecting an appropriate location provider and obtains a LocationProvider instance that is able to fulfil these criteria as closely as possible. The LocationProvider creates the Location objects representing the location of the terminal at the time of the measurement. The application can either request a single Location object or can be updated with new Location objects via another implementation of the application the LocationListener.

Figure 4: Showing the current Location of the user, the Places that are near him and some of the Places he recently passed by (frmLAPI).

The location is represented by the Location object that contains a QualifiedCoordinates object representing the geographical coordinates (latitude, longitude and altitude) and information about their accuracy, a timestamp and possibly information about speed and course of the terminal. For some location methods, the Location object may also contain an AddressInfo object that includes textual address information, e.g. a street address.

This package also includes a device-based database of landmarks. A landmark is a known physical location that is associated with a name representing that location for the end user. The user gets landmark information directly from the server according to his location. For example if the user is in the eastern side of Thessaloniki and he activates the application he will get from the server info about the places near him (e.g. Macedonia airport). The grouping of the landmarks is used so that the mobile phone won't have big memory needs and it depends on the administration of the application from the server side.

4 CASE STUDY

The application is implemented with the Java Wireless Toolkit (version 2.3), a Java based environment designed for mobile applications development. Our application takes advantage mainly of the location API which is designed to offer location based information. The purpose of our application is to highlight some of the aforementioned advantages that LBS have to offer to end users who possess mobile devices.

Figure 5: Extended Information form about a point of interest, e.g. The Mall (frmMoreInfo).

The application is composed by a client application and an online "database". The two parts of our application communicate when it is needed to exchange information. The main purpose of the client application is to alert the user about nearby places of interest and if the user is interested in them, he can have access to extended info. The client application also has to filter the appearing places according to the user's profile.

The server, to which the application connects to, is used to store all the information that is provided through the client application on the mobile device. The server is the one that contains all the multimedia information (e.g. direction maps, commercial videos and pictures) and contains all the information of the landmarks that appear to the user. The server is also

the one that streams the informative videos to the device.

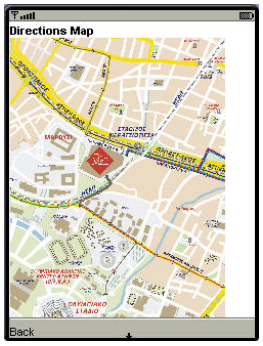

Figure 6: A direction map indicating the precise location of the point of interest (frmMap).

The goal is to make feasible a scenario, where a client should be informed about things that interest him according to his geo location at any time without having to ask for them. To manage this, a user profile should be firstly created (fig. 2). By creating a user profile the places that appear can coincide with the exact interests of the user. This way the application becomes more user-friendly and less annoying.

After setting the profile, user can start using the application. When the "Location Informer" form is opened, the application creates the proper objects (Criteria, Location, LocationProvider) and the LocationListener (fig. 3) so that the mobile phone can start getting location information from a source. After all the necessary objects have been created and initiated, the LocationListener updates every 7 seconds the location of the user. If there are any places of interest in close proximity the user is alerted through the "Location Informer" form (fig. 4). If user is interested in one of the Landmarks on screen he can request for more information selecting them.

The information sent to the user is intended to be in multimedia form such as a video in streaming format. An example scenario could be a man roaming with his car to an unknown city for him where he is for business purposes. While he enjoys the miscellaneous sightseeing's his mobile device informs him that in proximity of 30 meters a mall centre exists. In this point as shown in picture the user has the option to choose to see more info (fig. 5) about the mall, with the use of a video stream held in a web streaming server. In addition to that he has the option to see a map (fig. 6) of the area and the precise location of the mall.

Multimedia info can excite the user's interest better than plain text. So the user after seeing how many different things about this mall can offer and the fact that it is next to his current location he decides to pay it a visit. After being directed by the map about the precise location and starting walking glancing here and there, the predefined profile settings of the user (cinema, restaurants, mall centres) addresses the application to inform him that he is outside a place of interest: cinema. By choosing "more info" he has the advantage to see a trailer of the current playing movies in a streaming format video. On the other hand, if the user does not wish to activate the LBS, he can simply browse all the registered landmarks (fig. 7) of his location.

Figure 7: The provided landmarks (list1).

By selecting any of them he can have access to extended information. Below, in fig.8, the application's GUI and the connections between all the forms we have described above are presented:

The server side of the application provides some web-based tools to the system administrator for the landmark management. Through a specific web page the administrator can add new or edit existing landmarks (fig. 9). When the landmarks on the server are updated the application users will be able to get the updated land marks the next time, they connect to the server to get landmark info. In addition, the administrator can also change the settings of the streaming services which are also provided from the server, through a streaming server.

5 CONCLUSION

In a few years, most mobile phones will have location tracking methods. So, our goal is to take advantage of these future capabilities, to allow users to make use of them in their day-to-day life.

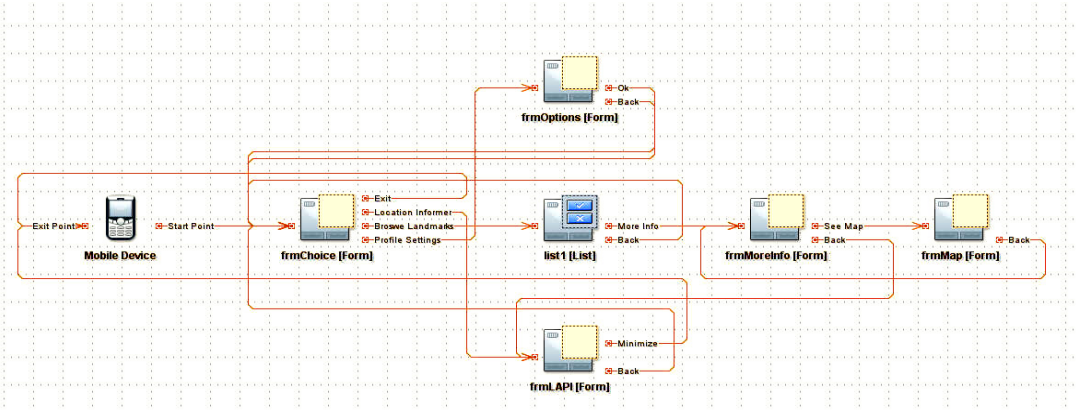

Figure 8: The GUI navigation chart of the application.

Our demonstrative application case study shows how users can always be aware of their location and also how can be informed about places of their interest near their current location. When user is alerted that is in close proximity of place that he may be interested (according to his profile), he has the ability to ask for more information about it. He can see basic info in text form, a direction map or streaming video about that place. Even in times of emergency, the application can be used to inform him about the nearest hospital or pharmacy.

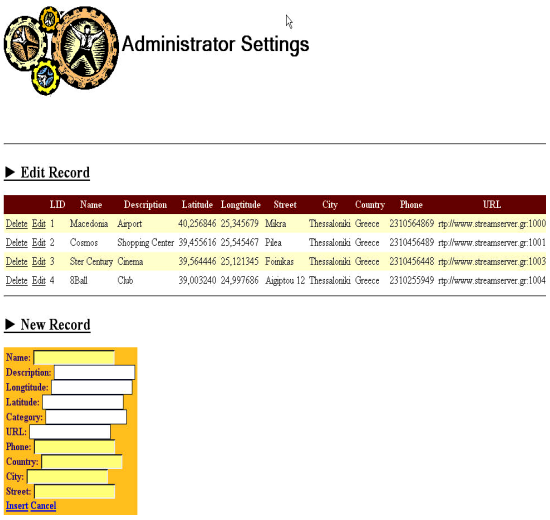

Figure 9: The administrator web page.

All of the above functions may be useful to either a tourist in case that he feels "lost" or to a permanent citizen of the city. Furthermore, the search time for everyday places a certain person usually look for, is deceased. Even from the advertisers point of view, the application indicates a viable way to target to a specific group of people (e.g. for a shop, all the people who walk by and may not notice it). LBS applications may facilitate the approach of people who are interested in a shop's products and also have the ability to go visit it (with almost no waste of time).

REFERENCES

Elliot, G., Phillips, N., 2004. *Mobile Commerce and Wireless Computing Systems*, Addison Wesley – Pearson Education. Harlow, England.

Georgiadis, C.K., Mavridis, I., and Manitsaris, A., 2005. Context-based Humanized and Authorized Personalization in Mobile Commerce Applications, *IJCIS*, Vol. 3, No. 2, 1-9.

Giaglis, G., 2004. *Mobile and Wireless Business*, I. Sideris Press, Athens, Greece.

JCP, *The Java Community Process*. Retrieved January 25, 2007, from http://jcp.org/en/jsr/detail?id=179

LBSZone, 2006. *The Location Based Zone*. Retrieved December 22, 2006, from http://www.lbszone.com/

Nokia, 2002. *Mobile Internet Technical Architecture: Technologies and Standardization*, Edita Publishing Ltd./IT Press, Helsinki.

Spinney, J., 2004. Location-Based Services and the Proverbial Privacy Issue - *Directions Magazine*, Retrieved January 17, 2007, from http://www.directionsmag.com/article.php?article_id=510&trv=1

Spinney, J., Mabrouk, M., 2005. *Location Technology Development Lead*, Retrieved October 29, 2006, from http://www.lbs360.net/LBSArticles/ESRI.UsingJ2ME.pdf

Tauber, D., 2001. *What's J2ME*, Retrieved September 22, 2006, from http://www.onjava.com/pub/a/onjava/2001/ 03/08/J2ME.html

Ververidis, C., Polyzos, G.C., Mehdi, K.-P., 2006. *Location-Based Services in the Mobile Communications Industry* - Encyclopedia of E-Commerce, E-Government and Mobile Commerce, Idea Group Reference, Hershey, USA.