iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 4 **Issue:** II **Month of publication:** February 2016

DOI:

International Journal for Research in Applied Science & Engineering Technology (IJRASET)

A Survey on Location Based Service Applications for Mobile Users

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Abstract: Location-based applications are one of the most anticipated new segments of the mobile industry. These new applications are enabled by GPS-equipped phones and range from Emergency 911 (E-911) applications to buddy finders (e.g., "let me know when my friend is within 1000 feet") to games (e.g., treasure hunt) to location-based advertising (e.g., "enter the Starbucks to your left and get $1.00 off a Frappuccino"). These services are designed to give consumers instant access to personalized, local content. Some of these applications will couple LBS with notification services, automatically alerting users when they are close to a preselected destination. LBS proponents believe that these services will create new markets and new revenue opportunities for device manufacturers, wireless providers, and application developers. This paper provides the survey about Location Based service and its application for mobile users.

Keywords: Location Based Service Applications, Point of interest, Mobile Technology, Data capture,Query processing techniques

I. INTRODUCTION

Analysts and researchers have taken several approaches to classifying LBS applications. A major distinction of services is whether they are person-oriented or device-oriented.

Person-oriented LBS comprises all of those applications where a service is user-based. Thus, the focus of application use is to position a person or to use the position of a person to enhance a service. Usually, the person located *can control the service* (e.g., friend finder application).

Device-oriented LBS applications are external to the user. Thus, they may also focus on the position of a person, but they do not need to. Instead of only a person, an object (e.g., a car) or a group of people (e.g., a fleet) could also be located. In device-oriented applications, the person or object located is usually *not controlling the service* (e.g., car tracking for theft recovery).

In addition to this first classification of services, two types of application design are being distinguished: push and pull services(1).

Push services imply that the user receives information as a result of his or her whereabouts *without having to actively request it*. The information may be sent to the user with prior consent (e.g., a subscription-based terror attack alert system) or without prior consent (e.g., an advertising welcome message sent to the user upon entering a new town).

Pull services, in contrast, mean that a user actively uses an application and, in this context, "pulls" information from the network. This information may be location-enhanced (e.g., where to find the nearest cinema)(17).

Some services such as a friend finder or date finder integrate both push and pull functionality.

Most of the early location services in Europe have been pull services, especially information services. Push services have not come to flourish yet. Unproven economics and privacy concerns are the main reasons for this situation.

Economically, it is unclear to what extent push services can be profitable(16). On the cost side, it has been argued that push services take up disproportionate amounts of network resources because they require a constant update of users' locations. For example, in order to push a restaurant coupon to all mobile users who enter a certain area, the network of that area needs to be "paged" at regular intervals to request the cell phone number of all those users passing by. In other words, the entire location area is queried about whether new phones have entered the respective cell area and whether any of these users are subscribed to the service(2). Yet, some services involving push may not require network paging. An example of this is a friend finder service. Here, a message is pushed to a subscriber A indicating to him that somebody else (person B) wants to locate him. In this type of *passive* service, no cost-intensive network paging is required.

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II. CATEGORIES AND EXAMPLES OF LBS APPLICATIONS

A. Person-oriented

1) Communication

a) Push Services-Ex: You get an alert from a friend zone application that a friend has just entered your area. Ex. A message is pushed to you asking whether you allow a friend to locate you

b) Pull Services-Ex. You request from a friend finder application who is

2) Information

a) Push Services-Ex: You get an alert that a terror alarm has been issued by the city you are in.

b) Pull Services-Ex: You look for the nearest cinema in your area and navigation instructions to get there.

3) Entertainment

a) Push Services-Ex: You have opted to participate in a location-based "shoot 'em up" game and are being attacked.

b) Pull Services-Ex: You play a location-based game and look for another opt-in in your area to attack.

4) M-Commerce and Advertising

a) Push Services-Ex: A discount voucher is being sent to you from a restaurant in the area you are in.

b) Pull Services-Ex: You look for cool events happening in the area you are in.

B. Device-oriented

1) Tracking

a) Push Services-Ex: An alert is sent to you from an asset-tracking application that one of your shipments has just deviated from its foreseen route. Ex: You get an alert that your child has left the playground.

b) Pull Services- Ex. You request information on where your truck fleet currently is located in the country.

III. LBS AND PRIVACY

Consumers care about their privacy and are wary of any intrusions. As a result, operators and marketers, but also friends among each other, must be careful and sensitive about the way they handle the localization of others (18).

Main points covered in the directive are as follows:

Automated calling is only allowed in respect to subscribers who have given their PRIOR CONSENT.

Only the body that a user has a purchase contract with is allowed to use contact details for direct marketing purposes.

If the operator wants to do direct marketing, then the user must be given the opportunity to object, free of charge and in an easy manner, to the use of his or her contact data. This opportunity must be given at each message.

Electronic messages that conceal the identity of the sender OR are without a valid reply address are prohibited.

IV. LBS PLATFORM CONSIDERATIONS

Before delving into the actual AT&T application, it is critical to assess the two overall areas that contribute to the quality of results from any LBS application: the mapping data and the LBS Engine software (3).

A. Data Capture and Collection

LBS applications typically use information from several content databases:

The road network (digital maps)

Business and landmark information, often referred to as Yellow Pages, or POI information

Dynamic data such as traffic and weather reports

B. Digital road databases

Building LBS applications starts with the collection of road data. The United States alone contains millions of individual road segments. Map database vendors collect and convert raw geographic content into digital formats. The map data are captured in many ways, ranging from satellite imagery to scanned maps to manually digitizing paper maps(4). Some vendors physically drive each road segment in GPS-equipped cars, recording every change of direction and photographing road signs to keep track of specific road conditions such as turn and height/weight restrictions.

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Each vendor's data are different, which accounts for some of the discrepancy in the maps and routes generated(19). Some data are extremely accurate but have only partial coverage. Some vendors provide complete coverage but have data with positioning errors and geometry problems.

Map data are stored in a vector format composed of line segments (links) representing the roads and connecting points representing intersections or other road features. Each link has start and end points and may also incorporate shape points to model the curvature of the road. In addition to geometry, the data contain feature attributes such as one way streets, exit signage, prohibited turns and maneuvers, vehicle-height restrictions, bridges, tunnels, and street addresses.

The complexities of modeling the idiosyncrasies of the road system are significant. Consider an example such as the Golden Gate Bridge in San Francisco. The bridge has moveable dividers that split the road into one-way sections in each direction and a shared lane that changes direction before morning and evening rush hours. To model this system accurately, a vendor needs to double-digitize the shared lane and flag the lanes with time-of-day restrictions for closures. Or consider the challenge of the European roundabout or traffic circle. Each road meeting at the circle is typically two-way, but the circle permits travel in only one direction.

C. Point-Of-Interest Information

One of the most popular LBS applications is Yellow Pages, or concierge services. Mobile concierge-type services help users locate businesses near a specified location. These services help answer questions such as, "Where is the airport?" "Where can I find a Chinese restaurant?" or "Where is the nearest gas station?" Some services will even make hotel or dinner reservations, order flowers, and coordinate other fetch-and-get tasks. Concierge applications use business and landmark information that has been compiled into POI databases. Integrating the map database with the POI database creates a detailed, digital representation of the road network and business services available along it.

These POI databases contain the kind of detailed information typically found in a phone directory and add value to the map database's geographic content (5). As is the case with a map database, POI databases collected from multiple vendors can be merged to form a single, comprehensive data set. Each record in an individual POI database is geocoded, or assigned a latitude/longitude coordinate, before being combined with other POI databases. After multiple POI databases are integrated, the resulting "super" POI database is indexed and each record is assigned a unique identifier so that it can be associated to a link in the map database.

In addition to permitting the merge of multiple POI data sets, some LBS technology providers let vendors add their own unique POI information to the data set. For example, retail corporations can have store locations digitized, allowing prospective customers to search for the stores closest to them. This allows LBS application developers to contribute unique value to the data and/or to address specific vertical markets (15).

Integrating the map database with the POI database yields a detailed, digital representation of the road network with the accuracy and coverage necessary for high-quality LBS. Some providers, in the rush to get to market, have not taken stringent steps to guarantee the quality of their map databases. Although some vendors handle conflation using rigorous techniques such as Selective Area Merging, many rely on haphazard, manual data-integration methods that result in inaccurate and incomplete product offerings. Only providers who use high-quality data and data Applications.

V. RESEARCH CHALLENGES IN LOCATION-BASED SERVICES

We proceed to describe three research challenges posed by location-based services.

A. Support for Movement Constraints and Transportation Networks

The movements of the users of location-based services are often subject to two types of Constraints. In the *blocking objects* type of constraints, objects block the movement of users. As examples, the movements of skiers are blocked by terrain without snow, and the movements of sea vessels are blocked by land. In the *network* type of constraint, the movement of objects occurs in, and is constrained by, networks. Such networks encompass transportation networks, including road and rail networks, and the infrastructures of buildings consisting of rooms connected by walkways and stairways.Knowledge of such constraints may be exploited by a service to better estimate the position of a user, which may lead to more accurate position information or a lower sampling rate.

Transportation networks1 are particularly interesting. When a user’s movement is constrained to such a network, the movement is effectively constrained to a space with a lower dimensionality [5]. For example, if a user is moving on a road and is interested in advertisements of sales, the problem of finding the locations of sales nearest to the user may in a sense be reduced to a one-dimensional problem, even if the user is really moving in what is perceived as a two-dimensional world.

In the case study, we would maintain a representation of the infrastructure, in which movement occurs, separately from the data warehouse proper. And we would attempt to determine the changing transportation modes of the users. For example, a user may be walking, using public transportation, or driving a car. The user may indicate the mode to 1 Note that a transportation network is different from the mathematical notion of a (directed) graph. In a transportation network the (geographical) location of the nodes is significant, while the notion of position of the nodes in a graph is non-existent. the service(9), or the service may determine the mode based on the user's location, speed, or general movement pattern, or based on yet other attributes.

B. Support for Spatial Data Mining on Vehicle Movement

Location-based services will frequently be used from vehicles. In step with the increasing volume of vehicles, the need for further knowledge about possible routes and traffic conditions, as well as the prediction of troublesome situations gains in prominence.

The area of computer science dealing with the discovery of spatial knowledge is called spatial data mining(6). Typical scenarios in which spatial data mining methods are useful include the following:

Extraction of knowledge about the movement of vehicles based on already existing

Data. Examples are: "busy routes," "number of users moving towards the city center," and "routes on which cars speed up."

Prediction of the times and locations of troublesome situations(10), such as traffic jams.

Provision of alternatives, such as alternate routes with different characteristics (e.g., small probability of accidents, low toll, scenic, small variation in travel time).

For the realization of this idea, theories from the areas of general data mining [3], spatial data mining [12], and trajectory management [11] need to be combined. In relation to

GIS, this should result in efficient support for forecasting and risk analysis based on the analysis of moving-object and static data, including real-time data and stored, past data.To support location-based services, such analyses must occur in real-time.

C. Support for Continuous Location Change in Query Processing Techniques

Two classes of implementation techniques are essential to ensuring adequate performance of querying, namely indexing and pre computation we consider the challenges posed to indexing by the continuous change of user locations .Indexing is a fundamental technique in data management, as it makes it possible to locate desired data items in very large databases efficiently, typically in time logarithmically proportional to the total number of data items. Because data access is increasingly becoming a bottleneck, indexing techniques are becoming increasingly important. Traditional indexing techniques work only for static data, meaning that the indices have to be explicitly updated when changes occur to the data(7). For large, continuous datasets, e.g., those capturing the positions of moving users, the constant updating of the indices would require very large computing resources, rendering the use of indices either impractical or totally impossible. Or, alternatively, the large volumes of updates and the mechanisms that regulate the concurrent use of the indices would combine to block the querying of these structures, also rendering them useless(13).

It is a fundamental challenge how to obtain, if at all possible, the well-known and widely relied upon benefits of indexing when the data being indexed change continuously.Two general approaches may be taken towards accommodating continuity. Techniques may be applied that (i) create less updates, or (ii) the existing techniques may be enhanced to support rapid, non-bulk update(8).

One example of the former is the representation of the movement of a user by a position and a velocity vector, instead of simply by a position(14). With the velocity vector available, the position needs only be updated when this vector changes, which generally leads to less updates. Many techniques may play a part in supporting rapid updates. For example, buffer techniques [1] may be applied. Briefly, these remedy the inefficiencies of transferring blocks with little data between main memory and disk by buffering updates.

VI. CONCLUSION

In this survey we have presented an overview of Location based services and its application. Location-based services is rapidly emerging as a prominent area of deployment of "geographic "and data management technologies, the remainder of the paper is devoted to the discussion of research challenges posed by location-based services. The Challenges concern various aspects of the support for "location."The system from the complex types of spatial regions in which objects move, from the limitations inherent in the capture of the locations of moving objects, from the complex nature of the captured data, and from the rapid database change implied by the capture of continuous movement.

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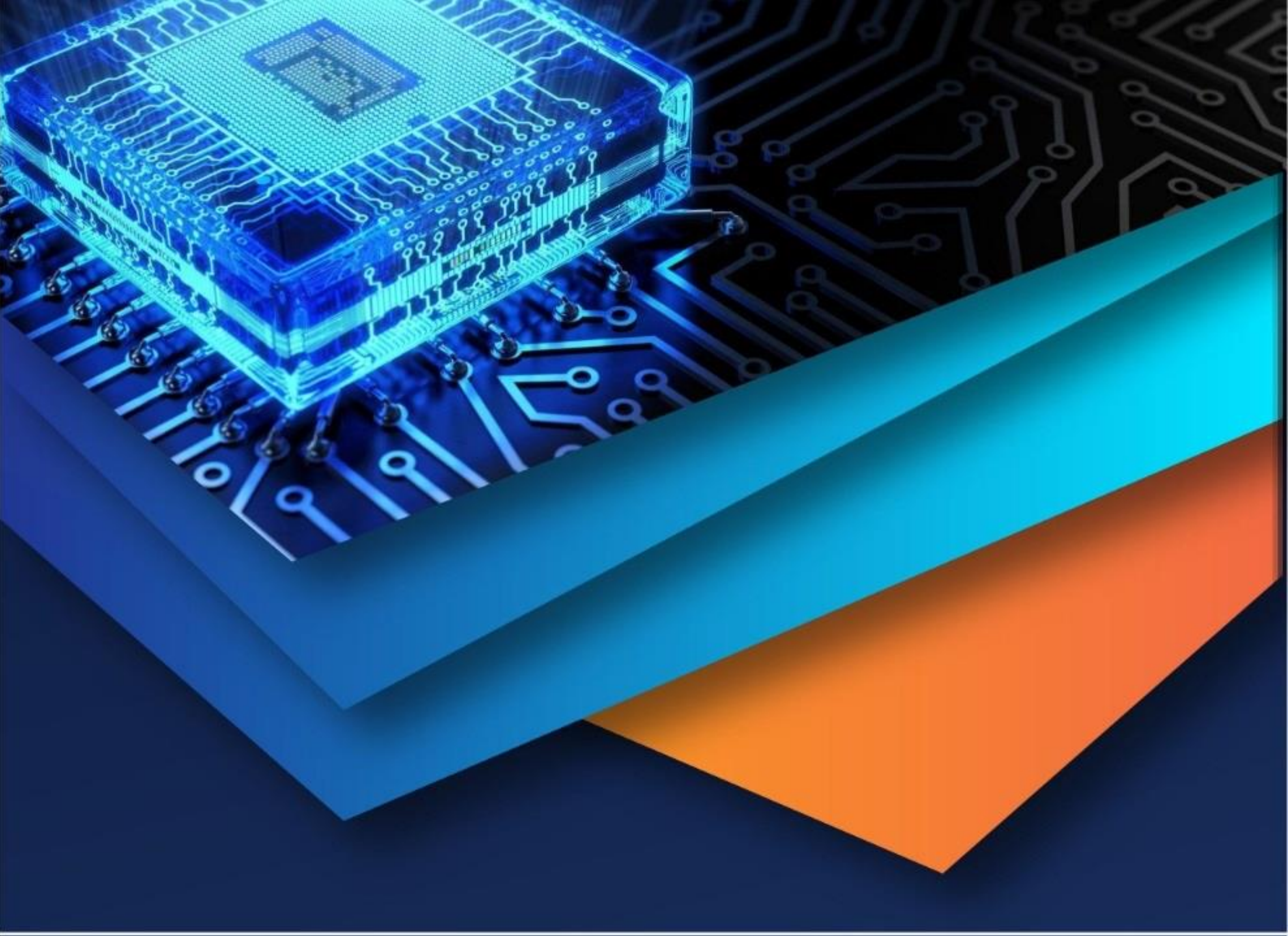

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