Location Based Services – Android App

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Abstract— Initially mobile phones were developed only for voice communication but now days the scenario has changed, voice communication is just one aspect of a mobile phone. There are other aspects which are major focus of interest. Two such major factors are web browser and GPS services. After the release of android based open source mobile phone a user can access the hardware directly and design customized native applications to develop Web and GPS enabled services and can program the other hardware components like camera etc. In our project we are developing android application that give the information about user location and provide additional features to make it more useful and user friendly.

Key words: Location based Services, GPS, LBS

I. INTRODUCTION

With the increasing use of mobile phones nowadays, location based services have become more popular. But such services require location estimation as a major task. We have GPS, the classical way of tracking which involves determining the latitude, longitude and altitudinal position of an object with a very high accuracy. However this requires a dedicated device consuming high power for communicating with the GPS access points. Thus it increases the cost to make avail such service. There are other methods too like Infrared, Bluetooth and Wi-Fi based Positioning. But these methods are mostly used for indoor localization. Hence in the recent years the focus has now shifted on finding other ways of tracking. This has led to the emergence of alternate technologies. GSM localization technique is one of them for outdoor tracking. Use of GSM network for tracking, in the initial days, did not prove useful because of the lack of widespread use of mobiles. But of late the number of mobile users has increased dramatically due to the decrease in cost of mobile communication, as a result of which mobile phones have become a potent tool for tracking.

To introduce this project is our purpose is to mark the mobile phone smarter as that we not seen in early days. To make this application user convenient so that user can track the location of other user, parent can know the child location and user can find the location of their mobile phone in case of mobile phone is lost.

Our aim to is to develop the android based application where the both the user has the android application and any user of the application can know the current location of the user when the both the user make the communication with each other.

II. SYSTEM ARCHITECTURE

LBS architecture consists of following components. According to the description in the business registry, they facilitate integration with each other over the Web. This model makes LBS easy to integrate and roam. When LBS Works under Web Services environment, system components have slight modifications. Functions of each component are described as follow:

A. Location Service (LCS):

In web services each provider must register on UDDI registry with LCS. Considering the functionality of LCS, the infrastructure of positioning in a cellular network is always owned by tele-operators. In this architecture LCS become a Web Services. The LCS Server accepts the requests, estimate location, and returns locations to clients. Client specifies user name, password and one or more MSIDs in positioning requests. Then LCS server shall translate geographical location into a well-defined universal format.

B. Location Based Service (LBS) Provider:

First, client makes request to LBS via Internet or WAP. The LBS queries LCS about geographic locations of targets, identified by MSIDs. Then, LBS gets geographic information from GIS based on the location calculated by LCS. Finally, the responses are sent to clients.

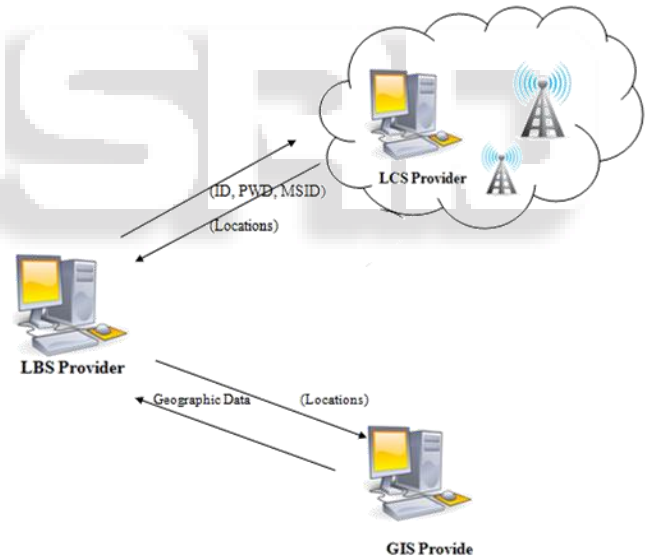

Fig. 1: Working Model of LBS.

The coordinate data of returned locations is expressed as the latitude, longitude and altitude system. If the geodetic coordinate of LCS does not match that of GIS, LBS is responsible for transformation of geodetic datum and coordinate.

C. UDDI Registry:

In our proposed model, the UDDI registry plays a critical role. When a business develops new LBS, it searches UDDI registries for cooperative LCS and GIS providers. Users find LBS in a web services portal, then contact with the service provider. After users install applications and provide the account information, LBS is ready to be used. The UDDI registry is like the phone book for web services. It facilitates the interoperability between providers and clients.

D. LBS Client:

The LBS client in this architecture is also a web services client. When Web services clients communicate with services providers, the application in the client could be generated in design time or run time. The generating time is dependent on resources of clients and services types. In LBS operation model, the client run-time environment is always personal devices. The computing power and network resources are limited because of the light weight and power consumption limitations. So the client application could be generated in design-time, or may be built automatically at first-time execution. If services are not changed, the application generated at first-time execution will be still executed under client environment. This approach can decrease the overhead of computing power. The LBS client needs to specify essential information when client applications communicate with LBS. The information includes user identity, user password and located objects. User identity and password may be stored in client's storage. The located objects are dependent on services types. All these information are stored in client applications and automatically sent to servers when the client uses LBS.

III. LBS COMPONENTS

All In order to make LBS services possible, some infrastructure elements are necessary, including mobile devices, applications, communication network, positioning component, and service servers Mobile devices are tools used by users to access LBS services, to send requests and retrieve results. Such devices can be portable navigation devices (PNDs), Personal Data Assistants (PDAs), laptops, mobile phones, and so on. Application is the interface for users to access the LBS service. It is usually software developed by an application provider, downloaded and installed on user's mobile device. A specific application is usually developed for a specific LBS service. Due to the restrictions of mobile devices (small screen size, limited processor power and memory, battery capacity), LBS applications need to be lightweight and battery saving.

Communication network refers to the mobile network which transfers service request from user to service provider, and requested information back to the user.

A positioning component is usually needed in a LBS application to determine the location of user's mobile device. Service providers maintain service servers which offer different kinds of LBS services to users and are responsible for processing service requests and sending back request results. Servers calculate positions, search for a route, or search specific information based on user's position. Service providers usually do not store and maintain all the information requested by users. Instead, content providers are responsible for collecting and storing geographic data, location-based information, and other related data.

These data will be requested and processed by service servers and then returned to users. Fig.2 shows the interactions among these components, and the process of a LBS service. First, user sends a service request using the application running on mobile device (Step 1). The service request, with user's current location information obtained from the positioning component (in this example, GPS data), is sent to service server via the mobile communication network (Step 2).

The service server requests geographic database and other related database to get required information (Step 3, 4). At last, the requested information is sent back to user's mobile phone via mobile communication network paragraphs must be indented.

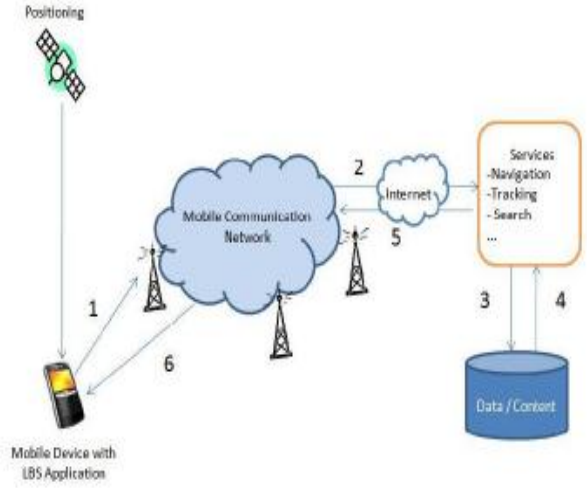

Fig. 2: LBS components and Service Process

Every LBS's contain a number of components including maps and Geographic Information System (GIS) information, location collection services, and LBS application-specific subcomponents. The architecture of LBS can be generalized as shown in Fig 2.

A. LBS Application:

This represents a specific application such as a ―find my friend's application. This consists of a Smartphone component, which has a number of sensors, and potentially a server component that includes application specific data (such as location-tagged information)

B. LBS Middleware:

This wraps access to Core LBS Features (Location Tracking, GIS Provider and Location Collection Services) to provide a consistent interface to LBS applications.

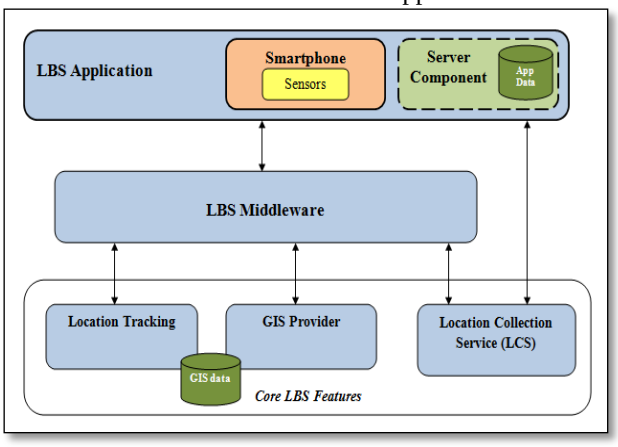

Fig. 3: Components of LBS

C. Location Tracking:

This component stores the location trace of individual users. This represents a fundamental component in next generation. LBS as it contains the data that allows a user's route to be determined and potentially predicted. In

particular, this component would typically support the following functionality:

(1) Keep records on user's current and past locations.
(2) Notify other components when a specific user has moved, or when they move in or out of an area. This supports location-based notifications being sent to users.
(3) Determine which users are within a defined location this supports geo-casting features.
(4) Queries of location trace to generate user movement models.

D. GIS Provider:

This component provides geospatial functionality for many LBSs including map information, map visualization and directory services. Google Maps with its API can be considered a GIS provider.

E. Location Collection Service:

This component performs location collection to get a latitude and longitude for a specific user. Depending on the technology, this component may be accessed via the LBS Middleware (e.g., mobile network triangulation via a service provider) or directly (e.g., via GPS receiver in the Smartphone). Android provides access to the above components to facilitate the implementation of LBS services through the help of following classes;

(1) Location Manager
(2) Location Provider
(3) Geo-coding
(4) Google-Map

1) Location Manager:

Location Manager Class of android is present to manage all other components needed to establish a LBS system.

2) Location provider:

Location provider represents the technology to determine the physical location i.e. to handle GIS. Location Provider component of Android application is a present to facilitate the determination of available provider and selection of suitable one.

Finding the List of Available Location Provider

To get a list of names for all the providers available on the device, call get Providers, using a Boolean to indicate if you want all, or only the enabled, providers to be returned:

```
boolean enabledOnly = true;
List providers =
 LocationManager.getProviders(enabledOnly);
```

In addition to this GPS provider and Network provider can be accessed directly by using the static variables defined in the Location Manager class:

```
LocationManager.GPS_PROVIDER
LocationManager.NETWORK_PROVIDER
```

Furthermore for finding the provider on the basis of some criteria we can use the criteria class and then can find the best provider for defined criteria using the Best Provider Method as shown is the following code snaps:

```
Criteria criteria = new Criteria();
criteria.setAccuracy(Criteria.ACCURACY_COARSE);
criteria.setPowerRequirement(Criteria.POWER_LOW);
String bestProvider =
locationManager.getBestProvider(criteria, true);
```

If more than one provider is available fulfilling the given criteria then the one with best performance is returned. On the other hand if no provider is found for the defined criteria then criteria are loosened in order Power use, Accuracy, Ability to return bearing, speed, and altitude.

3) Geocoding Reverse geocoding:

It provides a way to convert geographical coordinates (longitude, latitude) into street address and forward geocoding provides a mean to get geographical coordinated from street address. For forward geocoding we use getLatitude() and getLongitude() method as shown is the Following code Block

```
double latitude = location.getLatitude();
double longitude = location.getLongitude();
```

For reverse geocoding we use getFromLocation method with geocoder variable as shown is the following code

```
block //geocod is geocoder variable
addresses = geocod.getFromLocation(latitude, longitude,
10);
```

4) Google Map in Android:

Android provides a number of objects to handle maps in LBS system like MapView which displays the map. To handle this a MapActivity class is there. To annotate map it provides the overlays class. Even it provides canvas by which one can easily create and display multiple layers over the map. Moreover, sufficient provisions are there to zoom the map, localize the map by means of MapController.

IV. WORKING OF TRACKING SYSTEM

The technology of locating is based on measuring power levels and antenna patterns and uses the concept that a powered mobile phone always communicates wirelessly with one of the closest base stations, so knowledge of the location of the base station implies the cell phone is nearby. Taking advantage of this property of signal towers and applying some high school geometry, we can actually trace the location of an individual cell phone with an approximate error of at least 25 meters. Here is how you can triangulate a cell phone.

(1) Turn on the cell phone that is subscribed to any mobile service. Once you turn your cell phone on, it will emit and receive signals from different signal towers. The tracing of the location of the cell phone begins here.
(2) Locate the strongest signal tower: First locate the signal tower that registers the strongest signal from the cell phone using Channel API of J2ME. From here, draw the circle that the signal tower can cover. You now know where the most probable area the cell phone might be is.
(3) Locate the next signal tower. Another signal tower will be covering the cell phone. Once you located this second signal tower, draw another circle that the signal tower covers. Ensure that this signal tower will coincide with your first signal tower. If it doesn't, seek other towers. Notice that the circles emanating from the two towers intersect at 2 points. The cell phone will most probably be between these two points.
(4) Locate a third and final signal tower. Select the next strongest signal tower that registers the cell phone. Again, draw another circle that covers the

tower's signal. Ensure that the circle covers at least one point of intersection from the previous circles.

Once we have triangulated the cell phone we wish to communicate with these towers requesting their Cell-ID using Cell API of J2ME and calculating the distance using Euclidean distance formula. Following are the steps for communicating with cell towers:

- Client sends a broadcast signal (with a timestamp field that contains the exact time of transmission of packet) directions so that nearby towers may accept this signal.
- Towers accept this packet and sends an acknowledge packet which contains the coordinates of the tower as well as the original timestamp and unicast it back to the mobile.
- The mobile receives the acknowledge packet and calculates the time interval for the round trip.

V. CONCLUSION

In this paper we probe into Location Based Services, which utilizes the knowledge of the geo-specific location of a location-aware mobile device and facilitates services based on that information. We also discussed about LBS Components and LBS Architecture. Location Based Services uses technologies like GPS, cellular network, Wi-Fi to provide various services. Android provides various services to implement location based applications. Our paper discusses APIs like Location API, Google Maps, Direction API and Places API which helps in making location-aware applications under android platform.

Today android is the most used mobile operation system in the market. Hence developing LBS applications on android platform can help maximum population to get the benefits of this technology. Hence Location Based Services can help the users in a variety of aspects and has a greater scope of development in various mobile operating system technologies like Android.

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