



Potentials of Location Based Services for Pakistani Cellular Market

Shiraz Latif*
Aftab A. Memon*
Ghazanfarullah Khan*
Muhammad Shahzad*

Mehran University of Engineering & Technology

ABSTRACT

Mobile phones are pervasive; according to some estimates, there are 2.15 billion mobile phone users in the world and there are 50 million subscribers in Pakistan. The more mobile devices are sold, the more mobile services are developed and downloaded. Location Based Services (LBS) is one of those popular technologies. It provides valuable information based on user's location such as nearest gas station for drivers and nearest ATM in the vicinity, road route selection (navigation), vicinity gaming, and most of all providing emergency services to the subscribers.

This paper points out some charming applications as a part of location based services which can be implemented to increase the revenue for cellular operators and hence mobile operators will be encouraged to invest in better position determination technology for localization of target mobile.

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1) INTRODUCTION

In the U.S. the FCC requires that all carriers must meet certain criteria for supporting location-based services (Wang, 2000). Dialing 911 from a mobile phone is a location based emergency service application that pinpoints caller's location and relays it the appropriate authorities. The FCC has mandated that all wireless carriers in the United States must provide a certain degree of accuracy in pinpointing the location of mobile users who dial 911 (Wang, 2000). This system was named as E-911. In Europe a similar system E112 is on track to become law by 2011.

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- * Shiraz Latif : shlatif@uit.edu
- * Aftab A. Memon : aftab.memon@muet.edu
- * Ghazanfarullah Khan : mgukhan@uit.edu
- * Muhammad Shahzad : mshahzad@uit.edu

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Ibrahim Hydri Road, Korangi Creek, Karachi-75190, Pakistan.

This paper focuses for implementing a similar system for Pakistan which can precisely gather the target position using particular position determination technology.

According to FCC, there would be a restriction over network operators to provide the location of the caller with certain accuracy, which depends on whether the system is network operated or mobile operated.

In Pakistan, Location Based Services is quite a new concept. Finding the mobile subscriber's current location is a concern for our law-enforcing agencies and intelligence agencies. Tracking of people involved in terrorist activities is the first and foremost priority of our agencies in which they are failed to get succeeded. Our agencies can even record the calls of wanted people but not able to get the target position because the operators do not have any such mechanism to get the target exact position, except the cell-id. Keeping in view the current situations in Pakistan, cellular operators working in Pakistan should be enforced by Government officials to implement the setup for position determination technology. The best way to encourage them is by introducing some appealing Location Based Services which they can include in their Value Added Services and hence can attract more users to get benefited by these services.

2) BACKGROUND

Initially the development of Location Based Services (LBS) progresses with the success of cellular networks. The idea was to transfer a network location into a spatial and descriptive location using spatial databases and GIS to exploit the resulting location information for LBS. However very soon it was realized that the location accuracy is not sufficient to meet the requirements of many applications where you need precise location to be measured and communicated, especially in the case of Emergency services.

Table-1
Mobile phone location determination accuracy requirements

Solutions	67% of calls	95% of calls
Handset-based	50 meters	150 meters
Network-based	100 meters	300 meters

Table-2
Performance comparison of different cellular based position determination technologies

	Accuracy			Consistency	Yield
	Rural	Suburban	Urban		
Cell-Id	>10 km	2-10 km	50-1,000 m	Poor	Good
E-OTD & OTDoA	50-150 m	50-250 m	50-300 m	Average	Average
U-TDoA	50-120 m	40-50 m	40-50 m	Average	Average
A-GPS	10-40 m	20-100 m	30-150 m	Good	Good
	TTF	Terminal	Overhead	Costs	
Cell-Id	approx. 1 s	No changes	Very low	Very low	
E-OTD & OTDoA	5-10 s	Dedicated software	Medium/high	High	
U-TDoA	5-10 s	No changes	Medium	Medium	
A-GPS	5-10 s	Dedicated software	Medium/high	Low to	

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The success for Location Based Services relies on the technology used for Position Determination and how much accurate spatial coordinates it gives to the system for a particular service. Positioning technology for LBS may use satellite positioning, cellular positioning or Indoor positioning like Wi-Fi, RFIDs etc.

Current position determination technologies make use of one of following technologies.

1. Cell-ID,
2. E-OTD,
3. U-TDOA,
4. AGPS

Each these techniques have there own advantages and disadvantages which are summarize in table -2

3) PROPOSED SERVICES:

Location Based Services are classified as emergency, navigation, information, advertising and tracking (G.M.Giaglis). Until now LBS is a new concept for Pakistan, although some developed countries have some LBS implemented in their cellular network. Table-3 summarizes the services implemented in Germany and UK, (Koutsouris, 2007).

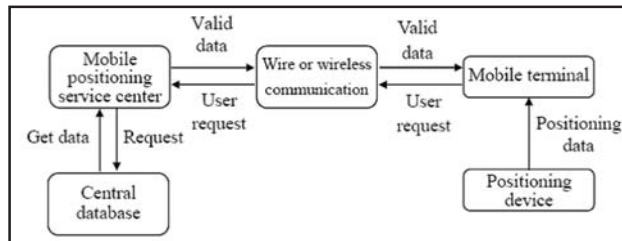
Table-3
Location Based Services implemented by different operators in Europe.

Country	Company	Services	UK	121.2% penetration (1/2006)	
Germany	Vodafone D2	100% penetration (6/2006)	O2	Traffic information	
		Gas stations		Maps (1-mode)	
		Restaurants	Orange	Nearest bank, cinema, train station, Weather services	
		ATM finder	Vodafone UK	Fleet management	
		Yellow pages		Yellow pages	
			"Find your friends"		Maps and navigation (Vodafone Live!)
			Fleet management	Hutchison 3G UK	Maps, Navigation
			Home billing		Nearest hotels, restaurants and shops
		O2	Yellow pages	BT Cellnet	O2
			Fleet management	Virgin Mobile	MVNO: T-Mobile network
			ATM finder	Tesco	MVNO: O2 network
			Entertainment info	EasyMobile	MVNO: T-Mobile network
			Gas stations	Talk Talk Mobile	MVNO: T-Mobile network
			Navigation		
			Taxi finder		
		Home billing			
	T-Mobile	Navigation			
		Car finding			
		Home billing			
	E-plus	Fleet management			
		"Find your friends"			

LBS workflow is shown in Figure-1, it contains positioning device, central database, and mobile positioning services. Two processes are generally included in LBS: collecting the spatial position data, providing the required service (Chen, 2004).

This paper points out some Value Added Services in the field of Location Based Services especially considering Pakistani cellular subscribers tradition and nature.

Figure-1
Work Flow of LBS Applications



1. Safety and Emergency Services:

The most important Location Based Service is the safety and Emergency service. Uptil now it is not possible in our current network to identify the callers exact position. Emergency services will make the rescue operation easier as it will not only tell the rescuer the victim's position where to reach but also can continuously update the victim about the position of the rescue team hence the victim will be mentally prepared regarding the time taken to start the rescue operations.

2. Social Networking:

One of the most attractive Location Based Service is in the field of social networking. A user can activate the service of 'Friend Finder' where you can be informed about the presence of your friend in your vicinity. Let subscriber A is located at coordinate (x1,y1) and subscriber 'B' who is included in subscriber 'A' friends list with a mutual acceptance comes at the same place, subscriber 'A' will be informed that B is at the same place. Hence they can communicate further.

3. Intelligent Transportation System:

Transportation system is termed intelligent if the system guides the rider to take a particular route which benefits him. Currently intelligent transportation system all relies on Global Positioning System (GPS) where each vehicle must be equipped with dedicated GPS receiver. In cellular based ITS, vehicles will be guided using the already available cellular network hence do not need any additional equipment for communication. Some of the applications that can be included in VAS as a part of ITS includes but not limited to Automatic route guidance, travel information, current area information and road safety instructions. Currently available GPS enabled handsets will be handy for these applications. One of the early Intelligent Transportation Systems is Mayday which implements a reactive LBS application for navigation system (Yilin Zhao, 2000).

4. Location Based Billing:

Location Based Billing is an attractive service where a subscriber will be charges at reduced rates if he is using his cell phone at his home. This will benefit the service provider as it attracts the user to use the cellular service while he is not mobile and he has the availability of land line. Another option for location based billing is the selection of home zone where the subscriber will be charged at special rates. There is also an idea of implementing location based billing where the caller will be charged less if the callee is within the same area, building or zone.

5. Parental Eye :

This is the service where parents can get their children exact position. Parents can have

an eye on the roaming of their child and can guide their young child in a better way. This does not only involve keeping an eye on children but also will enable parents as well as other family member and friend to know the position of their loved ones while waiting for them or in other scenarios. Child Locator Service is an example of such applications. (Carrie, 2007)

6. e-marketing:

In e-marketing, different promotion will be sent to the mobile subscriber depending on its current location. For example if a person enters Millennium Mall, he will get the information of any promotion and clearing sale etc on his mobile so no need to look around and keep on searching the promotion banners. The operator may implement the application either as proactive or reactive service.

7. Point of Interest:

Searching for point of Interest is also a valuable application of Location Based Service. Through this application the subscriber will be capable to seek the guidance of some particular point of interest depending on its current location. For example you are at point A and want to look for a petrol pump; you can get all the nearest petrol stations with the route guide. Similarly POI can be nearest ATM machine, nearest mosque etc.

8. Report generation:

LBS can be used to know the current density of people in a certain area (assumption: every person has a single cell phone). For example the population inside a ground, the number of people in the exhibition hall, the number of persons gathered in a political activity. A Case study of Location Based Traffic Report Service can be studied in (Woo-Jin Choi, 2003)

9. Location Based Voting:

LBS applications can be used for location based electronic voting system provided that every individual will be having one and only one cell phone. for example getting the users feedback after visiting certain exhibition. when the visitor is about to leave the exhibition premises, which will be detected by the position determination technology as well as the motion of the person, he will receive a message to reply with his feedback, or even some interactive form can be programmed for this purpose. Similarly voting for best actor in a particular film can be voted inside a cinema hall.

10. Cellular Cab Services:

In Radio Cab services, the customer, let's say in region A, first calls the taxi Radio room to hire the taxi, the radio operator will then broadcast the message to all the taxi driver through leased VHF radio lines, so that the driver currently in region A will reply. After that the driver asked to carry the passenger to the destination. In Cellular Cab Service, instead of involvement of so much working, the customer will be automatically linked to the driver whose location is the nearest to the customer, hence its much faster and less effort is involved.

11. Weather monitoring:

Currently offered weather monitoring service from different cellular operators in Pakistan do not take care of the area in which subscriber resides, rather it broadcasts the general weather profile to the subscribed users. Location based weather monitoring will allow the users to get the precise weather condition according to his own locality.

12. Health care services:

Location based services can be used for different health care applications. An example of such service is the awareness of the population of some particular area for a disease which is common in certain areas. For example if some lake becomes polluted and can be harmful for people, this message can be sent to only the people who live nearby that lake. Digital angel technology provides the location based 'Mobile Patient and automated emergency call' system. (Maged, 2003)

4) FUTURE RESEARCH:

All the above applications of location based services are to be explored in full detail in order to be implemented. A frame work for these applications is the basic need for these specialized applications. Research in the field of position determination technologies is mandatory for the success of LBS. Research is towards finding a PDT which does not only allows the target mobile to be precisely located but is expected not to impose extra burden on network in terms of computation and infrastructure. Also there is a need of research in the network based systems, not terminal based systems i.e. there the current devices should be capable to use the upcoming location based services without much change in the mobile sets.

5) CONCLUSION:

Location Based Services are quite attractive applications to be implemented by the network operators not only as a part of their value added services but also for the security and rescue operation in the country. Subscriber needs and profile do affected by his locality which should be considered while delivering information and personalizing the information for different location users. If Government plays its part to formulate rules for the location determination for mobile devices, the mobile operator will be able to earn revenue by introducing a long list of location based services. Obviously the most beneficent would be the end-user, the subscriber.

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