

Location-Based Services for Mobile Technology in Nigeria

A .N Okumbor

Department of Computer Science,
Delta State Polytechnic
Otefe-Oghara

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Abstract

Real-time location tracking is what location-based services LBS technology depends to function. To embrace LBS the benefits are enormous as it offers customers significant services and its use by companies have found its ways to harness use device information. In this work, the objective is to examine the benefits and uses, the tracking mechanism cum component technologies required for location-based services. The precise location-tracing services incorporates more than one technology and it represent the convergence of several technologies. But privacy remain the primary concern of LBS app users.

Keywords: *Real-time, Mobile, Location-Based, Technology, Services and Tracking*

1.0 Introduction

A location-based service is any technology that depends on real-time location tracking to function. The technology persistently identifies the user's geographical and physical location which is used to perform functions and services. It is commonly used with mobile devices, but it can be applied to any device able to provide a location, including desktop PCs. Location-based services combine information and communication technologies, geospatial technologies and the Internet to provide targeted information to individuals based on their geographic location in real-time. Mobile location-based services consist of a content provider to provide geographic-specific information, an end user's mobile device, a positioning component, a mobile network to transmit the data and location-based services software. It is a set of applications that exploit the knowledge of the geographical position of a client mobile device in order to provide services based on that information. The driving force that captured the interest of the telecommunications vendors, network operators and mobile network users is due to location based services (LBS), and new potential revenue streams it creates (Reed et al, 1998 and Ezema et al, 2014). The objective of this paper is to discuss the benefits, what is used for and the tracking mechanism cum technologies and component required for location-based service.

1.1 Background

According to Heay.Ai, (2022) there are four primary types of location-based services: information services; applications; tracking services; and maps and navigation. In information services local contacts search white/yellow pages, city guides, user generated

content. Applications context are advertising and social networking. Tracking services real-time traffic updates, vehicle tracking, friends and family finder. Maps and navigation are maps, routing, and assisted navigation services

The Benefits of Location-based Services

LBS lets consumers receive personalized ads and relevant content, helps minimize fraud risk and make the most of their traveling experience. For customers, location-based services offer an extra sense of security in emergencies. For example, they can easily access car assistance, and ambulance services can instantly respond if there is an accident. There are further reasons to embrace location-based service (Nadia and Ryan, 2021).

Maximize marketing efforts: You can notify customers near your business's location about current offers and special events, comments and reviews on a location-based app can help attract new customers.

Receive detailed insights into customer behavior: Location-based services can help you understand your customers buying patterns. Whether they take advantage of your offers, how many people visit your business and when they visit.

Improve the customer experience: You can also help navigate them to your nearest store location. By tracking offering loyalty programs and regular check-ins you can identify and reward your best customers. With LBS, you can offer customers relevant content and services rather than annoying them with generic ads and marketing offers.

Uses of location-based services

Companies have found many ways to use device location information.

- a) *Mobile workforce management:* For logistics-dependent companies that employ individuals out in the field or at multiple locations, an LBS lets employees check in at designated locations with their mobile devices. Businesses managing remote workers often rely on geographic data to ensure workers are where they need to be.
- b) *Roadside assistance:* Many roadside assistance companies provide an app that allows them to track exact location if the user experiences a blown tire or car accident, so they don't need to give directions.
- c) *Fraud prevention:* Location-based services can mitigate credit card security risks. For example, an LBS creates another level of security by matching a customer's location to a credit card transaction. Tying the smartphone's location to a credit card lets the company flag transactions made across several geographic locations over a short time.
- d) *Store locators:* These allow retail customers to quickly find the nearest store location.
- e) *Proximity-based marketing:* This means local companies can push ads only to individuals within the same geographic location. Location-based mobile data can improve local marketing strategies by identifying potential customers who are likely to act on the information.
- f) *Travel information:* A location-based service can deliver real-time information, such as traffic updates or weather reports, to a smartphone so the user can plan accordingly.

2.0 Related Literature

Several published stories in the United State (US), regarding the insufficient of emergency services for mobile callers led the Federal Communications Commission (FCC) to announce its mandate for enhanced emergency services for mobile callers in 1996 (Reed et al, 1998). With this, all carrier services common wireless– some special mobile radio (SMR), cellular, personal communication services (PCS) and were mandated to locate a mobile caller within a certain accuracy requirement by October 1997. They were required to implement the Phase I Enhanced 911 service by March 1998. This required the operators to send to the Public Safety Management Centre (PSMC) or Public Safety Answering Point (PSAP) the position of the base station receiving the call and originating number of the emergency caller. With accuracy requirement of 125m as the root mean square (RMS), the final phase was to be implemented on October 1, 2001. The RMS which indicates the location accuracy for 67% of the time as well as longitude and latitude. In phases, the FCC regulations have come with phase II accuracy requirement in use, while the Phase III was announced in February 2015, and expected to be actualized in 2021.

In Nigerian a review of the environment reveals that the technical proficiency and administrative necessary for continuous emergency management are disgusting uncoordinated and insufficient. Irrespective of the application of mobile, web GIS in emergency management a massive mobile subscriber base in Nigeria, the underutilization of these devices is one major reason for delay in response time by police, ambulance services, fire fighter, public safety management agencies (like NEMA) to emergency situation. To efficiently and effectively transmit and update a real-time data using these technologies require stable and excellent network which is far cry in Nigeria. LBS is one technological based service based on mobile application that can help improve emergency services in Nigeria among other applications (Njar, 2015).

3.0 Location-Tracking Methods Work

The most common technologies are Wi-Fi, cellular technology, RFID and GPS. The most precise location-tracking services incorporate more than one of these technologies as contributed by (Freedman, 2022).

Wi-Fi: Short-range positioning beacon location-based services, such as WiFi may be used to geolocate mobile users using indoor location-based services. Typically, a device only connects to one Wi-Fi network at a time, eliminating the possibility of triangulation. Every network has a physical IP address that allows the greater internet to know where it is so it can send information across the internet infrastructure accurately, and Wi-Fi location tracking uses IP addresses. To know your current address, when your phone connects to a Wi-Fi network, it pairs with that network's physical IP address, allowing location services.

Cellular technology: Cellular tracking works much like GPS. Instead of connecting to satellites, your device connects to cellular towers. You will usually be in the range of at least two towers, enough for the system to use triangulation to find your location. For determining the geographic location of a mobile user is with the use of the mobile phone network and the cell ID, which can pinpoint the location of the base transceiver station.

RFID: An RFID scanner typically has a static location; one can log the scanner's location when it pings off other networks. When the RFID scanner is activated, it tags its location

when it records the access. This process can identify the location of the device accessing the scanner. RFID tracking is a combination of these other methods.

GPS: To help find items across the planet, the Global Positioning System is an array of satellites that exist to perform such task. Any device with a GPS receiver (including most smartphones) can ping these satellites. This capability the device communicates with at least four satellites. Where the signal originated the satellites compare the signal delay to pinpoint the signal. This process lets provide turn-by-turn navigation and your phone know precisely where you at each point in time. GPS fleet tracking software, which businesses use to remotely keep tabs on company vehicles and their drivers' performance is a widespread business use for GPS technology. GPS satellites which is a more accurate method as many smartphones are built with GPS receivers.

4.0 Location-Based Service Technologies and Components

Location-Based Service represent a convergence of several technologies, these includes: translating coordinates into human readable address; storing location data and obtaining location information of a mobile device from base stations or satellites. Location Based Service systems contain a number of components as shown in figure 1 and defined by (Steiniger, et al., 2006).

Positioning Component: The user position can be obtained either by using the mobile communication network or by using the Global Positioning System (GPS). The positioning component estimates the user's position using known measurements from fixed receivers/transmitters to estimate the location of a mobile station (MS). It is for the processing of a service request, usually the user position has to be determined.

Mobile Devices: A tool the user requests for needed location information with possible devices include laptops, mobile phones, personal digital assistant (PDA) etc. Location information requested for can be given in form of pictures, text and so on.

Communication Network: The link transfers the user's data and service request from the mobile device to the service provider and then the requested information back to the user. This the connection between a MS and mobile network operator.

Service and Content Provider: Service providers will usually not store and maintain all the information which can be requested by users. But the process service requests of users offer location information based on user's request. This information is stored and maintained by the appropriate authorities for example, industry partners, businesses, governmental and private mapping agencies. Such information for examples includes geographic data and information data of a particular area, state or country. These organizations or agencies maintain the maps by making sure that up-to-date information is made available to service providers when needed and stored.

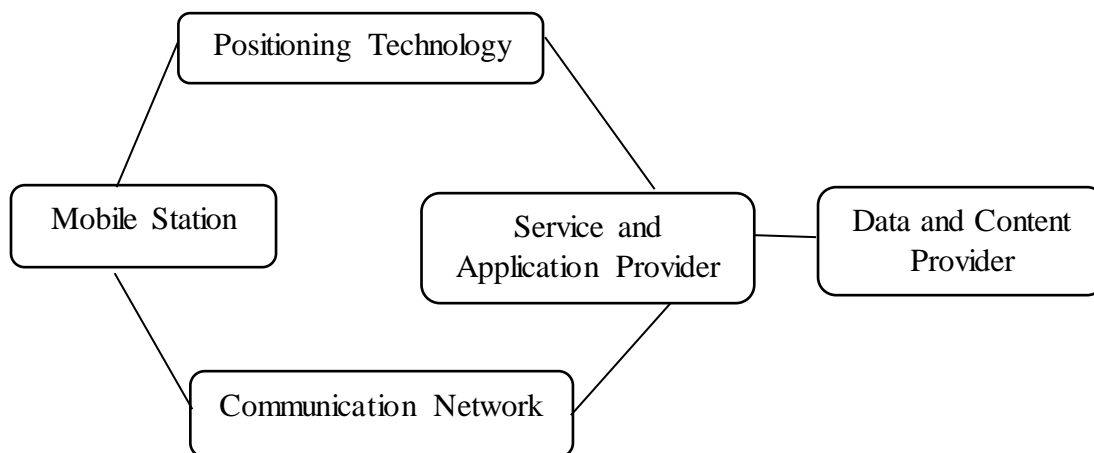


Figure 1: The basic components of Location-Based Service

Device's Location Determination

LBS use real-time positioning methods to discover the location of the device. Locations can be expressed in spatial terms or as text descriptions. A spatial location can be expressed in the widely used altitude-longitude-latitude coordinate system. Altitude is expressed in meters above sea level. Longitude as 0-180 degrees east or west of the prime meridian, which passes through Greenwich, England. Latitude is expressed as 0-90 degrees north or south of the equator. A text description is usually expressed as a street address, postal code, including city, etc. Applications can call on any of several types of positioning methods.

Using short-range positioning beacons: In relatively small areas, such as a single building, a local area network can provide locations along with other services. For example, appropriately equipped devices can use bluetooth for short-range positioning.

Using satellites: GPS determines the device's position by calculating differences in the times signals from different satellites take to reach the receiver. GPS signals are encoded, so the mobile device must be equipped with a GPS receiver. GPS is potentially the most accurate method (between 4 and 40 meters if the GPS receiver has a clear view of the sky), but it has some drawbacks: The extra hardware can be costly, consumes battery while in use, and requires some warm-up after a cold start to get an initial fix on visible satellites. It also suffers from "canyon effects" in cities, where satellite visibility is intermittent.

Using the mobile phone network: The current cell ID can be used to identify the Base Transceiver Station (BTS) that the device is communicating with and the location of that BTS. Clearly, the accuracy of this method depends on the size of the cell, and can be quite inaccurate. A GSM cell may be anywhere from 2 to 20 kilometers in diameter. Other techniques used along with cell ID can achieve accuracy within 150 meters.

In addition, location methods can connect to a mobile position center that provides an interface to query for the position of the mobile subscriber. The API to the mobile position center is XML-based. While applications can be fully self-contained on the device, it is clear that a wider array of services is possible when a server-side application is part of the overall service.

5.0 Potential drawbacks of using LBS

Privacy remains the primary concern of LBS app users. Unfortunately, some businesses can be careless with sharing customer data and storing thereby leading to data breaches and leakage. Company should provide users with a clear and straightforward way to opt in or out of location-based services. For business, reliance on smartphones users without appropriate devices are automatically excluded. The potential effect of a VPN and other factors for determining the customer's location. Increased risk of irrelevance if the user is constantly on the go or traveling and the possibility of getting lost among the noise from other LBS apps.

6.0 Conclusion

We defined location-based services as the technology that depends on real-time location tracking to function. The benefits and uses of LBS were highlighted and related literature were discussed. The technologies incorporate one of such as Wi-Fi, cellular technology, radio frequency identification RFID and global positioning system GPS were examined. The convergence of technologies which LBS represent and the potential drawbacks of using LBS were discussed.

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