Mobile Location Based Services

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INTRODUCTION

Mobility has become a key factor around the world, as the use of ubiquitous devices, including laptops, personal digital assistants (PDAs), and mobile phones, are increasingly becoming part of daily life (Steinfield, 2004). Adding mobility to computing power, and with advanced personalization of technologies, new business applications are emerging in the area of mobile communications (Jagoe, 2003). The fastest growing segment among these applications is location-based services. This article offers a brief overview of services and their supporting technologies, and provides an outlook for their future.

BACKGROUND

The popularity and usage of mobile devices and communications are on the rise, due to convenience as well as progress in technology. This section initially takes a closer look at the underlying statistics and then tries to define these services from a synopsized view of many authors.

While industrialized nations have imbibed mobile technologies by almost transitioning technologies, even in developing nations, mobile communication has taken over fixed-line services (ITU, 2003). This progress is driven by mobile network operators who continue to look for potential revenue-generating business models in order to increase the demand for services, as there is increased competition reducing prices for voice services. One of the popular and progressive business models is mobile location-based services for the Global Systems for Mobile communications (GSM) networks. These services provide customers with a possibility to get information, based on their location. Such information may be, for example, the nearest gas station, hotel, or any similar service that might be stored by the service provider, in relation to any particular locality. These services are location-aware applications (VanderMeer, 2001) that take the user's location into account in order to deliver a service.

Location-based applications have developed into a substantial business case for mobile network operators during the last few years (Steinfield, 2004). ITU estimates worldwide revenues from LBS would exceed US $2.6 billion in 2005 and reach US $9.9 billion by 2010 (Leite & Pereira, 2001). Market research by Strategy Analytics in 2001 indicated that these services have a revenue potential of US $6 billion of revenue in Western Europe and US $4.6 billion in North America by the end of 2005 (Paavalainen, 2001). An ARC Group study predicted that these services will account for more than 40% of mobile data revenues worldwide by 2007 (Greenspan, 2002). According to Smith (2000), more than half of the US mobile customer base was willing to accept some form of advertising on a mobile handset, if they were able to use location services for free. An Ovum study predicts Western European market to touch US $6.6 billion by 2006 (Greenspan, 2002).

Mobile subscribers, especially in industrialized societies, are unwittingly using a location determination technology (Steinfield, 2004) due to the fact that regulators in most of these nations have initiated rules requiring network operators to deliver information about the location of a subscriber to public safety answering points in the event of an emergency. In the US, the Federal Communications Commission requires operators to provide the location of all mobile emergency calls, and, therefore, the market itself was government driven (FCC, 2003). The European Union is developing a similar requirement for its emergency services (D'Roza & Bilchev, 2003). Corporations have begun to realize the benefit in deploying these cost-effective services in order to increase the efficiency of field staff (Schiller, 2003).

Prasad (2003) purports that location-based service is the ability to find the geographical location of the mobile device and provide services based on this location information. Magon & Shukla (2003) agree that that it is the capability to find the geographical location of the mobile device and then provide services based on this location information. The concept of these services is based on the ability to find the geographical location of the mobile device and provide services based on this location information. Therefore, they can be described as applications, which react according to a geographic trigger. A geographic trigger might be the input of a town name, zip code, or street into a Web page, the position of a mobile phone user, or the precise position of your car as you are driving home from the office (whereonearth, 2003).

In the popular context, mobile location services have become solutions that leverage positional and spatial analysis tools (location information) to deliver consumer applications on a mobile device (Jagoe, 2003). Currently, these services are at the conjuncture of geographic information systems and the wireless networking industries. Location information analysis technologies developed for Geographic Information Systems have been repurposed for the speed and scalability of mobile location-based services. Positioning technologies leverage wireless and satellite technologies to perform complex measurements to pinpoint the location of a mobile user—a critical piece of information in mobile location-based applications. Mobile data networks are used for application deployment. The following section aims at characterizing positioning technologies that support mobile location-based services.

CHARACTERIZING POSITIONING TECHNOLOGIES

The critical factor for mobile location-based service is the determination of a user's location, using positioning technologies. Drane and Rizos (1998) emphasize three conceptually different approaches to generic positioning technologies, such as signpost, wave-based systems, and dead reckoning. Within the mobile communication networks, Röttger-Gerigk (2002) distinguishes between network-based and specialized positioning services.

Sign-post systems represent the simplest sort of positioning, which is based on an infrastructure of signposts (i.e., landmarks or beacons). Positions are measured by determining the nearest beacon to the mobile object. Therefore, positioning is reduced to the statement that a mobile object is nearby or in certain proximity of a certain beacon. The accuracy of signpost systems is given by the distance between two neighboring signposts. Currently, signpost systems are used for automatic toll collection on highways (Hills & Blythe, 1994).

Wave-based positioning systems use propagation properties of usually electro-magnetic waves to determine the position of a mobile object. Locations of mobile objects are determined relative to one ore more reference sites. The availability of wave-based positioning systems is limited by an undisturbed reception of the radio waves sent by the reference points.

Dead reckoning systems consist of several vehicle-mounted sensors for the detection of a mobile object's movements. These sensors are used for the continuous determination of a vehicle's velocity and heading. Starting from an initial reference point, a mobile object can be located by logging its speed and heading over time.

Another classification of positioning technologies uses the approach as to where the location of a mobile object is determined (Röttger-Gerigk, 2002). Here, positioning systems are characterized as self-positioning or remote positioning. In self-positioning systems, the position is determined in the mobile device itself. Hence, the position is primarily known by the mobile object itself. Complementary, the information about the location may be transmitted to external systems or partners over a mobile communication infrastructure. Remote positioning systems provide positioning services only for external systems, which can then use this information for customized location base.

The hitherto presented types of positioning technologies usually result in an absolute specification of a mobile user's location. Signpost systems specify a position based on a network of landmarks and wave-

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