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Note from the Authors: This article is an excerpt from Chapter 3, Section 3.5 of *Wireless Internet & Mobile Business How to Program, 1/e*. In this article, we discuss various location-based services and location-identifying technologies under development and in use today. We examine the automotive industry, fleet tracking, wireless marketing and advertising, wireless mapping, security and theft control and location-based technologies used in the agricultural and environmental fields.

3.5 Location-Based Services

The ability to locate users and provide them with information is crucial to the development of the wireless Internet. Some of the most popular applications include fleet tracking, employee and supply management, shipping applications, mapping services and gaming. Location-based services also raise significant privacy questions. Location-identification technology will allow anyone with the right equipment to track the location of a given mobile device at any time. Device manufacturers and legislators will have to regulate location-based services to prevent privacy violations. In this section, we review the applications of location-identification technology and feature some leading providers of location-based services.

3.5.1 Automotive

Automobile-related services were one of the earliest applications of location-identification technology. Drivers feel secure knowing that their cars are equipped with a GPS security system. In the event of an accident or breakdown, emergency rescue systems and towing companies can locate the vehicle using location-identification technology.

The Motorola *OnStar* system, introduced in 1996, provides security and reliability to customers. Its services have been expanded to include such features as *OnStar Med-Net*, a service that gives rescuers instant access to medical histories at the scene of an accident. If drivers are concerned about recurrent noises, poor gas mileage or other common problems with their automobiles, a call to the OnStar Center will provide them with real-time diagnostics. OnStar also offers premium features, such as taxi services, route support and a concierge. Each of these services utilizes GPS technology. Motorola gains 1500 new subscribers to the system daily.[27]

Ford offers similar services to its Lincoln customers through a partnership with ATX technologies. ATX RESCU location-based roadside assistance service has been in use since 1996. Ford has also formed partnerships with Qualcomm and Sprint PCS to provide additional telematics services in a system called *Wingcast*. Wingcast services will be available to U.S. customers in 2002.[28]

Location-identification technology can improve traffic monitoring. Researchers in Maryland and Virginia recently began reviewing traffic patterns via the locations of a number of mobile devices. In the future, commute times will be calculated by recording the actual drive times of motorists, rather than through estimations made by traffic helicopters. Local news organizations will be able to use wireless communications to contact drivers and direct them to alternative routes.[29]

U.S. Wireless Corporation (**www.uswirelesscorp.com**) has formed partnerships with local governments in California and Maryland to analyze real time traffic patterns with wireless devices. Using location pattern matching, U.S. Wireless informs wireless-device users of traffic and alternative routes based on the movement and location of the wireless users.[30]

3.5.2 Fleet Tracking

Location-based services will enhance a company's ability to track its employees and products. This is a particularly important feature for trucking companies. Location-identification technology will allow customers to track each shipment. Furthermore, shippers know precisely where their packages are at all times.

Trucking companies will benefit from location-based services. Truckers that minimize their mileage will save money and "wear and tear" on their vehicles. Terion Corporation has created a solution for trucking companies that is intended to minimize cost, increase customer satisfaction and protect drivers if they are lost or in an accident. The system uses GPS to provide both the dispatcher and driver with real-time location information. A device, which includes a liquid crystal display (LCD) screen for mapping, is mounted in the truck's cab and allows the driver to keep in touch with the company, friends and family.[31]

Cimarron Technologies (**www.cimtechcorp.com/avlsoftware.htm**) offers a GPS-based fleet-tracking system that monitors a vehicle's location, speed and direction. For example, a taxi dispatcher can find the taxi closest to a caller and send the cab to the caller, thereby maximizing the effectiveness of the fleet. Similar fleet-tracking products are available from Manning NavComp (**www.navcomp.com**) and Telogis (**www.telogis.com**).

The United States Army has created the *Army Movement Tracking System (MTS)*, a GPS-based system used to track the location of supply vehicles, weapons, fuel trucks and other military vehicles. Many vehicles do not have radios and have a difficult time locating their destinations. The MTS allows these vehicles to be monitored and directed to their destinations.[32]

Fleet tracking is not restricted to land-based vehicles. The Royal Australian Navy uses location-based fleet tracking to manage its unmanned remote-controlled minesweeping vessels. Fleet tracking and GPS make finding live mines and lost vehicles a safer process. A demonstration of the system used by the Royal Australian Navy is available at **www.gpsonline.co.nz/Products/ProductBrochures/Navy.htm**.

3.5.3 Location-Based Advertising and Marketing

Advertising and marketing applications are some of the most intriguing and potentially lucrative location-based services. Advertisers can offer promotions on shoppers' phones or PDAs. Discounts and promotions can be transmitted to shoppers instantly to entice them into particular stores. Radio advertisers can broadcast personalized commercials to drivers in close proximity to restaurants, sporting events or stores.

Lucent Technologies (**www.lucent.com**) and Profilium, Inc. (**www.profilium.com**) have partnered to offer permission-based, location-sensitive marketing and advertising to wireless device users. Those opting into the service will receive advertisements over their wireless devices.[33]

go2 Systems, Inc. (**www.go2systems.com**) has formed partnerships with companies nationwide to allow users to get directions to local restaurants, schools, shopping malls and various retail stores. A demonstration of its location-based marketing service is available at **www.go2online.com/webbrowser/go2rimFlashDemo.html**. Coca-Cola (**www.coke.com**) has signed a deal with go2 Systems, Inc., to offer wireless users access to local purchasing information on Coca-Cola products. The service will give users discount offers and directions to the nearest retailer.[34] Motorola (**www.motorola.com**) offers a similar service called *Virtual Advisor* in connection with its new OnStar systems. The system alerts drivers when they enter the vicinity of their preferred gas station, convenience store, ATM or any other location specified by users.[35]

3.5.4 Agriculture and Environmental Protection

Planting and harvesting must be executed precisely to produce the best crop yields. Using GPS and other location-identification technologies, farmers can map their lands and maximize the use of each acre. During growing seasons, a farmer can use GPS measurements from previous years to estimate yields and market conditions for the present year. At harvest time, a farmer can plan out the most effective harvesting strategies. GeoFocus, Inc. (**www.geofocus.com**) has developed a product that helps farmers accomplish these goals.

Forestry officials and conservationists can use location-identification technology to regulate planting and logging guidelines. Growth patterns and the effects of deforestation can be mapped and measured. Similar applications can assist officials in protecting wildlife populations, reducing pollution and measuring rainfall levels around the world. The United States Environmental Protection Agency (EPA) has established the Location Data Policy to enhance its protection efforts. The EPA uses advanced mapping systems to locate pollution and monitor environmental hazards. An overview of the Location Data Policy is available at **www.epa.gov/enviro/html/spatial_data.html**.

Navigation and tracking systems are essential to the commercial fishing, shipping and travel industries. A vessel-tracking system based on GPS is available from Sasco-Inc. (**www.sasco-inc.com**). The Sasco product maps oceans and fishing grounds to improve catch percentages and monitor vessel locations. A free software demo of the system is available at **www.sasco-inc.com/demo_form.htm**.

3.5.5 Security and Theft Control

Theft is a concern for any company. Retailers worry about shoplifters, manufacturers worry about the loss of proprietary data and technology and homeowners worry about burglary. Location-identification technology offers a tracking solution for each of these problems. Automobile owners already have location-identification options available as security features. For example, the LoJack® Stolen Vehicle Recovery Network (**www.lojack.com**) uses small location devices in registered vehicles to locate stolen vehicles. If a low-cost tracking method is developed, it will be possible to track smaller, less expensive stolen items, such as sweaters and CDs.

Location-identification technology will also enhance efforts by law enforcement officials to track criminals. Pro Tech Monitoring, Inc. (**www.ptm.com**) offers GPS tracking for this purpose. The systems reduce criminal activity by tracking the movements of paroled criminals. In addition, tracking enables local law enforcement agencies to trace stolen objects and apprehend perpetrators. Visit **www.ptm.com** for additional information and a demonstration of this application.

3.5.6 Accessibility and Wireless Technology

Location-based services offer new freedom to people with disabilities. Individuals can access advanced navigation tools, connect to enhanced emergency services and maintain a feeling of security when using devices enabled with location-identification technologies. A person with visual disabilities navigating the streets could use wireless devices with map-

ping and voice capabilities. As technology advances, maps might be specialized to include landmarks such as park benches and other obstacles.

By using a handheld device with location-identification technology, people with Alzheimer's can access location information, local authorities and family members. For the family members and friends of people with disabilities such as Alzheimer's and autism, wireless location-identification technology can provide peace of mind. The same technology that enables patients to call for help could be built into wristbands for Alzheimer's patients and small children, allowing family members to find them immediately (see the Digital Angel feature).

3.5.7 Wireless Mapping

Mapping services are available on handheld devices. Location-identification technology enhances these services by allowing users to track their locations while they follow digital maps.

GeoView™ Mobile, built on the Palm OS®, is one of many mapping services available to mobile-device users. GeoView Mobile provides users with area maps, landmark information and distance measurements.

The Geodiscovery™ (**`www.geodiscovery.com`**) *Geode™* GPS module identifies a location and guides the user through a city in real time. Maps are available for locations across the United States. The Geode GPS Module uses the *Wide Area Augmentation System (WAAS)* to identify a user's location within a few meters.[37] The module also uses a digital compass to determine the direction the user is facing and provides directions accordingly.

Mapquest (**`www.mapquest.com`**), a leader in Internet-based mapping services, also offers wireless services. Customers using Nokia or Palm™ handhelds can access mapping services while on the road. Mapquest cites traffic updates and precise mapping as major advantages of their service.

Digital Angel: Wireless Location-Based Technology

Digital Angel™ Corporation offers location-based products and services intended to help people who are lost or in distress. These products, which include watches and pagers, are equipped with GPS location-identification technology.

It is not uncommon for a person suffering from Alzheimer's to become lost and disoriented. *Digital Angel™* devices can help friends and family members locate lost Alzheimer's patients. Digital Angel includes a GPS location-identification device and a wristwatch that monitors vital signs such as heart rate and body temperature. The wristwatch includes a panic button, allowing family members and emergency personnel to receive distress calls from lost or ill individuals. In addition, families can request location information and health status of individuals through a password-protected Web site.

Digital Angel also markets its products to parents who wish to keep track of their children. Pet owners can monitor their animals with a Digital Angel device.[36] See Fig. 3.1 for examples of Digital Angel devices. A Flash demonstration of these services is available at **`www.digitalangel.net`**.

Digital Angel: Wireless Location-Based Technology (Cont.)

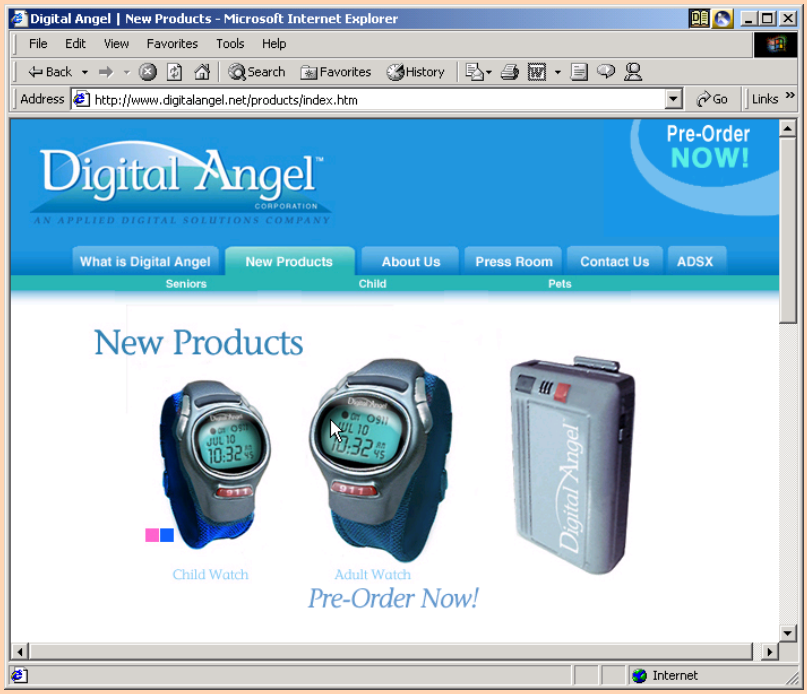

Fig. 3.1 Digital Angel ™ accessibility products. (Courtesy of Digital Angel™ Corporation.)

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