Perimeter Security Using Geo-Fencing Technology

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Abstract— **The word Geofencing has not yet entered common usage, it has been researched for years by all the major mobile companies, and a wide range of Geofencing applications are reaching market. The latest mobile devices utilize the technology to help remind users of tasks that need to be completed, or alert them when their device is outside of the geo-fence perimeter. This technology has tremendous promise for telecare users and people utilizing assisted living technologies. Particularly useful for dementia and Alzheimer's suffers, this technology alerts careers should the user wander outside of, or into certain areas.**

Index Terms— **Geofencing, GPS, Location-based technology.**

I. INTRODUCTION

Recently, Global Positioning System (GPS) receivers have been mounted on Smartphone, cell phones, and tablet PCs. In an outdoor environment, position data can be acquired with more than four visible GPS satellites Moreover, acceleration and magnetic direction sensors are mounted on recent smart phones and tablet PCs. In the current state, assisted GPS is provided to improve accuracy and availability in positioning. The indoor messaging system (IMES) (Manandhar et al. 2008), Wi-Fi (Liu et al. 2012), radio frequency identification (RFID), and Bluetooth have also been developed for use as indoor positioning and navigation services. These indoor systems with Global Navigation Satellite Systems including GPS can provide indoor-outdoor seamless positioning and navigation services. Mobile marketing has become one of the most powerful ways to engage a customer.

Setting up a Geofencing allows marketers to use not only the ability of reaching a consumer anywhere, but the ability to know in the real time when a customer is in a prime area to be engaged. First the basics-Geofencing is the virtual perimeter set around or in a particular location. For example, when setting up a Geofence it could define the area within a certain radius of a location and trigger alerts whenever a device enter or leave that Geofence boundary. The Geofence could be used in such ways around an event, or retail location.

A geo-fenced environment takes this a step further, as it provides a virtual boundary around a specific area for a specific reason. Now, take this concept in your mind, and apply it to a large event. Today, event apps are a must-have, and attendees are willing to opt-in to have immediate and real time access to information wherever they are in the venue. In fact, attendees expect it. And now, with a location-enabled app using geo-fencing, the attendee experience is optimized, they make a stronger connection to the brand, and marketers can measure effectiveness.

II. LOCATION-BASED TECHNOLOGY

Location-based services (LBS) are a general class of computer program-level services used to include specific controls for location and time data as control features in computer programs. This has become more and more important with the expansion of the Smartphone and tablet markets as well. Services which use the location co-ordinates of the end-user to improve the relevance, context, and value of the application are defined as location based services (LBS).
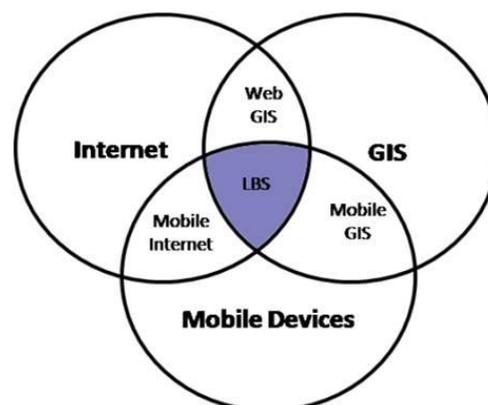

Fig1 : LBS covergence

Maps and Navigation are the basics services and these services are the basic hygiene and increasingly it may not be possible to monetize them. There is huge potential from tracking, information & application services and context advertising would be a way to monetize these services with maps serving as the basic framework. A key requirement for the location based services is to get the co-ordinates of a location with as much accuracy as possible.

Several categories of methods can be used to find the location of the subscriber. The simple and standard solution is GPS-based LBS. Sony Ericsson's "Near Me" is one such example. It is used to maintain knowledge of the exact location, however can be expensive for the end-user, as they would have to invest in a GPS-equipped handset. GPS is based on the concept of trilateration, a basic geometric principle that allows finding one location if one knows its distance from other, already known locations.

III. GEO-FENCING TECHNOLOGY

Geo-fencing technology is gathering attention as one of the most important technologies toward the next generation of location-based services. Geo-fencing is a critical element to telematics hardware and software. It allows users of the system to draw zones around places of work, customers' sites and secure areas. These geo-fences when crossed by an equipped vehicle or person can trigger a warning to the user or operator via SMS or email. In extreme circumstances, the zones can be linked to immobilization equipment within a vehicle and stop the engine.

Fig2 : Geo-fencing

A geo-fence could be dynamically generated as in a radius around a store or point location. It can be a predefined set of boundaries. When location-aware device of a location-based service (LBS) user enters or exits a geo-fence, the device receives a generated notification. This notification might contain information about the location of the device.

Geofencing in a security strategy model provides security to wireless local area networks. This is done by pre-defined borders, e.g., an office space with borders established by positioning technology attached to a specially programmed server.

Geofencing technology is gathering attention as one of the most important technologies toward the next generation of location-based services. When a user enters a geofence, which is a virtual perimeter defining a geographic area, the event is detected and predefined actions are triggered automatically.

Geo-fencing has been touted as one way that non-virtual storefronts can increase foot traffic. When customers who have opted in are within a digital perimeter of a store location, they receive a text message for a special offer, or a deal or coupon to tempt them to actually the store. The basics are simple. But it still depends on customers opting in, so the more creative the campaign, the more likely it is to really work.

Fig3 : Geo-fencing

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The act of geo-fencing generates a notification when a location-aware device enters or exits a geo-fenced area, or crosses a geo-fence. Under this definition, geo-fencing does not directly prevent the user of a location-aware device from crossing a geo-fence, or restrict the functioning of the device.

Fig4 : Geo-fencing Location based area

Various technologies have emerged more recently that are designed to address the issue of distracted driving, by preventing the use of cell phones while driving. Such technologies rely on the ability to detect the movement of the location-aware device at speeds faster than walking. These technologies are not geo-fencing products, as defined above, in that they do not require a virtual perimeter or boundary to

be defined, and they do not generate notifications when such geo-fences are crossed.

For smart phone calendar and to-do list users, Geofencing will alert you as you pass a store that sells the milk you need. For retailers, Geofencing will run your store's app automatically as the user is passing by a store branch, with an appropriate promotion or suggestion. For office workers, Geofencing will notify you when walking by the desk of a person you need to talk to, based on you work flow system to-do list. For companies, Geofencing will protect your vehicles and other assets.

IV. POWER IN GEO-FENCING

Users of smart phones, tablets, and other devices expect position with the highest level of accuracy, always available, with the least amount of power consumed. The application processor (AP) of a handset device is very powerful, and is the part that consumes most of the battery life. Today's smart phone multi-core application processor is faster than many desktop computers that are just a few years old. Whatever the application, when it uses the AP, it can draw up to hundreds of milliamperes (mA).

For the last few years, the trend for GNSS has been host-based positioning. Host-based designs have less logic on the GNSS integrated circuit (IC) and employ the host AP for a portion of the positioning computation. This strategy has three advantages:

- Shares memory and code resources with the application processor.

- Reduces the cost of the dedicated GNSS hardware.

- Sharing the processor makes sense since it is already running.

ALWAYS-ON APPLICATIONS

Geofencing is an application that sends reports or triggers alarms when a predefined area is crossed. For example, users can be alerted to discounts with e-coupons when walking through a mall, or to "don't forget the milk" — users can set their own reminder notifications based off of location; also, social networking. Geofencing applications run in the background for long periods of time, and their main task is to compute positions (fixes) without the need of assistance from other applications.

Geofencing is not something new. API support has been provided in mobile OS for many years, but only now can it be used without draining the battery, thanks to this new host-offload architecture. Figure shows a circular geofence boundary and an alarm. In that example, the alarm was triggered when entering the fence.
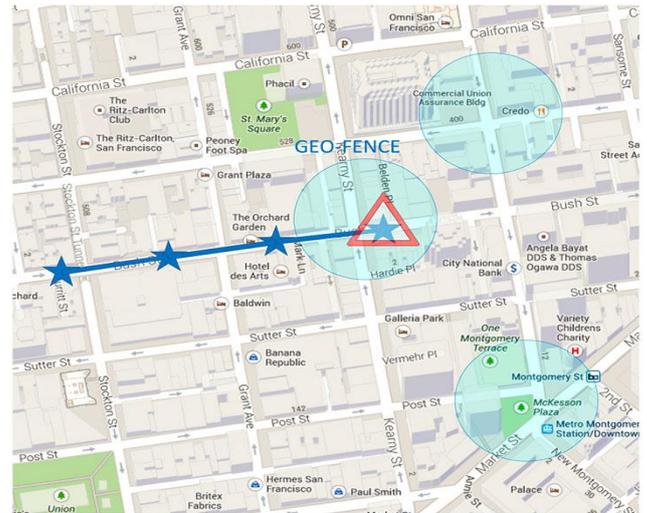

Fig5 : Alarm when the vehicle enters a geo-fence area.

GEOFENCING METHODS

Certain OS application APIs have been supporting geofencing for many years. Currently, we can find geofencing APIs in most of the mobile OSs in the market. There are four main types of geofencing: GNSS software geofencing, GNSS hardware geofencing, network software geofencing, and network hardware geofencing.

TABLE 1 : GEO-FENCING METHODS

	GNSS Geofencing	Network Geofencing
Software	Each GNSS position needs the AP running	Each network cell-id/MAC report is checked by the AP
Hardware	GNSS positions doesn't need the AP	Data-base partially off-loaded from the AP to the HW

V. APPLICATION OF GEO-FENCING

Geofencing is emerging as a key technology enabler for a new generation of mobile applications, services and business models. While the word Geofencing has not yet entered common usage, it has been researched for years by all the major mobile companies, and a wide range of Geofencing applications are reaching market. Geofencing is poised to revolutionize smartphone applications and services. Applications become proactive, running automatically when nearing a relevant location, and targeting their services to the user and to the location.

Geo-fencing (Geofencing) is a feature in a software program that uses the global positioning system (GPS) or radio frequency identification (RFID) to define geographical boundaries. A geofence is a virtual barrier. Programs that incorporate geo-fencing allow an administrator to set up triggers so when a device enters (or exits) the boundaries defined by the administrator, a text message or email alert is sent. Many geo-fencing applications incorporate Google Earth, allowing administrators to define boundaries on top of a satellite view of a specific geographical area.

Geo-fencing uses in the many fields such as:

USE	EXAMPLE
Fleet Management	When a truck driver breaks from his route, the dispatcher receives an alert.
Human Resources	An employee smart card will send an alert to security if an employee attempts to enter an unauthorized area.
Compliance Management	Network logs record geo-fence crossing to document the proper use of devices and their compliance with established rules.
Marketing	A restaurant can trigger a text message with the day's specials to an opt-in customer when the customer enters a defined geographical area.
Asset Management	An RFID tag on a pallet can send an alert if the pallet is removed from the warehouse without authorization.
Low enforcement	An ankle bracelet can alert authorities if an individual under house arrest leaves the premises.

VI. CONCLUSION

Geofencing is poised to revolutionize smartphone applications and services. Applications become proactive, running automatically when nearing a relevant location, and targeting their services to the user and to the location. In this technology trend report, Geofencing: Enabling Location-Based Reminders, Ads, Promotions, Proactive Apps, Security & More, Grizzly Analytics answers the questions you have about this new technology. Geofencing will protect your vehicles and other assets. These are only a small number of the myriad of applications and services that Geofencing enables.

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