Location-Aware Tracker for Mobile Ringing Tone Management

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Abstract: User/Device tracking were developed before the mobile device has been introduced to the market. The traditional system includes a secure and expensive system such as RFID and Thumb print technology. With the emergence of the GPS enabled device in smart phone, there is a need to introduce a smart phone as a medium for entry and exit events to design and implement many location context aware real–time applications. To comply with the regulation, user must have their cell phones set to non disturbing modes during different activities viz. attending lectures, consultation with their professors, in libraries, in hospitals, in conferences etc. Therefore user need to have their phones automatically switched to silent mode or vibrating mode while he/she is involved in one of these activities and switch back to original ringing mode when they are engaged in none of these activities. In this paper, we will discuss the Geo-fence technique and its implementation to track and trace the user using

android platform. From the implementation, the system has been successfully tested in real situation.

Keywords: GPS, Smart phone, Geo-fence, Events, Geographic data, LBS.

Introduction

Location based service is the one which compute location with the help of the location providers. There are two widely used location providers named GPS provider and network location provider. The GPS provider picks location by extending GIS capabilities and it needs no internet connection whereas the network location provider picks location based on the cell phone tower. So it needs any one of the mobile networks or Wi-Fi to be enabled. The location details are taken as the two parameters such as latitude and longitude. These parameters will be converted in the form of address or anything depends on the requirement of the service created.

Usually location based services are very popular by performing some event required by the user. But generally, these services are provided to target somewhat limited population of specific domain. For example, “Forget-me-not” application is one of the location based services that will provide the ability to remind about the activities yet to be completed in organization and “Tour-Guide “and “Mobile Tourism Directory” will provide tour information services by people-centric computing. Location-based technology is opening up a world of possibilities for marketers — but it’s also complicated, as new capabilities and use cases seem to emerge every day.

A Geo-fence is a virtual boundary for a real-world geographic area. Geo-fencing combines awareness of the user's current location with awareness of the user's proximity to locations that may be of interest. To mark a exact location, it should specify its latitude and longitude. To adjust the proximity for the location, it should add a radius. The latitude, longitude, and radius define a Geo-fence, creating a circular area or fence around the location of interest.

Geo-fencing is executed on the mobile devices. It includes the continuous positioning and/or tracking of the mobile device as well as the continuous matching of the mobile device's position with a set of virtual boundary.. Geo-fence can be circular or polygonal [1][2]. The mobile device is considered to be a client that is mainly responsible to locate itself and the continuously comparison of the mobile's position with a large set of geo-fences.

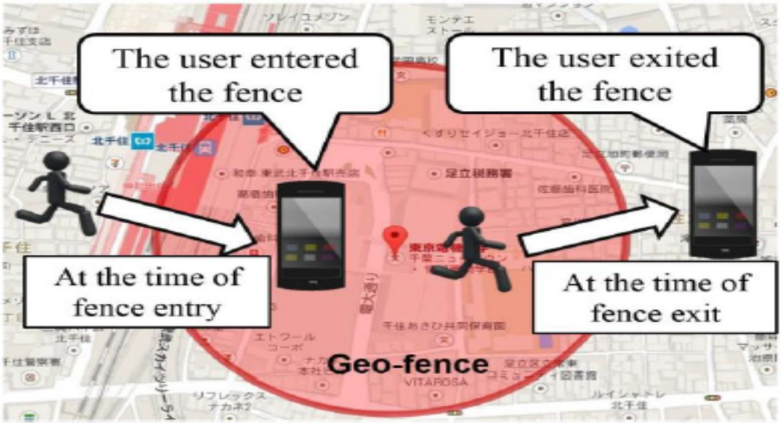

Fig.1 Geo-Fence

Geo-fencing is mainly the use of the Global Positioning System (GPS) satellite network and/or local radio-frequency identifiers (RFID such as Wi-Fi nodes or Bluetooth beacons)[3] to create geo-fence i.e. virtual boundaries around a location in map. Geo-fencing uses GPS coordinates to encapsulate a geographic area and takes a mobile user's (who has opted in to receive push notifications)[4] location data via GPS to determine his/her proximity to that particular region(whether mobile user inside geo-fence or outside geo-fence or if mobile user just went in and came out of that particular area in a matter of seconds).

This paper is organized as follows. In Section II, we will investigate the research background. The design of the proposed system is presented in Section III. The implementation and experimental results are described in Section IV. Finally, Section V provides concluding comments and suggestions for further research.

Related work

Location Based Services (LBS) have become more and more important with the expansion of Smartphone and Tablet PC markets as well [5-12]. LBS are used in a variety of contexts, such as health, indoor object search, entertainment, work, personal life, *etc* [5, 8-12, 18]. Especially, the term "geo-fence" or "geo-fencing" using LBS is popping up all over discussions of location-based services, with a special focus on its use in retailing [15].

A geofence is a virtual perimeter for a real-world geographic area [13, 14, 16]. A geo-fence could be dynamically generated - as in a radius around a store or point location or a geo-fence can be a predefined set of boundaries, like school attendance zones or neighborhood boundaries. Custom-digitized geo-fences are also in use.

The term "geofencing" is used from around 2000. It appeared in research literature by Munson and Gupta [22] in 2002. Geofencing is one of core technologies today for location-based services (LBS) including advertising, tracking, and risk management. Szczytowski [23] proposed an approach based on combining geofencing with social networking systems (SNS) to organize unstructured information collected from SNS. Yelne and Kapade [24] designed a help-me application running on an android operating system based on geofencing. Detection accuracy and power consumption are very important for geofencing applications. Nakagawa et al. [25] proposed a method for position detection whose activation frequency is determined by speed toward the target spot. Alsaqer et al. [26] investigated accuracy and battery-use of Esri's geo-trigger service in small, outdoor, geo-fenced areas. Akira Suyama et. al.[27] proposed a method for disaster information system.

When the location-aware device of 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. The geo-fence notice might be sent to a mobile telephone or an email account. For example, Geo-fencing or targeting shoppers near the point of sale are also catching on, express offers coupons to

those in and near its stores with its mobile application. The North Face offers deals not only to those near its stores, but also to those in recreational areas, via its VIPeak program. Its application offers lots of product info and great videos that the company's shoppers can engage with even when they are not shopping.

Many geo-fencing applications incorporate Google Earth, allowing administrators to define boundaries on top of a satellite view of a specific geographical area. Other applications define boundaries by longitude and latitude or through user-created and Web-based maps. Recently, according to Google Co., Android location services now support geo-fencing from Google I/O 2013. With the new geo-fencing API, an application can define geographic boundaries around specific locations and then receive notifications when a user enters or leaves those areas. Even in the hardware field as well as software, there are emerging new devices such as Broadcom Corporation's GNSS(Global Navigation Satellite System) location chip with geo-fence capabilities, Philips' Hue light bulbs[18, 19].

The Proposed system

Fig. 2 shows a flow of data and processes within the system. Administrator will create using Google Map API, required number Geo-fences as the case may be and add them to the database. User can register for any or all the Geo-fences thus created to avail the services. When user enters into any one of the Geo-Fence, his/her phone ringing tone will switch to salient or vibrate mode and entry-time is recorded in database automatically without intervention of user. When user exits the Geo-fence, ringing tone will switch to original tone and exit time is recorded. The process of checking boundary for correct location of each user will be done automatically by system using data provided by administrator.

The following algorithm will be invoked by two modules, which are Entry and Exit events. The algorithm will automatically check the boundary for each user based on information provided by administrator. The algorithm will be able to recognize the users in an organization and works in different location by a set of

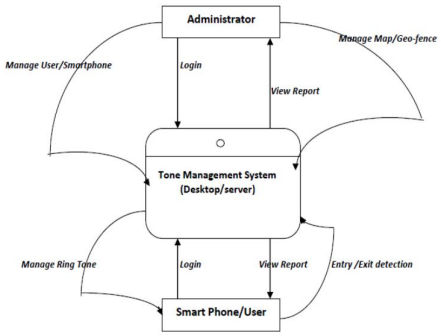

Fig.2 Context Diagram of Location Context-Aware system

GPS locations belong to certain users. The algorithm below assumes that Geo-fence is already created with appropriate location <Longitude, attitude> and radius and it is enabled. If the user is out of the boundaries of the Geo-fence, the system will not have any effect on user and hence on his device.

START

1. Login by user <get the UserID >;
2. Searching for GPS Location;
3. Read GPS location <longitude, Latitude> of user;
4. switch (Event) {
5. case “entry”: // Geo-Fence Entry by user
    - Save the current ring tone;
    - Store the entry- time into database;
    - Switch the ring tone to Salient or Vibrate mode as per the information stored in the database at the time of user registration to appropriate Geo- fence;
    - break;
6. case “exit”: //Geo-Fence exit by user
    - Restore the original ring tone;
    - Save the exit-time into database;
    - break;

7. go to (2)

END

Implementation and Results

Mobile ringing tone management system by GPS enabled Android smart phone is the system that using Geo-fence Technology and GPS allow the user's smart phone to switch from current ring tone to either vibrate or salient mode automatically without intervention of users when he/she enters into Geo-Fence and allow the smart phone to switch back to original ring tone when he/she leaves Geo-fence. Also, it stores entry and exit time into database for further uses to track and trace user whereabouts. It is suitable for the reserve premises viz. Lecture room, libraries, conference hall, Hospitals etc. where the salience and discipline are desired. The system provides ease of management for the administrators to create geo-fence, add users, view and track users. This system can also be adopted for many other applications with little or no modifications viz. staff attendance in an organization, monitoring student's activities in school and college campus etc., in more secure and effective manner.

Fig.3 Screen to manage Geo-fence and users

Fig.3 shows the main interface for MRTM application. Through this interface, Administrator may create and set boundaries for geo-fence, add new users, view list of Geo-fences already created and stored in the Database.

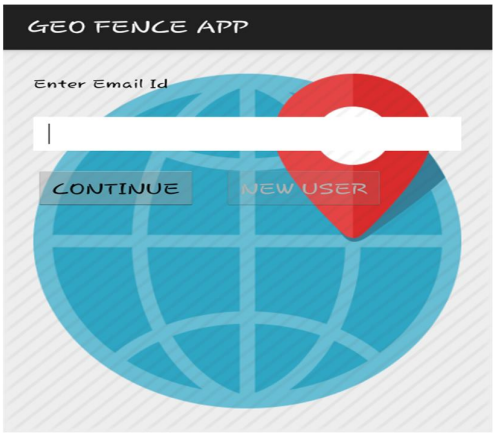

Fig. 4. User Registration Page

Fig. 4 shows the registration interface for MRTM application. New user can be registered through this interface. If the user is already registered, then he/she may login once using valid User ID to avail the features of the application.

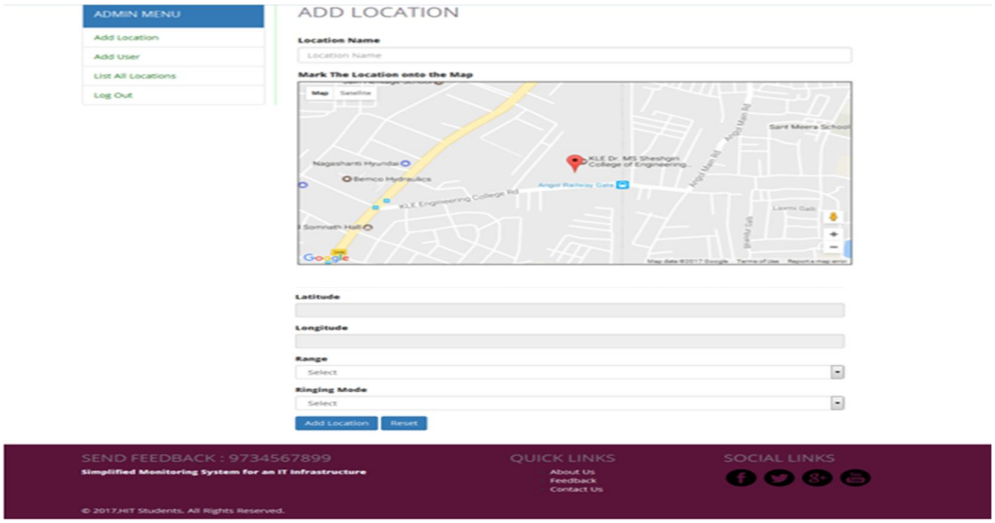

Fig.5 Screen to create Geo-fence and define the boundary

Figure-5 shows the interface through which an administrator can add new Geo-fence. The GPS location <longitude, latitude> is collected automatically by pointing on Google Map for the desired point and boundary is defined by

entering radius manually. All the created Geo-fences are stored in Database with unique ID.

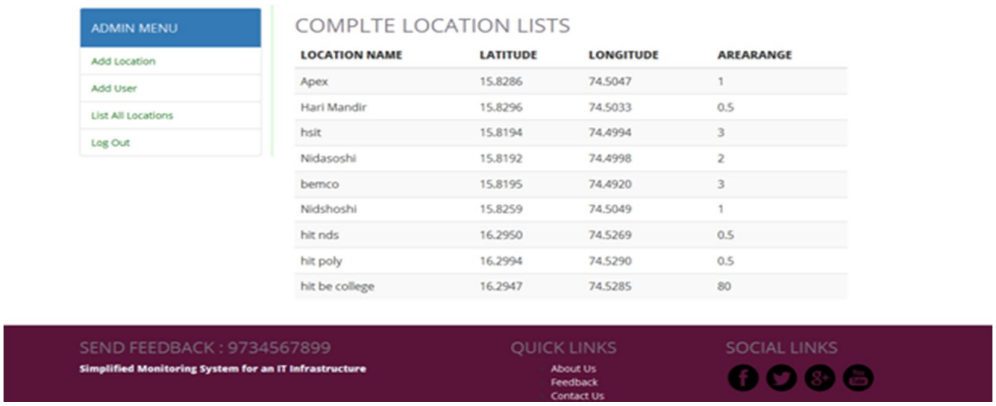

Fig.6. Database of Geo-fences created

Fig.6 Shows list of Geo-fences created and stored in database with attributes: <location ID, Longitude, Latitude, radius>

Conclusion

The Mobile Ring Tone Management System developed, consists of an Android smart phone, GPS Technology, Wi-Fi access point, Geo-fencing Technology and a server. The function of the entire system is very simple. It involves the GPS receiver embedded in a smart phone to get the registered user location and automatically switch from current ring tone to vibrate/silent when user enters into Geo-fence and vice-versa when user leaves geo-fence. It will also maintain the entry and exit times, so that one can use it to track and trace the user. The system is a possible option for replacing the current methods such as Jammer. It provides a user friendly GUI to administrator to Acquire and Manage user database and his/her Device. From the implementation, the system has successfully tested in real situation inside and outside the building. The future scope of the application is to develop for other phones as well such as Symbian, Blackberry, and IOS. The

proposed system can be extended for other applications in conjunction with WPS (Wi-Fi Positioning System), HPS (Hybrid Positioning System) in future.

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