Research Paper

Implementation of GPS Based Object Location and Route Tracking on Android Device

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ABSTRACT

Location based services has enable people to locate and track the location of other people, objects, machine, vehicles and resources, from the comfort of their home as long as they have the required gadget such as smart phone, PDA’s, and others (Adusei, et al, 2004). Requesting location sensitive information is usually initiated by a user called the client or network provider. Most application today use Global Positioning System (GPS) provide location information; for example social network site like Facebook allow users to share their location with friends and family, another common example are application that allow users retrieve weather forecast data based on their current location.

With the numerous benefits emanating from the use of location-based service, there is however issues that bothers on the privacy of user; hence there is need for proper government regulations.

The purpose of this project to develop a tracking / monitoring Android application (mobile) using object GPS devices to ascertain its current location, and previous location at specified intervals, this system unlike previous tracking system will give user the ability to create
bookmark of current location and ability to route back to that location from anywhere using Google Maps API's in case they can't remember the prices location.

**Keywords:** Global Positioning System, Location Based Service, Tracking, Privacy, Android device.

1.0 INTRODUCTION

1.1 Mobile Applications

Mobile applications are usually accessibility through various distribution platforms that are either under individual or organizational control common examples of such platforms are Google Play, Window Phone Store, Blackberry App World and Apple App Store. There has been a proliferation in mobile application development which has further accounted for application such as LBS (Location Based Services), GPS (Global Positioning System), factory automation, gaming application, mobile banking, and order tracking applications. LBS and GPS which actually are extension of mobile apps is the central focal of the proposed system and research work.

1.2 Background Study

LBSs (Location-Based Services) are model for organization and clients to easily gain access to geographical location of an object of interest which will either be a smart phone, tablet or PDA’s. A common example of using an LBS will be to locate restaurants, or nearest train station using any of the listed handheld devices. Since July 1996 when FCC (the Federal Communication Commission) issues the operational permit for the provision of emergency wireless services, Location Based Services has gradually become the major focus of mobile operators (Adusei, et al, 2004)

Location-Based Services (LBS’s) are used majorly in obtaining the current and previous location of users (actually objects such as smart phones held by the user) with this information we can provide information that may answer questions such the GPS location (Longitude and Latitude), predict the future location of that object with data mining, tracing back to a previous location (Adusei, et al, 2004). Wang, et al (2008), asserts that these services also include:

At this point it is very important to remember that Location Based Service is actually an intersection of three main technologies which are; "New Information and Communication Technologies" that encapsulate “mobile telecommunication system”, handheld devices and GIS (geographical information system) (Shiode, et al, 2004)
1.3. Problem Statement

So far the available device tracking systems are mainly (Global Positioning Systems) used specifically for space orientation and navigation. Some of the problems that the author has been able to identify with the designs of existing Location-Based Service are listed below:

- Most of the LBS application that has been developed don't produce very accurate result
- Privacy of object that is location is been track has been a challenge.
- Inability to predict future location from store data
- Improper application / utilization of data mining algorithms.

Objectives

The objectives of this research work are:

- To develop a system that will be able to locate the GPS position of device and track its current route
- To develop an algorithms that will enable end user bookmark their previous location and trace back to that location using descriptive navigation mapping
- To create an interface to Google Map and obtain data
- To Install and test the application in an Android mobile operating system.
- To evaluate critically the applications performance with that of existing systems.
- To send notification to the tracking device if a tracked devices changes location

2.0. LITERATURE REVIEW

2.1. Timeline of Events leading to LBS

Location Based Services has developed in a gradual and progressive manner over the year. In this section of the review of literature the author seeks to provide a chronological events leading to the present-day state of LBS.

In the year 1996, the government of United State approved the use of selective accessibility of Global Positioning System signals in order to allow the quick retrieve of high precision location data for navigation. The authorization also mandated network provider to provide enhanced emergency service that will aid in locating all mobile phone (users) within US. This is actually the beginning of LBS.
The development of Google Maps API in the year 2005, allowed java based mobile phone to display mapping information. Google Maps Application Programming Interface allowed maps to be easily integrated into website for all forms of geo-tagging and information mash-ups. Google also purchased Android Inc, a mobile device platform in 2005 (Steele and To, 2011).

In June 2007, Apple released the first iPhone with map, accelerator and GPS, facilities. IBM in the year 2009 released a major application that provided new technique of visualising LBS (Shek, 2010).

2.2. Components and concepts of Location Based Service (LBS)

The various components that makes up the Location-Based Services architecture are depicted in Figure 2.1 below are mobile devices, communication network, positioning component, application / service providers and finally data / content provider.

In order to better understand the project better it is important to have a closer look at the LBS architecture shown in the Figure 2.1. The core components are directly linked with object route and location tracking. The functionality of the main features of LBS which are essential for the implementation of this project is discussed briefly in the section below:

2.2.1. Location Tracking – This component allows the route and location of a GPS device to be tracked and stored (Shek, 2010). Some function of location tracking component as given by Shek (2010) are:

- Record current and past location of an object / device
- It helps in notifying other components when a GPS object / device moves in and out of a specific location. It serves as the basic for sending location changed alerts.
- It has support for geo-casting feature which helps in detecting all objects within a well-defined location.
2.2.2. **Location Collection Services** – this component is used in obtaining the longitude and latitude values for any object / device.

Global Positioning Systems (GPS) receiver on android devices receives radio-signal from the satellites and then compares it with local geo data duplication in order to calculate the actual location of the device / object on the Earth. The address / street name of the location the device can be derived from Google Maps API. Data receives from satellites can be used to perform two or three dimension location calculation (Two dimensional includes only the longitude and latitude while three dimensional includes longitude, latitude, and altitude) which can increase the accuracy of result (Gadri, et al, 2012).

2.3. **ANDROID**

The word “ANDROID” is an acronym for “Automated Numeration of Data Realized by Optimized Image Detection” (Gadri, et al, 2012).

“Android Beta SDK” an open source and free mobile OS was released in November 2007 by Open Handset Alliance (Rani, et al, 2012) based on Linux 2.6 kernel

**Features of Android OS**

- No distribution / licensing fees is required
- Support complete IPC message passing
- Application and background processes can run concurrently on the device
- It utilises shared data stores
- It is supported by 3G, 4G Edge network and GSM
- Full interactive multimedia programs hardware mechanism is possible
- Inbuilt API’s (Application Protocol Interfaces) such as GPS used for location based services.

2.4. **Related Works**

There have been several researches relating to mobile communication. As stated earlier, mobile applications generally were developed to improve / boost productivity and retrieval of information such as e-mail, date time calendar, stock price, contacts, and weather report nevertheless with increasing demands and high availability of development tools application in categories such as order tracking, factory automation, GPS, location based service and mobile game quickly exploded the market making human more dependent on smart phones.
Further insight was provided by Shek (2010) about the opportunity of next-generation Location Based Service applications on smartphone and imminent trends in Location Based Service (LBS).

2.4.1 Recent researches on device tracking with android

Some useful tracking applications which have been built on Android mobile platform are:

1. LifeMap application by Chon et al (2012)
2. The “next generation children tracking system” built with java the MANET was based on Bluetooth hence it had nothing to with GPS or location manager (Morii et al, 2012).
3. Rani et al (2012) designed an android routing application used for discovery the route between two locations.
4. Gadri et al (2012) designed an android based land vehicle tracking app using. Their application was able to determine and display the current location of land rover that has an embedded GPS receiver on a map

2.4.2. Comparison between the proposed system and other related systems

<table>
<thead>
<tr>
<th>Name</th>
<th>Security</th>
<th>Accurate Prediction</th>
<th>Usability</th>
<th>Bookmarked Certain Location</th>
<th>Trace Bookmarked Location</th>
<th>SMS Notification</th>
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<td></td>
<td></td>
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<tr>
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</tr>
</tbody>
</table>

Table 2.1 – Comparison with existing system

2.4.3. SUGGESTIONS TO THE PROBLEMS STATEMENTS

- Most of the LBS application that has been developed doesn’t produce very accurate result-GPS, Wi-Fi, 3g and 4g mobile networks are the main location collection technologies. Global Positioning System (GPS) which is composed of GPS receivers and satellites produces the most accurate location collection result and it is not dependent on mobile network provider. To solve this issue the proposed system will use GPS technology.
• **Privacy of object that is location is been track has been a challenge.**

Privacy of users will be given a top priority, this application will use location information with the complete knowledge of the user and in the case on monitoring employees it will only access such information only during office hours that way the user’s privacy wouldn’t be compromised.

• **Inability to predict future location from store data & improper application & utilization of data mining algorithms**

The proposed system will use a predictive algorithm which will enable user store specific location which they which to remember, the system will then be able to direct the user to that spot using Google Maps API.

The proposed system would incorporate features that will help solving data mining problems associated with location based system, using the bookmarked information to predict and route location.

**3.0. RESEARCH METHODOLOGY**

In this chapter the author will focus on identifying the research and system methodology which will be used for the proposed system “Implementation of Object Location and Route Tracking on Android Device Using GPS”.

**3.1 Research Methodology**

The author chose to use **quantitative** research methodology because it best for project that target a large audience, giving strength and accuracy to the research argument and work being carried out. It can easily be distributed online via email, or phone.

**3.2 Research Design**

**Questionnaire** - The method that will be used for this research is "questionnaire"; these questions were designed and target at organization, employees and individual.
3.2.1 Analysis of Questionnaires

This author in this section will provide a comprehensive analysis of the outcome of data which was collected thorough questionnaire survey embarked on for the proposed GPS Tracking system.

3.2.1.1. Showing the Age bracket of respondents and Correspondent Occupations

Chart 3.1 Pie Chart representing age distribution

Chart 3.1 shown above represents the age bracket of respondents who participated in this survey. From the chat above 3% of participants are 19 years and below, 17% are 35 and above, another 33% are between 19 and 24 while 47% are between the ages of 25 - 30.

Also Chart 3.2, above shows that the majority of respondent that participated in this exercise are worker class adults with 50%, 24% of respondents are student, 17% represent company owner / director and 6% are lecturer making a total of 100%.

3.2.1.2 Correspondents who think it is right for organization to monitor their workers while on duty and number of correspondent who are using Android smart Phones

Chart 3.2 Pie Chart representing the occupation

Chart 3.2 shown above indicates that the majority of respondent who believe it is right for organization to monitor their workers while on duty are Android users with 70% and others with 30%.
The bar chart shown above represent of number of students, lecturers, company directors and worker who think it is ethical for organization to monitor their own staff when they are officially out on an assignment. The result shows that about 12 students disagree, 10 strongly agrees, 8 agree and 2 disagree, about 7 company directors strongly agree, about 3 agrees, and about 11 workers strongly about 7 agree, about 8 strongly disagree, and about two lecturer agrees. The analysis show that most respondent think it is appropriate for organizations to monitor worker on assignment. And the Chart 3.4 Pie chart representing Respondents who have Android smart phone, from the analysis, 70% are Android smart phone users while 30% are using other mobile operating system.

3.2.1.3 Those who think tracking is a violation of privacy

<table>
<thead>
<tr>
<th>No. of Respondents</th>
<th>No. of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes 45%</td>
<td>No 20%</td>
</tr>
<tr>
<td>No 55%</td>
<td>Undecided 13%</td>
</tr>
</tbody>
</table>

Chart 3.5 Respondents who thinks tracking violets privacy and Chart 3.6 respondent who suppose the use of GPS tracking

Chart 3.5, from the analysis shown in the chart above 55% of respondents thinks it is not a violation of their privacy if they employees track their movement while another 45% thinks it is a violation of their privacy. And Chart 3.6, show that 67% of respondents who are worker are fully support their organization to implement a mobile based tracking system, 20% said they are not in support for personal reason while the other 13% are undecided.

4.0. Conclusion

The author has given a broad overview of location based service, its history and current trends, the author will discuss extensively the main concept and events leading to the technological advancement of Location Based Service (LBS), previous research work on the proposed system, and the components of Android Operating system.
From the result of the analysis done on the raw questionnaire data it can be concluded that the research is viable and will yield meaningful outcome. If this research is implemented it will go a long way to save organizations useful time that otherwise have been wasted on non-official duty why pretending to on official duty.

In order to improve and better this application in the future the following recommendation are suggested by the author:

- A reliable server with a restful API and Generate static IP Address for each device
- Organization specific map in place of Google Map API

Optimize the application for reduced power consumption on target device and Incorporate multimedia features such as videos, images and audio in order to enhance user experience

REFERENCES


