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Campus Monitoring System

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Abstract: This paper proposes a cost effective method of locating a human's position using two technologies via General Packet Radio Service (GPRS) and Global Positioning System (GPS). The whole system allows the user's current position to be located using a mobile phone which is equipped with an internal GPS receiver and a GPRS transmitter. A mobile phone application has been developed and deployed on an Android Phone whose responsibility is to track the GPS location and send it to a remote location by creating a GPRS packet. As unique identifier we have used mobile's Irrational Mobile Equipment Identity (IMEI) number which will be sent along with the coordinates. The person's position is further saved in a Mobile Object Database (MOD) which is created in MySQL. From MOD the data will be first transferred into an XML file which will be fed as an input to a web application which is developed with JavaScript based Google Map API integrated into it which will be responsible for the showing the current location of the mobile phone. Most of the applications developed so far use a handheld GPS receiver device for tracking the location, but we have reduced the cost of device by using the mobile phone which has an inbuilt GPS receiver. And further the cost is reduced by using GPRS rather than using Short Message Service (SMS) for communicating the information to the server.

Keywords: GPS, GPRS, XML, Google API.

I. INTRODUCTION

A GPS tracking unit is a device that uses the Global Positioning System to determine the precise location of a vehicle, person, or other asset to which it is attached and to record the position of the asset at regular intervals. The recorded location data can be stored within the tracking unit, or it may be transmitted to a central location data base, or internet-connected computer, using a cellular (GPRS or SMS), radio, or satellite modem embedded in the unit. This allows the asset's location to be displayed against a map backdrop either in real time or when analysing the track later, using GPS tracking software.

Mobile technology has been continuously and rapidly developed over the decades. Not only the cellular network that has been improved but the mobile phone itself has also been greatly improved. The mobile phone operating system are also more capable of handling faster, larger and more tasks with variety of choices from many famous software developers to choose from, for example, Symbian by Nokia, Windows Mobile by Microsoft, iPhone by Apple and Android by Google. Nowadays, Wi-Fi is considered a standard feature for most mobile phones, and so is GPS. One important task which a mobile phone accomplishes well is that it supports tracking using GPS.

GPS works by triangulating the signals from satellites orbiting around the earth. GPS usage will be impossible once the satellite signals cannot be received, for example, inside buildings, tunnels or undergrounds, places where the signals from the satellites are not reachable. This is regarded as a limitation of GPS. Hence, tracking mobile phone position by GPS alone is not sufficient. In order to provide some more accurate indoor positioning, Wi-Fi is used. Cell ID positioning is also used since it is less power consuming, and is available both indoor as well as outdoor. In our work, we have combined the use of GPS and Cell ID in order to make the application as efficient as possible.

The main focus of our research is to reduce the overall cost of tracking based on GPS system which is a satellite based service which is available 24X7 everywhere in the whole world. GPS system can be used to get location which includes details like latitude, longitude and altitude values along with the timestamp details etc. it a free of cost service the timestamp details etc. it a free of cost service

II. SYSTEM OVERVIEW

The system proposed in this paper works in two phases: tracking phase and mapping phase as shown in the figure 1 above. In the tracking phase the mobile device's application developed in Android using the mobile phone GPS receiver fetches the GPS location, after calculating the exact location it further creates a GPRS packet which includes the along with the location details a unique identifier called International Mobile Equipment Identity (IMEI) number and timestamp details. The same application later sends this GPRS packet to the server which stores the data in a Mobile Object Database (MOD) developed in MySQL. The next phase is mapping phase in which the data is fetched from the database and is displayed on the Google map on the web application developed in JavaScript based technology for live tracking.

Mobile application specification

We need a GPS receiver enabled Android Mobile phone for receiving the GPS data from the satellite There are a wide range of such mobiles are easily available in the market. This mobile will act as a both GPS receiver and GPRS transmitter which will use the GSM network to transmit the GPRS packets. On this phone itself we'll install our application which is supposed to perform all the operations of the first phase that is tracking phase.

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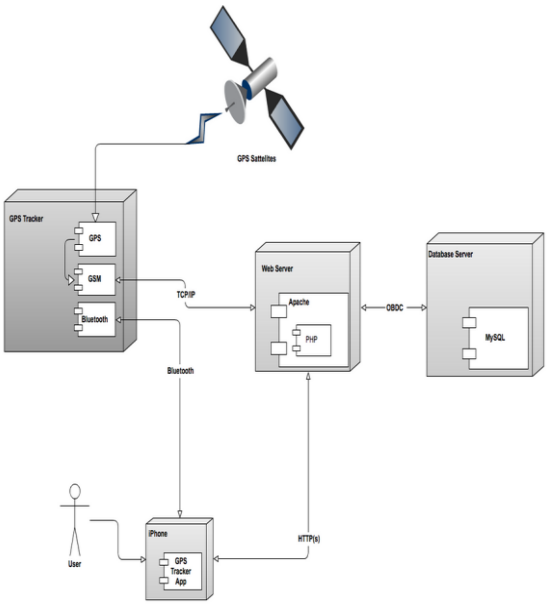

Fig. 1 Overall description of system

As soon as Mobile Application is installed and started for the first time it will ask to enter his roll no. which is unique code as primary key for database will be added to server database and by default keep the status as unknown.

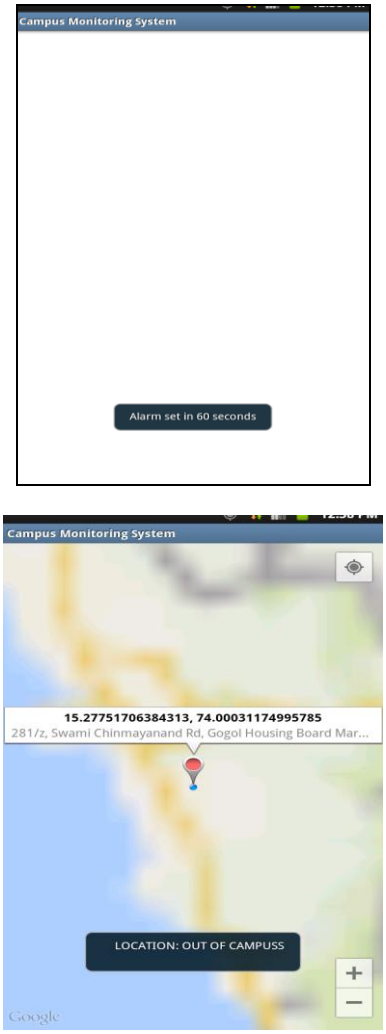

Fig. 2 Snapshot of Mobile Application after Installation on the Android based Phone

Once the mobile application successfully logins it goes into the background and starts fetching the GPS coordinates of the mobile then it will redirect to Maps Screen to display his current location. in the background a service will start and run every minute to get its current location and updated on the server database. At server side it will check the latitude longitude values and find the distance with the specified campus latitude longitude values and change the status as whether is inside or outside the campus. Even Application will show his current status INSIDE/OUTSIDE when he enters into maps screen

The mobile application will work in two modes:

1. Activity (the visible portion of application): this will ask user to enter his roll no and it will start the tracker service button.
2. Service: This will run in background and send location data to server along with roll no.

Google API

1. *Clustering:* We normally cluster points to make representation a lot easier. Our system can work with three types of location measurements: types A, B and C. Those types having only mobile network cell ID are type A. They are collected when no GPS or Wi-Fi is available. Firstly no clustering is performed and each distinct cell ID observed is regarded as a distinct location point. Type B are those having a cell ID and also coordinates derived from GPS. Measurements however these measurements contain different levels of uncertainty about a person's location, with type A having the largest uncertainty and type B the least

2. *Filtering, Clustering, Pruning of GPS data:* Clustering of type B requires three steps: filtering out raw measurements, clustering of data into smaller sets, and pruning of locations with insufficient data. When we record the GPS data, we also record the HDOP (Horizontal Dilution Of Precision) which indicates the accuracy level of GPS location. For clustering of filtered data , we make the use of k-means algorithm. According to our experiment, we set the cluster radius to R=10m. We take the first location point in our collected data as the first centre, and then draw a circle of radius R around this centre.

III. DISCUSSION ON LOW COST FACTOR

We have put our best effort to reduce the total cost of the system including the device and services. We have used available resource i.e. our mobile phone which is any usual Android based mobile phone which has GPS and GPRS facility. By using free Google API we have drastically reduced the cost of the services. This system which is presented in the paper can be used by any person who has a mobile phone. A high cost GPS receiver's requirement has been eliminated by using mobile phone as both GPS receiver and GPRS transmitter. Instead of using costly SMS system for sending the information to the server, we have used GPRS for that purpose. The SMS based systems are neither efficient nor they are cost

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effective. Most of the service providers provide a cheaper GPRS in around 1 paisa/1KB as compared to SMS whose cost ranges from 50paisa to 1 Rupee per SMS. In order to reduce the cost of using GSM/GPRS/GPS using separate devices, we have used a mobile phone which contains all the facilities and can be used very easily with a mobile application.

IV. MARKET DEMAND AND CHALLENGES

Performance demands on GPS are being driven by the market for location-based services (LBS). In the next subsection, we discuss the LBS market, representative applications, and the requirements they impose on location technology. Most of the high-value LBS applications call for the high levels of accuracy that can be offered by GPS. In the section the urban challenge we discuss the challenges that the LBS market poses to GPS.

A. The market for location-based services

The LBS market is projected to grow dramatically over the next several years. Analysts predict annual revenue to be anywhere from $18 billion (Taylor 2001) to $20 billion (Green and Betti 2000) to $33 billion (Saunders et al. 2000) By 2006. To date, over 50 wireless carriers in Europe and Asia have deployed LBS, generally using low accuracy technology (e.g., cell ID technology, with a location uncertainty of 300 m to 2 km). Due to the low level of precision available, carriers can only support a limited number of applications at this time. LBS applications of higher value to consumers tend to require better accuracy. There are five categories of location-based services:

1. Information services. This category includes enhanced directory assistance, traffic information, and navigation services. Although some information service applications can function with low accuracy location technology, much of the value to the consumer will come with increased accuracy.
2. Trigger services. Location sensitive billing and event based advertising and promotions are applications that are classified as trigger services. Location-sensitive billing allows wireless carriers to compete with landline connectivity providers. Event-based advertising can help stores to attract potential customers in the vicinity.
3. Entertainment. A large portion of entertainment-related LBS consist of gaming applications. Location-enabled Games are anticipated to be multi-player, involving small groups and/or a mass market.
4. Safety. In the US, safety is the primary market driver for Location technology deployment. While the E-911 mandate in the US and similar anticipated regulation in the European and East Asian markets is the most recognizable portion of the safety application segment, it is not expected to derive substantial revenues for wireless operators. Revenues will more likely come from applications such as roadside assistance and personal security.
5. Third party tracking. This consists of enterprise applications, such as fleet management and the tracking of assets, and consumer applications, primarily of the people-finder type. Services to track children and the elderly have already been launched in some regions. People-finder applications are also gaining popularity, particularly among younger consumers.

A. The urban challenge

Sensitivity: The level of C/N0 in dB-Hz required for reliable acquisition of a satellite signal. We take C/N0 to denote the signal power divided by noise power spectral density, measured at the input to an A/D converter.
Time-to-first-fix (TTFF): The time in seconds required to compute a position fix assuming cold-start conditions (i.e., no information from previous fixes).
Accuracy: The root-mean-squared error in meters among location fixes that are not false alarms.

V. CONCLUSION AND FUTURE SCOPE

This paper presents a low cost human tracking system using GPRS GPS on GSM network. The combination of both the technologies i.e. GPS and GPRS provides a constant, continuous and real time human tracking system. The cost of the overall system has been reduced by two facts one is using the existing mobile phone and another is using GPRS instead SMS. It has been hoped that the use of the overall system can eliminate the requirement of first the traditional GPS receivers and second costly SMS based tracking systems.

The future scope of such system is that it is Android based tracking system, and the same application can be developed for other phones as well such as Symbian, Blackberry etc.

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