IMPLEMENTATION OF GEO-MESSAGING USING GOOGLE CLOUD MESSAGING AND LOCATION BASED SERVICES API OF ANDROID

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ABSTRACT

In this paper, we are proposing the implementation of Geo-Messaging using Location based services and Google Cloud Messaging API’s of Android. Geo-Fencing can be defined as the process of sending messages tied to a location which means the receiver will not get the message until he enters the vicinity of the specified location. Geo-Fencing can be implemented using Location based services support provided by the Android platform. Location based services can be pull- based or push-based services. Pull based services are where the user sends a query to get the results for example if the user wants to get the nearest petrol bunk he has to send the query as “Where is the nearest petrol bunk”. Push based services are where the messages will be automatically pushed to the users based on their location without explicitly requesting/pulling them from the server.

Keywords: Location-Based Services, Geo-Fencing, Android, GCM (Google Cloud Messaging), GPS.

I. INTRODUCTION

Geo-Fencing is one of the applications of Location based services which is generally used for proximity marketing or advertising. Geo-Fencing technology uses the GPS (Global Positioning System) to select the geographical boundaries. Geo-Fencing uses the location based services to retrieve the current location of the user/customer.

Geo-Fencing has many practical uses. For example if a customer has downloaded a geo fencing app which sends alert messages either in the form of text messages or as email alerts then whenever the customer comes to that boundary of the location then the customer will receive some discounted coupon codes of the restaurant. Another use case for the usage of Geo Fencing is where a student smart card will send an alert to the security guard if a student tries to enter a restricted area.
Location based personalized recommendations makes sense when they are provided through a mobile application where the user can look up when he requires. Mobile analytics applications offers key trends in mobile data usage which in turn helps the service providers and users to receive right recommendations at the right time.

Geo-Fencing unlocks a new world of innovative applications to create location aware smart apps in a non-intuitive way. Geo-Fence can be created by specifying the boundaries on the Google Maps or location-based

This paper presents a mobile application that sends messages to the users at the right time personalized to their needs and contextualized to the device location.

II. BACKGROUND/RELATED WORK

For determining the location of the user automatically there are various mechanisms available and are in use today. These techniques are classified into two types, one which is suitable for finding location in outdoor environments and the other one that is suitable for finding location in indoor environments.

Capturing the location of the user in outdoor environments can be done in three ways: one is finding the location based on the mobile device built in capability i.e., using GPS, second is finding the location based using the mobile cellular network and the third way is to use the combination of both the above two techniques.

The first technique to determine the user location is through GPS, GPS captures the signals from the satellites to capture the location information. It gives highly accurate location information and doesn’t require any additional infrastructure to use it. It provides enhanced privacy to the user. However this technique doesn’t work in indoor environments and there will be some delay in computing the user location.

The second technique used to determine the user location is through the Cell ID of the cellular network. This technique uses the location of the base station of the network operator to find the location of the user. It is a low cost mechanism and there is no modification required to the mobile handset. However the accuracy of the location is low when compared to the GPS technique.

The third approach to determine the user location is using the combination of the above two approaches. Assisted GPS is the hybrid approach of this category, in this technique GPS receivers are rooted in the mobile cellular network which helps in assisting to get the location information by reducing the computing burden.

Apart from GPS most of the other techniques are not widely implemented. Regarding the indoor techniques to find the user location of mobile handset are difficult to implement as there is no sight with the satellites. Indoor techniques are mostly suited to laptop and desktop users where the location information can be fetched from Infrared or Bluetooth or Wi-Fi.

Hightower and Borriello (2001) gave six attributes to distinguish the techniques to determine the location. The six attributes are:

- **Physical position and Symbolic Location:** GPS receiver gives the physical position in terms of Latitude and longitude values, whereas the symbolic location indicates the target device being in some nearby place or in a room.

- **Absolute vs. Relative:** Absolute location gives the exact the location of the handset in terms of latitude and longitude. Relative location gives the location with reference to other objects.
Localized location computation: In Assisted GPS systems, the handset takes the information supplied by the network to compute its own position. This provides privacy because no other object knows the location of the device until the device reveals this information.

Accuracy and Precision: The location tracking system should give an accurate position details instead of locating the position within 10mts of the destination. Precision refers to how often the system is recording the accurate position.

Scale: Scale refers to the area size within which the object location is achievable. Hightower and Borriello (2001) recommend assessing scale in terms of the coverage area per unit of infrastructure and the number of objects that can be located per unit.

Cost: Different location sensing systems vary in their costs. There are lot of costs involved in using a location sensing system like time costs, maintenance costs and space costs.

III. PROPOSED SYSTEM

In our proposed system, we are developing an application to send messages to the students who enter the vicinity of the college. Messages can be related to the latest happenings in the college or some kind of important notifications. These messages will be send only if the student is in the college vicinity, once the student goes out of the college area notifications will no longer be sent to the student.

In order to implement this we are using two API’s of Google Android Platform, one is Geo-Fencing API to set the boundaries of the location that we want to use to track the students entry and exit. The second API is Google Cloud Messaging API which is used to push the messages sent by the server to the devices.

System Architecture
The workflow of the architecture contains three main components of the application. They are:

- **Google Connection server** which is used as the push server which can push the messages to the user devices. This receives the notification messages and the location boundaries of the area to the connection server.

- **Application Server** side code is used for sending the messages/updates to the GCM Connection server.

- **Client Application** which runs on the user device and receives the notifications from the Google Connection server.

In order to receive the notifications from the Google Connection server to the client application, first the client device has to register itself to the connection server. Registration of the device can be done programmatically using the Google Cloud Messaging API method `register()`. The server side code should send the notification messages along with the Latitude and Longitude information to the Google connection server. Once the GCM server receives the messages it will push the messages to all the devices registered with it. But the notification message gets displayed to the user only when he is in the boundary of the given location.

Setting the boundary for pushing the messages can be implemented using the Geo-Fencing API of Android where the entry and exit by setting the latitude, longitude and radius of the location. Geofence is generally treated as an area rather than as proximity by the location services. We can handle both the entry and exit events of Geofence to keep track of the user movement.

In the client application, first the user device has to register with the GCM connection server to receive the notifications. In order to register the device first we have to create Google API project and enable the GCM service for it. Using this GCM service we have to create Project ID and API Key. Getting the Registration ID for the device using the GCM API method as below:

```java
protected void onCreate(Bundle savedInstanceState) {
    if (GCMRegistrar.getRegistrationId(this).equals("")) {
        GCMRegistrar.register(this, "12345678910");
    }
```

Once the registration ID is received, send the registration ID to the server. Once the server has the device registration ID’s then it starts sending the notifications to the GCM connection server and in turn it sends them to the client device.

Once the notification reaches the client application, then the client application will check whether the device is in the proximity of the location that is set by the server, if it is in the vicinity of the location then it displays the message to the user, otherwise it will not display the message.
For setting the Geofence in the client application first we have set the permissions in the device to capture the location. These permissions are to be configured in the AndroidManifest.xml file as below

```xml
<uses-permission android:name="android.permission.ACCESS_FINE_LOCATION"/>
```

Once the location latitude, longitude and radius are identified, then we can add the geofence using Pending Intent. As soon as the geofence is created then the device starts displaying the notifications whenever the user enters or exits that location. Below is the screenshot of the Notifications received when the user enters the premises of IARE College.
IV. CONCLUSION

In the age of smartphones, location based personalized recommendations based on the user’s needs help the businesses to reach their customers and improve their profits. This paper presents an application that uses the device tracking ability and sending the notifications based on the location in which the device is present. The Location Based services helps the user to find the nearest places like Hospitals, petrol Bunks, schools and etc., whereas the Google Cloud messaging is the cost free approach to send the notifications to any number of devices without incurring any operator charges.

V. FUTURE SCOPE

The near future holds a bundle of smart applications that gain from location based services and their personalized recommendations. Location based gaming like gaming through mobile applications for large gathering in shopping mall, social media connectivity and identifying the unauthorized entry of the people into restricted areas are seen as the future of Location based services. Undoubtedly, location based real time analytics is way to go.

REFERENCES

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