

# Energy Efficient Smart Phone Application for Navigation cum 360° Destination Reach using PNT user Equipment Modernization Architecture

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**Abstract**— Most of the reminder applications available today in mobile phones are time and date based. In which the user has to save the time and date of when he/she wants to be reminded about in the reminder. If the reminder is ON, the device continuously tries to match the device time and date with the saved time and date, and the user will be alerted if it is a match. But in many cases the user will not be aware about the time and date, but he/she will be aware about the place where he/she wants the reminder. In this project, I have tried to design an application which gives alert about the reminder when he/she enters into the geographical region specified in the reminder. While a time based alarm application alerts a user at a specified time, a location based alert application alerts a user when he/she is in the proximity of a specified location. Location alert applications are quite useful when time of an event is unknown.

**Keywords**— *Android Mobile Operating System, Location Based Services (LBS), GPS, GIS.*

## 1. Introduction

The aim of this project is to create an application to provide location based alerts on Android mobile phones.

While a time based alarm application alerts a user at a specified time, a location based alert application alerts a user when he/she is in the proximity of a specified location. Location alert applications are quite useful when time of an event is unknown. The application uses Android mainly because it is open source and provides a complete software stack and tool set that make mobile application development easier.

The application lets the user specify address of central location of a region and a radius around it and alerts the user when he/she enters the circular region. It uses both Global Positioning System (GPS) and Network Location Provider to acquire user location information. GPS, a satellite based navigation system provides location information to Android devices that come with built in

GPS receivers. Network Location Provider on the other hand uses cell tower and Wi-Fi signals to provide location information.

Location based alerts have several day-to-day applications. For instance, when a person gets into a train or bus, he/she can provide address of the destination station to the application and engage himself/herself in any activity (read books, take nap etc.). When the bus or train reaches within the specified radius of the destination, the application beeps and alerts the user. This way the application helps the user realize that he/she is somewhere near to the destination and the user does not miss his destination.

### 1.1 Objective

The aim of this project is to create an application to provide location based alerts on Android mobile phones.

The application lets the user specify address of central location of a region and a radius around it and alerts the user when he/she enters the circular region. It uses both Global Positioning System (GPS) and Network Location Provider to acquire user location information.

### 1.2 Scope

In many cases the user will not be aware about the time and date, but he/she will be aware about the place where he/she wants the reminder.

In this project, I have tried to design an application which gives alert about the reminder when he/she enters into the geographical region specified in the reminder.

## 2. Methodology

### 2.1 Geocoding

A geocoding technology to convert street addresses provided by user to latitude and longitude coordinates. As geocoding lookups are done on the server, the application

requires internet access to implement this functionality. The permission constant INTERNET is declared in manifest file as shown below to provide internet access to the application.

```
<uses-permission android:name=  
"android.permission.INTERNET"/>  
geocoder = new Geocoder(this, Locale.getDefault());
```

Fig. 1: Permission for internet

Android system provides a class named Geocoder that includes all APIs for implementing geocoding. We can specify the locale to be used using the constructor of this class. Locale specifies country and language details to be used by the APIs of the class while presenting information to users. When no locale specific details are provided, the default system locale is used.

Locale represents a language/country/variant combination. Locales are used to alter the presentation of information such as numbers or dates to suit the conventions in the region they describe.

The API getFromLocationName when queried returns a list of addresses corresponding to user specified address. When user specified address is not meaningful or network is unavailable, the API might not return a valid address. It might throw an exception or return an empty list of addresses.

## 2.2 Proximity Alerts

Android includes LocationManager class to provide location services supported by the device to an application. The application uses API for setting proximity alert for a given address. The API requires latitude/longitude geographic coordinates, radius around the central point of alert region and an expiration time for the alert.

It notifies the application when user crosses the specified radius of the location and takes care of deleting the alert after the expiry time. It also decides the frequency in which location updates are received and automatically chooses a location provider based on location settings. The API also accepts a PendingIntent parameter that gets fired when the alert is triggered. A PendingIntent object wraps an intent that gets fired at a later point of time. The API usage is shown below.

```
locationManager.addProximityAlert(latitude, longitude,  
radius, expiration, pendingIntent);
```

Fig. 2: Proximity alert

## 2.3 Intent and Pending Intent:

Three of the core components of an Android application - activities, services, and broadcast receivers are activated through messages, called intents.

A PendingIntent is a token that you give to a foreign application (e.g. Notification Manager, Alarm Manager, Home Screen AppWidget Manager, or other 3rd party applications), which allows the foreign application to use your application's permissions to execute a predefined piece of code.

If you give the foreign application an Intent, and that application sends/broadcasts the Intent you gave, they will execute the Intent with their own permissions. But if you instead give the foreign application a PendingIntent you created using your own permission, that application will execute the contained Intent using your application's permission.

## 2.4 Service Invocation

Service running in background will track the user location continuously. Android Software Development Kit (SDK) does not provide a special intent that will listen for changes in location. Broadcast Receiver listens for BOOT\_COMPLETED event. Therefore once the device is booted on, the location service is invoked automatically using our service routine. Permission has to be set in the Android Manifest file as shown in the Fig 3.

```
<uses-permission android: name=  
"android.permission.RECEIVE_  
BOOT_COMPLETED"/></uses-permission>
```

Fig. 3: Permission for Boot

## 2.5 Location Services

The application declares the following permissions in the manifest to make use of location providers.

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

Fig. 4: Permission for GPS and Network provider

Location information is retrieved with the help of Location Manager System by invoking the command getSystemService (Context. LOCATION SERVICE). Code for invocation is shown in the Fig.5.

```
lm=(LocationManager)getSystemService  
(Context.LOCATION_SERVICE);  
locationListener=new MyLocationListener(lm).  
requestLocationUpdates(LocationManager.GPS_PROVIDER  
, 0, 0,locationListener);
```

Fig. 5: Location Manager Invocation command

### 2.5. Persistence

Whenever the application is opened, it needs to display the list of alerts previously created by the user so that the user can view, edit or delete the alerts. The application stores the list of previously created alerts in permanent storage in order to display the list whenever it is opened.

When user creates a new alert, the application creates an alert entity object that has all the details about the alert including alert name, address, latitude, longitude, radius, alert id and status of the alert indicating whether the alert is enabled or not.

### 2.6. Broadcast Event

When a proximity alert is set, location manager keeps tracking user location in the background. When user crosses the set radius boundary of his/her point of interest, location manager fires the registered pending intent with extra information on whether user is entering or exiting the set radius boundary. The application specifies its interest in the broadcast intent by registering a broadcast receiver in its manifest file using intent filters.

When broadcast receivers are registered in the manifest, the application is not required to run in the foreground to receive the proximity alerts. When an alert is triggered, the onReceive method of the registered broadcast receiver gets called by the system. Inside this method, the application checks the extra information sent by location manager and notifies the user only when user enters the radius boundary of the set location.

### 2.7. Notifications

The application makes use of Android notification service to notify user when an alert is triggered. Notification and NotificationManager classes in Android provide services to notify user by creating status bar icons, displaying messages in extended status bar window, flashing LEDs, vibrating phone and making audible alerts.

### 2.8. Address Input Options

The application provides options to enter address for setting proximity alerts. User can type an address and get latitude, longitude using reverse geocoding process.

## 3. Architecture Diagram

It can be divided into three parts which are getting current location details, Destination details-Periodic measurement for current position, trigger management component. The work flow of this architecture is shown as following figure 6.

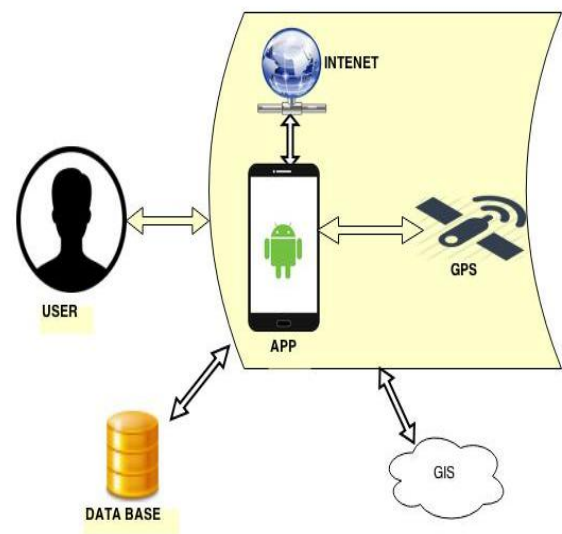


Fig. 6: Architecture Diagram

### 3.1 Get a Source location Details



Fig. 7: Get a Source Location Details

Application send the request to GPS and get the source location details then store it to the database.

### 3.2. Periodic measurement and trigger the alert to user

Then the application get the destination location details from the Geographical Information System (GIS) then it will be store in the database. After that application do the periodic measurement of the current position while travelling if it matches to destination range the trigger will alert to the user.

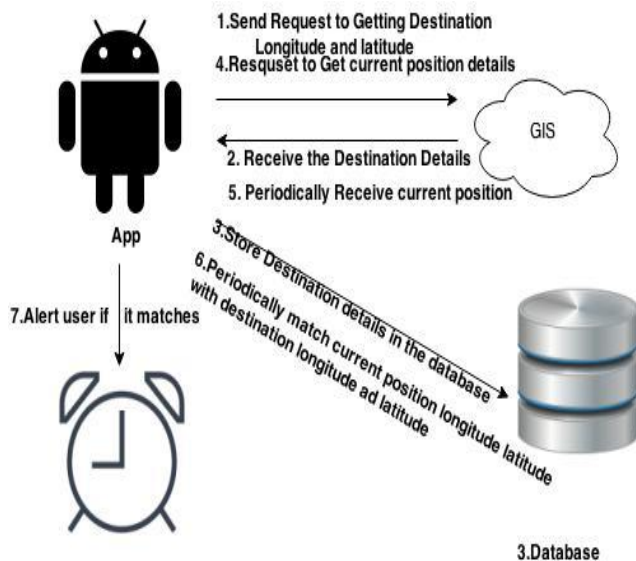


Fig. 8: Periodic Measurement for Current Position

#### 4. Conclusion

This project investigated framework for automated location based remainder.

The conceptual architecture is designed for the implementation of Navigation cum 360<sup>o</sup> Destination Reach using PNT User Equipment Modernization Architecture and the overall system functional requirements are captured and the system functionalities are designed using analysis models.

#### 5. Future Work

The application can implement an algorithm that gives a better battery life when compared to the default implementation provided by Android. The algorithm should reduce the power consumption. Google maps can be added as one of the address input options since it is easier to find a location using maps when address of a place is not known. And when we get to know the user's place of visit and reason, we can help the user fetch required items related to their purpose of visit. Ex: When the user gives input "Going for Birthday Party", we can help the user shop gift shops near the place with new offers.

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