Geolocation and Places-Analytics

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Abstract: *World is the full of interesting places and can be confusing and overwhelming at the same time. There can be instances where people might get lost or enter unsafe areas unknowingly. To address such issues, GAP Analytics (Geolocation and Place-Analytics) is an android app and a Web application that helps its users to know their current location, search for places of their interest like hotels, police-station, hospitals etc around them. Using android as its platform is beneficial looking at the market share of android OS as it can reach out to many people. It will help data analysts to get statistics of activity of people around a geographic location from online dash board by maintaining the privacy of the users. Smartphones are great device which are intelligent and if used properly, it can saves us from a lot of unpleasant situations. By using location services from android environment, this app provides location features. This app uses Google location API V2, Google Places API and Google Maps API in its android client application. On the server side it uses windows ASP.NET Web Services to serve client requests.*

Keywords: LBS, Geolocation, Geofencing, GPS, API, WCF, NFC, GCM, REST

I. INTRODUCTION

World is digitizing, so is India along with its Digital India initiative, it will be a fierce battle to digitize important aspects of people's lives. People have access to internet and smartphones, so we can exploit such available infrastructure and resources to provide a personalized and context aware business, government, security and entertainment services. Our project brings location based services (LBS) through mobile computing paradigm on android platform. LBS has become a more important candidate which is affecting user experiences due to cheap GPS hardware and smartphones being manufactured. Motivation to choose android platform is due to its mammoth market share and a company like Google behind it. We can reach out to maximum people through this platform.

II. ARCHITECTURE

This app is based on client server model where android app is the client whereas ASP.Net web service serves client from the server. Server gets the requesting client the coordinates of the subject to be tracked through HTTP request and response method. We can use either SOAP or REST full service model for client-server communication implementation. Our project works on the principle of distributed computing. In distributed computing, the system is divided into components which are physically remote to each other. But when user uses this system, he gets the illusion that the computer he is using has all its resources at one place. In this project, the components of distributed system are:
1. Android Client: This is the app that is installed on end users smart phone.
2. Web server: It provides back end for storing location related data.

Whenever client starts his app, he can use the data available on servers without knowing that such data is stored remotely and is being transferred through internet. Such distributed nature is seen when a user tracks another user, searches for nearby places and checks if anyone is around him or not. Application specie server stores user location data on the cloud and acts as an interface between multiple android clients. Server performs deferent operations like computing distance between two locations, searching contacts, registering users, sending alerts and geofencing. For all data relating to nearby places and maps, it is handled by Google

servers by the use of Location service APIs from Google. To get detailed information about your current location, Wikipedia provides the information. We make use of GPS, Wife, network signal and Proximity sensor for their respective operations. We use REST service framework to make calls to deferent servers from our client app.
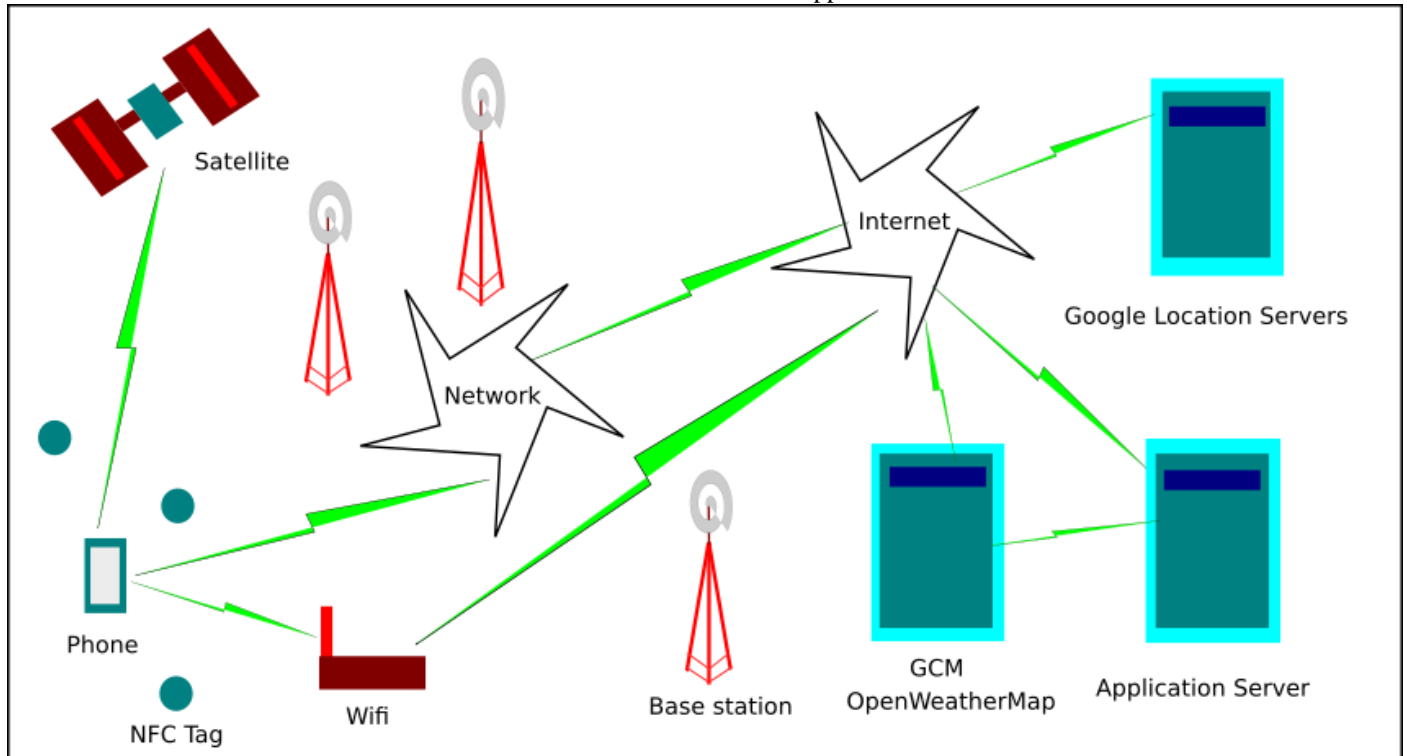

Figure 1.Architecture Diagram

Modified architecture includes the following additions:
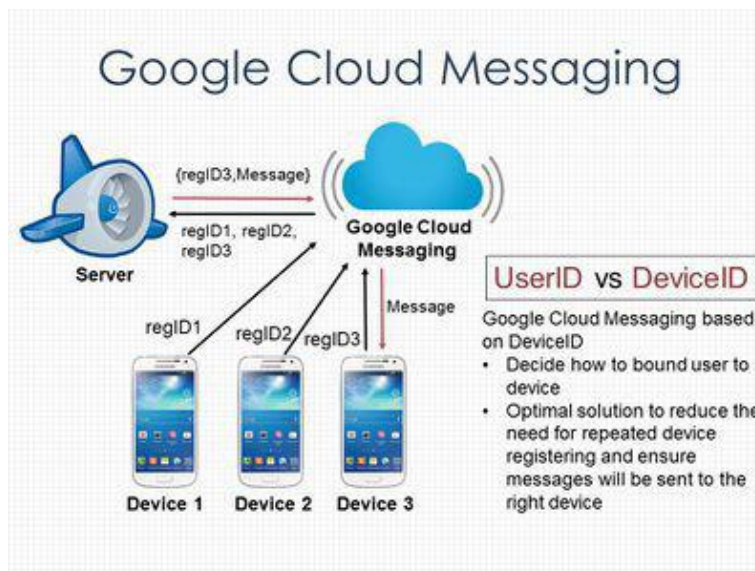• GCM and Open Weather Map servers
• NFC Tags

Fig- 2.GCM Architecture

Above figure shows Google Cloud Messaging architecture and how it is used. It shows how it uses device id to register each device to uniquely identify each device to send push notifications. Notifications are sent to respective devices from registered device id and our application server forwards the notification to GCM server, then if device is connected to internet, GCM will intelligently Send push notification.

Functions and Interfaces:

Following are the interfaces between our client-server connectivity:
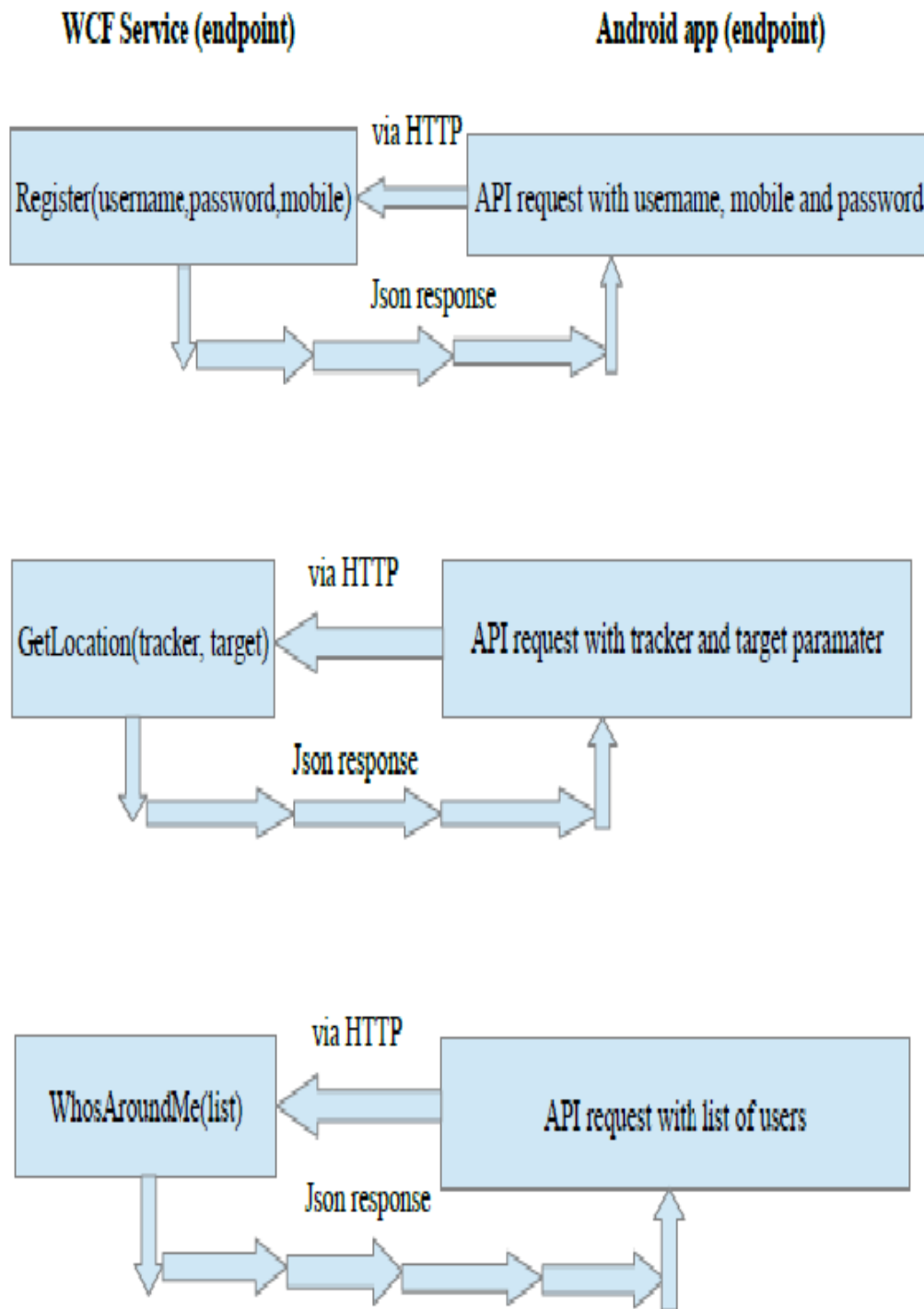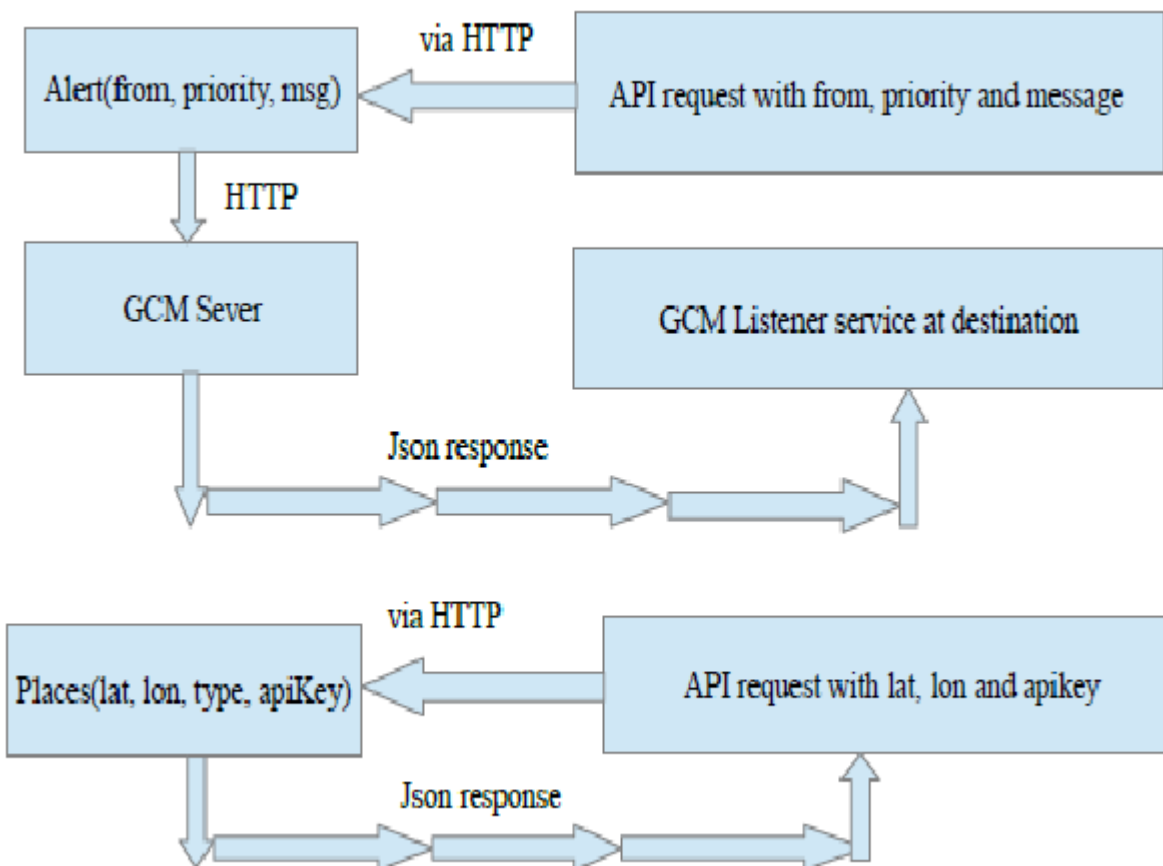
As we can see from above diagrams, HTTP is the basic interfacing protocol and JSON the basic communication data format between client and server. Such interaction takes place through internet as the main communication channel. No sessions are maintained, rather stateless HTTP is used. All WCF endpoints are connected to a single instance of Database server from where we fetch our data.

Following are important functions in our application:

Register(username, password, mobile):
It is responsible to register a new user from provided data.

GetLocation(tracker, target):
It provides tracking functionality to users if tracker and target are both sharing location with each other.

WhosAroundMe(list):
It provides notification about people in your contact list who are withing 500 meter radius from your location.

OpenWeatherMap(lat, lon, apiKey):
This is api service from OpenWeatherMap which provides weather data for provided location latitude and longitude with registered API Key for authentication.

Places(lat, lon, type, apiKey):
This function takes latitude, longitude and Google API key for Google Places web service and returns
list of specified place type in the type parameter

System Features

1. Tracking

- Find your friends/family/colleagues on Google Map.
- Find who around you within a specified range.
- Find last known location.

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• Send distress message/alarm to your near ones.

2. Geofencing

It allows user of the system to draw zones around place of work, customer sites and secure areas these geofences when crossed by an equipped person can trigger a warning to the user via SMS or email.

• Detect if you enter/exit an area of interest/danger.
  • Set alarm/reminder for a particular location.
  • Geofencing used with child location services, can notify
  • Parent if a child leaves a designated area.
  • Change mobile profile depending on particular geofence.

3. Places

• Find police station around you.
• Find the Bus stop/air-ports around you.
• Find hotels near you.
• Find hospitals around you.
• Find ATMs near you.
• Find the important landmarks near you.

4. Weather

• Get current weather based on your current location.
• Get current weather of your family/friends/colleagues from their location.

5. Analytics

• Get data about people's location patterns over a period of time.
• Get danger zone areas from users who triggered SOS messages.
• Get report on frequently visited places by users.

6. NFC based indoor positioning

• Hover over NFC tags to broadcast your indoor location.
• Also automate profile.

7. SOS

• Send SOS message to emergency list when in danger along with your current location through panic button

8. System Alert

• User wish to send alerts to their contact list.
• Alert is delivered to destination through GCM messaging.

Login Activity:
This activity deals with following options:
• Login if not registered.
• Allows you to navigate to register activity from menu if not yet registered.
• Allows to navigate to reset password activity from menu.
• Allows to navigate to recover account activity from menu.

Map Activity:
This is the main activity which deals with:
• Show current location on map
• See current weather for your location
• Search for places like Police station, hospitals, restaurants etc around you.
• Track other people on map

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Add Geofence:
This option is available from map activity after long touch on google map.
• Enter a unique name for every new geofence.
• Select radius of geofence, by default it will be set to 100 meters.

Weather Report:
This option is available from map activity by pressing weather button.
• Get current location weather.
• Get weather of tracked person.

Fence List:
This activity shows list of fences and settings for each fence:
• Add a geo-note to each geofence.
• Set profile for each geofence.
• Set whether to send notifications through SMS or Internet about enter or exit of geofence.
• Remove geofence from the list of geofences.

NFC Read/Write:
Program an NFC tag to do one of the following tasks:
• Broadcast indoor location
• Change profile of your phone.
• Use NFC tag as a sticky note.

My Location Wiki:
This is a webview of android that will load the information about current city of user.

Forecast Activity:
This activity shows weather forecast of current location for next 7 days.
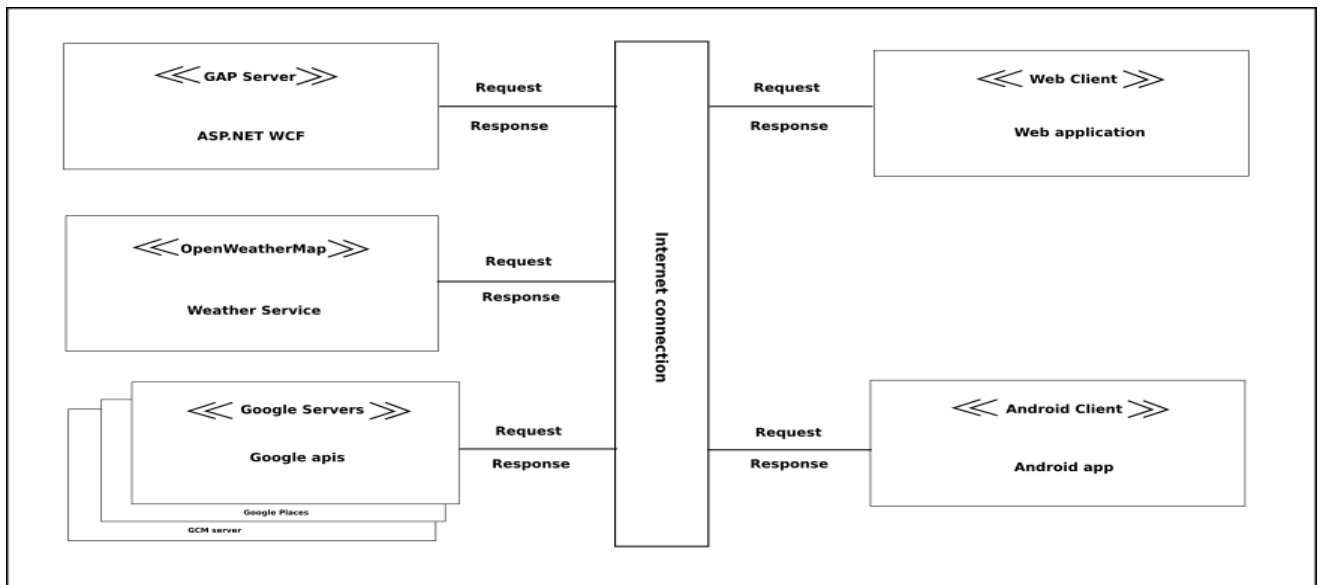
Deployment Diagram:

Fig-03 Deployment Diagram

CONCLUSION

Users of this app can be sure about the movement of their near and dear ones. People can track and get valuable information about their surrounding environment through Google Places API. We can make proper use of smart phones as an intelligent devices by using its features like wi , mobile network data and GPS. Thus, city planners, analysts and security services can use this project to study location patterns and monitor people about their geo-points of interest.

ACKNOWLEDGMENT

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