

A Recent Study on Early Disaster Warning & Evacuation System on Mobile Phones Using Google Cloud

Rohit Khudabadi

Student (BE Computer), ACOE, Pune, Email ID: rohit.khudabadi@gmail.com

Ashu Ranjan

Student (BE Computer), ACOE, Pune, Email ID: ashuthesmasher@gmail.com

Hardik Varma

Student (BE Computer), ACOE, Pune, Email ID: varmahardik7@gmail.com

Sudhir Kadam

Student (BE Computer), ACOE, Pune, Email ID: sudhirkadam0007@gmail.com

Prof. Priyadarshani V. Kalokhe

Professor, Computer Department, ACOE, Pune, Email ID: kpriya.acem@gmail.com

Abstract — Natural Disasters have threatened mankind since creation of earth. Also during natural disasters many people who are physically handicap faced many difficulties. For this reason, they have proposed a location based early disaster warning and evacuation system for both normal and handicap people using OpenStreetMap (OSM). The system is implemented on android mobile phone. So, this system comprises a third-party server named Disaster Management Server (DMS), android device with this application installed on it and user. The local weather office updates the disaster (tsunami, cyclone or flood) data on DMS. Device user registers on Android Cloud to Device Messaging (C2DM) server to get automatic notification of upcoming disaster otherwise user gets manual notification. The user communicates with DMS to have updated data sending the current position obtained by GPS or network provider. The probable disaster affected area is determined by ray casting algorithm. Evacuation progress is also tracked using DMS and national identification of user.

Keyword — Android, Cloud messaging, Disaster Warning, Evacuation Guideline, GCM service, OpenStreetMap,

1. INTRODUCTION

In this paper system is used to send early disaster warning messages to all the area users using Google Cloud Messaging using internet. Warnings need not be a disaster all the time it can be anything that causes discomfort to users E.g. Heavy traffic during festival days, flood due to heavy rain. Aim of this paper is to intimate users with area specific early disaster warnings, user's location will be dynamically sensed using GPS and it will be stored on the centralized server. Evacuation control authority or admin will broadcast messages to specific area users using Google Cloud Messaging

Service before the disaster occurs. Users will receive evacuation guideline as a text/speech notification. Notifications are PUSH messages, pushed automatically by server, Push messages are similar to auto application updates in android phone.

In the process of development based on Android platform, traditional method of pulling can keep the data synchronization between the Android terminal and server-side. Each Android terminal has to poll the server to see whether data is updated, which wastes a lot of unnecessary network traffic and mobile-phone battery. In order to overcome the weakness of pulling method, the other paper create an application using the cloud pushing based on Android GCM service, which is integrated into their information management system. The new data is sent to Android client-side by the server.

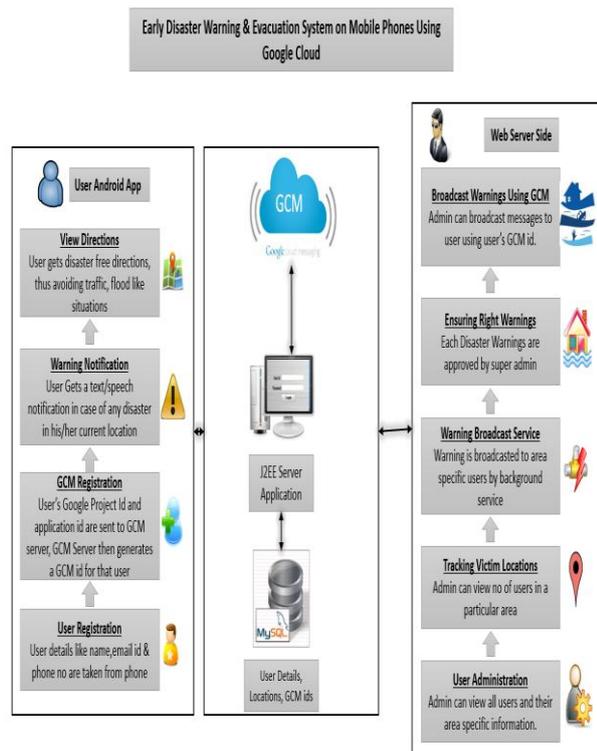
2. PREVIOUSLY WORK DONE

OpenStreetMap (OSM) is a rapidly growing open source map of the world because of the availability of map information across the world and the advent of inexpensive portable GPS devices [1]. This open source OSM has recently been employed in many projects like WikiProject Libya and WikiProject Haiti etc. In the WikiProject Libya [2], the roads and places of interest were mapped in details. The WikiProject Haiti facilitated the rescue work and helped in providing relief aid after the devastating earthquake at Haiti in 2010 [3]. So, OSM has achieved the popularity to use instead of using restricted Google map. The demand of location based services is also increasing day by day with the burgeoning growth of smart phones. Our location based system is also an android platform based smart phone application to render location based services showing the warning of upcoming disasters (tsunami, cyclone, and flood etc.) if the user is in the possible disaster affected area or near to that area and demonstrating nearest safe zone or shelters on the map of the application. Our

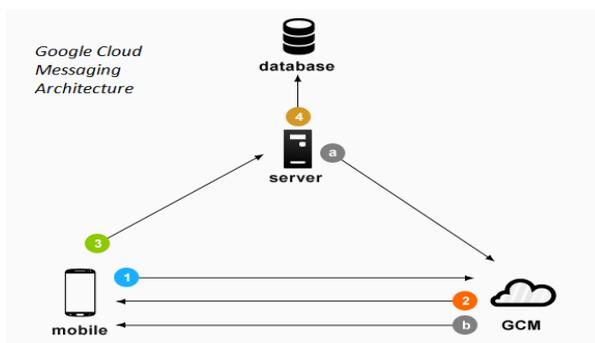
proposed system is developed for both the normal and blind people. The usability of OpenStreetMap (OSM) is ensured for all users as it is free. Users of our application will get both text and audio warning message and evacuation direction on the map

3. THE OVERALL DESIGN

Fig.1. Overall Design



1] Google Cloud To Device Messaging:



1. First android device sends **sender id, application id** to GCM server for registration.
2. Upon successful registration GCM server issues **registration id** to android device.
3. After receiving registration id, device will send **registration id** to our server
4. Our server will store **registration id** in the **database** for later usage

- a) Whenever push notification is needed, our server sends a **message** to GCM server along with device **registration id** (which is stored earlier in the database)
- b) GCM server will delivers that message to respected mobile device using device registration id

Fig.2. Google Cloud to Device Messaging

This Google Cloud Messaging Service registers the user for sending the intimations for the user. Once the user is registered in the server via the web server, the user device is added to the database of the server. For sending any message to the device the server creates the message and sends it to the Google Cloud for forwarding it to devices which are associated with the device Id which is registered with the server database.

2] **Location Tracking of Victim:** System gets initialized and detects the current position of the user's mobile & fetches the location latitude and longitude using android phone's GPS Device. Device then connects to Google map to get location name from the current position of the mobile.

3] **Disaster Warning:** The Server sends disaster warning through Google cloud server to intended users using Internet. Server needs a connection with Google cloud server and messages are push type of messages. It is the responsibility of admin to send fire/flood/earthquake/political warnings to users.

4] **Define Evacuation Points in the City:** Whenever Admin declares a disaster warning; he has to define evacuation areas in the city. People will get the evacuation area list on their phone and nearest area from the current place will b highlighted.

5] **Victim Notification:** Whenever there is a disaster, user gets the notification on the phone. Notification consists of disaster details and evacuation areas. User can click on each area and view the roadmap on Google map.

6] **Location Tracking of Victim:** Determines victim's device location in GPS/NON-GPS devices and reports to admin via server application.

4. ALGORITHM USED

1] **Point in polygon for finding if a person is inside a disaster area:**

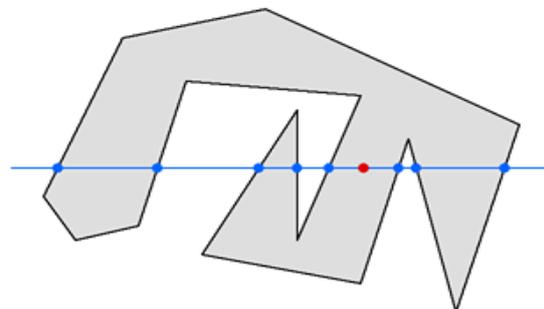


Fig.3. Point in polygon for finding if a person is inside a disaster area

The solution is to compare each side of the polygon to the Y (vertical) coordinate of the test point, and compile a list of **nodes**, where each node is a point where one side crosses the Y threshold of the test point. In this example, eight sides of the polygon cross the Y threshold, while the other six sides do not. Then, if there are an *odd*

number of nodes on each side of the test point, then it is inside the polygon; if there are even numbers of nodes on each side of the test point, then it is outside the polygon. In our example, there are five nodes to the left of the test point, and three nodes to the right. Since five and three are odd numbers, our test point is inside the polygon.

2] GPS based distance formula:

This uses the ‘haversine’ formula to calculate the great-circle distance between two points – that is, the shortest distance over the earth’s surface – giving an ‘as-the-crow-flies’ distance between the points (ignoring any hills they fly over)

Haversine	$a = \sin^2(\Delta\phi/2) + \cos \phi_1 \cdot \cos \phi_2 \cdot \sin^2(\Delta\lambda/2)$
e	$c = 2 \cdot \text{atan2}(\sqrt{a}, \sqrt{1-a})$
formula:	$d = R \cdot c$

where ϕ is latitude, λ is longitude, R is earth’s radius (mean radius = 6,371km); note that angles need to be in radians to pass to trig functions!

5. CONCLUSION

In recent years, the Android-based application development has become more extensive. Traditional method of pulling in the process of updating data requires Android clients to poll application server regularly, which wastes lots of network traffic and phone’s power. To remedy such shortcomings, they adopt the way of pushing, and implement the cloud messaging system based on GCM service. Also there location based disaster management system is an android mobile phone application employing OpenStreetMap (OSM), Google C2DM server, Disaster Management Server (DMS) as third-party server. There application provides visual and audio disaster warning and evacuation help on the map of the application to user if the device user is in probable disaster affected area considering the user’s current location. This helps both normal and blind people to go to the safe area or shelter place prior to the disaster.

6. REFERENCES

[1] OpenStreetMap in Wikipedia
[<http://wiki.openstreetmap.org/wiki/OpenStreetMap>]

[2] Project Libya [http://wiki.openstreetmap.org/wiki/WikiProject_Libya]

[3] Project Haiti [http://wiki.openstreetmap.org/wiki/WikiProject_Haiti]

[4] Agarwal S, “Toward a Push-scalable Global Internet,” In: Proceedings of 2011 IEEE Conference on Computer Communications Workshops (INFOCOM WKSHPs). Piscataway: IEEE Press, 2011, pp. 786-791.

[5] Zhou Hong, Zhang Bei, Jiang Ai-rong, Zhang Cheng-yu, “Design and Implementation of Library Bibliography Information Self SMS PushService,” New Technology of Library and Information Service, vol 7, pp. 127-131, 2011.

[6] Zhang Jing, Liu Fu-ying, “Study and Implementation of FoxNews-MID Based on Android C2DM,” Computer Science, vol. 38, pp. 461-463, Oct 2011.

[7] Implementation of Cloud Messaging System Based on GCM Service Penghui Li1, Yan Chen1, Taoying Li1, Renyuan Wang1, Junxiong Sun11 Transportation Management College Dalian Maritime University Dalian, China hui_sdlm@163.com, 2013 International Conference on Computational and Information Sciences

[8] Jayasinghe, Gamini, Fahmy, Farazy, Gajaweera, Nuwan, and Dias, Dileeka, “A GSM Alarm Device for Disaster Early Warning,” pp. 383-387, May 2007. [1st IEEE international Conference on Industrial and Information Systems]

[9] Anas Aloudat and Katina Michael, “Toward the Regulation of Ubiquitous Mobile Government: A Case Study on Location-Based Emergency Service in Australia,” Journal of Electronic Commerce Research, Vol. 11, Issue 1, Article 3, pp. 31-74, Jan. 2011.

[10] Sufian Latif, K.M. Rakibul Islam, Md. Monjurul Islam Khan, and Syed Istiaque Ahmed, “OpenStreetMap for the Disaster Management in Bangladesh,” pp. 429-433, Sept. 2011. [IEEE Conference on Open Systems]