Early Disaster Warning & Evacuation System on Mobile Phones Using Google Street Map

Abhishek Soni, Ankit Sharma, Pushpanjay Kumar, Vipul Verma, Prof. Shiv Sutar

***Abstract*— A natural disaster is a major adverse event resulting from natural processes of the Earth; examples include floods, earthquakes, tsunamis, and other geologic processes. Many of the natural disasters occurring in India are related to its climate, causing massive loss of life and property. Timely disaster warning and evacuation guideline can save many lives. The present paper discusses the proposed work/system which helps people by providing early disaster warnings and evacuation guidelines to reach safer places. The system is implemented on android devices because of its flexibility and is very popular in India. So, our system comprises a server and android device with our application installed. Server gets automatically updated by the website called http://gdacs.org/ or administrator is also given the ability to update it manually. We are using one of the most popular Google Cloud to Device Messaging(C2DM) service. User must have to be registered with C2DM server to receive automatic notifications about upcoming disasters. Firstly, system gets initialized and detects the current position of the user's mobile & fetches its latitude and longitude using android phone's GPS. When our application recognizes the user in probable disaster zone then application will send visual and audio disaster warning and evacuation guideline including shortest path of shelter or safe zone.**

***Index Terms*— disaster, C2DM server, latitude and longitude using android phone's GPS, disaster warnings .**

I. INTRODUCTION

The Natural disasters are naturally occurring events, or extreme forces of nature, that cause death or destruction of people and or their property. Natural disasters such as flood, fire, earthquake, tornado and windstorm affect thousands of people every year. Since India is most natural disaster-prone country, so prevention is necessary for protecting lives and properties. The 2013 Uttarakhand tragedy was a reminder of its historical past, which was full of natural and man-made disasters. Since many centuries, India has been at the receiving end of the nature's fury and has been plagued by many calamities of massive proportions in the past. Sometimes people may be unaware about the upcoming natural hazards. Lack of preparedness of people causes the major damage during disaster. So, adequate prior disaster warning and effective evacuation system can save significant number of lives in the country prone to frequent disasters. Hence, we have proposed a location based early disaster warning and evacuation system on mobile phones using Google Maps and GPS technology. We are going to Develop a location based information system on mobile phones using GPS coordinates and intimating android devices connected to Google Cloud for Evacuation Control Authority and mobile phone users prior to the occurrence of disaster through this system. This Cloud Messaging will also analyze and send evacuation guideline to the users of the system. The rest of the paper is organized as follows. In Section II, we discuss about some related works and their shortcomings in brief. Section III describes the system's Architecture in detail. In Section IV, Proposed methodology are described. Finally, we conclude this paper stating the future plan in Section V.

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II. RELATED WORKS AND THEIR SHORTCOMINGS

The Early Disaster Warning and Evacuation System is very common disaster management approach in disaster-prone areas of the world. In recent years, efforts in disaster management have gained the impetus from unprecedented development of Mobile Technology. Currently, mobile phones provide vital support for disaster management in many ways: monitoring, communication, warning dissemination, evacuation, and rescue and relief aid. Moreover, the advent of smart phones supporting GPS functions assists in disaster management. To date, different researchers from all over the world have conducted decent number of researches about early disaster management system. Among them, Short Message Service (SMS) is used to collect the upcoming flood warning and send back to all citizens from the server. Here, lots of SMS transfer can cause the network congestion which might impede the voice call communication through the same network. This can make the evacuation process difficult either. In, Cell Broadcasting Service is utilized to directly send messages to the users in a specific area.

Researchers also propose Area Mail disaster information service provided by NTT Do Como for tsunami alert and evacuation system with a view to support fishery workers. The area mail service makes it possible to deliver information simultaneously in a limited area among the vulnerable persons to the damage due to disaster.

This existing solution raises privacy, reliability and security concerns on sending internal network information to a third party. This approach has to build a huge database on device profiles and needs user feedback on any device that is not in the database. Thus it needs to keep the Device Information in Google Cloud for sending information to the network service.

III. System Architecture

A. System Requirements

The proposed Automation Tool uses the following technologies :

1) Android Sdk: The Android SDK provides you the API libraries and developer tools necessary to build, test, and debug apps for Android.

2) Apache Http Client: It provides different packages and libraries for developing client-side application that use HTTP/HTTPS protocol

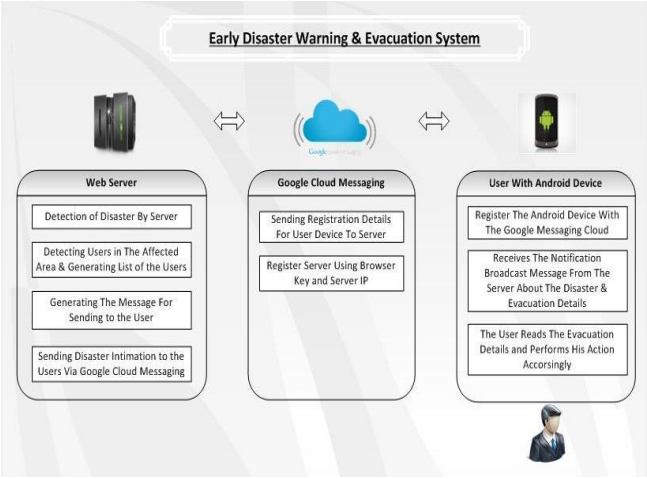
3) XML: Extensible Markup Language (XML) is used for encoding Documents and it is widely used for representation of data Structure in web services.

B. Architectures

Web server: web server is used to store the registration id of the user which is generated after the registration of the user with C2DM server.web server is updated by the website and it detects the user in the affected area by running ray-casting algorithm.

Google Cloud Messaging: Android Cloud to Device Messaging (C2DM) server is a Google server involved in taking messages from the web server and sending them to the device. Cloud to Device Messaging (C2DM) is also a service to send data from server to the applications on Android devices . The service provides a simple, lightweight mechanism that servers can use to tell mobile application to contact the server directly, to fetch updated data.

User with Android device: User must have to register with the C2DM server to receive warning alerts and noticification about upcoming disaster. After registration a unique registration id is generated in C2DM server which is received by the device and it is saved in our web server.



C. Algorithm

The web server runs Ray casting algorithm to determine the probable disaster affected areas. If user's current position is in these areas, then server returns the feedback message to the device and in turn to the application. The algorithm counts the number of intersections for a ray passing from the exterior of the polygon to any point. If the count value is odd, it shows that the point is inside of the polygon. And if the count value is even, it shows that the point is outside of the polygon. We have modified the algorithm to get correct result when the point is in the boundary of the polygon, it shows that the point in the boundary is also inside of the polygon. The pseudo code of the algorithm is as follows:

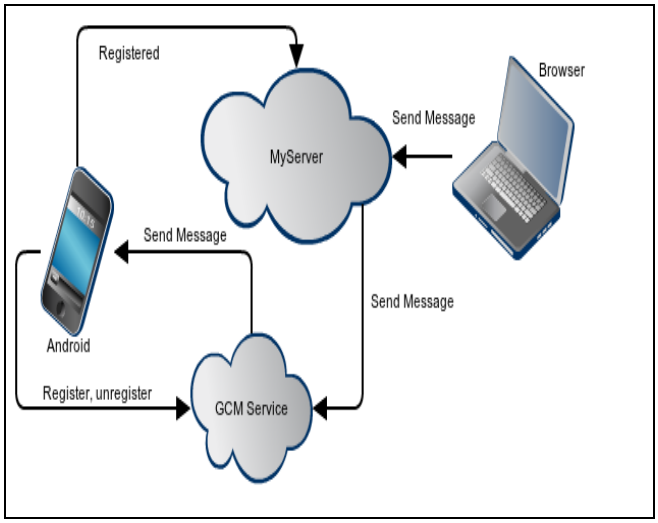
count ← 0
foreach side in polygon:
if ray_intersects_segment(P,side)
then
count ← count + 1
if point is on an horizontal
polygon boundary
then
return boundary
if point is on the polygon
boundary (other than horizontal)
then
return boundary
if is_odd(count) then
return inside
else
return outside

IV. PROPOSED METHODOLOGY

Our proposed system will have follow phases:

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.



1. **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.

2. **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.

3. **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.

4. **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.

5. **Cloud to Device Messaging**: Server can send data from Server Machines to their application on the Android Device. Device will show these messages in type of a Broadcast Message to all the cloud connected devices.

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

V. CONCLUSION AND FUTURE ENHANCEMENTS

We have proposed an android application which helps people by providing early warning message about upcoming disaster and other evacuation details. Our 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.

We have a future plan to implement another application to assist in rescue and relief operation after the disaster and a better server side application to totally automate the system of detecting disaster prone area.

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[5] http://gdacs.org/ : a cooperation framework between the United Nations, the European Commission and disaster manager worldwide to improve alerts, information exchange and coordination in the first phase after major sudden-onset disaster.

Prof. Shiv Sutar, has completed. Her research areas include and currently working as a , Pune University for ME Computers & Asstt. Professor at MITCOE, Pune. She has guided nearly projects at UG and PG level.

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