Havoc awake & Notification System via Android app

Mr. Amit S. Gosavi, Miss. S. S.Vishnu

M.TECH Scholar, Asst.Professor, Department of Computer Science & Engineering, Maharashtra Institute of Technology (MIT), Aurangabad, Maharashtra, India

[1]gosavi.amit766@gmail.com
2swativishnu@gmail.com

Abstract-- Since history started, human activities becomes responsible for many natural disasters. Countries or areas which are near to oceans or situated nearer to oceans are most delicate to natural disasters, due to change in climate and geographic position. Still some developing countries are unable to construct efficient disaster preparedness systems to handle natural disasters. Providing warnings and guidelines can save lives of peoples of such disaster prone areas. System is implemented on Android phones as Android phones become extensively famous. Proposed system administer warnings and evacuation process delivery to tourist and blind peoples who can face troubles in searching shelter in new or unknown area. Our system delivers track of closer safe place using Google map. Google map is proven very competent as compared to OpenStreetMap (OSM) and other mapping techniques. Google map delivers faster updates of maps and other interfaces. The experimental result proves the effectiveness of our system.

Keywords-- *Natural Disaster, Google Map, OpenStreetMap, Disaster Warning, Android.*

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I. INTRODUCTION

Natural disaster is the reaction of some natural hazards like earthquake, tsunami, flood, and storm etc. The earth has realized hurtful and disastrous mode of nature due to which millions of peoples lost their lives. The Japan earthquake and tsunami occurred in year 2011, the Haiti earthquake in 2010, the cyclone Nargis in year 2008, the Indian Ocean Tsunami in 2004, the Bangladesh cyclone in 1991are few recent cases of cruel natural disasters. Generally, natural disaster occurs in areas which are sensitive, delicate. According to the ranking report of United Nation's International Strategy for Disaster Reduction (UNISDR) on Mortality Risk Index (MRI), countries those are situated nearer to oceans are sensitive and are at danger from earthquakes, floods, tropical cyclones, and landslides [1]. So, in such delicate area, precaution and prevention is needed to save lives of millions of peoples. Many times peoples are unaware about the upcoming natural disasters. Therefore shortage of alertness results into the large-scale suffering from natural hazards. So, evacuation system and some former precautions can save lives of huge number of people's in the sensitive areas which suffered from frequent disasters [2]. In such delicate areas, new comer, blind peoples or tourist can mask problems in searching protected shelter from their present location.

To avoid such situation here we have proposed location disaster warning and evacuation system on android mobile phones using Google Map. Proposed method provides audio and visual messages to new comers, tourist and blind peoples to find out protected shelter [1]. As Google map provides crosswise information of the world and is almost inexpensive portable GPS devices, it is widely used.

The term disaster management includes four basic steps as mitigation, preparedness, response, and recovery. Among them, we focus on the term preparedness which includes development of secure system to carry out action plans against upcoming natural disasters [2]. For this, we present disaster alert and notification system including audio and visual warning and evacuation process on the map of the system.

Emerging era of smart phone demands the use of such location based services. Proposed system is implemented on android platform for delivery of location based services and provides notifications to the users when there are any chances of forthcoming disasters or natural hazards. Proposed system also spectacles nearest shelter using Google map. As it provides both audio and text messages, it is useful for normal as well as blind peoples. Figure of proposed location based early disaster warning and evacuation system shown below describes the system architecture.

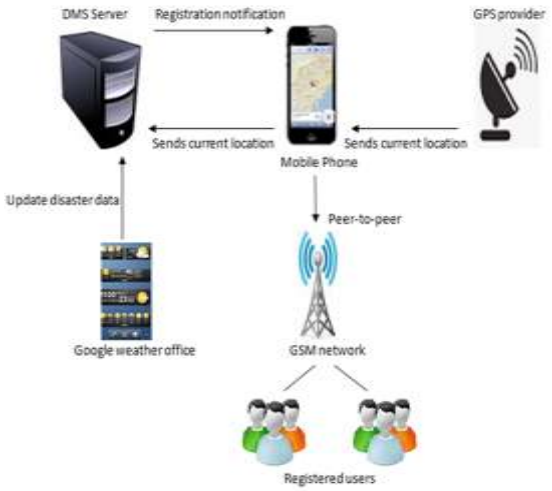

Figure:1 Proposed location based early disaster warning and evacuation system

Proposed system includes Disaster Management Server with GSM supported android mobile phones on which our application is installed and users with national id of respective country. List of all disaster sensitive areas is located in DMS server and registered users information is saved in database.

Disaster Management Server (DMS) is a third party server which stores the list of disaster prone area and the details about the users in its database. We have provided access to Regional weather offices so that they can update the disaster sensitive areas into the database. To collect notifications and alerts of revised information, user has to register on DMS server [9]. With reference to the ongoing position of user, our system is able to identify that if user is in disaster prone area or not. If system finds any registered user in disaster delicate area, system circulates alerts to user with audio and visual message with nearest safe place [13]. Regional evacuation control authority keeps track of evacuation progress with the help of DMS which accelerate the evacuation process and the stored national id of the user. The overall procedure is carried out as follows:

1) *Registration/Unregistration process:*

User using our application on android phone along with GSM phones is able to register or unregister from the Disaster Management Server (DMS). When registration process on to server is fulfilled, application generates a unique registration id for users which stored into DMS. Then the device user gets revised notifications about the forthcoming disasters. This method provides prosperity to the persons who are unfamiliar about the forthcoming disasters [2]. If user get unregistered from DMS server then authorized registration id of the user gets deleted from DMS.

2) Connection with Disaster Management Server (DMS):

Our application gets the current position of user through GSM of user's mobile phone and application communicates with DMS to send the latitude and longitude of user's current location. For registered users, DMS demands to dispatch a message to user's android application [3]. It then enquires to broadcast the message [5] via an HTTP POST method. Afterwards, proposed android application yields the data from DMS.

3) Probable Disaster Affected Area Determination: The DMS server plays important role in finding the user in probable disaster affected areas. If user's ongoing position is in such delicate areas, then first server returns the feedback message to the device and then to the application.

4) Dissemination of Disaster Warning and Evacuation Guideline: When the application finds its user in a disaster delicate zone, it will generate a notice with both an audio message and vibration. Finally, the user of application gets recent disaster warning message both in visual and audio message on map of the application. The TTF (Text-to-Speech) engine provides the audio direction to the user as evacuation guideline [1].

II. COMPARISION OF OPEN STREET MAP WITH GOOGLE MAP

OpenStreetMap started in London in August 2004. The main purpose of OpenStreetMap is to design a free digital map of the whole world and is enforced through the commitment of participants in a way similar to software development in Open Source projects [4]. The information is assembled from many participants, concentrated on a central database and distributed in multiple digital formats using the World Wide Web (Web). OSM establishes map data which is free to use, can be alter and is licensed under Creative Commons Open Database License copyright schemes. Using Creative Commons, the project can be prevented from unfair use by either participants or a third party. The primary inspiration for this map is to provide free access to present digital geographical information crosswise the world which is not available yet. One can easily rearrange OSM information with the help of wiki-like interface. For this purpose, users have to create an account for once, and he/she can able to prospect and edit the map [6]. OSM also institutes a series of local workshops which are called as mapping parties. Mapping parties are well known for design and observations on localized geographical areas. The OSM data are assembled on servers at University College London, and Byte mark.

But the OSM dataset cannot be more accurate than the quality of the GPS receiver. So there is demand to contribute an efficient map in disaster sensitive area which can provide correct path to the users who are stuck in the disaster situations [11]. To avert the problem, we used Google map to display nearest shelter to help out the person.

Google Map is very well known for Web-based service which gives structured [14] and detailed information of the word as all geographically located provinces and sites. In consolidation with road maps, Google map delivered area wise maps which provide ease to user [7]. A Google map also provides satellite views of many places. For some locations, Google Maps offers street views consisting of photographs [15] taken from vehicles.

Google Maps offers some services as part of the larger Web application, as follows.

- The term route planner provides guidance for drivers, walkers, bikers and users of public transportation who want to take a trip from one location to another with the help of Google Map.
- Application program interface (API) of Google Map provides opportunity to Web site administrators to enclose Google Maps into proprietary sites which include a real estate guide or community service page.
- Google map contributes utility to android mobile phones to use Global Positioning System (GPS) location of device [14] with cellular networks and wireless data.
- Horizontal and vertical panoramic street views of cities offered by Google helps user to navigate from one spot to another in city or around the world.
- Google map services also provide images of the moon, Mars, and the heavens for hobby astronomers.

Basically, Google map is web mapping utility for desktops and mobiles delivered by Google. It also supports the maps located on third party websites with reference to Google Maps API. Satellite images of some locations provided by Google are never updated on real time. Google always insert data in the primary database regularly. Google make use of those images which are not older than 3 years. Google maps uses different solution than Mercator projection and hence is unable to display areas which are nearer to poles [7]. Google also provides application for android mobile users named as Google Maps for mobile which is very famous worldwide.

The major difference between OpenStreetMap and Google Map is the way in which they deal with the data we fodder in to it. As name describes, OpenStreetMap (OSM) is open data source [8], one can smoothly adventure the maps implemented by OSM without any charge. OSM delivers cost free maps.

OSM is recently shifted to Open Database License (ODbL) from a Creative Commons license, which is share-alike license. It is usually analogous to Creative commons license. It allows users to use and share data as long as data is available. While Google map is closed application and whatever information we added becomes private property of Google.

Once you place your information in to Google, submitted data becomes regular, irreversible, perceptual, worldwide, authority free and also Google can modify, adapt, distribute, reproduce, and publish the user submitted data. Some criteria are listed below from which we can analyze OSM and Google Map:

1) Speed of update

OpenStreetMap (OSM) allows you to update the maps using JavaScript-based iD editor [8].OSM provides advantage to prospect updated information immediately. After user alters data, attentive editors like Wikipedia keeps track of correct maps updated by user or organization, will revised updated data and then remove or change the faulty addition and edits.

Google Maps also allows user to prospect their revised data immediately, but Google map take precautions that added or updated information must be reviewed by attentive editors [14] before it officially get added onto the map. Google also provides utility to view other peoples alterations into the map, so if person adding or altering map for first time then this utility provides a way to get your edit reviewed more quickly.

So, all alterations in map using Google map are more correct and accurate as all additions and alterations are firstly reviewed by editors and then uploaded officially.

2) Interfaces

With the help of OpenStreetMap one can view any area using iD editor without specifying geographical areas of interest or expertise. While in Google Map, we are able to give specifications according to our interest [4] to view any area. So, one can prospect exact location of sites using Google map by giving location specifications.

Adding road, town boundaries, buildings, place of interest is same in OSM and Google map. But Google maps seem to be most straight forward and user friendly.

Ray Casting Algorithm of OSM:

In our base paper, author has implemented ray casting algorithm along with OSM. Ray casting algorithm is used to solve number of computer graphics and computational geometry problems by using ray-surface intersection [6]. It was formulated in 1982 by Scott Roth to express technique for restoring constructive solid geometry models.

Generally**,** Ray casting can indicate number of problems and techniques as below:

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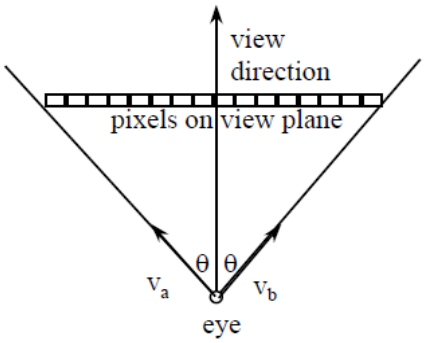
- The problem of regulating the first object intersected by a ray,
- A method for finding hidden surface removal depending on calculating the first intersection of a ray cast from the eye through each pixel of an image,
- A non-recursive ray tracing rendering algorithm that only casts primary rays,
- A direct volume rendering method, also called volume ray casting, the ray is "pushed through" the object and the 3D scalar field of interest is sampled along [6] the ray inside the object. Secondary rays are not generated in this method.

Algorithm:

1) Calculate the distance towards the final destination for all grid cells which are visible from our destination.
2) In second step, find out such grid cell X_0 which is closest to final destination for all those grids for which we have assigned a distance having at least one neighbor which is neither an obstacle and nor has been assigned distance towards destination which is maximum.
3) Then calculate distance of final destination from all grid cells which are visible from X_0. If there are some cells which are still visible from X_0 and already has a distance assigned towards the destination, then accredited distance is overwritten if and only if newly calculated distance is smaller than previous.
4) Repeat the same procedure unless and until we calculate distance of final destination from all grid cells.

2D ray calculations:



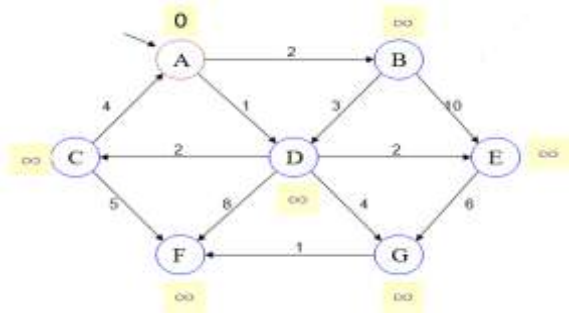
right = (**view**$_y$, **-view**$_x$)
$\mathbf{v_a}$ = **view** - tanΘ * **right**
$\mathbf{v_b}$ = **view** + tanΘ* **right**

step = ($\mathbf{v_b}$ - $\mathbf{v_a}$) / num_pixels
$\mathbf{v_0}$ = **va** + **step** / 2
$\mathbf{v_i}$ = **vi-1** + **step**

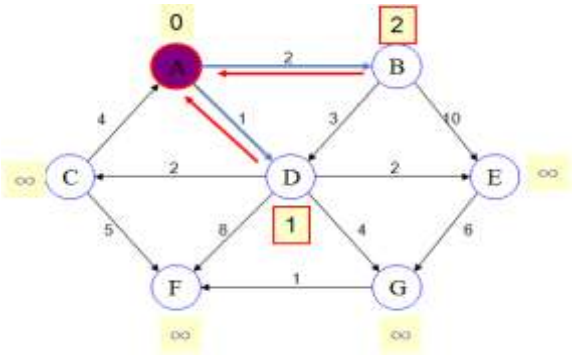
Note: take equal-sized steps in viewing plane, not equal angles.

Finding nearest path using Google Map using Dijkstra's algorithm -

The algorithm calculates from each vertex u, the distance to the vertex u from starting point v. That is nothing but the shortest path between vertex u and starting point v [10]. This algorithm keeps track of all set of vertices for which distance has been calculated from set of vertices. Each vertex has its own label as D. For any vertex as u, D[u] kept the approximate distance between the starting point v and vertex u [15]. The distance D[u] is gets updated when algorithm founds shortest path than previous distance of u to v.



Consider Distance (source) = 0
Distance (all vertices from source) = ∞



Distance of node B from source A = 2
Distance of node D from source A = 1

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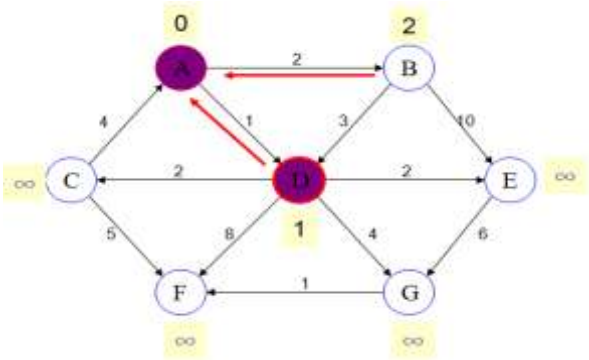
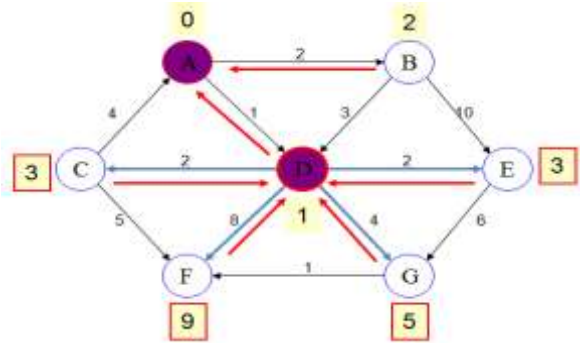
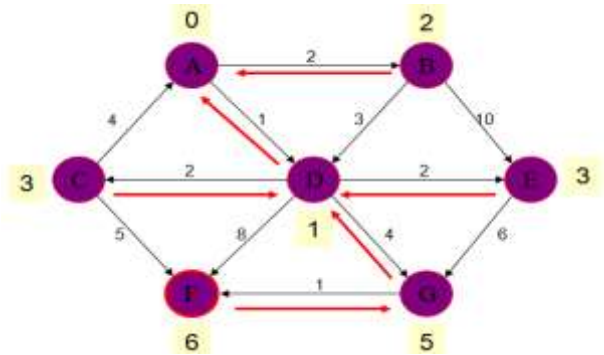


Pick vertex in List with minimum distance, i.e., D



Distance of node C = 1 + 2 = 3
Distance of node E = 1 + 2 = 3
Distance of node F = 1 + 8 = 9
Distance of node G = 1 + 4 = 5

Distance of node D is not updated because D is already known and distance of node E is not updated since it is greater than previously computed distance.
Pick vertex List with minimum distance from each vertex and update neighbors.
Minimum distance (E) is not updated because newly calculated distance is larger than previous one.
Distance of node F via C = 3 + 5 = 8
Distance of node F via G = min (8, 5+1) = 6
So, the previous distance of F is overwritten by newly calculated distance as 6.



III. RESULT AND ANALYSIS

Google Map is developing of very hasty. It also strengthens development, circulation and improvement of complementary geospatial data and allows geospatial data for anyone to use and share. Google map has proven very effective and efficient. Google map administer alterations of maps by reviewing it with help of attentive, aware editors. So, user can grab exact path of sites.

Google Map accepts specifications of users which results into most straight forward and user friendly maps according to user interests. We can easily add our place of interest with roads, buildings, town boundaries using Goggle Map.

Following figures describe the maps captured using OpenStreetMap and Google Map respectively, by which one can easily compare the difference between this two maps.

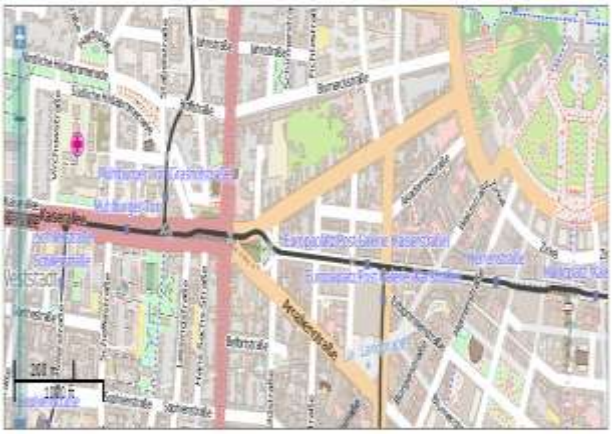


Figure 2: OpenStreetMap (OSM)

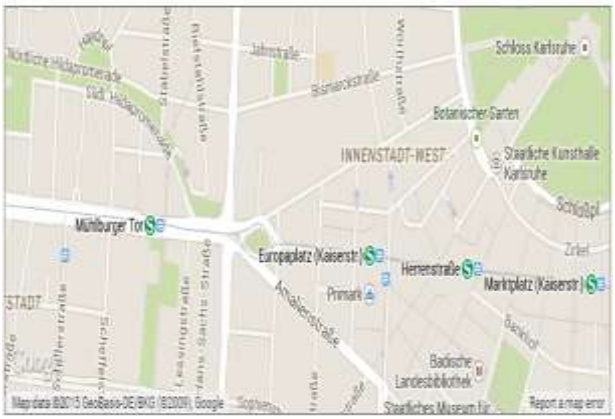


Figure 3: Google Map

We also compare web map services provided by OpenStreetMap and Google map by considering features like degree of motion of map, map types, backend provider, map data providers, etc. Google map results into more features and provides more facilities than any other mapping system like OpenStreetMap (OSM).The following table

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shows the comparison between OpenStreetMap (OSM) and Google Map based on different features.

Table I: Comparison table of different web map services:

Feature	Google Map	OpenStreetMap
Degrees of motion	Vertical, Horizontal, Rotation (beta), Depth, 360 Panoramic (Street view), 3D Mode (Google Earth JavaScript).	Vertical, Depth, Horizontal,
Map Zoom	19 (more levels available through parameter)	19
Dynamic search results based on dragging of the Map	Yes	No
Map Types	6: Map data with traffic data (separate transit and bicycle view), Satellite with Traffic data (3D LiDer for certain places not present in most places), Hybrid	5: Standard Map, Transport Map, Cycle Map, MapQuest Open, Humanitarian
Backend	JSON	XML
Map data providers	MAPIT, DgitalGlobe TeleAtlas, User contribution , MDA Federal,	User contribution
Multiple Destinations	Yes	No
Set Home Location	Yes	If and only if user is registered
Send hyperlink to email	Yes	No
Types of Maps (using Mobiles)	Map, Satellite, Terrain, Street	Map, Terrain
Readily Available Overlays for collaboration	Yes	No

Table II: Comparision of time complexity and space complexity

Algorithm Name	Time Complexity	Space Complexity
Ray casting Algorithm	$O(n^3)$	*O(V^2)*
Dijkstra's algorithm	$O(n^2)$	*O(V^2)*

The time complexity of an algorithm computes the time required by an algorithm to run as a function of the length of the string which produces the input. The time complexity of an algorithm is commonly expressed using big O notation. Time complexity is commonly estimated by counting the number of elementary operations performed by the algorithm, where a fundamental operation takes a certain amount of time to perform. If time complexity of an algorithm is as minimal as possible, more instantly it can execute calculations. In similar way, space complexity of an algorithm denotes the number of memory cells required by algorithm. A good algorithm practices to keep the number of cells as minimal as feasible. Ray casting algorithm and Dijkstra's algorithm has same space complexity. It is exhibited that time complexity needed by Dijkstra's algorithm is competent than Ray Casting Algorithm. Dijkstra's algorithm takes minimal time to compute all operations.

Table below shows the response time required for OSM, Google Map and Customized Dijkstra's algorithm from source to destination. From table we can evaluate that Customized Dijkstra's algorithm provide shortest path between source to destination with minimal response time, as compared to Open Street Map (OSM) and Google Map. Figure 4, Figure 5 and Figure 6 describes the track from source to destination using Open Street Map (OSM), Google map and Google map using Customized Dijkstra's algorithm. Customized Dijkstra's algorithm contributes shortest path from source to destination.

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Table III: Response time required from source to destination

	Source		Destination		Response time
	Latitude	Longitude	Latitude	Longitude	millisec (ms)
Open Street Map (OSM)	19.884737	75.368415	19.849949	75.368415	0.67 ms
Google Map	19.884737	75.368415	19.849949	75.368415	0.53 ms
Customized Dijkstra's algorithm	19.884737	19.849949	19.849949	75.368415	0.49 ms

Figure 4: Open Street Map form source to destination

Figure 5: Google Map from source to destination

Figure 6: Google map using customized Dijkstra's algorithm from source to destination

IV. CONCLUSION

By comparing Google map with OpenStreetMap (OSM), we conclude that Google Map using Customize Dijkstra's algorithm is proven extra adequate. One can comfortably insert roads, boundaries and building etc. into Google Map. A Google map delivers exact updates of maps. Speed of updates is more while dealing with Google Map. It also furnishes numerous directions and aspects of the map. Google Map using Customize Dijkstra's algorithm delivers shortest track from source to destination. Google offers Vertical, Horizontal, Depth, Rotation, 360 panoramic views of data. Google map provides more map types than any other maps. Map, Satellite, Terrain, Street types of maps are provided by Google on smart phones.

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