Geographic Information System and Web Base Emergency Management System

Soobia Saeed, Syed Mehmood Raza Naqvi

Abstract *—**Agile response in case of emergency can minimize the risk of losing life or property. An hour when accident has occurred is the golden time to get recovery and response. The main purposes of this paper is to design real time web based, GIS application for android which can encounter such emergency situations especially in those exceptional areas where no as such emergency recovery system is exist. Common emergency situations are natural disasters, road accident and fire. Our system will determines and analyzes the situation and by using GIS information about the located coordinate of the incident, police, fire brigade, hospitals, transportation and recovery team it responds accordingly.Spatial database is created for the historical records analysis where ArcGIS server is used as background engine and WCF service with basic map interaction and ASP.NET technology at the front end development. Signal was generated by the victim through his/her smart phone and application will be able to respond according to the scenario.*

Keyword: Agile, GIS application, database, WCF, emergency, disaster

I. INTRODUCTION

a. Overview

In country like Pakistan where so many incidents occur every now and then there is a need of a emergency management software which can help people and save many lives. Currently implemented system are more telecommunication bases system where sufferer need to call on helpline service and then rescue team used to take his address or location. There is every possibly that helpline service is down or busy and victim person need to wait for long. Old system also has a chance of fake calls so the person who really needs a recues may be ignore [1].

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a. Problem Statement

There is no such system present which can perform quick service to victimized people.

b. Background

Often such sudden event occurs where live of a people become threaten. To respond in such situation there is a need of Emergency Management System (EMS). Usually recue department fail to perform quick action because of delayed information and unclear victim location. Such emergency can arrives after any road accident, natural disasters, act of terrorism, explosion and fire. People suffering in these situation requires quick response team to safe their and other life [2] [3].

Different types of systems like DVE (Decision centered Visualization) and AERS (Advance emergency response System) were develop to facilitate the victims of such situations and to ensure the quick communication link and manage available resource. Most of the old rescue systems are deployed on the desktop computers which become time consuming in case of emergency. Modern portable and hand handled devices has replaced the old desktop systems. People are accessing everything under their figure tips. Our system is compatible with such devices so quick emergency information can be transmitted to concern department and by determiningexact location through GPS technology prompt action can be taken against it [4].

c. Out Line

Living standard of people in most countries are increasing day by day, people mostly travel through their own vehicles which has caused increase in traffic load due to which chance of accidents has also increased. Heavy traffic also causing problems in rescuing service like ambulance or fire brigade etc[5].

Delay in rescue service can occurs due to any maintenance work or construction across the road which was previously unknown to the rescue team. EMS app can provides the exact location, type of incident and shorts path to reach the spot. In case of natural disaster it is impossible to provide service on the spot because usually everything in sounding is destroyed. EMS also store the data which can be used in analysis and helps government to calculate type of incident, how severe is the incident, number of causalities or injuries etc[6][7].

d. Definitions

i. Emergency

Emergency is unexpected situations that occur providing imitate risk to life, health, property or environment.

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ii. Recovery

Recovery is a process of getting rid from any emergency

iii. Geographic Information System -*GIS*

Geographic information system is design to capture and store all type of geographical and spatial data.

iv. Sensors

It is a sensing device which measures any respective change and inform about it.[8]

e. Use of Sensors in EMS

Many of the latest smart phones are coup up with the multiple sensors used for different purposes like temperature sensor, air pressure, fast fall algorithm and gyroscope. In emergency management system sensor can be beneficial in a way that it generated the SOS for the rescue if he/she is away from his cell phone or tablet.

Suppose an incident has occurred and owner is far away from his/her mobile, mobile sense the situation on the basis of certain conditions and generates a message informing the owner about an emergency situation. Application will wait at least three minutes to get the owner response on failure same message will be popup. If user still not respond or not in the position of responding on the fourth attempt the application will automatically send a predefine message like 'NEED SOME HELP PLZ SAVE ME' to SOS person already define by the owner in settings. This approach is most common where owner having heart attack, blood pressure, mental distress or any other unconsciousness behavior [9].

f. *Type of Sensors*

i. Gyroscope and Accelerometer

Accelerometer as name suggest is use to detect phone orientation. Gyroscope provides additional dimension regarding the rotation and twist tracking. Gyroscope sensor is responsible of measuring the angular movement of a cell while accelerometer is more focus on linear acceleration. Both sensors in combine use to maintain the equilibrium of mobile phone. Such sensors are useful in case of earthquake or vehicular accident.

ii. Air Pressure Sensor (Barometer)

Pressure sensors are specially designed to provide high resolution and high accuracy. Change in atmospheric pressure can affect the overall accuracy regarding absolute altitude. These useful sensors can help us to implement very accurate and reliable altimeter function which can measure the change in atmospheric pressure due to tsunami, cyclone etc[10].

iii. Temperature Sensor

Android platform offers some built-in temperature measurement sensor application like Android Sensor.
This application can play a big part in our emergency management system where victim is caught into fire or stuck into volcano eruption process [10].

II. Literature Review

There are many application, platform and technology are in used for emergency management. For example iGaDs (Intelligent Guard against Disaster) used for predicting expected natural disaster and launch upcoming disaster alert. Smart device is connected to sense and authenticate disaster and launch alert message. Sever to server web hook-based p/s protocol is used with mobile device [11].

Another project with the name of EPIC(Empowering the Public with information in crisis) provides information and updates to the public during emergency. Social media forum like twitter is use by this system to promote, visualizing, mapping and monitoring the hazard. People stocked in any cisies can spontaneously twit to alerts others [12][13].

BRIDGE (Bridging Resources and Agencies in Large-Scale Emergency Management) is the system which offer organizational and technical solution to enhance emergency response in crisis

UN-SPIDER is United Nation platform use space technology to inform and provide emergency response by exploiting space.MRCCFR (Mobile rich media communication and collaboration tool for first responders and a web-based information merging and visualization application) provide real time awareness to tackle any situation by mean of audio and inter agency communication. This application also performs human tracking. People need to tag different symbols locating different hazard [14].

III. METHODOLOGY

a. Data Collection

GIS data is usually found in the form of maps, images, scale, dimensions (2D, 3D), Geo referencing, Geo location, Schema etc and stored in spatial database.

b. Platform Design

Our system design for server will be consist of 3 parts. (1) Designing of Web server (GIS)(2)designing of data server (3)designing of Smart phone app (PDA). Smart phone application first sends the request to web server which has all the GIS data like maps, Coordinates locator, globes etc. Web server utilizes the web services and retrieves data from data server and locates the responder on globe.

c. Phase in EMS

Several domains need to be address when building emergency management system:

- ✓ Planning
- ✓ Mitigation
- ✓ Preparedness
- ✓ Response
- ✓ Recovery

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Figure.2: Emergency management cycle

Different phases have different data source. Data need to be accurate and well organized in order to take full advantage of this system. In case of emergency there is minimum margin of time so there is a need of pin point data so appropriate safety measure can be adopted. Different rescue teams look after and update concurrent data and keep track of the map by utilizing GIS resources.

d. Reasons to Use Mobile Phones

The Mobile phones have become essential part of human life and provide all the functionality at the hands with significant development. Explosive application like emergency management system with authentication functionality will enhance the rescue procedure of state and provide urgent command and control action against any disaster like terrorist attack, traffic accident, natural disaster, explosion, fire or other horrible events.

On ground this application will work in such a way that whenever any event occur the person having a mobile phone or tablet with installed application will run this application. After running it responder need to fill some text field data which is asking further details about responder and scope of incident. After submitting the information application will then send the latitude and longitude position along with other details filled by victim to the server and these were shown to the administration on map via built-in GPS/GSM.

e. Reasons to Use Web Services

In Emergency management system real time identification of different emergency service like hospital location, ambulances availability, rescue helicopter, accidental site, traffic scenario etc need to be shown map as in figure.3, GIS map is designed with the relevant data available on server.
Main focus of web service is to implement the information up to its extreme usage. It is the area of communication between user and computer.

In our system web service means software that supports the coloration between mobile and server over the network. The communication is done on the standard of Window Communication Foundation (WCF), get method, set method (Restful Services) with mobile. Web service normally uses XML as input from mobile device and display the location of user on the map by using GPS/GSM information store in database.

f. The Function of GIS in Web Service

Web service provides assistance to other application. User normally is not familiar with the development of these services they only concern with the usage of these services. Web applications use these services to fulfill different requirements. Normally web services are hidden from the user but ArcGIS web service provides all the functionality of GIS to the system with granting necessary user experience.
GIS server enables user to share GIS data across the system by creating maps, spatial database, and mobile app, KML (keyhole Markup Language), WMC (Web mapping service), Geoinformation and Geodata.

g. Algorithm

```
Incident occur
{
        User opens application;
        // where victimized person inputs entities from
        smart phone
        If (input == correct entities)
        Get location via GPS ();
        Store location (varlat, long);
         Send location (post method);
}
Get location via GPS ()
{
        //connect to satellite
        Get the current location via GPS;
}
Store location ()
{
        Varlat;
        Var long;
        String (lat, long)
        Store the location get via satellite;

}
Send location ()
{       Method (post);
        // where services used are restful post services
        Lat, long sent to the server;

}
Store location in DB ()
{       Get lat, long from the smart phone using restful
        services;
         Store in DB;
        Show position on the map;
}
// identifying the location of the user, rescue teams are sent
towards the victimized area using shortest path.
```

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IV. RESULT AND DISCUSSION

In this research article, the system are implemented to any kind of emergency situation arrives. In the First character of this application is the person who wants to avail the service say responder; he/she must have IPAD, smart phone because this device is the way to locate the responder using GPS/GSM technology.

In our country Pakistan there is no as such emergency management system or quick emergency response force is available so this application will help people in a great way.

EMS application required some text field to be filled by the responder for example the type of help, of scope of incident etc. GPS coordinates form the mobile is pass to the server where DBS manager search the database and located the location on the map. Rescue teams who are in continuous touch with the database will send to affected area for necessary action.

Figure. 4: Interface that should be filled by responder

V. CONCLUSION& RECOMMENDATION

a. *Conclusion*

Human life is so precious and by combining different technology like GIS/GPS, Android and web application in an emergency management system can secure many precious lives and property. This application not only provides enormous amount of benefits to the agencies responsible for dealing in emergency but also provide huge relief to the user or victim. Quick and agile movement of aid can save many lives and brining such service to the smart phone is itself an incredible change.

b. Recommendation

The Country like Pakistan do need smart application like EMS to overcome the amount of causalities and damages occur due to any disaster or hazard. In future disaster management system can be design using GIS and satellite images which able to analysis earthquake, drought, land sliding or flood analysis and play helping hand to establishes awareness among the people of Pakistan for safety measures.

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REFERENCES

[1] Tiana, H., Liu, Z., Zhang, J., Luo, C., Liu, "Design and development of emergency response geographic information platform based on web service", pp.101-103,2016.

[2] Zerger, A., Smith, "Impediments to using GIS for real-time disaster decision support (Centre for GIS and Modelling", Department of Geomatics, The University of Melbourne, Victoria 3010, Australia), Centre for Resource and Environmental Studies, Australian National University, Canberra 0200, Australia,pp.32-34,2016.

[3] Ganesh Kumar, B., Ramesh, D., "Emergency Response Management and Information System (ERMIS)" conference based on A GIS based software to resolve the emergency recovery challenges in Madurai city (PSNA College of Engineering & Technology, Dindigul, and Tamilnadu, India), pp.112-118, 2015.

[4] Zlatanova, S., Holweg, "D.: 1GISt, 3D GEO-Information in emergency response: A framework (Delft University of Technology", Delft, The Netherlands, 2-Fraunhofer IGD, Darmstadt, Germany),pp.223-229,2016.

[5] GIS Technology for Disasters and Emergency Management. An ESRI White Paper (Russ Johnson Public Safety Industry Manager, ESRI)

[6] ESRI White Paper. GIS for emergency management (July 1999), http://www.esri.com/library/whitepapers/pdfs/emermgmt.pdf

[7] How smartphone and tablet technologies enhance emergency mass notification systems, http://www.gsnmagazine.com/node/24080

[8] Zhang, X., Chen, H., Hong, "H.: Service-Oriented Geographic Information Sharing and Service Architecture for Digital City". Advances in Intelligent Web Mastering 43, pp.381–386, 2007.

[9] Coors, V., Flick, S. "Integrating Levels of Detail in a Web-based 3D-GIS", In: 6th ACM Symposium on Geographic Information Systems (ACM GIS 1998), Washington D.C., USA ,pp.78-83,1998.

[10] Zlatanova, S., van den Heuvel, F.: "3D GIS for outdoor AR applications". In: Proceedings of the Third International Symposium on Mobile Multimedia Systems & Applications, Delft, The Netherlands, December 6, pp. 117–124 ,2002. ISBN 90-9016467-7

ISSN 1816-613X

[11] Li, Q., Stankovic, J.A., Hanson, M., Barth, A., Lach, J.: "Accurate, Fast Fall Detection Using Gyroscopes and Accelerometer-Derived Posture Information, University of Virginia, vol.7 (2):129-136, 2011.

[12] Ou, Y. Z., Huang, C. M., Hu, C. T., Liu, J. W. S., Chu, E. T. H., & Shih, C. S., "An Asynchronous Message Delivery Service for iGaDs (Intelligent Guards Against Disasters)". Paper presented at the Innovative Mobile and Internet Services in Ubiquitous Computing (IMIS), 2013.

[13] Starbird, K., &Stamberger, J.,"Tweak the Tweet: Leveraging Microblogging Proliferation with a Prescriptive Syntax to Support Citizen Reporting". Paper presented at the 7th International ISCRAM Conference, Seattle, USA, pp.24-31, 2010.

[14] Bakopoulos, M., Tsekeridou, S., Giannaka, E., Tan, Z.-H., & Prasad, R., "Command & Control: Information Merging, Selective Visualization and Decision Support for Emergency Handling". Paper presented at the ISCRAM, Lisbon, Portugal, pp.12-15, 2011.

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APPENDIX

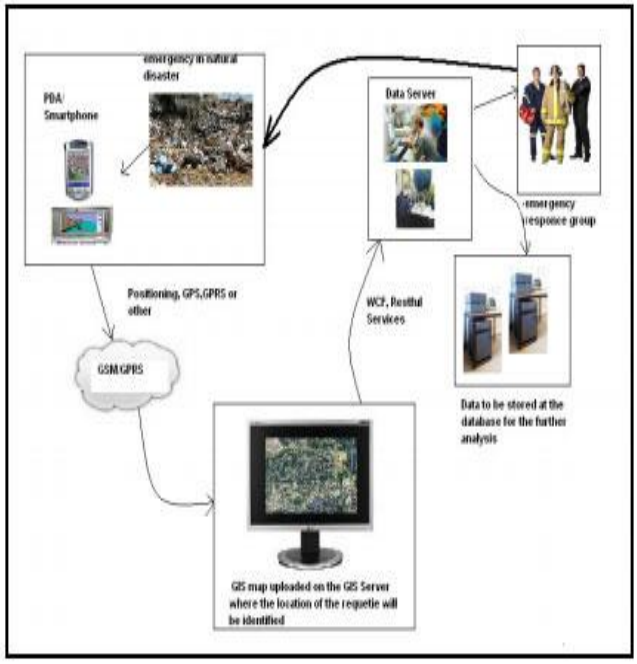

Figure.1: Architecture of EMS

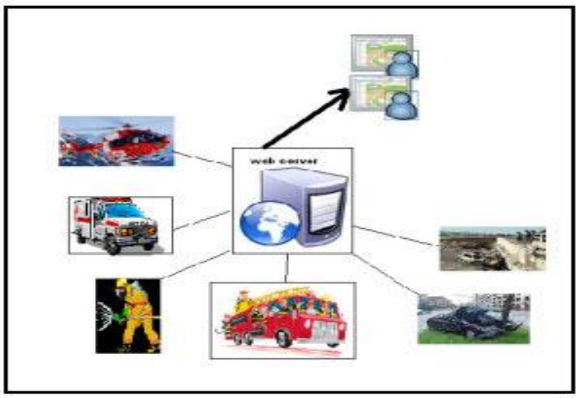

Figure.3: EMS web server sketch

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Flow Chart

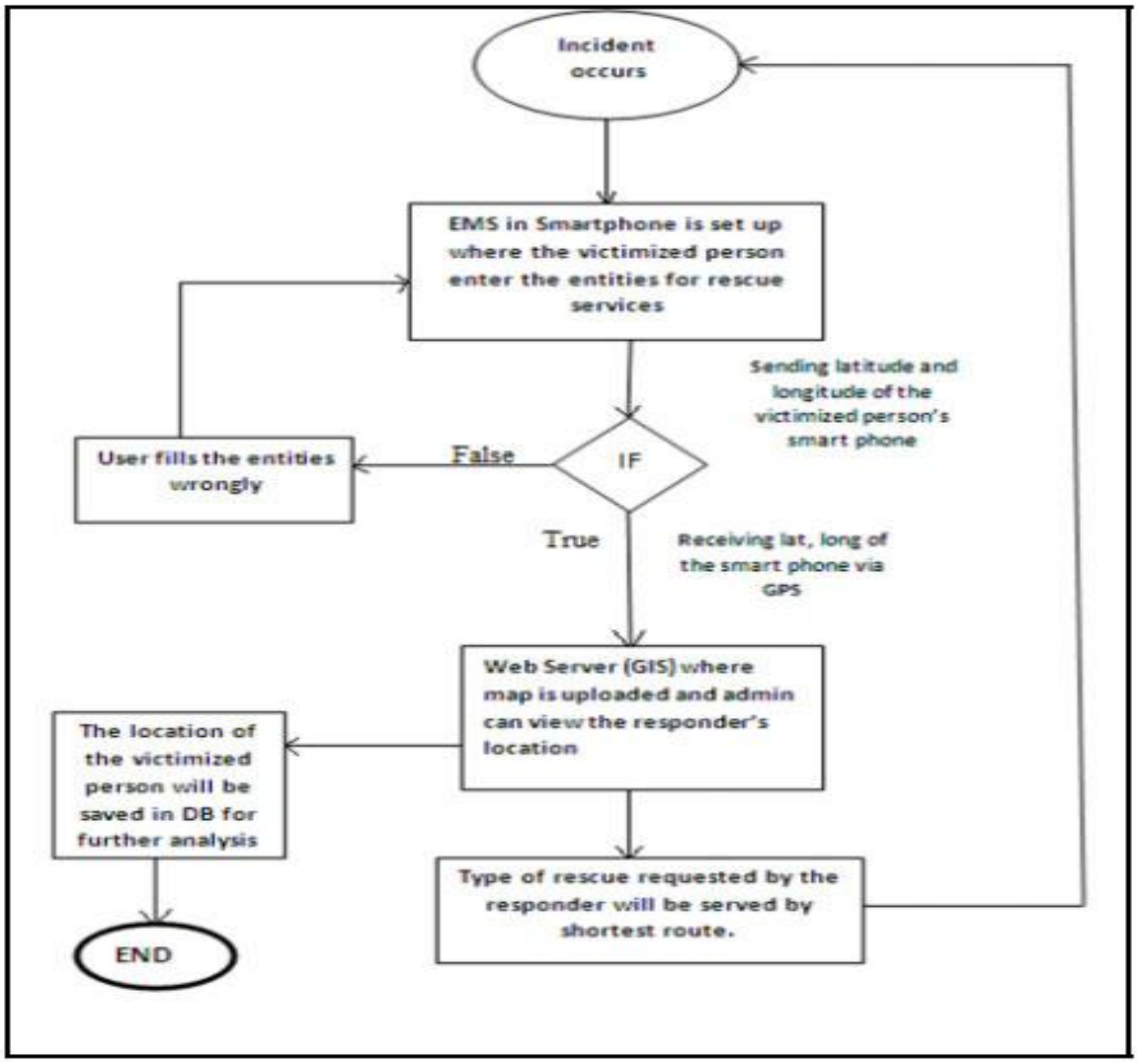
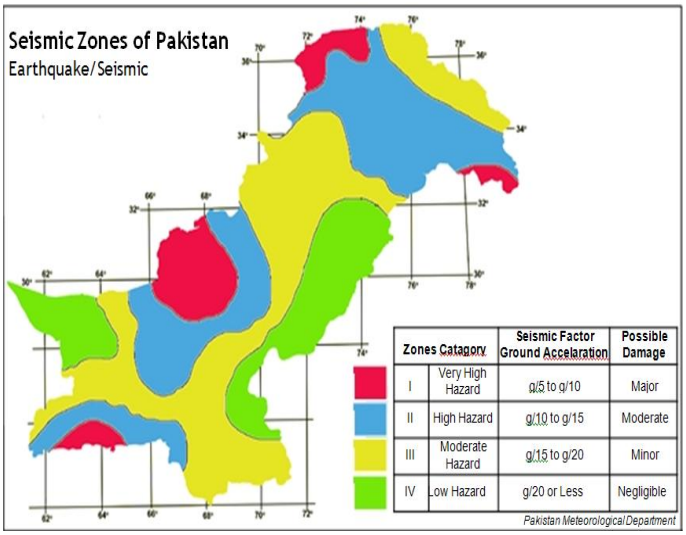
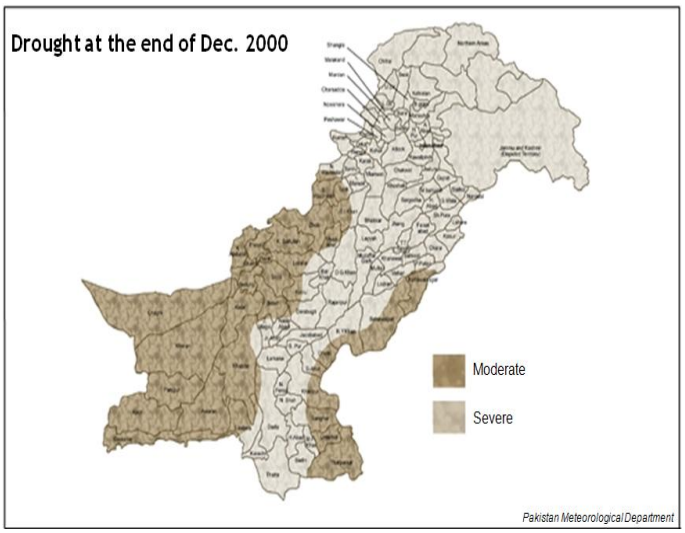


Figure. 6**:** Flow Chart of EMS





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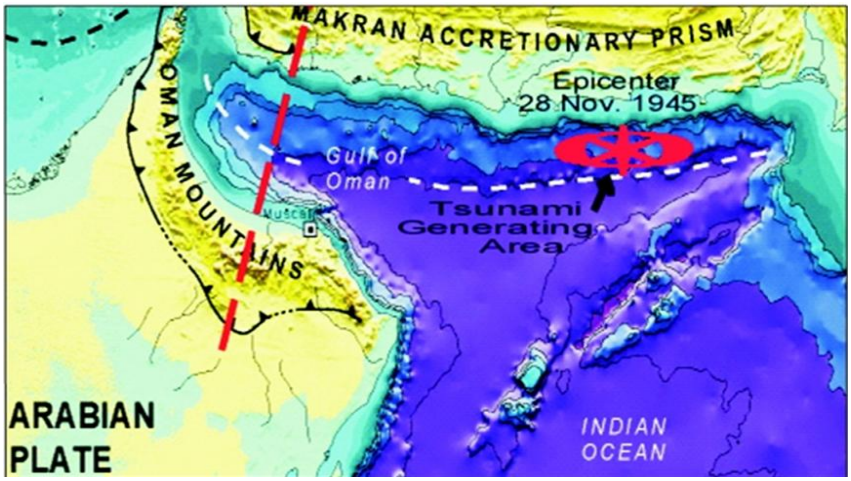

Figure.7: Land Sliding Near Northern Area

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