

# Web Based GIS for Disaster Management System

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## Abstract

Natural hazards like earthquakes, floods become disaster when they knock the human environment. To downsize the impact of every disaster, governments fix strategy, called disaster management. Availability of data such as lifeline systems, roads, hospitals and buildings will help the managers for better decision-making. This System explores fundamental principle of geography, the location is important in human life. It is used to inventory, analysis and manage many aspect of the world and it takes number & words from the database & put on map. Now in this time, Many organizations which involve in disaster management, require to access to the right data in the right time to make the right decisions. Using this system, managers of organizations can easy access information about disaster any time and any where they are. Disaster management can be divided into four major phases like: Planning, Mitigation and Preparedness are all pre-event phases, Response and Recovery are two during and post-event phases. These phases are related by time and function to all types of emergencies/disasters. As disasters (earthquakes, floods and hurricanes...) are usually spatial events so all phases of disaster management depend on data from a variety of sources. So, Geographical Information System as a tool to collect, store, analyze and display large amount of spatially Information layers, supports all aspects of disaster management[4]. In this Proposed System we are going to provide geo-graphic information in case of various emergencies for disaster in terms of map, reports, statistics and quick response via SMS or E-mail. The proposed web-based GIS is designed to work on Geo graphical data and it will process on the various maps. It also includes the processing of database information which is related to the maps. This GIS system not provides any information regarding Pre-event phases of disaster management that are Preparedness and planning.

## Keywords

Phases of GIS system, Database processing through maps and reports, better decision making, geo-graphical data

## I. Introduction

Geo-Information System is a System that explores fundamental principle of geography, the location is important in human life. GIS is used to inventory, analysis and manage many aspect of the world. GIS takes number & words from the database & put on map.

The map legend is the little box on the map with symbols on it to locate where we are on the map. Basically maps are drawn using the data stored using raster and vector methods in GIS. And when user edit the symbol of legend the part of map associated to that symbol would show the changes we want to apply. Raster data are generally in the form of the images which can't be modified while vector data are in the form of database which we can modify as per our requirements. Web-GIS provide a low-cost and rapid methodology of disaster management as well as critical information for decision support by emergency managers and the disaster response community. There are several terminologies like[1]:

## A. Emergency

Emergency is a deviation from planned or expected behavior or a course of events that endangers or adversely affects people, property, or the environment.

## B. Disaster

Disasters are characterized by the scope of an emergency. An emergency becomes a disaster when it exceeds the capability of the local resources to manage it. Disasters often result in great damage, loss, or destruction.

## C. Risk

Risk is the potential or likelihood of an emergency to occur. For example, the risk of damage to a structure from an earthquake is high if it is built on or adjacent to an active earthquake fault. The risk of damage to a structure where no earthquake fault exists is low.

## D. Hazard

Hazard refers generally to physical characteristics that may cause an emergency. For example, earthquake faults, active volcanoes, flood zones, and highly flammable brush fields are all hazards.

## II. Scope

The proposed web-based GIS is designed to work on geo graphical data. The system does the processing on the various maps. The system also includes the processing of database information which is related to the maps.

In the process of disaster management, there is a need to decide and translate the measures into action which are to be executed in each stage of disaster prevention, emergency response, and recovery and construction. The data necessary for taking actions has been accumulated by the relevant divisions and made ready for decision making.

This GIS system will not provide any information regarding Pre-event phases of disaster management that are Preparedness and planning.

## III. Objective

Accessibility and dissemination of timely and accurate information.

## A. Centralized Control

A web GIS can disseminate information from a control room which can reach everyone. Authenticity and accuracy are guaranteed. Instant Feedback and updation: The current status can be updated from moment to moment.

### IV. GIS in Disaster Management System: Conceptual Framework

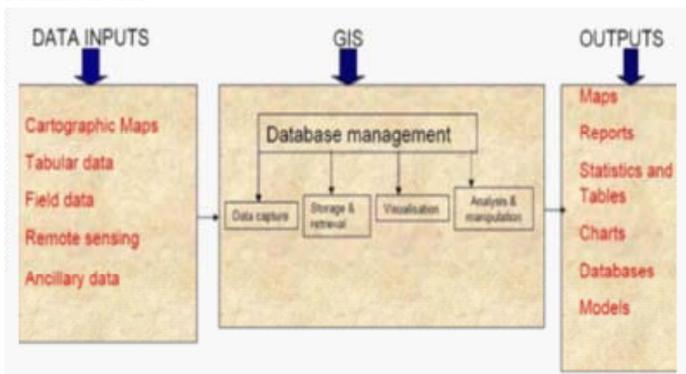


Fig. 1: GIS framework [3]

In this system input can be taken as tabular data or maps on basis of that GIS can analyze & visualize and generates important information as maps, reports, statistics etc.

### V. Functional Requirements

1. System provides information regarding various disasters like its type, its group, location etc.
2. It will also give information about killed and affected zone nearby.
3. System records the timings of disaster and gives assessment on particular disaster.
4. Manager can view the map and relevant information about disaster [2].

#### A. Earthquake

1. System provides info. About earthquake like its location and epicenter.
2. It also gives location of safe and destructed areas for disaster.
3. System provides no. of hospitals and location of shelters.
4. It will also provide contact info. of various NGOs.

#### B. Flood

1. System provides location of flood, safe and affected areas.
2. It will also give information about hospitals, contact no. of NGOs, details of boats and swimmers.
3. Information about the drainage lines and river level.

#### C. Fire

1. System provides co-ordinate location of fire and information about fire station.
2. Information about statistical and hazardous areas around the place.
3. It will give information about hospitals and emergency centres.

### VI. Nonfunctional Requirements

#### A. Performance

90% of the responses should be within seconds, speed should be uniformed.

### B. Safety Requirements

The data handled in the GIS system is very vital. The server should always be confirmed to run properly and the data are saved to the database at consecutive intervals.

### C. Data Retention

Updating of new data to the database is important so that exact and correct information can be available.

### VII. Flow Chart

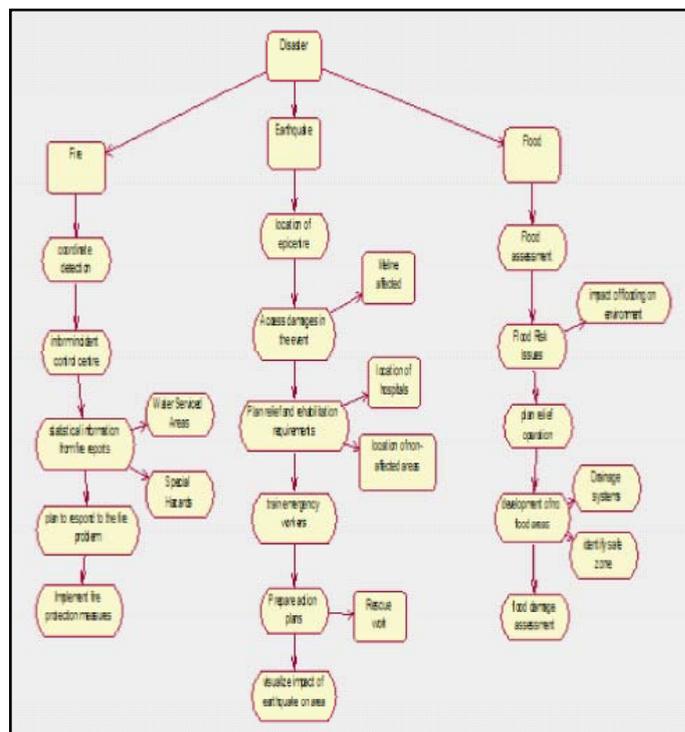


Fig. 2: Flow chart of Disaster Post-Event Phases

Above flow chart depicts how events come into action once disaster happens and planning and mitigation takes place.

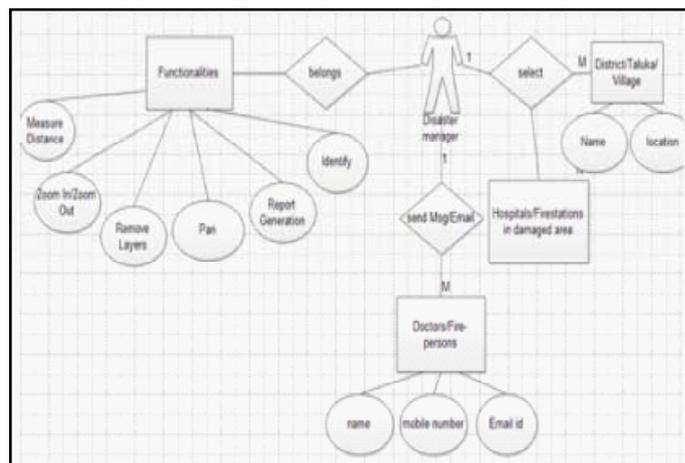


Fig. 3: Role of GIS Manager

### VIII. GIS Manager

Here GIS manager/Administrator plays a major role once post event phases are to be taken place. Manager will interact with web based system (GIS) and comes out with various reports and decisions which have to be taken after disaster happens.

Manager can select disaster affected area into system and can measure various things like distance to that affected area, no. of hospitals nearby, road lines, etc. He also can communicate with local authorities via Email or SMS directly from the system.

**IX. Overall Description**

This software will work on geo graphical data and system will process on various maps. Proposed System will provide geographic information in case of various emergencies for disaster. The software is intended majorly for taking emergency steps in case if disaster takes place. The user of the software can be a GIS manager and other intended users.

In addition, this proves to be a useful point of reference to compare actual costs as the project progresses. There could be various types of intangible benefits on account of automation.

These could include increased customer satisfaction, improvement in product quality better decision making timeliness of information, expediting activities, improved accuracy of operations, better documentation and record keeping, faster retrieval of information, better employee morale.

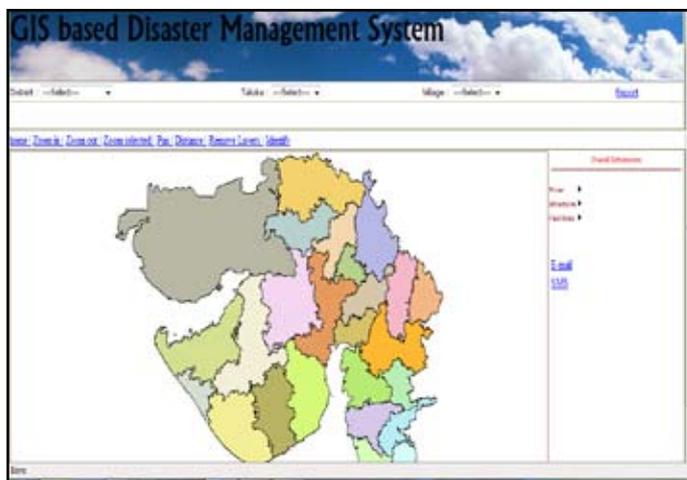


Fig. 4: Sample Webpage of Disaster Management System

In above figure, district has been selected and as per requirement we can perform various operations on it and take decisions as part of report generation.

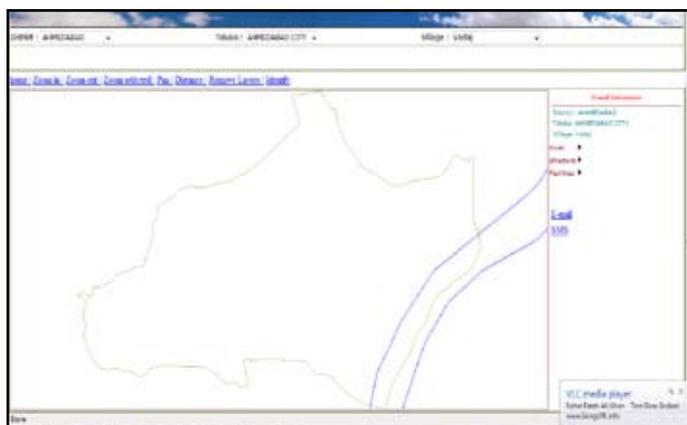


Fig. 5: Map Showing River Going Across the Selected Region

**X. Conclusion**

Emergency management programs are developed and implemented through the analysis of information. The majority of information is spatial and can be mapped. Once information is mapped and

data is linked to the map, emergency management planning can begin. Once life, property, and environmental values are combined with hazards, emergency management personnel can begin to formulate mitigation, preparedness, response, and recovery program needs.

A Web-based GIS has been developed for supporting disaster management. This system helps to estimate the extent and size of damages, just after the particular disaster. It also, helps the managers to rapidly response to various disasters. This takes a lot of advantages to the managers by decreasing the cost and response time to make better decision during and just after the disaster.

**References**

- [1] UNCRD’s 25th Anniversary Commemorative Program for GIS for Disaster Management Proceedings of the 9th International Research and Training seminar on Regional Development Planning for Disaster Prevention
- [2] GIS Technology and Applications for the Fire Service An ESRI® White Paper • March 2006.
- [3] Integrated Distributed GIS Approach for Earthquake Disaster Modeling and Visualization Rifaat Abdalla, PhD candidate, GeoICTlab, Canada Vincent Tao, PhD candidate, GeoICTlab, Canada
- [4] M. Saydi, M.J. Valadan Zoej, A. Mansourian, ”Design and implementation of a web-based GIS (in response phase) for earthquake disaster management in Tehran city”, Commission PS WG VII/5.



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