

Forecasting and Early Warning Systems & Communication and Information Technology for Various Types of Disasters

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Abstract— Disaster is one of the major accident which gives us major human loss economic loss and environmental loss whereas no one can stop the disaster because it is natural made but we can reduce the risk when we know about the disaster that which can be occurred and when it will be occurred so that we can reduce the risk instead of losing the human and economic loss we can take certain precautions to reduce the risk now a days the technology has been grown up a huge extent where we can utilize the technology to predict the time that disaster will occur the system has been changed before the technology the casualties was more when the disaster occur now it has been reduced in many cases and many cities now if we look in modern technology after the disaster Tsunami in 2004 the government of India took a wide intention and On 23 December 2005, the Government of India enacted the Disaster Management Act, which envisaged the creation of National Disaster Management Authority (NDMA), headed by the Prime Minister.[1]

After this the formation of the cell at central, state, district and local level then there is a separate cell for the disaster, Early warning system and new technology using both of this the reduce the risk from the disaster.

The below paper explain details about the Forecasting And Early Warning Systems for Various Types of Disasters and Communication And Information Technology In Disaster Management.

Keywords—Early warning, Information communication system, Hazard, and Management

1. INTRODUCTION

A sudden damage, such as an accident or a natural catastrophe that causes great damage or loss of life and economy we cannot estimate that type of disaster.

Disaster brings us surprises such as no telephone connection, no transportation no food etc., but we can learn from experience, we cannot choose what happen to us no one can easily expect the same disaster will occur to the same city, but we can choose preparedness and early warning technology by using certain mapping of the city .

Disaster is one of sudden reaction that will appear without any intimation but there will be huge damage to humans and economic but nowadays there are lot changes has been happened there is certain equipment's where we can detect disaster before it occurring by technology which can be used to detect the disaster pronely

There are two types of disaster they are natural and manmade in natural disaster they are Floods, drought, cyclone landslides etc., and manmade are the chemical disaster, war etc.

1.1 Natural Disaster in India:

The Indian subcontinent is one among the world's most disaster-prone areas. Almost all the area is vulnerable to the disaster prone area. Out of 29 states and 7 union territories, 22 are disaster-prone.

Table-1: Percentage of land Vulnerable to disasters

Land vulnerable to	Percentage
Earthquake((high seismic zones III-V)	57%
Drought	68%
Cyclones	8%
Floods	12%

1.2 Manmade disaster in India:

The major man-made disaster is Bhopal gas tragedy, not following the guidelines etc. For both the disaster, we need to have certain preparedness or precaution to reduce the risk by using certain technology by using the technology and early warning system as a tool to reduce the disaster risk some of the IT technology are also mentioned below. [4]

2. BACKGROUND:

India has large natural disaster prone area. When we look into the statistics of India the disaster per year is increasing and due to some early warning, the reduction of deaths has been reduced.

3. FORECASTING AND EARLY WARNING SYSTEMS FOR VARIOUS TYPES OF DISASTERS:

3.1. Early Warning Systems:

The early warning system is useful to detect, forecast and issue the alert when the disaster occurs. This early warning system will help to communicate with the people before the disaster and useful to the response before the disaster.

In India some of the nodal agencies in the India is mandated for early warning of different natural hazards:

Table-2 Nodal agencies in Government of India

Disasters	Agencies
Floods	Central Water Commission
Tsunami	Indian National Centre for Oceanic Information Services
Cyclone	Indian Meteorological Department
Landslides	Geological Survey of India

Source: Standard operating procedure for responding to natural disasters, 2010

It needs to be communicated in such a way that timely action should be taken some of the early warning information come from some of the sources like Ministries of Health (for example, disease outbreaks) and Agriculture (for example, crop forecasts); nowadays there is huge increase from media and the internet for early warning system .

The early warning system helps to prevent loss of life and reduces the economic loss from disasters.

The effective early warning system needs to actively involve the people at risk, to know and to create awareness of risks, effective early warning and alerts will help to know constant preparedness in state and local levels.

A complete and effective early warning system supports four main functions:

1. Risk analysis,
2. Monitoring and warning;
3. Dissemination and communication;
4. Response capability.

The early warning helps to identify the factors that indicate the disaster involves a study of the factors that indicate a disaster is brewing and also used to detect the methods to identify the factors. To communicate the risk information and early warnings to reach those in danger in such as it should be clear and easy to understand. Mainly a sufficient plan should be prepared the building of national and community response plan, to look over that people should know how to respond to the early warnings.

This early warning system can be used as a chain of information and comprises sensors, event detection, decision support, and message broker subsystems. Everyone works together to forecast the early warning of the disaster and signal disturbances that will affect the stability of the physical world, this will provide time for response system dying time for the response system to prepare for the adverse event and to minimize its impact.

An early warning system is more important than the warning system, which gives the alert to the public so that easy to awareness and action can be taken according to preparedness.

Table-3: Dedicated Hazard Forecasting and Warning Networks in India

Hazard Forecast & Warning Network	Purpose
Flood forecasting and Warning Network	Based on hydro-meteorological data recorded by observers.
INSAT Based Distress Alert Transmitter for Fishing Boats	The transmitter sends different types of emergency signals for fire.
VHF Radio Communication System	Fishermen carry VHF sets to make calls and to send their position data to the shore Station
Cyclone Warning Network	Satellite imagery and Radar are useful in detecting the development and movement of Tropical Cyclones.
Seismological Observations Network	A national network of Seismic Stations.
Drought Warning Network	observed green vegetation cover of a district
Tsunami Warning Network	Indian tsunami warning system operates using 3 tiers, e.g., 'watch', 'alert' and 'warning'

Source: National Disaster Management Authority.

4. COMMUNICATION AND INFORMATION TECHNOLOGY IN DISASTER MANAGEMENT:

Although it is not possible to control natural disaster we can take certain preparedness and management of disaster through scientific technology to reduce the risk some of the application are like

1. GIS
2. Remote sensing
3. Internet
4. Satellite
5. Radio and TV
6. Mobile fax and Email.

GIS, remote sensing and the Internet that can be used in disaster management which gives accurate in prevention, preparedness, and relief.

Also, technology can be applied effectively in different stages of disaster management process to reduce the physical social and economic losses to the city or the country. So that it will be easy to recover.

4.1 GIS and remote sensing:

GIS is used as a tool for Accessing Spatial and non-spatial data, the GIS and Remote sensing is used to prepare the vulnerability maps within the city, Risk assessment like Hazard mapping to the earthquake, landslides, floods or fire hazard all these maps was done to the city, town, village and regional level.

This maps can be used to before and after the disaster before a disaster, we can assess the vulnerable area and easy to shift the people and after the disaster we can easily find the damaged area and easy to recover the area. This will be used for local government to take preparedness according to the location.

Remote sensing can get data faster and easily and also cover a large area the Aerial photography and satellite image which can be easy used in natural hazard assessment in the border level. We can study by assessing various factors such as land use, climate etc.

This software is used in monitoring involves assessment of the damage incurred during the disaster
 Some application of GIS and remote sensing in various disaster as follows;

4.1.1. Drought

GIS and remote sensing can be used in a drought such as the data that can be collected from the satellite can be used to identify the groundwater depth, water sources some tools in GIS and remote sensing can be used to identify desertification and also identify the natural condition in the selected area. [1]

4.1.2. Earthquake:

The GIS and Remote sensing can be used to prepare Hazard map, basically, India has 5 earthquakes prone zone by the mapping we can identify the affected areas and it's easy to assess the exact nature of risk in the location. [1]

4.1.3. Floods:

The satellite data and also the flood mapping which can be used for flood hazard mapping, zoning of flood vulnerability. [1]

4.1.4. Landslides:

Landslide zoning map and vulnerability to landslides map are the maps that can be used in the preparing the landslide maps in GIS. [1]

4.1.5. Multi-hazard mapping;

By using all the maps in the city we can make a multi-hazard map where all the maps are overlapped and final map will be exported where we can easily identify highly vulnerable and least vulnerable area.

Uses:

This technology is also used to identify the escape routes and location for storage of temporary housing also this technology is used to identify the high and lowline areas according to this rescue operation can be done.

4.2. Creation of some apps by a government of India such as:

4.2.1. Bhuvan App

This will allow sharing of damage details in post-Nepal Earthquake. [2]

4.2.2. Event Reporting App

This will help to integrate SMS based mobile solution which helps users to report disaster events for visualization and analysis. [2]

4.2.3. Relief Management App

This is the mobile based app used to integrate with web GIS, Geotag images are collected and can be upload in web portal on time. [2]

4.2.4. Collection of Field Data on Emergency Facilities

By using GPS coordinates, digital photos can be uploads to the main server. [2]

5. CONCLUSION

It is observed that the technology has been advanced in such a way like an internet, GIS, remote sensing. Satellite communication, etc., all this help in planning and implementation of hazard reduction. New technology for public people should be made use and natural disaster mitigation messages should be conveyed through these measures. GIS tool will help to improve the quality and power of natural hazard assessments, this tool helps the local government easy to evacuate and to take mitigation measures and also preparedness and response action. Remote sensing is a tool which can be effectively used to identify the hazard areas, easy to monitor the planet for its change in real time and give an early warning before the disaster occur.

This ICT will help in emergency communication and timely relief measures. By integrating space technology into natural disaster monitoring and mitigation mechanisms is critical for hazard reduction. It is very important to create the awareness among the public as well as decision makers for allocating the resources by investing in information technology.

In developing countries such as India which has high threat with disaster should use more use with this communication technology to reduce the risk and prevent from disaster

An early warning system is a tool which reduces the loss of human and economic loss by giving warning proper warning system.

The early warning technologies have been benefited from new ICT and a proper knowledge of natural hazards and the underlining science.

Many gaps still exist in early warning technology nowadays the casualties has been reduced after the implementing of early warning system. Many gaps still exist in early warning technology, especially in developing country like India. Effective decision making needs to slow the hazard and to rescues the people from hazards.

Table-5: ICT Intervention at each layer:

Channel	Benefits	Challenges
Radio and Television	Widespread	Takes time to get the warnings Limited use at night
Telephone SMS and cell broadcasting	Messages delivered quickly and Quick Messages can be sent to groups	Problems of authenticity Does not reach non-users Local language problems
Satellite radio	High reachability	Cannot be used to educate masses Only good for specific points
Internet/Email	Interactive Multiple sources can be checked for and accuracy of information	Not widespread
Amateur/Community radio	Excellent for rural, poor and remote communities	Not widespread People lose interest if used only in the case of disaster
Sirens	Can be used even at night Good in rural areas	Maintenance of the system Cannot disseminate a detailed message

6. BELOW ARE SOME RECOMMENDATIONS:

We need to boost our self's by identifying the weakness and gaps in existing early warning systems. There should be the global early warning system not only India.

It is important to promote education programs on disaster mitigation and preparedness in the country. Development plays a key role and has a significant impact on disaster risk.

The key targets for capacity building include:

1. The improvement of research, monitor and assess the capacity,
2. Supporting national and regional institutions in data collection, analysis and monitoring of natural and man-made hazards;
3. Give access to scientific and technological information.
4. Education and awareness-raising, including networking among universities with programmers of excellence in the field of the emergency management;
5. Organizing of training courses for local decision makers and communities;
6. Bridging the gap between emergency relief and long-term development.

Bridge the gaps between science and technology advances in modeling, if science were effectively translated into disaster management actions. The major challenge is to ensure early warning system. Both local state government will keep clean interest in disaster management. The early warning should be reached to the end user. This can be done by using easy to use tools such as maps, emails, SMS etc., by using all technology the information of disaster should be reached to all people by media, SMS, Mails and web services.

This information system will help in public alerting systems, which include radio and television, with a multi warning system and modern technology.

More often, time-sequenced warning messages are released in early warning processes, implying a decrease in warning times available for action and in the reliability of the information. [5]

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