Planning for Disaster Management in India using IOT

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***Abstract*— This paper, focuses on challenges of natural disasters in India as well as the tools-technologies for cope up with those challenges.. Disaster Management consists the management functionalities such as planning, organizing, staffing, leading and controlling. Analysis based on past events, ICT technologies for disaster management is used. In this we also provided comparisons of existing various systems which is based on IoT. The purpose of this study is to "How we can use latest technology for the prevention, mitigation and preparation. Changing technologies such as IOT and Artificial Intelligence can help in early alert and control in disaster management.**

Keywords*— Disasters, Floods, droughts, cyclones, landslides, earthquakes, ICT, IOT, Artificial Intelligence etc.

I. INTRODUCTION

Disastrous events are have been showing off own mastery. From last few decades millions of peoples have lost their lives in natural disasters like flood, tsunami, earthquakes, cyclones etc. According to International Federation of Red Cross and Red Crescent Societies, 3,751 natural hazards events recorded over last 10 year and approximately two billions peoples affected by natural hazards. Estimated cost of damage was US$ 1658 billion in 141 countries. The rapid growth of world's population, pollution and manmade environmental threats that also leads to severe natural disaster in future.

According to International Federation of Red Cross and Red Crescent Societies 84% are weather related hazard and 95

% peoples are affected due to weather related hazards in last ten years.

India is most vulnerable to large number of disasters. According to statistics of Natural Disaster Management Authority [NDMA] of India, more than 58.6 percent of landmass of India is earthquake prone, 12 percent land prone to flood and river erosion, and 7,516 Kms long coastline is prone to cyclones and tsunamis. India is also vulnerable to Chemical, Biological, Radiological and Nuclear (CBRN) emergencies and other man-made disasters. In current scenario, floods in various states of India such as Assam, Maharashtra and Bihar (2019).

Due to natural disasters, that kills thousands of peoples and also destroys billions of dollars of habitat and property each year. So that the need arises for prediction and management of disaster events in uncertain weather environment.

II. INDIA AND DISASTER MANAGEMENT

In India, Government formed different agencies to coordinate response to natural or man-made disasters and for capacity-building in disaster resiliency and crisis response.

Some of these are listed below:

1. National Disaster Management Authority (NDMA)
2. State Disaster Management Authority (SDMA)
3. District Disaster Management Authority (DDMA)
4. National Disaster Response Force (NDRF)

India is at high risk of extinction to various natural disasters because of the geographical as well as climatic condition. According to statistics more than 11 million peoples have directly or indirectly got affected during last decade.

Table 1 shows number of deaths occurred in natural disaster from 1999 to August 2019.

Table I: Natural disasters in India

Disaster Type	Year	Origin (India)	Death Tolls
Landslide	2014	Pune	28
	1998	Mansarovar	380
Earthquakes	2001	Gujarat	20,000
	1999	Chamoli	150
Floods	2019	Maharashtra (August, 2019)	50
	2019	Karnataka (August, 2019)	48
	2019	Bihar (July, 2019)	127
	2019	Orissa (August, 2019)	225
	2019	Kerala (August, 2019)	60
	2007	Bihar	41
	2005	Mumbai	910

Cyclones	2019	Orissa (Fani Cyclone)	64
	2012	Tamil Nadu	20
	2011	Tamil Nadu	41
	2010	Andhra-Pradesh	32
	2009	West-Bengal	100
	1999	Orissa	15000
Tsunami	2004	Indian Ocean	2,30,000
Cloud Burst	2014	Jammu & Kashmir	4,5000
	2013	Uttarakhand	5,700

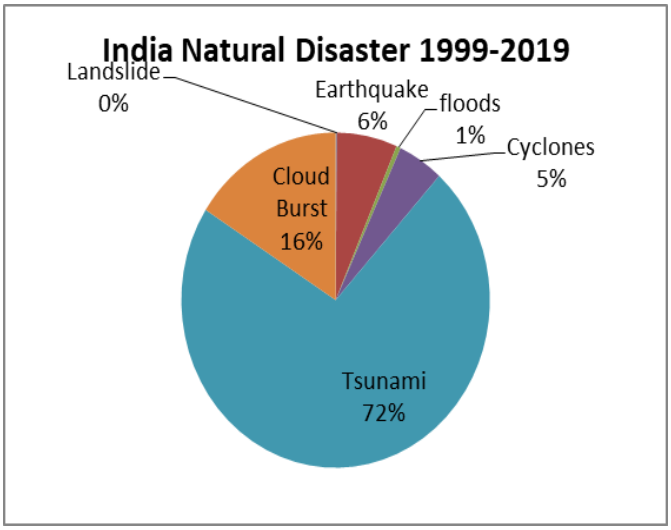
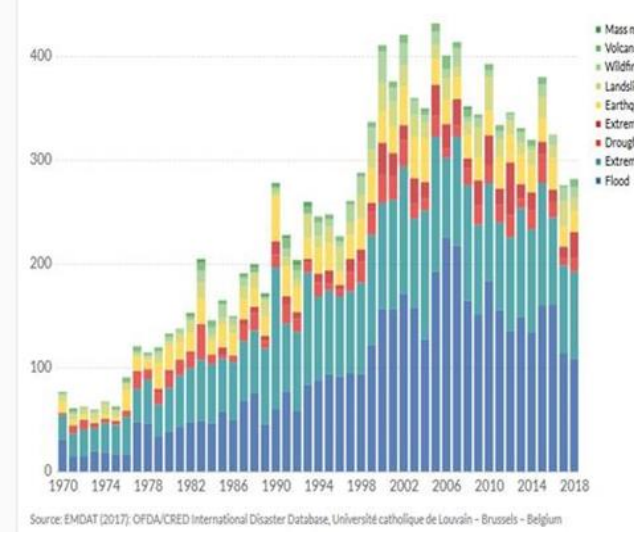


Fig 1: India Natural Disaster 1999-2019

III. GLOBAL NATURAL DISASTER

The graph shown below shows the global reported disasters by its types such as dry, volcanic activity, wildfire, landslide, earthquake, extreme temperature, drought, extreme weather and flood from 1970 to 2018.



GRAPH 1: Annual Reported Number of Natural Disasters categorized by type

IV. MODERN TECHNOLOGIES FOR DISASTER MANAGEMENT

In the recent days, progress of India towards modern development in tools and technologies lead India towards smart cities and digitalization. Use of Social media could be useful as new information sources for disaster relief agencies. The agencies can use this media for informing or creating situational awareness in peoples and also get meaningful inputs from this media. In short Social media can be effectively used for communication between social users and the government agencies.

ICT: Information and Communication Technology (ICT) can play very important role in minimization and prevention of risk by planning, preparing by using E-learning tools, emergency communication and response system. The use of ICT tools and historical data, we can manage disasters in some extent.

Artificial Intelligence: Artificial intelligence is one viable option that can potentially prevent massive loss of lives while at the same time make rescue efforts easy and efficient. AI enabled technologies and systems such as Drones, Sensors and Robots can provide accurate information about damaged buildings, and landscapes which can help to rescue team to save lives of peoples. Machine Learning tools can be used for prediction of disasters by considering historical data, and present data.

IoT: Internet of Things is simply the network of interconnected things/devices which are embedded with sensors, software, network connectivity and necessary electronics that enables them to collect and exchange data making them responsive. Due to increasing use of IoT smart devices in home automation, agriculture, industries, health care, robotics etc., researchers get attention to use of this emerging technology for disaster management. IoT could be useful in disaster prediction and control in various ways such as sensor-based network system can deploy to detect water- level rise in a river and inform to a local authority to improve prediction of river flooding and real-time situational analysis. IoT can be also used for detection of earthquake and act as emergency alert system. Recorded information would be useful when integrating hazard assessments into disaster planning.

V. BUILDING IOT SOLUTION

Figure 2 shows different components of IOT solution such as edge, network and core with protocols. This core IOT infrastructure can be used to develop solutions to different business or research problems.

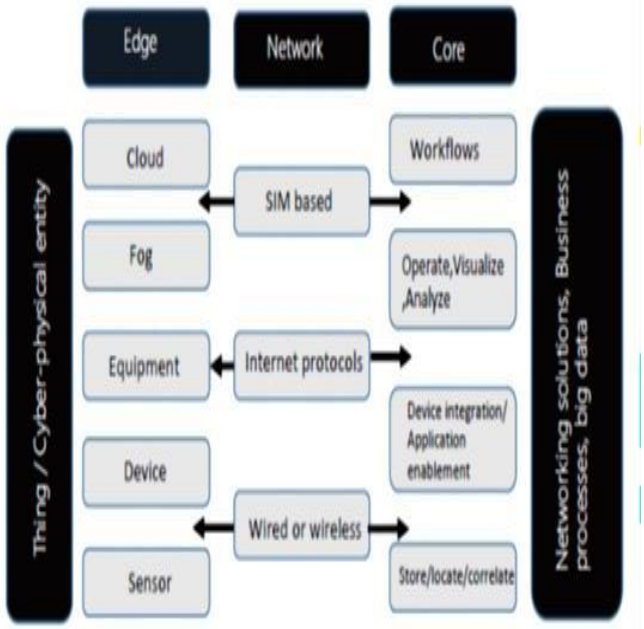


Fig 1: Components of IoT Solution

The Edge device may be remotely placed physical sensor based device connected to Fog or Cloud, which transmits real- time information to cloud.

The Network: Internet connectivity is ubiquitous and provides facility of wired or wireless communication between edge and the cloud server.

The Core: Core infrastructure includes operational and information system or servers. Both systems can be isolated or on same server. The core is responsible for making decision

Developing an IOT solution for Disaster Management involves three major steps or phases as given below:

Data integration: It integrates a variety of data from the edge to the core into a more logical and rational form.

Data management: This step includes storing large volumes of data and the system to operational system to manage stored data.

Business innovation: Data integration and management is the foundation for many type of innovations, predictions and research for any organization.

- Using NFC for geo fencing and parameter fencing
- Situational awareness and incident management through streaming data, unstructured data handling, predictive analysis, big data, complex event processing and social medial analytics.

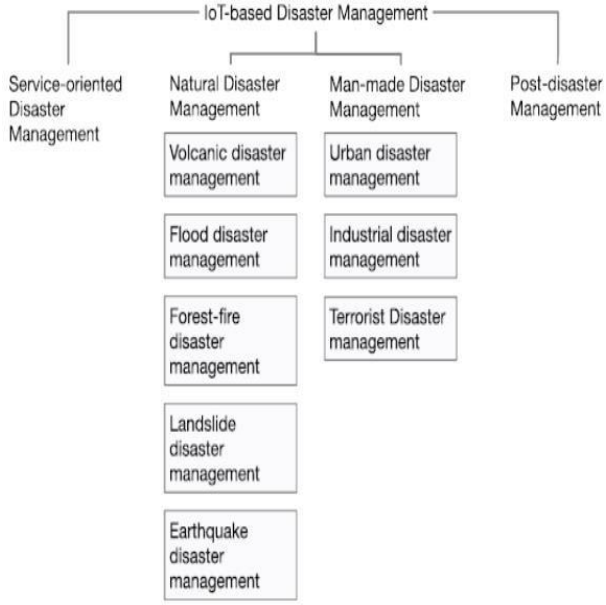


Fig 2: Classification of IoT based Disaster Management System

VI. EXISTING DISASTER MANAGEMENT SYSTEMS

In this section, a few examples of IoT-based existing Disaster Management systems for earthquakes, flood, lighting, tsunami etc. In Table 3, it shows comparisons of these systems.

Table II: Comparative Analysis of Existing IoT enabled DM Systems

DM System	**Cloud-Enabled**	**App-based**	**Key Sensors**	**Communi-cation**	**Application**
Brinco	Yes	Yes	Accelero meter	WiFi and BLE	Earthqua ke and tsunami
Brek	Yes	No	various	WiFi and GSM, Ethernet	Various
Grillo	yes	yes	Accelero meter	WiFi and BLE	Earthqua ke and tsunami
Flood Network	Yes	No	Ultrasonic range finder	GSM	Flood
Flood Beacon	Yes	No	Ultrasonic range finder	GSM and BLE	Flood and tsunami
Floating Sensor Network	Yes	Yes	Accelero meter and Ultrasonic range finder	GSM and BLE	Flood and tsunami
Lighting Detection	Yes	No	Lightning sensor	Radio	Lighting
ALARMS	Yes	Yes	Accelero meter	Radio and BLE	Landslide
MyShake	Yes	Yes	Accelero meter	CDMA, WiFi and BLE	Earthqua ke

VI. CONCLUSION

In this paper, I briefly reviewed the importance and effective use of ICT as well as IoT in disaster management. It also refers to various IoT enabled disaster management system with its comparisons. The use of latest technologies such as IoT, AI, machine learning, data mining and analytics are capable to find solutions for natural disasters and can save numerous lives and significant damage to the properties. This paper is to help in planning for the IoT-based disaster management systems in India. With reference to ICT and IoT used worldwide, we recommend a hybrid system for India which will be the combination of both ICT and IoT.

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