Role of Internet of Things in disaster management

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Role of Internet of Things in Disaster Management

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***Abstract*— Disasters, both man-made and natural, occurs frequently throughout the globe. When these happen, it furnishes some outrageous results. Loss of life, property and habitat are few of the outcomes of the disasters. Efficient management techniques should be implemented for minimizing the damage and risks involved with disasters. Technology growth is not reflecting in the area of emergency management. Internet of Things, rapidly evolving to Internet of Anything and Everything, can be introduced to manage disaster scenarios. Rescue events can be interlinked through IoT for proper management approach. Disaster warning systems, rescue methods, follow-up, and regulation techniques can be conjugated for this purpose. This paper introduces a novel architectural system for productive disaster management using IoT techniques which reduces the fatality of a disaster phenomenon.**

***Index Terms*— IoT, Disaster management, Smart network.**

I. Introduction

II. Disaster management or emergency management is the creation of schemes through which communities are encouraged to reduce the peril towards hazards and are trained to cope with disasters. Disaster management is not about averting or eliminating the threats; instead, it emphasis on creating plans to decrease the consequences of disasters [1]. Disasters are of two types, natural and man-made. Natural disasters comprises of earthquake, volcanic eruptions, floods, Tsunami, droughts, cyclone, forest fires and landslides. Events such as chemical leaks, nuclear leaks, road accidents, structural damage and terrorist attacks can be listed under man-made disasters. All of these disasters are more frequently happening in this century due to urbanization and globalization. Many early warning systems are present, but management techniques are restricted to rules and regulations. With rapid technology growth, significance should also be given to management process.

In India, the rate of disaster happening per year is increasing every year. The devastation involving with the catastrophe are also increasing. Government organizations have been established since early 70's to overcome the wreckage of disasters. Top challenges met by them are budget limitations, insufficient IT resources and lack of in-house expertise. We can play our role in providing better IT facilities and becoming an expert ourselves. Connecting things to internet and interlinking them through a server can enable us to meet this requirement. As the embedded area is witnessed with a swift growth in IoT, this area opens up a wide opportunity for research. This paper deals with the technological part that can be used to implement an efficient management system. Connections based on IoT can be utilized for interlinking every departmental works together. This makes to work every organizations and departments as a unit and provides new opportunities for timely and effective rescue plans for the societies. Thus technology can bring about a revolution in saving life and property in time of disasters.

Later parts of this paper are organized as follows; Section II describes about the present disaster management techniques. Section III explains about using IoT for effective management plans. In section IV, we conclude with the advantages and also the future works that can be done in this area.

II. Disaster Management Techniques

A. Need for disaster management

Disasters are inevitable, and have a huge influence on humans and the environment. Predictability of certain disasters provides chance to plan for a devastating event occurrence. Managing disasters involves planning of things to be done before, during and after any occurrence of an event. By proper planning, we can reduce the risk involved with loss of life and property. Anticipating the possibility of happening of certain categories of disasters more timely can lead to reduction in vulnerability of the damage in the community. Disaster management helps us to be aware about the hazards resulting from the disasters and makes us prepared for the consequences.

B. Management Techniques

Ministry of Home affairs in India has established an agency, National Disaster Management Authority (NMDA), to coordinate response to man-made or natural disasters and to enact resiliency towards disasters and crisis response. This was formed in 2005, as the Prime Minister as its ex-officio chairperson. Their duty is to frame laws, guidelines and to co-ordinate with State Disaster Management Authorities (SDMAs). Central sector scheme for disaster management implies the following guidelines for management:

(a) Human resource development
(b) Setting up of Disaster Management Faculties in States
(c) Setting up of National Centre for Disaster Management (NCDM).

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(d) Programs for community participation and public awareness.

Another disaster management team includes the Red Cross and Red Crescent [2]. Their primary goal is to respond to any disasters as rapidly as possible. They have a coordinate manner to respond to these scenarios. Their mode of acting is as:

(a) Community preparedness and risk reduction
(b) Disaster Services.
(c) Shelter and settlement

They provide their services in more than 190 countries, for both man-made and natural disaster rehabilitation, relief, mitigation and rescue. The Fig. 1 shows their mode of approach towards the disaster.

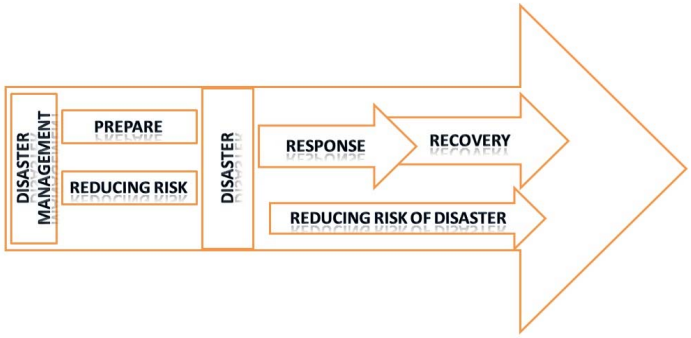

Fig. 1 Disaster management scheme for reducing the risk of disaster.

The International Displacement Monitoring Centre (IDMC) has estimated that between 2008 and 2014, an annual average of at least 22.5 million people were displaced by the direct threat of floods, landslides, storms, wildfires, and extreme temperature on their safety, homes and livelihood [3]. This rate increase when man-made disasters are also taken into considerations. A large number of people are mitigated when such disaster happen. These are based only on a probability conditions, which can be altered with introduction of technology.

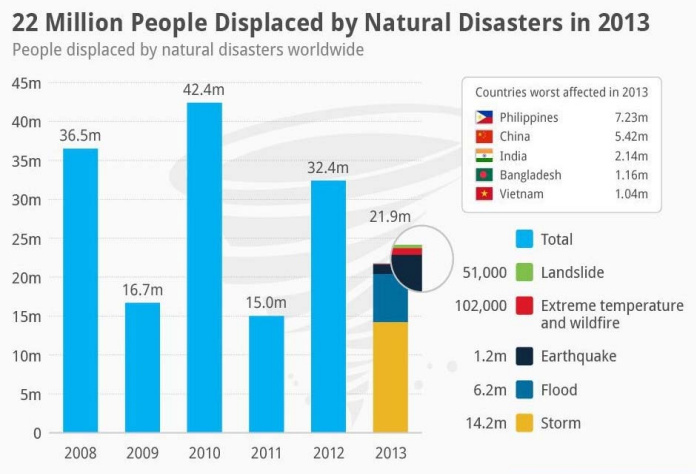

Fig. 2 people displaced by natural disasters during 2008-20013 worldwide.

Fig.2 shows the graph of mitigated people during this period. When technical aspects are concerned, not many researchers are emphasizing on IoT based management system. Reference [4] talks about the smart city concept along with the disaster management system using IoT. More concentration is given to the smart city concept and only a few sentences are mentioned about the idea of disaster management. Reference [5] suggests the method of using social networks for disaster management. Authors in Reference [6] talks about situation handling in case of forest fires. Many other researchers have also applied their thought in developing a proper management system [7] [8] [9]. Here through this proposed method, we are introducing an efficient way to manage a crisis through Smart Networks

C. Managing Issues

The main issue related with the disaster management is that, there is no proper technical support. Coordination of preparing to meet a disaster, functioning of management team while disaster is happening and facing the aftereffects of disasters are never being organized. The Fig 3. Show the various scenarios that should be taken into consideration while preparing to meet a disaster.

Fig. 3. Areas to be concentrated when a disaster is occurring.

At any instance, on the occurrence of a disaster, the following events should be handled properly:

i. Transportation facilities
ii. Ambulance and medical services
iii. Police and rescue team arrival
iv. Alert and updates about the disaster to public
v. Short term measures such as Food, shelter, hospitality, water and electricity.
vi. Long term techniques such as providing rehabilitation, relief and packages based on the destruction.

III. IoT in Management

Considering the above managing issues, we can develop a system that is interlinked by technology to one another for a proper management system. IoT can be used as a technology to connect systems together. Consider Fig 4. The figure shows a two way communication between the control station and other departments. Similarly, keeping control station as the center, departments can also communicate among them. Thus we can bring every departments under one tree. This provides flexibility in controlling the events accordingly. Single administrator or administrating team can take over the entire emergency management rescue. A specific mobile app can be developed to monitor the disasters.

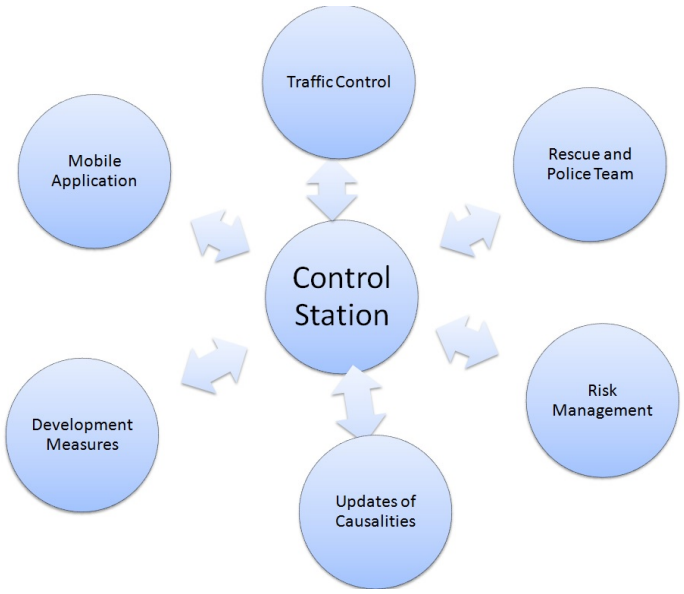

Fig. 4. Bi-directional communication model between the control center and various departments functioning with disaster management.

Let us now see an example of events that happens according to a well-planned management structure when a disaster is happened as shown in the Fig. 5. In case of natural disasters, they are often warned early in some occasions. Necessary actions can be taken to minimize the risk of losing life and property. These warnings can be given to the control center for creating awareness among people. Then the emergency services such as ambulance, rescue services, police aid can be notified to be ready to face the disaster. Government officials and public can also be given alert signal. Control and remedial measures can be taken according to the devastation of the event. Nature of the disaster can be analyzed to provide the make the medical and hospitality arrangements. From the control center, we can regularly update about the situations to the media and public to reduce the emergency state. We can also provide the escape routes and safe places if necessary. Rehabilitation measures can be planned quickly and can be implemented effectively in a short period, thereby minimizing the hazard of the disaster. This how, we can manage a disaster from the control center using IoT Interlinking.

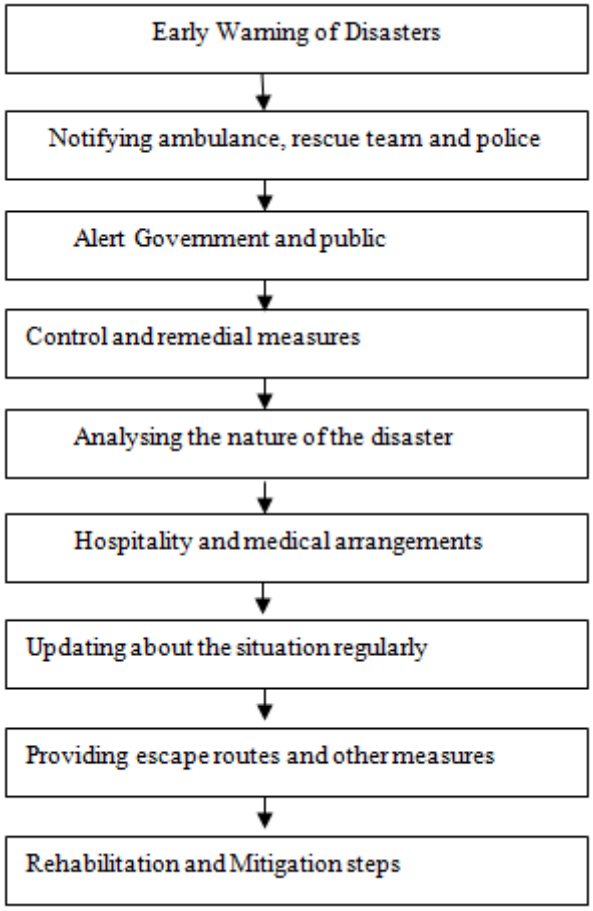

Fig.5. Flow of events that are arranged on their priority of occurrence when a disaster is occurred.

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IV. Conclusion

We have discussed about how IoT can be used in disaster management techniques. Interlinking every department through IoT opens up the windows to reduce the damages of disaster. Sensor networks, IoT, and embedded system structures can be used to for the smart networks for emergency handling. If this proposed system can be implemented successfully, every disaster can be fought with a courageous mind set. The future work of this project includes preparing an algorithm for coordinating ever departments, linking them with satellite communication and also to track the occurrence of each events and their rescue.

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