ASSISTIVE SYSTEM FOR FLOOD AND EARTH QUAKE DETECTION AND RESCUE SYSTEM USING IOT TECHNOLOGY: AN OVERVIEW

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***Abstract*—**Flooding and earthquake is a great treat towards mankind as it is also considered one of the most devastating natural disasters in the world. Flooding and earthquake is not an abnormal scenario worldwide since it results in great damages to agriculture land, residential area and even cities with a high cost in lives and towards the economy of the country. Baring the cost and safety measures, this paper highlights the overview of different techniques and technologies used to implement Flood and earthquake Observatory System as a warning and alert system to efficiently monitor the critical flood prone and earthquake areas in real time basis. The first section in this paper gives a general idea about the flood and earthquake detection system and its associated problems. The second section discusses the latest developments in implementing flood and earthquake detection system using various techniques. The third section includes the performance comparison of different techniques.

Keywords*—Flood forecast system (FFS); Global Positioning System (GPS); Radio Frequency Identification (RFID); Artificial neural network (ANN); Internet of Things (IOT); Operational flood alarming system (OFAS)***

I. INTRODUCTION

Flood and earthquake are considered a big threat to people lives and economic properties of livelihood. 0.66% of the land areas are threatened by the severe floods in varying degrees in different parts of the world, mainly several parts of China, Malaysia, Indonesia etc. During 1980's, the flood loss has been growing from tens of billions on average to more than 400 billion in 1998. In recent years, our country has taken the action of large-scale river regulation systems, and has built different kinds of flood-prevention project systems thus improving the capacity of flood-prevention and reducing the losses created by the flood. But at the same time, there are limitations of flood and earthquake prevention project exist too [1].

Flood disaster management is affected by many factors such as hazardous factors and environment and diversity of evaluation methods. Therefore, flood disaster risk Management system is still a worldwide research topic both in the field of natural science and technical science [2].

In the recent past, unexpected tremendous tragedies of natural disasters have happened in the world which deleteriously had affected the society and environment. Due to tropical unstable climatic conditions, combined with high population density and inadequate infrastructure are the main reasons for natural calamities. India is one of the developing countries to suffer very often from various natural disasters, namely drought, flood, cyclone, earthquake, landslides, forest fire, storm, etc. Such natural disasters involve tremendous tragedy conditions and cause a devastating impact on the environment, an economy of the country and especially lives of human. Though it is almost impossible to fully recover the critical damages caused by natural disasters, it is possible to minimize the risks by developing early warning detection methods, prepare and implement strategic plans to provide resilience to such natural disasters [3].

The U.S. Geological Survey had reported approximately 21 Earthquakes per year with a magnitude 9 and higher in the last 21 years. Due to the tsunami generated during the year, 2011 (M9.0 Tohoku) earthquake in Japan resulted in unpredictable social and economic impacts locally and globally ,such special issues provides tutorial treatment of some of the new or recent remote sensing technologies, and integrated systems for decision support in early warning , prevention, rescue system to reduce the natural disasters[4].

Thus there is a need for a Flood and earthquake observatory and warning system which can save lives of human, environment, an economy of the country. Recently Kerala faced dangerous floods which resulted in deaths of human, fauna and destroyed the environment of the state which reduced the economic status of the state. To solve such issues and creating a remedy such as introducing early warning, detection, and rescue system of flood and earthquake. The purpose of this paper is to review the works

done in implementing various Flood and earthquake observatory and warning system.

II. RELATED WORK

Various techniques have been developed by the researchers to implement Flood and earthquake observatory and warning system.

SwarupMandai proposed a prediction model for flood disaster management system using sensor networks. Model is based on artificial neural network and multi-layer perception [5]. Data is taken from sensors which act as input to flood forecast system (FFS) to predict the occurrence of the flood. The Database consists of a flood, non-flood, and even climatic data.OFAS (operational flood alarming system) is a subpart of FFS. Occurrence and non-occurrence of the flood are detected by ANN (artificial neural network) model by training 50 occurrences and non-occurrences of flood using climatic data as input. Alert system act as a subsystem of OFAS which is used to collect data from the environment. There is also a sensor layout scheme which consists of base sensors such as humidity, temperature, water level sensors which monitor parameters such as rainfall, humidity, temperature etc.

Elizabeth Basha presented a method known as an early warning flood detection system for developing countries [6]. The proposed method uses sensor network and divides this method into four tasks (event prediction, authority notification, community alert, and evacuation) between CTSAR (Centro T´ecnico San Alonso Rodr´ıguez) which is a non- governmental organization (NGO), headquartered in Tocoa and ourselves. Both groups decided to install this system in river basins. This method monitor events over a large geographic region, detect and predict the river flood.

Rifaat Abdalla proposed a method known as Flood emergency Management based on the Web GIS using the GeoServNet [7]. (GSN) which is a distributed computing architecture and it is centrally managed. Distributed computing is an important term that includes other terms like Internet, web, network-centric and more. Here flood simulation process is a completed through 3 stages, preprocessing, post-processing and web publishing.

Munyaradzi Magomelo implemented an early warning of floods by using context-awareness along the Zambezi basin [8]. Context-awareness is defined as any system that is capable of manipulating contextual information, in computing it is defined as software or hardware that examines and reacts to an individual changing context. This system could identify people in a region and provide indicators of problems when the system failed to warn. System overview consists of hydrological tower act as a sensor that is immersed in the Zambezi river basin. Data collection server is placed in South Africa obtain readings from the sensor. Thus the authorities in South Africa warn the communities. The system also consists of two applications i.e.; one is client system runs on the mobile device (determines GPS coordinates) and another application (GPScoordinate+phone number), sent by the client is received and status of the phone number is also identified

Z.N Khalil Wafi presented the main idea of Disaster Surveillance System (DSS) system and an early alarm system (ERA) with a wireless network using smart communication Platforms system (SCPS) [9]. If water level increases to a dangerous level, the sensors it will send a signal through the microcontroller to control system via Ethernet shield board. The system derives its energy-using photocells that accompany with DSS system addition to charger batteries. These data are collected and transmitted over the sub-platforms to the main unit. This data transmitted via Wi-Fi to the ground unite (GN).Using (SCPS) system helps to ensure the connection with (DSS) proposed and together works to reduce the time for data transfer and cost of surveillance devices.

Hamra Afzaal proposed a model of cloud computing based flood detection and management system (FDMS) using wireless sensor and actor networks (WSANs)[10]. Sensors are used to monitor water level conditions, that is, water in a river or rainfall level. The proposed model is described by the technique, Vienna Development Method-Specification Language (VDM-SL) for a detailed level experimental analysis, specification and implementation of the system. It is used to generate possible test cases to reduce errors and omissions in a system.

Ssu-Ying Chen presented the idea of bridge scour sensor system using accelerometers in the real-time analysis [11]. During Typhoon in Taiwan, bridge scour is the main reason for bridge collapse. The system consists of underwater sensor nodes with wired power over Ethernet protocol (implemented in 2-stacked octagon PCB and enclosed in steel hollow ball i.e.; and a model irrelevant algorithm (Temporal difference and Q learning is used). Among these, Q learning algorithm is stated in the paper. Steel cage, POE switch and data logger with a proposed algorithm to detect the bridge scour. The vibration sensing mechanism is adopted by under-water sensor node using the accelerometer sensor.

Mohamad Nazrin Napiah proposed flood alert system based on Android application using IOT [12].Micro-controller (NXP LPC176) architecture based on ARM technology. For communication device use XBEE ProS1 uses ZigBee protocol for communication. The advantage of using this protocol is lower power consumption, water level sensor that can measure high of the drainage water level. All the data that collected by the sensor will store in the Database (API) before it sends to last output which is the end user. This feature shows the nearest river name, city name, and its condition such increase level, warning level or danger level.

MVSS Babu, presented flood alert system using IOT [13]. Sensor used to measure water level in rivers, lakes, lagoons and streams. Micro-model is constructed with a water level measurement sensor based on a simple open circuit that closes when in contact with water and experimentally tested into a

water container under a controlled environment.Netduino plus2 board based on Ethernet technology used here. The container which is empty and dry was filled with water up to the level of the first wire (green terminal). Then the computer program installed on the laptop triggered an audible signal and a message of green alert was displayed, the same happens in a smartphone (alert message is shown). Simultaneously pour water into the container up to the level of the second wire (yellow terminal). Similar to the previous condition, the application on the Laptop triggered an audible signal and a yellow message was displayed, the same happens in the Smartphone, a yellow message was also displayed on a screen. At last, we continued filling the container with water that was in the yellow state level, the water reaches the third and final level (red wire). PC application immediately sounded the siren and green warning message was displayed on the monitor, while in the smartphone displays the same red alert message, indicating that the population should evacuate.

Md Kamruzzaman proposed a method known as post-disaster management based on IOT technology (Internet of Things) [14]. Ad-hoc network formation is used in post-disaster management system based on flowchart/algorithm linked to device-to-device communications. IOT act as uniquely identifiable interoperable connected objects using radio-frequency identification (RFID) technology

III. PERFORMANCE COMPARISON

In the previous section, the various methods for developing Flood and earthquake warning and observatory have been discussed.

Table I shows the comparative performance analysis of Existing Systems

Technique	Advantages	Limitations
Artificial neural network(ANN)[5]	Less Costly	-Prediction model -less accurate
Sensor network[6]	-detection and prediction model	-not a rescue System -somewhat accurate
Web GIS [7] Using GeoServNet	-Less cost -Better accuracy	Always need an internet connection.
Context Awareness Using GPS[8]	-Cost Effective -Easy to use -Accurate	-only location tracking of people in a region affected by flood
Wireless Network using SCPS[9]	-Reliable -Efficient	-not cost effective
wireless sensor and actor networks (WSANs) using (VDM-SL) language[10]	-cost effective	-only generate test cases and Omissions in a system
Q learning algorithm[11]	-High security -Less expensive	-Ethernet protocol is used
ARM Technology[12]	-low power consumption	-Zigbee protocol
IOT[13]	-Cost Effective - Accurate	Netduino plus2 board based on Ethernet technology
IOT[14]	-Less cost	Ad-hoc network

IV. FUTURE TRENDS

Even though significant progress has been made during the last decade in the field of developing and implementing efficient flood and earthquake observatory and warning system, there are a lot of challenges faced by the researchers. There is a need for an intelligent flood and earthquake observatory and warning system which is fast, efficient, simple and accurate. Flood and earthquake observatory and warning system using IOT is a new technology to implement an efficient flood and earthquake observatory and warning system with high security and researchers are showing great interest in this technology. Also, this can develop and implement flood and earthquake observatory and warning system that will help to save lives of society, and the economy of the country.

V. CONCLUSION

In this paper we have introduced the various methods that have been proposed by the researchers to develop intelligent flood and earthquake observatory and warning system by a detailed review of techniques used in existing systems. Also the performance of these techniques is compared in terms of advantages and limitations. We hope that this paper will serve as an introductory review to those who are new to the topic.

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