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Automatic and Intelligent Integrated Web-based Early Rain Disaster Alarming System Using the Android and Cloud Based Application for Remote Hilly Region of the Uttarakhand

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Abstract: ***Rain and thunder alarming is of the biggest necessity and requirement especially for hilly region of the Uttarakhand. It has been seen number of time without this alarming system the biggest natural calamity happens (previously Kadharnath calamity is one of its example). As per survey and personal investigation, presently there is no rain alarming system. So there is an urgent need of the heavy rain/snowfall alarming system so that the valuable human life and property can be saved in advance. However there are numbers of sites which displayed weather forecast but they never send any intelligent alert to the people of particular region.***

Key words: Mobile phone disaster message notification system, Automatic Rainfall Warning System, Wireless Sensor Network, Weather Station, Disaster Risk Reduction, Early Warning Systems, Disaster Risk Management.

I. INTRODUCTION

In Uttarakhand, around 5000 people lost their lives, mostly because of floods and landslides caused by heavy rains and cloud burst in the rainy season of 2013. The idea of the paper is originated from the kadernath calamity (Uttarakhand), one of the biggest calamities of the India and world, where thousands of lives and approx millions roupees of property has been lost. If we could generate any early rain disaster warning/alarming before that calamity then it will protect people's lives, mitigating disaster damages and minimize damage to critical infrastructures in different areas. Therefore the idea for this proposal has been originated.

As per the definition of the problem the disasters are divided into 2 basic groups: natural and man-made. Among the natural disasters are earthquakes, volcanoes, hurricanes, floods, heavy rain and fires. Among the different natural disaster rain disaster is one of the biggest problem especially for the hilly region of the Uttarakhand. The major disaster effects are the destruction of local health infrastructures—hospitals, doctor's offices, clinics, dialysis centers, pharmacies, and the like; the environmental impact, such as increased risk of communicable diseases, premature death, and decreased quality of life, psychological effects, including anxiety, neuroses, and depression, food shortages and nutritional consequences, and, in some places, large population movements. Therefore we have proposed the paper which is real time web based early Rain Disaster Alarming/Warning System. Web based means that the forecasting data collected through web, and the forecasting also be analyzed and taken through cloud based software.

II. OBJECTIVE

The objective of the paper is to develop a proposal for the web based real time Automatic and intelligent rain disaster alarming system using the android and cloud based application for remote hilly region of the District Nainital of Uttarakhand.

The aim of the paper is to provided proposal method which send forecasting alert to the common people about heavy rain and any type of rain based natural calamity in a efficient and quick way, so that the risk of life and property can be minimized, also to send alert to some of agency like News paper, News Chanel, Government District headquarter, on monthly, daily, hourly basis.

III. REVIEW OF LITERATURE

From 1995 to 2004 in Korea, an annual average of 131 people lost their lives, mostly because of floods and landslides caused by typhoons and torrential rains in the summer. Various systematic multihazard warning systems have been proposed and established to protect people's lives and minimize damage to critical infrastructures in different areas. Some of them may be directly connected with nowcasting concept and some of them are just warning systems that Korean government is practicing. General warning sequence is about the hazard and disaster information produced, transmitted, received, understood, believed, confirmed, etc. This research, as a disaster management point of view, is not about the generation of warning information, rather it is about how to transmit it to the public. One of the benefits that nowcasting technology can contribute to the public is mitigating disaster damages, especially disasters caused by hydro-meteorological phenomena.[1]

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Early warning is a major element of disaster risk reduction. It saves life and reduces economic and material losses from disasters. To be effective, community based early warning systems need the active involvement of the community people, a strong public education on and awareness of risks, an effective communication system ensuring a constant state of preparedness. This Practitioner's Handbook on Community Based Early Warning System is an effort to put together the early warning learning experiences from the field and communities in Nepal for wider uses for establishment of community based early warning Systems in flood prone areas of Nepal. Mercy Corps and Practical Action would like to acknowledge the support of the European Commission's Humanitarian Aid and Civil Protection department, which both helped produce this training material and the funded projects implemented by Mercy Corps and Practical Action, respectively under several action plans. The commitment of communities in Banke, Bardia, Chitwan, Kailali and Nawalparasi made the early warning systems the success they have been. They have willingly shared their knowledge with communities and organisations from other regions of Nepal and beyond. We sincerely hope that the community based early warning systems will bring not only these communities, but many more communities in Nepal, in the region and in other places similar vulnerable greater security in the future. This manual and the community based early warning systems established with the support from Mercy Corps and Practical Action would not have been possible without the openness, support and enthusiasm of the Government of Nepal staff in all five districts and those of Department of Hydrology and Meteorology based in the field as well as at the Department in Kathmandu.[2]

Monitoring and warning of geological disasters accurately and in a timely fashion would dramatically mitigate casualties and economic losses. This paper takes Lanzhou city as an example and designs a Web-based system, namely the information system for geological disaster monitoring and warning (ISGDMW). Presented are its framework, key developing technologies, database, and working flow. The information system adopts a Browser/Server (B/S) structure and has three-tier architecture, combining in-situ monitoring instruments, the wireless sensor network, WebGIS techniques and the grey system theory. The framework of the ISGDMW can be divided into three categories: (1) in-situ monitoring system, it aims to monitor geological disaster sites and get state information of geological disaster sites; (2) database, manage in-situ monitoring data, antecedent field investigating data and basic data; (3) analyzing and warning system, analyze in-situ monitoring data, understand the deformation trend of the potential geological disaster, and release disaster warning information to the public. The ISGDMW allow the processes of geological disaster monitoring, in-situ monitoring data analysis, geological disaster warning to be implemented in an efficient and quick way, and can provide scientific suggestions to commanders for quick response to the possibility of geological disaster[3].

In the last few years, the occurrences of natural disasters have been continuing changing our lives, damaging property and life styles in many different ways. In this Research, we present a system that can be used to prevent enormous damage from natural disasters. In this system, a wireless sensor network based on Zigbee/IEEE802.15.4 standard is utilized as a weather station network sending weather information and disasters' alerts. The weather information is analyzed by using decision tree techniques to announce the disasters' alerts. This proposed system takes advantage of wireless sensor networks which can send signals over far distances by using a mesh topology, this transfers the data and also consumes low power. Therefore, this system can be installed in locations that are difficult to hardwire or have no access to electricity[4].

The Philippines is no stranger to being ravaged by extreme natural events such as typhoons. Year after year, valuable agricultural lands, settlements and human lives have been claimed by and put at risk by the resultant floods, landslides and mudslides. The most vulnerable are the poor. They often do not know what to do in preparation for disasters or in actual emergencies to save their lives and properties. For local government units, they still do not have sufficient capacities to deal with natural hazards. They lack expertise, robust local data, management capacity and the funds to plan and implement well-targeted disaster risk reduction measures. Since 2007, local governments in Region 8 have accumulated vast experience and knowledge in the setting up and management of Local Flood Early Warning System (LFEWS). LFEWS has a straightforward proposition: human vulnerability and suffering could be reduced by monitoring sources of floods, predicting where and when floods could possibly happen, identifying who would be affected and strengthening the capacity of local disaster risk reduction and management institutions to make informed decisions[5].

This study is about the design and development of an integrated web-based system for tropical rainfall monitoring. The system gathers data using a network of low-cost, Android-based acoustic rainfall sensors, a nationwide infrastructure of 5 GHz wireless broadband links, and remote weather stations. The low-cost Android-based acoustic rainfall sensors are deployed at high densities over a local area and the 5 GHz wireless broadband sensors gather rainfall information on a nationwide scale. The sensor network provides information about spatial-variations that are characteristics of tropical rain rates, and complement data from the scarcely deployed remote weather stations. Gathered data is then processed and displayed on a web interface[6].

Flooding is one of the major disasters occurring in various parts of the world. The system for real-time monitoring of water conditions: water level; flow; and precipitation level, was developed to be employed in monitoring flood in Nakhon Si Thammarat, a southern province in Thailand. The two main objectives of the developed system is to serve 1) as information channel for flooding between the involved authorities and experts to enhance their responsibilities and collaboration and 2) as a web based information source for the public, responding to their need for information on water condition and flooding. The developed system is composed of three major components: sensor network, processing/transmission unit, and database/ application server. These real-time data of water condition can be monitored remotely by utilizing wireless sensors network that utilizes the mobile General Packet Radio Service (GPRS) communication in order to transmit measured data to the application server. We implemented a so-called VirtualCOM, a middleware that enables application server to communicate with the remote sensors connected to a GPRS data unit

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(GDU). With VirtualCOM, a GDU behaves as if it is a cable directly connected the remote sensors to the application server. The application server is a web-based system implemented using PHP and JAVA as the web application and MySQL as its relational database. Users can view real-time water condition as well as the forecasting of the water condition directly from the web via web browser or via WAP. The developed system has demonstrated the applicability of today's sensors in wirelessly monitor real-time water conditions[7].

A database environments is also be developed a tailor-made geospatial web-based system to identify flood risk. This approach can directly target specific needs and has advantages over existing noncommercial systems. We analyzed the river network in the Chubu region, which encompasses nine prefectures in Central Japan, to understand rainfall-water-level relationships. A spatial web-based system was then developed to monitor rainfall and river-water levels in the study area. This database system assesses near-real-time rainfall and water-level data. A map service was configured using Open Layers, an open-source software package. This proposed system will deliver early-warning flood messages via a scripting mailer system. However, device error could occur, which necessitates human verification before a final decision is made. Self-geolocation helps individual users determine their risk. Improvements in the visualization and recognition of existing data using map-service tools and technology may help reduce tragedies and damage resulting from flooding[8].

The key techniques of building a real-time forecast model for debris flow disaster using neural network (NN) method are explained in detail in this paper, including the determination of neural nodes at the input layer, the output layer and the implicit layer, the construction of knowledge source and the initial weight values and so on. The neural network-based real-time forecast model for debris flow disaster is built using the rainfall parameters of 40 historical debris flow disasters as training data, which included multiple rainfall factors such as the rainfall of the day disaster happening, the rainfalls of 15 days before the disaster, the maximal rainfall intensity of one hour and ten minutes. Based on the torrent classification and hazard zone mapping of the study region, combined with the rainfall monitoring in the rainy season and real-time weather forecast models, the NN-based early-warning system for debris flow disaster ran well. In this system, GIS technique, advanced international software and hardware were applied, which made performance of the system steady and its applicability wide. It can forecast some most important indices, the probability, the critical rainfall, the warning rainfall, and the refuge rainfall of debris flow occurring, and reduce the direct disserve in the debris flow disasters through the real-time monitoring of rainfall or local weather forecast. As it was a visual information system, we could monitor the variation of the torrent types and hazardous zones, and the torrent management through it, so it could serve the local management and decision-making on the debris flow disaster warning and prevention[9]. Artificial Neural Network Based Proposal also used for Disaster Forecasting and Disaster Mitigation [10-11].

The Automated Meteorological Data Acquisition System (AMeDAS) Data is used along with compound disaster information for a geographic information system (GIS) by integration into the Japan Meteorological Agency (JMA) disaster prevention information XML data. A JMA XML format is a next generation format that contains weather warnings, tsunami warnings, and earthquake information, etc. However, it is not possible to process it by reading disaster prevention information XML Data and AMeDAS Data directly to the GIS system. Therefore, development of a program that converts the data structure is important to consolidate a variety of disaster prevention information on the GIS system. Information on escape routes and evacuation sites, etc. were given as points for regional meteorological observation forecasts using AMeDAS Data by disaster prevention information XML data and integrating it where the disaster was generated, giving a range of expansion of damage and a damage level. There are two main aims; the first is to deliver these compound data of disaster prevention information XML data and AMeDAS Data via the Internet. The second aim is to provide GIS files (shapefile format) of these data to such as local governments for their individual analysis. This was furthermore confirmed to enable the construction of a system using WebGIS (Google Maps) and Open Source Software GIS to monitor disaster information at low cost [12].

As per the above literature survey the paper is very important and for novel cause because real-time early warning on mobile, will help to minimize the risk of life and property and revenue.

The paper proposal work is especially for the hilly region of Naintal District of the Uttarakhnd. Due to the heavy rain or cloud burst maximum landslide happen in the hill area of the Uttarakhand in Rainey season. In June 2013 due to the land slide and cloud burst Kedarnath disaster happened. In Kedarnath disaster around 5748 Fatalities happens, and around 4200 villages were affected. Due to the destruction of bridges and roads, around 100,000 pilgrims and tourists left about in disaster affected area of the Uttarakhand. More than 110,000 people were evacuated by Indian army and the Indian Air Force. Over 70,000 people were stuck in various regions because of damaged or blocked roads. Late September 2013 thousands of dead bodies were found, out of which many bodies were found in highly decomposed state during fourth round of search operations. Therefore considering the critical disaster prone situation of Uttarakhand, its hill district may be selected for the project.

IV. TARGET BENEFICIARIES OF THE PROPOSAL

The target beneficiaries of the proposed work would be common people living in the remote hill area of the district Nainital, Tourist, pilgrims and devotee who are visiting the same area. The proposed proposal is web based system, so there is not any environmental risk. However it is indirectly helpful to minimize risk of life, and also protect the environment. The proposal is very impactful. We have seen in past rainy session, a huge loss of life and public and private property in Kadarnath, Uttarakhand. By using Information Technology, we can minimize the loss to some extent. Through this proposal we can give chance to the people to save themselves by the early warning therefore the paper proposal will be Impactful.

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V. METHODOLOGY

The proposed methodology for the paper is divided into five different phases:

1. In the first phase is to review the state of the art in Automatic and intelligent Integrated Web-based early rain disaster alarming system using the android and cloud based application for remote hilly region of Uttarakhand.
2. In second phase, to identify the trusted Government and Private authority, who perform weather forecasting.
3. In third phase, analyze the cloud based and other weather forecasting, also analysis of their comparative forecasting result and accuracy and finally to identify the best rain forecasting procedure.
4. In forth phase, to develop web based automatic and intelligent software to sense the next day (24 hour later) rain condition daily and hourly basis of a particular hilly region.
5. As per the sensed rain information, if any critical situation (or the heavy rain fall indication) seems in advance by the cloud based already available application, then the our software will automatically broadcast heavy rain alert to all the mobile users and internet user surrounding of that place (or nearby area) through message, notification in social media, or recent mobile application etc. with help of mobile tower.

The above different phases of project methodology are also mentioned in the Figure 1. Major research effort will be concentrated in designing the Automatic and intelligent Integrated Web-based early rain disaster alarming system and also the research is concentrated on how warning information produced, how to transmit to public, received, understood, believed, confirmed, etc.(Figure 2) The project will also send alert to some of agency like News paper, Government District headquarter, on monthly, daily, hourly basis so that the disaster warning can be broadcasted to the public. Once the alarming system is developed, it can then be modified for other area of the country and for other natural calamity.

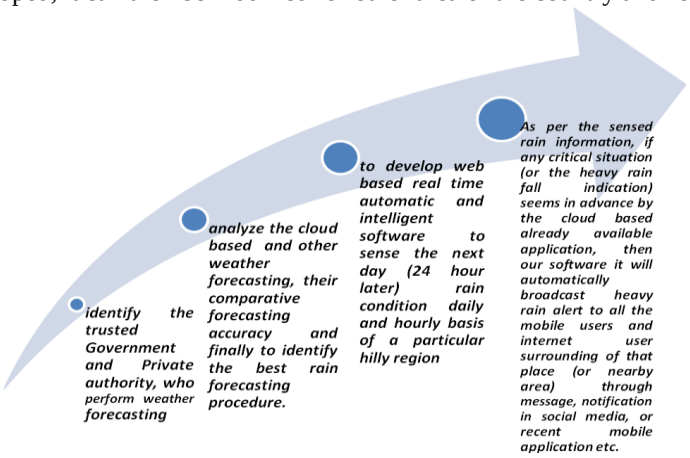

Figure 2 Phases of Intelligent Integrated Web-based early rain disaster alarming system

Organization of work elements

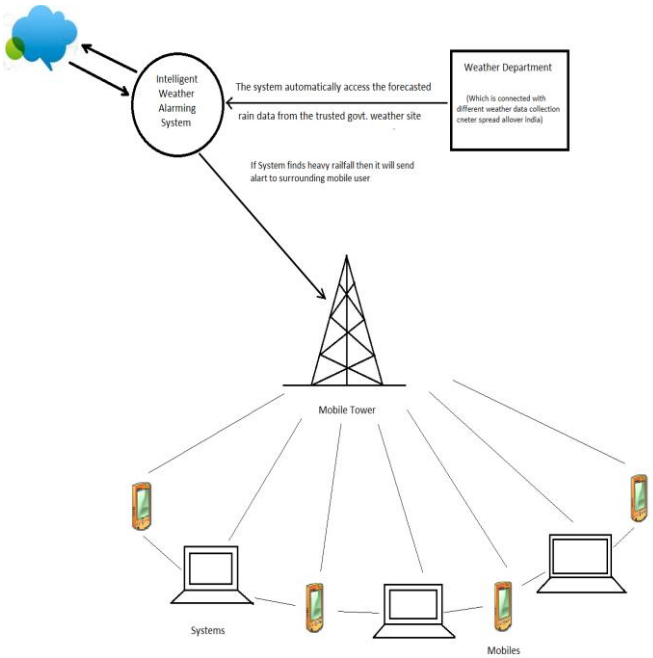

Figure 2 Intelligent Integrated Web-based early rain disaster alarming system

The above diagram showing that the organization of people, weather forecasting organization, mobile tower cloud application. Their working is already described in the methodology.

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VI. CONCLUSION

As we have already suggested that the early rain disaster warning message automatically generated by our system and it will be broadcasted in the form of message. Message will also be broadcasted in local language to all mobile user of nearby area, registered Government official (who are responsible for disaster mitigation) and print media and electronic media for further broadcasting. The people become alert by the early disaster warning. If tourist or pilgrims are in that area they may plan their journey accordingly. The National Disaster Management Authority (NDMA) and Government team also prepare themselves as per the alert. Warning of Automatic and intelligent Integrated Web-based early rain disaster warning accurately and in a timely fashion so that it would dramatically mitigate casualties and economic losses.

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