Wireless Sensor Network for Landslide Detection

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Abstract: *The Power of wireless sensor network technology has provided the capability of developing large scale systems for real time monitoring. The recent years, people were unknown for all kind of natural disaster and calamities. Natural calamities like Earthmovers (earthquake), Heavy rainfall, Flood, Tsunami. This paper describes the evolution of a wireless sensor network system for landslide detection in the particular area. The development of a wireless sensor network (WSN) to detect landslides, which includes design and development of WSN for real time monitoring system. If movements of rocks or soil are observed, the collected data sets are automatically transmitted to a connected server system for further diagnoses. The landslide monitoring system presented in this paper is RF transreceiver and provides real-time information about the current state of the monitored slope. Laboratory tests have been conducted to validate the performance of the monitoring system. After the landslide detection people alert by using buzzer or through SMS.*

Keywords: *Automatic Detection, Landslides, Wireless Sensor Network, RF Transreceiver.*

I. Introduction:

Every year there is great loss of life and property due to landslides. An early warning system for landslide prediction could help in preventing these losses. A landslide occurs when the balance between a hill's weight and the countering resistance forces is tipped in favor of gravity. While the physics governing the interplay between these competing forces is fairly well understood, prediction of landslides has been hindered thus far by the lack of field measurements over large temporal and spatial scales necessary to capture the inherent heterogeneity in a landslide. We propose a system of sensor deployed at hills with landslide potential with the purpose if detecting the early signals. Detection is performed through a accelerometer tilt sensor & Load of land or soil slides. First, sensors collectively detect small movements consistent with the formation of a slip surface separating the sliding part of hill from the static one. In this moved sensors self-localize through a trilateration mechanism and their displacements are calculated. Finally, the directions of the displacements as well as the locations of the moved nodes are used to estimate the position of the slip surface. This information along with collected soil measurements (e.g. soil pore pressure) are subsequently passed to highways authorities that predicts whether and when a landslide will occur.

II. Related Work:

The research includes some wireless sensor monitoring node distributed on the hillside; they construct a wireless data connection network based on Zigbee. This combines GSM technology and wireless technology. So with the help of this system we can warn the main centre about where the landslides happen. We also check the status of tunnels and landslides prone area[1].

Space location system is based on the wireless technology which goes through three main stages; the first two stages are consist of both adapt RFID technology. RFID is radio frequency identification technology, which uses radio waves to read and write on the recording media. Reader of this technology is expensive, to achieve staff-intensive to track the location, the system cost will be unbearable[2].

The Drought Forecast and Alert System (DFAS) has been proposed and developed it uses mobile communication to alert the users, whereas the deployed system uses real time data collection and transmission using the wireless sensor nodes, WiFi, satellite network and also through internet. The real streaming of data through broadband connectivity provides connectivity to wider audience[3].

The research includes the development of a wireless sensor network (WSN) to detect landslides, which includes design and development of WSN for real time monitoring system. A laboratory trial has been performed using wireless sensor networking with the integration of different sensors to detect the landslide[4].

RFID is an automatic identification technology that enables tracking of people and objects. Both identity and location are generally key information for indoor services. The research proposes a classification and survey the current state-of-art of RFID localization by first presenting this technology and positioning principles[5].

This paper, proposes various distributed detection algorithms for landslide prediction using Wireless Sensor Network. Simulation results show that statistical detection methods outperform traditional threshold based detection in low SNR conditions[6].\

Research has shown that other than geotechnical sensor deployment and monitoring, other techniques such as remote sensing, automated terrestrial surveys, and GPS technology, etc. The results of the analysis in the form of landslide warnings and risk assessments will be provided to the inhabitants of the region[7].

This paper presents a preliminary research effort towards the development of an autonomous landslide monitoring system based on wireless sensor networks that is capable to collect and process data autonomously. A distinct advantage, compared to conventional landslide monitoring systems, is that the presented system observes slopes without permanent human interaction[8].

III. Proposed Block Diagram:
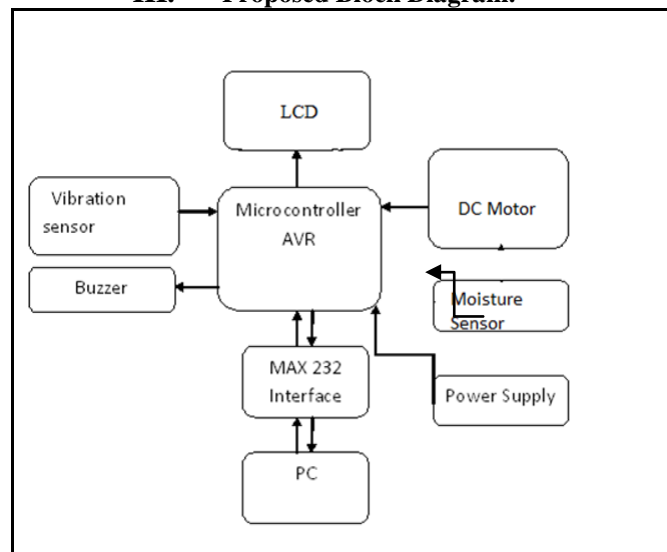
IV. Sensors For Landslide Detection:

Three distinct physical events occur during a landslide:
-the initial slope failure,
-the subsequent transport, and
- the final deposition of the slide materials.

The initial slope failure can occur due to the increase in pore pressure and soil moisture content, under heavy rainfall,which necessitates the inclusion of geophysical sensors for detecting the change in pore pressure and moisture content with the warning system developed for landslide detection.So the system discussed in this paper also includes sensors such as vibration sensor and moisture sensor for capturing the measurement.

V. Monitoring Techniques:

5.1: Radio Frequency Identification Technology (RFID):

RFID technology consists of a combination of tags and readers. The tags store and transmit data to readers using radio waves. The readers take data from the different tags and then send them back to the server for other analysis and processing. The system serves the purposes of identification, monitoring, authentication and alerting through this exchange of data between the tag and the reader. The process is automatic and both the tag and the reader do not need to be in same sight. In other words, the RFID system facilitates remote and automatic identification.[5]

5.2 Infrared Localization (IR):

Infrared Localization is a one of another method to determine position of objects or people by using various infrared emitters and receivers. The Infrared localization method using Modulated Infrared (IR) technology provide advantages such as confinement of the signals inside the room (IR does not passes through walls) and the absence of radio electromagnetic interference. In addition, the power of transmitted IR signal can be easily adjusted to cover only the area of interest.[2]

5.3 RF Transreceiver:

A RF module (radio frequency module) is a small electronic device used to transmit and/or receive radio signals between two devices. In an embedded system it is often desirable to communicate with other device wirelessly. This wireless communication accomplished through optical communication or through radio frequency (RF) communication. Hence We will used RF transreceiver in our project for communication.

VI.   Application Of Wsn System:
6.1 Lanslide Detection:

Landslide causes because of Undercutting of a slope by stream erosion, wave action, glaciers, or human activity such as road building, and Intense or prolonged rainfall, rapid snowmelt, or sharp fluctuations in ground- water levels.Shocks or vibrations caused by earthquakes or construction activity and Loading on upper slopes. So to alert people from this landslide we have used the wireless sensor which useful to reduce damage.[2]

6.2 Health Application:

We can use sensor in human body to detect any physiological changes occur in body. Also it is having different purposes such as Tele-monitoring of human physiological data, Tracking and monitoring patients and doctors inside a hospital, Drug administration in hospitals. There are many products applicable for health care such as Pulse Oximeter, Glucose Meter, Electrocardiogram (ECG), and Social Alarm Devices.[2]

6.3Warehouses Management:

In supply chain management, the warehouses management is an important component. It is necessary to improve storage management efficiency and reduce cost and error rates.so, it needs a new logistics information technology to replace the traditional mode of storage operation. WSN technology can solve this problem. In this it can manage entering storage, delivery of cargo and inventory pre-warning, and can push services actively. This model greatly improves the level of human computer interaction and enhances the level and efficiency of warehouses management.[2]

VII.   Conclusion:

Landslide causes significant changes in the Earth's natural environment. It is relatively local event. Therefore, non-geodetic monitoring technique might help more significantly. WSN is also an emerging, reliable and inexpensive technology and is capable of presenting the real time monitoring over a long distance and inhospitable terrains. By reviewing all reference papers we are planning to use WSN for collecting the information of all kinds of environment and objects in a real time situation. For communication purpose we are planning to use RF Transreceiver.

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