Survey on IOT Based Landslide Detection & Monitoring System

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ABSTRACT

Landslide is a natural disaster and it occurs due to natural or manmade activities. A landslide is defined as the movement of a mass of rock, debris, or wide range of ground movement. Landslides are a type of "mass wasting," which denotes any down-slope movement of soil and rock under the direct influence of gravity and it damaging the social life every year. India also faced the loss of humans due to landslides which occurred last few years during monsoon in Kerala. The aim of the proposed system is to detect that condition which leads to the occurrence of landslide and notify it well before time. And necessary steps can be taken to reduce or save the human loss. The system uses soil moisture and accelerometer sensors. Soil Moisture sensor measures the moisture content in the soil whereas accelerometer monitors the movement of land. The readings crossing the defined thresholds give an alarm to local citizens in the form of message through GSM. The sensed data are also transmitted via MQTT protocol to the Raspberry Pi (Rpi) used in the monitoring station. Raspberry pi is interfaced with a laptop to display the SAFE, MIDDLE and DANGER zones. All the readings from Rpi are also uploaded to IoT cloud for future analysis. The system takes only less time to collect data from sensors and transmit it to Rpi and also to upload data from raspberry pi to IoT cloud.

Keywords: Soil moisture sensor, Accelerometer, GSM, Raspberry Pi, IoT cloud, MQTT protocol.

INTRODUCTION

In the present paper, the authors deal with the landslide issue and the associated risk management. The design of a sensor network for monitoring landslide triggering events is proposed. The network consists of web-sensors using IoT technology to share measurement results and information. The aim is to provide timely landslide hazard maps. The projected measurement system is a configurable network of wireless and smart sensors geographically distributed. The monitored area is divided in local zones, each zone is monitored by a smart sensor.

A landslide is movement of a mass of rock, debris, or earth down a slope. In monsoons the rain water percolates and develops hydraulic pressure which exceeds the elastic limit of the soil or rocks. Due to this the strain gets accumulated which forces the soil and rocks to loosen their adhesive strengths entailing landslides. Landslides destroy agricultural/forest lands, road transports, destroys earth's natural environment as a whole causing great loss to life. Landslides can also be said of "Mass Wasting", which refers to any down slope movement of soil and rock due to gravity. It causes property damage, injury and

death. Also, it adversely affects a variety of resources such as water supplies, stable to an unstable condition. This change in the stability of a slope can be caused by many factors together or alone. The Natural causes, such as, ground water pressure acting to destabilize the slope, erosion at the bottom of a slope by rivers or ocean waves, earthquakes adding loads to barely stable slope, earthquake caused liquefaction destabilizing slopes. The Manmade causes, such as, deforestation, cultivation and construction which destabilizes the already fragile slopes, vibrations from machinery or traffic. Rock avalanches, debris flows, soil movement, mud flows are the various forms of landslide. Landslides occur in rocky mountainous regions like Himalayas, konkan railways, lonavala ghats and marshy regions of kerala in India. Lanslides are hazards all over the world. Hillsides with steep slopes are prone to landslides. Landslide prediction, detection and monitoring have been done by researchers for different case studies all over the world. Landslide detection can be done by using diverse methods like visual inspection using image/video processing, satellite remote sensing, using statistical methods or using machine learning algorithms. Landslide detection can also be based on data driven approaches using wireless sensor networks (WSN). The main objective to study the landslide detection is to prevent the natural calamity by detecting its early movement. This will reduce or save the human loss caused by the landslide. Also, the objective is to find a certain way in which the sensing elements should respond quickly to rapid changes of data and send this sensed data to data analysis center. The proposed WSN/Internet of things (IoT) based landslide detection and monitoring system is a low cost, robust and delay efficient

OBJECTIVE

Sensor networks are commonly used for environmental monitoring applications. The basic aim is to improve knowledge on the surrounding environment. Sometimes monitoring campaigns are necessary for risk assessment and management purposes. In fact, attention has to be paid towards those processes that can put people life at risk. In such cases, the main goal of the monitoring is to verify the status of our habitat in order to keep under control the quality level of life. In this manuscript, the authors focus attention on the landslide issue. Landslide is a phenomenon widely spread in the Mediterranean, and it is often cause of death and economic damages. It represents a natural process that shapes the Earth surface. As a matter of fact, it affects principally mountainous areas and zones with cut slopes. The consequences of such a process can be catastrophic when it occurs in proximity of residential areas. Methodological monitoring processes can avoid or reduce possible harms for the exposed population. Suitable measurement systems and data processing models can allow risky situations to be characterized. In this way, warning or alert events can be timely managed by means of corrective actions.

SCOPE

The landslide detection system is successfully implemented as a prototype. All the sensors and other stuff works as per the expectations. The system design communication is via wifi, use of GSM is also implacable for such system. The precise threshold values for each of the sensors can be obtained through detailed study on the landslides and type of soil that the system is to be implemented in. Application of such system can also be developed in future by collaborating with IT department.

LITERATURE SURVEY

A re-view of this literature indicates that the study of landslides enables the geomorphologist to reconstruct past land forming sequences, and is an aid in the comprehension of present and future topographic processes. Whereas the civil engineer is concerned primarily with the safety factors of natural or artificial slopes, and with landslide prediction, prevention, and control, geomorphologists are concerned basically with their causes, courses of movement, and resulting surface formations. The information gained from geomorphologists and civil engineers is important to land use planners in their efforts to identify potential hazard areas.

EXISTING SYSTEM

1   Register phone numbers of every traveler.

2   Send the values of Vibration, Moisture, Rain, Latitude and longitude to the cloud

3   Display values on the Dashboard

4   If some widget becomes large, it indicates a landslide

5   If land slide occurs and SMS to travelers

6   Also send alert SMS to the concerned Govt.authorities

7   Keep record of data (Data Logging)

8   Sensors we use

    Accelerometer(Vibration), Soil moisture, Rain, Humidity, Temperature.

SENSORS

Temperature sensors
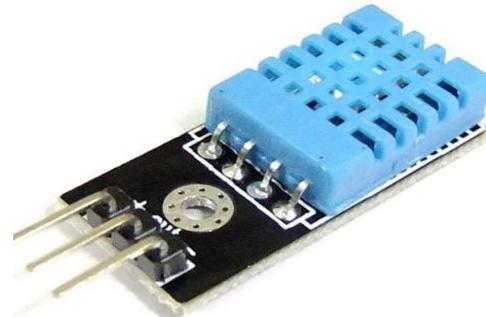
Fig. 2 Temperature sensor
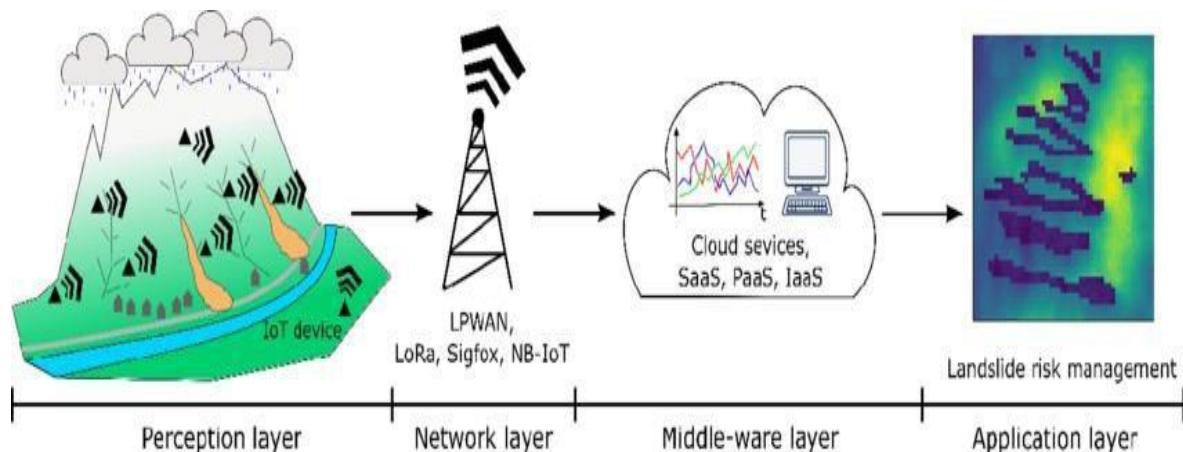
Fig. 1 Layers in Proposed Model

PROPOSED SYSTEM

Landslide is a rare and sudden event. At the same time, it is a critical hazard which causes damage to both infrastructure and human life. Slopes in the vicinity of infrastructure and human need to be monitored by a vigilant and accurate system to avoid such damage. As landslide is affected by several factors from both internal and external environments, the monitoring and prediction systems need to cover all those possible factors that can influence slope stability and trigger a landslide.

Humidity sensors

Fig. 3 Humidity sensors

Soil moisture sensors
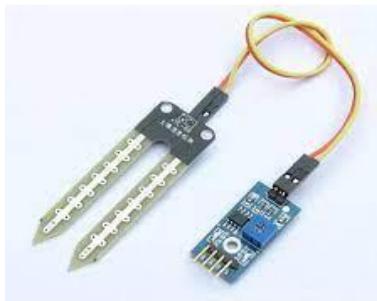
Fig. 4 Soil moisture sensor

Rain drops sensors
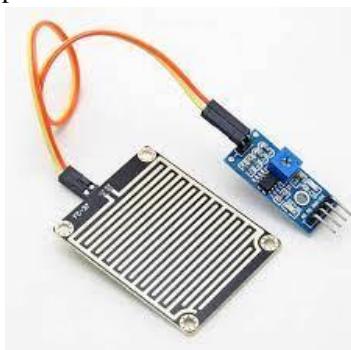
Fig. 5 Rain drop sensor

Accelerometer sensors(Vibration sensors)
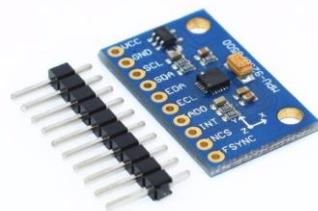
Fig. 6 Vibration sensor

Latitude and Longitude
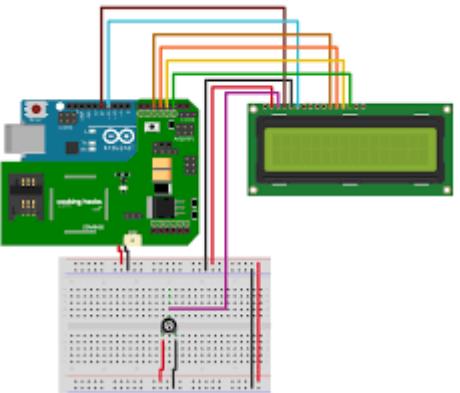
Fig. 7 Latitude and Longitude

CONCLUSION

Real-time monitoring of landslides is one of the challenging research areas available today in the field of geophysical research. The IoT based landslide detection system is to detect those conditions which lead to the occurrence of landslide and notify it well before time and able to save the human loss. The current land slide detection systems are less accurate. Here the proposed system is a real-time monitoring system and more accurate too. It is also very easy to set up. All the current systems are not completely automatic. They all require human interaction at some point. Here the proposed system is completely free of human interruption. The system is a robust and delay efficient system. It predicts occurrence of landslide at early stages thereby reducing the fatalities due to landslide.

ACKNOWLEDGEMENT

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