IOT BASED LANDSLIDE PREDICTION SYSTEM

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ABSTRACT
According to recent survey 64.15% of fatalities are due to natural calamities which includes landslide as the major problem. Studies show that due time consuming and unreliable prediction system there is increase in rate of fatalities due to landslide. Only way to reduce these severe effects is predicting landslide efficiently and accurately without consuming much time. Most of the papers surveyed use sensor technology , and the most commonly used one is WSN(Wireless Sensor Network) since this sensor network provides large scale monitoring. If the chance of occurrence of landslide is high after the prediction an alert is sent to the disaster management department. Each of these methods have different percentage of accuracy. This survey paper discusses various approaches for detecting and predicting landslide thereby reducing fatalities.
KEYWORDS: Landslide, Prediction , Sensor technology , Wireless sensor network , Alert.

INTRODUCTION:

Every year there is great loss of life and property due to landslides. A landslide occurs when the balance between a hill's weight and the countering resistance forces is tipped in favor of gravity. An early and efficient prediction system can reduce the severity of landslides and save many lifes [1]. Landslide is a frequently occurring natural disaster in hilly regions. Major landslide prone areas in India are the Himalayas, Indo-Burmese Range, Western and Eastern Ghats, Nilgiris, and Vindhya Range. It affects approximately 15% of land areas of India which is approximately 0.5 million square kilometre. To overcome this an effective technology called wireless sensor technology is used because this can respond to rapid change of data, hence landslide is predicted with at most accuracy. Natural disasters are becoming more severe. One important reason is the results of global warming around the world causing many of the disasters. To carefully protect people in these areas, we need a monitoring and alarm system. In many events such as landslides and water flooding, they can be warned by a raised alarm within in a specified period. Hence different sensors and efficient decision making techniques are used to detect landslide and raise alarm within a specified period.

LITRATURE REVIEW:

Archana Chavan *et al* proposed a system that uses 2 sensors for accurately detecting landslide , the sensors are moisture sensor and vibration sensor. A microcontroller is used for integrating the sensors .

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.

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.

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.

With these technologies an early and efficient landslide prediction system is built thereby reducing the consequences of landslide.

Pranav Pravin Garje *et al* proposed a system that has modules of Zigbee for remote correspondence and three sensors for information retrieval. The sensors utilized are Soil moisture sensor, Humidity sensor and accelerometer sensor. There will be warning system at the remote place which will be activated when the sensor values cross threshold value. The information gathering and monitoring unit gathers the information through different sensors and control utilizing LPC 2148 microcontroller .

The information is transmitted from the gathering and control segment, consequently it go as transmitting unit. The sensors are connected to the ADC 0 and ADC 1 of microcontroller. The signal conditioning circuit is used for sensors to get appropriate output.

The data collected from the sensors is in voltage form thus we convert it in suitable format to display the results. The transmitting of data is done using zigbee. The receiver consists of zigbee and computer for monitoring the data. The warning system is activated when the threshold value is crossed.

The system is turned on at first then the real-time monitoring is started. The monitoring takes place for every 1 second, that is, the data is checked every second. Then the threshold value is set on the device by the user. The microcontroller processes the data and it is checked constantly if it crosses the threshold value. If the threshold value is crossed then the buzzer alerts are given.

Ankit Suthar *et al* proposed a system that uses number of sensors for detecting landslide. Number of sensors are placed in landslide prone areas . These sensors are acceleration sensors .When soils and rocks fall down , the movements of soil and rocks and the vibration generated by them is sensed using the acceleration sensor.

When Landslides occurs soil and rocks are falling down. Because of movement of Soil and rocks Vibration generated and the vibration is sense by acceleration sensor. When landslide happens this acceleration sensors also vibrate and they give 3 voltages according to their x, y, z position. According to previously set some threshold value we can sense the Landslides.

The working of this system can be explained with following steps: 1. Every Acceleration sensor has Zigbee Tx. 2. When landslides happens sensor sense that and transfer data through router to the coordinator. 3. Coordinator has GSM+Zigbee Rx. 4. Coordinator receives it and this information is transmitted by GSM to the Control centre. 5. GSM in the Control centre receives this and transfer this information via GSM to rescue team. 6. We can also check the status of sensor by sending message.

Amrutha Joshy *et al* proposed a system which has 2 main components 1. Receiver station and 2. Sensor column . The sensor column has 2 components , the sensing component and the computing component . Each sensor column includes flex sensor and MEMS or accelerometer.The sensor column uses UDP for receiving and transmitting data.The working of this system is . Firstly ARM and needed peripherals should be initialized. Then it needed to read the status of sensors which are used to detect landslide. If flex sensor value changes, it shows the degree of tilt then MEMS reads the tilted direction. Using these sensed data forewarning time is calculated and that time value sends to UART for transmission.

METHODOLOGY:

In this section we summarize the working of the proposed system.The proposed system has 3 modules and they are :

1. Input module
2. Data processing and Decision making

3. Data transmission

Each module plays a vital role in the working of proposed system.
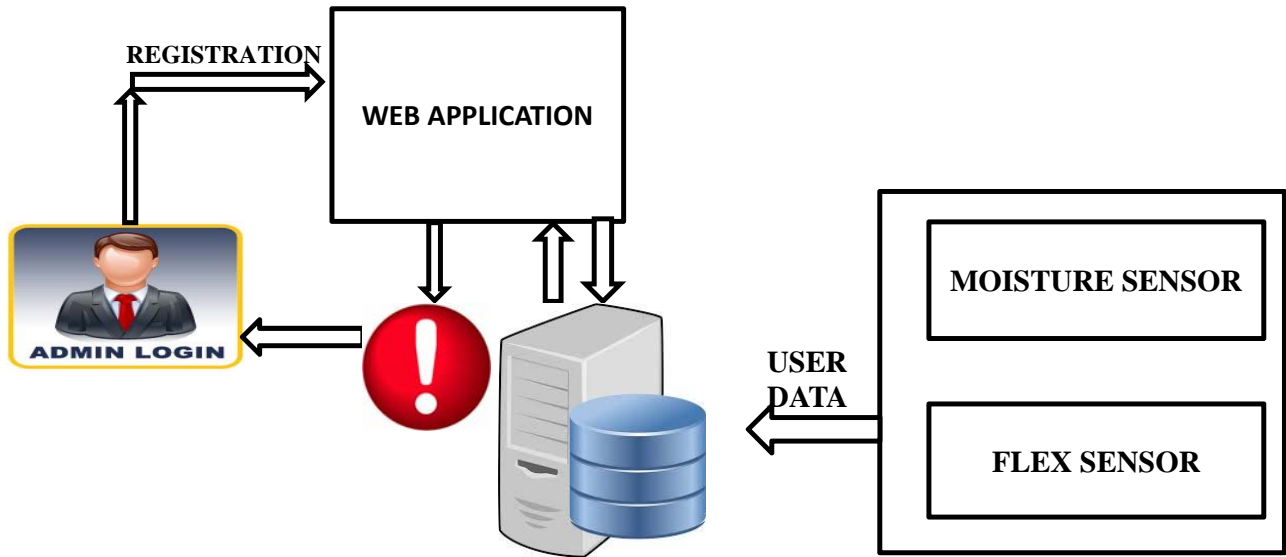
INPUT MODULE:

The user must register in the web application to receive the notification when landslide is predicted.The user in this proposed system is admin in the disaster management center .Two sensors are used in this system for detecting landlside and they are moisture sensor and flex sensor.The parameter like humidity or water content of the soil is sensed using moisture sensor and also landslide is detected using flex sensor which senses the angle of bending.
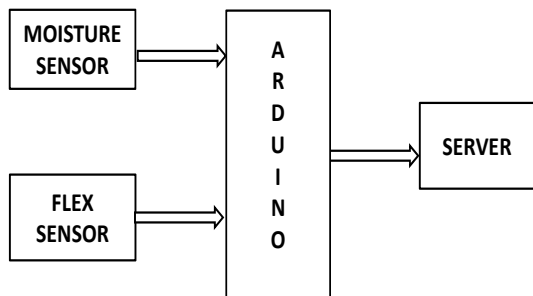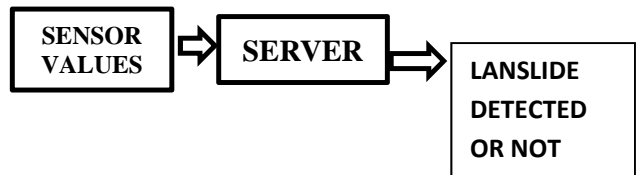

Fig 2-Sensor data acquisition

Fig 2 depicts how sensor data is being acquired.The sensors are integrated using arduino, Once the sensor values are acquired it is transmitted to the server for comparison with threshold value.

DATA PROCESSING AND DECISION MAKING:

Fig 3-Data Processing

The values from the sensor are acquired and sent to the server for comparison with the threshold value. Once the values from the sensor are sent to the server decision making is done using an algorithm . The algorithm used for decsison making is fuzzy logic multi attribute decision making.This algorithm generally considers several attributes and according to the priority of attributes decision is made.

In this system the decision is made by considering the attributes like humidity and bending , which are the attributes related to the sensors.The weight of each attribute is calculated and is normalized , then a normalized score is

calculated from this priority of each attribute can be identified. The attribute with highest priority is identified and decision is made according the attribute with highest priority.

FUZZY LOGIC – MULTI ATTRIBUTE DECISION MAKING:

- Input: Values(Attributes) from sensors S1 , S2 (0 to 1)
- Weight the attributes based on priority:

    S1->w1

    S2->W2

    Normalize the weights:

    $\Sigma w_i = 1$

- Score the attributes and normalize:

    $\Sigma x_{ij} w_i$

Attribute S1 or S2 with highest score is taken as a priority and decision is made.

DATA TRANSMISSION:

Once decision is made and if landslide is predicted a notification has to be sent to the registered user via web application.
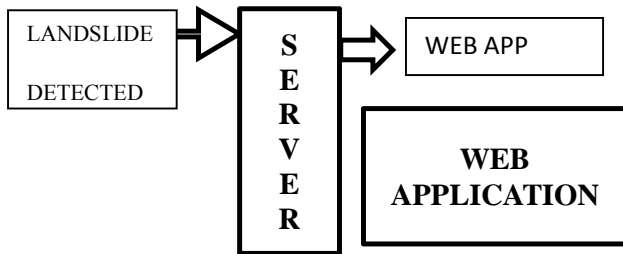

Fig 4-Data Transmission

Fig 4 depicts how data is transmitted when landslide is predicted. A notification is sent to the web application based on the decision made using the attributes.

CONCLUSION

In this paper we proposed and implemented an IOT system which may help the society decreasing the fatalities resulting from landslide.The results show that this system predicts occurrence of landslide at early stages thereby reducing the fatalities due to landslide.

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