IOT Based Land Slide System

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Abstract - Landslides are one of the major problems facing India, especially in the northern region. This is a serious issue that needs to be addressed and can lead to not only the deaths of many people, but also economic destruction. In the proposed system, we developed an IOT-based landslide detection with several parameters to detect landslides. The proposed system mainly consists of three different modules: a river slide module, which is installed to check the water level, and a landslide module, which checks the water level and detects moisture in the ground. The last and most important module is the main module, which is located in a government agency. This main module continually queries data from the Hang module in the Riverside module and constantly updates the data on the website. The connection between the website and the modules is done through GSM technology, which plays a very important role in this proposed system.

1. INTRODUCTION

Landslide is the movement of a mass of rock, debris, or earth down a slope. In monsoons, the rainwater 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, and road transport destroys the earth's natural environment causing great loss of life. Landslides can also be said of "Mass Wasting", which refers to any down slope movement of soil androck due to gravity. It causes property damage, injury, and death. IoT-based systems can help in achieving this goal: IoT-based systems can provide a more efficient and cost-effective solution for landslide detection and monitoring. By integrating sensors and data communication technologies, IoT-based systems can collect and transmit real-time data on soil moisture, temperature, and other environmental factors that can affect landslide activity. This data can be analyzed using machine learning and other advanced techniques to provide early warning systems and accurate predictions of landslide activity. IoT-based systems can also enable remote monitoring of landslide-prone areas, reducing the need for manual surveys and increasing the safety of monitoring personnel. Overall, IoT-based systems have the potential to improve the accuracy and timeliness of landslide detection and monitoring, reducing the risk of loss of life and property damage.

A. Advantages

1. IOT Based technology as the capacity of large scale deployment and real time detecting of landslide losses.
2. IOT based network detect the slightest movements of a ground or slop instability due to the several reasons such as dielectric moisture, pore pressure and so on that may occurs during a landslide.
3. It has the ability of automatic tools to acquire and elaborate data independently.
4. Easy to operate.
5. To save the human life and sources.
6. The main objective to study the landslide detection is to prevent the natural calamity by detecting its early movement.
7. The purpose internet of thing based landslide detection and monitoring system is low cost robust and delay efficient.

B. Problem statement

To design a system that monitors and provides early warning

of landslides and risk assessments to the inhabitants of the area using a sensor network and internet of things technology.

C. Aim and Objective

Aim

Monitoring, forecasting and warning of landslide are the essential features for saving the lives and assets from devastation the project will help to give alert to citizens whenever a landslide occurs If any other emergency is there that can also be taken into consideration. The IOT website will help us to fetch the data and send it to the hardware and the admin can also display a message at the website itself. ⊕arly detection is beneficial to all the stakeholder

Objectives

It gives all the information and requirements of the Landslide Detection and Prevention. The purpose of the Software Requirement Specification (SRS) is to define the user as well as the system requirements before moving on to the initial design phase. Overall description provides information to the system user regarding each system component. It will help to user for understand and its purpose better. The document covers all the functional requirements, non-functional requirements, performance requirements and technical requirements that relevant to the by addressing to mentioned areas. Memory constraints, operations, deployment requirements, user characteristics, Assumptions and dependencies are also discussed under the overall description section. Under specific requirements the detailed description is given to the user assuming the user to be a developer. In this, information about user interfaces, hardware, software and communication interfaces.

2. MODULE DESCRIPTION

Research methodology refers to the techniques or tactics used to collect, select, process, and analyze information about a topic. A research article's methodology section allows the reader to objectively evaluate the study's overall validity and dependability. The proposed methodology incorporates both qualitative and quantitative perspectives. The following modules will be included in the system:

1. River Side Module

The river side module has two different and efficient sensors that is water level and vibration sensor the task of the water level sensor is to detect the water level and the task of vibration sensor is to the check and validate the vibration level and the battery will be given through the solar power battery supply. Wireless module will help to send data to the next module.

2. Hill Side Module

The hill side module consist of three different censors that include water, vibration and soil the tasks are same the soil censor here will detect the moistness of the solid in the hill it will be placed under the ground.

3. PROPOSED SYSTEM

A Sensor networks used to alarm the effects of landslides well in advance before landslide occurred. The proposed work considers a sensor node for the application with base station or the access point. The wireless transceiver receives the data's from the sensors and transmitted to the access point or the base station. Continuous monitoring can also be done. When the angular sensor gets tilted some voltage gets produced when this voltage reaches or increases the threshold value it will produce an alert. It can be monitored from the base station.

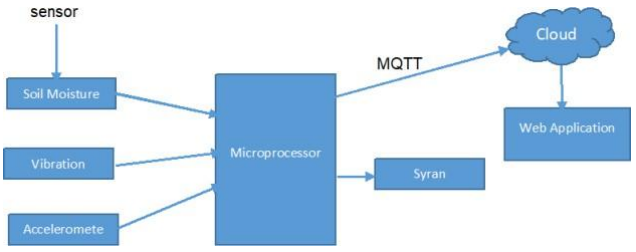
1. Soil Moisture sensors

Soil Moisture sensors measures the volumetric water contain in soil. The direct gravimetric measurement of free soil moisture require removing, drying, and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using the property of soil moisture such as electrical resistance, dielectric constant, or interaction with neutrons as a proxy for the moisture content.

2. Gyroscope/Accelerometer: An accelerometer is an electromechanical device used to measure acceleration forces. Acceleration is the measurement of the change in Velocity or Speed divided by Time. The motion sensor IOT based Landslide Prevention and Detection System 10 in accelerometer used to detect earthquake. A dynamic accelerometer measures gravitational pull to determine the angle at which a device is tilted with respect to the earth. By sensing the amount of acceleration, users analyze how the device is moving.

3. Vibration Senor The vibration sensor Detector is designed for the security practice when vibration sensor sense vibration, it sends a signal to either control panel developed a new type of omnia direction detector with omnia directional detection.

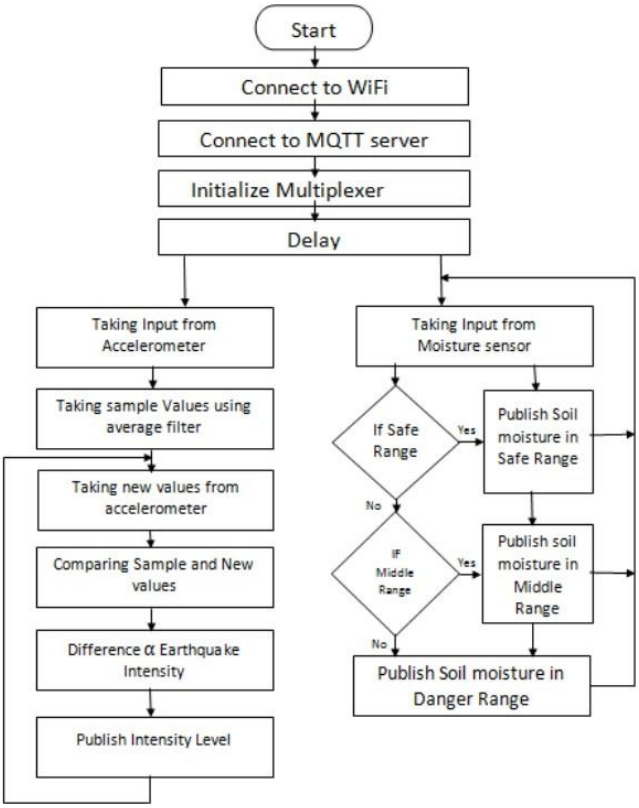
4. System Architecture The landslide monitoring system is to enable early detection of hazardous slope movements. If having identified prefailure slope deformations, the system automatically informs human individuals about potential landslides. Relevant measurements taken from the observed slope are continuously stored and available for detailed diagnoses of the slope movements. The landslide monitoring system automatically calculates the inverse velocity, and determines whether and when land-slides can be expected. The system is composed of two subsystems, a wireless sensor network and a server system.



Circuit Diagram

5. FLOWCHART

When the system is powered up, the NodeMCU configures itself to the Wi-Fi and the MQTT server. After making these connections successfully, it initializes multiplexer. Then, it starts accepting readings from soil moisture and accelerometer sensors. First, it accepts the soil moisture sensor reading and compares it with the programmed threshold values. The values are mapped in between 0-255 levels. If the received reading lies in between (160 to 255), it publishes the message as “Soil Moisture is in SAFE range” under soil moisture topic over MQTT. If the received reading lies in between (130 to 160), it publishes the message as “Soil Moisture is in MIDDLE range” and if reading lies below 130, then the published message is “Soil Moisture is in DANGER range”. After publishing soil moisture status, controller receives accelerometer readings. The average of the values is calculated and the result is saved as “sample/reference value”. Then all next values are compared with this reference value. The difference between the new received value and the reference value directly represents the vibration intensities. According to the difference, one of the message (i.e. Intensity) will be published as per Table



Different landslide zones in india

Landslides can occur in a wide range of geographical areas. In mountainous and hilly areas, it is in the form of rockfall and mudflows. In Slopes and Riverbeds areas, it is in the form of debris flow. Landslides are prone in coastal areas and underwater structures due to continuous tides.

List of Landslide Hazard zones in India as classified by National Disaster Management Authority (NDMA) :

1. Very high Hazards: These areas are prone to earthquakes and receive heavy rainfall. These areas in India include the Greater himalayan range. In states of J&K, Himachal Pradesh, Uttarakhand, and parts of north eastern states.
2. High hazard: These areas include Himalayan region between Greater Himalaya and Shivalik range. Himalayan states mostly come under high hazard zones.
3. Moderate hazard: Trans himalayan areas of ladakh and Spiti valley of himachal pradesh. Mountains in Meghalaya, Aravali mountains, Rain shadow areas of western and eastern ghats. Mines, due to blasts, come under moderate hazard zones.
4. Low Hazard: It includes the remaining parts of the country. Which are safe from landslides.

7. CONCLUSIONS

Real-time monitoring of landslides is one of the challenging research areas available nowadays within the field of geophysical research. The event of an actual field deployment of a wireless device network primarily based landslide detection system. This system uses wireless sensor nodes, and MQTT protocol for efficient delivery of real-time data to the system for monitoring and providing warnings and risk assessments to the inhabitants of the area. This network will be used for understanding the capability and usability of wireless sensor networks for critical and emergency application.

6. REFERENCES

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