# IOT Based Landslide Detection & Prevention System

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## ABSTRACT

*A Landslide, also known as a landslip, is a geological phenomenon that includes a wide range of ground movements. Monitoring is essential to predicting the behavior of landslide and forecasting which storms can trigger large number of landslides. This can help saving number of lives and prevent loss of life and property as people will be aware of the upcoming danger slide can take necessary steps for safety. Network of IOT is used in the project that helps updating the information about landslide on the internet. Moisture sensor and Vibration Sensor are employed that detects landslides as some critical value will be set for these sensor, if value exceeds these critical value the people will be noticed about the for a coming landslide and huge loss can be prevented. Raspberry Pi (SOC) takes the information and updates the information on the webpage using a MQTT protocol. This telemetry project help notify the residents about the for coming disaster and can help tackle the situation better*

**Keyword :** - *Automatic Detection, Landslides, Sensor Network, Internet Of Things.*

## 1. Introduction

Landslides are a geographical disaster occurs in a short period due to the variations in environmental actions and causes damages in human lives, properties of agriculture. During the rainy season, unlike divisions of India are affected by the landslide natural hazard every year. IOT based technology has the capacity of large scale deployment and real time detecting of landslide losses. IOT based network detect the slightest movements of ground or slope instability due to the several reasons such as dielectric moisture, pore pressure and so on that may occurs during a landslide.

### 1.1 Objective

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.

### 1.2 Scope

Monitoring, forecasting and warning of landslide are the essential features for saving the lives and assets from devastation. There are three fundamental ways for monitoring the landslide viz, visual, surveying and instrumentation. Each monitoring technique has its own advantages, Disadvantages and application range. Surveying equipment such as levels, theodolites, electronics distance measurement (EDM), and total station provide some of the prominent landslide features however, aerial or terrestrial photogrammetric provides contour maps and cross section of landslides. The compilation of photogrammetric data enables a quantitative analysis of change in slope morphology and determination of the movement vectors. Instrumentations may include installing equipment for periodic reading of the different monitoring sensors such as inclinometer, strain gauge, rain gauge, clinometers, extensometer, pore pressure sensor etc. The monitoring techniques also can be divided into two groups:
**i) Geodetic technique ii) Non-geodetic technique**. It focuses on instrumentation monitoring and non-geodetic techniques for detecting the landslide. WSN has the capability of large scale deployment, low maintenance, scalability, adaptability for different scenarios and low maintenance requirement which made it one of the best suited technologies for real time monitoring. A landslide detection system with use of wireless sensor network can detect the slides moments of soil or slope instability due to the several reasons such as dielectric moisture, pore pressure etc. that may occur during a landslide. All this data will be sending and stored in cloud for further analysis for researchers.

## 2. Literature Survey

Some of the research papers are studied to get knowledge of latest technology and implementation design. Following table shows list of these articles along with some researches which we are studying these papers.

**Table -1:** Literature Survey

| Sr. No. | Year | Researcher | Topic |
|---|---|---|---|
| 1 | 2015 | Y. Lami, D. Geno Catalot, N. Fourty, A. Lagreze | Wireless sensor network for landslides prevention |
| 2 | 2016 | Yong Wang, Zhipu Liu, Dianhong Wang | Anomaly detection and visual perception for landslide monitoring based on a heterogeneous sensor network |
| 3 | 2017 | S.Karthikvb, K.Yokesh, Y.M.Jagadeesh, R.K.Sathiendran | Smart Autonomous Self Powered Wireless Sensor Network based Low-cost Landslide Detection System |

### 2.1 Existing System

1. Safety measure are taken only after landslide occurred.
2. Need human help for checking position to detect weather fall can occurred or not.

### 2.2 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.

**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.

**Fig -1**: Soil Moisture Sensor

**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.

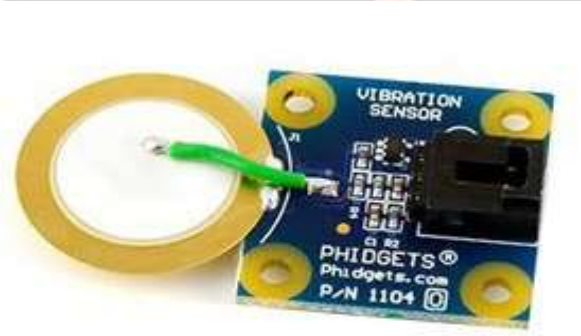


**Fig -2**: Vibration Sensor

**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.

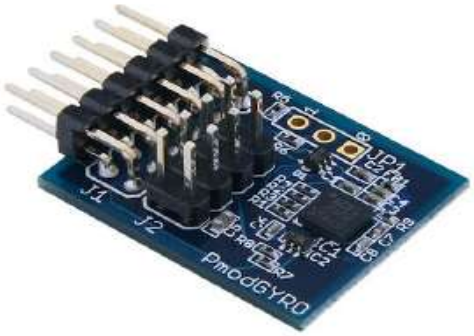


**Fig -3**: Gyroscope/Accelerometer

## 3. System Architecture

The landslide monitoring system is to enable early detection of hazardous slope movements. If having identified pre-failure 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.

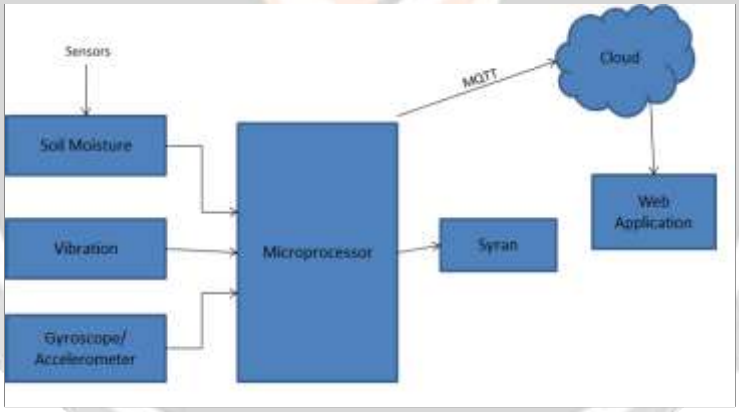


**Chart -3.1**: System Architecture

### 3.1 Web Application

**Cloud Server**

A cloud server is a logical server that is built, hosted and delivered through a cloud computing platform over the Internet. Cloud server process and exhibit similar capabilities and functionality to a typical server but are accessed remotely from a cloud service provider.

**MQTT Protocol**

MQTT (Message Queue Telemetry Transport) is an ISO standard publish-subscribe based "lightweight" Messaging protocol for use on top of the TCP/IP protocol. It is designed for connections with remote locations where a "small code footprint" is required or network bandwidth is limited. The Message broker (MQTT) is responsible for distributing messages to clients based on landslide related data.

## 4. 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, MQTT protocol for efficient delivery of real time data to the system for monitoring and provide warnings and risk assessments to the inhabitants of the area. This network will be used for understanding the capability and usability of wireless sensor network for critical and emergency application.

## 5. REFERENCES

[1]. Andreas Gunther , Miet Van-Den Eeckhaut , Jean Philippe Malet , Paola Reichenbacjh and Javier Hervas , Climate physiographically diffrentiate Pan-European landslide susceptibility assessment using spatial multi-criteria evalution andtransnational landslide in-formation Geographology , 224:69-85, November 2015.

[2]. D. Petly , Global patterns of loss of life from landslide , Geology, vol.40 , no. 10, p.927, 2014.

[3]. M. V. Ramesh,Design, development, and deployment of a wireless sensor network for detection of landslides, Ad Hoc Netw., vol. 13, pp. 218, Feb. 2014.