

# Risk Assessment and Management Techniques to Avoid Landslide Hazard

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**Abstract** - : This paper covers the literature review on study of landslide occurrence at hillside areas in India. Landslides have become one of the most significant natural hazards. It is necessary to protect people from landslides and to minimize the damage of houses, roads & other facilities. To accomplish this goal, many landslide prediction methods have been developed around the world. In this study, a prototype of landslide detection is introduced. This system is based on the sensor network (SN) i.e. composed of sensor nodes, gateway, and server system. Mobile and landslide detector based on sensor network for landslide detection. The whole system was validated by the issuance of landslide warning which facilitated pre-emptive action by the local government and community to prevent loss of human life. In this system soil moisture sensor, flex sensor, accelerometer sensor these sensors are used for detection of landslide. The sensors integrated with SN, provide an accurate and contiguous data for analysis and interpretation. Sensor Network (SN) appears to be the best suitable infrastructure to sense environmental parameter of our interests.

**Key Words:** Landslide, Sensor Network, Risk Assessment, Landslide detection, etc

## 1. INTRODUCTION

A landslide happens when rocks, debris, and soil move down a slope. They're also known as landslips. Things can go downhill suddenly, or they can slide at the snail's pace of just a couple centimeters a year. They can come from natural causes or from the activities of people. The one thing they all have in common is gravity. A landslide is a downward or outward movement of soil, rock or vegetation, under the influence of gravity. Necessary to protect people from landslides and to minimize the damage of houses, roads and other facilities to accomplish this goal, many landslide methods have been developed around the world. Landslides occur in a variety of environments, characterized by either steep or gentle slope gradients: from mountain ranges to coastal cliffs or even underwater, in which case they are called submarine landslides. Gravity is the primary driving force for a landslide to occur, but there are other factors affecting slope stability which produce specific conditions that make a slope prone to failure. In many cases, the landslide is triggered by a specific event (such as a heavy rainfall, an earthquake, a slope cut to build a road, and many

others), although this is not always identifiable following types of landslide

- Debris flow
- Earth flow
- Debris slide
- Rock avalanche
- Shallow landslide
- Deep-seated landslide.

### 1.1 Landslide Prevention and Control

The control works actually carried out in landslide areas are as follows:

1. To save lives;
2. To preserve public structures and buildings;
3. To prevent the disruption of road traffic.
4. The detailed landslide survey, relating to the characteristics and locations of landslide movements and rupture zones etc.
5. Landslide prevention and control works are implemented to stop or slow down landslide movement or avoid landslide in order to prevent any further damage by landslide movement.

Landslides have frequently occurred on natural slopes during period of intense rainfall. With rapidly increasing population on or near steep terrain, landslides have become one of the most significant natural hazards. Thus, it is necessary to protect people from landslides and to minimize the damage of houses, roads and other facilities. To accomplish this goal, many landslide prediction methods have been developed around the world. In this study, a prototype of landslide detection is introduced. This system is based on the wireless sensor network (WSN).

WSN plays significant and vital role in detection, prediction and management of debris. Different sensors like accelerometer sensors to sense the vibration and management of changes in speed. Moisture sensor to evaluate volumetric water content, ultrasonic sensor, video camera, pendulums etc.

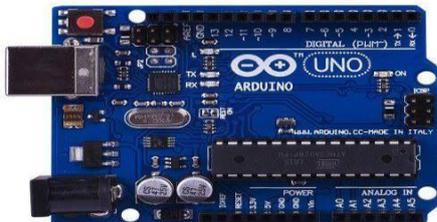
Wireless sensor networks (WSN) is one of the major technology that can be used for real-time monitoring of these events. WSN has the capability of large scale deployment, low

maintenance, scalability, adaptability for different scenarios. WSN has its own limitation such as low memory, power, bandwidth etc., but its capability to be deployed in hostile environment made it one of the best suited technologies for real-time monitoring.

The modules which were used for detecting the small vibration generated before the avalanche comes. The sensor node senses those vibrations by geographic sensor and we have used 3-axis sensor to detect the vibrations. The data from sensing node is gathered at the master node, master node upload that data to server via GSM.

## Theoretical content

### 2.1 Microcontroller



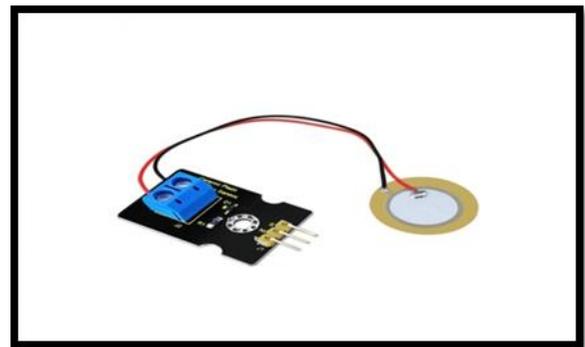
Arduino board is a mini computer having size of a credit card. It functions like a normal computer does and needs to be connected with external input output devices (mouse, keyboard (display). Arduino board uses various types of microprocessors and microcontrollers. All versions consist of a Broadcom system on a chip with an integrated ARM compatible CPU .Boards also have feature of loading programs from personal computers through Universal Serial Bus (USB) . The microcontrollers are regularly customized utilizing a feature from the programming dialects C and C++. Arduino board is microcontroller so it is used to run one program at a time over and over again. Arduino is very simple to interface with sensors and other electronic components. We can address hardware properly using code. An Arduino board is best used for simple repetitive tasks: opening and closing a garage door, reading the outside temperature and reporting it to Twitter, driving a simple robot.

### 2.2 Moisture sensor



The moisture sensor measure the volumetric water content present in the soil. The moisture sensor used for soil measures the volumetric water content indirectly by using some other properties of the soil, such as the electric resistance, dielectric constant or the interactions with neutrons as a proxy for the moisture content. The Moisture Sensor uses capacitance to measure dielectric permittivity of the surrounding medium. The sensor creates a voltage which is directly proportional to the dielectric permittivity.

### 2.3 Vibration sensor



Vibration sensors are used to measure displacement, proximity, linear velocity and acceleration. Here in this project we are using vibration sensor which detect the seismic vibration of earth. A vibration sensor also called as an accelerometer. It is a sensor which produces electrical signals which are directly proportional to the seismic vibration of the earth to which the sensor will be attached. These signals produced by the accelerometer are passed on to the instrument that in turn converts this signal in the form of velocity signal

## 3. CONCLUSION

The a prototype of landslide detection by WSN has been describe landslide monitoring system are becoming more precise and cost effective landslide monitoring system by wireless sensor network will be an alternative to detect and predict slope failure including debris flows in order to develop the technology.

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