Landslide Monitoring and Alerting System using GSM Module
Adarsh Prakash1, Aboli Patil2, Hitesh Pathania3
Department of Electrical Engineering
BVDUCOEP, Pune, India

Abstract:
The sensor is major device in electronics and electrical for measuring physical data from the environment. Immense application in the field of an early warning system in space science and aeronautical engineering have been explode by various workers. It has been realized that landslide is frequently occurring natural hazard in the hilly terrains of India; consequent upon every year there is a great loss of life and property sensor can be used for early prediction system of landslide it could help in preventing the millions of the losses due to natural hazard. In the direction of the landslide prediction, sensor can play a great role where sensor connected with wireless protocol can make it very useful for remote areas landslide mapping, detection, analysis and prediction etc. a wireless sensor network consist of spatially distributed autonomous sensors to monitor physical and environmental condition including temperature, sound, pressure, vibration etc. is found be worthwhile.

Keywords: landslide, mapping, detection, analysis.

1. INTRODUCTION

Early warning system (EWSs) have been applied to reduce the risk from natural hazard and are defined as “monitoring device atleast to minimize, the impact imposed by a damaged to properly, the environment, and to more basic element like livelihoods”. Landslide EWSs have become more applied in recent year; they generally have lower economic and environmental impact than structural interventions thanks to their capacity to reduce risk by alerting people expose to the landslide hazard so that they can take action to avoid or reduce their risk and prepare for effective response. However, many EWSs suffer from imbalance among their components; for instance, some of them may lack in the instrumental/ technical element, some in the social/communication aspect or in the understanding of landslide occurrence and their triggers. Establishing an operational landslide EWSs require careful planning due to their complex structure and the environment of specialist from several different fields. The key task in the design face of a land slide EWS are:

- Determining the needs and vulnerability of the population at risk.
- Identifying any impediments to the population taking action if the warning is issued.
- Characterizing the geologic and meteorological setting and conditions that lead to landslide initiation.

This condition is referred to as the geo indicators. Monitoring, which includes instruments installation & data communication and analysis, is a crucial activity that must be performed throughout the life of the EWSs.

The landslide monitoring is done with multi sensors networks of hardware and software in a cost effective-manner. To design system with appropriate protocol and algorithms would provide us appropriate information through GSM technique for preventing natural resources. We can also use this system for real-time monitoring of this events modules are more durable and accurate to understand unknown danger to mankind and it also helps from heavy damage and destruction. Downward & outward movement soil, rock or vegetation under the influence of gravity.

1. Natural factors 2. Anthropogenic factors

Need to develop a system which monitors and alert the authority to take preventive measures. Project puts forward solutions to the landslide in heavy rainfall region and also in places such as mines where due to land sliding many workers lose their life.

2. SYSTEM CONTAINS

A. Arduino UNO

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable.

b. Soil Moisture Sensor FC-28

Soil moisture sensor measure the moisture content in the soil. LM393 comparator is used to give both analog and digital output to the controller. When there is more water, the soil will conduct more electricity which means that there will be less resistance. Therefore, the moisture level will be higher. Dry soil conducts electricity poorly, so when there will be less water, then the soil will conduct less electricity which means that there will be more resistance. Therefore, the moisture level will be lower.

c. Vibration Sensor SW-420

This sensor module produce logic states depends on vibration and external force applied on it. When there is no vibration this module gives logic LOW output. When it feels vibration then
output of this module goes to logic HIGH.

d. GSM SIM900
GSM SIM900 works on the frequencies 900/1800 MHz. It sends message to the mobile number which is feed into the controller. This module is used to make audio calls, SMS, Read SMS. Support SIM Interface: 3V

Form factor:
- Dimension: 55.5 x 40 x 5.5 mm
- Weight: 13 g
- Power Operation Voltage: 3.3V – 4.2V
- Power Consumption:
  - Speech Mode: 165 mA (min), 280 mA (max)
  - Standby Mode: < 5 mA (paging rate 2), <3mA (paging rate 9) at GSM 900MHz
  - GPRS: 250 mA (class 8, average); 380 mA (class 10, average) at GSM 900MHz
- Hardware Output: 44 Pins female connector interface.

a. Buzzer
When the alert message is generated by the controller, then the buzzer rings.

b. Power Supply
We require +5, +12 Volts DC supply. +12 volts is given to Arduino and GSM module, +5 volts to all sensors and buzzer.

3. OPERATION
The Arduino Uno is programmed and threshold value is provided in the code. The program or code controls the operation of the circuit. The sensors present in the circuit always keeps operating such that it keeps on measuring the volumetric water content in soil. The vibration sensor module also keeps on sensing the ground vibration. Data or values acquired by sensor can also be viewed by a person through LCD or a computer. If the values sensed by sensors is slightly greater than the threshold value, a warning-text message will be displayed on the mobile no. which can be edited in the program. This is done with the help of GSM module present in the circuit, which helps to establish connection with people and is used to send alert messages and voice calls. If these values become much greater than threshold value, a warning-audio call and buzzer starts its operation.

4. ALGORITHM
1. Start.
2. Initialize input and output pins of arduino.
3. Initialize the GSM Module.
4. Initialize input and output variables.
5. Fetch the sensor value and display it.
6. Compare sensor value and threshold value.
7. If the sensor value is greater than threshold value, display landslide
8. If the sensor value is slightly greater than threshold value, display warning-text message
9. An alert message is sent through the GSM module.
10. Stop.
5. CIRCUIT DIAGRAM

6. CONCLUSION

We have designed, developed and deployed a multi-sensor for monitoring landslide. Thus, prevention of landslide is achieved through multi-sensor network of hardware and software in a cost-effective manner. The system been designed with appropriate protocols and algorithms would provide us appropriate information through GSM technique.

7. REFERENCES

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