Landslide Monitoring System with GSM Module

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ABSTRACT

Landslides cause significant damages to civil infrastructure. There have been many methods to determine the risk of landslides and to detect hazardous slope movements. This paper presents an autonomous landslide monitoring system based on wireless sensor networks. Provides real time measurement of various parameters such as amount of rainfall, moisture, and movement of land when trees and rocks are about to fell and also movement of the land as landslide occurs due to the earthquake are read by the microcontroller. We present an accurate values detected from the sensors provided and when there is some changes from the threshold value which is set from the keypad, then GSM modem transmits the Short Message Service to the server system which is connected wireless. And the information is alerted to nearby places through voice output from the APR9600 voice module. This greatly protect the heavy damages to the human lives.

Keyword*: landslides, hazardous slope movement, sensors, threshold values, GSM*

INTRODUCTION

Landslides are gravitational movements of soil or rock down slopes that can cause severe distroy to environment. Numerous fatalities and structural failure caused by landslides have been reported over the years therefore, efforts to measure and to monitor potential landslides are essential to ensure human safety and to protect civil constructions. To study the behavior of slopes, monitoring systems have been installed or manual inspections by human experts have been conducted.

Several measurement techniques have been proposed to identify slope instability and to estimate the risk of landslides. For example, map analyses and aerial and reconnaissance are used to access the risk of landslides based on interpretation of terrain and geological information. These methods, however, are known to be costly and laborintensive as well as highly subjective because results depend on the experience and the judgment of the human experts. Furthermore, landslide-indicating features in certain terrains cannot be identified by these techniques. In this landslide monitoring system would have GSM technique introduced in it.This is used for long distance information transfer and immediate rescue operation.The various details gathered by the rain sensor, humidity sensor and accelerometer sensor. Will be sent to the server present in the emergency unit this enables to take precaution measures for the landslide.

1.1 Accelerometer sensors:

It is a first generation 3 axis acceleration sensor. User can get acceleration value of X, Y, and Z axis. And it is widely used in shock, slope, and moving detection. Output sensitivity could be select by simply set voltage level on more pins. .The input voltage of accelerometer sensor is 3.3V. The output data would be a analog data. This analog value is than converted into digital value using ADC before applying to microcontroller. The concept of Accelerometer sensor are 3-axis sensing small, low profile package 4 mm × 4 mm × 1.45 mm, Supply operation: 1.8 V to 3.6 V, Supply

operation is 1.8V to 3.6V,10,000g shock survival, It has excellent Temperature stability, Bandwidth adjustment with a single capacitor per axis. The Applications of accelerometer sensors are sensing applications, Image stabilization, sports.

1.2 Vibration Sensor:

Vibration sensor is also known as piezoelectric sensor. A piezoelectric sensor is a device that uses the piezoelectric effect to measure pressure, Acceleration, strain or force by converting them to an electrical charge. The three main modes of vibration sensor operations are transverse, longitudinal and shear. Transverse effect a force is applied along a neutral axis (y) and the charges are generated along the (x) direction, perpendicular to the line of force. The amount of charge depends on the geometrical dimensions of the respective piezoelectric element. Longitudinal effect the amount of charge produced is strictly proportional to the applied force and is independent of size and shape of the piezoelectric element. Using several elements that are mechanically in series and electrically parallel is the only way to increase the charge output.

1.3 Humidity Sensor:

The Humidity sensor is use to measure the amount of water presented in air. The hh10d relative humidity sensor module is comprised of a capacitive type humidity sensor, a CMOS capacitor to frequency converter and an EEPROM used to hold the calibration factors. Due to the characteristics of capacitor type humidity sensor, the system can respond to humidity change very quickly. Each sensor is calibrated twice at two different accurate humidity chambers and two uique sensor related coefficients are stored onto the EEPROM on the module. The features of humidity sensors are 12C interface, 2.7-3.3 input, 150uA current consumption, -10 to 60 degrees temperature range.

1.3 Rain sensor:

A rain sensor or rain switch is a switching device activated by rainfall. There are two main applications for rain sensors. The first is a water conservation device connected to an automatic irrigation system that causes the system to shut down in the event of rainfall. The second is a device used to protect the interior of an automatic mode of windscreen wipers. An additional application in professional satellite communications antennas is to trigger a rain blower on the aperture of\ antenna feed, to remove water droplets from the mylar cover that keeps pressurized and dry air inside the wave-guides.

1.4 Power Supply:

The Atmega8 microcontroller allows only 5v DC power supply. By using the rectifier circuit 230V AC is converted into 5V DC.Transformer which transfers electrical energy from one circuit to another, either at the same voltage or at different voltage but at the same frequency. The function of the rectifier is to convert AC to DC current or voltage. The Filter is used to remove the pulsated AC. A filter circuit uses capacitor and inductor. The function of the capacitor is to block the DC voltage and bypass the AC voltage. The function of the inductor is to block the AC voltage and bypass the DC Voltage regulator constitutes an indispensable part of the power supply section of any electronic systems.

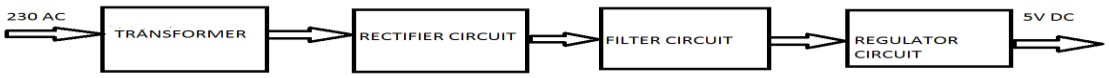

Figure 1

2.1 PROGRAMMABLE LOGIC:

The various details collected from the Rain sensor, Humidity sensor, Vibration sensor and Accelerometer sensor are given to the Atmega8 Microcontroller. Each controller is given a threshold through the keypad. If it is exceeds the threshold value the programmed Atmega8 microcontroller will use the GSM module in alerting the authorities. If the threshold value is exceeded the GSM (Global System for Mobile Communication) will send a warning message to the emergency server units. If it continues to exceed the threshold value, indicating severe landslide the GSM module will send a short message to emergency unit and APR9600 voice module which gives voice message alerting nearby places in danger

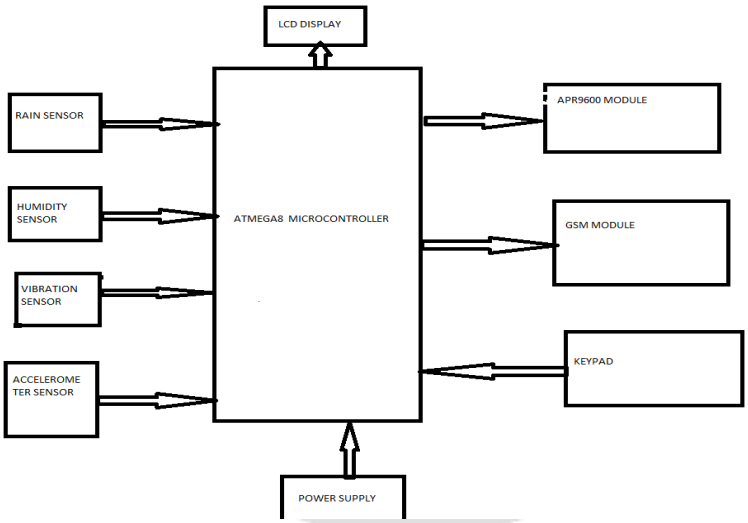

Figure 2

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3.APR9600 VOICE MODULE:

ApR9600 is a low cost high performance sound record/replay IC incorporates flash analogue storage technique. Recorded sound is retained even after power supply is removed from themodule. The replayed sound exhibits high quality with a low noise level. Sampling rate for a 60 recording period is 4.2 kHz that gives a sound record/replay

bandwidth of 20Hz to 2.1 kHz. However, by changing an oscillation resistor, a sampling rate as high as 8.0 kHz can be achieved. This shortens the total length of sound recording to 32 seconds.

Total sound recording time can be varied from 32 seconds to 60 seconds by changing the value of the single resistor. The IC can operate in one of two modes serial mode and parallel mode. The APR9600 has a 28 pin DIP package. Supply voltage is between 4.5V to 6.5V.

During recording and replaying, current consumption is 25mA. An idle mode, the current drops to 1uA. An 8-16 ohm speaker is to be used with the module. Users can select different modes using the mode selection switch. The module is measured 80mm*55mm. APR9600 voice module which gives voice message alerting nearby places in danger.

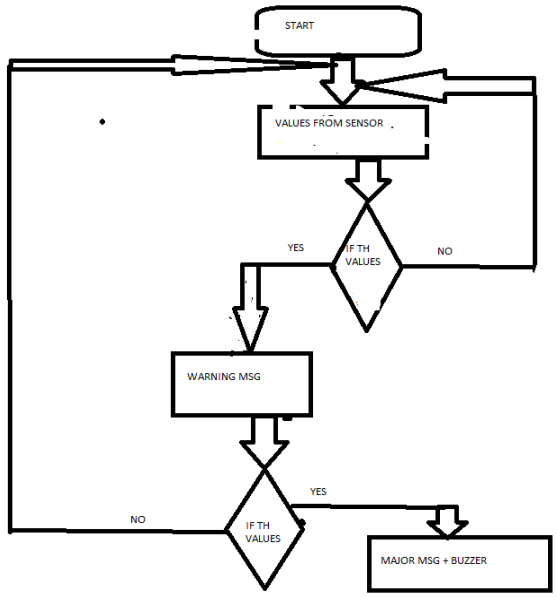

Figure 3

4.CONCLUSIONS

We have designed, developed, and deployed a multi-sensor network for monitoring landslides. Thus the prevention of landslide is achieved through multi-sensor networks of hardware and software in an cost-effective manner. The system being designed with appropriate protocols and algorithms would provide us appropriate information through gsm technique to preventing natural resources.

5.ADVANTAGES:

- Seismic Hazard landslide and Earthquake monitoring
- Safety and security
- Safety foe the humans and vehicles

- Safety for the animals
- Real time monitoring
- So easy to install
- Low power consumption III.

6.REFERENCES

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