

EARLY-WARNING SYSTEM FOR LANDSLIDE

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Abstract— landslide is a common geological disaster, which seriously threatens people's safety and property. For landslide, this paper proposes an early warning system for landslide. It uses 89c52 microcontroller to construct node. Each node contain four sensors such as moisture sensor, acceleration sensors, rain gauge, flex sensor and zigbee are used to connect multiple nodes. Zigbee is used to transmit all reading to receiver side through monitoring host. VB display received data or by SMS we can alert the people and saves lives and property. The system is completely useful according to result. Efficiency of solar panel systems must be maximized to make solar energy more usable. By sun tracking we can increase the efficiency of solar panel.

Index Terms— Landslide, Sensors, Zigbee, Microcontroller, Sun Tracking

I INTRODUCTION

In India, hilly areas like Himalayan Mountains, Western Ghats and northeastern part landslide have been major issue which causes life loss and property loss. India faces landslides every year with a large threat to human life causing annual loss of US 400 million dollar. For example, On 30 July 2014, a landslide occurred in the village of Malin in the Ambegaon Taluka of the Pune District in Maharashtra, India. The landslide, which hit early in morning, which was believed to have been caused by a heavy rainfall and killed at least 134 people.

Landslide contains all type of mass movement of hill slopes and it is defined as movement of material on slope. Material is a mixture of rocks, soils, artificial fills etc. they may move by falling, sliding, spreading. Some landslide occurs quickly, whereas other may take hours, week, month or even longer to develop. Many factors responsible for landslide such as Gravity, Geology, Groundwater, Wave action, Human action

In order to avoid impact of landslide, landslide monitoring is very important. Landslides are geological term causing loss of life and loss of properties. Therefore technology has to be developed to give signals with minimum monitoring delay. Wireless sensors are used because it can quickly respond to rapid changes of data and

send data to receiver section. It consists of zigbee network,

GPRS/ GSM module, solar panel. Zigbee use as hardware functions to construct zigbee wireless sensor network and then uses GSM/GPRS for data transmission and earlier warning information. It has versatility and good scalability, it can overcome the traditional monitoring method of single function which function is low and cost is high; it can effectively achieve landslide monitoring and prevention of the adverse geological condition under the mountains

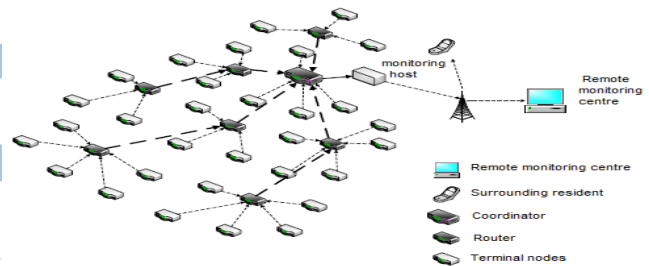


Fig. 1 Overall Architecture

II WIRELESS SENSOR NODE

Wireless nodes consist of moisture sensor, flex sensor, accelerometer, rain sensor, solar panel, power supply module.

Moisture sensor is KG-003, used to measure water content in soil. Measuring the capacitance between two electrode placed in the soil, the soil water content may be determined. It has fixed bolt hole, convenient installation. In this we using two probes to be placed in soil we will get analog output changes from 0.60volts-5volts.

Accelerometer is ADXL335. It is small, Thin, low power, 3 axis accelerometer with high resolution measurement at up to 16g. It contains a poly silicon surface-micro machined sensor and signal conditioning circuitry to implement open-loop acceleration measurement architecture.

This sensor comes with 3 analog output for X, Y and Z axis breakout board. The VCC take up to 5V in and regulates it to 3.3V with an output pin.

Flex sensor is Flex 22', used for measuring the soil movement such as very slow creep movements or sudden movements. It is operated in Temperature Range of -35°C to +80°C. It tolerate up to 30% tolerance

Rain sensor is used to measure intensity of rain. The effect of rainfall infiltration on a slope can result in changing soil suction and positive pore pressure, as well as

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the depth of the main water table or the raising the soil unit weight and reducing the anti-shear strength of rock and soil that may trigger a landslide.

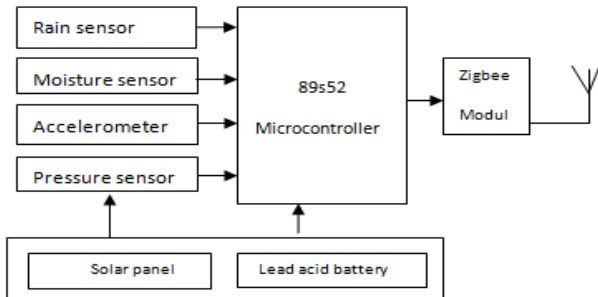


Fig2. Transmitter Section

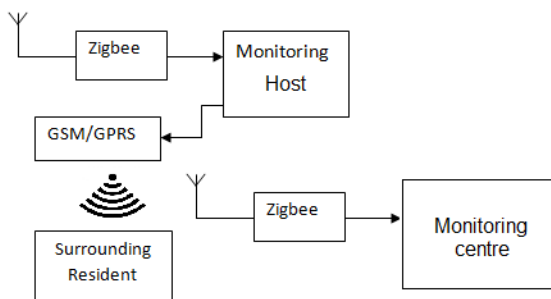


Fig3. Receiving section

III POWER MANAGEMENT MODULE

Important part of landslide is power management module, directly related to the system performance. Solar panel is important part of monitoring system. Stable power supply is required for terminal. In this system, power supply relies on solar panel and lead acid battery, with solar panels charging the battery. Systems can continuous and reliable working without replacing battery.

IV MONITORING HOST

System requires low power, stable processing speed, so we use ATmega328 controller, zigbee module and also GPRS module available in monitoring host. It is communication interface between sensor nodes and monitoring centre. During normal operation monitoring host send data to monitoring centre, if any sensor detect value above threshold value then GPRS send data to surrounding resident.

V ZIGBEE

For communication purpose zigbee module is used. We have three zigbee modules two at transmitter, one at monitoring host and another at receiver side. We don't need any external signal for this communication, so we use this zigbee module anywhere even in forest, hill station etc. in this we have peer to peer communication. The transmitter zigbee transmits the data obtained from transmitter side

controller it transmits without having delay. Then receiver side zigbee receives the signal and automatically receives data transmitted from transmitter. In this we don't have data loss so it is safe.

VI GPRS DESIGN

The GPRS chip has consumption of the standard is 2.5mA in sleep mode power with low power consumption with wide frequency Band and powerful TCP/IP protocol stack embedded in, and its working voltage is 3.4V-4.5V. To program the module by AT commands to achieve high speed transmission of voice, SMS, data and fax information. This kind of Command supports multiple SMS formats and also can achieve bidirectional data transmission by two serial interfaces. The module sends AT commands for network Communication and SMS through the serial port, whose biggest advantage is that the instructions related to the response and information exchange with the network are done automatically inside the module. When the module is powered on, the network logged on automatically and kept. So the module is high real-time, without dial-up time.

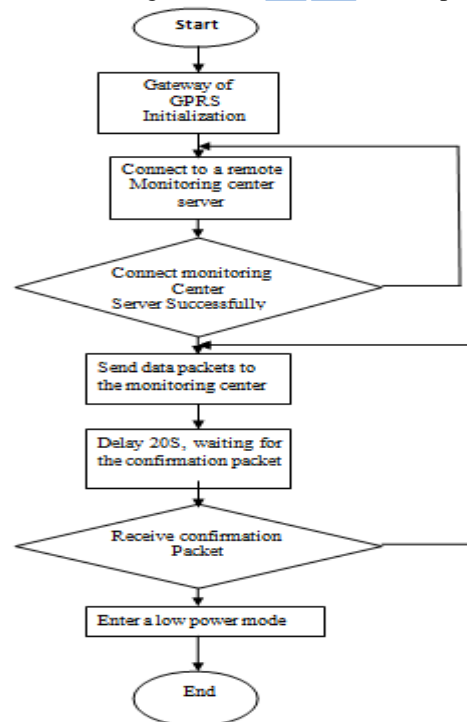


Fig4. GPRS Network Connection Process

VII VISUAL BASIC

Visual basic is used to display all information collected from sensor node through GSM/GPRS. It displays continuously reading from two sensor nodes.

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Fig. 5 result from acceleration sensor and flex sensor

VIII CONCLUSION

We have designed the real time system for landslide detection. This system is developed using 89s52 controller and ATmega328 controller. The main component used in this system is zigbee, GPRS/GSM. We have attached three sensors like moisture sensor, accelerometer, rain sensor, flex sensor. In this transmitter section we have sensors connected to 89c52 controller. Data collected from sensors send to monitoring centre through monitoring host. If monitoring host detect any value above threshold value then it send to surrounding resident

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