Landslide Detection System using AVR microcontroller

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Abstract – *This paper puts forward the solution to the landslide in heavy rain fall areas. Now days this becomes serious problem in hill areas. The system shown in this paper uses different types of sensors like rain ,soil moisture, accelerometer etc. for detection and uses AVR microcontroller which has inbuilt ADC modules. This data or indications can be sent over large distance using GSM and GPS system.*

***Key Words*: Sensors, AVR, threshold value, GSM, GPS**

1. INTRODUCTION

Landslide means "mudslide". Landslide is a sliding of a mass of soil, detritus, or rock on or from a steep slope. Landslide describes a wide variety of processes that is downward and outward movement of slope-forming materials including rock, soil, artificial fill, or a combination of these. Slope saturation by water is a primary cause of landslides. This effect can occur in the form of intense rainfall, snowmelt, and changes in ground-water levels. There are types of landslides which are Rotational slide, Translational slide, Block slide. Landslide is also known as "rock fall".

On 30 July 2014, a landslide occurred in the village named Malin in the Ambegaon taluka of the Pune district in Maharashtra, India. This landslide disaster was caused by heavy rainfall. In this incident many people lost their lives and still some are missing. Because of heavy rainfall, augment in soil moisture level and due to this the movement in earth takes place hence landslide occurs. To prevent this incident in future we have made landslide detection system which gives alerting message before landslide.

1.1 Sensor for Landslide Detection System

When we design our project landslide detection system, our first work was to determine which sensors to use. As we know most of times landslide get happen due to the heavy or continuous rainfall, so we have used rain sensor (fig. 1)

Figure 1: Rain sensor

The rain sensor module is an easy tool for rain detection. It can be used as a switch when raindrop falls through the raining board and also for measuring rainfall intensity. The module features, a rain board and the control board that is separate for more convenience, power indicator LED and an adjustable sensitivity though a potentiometer. The analog output is used in detection of drops in the amount of rainfall .Connected to 5V power supply, the LED will turn on when induction board has no rain drop, and DO output is high. When dropping a little amount water, DO output is low, the switch indicator will turn on. Brush off the water droplets, and when restored to the initial state, outputs high level.

Soil moisture sensor: Soil moisture sensor is mainly used to detect the moisture content in the soil. The control board can get the moisture value or threshold in the soil via analog or digital pins. To get output of soil moisture sensor we have to dip probes in soil continuously. Hence we get

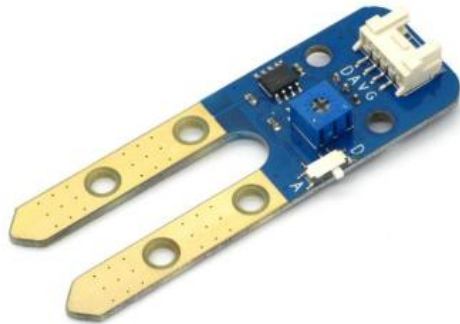physical parameter to convert it into digital form we are using inbuilt ADC.

Figure 2: Soil moisture sensor

Accelerometer (ADXL335): Accelerometer is a tiny, thin, low power and complete 3-axis acceleration measurement system. The ADXL335 has a measurement range of ±3 g minimum. Vibration or movement under the ground is sensed by accelerometer.
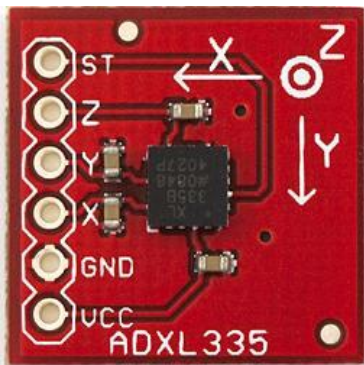

Figure 3: Accelerometer

1.2 System concept

We are designing landslide detection system for monitoring landslide. In this we are using AVR microcontroller. AVR microcontroller is 16 bit on chip with RISC command system. AVR have some inbuilt peripherals such as ADC, CLOCK, USART, Analog comparator, SPI, JTAG compared to other microcontrollers. AVR is of two packages which are DIP and QFP. Here we are using 40-pin DIP package which has the same pin configuration as of 8051 microcontroller, including the external multiplexed address and data bus. AVR have four ports which are PORT A, PORT B, PORT C, PORT D. PORTA considered as input of ADC. PORT B is output port which is connected to LCD and Buzzer.   PORT C connected to RF module and PORT D connected to GSM.
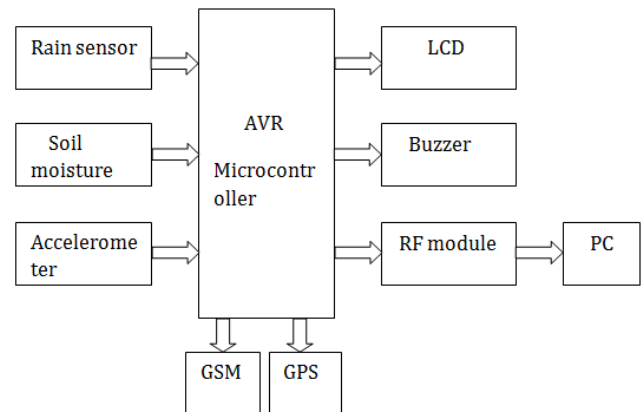

Figure 4: Block diagram

In our project we are using 3 sensors which are rain sensor, soil moisture, and accelerometer. All sensors connected to ADC of AVR as input form. The information collected from all sensors as a output is in analog form hence it is converted into digital form by ADC. All sensors output values are display on LCD continuously. AVR compare all sensors' output values with threshold values. This compared output passes through USART and decoding in transceiver. If output value goes above threshold value then buzzer will ring and warning SMS send to registered mobile number through GSM with its location. Using RF module we can display and store all information for further applications in PC.

2. Desired output

In our landslide detection system project we are using LCS, Buzzer, GSM and GPS at output side.

We have used 16*2 LCD i.e. 16 character in 1 line, total 2 lines are there. LCD is used to display output. LCD has 16 pins in which D0 to D7 are used for data transmission. There are two VCC and ground in which one is used for LCD and another for backlight. Register used are RS0 and RS1 in which RS0 for displaying command and RS1 for data.

GSM means "Global System for Mobile". GSM has range up to 100m and operating frequency range from 800MHz to 1800MHz. AVR receiver connected to GSM transmitter and AVR transmitter connected to GSM receiver. When values of sensor goes above the threshold values then alerting message is send through the GSM to registered mobile number.

GPS means "Global Position System". The satellite broadcast signals from space that GPS receivers and which is used to three dimensional location and also precise time.

3. CONCLUSIONS

It is obvious that landslides have becomes very serious problem at hill and mountain area. Because of landslide disaster many people lost their lives and also property. Hence landslide detection system alert before landslide by using sensor values. So it will help to conserve losses which are due to landslide.

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