Real Time Landslide Detection System

Pranali Chavan [1], Ashwini Kamthe [2] Anushri Karle [3], Dr. D. K. Shedge (Guide)[4]
[1, 2, 3, 4] Dept of Electronics and Telecommunication
[1, 2, 3, 4] AISSMS IOIT Kennedy Road Pune, India.

Abstract- *Wireless Sensor Network (WSN) is one of the most promising field and has innumerable applications in the real-time systems. This technology has provided the capability of developing large scale systems for real-time monitoring. Implementation of WSN in real-time system for landslide detection and warning system is discussed in this paper. Sliding of rocks and soil is called landslide. Landslide mainly happens especially due to heavy rainfall which leads to considerable loss of lives and property, communication damage, damage to agricultural and forestlands. Using real-time monitoring the landslide can be detected and can be predicted with the help of suitable warning system through which people can be warned. In this paper we are implementing the hardware which contains an accelerometer sensorwhich monitors the environment. The details are monitored and send to the microcontroller and then to the GSM module, LCD module and to the live announcement circuit to alert the people in the nearby places. Continuous monitoring enables prediction of landslide. The type of sensors used in current practice provides valuable data related to landslides, but incur costs in excess of US$300,00 per site.*

Keywords- Accelerometer and soil moisture sensor, live announcement circuit, predict and detect the landslide.

I. INTRODUCTION

In India landslide mainly occurs especially due to heavy rainfall which leads to considerable loss of life and property, communication damage, damage to agricultural and forestlands. They cause considerable damage to highways, railways, and pipelines. They generally occur with other major natural disasters such as earthquakes, volcanic activity and floods are caused by heavy rainfall. In many cases, expanded development and human activities, such as modified slopes of land and deforestation, can increase the incidents of landslide. The annual loss sometimes even crossed around $400 million. Landslide is a frequently occurring natural disaster in hilly regions. Major landslide prone areas in India are the Himalayas, Indo-Burmese Range, Western and Eastern Ghats, Nilgiris, and Vindhya Range. It affects approximately 15% of land area of India, which accounts nearly 0.5 million square kilometer. An early warning system for landslide prediction can reduce these losses to a great extent.

Yong Wang etal (2017) develop a landslide monitoring system based on wireless sensor networks, which consist of geological sensor nodes and camera sensor nodes. Once Geological sensor nodes confirm a slope anomaly, camera sensor nodes will be activated to perform visual analysis involving object detection and image compression. [1]

Rafael C. Gonzalez etal (2004) has been developing various methods to protect himself from natural calamities since ages. A highly accurate, effective and efficient landslide detection system has been done using MATLAB and a low-resolution webcam was used for acquiring sample video frames. [2]

Shijian Pei etal (2007) has done statistical modeling of the landslide strain data and the distributed detection algorithm are mainly analysed. The strain data are modeled using variable mean of Gaussian process. Miss alarm ratio is a critical performance parameter to landslide prediction. [3]

Rahmat Salam etal (2015) The raise of land usage and human population increase the number of areas which are prone to landslide disaster. Real time monitoring system on these risk areas can minimize the losses caused by it. This paper discusses about the implementation of wireless sensor network for real time system. The system consists of Inclinometer, GPS, SIM900 and power supply. [5]

Therefore, after the successful Literature Survey we have found the method of using Wireless Sensor for detecting Landslide. Wireless sensor technology has generated enthusiasm in computer scientists to learn and understand other domain areas which have helped them to propose or develop real-time deployments.

Landslide is a general term used to describe the downslope movement of soil, rock and organic materials under the influence of gravity. In India, landslides mainly happen due to heavy rainfall, so this study concentrates on rainfall induced landslides. Earthquakes can also cause landslides, however in India this is primarily confined to the Himalayan belt. High rainfall intensity accelerates the sliding and slumping in the existing hazard zones. The annual loss due to landslides in India is equivalent to $400 million. To

avoid the destruction of Thousands of lives we are implementing this project. This project aims for Monitoring, forecasting and warning of landslides for saving the lives and assets from devastation. This system can be very useful to avoid traffic after landslide and awareness to main station on LCD and in form of text messages to operator with the help GSM module.

In this paper we are implementing the hardware which contains an accelerometer sensor and soil moisture sensor which monitors the environment. The details are monitored and send to the microcontroller and then to the GSM module, LCD module and to the live announcement circuit to alert the people in the nearby places. Continuous monitoring enables prediction of landslide.

II. METHODOLOGY

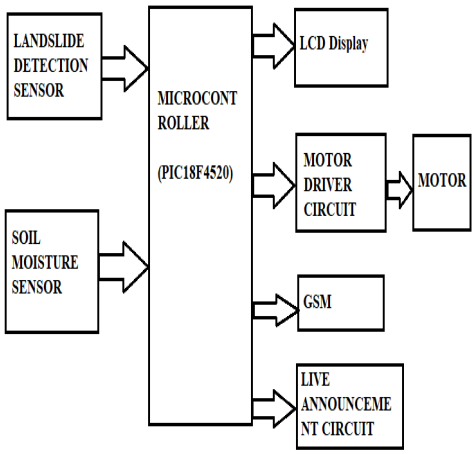

Fig 1: Block diagramof proposed system

The Real Time Landslide Detection System consist of controller, sensors, GSM module, motor and LCD display.

We use accelerometer sensor as landslide detector sensor which has two axes i.e. x and y, as we tilt the x or y axis of accelerometer it gives the landslide detected signal to microcontroller. Another sensor is soil moisture sensor it uses for prediction of landslide (sometimes landslide may occur due to heavy rain fall and soil moisture sensor measure the volumetric water content in soil). When the signal from the sensors given to the controller it sends signal to the LCD, motor, live announcement circuit and GSM to alert the people in the nearby places. Continuous monitoring enables prediction of landslide.

MICROCONTROLLER–

It is PIC18F4520microcontroller.ItsOperating Voltage 2.0-5.5V. It has I/O Pin 36. It has Flash Memory 32KB, SRAM1536 bytes&EEPROM 256 bytes. 10 bit up to 13 channel analog to digital convertor module. In circuit debug(ICD) via two pins. Flash/data EEPROM retention:100 year typical.

Accelerometer Sensor –Module: ADXL345
Operating voltage range: 2.0 V to 3.6V
Small and thin: 3 mm × 5 mm × 1 mm LGA package
Free-fall detection.
I/O voltage range: 1.7 V to VS
Temperature range (−40°C to +85°C)

Soil MoistureSensor – Range ofsoil volumetric water content (VWC): 0 – 0.57 m3/m3(0-57% VWC)
Moisture: 0~100%, 8-bit
Temperature range: −40°C to +85°C
Measurement Time: 10 ms

Live announcement circuit– Module: aPR33A3
Operating Voltage Range: 3V ~ 6.5V
Resolution up to 16-bits
Averagely 1,2,4 or 8 voice messages record & playback
Single Chip,High Quality Audio/Voice Recording & Playback Solution
Voice Recording Length:170/ 340/ 680 sec.

III. CIRCUIT SCHEMATIC

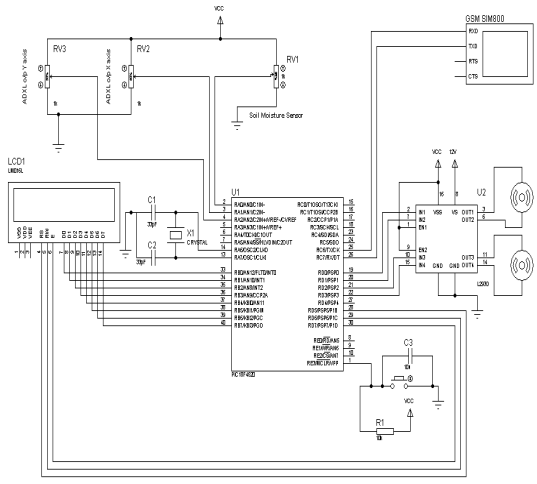

Fig2: Circuit schematic of proposed system

As per shown in circuit schematic (Figure 2), Power supply gives 12V supply to the system. Sensors gives the signal to microcontroller. Microcontroller gives that signal to

LCD display which will display the message i.e. landslide may occur /occurred. At the same it sends signal to GSM module, Motor and Live announcement circuit. GSM send message to villagers, motor is using to open and close the gates on hills and announcement circuit is to alert the people in nearby places.

IV. EXPERIMENTATION

As per shown in above block diagram (Figure1), We have proposed our system as per the below figures. As per shown in working model, there is accelerometer sensor to detect the landslide and soil moisture sensor to predict the landslide. The output of these two sensors are displayed on LCD and at the same time GSM will send the message to villagers. (Figure 3).

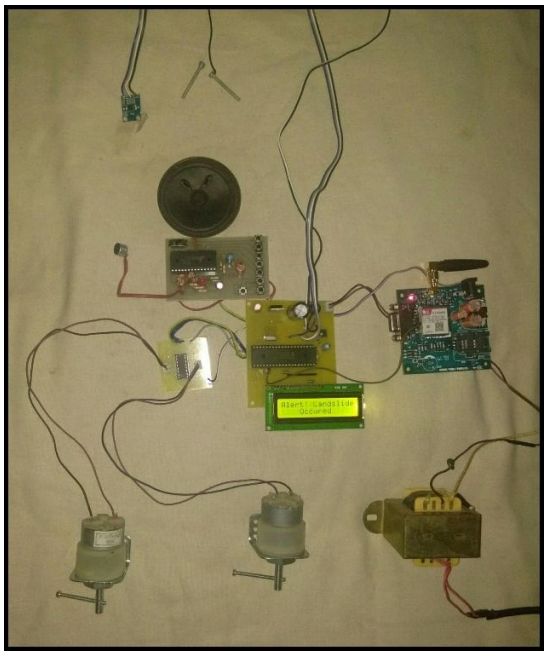

Fig 3: working model

V.CONCLUSION

In this paper we described the design, implementation, and evaluation of landslide prediction system. From the related papers we have studied that in detection of landslides, we will able to design and build a fully functional system for landslides detection. It will automatically detected and take action during landslides. Using this system as framework, the system can be expanded to include various other options which could include WSN using Wi-fi, Zigbee, real time monitoring etc.

REFERENCES

[1] Yong Wang, Zhipu Liu, Dianhong Wang, Yamin Liu" Anomaly Detection and Visual Perception for Landslide Monitoring Based On Heterogenous Sensor Network", IEEE sensors journal, VOL.17, NO.13, JULY 1,2017.

[2] Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using Matlab" in , Pearson Education, 2004.

[3] Shijian Pei, Zujun Wang. "Application of GPS technology in landslides monitoring [J] ." Geotechnical Investigation & Surveying, vol. 10, 2007, pp. 55 -58.

[4] Aibek Musaev, De Wang, Calton Pu "LITMUS: A Multi-Service
Composition System for Landslide Detection", IEEE TRANSACTIONS ON SERVICES COMPUTING, VOL. 8, NO. 5, SEPTEMBER/OCTOBER 2015.

[5] Rahmat Salam, Masyhur Irsyam, Elfi Yuliza "Design And Implementation Of Wireless Sensor Network On Ground Movement Detection System",2015 International Conference On Computer, Control, Informatics And its Applications.