www.ijecs.in
International Journal Of Engineering And Computer Science ISSN:2319-7242
Volume - 3 Issue - 8 August, 2014 Page No. 7793-7797

Wireless Sensor Network For Landslide Assessment

Mr.Sagar D. Solanki, Mr. Ankit Suthar

PG Student, E&C Department,
A. D. Patel Institute of Technology.
New VallabhVidhya Nagar, Gujarat, India.
E-mail:sagar_358@yahoo.com

Asst. Prof., E&C Department,
A. D. Patel Institute of Technology.
New VallabhVidhya Nagar, Gujarat, India.
E-mail:ec.ankit.suthar@adit.ac.in

***Abstract* — Natural disasters are increasing worldwide due to the global warming and climate change. We are focusing on Landslides disaster. However, this disaster is largely unpredictable and occurs within very short spans of time. Therefore technology has to be developed to capture relevant signals with minimum monitoring delay. Wireless Sensors are one of the cutting edge technologies that can quickly respond to rapid changes of data and send the sensed data to a data analysis centre in areas where cabling is inappropriate. The heart of this project lies with the use of a GSM + Zigbee + Sensor. Every sensor has Zigbee Tx mounted on it. When landslides happens sensor sense that and transfer data through router to the coordinator. Coordinator has GSM + Zigbee Rx. Coordinator receives it and this information is transmitted by GSM to the Control centre. GSM in the Control centre receives this and transfer this information via GSM to rescue team. We also check the status of sensor by sending message. Monitoring Landslides is very helpful to protect people and avoid accident. Because of landslides many accident occur on highway, hill station and railway track. So with the help of this system we can warn the main centre about where the landslides happen. We also check the status of tunnels and landslides prone area.**

***Keywords* - GSM, PIC microcontroller, ZigBee Technology, Wireless sensor network.**

I. INTRODUCTION

Natural disasters are becoming more severe. One important reason is the results of global warming around the world causing many of the disasters. To carefully protect people in these areas, we need a monitoring and alarm system. In many events such as landslides and water flooding, they can be warned by a raised alarm within in a specified period.

There are many natural disasters happen like Flood, Earthquake, Tsunami, and Landslide. We are focusing on Landslides. India faces landslides every year with a large threat to human life causing annual loss of US $400 million.

From the survey found that most landslide prone area in India are:

1. Western Himalayas (Uttar Pradesh, Uttaranchal, Himachal Pradesh and Jammu & Kashmir).
2. Eastern & N.E Himalayas (West Bengal, Sikkim and Arunachal Pradesh).
3. Naga-Arakkan Mountain belt (Nagaland, Manipur, Mizoram and Tripura).
4. Western Ghats including Nilgiris (Maharashtra, Goa, Karnataka, Kerala & Tamil Nadu).
5. Plateau margins in the Peninsular India and Meghalaya in NE India.
6. Konkan Railway tunnel.

In konkan railway there are 1998 Bridges (179-Major; 1819-minor) and 92 tunnels, More than 1000 cuttings in the track and Landslides a common problem due to excessive rainfall. So when tunnel like this Landslide happens it can block the tunnels and train accident occurs.

II. PREVIOUS WORK

Zhang [1] distributed some sensor nodes on the hillside; they construct used Zigbee protocol for wireless data collection. This design combines GSM wireless communication technology and wireless sensor network, it have completed the work from the system solution to the whole process of software and hardware design. The result proves that each node works stably and the status of network communication is good. This design can collects the depth of water in the mountain and the slope angle of the hillside, and provides the monitoring center with warning information in time, so related departments can take effective measures rapidly to protect people's lives and properties.

Gu Aihua [4] designs a wireless sensor network (WSN) to adapt the request of mountain torrent disaster early-warning system. The sensor node collects the information such as soil water content, permeability coefficient, displacement and rainfall, etc. To realize real-time data storage and process, the

gathering node receives the real-time data and sent it to information center through GPRS networks. This system is cost effective solution other than wire communication.
When the disaster happen, general communication methods, e.g., cell phone, may not work well due to the damage of communication infrastructure or restriction of usage of communication resources. How to let users quickly confirm safety is a critically important problem after a disaster. Therefore, Junbo[3] propose a design of safety confirmation system integrating WSN and smart phones. Users can input messages using smart phones and the messages are sent through WSN built based on sensor nodes mounted on smart phones.

III. PRAPOSED SYSTEM

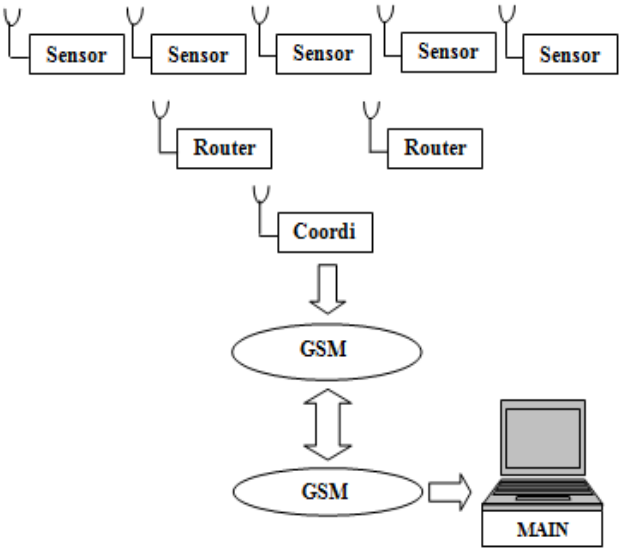

Figure 1: System blockdiagram

Figure 1 shows the system overview. The working of this system can be explained with following steps:

1. Every Acceleration sensor has Zigbee Tx.
2. When landslides happens sensor sense that and transfer data through router to the coordinator.
3. Coordinator has GSM+Zigbee Rx.
4. Coordinator receives it and this information is transmitted by GSM to the Control centre.
5. GSM in the Control centre receives this and transfer this information via GSM to rescue team.
6. We can also check the status of sensor by sending message.

In figure 2 placement of sensor is shown. Numbers of sensor are placed near the Landslides prone area. These sensors are acceleration sensors.
When Landslides occurs soil and rocks are falling down. Because of movement of Soil and rocks Vibration generated and the vibration is sense by acceleration sensor. When landslide happens this acceleration sensors also vibrate and they give 3 voltages according to their x, y, z position. According to previously set some threshold value we can sense the Landslides.

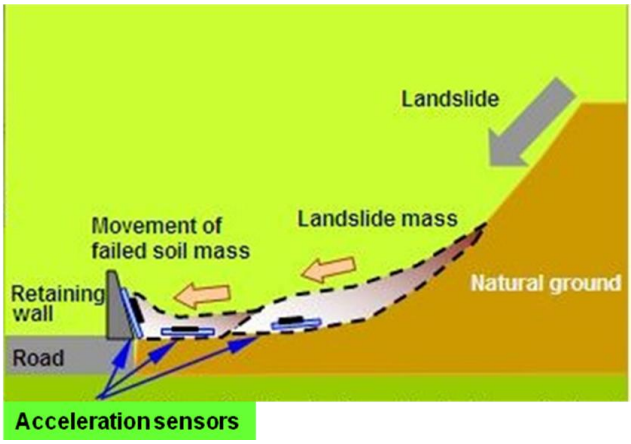

Figure 2: Sensor placement

IV. METHOD AND RESULT

First part to make this system is we have to design PIC development board which can support sensor, GSM module, and Zigbee module and LCD. For PIC development board PIC16f887 ic is used and design is made in EAGLE software

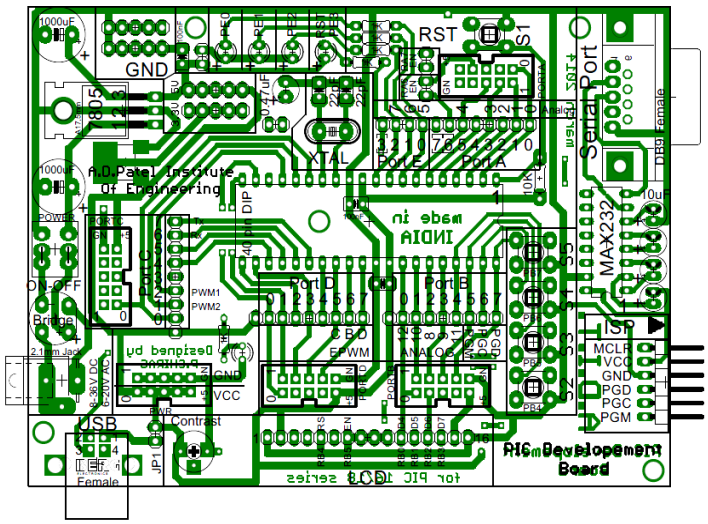

Figure 3: PIC development board

As shown in figure PIC development board is multipurpose board it has USB, RS232, LCD and programming pin.

To know threshold value for vibration sensor analysis is necessary. For sensor analysis sensor is connected with DAQ card as shown in Figure 4. Sensor used is acceleration sensor MMA7361. And result of sensor output is shown in graph. Graph of Figure 5 shows that when sensor is steady and graph of Figure 6 shows that sensor is vibrating.

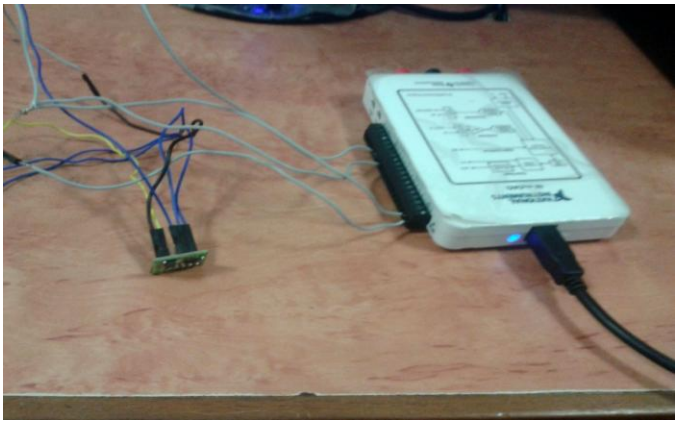

Figure 4: Sensor connection to DAQ card

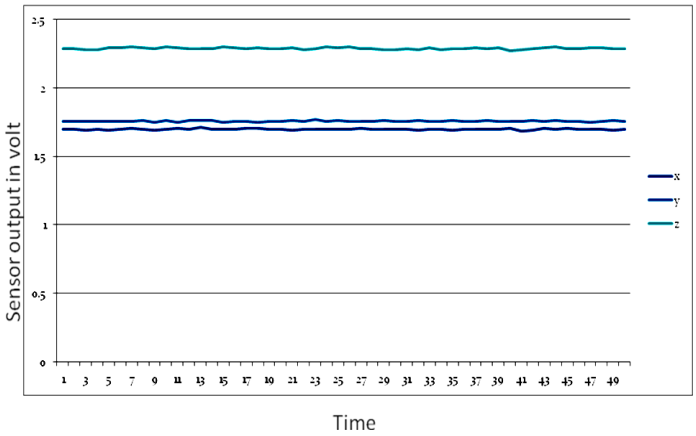

Figure 5: Sensor is steady

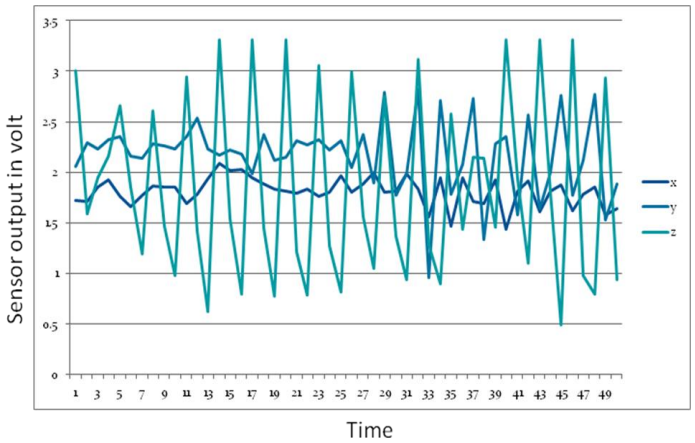

Figure 6: Sensor vibrate

Then place sensor on the table and measure vibration and result of sensor is taken by ADC in to microcontroller. Figure 7 shows result of sensor in steady condition Figure 8 shows result of vibration.

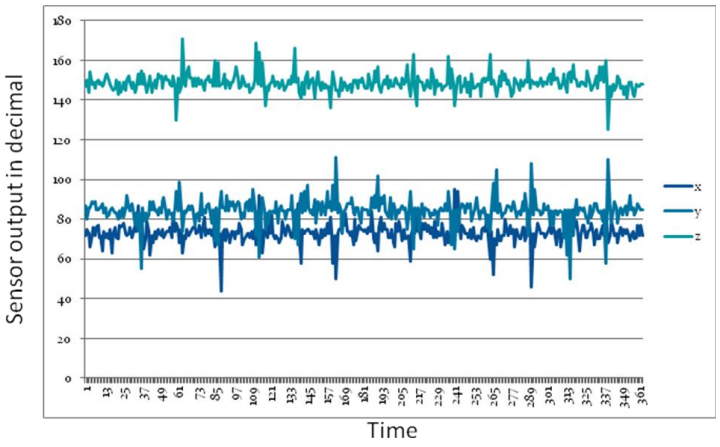

Figure 7: Sensor is steady

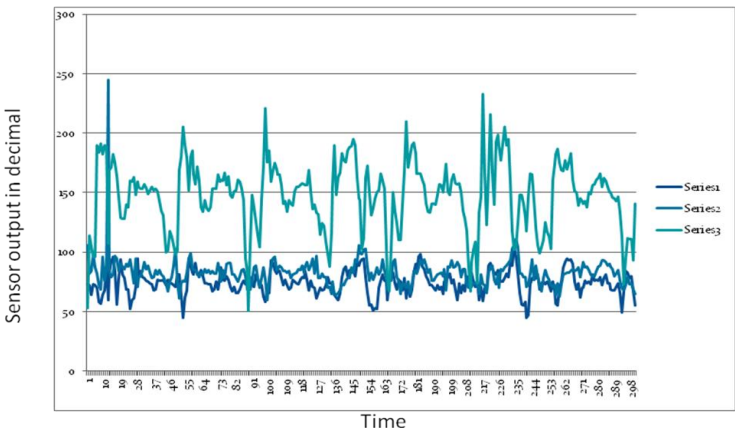

Figure 8: Sensor Vibrate

We have to place sensor in tunnel so we have to differentiate vibration between landslide and train vibration. So for that I have done small analysis. I placed sensor in pipe as shown in figure and put this pipe near roadside and take sensor reading

Figure 9: Sensor in pipe

Figure 10:Pipe near road

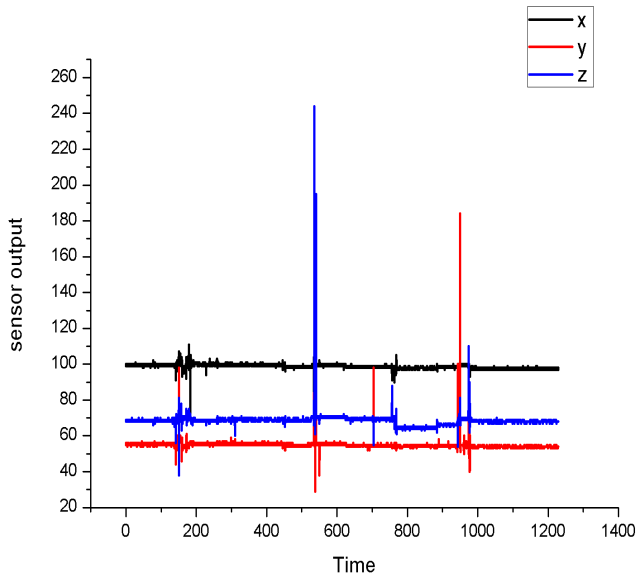

Figure 11: Sensor in pipe

Figure 11 shows analysis result small vibration shows vibration due to vehicle and peak in graph shows vibration because of manually created landslide. so we can easily differentiate two vibration.

In final setup I checked system between two node Tx and Rx. Tx has sensor and zigbee module connected. Rx has GSM and zigbee module. when sensor vibration is above predefine threshold value it Tx sends landslide message to Rx via zigbee. When Rx receive landslide message it gives command to GSM to call particular number.

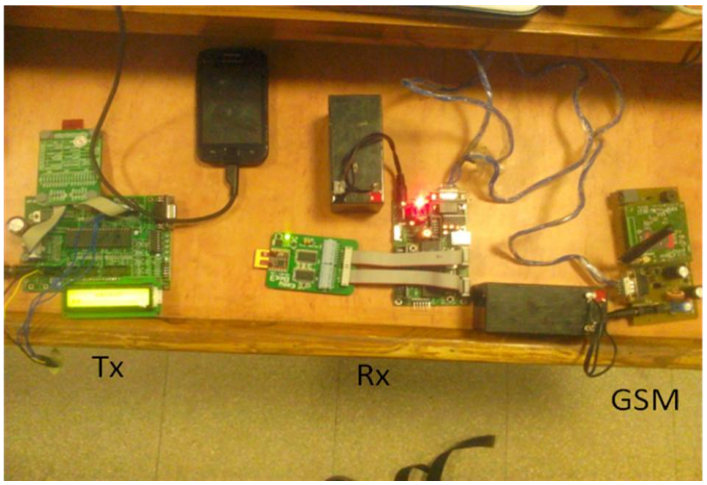

Figure 12:Setup for landslide detection between Tx and Rx

I have check power of system with network analyzer. Figure shows output of network analyzer peak at 2.4 GHz indicate that its operating frequency and -40.12 dBm power as distance increases power level goes to -60 dBm

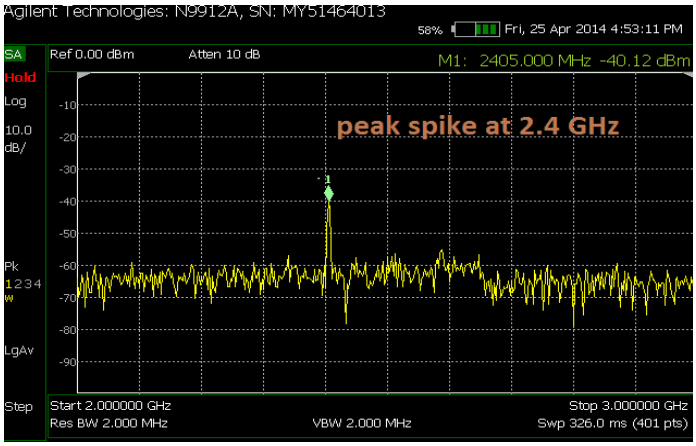

Figure 13:Power measure

Figure 14:input current measure

As shown in figure 14 input current is 47.9 mA

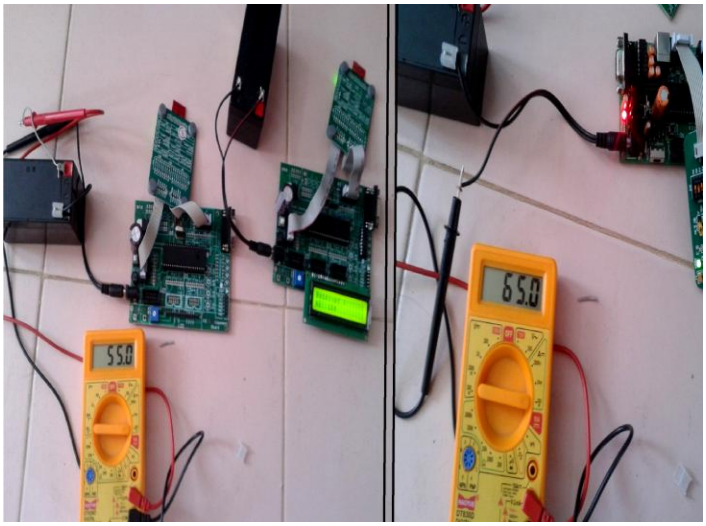

Figure 15:current measure

Figure 15 shows that when Rx is connected current is increase up to 55 mA. And as distence increase current goes to 65 mA.

V. CONCLUSION

Wireless Sensor Networks (WSNs) are emerging technology and most literature available is theoretical, so practical deployments of WSNs are very few if any. Using real practical experience, this overview of operations is one such guide providing the methodical steps and outlining the basic requirements when designing and deploying a WSN into any given application

System is very helpful to protect people and avoid accident where landslide happens. Because of landslides many accident occur on highway, hill station and railway track. So with the help of this system we can warn the main centre about where the landslides happen. We also check the status of tunnels and landslides prone area.

The knowledge gained from this actual experience is useful in the development of other systems for continuous monitoring and detection of critical and emergency applications.

VI. BIBLIOGRAPHY

1. Zhang Wenlong, Guo Qing, Liu Baoshan "Design of Landslide Warning System", *International Conference on Measuring Technology and Mechatronics Automation* 2011
2. Yingtong Liu1, Xianggen Yin, Jian Xu, Zhenxing Li 'Mechanical Monitoring and Risk Assessment under Ice Disaster Based on Wireless Sensor Network', *2011 IEEE* ISBN: 978-1-4244-9690-7/11
3. Junbo Wang, Zixue Cheng, Isao Nishiyama, Yinghui Zhou "A Wireless Sensor Network for Weather and Disaster Alarm Systems" *2011 International Conference on Information and Electronics Engineering IPCSIT vol.6 (2011) © (2011) IACSIT Press, Singapore*
4. Gu Aihua, Yan Xijun , Xia Wei, Wang Huibin , Li Xiaofang, Wei Xiaodong "Design of WSN Node for the Mountain Torrent Disaster Warning System" *2011 IEEE* ISBN: 978-1-4244-7255-0/11
5. Emad Aboelela, William Edberg, Christos Papakonstantinou and Vinod Vokkarane "Wireless Sensor Network Based Model for Secure Railway Operations" *2006 IEEE* ISBN: 1-4244-0198-4/06
6. Zigbee Specification v1.0,Zigbee Alliance, http://www.zigbee.org 2005.
7. MikroCPRO for PIC http://www.mikroe.com/en/compilers/mikroc/pro/pic/
8. MRF24J40MA Transceiver module datasheet, www.microchip.com/downloads/en/DeviceDoc/DS-39776b.pdf
9. PIC16F887 Microcontroller datasheet, http://www.microchip.com/downloads/en/DeviceDoc/41291F.pdf
10. EasyPIC5 Development Board, http://www.mikroe.com/en/tools/easypic6/