Volume 4, Issue 7, July 2014 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

A Methodoly for Landsliide Measurement

Mr. Sumedh V. Dhole
Assistant Professor
Electronics Department, BVDU College of Engineering Pune-43
India

Priyamvada Bajpai
B.Tech Electronics Department
BVDU, College of Engineering
India

Abstract: Natural hazards like earthquakes, landslides, tsunami etc. cannot stop. So the only way to reduce the possible damages is the prediction mechanism. The key issues to reduce the possible damages are an accountable disaster prediction and the appropriate forewarned time is. The power of wireless sensor network technology has provided the capability of developing large scale systems for real-time monitoring and can also help us to determine beforehand if the landslide is about to occur.. This project consist of an ARM based microcontroller board which continuously monitors the condition in the highly mud slide affected area, and send the status of the devices through internet. Accordingly the traffic department can be informed about the calamity and the citizens can be alerted to avoid the affected area.

Keywords: GPS, Zigbee, ARM Controller, wireless Communication

I. INTRODUCTION

Landslides are the natural hazards which include a wide range of ground movement such as rock falls, slope failure etc. The reasons for these are variation in water concentration, earthquakes etc. Such calamities cause huge destruction and significant loss in lives of people and economical loss. Although a basic understanding of the causes and behavior of landslides is available, systems that predict the occurrence of a landslide at a specific site do not exist. The main causes of landslides are:

1. Geological causes: Rainfall and snow fall, Earthquakes
2. Morphological causes: Slope angle, Erosion
3. Physical causes: Volcanic eruption, Ground water changes
4. Human causes: Quarrying, Deforestation.

But basically are caused due to loose grip which in turn causes vibration between the rocks and make them displaced from their positions. These loose rocks may roll down to the pathway or may cause other rocks along with the sand that is clinged with the rock and nearby to fall down along the slope of the mountain, hill etc.

In the systems which is already in existence, the safety measures are taken only after the landslide occurs in an area. Also, these system need human help for checking position and to detect whether the fall can occur or not in the area.

A wireless sensor networks is used to alarm the possibilities of the landslides well in advance before landslide actually occurs. The proposed work considers a sensor node for the application with base station or the access point. The wireless transceiver receives the data's from the sensors and transmitted to the access point or the base station. Continuous monitoring can also be done. When the sensors feel the values reaches or increases the threshold value it will produce an alert. It can be monitored from the base station, which can be the traffic controller office. The exact position of the landslide prone area can be determined precisely using GPS which gives the latitude and the longitude of the area. The safety measures can be taken well in advance by the authority and the citizens can be alarmed beforehand.

II. PROPOSED SYSTEM

The proposed work considers issue of land sliding in a region with disasters or heavy rain fall. To monitor such areas wireless sensor networks can be considered, typical low cost sensors will fit for such applications. Monitoring can be considered as an important issue, to prevent from the harm caused to the society. In the existing systems safety measures are taken only after landslide occurs. Need human help for checking position to detect whether the fall can occur or not. In the proposed system a wireless sensor networks used to alarm the effects of landslides well in advance before land sliding b occurs. The proposed work considers a sensor node for the application with base station or the access point. The wireless transceiver receives the data's from the sensors and transmitted to the access point or the base station. Continuous monitoring can also be done. When the angular sensor gets tilted some voltage gets produced when this voltage reaches or increases the threshold value it will produce an alert. It can be monitored from the base station. This system is formed by considering a remote areas like hills that are often unreachable, where setting up an infrastructure less network by a base stations are done and sensor nodes are deployed randomly on the monitoring object and exact location can also be determined in terms of latitude and longitude.

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III. BLOCK DIAGRAM

A. TRANSMITTER:

In the transmitter section the power supply provided is of 5V and 3.3V in the arm controller. The mems sensor and temperature sensors are connected with the arm controller which senses if there are any kind of disturbances in the region. These sensors have a preset threshold value, exceeding which the alarm goes off. The GPS attached with the system provides the latitude and the longitude of the affected area. The details from the sensors are then passed to max 232 which converts TTL to CMOS and then passed to the zigbee transmitter. The crystal oscillator attached with the arm controller provides the frequency of 12MHz. the values are constantly sent to the base station, by continuous monitoring of the values sent over, the pre determination of landslides can be done. By using the zigbee for transmission the data can be sent over large distance of up to few kilometers. The Kiel software is used for coding of the micro-controller and sensors.

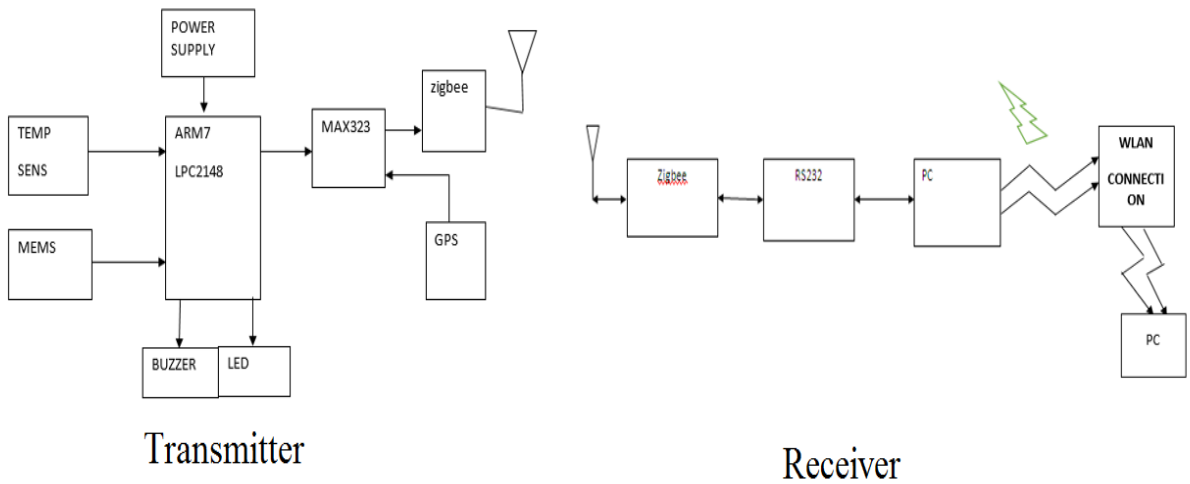

Figure 1: Block Diagram

B. RECEIVER SECTION:

The data sent over the zigbee transmitter is received at base station by zigbee receiver. The data is sent to the PC at the base station by RS 232 serial communication cable. This data received at the PC of base station are the values measured by the mems sensor and the temperature sensor used with the arm controller and the position of the area from the GPS is also received. In the receiver section, the content is connected with the PC, with the help of cable and the output can be easily seen in visual basics.

IV. CIRCUIT DIAGRAM

IN the circuit diagram, arm controller is used as the basic microprocessor. Through which we have connected the mems sensor and the temperature sensor. This mems sensor measure if there is any vibration in the rocks. These vibrations may occur due to various reasons. One of them being geological faults, earthquake, or the heavy rainfall. Due to such factors the rock may get displaced from their original position which may cause vibration and thus change in temperature. These values are measured by the sensors and send over to the base station. A threshold value is set, if the measured values touches the threshold value or get increased than that the buzzer goes off and the civilians can be alerted. The data is transmitted using Zigbee which has a range up to few kilometers.

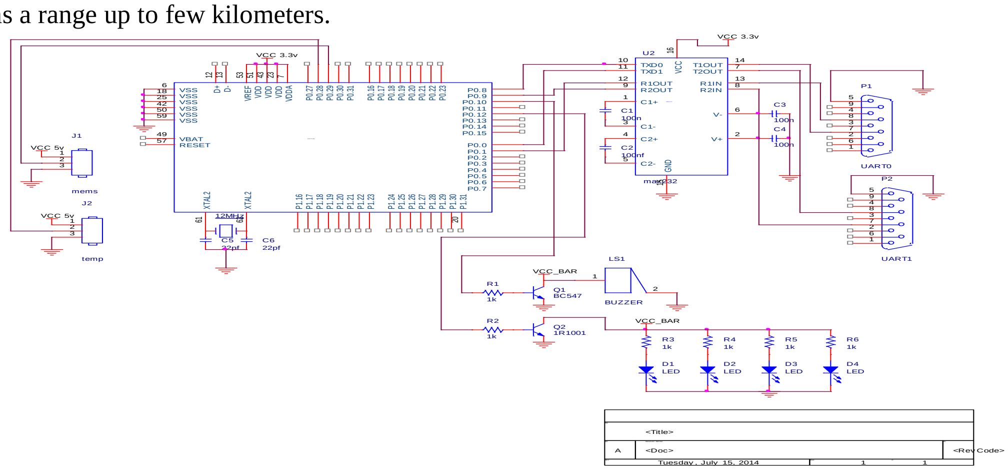

Figure 2: circuit diagram of transmitter

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V. ARM CONTROLLER LPC214

The LPC214 microcontrollers are based on a 32/16 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combines the microcontroller with embedded high speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and a unique accelerator architecture enable 32-bit code execution at the maximum clock rate. It provides full Speed device, and has multiple UARTS.The crystal oscillator used with our ARM processor give frequency if 12 MHZ.

The software for programming of the ARM controller is Keil software.

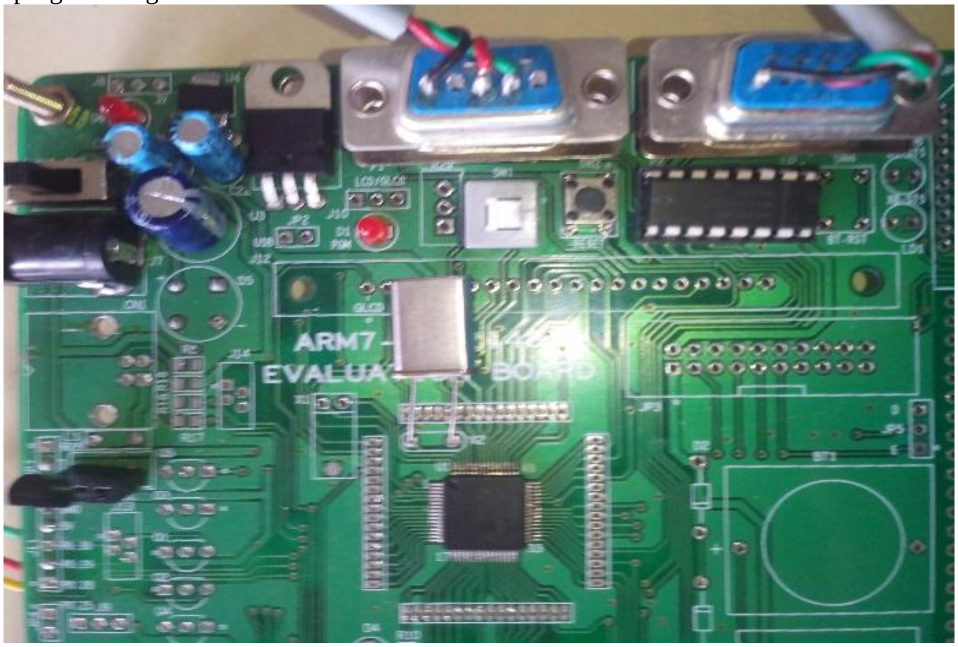

Figure 3: ARM Controller

VI. LM35 PRECISION CENTIGRADE TEMPERATURE SENSORS

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 is rated to operate over a −55˚ to +150˚C temperature range, while the LM35C is rated for a −40˚ to +110˚C range (−10˚ with im- proved accuracy). The LM35D is also available in an 8-lead surface mount small outline package and a plastic TO-220 package.

VII. MICRO-MACHINED ACCELEROMETER & GPS MODULE

The MMA7260QT low cost capacitive micro-machined accelerometer features signal conditioning, a 1-pole low pass filter, temperature compensation and g-Select which allows for the selection among 4 sensitivities. Zero-g offset full scale span and filter cut-off are factory set and require no external devices. Includes a Sleep Mode that makes it ideal for handheld battery powered electronics. The MEMS sensor used is of 1.5g sensitivity.

Photo of MEMS

Figure 4: MEMS Module

Hardware of GPS module is as shown below:

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Figure 5 : GPS Module

VIII. POWER SUPPLY USING 7805

As shown in circuit below, the 5 V power supply is used for zigbee and GPS module.

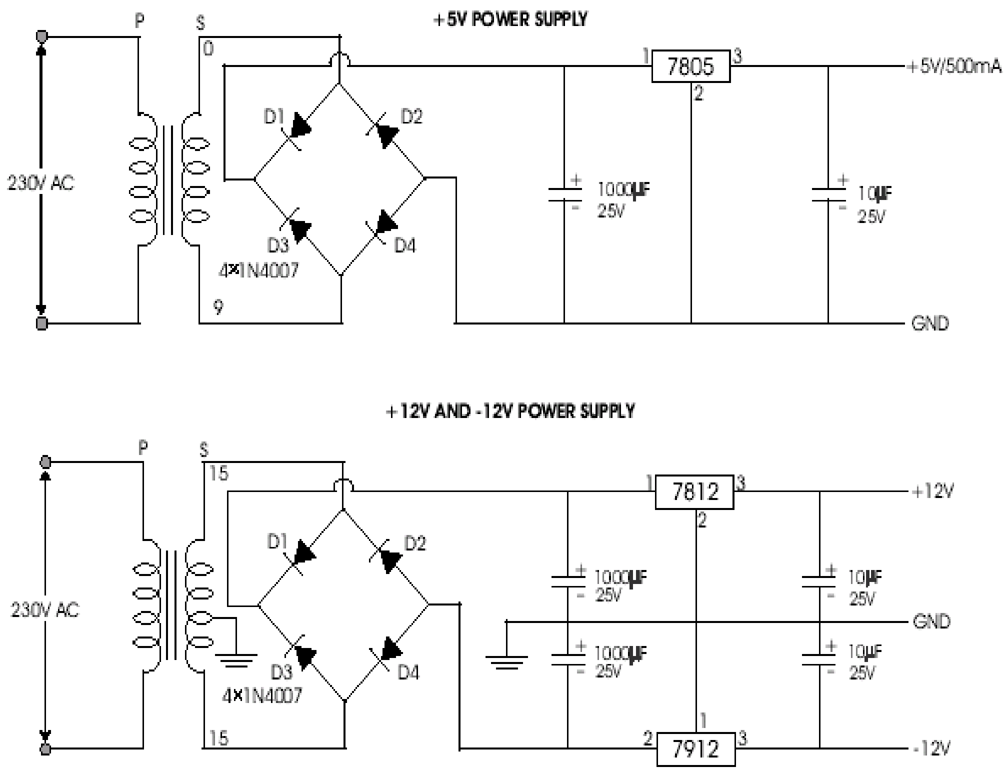

Figure 6 : circuit of power supply

Also, the 12V power supply unit shown above is used for the ARM controller.

IX. VISUAL BASICS

Visual Basic is a third-generation event-driven programming language and integrated development environment (IDE) from Microsoft. A programmer can create an application using the components provided by the Visual Basic program itself. Over time the community of programmers have developed new third party components, keeping this programming language to modern standards. We are using this as the platform for output of the project, in this we can design GUI (Graphical User Interface) for the output. We connect the zigbee receiver with the RS232 cord to the visual basic.

X. TESTING OF PROJECT

To test the project we can:

- Use the soldering gun for showing the effect of the temperature change on the temperature sensor, after a specific value the buzzer goes off.
- We move the mems sensor, causing the tilt in it. After a specific change in angle the buzzer goes off.

XI. HARDWARE

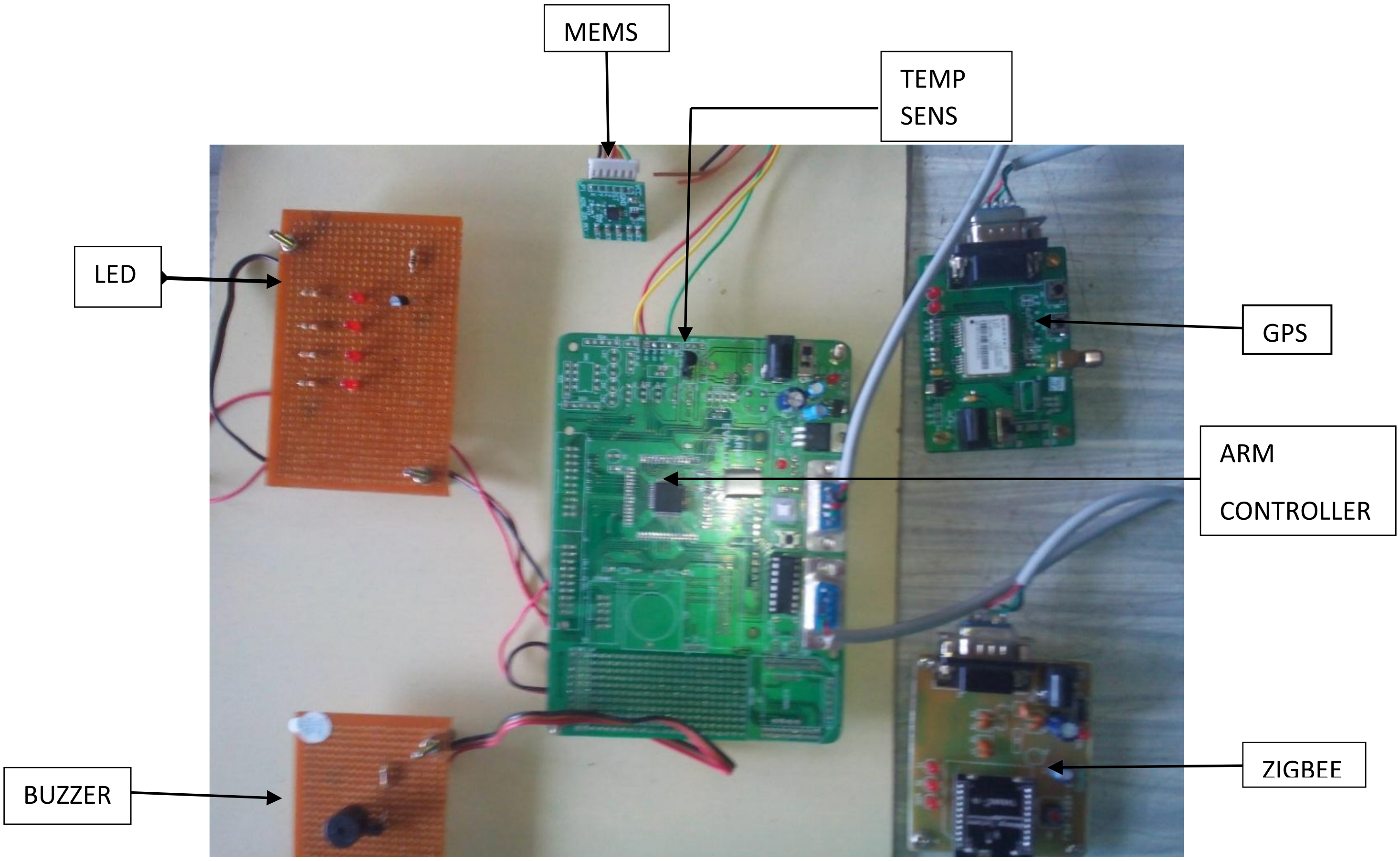

Figure 7: Transmitter section

Figure 8: Receiver Section

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XII. SIMULATION & RESULT OF PROJECT

A visual basics coding is done in order to run the simulation model developed by us. After the setup, sensor nodes senses the variations of the object, and is transmitted to base station through air interface, further in order to visualize the data, base station is connected to the processor with wire RS 232.

- Each time the value of MEMS cross the threshold value the buzzer and led goes off.
- Every time the value of temperature sensor crosses threshold value the buzzer and led gets ON.
- By constant observation, the landslide can be predetermined and the civilians can be alerted.

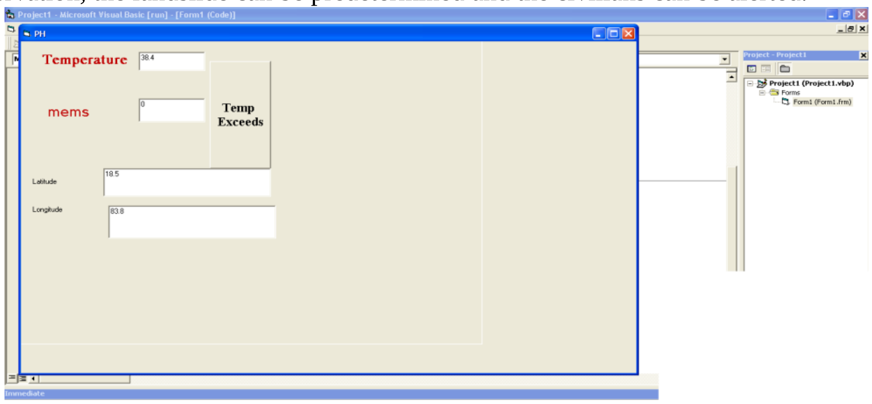

Figure 9 : output on visual basic

XIII. CONCLUSION

To address challenges, such as low accuracy, incapability of measuring on a remote, real-time, and expensive cost of the existing methods to measure the displacement and sliding tilt due to landslide, two sensors are used in this paper, which is capable of see the change if any and also alert the traffic controller if the measured values crossover the threshold value . So promises to monitor landslide are more convenient and accurate with a relatively simple and low-cost design. Also, the mounting of these devices must be associated with the public utilities system to reach where people are living. So it is a system that ensures prediction of landslides along with detection and monitoring.

These sensors send real time data so that they can be flexible in monitoring applications and can be considered as emerging technology, as with a group of low cost sensors, a large areas can be monitored for their favorable conditions. The work provides the advantage of monitoring the remote, risky, unreachable areas where human intervention is uncommon. This system can be used in future for many other applications with little modification.

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