Implementation of WSN in Disaster Detection and Monitoring

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Abstract

Wireless sensor networks are one of the emerging areas which have equipped scientists with the capability of developing real-time monitoring systems. This paper discusses the development of a wireless sensor network (WSN) to detect landslides, which includes the design, development and of a WSN for real time monitoring. When a lot of soil, rocks and other stuff slides down a hill it is called a landslide. Landslides are caused by rain and melting snow that goes into cracks in the earth on top of a mountain or hill. Then the earth is weakened because the water makes the soil loose. Detection, monitoring and control are the three major issues regarding Real-Time applications. A Land-Slide detection system is being developed at Dehradun, India, a region with high rainfall and versatile climatic behavior most of the year. In this project we proposed using ARM microcontroller and zigbee wireless technology.

I.Introduction

Wireless sensor network (WSN) technology has the capability of quick capturing, processing, and transmission of critical data in real-time with high resolution. However, it has its own limitations such as relatively low amounts of battery power and low memory availability compared to many existing technologies. It does, though, have the advantage of deploying sensors in hostile environments with a bare minimum of maintenance. This fulfills a very important need for any real time monitoring, especially in hazardous or remote scenarios. We aim to use the wireless sensor networks in the landslide scenario1 for estimating the chance occurrence of landslides. India faces landslides every year with a large threat to human life causing annual loss of US $400 million. The main goal of this effort is to detect rainfall induced landslides which occur commonly in India.

Landslides occur during monsoons in India, causing great loss of life and property. An early warning system for landslide prediction can reduce these losses to a good extent. 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 center in areas where cabling is inappropriate. Wireless sensor network (WSN) technology has the capability of quick capturing, processing, and transmission of critical data in real-time with high resolution. A sensor network can collect, aggregate, and analyze from a multi-point perspective diverse and distributed data.

The availability of distributed data can improve the general understanding of landslide dynamics and can enable the detection of patterns that would be otherwise very hard to identify. In the case of landslides, particular patterns of relevant parameters (e.g. pour water pressure or slope displacements) could indicate the approaching of critical conditions of the slope.

II.Related work

The term' landslide' includes all varieties of mass movements of hill slopes and can be defined as the downward and outward movement of slope forming materials composed of rocks, soils, artificial fills or combination of all these materials along surfaces of separation by falling, sliding and flowing, either slowly or quickly from one place to another. Although the landslides are primarily associated with mountainous terrains, these can also occur in areas where an activity such as surface excavations for highways, buildings and open pit mines takes place.

Landslide is a general term for a wide variety of down slope movements of earth materials that result in the perceptible downward and outward movement of soil, rock, and vegetation under the influence of gravity. The materials may move by falling, toppling, sliding, spreading, or flowing. Some landslides are rapid, occurring in seconds, whereas others may take hours, weeks, or even longer to develop. Many factors contribute to slides, including geology, gravity, weather, groundwater, wave action, and human actions. Although landslides usually occur on steep slopes, they also can occur in areas of low relief. Landslides can occur as ground failure of river bluffs, cut and-fill failures that may accompany highway and building excavations, collapse of mine-waste piles, and slope failures associated with quarries and open-pit mines. Underwater landslides usually involve areas of low relief and small slope gradients in lakes and reservoirs or in offshore marine settings.

III.Proposed system
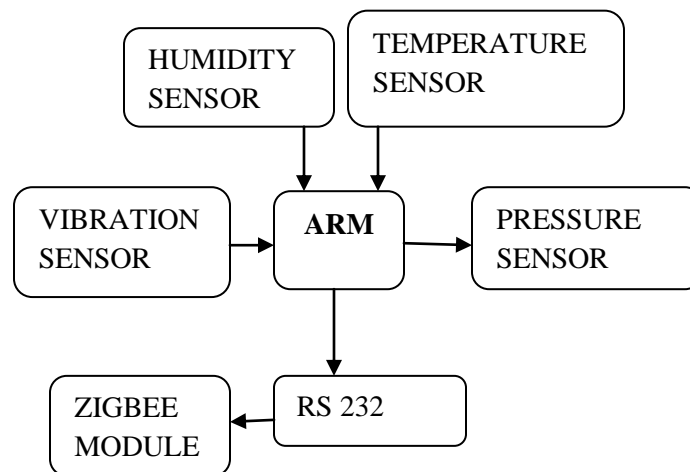
Figure1 *Proposed Block Diagram*

The paper proposed landslide prediction using zigbee wireless technology. The parameters are temperature, pressure, MEMS (vibration), humidity sensors are going to be monitored the updated value.

Monitoring section

As embedded applications include more functionality, the challenge is making these functions accessible to the end user in a meaningful way. Design the hand held hardware with sensors, Zigbee transceiver. Design the power supply selector circuit for peripheral and controller. Write the programmer for the main controller using embedded 'c'. Design a driver for sending or receiving message.
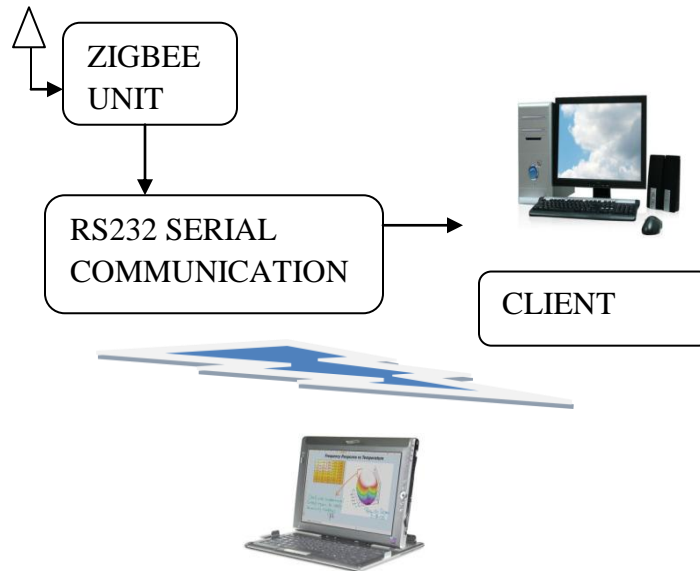
Figure2 Monitoring Section

The sensors used to get the parameters of Land Slide Detection. The parameters are converted into digital value by on chip ADC module of the micro controller. The micro controller sends the value to monitor section via Zigbee transceiver. In monitor section the computer compare the value with predefined value.

IV.Sensors using landslide detection
1. HUMIDITY SENSOR

Humidity is the presence of water in air. The amount of water vapor in air can affect human comfort as well as many manufacturing processes in industries. The presence of water vapor also influences various physical, chemical, and biological processes. Humidity measurement in industries is critical because it may affect the business cost of the product and the health and safety of the personnel. Hence, humidity sensing is very important, especially in the control systems for industrial processes and human comfort.

SY-HS-220 Humidity
sensor Module

Controlling or monitoring humidity is of paramount importance in many industrial & domestic applications. In semiconductor industry, humidity or moisture levels needs to be properly controlled & monitored during wafer processing. In medical applications, humidity control is required for respiratory equipments, sterilizers, incubators, pharmaceutical processing, and biological products. Humidity control is also necessary in chemical gas purification, dryers, ovens, film desiccation, paper and textile production, and food processing. In agriculture, measurement of humidity is important for plantation protection (dew prevention), soil moisture monitoring, etc. For domestic applications, humidity control is required for living environment in buildings, cooking control for microwave ovens, etc. In all such applications and many others, humidity sensors are employed to provide an indication of the moisture levels in the environment.

2. TEMPERATURE SENSOR

The most commonly used type of all the sensors is those which detect temperature or heat. These types of temperature sensor vary from simple ON/OFF thermostatic devices which control a domestic hot water heating system to highly sensitive semiconductor types that can control complex process control furnace plants. There are many different types of Temperature Sensor available and all have different characteristics depending upon their actual application.

The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in $^{\circ}$C).It has an output voltage that is proportional to the Celsius temperature.

3. VIBRATION SENSOR

The three parameters representing motion detected by vibration monitors are displacement, velocity, and acceleration. These parameters can be measured by a variety of motion sensors and are mathematically related (displacement is the first derivative of velocity and velocity is the first derivative of acceleration). Selection of a sensor proportional to displacement, velocity or acceleration depends on the frequencies of interest.

4. PRESSURE SENSOR

A pressure sensor measures pressure, typically of gases or liquids. Pressure is an expression of the force required to stop a fluid from expanding, and is usually stated in terms of force per unit area. A pressure sensor usually acts as a transducer; it generates a signal as a function of the pressure imposed. For the purposes of this article, such a signal is electrical.

Pressure sensors are used for control and monitoring in thousands of everyday applications. Pressure sensors can also be used to indirectly measure other variables such as fluid/gas flow, speed, water level, and altitude. Pressure sensors can alternatively be called pressure transducers, pressure transmitters, pressure senders, pressure indicators, piezometers and manometers, among other names. Pressure sensors can vary drastically in technology, design, performance, application suitability and cost. A conservative estimate would be that there may be over 50 technologies and at least 300 companies making pressure sensors worldwide.

There is also a category of pressure sensors that are designed to measure in a dynamic mode for capturing very high speed changes in pressure. Example applications for this type of sensor would be in the measuring of combustion pressure in an engine cylinder or in a gas turbine. These sensors are commonly manufactured out of piezoelectric materials such as quartz.

Some pressure sensors, such as those found in some traffic enforcement cameras, function in a binary (off/on) manner, i.e., when pressure is applied to a pressure sensor, the sensor acts to complete or break an electrical circuit. These types of sensors are also known as a pressure switch.

V.RESULT
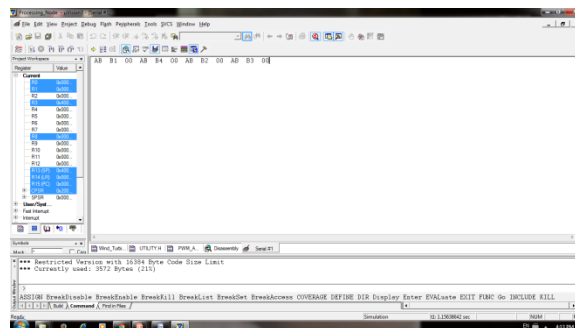
V1.CONCLUSION

In this paper, the development of an actual field deployment of a wireless sensor network based landslide detection system. This system uses a zigbee wireless technology and ARM microcontroller composed of wireless sensor nodes. In the future, this work will be extended to a full deployment by using the lessons learned from the existing network. This network will be used for understanding the capability and usability of wireless sensor network for critical and emergency application.

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