Proffer for Landslide Monitoring in Multi sensor Networks

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***Abstract* - The advent of sensor networks and wireless technologies offers the capability of quick capture, processing, and transmission of critical disaster data in real-time from inaccessible sites, incurring minimum maintenance as well. India faces rainfall-induced landslides every year with a large threat to human life and an annual loss of U.S. $400 million. A landslide is a short lived and suddenly occurring phenomenon, and its causative factors can be accumulated rainfall, moisture and pore pressure saturation in the soil, or a steep slope angle, among others. This research focuses on sensor networks for detecting landslides, paying particular attention to data reduction and energy minimization.**

1. INTRODUCTION

Sensor networks and wireless technologies offers the capability of quick capture, processing, and transmission of critical disaster data in real-time from inaccessible sites, incurring minimum maintenance as well. India faces rainfall-induced landslides every year with a large threat to human life and an annual loss of U.S. $400 million. A landslide is a short lived and suddenly occurring phenomenon, and its causative factors can be accumulated rainfall, moisture and pore pressure saturation in the soil, or a steep slope angle, among others. This research focuses on sensor networks for detecting landslides, paying particular attention to data reduction and energy minimization.

2. RELATED WORK

One of the existing system have sensors using solar power for their energy needs. Solar power tends to rapidly diminish during the rainfall season. Hence minimizing the energy becomes an overwhelming priority for sustained operation of the network, particularly during the imminence of landslides.

In another existing paper, has two parts related to identification of area of instability and geotechnical determination of unstable soil/rock mass for the following stability and remedial action analyses. Detail landslides mapping is expected by Autonomous Mapping Airship (AMA), which has been developed within research project. AMA is suitable for mapping of medium-wideareas. Its properties are discussed and compared with other means of aerial mapping in the paper. AMA operates up to 3 hours at a time and can carry INS/GPS unit, modified laser scanner, DSLR camera, thermometric camera or other sensors. Set of detailed digital surface models from different time epochs can be processed as difference models. This system has time constraint and it cannot cover very wide areas.

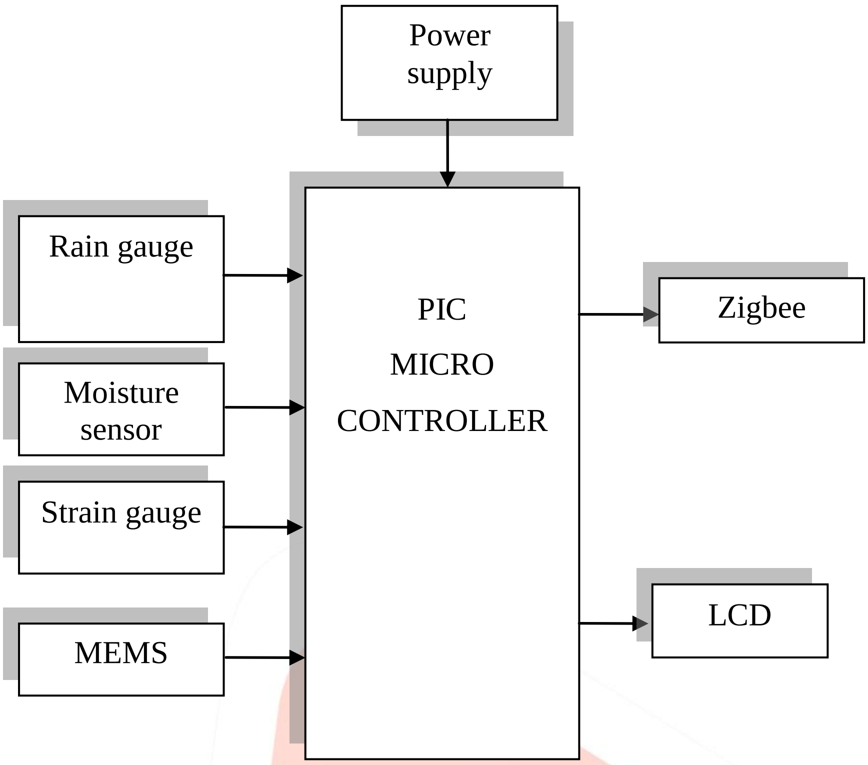
3.PROPOSED SYSTEM

Overview of the approach

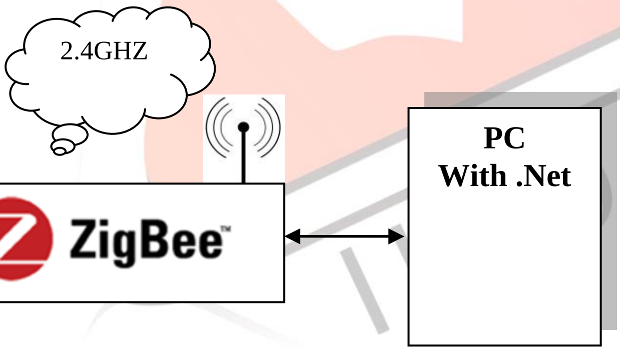
This paper presents a system that can be used to monitor the landslide in hill areas. The microcontroller is connected with four types of sensors called as rain gauge sensor, moisture sensor, strain gauge sensor and mems sensor. The rain gauge sensor is used to measure the rain fall. The moisture sensor is used to measure the moisture of the land. The strain gauge sensor is used to measure the strain in the land. The mems sensor is used to monitor the tilt of the land. All the sensor values are displayed in the LCD. Also the data’s are send to the control section through wirelessly using Zigbee. In receiving control section the data’s are gathered and stored as database using dot net software.

Block Diagram:

Land slide area Section:



Control Section:



1.Moisture sensor: This sensor is used to measure the moisture level and the information is transmitted continuously to the control section and then corresponding values will be displayed

2.Rain Gauge sensor

This sensor is used to measure the Rain fall level and the information is transmitted continuously to the control section .

3.Strain Gauge sensor

This sensor is used to measure the amount of strain applied and the information is send to the control section

4.MEMS sensor

This sensor is used to identify the changes in shapes and angles of the landscapes and the information is transmitter and displayed on the LCD.

5.LCD

A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals (LCs). LCDs do not emit light directly. The main use of this is to view the current status of the Process such as Moisture level, Rain and Strain Gauge level etc.

6. Software Unit

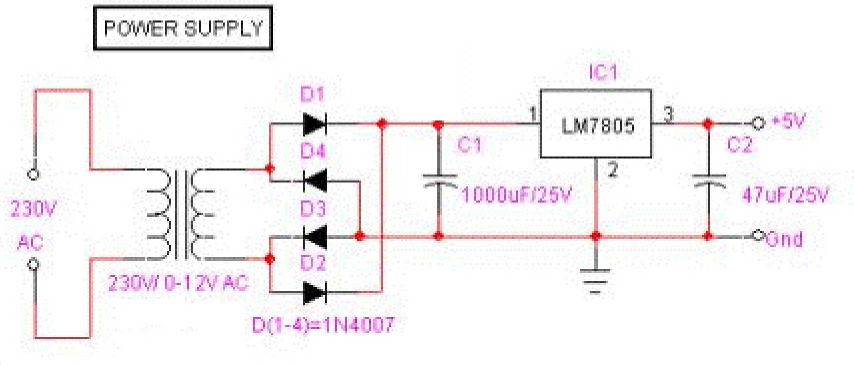
Software is used to compile the coding of the desired application for the corresponding embedded system.

7. MPLAB COMPILER:

The MPLAB X IDE is the new graphical, integrated debugging tool set for all of Microchip's more than 800 8-bit, 16-bit and 32-bit MCUs and digital signal controllers, and memory devices. It includes a feature-rich editor, source-level debugger, project manager, software simulator, and supports Microchip's popular hardware tools, such as the MPLAB ICD 3 in-circuit debugger, PICkit 3, and MPLAB PM3 programmer. Based on the open-source NetBeans platform, MPLAB X runs on Windows OS, MAC OS and Linux, supports many third-party tools, and is compatible with many NetBeans plug-ins.

8.Power Supply for PIC Microcontroller

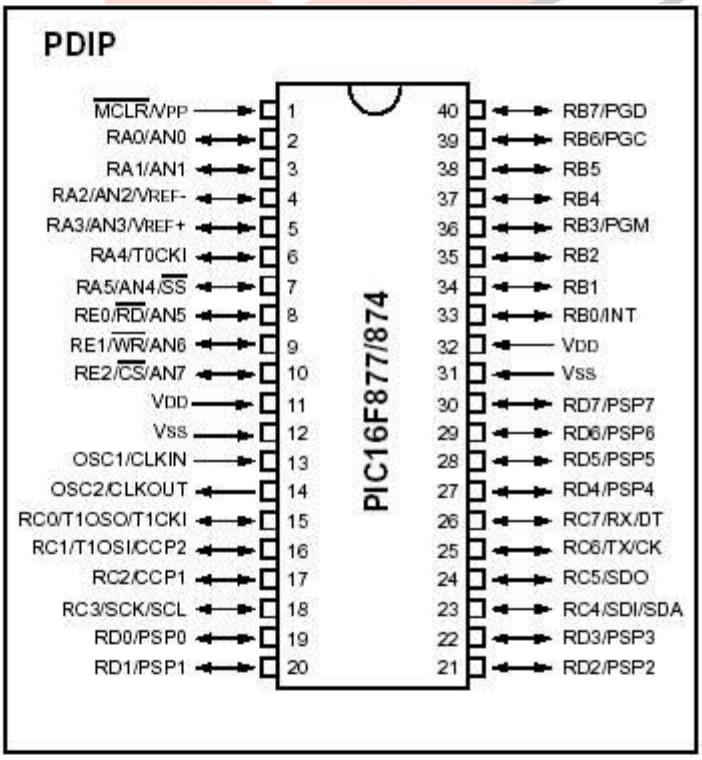
This section describes how to generate +5V DC power supply



The power supply section is the important one. It should deliver constant output regulated power supply for successful working of the project. A 0-12V/1 mA transformer is used for this purpose. The primary of this transformer is connected in to main supply through on/off switch& fuse for protecting from overload and short circuit protection. The secondary is connected to the diodes to convert 12V AC to 12V DC voltage. And filtered by the capacitors, which is further regulated to +5v, by using IC 7805

9.INTRODUCTION OF PIC16F877A:

The PIC16F877A CMOS FLASH-based 8-bit microcontroller is upward compatible with the PIC16C5x, PIC12Cxxx and PIC16C7x devices. It features 200 ns instruction execution, 256 bytes of EEPROM data memory, self programming, an ICD, 2 Comparators, 8 channels of 10-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, a synchronous serial port that can be configured as either 3-wire SPI or 2-wire I2C bus, a USART, and a Parallel Slave



(BOR). High-Performance RISC CPU:

Only 35 single-word instructions to learn, All single-cycle instructions except for program branches, which are two-cycle, Operating speed: DC – 20 MHz clock input DC – 200 ns instruction cycle, Up to 8K x 14 words of Flash Program Memory, Up to

368 x 8 bytes of Data Memory (RAM), Up to 256 x 8 bytes of EEPROM Data Memory, Pinout compatible to other 28-pin or 40/44-pin PIC16CXXX and PIC16FXXX microcontrollers

Peripheral Details:

Timer0: 8-bit timer/counter with 8-bit prescaler, Timer1: 16-bit timer/counter with prescaler, can be incremented during Sleep via external crystal/clock, Timer2: 8-bit timer/counter with 8-bit period register, prescaler and postscaler, Two Capture, Compare, PWM modules, Capture is 16-bit max, resolution is 12.5 ns Compare is 16-bit max, resolution is 200 ns, PWM max, resolution is 10-bit Synchronous Serial Port (SSP) with SPI (Master mode) and I2C (Master/Slave), Universal Synchronous Asynchronous Receiver Transmitter (USART/SCI) with 9-bit address detection, Parallel Slave Port (PSP) – 8 bits wide with external RD, WR and CS controls (40/44-pin only), Brown-out detection circuitry for Brown-out Reset

Special Microcontroller Applications:

100,000 erase/write cycle Enhanced Flash program memory typical, 1,000,000 erase/write cycle Data EEPROM memory typical, Data EEPROM Retention > 40 years, Self-reprogrammable under software control, In-Circuit Serial Programming via two pins, Single-supply 5V In-Circuit Serial Programming Watchdog Timer (WDT) with its own on-chip RC oscillator for reliable operation Programmable code protection, Power saving Sleep mode, Selectable oscillator options, In-Circuit Debug (ICD) via two pins.

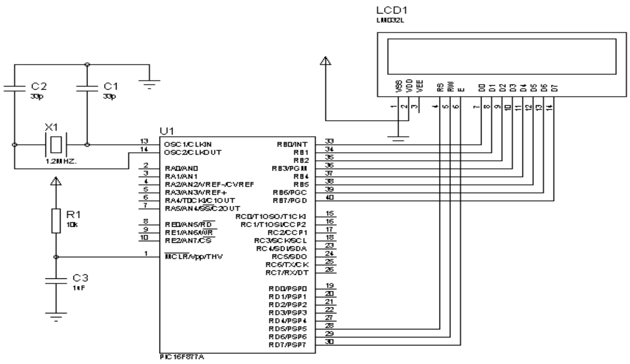
Zigbee

ZigBee is a wireless technology developed as an open global standard to address the unique needs of low-cost, low-power, wireless sensor networks. The standard takes full advantage of the IEEE 802.15.4 physical radio specification and operates in unlicensed bands worldwide at the following frequencies: 2.400–2.484 GHz, 902-928 MHz and 868.0–868.6 MHz

1. The power levels (down from 5v to 3.3v) to power the zigbee module.
2. The communication lines (TX, RX, DIN and DOUT) to the appropriate voltages.

The Zigbee module acts as both transmitter and receiver. The Rx and Tx pins of ZIGBEE are connected to Tx and Rx of 8051 microcontroller respectively. The data's from microcontroller is serially transmitted to Zigbee module via UART port. Then Zigbee transmits the data to another Zigbee. The data's from Zigbee transmitted from Dout pin. The Zigbee from other side receives the data via Din pin.

LCD



The LCD standard requires 3 control lines and 8 I/O lines for the data bus.The 8 data lines are connected to PORT 1 of 8051 microcontroller. The three control lines(RS,RW and EN) are connected to PORT 3.5,3.6 and 3.7 respectively.

Advantages:

- The Severity of the landslide can be reduced . .
- The people can be saved with automatic intimation system.

The system can be expanded in future by adding the speaker and buzzer alert system to intimate the chances of landslide.

4.FUTURE ENHANCEMENT

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5.CONCLUSION

We have designed, developed, and deployed a multi-sensor network for monitoring landslides in the equatorial forests of southern India. With data reduction and energy minimization always in the back of our minds, we have evolved the network starting from a set of homogeneous sensors, then into a network of dual sensors, followed by a trisensor network and ultimately a full-fledged quad sensor network. We have kept the network operational for more than two years amidst inclement weather, gathered extensive data from the field, experimented several policies for monitoring the climate parameters, and analyzed their energy requirements. We have then proposed energy minimization mechanisms and their implementation via cooperative and coordinated action by each of the sensors.

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