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Security of Buliding Devastation Using Wireless Sensor Network

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Abstract:
Landslide is a land sensation that incorporates an extensive variety of ground developments, for example, rock falls, profound disappointment of inclines and shallow garbage streams. Analysis of the stability of the building is a needed measurement process for all buildings in the cities. Periodic monitoring of the structure for such damage is therefore a key step in rationally planning the maintenance needed to guarantee an adequate level of safety and serviceability. However, in order for the installation of a permanently installed sensing system in buildings to be economically viable, the sensor modules must be wireless to reduce installation costs, must operate with a low power consumption to reduce servicing costs of replacing batteries, and use low cost sensors that can be mass produced such as MEMS sensors.

I. INTRODUCTION
This project deal with the stability of the building is needed measurement process for all building in the cities. Periodic monitoring of the structure for such damage is therefore a key step in rationally planning the maintenance needed to guarantee an adequate level of safety and serviceability. In order to installed sensing system in building permanently using wireless system should be low cost and must be operate with a low power consumption to reduce the cost of replacing batteries and used low cost sensor that can be mass produced such as MEMS sensors. To perform any application in the embedded system we require microprocessor and microcontroller.

In the microprocessor an external memory is connected which increases the size of the microprocessor and multiple operations are being performed by the microprocessor but whereas in the microprocessor the memory is inbuilt and also we can use this controller only for the specific applications where the speed is increased so most probably microcontrollers are used in the different applications in the embedded systems rather than microprocessor.

II. PROPOSED SYSTEM
In this project we have MEMS accelerometer to sense the shaking of the building which in sends to the microcontroller which in turn sends to the monitoring section through Zigbee wireless technology. Here we have three sections, the two floor sections has ARM 7 microcontroller, Zigbee device and MEMS accelerometer. The monitoring section has PC and a Zigbee wireless device, which will collect the data from the floor sections and analyze the stability of the building.

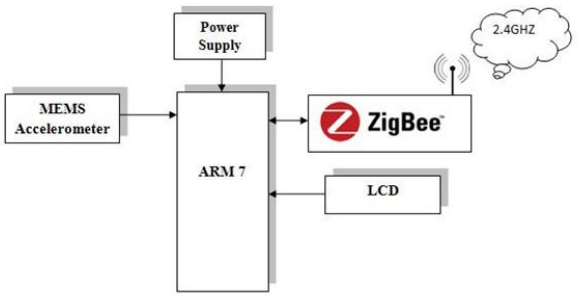

Fig. Floor-1 Block diagram

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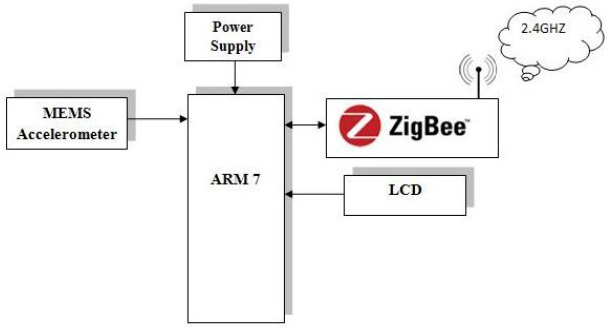

Fig. Floor-2 Block diagram

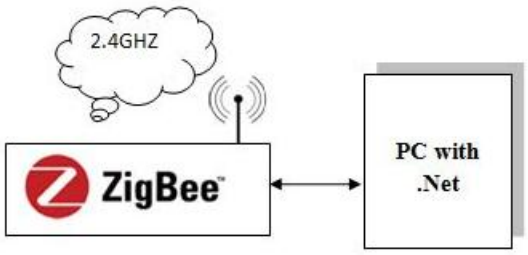

Fig. Monitoring Section

A.ADVANCED RISC MACHINE 7(ARM7)

The LPC2148 is based on a 16/32 bit ARM7TDMI-S"CPU with real-time emulation and embedded trace support, together with 128/256 kilobytes (kb) of embedded high speed flash memory. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at maximum clock rate. For critical code size applications, the alternative 16-bit Thumb. Mode reduces code by more than 30 % with minimal performance penalty. With their compact 64 pin package, low power consumption, various 32-bit timers, 4-channel 10-bit ADC, 2 advanced CAN channels, PWM channels and 46 GPIO lines with up to 9 external interrupt pins these microcontrollers are particularly suitable for automotive and industrial control applications as well as medical systems and fault-tolerant maintenance buses. With a wide range of additional serial communications interfaces, they are also suited for communication gateways and protocol converters as well as many other general-purpose applications.

Key Features

- 16/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package.
- 16 kb on-chip Static RAM.
- 128/256 kb on-chip Flash Program Memory. 128-bit wide interface/accelerator enables high speed 60 MHz operation.
- In-System Programming (ISP) and In-Application Programming (IAP) via on-chip boot-loader software. Flash programming takes 1 ms per 512 byte line. Single sector or full chip erase takes 400 ms.

B.MEMS ACCELEROMETER

An accelerometer is an micro-electromechanical device that measures acceleration forces. These forces may be static, like the constant force of gravity pulling at our feet, or they could be dynamic - caused by moving or vibrating the accelerometer. There are many types of accelerometers developed and reported in the literature. The vast majority is based on piezoelectric crystals, but they are too big and to clumsy. People tried to develop something smaller, that could increase applicability and started searching in the field of microelectronics. They developed MEMS (micro electromechanical systems) accelerometers.

Fig. MEMS Sensor

MEMS accelerometer use nanotechnology in order to enhance the natural abilities common between all accelerators; hence, these devices are extremely fine-tuned and accurate. MEMS stands for Micro Electro Mechanical Systems, and when discussing the technicalities of accelerometers it refers specifically to a mass-displacer that can translate external forces such as gravity into kinetic motion energy.

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This part of the accelerometer usually contains some type of spring force in order to balance the external pressure and displace its mass, thus leading to the motion that produces acceleration.

C.LIQUID CRYSTAL DISPLAY (LCD)

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

D. ZIGBEE

ZigBee is a specification for a suite of high level communication protocols used to create personal area networks built from small, low-power digital radios. ZigBee is based on an IEEE 802.15 standard. Though low-powered, ZigBee devices often transmit data over longer distances by passing data through intermediate devices to reach more distant ones, creating a mesh network; i.e., a network with no centralized control or high-power transmitter/receiver able to reach all of the networked devices. The decentralized nature of such wireless ad hoc networks make them suitable for applications where a central node can't be relied upon. Though WPAN implies a reach of only a few meters, 30 feet in the case of ZigBee, the network will have several layers, so designed as to enable intrapersonal communication within the network, connection to a network of higher level and ultimately an uplink to the Web. The ZigBee Standard has evolved standardized sets of solutions, called 'layers'. These layers facilitate the features that make ZigBee very attractive: low cost, easy implementation, reliable data transfer, short-range operations, very low power consumption and adequate security features.

CHARACTERISTICS

The focus of network applications under the IEEE 802.15.4 / ZigBee standard include the features of low power consumption, needed for only two major modes (Tx/Rx or Sleep), high density of nodes per network, low costs and simple implementation.

These features are enabled by the following characteristics:

• 2.4GHz and 868/915 MHz dual PHY modes. This represents three license-free bands: 2.4-2.4835 GHz, 868-870 MHz and 902-928 MHz. The number of channels allotted to each frequency band is fixed at sixteen (numbered 11-26), one (numbered 0) and ten (numbered 1-10) respectively. The higher frequency band is applicable worldwide, and the lower band in the areas of North America, Europe, Australia and New Zealand.

• Low power consumption, with battery life ranging from months to years. Considering the number of devices with remotes in use at present, it is easy to see that more numbers of batteries need to be provisioned every so often, entailing regular (as well as timely), recurring expenditure. In the ZigBee standard, longer battery life is achievable by either of two means: continuous network connection and slow but sure battery drain, or intermittent connection and even slower battery drain.

• Maximum data rates allowed for each of these frequency bands are fixed as 250 kbps @2.4 GHz, 40 kbps @ 915 MHz, and 20 kbps @868 MHz.

• High throughput and low latency for low duty-cycle applications (<0.1%)

• Channel access using Carrier Sense Multiple Access with Collision Avoidance (CSMA - CA)

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• Addressing space of up to 64 bit IEEE address devices, 65,535 networks

• 50m typical range

• Fully reliable “hand-shaked” data transfer protocol.

• Different topologies as illustrated below: star, peer-to-peer, mesh

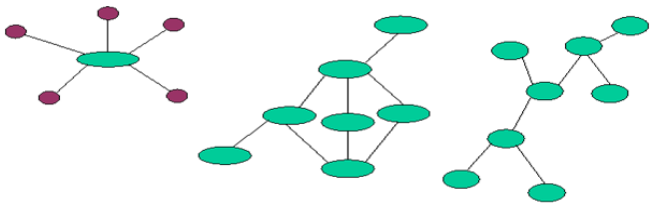

Fig. ZigBee Topologies

Licensing

For non-commercial purposes, the ZigBee specification is available free to the general public. An entry level membership in the ZigBee Alliance, called Adopter, provides access to the as-yet unpublished specifications and permission to create products for market using the specifications. The click through license on the ZigBee specification requires a commercial developer to join the ZigBee Alliance. "No part of this specification may be used in development of a product for sale without becoming a member of ZigBee Alliance."

The annual fee conflicts with the GNU General Public License. From the GPL v2, "b) You must cause any work that you distribute or publish, that in whole or in part contains or is derived from the Program or any part thereof, to be licensed as a whole at no charge to all third parties under the terms of this License." Since the GPL makes no distinction between commercial and non-commercial use it is impossible to implement a GPL licensed ZigBee stack or combine a ZigBee implementation with GPL licensed code. The requirement for the developer to join the ZigBee Alliance similarly conflicts with most other Free software licenses.

E. KEIL SOFTWARE

Keil compiler is a software used where the machine language code is written and compiled. After compilation, the machine source code is converted into hex code which is to be dumped into the microcontroller for further processing. Keil compiler also supports C language code. The µVision3 IDE is a Windows-based software development platform that combines a robust editor, project manager, and makes facility. µVision3 integrates all tools including the C compiler, macro assembler, linker/locator, and HEX file generator.

III. WORKING PRINCIPLE AND RESULTS

In this project, we are using LPC 2148 Board as our platform. It has an ARM-7 based SOC with integrated peripherals. In this project we have MEMS accelerometer to sense the shaking of the building which in sends to the microcontroller which in turn sends to the monitoring section through Zigbee wireless technology. Here we have two sections; the floor section has ARM microcontroller, Zigbee device and MEMS accelerometer. The monitoring section has PC and a Zigbee wireless device, which will collect the data from the floor section and analyze the stability of the building.

Fig. Output representation of MEMS Acceloremeter

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IV. ADVANTAGES

- Prevention of devastation
- Can be implemented in multi storey building in the city area
- The major advantage of this system is the use of wireless communication to transfer the data
- Usage of cable is removed
- Easy to implement and low cost technique

V. CONCLUSION

The presented wireless system for building monitoring takes advantage of the unique features of custom-developed MEMS sensors and read-out ASIC combined with an optimized network and module architecture, to realize a solution which offers long battery lifetime and potentially low cost in manufacturing, installation and maintenance, while providing high-quality sensor data at the right time.

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