A Zigbee Based Smart Sensing Platform For Monitoring Environmental Condition In Indoor Stations.

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Abstract: In this paper, reports an effective implementation for control system used for monitoring regular domestic conditions by means of low cost ubiquitous sensing system. The description about the integrated network architecture and the interconnecting mechanisms for the reliable measurement of parameters by smart sensors and transmission of data via zigbee is being presented. The framework of the monitoring system is based on a combination of pervasive distributed sensing units, information system for data aggregation, and reasoning and context awareness. Device control is a process that is done in the day to day life of mankind. Usually there are a number of devices associated with home and an efficient control of these systems is a tedious task. The rapidly advancing mobile communication technology and the decrease in costs make it possible to incorporate mobile technology into home automation systems. In this project we can monitor the home environment and control the indoor stations loads using wireless communication i.e.Zigbee. Here temperature, LDR and smoke sensor will measure the temperature, light in surroundings and it will send to PC. There are two loads, these are controlled from PC through Zigbee network. All these techniques are successfully merged in a single wireless industrial automation system. This system offers a complete, low cost, powerful and user friendly way of real-time monitoring and remote control of indoor stations.

Keywords: *Indoor station automation, Atmel microcontroller, Zigbee communication, Internet, wireless.*

I. INTRODUCTION

MORE than a decade ago, the Internet of Things (IoT) paradigm was coined in which computers were able to access data about environment without human interaction. It was aimed to complement human-entered data that was seen as a limiting factor to acquisition accuracy, pervasiveness, and cost. Two technologies were traditionally considered key enablers for the IoT paradigm: the radio-frequency identification (RFID) and the wireless sensor networks (WSN).

Indoor_Automation is all about making home, industries Smart. Just the same as with the people, for a home, industries to be smart it needs information. this information can come in the form of programs and commands, but often _it will be collected directly by base station using sensors and automated functions. Sensors are therefore the foundation stone of any industrial automation system. Because of this, the range and quality of the sensors choose to install will determine the industrial automation system capable of doing and how efficiently it operates.

In this paper, it will guide sensors that are used in indoor station automation systems, describing the technology and its most popular applications. As the integrated circuits and microcontrollers become more and more accessible and the Internet communication is a fact of today with the improved availability of Zigbee networks, these advancements naturally should find use in indoor automation systems. These systems provide the consumers increased security and safety, economic benefits and convenience by giving them control over all the appliances in industries. Designing a indoor automation system for monitoring and controlling various devices in remote locations can be done through a variety of communication options such as wireless LAN technologies, dial-up modems, private Radio networks, satellite communication, Internet, cellular network and so on. Several studies on home automation have been done using different types of control methods. However, they are not too feasible to be implemented as a low cost solution. Recently introduced a low Zigbee-Based indoor Automation System. The real time monitoring has been an important feature that can be used in the indoor automation systems. As a change in the status of the devices occurs, the user can be informed in real time. Thus, our main objective for using Zigbee network for the communication between the indoor station and the user is its wide spread coverage which makes the whole system online for almost all the time. Another advantage of using the Zigbee network in indoor station automation is its high security infrastructure which provides maximum reliability so that the information sent or received cannot be monitored by an eavesdropper. Although using Zigbee network has all these important advantages over other communication methods, it would be a tedious, time and money consuming task for the user to use his computer or laptop to communicate. So we suggested and implemented another method which uses the voice of the user to control the system.

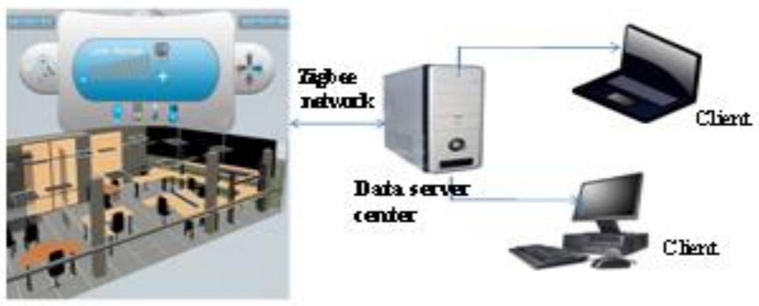
II.RELATED WORKS

WSN is a modern information technology with the integration of sensor technology, automatic control technology, data transmission network, storage, processing and analysis technology Compared with traditional monitoring techniques, WSN is featured by its low-cost, low power consumption, simple to deploy, without onsite maintenance, etc., and it can achieve a variety of regional low-cost unmanned continuous monitoring . WSN is a modern information technology with the integration of sensor technology, automatic control technology, data transmission network, storage, processing and analysis technology. Advances in WSN technology as well as the development of tiny sensor devices enable us to monitor environmental information. WSN have become significant tools for analyzing natural phenomena. Over the past 10 years, a great deal of research effort has been devoted to the development of environment monitoring based on tiny WSN systems. Therefore, based on technologies of micro-sensors, Zigbee communication to meet the need of industrial monitoring as well as home security. WSN environmental monitoring includes both indoor and outdoor applications. The later can fall in the city deployment category (e.g., for traffic, lighting, or pollution monitoring) or the open nature category (e.g., chemical hazard, earthquake and flooding detection, volcano and habitat monitoring, weather forecasting, precision agriculture). The reliability of any outdoor deployment can be challenged by extreme climatic conditions, but for the open nature the maintenance can be also very difficult and costly. To be cost-effective, the sensor nodes often operate on very restricted energy reserves. Premature energy depletion can severely limit the network service and needs to be addressed considering the IoT application requirements cost, deployment, maintenance, and service availability.

The understanding of such environments can considerably benefit from continuous long-term monitoring, but their conditions emphasize the issues of node energy management, mechanical and communication hardening, size, weight, and deployment procedures. This paper contributions of interest for researchers in the WSN field can be summarized as: 1) detailed specifications for a demanding WSN application for environmental monitoring that can be used to analyze the optimality of novel WSN solutions, 2) specifications, design considerations and experimental results for platform components that suit the typical Internet of things application requirements of low cost, high reliability, and long service time, specifications and design considerations for platform reusability for a wide range of distributed event-based environmental monitoring applications.

III.SYSTEM OVERVIEW

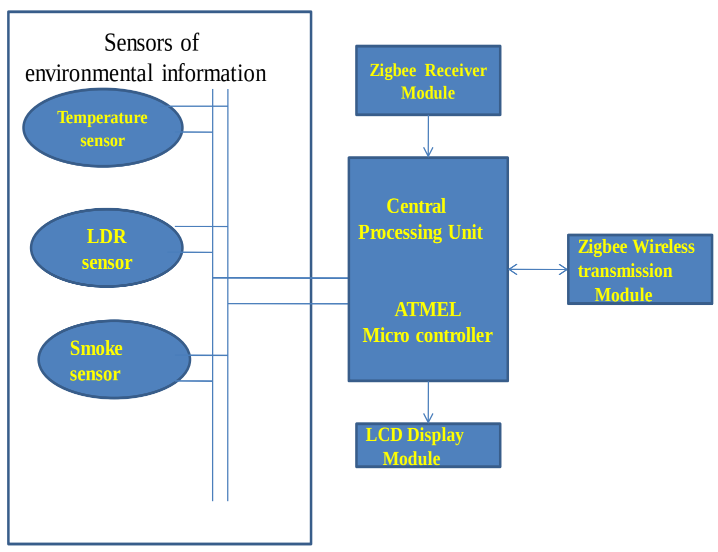
The main purpose of the WSN platform is to provide the users of the Internet of things application (human operators or computer systems) an updated view of the events of interest in the field. The overall system shown in fig. It is comprised of a self organizing WSN endowed with sensing capabilities, a Zigbee Which gathers data and provides information toward remote server and web application which manages information and makes the final user capable of monitoring and interacting with the instrumented environment.



System structure of environmental monitoring system.

IV.HARDWARE INFRASTRUCTURE

Environmental monitoring equipment based on WSN are mobile devices used by humans. The equipment is composed of the environment sensors array, Zigbee receiver module, central processing unit, LCD display module and Zigbee wireless transmission module, as shown in Figure 2.



Hardware infrastructure diagram of Monitoring system

A. Microcontroller

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel’s high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a Highly-flexible and cost-effective solution too many embedded control applications.

The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

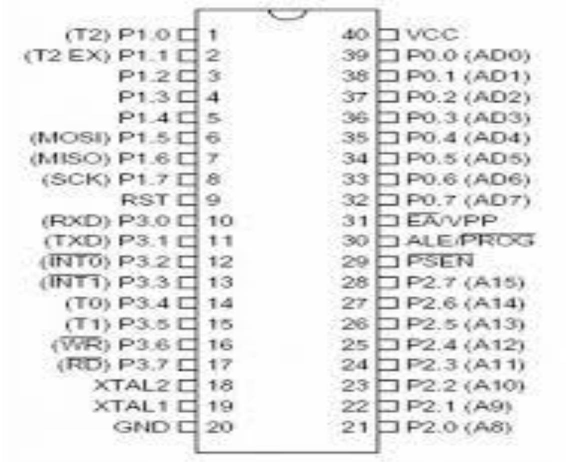
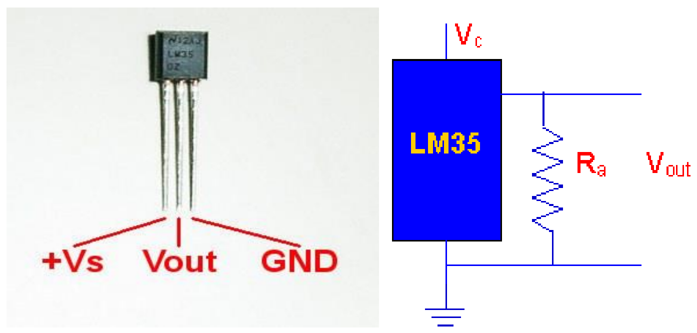


Figure3: AT89S52 pin diagram.

B. Temperature sensor:

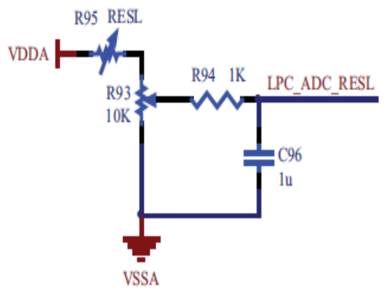


The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in § Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of g(/4§C at room temperature and g*/4§C over a full b55 to a150§C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and Minus supplies. As it draws only 60 mA from its supply, it has very low self-heating, less than 0.1§C in still air. The LM35 is rated to operate over a b55§ to a150§C temperature Range, while the LM35C is rated for a b40§ to a110§C range (b10§ with improved accuracy). The LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D is also available in an 8-lead surface mount small outline package and a plastic TO-202 package.

Features are

- Calibrated directly in § Celsius (Centigrade)
- Linear a 10.0 mV/§C scale factor
  0.5§C accuracy guarantee able (at a25§C)
- Rated for full b55§ to a150§C range
- Suitable for remote applications
- Low cost due to wafer-level trimming Operates from 4 to 30 volts Less than 60 mA current drain
- Low self-heating, 0.08§C in still air

C. LDR sensor:



A **light-dependent resistor**, alternatively called LDR, photoresistor, **photoconductor**, or *photocell*, is a variable resistor whose value decreases with increasing incident light intensity. LDRs or Light Dependent Resistors are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1000 000 ohms, but when they are illuminated with light resistance drops dramatically. When the light level is low the resistance of the LDR is high. This prevents current from flowing to the base of the transistors.LCD doesn't. However, when light shines onto the LDR its resistance falls and current flows into the base of the first transistor and then the second transistor. The preset resistor can be turned up or down to increase or decrease resistance, in this way it can make the circuit more or less sensitive.

D. Smoke sensor:

The Smoke sensor is used to detect fire flames. The module makes use of Fire sensor and comparator to detect fire up to a range of 2 meters. Smoke alarm is a device that detects smoke, typically as an indicator of fire. Commercial, industrial, and mass residential devices issue a signal to a fire alarm system, while household detectors, known as **smoke alarms**, generally issue a local audible or visual alarm from the detector itself.

Smoke detectors are typically housed in a disk-shaped plastic enclosure about 150 millimeters (6 in) in diameter and 25 millimeters (1 in) thick, but the shape can vary by manufacturer or product line. Most smoke detectors work either by optical detection (photoelectric) or by physical process (ionization), while others use both detection methods to increase sensitivity to smoke. Sensitive alarms can be used to detect, and thus deter, smoking in areas where it is banned such as toilets and schools. Smoke detectors in large commercial, industrial, and residential buildings are usually powered by a central fire alarm system, which is powered by the building power with a battery backup. However, in many single family detached and smaller multiple family housings, a smoke alarm is often powered only by a single disposable battery.

Features are, it allows your robot to detect flames from up to 1 M away

- Typical Maximum Range: 2m.
- Calibration preset for range adjustment.
- Indicator LED with 3 pin easy interface connector.
- Input Voltage +5VDC.

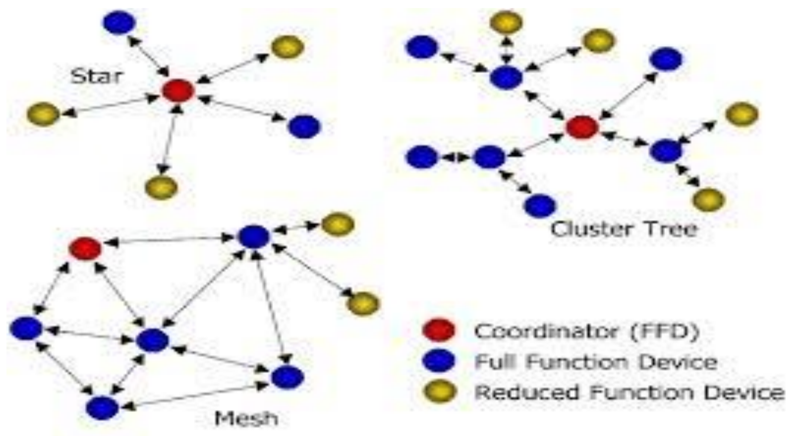
E. LCD display: LCD display is an inevitable part in almost all embedded projects and this article is about interfacing 16×2 LCD with 8051 microcontroller. Many guys find it hard to interface LCD module with the 8051 but the fact is that if you learn it properly, its a very easy job and by knowing it you can easily design embedded projects.

F: 2-CHANNEL RELAY:

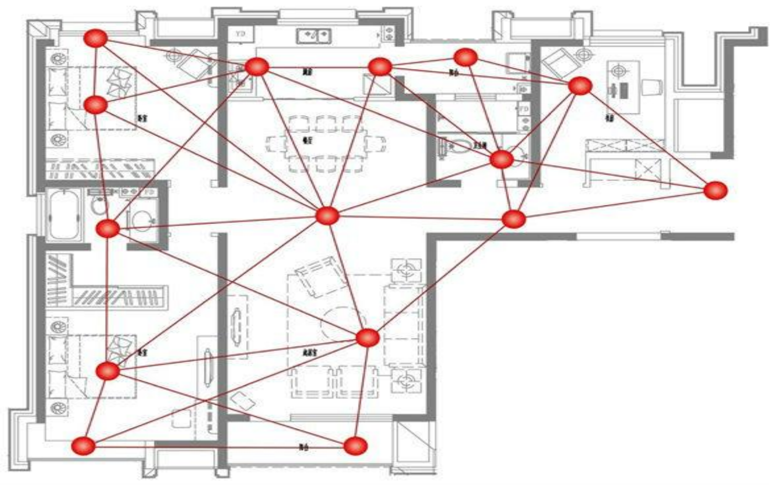
Relay module allows a wide range of microcontroller such as Arduino, AVR, PIC, and ARM with digital outputs to control larger loads and devices like AC or DC Motors, electromagnets, solenoids, and incandescent light bulbs. This module is designed to be integrated with 2 relays that it is capable of control 2 relays. The relay shield use one QIANJI JQC-3F high-quality relay with rated load 240VAC, 10A/125VAC,10A/28VDC.The relay output state is individually indicated by a light-emitting diode.

Communication methods:

A. Zigbee transceiver:



Signal transfer for zigBEE



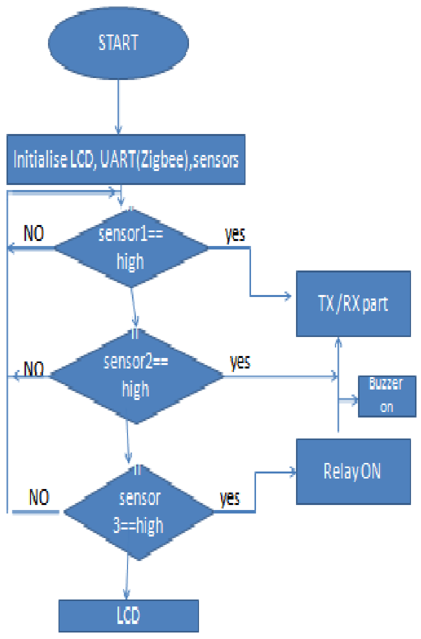
ZigBee is the only standards-based wireless technology designed to address the unique needs of low-cost, low-power wireless sensor and control networks in just about any market. Since ZigBee can be used almost anywhere, is easy to implement and needs little power to operate, the opportunity for growth into new markets, as well as innovation in existing markets, is limitless. Here are some facts about ZigBee:

- With hundreds of members around the globe, ZigBee uses the 2.4 GHz radio frequency to deliver a variety of reliable and easy-to-use standards anywhere in the world.
- Consumer, business, government and industrial users rely on a variety of smart and easy-to-use ZigBee standards to gain greater control of everyday activities.
- With reliable wireless performance and battery operation, ZigBee gives you the freedom and flexibility to do more.
- ZigBee offers a variety of innovative standards smartly designed to help you be green and save money.

B. Internet:

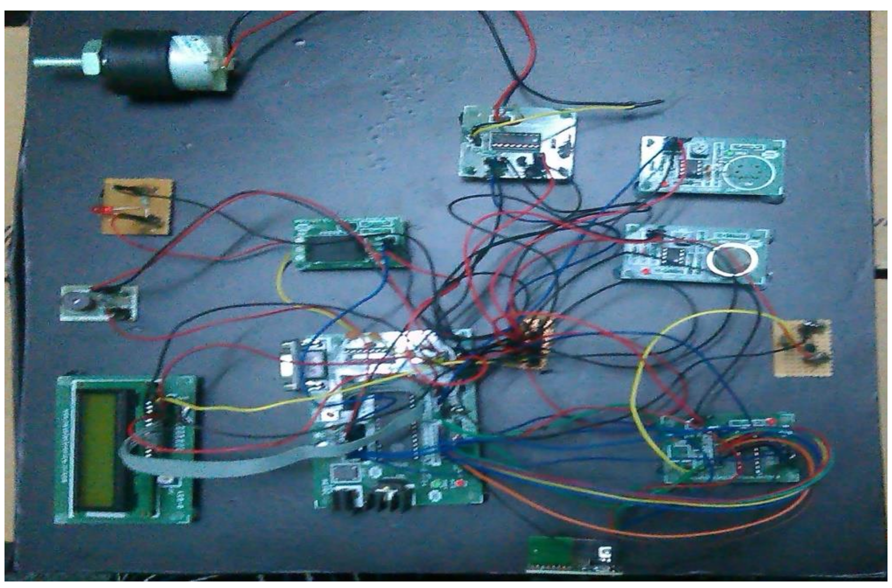
In order to achieve interaction with the indoor automation network from outside, the option is to use internet. to accomplish this, a web server is built to take request from the remote clients. The clients can send request to the home or industrial appliances. it sends their status to be displayed for the remote client through the server. A web page is constructed as an interactive interface where commands can be submitted by the client to change and also monitor the status of the devices.

IV. FIRMWARE FLOW



V.IMPLEMENTATION

Remote real-time monitoring equipment for environmental monitoring for indoor stations is successfully developed, which can realize Automatic storage of data, real-time display and wireless transmit the data of temperature, light intensity to the base station through data server. With size of 6 cm × 12 cm × 18 cm, the weight of monitoring equipment is 750g. It can be easily arranged in a variety of experimental environments for its simple and portable. The implementation of circuit board is as shown in Figure.



The online monitoring developed using Embedded C programming language, which running on the keil vision software . For the database, the Embedded C language is used because of its speed and reliability. Create, optimize, and deploy stunning cross-browser web maps with the OpenLayers. Flash magic software is used to burn the code to the microcontroller, which converts code into Hexadecimal code. OpenLayers is a powerful, community driven, open source, pure Embedded C web-mapping library. With it, we can easily create our own web map mash up using WMS, Google Maps, Based on the development of the embedded GIS prototype instrument, take Xuzhou city in Jiangsu province, china as an application example, the data collecting and Sending terminal whose device ID is 353236012283399 is in wireless transmission at 14:20, May 18, 2012. The device ID (353236012283399) is the unique device identification code (IMEI) obtained from the SIM900A Zigbee module, and the current time corresponds to the time reading from the LCD.

Advantages:

- ZigBee wireless sensor network for monitoring the environmental condition by deploying sensors in the *homes, industries*.
- *water level* for lakes, streams, sewages;
- *gas concentration in air* for cities, laboratories, deposits;
- *soil humidity* and other characteristics;
- *inclination* for static structures (e.g., bridges, dams);
- *lighting conditions* either as part of a combined sensing or standalone, e.g., to detect intrusions in dark places;

Applications:

- Presents most relevant applications in agriculture and food industry.
- These technologies are very suitable for distributed data collecting and monitoring in tough environments such as greenhouses, cropland, warehouses or refrigerated trucks. However, some areas have been developed faster than others. For example, there are several applications for monitoring greenhouses or livestock and just a few in farm machinery.
- Farm Machinery.
- Climate Monitoring.

VI.CONCLUSTION

This paper addresses all phases of the practical development from scratch of a full custom WSN platform for environmental monitoring indoor applications. It starts by analyzing the application requirements and defining a set of specifications for the platform. A real-life, demanding application is selected as reference to guide most of node and platform solution exploration and the implementation decisions. The platform components are implemented and support the operation of a broad range of indoor field deployments with several types of nodes built using the generic node platforms presented. This demonstrates the flexibility of the platform and of the solutions proposed. The flow presented in this paper can be used to guide the specification, optimization and development of WSN platforms for other Internet of things application domains.

Wireless fidelity is a practical solution from both technical and cost perspectives, and its use is expected to expand rapidly. Wireless technology is an important enabler in condition monitoring systems, overcoming barriers to implementation such as cost, practicality and mobility. Zigbee will continue to be on the forefront of wireless monitoring technologies that are innovative and reliable and that benefit customers in new and traditional applications. Wireless capabilities expanded for huge areas Temperature and bearing condition data in industries and homes with ease, safety and accuracy. This newest model is certified to Zigbee wireless transmission Zone, allowing it to be used in most areas in industries where maintaining the environmental condition is important . The device, which can be powered by batteries, is compatible with standard hazardous-area certified sensors. In addition, the Multilog WMx supports WEP, WPA or WPA2 encryption for increased security. Troubleshooting and remote monitoring, the Zigbee can be a cost-effective choice, by speeding time to implementation and reducing the need for expensive cabling. By turning to the wireless technology that enables laptop users to surf the Internet, Zigbee has created a powerful new tool for use in condition monitoring systems. With Wi-Fi-enabled monitoring systems, Zigbee has helped remove the barriers to the wider use of condition monitoring by creating a system that is practical, cost-effective and highly mobile.

References:

[1] B. Yahya and J. Ben-Othman, "Towards a classification of Energy aware MAC protocols for wireless sensor networks," *Wireless Commun. Mobile Comput.*, vol. 9, no. 12, pp. 1572–1607, 2009.

[2] N. Burri, P. von Rickenbach, and R. Wattenhofer, "Dozer:Ultra-low power data gathering in sensor networks," in *Inf.Process. Sensor Netw.*, Apr. 2007, pp. 450–459.

[3] K. Romer and F. Mattern, "The design space of wireless sensor networks," *IEEE Wireless Commun.*, vol. 11, no. 6, pp. 54–61, Dec. 2004.

[4] I. Talzi, A. Hasler, S. Gruber, and C. Tschudin,Permasense: Investigating permafrost with a WSN in the Swiss Alps," in *Proc. 4th WorkshopEmbedded Netw. Sensors*, New York, 2007, pp. 8–12.

[5] G. Barrenetxea, F. Ingelrest, G. Schaefer, and M. Vetterli, "The hitchhiker's guide to successful wireless sensor network deployments," in *Proc. 6th ACM Conf. Embedded Netw. Sensor Syst.*, New York, 2008, pp. 43–56.

[6] R. Szewczyk, J. Polastre, A.Mainwaring, and D. Culler, "Lessons from a sensor network expedition," *Wireless Sensor Netw.*, pp. 307–322,2004.

[7] G. Tolle, J. Polastre, R. Szewczyk, D. Culler, N. Turner, K. Tu, S. Burgess, T.Dawson, P. Buonadonna, D. Gay, and W.Hong, "A macroscope in the redwoods," in *Proc. 3rd Int.Conf. Embedded Netw. Sensor Syst.*, New York, 2005, pp. 51–63.

[8] L. Bencini, F. Chiti, G. Collodi, D. Di Palma, R. Fantacci, A. Manes,and G.Manes, "Agricultural monitoring based on wireless sensor network technology: Real long life deployments for physiology and pathogens control," in *Sensor Technol. Appl.*, Jun. 2009, pp. 372–377.

[9] S. Verma, N. Chug, and D. Gadre, "Wireless sensor network for crop field monitoring," in *Recent Trends Inf., Telecommun.Comput.*, Mar.2010, pp. 207–211.

[10] Y. Liu, Y. He, M. Li, J. Wang, K. Liu, L. Mo, W. Dong, Z.Yang, M. Xi, J.Zhao, and X.-Y. Li, "Does wireless sensor network scale? A measurement study on GreenOrbs," in *Proc. IEEE INFOCOM*, Apr. 2011, pp. 873–881.

[11] M. Kuorilehto, M. Kohvakka, J. Suhonen, P. Hmlinen, M. Hnnikinen, and T.D. Hmlinen, *Ultra-Low Energy wireless Sensor Networks in Practice*. New York: Wiley, 2007

[12] M. M. Louwerse, A. C. Graesser, D. S. McNamara, and S. Lu, "Embodied conversational agents as conversational partners," Applied Cognitive Psychology, vol. 23, no. 9, pp. 1244–1255, 2009.