International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue-17
December 2017

Energy Efficient Environmental Monitoring System

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Abstract:

This paper presents the development of energy efficient environmental monitoring system that monitors the greenhouse gases such as CO, CO2, SOx, NOx, O2 in the environment, and environmental conditions or the ambient conditions in indoor spaces at remote locations. In order to achieve the target design goals, the communication module, the wireless smart transducer interface module, and ARM processor have to be used. The communication between the system's components is performed using the existent wireless infrastructure based on the IEEE 802.11 b.g standards. Visual basic is created to show the digital representation of the sensed data on user PC. The Gas sensor Will Sense the Gas and it will display in our LCD Module and System

Keywords: *lpc 2148, Humidity, Temp, Gas, ZIGBEE.*

Introduction

The IMPORTANCE of environmental monitoring is undoubted in our age. This is the field where wireless sensor networks (WSNs) have been first used, their primary purpose consisting in the observation of the physical world and the recording of physical quantities characterizing it. WSNs are large networks of resource-constrained sensors with processing and wireless communication capabilities, which implement different application objectives within a specific sensing field. They can also be used for ambient monitoring, a topic of great interest nowadays as well, indoor air quality representing an important factor affecting the comfort, health, and safety of building occupants. Finally, the use of wireless ambient sensors can lead to more energy-efficient buildings. The constant attempts of social and economic bodies for the development of technologies for improving energy efficiency and reducing pollution and for the more efficient use of national infrastructure along with the needs of decreasing the cost of computation, networking, and sensing had lead to the emergence of a new generation of digital systems, called environmental monitoring systems, less than a decade ago. These include embedded systems, sensor networks, actuators, coordination and management processes, and services to capture physical data and to act on the physical environment, all integrated under an intelligent decision system .

This paper presents a system for environmental and ambient parameter monitoring using low-power wireless sensors connected to microcontroller, which send their measurements to monitoring PC using the IEEE 802.11 b/g standards. Finally, data from all sensors can be remotely visualized from the PC connected to the microcontroller. This overcomes the problem of system integration and interoperability, providing a well-defined architecture that simplifies the transmission of data from sensors with different measurement capabilities and increases supervisory efficiency. Until recently, Zig bee technology has not been considered for implementing wireless sensing solutions because of its inability to meet the challenges in these types of systems, with the major drawback consisting in the unsatisfactory energy consumption. However, this has changed, since new power-efficient Zig bee devices have been developed and new solutions can benefit from several advantages offered by this technology, namely, the reduction of infrastructure costs, self configuring, long battery life, and high reliability, and the existence of familiar protocols and management tools. Furthermore, high transmission rates, which are required in industrial applications, are achievable and the access to the network in this case is easy and no special wireless adapters are required.

LITERATURE SURVEY:

The literature contains a large number of efforts for developing monitoring solutions that benefit from the advantages provided by wireless sensing technology. Reference [13] presents an automated irrigation system based on a distributed wireless network of soil moisture and temperature sensors that achieves water savings of 90% compared with traditional

Implementations. Sentinella is a smart monitoring solution for the assessment of possible causes of power inefficiency at the photovoltaic panel level based on WSNs [14]. The employment of WSNs in smart grid applications and electrical energy monitoring solutions for large buildings was also investigated [15], [16]. A series of industrial WSNs achieving the acquisition of heterogeneous sensor signals, higher sampling rates, and higher reliability levels has been developed as well [17], [18]. However, most of the proposed solutions are based on the IEEE 802.15.4 standard and ZigBee applications, and they rely on gateways when the data has to be sent to the Internet. Furthermore, in this case, additional applications have to be developed for encapsulating the data in Internet protocols, such as user datagram protocol (UDP) or transmission control protocol (TCP). Another promising technology providing high power efficiency is Bluetooth Low Energy (BLE), which was first introduced in 2010 with the goal of expanding the use of Bluetooth to power-constrained devices such as wireless sensors [19]. However, a lot of research work still has to be performed in this direction, for finally being able to receive relevant information from remote BLE-enabled devices requiring small amounts of data communication and energy. Furthermore, gateways are also required for sending the data to the Internet. Therefore, the use of Wi-Fi sensors, as the ones in the system presented in this paper, which connect directly to the existing IEEE 802.11 b/g infrastructure seems to be a better, more straightforward, and less expensive solution. This is beneficial especially for applications deployed in indoor spaces or urban areas, where there is a high probability that access points are present.

SYSTEM ARCHETECTURE

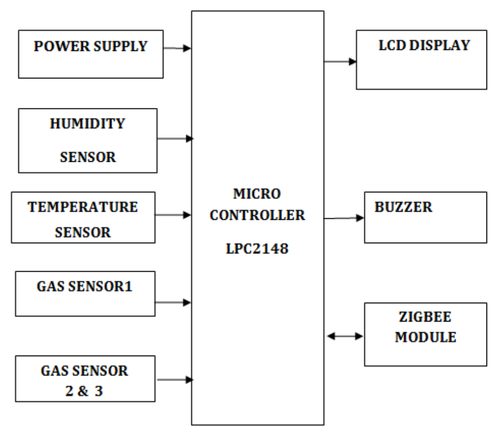
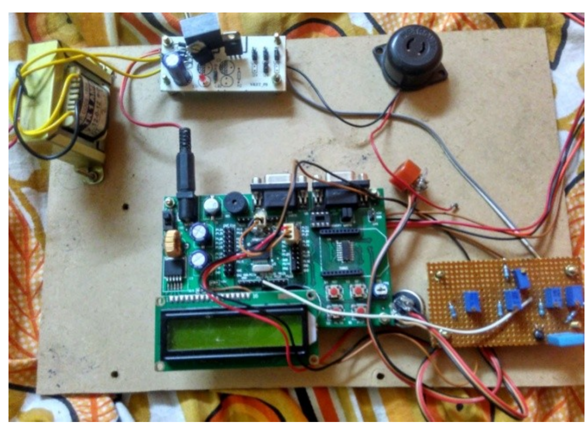


Fig:1: block diagram



METHODOLOGY:

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue-17
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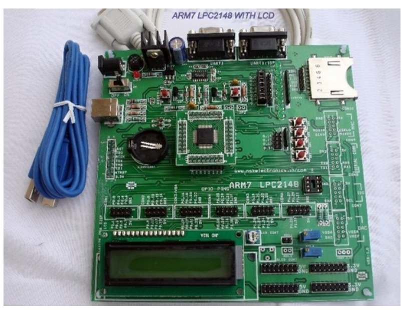
Micro controller: This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

ARM7TDMI: ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs.



Liquid-crystal display (**LCD**) is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock.

Temperature sensor:

A thermistor is a type of resistor whose resistance is dependent on temperature. Thermistors are widely used as inrush current limiter, temperature sensors (NTC type typically), self-resetting over current protectors, and self-regulating heating elements. The TMP103 is a digital output temperature sensor in a four-ball wafer chip-scale package (WCSP). The TMP103 is capable of reading temperatures to a resolution of 1°C.

Fig: 2:Temperature sensor

Humidity sensor:

Humidity sensor is a device that measures the relative humidity of in a given area. A humidity sensor can be used in both indoors and outdoors. Humidity sensors are available in both analog and digital forms. An analog humidity sensor gauges the humidity of the air relatively using a capacitor-based system. The sensor is made out of a film usually made of either glass or ceramics. The insulator material which absorbs the water is made out of a polymer which takes in and releases water based on the relative humidity of the given area. This changes the level of charge in the capacitor of the on board electrical circuit. A digital humidity sensor works via two micro sensors that are calibrated to the relative humidity of the given area. These are then converted into the digital format via an analog to

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digital conversion process which is done by a chip located in the same circuit. A machine made electrode based system made out of polymer is what makes up the capacitance for the sensor. This protects the sensor from user front panel (interface).

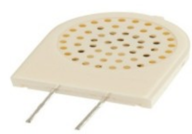

Fig:3: Humidity sensor

GAS sensor:

They are used in gas leakage detecting equipments in family and industry, are suitable for detecting of LPG, i-butane, propane, methane, alcohol, Hydrogen, smoke. The surface resistance of the sensor Rs is obtained through effected voltage signal output of the load resistance RL which series-wound. The relationship between them is described:

Rs\RL = (Vc-VRL) / VRL

Fig: 4:Co2 sensor

ZIGBEE:

Zigbee modules feature a UART interface, which allows any microcontroller or microprocessor to immediately use the services of the Zigbee protocol. All a Zigbee hardware designer has to do in this case is ensure that the host's serial port logic levels are compatible with the XBee's 2.8- to 3.4-V logic levels. The logic level conversion can be performed using either a standard RS-232 IC or logic level translators such as the 74LVTH125 when the host is directly connected to the XBee UART. The X- Bee RF Modules interface to a host device through a logic-level asynchronous Serial port. Through its serial port, the module can communicate with any logic and voltage Compatible UART; or through a level translator to any serial device.

Data is presented to the X-Bee module through its DIN pin, and it must be in the asynchronous serial format, which consists of a start bit, 8 data bits, and a stop bit. Because the input data goes directly into the input of a UART within the X-Bee module, no bit inversions are necessary within the asynchronous serial data stream. All of the required timing and parity checking is automatically taken care of by the X-Bee's UART.

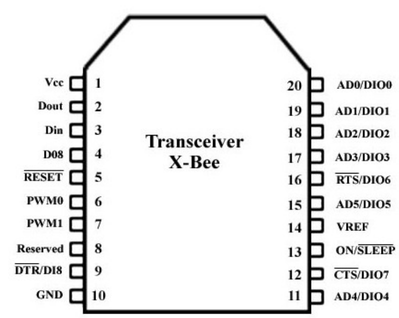

Fig: ZIGBEE pin diagram

RESULT

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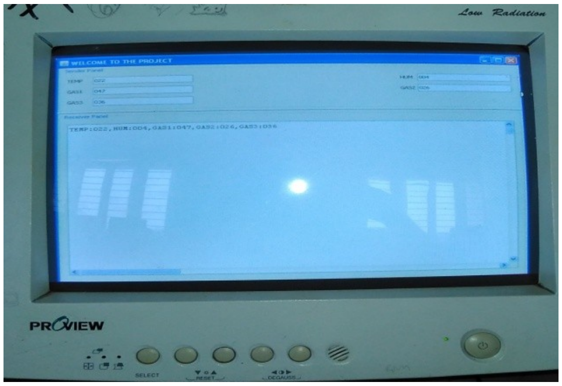

CONCLUSION

The development of energy efficient environmental monitoring system, which monitors environmental parameters based on the existent IEEE 802.11 infrastructure, was presented. It employs sensors measuring the ambient or the environment, which send messages to zigbee receiver. The communication protocol and the design of the nodes help in achieving low power consumption, offering battery lifetimes of several years. The system provides the digital values of gas concentration where we can observe in visual basics software which runs on user PC, and can be used in a wide range of monitoring applications. Future work intends to enhance the reliability and security of the proposed system.

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