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Environment Monitoring System using Sensor Motes and Internet of Things

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***Abstract*- Wireless Sensor Networks consists of sensor devices that are intended for sensing, processing and transmitting physiological signals using wireless medium. The proposed system describes the hardware design and development of a real time monitoring system based on ZigBee, characterized by lower energy consumption, low cost and reduced dimensions. This paper focuses on sensing environmental parameters with the help of sensor motes and the sensed parameters are saved in web server using IoT. The IoT modem consists of GPRS and GPS module that helps in locating the node. The deployed sensors monitors the level of ambient temperature, relative humidity, pressure and angle. The hardware setup is interfaced with personal computer using serial communication port where the parameter values are observed using datalogger and the variation can be monitored with updation of parameters in web server using Internet of Thing.**

Keywords:- Datalogger, Environmental parameters, GPRS, GPS, Internet of Things(IoT), Wireless sensor network, ZigBee.

I. INTRODUCTION

Wireless sensor networks have attracted the researchers due to their wide application in military, security, air traffic control, video surveillance, industrial and manufacturing automation, process control and environmental sensing. Fig 1 shows a sensor mote in which there are five basic components namely sensor modules, microcontrollers, power supply source, transceiver and a memory element.

WSNs have evidenced its use in the current years with the increasing in necessity for wireless sensing and monitoring applications.

Lower cost for maintenance and deployment, fail-free operating circumstances and varied application situations have ensured the augmented usage of WSNs.

Michael Johnson, Michael Healy, Pepijn van de Ven, Martin J. Hayes, [1] present a relative review of numerous wireless sensor network motes and analyse these wireless based sensor devices under a number of different parameters and criteria, including processing ability, expected lifetime and measurement capabilities. Sachin Gajjar, Nilav Choksi [2], depicts motes run the network etiquette programs that most of the time snooze, and occasionally collect, process, store and communicate the data to Base Station (BS). K. K. Khedo, R. Perseedoss, and A. Mungur [3], describes air contamination is one of environmental issues that cannot be disregarded. Industrial development and urbanization results in the air contaminants concentrations in many areas. Mohanchur Sarkar, Kankar Dasgupta [4] describes smart sensor motes can gather vast amount of previously anonymous data for a complete new sectors of computing applications. Francisco S´anchez-Rosario, David S´anchez-Rodr´ıguez, Jes´us B. Alonso-Hern´andez, Carlos M. Travieso-Gonz´alez, Itziar Alonso-Gonz´alez,, Carlos Ram´ırez-Casa˜nas and Miguel A. Quintana-Su´arezn [5] proposed wireless sensor networks (WSN) for environmental monitoring systems because it can be used to improve the quality of life and living conditions are becoming a major concern to people.

This paper is organised with Introduction to sensor networks followed by background of sensor networks. The description of sensor motes and modules are given followed by the working module and experimental result.

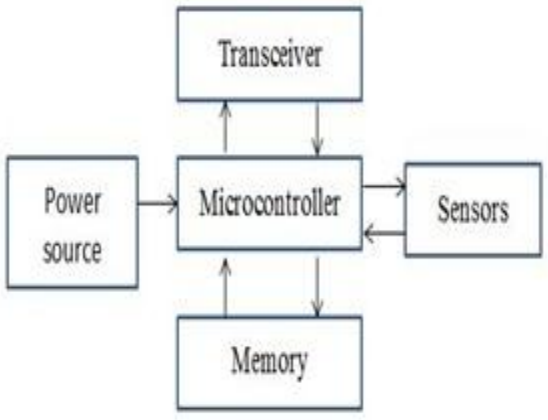

Fig.1 Basic components of Sensor Mote

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II. SENSOR MOTES

A sensor node also recognised as mote are capable of accomplishing sensing, processing the sensed data and communicating with other nodes Most significantly, a sensor node is coupled to a group of sensors as shown in fig2. The collected data are processed and communicated to a destined node which uses the data received for further manipulations.

Although the availability of commercial modules are more in number, most of them may not be suited for specified applications. Certain aspects which influence the decision for selection of an application specific wireless module are discussed below

A. Power Consumption

The power consumption constitutes an significant role in choosing a node. The power source required to deploy a sensor node may be of battery or a non-renewable energy source. The consumption of power can be minimised by controlling the energy consumed by mote components during ideal state.

B. Inclusion of In-Built and External Sensory Elements

Simpler interfacing of external and inbuilt sensors enhances the credibility in mote assortment. Modifying a commercially accessible mote with specific sensor elements creates a transaction between the market scope and functioning need for any application. But with the rise in semiconductor technology and addition of more sensing elements like accelerometers, pressure, temperature sensors etc., this trade-off is minimized.

C. Deployment Environment

The deployment environment also plays an imperative role in mote assortment. For applications where the mote needs to be installed in an open atmosphere, the hardware needs to have components with industrial standards to withstand intense temperature and environmental changes. Moreover, in certain applications, the sensors on-board the mote may get influenced due to inert charges in the deployment environment.

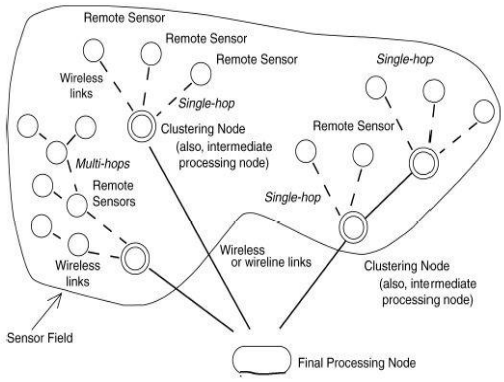

Fig 2. Sensor Network Arrangement

III. SENSOR MODULES

Sensor is an object which is used to sense events or changes in the environment and sends the information to the computer which tells the output device to provide the equivalent output.

The sensors used in this paper are described as below

A. Temperature Sensor –LM35

A device is used to measure the quantity of heat energy that allow us to detect a physical change in temperature, producing either a digital or analog output is known as Temperature Sensor(LM-35). It is designed which was used to measure the heatness or coldness of an object. The LM35 device which will operate from −55°C to 150°C temperature range

B. Pressure Sensor- FSR

Force Sensing Resistors (FSR) are sensing device made up of Polymer Thick Film that operates based on the principle of decreasing the resistor value with increase in pressure applied on surface of the film . The force sensitivity is optimised for the use of human touches in the electronic devices. The pressure values can be measured with the help FSR.

C. Humidity Sensor-DHT11

A humidity sensor will sense, measures and reports the relative content of humidity present in the air. Therefore it measures the moisture and air temperature. The DHT11 is a basic, low-cost digital based sensor for measuring the humidity level. The atmospheric air are sensed with the help of thermistor and an capacitive type humidity sensor that spits out a digital signal on the data pin.

D. Accelerometer Sensor ADXL 335

The ADXL335 is a small, low power, 3-axis accelerometer with voltage outputs that are signal conditioned. The device measures angle with a least full-sized range of ±3 g. It can measure the inert angle of gravity in tilt-sensing applications and also active acceleration resulting from motion, shock, or tremor.

IV. WORKING MODULE

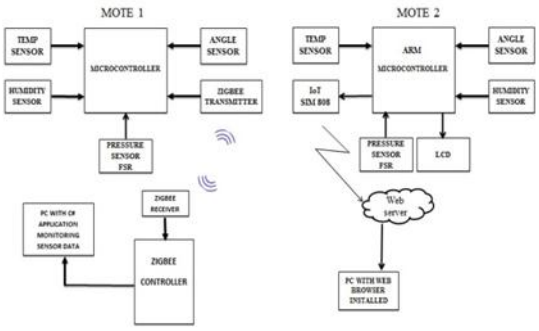

Fig 3. Block Diagram of Working Module

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The proposed system consists of transmitter module and receiver module that sense the parameter and transfers to the receiving module as shown in fig 3.

The transmitter module consists of two motes namely Mote 1 and Mote 2. The mote 1 consists of various sensors such as temperature sensor LM35, humidity sensor DHT11, pressure sensor FSR, angle sensor ADXL335 to sensor their respective parameters. The sensed parameters are processed using an Micro-controller. The transmissions of processed data are made with the help of Zigbee transceiver unit. The mote 2 consists of same components as that of mote 1 in addition that mote 2 is interfaced with Internet of Thing (IoT) module sim 808 for transmission of data to web server instead of using ZigBee transceiver.

The receiver module for mote 1 consists of ZigBee receiver that helps in receiving the transmitter data from the various sensor units. The received data are controlled using an ZigBee controller. The data are sent to the PC for viewing the received data via USB to UART serial communication. The receiver unit of Mote 2 can be a PC installed with web browser so that the sensed data are viewed globally using a web server where the processed data are stored

V. EXPERIMENTAL RESULT

Fig 4. Datalogger Output

The output is obtained with various values received from the pressure, humidity, temperature, angle sensors and processed using the AVR studio in which the monitored data are plotted using the datalogger as shown in fig 4.

VI. CONCLUSION

In this proposed work the design and development of a real time system for environmental monitoring in wireless sensor network using ZigBee transceiver is implemented. The system is capable of monitoring ambient temperature, relative humidity, pressure and angle using accelerometer sensor. In order to minimize the energy consumption, ZigBee protocol and programmable interruptions were used to wake up the mote when only an event occurs. The IoT module is used to view the sensed data globally with the help of web server that stores the data for regular interval of time.

The future enhancement of wireless monitoring system can be made using multiple motes for monitoring the environmental condition from various area and enabling the transmission of data collected from respective motes to the receiver module. Additional future development can be made using the GSM service that helps in obtaining the parameter values in a message format to mobile handsets thereby helps in reducing the complexity and time consumption to greater extend.

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