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LOW COST WIRELESS WEATHER MONITORING SYSTEM

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Abstract:

Weather monitoring holds great importance and have uses in several areas ranging from keeping track of agricultural field weather conditions to industrial conditions monitoring. Weather monitoring plays an important role in human life, so the collection of information about weather changes is very important. This paper describes a weather monitoring system which enables the monitoring of weather parameters like Temperature, Humidity and Light intensity. Sensor module includes the sensors like temperature, humidity and light sensor. The system is developed using ZigBee wireless module. The measured weather parameters are Temperature, Humidity and Light intensity. The developed system is cost effective, compact and portable.

Keywords:

Humidity, Light Intensity, Temperature, Weather monitoring system, ZigBee.

1. INTRODUCTION

In an industry during certain hazards it will be very difficult to monitor the parameter through wires and analog devices such as transducers. To overcome this problem we use wireless device to monitor the parameters so that we can take certain steps even in worst case. Few years back the use of wireless device was very less, but due the rapid development in technology, now-a-days, we use maximum of our data transfer through wireless like Wi-Fi, Bluetooth, Wi-Max, etc. A wireless weather monitoring system which enables to monitor the weather parameter in an industry or anywhere can be designed by using ZigBee technology. The parameters can be displayed on the PC's screen.

This paper focuses on the use of multiple sensors; several sensors that are able to continuously read some parameters that indicate the weather conditions such as temperature, humidity and light intensity. As the monitoring is intended to be carried out in a remote area with limited access, signal or data from the sensor unit will then be transmitted wirelessly to the base monitoring system.

Presently, there are two types of technologies used for the nodes of wireless sensor network viz ZigBee and Bluetooth. On extensive study of characteristics of ZigBee and Bluetooth

technology, it is found that ZigBee technology is most reliable and suitable for indoor as well as outdoor sensor network. ZigBee is a communication standard for use in the wireless sensor network defined by the ZigBee Alliance that adopting the IEEE 802.15.4 standard for its reliable communication. It fulfills the requirement for a low cost, easy to use, minimal power consumption and reliable data communication between sensor nodes. It provides a transmission speed typically 250 kbps over a range of 10 to 100 meters and can be configured in star, mesh or peer-to-peer topologies.

The development of Graphical User Interface (GUI) for the monitoring purposes at the base monitoring station is another main component. The GUI should be able to display the parameters being monitored.

2. MATERIALS AND METHODS

2.1. WIRELESS SENSOR NETWORK (WSN)

WSN can operate in a wide range of environments and provide advantages in cost, size, power, flexibility and distributed intelligence, compared to wired ones. Monitoring applications have been developed in medicine, agriculture, environment, military, machine/building, toys, motion tracking and many other fields. Architectures for sensor networks have been changing greatly over the last 50 years, from the analogue 4-20 mA designs to the bus and network topology of today. Bus architectures reduce wiring and required communication bandwidth. Wireless sensors further decrease wiring needs, providing new opportunities for distributed intelligence architectures. For field bus architecture, the risk of cutting the bus that connects all the sensors persists. WSN eliminates all the problems arising from wires in the system. This is the most important advantage of using such technology for monitoring.
A WSN is a system comprised of radio frequency (RF) transceivers, sensors, microcontrollers and power sources.

Currently two standard technologies are available for WSN: ZigBee and Bluetooth. Both operate within the Industrial Scientific and Medical (ISM) band of 2.4 GHz, which provides license free operations, huge spectrum allocation and worldwide compatibility.

For applications where higher data rates are important, Bluetooth clearly has the advantage since it can support a wider range of traffic types than ZigBee. However, the power consumption in a sensor network is of primary importance and it should be extremely low. Bluetooth is probably the closest peer to WSNs, but its power consumption has been of secondary importance in its design. Bluetooth is therefore not suitable for applications that require ultra-low power consumption; turning on and off consumes a great deal of energy. In contrast, the ZigBee protocol places primary importance on power management; it was developed for low power consumption and years of battery life. Bluetooth devices have lower battery life compared to ZigBee, as a result of the processing and protocol management overhead which is required for ad hoc networking. Also, ZigBee provides higher network flexibility than Bluetooth, allowing different topologies. ZigBee allows a larger number of nodes – more than 65,000 Sensors – according to specification.

2.2.SYSTEM ARCHITECTURE

The system contains two parts. One is transmitter part and another one is receiver part. The transmitter part consists of weather sensors, microcontroller and Zigbee and the receiver part consist of a PC interfaced with Zigbee through PC serial port. The system monitors temperature, humidity and light intensity with the help of respective sensors. The data from the sensors are collected by the micro controller and transmitted to the receiver section through wireless medium. All the parameters are viewed by the PC using program in the receiver side.
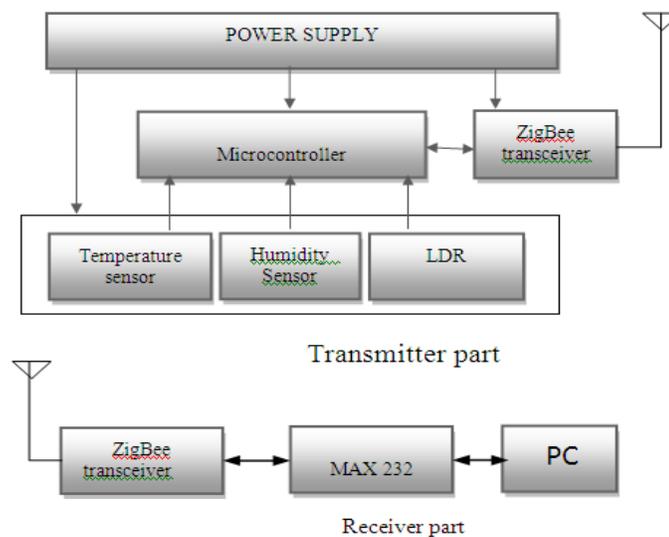

Fig 1: System Block Diagram

The modules included in the system architecture are as follows-

1. Microcontroller

2. ZigBee Network

3. Sensors

1. Microcontroller

The AT89C52 is a low-power, high-performance CMOS 8-bit microcomputer with 8K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 and 80C52 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 Flash on a monolithic chip, the Atmel AT89C52 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications.

2. ZigBee Network

ZigBee is a specification for a suite of high level communication protocols using small, low power digital radios based on an IEEE 802 standard for personal area network. The technology defined by the ZigBee specifications is intended to be simpler and less expensive than other WPANs such as Bluetooth. ZigBee is targeted at radio frequency applications that require a low data rate, long battery life and secure networking.

3. Sensors

A sensor is a device that measures a physical quantity and converts it into a signal which can read by an observer or by an instrument.

A. Temperature Sensor

National semiconductor's LM35 IC has been used for sensing the temperature. It is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature. The temperature can be measured more accurately with it than using thermistor.

B. Humidity sensor

Humidity sensor works on the principle of relative humidity and gives the output in the form of voltage. This analog voltage provides the information about the percentage relative humidity present in the environment. A miniature sensor consisting of a RH sensitive material deposited on a ceramic substrate. The AC resistance (impedance) of the sensor decreases as relative humidity increases.

C. Light Dependent Resistor (LDR)

Light Dependent Resistor (LDR), is light sensitive device most often used to indicate the presence or absence of light, or to measure the light intensity. In the dark, resistance is very high, sometimes up to 1MΩ, but when the LDR sensor is exposed to light, the resistance drops dramatically, even down to a few ohms, depending on the light intensity. LDRs have a sensitivity that varies with the wavelength of the light applied.

2.3.SYSTEM IMPLEMENTATION

The system is designed and the sensors are fixed to measure the weather parameters. The base station (receiver part) consists of a same Zigbee module programmed as a coordinator that receives the data sent from the sensor node (transmitter part) wirelessly. Data received from the sensor node is sent to the computer using the RS 232 protocol and data received is displayed using the built GUI on the base monitoring station.

2.4.SOFTWARE DETAILS

Software is an integral part of any control system; it interacts with hardware to carry out different functions. In the given problem the software can be divided into following subparts:

- To assign different ports (pins) of microcontroller (AT89C52) to different components of the system.
- To display different input values.

KEIL µVision3 software has been used.

3. RESULTS AND DISCUSSIONS

The goal was to design and develop a low cost Microcontroller based Wireless Weather Monitoring System. To achieve this hardware was developed with compatible software in KEIL so that the above mentioned parameters can be monitored. The hardware with compatible software is of simple design, cost effective and accurate. It can be observed that the temperature sensor shows a good level of stability as well as accuracy. The humidity sensor and LDR of system also shows a very good accuracy.

4. CONCLUSION

The system has been successfully implemented. The implemented system is successful in measuring the Temperature, Humidity and Light intensity. Real-time data can be seen from a GUI window in Personal Computer.

5. *REFERENCES*

[1] *Zigbee Alliance, Zigbee Specification. Version 1.0 Zigbee Document 053474r06, December 14th, 2004.*
[2] *William Stalling, "Wireless Communication and Networks", Fourth Edition, Pearson Publication Limited, 2004, Pp 39-118.*
[3] *Dipanjan Bhattacharjee, Sushaban Choudhury, Ajay kumar, "Wireless intelligent smart sensor node for hazardous gas monitoring" international journal of Computer Science and Information Technology (IJCSIT), Vol 3, No 1, Pp. 53-57. June 2010*
[4] *Guo X. & Song Y., "Design of Automatic Weather Station Based on GSM Module", Int. Conf. on Computer, Mechatronics, Control and Electronic Engineering.*
[5] *Kang. J. and Park S. "Integrated comfort sensing system on indoor climate" Sensors and Actuators. 2000. 302-307.*
[6] *D. Culler, D. Estrin, and M. Srivastava, "Overview of Sensor Networks," Computer, vol. 37, no. 8, 2004.*
[7] *"LM 35 precision centigrade temperature sensors datasheet," National Semiconductors.*
[8] *Zigbee Alliance,www.zigbee.org*
[9] *National semiconductors, at national.com*
[10]   *Free scale Semiconductor, Zigbee Implementer's Guide; Document Number: F8W-2004-0007, May 23, 2005.*