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DESIGN AND IMPLEMENTATION OF WIRELESS SENSOR NETWORK FOR MULTI-STORAGE BUILDING

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***Abstract*:** In recent years, Wireless Sensor Network (WSN) is considered as a potential solution for home automation because of its reliability, low-cost, low-power consuming characteristics. Several researches have been carried out using WSN for home automation; however most studies have been experimented in small houses or in one storey of a building. There has been little discussion about design and implementation of WSN automation system in multi-storey buildings. This paper describes a practical design and implementation of WSN for controlling and monitoring system in multi-storey building. A building automation system using Microchip ZigBee WSN was developed and set up in the International University (IU) building for system evaluation. The performance results confirm that Microchip ZigBee WSN based home automation system is practically applicable in multi-storey building environment.

Keywords: Microcontroller, GSM/GPRS Modem, LCD display, Temperature Sensor, LDR Sensor, ZIGBEE module.

Introduction

In recent years, home automation system is becoming more and more popular. People want to live in intelligent living spaces equipped with home automation systems, these systems not only provide them convenience, comport, security but also reduce their daily living cost by energy saving solutions.

The demand for home automation products has been increased rapidly, which promise a potential market trend in near future.

The traditional home automation systems use wired connection solutions. However the implementation of these systems requires cable installation at the same time with house building.

This problem causes inconvenient for users, especially when their houses have been built, few of them accept wired solutions because the installation of new cable system can destruct the original interior decoration. Recent development of wireless technologies has innovated home automation field. It allows the installation of home automation system is Independent with house building.

I.The Hardware System

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):

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. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

II. Design of Proposed Hardware System

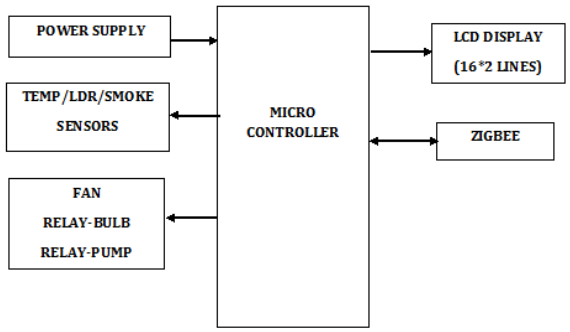

Fig 1.Buillding Section

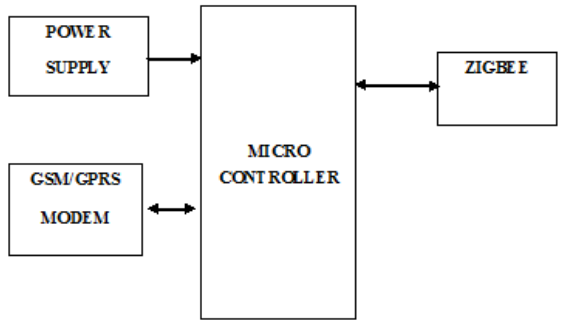

Fig 2.Monitoring Section

In this paper, the development of the automated irrigation system based on microcontrollers and wireless communication at experimental scale within rural areas is presented. The aim of the implementation was to demonstrate that the automatic irrigation can be used to reduce water use. A microcontroller for data acquisition, and transceiver; the sensor measurements are transmitted to a microcontroller based receiver. This gateway permits the automated activation of irrigation when the threshold values of soil moisture and temperature is reached. Communication between the sensor nodes and the data receiver is via the Zigbee. This receiver unit also has a duplex communication link based on a cellular Internet interface, using General Packet Radio Service (GPRS) protocol, which is a packet oriented mobile data service cellular global system for mobile communications (GSM).

III .Board Hardware Resources Features

Temperature Sensor:

Thermistors are thermally sensitive resistors whose prime function is to exhibit a large, predictable and precise change in electrical resistance when subjected to a corresponding change in body temperature. Negative Temperature Coefficient (NTC) thermistors exhibit a decrease in electrical resistance when subjected to an increase in body temperature and Positive Temperature Coefficient (PTC) thermistors exhibit an increase in electrical resistance when subjected to an increase in body temperature. U.S. Sensor produces thermistors capable of operating over the temperature range of -100° to over +600° Fahrenheit. Because of their very predictable characteristics and their excellent long term stability, thermistors are generally accepted to be the most advantageous sensor for many applications including temperature measurement and control.

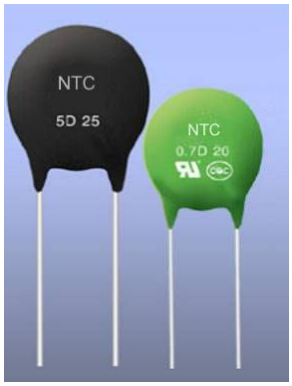

Fig.3.Temperature Sensor

ZIGBEE:

ZIGBEE is a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4-2003 standard for Low-Rate Wireless Personal Area Networks (LR-WPANs), such as wireless light switches with lamps, electrical meters with in-home-displays, consumer electronics equipment via short-range radio needing low rates of data transfer. The technology defined by the ZIGBEE specification is intended to be simpler and less expensive than other WPANs, such as Bluetooth. ZIGBEE is targeted at radio-frequency (RF) applications that require a low data rate, long battery life, and secure networking.

ZIGBEE is a low-cost, low-power, wireless mesh networking standard. First, the low cost allows the technology to be widely deployed in wireless control and monitoring applications. Second, the low power-usage allows longer life with smaller batteries. Third, the mesh networking provides high reliability and more extensive range.

Fig.6.ZIGBEE Module

Relays:

A relay is an electrically controllable switch widely used in industrial controls, automobiles and appliances. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. The relay allows the isolation of two separate sections of a system with two different voltage sources i.e., a small amount of voltage/current on one side can handle a large amount of voltage/current on the other side but there is no chance that these two voltages mix up.

GPRS:

GPRS technology enabled much higher data rates to be conveyed over a cellular network when compared to GSM.GPRS technology offering data services with data rates up to a maximum of 172 kbps, facilities such as web browsing and other services requiring data transfer became possible. GPRS and GSM are able to operate alongside one another on the same network, and using the same base stations. However upgrades are needed. The network upgrades reflect many of those needed for 3G, and in this way the investment in converting a network for GPRS prepares the core infrastructure for later evolution to a 3G W-CDMA / UMTS.

LDR:

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. The image shows that when the torch is turned on, the resistance of the LDR falls, allowing current to pass through it. In a light sensor circuit, When the light level is low the resistance of the LDR is high. This prevents current from flowing to the base of the transistors. Consequently the LED does not light.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 LED lights on.
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.

IV .CONCLUSION

In this paper, a wireless sensor network based multi-storey building automation system has been designed, implemented and tested. The system can be used for several applications such as indoor environmental data acquisition, building security monitoring, and human-tracking light control. Moreover, the system can remotely control of home appliances through Internet and mobile network. The system is expected to be developed for many other applications such as intelligent community administration system, remote industrial control system, and remote patient monitoring system.

The performance results confirm that WSN based home automation system is practically applicable in multi-storey building environment; the system can also work well in Wi-Fi existing environment.

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