**A Remote Home Security System Based On Wireless Sensor Network, Zigbee And Gsm Technology**

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***Abstract***

 *In this paper, a low-power consumption remote home security alarm system developed by applying WSN and GSM technology is presented. It can detect the theft, leaking of raw gas and fire, and send alarm message remotely. The hardware of this system includes the single chip C5081F310, wireless receiving and sending chip CC1100 as well as the SIMENS TC35 GSM module. The system software developed in C51 language has the ability of collecting, wireless receiving and sending data, and can send a piece of alarm short message to the user’s mobile phone when some dangerous condition has been detected. Security monitoring systems are popular in home automation, and Zigbee is a new industrial standard wireless sensor networks.*

 *This paper introduces an experimental home security monitoring and alarming system based on Zigbee technology, it is capable of monitoring door & window magnetic contact, smoke, gas leak, water flooding, providing simple controls such as turning off the valves, and sending the alarms to the residential area security network etc. The security alarming system is based on Zigbee chip MC13192 and*

*low power consumption micro-controller MSP430F135. A description of the system architecture, circuit principle and the firmware flowchart is presented. The system uses a control key fob for activating and de-activating the alarm easily, supports Web interface so that user can access the system remotely to control, search or review the history record, and offers a LCD panel for simple configuration.*

 *Keywords-wireless sensor network; global system for mobile communications; home security system; short message I; Zigbee*

1. **Introduction**

 Safety is the most important requirement of home for people. With the development of IT technology, network and automatic control technology, a remote home security monitoring and alarming system becomes more and more practicable today. By combining wireless sensor network(WSN) and GSM technology, this paper designs a low-power consumption remote home security monitoring and alarming system that can detect the theft, leaking of raw gas and fire, and send alarm message to the house owner’s mobile phone .Wireless sensor network is composed of a large amount of miniature self-organizing wireless sensor nodes. By combining three kinds of technology such as sensor, micro mechatronics and wireless communication, WSN can detect, collect and deal with the object information in its covering area, and send data to the observer. In a word, WSN technology has the advantages of wide covering area, able to remote monitoring, high monitoring precision, fast network

establishment and reasonable cost . GSM network has the advantages of mature technology, wide covering area, long communication distance, and sound communication effect and so on. The remote home security system presented in this paper combines so many advantages of WSN and GSM. Firstly, wherever the users are, once some dangerous instance happens in home, such as gas leaking or thief intruding, this system can send alarm short message to the users through GSM network immediately, informing people the possible dangerous circumstances in home. Secondly, the wireless sensor network established in home has the features of ease establishment, without use of cable, and low-power consumption. Intelligent home, also known as the smart residential home, is moving towards the wireless remote control, multi-media control, and high-speed data transmission. The key technology of intelligent home is compatible to household controllers and it can also meet the transmission requirements through home networking . At present, lots of integrated transport network is based on comprehensive wiring technology , limiting the system to special places, and higher cost. Currently, researches on the wireless intelligent home security surveillance system is becoming a hotspot due to its flexibility and convenience. At present, the application of intelligent home wireless communication technologies mainly include: IrDA infrared technology, Bluetooth and ZigBee technology, and so on . IrDA is a short distance for the half-duplex point-to-point communication. Besides, it’s inconvenient and of high error rate, which make IrDA not applicable to the family network communication. Bluetooth technology is limited by network capacity and it costs much. So Bluetooth technology is not suitable for the home network with a large number of nodes. ZigBee technology has the moderate transmission range and larger network capacity. Here ZigBee technology is developed in the monitoring system.

1. **System Architecture**

Modular Design is throughout the system. System is built on the embedded system, and it can monitor the important position through the CMOS camera. Home state SMS and images MMS are sent to specialized mobile phones. Besides, household appliances can be remotely controlled by SMS. ZigBee module connects household appliances, the system motherboard with smoke, temperature, gas sensors, forming a wireless networking. The system motherboard core controller is S3C44B0X-32 microcontroller and mainly responsible for dealing with the data. Through MMS modules and ZigBee module it can send information and instructions. And Expand access plate to smoke, infrared, gas and other domestic security state sensor. MMS module makes the system controller send the family security status information to mobile phone users. Users send and receive text messages of instruction; ZigBee module is responsible for the system motherboard with the expansion of household appliances between the board and cross-linking of data. The system structure is illustrated in Fig.1. It is composed of the MCU-based home wireless control center, one WSN center node module, and several data collecting nodes, GSM module, GSM network and mobile phone. The WSN data collecting node modules are connected with pyroelectric infrared detector, temperature sensor, smoke detector and gas sensor separately. When the pyroelectric infrared detector finds that some people intrudes into the house abnormally; or when the temperature sensor detects too high indoor temperature and at the same time, the smoke sensor detects overproof smoke concentration; or when the gas sensor detects overproof. combustible gas concentration, the sensors will send encoded alarm signal to the home control center through the wireless sensor network established in home. Once the wireless control center receives alarm signal, it will send alarm short message to the users through the GSM module and GSM network immediately.

**3.Wireless Sensor Network Characteristics**

For measuring and monitoring physical and non-physical activities in a remote area, various types of wireless sensors are generally grouped in a network . Apart from the sensors, the network may incorporate repeater hubs to extend the transmission range of the retrieved data. The network may also incorporate processing units to analyze the data. The sensor networks employ small, low power devices to do all the tasks. The sensors in the network capture the activity and the collected data is communicated to a remote monitoring centre using wireless data transfer techniques such as Radio Frequency (RF) communication. The size and cost constraints on these types of network result in corresponding constraints being exerted on the resources such a energy, memory, computational speed and bandwidth. a typical wireless sensor network. It consists of a Data Acquisition Network (DAN) and a Data Distribution Network (DDN). In the Data Acquisition Network, the data collected by the sensor nodes are transmitted, using RF channel, to the Base Station Controller (BSC), which in turn is connected to the Management Centre using wired or wireless connection. Some pre-processing of data is often done at the base station which, for a small and simple sensor network, is generally equipped with a microprocessor or microcontroller. The entire network is monitored and controlled by the Management Centre which is equipped with large storage capacity and computational resources to undertake data analysis and presentation. The Base Station provides a gateway to the Data Distribution Network. For distribution of data within the DDN, various kinds of transmission techniques are used, such as Wi-Fi, Bluetooth and Cellular networks (CDMA/GSM). Data may be distributed to remote PCs/ Notebooks, handheld PDAs and cellular phones. Thus, to build and implement a sensor network, a designer needs to consider several aspects which are discussed in the following sub-sections.

**3.1 Wi-Fi**

 Wi-Fi networks use radio technologies IEEE 802.11x standard, which is a standard that uses the 2.4 GHz and 5 GHz bands, to transmit and receive the wireless data . Wi–Fi is useful in implementing ad-hoc wireless networks.

**3.2 Bluetooth**

 Bluetooth is an open standard for short-range, low power, and low-cost digital radio wireless communication. Bluetooth is now being used in a wide range of personal products and the technology is readily available in the market. The blue tooth transceiver use unlicensed 2.4 GHz frequency band, with a nominal bandwidth of 1 MHz for each channel. It offers an effective range of 10 meters (32 feet). Bluetooth can indeed be used in wireless sensor network for short range applications.

**3.3 ZigBee**

 Zigbee is a relatively new, wireless personal area network technology based on IEEE 802.15.4, with a transmission range of 100+ meters . ZigBee based communication devices consume very little power and hence the battery life of 1000+ days is common. ZigBee has enormous advantages compared to Bluetooth when used in wireless sensor networks. The reasons include more coverage area, less power consumption, and secure networking. ZigBee operates in the industrial, scientific and medical radio bands - 868 MHz in Europe, 915 MHz in the USA and 2.4 GHz in most other countries in the rest of the world.

**3.4 Network Topology**

 In any communication network, the message should be transmitted with a prescribed throughput and reliability. This is usually termed as “Quality of Service” (QoS). It can be specified in terms of message delay, bit error rates, packet loss, economic cost of transmission, transmission power, etc. Depending on the QoS, the installation environment, eco-nomic considerations, and the application, one of several basic network topologies such as star, ring bus or tree connection may be used. A communication network consists of nodes, which in our case are sensors, each of which has computing power and can transmit and receive messages over communication links, wireless or cabled.

**3.5 Communication Protocols and Routing**

 In a wireless sensor network, one can implement different types of communication protocols and routing techniques. The protocol employed depends on the application in which the sensor is meant to be used. A basic communication pro-tocol consists of packets of data which has a header for identification, data bits and also some special frames to identify and correct errors in transmission. When a sensor node desires to transmit a message, handshaking protocols are implemented with the destination node to improve reliability and ultimately the QoS of the wireless network. This hand shaking protocol makes the sensor node to retransmit messages that were not properly received. To use the extremely limited resources effectively and efficiently, a new technique called CodeBlue is implemented in wireless networks in order to cope up with the sensor nodes which have limited communication and computation capabilities. The CodeBlue integrates sensor nodes and other wireless devices in the network, thus performing various tasks, such as device discovery - naming, routing, prioritization of critical data, security and tracking device locations. The inventors designed Code Blue for rapidly changing, critical care environments. It acts as an “Information Plane”, letting various devices detect each other, report events, and establish communication channels. For medical applications, Code Blue is designed to scale across a wide range of network densities, ranging from sparse clinic and hospital deployments to very dense, ad hoc deployments at a mass casualty site.

 CodeBlue must also operate on a range of wireless devices, from resource-constrained motes to more

powerful PDA and PC-class systems. The main advantage of this kind of structure is, it incorporates a flexible naming scheme, robust publish and subscribe routing framework; authentication and encryption provisions and handoff. The other services the Code Blue provides to the network are location tracking, in-network filtering and aggregation.

**3.6 Power Management**

 Since the wireless sensors are geographically distributed, often in remote sites, the lifetime of the sensor nodes is important. Power generation, power conservation and power management play very important roles in extending the lifetime of the motes. Most of the power is consumed in the process of RF communication since the required transmission power increases as the square of the distance between source and destination. While software power management techniques can greatly decrease the power consumed by RF sensor nodes, TDMA is especially useful for power conservation, since a node can power down between its assigned time slots, waking up in time to receive and transmit messages.

**3.7 Network Coverage**

 The coverage area of the sensor is defined as the effective range of the sensor connected to its sensor node. In a network, high coverage makes it robust system and this can be exploited to extend the network lifetime by switching redundant nodes to power-saving and sleep modes.

**Conclusions**

 This paper presents one solution for establishing a lowpower consumption remote home security alarm system. The system, based on WSN and GSM technology, can detect the theft, leaking of raw gas and fire, and send alarm message remotely. The hardware of this system includes the single chipC5081F310, wireless receiving and sending chip CC1100 as well as the SIMENS TC35 GSM module. The system software developed in C51 language has the ability of collecting, wireless receiving and transmitting data, and can send a piece of alarm short message to the user’s mobile phone when some dangerous condition has been detected. With the advantages of reliability, easy usage, complement wireless, and low power consumption, the system also has practical value in other fields.

 This paper presents the design and completion of a ZigBee based smart home security monitoring system, respectively, from the system, hardware design, software design, experimental data analysis and other aspects of the ZigBee technology in the application of the system. ZigBee technology will be applied in the intelligent home to achieve a rapid rate, low-cost, low-power wireless communication network.

 Through connecting the traditional sensor alarm system and image monitoring system, a new type of smart security system is formed. Users can use the phone or PC to receive MMS information. According to the need, users can set the mobile phone to achieve a flexible and convenient home security monitoring.

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