

Warehouse Monitoring System Based on Wireless Sensor Networks

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Abstract: We put the wireless sensor network technology and intelligent warehouse control systems together. According to the features of wireless sensor networks and intelligent warehouse monitoring system, we designed an intelligent warehouse monitoring system based on wireless sensor network. The system reflects the characteristics of wireless sensor networks, is easy to use, stable and reliable.

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1. Introduction

With the sensor technology, embedded computing technology, communication technology and semiconductor and MEMS manufacturing technology rapid development, with perception, computing and communication capabilities of storing micro-sensors used in military, industrial, agricultural and aerospace fields. Wireless sensor network is a set of sensors actuators, controllers and communication devices in one. Set sensing and drive control capabilities, computing power, communications capabilities in a resource (computing, storage, and energy) constrained embedded devices. From these tiny sensors in wireless sensor networks can constitute a real-time monitoring, sensing and distribution network in the region collect various monitoring object information, and information processing, the information sent to the needs of the user. Wireless sensor network has low price, small size, convenient networking, flexible features. Here will be the introduction of wireless sensor network security protection system, give full play to the advantages of wireless sensor networks to improve the intelligent warehouse security protection system's overall performance. Intelligent warehouse security protection system has its own characteristics. The sensor nodes can be targeted pre-arrangement, which has a relatively fixed network topology, network communications and routing protocols, also has its characteristics. Therefore, the system design should carefully consider these issues.

2 Unlimited sensor network based warehouse control system

Wireless sensor networks [1] WSN (Wireless Sensor Network) is deployed in the area to monitor a large number of cheap micro sensor nodes through wireless communications to form a multi-hop self-organizing network system, its purpose is collaboration and awareness, acquisition and processing network coverage area of the sensing objects, and send the viewer. Based on wireless sensor network monitoring system network consists of a warehouse door switches, temperature sensors, humidity sensors, microwave sensors, fire, smoke sensors, glass break sensors, sensor network nodes. In the network using star topology, a plurality of wireless communication module connected to the computer center as a network node can be in any one of the underlying network node communication, network nodes on the environment in the various parameters were measured, the sample will be collected the data sent to the sink, the sink node upload data to the console, and the analysis and processing of data sent to the console, commands, complete the appropriate action. Figure 1 is a single-sensor Warehouse Monitoring system framework.

Sensors in the system plays a very important role. Commonly used class of fire detection sensor smoke sensor HIS-07, NIS-09C, a temperature sensor TPS-333, TPS-334, anti-theft alarm class pyroelectric infrared sensor PIS-209S, RE200B, glass break sensor BS-02, door switch sensor FD series, like a gas leak gas sensor MQ-5, MQ-216 and so on.

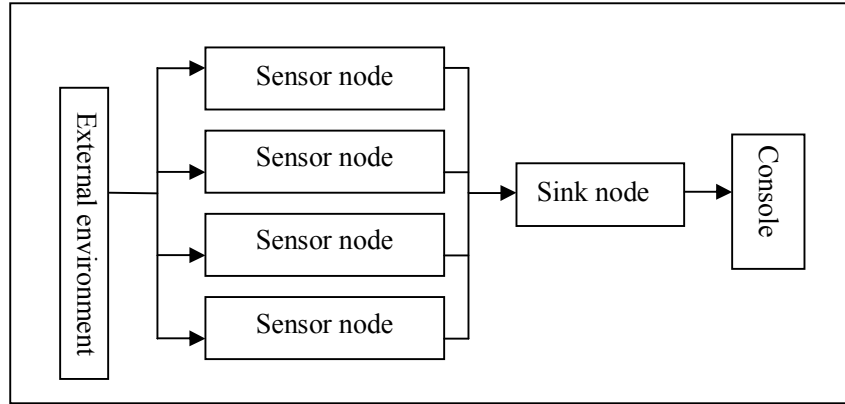


Figure 1a single sensor monitoring system framework Warehouse

This was expanded to Figure 1, the sink node as a small, infrared sensors, temperature sensors, such as different sensor nodes together constitute the entire warehouse area network wireless sensor network, shown in Figure 2.

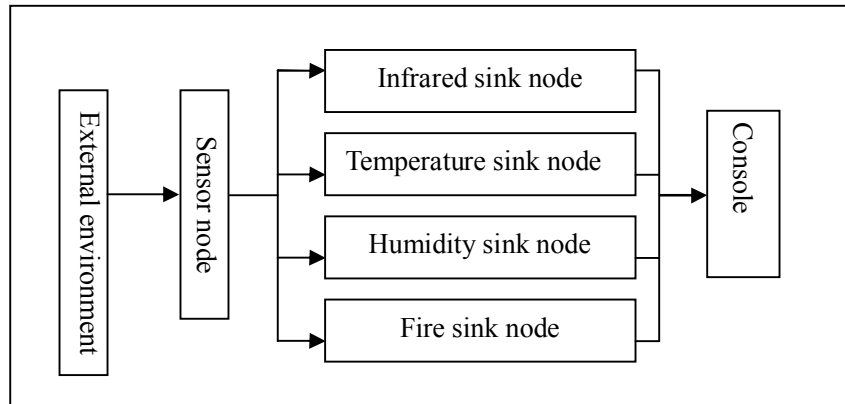


Figure 2 multi-sensor Warehouse Monitoring System

3 Design of Wireless Sensor Network Node

Design of sensor nodes, consider miniaturization, scalability and flexibility, stability and security, cost and so on. Warehouse Monitoring System wireless sensor network node is the basic unit, is based monitoring system. Wireless sensor network node to complete the data collection and transmission functions, the node's internal power supply module is responsible for energy, battery usage time decision node of use. Taking into account the scalability and flexibility to select common components. System design is modular in design, through various functional modules, to achieve normal operation. Sensor nodes including data acquisition, data processing, wireless communications and the battery module, the structure shown in Figure 3.

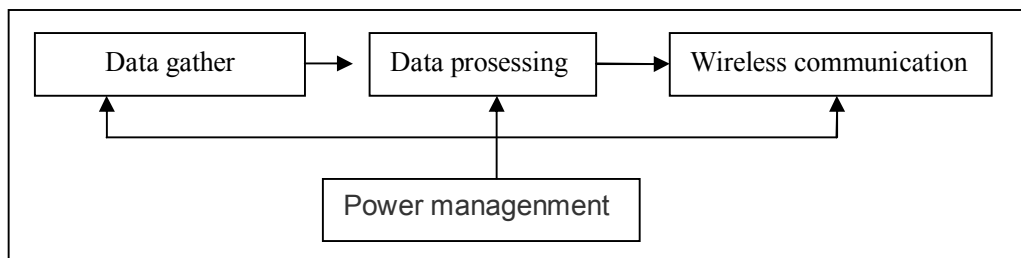


Figure 3 sensor nodes

(1) data processing module

Data processing module is core computing wireless sensor nodes. All device control, task scheduling, energy calculation and functional coordination, communication protocols, data integration and data dump program in

support of the completion of the module. Therefore, the choice of processor nodes in the design of the sensor is essential. Sensor network node processor used should be met: small size, high integration, low power consumption and supports sleep mode, running speed is as fast, there must be adequate external universal port and communication interfaces, low cost, there are security guarantees and so on.

Currently using more TI's MSP430 ultra-low power family of processors [2], not only full-featured, high integration, and according to the storage capacity of a variety of pin-compatible processors, enabling developers easily smoothed according to the application object upgrade the system. MSP430F149 processors used here. Supply voltage is only 1.8 ~ 3.6 V, with a 16-bit RISC architecture, 125 ns instruction cycle with up to 60 KB Flash ROM and 2 KB RAM. In addition the device comes with: 12 200 kS / s of MD converters (comes with sample and hold), internal temperature sensor, with three capture / compare registers are 16-bit timer Timer_A / Timer_B, 2 serial ports (working in UART or SPI mode), 6 8 parallel (two with interrupt capability) and a hardware multiplier, the entire circuit is compact and efficient. Its rich addressing. Compact core instruction. Higher processing speed, a large number of registers and data memory so that it has powerful processing capabilities, rich peripheral interfaces within the device to simplify the circuit design to reduce node power consumption and size, Ideal node design.

(2) Wireless communication module

The wireless communication module is responsible for wireless communication with other nodes. Exchange control information, collecting data acquisition [3]. In addition, the communication module in the sensor node energy consumption is dominant, so consider working mode wireless communication module and charging energy is very important. Wireless transceiver device uses the modulation mode, data rate, transmit power and the operating cycle energy consumption affects the communication are all key factors. Select the wireless transceiver devices should consider power, transmit power, receiver sensitivity, the number of external components required for sending and receiving devices, and device cost and other factors.

Type used here CC2420 wireless transceiver. Chipcon CC2420 is compatible with the company introduced a 2.4 GHz IEEE 802.15.4 wireless transceiver. CC2420 based SmartRF03 technology, using 0.18 μ m CMOS process to produce high integration. CC2420 ZigBee technology is the first line with a highly integrated RF transceiver industry, its MAC and PHY layer protocols comply with the IEEE 802.15.4 specification, operating in the license-free 2.4 GHz band. With this device developed short-range radio frequency transmission systems, low cost, low power consumption, suitable for long-term battery-powered; and has hardware encryption, secure, reliable, flexible networking, invulnerability and other characteristics, can provide the ideal sensor network nodes solution.

4 signal acquisition

(1) sensor nodes signal acquisition

Any temperature objects are constantly infrared radiation to the outside world, the body surface temperature is generally 37 ° C, most of its radiation energy is concentrated in 10 μ m wavelength range. If the person's direct exposure to infrared radiation in the pyroelectric infrared sensor temperature changes can cause the output signal, but the detection distance far enough. Detection distance is lengthened for additional optical system to collect infrared radiation, usually plastic Fresnel lens focusing system as infrared radiation.

Magnetic switch sensor is actually a reed switch, which consists of two closely spaced metal spring composition. These two pieces of soft magnetic metal spring, when the reed switch to magnetic fields, the metal spring is magnetized to attract each other, the contact, when the magnetic field when the reed springs lose their magnetism, since the two metal spring force of separate signal. Broken glass, will be issued when certain sound waves. Acoustic glass break sensors are made according to the police. The method is to prevent the illegal invasion of an aid is installed, as the case may be.

(2) fire alarm signal acquisition

Substance combustion process, in general, heat (temperature), gas and smoke, flame phenomena for different phenomena have different fire signal detection method. Ionization smoke sensor utilizes radioactive radiation generated and detected air ionization produced by micro-current.

Currently most of the ionization smoke sensor using single-source dual-chamber work, which uses a radioactive source, two studios, namely the reference chamber and the detection chamber. No smoke enters the detection chamber, the chambers of the micro-current balance: When smoke enters the detection chamber, the detection chamber current changes. Balance is destroyed, the sensor will detect a positive signal to the feedback circuit, an alarm is generated.

The temperature sensor according to the heat of combustion of materials caused by ambient temperature change or the size of, and through the thermal elements and the electronic circuit to detect a fire.

(3) Humidity signal acquisition

Storage warehouse items must be kept dry when the humidity is too large may affect the quality of goods in storage. Using the humidity sensor can detect humidity exceeds the threshold value, and generate an alarm signal.

(4) Human close to the signal acquisition

Microwave sensors can be used to detect the human body is a proximity sensor that can accurately ascertain neighborhood close to humans, the use of microwave sensors can effectively prevent the illegal invasion.

(5) Temperature signal acquisition

When the temperature is relatively high or light intensity is large, stored in the warehouse of special categories of goods such as flammable materials may be in an unstable state. The temperature sensor detects the temperature of the goods within the warehouse, when an alarm threshold is exceeded.

5. Smart warehouse security system design

The system design includes node software and control PC software in two parts. Node software is mainly used to implement data collection and control energy consumption, control node status, etc. [4].

Control terminal software features include: Sink node receives the data transmitted, transmission of different types of sensor data fusion process and determine the current status of the warehouse, real-time dynamic monitoring of the environment, in addition to the control node power consumption, but also the control terminal functions to be achieved [5]. Warehouse system design shown in Figure 4:

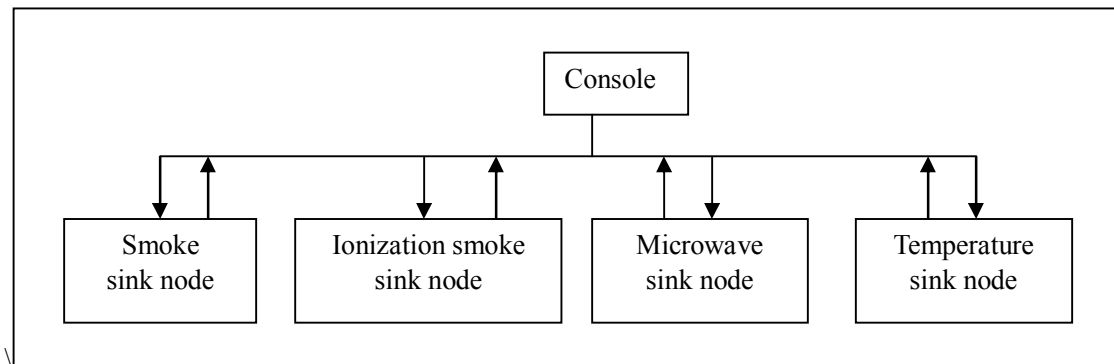


Figure 4 WSN Warehouse Monitoring System Design

6. Conclusion

According to the characteristics of wireless sensor networks, based on wireless sensor networks to design a warehouse security system. The system can be real-time monitoring of the entire warehouse security environment. The system network is convenient and flexible, easy to upgrade, inexpensive, but also applicable to other similar applications. Can warehouse fire alarm, anti-theft and a series of unsafe events effectively monitored. In the event of threats to security incidents, the system automatically sends a corresponding alarm. Managers can know immediately and take effective measures against security incidents for emergency treatment and avoid property damage. Through the lab to build a small storage warehouse security systems tested, the results showed that: using wireless sensor networks with high security system security and stability, the system easy to upgrade, with a wide range of practical applications.

References

- [1] Sun Limin, Li Jianzhong, etc., wireless sensor networks [M]. Beijing: Tsinghua University Press, 2005.5
- [2] Shen Jianhua, Yang Yanqin, Quxiao Shu, MSP430 family of ultra-low power microcontroller 16 Principles and Applications [M]. Beijing: Tsinghua University Press, 2004.11
- [3] Min Chen et al Mobile Agent Based Wireless Sensor Networks. JOURNAL OF COMPUTER, 2006,1 (1): 14 ~ 21
- [4] Jason Hill, A Software Architecture Supporting Networked Sensors, Masters these. The Department of Electrical Engineering and Computer Sciences, University of California at Berkeley, December 200
- [5] Akyildiz IF, Su W, et al, Wireless Sensor Network: A Survey [J]. Computer Networks, 2002,38 (4) :393-422.