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Remote Environmental Monitoring Embedded System Design Based on Wireless Sensor Networks

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This article is designed and implemented in the environment for real-time monitoring of temperature and humidity system, which not only can choose wired or wireless data collection on the next bit machine, but also can display real-time data on display on the lower-bit machine and PC computer screen. Between the lower computer and host computer used standard communication protocols, data transfer can be achieved in various ways. The way ensured that the use of check data transmission link reliability. This system not only real-time collection temperature and humidity values of the sampling points, but also can quickly process the data showed that while stored for future comparative study. Based on system function expansion needs, the paper uses a modular design approach, if there is a change on the functional requirements, small convenience can be achieved. This design system is based on embedded environment monitoring system which can be widely used in medicine warehouses, food industry, greenhouses and fields and archives and other places. There have certain requirements on the environment for production and daily life, records management etc. To provide protection, while improving the level of environmental monitoring information management system, reducing the waste of manpower, improve the efficiency of monitoring and management.

1. Introduction

Things as a new network, has more and more attention of researchers (Gubbi and Satyanarayana, 2013). Analysis carried out from all angles, including the important technical things the following aspects: (1) wireless sensor network technology. It is a combination of distributed data acquisition, processing and network transmission technology, due to the low cost, small size, reliability, and flexible deployment, networking mode, etc., aroused great interest in research. Things is based on a large number of sensor nodes deployed throughout the sensor network and to perceive the objective world. (2) radio frequency identification technology, which is a non-contact automatic identification technology at the time the information Bian set (Celandroni, 2013). The radio frequency signal and its transmission performance, automatic identification of stationary or moving the object to obtain its associated value, to obtain information on the RFID tag. (3) smart technology, a variety of methods in order to achieve some of the intended purpose and use (Paek and Hackmann, 2014). Things goal is intelligent objects, and objects interact or dialogue between objects and objects. Current smart technology, embedded technology, intelligent systems mounted inside the object, the object and purpose of the user's communication. (4) nano-technology, mainly used in a variety of micro-sensing device design, the application of this technology can be used to meet the networking between the small volume of the object (Srbinovska, 2015).

Wireless sensor network consists of a large number of ubiquitous, tiny sensor nodes with communication and computation-intensive layout capabilities can customize according to the environment to complete the assigned task of autonomous intelligent control network system in the monitored area unattended constituted (Yu, 2013). Mutual cooperation between the surrounding environment sensing node, the collected data to a specific application, the same can also be monitored with the operation of the sensor node, enabling the computer communicate with the real world physical world. Wireless sensor networks and traditional wireless networks (such as WLAN and cellular mobile telephone network) has a different design goals, which is highly mobile in the environment by optimizing the utilization of routing and resource management strategies to

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maximize the bandwidth to provide users with a certain quality of service assurance in a wireless sensor network, in addition to a few nodes need to be moved outside, most of the nodes are static, because they usually run on poor people inaccessible and even dangerous, remote environment, energy cannot be replaced, effective design strategy to extend the life cycle of a core network of wireless sensor networks (Somov and Xu, 2014).

In the present study the environmental monitoring system, based on the embedded development is the main research directions. This article is designed and implemented in the environment for real-time monitoring of temperature and humidity system, which not only can choose wired or wireless data collection on the next bit machine, and can display real-time data on display on the lower-bit machine and PC computer screen. Between the lower computer and the host computer using standard communication protocols, data transfer can be achieved in various ways, and the way to ensure that the use of check data transmission link reliability. This system not only real-time collection of temperature and humidity values of the sampling points, and be able to quickly process the data showed that while stored for future comparative study. Based on system function expansion needs, the paper uses a modular design approach, if there is a change on the functional requirements, only need to change small convenience can be achieved. This design is based on embedded environment monitoring system can be widely used in medicine warehouses, food industry, greenhouses and fields and archives and other places have certain requirements on the environment, not only for production and daily life, life, records management etc. to provide protection, while improving the level of environmental monitoring information management system, reducing the waste of manpower, improve the efficiency of monitoring and management.

2. The basic architecture of things

2.1 Architecture of wireless sensor network

Wireless sensor networks, the nodes can be common sense and simple data storage, processing, and can be single or multi-hop relay hop manner own perception data, and other data transmission nodes to transmit to the Sink node (Lazarescu, 2014). And sink node with strong data processing, storage and forwarding capabilities through sink node, wireless sensor networks can monitor data across the network to the upper network, as the basis for the application of decisions. Figure 1 showed generally described wireless sensor network architecture.

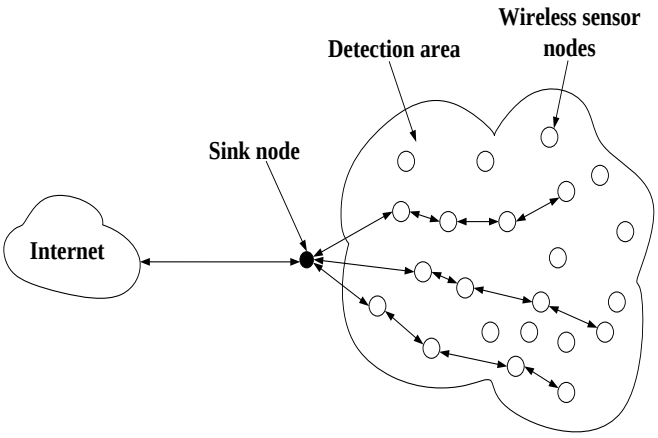

Figure 1: Architecture of wireless sensor network

Node energy is limited. In wireless sensor networks, sensor nodes generally use limited energy miniature batteries provide energy, because the volume of nodes is very small, portable energy is limited, and is usually arranged in even poor people cannot be close to the dangerous environment, energy cannot be added . Although in theory, starting from hardware to improve the performance of the battery, however, the present case, the battery also has improved very difficult. Therefore, efficient and balanced use of energy to extend the life of wireless sensor networks is a major issue to be considered. Wireless sensor nodes consume energy module generally includes a sensor module, a processor module, and communication module (Leccese and Alamri, 2013).

2.2 Sensor configuration optimization for networking applications

Due to historical reasons, different departments will be in the same area for different application needs repeating several times various sensors deployed. Thus, in the background of things, wireless sensor networking applications in different networks as a shared resource, which will be a huge number of wireless sensor nodes in order to fully and effectively utilize these sensor nodes need to be clear when the object-oriented networking applications, wireless sensor networks with which the new requirements:

(1) It is no longer a one to one relationship between object data service in wireless sensor networks and data. Here, the target data is referring to things networking application. For application of wireless sensor networks based on data provided by a plurality of sensor network applications will be shared;

(2) Things applications may be simultaneously designed with concurrency, it may be the turn with concurrency. Thus, when the end of the run some applications, there may be other applications continue to use the wireless sensor networks;

(3) Different sensor nodes will be the use of different applications, some of the sensor nodes shared by different applications, but some applications and some sensor nodes are exclusive;

(4) Networking applications running time is inconsistent, some applications require sensor nodes work year round, but some applications require only temporary use of sensor nodes for monitoring.

Figure 2 shows the data collection framework for the entire object-oriented networking applications. The framework is designed to use the wireless sensor networks has a good layout, configure optimized so that it can effectively provide long-term data collection services for the system of things in a variety of applications.

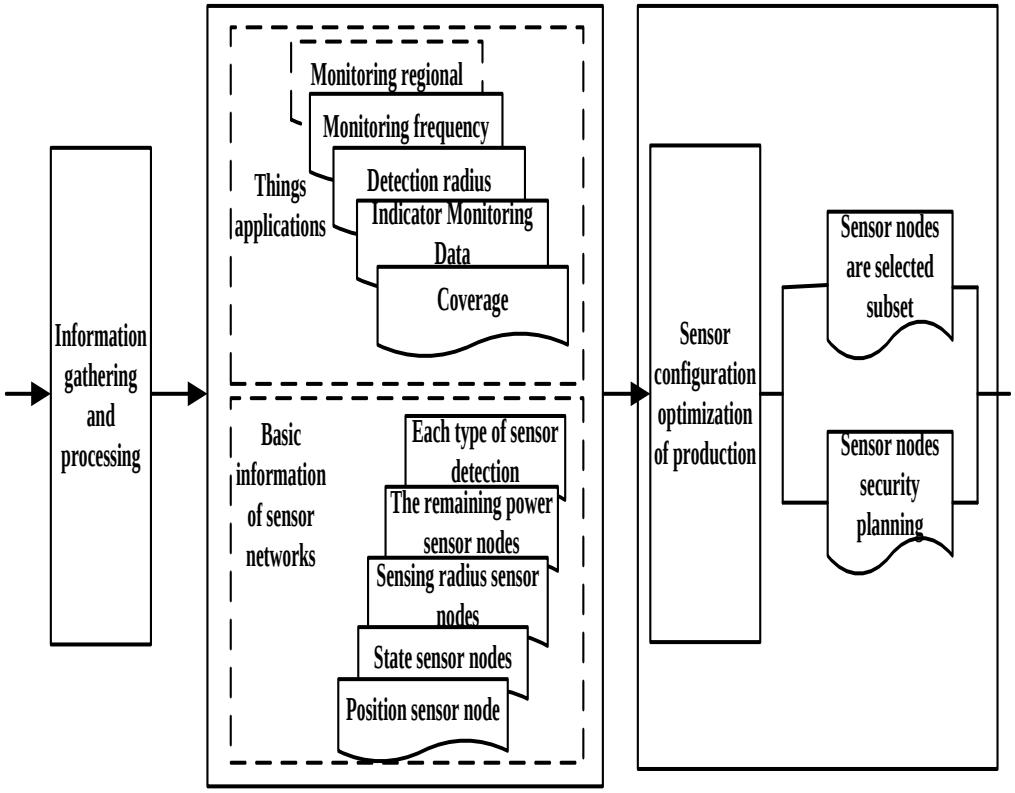

Figure 2: Object-oriented data networking applications set the framework

3. Experiments and results

3.1 Modbus protocol transmission mode measurement units, numbers

MODBUS agreement RTU and ASCII transmission mode has two kinds. Both models have their own characteristics, RTU data transmission to binary form, and can support a large amount of data communication; and transmission of data in the form of ASCII text format, RTU Compared to a relatively small amount of data transferred. Taking into account the data format and speed of the system needs to be transmitted, so the use of RTU mode. The system determines the transfer mode after a good fit, not only to determine the communication parameters for each port, but also to ensure that the system of communication and

transmission mode parameters of each controller are the same, this is an important prerequisite for the construction of the system, but also the normal inter-controller communication only guarantee.
In the function field, the function code byte space occupied by a specific scope decimal representation of 1 to 255. In the MODBUS protocol function code can be divided into public, customize and set aside three forms embodied. The first function codes apply to all devices in the network, has been verified through the relevant agencies, it has a unique system of nature. The second function code for the user's needs and develop more, the user can define according to their function code specifically for certain types of devices. The third has not yet been developed for future use. Conventional CRC generator polynomial g (x) is divided into the following categories:

$$\text{CRC-CCITT}: g(x) = x^{16} + x^{12} + x^5 + 1; \tag{1}$$

$$\text{CRC-16}: g(x) = x^{16} + x^{15} + x^2 + 1; \tag{2}$$

$$\text{CRC-12}: g(x) = x^{12} + x^{11} + x^3 + x^2 + x + 1; \tag{3}$$

For the (n, k) linear block code, cyclic code generator matrix G can be generated by the generator polynomial g (x), as shown in Equation 4:

$$G(x) = \begin{bmatrix} x^{k-1}g(x) \\ x^{k-2}g(x) \\ \vdots \\ xg(x) \\ g(x) \end{bmatrix} \tag{4}$$

If no error occurs during transmission, i.e., the codeword A and B are identical:

$$S = B * H^T = A * H^T = 0 \tag{5}$$

3.2 Architecture of embedded environmental monitoring system

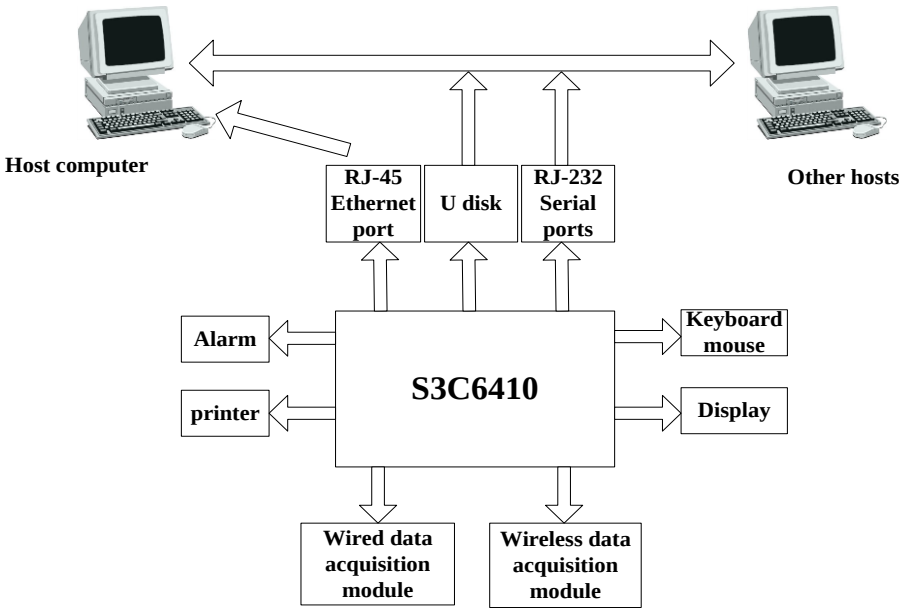

Figure 3: Embedded system architecture Based on environmental monitoring system

Figure 3 is an embedded system architecture based on environmental monitoring system. This selection of Samsung S3C6410 was an embedded microprocessor chip. Frequency of stable work in 667MHz / 533MHz, the enhanced exception handling and interrupt enable real-time processing tasks more quickly, to meet the system requirements for functionality, integrated USB port, serial port, Ethernet, Audio, LCD, touch screen and other features. Furthermore, since the system also integrates SD and MMC interface, you can extend the content of the memory card.

Here Select (15,11,1) code word simulation results shown in Figure 4, the abscissa represents the signal to noise ratio, and the ordinate represents the bit error rate. Simulation results show that the codeword SNR is 8dB, the bit error rate has reached 10-4, which is a code word error correction coding to reflect the very good performance, compared to uncoded codeword information through the same channel surroundings.

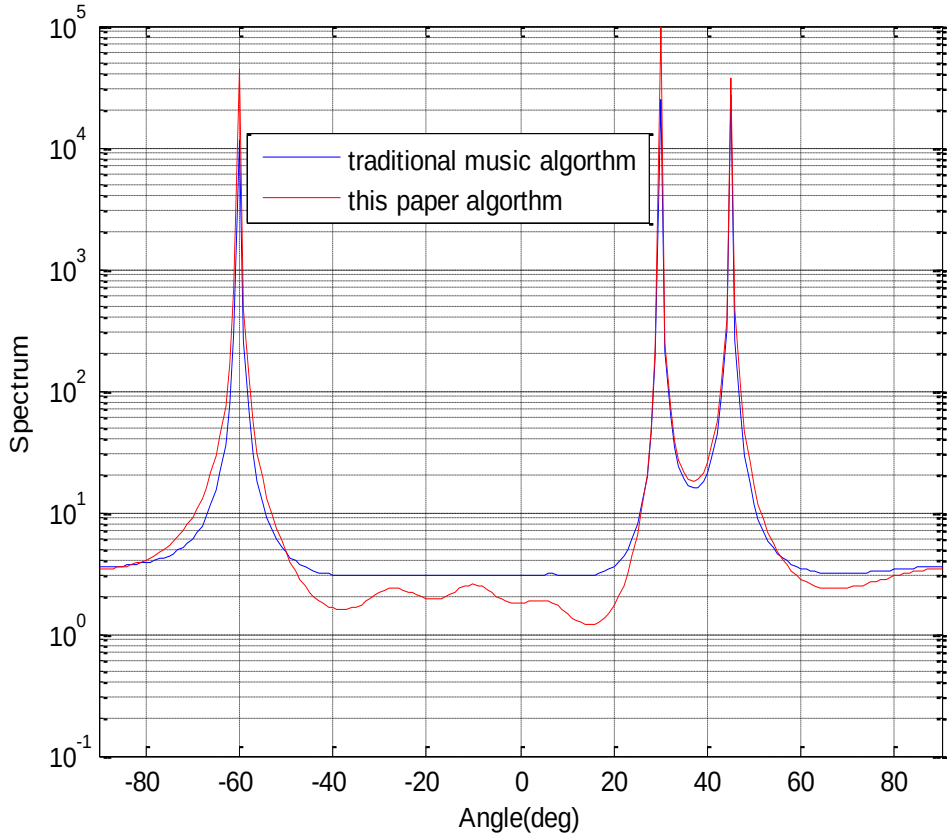

Figure 4: Simulation results

4. Conclusions

This article is designed and implemented in the environment for real-time monitoring of temperature and humidity system. Between the lower computer and the host computer using standard communication protocols, data transfer can be achieved in various ways, and the way to ensure that the use of check data transmission link reliability. This system not only real-time collection of temperature and humidity values of the sampling points, and be able to quickly process the data showed that while stored for future comparative study. The paper uses a modular design approach, if there is a change on the functional requirements, only need to change small convenience can be achieved. This design is based on embedded environment monitoring system can be widely used in medicine warehouses, food industry, greenhouses and fields and archives and other places have certain requirements on the environment, not only for production and daily life, life, records management.

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