Design of Remote data acquisition system based on Internet of Things

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Abstract. Aiming at the current situation of remote data monitoring, the study uses the sensor network to realize automation of remote data monitoring. This monitoring system is developed by Internet of Things technology, software technology, network evaluation technology and so on. The system has the characteristics of data real-time processing, visualization, and alarm on abnormal occasion, and has the ability to monitor data remotely and automatically.

Keywords: Internet of Things; Linux; system assessment

1   Introduction

In recent years, with the rapid development of wireless communication, integrated circuit, embedded computing and MEMS (Micro-Electro-Mechanical system) technology. Micro wireless sensor began to appear in the world which has the sense ability, computation and communication capabilities. The sensor has the low cost, low power consumption, multiple functions and so on. The Sensor network is composed of these tiny sensor nodes, so it can easily have real time monitoring, sensing and collecting a variety of environmental or monitoring information, dealing with these data to obtain detailed and accurate information, transmitted the information to the users who need it.

China is a vast country, compared with other countries ,China is still in the initial stage in data monitoring .The monitoring data are mostly manual samplings, sample analysis is performed by Using a handheld portable monitor, or in laboratory. This way of working is unable to monitor in real time, to sample in high frequency. To reflect the continuous change of parameters dynamically.

China also has established its own on-line monitoring system. This system uses the single-chip microcomputer as the host machine, uses the monitoring instrument as the lower position machine, the system monitors the specific data on line through the RS232 serial communication. But the data monitored by this kind of system is not precise. With the increase of monitoring point, the communication cost will be too expensive to bear.

The study is to set up a remote data acquisition system which based on Internet of Things technology, software technology, network evaluation technology and so on. In this system, sensors as terminal test nodes , the Internet of things technology as the

communication platform, Linux system as the software platform, This kind of construction realized the real-time remote monitoring in large-scale area .

2   Data Acquisition system model based on Internet of Things

In this study, the sensor is used as the terminal test node, the technology of the Internet of things is used to communicate, and Linux system is used as the software platform. Different sensors are used to the different system for different purposes.

2.1. The construction of the hardware monitoring platform

The hardware structure of this data monitoring system mainly includes three parts: the terminal node, the gateway routing node (center gateway, border gateway), remote central monitoring node. Each node performs different functions. The terminal nodes of remote data monitoring system are improved on the performance of power management, network routing algorithm, network communication protocol and the center monitoring software system, so in the course of construction we should take these factors into account and use the hardware and software which can meet its requirements. The actual hardware topology is shown in Figure 1
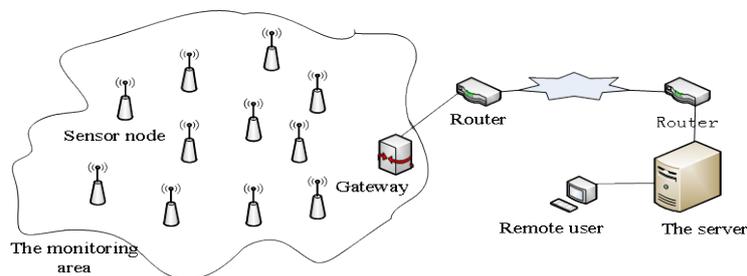

Fig. 1 The hardware topology

In the remote data monitoring system based on Sensor Networks, you can choose different sensors for detecting various parameters. The terminal nodes can transform the data parameter into data modulated signal through the sensor, then modulates the radio frequency signal and generates a modulated signal, and then the modulated signal is sent to the gateway node through the terminal node of the antenna for data fusion and aggregation.

Each node of monitoring terminal includes data acquisition module (various types of sensors), data processing and control module (microprocessor, memory), communication module (wireless transceiver) and power supply module. In the design it is very necessary to consider these factors(e.g. node efficiency ,node reliability, economic cost and so on) , the terminal node can be adjusted according to the need, the work required is only adding terminal nodes of different data parameter test.

In addition to self-organized characteristics, the gateway node is responsible for information analysis and processing firstly, and stores the processed data to the

embedded database for the query. The gateway node is usually limited in number, generally the power requirements are not strict, can use a variety of means of communication with other nodes of the network (such as Internet, satellite or mobile communication network). In the monitoring data system of the internet of things , star type topology design is adopted.

The remote central monitoring node is the management center of the whole system, collecting and processing the data parameters of each region, and put forward different reasonable suggestions according to the results of the analysis, complete data storage and processing, data visualization, the management of the Internet of things. The hardware is mainly the large-scale disk array and high performance workstation server.

2.2. Software system integration and design

For the convenience of the different module interface, the overall software design shall adopt consistent, modular design. Because the Linux system is matured and stable, open source code, and particular has its unique advantages in the aspect of network communication. So all the node platforms for Development and application use the Linux operating system. In the data acquisition system, the management function is more complex, tasks and monitoring parameters are variety. So must set aside software interfaces for other parameter testing software in the future. The terminal nodes due to its energy saving aspects, can use the minimum embedded Linux operating system after cutting, the gateway node use the common embedded Linux operating system , while the center node using the complete Linux system. This software platform architecture ensures the software, consistency of the whole system, in order to facilitate the future security and maintenance.

Terminal node hardware platform mainly includes the core controller, I/O interface, memory module and RF transceiver module. Its hardware structure determines the terminal node with minimum embedded Linux operating system after cutting, must use the revised protocol stack to realize message fragmentation and reassembly, header compression ，address auto configuration, multicast and security. Protocol stack data frame format conforms to IEEE802.15.4, the data parameter testing protocol frame format is shown in Figure 2.The MAC load part includes control information of the upper layer protocol frame and data parameters, sensor node number and other information.
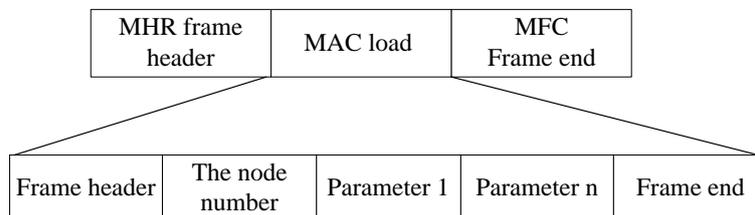
MHR frame header	MAC load	MFC Frame end

Frame header	The node number	Parameter 1	Parameter n	Frame end

Fig. 2 The testing protocol frame format

As the terminal nodes, the software design of energy saving is an important consideration. The terminal nodes use the working mode based on threshold: when the monitoring data size is below the threshold, not to send; when the monitoring data size is between a reporting threshold and alarm threshold, circularly report the real-time data in longer time ; when the monitoring data size exceeds the alarm threshold; circularly report the real-time data in shorter time. The working mode not only ensure reliable access to critical real-time data, but also reduce the energy consumption by frequently sending useless data.

The software system platform of monitoring center is Linux system, the database is ORACLE large relationship database .The document processing module can realize the data storage, retrieval and printing function, can also save the application work environment parameters, in order to comprehensively cope with later data.The system configuration module can realize the hardware and software configuration of the entire data acquisition system, including the detection of hardware when the application starts , the software and hardware initialization environment after the hardware detection.

The analysis and processing module is the core module of the monitoring center, mainly includes the analysis of monitoring data, classification, comparison, model building, data normalization, data curve plotting and display. g and evaluation to the terminal node, sampling data parameter accuracy and reliability assessment and the whole network communication quality and the network life cycle. Only the whole network to achieve the expected target of design, the data parameters of testing system, is true and reliable, can be used in actual engineering.

3   Conclusion

data acquisition system based on Internet of things technology is flexible networking, physical limitations of loose, Can easily realize the data parameter test network, In this project can be very convenient to achieve to the water temperature, PH value, dissolved oxygen, water level and other parameters of the test, You can also easily monitor online and real-time data of the test area by adding a terminal point on the network without changing the overall structure of the system. Through the aviation network, the construction of Internet of things can be made in some inaccessible region, thus remote monitoring data.This point for disaster monitoring, especially plays an important role.

References

1. Chakrabarti D, Maitra S, Roy B. A Key Pre-distribution Scheme for Wireless Sensor Networks: Merging Blocks in Combinatorial Design. Journal of Information Security, 2006, 5(2):105-114.
2. Kawadia V, Kumar PR. Principles and Protocols for Power control in Ad Hoc networks. IEEE Journal on Selected Areas in Communications 2005，23(1):76-88.

3. Heinzelman WR, Chandrakasan A, Balakrislman H. Energy-efficient communication protocol for wireless micro sensor networks. System Sciences，2000 Proceedings of the 33rd Annual Hawaii International Conference on. Maui, USA, IEEE, Los Alamitos, CA, USA,2000, 3005-3014.

4. O Y, S F.HEED:A Hybrid，Energy-Efficient, Distributed Clustering Approach for Ad HocSensor Networks. IEEE Transactions on Mobile Computing.2004,3(4):366-379.

5. K S, W M, J E. Scalable self-assembly for Ad hoc wireless sensor networks. IEEE Transactions on Mobile Computing.2004,3(4):317-331.