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Design of a Remote Health Monitoring System Based on Wireless Sensor Networks

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Abstract. A multi physiological parameter acquisition system is designed through the research of telemedicine application and wireless communication technology in this paper. The sensors installed on the ZigBee terminal nodes collect the physiological parameters of the human body without delay and transmit information to the sensor gateway; the gateway sends the collected information to the system server and eventually displays the results in real time. When the physical condition of the monitored person has problems, the system starts the alarm display. Experiments show that the effect is good.

Introduction

Many people are in a state of sub health, and more attention should be paid to whether the body is healthy or not. Many elderly people decline in body function. If the physiological parameters can be monitored in real time, it can reduce common diseases such as high blood pressure and low blood pressure. The portable physiological parameter monitoring device can help people solve the problems mentioned above. The device monitors the physiological parameters including pulse rate, blood oxygen, body temperature and so on. Once the problem occurs, the device can be informed in time and the corresponding rescue measures are taken. In addition, in the hospital medical care, the establishment of a real-time multi parameter monitoring system is also very useful for the patients. Such a monitoring system can improve the efficiency of guardianship and reduce the workload of nurses and doctors [1].

The system consists of the following parts: sensor node, wireless gateway, remote monitoring center and guardian. The guardians carry portable medical parameter detection device or sensor nodes for real-time detection of physiological parameters. Through the wireless sensor network to achieve communication between nodes, these data are sent to the wireless sensor gateway. The wireless sensor gateway sends physiological parameter data to the remote system server through Internet. Experts carry out remote diagnostics and send care programs to users [2].

Experiments have proved that the system has the advantages of low cost, low power consumption, strong stability and easy expansion. It can be widely used in home monitoring, and build a remote medical monitoring system for families and communities.

Overall Design of the System

The system is composed of wireless sensor LAN and an external Internet network that is accessed. Wireless sensor network belongs to the perception layer of the Internet of things, which is based on the IEEE 802. 15. 4 protocol of PHY layer and MAC layer. The network consists of temperature sensors, blood oxygen sensors, pulse rate sensors and gateways [3].

The sense layer data is collected at the gateway, and the gateway is connected to the system server through the network port. They communicate with each other through the TCP/IP protocol. The system server is accessing the external Internet network. The user terminal uses the TCP/IP protocol to access the server information, and when the abnormal information occurs, the system gateway sends control information to the caretaker.

The data collected by the perception layer is converged on the wireless sensor gateway, and the gateway connects the system server through the network port and connects with each other through the TCP/IP protocol. The system server is allowed to access to the external Internet network. The user terminal can access the server also. When abnormal information occurs, the system gateway sends control information to the police.

Wireless Sensor Nodes

Wireless sensor nodes are responsible for collecting physiological information, data aggregation and transmission. Wireless communication between nodes adopts ZigBee technology based on the IEEE 802. 15. 4. The communication between the wireless sensor nodes and the upper layer network is realized through the gateway [4].

Sensor Gateway

Sensor gateway is the core part of the system. The gateway communicates with the wireless sensor nodes through the serial port and communicates with the network layer through the TCP/IP to realize the transmission and aggregation of physiological information. The gateway is responsible for data collection and data exchange with the server.

Network Database and Web Server

The system server implements network database and Web server, realizes remote data processing and storage, and provides service to application layer through Web server. Users and health care providers can use PC and other terminal devices to access user data with a browser.

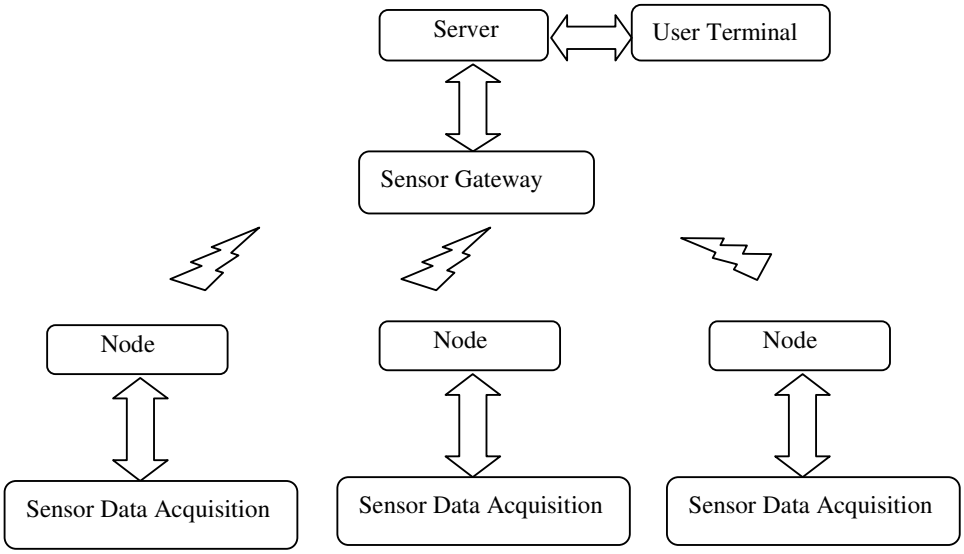

Figure 1. Overall structure diagram of the system.

Design of Node

The function of sensor nodes in ZigBee system is to join the gateway (Coordinator) to establish the wireless communication network, to achieve communication with the gateway or other nodes, and to upload the data collected by the sensor. This design uses TI Company's CC2530 as the node controller. In this paper the scalable multi-sensor integrated node consists temperature and humidity sensor module, wireless transmitting and receiving module, pulse rate acquisition module, blood oxygen acquisition module and power module. In this paper, scalable multi sensor integrated node includes temperature and humidity sensor module, wireless transmitting and receiving module, pulse

rate sensor module, blood oxygen sensor module and power module. It can control LED lights and buzzer according to the data acquisition.

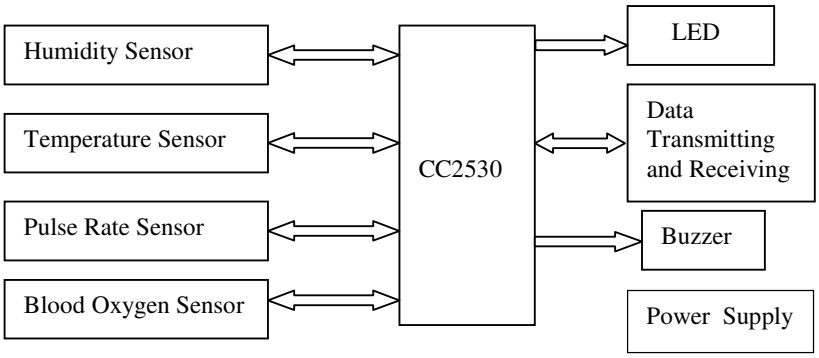

Figure 2. Sensor node structure.

Design of Wireless Sensor Gateway

Wireless sensor gateway, including processor, Ethernet interface, USB port, RF module and so on, realizes the connection of wireless sensor network and Internet.

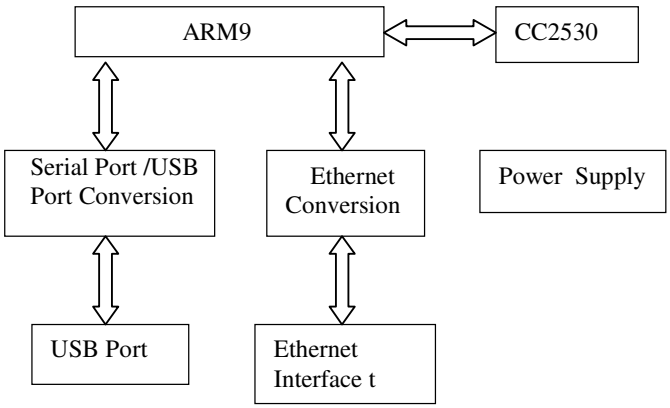

Figure 3. Structure of wireless sensor gateway.

In this design, the CC2530 module, as the RF transceiver module, is responsible for receiving information from other network nodes, and the control information of the server is also transmitted to other nodes via this RF module.

As the master processor, the ARM9 chip processes the information arriving at the gateway. The processed information will reach the Ethernet port via Ethernet conversion chips. Following the TCP/IP protocol, the data will be uploaded to the system server. The USB port is used to set the initial IP address for the ARM9 processor and to prepare for the use of the TCP/IP protocol.

Web Server and Network Database

This system uses Socket to communicate between applications in the framework of Windows. NET . This design uses the model of "server-client", in which the server has concurrent access function. In the system, the network port and the router are used as the transmission channel to realize the data transmission. Form applications send and receive data and display in the form, monitor the current network status, and if the network is faulty, catch the exception and report it.

As a local database, the network database on the Web server stores sensing data into its own small database; It provides users with graphical applications, real time data display and query of historical data, and also realizes user registration and user information identification.

Summary

With the combination of sensor technology, wireless sensor network technology and Internet of things technology, a real-time remote monitoring system is designed to acquire the basic characteristics of human life, respiration, pulse, temperature and oxygen in real time. the system mainly includes wireless sensor nodes and wireless sensor gateway. Based on the protocol stack Z-Stack, this system has designed the software platform, mainly including the ZigBee networking, the physiological parameter collection program design, the host computer, the server monitoring interface design and so on.

Test environment is set up in laboratory, more than five people are tested simultaneously each time. Each person is to wear more than one sensor node. Gateways and one server are used. A PC acts as a client terminal. After the system is running, click the node icon at the gateway interface to display the real-time parameters. After many tests, the system runs stably, and the data can be displayed normally when power is switched off and power is switched on again. The parameters are accurate and the accuracy meets the design requirements. The whole system has low power consumption and friendly man-machine interface. Experiments show that the effect is good.

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