Advances in Engineering Research, volume 122

7th International Conference on Applied Science, Engineering and Technology (ICASET 2017)

Design of Monitoring System Software Based on Hadoop Technology

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Abstract: This research is to develop agricultural greenhouse monitoring system based on Internet of Things. Software design includes the program design of the nodes of wireless sensor network and the program design of monitoring terminals. In the whole monitoring system, the wireless sensor network at perceptive interactive layer of Internet of Things is responsible for collecting and transmitting the environment information in greenhouse to the coordinator nodes of network. The monitoring system chooses Hadoop wireless technology and builds Hadoop wireless sensor network as the perceptive part of the whole system. Through system debugging, the system can collect, transmit and display information. Embedded hand-held terminal can send the command of displaying and controlling data.

Keywords: Greenhouse, Hadoop, Monitoring system

Introduction

With the progress of science and technology of our country, agricultural modernization develops rapidly. In the management of agricultural production, the initial computer control develops to be present Internet of Things. More and more agricultural monitoring systems based on Internet of Things have been developed. In our country, the number of agricultural greenhouses is becoming larger and larger. Most agricultural greenhouses are in labor management. As for the greenhouse monitoring system based on computer technology, wiring is in large scale and energy consumption is in large amount[1]. Therefore, management cost is too high. On the basis of researching Internet of Things, an agricultural greenhouse monitoring system is put forward in this paper based on the technology of Internet of Things. The system is designed according to the structure of Internet of Things. Hadoop wireless transmission technology is used to build wireless sensor network and monitor environmental parameters such as temperature, moisture and the concentration of carbon dioxide[2]. The agricultural greenhouse monitoring system based on the technology of Internet of Things is designed according to the work thought of the perception, transmission and application of Internet of Things. Wireless sensor network is mainly responsible for the tasks of perception and transmission. User monitoring terminal is mainly responsible for receiving and displaying data. Finally, on the basis of monitoring data, corresponding equipment can be automatically adjusted and controlled.

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Overall design of software

Software design of the system can be divided into two parts: the monitoring program of monitoring terminal PC and the sensor node program in wireless sensor network. Sensor node program includes node description, node binding and data transmission. The program of coordinator node includes node description, node binding, receipt reception and serial port communication. The monitoring program of monitoring terminal PC is a visible human-computer interaction interface, including the storage, display and retransmission of data monitored. There are two directions of data retransmission. A part of data is sent to the website system of monitoring terminal. In this way, the remote computer on the internet can access website and inspect the environmental parameters of agricultural greenhouse at any time. The other part of data is sent to the embedded equipment as controller to simply control the motor of roller shutter, irrigation equipment, ventilation equipment and lighting equipment. The growth parameters of the crops in greenhouse can be automatically adjusted. As for the environmental parameters of greenhouse, temperature and moisture determine the metabolic rate of crops; the concentration of carbon dioxide and illumination intensity determine the photosynthesis rate of crops.

Introduction of the development environment of Hadoop wireless network

As for the data collection function of wireless sensor network, IAR is used to develop it in this paper. The operation interface is succinct. It is an embedded development platform. C code can be edited on this development platform to make the function development of sensor network become simple. In IAR development environment, the compiler of C language and assembly language is integrated. C language code can be edited and assembly language can be planted into the code. IAR development environment integrates many operation interfaces, such as embedded C++ compiler, debugger, connection positioner[3], simulative debugger and project documents manager. Functions become more complete and operation interface is simple and convenient for use. It is a typical embedded program development platform. On IAR development platform, developers can compile and connect source code and produce executable code through C++ compiler. In many embedded microprocessors, 8051 core is integrated in them. Compiler supports the code of most classical and enhancement-mode 8051 cores. The debugger on IAR platform can achieve the breakpoint debugging, single-step debugging and continuous debugging of code. In debugging process, the work status of registers can be simulated. These characteristics can make it convenient for developers to find the errors in program in short time.

In the process of developing Hadoop protocol stack, IAR development platform supports the delamination development of protocol stack system. Users can conveniently build user program and achieve the function of user definition through API development. IAR development platform can use JTAG emulator to burn binary files into development board. The binary files are output after source code is compiled. The file manager in IAR can achieve the program segmentation of different nodes of wireless sensor network. Program code can be commonly used to decrease storage of development files and make source code simple and efficient. IAR development platform can not only edit, debug, optimize, execute and output code but also achieve online programming of JTAG emulator with high-efficiency development. The files needed in development can be overall generated. Based on above

characteristics, IAR development platform can be well suitable for the function development of Hadoop protocol stack.

Software design for the node equipment of network

Terminal node is the terminal equipment of network. It mainly completes corresponding information collection task. In this monitoring system, corresponding sensor module is integrated and mainly responsible for collecting and transmitting the environmental information of greenhouse. Its main work procedures: power on, initialize, search the internet, request to join network, join the network and upload information to the network. The work procedures of terminal node are shown in Fig.1.

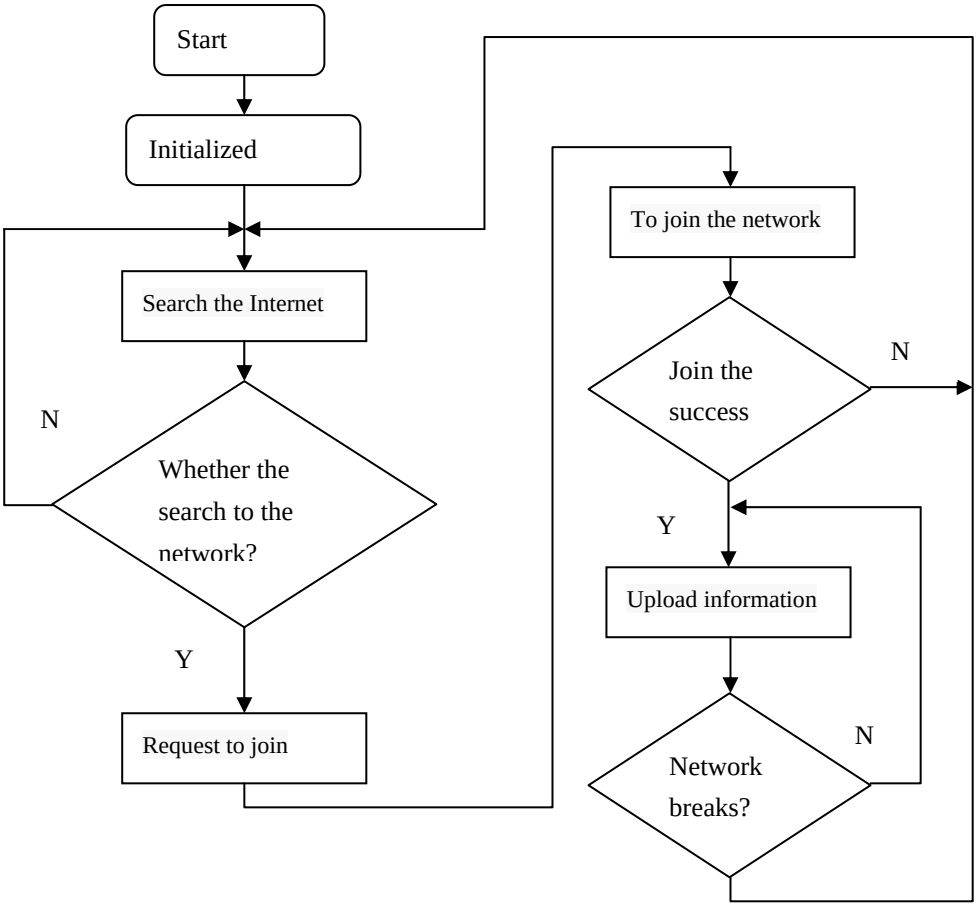

Fig.1 Program flow chart of terminal nodes

The node equipment of wireless sensor network in monitoring system uses Hadoop protocol stack system to build network and manage network. Protocol stack Z-Stack is mainly used. Z-Stack is a small system built specially for Hadoop networking and based on real-time operation and task polling mechanism. It can be also regarded as a large program. Z-Stack-V1.3.2 is chosen in this paper. Its components mainly include hardware abstraction layer, MAC layer, monitoring test, abstraction layer of operating system, service, Z-Stack protocol stack and MAC transplant layer. The contents on hardware abstraction layer mainly indicate the definition of the IC ports of processor. They are relevant to the function definitions of target board. Monitoring test components mainly include monitoring test codes. With these codes, many functions can be achieved, such as debug tracing, AF layer

monitoring test, MAC layer monitoring test, API monitoring test and ZDO monitoring test. The design of network nodes mainly includes the design of terminal node, router node and coordinator node.

Program design for temperature sensor

While measuring environmental parameters, temperature sensor and moisture sensor can be used. Different environment in soil can bring different data perturbation to the measurement of sensor. Temperature sensor DSl8B20 is integrated in node. It is a digital temperature sensor which can be operated simply, including three pins: a power pin, a data pin and a control pin. Its main control commands are temperature transformation, transient memory reading, transient memory writing and transient memory copying[4]. The work process is in the following:

(1)Start temperature sensor and write command data 44H; start outputting temperature data.

(2)Read 9-bit binary data in transient memory; achieve it through writing data BEH into reading transient memory.

(3)Data 4EH in a register is written into registers TH and TL.

(4)CPU gets the signal of power supply and sets the working mode of power source.

Temperature is mainly used to measure the temperature in greenhouse. Temperature collection cycle can be set to be 0.5 second. Processor reads the data collected by the sensor and processes it. DSl8820 is a digital sensor. Therefore, there is no need to transform analog signals to be digital signals or transform digital signals to be analog signals. With corresponding data pin, the node equipment of sensor can directly read data.

Program design for monitoring terminal

In the monitoring system of Internet of Things, the data monitored will be finally transmitted to application terminal to achieve the actual functions of the application layer of Internet of Things. Therefore, application terminal has important functions in monitoring system.

In the monitoring terminal system based on the technology of Internet of Things, monitoring terminal is mainly responsible for displaying and retransmitting information. In this design, two types of monitoring terminal design are involved. Therefore, corresponding monitoring terminal program design includes two parts: one part is the program design for the PC monitoring terminal in monitoring room; the other part is the program design for embedded hand-held monitoring terminal which is conveniently portable for the workers in agricultural greenhouse. Serial communication is used in both designs to complete the information transmission between coordinator and PC and the information transmission between coordinator and the main controller LPC2103 on hand-held monitoring terminal.

Conclusion

In the paper of researching Internet of Things, an agricultural greenhouse monitoring system is put forward in this paper based on the technology of Internet of Things. The system is designed according to the structure of Internet of Things. Hadoop wireless transmission technology is used to build wireless sensor network and monitor environmental parameters such as temperature, moisture and the concentration of carbon dioxide. The agricultural

greenhouse monitoring system based on the technology of Internet of Things is designed according to the work thought of the perception, transmission and application of Internet of Things. Wireless sensor network is mainly responsible for the tasks of perception and transmission. User monitoring terminal is mainly responsible for receiving and displaying data. Finally, on the basis of monitoring data, corresponding equipment can be automatically adjusted and controlled.

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