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Design of Artificial Intelligence Wireless Data Acquisition Platform Based on Embedded Operating System

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Abstract: Advances in microprocessor technology, sensor technology and wireless communication technology have promoted the generation and development of wireless data acquisition systems. The wireless data acquisition system is an ad hoc network system formed by a large number of sensor nodes through wireless communication. Data acquisition is an important means for people to obtain external information. It is an indispensable and important link for preparing a measurement and control system. With the advent of the network era, the traditional data acquisition method has been unable to meet the new production requirements. Based on the embedded operating system, the design of the artificial intelligence wireless data acquisition platform focuses on the characteristics of high compatibility and flexible interface. This paper presents an artificial intelligence wireless data acquisition platform based on embedded operating system. Through this platform, wireless data acquisition and USB interface transmission can be carried out to realize centralized monitoring and management.

Keywords: Wireless communication, data collection, embedded operating system, artificial intelligence.

Introduction

With the rapid development of microelectronic technology and the arrival of the post-PC era, the number of embedded computer systems has far exceeded all kinds of general-purpose computers. Various embedded devices are changing people's daily life in different forms, and at the same time greatly promoting the development of automation and informatization in industry and other fields. In order to be able to feed back the product information in time, people need such a system to realize concise, efficient and real-time data collection and analysis [1]. The traditional data acquisition system has the disadvantages of low efficiency, large error and difficulty in inputting data into the computer, etc. In addition, most of these methods originally used

wired network and other communication methods, and their inherent defects greatly limited their use occasions [2]. Traditional data acquisition and transmission systems mostly use single chip microcomputer as the core. Although the implementation is simple and the cost is low, the wired data transmission mode greatly limits its application occasions and cannot be applied to some scattered and unattended sites. It is necessary to collect the data regularly so as to know the site situation in time [3]. The data acquisition system is a system for real-time acquisition, detection, processing and control of various analog signals generated in the fields of data analysis systems, instrument detection, industrial real-time control, and medical devices.

In the past few years, the CPU has become a low-cost device, and various industrial controls, network equipment, communication equipment, information appliance systems, home medical equipment, and electromechanical equipment have been or are embedded in CPU chips, thus forming an embedded system [4]. Before the special computer system has matured, most data acquisition systems use a PC to connect all sensors and actuators, and the control decisions in the system are done by the PC [5]. If a wired transmission method is adopted, it is technically and economically undesirable, and wireless transmission is required for long-distance data transmission. Commonly used data acquisition terminals must transfer data to the computer through keyboard emulation or communication ports, and cannot be used offline. The wireless data collection terminal can make up for the shortcomings of the online data collection terminal, and has good mobility, mobility and flexibility [6]. As the application conditions of the data acquisition system become more and more complex, the data acquisition system based on the single-chip computer gradually fails to meet the needs in terms of function, user interface, operation speed and accuracy [7]. The artificial intelligence wireless data collection platform based on the embedded operating system is designed to reflect the characteristics of high compatibility and flexible interface, with multiple data collection methods, high speed and large storage capacity.

Overall structure design of the system

Embedded system refers to an independent system composed of embedded microprocessor, which has its own operating system and specific functions, is used in specific occasions, and has strict requirements on reliability, cost, volume and power consumption. Due to the huge amount of data brought by human activities, wireless sensor networks will face many security risks in the process of collecting, storing and using these huge amounts of data [8]. As a server, the monitoring center can simultaneously receive data from a plurality of acquisition terminals distributed at far geographical locations, and control and manage all the acquisition terminals.

The data removed by the data preprocessing module should be error data caused by some unpredictable factors, such as error information caused by external interference during data collection or transmission. Data transmission is carried out between the health data acquisition equipment

and the data receiving module through an interface. The data format is shown in Table 1.

Table 1. Data format

Name	Length
Starting mark	2
Data length	4
command word	3
Data section	12
Termination code	3

The monitoring center is a computer running monitoring software. The monitoring software has the functions of displaying data of each terminal, processing and analyzing data, generating alarm signals, and controlling the operation of the monitoring terminal. The software process is shown in Figure 1.

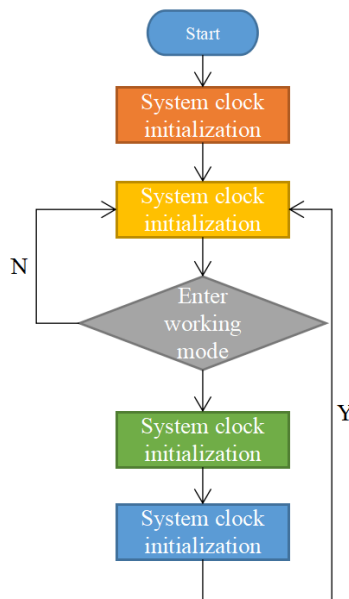


Figure 1. Software flow

The data receiving module is mainly responsible for receiving the data information sent by the health data collection device and storing it in the corresponding user data table. If any errors such as reception errors occur during data reception, corresponding error feedback is sent to the health data collection device to ensure the correctness and integrity of the data reception. There are usually three methods for long-distance communication, low-voltage power line carrier, radio stations, and the use of existing mobile

communication networks. Because of the interference characteristics, impedance changes and signal attenuation of low-voltage power lines, it is difficult to find a clear analytical or digital model to describe, which is the main technical obstacle to the quality of communication. Although the more types of data collection, the better, which makes it easier to analyze energy consumption. However, the increase in the types of data collection will definitely have requirements on the system cost, the power consumption of the system will also increase, and the stability will also decrease. Product design using a combination of high-performance, low-power microprocessors and wireless communication technology will make it have broad application prospects and a long life cycle.

Safety and reliability design of data acquisition system

The data analysis module is the core of the system, which is used to analyze the current health status of users and predict the development trend of users' health status. We first cluster a large number of preprocessed data to form sample data with small data volume, and then calculate the average value of corresponding types of sample data through weighted average algorithm. The acquisition terminal and the monitoring center adopt C/S mode, and the monitoring center serves as a server, passively waiting for the connection of the acquisition terminal, receiving data and sending control commands. As a client, the acquisition terminal actively connects to the server, sends data to the monitoring center through UDP protocol, and receives control commands from the center [9]. Data acquisition and analysis systems have different requirements for data security according to different application occasions. A perfect data acquisition system should have data protection and be able to flexibly cut and expand the system. Before the specific software development, the designer needs to plan which parts of the software functions should be implemented from the macro level, and then select the corresponding solutions according to the actual situation.

The whole wireless data acquisition system is designed with integrated chips. Compared with discrete components, the reliability is improved and the bit error rate is extremely low. The system is divided into sensor module and receiver module. The sensor module comprises an independent power supply part and a triaxial acceleration sensor. Through digital filtering technology and data fusion technology, this first-hand information can be processed quickly and necessary. In order to test it, a small test system is built. The system has two wireless data acquisition cards, one of which continuously sends known data. Data processing and storage preprocesses the collected original data and stores it locally. Any system is not absolutely ideal and reliable. It is necessary to test the reliability and bit error rate of this communication system. As the bit error rate of the system is at a lower level, it is possible to find the bit error phenomenon only by transmitting a large amount of data. For any type of wireless RF transmission chip, its effective transmission distance is a very critical parameter.

Conclusion

With the development of microprocessor, embedded technology has been fully developed and widely used in wireless communication, information appliances and industrial control. Embedded-based data transmission system, supported by fast-developing embedded high-performance processors and increasingly powerful embedded operating systems, combined with increasingly perfect wireless network technology, is gradually developing towards multi-function, multi-task, multi-communication mode and high real-time performance, with broad application prospects. Starting from the extensive application of embedded systems in the industrial field, this paper briefly analyzes the current development situation and the problems that will be faced in the remote transmission of data by wired and wireless methods. The adoption of a completely open source and free embedded artificial intelligence operating system not only greatly improves the plasticity and expansibility of the wireless data acquisition and analysis system, but also is very beneficial to the commercialization of products. Embedded systems are widely used in industrial control field due to their high efficiency, stability, configurability and convenient installation. With the rapid development of wireless network communication technology, more and more information devices begin to adopt wireless communication technology. Wireless communication technology eliminates the need to arrange special cables and connectors between devices in offices, homes and on trips.

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