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The Cloud Terminal Online Monitoring System of UPS Battery Performance based on MSP430 MCU

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Abstract

Aiming at some problems in the process of UPS battery real-time monitoring, on the basis of the cloud terminal technology is proposed in this paper, a new method of remote online monitoring, and based on MSP430 single chip microcomputer, combined with modular guiding ideology, in order to improve the UPS battery remote monitoring automation as the core, through the reasonable design of hardware structure, the implementation of UPS battery on-line real-time monitoring of voltage, current and temperature. At the same time, the system based on ADO database access technology and C++ programming to complete the data management, human-computer interaction, and system control, by the cloud terminal implementation monitoring system data transmission between lower place machine and super-ordination machine. Practice has proved that the technology security and stability, has the very good practical and promotional value.

Keywords: *MSP430 single chip microcomputer; Cloud terminal; Monitor system*

1. Introduction

No matter in power plants, substations, or communications, medical, and other areas of the business, its power supply system with battery as backup power supply. UPS battery pack section contains many batteries, when external electric sudden interruption or voltage instability, as backup power supply, UPS successfully ensure the continuous supply of power system [1].

However, equipped with a UPS system is not once and for all, the reason is that it has yet to reach the scientific monitoring management and automation, existing UPS battery design of remote monitoring system structure is more complex, with low price. As a result, with the popularity of "unattended" regulatory situation, the current system can't fault under the emergency battery well make a timely report to the police, timeliness is low, at the same time, management of UPS battery must be regular maintenance to ensure the normal power supply system performance stability, in the process will waste a lot of manpower and material resources and time. Second, when power failure accident of power system blackout or for long periods (for example: special circumstances power tripping, power grid maintenance and power outages, etc.) for a long time, people can't timely access to information to ensure the UPS system is working correctly.

Therefore, in the study of UPS battery of the remote monitoring system in the process, do not open the power switch, also need not change any circuit, not to mention the main loop of the adjustment in the series of internal, of monomer battery in the battery voltage, current and temperature of the online real-time monitoring, by comparing the performance parameters to realize the battery health degree of judgment, timely find the fault battery, send alarm information, the operator immediately found abnormal battery performance and shall be timely replacement [2-3].

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2. The Overall Scheme Design

With the constant improvement of the application of automation technology, the article through the software and hardware design, combined with "remote" and "remote communication technology" [4-5], build UPS power equipment remote monitoring system. In the aspect of hardware, design battery performance monitoring module; On software, combining with the relevant knowledge database, the design has friendly man-machine interface of upper computer software system, electric system when the abnormal power or power failure for a long time, to be able to take emergency measures to send the alarm information, process the information important and must be saved, the system can automatically save important information and close the system, and provide reference for effectively battery management and use, as shown in Figure 1.

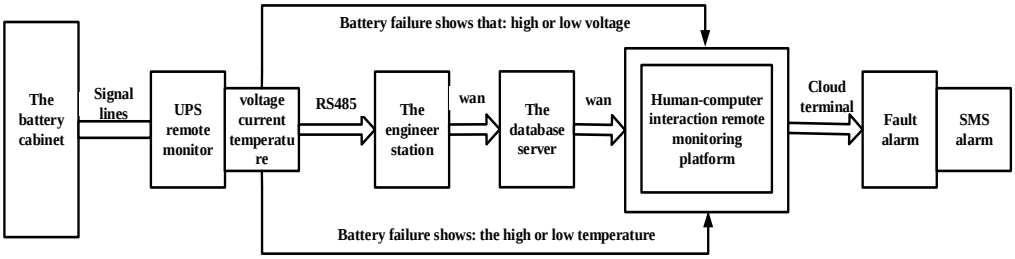

Figure 1. UPS Battery Remote Monitoring System for the Overall Design Diagram

3. Cloud Terminal Design

The so-called "cloud", actually refers to the backend (server), common at ordinary times is "the client", and seldom able to see the end, have a sense of illusory. Cloud terminal is the essence of the network computer: on the one hand, it can be run as a separate PC operation, browse the web; On the other hand it can realize network platform sharing, as a kind of advanced innovation model to broaden the advantages of conventional operating network.

Cloud terminal computer integrated design of software and hardware, and is conducive to maintaining and convenient management. It has a small and no noise interference, power saving, saving green healthy environmental protection low radiation, low failure rate. Focus on using multiple computers can be connect to the server, remote Shared resources, at the lowest cost to build the network, a server can take 60-100 PCs, is a highly integrated computer network, network diagram as shown in Figure 2 [6].

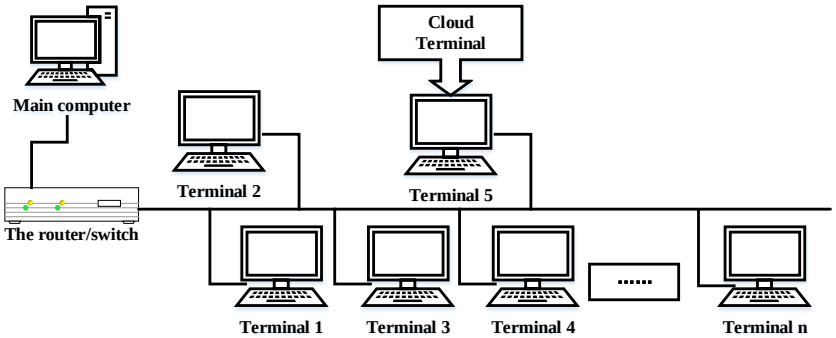

Figure 2. Cloud Terminal Computer Network Structure

4. The Hardware Structure Design

4.1 The Selection of Single Chip Microcomputer

Single chip microcomputer as the master CPU monomer batteries in the battery voltage, current and temperature data signal acquisition, and then through the simulated load control relay connections, and by the method of secondary voltage of battery internal resistance measurement, finally using RS485 communication data real-time upload first place machine. Based on hardware precision and function component costs, combined with the internal structure of main control module, we select MSP430F149 ultra low power microcontroller to realize the function of the main controller [7].

Relative to other micro controller (80C51), its advantage lies in: MSP430 MCU built-in Flash, in this way can save the hardware circuit board wiring space, reduce the power consumption of the system of five times at the same time, and combined with the hardware of MCU assembly language and C language programming, the system of the MSP430 are closely, timeliness is greatly increased.

4.2 Structure Design

UPS battery monitoring system by the more advanced microprocessor and necessary peripheral circuit composition, collect the battery in the current state of the monomer battery parameters: voltage, current and temperature, etc., and the information after processed by RS485 communication transmission.

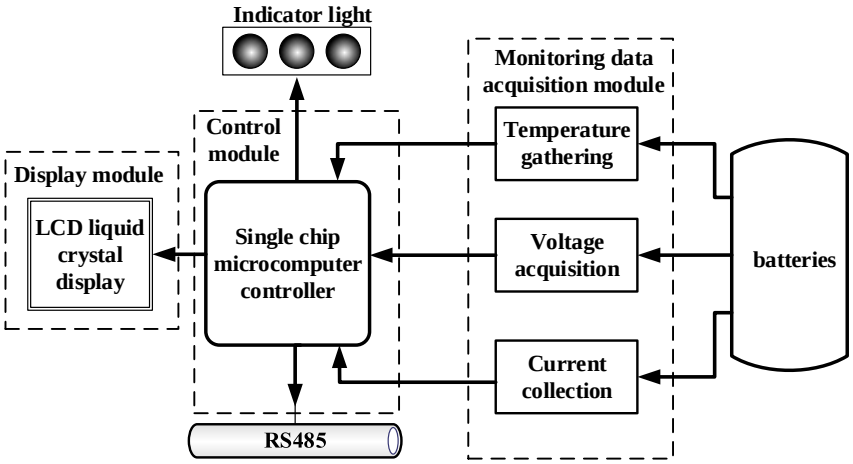

Figure 3. Battery Performance Monitoring Module Hardware Structure Diagram

UPS battery performance monitoring module called lower machine, hardware design was carried out on the lower machine, mainly includes the display module, control module and monitoring data acquisition module three parts, as shown in Figure 3.

4.3 Functional Design

(1)Monitoring data acquisition module, to achieve the isolation of the single cell with other battery, system, high dielectric strength, can guarantee the system safe and reliable. UPS battery inspection data, the built-in CPU work independently, is equipped with a voltage detection circuit, current detection circuit and temperature detection circuits; it has realized the conventional voltage, current and temperature of online real-time measurement.

(2)The control module as the core of UPS battery remote monitoring system hardware design, it adopts MSP430 single chip microcomputer as control chip to realize the

monitoring function of the battery, it can realize the high speed processing analysis of the data at the same time and save the query. Control module receives signals from voltage acquisition module, high-speed electronic switch will quickly read each section of monomer battery voltage, and then input 12 bit A/D chip, modulus conversion, then the output of 430 single chip microcomputer for processing digital signal input analysis, finally displayed on the LCD panel. When the system is in the monitoring process, the battery voltage, current and temperature are for regular inspection, to prompt alarm beyond the threshold voltage of the battery. Control module such as RS232, RS485 or inside of the MODEM communication interface, A multi-channel A/D, D/A, PWM and other I/O interface, can realize to the remote computer data transmission, adjust the parameters and receive instruction, as well as flexible application in related the information data acquisition and control system of dc.

4.4 Communication Module Design

MSP430 MCU interface has two work modes: one is the asynchronous communication mode; the second is synchronous communication mode. Sync signal produced by the baud rate generator to identify the location of the each data, it is the basis of the serial communication. In the design of the circuit in experiment, also need a MAX1480 chip, the chip with a complete photoelectric isolated RS485 communication interface, data and diode, such as switches, photoelectric coupler device assembly in a single dual in 28 pin package, form the final RS485 transceiver. On the basis of half duplex serial communication mode, the logical side MAX1480 working voltage from V_{cc1} to V_{cc5} to 5 v power supply. Here, we build the MSP430 MCU RS485 communication circuit diagram (as shown in figure 4), or gate chip 74 ahc86 V_{cc} to 3.3 V, then the logical side V_{ccl} to V_{cc3} connect 5 V, V_{cc4}, V_{cc5} 3.3 V. Because V_{cc4} and V_{cc5} working voltage is different from MAX1480B, so need to adjust the part of the parameters of the components.

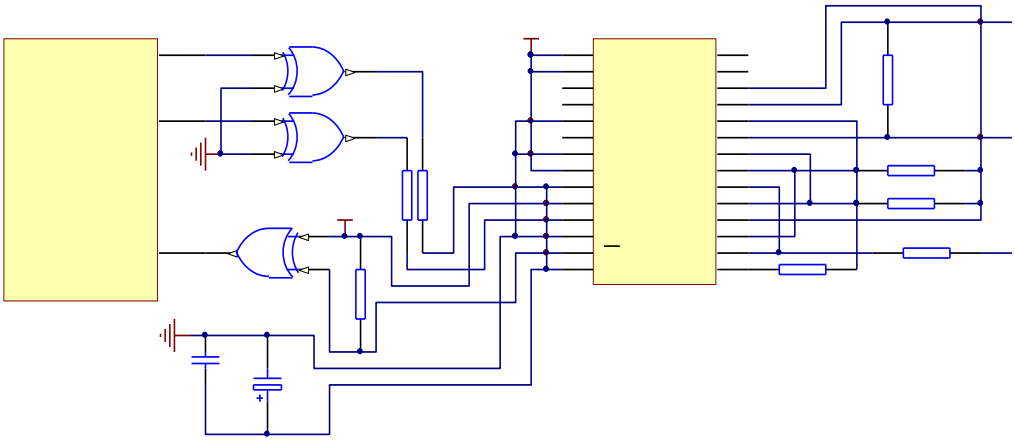

Figure 4. RS485 Communication Circuit based on MSP430

5. The Software Design

PC software design platform to industrial field commonly used C++ as a development language [8]; the design mainly includes the following three aspects: PC software design; each function module and realization; the system interface design.

5.1 PC Software Design

PC by running a database access battery, the battery's running status data statistical analysis, data compression algorithm for data reduction, such as real-time display battery

related parameters and the corresponding curve drawing, the abnormal situation, when the battery has SMS and alarm function . The battery remote monitoring system software design scheme is shown in Figure 5.

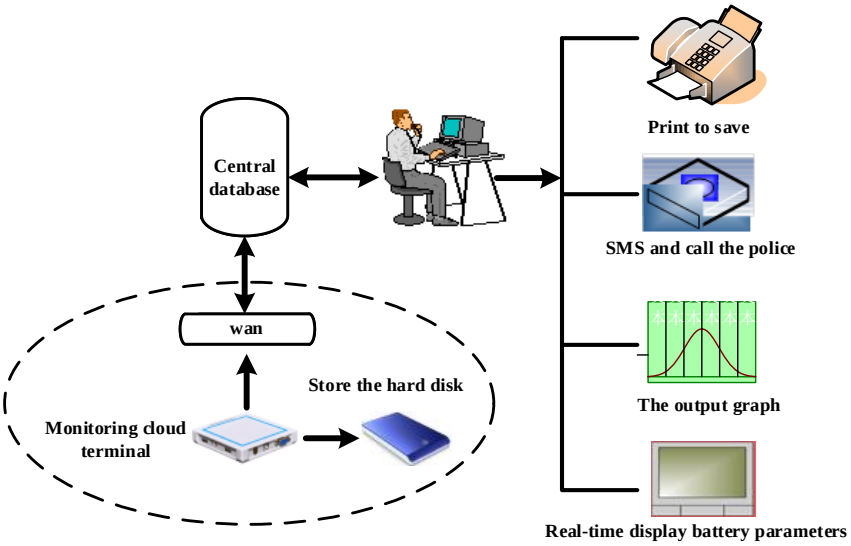

Figure 5. Battery Remote Monitoring System Software Design Scheme

PC software as the important platform for human interaction with the staff, not only the UPS battery remote monitoring and control, management of the entire system, but also has the function of maintenance. In PC software design process, with high efficiency, convenience, intuitive for the principle, realize the remote real-time monitoring, user management, battery performance parameters of the acquisition and processing, fault analysis and alarm display, etc.

5.2 Each Function Module and Realization

(1)The communication module, to achieve the networking of the upper and lower position machine, this scheme USES the TCP/IP protocol. Which contains both LAN transmission, also contain wan communication module.

(2)Data processing: the data statistics and data compression, etc., this paper realize the simplified data processing and battery related parameters curve drawing, better reflect the actual battery.

When monitoring to a terminal sends data, the server begins to read the data packets, according to the TCP/IP communication protocol began to parse the data, and then through the PC monitoring software for data processing a large amount of data compression (data compression algorithm, fault tolerance, etc.), the last in the compressed data to the database.

(3)Abnormal cell abnormal alarm function design battery alarm module is through the design of fault diagnosis model, and through this model to realize real-time data was compared with the control limit, then realize the function of the host alarm and send SMS at the same time. The phone use SMS MODEM when you send text messages.

7. Conclusion

In this paper, based on the technology of cloud terminal UPS battery remote monitoring system, the system guided by the modular thought, reasonable choice of main control module MSP430F149 chip, hardware part mainly discusses the UPS battery remote monitoring system of circuit design and function realization, and using database and C++ programming for landing system main interface, battery real-time information

display interface, the construction of the real time curve and history curve interface, through TCP/IP protocol Ethernet data real-time upload, in the end by the upper machine system and intuitive processing, summary and analysis show that the performance of the single cells in the battery parameters, highlights the characteristics of the system main function, improve the timeliness and consistency of the whole system.

In addition, the system structure has strong expansibility, for example by external monitoring circuit resistance, or uses the CAN communication data network transmission, etc. So, the technology can be widely used in the field of UPS battery group monitoring and open up new situation.

Acknowledgements

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