Research on Embedded Measurement and Control System Based on μC OS – II

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Abstract. In recent years, the function of measurement and control system has become increasingly complicated. The traditional embedded microprocessor has not been able to meet the requirements. In order to meet the application requirements, the embedded operating system suitable for measurement and control system based on μC / OS-II is designed. By modifying the μC / OS-II include files and processor custom files to complete the target microprocessor platform migration; On the basis of transplantation, the common module is added to the measurement and control system, which mainly has data control, filtering, alarm and control algorithm, and the serial communication module and the network function module, Using Modbus and RS485 bus to form a field-level network monitoring and control system, the use of time scheduling to ensure system real-time. The embedded measurement and control system designed in this paper has strong adaptability and expansibility, and can be applied to the increasingly effective measurement and control system.

1. Introduction
With the development of social production, monitoring and control areas continue to expand in depth there are increasingly demanding for the function of equipment. We expect them have a considerable degree of intelligence to CNC precision molding grinding system. For example, people expect to use the machine's intelligence Real-time detection of the state of the grinding wheel and control the entire grinding process. The work piece can be accurately grading and grinding wheel repair, automatic completion of the grinding process and grinding wheel repair. Another example is the intelligent welding machine system, involving many complex state recognition and intelligent control, which require intelligent components to complete the information processing and control.

At present, the field of measurement and control commonly used embedded microprocessors plus traditional front and background console programming development model, has become increasingly unable to meet the complex application requirements of measurement and control system. The embedded operating system is designed to meet the increasingly complex embedded system design. CNC and intelligent control system have Main features: high reliability and real-time requirements, transmission data structure is simple and the amount of data less. In the measurement and control applications, there are certain common in analog acquisition filtering and computing and control algorithms and serial communication and control system networking. Put these common functional designs directly to the operating system, the development of embedded measurement and control system based on the μC / OS-II real-time operating system [1]. The development of an embedded operating system suitable for a particular application area allows application design engineers to
design, and improve efficiency in the project development process without repeating these functions.

In the complex measurement and control system, need to set up a network control system. So use of embedded real-time operating system μC / OS-II, select the 51 series of embedded microprocessors, μC / OS-II is transplanted to the microprocessor hardware platform; for monitoring and control system equipment characteristics and common requirements for the operating system Appropriate cut and function expansion, add application interface to meet the needs of monitoring and control applications, in order to make the design of embedded systems to adapt to the requirements of network control, select the industrial standard Modbus protocol embedded in the system to build intelligent monitoring and control applications for embedded Network control system. Making the control system is fast real-time, low cost, practical and reliable, easy to upgrade and so on.

2. Overview of Embedded System

Embedded system is an application system. It is a unity with hardware and software, hardware platform is the foundation, and software in the embedded system has a more important position. For the NC class, intelligent control system, with the embedded application is becoming more and more complicated; in the embedded system development process using the operating system becomes inevitable.

Embedded microprocessor is the core of the entire embedded system hardware and operating system software running the basic platform. The system chooses W77E58 as the target microprocessor considering the multi-factor. μC / OS-II is a highly simple. It can be ROM solidified and cut to achieve preemptive real-time multi-tasking operating system kernel. And it can be used for a variety of microprocessor systems. The system design and development of embedded. The hardware platform is designed in a completely open and multi-expansion. It provides multiple I / O interfaces and a bus interface, can be easily used for external device access, such as keyboard, monitor, etc., and can expand other functional interface module. The use of the ADM691 chip in the reset circuit provides the system with functions such as microprocessor reset, backup battery switching, watchdog circuit, CMOS-RAM write protection and power failure alarm, and the system adds two serial communications Interface, an RS232 interface and an RS485 interface[2]. Based on the W77E58 hardware platform to complete the μC / OS-II transplant work, write test procedures, direct observation system operation results. After testing, the system is running normally.

Actually μC / OS-II just only a real-time operating system kernel, it’s basic functions contain only the task scheduling, task management, time management, simple memory management, communication and synchronization between tasks .compared with the commercial real-time operating system ,it did not provide input and output management, file system, network and other additional services. However, due to the portability and openness of μC / OS-II, users can add the corresponding function modules according to their own needs. It is one of the main contents of this paper to design the peripheral function module for μC / OS-II to facilitate the application. It is the basis of user application design [3]. The basic framework for the μC / OS-II expansion module is shown in Figure 1.

![Figure 1. The basic framework for the μC / OS-II expansion module](image-url)
3. Function Extensions and Filter Design for Measurement and Control System
Aiming at measurement and control system project, this paper extends the application function of NC system and intelligent control system based on the embedded operating system μC / OS-II, adds the application control class library function, and gives the application program interface. The serial communication and network functions. Users in the specific application process can be based on different practical requirements to choose and cut, build their own requirements of the software system platform, making the software design simple and efficient, to avoid duplication of programming work, reduce system development costs, and shorten the development cycle.

In the industrial process control system, often use digital filtering method to suppress the interference signal in the effective signal to eliminate random errors. Digital filtering methods are many, according to different measurement parameters to choose. Several digital filtering algorithms used in industrial control software: dead zone processing, arithmetic mean method, median filter method, low pass filter method, sliding filter method [4].

Because the computer output is incremental, so the impact of small errors, from manual to automatic switching, and the original position of the valve has nothing to do, so easy to achieve from manual to automatic non-disturbance switch, and Easy to get better regulation of quality.

But this control method has some inadequacies: integral cross section effect and static error and overflow effect. Therefore, the actual application should be based on the actual situation of the controlled object to be selected. It is generally believed that a positional PID algorithm should be used in a system where a thermistor or servo motor. It is used as an actuator or higher control accuracy. In a system that performs a device with a stepper motor or a multi-turn potentiometer Using incremental PID algorithm.

The digital PID regulator of the system is designed for temperature control system, so the use of position-based PID control algorithm. In the actual use of the process, the specific PID parameters must be determined by the specific controlled object through the experiment. Due to the processing speed of the embedded CPU and the limitation of the RAM resources, the program is not designed with floating point arithmetic, and all the parameters are all expressed in integers. The operation is finally divided by a 2 N-th power (corresponding to the shift ), Similar to the fixed-point operation, can greatly improve the speed of operation, according to the different requirements of control accuracy, when the accuracy requirements are high, pay attention to retain the shift caused by the "remainder", do the remainder compensation[5].

4. serial communication functions
In the embedded system design, the core microprocessor W77E58 has two enhanced full-duplex serial port, Using the RS-232C and RS-485 interface standard with the outside world to communicate. Through the RS-232C interface can be and PC or other equipment for point-to-point short-range data transmission; through the RS-485 interface to achieve multi-point remote transmission between devices.

Early research and control systems often contain only a handful of intelligent components, which are relatively simple and interchangeable with information exchange, can use the traditional control system structure, but with the continuous improvement of the requirements, such a structure appears to have many deficiencies, such as function Scalability and flexibility, performance cannot meet the growing needs of people. With the rapid development of microelectronics technology, and now we can achieve intelligent for each individual unit, such as intelligent sensors, intelligent instrumentation, and other intelligent features, so that the entire measurement and control system, there are many Intelligent components, they need to interact with information, share resources, coordinate work. Their connection in a certain way, and the use of a protocol for information exchange, it constitutes an intelligent control network.

In this paper, the design of the embedded system, through the RS-485 interface standard can effectively build industrial field-level monitoring and control network. According to the characteristics of point-to-multipoint control, in order to better meet the reliable and stable communication
requirements of the control network, the Modbus protocol of the industrial control industry is adopted, and the Modbus protocol is embedded in the operating system to realize the addition of the network function module.

5. Summaries and Prospect
The rapid development of hardware and software technology of embedded system has greatly promoted the development of measurement and control system. In this paper, the good portability of embedded systems is applied to the measurement and control system, so that the development of monitoring and control equipment is quick and intelligent. Custom is the biggest feature in embedded system. These are also the essential requirements of embedded systems. On the basis of this, the characteristics of the equipment in the field of monitoring and control are expanded to realize its function in the field of measurement and control, and it is easy to be cut and applied. It eliminates the repetitive work of each intelligent node in the design and control system. And it can reduce Cycle and cost.

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