Design and Implementation of Carbon Monoxide Intelligent Monitoring Terminal for Iron and Steel Plant

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Abstract

Based on carbon monoxide detection technology and embedded technology at present stage, a carbon monoxide intelligent monitoring terminal based on MIPS kernel and 4G mobile communication technology is proposed and developed.After the completion of the overall scheme and the function design of the intelligent monitoring terminal, the hardware and software design methods of the intelligent monitoring terminal are introduced in detail.The intelligent monitoring terminal can not only realize the detection function of the traditional handheld carbon monoxide detector, but also has the function of remote communication, and has high practical value.

Keywords

Embedded system, 4G, Carbon monoxide detection.

1. Introduction

Gas is an important energy medium for iron and steel enterprises, and it is the key to energy saving and consumption reduction. Due to urgent production tasks, inadequate operation plan and safety measures and so on, iron and steel enterprises are prone to poisoning and explosion accidents with gas operations, which seriously threaten the safety of workers in factories.Because carbon monoxide is the main harmful gas of gas, strengthening the detection of carbon monoxide concentration in the production area of iron and steel enterprises is one of the key links to ensure safety in production.At present, most iron and steel plants have carbon monoxide leakage production area and have no independent on-site inspection equipment. They can only rely on staff to use hand held carbon monoxide monitor for on-site inspection. Because of the single function of the handheld carbon monoxide detector and unable to connect with the monitoring center, it is difficult to realize the effective monitoring of carbon monoxide leakage. Therefore, it is urgent to study an advanced, reliable and functional carbon monoxide intelligent monitoring terminal with networking function instead of the existing handheld carbon monoxide detector.Based on this, this paper designs a solution of carbon monoxide intelligent monitoring terminal based on embedded and 4G network.

2. Overall scheme design of intelligent monitoring terminal

2.1 The overall scheme design of the system

The intelligent monitoring terminal of carbon monoxide is based on 4G network, taking the CO concentration of iron and steel production site as data source, the existing Internet network as the skeleton and the embedded system as the hub, the seamless connection between monitoring terminal and Internet network is realized[1].It not only has the detection function of traditional detection equipment, but also has the ability of remote communication. Combining the latest 4G network technology with embedded technology, it has great superiority in performance and cost. In addition, the embedded terminal has its own network address through 4G as an independent node on the Internet network. Any authorized staff in the factory can check the CO concentration information of the corresponding area in real time through the Internet network.The carbon monoxide intelligent monitoring terminal system based on embedded and 4G networks is shown in Figure 1.

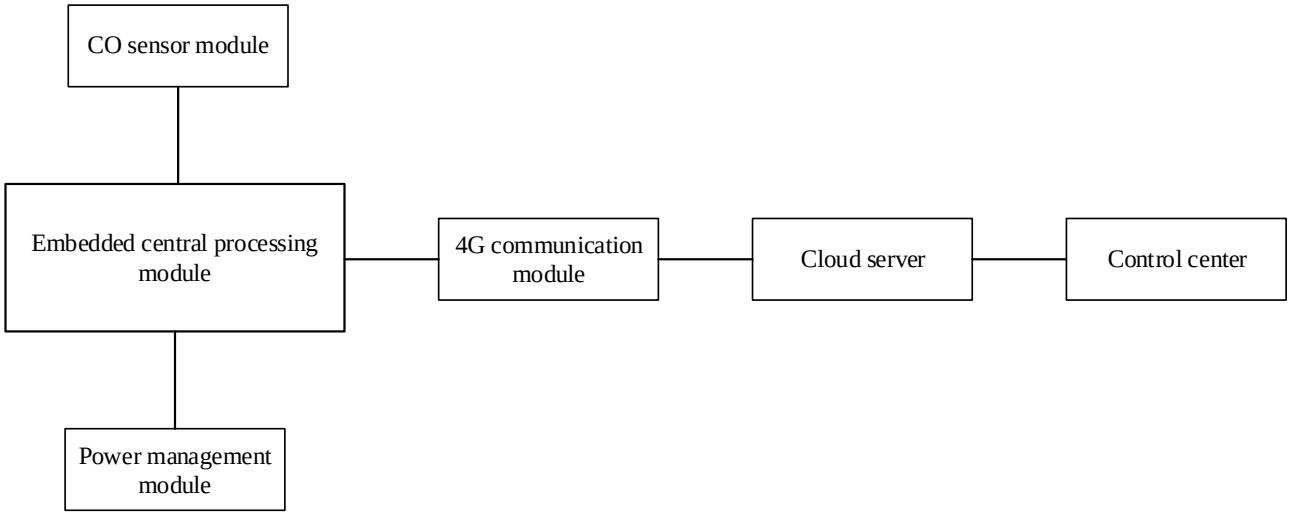

Fig. 1 The structure of intelligent monitoring terminal system

2.2 Hardware design of intelligent monitoring terminal

The core of the intelligent monitoring terminal is the embedded microprocessor. According to the design requirement, the microprocessor selects MT7620A produced by MediaTek, which is a powerful processor chip for data processing[2]. The embedded monitoring terminal centered on this processor is a bridge connecting CO data to the higher level management and control system and the lower production area. It completes a series of functions such as data collection and uploading, data processing and integration, alarm processing and so on.The hardware components are shown in figure 2.

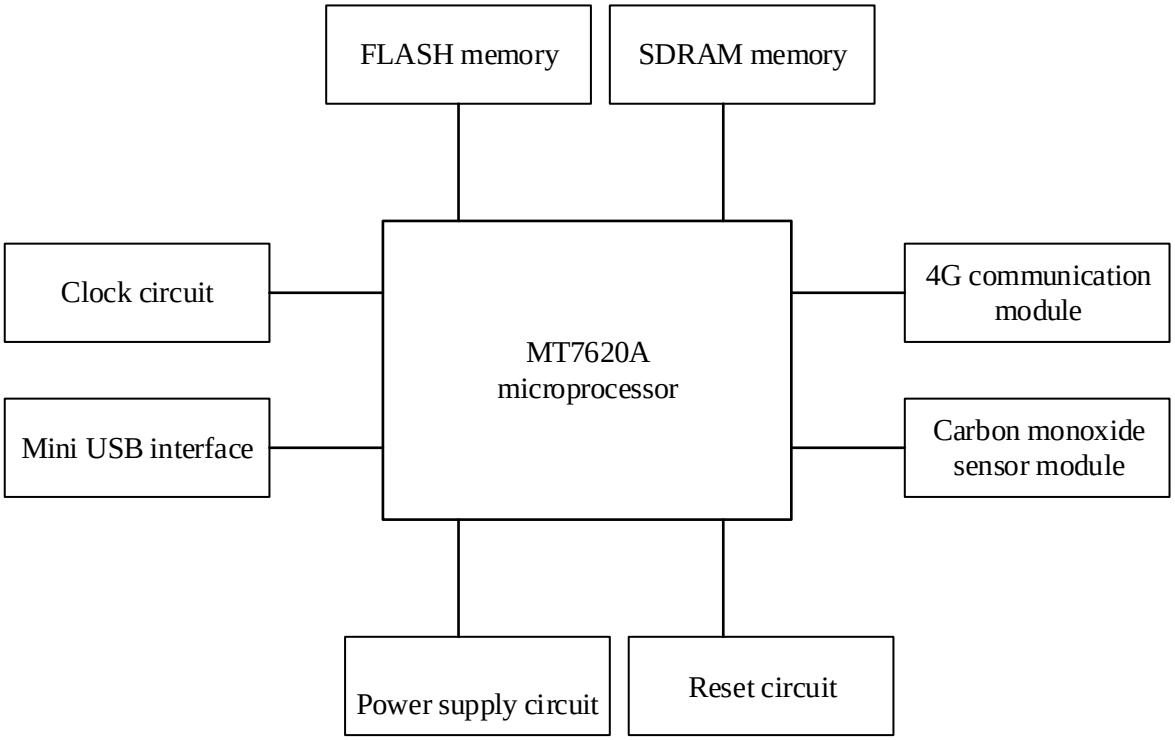

Fig. 2 Hardware composition block diagram

In the hardware system, DC-DC converter power supply circuit 3.3V for 24V, MT7620A and other peripheral circuits to supply 3.3V power supply; interact with microprocessor 4G data communication module through the USB interface; micro controller through the serial port connected with the CO sensor, CO concentration data acquisition; the reset circuit is the main power on reset terminal and when the user presses a key reset; the clock circuit provides clocks to the terminal;

through the mini USB interface for programming and debugging of the system; the FLASH memory can store the user application program, has been debugging the embedded operating system or other data need to be saved in the system after power off; SDRAM memory as the main area of system operation the system and the user data are stored in the SDRAM stack.

2.3 Software implementation of intelligent monitoring terminal

The software implementation of intelligent monitoring terminal is a key part of realizing the overall function. It mainly involves several main aspects, such as ME3760V2 dial-up Internet script program, CO concentration data acquisition program and system main program design.

2.3.1 The design of ME3760V2 dial-up Internet script program

Before the data is transmitted, the terminal must first connect with the Internet network, so we need to write the dial-up Internet script program, and the specific program is designed as follows:

```
#!/bin/sh
cat /dev/ttyUSB0 &;   Open the virtual serial port ttyUSB0
echo at>ttyUSB0;  Enter the AT instruction to the virtual serial port ttyUSB0
echo at+cfun=1>/dev/ttyUSB0;   Make the module fully functional.
echo at+cgact=1,1>/dev/ttyUSB0;   Get the IP address of the network connection   usb0.
   echo at+zgact=1,1>/dev/ttyUSB0;   Establish a data link.
```

2.3.2 Design of CO concentration data acquisition program

The program flow chart of the CO concentration data acquisition subroutine is shown in Figure 3. This design uses the CO sensor module to send a data to the serial port every other 1s, so the design of this part of the program is mainly the configuration and operation of the serial port[3].

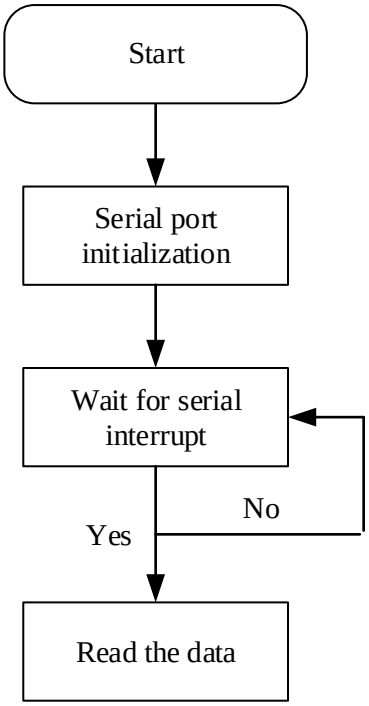

Fig. 3 Carbon monoxide data collection subroutine flow chart

2.3.3 System master program design

The main program of the system is mainly used to realize the specific function of the monitoring terminal. After the 4G module is powered up, it first establishes the network connection through script. Then the application program establishes the connection with the 4G network through the instruction, listens to the output data of the CO sensor through the serial port. After receiving the data,

the microprocessor is sent to the monitoring center through the 4G network to realize real-time monitoring. The main program flowchart is shown in Figure 4.

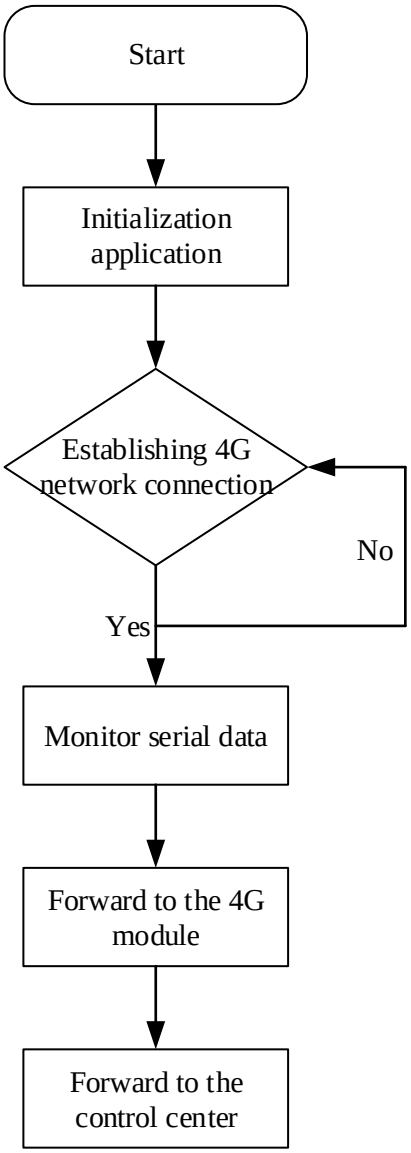

Fig. 4 Main program flow chart

3. Conclusion

In this paper, the advanced 4G mobile communication technology and embedded technology are combined, and a carbon monoxide intelligent monitoring terminal for iron and steel enterprises is designed [4]. In function, it can not only detect the CO gas in the steel production area, but also realize the remote transmission function of monitoring data, improve the safety guarantee of workers in the production area, and has high practical application value.

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