Design and Implementation of CAN Bus Real-time Monitor Based on Cigarette Set Based on Computer-aided Technology

Jie Li¹*, Ming Chen¹, Zanzan Chen¹, Miaojie Shen¹, Meng Shu¹

¹Zhejiang Tobacco industry co. LTD, Zhejiang, China, 315000

*Corresponding author e-mail: 13505882268@139.com

Abstract. This paper introduces the connection mode of CAN bus on PROTOS70 coiling unit based on computer-aided technology. Data transmission and reception are accomplished by CAN bus communication, and centralized processing and decentralized control are realized. In this paper, CAN bus technology is used to realize distributed control of cigarette machine equipment. The actual operation effect is stable and reliable. This paper expounds the necessity of the design of the monitor based on computer-aided technology. With PCI-9810 (non-intelligent single-channel CAN card) as the hardware interface, this paper develops a real-time CAN bus monitor based on DSP.

Keywords: CAN Bus, Real-time Monitor, Cigarette Unit, Computer-aide Technology

1. Introduction

At present, the widely used cigarette machines in China are PROTOS-70 and PASSSIM-7000, whose technology is the level of the early 1990s. The cigarette maker has four circuit board control boxes: control, MAX control, weight control and picking, cigarette quality detection. With the continuous maturity of computer technology, IPC and PLC are constantly integrated in the field of control. With the improvement of computer operation ability, the response speed of the system is also faster and faster. Field bus technology provides convenience for centralized management and decentralized control[1].

Communication between nodes in cigarette production is frequent. There are many data objects and various types of data, including parameter upload, download, instruction, domain data and so on. Therefore, there are inevitably errors because of human errors or the controller itself. But when mistakes occur, we need to analyze them as soon as possible, find them and solve them. Therefore, we need to establish a reliable error judgment mechanism. The real-time listener discussed in this paper is exactly in response to this demand. According to the timely data captured by the real-time monitor and displayed friendly on the line, the staff can analyze which side has the problem and what type of problem has occurred. This plays an important role in safety production and accurate control.

2. Composition of CAN bus node

2.1. MLP data received from bus
First, CIS detection data mainly include short signal detection value, leakage signal detection value, OTIS signal detection value, gap signal detection value, bad cap detection value, waste statistics and feedback value.

Secondly, SRM detection data mainly include microwave scanning value, reference value, flattener position, short-term deviation, long-term deviation, trend data of cigarette weight control, statistics of weight and waste smoke, internal processing monitoring data and feedback value, etc.

Thirdly, the test data of tight-end tracking control mainly include the current compaction end position, the average compaction end position of setting refresh times, alarm code, the position of accumulative compaction end and feedback value\(^2\).

2.2. Data sent by MLP to bus

First, CIS sets parameters. The control parameters needed by CIS quality detection system include short head, leakage, relative threshold value of OTIS detection, absolute threshold value, peak-valley sampling clock shift value, corresponding detection enablement, all kinds of bad smoke removal shift value, etc.

Second, SRM sets parameters. The control parameters of SRM weight control system include cigarette weight setting, cut distance setting, upper and lower limit setting, shift setting, sampling parameter setting, weight control enabling, sampling displacement and rejection displacement.

Thirdly, the parameters of tight-end tracking control are set. The control parameters needed by the tight-end tracking system include the number of pulses per millimeter, the average position refresh of the compaction end as the control parameters, the tight-end tracking enablement and the alarm limit of the tight-end position.

Fourthly, the fault code of the cigarette machine is sent to the fault display. Therefore, the cigarette unit can display the current cigarette machine fault information\(^3\).

2.3. Implementation of CAN bus node

Through the CAN bus controller PCI9810, MLP realizes the CAN bus communication. The CAN bus nodes of the four systems are completed by circuit boards, which include microprocessor (PIC16F877A), CAN controller (MCP2510), high-speed photocoupler (HCPL7721) and CAN bus transceiver (PCA82C250). The structure diagram is shown in Figure 1. In the design of the circuit, the photoelectric isolation device is used to realize the electrical isolation between the nodes on the bus, which can filter out the high frequency interference on the bus and prevent electromagnetic radiation. Anti-jamming measures improve the anti-jamming ability and security performance of CAN bus nodes. The design of CAN communication software includes microprocessor, communication interface module of CAN controller, initialization of CAN controller, detection, sampling, processing and analysis data to the host computer.

![Figure 1. The structure diagram of CAN Bus Node.](image)

3. Software flow

Monitor system software is mainly divided into two major functional parts, one is the main program part, the other is the data acquisition and processing part. There are the core parts of the whole system\(^4\).

3.1. Main program flow chart
After power-on, the system initializes the universal I/O ports to check whether the external system voltage is normal.

After the system interrupt, system timer and peripheral initialization are completed, the system interrupt and wait for the host computer to send the start-up monitoring instructions.

![Diagram](image)

**Figure 2.** Main program flow chart.

### 3.2. Flow chart of data acquisition and processing

According to the timing requirement, two interruptions are needed to complete one data acquisition. The first interrupt source is the BOD or COM signal from the regulator, in which the timer is initialized and started. When the timer interrupt occurs, we can collect data\(^5\).

![Diagram](image)

**Figure 3.** XINT2 External interrupt flow chart.
4. Conclusion
The bottom layer of industrial control has its particularity, especially the cigarette machine equipment. Many decentralized devices transmit short frames of information. But it requires strong real-time and high reliability. As a simple and reliable communication protocol, CAN bus protocol has a good application prospect in cigarette equipment. Drawing on the experience of the former and innovating in practice, we have successfully designed a real-time monitor and passed the actual test. The real-time monitor designed in this computer project is practical, real-time and accurate[6].

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