Design of Ship Power Station Monitoring System Based on CAN Bus Technology

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Keywords: Ship power station; CAN bus; monitoring system

Abstract: The ship power station is important equipment for the ship's engine room. The large-scale ship and the streamlined configuration of the personnel put forward higher requirements for the automation of the ship power station, the integration of the engine room monitoring and alarm system and the convenience of operation and management. This paper introduces the function and status quo of the ship power station monitoring system, and builds a ship power station monitoring system based on CAN bus technology. Such an open power station monitoring system is more reliable and easier to expand, and has positive significance for the whole ship cabin automation.

1 Introduction

With the continuous increase of ship capacity and tonnage, the automation level of ship power stations is getting higher and higher, and people have put forward higher requirements on the power quality of ship power stations and the safe and reliable operation of power equipment. Therefore, it is extremely important to construct a stable and safe ship power plant monitoring system. At present, most of the ship power station monitoring systems use PLC as the core, and control the main switchboard and generator set of the ship power station through the IO module, analog module and communication module. Although PLC has the advantages of mature and reliable, and wide application, there are relatively large technical barriers between PLCs of different manufacturers and control systems of PLCs and other core controllers, resulting in the design goal of integrated integration of ships. Different communication systems can only use the communication protocol of the corresponding manufacturer. The existence of multiple protocols will reduce the consistency of the system. In this paper, the dual CAN field bus is designed. Since the CAN protocol format is a standard format, it can be easily connected with the cabin monitoring and alarm system to realize the integration of the ship power station monitoring system.

The traditional power distribution board of the ship power station uses the button to issue control commands. It needs to be equipped with a large number of indicating instruments and buttons. The power distribution board sends out control commands through the operation buttons. In addition, because it needs to provide signal lines for each meter and button, the rear of the power distribution board the cable will be densely packed, which will also cause some pressure on the installation and maintenance of the equipment. Therefore, the touch screen with good interactivity, combined with the fieldbus technology, provides convenience for designing the embedded ship network monitoring system. The touch screen is used to realize the virtual button, indicator light and display instrument, and the function of the entire power distribution board is transplanted to the touch screen, and the command is sent to the control unit of each unit through the CAN bus, and can be conveniently arranged according to needs, when the control system needs to be upgraded. When you change the program, you don't need to make too many changes to other hardware configurations, which reduce the cost of equipment maintenance and upgrade.

  DOI: 10.25236/epcimms.2019.26

2 Power station monitoring system features

The ship power station monitoring system is the electric power automatic management system of the ship power station. Its main task is to ensure the safety of the power supply of the ship power station and reduce the labor intensity of the on-duty personnel, so that the ship power station can operate more reliably and economically. Its main features include:

(1) Start-stop management of the generator set: The system automatically activates the standby unit according to the ship's power load demand or disassembles the unit on the network.

(2) Automatic quasi-synchronous parallel car: After the unit starts and establishes voltage, it completes the automatic quasi-synchronous and car operation, and integrates the unit into the grid.

(3) Automatic constant frequency and automatic active power distribution: In order to ensure the stability of the power system frequency, the system controls the prime mover governor, adjusts the grid frequency within the allowable range; and distributes the active power proportionally according to the capacity of each unit.

(4) Automatic fault handling function: In order to ensure continuous power supply and prevent equipment damage, the system needs to be able to automatically identify common fault types and make corresponding protection actions.

3 The composition of the power station monitoring system

The ship power station monitoring system based on CAN bus technology drives the hardware equipment through software program, completes the collection of power plant engineering quantity values and setting commands, and realizes the information exchange and instruction between the control terminals of each distributed generator through CAN bus communication. Transfer and sync. According to the operation law and control flow of the power station, the operation status of each generator set of the ship power station is analyzed, and the corresponding control commands are output to realize the overall network monitoring function of the ship power station. Figure 1 shows the schematic diagram of the power station monitoring system.

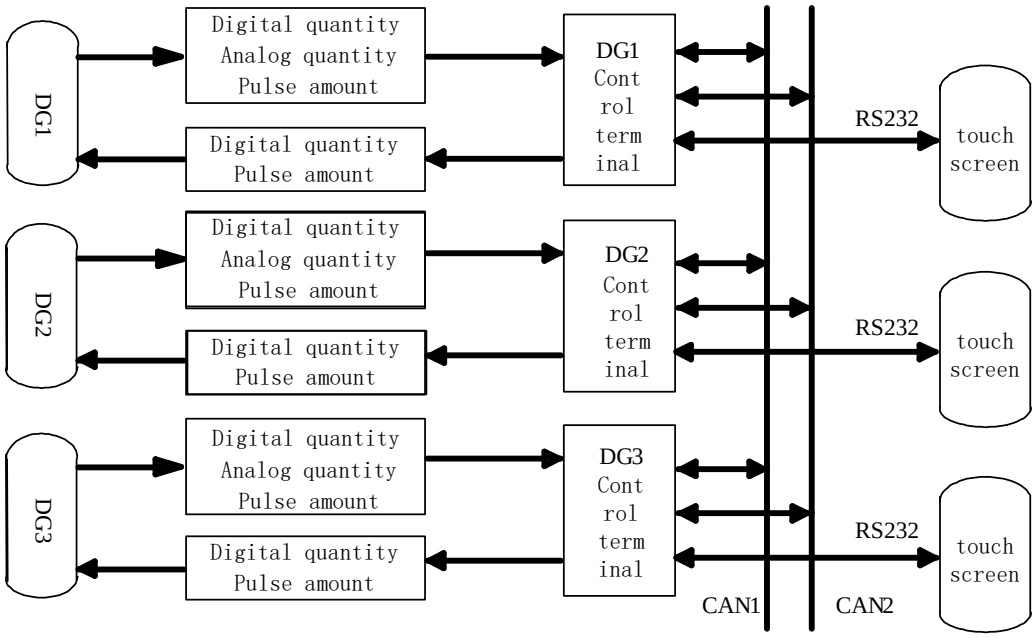

Figure 1 Schematic diagram of the composition of the power station monitoring system

4 Power station monitoring system hardware design

Through the hardware design of the power station monitoring system, the production of the control terminals of each generator set is completed. The control end of the ship power generator set is used to collect the working status, power parameters, main switchboard status information and command

information of the power station generator set; realize information exchange and command transfer through the dual CAN bus and other distributed control terminals; Industrial touch screen interaction; output control commands control the working state of the generator set and the power distribution equipment. The design scheme of the hardware circuit of the power station monitoring system is shown in Figure 2.

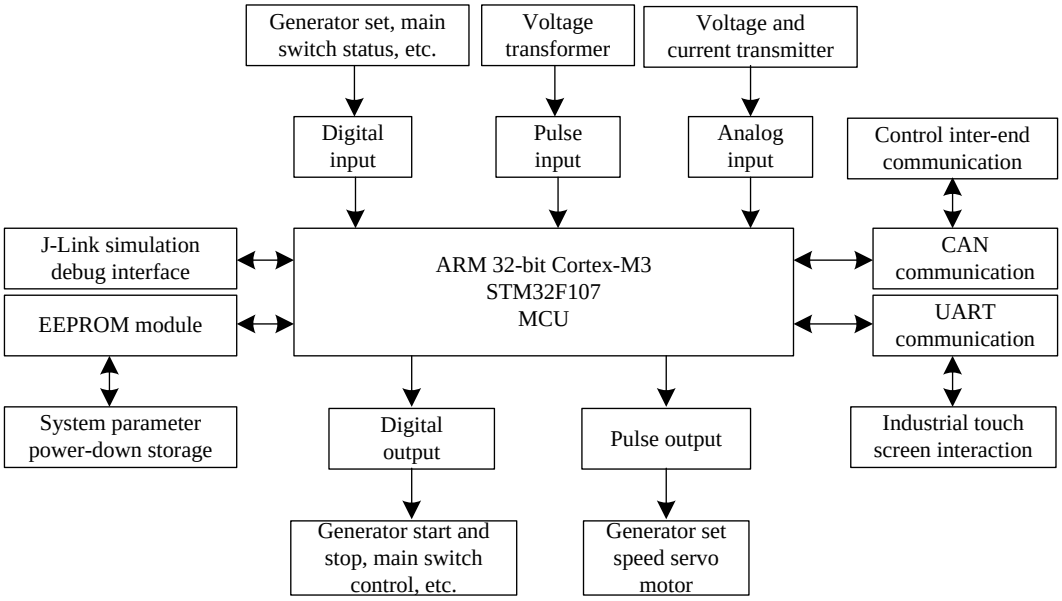

Figure 2 hardware design plan

In the hardware circuit, 16-channel digital input interface (DI24V), 16-channel digital output interface (DO24V), 3-channel pulse input interface (FI5V), and 2-channel pulse volume are designed for the genset control terminal. Output interface (FO24V); 8-channel analog input interface (AI: 4 ~ 20mA current); two CAN communication interface (CAN2.0B), one UART serial communication interface (RS232) and other auxiliary interface modules.

5 Power station monitoring system software design

The monitoring system of the ship power station based on CAN bus, through the software program to drive the hardware equipment, complete the collection of power plant engineering quantity values and setting commands, and realize the information exchange and instruction between the control terminals of each distributed generator through CAN bus communication. Transfer and sync. According to the operation law and control flow of the power station, the operation status of each generator set of the ship power station is analyzed, and the corresponding control commands are output to realize the overall network monitoring function of the ship power station.

Figure 3 shows the workflow of the ship power plant analysis task. After updating the generator group status data structure, the task puts the structure data into the CAN send data message queue, and the data is shared by the sending task to the other unit control terminals. And sent to the touch screen display through the UART serial port.

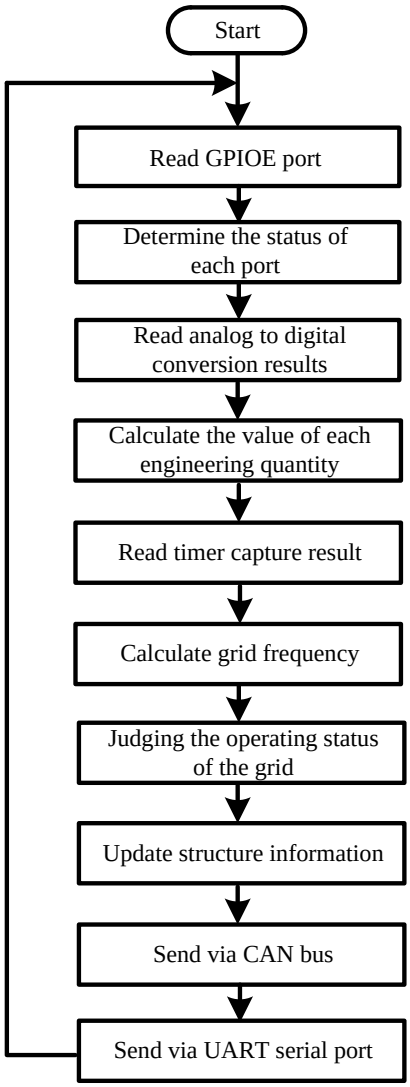

Figure 3 state analysis task work flow chart

6 Conclusions

This paper studies the main functions of the ship power station, designs the overall structure of the ship power station network monitoring system based on CAN bus, completes the hardware design and software flow design of the ship power station network monitoring system, realizes the distributed power generation through the dual CAN bus. The unit controls the network communication of the terminal to complete the information exchange and command transmission between different control terminals. Thanks to the advanced fieldbus technology, the function of the power station monitoring system is greatly improved and enhanced, and the construction workload is reduced and the cost is saved. It is foreseeable that this plant monitoring system will play a unique role in the field of ship cabin automation in the 21st century.

Acknowledgements

This research was financially supported by the College Science and technology project of Shandong Province (J18KB164) and Qingdao Huanghai College-level scientific research project(2017kj14)

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