Design and Implementation of Flight Monitoring Simulation Training System

To cite this article: Gaofeng Pan et al 2019 IOP Conf. Ser.: Mater. Sci. Eng. 585 012111

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Design and Implementation of Flight Monitoring Simulation Training System

Gaofeng Pan, Yan Su, Sifang Liu, Pei Li

Marine Department of Satellite Tracing and Metering, Jiangyin, China, 214431
Email: liumaster2006@163.com

Abstract. The calibration flight is an important technical means to verify the performance and accuracy of the TT&C equipment. In the flying, the equipment is power-on/power-off and the transponder mode is switched according to the needs. The transponder is a borrower. In the case of giving-back, it is especially important to recurring maintenance for the attachment. Through the system design, the original monitoring standby machine, the analog power supply chassis and the analogue controllers state of the transponder state, and three Bosch card and one serial server are used to fully simulate the on-board application environment. The industrial tablet application software adopts C# design to realize effective information interaction with the monitoring standby machine through serial port and network communication. The characteristics of the system are the continuous assessment of the power-on maintenance of spare parts, personnel training and actual system software, which is of great significance to the actual work.

1. Introduction

Flight calibration is a technical means to test the performance and calibrate the accuracy of the measurement and control equipment. It is necessary to carry the monitoring computer, power cabinet and transponder on the aircraft, among which the transponder is an external borrower. In the flight route, RS485 bus is used to control the power cabinet by monitoring the computer, and RS422 bus is used to switch the mode of transponder. When the flight is over and the transponder is returned, the daily maintenance of spare parts on board, the decrease of familiarity caused by the long interval of flight, and the inspection of monitoring system software are very important.

By analyzing the principle of flight calibration system and designing the power supply cabinet and the analogue controllers of the transponder, realizes the daily maintenance and other functions of the on-board standby monitoring microcomputer with the necessary bosch card and serial port server.

2. System Design

The main function of the system is to simulate the power supply chassis, using RS485 bus to complete the device plus/off control, and using RS422 bus to complete mode switching for the analog transponder.

The system consists of standby monitoring computer, power supply chassis and analogue controllers of transponder, three Bosch card, one serial server and power supply. The principle is shown in Figure 1. The spare computer is the spare part of the on-board monitoring computer. Its model is YC-ePC-A104s-W-Wince industrial tablet computer of Yangchuang Science and Technology. It is equipped with organic control software with external interface of 2 routes RS232 and 1 routes RS485. 1 # Bosch card is used to convert RS485 bus into RS232 bus and simulate the information link of the power box. 2 # and 3 # Bosch card are used to convert RS232 bus into RS422 bus and simulate the letter of the transponder. Information link; serial server model is Kanghai NC602D, which...
converts two RS422 signals into network signals; analogue controllers provides two RS232 and one network interface for Senker tablet computer, which is used to simulate power box and transponder, analog transponder information exchange is realized through network, analog power box information exchange is realized through one RS232.

![System schematic block diagram](image)

After the standby monitoring computer sends control instructions, through information conversion, the analogue controllers responds after receiving the instructions, and feedback the response information. The standby monitoring computer receives the response instructions, thus realizing the reproduction of the on-board environment.

3. System Design

3.1. Standby Monitoring Computer Software

The original monitoring computer software only has the functions of device plus/off control and instrument mode switching. In order to ensure that personnel do not need to participate in the process of equipment maintenance, it is necessary to upgrade the software and have the ability to parse the control flow instructions.

3.1.1 Software Function. It mainly completes the instruction to power chassis through RS485 bus, mode switching instruction to transponder through two RS232 serial ports, parsing and executing control flow [3], etc.

3.1.2 Software Processing Flow. According to the external interface and the difficulty of recording and distinguishing, this paper uses INI file to arrange the control flow, and designs three nodes, each node has four keys, representing the control instructions of power chassis and transponder respectively, which are parsed into three lists and sent in a timer. The software flow is shown in Figure 2.
3.1.3 **Software Download.** Because the standby monitoring computer uses Wince system, the project template in C# development needs to select intelligent equipment, and the Active synchronization software is also needed for XP system. The software can be synchronized to the designated catalogue of standby monitoring computer by deployment command.

3.2. **Analogue Controllers Software**

3.2.1 **Software Function.** The analogue controllers is used to simulate the terminal equipment on the simulator, including the power box and the transponder. The power box mainly completes the function of adding/disconnecting the equipment, and the transponder needs to have the function of mode switching. The software mainly completes the functions of sending and receiving serial port data, network data, real-time display and recording.

3.2.2 **Software Processing Flow.** Software design involves network and serial communication. Serial Port control with C# is used in serial port. Serial port function can be completed by using the properties and events of the control itself. Socket class is used in network communication, and network communication function is completed by creating two Sockets and two receiving threads. File recording adopts text file recording mode, the file name is precise to second time value, which is received. After the control instructions, the content of the initial generated file is added, and the flow chart is shown in Figure 3.

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*Figure 2. Software flow of standby monitoring computer*
4. Test Verification

4.1. Test Environment Construction
The test environment is shown in Fig. 4. The front row is a standby monitoring computer, the back row is an analogue controllers, and between the two are Bosch card and serial server.

![Figure 4: Test environment diagram](image)

4.2. Test Results
After the normal start-up and setup of the equipment, the standby monitoring computer sends instructions in accordance with the instruction flow cycle, and the analogue controllers can receive and feedback instructions accurately.
4.3. Results
Through testing, the analogue controllers can completely simulate the actual working state of the power chassis and the transponder; the monitoring software also adds relevant control content, which has no effect on its own software functions, and can be used as a software testing state. It shows that the system is almost completely simulated in accordance with the on-board environment, and can be used for personnel training and other work.

5. Acknowledgments
To introduce the design method of a simulation system for school flight monitoring. The system is used to simulate the control and equipment response of school flight timing. It can be used to facilitate the daily power-on maintenance of spare parts for school flight, and make the maintenance more image. It is also convenient for technicians to understand and master the whole equipment control situation of school flight, so as to make the training more targeted; and third, it is convenient to test the school flight. Maturity of flight control software and application of monitoring equipment. The whole system is developed by C#, through effective hardware connection and software design using two technologies of network and serial communication. It has the functions of adding/disconnecting analog equipment and switching equipment mode. It is basically a full-state demonstration of school flights, which can meet the design requirements.

6. References
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