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A Monitoring Software Design for Aviation Airborne Computing Platform

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Abstract: Power load forecasting is very important for power dispatching. Accurate load forecasting is of great significance for saving energy, reducing generating cost and improving social and economic benefits[1]. In order to accurately predict the power load, based on BP neural network theory, combined with the advantages of Clementine in dealing with big data and preventing overfitting, a neural network prediction model for big data is constructed[2].

1. Introduction

By analyzing the monitoring and performance testing requirements of the documented computing platform, the software system designed in this paper needs to satisfy at least three major segments of operation monitoring, unit testing, and system management, and the integration and operation of nine sub-functions, namely, operation detection, performance testing, signal processing testing, image processing testing, communication testing, test library, user login, and user management[3]. The ultimate use of this system is to monitor and test distributed hardware processing units, so the nine sub-functions are divided into two categories based on whether they interact with the hardware, i.e., the configuration management module and the monitoring and processing module.

2. Software design

2.1 Configuration management modules

(1) Test Library Configuration Management Module: This module is responsible for managing and accessing test data and test models, including test data management, test model management, test library query and other functions.

(2) User and Authorization Management Module: This module is responsible for adding, deleting, modifying detailed information, querying and controlling the access rights of platform users[4].

(3) Control Communication Service Module: This module is responsible for software communication with various processing units managed by the industrial control machine, transmitting control commands and data of various tasks, and monitoring the connection status of various

processing units and the industrial control machine, with the functions of communication protocol management, data transmission, status monitoring, and data caching.

(4) Test Dispatch Management Module: This module is responsible for the dispatch and load balancing management of various test tasks. The main functions include test task dispatching, load balancing management, test task tracking, test resource management, and so on.

(5) Signal Processing Configuration Management Module: This module is responsible for the interaction and configuration of signal processing algorithm testing, display of test results, recording and querying of test results, statistics and other functions. The main functions include signal processing algorithm test interaction and configuration, loading and preprocessing of input signals, invocation and execution of signal processing algorithms, and display of test results.

(6) Image Configuration Management Module: Image Configuration Management Module is responsible for managing the configuration information of image processing test, enabling users to flexibly configure the parameters of image processing algorithm test. The main functions include algorithm selection, interactive configuration, data storage, parameter verification.

2.2 Monitoring and processing modules

(1) Resource Operation Detection Module: This module is responsible for monitoring the status and parameters of various resource devices to ensure the normal operation of the hardware, and its main functions include resource monitoring, performance indicators, alarms and notifications, historical data recording, real-time communication, and monitoring of hardware connections.

(2) Signal Processing Module: This module is responsible for constructing the operating environment of signal processing algorithm, receiving the data and commands to be processed, completing the signal processing in the processing unit and returning the resultant data to the industrial controller, and is responsible for the construction, guidance, execution and result transmission of the signal processing algorithm.

(3) Image Processing Module: This module is responsible for the interaction and configuration of image processing algorithm testing, and the display of the results of various types of image processing algorithm testing. The main functions are image processing algorithm test interaction and configuration, image processing algorithm test results display.

(4) Task communication service module: this module is responsible for providing various communication services between the processing unit and the industrial control machine, and recording the error log of the communication service and returning it to the industrial control machine. The main functions of this module include communication protocol support, data transmission, error log recording, communication security, and communication log reporting.

(5) Network Transmission Performance Monitoring Module: This module is responsible for collecting and analyzing data about network transmission so that administrators or system operation and maintenance personnel can understand the network's health, performance level and potential problems. The main functions include network transmission environment simulation, performance test data collection, performance test data analysis, and display of performance test results[5].

(6) Processing Unit Performance Monitoring Module: This module is responsible for collecting and analyzing performance indicators related to processing units in order to assess the system's operation status, performance bottlenecks and optimization opportunities. The main functions include real-time monitoring of processing unit performance, recording and analysis of processing unit performance data, triggering and alarming of abnormal events and graphical interface.

(7) Platform overall resource operation monitoring module: This module is responsible for displaying the real-time operation status of all access resources of the platform, resource utilization, task operation status and other information. It mainly includes overall resource information display,

overall resource utilization display, platform task operation status display, hardware data visualization display, alarm prompts and other functions.

3. System testing

3.1 Resource monitoring module testing

The main function of the resource operation detection module is to receive from the back-end server the resource operation status of the specified processing unit and important hardware information such as kernel temperature and display it to the user in the front-end. The front-end page of the test results is shown in Figure 1.

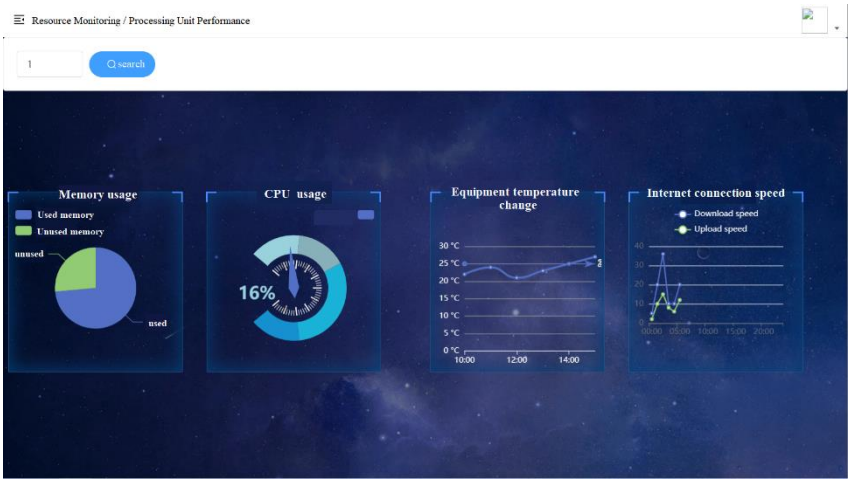

Figure 1. Resource operations detection module front-end page

3.2 Test module testing

The test module includes a signal processing test and an image processing test. The test results show that the signal processing test module can correctly process the signal file uploaded by the user and return the processing results, and the image processing test module can process the image file uploaded by the user and display the processing results. The front-end page of the signal processing test is shown in Figure 2. The image processing test front-end page is shown in Figure 3.

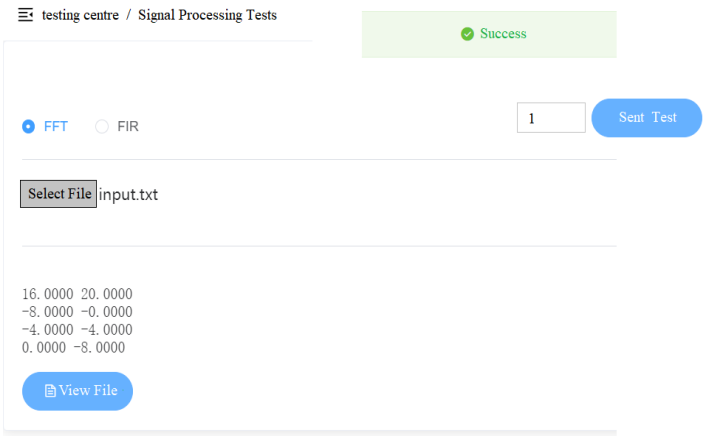

Figure 2. Signal processing test front-end page

The image processing test front-end page is shown in Figure 3.

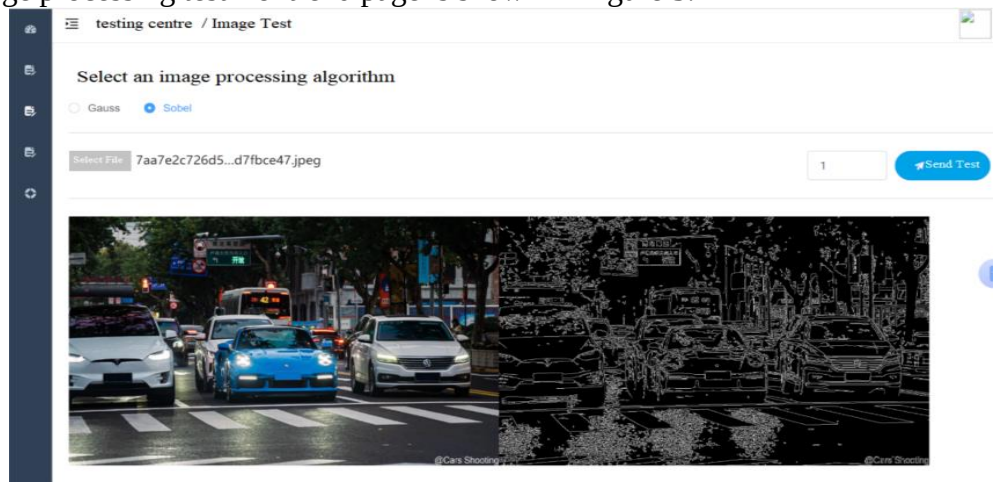

Figure 3. Image processing test front-end page

4. Conclusion

The airborne software system designed in this paper improves the stability and reliability of aircraft systems through real-time monitoring and performance testing, and provides an effective solution for monitoring and testing of distributed avionics systems.

References

[1] Wang H, Pan A J, Yang Z C, et al. Intelligent Testing and Monitoring Technology of Airborne System [J]. Measurement & Control Technology, 2022, 41(10) :1-6.

[2] Dai Xiaodi, Duan Haijun. Research on airborne distributed middleware technology [J]. Aeronautical Computing Technique, 2021, 51(01):75-79.

[3] CHEN Sheng, LUAN Jianze, et al. A design for the configuration management of IMA system [J]. Avionics Technology, 2023, 54 (01): 9-13.

[4] Qi Xiaobin, Lin Zhuo, Wang Jiqian, et al. Research on Runtime Performance Monitoring Technology of Embedded Operating System[J]. Aeronautical Computing Technique,2023,53(5):100-104.

[5] Pan Yunsong. Research and implementation of optimal allocation of DIMA avionics system resources.[D]. Nanjing University of Aeronautics and Astronautics,2017.