Research on the Design of Intelligent Energy Efficiency Management System for Ships Based on Computer Big Data Platform

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Abstract. In the process of protecting ecological environment, constructing ecological civilization and constructing harmonious environment between man and nature, energy efficiency management is our only way. In this paper, the design of ship intelligent energy efficiency management system using computer big data is introduced from three main components, and the functions of the main system are given.

Keywords: Big Data Platform, Ship, Energy Efficiency Management

1. Introduction
The understanding of energy consumption monitoring and management in domestic manufacturing industry started late, and Steel Company was the first to apply energy consumption intelligent management system to enterprise production. The application of this energy consumption management system helps it to realize the overall monitoring of energy consumption, improve the production efficiency of enterprises, and achieve the results of unexpected results [1]. After it has achieved practical results, other large steel mills in China have gradually introduced energy consumption monitoring and management system, and in practical application, according to the characteristics of the enterprise itself, the system has been continuously improved, which has achieved the result of saving energy and reducing consumption. Since then, energy consumption management and research applications began to accept, other domestic industries began to introduce, in various fields to apply and promote. Although domestic scholars and enterprises have begun to realize the advantages of energy consumption monitoring and management system, the application of energy consumption management system is still in the primary stage. At present, the ship industry has established energy consumption monitoring and management system, but there are still a large number of free data has not been effectively used, the management of big data still needs to be improved. Even if the energy consumption monitoring and management system has been initially applied, it is a statistics of energy consumption data. However, the research on intelligent energy efficiency management of ships using big data platform meets the requirements of constructing ecological civilization society, so it is widely studied.
2. Research methodology

2.1. Design and implementation of ship intelligent energy efficiency management system

According to the basic functional requirements of ship intelligent energy efficiency management system, the overall architecture of the integrated system is designed, and the hardware, software and database in the overall architecture are designed, and the concrete implementation methods of hardware and software are discussed \[2\]. Figure 1 is the framework of intelligent energy efficiency management system for big data platform ships.

![Architecture of intelligent energy efficiency management system for shipboard with big data platform](image)

**Figure 1.** Architecture of intelligent energy efficiency management system for shipboard with big data platform

2.2. Research on data processing and statistical methods

The ship intelligent energy efficiency management system needs to collect a large amount of real-time data. Because of the influence of the accuracy and stability of the acquisition equipment and the strong electric interference of the communication line, there will be packet loss or numerical anomaly. At this time, the data collected in real time should be preprocessed. In this part, all kinds of data features collected in real time will be analyzed, and reasonable preprocessing methods will be discussed to make all kinds of statistical analysis and calculation based on massive real-time data reasonable and effective. Finally, based on the massive data after processing, how to statistics the related energy consumption and energy efficiency indicators.

3. Hardware system design

The hardware part of ship intelligent energy efficiency management system is the basis of realizing the backup of the whole system from data acquisition, transmission, processing, and data remote communication \[3\]. Therefore, reasonable and perfect hardware facilities are indispensable. Hardware equipment can be divided into data sensing equipment, data acquisition equipment, data storage equipment and communication equipment according to different functions. Figure 2 shows the
hardware architecture of the system.

4. System software design

The system software design should meet the business requirements of the ship intelligent energy efficiency management system, reduce the crew operation as far as possible, and improve the convenience of the system operation. According to the following three task characteristics: (1) the status monitoring and management of ship energy consumption equipment and other monitoring equipment by crew; (2) statistics, evaluation and analysis of ship energy consumption and energy efficiency according to the collected data; (3) help crew to manage ship energy efficiency by auxiliary decision-making [4]. The system designs the following functional modules, as shown in figure 3.
4.1. System management module
This module is mainly used to view the ship static data, such as the ship's main scale, correlation coefficient, and propeller parameters, as well as the diesel engine parameter information used by the ship's main energy consumption equipment, and can configure the ship server serial communication port, data signal channel, instrument display range and so on.

4.2. Data monitoring module
The module is mainly responsible for the acquisition, storage and display of sensor data. The data monitoring module will consist of two interfaces. One is the main monitoring interface, which includes the display of all the monitoring data of the system and the input of port data [5]. The other interface can be used to display monitoring data about energy consumption equipment, such as fuel consumption data, power, torque, and so on.

4.3. Data processing and energy efficiency indicators calculation module
It is mainly used for data pre-processing and post-processing, as well as the numerical calculation of main energy consumption index and energy efficiency index.

4.4. Energy efficiency support decision module
This module mainly assists the crew to manage the energy efficiency by using the collected data through curve and statistical analysis and chart comparison and analysis of energy efficiency indicators.

4.5. Ship speed optimization module
The main purpose of the speed optimization system is to fit the parameters in the preset data fuel consumption model according to the energy efficiency data collected, and to optimize by using the optimization algorithm, and finally to obtain the suggested energy saving speed [6]. The proposed fuel consumption model can also be used to predict the fuel consumption per unit time of the ship.

4.6. Report module
The corresponding voyage, segment, annual, quarterly and monthly statements can be obtained according to the needs of the crew.

5. System database design
According to the requirements of the energy efficiency management system for the database, the data stored in the database can be classified into four categories: monitoring data, basic information, calculation value and decision data ship intelligent energy efficiency management system database are the core components of the system. From the overall architecture of the system, it can be seen that the database is the link between hardware and software system, and also the core part of the ship and shore [7]. Therefore, according to the ship energy efficiency management database, the demand for data storage query is large, convenient, efficient and low redundancy. According to the business function requirement of ship intelligent energy efficiency management system, it is necessary not only to monitor and collect the ship state data, but also to obtain the energy efficiency index by analyzing and calculating the monitoring data, and to evaluate the energy consumption. The data types involved in the intelligent energy efficiency management system of ships can be divided into the following two categories: (1) the navigation state of the ship, the data of the main energy consumption equipment in the engine room, the external conditions and so on; (2) the data after the calculation and processing of the monitoring data.

6. Conclusion
Ship energy efficiency management is an important link in ship operation management. Ship managers should: respond positively to the requirements of energy conservation and emission reduction at home
and abroad, strengthen ship energy efficiency management; expand methods to improve ship energy efficiency in many ways, and comply with the requirements of information and intelligence, Research ship energy efficiency management information means and ship intelligent energy efficiency management system to improve ship energy efficiency management efficiency.

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