

# Design and Application of the Intelligent Monitoring System for Ship Cargo Transportation

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**Abstract:** China's water transportation is favored by various industries because of its low cost and large volume of transportation. However, due to the imperfect management system of water transportation in China, accidents often occur in the process of shipping cargo transportation, so the design of the intelligent monitoring system is of great significance. In this paper, the software design and hardware design of the intelligent monitoring system for ship cargo transportation are described, and the monitoring system is tested experimentally. The experimental data show that the intelligent monitoring system for ship cargo transportation is safe and reliable.

**Keywords:** Ship; Cargo transportation; Intelligent monitoring system; Design; Application

## 1. Introduction

With the continuous development of China's transportation industry, ship transportation has become a relatively common mode of cargo transportation. However, at present, there are still many shortcomings in China's ship cargo transportation, especially in terms of security protection and intelligent management monitoring. If the ship is transported under the harsh environment, it will lead to a series of casualty accidents, and even bring heavy personal injury and huge property loss. Therefore, how to strengthen the intelligent monitoring of ship cargo transportation is the key point for the related workers to study. Combined with the specific conditions of every river or sea area, the effect of the system is better[1]. The existing water transportation system in China is still not perfect in many aspects. It is necessary to improve the intelligent monitoring system from the aspects of design concept, monitoring equipment and application mode. In the intelligent monitoring system for ship cargo transportation, the collection and transmission of monitoring information is also an important task, and it requires real-time performance. Some advanced network technology is used to monitor the navigation track, speed and all aspects of the ship. Information and data were consolidated and transmitted to the management center through the wireless network. If any indicator is found to be problematic, the management center will feed back the information in time. Related technical personnel will handle the feedback problem as quickly as possible, and strengthen the control of water transportation so that ship cargo transportation can be better developed.

## 2. Hardware Design of the Intelligent Monitoring System for Ship Cargo Transportation

The intelligent monitoring system of ship cargo transportation contains many modules, including the monitoring of audio and video, the transmission of data and the execution of decision making which is a very powerful system. The hardware of the monitoring system needs to be connected with the terminal hardware device of the management center, and can collect and compress the monitoring data and then transmit the data to the hardware terminal, so that the data is real-time and accurate[2]. The most prominent of all hardware designs is Internet communication technology. In the past, it was difficult to get in touch with the land during the process of water transportation, and the traffic control capacity was greatly reduced. Through the use of advanced communication technologies, the communication have become possible. Combined with the unique advantages of network technology, communication technology has been expanded. Communication meeting between water and land can be carried out to realize remote management and detection of ships. If there are security risks and other hardware problems, information will be fed back promptly. The management center will formulate the treatment plan as quickly as possible, and remotely guide and control through communication technology, making the ship transportation more safe and efficient. Compared with other traffic monitoring systems, the intelligent monitoring system for ship cargo transportation is more complex and requires a strong hardware design as a basis. In addi-

tion to the most basic monitoring functions, various auxiliary functions have also been developed. By recording and comparing the various parameters of the ship's operation, we can analyze the deficiencies of the ship monitoring system, and continuously find problems and improve the system during the application process. According to the current development level of intelligent monitoring technology, DCS is the most commonly used hardware design. In the monitoring system, multiple corresponding monitoring points and control points are designed, and these points are connected to an information network through advanced Internet technology to realize intelligent monitoring of ships. In different rivers and sea areas, different hardware design methods will be used to make the intelligent monitoring system more widely applicable[3]. At present, the communication networks that we can use in our daily life can be divided into the following categories: Wireless Wide Area Network, Wireless Metropolitan Area Network, Wireless Local Area Network, Wireless Personal Area Network, and Wireless body Area Network. The Wireless Personal Area Network is the most used in the intelligent monitoring system for ship cargo transportation. According to the requirements of hardware design, the communication networks and communication technologies applied in different systems are also different. The power consumption of different communication networks is different. In a ship intelligent monitoring system, it is necessary to fully consider the power consumption and other factors. Due to the limited energy in the water transportation, it is necessary to minimize energy consumption. This hardware design technology used in intelligent monitoring system can effectively solve this problem. Because of the particularity of ship transportation, the technology can be separated from manual control through continuous development. Even in a very complex environment, the system can achieve the desired results. The operation of the system requires multiple hardware devices, but these devices are deployed by the same controller which is the limitation in the application process and imposes higher requirements on hardware devices, so the hardware needs to have more comprehensive functions. The specific hardware device types are shown in Table 1.

**Table 1. Types of hardware equipment for intelligent monitoring system of ship cargo transportation**

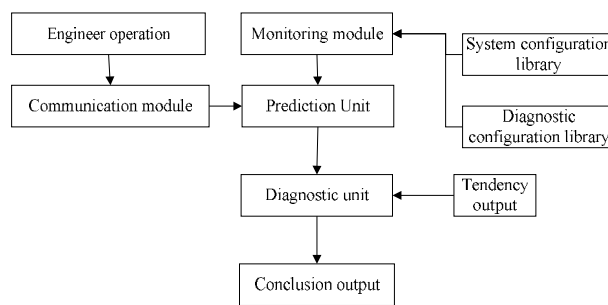
Equipment type	Full-featured equipment	Streamlined function device
Topology	Grid	Star-type
Whether to become a coordinator	Yes	No
Whether to become a router	Yes	No
Whether to become a terminal device	Yes	No
Whether to become a terminal device	Yes	No

Memory resource requirement	High	Low
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The monitoring system usually counts the data in a sort-by-category way, in which different hardware facilities play different roles. Firstly, the keyboard and mouse are capable of writing data and information. Video equipment and audio-visual equipment can capture video and audio data. The system is composed of many modules. The link between the network communication module and the information collection module needs to be designed by the hardware to make the data transmission work more real-time and accurate. The system uses advanced GPS technology to locate the ship. The signal is transmitted to the hardware of the ship by the satellite, and the position is fed back to the management center for monitoring in real time. The situation of ship cargo transportation is more complex, which requires higher requirements for the hardware devices of the system. Therefore, we need to use more advanced core processors and hardware devices to make the intelligent monitoring system work properly.

### 3. Software design of the intelligent monitoring system for ship cargo transportation

The traditional monitoring system has exposed many deficiencies in the application process. Therefore, the software for the intelligent monitoring system of ship cargo transportation should be redesigned. Water transportation is complex and variegated. In the face of such a complicated monitoring environment, a new software design scheme must be applied. The software design includes multiple units and modules, and these modules and units are effectively combined. The virtual monitoring system is used to monitor and eliminate faults. The specific software flow is shown in Figure 1.



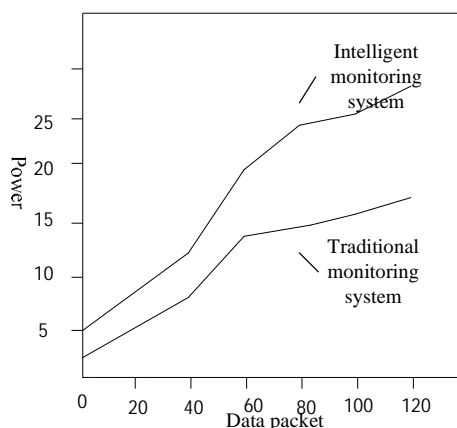
**Figure 1. Software Flow Chart of the Intelligent Monitoring System for Ship Cargo Transportation**

In the software design of the intelligent monitoring system, it is necessary to strengthen the management and transmission of data, and to judge the indicators of various aspects of the ship based on the feedback information. The most commonly method used in this process is the

adaptive judgment method. This kind of judgment method is based on the powerful Internet to predict and analyze the possible failures of the virtual model in the system. With the continuous development of science and technology, more and more judgment methods have emerged, which make the change of the virtual model clear, simplify the overall prediction process, and improve the speed of the intelligent monitoring system. In the actual application process, each forecasting method has its own unique characteristics, which has been commonly used in the forecasting module and the judging unit and plays an important role. In the troubleshooting software, there are two calculation methods. To a certain extent, these two calculation methods are analyzed from a broad perspective[4]. These two methods are applied to the system's diagnostic module. The system adopts a manual and automatic control method. The virtual model is detected through manual operation and connected with the alarm software. Once a fault occurs, the data is fed back in time and the ship is repaired.

#### 4. Experimental Data and Results Analysis

The test of the intelligent monitoring system is a very important task. It can find the imperfections of the system and improve it in time, and determine whether the system is in line with relevant national regulations. In addition to the simulation experiment, it can also test the application and efficiency of each module and unit in the system, and analyze whether it meets the requirements of the intelligent monitoring system for ship cargo transportation. The test work needs to form a complete system and use advanced network technology to upgrade and improve the system[5]. In the process of data packet transmission, the transmitting power of traditional monitoring system and intelligent monitoring system is detected respectively without interference. The result is shown in Figure 2.



**Figure 2. Curve Chart of Transmission Power of the Traditional Monitoring System and the Intelligent Monitoring System**

The comparison of the experimental data shows that the launching power of the ship intelligent monitoring system is much higher than that of the traditional monitoring system, and it can monitor the ship transportation more accurately. The difference between intelligent monitoring system and traditional monitoring system is analyzed, and all aspects of intelligent monitoring system are improved. In the process of testing and application, the most appropriate figures and indicators are found through repeated design. According to the requirements of water transportation, the best plan is designed to strengthen the management of water transportation and make the intelligent monitoring system play the biggest role.

#### 5. Conclusions

To sum up, the intelligent monitoring system has played a crucial role in the transportation of ship cargo, strengthened the system design process and achieved the goal of obtaining the best results with the least cost. The monitoring system not only plays an important role in the transportation of ships, but also plays a role in water traffic management[6]. With the continuous development of science and technology, the intellectualization of the monitoring system reduces the manual work gradually. It not only avoids the error caused by manual work, but also increases the running speed of the monitoring system, which makes the ship cargo transportation more safe and reliable, and promotes the development of the water traffic.

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