Remote Monitoring System of Ship Running State under Wireless Network

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Abstract: In order to improve the stability and safety of ship operation, real-time monitoring to running state of the ship, a ship remote monitoring system, the running state of the design of wireless network system, including ship running state feature acquisition module, AD conversion module, bus transmission module, wireless network communication module, integrated control module and human-computer interaction module, ship communication network uses remote satellite communications and wireless sensor networking technology, SIP session initiation protocol H. 23 protocol based on IETF and wireless network communication for ship design. To focus on the implementation of the multi thread control method for ship running state monitoring instruction, monitoring system application development and integration in cross compiler GCC compiler environment, design software platform monitoring system using heterogeneous and hierarchical middleware technology, network access services and real-time monitoring service ship monitoring system, the system test results show that the designed remote monitoring system of ship running state can monitor the running state characteristics of ship in real time, and the system has good adaptability and reliability.

Key words: Wireless network, ship, condition monitoring, system design, middleware, software.

1. Introduction

When the ship is sailing at sea, the running status of the ship is mainly affected by sea state, seabed topography, wind and waves, human operation and ship machinery parts and other factors, the influence of such factors as limiting factors to ensure the safe sailing of the ship has diversified characteristics. In order to ensure the safety of navigation of ships, it is necessary to carry out real-time remote monitoring of ship running state to ensure the safety and reliability of ship operation [1]. The optimization design method of remote monitoring system for ship running state is of great significance in ensuring the safety of navigation and improving the operation efficiency of ships, the research of related system design methods has attracted great attention.

The traditional design method of ship condition monitoring system cannot achieve the point to point wireless communication between ship and ship, and the loss rate of the monitoring data output packet is higher, the reliability of remote monitoring is not good [2]. This paper designs a remote monitoring system of ship running state based on wireless network. First of all, the overall design framework of the system is analyzed, and then the function module design of the system is carried out, mainly carrying out the system network signaling design, application development, cross compiler design and software platform design. Finally, the system test shows the superiority of the ship running status monitoring system designed in this paper.

2. System Overall Design Framework

2.1 Design Principle Description and Function Structure Analysis

In order to realize the design of ship running status monitoring system based on wireless network, the overall structure of the system is analyzed firstly. The functions of the monitoring system based on wireless network mainly include:

1. Video acquisition and operation data acquisition
and identification function of ship running state;

(2) Access function of wireless network and satellite communication network;

(3) Remote transmission functions of ship running state;

(4) Multi channel ship running state information recording and analyzing function;

(5) Abnormal alarm and remote control function of ship operation [3].

The video information collection and remote bus control of the ship operation are carried out by using the dedicated short range communication standard protocol, and ship operation attitude information and channel information collection and upload are carried out through the RFID module of the wireless RF network, and the video monitoring information and attitude sensing information of the ship running state are connected to the wireless sensor network through the wireless transceiver. The wireless sensor network is designed with ZigBee network and IPv6 network [4]. In this paper, the remote monitoring system of the ship running state under the wireless network is designed with 3 layers of architecture, which are the basic layer, the middle layer and the application layer. In the basic layer, the characteristic information of ship running state is collected, and the characteristic parameters of input state and video information are input, the wireless access and uploading of monitoring information are processed by image processing and video coding, using RFID information tag identification technology to carry out the original data sampling and ship operation log base construction, the digital mode conversion of the original state data is realized in the AD conversion module. Then, the ship’s operation status information is input into the middle layer to realize ship attitude control, ship operation abnormal characteristic analysis and dynamic real-time information output. In the application layer, the real-time output of ship operation status monitoring is carried out, the channel information and the position and orientation information of the ship are displayed, realizing the human-computer interaction between the remote satellite communication and the monitoring information of the ship [5]. According to the above design principle, the overall structure of the remote monitoring system of ship running state of the wireless network designed in this paper is shown in Fig. 1.

2.2 Construction of System Development Environment and Signaling Design

According to the analysis of the above design principle, the ship monitoring system designed in this paper includes the ship running state feature acquisition module, AD conversion module, bus transmission...
module, wireless communication module, integrated control module and human-computer interaction module, function composition as shown in Fig. 2.

According to the overall design framework of the remote monitoring system of ship running state shown in Fig. 2, it conducts modular development and design of the system. In this paper, the design of ship monitoring system is established under the wireless network environment, the wireless network design of remote monitoring system is divided into 4 levels: network adaptation layer, basic software layer, application development layer and application service adaptation layer.

3. System Development Design and Implementation

3.1 Wireless Network Design of the Monitoring

Under the framework of wireless network, the network design of ship operation condition monitoring system is carried out, and the multi point and multi thread control method is used to implement the centralized operation of the monitoring instructions of the ship’s running state [6]. In the integrated GCC compiling environment, the application development and cross compiling of monitoring system are conducted. The design of network layer is mainly the component design of monitoring system, the monitoring system uses the wireless network communication interface to realize the multimedia flow collection of the ship running state information collection [7]. In the middleware design of the network layer, the hardware abstract component, the integrated hardware component and the high-level software component are designed in multi thread, using the distribution mechanism of QOS detection to send statistical data to the central processor of the monitoring system [8, 9], constructing the network protocol library, sensor drive library and hardware platform library of the monitoring system. In the embedded Linux environment, carrying out the cross compiling of monitoring instructions, completing the wireless network design of monitoring system, constructing the network protocol stack, and using the SIP URI (Unified Resource Identification) realize the coding and output scheduling of the ship operation status monitoring video [10, 11].

3.2 Communication Interface Design

In order to improve the accuracy of ship remote monitoring data transmission and reduce packet loss rate, it is necessary to design the communication interface. The communication interface distributes and centrally monitors the collected remote monitoring information of the ship, and reads, writes and loads the data on the underlying hardware.

4. Experimental Test Analysis

The experiment of remote monitoring system for ship operation status is based on MFC application program, building the client/server model to analyze the performance of wireless network, and developing the related programs to monitor the performance of the ship. Firstly, defining a variable $s$ of the SOCKET...
type, socket function socket (int af, int type, int protocol), invoking recvfrom to receive the data sent by the client, and realizing the network access service and real-time monitoring service of the ship monitoring system. Then invoking the recvfrom function to receive data, and analyzing the accuracy of wireless network data transmission, after the data are sent, the close socket function is called to close the socket, and the dispatch request is sent out by the client process to the server process. Finally, the WSA cleanup function is called, and the driver sends the monitoring information to the network by socket, and terminates the use of the socket font library. The procedure of invoking the simulation test program of the ship condition monitoring system is shown in Fig. 3.

According to the above simulation environment settings, the analysis of the ship running state monitoring is carried out, and the relative view effect diagram of the ship running state monitoring is shown in Fig. 4.

The analysis result of Fig. 4 shows that the monitoring system of ship running state designed in this paper can monitor the running track and state characteristics of the ship accurately and in real time. In order to test the network connectivity of the remote monitoring system designed in this paper, Fig. 5 gives the connectivity test results of ship remote monitoring using this method and the traditional method. The analysis shows that the connectivity of the network

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![Fig. 3](image3.png)  The test procedure call process.

![Fig. 4](image4.png)  The relative view of ship operation status.

![Fig. 5](image5.png)  Network connectivity test of remote monitoring system.
is better by using this method for the wireless network
design of ship monitoring.

5. Conclusions

Aiming at the problem of low monitoring precision
in the traditional monitoring system, this paper studies
the design method of ship operation status monitoring
system under wireless network. The system includes
ship running state feature acquisition module, AD
conversion module, bus transmission module, wireless
network communication module, integrated control
module and human-computer interaction module. The
experimental comparison and analysis are also carried
out, and the test results show that this method has
good reliability in remote monitoring of ship running
state, and the connectivity of network access is higher,
and the performance is stable and reliable.

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