

The Development Status and the Main Technologies of Smart Ships

Qian Hu, Xiao He

Chongqing Jiaotong University, Chongqing 400074, China.

Abstract

With the continuous development of intelligent technology and big data, intelligent ships have become the main direction of future ship development. This article combs the three classification societies' expositions on smart ships, and defines smart ships. Secondly, this paper studies and compares the development status of smart ships at home and abroad, and analyzes the differences in development routes, R&D models and technical levels of smart ships at home and abroad. Then, this article analyzes in detail the main technologies used by smart ships. Finally, this article describes the future development trend of my country's smart ships based on the development status of my country's smart ships.

Keywords

Smart Ship; Development Status; Main Technology; Development Trend.

1. Definition of smart ship

With the continuous development of intelligent technology, coupled with the rise of computers and artificial intelligence, marine electrical equipment such as ship automation and ship communication is developing in the direction of interconnection of all things, and the level of ship intelligence is constantly improving. Today's smart ships are already feasible.

The development of smart ships has become a consensus in the shipbuilding industry, and shipbuilding companies and research institutions in various countries have carried out a lot of research on smart ships. Our country's definition of smart ships is the use of sensors, communications, Internet of Things, the Internet and other technologies to automatically perceive and obtain information about the ship itself, the marine environment, logistics, and ports, and use big data to process and analyze information.

Although there are certain differences in the definition of smart ships by classification societies, three characteristics of smart ships can be summarized: summary of the entire ship's information, independent evaluation, and integration of ship and shore.

1.1 Ship information summary

The information aggregation of the entire ship refers to the use of sensors and Internet technologies to establish a network system and intelligent perception system that contains information about the entire ship. These systems can collect and integrate information about the entire ship and the surrounding marine environment.

By collecting the status information of equipment such as main engine, auxiliary engine and propeller shaft, the navigation status information of the ship's navigation speed and direction at sea, information of the navigation environment such as sea waves, wind current and weather, as well as cargo category and cargo weight, Such as transportation information, the various information collected by the system on ships sailing at sea can pave the way for subsequent data analysis.

1.2 Self-assessment

Autonomous evaluation utilizes the ship-wide information collected by the big data analysis and processing system to realize the ship's autonomous analysis, evaluation, prediction and optimization functions. The ability of autonomous evaluation can directly reflect the degree of intelligence of the ship. From the display of the ship's own condition, the ship's maritime autonomous control or remote control by personnel, to the autonomous navigation in local waters, it can realize timely analysis of feedback information during the autonomous navigation process. And make corresponding measures to avoid maritime hazards and improve the efficiency of maritime navigation.

Autonomous evaluation is a very important part of smart ships. If the level of autonomous evaluation of ships is low, that is, they cannot analyze and process the collected information, and cannot feed back the results of analysis in time, then such ships are different from traditional mechanical ships. It can't be called a smart ship. Only by doing a good job of core technology, deeply improving the ability of independent evaluation, and shortening the time for the evolution of intelligent ships, can we realize the high intelligence of marine ships earlier, but the improvement of independent evaluation requires technical support and high-efficiency technology research and development.

1.3 Ship-shore integration

Ship-shore integration is a key sign that distinguishes smart ships from ordinary ships. Ships operate on wide seas, and the only link with land is communication. To realize the high intelligence of ships, it is indispensable to ensure good communication technology. Establish a complete ship-to-shore communication technology, build a complete ship-to-shore integrated information platform, and realize information interaction on the sea and on the shore.

2. Development status of smart ships at home and abroad

2.1 The development status of foreign smart ships

Japan, as a country surrounded by the sea, has a relatively developed import trade due to its small area. In order to develop marine resources, its ship technology is also at the forefront of the world. Japan's research on smart ships is mainly based on the development of smart ship application platforms, which mainly study the ship's intelligent navigation functions at sea. This smart application platform has developed a variety of smart ship systems that can automatically select the most suitable route and speed to avoid ship collision. At the same time, the Japan Classification Society has also established a ship big data center to collect real-time data from the engine room to facilitate the analysis of the ship and provide suggestions for equipment optimization and maintenance.

European smart ship research is relatively early, and it has carried out a large number of forward-looking smart ship research, and the level of research and development is world-class. The intelligent ships developed by European countries are mainly based on unmanned ships. Unmanned ships are still controversial. Because ships are super large machinery, if their intelligent technology is flawed, the safety of unmanned ships, the transport of goods, and the marine environment are all controversial. There is no guarantee, but for now, unmanned ships can achieve remote control, and fully autonomous unmanned ships have not yet been realized.

European countries have relatively complete plans for unmanned ships. They plan to achieve remote ship support and operation to reduce crews by 2020, achieve remote control of offshore ships in 2025, remote control of offshore ships in 2030, and fully unmanned ships in 2035.

2.2 The development status of domestic smart ships

Compared with the development of smart ships in foreign countries, the development of smart ships in our country started relatively late, and smart ships are in their infancy in terms of technology research and development and market applications, and research and exploration work on smart ships is actively underway. We adopt a step-by-step approach to plan the development route of my country's

smart ships, and what goals we must achieve under each route, so that we can develop smart ships in a clear and orderly manner.

The development of smart ships in China is divided into three phases: before 2020, the first-generation smart ship that realizes integrated data application and decision-making assistance; before 2025, the second-generation smart ship that realizes remote control and partial autonomy; Before 2035, a fully autonomous third-generation smart ship will be realized.

2.3 Comparison of the development status of smart ships at home and abroad

The development starting point and development plan of smart ships in my country and foreign ones are different, leading to a big difference in the status quo of the development of smart ships at home and abroad, which is mainly reflected in the following three aspects.

2.3.1 Different development routes

Each country has formulated a smart ship development route that suits its national conditions and strengths, because each country has different development conditions, and there are certain differences in these development routes.

2.3.2 The research and development model is different

Foreign shipping companies pay more attention to the exchange and cooperation of multiple enterprises, and the cooperation of industry and academic research. Although my country has also adopted the model of joint research and development, the scope, depth, investment funds and the establishment of the intelligent ship industry chain are with foreign countries. All have a big gap.

2.3.3 The level of technology is relatively low

The level of development of smart ships is compared with the development of technologies such as smart monitoring, smart navigation, and unmanned driving. Foreign research on smart ship technologies is relatively early. The formulation of regulations is in a leading position, and the development of smart ships in my country is still in its infancy, and the technical level is still low.

3. Important technologies for smart ships

3.1 Information Perception Technology

Ship information perception technology is a necessary technology for the development of smart ships. It refers to that the ship can obtain information about the ship itself and the environment based on various equipment, such as sensor equipment, sensor network, and information processing, After preliminary analysis, a technology that can ensure the safe and reliable navigation of ships at sea.

Ship perception information mainly includes information about the ship itself and the surrounding environment of the ship. The information of the ship itself is the information of equipment such as the ship's engine room and bridge, and the information of the surrounding environment of the navigation is information other than the ship itself. The collection of perception information mainly uses radars, cameras, various sensors, and electronic navigation maps. In the future, the development and development of related intelligent sensing equipment will further promote the development and growth of intelligent ships.

3.2 Energy efficiency control technology

In order to reduce the emission of greenhouse gases from ships and improve the energy efficiency of ships, the International Maritime Organization has proposed evaluation indicators such as the design energy efficiency index for newbuildings and the energy efficiency index for ship operations. The development of intelligent broadcasting should conform to the development concept of "saving energy and protecting the environment", analyze the relationship between the engine speed, deadweight, draught, route, etc. and the ship's energy efficiency index, and minimize emissions and emissions while ensuring the safety and efficiency of ship operations.

3.3 Condition monitoring and fault diagnosis technology

Condition monitoring technology understands the condition of the equipment to determine whether the equipment is in a stable state or is deteriorating. Condition monitoring and fault diagnosis of the equipment can minimize the occurrence of ship accidents and improve the safety and efficiency of ship operation. In the future, ship fault diagnosis should be based on big data and apply a variety of mathematical models to construct an equipment condition monitoring system in an all-round way to improve equipment efficiency and operational reliability, prevent problems before they occur, and avoid disasters.

3.4 Autonomous navigation technology

Automatic navigation technology is the use of computer technology to analyze and process the information obtained, and to optimize the navigation route and speed of the ship. Research on autonomous navigation of ships in foreign countries is relatively early. Western maritime powers have developed unmanned underwater submarines, which are mainly used for military reconnaissance. my country has also carried out research on autonomous navigation of ships.

4. The development trend of smart ships

Based on the current development status of smart ships in our country, environmental perception technology, communication and navigation technology, condition monitoring and fault diagnosis technology have been practically applied, but some technical theories lack verification in the actual environment. Therefore, Smart ships as a whole are still in a stage of rapid development, It is in a stage of rapid development and not yet fully mature. But with the development of big data and computers, smart ships are the inevitable trend of future ship development.

Intelligent ships need to use a variety of intelligent technologies to achieve autonomous navigation , which can give intelligent suggestions and operations based on various information collected by sensors to ensure the accuracy of the ship's route and the safety of operation.

The development of smart ships requires the establishment of a complete database, which records information about ship operations, integrates and processes the information, and uses the collected data to Smart ships should realize intelligent energy efficiency management, judge ship operating conditions through automatic energy efficiency management, and monitor ship energy consumption in real time, and use big data to evaluate and optimize various hull data, so as to provide auxiliary decision-making for energy efficiency management. provide decision-making recommendations for hull operations.

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