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Research on the design, promotion and application of INMARSAT F station simulator for nautical colleges

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Abstract

[Objective], in order to solve the time and space conditions of nautical students learning GMDSS (Global Maritime Distress and Safety System) training theory and experimental content, improve the professional quality of nautical students, improve the professional quality and training significance of professional crews, etc., a method to promote the design of INMARSAT F station simulator in colleges and universities is proposed. [Methodology] The simulator is used to simulate a real Inmarsat F station, so that users can better participate in vocational training or course teaching. [Results]Through the use of the double-end entrance of teacher and student education, the purpose of simultaneous teaching practice can be better realized, and the dual purpose of exercise and test can be achieved by issuing different instructions from the teacher, which has the function of assessment. [Conclusion] It can solve the overall demand of the current society and some universities for the knowledge update of this simulator and nautical students, and also explains the general demand for this simulator in society and some universities to a certain extent.

Keywords

Inmarsat F station, simulator, popularization.

1. Introduction

The Global Maritime Distress and Safety System (GMDSS) is a system established under the framework system of the International Maritime Organization (IMO) based on the unanimous approval of member states to ensure the safety of life and property at sea, including but not limited to safety-related operating procedures, ship equipment requirements and maritime communication protocols, etc., mainly used to achieve ship distress warning, search and rescue and coordination, positioning, Functions such as maritime safety information (MSI) broadcasting and bridge-to-helm communication. [1]

Inmarsat F station communication system has voice and high-speed data services. Includes a receiver transmitter, a marine satellite dish, handheld terminals and mounts. An IP router can be connected to the ship's LAN through the MPDS and ISDN network links to the satellite signal receiving transmitter; Any ISDN communication device can be connected through the ISDN network. The device takes into account data and voice communication, and its data communication part supports Web browsing, large and small file transfer, email, database access, video conferencing, video streaming, video storage and forwarding, etc. The Inmarsat-F system is an enhanced global area network for maritime use that uses an enhanced next-generation signaling system to ensure compatibility with Inmarsat's fourth-generation satellites and a new call prioritization program to improve distress call handling. In addition to this, it uses improved satellite connection plugs and more advanced EIRP control and point beamselection for greater communication security and efficiency in maritime environments. [2]

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This simulator is mainly used to simulate the F-station radio station on the ship, and is mostly used for GMDSS training for nautical students and professional crew members in society. It is of exploratory significance for the practical education and teaching of nautical students and crew members trained in society. Universities and training institutions can make full use of a small number of real equipment to improve students' intuitive sense of equipment, and at the same time combine with a large number of training of virtual simulation network training systems to establish students' proficiency in equipment operation. The assistance of the F station radio simulator is of great significance to the training of nautical talents. We can simulate different actual maritime scenarios through this equipment, and can achieve the purpose of reasonable, correct and timely selection of equipment to complete various types of maritime communication through repeated practice, and can randomly set different scenarios through the teacher to achieve the purpose of strengthening students' resilience. Providing teaching resources for practical teaching in teaching is of great significance to the rational allocation and application of teaching resources. During the period when students cannot be in school, remote practical teaching can be achieved through this system, and "0 delay" can be achieved for education and teaching, and every student can also meet the needs of personal operation and personal practice during school, expanding education and teaching resources.

2. Problems in the popularization of INMARSAT F station simulators

At this stage, many schools or training institutions do not have such simulators or use simulators that were used on ships many years ago, but such models and the equipment used on ships today have changed greatly in terms of function and interface. Updating the existing real equipment is too expensive, with the progress of the times, GMDSS maritime satellite system replacement is fast, if you want to progress with the times, to achieve teaching and reality is not out of touch need to update the equipment in real time, and GMDSS equipment is often tens of thousands or even hundreds of thousands of hundreds of thousands is not every school and training institution can bear. It is not possible to use too much of a real marine machine because the signal will interfere with the normal use of the ship on the sea. At the same time, limited by the simulator software electronic dongle, students can only carry out equipment experiment training in a fixed laboratory, and cannot practice freely after class.

3. A perfect approach to simulator design

The main contents of GMDSS include ground communication systems, satellite communication systems, emergency services, etc., among which: the ground communication system includes equipment such as narrowband printed telegraph (NBDP), digital selective call (DSC), navigation telex (NAVTEX), etc.; The satellite communication system includes satellite C station, satellite B station, satellite F station and emergency position indicator (EPIRB); Emergency services include distress, emergency and security communications. [3]

Station F consists of an Operations Control Center (OCC), Satellite Control Center (SCC), Network Coordination Station (NCS), Ground Station (LES) and Mobile Ground Station (MES). Based at Inmarsat's London headquarters, OCC coordinates a range of activities within the Inmarsat system, including the launch of mobile ground stations.

Station F divides the world into four regions, each with satellite coverage.

IMMARSAT system satellites:

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Table1: System satellites Introduction

region	satellite	satellite location
AOR-West	Inmarsat 3,F4	54.0°W
AOR-East	Inmarsat 3,F2	15.5°W
IOR	Inmarsat 3,F1	64.0°E
POR	Inmarsat 3,F3	178.0°E

Each area has an NCS (Network Coordination Station) and several LESs (Ground Stations). NCS (Network Coordination Station) records all Inmarsat-C messages and broadcast information such as navigational alerts, weather reports, and news in the area. LESs (Ground Stations) provide MES (Mobile Ground Stations) and terrestrial telecommunications networks via satellite.

The simulator uses VB language to compile SAILOR F station radio control unit simulator, narrowband direct print telegraph (NBDP) terminal simulator, simulated coastal radio station and simulated land telex users, and uses background support, simulation database and other networks to simulate various types of maritime GMDSS communications. The simulation system can reflect the communication characteristics of offshore F station without server, and can facilitate networking training.

Website building

The core framework of the website is Spring Boot 2.1, the security framework is Apache Shiro 1.4, the view framework is Spring MVC 5.0, the persistence layer framework is MyBatis 3.3, the timer is Quartz 2.3, the database connection pool is Druid 1.0, the log management is SLF4J 1.7, Log4j, and the page interaction is Vue3.x.

Core introduction

The front-end core framework used by websites, Vue, is a progressive framework for building data-driven web interfaces. The goal is to implement responsive data binding and composition of view components through the simplest possible API. Simple and compact core integrated with third-party libraries or existing projects, progressive technology stack, enough to handle any size application, 20kb min+gzip run size, ultra-fast virtual DOM.

4. Ideal future prospects for INMARSAT F station simulator design

At present, the operation panel of the simulator is mostly limited to flat graphics, and the realism is not strong when using the mouse to operate on the computer. Therefore, it is necessary to continuously improve and break through in hardware, using real chassis and buttons, and replacing internal movement with software. The role of software is to give external devices (displays, antennas, buzzers, printers) a realistic machine effect when operated by the operator. Secondly, the functions of each part of the equipment should be as complete as possible in the software. When upgrading software, consider the model of equipment currently used on the vessel. Ideally, it is best to cooperate with shipping companies and participate in the development of simulators. Since the simulator is mainly realized by computer technology, the company or ship can be equipped with a set of independent training software, the cost is not large, the crew can practice at any time during rest or leisure, and the unskilled driver can also be explained and taught by the licensed personnel, to achieve twice the effect with half the effort, and enable the personnel on board to use GMDSS equipment and mobile phones, which truly ensures the navigation safety of the ship [4, 5].

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5. Innovation and discussion

Advantages of simulator platform: The use of satellite signal simulator solves the defects of the randomness of the sky satellite signal and the influence of the external environment when the satellite receiver directly receives the satellite signal during the test, as well as the error of the satellite navigation path in different environments in real time. By comparison, satellite signal simulator and real satellite signal in the test, when the test environment in the indoor laboratory, signal closed plant, satellite receiver through the antenna connection, receive real-time satellite signals, by forwarding satellite signals to the room, will produce noise and signal amplification at the same time, in harsh environments, resulting in fewer satellites or can not receive satellite information, difficult to complete normal testing. At this time, it is necessary to use a satellite signal simulator, there is no external environmental influence, no noise and interference and other influences, which can effectively solve the test in various test environments.

Students can only carry out Inmarsat-F equipment experimental training in a fixed laboratory, and cannot practice freely after class, which greatly reduces the training significance of professional crews. In contrast, an online simulation training platform is more in line with the current social situation. Research and development of INMARSAT-F simulator based on WEB to realize the basic functions of Inmarsat-F, message editing, storage, retrieval and deletion, message sending, e-mail, distress alarm sending and testing and other experimental projects.

(1) This kind of simulator is based on the design of web pages, which can break through various limitations such as time and space to achieve multi-time and multi-use without restrictions. It simulates various situations during sea navigation more realistically and feasiblely, which provides a good education and teaching environment for the daily learning and training of nautical students, and establishes a solid foundation for the implementation of teaching activities of nautical students.

(2) It has a double-ended entrance mode for students and teachers, which can realize the simultaneous conduct of teaching practice and can achieve the dual purpose of exercise and test by issuing different instructions through the teacher, and has the function of assessment.

(3) The simulator completely restores the INMARSAT F station communication satellite in 1:1, and at the same time, it can also simulate a diversified maritime environment, and will not send false signals to the incoming and outgoing ships to affect the normal navigation of ships.

6. Concluding remarks

This project effectively combines the disciplinary characteristics of nautical students, stimulates students' interest in the research of nautical simulation systems, and can complete this project under the guidance of the faculty of nautical majors in the college, and the project team has developed a feasible experimental plan based on reviewing a large number of relevant literature and practical learning. When encountering difficulties, actively discuss and communicate with professional teachers, and constantly improve and perfect the experimental plan. The project has high feasibility, and in the process of research, it is convenient for students to deeply understand GMDSS, and also improves students' ability to think actively, solve problems and innovate independently, which is of great help to future study and work. The results of the project can also be used as teaching resources for teachers, which will help the training of future nautical students and have high effectiveness.

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