Design and implementation of marine crew training system

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ABSTRACT

In order to improve the effect of crew training on board, this paper establishes a crew training management system based on B/S architecture. "Crew training system" is a set of system for information management of crew training on board. Through the use, it is found that the system improves the training effect of the crew, provides a management means for the shipping company, and also helps the career development of the crew.

Keywords: crew training; B/S; System design; information system

1. INTRODUCTION

By the end of 2021, China has more than 1.8 million registered crew members, ranking first in the world in terms of scale. It is a large crew country, but not a powerful one. The overall quality of China's crew members cannot meet the needs of national strategy and shipping development. At the same time, with the Manila Amendment to the STCW Convention and the MLC2006 coming into force, the Convention has put forward higher and higher requirements for the comprehensive quality of seafarers, the world shipping competition has become increasingly fierce, and the international performance environment has become more stringent. In view of the current situation, how to do a good job of crew training on board to improve crew quality is a problem worth studying. Due to the particularity of the crew's occupation, it needs strong practicality. On board training is the most direct, convenient and effective training method for the crew[1]. Therefore, making good use of the opportunities of crew members while on board, actively organizing training on board, and using appropriate means to improve the effectiveness of training on board play an extremely important role in promoting the personal growth and career development of crew members, ensuring the safe transportation and production of ships, and improving China's shipping strength. However, there are some defects in traditional training, resulting in unsatisfactory efficiency and effect of training.

With the continuous development of modern information technology, information training system has appeared in all walks of life. At the same time, with the emergence of maritime satellite system, This paper intends to use information technology to design a crew training system to improve the training effect, and to provide a convenient, stable, easy company management, and conducive to the crew's career development information training environment.

2. Main technologies and introduction

2.1 SSH

SSH framework set is a framework set that will be used in most software design processes. The system integrating SSH framework is divided into four layers in terms of responsibilities: presentation layer, business logic layer, data persistence layer and domain module layer to help developers build Web applications with clear structure, good reusability and easy maintenance in a short time.

2.2 B/S architecture

B/S architecture is composed of prefabricated components. Low overall cost of ownership, easy maintenance, strong distribution, simple development, it can be operated anywhere without installing any special software, the client has zero maintenance, and the system expansion is very easy, as long as there is a computer that can access the Internet. As a training platform, the crew training system is extremely important for its convenient accessibility and easy upgrade and maintenance. Based on the above comparison, the development trend of Internet mainstream technology, and the needs of the crew training system, the training system in this paper is built using B/S architecture. Its architecture is shown in Figure 1.

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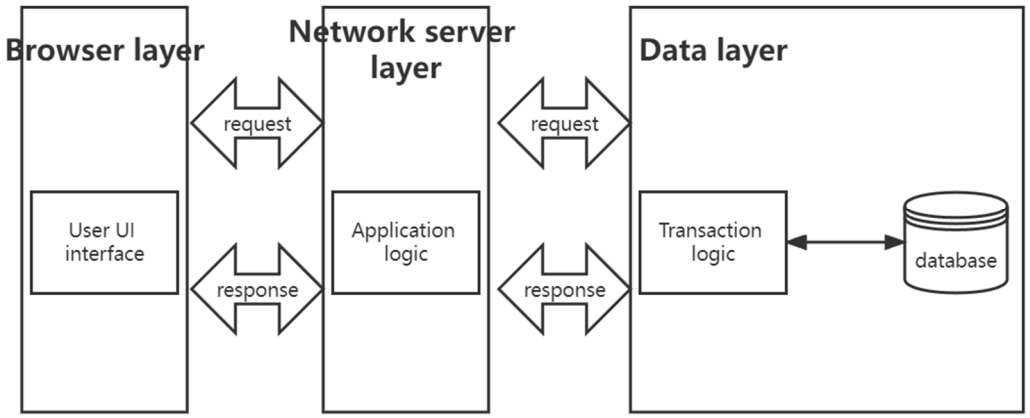

Figure 1 B/S architecture diagram

2.3 MySQL database

MySQL, as a relational database management system, stores different data in different tables, increasing speed and flexibility.

3. Requirement analysis

The main service content of this system is mainly used for crew training and convenient management of shipping companies. There are three main types of users: shore administrator, ship administrator and ratings.

The main purpose of the crew training system is to provide knowledge training on various aspects of ship training (such as conventions and regulations, rules and regulations, professional skills, etc.), mainly including safety education and training for marine crew. It can make use of the advantages of online education and training, and the information-based crew training management process, which not only saves the manpower consumption of teaching staff, but also helps promote the career planning and development of crew, and ensures the healthy and sustainable development of enterprises. Therefore, the basic business process of the training system includes: training plan learning, examination, knowledge learning, system personnel management, learning materials management, system daily maintenance, etc.

According to the demand survey and business process of the crew training system, the basic functions of each module of the system are as follows:

The function of the shore end administrator module: it has the function of daily system maintenance, system database management and other related system management; Have the function of crew ship information statistics; Crew user training plan formulation, release and management; It has the functions of classified management of learning materials; It has the functions of testing the learning effect after completing the training plan and managing relevant test papers; The analysis and management of crew members' scores after the examination.The above functions can be divided into five parts, including system management related functions, user management related functions, data management related functions, training plan related functions, examination related functions, and score related functions.Among them, the system management related functions are dedicated to the authority of the system administrator, while the user, data, and examination related functions include the special part of the authority of the teaching staff and the part of the authority of the students.

Ship end administrator module function: It has the function of daily maintenance of ship end system and other related system management; It has the function of crew information statistics; Crew user training plan receiving and viewing functions;learning materials management and other functions; View the crew learning status and other functions; Functions such as receiving and managing the scores of crew members after the examination.

Ship end common user module function: it has the function of receiving and viewing training plans; It has the function of viewing and learning system knowledge; Have examination related functions; It has the function of crew personal information management.

4. System Design and Implementation

4.1 Design principles

(1)Information security: the system organizes and plans the data in a unified way, and encrypts important configuration information and sensitive data according to the requirements of the enterprise for the security of system data such as training information.

(2)System reliability: It is necessary to maintain the stability and efficient operation of the system no matter from the requirements of the convention or the company.

(3)Scalability: considering the requirements of future development, it supports the storage of data in various formats and the integration of peripheral system interfaces.

4.2 Quality requirements for marine crew

At present, the comprehensive competency of seafarers is required to be higher and higher in the international shipping market. When hiring sailors, shipping companies and shipping enterprises should not only have the competency certificates for the corresponding posts, but also have strong adaptability, better education background, a higher sense of teamwork, higher management ability, better service awareness and a higher sense of responsibility. The competency certificate obtained by a seafarer through the examination of the Maritime Safety Administration can only indicate that he or she has the qualifications to perform corresponding duties on the ship, which is also the most intuitive condition for judging the competency of a seafarer. However, obtaining the competency certificate does not mean that his or her competency is certain high. There are some abilities and awareness that need to be accumulated and trained in work experience[2].

Man, ship and environment system are three closely related subsystems in the large ship transportation system, which is also the classification standard for the comprehensive ship system in ship transportation safety. Years of research shows that people are the main influencing factors of accidents. The Maritime Safety Administration has carried out statistical analysis and research on the human factors in the causes of maritime safety accidents in recent years, given the possible causes of human errors, and then systematically analyzed that the main causes of crew errors and accidents are directly related to several factors, which are: crew's physical health, maritime work experience Knowledge level (including rules for collision avoidance at sea, professional and technical level, crew's mastery and understanding of relevant laws and regulations, etc.), good seamanship (including the ability to cope with complex situations, the ability to judge critical situations, the ability to manipulate urgent situations, etc.), and ideological awareness (including safety awareness, responsibility awareness, professionalism, work attitude, etc.).

This article mainly uses the crew training system to train the knowledge level and ideology of the crew.

4.3 System introduction

The shipping company uses the system to formulate and release training and other related content for the marine crew, and at the same time, the system will feed back the training effect of the crew to the shipping company. In this way, the shipping company realizes the centralized management and remote monitoring of the crew, and the crew themselves get appropriate training. Due to the particularity of crew occupation, ocean going ships and land shipping companies are far away from each other. In order to facilitate the management and operation of the system, the marine crew training system consists of two subsystems: shore end system and ship end system. The shore end system is only used by the pipeline operator of the land shipping company to manage various users on the ship end. The shore end administrator is the highest authority owner of the entire crew training system. The ship end system can be divided into two modules according to the different use rights: the ship end administrator module and the rating module. Among them, the ship end administrator module is used by the ship end administrator to manage common users of the ship end and feed back to the shore end system at the same time. Only one ship end administrator is assigned to any ship, and the jurisdiction of the ship end administrator of any ship is limited to that ship. The ship end common user module is used by the ratings (including the crew of various professional ranks on the ship), mainly for the training, learning and examination of the crew. The system structure is shown in Figure 2.

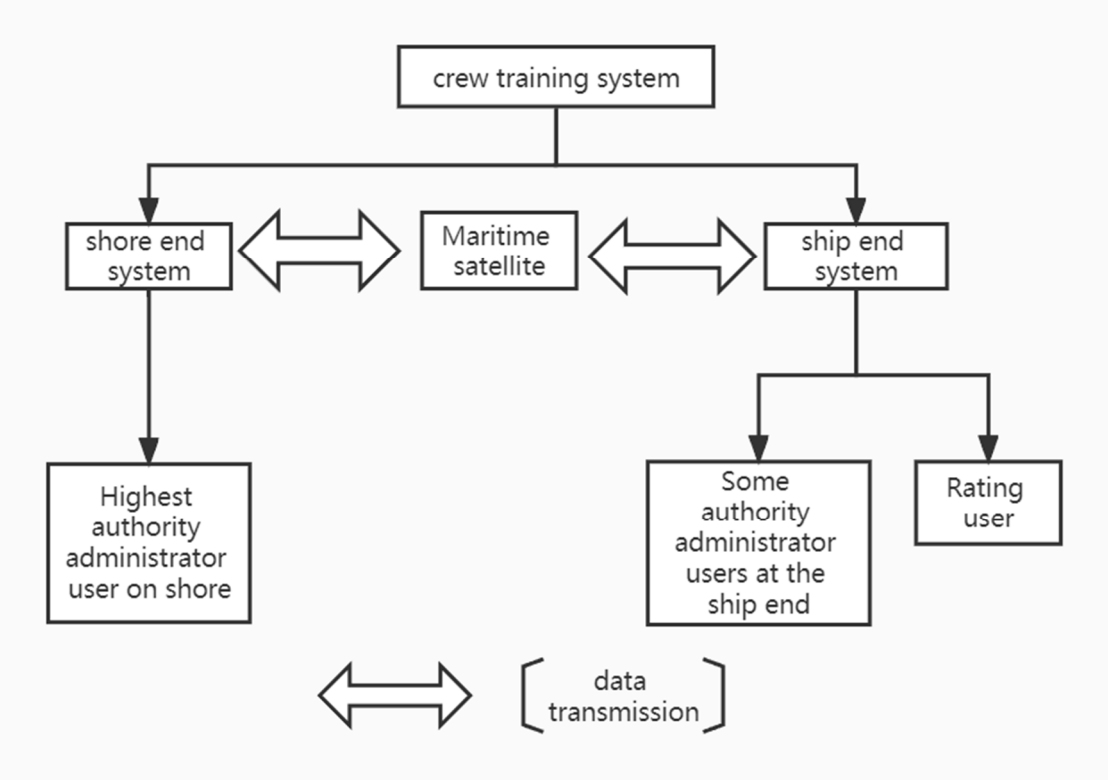

Figure 2 System structure diagram

4.4 Learning and assessment feedback process of offshore crew training plan

The learning and assessment feedback process of marine crew training plan learning can be divided into four stages: preparation stage, formulation and release stage, reception and implementation stage, and result feedback stage. The specific dynamic structure is shown in Figure 3. Detailed process description:

(1)Plan preparation stage: according to the requirements of shipping companies, maritime departments and other relevant units, the shore end administrator uploads the materials that meet the requirements in the shore end system, and then sets the corresponding test questions for the specific content of the training materials, that is, associated test questions. The type of questions (such as judgment questions, multiple choice questions, etc.), difficulty and other attributes can be set, and then assign corresponding scores to each test question.

(2)Plan formulation and release stage: the shore end administrator uses the above materials to formulate the corresponding training plan, and then releases the training plan to the ship end. Before the plan is released, the administrator can make targeted modifications if there are any defects.

(3)Plan receiving and implementation stage: the ship end administrator and crew members receive the training plan issued by the shore end through the maritime satellite, and the ship end administrator views the plan and supervises the crew members to implement the plan. Crew members can view and learn the training plan, and can take an examination after completing the planned study.

(4)Plan result feedback stage: after the examination is completed, the crew members can view their learning hours and examination results for the plan, and these data will be fed back to the ship end administrator, who will summarize the learning status and examination results of all the crew members implementing the plan on the ship, and then synchronize these data to the shore end through the maritime satellite.

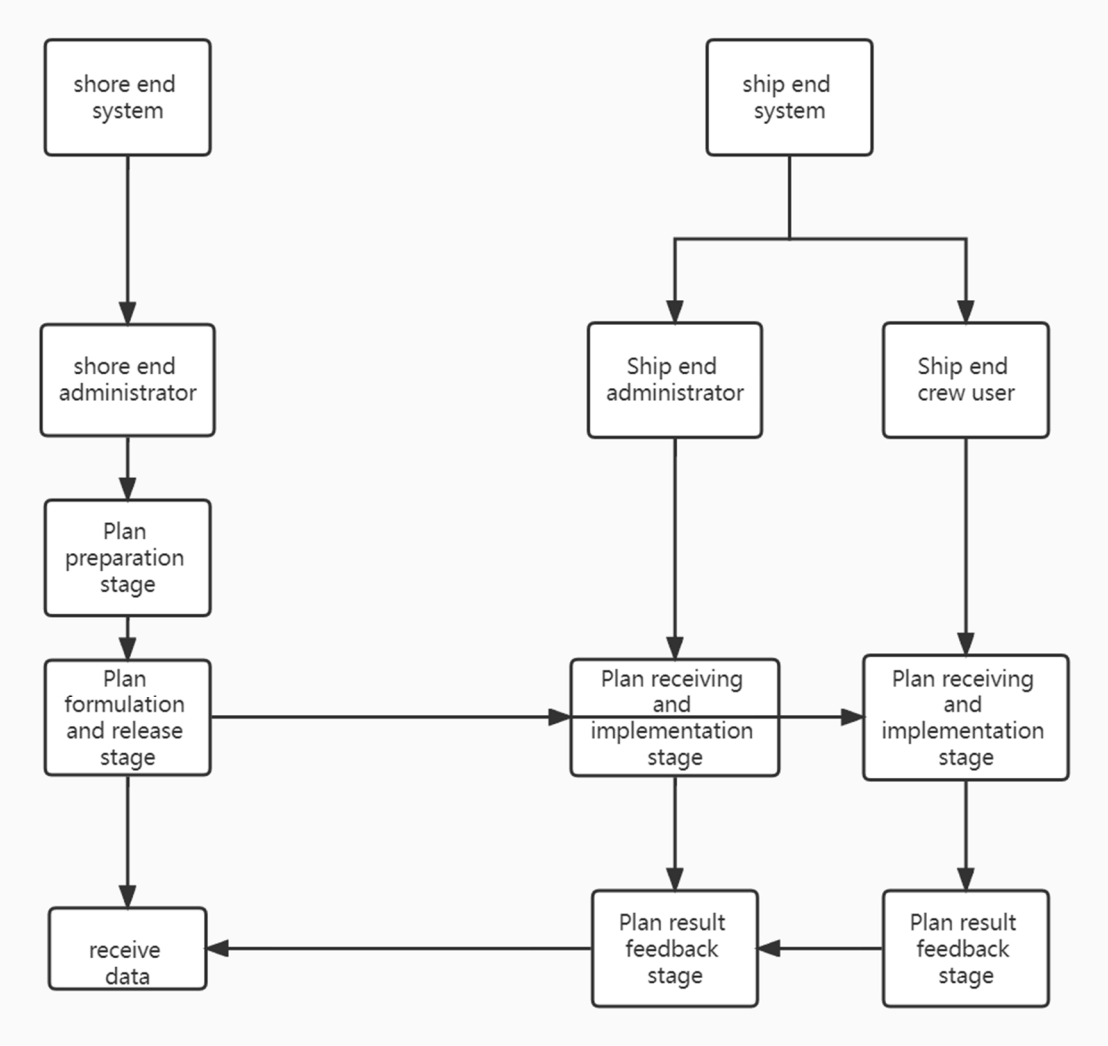

Figure 3 Flow Chart of Crew Training Plan Learning and Assessment Feedback

4.5 Overall framework of marine crew training system

According to the principle of high cohesion and low coupling in the system design, the static structure design of the crew training system is shown in Figure 4.

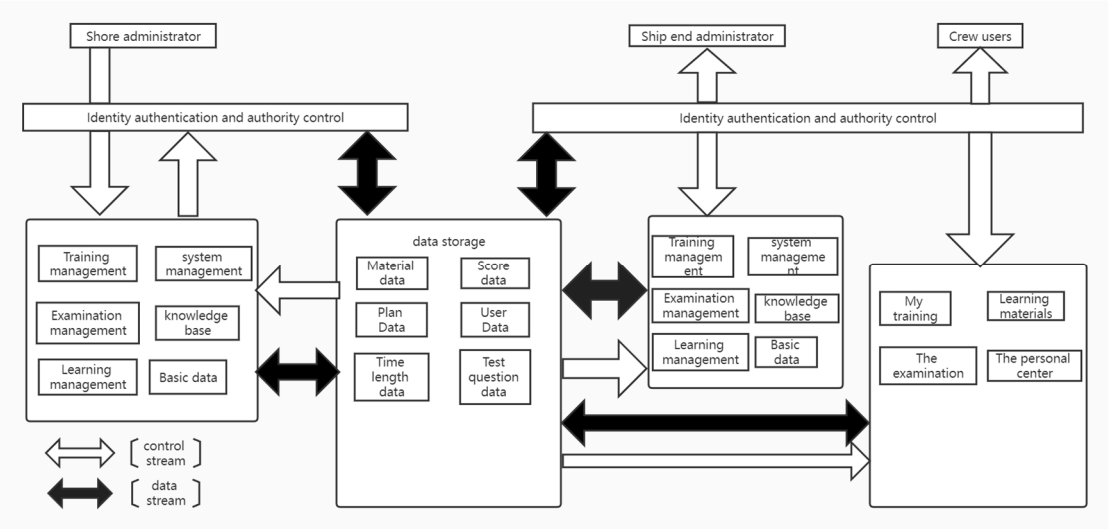

Figure 4 System static structure diagram

It can be seen from the static structure diagram of the system that the administrator side is mainly divided into several functional modules: system management, training management, examination management, knowledge base, learning management, and basic data. The ship end user side is mainly divided into several functional modules: my training, knowledge base, examination, and personal center. At the same time, there are two auxiliary modules: identity authentication and authority control, and data storage. The functions of several major functional modules have been analyzed above, so we will not repeat them. The functions of the two auxiliary modules are as follows:

(1)Data storage: This module is the data center of the entire crew training system, and stores various data of the system by category.

(2)Identity authentication and authority management: As the crew training system is a web system with multi-user roles, this module is responsible for verifying the identity and authority management of the system login users and completing the system authentication. All system users will first authenticate their identities when logging in. When their identities are reasonable, they will authenticate according to their roles, and display the corresponding functional modules according to the user permissions[3].

4.6 System login module design

Due to the particularity of the marine crew's occupation, the crew training system is divided into two subsystems, namely shore end system and ship end system. This system is targeted at the sea crew and land managers. There are a large number of users, and there are three types of users, namely shore end administrator, ship end administrator and ratings user. Considering the security and convenience of users, the login interface of each subsystem is designed with the link of entering account and password. The onshore system is designed with an optional permission to enter the onshore administrator interface by entering the correct account and password. The ship end system is designed with two optional permissions. By entering different accounts and passwords, the corresponding login interface will be different, including the ship end administrator interface and the rating interface. Before logging in, you need to register the ship end administrator user and the rating user.

4.7 Design of shore end function module

The shore end system is used on land, and the shore end administrator is the highest authority owner of the entire training system. Through the maritime satellite, some information can be synchronized with the ship end. This part mainly has six sub function modules, including training management, knowledge base, basic data, system management, learning management and examination management. The following are detailed one by one:

(1)Training management. This module can upload learning materials (including videos, documents, audio, etc.), and can set the material name, type, applicable job and other attributes of the material. The administrator can associate the uploaded materials with test questions, that is, add corresponding test questions according to the content of the material, mainly including judgment questions, single choice questions, and multiple choice questions. After adding the test questions, the

material becomes a whole with learning content and relevant test questions. At the same time, the administrator can perform post management on the uploaded learning materials, including viewing, modifying, updating, deleting and other operations. Similarly, the administrator can perform similar management on the added test questions. After handling the uploaded learning materials, the administrator can make a training plan by using the added learning materials as training content, and then publish the prepared training plan to a fleet (or specific to a ship). The ship end crew will feed back to the shore end after learning the training plan, and can check the implementation of the released plan of each ship, fleet and company in this module.

(2)Knowledge base. The administrator can upload learning materials (including videos, documents, audio, etc.) in this module. The uploaded learning materials are stored in the database shared by the ship end and the shore end, and the ship end can view and learn in the ship end system. Similarly, the administrator can modify, update and delete the uploaded learning materials.

(3)Basic data. This module can be used to manage crew information and ship information.

(4)System management. It is mainly used for permission control and system configuration. It also has the function of data transmission.

(5)Learning management. It is used to view the crew's implementation of the plan, including the time of starting learning, the time of ending learning, the total length of time, and whether it is completed.

(6)Examination management. It is used to view the examination results of crew members, and it can also be counted by examination papers, examination questions, ships and positions.

4.8 Ship end function module design

For the ship end system, the user can enter two types of users through the account and password in the login interface, which are the ship end administrator and the rating user

Class I, rating users

The ratings user is the main service object of the system. After the ship carries the system, the crew can use it to complete the released training plan when at sea, and can use the free time to learn the learning materials of the system. The rating system mainly has the following four functional modules.

(1)My training.Crew can view the training plan.

(2)Learning materials .The crew can freely view various learning materials.

(3)The examination.It is used for learning the training plan and examination, and you can view your historical scores.

(4)The personal center.It is used to view your own charts and write logs.

Class II, ship end administrator

The ship end administrator is the manager of the crew training on the ship and the owner of part of the authority of the crew training system. Like the shore end administrator, its functional modules are divided into six functions: training management, knowledge base, basic data, system management, learning management and examination management. However, it cannot upload training materials or formulate and publish training plans. Other functions are basically similar, but the jurisdiction is limited to the ship, It can refer to the shore end and will not be repeated.

4.9 Database design of crew training system

The crew training system involves a lot of data. In order to make a good analysis of the structure of the data involved, it can be described with the help of data flow diagram. According to the module division of the above system, the data tables involved in the crew training system can be divided into five categories, namely, plan data table, material data table, user data table, score data table, duration data table, and test question data table.

Material data table: used to store information related to learning materials for administrators to view. It mainly includes information such as material number, material name, material description, related questions, directory, applicable rank, material uploader, submission date, etc.

Plan Data Table: used to store training plan related information so that administrators can learn about the plan details. It

includes plan number, plan name, plan description, publishing status, plan status, start date, end date, plan maker, plan making date, etc.

User Data Table: it is a management form for users to manage the system and assign login query users[4]. Including user name, password, user category, real name, gender, job title, mobile phone number, email, ID number, registration time and other information.

Score data table: used to store information related to crew examination scores, so that administrators can understand the training effect of crew members. Including plan number, plan name, test paper number, test paper name, certificate number of the respondent, name of the respondent, score, answer date, material name and other information.

Time length data table: used to store information about the crew's learning status, so that the administrator can monitor the crew's learning attitude. Including crew name, certificate number, plan name, plan number, material name, material number, learning duration, start time, end time, completion and other information.

Test question data table: used to store relevant information of test questions, so as to realize the temporary query function of test questions. It includes information such as question number, status, category, question type, question, difficulty, applicable rank, question bank, entry date, user, and question source.

5. Conclusion

The crew training system meets the requirements of STCW and relevant laws and regulations of China,and it also builds IT systems for various shipping enterprises, such as training plan management, training material management, user management, question bank management, performance management and internal system management. In this way, the system overcomes the disadvantages of traditional shipboard training to a certain extent.At the same time, as a large enterprise, in order to achieve talent management and build a learning enterprise organization, it is necessary to establish a complete training mechanism. The establishment of the training management system must rely on the comprehensive training management platform. Login and use of this platform can provide training opportunities and career development channels for crew members, and double the comprehensive ability and performance of employees. The establishment of this management system has saved departmental costs, improved communication efficiency, optimized business processes, ensured the safety and accuracy of information flow, and made office work more environmentally friendly[5].

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