

IP-RFID based Small Ship Management System

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Abstract—In the large ships, the equipment and the elements for the ship operation are controlled through diverse expensive equipments. But, in case of small ships, the equipments, the persons and the port-entry/departure are not well managed because of high cost for purchase of the equipments. It has caused diverse problems such as the equipment disorder, the deficient management of persons and the delay of port entry or departure. To solve the problems, this study proposes the small ship management system using the IP-RFID technology along with its requisite service items for the replacement of existing expensive equipments. Describing the necessity of small ship management, this study also draws out the necessity of application of IP-RFID technology to the small ships and proposes each service. In addition, it suggests the services to be given by the system for the actual application of the proposed system. It can be a good method to manage the small ships actually with a low cost and to elevate the efficiency of management as well as the prevention of accidents.

Keywords—RFID, IP-RFID, Small Ship Management.

I. INTRODUCTION

Small ships have weaker infra and less sufficient ship-management system than the large ships or the international vessels. Therefore, the location and equipment management of small ships are not well carried out on the sea[4]. So, the accident frequency of small ships on the sea is very high. In addition, as the port-entry/departure management is not properly made for them, many problems are caused in the

transaction. The equipments in the small ships are usually managed by hands, and so the damage by the malfunction can hardly be handled in advance.

To solve these problems, it is necessary to manage the position, the main equipments and the sailing information of small ships. But small ships can hardly buy and install the expensive equipments, like large ships do, such as the automatic identification system(AIS). Therefore, this study suggests a new system to manage small ships at a relatively low cost through the new IP-RFID technology. The IP-RFID is a fusion of RFID and IP technologies in which RFID tag can perform the IP communication.

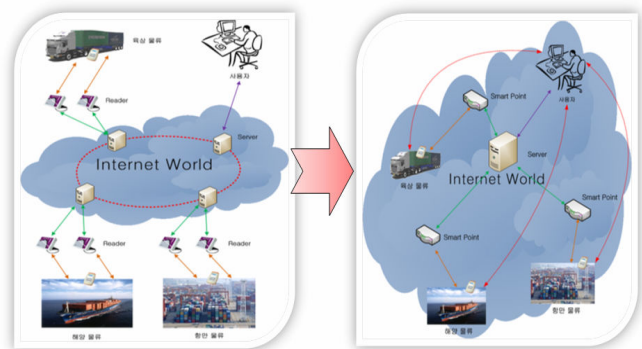


Fig. 1 RFID and IP-RFID

In the existing RFID technology, the tag information is provided in corporation with a specific information system. But, in the IP-RFID technology, the tag information is directly transmitted to the user. It is because the IP-RFID tag can execute the IP communication directly. The small-ship management system proposed in this study collects diverse information and transmit it to the ship owner or the ship company directly through the IP-RFID technology. The ship owner can directly process the diverse information collected from the IP-RFID tag and apply it for diverse purposes. Therefore, this study presents the explanation on the IP-RFID technology and the small-ship management technology through this.

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II. PROBLEMS IN SMALL SHIP MANAGEMENT

Previous management of small ships has mainly three problems. First, the equipment management is weak. Small ships usually have no system to check the disorder of equipments in them. In case that a problem happened, the captain or the engine driver frequently treats it in a subjective way. This may cause a large accident due to the lack of objectivity. When there is a problem in an equipment, it can be checked only after a specific time point. In fact, the life cycle and the maintenance cycle of the equipment can hardly be comprehended. Second, the management of ship passenger is not sufficient. In most cases of small ships, one or two crews carry out diverse duties in person. Therefore, the work efficiency becomes low and the passengers except the crews are not so managed well that they are exposed to the danger of ship accidents. Third, the sea traffic management is insufficient. Big ships can connect themselves to the nationwide network and communicate with the land. But, in case of small ships, though they have the equipments which can make the VHF or UHF communication, the equipments are not used well to increase the accident rate on the sea. Furthermore, while large vessels can share the traffic information of the sea with the land through the AIS(Automatic Identification System), small ships actually have no system provided by national institutions.

Due to these problems, the sea accident of small ships covers 90% or more of the total sea accidents. So, it is urgently necessary to introduce a special system to solve the problems. The small-ship management system using the IP-RFID technology proposed in this paper can be a solution. Before the detailed description of the system, the IP-RFID technology is explained in Chap.3 to emphasize the necessity of the relevant technology in the small ships.



Fig. 2 Problems in Small Ship Management

III. IP-RFID TECHNOLOGY

IP-RFID technology is the one that the IP technology is added to the existing RFID technology to let the user use the information through the IP communication method. In the previous RFID technology, the information collected by the

RFID tag is saved in the server or other storage after passing through the middle ware before it is used by the user. But, in the IP-RFID technology, no middle ware is necessary and the user can use the information directly through the internet without a special storage.

In the previous RFID system, in order to request specific data to the RFID tag or to receive the data from the RFID tag, the user had to make the communication through the middle ware, the middle ware had to have all the information about the tag and a separate mapping table had to exist for the communication between the user and the tag. It means that the user could not approach the tag directly to take the necessary information. But, as the IP-RFID system has the IP in it, the middle ware function is not necessary. Through the IP communication, the user can approach the tag directly on the internet to take the necessary information or to revise the tag information, if necessary.

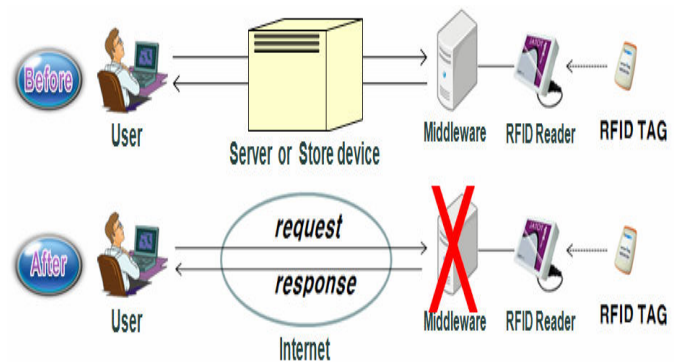


Fig. 3 Difference between RFID and IP-RFID

This IP-RFID system is very cheap and easy to use in comparison with AMS(Alarm Monitoring Systems) for the equipment management or AIS for the sea traffic management in the large vessels. In fact, the AMS and the AIS have to be installed during the ship constructing procedure, but the IP-RFID system can be installed additionally after the ship was constructed. Thus, it has a good extensibility. Therefore, the IP-RFID which is relatively cheap and easy to install in comparison with the equipments in the large ships is appropriate to be applied to the small ships.

In Chapter 4, the method to apply the IP-RFID actually to the small ships is described.

IV. IP-RFID BASED SMALL SHIP MANAGEMENT

This chapter presents the system to manage the equipments and the state of the small ship in real time by using the IP-RFID technology and explains its service types.

Through the IP-RFID technology, the ship owner can monitor and control the ship position and the main equipments not only in the ship but also on the land. In addition, the persons in the ship can be managed in real time, and diverse information collected on the sea can be transmitted to the land. Thus, the persons in the ship and the sea traffic can be controlled actually.

The small-ship management system can be largely divided into 3 concepts: the equipment management system, the person

management system and the sea traffic management system. In case of the equipment management system, a reader which enables the IP communication with the IP-RFID tag is installed on the ship to send the information collected by the IP-RFID tag to the ship or to the land directly. By providing the information collected on the ship in real time, it checks the disorder of ship equipments to prevent the sea accident through the real-time information collection. The collected information can be used diversely through the re-processing.

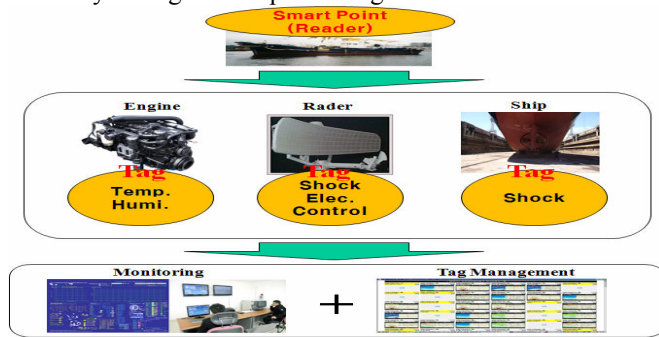


Fig. 4 Concept Diagram of IP-RFID based Equipment Management

In case of person management system, it manages the persons in the ship by having them get the IP-RFID tags when they are boarding the ship, like the equipment management system.



Fig. 5 Concept Diagram of IP-RFID-based Person Management

The sea traffic management system is the one to provide the sea traffic information to the small ship without AIS by connecting it to the existing VTS(vessel traffic system) through the IP-RFID system installed on the ship. In this system, the IP-RFID tag is applied to the ship and the reader is attached on the sea structures such as buoy, light house or sign. The collected data are incorporated into the data base of the costal vessel traffic control center and provided not only to the ship but also to the local sea port office, the sea police station, the ship company/ship-owner/agency etc. to facilitate the sea traffic control of the small ship.



Fig. 6 Concept Diagram of IP-RFID-based Sea Traffic Management

Foregoing three detailed systems provide the services in [Table 1], which are in turn divided into sub services. In case of the equipment and the personal control service, it is divided into 5 items: the ship identification, the equipment identification, the person identification, the remote control and the functional control. First, the ship identification is the service to identify the ship through the tag. As every tag on the ship has its own IP and the proper number, the ship management is possible with it. Second, the equipment identification is the service to check where the equipment is located in the ship. It can be monitored in both of the ship and the land. Third, the person identification is the service to manage the persons with the tag in real time, like the ship and the equipment identification. Fourth, the remote control is the service to change or revise the information of tag on the ship in the remote area directly through the IP communication. This service eliminates the temporal and spatial restrictions between the tag and the user. Finally, the function control is the service to control the tag on the ship remotely in order for the user to control the function of each tag directly.

In case of the real-time state information provision service, it is divided into four items. First, the state information collection service is to collect the information about the state of the ship with the tag in real time through the sensor attached to the tag and the proper function of the tag. The information collected with it can be re-processed before use according to the request of the user. Second, the monitored information transmission service is to enable the user to monitor the state in real-time through the tag and the IP communication. In the previous technology, the real-time collection of the state information depended on the communication equipment embedded in the ship and the information for the direct monitoring of the state could not be collected. But, in the IP-RFID system, the information to monitor the state in real time can be collected. The third is the main network connection service. It is the service to connect the diverse information collected from the tag directly to the DB operated by the institutions to have it used for the sea traffic control or so in real time. Finally, the tag information transmission service is to comprehend the information of IP-RFID tag/ reader attached to the ship or the sea structure in real time. It is the service to facilitate the management of the system applied by it.

Presently, the method to check the state of small ship on the land in real time is only the man-to-man communication between the ship and the land. And the disorder of equipments in the large ships can be checked by using the electronic facility in real time. But, in the small ships it is dependent so much on the experience of the captain or the engine driver that the correct and objective cause of the disorder can hardly be found. The management of persons in the small ship is not well carried out too. Furthermore, as most of small ships are out of the traffic control on the sea, it becomes a major cause of the sea accident. For the control of them, the IP-RFID technology provides the service to monitor and manage the small ships in real time on the sea or the land.

When this IP-RFID technology is applied to small ships, the small ship accidents, which cover the major part of ship accidents, can be prevented. In addition, the equipments and the persons in the small ship can be managed in real time and the state of the ship on the sea can be checked. Thus, this technology can create new values.

TABLE I
SERVICE TYPE OF SMALL SHIP MANAGEMENT

Service Type	Detailed Item	Description
Equipment & Person Control	Ship Id.	Through the proper info of the tag, the ship with it can be identified. The management by ships can be made.
	Equipment Id.	Through the proper info of the tag, the type and the location of the equipment with it can be identified. The monitoring and management can be made on the sea and the land.
	Person Id.	Through the tag given to each person, the position of each person in the ship can be identified in real time.
	Remote Control	Tag on the ship can be managed from the distance through the IP.
	Function Control	Function of tag on the ship can be managed through the IP
Real-time State Info Provision	State Info Collection	Through the sensor in the tag and the tag functions, the state info of the tag-attached equipment and ship can be collected in real time
	Monitored Info Transmission	Tag info is served as the real-time monitorable info through the IP
	Connection to Main Network	Diverse info from the tag is collected in real time and connected to the DB operated by institutions.
	Tag Info Transmission	Through the Smart Point and the Tag IP, the information is sent to the place managing the tags.

V. CONCLUSION

This study suggested a system and service types for the small ship management by using the IP-RFID technology which is in development now. This study presented an application part of the new technology and concrete service types when IP-RFID is

applied to the small-ship management system. Later, it is necessary to present the applicable scenario based on this study and the business model for its application to the real field.

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