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# Design of a smart vessel platform for remote monitoring

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**Abstract.** In this study a smart vessel platform design is shown which can be used to monitor the data of control systems and sensors in the vessel as well as provide diverse marine information. With it, the base which provides information on the vessel and service information is available. Also, it is expected that through use of this system marine accidents which might occur during navigation can be prevented, marine information can be provided and the safety and efficiency of the system can be enhanced.

**Keywords:** marine information, vessel platform, remote monitoring, marine accident

## 1 Introduction

Recently, as control systems and sensors in vessels have increased, there has been research on development of a platform to control or monitor them. In particular, with the development of IT technology and mobile communications, diverse attempts to provide various services involving the platform have been made. If previous vessel platforms controlled or monitored control systems and sensors in the control panel of the vessel, a smart vessel platform can create remote monitoring using mobile communication technology from close by or from a long distance. By monitoring specific behavior of a vessel in real-time, different types of incidents which might occur during navigation can be prevented, marine information can be provided and the safety and efficiency of the system during navigation can be enhanced.

Therefore, for safe and economical navigation of a vessel, it is necessary to efficiently manage the data that come from each system in a vessel[1]. In the U.S.A. and the E.U. there have been a number of studies on digital vessels including research and development on digital vessel integration and land support systems for vessel navigation. [2].

1 Please note that the LNCS Editorial assumes that all authors have used the western naming convention, with given names preceding surnames. This determines the structure of the names in the running heads and the author index.

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This study aimed to design a smart vessel platform which can monitor the data from the control systems and sensors in a vessel and provide various pieces of marine information.

## 2 Development trends of the vessel monitoring system and navigation platform

Lee[3] proposed a vessel status monitoring system which can monitor the status of the vessel and the surrounding environment. For the proposed vessel monitoring, reliability and communication speed were enhanced through CAN communication which can control in real-time. For safety and efficiency in electronic sailing technology, RFID communication was used. For the boiler room in a vessel, a CAN cable network was integrated with a mobile network and to check the status of the containers outside the vessel. Lee[4] analysed information of the AIS system which automatically sends information on a vessel that is broadcast to the vessel and the land and receives information on neighboring vessels. Based on the information received, it classified the information on the neighboring vessels and displayed it in Google Map using HTML5. Kim[5] realized a system where a network of systems and equipment in developed that transmits information to the shore through an integrated protocol for management and support from land. Lee[6] developed a vessel motion control system based on Oldenburger's control theory which mathematically imitates the motion characteristics of a vessel and designed an autonomous vessel navigation and motion control system.

For the system proposed by Weilian[7], building and maintenance expenses are low because installment and maintenance is easy. As USN, which is built in a mobile environment, uses mobile communication and a network with low specifications, low speed, and with low expense, a zigby communication system can be built and used. Endsley[8] designed a risk analysis system based on USN middleware and vessel context-awareness as a vessel is affected by resistance and sway motion as the vessel contacts sea water directly during navigation by waves and current.

To more effectively integrate diverse artificial intelligence systems in the intelligent autonomous navigation system, a model of a Reactive Layer Virtual World Considerative Layer(RVC) was proposed, The RVC model which has a sharing information storage area called a virtual environment collects diverse pieces of information on a vessel and realizes damage detection, navigation, collision avoidance, and vessel motion control using artificial intelligence[9]. Lee[10] developed a composite navigation support platform. It provides remote support service and a remote support platform through an intelligent maintenance and management system, a vessel context monitoring service, and an optimal navigation performance support system according to navigation records and real-time vessel context, and supports a vessel environment support platform through an accident history management system and risk monitoring system.

## 3 Design of the smart vessel platform in this study

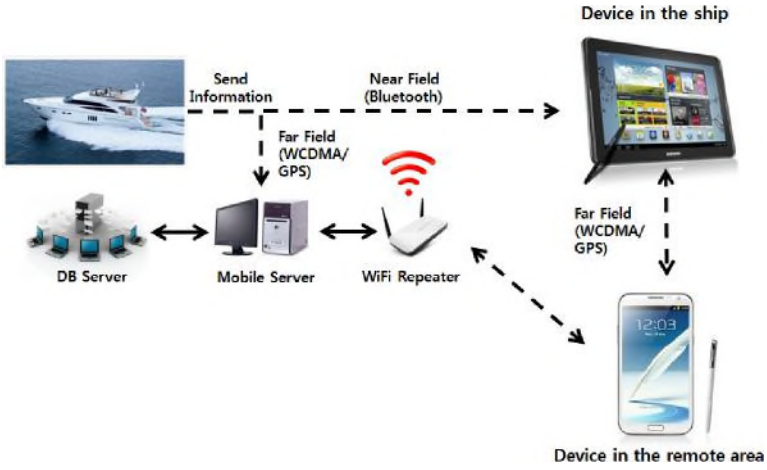


**Fig. 1.** Concept of the smart vessel platform

Figure 1 shows the smart vessel platform realized in this study. The platform uses NFC communication and smart systems in a vessel during navigation to identify information on the vessel. Also, WCDMA or GPS systems send vessel information to the server remotely and support its identification using smart devices. Finally, through WCDMA, it supports identification of the information on the vessel by connecting smart devices in the vessel to those in a remote area.

**Fig. 2.** Interface of a menu screen

Figure 2 shows the configuration of sectors in the initial menu screen of the smart vessel platform designed.

Figure 3 is a service screen to provide weather and leisure information and maps to a vessel in navigation, for which weather and leisure information was obtained from relevant sites(The Korean Meteorological Association and The Korean Ocean Research Institute). Naver Map was used and locations in the ocean were overlaid on

 

the map with real latitude and longitude locations. Click on the overlaid icons and the weather of the location is displayed to the right of the screen.

(a) Location Information

(b) Leisure Information

(c) Sectional Weather Information

(d) Ocean Point Weather Information

**Fig. 3.** Information Supply Service Screen


**(a)**

**(b)**

(a) Remote monitoring transmission screen (b) remote monitoring data display screen

**Fig. 4.** Remote monitoring screen

Figure 4 presents a module which transmits data with smart systems in remote areas by realizing a virtual system which transmits vessel information: (a) sends information on current actual navigation, problems, and position and (b) analysis data is sent and displayed on screen.

## 4 Conclusion

This study designed a smart vessel platform which can monitor data on control systems and sensors in a vessel and provide diverse pieces of ocean information. The platform has a base which provides information on a vessel and services in remote areas. Also, it is expected that this can be used to prevent diverse ocean incidents, provide information on ocean characteristics and enhance the stability and efficiency of the system during navigation.

Further research should give focus to development of a system which is connected to WCDMA communication for long-distance tests and its connection test with real vessels for verification in an ocean environment.

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