FLBT Multi Docking Aid System Design and Development
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ABSTRACT
Since 2012, the Baltic sea and some parts of American Sea have been set as Emission Control Areas (ECAs) by International Maritime Organization (IMO). ECAs are being spread rapidly as the result of tightening environmental regulations. Accordingly, the demand for LNG powered ships has been increased. As a result of this, discussions on LNG bunkering have been opened in Singapore, China and Europe. Korean government has recently initiated a research program for development of a Floating LNG Bunkering Terminal (FLBT). In this paper, a concept of a multiple docking aid system for FLBT operation is introduced. The proposed multiple docking aid system has ability to monitor a LNG Carrier (LNGC) and a LNG Bunkering Shuttle (LNGBS) simultaneously.

KEY WORDS: FLBT, LNGC, LNGBS, safety multiple docking aid system, RTK GPS, DGPS.

INTRODUCTION
Since 2012, the International Marine Organization (IMO) has set a part of waters as an Emission Control Area (ECA), and European Union and USA have further reinforced the regulation for such emission gases from ships as nitrogen oxides (NOx) and sulfur oxides (SOx). In addition, IMO has set the goal of reducing the amount of future greenhouse gas emissions by 20% by 2020 and by 50% by 2050 on the basis of 2005, strengthening the regulation for greenhouse gas emission so that the ships built and operated from January, 2013 should comply with the regulation of Energy Efficiency Design Index (EEDI). In line with such trend, the number of ships of using Liquefied Natural Gas (LNG) as a fuel has increased in order to reduce such air pollutants as sulfur oxides and nitrogen oxides generated from ships on the sea. Here, since LNG is judged more economical as a substitute fuel than Heavy Fuel Oil (HFO) which has been used mainly as an existing ship fuel, the attempt to use LNG as a ship fuel has started in Europe and expanded into different regions including USA. Currently, In line with the trends for the environmental regulatory reinforcement and the preparation for high-price oil, Korean government has also promoted such tasks as LNG-propelled ships, development and standardization of LNG bunkering technology, and improvement of systems. In addition, under review are the control system and the introduction and development of Floating LNG Bunkering Terminal (FLBT) for efficient fuel supply together with the introduction of ships of using LNG as a fuel.

The process of docking large ships including FLBT is one of the most difficult parts of ship operation even to experts. Such large ships as FLBT, LNG Carrier (LNGC), and LNG Bunkering Shuttle (LNGBS) dock the piers with the use of pilots and tug boats. In this paper, investigated are RTK GPS and DGPS technologies, which can measure the position of ships, and proposed is the multiple docking aid system, which can monitor real time the multiple LNGC and LNGBS to dock FLBT. The proposed system provides necessary information so that pilots may dock easily, and can help even sailors not accustomed to docking to dock. In addition, the system can prevent collision accidents in advance by confirming the time, distance, and collision risk alarm expected for docking between FLBT and LNGC/LNGBS, and may be utilized to safe docking of ships by confirming the surrounding environment through CCTV installed at FLBT.

POSITIONING METHODS USING GPS
The error in position measurement of GPS varies a great deal depending on the time and place. The factors of decreasing the accuracy in position measurement of GPS include the error in time and position of artificial satellites, the refraction of ionization layer and convection layer, such a structural factor as noise, and the geometrical factor due to the situation of satellite arrangement. As the technology devised to improve the position accuracy of objects under movement, available are Real-time DGPS and Real Time Kinematic GPS. The two systems provide accurate positions by delivering to users the error information from the reference station which has already known of the accurate positions. In addition, due to the characteristics of the system, the error information is transmitted by using such wireless communication networks as the wireless modem and the mobile communication.