A Study on 3D Design Model-based-visualization System to Support Pipe Maintenance

Jin-Ho Kim**, Kyung-Ho Lee*, Jung-Min Lee** and Gwang Lee**
Dept. of Naval Architecture and Ocean Engineering, Inha University, Incheon, Korea*
Dept. of Naval Architecture and Ocean Engineering, Graduate School, Inha University, Incheon, Korea **

ABSTRACT
An increase in maintenance has been observed of late in the shipbuilding industry. Moreover, the increase in marine freight transportation has led to bigger ships, and the increase in the use of natural gas and its rising global prices have affected the development of seabed resources. These developments are bringing about an increased demand for high-value-added ships such as FPSO, LNG, and CNG. These ships must have sustainable products operational ability, and ability to handle the matter because these operate in the sea for a lifecycle. However, the aforementioned developments lead to increasing complexity and specialty of ship, which will make it difficult for workers to judge a particular situation that may arise, and will thus make it easy for them to make a mistake. In actually, as shown by marine accident investigation, approximately 64% of all marine accidents are caused by human error. Therefore, this paper will say that the system enable worker who has no special engineering knowledge or background to help to deal with problems by quickly presenting to him an accurate analysis of the problem. The system is aimed at visualizing through the convergence with augmented reality which is based on 3D design models considering the product design information and production, so that the worker will be able to accomplish his maintenance-related tasks faster and more accurately.

KEY WORDS: 3D design model, pipe, maintenance, Augmented Reality

INTRODUCTION
The exhaustion of natural resources and the rising oil prices have led to an increased demand for high-value-added ships (e.g., FPSO, Drillship, CNG) for the development of the resources at the sea bottom, and of green energy (FPSO and Drillship are shown in Fig. 1). Especially, the structure of FPSO (Floating Production Storage and Offloading) is very complex and huge because of its functions performing to produce, separate, storage and offloading of crude oil. If one function of the ship cannot be used during the work period, it will cause a great loss on the part of the ship owners as well as critical damage to the shipbuilder. For these, it is important for ships to have effective preventive maintenance as well as precise design and production. FPSO which has to produce oil, however, consists of very complex pipe structure system in limited space. These FPSO conditions make it hard for the workers to inspect or maintenance it and make the workers feel like a wet rag. So, the workers need to proficient technology and wide experience to accurately carry out their tasks. In actually, as shown by marine accident investigation, approximately 64% of marine accidents are caused by human error.

Already, in many other industries, efforts have been made to develop the support systems that can effectively provide technical information to workers, who are inexperience and working in unfavorable work condition. As augmented reality can help engineers improve their understanding ability in their work sequence, it has applied to preventive maintenance systems. Augmented Reality is that three-dimensional (3D) virtual images appear superimposed over real objects. Augmented Reality applications typically use head mounted or handheld displays to make computer graphics appear in the user’s environment. (Billinghurst, M 2005) Therefore, at the point that technical information can be displayed in the real world at simply devices, augmented reality could play a role in fully supporting engineers working in poor work environments.

We think that Augmented Reality can help workers improve their recognition of complicated pipelines on offshore structure such as FPSO, so that they are able to effectively carry out pipeline inspection and correction. In this paper, we propose that supporting system that includes 3D cad design information based on Augmented Reality for the pipe maintenance.

Fig. 1 Kind of Marine Structure : FPSO and Drillship