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A Study on Augmented Reality Remote Maintenance Support System for Ships and Offshore Structures

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Extended Abstract

From the viewpoint of safety and sustainability, the demand for autonomous vessels is increasing. Due to technical and administrative limitations, achieving a fully autonomous ship is through sequential development and application, and this can be confirmed through the 4 unmanned surface ship degrees [1] established by the IMO. As an intermediate step, the main concern is the operation of the ship with minimal onboard crews, and this is a similar situation for offshore structures. In a crew-minimized environment, one crew member should be able to perform multi-discipline techniques, but it is practically impossible to establish such an environment in a short period of time. For this reason, research and development are focused on systemic support to onboard crews that can operate and maintain in a minimal crew environment. And the activities define a vessel in this operating environment as a smart vessel and approach it as a pre-stage of fully autonomous vessels. In case of smart ships, studies like [2] are being conducted on monitoring and detecting abnormal situations in equipment that occur during operation on ships. In addition, studies [3] are being conducted to converge condition monitoring data and the cyber physical system and apply them to ships and offshore structures. These studies are related to systems supporting the maintenance in point of the Fail Safety, and the purpose of the Fail Safety is to support the sustainable operation of ships or offshore structures. The Fail Safety system consists of two main components, those are the diagnosis of the equipment status based on the monitoring information and supporting a proper maintenance plan based on the diagnosis result.

In this study, the Fail Safety system related to providing maintenance plan is developing to consider the working environment to support effective maintenance work information for workers who need to perform unfamiliar work in non-specialized fields. In the above system, a maintenance support code related to an abnormal condition of equipment or system is generated through Condition Based Monitoring system and transmitted to a remote maintenance management system. Based on the maintenance support code, an appropriate Maintenance Work Package is generated which developed through this research. The selected Maintenance Work Package provides maintenance details by visualizing documents, drawings, or 3D model instructions with digital twin to workers. For maintenance situations that are not resolved through Maintenance Work Package, the system is designed to support maintenance through remote expert support or to share work status for requiring decision-making. In addition, to verify the system, the mock-up verification process of the test bed is introduced.

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References

[1] T. Kim and S. C. Mallam, “A Delphi-AHP study on STCW leadership competence in the age of autonomous maritime operations,” in WMU Journal of Maritime Affairs, 2020, vol. 19, no. 2, pp. 163-181.
[2] J. H. Kang, H. H. Lee, W. J. Lee, I. H. Lee, J. W. Kim and C. H. Park, “Analysis of Real Ship Operation Data using a Smart Ship Platform,” Journal of the Korean Society of Marine Environment and Safety, 2019, vol. 25, no. 6, pp. 649–657.

[3] S. S. Johansen and A. R. Nejad, "On Digital Twin Condition Monitoring Approach for Drivetrains in Marine Applications," in Proceedings of the ASME 2019 38th International Conference on Ocean, Offshore and Arctic Engineering, Glasgow, Scotland, UK., 2019, vol. 10.