Develop an experimental for remote survey for emergency machineries

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ABSTRACT
Remote surveys for non-emergency machinery are expected to be actively researched and invested in. On the other hand, the remote survey for emergency machinery is not accepted to modify once it is already approved under the classification rules and international conventions. The aim of this study is to develop an experimental method for remote surveys for emergency machinery. It is proposed to use the Edge AI with image processing for remote surveys. The result of this study showed the remote survey model proposed in this study does not require any modification of the existing machinery and the installation of additional equipment for the survey is simple. Several findings from this research are expected to contribute to future research on a remote survey of other emergency machinery.

1. Introduction

The emergency machinery such as an emergency fire extinguishing pump, emergency generator, fire damper, quick closing device, etc., is a crucial portion of the ship survey. The emergency machinery survey will be continued even if the MASS (maritime autonomous surface ship), which leads to unmanned ships according to reducing the number of seafarers, would be realized. However, the current technology still requires the roles of seafarers, and a lot of research will have to be conducted to support it until achieving a complete unmanned vessel (VTMIS ,2020). MSC (maritime safety committee in IMO) is invited to consider and finalize the draft road map at 105 sessions, with the understanding that finalization of the road map is a prerequisite to commence further work on this item (MSC 105/7, 2022). It is required a considerable amount of time that the finalization and approval of amendments to the existing convention necessary for the entry into force of the new convention for MASS. Therefore, remote survey for emergency machinery is not accepted to modify once until the MASS code/convention is approved. The purpose of this study is to introduce a method of remote survey for emergency machinery without any modification using Edge AI (artificial intelligence)

2. Method

This study is to propose an experimental device assuming that the emergency fire extinguishing pump is carried out survey by remotely among many kinds of emergency machinery on the training ship M/V Hannara.

2.1. Traditional survey method
According to SOLAS, the emergency fire extinguishing pump shall in any event be capable of delivering at least the two required jets of water (SOLAS / Ch.II-2 / Reg. 10.2.2.4, 2009). KR, one of the IACS (international association of classification societies) members, is carried out the emergency fire extinguishing pump survey as below (PSC Checklist, 2022)
 - Starting test (Several times if possible, instructing the caution of low draft starting. Self-ejecting function incl. vacuum pump)
 - Suction pressure
 - Two jets of water (Fore/Bridge)

2.2. Pipe line of the M/V Hannara

The type of ship, M/V Hannara, is the Special purpose ship as the training ship and the SPS code is applied. So, the forward fire extinguishing pump is not named an emergency fire pump. However, the location, configuration, and usage of the pump are the same as an emergency fire pump. Therefore, the forward fire extinguishing pump was assumed for the emergency fire pump. Fig. 1 depicts the piping diagram of the fire pump. The forward fire extinguishing pump is located on Tank Top Deck and the starting test and suction pressure could be confirmed at the pump side by the suction pressure gauge and discharge pressure gauge. The two jets of water could be confirmed by a pressure gauge installed on the end of the fire line located on the Compass deck and Shelter deck.
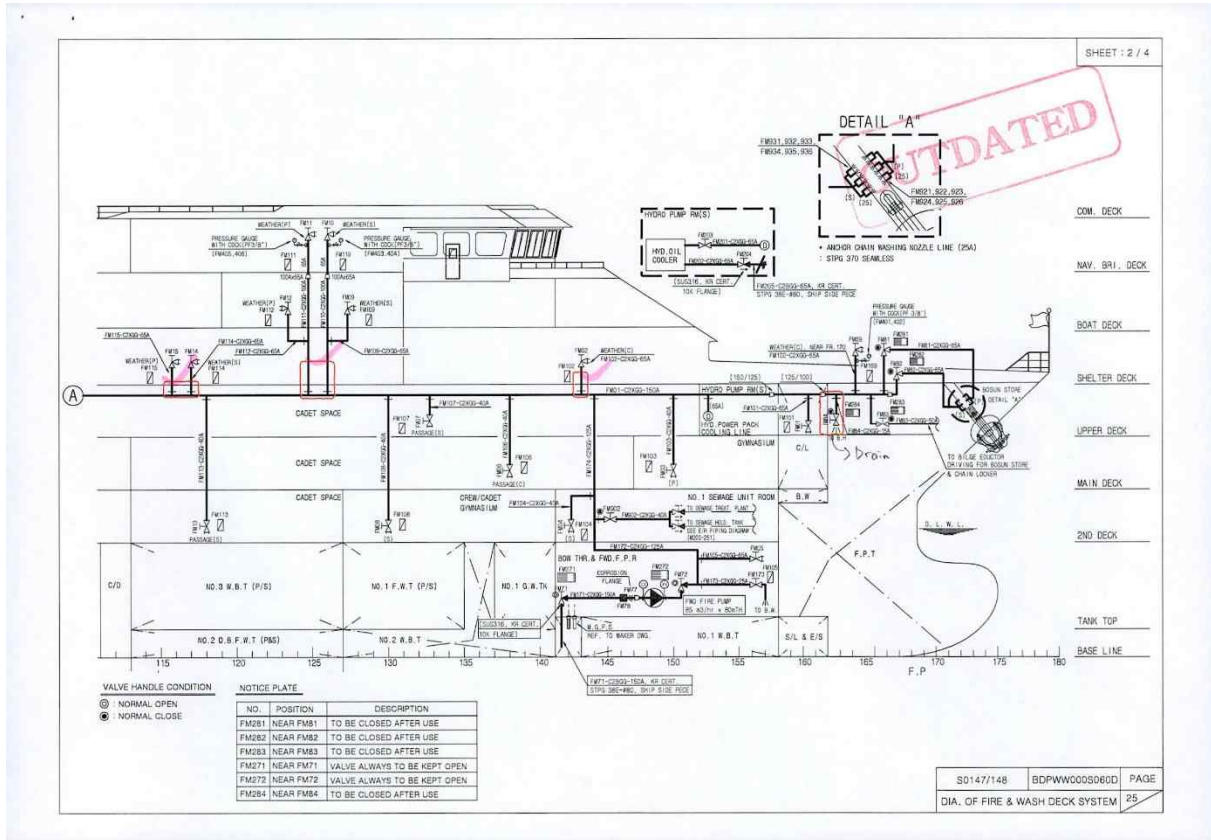

Fig. 1. Piping diagram of (emergency) fire extinguish pump for M/V Hanara

2.3. Proposed remote survey method

The approach taken in this study is edge AI. The edge Ai runs a machine learning algorithm on the local side. The image-based edge AI could be analyzed the gauges image installed on the suction and discharge line without any modification. Since a machine learning algorithm takes place on the local side, the remote survey could be carried out with a minimal amount of data.

3. Experiment equipment

Given the above, the experiment equipment for this study includes the water pump, steel pipe, and nozzle, pressure gauges. And the edge Ai equipment is used Jecton Nano[tm] Developer kit manufactured by NVIDIA. Fig. 2 shows the actual experiment equipment (left picture) and configuration of the Jecton Nano[tm] (right picture)

Fig. 2. Arrangement of experiment equipment

4. Conclusion and Discussion

This study has found the following possibilities: (a) the remote survey for the fire extinguishing pump could be carried out without any modification. Only install the edge AI in front of the gauges. (b) A minimal amount of data is required to submit the result of the survey. (c) the edge Ai is relatively simple and inexpensive. These possibilities indicated that it can be applied to other emergency machinery. And it is planned to study the determination of acceptance of the survey through image information obtained by edge AI.

The new remote survey technology not only has a positive practical significance on the implementation of ship survey and the protection of ship navigation safety under the current epidemic, but also represents the development trend of ship survey technology. The development and application of remote survey technology will bring more convenience to ship survey. Remote survey technology can handle the ship's emergency (sea and machinery damage, occasional survey, etc.). Periodic survey may be carried out step-by-step. For example, partial survey items may be carried out during the voyage, which can avoid the limitations of survey conditions after berthing and impact on crew's daily schedule.

References

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