

Skill Extraction of Expert Refinery Plant Inspectors Using Virtual Reality System

A daily patrol inspection is conducted by human inspectors to prevent a serious accident from occurring in refinery. They walk through vast refinery area and try to find defects such as leakages or corrosions, and expert inspectors can find even the slightest one that would be overlooked by inexperience or novice inspectors by using their rich experiences. In this study, we developed the virtual reality (VR) system to extract the inspection skills of expert human inspectors. Previous studies which addressed the skill extraction of inspection task has mainly focused on visual inspection [1], and measured and compared the eye behavior of expert inspectors and novices (e.g., [2]). However, in refinery patrol inspection, it is difficult for inspectors to fit all targets in the field of view at once due to the large size of inspection target. Therefore, due to this unique nature of the refinery, measuring the eye behavior alone is not a suitable manner for extracting expert skills in refinery inspection task.

From these backgrounds, in this study, we developed the virtual reality system which can measure both eye behavior (gaze position) and motor behavior (head position) during refinery patrol inspection task (Figure 1) [3]. Specifically, we integrated a part of refinery model into the virtual environment and set some defects on it based on the accident cases' reports. The inspection behavior for the model can be measured from both viewpoints of eye behavior and motor behavior by using the eye tracker inside the head mount display and lighthouse position tracking system.

Using the VR system we developed in this study, we measured and compared the inspection behavior between experts and novices. As a results, we found that expert inspectors tend to 1. gaze the refinery from a father distance, 2. set their head in lower position than novices. These results suggested because the information inspectors get from the target is changed depends on the body states of inspectors such as distance from the target and head height, hence, expert get different information from novices due to the differences in these motor behaviors, and this may lead the differences in detection rate in inspection task. In our future study, we will add other kinds of information than visual such as haptic, olfactory and auditory, and achieve the "multi-modal" skill extraction system for understanding expert inspection skill more deeply.

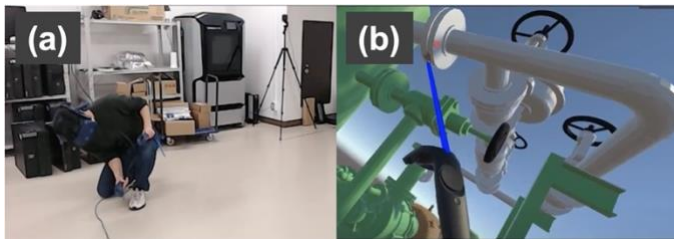


Figure 1. Virtual reality system for extracting skills of expert inspectors

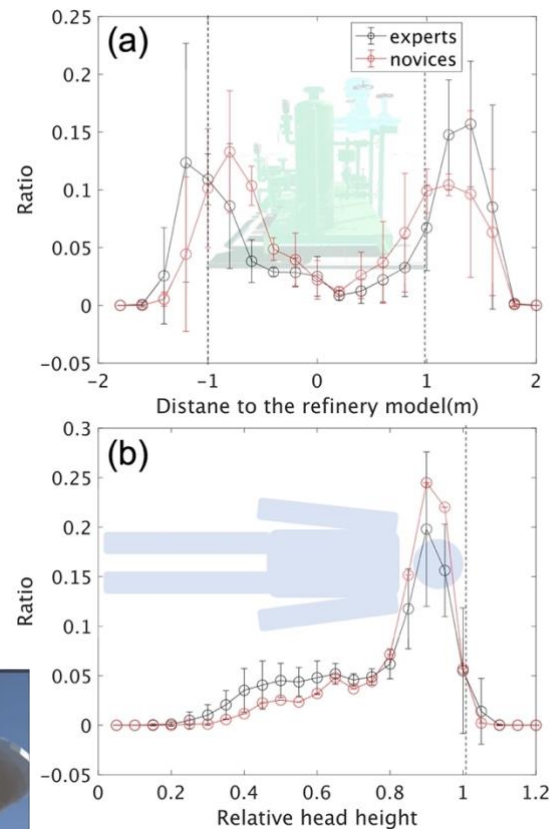


Figure 2. Results of our experiment, the differences between experts and novices in (a) distance from the model, (b) head height.

Keywords: Inspection, refinery, skill extraction, eye tracker

References:

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