

Multisensory Virtual Reality for the Analysis of Expert Inspection Skills

Refinery inspection is the fundamental maintenance task that expert inspectors move around the vast refinery area and try to find any defects or sign of it. Since even the slight defects will cause serious accidents in the real refinery, it owes a critical role for safety management. Therefore, to achieve the more stable and safety refinery operation, it is important to investigate how expert inspectors can find such a small defects from a vast refinery area, and how different their inspection behavior from novice's one, namely, analysis of the expert inspection skill is a critical aspects for refinery safety management.

From the above background, in a previous work, a Virtual Reality (VR) system is used to collect data of both experts and novices inspectors, and clarify the differences between them [1]. As a results, they revealed that expert inspectors tend to set their head in more effective position for finding the defects (e.g., lowerer position for leakage inspection). However, the problem of these previous studies is the lack of multimodality of the provided stimuli from the system. While the expert inspectors identify the multisensory information of the auditory, olfactory and haptic in addition to the visual information, the existing VR system can only provide the visual information. To deeply understand the expert skills in the refinery inspection task, we need to evaluate the inspection behavior under the provision of the multisensory information.

From the above back ground, this study newly developed multisensory virtual reality system that can provide four different sensory information of the visual, auditory, haptic and olfactory information simultaneously [2]. Figure 1 shows the overview of the developed system. In this system, the user tries to find a defect in the virtual refinery while using the multisensory information such as “see the bottom part of the pipe because the anoral vibration was detected.”

To verify the effectiveness of the developed system, we conducted the experiment. The 9 expert and 11 novice inspectors participated in the experiment. The experimental task is to find the anomalies randomly set on the virtual refinery within the 2 min. The results of the experiment revealed that (1) the expert inspectors showed the higher probability for the “multisensory anomalies” which require inspectors to use more than two different sensory stimuli for the detection (2) they tend to both gaze at and touch on a longer time with the important component such as a rotating machine. These results showed the effectiveness of our developed system to analyze the complex perceptual-motor behavior of the expert inspectors.

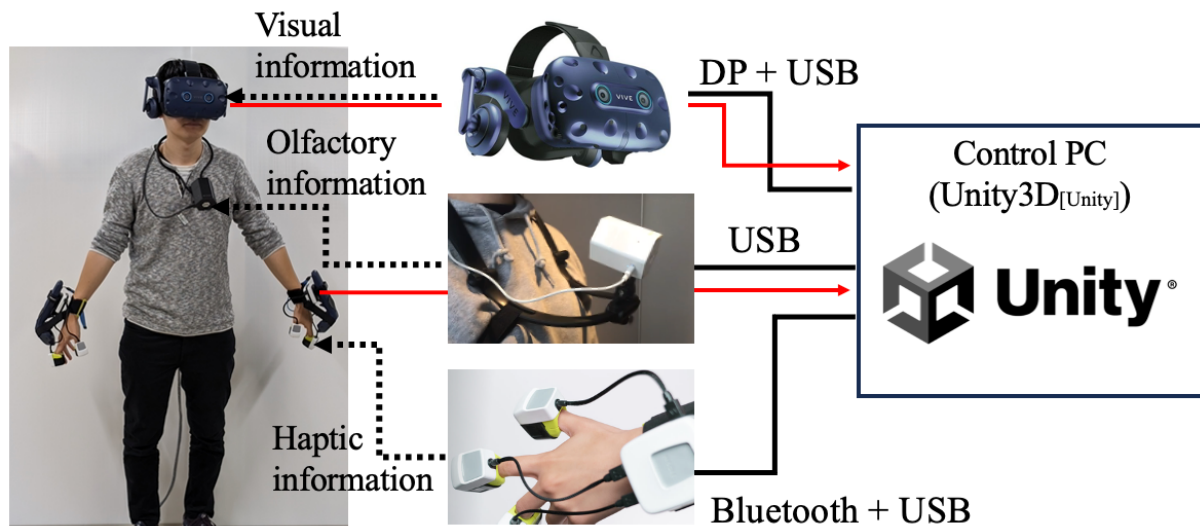


Fig 1. The multisensory virtual reality developed in this study.

Keywords: Expert Skills, Virtual Reality, Multisensory Information, Inspection

References

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