Evaluation based on virtual networked environment for the hazards resulting from human errors during decommissioning of a nuclear facility

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1. Introduction

Decommissioning of a nuclear facility has to be accomplished by assuring the safety of workers because the decommissioning activities of a nuclear facility are under high radioactivity and work difficulty. The limitations of the legacy system are unable to real-time change working direction and to measure the occupational dose in a workplace and evaluate the hazards from human errors during decommissioning of nuclear facilities. An augmented reality has been used in decommissioning of a nuclear facility to support temporary placement and conveyance operation simulation system. The limitations of the legacy system are unable to real-time change working direction and to measure the occupational dose in a workplace and evaluate the hazards from human errors during decommissioning of a nuclear facility.

This paper was intended to suggest an innovative safety assessment system for measurement and evaluation during decommissioning of a nuclear facility.

2. Evaluation on the hazard from human errors during decommissioning of nuclear facilities

2.1 Considerations of evaluation on the occupational exposure from human errors

The structure of evaluation model consists of two categories. One is to evaluate the exposure under normal environments. Another is to evaluate the exposure under abnormal environments. Evaluation of normal environments is to estimate the exposure from the dose distribution in a work place. Evaluation of abnormal environments is to estimate the exposure from physical errors, procedural errors, and operational errors.

2.2 Configuration of the safety assessment system

The safety assessment system based on virtual networked environment is show in Fig. 1. The system was developed with several modules. The modules are made up of five modules such as a module of database, a module of multi-subjects, a module of multi-subjects control, a module of multi-subjects evaluation, and a module of optimal evaluation. The module of database is to manage all data from the system. The module of multi-subjects is to carry out decommissioning activities in a virtual workplace under networked environment. The module of multi-subjects control is to real-time monitor with one-person mode and third-person mode. The module of multi-subjects evaluation is to evaluate the working time, exposure dose, and waste from decommissioning activities. The module of optimal evaluation is to suggest a working route to reduce the exposure dose and working time.
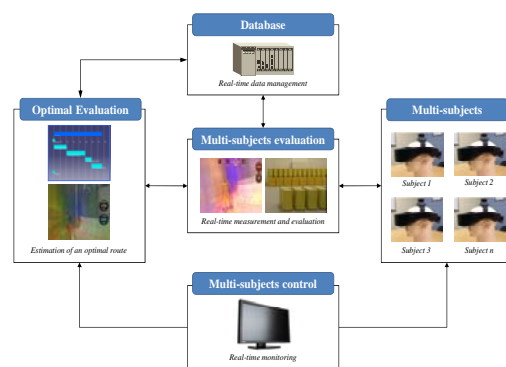

Fig. 1. Configuration of the safety assessment system.

2.3 The innovative features in the developed system

The safety assessment is based on virtual networked environment. Several subjects can at the same time enter into a virtual decommissioning workplace. This function enables the subjects to take parts in several roles of a workplace as shown in Fig. 2. The number of the subjects and roles is no limit under virtual networked environment. Fig. 3 shows that the system provides subjects with one worker (a crane operator role) and another worker (a working role). And a monitoring mode is the basic mode which works as the system is in operation.

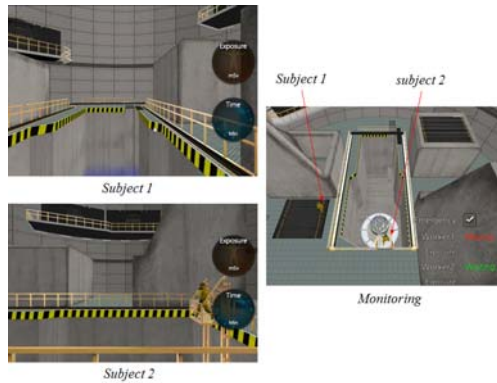Fig. 2. The safety assessment system based on virtual networked environment.

Fig. 3. The Multi-subjects operation in the virtual networked environment.

2.4 The real-time measurement and evaluation under virtual networked environment

The occupational dose is measured and evaluated when a subject moves and an incident occurs in virtual decommissioning environment. Fig. 4 depicts that a subject enter into a workplace and the subject collides with dose distribution in the workplace. The occupational dose can be measured and calculated by every one second with dose distribution and duration time in a virtual decommissioning environment.
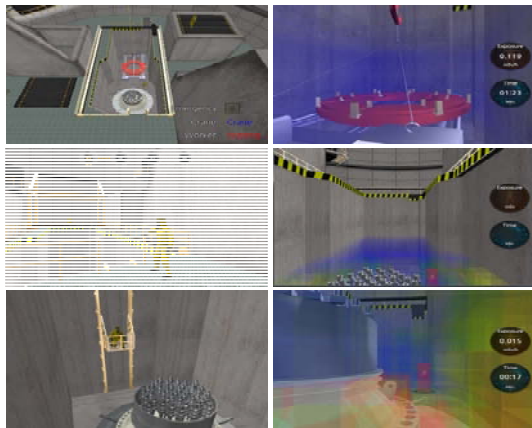

Fig. 4. A feasibility test of the developed system.

3. Conclusions

The safety assessment system was developed under virtual networked environment to measure and to evaluate on hazards during decommissioning of a nuclear facility. The system has the features of arbitrarily changing direction in a workplace and of real-time measuring personal dose and collective dose in a workplace.

It can be concluded that the developed system enables workers to improve familiarization of a workplace prior to entering into a workplace and can be utilized as a training tool for preventing workers from accidents during decommissioning of a nuclear facility.

4. Acknowledgement