Design of the Advance Remote Dismantling System Framework

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1. Introduction

The dismantling process of core equipment for high radioactivity in nuclear power plants is a complex process that requires various technologies and equipment, while considering economy and safety [1]. The basic concept of the advanced remote dismantling system under development is to optimize the disassembly process in real time through 3-dimensional process simulation based on the design data and on-site environment data, and to perform the dismantling process safely and efficiently with the robot remotely. This paper introduces the framework of advanced remote dismantling system set up for this purpose.

2. Module configuration of the system

The main components of the advanced remote dismantling system are environmental information acquisition module, environmental information feedback module, and a number of remote operation modules for cutting and transporting and so on. The environmental information acquisition module acquires the on-site environment information of the dismantling process as point cloud data through three-dimensional space scanning and obtains the as-built drawing using the obtained point cloud data. The environmental information feedback module compares the measured drawings with the existing design drawings, updates the design drawings when differences are found, or detects changes in the progress of cutting operations and reflects them in the work plan. Remote operation modules is a module for performing remote cutting and transfer operations through pre-simulation such as multi-axis robot manipulator capable of remote or autonomous control, vertical rail for conveying the manipulator, and gantry crane.

3. Design of the system framework

Since each module composing the advanced remote dismantling system must interoperate with each other in real time during operation, its system framework should be constructed considering simplification of communication network and load distribution of unit system. The requirements for the modules of the advanced remote dismantling system include a number of functional requirements for

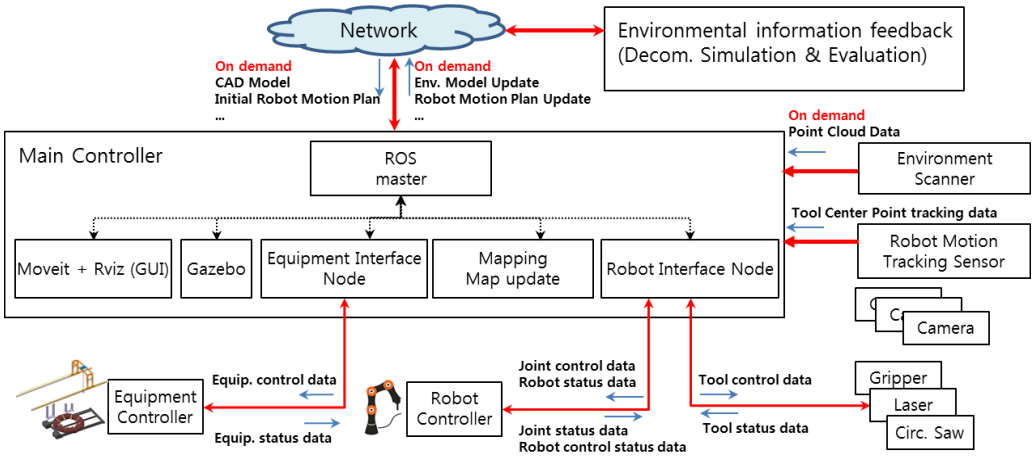

Fig. 1. System framework of the advanced remote dismantling system.

master controller, command generation, three-dimensional geometry mapping & update, dynamic re-planning, interactive remote control and so on. Figure 1 shows the overall system framework for interoperating modules based on these functional requirements. This framework links each component based on ROS-based master controller including sub-functional elements such as Mapping & Update part, Robot interface node, Equipment interface node, etc., and allows each component to exchange necessary information according to the derived functional requirements.

4. Conclusion

The designed framework will be continuously improved through ongoing research and will be validated through virtual commissioning technology. The advanced remote dismantling system to be developed through this framework is expected to provide an innovative way to economically and safely dismantle nuclear facilities with high radioactivity.

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