論　文　要　旨
Thesis Abstract

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主論文題名　(Title)

Integrating ROS with Coppeliasim Simulator for Development Real-Time Simulation with Dynamic Control

内容の要旨　(Abstract)

Robotic simulators can be used for testing system architecture, design, and develop¬ment, and, in a wider context, for artificial creatures. The visualization tools and interfaces with the robot or simulate the operation of the robotic systems in a very realistic way design and test control algorithms for different platforms. The robotic simulator is useful for real-time simulation or actual robot control in a wider context.

This study proposes a teleoperation system for assistive control of mobile robots' movement over a narrow path. That integrates simulation and the real world via the robot operating system (ROS) framework. The teleoperation system is a combination of real and virtual devices. First, we applied the object avoidance algorithm, the Braitenberg algorithm, and the path generating module (OMPL) in CoppeliaSim. The Braitenberg algorithm is a sensor-based automatic motion designed to aid the robot operator in maneuvering through a narrow path. While the OMPL module helps create a path for the operator to control the robot into narrow spaces or intersections within limited spaces, a virtual proximity sensor is used in the simulations to fulfill the Braitenberg algorithm requirement. A real laser range finder gathers the environmental data on the simulation screen. The virtual proximity sensor and Braitenberg algorithm are applied to the simulation scene with dynamic simulation. After that, simulation scripts are written to incorporate the linear and angular velocities into an ROS for real-time robot control. By simulating an actual narrow path scenario, we validated. The results indicated that the system could merge real-time dynamic simulation with real world; the proposed system can assist the operator in narrow path environments without collision.

Next, this study proposes a system for detecting small objects and surface conditions to im-prove environmental awareness in areas with low communication signals, proposes

a teleoperation system that integrates a CoppeliaSim robotics simulator with the real world via ROS. The proposed system is a real-time display system that can provide small object and floor conditions then visualization in simulation. A fusion of inertial measurement unit sensor and odometry data will be sent to the simulator to display the posture of a robot. CoppeliaSim constructs an algorithm to display small object and floor conditions on the robot's path. Thereafter, CoppeliaSim uses real-time and obstacle data for dynamic real-time simulation, in¬dicating the object's movement mounted on the robot. The results show that the proposed system can display the robot posture, small object, and floor conditions during robot move over on, and real-time dynamic simulations to assess the movement and the position of objects carried by the robot.

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