Environmental Support for an Intelligence Robot

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Our group aims to realize a robot that executes various tasks in home or office. To accomplish it, the robot has to execute followings; (a) measuring pose (i.e. position and orientation) of objects, (b) understanding of contents of task (e.g. how to operate or grasp), (c) generation of appropriate motions in response to the tasks. As far as (a) and (b), we attached marks that indicate (a) and (b) on objects. On the other hand, to deal with (c), we have proposed following three methods.

(1) Semi-Optimal Path Generation System for a Mobile Manipulator (Fig. 1)

If a robot —a mobile manipulator— executes several tasks at various places, a user has to teach the robot a sequence of tasks, configurations of the robot, trajectories of the manipulator, and the path connecting each work place to the other. However, deciding the above items is too hard for the user who is not sure of a structure of the robot. Therefore, we have developed a system that outputs the semi-optimal solutions of the above items if the user only inputs information regarding tasks. So far, the method for generating a path between two work places is established, avoiding collisions between the robot and obstacles.

(2) Handling of Objects with the Marks by a Robot (Fig. 2)

A robot has to know pose of objects, plan a sequence of conveyance and a pose for grasp. The robot estimates pose of objects measuring marks from some points of view and using least-squares method. Then, the robot can handle and convey the objects through planning a sequence of conveyance and a pose for grasp that is based on the pose of objects, candidates for grasp pose informed by the mark, and signals from proximity sensors.

(3) Environmental Support Method and Motion Generation Method for Robots (Fig. 3)

We assume that a robot operates an object that has a movable part, such as a sliding door, being assisted by a mark on the object. In this situation, it is important to decide following two items; a location in which the mark should be attached —Environmental Support Method—, selection of sensor necessary for executing the task —Motion Generation Method—. In this research, we have proposed a methodology for deciding an appropriate set of above two items, considering both success rate and completion time. In evaluating success rate and completion time, a grade method that is a kind of reliability theory is introduced. The present method was applied to a faucet-closing, and the robot realized the task.

Keywords: Service Robotics, Environmental support, Path Planning, Manipulation

References

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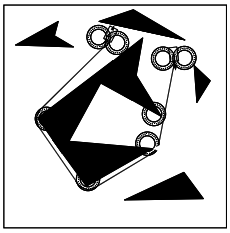

Fig.1 Example of paths

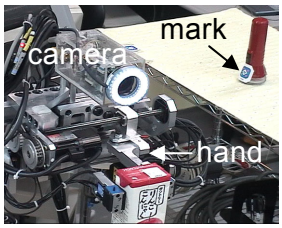

Fig. 2 Handling of a packed juice

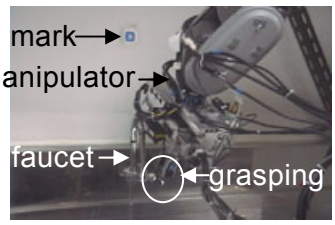

Fig. 3 Turning off a faucet