Environmental Support for Robot's Handling of Various Objects

Service robots will play important roles in assisting people at home, office or hospital. This approach can be distinguished from the past application which robots had been used in manufacturing place. A service robot must realize many kinds of tasks while interacting with various objects in real world environment. However the inadequate function of sensing and recognition obstructs the development in this area. In our research, we have proposed a methodology of environment support for autonomous mobile robots using visual marks with QR code as memory storage.

This study concentrates on the handling of various objects. The visual mark is improved from using reflexive paper to color printing on ordinary paper. With an additional dot, the pose of mark can be estimated while the mark is rotated. The modified version of mark is shown in Fig. 1. The marks were attached around an object so that it can be observed from all views. The necessary parameters consist of the number of marks, position of marks, figure of objects and the handling positions. To illustrate the figure, an object is spitted to a set of small parts represented by cylinder and box shape. The handling position is decided associated with the cylinder or box shape (Fig. 2).

To demonstrate the efficiency, an experiment on clean-up-table task was accomplished using a manipulator with 2-finger-gripper (Fig. 3). There are 2 CCD cameras for QR code reading and object finding. The task is to deliver 2 kinds of objects; a teacup and a basket; out from the table. The result is that the robot could complete 8 out of 15 trials for the teacup and 9 out of 15 for the basket. The main reason for failure was the inability to estimate the landmark part on visual mark. Positioning error also caused failure to code reading and the malfunction of gripper became the minor factors. Further study on error estimation can improve this methodology.

Keywords: Service Robotics, Environmental Support, Mark Recognition, Object Handling, Manipulator,

References

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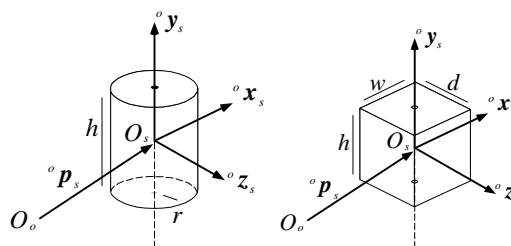
Fig. 1 Virtual marks on teacup   Fig. 2 Cylinder and box coordination   Fig. 3 Experimental scene