

# A Strategy for Fast Grasping of Unknown Objects using Two 2D Range Sensors and Partial Shape Information

Fast transportation of objects is important for productivity and efficient improvement in factory operations. Therefore, fast grasping of unknown objects is important. To improve the grasping efficiency, we propose a method for a mobile robot with a gripper to grasp an unknown object quickly based on partial shape information from two 2D range sensors.

The objects can be grasped and lifted by a gripper if the following three conditions are satisfied: ①There are flat parallel surfaces or parallel tangent planes on the objects. ②The distance between parallel flat surfaces or parallel tangent planes is not larger than the maximum opening width of the gripper. ③There is no obstacle near the grasping part when a robot is grasping objects. The conditions given above can be defined as three features, depth differences, flat surfaces or parallel tangent planes, and gripper insertion space, all of which are used to identify the grasping point. The 2D range sensor scans the object  $N$  times while the robot is moving forward to acquire the partial shape information of an object. The features are then extracted from the scanned data of partial information of an object. Whether a pair of grasping points is included in the scanned data is determined on the basis of these features. If no grasping points are detected, the robot moves to the next scan position to detect a possible grasping point. Otherwise, if a pair of grasping points exists in the scanned data, the grasping position is calculated. Finally, the robot moves to the grasping position and grasps the object.

The proposed approach is tested with experiments. A mobile robot with a parallel-jaw gripper can successfully grasp a wide variety of objects. The grasp success rate is about 90%. The grasping time of the proposed approach is 49% shorter than that with the 3D model construction method.

*Keywords:* Feature extraction, partial shape information, fast grasping of unknown objects

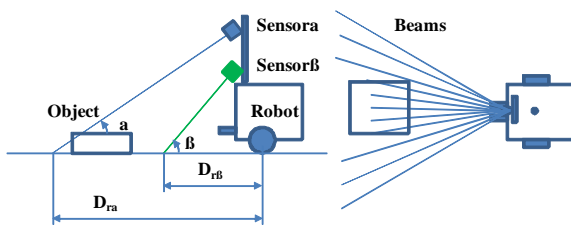


Fig. 1 A mobile robot with two 2D range sensors.

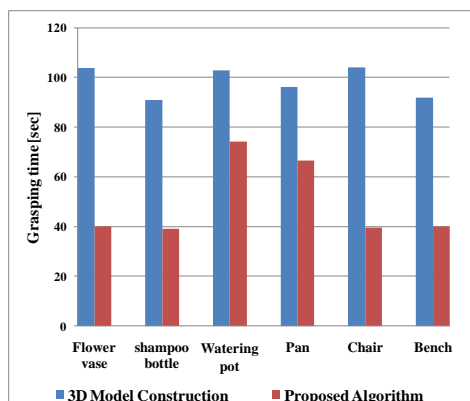


Fig. 3 Comparison of the grasping time of every object by using the proposed method and 3D model construction.

## Reference

- 1) Z.J. Liu, L. B. Gueta and J. Ota, Robotic Grasping based on Partial Shape Information, Proc. 2010 IEEE/SICE Int. Symp. System Integration, 299-304 (2010).

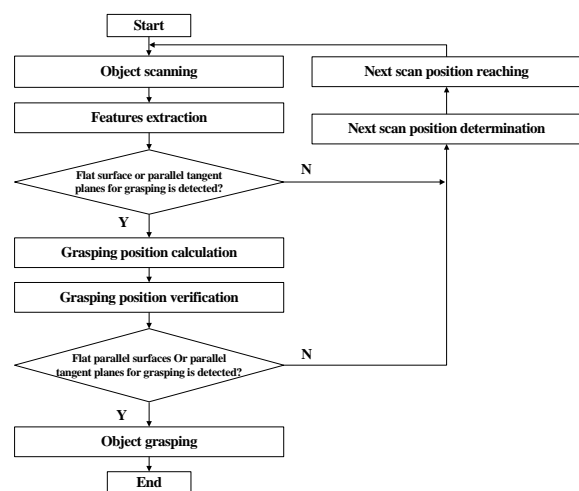


Fig. 2 Proposed approach.