Rearrangement Task Using Multiple Mobile Robots

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A rearrangement of multiple objects is a basic task and is applied in various applications such as production systems. Generally, distributed autonomous systems using multiple robots are considered superior to others in terms of reliability, expandability, and flexibility.

In these tasks, there are constraints among tasks, which require a sequential execution. Because of very high computational complexity, it is infeasible to calculate all constraints beforehand.

Related works can be classified into two main topics: (a) basic motion planning, (b) multi-robot cooperation. Approaches in (a) assume several objects and single manipulator. Researchers in category (b) have focused on rearrangement projects with a low degree of complexity. However, as far as we know, no research has been conducted on a rearrangement task requiring multiple robots in a dynamic environment. We developed a rearrangement system using multiple robots in an iterative manner of planning and execution.

To decrease the computational complexity, we classified task constraints into two groups and a different strategy is applied for each group as shown in Fig. 1: (I) constraints that can be calculated by positions of objects, (II) constraints that require path planning repetition before they can be detected. Group (I) has low computational complexity and robots attempt to locate this group at every allocation process. Group (II) requires a higher computational complexity; therefore, robots accept these kinds of constraints only in cases in which allocated tasks are unachievable. The proposed system has been tested in a simulated environment (Fig. 2).

Keywords: Multi-robot cooperation, Task constraints, Rearrangement problem, Movable objects, Mobile robots

References

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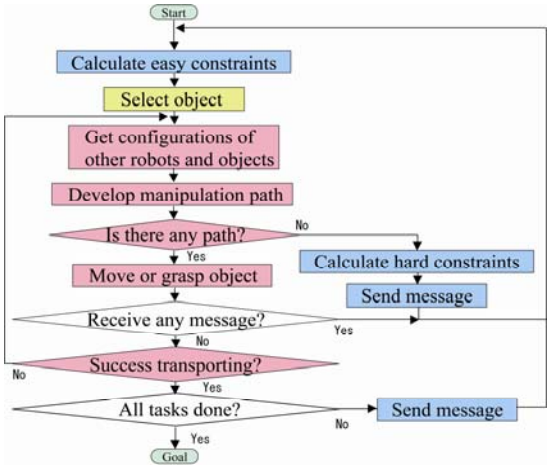

Fig. 1 An overview of the system

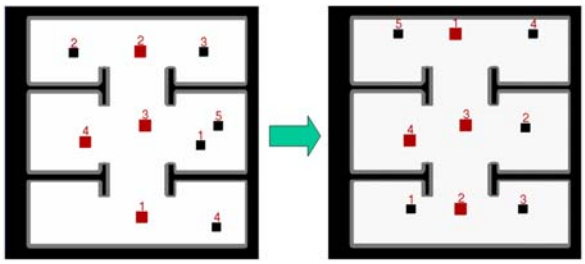

Fig. 2 A rearrangement task with two robots and ten objects