Rearrangement Task Using Multiple Mobile Robots
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A rearrangement of multiple objects is a basic task and applied in various applications. Generally, distributed autonomous systems using multiple robots are considered superior to others in terms of reliability, expandability, and flexibility.

One of the important aspects in rearrangement task is the collision avoidance between robots. In former researches of this task, working environments are expected either to be wide enough to contain some space for refugee in order to avoid collision. On the other hand, there are several researches on the iterative transportation that a robot hand objects to other robots in a comparative narrow working environment, while some are focus on the task exchanging method.

The goal of this research is the realization of rearrangement task in limited environment that contains a narrow passage, where it is impossible to allow two robots to pass. This working environment is difficult to be solved using former methodology. The challenging points are as follows: 1. It is essential to eliminate all the possibility of collision. 2. The computation time for calculating transportation orders must be feasible. In order to solve these problems, we are proposing two approaches. First, the leader robot decides the exclusive working area for each robot so that they will not overlap. Second, we propose a calculation procedure for transportation orders using combination of TSP solver and meta-heuristics.

Generally, motion planning in composite configuration space is indispensable to avoid collision in limited working environment. However, calculation costs necessarily get growth and usually it is unfeasible. The approaches that we proposed capable to divide this large-scale problem into several small-scale ones and control increasing of calculation cost. An overview of the system is shown in fig. 1, while an example of problem setting is shown in fig. 2.

Keywords: Multi-robot cooperation, Task constraints, Rearrangement problem

References

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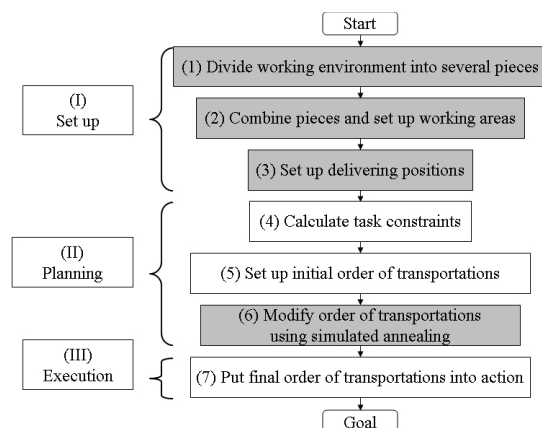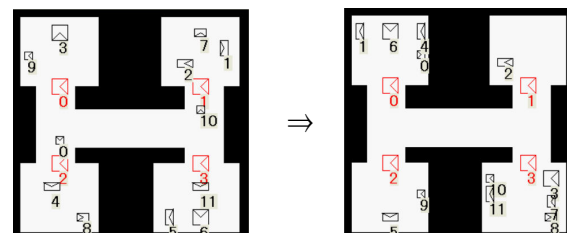
Fig. 1 An overview of the system

Fig. 2 A rearrangement task with four robots and twelve objects