

MULTI-AGENT SYSTEMS

Cooperation of Multiple Mobile Robots -- Cooperative Transportation --

This research deals with task planning of multiple mobile robots that change their role in the group adaptively according to the environment (Fig.1). For example, to transport a large object to the goal in the environment with many people or obstacles, various functions (tasks: to look around, to remove an obstacle, to handle an object, etc.) are needed. Here, we propose real-time planning architecture that repeats the following two steps: (1) assign needed tasks, (2) plan motion of robots independently of each task. This enables us to cope with dynamic environmental change. As for (1), we propose an architecture that generates task instances by inputting sensory information into templates in which tasks are described, and assigns them among robots with linear programming method considering. Effectiveness of the architecture was verified by simulations (Fig.2). As for (2), we mainly deal with “looking around” task. We proposed cooperative sensing strategy that calculates the area to be sensed and allot to robots. A simulation verified the effectiveness of this strategy (Fig.3). Our architecture was implemented on omni-directional mobile robots (Fig.4), and validated through the experiments. Generalization of the tasks is next target of this study.

Keywords: Multiple Mobile Robots, Cooperative Transportation, Real-Time Task Assignment, Linear Programming Method

References

- 1) Natsuki MIYATA, Jun OTA, Yasumichi AIYAMA, and Tamio ARAI: “Real-time Task Assignment for Cooperative Transportation by Multiple Mobile Robots,” Proc. 1999 IEEE/RSJ Int. Conf. on Intelligent Robots and Systems, pp.1167~1174, 1999.
- 2) Natsuki MIYATA, Jun OTA, Yasumichi AIYAMA, Hajime ASAMA, and Tamio ARAI: “Cooperative Transport in Unknown Environment —Application of Real-time Task Assignment—,” Proc. 2000 IEEE Int. Conf. on Robotics and Automation, pp.3176~3182, 2000.

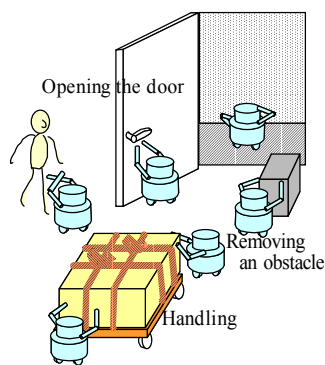


Fig. 1 Robots in cooperation

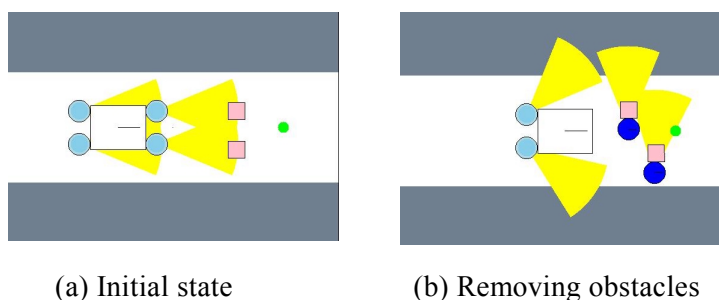


Fig. 2 Simulation results (task assignment)

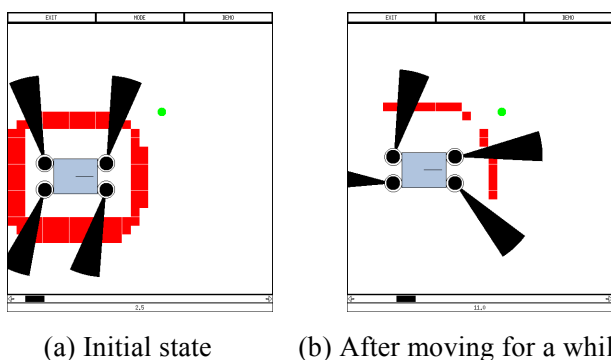


Fig. 3 Simulation results (cooperative sensing)

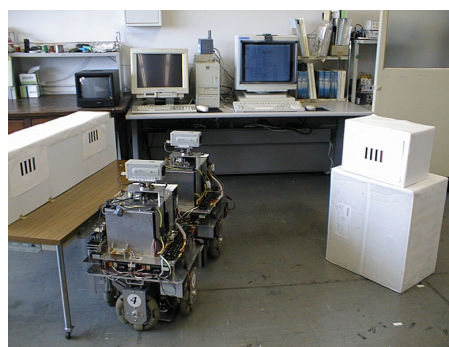


Fig. 4 Experimental setup