Cooperative Mobile Robots for Object Manipulation

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In an automation system nowadays, mobile robots have been used in either transportation or manufacturing process. In order to increase manufacturing system productivity and flexibility, robots should have high mobility and be able to change their functions automatically according to job ordering. Such robot capabilities have been improved continuously by many researchers.

Many research-and-developments in environment mobile robots for operating in household environment and factory attempt to control a group of robots to work as a team. Robots should be autonomous and able to communicate with other robots in their group.

According to previous researches related to cooperative mobile robots for object manipulation, control algorithms can be divided into 3 parts, i.e.

1. Controlling mobile robots in order to move to a common goal or an object.
2. Controlling mobile robots for moving the object
3. Controlling mobile robots for object assembly

In a preliminary study, cooperative algorithm had been designed in order to control a group of robots moving to a common goal. Central control unit had been used. Using Potential field concept, repulsive force has been induced between a robot and the others. Attractive force is produced between the robot and the goal. Such robots try to avoid collision with another robots and to move to the goal. Fig.1 shows simulation of the preliminary study. There are 9 omnidirectional mobile robots, which are placed randomly in an initial state.
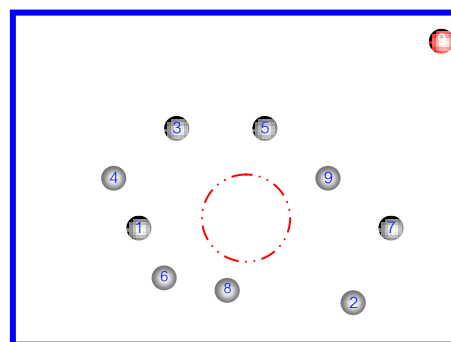

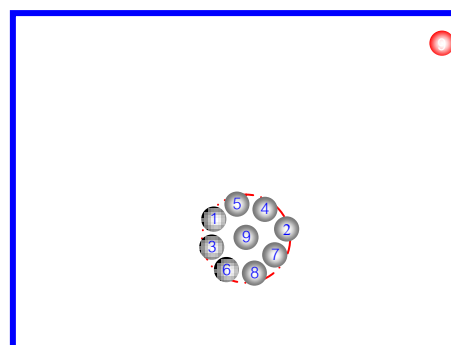**Fig 1 shows robots in an initial state**

Fig 2 shows a group of robot move to the goal

Fig. 2 shows a simulation result. As seen in Fig.2, robots move to make a group in the desired goal area. Changing the goal position, robots still are able to move to the goal while maintaining a group formation.

According to the simulation, we summarize that
-   A constant parameter in the Potential field concept varies with a number of the robots. Improper parameter setting causes robots come to collide with another.
-   Though the control algorithm is applied quite well in static environment. Using local information in each robot for making a decision by itself should be studied further to improve the cooperative algorithm.