Cooperative Mobile Robots for Object Manipulation with rope

Mr. Prasertsak Detudom and Dr. Thavida Maneewarn

Introduction

In object manipulation, we can manipulate object easily by using high precision robot arm. If we want to control position of object with simple tools such as rope or cable, how can we manipulate an object with those tools?

The concept we study called nonprehensile pulling which is pulling an object that is not completely tied by a rope so the object can roll or slide along the rope. This is the main focus of our study. The mechanics of nonprehensile pulling is used to define the set of feasible motion directions of the object that is used for planning the coordinates between two robots.

Problem

We can not define force in system and do not have rope model. It means we can not control exact motion of rope but we can predict direction of moving object. So we must understand the mechanics of pulling. These involve answering several questions including, how can object be pulled? How does object move when it is pulled? And how does object rotate when it is pulled?

Methodology

Concept of object manipulation with rope is how to pulling object and always maintain contact with rope.

Multiple robots have to coordinate by pulling in the specified direction in order to move an object along the desired path. The mechanics of nonprehensile pulling is defined from the relationship between a friction force between the object and the rope. The set of allowable pulling directions is defined from the procedure STABLE PULL

Result

This result shows that pulling has an advantage over pushing in term of more stability and larger set of allowable velocity directions.

We can manipulation object with flexible tools such as rope or cable by using cooperative mobile robots

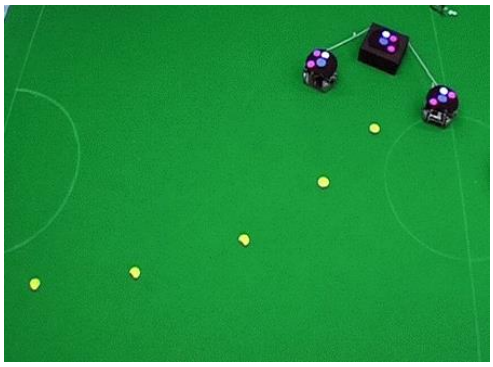

Fig [1] Show Experiment translation single object in desired path

Future Work

Develop a control law that allow multiple robots to manipulate single and multiple objects more precisely using nonprehensile pulling.

References

1. K. M. Lynch, M. T. Masan,"Stable Pushing: Mechanics, Controllability, and Planing", The International Journal of Robotics Research,Vol 15, No. 6, December 1996, Page 522-556.
2. Yamashita A., Sasaki J., Ota J. and Arai T. "Cooperative Manipulation of Objects by Multiple Mobile Robots with Tools," Proc. Of the 4th Japan-France/2nd Asia-Europe Congress on Mechatronics, Oct. 1998 pp.310-315.
3. Donald B., Gariespy L. and Rus D., Experiments in Contrained Prehensile Manipulation: Distributed Manipulation with Ropes," Experimental Robotics VI, Lecture Notes in Control and Information Sciences, ed. P. Corke, Springer-Verlag, 1999 .