Object Transportation using the *Grasp Alone* Technique

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November 7, 2013

Table of Contents

Goals

Perform transport of objects arranged in an environment using the technique *Grasp Alone* [1], in order to lead them to a region previously known.

[1] When the robot is able to hold the object to be transported

Table of Contents

Motivation

Transport of objects can be used in various situations, such as:

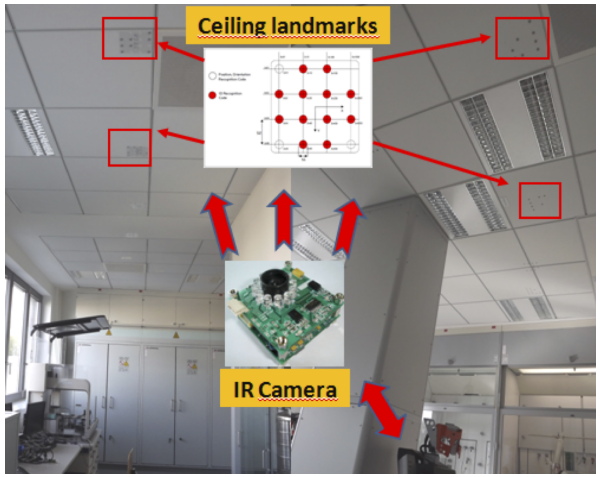
- Object manipulation;
  - Everyday things (Cook, Clean)
- Structures construction;
  - Assembly line;
  - Housing.
- Exploration, removing obstacles;
- Rescue.

Table of Contents

Related Work

A Fast Method for Mobile Robot Transportation in Life Science Automation. Liu, Hui, et al. I2MTC, 2013

Describes a technique for use robots in a life science laboratory. They need to walk inside the lab, transporting items based on users requests. Using ceiling landmarks for localization with systems for obstacle avoidance, path planning based on start and end points and a TCP/IP communication network.



Related Work

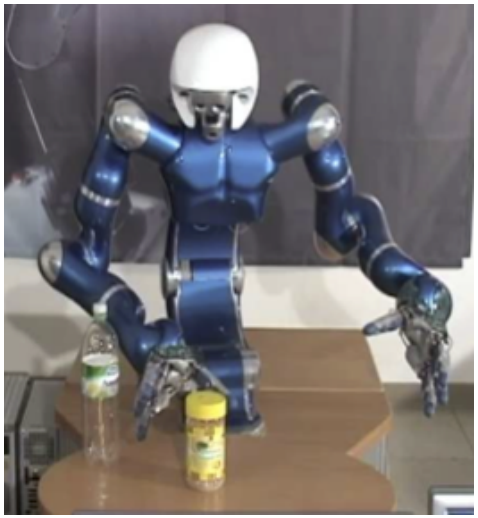
Planning pre-grasp manipulation for transport tasks. Chang, Lillian Y., et al. ICRA, 2010

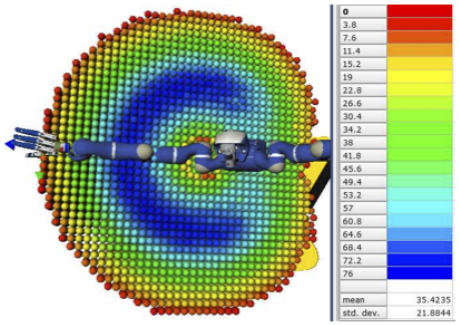
Shows a study of how a pre-grasp manipulation can improve the Grasp Technique itself. This manipulation is described as a change of the pose of the object, rotating it to archive a better position for the Grasp transportation.

Related Work

Capturing robot workspace structure: representing robot capabilities.
Zacharias, Franziska, et al. RSJ, 2007

Demonstrate how create a workspace structure for a robot arm in a form of a map, named capability map. Through this map, the manipulator can deduce places that are or not easy to reach.





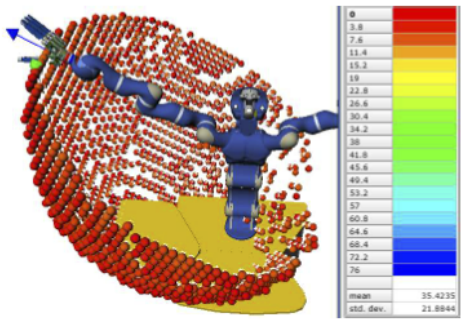


Table of Contents

Platform

(a) ROS - Hydro

(b) Gazebo

Figure : Software

Platform

(a) iRobot Create

(b) AX-12A Arm

(c) Webcam

Figure : Hardware

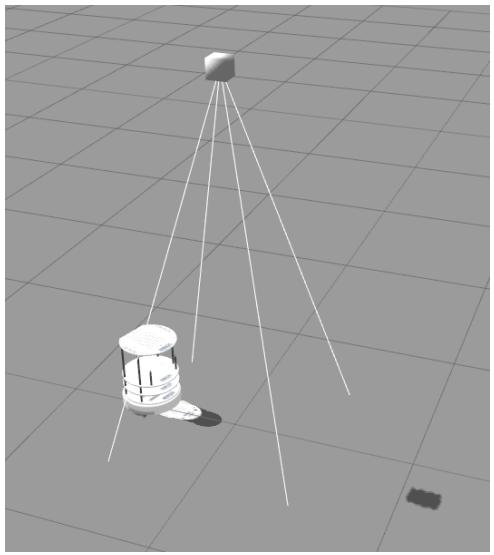
Table of Contents

A camera set above the scene will be used to locate items of interest, such as:

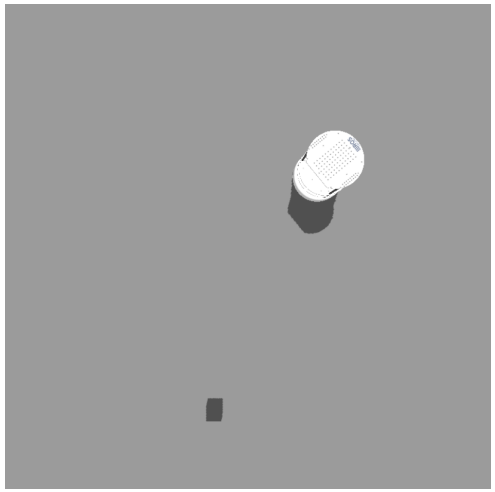
Robot With a marker on it, enabling to recognize your pose;

Objects Also with markers, to know your position and orientation;

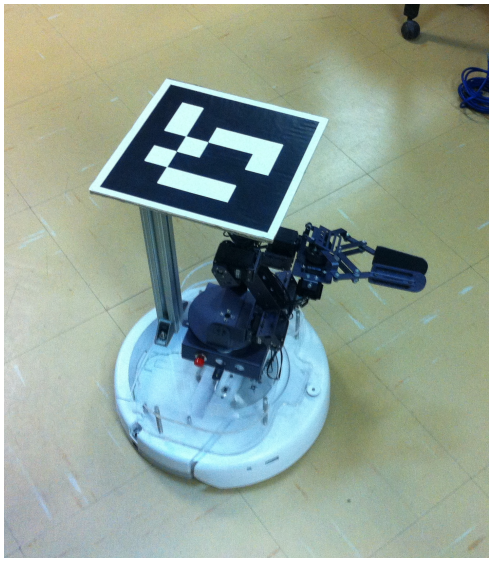
Deposit Place A square around the start point of the robot;



(a) Environment Simulation



(b) Ceiling Camera View



(c) iCreate with Marker

Figure : Localization

Some steps will be undertaken to reach objects and perform your transport. A PID[2] controller will be implemented to achieve the objective.

Transport priority Objects closer to the base will be transported first. Ensuring that there is no need a system for obstacle avoidance.

Navigation Action The robot will move until the target object is within range of the robotic arm.

Hold Action The robotic arm holds the target object, and moves to the transport position.

Transport Action Robot moves to safe place and leaves the object.

[2] Proportional Integral Derivative Controller

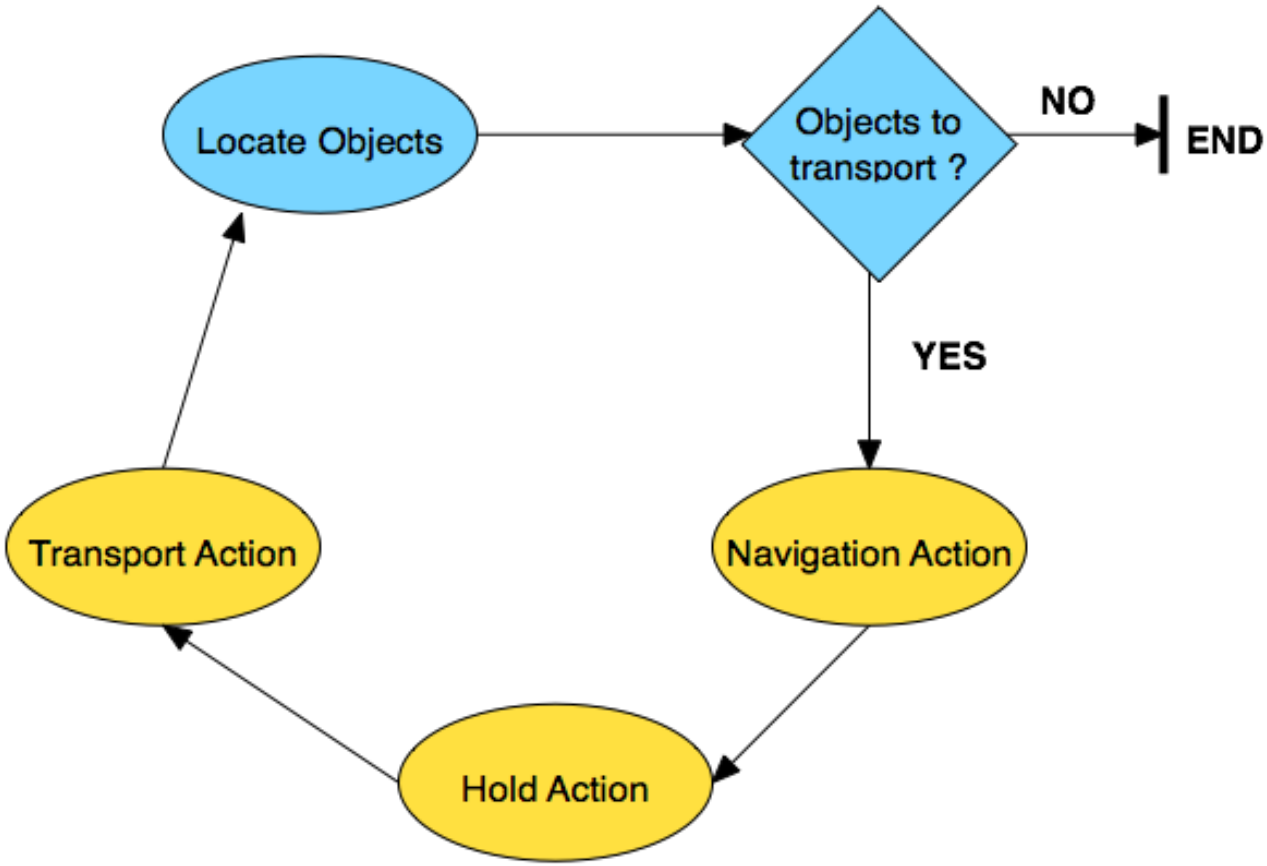
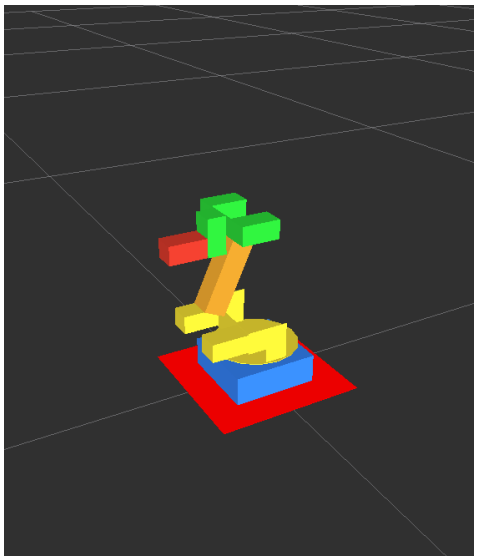


Figure : State Machine [Controller Action, Robot Action]

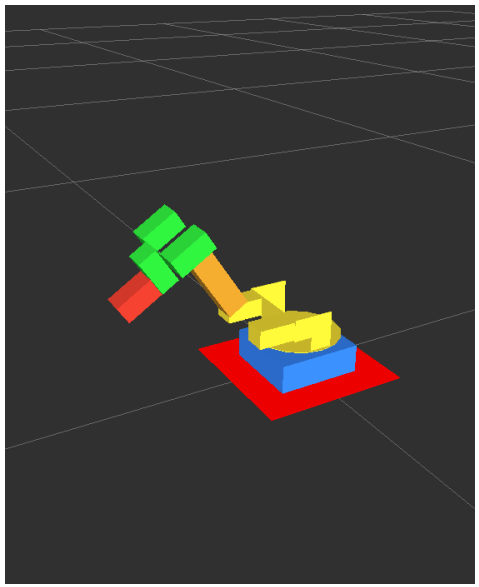
Table of Contents

Partial Results

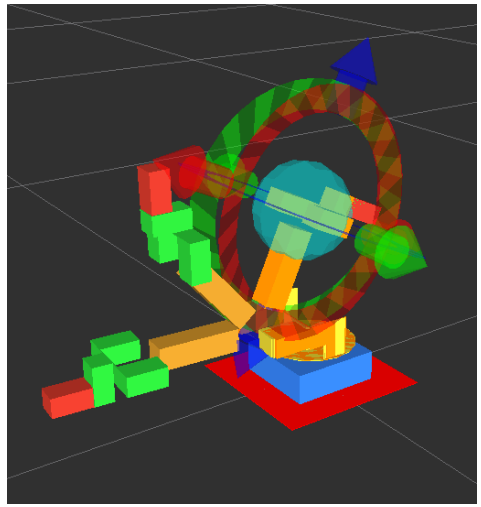
Arm Controller Implemented in ROS, whereas previously there was only one controller for Player. A simulation model was also created in order to replicate all the actual movements of the arm.



(a)



(b)



(c)

Partial Results

Simulation Environment Implemented in Gazebo, will represent the real environment of the experiment, including your metrics and possible noises.

Remote Control Setup configuration for remote control of the iRobot Create and the Robotic Arm.

Marker Detection Initial tests to detect de pose of a marker.

Table of Contents

Next Steps

1. Finish the simulation, attaching the arm on the robot;
2. Detect the robot's pose by the marker;
3. Detect objects in the environment and your positions;
4. PID Controller;
5. Grasp Strategy.

Review

References

Liu, Hui, et al. "A fast method for mobile robot transportation in life science automation." Instrumentation and Measurement Technology Conference (I2MTC), 2013 IEEE International. IEEE, 2013. Chang, Lillian Y., Siddhartha S. Srinivasa, and

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