

Project

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Course: *Robotic Systems Control* – Professor: *Tassos Natsakis*
Due date: *January, 2022*

Robotic platform description

I have chosen as my robotic platform the **CRANE-X7** robot which is of type manipulator. It features a 7 DOF; this robot is compact, nice styled and it's ideal for research of collaborative robots.

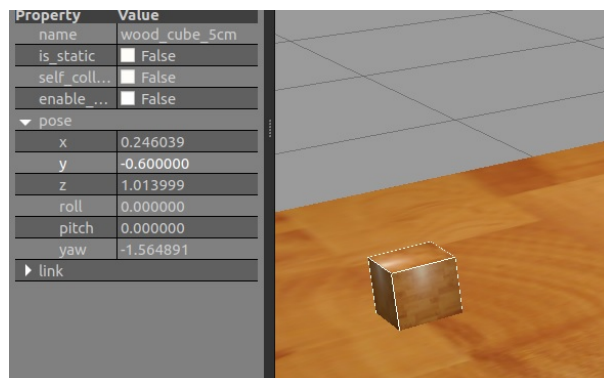
Main features:

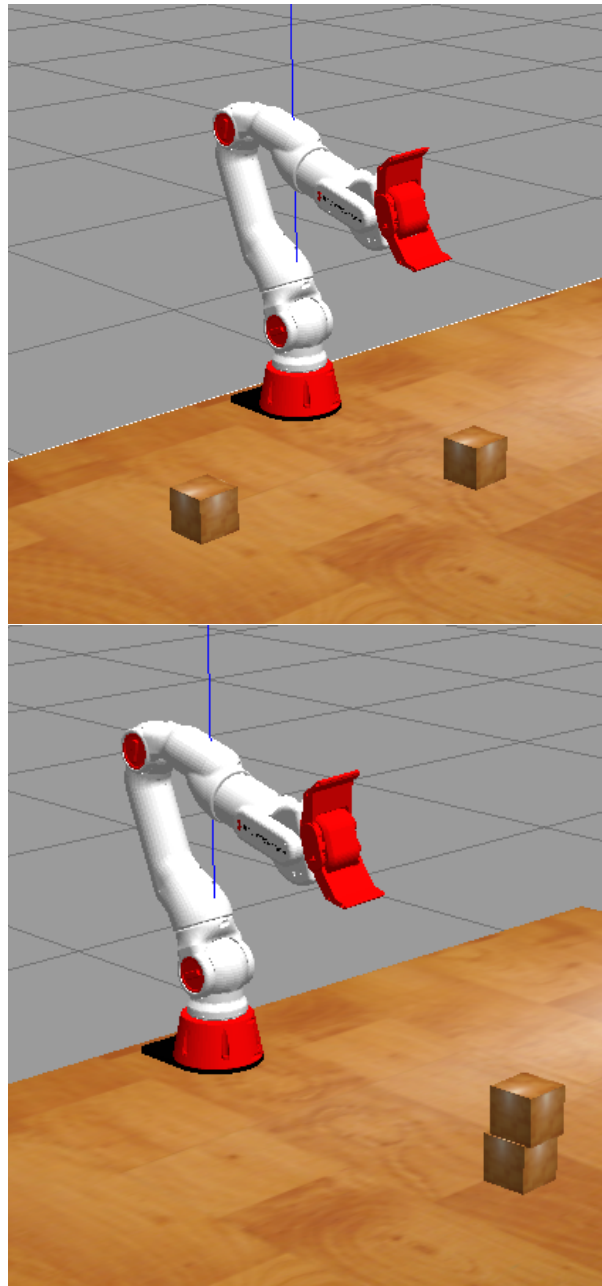
- (a) Work operation with obstacle avoidance
- (b) Selectable Mode
- (c) ROS Adaptive
- (d) Two Finger Hand End effector equipped
- (e) Compact Body
- (f) Selectable body color

The robot is simulated with Gazebo Simulator and controlled using MoveIt Motion Planning Framework.

Description of the task implemented by the robot

I have chosen to implement a pick and place task. In Gazebo Simulator I have on the table 2 wooden cubes which need to be placed one on top of the other. The 2 cubes initially are placed at different coordinates. The robot should pick one cube from its location and place it to a fixed location defined in the script then repeat the task for the second one. Cubes coordinates can be modified in Gazebo Simulator.





Performance of the implementation

The implementation of the task is written in Python.

Accuracy. Due to various approximations and errors from numerical operations the accuracy is pretty good but it's not the best. When the cubes are stacked they are not exactly in the same position, the cube from the top is slightly moved.

Performance. The implementation has pretty good performance. The algorithm is following the next steps:

- (1) It's opening the gripper if something remained blocked from previous execution
- (2) Move the robot in initial position

- (3) Checking if the cube is present
- (4) Getting the posture of the cube
- (5) Approaching the cube
- (6) Grabbing the cube
- (7) Moving the cube to the final position
- (8) Placing the cube
- (9) After both cubes are placed the robot is returning to initial position

Between various steps there is a small time delay of 0.1 second in order to run smoothly and efficiently. The task requires 16 second to complete.

The limitation of the robot is the range in which the cubes can be placed.

Video demonstration

Can be found at the next url: <https://drive.google.com/file/d/1qdoAs-V5QZDq0gI9GrRpvNZbkPy/view?usp=sharing>

Links for all the resources used

<https://robots.ros.org/crane-x7/>

https://github.com/rt-net/crane_x7_ros

http://docs.ros.org/en/melodic/api/moveit_tutorials/html/index.html

http://docs.ros.org/en/melodic/api/moveit_tutorials/html/doc/move_group_python_interface/move_group_python_interface_tutorial.html

<https://wiki.ros.org/>