NANYANG TECHNOLOGICAL UNIVERSITY

Robotics Research Centre

Principal Investigator:
Prof Chen I-Ming
Team Members:
Dr Liang Cong Hui, Mr H. Yan, Mr L Zhou
Mr H. Jr. Marcelo, Mr Z. Huang

RADOE: Robot Application Development and Operating Environment

Project Motivation & Objectives

This project aims to develop RADOE: Robot Application Development and Operating Environment. RADOE is an open source software that allows easy, convenient and interactive access to controlling industrial robots. It is easy to communicate with different robots, sensors and automation devices. It is typically meant for industrial robots used in manufacturing sector but can be used for other applications.



Advantages:

- ❖ *A friendly GUI with easy graphic programming capability.*
- ❖ *Easy to communicate with and programming different robots with intermediate language.*
- ❖ *Allow rapid and flexible architecture of widget for further development of value-added robotic modules and customized applications.*

Methodology & Results

RADOE is developed using ROS in Ubuntu Linux environment. Its basic modules are built on the base of ROS-Industrial, Moveit!, Rviz, Gazebo, OpenCV , PCL and other open source packages. It is also an incorporation of high-level robotic software that has been developed in the A*STAR SERC industrial robotics research program for diversified robotics application development.

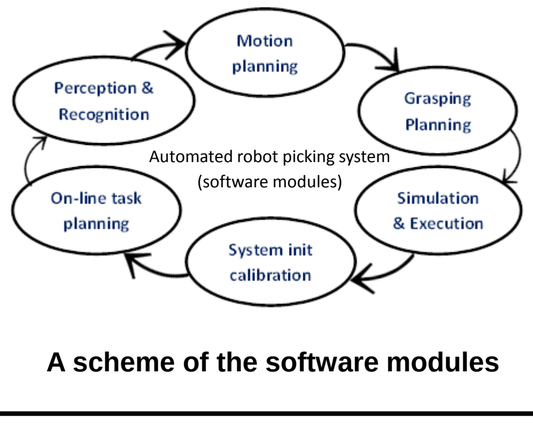
RADOE is composed of simulation module, interface module, intermediate robot language, drive libraries, and other advanced capability modules.

Application Demos

Automated Robot Items Bin-picking System for E-commerce Warehouse Application

This demo is built to show an automated robot bin-picking system to pick different sized, shaped & materialized objects from a shelf bin and finally placing it properly in an order bin within a limited time period.

Results:
Picking more than 25 different objects in less than 15 minutes.
Picking successful ratio > 95%.
Team Nanyang attended ICRA'2015 Amazon Picking Challenge held in Seattle, US.



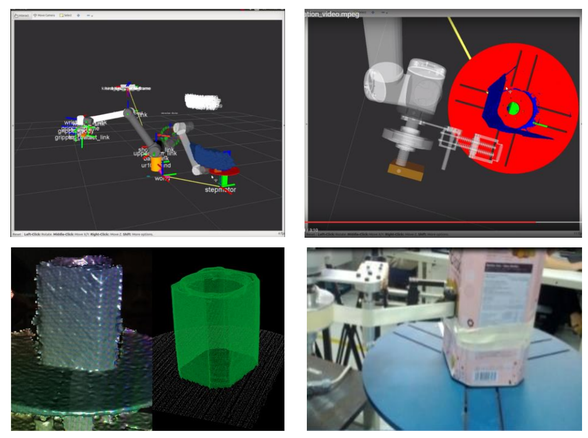
A scheme of the software modules

Robot bin-picking prototype

Automated Robot Taping for Aircraft Component Repair Process

This demo built an automatic robotic taping system and corresponding software algorithm to do the surface covering of objects of different geometries, using masking tapes. It aims to tackle the tedious manual taping in aerospace components repairing industry.
The taping procedure can be simulated in the RADOE environment. Obtained simulation results help to select suitable robot, taping tools and configure taping parameters and evaluate whole performances. RADOE also generates execution commands for the robot and rotation platform.

Robot taping experiment setup



RADOE simulation and execution

Publications

1.Liang, C., Zou, Y., Chen, I.-M. and Ceccarelli, M. Development and Simulation of an Automated Twist-lock Handling Robot System, Springer Mechanism and Machine Science 33 : Proceeding of the 3rd IFToMM Symposium on Mechanism Design for Robotics, Meder2015, 2-4 June, Aalborg, Denmark, pp.145-153, 2015.
2.Liang, C., Yan, H., Li, R., Chen, I.-M., Marcelo, H. Jr. and Huang, Z., An Integrated Software Package for Advanced Industrial Robot Applications, Springer Robotics and Mechatronics: Proceedings of the 4th IFToMM International Symposium on Robotics & Mechatronics, ISRM2015, 23-25 June, Poitiers, pp.261-269, 2015.
3.Liang, C., Chee, K.J. and Chen I.-Ming, Automated Robot Picking System for E-Commerce Fulfillment Warehouse Application, In Proceedings of the 2015 IFToMM World Congress, 25-30 October, Taipei, paper no. OS13-077, 2015.

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