Mobile Robot Navigation and Manipulation for Valve Turning

—— MBZIRC challenge 2

Robotics Research Institute
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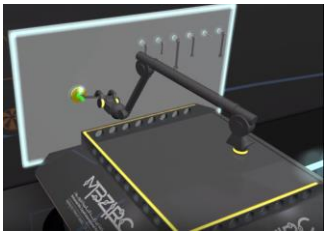
Introduction



- Robotics has the potential to have an impact that is as transformative as the internet, with robotics technology poised to fuel a broad range of next-generation products and applications in a diverse array of fields.
- The Mohamed Bin Zayed International Robotics Challenge (MBZIRC) aims to provide an ambitious, science-based, and technologically demanding set of challenges in Robotics, open to a large number of international teams.
- It is intended to demonstrate the current state of the art in robotics in terms of scientific and technological accomplishments, and to inspire the future of robotics.

Task in the Challenge 2

Challenge 2 requires an UGV to locate and reach a panel, and physically operate a valve stem on the panel, and will involve the following tasks:

- Locate panel and navigate to approach the panel
- Identify and locate a valve stem on one panel, and approach the valve stem
- Analyze the valve stem and select the appropriate tool to close the valve stem from a set of provided tools.
- Use the manipulator attached to the UGV to pick up the tool and operate the valve stem

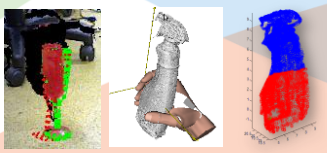
❑ Visual servoing

❑ Autonomous grasping and manipulation

Research Challenges and Approaches

❑ Mobile robot autonomous navigation

❑ Object identification



❑ Robot hand/gripper design

Work Packages

1. Exploration and mapping: to control the mobile robot to locate the vehicle, and the valve on the panel in the terrain/arena
2. Visual servoing: to locate the appropriate tool to use in order to operate the valve, and monitor the tool position during execution
3. Robot arm manipulation: to plan and execute the trajectories needed to grasp the tool and operate it
4. Systems architecture: this includes deciding the appropriate components, and integrating them in a real-time system that efficiently bridges software and hardware components

Education and Training

- PhD: Autonomous Grasping and manipulation;
- MSc: Visual servoing;
- Undergraduate: senior design project on robot gripper design for valve turning
- Student training on Robotics Operation System (ROS)