Robowflex: Robot Motion Planning with MoveIt Made Easy

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Mobile Robotics
Assignment 01

Introduction:

Robowflex is a software library for robot motion planning in industrial and research applications, leveraging the popular MOVEIT library and Robot Operating System (ROS) middleware

Features:

- Robowflex provides an augmented API for crafting and manipulating motion planning queries within a single program, making motion planning with MoveIt easy.
- Robowflex's high-level API simplifies many common use-cases while still providing low-level access to the MoveIt library when needed.
- Robowflex is particularly useful for developing new motion planners, evaluating motion planners, and complex problems that use motion planning as a subroutine (e.g., task and motion planning).
- Robowflex also provides visualization capabilities, integrations to other robotics libraries (e.g., DART and Tesseract), and is complementary to other robotics packages.

The high-level goals of the project are as follows:

- Provide an easy to use interface to complex robotics libraries by brushing cruft and idiosyncrasies under the rug.
- Provide access to all underlying capabilities of the libraries so users are not hampered by Robowflex in any way.

- Remain untied as possible to the greater ROS system, and support all distros from Kinetic onward.
- One of the strengths of Robowflex is motion planning in isolation. That is, being able to use many different instances of robots, scenes, and motion planners all within the same script

Modules:

- Python scripts for visualizing robots and motion plans in Blender.
- Optionally compiled library component that adds more direct access to OMPL through a new robowflex::Planner.
- Optionally compiled library component that adds support for tesseract-based planners.
- Library component with helper classes and functions to interact with a move_group process being used for motion planning.
- Optionally compiled library that adds support for modeling and planning through DART (Dynamic Animation and Robotics Toolkit).
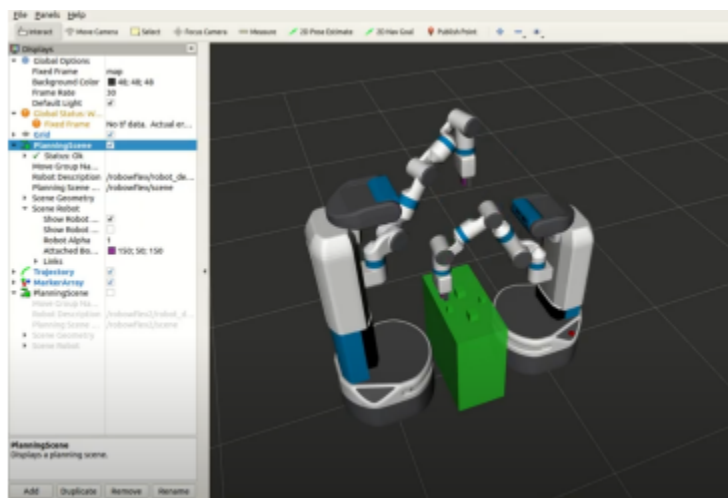

Fig 01 : Two Fetch robots displayed in RViz executing a task and motion plan (TAMP) to rearrange blocks. The motion planning component of this TAMP problem is done through the DART module of Robowflex. Robowflex enables the TAMP algorithm to have integrated access to the motion planner, which allows for trying many queries simultaneously, extracting collision information, and more. Image courtesy of Tianyang Pan
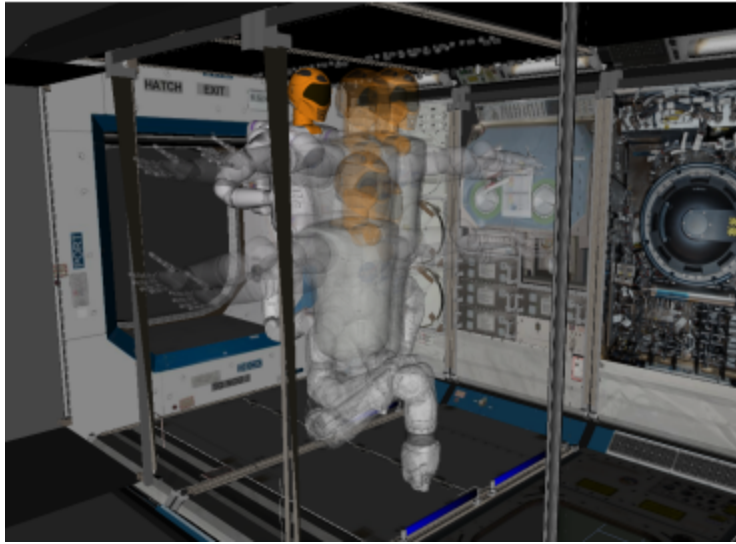
Fig. 02 : NASA's Robonaut 2 inside of a module of the International Space Station, visualized in RViz. For a given step between handrails, many possible configurations are evaluated through Robowflex. Image courtesy of Misha Savchenko and NASA.
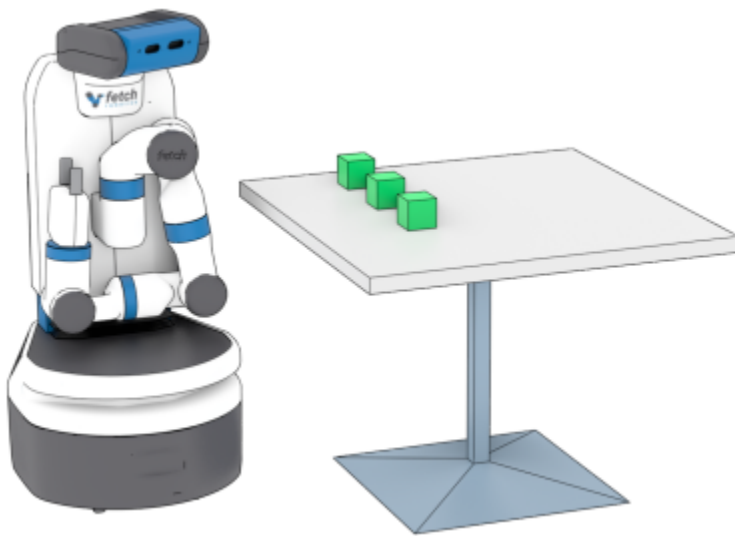
Why is RobowFlex Useful and Easy to Use:

Fig. 03 : A Fetch robot and planning scene rendered in Blender using Robowflex's visualization module.

Conclusion:

The core advantage that Robowflex provides over the default distribution of MOVEIT is the ability to easily access and modify core data structures within the program itself, rather than through ROS messages to the provided MOVEGROUP program

References:

Kingston, Z., & Kavraki, L. E. (2022, October 23). Robowflex: Robot motion planning with moveit made

easy. *2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS).*

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