Grasping Robot Integration and Prototyping: The GRIP Software Framework

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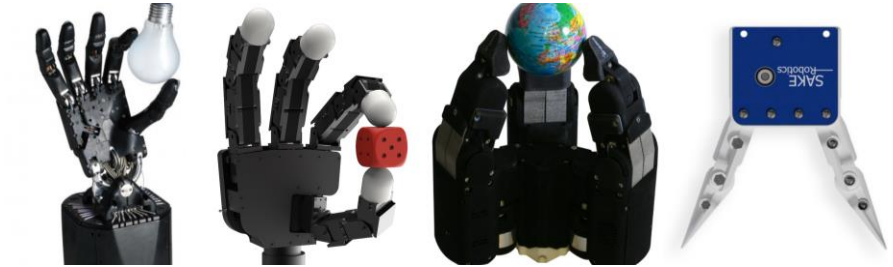
Advanced Robotics @ Queen Mary ARQ | Queen Mary University of London | Shadow Robot Company | CRISP | NCNR National Centre for Nuclear Robotics | EPSRC

Robotic grasping and manipulation

An unsolved, yet fundamental skill required in many real-world applications. An active field of research proposing new solutions related to

- Hardware
- Software
  - Low-level (controller, planner, etc.)
  - High-level (grasp pose detection, etc.)



Example of robot end effector capable of grasping and/or manipulation tasks

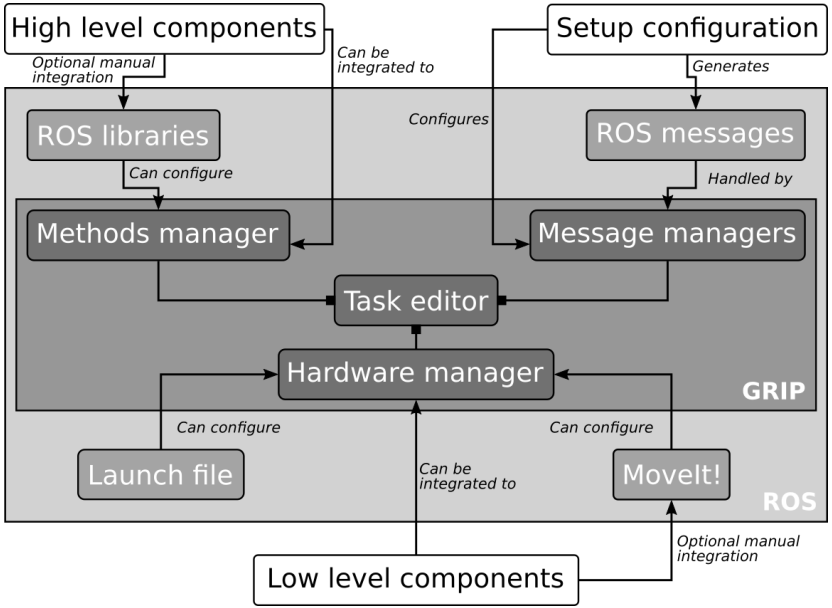
Example of some RGBD sensors

Example of some tactile sensors

The GRIP Software Framework - Overview

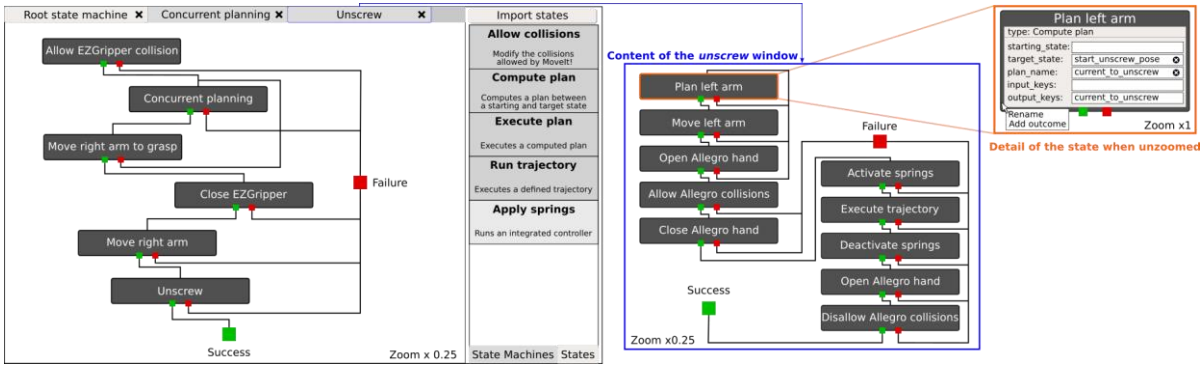
- **ROS-based** open-source framework to quickly and easily design robot manipulation tasks with integrated components
- Integration of software and hardware components made flexible
- Reactive and intuitive GUI guiding the user from robot integration to task execution
- **Not** meant to be an optimized and high-performance pipeline

Documentation available online at
https://sr-grip.readthedocs.io/en/latest/



Overview of the GRIP framework, allowing users to configure a robot and a task from integrated components

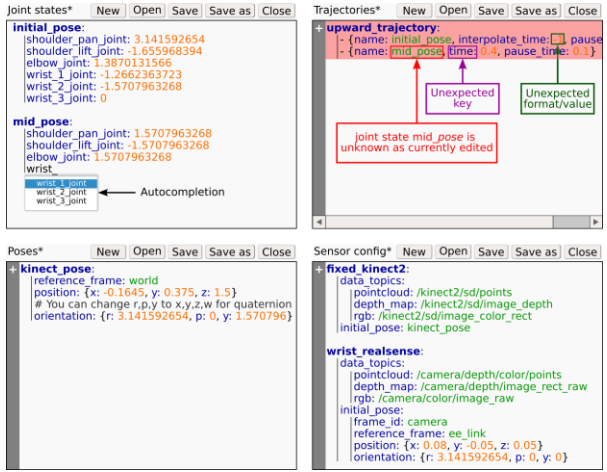
The GRIP Software Framework – Task design



Abstract view of the task editor allowing the user to design the task graphically

Graphical programming paradigm

- State machines and states provided by GRIP
- Possibility to add new elements



Reactive mechanisms implemented to helps users successfully configuring the setup

Use-case: Visuo-tactile closed-loop grasping for precise placing of objects

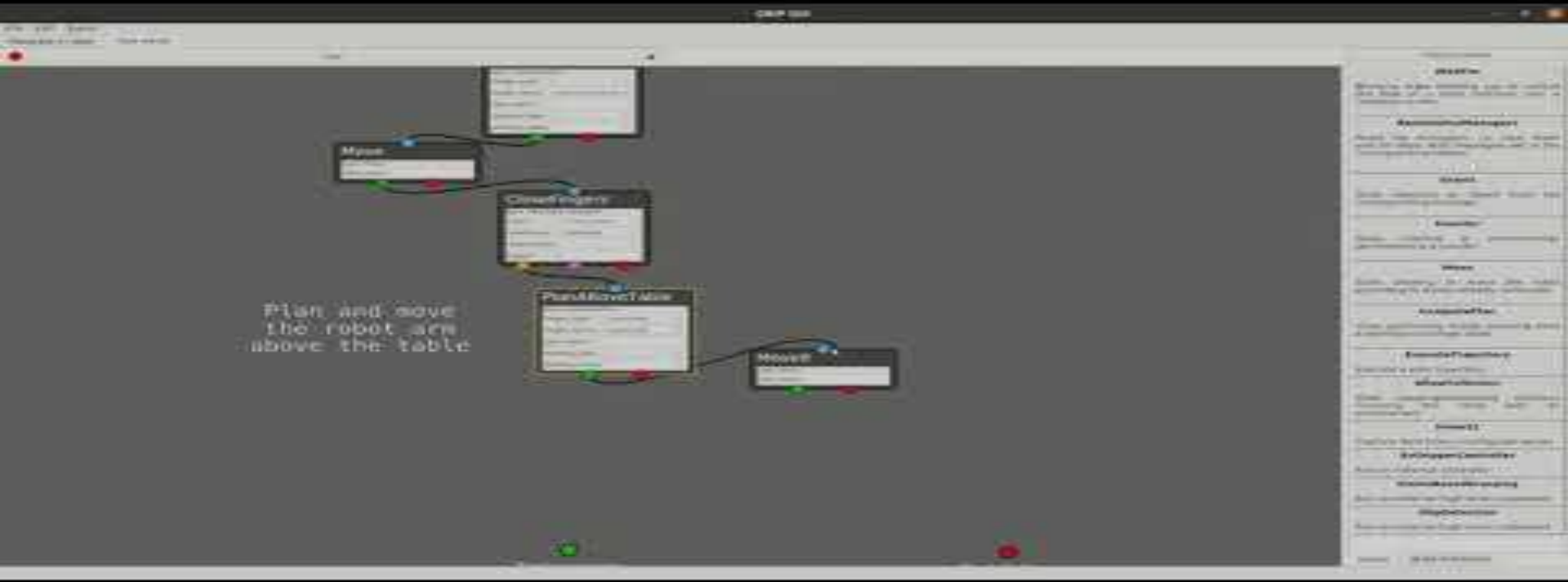
Robot setup composed of:

- Universal Robot 5
- EZGripper – Sake Robotics
- uSkin sensor – Xela Robotics
- Kinect version 2

High level methods to run:

- Vision based grasp pose detection [1]
- Slip detection [2]

Robot and sensors to integrate to GRIP in order to carry out the closed-loop grasping


Plan and move
the robot arm
above the table

References

[1] T. Suzuki and T. Oka, "Grasping of unknown objects on a planar surface using a single depth camera", in 2016 IEEE International Conference on Advanced Intelligent Mechatronics (AIM), IEEE, 2016.

[2] R. Zenha et al., "Tactile Detection in the Wild Leveraging Distributed Sensing of both Normal and Shear Forces", in 2021 IEEE International Conference on Intelligent Robots and Systems (IROS), IEEE/RSJ ,2021.

GRIP documentation: https://sr-grip.readthedocs.io/en/latest/

B. Denoun et al., "Grasping Robot Integration and Prototyping: The GRIP Software Framework", in 2021 IEEE Robotics and Automation Magazine, IEEE, 2021.

Thank you

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