



WPI

Design and Implementation of a Mobile Robotic Base

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Problem

Mobile robotic bases provide mobility for robotic serial manipulators and are essential for service technologies, warehouse applications, and robotics research. However, current mobile bases are expensive and require significant effort to integrate with robotic manipulators.



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Kinova Gen3

Objectives

1. To provide modularity between different robot arms mechanically, electrically, and programmatically
2. To add degrees of freedom to the attached manipulator, enhancing its mobility and expanding its workspace
3. To ensure reliable and robust operation



Acknowledgments

We would like to thank Professors Calli and Michalson for their invaluable knowledge, guidance, and patience throughout this MQP.

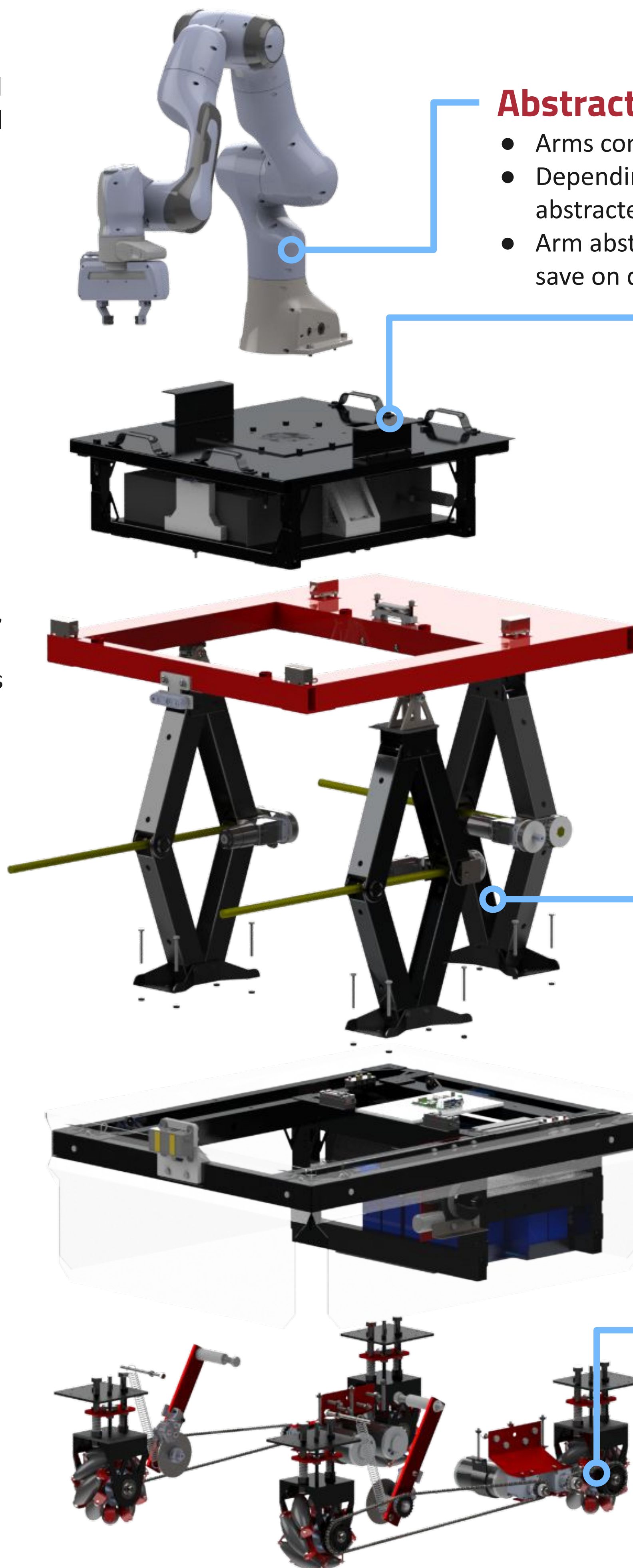
Special thanks to: Tinkerbox, FRC Team 78, FRC Team 190, the Manipulation and Environment Robotics Lab, European Metal Recycling Group, and NSF ROSE-HUB.



Modularity

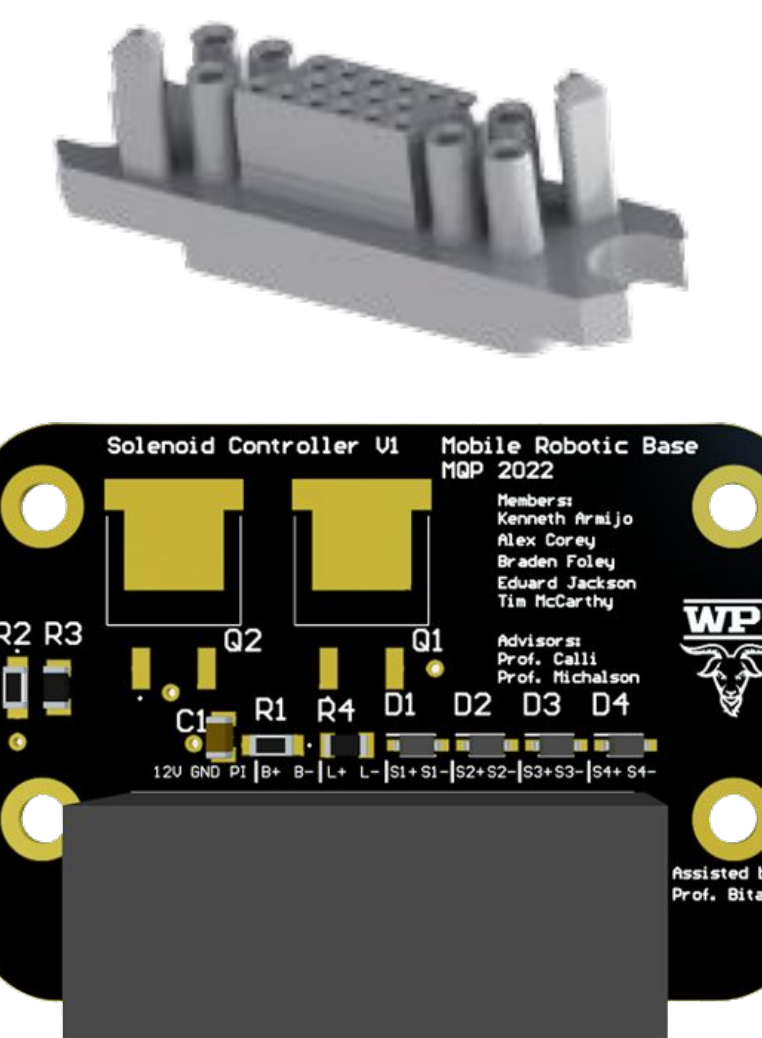
Abstracted Arm Control

- Arms controlled via MoveIt
- Depending on installed arm, positions are routed through abstracted server layer to respective drivers
- Arm abstraction developed with ROS and simulated in Gazebo to save on development time



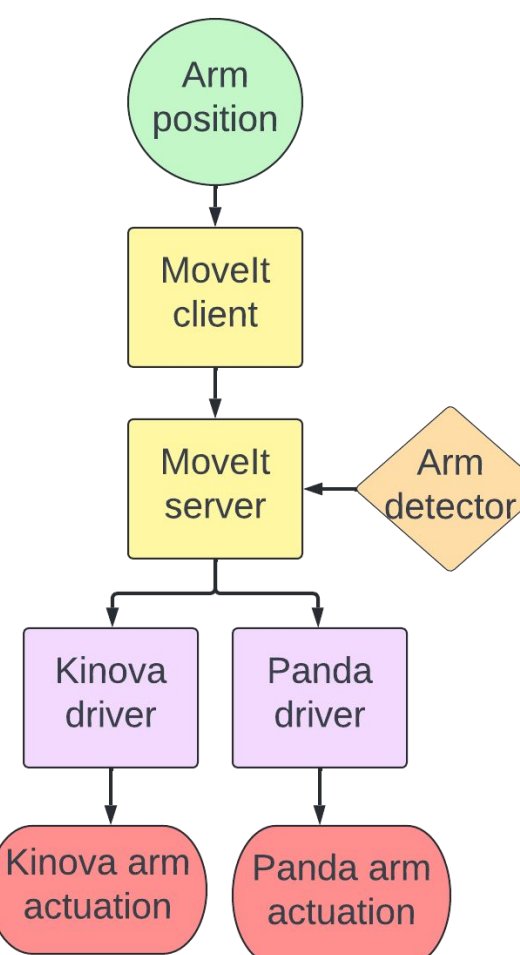
Modular Insert

- Designed to house multiple types of hardware connections and controllers
- Easily interchangeable with other modular inserts via the home base
- Secured in place with solenoids driven by custom PCB



Universal Plug

- Single interface between base and arm
- Marries ethernet, power, and internal communications
- Mechanically aligns pins for seamless connection



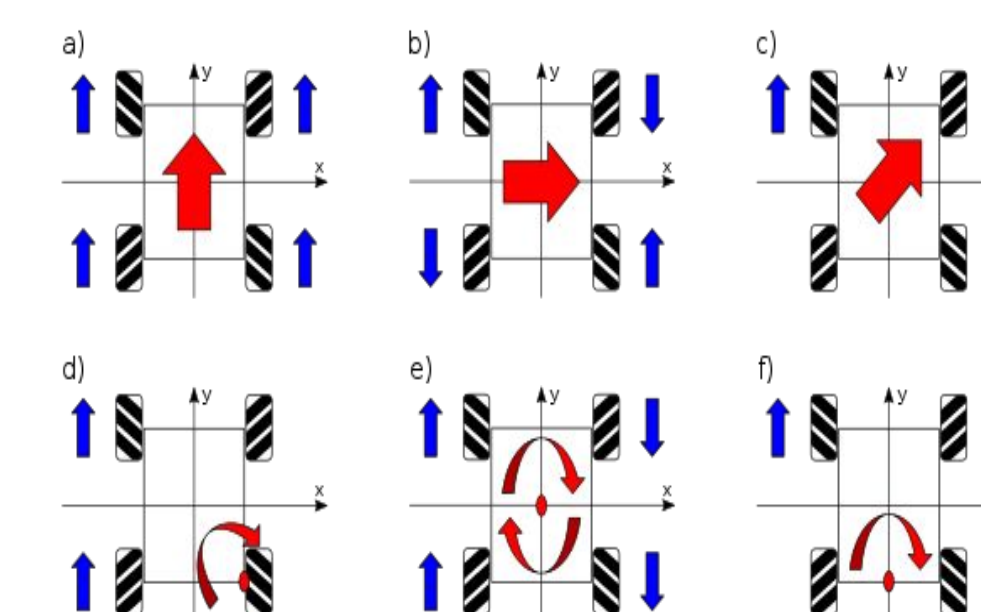
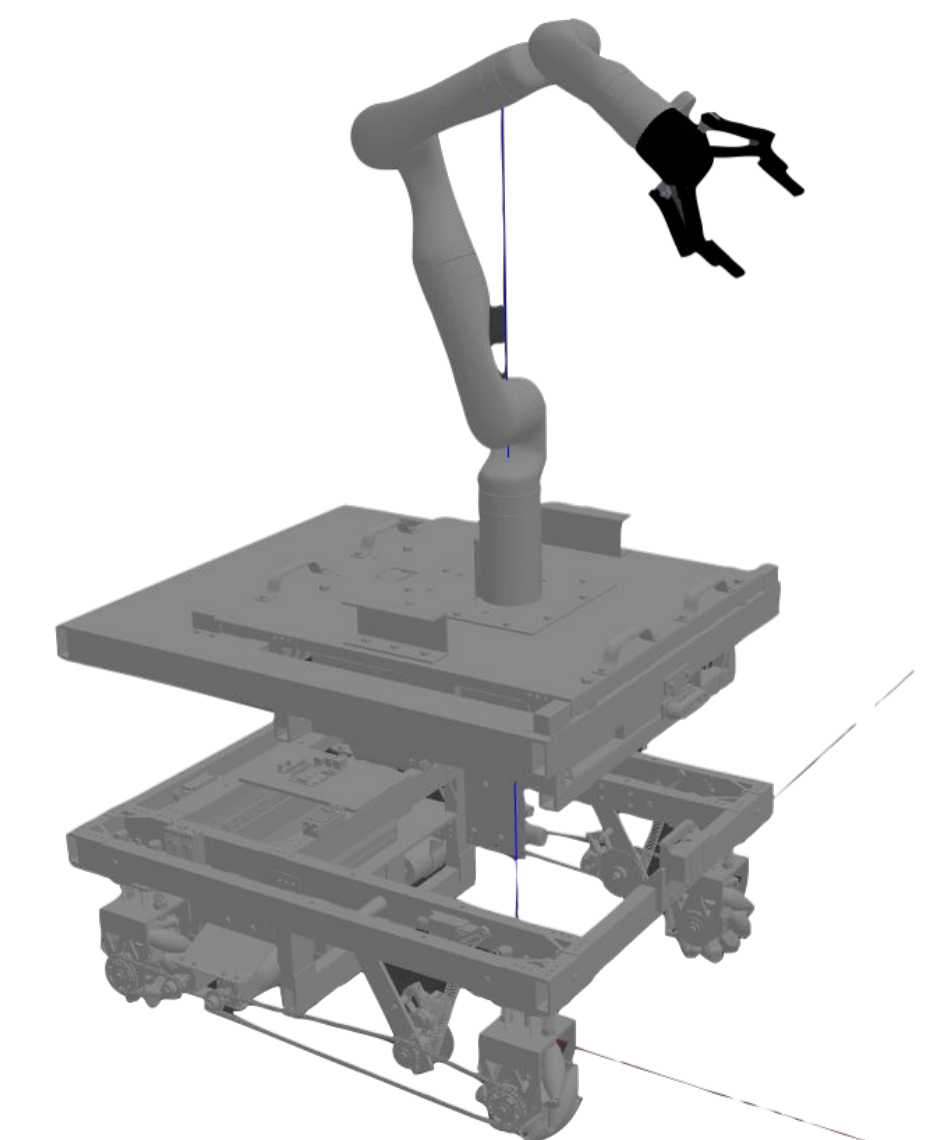
Mobility

Elevator

- Increases maximum arm workspace height: 5 in. - 24 in.
- Tabletop laterally pivots due to individually actuated scissor jacks
- +2 degrees of freedom

Holonomic Drive

- Utilizes mecanum wheels to drive, strafe, and rotate
- Capable of traversing handicap ramps (15 degrees)
- Fits through narrow doors and hallways (28 in. wide)
- +3 degrees of freedom



Reliability

Simulation

- Constructed in Gazebo for implementing untested robot code

BMS

- Provides overcurrent, overcharge, and undercharge protection
- Balances individual cells
- Monitors battery health and charge



Citations

- [1] <https://robokind.de/wp-content/uploads/2020/10/franka-e1603792761326.png>
- [2] https://www.kinovarobotics.com/uploads/_1000x1000_crop_center-center_none/Gen3-robot-img-Cover-img-is-loaded-block-1B.pn
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- [4] http://www.sgbotic.com/images/detailed/16/03087-01_qys0-s0.jpg?t=1604112766