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

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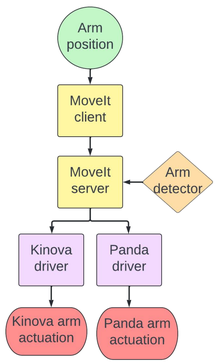
Modularity

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

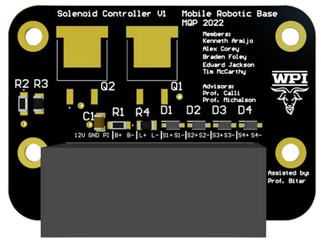


Modular Insert

- 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



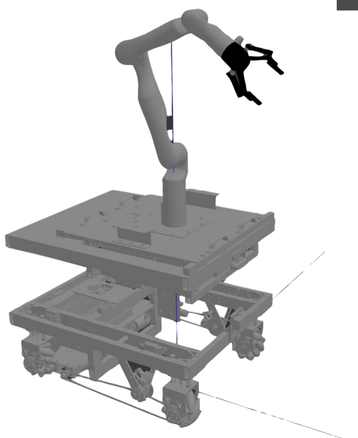
Mobility

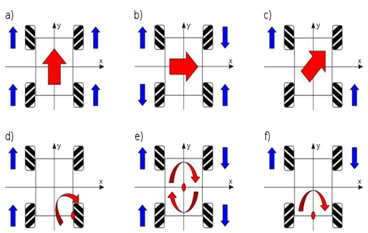
Elevator

- 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
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