Compliant Parallel Mechanisms as Robot Fingers

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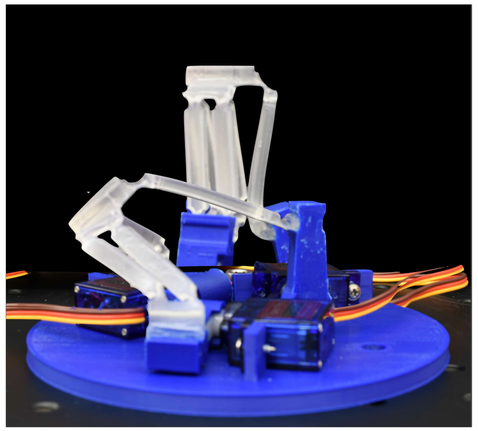
Dexterous Compliant Manipulation Using Delta Arrays

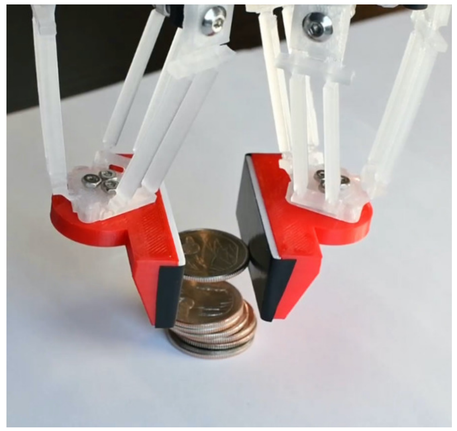
Motivation

This project focuses on building dexterous manipulators consisting of arrays of three degrees-of-freedom parallel delta robots. We use compliant materials to manufacture parallel mechanisms to enhance safety when assisting and interacting with humans.

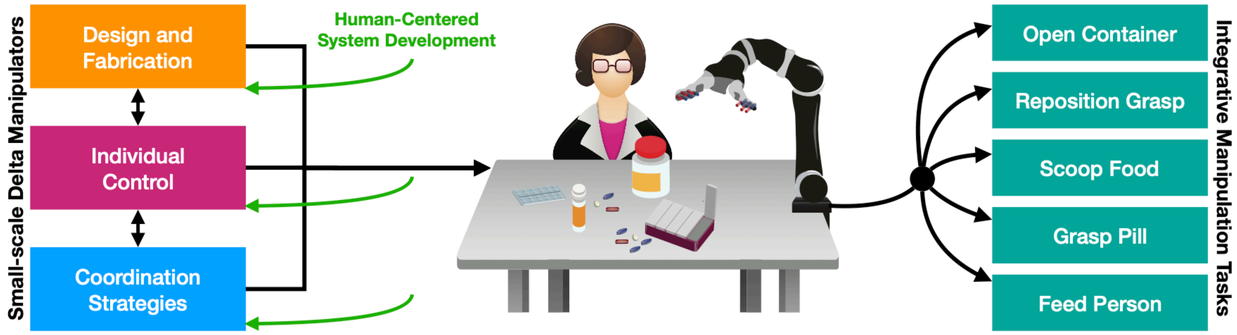
Challenges

- Modeling and control of compliant linkages
- Implementation of sensors into the structure
- Coordination between individual mechanisms
- Need of mapping from high-level task objectives to low-level control policies
- Incorporating human signals to improve comfort and ease of use

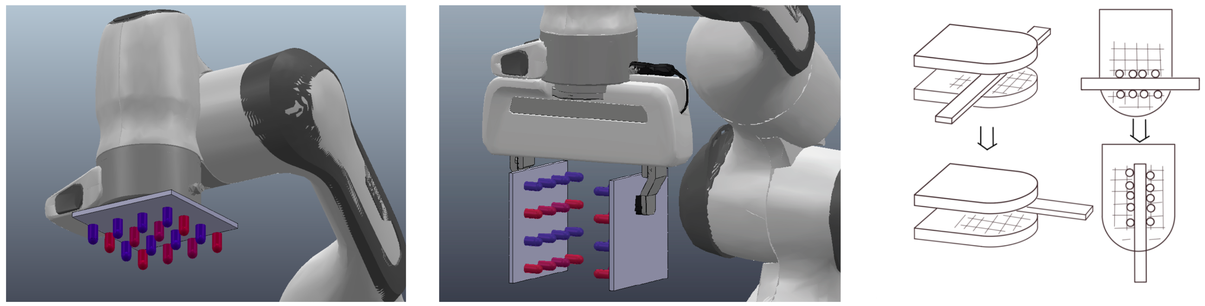




Left: 3D printed delta mechanism. Right: Delta fingers taking a coin from a pile and performing in hand rotation.



This integrative project will create novel paradigms for dexterous manipulation in co-robots.



Left: Planar gripper. Middle: Enveloping gripper. Each blue/red capsule represents a 3DoF delta manipulator in the array. Right: Example of in-hand yaw rotation and translation with enveloping gripper.

Scientific Impact

- Human-centered design of compliant robots with embedded sensors using different modalities
- Transferrable control approaches and a unified framework for coordination strategies within robot arrays

Broader Impacts

- Easy and accessible techniques to lower barriers to entry
- Human-centered approach to assistive feeding models

2021 NRI & FRR Principal Investigators' Meeting
March 10-12, 2021

Award ID#: 2024794