Rethinking Multi-Legged Robots:
Passive Terrain Adaptability through Underactuated Mechanisms and Exactly-Constrained Kinematics

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This project seeks to thoroughly examine underactuated mechanisms in multi-legged robots for rough terrain, working towards drastic performance improvements by parting with over-constrained kinematics and complicated redundant control schemes in favor of designs that are **passively stabilized due to their large-scale mechanical adaptability and exactly constrained kinematics.**

Main research directions:

- Investigate the necessary degrees of freedom and actuation for passive adaptability to rough terrain
- Explore mechanisms that provide adaptability without compromising stability or performance
- Gait synthesis and control framework for continuous locomotion with limited intrinsic and extrinsic sensing

Current Approach:

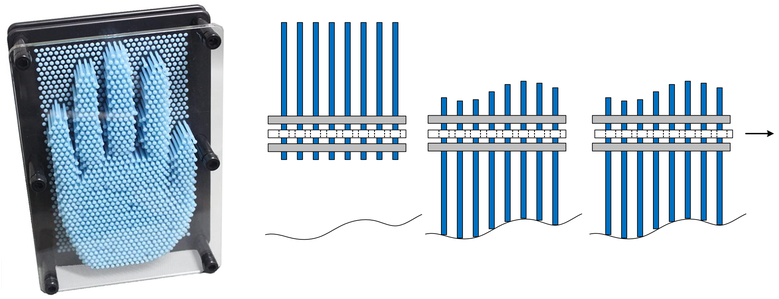
- Use underactuated prismatic legs
- Let gravity actuate them, passively contouring to the ground
- Lock the legs after ground contact

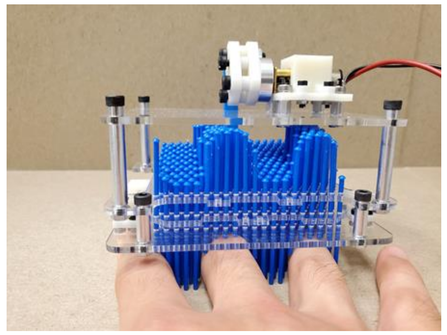
Broader Impacts:

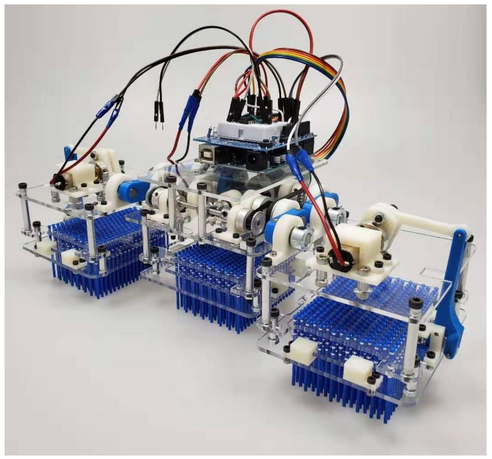
- Robust, low cost, and low power deployment in unstructured environments
    - Search and rescue
    - Exploration in natural environments
- Additional applications in non-robotic vehicles

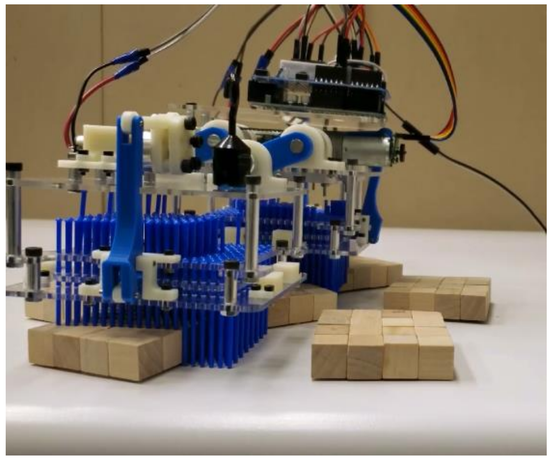
Main Progress since last year:

- Examined concept of “drop and lock” legs
    - Passively contour to the ground, then locking to support the load of the robot
    - Minimal force to retract the legs
    - Forward motion and steering done with decoupled additional actuation









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