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Soft & Dexterous Robotic Manipulation

Engineering a safe, multi-use robot hand

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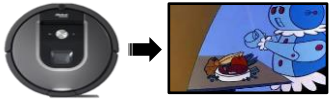
Robots improve quality of life

Robots have begun to make their way into people's homes. These robots **lack multi-functionality** and **are not safe**. A **dexterous**, yet **soft** robot hand would help mitigate these issues.



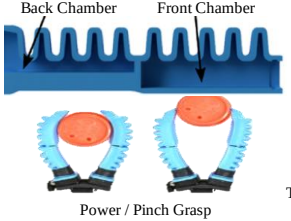
Soft grippers are great

- Safe for humans, work environments & objects
- Heat & liquid resistant
- Do not require feedback to grasp objects
- More durable in a home setting
- Cheap & easy to manufacture

Creating degrees-of-freedom

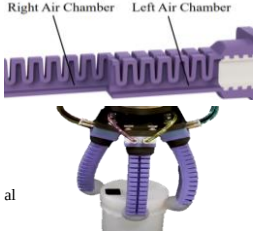
Series

- Front and back air chambers can each be individually pressurized
- Pressurize front → **pinch** grasp
- Pressurize back → **power** grasp
- Grasps large range of objects



Parallel

- Left and right air chambers can each be individually pressurized
- Pressurize right → **leftwards bend**
- Pressurize left → **rightwards bend**
- Pressurize both → **standard bend**
- Helps with translation and rotation



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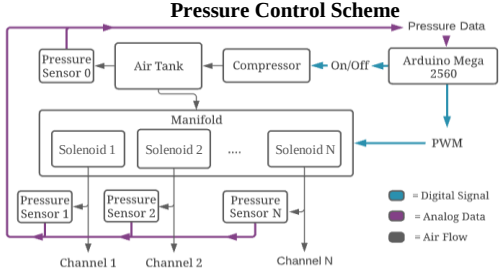
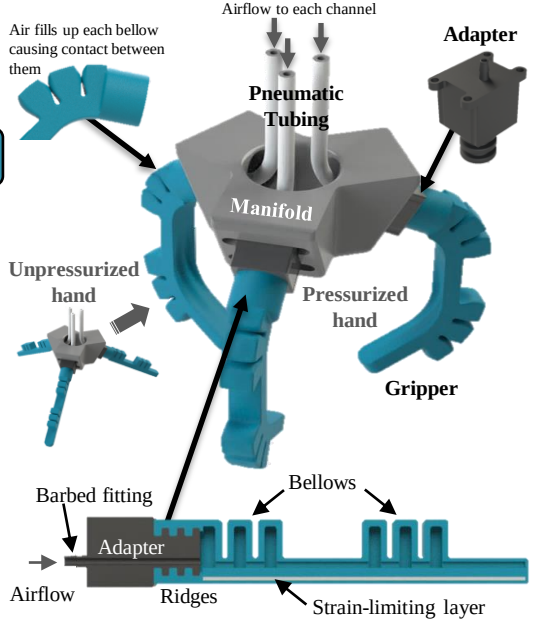
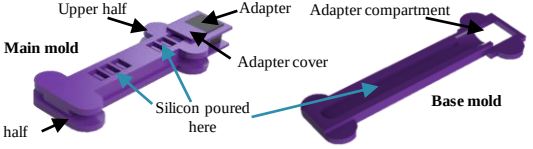




How grippers are made



We conducted tests with multiple types of silicon: *Ecoflex*, *Dragonskin-10* and *Dragonskin-20*. We found that ***Dragonskin-10*** provided us with a good middleground between compliance and rigidity.

Good example

- Proper curve
- No overinflation

Poor example I

- No curve
- Main channel blocked
- Overinflation in singular bellow

Poor example II

- No curve
- Bellows blocked
- Overinflation in main channel

How do we make a perfect gripper every time? → **Solution I**: insert thin metal rod to ensure continuity. → **Solution II**: use a more compliant silicon.

Discrete vs continuous bellows

Our first design involves removing bellows to make each gripper more discrete. We hypothesize that curvature like that of human fingers has subtle advantages over continuous curvatures.

Next steps

- Increase the degrees-of-freedom (DoF) of each gripper
- Evaluate advantages of discrete finger designs
- Prototype current state-of-the-art designs
- Implement electronic actuation system