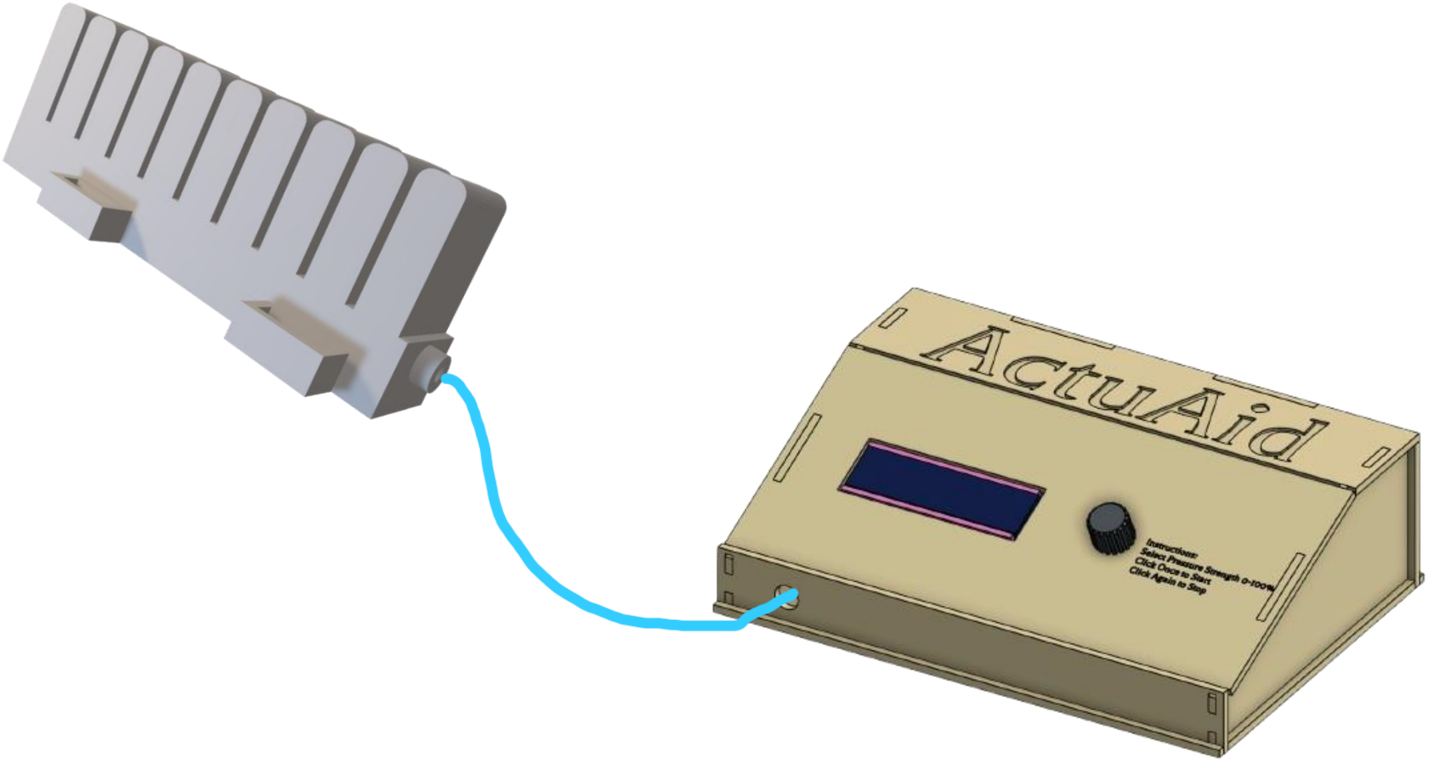


ActuAid

BY STEVEN RAUSO, PAUL GALVAN, AND JEVON CONEY

Problem

- Hand injuries account for 25% of all sports-related injuries, highlighting their prevalence and impact [1].
- There are limited treatment options currently available for addressing hand injuries effectively [2].

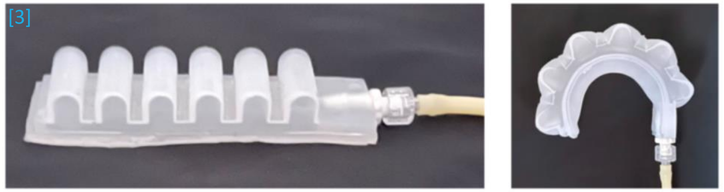
[2]

[1] Hand injuries in sports, Viola AStögner, Alexander Kaltenborn, Hans Laser, Peter M Vogt, 2020
[2] Unraveling the UCL Injury of Thumb, Randon Hall, MD, 2018

Approach

- We used 3D-printed fluidic actuators to develop advanced and innovative treatment options for individuals with hand injuries.
- These actuators aim to improve both functionality and accessibility for rehabilitation.

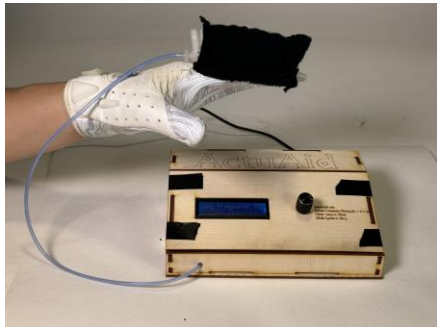
[3]



[3] Printable Flexible..., Savita Kendre, Gus Teran, Lauryn Whiteside, et al., 2022

Results

- A Fluidic Actuator connected to a glove that can serve as a personal medical rehabilitation device.



Impact

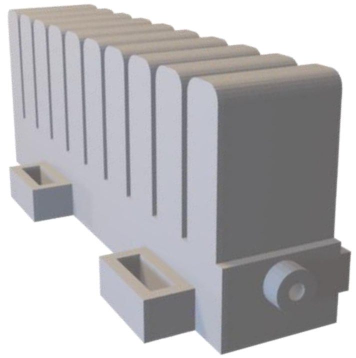
- The developed 3D-printed assistive device offers multiple benefits, including low cost, customizability, and quick manufacturability.
- This device has the potential to transform rehabilitation by providing affordable and effective solutions.

Our Journey

WEEKS 1-2

Week 1: Create a feasible bending actuator

Week 2: Research



WEEKS 3-4

Week 3: Integrate electronic components

Week 4~~: Add bending sensor(s) to the actuator~~

WEEKS 5-6

Week 5: Develop a glove prototype/ Finalize the product

Week 6: Final project presentation:

Papers of Interest:

- In the first week of our design process, we read multiple articles to help inform our design plan moving forward.
- In one of the articles, we investigated examples of wearable soft robotics to prove that it was possible [4].
- We found that there were a lot of different methods that we could use to achieve our result [5].
- As a proof of concept, we saw that similar 3-D printed soft robotic exoskeletons were designed to aid stroke patients regain dexterity and fine motor skills. [6].

Ultimately, we found that our goal was achievable

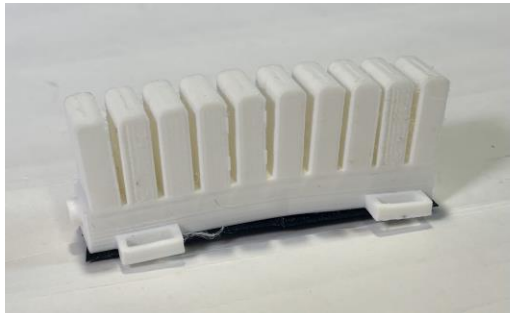
Our Actuator Progression

1st Iteration

Pros:
- Air-Tight

Cons:
- Lack of Deflection
- Chamber spacing too high
- Velcro Holes too small

2nd Iteration



Pros:
- Air-Tight
- Good Chamber Spacing
- Holes could fit Velcro straps

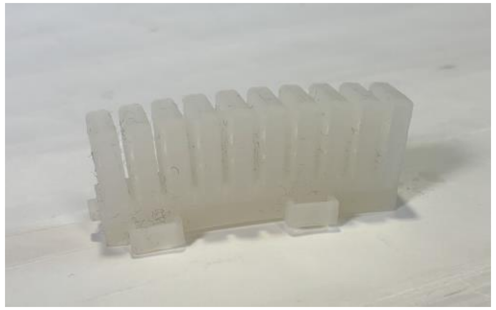
Cons:
- Little Deflection
- Tall

3rd Iteration

Pros:
- Closer Chamber Spacing

Cons:
- Leaks
- Little Deflection

4th Iteration

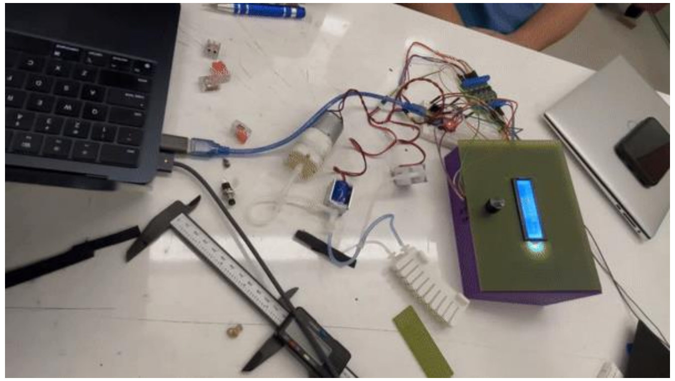


Pros:
- Good Deflection
- Better Placed Holes
- Air-Tight

Cons:
- Bulky

Electronic Iterations:

1st Iteration

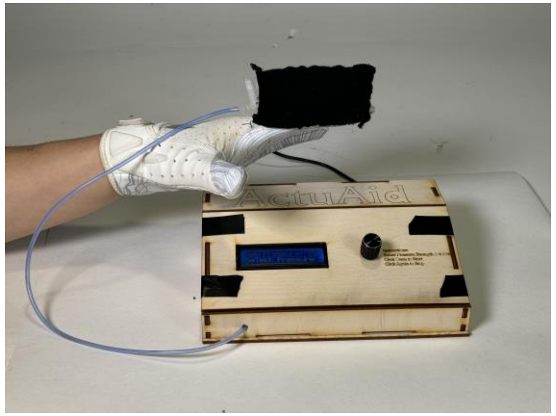


- 1 5V valve -atmosphere
- Pump to inflate Actuator
- No encoder Usage
- LCD showed state of pump

2nd Iteration

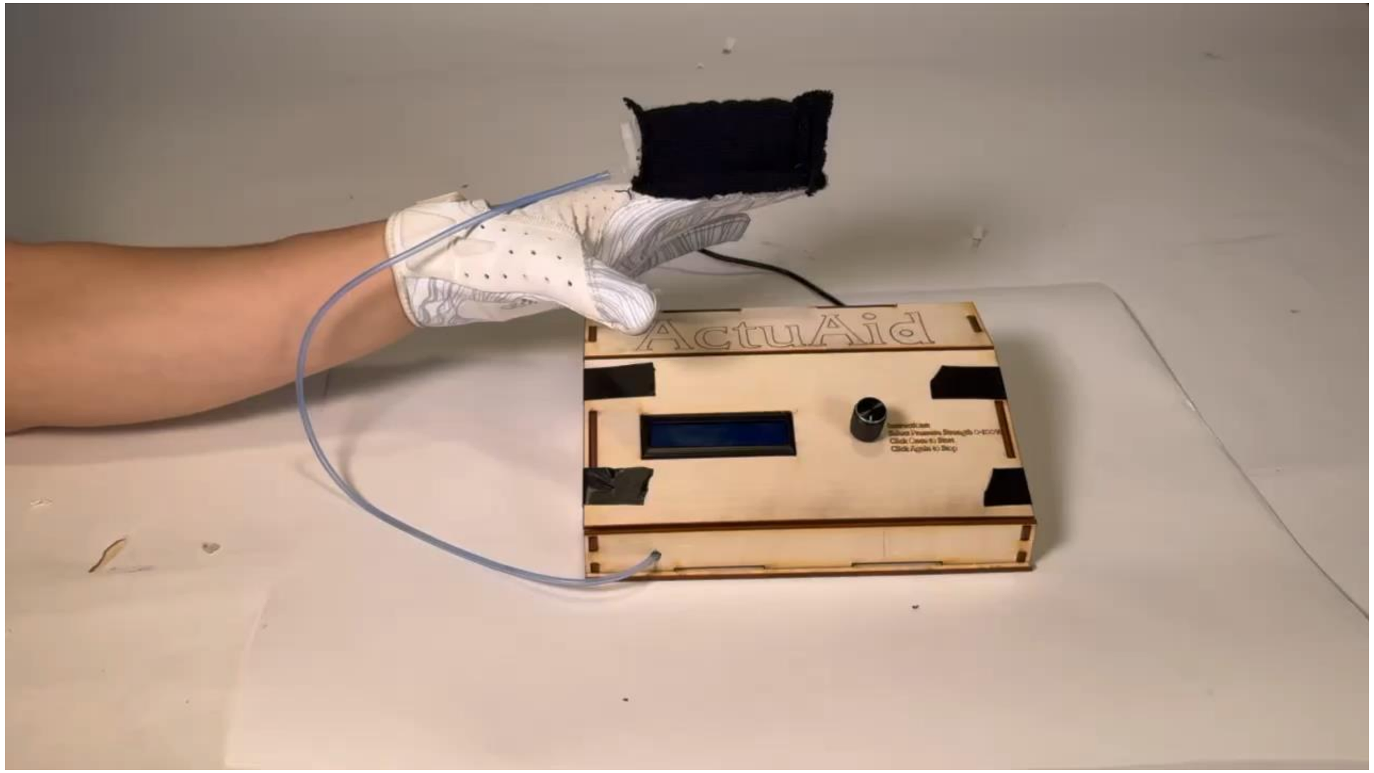
- 2 12V valve used to control pressure and atmosphere
- Pump to inflate Actuator
- No encoder Usage

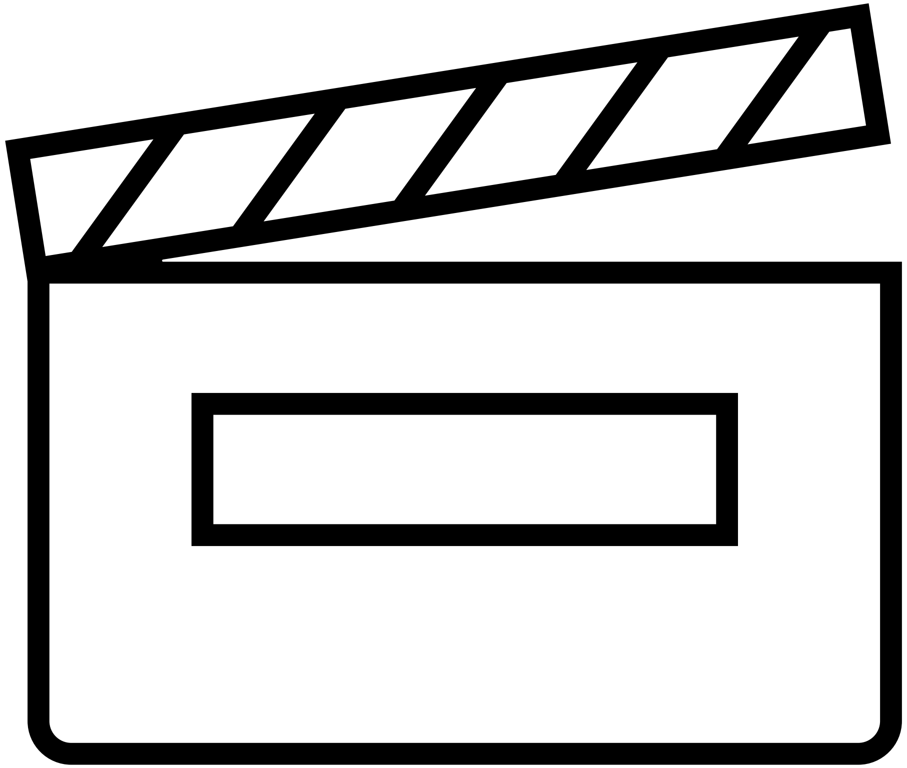
3rd Iteration



- Rotary encoder used to adjust pressure
- LCD display shows setting

Final Prototype



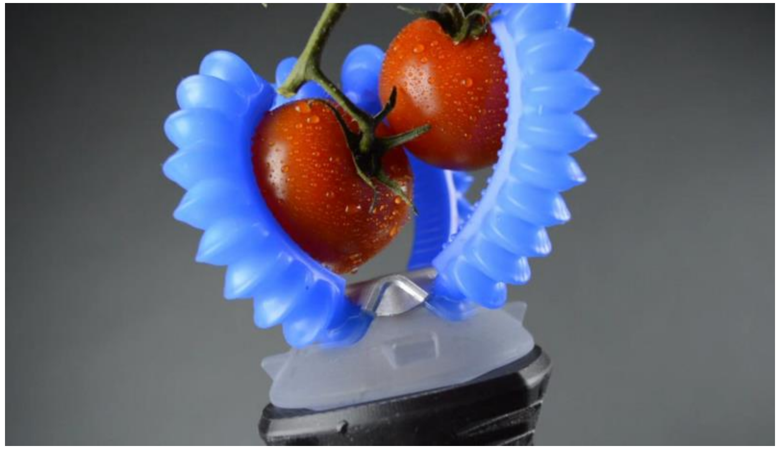


Live Demo

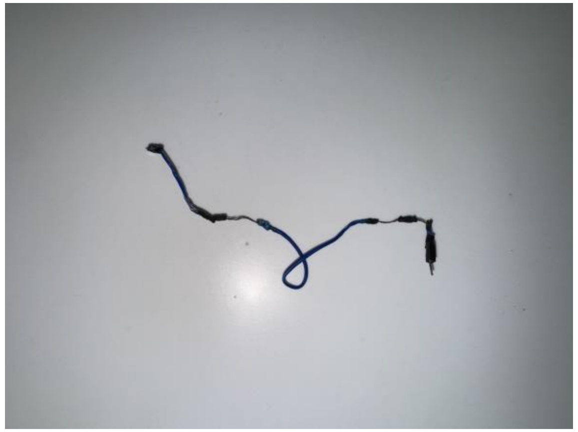
Reflection

Biggest Takeaways:

- There are alternative solutions to traditional Robotics
- 3D printers are extremely versatile in what can be created with different filaments and printers
- Incorporating electronics and soft robotics leads to a wide range of inventions



[7]



[8]

Thank You & References

[1] V. A. Stögner, A. Kaltenborn, H. Laser, and P. M. Vogt, "Hand injuries in sports," 2020.
[2] R. Hall, MD, "Unraveling the UCL Injury of Thumb," 2018.

[3] Kendre, Savita & Teran, Gus & Whiteside, Lauryn & Looney, Tyler & Wheelock, Ryley & Ghai, Surya & Nemitz, Markus. "Printable Flexible Robots for Remote Learning," 2022.

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[5] Z. T. H. Tse, Y. Chen, S. Hovet, H. Ren, K. Cleary, S. Xu, B. Wood, and R. Monfaredi, "Soft Robotics in Medical Applications," 2018.
[6] K. Sasaki, T. Noritsugu, H. Yamamoto, and K. Takaiwa, "Print-it-Yourself (PIY) Glove: A Fully 3D Printed Soft Robotic Hand Exoskeleton for Post-Stroke Hand Rehabilitation," 2017.

[7] C. Loisos, "Material Impact, a new fund focused on materials technology, just closed its debut fund with $110 million", 2018

[8] Prusa