Prototyping of Pneumatic Hand Glove for Finger Joint Rehabilitation

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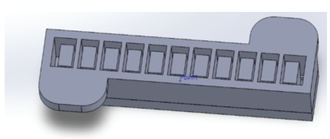
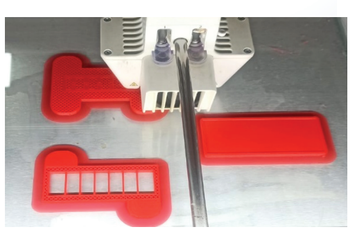
INTRODUCTION

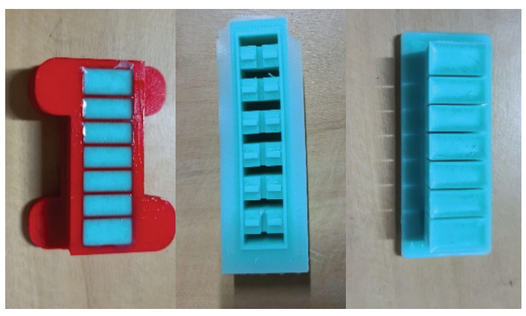
This research focuses on developing a soft robotic glove using PneuNets actuators for finger joint rehabilitation. PneuNets, which mimic natural movements through interconnected air chambers, offer a promising solution for assisting individuals in regaining hand function after injury or stroke. The goal is to provide a safe and effective alternative to traditional rehabilitation methods.

METHODS

CAD Design and 3D Printing: The actuator is designed using CAD software (SolidWorks/Fusion), ensuring precise geometry and dimensions. The mold is 3D printed using ABS or PLA filaments.

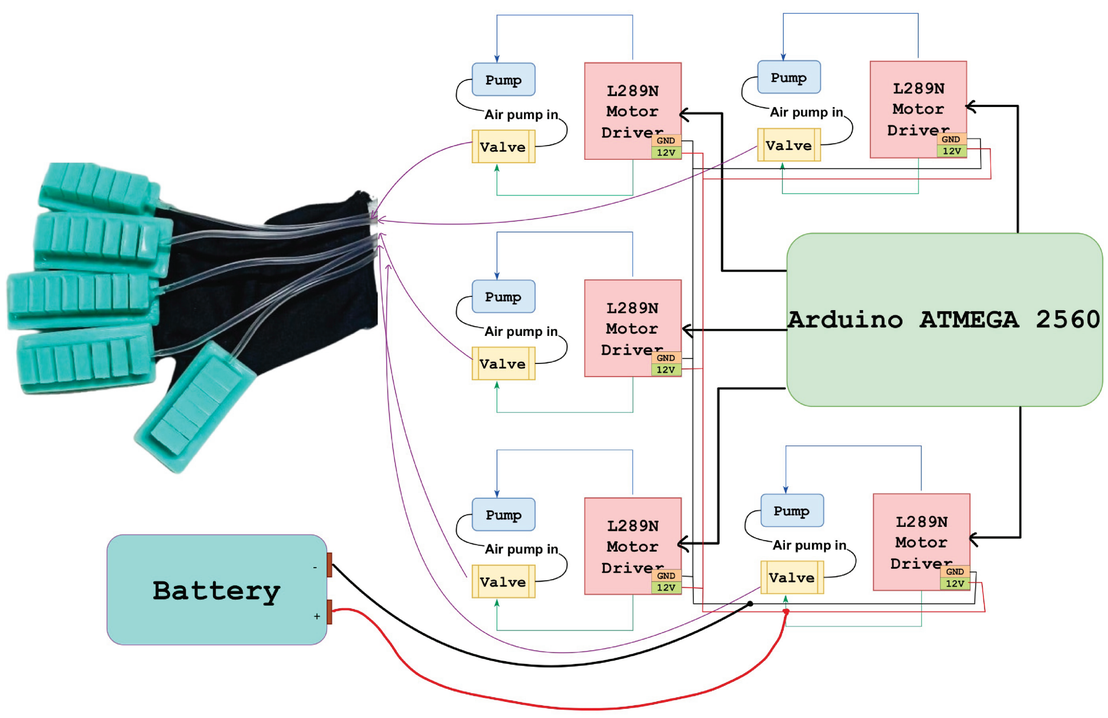




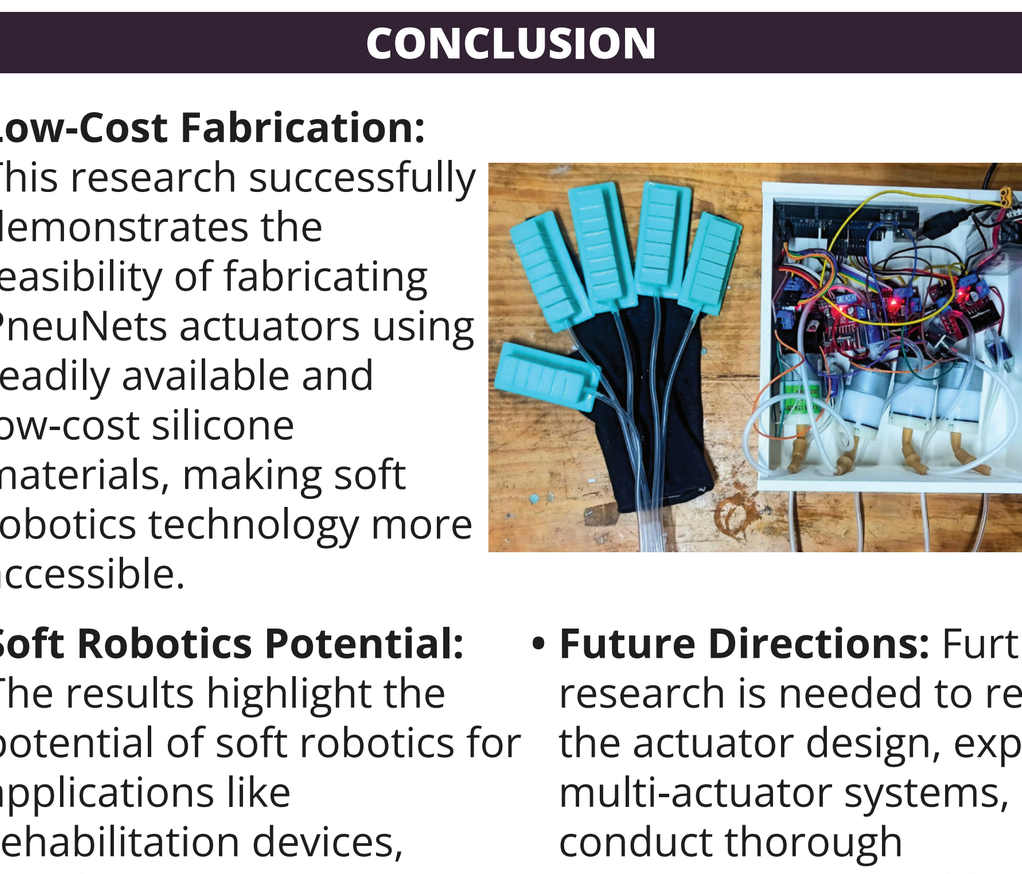


Silicone Mixture Preparation: Mold Star 15 silicone rubber parts A and B are mixed in a 1:1 ratio, degassed to remove air bubbles, and poured shape into the 3D printed mold to form the actuator. The silicone is then cured at room temperature for 4 hours.The cured actuator is combined with a paper strain-limiting layer and a base for structural support.

CONTROL UNIT



RESULTS & DISCUSSIONS



CONCLUSION

- **Low-Cost Fabrication:** This research successfully demonstrates the feasibility of fabricating PneuNets actuators using readily available and low-cost silicone materials, making soft robotics technology more accessible.

- **Soft Robotics Potential:** The results highlight the potential of soft robotics for applications like rehabilitation devices, offering safe and adaptable solutions for human-machine interaction.
- **Future Directions:** Further research is needed to refine the actuator design, explore multi-actuator systems, and conduct thorough evaluations for specific rehabilitation applications.

FUTURE WORK

- **Fabrication Quality:** Refine techniques to ensure even pressure distribution and consistent chamber formation for precise actuator behavior.
- **Control Unit Optimization:** Use PCB, solenoid valves, or multi-channel motor driver ICs for a more compact and efficient design.
- **Advanced Sensing and Control:** Integrate real-time feedback sensors and enhance control algorithms for precise, responsive actuation in diverse environments.

References

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