Underwater Soft Robot for Underwater Navigation

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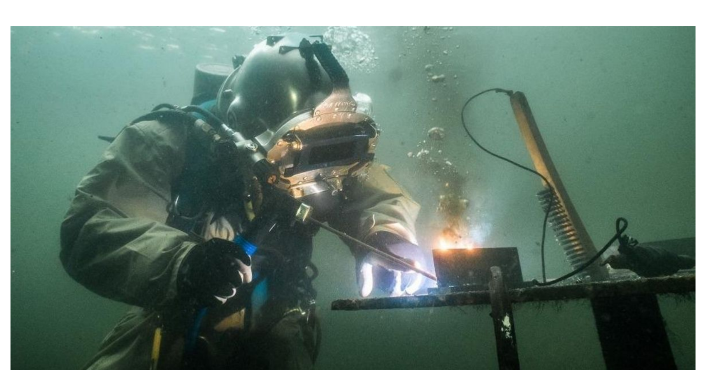
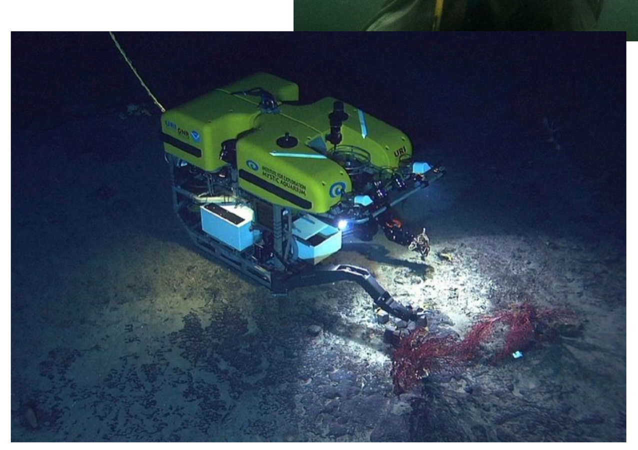
Background

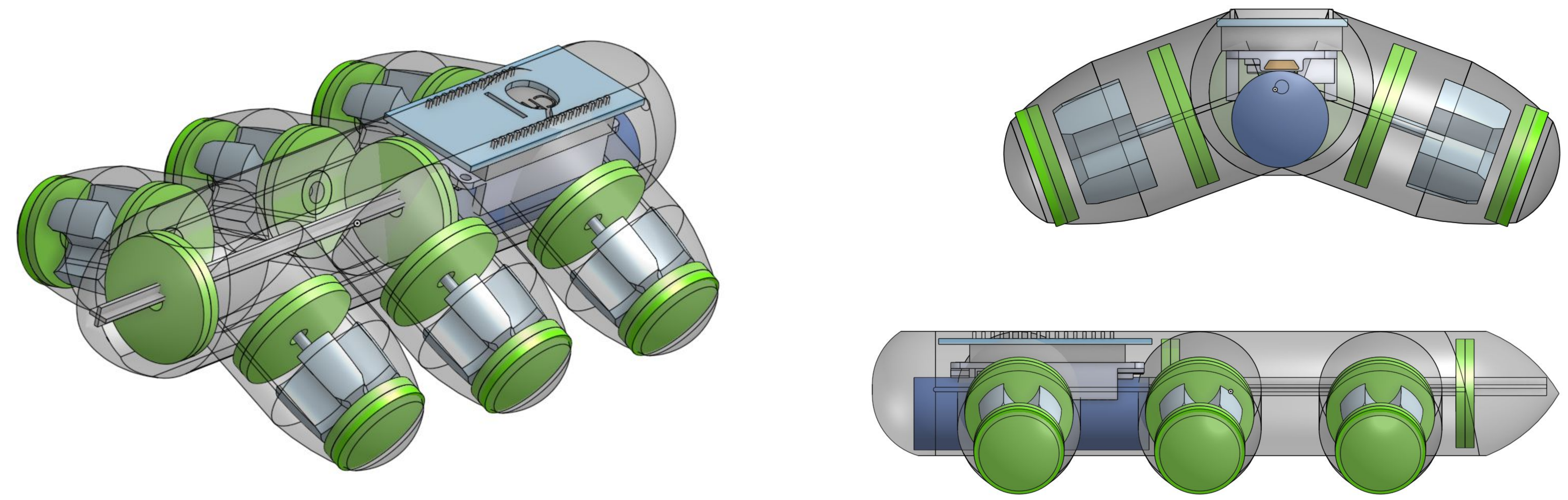
Soft robots are robots that are mostly or entirely made of flexible materials. They provide a number of benefits like inherent adaptability, resistance to blunt force, and pressure resistance. However, they must also rely on unconventional actuation, and complicated control schemes as a result of their flexibility. Today, almost all underwater exploration and repair is performed by human divers or rigid robots. Rigid robots are built with the risk of water pressure, and are especially vulnerable to blunt force, essentially restricting them from operating in tight environments. Human underwater welders face an extremely dangerous profession, with an estimated death rate of 15%. As underwater infrastructure like offshore windmills continue to grow, there is a great need for a safer alternative.

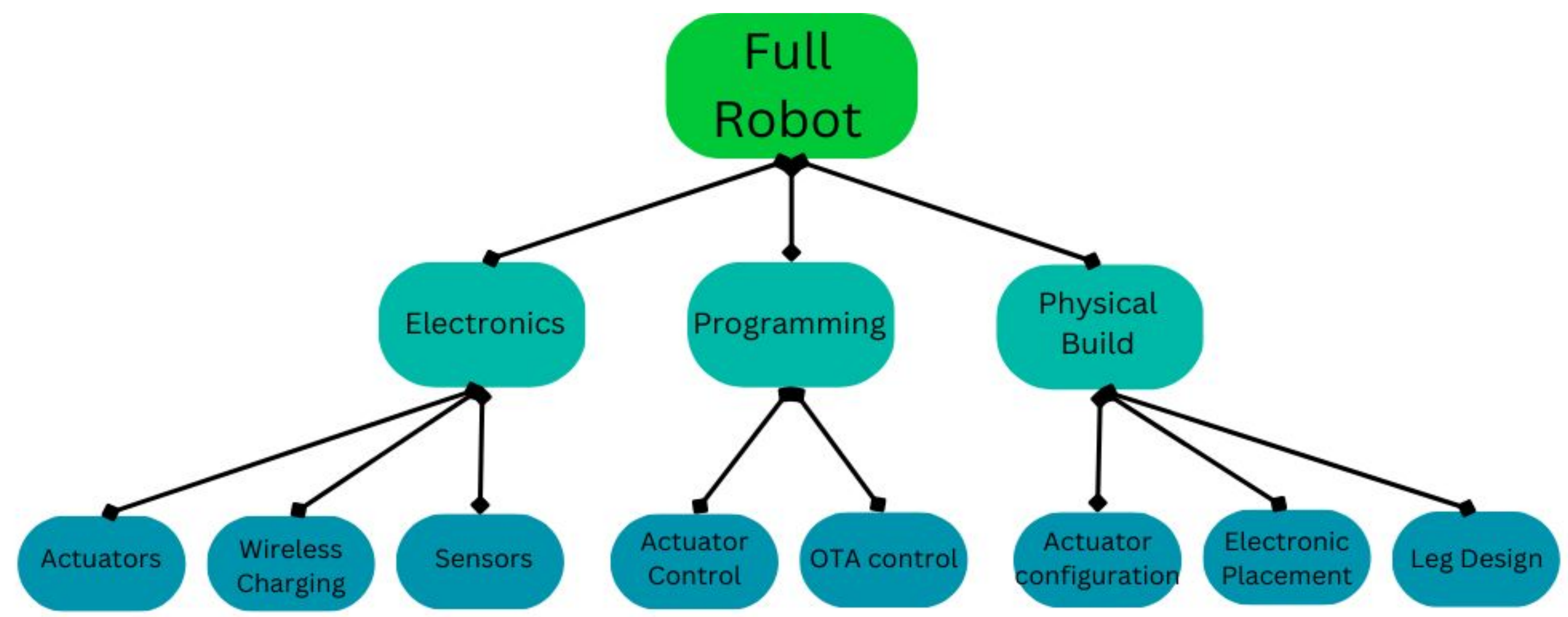




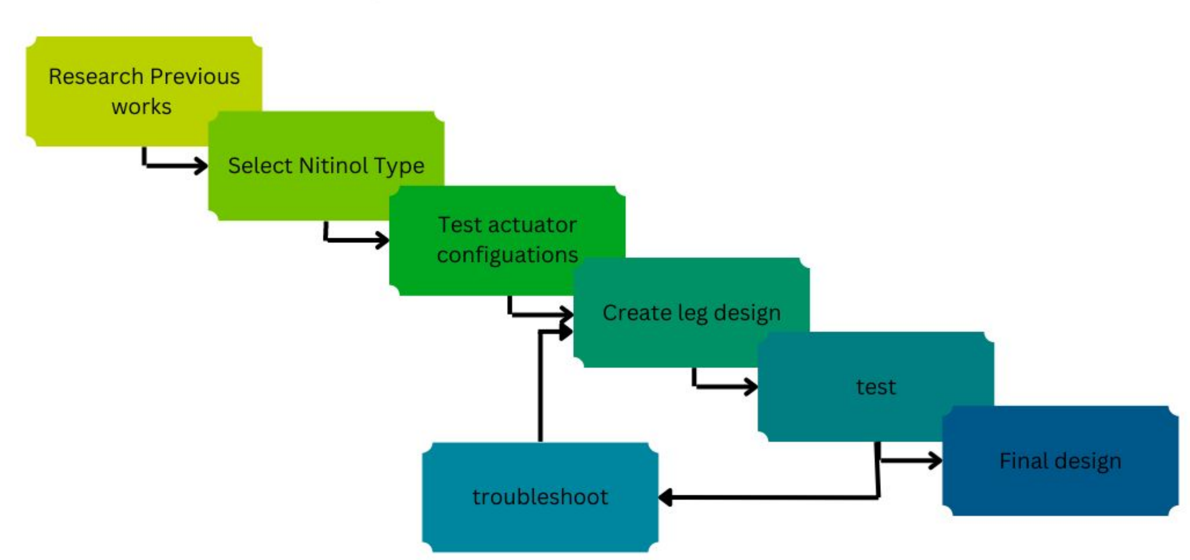
Project Goal

The goal of this project is to fabricate a soft robot designed for operation on underwater surfaces, which is capable of locomotion on several substrates.

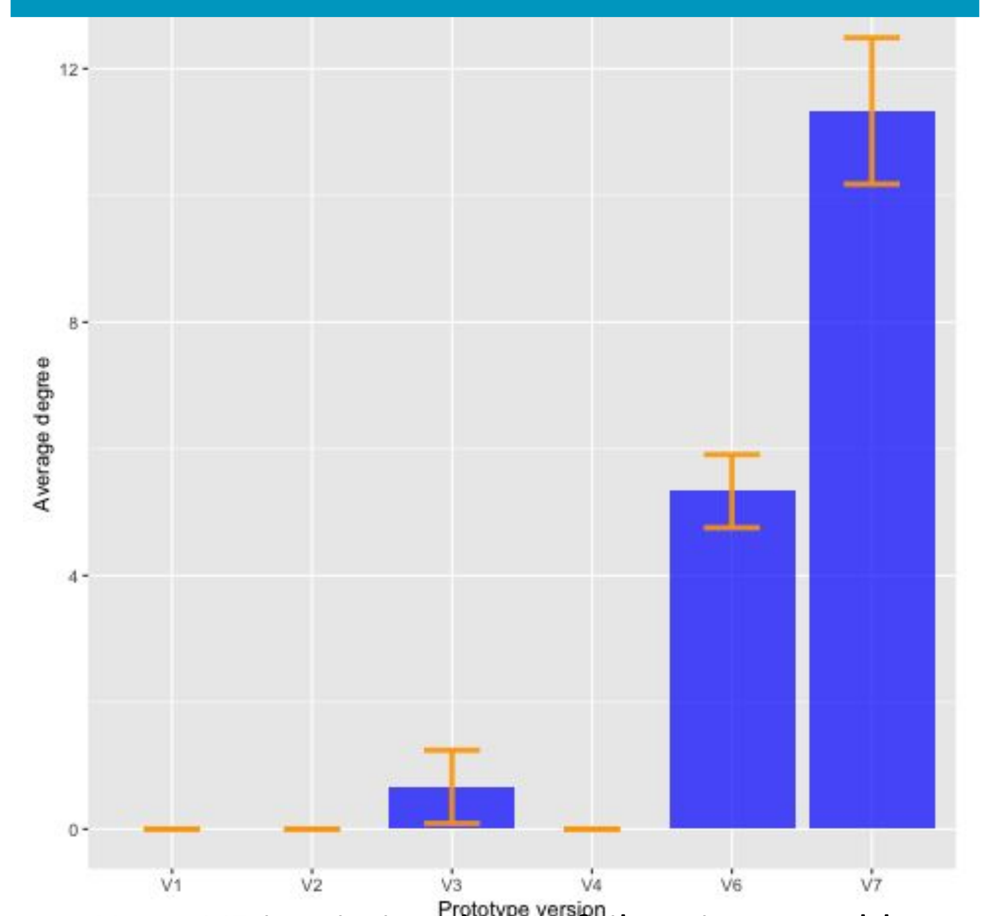




Leg Development Process



Testing Data



Note: V5 is missing due to failure in assembly process

Conclusion

The results demonstrate the feasibility of an underwater soft robot. While an average angle of 11.3 degrees is far from ideal, it is clear proof of concept that a soft robot could be entirely actuated with nitinol. The final design is remarkably simple and cheap to build, costing under $30 and requiring only a 3D printer and soldering iron as tools. However, this prototype clearly suffers from a lack of power, and its performance over extended periods of operation remain untested

Future Studies

- Refine physical design of robot
  a. Increase force output of actuators
  b. Incorporate more sensors
  c. Remove irregularities in fabrication process.
- Develop comprehensive control system

References

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