Thesis Project Portfolio

Novel EMG-IMU Sensor Array for a 5-DOF Wearable Robotic Upper-Limb Exoskeleton

(Technical Report)

The Emerging Influence of Wearables on Adult Users in the Health Ecosystem

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science
University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree
Bachelor of Science, School of Engineering

Justin Glassman

Spring 2022

Department of Mechanical and Aerospace Engineering

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Sociotechnical Synthesis

Introduction

The technological development of wearable exoskeletons in the medical device industry has the potential to help patients with neuromuscular disorders regain the use of their limbs. The complexity required for these assistive exoskeletons to interpret the user's intention and achieve the desired motion while also being comfortable for continuous use remains an ongoing challenge for engineers.

The widespread adoption and enhancement of wearables, like the smartwatch, leads users to gain a sense of trust in the information provided. Motivating users to become and remain active is crucial for improving personal health. Concerns arise from these devices' increasing influence on consumers—of which they need to be aware.

Research into the social and personal implications of wearables will allow me to be cognizant of how my team's exoskeleton may affect consumers on a broader and more personal level than just physiologically. In addition to developing a novel apparatus, the user must also feel comfortable interacting with it and trust that it will produce a positive outcome for it to be considered a success. My research into the risks associated with wearable technology aims to increase the transparency between users and their devices to avoid any unfavorable experiences.

Technical Topic: Novel EMG-IMU Sensor Array for a 5-DOF Wearable Robotic Upper-Limb Exoskeleton

My technical capstone project intends to design and build a wearable upper-limb exoskeleton that integrates wearable electronics, pneumatic actuators, and feedback control. Neuromuscular disorders can result in partial or total paralysis of a person's limb or limbs, making even the more basic of tasks nearly impossible. We hope to create a practical and less-bulky device that allows for five degrees of freedom—3 for the shoulder and two for the elbow. The end product will hopefully improve the patient's quality of life by enabling them to gain or regain motor function of their arms.

STS Topic: The Emerging Influence of Wearables on Adult Users in the Health Ecosystem

The goal of my STS research is to bring awareness to the influence of wearable devices on users and the risks involved with long-term use. These devices have grown beyond just the ability for users to track their present and past activity into an ecosystem including employers and health insurance agencies, a new form of social media, and gamified interfaces with curated visualizations. With more data captured by the devices, the less the user is informed about how that data is collected, how it is being presented to them, where it is going, and the impacts that it has on mental and physical health. Unfortunately, many consumers remain unaware of the potentially damaging impacts on user behavior.

Conclusion

My team started this project from scratch, creating a foundational prototype that includes the necessary elements of a functional exoskeleton. The feedback control and developing a more sleek design should be a goal going forward for future students. I learned a great deal about the influence of one type of wearable on a singular group of users. There is more to delve into concerning other demographics.