

Thesis Project Portfolio

Soft Robotic Exoskeleton for Elbow Assistance

(Technical Report)

Technology and Surf Extinction; How Artificial Waves Threaten Traditional Surf Ideals

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

Advancements in wearable technology push the envelope of what is possible in both the medical field and athletics alike. Wearable technology in the medical field allows for better biomedical sensory readings and can also help assist those with disabilities. The capstone project outlined in this portfolio falls under this theme, with the goal of designing wearable technology that assists those with neuromuscular disorders to achieve comfortable mobility for daily tasks. This project exemplifies how wearable technology advancement can have significant beneficial effects on the lives of those in need. Wearable technology also has major role in sports technology, leading to safer padding and helmets, better heart rate monitors, and even prosthetics for disabled athletes. Another major advancement seen in sports technology recently is the development of artificial environments tailored toward specific sports. The STS research paper included in this portfolio studies this theme, specifically looking into the development of artificial wave pools and what this artificial environment means for the future of the sport of surfing. This project investigates how technology completely reshapes the future of a sport that's existed for hundreds of years and can help predict how similar advancements could affect other sports as well.

This technical project of creating an upper body exoskeleton aims to comfortably assist patients with neuromuscular disorders to accomplish daily tasks with their upper body. Furthermore, the goal is to create the most efficient design both mechanically and electronically to ensure that the exoskeleton is usable for long periods of time. Initially, the group learned and understood each component of a mechatronic system as basic background to reach the final goal. Once each component has been experimented with and understood, the team is divided into three groups: one to design and perfect the circuitry and sensors behind the exoskeleton, one to draft

and create the mechanical structure of the shoulder joint, and one to design the structure of the elbow joint. I am a part of the elbow mechanical design team, with the goal of designing the actuators to achieve the two degrees of freedom observed in the elbow joint. The three parts are then integrated into one design, and the exoskeleton is refined. After the initial prototype is completed, the team plans on obtaining feedback by having UVA hospital patients use the exoskeleton, and surveying both patients and providers to determine ways to improve the next iteration of the design.

The surf community is one built off the traditional ideas of freedom, connection with nature, and spirituality, and surfers tend to be passionate about keeping the sport true to these ideals. The recent progression of wave pool technology is incredible from a technical standpoint, but it also draws controversy as some surfers say it threatens the core ideals of traditional surfing. According to these opposers, wave pools take away the adventure, skill, and authenticity that real waves bring, while also utilizing the sport for major profit. The goal of this paper is to determine the relationship and effects of wave pool technology on the surf community, and how artificial waves may shape the sport in the future. Academic research papers and colloquial articles from members of the surf community are utilized to gain a full understanding of wave pools and surf culture, from which discourse analysis is applied. STS concepts and frameworks such as social construction of technology (SCOT) and technological momentum are used to comprehensively analyze the bidirectional influences of wave pool technology and the surf community. Results should shed light on the controversy around wave pools and give insight into possible future positive and negative unforeseen consequences that come with the invention of completely fabricated repeatable waves.

While both projects are rooted in themes of different technological fields, each theme compliments each other as both investigated some of the most impactful advancements in their respective field, and how they will affect people's daily lives. Working on both projects at the same time allows me to analyze each theme with a fuller picture of how technology can affect society, as what was learned in one area can help give insight into the other area. This assists in eliminating narrow mindsets on any specific topic allowing for a more sufficient and comprehensive study overall. Each project also had a different approach, the STS paper being purely based in research on the topic and the capstone project being based in experimentation and physical testing. Documentation research provides an overarching understanding of the background of the topic and helps with analysis skills, and physical experimentation helps with understanding application to the real world and its physical results. Each type of research brings its own insights, but together they work synergistically to provide a well-rounded research portfolio.