Thesis Project Portfolio

The Light Show

(Technical Report)

How Language Affects Adoption of Prosthetics

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

Technical Paper Abstract

The Light Show uses InfraRed (IR) sensors to detect nearby objects or body parts and uses these proximity values to light an LED array. IR sensors capture reflected light. Nearby objects reflect more IR light back to the sensor, resulting in a higher output voltage. The STM32 micro-controller will capture the voltage from each sensor and determine whether to turn neighboring LEDs according to the voltage from each sensor. Additionally, the micro-controller will also control a PWM signal to the illuminated LEDs. A PWM signal will allow the micro-controller to set the light intensity for the array of LEDs, detecting close proximity will yield an intense light while far proximity will yield a less intense light. This data is sent to an integrated circuit which selects the desired LEDs using a set of muxes, turns them on at the correct brightness, and stores their state.

This project showcases a simple, cost-effective approach to proximity sensing and has potential applications in backup cameras, touchless light switches, and education. In general, the end-user is anyone, as the LED screen will essentially detect any type of IR light being reflected back, this can come from objects being placed in front of it or a hand sweeping across the screen. For students, it will be a learning tool as they can in real-time experiment with IR sensing capabilities and witness feedback from the screen.

STS Paper Abstract

Although prosthetics are readily available, amputees do not utilize them due to a multitude of factors. The way in which society speaks of and views prosthetics undoubtedly has an effect on the adoption of prosthetics. Throughout my STS essay, I utilize various experiences and sources to examine how media representations and society influences perceptions of prosthetic technology adoption. I utilize disabilities studies and discourse analysis as a framework to analyze and drive my STS research. I draw inspiration from the work of Shew and Earle, where they propose a new philosophical framework in which cyborgs and technology are related.

Discourse analysis serves me to examine the language surrounding prosthetics, disabilities, and adoption. Rather than focusing on individual meanings of words, I look at how narratives within cultural, medical, and commercial contexts shape societal attitudes towards prosthetics. I define the cultural aspect as to how the media depicts and talks about prosthetics and devices. Moreover, different societies across the world may have different values, religions and preconceptions that form peoples' beliefs and views towards disabilities and how to aid disabled folk. I define the medical aspect to how prosthetics are spoken about in research, medical, and scientific papers. I refer to the commercial language as the language and ways in which companies market and sell their products for the disabled.

Throughout my research, I found that there is a need to speak of prosthetics and people with disabilities with more nuance, care, and empathy. There are a multitude of reasons why people may not adopt prosthetics, and one of the reasons may be that people do not wish to utilize them and they find their own way of life perfectly fine. Engineers should direct their attention towards ways to support and empower those with disabilities. Tangible objects may not

be the solution, but rather the conversation and ways we approach our mindset towards disability would be helpful.

Connection

My initial idea of my capstone project differs from the actual project that I completed. I was more interested in a project about a prosthetic hand embedded with FPGA and AI technologies to enhance the user experience. This prosthetic, equipped with cameras, could identify the color and depth to determine the best grasp for an object. It would have cutting edge technology that would allow the user to experience complex interactions that would vary based on the environment, strongly mimicking a biological arm. The connection between my initial capstone project and STS paper is much stronger, as I seeked to analyze if my product would be something that is desirable and what I could do to make it so that it met the needs of the audience. I wanted to uncover the ways in which disabled people experience society by analyzing how disabilities and prosthetics are spoken about.

Although my actual capstone did not focus on prosthetics for the disabled, my STS research provided a deeper understanding of knowing what engineers should consider when creating products. I focus on a particular target audience, amputees, and analyze what made them want to adopt a particular technology. I find that a variety of factors must be considered when analyzing the adoption of technology, such as culture, lifestyle, and personality of the individual. With the interactive LED board, I have to consider the ways in which it will be interacted with in society and what makes my product desirable for use. With the end user being so diverse, it is important to broaden my scope beyond just function and consider accessibility and cultural context. This will enhance my design to be user-centered.