Thesis Project Portfolio

Gesture-Controlled LED Matrix Display (Technical Report)

An Analysis of the Impact of Apple's Proprietary Electronics Design Practices on Electronics Education (STS Research Paper)

An Undergraduate Thesis

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My technical project and my STS research project focus on different facets of the same central issue in the electronics industry today: the growing gap between the expected and actual understanding of students studying electronics. The technical project was meant to demonstrate the feasibility and appeal of designing technology with user understanding in mind. My technical project group designed a gesture-controlled LED matrix meant to be enjoyable and inspiring for young students along with a guide for producing similar projects using online information. My STS research project focused on the ways in which Apple's modern design practices are stifling innovation and learning in the electronics industry. Thus, my technical project served as a proof-of-concept for how Apple (and maybe even other companies) can design with understanding and repair in mind, without compromising on user experience and still upholding the duty of care discussed in my STS research project.

The technical project was based on a question that arose during my group's brainstorming process: How can we design an enjoyable piece of technology that is also capable of inherently or intuitively teaching students how it works? We concluded that something flashy with direct, natural user interaction would be the most straightforward way to make something engaging and that using well-documented technology solutions would make it easy to understand. This led us to the idea for a gesture-controlled LED matrix. This matrix uses a modular design where two microcontrollers (an STM32 and an Arduino) communicate; the Arduino handles a strip of addressable LEDs configured in a 25 by 20 matrix and the STM32 processes gesture data from a Time-of-Flight sensor. Users can move their hand in front of the matrix to draw on it and perform gestures to change settings.

The STS research project is a kind of extension and application of information I gathered from another research project I completed during my STS coursework about Apple and the Right to Repair movement. Its key focus is supporting a perspective on current electronics design practices that sees modern proprietary designs as detrimental to innovation and learning. This was explored using the care ethics framework, where Apple's relationships with consumers and others in the industry were examined in relation to moral norms of care. Apple's Mac computers served as the main case because they have evolved from products created using off-the-shelf components (like my technical project) to designs that are barely meant to be accessible or repairable, showing this failing of care.

Since I completed my technical project entirely in the semester before writing my STS research project, my feelings about the STS project were directly influenced by my experience with the technical project. I learned that while it is difficult to design for understanding and teaching, it is also highly possible and extremely rewarding. This gave me a sort of frustrated perspective when completing my STS research project. I discovered all the ways that Apple's design practices are affecting the industry which I have chosen to pursue after learning just how possible it is to design openly and with repair in mind. For me, it stands as a lesson to ensure that my designs contribute to furthering the field while still being good products, instead of focusing on protecting revenue and intellectual property.