Thesis Portfolio

Distributed Smart Solar Charge Controller for UVA Solar Car
(Technical Report)

Iteration of Curriculum: Comparison of Old and New Computer Science Program at the University of Virginia
(Technical Report)

Cultural, Political, and Economic Barriers to Transportation Decarbonization
(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

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Sociotechnical Synthesis

One of my technical projects aimed to create a better power transfer system for a solar car. My STS research is motivated by the technical project with its focus on transportation-based carbon emissions. The research explores the current work being done, which includes the adoption of electric vehicles. My other technical report compares the old and new CS curriculum at UVA and offers insights into the new curriculum.

In my STS research, I explored the state of transportation emissions to understand the impediments to reducing emissions and how they interact with each other. Currently, goals to reduce transportation emissions can be split into short-term and long-term efforts. The short-term goals are aimed at increasing the adoption of electric vehicles and increasing the availability of electric vehicle infrastructure, while the long-term goals are focused on restructuring cities to encourage the use of public transportation.

The technical portion of my project produced a distributed maximum power point tracking (MPPT) controller, which was designed to be mounted to a solar car and improve the power throughput over using a single MPPT controller. The distributed MPPT system was designed using both a printed circuit board and a microcontroller feedback system to control the power output from solar panels. By cascading several panels with a controller each, the power output of each panel can be maximized, which is better than simply maximizing the output with only one controller.

The other technical project conducted was a comparison of the new and old CS curriculum at UVA, where I explored the thought process of the design of the new CS curriculum and compared grade point averages (GPAs) to see if there was significant improvement. Overall, there was not too much difference in GPAs, but some classes in both curricula saw an improvement in the new curriculum, indicating that students were better prepared.

From my technical projects, I learned the importance of attention to detail, especially in the design of the distributed MPPT controller. Some small oversights of the datasheets about the components we used as well as some mishaps in the PCB design caused major setbacks, however, we were able to get a somewhat working product by the end. The comparison of the old and new curriculum helped me explore the process of designing a new curriculum and the thought that goes behind it. There are also limitations present in my data collection that require further research with contextual considerations such as the coronavirus and how that may have also impacted performance and changes to teaching. My STS research showed that the main efforts are to encourage people to adopt sustainable alternatives as opposed to heavy regulations.