Thesis Project Portfolio

Optimizing Routes for UVA's Facilities Management Fleet: Enhancing Sustainability and Pedestrian Safety

(Technical Report)

Building Trust in AVs Requires Transparency, Cooperation, and Communication Across the Network

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

Car crashes remain one of the leading causes of death globally, claiming thousands of lives every day. Researchers have explored many solutions to this issue, one of which is the development of Autonomous Vehicles (AVs), as they aim to reduce the human error factor in car accidents. However, the growth of AVs has slowed, mainly due to public distrust in their safety and reliability. In my STS research, I examine the key actors in the AV network and their role in rebuilding public trust, aiming to support the integration of AVs into society and save lives. Another strategy for reducing crashes is optimizing traffic patterns to improve safety. In my technical research, I analyzed the University of Virginia's Facilities Management (FM) fleet's telematics data to understand their routing patterns. Our goal was to reduce FM's presence on high-traffic roads around Grounds to minimize accidents and increase pedestrian safety for students.

In my technical project, the core problem centered on the heavy presence of UVA's FM fleet and the risks it creates for student pedestrians. We focused specifically on McCormick Road, a highly trafficked route through central Grounds, analyzing FM vehicle routes across three two-week periods in 2023, including one period during road construction. Using Python, we mapped the most common FM routes through McCormick Road, identifying frequent destinations such as Culbreth Parking Garage, Behind Clark Hall, and the Hospital Area. After identifying these common routes, we explored alternative routes that would help FM vehicles avoid McCormick Road. When avoidance was not possible, we analyzed peak pedestrian traffic times to recommend safer travel windows. Our findings showed that with these route adjustments, FM operations could become more efficient, lower environmental impact, and

improve campus safety. Our research offers practical guidance for creating a safer and more sustainable pedestrian environment at UVA.

In my STS research, I addressed the issue of public distrust as a major obstacle to AV adoption. Applying Actor Network Theory, I analyzed how four key actors shape public trust in AVs: pedestrians, manufacturers, the media, and policymakers. I argue that building trust requires all stakeholders to prioritize transparency, collaboration, and clear communication. Through case studies, I examined how pedestrians interact with AVs and the several types of trust involved, how manufacturers hold ethical responsibility for safety and transparency, how the media's portrayal of AVs influences public perception, and how policymakers shape the regulatory environment. I concluded that earning public trust in AVs depends on ethical leadership and shared responsibility among all actors involved in the AV network.

Together my STS and technical research tackle various aspects of the broader problem of traffic-related injuries and fatalities. My STS research investigates the role of trust in advancing AVs as a long-term solution to reduce crashes, while my technical research applies a practical, short-term solution for improving pedestrian safety at UVA. Although my STS research covered a lot of ground, I wish I got to explore how socio-economic factors and community differences influence trust in AVs. Similarly, my technical project provides opportunities for future studies on sustainability in fleet operations, including metrics like engine idling and emissions, to align more closely with UVA's environmental goals. Both projects are starting points to create safer and more sustainable transportation systems.

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