

Thesis Project Portfolio

Election Security: Fortifying Election Localities with Policy and Planning

(Technical Report)

Trust on Trial: Navigating Accountability Diffusion in Autonomous Vehicle-Pedestrian

Incidents Using Geels' Multilevel Perspective

(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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Fall, 2024

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Sociotechnical Synthesis

(Executive Summary)

Bridging Accountability in Cybersecurity and Autonomous Vehicles

In the intricate web of technology and society, accountability is the thread that keeps it all from unraveling. My technical work addressed election accountability by implementing key protocols such as encryption and incident response plans in critical election infrastructure. My STS research examined how accountability is diffused in autonomous vehicle accidents by exploring the interplay between various domains and actors in the sociotechnical system. Both projects emphasize the need for robust mechanisms to assign responsibility and mitigate harm when complex systems fail. By integrating technical and social dimensions through STS perspectives, engineers can contextualize the ethical implications of their engineering decisions and make sure that the practice is aligned with societal expectations, safety, and trust.

The technical project was a cybersecurity consulting internship with Amelia County where my group aimed to enhance the election security compliance with Virginia's Locality Election Security Standards (LESS). This project involved an initial assessment of the locality's adherence to cybersecurity standards in five critical areas: encryption, backups, incident response, inventory, and miscellaneous compliance measures. Our work produced several key deliverables such as the Business Impact Analysis, role-based training documents, post-incident interview procedure, and several other policy documents and guides specified in LESS. By the end of the internship, Amelia County's LESS compliance progressed from 74.0% to 87.5% at the baseline level and has plans to reach a full 100% compliance. A critical aspect of the experience was addressing gaps in accountability and clarifying roles in the event of a cybersecurity breach or failure. By emphasizing the importance of well-defined protocols and responsibility

structures, the project underscored how unclear accountability can hinder incident response and recovery efforts, and this focus on accountability in sociotechnical systems serves as a parallel to my STS research.

As a result of spending a summer learning about accountability in cybersecurity. I wanted to explore how accountability is handled during failures in other sociotechnical systems. I investigated accountability diffusion in autonomous vehicle (AV) accidents, focusing on a case study of a 2023 incident where a pedestrian was struck and dragged by a Cruise AV in San Francisco. My research highlighted how accountability is fragmented and interconnected across technical, regulatory, and societal layers and how it affects public trust in widespread AV adoption. Using Geels' multilevel perspective, I analyzed the technical root cause of the incidents, gaps in regulatory oversight, and societal pressures resulting from the incident. This approach revealed how vague accountability mechanisms exacerbate the challenges of building trust in AV technology. Furthermore, I draw conclusions as to how cohesive regulatory frameworks and transparency from AV companies can ease public concerns and build trust in this emerging technology.

Both of my projects underscore the centrality of accountability in engineering practice because of the STS perspectives integrated in the approach, which illuminates the shared ethical responsibility of the technical, regulatory, and societal levels. Boeing's 737 MAX failures are prime examples of how lapses in accountability at various levels can result in disastrous consequences and further push the need for STS-oriented engineering practices. By applying STS frameworks, engineers can identify accountability failures in their practice and redesign solutions to address the ethical implications of those failures, which fosters confidence that their work serves as a pillar of ethical and moral progress in society.