Safe and Sustainable Route Guidance Harnessed by Vehicular Telematics Data

Addressing Public Skepticism of Autonomous Vehicles through Stakeholder Perspectives and Media Analysis

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By
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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction

The overarching problem my research will address is the lack of sustainable practices and public trust within the transportation industry. My technical research tackles the need for sustainable and safety-focused route optimization for UVA's Facilities Management (FM) fleet. FM faces challenges in route compliance, as drivers often opt for shorter but unsustainable routes through student-heavy areas like McCormick Road, increasing the risk of student-vehicle conflicts. My group's research aims to map alternative routes that minimize environmental impact and avoid high pedestrian zones during peak hours, enhancing both safety and sustainability. Additionally, FM's reliance on diesel vehicles presents another problem. To support UVA's carbon neutrality goals by 2030 and fossil-fuel freedom by 2050, FM has tasked us with identifying cleaner fleet options. These efforts align with FM's goal of winning the NAFA Green Fleet Award, which recognizes fleets that have made significant efforts to reduce their environmental impact through vehicle management strategies (Green Fleet Awards, 2021).

My STS research examines the high levels of public distrust surrounding autonomous vehicles (AVs), despite their potential to improve transportation safety and sustainability. This distrust threatens the adoption of AVs, preventing society from experiencing their benefits, which, as Bagloee et al. (2016) describe in the peer-reviewed *Journal of Modern Transportation*, include "reduced crashes, energy use, pollution, and congestion while at the same time increasing transport accessibility" (p. 284). My research aims to identify the types of distrust among key stakeholders—such as pedestrians, AV drivers, and non-AV drivers—to understand their unique relationships with AVs and the specific factors contributing to their distrust.

Together, my research contributes practical strategies for sustainable transportation for UVA FM's fleet and insights into fostering public trust in AVs, aiming to bridge the gap

between innovative solutions and societal readiness. Ultimately, this work envisions a transportation system that is both environmentally sustainable and trusted by the public.

Safe and Sustainable Route Guidance Harnessed by Vehicular Telematics Data

UVA's FM vehicles maintain a high visibility on campus, particularly around high-traffic areas like McCormick Road during peak pedestrian hours, which increases the risk of pedestrian-vehicle conflicts. This issue is heightened by the low compliance of FM drivers with designated rules, such as avoiding McCormick during class changes when pedestrian density is highest. Additionally, these routes are often inefficient, creating both time delays and sustainability concerns. My group's task is to analyze FM's route patterns and compliance levels to identify safer and more efficient paths that minimize interactions with pedestrians and reduce idle times, which is crucial given UVA's ambitious carbon-neutrality goals. The work of Coloma et al. (2019) on eco-routing is highly applicable to this analysis, as it explores strategies for selecting the most environmentally friendly routes in smaller, university-centric cities like Caceres, Spain – a city that mirrors Charlottesville in many ways. Coloma et al. (2019) demonstrate that factors such as distance and stop frequency significantly affect emissions in compact urban areas. By applying Coloma et al.'s eco-routing concepts, our research aims to design alternative routes for FM vehicles that reduce their environmental impact while also prioritizing pedestrian safety.

In addition to route optimization, we are tasked with evaluating the emissions of Kubota vehicles, which are the least sustainable vehicle in the FM fleet and compromise UVA's efforts toward environmental goals, like the NAFA Green Fleet Award. Mehar et al. (2015) provide valuable insights into the sustainable management of vehicle fleets, particularly through their sustainable transportation management system (STMS) model. This model emphasizes aspects such as power consumption, route planning, and energy efficiency in fleet operations, serving as

an ideal framework for UVA FM to consider. Mehar et al. (2015) argue that organizations transitioning to plug-in hybrid or electric vehicle fleets observe significant reductions in greenhouse gas emissions due to cleaner energy sources and more sustainable practices. UVA FM already employs GeoTab, a data monitoring tool like the real-time systems advocated by Mehar et al. (2015), to track fleet routes and non-compliance. By leveraging data from GeoTab and adopting the STMS approach, my group aims to develop recommendations for UVA FM to increase fleet sustainability and support their transition toward a greener, more eco-friendly fleet. Together, these efforts align FM's operational practices with UVA's broader environmental objectives while addressing pedestrian safety concerns around Grounds.

Addressing Public Skepticism of Autonomous Vehicles through Stakeholder Perspectives and Media Analysis

Public distrust in AVs presents a substantial barrier to their widespread adoption, undermining potential benefits like increased transportation safety, efficiency, and reduced environmental impact. Bagloee et al. (2016) discuss the significance of AVs as part of an integrated "system of systems" (p. 299), suggesting that as AVs become interconnected with other vehicles and infrastructure, they have the capacity to transform urban mobility. However, this potential transformation depends on public acceptance. Despite Bagloee et al.'s (2016) optimism about AV technology, they overlook the impact of public skepticism – a critical oversight, as distrust in AVs hinders public willingness to use them. Anania et al. (2018) add depth to this issue by examining how media influences public perception, revealing that negative media coverage has a more deep and lasting effect on attitudes towards AVs than positive coverage. Their findings are supported by Tapiro et al. (2022), who study the impact of the first pedestrian fatality involving an AV and note that the public trust, especially in perceived safety,

did not return to pre-incident levels, indicating that restoring public trust after a failure is a significant challenge. This skepticism is made up of diverse stakeholder perspectives, each influencing public opinion in distinct ways. Hamadneh et al. (2022) conduct a stakeholder analysis that reveals insurance companies and manufacturers, while incentivized to promote AVs, are still wary of their associated risks. Insurance companies, for example, view AV safety as a major concern, complicating their interest in endorsing AVs due to liability risks. Together, these sources underscore that public mistrust of AVs is influenced by isolated incidents, media portrayals, and stakeholder positions.

To explore this mistrust more deeply, my research will apply Zhou et al.'s (2022) theoretical framework, which categorizes trust into three levels—dispositional, situational, and learned—across various stakeholders, as identified by Hamadneh et al. (2022). This approach will help me uncover each group's perspectives on AVs and assess whether these views support or hinder AV adoption in society. According to Zhou et al. (2022), dispositional trust is shaped by personality and prior experience, situational trust is influenced by specific contexts like road conditions, and learned trust is developed through repeated interactions with AVs. While initially developed to examine pedestrian trust, this model provides a comprehensive view for analyzing AV skepticism across stakeholder groups and highlights specific barriers to AV acceptance. I will use this framework to analyze evidence from research on the perspectives of pedestrians, AV drivers, non-AV drivers, passengers, insurance companies, and the media.

Additionally, my research will use the theory of Social Construction of Technology (SCOT) to show how the media shapes public perceptions of AVs. Media portrayals often amplify AV-related fears by focusing on isolated incidents, like the trolley problem, which presents AVs as incapable of human-like moral judgement. LaCroix (2022) defines the trolley problem as "a set

of ethical dilemmas wherein a subject must choose between some set of options involving (typically) human lives" (p. 739). In other words, AVs are the subject, and they must choose which lives to save in a worse-case scenario. In my research, I plan to support LaCroix's (2022) critique, which argues that the trolley problem oversimplifies AV decision-making and implies a moral rigidity that heightens public fear. Published by Society for Science in *Science News* and written by experienced science journalists, Hutson (2017) adds that trust in AVs should not stem from blind faith but transparency, suggesting that making AVs more communicative could ease public skepticism. Hutson's (2017) argument presents a potential solution for regaining public trust, an area I plan to explore further in my research.

Integrating Zhou et al.'s (2022) trust model, LaCroix's (2022) critique, and Hutson's (2017) focus on transparency, my research proposes targeted communication strategies for various stakeholders to encourage informed trust. By addressing the factors influencing public opinion and focusing on evidence-based solutions provided in AV research, this approach aims to foster a realistic and supportive view of AV technology, which is essential for advancing AV acceptance.

Conclusion

My STS and technical research tackle the pressing issues of public trust in AVs and the need for a safe and sustainable fleet. My analysis of UVA's Facilities Management fleet routes and emissions focuses on improving safety for student pedestrians and reducing environmental impact, supporting UVA's carbon neutrality goals and the NAFA Green Fleet Award. Meanwhile, my STS research uses Zhou et al.'s (2022) trust framework to uncover key factors behind AV skepticism across all stakeholders, highlighting the importance of transparency and ethical considerations in gaining public acceptance. By addressing both practical and social dimensions

of transportation challenges, my research offers actionable insights that can guide policy and industry practices for both UVA and the greater society, fostering a more trusted and sustainable transportation ecosystem. Together, these studies lay the groundwork for transportation solutions that align with societal and environmental goals, advancing a future where AVs and other transportation systems are integral to sustainable mobility.

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