Enhancing Route Efficiency and Sustainability for UVA Facilities Management Vehicles Through Telematics Data

Protecting Employee Surveillance and Privacy While Maintaining Workplace Efficiency

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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

Companies are increasingly collecting vast amounts of data on their employees and customers, often without their awareness, to improve operational efficiency and make informed business decisions. However, extensive data collection presents a sociotechnical problem: there is an unclear boundary between beneficial data collection and the point at which it becomes intrusive to employee's privacy. This issue is further complicated due to the lack of U.S. data regulation frameworks that could protect individuals from privacy invasions and misuse of their data (Martin & Murphy, 2017). Some argue that stronger regulations could harm innovation, while others highlight the risks of leaving privacy largely unregulated, as seen in cases like the Cambridge Analytica scandal (Jamison, 2019).

To address this issue, my technical research will focus on optimizing route efficiency for UVA Facilities Management vehicles using telematics data and highlighting how this data collection can improve both efficiency and sustainability. My STS research will then explore the broader ethical and social implications of workplace surveillance from both employee and business perspectives. These topics will examine how companies can balance the benefits of data collection while respecting individual privacy, helping define a line between workplace efficiency and ethical responsibility.

Technical Topic

The current routing system for UVA Facilities Management (FM) vehicles faces inefficiencies, especially during times of heavy student activity on highly trafficked roads. This congestion leads to increased fuel consumption, emissions, operational costs, and longer travel times, increasing UVA's carbon footprint. Route optimization is crucial for

both sustainability and operational efficiency**.** For example, a case study done in Sydney, Australia focuses on reducing overall travel distance for large garbage trucks to minimize fuel consumption and greenhouse-gas emissions (Karimipour et al., 2017). Their findings showed that optimized routes can reduce travel distance by 8 km per day, cutting daily CO2 emissions by 5.5 kg per truck. This study provides evidence on the benefits of route optimization in relation to sustainability goals, suggesting that incorporating GIS techniques could strengthen my approach for analyzing optimized routes at UVA. This highlights how even small improvements in FM routing could significantly help UVA meet its goal of becoming carbon neutral by 2030.

My approach will use telematics data, which comes from vehicle tracking technology in every FM vehicle that monitors speed, location, and fuel consumption. Telematics data can significantly contribute to efficient route planning by minimizing fuel consumption and emissions (Erdinç et al., 2019). Erdinç and coauthors explore route optimization for electric garbage trucks used for waste collection, arguing that when electric vehicles use optimized routes found by advanced vehicle monitoring, there are significant energy savings and efficiency improvements. Their study, conducted with real-world road data in Istanbul, showed that optimized routes reduced overall energy consumption by 32%. This source aligns closely with my project, as both investigate energy consumption and route optimization for electric vehicles, which are part of the UVA facilities fleet. This study provides real-world support for using telematics data to improve energy efficiency and demonstrates how electronic monitoring led to positive outcomes.

I plan to identify the top 10 most frequently traveled to destinations by UVA FM vehicles leaving from the Facilities Management parking lot. By examining their current

routes, I plan to identify the most efficient path from the FM home base to the destination based on vehicle speeds in relation to carbon emissions. I will also incorporate data from a period when McCormick Road, a highly pedestrian trafficked road, was closed. Comparatively analyzing this road closure period potentially encouraged the use of alternate routes, possibly providing insight to analyze more road options for route optimization. I will also analyze diesel Kubotas, the fleet's highest carbon-emitting vehicles, to evaluate if switching to electric or hybrid models could reduce UVA's carbon footprint and be cost-effective. This telematics data analysis will inform route optimization and support UVA's sustainability goals.

STS Topic

My STS research will address the growing ethical and social concerns around workplace surveillance and data collection. U.S. privacy laws often fail to adequately protect employees from invasive data collection, leading to privacy violations when required to share personal information for work. Willborn argues that employee consent is often forced or given without full understanding, especially in situations of significant power imbalance, making it a weak justification for workplace surveillance (2006). This issue raises the question of how companies can ensure transparency and voluntary consent in performance monitoring while still meeting business needs. Miller and Weckert (2000) similarly argue that monitoring for increased efficiency does not outweigh employee rights to privacy without proper consent or clear guidelines. Both sources have strong frameworks, legal and ethical, but lack evidence that may limit real-world application of

their claims. To address this, I will use industry specific case studies that demonstrate an imbalance of monitoring and employee privacy.

To analyze these dynamics, I will use Actor-Network Theory (ANT) to explore relationships between human actors, such as employees, employers, and regulators, and non-human actors like data collection technologies, privacy laws, and surveillance methods. ANT provides a framework for examining how surveillance systems shift power dynamics toward employers, often reducing employee autonomy and privacy. ANT highlights the role of "translation", where actors in a network redefine each other's roles (Moore et al., 2009, p. 647). By focusing on "translation," I aim to explore how surveillance tools can integrate employee privacy and create a more balanced power dynamic. This analysis will help reveal how actor-networks can be restructured to create more equitable systems that prioritize both operational efficiency and employee privacy.

Workplace privacy issues become prominent in heavily monitored industries, clearly exposing ethical risks. Alimahomed-Wilson and coauthors (n.d.) provide a unique perspective by exploring the experiences of Black, Indigenous, and people of color monitored under Amazon's intensive workplace surveillance. Using interviews with 35 Amazon warehouse workers, the authors argue that Amazon's surveillance practices exploit marginalized workers, creating extreme inequalities by using monitoring as a means of control. This surveillance environment places immense pressure on these employees, leading to high turnover, health risks, and poor treatment based on race. Although this source highlights the exploitative use of surveillance, it does not consider potential benefits of data collection if implemented ethically. My research will address this gap by advocating for a balanced approach, considering operational efficiency and

employee protection to ensure workplace data collection does not lead to similar inequalities.

In contrast some studies highlight ways to make monitoring more employee-centered and less invasive. DeTienne and Abbott (1993) argue that monitoring systems developed with employee input and allow for adaptability are more effective and less resisted by employees. Involving employees in the monitoring system's design and implementation helps organizations meet operational goals without hurting the well-being of employees. Similarly, Stanton and Barnes-Farrell (1996) demonstrate that employees who retain some control over monitoring systems experienced higher satisfaction and performance. However, too much employee control may decrease productivity or create a divide between employees and employers. Together, these studies suggest that monitoring systems that consider employees' perspectives and offer balanced control can create a healthier work environment, supporting both productivity and employee well-being.

The absence of standardized privacy regulations in the U.S. further complicates efforts to balance workplace monitoring with privacy rights. Jamison (2019) presents the data privacy law challenges in the United States. His research explores the need for a standardized federal law for privacy protection, given the complexity of privacy regulations that differ on the federal and state levels. Unlike the European Union's General Data Protection Regulation, the U.S. lacks a unified data privacy law, resulting in inconsistent privacy practices that allow companies to prioritize operational goals over ethical obligations. This regulatory gap permits companies to implement surveillance practices without guardrails, raising the risk of privacy violations. My research will emphasize that a

consistent regulatory framework would help establish clearer standards for data collection, protecting employees from intrusive practices.

Incorporating transparency and focusing on employee development within monitoring systems can help mitigate many negative effects of surveillance. Tomczak and coauthors (2018) argue that while employee performance monitoring (EPM) can enhance efficiency, it comes with risks that can be mitigated through proper implementation of monitoring, a point they support using evidence from various organizational studies. Their findings suggest that focusing on transparency and using data for employee development typically reduces the stress associated with monitoring, aligning with my goal of identifying monitoring methods that respect both productivity and privacy. This evidence-based perspective supports my ANT analysis by demonstrating how transparent and development-focused monitoring methods encourage positive relationships between employees and employers.

In addition to monitoring implementation methods, the types of monitoring tools impact employees' privacy. Trivedi and Patel (2021) analyze various remote monitoring technologies like time-tracking software, random screen captures, URL/app tracking, and facial recognition and their impact on employee productivity and sense of security. They argue that more invasive tools, like facial recognition, tend to create greater privacy concerns among employees compared to simpler methods like time-tracking. Selecting less intrusive tools can help maintain productivity and workplace trust without unnecessarily invading employee privacy. Using this perspective within my ANT framework, I will examine how various technologies influence the overall workplace surveillance network, impacting employee trust and performance.

This research will address the challenge of balancing operational efficiency with employee privacy in workplace surveillance. These sources will help me investigate the varied impacts of workplace surveillance through Actor-Network Theory (ANT), allowing me to explore the relationships between employees, employers, surveillance technologies, and regulatory frameworks. By examining different monitoring tools, limited privacy regulations, and transparent practices, I aim to identify ways these networks can be restructured to balance business goals with individual privacy.

Conclusion

In conclusion, my technical deliverable will be an optimized route system for UVA FM vehicles designed to reduce fuel consumption, emissions, and operational inefficiencies, contributing to UVA's 2030 carbon neutrality goal. My STS research will provide a deeper understanding of the ethical and social implications of workplace surveillance, with a focus on balancing data collection's operational benefits with the need to protect employee privacy. Using Actor-Network Theory, I will explore how companies can create more transparent and equitable surveillance practices, examining how tools, regulations, and implementation practices interact. Ultimately, my research aims to propose solutions that align business objectives with ethical considerations, helping to define clearer boundaries between innovation and privacy in today's data-driven workplace.

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