Autonomous Campus Vehicle

Jesus Take The Wheel: Exploring Public Perceptions and Attitudes Towards Autonomous Vehicles

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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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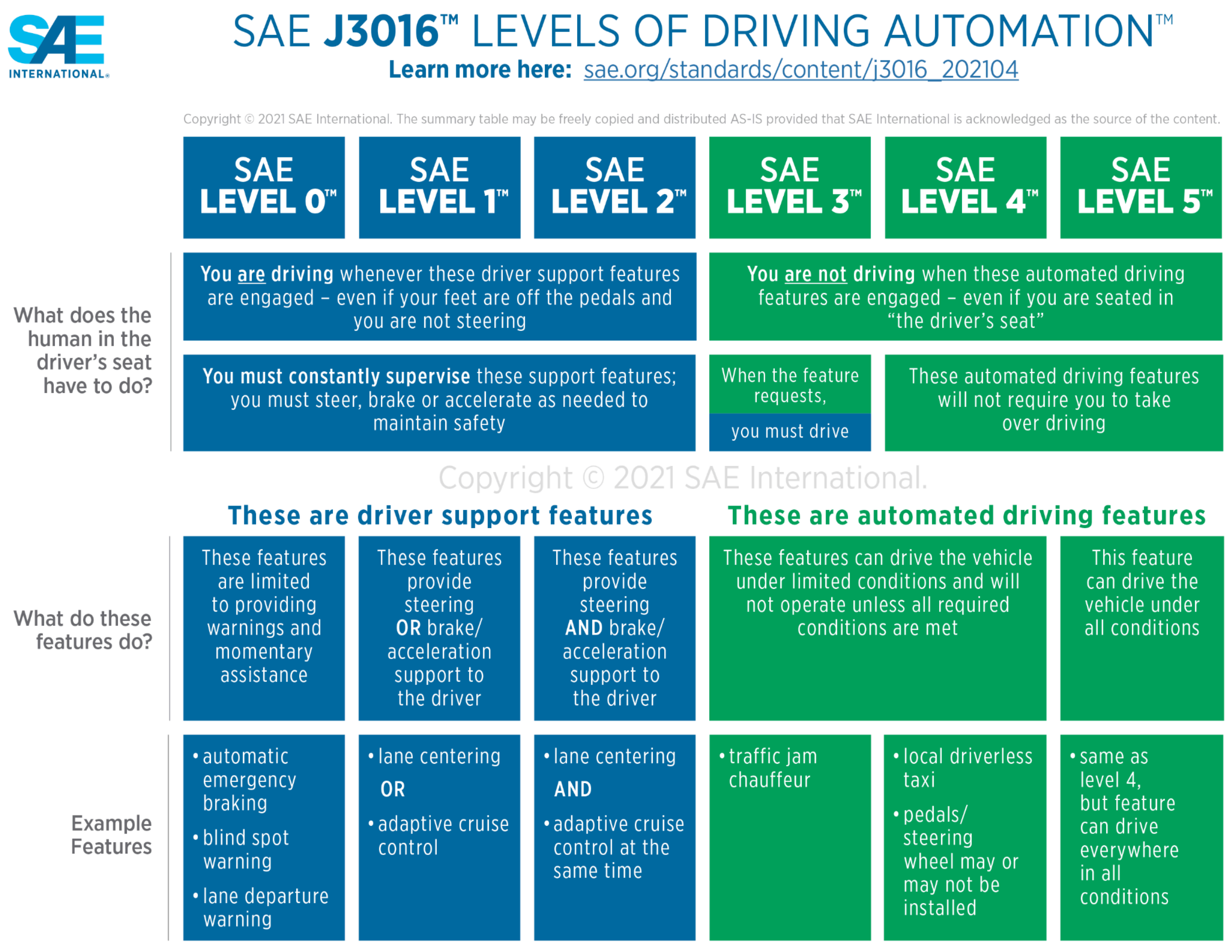
Introduction

Within the past two decades, autonomous vehicles (AVs) have quickly gained prominence with the potential to transform society. However, in light of its popularity, AVs have garnered major concerns regarding safety, job security, and its overall integration into society (Thomas et al., 2020). My research intends to address these concerns and understand the factors that contribute to such perceptions on AVs. The implications of AV technology on the elderly, disabled, and general public will also be further explored.

Autonomous vehicles first began its roots in 1925 when they were conceptualized by an electrical engineer, Francis Houdina, who presented his unmanned vehicle driven via radio control. Inevitably, as the vehicle made its way down Broadway in New York City navigating through corners and shifting in acceleration, the demonstration ended with it crashing into another vehicle (Engelking, 2019). Despite this marking an era for driverless vehicles, it wasn't until the 1980s when the first truly autonomous vehicle was integrated with a computer to successfully drive autonomously (Gil, 2021).

Today, AVs are classified into six levels, established by the Society of Automotive Engineers (SAE). Only at SAE Levels 3 and above are the vehicles driving on their own with automated driving features. SAE Level 2 and below vehicles utilize driver support features such as automatic emergency braking and adaptive cruise control (*SAE Levels of Driving Automation*, 2021). Notably, this classification exists within a dynamic regulatory environment resulting in legislation disparities for AV technology among many states in the United States (*Autonomous Vehicles: Self-Driving*, 2020).



SAE J3016™ LEVELS OF DRIVING AUTOMATION™

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	SAE LEVEL 0™	SAE LEVEL 1™	SAE LEVEL 2™	SAE LEVEL 3™	SAE LEVEL 4™	SAE LEVEL 5™
What does the human in the driver's seat have to do?	**You are driving** whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering			**You are not driving** when these automated driving features are engaged – even if you are seated in "the driver's seat"		
	You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety			When the feature requests, you must drive	These automated driving features will not require you to take over driving	
	These are driver support features			These are automated driving features		
What do these features do?	These features are limited to providing warnings and momentary assistance	These features provide steering **OR** brake/ acceleration support to the driver	These features provide steering **AND** brake/ acceleration support to the driver	These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met		This feature can drive the vehicle under all conditions
Example Features	• automatic emergency braking • blind spot warning • lane departure warning	• lane centering **OR** • adaptive cruise control	• lane centering **AND** • adaptive cruise control at the same time	• traffic jam chauffeur	• local driverless taxi • pedals/ steering wheel may or may not be installed	• same as level 4, but feature can drive everywhere in all conditions

Figure 1. SAE Level descriptions and classifications for driving automation.

My technical project will expand on previous years' work to create an SAE Level 3 to 4 platooning system using golf carts to transport University of Virginia (UVA) students from Engineer's Way to the Observatory Mountain Engineering Research Facility (OMERF). Platooning is a subset of AV technology which fundamentally is a follower-leader system. With the aid of a manually driven leader vehicle, a working platooning system would enable a vehicle or series of vehicles to follow the path of the leader vehicle autonomously. This area of research is most prominent in the truck industry who are aiming to increase fuel efficiency, reduce CO_2 emissions, and improve overall safety for its drivers traveling long distances (*Truck Platooning*, 2021). However, with the modification of this technology, a platooning system can be utilized to transport the elderly, disabled, and general public across UVA as an alternative to buses with fixed schedules and drop off spots or rentable scooters and bikes which do not encourage large group mobility.

For my research project, I will be bridging the gap between technology and society in understanding the response and attitudes towards AV technology. Specifically, SAE Level 4 and above vehicles which do not require human interaction on the road. Although this technology's use is not fully encouraged today, it is predicted that within the next two decades, fully autonomous vehicle technology will emerge as a consumer product (Litman, 2023). In anticipation of this, my research will hope to ensure that the technology's integration will align with current societal values and expectations in both the ethical and political dimensions. By accomplishing this, we will be a step closer towards greater innovation and increased integration of autonomous technologies throughout society within the lines of our own ethical and moral confines.

Technical Project

My technical project is centered around the development of a platooning system designed to enhance transportation services within the University of Virginia campus, specifically catering to the commute from OMERF to Engineer's Way. The project capitalizes on the utilization of golf carts, which present a promising opportunity for enabling safer, quicker, and more efficient travel within the campus. Since this project's platooning system depends on a manually driven golf cart to take the lead, the safety risks associated with driving in public are reduced and made simpler allowing the goal of campus-wide implementation to be more attainable. The problem that this technology project seeks to address is twofold. Firstly, the existing bus system within the university might not be as reliable or efficient for serving certain locations or routes within the campus. In particular, the route from OMERF to Engineer's Way could benefit significantly from an alternative transportation solution. By introducing a platooning system, this project aims to offer a more streamlined and effective mode of transportation that directly addresses the reliability issues faced by students and staff while navigating the campus.

Secondly, the project emphasizes inclusivity by recognizing that some members of the university community, such as individuals with disabilities or the elderly, may face additional challenges when using the existing transportation options. With the increased range of mobility of these golf carts, users are able to be dropped off at optimal locations without the extra distance. The project seeks to bridge this gap by providing a solution that is not only efficient but also accessible and accommodating to all user needs.

In practical terms, the project embraces platooning technology, allowing a group of more than two golf carts to travel in close proximity, resembling a train-like formation. This platooning system leverages efficient driving techniques and advanced safety measures to create a well-coordinated and safe transportation network within the campus. In addition to the platooning system being manually led, emergency stops or autonomous disengagements are put in place to prevent accidents. With the addition of sensors, the vehicles will have 360 vision at all times enhancing safety beyond what humans normally are able to perceive.

In essence, my technical project not only addresses the immediate transportation challenges faced within the UVA campus but also showcases the potential of advanced autonomous technologies in solving real-world problems. Since safety is of top priority, manual and autonomous disengagement procedures will also be integrated to align with ethical concerns and legal regulations (*Autonomous Vehicles: Self-Driving*, 2020). By utilizing safe and efficient platooning techniques, this technical project offers a practical, reliable, and accessible transportation solution that has the potential to impact the way individuals travel across campus.

STS Topic

The sociotechnical dimension of this research is deeply rooted in the investigation of how different groups perceive AVs and the complex interplay of factors that shape these perceptions. In an era marked by the rapid advancement of autonomous driving technology, it becomes crucial to understand the complex dynamics of trust, acceptance, and skepticism surrounding emerging AI technology and automation (Ajenaghughrure, 2020). At the core of this socio-technical exploration is a combination of fundamental research questions: How can individuals be made more accustomed to, or accepting of, AV technology? What are the determinant factors that influence a person’s perception of AVs?

These research questions hold profound significance due to its far-reaching implications, encompassing both the technical and sociotechnical aspects of AVs. The acceptance of AVs is not a matter of personal preference; it is a critical factor that influences the successful integration of this technology into our society. It touches on much more than just how individuals perceive AVs and delves into the influences and determinant factors that shape these perceptions. These influences can be social, cultural, psychological, and technological (Thomas, 2020). Therefore, understanding their dynamics is essential for addressing the broader question of how we can foster greater trust and acceptance of autonomous technology (Raats, 2020).

To navigate the complexities of this socio technical issue, a comprehensive methodology is adopted. This includes the utilization of case studies, a thorough analysis of existing regulations and policy measures, and the administration of surveys (Raats, 2020). Case studies serve as invaluable tools for delving into the real-world implications of AV technology, offering a window into how various groups interact with and perceive this transformative technology. Analyzing regulations and policies provides insights into the legal framework surrounding AVs, shedding light on the governance and oversight mechanisms in place and their impact on societal perceptions. Surveys, on the other hand, provide a direct means of gathering data on how individuals perceive and trust AVs.

Moreover, this research benefits from the integration of personal surveys, drawing on the experiences and feedback of those engaged with autonomous technology including personal experiences in its developmental process. These first-hand accounts offer an enriched perspective on the practical implications and challenges associated with AVs. It is important to acknowledge the contextual and cultural factors that may influence trust in autonomous technology (Thomas, 2020). The evidence will be thoroughly analyzed to identify patterns, correlations, and trends, offering deeper insights into the key factors of trust and acceptance in AV technology.

Through this sociotechnical analysis, this research aspires to make meaningful contributions to the ongoing discourse surrounding AVs. By promoting the responsible integration of autonomous technology into our society, the research seeks to pave the way for improved technology and seamless integration. This emphasizes that only through informed and accepted views of AVs can we harness their full potential and realize the future of transportation and mobility. The research highlights the interdisciplinary nature of addressing this challenge, focusing on the importance of both technical innovation and sociotechnical understanding in shaping the future of autonomous driving.

Conclusion

The societal perceptions surrounding autonomous vehicles are as diverse as the factors that influence them. While some embrace these revolutionary technologies, concerns and skepticism continue to persist. However, it must be recognized that these concerns, rather than hindering progress, can be catalysts for fostering a more informed and responsible integration of autonomous vehicles into our daily lives.

The technical project seeks to address the practical challenges of transportation within the University of Virginia campus by embracing platooning technology. This innovation not only enhances efficiency but also strives to create an inclusive and accessible transportation solution for all. Simultaneously, the sociotechnical aspect of it focuses on understanding the factors that shape perceptions of AVs and the measures required to instill greater trust in this transformative technology.

Upon the completion of this research, I anticipate contributing to the ongoing understanding of the challenges facing the adoption of autonomy and AI in our daily lives. By bridging the gap between societal perceptions and technological advancement, I aim to pave the way for a future where autonomous technologies are not only trusted but embraced. This would ultimately enable safer, more efficient, and more accessible future autonomous innovations for the greater good.

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