

Thesis Project Portfolio

Adaptive Trailer Hitch System

(Technical Report)

Exploring the Implications of Autonomous Vehicles on Urban Social Inequality

(STS Research Paper)

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Executive Summary

Vehicles and transport have a significant impact on everybody's daily lives in modern society, whether directly or indirectly. The technical research explores a method to increase the maneuverability and safety of lightweight truck-trailer systems. This is to ensure that the 50,000 accidents caused every year by trailer-sway related safety issues are mitigated while also making it easier to drive truck-trailer systems in reverse (Hayesbc, 2019). Conversely, the socio-technical research is regarding Autonomous Vehicles (AVs) and their impact on urban social inequality. With a significant portion of society and the economy related to transport, it is imperative that governments come up with regulations before AVs are mass deployed to ensure everyone can enjoy the benefits of AVs (Wallace, 2017). The technical research involves the use of embedded systems, circuit board design, and testing / debugging, relating to the major of computer engineering. Similarly, AVs are related to computer engineering due to the complex software, hardware, and integration requirements to bring them to reality.

Due to the physics inherent to truck-trailer systems, adding a trailer to a truck means that the effective wheelbase increases. This makes it difficult to maneuver the truck-trailer system. It also leaves the system susceptible to trailer sway, a phenomenon where improperly loaded and driven truck-trailer systems enter an unstable sinusoidal sway pattern that can end in deadly crashes (Hayesbc, 2019). Current systems that prevent trailer sway also suffer in the fact that they are permanent, which makes them less likely to be adapted and installed. To mitigate both, a fully detachable trailer maneuverability and safety mechanism was constructed.

As of the time of this writing, official data has not been gathered and analyzed. However, expected results have been laid out. It is expected that the trailer maneuverability and safety system will increase maneuverability of the trailer when reversing by at least 10%. This is

measured by observing the turning radius, with decreased turning radius associated with increase maneuverability. It is also expected that trailer sway will be mitigated by at least 10%, shown in simulation due to safety concerns of real-life testing. This is measured by observing the distance the trailer travels laterally from the goal path. This would show the prototype successfully increased maneuverability and safety of trailer hitched travel, making the road a safer place.

Major AV researched began in the 1980 with military interest, and it slowly began creeping its way into the private sector with government funded research grants and competitions (Stanchev & Geske, 2016). Transportation has a significant impact on modern society and economy. 1 out of every 9 jobs are in some way related to the transportation industry, including vehicle drivers, public transit workers, road and infrastructure construction workers, and vehicle manufacturers, so a significant shift in transport would mean a significant shift in society (Wallace, 2017). Although AVs promise to bring safety, equity, and increased productivity, the benefits might not be equally spread out, causing increased inequity (Wallace, 2017). With AVs coming within the next two decades, it is imperative for governments and regulators to act proactively rather than reactively to ensure an equitable future with AVs (Littman, 2023). This research uses Actor Network Theory (ANT) to examine how AVs will impact urban social inequality.

Without proper regulation and check systems, AVs will increase urban social inequality, and many of the benefits promised by AV manufacturers will not be realized. In the beginning, AVs will be an expensive technology that only the wealthy will be able to afford, leading to increased inequality. No regulation also means AVs will not have to cater to the elderly and disabled, again leading to increased inequality. Government regulation that pushes towards a shared model of ownership would serve to decrease urban social inequality by making sure all

socio-economic groups gain access to all benefits of AVs at the same time. It would provide the disabled and elderly the freedom of personal transport, allowing the entire spectrum of economic classes to utilize AVs (at a cost comparable to public transit with government subsidies).

Government regulation promoting a shared model of ownership is necessary to decrease urban social inequality.

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