

Undergraduate Thesis Prospectus

ASNE PEP2024 Unmanned Design Competition

(capstone project in mechanical engineering)

The Struggle Over Automated Driving in California's Cities

(sociotechnical research project)

by

Jona Zvazenewako

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capstone project collaborators:

Connor Lyons

Nathan Vu

Ryan Wood

William Renken

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.

Jona Zvazenewako

Technical advisor: Tomonari Furukawa, Department of Mechanical Engineering

STS advisor: Peter Norton, Department of Engineering and Society

General Research Problem

How can vehicular efficiency be improved? Technology in vehicles today is constantly developing to improve operation and safety. This technology is automation where certain functions are done by the machine for the human. In theory, operation done by automation is done with higher accuracy input, thus eliminating human error. However, we are not at the stage of full automation where the vehicle can operate independently in all conditions. The Society of Automotive Engineers (SAE) defines 6 levels of driving automation from 0 to 5, with 0 being no automation and 5 being full automation. The current stage of automation is at Level 4 of High Automation where a self-driving vehicle can operate under limited conditions but will not operate if they're not all met (SAE, 2021). Vehicles that fall under High Automation include driverless taxis.

Developing an Unmanned Electric-Propelled Vessel

What is the optimum feasible design for an unmanned electric-propelled vessel? The capstone project is to design and build an unmanned vessel powered by electric propulsion. Collaborating with William Renken, Conor Lyons, Ryan Wood, and Nathan Vu, the goal is to design a vessel that completes a racecourse in a time trial. Our vessel will compete in the Promoting Electric Propulsion organized by the American Society of Naval Engineers. The technical advisor for our project is Tomonari Furukawa in the Mechanical Engineering department. We elected to develop an unmanned vessel as successful operation of one would expand the range of possible tasks that would be otherwise difficult to complete with consideration of human accommodations and risk.

The Struggle Over Automated Driving in California's Cities

In the US, how are tech companies, automakers, insurers, advocacies, transit agencies, and policymakers competing to determine the proper place of automated driving technology, if any, in the future of urban mobility? Tech companies are pushing to develop the technology to where autonomous vehicles can join public roads. These efforts bring concerns in cities across the US of the consequences in safety and ethics should automated driving technology be used on a larger scale.

One of the fiercest battlegrounds for the position of automated driving on American roads is taking place in San Francisco. The city in recent years has seen a surge in autonomous vehicles on the streets which is set to continue as the California Public Utilities Commission (CPUC) in an August 2023 ruling approved permits for Waymo and Cruise to expand their respective driverless car operations during all hours of the day (CPUC, 2023). It was only in February 2022 when CPUC issued Drivered Deployment Permits allowing Waymo and Cruise to begin passenger services in autonomous vehicles with a safety driver present (CPUC, 2022). The latest resolution removed the requirement of a safety driver being present. Waymo and Cruise are the most prominent in San Francisco for testing automated-driving technology.

Waymo began in 2009 as the Google Self-Driving Car Project, tasked with the challenge of driving autonomously multiple routes in Toyota Prius vehicles. In 2015, it performed the first ever self-driving ride on public roads carrying a legally blind man. Since becoming an independent company from Alphabet, Waymo has worked on growing its rider programs which includes trials involving the public and the launch of its ride-hailing service, Waymo One. The company's stated mission is "to make it safe and easy for people and things to get where they're going." The company sees the work as data collection which it believes will further improve its automated driving technology (Waymo, 2023).

Cruise was founded in 2013 by Kyle Vogt in San Francisco, joined by Dan Kan a year later. In 2016, General Motors acquired Cruise for \$1 billion as part of its strategy to get self-driving cabs on the roads quickly (Ziegler, 2016). The move by GM brought technical and vehicular support to Cruise. Despite GM owning Cruise, Honda is a major investor pouring billions into developing an autonomous vehicle of its own, the Origin. These major investments enabled Cruise as a company to expand and sustain a fleet to where it can provide a rideshare network of its own (Cruise, 2023). The company has stated that it uses a portion of its fleet for its “Cruise for Good” program where it provides meal deliveries and free rides for the late-night service workers (Lenaghan, 2023). Cruise’s mission is divided into Safety, Sustainability with the renewable energy support, and inclusivity. It hopes through programs like “Cruise for Good” the local community will view AVs positively and welcome them as a viable form of transport.

Waymo and Cruise are members of the Autonomous Vehicle Industry Association (AVIA). AVIA members consist of automakers, rideshare services, tech, and delivery companies whose mission is to “advocate for the safe and timely deployment of autonomous driving technology” (AVIA, n.d.). The association operates at a state, national, and international level in creating frameworks on how policymakers should deploy and regulate AVs on public roads. AVIA has an active role in CPUC’s management of its AV programs shown when it addressed questions from a ruling on new data reporting requirements. The general counsel in a letter explained why data currently collected by the California Consumer Protection and Enforcement Division (CPED) concerning AV operations is sufficient, why data should not be submitted to the Commission more frequently than quarterly, and why the new data collection should not take into effect right away (Wolf, 2023). This is an example of how through an association multiple companies in a common industry can influence policymaker opinions and decisions.

The ramp up in robotaxi operations by Waymo and Cruise is concerning San Francisco city officials and advocacies. They feel the two companies are too eager in launching rideshare services when AVs have been involved in hundreds of crashes across California in the past five years and reports that test drivers often override the vehicles due to safety issues (Lu, 2023; Shaban et al., 2023). San Francisco police and firefighters have reported instances where AVs interfere with operations. One such instance was when a Waymo AV was inching closer to the scene of a fire, almost running over a water line. It's brought frustration prompting the fire chief to declare, "...it is not our job to babysit their vehicles" (Kerr, 2023).

An October 2nd incident involved a woman being trapped under a Cruise AV after being victim of a hit-and-run by another vehicle. In a blog for a review of the incident, the company explained that its AVs are "designed to perform a maneuver to minimize the safety risks to the extent possible within the driving context", saying that the incident will be incorporated into future simulation tests to help the vehicle better determine its next moves (Cruise, 2023). Since this incident, Cruise has been under multiple investigations conducted by U.S. regulators and the National Highway Traffic Safety Administration (NHTSA) over incidents that reveal risk to passengers and pedestrians. As of October 27, all Cruise driverless operations nationwide have been suspended after the California Department of Motor Vehicles revoked the company's deployment and testing permits, citing risk to public safety (AP, 2023).

Cruise and other companies counter concerns by claiming AVs are safer than human drivers because they are not subject to distraction or impairment (Shaban et al., 2023). In a safety review conducted by Cruise following the October 2nd incident, the company reported that it ran simulations of the scenario and claimed that if its AV was in place of the human-driven Nissan, the collision with the woman would've been avoided (Cruise, 2023). Companies often refer to

reports of tens of thousands of fatalities from traffic accidents annually and blame human error for many of them. Waymo has referred to a study conducted by Swiss Re that documented after 3.8 million miles of driverless travel in San Francisco and Phoenix, there were zero bodily injury claims and significant reduction in property damage claims, prompting them to conclude autonomous vehicles are significantly safer than human-driven ones (Waymo, n.d.). It's to note that Swiss Re, a reinsurance company, partnered with Waymo to do this study rather than conducting an independent study.

Safe Street Rebel, an activist group, has launched a campaign against robotaxis, dubbed "ConeSF", as part of its larger effort of eliminating 'car dominance' in cities for a shift in priority to public transport and spaces (Paul, 2023). The group feels that AVs will create a multitude of issues involving pedestrian safety, the environment, and police surveillance. They've made their displeasure known by disabling the AVs by placing traffic cones on the hoods and posting it across social media (Paul, 2023). Safe Street Rebel in a statement on its official website championed the news regarding the DMV order for Cruise to stop driverless operations, stating that it was "long overdue" and that "our shenanigans made this an international story and forced a spotlight on the many issues with AVs" (Safe Street Rebels, 2023). Ending the statement, the group still has its sights on Waymo emphasizing their job is not done and the cones will continue.

Whether it's through policymaking, protesting, or providing public service programs, each key player is competing to determine the place of automated driving technology that serves their interests, and that competition is intensifying with time.

References

- A. P., 2023, (2023, October 27). GM halts Cruise driverless robotaxi operations nationwide after losing its license in California. *Business Insider*. <https://www.businessinsider.com/gm-halts-cruise-driverless-robotaxi-operations-nationwide-2023-10>
- AVIA. (n.d). Autonomous Vehicle Industry Association (AVIA). About. <https://theavindustry.org/about>
- AVIA. (n.d). Autonomous Vehicle Industry Association (AVIA). Policy. <https://theavindustry.org/policy>
- Bigad Shaban, M. B. (2023, August 9). Driverless car companies seek expansion in SF despite worries Tech lacks safety guard rails. *NBC Bay Area*. <https://www.nbcbayarea.com/investigations/driverless-cars-san-francisco/3289955/#:~:text=Despite%20the%20city%27s%20legacy%20of,pedestrians%2C%20and%20other%20urban%20obstacles>
- CPUC (2023, August 10). California Public Utilities Commission. CPUC Approves Permits for Cruise and Waymo To Charge Fares for Passenger Service in San Francisco. <https://www.cpuc.ca.gov/news-and-updates/all-news/cpuc-approves-permits-for-cruise-and-waymo-to-charge-fares-for-passenger-service-in-sf-2023>
- CPUC (2022, February 28). California Public Utilities Commission. CPUC Issues First Autonomous Vehicle Drivered Deployment Permits. <https://www.cpuc.ca.gov/news-and-updates/all-news/cpuc-issues-first-autonomous-vehicle-drivered-deployment-permits>
- Cruise (2023, October 24). A detailed review of the recent SF hit-and-run incident. <https://getcruise.com/news/blog/2023/a-detailed-review-of-the-recent-sf-hit-and-run-incident/>
- Cruise (n.d.). Cruise Self Driving Car Company Mission. <https://getcruise.com/about/>
- Cruise (n.d.). History of Cruise. <https://getcruise.com/about/>
- Kerr, D. (2023, August 10). Why police and firefighters in San Francisco are complaining about driverless cars. *NPR*. <https://www.npr.org/2023/08/10/1193106866/why-police-and-firefighters-in-san-francisco-are-complaining-about-driverless-ca>
- Lenaghan, A. (2023, March 15). Cruise for Good: Providing free rides to late-night service workers (blog). *Cruise*. <https://getcruise.com/news/blog/2023/cruise-for-good-providing-free-rides-to-late-night-service-workers/>
- Lu, Y. (2023, August 9). San Francisco balks at expanding driverless car services on city's roads. *The New York Times*. <https://www.nytimes.com/2023/08/09/technology/san-francisco-driverless-cars.html>

- Paul, K. (2023, July 26). The rebel group stopping self-driving cars in San Francisco – one cone at a time. *The Guardian*. <https://www.theguardian.com/us-news/2023/jul/26/san-francisco-stop-self-driving-cars-traffic-cone-safe-street-rebel>
- SAE (2021). Society of Automotive Engineers. SAE J3016 Levels of Driving Automation. https://www.sae.org/binaries/content/assets/cm/content/blog/sae-j3016-visual-chart_5.3.21.pdf
- Safe Street Rebel. (2023, August 1). ConeSF: A Campaign to Rein In Robotaxis. <https://www.safestreetrebel.com/conesf/>
- Waymo (n.d.). Waymo Story. <https://waymo.com/about/>
- Waymo (2023, September 6). Waypoint - The official Waymo blog: Waymo’s autonomous vehicles are significantly safer than human-driven ones, says new research led by Swiss Re. Waypoint – The Official Waymo Blog. <https://waymo-blog.blogspot.com/2023/09/waymos-autonomous-vehicles-are.html>
- Wolf, A. S. (2023, June 15). Comments of the Autonomous Vehicle Industry Association on Assigned Commissioner’s Ruling on Development of New Data Reporting Requirements for Autonomous Vehicles. *Autonomous Vehicle Industry Association*. <https://theavindustry.org/resources/AVIA-Comments-on-New-Data-Reporting-Requirements.pdf>
- Ziegler, C. (2016, March 11). GM aims to speed up self-driving car development by buying Cruise Automation. *The Verge*. <https://www.theverge.com/2016/3/11/11195808/gm-cruise-automation-self-driving-acquisition>