Thesis Project Portfolio

Comparison of Connected Automated Vehicle to Pedestrian Interaction Systems to Reduce Vehicle Waiting Times

(Technical Report)

Social and Technical Efficacy of Interconnected Multimodal Transit: An Integrated Commute

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

Recent developments in semi and fully autonomous vehicle technology by companies such as Tesla, Uber, and Waymo have pointed towards a flurry of changes to the traditional commute. Fully autonomous vehicles will soon deeply inhabit global roadways and have the potential to make commutes much safer and more efficient by eliminating human error. My STS and Technical projects focus on how this new implementation will affect future transportation systems, with the STS project focusing on the big picture and the technical project examining a specific aspect of the new technology. The technical project seeks to understand how a traditional obstacle detection system – technology which forces an autonomous vehicle to stop at the time of a perceived "obstacle" such as another vehicle or pedestrian – would fare in a situation for which there are many pedestrians at a crosswalk not crossing a street, potentially causing traffic backup as the obstacle detection system may go into overload. My STS research project seeks to understand which social and technical forces must occur in order for transportation systems in large cities to become more interconnected and efficient, with a vast autonomous vehicle network being an integral part to the success of such systems.

Waymo, an American company focused on the development of autonomous vehicles for ridesharing purposes, has reported that in a 20 month period between 2019 and 2020 their vehicles registered 18 incidents with pedestrians. Although this is admittedly a small number, especially considering their vehicles traveled 67,000 miles in that period, it is enough of a factor to elicit concern from the general public. As autonomous vehicles are developed, how can those developing them be sure that the technical angle they take in their development is the correct one? For autonomous vehicles to work properly, they must perfect a key component of the technology – an obstacle detection system. Autonomous vehicles must be able to adequately

determine when to stop for pedestrians, obstacles, or other vehicles – however, at a busy intersection, with many pedestrians on the sidewalk, there may be gray areas for which pedestrians trip the sensors unnecessarily. How may this affect traffic? For a one way roadway with a single crosswalk, it may cause significant backup. Hence, the technical project focused on comparing a normal obstacle detection system at an unsignalized crossing to a system for which pedestrians "notified" the vehicle that they needed to cross, allowing the vehicle to not solely rely on their obstacle detection mechanisms. In reality, the ideal system most likely compares both obstacle detection and pedestrian-vehicle communication elements.

Once connected and automated vehicle (CAV) technology is developed to the point of efficiency between such vehicles, pedestrians, and the surrounding environment, it will allow for vastly more efficient transportation systems. CAVs will, however, need to connect to other elements of a city's transportation system in order to make the system work fluently. In my STS research paper, I investigate the social and technical elements which may push society to work to implement fully interconnected multimodal transit systems. I suggest that, due to the continuous growth of large global cities, and the pollution concerns which will follow such growth, fully efficient and interconnected transportation systems will become a key tenet of future city development. I examine the interplay between governments, scientists, constituents, and private industry in the inception of these new technologies, and the conflicts which may arise as they work together. My research largely concluded that society is moving towards these developments already, and each actor will have to make significant compromises to allow for these new developments.

Through my work on the technical paper and STS research paper, I have shown that although CAV and other autonomous technology presents the possibility for significant benefit to city transportation systems, however is a fledgling technology which requires patience and careful, thoughtful development. The STS research paper illustrates how government red-tape and stakeholder interests may inhibit the development of fully connected transportation systems despite the societal need, while my technical project implies that the integration of autonomous vehicles to roadways worldwide will require development of special infrastructure to allow for communication between the vehicles, pedestrians, and surrounding environment. Conducting these projects showed me that although this new technology is exciting and has plenty of potential, there are many issues – both small and large scale – to be ironed out before it becomes a significant factor in global transportation systems.