Thesis Project Portfolio

Fast, Safe, and Proactive Runtime Planning and Control of Autonomous Ground Vehicles in Changing Environments

(Technical Report)

Autonomous Vehicles and Accessibility: A case study of the benefits and challenges posed by autonomous vehicles to people with disabilities

(STS Research Paper)

An Undergraduate Thesis

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Bachelor of Science, School of Engineering

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Sociotechnical Synthesis

Like any new technology, the rise of autonomous vehicles brings many new opportunities. Unmanned ground vehicles (UGVs) can explore areas that are either inaccessible or too dangerous for humans, and human-transporting autonomous vehicles bring possibilities of increased safety, more accessibility, less pollution, and more. My technical and STS research focus on furthering research in both of these areas, so that potential benefits of autonomous vehicles can be fully reaped.

My technical research aimed to safely but efficiently control a UGV through diverse environments. We wanted to ensure our approach would allow UGVs to traverse terrains with obstacles, sharp turns, ramps, and different levels of surface friction. We began to solve this problem by implementing a simple algorithm that would get a UGV from its starting location to a goal at a constant speed. Once the UGV could successfully get to its goal, we began training a neural network that would output the fastest speed the robot can safely travel given certain environmental conditions. We created and trained more neural networks to both identify ramps along a path and find the optimal speed to traverse them. After all components of our approach were complete, we created a case study environment which included various turns, ramps, and surface frictions to test our control system. Using our neural-network based approach, the UGV was able to traverse the complex environment and successfully reach the goal.

While my technical research aimed to implement an approach for an autonomous vehicle to safely and efficiently get to a goal, my STS research investigated the impacts of autonomous vehicles on the disabled community. Autonomous vehicles have the ability to improve transportation access for many groups, especially people with disabilities. I researched different ways autonomous vehicles may become integrated into society, and how each of these

trajectories could both benefit and challenge people with disabilities. Furthermore, I analyzed studies that survey people with disabilities and their concerns about autonomous vehicles. I also explored possible accessibility challenges that different autonomous vehicle designs could bring to different groups within the disabled community. Ultimately, I found that autonomous vehicle stakeholders must understand that the disabled community has an incredibly diverse set of needs and preferences, and these should be incorporated into autonomous vehicle design, integration, and regulation in order to maximize transportation accessibility.

My research team was able to create a successful approach that maneuvers a UGV to a goal in a complex environment. The next step in furthering our work would be expanding the approach to include unknown environments. As for my STS research, I was happy with the sources I found, but I wish there was more research studying the interaction of people with disabilities and autonomous vehicles. The lack of research, along with uncertainties of autonomous vehicle futures, made it difficult to make specific recommendations to improve accessibility. However, I hope that my analysis helps further the important discussion involving how autonomous vehicles can improve accessibility for groups marginalized by the current transportation industry.