

**OPTIMIZATION OF VDOT SAFETY SERVICE PATROLS TO IMPROVE VDOT
RESPONSE TO INCIDENTS**

(Technical Report)

PRIVACY CONCERNS IN THE WORLD OF AUTONOMOUS VEHICLES

(STS Research Paper)

An Undergraduate Thesis Portfolio
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Sociotechnical Synthesis

With millions of vehicles on the road each day, traffic delays and interstate congestion result in loss of productivity and millions of dollars each year. A majority of these traffic delays are caused by traffic incidents including crashes and disabled vehicles. These incidents are safety hazards and can lead to secondary crashes. Rapid clearance of these events and scene management during an incident can significantly reduce the impact of congestion. To combat hazardous conditions and decrease congestion related delays, the Virginia Department of Transportation (VDOT) has a fleet of Safety Service Patrols (SSP) that monitor highway conditions and assist emergency responders in scene clearance and traffic management. Managers of the SSP program seek to schedule patrollers in a manner that optimizes their influence on safety and congestion. The technical project proposes a Genetic Algorithm based route scheduling algorithm that assigns SSP routes with the goal of minimizing the total time vehicles are stranded before an SSP vehicle arrives. The algorithm will adapt to different incident rates and response times to produce schedules that vary by time-of-day and day-of-week. The results indicate that a new route schedule could lead to a reduction in total time waiting for VDOT assistance, helping VDOT maintain safety, increase impact, and *Keep Virginia Moving*.

One of the most exciting innovations today is the promise of autonomous vehicles. The automotive industries working with this future technology propose that the autonomous vehicles (AVs) will achieve the remarkable by transporting passengers to their destinations with minimal human intervention while at the same time offering an abundance of benefits including improved

safety, shorter commutes, less stress, fewer environmental impacts, and freedom for immobile persons. These benefits, however, can only be realized if the algorithms that navigate the autonomous vehicles are fed vast amounts of data via GPS, voice-recognition, cameras, and other sensors. In light of the numerous recent data breaches there is growing public concern regarding data privacy. The AV's sonar, radar, cameras, and wireless communication necessary for a safe and efficient ride will potentially put consumers at risk for personal data loss, surveillance, and manipulation using profiled advertising, as the vehicle itself would be a repository of personal information susceptible to hacking, burglary, and misuse. This technology will have a potentially positive impact for many people however it is important that the consumer's privacy rights be maintained. The user's personal data and autonomy will need to be safeguarded with regulations establishing what data will be collected and how it will be used. The advances of autonomous vehicles can be understood with Thomas Hughes' framework of technological momentum. Automobile transportation in the United States has been sustained for over a century, attaining technological momentum by possessing direction, goals, and experiencing a rate of growth suggesting velocity. The methods for analysis include technical exploration and prior legislative policy research. The communication, data transmission, and storage technology of the autonomous vehicle are explored to understand the components associated with privacy issues and potential mitigations in three areas: personal information, personal autonomy, and surveillance. Current and past legislative actions, hearings and testimony is collected in order to elucidate discourse from federal, state, municipal, and auto industry participants on security and privacy topics. Research results identify privacy exposures within the AV technology and determine an understanding of current legislative actions in the field. Investigation of current vulnerabilities associated with autonomous vehicle privacy, security, and

personal autonomy will aid in the identification of potential mitigations for user's privacy protection. This topic is important because without clear privacy protections in place, autonomous vehicles may encounter public resistance from users who perceive them as a privacy threat. Additionally, issues that are identified up front during the design phase can be solutioned more successfully and with less effort while the technology is still in development.