Thesis Project Portfolio

Brake Dynamometer Development: Unveiling Precision and Performance
(Technical Report)

Navigating the Road Ahead: Ethical Considerations in Autonomous Vehicle Development

(STS Research Paper)

An Undergraduate Thesis

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Socio-technical Synthesis: Navigating Autonomous Vehicles and Braking Enhancement

Although seemingly unrelated, the development of automated driving systems (ADS) and advanced braking dynamometers correlate based on vehicle safety. Both my research and technical design projects explore their specific subjects while intersecting the need for meticulous safety systems. Mechanical engineering, more specifically the mechanical components of vehicle engineering, is paramount to ensuring the safety of individuals as millions of individuals lose their lives to global road incidents. Where these two investigations differ is in the repercussions of malfeasance. The Arizona self-driving Uber crash explores the culpability of the stakeholders and the outcome of their actions in facilitating the death of Elaine Herzberg. Conversely, the brake dynamometer is a solution to mitigate motor vehicle incidents such as Ubers. Despite the technical differences, both seek to mitigate and provide perspective on the overall impact of vehicle death from a particular lens.

My technical design required the construction of a specialized brake dynamometer to enhance the performance of vehicle braking systems and reduce risk. The capstone team analyzed the components of existing braking systems and manufactured a reliable testing alternative. With this design in mind, the dynamometer was developed to test braking systems to provide rapid deceleration and endurance under extreme temperatures and stresses often encountered in racing scenarios. A combination of calculations and vehicle parameters, including the durability of components, were considered to emphasize safety protocols. The device possesses several safety features and redundancies to eliminate potential failure modes in parts not limited to the hydraulic circuits and brake pedals. This ensures the user's safety when operating the dynamometer and creates reliability when utilized on the braking subsystem. The

applications of this device are myriad, and this project produced a well-engineered solution to improving braking performance and safety.

The science, technology, and society (STS) investigation sought to understand the morality of the self-driving Uber vehicle crash in Tempe, Arizona, which was influenced by a lack of vehicle and stakeholder safety. Upon reflecting on the incident, the analysis considered the implications of autonomous vehicles in society through the lens of utilitarian ethics. It also examined how the organizations involved and technology failed to act in accordance with engineering ethical principles. The facts involved in the case study, as well as the behavior of individuals and organizations, yielded the argument that the stakeholders were morally liable for the death of Elaine Herzberg. Their violation of utilitarian ethical principles and safety protocol was scrutinized and functions as a precedent for vehicle engineering safety.

The design and analysis of autonomous vehicles and braking systems enabled me to expand my knowledge and understanding of mechanical engineering and safety. The STS research paper helped me better comprehend engineering ethics, specifically utilitarianism, and provided insight into the safety necessary for vehicle design. The brake dynamometer allowed me to design, manufacture, and test effective solutions to mitigate automobile failures. Ultimately, through hands-on experience with braking systems and theoretical exploration of engineering ethics, I have gained a multifaceted understanding of the importance of safety in design. Armed with this knowledge and experience, I am confident I can contribute to developing safer industry practices.