Thesis Project Portfolio

Brake Dynamometer Development: Unveiling Precision and Performance

(Technical Report)

Ethical Considerations of Free Open-Source Software

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

This thesis explores engineering innovation through a dual focus: developing a brake dynamometer for Formula SAE vehicles and analyzing the ethical considerations of Free and Open-Source Software (FOSS). It emphasizes the integration of technical expertise with ethical deliberation, underscoring the importance in today's technology-driven landscape. This preface outlines the projects' individual contributions and their interconnections, setting the stage for a discussion on aligning technological advancements with ethical standards. Through this exploration, the thesis aims to demonstrate how engineering can effectively balance innovation and responsibility, contributing positively to society.

Abstract of the Technical Project: Brake Dynamometer Development

This project focuses on the design and implementation of a brake dynamometer tailored for Formula SAE competition vehicles, specifically engineered to enhance the performance analysis of braking systems under simulated race conditions. The brake dynamometer allows for precise measurement of braking torque, force, and temperature dynamics, enabling the evaluation of different brake materials and configurations under controlled conditions. Its development involved rigorous mechanical engineering principles, including material selection, mechanical testing, and system integration, driven by the necessity for robust, reliable, and repeatable performance metrics. The dynamometer serves not only as a critical tool for optimizing vehicle safety and efficiency but also as a platform for empirical research in automotive engineering. By simulating real-world conditions, the brake dynamometer provides valuable data that informs improvements in vehicle design and contributes to the broader understanding of dynamic vehicle behavior in high-stress environments. This technical endeavor

highlights the application of advanced engineering techniques to solve complex problems in a competitive and innovative context.

Abstract of the STS Paper: Ethical Consideration of Free and Open-Source Software

This sociotechnical study delves into the ethical considerations surrounding Free and Open-Source Software (FOSS), emphasizing how major technology firms engage with open-source communities. The paper explores the transformative role of FOSS in shaping global technological infrastructures and the ethical challenges that arise from its commercial exploitation. Through an analysis of historical evolution, current practices, and a detailed case study of Indeed's FOSS Contributor Fund, this investigation addresses the balance between corporate benefit and community contribution. It critically examines the implications of FOSS for sustainable development, equity in technology access, and corporate responsibilities in maintaining and enhancing communal software assets. This analysis highlights the need for ethical practices that extend beyond legal compliance to foster genuine collaboration and innovation in the open-source ecosystem, proposing pathways towards more equitable technology development.

Thematic Link Between the Projects

The thematic bridge linking the brake dynamometer development and the ethical analysis of Free and Open Source Software (FOSS) is underscored by a shared emphasis on innovation, ethics, and community collaboration. The brake dynamometer project, fundamentally technical, heavily utilized Arduino—an open-source hardware platform—for control processes, and SciPy, a Python-based open-source scientific toolkit, for data analysis. These tools epitomize the open-

source philosophy, aligning closely with the principles explored in the FOSS paper. This connection not only enhances the project's technical robustness but also integrates the ethical dimensions of transparency, accessibility, and community-driven development. The analysis of FOSS further explores how these principles can guide corporate behavior towards more sustainable and equitable tech practices. Collectively, these projects illustrate the profound impact of ethical considerations in shaping engineering solutions and technology policies, fostering a synergy that drives forward both technological and societal advancements.