Thesis Project Portfolio

FSAE Data Acquisition Corner Board

(Technical Report)

Designing a High-Low Tech System using Enthusiast Automobiles

(STS Research Report)

An Undergraduate Thesis

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Executive Summary

Technology is critical in high performance motorsports, enhancing both vehicle capabilities and driver performance. However, technological integration in a vehicle must be done thoughtfully to preserve the connection between the driver and the car. Skill automating technologies like traction control and antilock brakes increase the safety and performance of vehicles but can reduce the driver's ability to feel feedback from the machine if overused. On the other hand, data driven tools can be used to enrich the driving experience by helping drivers and engineers better understand vehicle dynamics, identifying grip limits and optimizing suspension for example.

The technical portion of my research project was developing a data processing computer for Virginia Motorsports' 2025 electric FSAE car (VM25E), which will compete in the annual FSAE Electric competition in Michigan. The goal of the project was to provide hardware for the data acquisition team to build data-driven tools needed to optimize driver feel and suspension parameters of the car. My team designed and implemented a system based on an ARM Cortex M7 MCU using the Teensy 4.1 microcontroller as a foundation. The board process data from the analog and digital sensors contained in each wheel assembly and transmits the data to the central computer using the CAN bus communication protocol. An initial version of the project was tested successfully with minor revisions planned for the final version to go in the car. Future iterations of the project will include real-time clock (RTC) hardware integration for data synchronization, hardened power supplies for improved reliability, and automatic data rate adjustments based on packet drop rate.

The STS portion of my research project proposes a new sociotechnical framework for technological design which I call the "high-low tech" system. The design philosophy seeks to

balance advanced technology with meaningful human interaction using enthusiast automobiles as a case study to define its principles. Historical analysis of automobile technological development revealed that driver deskilling began long before the introduction of electronics, and that the "sporting crowd" of automotive enthusiasts have been against changes to make driving easier since the end of the 19th century. This shows that the enthusiast driver, despite complaining, still adapts with technology as vehicles change. Next, the enthusiast drivers themselves were characterized, finding that cars of the 1960s to 1990s were desired for the experience driving them, the perceived quality, and machine character rather than the mere absence of technology.

The principles of the "high low tech" system were defined by following the rules of sociotechnical design: allowing flexibility and interpretation, adapting to its intended audience, considering information flow, and focusing on human values. To keep the system as flexible as possible, three principals were defined, the mutuality principle, the experience principle, and the comprehensibility principle.

- Mutuality Principle: Technology should work in tandem with the user, neither fully automated nor entirely manual.
- Experience Principle: Interaction with a system should be memorable and mentally engaging.
- Comprehensibility Principle: Technology should be transparent and help users understand it.

In conclusion, high-low tech design may not suit all users or systems—it currently fits best within fringe communities like automotive enthusiasts who value experience over efficiency. However, the framework still raises questions about how technology should be incorporated to best elevate people and machines together. What would a high-low tech

slideshow editor, cell phone, or washing machine feel like to use? At what point does technology transcend its role as an appliance and become something more like an extension of the self, like an automobile? Even if the approach only appeals to a niche audience, providing meaningful, engaging technological experiences is a worthwhile design goal. At its core, the high-low tech design philosophy simply asks if modern technology has become “cheaper” and “soulless” in ways that go beyond simple nostalgia.