Thesis Portfolio

Self-Balancing Remote Control Toy Bike
(Technical Project)
Ethics and Manipulation in Digital Interfaces
(STS Research Paper)

An Undergraduate Thesis Presented to

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Ky Nguyen
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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

Advisors
Travis Elliot, Department of Engineering and Society
William Stafford, Department of Engineering and Society
Adam Barnes, Department of Electrical and Computer Engineering

Technical Project Teammates
Pranav Ramkumar
Dylan Pierre Lewis
Josiah Suwargo
Lance Tecson

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This thesis explores the engineering and ethics behind technologies that require data collection and user interfaces. The technical project focuses on a remote control toy bike that includes modular components allowing children to experiment and learn fundamental physics concepts such as balance and dynamics. Similarly, the accompanying STS research paper addresses the ethical dilemmas faced by user interfaces designers in creating digital interfaces that inherently influence user decisions. The paper researches the prevalent tactics like 'dark patterns' and aggressive data collection utilized by every tech giant, which manipulates its user base. This synthesis of the technical project and the STS paper provides an outlook on how technology can be designed with a strong moral compass to enhance educational outcomes while safeguarding user privacy and autonomy.

Abstract of the Technical Project

This technical project details the development of a self-balancing remote control toy bike, designed to engage young learners in the fundamentals of physics through hands-on interaction. The bike includes a small playground set, where children can conduct experiments and play with modular components such as the reaction wheel, wheels, and steering column. This modularity allows children to actively engage in learning by adjusting and reconfiguring the bike to understand the principles of balance and dynamics. Central to the bike's functionality is a system comprising sensors, motors, and a STM32 microcontroller, which collaboratively processes environmental and operational data to maintain stability and maneuverability. The bike is equipped with a reaction wheel mechanism inspired by spacecraft technology, adapted here to control balance through dynamic adjustments in angular momentum. Additionally, an intuitive

mobile application allows users to control the bike, providing a user-friendly interface that enhances the learning experience.

Abstract of the STS Research Paper

The accompanying STS paper researches the ethical challenges inherent in UI/UX design for digital interfaces, particularly the fine line between user engagement and manipulative practices. As digital interfaces become increasingly prevalent, major companies often incorporate psychological manipulations, particularly targeting less technologically literate populations like the elderly, to outpace competition. This research critiques such tactics, highlighting "dark patterns" that trick users into unintended decisions and aggressive data collection strategies through cookies that compromise privacy. Through an in-depth analysis of case studies from tech giants such as Facebook, Amazon, and Google, and examining the psychological impacts of UI/UX decisions, this paper discusses how these unethical designs are influenced by a complex interplay of factors. Applying Actor-Network Theory, it explores the roles of various human and non-human stakeholders that shape these harmful design decisions. The paper proposes a robust set of ethical guidelines aimed at protecting young and vulnerable users, emphasizing transparency, informed consent, and the reduction of manipulative features. These guidelines advocate for a UI/UX design philosophy that prioritizes user well-being and privacy over commercial interests, challenging the prevailing norms within the industry.

The connection between the technical and STS components of this thesis is evident through my role in both developing the data collection system and designing the UI/UX for the

toy bike's control application. This synthesis ensures that the bike not only functions efficiently but also adheres to strict ethical standards in data handling and user interaction. The project addresses specific challenges in ensuring that the bike's system is secure from vulnerabilities that could compromise user privacy. Additionally, it emphasizes the necessity of ethical UI/UX design to prevent manipulative practices that could exploit young users, focusing on creating a safe and positive user experience. The overarching aim of this thesis is to model an approach to engineering design that integrates technology with ethical integrity. Through the development of the self-balancing bike and a critical examination of unethical practices in digital interface design, this thesis demonstrates that it is indeed possible, and best for society, to combine cutting edge technologies with strong ethical standards, resulting in products that are not only effective but also ethically sound. By ensuring user autonomy and privacy, and aligning technological advancements with the highest standards of ethics, this work serves as an inspiration for creating user centered technology that works well as well as respects user rights.