Thesis Project Portfolio

UVA Pinball Machine 2.0

(Technical Report)

Towards Ethical Software Development: Safeguarding Users in the Mobile Age

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Executive Summary

This summary serves as an introduction to my senior technical thesis and sts research paper. The two are unrelated in their research goals but both served as a look into modern technology; one being an application of modern mechatronics to a once mechanical game, and the other being an insight into current trends within the modern tech industry. The technical project was completed in the fall of 2023 and involved designing and constructing a UVA themed pinball machine with the goal of installing it in 1515 on the corner. This machine was designed to attract students to 15 15 to study and congregate, promoting academics and social connections. The project itself involved an intensive experience of mechanical design and a survey of basic manufacturing techniques that I hope to apply in my career. My sts paper involved research into trends in the current tech industry surrounding mobile technology and software development, specifically social media applications. It examined some of the causes and afflictions of mobile addiction as well as initiatives from other companies to provide technological solutions. Further, the paper found the need for an updated ethical framework to guide software application developers with an emphasis on user safety and user behavior, concepts that the industry has seemingly lost sight of in their pursuit of user engagement. These projects have provided me with experiences in the different directions in which modern technology can be applied and demonstrated the importance of fully considering the implications of an engineer's work.

The senior technical thesis and pinball machine project involved coordinating within a team of 13 to make the project come together. We divided up the project and responsibilities amongst the team weekly, but were sure to not force people to stick on one particular aspect the whole semester. Personally I worked with one other individual on the main feature of the game

so I was on this most of the semester. My and my partner's task was to design a controllable drop target assembly that allowed us to raise and lower the drop targets on command allowing for a customizable modernized improvement on traditional pinball games. This was the heart of our game as the player had to score on the drop targets to advance through the different progressions of our game. By the end of the semester my partner and I had gone through three major design iterations that culminated in a seamlessly functioning drop target assembly that met considerations such as weight, manufacturability, controllability, and functionality. We both gained experience in riveting, machining, water jetting, and full solidworks modeling. Ultimately this project peaked my interest in manufacturing and engineering design which I feel could be a viable career path.

The sts research paper aimed to determine the extent to which deceptive tactics have become entrenched in software development and the extent to which mobile affiliations have rooted themselves in society. The paper started by defining specific aspects of the problem as well as current guidelines that developers follow. This included an overview of features in social media apps such as infinite scrolling, variable rewards, and the illusion of choice, all which inherently deceive the user to increase engagement. These issues are exacerbated by the fact that modern platforms such as the app store and google play stores fail to emphasize the importance of user safety. What once may have been unintended consequences of mobile technology, are now ignored consequences that continue to agitate and divide society. In the results, the paper defines key guidelines an updated framework for mobile application development should hold paramount, as well as current technological initiatives aimed at helping individuals self regulate. The research I conducted gave me insight into the daily affects mobile technology has on the

individual as well as an understanding of how technology, without proper consideration, can take such a wrong turn.

I am proud of the work I accomplished in these projects and think both are valuable to keep in mind in my future. In the technical project in the fall I was able to exercise the engineering skills I had been practicing for the first three years of my undergraduate and was pleased with the results. I felt it rewarding to undertake a difficult task that initially didn't have a direction or plan, just constraints. I would be curious to see how the engineers in pinball manufactures like jersey jacks would critique the drop target assembly we came up with because it was unique, functional, and hadn't been done before. In terms of the overall project we did not complete and install the pinball machine but I feel that it wasn't due to a lack of our team's effort but more so that we undertook too much. I also feel that my sts research paper discusses a valuable and relevant topic that I think more need to become aware of. I feel like there is certainly more research to be done and am curious to see how some of the trends I discussed will play out in the coming years. I am pleased with my work on both projects and hope they can both be furthered by the coming classes of UVA students.