

Thesis Portfolio

Design and Construction of a Ferrofluid Kinetic Art Clock

(Technical Report)

Waste Food Management Actions in Smart Cities around the Globe

(STS Research Paper)

An Undergraduate Thesis

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

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science in Mechanical Engineering

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Sociotechnical Thesis

Engineering always has more to expect than mere formulas and computations. The versatile usage of engineering tools can not only enrich our daily life through small inventions but also help resolve severe problems that disturb a considerable group of people. My theses aim to present the potential of engineering from different facets. The technical part reports a combination of physics and art, the product of which stands as a decoration for the engineering school as well as a stimulation for future students to explore the possibility of Mechanical Engineering. The STS research part uses systematic analysis to learn smart city methods worldwide in food management and to explore the solution to the food insecurity in Charlottesville. These two theses both present the value of engineering, one from a practical aspect while another from a more macroscopic aspect.

The technical thesis focuses on the construction of a novel kinetic art --- magnet clock. Kinetic art is any form of art that moves, often lending itself to having a helpful function through this motion. The core idea of this project was to create a piece of kinetic art that also functioned as a digital clock through the deployment of magnets to cause ball bearings to display the time. The clock should have the same functions as any other digital clock, such as the ability to have the time reset in case of Daylight Savings Time or a power loss. The constraint of keeping the clock reasonably quiet was artificially applied so that the clock could be displayed on the second floor of the Mechanical and Aerospace Engineering building. The clock should be able to be powered by a standard 120V AC wall outlet. The aesthetic concept was decided to be that the magnets would attract the bearings through a thin front face, obscured from the sight of the viewer. This will create the illusion that the bearings are being held “by magic.” Additionally, as

much of the mechanism not involved in the actuation of the magnets should be visible to add visual interest to the piece.

The STS thesis tries to seek a solution to balancing the food surplus and food shortage in the city of Charlottesville. Based on the statistics by the US Census Bureau, 11.8 percent of people are living below the poverty line in the United States, while lack of nutritious food contributes significantly to poverty; however, roughly one-third of the food produced every year is wasted. Previous attempts to enhance food-management efficiency in other countries have proved the usefulness of smart city tools, especially ICT (Information, Communication, and Technology) in collecting wasted food and sending it to people in need. By gathering the information of an area as comprehensive as possible, those attempts have successfully connected parties of interest and monitored the redistribution of leftover food from one place to another. Moreover, it is suggested that an amalgamated organization tends to be more effective than separate groups due to shared resources and wider coverage. The lessons from other countries lead to a preliminary concept of developing a food distribution platform in Charlottesville. At the same time of evaluating the pros and cons of international experiences, the local circumstances of CVill are also taken into consideration. By bridging government, local community, and food donors, this platform has the potential to alleviate the food insecurity to a certain extent.

The work on both projects has greatly challenged me and at the same time, taught me the importance of persistence, strictness, appreciation of group work, etc. Moreover, the achievements in both projects assure me of my capability and responsibility as an engineer to elevate social well-being.