Thesis Project Portfolio

Thermo-Stasis: A User-Controlled, Temperature-Regulated Compartment

(Technical Report)

Technological Evolution and Food Safety Practices

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

According to the World Health Organization, foodborne illnesses cause over 420,000 deaths, in which 30% of them occur among children under 5 years old every year. This issue has been prevalent in our everyday lives since not only does it affect us physically, it also affects us financially and emotionally as well. This portfolio will focus on the intersection between technology and food safety via the technical project as well as the science, technology, and society (STS) project. The technical portion of this project, “Thermo-Stasis”, focuses on the development of a battery-powered box that serves to regulate the temperature inside the box to any temperature specified by the user. “Thermo-Stasis” allows users to increase or decrease the temperature by interacting with buttons, as well as view the actual temperature in the chamber and the desired set temperature via a Liquid Crystal Display (LCD) screen. The purpose behind the technical project is to alleviate the ongoing issues of improper food storage by providing a portable device in which the user can store items at a stable desired temperature for a prolonged period. It also allows the user the flexibility to use it for a variety of applications by providing both heating and cooling options. The STS project focuses on answering the following questions: how new technologies assist with better food safety practices, and how the need for better food safety practices affect the motivation for technological advancement. These two projects are connected with one another since they both are related to the intersection between technology and food safety. “Thermo-Stasis” is a portable, temperature-regulated compartment that is capable of heating and cooling objects. The user can choose to increase or decrease the temperature by interacting with buttons, as well as view the actual temperature in the chamber and the desired set temperature via a Liquid Crystal Display (LCD) screen. The buttons will increment or decrement the temperature in Fahrenheit by 10 degrees per press. The MSP430

microcontroller communicates the user's input from the buttons to the Peltier-based heating and cooling element, based on the result of the fuzzy control algorithm. The LCD screen and buttons will be coordinated with the Peltier based heating/cooling element via a MSP430 microcontroller. The device has three temperature sensors to keep track of the current temperature inside the compartment and the temperatures of the two heat sinks, which are internal and external. From there, the Peltier modules will generate electrical heating or cooling based on the user's input and the current temperature in the compartment. The heat/cold generated by the Peltier device will be distributed through air circulation with a fan, and the excess heat will be pulled from the Peltier device by a heat sink. The cooling/heating device will run off a battery for portability, with an option for plugged in charging to both recharge the battery and run the device. The STS research paper for this portfolio focuses on the relationship between technology and food safety, and explores how new technologies assist with better food safety practices, and how the need for better food safety practices affect the motivation for technological advancement. To answer these questions, the paper will investigate the causes of foodborne illnesses, settings in which they occur, relevant social groups affected, what tools are developed for this purpose, and whether or not technological tools are sought out by those social groups. The number of people affected by foodborne illnesses around the world has not necessarily gone down, signaling that this issue remains prevalent in our daily lives. Most of this research will be conducted via reviewing relevant articles, research papers, and any relevant government journals. Additionally, the social construction of technology (SCOT) framework will be used to further analyze the result of the research, specifically how the relevant social groups are affected by foodborne illnesses and benefitted from the technological advancement for food safety. The final result of this research will shine light on the relationship between technological

evolutions and food safety, as well as how different social groups are affected. Overall, both of the technical and STS portions of this portfolio are related to the intersection between food safety and technology. The technical project, “Thermo-Stasis”, is a battery-powered device that can regulate the temperature inside the compartment based on the user’s input. This device was inspired by the need to better alleviate foodborne illnesses on the go. The STS project focuses on exploring the relationship between technological evolutions and food safety to better understand how the needs for better food safety can influence the development of better technological tools, and vice versa. Working on these two projects concurrently was beneficial since the technical project itself is an example of how technological tools can be developed to solve prevalent problems with food safety.