Blue People
(Technical Report)

Boeing 737 MAX Case Study According to Care Ethics
(STS Research Paper)

An Undergraduate Thesis Portfolio

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Bachelor of Science in Computer Engineering

By

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Socio-technical Synthesis

My technical work and my STS research are connected primarily through the application of embedded software and computer systems. Though both projects extend well past this subject area, my work with both of them focused around embedded software. Embedded software is written to control systems or devices that are not usually thought of as traditional computers, and these systems typically have memory, power, or other constraints associated with them. My technical work focuses on creating a novel point of use water treatment device which works by releasing a set amount of silver ions to disinfect the water; the amount of silver ions released is controlled by an embedded software application. My STS research focuses on an embedded software system which had a safety-critical function and contained a deadly flaw. While my technical work and my STS research consider embedded software and computer systems from different angles, the theme of embedded software is consistent throughout.

My technical work focuses on creating a point of use water treatment device for use in low income areas. Working with the civil engineering department at the University of Virginia, my capstone team and I created a portable, durable, and effective water treatment device. The device successfully underwent field testing in Limpopo, South Africa in January 2020 where it demonstrated more than a 3-log reduction of total coliform bacteria, while maintaining silver levels below the World Health Organization standard. The inner workings of the device were designed by my team and included a custom printed circuit board and a MSP430 micro controller which controlled and monitored the system. The device was powered by a 9 Volt battery and contained some data recording capabilities. My specific contribution to the project focused around the embedded software design of the system.

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My STS research explores the potential consequence of a flaw in an embedded software system on the Boeing 737 MAX. Specifically, I focus on the design and marketing decisions that led to the aircraft's two fatal crashes. Most experts agree the proximate cause of the crashes was the Maneuvering Characteristics Augmentation System (MCAS) which was an embedded system in the aircraft; however, my research focuses on the decisions that created the faulty MCAS system, the decisions which kept its existence hidden, and the ethical implications thereof.

The completion of my technical project in the fall of 2019 greatly informed my research in the spring of 2020 on the Boeing 737 MAX incident. The short and rushed timelines I experienced while working on my technical project gave me a better appreciation for the decisions that were made during the development of the 737 MAX which was also on a rushed timeline. My technical work gave me an appreciation for the development cycle of a new product and allowed me to better analyze the development of the Boeing 737 Max. Essentially, my technical work provided the perfect lens through which to analyze the 737 Max incidents.