

Low Power Wireless Networks in Vineyards
(Technical Report)

A Care Ethics Analysis on the Morality of the We-Vibe Producers
(STS Research Paper)

An Undergraduate Thesis Portfolio

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Bachelor of Science in Systems Engineering

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Socio-technical Synthesis: The IoT Applications and Implications

My technical work and STS research both explore the Internet of Things. The Internet of Things (IoT) is defined as technology that enables wireless communication to other devices. These “smart” devices combine sensors, actuators, and information processors with communication protocols, enabling “increased automation or action-at-a-distance” (Allhoff, 2018, p. 55). While my technical work focuses on exploring potential applications for IoT technology, my STS research sought to analyze the ethical implications of these remote monitoring solutions. Even though my STS work looks to past IoT examples and my technical work creates new ones, both are extrapolations of the Internet of Things technology.

My technical work sought to evaluate a new branch of IoT communication protocols and find potential use cases for them. We investigated the Low Power Wide Area Network (LPWAN) protocols of LoRa, NB-IoT, and CAT-M and came up with viable applications for our client to consider. Our research ultimately led us to focus on the LoRa protocol in the precision agriculture industry. Vineyards in particular were found to have use and demand for a device that could remotely monitor important vitality metrics of their vines. We ultimately designed a pole-like device with sensor “segments” that aligned specific sensors with important parts of the plant. These sensors would be connected to a LoRa chip and antenna, which would send the data across the vineyard to the LoRa gateway using the LoRaWAN communication protocol. The gateway would have access to WiFi and connect to the app on the user’s phone and desktop. The user could use the app to see notifications, warnings, or to analyze year-over-year trends with various

data visualizations. The goal of this device is to provide a low-cost way of integrating a data-first approach into vineyards, which would reduce costs, increase crop yields, and conserve resources.

My STS research focused on a different side of the Internet of Things. With its rapid growth, governing bodies have struggled to regulate the IoT. Many ethical dilemmas have subsequently risen from the remote capabilities of the IoT and create an important facet of the field. I studied a 2016 lawsuit and scandal of a smart sex toy company (We-Vibe) to find out what decisions or actions were made in that specific situation. Analyzing those decisions through the lens of care ethics enabled me to determine the morality of those involved, with the hopes of helping future producers or users better understand the moral challenges associated with the rapid expansion and popularity of the Internet of Things technologies.

Working on both projects simultaneously helped deepen my understanding of both. Creating an IoT device allowed me to experience what it is like working with new and unknown technology, with no restrictions on uses and no warnings on potential consequences. By analyzing ethical implications of existing IoT devices in my STS work, I was able to be more cautious in our creation process and to make sure to consider potential ethical issues with our different applications. As the IoT continues to grow unabatedly, I think it is extremely important for creators to be aware of potential moral issues so their devices can be safe and ethical for their users. It was also valuable as a potential user to demystify how the IoT works from my technical work and understand where possible ethical issues could come into play from my STS research. In total, working on both projects at the same time enabled me to learn significantly more from the experience.