

Design and Development of a Semi-Autonomous Vertical Farming Management System
(Technical Report)

The Péligre Dam: An Application of Utilitarianism in Haiti
(STS Research Paper)

An Undergraduate Thesis Portfolio

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My technical project and STS research paper revolve around applications of engineering designed to benefit others. The purpose behind my technical project, a vertical farming plant management system, was to shift the responsibility of plant upkeep from the user to the semi-autonomous system, thus expanding the access to fresh produce. Likewise, the Péligre Dam in Haiti, a real-world example of a hydroelectric dam, provided irrigation canals for farming as well as a source of renewable energy. However, while the general application of both technologies is positive, the construction of the Péligre Dam resulted in outcomes that negatively impacted Haitians' welfare. As such, the case study examined in my STS research paper emphasizes the importance of considering the sociotechnical context in which a technology exists, not just its technical capabilities.

My technical project featured a semi-autonomous plant management system designed for a residential application of vertical farming. The goal of the project was to automate two main processes related to plant upkeep: dispensing water and providing light. As such, the semi-autonomous system interprets sensory information from soil moisture sensors and determines whether to turn LEDs on/off and/or dispense water from a reservoir. Ultimately, while controlled environment agriculture (CEA) technology, which my technical project is an example of, already exists, our team applied the technology specifically to a vertical farm. In order to conserve space, vertical farming cultivates agriculture on vertically inclined surfaces. Integrating the semi-autonomous system with a small-scale residential application of vertical farming was unique to our capstone project. The intent was to create an assistive tool for users, ultimately expanding access to fresh produce and diminishing the effects of food deserts in urban settings.

My STS research paper used the Péligre Dam in Haiti to explore ethical concerns related to foreign-sponsored infrastructure projects. During its establishment, political and social controversy surrounded the dam; while foreign-elites living in Haiti's capital Port-Au-Prince received electricity from the dam, peasants lost their farms and were forced to the eroded hills. Today, high silting rates plague the dam, reducing its holding capacity, power generation, and lifetime. Repercussions associated with dam failure include reduced power generation, lowered agricultural production, and mass migration of citizens living in the Artibonite region, Haiti's most productive region for agriculture. Additionally, efforts exist that counteract sedimentation, such as manually removing the sediment and reforestation; however, the poor state of Haiti's economy prevents the country from intervening. Ultimately, the repercussions associated with the Péligre Dam's failure negatively impact the welfare of Haitian's citizens; thus, from a utilitarianism standpoint, it was unethical to build the installation in a setting in which it cannot be sustained. Ultimately, the overall research objective was to raise awareness on how the pursuits of developed countries, via large-scale installations, can worsen the status of developing ones. As such, the concept of sustainable becomes critically important when considering infrastructure projects in foreign countries.

After completing both the technical project and STS research paper, I am confident in my ability to address both technical and societal problems. One of the advantages of attending UVA is the opportunity to learn knowledge outside of your technical discipline; STS is one outlet of doing so. As such, this makes graduates more versatile and cognizant of different perspectives. The thesis portfolio instills in students the ability to "see the bigger picture" and think about societal concerns related to the field of engineering. I am not only equipped to address technical challenges but also ones pertinent to society.