

## **Thesis Project Portfolio**

### **A User Interface Informing Medical Staff on Continuous Indoor Environmental Quality to Support Patient Care and Airborne Disease Mitigation**

(Technical Report)

### **To Parachute or Perish: A Dive into the Ethical Implications of Parachute Researching**

(STS Research Paper)

An Undergraduate Thesis

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

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## **Sociotechnical Synthesis**

Engineering and society are not mutually exclusive. In fact, they are so intertwined that they are constantly impacting and influencing each other. This semester, I have worked on both an STS project and a technical project. My technical project was to create a user interface informing medical staff on continuous indoor environmental quality to support patient care and airborne disease mitigation. On the other hand, my STS project is not related to my technical project at all. I have been working with a hospital in Rwanda all year, and this got me thinking about the effects that researchers like myself from other countries have on these developing nations. This made me decide to pursue the ethical implications of parachute researching in these developing nations. Emphasizing how to measure different solutions and compare them against each other.

My technical project investigated the issue of indoor environmental quality in hospitals. Specifically, the improvement of indoor air flow has shown to reduce the risk of airborne virus exposure. We investigated various metrics in a room such as room-specific light, noise, temperature, CO<sub>2</sub>, humidity, VOC, and PM<sub>2.5</sub> levels which can be monitored with a sensor. I designed the interface using the CRAP principles (contrast, repetition, alignment and proximity) and input from actors in the system such as medical personnel and experts. The main distinguishing feature of this interface is the easy and intuitive access to different rooms and metrics. This will assist nurses and improve patient care in hospitals with environmental data. The key takeaway I had from this project is that by approaching the issue of IEQ from a systems perspective, healthcare workers and engineers can work together to develop innovative solutions that address unprecedented challenges to the hospital indoor environment.

In my STS research, I explored the ethical implications of parachute researching in developing nations. I dove into what problems parachute research causes and evaluated the different solutions to fix these issues. I developed a method to evaluate different virtue ethical principles and applied those methods to different attempted solutions. To develop the method, I used virtue ethics and determined which virtues are relevant to parachute researching. There were two key distinguishing features that I took away from the results. First, that the virtues ambition and knowledge are unaffected by any of the policies as these are essential virtues to anyone doing research. And second, that the virtues flexibility and faith are higher with no oversight than in any of the attempted solutions. The new understanding of this problem that I came to understand is that, although my research might not be perfect and has many areas that can be expanded, virtue ethics can be an effective way to evaluate and compare solutions to many different problems and this research could be a good foundation for future research.

These projects together have taught me a lot. Together, I realized how many times the technical project is only part of the solution to developing a new technology. Understanding and analyzing the STS components and societal implications of my technology is vitally important and needs to be done with great care. My project as a whole explores how cultures and organizations like the WHO can affect technology as taught in STS 4500. This along with the theme of virtue ethics, one of the major themes of STS 4600, have really let me synthesize everything I learned this year into one paper. My work could serve as a base for future people implementing solutions to solve parachute research, or as a foundation to build upon to more accurately measure the ethics of different solutions. To future fourth year students, at first, STS may seem like a waste of time. After all, why are engineers writing essays? Honestly, I did not see the benefit of this class until the end of the first semester writing the first draft of my STS

essay. I learned a lot from both projects, but my STS project opened my eyes to something that hardly crossed my mind before. What I liked about parachute researching is that medicine in developing countries is something I am really interested in. My advice to anyone trying to choose a topic for their STS research paper is to choose something that you are passionate about. It makes the research process and entire experience in the class really engaging and enjoyable. In twenty years, I might not remember every small detail about this class, but I have definitely learned to think about the potential consequences of technology in different societies.