Detecting Wildfires with the Internet of Things Wireless Sensor System

Preventing Wildfires, Mitigating Natural Disasters, and "Avoiding the Inevitable"

An Undergraduate Thesis Portfolio Presented to the

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Zimeng Yang

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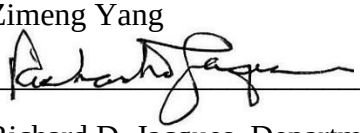
Zimeng Yang

Approved  Date 05/10/2021

Richard D. Jacques, Department of Engineering and Society

Only human beings can recognize catastrophes, provided they survive them; nature recognizes no catastrophes.

—Max Frisch, *Man in the Holocene,* 1979

From the biblical Great Flood to the Eruption of Mount Vesuvius near Roman city Pompeii and Herculaneum, natural disasters have been around since the earliest records of history. For thousands of years, humanity not only withstood nature's trials but has prospered into the modern societies we live in today. However, in recent years, the storm has grown wilder, the weather has become more erratic, and the average global temperature has been rising like never before.

Rapid industrialization has led to widespread modernization and tremendous economic growth with a sacrifice. We have often exploited the environment irreversibly. This loosely coupled thesis portfolio hopes to raise awareness for climate change through wildfires and advocates for a sustainable development path in the STS research while presents a technical solution to early wildfire mitigation and prevention in the technical project.

It is paramount that societies strive to "do their part" in the fight to eliminate technological disasters and reduce natural catastrophes' adverse effects. In my STS research, I found that social vulnerability is often neglected on the macro-geographical and demographical scale. Most importantly, local communities need to incorporate risk management into sustainable development to maximize their efforts in combating the "ecological fallacy." In the case study on wildfires, evidence showed that climate change has indubitably expedited the swift expansion of wildfires in recent years with warmer and drier weather. In contrast to global warming conspiracy theorists, many students and scholars across the country have already begun their research and study to battle the inferno from hell.

In the technical portion of this thesis, my capstone team and I built a sensor system using a distributed Internet of Things (IoT) network to monitor and detect hazardous conditions, such as wildfires, remotely. The system gathers atmospheric data, transmits them to a web application, and signals any abnormalities. Using this system, we wish to help humans better respond to these significant threats, track and mitigate fires early on, and ultimately prevent large-scale fires and avoid invaluable economic losses.

Although many natural disasters are inevitable by nature, humans can both recognize and alleviate their effects. Alongside technological advances, society as a whole can temper the magnitude of climate change by leaving fewer carbon footprints. And with efficient economic, environmental, and social policies, disadvantaged communities can have a resilient recovery in the face of natural disasters. Researches and studies present a prominent future, but whether civilization decides to embark on such an endeavor remains the question.

I want to thank my capstone team for our IoT sensor system's successful build, especially in the uncertain and strenuous time of the pandemic. If economically viable, this system can considerably lower the cost of wildfire monitoring. I also want to thank Professor Jacques for his rich background in wildfires and emergency management. He has provided numerous valuable resources throughout my research process. This research explored through a broad scope of subjects, but it is still far from comprehensive. Future works can inquire farther down the road to sustainability and ponder in-depth on amending social vulnerability at the micro-level.

Humankind has trekked the Earth for thousands of years, and the advancement of our civilization is awe-inspiring. I have faith that with sustainable expansion, society will thrive further in the generations to come.