Thesis Project Portfolio

Smart Forest Management System

(Technical Report)

Examining Pacific Gas and Electric's Culture of Negligence as a Cause of Devastating Wildfire

(STS Research Paper)

An Undergraduate Thesis

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Wildfire is terrifying. When faced with wildfire, you very quickly realize how small and powerless you are in the face of disaster. You cannot stop it. Everything you have ever known - your favorite restaurant, your home, your town, can and will be turned to nothing but smoke and ash in a matter of hours or days. Now more than ever, wildfires are weighing heavily on the minds of the public, think the Los Angeles, South Korea, and New Jersey wildfires. My personal motivation stems from my experience as a firefighter in Albemarle County, where wildfires burn thousands of acres and threaten hundreds of people every year. Through my experiences, I have come to realize that education and prevention are much easier, safer, faster, and more effective than trying to fight fires after they have started. The goal of my capstone project is to reduce the severity and occurrence of utility caused wildfires. My technical project is a system designed to be deployed along powerlines to monitor for initial stage fires and my STS project explores how our government and society enable utility companies to behave irresponsibly, which leads to more wildfire.

My technical project, done with JJ Mirkovich, Sean Mahoney, and Quentin Olsen, is a powerline monitoring system that we call the Smart Forest Management System (SFMS). The purpose of the SFMS is to allow for utility companies to remotely monitor high risk or remote powerlines for fires that would have gone unnoticed for significant periods of time. The SFMS is a network of many sensor nodes that each contain an infrared sensor, temperature sensor, radio, battery, and solar panel. The nodes have the ability to detect a powerline caused fire using the infrared and temperature sensors. If a fire is detected, the node uses its onboard radio to communicate with a central operator, who can then mobilize emergency resources. The nodes are designed to use as little energy as possible and be powered by a solar panel so that they are able to operate in the field for years without maintenance. We were successfully able to develop

several prototypes that were able to detect fire and abnormal heat, along with being able to communicate with other nodes, allowing for message transmission over hundreds of miles.

In my STS research, I wanted to figure out why Pacific Gas and Electric (PG&E) is still allowed to operate after killing nearly 100 people total between the San Bruno Pipeline Explosion and the Butte County Camp Fire. After the San Bruno Pipeline Explosion, California Senator Jerry Hill said, "it was based on circumstances where you have a utility that diverted hundreds of millions of dollars from safety, from maintenance, from testing, and from service." PG&E has a long, well-known track record of placing shareholder profits above both safety and the citizens of California, yet they are allowed to remain in operation. Even after going bankrupt from the costs of the Camp Fire, PG&E is still a massive utility corporation that continues to behave unethically while 'servicing' millions of people. In this paper, I explore how PG&E is continuing to prioritize profit over safety and consumers, along with the government policy and regulation in place to keep PG&E and other Californian utility corporations from facing the full consequences of their deadly negligent management and behavior.

Wildfires stemming from electrical equipment is a complex problem that does not have a singular solution. The deployment of better technology, such as the SFMS, can reduce the severity of these utility wildfires, but will be ineffective if those corporations continue to engage in irresponsible behaviors that increase the chance of devastating wildfires. A social analysis of the causes of irresponsible utility behavior allows for the development of a more holistic solution where ideas beyond new technology can be applied for a safer future. A solution that addresses the issue of utility caused wildfire through the development and deployment of new technology and societal, cultural, and regulatory factors and changes will lead to real change that saves many lives and the environment.