

Thesis Project Portfolio

**Fabrication and Read-out of Integrated Photonic High Frequency Acoustic Wave
Detectors**

(Technical Report)

Social Constraints of Implementing New Energy System

(STS Research Paper)

An Undergraduate Thesis

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

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In Fulfillment of the Requirements for the Degree

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Introduction

Acoustic microscopy for tissue imaging has been used broadly for medical and research purposes. It is based on the effect of the local temperature rise when tissues absorb light. Since optical scattering is stronger than ultrasound scattering in biological tissue, photo acoustic microscopy could result in a higher resolution than conventional methods. However, previous methods involve complicated systems of piezoelectric material. Therefore, it motivates us to build an acoustic wave sensor following the standard CMOS procedures which could be integrated in the future. This is a newly developed technic for medical application. When it is being applied in real use instead of laboratory simulation, there are many obstacles will appear both in technicals as well as socials. Human factors play an important role when it comes to adopting any new technology changes. In order to best utilize the benefit of new technology, it is essential to identify social constraints when it comes to implementation of that new technology. Therefore, I choose my STS research project to be investigating the social constraints to implement a new energy system in Charlottesville. My STS research project helps me to understand how to build a sociotechnical model for analyzing the social factors for new technology implementations such as my capstone project.

STS Research Project Summary

In my STS research, I identified the existence and importance of social constraints to implement new energy systems. The Social Construction of Technology(SCOT) framework was used to analyze the sociotechnical situation for new energy system implementation. Stakeholders were identified as power company, local citizens, power-line workers, engineers, environment,

and local government. The interconnections of problems, stakeholders and solutions were presented and analyzed in a SCOT diagram. Two methods were proposed to incorporate social constraints with new energy system implementation. The first one is to hold energy awareness campaigns to inform and educate citizens of energy usage. This will help to reduce the use of coal and natural gas power and help to implement clean energy solutions. Values like consistent access to power, embrace clean energy and awareness of power consumption were presented. The second one is to do more in-depth social field research for companies which could bring people and technology closer and have each party to take each other's benefits into account to create a more efficient solution.

Capstone Project Summary

My capstone project built a system for acoustic wave sensing including an optical ring resonator based acoustic wave sensor for the purpose of photoacoustic microscopy. The fabrication of this sensor follows the standard CMOS procedure. A membrane was designed and fabricated in the UVA microelectronic cleanroom to increase the sensitivity of this sensor. A readout system was built to analyze the output optical signal from this sensor including an electrical circuit to amplify and filter the output signal, and a sampling section to digitalize the signal for later analysis. We also designed a Labview system to control the laser finishing a wavelength sweep for the desired frequency range.

Conclusion

From both projects, I learned that when it comes to realizing a new technology, there are more to just solving math equations and engineering problems in general. Technology could not be separated from human activity. There is social resilience when adopting new technology.

Without people and technology working closely towards the same goal together, the technology may not have the same effect as designed.