

Thesis Project Portfolio

AFC HUB: Using Java Spring and React to Build an Automated Frequency Coordination Platform

(Technical Report)

Analyzing How Sociotechnical Systems Impact Overreliance on Over-the-Counter Medications and the Long-Term Implications for Public Health and Society

(STS Research Paper)

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Introduction

My technical work on the Automated Frequency Coordination (AFC) Hub platform and my STS research on overreliance on over-the-counter (OTC) medications meet at the intersection of technology and human behavior. The AFC Hub creates a digital platform that balances technical requirements with regulatory compliance in wireless spectrum management, while my STS research investigates how the network of relationships surrounding OTC medications shapes consumption patterns and healthcare practices. The motivation for developing the AFC Hub stemmed from recognizing the growing demand for wireless connectivity and the need for efficient spectrum management solutions. Concurrently, my interest in OTC medication overreliance emerged from observing how accessible medications have transformed healthcare practices, creating patterns of consumption that warrant a closer look through an STS lens.

Capstone Project Summary

Constructive and deconstructive microwave frequency interference creates significant challenges in maintaining signal quality for wireless communication systems, requiring comprehensive coordination and planning of microwave receivers. I created the Automated Frequency Coordination (AFC) Hub platform to coordinate with all nearby microwave receivers by taking in the specifications of a theoretical receiver location, assessing all potential lines of interference, accounting for an area of uncertainty, and then providing allowable transmit powers in accordance with the Federal Communications Commission (FCC). This process is known as a spectrum check. AFC Hub utilizes a React user interface with tabular and geographical visualizations to create and organize the user's spectrum checks. AFC Hub also has a Java Spring RESTful API to interface with an Amazon Web Services (AWS) DynamoDB database

and an internal analysis tool. AFC Hub resulted in a complete project that allowed engineers to conduct cell tower research efficiently and in an organized manner. Future work will focus on optimizing this project to transition from internal use to commercial use and full integration within the broader AFC service.

STS Research Paper Summary

OTC medications have become a cornerstone of self-care, enabling individuals to manage minor health issues without professional medical intervention. However, the increasing accessibility of these drugs has led to overreliance, raising significant concerns about long-term public health implications. This research investigates the question: How do sociotechnical systems impact overreliance on OTC medications and what are the long-term implications for public health and society? The study employs Actor-Network Theory (ANT) as its analytical framework to explore the complex interplay between human and non-human actors within the sociotechnical systems surrounding OTC medication use. ANT provides a lens to examine the relationships among pharmaceutical companies, healthcare professionals, patients, regulatory bodies, and the medications themselves. By mapping these networks, this research aims to uncover how various actors influence patterns of OTC drug consumption and perpetuate overuse. Preliminary findings are expected to reveal that overreliance on OTC medications is not merely a result of individual behaviors but is deeply embedded in sociotechnical systems shaped by regulatory policies, market dynamics, cultural norms, and technological innovations. This research is significant because it shifts the focus from individual responsibility to systemic factors, offering a more comprehensive understanding of the issue. The insights gained could inform targeted interventions at multiple levels—policy reform, public education campaigns, and

industry practices—ultimately contributing to improved public health outcomes and advancing the field of STS.

Concluding Reflection

Working on my technical capstone project and STS research paper provided a unique opportunity to develop a more nuanced understanding of sociotechnical. Engaging with these projects separately allowed me to apply theoretical concepts from STS to my technical work and, in turn, ground my STS research in practical engineering experience. The AFC Hub project required me to consider not just the technical aspects of spectrum management but also the regulatory frameworks, user needs, and organizational contexts in which the platform would operate. My work with Actor-Network Theory in my STS research enhanced my ability to recognize how the AFC Hub itself would become an actor in a complex network, mediating relationships between engineers, regulatory bodies, and wireless technologies. This perspective allowed me to understand the platform with greater attention to how it shapes user behaviors and decision-making processes, resulting in a more thoughtful and effective technical solution. Conversely, my hands-on experience developing a technical system informed my STS research by providing a real-world example of how technologies embody values, delegate authority, and reconfigure relationships. When analyzing the actor-network of OTC medications, I could draw parallels to how the AFC Hub redistributes expertise and authority within its domain. Developing the ability to move fluidly between technical and social considerations is the most valued engineering skill that I gained in these projects. Education often emphasizes technical problem-solving while treating social factors as secondary constraints. Similarly, STS analysis can sometimes remain abstract without direct engagement with technical development.