

Thesis Portfolio

Design and Optimization of an Interoperable Hospital Database System
(Technical Report)

An Investigation into the Disparities in Hospital Database System Designs: Issues of Usability and Interoperability
(STS Research Paper)

An Undergraduate Thesis

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

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Sociotechnical Synthesis

My technical project and my STS research both are relevant to electronic database systems that aim to improve and support healthcare. While such database systems are an ingenious solution to the age-long problem of accurately and safely recording healthcare information, there are a number of issues rampant amongst such systems, particularly in regards to their usability and interoperability. While my STS research explores these issues in depth within the context of medical professionals and hospital systems at large, my technical work aims to provide a rudimentary solution that would improve the sharing of hospital data – a key issue covered in my STS research.

In my technical work, I strive to provide a solution that will facilitate hospital systems with different hospital database schemas to share their data more easily and efficiently with one another. It involved developing a centralized, non-relational database tool with Google Cloud Firestore that would enable different organizations to securely interact with patient data. The database format itself is based on a normalized, minimal set of data fields relevant to storing patient information that is necessary to have for effective healthcare at any hospital system. Authenticated users of such a system can safely add and change patient information, which can theoretically be viewed by authenticated users at external organizations.

In my STS work, I explore issues relating to both the usability and interoperability of hospital database systems in the United States, and around the world. My analysis focuses on how these systems tend to be designed and implemented without a clear representation of users in mind, which contributes to these issues. The science, technology, and society (STS) framework of user configuration is employed to explain how the issues of usability and interoperability of these systems pertain mainly to the user classes of medical professionals and

hospital organizations, respectively. I argue that imprecise representations of these user classes in the minds of those responsible for designing these systems leads to a lack of attention given towards their unique needs, concerns, and abilities, which is ultimately real users often find many frustrations and barriers to using these systems. The goal of my analysis and research is to underscore the importance of a user-centered approach while designing, developing, and implementing such systems.

These two projects, which I worked on simultaneously, greatly added value to each other. My technical project gave me insight into how medical data is collected in a hospital setting and potentially shared across different hospital organizations, which gave me physical context on which to ground the issues I cover in my STS paper. Likewise, the research I conducted for my STS paper helped to elucidate how important real users actually are to the design and development of such systems. This led to important discussions about who the real users of the backend system I was designing would be, and allowed me to better design a system that could potentially better suit the needs of the users. Working on both my STS project and my technical project, in summary, has allowed me to better understand the transformative impact that technologies, such as electronic health records, can have on the medical field, as well as the potential that these technologies can have in truly improving healthcare for all.