Thesis Project Portfolio

Hydrologic Modeling and System Optimization for IoT Flood Management

(Technical Report)

Disaster Preparedness Resources for the Rio Grande Valley Region in Texas

(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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Sociotechnical Synthesis

My capstone research addresses how to increase insights into how hydrological systems respond to extreme rainfall events by adding real-time monitoring through the Internet of Things (IoT) network which can help minimize potential damage by building proactive solutions for the community. Ultimately, as the increasing frequency and severity of storms due to climate change is magnifying flooding impacts, when combined with water systems, IoT can aid in emergency management efforts before and during extreme weather events. For my capstone, we provide a way to translate forecasted extreme rainfall events into flood impacts and optimize an IoT sensor network for real-time flood monitoring. It's important to consider the human and social dimensions of this because the information provided needs to be understandable and accessible to people for them to act accordingly whether that be relying the information to the city or taking actions to prepare for an upcoming storm. A theory of STS that could apply to analyze this problem is Actor Network Theory because there's a lot of actors, both human and non-human, working together to allow this network to flourish. For my STS paper, I've chosen to study what available resources there are for flood preparedness in Rio Grande Valley, Texas. To conduct this research, I explored previous literature about socio-economic and demographic factors impacting the region which also contained survey data, and I found internet and local resources that residents could use as well. I found that there are lots of factors such as age and disaster experience that impact people's abilities to effectively prepare for storms and that there's a lack of in person opportunities to educate people on how to effectively prepare for floods. When considering these two topics together, there's an increase in flood awareness and preparation as storm frequencies and severities increase due to climate change.