Thesis Project Portfolio

A Solar-Powered Fleet Tracking System for Rural IoT Applications

(Technical Report)

Byte Back: Guidelines for Improving Security in Connected Devices using Actor Network Theory

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

Millions of cyber-attacks occur every day. Some of the most dangerous attacks target internet connected devices, many of which have the capability of causing physical harm to humans if operated maliciously. My STS and technical projects examine security in connected devices and the technical and organizational strategies engineers can implement to improve security. The technical portion of my thesis involved the design and realization of a secure location tracking device. In my STS research, I formed a set of guidelines outlining how to design connected devices to be reliable and secure.

Currently, when organizations wish to track the location of their assets in real time, they must make a sacrifice between compatibility, reliability, and security. Customers must decide between battery powered devices, which require frequent maintenance, and hardwired devices, which can expose the control systems of vehicle to remote cyber-attacks. My technical design produced a self-powered GPS tracking device that aimed to offer all three aspects without limitation. In order to achieve these goals, my capstone group created a device powered by a solar panel that could mount externally to any vehicle. Since it is electrically isolated from the control system of a vehicle, cyber-intruders have no potential to cause physical harm to the passengers. Additionally, the solar panel allowed for our device to power itself, avoiding the need for frequent maintenance.

Many engineering shortcomings, such as Boeing's 737 Max plans and Shadow's Iowa Caucus mobile application have been caused by organizational issues within engineering companies. In my STS research, I examined such failures and applied the framework of actor network theory to formulate a set of guidelines for creating secure connected devices. The first guideline outlines that any connected device ought to be compared to its offline predecessor to

assess its relative utility, reliability, and safety. Next, while designing and building devices, engineers ought to assume every component with wireless connectivity can and will be hacked. Finally, during all phases of the engineering process, a diverse group of individuals should be consulted to ensure that the finished product is aligned with technical, organizational, and cultural standards.

My technical project enriched my STS research by presenting a real-world example that could serve as a case study for my guidelines. The STS research aided my understanding of the technical project because it formalized the concepts and techniques my capstone group implemented in the engineering process. I believe that this work is ethically significant because it offers a straightforward set of guidelines and a tangible example of how connected devices can aid society without sacrificing security or reliability.