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STS 4600: Socio-Technical Synthesis

An unpremeditated initial interest in electronics in high school, led me to pursue degrees in Computer Science and Engineering at UVA. As I gained deeper knowledge into the subfields within this area of study, my interest kept wandering back to the field of Internet of Things, because of its unique blend of interdisciplinary topics such as big data, advanced sensors, networking and electronics and novel computing architectures. When coming up with the idea for my Technical Project, I let my interest guide me to build a small scale IoT system for early detection of forest fires. Given the technical knowledge accumulated with my experiences thus far, I wanted to deeply explore the societal implications and the potential harm that could be caused by a wide-scale adoption of such a system, to better understand the merits and drawbacks of pursuing innovation in this area. As the Uyghur crisis looms as one of the worst humanitarian crises of the 21st century, I wanted to see how IoT technology played a role in the enabling and wide scale suppression by the CCP, which has embraced the use of surveillance and IoT technology to spearhead their brand of digital authoritarianism. The common thread that ties both my Technical Project and STS Research Paper together is its deep roots in the field of IoT; the technical project chooses to use various technologies to implement an IoT system, whereas the STS Research delves into how an existing IoT system can and is being actively used to negatively affect society (in this case, to exploit a minority populace).

The technical project involved the building of an IoT wireless sensor network to aid in the detection of early instances of forest fires. To achieve this, an array of hardware and software technologies were used. In terms of hardware, the sensor nodes we build utilized low-cost, low-power, embedded systems, temperature, humidity, gas sensor(s) integrated into custom circuit boards, and utilized WiFi modules to enable wireless communication between the nodes and to the Cloud Computing service. In terms of software technologies, we utilized custom firmware written to extract data from the sensor(s), the HTTPS GET/POST protocols (via Wi-Fi) and AWS Application Programming Interfaces (APIs) to transmit that sensor data from the embedded systems to an AWS DynamoDB cloud database, which then stored all the sensor data and served it up to an analytics front-end web application (via another API), that we built using the open-source JavaScript framework AngularJS. The web-based analytics dashboard served as the user interface that provided all the relevant information to human operators, to aid them in detecting early indications of forest fires and respond accordingly.

In the STS Research Paper I use ANT to analyze and evaluate the successful construction of the complex sociotechnical actor-network of mass surveillance of the Uyghur populace in Xinjiang, China. Using Callon's concept of translation (specifically with the four phases of translation: problematization, interessement, enrollment, and mobilization) I identify how key officials in the CCP, alongside the contributions of businesses and engineers, were instrumental in building and stabilizing the surveillance state actor-network in Xinjiang and how key technological commodities and policy decisions were leveraged for the wide-scale surveillance and detainment of the Uyghur Muslim population.

As engineers and technologists, the core inquiry that drove my group's actions during the duration of the construction of our technical project was "Can this be done?" However, having worked side by side on the STS Research Paper (and discovering how a similar system is being used for a contemptible purpose such as the suppression of an entire populace), my thinking shifted more to ponder the following question: "Should this be done?" Having undertaken several engineering tasks as part of our technical work, my group and I gained first-hand experience working with all the technology components (including all the supply chain logistics that would need to be accounted for) in order to bring this idea to market. However, by seeing how the contributions made by policy directives, government officials and technology companies in China, I was able to gain a deeper understanding as to how technology, if not properly held to ethical standards, can be used in service of an unjust cause. Technology is not inherently good or evil. It takes on the shape of its user. If a user wants to use technology to do good, the right technology can provide unprecedented benefits to society. However, in the wrong hands technology can be used to systemically amplify injustices in society. Understanding this key property of technological innovation was crucial as a builder, because it gave me pause when developing our technical project. As engineers and evangelists of the technology that we build, the role we would fill is a corporate/commercial and technical role in our Chinese socio-technical network. Having a grasp on the technical, social, financial and political aspects, enables us to make better-informed decisions as we delve further into the development of this product, while also ensuring that the product does not fall into the wrong hands. Had we tackled this issue with only a technical mindset, we probably would have developed a commercial product, but would have no foresight into how our work could be used to do harm. Doing the Technical and STS projects together forced us to account for all those constraints in every stage of our decision making process, while also ensuring that we thought deeply about the ethical and long term ramifications of deploying our product in the field.