Thesis Project Portfolio

Using Text-Based and Example-Based Querying to Improve Usage of IoT Sensor Data in Smart Buildings
(Technical Topic)

IoT Devices and Smart Buildings: Starting on the Right Foot
(STS Topic)

An Undergraduate Thesis

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In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

Andrew Villca-Rocha

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Department of Computer Science

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Sociotechnical Synthesis

Achieving Industry 4.0: Improving the Use of IoT Device Data in Smart Buildings

Current industrial trends show a push for Industry 4.0 (I4.0) technology. I4.0 is regarded as the "next industrial revolution" through the use of interconnected technologies. Smart buildings are a part of I4.0 and utilize Internet of Things (IoT) devices and their data to increase the efficiency of the operation of their buildings. Both my technical project and my STS research focus on taking a step towards implementing the vision of I4.0 in the smart building sector. My technical project proposes an information retrieval solution for smart buildings to solve the difficulties around managing vast amounts of IoT sensor data. While my STS research stresses how a lack of infrastructure for IoT device use may result in a hindrance on the journey towards I4.0.

Buildings are increasing their use of IoT devices to manage their logistics. Because of this, modern building management systems struggle to utilize the vast and complex data provided by these devices. In my technical project, I designed and developed a solution that uses information retrieval techniques to extract information from IoT devices. My solution does this by requiring the user to form one of two types of queries. They can either query by example or use a generic text query. Query by example involves the user identifying a graphical trend in sensor data (e.g. temperature spike) and the system will retrieve other sensor data that exhibits this trend. Generic text queries are simple keywords strung together that identifies what type of sensor data the user is looking for. This is similar to questions you would ask in a google search. Both these queries aim to better capture the search intent of the user. Through these queries, my system is able to provide a new and different approach to retrieving data for users.

Even though the trajectory towards smart buildings seems clear and optimistic, the involvement of IoT devices requires a robust and secure infrastructure to successfully utilize the data involved with it. My research navigated various sources on existing I4.0 research and identified that the lack of infrastructure for IoT device use may impede the success of smart buildings.

Both of my projects enrich each other by covering the entire scope of the problem definition. The system I propose in my project solves the difficulty in retrieving vast and complex data from IoT devices in smart buildings. And, my STS research covers the sociotechnical aspect of the problem by identifying stakeholder issues that may hinder the technical achievements of my work. Through this, I have enriched my personal process of defining engineering problems to not only include a technical aspect but also a sociotechnical perspective. Additionally, this has led to a restructuring of how I view the responsibilities of engineers. We, as engineers, are not only here to solve problems using the skills we acquired, but also are ethically responsible to use our own virtues to push society towards a better place.