ELECOMP CAPSTONE SYMPOSIUM
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THE UNIVERSITY OF RHODE ISLAND

THINK BIG WE DO℠

Data Collection Using IIoT

Industrial Internet of Things

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Project Motivation

Supfina Machine Company is one of the largest suppliers of abrasive finishing machines and attachments. Their machines improve the surface geometry of parts using a variety of abrasive media, with a focus on automotive parts and bearings. Recent developments in software technologies have created room for improvement in the machining industry. Supfina aims to stay on the cutting-edge and ahead of its competition by developing an IIoT data collection system for its machines. With IIoT facilitating data collection, this system will allow engineers to analyze trends more efficiently than before, detecting flaws and allowing workers to plan for downtime long before it starts. Our design makes use of modern hardware and software, with industrial grade sensors communicating via IO-link to transmit process data. Eventually, this data will be forwarded to the cloud-based storage system via the eWON Flexy data gateway, allowing it to be analyzed and viewed by customers and engineers at Supfina.

Anticipated Best Outcome

The development of a comprehensive monitoring system will allow Supfina to have greater insight into machine performance, individual component functionality, and trends of customer use. This will result engineers having a better understanding of how to further improve Supfina’s technology. In addition to these new insights, Supfina will be able to predict when a component would need to be serviced, or replaced entirely. This advanced notice will decrease the customer’s system downtime and operational costs, in turn optimizing efficiency and increasing customer satisfaction. The IIoT system will use a web server that will enable remote monitoring, eliminating the need for travel, saving thousands in travel costs and downtime.

Key Accomplishments

IIoT Technology Analysis: All members of our team conducted research on IIoT and IOLink. Research on IIoT was vital, since there are a variety of methods on how data is communicated throughout our planned system, with only a few of them being optimal.

IIoT Device Selection: Our electrical engineering team selected sensors best suited to our project. The heart of this project is the collection of data from sensors on Supfina’s superfinishing machines. Sensors chosen measure variables such as vibration, temperature, power consumption and flow. Factors we took into account when selecting optimal sensors included thresholds (the limits to how high of a frequency a sensor could measure at), cost and size. Through extensive research on the different types of sensors as well research on some of the sensors that Supfina currently uses on their machines, a list of sensors for our project was finalized and delivered.

Learned Fundamentals of Software Tools: The computer engineering members of our team learned to use Java and the Eclipse IDE on a fundamental level. We downloaded packages that allowed functionality with Amazon Web Services, and ran tests on Supfina’s DynamoDB test code. We plan to use Eclipse for developing our web server and testing data collection.

Learned Fundamentals of Web Development: Our computer engineers also learned web development concepts. In addition to learning HTML and CSS, we learned more about the best practices for web development such as using the inspect tool to learn from existing websites. Using these concepts, we built a preliminary design for our website, called a “wireframe”.

Finalized Wireframe Design: Our computer engineers created a wireframe for our website (Fig. 1). The wireframe will be used as a preliminary design for our finished product, and was built upon a draft wireframe created in the earlier stages of the project. Some of the elements in the wireframe are already being implemented.

Figure 2: (T) Nano Machine (B) Spiro F5 Machine

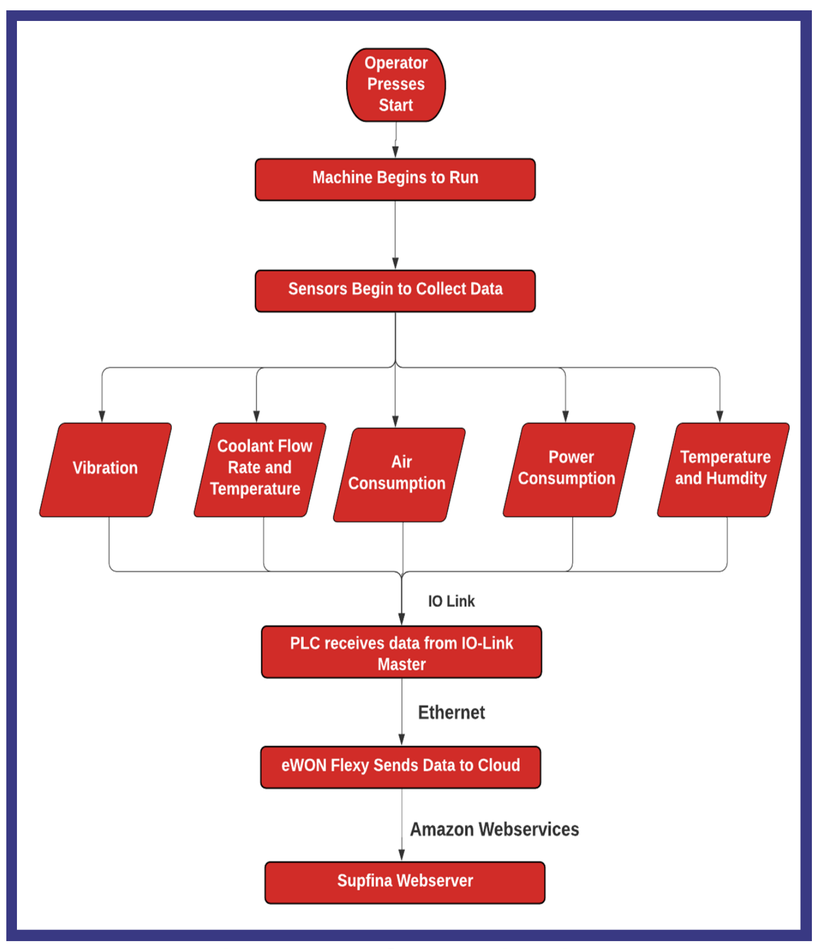

Figure 1: IIoT System Flowchart

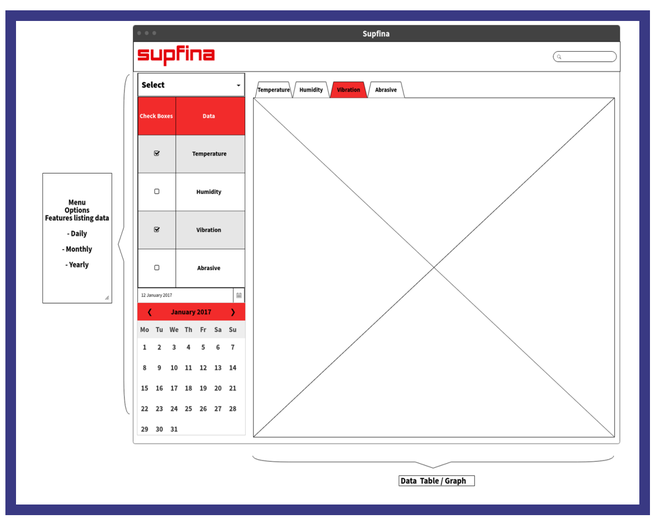

Figure 3: Supfina Website Wireframe

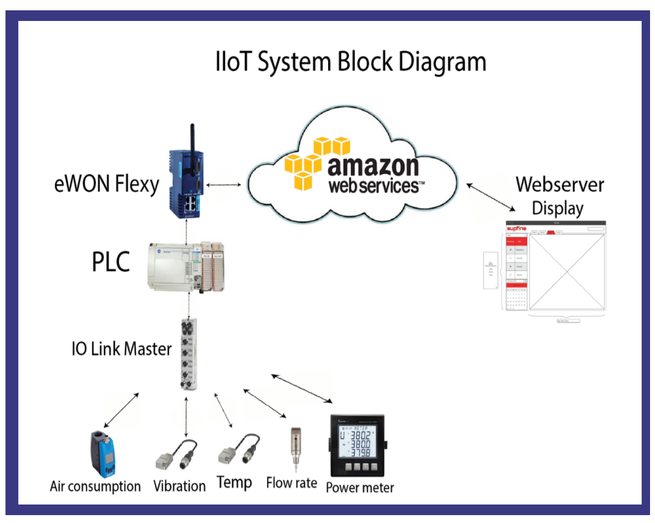

Figure 4: IIoT System Block Diagram

Remaining Technical Challenges

Integrating IIoT Sensors: Some of the machines in Supfina are unequipped in terms of data collection (Fig. 2). The sensors chosen by our electrical engineers will be integrated with the machines to collect process data such as power consumption, temperature, and vibration. Positioning must be considered when integrating the sensors, as it can affect the quality and accuracy of the data collected.

Website Development: The AWS system requires a web page to test and display machine processed data. The computer engineers have designed the wireframe and are currently in development of the website. The site will display the data sent from the PLC in a clear and organized fashion. The information will be shown in a variety of graphs for the purpose of visualization and trend analysis. By being able to further view data from different angles, the customer is able to see the condition of the machine and make adjustments towards the device’s needs.

Mobile site and Responsiveness: One of best practices for developing websites is responsive development. With companies integrating smartphones and tablets, developed websites must be compatible with all kinds of displays. Customers will use various devices to view their machines’ data, so the site will need to function comfortably on any display. A well-organized, accessible, and responsive website is extremely important for attracting new customers.

Linking AWS to PLC and Website: As seen in the flowchart, linking the PLC and AWS is essential to the system. AWS offers a NoSQL database which uses Amazon DynamoDB. It is a key-value for the document database that delivers millisecond performance at any scale. Supfina has test code that utilizes DynamoDB that can be used for reference for the project.

Implications for Company & Industry

There is an increasing demand in the manufacturing industry for the development of faster processes, smarter machines, and reduction of waste. Reducing downtime through predictive maintenance made available by the implementation of data collection using IIoT will improve customer satisfaction. Being able to view the process data of the machine will allow the company to further develop and personalize their designs and services for their current and future customers. This system could have a positive economic impact on the company, as it could increase customer satisfaction and allow the company to focus and branch out to more growing technologies.

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