



Data Collection using IIoT

(Industrial Internet of Things)

ELECOMP Capstone Design Project 2020-2021

Supfina is continuing their support of the Program for the 2nd year.

Sponsoring Company

Supfina Machine Company, Inc.

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Company Overview

Supfina Machine Company is one of the largest suppliers of abrasive finishing machines and attachments. Our machines improve the surface geometry of parts using a variety of abrasive media, focusing on automotive parts and bearings. The current economic and geopolitical climate, and the advent of exciting disruptive technologies in the industrial world have presented Supfina with an opportunity to grow and adapt to new markets by transitioning to being a provider of engineering solutions. Supfina now looks to leverage its vast knowledge and experience to combine automation, IIoT (*Industrial Internet of Things*), AI, and AR technologies with our vast product and service offerings offering them to our target market of component manufacturers.



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Project Motivation

There is a paradigm shift happening in the world of industrial manufacturing. Plants are forced to compete in an ever-growing global market with tighter and tighter margins. Manufacturers are demanding more uptime, faster processes, smarter machines, comprehensive monitoring of machine and component data, and vast reduction of human labor, all as part of keeping up with the fourth industrial revolution.

Supfina is developing solutions to ease the burdens of manufacturers in the 21st century by combining automation, IIoT, and AI technologies into a comprehensive industry 4.0 platform. The arrival of modern industrial edge computing devices has made it easier than ever to integrate with existing control systems and collect component level machine data. The aggregation and analysis of data from individual machines up to the supply chain level reveals obscured trends that, when displayed to the end user in an intuitive and interactive manner, enable critical decisions to be made confidently. This directly translates to reduced downtime, labor, and material costs.

The development of this total industry 4.0 solution will cement Supfina's position as a leader in both abrasive machining as well as manufacturing automation and support, and allow us to better serve our customers.

Anticipated Best Outcome



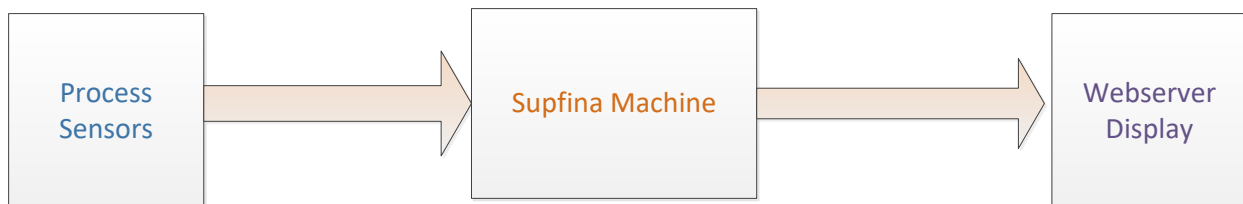
The goal is to successfully design and implement a running IIoT system to Supfina Machines to collect process data for analysis. The data would eventually be tied into a cloud-based system where data will be analyzed, and customers can view their machine data wherever they are located. The system should be modular to integrate into non-Supfina machines in the future.

Project Details

The electrical engineers and the computer engineers will not only work closely but they also must communicate with Supfina's mechanical engineering and application engineering departments to learn the machine's design and function. Mechanical engineers design the tooling, machine footprint, fluid mechanics, and overall machining system. The applications engineers run and service the machine while monitoring the process to achieve the best possible results.

The electrical engineers will integrate the necessary sensory hardware to collect process data to aid in the analysis of the machine's condition. Doing so, they must specify a multitude of sensors and communicate with the machine's controller to read the sensory data using a combination of analog, digital, and I/O link signals in preparation to report the data to the webserver.

The computer engineers will need to collect the data from the machine's controller and design a webserver to display the data in a comprehensive way. The ideal webserver would be a combination of graphs/ charts and numeric values to easily distinguish a healthy machine and predict any trends that require machine maintenance and repairs.



Block diagram of IIoT system.



Hardware Tasks:

- Identify Process Data to be collected.
- Specify necessary sensors and hardware for data recording.
- Become familiar with ProfiNet and Ethernet /IP Communications.
- Create accurate BOM that meet budget requirements.
- Integrate and test hardware on Supfina-supplied lab machines.
- Create electrical schematics.

Software Tasks:

- Design architecture / structure of webserver.
- Test and Display machine process data to webserver.
- Become familiar with MQTT network protocol.
- Modular programming.

Composition of the Team

Two (2) electrical engineers and Two (2) computer engineers

Skills Required

Electrical Engineering:

- Understand power systems/distribution
- Read and interpret electrical schematics
- Experience with digital and analog circuits
- Basic programming skills

Computer Engineering:

- Possess strong documentation skills (JavaDoc Style Comments and UML)
- Object-oriented and WebDev programming
- Basic database programming
- Basic electrical principles



Anticipated Best Outcome's Impact on Company's Business and Economic Impact.

Supfina will be able to monitor products remotely from anywhere in the world and be able to address issues before they arise. This will help minimize downtime and save thousands of dollars in travelling costs every year. Developing the capabilities on our lab equipment will allow us to showcase these features and to offer packages to new and existing customers for their manufacturing processes. The savings will further transform into additional revenue and allow the company to focus more on the growing technologies.

Broader Implications of the Best Outcome on the Company's Industry

This will enhance Supfina's product line by supporting Supfina's direction on becoming an engineering solutions company in tandem with its abrasive machining background. The IIoT package will provide a platform to further research, develop, and improve maintenance to achieve better customer relationships.