CASE STUDY

RIT | Golisano Institute for Sustainability

Craft Cannery implements IIoT-enabled temperature monitoring to support facility expansion

Company	Sector	Size	Location
Craft Cannery	Food manufacturing and packaging	Less than 100 employees	Bergen, New York

At a glance

- Craft Cannery is a small business specializing in customized food manufacturing and packaging. In the three years since its launch in 2020, the company has quadrupled in size.
- With plans to expand its factory in 2024, Craft Cannery's CEO Paul Guglielmo looked to Industry 4.0 for opportunities to enhance the plant's performance as part of the scaleup. He identified temperature monitoring as a top priority to minimize risks associated with the expansion. Adding this capability would enhance food safety, simplify regulatory reporting requirements, and protect valuable perishable ingredients, delivering a quick return on investment (ROI).
- Craft Cannery partnered with Rochester Institute of Technology's (RIT) Industry 4.0 Transition Assistance Program to develop and outline a digital, connected system to monitor refrigerator, freezer, and cook kettle temperatures across the company's facility. Together, RIT and Craft Cannery laid out plans to implement machine monitoring powered by the Industrial Internet of Things (IIoT). A pillar of Industry 4.0, IIoT uses a mix of hardware and software to collect data from the shop floor and store, analyze, and visualize it for decision-makers.
- The goal of the IIoT-enabled machine-monitoring system was to provide Craft Cannery's factory staff a quick and reliable method for checking refrigerator, freezer, and cook kettle temperatures, alerting them well before any deviations affect food safety. Once implemented, the automated monitoring system will allow them to become aware of potential problems and to react to them immediately, thereby avoiding spoilage and factory downtime.
- RIT's engineers provided Craft Cannery with a detailed concept for a monitoring system, complete with a list of hardware and software that it would require. It offered a phased approach, allowing the company to target high-priority needs sooner for an immediate ROI, as well as to set future milestones to meet as the business grows.
- Based upon RIT's recommendations, Craft Cannery purchased a Wi-Fi-enabled temperature sensor and a communications hub to facilitate a trial of the temperature-monitoring system at RIT. The trial is ongoing, and the results so far indicate that the selected hardware and software will indeed work in the next phase of implementation. A follow-on project has been planned to deploy temperature sensors across the company's refrigerator, freezer, and cook kettles.

Company

Craft Cannery is a food manufacturer located in Bergen, New York. The company manufactures sauces, dressings, oils, marinades, teas, soups, meat sauces, meals in jars, and other related food items. Several of these are sold under its own brand, Guglielmo's. As a contract manufacturer, the company partners with many different brands with a focus on replicating signature recipes and using custom ingredients.

Business challenge

After successfully launching Craft Cannery in 2020, Paul Guglielmo, owner and chief executive officer, saw the company quadruple production over the course of three years. After winning a $500,000 Grow-NY prize in 2022, the manufacturer laid plans to expand the factory in 2024. For Guglielmo, the expansion offered an opportunity to not only increase Craft Cannery's footprint, but also to enhance its technological capabilities. To that end, he and his team considered different Industry 4.0 strategies. Promising a fast return on investment while addressing a major driver of product quality and throughput, they identified temperature monitoring as the best starting point for digitalization.

Temperature control is critical to food manufacturing: It drives taste and quality as much as it does health and safety. Craft Cannery regularly receives inspections from federal and state agencies to ensure that its processes meet existing consumer-health regulations. Guglielmo and his team looked to implement a machine-monitoring system that could automate some of the record-keeping and temperature-monitoring work. They wanted to make it easier for operators to track temperatures across the expanded factory and, when needed, correct problems quickly when they arise. To design this system, they partnered with RIT's Center for Advanced and Sustainable Manufacturing (COE-ASM).

The Industry 4.0 solution: Machine monitoring through the Industrial Internet of Things

The Industrial Internet of Things (IIoT) is a term for a set of technologies that can be used to collect, analyze, and interpret manufacturing data. IIoT's namesake—the Internet of Things (IoT)—was first coined to describe the system of software and hardware for consumer products that facilitates data collection with sensors, public and private networks, and web-based software. Everyday conveniences, like smartphones, smart thermostats, and doorbell cameras, are all consumer-level IoT applications. IIoT offers this same kind of connectivity and automation to manufacturers.

A steady stream of new hardware and software on the market is reshaping how data can be used in the factory environment to monitor equipment performance in real time. On the manufacturing shop floor, access to a network is critical to IIoT; wireless networks are increasingly being used for this purpose. Cloud-computing leaders like Google, Microsoft, and Amazon all have IIoT software platforms that provide architectures for data management and software deployment.

At its heart, IIoT-enabled machine monitoring carries data across a manufacturing plant in three phases, outlined below.

1. **Measure and connect:** First, wireless digital sensors measure a specific parameter that a business defines, such as color, weight, or temperature. These sensors are physically installed on equipment. In addition to sensors and measuring equipment like probes, data connectivity is established at this point, typically using a Wi-Fi or wired gateway device.
2. **Connect, collect, and visualize:** A computer—usually an edge device—is installed on relevant equipment. It features software that allows it to "talk" to the sensors and collect data. From there, the data is sent to an information network, transformed if necessary, and displayed on a dashboard on a digital device for staff members to interpret.
3. **Collect, store, and notify:** Once data has been collected and displayed, it needs to be recorded and archived so it can be retrieved for broader analytics activities, such as tracking of historical trends. Data can be stored on a local network or on a cloud-based service, as security and access considerations allow. Alarms can also be set—technically, coded—to signal when specific conditions (e.g., unusually high numbers of defects) are met within the data.

Why machine monitoring?

- **Spend less time recording data and addressing issues:** IIoT-enabled machine monitoring provides a direct value-add when it replaces manual condition-monitoring activities. Manually collecting data from machines can require significant labor hours and lead to inconsistent results due to human error and variation between how technicians record those data.
- **Know before it blows:** Leveraging hardware to collect machine data and software to analyze and display it, a machine-monitoring system can warn operators or maintainers when a piece of machinery is running abnormally or nearing failure—this prevents costly quality spills or unscheduled downtime.
- **Brings everything under one umbrella:** Machine-monitoring technologies can be applied to a wide range of critical production equipment and infrastructure systems, from injection molders and packagers to air compressors and chillers. An IIoT system allows process data from different machine makes and model years to be brought together, integrating them into a single, unified system.

Approach

To start with, the RIT team visited Craft Cannery's facility in Bergen to review its production processes and identify all the specific locations where the temperature-monitoring system would need to be installed. They assessed temperature-controlling assets in the company's existing factory, which featured three cook kettles, a refrigerator, a freezer, and an automatic filler and capper. They also evaluated similar equipment that may be added as part of the 2024 expansion, such as two new cook kettles, with one three-times larger than any it had before, and a new bottle-and-package filler.

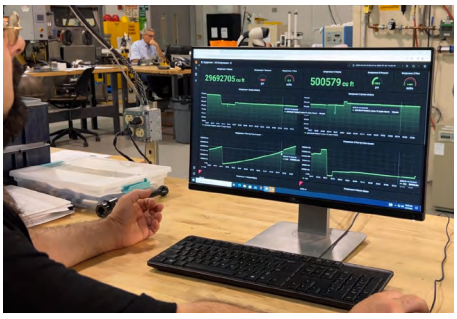
"We partnered with RIT to really look into our critical processes and map out some approaches to add the right type of temperature-monitoring system for us. They helped define a realistic budget we could live with, understand how a temperature monitoring system could work on the shop floor, and select hardware and software that was a good fit."

Paul Guglielmo, Owner and CEO, Craft Cannery

Each asset presented specific temperature-related requirements, either to keep ingredients cool or frozen before processing, or to heat and maintain temperature during production. Although the company followed a stringent process to check and monitor these temperatures, manually recording measurements on paper logs and then typing them into a record-keeping system is a tedious task. Additionally, temperature deviations during processing can ruin a batch if not corrected quickly. Moreover, improper operation of storage systems including during power outages, can lead to spoilage of raw ingredients. Anomaly identification and the ability to rapidly notify key staff were, therefore, both important requirements for Craft Cannery's unique monitoring system. Through the assessment, the RIT engineers were able to systematically define requirements like these to create a design concept.

Solution

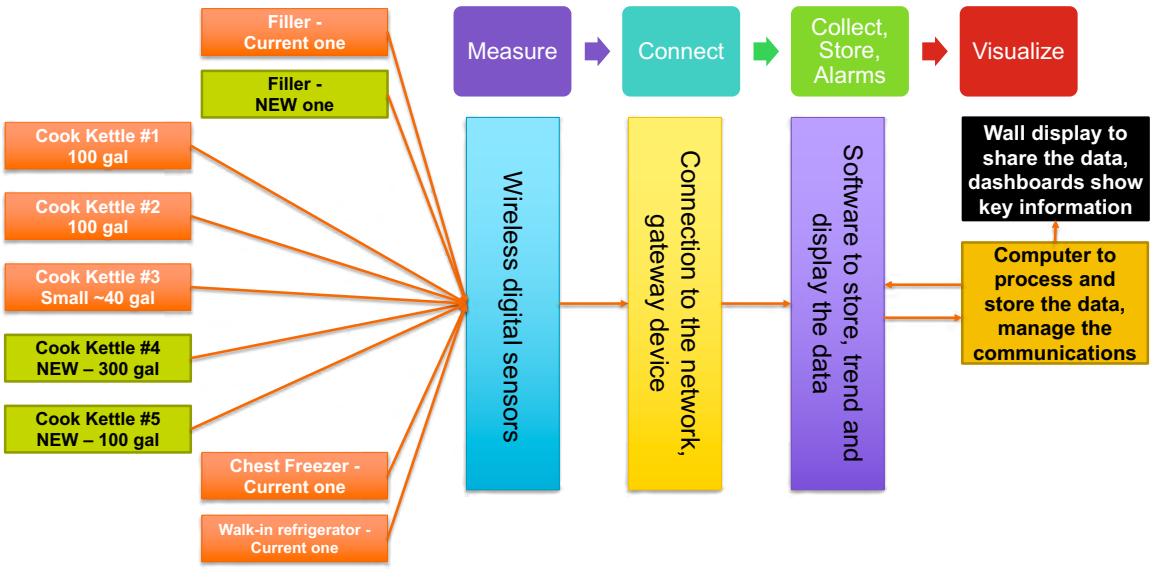
Following a careful analysis of both Craft Cannery's existing facility and considering the company's expansion plans, the RIT team put together a concept for a monitoring system using a range of off-the-shelf software and hardware products. The concept system involved robust, industrial-grade components, and was designed to be modular to allow Craft Cannery to grow or adjust it as needed. Taking into account budget considerations, RIT recommended that Craft Cannery pilot the system on a representative cross-section of critical assets, and then build the system up as it is validated and as funding becomes available.



To measure and collect data, RIT recommended a series of industrial-grade, wireless temperature sensors and probes with long battery life that would send data out via a Wi-FI gateway. To connect, collect, and visualize the data—the second phase in the machine-monitoring journey—RIT recommended use of an edge device in the form of an industrial-grade computer connected to both the gateway and the Internet. Installed on the shop

floor and connected to the network, this would receive data from installed sensors using NodeRED, an open-source software platform, and push the information to a cloud time-series database, Amazon Timestream. The Grafana cloud service will provide a way to display both live and historical temperatures. Craft Cannery will use this to create a wall display in the kitchen to share this information with workers, as these types of displays have been shown to improve employee engagement and awareness. Grafana will also send out alarm notifications if a refrigerator or freezer departs from its normal range, or if they stop reporting (including due to a building power or communications connection failure). The Grafana "OnCall" notification system also includes alarm de-duplication and automatic escalation. For example, if the primary receiver does not respond within a certain time frame, the system will notify someone else.

Monitoring system concept diagram



Results and next steps

At the end of the project, RIT presented the conceptual design of the temperature-monitoring system to Craft Cannery and provided guidance on what to expect from each of the different segments of the system. The final deliverable included a "shopping list" of the hardware and software products that it required.

Based upon RIT's recommendations, Guglielmo purchased a Wi-Fi-enabled temperature sensor and a communications hub to facilitate a trial of the temperature-monitoring system in a testbed at RIT. The trial is ongoing, and the results indicate that the selected hardware and software will indeed work in the next phase of implementation. Guglielmo and his team look to partner with RIT in a follow-on project to deploy temperature sensors across the company's refrigerator, freezer, and cook kettles.

RIT | Golisano Institute for Sustainability

For more information please contact us:

585-475-4210
centerofexcellence@rit.edu
rit.edu/advancedmanufacturing
190 Lomb Memorial Drive
Rochester, NY 14623

This material was prepared by Rochester Institute of Technology using federal funds under award No. 01-79-15124 from the Department of Commerce Economic Development Administration and using funds from the NYS Department of Economic Development. The statements, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Department of Commerce, the Economic Development Administration, or the NYS Department of Economic Development.