

Case Study

Sprinkler Monitoring System via UNS

Industry 4.0 Digital Transformation: Sprinkler Monitoring System via UNS – Case Study Report

Global Pharmaceutical company with revenues of over \$11 billion has a core business of prescription drugs with a focus on areas of urology, immunology, cardiology and infectious diseases. New advanced sprinkler monitoring system product created as part of the “Nucleus” Smart Factory Gallarus offering.

Introduction

In the face of operational challenges and the need for preventative maintenance related to a Corrective and Preventive Action (CAPA), an \$11 billion turnover pharmaceutical company sought Gallarus' expertise to address a pin hole leak in their finished goods warehouse's sprinkler system. It's critical to remember these challenges did not just arise, rather utilities are tasked with these operational challenges every day, many of which have financial and regulatory implications. Let's delve into how this new cutting-edge solution sparked unprecedented results and the benefits achieved through advanced monitoring with real time data.

Current State

The sprinkler system has a distributed pipe network in their production facility and is major a fire protection method, consisting of a water supply system, providing adequate pressure and flowrate for the purpose of fire suppression. A leak at the highest point of the 17m high warehouse, coming down through all the racks and material would cause a lot of damage before it reaches the floor. Even if the client had traditional leak detection software it would take 5-10 days for that to be triggered. The impact of that type of damage on the material would be huge to the company. The company spoke to their sprinkler system vendors who pointed them towards the traditional leak detection solutions on the market. However, the client needed a creative solution as nothing was available on the market to address all requirements.

Challenge

Gallarus were tasked to provide a real time sprinkler system monitoring solution (via the Unified Namespace) supporting utilities to have visibility into pipe leakage. This solution needed to provide preventative maintenance, gathering anomaly data including changes in stable state ultimately reducing costly failures in their controlled license environment where there is risk of high value product contamination and impacts to site compliance from such failure. Leakage and pipe failure monitoring relies on engineering inspection and judgment and possibly assumed degradation factors for failure prediction. Enter the Unified NameSpace to provide real time data and solve these requirements.

Solution

In a number of weeks Gallarus provided a proactive stateful monitoring of the warehouse sprinkler system to baseline the environment of the deployment and from that point on detect anomalies. This allowed the implementation of a preventative maintenance solution to get visibility of potential issues before they happen, detection of anomalies as they happened and identify the possibility of a leak in the system and alert the team.

The solution was tracked by software based on an MQTT lightweight communication protocol that reports by exception only, to exchange data within an Industry 4.0 data ecosystem for easy plug in and out called the Unified Namespace (UNS). The hardware solutions included vibration/acoustics sensors for leak and impact detection, humidity and temperature sensors for real-time environmental monitoring, and an accelerometer sensor for advanced vibration analysis. Additionally, Gallarus deployed server and firewall infrastructure alongside software tools like Ignition for data connectivity, Canary as a data historian, an MQTT broker, cybersecurity measures, and a GUI for user-friendly access to key data points.

Successful tests and simulations on leak detection and change in stable state were completed. Testing was carried out on installed sensors to determine baseline values for setting alarm levels for leak and impact detection. This all provided real time alerts and stateful data at the fingertips of the team.

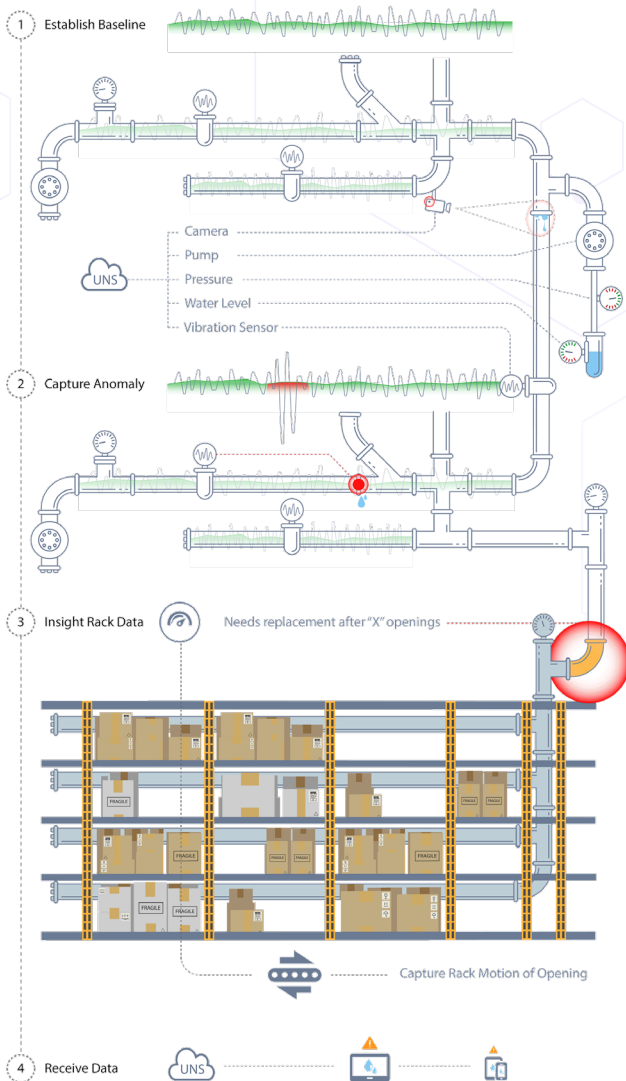


Figure 2 Sprinkler Monitoring via UNS (Concept Design)

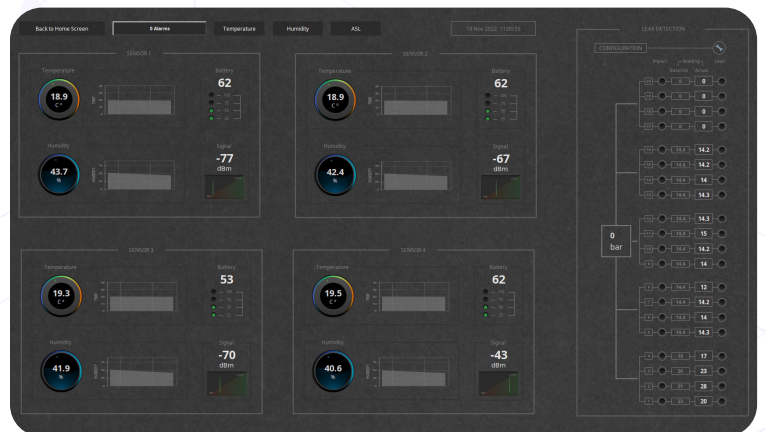


Figure 1 Sprinkler System Monitoring Unit via UNS (Final Architecture)

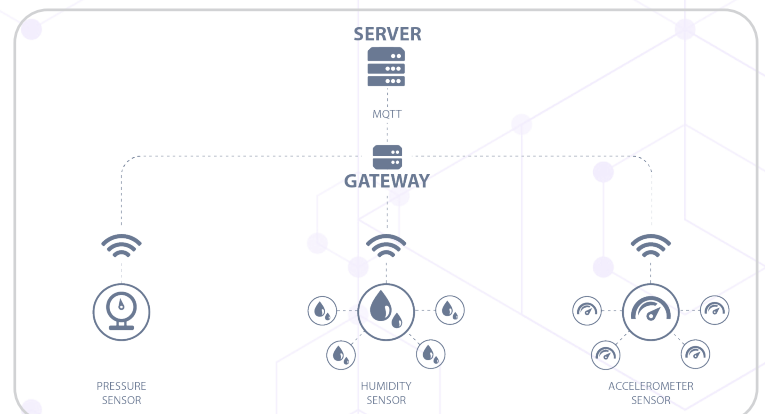


Figure 3 Warehouse Leak Detection GUI Landing Page

New State: Validated Monitoring System via UNS

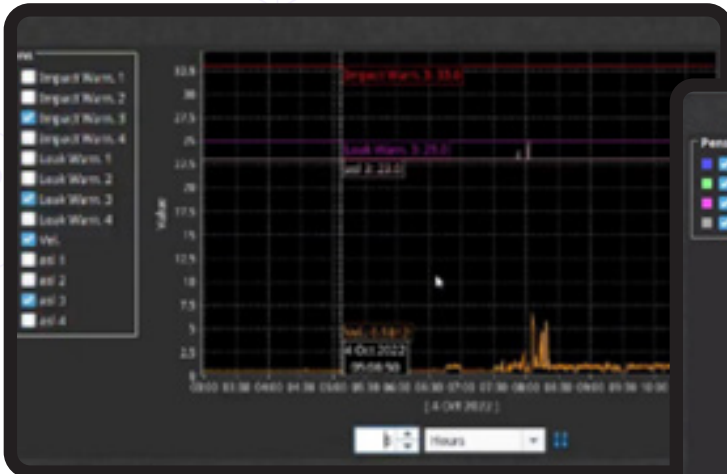
Following a successful and validated deployment of a UNS implemented monitoring system, the following are layout screens displayed real time values of the monitoring system from custom designed User Interfaces on desktop, tablet and mobile for Operations Management.



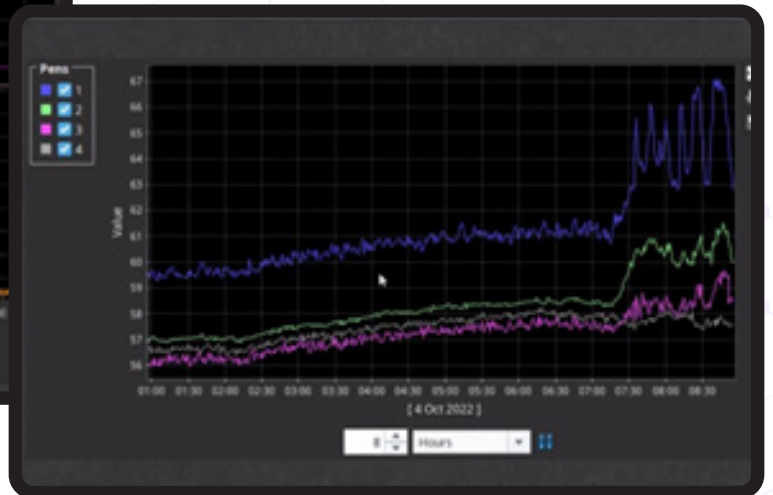
Active Alarm Page – here all active and inactive unacknowledged alarms will be displayed.



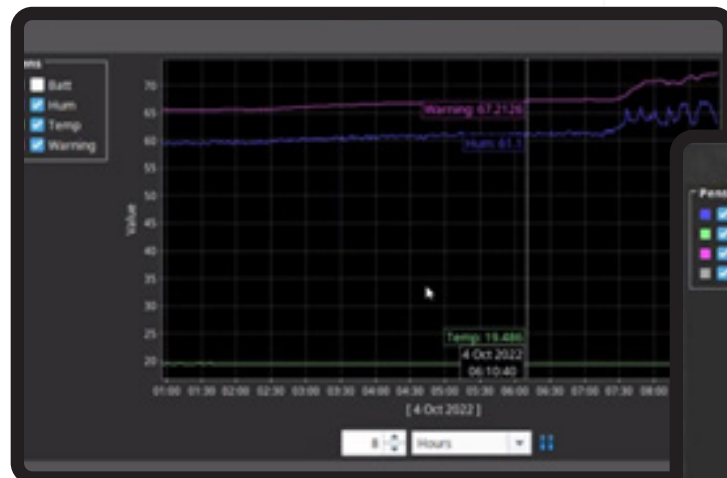
Trends of record temperatures for installed sensors – ability to adjust the historical time frame and also select individual sensor values



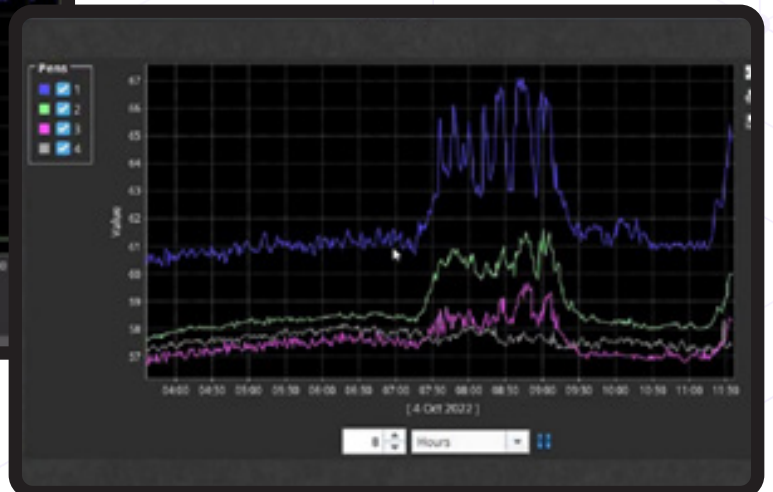
Temp and Humidity sensor values



Historical ASL values from AE sensors



Trends of recorded humidity for installed sensors



Recorded Humidity values

Benefits

The pharmaceutical company widely recognized the significance of the implemented solution, particularly in preventing extensive damage caused by leaks. Traditional leak detection software would have taken days to trigger an alert, resulting in substantial material loss into the millions. The UNS-based monitoring system, combined with machine learning and AI capabilities, allowed for the detection of anomalies and unusual patterns, facilitating early leak detection, and greatly reducing the risk of any product contamination. The UNS was the heart and soul of the project because the monitoring system was designed so it would learn over time all the operational factors within the warehouse such as doors opening, AHUs turning on, build up patterns and use machine learning and A.I. to detect unusual anomalies. The client is now extremely confident that if they have a leak, they can detect it before any damage occurs. The way it is set up it will either hear the leak or detect it through very sensitive relatively humidity sensors.

Benefits include :

- Early detection of any pipe anomalies.
- Proactive stateful monitoring of the warehouse sprinkler system.
- Machine learning and AI for predictive maintenance.
- Prevention of product contamination caused by leaks.
- Real time alerts to the team.



Future and Next Steps

Building on the foundation of the validated UNS implementation, captivating opportunities come into view for utilities and all departments in the business. Further rollout considerations include pump sensors, pressure reading, flow sensors, multi-access motion sensors, water level sensors, and cameras for leak detection at weld points. The flexibility and modularity of the UNS infrastructure also paves the way for future expansion into critical areas such as laboratories, utilities, and operations. The success of the solution demonstrates the transformative potential of Industry 4.0 in the pharmaceutical industry, emphasizing the importance of advanced systems and proactive monitoring for enhanced operational efficiency and compliance.

