

OPTIMIZING CUSTOMER EXPERIENCE FROM DESIGN TO OPERATION USING INDUSTRIAL INTERNET OF THINGS (IIOT)

ABSTRACT

One of the key objectives of Industry 4.0 is to drive manufacturing forward and to be faster, more efficient, and customer centric. By embedding modern technology into manufacturing, you essentially achieve Industry 4.0 objectives. Industry 4.0 also aids to push beyond automation and optimization to discover new opportunities and business models.

This paper provides a perspective on using Industrial Internet of Things (IIoT) and Analytics of Things (AoT) to enable Industry 4.0 principle. The paper further discusses the implementation of key use cases such as digital transformation, developing digital twin, remote process monitoring and predictive maintenance and how it offers the following benefits:

- Complete Archiving of Process data for Anytime Anywhere access providing traceability
- Anomaly detection and trend analysis through AI based Machine Learning models to reduce rejection
- Monitor Machine parameters to reduce downtime and increase productivity
- Access to operation manual and troubleshooting tips on occurrence of specific events
- Realtime information on running time, idle time and alarm alters/ notifications.

INTRODUCTION

As a principle, Industry 4.0 talks about how to use the data being collected to improve operational efficiency at the same time bring in innovation at process, service, product and business level. By pushing the data to key stakeholders at the right time we will be able to enable decision automation. This is where Industrial Internet of Things (IIoT) plays a key role in real time data collection. Using cloud computing capabilities, one will be able to store and process the data collected using IoT and provide visualisation on a front-end application.

Thingstel Industrial Solution uses some of the latest innovations in device, network, cloud and analytics technologies to offer remote monitoring and predictive maintenance use cases through its sophisticated monitoring/diagnostic features in real time and at reasonable costs.

By tracking the process data in real-time the solution will be able to predict anomaly and alert the operator about possible causes. Based on the parameters that have gone beyond threshold specific notifications can be shared over emails, SMS and/or WhatsApp along with options to address the issue through troubleshooting tips, charts, images and videos.

Machine parameters can be monitored for operating range and variations in any can be intimated to the maintenance team. Artificial Intelligence based Machine Learning models can be used to detect the probability of a breakdown with information of what parts may require replacement.

In most cases collecting contextual data like ambient temperature, machine vibration, air pressure, etc. can help analyse physical condition and machine running time.

Thingstel Industrial solution provides a fresh look to operating and maintaining a machine by collecting, monitoring and eventually predicting outcomes with IoT.

SITUATION OVERVIEW

The current solutions at most manufactures are limited to what is termed as Operational Technology with data visualisation over Digital Interface like SCADA, HMI, etc. This not only restricts data access to a local system but also makes storage and retrieval of historical data a challenge. Further, data processing and analytics are limited by the resource availability making it expensive. Scalability is also difficult when hosted locally.

Machine maintenance and servicing has been an expensive and time-consuming process. Done in an ad hoc manner, it is easy to miss the key process resulting in a breakdown thus requiring site engineers to visit physically and check on malfunctioning parts. This would result in travel time and delays to get this machine operational again.

Implementation of Industry 4.0 looks towards a convergence of Operational Technology and Information Technology to develop a digital twin of the physical shop floor. This provides anytime anywhere access to process and equipment data while enabling complete scalability.

Reducing unscheduled downtime by proactively monitoring and detecting any issues is a big cost saving in manufacturing. Industry 4.0 talks about access to important information to react faster to any impending issue.

SOLUTION ARCHITECTURE

Thingstel Industrial solution offers customised platforms to OEMs and Manufactures to monitor their machines in real-time and to create value from the data that is available from the machines (process and equipment). Ready to use visualisation, reporting, analytics and data science modules categorised into Information Center, Documentation Center and Production/Maintenance centre provides a quick and flexible deployment to customers depending on the requirements.

Data Transmission:

The solution provides some of the most preferred network technology options such as wires internet, Wi-Fi and GSM. Low Powered Wide Area Network (LPWAN) technology can also be integrated wherever feasible hence bringing down the cost of device and connectivity.

Our partner edge device has the capability to communicate with most PLCs in the world over multiple protocols like MODBUS, Profinet, BACNET and OPC UA.

Data Storage/Analytics:

All data collected is stored in data lakes that serve as a repository and sorted by timestamps for easy retrieval and analysis. Serverless architecture will be used to process incoming and stored data and generate analytics. Using microservices provides cost efficient resource usage at the same time making best use of services being offered.

Data Science:

The solution offers a data science module for use cases such as classification, clustering, association rule, decision trees, regression, correlation and human brain simulators using some of the industry leading libraries.

Data Visualisation:

All data will be visualised through a web and a mobile application. Additionally, voice query and control systems like Alexa integration can be explored for cases where the data collection is huge and dashboards are complex.

USE CASES

Thingstel Industrial Solution in the way it is architected covers several different use cases. Below are a few specific ones that offer tangible benefits to customers.

Usage Optimisation

The solution provides visibility on process, equipment and contextual data collected which in turn helps track the machine running/idle time over intervals. This helps the production team to make sure the machine is run at the optimum levels. Standard values can be set to make sure the deviation is within a specific range. This allows for better utilisation of resources personnel operating the machines.

With alerts and notifications being sent out to key stakeholders escalated through an authority matrix, key alarms get addressed more efficiently reducing the machine idle time.

Process Traceability

The solution tracks the process data at regular intervals provides auditable logs to retrace the process cycle. Timestamped reports can be generated over the front-end application with an export to mail functionality. This when combined with Barcode or NFC based tags will help trace the material from incoming to dispatch.

The solution platform offering scalability to connecting over multiple machines across different sites connecting factories globally with all

process being available on a central cloud.

Predictive Maintenance

Solution offers predictive maintenance by applying analytics to data stream correlating it to historical sets combining preventive and corrective action. The output predicts the risk of failure and throws out alerts/notification even before its occurrence. This way maintenance can be performed based on the condition rather than an ad hoc manner.

Predictive maintenance integrated to the connected machines can help monitor trends and detect anomaly through the data collected. This helps the maintenance team to be prepared with resources and parts required.

Remedy

The solution offers troubleshooting tips for specific alarms through text, charts, pictures and videos sent over front-end application, emails and WhatsApp. The solution can also be integrated with chatbot providing answers to standard set of questions. This feature can be particularly useful to inexperienced operators who are looking for help to address symptoms.

CONCLUSIONS:

With the expansion of intelligent, connected machines for mission-critical operations, we are witnessing the convergence of information technology (IT) and operational technology (OT). The ability to monitor or control machines over the Internet brings with it an imperative to apply IT disciplines like security and data governance to the realm of industrial operations.

Solution through data collected from multiple sources can support future innovations at the product and service level. Understanding the machine

down time, causes for it, parts that require frequent replacement, correlated process data and efficiently managed maintenance can all help manufacturers better the product/service.

The capability to engage with a customer through predictive maintenance from a remote location is an excellent unique selling proposition that OEMs can offer to their clients as part of their service package. OEMs can look to offering the solution developed to their end customers on a platform adding a completely new revenue vertical thus influencing business innovation.

REFERENCE LINKS

https://www.mouser.com/pdffdocs/ONSemi_IoT_TechNote.pdf

<https://www.industrialheating.com/ext/resources/White-Papers/IHWhitePaper-Optimizing-Operations-Predictive-Maintenance.pdf>

<https://www.industrialheating.com/ext/resources/White-Papers/IHWhitePaper-Optimizing-Operations-Predictive-Maintenance.pdf>