

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

ABSTRACT

One of the many key objectives of Industry 4.0 is to drive manufacturing forward by being faster, efficient, and customer centric. By embedding modern technology into manufacturing, manufacturers 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 the usage of Industrial Internet of Things (IIoT) and Analytics of Things (AoT) to enable Industry 4.0 principles. The paper further discusses the implementation of key components such as digital transformation of existing functions, development of a digital twin, remote process monitoring and predictive maintenance and how it offers the following benefits:

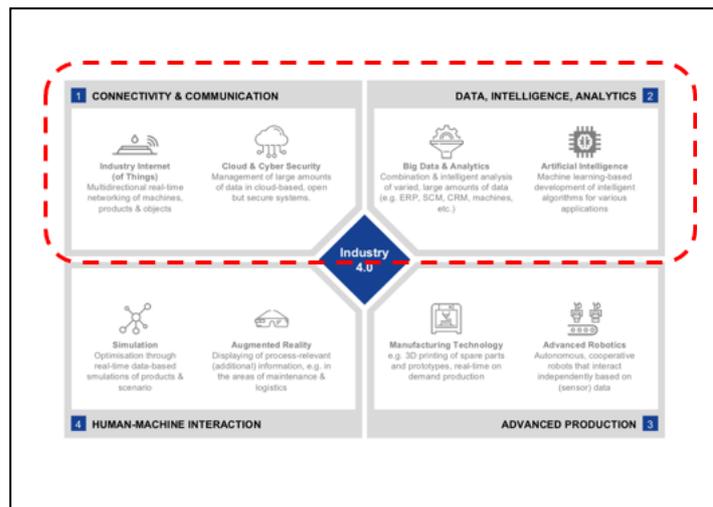
- Complete archiving of Process Data for ubiquitous access and traceability
- Anomaly detection and trend analysis through AI based Machine Learning models to reduce rejection
- Monitor Machine Parameters to reduce downtime and increase productivity
- Access to operation manual and troubleshooting tips 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 the utilization of 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 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 anomalies and alert the operator about critical causes. Based on the parameters that have gone beyond threshold, specific notifications can be shared over various channels such as emails, SMS and/or Chat Applications 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 conditions and machine operation time.

Thingstel Industrial solution provides a fresh look into the operations and maintenance of a machine by collecting vital data, monitoring them and eventually predicting outcomes with IoT.

SITUATION OVERVIEW

The solutions that exist today are limited to just Operation Technology with a provision for data visualisation over Digital Interfaces like SCADA, HMI, etc. This system not only restricts data access to a local system but also makes storage and retrieval of historical data a challenge. Further, it caps the resources utilized for data processing and analytics making it expensive which in turn restricts scalability when hosted locally.

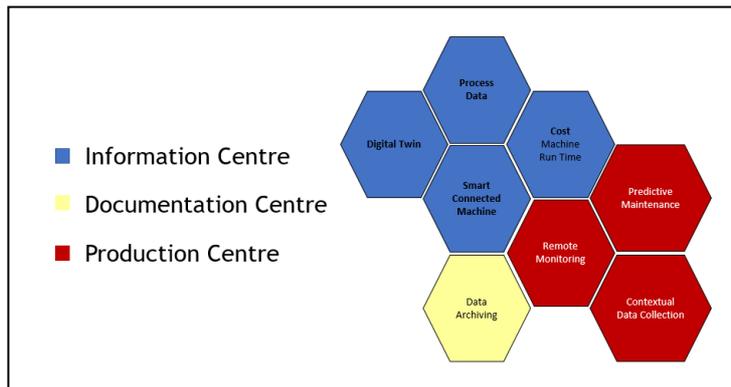
Machine maintenance and servicing has been an expensive and time-consuming process. Done in an ad hoc manner, with this process, it is easy to overlook the many key processes, which may result in breakdowns that would require manual interventions and inspections of malfunctioning parts, essentially accruing travel time and delays to achieve machine operational normalcy again.

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

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

SOLUTION ARCHITECTURE

Thingstel Industrial solution offers customised platforms to OEMs and other Manufactures to not just monitor their machines in real-time but to create value from the data that is collected from the machines (process and equipment). Comprising of ready to use visualisations, reporting, analytics and data science modules categorised into Information Center, Documentation Centre and Production/Maintenance Centre provides a quick and a flexible deployment pipeline to customers depending on the requirements.



Data Transmission:

The solution provides some of the most preferred network technology options such as wired Internet, Wi-Fi and GSM. Low Powered Wide Area Network (LPWAN) technology, which can be integrated, based on the application thus bringing down the cost of the device and the connectivity.

The Edge Devices, endorsed by our partners, have the capability to communicate with most PLC interfaces across the world over multiple protocols like MODBUS, Profinet, BACNET and OPC UA.

Data Storage/Analytics:

All data collected is stored as data lakes that serve as a repository. Sorted by timestamps, the data is easy for retrieval and analysis. Serverless architecture is used to process incoming and stored data to generate analytic inferences. Using a micro-service architecture facilitates cost efficient resource utilization, simultaneously making the best use of services being offered.

Data Science:

The solution offers a data science module for use cases that involve classification, clustering, association, decision-making, regression, correlation and human brain simulations using the best of the industry leading AI technologies.

Data Visualisation:

All data is visualised through web and mobile applications. Additionally, Voice User Interfaces (VUI) query and control system (like Alexa, Google Home) integration can be explored for cases where the data volumes are large and dashboards are complex.

USE CASES

Thingstel Industrial Solution is architected to cover several different use cases. Below are a few that offer quantitative benefits to customers.

Usage Optimisation

This solution provides visibility into process, equipment and contextual data collected which in turn helps track the machine operation and idle time over specific intervals. This aids the production team to maintain optimum levels during operations. Standard values of parameters can also be set to check deviations within a specific range. This allows for a 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 thus reducing the machine idle time.

Process Traceability

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

The solution platform also offers scalability by connecting over multiple machines across different sites, which connect factories globally. This provides access to all process insights and data on a central cloud.

Predictive Maintenance

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

Predictive maintenance ^[4] integrated to connected machines can help monitor trends and detect anomalies using the data collected. This helps the maintenance team to be well prepared with resources and parts when required.

Remedy

The solution offers contextual troubleshooting ^[5] tips for specific alarms via text, charts, pictures and videos sent over the front-end application, emails and Chat. The solution can also be integrated with Chatbots to provide answers to a standard set of questions. This feature can be particularly useful for inexperienced operators who are looking for help to address oddities.

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.

Solutions implemented on the principle of data collection from multiple sources can support future innovations at the product and service level. Understanding factors such as machine down time interval, causes for downtime, imperative parts that require frequent replacement, correlated process data and efficiently managed maintenance can aid manufacturers to better the product or 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 at offering Industry 4.0 solutions developed for their end customers on a platform facilitating a completely new revenue vertical thus influencing business innovation.

REFERENCE LINKS

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[4] Redhat, Bridging the Gap Between Operational Technology and Information Technology
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