WHITEPAPER

Sustainable automation: Digital Factory meets Machine Learning.

Pioneering sustainable automation

In today's fast-evolving manufacturing scene, the potential of digital transformation, known as Industry 4.0, is clear. This shift not only promises financial gains but also offers a crucial opportunity to boost sustainability.

Harnessing data insights, advanced analytics, and artificial intelligence (AI), manufacturers can significantly enhance critical performance metrics like Overall Equipment Effectiveness (OEE), downtime reduction, cycle time, and Quality Control (PPM defects). Additionally, the convergence of the Industrial Internet of Things (IIOT) and data analytics plays a vital role in reducing CO_2 emissions. Central to this transformation is the role of data, empowering analytics and Machine Learning (ML) to uncover actionable insights within manufacturing processes, identifying root causes behind issues like micro stoppages, asset breakdowns, and quality concerns.

Navigating data infrastructure challenges in manufacturing

Realizing the promise of digital transformation relies on the availability and accessibility of comprehensive data accurately representing processes and assets. In process manufacturing, traditional systems like SCADA (Supervisory Control and Data Acquisition) or DCS (Distributed Control System) centralize and store data, offering a structured asset hierarchy and standardized naming conventions typically aligned with the ISA88/95 standard.

However, the absence of such centralized systems complicates data collection and contextualization due to the distributed nature of PLCs (Programmable Logic Controllers) and HMIs (Human Machine Interfaces). Effective data contextualization is crucial for ensuring user understanding without specific process knowledge.

Factors like constrained computing resources, proprietary protocols, inaccessible PLC programs, and the lack of uniform naming conventions further add to the complexity. To address sustainability requirements effectively, equipping machines with energy metering is fundamental for accurate measurement and management of CO_2 emissions.

Embracing best practices to overcome data challenges

To tackle these challenges, industry best practices can be employed. PLC/HMI tags should ideally adhere to OPC-UA variables or objects, following naming conventions outlined in an OPC–UA Companion Specification (CS) for the respective asset/process, if applicable. Structuring the hierarchy logically in line with the ISA88/95 standard enhances transparency and interoperability across stakeholders aiming to leverage machine/process data. Introducing an intelligent middle layer, positioned between layers two and three in the ISA 95 model, effectively addresses these needs. This gateway serves as the single source of truth for industrial data, integrating firewall capabilities to manage access and segmentation between OT- and IT-networks. Additionally, the gateway manages communication to business applications on layer three and higher, while providing data to analytics and AI/ML use cases, all in accordance with standards and regulations like NIS2, CRA, and IEC 62443.

Streamlining AI initiatives to unleash manufacturing potential

Despite having a robust data infrastructure in place, developing and deploying ML models remains a significant challenge due to a shortage of Data Scientists with production process knowledge. In response, Phoenix Contact and Intelecy have pioneered an end-to-end solution, empowering factory engineers to seamlessly build, train, deploy, and maintain ML models without coding expertise.


Illustration: Intelecy no-code industrial AI platform

Leveraging a configurable Data Collection Box (DCB) or so-called gateway (see architectural diagram on next page) embedded with PLCnext[1] technology, data harmonization and contextualization are seamlessly orchestrated at the shop floor level. This synergy, reinforced by the Intelecy no-code Industrial AI platform, empowers frontline personnel, who intimately understand the challenges, to spearhead digitization efforts, thereby accelerating the realization of tangible business value and return on investment.

Intelecy and Phoenix Contact's end-to-end solution for manufacturing AI

The solution begins with a configurable and rugged enclosure housing essential hardware, known as a Data Collection Box (DCB) or gateway. The core of the DCB is the PLCnext platform, responsible for data collection, harmonization, and contextualization from the shop floor. PLCnext offers fieldbus drivers, OPC server functionality, I/O mirroring, and connection to additional sensors for energy measurement.

Acting as a host to the Intelecy Gateway[2], PLCnext facilitates connectivity and communication to the cloud. Furthermore, the DCB contains necessary network and security hardware for secure communication and access management. Phoenix Contacts Digital Factory Now[3] concept and the Intelecy No-code Industrial AI platform enable factory personnel to drive the digitization journey autonomously, expediting the realization of business value and ROI.
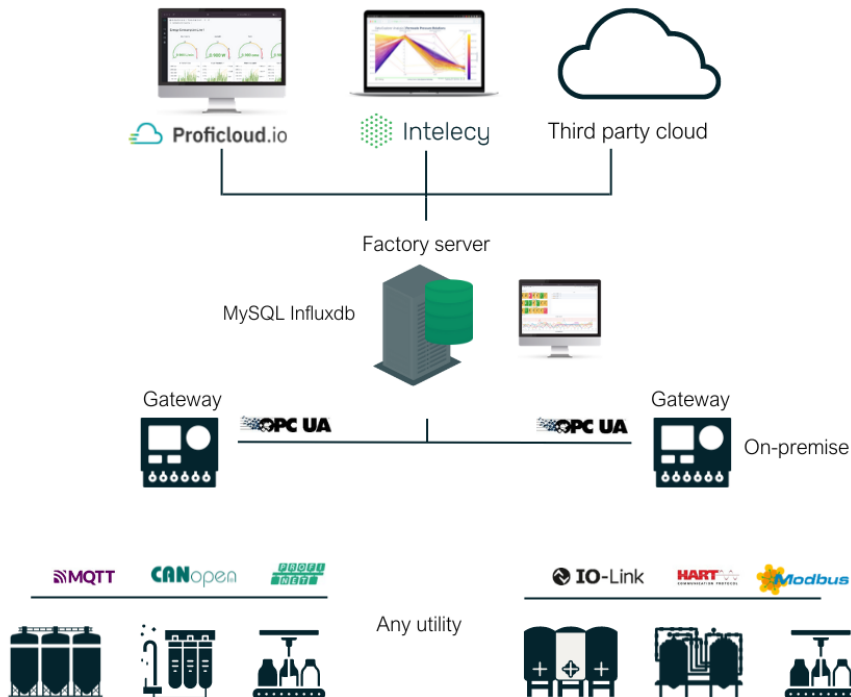
1. PLCnext is a Linux based PLC supporting PLC programs as well as Linux applications and containers.
2. Intelecy Gateway is a container-based software that collects data and forwards it securely to the cloud application.
3. Digital Factory Now is a solution that enables data collection, data transformation, and secure connectivity to the cloud and back.

Empowering data-driven decision-making and ML-deployment

With data available in the Intelecy platform, users access an intuitive application interface for advanced analytics and ML model building without coding experience. Activating the model into production is simplified, allowing for easy implementation of process improvements through a closed loop back to PLCnext. This facilitates the creation of a data-driven manufacturing environment, where analytics activities and running ML models for process control become central components.

Using AI/ML in production processes is fundamental for realizing the vision of Industry 4.0 and driving improvements in quality control. SCADA system facilitated real-time decision-making, leading to significant improvements in quality yield. This integration illustrates the transformative potential of data-driven decision-making in modern manufacturing.

Use case: Optimizing quality product leveraging AI forecasts

A potential scenario: In an application of Intelecy's no-code AI platform, a juice company sought to optimize its pulp production process. By leveraging predictive analytics powered by Machine Learning (ML), skilled process engineers developed models to predict changes in pulp concentration and size up to one hour ahead. These forecasts empowered operators to proactively adjust production parameters, maintaining quality standards and product specification. The seamless integration between Intelecy's AI platform and the plant's SCADA system facilitated real-time decision-making, leading to significant improvements in quality yield. This integration illustrates the transformative potential of data-driven decision-making in modern manufacturing.

Conclusion: Advancing towards a sustainable future

Innovative solutions offered by Intelecy and Phoenix Contact bring sustainable automation within reach. By addressing data challenges and simplifying AI complexity, manufacturers can unlock operational efficiency and sustainability. Together, Intelecy and Phoenix Contact champion a future where data-driven insights and AI-driven optimization redefine modern manufacturing.

Join us in embracing the transformative power of sustainable automation. Let's collaborate to unlock operational efficiency, drive innovation, and build a future where data-driven insights and AI-driven optimization redefine modern manufacturing. Contact us today for a free feasibility assessment to embark on this journey towards a more sustainable and efficient future.

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About Phoenix Contact

Since 1923, Phoenix Contact has been at the forefront of developing innovative solutions for connecting, distributing, and controlling power and data flows. Their products are integral to a wide range of industries, from industrial production facilities to renewable energies, facilitating automation and sustainability. With a commitment to excellence and environmental stewardship, Phoenix Contact is dedicated to paving the way toward a climate-neutral and sustainable world. Explore more at www.phoenixcontact.com

About Intelecy

Intelecy stands at the forefront of sustainable production, offering a pioneering no-code Industrial AI platform tailored for industrial practitioners. Through intuitive tools and advanced algorithms, Intelecy empowers engineers and operators to maximize resource utilization, prevent downtime and minimize environmental impact without the need for coding expertise. Explore more at:
www.Intelecy.com