

Smart Factory applications in discrete manufacturing

The Smart Factory is helping discrete manufacturers by providing real-time interactions of people, machines, assets, systems, and things that collectively enable processes to govern themselves through machine learning and cognitive computing.

Daniela Previtali, Wibu-Systems AG
01/21/2018

The Internet of Things (IoT) is a term that has slipped easily into our everyday vocabulary, bringing with it exotic notions of smart appliances, driverless automobiles, intelligent monitors, and the like. How does it fit in the industrial world, though?



Quite nicely, actually. Just as the IoT has turned the consumer world upside down, the Industrial Internet of Things (IIoT) is poised to do the same on the manufacturing floor under the guise of the Smart Factory. The Smart Factory is driven by real-time interactions of people, machines, assets, systems, and things that collectively enable processes to govern themselves through machine learning and cognitive computing.

The Smart Factory is creating an industrial ecosystem characterized by machines capable of aggregating, analyzing and acting upon data to make real time manufacturing decisions. The ultimate vision is to create a factory environment where down time is minimized, waste is eliminated, and process behavior is optimized based on decisions made given current operating conditions. The evolution of the Smart Factory promises a level of Lean operations and efficiency that was previously impossible to achieve. ■

Industrial applications: where is the business value?

Manufacturers are facing challenges from many fronts—changing customer expectations, accelerated time to market cycles, regulatory pressures, and rising

material costs, to name just a few. While the IIoT does not necessarily represent the ultimate answer to solve many of these challenges, there are examples where the IIoT is delivering bottom line business value today and where it is expected to flourish in the future. The IIC created testbeds in nine areas to increase the collective understanding of the technical as well as the IIoT's business aspects:

1. System-wide visibility – Data flow from the shop floor to the top floor: In the factory, system-wide visibility enables timelier product manufacturing and shipment, reduced rate of product rejection, faster product repair turnaround, and enhanced production throughput.

2. Product automation – Fewer tradeoffs between cost, quality, and speed: Time-sensitive networks will open up critical control applications such as robot control, drive control and vision systems to the industrial internet. This connectivity then enables customers, suppliers and vendors to more readily access data from these systems and to apply preventive maintenance and optimization routines to these systems.

3. Predictive maintenance – Machine downtime visibility and reduction: Conditioning monitoring provides a high return on investment (ROI) in many scenarios by improving asset life, reducing asset downtime, maximizing production, and enabling the predictable delivery of services for assets.

4. Industrial digital thread – Linking manufacturing and service data: The insight generated from the Digital Thread improves overall efficiency of manufacturing setup and end product quality, while reducing asset downtime during service.

5. Global supply chain integration – Supplier to factory to customer and back: This technology will enable the "tools-as-a-service" business model for equipment vendors. It will also provide manufacturers with enhanced productivity, production, quality, and work safety.

6. Resource efficiency – Management of input costs and environmental impact: The testbed will result in 5 to 10% year over year reduction in energy consumption. It will also provide tools to plan the expansion of operations and to achieve sustainability objectives. Overall energy utilization will be normalized and equipment will run optimally resulting in the reduction of operating expenses.

7. Human-machine collaboration – Improved safety and productivity: More rapid development of testbeds and IIoT innovation. Having the right work instructions directly on a mobile device will not only improve the productivity but also the safety of the operator.

8. Mass customization – Dynamic manufacturing processes: The testbed enables retrofitable hardware solutions that reduce the costs of the physical installation. Easy access to a high volume of near real-time data enables the improvement of current analytics and the development of innovative applications.

9. Business model execution – Monetize data and shift to services: The testbed creates and validates business models with the flexible assignment of production resources across factory locations. This creates new opportunities for SMEs, allowing them to respond flexibly to manufacturing orders.

Core IoT technologies and enabling change

The convergence of operational technologies (OT) and information technologies (IT) via internet connectivity is transforming the digital manufacturing world. New use cases are emerging, based on the ability to aggregate, analyze and act on data in connected manufacturing processes. Sensors represent the first step in the process of data aggregation. Cost effective communication technologies are used to move the data, and analytics platforms extract insight that can be acted upon. The

combination of these existing and new technologies is the foundation for the next generation technology innovations.

The two primary drivers that are enabling these new IIoT use cases are cost reductions and performance improvements. Enhanced manufacturing processes are reducing cost for existing technologies, such as sensors, while new technologies, like cloud computing, improve capabilities for scalable storage and data processing that make access to these new innovations affordable for all the players, including small and mid-sized manufacturers.

Interoperability is key to allowing the diverse IIoT technologies to exchange data between both new and legacy systems and emphasizes the importance of standardization across all fronts. Out of the box "plug and play" integration with existing IT and OT systems will dramatically accelerate implementation and reduce required investments. Standards will play a key role in the technology adoption rate.

IIoT adoption barriers for manufacturers

The three most prominent challenges to the widespread adoption of IIoT systems include the retrofitting of legacy assets, accommodating rapid data growth, and protecting sensitive assets and systems from cyber-attacks.

In the past, capital equipment was often expected to perform for a decade or longer, often with no upgrades to the original hardware and software. Hardware will become the limiting factor in technology improvements due to the inability for hardware to evolve at the high rate of software. To leverage the full benefits of the IIoT, manufacturers must replace or augment their legacy assets with advanced technologies to maintain competitiveness as their equipment ages.

Data is the lifeblood of every IIoT system and the ability to efficiently extract and integrate data from disparate sources and formats is crucial. Vast amounts of sensor data must be collected, transported and stored, and then filtered and processed to extract meaning and value. The volume, velocity, and variety of this data is daunting and data management capacity must be greatly improved.

The last challenge is cybersecurity. This important topic resides in the domain of the IIC's Security Working Group and IT/OT Task Group. In the IIoT, industrial networks originally designed to be isolated are exposed to continuous attacks of ever-increasing sophistication. Industrial connected devices require protection against malicious attacks as well as errors and mischance.

Protection against piracy, reverse engineering and intellectual property theft is also a major concern. In its 2016 Piracy Study, the German Engineering Federation, VDMA, revealed that 70% of manufacturing companies surveyed in Germany had been affected by product or know-how piracy, which in turn cost the national GDP an estimated 7.3 billion euro and caused the loss of 34,000 jobs. To ensure the highest level of protections, it is imperative security is a fundamental, built-in design consideration with regards to the IIoT.

Preparing for digital transformation

The fusion of OT and IT is allowing manufacturing organizations to drive the digital transformations shaping the Smart Factory. Mature technologies combined with the emergence of new IIoT technologies will power the next generation of efficiency improvements, economies of scale, and capabilities that will be seen in the evolution of the Smart Factory.

Daniela Previtali, global marketing director, Wibu-Systems AG. This article originally appeared on the [Industrial Internet Consortium's \(IIC\) blog](#). The IIC is a CFE Media content partner. Edited by Chris Vavra, production editor, *Control Engineering*, CFE Media, cvavra@cfemedia.com.

ONLINE extra

Learn more about the IIC's findings about the [Smart Factory and discrete manufacturing in their white paper](#).
