

ST and the Coming of "Smart Industry"

Two hundred years after the dawn of the Industrial revolution, the concept of the factory has barely changed. Typically, a factory produces one kind of product at a predictable rate. This model has persisted even though changing what the factory makes – or repairing equipment – often requires considerable downtime and re-engineering because we didn't have better options.

Today, semiconductor technology is helping the Industrial world change in a trend that goes under a variety of names including Industry 4.0, the 4th industrial revolution, Industrial Internet of Things (IIoT) and smart manufacturing. At ST we call this trend "Smart Industry" and recognize how it can radically change the way factories work. The factory in the emerging "Smart Industry," is less like a regularly beating mechanical heart and much more like the central nervous system that is continually adapting to new information from its environment.

Machines in these factories will have the built-in intelligence and connectivity that allows workers to monitor their operation and anticipate the need for maintenance and even repairs. Rather than setting factory output by just the raw capabilities of machines, a web of smart analytics will keep real-time tabs on the needs of the supply chain and adapt production accordingly. Those analytics will also be crucial to easy re-configurability that will adapt a factory's static output to allow companies to keep up with the constantly changing needs of their customers. And these factories will of course be safer for the people working there.

Interest in energy efficiency will also be fundamental to everything from assembly lines to factory lighting. With factories accounting for 40% of the world's energy consumption, reducing their energy use will play a major role in putting the planet on a more sustainable course.

To make industry smarter we see industrial infrastructure evolving in three directions:

More Efficient

- Higher efficiency can be improved at all points in power usage with a focus on power conversion & energy harvesting, power management, power storage and motor control (since 50% of the energy in a factory is consumed by electric motors).

More intelligent and aware

- Making machines aware of the humans around them and providing new interfaces, including smart tools, augmented reality and touchless interfaces for easier and safer interactions.
- Sensors constantly collect information about every machine and then use safe-and-secure distributed local-processing to turn the data into information, allowing real-time monitoring and predictive maintenance and repair.
- Products contain the instructions for their manufacturing and carry that information with them throughout their lifecycle.

More Connected

- Machines are connected inside the factory to the larger supply chain and to the cloud, allowing orders to be customized in real time and manufacturers to build only what is needed enabling optimal planning and flexibility in manufacturing.
- Real-time communication down to the lowest level of sensors and actuators, ensuring optimal reactivity and real-time analysis processes.
- And of course all of these communications are secure.

In a number of important cases, the manufacturing sector is collaborating to help drive these innovations and ST fully supports these endeavors.

Silicon, the unique semiconducting element used in the microelectronics that underlies all of today's high-technology segments, is the key enabler behind Smart Industry and the digital intelligence that it makes possible throughout the entire supply chain. As a supplier with over 30 years' experience in developing products for factory automation and industrial applications, ST is playing a leadership role with its catalog of products that help make smart industry a reality, today. ST's product range includes smart sensors and micro-actuators, as well as ultra-low-power real-time connectivity, and power-supply and -management solutions. ST also offers a comprehensive range of microcontrollers that cover the entire price-performance spectrum, from low-cost, energy-efficient, and robust 8-bit MCUs to the highest-performance 32-bit ARM® Cortex®-M-based devices. ST's flexible and powerful development tools, including the STM32 Open Development Environment, simplify development and accelerate time-to-market.

A few examples illustrate ST's position at the leading edge of the move to the Smart Factory.

- Data centers and server farms account for about 1% of global electricity consumption. While the printed circuit boards inside computers and servers have traditionally operated at 12V DC -- supplied by rectifying and down-converting from 240 or 120V AC power source -- the engineers at Google, responsible for designing giant data centers, have maximized energy efficiency by running server motherboards at 48V. ST's innovative 48V isolated resonant direct-conversion technology, implemented in a 3-chip set, has become the industry's go-to solution for efficient, reliable 48V power supplies, and it is now being rolled out to data centers powering the Internet's busiest websites.
- Highly intelligent and ultra-precise motor controls enable the creation of the robotic systems that play a critical role in the modern factory. These motors can power a range of machines from those using large and

powerful motors to those requiring ultra-precise micro-motors. ST offers a complete suite of motor-control products, including microcontrollers, power-supply and -management systems, sensing devices, and connectivity modules. In addition, the Company provides high-quality design tools to simplify and build smart motors into industrial applications. These smart motors provide the intelligence necessary to, for example, make the sort of minute spin-rate adjustments necessary to optimize performance and minimize wear. They also help engineers design robots that can better "see," "feel," "smell," and "hear" their environment, so they can identify changes and make appropriate adjustments.

The day is not far off when the factory has been transformed into a model of flexibility and efficiency in which downtime and waste are things of the past, and digital information is more useful than all the gears and pulleys, steam, and coal of an earlier era. The day of Smart Industry.