Machine Sensorization and Digitalization

Discover how you can power your industrial processes with a data-driven approach

SICK
Sensor Intelligence.

Introduction

Since 2011, the Fourth Industrial Revolution has been changing the game in industrial manufacturing. With trends and strategies constantly popping up, it can be hard to keep up with what may work best to create a connected, networked, and digital manufacturing or warehousing facility. But have no fear, SICK's Consulting and Digital Solutions team brings forth a wealth of knowledge to aid in the digitalization and networking of machines

In this document, we'll break down machine data, digitalization, sensorization, remote monitoring, analysis, and diagnostics.

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What is Industry 4.0?

The Fourth Industrial Revolution, often called “Industry 4.0,” is a moniker for the sweeping technological change happening in the world right now. The term was coined in 2016 by Klaus Schwab, Founder and Executive Chairman of the World Economic Forum (WEF).

It is characterized by the advancement of manufacturing to create smart factories – one that learns as it works, continuously adapting and optimizing processes. These new technologies have allowed the physical and virtual worlds in production and logistics to merge to form cyber-physical systems.

Since 2011, these developments have been referred to collectively as Industry 4.0. Machines have the ability to communicate with one another autonomously, thereby optimizing process flows. Industry 4.0 clearly relates to networking in the industrial field, and sensors play a very important role in the value creation chain in this area.

The prerequisite for communication is an abundance of information, which is what smart sensors deliver. The smart factory is a prerequisite for Industry 4.0. Every sensor, every machine, and every human involved can communicate with and among one another at any time. This information exchange does not end at the factory gates, however.

The interplay of edge and cloud also allows production and data management from and to the outside. This intensive cooperation between technology and humans makes the process more transparent, productive, and profitable.

Machine Data Increases Productivity

Digitalization has made machine data available for remote diagnostics and analytics, which has then advanced the promise of productivity as a service, equipment as a service, and maintenance as a service. All of these services are an offshoot of digitalization.

From the digitalizing of sensors and production data from a paper system into Excel spreadsheets, we're all aware of how digitalization has provided access to a lot of raw data.

The next step is to combine this raw data with some contextual information to make it into actionable data. There's no shortage of raw data but turning it into actionable data is the challenge. This process of turning adding actionable data in our daily operations is what we are now calling digital transformation. How do we transform our operation and our businesses using this digital data?

Traditionally, once the machine builder sets the equipment and successfully installs it, they have very limited insight into their equipment. Imagine having access to real-time operational data to see how well your equipment is performing, analyzing if the machine has been used ideally, for example, within the design specifications, and performing remote maintenance where you can see metrics drifting or components in the field, this enables the machine builders to provide additional services to their customers, like maintenance as a service.

So, digitalization is opening up everything that you mentioned, productivity as a service, equipment as a service, maintenance as a service, access to data so you can do your own R&D. That's a lot of things that digitalization is making changes into the industry.

Digitalization and Remote Connectivity

Sensors are the backbone of the digitalization movement. The Fourth Industrial Revolution, with its digitalization and networking on machines, has been changing our life for some time now. These new technologies have allowed the physical and virtual worlds in production logistics to merge.

Machines can communicate with each other autonomously to optimize process flows. Industry 4.0 clearly relates to networking in the field, with sensors playing a very important role. When it comes to technologies, the most important factor is that it provides the ability for machines to talk to each other, see each other, and communicate. This communication is an abundance of information provided by smart sensors.

Other things like big data analysis, machine learning, artificial intelligence, edge computing, and cloud computing, are all helping us get a better insight into machine performance as we move forward.

Productivity Gains from Maintenance

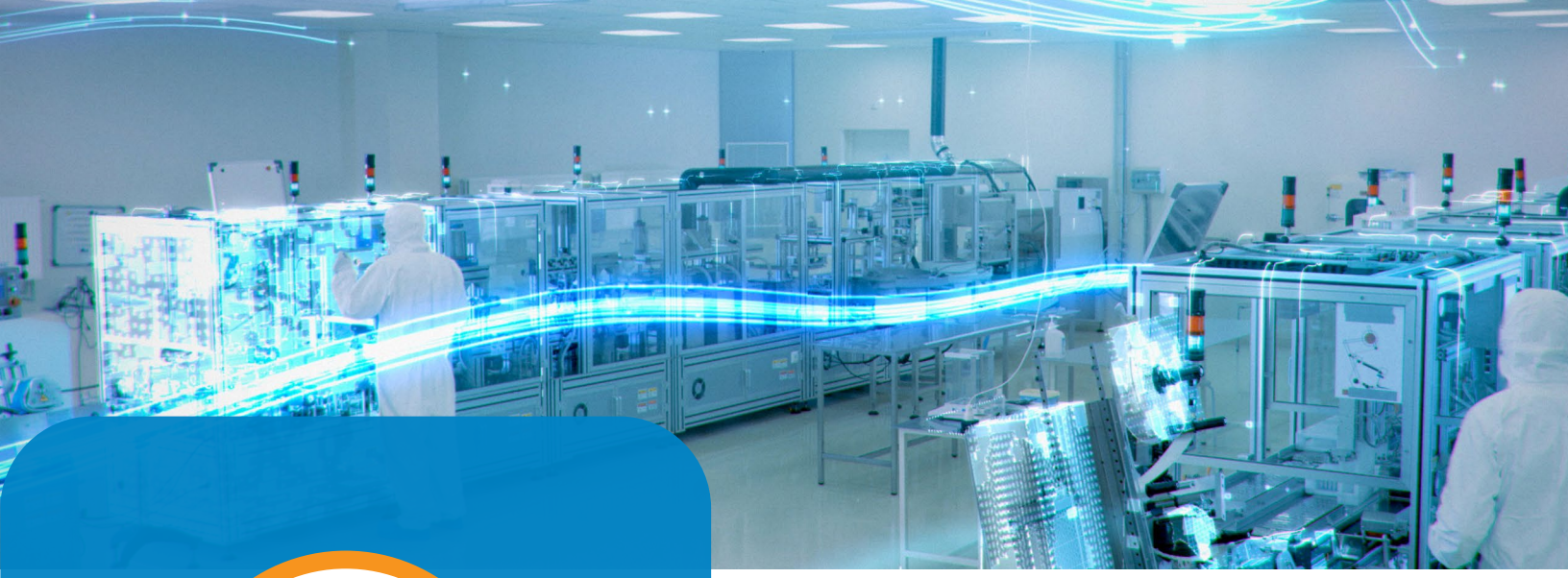
With any machine process, the biggest gain for productivity is in reducing downtime. This is often done through predictive or prescriptive maintenance, but besides maintenance-related applications, other applications are benefiting from this digitalization.

Machine digitalization is ultimately about access the information available, which makes smart sensors of vital importance. Having sensors on the machines to sense the process variables and make them available for either machine control or to perform production counts, quality control, besides productive maintenance.

Thus, these sensors can also transmit the data to higher-level systems for data analysis or to feed into digital twins. There are cases where machines have been commissioned with a very skeletal crew at site, while the majority of the team watched and monitored the operations remotely, because now everything is connected to the cloud.

Many customers have done virtual factory acceptance testing, which allows customers to conduct a walk through with a camera, but also monitor all the data coming directly on a dashboard coming in and see the operations in action. The possibilities are endless of what you can do. Once the data is available, what you do with the data, and how you use the data, there is no limit to how you want to use it.

In some instances, SICK is connecting our sensors to an edge gateway that is then transmitting the real-time status to our cloud solution. Machine builders can then monitor the various parameters, and can then be deployed globally, but they can still watch these monitors and watch these parameters and the settings. Based on all the different criteria, the machine builder can schedule the field-service team to go out there to fix any abnormalities or replenish any stock.



Digital Twin

A digital twin is a virtual model designed to accurately reflect a physical machine or asset.

Machine Digitalization

The conversion of a unit of data, such as a mechanical reading, to an electronic format.

Machine Digitalization and Digital Twins

A digital twin is a virtual model designed to accurately reflect a physical machine or an asset. The machine being virtualized is outfitted with various sensors related to vital areas of functionality. The most important thing is that the physical asset needs to have a lot of sensors that pick up the data so you get a real-time view of what's happening.

These sensors produce data about different aspects of the machine's performance such as energy output, production counts, temperature, vibration, and more. This data is then relayed to a cloud system and applied to the digital copy. That digital copy is what we call the digital twin.

You're getting the real-time data from your physical machines, and you're transferring them to a virtual copy, which exists in the cloud, which you are calling the digital twin. So once informed with this real-time data, the virtual model or the digital twin can then be used to run simulations, study performance issues, and generate possible improvements, all with the goal of generating valuable insight, which can then be applied back to the original machine.

Sensorizing Legacy Machines

One of the biggest misconceptions regarding digitalization is that it requires machine replacement or even at least an upgrade to what's in operation. So how can a machine builder execute an affordable modification to machinery in existing brownfield locations where there's already an installed base?

It's a common mistake to think that legacy systems must be upgraded or replaced to take advantage of digitalization. Instead of a complete upgrade, what is typically needed is the addition of sensors on the existing machinery. This is referred to as sensorizing the machines. Do you have sensors to pick the values, the variables that you're looking for, the indicators that you're looking for? If you have those today, you collect that data, then the question is, how do you get the relevant data out of those systems?

If you have older sensors, if you have older machines, SICK can still connect to those with various new gateways. You don't have to replace the machines or buy new equipment with the new sensors on them, you can sensorize your existing equipment and pull all the data out as needed.

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