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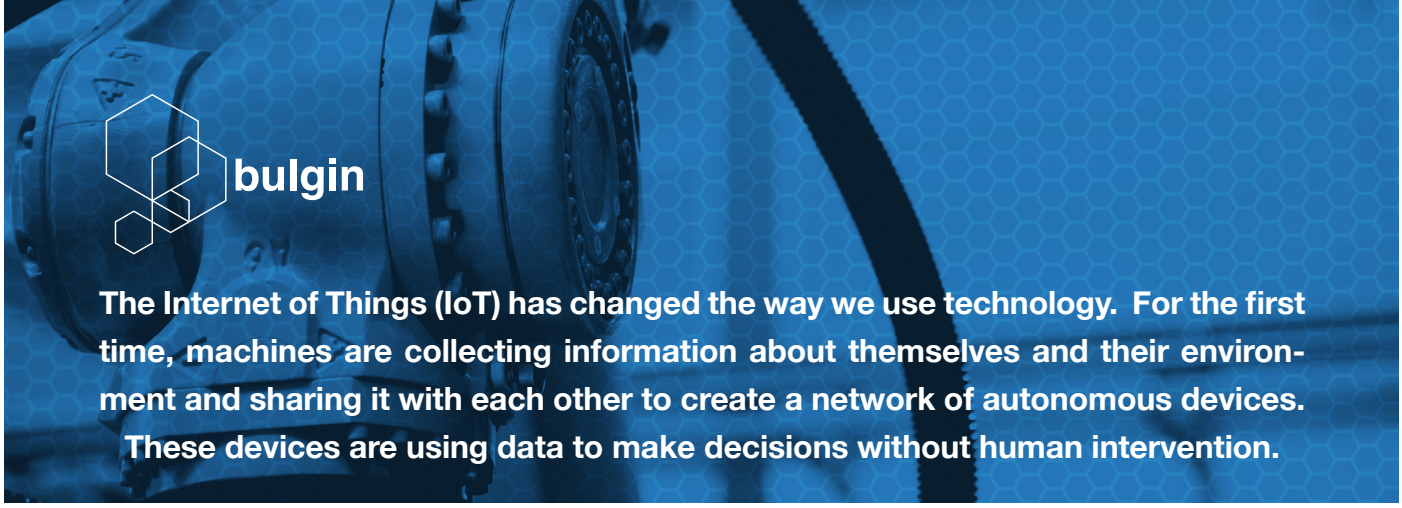
The Challenges of Implementing IoT in Industrial Automation Environments



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The Internet of Things (IoT) has changed the way we use technology. For the first time, machines are collecting information about themselves and their environment and sharing it with each other to create a network of autonomous devices. These devices are using data to make decisions without human intervention.

Most of us have seen the effects of the IoT in the domestic marketplace. From refrigerators that inform us when we need to order groceries to smartphones that let us to control our heating remotely, the IoT is creating a new generation of smart homes.

However, the IoT is not only limited to consumer devices. The potential for the Internet of Things to transform the industrial environment is far greater than in the home. It has even been suggested that the Industrial Internet of Things (IIoT) is the beginning of the next industrial revolution, a revolution that has even been given its own name - Industry 4.0.

Terminology and Topology

The purpose of the IIoT is to bring every element of the manufacturing process together in order that it functions as a single entity, often known as the smart factory. However, in order to illustrate how the IIoT works, it is important to understand the structure within this new factory and how it affects the production process.

In the traditional factory, all elements of the manufacturing process were separate, from the receipt of raw materials, through production and finally to the despatch of completed goods. Each machine within the production line was separate from all others, and the process was managed from a high level. The factory was organised in such a way to be very efficient at one task, but not flexible enough to be able to accommodate changes easily.

The smart factory provides the flexibility that traditional factories cannot. The IIoT allows each machine to collect data about its own function and status, which is then shared with the entire network. Not only does this sharing of information allow the efficient running of the factory, but it also allows any potential problems to be identified so that action can be taken to minimise disruption.

The topology or structure of the smart factory is an important factor in its success. The topology is described as a series of layers. At the top is the enterprise layer. Contained within this layer are all of the systems that administer and control the business, from sales and marketing to logistics and maintenance. It is at this level that the overall running of the organisation is conducted.

Below the enterprise layer is the control layer. This contains the systems that receive the demands from the enterprise layer and converts them into a work schedule, ensuring that the raw materials are in the right place and that the operators are ready.

At the lowest level is the device layer. This is the factory floor where all of the machines are operated. In a traditional factory before the era of the IIoT, these machines would all have been controlled locally. Skilled operators would ensure that the processes ran smoothly, with little interaction with the rest of the operation.

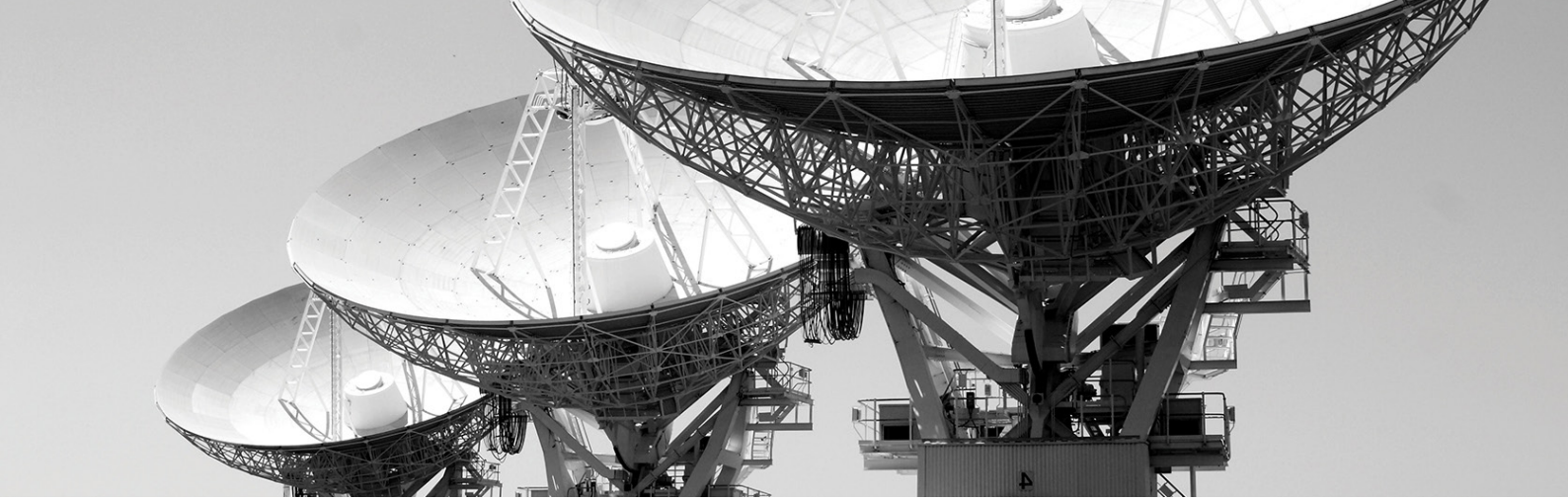
With the advent of the IIoT, all of the machines at the device layer are connected, sharing data both with each other and with the upper layers of the business. Therefore, information has become a critical raw material within the smart factory, and it is shared between all layers of the factory.

Industrial Automation and the IIoT

Industrial automation forms an integral role in the modern production line. From simple motors to complex robots, many manufacturing processes take advantage of the latest technology to reduce the need for human input. This automation equipment has become even more important in the new smart factory.

In contrast to traditional factories, the latest generation of industrial automation equipment plays an active and important role in how IIoT has changed the manufacturing environment. As the IIoT depends on the feedback from all elements at the device level, there is the need for industrial automation equipment to be equipped with sensors that monitor their performance. This information is shared with the control level in order to understand how the machine is functioning.

This has brought with it a number of benefits for the user. The first is that the performance of the production line can be viewed as a whole. If one machine is running more slowly than others, the production line can be reconfigured to allow for the change. In fact, the two-way communication with automation equipment has a significant effect on the flexibility of manufacturing by allowing the user to respond quickly to changes in demand.



Monitoring the performance of individual machines also brings with it advantages when the time comes to carry out maintenance of the production line. With a wide range of parameters being recorded from temperature to energy consumption, the data collected provides early warning of any upcoming maintenance requirements. For example, an increase in vibration within a motor might suggest that a bearing needs to be changed, or a rise in the energy needed for a moulding machine could indicate a failing heating element.

It is this sharing of information within the smart factory that makes it so important to manufacturers. The smart factory will feature improved flexibility and the ability to respond rapidly to changes in demand. Analysing performance data allows increased emphasis on preventative maintenance to reduce down-time. These features will provide manufacturers with a reduced time to market and a true competitive edge.

Tough Conditions

The factory floor is a tough environment. Depending on the particular industry, factories can be home to hazardous atmospheres, harsh chemicals and waste products. Even industries that depend upon sterile environments, such as the food preparation and pharmaceutical sectors, use machines that will create heat and vibration whilst working, and will also require periodic cleaning.

Even under these harsh conditions, collecting data from machines is a vital element of the IIoT. The smart factory depends on the feedback provided by the constellation of sensors that will be part of every IIoT installation, and each of these sensors will require both power to operate and connection to the network so that they can share information. This means that the number of connections required within the factory will increase.

In fact, the volume of information travelling around the smart factory has given rise to new solutions. One of the most interesting is the advent of edge computing. With the profusion of drives, controls and sensors in the modern factory, the time taken for data to be shared and processed becomes a real concern. In order to minimize latency, edge computing brings intelligence to the edge of the network, and closer to the point of need. This trend will see more sophisticated equipment installed on or around machines to create the shortest possible lag. This equipment will need protecting from the harsh factory conditions, even while it is providing the high-speed, secure communications that allow it to integrate with the rest of the network.

The increase in the number of devices that are part of the network, along with the deployment of sophisticated computing equipment on the factory floor, has led to the need for greater numbers of connectors than ever before. These connectors need to offer superior performance, whether delivering power to energy-intensive processes or providing secure high-speed communications for intelligent automation equipment. At the same time, these connectors need to be robust and sealed, ready to resist the harsh environments found on today's factory floor.

Connectors need to be designed to provide sealing against the ingress of water and other contaminants, and the materials from which they are constructed need to resist the chemicals that will be found in the environment. In the event of a hazardous atmosphere, the connectors need to be ATEX rated to ensure that they will not create the conditions for fire or explosions.

Connectors for the Factory of Tomorrow

At the same time, connectors need to be easy to assemble and terminate. Data connectors need to be able to interface with existing computer networks using familiar methods such as RJ45 and USB, and potentially even fibre optics. Finally, the volume of connections required for the large number of sensors, drives and controls in the smart factory means that connectors should be small and compact.

The Industrial Internet of Things offers a huge opportunity for manufacturers to adapt to new ways of working. The smart factory market is growing, with Reuters predicting a growth of 10% per annum for the foreseeable future. The adoption of this new technology will see both brand new factories being built and existing users adapting their facilities to take advantage of the benefits it will bring. Connectors will form an important part of this revolution. Make sure that your connectors are ready for the challenge of the new industrial environment.

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