Using Industrial IoT for existing plants
Increase and permanently monitor the effectiveness and quality of processes

Industrial IoT gateways are intelligent links that are used at the interface between the control level (Operational Technology = OT) and the industrial IT systems (IT). IIoT gateways are also referred to as edge gateways. They make it possible to integrate both new plants (greenfields) and existing plants (brownfields) into modern automated processes without having to change the existing control hardware or software.

This means that even older machines and plants can now communicate with modern industrial IT systems. IIoT gateways are used whenever machines and plant operators want to automatically collect and analyse data from their machines in order to tap into additional value-added potential. Nowadays, it is clearer than ever to operators of production plants that the optimisation potential of a production infrastructure through the use of intelligent automation is great and that additional value-added potential can be generated from existing plants through a higher degree of automation. Since older machines are often already written off, the economic effect of increased productivity - without major new investments - is particularly interesting and very helpful in order to survive in international competition.

The linchpin in the modernisation of automation technology is the operating data of the machines, which must be recorded and evaluated as precisely as possible. In addition, the conclusions drawn from these evaluations must also be transferable to other production sites - regardless of whether they are new plants or existing plants.

Overcoming hurdles

In reality, there are a number of hurdles to overcome during implementation. In many production facilities, it is not uncommon for devices, machines and systems to have been working autonomously for three or four decades on a single order without being connected to a higher-level production system.
The interface landscape in a typical production hall is as heterogeneous as the machinery.

In order to maintain the necessary overview, a lot of manual work is still necessary today. Data has to be taken from individual machines, noted down manually and finally entered into Excel lists or production systems. This is not only time-consuming, but also error-prone, expensive and inefficient. In addition, it is always accompanied by a loss of information. In many cases, it is quite easy to obtain the most important information from an existing machine for online evaluations and to use it for optimisation purposes.

In order for the modernisation of existing plants to pay for itself as quickly as possible and to minimise the risk of production disruptions due to changes, it makes sense to leave the machine control system with its hardware and software as unchanged as possible. Often, the documentation

no longer matches the current version of the PLC program, or the configuration program, which is getting on in years, can no longer be run under the current Windows version.

True to the motto "Never touch a running system", it is important during modernisation to make do only with the possibilities that are supported by the respective control system as standard. This challenge can best be solved by using an IIoT gateway which, on the one hand, masters as many of the various PLC and fieldbus protocols as possible and, on the other hand, supports the current communication standards such as OPC UA and MQTT for coupling with the modern IT systems.

Upgrade for existing systems

IIoT gateways are true multi-talents, because they support many different protocols and usually also offer the possibility for remote access via a VPN connection.
For coupling to the machine controls, the gateways support a variety of different fieldbus, Ethernet and PLC protocols. The gateways can thus communicate with almost all current and many older control systems.

In existing plants, older controllers such as the Siemens Simatic S5 are often still used, where proprietary protocols such as the Siemens MPI protocol are used for communication. When selecting an edge gateway, it is therefore important to find out which protocols are supported by the controllers used in the existing machines and whether the planned edge gateway also supports these protocols.

Edge gateways are usually connected to the configuration port of the control system and thus have access to the programme and data areas of the control system - without having to change the PLC programme or the configuration of the control system. In the event that communication cannot be established due to incompatibility of the pro-tools, powerful edge gateways also offer the possibility of directly connecting digital or analogue I/O signals and integrate the data from these signal sources into the data stream to the higher-level IT systems. Coupling to the modern IT systems takes place either locally or remotely via a secure VPN connection and standardised protocols such as OPC UA or MQTT.

Reaching the goal in small steps

Depending on the degree of automation in the respective inventory plant, it is first useful to pay attention to the machine availability and the actual utilisation. If there are several identical machines in the plant, it makes sense to benchmark the individual machines and their respective operating procedures.

In practice, it has proven useful to start with small steps and gather experience before introducing plant-wide or even cross-site measures. Often, even simple measures such as setting up remote access for support by the machine manufacturer in the event of a fault can lead to considerable improvements. Because this also creates opportunities for predictive maintenance. The way is the goal, but waiting until there is a generally applicable patent solution is the worst option.

The following approach has proven successful in practice:

Step 1: Set up remote access
In the first step, remote access to the respective control is established at the machine on site by connecting the IIoT gateway, which functions as a VPN router and enables remote access to the control on site via a secure VPN connection. Suitable IIoT gateways implement the guidelines of the Federal Office for Information Security for cyber security in industrial applications according to ISA62443 and NIST SP800 in accordance with the "Defence in Depth" principle for staggered defence and thus meet the highest security requirements.

Step 2: Monitor and collect data
Once secure remote access to the plant has been established, important production and quality-relevant machine data such as operating status, utilisation and output are continuously recorded, visualised and made available for evaluation in superordinate systems, analysis tools and databases. This is where the keyword "Big Data" can be classified here.

Both the system operator and the machine manufacturer can analyse and monitor the machine data via the VPN connection. It often makes sense to initially record a few data points over a longer period of time and to mark important events (malfunction, break, quality problem) in the data stream.

Step 3: Recognising correlations
Step by step, correlations can be recognised and measures for optimising productivity can be derived from them. For example, predictive maintenance can increase availability and reduce costs. Energy and resource consumption can be determined, presented and reduced on the basis of the total data. The machine data also form the basis for optimising utilisation, increasing throughput and improving quality.

The same VPN connection can be used to implement further applications (remote services) that create added value and optimise the integration of the individual system components into a perfectly coordinated overall system. Remote services are the basis for more intelligent and flexible factories and enable new digital business models with a focus on life cycle and service optimisation.

Under the framework conditions of Industry 4.0, companies can offer their products in a completely new way or generate additional customer benefits through value-added services throughout the product life cycle. The procedure can be clearly illustrated using a pyramid.

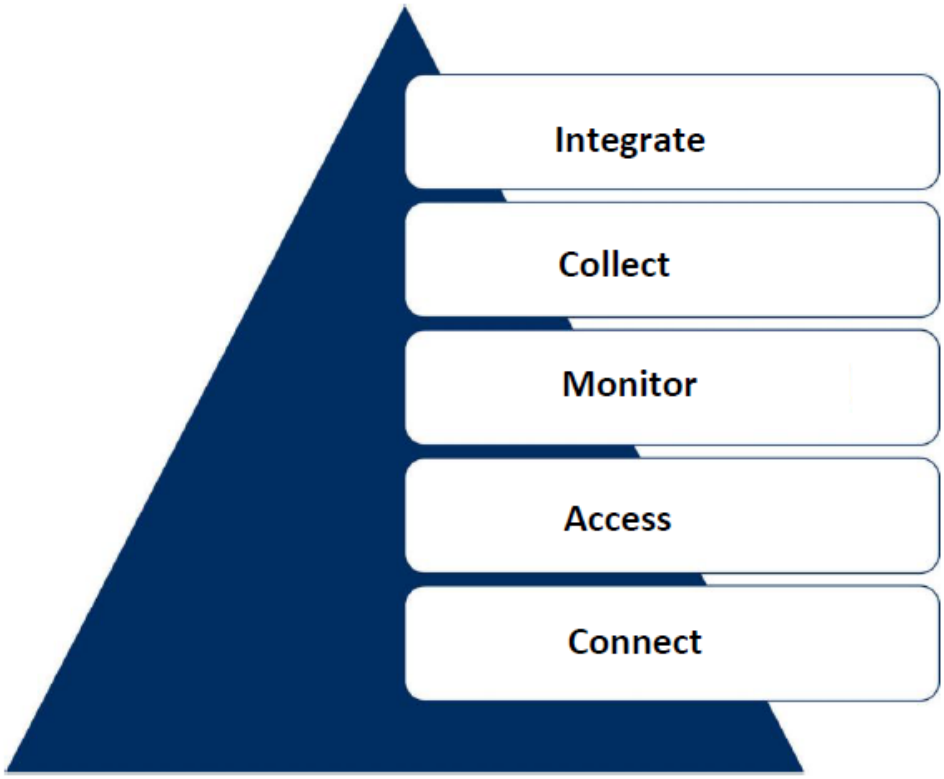
Partnership for the solution

IIoT gateways play a key role in the retrofitting of existing systems. However, the use of such a gateway alone does not generate added value. Added value is only created by analysing the data and the resulting optimisation of the production process. Close cooperation between the plant operator, the communication specialist and experts for data and process analysis is required for implementation.

For example, HMS Industrial Networks, as an expert in communication technology, has a network of specialised and qualified partners for the areas of data visualisation, data analysis and data management.

Key function

Data communication via flexible IIoT gateways plays a key role in the retrofit of existing plants. In order to communicate with all components in heterogeneous production environments, a multitude of interfaces in all directions of the process chain is a basic requirement. Modern IIoT gateways create the necessary communication channels to bring together data from all common systems and components from different manufacturers and integrate them into higher-level IT systems. Only through the cooperation of qualified and specialised partners can a complete solution be created with which plant operators can realise new value-added potential with existing plants.



Step by step to increase value creation from existing plants.