The Wireless Path to Success

Wireless communication in systems of the food and beverage industry, a reliable alternative

A prime example for the implementation of a consistently integrated automation concept, from the control system down to the field, is the new Technical Service Center for Food Technology of Zeppelin Systems. The food experts wished to have as few cables as possible so that the modular test facility could be converted as fast and efficiently as possible. The data required for the plant control and for operator monitoring and control are therefore transferred as far as possible through IWLAN. Which proves: Wireless communication in an industrial environment is reliable.

2.6 million Euros were invested by Zeppelin Systems, one of the global leaders in plant engineering for handling high-quality bulk goods and liquids, in its new Food Technology Center in Rödermark, Germany. It is a technical service center, customer center and showroom all in one. The new building meets all the requirements of modern plant technology. "Standstill is not an option. We installed all the cutting-edge technology available in the Technical Service Center", says Andreas Hofmann, Head of Process Engineering at Zeppelin Systems in Rödermark, not without a certain sense of pride. "It was my express wish that we would be extremely modular", Andreas Hofmann continues. "We took the modular concept to its limits."

The Head of Process Engineering with an in-house invention: The mobile operating station with touch screen can be used to control the entire plant from any spot in the hall.
IWLAN, useful for moving objects

When talking about cutting-edge technology, wireless communication is a vital part which is often struggling to gain acceptance in other areas. For the Head of Process Engineering the decision for Industrial WLAN (IWLAN) was clear from the very beginning and the company placed its trust in its automation partner Siemens. The result: Hardly any cables in the whole Technical Service Center. The wireless plant bus, which is based on the PROFINET bus system, transfers standard and process data in parallel, just like time-critical and fail-safe data—securely, reliably and in real-time.

Operator control and monitoring is also implemented completely via the bus. Each plant module, whether simple vessel, agitator vessel or screening machine, only requires two external energy sources, namely electricity and compressed air. Andreas Hofmann states: "Here, where maximum flexibility is required, WLAN is an almost perfect solution. The Technical Service Center is also a playing field for us on which we can test to what extent modularization makes sense. Wireless may be good, but it is not an objective in itself. In the end it is always competitiveness that counts. And control technology is one of the major factors." Wireless communication therefore is not a panacea for the food expert, but he believes that the degree of acceptance with users will continue to rise. Not least because the younger generation has grown up with wireless technology at home as a part of life.

WLAN always makes sense in the industrial sector in particular when moving applications are involved, for example, in case of container systems or industrial transportation systems. And in the new Technical Service Center of Zeppelin Systems there are practically only moving objects.

PROFINET offers another advantage: The number of modules is virtually unlimited. The number of nodes is often limited in other bus systems. And PROFINET communication is possible completely without wires: "When we have new modules, we simply equip them with a WLAN module and do not have to worry about linking them with the PLC system", emphasizes Andreas Ott, member of the Automation and Control Technology Department at Zeppelin Systems, who played a decisive role in planning the wireless system.

Andreas Ott, the engineer responsible for the automation and control technology of the Technical Service Center, with a wireless SIMATIC Mobile Panel 277 from Siemens. It is ergonomic and robust and is implemented with IP65 degree of protection and was conceived especially for wireless application in PROFINET environments.
Two access points ensure WLAN communication

The shielding of the WLAN through the many metal surfaces was a real technical challenge. The system “lives”, changes every few days and the design influences are constantly changing. In order to achieve optimal positioning of the SCALANCE W788 access points and excellent coverage of the complete hall by the WLAN signal, Siemens experts measured the radio coverage in the building very carefully and recommended the use of two access points to be absolutely sure. This recommendation paid off for the company. The hall has a stable radio field, right into the remote corners, and thus ensures reliable communication.

The access points not only convince with their reliability, robustness and security, but also allow the implementation of wireless networks with two different frequencies. The responsible personnel at Zeppelin Systems opted for the 5 GHz frequency band, because it is far less error-prone that the frequently used 2.4 GHz band. The iPCF function (Industrial Point Coordination Function) allows particularly rapid transfer of the information. It even offers real-time wireless communication when nodes move from one radio cell to another and update times of up to 20 ms are required.

iPCF extends WLAN through a deterministic access procedure that assigns transmitting and receiving times to all nodes cyclically and coordinated. Simple WLAN, on the other hand, is used by the node that “gets there first”. Other nodes can then be slowed down and critical response times can be exceeded. Up to 50 nodes can be operated simultaneously under real-time conditions in one radio cell. This is a unique characteristic of the Siemens technology that cannot be offered by a standard WLAN.

Two radio networks were deliberately established in the Technical Service Center. One of the access points therefore has four antennas instead of the usual two. One network is solely dedicated to production. Encryption takes place through reliable authentication and encryption methods (WPA2, AES) that satisfy even demanding administrators.

The other network can be used by employees to access Intranet and Internet. It is protected by a so-called radius server that checks during login whether the user has the necessary authorization. This means it is not necessary to change the access data of each individual device every time an employee resigns.
Harmonious interaction of PROFIBUS and PROFINET

PROFIBUS and PROFINET communication takes place side-by-side in the Technical Service Center. “The decisive criterion is the use of the modules. If a module is always located in one place, the data is transferred by PROFIBUS. All flexible modules definitely have a WLAN connection”, explains Andreas Ott. If the module is used only in the control system of the Technical Service Center, it transfers its PROFIBUS signals through an IWLAN/PB Link PN IO from Siemens and is controlled by the higher-level SIMATIC S7-400. Modules that are to be exhibited at fairs or are provided to customers for testing are different. A screening machine was, for example, also equipped with its own PLC and an HMI.

Because an Ethernet connection is required here, SCALANCE W747-1 client modules are the first choice. They convert the WLAN signal so that it is Ethernet-compatible and ensure powerful wireless communication even under the toughest industrial conditions.

SIMATIC S7-300 and SIMATIC S7-1200 control modules as well as IM 151 CPU interface modules operate in the autonomous modules. And not surprisingly, they too communicate wirelessly with the controller in the control system. The industrial transportation system used has its own safety-related SIMATIC S7-315F controller. Here too IWLAN transmits safety-related and real-time information through the same communication channel.

Do-It-Yourself with SIMATIC WinCC SES

The company also has to map different processes to control technology systems. The challenge for the Technical Service Center team was to create an interface through which non-electricians and non-programmers can work. “And I want to be extremely efficient. It’s not much use if the new test structure has to be programmed for days on end by the electrical departments every time. I have to be able to do it myself with my team as an ‘amateur’. The ‘matrix-based’ technology in WinCC SES makes this possible”, says the Head of Process Engineering.

SIMATIC WinCC SES (Sequence Execution System) is an add-on for the tried-and-tested operating and visualization software from Siemens that was developed especially for the requirements of the food and beverage industry. The software for the sequential control of recipe-based and sequence-based processes, such as blending procedures in food production, saves a considerable amount of time in engineering and commissioning through prepared visualization templates and function blocks. The user can describe and modify the production processes simply without system know-how by means of an application-oriented user interface. The add-on supports the module character optimally. Only when the module really changes, for example though a new motor, does Andreas Hofmann require an expert for programming.
Available solutions: Mobile operator control and monitoring

One of the highlights of the system is a mobile operator control and monitoring system. The data is transferred wirelessly via PROFINET to the Industrial Thin Client SIMATIC ITC 2200 – a solution, developed by the plant engineer, not available in a catalog. The 22” touch panel was fitted into a normal industry-compatible control unit, equipped with two WLAN antennas and mounted on four wheels. The ingenious aspect here is that the entire plant can be controlled with the mobile “screen extension”. “One can move directly to any test and work at any point in the hall. I am always right there and can see exactly whether the system docks in correctly. During the test set-ups we have to hear whether it ‘grates’ anywhere – for which the mobile touch panel is optimal” says Andreas Ott. And Andreas Hofmann adds: “An experienced plant operator relies on his hearing. But what one hears should also be visible. This is why this self-developed decentralized wireless solution is simply ideal for us.” For the company the focus lies on monitoring the system. But trend tracing is also possible. And the team of the Technical Service Center has got to cherish the implemented trace functionality.

Another extremely useful aid for the team in day-to-day operation is the SIMATIC Mobile Panel 277 IWLAN V2 on which WinCC flexible runs. The complete machine control system can be operated via the mobile HMI device–including reliable operation and high safety. The ergonomically designed and robust panel is implemented with IP65 degree of protection and was conceived especially for wireless application in PROFINET environments. Its smooth changeover between several access points allows operation even in large plants.

From blimp to food technology

Zeppelin Systems GmbH belongs to the Zeppelin-Holding, based in Friedrichshafen, Germany. Even now, more than 100 years after its development, the legendary blimps can still be seen floating above Lake Constance. But the company is characterized by much more than its blimps.

As a global leader in plant engineering for handling of high-quality bulk goods and liquids, Zeppelin Systems GmbH works for industrial branches such as polymer plants, plastics processing & rubber plants, food and beverage, and supplies everything from basic engineering over manufacturing of own components to the final assembly of complete turnkey installations from a single source. Zeppelin Systems, headquartered in Rödermark, Germany has specialized in automation and plant solutions for silo facilities, conveyor systems and high-quality apparatuses in the field of food technology. Through the construction of a Food Technology Center the company wants to test its innovative solutions stringently and extensively. Also used as a customer center and showroom, the platform provides the perfect opportunity to gauge customer requirements and make innovative technology tangible.