

Integrated automation in hospital logistics

At Ingolstadt Hospital in Bavaria, Germany, fully automated transport and product delivery systems have been implemented to guarantee the punctual provision of food, laundry and other hospital necessities and play a vital role in satisfying both patients and hospital staff.

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'Total Quality Management' is the guiding principle behind all patient-care procedures and other services provided at the Ingolstadt Hospital in Southern Germany. Simply stated, this involves keeping to deadlines and providing all services on time. One example of this and significant challenge is the need to supply three meals a day to more than 1000 patients in a precisely defined time frame. In addition, there is the provision on demand of medication, sterile utensils for care and treatment, fresh bed linen and cleaning agents. The prompt removal of all used items from the wards must also be guaranteed and needs a strict separation between the 'supply' and 'disposal' chains to prevent cross-contamination. An essential aspect of such a transport system is of course its smooth and uninterrupted operation.



Figure 1: Particularly at mealtimes, there are busy scenes in front of the elevators in the main ward building. Everything is managed quickly, safely and without collision by the control network.

At Ingolstadt Hospital, all these processes have been automated from the beginning. When the clinic was built in the early 1980s, an automated goods transport system (AGT) was installed by the Berlin-based Schindler Fördersysteme (Conveyor Systems) company. From the 'dispatch store' and the kitchen, this AGT system supplies the required goods to the central hospital ward building, the outlying psychiatric department, the emergency room, the OR and all other hospital departments. Every day, one thousand containers are transported via 13 traverse units on a ceiling-suspended rail system (Figure 1). Along the 500-m route, 11 stops are scheduled.

At these points, the containers are transferred onto platform trolleys, rolled into elevators and distributed over as many as eight floors. Stringent hygiene requirements are met by three integrated container cleaning systems.

After almost 25 years of satisfactory operation, a comprehensive modernisation of the entire automation system has been initiated. The hospital decided that it would be greatly beneficial to develop a technical solution using standardised industrial components. Automation and upgrade engineers jointly developed an end-to-end solution on the basis of standardised, high-speed series components from Siemens's range of automation products.

Totally revitalised electronics

Two main criteria for the selection of the control-and-drive system are 'compact' design and smoothness of movements so that food can be delivered without spillages. To meet these requirements, it was decided to implement a new Simatic central processing unit (CPU), a compact frequency converter, a series of asynchronous motors and Simatic OP3 operator panels (Figure 2) on each traverse unit.

Always at the height of events

To determine precisely the current position of each individual container on the 500-m-long rail track, the Moby D radio frequency (RF) identification

system was selected. Each of the 13 traverse units is fitted with a system that records and transmits the position from approximately 90 data memories mounted along the track. There is no physical contact as the units pass by. The information finally reaches the main controller via the traverse unit controller and a serially connected infrared system.

Experiments showed that the contactless data transmission functions perfectly, even when the traverse units are travelling at twice the normal speed. Control of the speed of the traverse units is regulated by means of the Moby system before curves, switches and the destination positions at the elevators. Magnetic switches ensure a precise approach to the transfer position. Once this is reached, the platform trolley moves out from the elevator, positions itself under the container, and the trolley table rises. The container lock on the traverse unit is released, the platform trolley and container are transferred into the elevator and automatically taken to the appropriate floor. The platform trolley then moves the container out of the elevator and lowers it gently onto its destination set-down point. Depending on the urgency, the staff on the ward are alerted to the arrival of the container by a visual and/or an acoustic signal.

Network controllers

The containers can be sent on their way to more than 30 transfer points. For this purpose, transfer buffers, which can hold either up to two or up to ten containers, are set up in front of each elevator in the kitchen and in the dispatch store on the supply



Figure 2: After entering the destination number on the Simatic OP3 operator panel, containers are automatically transported to the relevant floors from the dispatch store to the supply floor.

floor. To transport food and other 'clean' goods, it is only necessary to enter on the operator panel of the transfer buffer a two-digit number for the destination. As used containers are all destined for the collecting point at the cleaning station, no manual operation is required for their release.

The user interfaces are Simatic OP3 operator panels. "Handling has become easier and the operation of the system was quickly understood by the employees, which means that the system was readily accepted by all concerned," said Michael Meyer, Head of Technical Services at the hospital.

All floor controllers exchange data directly with the coordinating main controller by means of standardised communication processors and high-speed communication in data blocks. The main controller knows the destination and the current position of each individual traverse unit/container at all times, ensuring smooth, automatic operation.

In just four months, approximately 70 programmable logic controllers (PLCs) have been installed and combined into an efficiently functioning self-contained system. This is a made-to-measure and cost-effective solution that benefits from the use of common data management and standardised communication technologies.

Minimising downtimes

Any faults in this complex network are transmitted on the spot to a visualisation PC. This functions simultaneously as an OPC server and distributes the information to other client PCs in the kitchen, the dispatch store, the instrumentation and control centre and in the workshop. Errors can be quickly pinpointed and suitable countermeasures initiated rapidly.

"Availability levels are kept high. In this way we can guarantee that our patients are supplied exactly as planned with food, medicines and anything else they need for their comfort and well-being. We can

implement Total Quality Management in this elementary area without any compromises," concludes Michael Meyer.

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Figure 3: Combined PLC and operator panel