The Fuwai Hospital complex in Yunnan, China

Fuwai Hospital: PC-based building control system automates hospital network in Yunnan, China

Complex building automation requires more than 200 DDC stations and 1,200 Bus Terminal I/Os

According to China's national Class A Level 3 standard, the country's hospitals must be equipped with energy-saving building systems and the capability to reduce the overall energy consumption. Meeting this standard requires the installation of comprehensive automation systems to control fans, pumps and lighting, among other systems. Fuwai Hospital in Yunnan accomplished this with a sophisticated PC-based control system integrating more than 200 DDC (Direct Digital Control) stations.

Fuwai Hospital, which specializes in cardiovascular diseases, is located in Yunnan Province in Southwest China with connections to South Asia and Southeast Asia. It is operated by the government of Yunnan Province and the Chinese Academy of Medical Sciences. Inaugurated in 2014, the hospital has a total floor space of 229,500 square meters (almost 2.5 million square feet). It cost roughly 3.273 billion yuan (approximately 470 million U.S. dollars).

The 1,000-bed building complex, which consists of the Yunnan Fuwai Hospital and the Yunfu International Hospital, both for cardiovascular diseases, was designed to treat 1,200 outpatients per day, or 300,000 outpatients per year. The Yunnan Fuwai Hospital includes an emergency department building with four floors, a five-story building for medical technology, two inpatient buildings for stationary treatments (11 floors and 15 floors, respectively), a building housing the Southwest Medical Center of the National Research Center for Cardiovascular Disease (four floors) and 12 operating rooms. The Yunfu Hospital is housed in a 20-story multi-function building with rooms for outpatient services, medical technology, inpatient treatment and three operating rooms.

Open system architecture makes implementation easier

Because of the large number of buildings and the complex equipment they contain, automating the entire facility required an open and finely scalable control system. As a result, the people in charge selected PC-based control from Beckhoff because it features all the benefits of an open system with a wide spectrum of fieldbus interfaces. Another key factor was Beckhoff's successful history of building automation applications all over the world.

The objects controlled by the automation system are spread throughout six buildings. To control the various areas locally and independently, CX8090 Embedded PCs and BC9050 Bus Terminal Controllers from Beckhoff are used. The system also has more than 200 CP6606 Panel PCs for visualization and operation. The hospital's central monitoring center uses a workstation that runs the Windows 10 operating system. This is also where the TwinCAT OPC Server resides for communication with the various DDC stations. The data traffic between the monitoring software and the Beckhoff system also runs over OPC. The DDC stations are housed in high/low-voltage control cabinets and are used

CX8090 Embedded PC of a DDC station

Control center for monitoring the building automation systems across the entire hospital facilities

mainly to monitor the ventilation, air conditioning, cooling systems, the room housing the hot-water pump, lighting, water and wastewater, power supply and distribution, medical gas supplies and the hot water system.

More than 200 DDC controllers and 1,200 Bus Terminals, including more than 30 communication modules, were installed to handle more than 20,000 OPC variables. The highly efficient ADS communication and the multi-thread mechanism of the TwinCAT OPC Server are able to manage this large volume of data with ease.

Flexible, compact and powerful control technology

Fuwai Hospital uses the CX8090 Embedded PC to handle the performance requirements of the local controllers and communication gateways. The hospital's operator believes that its compact design and its low power consumption in connection with the high computing performance of its 32-bit ARM processor running at 400 MHz make it ideal for this purpose. TwinCAT 2 automation software is used for programming according to IEC 61131-3.

Three Ethernet ports and the support of a broad range of communication protocols such as TCP/IP, Modbus-TCP and ADS make the CX8090 particularly flexible. The modular I/O system can be adapted in accordance with the distribution of the respective data points. The Bus Terminals from Beckhoff support over 20 fieldbus protocols such as serial interfaces, Modbus-RTU, M-Bus, MP-Bus, DALI, EIB/KNX and EnOcean, which support access to third-party sensors and actuators. For example, the water meter uses the RS485 protocol, the power meter runs with Modbus-RTU, and the high-precision air conditioning system uses BACnet. According to Fuwai, all these devices and systems could be easily integrated with the Beckhoff system, which reduced the overall implementation costs. Based on the broad I/O spectrum from Beckhoff, which ranges from simple switch terminals to dimmer terminals, power measurement terminals and communication terminals with one, two, four or 16 channels, a DDC station can acquire not only the status of all devices, but also be used for the power data communication and as a gateway for communication with third-party systems.

Exact object control improves comfort

The water valve for fresh-air supply by the air handling and air conditioning unit is controlled via a closed-loop PID circuit that makes it possible to regulate temperature variations of as little as 0.2 degrees Celsius (approx. 0.4 degrees Fahrenheit) via TwinCAT PID function blocks. Since the characteristic values of the individual units differ slightly, a single set of PID control parameters is not suitable for all of them. According to Fuwai, the intuitive TwinCAT Scope View makes it possible to optimally visualize changes in the target and feedback values, which simplifies the setting of parameters considerably.

More information:
www.fuwai.com
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