When a building project is planned and executed, expectations tend to be high, and naturally the goal is to complete the project exactly as planned. After all, the home should be the domain of rest and relaxation so everything should be just as the owners dreamed. One could make a case that the final frontier of human comfort is in home automation. However, practical experience shows that there is a way to go for many high-end building projects to be executed harmoniously. The more trades and companies are involved in a building project, the more difficult the seamless implementation of the required comfort may become. The project goals can be achieved more successfully if as many tasks as possible are carried out by a single company because any requests for changes by the client during the construction phase or at a later stage can be implemented more easily.

An impressive home automation example is an exclusive urban villa in Hanover, Germany, for which the Beckhoff Group handled the complete design and installation. Around 1,200 square meters of living space on three levels plus a cozy basement accommodate 14 living rooms, bedrooms and children’s rooms, three offices, four bathrooms, two steam saunas, three kitchens, several utility, storage and plant rooms, a fitness room, and a high-end home cinema. The building has an elevator from the basement to the second floor. Two roof domes – one above the stairwell, the other above the spacious living room – provide plenty of sunlight throughout the house. In addition, the domes capture solar energy, providing a comfortable atmosphere in the winter. The two roof domes can be opened, closed and of course shaded either manually or automatically via a motor, depending on the weather situation. The automation throughout the house includes control of lighting scenes, window shading devices, daylight regulation with the aid of blinds, the heating, air-conditioning and ventilation system, the watering and lighting system for the garden including a fountain, all multimedia applications and numerous individual room controls (e.g. living room, bathrooms, fitness studio, cinema, etc.). If required, the whole system runs fully automatically without user intervention. Of course, the occupants can intervene to make changes at any time. In addition to various control options, the automation system offers extensive diagnostic options: it not only indicates that an event has occurred, but also where it occurred.
All parameters required for controlling the building functions are supplied to the building control system via sensors. For example, the weather station receives the data required for shading. Keys with RFID transponders tell the building control system who is present in the house. Other sensors report water pipe fractures or open windows. The air intake for the ventilation system is monitored so that the external air supply can be shut off if harmful gases are detected. In addition to the sensor data, the building control system uses information from other systems, including the fire alarm system, the intruder alarm system and the video surveillance system, which, at the control units of the home automation system, can show uninvited guests lingering outside the house without the user having to retrieve the camera images manually. If the monitoring function is active, a window showing the monitoring image opens automatically if an unauthorized person approaches a window or a door. The wealth of functions offered by the home automation system is too extensive to fully list here. It is able to meet all conceivable user requirements. Even the height of the flame in the chimney and the color of the lighting around the garden fountain can be controlled as desired.

**Open control system permits bundling of all functions**

The openness of the PC-based control system plays a special role in this home, since the Industrial PCs – the robust automation centerpieces – must access the data of all building components. The PCs are equipped with state-of-the-art processors, which are optimized for high performance with low energy consumption. For example, the power consumption of a Beckhoff PC in this application is only 7 watts. Several Panel PCs were installed in different locations around the building in which each feature a monitor, control unit and PC all in one device. They are integrated in walls, cupboards, cabinets or worktops and enable convenient operation.
and monitoring. Beckhoff has developed numerous special interfaces for building automation applications such as heating, ventilation and air-condition systems as well as safety and fire alarm systems, which make integration of the different components not only simple, but also cost-effective. The synergy between PC and the I/O terminal system via standard Ethernet saves installation costs, since structured Ethernet wiring is readily available in modern residential buildings. Numerous interfaces are already integrated in the Beckhoff Bus Terminal system as standard, including components for KNX/EIB, LON, MP-Bus, DALI, DMX, EnOcean, Ethernet and serial interfaces with a range of other protocols. In addition, the Hanover project also required special solutions. For example, the control system for the heating system was completely reprogrammed and integrated into the building control system so the client could influence certain parameters that were not available in the standard control system that was provided by the heating system supplier.

Convenient operation made simple

Operation of the whole system is straightforward: the entire house is represented in virtual form in the (permanently installed or mobile) operating devices. The user first selects the room and the required function (e.g. curtain control) and then enters the required value (e.g. ‘open’/’half’/’three quarters’/’closed’, to move the curtain accordingly). The operation is straightforward, even for “novices.” In many cases, basic functions do not require an operating device. For lighting control purposes, at least two control buttons are available in each of the living spaces and at each door for calling up preprogrammed lighting scenes such as those for ‘reading’ or ‘guests.’ Incidentally for the Beckhoff system, it is irrelevant which switch range is used, because the switches merely transmit a signal to the controller which analyzes the pulse and performs the preprogrammed action, depending on the time or any other sensor values. The system can be flexibly adapted to changing situations, and offers effective protection from the influences of “electrosmog” from household electronic devices, an aspect that is particularly important in children’s room and in bedrooms. The whole control system is based on the common 24 V industry standard. 230 V sockets can be switched off at the push of a button at night-time, if required.
dressed at an early stage, which in comparable projects would only have been clarified after commissioning by the subcontractors. The fact that the automation hardware and software, the installation system (including lamps, multimedia, cinema, washing machine and coffee maker) come from one source ensures that all components work in perfect harmony with each other. Beckhoff’s own control cabinet building division ensures that the installation meets stringent requirements in terms of quality and attention to detail. Complexity is made manageable by the transparent control topology. Each floor features a sub-distribution system for rapid troubleshooting, aided by the automation: if a residual current circuit breaker is triggered, an error message is immediately sent to all panels. At the same time, an e-mail is sent to a technician, if required.

**Technology operates discreetly in the background**

One may think that in view of so much technology a pleasant living atmosphere would hardly be possible. However, the opposite is the case, since the technology operates discreetly in the background and leaves the user plenty of creative freedom. The buttons in this urban villa in Hanover are anything but standard. Instead, they feature ornate Swarovski crystals and are part of the wall decoration. External cameras are integrated in natural stone and operating elements are painted in different RAL color to ensure that all colors are paired well. The sub-distributions are invisibly located behind wall panels. The technology is unobtrusive to occupants by being virtually invisible and totally inaudible.

**Beckhoff Group offers complex building services from one source**

In high-end homes, meeting all the requirements of a home automation solution from a single source is often difficult to achieve. The Beckhoff Group, with its headquarters in Germany, is one of the few companies that are able to plan and implement complex home automation systems without having to involve numerous subcontractors. Elektro Beckhoff deals with design and installation, Beckhoff Automation produces and supplies intelligent control technology components, while Beckhoff Technik und Design is responsible for the selection and supply of multimedia components, domestic appliances and lighting systems.

Elektro Beckhoff  
www.ebeckhoff.de

Beckhoff Technik und Design  
www.beckhoff-verl.de

Beckhoff Building Automation  
www.beckhoff.com/building