PC-based control ensures reliable communication between all subsystems and Scada control system

Marmaray rail tunnel connects Europe and Asia

The Marmaray tunnel in Istanbul, connecting the European and Asian parts of the city, is used by 1 million people every day. The journey through the 1.4 km tunnel section, at a depth of 56 meters below sea level, takes just four minutes. The ambitious tunnel project took nine years to build and was opened in October 2013. It is one of the largest infrastructure projects in the world. The total length of the rail system is 76 km, 13.6 km of which runs through tunnels. Since 2015, alongside the Marmaray tunnel, the Gebze-Pendik section of the line is open for long-distance trains coming from Ankara to İstanbul. The full rail system is scheduled for completion in 2018. Of course, precise monitoring is required to ensure that rail traffic always runs smoothly, making this an ideal application for Beckhoff technology.

The Istanbul Strait is 30.5 km long and links the Black Sea with the adjacent seas. Each year, 50,000 cargo ships pass through this natural waterway, making it one of the busiest shipping lanes in the world. While the Bosphorus is a vital sea link, it splits the city into two parts. In the past, the two bridges crossing the Strait had to cope with a huge volume of traffic, generated by approximately three million commuters every day. The Marmaray tunnel eliminates this bottleneck.

The Marmaray commuter rail system, linking Gebze on the Asian side and Halkalı on the European side, has 42 stations. Five stations are inside the actual Marmaray tunnel, between the Ayrılık Çeşmesi and Kazlıçeşme stations. The building systems of the 42 stations and 15 utility buildings include drainage/waste water, booster pumps, HVAC and lighting systems, which will be all monitored and controlled via Scada and Embedded PC systems. Siemens Rail Automation, which provides the signaling and control

The Marmaray commuter rail line linking Gebze and Halkalı is represented in blue. It includes 42 stations and 15 utility buildings. The section between the Ayrılık Çeşmesi and Kazlıçeşme stations is referred to as the Marmaray tunnel.
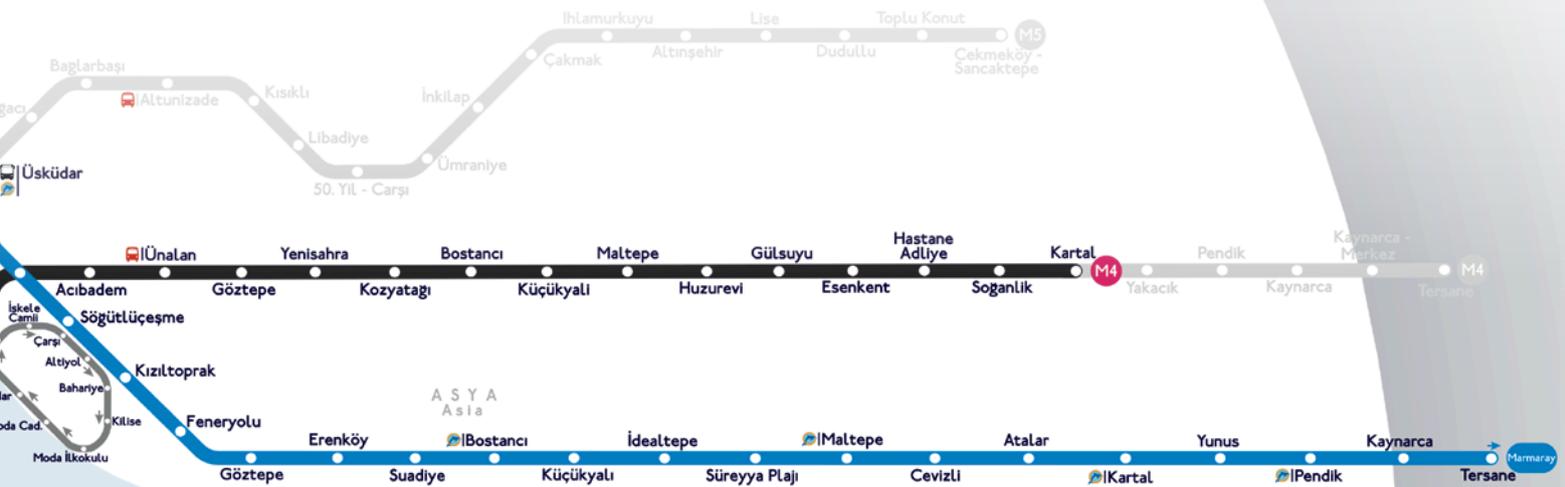
equipment for the Scada project, commissioned Spanish company, Wico de Coprel to design, deliver, install and commission all RTU systems for the entire railway line.

Embedded PCs ensure universal communicaiton between all systems

A total of 84 Beckhoff CX2020-0121 Embedded PCs with Intel® Celeron® 827E 1.4 GHz processors are used in this project as a gateway control system in 42 rail stations. Two CX2020s are installed in control cabinets in each rail station, and if one of the Embedded PCs shuts down, the second one takes over and ensures uninterrupted communication. The system collects all data coming from the different subsystems in each station and transmits it to the building management system in different protocols. On average, each station features 30 different interfaces to control more than 50 building systems. The Embedded PCs also control higher-level systems outside the stations, including the power supply for all six transformer stations along the route. Further demonstrating the power and flexibility of the control system, it also includes a wide range of other systems within the complex building management system.

The different building systems each generate more than 100,000 signals, controlled via Scada. On average, each Embedded PC processes more than

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Wico de Coprel

The company Wico de Coprel was founded in 1997 by a group of Spanish engineers and is based in San Sebastián de los Reyes, Madrid, Spain. Wico de Coprel specializes in engineering, development, production, installation and commissioning services, particularly in the areas of power distribution, automation and software updates. In cooperation with Siemens Rail Automation SAU, Wico de Coprel operates as Scada subcontractor according to the Marmaray CR3 project agreement.

2,000 individual signals. Each of these signals is collected from Beckhoff Bus Terminals and from different subsystems (like electrical power supplies, lighting systems, HVAC systems, etc.) supporting all corresponding communication protocols.

PC Control offers impressive performance, modularity and compact design

Francisco Alonso, Project Manager at Wico de Coprel, says: "The products provided by Beckhoff fully meet our requirements. In addition to its high performance, the Embedded PC platform with attached Bus Terminals has an impressively compact design. With a width of only 12 mm, the terminal housings enable tremendous space savings in control cabinets, where room must be made for thousands of I/O components." CPU, I/O racks and all accessory elements are installed in cabinets along with other computers and communication equipment making the whole system compact, maintainable and easily scalable to each particular site. In addition, the wide range of Beckhoff I/O terminals enables Wico de Coprel to respond flexibly to unforeseen changes. "Since this is an ongoing project, the Beckhoff product portfolio provides us with the flexibility to easily adapt to new necessities with the scalable I/O components but without having to change the control system itself," Francisco Alonso recalls.

Optimized communication

In addition, such a complex system uses different messaging protocols. "The fact that Beckhoff offers a wide range of products covering all communication requirements, without the need for a third-party converter, simplifies our work in terms of system integration," Francisco Alonso continues. "Each station is equipped with RS232, RS485 and single mode fiber optic interfaces; when it came to the optional interface for the CX2020, we decided to use PROFIBUS. Based on the open automation concept from Beckhoff, different protocols like Modbus RTU, Modbus TCP, IEC 60870-5-104, IEC 61870-104, IEC 61850 are integrated using existing TwinCAT libraries and the interfaces available on the CX; no additional gateways are required. A further advantage is the compatibility of the PC-based automation platform with standard tools such as NTP (Network Time Protocol) and SNTP (Simple Network Time Protocol)."

Flexible programming

According to Francisco Alonso, further benefits provided by Beckhoff include the extensive software portfolio, the option to use standard PLC logic programming languages such as Function Block Diagram for engineering, the fact that code written in Structured Text for complex PLC applications is easily traceable and the combination of different automation languages improves flexibility. "All this has helped us reduce our engineering costs significantly," he emphasizes.

Further information:
www.wico.com.es
www.beckhoff.com.tr