From doorman to CAN-controlled turnstile

Figure 1: Many optical turnstiles with ticket readers use embedded CAN networks to link the internal electronic devices (Source: Kaba)

Doormen and gatekeepers are as old as doors and gates. In modern times, turnstiles substitute them. Some of them use embedded CAN networks.

Links
www.teamaxxess.com
www.cmolo.com
www.dresden-elektronik.de
www.a-e.cn
www.gunnebogroup.com
www.kaba.com
www.ac-magnetic.com
www.en.gdyuan.cn

Access control has a long history. During the time of the Roman playwright Plautus (245 to 184 B.C.), doorman was already an occupation. Today bouncers and security guards still supervise entrances and exits. But increasingly turnstiles are used to separate people and to control access to certain areas. It could be a gate at an airport, the entrance to a sports arena or a metro station, and many other public facilities including fairgrounds. Clarence Saunders (1881 to 1953) introduced turnstiles in his Piggly Wiggly stores. These first supermarkets allowed customers to browse the aisles and select products on their own. Shoppers entered the stores through a turnstile and followed the predetermined four-aisle path. After paying at the checkout counter, customers exited through a second turnstile.

Mechanical turnstiles often use ratchet mechanisms to allow rotation of the stile in only one direction. Modern turnstiles are often controlled electronically and are sometimes equipped with ticket readers or payment units for coins or tokens (fare-gates). They are also used to count people passing through gates.

The electronic units in a turnstile need to communicate. Often, serial links (e.g. EIA 485) are installed to exchange data between the devices. Some providers have implemented embedded CAN networks to communicate between the turnstiles and also deeply embedded CAN networks to link the motor, the sensors, and the displays to the main controller. Normally, proprietary higher-layer protocols are used. But there is an increasing need for standardized higher-layer protocols, when third-party products such as card-readers need to be integrated without re-programming them. CANopen provides all necessary functions.

Access control

Access control is one of the main purposes of turnstiles. There are many different types available: tripod turnstiles, waist- and full-height turnstiles as well as optical turnstiles – opening when a person is detected (e.g. by infrared sensors) or closing if the passing person is not authorized (no valid ticket). The first optical turnstile was developed for the San Francisco market. In most cases, they allow only one person to enter or exit. They enforce one-way traffic.

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Figure 2: Typical turnstile applications at Venice's Vaporetto stations (Venice) and on the Vienna fair-ground controlling the access and counting the number of people passing through (Source: Axxess)

In the middle of the 60s, Omron in cooperation with Kinki Nippon Railway developed an automated railway station with an automatic ticket gate for commuters. Later, the Japanese company developed an automated ticket gate capable of handling both commuter passes and regular train tickets. The world's first fully automated (unmanned) train station system was completed and put into use in 1967.

Nowadays, many turnstiles are in operation all over the world and the number is growing steadily. Especially in the Far East, the turnstile business is still growing. The Pedestrian Entrance Control equipment sales surpass US-$600 million this year according to an IHS Electronic & Media's report. Of course, turnstiles are just one part of this market, which also covers speed gates, security doors, and normal entrance doors.

There are many turnstile suppliers; some operate worldwide, while others provide customized products in a specific country or application field. The Swiss company Kaba Group, founded in 1862, is one of the market leading turnstile manufacturers. The enterprise produces for example the Kerberos tripod turnstiles, half- and full-height turnstiles as well as swing, sliding, and revolving doors. All turnstile types are controlled by the ETS 21 controller, which features CAN connectivity. In 2013, the company reported a turnover of about 1 billion CHF. This figure exceeded the target. The 6,8-% growth in Asia was higher than in America (5,2 %) and Europe (4,9 %). Kaba is adjusting its group structure; it will complete the process by the end of 2014. The existing Access + Data Systems (ADS) EMEA/AP division, which currently generates around 60 % of consolidated turnover, is being split into an ADS EMEA (Europe, Middle East and Africa) division and an ADS AP (Asia Pacific) division. Just over 10 % of Kaba's turnover ▷

Dynamic traffic signs

Dresden Elektronik (Germany) has developed dynamic signposting solutions based on CAN networks. The modular system makes it possible to equip one location with up to 100 prism groups, which can be up to 500 m away from the outstation. The communication between sign and outstation works via CAN and the communication with the control center via Ethernet. The IEC 61131-3 programmable outstation provides up to ten CAN interfaces.

Dynamic signs display information depending on the current traffic situation. Bottlenecks can be detected via a control center and displayed guidance routes can be optimized. Traffic obstructions can be improved and solved without major effort. The company also offers traffic light systems, which implement up to four CAN networks.

Dynamic traffic signs are connected to the outstation via a CAN network; the outstation comprises up to ten network interfaces (Source: Dresden Elektronik)

The networks allow configuring application-specific solutions. The maximum length of the networks is about 500 m.

Figure 3: As early as 1918, Piggly Wiggly stores used turnstiles at the entrance and at the exit

is generated in Asia at the moment, and the aim is to increase this proportion profitably. Recently, the company has made acquisitions in China and India.

Cmolo (China) is one of the competitors in the Asian turnstile market. The company provides optional CAN connectivity for its products including embedded motor controllers. Yuan, another Chinese tripod turnstile provider, also offers an optional CAN interface. Another Chinese turnstile company, Essence, founded in 1999, also uses optional embedded CAN networks in its ES2000 and ES3000 tripod turnstiles. In many of the turnstiles, servomotors can optionally be connected to an embedded CAN network. The Smartgate by Access (Austria) comes with an internal CAN network and communicates with other turnstiles by means of wireless communication. Its AX500 CAN-connectable Linux-based control module can optionally be equipped with an operator display. The Austrian company is similarly increasingly active in Asia: In China, Axess's systems have already been in operation since the beginning of 2014. The first installation in Japan was installed recently. In early summer, a contract with one of the largest operators of Japan, which administers 21 resorts, was signed. The SXT Smartaxess terminal is connected to a unit that counts the number of people passing through the turnstile via CAN. This is another important task of modern access control systems such as turnstiles.

Magnetic Autocontrol (USA) also operates globally. The company provides all kinds of turnstile types and swing gates. Optionally MMC-12X motor controllers and MBC-110 central control unit as well as other devices communicate via CAN. The Swedish company Gunnebo offers optional CAN connectivity for its Boardsec optical turnstile, too. The Safecoin coin roll dispensing system by the same company also uses an embedded CAN network.

The embedded and deeply embedded CAN networks used in turnstiles and similar access control systems link mainly devices manufactured by the provider. However, for rarely needed devices and low-volume applications, the employment of third-party devices could reduce development and production costs. In this case, standardized higher-layer protocols and profiles, such as CANopen, would simplify system integration. Additionally, off-the-shelf tools could be used for system integration as well as diagnostic services.

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