Shanghai Metro Constructs an “Intelligent Metro”

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The World Artificial Intelligence (AI) Conference 2020 opened in Shanghai on July 9, 2020. The AI application scenarios presented by Shanghai Shentong Metro Group Co., Ltd. (Shentong Metro Group) have attracted a lot of attention of visitors. On July 9, 2020, the total passenger flow of Shanghai Metro exceeded 10 million, reaching 10.048 million, and Shanghai will enter the normal state of “ten million passenger flow” every day. At present, the operating mileage of Shanghai Metro reaches 705km, ranking first in the world. According to the new line planning and construction trend, the Shanghai Metro network will continue to expand, and there will be even more passenger flows in the future. Therefore, corresponding measures must be taken, and the safety management and control of facilities and equipment must be adapted. Shanghai Metro has begun to explore intelligently, adopting emerging technologies such as AI, big data, and the Internet of Things, to create a metro operation and service system with intelligent business linkage.

What is “Intelligent Metro”? According to experts from Shentong Metro Group, “Intelligent Metro” aims to ensure the overall safety of the metro, improve operating efficiency, increase business benefits, and improve service quality. It adopts technologies such as the Internet of Things, cloud computing, big data, and AI to enhance holographic perception and real-time analysis, scientific decision-making, and precise execution capabilities, to create a metro operation and service system with intelligent business linkage and resource allocation.

Metro “Intelligent Station” with high technology

“Commuters” who take the metro every day are most familiar with the appearance of metro stations, but are relatively unfamiliar with the high-tech facilities inside. The Metro Stations in Shanghai are presently building an “AI” operation to realize the monitoring and estimation of the passenger flow in the station, in order to diversify the control and guidance in the way for passengers to enter the station. It can also calculate relevant data such as the crowdedness in the corresponding time zone of each metro station based on the historical passenger flow.

At present, for the super-large hub station where the three metro lines of Shanghai Metro are interchanged, the passenger flow in the station during the morning rush hours is no longer dependent on the visual inspection of the metro staff, but on the accurate display of the large computer screen in the vehicle control room. The Hanzhong Road Station of Shanghai Metro has the above precise display function. The station also has “special functions” such as abnormal passenger flow warning, face recognition, and voice ticket purchase. Currently, there are 5 such smart rail transit stations, which are Huinan Station, Hanzhong Road Station, Xinjiangwancheng Station, Zhuguang Road Station, and Gucun Park Station.

The “Intelligent Station” of Shanghai Metro has several smart functions. First of all, the passenger flow monitoring system can clearly display the distribution of passenger flow in the station through the thermal map. Secondly, eagle-eye lenses are installed in
important passages of the station, so that the staff can observe the status of the transfer passage in the vehicle control room without blind spots. In the office area of the station, a new face recognition device has been added, making it safer for the staff to enter and exit the workplace. In addition, the station hall is also equipped with a "voice-operated ticketing machine". Passengers only need to tell the machine a scenic spot near a station, the amount of money for the corresponding ticket will displayed on the screen of the "voice-operated ticketing machine", and the ticketing will be automatically completed.

**Figure 1.** Voice-operated ticketing machine.

**Construction of the smart station of Huinan Station on Line 16**

Currently, Shanghai Metro is building smart stations, and more new service functions related to the AI technology are being piloted in Shanghai Metro. For example, Huinan Station of Shanghai Rail Transit Line 16 has already been in the forefront of smart station construction. Line 16 has realized the automatic control of the switches of the equipment in the station. In the past, the staff had to inspect and turn on the equipment inside and outside the station more than an hour in advance. But now, he can control the switches of the equipment with a key on the keyboard of the computer, which has increased the work efficiency by about 20 times.

On the BIM (building information modeling) construction management platform of Huinan Station of Line 16, a 3D station model with accurate simulation was built, including everything from surveillance cameras to elevators at entrances and exits. In the real-time display of the station equipment status on the platform, once a failure occurs, the platform will send an early warning in advance, and the staff can instantly check the cause of the failure. He can even get the information of the manufacturer and the number of past failures at a glance.

**Figure 2.** User interface of BIM construction management platform for Huinan Station of Line 16.

Tidal passenger flow is the most distinctive feature of Huinan Station. During the morning rush hour, passengers on trains bound for Longyang Road can hardly get on and off, and the current limit is a prescribed action. How to make this action more accurate and correct? The intelligent passenger flow guidance interface of the BIM construction management platform can display the real-time passenger flow at the entrances and exits of the station, the information of vehicles arriving at the station, and the passenger flow downstream of other flow-restricted stations on the screen. Based on these data, the system can calculate and dynamically update the recommended passengers to be released through internal algorithms. The smart station allows the staff to observe beyond the physiological limitations of the senses, so that problems can be found earlier, actions can be taken faster, and positioning is more accurate.
make voice inquiries about their destinations and obtain guidance information on their routes via WeChat code scanning. However, an intelligent metro cannot be achieved overnight, for example, improving the Internet of Things and security system architecture, optimizing the smart operation and maintenance system, etc. There are still many things for Shanghai Metro to do next. (Source: July 9, 2020 Sina.com on)

Figure 3. Vehicle control room of Huinan Station. According to Shentong Metro Group, the use of intelligent technology is beneficial to upgrading metro services. In terms of smart ticketing, Shanghai Metro is trying to realize the sharing and integration of biometrics recognition, voice ticketing, and gate scanning, so as to gradually form a new smart ticketing and checking mode. On the self-service machines of some large-scale stations, passengers can...