Development and Standardization of Electronic Display for Elevator and Escalator

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ABSTRACT

This paper introduces the industry application status of electronic display for elevator and escalator. The issues of current technology and developing trend are discussed. The latest standardization status in ISO, CEN, CEA and IEC TC110 will also be introduced.

1 Background

With the rapid development of urbanization, more and more high buildings appear and are needed all over the world. Meanwhile, the elevators and escalators are needed in the high buildings. According to the summary of the elevator industry, there are more than 1.3 million elevators newly installed in the world in 2018[1][2] (Figure 1). The size of elevator/escalator market would be more than hundreds of billions USD.

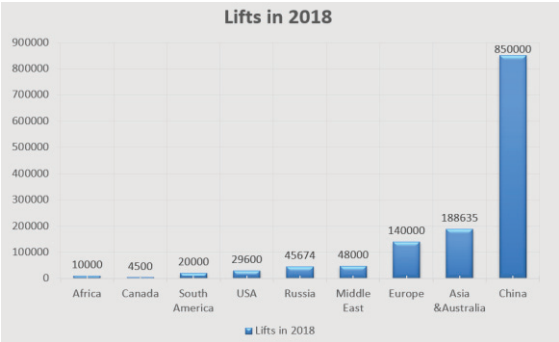

Fig. 1 Lifts market in 2018

Electronic displays are more and more used in elevators and escalators. There are many functions and benefits while using electronic displays in elevator and escalator, some examples are as followings:

(1) Indicating the floor;
(2) Display the running status of the elevator and escalator;
(3) Commercial advertisement;
(4) Emergent information for people trapped in elevator;
(5) digital information signage.

With wider and wider use of electronic display in the elevator industry, and the development of electronic display technologies, all kinds of new applications are proposed. More and more new electronic display technologies are used in this industry. And also, many issues appear and international standardization requirements are proposed in the industry.

2 Traditional display applications in elevator and escalator

In past years, electronic displays are always used for indication and information in elevator and escalator, just as floor display, hall call, landing display, buttons, information displays, and etc. [3] (Figure 2).

LED dot matrix displays are always used for indicator in the elevator and escalator. Most of their functions are only indication of the current floor or target floor. The image quality is dull and the information for passengers is very poor. TFT monochromatic LCDs have been used in the elevator for better display in the start of this century.

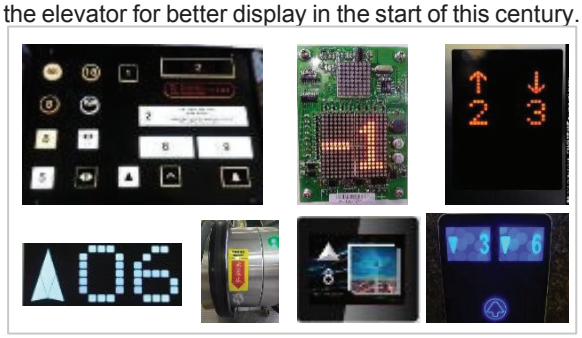

Fig. 2 Traditional display applications in elevator and escalator

3 New applications of display in elevator and escalator

Recent years, the development of new technologies is rapid. 5G, Cloud Computing, AI, Nano Technology, Big Data, IoT, Virtual Reliability and all kinds of innovated technology enter into the industry and human life. Different subjects, different technologies, and different industries are fused into each other. More and more new fused technology is created. People finds that innovation revolution is underway for electronic displays in Elevator/Escalator Industry.

OLED, transparent display, laser projection display, flexible display and other new display technologies are now more and more used in elevator and escalator. And

different parts have used different electronic display for different functions, such as the ceiling, floor and wall of car, the control panel, the car door [4], hall and shaft, side wall and hall floor of escalator.

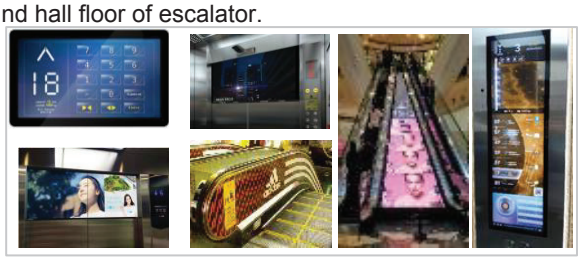

Fig. 3 New applications of display in elevator and escalator

4 Display Issues in elevator and escalator

Since the use condition of electronic display in elevator and escalator is different from the common use condition. It's special and quite bad than other common usage. It will meet emergency stop and safety clamp braking during the running of elevator, the impact of buffer from car and the effects from wide temperature range (-25℃ to 60℃) of shaft, the electromagnetic Interference from controlling system or magnet motor of the elevator.

4.1 Display Performance

In the traditional elevator industry, people always paid more attention on the motor, controlling system and safety parts. The electronic display is always less focused. With wider and wider use of electronic display in elevator and escalator, more and more display performances are focused by the manufacturer, passenger and owner. Many displays are only used for showing the floor or simple information with low luminance and low resolution. Some displays have the problem on flash, color reproduction. The multiple reflection from the car walls also affects the visual quality. The ambient lighting condition also cause the visual performance of the electronic display. However, there is less solution for above problems in elevator industry till now.

4.2 Safety

The safety is one of the most important factors for the elevator, there are many safety problems during the use of the electronic display for elevator. For example, since the car of elevator always move vertically in the shaft with different acceleration, if the mechanical installation of display is not installed fast, the electronic display will drop or be destroyed during the movement of the elevator.

The power supply for the electric parts of the elevator are strictly limited by the specifications. But many displays are installed with the improper input power supply. Some electric displays get the power supply directly from car top, which is only for the maintenance work. In a shopping mall Shanghai China, there was a fire accident caused by the improper electricity connection of the electronic display in elevator car. And more, leakage of electricity, inversed connection and other electricity issues are the hidden danger for the safety.

With the development of projection technology, the projection display with LED and laser source has been used in elevator car for the advertisement. The projector with long focus projects the image from the opposite car wall. The projector with short focus projects the image from the top of the door. It projects the image on the car door while the door is closed, and turns off the light output while the door is opened. The high-power LED or laser source bring the issue of photobiological safety of projection display. The potential photobiological hazard for passenger should be considered.

4.3 Reliability

Reliability of the electric part in the elevator car and shaft is an important specification, especially for the electrical display. The Interruption by the vibration of the elevator car, and the malfunction at low/high temperature, the working reliability while meet the fire, are the problem need to be considered for the electric display in elevator.

4.4 Lifetime

Since the electric display is not concerned by the people as the consumer electrical products, its quality level is not so good as them. The lifetime of electric display in the elevator has not even been considered by the electrical engineer of the elevator. Short lifetime, Unanticipated burning becomes a problem in this field.

4.5 Display Content

Display content would be treated as not a problem for most of people. It is always thought that elevator display only need to show the floor, direction, advertisements and other simple public information. However, more and more information are needed by the passengers, owners, manufacturers and administration organization. Especially, with the development of IoT, 5G, and virtual reliability technology, rich information could be shown on the display terminal of elevator or escalator. The display content would be as followings:

(1) Running Status
(2) Conciliating Info/Video at Urgent Event (Fire, Stranded…)
(3) Malfunction Info
(4) Inspecting Info
(5) Maintenance Info
(6) Safety Prompt

In China, the display content has been listed into some local standard as mandatory requirements.

5 Current status standardization of displays for elevator & escalator

Currently, there are several international standardization organizations on elevator/escalator, and electronic displays. However, most of them are independent for single field. Only elevator/escalator or only electronic displays are focused on in each organization. The joint work on electronic displays for elevator and escalator is

blank now in international standardization.

5.1 ISO TC178

ISO TC 178 “Lifts, escalators and moving walks” is an ISO technical committee focus on the standardization of all aspects, including safety, of lifts, service lifts, escalators, passenger conveyors and similar apparatus. It is one of the most influential international standard organizations in the elevator industry [5]. ISO TC178 owns 9 working groups as followings:

ISO/TC 178/AHG 1 New technologies
ISO/TC 178/WG 2 Guide rails
ISO/TC 178/WG 4 Safety requirements and risk assessment
ISO/TC 178/WG 5 Escalators and moving walks
ISO/TC 178/WG 6 Lift installation
ISO/TC 178/WG 8 Electrical requirements
ISO/TC 178/WG 10 Energy efficiency
ISO/TC 178/WG 11 Methodology for the improvement of safety of existing passenger and goods passenger lifts

ISO TC178 has published 42 ISO standards. There are 13 ISO standards under development now. All of these above ISO standards focus on all kinds of aspects of elevator and escalator and moving walks. However, there is no ISO standards on electronic display for elevator and escalator. As a professional ISO technical committee on elevator, it would be a defection without the standardization work on the electronic display for elevator and escalator.

5.2 CEN TC10

CEN/TC 10 (CEN Technical Committee 10), whose name is “Lifts, escalators and moving walks”, is a technical decision-making body within the CEN system working on the establishment of safety rules for the construction and installation of lifts, escalators, and passenger conveyors in the European Union. It is one of the famous organizations in the international elevator industry. EN81 series standards published CEN/TC10 are referred by many countries’ national standard. In this technical committee, there is also no work on electronic display for elevator and escalator.

5.3 IEC TC110

IEC TC 110 “Electronic displays” is the biggest international standard organization on electronic display. It focusses on standardization, in the field of electronic displays and specific relevant components, of terms and definitions, letter symbols, essential ratings and characteristics, measuring methods, specifications for quality assurance and related test methods, and reliability [6].

IEC TC110 has different working groups on LCD, OLED, 3D display, eyewear display, laser display, and other new display technologies. Its work has not involved the application of electronic display for elevator and escalator. In 2018 plenary meeting of IEC TC110 held in Busan, IEC TC110 decided to establish a new Ad hoc working group AHG 16 Electronic displays for special applications (SPA). The electronic display for e-tile display, automotive display, gaming display and other applications are researched and discussed.

5.4 CEA (China Elevator Association)

China Elevator Association is an association gathering the elevator manufacturer, research institute, testing organization, laboratory, engineering, and maintenance. CEA’s standard committee has established more than ten group standards on elevator.

A task force on electronic displays for elevator and escalator was established in January 2019. After more than half year’s investigation in elevator and display industry. The standardization committee of CEA has approved the establishment of working group for elevator display in August 2019. Experts of elevator and display industry joined in this working group for the standardization of electronic displays for elevator, escalator and moving walks. Now there are two projects on optical performance and image quality of electronic displays for elevator and escalator are carried on in CEA standardization committee.

6 Standardization work in IEC TC110 AHG16

IEC TC110 AHG16 held the first meeting in Monterey in February 2019. In this meeting, China NC (National committee) introduced the proposal of “IEC standardization of Electronic Displays in Elevator/Escalator”. After the meeting, China NC arranged to make a technical report on this topic. In San Jose meeting in May 2019, China NC proposed to make the TR “ELECTRONIC DISPLAYS FOR ELEVATOR AND ESCALATORS – Part 1-1: Generic introduction” in order to clarify the situation and consider the standardization strategy. In July and September 2019, AHG16 held two web meetings for discussion. Meanwhile, CEA and SAC/TC547 in China started an investigation on candidate items for standardization of electronic displays for elevator and escalator. The survey was carried based on different standardization items for different applications in elevator and escalator. For example, electronic displays can be used for control panel, wall, floor, ceiling and door of elevator car, control panel and wall of elevator hall, the wall of elevator shaft (Transparent display or LED display), side wall of escalator, and etc. For the above different applications, there are measuring methods and specifications for mechanical, environmental, electrical, optical, image quality, stability and lifetime for standardization.

7 Future works

The technical report on electronic displays for elevator and escalator in IEC TC110/AHG16 will be completed before IEC TC110 Plenary meeting held in Shanghai in October 2019. The necessary, demands of stakeholders,

and strategy for standardization will be discussed. The technical report would be published in 2020. And then the related standardization project will be started. It is expected that the joint working group between IEC TC110 and ISO TC178 could be established for promoting the development of technology and standardization.

8 CONCLUSIONS

With the development and industrial convergence of electronic display and elevator, the electronic display for elevator and escalator would create a new industry and huge market. The standardization work on this field will also meet new topics. It would be finally benefit for the user of the elevator and escalator.

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