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上海三菱电梯
SHANGHAI MITSUBISHI ELEVATOR

慧眼
SmartEye

Smart Elevator and Escalator Monitoring System

Artificial Intelligence
Proactive Intervention
Safety Guarantee

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Artificial Intelligence | Proactive Intervention | Safety Guarantee

慧眼 SmartEye

SmartEye is a Smart Elevator and Escalator Monitoring System of Shanghai Mitsubishi, which gives elevators and escalators smart eyes. It not only monitors the running state of the elevators and escalators, passengers' behaviors and surroundings (function as "eyes"), but also makes decisions and appropriate response according to the changes of the above information (function smartly), making it a more intelligent monitoring system.

Background

An Integrated Elevator Monitoring System (SMOS-II) is used to monitor and control all types of elevators of Shanghai Mitsubishi. The PC of the system can display the running state of the monitored elevators in videos or words in real time, and monitor faults and exceptions and automatically trigger alarms. In addition, the system supports operations on PC to achieve control over service floors, manual or timed triggering services like Remote-control Car Stop, and emergency control features like Fire Emergency Return. To provide more valuable services, Shanghai Mitsubishi has launched a monitoring product integrating with more intelligent technologies.

The Smart Elevator and Escalator Monitoring System solves the following pain points:

- **Monitoring of the state of elevators and escalators:**
  - ◇ Monitoring terminal/PC;
  - ◇ Mobile terminal App;
  - ◇ Video surveillance.
- **Smart monitoring of state:**
  - ◇ Identification and warnings of dangerous behaviors of passengers (slippage reverse traveling);
  - ◇ Identification and warnings of dangerous behaviors of passengers (exit congestion);
  - ◇ Elevator floor control: NS mode, immediate floor locking;
  - ◇ Elevator service control: Up/Down Peak Service, VIP Service, Return Operation, Remote-control Car Stop, etc.;
  - ◇ Elevator emergency control: Earthquake Emergency Return, Operation by Emergency Power Source, Fire Emergency Return, etc.

Note: The management organization can control the elevators or escalators through the monitoring terminal/PC in the monitoring room according to the monitoring result or control requirements.

- **Smart start and stop every morning and evening and preliminary fault diagnosis;**
- **Smart Auto Announcer adaptive to ambient sound volume;**
- **Statistics function:**
  Fault records, operation records, access records, traffic analysis;
- **Replay:**
  Replay the history of running state;
- **Elevator IC card information management;**
- **Integrated with the building monitoring system;**
  Output the key running state of elevators and escalators through the Ethernet BA interface.

Function Overview

As the city grew, the need for elevators and escalators has been increasing in various applications, including subway stations, airports, shopping malls and hotels. The elevators and escalators are used to transport a large amount of passengers every day, especially subway stations. Therefore, Shanghai Mitsubishi has launched SmartEye by introducing smart image sensor technology, smart control technology, smart interaction technology, and smart IOT technology to achieve smart control over elevators and escalators. The system uses artificial intelligence to upgrade the function of monitoring system from "passive tracing" to "proactive intervention, helping owners to improve operation efficiency and operations management.

1 Monitor the state of elevators and escalators through the monitoring terminal

Monitor the state of elevators and escalators through the monitoring terminal, including:

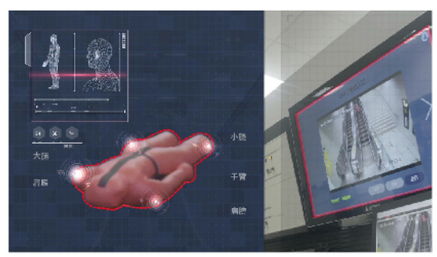
- Monitor the running state of elevators and escalators, including Run/Stop, Up/Down, and comprehensive fault;
- Monitor the operation faults of elevators and escalators, including safety device function, power failure, and motor faults;
- Fault statistics record the details and the time when the fault occurred and is fixed;
- The main interface of standard monitoring terminal is shown in the picture: It displays the state of elevators and escalators by area and brand.

2 Mobile terminal monitors the state and manages the records of elevators and escalators

To further increase the convenience the management organization monitors and manages the elevators and escalators of Shanghai Mitsubishi remotely, Shanghai Mitsubishi has developed a mobile remote monitoring App, through which the management organization checks on the phone the running state of elevators and escalators and the faults and troubleshooting records in real time, calculates the fault rate and views the operation statistics of elevators and escalators, so as to fully master the running conditions of all elevators and escalators and provide on-demand and targeted management and maintenance.

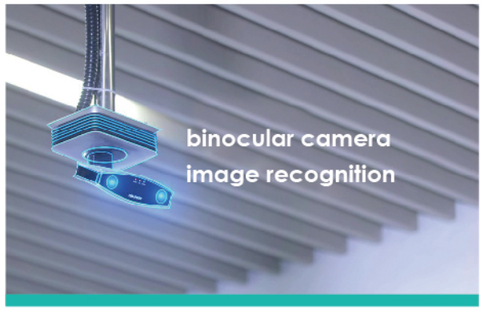
3 Identification and warnings of dangerous behaviors of passengers (slippage/reverse traveling)

As one of the most crowded space, escalators in subway stations are the place for 70 to 80 passenger injury accidents in Shanghai every month, which accounts for 60% of passenger injury accidents happened in subway stations. To protect passengers' safety, Shanghai Mitsubishi introduces the function of slippage/reverse traveling detection and warning and advanced deep learning image recognition technology to automatically identify abnormal changes in passengers' postures, and displays warnings and videos on the smart escalator management terminal in the control room to help the workers to take measures the first time.



4 Identification and warning of dangerous behaviors of passengers (exit congestion)

In the event of heavy traffic or rain, subway stations, especially the exit of escalators at the entrance are very likely to cause congestion, thus increasing the risk of accidents. Therefore, Shanghai Mitsubishi has researched and developed the function of smart congestion detection and warning by introducing binocular camera image recognition technology to detect the congestion at the escalator exit, broadcast safety tips, and display warning video signals on the smart escalator management terminal in the control room to prompt the management organization to carry out remote control and guarantee passengers' safety.

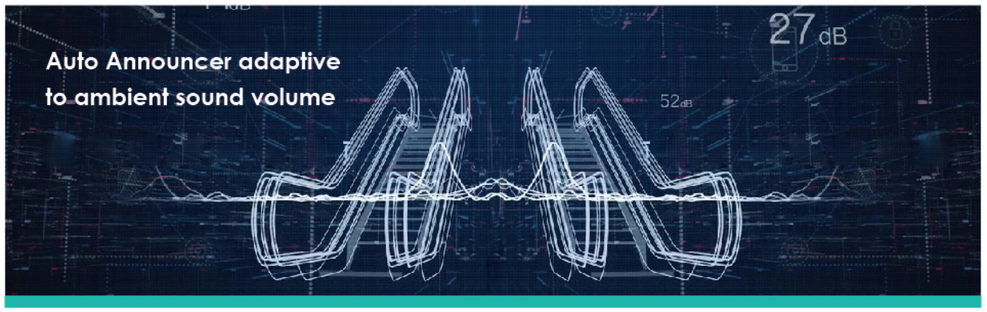


5 Smart safe start and stop every morning and evening and preliminary fault diagnosis

To match with the opening time of the place where escalators are used, the escalators must be started and stopped one by one manually every morning and evening, which is time and labor consuming. With Shanghai Mitsubishi's patented smart automatic escalator start and stop service and preliminary fault diagnosis technology, on the premise that there is no passenger, the escalators can be started and stopped automatically at a given time every morning and evening, and detect faults at the same time to inform maintenance staff. The whole process can be done remotely through the smart escalator management terminal in the control room, without human intervention.

6 Auto Announcer adaptive to ambient sound volume

Auto Announcer is a typical additional prompt feature for elevators. The announcement volume cannot be accurately controlled in real time, which may result in the following problems: When it is too noisy on site, the announcement volume is too low to prompt passengers; when it is quiet, the announcement volume is too high, causing noise pollution. Mitsubishi's patented Auto Announcer adaptive to ambient sound volume automatically adjusts the volume in real time by detecting the ambient noise level and combining the intelligent filter algorithm to ensure the voice information can be broadcast effectively.



7 Statistics function

Records:
Include three kinds of records: fault records, operation records, and access records. All the records can be exported.

Type of records	Description
Fault records	Records of all faults and exceptions of the elevators and escalators
Operation records	Server and client login and logout records
Access records	IC card swiping records (If IC car function is available)

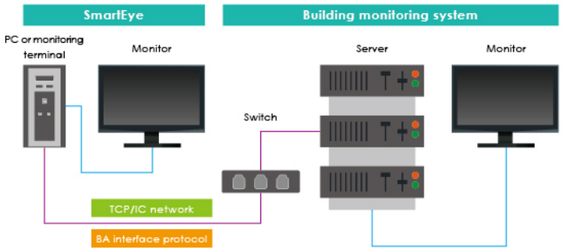
Traffic analysis:
Analyze the operation history of the elevator to calculate the traffic.
- ◇ Analysis conditions: Select the Car No of a group or a single car, analysis start time and analysis end time;
- ◇ Analysis result: Number of Hall Calls, max. wait time (s), average wait time (s).

Replay function:
Analyze the operation history of the elevator to calculate the traffic.
- ◇ Can check the running state of the elevator at some time and display it in animation;
- ◇ Can check the running state of the elevator at some time and display it in logs.

IC card information management:
Control and manage the IC card function of elevators.

Function	Remarks
Personal information	Manage all IC cards
IC card No. setting	Register related information and issue cards (can set the validity of the card)
Personal registration information	Connect IC card information with the elevator
Access rights setting	Set the floors open to the IC card
Information download	In connected IC card management mode, download IC card information to the elevator
Access records	Check the times when the passenger uses the IC card to ride the escalator

Integrated with the building monitoring system:
Provide the information of the elevator state to the building monitoring system through "BA interface protocol" based on ICP/IP network. The PC and the server of the monitoring system should be connected with the same network through switches provided by the customer.



Integrated with the building monitoring system

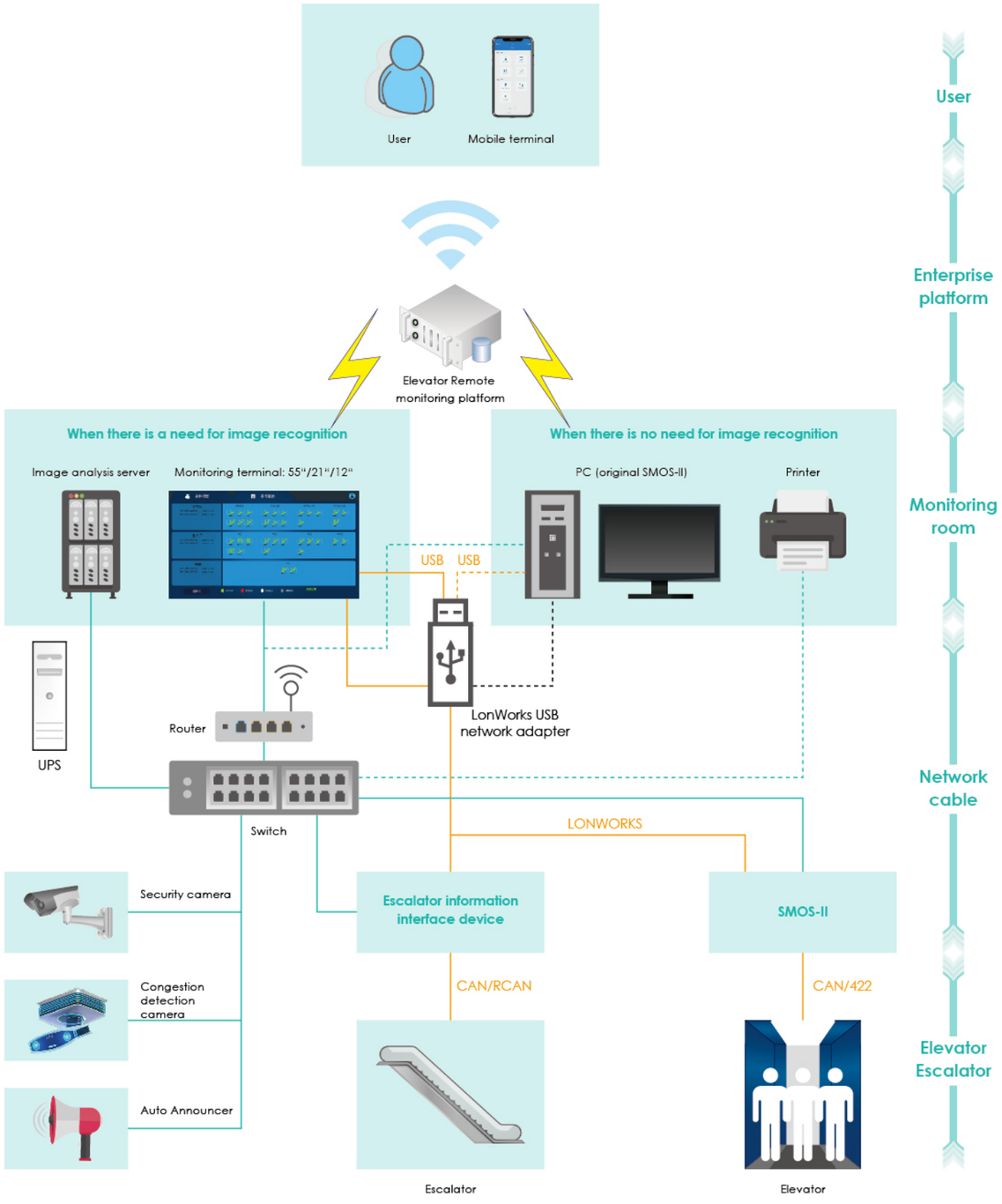
Main application scenarios include:

- **Elevators**
  - ◇ No special limits on places;
  - ◇ Do not provide image recognition function for car at the moment.
- **Escalators**
  - ◇ No special limits on places if there is no need for image recognition;
  - ◇ If there is a need for image recognition, main applications include: subway stations and light rail stations; non-standard design is required for other applications.
- **Scope of monitoring:**
  - ◇ Elevators and escalators of Mitsubishi
  - ◇ Elevators and escalators of other brands

(need to provide communication interfaces and protocol)

※ To install SmartEye for elevators in use, escalators made by Japanese companies, and elevators and escalators of other brands, non-standard design is required.

System Structure



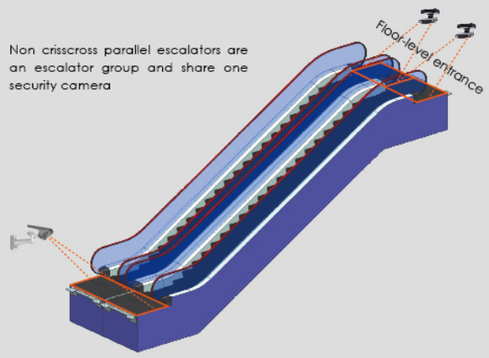
System Configuration

Category	Component	Quantity	Configuration	Remarks
General	Escalator information device	One per escalator	Standard	
	SMOS-II	One per elevator or escalator group	Standard	
	Uninterrupted Power Supply (UPS)	One per system	Standard	Rated capacity 500 W
	LonWorks USB network adapter	One per system	Optional	TP/FT-10(Model 75010R). TP/FT-10(Model 75010R) when LonWorks data transmission network is used.
	LonWorks relay	One per 2700 m	Optional	When LonWorks data transmission network is used and over 2700 m; working voltage 220VAC provided by the customer. 220VAC provided by the customer.
	Switch	One per system	Optional	When TCP/IP transmission network is used or when there is a need for image recognition, include DHCP function.
	Switch	N per system	Optional	Provided by the customer: N depends on the quantity of elevators and escalators.
	LonWorks transmission network	One per system	Optional	Cabling done the customer; cables can be purchased from Shanghai Mitsubishi.
	Optical fiber transmission network	One per system	Optional	The customer provides cables and wires; Shanghai Mitsubishi states the cabling requirements.
	TCP/IP transmission network	One per system	Optional	Cables and wires are provided by the customer.
When escalator image recognition is not used	PC (mainstream configuration)	One per system	Standard	
	Monitor (mainstream configuration)	One per system	Standard	Resolution over 1280×1024
	Printer (mainstream configuration)	One per system	Standard	USB interface
When escalator imagerecogni-tion is used	Voice Announcer (embedded)	One per escalator	Optional	If the speaker is installed at the exterior of the escalator and cables cannot be laid across floors, one group of smart Auto Announcer should have two smart voice control devices.
	Security camera	One per escalator group	Optional	Used for abnormal state/behavior detection. See the following picture for the definition of escalator group and entrance escalator.
	Congestion detection camera	One per entrance escalator	Optional	Only applicable to entrance escalator. See the following picture for the definition of escalator group and entrance escalator.
	Monitoring terminal	One per system	Standard	55"/21"/12"
	Image analysis server and remote control device	One every 15 escalators	Standard	
	Mobile terminal	Three per system	Optional	
When elevator camera surveillance is used	Camera	One per elevator	Optional	
	Hard disk recorder	N cameras for one elevator	Optional	N depends on the model of hard disk recorder.
	Video surveillance monitor	One per system	Optional	Mainstream size or specify by the customer.

Definition of escalator group and entrance escalator

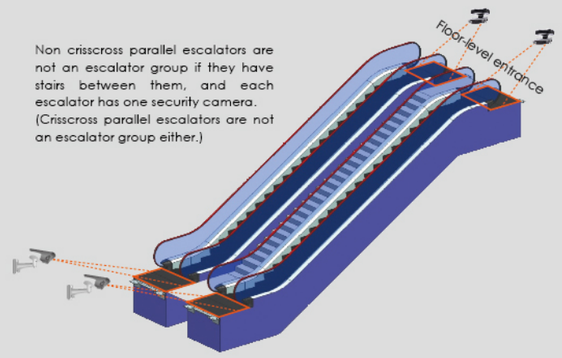
Provide one set of congestion detection cameras for each escalator

Non crisscross parallel escalators are an escalator group and share one security camera



Layout of escalator group

Non crisscross parallel escalators are not an escalator group if they have stairs between them, and each escalator has one security camera. (Crisscross parallel escalators are not an escalator group either.)



Layout of non-escalator group

Features List

S: Standard feature; A: Optional feature; D: Requires confirmation or non-standard design.

Feature Configuration	Name	Code	Configuration Code
Monitoring of elevator/escalator state	Monitoring terminal monitors the state of elevators/escalators	IMT-S	S
	Mobile terminal monitors the state and manages the records of elevators/escalators.	IMT-M	A
Smart monitoring of state	Identification and warnings of dangerous behaviors of passengers (slippage).	WDB-S	A
	Identification and warnings of dangerous behaviors of passengers (reverse traveling).	WDB-WR	A
	Identification and warning of dangerous behaviors of passengers (exit congestion)	WDB-CLA	A
Smart safe start and stop every morning and evening	Smart safe start and stop every morning and evening and preliminary fault diagnosis.	IAM	S/D *1
Smart Auto Announcer	Auto Announcer adaptive to ambient sound volume	IAAN	A
	Control features 1-6	M_FUN1~6	S
	Traffic analysis	M_TALO	S
	Replay feature	M_ROLB	S
	Integrated with the building monitoring system (BA interface)	M_BADV	A
	Remote monitoring	M_REMO	A
	Video surveillance (car)	M_ITVS	D

Remarks:

*1 S: Shanghai Mitsubishi escalators; D: Escalators of other brands

System Specifications

Item			Specifications	Remarks
Number of elevators /escalators to be monitored	LonWorks transmission network		63	
	TCP/IP transmission network		254	
Parameters at the elevator side			SMOS related parameters	
Control capability of the image analysis server and remote control device components			15 escalators/1 set of components	
Method of connecting with the elevator/escalator	Single-car	Imported elevator	One SMOS-II for each elevator	RS-422
		Proprietary elevator		CAN
	Parallel-car	Imported elevator	One SMOS-II for main elevator	RS-422
		Proprietary elevator	One SMOS-II for each elevator	CAN
	Group control	Imported elevator	One SMOS-Ii for group control panel	RS-422
		Proprietary elevator		CAN
	Escalator	Other brands	One escalator information interface device for each escalator	Interface and protocol is required
		Proprietary elevator		CAN
Multiple clients	LonWorks transmission network		Not supported	
	TCP/IP transmission network		Supported	

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