



IRSC 2022

INTERNATIONAL RAILWAY
SAFETY COUNCIL

SEVILLA, OCTOBER 16-21, 2022



機電工程署
EMSD



FACILITATION AND PROMOTION OF I&T FOR ENHANCEMENT OF RAILWAY SAFETY – HONG KONG EXPERIENCE

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AGENDA

Part 1

Railway Safety Regulator in Hong Kong

Part 2

Ways to Facilitate and Promote I&T Applications

Part 3

Examples of I&T Applications

Part 4

Conclusion

Part 1

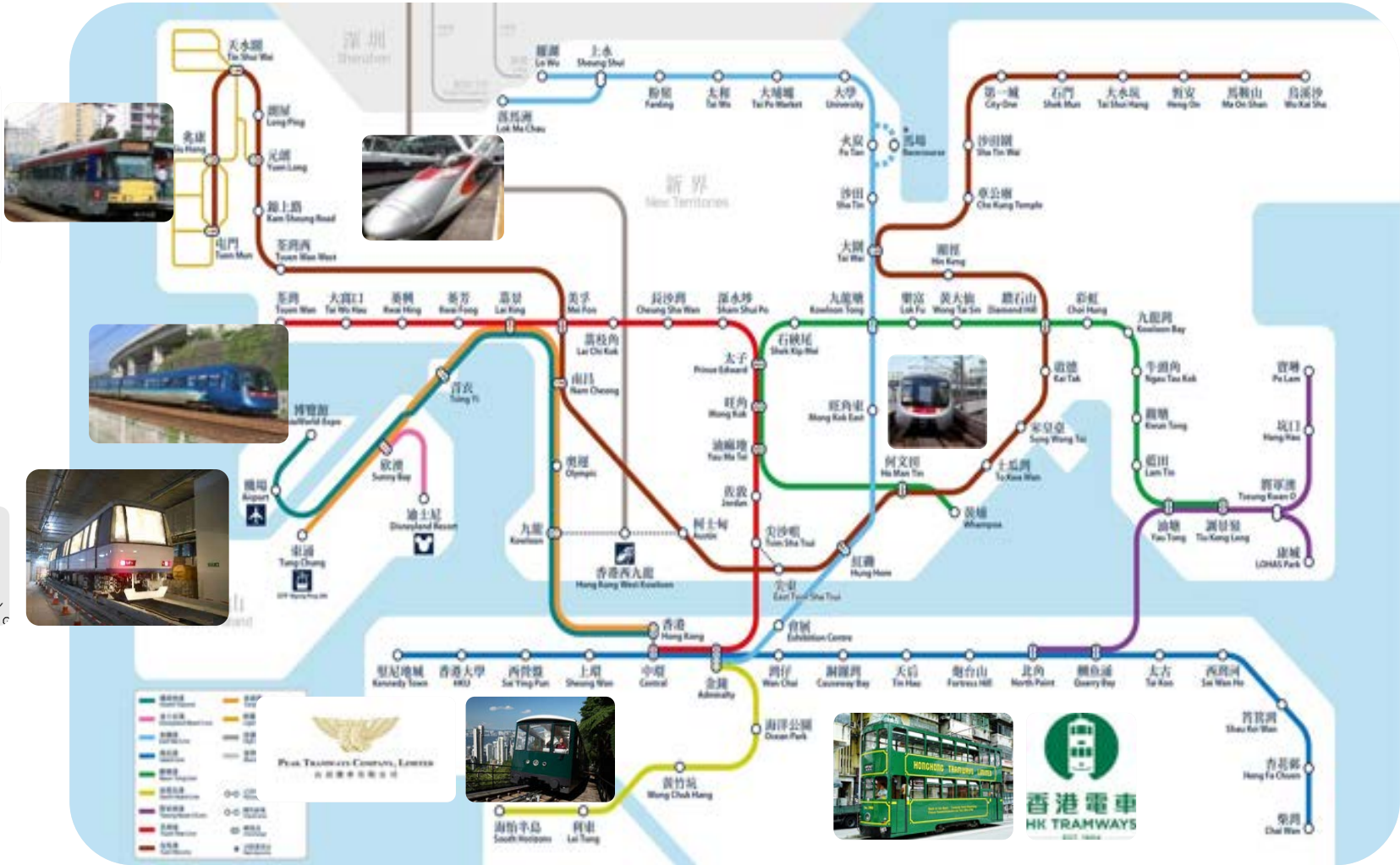
Railway Safety Regulator in Hong Kong

Railway Safety Regulator - Electrical and Mechanical Services Department (EMSD)

EMSD is the railway safety regulator in Hong Kong which regulates safety of mass transit railways, tramways and peak trams through law enforcement and continuous public education. Regulatees include:



Hong Kong Railway Lines



Role of Innovation facilitator

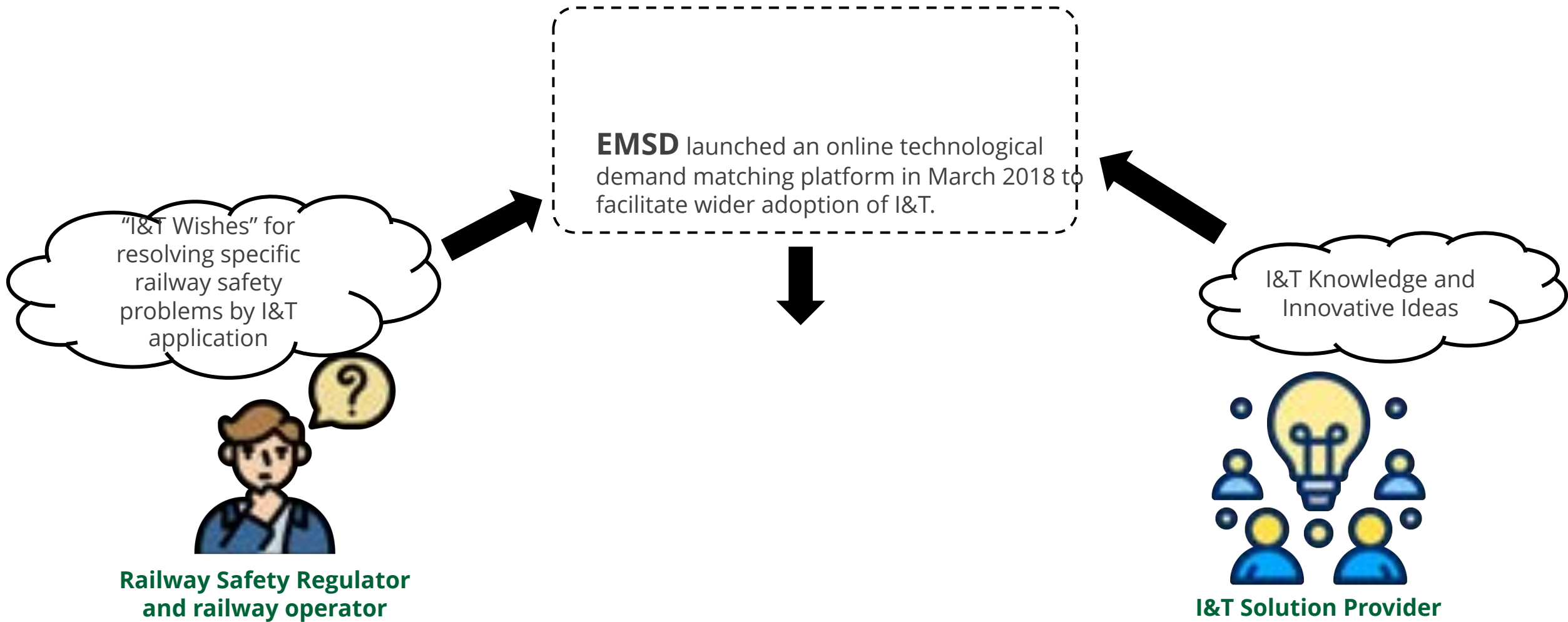
Under the Pro-innovation Government Procurement Policy, **EMSD** is the “**Innovation facilitator**” of the Government, who supports and facilitates the application of innovative technologies by bureaux and departments to improve services and support smart city development.



Part 2

Ways to Facilitate and Promote I&T Applications

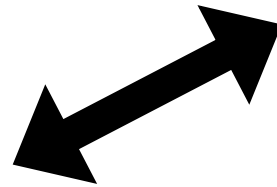
E&M Inno-Portal



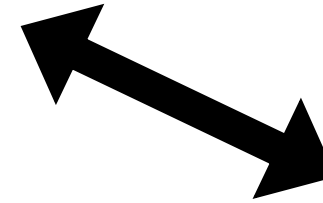
E&M Inno-Portal



**Railway Safety Regulator
and railway operator**

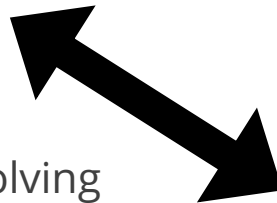


2 List the wish on
"I&T Wish List"



I&T Solution Provider

3 Propose their innovative
solutions to the "wish"



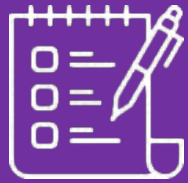
5 Coordinate with railway operators to implement
pilot I&T projects in railway environment

1 Post the "I&T Wishes" for resolving
specific railway safety problems

4 Accept appropriate I&T
proposal and initiate pilot
project

E&M Inno-Portal (<https://inno.emsd.gov.hk/en/home/>)

I&T
Wishes



410+

I&T
Solutions



960+

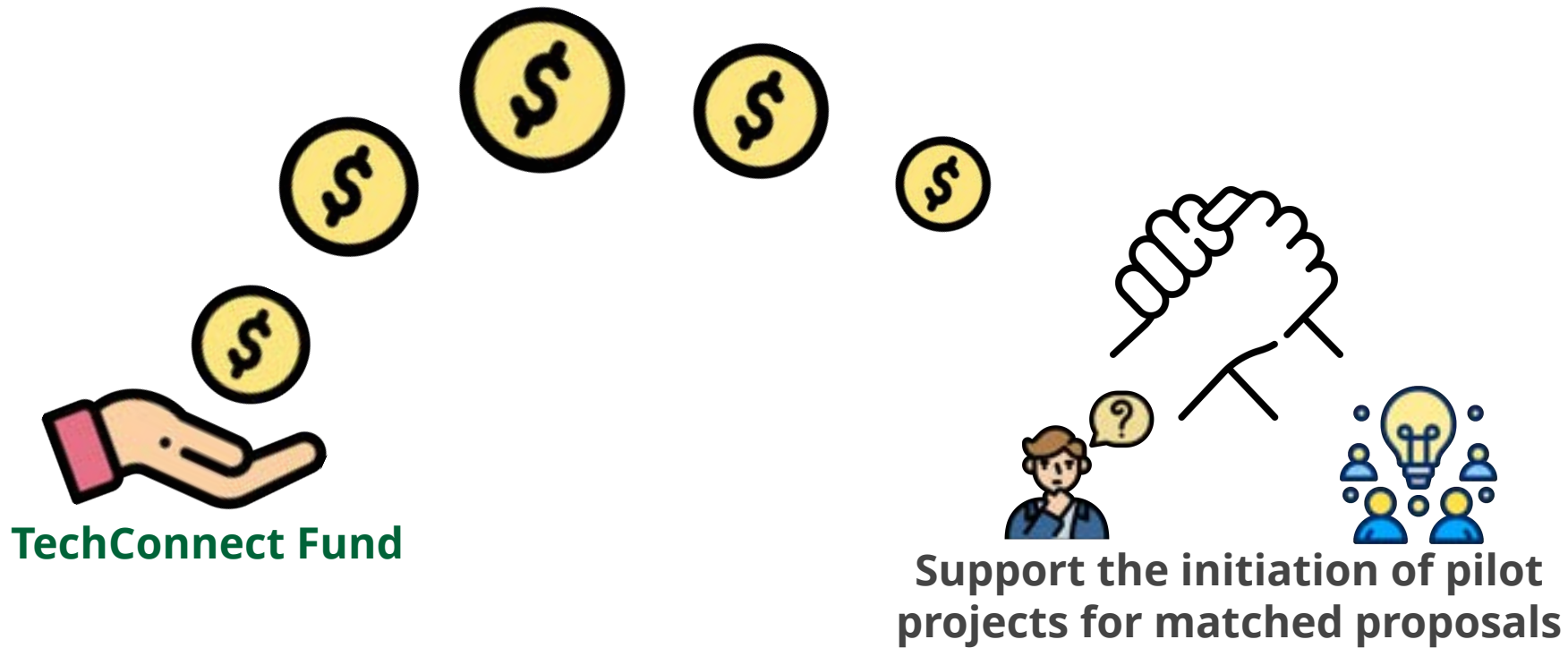
I&T
Trials



150+

TechConnect Fund

- The Innovation and Technology Bureau (ITB) rolled out a funding scheme, **TechConnect (block vote)**, in mid-2017 to assist government departments to improve the quality of public services through technology adoption.
- Funding of **6 pilot projects** related to railway safety have been approved.



Regulator-Regulatee Partnership Approach



Regular I&T Forum



Communication Workshop

Regulator-Regulatee Partnership Approach

EMSD / Regulatee Collaboration I&T Project

Large object detection system
(Escalator accident detection and safety message dissemination System)
Semantic AI for Predictive Maintenance of Railway Track System

Internet of Things (IoT) Vibration Sensor Installed at Advertising Panels
Real-time intrusion detection at track sections
AI-based Object Detection System at Jordan Station
Large Object Detection for Escalator
Smart Driver Assistant for Automated People Mover
Tram speed alert system
Tramway track small/foreign object detection system
Adoption of 3D Point Cloud Technology for AI Analytics of Railway Infrastructure Condition
Haulage Rope AI Condition Monitoring System for Peak Tramway System
Smart Scanning for AI Analysis of Railways Station Concrete Condition
Overhead Line Wire Real-time Monitoring and Data Analytics System
Smart Detection System for Operator Fitness and Attendance

Regulatee I&T Project

Passenger Loading System
Waiting Time Indicator
Smart Toilets

Visualized Overhead Line Remote Earthing
3D Printed Combs for Escalator (Trial)
Automatic Radar-based Intelligent Shunting Application

Video Analytics Application in Stations
Integrated Speed and Positioning System for Light Rail (iSPS)
Escalator Object Identification System
Escalator Real-time remote monitoring and predictive diagnostic system
Video Analytic Detection System at Light Rail Junction
Signal Aspect Detection by Light Sensor
Performance & Health Monitoring for R-train
LiDAR/RFID application on Infrastructure Application
Fitness Monitoring System for Operation Control Centre
Smart Safe Manual Train Movement in Depot
Application of IoT Sensor for PSD

Foster I&T Cultural Development

inventions Geneva



Participate in International Competitions

EMSD wins 19 awards at International Exhibition of Inventions of Geneva in 2022. Railway safety related awards:



Gold medal:

Smart Driver Assistant for Automated People Mover for prevention of human fatigue and errors during manual driving of a train

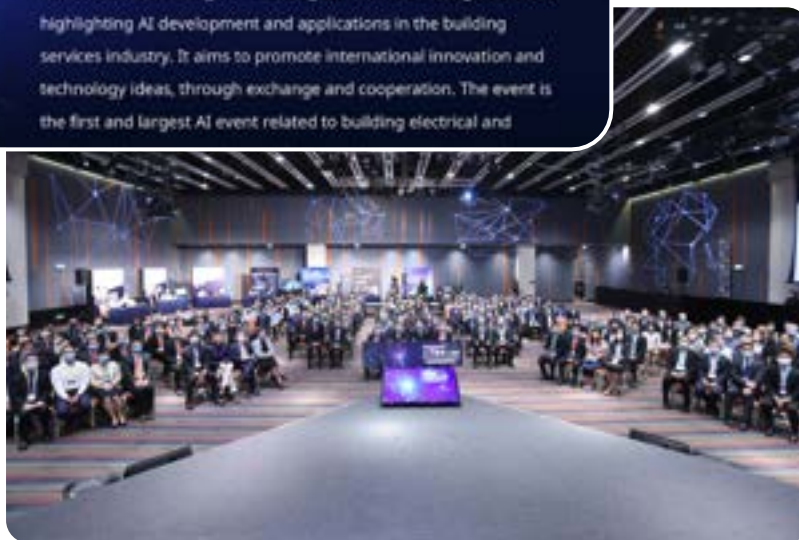


Silver medal:

Semantic AI for Predictive Maintenance of Railway Track Systems for analyse massive maintenance data and incidents and derive health indices for indicating the healthiness of railway track system

Foster I&T Cultural Development

Organise I&T Seminars, International Conferences,
Technical Visits and I&T Competitions



Participation in
International Organisation

Part 3

Examples of I&T Applications

Smart Maintenance

Semantic AI for Predictive Maintenance of Railway Track System

Problems

- No prediction on permanent way incidents
- Difficulties in analyzing massive permanent way maintenance data

Solution

- Semantic AI
- Predict permanent way incidents from asset data, maintenance records, incident reports and real time condition measurement results
- Dashboards for Incident Trends
- Automation of Incident Analysis



Smart Maintenance

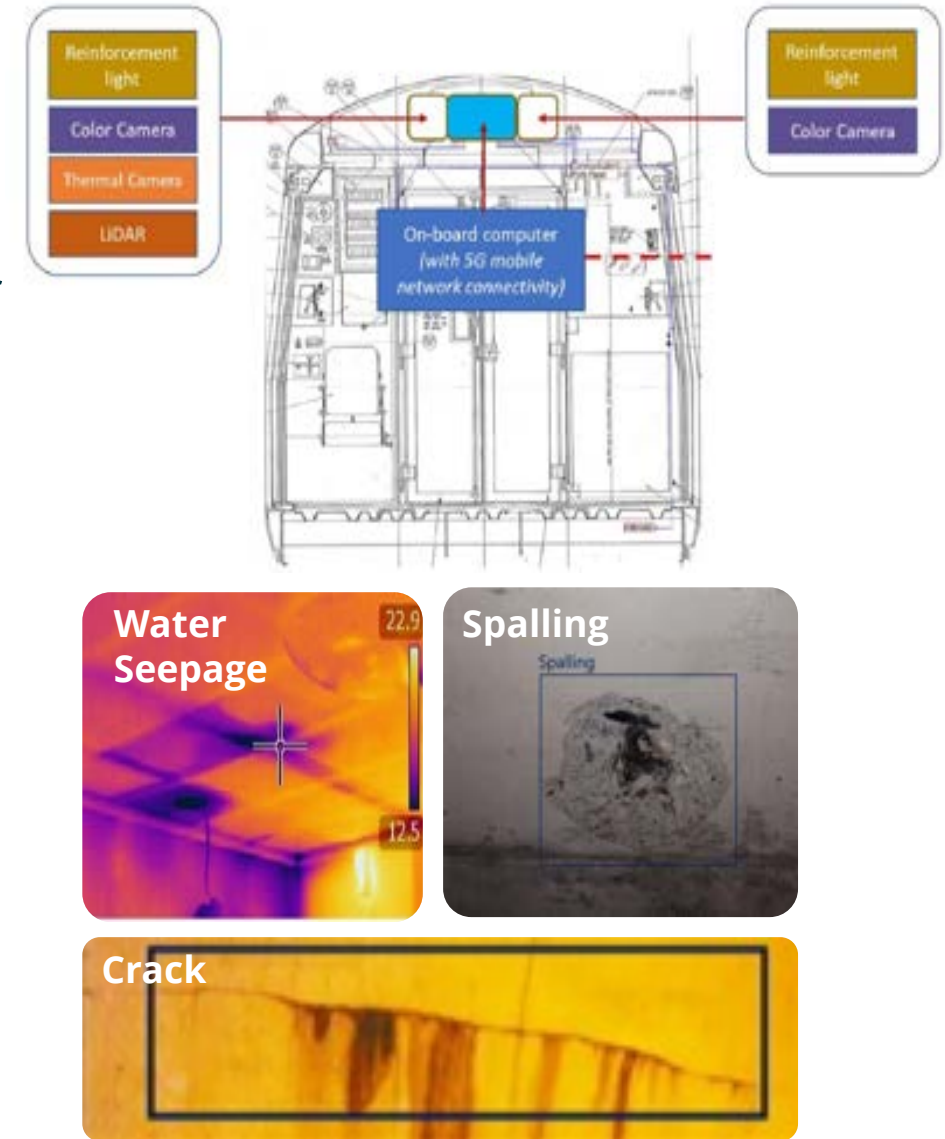
Adoption of 3D Point Cloud Technology for AI Analytics of Railway Infrastructure Condition

Problems

- Less efficient and less effective in manual patrolling for railway infrastructure which required more staff and time for routine inspection

Solution

- 3D scanner to produce 3D images of the railway infrastructure during traffic hours
- AI analytics for automatic comparison of the 3D images and evaluation of the infrastructure conditions.
- Automation of the inspection process



Smart Operation

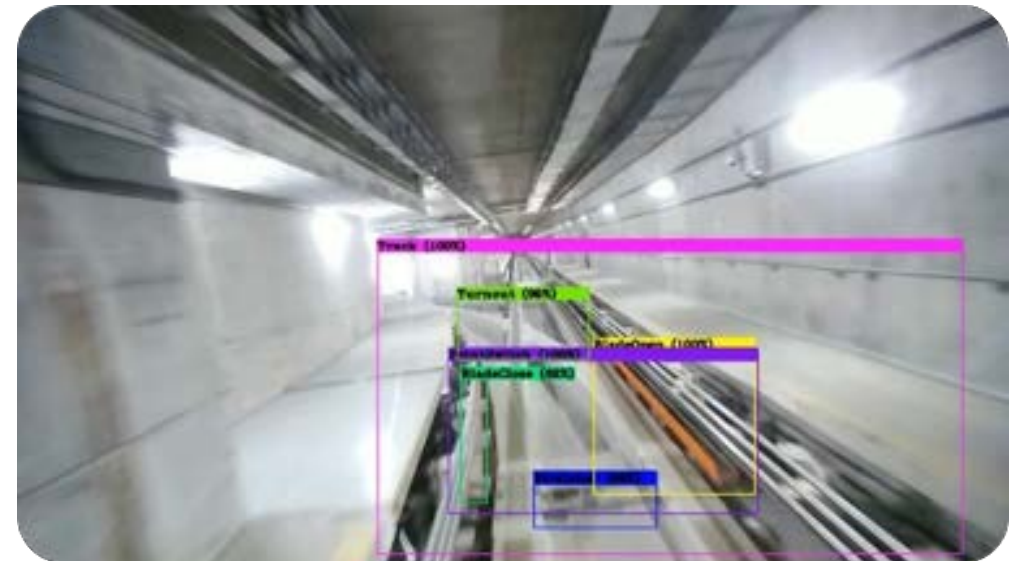
Smart Driver Assistant for Automated People Mover

Problems

- Incidents such as Signal Passed at Danger (SPAD) caused by human factors during manual mode driving.

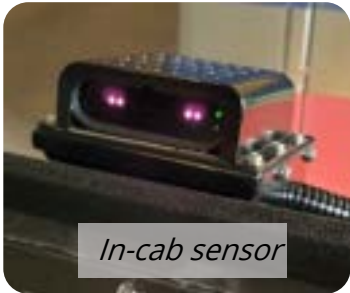
Solution

- AI and video analytics for real-time detection of the improper driving behaviours (e.g. fatigue, yawning or inattention) and trackside condition (e.g. stop signal, improper blade position, foreign object on the track)
- Provide the alert to train driver and send SMS to APM controller when abnormal event detected.



Smart Operation

Driver Fitness Monitoring System



Trackside Signal and Object Detections System

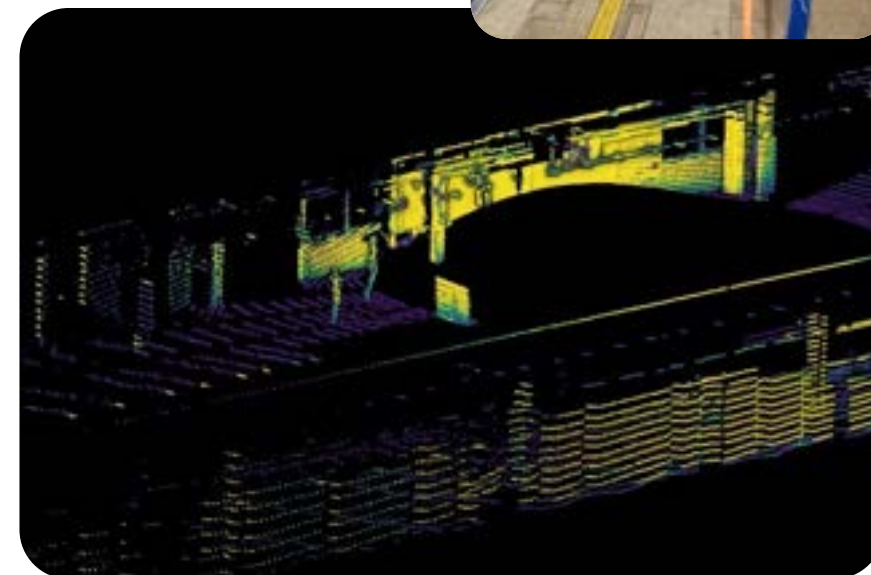
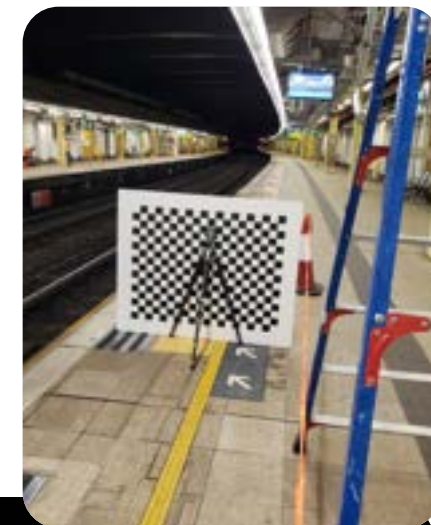


Similar design concepts are being applied to the light rail system in Hong Kong.

Management of Passenger Behaviour



LiDAR Crowd Control System



Tramway Track Small / Foreign Object Detection System

Part 4

I&T Solutions Sharing / Transfer

I&T Solution Sharing / Transfer

EMSD/Regulatee Collaboration I&T Project	Status
Large object detection system (Escalator accident detection and safety message dissemination System)	Completed
Semantic AI for Predictive Maintenance of Railway Track System	Completed
Internet of Things (IoT) Vibration Sensor Installed at Advertising Panels	Completed
Real-time intrusion detection at track sections	Completed
AI-based Object Detection System at Jordan Station	Completed
Large Object Detection for Escalator	Completed
Smart Driver Assistant for Automated People Mover	Completed
Tram speed alert system	In progress
Tramway track small/foreign object detection system	In progress
Adoption of 3D Point Cloud Technology for AI Analytics of Railway Infrastructure Condition	In progress
Haulage Rope AI Condition Monitoring System for Peak Tramway System	Planning
Smart Scanning for AI Analysis of Railways Station Concrete Condition	Planning
Overhead Line Wire Real-time Monitoring and Data Analytics System	Planning
Smart Detection System for Operator Fitness and Attendance	Planning

Completed solution

Sharing / Transfer Mechanism

Purposes	Conditions	Deliverables
Design Reference	Nil	<ul style="list-style-type: none"> ✓ Quotation Document ✓ Hardware & Software Lists
Trial Use	Signed off the Non-disclosure Undertaking Document	<ul style="list-style-type: none"> ✓ Detailed Design Report ✓ Executable File / Installation Package
Further System Development	Signed off the Licensing Agreement	<ul style="list-style-type: none"> ✓ Source Code

Sharing / Transfer

Regulatees



I&T Solution Sharing / Transfer

Sharing with Overseas Railway Regulator / Operator

Local Transport Authority, SMRT Corporation and SBS Transit Limited, Singapore

- Introduction of Smart Driver Assistant device
- Site demonstration to be arranged



Smart
Assistant
for
People

Driver
Automated



Gold medal Award
International Exhibition of
Inventions of Geneva in 2022

Part 5

Conclusion

Conclusion

- With expanding railway networks and patronage, and ageing railway assets in Hong Kong, maintaining a safe operation of railways will become more challenging.
- EMSD is committed to expedite the I&T transformation to sustain improvement in railway safety and regulatory enforcement in railway safety.
- Through adopting a regulator-operator partnership approach, EMSD leads by example to carry out proof of concept projects to demonstrate a series of I&T solutions to the railway operators.
- Looking ahead, EMSD will continue to work towards a smart regulator by enhancing effectiveness and efficiency of work process by digitization and automation.



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