



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

Mr C. F. CHAN

Assistant Director/Railways
Electrical and Mechanical Services
Department, Government of HKSAR,
China

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



IRSC 2022
INTERNATIONAL RAILWAY SAFETY COUNCIL
SEVILLA, OCTOBER 16-21, 2022



機電工程署
EMSD



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:



IRSC 2022
INTERNATIONAL RAILWAY SAFETY COUNCIL
SEVILLA, OCTOBER 16-21, 2022



機電工程署
EMSD



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.



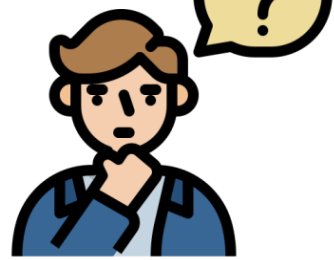
Part 2

Ways to Facilitate and Promote I&T Applications

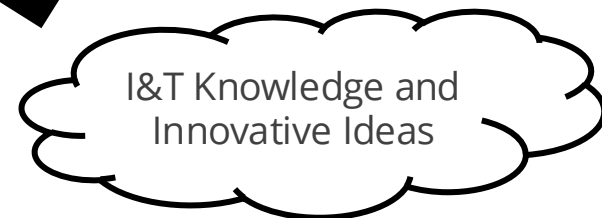
E&M Inno-Portal



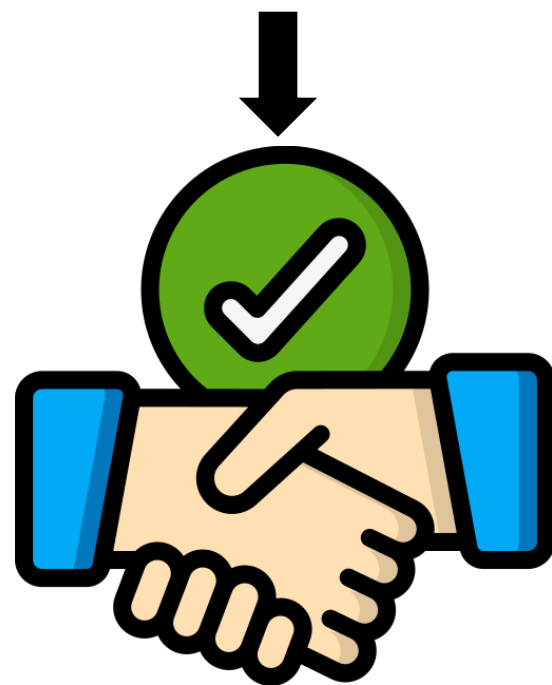
EMSD launched an online technological demand matching platform in March 2018 to facilitate wider adoption of I&T.



Railway Safety Regulator and railway operator



I&T Solution Provider



E&M Inno-Portal

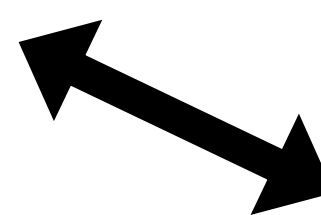


Railway Safety Regulator and railway operator



E&M InnoPortal®

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

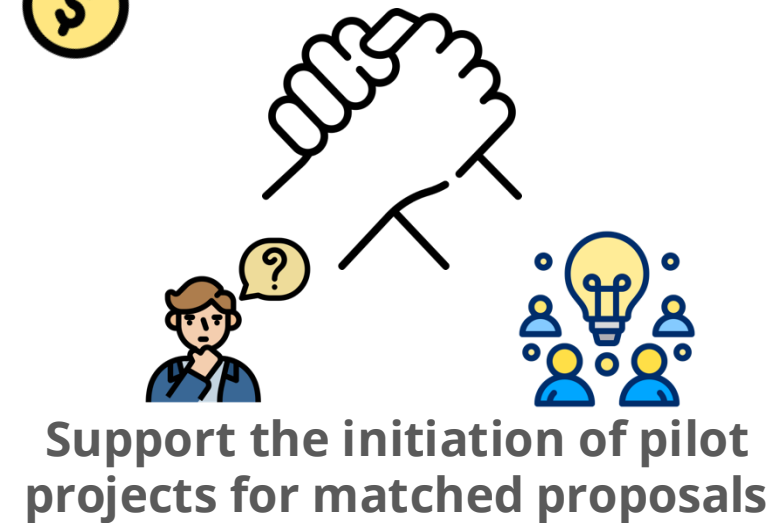


150+



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

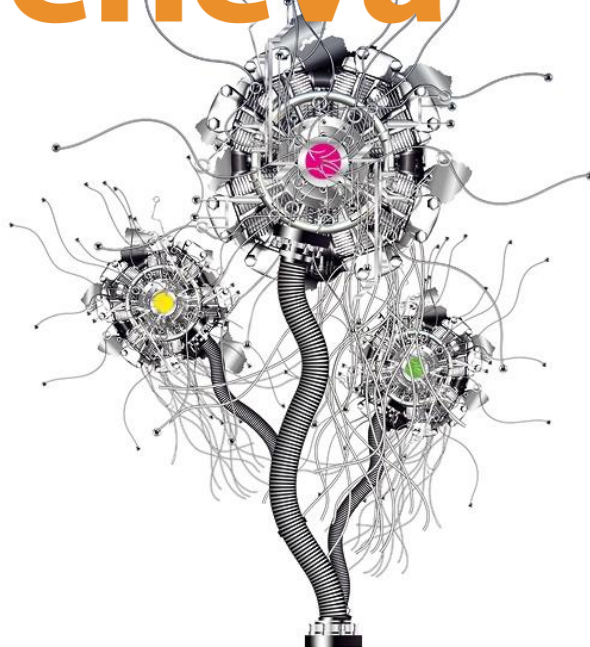
Fitness Monitoring System for Operation Control Centre

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

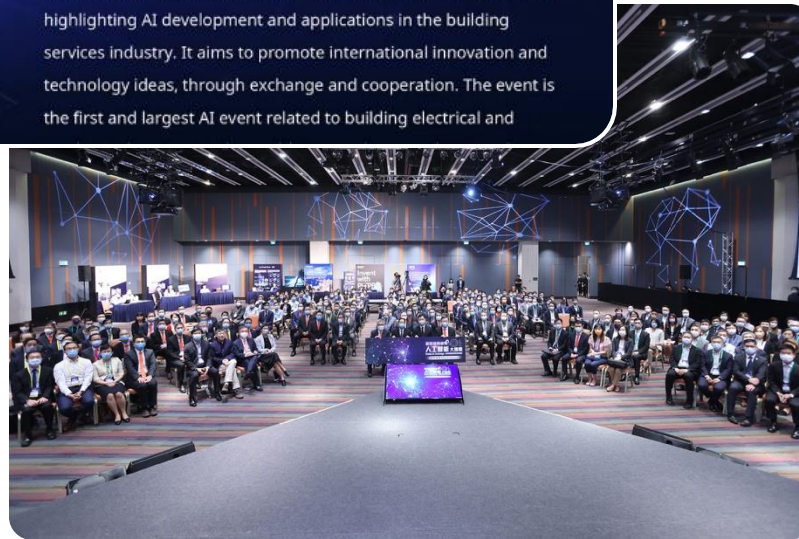


Silver medal:

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

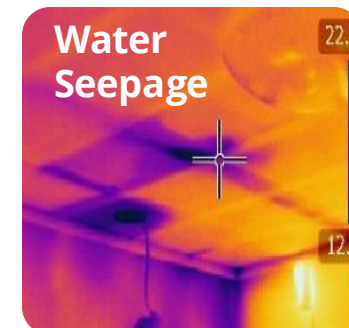
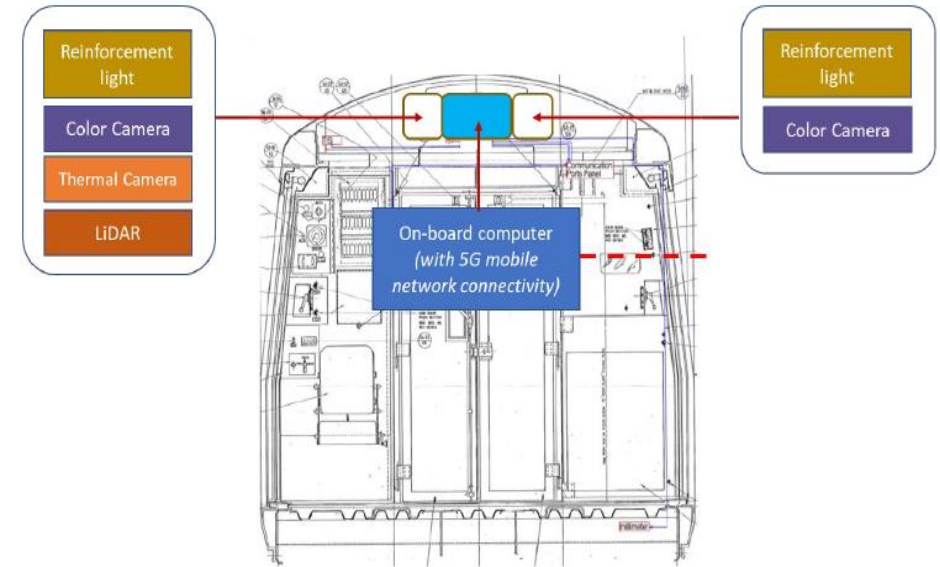
Adoption of 3D Point Cloud Technology for AI Analytics of Railway Infrastructure Condition

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

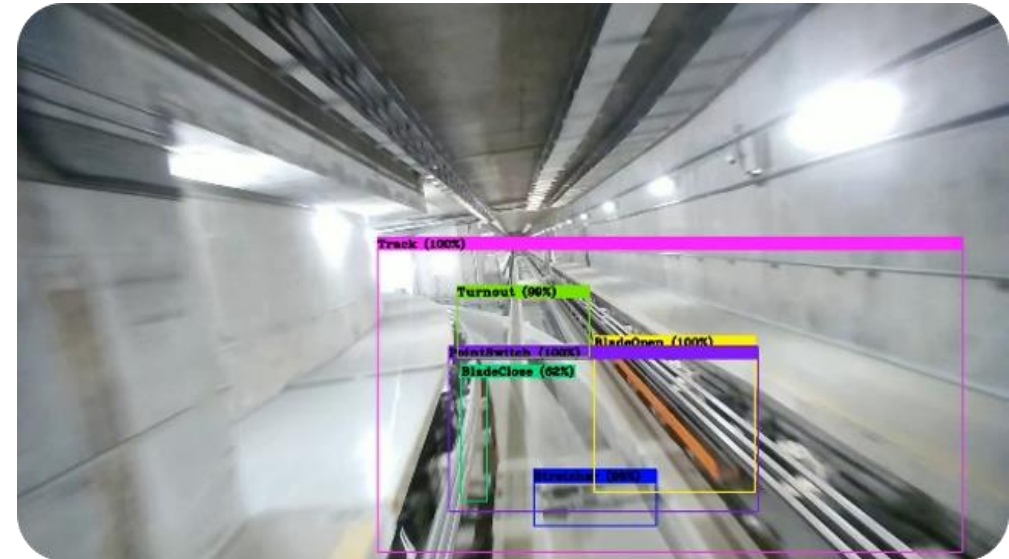
Smart Driver Assistant for Automated People Mover

Problems

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

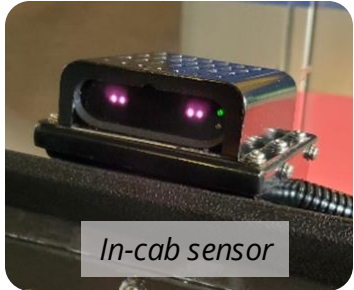
Solution

- 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.

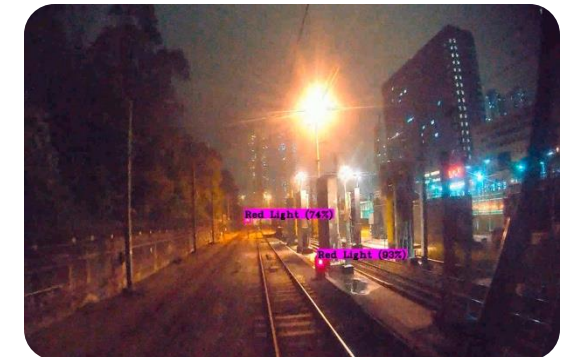
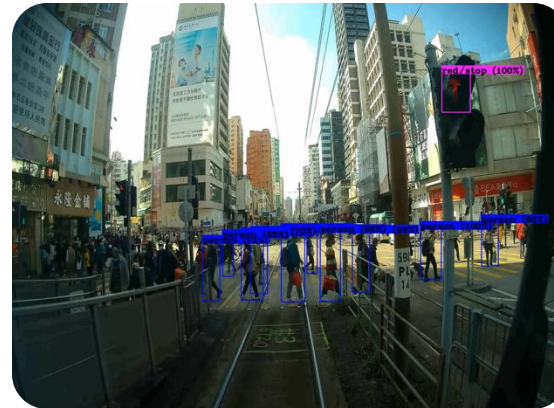


Smart Operation

Driver Fitness Monitoring System

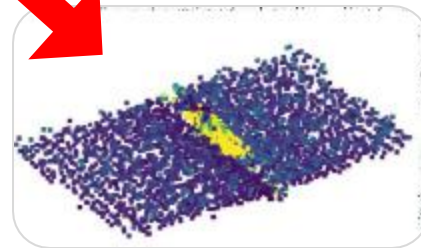


Trackside Signal and Object Detections System

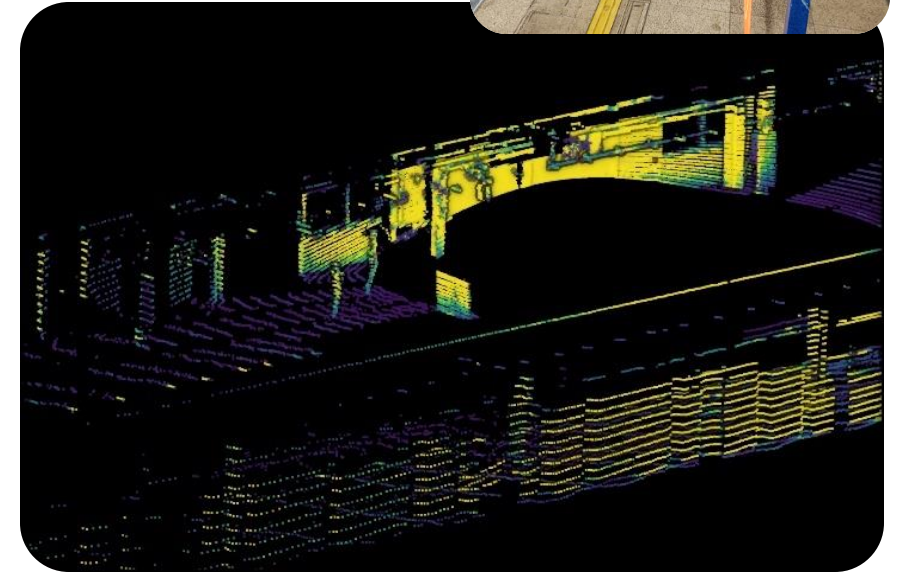
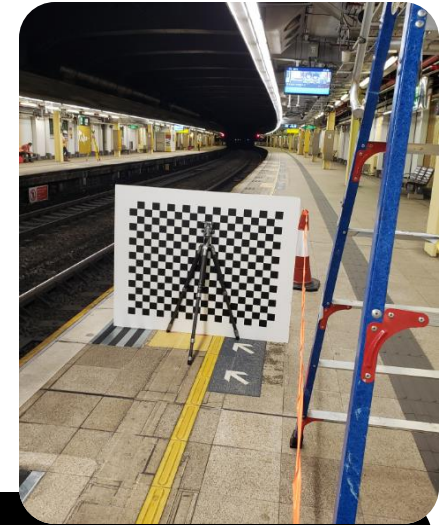


Similar design concepts are being applied to the light rail system in Hong Kong.

Management of Passenger Behaviour



LiDAR Crowd Control System



Tramway Track Small / Foreign Object Detection System

Part 4

I&T Solutions Sharing / Transfer

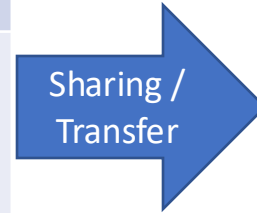
I&T Solution Sharing / Transfer

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



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



Regulatees



IRSC 2022
INTERNATIONAL RAILWAY SAFETY COUNCIL
SEVILLA, OCTOBER 16-21, 2022



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 Driver Assistant for Automated People



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.



IRSC 2022
INTERNATIONAL RAILWAY SAFETY COUNCIL
SEVILLA, OCTOBER 16-21, 2022





機電工程署
EMSD



www.irsc2022.com

