

# Adoption of Artificial Intelligence Technology for Prevention of Incident during Manual Driving of Automated People Mover

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# Background

Electrical and Mechanical Services Department (EMSD) is the regulatory authority on railway safety of Heavy Rail, Light Rail, Automated People Mover (APM), Peak Tram and Tramway in Hong Kong and monitors the safe operation of these railway systems.



Mass Transit Railway



Automated People Mover



Tramway

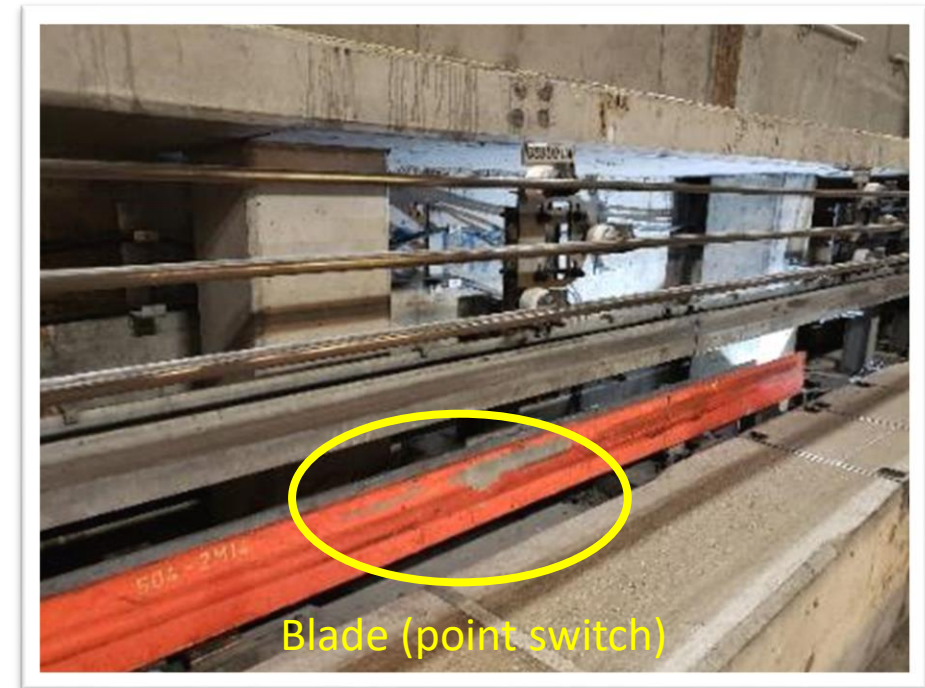


Peak Tram



# APM – Signal Passed at Danger (SPAD) Incident

A manual driven Automated People Mover (APM) vehicle did not stop at red signal (SPAD) during non-traffic hours and caused damages to the vehicle's guide wheel, guideway and point switch.



# APM – Signal Passed at Danger (SPAD) Incident

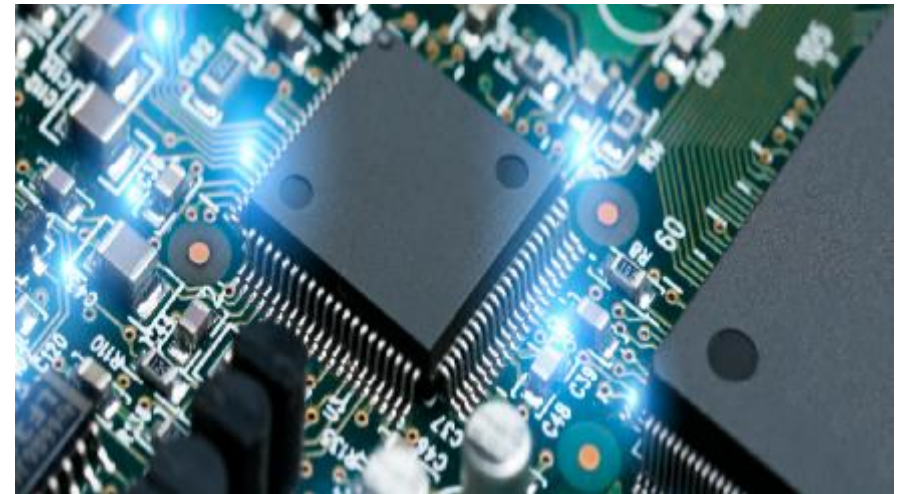
EMSD initiated a proof of concept (PoC) I&T project after the incident:

- Adoption of innovation and technology (I&T) for prevention of similar incidents (artificial intelligence, video analytics, edge computing, etc.)
- Develop a device to alert APM driver during manual driving and APM traffic controller
- Good working companion to driver for safe operation

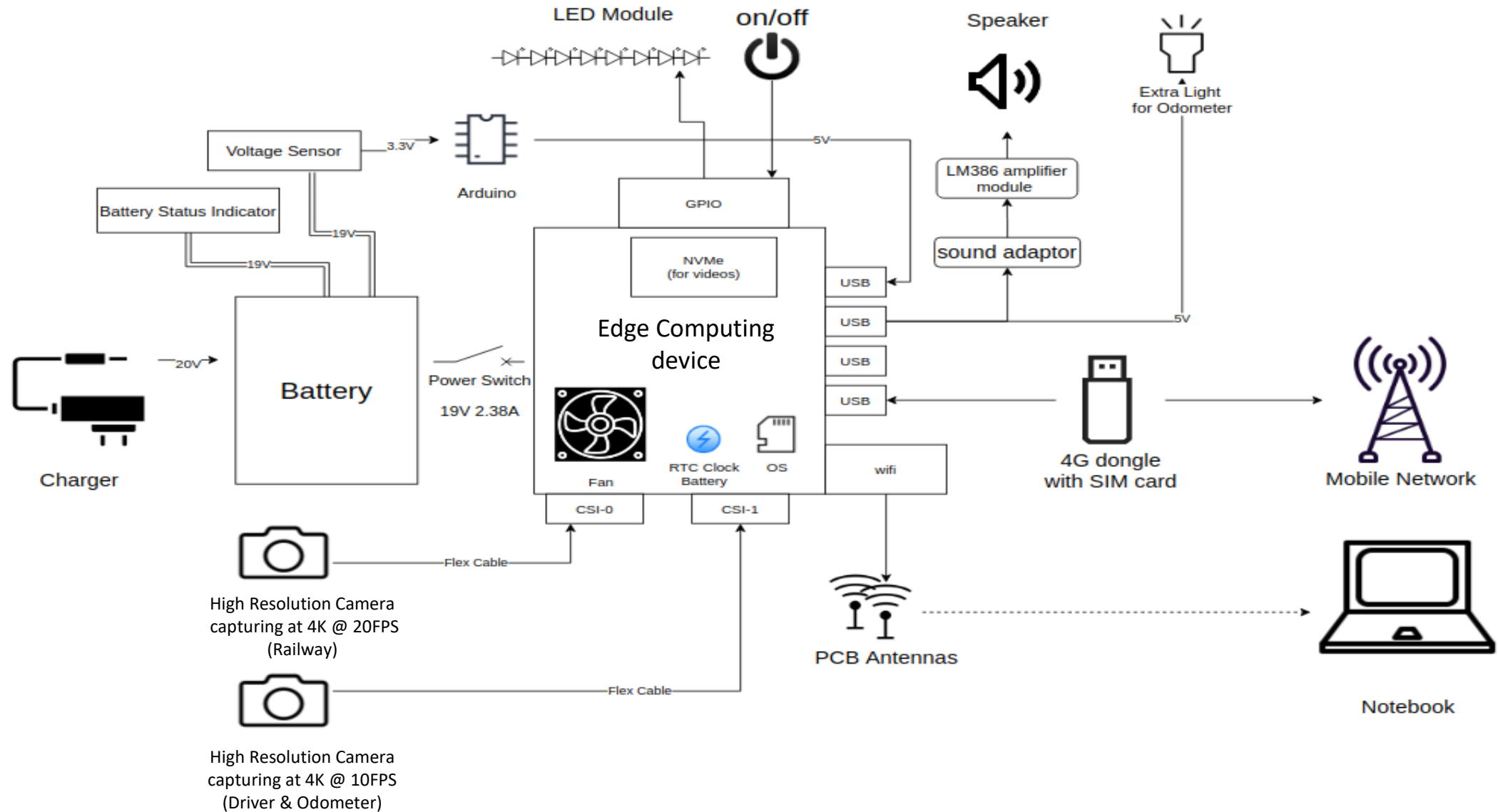


# Design Criteria

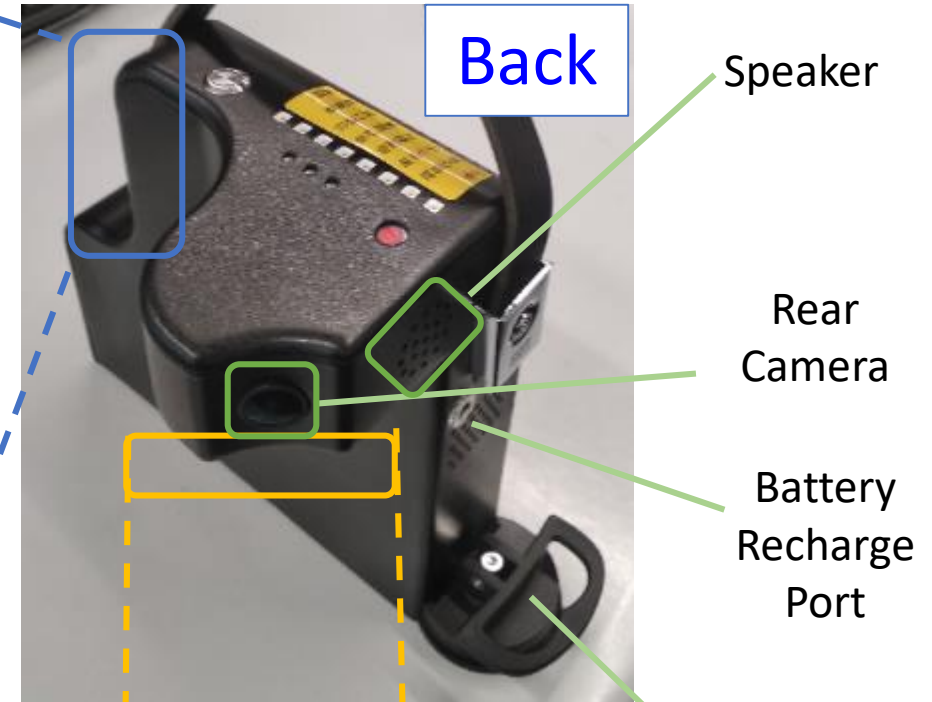
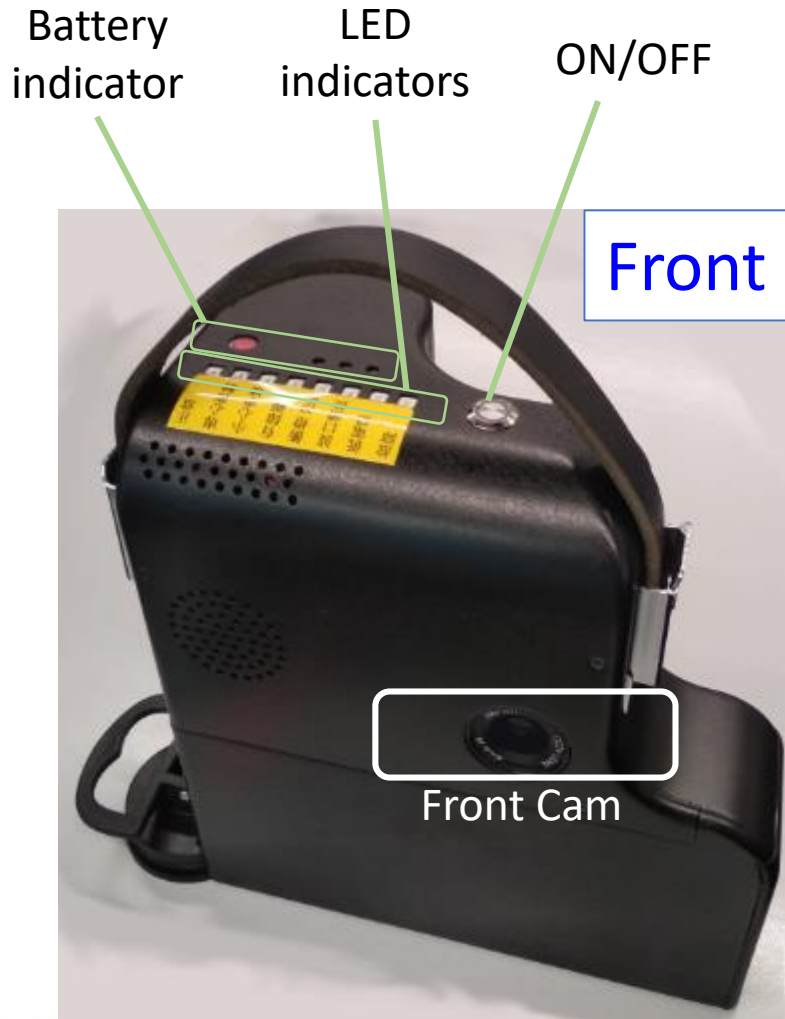
- All-in-one detection device
- High adaptability and portability
- Adoption of I&T
- Alarms to driver and APM traffic controller (audio & visual, SMS)
  - Signal Passed at Danger (SPAD), Buffer Stop ahead
  - Guideway (APM track)
  - Speeding
  - Improper behavior
  - Tiring/Loss of concentration



# System Block Diagram



# All-in-one detection device



# High Adaptability & Portability

➤ One design fits all types of APM



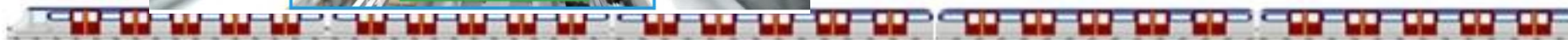
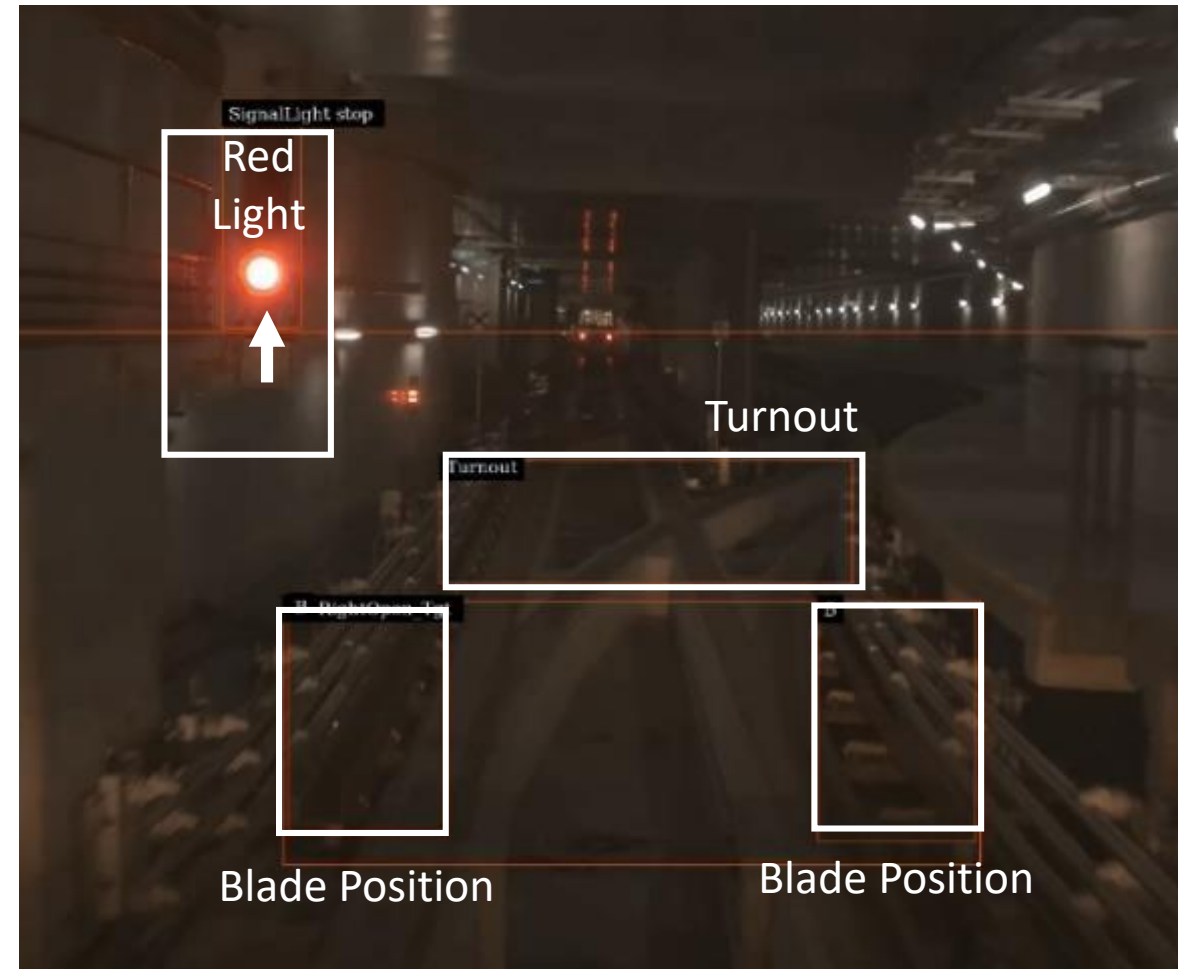
➤ Weight 2kg (highly portable)

- Ease of fixing (Industrial grade sucker cup)
- Ease of operation (one button ON/OFF)



# Adoption of Innovation and Technology

- Artificial Intelligent (AI) technology
  - Real time AI processing on device
  - AI Deep Learning
  - Advanced computer vision methods
- Video analytics technology



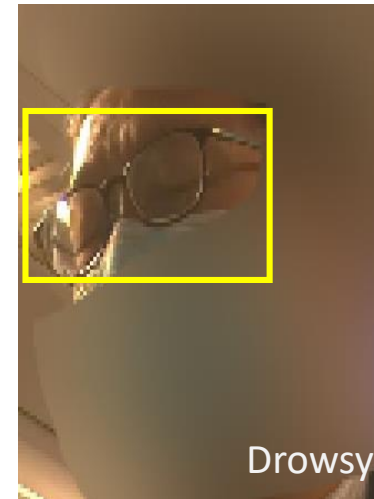
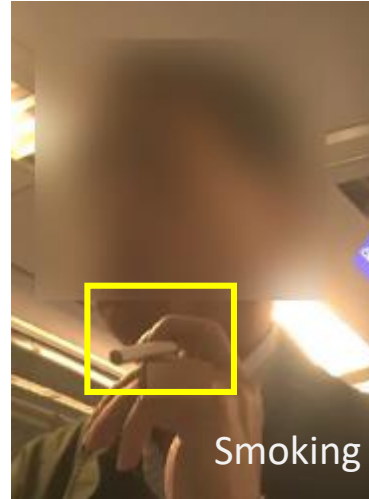
# Alerts to APM driver and traffic controller

## ➤ Improper behavior/ tiring/ loss of concentration

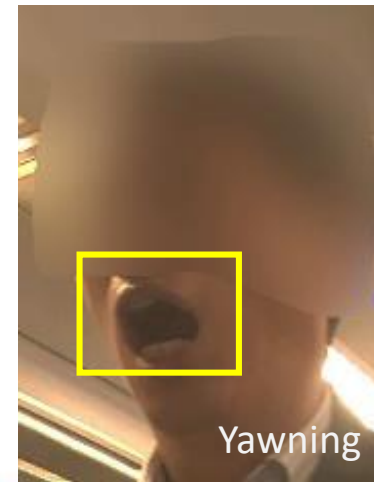
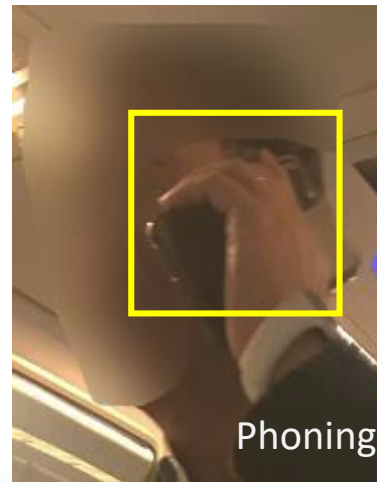
- Phoning (with/without face mask)
- Smoking
- Drowsiness (with/without face mask)
- Yawning

## ➤ Speed detection from odometers video image

- Reminder of driving at normal speed
- Alarm on speeding



(image redacted for privacy consideration)



(Speed detection from the odometer video)



# Alerts to APM driver and traffic controller

- Signal passed at Danger (SPAD)
  - Early warning before the stop light
  - Signal Passed at Danger (SPAD)
- Buffer Stop Reminder
- Guideway condition
  - Improper Blade Position
    - Signal-blade mismatch
  - Foreign Objects
    - People, traffic cone, toolbox, cable drum, hoarding, etc.
  - Buffer Stop ahead alert

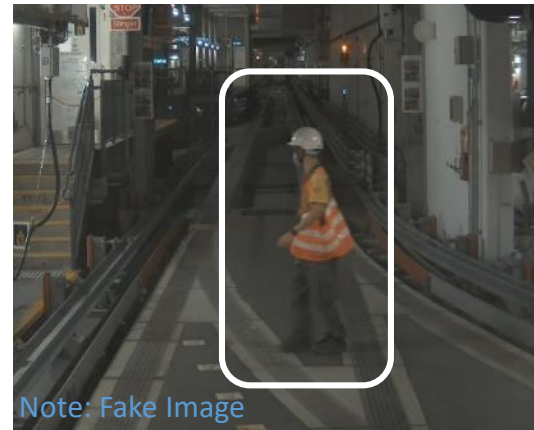


Note: Fake Image

Early warning of stop signal, SPAD alarm if stop signal is passed

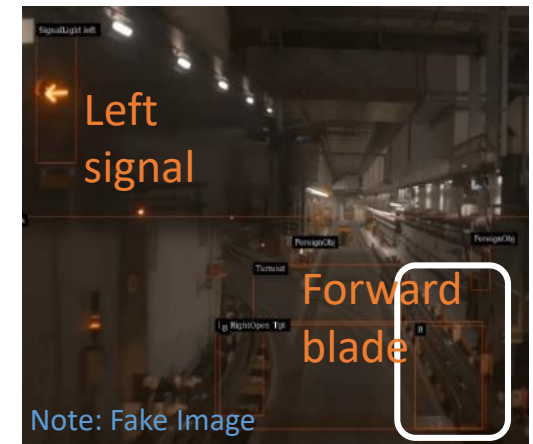


Buffer Stop alert



Note: Fake Image

Alarms for foreign objects on track



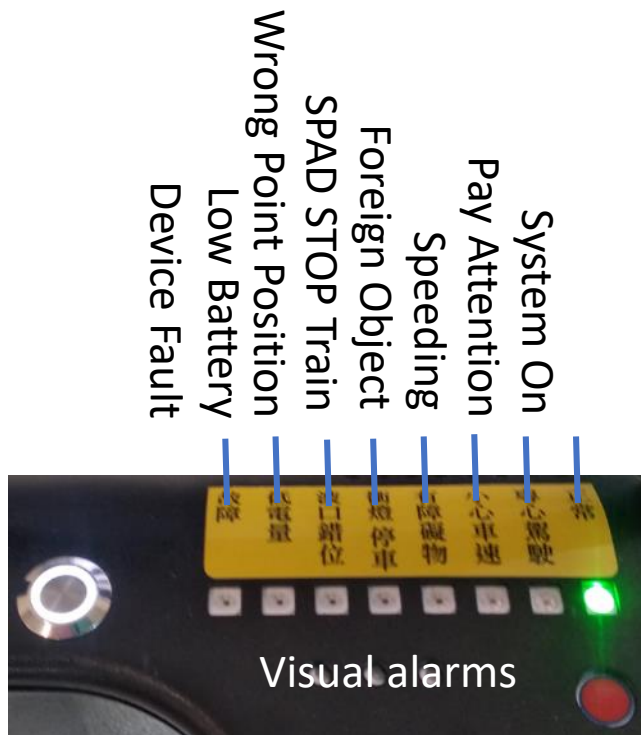
Note: Fake Image

Improper blade situation



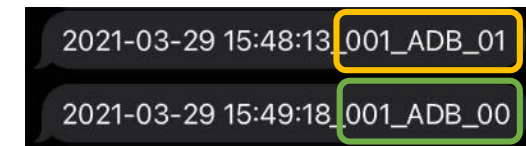
# Alerts to APM Driver and Traffic Controller

- Visual and audio alarms to driver and SMS alert to APM traffic controller



Audio Alarms
Pay Attention
Speed alert
Speeding Alert
"beep" at increasing frequency when approaching the buffer Stop
Red Light
SPAD, STOP the Train
Foreign object
Wrong point switch position

## SMS alert



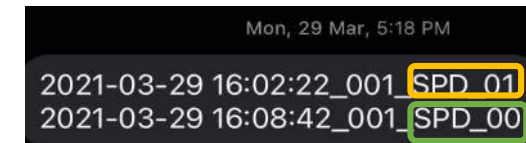
Abnormal Driver Behaviors (ADB)

Code: **ADB**

Event interval: 15:48:13 – 15:49:18

**ADB\_01** -> beginning of the ADB incident

**ADB\_00** -> end of the ADB incident



Signal passed at Danger (SPAD)

Code: **SPD**

Event interval: 16:02:22 – 16:08:42

**SPD\_01** -> beginning of the SPAD incident

**SPD\_00** -> end of the SPAD incident



# Experience Sharing



# Experience Sharing

## Challenges

- Regulatees lack of motivation to adopt I&T solutions for improvement
- Long development cycle of I&T solution and success is not guarantee
- No extra manpower resources / experts to lead the I&T development



# Experience Sharing

## Get it Work

- Authority to lead by example in driving I&T solutions
- Collaboration with the University and Research Institute for development of I&T solutions
- Implement pilot project to demonstrate a quick win solution
- Regulatees to adopt pilot I&T solutions for full implementation



# Experience Sharing

## Butterfly Effect

- Successful Cases Sharing in I&T Forum with Regulatee
- Win-Win-Win (Regulator, Regulatee and Passengers)
- Enhance railway safety



# Regulator-Operator Partnership

Platform and funding for pilot trial of I&T solutions



Wider I&T applications  
(MTR, Airport Authority, HK Tramways, Peak Tram)



# Thank You

For further information, please contact  
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