GS1 Hong Kong

The Hong Kong Internet of Things
Industry Advisory Council

IOT DATA HACKATHON 2024

A Casebook of Winning Solutions

Content

About IOT Data Hackathon 3

Student Stream

Champion 4
CHML
Renovation of In-Store Inventory System

1st Runner Up 6
Roomates
Smart Charge

2nd Runner Up & Smart IoT Solutions Award for EV Charging 7
TEAM CITYU
SparkLink

Professional Stream

Champion 8
TriTerra Technology Limited
Car Park Load Shifting Charging System

1st Runner Up & Smart IoT Solutions Award for EV Charging 10
Reunion
Smart Plug

2nd Runner Up 11
DevAdventurers
All-In-One Monitoring & Predictive Maintenance Platform

Best ESG Achievement Award 12
CECAS
AIOT Lift & Escalator Maintenance System

Innovator of Secure by Design 13
RightPick Technology Limited
Cybersecurity Solution

Organising Committee 14

Acknowledgements 15

About the IOT Data Hackathon

As the world becomes increasingly interconnected, the Internet of Things (IoT) has emerged as a powerful force, generating an abundance of data from sensors, devices and systems. This wealth of data holds immense potential to revolutionize industries, optimize processes, and drive business growth. The IOT Data Hackathon serves as a platform to bring together young innovators, problem-solvers and data enthusiasts in Hong Kong to harness the power of IoT data for building impactful solutions, and tackling real-world business challenges in the themes of “Smart City” and “Smart Supply Chain”.

More than 80 teams of local tertiary students and business professionals joined the hackathon. After a rigorous initial proposal screening process, 22 teams — 12 from the Student Stream and 10 from the Professional Stream — emerged as finalists to participate in the final 2-day hackathon, where they worked together to develop and pitch their innovative solutions to a judging panel of 14 industry experts. A dedicated group of 22 mentors, consisting of industry professionals and subject matter experts, provided valuable guidance and mentorship to the finalists throughout their hackathon journey.

In total, 10 awards are granted to 8 teams across the Student and Professional Streams, recognizing their outstanding achievements and creativity. The winning solutions demonstrated the innovative use of IoT & alternative data, and cutting-edge technologies to transform businesses, and shape a more sustainable future.

IOT DATA
HACKATHON
2024

IOT DATA
HACKATHO
N 2024
Organiser
Co-organisers
HKSTP
Government Support
Office of the Government Chief Information Officer
Technology Partner
Collaboration Partner
EXIT出口

Student Stream - **CHAMPION**

CHML

Renovation of In-Store Inventory System

THE CHALLENGE

PARKnSHOP, a prominent industry player, is looking for solutions to address out-of-stock issues. Two problems have been identified:

1. Demand forecasting has greatly benefited inventory management in many industries. However, accurately predicting inventory levels during unexpected events like sudden typhoon hits, remains a challenge.

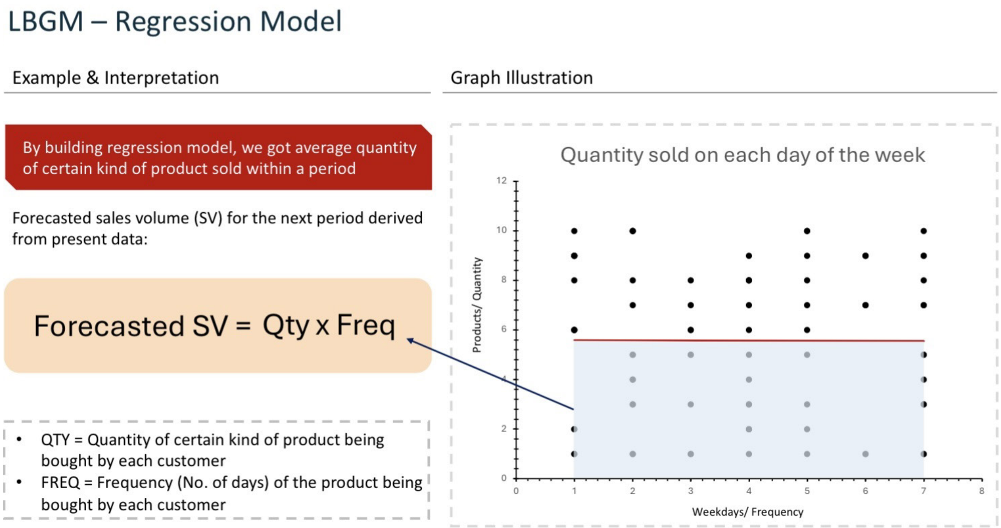
2. The lack of effective translation between stock availability in the storeroom and replenished shelves by store staff leads to customer frustration and loss of potential buyers. Customers may assume products are sold out and leave for other supermarkets, resulting in a negative brand image and diminished customer loyalty over time.

THE SOLUTION

The solution includes a new forecast system "Forecast X" and a new inventory system "SmartStock".

Forecast X

To improve inventory planning in supermarkets, a precise forecast model called LightGBM (LGBM) is implemented. This model offers increased speed, efficient handling of high-dimensional datasets, and robustness to outliers. LGBM's unique columnar structure allows for quick processing and adaptability with different parameters. Incorporating variables like "on promotion" improves forecast accuracy by considering factors like increased sales during promotions and vice versa. The flexibility of the model's architecture extends to adjusting outputs for different variables like "extreme weather conditions," enhancing inventory planning accuracy by addressing various influencing factors on consumer behavior.


LBGM – Regression Model

Example & Interpretation

By building regression model, we got average quantity of certain kind of product sold within a period

Forecasted sales volume (SV) for the next period derived from present data:

Forecasted SV = Qty x Freq

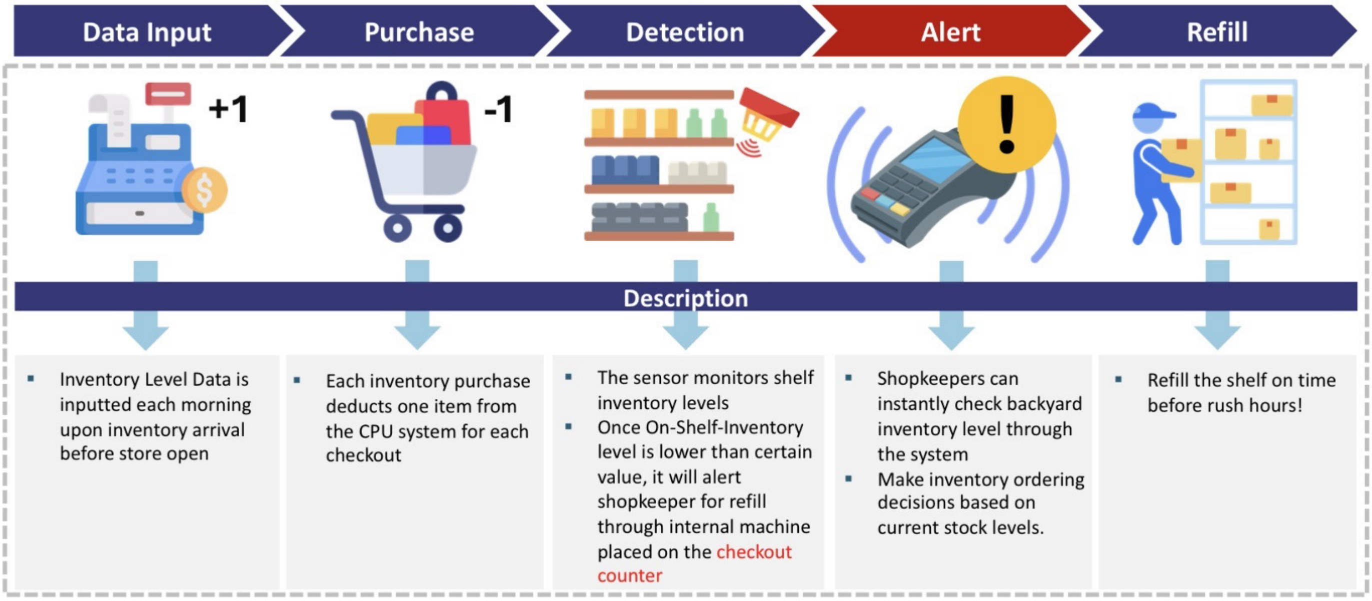
- QTY = Quantity of certain kind of product being bought by each customer
- FREQ = Frequency (No. of days) of the product being bought by each customer

Graph Illustration

SmartStock

The "SmartStock" system intends to address out-of-stock issues in PARKnSHOP stores by monitoring inventory levels. Inventory data is input into the system every morning, and items are deducted as customers make purchases for accurate tracking of stock levels. Sensors on shelves continuously monitor inventory levels and trigger alerts when stock falls below a predefined threshold, which is determined by the "AI-driven Stock Refill System" using Dynamic Rate Adjustment and Historical Data Analysis. The system alerts shopkeepers to refill shelves promptly, prevents complete stockouts, improving operational efficiency and customer satisfaction.

How SmartStock Works?



Data Input

Purchase

Detection

Alert

Refill

Description

- Inventory Level Data is inputted each morning upon inventory arrival before store open

- Each inventory purchase deducts one item from the CPU system for each checkout

- The sensor monitors shelf inventory levels
- Once On-Shelf-Inventory level is lower than certain value, it will alert shopkeeper for refill through internal machine placed on the checkout counter

- Shopkeepers can instantly check backyard inventory level through the system
- Make inventory ordering decisions based on current stock levels.

- Refill the shelf on time before rush hours!

BENEFITS & IMPACT

Forecast X

- Enhance customer experience and satisfaction through improved product availability, leading to improved customer retention and higher profitability
- Streamline the supply chain and enhance operational efficiency
- The LGBM-based demand forecaster offers insights and analytics for data-driven decision-making, capturing market opportunities and mitigates risks
- Align with the Zero Waste movement by accurately predicting demand to minimize excess inventory, and reduce waste and associated carbon emissions throughout the product lifecycle

SmartStock:

- Leverage advanced predictive analytics to help businesses have the right products available at the right time
- Real-time data enables businesses to collaborate with suppliers in real-time, enhancing supply chain efficiency
- Avoid excessive purchasing, reduce pressure on suppliers, and minimize potential labour exploitation
- Promote responsible resource allocation

THE FUTURE

The integration of AI in various sectors will bring breakthroughs in business models. Technology enables precise data collection and analysis of large datasets, while AI and quantum computers minimise uncertainty by providing accurate predictions.

The vision is to promote widespread use of AI in the consumer retail industry, benefiting both consumers and businesses. The project’s next phase aims to refine product market fit and enhance key functionalities for ensure seamless implementation. Scalability and flexibility are important as more stores adopt the system to meet evolving demand. Future efforts will focus on accommodating growing data volume and adapting to changing business needs.

Student Stream - **1st RUNNER UP**

Roomates

Smart Charge

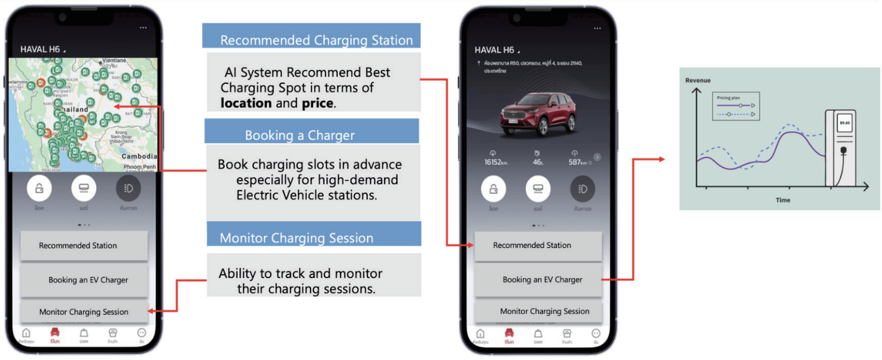
THE CHALLENGE

Property managers struggle with meeting the growing demand of electric vehicle (EV) charging while enhancing profitability. EV users face difficulties in finding affordable, convenient, and reliable charging spots amidst crowded parking lots. The main issues include underutilized charging stations, misuse, and imbalanced AC and DC chargers.

THE SOLUTION

A comprehensive solution has been developed to optimizes charging station utilization, prevents misuse, and strategically balances AC and DC chargers.

App Recommendations from EV Charger App



Recommended Charging Station

AI System Recommend Best Charging Spot in terms of **location** and **price**.

Booking a Charger

Book charging slots in advance especially for high-demand Electric Vehicle stations.

Monitor Charging Session

Ability to track and monitor their charging sessions.

Dynamic Pricing Strategy

- Allow businesses to adjust prices in real-time based on market conditions and demand
- Use algorithms and data to continuously monitor and analyze factors like supply & demand, competitor prices, consumer behavior, and external events to determine optimal prices
- Maximize occupancy by redistributing usage through price adjustments
- By analyzing EV charging station data from the Environmental Protection Department, it can build a heat map showing demand at each charging points
- Lowering prices at stations with low demand can increase usage, and vice versa
- Further user behavior analysis is needed to recommend charging stations based on individual values

BENEFITS & IMPACT

- Property managers benefit from efficient charging station management, reduced manpower, and increased profitability
- EV users experience affordability, convenience, and reliability with features like real-time availability checks, reservation systems, and personalized recommendations
- Secure authentication and flexible billing options minimise misuse cases
- Support zero vehicular emissions, sustainability, and environmental stewardship

THE FUTURE

Smart Charge offers scalable EV charging infrastructure with flexible billing options, advanced monitoring, and data-driven insights. Integration with smart grids and renewable energy sources aligns with sustainability goals and positions Smart Charge as an eco-friendly solution. It opens doors for partnerships and market expansion, supporting the evolution of EV charging for a greener future.

Student Stream - **2nd RUNNER UP** & Smart IoT Solutions Award for EV Charging

TEAM CITYU

SparkLink

THE CHALLENGE

Hong Kong is facing significant challenges due to a lack of charging infrastructure for electric vehicle (EV) owners. This scarcity causes long queues and difficulties in finding available chargers, creating barriers for both EV owners and parking lot managers.

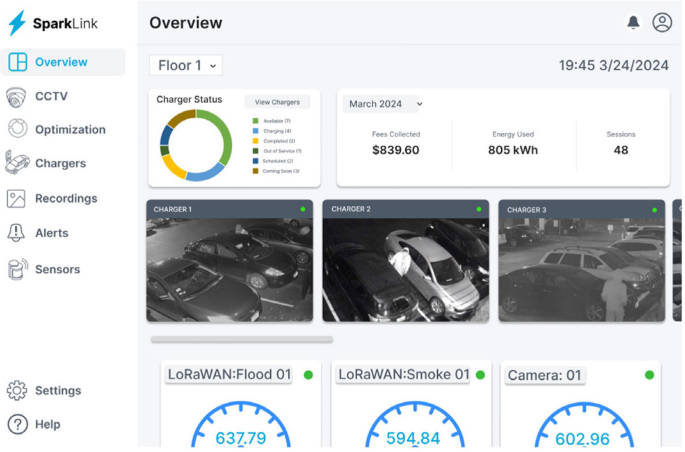
THE SOLUTION

SparkLink is an innovative application that simplifies EV charger management in car parks, aiming to enhance charger accessibility and parking efficiency with the following features:

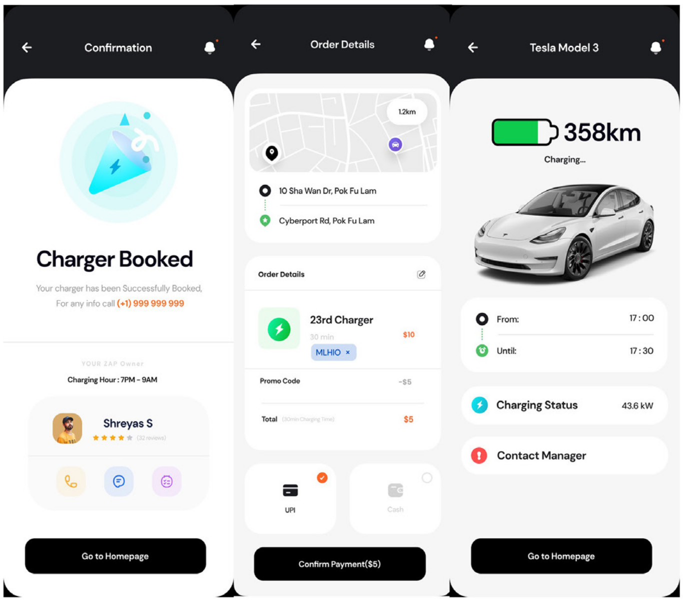
- **Vehicle Classification**: uses a RestNet-18 deep learning model to accurately classify EVs and non-EVs
- **Predictive Vacancy Modelling**: predicts parking slot availability based on customer behaviour data and environmental factors such as rainfall
- **Intelligent Management System**: employs sensors to provide real-time updates on charger occupancy and environmental conditions
- **User-centric Interface**: the app simplifies user interactions, offers real-time information and a streamlined experience

BENEFITS & IMPACT

This AI-powered system benefits all stakeholders. EV drivers experience improved convenience as they spend less time waiting and easily locate available chargers. Parking lot managers get access to a user-friendly control panel for better traffic management. It enhances customer satisfaction, potentially boosts sales effortlessly. The data gathered assists in understanding client needs and customising parking facilities accordingly.


SparkLink
Overview
CCTV
Optimization
Chargers
Recordings
Alerts
Sensors
Settings
Help
Overview
Floor 1
19:45 3/24/2024
Charger Status
View Chargers
Available (7)
Charging (4)
Completed (3)
Out of Service (1)
Scheduled (2)
Coming Soon (3)
March 2024
Fees Collected
$839.60
Energy Used
805 kWh
Sessions
48
CHARGER 1
CHARGER 2
CHARGER 3
LoRaWAN:Flood 01
637.79
LoRaWAN:Smoke 01
594.84
Camera: 01
602.96

Web UI


Confirmation
Charger Booked
YOUR ZAP Owner
Shreyas S
(32 reviews)
Go to Homepage
Order Details
1.2km
Order Details
23rd Charger
30 min
$10
MLHIO
Promo Code
-$5
Total
(30min Charging Time)
$5
UPI
Cash
Confirm Payment($5)
Tesla Model 3
358km
Charging...
Charging Status
43.6 kW
Contact Manager
Go to Homepage

Your charger has been Successfully Booked,
For any info call (+1) 999 999 999

Charging Hour : 7PM – 9AM

10 Sha Wan Dr, Pok Fu Lam
Cyberport Rd, Pok Fu Lam

From: 17 : 00
Until: 17 : 30

Mobile UI

THE FUTURE

SparkLink's versatility allows for scalability and collaboration with EV manufacturers, utilities, and government agencies. Its adaptability to diverse environments, from shopping centers to airports, creates opportunities for partnerships with car manufacturers and local governments. Addressing the current EV infrastructure concerns in Hong Kong, SparkLink hopes to pave the way for a sustainable urban transport network, offering significant business and societal benefits in the transition to electric mobility.

Professional team - **CHAMPION**

TriTerra Technology Limited

Car Park Load Shifting Charging System

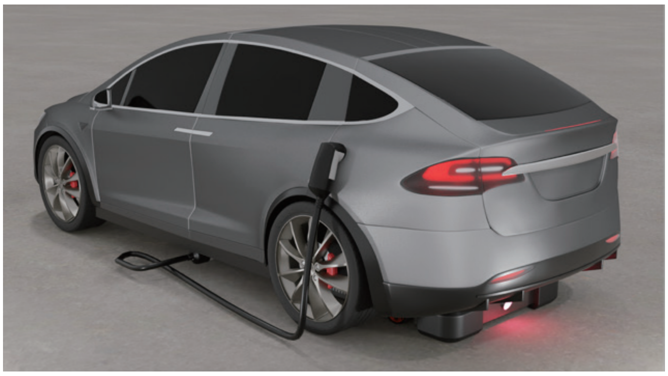
THE CHALLENGE

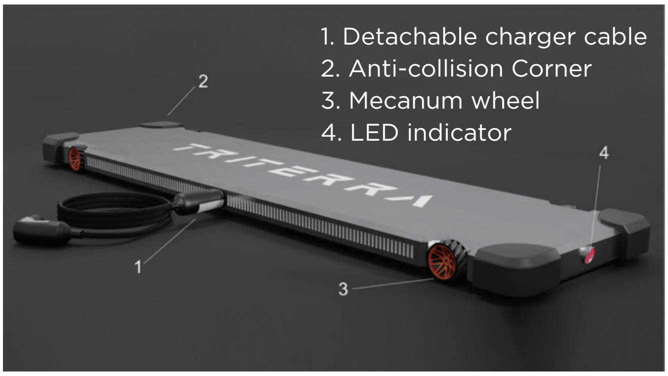
The worldwide adoption of electric vehicles (EVs) is on the rise. However, the limited number of charging stations hinders their expansion. Installing additional chargers in existing car parks can be expensive or impractical. Misuse of chargers, such as non-electric vehicles parking in EV spots or unauthorized charging, further complicates the situation. Resolving these issues is essential to maximize the efficiency of charging infrastructure and encourage widespread EV adoption.

THE SOLUTION

The TriTerra team have developed the **M**obile **E**lectric **C**ar **C**harging **S**ystem (MECCS), which features a movable charger to address the issue of non-electric vehicles occupying charging spaces. The charger can be removed and relocated once charging is complete.

The MECCS consists of hardware, software, and models. The hardware includes mobile chargers and accessories like remote, gateway and beacon devices. The charger's design prioritizes functionality and safety, with features such as a detachable cable, anti-collision corners, and mecanum wheels for easy maneuverability.

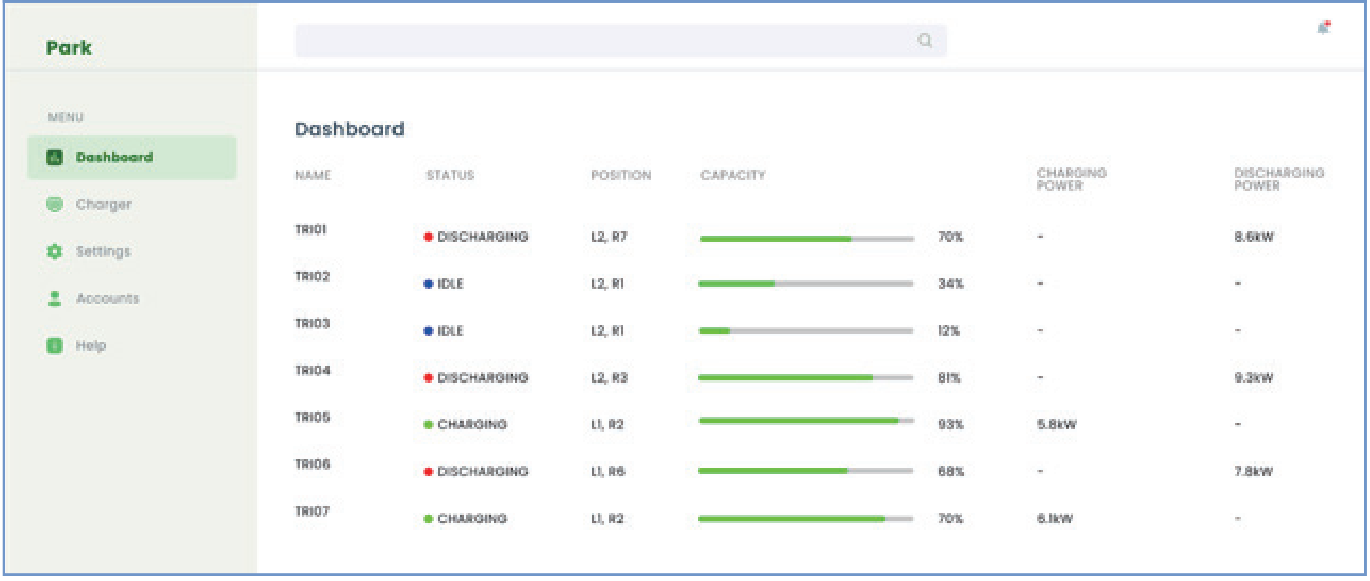




The software comprises a backend application for handling charger data and a user-friendly dashboard for car park management staff to efficiently monitor and manage the chargers. The system also includes a mobile application for car park users to book chargers and receive notifications.

A model will be trained to provide insights on staff duty arrangement and charging speed optimization. Real-time traffic data and various parameters such as weather, booking status will be considered to determine the significance level of the chargers and guide prioritization. Continuous evaluation and refinement of the model's performance will be carried out to enhance accuracy and reliability.

Software (Management Console)
To monitor the charger status, and check the charger position



Dashboard

NAME	STATUS	POSITION	CAPACITY	CHARGING POWER	DISCHARGING POWER
TR101	🟥 DISCHARGING	L2, R7	70%	-	8.6kW
TR102	🟦 IDLE	L2, R1	34%	-	-
TR103	🟦 IDLE	L2, R1	12%	-	-
TR104	🟥 DISCHARGING	L2, R3	81%	-	9.3kW
TR105	🟩 CHARGING	L1, R2	93%	5.8kW	-
TR106	🟥 DISCHARGING	L1, R6	68%	-	7.8kW
TR107	🟩 CHARGING	L1, R2	70%	6.1kW	-

BENEFITS & IMPACT

The MECCS solution is a breakthrough that addresses the limitations of power supply, space, and the number of stationary chargers in car parks, which are the challenges faced by most car parks in Hong Kong, and often lead to frustration among EV drivers.

Benefits:

- Potential charging capacity increased by up to 60%
- Possibility to create a new revenue model
- VIP reservation income
- Estimated annual interest rate of 39.42%
- Estimated Return on Investment (ROI): 500%
- Enhanced customer experience and satisfaction
- Increased business traffic from EV drivers and their families
- Utilization of EV charging data for potential point redemptions
- Building a premium image

THE FUTURE

Outdoor charging

Charging electric vehicles outdoors is challenging due to complex fixed charger installations. Portable chargers offer a solution by allowing indoor charging and subsequent outdoor use. For this purpose, durable and waterproof chargers are essential to withstand outdoor conditions.

Rental service

The solution can provide additional societal benefits. Pre-charged portable charger can be rented to various parties in need, including disaster rescue teams, engineering projects, areas expecting high population density during special events, and stranded EVs on the road.

Professional Stream – **1st RUNNER UP** & **Smart IoT Solutions Award for EV Charging**

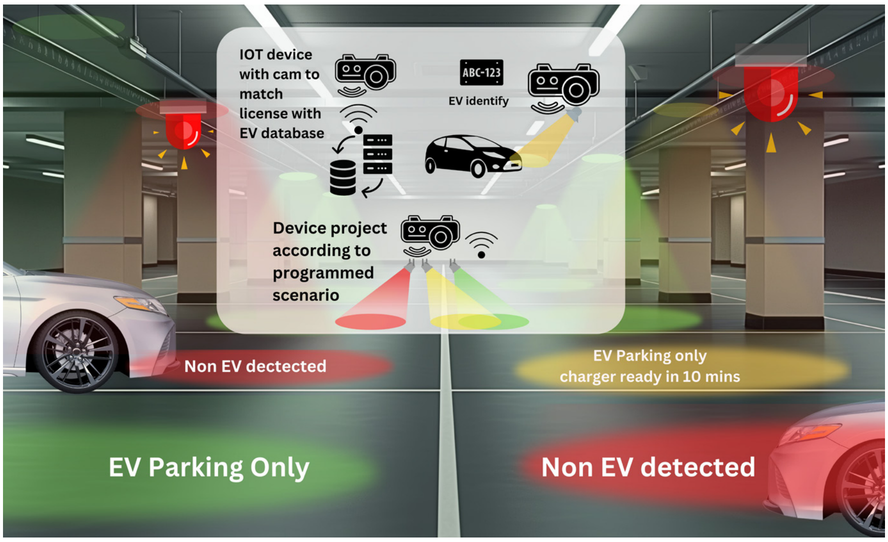
Reunion

Smart Plug

THE CHALLENGE

The electric vehicle (EV) industry is facing the challenge of accommodating the growing number of electric cars, surpassing the capacity of current facilities. Installing charging stations for each parking space is costly, and there is a manpower shortage to monitor parking areas effectively.

THE SOLUTION



Reunion proposed a solution to reorganize parking lots to allocate EVs to charging spaces and non-EVs to others. This system utilises cameras to capture license plate numbers, which are then used to update the government's EV database for identification. EVs can access charging areas through unfolding barriers or illuminated green lights.

The solution incorporates "smart plug" technology, enabling users to effortlessly plug vehicle charging cables into adapters upon entering the car park. Inner-adapter robots then connect to the charging terminals along the track. Once charging is complete, the robots automatically disconnect and move to the next charging point, optimizing parking usage without the need for fines to enforce prompt vacating of charging areas, enhancing the overall customer experience.

BENEFITS & IMPACT

The solution presents considerable business opportunity by offering the installation and maintenance of IoT devices, EV car park development and management services, along with "smart plug" adapters and associated charging infrastructure. It not only addresses infrastructure challenges, but also capitalizes on the growing demand for EV solutions to enable revenue generation.

From a social impact perspective, the solution promotes sustainable transportation and reduces carbon emissions. Automated systems optimize parking space efficiency and provide convenient charging solutions for EV owners.

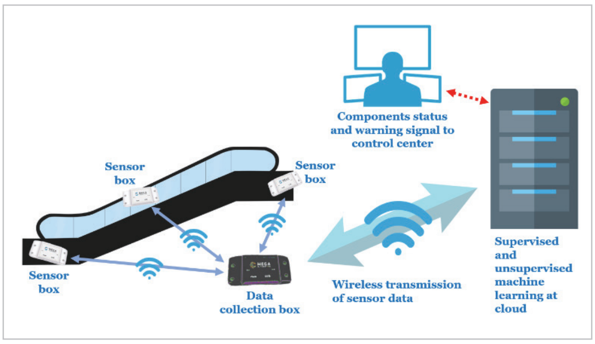
THE FUTURE

The solution leverages IoT technology to revolutionize EV infrastructure, enhance charging experience, promote EV adoption, and pave the way for a more sustainable future. Positioned for scalability and continuous development, this solution is poised to shape the future of EV infrastructure and management.

Professional Stream – **2nd RUNNER UP**

DevAdventurers

All-In-One Monitoring & Predictive Maintenance Platform

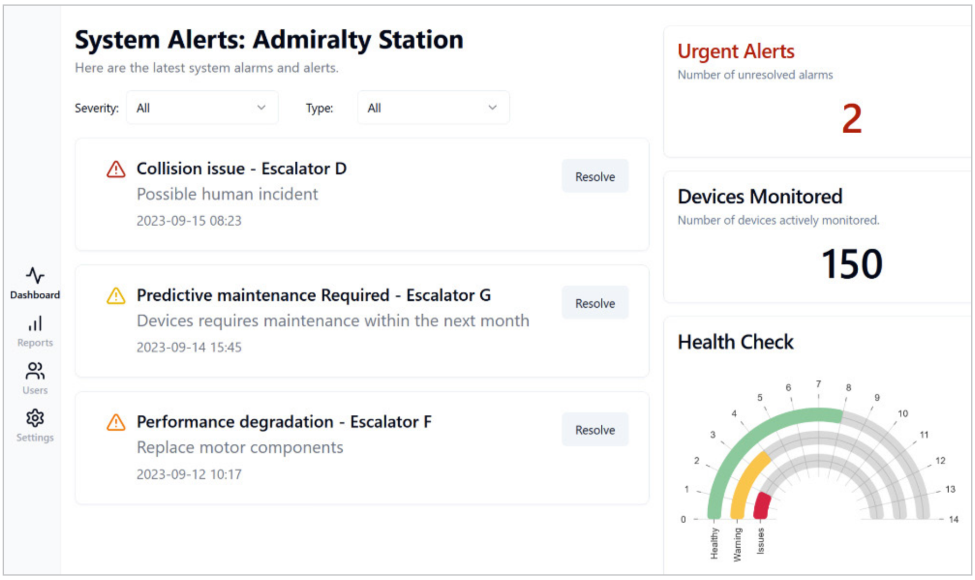

Components status and warning signal to control center
Sensor box
Sensor box
Sensor box
Data collection box
Wireless transmission of sensor data
Supervised and unsupervised machine learning at cloud

THE CHALLENGE

Hong Kong's MTR facilitates over 10 million passenger journeys daily, unexpected downtime of lifts and escalators poses challenges, particularly for passengers with mobility issues or heavy goods. Delays, crowding, and safety concerns arise, with escalator-related deaths not uncommon. The current bi-weekly manual maintenance process, inspecting numerous components across thousands of lifts and 1200 escalators, is costly, time-consuming, and inefficient.

THE SOLUTION

Leveraging MTR's IoT and smart-sensor technology, the team extracts useful insights from data to build an all-in-one monitoring and management platform.


Dashboard
Reports
Users
Settings
Severity:
All
Type:
All
Resolve
Resolve
Resolve
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Healthy
Warning
Issues

System Alerts: Admiralty Station

Here are the latest system alarms and alerts.

Collision issue - Escalator D
Possible human incident
2023-09-15 08:23

Predictive maintenance Required - Escalator G
Devices requires maintenance within the next month
2023-09-14 15:45

Performance degradation - Escalator F
Replace motor components
2023-09-12 10:17

Urgent Alerts
Number of unresolved alarms
2

Devices Monitored
Number of devices actively monitored.
150

Health Check

Vibration sensors attached to escalators send real-time data via WiFi to cloud servers, where heuristics and Machine Learning algorithms identify passenger emergencies and escalator maintenance needs. By monitoring vibration trends and detecting shifts in baseline vibration, specific component wear and tear can be identified. Three-dimensional inspection locates specific issues like misalignment or imbalance.

Real-time alerts and insights are displayed on a dashboard, providing asset health status (Red-Amber-Green) and highlighting upcoming maintenance needs. This dashboard can integrate various datasets for comprehensive asset monitoring and predictive maintenance.

BENEFITS & IMPACT

- Reduction in maintenance costs
- Reduction in cost of failure and frequency of failure
- Facilitation of remote diagnosis, and support a lower frequency of routine maintenance
- Better management of manpower and the need for spare components
- Resources can be allocated just-in-time, instead of just in case
- Improved passenger safety and greater escalator uptime

THE FUTURE

The scalable SaaS product offers customisable smart asset management solutions. The vision is to create an all-in-one building management product powered by a library of predictive machine learning models. As a capital-light SaaS, it can be tailored to different situations and offers modular pricing.

Best ESG Achievement Award

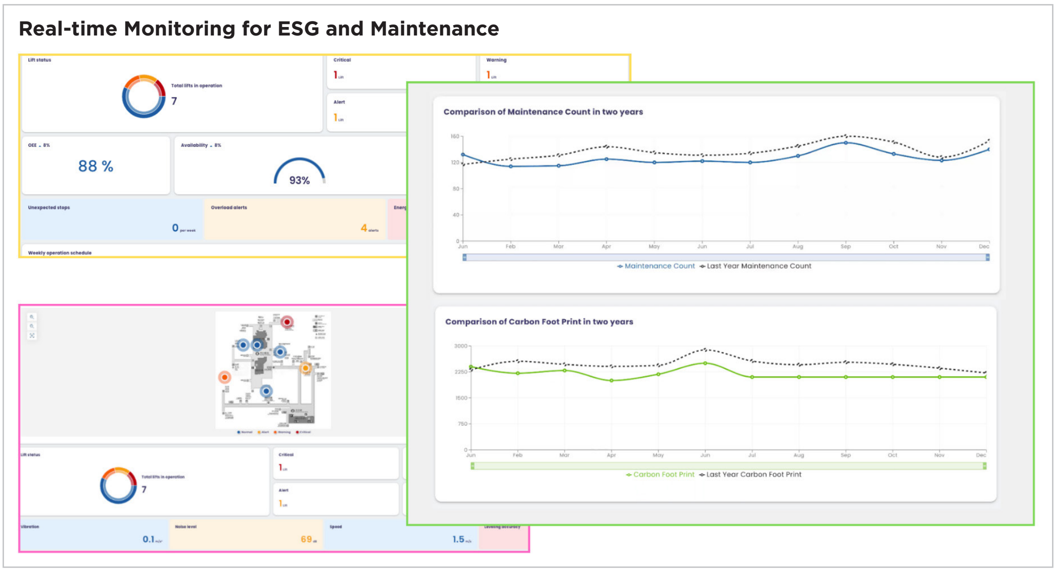
CECAS

AIOT Lift & Escalator Maintenance System

THE CHALLENGE

Lift and escalator operators encounter a range of challenges, such as ensuring safety, complying regulatory requirements, managing maintenance expenses, minimizing facility downtime, and supporting ESG goals.

THE SOLUTION



Real-time Monitoring for ESG and Maintenance

Lift status
Total lifts in operation
7
Critical
1 Lift
Warning
1 Lift
Alert
1 Lift
OEE ⌄ 8%
88 %
Availability ⌄ 8%
93%
Unexpected stops
0 per week
Overload alerts
4 alerts
Weekly operation schedule
Comparison of Maintenance Count in two years
160
120
80
40
0
Jun
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Maintenance Count
Last Year Maintenance Count
Comparison of Carbon Foot Print in two years
3000
2250
1500
750
0
Carbon Foot Print
Last Year Carbon Foot Print
Vibration
0.1
Noise level
69
Speed
1.5
Leveling accuracy

The proposed solution addresses challenges with the following features:

- **Abnormity Detection with AI**: utilizes AI-powered risk prediction systems to analyze real-time equipment condition data, including vibration readings, enabling early detection of abnormalities, addressing minor issues proactively before they become critical.
- **Compliance Readiness**: provides a digital logbook, query system, and reporting tools to facilitate compliance requirements, saving time during audits and examinations.
- **Cost-Optimized Schedule**: a scheduling engine that calculates maintenance schedules based on factors and analysis by station managers, maintenance teams and senior management.
- **Data Visualization**: dashboard visualizes equipment status across selected stations for easy monitoring and analysis by station managers, maintenance teams and senior management.

BENEFITS & IMPACT

The system enables real-time monitoring, predictive maintenance, optimised schedules and improved efficiency. Maintenance engineers benefit from proactive maintenance and streamlined workflows, management gains cost savings and improved asset management, and passengers experience enhanced safety, convenience & reduced downtime. It helps track the carbon footprint of maintenance, demonstrating sustainability commitment and effective governance.

THE FUTURE

To maximize future business potential, essential steps include prototype development, support from incubators, investors & early adopters, product refinement via MVP approach, sector adaptability, promotion through exhibitions & competitions, patent protection, and ISO certification to safeguard

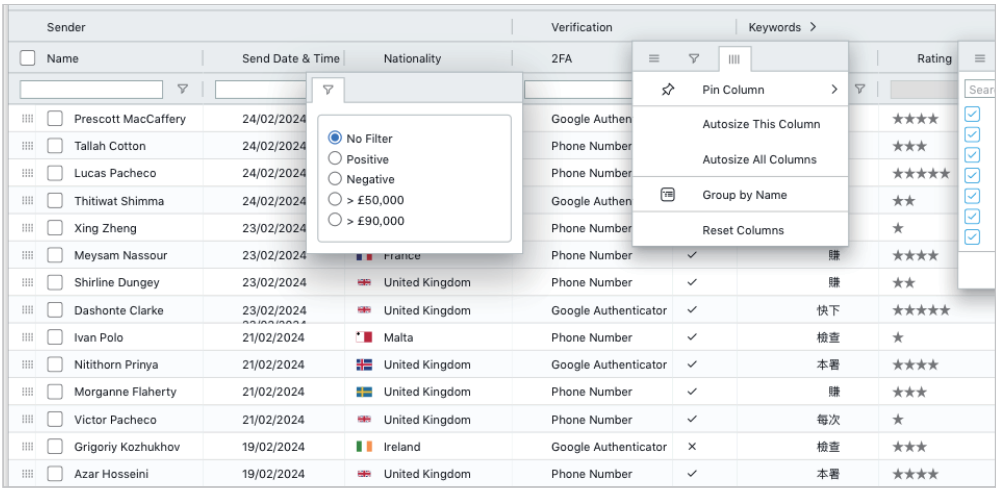
Innovator of Secure by Design

RightPick Technology Limited

Cybersecurity Solution

THE CHALLENGE

In the digital age, rising cyber threats present significant challenges to individuals and organisations. Sophisticated viruses, malware, data privacy breaches, and phishing attacks endanger sensitive information and systems. The demand for robust cybersecurity solutions is crucial to combat these evolving threats effectively.



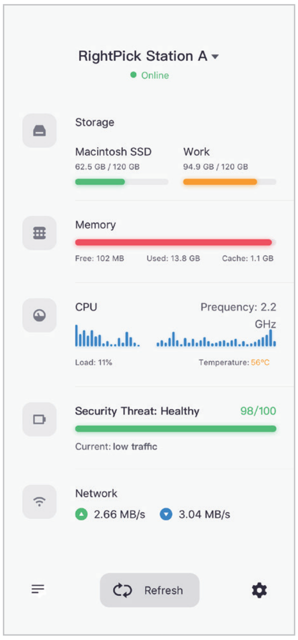
Sender			Verification		Keywords >	
Name	Send Date & Time	Nationality	2FA			Rating
Prescott MacCaffery	24/02/2024		Google Authen			★★★★
Tallah Cotton	24/02/2024		Phone Number			★★★
Lucas Pacheco	24/02/2024		Phone Number			★★★★★
Thitiwat Shimma	24/02/2024		Google Authen			★★
Xing Zheng	23/02/2024		Phone Number			★
Meysam Nassour	23/02/2024	France	Phone Number	✓	賺	★★★★
Shirline Dungey	23/02/2024	United Kingdom	Phone Number	✓	賺	★★
Dashonte Clarke	23/02/2024	United Kingdom	Google Authenticator	✓	快下	★★★★★
Ivan Polo	21/02/2024	Malta	Phone Number	✓	檢查	★
Nitithorn Prinya	21/02/2024	United Kingdom	Google Authenticator	✓	本署	★★★★
Morganne Flaherty	21/02/2024	United Kingdom	Phone Number	✓	賺	★★★
Victor Pacheco	21/02/2024	United Kingdom	Phone Number	✓	每次	★
Grigoriy Kozhukhov	19/02/2024	Ireland	Google Authenticator	×	檢查	★★★
Azar Hosseini	19/02/2024	United Kingdom	Phone Number	✓	本署	★★★★

● No Filter
○ Positive
○ Negative
○ > £50,000
○ > £90,000

THE SOLUTION

The proposed solution is a two-part approach that combines advanced technologies to provide robust protection against cyber threats.

- The first part focuses on virus/malware detection, data privacy protection, and access & device protection. By employing advanced algorithms and machine learning, we proactively identify threats. Real-time scanning and behavioral analysis neutralise malicious software, while encryption, access controls and secure storage safeguard sensitive data. Multi-factor authentication, secure remote access and device tracking enhance system security.
- The second part includes a self-trained AI model for anti-phishing. Leveraging machine learning algorithms, the AI model is trained to analyse email subject lines, content, and embedded images to detect potential phishing attempts. Alerts users on suspicious emails proactively, reducing the risk of falling victim to phishing attacks.



RightPick Station A
Online

Storage
Macintosh SSD 62.5 GB / 120 GB
Work 94.9 GB / 120 GB

Memory
Free: 102 MB
Used: 13.8 GB
Cache: 1.1 GB

CPU
Prequency: 2.2 GHz
Load: 11%
Temperature: 56°C

Security Threat: Healthy 98/100
Current: low traffic

Network
2.66 MB/s
3.04 MB/s

BENEFITS & IMPACT

- Enhances protection against viruses, malware, and data breaches, safeguarding sensitive information, ensuring system integrity & business continuity, and fostering customer trust.
- Enables users to identify and avoid threats, mitigating financial and reputational risks.
- Improves cybersecurity practices by raising awareness, aiding individuals and organisations in building resilience, and promoting a safer digital environment for responsible online behavior.

THE FUTURE

The solution aims to stay at the forefront of cybersecurity innovation by continuously improving the algorithms and incorporating cutting-edge technologies. Future plans include expanding capabilities to address emerging threats, integrating with cloud-based platforms, and collaborating with industry leaders and experts to refine the solution.

Organising Committee

Chairman

Mr Sean TAN
Information Technology Director, Jebsen Group, Jebsen Co Ltd

Members

Ir Eric CHAN
Chief Public Mission Officer, Hong Kong Cyberport Management Company Limited

Dr Toa CHARM
President, HK IoT Industry Advisory Council, GS1 Hong Kong Limited

Ms Mignone CHENG
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The Hong Kong Internet of Things Industry Advisory Council

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數碼港 Cyberport

香港科技園 HKSTP

Government Support

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WTIA 香港無線科技商會

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PREFACE

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