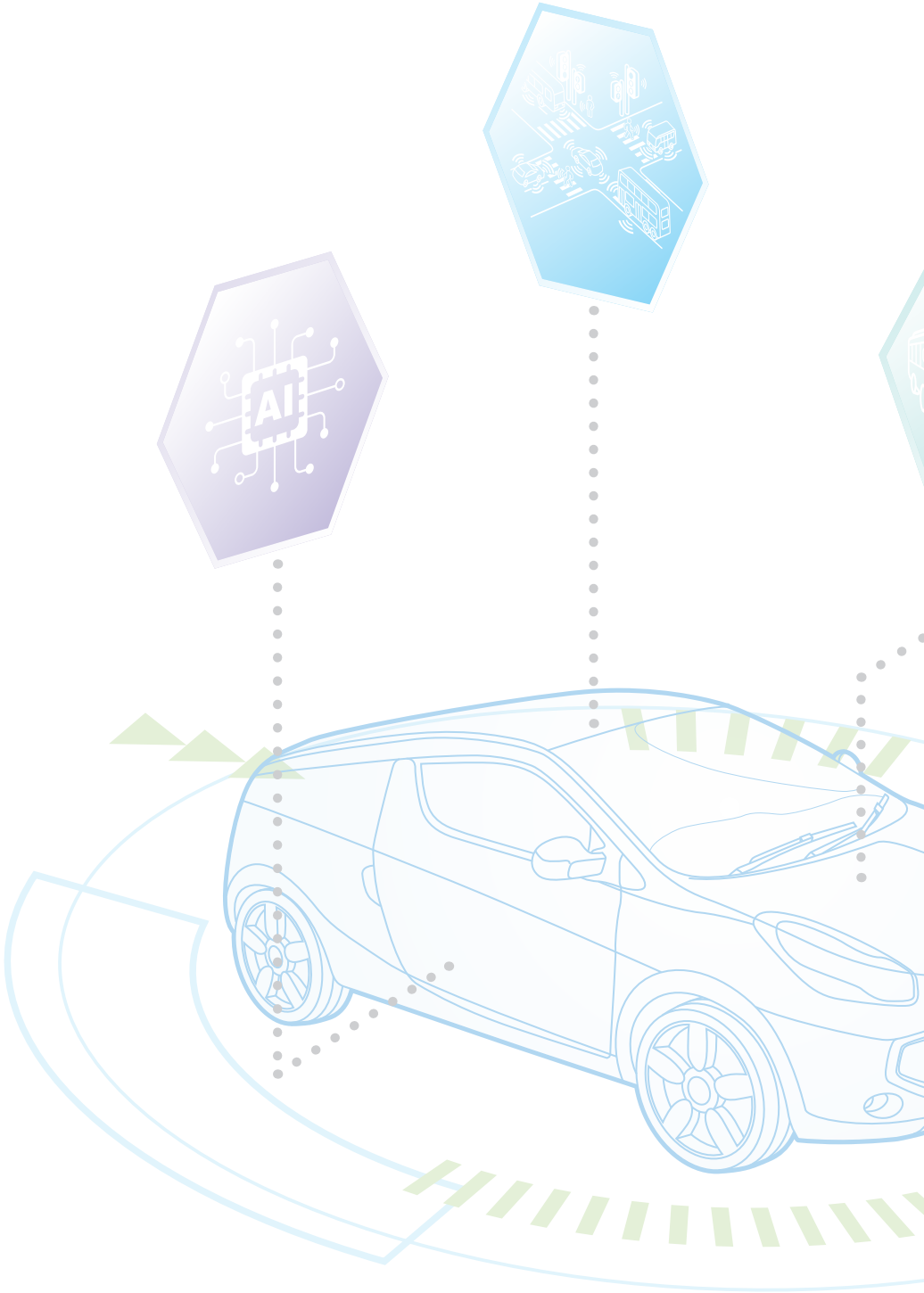
APAS
汽車科技研發中心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About APAS
研發中心簡介

Hong Kong Automotive Platforms and Application Systems (APAS) R&D Centre was established in 2006 by the Innovation and Technology Commission of the HKSAR Government and undertaken by the Hong Kong Productivity Council (HKPC).

Over the years, APAS has been collaborating with industries, universities and technical institutions on technological researches and the commercialisation of R&D results, thereby promoting the development of automotive technology. Over 100 projects have been implemented since the establishment of APAS. To facilitate synergy and further enhance cost effectiveness, APAS has become part of the HKPC since 1 November 2012.

Vision

To become a leading automotive platforms and application systems R&D centre in the region and assist Hong Kong's foundation industries to enter into or expand in the automotive market. The 3 major focus areas of APAS' technology roadmap are –

(a) green transportation
(b) smart mobility
(c) intelligent systems

Mission

(a) develop R&D competencies in selected core technical areas
(b) establish related networks in the Mainland and overseas
(c) collaborate with Mainland and overseas R&D partners
(d) promote R&D services and expand user base
(e) support HKSAR Government's initiatives of smart city and re-industrialisation

香港汽車科技研發中心於2006年由香港特區政府創新科技署成立，並由香港生產力促進局（生產力局）承辦。

多年來一直與業界、大學和技術機構合作研發技術，並把研發成果轉化為商品，從而促進汽車科技發展。本研發中心自成立以來，已執行超過100項目。為促進合作並進一步提高成本效益，研發中心2012年11月1日成為生產力局旗下部門。

願景

成為領先的汽車科技平台及系統應用研發中心，協助香港基礎產業進入或拓展至汽車市場。 APAS 技術路線圖的3個主要重點領域是

(a) 綠色運輸
(b) 智慧出行
(c) 智能系統

使命

(a) 發展指定核心技術領域的研發能力
(b) 建立內地和海外相關網絡
(c) 與內地及海外研發夥伴合作
(d) 推廣研發服務，擴大用戶群
(e) 支持香港特區政府的智慧城市和再工業化措施

Innovation Technology Fund
創新科技基金

APAS R&D Centre coordinates automotive-related project funding applications to the Innovation Technology Fund. Types of project include:

研發中心負責統籌創新科技基金範疇下的汽車科技項目申請。項目種類包括：

Project Type 項目種類	Government Fund 政府基金	IP Owner 知識產權擁有者	Licensing Fee△ 許可費用△	Royalty Sharing△ 提成共享△
Seed 種子	100%	HKPC 生產力局	✓	✓
Platform 平台	90%	HKPC 生產力局	✓	✓
Collaborative 合作	49%	Sponsor 客户		✓
Contract 合約	0%	Sponsor 客户		

△ Negotiable
△ 可協商

Examples 例如 (in HKD 港幣)：

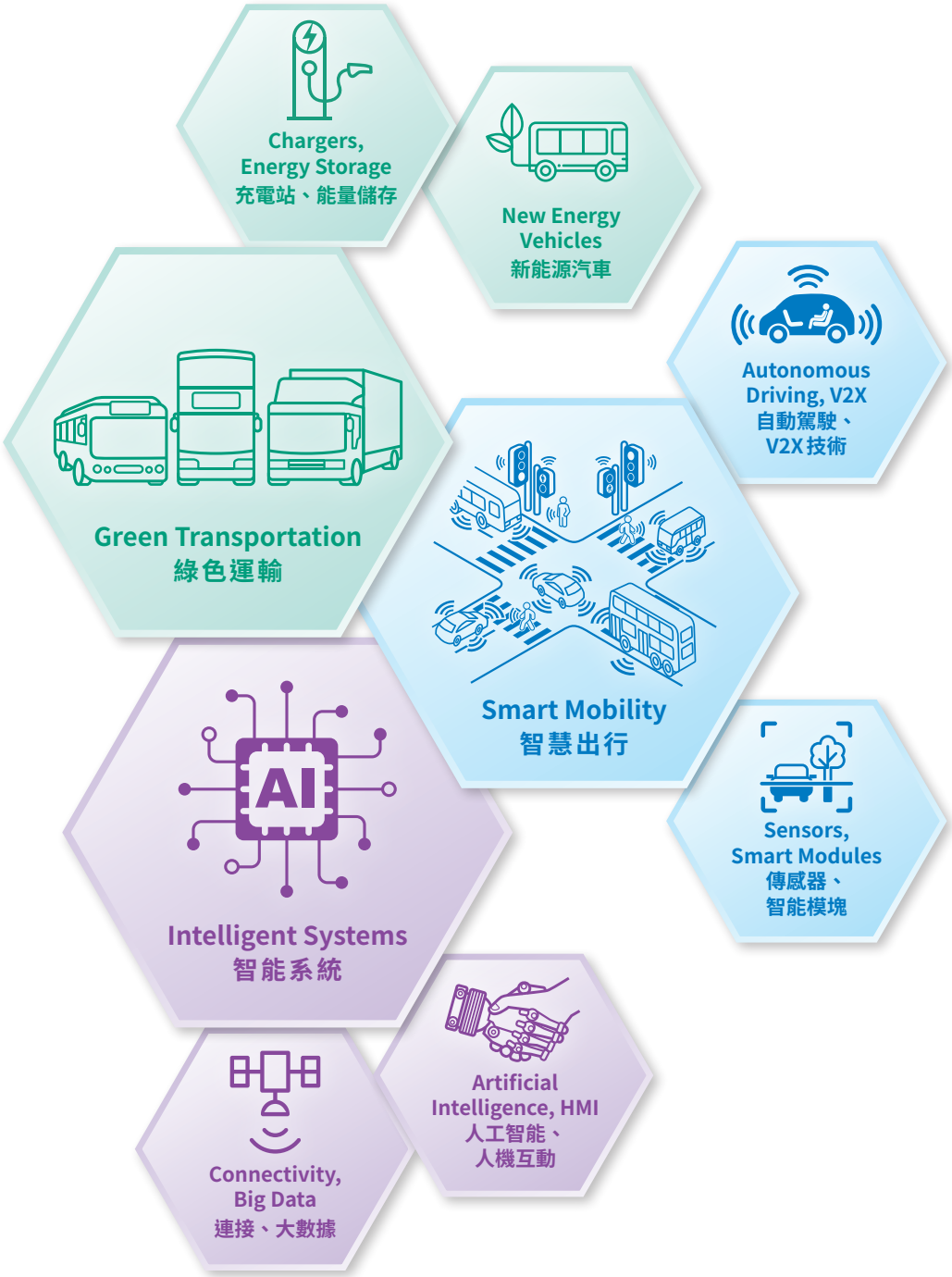
Project Sum 項目總和	Project Type 項目種類	Gov Fund 政府基金	Industry Sponsorship 業界贊助資金	Cash Rebate* 現金回贈 *	Profit Tax Savings# 稅務扣減 #	Industry Actual Sponsorship 業界實際贊助
$100萬	Platform 平台	$90萬	$10萬	$4萬	約$3萬	約$3萬
$100萬	Collaborative 合作	$49萬	$51萬	$20.4萬	約$15.1萬	約$15.5萬

* Under the scheme, the approved industry sponsorship will be able to receive a cash rebate equivalent to 40% of its expenditure from ITF.
* 透過計劃，公司的研發項目的開支可獲40%的現金回贈。
\# The deduction will be 300% for the first $2 million of the aggregate amount of qualifying R&D expenditure, and 200% for the remaining amount. There is no cap on the amount of relevant tax deduction.
\# 合資格研發支出總額的首200萬元， 可獲 300 % 稅務扣減，餘額亦可獲200 %扣減；額外扣稅金額不設上限。

Innovation and Technology Commission has introduced new improvement measures to the Innovation and Technology Fund. For details, please visit http://www.itc.gov.hk

創新科技署推出了多項創新及科技基金優化措施，詳情可瀏覽 http://www.itc.gov.hk

Featured R&D Technologies
重點研發技術領域



300kW Pantograph High Power Charging Station & Pure Electric Minibus
300kW集電弓高功率充電站及純電動小巴

300kW Pantograph High Power Charging (HPC) Station supports international CCS OppCharge standard thereby fulfilling the busy turnaround cycles required by the commercial fleet operators. It only takes 8 minutes to charge the Pure Electric Minibus up to 80% battery level at the Pantograph HPC Station. The battery status of the minibus can be known in advance through Wi-Fi, so as to provide a suitable charging current. Pantograph HPC charging station also works for the 12-metre Hybrid Electric Coach developed by APAS, which takes 15 minutes to charge up to 80% battery and supports prolonged and emergent operations in hybrid mode.

300kW集電弓高功率充電站支持國際CCS OppCharge標準，可以滿足繁忙的商用車輛營運需求。純電動小巴使用此集電弓高功率充電站，只需要8分鐘便能為電池充滿8成電量。充電站更可透過Wi-Fi預先了解小巴的電池狀態，方便提供合適的充電電流。充電站亦適用於APAS研發的12米混合動力客車，只需15分鐘便能為電池充至8成電量，並可在混能模式下，支持長時間和緊急的運作需求。

Major Benefits 主要的好處

1) Charging speed 6 to 8 times faster than the 50kW quick charger
2) Compliance with international CCS OppCharge protocol for charging safely
3) Quick charge solution to cater for busy commercial vehicles operation

1) 相比50kW快速充電站，充電速度快6至8倍
2) 符合國際CCS OppCharge標準，確保充電安全
3) 快速充電方案滿足繁忙的商用車輛營運需求

Application Areas 應用領域

1) Public minibus
2) Coach

1) 公共小巴
2) 旅遊巴

12-Metre Plug-in Hybrid Electric Coach
12米插電式混合動力客車

The 12-metre Plug-in Hybrid Electric Coach, the-first-of-its-kind to be designed, developed, and assembled in Hong Kong, can recharge its Lithium Titanate batteries on the fly, thereby fulfilling the busy turnaround cycles required by the commercial fleet operator. As compared to traditional diesel coaches, it can save at least 40% fuel and reduce 50% emission. Fuel can be further saved if batteries are recharged at the fast-charging stations. It only needs 25 minutes to charge up to 80% battery level.

首部香港設計、開發及組裝的12米插電式混合動力客車，可以在行駛過程中為車上的鈦酸鋰電池充電，滿足客車服務營運商的繁忙續航要求。插電式混合動力客車比一般柴油客車節省超過40%柴油消耗、減少超過50%廢氣排放。若使用快速充電站直接為電池充電，可再減低油耗，只需25分鐘便能充8成電。

Major Benefits 主要的好處

1) Zero emission under pure electric driving mode
2) Achieve up to 50% fuel saving as compared to traditional diesel coach
3) Travel continuously without stopping for recharging. Suitable for commercial vehicles in busy operation

1) 純電動模式下，可達到零排放
2) 相比一般柴油客車節省最多50%柴油
3) 客車可持續行駛而無須停下來充電，滿足繁忙營運需求

Application Areas 應用領域

1) Coach, school bus and circular route bus
2) Can operate in zero emissions zones under pure electric mode

1) 旅遊巴、校巴及循環線巴士
2) 純電動模式下，可在零排放地區行駛

Swappable Battery Low Platform Electric Minibus & Truck
可換電池低地台電動小巴及貨車

The Swappable Battery Low Platform Electric Minibus is natively designed to cater for busy commercial vehicles operation in Hong Kong. The drained battery can be automatically replaced with a fully charged battery within 7 minutes, which is 8 times faster than recharging the battery. Without sacrificing commercial fleet efficiency, this zero-emission bus greatly enhances the roadside air quality. The stable low floor chassis design offers better accessibility for children and elderly. It also has a monitoring system to send real-time operation data to the fleet centre.

可換電池低地台電動小巴是以滿足香港繁忙的商用車營運需求而設計。耗盡電量的電池可以在7分鐘內自動更換為充滿電的電池，這比傳統充電快8倍，小巴不會因充電需時而影響班次安排。在不犧牲商業車隊效率的情況下，這種零排放公共交通工具將大大提高路邊的空氣質素。而穩定的低地台設計，為兒童和長者提供更安全及方便的乘車體驗。它還配備了1個監控系統，可以向車隊中心發送實時操作數據。

Major Benefits 主要的好處

1) Zero roadside emission
2) Fast battery swapping in less than 7 minutes
3) The low floor design is safe and easy for passenger boarding and alighting the minibus
4) Real-time data feedback of passenger counts, seat-belt monitoring and vehicle running data to fleet operation centre

1) 可達到路邊零排放
2) 可於7分鐘內完成更換電池
3) 低地台設計令上落小巴較容易和安全
4) 乘客數目、安全帶監控和行車數據可以實時傳送到車隊運營中心

Application Areas 應用領域

1) Public minibus, Company shuttle bus, School bus
2) Delivery truck

1) 公共小巴、公司穿梭小巴及校巴
2) 運貨車

16-Tonne Pure Electric Truck
16噸純電動勾斗車

The 16-tonne Pure Electric Truck is equipped with a high efficiency Permanent Magnet Synchronous Motor (PMSM) and high-capacity battery pack for long range driving. The integrated motor controller and modular battery pack can be fine-tuned for different driving ranges and road gradients commonly seen in Hong Kong and China.

16噸純電動勾斗車配備了高效能永磁同步馬達和高容量電池組，適用於長距離行駛。集成的馬達控制器和模組化設計的電池組可以進行微調，以配合香港及中國內地的不同行駛距離和路面坡度。

Major Benefits 主要的好處

1) Long driving range up to 200km per charge
2) 1-hour battery charging time (using a 180kW off-board charger)
3) Localised PMSM and Automatic Transmission gearbox designs for high road gradient of up to 20%
4) Universal chassis system design for various applications

1) 續航能力強，充一次電可行駛 200 公里
2) 電池組充滿只需 1 小時 (使用 180 千瓦時的充電樁)
3) 本土化設計的永磁同步馬達和自動變速箱，能於坡度為 20% 的道路行駛
4) 通用式底盤設計，能配合不同車身，應用於不同領域

Application Areas 應用領域

1) Solid waste collection trucks
2) Logistics trucks
3) Sweepers

1) 固體廢物回收貨車
2) 物流貨車
3) 機動掃街車

Single-deck Pure Electric Bus
純電動單層巴士

The 12-metre Single-deck Pure Electric Bus is equipped with high efficiency Permanent Magnet Synchronous Motor (PMSM), lightweight body shell made of T6 grade aluminum alloy, advanced Battery Management System (BMS), Smart Driving System, Vehicle Data Cloud Network Platform and aerosol fire extinguisher, fine-tuned for the Hong Kong and Mainland China markets.

12米純電動單層巴士配備了高效能永磁同步馬達、輕量化鋁合金車身、先進的電池管理系統、智能駕駛系統、車聯網雲端大數據平台和氣溶膠電池滅火裝置，適合香港和中國內地市場使用。

Major Benefits 主要的好處

1) Lightweight bus body made of T6 grade aluminum
2) Smart driving system enhances driving safety
3) Vehicle Data Cloud Network Platform facilitates fleet management

1) T6級鋁合金輕量化車身
2) 智能駕駛系統可提升駕駛安全
3) 車聯網雲端大數據平台協助管理車隊

Application Areas 應用領域

1) Franchised public bus
2) Non-franchised public bus
3) Sightseeing bus in tourist attraction areas

1) 專營巴士
2) 非專營巴士
3) 旅遊觀光巴士

Portable Charger Kit
手提式電動車充電系統

The Portable Charger Kit (PCK) is a handheld electric vehicle charger. It replaces the traditional wall-mounted AC charger by a PCK socket, which is small, affordable, and easy to install and maintain. It uses a proprietary AC power socket with wireless authentication for medium to fast charging, reducing the need and cost to install numerous PCK sockets in car parks.

手提式電動車充電系統便於攜帶，毋須安裝傳統的掛牆式充電裝置，體積小巧、成本低，易於安裝和維修保養。系統備有獨立充電器及插座，採用無線認證技術，電動車車主只需將自攜手提式充電器，插於對應的停車場插座，即可為座駕進行中速至快速充電，大幅降低停車場安裝充電樁的成本。

Major Benefits 主要的好處

1) Low installation and maintenance cost
2) Small and easy to install
3) No networking infrastructure required

1) 安裝和維修成本低
2) 體積小，易於安裝
3) 不需要網絡基礎設施

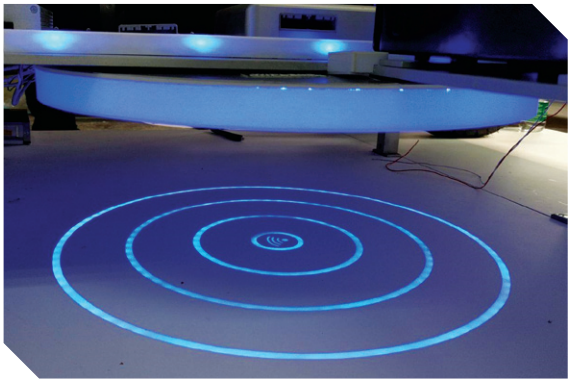
Application Areas 應用領域

1) Provide medium to fast charging for electric vehicles
2) Provide charging points in car parks of commercial and residential buildings
3) Car parks where non-designated (floating) parking spaces is dominant or parking spaces are congested

1) 為電動汽車提供中速至快速充電
2) 在商業和住宅建築的停車場提供充電點
3) 特別適合於非指定（浮動）停車位為主或高密度的停車場安裝

Electric Vehicle Wireless Charger
電動車無線充電器

The Electric Vehicle Wireless Charger (EVWC) charges Electric Vehicles (EV) via the air by magnetic resonance. The EVWC transmits electrical energy from the transmitter coil on the ground to the receiver coil on the EV chassis with high energy transfer efficiency. APAS has developed an efficient and safe EVWC with medium charging power and magnetic flux leakage protection. It is designed to meet the SAE standard J2954 on wireless power transfer and is compatible with European, American, Japanese and Chinese EVs.



電動車無線充電器通過磁力共振原理為電動車隔空充電，利用安裝在地面的發射線圈，高效地把電能發送到安裝在車底的接收線圈。此無線充電器是根據SAE J2954標準設計，兼容歐洲、美國、日本和國內電動車，並具備電磁洩漏保護設計，令充電更加安全。

Major Benefits 主要的好處

1) More convenient EV charging
2) Medium charging power (7kW – can charge up a BMW i3 in 3 hours)
3) Magnetic flux leakage protection
4) Designed with SAE standard J2954 for high compatibility

1) 令電動車充電更方便
2) 中速充電 (7kW – 以BMW i3 EV為例，只需3小時便可充滿)
3) 具備電磁洩漏保護
4) 根據SAE J2954標準設計，兼容性高

Application Areas 應用領域

1) Pure Electric Vehicle (PEV)
2) Plug-in Hybrid Electric Vehicle (PHEV)
3) Other battery-powered vehicles

1) 純電動車 (PEV)
2) 插電式混合動力電動車 (PHEV)
3) 其他使用電池驅動的交通工具

Smart Mobile EV Charger
智能流動電動車充電器

Smart Mobile EV Charger is a mobilised emergency charger that offers roadside assistance when an Electric Vehicle (EV) is out of power. It takes 4 minutes to give the battery-drained EV an extra 20km mileage so that the EV can reach the nearest charging station for proper charging.

智能流動電動車充電器能夠提供緊急電動車充電服務，解決電動車於路上「無電拋錨」的問題。只需充電4分鐘，即可為電動車續航20公里，讓電動車可行駛至就近的充電站進行充電。

Major Benefits 主要的好處

1) Provide effective charging services to ease EV drivers' range anxiety
2) Fast charging for 4 minutes to gain 20km ranging distance, or charge an EV to 80% in just 40 minutes*
3) All-in-one solution for different EV standards including Japan CHAdeMO, Euro IEC CCS (Combo2) and IEC 62196 single-phase
4) Promote EV adoption in the community

1) 提供有效的流動充電服務，有助解決電動車駕駛者的里程焦慮問題
2) 只需快充4分鐘，便可讓電動車增添20公里里程；或只需40分鐘便可把電動車快充至8成電*
3) 符合多個充電標準，包括日本標準CHAdeMO、歐洲標準IEC CCS (Combo2)及IEC 62196單相交流中速充電
4) 促進電動車普及化

Application Areas 應用領域

1) Public parking areas (e.g. shopping centres, public car parks)
2) Emergency roadside charging service

1) 公共停車場（如購物中心、公眾停車場）
2) 路邊緊急充電服務

* Estimation based on Nissan Leaf or BMW i3
* 以日產LEAF或BMW i3電動車估算

50kW Fast EV Charging Station
50kW 快速電動車充電站

Following its inaugural launch, the 50kW fast EV charging station with more robust features is introduced to facilitate Electric Vehicle (EV) adoption in Hong Kong.

The station takes as fast as 20 minutes to charge an EV up for travelling 150km. It has attained international certification for its excellent performance of maintaining battery life, driving safety and compatibility with electricity networks.

「加強版」50kW 快速電動車充電站功能比第一代快速充電站更強，幫助推動電動車在香港的發展。

以一般電動私家車為例，最快只需 20 分鐘便能充電 8 成，足夠行駛 150 公里。充電站在保障電池壽命、行駛安全和供電網絡兼容等各方面表現卓越，更獲得國際認證。

Major Benefits 主要的好處

1) Provide greater convenience and efficiency in using EVs
2) Offer a complete quick charge solution for both Japanese and European electric vehicles in market

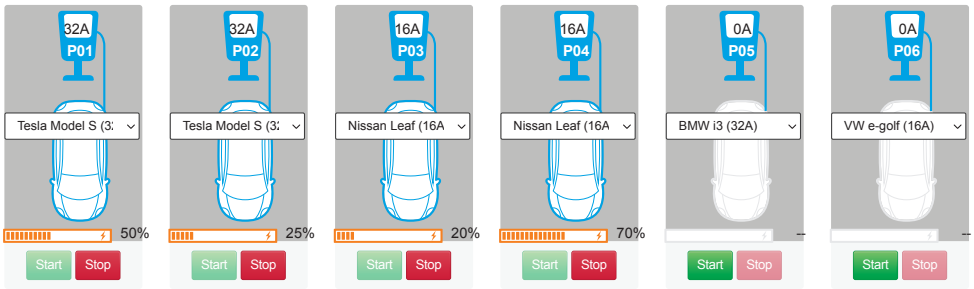
1) 讓司機更方便及更有效率地使用電動車
2) 為市場上的日系及歐系電動車提供更完善的快速充電方案

Application Areas 應用領域

1) Public charging stations (e.g. shopping centres, public car parks, highways)
2) Private car parks
3) Public transportation and commercial fleets

1) 公共充電站 (如購物中心、公共停車場、高速公路)
2) 私人車位
3) 公共交通及商用車車隊

Smart EV Charging Station Load Management System
智能電力分配系統



The Smart EV Charging Station Load Management System connects multiple parking spaces to monitor and analyse power usage of Electric Vehicle (EV) chargers in real-time, optimising the use of limited power. It provides rated power (100%) when there are only a few EVs. When more EVs are connected, the system can reduce power output of some chargers (e.g. 50%) so as to allocate additional power to the just-arrived vehicles.

智能電力分配系統連接多個充電車位，實時監察和分析充電器的用電情況，善用有限的能源。當只有少量電動車充電時，充電器能以額定值（100%）為電動車充電；當同時有多輛電動車需要充電，系統會因應電池的電量來分配電力，調低部份充電器的電力輸出（例如50%），以騰出電力為剛到達的電動車充電。

Major Benefits 主要的好處

1) Real-time monitoring of the power usage of EV chargers
2) Fully utilise carpark electricity capacity for EV charging station
3) More EV chargers can be installed in old buildings or buildings with limited spare electricity capacity

1) 實時監測充電器的電力使用情況
2) 更有效地分配停車場的電力以供充電站之用
3) 使更多電動車充電器可裝設在一些落成已久或後備供電容量有限的大廈停車場

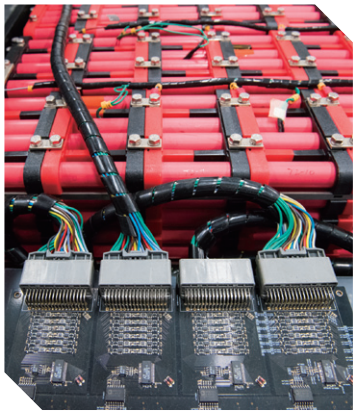
Application Areas 應用領域

1) Carpark with limited spare electricity capacity for EV charging station
2) Carpark requiring large-scale installation of EV chargers

1) 落成已久及後備供電容量有限作充電站的停車場
2) 需要大規模裝設充電設施的停車場

ISO26262 Compliant BMS
符合ISO26262的電池管理系統

Battery Management System (BMS) was re-developed in compliance with ISO 26262 ASIL C which is on par with the safety integrity level set by leading car makers. Detailed technical design was derived from holistic high-level safety analyses including HARA, FTA, FMEA, HAZOP, etc. As a result of complying with state-of-the-art engineering practices, the correctness and completeness of requirements, specifications, and technical implementation were verified. The outcome is a significant improvement in quality, reliability, and safety – a hallmark of the automotive electronic control system.



重新設計的電池管理系統 (BMS) 遵從汽車功能安全ISO 26262 ASIL C規範，提升了現有的電池管理系統的品質和安全性，使其安全等級與業內領先的汽車生產商一致。技術設計從整體的安全分析開始，涵蓋功能安全風險評估(HARA)、故障樹分析 (FTA)、失效性分析 (FMEA)和危險與可操作性分析 (HAZOP)等流程。APAS BMS採用最先進的系統工程規範，確保準確及徹底符合所有要求，規格及技術方案皆通過驗證，使其系統品質、可靠性和安全性均大幅度提升，而這些特性正是汽車電子控制系統的重點。

Major Benefits 主要的好處

1) Provide diagnostic coverage for Single Point Fault Metric (SPFM), Latent Fault Metric (LFM) and quantitative target of Probabilistic Metric for random Hardware Failure (PMHF)
2) Use AUTOSAR OS as Software Element Out Of Context (SEooC) to boost efficiency of software development
3) Maintain holistic work products for development of ISO 26262 systems

1) 提供單點故障(SPM)和潛在故障(LFM)的診斷覆蓋及硬件故障概率(PMHF)的定量目標
2) 採用AUTOSAR作業系統作為SEooC以提升軟體發展效率
3) 全面的維護管理，以便開發其他ISO 26262系統

Application Areas 應用領域

1) Battery Management System
2) Vehicle Control Unit
3) Safety Critical Automotive Control Systems

1) 電池管理系統
2) 整車控制器
3) 汽車安全控制系統

Advanced and Integrated Motorcycle Electronic Fuel Injection System
先進的集成式電單車電子噴射系統

The advanced and integrated electronic fuel injection system for motorcycles uses sophisticated control algorithm to realise the optimum air-fuel ratio so as to fulfil the Euro-IV Emission Standard. The system is able to calibrate different types of motorcycle engines through the tailor-made tuning software. The system is also equipped with advanced On-Board Diagnostics (OBD) and Bluetooth module to help the driver inspect the motorcycle operation status and diagnose the motorcycle faults for timely maintenance.

電單車電子燃油噴射系統採用了先進的控制算法，以實現最佳的空氣燃料比以符合歐盟四期排放標準。定制的標定軟件方便系統調校不同排量的電單車發動機。系統還配備了先進的車載診斷系統 (OBD) 與藍牙模組，方便駕駛員檢查電單車狀態、診斷車輛故障並作出及時維修保養。

Major Benefits 主要的好處

1) Enhance fuel efficiency and reduce emissions
2) Improve the drivability under different engine operation modes
3) Low retrofit cost of electronic fuel injection for conventional carburetors
4) Inspect the motorcycle status and diagnose the motorcycle faults

1) 改善油耗和降低排放
2) 改善不同情況下電單車的驅動性能
3) 改裝電子噴射系統的成本較傳統化油器的成本更低
4) 檢查電單車的狀態並診斷車輛故障

Application Areas 應用領域

1) Motorcycle engines (to fulfil Euro-IV Emission Standard)
2) Industrial machines with small engines (such as lawn mower)

1) 不同排量的電單車 (需符合歐盟四期排放標準)
2) 配備小型發動機的工業設備 (如割草機)

Smart Vehicle-to-Home (V2H) System
智能 V2H 電力供應系統

The Smart Vehicle-to-Home (V2X) System transforms Electric Vehicle (EV) batteries into energy storage devices for households. With the V2H system, electrical power stored in the EV batteries can be transferred to households in peak hours when electricity is at a high price. It helps to save electricity costs and alleviates the high electricity demand in peak hours.

智能V2H 電力供應系統可將電動車電池用作家居儲能裝置。在電費高峰時期，系統可以把儲存在電動車電池中的電力轉移到用戶家中使用，不但節省電費，更有助於緩解高峰時段的電力需求。

Major Benefits 主要的好處

1) Save electricity cost when there is time variant tariff
2) Relieve the high-power consumption situation in peak load hours
3) EVs can serve as emergency power sources

1) 於電價高企時節省電費
2) 緩解電力高峰時段的供電需求
3) 以電動車作為應急電源

Application Areas 應用領域

1) Energy storage devices for households
2) Emergency power source when there are power outages
3) Temporary power source for premises without power sources

1) 用作家居儲能裝置
2) 停電時提供應急電源
3) 為沒有電源的場所提供臨時電力

High Efficiency Silicon Carbide (SiC) Motor Controller
碳化矽(SiC)高效能馬達控制器

Motor controller is used in vehicles with electric powertrains. It supplies battery power to the traction motor during operation and recharges the battery using energy recovered during deceleration. APAS has developed a 150kW high-performance motor controller based on the latest Silicon Carbide (SiC) technology, with lower energy losses and 30% boost in power density.

在電動交通工具中，馬達控制器負責馬達功率驅動及控制，在車輛駕駛時將電池能量變換為驅動馬達的電能，而在車輛減速時可將能量回收至電池。 APAS利用最新的碳化矽(SiC) 技術成功開發出一款高性能150kW 馬達控制器，相對傳統馬達控制器，它的效率更高，功率密度也提高了30%以上。

Major Benefits 主要的好處

1) Higher efficiency with 99% and higher power density with 23KW/L
2) Less current ripple and low noise
3) With robust control algorithm and reliable protection strategy
4) Driving range extends over 5%

1) 效率高達99%，功率密度高達23KW/L
2) 更小的電流紋波、低噪音
3) 採用先進的控制算法和可靠的軟硬體監控保護措施
4) 續航里程可增加5%以上

Application Areas 應用領域

1) Pure Electric Vehicle (PEV)
2) Hybrid Electric Vehicle (HEV)
3) Other battery-powered vehicles

1) 純電動車
2) 混合電動車
3) 其他使用電池驅動的交通工具

Fault Tolerant Steer-by-Wire System
具有容錯功能的線控轉向系統

Fault Tolerant Steer-by-Wire System is a technology developed for autonomous driving. SbW replaced the mechanical linkages between the steering wheel and the steering rack mechanism with the linkage of sensors, controllers and electrically controlled actuators. The creation of SbW is based on intelligent digital model, which can optimise steering related parameters to provide a personalised and natural steering experience to users.

In order to fulfil the safety requirements, electrically controlled actuator is designed with fault tolerant feature. 2 magnetically, mechanically and thermally isolated windings were built in the steering motor, if either of the windings break down due to short circuit or open circuit, the steering function is guaranteed to ensure the vehicle can still pull off safely to the hard shoulder under an emergency situation.

線控轉向系統是一款為無人駕駛而開發，具有容錯功能的低成本技術。線控轉向系統以連接傳感器、控制器和電控執行器取代方向盤和轉向機構之間的機械連接。此線控轉向系統建基於智能數碼模型，能夠優化轉向相關參數，為用戶帶來具個性化和自然流暢的轉向體驗。

為了滿足車輛功能的安全要求，電控執行器被特別設計成擁有2個在導磁性、機械結構和熱傳導性上完全互不干擾的定子綫圈。確保在任何一綫圈發生故障時，車輛仍具備轉向功能，在緊急情況下能安全地駛到路肩等候救援。

Major Benefits 主要的好處

1) Enable future autonomous development by going Steer-by-Wire
2) Remove the mechanical linkage between steering wheel and steering rack
3) Fault tolerant in a cost-effective solution

1) 為無人駕駛車輛後續發展提供線控轉向系統方案
2) 取消車輛方向盤與轉向機構之前的機械連接
3) 低成本且具備容錯功能的電機設計

Application Areas 應用領域

1) Autonomous driving vehicle
2) Industrial motor control system with enhanced safety requirement

1) 無人駕駛車輛
2) 需要增強安全性的工業電機控制系統

Autonomous Driving R&D Platform
自動駕駛研發平台

The Autonomous Driving R&D Platform is equipped with robust drive-by-wire capability, Artificial Intelligence platform, HD cameras and 3D LiDAR. A 5G receiver is installed on the platform by CMHK, enabling it to be controlled through 5G signal. It is built with multiple levels of operational redundancy, putting functional safety as top priority. At any point, the driver can regain full control.

自動駕駛研發平台具備線控技術、人工智能平台、高解像鏡頭和3D光學雷達 (LiDAR)。平台亦安裝了中國移動的5G接收器，可透過5G訊號控制平台。此外，平台提供了多重後備運作系統提升安全性，司機可在任何情況下重新控制車輛行駛。

Major Benefits 主要的好處

1) Solve lack of drivers of certain commercial vehicles in Hong Kong
2) Improve safety by avoiding accident caused by drunk driving and distracted drivers
3) Enable V2X applications with 5G technology, including traffic management to improve throughput and safe traffic

1) 解決香港某些商用車輛司機短缺的問題
2) 避免醉酒駕駛和司機分心駕駛所造成的事故，提高安全性
3) 透過5G技術應用V2X，包括流量管理，以提高吞吐量和交通安全

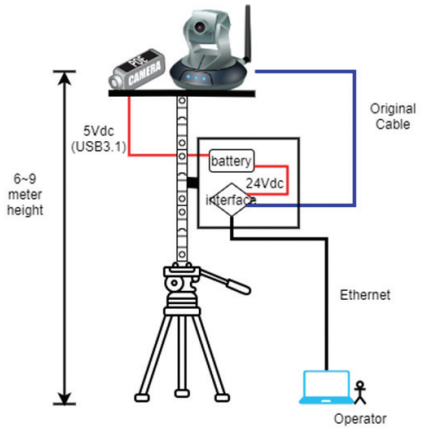
Application Areas 應用領域

1) Autonomous taxi, public bus and tractor
2) Low latency remote controlled driving and traffic management
3) Other autonomous mobile machines used indoor, e.g. mobile vending machine

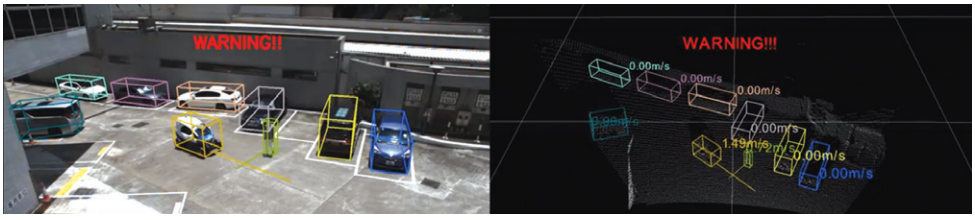
1) 自動駕駛的士，巴士和拖拉機
2) 低時延遠程操控駕駛和交通管理
3) 其他於室內使用的自動行駛機器，如流動售賣機

Roadside LiDAR and V2X Technologies
路側激光雷達與車聯網技術

Due to the limitations of an autonomous vehicle's sensing and perception system, such as limited detection range and sensor blind spots, the ability of autonomous driving to respond to unexpected situations is still intensively concerned. With considerations on cost and safety, an active safety control system with roadside LiDAR based on perception system will become necessary for the scaling up and commercialisation of autonomous vehicle.



無人駕駛汽車的智能與感知系統有探測距離及感知盲點等局限，因此自動駕駛技術在應對突發狀況方面的能力仍備受關注。在成本與安全兩方面的考慮之下，具備路側感知功能的自動駕駛車聯網主動安全控制系統，將成爲自動駕駛規模化與商業化落地的必要條件。



Major Benefits 主要的好處

1) Roadside LiDAR based on active objects identification and safety control to improve the safety of autonomous driving
2) Realise real-time traffic information collection based on roadside LiDAR
3) Can assist manual driving to improve safety through sending safety warnings by V2X system

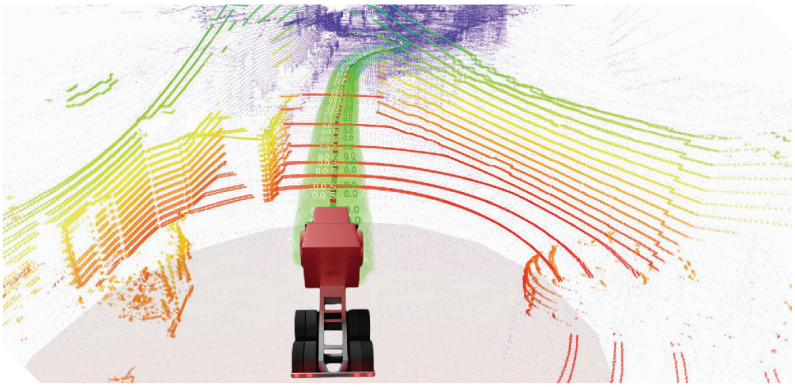
1) 路側激光雷達的主動識別和安全控制能提升自動駕駛的安全性
2) 能透過路側激光雷達實現交通實時信息採集
3) 通過車聯網系統發送安全警告輔助人工駕駛，以提升安全性

Application Areas 應用領域

1) Active safety control for smart mobility
2) Autonomous driving system
3) Traffic information collection for smart mobility, vehicle classification and statistics

1) 智能交通系統主動安全控制
2) 自動駕駛系統
3) 智能交通信息採集系統、車型的分類識別與統計等

Autonomous E-tractor Assessment
自動駕駛電動拖頭車評測



The autonomous E-tractor equipped with 2 sets, total of 8 high-definition cameras and 3 optical radars, which is safer and smoother than traditional manual driving. This project was extensively tested by APAS to ensure the quality, safety and stability of the tractor, and function properly in the dedicated area of Hong Kong International Airport. The tests cover a variety of situations which is possible to encounter in the daily operation, such as crossing curved roads, merging lanes, tunnels or roundabouts. APAS provided professional recommendations and assessment reports about the satisfaction on both functional and safety requirements.

自動駕駛電動拖頭車旁設有2組、共8部高清攝影機，亦配備3個光學雷達，較傳統以人手駕駛拖車更安全及暢順。此項目是由APAS進行廣泛的測試，以確保拖頭車的質量、安全性和穩定性，並可在香港國際機場專用區域正常運作。測試涵蓋拖頭車日常操作中會遇到的各種情況，如穿越曲線道路、合併車道、隧道和迴旋處等。APAS 提供了專業建議和有關功能和安全要求滿意度的評估報告。

Major Benefits 主要的好處

1) Qualify the stability and safety of autonomous vehicles
2) Provide assessment methodology and standard for autonomous vehicles

1) 確保自動駕駛車的穩定性和安全性
2) 為自動駕駛車提供評估方法和標準

Application Areas 應用領域

1) Confined area of airport and seaport
2) Amusement parks or resorts

1) 機場及港口的限制區域內
2) 遊樂園及度假區內

Autonomous Delivery Mover (MiniMover)
自動駕駛運載系統

The Autonomous Delivery Mover, MiniMover, is equipped with an advanced sensor suite. Through the technologies of deep learning and sensor fusion, MiniMover is capable of planning suitable path with collision avoidance of stationary or moving obstacles in a crowded and dynamic environment. Moreover, Minimover can take loft rides and pass-through doors autonomously by communicating with elevators and doors.

自動駕駛運載系統 MiniMover 備有一系列的傳感器，先進的透過運用深度學習及傳感器融合等技術，自動駕駛運載系統能在人多和複雜多變的環境，規劃出合適的行走路徑來避免碰撞靜止或移動的障礙物。再加上與升降機和自動門溝通的功能，它能自主地乘搭升降機並穿過門間以進行短程運送任務。

Major Benefits 主要的好處

1) Ability to fully customise for different application and scenarios
2) Instant communication with elevators and doors to perform delivery tasks autonomously

1) 針對不同應用和場景進行完全定制的能力
2) 能自主地乘升降機並穿過門間以進行運送

Application Areas 應用領域

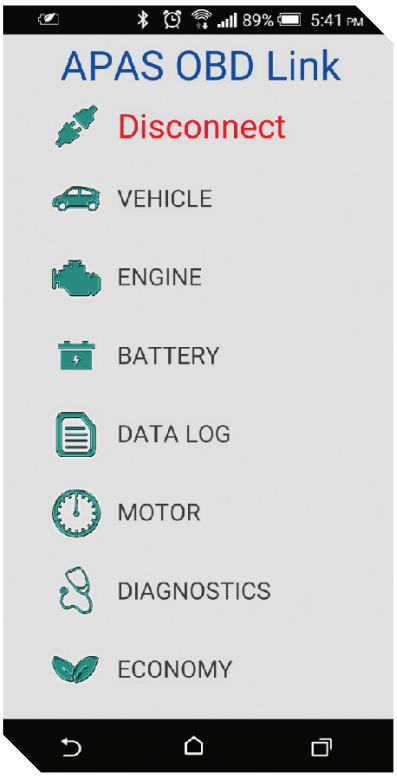
1) Last-mile delivery in buildings, parks or warehouses, or indoor delivery in buildings
2) Perform inspection and patrol tasks

1) 建築物內外、園區或倉庫內的短程運送或室內運送
2) 進行視察和巡邏等任務

Smart Remote Diagnostics System
智能遠端診斷系統

Unpredicted interruption of service due to component or system failure is a costly penalty to fleet operators. Periodic maintenance is one of the preventive measures to counter the problem. However, replacing parts ahead of its failure increases maintenance costs. Smart Remote Diagnostics System is powered by IoT and big data analytics, with predictive maintenance algorithm to predict part failure in its infancy. Thus, unpredicted service interruption can be avoided and maintenance cost is minimised.

對於車隊營運商而言，個別車輛零件或系統失效導致的非預期壞車，會大大增加營運成本及降低服務質素。定期檢查維護可以降低車輛無故拋錨的機會，但過早更換未損壞零件亦會增加維護成本。智能遠端診斷系統利用車聯網及大數據分析，監察車輛系統資料，從而在零件即將損壞前發出預警。這樣既可以降低車隊維護成本，又可以避免預期外的拋錨事故。



Major Benefits 主要的好處

1) Predictive maintenance based on actual condition of components
2) Detection and monitoring of driver behaviour
3) Lower maintenance costs due to extended parts usage
4) Higher availability of vehicles

1) 基於零件實際狀態的預測性保修
2) 偵測及監察司機駕駛行為
3) 更充分利用車輛零件，從而降低維護成本
4) 更高的車輛出勤率

Application Areas 應用領域

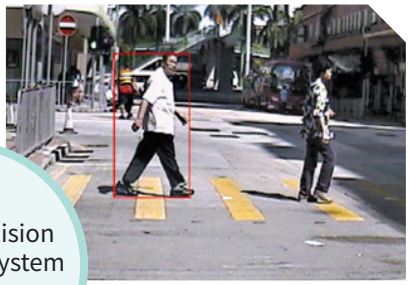
1) Commercial vehicle fleet
2) Government vehicle fleet
3) Driver behaviour-based insurance

1) 商業運輸車隊
2) 政府運輸車隊
3) 基於駕駛行為的車輛保險

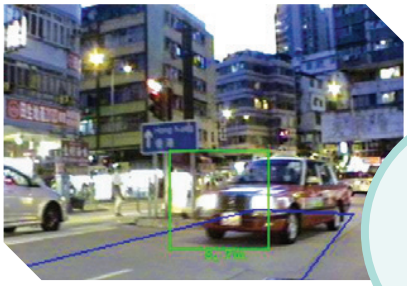
Advanced Driver Assistance System (ADAS)
先進駕駛輔助系統

The Advanced Driver Assistance System (ADAS) is developed to enhance on-road safety and driving experience. The system helps to avoid collisions and accidents by image detection technology that alerts the driver of potential problems on road.

先進駕駛輔助系統能夠提升駕駛安全性和駕車體驗。系統利用視像檢測技術協助避免碰撞和事故發生，並向駕駛者發出警示，提醒路上潛在安全問題。



The 3 systems in ADAS include:
先進駕駛輔助系統包含3個系統：



- Vehicle Collision Avoidance System 汽車防撞系統
- Lane Change Assist & Blind Spot Detection System 轉線輔助與盲點檢測系統
- Pedestrian Warning and Protection System 行人識別警報系統

Major Benefits 主要的好處

1) Comfort (Improve driving comfort and reduce driver's work-load)
2) Safety (Prevention of accident and reduction of crashworthiness)
3) Economy (Reduce maintenance fee)

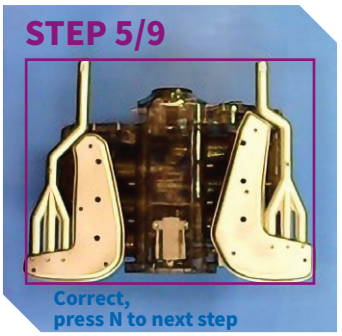
1) 舒適 (提高駕駛舒適性以及減少駕駛者工作量)
2) 安全 (預防事故發生以及減少碰撞)
3) 經濟 (降低汽車意外事故維修費用)

Application Areas 應用領域

1) Autonomous Vehicle & Driverless Electric Vehicle
2) Surveillance system
3) Railway transportation system
4) Construction site

1) 無人駕駛
2) 監控系統
3) 軌道交通系統
4) 建築地盤

AI Master
人工智能師傅



The AI master can learn the working procedures from the human master in the workshop, and guide the apprentices' work through identifying whether the fetched parts, or the assembled modules are correct in each processing step automatically. All the correct processing steps and the final product quality are secured through the monitoring and guidance of the AI master. Besides, the AI master can also be used to train new apprentices.

人工智能師傅透過人工智能演算法，學習人類師傅在車房的工作工藝流程，並通過自動識別每個加工步驟中取出的零件或者組裝成的模塊是否正確，能夠檢查及指導學徒工作。人工智能師傅的監測和指導能夠保證所有加工步驟正確，並確保最終產品質量。此外，人工智能師傅還可將所學的知識用於培訓新學徒。

Major Benefits 主要的好處

1) Intelligent assembly process detection and prevention of wrong operation
2) Guidance and tips for assembly processing steps
3) Inspection of final product quality
4) Training and assessment of new apprentices

1) 智能檢測裝配加工工序，預防錯誤操作
2) 指導並提示裝配加工步驟
3) 檢測最終產品質量
4) 培訓和考核新學徒

Application Areas 應用領域

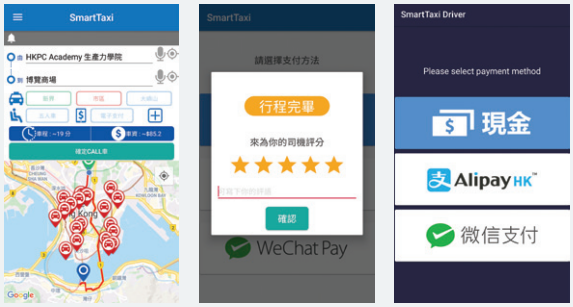
1) Inspection and guidance of the assembly process flow of the production line
2) Inspection and guidance of the operation steps in the repair workshop
3) Training and assessment of apprentices or students

1) 生產線裝配加工工序的檢測和指導
2) 車房修理步驟的檢測和指導
3) 學徒或學生的培訓與考核

Smart Taxi Meter
智能的士咪錶

The smart taxi meter is part of an integrated system that provides a quality taxi hailing service. The system includes a re-designed smart taxi meter that features a 5-inch LCD touch display and cloud system that provides taxi hailing, electronic payment, digital receipt and fleet management functions.

智能的士咪錶是一個集合召喚的士服務、電子支付、電子收據以及車隊管理功能於一身的咪錶和雲端後台綜合系統，擁有5吋觸控式屏幕，為市民提供優質的士服務。



Major Benefits 主要的好處

1) Integrating the smart taxi meter and the cloud system to provide a one-stop system
2) Real time locations of all taxis and service statuses at a glance
3) Optional functions include dash cameras and driver behaviour for improved vehicle safety

1) 集多種功能於一身的的士服務系統
2) 一目瞭然的實時車輛資訊
3) 可擴展功能包括攝影和駕駛者行為分析，增強行車安全

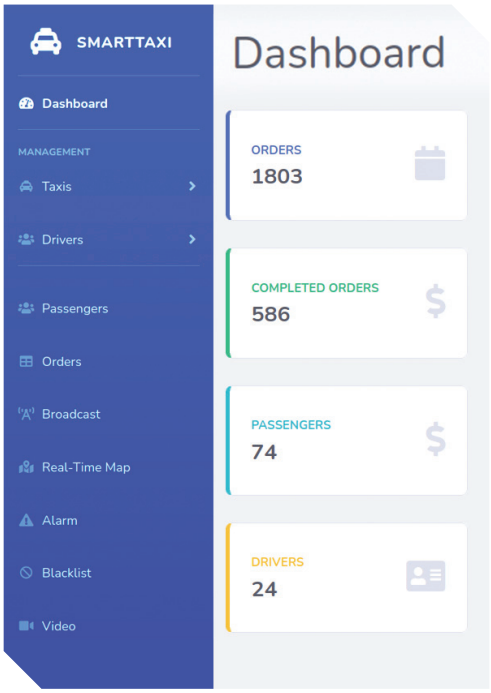
Application Areas 應用領域

1) Taxi company / owner
2) Logistic companies
3) Vehicle fleet management

1) 的士公司 / 車主
2) 物流公司
3) 車隊管理

Smart Taxi Fleet Management and Ride-hailing System
智能的士車隊管理及乘車系統

This system enhances the current taxi fleet in Hong Kong by introducing the in-vehicle telematics device, smart taxi meter and dedicated backend cloud services. Thus, all taxis will stay connected to provide accurate and important data for fleet management and real-time ride-hailing. Related data include video from the camera and vehicle status like speed and acceleration, altogether helping to monitor drivers' behaviour and status. Mobile applications for taxi drivers and passengers to facilitate better ride-hailing and matching services.



智能的士車隊管理及乘車系統通過引入車載遠程信息處理設備、智能的士咪錶和專用的雲端服務，增強目前香港的士配置。相關配置為所有的士提供連線上網，以便為車隊管理和實時叫車提供準確和重要的數據。相關數據包括攝像機視頻以及車輛狀態（例如速度和加速度），有助偵測司機的駕駛行為和狀態。項目亦開發流動應用程式，以提供更佳的叫車配對服務。

Major Benefits 主要的好處

1) Real-time monitoring of driver and vehicle status
2) Collect data to analyse useful information for fleet management
3) Stay connected for potential Vehicle-to-Everything (V2X) applications

1) 實時偵測司機及車輛狀態
2) 收集並分析數據，為車隊管理提供有用資訊
3) 為車輛提供聯網並保持在線，以實現各種不同的V2X應用

Application Areas 應用領域

1) Smart ride-hailing system
2) Real-time taxi monitoring and driving behavior tracking
3) Fleet analysis and management system

1) 智能叫車系統
2) 實時的士偵測、駕駛行為記錄
3) 車隊分析和管理系統

Retired EV Battery Mobile Charger
配備退役電動車電池的流動充電系統

The Retired EV Battery Mobile Charger provides medium charging to Electric Vehicles (EV) or supplies alternating current (AC) electricity. Since a retired EV battery pack still has 60-80% of the original capacity, it is still useful for less demanding energy storage applications so as to extend the life cycle of EV batteries. Besides, the real-time status information is uploaded to the backend server via mobile network. Administrators can monitor and remotely control the on/off of the Mobile Charger.

配備退役電動車電池的流動充電系統為電動車提供中速充電服務，或作為交流電電源。由於退役電動車電池仍然有 60 - 80% 容量，這些電池可應用於對電力要求較低的儲能系統，從而延長電動車電池的使用壽命。此外，系統經流動網絡將實時系統狀態數據傳送到後台管理系統，管理人員可登入網站以監察及遙距開關流動充電系統。

Major Benefits 主要的好處

1) Repurpose retired EV batteries to extend their life cycle
2) Real-time online monitoring of charger and battery status (e.g. operating mode, battery voltage, current, state-of-charge, transaction records)
3) Remotely control the on/off of the mobile charger

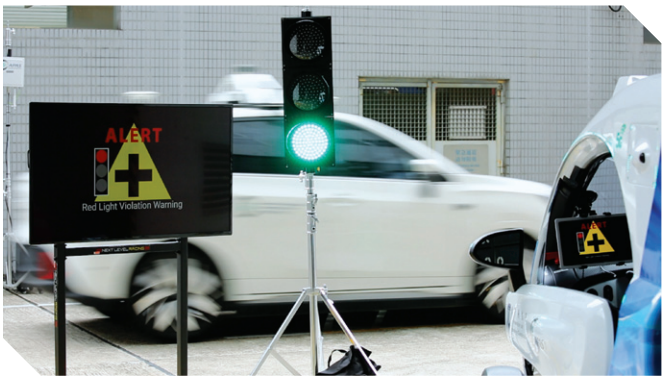
1) 重用退役電動車電池，延長電池的使用壽命
2) 實時線上監察系統及電池狀態 (如運作模式、電池電壓、電流、剩餘電量和使用記錄等)
3) 遙距開關流動充電系統

Application Areas 應用領域

1) Mobile EV charging service
2) Mobile or emergency power source (e.g. at roadworks, during power outage)

1) 電動車流動充電服務
2) 流動或應急電源 (如在道路工程中和停電時使用)

Red Light Violation Warning System
智能衝燈警報系統



The Red Light Violation Warning System utilises edge computing, AI and Vehicle-to-Everything (V2X) technology at a signalised intersection. Easy-to-install and cost effective, the system only comprises a camera with image processor, a Road Side Unit (RSU) and an On Board Unit (OBU) for detecting the on-coming vehicles' locations, speeds, vehicle types and estimating the travelling time and required stop time at the same time. If the system predicts that a vehicle cannot stop securely in front of the stop line when traffic light is about to turn red, warning will be delivered.

此系統利用了邊緣計算和人工智能及車聯網技術 (V2X)，偵測系統製作成本便宜而且安裝簡單，只需配備圖像處理器的攝像頭、路側單元 (Road Side Unit) 和車載單元 (On Board Unit)，就能夠準確檢測在十字路口中駛向不同方向的車輛類型、位置、車速，同時計算車輛與停車線 (Stop line) 的距離和所需煞車時間。當偵測和預計到車輛無法在轉紅燈前於十字路口前停下，系統會發出警報。

Major Benefits 主要的好處

1) Used localised vehicle models in Hong Kong as the deep learning model
2) Detection accuracy up to 96%
3) Provide RLV alert before violating vehicle enters into the intersection region to allow more reaction time for all road users

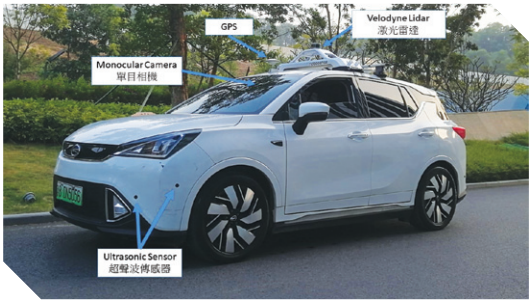
1) 利用了本地常見車型作為深度學習模型
2) 檢測準確率高達96%
3) 如預計到車輛無法在紅燈前停下，便能作出預警，為所有道路使用者提供更多反應時間

Application Areas 應用領域

1) Major traffic accident black spots of road intersections
2) Adapted to ordinary traffic light systems for upgrading to intelligent transport system

1) 交通事故黑點的十字路口
2) 加裝在傳統交通燈系統上，使之成為智能交通系統

Remote Automatic Parking System
遠程自動泊車系統



The remote automatic parking system is developed to improve parking efficiency for drive-by-wire vehicles from entrance to parking lots within confined areas. The steering, driving with gear shifting and braking system are all automatically controlled by smart multi-sensor fusion algorithms. It helps the vehicle navigate itself from entrance into a parking space with no driver intervention involved. It offers maximum space utilisation of parking facility by eliminating the driver and passengers from the vehicle parking process.

遠程自動泊車系統為具有線控底盤的汽車提供最後1公里服務，可以實現特定區域的遠程自動停車，提高停車效率。它利用多傳感器融合的智能算法，實現對轉向、驅動及制動的自動控制，從停車場入口開始至完成泊車，期間無需駕駛員介入，提升停車場的使用效率。

(A) Front entering Straight car-park space
頭入泊車

(B) Rear entering S-shaped (parallel) parking
S位泊車

(C) Rear entering L-shaped parking
L位泊車

Major Benefits 主要的好處

1) Automatic last mile service without driver involved
2) Static and dynamic surrounding obstacles detection in real time to avoid collision
3) Improve parking efficiency, accuracy and safety

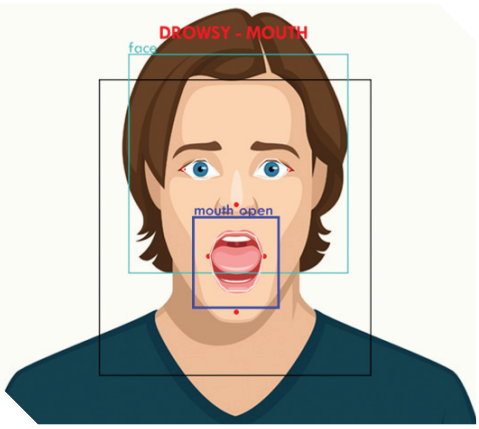
1) 無需駕駛員介入的最後1公里自動駕駛服務
2) 實時監控周圍動靜態障礙物以防止碰撞
3) 提高泊車效率、準確性及安全性

Application Areas 應用領域

1) Drive-by-wire vehicles
2) Community auto shuttles
3) Auto cargo vehicles

1) 具有線控底盤的汽車
2) 社區無人駕駛穿梭巴士
3) 機場、貨櫃碼頭的自動貨運車

Drowsiness-Fighter
駕駛睡意偵測助理



Advanced embedded system to detect driver drowsiness instantly based on fusion of Artificial Intelligent image algorithm and sensors. It can provide audio alert to driver if any drowsiness is detected to enhance driving safety. This is a low-cost and low-power solution which can be easily installed in various automobiles.

這是一種利用人工智能圖像算法和傳感器融合技術的先進嵌入式系統，可以即時檢測司機的精神狀況，並在檢測到任何睡意時以聲音提醒司機，以減低駕駛時發生意外的風險。這是一種低成本、低功耗的解決方案，更可輕鬆安裝在任何汽車上。

Major Benefits 主要的好處

1) Prevention of accident and reduction of crashworthiness
2) Reduce maintenance costs due to accident
3) Low cost and low power consumption solution

1) 預防事故發生及減少碰撞
2) 降低汽車意外事故維修費用
3) 低成本及低功耗方案

Application Areas 應用領域

1) Automotive Vehicle
2) Fleet Management
3) Railway Transportation System

1) 任何車輛
2) 車隊管理
3) 軌道交通系統

5G Tele-operation
5G 遙距駕駛

5G tele-operation of an autonomous vehicle, the application utilises the advantages of 5G network technology: low latency and high data transfer rate to enable distant driving with high resolution video streaming of the traffic condition. Tested on various frequencies (3.5GHz / 4.9GHz / 26 – 28GHz) of 5G tele-operation technology, driver in the driving simulator controls a car with real time video streaming from the car regardless of the location, while enjoying realistic driving experience.

此5G遙距自動駕駛汽車應用建基於5G網絡低時延和高速傳輸的優點，令遙距駕駛變成可能，駕駛者能實時觀看車輛回傳的路面資訊。透過多種5G通訊頻段 (3.5GHz / 4.9GHz / 26 – 28GHz)，駕駛者在模擬駕駛艙遙距操作車輛而不受地域限制，同時駕駛者能夠享受真實的駕駛感。

Major Benefits 主要的好處

1) Low latency and higher bandwidth for video streaming, providing a more realistic driving experience
2) Enable tele-operation in a remote area without too much infrastructure investment
3) Enable control of many vehicles by 1 driver

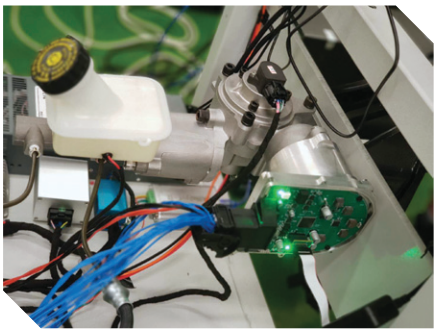
1) 利用5G低時延和高速的頻寬，增強駕駛真實感
2) 無需投資大量基礎設施
3) 1個駕駛者能夠控制多輛車輛

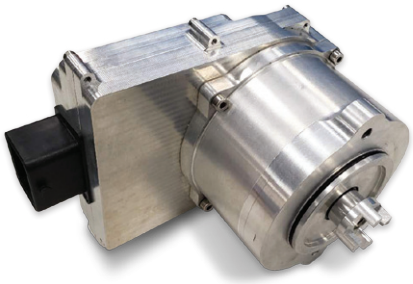
Application Areas 應用領域

1) Remote driving in harsh environment, such as Port / dock / landfill
2) Inspection in construction sites
3) Inspection in restricted areas, e.g. sewage / drainage

1) 遙距控制車輛於惡劣環境行駛，例如港口、碼頭、堆填區
2) 檢視建築工地
3) 檢視受限區域，例如下水道、排水管

Smart Electric Brake Booster
智能電動制動助力器





Brake Booster is a key device that increases the force applied from the brake pedal to the master cylinder during vehicle braking. The traditional vacuum brake booster utilises the pressure difference between atmosphere and vacuum to provide auxiliary force for the brake. APAS has developed a vacuum-independent, high performance, electric brake booster that meets the demand of a modern braking system. It can be used with all drivetrain configurations and is particularly suited to EVs and automated driving vehicles.

制動助力器作為汽車的關鍵部件，用來在剎車過程中增加踏板助力。傳統真空助力製動器是利用進入助力器後腔的空氣與真空的壓差來產生制動要求的助力。APAS 成功開發出一種新型、高性能，而且不需要真空源的機電伺服助力系統，它幾乎可應用於所有動力系統，尤其適用於電動車和自動駕駛車，滿足現代制動系統的需求。

Major Benefits 主要的好處

1) Smaller volume and easy installation by omission of vacuum pump and pipes
2) Flexible pedal characteristics adjustable by software
3) Highly dynamic shortens stopping distances for automatic emergency braking
4) Regenerative braking to increase driving range up to 15%
5) Enable brake-by-wire function

1) 體積小，安裝方式靈活
2) 通過軟體調整助力性能曲線，實現不同的踏板感
3) 快速的建壓特性有助於縮短緊急制動距離，提高車輛安全性
4) 可通過制動回收，增加續航里程高達 15%
5) 可實現線控制動

Application Areas 應用領域

1) Pure Electric Vehicle (PEV)
2) Hybrid Electric Vehicle (HEV)
3) Automated driving vehicles

1) 純電動車
2) 混合電動車
3) 自動駕駛車

APAS R&D Centre Testing Services
研發中心測試服務

APAS R&D Centre test lab is capable to provide support to the research projects related to automotive parts and accessories, as well as testing services to the industry. Apart from providing testing facilities and consultation, the Centre also helps to develop test plans, analyse data, design test fixtures, and provide diagnostics and technical supports. Below is a list of tests provided by the Centre:

研發中心實驗室支援汽車零部件的項目研發，以及給業界提供有關的測試服務。研發中心除提供測試設備及諮詢服務，亦幫助制訂測試計劃、分析數據、提供診斷和技術支援。以下是研發中心可提供的測試服務：

Testing Equipment 測試設備	Test Standards 基本試驗	Functions 主要功能
Battery Testing System 電動車單體電池測試設備	IEC 62660 	Measure single cell battery charge / discharge performance, as well as its temperature move. 測量單體電池充放電性能以及電池溫度曲綫。
EV Battery Testing System 電動車電池能量模擬及測試系統	ISO 12405 	Simulate and evaluate EV battery via high power and adjustable system. 透過大功率可調式系統，模擬及測試電動車電池的性能。
Power Logger 電能質量記錄儀		Conducting energy, load and power quality testing. 進行關於能量、負載和功率品質的測試。

Handheld Spectrum Analyser
手持頻譜分析儀

Used for maintaining or installing transmitter systems, checking cables and antennas, assessing signal quality in broadcasting, radiocommunications and service, measuring electric field strength, or in simple lab applications.

用於維護或安裝發射機系統、檢查電纜和天線、在廣播、無線電通信和服務中評估信號品質、測量電場強度，或簡單的實驗室應用。

Impedance Analyser
阻抗分析儀

The equivalent circuit analysis function supports 7 different multi-parameter models and simulate equivalent parameter values of components.

等效電路分析功能支持 7 種不同的多參數模型和模擬試件的等效參數值。

Programable Electronic Load
可編程式電子負載

Simulate a variety of load conditions under high crest factor and varying power factors with real time compensation.

通過對電壓波形進行即時補償，來模擬在高峰值因數和變功率因數下的各種負載情況。

EV Charger Analyser
電動車充電分析儀

Analyse the EV charger performance.

分析電動車充電站的充電性能。

Dynamometer
測功機

Measure the speed, torque, power and efficiency of the motor.

測試電機的速度、扭矩、功率和效率等。

Data Acquisition / Switch Unit
數據採集儀

Record the real time current, voltage and temperature data.
即時記錄電流、電壓和溫度資料。

VBOX
汽車測試數據記錄器

The VBOX 3i is the industry standard data logger for automotive testing and validation.
VBOX 3i 是用於汽車測試及驗證的專業級別數據採集儀

Dewetron
電動車功率測試與分析

The Dewetron TRIONet is the data acquisition front-end for power analysis
Dewetron TRIONet 是用於功率分析的數據採集前端儀器。

The Centre provides tests related to the automotive parts and accessory systems of electric vehicle:
本中心提供以下針對電動車零部件的測試：

- Electromagnetic Compatibility (EMC)
  電磁兼容測試
- BT2000 Battery Characterisation System
  電池充放電系統
- Digatron EVT 300-600-2*80kW IGBT Electric Vehicle Tester
  電機動力測功系統
- EV Motor Dynamometer Platform
  電動車電機動力模擬測功平台

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