LSCM

Connecting Innovation & Reality
創新科研 與時並進

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Logistics and Supply Chain MultiTech R&D Centre
(Abbreviated as "LSCM")

The mission of LSCM is to foster the development of core competencies in logistics and supply chain related technologies and to facilitate the adoption of these technologies by industries in Hong Kong and the Mainland.

物流及供應鏈多元技術研發中心
（簡稱LSCM）

LSCM一直致力研發促進物流及供應鏈之相關行業發展的各種技術，並通過持續研發，提升物流及供應鏈行業的核心科技實力，同時協助本港及中國內地的行業採用有關技術以提升競爭力。

Joint Research Efforts with Local Universities for Technological Innovations in Hong Kong

香港浸會大學 HONG KONG BAPTIST UNIVERSITY
- Location-based Service (LBS) Technologies

香港中文大學 The Chinese University of Hong Kong
- E-Commerce, Logistics and Supply Chain Management
- IoT Technologies
- Gerontech & Community

香港城市大學 City University of Hong Kong
- E-Commerce, Logistics and Supply Chain Management
- IoT Technologies

THE HONG KONG POLYTECHNIC UNIVERSITY 香港理工大學
- E-Commerce, Logistics and Supply Chain Management
- Construction
- Location-based Service (LBS) Technologies

香港大學 THE UNIVERSITY OF HONG KONG
- E-Commerce, Logistics and Supply Chain Management
- IoT Technologies
- Construction

香港科技大學 THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY
- Location-based Service (LBS) Technologies
- IoT Technologies
- Construction
- Gerontech & Community

與本地大學聯合研發之創新科技

香港浸會大學 HONG KONG BAPTIST UNIVERSITY
- 位置基礎服務技術

香港中文大學 The Chinese University of Hong Kong
- 電子商貿、物流及供應鏈管理
- 物聯網技術
- 樂齡科技及社會服務

香港城市大學 City University of Hong Kong
- 電子商貿、物流及供應鏈管理
- 物聯網技術

THE HONG KONG POLYTECHNIC UNIVERSITY 香港理工大學
- 電子商貿、物流及供應鏈管理
- 建築
- 位置基礎服務技術

香港大學 THE UNIVERSITY OF HONG KONG
- 電子商貿、物流及供應鏈管理
- 物聯網技術
- 建築

香港科技大學 THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY
- 位置基礎服務技術
- 物聯網技術
- 建築
- 樂齡科技及社會服務
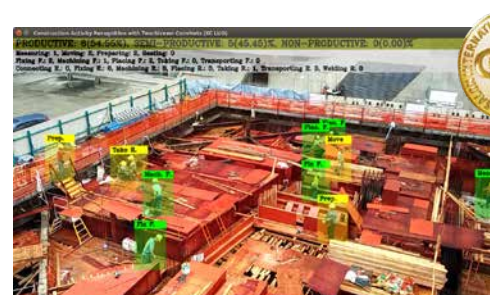
Inventions Geneva

LSCM Once Again Garners Five International Awards

At the 47th Geneva International Exhibition of Inventions Geneva, LSCM won five awards including two Gold medals and three Silver medals for its five submitted projects.

Gold Medal

Infrared Thermal Sensing Safety Alert System for the Elderly

Pi: A Smart Construction Quality Management System

Silver Medal

Smart Traffic Control System

Landslide Detection and Alerting System

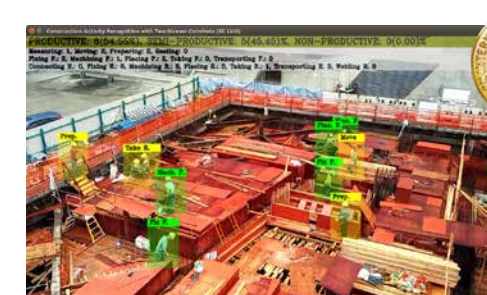Real Virtuality for Aircraft Inspection (ReVAI) Training System

LSCM揚威海外勇奪五項國際獎項

憑藉五項研發技術，LSCM於第47屆日內瓦國際發明展大放異彩，勇奪兩金三銀的驕人佳績。

金獎

適用於長者的紅外線熱能感應警報系統
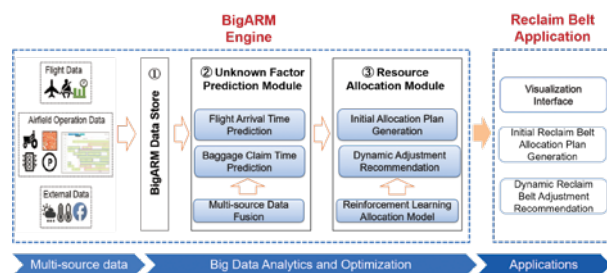
Pi:智能施工品質管理系統

銀獎

智能交通控制系統

智能山泥傾瀉監察及警報系統

虛擬實境培訓系統 - 飛機檢查

BIGARM ENGINE
基於大數據的
機場資源管理引擎

Big Data-Driven Airport Resources Management (BigARM) Engine and Application Tools

A Big Data-Driven Airport Resource Management (BigARM) Engine is developed to provide supports for efficient and smart airport resource management. The application can balance the load of reclaim belts of the Hong Kong International Airport and reduce the baggage collection time.

基於大數據的機場資源管理引擎及應用工具

由大數據驅動的機場資源管理 (BigARM) 引擎旨在為高效和智能的機場資源管理提供支援。它可以平衡香港國際機場之輸送帶的負載量及縮短提取行李的時間。

New Technologies that will be developed include:

- Storage system for accessing structural and unstructured airport big data from multiple sources
- Big data-driven algorithms to predict unknown factors at airport
- Big data-driven algorithms for making more informed resource allocation
- Big data-driven engine that integrates data storage system and the abovementioned algorithms
- Visualization tools for decision-making
- BigARM-based application for baggage reclaim belts allocation at HKIA

將研發的新技術包括：

- 能從多個來源擷取結構性和非結構性的機場大數據的存儲系統
- 可預測機場未知因素的大數據驅動計算法
- 可進行更明確的資源分配之大數據驅動計算法
- 集成了數據存儲系統和上述計算法的大數據驅動引擎
- 用於決策的可視化工具
- 適用於香港國際機場行李輸送帶的分配

BigARM: Big Data-Driven Approach
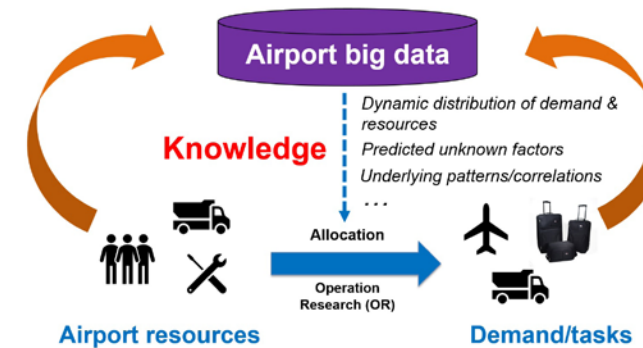
This project utilizes BigARM specially to deal with baggage reclaim belts allocation. The allocation of reclaim belts is expected to balance the utilization of belts and reduce the baggage collection time by eliminating baggage delivery stoppage due to conveyor belt congestion. This can be achieved by predicting the arrival time of flights and the time for passengers to arrive at the baggage reclaim area to balance the utilization load of reclaim belts.

這項目利用BigARM專門處理行李輸送帶的分配。透過分配行李輸送帶的負載，令各運輸帶得以均衡使用，從而減少行李因輸送帶堵塞而停止派送的情況發生，以達到縮短提取行李的時間。這是通過預測航班的到達時間和乘客到達行李區域的時間，以平衡行李輸送帶的使用量。

BigARM ENGINE
基於大數據的
機場資源管理引擎
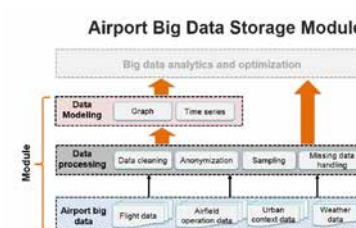
The big data related to airport resource management is heterogeneous. They are stored in SQL and NoSQL databases based on their structures, and then feature learning methods are applied to extract useful features for further analysis.

與機場資源管理相關的大數據都是不同的，所以這些數據會按它們的結構存儲在SQL和NoSQL數據庫中，然後透過深度學習提取有用的功能以作進一步分析。

Feedforward neural network is used to make prediction on unknown factors and detect emergency events; optimal allocation and reinforcement learning algorithms are devised to generate intelligent resource allocation plans.

這技術採用前饋神經網絡，對未知因素進行預測，並檢測緊急事故，設計出最佳的分配和強化學習的計算法，從而作出智能資源分配計劃。

Implement application tools including visualization tools and analytic tools are used to show statistics and analytic results on baggage reclaim belt allocation at the Hong Kong International Airport.
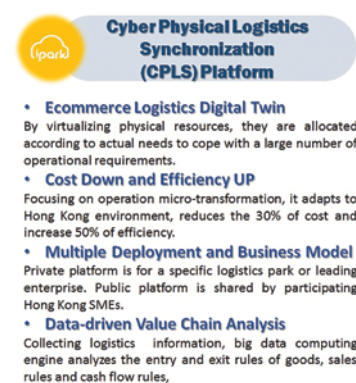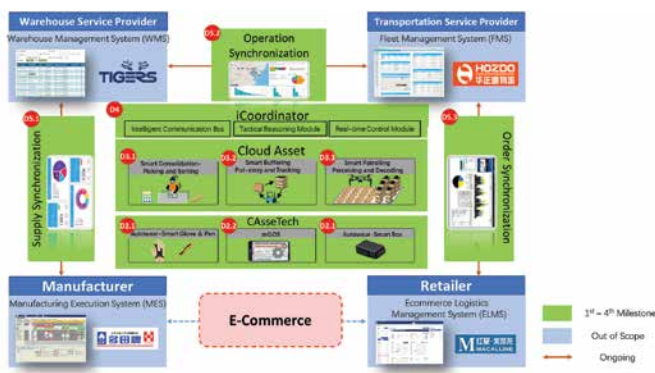
這項目採用了可視化和分析功能的應用工具，能顯示香港國際機場行李輸送帶的分配統計數據和分析結果。

E-COMMERCE, LOGISTICS AND SUPPLY CHAIN MANAGEMENT

電子商貿、物流及供應鏈管理

iPark: Core Technologies of Intelligent E-Commerce Logistics Parks

E-Commerce has developed exponentially in the Greater China region in recent years, while logistics have become bottlenecked. Traditional logistics operations are no longer able to cope with the challenges, such as long order fulfillment time, low utilization in space and huge fluctuation demands. Thus, LSCM and the University of Hong Kong have developed iPark to elevate the logistics services to meet the growth of E-Commerce.

智慧電商物流園區物聯網

近年，電子商務在大中華區迅速增長，然而物流卻成為限制其發展的瓶頸。傳統的物流管理模式，未能應對電子商貿爆炸性增長所帶來的挑戰，導致訂單處理時間漫長及倉庫使用率偏低的問題。因此，LSCM和香港大學研發的智慧電商物流園區(iPark)旨在改善物流服務，從而應對電子商貿的發展。

New technologies that will be developed include:

- Cloud asset technology: mGOS and Autowear
- Cloud asset enabled services: smart consolidation, smart buffering, and smart patrolling
- iCoordinator for synchronization and execution control
- Decision support tools, namely Supply Synchronization, Operation Synchronization, and Order Synchronization services
- iPark platform for SMEs in HK

將研發的新技術包括：

- 雲資產技術：mGOS和Autowear
- 基於雲資產的服務：智能組貨、智能緩存和智能巡查
- 適用於同步執行控制的iCoordinator
- 決策支援工具 ： 供應同步、業務同步和訂單同步服務
- 適用於香港中小型企業 (SMEs) 的智慧電商物流園區平台

The project will carry out several pilot project in Hong Kong and China. One is a private platform for leading enterprises with operations in the Greater China Region. The other is a public platform that is shared by participating Hong Kong SMEs included manufacturers, logistics service providers, warehousing service providers and retailers. Eventually, the platform will be "transplanted" to logistics and industrial parks.

本項目將會在香港和中國開展多個試點項目，其一是建立面向大中華地區的大型綜合性企業的私有平臺；其二是建立一個面向香港中小企業的公共服務平臺，包括製造商、物流服務供應商、倉儲服務供應商和零售商。最終，平台將會「移植」到物流園區。
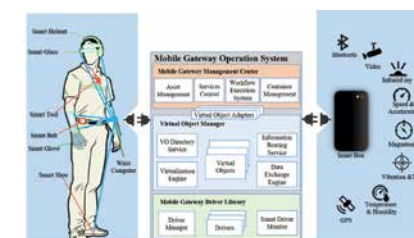
Cloud Asset Technologies is for real-time location acquisition of assets and the collection of necessary sensing data in the e-commerce logistics parks. It can improve project scheduling efficiency, reduce the searching time cost of manpower, help enterprises to track asset during monitoring, production, logistics process tracking, and playing a role in product management.

雲資產技術適用於實時獲取資產位置以及在電子商貿物流園區收集必要的感知數據。該服務能提高項目進度及效率，減少人力搜索的時間成本，幫助企業在監控、生產、物流跟蹤過程和管理產品中發揮作用。
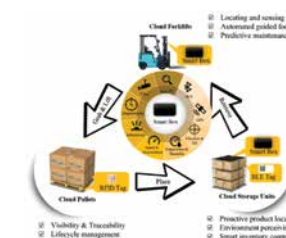
Smart buffering in logistics park defines the concept of operational scenario to transport and store products in the distribution centre. It contains three main components, which are cloud forklifts, cloud pallets and cloud storage units. It makes the physical assets smart because they are perceived by others and perceive their own surroundings.

物流園區的智能緩存定義是指在配送中心運輸和存儲產品的操作場景概念。智能緩存包含三個主要組件，即雲叉車，雲托盤和雲存儲單元。它能被他人感知，並且亦能感知附近的環境。

iCoordinator coordinates with mGOS according to the requirements of iSync Services. Then, the operators wearing smart ring can pick the materials with mobile consolidation station. The operators can finish the multi-order in one picking route according to the hints on the smart tablets and the light tags on the cloud storage unit.

iCoordinator將根據iSync Services的要求與mGOS協調。隨後，已佩戴智能指環的操作員可以在流動整合站挑選材料。他們也可以根據智能平板上的提示及雲存儲單元上的燈標一次過完成多個訂單。
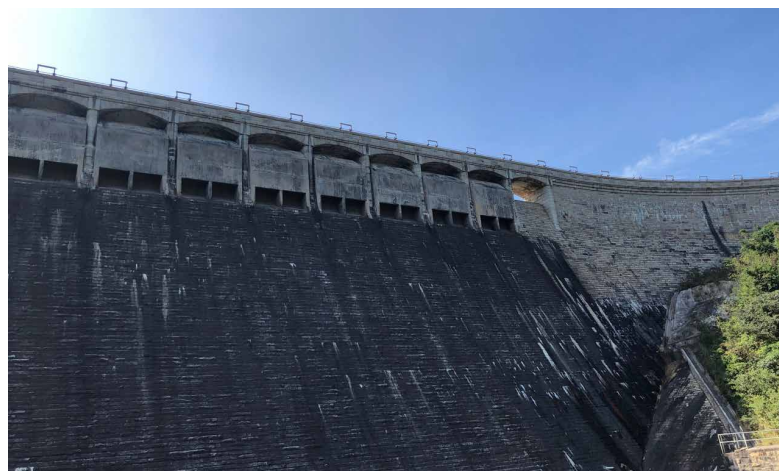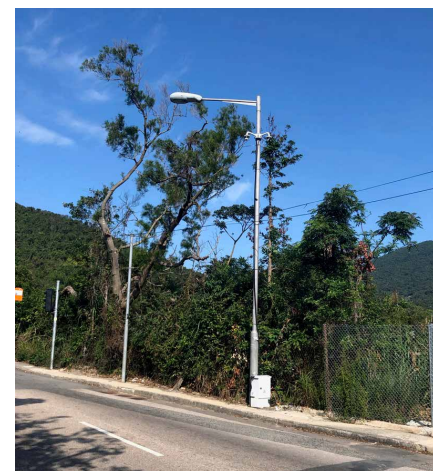
Smart Traffic Control System

The Tai Tam Road (Dam Section) was constructed more than a century ago and is part of the thoroughfare connecting Chai Wan and Stanley. As its width is only 5-meters, congestion problems often occur when large vehicles pass through the road. Since the dam is a declared monument, widening that section of road is not possible. The Smart Traffic Control System (STCS) based on video analytics technology is thus developed to identify types of vehicle and analyse the traffic flow, so as to control the traffic light smartly in order to shorten the traffic queue.

智能交通控制系統

逾百年前建成的大潭道水壩段是連接柴灣和赤柱的主要道路，路面寬約五米，當大型車輛使用道路時經常會出現堵塞問題。鑑於水壩是法定古蹟，路面不可擴寬。因此，應用了以影像分析技術的智能交通控制系統來分辨車輛的種類和計算車輛的流量，以控制交通燈的運作及疏導車輛。

Technologies ready to transfer include:

- Deep learning based image object detection modules
- Resource monitoring and management system with mobile notifications for different insufficiency statuses
- Traffic Control Mechanism
- Interaction with QTC traffic light controller

可供轉移的技術包括：

- 基於深度學習的影像目標物件檢測系統組件
- 應用目標物件檢測系統組件的視頻處理基礎架構和系統
- 交通管制機制
- 與QTC交通燈控制器的互動

This low-cost device can be easily installed and built upon an existing traffic control system and is especially useful in places where the roads cannot be widened, and that a smart traffic control device is needed to resolve traffic congestion. It can also generate detailed traffic reports to revamp the transportation system in the future.

這個低成本的系統易於安裝及應用於現有的交通管制系統，有助紓緩路面交通，尤其適用於無法擴闊的道路，以協助疏導車輛。此外，系統更可提供詳細的交通報告，以便將來改善交通系統。
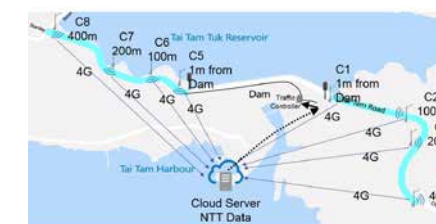
The Smart Traffic Control System (STCS) has been implemented in Tai Tam Road (Dam Section) since August 2018 and has been proven as twice as effective in terms of saving time compared with traditional traffic lights.

智能交通控制系統在2018年8月已在大潭道 (大壩段) 使用。跟傳統交通訊號燈相比，證實能節省兩倍的等待時間。

The STCS uses data from 8 traffic detectors to compute vehicle queue lengths on both sides of the Dam and adjust the duration of green traffic light signals to reduce overall delays in real-time.

智能交通控制系統使用來自8個探測器的數據來計算大壩兩側之車輛隊列的長度，從而調整綠燈訊號的執行時間，以減少總體的延遲。

The Smart Traffic Control System has won the Silver Medal at the 47th International Exhibition of Inventions of Geneva in 2019.
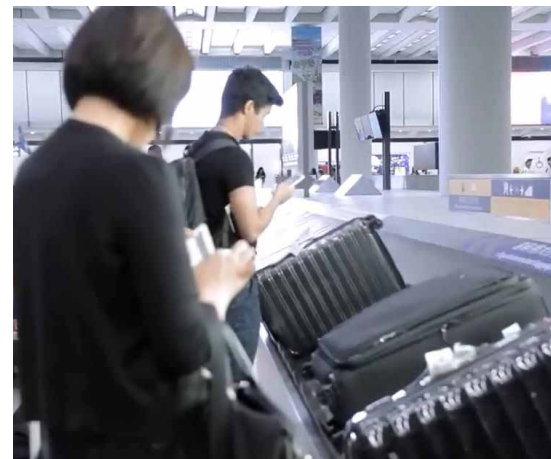
智能交通控制系統在2019年舉行的第47屆日內瓦國際發明展榮獲銀獎。

TROLLEY AVAILABILITY MONITORING SYSTEM
行李車供應監控系統

E-COMMERCE, LOGISTICS AND SUPPLY CHAIN MANAGEMENT

電子商貿、物流及供應鏈管理

Video Analytics for Resources Management

The trolley availability monitoring system disseminates updated information of trolley availability statuses via a mobile application to frontline staff. It helps ensure that sufficient trolleys are available to passengers.

資源管理視頻分析

行李車監控系統透過流動應用程式，向前線人員發放最新行李車供應狀態的資訊，以確保有足夠的行李車可供旅客使用。

Technologies ready to transfer include:

- Machine learning-based image object detection system modules for various types of resources such as baggage trolleys

- Video processing infrastructure and system using object detection modules

- Resource monitoring and management system with mobile notifications for different insufficiency statuses

可供轉移的技術包括：

- 機器學習為基礎的影像目標物件檢測系統組件，應用於檢出各類資源類型，如行李車

- 應用目標物件檢測系統組件的視頻處理基礎架構和系統

- 資源監控和管理系統，並備有針對各種不足狀態的手機通報功能
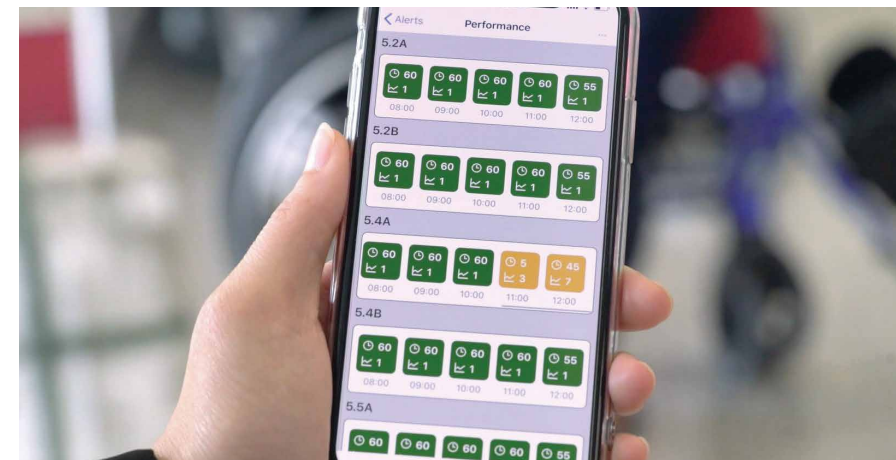
When the quantity of trolley in any pickup point drops below the pre-set level, the Trolley Availability Monitoring System will immediately notify the frontline staff via the Trolleys mobile app. The continuous trolley monitoring from the video streaming content of all pickup points distributed over a large area avoids the time lag data based on patrolling. The real-time quantity intelligence enables frontline staff to effectively replenish the trolleys and thus improves the quality of passenger services at the Hong Kong International Airport.

當任何領取點的行李車數量低於預設水平時，行李車供應監控系統便會透過Trolleys手機應用程式即時通知前線員工。由於巡查人員監察分佈在每個領取點的行李車數量的資訊往往滯後，系統可根據不斷更新的視頻影像內容，點算行李車的數量。實時行李車數量資料有助員工盡快補充行李車，以確保為旅客提供的行李車數量充足，從而提升香港國際機場客服務的質素。

TROLLEY AVAILABILITY MONITORING SYSTEM
行李車供應監控系統
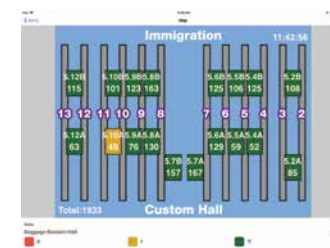
Through the continuously collected image data, the system applies corresponding machine learning technique and achieves a detection rate at about 92%. It has also been automatically computing numbers of trolleys over all 18 pickup points in real-time for the entire Baggage Reclaim Hall.

系統利用不斷收集所得的圖像數據，進行遞進式的機械學習，行李車偵測準確度達至92%；在整個行李認領大堂內，實時為總共18個行李車領取點自動點算行李車的數目。

The system does not require any equipment installation on any baggage trolley, which saves corresponding one-time installation procedure as well as long-term maintenance management.
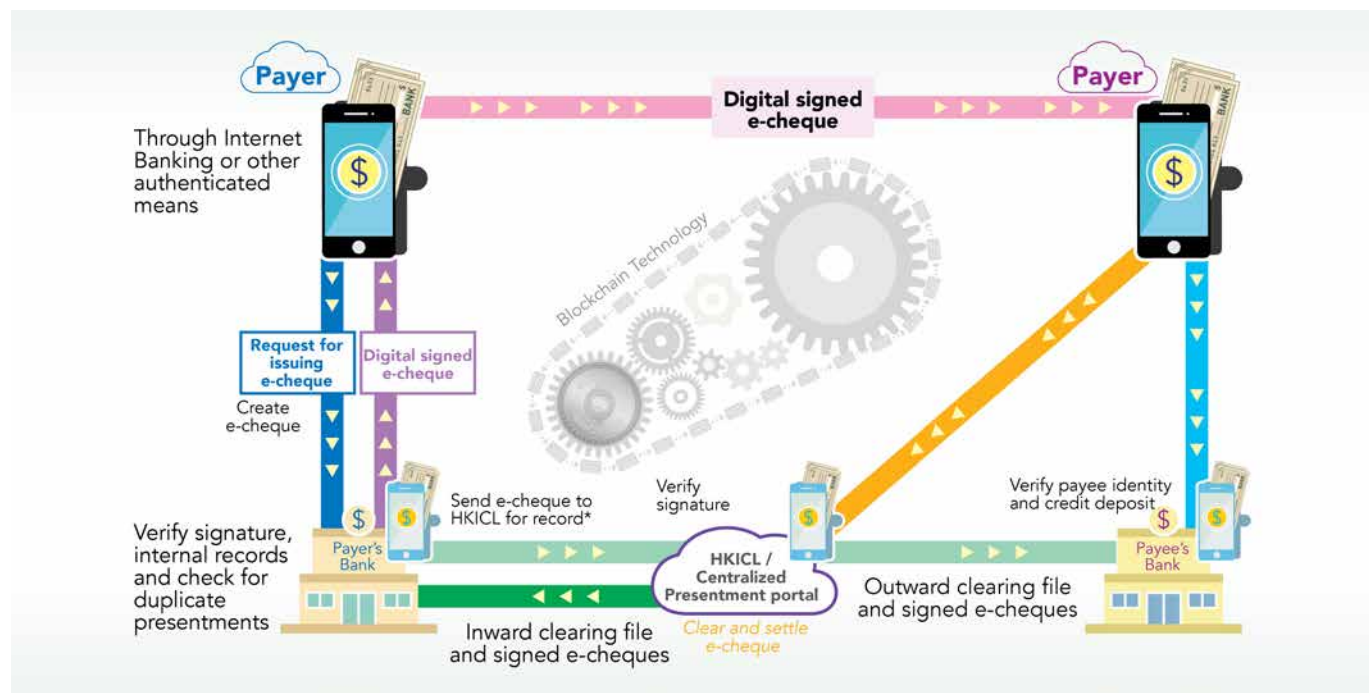
這監察系統並不需要在行李車上安裝任何設備，可省卻相關的一次性安裝工序，以及連帶的長遠維修管理。

In 2018, the Trolley Availability Monitoring System has won the Gold Medal at the 46th International Exhibition of Inventions Geneva.

行李車供應監控系統在2018年第46屆日內瓦國際發明展榮獲金獎。

E-COMMERCE,
LOGISTICS AND SUPPLY
CHAIN MANAGEMENT

電子商貿、物流及
供應鏈管理

e-Cheque Wallet App on Android platform

In contrast to most e-Wallets that use a traditional centralised ledger, LSCM e-Cheque app utilises the Blockchain technology which provides a safe and reliable system to eradicate replicated and counterfeit cheques and strengthen corporate's confidence on e-Cheques.

有別於其他以中央記帳方式記錄交易的電子錢包，LSCM的電子支票應用程式利用區塊鏈 (Blockchain) 技術，為電子支票提供一個更安全可靠的系統，杜絕重複及偽冒支票，增強企業使用電子支票的信心。

BLOCKCHAIN ENABLED E-CHEQUE APPS

基於區塊鏈的電子支票應用程式

With the help of file encryption and digital signature technique, authenticity of the digital assets is guaranteed. Each digital asset is uniquely identified on the Blockchain, so the owner cannot resend the same digital asset to more than one recipient.

使用文件加密和電子簽名技術，確保電子資產的真確性。每項電子資產被區塊鏈獨立標識，因此發票人無法將相同的電子資產發送給多於一個收件人。
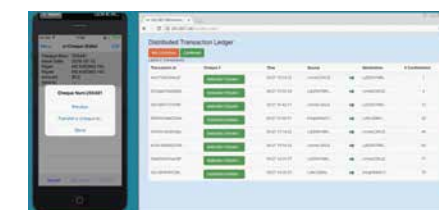
It offers trusted and speedy delivery of e-cheques. Issuers may issue digital assets and have them delivered to thousands of recipients in real-time.

它提供可靠和快速的電子支票交付。發票人可以發行電子資產，並實時地交付給眾多收件人。

In 2017, e-Cheque Wallet application has won the Silver Medal at the 45th International Exhibition of Inventions Geneva.

電子支票錢包應用程式在2017年舉行的第45屆日內瓦國際發明展榮獲銀獎。

Blockchain enabled e-Cheque App

e-Cheque Wallet applications developed by LSCM provide a more convenient platform for e-Cheque transactions, and facilitate new business models and entrepreneurship in e-Commerce/e-Logistics.
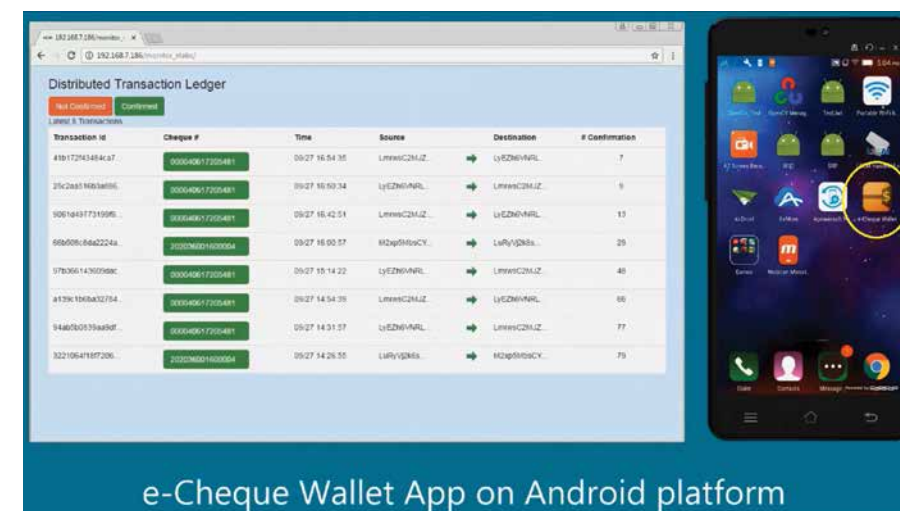
基於區塊鏈的電子支票應用程式

由LSCM開發的電子支票錢包應用程式，為電子支票交易提供了更方便的平台，並促進電子商務/電子物流方面的新業務模式和創業機會。

Technologies ready to transfer include:

- e-Cheque API
- Digital Asset Wallet and Blockchain Interface Library
- Encryption/Proxy Re-encryption Engine

可供轉移的技術包括：

- 電子支票API
- 電子資產錢包和區塊鏈界面庫
- 加密/代理重新加密引擎

imseCAVE
虛擬實境系統

A Virtual Reality (VR) System for Strategic Operation Training

The system is A fully immersive and automatic cave-like virtual environment - that can be delivered in a cost-effective manner - used for training, decision-making, and evaluating the high-order skills of professionals.

虛擬實境系統之應用—策略及實踐培訓

猶如親臨其境的洞穴型自動虛擬實境,為對高級管理和技術人員的決策和技能培訓和評估方面,提供一個嶄新而具成本效益的解決方案。

Technologies ready to transfer include:

- Learning Management System
- AI-based Human Behavior Analyser
- VR skill-based Training Content

可供轉移的技術包括:

- 學習管理系統
- 以AI為基礎的人類行為分析儀
- 以VR技能為基礎的培訓內容

In imseCAVE, the technologies of virtual and augmented reality, together with real-time motion capture, are deployed with an artificial intelligence-based behavior profiling algorithm. The algorithm was developed to achieve dynamic scenario creation, visualisation, user skills profiling, and performance evaluation in critical operations.

此項目透過使用人工智能行為分析計算法於虛擬實境、擴增實境和實時動作捕捉技術上,建立動態情景和將它可視化,讓用戶在完成這些重要的操作後,可獲得技能分析和表現評估。

imseCAVE
虛擬實境系統

A fully immersive and cave-like virtual environment trains high-level management and technical professionals to make strategic decisions during critical operations, in a timely manner.

一個猶如親臨其境的洞穴型自動虛擬實境,為高級管理和技術人員適時地作出關鍵性的決策培訓。

It transmitslife-like scenarios of complex operations through visualization and dynamic interaction, while users' activities and behaviors are recorded to be analysed .
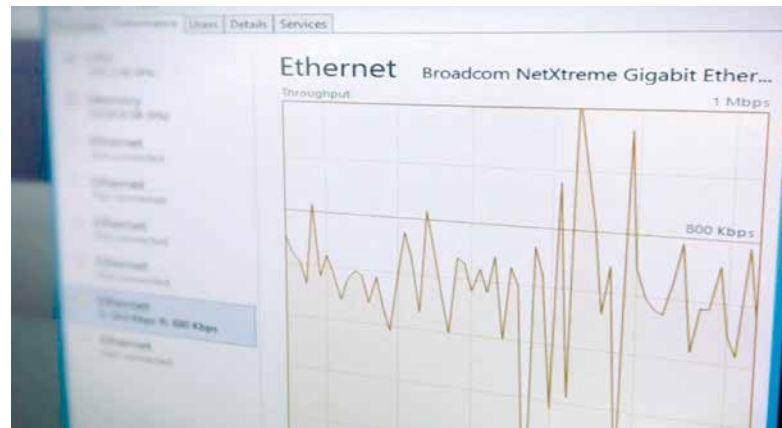
讓培訓者在栩栩如生的場景內體驗複雜的操作,並與動態的環境互動。系統會把他們的活動記錄下來,然後作出分析。

ReVAI, the VR training system developed for CASL engineers, has won the Silver Medal Award in the 47th International Exhibition of Inventions of Geneva in 2019.

為中國飛機服務有限公司的工程師所開發的虛擬實境培訓系統ReVAI,在2019年舉行的第47屆日內瓦國際發明展上獲得銀獎。

SHIELD
神盾計劃

SHIELD Smartbox

SHIELD – Critical Infrastructure Protection in Hong Kong

SHIELD is a platform for information sharing among different key stakeholders in preventing cyber-attacks, by facilitating the sharing of intelligence, and simulating cyber-attacks for the purpose of providing drills.

神盾計劃—保護香港關鍵基建

神盾計劃為業界提供一個網絡攻擊訊息共享平台，透過訊息、情報共享及模擬網絡攻擊的情況進行防禦練習。

Technologies ready to transfer include:

- The SHIELD platform which provides a training ground for expertise development in Hong Kong

- A vanilla version of the SHIELD for the retail industry and / or critical infrastructure suppliers

可供轉移的技術包括：

- 提供一個專業技術發展的訓練平台

- 為零售業和/或關鍵基礎設施供應商開發的普通版本神盾計劃

The SHIELD features 3 components: 1) a smart box, called SHIELD (Smart Hacking and Intrusion Entrapment with Lawful Detection), that is built to perform intelligent packet filtering; 2) a cryptographic model that sanities the information collected by the smart box in order to protect data privacy during digital investigations; and 3) a means for profiling cyber-attacks using the sanitised data.

神盾計劃包括以下3個部分：1）利用一個名為神盾（攻擊和入侵的智能誘捕及合法檢測）的智能盒，以進行智能數據包過濾；2）透過密碼學模型，對智能盒收集的訊息進行清理，從而保護數字取證調查過程中的數據私隱；3）使用網絡攻擊分析模型對清理後的數據進行調查。

SHIELD
神盾計劃

SHIELD helps avoid the threat arising from DDoS attacks where attackers will initiate heavy traffic to cripple and bring down e-Commerce web sites.

神盾計劃有助防禦DDoS攻擊者發出大規模數流量的威脅，避免電子商務網站因此而癱瘓。

The SHIELD provides detailed information of cyberattacks and alerts the key stakeholders to protect them from being attacked.

神盾計劃提供有關網絡攻擊的詳細訊息，並提醒有關人士免受攻擊。

The system generates the trace back plan which includes the recommended take down priorities of Bots and / or attack sources.
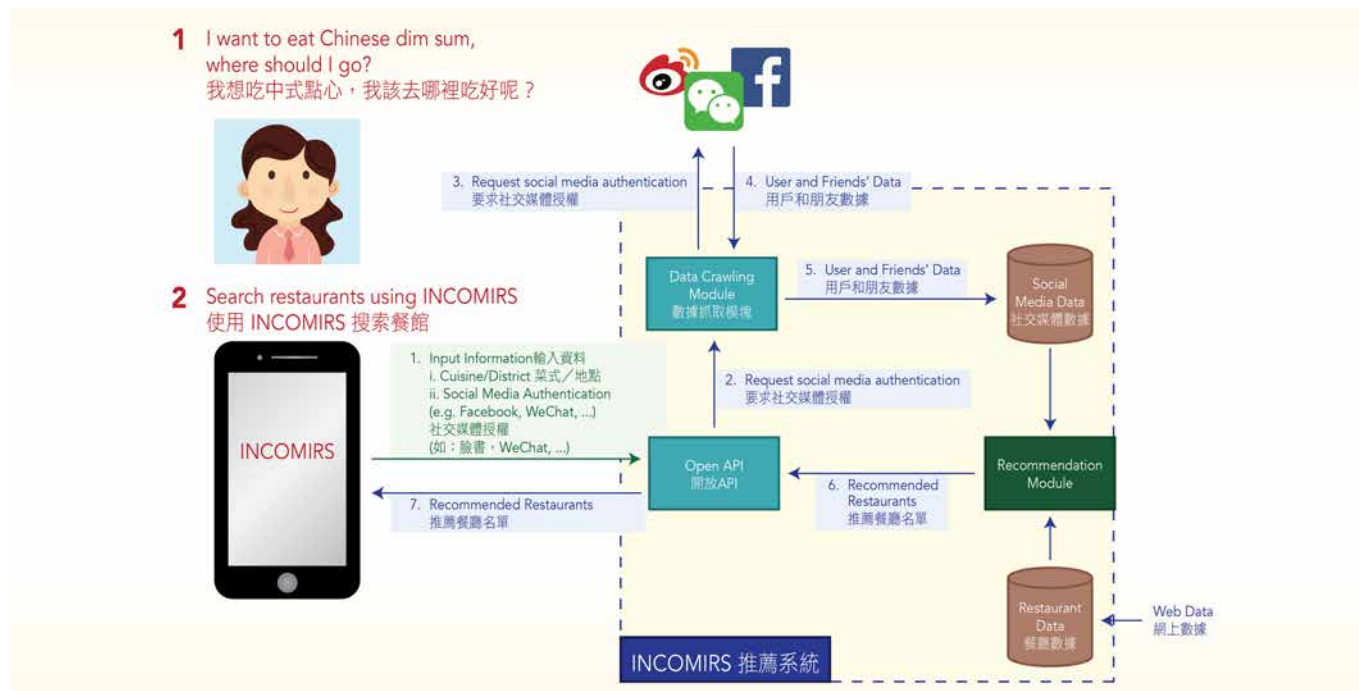
系統制訂追查攻擊來源的計劃，包括建議取消機械人及/或攻擊來源的優先次序。

INCOMIRS
以綜合群組為基礎的微博推薦系統

1. I want to eat Chinese dim sum, where should I go?
我想吃中式點心，我該去哪裡吃好呢？

2. Search restaurants using INCOMIRS
使用 INCOMIRS 搜索餐館

3. Request social media authentication
要求社交媒體授權

4. User and Friends' Data
用戶和朋友數據

5. User and Friends' Data
用戶和朋友數據

i. Input Information 輸入資料
i. Cuisine/District 菜式／地點
ii. Social Media Authentication (e.g. Facebook, WeChat, ...)
社交媒體授權 (如：臉書，WeChat, ...)

2. Request social media authentication
要求社交媒體授權

6. Recommended Restaurants
推薦餐館名單

7. Recommended Restaurants
推薦餐館名單

Web Data 網上數據

Data Crawling Module 數據抓取模塊
Social Media Data 社交媒體數據
Open API 開放API
Recommendation Module
Restaurant Data 餐廳數據

INCOMIRS 推薦系統

Integrated Community-based Microblog Recommendation System (INCOMIRS)

In this project, an effective community-oriented microblog recommendation system will be developed to jointly consider the importance of microblog and individual users' interests.

以綜合群組為基礎的微博推薦系統
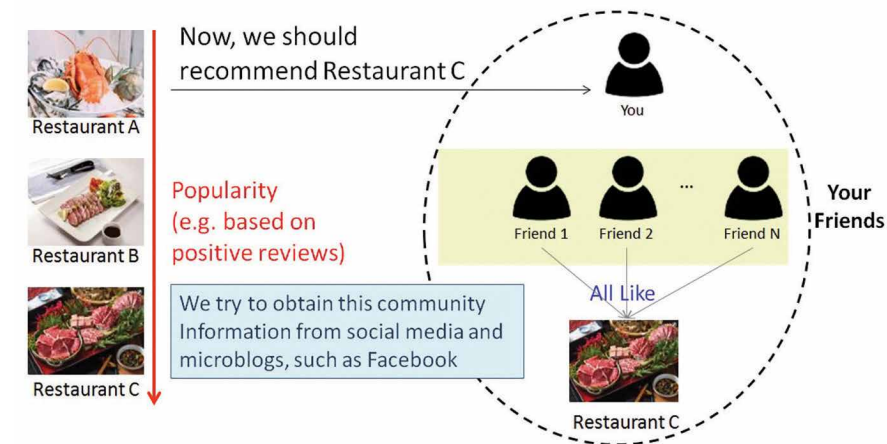
這個項目旨在開發一個有效而適用於社群的推薦系統，系統可同時考慮微博的重要性和個人用戶的喜好。

New technology to be developed includes:

- Integrating community engagement data into recommendation

將研發的新技術包括：

- 將群組參與數據整合到推薦中

Intuitively, we should recommend Restaurant A. With community information, the recommendation may be different.

Now, we should recommend Restaurant C

Popularity (e.g. based on positive reviews)

We try to obtain this community Information from social media and microblogs, such as Facebook

Restaurant A
Restaurant B
Restaurant C

You
Your Friends
Friend 1   Friend 2   ...   Friend N
All Like
Restaurant C

Accurately locate customers from the Internet is undoubtedly important for e-commerce nowadays. An effective way to do so is to analyse the information from microblogs, such as Weibo. Microbloggers with common interests usually form communities. By identifying the community interests, we can locate our customers more precisely.

從互聯網準確地鎖定目標客戶無疑對現時的電子商務非常重要，而分析微博等微網誌的數據是一個有效的方法。通常具有共同興趣的人會組成群組，透過識別群組的喜好，我們可以更準確地鎖定目標客戶。

INCOMIRS
以綜合群組為基礎的微博推薦系統
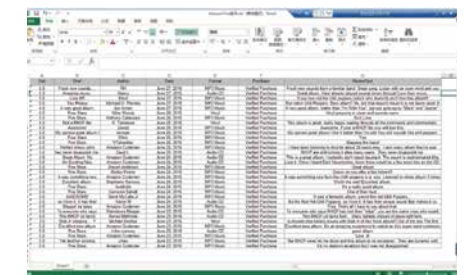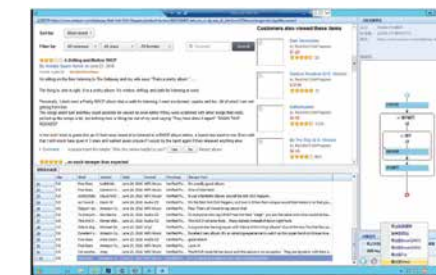
INCOMIS focusses on the interests of individual as well as the interest of communities.

以綜合群組為基礎的微博推薦系統不但關注個人用戶的喜好，同時亦顧及群組的想法。

INCOMIS adopts both quantitative and qualitative evaluations, which brings new insights on how to develop a highly reliable recommendation system.

以綜合群組為基礎的微博推薦系統透過定量和定性評估，為如何開發高度可靠的推薦系統帶來新的突破。

INCOMIS is able to handle a large dataset in real time.

以綜合群組為基礎的微博推薦系統能實時地處理大量的數據。

RFID-ENABLED SENSING TECHNOLOGIES
無線射頻識別傳感技術

RFID-Enabled Sensing Technologies for Real-time Environmental Monitoring and Facility Management

The RFID-Enabled Sensing Technologies provide continuous monitoring of ambient statuses surrounding environment-sensitive items like cultural artifacts, food and drug during exhibition, storage and transportation through pluggable, wireless and battery-powered sensors for preservation management. The technologies also support real-time indoor condition monitoring such as lux, UV, vibration, temperature and relative humidity for facility management.

應用於實時環境監測及設施管理的無線射頻識別（RFID）傳感技術

無線射頻識別傳感技術運用插件式、以電池供電的無線傳感器，在展覽、存儲和運輸過程中，為對週邊環境敏感的物品，如文物、食品和藥物，持續監控環境狀況，以支援物品的保存及管理。此技術亦支援實時室內環境狀態監測，包括光照、紫外線、震動、溫度和相對濕度，以便進行設施管理。

Technologies ready to transfer include:

- A real-time environmental monitoring system (communication tag, sensor modules, communication router and coordinator, monitoring and reporting software, customisation and consultancy, etc.)
- Communication tag, router, and coordinator design
- Universal sensor interface design
- Sensor module design
- Monitoring and alert application software

可供轉移的技術包括：

- 實時環境監測系統（通訊標籤、傳感器組件、通訊路由器和協調器、監測和報告軟件、度身訂造技術和諮詢等）
- 通訊標籤、路由器和協調器設計
- 通用傳感器接口設計
- 傳感器組件設計
- 監控和預警應用軟件

The sensing system consists of coin-sized pluggable sensor modules, the RFID communication modules, as well as wireless coordinators for transmitting RFID and sensor data. The system includes 24-hour sensing capability of measuring temperature, relative humidity, vibration, ultraviolet (UV), and illuminance (lux) for preserving valuable artifacts and goods. If the data deviate from the individually customizable range of allowable conditions, the system will alert the user accordingly.

傳感系統由硬幣般大小可插件式傳感器、無線射頻識別通訊系統、以及用於發送無線射頻識別訊號和數據的無線協調系統組成，可24小時監控個別展櫃珍貴文物的溫度、相對濕度、震動、光照及紫外線。如果數據偏離個別展品預設的允許範圍時，系統將會發出警報。

RFID-ENABLED SENSING TECHNOLOGIES
無線射頻識別傳感技術

The system makes use of license-free wireless spectrum. Up to five external sensor modules can be plugged into an active RFID communication tag for logging and wirelessly transmitting data and commands.

系統使用免費的無線頻譜，並可連接多達五個傳感器到有源無線射頻識別通訊標籤，從而發送數據和指令。

The small-sized pluggable sensor provides flexibility for exhibition designers to balance the exhibition aesthetic and the need for monitoring environment without blocking or drawing attention away from artifacts.

這部體積細小、插件式傳感器，讓展覽設計師既可兼顧展品的美觀性，又可在不阻礙觀眾觀賞展品的情況下監測環境。

The power consumption of sensors and wireless transmission is low so that the battery can last for about six months operating in either online real-time monitoring mode or offline data logging transit mode.

傳感器的耗電量少，無論是使用在線實時運作模式，或者是離線數據記錄運作模式，電池都可用上約半年左右。

PRODUCT AUTHENTICATION
產品驗證技術

Product Authentication at Retail Points – Infrastructure and Systems

LSCM Authen√Tick® is the Centre's proprietary product authentication technology, which enables users along the supply chain to securely verify the authenticity of goods in order to provide assurances of product genuineness from the point of certified manufacturers to the point of retail.

應用於零售業的產品核證技術─網絡基建與應用系統

LSCM「認」真「析」貨®系統是本中心已註冊的產品驗證技術，幫助供應鏈業界用戶安全地驗證產品，由生產地至零售點，確保產品的真確性。

Technologies ready to transfer include:

- LSCM Authen√Tick® system (software application, hardware design, system customisation and consultancy, etc.)
- Product authentication server software
- QR Code, UHF RFID and NFC mobile applications (for Android only)

可供轉移的技術包括：

- LSCM「認」真「析」貨®系統 (軟件應用、硬件設計、度身訂造系統和顧問服務等)
- 產品核證主機軟件
- QR碼、UHF RFID及NFC手機應用程式 (只支援Android制式)

Product Authentication technology avoids the pitfalls endemic to conventional anti-counterfeiting methods and powers a reliable and trusted authentication platform that can authenticate product labels using third-party operated readers and retain its integrity even when relying on unsecured data transmission in the Internet, making for seamless integration into existing user infrastructure.

產品驗證技術減少了傳統防偽方法的漏洞，提供一個可信賴的驗證平台，不但可透過第三方經營的閱讀器作驗證，即使在互聯網內傳送資訊亦能確保訊息的真確性，而且可以無縫地結合用戶現有的系統。

PRODUCT AUTHENTICATION
產品驗證技術

The robustness of the LSCM Authen√Tick® system allows it to work in tandem with different authentication mediums including but not limited to QR Code, UHF RFID and NFC technologies, which are bundled in the product authentication system.

LSCM「認」真「析」貨®系統可透過不同媒介進行驗證，包括二維碼、超高頻無線射頻識別 (UHF RFID) 及近場通訊技術 (NFC)。

The operation of the system is consumer-friendly. Merchants can set up an authentication point at the retail point When a NFC mobile phone is installed with the authentication app, it will become a personal mobile authentication station.

此系統的操作十分簡便。商戶可在零售點設立驗證站。當NFC手機上安裝驗證應用程式後，它便成為流動的驗證站。

The system will update its complex coding scheme continuously so as to effectively identify the counterfeit products in the market. The information will be encrypted after authentication, and released through registered authentication stations.

系統會不斷更新其複雜的編碼方案，從而有效地辨別市場上的偽冒產品。而這些經驗證的資訊亦會被加密處理，並由已註冊的驗證站發放。

E-LOCK
電子關鎖

IoT Cross-Boundary Fast-Clearance Security Application

The IoT Cross Boundary Fast-Clearance developed by LSCM helps interconnect the Hong Kong Custom's Intermodal Transshipment Facilitation Scheme (ITFS) with the speedy Customs Clearance (SCC) of the Mainland Customs. With the official launch of the 'Single E-lock Scheme' in late March of 2016, customs clearance between Hong Kong and Guangdong becomes more convenient and efficient.

物聯網跨境快捷通道應用程式

由LSCM開發的物聯網跨境快捷通道,將香港海關的「多模式聯運轉運貨物便利計劃」與內地海關的「跨境快速通關」連接。隨著2016年3月下旬正式推出的「跨境一鎖」計劃,香港與廣東之間的通關變得更加方便快捷。

Technologies ready to transfer include:

- E-lock Track and Trace Application Platform
- E-lock Interoperability Gateway for Transshipment
- Transshipment Track and Trace Backend Application
- Transshipment Track and Trace User Interface
- E-lock end-to-end information security server system

可供轉移的技術包括:

- 電子鎖追蹤應用平台
- 使用於轉運的電子鎖互操作性網關
- 轉運追蹤後端應用程式
- 轉運追蹤用戶界面
- 電子鎖端對端訊息安全服務器系統

Since the trial of the 'Intermodal Transshipment Facilitation Scheme' from 2012 and 'Single E-lock scheme' from 2016 , it has been extended to 52 clearance points in Guangdong province including Guangzhou Nansha Free Trade Zone, Jiangmen International Electronic Commerce Express Mail Sorting Clearance Centre and Guangzhou Airport, including the 12 clearance points in Hong Kong, included Hong Kong International Terminals and Kwai Chung Customhouse, 624 express intermodal transportation routes are offered. Up to May 2019, the scheme has been on trial for more than 118,900 times, with over 52 million consignments being handled.

自2012年「多模式聯運轉運貨物便利計劃」並於2016年「跨境一鎖計劃」試行,到目前為止計劃在內地廣東省共有52個清關點,包括南沙保稅港區、江門市跨境電商快件分揀清關中心及廣州機場等,加上香港12個清關點,例如香港國際貨櫃碼頭及葵涌海關大樓等,共提供624條聯運快線。截至2019年5月,已累積超過118,900車次,以及處理52,00萬件貨物。

E-LOCK
電子關鎖

The system supports real-time GPS tracking and monitoring. It also offers unique security token control.

此系統使用GPS實時追蹤和監控。它還提供獨有的保安編碼器監控。

While a single locking device (e-Lock) supports multiple jurisdictions, independent locking control across jurisdictions is achieved.
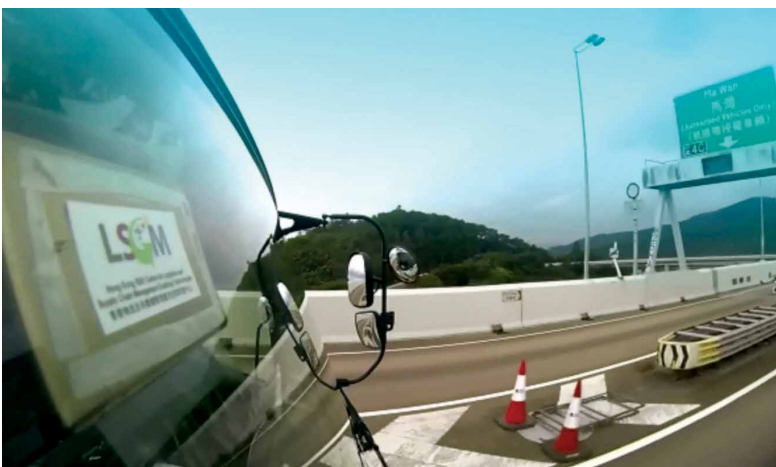
跨境一鎖設備 (e-Lock) 既適用於多個管轄區域,又能在每個區域獨立地被鎖定監控。

E-Lock has won the Silver Medal at the 45th International Exhibition of Inventions Geneva in 2017.

電子鎖技術於2017年舉行的第45屆日內瓦國際發明展中獲得銀獎。

ADVANCE TRUCK'S ARRIVAL NOTIFICATION SYSTEM
貨車抵達預報系統

Advance Truck's Arrival Notification System for Air Cargo Industry at the Hong Kong International Airport

Utilising the power of passive UHF technology, LSCM's advanced arrival notification system is able to monitor and identify vehicles travelling at high speed from a distance.

應用於香港機場空運貨站的貨車抵達預報系統

LSCM利用無源超高頻 (UHF) 射頻識別技術研發的抵達預報系統，可監察及遠距離確認高速經過的貨車。

Technologies ready to transfer include:

- Advance arrival notification system (tracking software, hardware design, system customisation and consultancy, etc.)
- Tracking and alerting software
- RFID tags and hardware design

可供轉移的技術包括：

- 抵達預報系統 (追蹤軟件、硬件設計、度身訂造系統和顧問服務等)
- 追蹤及預報軟件系統
- 無線射頻識別標籤及硬件設計
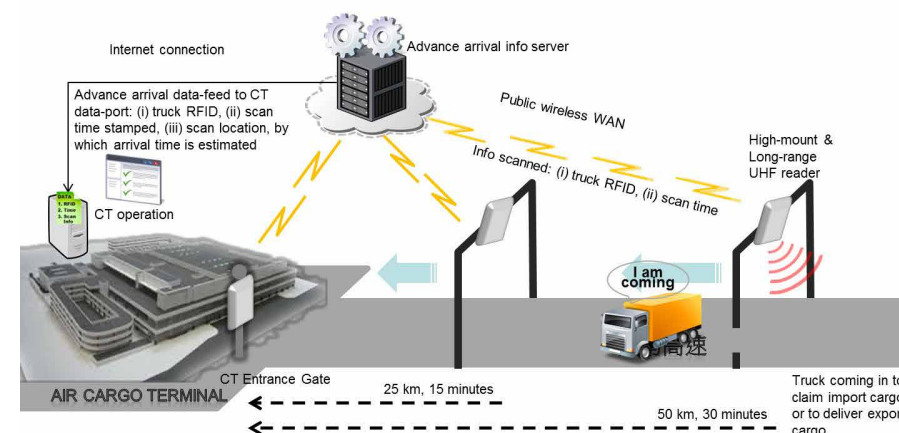
The Advance Truck's Arrival Notification System is already installed in one of the busiest highways in Hong Kong, tracking specific trucks as they make their way to cargo terminals across Hong Kong. The timely information provided can be used to maximise operational efficiency by enabling optimisation of parking space management, providing more reliable metrics to assess vehicle traffic at loading areas and allowing for advance preparations for loading or un-loading.

貨車抵達預報系統已應用於香港其中一條最繁忙的公路，以追蹤正在駛往空運貨站的特定貨車的位置。系統所提供的實時訊息可加強停車位置的管理，以提升營運效率；並提供可靠的資訊以確定上落貨區的情況，為貨車上落貨作預先準備。

For cargo terminals, it maximises the utilisation of docks and eliminates idle time. Cargoes can then be transferred between the aircraft and the truck more efficiently. It also helps cycling Unit Loading Devices (ULD) as efficiently as possible.

系統有助充分使用空運站內的站台位置，減少閒置時間，令貨物能更有效地在飛機和貨車間轉移。它亦能更有效地使用集裝器 (ULD)。

For truckers, it minimises the waiting time for truck docks. Quicker turnaround time on airport trips means more job opportunities for the truckers.

對於貨車司機而言，系統可以大幅度縮短貨車於貨運站的等待時間。當來往機場的時間減少，貨車司機便可處理更多的服務訂單。

For forwarders, the system helps provide better CRM services. They will be able to better utilise truck trips to the airport and to provide ULD to the warehouse for consolidation tasks. The transparency of the information allows them to be responsive to fleet contingency.

對於貨運代理而言，系統有助其提供更佳的客戶服務。他們能夠更有效地安排貨車前往機場，並向倉庫提供集裝器 (ULD) 以進行集裝服務。高度的訊息透明度使他們能夠應對車隊的突發事故。

RFID PARCEL LOCKER
無線射頻識別包裹儲物櫃

E-COMMERCE, LOGISTICS AND SUPPLY CHAIN MANAGEMENT
電子商貿、物流及供應鏈管理

RFID-enabled parcel locker system

The first generation of iPostal station was released in May 2016. As a system for providing lockers placed in the community, it offers flexibility to the public in collecting large-sized mails at their convenience. The 2nd generation of iPostal station is RFID-enabled, which facilitates more secure mail collection services in Hong Kong.
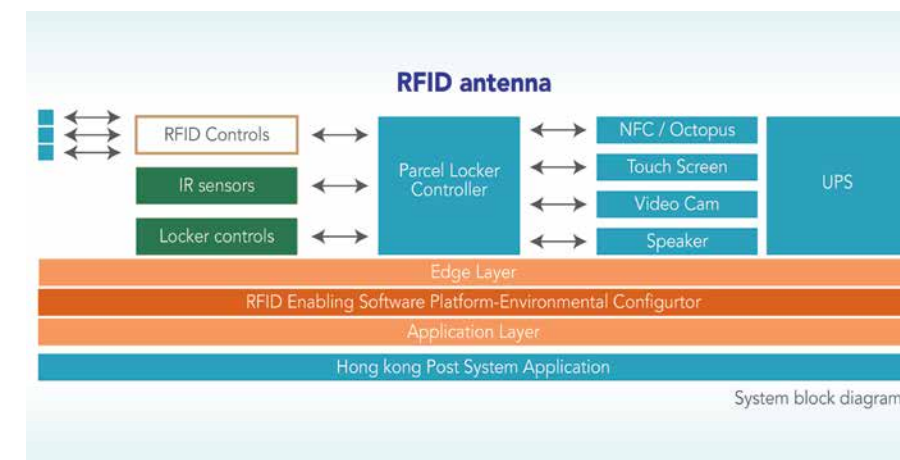
無線射頻識別包裹儲物櫃系

第一代「智郵站」於2016年5月開始推出。此系統為社區提供儲物櫃服務，為市民接收大型郵件，提供靈活性。第二代的「智郵站」具備RFID功能，從而在香港提供更安全的郵件收集服務。

Technology ready to transfer include:

- RFID-enabled parcel locker system

可供轉移的技術包括：

- 無線射頻識別包裹儲物櫃系統

System block diagram

Currently, Hong Kong Post has deployed around 12 of the iPostal stations at various locations within the HKSAR. Promulgation of the new generation of RFID–enabled iPostal Stations by Hong Kong Post, with the assistance of the new funding program from ITB, will allow Hong Kong Post to better serve the general public.

目前，香港郵政已在香港各區設置了約12個「智郵站」。在創新及科技局的新資助計劃協助下，新一代具無線射頻識別功能的「智郵站」讓香港郵政更有效地為廣大市民服務。

RFID PARCEL LOCKER
無線射頻識別包裹儲物櫃

The system streamlines the postman's process. The parcel would be automatically identified by the RFID system to the exact box number.

此系統簡化了郵遞員的工作流程。RFID系統會把包裹自動識別到準確的箱號。

RFID antenna is installed to accurately identify the right parcel for the right locker. The Infra-Red sensor is installed inside each locker to ensure that the parcel is kept safely.

系統安裝了RFID天線以準確地識別應放置在不同儲物櫃的正確包裹。每個儲物櫃內均安裝了紅外感應器，以確保包裹的安全。

The RFID-enabled Parcel Locker System has won the Gold Medal at the 45th International Exhibition of Inventions Geneva in 2017.

無線射頻識別包裹儲物櫃系統在2017年舉行的第45屆日內瓦國際發明展榮獲金獎。

ROBOTIC MATERIAL PREPARATION DEVICE FOR PRODUCT CONFORMITY ASSESSEMENTS

適用於品質檢定的材料準備機械人裝置

ROBOTICS TECHNOLOGIES

機械人技術

Robotic Material Preparation Device Using Tactile and Visual Guidance

Common material preparation procedures are critical for product safety and necessary to conduct in product compliance laboratories around the world. However, the conformity assessments are usually labour-intensive and repetitive. The robotic material preparation device facilitates product conformity assessments in an efficient way.

以觸覺和視覺導引的材料準備機械人

正確的材料準備程序對於世界各地許多產品安全和質量檢定的實驗室至為重要，但這些程序通常都是勞動密集和不斷重複的，而材料準備機械人裝置便能提高產品質量評估的效率。
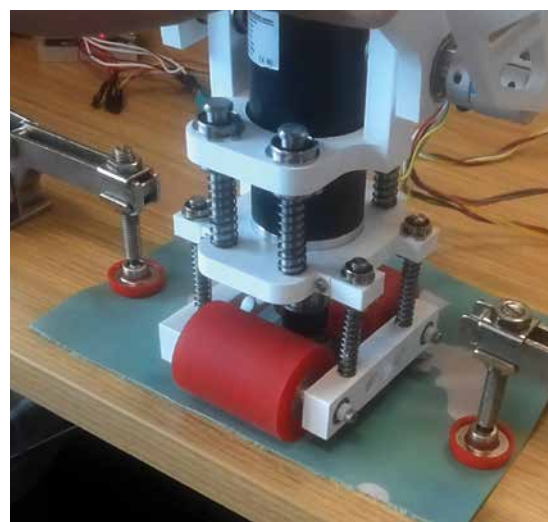
Technologies ready to transfer include:

- Engineering design and motion control software of passive force control grinding head

- Visual guidance technologies on Window platform for sample preparation machine

可供轉移的技術包括：

- 被動力控制磨頭的工程設計和運動控制軟件

- 用於Window平台上的視覺引導技術樣本準備機

ROBOTIC MATERIAL PREPARATION DEVICE

材料準備機械人裝置
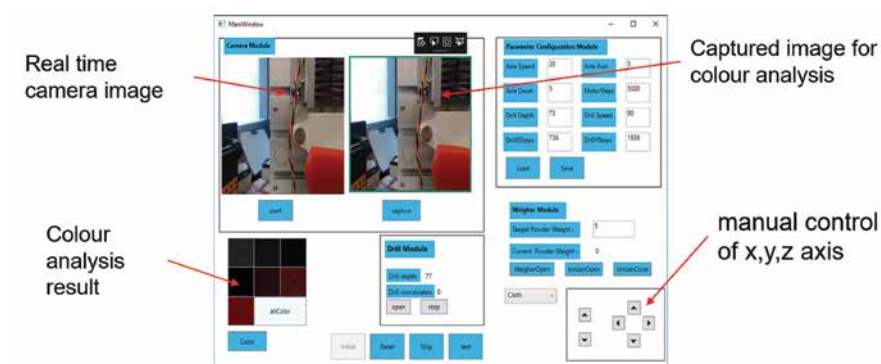
This robotic device is comprised of tactile and visual guidance. An ionized air blower and a sample collection tank in the device are designed to avoid cross-contamination. In addition to the design, there is a novel high-speed milling cutter function to remove samples from the surface of selected items effectively.

此機械人裝置是以觸覺和視覺來導引的。為了避免交叉污染，該裝置設置了電離吹風機和樣本收集箱。此外，還加設了一種新型高速切割機，從而有效地從所選項目的表面上拿取樣本。
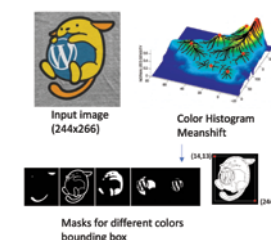
The robotic material preparation device can help to prepare product samples of kitchenware, garment/clothing, woodware toys and so on for chemical or biological conformity assessments.
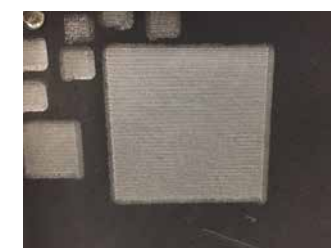
機械人裝置適用於拿取廚具、衣服/布料、木製玩具等產品的樣本，以進行化學或生物質量評定。

The samples obtained can be in different colours, shapes, sizes and made of various materials.

裝置可處理不同顏色、形狀、尺寸和物料的樣本。

The device has successfully passed the conformity test with the support of SGS, a renowned product safety and conformity assessment organization.

此機械人裝置在著名的產品安全和合格評定機構SGS的支持下，成功通過測試。

SMART SERVICE ROBOT
智能服務機械人

ROBOTICS TECHNOLOGIES
機械人技術

Smart Service Robot

LSCM has deployed key building block technologies for smart service robots, used in warehouses, banks and elderly homes. Object approaching, navigation and motion stability techniques are adopted to improve productivity and efficiency.

智能服務機械人

LSCM研發了應用區塊鏈技術的服務機械人，適用於倉庫、銀行和長者護理中心。它採用了對象定位、導航和穩定性運行技術，從而提高生產力和效率。

New Technologies that will be developed include:

- Computer vision and microphone array techniques for object locationing and identification
- Navigation
- Chatbot

將研發的新技術包括：

- 用於定位和識別受助者的計算機視覺和麥克風陣列技術
- 機械人導航
- 聊天機械人

In this project, object approaching techniques are developed, such as computer vision and microphone array techniques. Robot navigation using SLAM (Simultaneous Localization and Mapping) and RGB-D camera are also used to avoid a collision of mobile robots.

此項目採用了計算機視覺和麥克風陣列技術作為對象定位的技術。同時亦使用了SLAM(即時定位和地圖構建)和RGB-D相機為機械人導航。

SMART SERVICE ROBOT
智能服務機械人
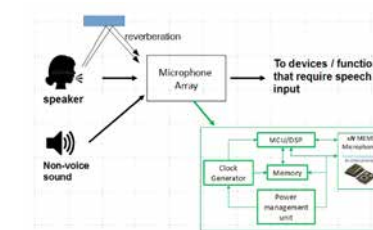
A locationing and identification technique that captures and analyses images of the same object from a series of video images is adopted.

此項目採用了一種視頻定位和識別技術，可從一系列視頻圖像中擷取和分析同一物體的圖像。

Microphone array could provide a non-visual mean of direct interaction with the service robot. Microphone array benefits from out of sight applications.
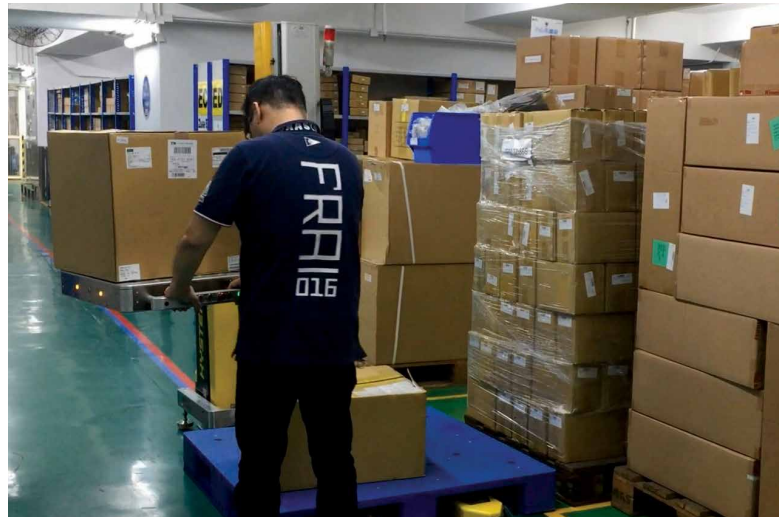
麥克風陣列讓使用者可以非視覺的方式跟服務機械人直接互動。麥克風陣列適用於非視線的應用上。
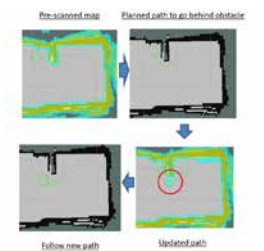
LIDAR and RGB-D are used for localization and for mapping (SLAM) the cameras of service robots. 2D LIDARs are relatively low cost and commonly used for collision avoidance.

這技術採用了LIDAR和RGB-D為服務機械人的攝像機作定位和構建地圖(SLAM)。2D LIDAR成本相對較低，通常用於防撞功能上。

SMART LIFTER
智能起重機

ROBOTICS TECHNOLOGIES
機械人技術

Smart Lifter/Transporter for Object Handling in Confined Space

LSCM's Smart Lifter is a lifter/transporter that can perform object handling tasks remotely through human-machine cooperation. It combines the functions of forklifts and cranes, and its size is even smaller than both machines. With the additional sensors, such as force sensors, the operation efficiency can be enhanced.

適用於擠迫環境的智能起重機/運輸機器

LSCM研發的智能起重機是一個可搖控的起重/運輸機器,可通過人機協作以遙控方式執行任務。體積雖小,但結合了叉車和吊車的功能。同時可加上不同的感應器(如力度感應器)來提高操作效率。

New Technologies that will be developed include:

- A new and modular end-effector for handling various objects
- Adjustable level controller to provide additional supporting force for object handling

將研發的新技術包括:

- 新的組合式末端執行器(及其控制器)
- 可調節的高度控制器以提供額外的支援力量來操控物件

LSCM's smart lifter/transporter is designed to cater to conventional warehouses in Hong Kong. It can carry out delegated and fine-manipulative tasks. In addition, it can be simply turned into a stratified (or personalized) lifter for elderly care applications. It would generate significant economic and social benefits for local industries and societies.

LSCM的智能起重機/運輸機器是迎合香港傳統倉庫而設計的。它不但可執行特定和精細的操縱任務,而且可以輕易地改裝變成適用於長者護理的起重機,對本地社會作出顯著的經濟和社會效益。

SMART LIFTER
智能起重機

An adjustable level controller will be generated to provide additional supporting force for object manipulation /handling.

可調節的高度控制器以提供額外的支援力來操縱和處理物件。

The lifter is a new equipment tailored for confined and unstructured warehouses or settings. It assists human operators to maneuver around such environments to enhance overall warehouse productivity and efficiency.

智能起重機有助操作人員在擠迫和非統一化倉庫或環境中工作,從而提高整體倉庫的生產力和效率。

A new modular end-effector (including its controller) is equipped for handling various and multiple objects of different sizes.

智能起重機包含一個新的組合式末端執行器(包括其控制器),幫助處理不同形狀和數量大的物件。

PHYSICAL SENSORY SYSTEMS
傳感系統

Physical Sensory Systems for Human-Robot Collaborative Tasks

Robot Safety is a major requirement for any robotics application. This project aims to develop new sensors deployed by robots, to ensure safety for humans in human-robot interactions.

協作機械人的傳感系統

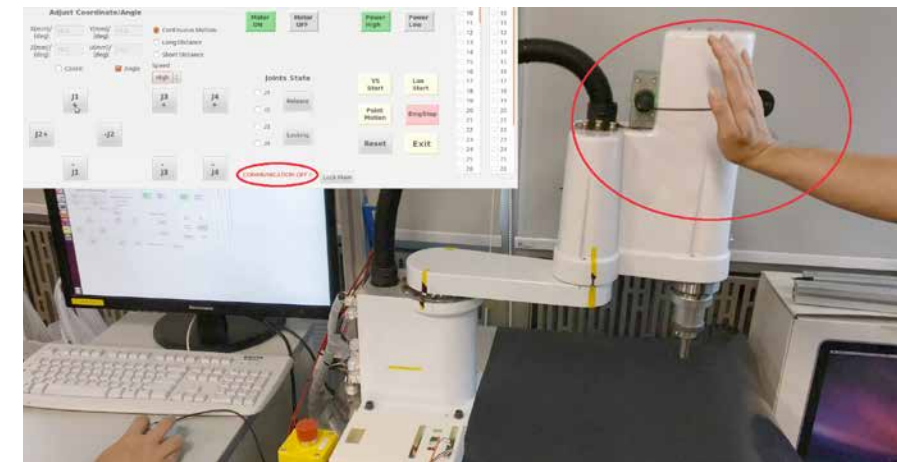機械人安全是任何機械人應用的重要要求。此項目旨在開發新的傳感器，讓使用者與機械人協作時能確保人身安全。

Technologies ready to be transfer include:

- Robot whiskers sensors
- Robot Skin (touch)
- Robot vision
- Human-robot collaborative controller

可供轉移的技術包括：

- 機械人鬍鬚傳感器;
- 機械人皮膚 (觸摸)
- 機械人視覺
- 人機協同控制器

Since conventional sensors may not be suitable for human-robot interactive tasks, in particular to outdoor settings, this project aims to develop sensors and sensing systems that can overcome these deficiencies through new cutting-edge technologies, such as robot whiskers, robot skin, robot vision, and a human-robot collaborative (HRC) controller that can facilitate the safe integration of robotics technology in local industries.

由於傳統傳感器不一定適用於人機協作，特別是在室外環境，因此此項目將開發尖端技術，克服這些傳感器和傳感系統的缺陷，例如機器人鬍鬚、機械人皮膚、機械人視覺，和人機協作 (HRC) 控制器，從而促進本地機械人技術的安全性。
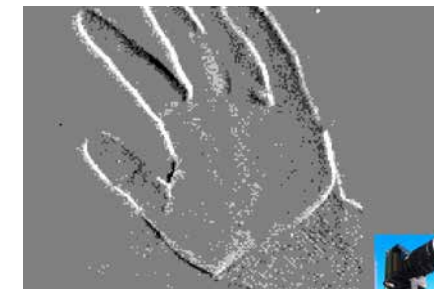
The project leverages DVS camera's high motion sensitivity and minimal data transfer overhead to detect the human body and react to it in real-time. It also uses Deep Learning (DL) for effectively recognized hand movements and identifying objects. moving hand

此項目充分利用了DVS攝像機的高動態靈敏度和低數據傳輸來檢測人體，並作出實時的反應。它還能透過深度學習 (DL) 進行有效的移動手部識別和對象識別。
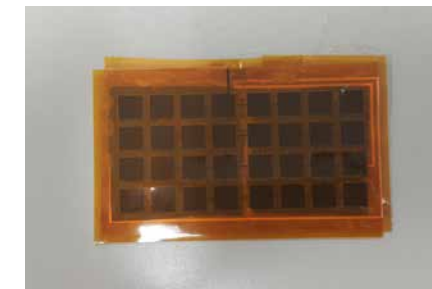
A low-cost flexible robot skin sensor array is used for the detection of force/pressure.
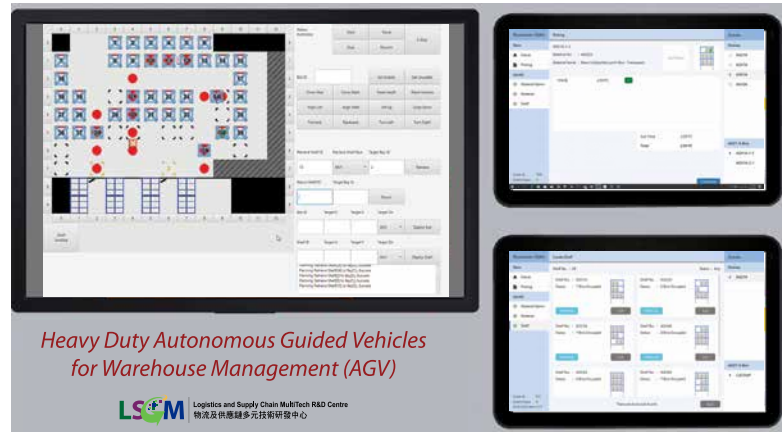
低成本的機械人皮膚傳感器陣列，適用於檢測力/壓力。

The robot whisker sensors aim to detect/sense the presence of humans or objects within the proximity range.

機械人鬍鬚傳感器用於檢測/感測附近的人或物體。

HEAVY DUTY AUTONOMOUS GUIDED VEHICLES

重型自動導航搬運車

Heavy Duty Autonomous Guided Vehicles for Warehouse Management (AGV)

Heavy Duty Autonomous Guided Vehicles for Warehouse Management (AGV)

To keep pace with the fast development of worldwide e-commence, businesses rely on advanced warehouse management system to minimize the processing time and enhance efficiency. The Heavy Duty Autonomous Guided Vehicle (AGV) developed by LSCM is suitable for using in local warehouses, factories and mass retailing shops. The AGV is not only capable of carrying goods, but also can do inventory stocktaking tasks during closing time.

重型自動導航搬運車（AGV）

隨着全球的電子商貿日趨成熟，客戶對倉存管理有極高的要求，希望藉此減少訂單的處理時間及提升整體管理和運作的效率。LSCM開發的重型自動導航搬運車（AGV）適用於本地貨倉、工廠和大型零售店，它除了可以處理搬運貨物，還可以於下班時段自動進行盤點工作，省時省力。

Technologies ready to transfer include:

- AGV motion control module (central 2 individual drive wheel type AGV)
- Engineering design of lifting mechanism
- Firmware of QR/AR code data recognition and orientation extraction
- AGV coordination system for efficient AGV task and route planning, with application programming interface (API) for seamless integration

可供轉移的技術包括：

- AGV移動控制模塊（中央2個獨立驅動輪AGV）
- 升降機制的工程設計
- QR/AR碼數據識別和方向提取固件
- AGV管理及協調系統以提供高效的車隊工作及路線規劃，並附有應用程式介面以容許與舊有系統作無縫整合。

A self-balancing mechanism (inertia measurement & control) is designed and installed to the AGV. The proposed mechanism is able to maintain 30-40kgs load subject to random and dynamic states.

這項目設計和安裝了瞬間（快速反應）自我平衡機制（慣性測量和控制）於AGV上。該機制在隨機動態中，能夠保持載重30-40kgs。

HEAVY DUTY AUTONOMOUS GUIDED VEHICLES
重型自動導航搬運車

The warehouse robot is a compact, high maneuverability and sensor rich AGV. It uses proximity sensors as well as other sensors for collision avoidance, data fusions, motion planning and control.

倉庫機械人體積小巧、高機動性、高負載和高感應度。它使用近距離傳感器和其他傳感器，能避免碰撞，達到數據融合、移動計劃和控制。
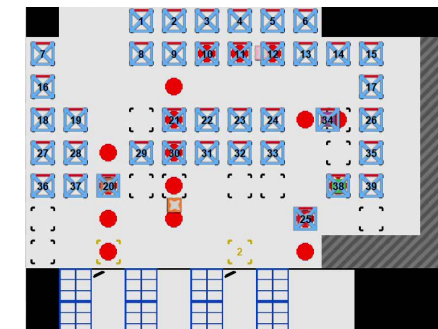
These robots navigate around on a predetermined route and can assist in performing inventory stocktaking and move around with a maximum loading of 500KG.

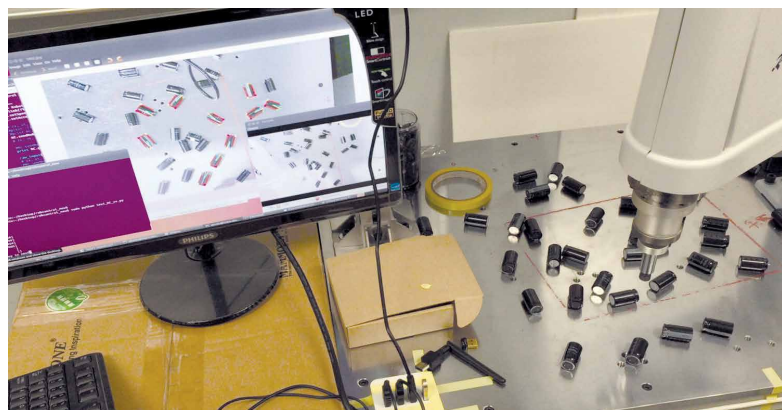AGV能按預設路線行走、快速點算貨架上的物品及負重500公斤的貨品行走，就像一部於貨倉自動工作的「倉務員」。

The latest AGVs are able to navigate around the warehouses by following tags and codes embedded on the floor of the warehouse, which ensure the navigation scope is within 10 cm and provide enhanced collision avoidance capability.

AGV依據鋪設在倉庫地下的標籤及條碼，可令準確範圍縮小至10厘米，同時可防止AGV互相碰撞。

Physical Sensory Systems for Human-Robot Collaborative Tasks

Robot Safety is a prominent requirement for any robotics application. In the past, robotic arms were installed in enclosed environments to avoid accidents involving humans. To reduce the potential hazards arising from such interactions, this project develops new sensors which can be deployed to ensure human safety when interacting with robots.

協作機械人的傳感系統

確保安全對於所有機械人的應用最為重要。以往，機械臂必須安裝在封閉的環境中，以避免對使用者造成傷害。為了減少意外，這項目研發了新的傳感器，它可以安裝在機械人上，以確保使用者和機械人在進行互動時的安全。

Technologies ready to transfer include:

- Robotic vision system for identifying capacitors
- Associated training application for training new electronic components

可供轉移的技術包括：

- 用於識別電容器的機械人視覺系統
- 用於培訓新電子組件的相關培訓應用程式

Model training

Collect ~200 capacitor images with various lighting and density

Label keypoints of non-occluded capacitors

Train new model for identifying capacitors
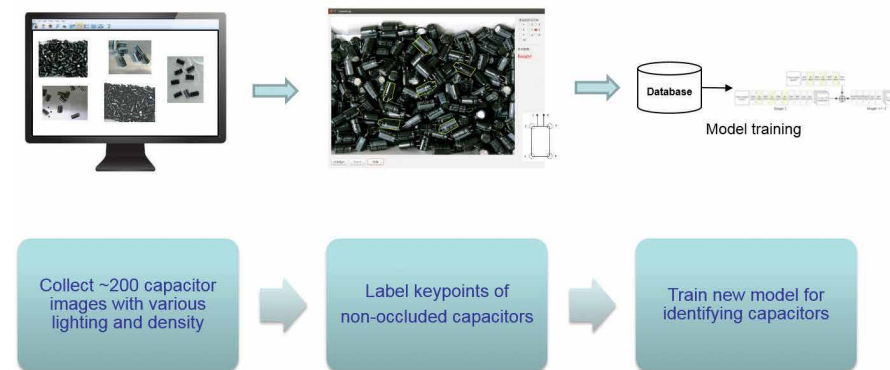
This technology detects and segments components from the background so that the robot can pick the correct components. It estimates the pose and sub-component for each type of component, so that the robot can pick up the component from the best direction. It also estimates the occlusion status of components so that the robot will not touch the components that are covered by others.

該技術可從後台檢測並分割不同類型組件，以便機械人選擇正確的組件。機械人能夠對每種組件的形態和配件進行評估，從而令機械人可從最佳的方向選取組件。同時，它能估計組件的遮擋狀態，這樣機械人便不會觸及其他被覆蓋著的組件。

PHYSICAL
SENSORY
SYSTEMS FOR
HUMAN-ROBOT
COLLABORATIVE
TASKS
協作機械人的
傳感系統

Hierarchical feature representations are learned in different layers of the neural network, and they simultaneously classify different types of components, detect the location of components, estimate pose and occlusion status. Once these features are learned, they can be applied to various tasks related to visual recognition of different types of product components.
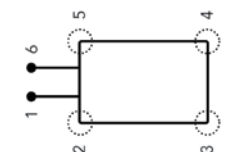
透過深度卷積神經網絡，在不同層面中學習分層特徵，並且同時將不同類型的組件分類、偵測組件的位置、估計其形態和遮擋狀態。一旦學習了這些特徵，就可以應用於不同類型的產品組件中，擔任各種視覺識別有關的任務。

Multi-stage framework saves computation cost and improves efficiency and accuracy. Smaller and faster networks first reject and accept candidate regions at the early stages, and then more complex networks handle harder examples.

多階段框架可以節省計算成本、提高效率和準確性。在最早階段會先拒絕或接受較小和較快的網路區域，然後讓更複雜的網路處理更難的情況。

The data from the vision sensor can be processed by the above-mentioned technology. After processing the data by vision algorithms, vision sensor can be installed on a robotic arm as impact sensor or position sensor.

視覺感應器的資料可以通過上述技術來處理。經過資料的處理，可以透過視覺感應器安裝在機械人手臂上，作為衝擊感應器或定位感應器。

SMART ROBOT HAND AND EYE CO-ORDINATION ENABLING TECHNOLOGIES

智慧型手眼協調機械臂定位系統

Smart Robot Hand and Eye Co-ordination Enabling Technologies for eCommerce Warehouse Management

LSCM's multi-camera vision coordination control system and flexible end-effector are designed for commercially available robotic arms to handle objects in different shapes, colours, sizes and surface textures that move along conveyor belts.

應用於電子商貿倉庫之智慧型手眼協調機械臂定位系統

LSCM設計的多種影像協調控制系統，以及靈活的機械人手臂，能應用到商用機械臂上，處理輸送帶上不同形狀、顏色、尺寸和表面紋理的物件。

Technologies ready to transfer include:

- RGB-D vision system
- Design specification for pneumatic end-effector for pick and place (Baggage label affixing)

可供轉移的技術包括：

- RGB-D視覺系統
- 氣動末端執行器進行撿起和放置動作的設計規範(行李標籤粘貼)

The Label Affixing system
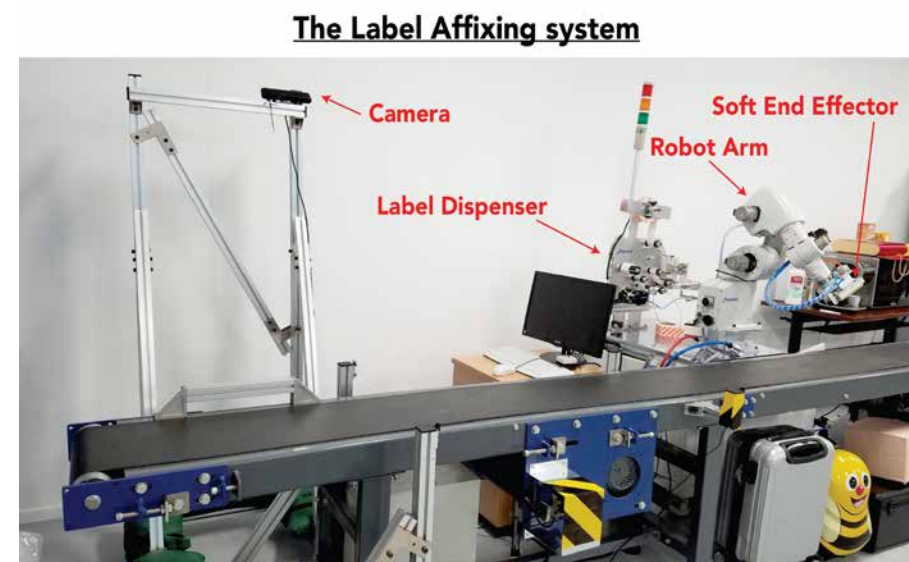
The RGB-D vision system sends shape, size and surface information of the baggage to pneumatic end-effector to operate on label affixing. The 3D model and RGB image are passed to a machine learning algorithm to segment objects in the scene.

RGB-D視覺系統將行李的形狀、尺寸和表面紋理的資訊發送給氣動末端執行器，進行標籤黏貼。機械學習演算法會把接收到的3D模型和RGB圖像進行分析，從而即時劃分物件的位置。
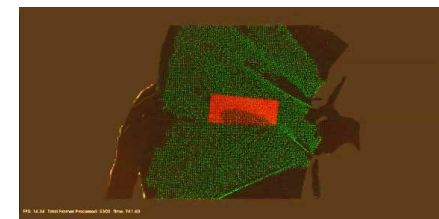
SMART ROBOT HAND AND EYE CO-ORDINATION ENABLING TECHNOLOGIES

智慧型手眼協調機械臂定位系統

After each object is detected and classified as target object of end-effector, surface fitting algorithm is applied to the 3D model to provide the suitable position for end effector to affix labels on the baggage.

當末端執行器偵測到物件，並把它鎖定為目標物件後，表面擬合演算法便會應用到3D模型中，從而在行李上找出適合黏貼標籤的位置。

The pneumatic end-effector uses vacuum bump to draw out labels from the label dispenser, and replicates manual label affixing tasks while using air-jet to place the labels on the baggage.

氣動末端執行器使用真空氣泵，從盛載標籤的容器中吸起標籤，然後模仿手動黏貼標籤的方法，使用空氣噴射將標籤貼在行李上。

The technology's pilot run has been conducted by the Hong Kong International Airport (HKIA) for testing it in the actual industrial environments.

此技術已在香港國際機場(HKIA)試行，以便在真實的工業環境中應用。

FOLLOW-ME ROBOTS AND PLATOONING TECHNOLOGY

自動隨行機械人和列隊行駛技術

ROBOTICS TECHNOLOGIES

機械人技術

Follow-Me Robots and Platooning Technology

Follow-Me Robots help the operator carry bulky and heavy items, so the operator only needs to retrieve items from the shelves. Related sensory and computer vision technologies will be developed to make the technologies user-friendly and ensure safety.

自動隨行機械人和列隊行駛技術

自動隨行機械人能幫助操作員搬運沉重、大件的物品，讓他們只需從貨架上取回貨物。即將開發的技術會使用感官和電腦視覺技術，令其既易於使用，又具安全性。

New Technologies that will be developed include:

- Follow-Me Robots
- Mecanum wheel and caster wheels

將研發的新技術包括：

- 自動隨行機械人
- 麥克納姆輪和腳輪

This technology looks into a novel platooning technology using ultra-wideband (UWB) technologies. Two UWB transceivers are installed on the "Follow-Me" (anchors) and one UWB transceiver is held by the operator with tag. By measuring their Time-of-Flight (ToF) using advanced digital signal processing techniques, the ranges between the tag and anchors can be found and the tag location can be calculated. The Follow-Me will be able to make the best moving distance, following angle and speed.

此列隊行駛技術使用超寬帶 (UWB) 技術，兩個UWB收發器已安裝在自動隨行機械人上 (錨點)，操作員會操控其中一個UWB收發器 (標籤)。透過先進的數碼訊號處理技術，便能測量它們的運行時間 (ToF)，從而找到標籤和錨點之間的範圍，並計算標籤的位置，令自動隨行機械人可以按照角度和速度選定最佳的移動距離。

FOLLOW-ME ROBOTS AND PLATOONING TECHNOLOGY

自動隨行機械人和列隊行駛技術

A vision camera using intelligent algorithms to recognize AR code mark. When an operator wears a cloth with AR code mark, the vision system recognizes the AR code and calculate the distance and angle between the robot and the operator.

使用智能演算法以識別AR代碼標記的視覺相機。當操作員穿著帶有AR代碼標記的衣服，視覺系統便會識別AR代碼，並計算機械人和操作員之間的距離和角度。

The lidars are placed in the front part of the robot for obstacles scanning. The scanning distance will be adjusted according to the speed of the robot. Robot controller will stop the robot when an obstacle enters the safety zone.

激光雷達放置在機械人的前部份，用於掃描障礙物。掃描的距離將根據機械人的速度而調整。當有障礙物進入安全區時，機械人控制器將停止機械人繼續前進。

The robot has at least two driving wheels. It can move forward, backward, turn left and turn right. A power management system provides stable power supply to motors, sensors and microcontrollers.
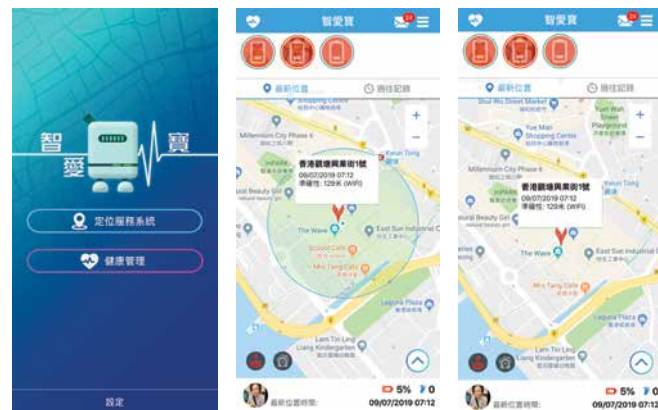
機械人至少有兩個驅動輪，讓它可以向前或向後移動、向左轉和向右轉。電源管理系統為電機、傳感器和微控制器，以提供穩定的電源。

IBAO
智愛寶

An Affordable Location Tracking System that Benefits HK's Elderly, Disabled and Alzheimer Patients

iBao is designed for the elderly and their families to track users' locations and monitor health information. With a full range of indoor and outdoor positioning technologies, the risk of wandering is reduced and the elderly can enjoy going out in a densely populated urban environment. Family members can also use the mobile app to take care of their beloved ones easily.

為長者、傷殘人士和腦退化人士而設的定位追蹤系統

智愛寶是專為長者及其家人而設的定位及健康訊息監控系統。備有全方位的室內外定位技術，減輕長者走失的風險，讓長者能在人煙稠密的城市環境中輕鬆自由生活，家人亦能輕易運用手機應用程式，照料摯愛，送上關心。

Product Available Include:

- iBao

可供出售的產品包括：

- 智愛寶
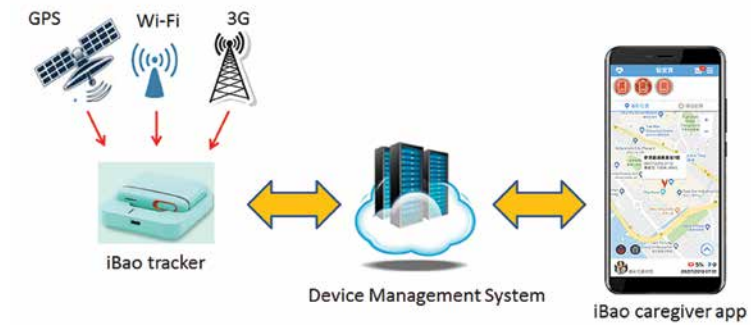
LSCM and its partner, Wing Wah Love Technology Services Ltd, have developed iBao - a low-cost, real-time, high-accuracy indoor and outdoor portable tracking device by using 3G + GPS + Wi-Fi positioning technologies. In addition, iBao includes a cloud-based device management system and a tracker monitoring mobile app for caregivers of elderly, disabled people, or Alzheimer and their patients.

LSCM與榮華愛心科技服務有限公司合作研發了智愛寶。它是一款低成本、實時、高精確度的室內和室外兼容的便攜式位置追蹤器。同時採用了3G、GPS和Wi-Fi的三重定位技術，及支援雲端追蹤器管理系統和監控移動應用程式，適合長者、傷殘人士和腦退化人士或其照顧者使用。

IBAO
智愛寶

The sleek and compact design of iBao makes it easy for the elderly to carry it around. In addition, the battery can be used for more than 30 hours. The shock-resistant and sprinkling-proof body allow the elderly to use it with a peace of mind.

智愛寶設計時尚簡約及體積輕巧，方便長者隨身攜帶。同時，電池可持續使用長達30小時以上，耐震及防灑水機身，讓長者安心使用。

When the elderly user is out of the preset geo-fencing zone, an alert notification will be sent out to the caregiver mobile app.

當長者用戶不在預設的地理圍籬區域時，系統將通過移動應用程式通知照顧者。

It provides elderly user identification for further service integration, such as eBao Health.

系統可提供長者用戶的身份識別，以整合其他服務，例如：智健寶。

ULTRA-WIDEBAND ACTIVITY MONITORING SYSTEM

超寬帶活動監測系統

The users do not need to put on any device, the UWB radars installed in the system use sub-cm-order time-of-flight information to determine their breathing rate and track their location. Also, it is not sensitive to ambient conditions and does not have privacy issues.

使用者毋需佩戴任何設備,系統中內置的UWB雷達使用微距離數據來量度他們的呼吸頻率及追蹤他們的位置。此外,它對週邊環境並不敏感,也不會涉及隱私問題。
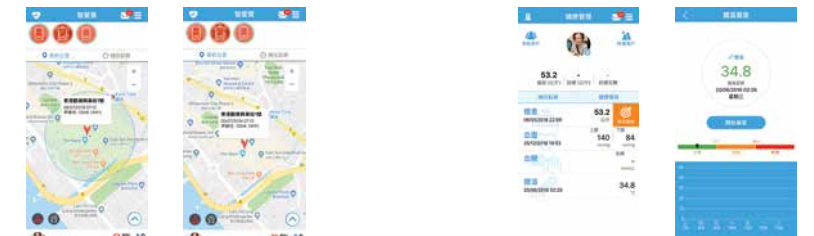
ULTRA-WIDEBAND ACTIVITY MONITORING SYSTEM

超寬帶活動監測系統

Ultra-Wideband Activity Monitoring System for Solitary Elderly

LSCM has developed a monitoring system to measure the activity levels of the elderly and detect any abnormal conditions by using state-of-the-art ultra-wideband (UWB) and signal processing technologies.

應用超寬帶技術於獨居長者活動監測

LSCM開發了一個監測系統,透過使用最先進的超寬帶(UWB)和訊號處理技術來測量長者的活動水平,並檢測異常情況。
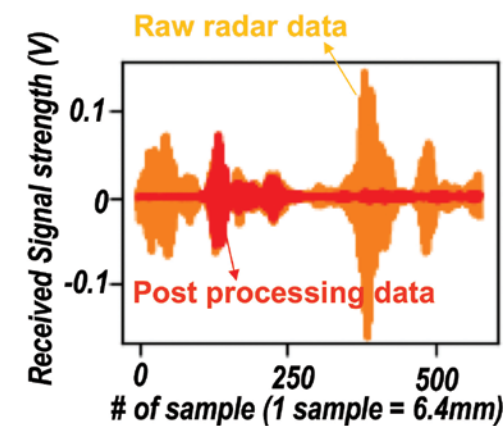
New Technologies that will be developed include:

- Algorithms to determine/sense different activities
- Algorithms for daily-activity comparison

將研發的新技術包括:

- 確定/感知不同活動的計算法
- 比較日常活動的計算法

This low-cost and privacy-preserving system provides real-time feedback to help caretakers provide efficient remote monitoring service for the elderly.

這個低成本亦可保障隱私的系統能提供實時反饋,以幫助看護人員為長者提供有效的遠程監控服務。

The hardware in the project will sense the movement/location of the target while the data will be sent to the backend for analysis by advanced signal processing techniques.

這項目中的硬件會感測目標人士的動作/位置,同時將數據發送到系統後台,透過高階的訊號處理技術進行分析。

In 2018, Ultra-Wideband Activity Monitoring System for Solitary Elderly won the Gold Medal at the 46th International Exhibition of Inventions Geneva.

應用於監測獨居長者活動的超寬帶技術在2018年第46屆日內瓦國際發明展獲得金獎。

RFID BLIND CANE
無線射頻識別視障人士手杖

RFID Blind Cane Navigation System

In Hong Kong, visually impaired faces various rehabilitation obstacles when travelling either indoor or outdoor. With RFID technology and audio navigation, the Blind Cane Navigation System provides guidance to the visually impaired and leads them to their destination by the shortest route.

無線射頻識別視障人士手杖系統

在香港，視障人士無論在室內或室外均面對很多康復上的障礙。LSCM研發的視障人士手杖系統，透過無線射頻識別技術（RFID）及導航語音為視障人士提供指引，帶領他們以最短路線抵達目的地。

Products available include:

- RFID Cane Reader Design
- Smart Navigation Mobile App used with the RFID Cane Reader
- RFID tag design in different form factors embeddable in various kinds of guiding paths / tiles for indoor and outdoor use
- Cloud platform for the visually impaired

可供出售的產品包括：

- RFID手杖閱讀器設計
- 配合RFID手杖閱讀器使用之智能導航手機應用程式
- 多種類型及適用於室內外環境使用的RFID標籤設計
- 為失明人士提供服務的雲端系統
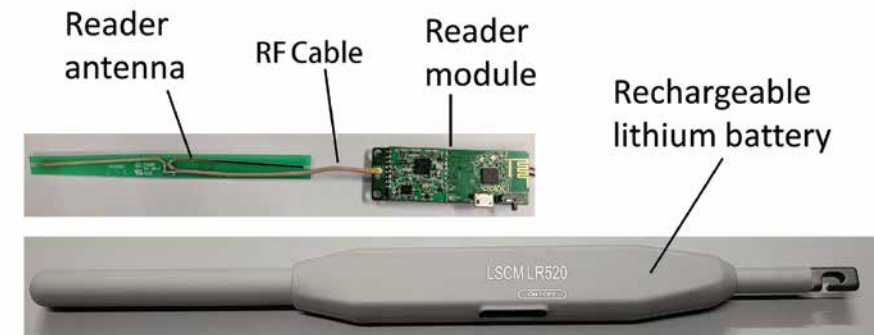
With the aid of the Blind Community Cloud Platform, the visually impaired can obtain the latest updates on the map and enjoy a seamless navigation across different regions. Functions such as item tagging are also available to make the living of visually impaired more convenient.

配合雲端技術，地圖資料能實時更新，使用者可享受無地域限制之導航功能。系統亦提供其他功能如物件標籤，使視障人士的生活變得更便利。

RFID tag design in different form factors embeddable in various kinds of guiding paths / tiles for indoor and outdoor use.

具有多種類型及適用於室內外環境使用的RFID標籤設計。

Barrier Free Access (HK) Limited, a wholly-owned subsidiary of The Hong Kong Society for the Blind, has started the relevant business to offer full-set of service backing the RFID Blind Cane Navigation System.

香港暢道科技有限公司（香港盲人輔導會轄下之社企）已發展相關業務，提供一系列完整配套服務。

RFID
BLIND CANE
無線射頻識別
視障人士手杖

RFID Blind Cane Navigation System was granted the Gold Medal in the 44th International Exhibition of Inventions Geneva in 2016.

無線射頻識別視障人士手杖系統於2016年第44屆日內瓦國際發明展中獲得金獎。

SERVICE LOGGING AND INFORMATION KIOSK SYSTEM

服務記錄及資訊查詢系統

Service Logging and Information Kiosk System

LSCM developed a Service Logging and Information Kiosk System which is suitable for deployment in elderly care centres and attention homes.
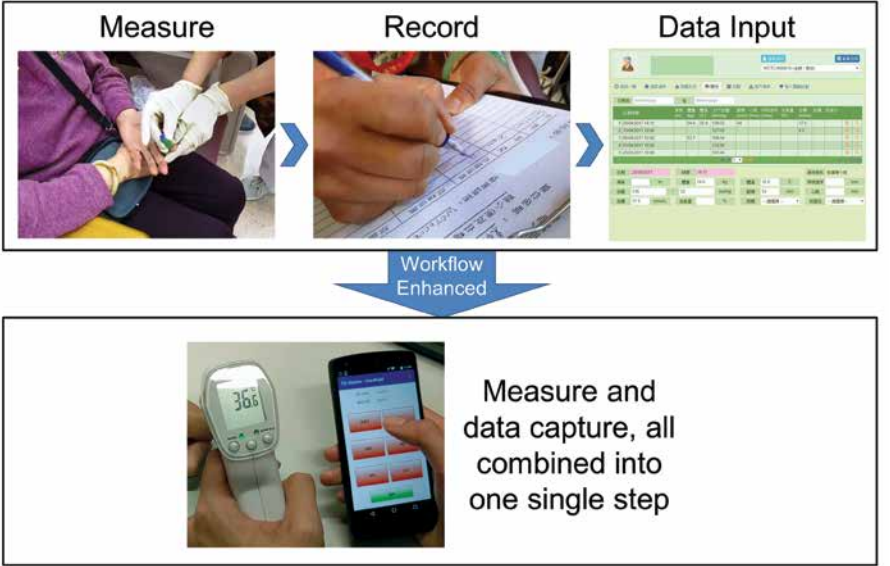
服務記錄及資訊查詢系統

LSCM研發了一套適合於長者護理中心使用之服務記錄及資訊查詢系統。

Technologies ready to transfer include:

- Server Software Development License
- Kiosk Software Development License
- Kiosk Industrial Design Document License
- Server Software License
- Kiosk Software License
- Kiosk Industrial Design

可供轉移的技術包括：

- 服務器軟件開發許可證
- 服務記錄及資訊查詢系統軟件開發許可證
- 服務記錄及資訊查詢系統工業設計文件許可證
- 服務器軟件許可證
- 服務記錄及資訊查詢系統軟件許可證
- 服務記錄及資訊查詢系統工業設計

Measure → Record → Data Input

Workflow Enhanced

Measure and data capture, all combined into one single step

With the help of RFID technology, nursing staff and caregivers can perform service logging and workflow management right on the spot after completion of the service, thus eliminate the steps of paper recording.

該系統可裝設於每間房間之內，配合無線射頻識別技術，護理人員可於每次服務及工作完成後，即時於該系統上記錄工作進度及管理整個工作流程，並可省略大部份紙張記錄工序。

SERVICE LOGGING AND INFORMATION KIOSK SYSTEM

服務記錄及資訊查詢系統
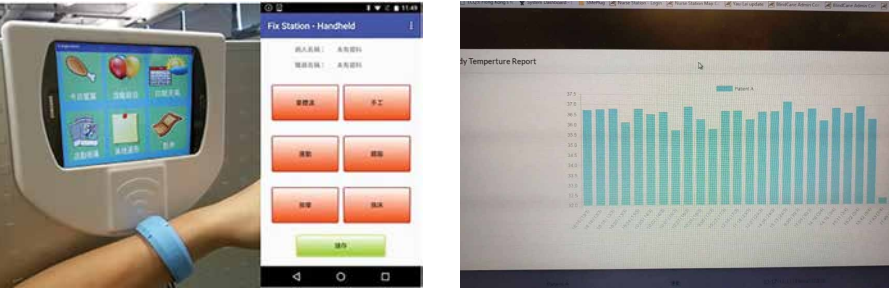
The Kiosk is wall-mounted in each room.

此系統安裝於每一房間的牆壁上。

The Kiosk can provide information to elderly residents, such as meal menu, daily activities information and schedule, weather report and forecast, etc. This will greatly reduce the workload of the caregivers.

該系統可為居於中心的長者提供所需要的資訊，例如每天用膳餐單、每天活動時間表、天氣報告及預測等，以減輕護理人員的工作負擔。

The technology has been pilot-run in Yuen Long Home for the Aged Blind (Jockey Club Yan Hong Building)

此技術己在元朗盲人安老院（賽馬會欣康樓）試用。

INFRARED THERMAL SAFETY SYSTEM

紅外線熱能感應警報系統

GERONTECH & COMMUNITY SERVICE

樂齡科技及社區服務

Infrared Thermal Sensing Safety Alert System for the Elderly

The Centre's infrared thermal sensing safety alert system is a privacy preserving system, designed for monitoring an individual's safety in a private space. It analyses the real-time thermal data of the private space to determine whether the individual needs support from their caretaker.

適用於長者的紅外線熱能感應警報系統

本中心的紅外線熱傳感警報系統,是一個高度保障私隱的安全監察系統。系統會根據實時熱能數據,分析有關長者是否需要護理人員協助。

Technology ready to transfer include:

- Infrared thermal sensing safety alert system

可供轉移的技術包括:

- 紅外線熱能感應監察系統

Normal　　　　Fallen

This low cost thermal sensing technology can help detect and analyse human movement. When body movement is not detected for a period of time, an alarm will alert the caretakers that the person being looked after may be in danger.

這個低成本的熱能感應技術,可以幫助檢測和分析人體的移動。當一段時間內未檢測到人體移動時,將發出警報,通知護理人員被照顧者有可能處於危險情況。

INFRARED THERMAL SAFETY SYSTEM

紅外線熱能感應警報系統

This device consists of several movement sensitivity levels and can be easily installed inside a toilet or a bathroom.

這個儀器擁有多個活動感應度,易於安裝在洗手間或浴室內。

If the individual falls and is unconscious, the system will alert the relevant caretakers to take immediate action.

如果偵測到危險,系統會向照顧者發出警報,使其作出相應行動。

In 2019, the Infrared Thermal Sensing Safety Alert System won the Gold Medal at the 47th International Exhibition of Inventions Geneva and a Silver Medal at the 1st Asia Exhibition of Inventions Hong Kong which was held in 2018.

此系統於2019年舉行的第47屆日內瓦國際發明展中獲得金獎殊榮及2018年舉行的第一屆亞洲發明展覽會-香港中獲得銀獎。

RFID-TAGGED VEST & GATE DOOR SYSTEM

無線射頻識別背心及閘門

RFID technologies for safeguarding the elderly from accidental wandering

The elderly wearing the vests with built-in RFID tags will be detected automatically in case they wander away from the elderlyhomes or centres without permission.

適用於長者監控的無線射頻識別技術

穿上內置RFID標籤外套的長者若走失或擅離院舍，護理人員可以更快知道，然後把他們尋回。

Technologies ready to transfer include:

- Passive RFID washable tag design
- RFID Entrance / Exit monitoring system

可供轉移的技術包括：

- 可水洗的無源RFID標籤設計
- RFID入口/出口監控系統

Staff of the elderly homes or centers will register the information of each vest using a RFID reader before deployment. Antennas are installed at the main exits, so the RFID signals can be detected from the RFID tagged vest. If an elderly wearing the RFID tagged vest leaves the elderly home or centre without permission, the system will alert the monitoring staff by providing an alarm, then, he/she can stop the elderly from leaving the home or centre immediately.

在使用這系統之前，中心的職員須先透過閱讀器登記每件背心的標籤資料，令系統可感應到每位長者的位置。在長者中心出入口的位置安裝收發射頻訊號的天線，用以偵測背心內RFID標籤的射頻訊號。若有穿上RFID背心的長者擅自離開院舍/中心，電腦系統便會發出警報，讓院舍職員立刻阻止該長者離開。

RFID-TAGGED VEST & GATE DOOR SYSTEM

無線射頻識別背心及閘門

Advocated and supported by Tung Wah Group of Hospitals - Wong Cho Tong District Elderly Community Centre, this RFID solution is used to detect the in / out status of Alzheimer's patients when they wander away from their care premises.

此RFID解決方案獲得東華三院黃祖棠社區服務中心的支持和採用，以幫助監察腦退化症患者進出護理場所的情況。
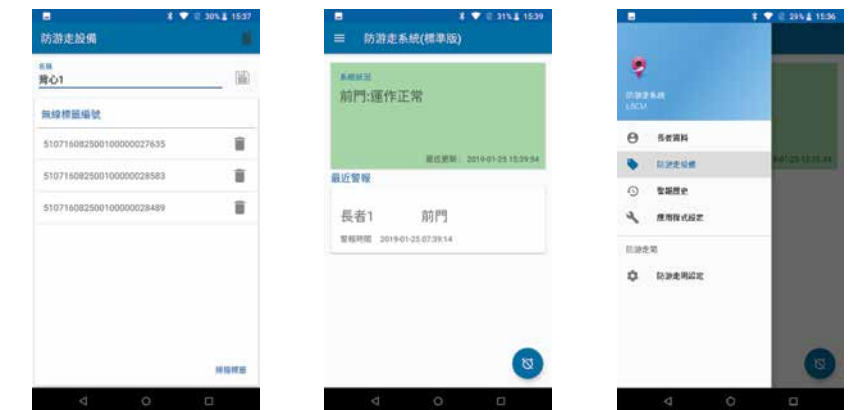
This technology provides more effective control comparing to manual observation and can release the pressure on the caretakers in looking for the elderly. The user interface of the system is clear and easy to use, so it does not require much training for the staff.

這系統比以往單靠人手監察長者遊走情況更有效，亦能減輕院舍/中心職員在照顧長者上的壓力。這系統的使用介面簡單易用，中心職員不需花很長的時間便可熟習使用。

GPS TRACKING TECHNOLOGIES
全球定位追蹤技術

GPS Tracking Technologies for Locating Missing Elderly Persons

The elderly who suffers from Alzheimer's or other forms of memory-related problems may get lost easily in outing activities. The GPS tracking technology can help find the missing persons.

適用於追蹤長者位置的全球定位追蹤技術
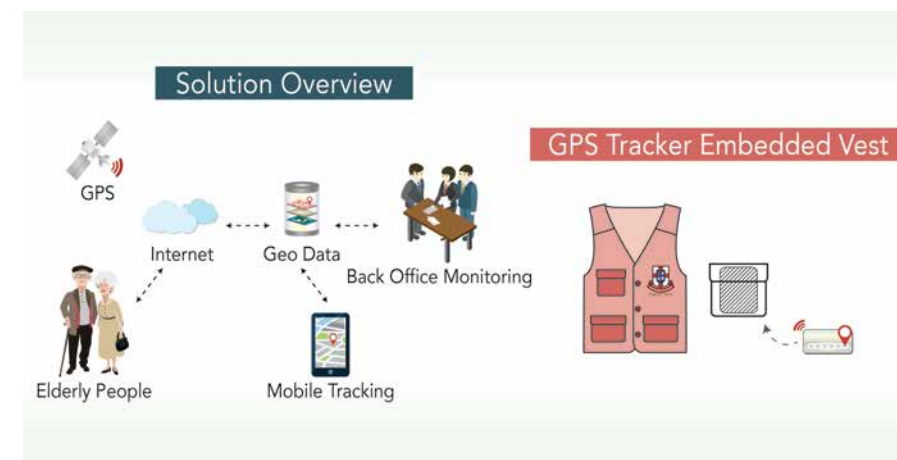
患有腦退化症或有其他與記憶力相關問題的長者在戶外活動時都較容易迷失方向。GPS追蹤技術可以協助尋找失蹤人士。

Technology ready to transfer include:

- Elderly Tracking Application Platform Software Modules

可供轉移的技術包括：

- 長者追蹤應用平台軟件模組

During outing activities, each elder will wear a vest embedded with a tracker. Location information of the tracker will be sent to the server. Operators in the service centre will define the geo-fencing zone. If a tracker is outside the zone, there will be an alert.

在戶外活動中，每位長者都會穿著附有追蹤器的背心，並把追蹤器的定位信息發送回伺服器。護理中心的操作人員可設定地理圍欄區域，如果被追蹤的長者離開了該區域，系統便會發出警報。

GPS TRACKING TECHNOLOGIES
全球定位追蹤技術

Supported by Tung Wah Group of Hospitals - Wong Cho Tong District Elderly Community Centre, the pilot-run and evaluation of the GPS tracking technology developed has been conducted in real-case setting.

在東華三院－黃祖棠社區服務中心的支持下，GPS追蹤技術已經在實際情況下試行和進行評估。

A vest with a location tracking system is developed to assist the Centre to better monitor the elders' location during outdoor activities.

開發具有定位跟蹤系統的背心，協助長者護理中心在進行戶外活動時，更有效地監測長者的位置。

The web-based GPS tracking system is easy to use by operators. The location of each person can be displayed on a map. Operators can also use the system to locate specific elderly person.

基於網絡的GPS追蹤系統易於操作，每個人的位置都可以顯示在地圖上。操作人員亦可以使用該系統來監測個別長者的位置。

BABY TAG
嬰兒標籤

Patented

Baby Tag and the Baby Tracking Management Control System

LSCM Baby Tag System is an integrated system using active radio communication technologies to effectively track babies and children patients in the hospital environment.

嬰兒標籤與嬰兒綜合管理監察系統

嬰兒標籤與嬰兒綜合管理監察系統是特別為醫院設計的實時追蹤系統，以監測嬰兒及小童的位置。

Technologies ready to transfer include:

- Physical product design of tracking tag for babies (small tag)
- Physical product design of tracking tag for children (large tag)
- Baby tag electronics design and firmware
- RF Reader component design and system software
- Monitoring system software with Nurse Station application

可供轉移的技術包括：

- 標籤設計 (嬰兒尺寸)
- 標籤設計 (小童尺寸)
- 標籤電子部份及軟體設計
- 閱讀器設計
- 監察系統軟件及手機應用程式

Components schematic
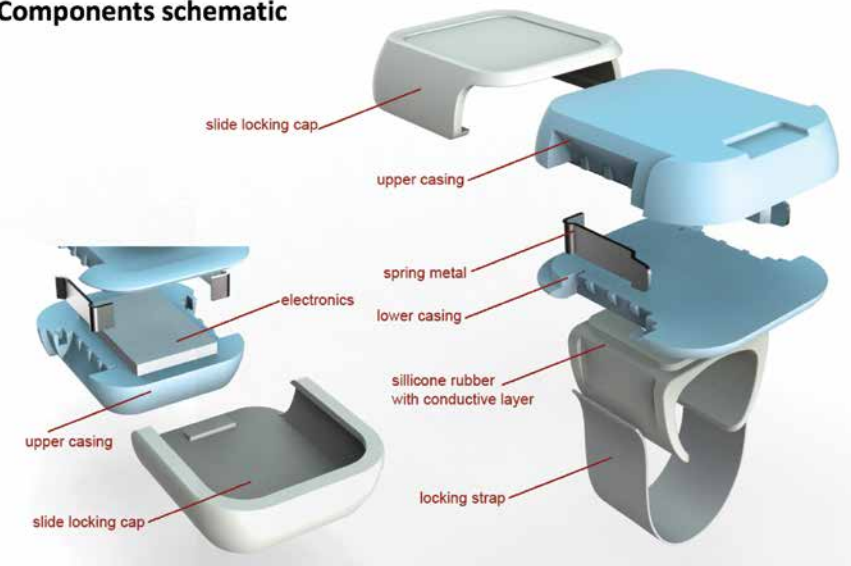
Baby Tag provides protection to new born babies against abduction by raising a visual and audio alert when unauthorised movements of new born babies or attempts in tampering of the tag have been detected.

當此系統偵測到初生嬰兒在未經授權的情況之下被移往別處，或當標籤遭受到破壞時，系統便會發出警示畫面及警報聲響。此技術可以加強嬰兒保安及減少嬰兒在醫院內被拐帶的風險。

BABY TAG
嬰兒標籤

Nurses of the ward can monitor the whereabouts of babies and children patients easily by using the online Nurse Station of the system.

病房的護士可以使用系統的在線護士站輕鬆地監控嬰兒和兒童病人的位置。

Full time monitoring features are supported by a radio communication system covering the whole ward.

覆蓋整個病房的無線電通訊系統支援全天候監控功能。

Warning alerts will be raised immediately even when the tag is damaged in an illicit attempt.

即使標籤被嘗試損壞，系統也會立即發出警示和警報。

RFID ASSET MANAGEMENT SYSTEM
無線射頻識別 物資管理系統

SMART CITY – IOT
智慧城市 – 物聯網
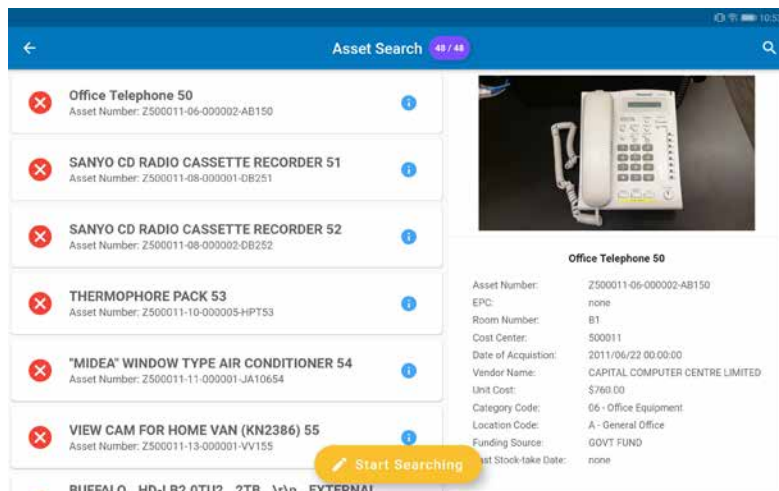
RFID Asset Management System

RFID Asset Management System is designed to transform traditional stock taking workflow from paper based to digitally automated. It shortens project completion time from months to a matter of days. The new system involves a few simple steps which consist of tagging, scanning, matching and reporting.

無線射頻識別物資管理系統

無線射頻識別 (RFID) 物資管理系統旨在改變傳統的盤點工作流程。這些工作一般涉及大量文書處理，並需時數月。新系統有助將盤點時間縮短到幾天，並只需簡單的步驟：編制標籤、掃描、配對和報告。

New Technologies to be developed include:

- Detachable antenna design
- Blockchain storage of inventory records

將研發的新技術包括：

- 可分離的天線設計
- 以區塊鏈存儲的庫存記錄

Asset Management Process Transformation With RFID
Tremendous Improvement On Productivity & Asset Protection

The RFID Asset Management Mobile Reader is self-contained, WIFI enabled and movable. It runs on rechargeable battery that can last up to a few hours on one charge and picks up RFID tags on assets via the large antennas attached.

無線射頻識別物資管理閱讀器設備齊全，能支援WIFI及可移動的。供電來源為充電電池，一次充電可持續使用數小時。只需連接大型天線，便能有效地準確讀取在物資上的無線射頻識別標籤。

RFID ASSET MANAGEMENT SYSTEM
無線射頻識別 物資管理系統
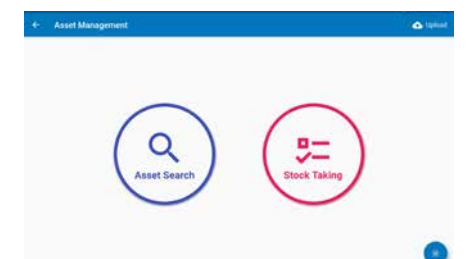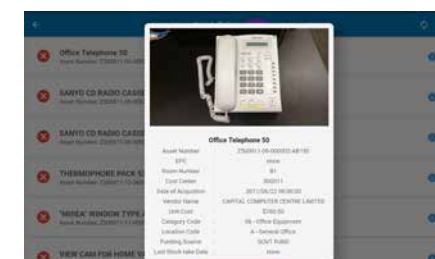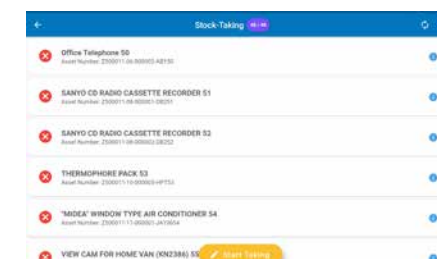
Compare with the traditional barcode-based system, RFID technology streamline asset registration process and enable asset scanning to record within minutes.

相比傳統的條碼系統，無線射頻識別技術簡化了物資登記的流程，令操作、掃描以至記錄物資的流程更加快捷方便。

It allows stock-taking to be done by batch versus having to manually identify and record item individually at a time.

系統可以整批地作紀錄，不需單靠人手為每件物件逐個記錄。

With a click of button, the scanning process can locate assets and identify missing items with ease.

只需輕按一鍵，便能輕鬆快捷地進行掃描及尋找指定的物資，並找出遺失了哪些物資。

LANDSLIDE DETECTION AND ALERTING SYSTEM

智能山泥傾瀉監察及警報系統

SMART CITY – IOT
智慧城市 – 物聯網

Landslide Detection and Alerting System

The landslide detection and alerting system allows real-time monitoring of falling debris and build-up, and uses a web platform and mobile app to issue alerts to the authority. This low cost, reliable, low power consumption system ensures real-time detection of landslide impact on barriers.

智能山泥傾瀉監察及警報系統

智能山泥傾瀉監察及警報系統實時監控掉落的泥石碎片及堆積情況，並利用網絡平台及流動應用程式向有關當局發出警報。這個低成本、可靠及低能量消耗的監察系統可實時偵測山泥傾瀉的風險。

Technologies ready to transfer include:

- A real-time environmental monitoring system (communication tag, sensor modules, communication router and coordinator, monitoring software, customisation and consultancy, etc.)
- Outdoor Communications design
- Universal sensor interface design
- Sensor module design
- Monitoring and alert design

可供轉移的技術包括：

- 實時環境監測系統 (通訊標籤、傳感器組件、通訊路由器和協調器、監測軟件、度身訂造技術和諮詢等)
- 戶外通訊設計
- 通用傳感器接口設計
- 傳感器組件設計
- 監控和預警應用設計

The landslide detection and alerting system enhances the effectiveness of remote barriers built through the years by the Civil Engineering and Development Department (CEDD) of the Hong Kong SAR Government. By deploying internet-of-things sensor technologies, the system can real-time detect landslide debris impacts onto the barriers and issue instant alerts to the authority.

智能山泥傾瀉監察及警報系統協助政府土木工程拓展署提高多年來於偏遠地區建立的山泥傾瀉防護屏障的效能。利用物聯網傳感器技術，系統可以實時檢測保護屏障是否遭到山泥撞擊，並即時通知相關部門跟進。

LANDSLIDE DETECTION AND ALERTING SYSTEM
智能山泥傾瀉監察及警報系統

To improve public safety against landslides, an instant camera system with infra-red light has been developed to provide image and instantly transmitted to the related department for follow-up immediately.

為了減低山泥傾瀉對公眾安全的危險性，同時應用具有紅外線的相機系統，提供實時圖像，以便立即傳送給相關的部門跟進。

An on-site Warning Message System (WMS) helps to deliver the landslide warning messages by using the technique of Moving Message Display and strengthen the structural support of the system to withstand the external load brought by extreme weather events.

系統使用移動信息顯示技術於最接近該山坡發出「警告」的訊息，令附近的居民及行人即時知道，並加強系統的結構支持，以承受極端天氣帶來的損壞。

The Landslide Detection and Alerting System has won the Silver Medal at the 47th International Exhibition of Inventions of Geneva in 2019.

智能山泥傾瀉監察及警報系統在2019年舉行的第47屆日內瓦國際發明展榮獲銀獎。

ULTRA-WIDEBAND PACKAGE SCANNER
超寬頻包裝掃瞄器

Radar array
Radar unit
Clamp
Wine Box
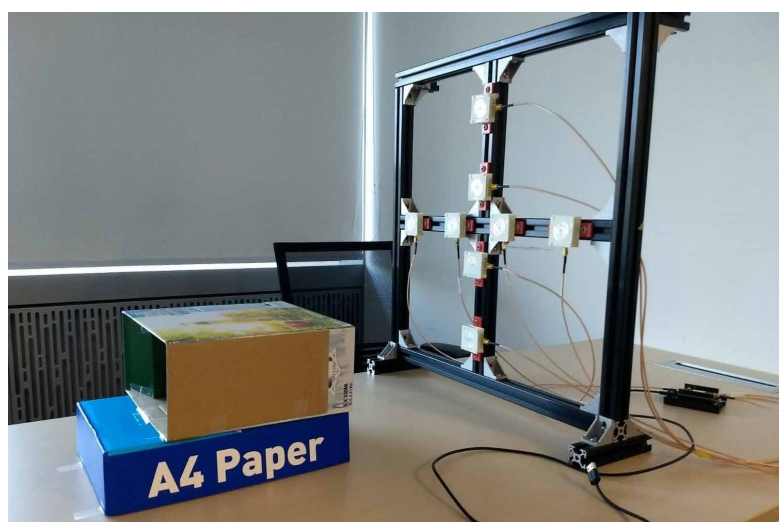
Ultra–Wideband Package Scanner for Inventory Management

This project adopts low cost ultra-wideband (UWB) radar technology to develop a non-destructive object scanner. By correlating changes of different radar output waveforms, it is possible to identify non-standard scanned objects for screening purposes.

應用於倉庫管理的超寬帶包裝掃瞄器

本項目應用了低成本的超寬帶雷達技術，開發出一種非破壞性的掃描器。透過不同雷達接收到的數據，篩選出不合乎標準的物件。
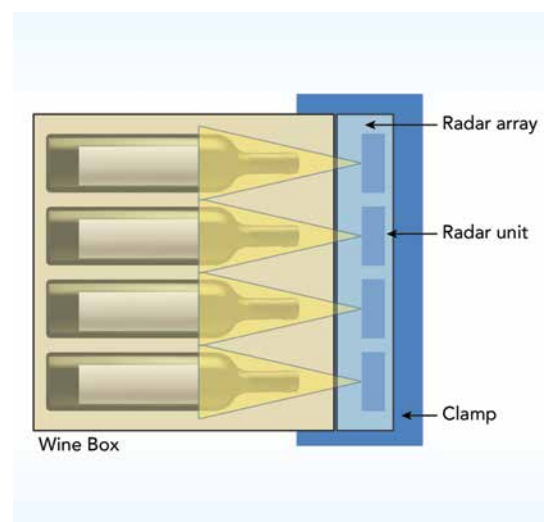
New Technologies that will be developed include:

- UWB antenna design
- UWB beamforming algorithms study

將研發的新技術包括：

- 超寬帶天線設計
- 超寬帶波束形成計算法研究

Antenna array
Radar scanner
Focused beam
package
3 Bottles
QA pass
package contents
Output to user
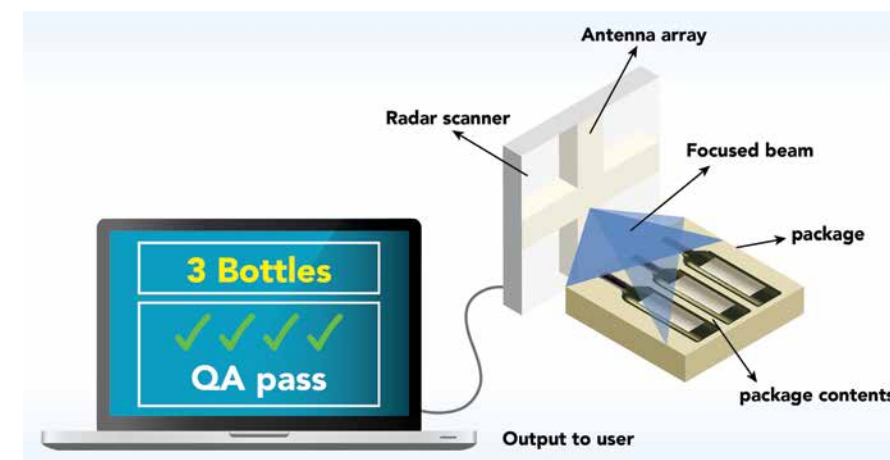
LSCM has developed a portable and non-invasive scanner which uses UWB and RF technologies. Utilising time-of-flight and waveform data collected by the sensors, the UWB scanner can analyse the inner conditions of an object by applying advanced digital signal processing techniques. This device can be applied to inventory control or quality assurance system without unpacking the items, ensuring an effective workflow and increased productivity.

LSCM開發了一個便攜式、非入侵性掃描器裝置，並應用了一系列超寬帶傳感器及射頻技術。透過傳感器收集的時間及波形數據，及採用先進的數碼訊號處理技術，UWB掃描器便可分析物件的內部狀態，在毋需打開包裹的情況下進行庫存監管或品質保證，確保有效的工作流程，提高生產力。

Radar element n
Scanning Prototype
Scanning Package

ULTRA-WIDEBAND PACKAGE SCANNER
超寬頻包裝掃瞄器
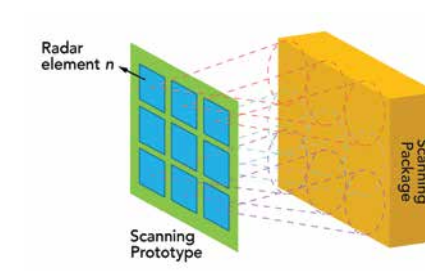
This solution will provide a low-cost non-destructive alternative for local SMEs in different operating environments such as logistics warehouses.

本項目將為中小企提供另一個低成本無損物體掃描技術的方案，並適用於不同的操作環境，如物流倉庫。

The quality control unit may use this scanner to compare the testing package with the standard reference package in order to identify any potential abnormal package for further re-checking.

品質控制管小組可以利用這個掃瞄器對掃描包裹裝進行掃描，再與標準數據作比較，從而抽出不正常的包裹裝作進一步檢測。

In 2018, Ultra–Wideband Package Scanner for Inventory Management won the Silver Medal at the 46th International Exhibition of Inventions Geneva.

應用於倉庫管理上的超寬帶包裝掃描器，在2018年第46屆日內瓦國際發明展榮獲銀獎。

SMART DRAINAGE SYSTEM

智能渠道管理系統

Installation of an underground device
安裝地下網絡設備

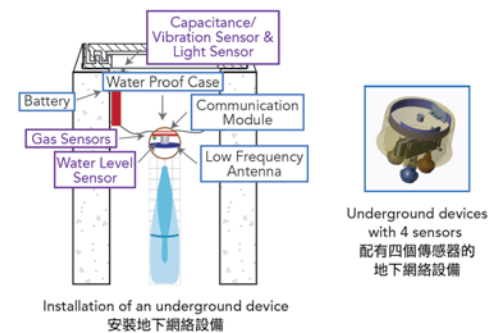Underground devices with 4 sensors
配有四個傳感器的地下網絡設備
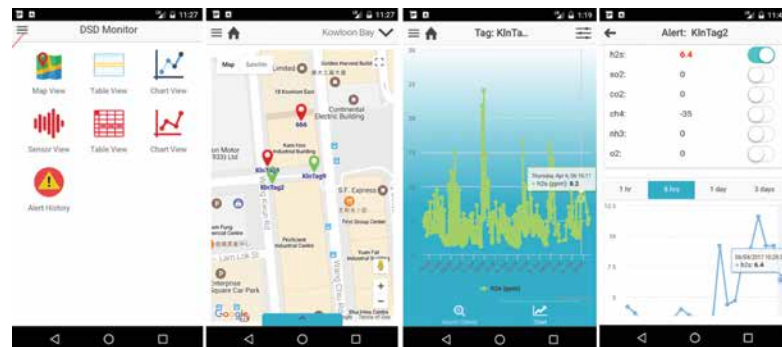
An Integrated Sensor Module and Ubiquitous Wireless Network for Smart Drainage System

A flexible and effective underground to above ground sensing and wireless network for real-time collection of water level and hazardous gas information from drainage and sewage systems has been developed for effectively monitoring water level changes and gas concentration changes within drainage and sewage manholes.

結合無線傳感模組及網絡的智能渠道管理系統

本項目旨在建立一個靈活高效、從地下到地上的無線傳感網絡，採集城市及周邊地區的排水渠及排污渠內的水位訊息及有害氣體訊息，實現對城市雨水及污水排放系統的實時監控。

New Technologies that will be developed include:

- An underground to above ground communication system has been developed
- An underground device with multiple sensors for detecting environmental changes within the sewage and drainage system has been developed
- A compact, conformal and adaptive antenna operating at lower frequency for minimizing the size of underground devices
- Application software and alert engines for managing sensing data has be developed

將研發的新技術包括：

- 一套用於地底到地面的無線數據傳輸網絡
- 開發於地底工作的無線通訊模組及傳感器模組
- 細小、共通型可調天線，可用於地底裝置的低頻訊號傳輸
- 開發應用層軟件及報警引擎以管理傳感器數據
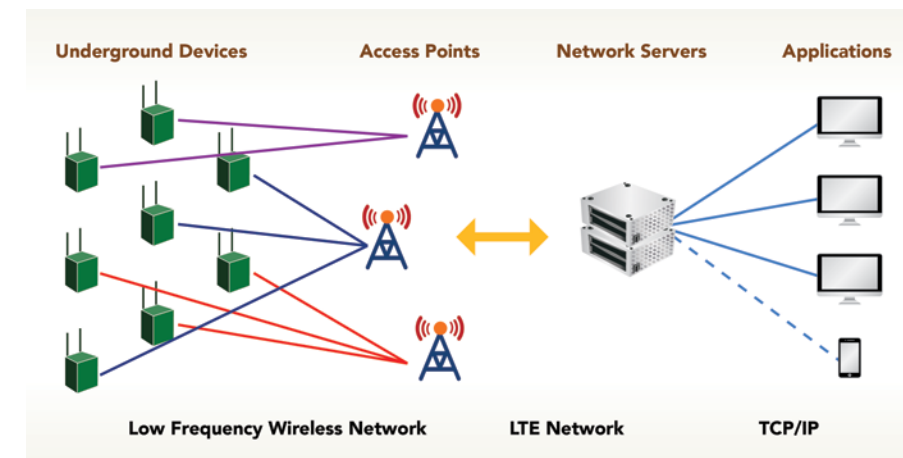
To monitor the collected data remotely, the data management system will be built based on cloud computing and storage technologies to allow convenient real time access to the data for analysis by users. At the same time, APPs will be developed for on-site data browsing. With the sensing network, application software, cloud computing and cloud storage technologies, high risk area such as flood blackspots, manholes with high density explosive gases and even areas at risk of landslides can be closely monitored.

此技術結合採集數據以及後台軟件管理系統、雲計算及存儲系統和用戶自定義的報警機制，實現對城市洪水黑點、可能的山體滑坡區域、人為非法傾倒導致水渠淤塞，以及有害氣體有可能導致的危險地區進行監控，及時地防範災害的發生。根據所收集到的實時數據和以往歷史數據分析，對可能發生的災害實現預警。

SMART DRAINAGE SYSTEM
智能渠道管理系統

Collect sensing data from underground device by handheld reader.

利用手提閱讀器，收集從地下設備收集的傳感數據。

Clear tag locations displayed on map view.

在地圖顯示需清除的標籤位置。

An underground to above ground communication system and an above ground mesh network is developed.

地下集成傳感器模塊設備安裝在排水孔內。

LOW PROFILE 3-AXIS POLARIZATION TECHNOLOGY

低尺度三軸極化技術

Novel Low Profile 3-Axis Polarization Technology for the Near Field UHF RFID Reader Antenna System

LSCM has worked together with the University of Hong Kong to develop a ground-breaking concept that overcomes the shortcomings of conventional reader antennas, which are generally configured using a 2-axis polarizations configuration.

近場天線系統的新型低尺度三軸極化技術

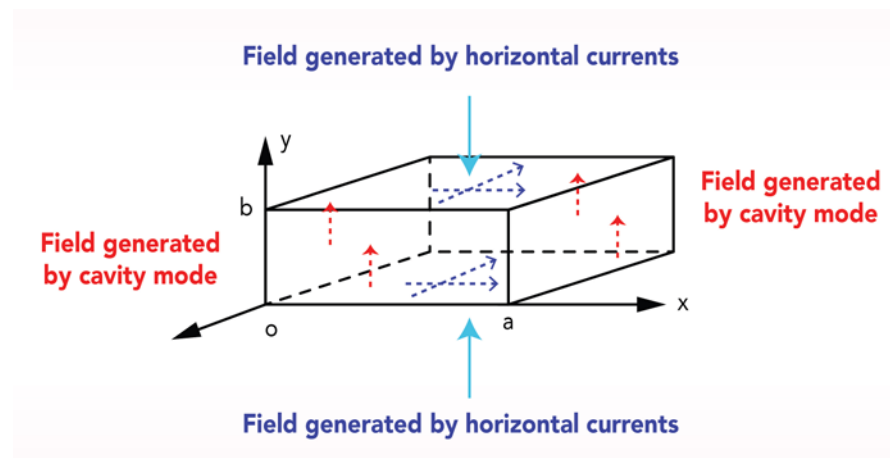LSCM與香港大學合作，開發了新型低尺度三軸極化技術系統。它打破了傳統讀寫天線二軸極化的局限，使設置於任何方向的線性標籤均能被讀取。

Technology ready to transfer include:

- Low profile 3-axis polarization near field UHF RFID antenna prototypes

可供轉移的技術包括：

- 低尺度三軸極化近場UHF RFID天線原型

The 3-axis polarization technology ensures that each orientation along the polarized tag antennas can be read by applying a 3-axis polarization approach, while maintaining a low profile feature.

三軸極化技術確保極化標籤天線的每個方向都可以通過應用三軸極化技術來讀取，同時保持低尺度的特徵。
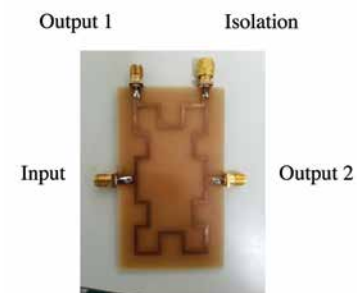
This technology greatly improves the reliability and flexibility of existing RFID systems.

這技術大大提高了現有RFID系統的可靠性和靈活性。

It can be connected to regular commercial UHF RFID readers.

它可以與普通的商業UHF RFID閱讀器連接。

LOW PROFILE 3-AXIS POLARIZATION TECHNOLOGY

低尺度三軸極化技術
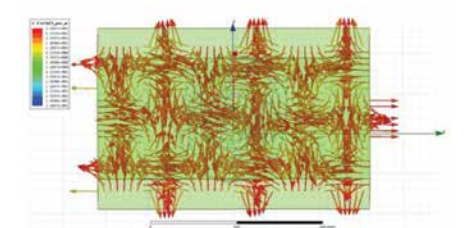
The low profile near field communication with full 3-axis polarizations is developed using new magneto-electric (ME) antenna concept and the balanced composite left/right hand (CLRH) metamaterial structure.

透過採用全新的磁電 (ME) 天線概念和平衡複合左/右方 (CLRH) 超材料結構，開發出具有完整三軸極化的低尺度近場通訊。

WIRELESS MESH NETWORK
無線網格網絡

This innovative technology can be deployed in areas where mobile carriers experience interference and dynamic blind spots, such as in container terminals with moving cranes, aircraft MROs (maintenance, repair and overhaul), libraries with shelves that experience frequent turnover, and open fields (such as those in use for mining operations). The mesh network also allows workers and facility assets to be located easily, improving the efficiency of daily operations.

此項技術適用於使用傳統Wi-Fi，但有動態盲點和干擾訊號的場所，例如設有移動起重機的貨櫃碼頭、飛機的保養、維修和翻新、需要經常調動書架的圖書館及露天礦場。此網格網絡有助為工人及不同的設備進行定位，提升工作效率。

WIRELESS MESH NETWORK
無線網格網絡

Innovative and Efficient Wireless Mesh Network for Outdoor Environment

As part of its ongoing collaborative efforts with academia and industry, LSCM and its partners, the Hong Kong University of Science and Technology and Openplatform Technology Company Limited, have developed a mesh network to extend the coverage range of existing Wi-Fi solutions utilising multi-hop routing technology.

創新高效的戶外無線網格網絡

LSCM一直與學術界及業界共同合作。此項技術由LSCM、香港科技大學及資訊坊科技有限公司共同研發，利用多跳網格網絡技術伸延現有的Wi-Fi訊號，以擴大無線網絡的覆蓋範圍。

Products available include:

- Wireless mesh network system (software, hardware design, customisation and consultancy, etc.)
- Network design

可供出售的產品包括：

- 無線網格網絡系統（軟件、硬件設計、度身訂造技術和顧問服務）
- 網絡設計

The mesh network is a self-adaptive network with failure resilience that enables complete and high-speed connections.

這個網格網絡具自我修復能力，令整個網絡系統的運作更加快捷和穩定。
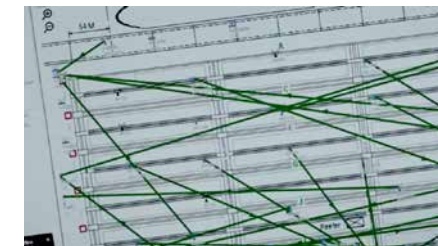
It supports real-time visual representation of mesh topology.

它支援實時的網格網絡可視化。

Mesh nodes communicating with each other and co-operating in forwarding traffic of each other to the nearest gateway. Each router manages and maintains optimal and backup paths which adapt to the environment.

透過網格節點互相通訊及協作，將一方的流量轉發到最近的網關。每個路由器均管理和選取最適合該環境的路徑和後備路徑。

RFID
HYBRID READER

無線射頻識別
集成閱讀器

Integrated Barcode / RFID Reader for Retailing and Inventory

LSCM's integrated barcode / RFID handheld reader contains both a 2D barcode and an RFID reader within a housing that is compact and trendy. The reader can be used for retailing and inventory checking.

應用於零售及庫存的條碼 / 無線射頻識別（RFID）集成閱讀器

LSCM研發的手持式閱讀器集結了二維條碼和RFID閱讀功能，而且它的外殼設計時尚輕巧，適用於零售業和貨物盤點。

Technologies ready to transfer include:

- RFID reader module design
- Omni-directional internal antenna design

可供轉移的技術包括：

- RFID閱讀器組件設計
- 全向性內置式天線設計

In combination with the Centre's low-cost reader chip and highly integrated module design, the reader is advantageously compact-sized, light-weight and, most importantly, low cost when compared to existing products in the market.

由於結合了本中心開發的低成本閱讀器芯片和高度集成的模塊設計，此閱讀器較現時市場上的產品更為纖巧、輕量，而最重要的是成本更低。

The omni-directional internal antenna design of the reader ensures that the reader can read the RFID tag regardless of its orientation. LSCM's RFID reader module provides significant value in reducing cost and improving readability.

全向性內置式天線設計確保閱讀器可在任何方向均能讀取RFID標籤訊號。LSCM的RFID讀寫器在減省成本和可讀性方面都有良好的表現。
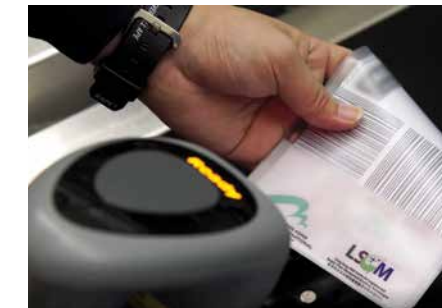
While many airports employ 1D and 2D barcodes for self-service baggage check-in kiosks, the Hong Kong International Airport utilises additional technologies which benefit from devices that can address RFID read / write requirements to provide enhanced services.

當大多數機場只於自助行李托運站使用一維和二維條碼，香港國際機場率先提供一個嶄新的設備，以解決RFID的讀寫要求，並提供服務。

Traditional asset management system associated with several complicated procedures which is difficult for users to keep track of the assets efficiently and manage inventories accurately. It is ideal for the application of wireless RFID hybrid reader, which helps to improve the accuracy of identifying assets and managing asset systematically. Since wireless RFID hybrid reader does not require direct line-of-sight, it is much easier to be adopted for inventory management.

傳統的物資管理系統涉及許多複雜的流程，難以有效和準確地追蹤和管理物資庫存。使用無線RFID多功能閱讀器便可解決這個問題，它不但可以大大提高識別和管理物資的效率，而且不需要連接電線，更易於使用於庫存管理上。

RFID
METAL TAGS

無線射頻識別
金屬標籤

SMART CITY – IOT

智慧城市 – 物聯網

Wet inlay (adhesive back)

0.4mm-thick FR4 substrate (Single layer)

2mm-thick FR4 substrate

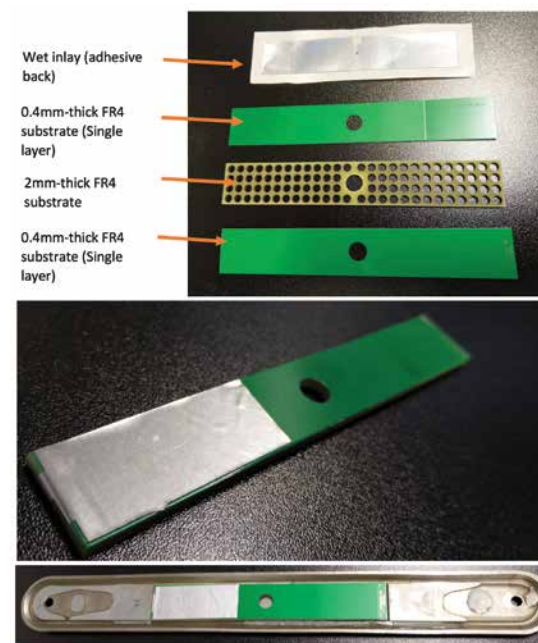0.4mm-thick FR4 substrate (Single layer)

RFID Tagging and Embedding Technology

Different kinds of RFID tag antennas have been designed with high performance. Measurement results show that they can be effectively used in product packages and blinding guide lines.

無線射頻識別標籤及嵌入技術

LSCM設計了多種高性能天線，適用於產品包裝的天線與內嵌標籤及盲人導航路線。

Technologies ready to transfer include:

- Various passive RFID tag antennas designed in different backgrounds (metal, brick, soil and plastic, etc.)
- RFID tag antenna customisation
- Soft printed RFID antenna technology on different materials

可供轉移的技術包括：

- 可用於不同場景的無源RFID標籤天線（金屬、磚塊、泥土和塑料等）
- RFID標籤天線的設計可按顧客需要訂造
- 可在不同材料上打印的RFID天線的技術
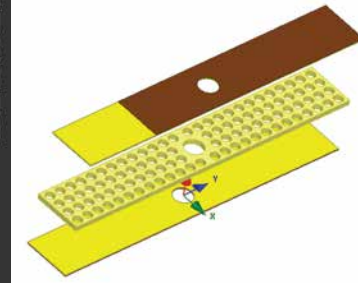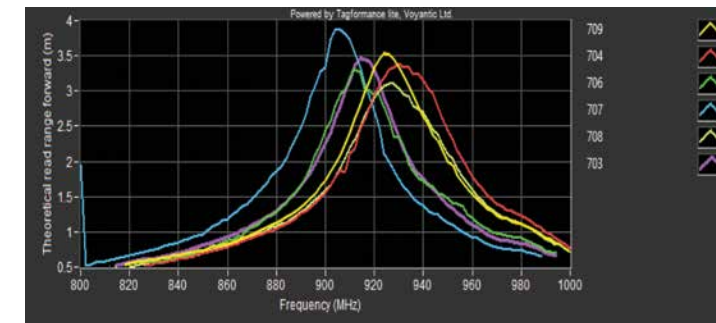
Every tag antenna is designed based on different backgrounds and working compatibility with different materials, like metal, soil, and plastic, etc. Additionally, the Centre has developed technologies for embedding RFID tags into product packages and make them adapt to different environment, with high performance.

每個標籤天線根據不同的應用背景設計，可與各種材料兼容，例如金屬、泥土、塑料等。此外，本中心亦研發了將RFID標籤嵌入產品包裝的相關技術，它可適應不同的環境，並且保持高性能。
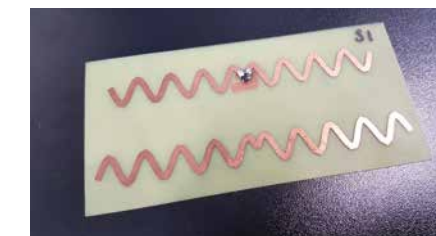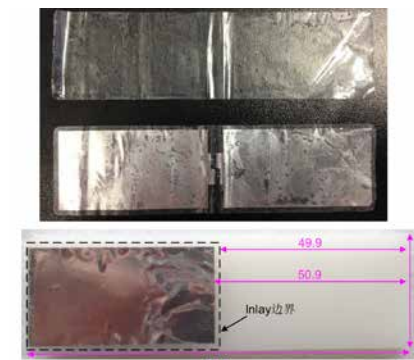
This tag antenna combines the technology of inlay with common substrate. A metal reflector is used for directional radiation. With innovative design and engineering, the tag delivers a long read range within the bandwidth of around 920MHz-928MHz.

此標籤天線利用inlay技術貼合在介質板上，背面利用金屬反射板進行定向輻射，具有很高的增益和傳輸距離。此標籤可在大約920MHz-928MHz的帶寬內提供長距離讀取範圍。

This tag antenna has directional radiation with a reflector dipole. A capacitor and a inductor are used for good matching. With the simple structure, a long reading distance is achieved.

此標籤天線利用反射振子實現定向輻射，利用電感電容實現良好的阻抗匹配。它的結構簡單，可以實現長距離閱讀。

This tag antenna uses a substrate with many holes to achieve low loss. The technology of inlay is utilised to print the antenna. It has a simple structure and is easy to be integrated.

此標籤天線採用打孔的介質板實現低損耗，利用inlay技術貼合在低損耗的介質板上。它的結構簡單，便於集成。
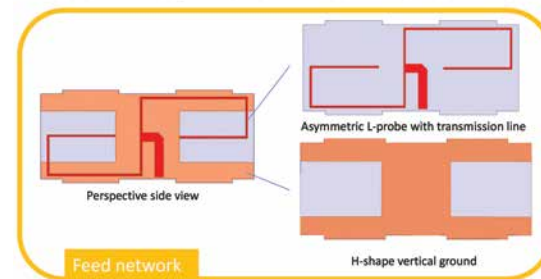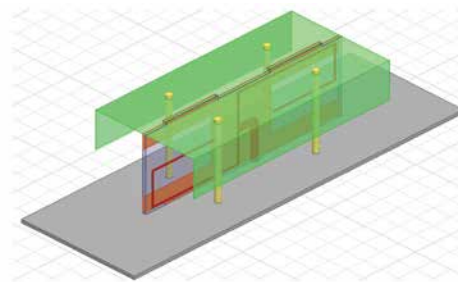
RFID READER ANTENNA

無線射頻識別 集成閱讀器天線
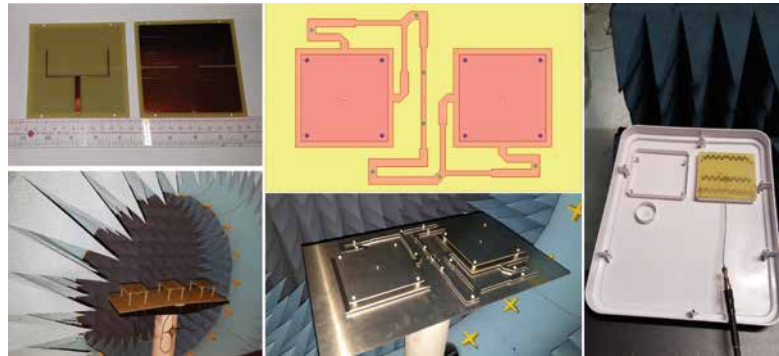
RFID Reader Antenna for Retailing, Inventory and Locationing

Various techniques have been used to enhance the antenna performance, such as gain and bandwidth. These reader antennas have very long reading distances. The reader can be used for retailing, inventory, and locationing.

應用於零售、庫存、定位的無線射頻識別（RFID）集成閱讀器天線
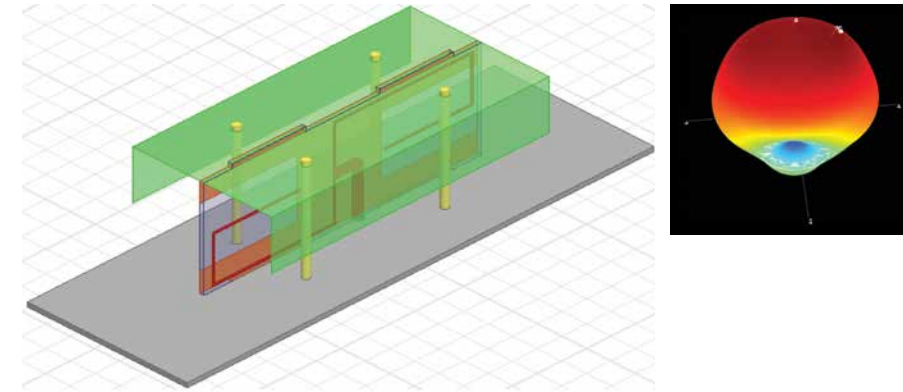
LSCM研發了多款高性能天線，例如高增益寬帶。天線具有較長的讀取距離，適用於零售業、貨物盤點和定位。

Perspective side view
Feed network
Asymmetric L-probe with transmission line
H-shape vertical ground

Technologies ready to transfer include:

- Compact RFID reader antenna design
- Unidirectional antenna design

可供轉移的技術包括：

- RFID閱讀器小型化
- 定向天線設計

This reader antenna has unidirectional radiation, long reading distance, and compact size compared to existing products in the market.

相比市場上同類型的產品，此閱讀天線具有定向輻射、長距離閱讀和小型化的特點。
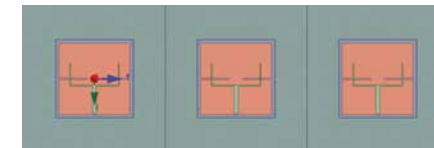
The unidirectional internal antenna design of the reader ensures the reader can enhance the reading distance.

定向天線可以增加閱讀距離，形成一定的天線方向可控性。
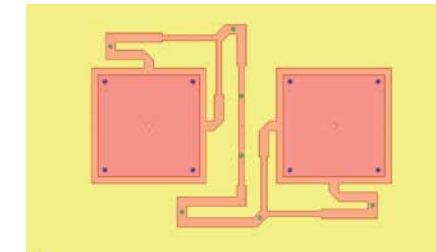
Circularly polarised reader antenna can receive signals regardless of the polarisation orientation. Two antenna elements can enhance the reading distance.
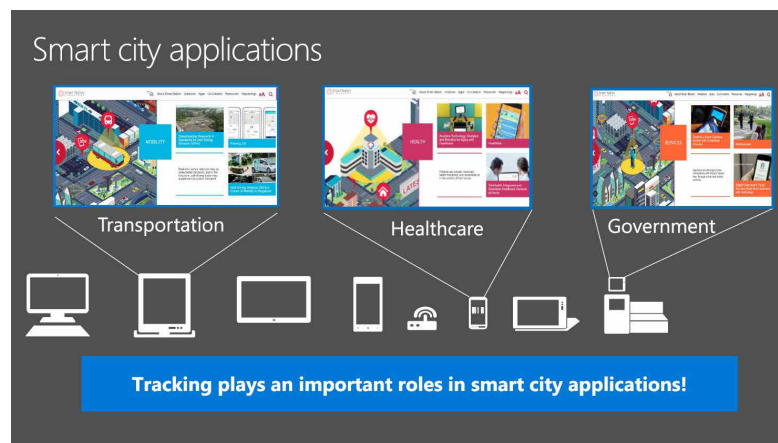
此閱讀天線採用圓極化設計，可以接收任何極化的訊號。二單元天線可以提高天線增益，增加閱讀距離。

The yagi antenna has the advantages of high gain, low cost, and simple structure.

採用八木天線，具有高增益，低成本和結構簡單等優點。

LORA IOT PLATFORM
LORA物聯網平台

SMART CITY – SMART MOBILITY
智慧城市 – 智慧出行

Smart city applications

Transportation | Healthcare | Government

Tracking plays an important roles in smart city applications!


LoRa IoT Platform for Smart City Technology and Applications Development

In order to support the development of Smart City, LSCM has developed LoRa network which integrates smart devices, citizens and the city's services together to achieve sustainability, efficiency and mobility in Hong Kong.

配合智慧城市發展的LoRa物聯網平台

為了配合智慧城市的發展，LSCM研發了LoRa網絡，將智能裝置、市民和城市的服務整合在一起，以實現香港的可持續發展、效率和流動性。
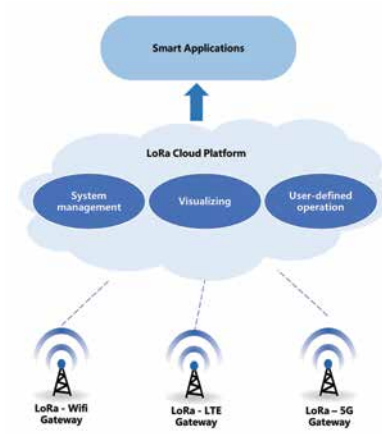
New Technologies will be developed include:

- LoRa-based Cloud prototype for loT
- A gateway between LoRa network and WiFi/L TE/5G network

將研發的新技術包括：

- 適用於物聯網的LoRa的雲原型
- 連接LoRa網絡和WiFi/LTE/5G網絡間的網關

LoRa System
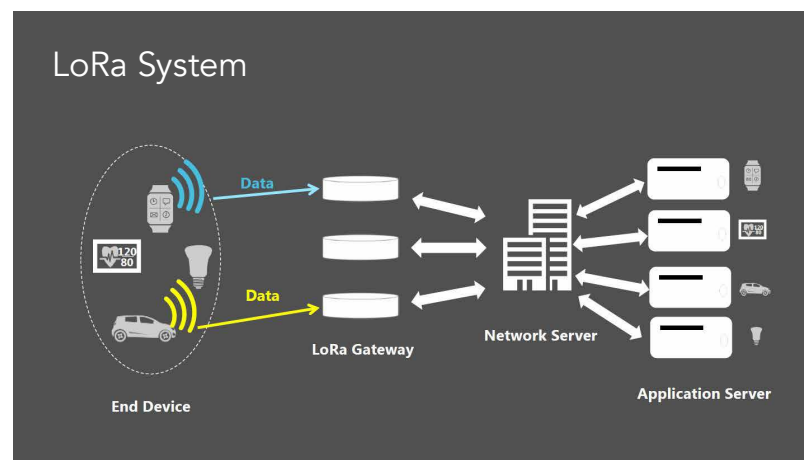
Three new LoRa-based Smart applications - interference-mitigated LoRa-based seamless localization, real-time performance in LoRa network and sub-metering will be implemented. These are the new applications which can provide accurate localization, as well as real-time and sub-metering services to potential users.

將實施的三個基於LoRa的新智能應用，包括低干擾的LoRa無縫定位、在LoRa網絡中進行實時的執行和分戶計量。這些新的應用程式可以為目標用戶提供準確的本地化、實時和分戶計量的服務。

LORA IOT PLATFORM
LORA物聯網平台
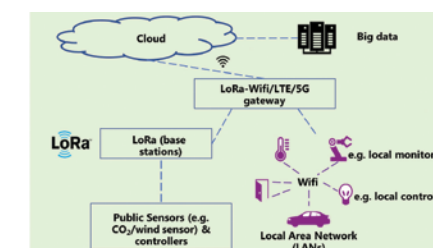
The newly developed LoRa-based Cloud prototype will facilitate long-distance data manipulation efficiency and reduce computation cost for users. This project offers an alternative solution to mobile platforms since a good link budget will be analyzed.

通過新開發基於LoRa的雲原型，將有助提高遠程的數據處理效率，並降低最終用戶的計算成本。通過分析，這項目能提供良好的鏈路預算，為流動平台提供了另一種解決方案。
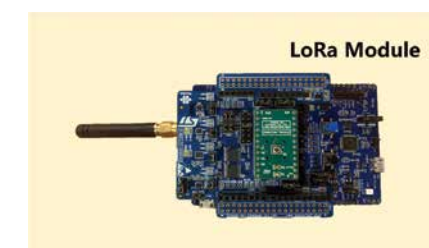
A novel seamless localization technique based on LoRa will be developed. It will be more accurate than other low signal-to-interference-plus-noise-ratio (SINR) wireless techniques.

此項目將開發一種基於LoRa的新型無縫定位技術，它比其他低訊號強度和干擾及背景訊號強度比（SINR）的無線技術更精準。

The technology will be tested in Hong Kong International Airport, City University of Hong Kong, and Tai Lam Tunnel to evaluate the effectiveness of the proposed network.

此技術將在香港國際機場、香港城市大學和大欖隧道進行測試，以評估這網絡的效用。

SEAMLESS NAVIGATION IN URBAN ENVIRONMENT
城市無縫定位系統

Reflected Path

Immigration Department

Direct Path

Direct Path Blocked (NLOS)
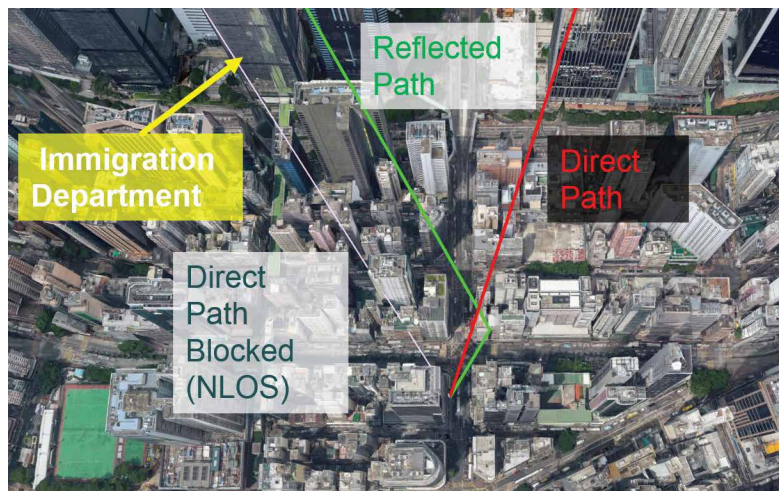
Seamless Navigation in Urban Environment through Multiple Sensor Fusion and GNSS Multipath Mitigation

This project will develop algorithms for GNSS multipath error mitigation and for improving positioning availability in dense urban areas. It will also provide a seamless positioning server platform that supports high precision positioning in Hong Kong.

基於GNSS多徑效應改正和多感應器融合的城市無縫定位系統

這項目將開發適用於改正GNSS多路徑誤差和改善人口密集的市區內的定位計算法。它亦能提供一個無縫定位伺服器平台，以提高定位服務的精確度。

New Technologies that will be developed include:

- GNSS multipath ray tracing algorithm
- Algorithms for multiple sensor fusion
- Server platform for mobile users for positioning computation
- Pilot APP for mobile phones

將研發的新技術包括：

- GNSS多路徑射線追蹤計算法
- 多感應器融合計算法
- 適用於定位計算的流動用戶伺服器平台
- 手機流動應用程式試用版
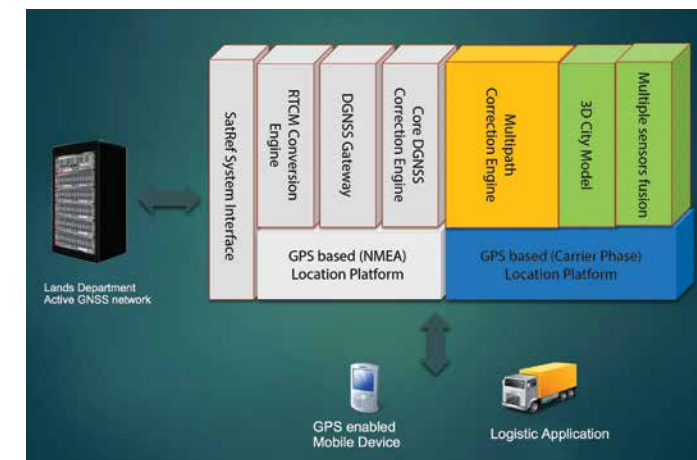
This project will develop an integrated solution to solve the multipath problem in Hong Kong. It will integrate multiple sensors, including Micro-electromechanical Systems sensors, WIFI, satellite in view, and multiple GNSS constellations together with 3D city model, to significantly reduce multipath effect by using advanced fusion algorithms and multipath modeling.

此項目將開發一個綜合的解決方案，以解決香港的多路徑誤差問題。它將集合多個感應器，包括微機電系統感應器、WIFI、衛星視野和多個GNSS星系以及3D城市模型，透過使用先進的融合計算法和多路徑模式，顯著地減低多路徑所產生的影響。

SEAMLESS NAVIGATION IN URBAN ENVIRONMENT
城市無縫定位系統
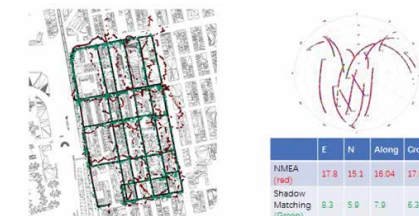
With this project, we can significantly increase coverage and reduce multipath errors in dense urban areas using the aforesaid algorithms.

透過這項目，可以使用上述計算法以顯著地提高覆蓋率，並減少人口密集的市區內的多路徑誤差。

By integrating multipath mitigation methods developed in this project and DGNSS platform for mobile phones that developed earlier, we will be able to provide an integrated service to offer metre level positioning accuracy in open areas and 10 meters accuracy in dense urban areas in Hong Kong.

透過整合本項目開發的減低多路徑影響的方法和已開發的手機DGNSS平台，將可提供綜合服務，在空曠地區提供以米為量度單位的定位精確度；而在香港人口密集的市區內則提供達至10米的精確度。

An android based pilot application will be developed for mobile devices which are equipped with necessary sensors (e.g. GPS, gyroscope and WiFi) and support pseudorange and carrier phase data output.

適用於流動設備，以Android為基礎的試用程式，該流動設備需要備有感應器（例如GPS、陀螺儀和WiFi），及可支援虛擬距離和載波相位數據輸出功能。

SMART CITY – SMART MOBILITY

智慧城市 – 智慧出行
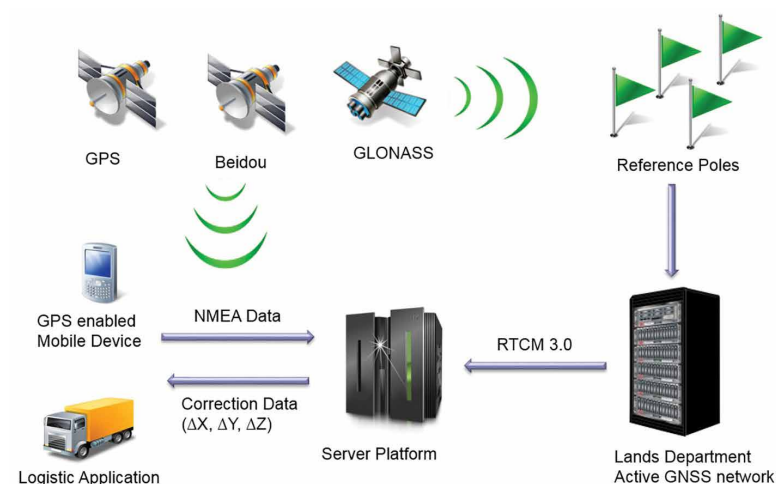
Development of a Hong Kong Positioning Infrastructure Based on GPS, Beidou, and Ground Based Augmentation System

Based on the existing Hong Kong SatRef network, the system offers a fundamental positioning infrastructure that provides multiple location based services to support economic development in Hong Kong.

基於GPS、北斗及地面增強系統的香港衛星定位平台

此系統建基於香港現行SatRef網絡的基礎定位設施，提供多種位置基礎服務，以支持香港在測量、物流操作、地理信息系統（GIS）應用及位置基礎服務的技術提升。
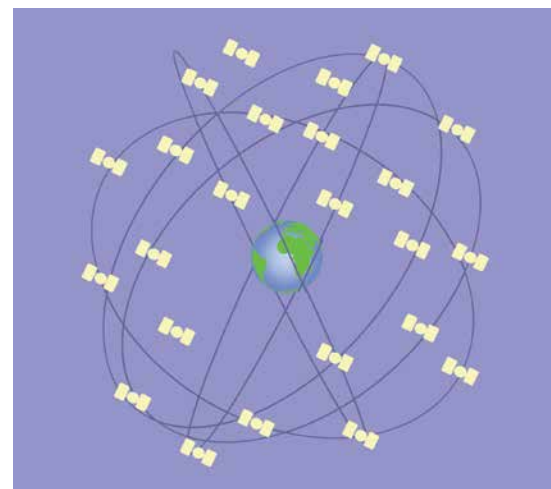
Technologies ready to transfer include:

- DGNSS server platform
- Software to support metre level accuracy for smartphone and tablet users
- RTK server platform and high precision Hong Kong geoid model
- Software for RTK positioning to achieve centimetre level positioning accuracy

可供轉移的技術包括：

- DGNSS服務平台
- 以米為量度單位的定位支援智能電話及流動設備的應用軟件
- 網絡RTK伺服平台和精準的香港大地水準面模型
- 以厘米為量度單位的定位支援RTK的應用軟件

GPS only: 12   GPS+GLONASS+Beidou: 33
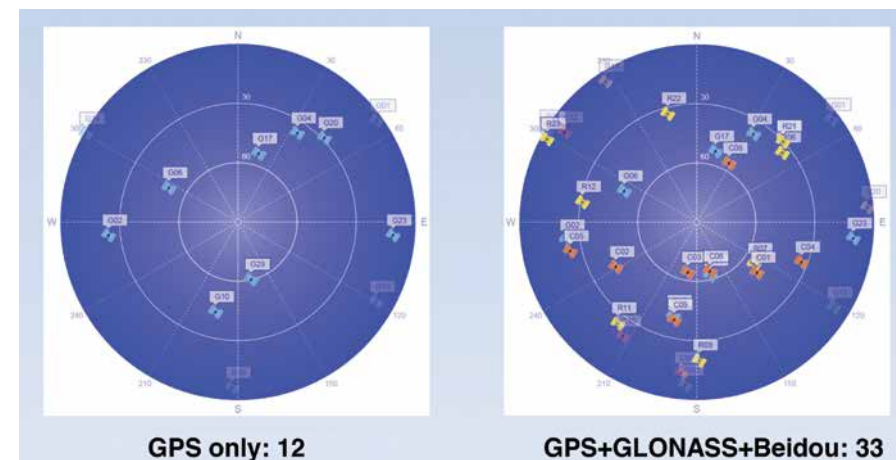
The system provides technological advancements in surveying, logistics operation, Geographic Information System (GIS) applications, and location-based services in Hong Kong. It enhances the performance of the SatRef network by integrating GPS and Beidou, and achieves more reliable Real-Time Kinematic (RTK) positioning with the accuracy of 1 centimetre for surveying and engineering applications.

這系統改進測量、物流操作、地理訊息系統應用及位置基礎服務的技術。它集成了 GPS 和北斗網絡，進一步提升 SatRef 系統的表現，在測量和工程應用上提供更可靠並定位至1 厘米精準度的實時動態（RTK）。
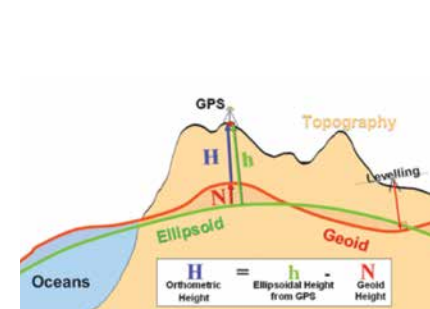
The system implements GNSS heightening in Hong Kong to improve engineering surveying efficiency.
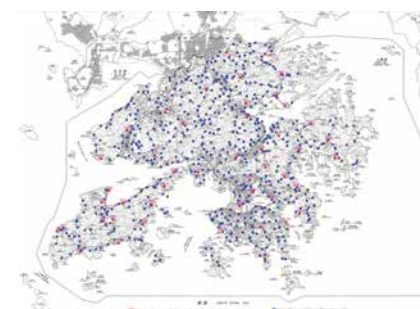
這系統在香港實施 GNSS 加高模式以提高工程測量效率。
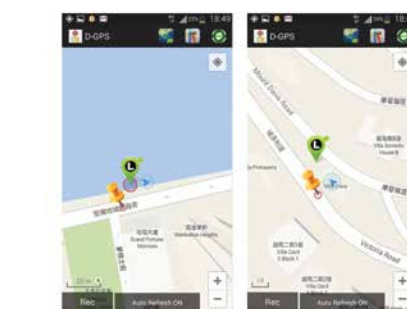
The system provides a reliable platform with DGNSS differential technologies for mobile operators in Hong Kong and surrounding territories to support personal and vehicle positioning & navigation with metre level accuracy (2 ~ 3m).

系統以DGNSS差分術提供一個可靠的平台，為流動網絡營運商在香港及周邊地區提供個人和車輛的定位及導航服務，並達至以米為量度單位的準確度 (2 ~ 3米)。

A full scale gravity survey in Hong Kong is measured with modern gravimeter to evaluate the quality of the existing gravity data available and to fill the gaps of the existing data coverage, particularly in mountain areas.

運用現代重力儀在香港作全面性的重力測量，以評估現有重力資料的質量，並填補現有資料 (特別是在山區) 覆蓋上的不足。

3D SEAMLESS SPATIAL DATA ACQUISITION SYSTEM

無縫三維空間數據採集系統
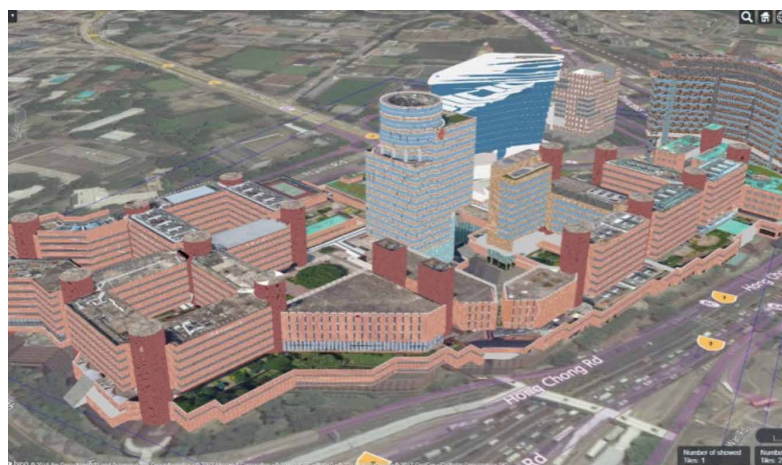
3D Geodatabase Framework for Hong Kong: A Lightweight 3D Seamless Spatial Data Acquisition System (SSDAS)

This project aims to develop a 3D geodatabase framework for Hong Kong on the demand of Lands Department for its wide GIS applications for the whole Hong Kong, enabling its applications in effective and efficient 3D urban environment.

香港的三維地理數據庫架構：輕量化無縫三維空間數據採集系統

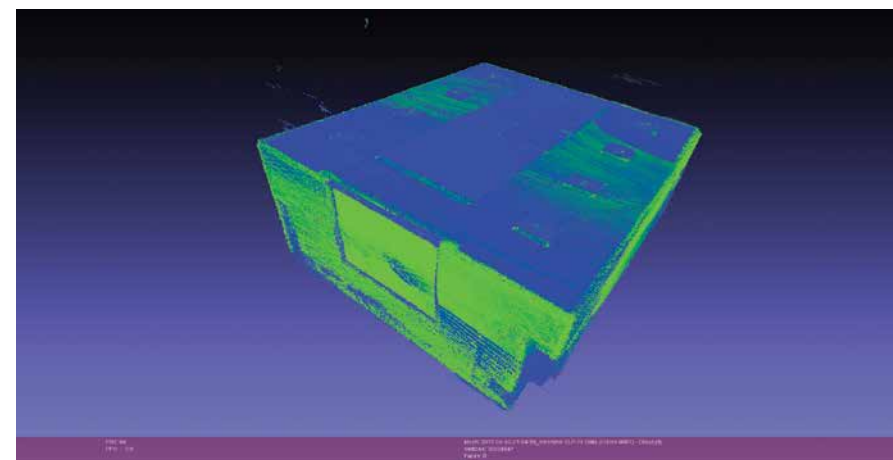此項目旨在為香港開發一套三維地理數據庫框架，提供一套針對三維城市環境行之有效，且強而有力的解決方案，在香港地理信息系統中得到廣泛應用。

New Technologies that will be developed include:

- A 3D geodatabase framework designed for Hong Kong
- A synergized hardware platform
- A post-processing software
- 3D geodatabases of pilot areas

將開發的新技術包括：

- 為香港而設計的三維地理數據庫框架
- 綜合的硬件平台
- 事後處理軟件
- 測試場地的三維地理數據庫

The key issue for implementing the 3D geodatabase framework is the corresponding data capture technology, and a lightweight 3D Seamless Spatial Data Acquisition System (SSDAS) is thus proposed for the corresponding 3D data capture.

實現3D地理數據庫框架的關鍵因素在於相應的數據擷取技術。因此，此項目針對有關的3D數據擷取技術，提議一個輕量化的3D無縫空間數據採集系統（SSDAS）。

3D SEAMLESS SPATIAL DATA ACQUISITION SYSTEM

無縫三維空間數據採集系統

This is a 3D interior building model produced by the spatial data acquisition system and the developed algorithm.

這是一幅利用新開發的空間數據採集系統及演算化產生的三維建築物內部模型。

The lightweight 3D Seamless Spatial Data Acquisition System synergises progressive spatial information technologies and a specialised software package for processing, generating and visualising 3D spatial data.

此三維數據採集系統是一個輕量化的三維無縫空間數據採集系統（SSDAS）。它是集合了先進的空間資訊技術，以及可以進行處理、產生、可視化三維空間數據的專業軟件。

The developed geodatabase and SSDAS will be widely utilised in many fields that need spatial information infrastructure in Smart City, including lands and resources surveying and management, civil engineering, autopilot, intelligent transport, highway maintenance and urban planning.

本項目所研發的三維地理數據庫框架與其對應的數據採集系統（SSDAS），有望被廣泛應用於智慧城市所需的空間信息基礎設施及相關的技術領域，包括土地與資源的測量及管理、土木工程，自動駕駛、智能交通、道路保養及城市規劃。

SMART AP
智能接入點

SMART CITY –
SMART MOBILITY
智慧城市 – 智慧出行

Smart AP: Wi-Fi Positioning and Optimisation for a Smart City

LSCM has joined forces with the Hong Kong University of Science and Technology to research and implement Smart Wi-Fi, an intelligent embedded software technology for Access points (APs), to overcome the challenges in the Wi-Fi environment, such as high interference between Wi-Fi APs, APs load unbalance, the lack of user/asset tracking capability etc.
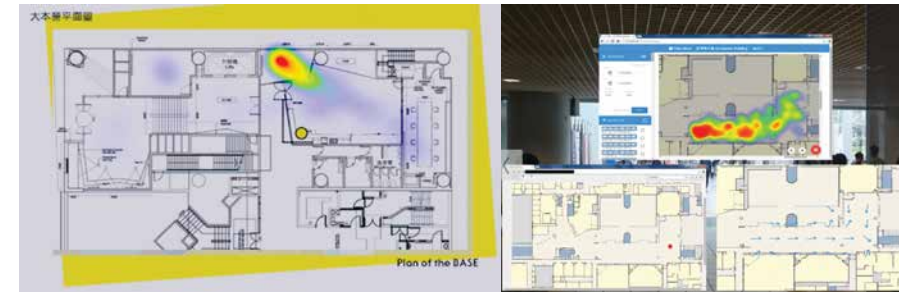
智能接入點：智慧城市的無線Wi-Fi定位和系統優化

LSCM聯同香港科技大學開發了創新的智能Wi-Fi，通過Wi-Fi接入點 (AP) 上運行的智能嵌入式軟件系統來克服Wi-Fi環境所面對的各種挑戰，如AP之間的高度干擾、AP負載不平均、缺乏用戶/物件追蹤能力等。

### Technology ready to transfer include:

- SmartAP Library

將研發的新技術包括：

- 智能接入點庫

User location information ("user heatmap") enables many commercial business opportunities. With the heatmap, a mall operator will be able to offer the best floor layout, rental schemes for their tenants, timely coupons and location-based recommendations through mobile push advertisement ("Online to Offline").

用戶位置訊息（即"用戶熱能圖"）為商戶帶來更多商機。透過熱能圖，商場經營者可透過流動推送廣告（在線至離線），提供最佳的商舖分佈圖、為租戶提供的租賃計劃，即時優惠券和位置建議。
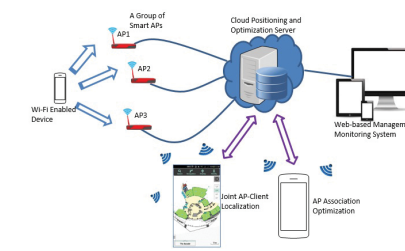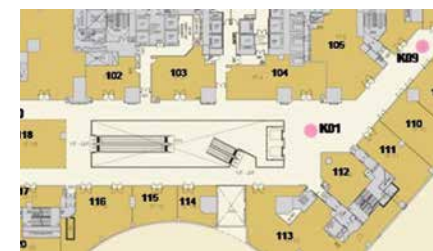
SMART AP
智能接入點

The SmartAP will scan the environment Wi-Fi signal to identify the location of Wi-Fi devices. The site owner can thus analyse the behaviour of their customers or track their valuable assets.

SmartAP可掃描附近的Wi-Fi訊號，以識別Wi-Fi設備的位置。因此，商場經營者可以分析其客戶的行為或追蹤其重要物件。

A mobile app is developed to communicate with the cloud server to identify the current loading and channel busy time with different surrounding APs. The SmartAP will automatically connect to the best AP for enhancing users' Wi-Fi experience.

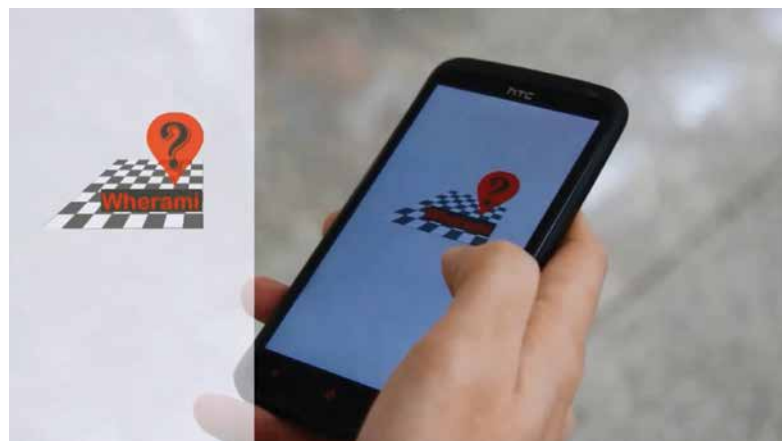透過流動應用程式及雲端伺服器進行通訊，以識別當前的負載和周邊不同頻道的繁忙時間。SmartAP將自動連接到最佳接入點以提升用戶的Wi-Fi 體驗。

In 2018, SmartAP has won the Silver Medal at the 46th International Exhibition of Inventions Geneva.

智能接入點技術在2018年第46屆日內瓦國際發明展獲得銀獎。

INDOOR LOCALISATION, TRACKING AND NAVIGATION

室內定位、追蹤和導向

Indoor Localisation, Tracking and Navigation

Satellite-based global positioning technologies are easy to use. They can easily locate and assist in navigation in outdoor areas. But for indoor environments, they become unsuitable due to poor reception of satellite signals. In light of the challenge, LSCM has collaborated with the Hong Kong University of Science and Technology to develop a WiFi positioning system, Wherami, for indoor localisation tracking and navigation.

室內定位、追蹤和導向

基於衛星的全球定位技術簡單易用。在室外，它可以輕易地進行定位及協助導航，但在室內環境中卻因為接收不到衛星訊號而無法使用。LSCM與香港科技大學利用室內廣泛存在的WiFi訊號，研發出一套既創新又準確的室內移動定位及導航系統－「依道」WiFi網絡定位系統。
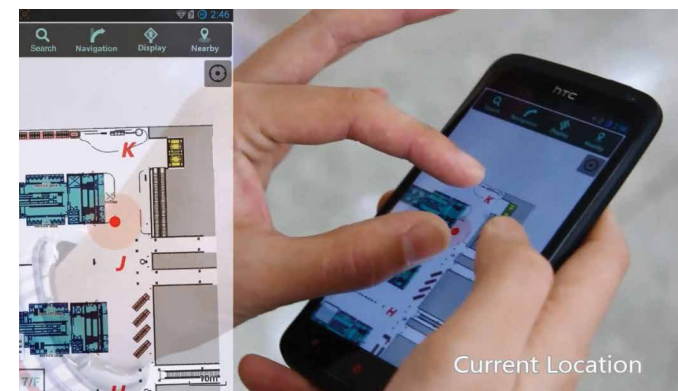
Technologies ready to transfer include:

- Indoor localisation system (tracking and navigating software, tracking device design, customisation and consultancy, etc.)
- Tracking or navigating application software (against indoor map)
- Tracking devices designs

可供轉移的技術包括：

- 室內定位系統 (追蹤及導向軟件、追蹤裝置設計、度身訂造技術和顧問服務)
- 追蹤及導向軟件程式 (對照室內地圖)
- 追蹤裝置設計

Current Location

Wherami is an innovative and highly WiFi-based accurate indoor positioning system (IPS) which is able to "fuse" different location estimations for a mobile user. The estimators may include WiFi fingerprinting, map matching, infrastructure hints, Inertial Measurement Units (IMU), etc. Using our software as add-on, improvements in accuracy can be achieved. It supports multi-storey and/or multi-site scenarios. The system will be interoperable with and non-intrusive to the existing WiFi infrastructure.

依道是一個創新而高度精確的WiFi室內定位系統 (IPS)，能為流動用戶「融合」不同的位置估計。估算器可包括WiFi指紋識別、地圖配對、基礎設施提示、慣性測量單元 (IMU) 等。使用我們的附加軟件後，可以提高精確度。它提供多樓層和/或多地點方案。該系統可與現有以WiFi作基礎的設施互相操作而並不互相干擾。
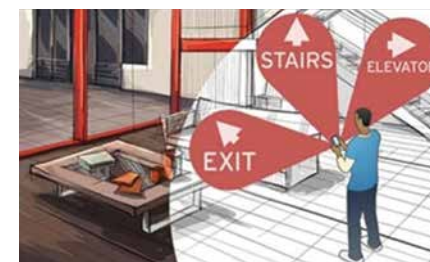
Mobile apps for indoor localisation, tracking and navigation, enabling targeted services and advertisement. The apps will run in various mobile platforms, including smart phones, tablets and personal computers.

流動應用程式可用於室內定位、追蹤和導航，提供針對性的服務和廣告。這些應用程式可用於各種流動設備，包括智能手機、平板電腦和個人電腦。

Current Location
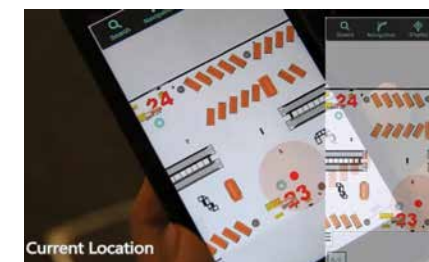
Map matching of building's floor plans together with an efficient route selection algorithm.
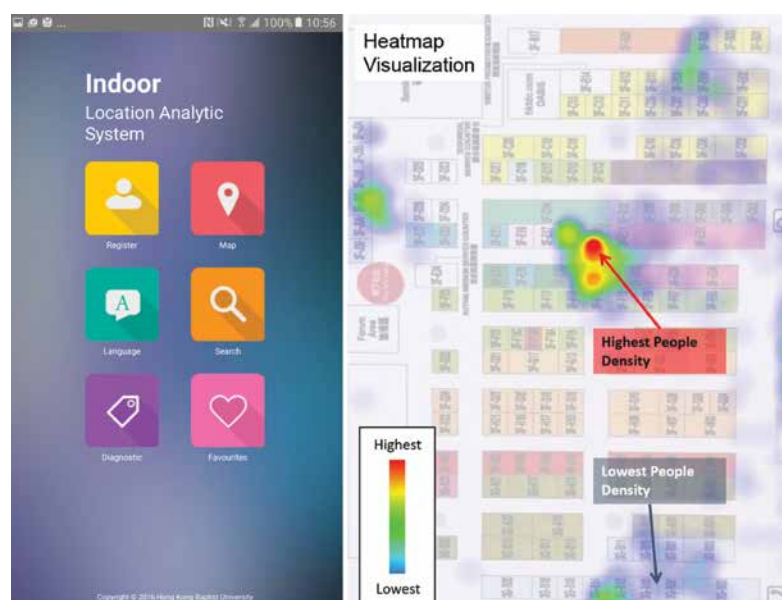
利用高效的路線計算法，把建築物平面圖配對於地圖上。

Computationally efficient algorithm to reduce the estimation time of location. The position estimation time does not increase with the size of the fingerprint model.

系統使用了有效的計算法，減少估計位置的時間。用作估計位置的時間不會隨著指紋模型的擴大而增加。

INDOOR LOCATION ANALYTICS SYSTEM

室內位置數據分析系統

SMART CITY – SMART MOBILITY

智慧城市 – 智慧出行

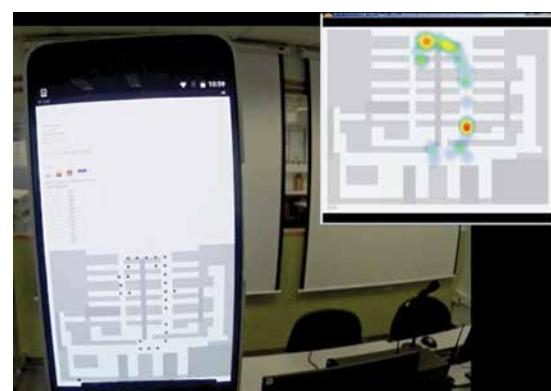### Physical Indoor Location Analytics System for Exhibition and Convention Industries

With limited space available for conventions and exhibitions in Hong Kong, there is a need to maximise efficient usage of the available space within exhibition halls. An Indoor Location Analytics System (ILAS) is developed to determine the dynamic flow of visitors in exhibition centres.

適用於展覽及會議業的室內位置數據分析系統

由於香港的會議和展覽空間有限，需要充份利用展廳內的所有空間。這個室內位置分析系統（ILAS）有助確認展覽中心內參觀者的動態流量。

New technologies to be developed include:

- Wi-Fi-based indoor positioning system
- Femtocell-based indoor positioning system
- Backend location analytics system server
- Location analytics APIs for mobile apps
- Fast calibration system

將研發的新技術包括：

- 基於Wi-Fi的室內定位系統
- 以Femtocell為基礎的室內定位系統
- 後端定位分析系統伺服器
- 供流動應用程式使用的位置分析應用界面
- 快速調校系統
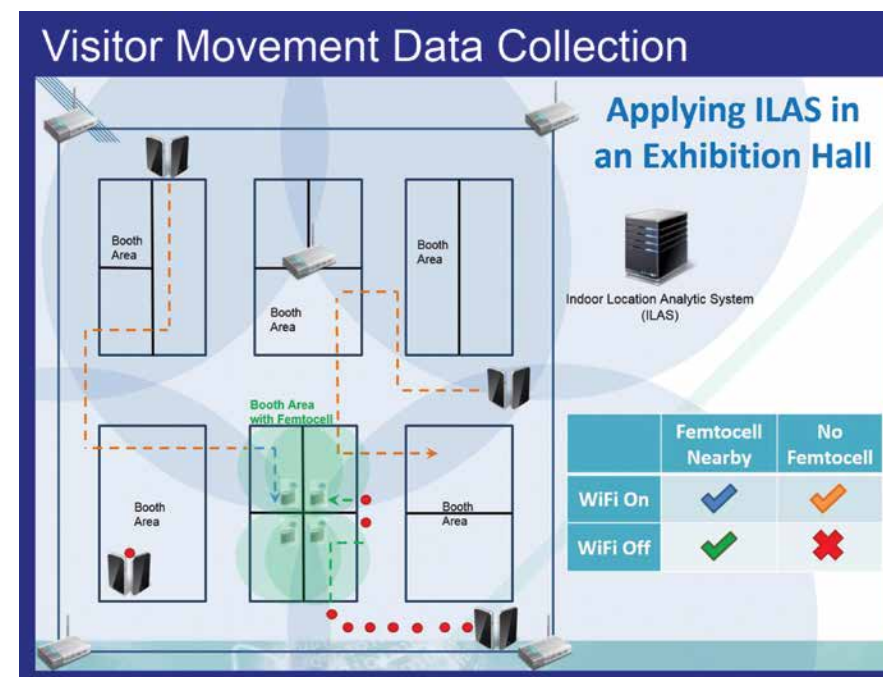
Backend Location Analytics System Server analyses the visitors' movement data and predicts their potential preference using the content-based and collaborative filtering approaches, and to make use of the flow patterns extracted for better booth arrangement for exhibitors, especially in the sub-optimal booth areas.

後端位置分析系統伺服器使用基於內容的協作過濾方法，分析參觀者的移動數據，預測他們的喜好，並利用所提取的流動模式，為參展商提供（特別是在次優的展覽區）更好的展位安排。

INDOOR LOCATION ANALYTICS SYSTEM

室內位置數據分析系統
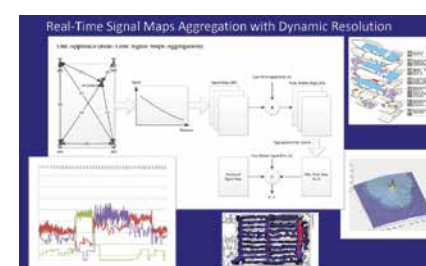
Location Analytics APIs for Mobile Apps is a set of programming interfaces to facilitate the development of Mobile Apps with location-based value-added services used in the exhibition.

位置分析應用程式介面是一組編程介面，有助開發應用於展覽會的位基增值服務流動應用程式。

Fast Calibration System is a trolley equipped with a smartphone as a Wi-Fi signal beacon. It goes around the exhibition hall for fast data collection and calibration of the indoor positioning system.

快速調校系統是一台配備了智能手機收發Wi-Fi信號的手推車。它圍繞展覽廳進行室內定位系統的快速數據採集和調校。
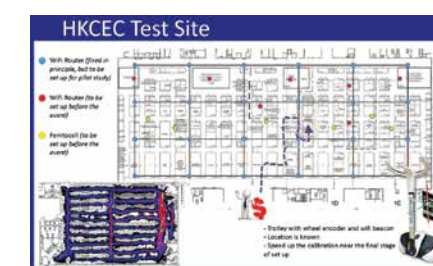
The system has been tested in two real trade fairs organised by HKTDC at HKCEC to evaluate the viability of its deployment.

該系統於香港貿易發展局在香港會議展覽中心舉辦的兩個展覽會進行測試，以評估其實際應用的可行性。

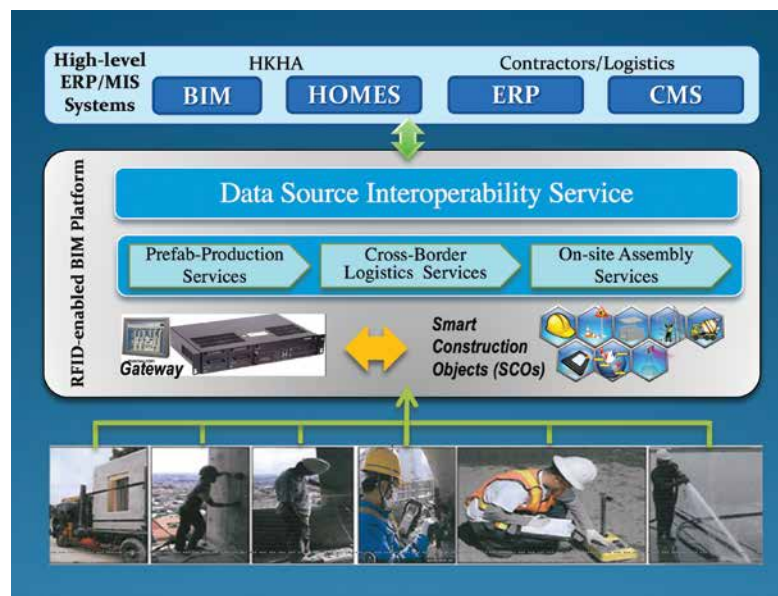# RFID-ENABLED BIM PLATFORM

無線射頻識別建設訊息平台

CONSTRUCTION
建築

### RFID-Enabled BIM Platform for Prefabrication Housing Production in Hong Kong

While Building Information Modeling (BIM) enables better productivity for public housing construction in Hong Kong, data fragmentation and discontinuity hinder its development. With the help of LSCM, an RFID-enabled BIM Platform for Prefabrication Housing Production in Hong Kong was developed jointly by the University of Hong Kong and the Hong Kong Polytechnic University.

基於RFID的香港預製房屋建設訊息平台

BIM有助提高香港興建公共房屋的效率,然而它面對兩個主要的問題,分別是數據碎片化,及操作的間斷性。在LSCM的協助下,香港大學及香港理工大學共同研發了一個基於無線射頻辨識技術的建築訊息(BIM)平台,並己投入本港預製房屋生產之用。
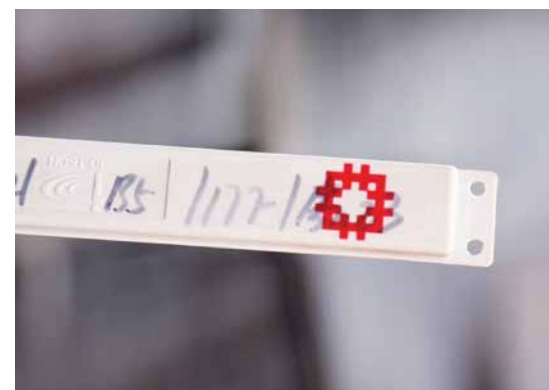
Technologies ready to transfer include:

- System architecture design
- RFID-enabled Building Information Modeling Platform (RBIMP)
- RBIMP Decision Support Services (RBIMP-DSS)

可供轉移的技術包括:

- 系統架構設計
- 支持RFID的建築訊息建模平台(RBIMP)
- RBIMP決策支援服務(RBIMP-DSS)

Three different attributes of the integrated platform include:
(1) seamless communication and coordination among multiple stakeholders through improved information interoperability between processes; (2) more efficient cross-border prefabrication logistics and supply chain management through improving real-time information visibility and traceability; and (3) seamless communication and coordination between the logistics and on-site assembly to enable a Just-In-Time (JIT) housing production.

平台主要涵蓋:(1)無縫溝通和協調多個項目之間的互相操作性關鍵技術;(2)跨境預製物流和供應鏈管理的可視化和可追蹤性技術;(3)透過物流及施工現場的實時溝通和協調,實現及時盤存的生產調節。

RFID-ENABLED BIM PLATFORM
無線射頻識別建設訊息平台

The solution uses RFID for tracking the pre-cast components from prefabrication production and transportation logistics to delivery at the construction site, and installation of the prefabrication components where the tracking data is used for life cycle management of the project. The geo-spatial data collected is then fed into the BIM system.

這個解決方案運用無線射頻辨識技術追蹤預製組件,由組合房屋的配件製造、運輸,以至送達到工地進行組裝,整個過程都需要用到收集到的數據,作整個項目的週期管理。收集所得的地理空間數據會輸入到BIM系統。

The project converts typical construction objects into Smart Construction Objects, using IoT and Cloud technology, which is introduced along with an innovative 'RFID-enabled Gateway' designed and developed for managing the SCOs.

這項目利用物聯網技術及將常見的建築物件轉化成智能建築物件,同時運用雲端技術和創新的RFID網關技術,以管理智能建築物件。

The RFID-enabled BIM platform allows real-time visibility and traceability of prefabricated components and facilitates site management. It also helps bridging the gaps between BIM and HOMES for more efficient and effective project management.
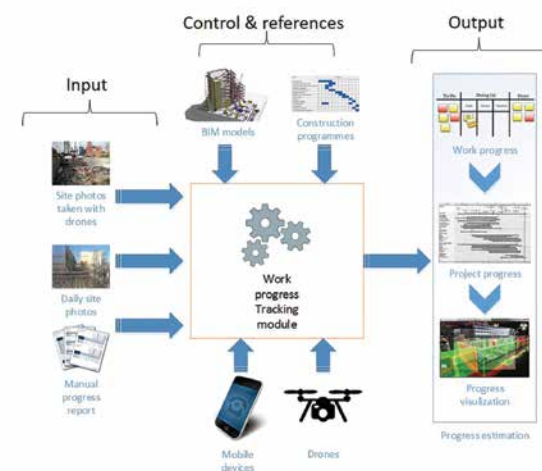
基於無線射頻辨識技術的建築資訊(BIM)平台讓整個建築工程項目可實時地作查察,亦能追蹤組件,以協助工地管理。它亦能填補BIM及HOMES之間的差距,有助提升項目管理的效率與效益。

SMART CONSTRUCTION PLATFORM
智慧建造管理平台

CONSTRUCTION
建築

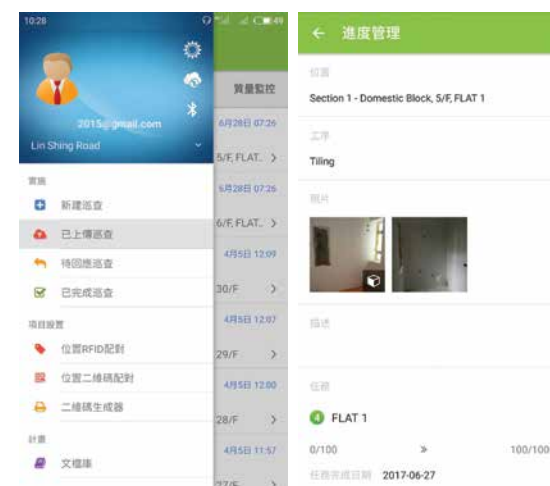## Smart Construction Platform based on Cloud BIM and Image Processing

In this project, a smart construction platform (abbreviated as BIMGLE) is developed by integrating Cloud BIM technology and Image Processing. The platform can enable project stakeholders (including the public) to keep abreast of the progress of a project. The technologies can also mitigate project delays and improve productivity of the industry.

基於BIM雲端和圖像處理技術的智慧建造管理平台

在這個項目中，LSCM透過整合雲端BIM技術和圖像處理，開發了一個智能建築平台（簡稱為BIMGLE）。該平台可以讓與項目有關的單位（包括公眾）可及時了解工程的進展情況。這些技術還可以減少項目延誤，並提高行業生產效率。

Technologies ready to transfer include:

- Smart construction platform based on cloud BIM and image processing for work order generation and management:
  - Δ BIM-based work order generation module
  - Δ Work order information extraction module
  - Δ Work progress tracking module

可供轉移的技術包括：

- 基於BIM雲端和圖像處理的智能建造平台，用於制作工作訂單和管理：
  - Δ 基於BIM的工作訂單制作模組
  - Δ 工單訊息提取模組
  - Δ 工作進度追蹤模組

This technology can systematically extract and transform Building Information Modeling (BIM) objects into a construction management platform according to construction plans. A BIM-based task decomposition and assignment technology enables workers to directly reach BIM information and work instructions, a means of information indexing and retrieval enable workers' convenient and timely access to information relevant to their work, and an image processing tool automatically estimates progress according to BIM models and site photos.

這技術能根據施工計劃，有系統地將BIM資料提取和轉換到另一個施工管理平台中。它是一個基於BIM的工作分配和指派技術，使BIM資訊和工作指令可以直接下達至工人。透過資訊索引和檢索，使工人可以更方便地及時獲得與其工作相關的信息。它可根據BIM模型和現場照片的圖像處理技術，作自動的進度估計。

SMART CONSTRUCTION PLATFORM
智慧建造管理平台

To support location-based progress monitoring, the project planner can define or reuse Location Breakdown Structure (LBS) and Work Breakdown Structure (WBS) in the platform. Then the activities in construction program can be assigned to LBS and WBS. In this way, the work order can be indexed according to location and works.

為了支援位置基礎進度監控，項目規劃人員可以在平台中界定或重新使用位置細分結構（LBS）和工作細分結構（WBS），然後將施工計劃中的活動分配給LBS和WBS。透過這種方式，工作訂單可以根據地點和工程編制索引。

In work progress tracking module, it allows site personnel to record and report work progress using images. A site image recognition engine is developed to automatically recognise and analyse the unsorted images by using the pattern recognition and deep learning technology.

工作進度追蹤模組可允許現場工作人員使用圖像記錄和報告工作進度。項目所開發的工地圖像識別引擎會利用模式識別和深度學習技術，自動識別和分析未分類的圖像。
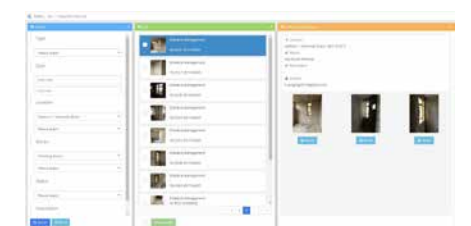
BIM models visualisation provides a progress visualisation platform, so that it facilitates better information-sharing among all project participants through mobile devices and web pages.

BIM模型可視化提供了一個可檢視進度的平台，以便透過流動設備和網頁跟所有項目參與者分享訊息。

IOT MESH
NETWORK AND BIM
物聯網網格
和建築信息模型
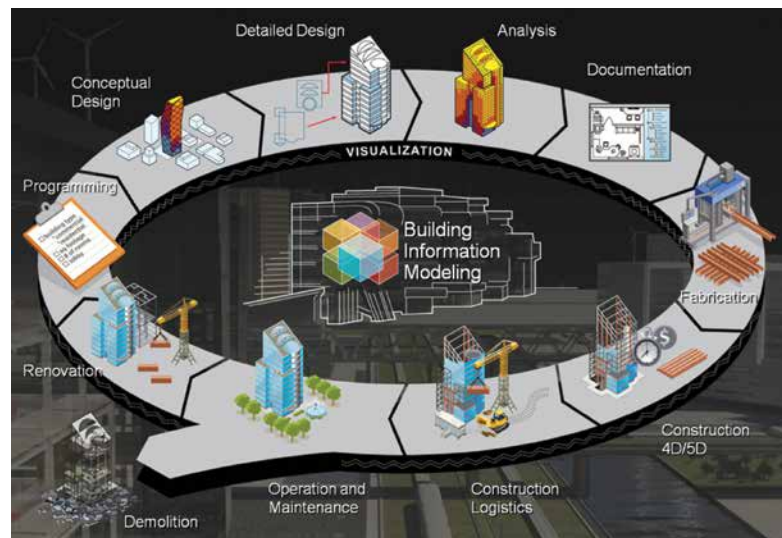
IoT Mesh network and Integrated Semantic knowledge-based BIM for Building Life Cycle Management

In this project, an integrated semantic knowledge-based BIM is adopted and further extended by attaching additional IoT information to the Mechanical, Electrical and Public Health (MEP) components, such that facility management and building analysis can be done in one portal interface.

利用物聯網網格和建築信息模型支援建築生命週期管理

此項目採用了建築資訊模型（BIM），並把額外的拓撲和語義訊息附加到機械、電氣和公共衛生（MEP）組件上，從而令設施管理及建築分析可於同一網站介面完成。

New technologies that will be developed include:

- A semantic knowledge based BIM system for building lifecycle management in the design and construction phase
- A portal of 3D BIM model integrated with Bluetooth beacon and RFID tagged building facilities for facility management

將研發的新技術包括：

- 用於設計和構建階段的建築生命週期管理之帶語義知識庫BIM系統
- 整合了藍牙訊標和RFID標籤的建築設施、適用於設施管理上的3D BIM模型的網站
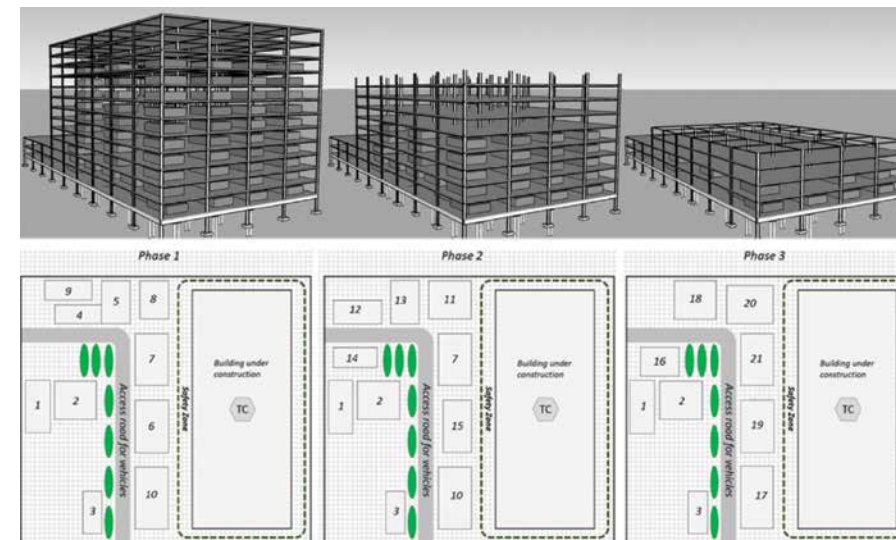
The project extends the current geometric information in BIM by including semantic information to enhance operations in construction and facility management. A novel multi-sensor network based on Bluetooth MESH technology provides updated tagged building facilities spatial location and their associated semantic attributes. Building facility managers can then monitor the maintenance and sensors information via the online BIM portal.

此項目把帶語義的訊息加入到現有BIM的幾何訊息中，以提升建築和設施管理的運作。基於藍牙技術的新型多傳感器網格，可提供已標記的建築設施最新的空間位置及其關聯語義屬性。建築設施管理人員便可透過已連線的BIM網站監控、維修和處理傳感器的訊息。
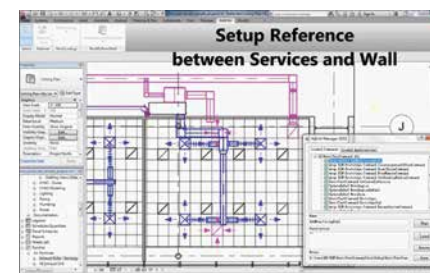
The integration of structural and MEP semantic information in BIM will enhance the quality and information exchange in BIM, leading to more efficient design layout and precise operation in building lifecycle management.

BIM的結構和帶語義訊息之整合可提升BIM質素及訊息交流，從而提升建築生命週期管理的設計及運作。
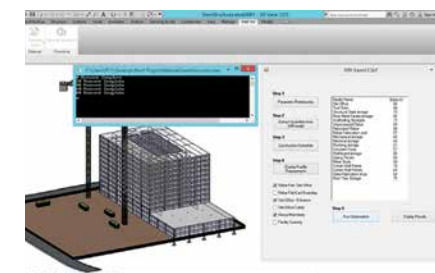
The integration of structural and GIS information in BIM will enhance the spatial planning and project management in building lifecycle management.

BIM的結構和地理訊息系統資訊之整合將改善BIM建築生命週期管理的空間規劃及項目管理。
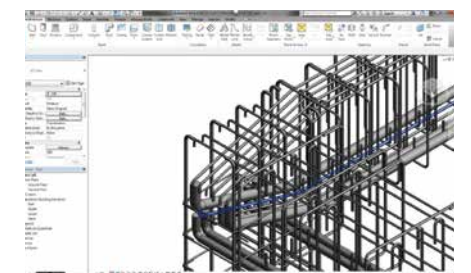
The integration of semantic BIM and sensors information through Bluetooth MESH Technology allows for speedy and accurate building facilities information exchange and control facilities maintenance operations in building lifecycle management.

透過藍牙網格技術整合帶語義的BIM和傳感器信息，從而在建築生命週期管理上，提供快速並準確的建築設施訊息交流，亦可控制設施維修的操作。

REAR RFID ALARM SENSING SYSTEM

無線射頻識別倒車警報系統

Rear RFID Alarm Sensing System for Vehicle in Construction Industry

In response to the accidents caused by reversing vehicles, LSCM has developed a RFID car reverse backup system that provides workers with RFID-tagged work vests and helmets. A RFID sensor system is also installed at the back of each vehicle and heavy-duty machinery, which will send a warning signal to the driver to prevent industrial accident if a worker is behind the car.

應用於工地的實時RFID感應警報管理系統

針對倒車所引起的意外，LSCM開發了一套無線射頻識別倒車警報系統，為工人提供附有RFID標籤的工作背心及安全帽，同時在每輛工車和重型機器的車尾裝上RFID感應系統。如果工人接近工車和重型機器的後方，RFID感應系統就會對駕駛員發出警告訊號，預防工業意外。

Technologies ready to transfer include:

- RFID tag design for safety helmet and reflective vest
- RFID sensing system
- Driver alarm unit design

可供轉移的技術包括：

- 安全帽以及反光背心的RFID標籤設計
- RFID感應器
- 駕駛員警報裝置設計

The RFID Sensing Unit detects the presence of RFID tags nearby and sends the alarm signals to the Driver Alarm Unit. The core components of RFID Sensing Unit are an RFID reader and a 2.4GHz RF transceiver. The RFID reader first broadcasts RF signals, and the nearby RFID tags will respond to it. The signals will be returned to the RFID reader again so that the RFID-tagged safety helmets and the reflective vests can be detected. The RFID reader also communicates with the 2.4GHz RF Transceiver, and sends signals to the Driver Alarm Unit. A Battery Management System in the RFID Sensing Unit provides power for the unit.

RFID感應系統會偵測附近的RFID標籤，並將警報信號發送到駕駛員警報系統。RFID感應系統的核心組件是一個RFID閱讀器和一個2.4GHz射頻收發器。RFID閱讀器首先發出射頻訊息，附近的RFID標籤便會隨之回應，訊號將再次發送到RFID閱讀器，從而偵測到安裝著RFID的安全頭盔和反光背心。RFID閱讀器還會與2.4GHz射頻收發器通訊，並向駕駛員警報系統發送訊號。RFID感應系統中的電池管理系統會為整個系統提供電力。

Since most market available RFID tags are not designed to be worn on human bodies, a specially designed RFID tag is developed and embedded in the safety helmets and reflective vests for construction sites.

由於市場上大多數的RFID標籤並不適合穿戴在人體上，因此需要研發一種特別的RFID標籤，並藏於安全頭盔和反光背心內。

The developed RFID tags are installed in safety helmets and reflective vests. More than one RFID tag is installed because workers approach the vehicle in all directions in construction sites.

RFID標籤將被安裝在安全帽和反光背心內。由於工人在施工地會由不同方向接近車輛，所以需要在安全帽和反光背心中安裝多於一個RFID標籤。

The installation of the RFID Sensing Unit is simple. Strong magnets are used to attach the RFID Sensing Unit on the rear side of the vehicle. Workers can simply fix the unit on the desired position and then turn it on.

RFID感應系統的安裝非常簡單，使用強磁鐵將RFID感應系統安裝在車輛尾部。工作人員只需將設備固定在所需的位置，然後啟動設備。

PROACTIVE CONSTRUCTION MANAGEMENT SYSTEM
主控式建築管理系統

CONSTRUCTION
建築

Location-based Technologies for Real-time Site Safety Management System

In order to reduce site accidents, LSCM and The Hong Kong Polytechnic University have developed the Proactive Construction Management System (PCMS). PCMS can enhance the capacities of workers to detect potential dangers, and provide proactive warnings to avoid accidents.

基於位置實時現場安全管理系統

為了減少工程意外，LSCM和香港理工大學研發了主控式建築管理系統(PCMS)。PCMS可用於提醒工人在建築工地的潛在的危險，並發出主動警報，以避免意外發生。

Technologies ready to transfer include:

- Real-time site safety management system (tracking software, hardware design, customisation and consultancy, etc.)
- Tracking and alerting software
- Tracking and alerting device hardware design

可供轉移的技術包括：

- 工地安全實時管理系統 (追蹤軟件、硬件設計、度身訂造技術和顧問服務等)
- 追蹤及警報軟件
- 追蹤及警報裝置硬件設計

PCMS integrates RTLS with VCS technologies. RTLS includes a series of wireless location tags and anchors. Location tags can be installed on the safety helmet and anchors are designed to be fixed somewhere as reference points. RTLS can calculate the positions by measuring the distances between tags and anchors. With these real-time positions, the system can track workers or moving devices.

PCMS整合了RTLS與VCS技術。RTLS包括一系列無線位置標籤和錨點。位置標籤可安裝在安全頭盔上，而錨點則被固定在某地方作為參考點。RTLS可以透過偵測標籤和錨點之間的距離來計算位置。透過這些實時偵測功能，系統可以追蹤工人或移動設備的位置。

Workers can receive warning signals from PCMS when they are entering dangerous areas, or when they are being threatened by moving devices.

當工作人員進入危險區域，或其安全受到移動設備的威脅時，工作人員可以收到警報信號。

PCMS provides various management functions via websites, such as define dangerous zones, configure anchors, and establish relations between tags and tag carriers.

PCMS還可以透過網站提供各種管理功能，如界定危險區域、配置錨點、建立標籤與標籤載體之間的連繫。

To ensure technical feasibility and robustness of PCMS, we have conducted many trial tests in the real-life projects of Civil Engineering and Development Department (CEDD).

為了確保PCMS技術的可行性和穩定性，此項目已經多次在土木工程拓展署 (CEDD) 的項目中試行。

SAFETY BELT ALARM SYSTEM

安全帶警報系統

CONSTRUCTION
建築

RF tags with sensors are installed in the rope grabs and hooks of the safety belts to detect the engagement status. Real-time safety belt engagement status is transmitted to RF readers installed in the site, so that it can be analysed by a computer program installed in the site server. Whenever a violation situation is found, a form of notification will be given to the worker directly or to a mobile device of their supervisor.

安全帶的抓繩和掛鈎上安裝了帶有感應器的射頻標籤，用以檢測連接狀態。安裝在現場的無線射頻識別閱讀器會接收到實時的安全帶連接狀態，以便透過安裝在現場的伺服器進行分析。若發現違規行為，它會直接向工人或其主管的流動設備發出通知。

Safety Belt Alarm System for Construction Safety

LSCM has developed a real-time sensing system to monitor the engagement of safety belts at a work site. The system will detect any dangerous situations, such as the absence of the lifeline, the irregular positioning of the lock, or the improper engagement status of the hook, and notify the site workers in real time to remind them to properly engage their safety devices.

應用於工地安全的安全帶警報系統

由LSCM開發的實時感應系統，可監察工地內使用安全帶的情況，同時亦能偵測危險狀況，例如：安全繩沒有繫上、安全扣的安裝方向不正確，或安全扣沒有扣上，並即時通知工人，提醒他們正確地繫上安全設備。
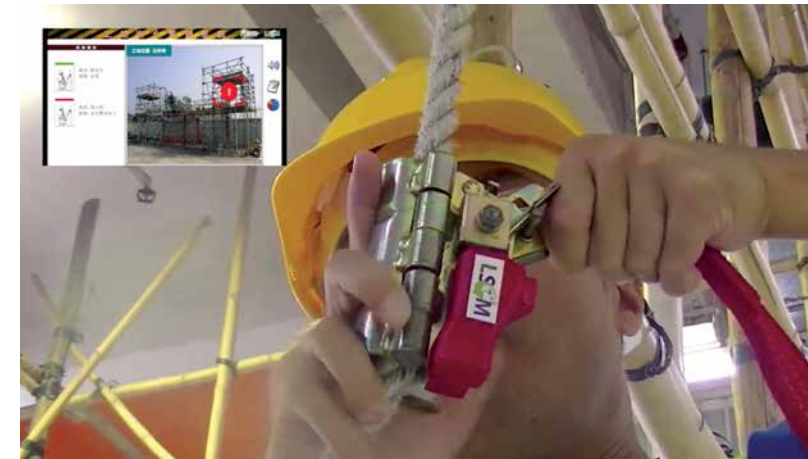
Technologies ready to transfer include:

- Safety Belt sensing tag design
- Reader design
- Monitoring System Software
- Handheld Device Application
- Wireless charger design

可供轉移的技術包括：

- 安全帶傳感標籤設計
- 讀卡器設計
- 監控系統軟件
- 手提式設備應用程式
- 無線充電器設計

In many safety violation situations, workers may unintentionally or deliberately not engage their belts to the lifeline for time saving. The design of the monitoring system is to detect these dangerous situations and to notify the site workers in real-time to remind them to engage the safety devices properly.

在許多違反安全規則的情況，工人可能有意或無意地沒有繫上安全帶上的救生繩，以節省時間。設計這套監控系統的目的是要檢測這些危險情況，並及時通知現場工作人員，提醒他們要繫上安全設備。

CIC has trial used the developed system in some construction sites, so that the system can be tested under different cases and variants of lifeline installation methods.

建築業議會已經在一些建築工地試用了這個系統，讓系統在不同的情況和不同的救生繩安裝方法下進行測試。

SAFETY BELT ALARM SYSTEM
安全帶警報系統

At the 44th International Exhibition of Inventions Geneva held in 2016, LSCM received a Bronze Medal Award for its IoT System for Construction Site Safety.

在2016年舉行的第44屆日內瓦國際發明展上，LSCM榮獲物聯網建築工地安全系統銅獎。

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