Driving Excellence Through

INNOVATIONS & TECHNOLOGIES

創新科技 成就卓越

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Hong Kong R&D Centre for Logistics and Supply Chain Management Enabling Technologies (LSCM R&D Centre)

The mission of LSCM R&D Centre 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.

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

- Location-based Service (LBS) Technologies

- E-Commerce, Logistics and Supply Chain Management
- IoT Technologies
- Health & Community

- E-Commerce, Logistics and Supply Chain Management
- IoT Technologies

- Construction
- Location-based Service (LBS)Technologies

- E-Commerce, Logistics and Supply Chain Management
- IoT Technologies
- ConstructionTechnologies

- Location-based Service (LBS)Technologies
- IoT Technologies
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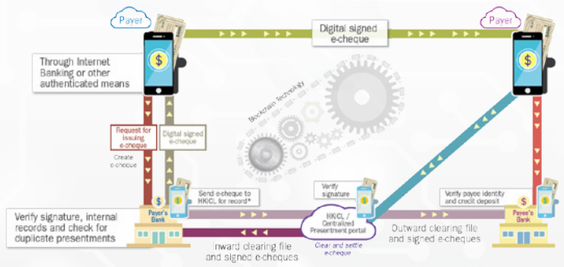
- Health & Community

LSCM Brings Home Three International Awards

At the 45th Geneva International Exhibition of Inventions in 2017, the LSCM R&D Centre has won a Gold Medal and two Silver Medals in the categories of “Computer Science, Software, Electronics, Electricity, and Methods of Communication”.

RFID-enabled Parcel Locker System

IoT Cross-Boundary Fast-Clearance (E-Lock) System



e-Cheque Wallet

香港物流及供應鏈管理應用技術研發中心（簡稱LSCM研發中心）

LSCM研發中心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。

與本地大學聯合研發之創新科技

- 位置基礎服務技術

- 電子商貿、物流及供應鏈管理
- 物聯網技術
- 醫療保健及社會服務

- 電子商貿、物流及供應鏈管理
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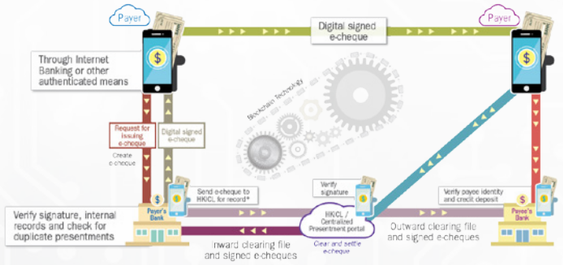
- 建築
- 醫療保健及社會服務

LSCM揚威海外勇奪三項國際獎項

LSCM研發中心研發的三項技術，於2017年舉行的第45屆日內瓦國際發明展中大放異彩，於「電腦科學、軟件工程、電子、通訊工程」類別勇奪1金2銀的佳績。

無線射頻識別 (RFID) 包裹儲物櫃系統

IoT物聯網跨境快速清關（電子鎖）系統



電子支票錢包應用程式

e-Cheque Apps Development Cloud

Hong Kong Monetary Authority has launched e-Cheque since 2015 to replace the need of physical delivery and presentation, as well as enhancing the circulation of credit transfer activities. E-Cheque Wallet applications developed by the LSCM R&D Centre provide a more convenient platform for e-Cheque transactions. In contrast to most e-Wallets that use a traditional centralized ledger, LSCM e-Cheque Wallet utilizes the Blockchain technology which provides a safe and reliable system to eradicate replicated and counterfeit cheque so as to strengthen corporate's confidence on e-Cheque.

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

Technologies ready to transfer include:

- ► e-Cheque wallet components (e-Cheque traceability via Blockchain)
- ► e-Cheque sanity utilities
- ► Encryption & proxy re-encryption API
- ► Key management API
- ► e-Cheque forensic

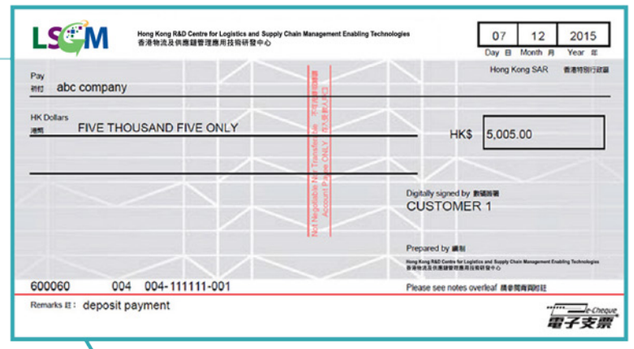
電子支票應用程式開發雲端平台

香港金融管理局自2015年開始推出電子支票，免除實物交收及入票的需要，加快商業上的支付轉賬活動。由LSCM研發中心開發的電子支票錢包應用程式，為電子支票交易提供一個方便快捷的平台。有別於其他電子錢包以中央記帳方式去記錄交易，此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，增強商業機構使用電子支票的信心。

在2017年，電子支票錢包應用程式於日內瓦國際發明展榮獲銀獎。

可供轉移的技術包括：

- ► 電子支票錢包組件（應用區塊鏈技術追蹤電子支票）
- ► 電子支票整理工具
- ► 加密及代理重加密API
- ► 密鑰管理API
- ► 電子支票取證



RFID-enabled Parcel Locker System

In October 2015, the LSCM R&D Centre conducted a research trial with Hongkong Post to assist in the realization of the next generation of mail collection services by developing an RFID enabled parcel locker system. The first generation of iPostal station was launched in May 2016, as a system for providing lockers placed in the community which provides flexibility to the public in collecting large-sized mail at their convenience.

Currently, Hongkong Post has deployed around 12 iPostal stations at various locations within the HKSAR. Promulgation of the new generation of RFID-enabled iPostal Stations by Hongkong Post, with the assistance of the new funding program from ITB, will allow Hongkong Post to better serve the general public. The RFID-enabled Parcel Locker System has won the Gold Medal at the 45th Geneva International Exhibition of Inventions in 2017.

Technical advantages for the new locker box as proposed in this project:

- ► RFID antenna is installed to accurately identify for the right parcel in the right box.
- ► It streamlines the courier's process when he/she feeds the parcel to the parcel locker as the parcel would be automatically identified by the RFID system to the exact box number.
- ► Each box is installed with an RFID antenna at affordable cost. As every parcel has an RFID label attached, the presence of the parcel inside the locker box can be detected in good accuracy.
- ► It is anticipated the proposed locker system can enable improvements to the current workflow by providing valuable information to the management system, whereas such information including: 1）the time of the parcel arrived the parcel locker, 2） the time the postman fed the parcel into the locker, 3）the time the user picked up the parcel, 4) what parcel in which particular locker box, is missing in the existing locker systems.
- ► The parcel status is therefore can be timely and accurately monitored as all the potential status changes can be logged in the system.

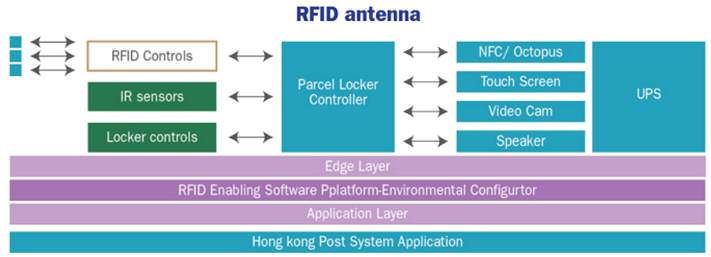
無線射頻識別（RFID）包裹儲物櫃系統

於2015年10月，LSCM研發中心與香港郵政進行試驗研究，協助實施新一代郵件收集服務，開發具備RFID功能的包裹儲物櫃系統－「智郵站」。第一代「智郵站」於2016年5月開始推出，為社區提供儲物櫃的服務，為市民接收大型郵件提供靈活性。

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。此技術在2017年舉行的第45屆日內瓦國際發明展榮獲金獎。

此項目提出有關新包裹儲物櫃的技術優勢：

- ► 已安裝的RFID天線能準確地識別儲物櫃內的包裹是否運送正確
- ► RFID系統能自動識別包裹所屬的儲物櫃號碼，有助簡化送遞包裹的程序
- ► 每個儲物櫃均能以合理成本安裝RFID天線。而由於每件包裹上均貼上RFID標籤，故能準確偵測儲物櫃內包裹的儲存狀況
- ► 此包裹儲物櫃系統為有關管理系統提供重要的資訊，改善目前包裹送遞流程，而目前一般儲物櫃系統並未能提供該等資訊，例如：1) 包裹送遞至儲物櫃的時間；2) 郵差將包裹放置於儲物櫃的時間；3) 收件人到取包裹的時間；4) 指定儲物櫃內所存放的包裹資料
- ► 此系統能記錄送遞過程所發生的任何情況，故能適時及準確地監控整個包裹送遞過程



System block diagram

SHIELD - Critical Infrastructure Protection in Hong Kong

The objective of this project is to provide a platform for information sharing among different key stakeholders in the prevention of cyber-attacks, by facilitating the sharing of intelligence, and simulating cyber-attacks for the purpose of providing drills. Being the last leg in the supply chain, the retail sector is the contact point between goods manufacturers and their end-customers. As more retailers move towards offering online shopping to their customers, their e-Commerce websites are prone to security risks. The most common threat is from DDoS attacks where attackers will initiate heavy traffic to cripple and bring down e-Commerce websites.

The SHIELD project 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 sanitizes 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 sanitized data. The Hong Kong Police established the Cyber Security Centre in December 2012 with the purpose to strengthen the cyber defense of Hong Kong and the SHIELD system allows the Police and industry members to receive alerts on potential cyber-attacks and to conduct respond to threats from cyber-attacks in a timely manner. The technology aims to help all related stakeholders to be better prepared for potential cyber-attacks, and improve the response time when facing these attacks in Hong Kong.

Technologies ready to transfer include:

- ► The SHIELD platform, providing a training ground for expertise development in Hong Kong
- ► A vanilla version of the SHIELD for the retail industry and/or critical infrastructure suppliers

神盾計劃

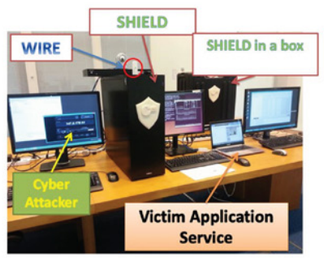
此項目的目標是為業內提供一個網絡攻擊方面信息共享的平台，特別是信息和情報共享以及網絡攻擊操練的實施。作為供應鏈的最後一站，零售業是商品製造商及其最終用戶之間的聯繫點。隨著越來越多的零售商為他們的客戶提供網上購物服務，他們的電子商務網站很容易出現安全隱患。最常見的威脅是DDoS攻擊，攻擊者將發出大規模流量導致電子商務網站癱瘓，並最終擊垮它。

神盾計劃項目包括以下3個部分：1）我們將搭建一個智能盒，稱為神盾（攻擊和入侵的智能誘捕及合法檢測），以進行智能數據包過濾；2）我們將基於密碼學模型，對智能盒收集的信息進行清理，從而保護數字取證調查過程中的數據隱私；3）我們將使用網絡攻擊剖析模型對第二步中清理後的數據進行調查。在2012年12月，香港警方建立了網絡安全中心，目的是加強香港的網絡防禦。當網絡攻擊來臨時，神盾計劃系統將向執法機關和業界發出預警，並進行快速應急回應。所開發的技術可以幫助所有業內人士對潛在的網絡攻擊做更充分的準備，並在香港面臨網絡攻擊時，提高警覺以及時應對。

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普通版本的神盾計劃

The SHIELD



SHIELD testbed with attacker, Smartbox and victim

eCommerce, Logistics and Supply Chain Management
電子商貿、物流及供應鏈管理

A Virtual Reality (VR) System for Strategic Operations Training

This project addresses the important issue of training high-level management and technical professionals in making timely strategic decisions for critical operations, with a particular emphasis for the logistics and services sectors. The integrated virtual reality-empowered platform provides the capability for professionals to experience the life-like scenarios of complex operations and virtually interact dynamically with such an environment, while having their activities and behaviors recorded for analysis, either in real-time or following completion. The technologies of virtual and augmented reality together with real-time motion capture are deployed with an artificial intelligence-based behavior profiling algorithm developed to achieve dynamic scenario creation and visualisation, user skills profiling and performance evaluation in completing these critical operations. This project provides a fully immersive and automatic cave-like virtual environment featuring the aforementioned capabilities, which can be delivered in a cost-effective manner for training and evaluating the decision-making and high-order skills of professionals.

The developed virtual reality training system represents a state-of-the-art design that capitalizes on virtual reality technology using artificial intelligence methods to deliver an integrated system that creates a versatile and reconfigurable, interactive and immersive training environment that readily supports evidence and discovery-based training in operations planning and decision making.

Technology ready to transfer include:

- ► VR-empowered training systems that correspond learning management systems for managing and supporting the domain specific training activities

虛擬實境系統之應用 - 策略及實踐培訓

此項目旨在培訓高級管理和技術人員，特別是在物流和服務部門，適時地作出關鍵性的戰略決策。這平台結合了虛擬實境，讓專業人士在栩栩如生的場景內體驗複雜的操作，並跟動態的環境互動，系統會把他們的活動記錄下來，然後作出實時的分析。虛擬實境、擴增實境和實時動作捕捉技術乃是建基於人工智能的行為分析計算法，建立動態方案和將它可視化，讓用戶在完成這些重要的操作後能獲得技能分析和表現評估。這項目完全沉浸在一個洞穴式的自動虛擬環境，能對專業人士在決策和高階技能的培訓和評估上，提供一個嶄新而具有成本效益的解決方案。

這套虛擬實境訓練系統，展示出一套運用了虛擬現實技術與人工智能的先進設計，創造了高性價比、多功能和可重置的互動培訓環境，支援以實證和發現為基礎的作業規劃和決策培訓。

可供轉移的技術包括：

- ► 由虛擬實境建立，符合管理和支援特定領域培訓活動的學習管理系統

Video Analytics for Baggage Trolley Availability Monitoring and Management at Hong Kong International Airport

This real-time video-based trolley availability monitoring system has been jointly developed by the LSCM R&D Centre and The Chinese University of Hong Kong. It is now fully deployed in the Baggage Reclaim Hall at Hong Kong International Airport. This research project uses artificial intelligence technologies to turn video imagery of baggage trolley pickup points into trolley availability data in real-time. The project also develops a trolley availability monitoring system to disseminate up-to-date trolley availability statuses via a mobile application to frontline staff. The system is to ensure sufficient trolleys are available for passengers to use.

When the number of trolleys in a pickup point drops below a certain level, the system will notify frontline staff via the mobile app. The system reduces the number of required staff and the frequency to patrol all the pickup points distributing over a large floor space. It also helps frontline staff effectively replenish trolleys. The goal is to improve the quality of passenger services by ensuring trolley availability. The computed results from image analysis technology are not perfect at all. The trolley detection rate was about 87% at the early R&D stage. Through the continuously collected image data, the detection rate was able to be improved to about 92% at the end of 2016 after progressively applying corresponding machine learning technique. Since then, the system has been automatically computing numbers of trolleys over all 18 pickup points in real-time for the entire Baggage Reclaim Hall.

This trolley availability monitoring system does not require any equipment installation on any baggage trolley. This saves corresponding one-time installation procedure as well as long-term maintenance management. Via artificial intelligence technology, the system is able to extend its capability to detect other baggage trolleys of different sizes or models. Thus, Hong Kong International Airport has carried out a plan starting in 2018 to gradually extend the video-based trolley availability monitoring system to cover other trolley pickup points in arrival and departure halls.

New Technologies that will be developed 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

應用於香港國際機場之行李車供應監控及管理的影像分析技術

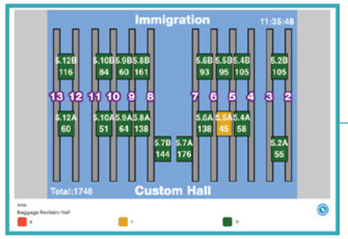
由LSCM中心與香港中文大學合作研發的實時視訊監察行李車供應系統，現時已全面應用在香港國際機場整個行李認領大堂內。這項目運用人工智能技術，開發了一個視訊監察行李車供應系統。此系統把行李車領取點的視訊影像，即時轉化為行李車數量數據，使前線員工實時掌握使用情況，為旅客確保有充足的行李車供應。

當領取點的行李車數量跌至一定水平時，系統便會透過手機應用程式即時通知前線員工。它不但減省巡查人手和次數，而且有助員工更有效地補充行李車，以確保行李車數目足夠，改善為乘客提供行李車供應服務的質素。雖然圖像分析技術並非完美，研發初期行李車偵測的準確率是87%，但利用不斷收集的圖像數據，進行遞進式的機械學習，在2016年底提升至92%。現時此系統實時為整個行李認領大堂全部18個行李車領取點，自動計算出行李車數目。

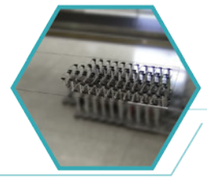
由於這監察系統並不需要在行李車上安裝任何設備，可省卻相關的安裝工序，以及連帶的長遠維修管理。而透過人工智能技術，系統可擴充至偵測不同大小和型號的行李車；因此，香港國際機場已落實計劃，把視訊監察行李車供應系統，於2018年逐步擴展至到港和離港層的其他行李車領取點。

將開發的新技術包括：

- ► 機器學習為基礎的影像目標物件檢測系統組件，應用於檢測各類資源類型，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



Bird's eye view of real-time trolley availability in Baggage Reclaim Hall
行李認領大堂行李車供應實時鳥瞰圖



Number of trolleys detected for a specific trolley pickup point at a particular moment
在某一刻於一個行李車領取點偵測到的行李車數目

eCommerce, Logistics and Supply Chain Management
電子商貿、物流及供應鏈管理

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. This solution avoids the pitfalls endemic to conventional anti-counterfeiting methods and powers a reliable and trusted authentication platform that can even 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 low-impact integration into existing user infrastructure.

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.

Technologies ready to transfer include:

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

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核證科技，使供應鏈上的使用者安全地核證產品，確保產品由生產地運送至零售點的可信性。此技術減少了傳統防偽方法的漏洞，提供一個可靠及可信的核證平台，不但可透過第三方經營的閱讀器作核證，即使在互聯網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。

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

可供轉移的技術包括：

- ► LSCM「認」真「析」貨®系統（追蹤軟件、硬件設計、度身訂造技術和顧問服務等）
- ► 產品核證主機軟件
- ► QR碼、UHF RFID及NFC手機應用程式

E-Lock Based Enabling Technology for Container Cargo Transshipment Process

Since November 2012, the LSCM R&D Centre has assisted Hong Kong Customs in the trial of the "Single E-lock Scheme" with Mainland Customs set out to interconnect the Hong Kong Custom's Intermodal Transshipment Facilitation Scheme (ITFS) with the Speedy Customs Clearance (SCC) of the Mainland Customs. Under the scheme, the processing time of customs clearance of registered trucks at land boundary control points can be reduced by up to two hours.

Over the years, the scheme has been extended to 32 clearance points in Guangdong province including Guangzhou Nansha Free Trade Zone, Jiangmen International Electronic Commerce Express Mail Sorting Clearance Centre, as well as Air Logistics Park of Guangzhou Baiyun International Airport and Bao'an International Airport, including the 12 clearance points in Hong Kong, 384 express intermodal transportation routes are offered. As of February 2016, the scheme has been on trial for more than 8,400 times, with over 2.55 million consignments being handled. Since the official launch of "Single E-lock Scheme" in late March of 2016 by both Customs authorities, the IoT Cross Boundary Fast-Clearance developed by the LSCM R&D Centre has made customs clearance between Hong Kong and Guangdong more convenient and efficient.

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

Technologies ready to transfer include:

- Web-based application system (E-Lock and vehicles tracking platform (GPS, GPRS, Wi-Fi communication technologies), E-Lock controller and consultancy)
- Vehicle tracking platform (supports GPS, GPRS, Wi-Fi and active RFID locating)
- E-Locks controlling system (supports multiple E-Lock vendors)
- Cross Boundary One E-lock Control Store Architecture (supports multiple control processes in one E-Lock)
- End-to-end Security Framework (supports secure locking/unlocking operations across public internet)

針對集裝箱貨物轉運流程的電子關鎖應用技術

由2012年11月開始，LSCM研發中心協助香港海關與內地海關合作試行「跨境一鎖」計劃，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，令計劃下的車輛可節省多達兩小時陸路口岸查貨時間。多年來，計劃已伸展到廣東省32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、廣州機場及深圳機場海關物流園等，加上香港12個清關點，共提供384條聯運快線，截至2016年2月，已累積超過8,400次試行，以及處理255萬多票貨物。隨著粵港海關於2016年3月底正式推行「跨境一鎖」計劃，由LSCM研發中心研發的IoT快速通關安全系統，令粵港物流的清關更方便快捷。而電子鎖技術更在2017年舉行的第45屆日內瓦國際發明展中獲得銀獎的佳績。

可供轉移的技術包括：

- 網絡應用系統（電子鎖和車輛追蹤平台（全球定位系統（GPS）、GPRS、Wi-Fi）、電子鎖控制器和顧問服務）
- 車輛追蹤平台（支援GPS、GPRS、Wi-Fi和有源無線射頻識別（RFID）定位）
- 電子鎖控制系統（支援不同的電子鎖供應商）
- 跨境一鎖架構（支援不同地區電子鎖應用流程集於一鎖之中）
- 端到端安全架構（支援電子鎖的安全操作於互聯網）

eCommerce, Logistics and Supply Chain Management
電子商貿、物流及供應鏈管理

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

Utilising the power of passive UHF technology, the Centre's advanced arrival notification system is able to monitor and identify vehicles travelling at high speed from a distance. Compared with the more traditional application of semi-active or active RFID technologies, this technology can provide a lower cost alternative with a lower maintenance requirement.

Our technology is already installed on 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 from the Centre's improved system 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.

Technologies ready to transfer include:

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

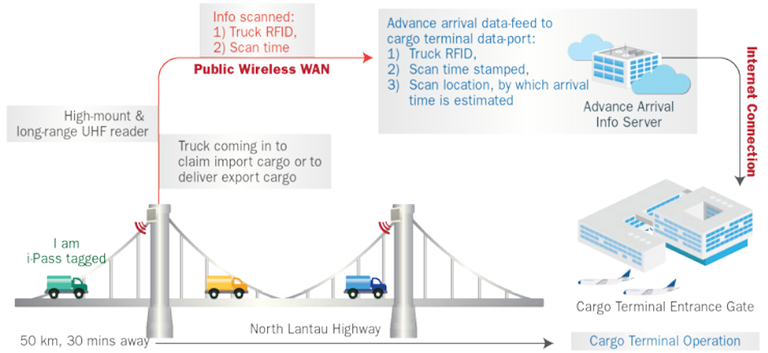
應用於香港機場空運貨站的貨車抵達預報系統

由本中心利用無源超高頻（UHF）射頻識別技術研發的抵達預報系統能監察及遠距離確認高速經過的貨車。相對傳統的半有源及有源RFID技術，這項技術不但令成本更低，同時使系統的保養更簡易。

此項技術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能加強停車位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。

可供轉移的技術包括：

- 抵達預報系統（追蹤軟件、硬件設計、度身訂造技術和顧問服務等）
- 追蹤及預報軟件系統
- 無線射頻識別標籤及硬件設計



SMe-Plug System for Logistics e-document Exchange with Service Platforms

The SMe-Plug software system is a light weight system designed to work in the computing environment of small and medium enterprises (SMEs) for handling e-document based communication with logistics service platforms such as airlines, terminals and sea liners. It facilitates SMEs to connect to these logistics service platforms with minimal effort and cost. The system can also help software developers to quickly connect to and make use of the services of these logistics service platforms.

SMe-Plug provides a framework for software developers to integrate reusable components to form their own specific solutions to cater for the problems faced by different SMEs. Moreover, it eases the integration work of SMEs' internal ERP system with logistics service platforms and operators.

Currently, electronic air waybill and selected ocean container transportation electronic documents are supported.

It provides the following features:

- ► E-document storage and exchange for storing of commonly used document templates (such as e-AWB)
- ► E-document mapping and conversion for easy conversion from SME's proprietary data into platform-compliant standard format (e.g. EDIFACT)
- ► Reusable access modules for connection / re-connection to logistics service platforms
- ► Model e-documents for daily SME operations for fast deployment
- ► User Interfaces for E-document review and modification for easy maintenance
- ► Pluggable software interface for easy system extension by third party software system integrators

中小企適用的電子平台轉插軟件

「中小企適用的電子平台轉插軟件」是特別為中小企的電腦環境而設計，用於處理不同物流平台之間的電子文件提交及轉換。此軟件可協助中小企以最少資源及成本連接到不同的物流平台如空運，碼頭及船運，以及讓軟件開發人員可以更有效及快速地開發連接到不同物流平台的應用軟件。

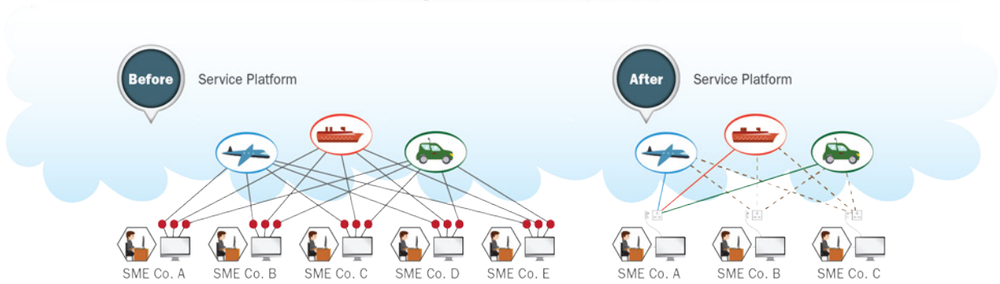
「中小企適用的電子平台轉插軟件」提供一個應用程式框架以讓軟件開發人員開發可重複使用的元件，以對應不同中小企所面對的問題而提供特定的解決方案。此外亦簡化了中小企內部的ERP系統、物流平台以及營運商之間的系統整合。

現在系統已支援空運提單以及遠洋貨櫃運輸的電子文件轉換。

產品特點：

- ► 提供常用文件格式儲存及轉換，如電子空運提單
- ► 提供文件轉換功能，可把中小企內部的電子文件轉換成兼容不同平台的標準格式，如EDIFACT
- ► 提供可重複使用的連接模組，可連接到不同的物流平台
- ► 可以為中小企日常運作有效及快速地制定新的文件格式
- ► 使用者介面提供審查和修改功能，可以更有效地處理電子文件
- ► 提供軟件開發界面給第三方軟件開發商，方便進行系統擴展及整合

SMe-Plug and Connectivity Model



Container Management System

The Centre's container management system makes use of active RFID technologies for the monitoring of containers transported by way of inland water shipping. The system can be easily integrated into other systems such as a feeder management system. Functions of the system include gate-in and gate-out monitoring, damage recording and stay time recording. The system is able to support both fixed and handheld RFID readers during operation and provides container management services for feeder operators.

Technologies ready to transfer include:

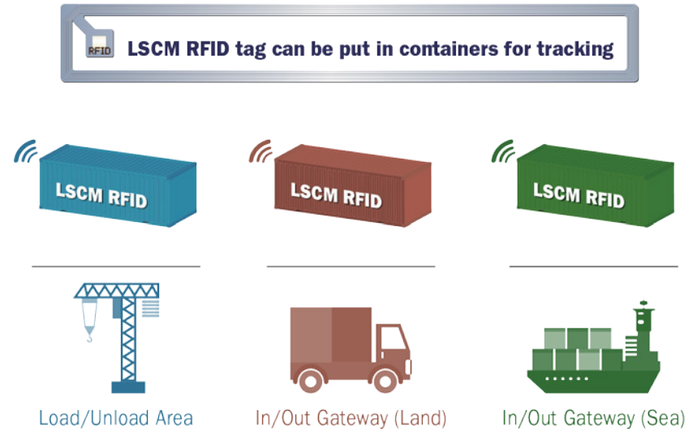
- ► Container management system (software, hardware design, customisation and consultancy, etc.)
- ► Active RFID tag / reader design

貨櫃管理系統

此貨櫃管理系統利用有源RFID技術，監測內河運輸的貨櫃，並能簡易地結合其他系統，如駁船管理系統等。系統的其他功能包括：進閘與出閘的監測、貨櫃損壞的記錄及停留時間的記錄。此系統在操作時可支援固定及手持式RFID閱讀器，為駁船營運商提供貨櫃管理服務。

可供轉移的技術包括：

- ► 貨櫃管理系統（軟件、硬件設計、度身訂造技術和顧問服務等）
- ► 有源RFID標籤 / 閱讀器的設計



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

This real-time sensing system was jointly developed by the LSCM R&D Centre and The Chinese University of Hong Kong. It costs ten times lower than those existing and commercially available systems and is now used in Hong Kong Museum of History and Hong Kong Film Archive.

The new 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.

This new technology offers potential advantages comparing to the traditional system on its compact size, pluggable configuration and ease of use. The new 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. 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. The power consumption is low, which the battery can last for about six months. Thanks to the ease of installation and operation, LCSD Conservation Office initiated the planning and setup of the system for the Special Exhibition of "Western Scientific Instruments of the Qing Court" from June to September 2015. The system helped monitor the exhibition environment for the national treasures displaying in Hong Kong Science Museum.

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

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

LSCM研發中心與香港中文大學合作研發的實時文物監察系統，其成本比市面上的系統低於十倍，現時已局部應用在香港歷史博物館和香港電影資料館內。

新的傳感系統由硬幣般大小可插拔的傳感器、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小時監控個別擺放了珍貴文物的展櫃溫度、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，系統將會發出響聲提醒用戶。

這項新技術比傳統系統小巧輕盈，裝置可隨便插拔，十分易用。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。這部體積細小、可插拔的傳感器，讓展覽設計師既兼顧到展覽品的美觀性，又能在不礙觀賞的情況下監測環境。它的耗電量少，電池可用上半年左右。由於傳感監察系統由安裝至運作皆簡易，康樂及文化事務署的文物修復辦事處自行在香港科學館架設系統，為二零一五年六月至九月的「西洋奇器清宮科技展」專題展覽，監察國寶級展品的展覽環境。

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

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Integrated Community-based Microblog Recommendation System (INCOMIRS)

The ability to accurately locate target customers from the Internet is undoubtedly important for e-commerce nowadays. An effective way to do so is to analyze 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. While recommendation system is very much on the agenda for many marketers, it mainly focuses on the interests of individual users and neglects the interest of communities.

In this project, an effective community-oriented microblog recommendation system will be developed — it jointly considers microblog's importance and individual users' interests. By adopting both quantitative and qualitative evaluations, this project will bring new insights on how to develop a highly reliable recommendation system.

New Technologies to be developed include:

- Integrating community engagement data into recommendation.

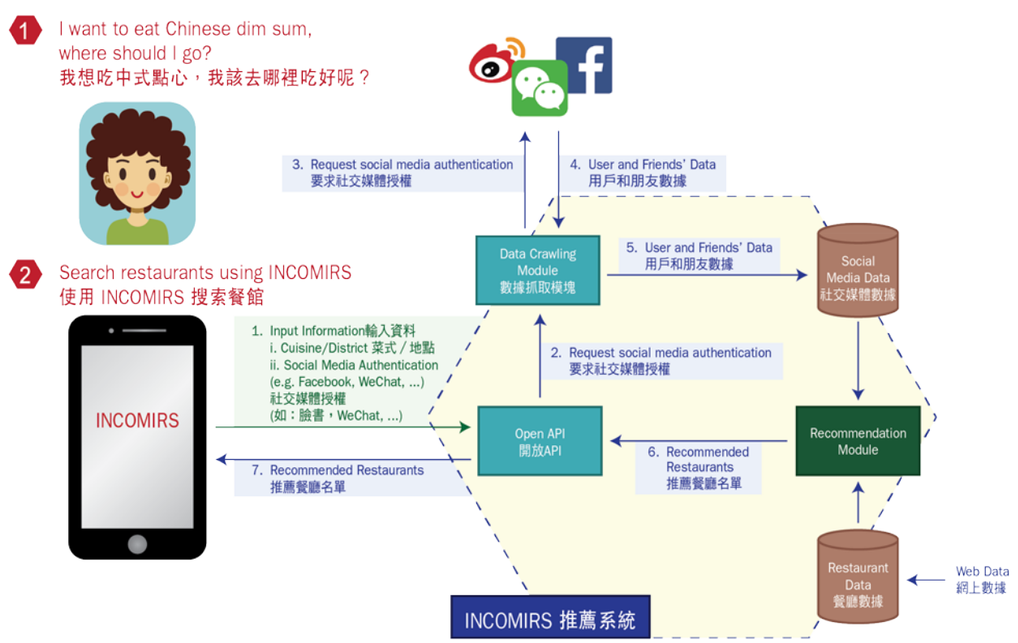
以綜合群組為基礎的微博推薦系統

能夠從互聯網準確鎖定目標客戶無疑對電子商務非常重要，一個有效的方法是分析微博等微網誌的數據。通常具有共同興趣的人會組成群組，通過確定群組的喜好，我們可以更精確地為客戶定位。雖然推薦系統對於許多營銷人員來說是非常重要，但它往往只顧及個人用戶，而忽視了社群的喜好。

這個項目旨在開發一個有效而面向社群的推薦系統-共同考慮微博的重要性和個人用戶的喜好。通過定量和定性評估，這項目將為如何開發高度可靠性的推薦系統帶來新的突破。

將開發的新技術包括：

- 將群組參與數據整合成為推薦系統。



Baby Tag and the Baby Tracking Management Control System

The Centre's Baby Tag System is an integrated system using active radio communication technologies to effectively track babies and children patients in hospital environment. It provides protection to new born babies against abduction by raising visual and audio alert when unauthorized movement of new born babies or attempt in tampering of the tag has been detected. Nurses of the ward can monitor the whereabouts of babies and children patients easily using the online Nurse Station of the system. Full time monitoring features are supported by a radio communication system covering the whole ward. Warning alerts will be raised immediately even when the tag is damaged in an illicit attempt.

Technologies ready to transfer include:

- ► Physical product design of tracking tag for baby (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

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環境而設計的實時追蹤系統。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離開的風險。

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

Health and Community
醫療保健及社會服務

Active RFID System for Equipment and Personnel Tracking

The Centre's active RFID tracking system is able to enhance hospital risk management in the prevention and control of hospital-acquired infections as well as enhancing preparedness for dealing with infectious disease outbreaks, by using a low-cost, position-able active RFID technology for personnel and asset tracking in an indoor environment.

RFID traceability technologies can be leveraged to strengthen patient care by providing information for back-tracing the spread and source of infections, real-time tracking of patients' whereabouts, and continuous monitoring of the health status of patients.

Technologies ready to transfer include:

- ► Active RFID system (software application, hardware design, customisation and consultancy, etc.)
- ► Active RFID tag design (assets tag, wristband tag, etc.)
- ► Active RFID reader design
- ► Positioning software with triangulation engine
- ► Assets and personnel tracking system (indoor)

追蹤醫療設備及病人的有源無線射頻識別（RFID）系統

此技術採用成本較低的有源RFID系統以追蹤醫院內的病人及設備，有助加強醫院的風險管理，亦能有效預防和控制醫院內的感染及防範傳染病爆發。

RFID溯源技術可提供追溯感染源頭和傳播途徑的資訊、實時追蹤病人的位置及持續監測病人的健康狀況，藉以加強病人護理。

可供轉移的技術包括：

- ► 有源RFID系統（應用軟件、硬件設計、度身訂造技術和顧問服務等）
- ► 有源RFID標籤設計（設備標籤、手帶標籤等）
- ► 有源RFID閱讀器設計
- ► 三角定位軟件
- ► （室內）設備及病人追蹤系統

RFID Technologies for Safeguarding Elderly from Accidental Wandering

Advocated and supported by Tung Wah Group of Hospitals - Wong Cho Tong District Elderly Community Centre, the Centre offers an RFID solution that can detect the in / out status of Alzheimer's patients when they wander away from their care premises. Elderly wearing the vests with built-in RFID tags will be detected automatically in case the elderly wander away from the homes or centres without permission.

Before use, staff of the homes or centres will register the information of each vest using a RFID reader. Antennas are installed at the main exits in order to detect the RFID signals from the RFID tagged vest. If elderly wearing the RFID tagged vest leaving the 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. This technology provides more effective control comparing to manual observation and can release the pressure of the caretakers in looking after the elderly. In addition, the user interface of the system is simple and easy to use, therefore it does not require much training for the staff.

Technologies ready to transfer include:

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

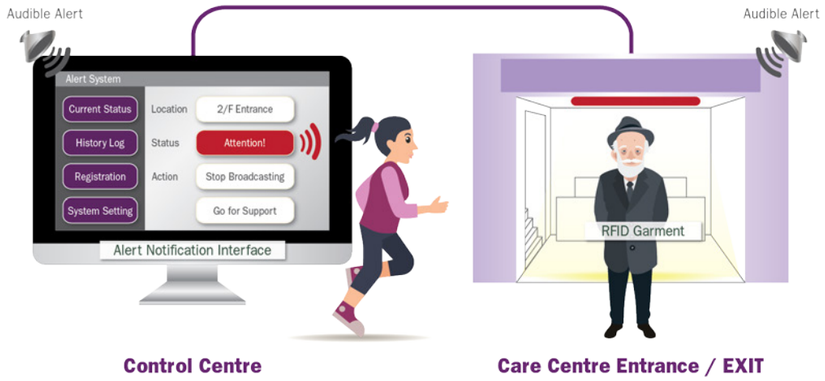
適用於長者監控的無線射頻識別（RFID）技術

在獲得東華三院黃祖棠社區服務中心的倡導和支持，本中心開發了RFID解決方案，感應腦退化症患者進出護理場所的情況。穿上內置RFID標籤外套的長者若有走失或擅離院舍，護理人員可以即時知道，然後把他們找回。

在使用這系統之前，中心的職員先透過閱讀器登記每件背心的標籤資料，這樣系統便可感應每位長者的位置。在中心出入口的位置安裝了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長者離開。這系統比以往單靠人手監察長者遊走更有效，亦能減輕院舍/中心職員在照顧長者上的壓力。此外，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。

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



GPS Locationing Technologies for Assisting Caretakers in Locating Missing Elderly Persons

To improve the quality of life of the elders, the Wong Cho Tong Social Service Centre of Tung Wah Group of Hospitals provides community support services and organises outings and social activities for the elderly. In order to prevent the seniors from lost during the outdoor activities, the social service centre makes use of GPS locationing technologies developed by the Centre to enable the monitoring of each individual's location.

Technologies ready to transfer include:

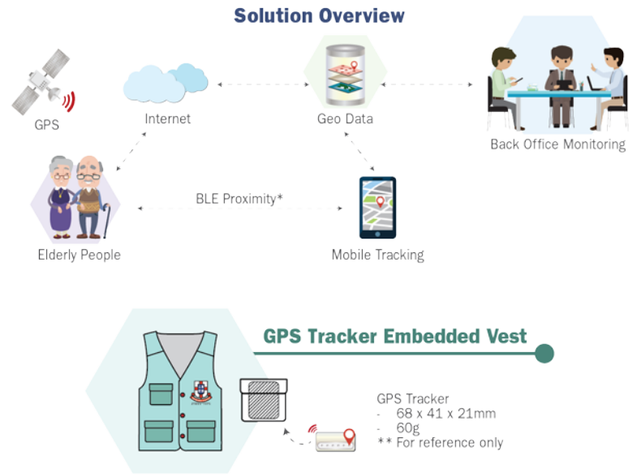
- ► Elderly Tracking Application Platform Software Modules
  - ◇ Elderly Tracking Core Web User Interface Module & Core Backend Application
  - ◇ Elderly Tracking Web API Module
  - ◇ Elderly Tracking Sample Mobile App
  - ◇ Geo-fencing Module
  - ◇ Activity History Module

適用於追蹤長者位置的全球定位系統（GPS）定位技術

為了改善長者的生活質素，東華三院黃祖棠社區服務中心向長者提供社區支援服務及組織郊遊和社交活動。為了防止長者在戶外活動期間迷路，社區服務中心利用由本中心研發的GPS定位技術作監控。

可供轉移的技術包括：

- ► 長者追蹤應用平台軟件模塊
  - ◇ 長者追蹤核心網頁用戶界面模塊和核心後端應用程式
  - ◇ 長者追蹤網頁API模塊
  - ◇ 長者追蹤示例手機應用程式
  - ◇ 地質圍欄模塊
  - ◇ 活動歷史模塊



RFID Blind Cane Navigation System

In Hong Kong, visually impaired faces various obstacles when travelling either indoor or outdoor. Although visually impaired can be guided by walking canes, blind guiding tiles and braille guiding facilities through training, their social circle is still limited by the lack of audible or braille guiding facilities for location or navigation information, such as name of the streets and house number, available facilities and directions, etc. Also, traditional guiding tiles can only provide guidance with the tactile paving, visually impaired can still easily get lost at a junction point.

The LSCM R&D Centre developed a Blind Cane Navigation System for the visually impaired. With RFID technology and audio navigation, the system provides guidance to the visually impaired and leads them to their destination by the shortest route. 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. The system was awarded the Gold Medal with Congratulations of the Jury at the 44th Geneva International Exhibition of Inventions in 2016. Barrier Free Access (HK) Limited, a wholly-owned subsidiary of The Hong Kong Society for the Blind, has also started the relevant business to offer full-set of service backing the RFID Blind Cane Navigation System. It is expected that the technology can be applied in places like shopping centres, public housing estates and streets in the near future.

New technologies that have been developed include:

- ► RFID Cane Reader Design
- ► Smart Navigation Mobile App for use with the RFID Cane Reader

New technologies that will be developed include:

- ► 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

無線射頻識別（RFID）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障礙。他們雖然可以學習使用盲人杖、盲人磚和盲文導向設施，然而他們的生活圈子仍然會受現時話音或盲文導向設施提供的導向資料（如街道名稱和號碼、設施和方向等）不足而受到限制。而傳統的導盲磚只能引導視障人士跟着有凹凸紋的道路行走，當視障人士到達分岔路口時，就沒法判斷應走向哪個方向。

LSCM研發中心研發了一套視障人士手杖系統，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；配合雲端技術，地圖資料亦能實時更新，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。這套系統於2016年第44屆瑞士日內瓦國際發明展中獲得評審團特別嘉許金獎。而香港暢道科技有限公司（香港盲人輔導會全資附屬社企）亦已發展其相關業務，提供一系列完整配套服務，希望於不久將來在商場、屋邨、街道等不同地方都可以應用此技術。

已開發的技術包括：

- ► 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

將開發的新技術包括：

- ► 多種類型的及可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

Infrared Thermal Sensing Safety Alert System for 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 is in danger. For example, if the individual has fallen unconscious, the system can be configured to detect the presence of the individual in a prone position upon the floor and will alert the relevant caretakers to take immediate action.

The technology has been pilot-run in TWGHs Jockey Club Rehabilitation Complex.

New technology that will be developed include:

- ► Infrared thermal sensing monitor system

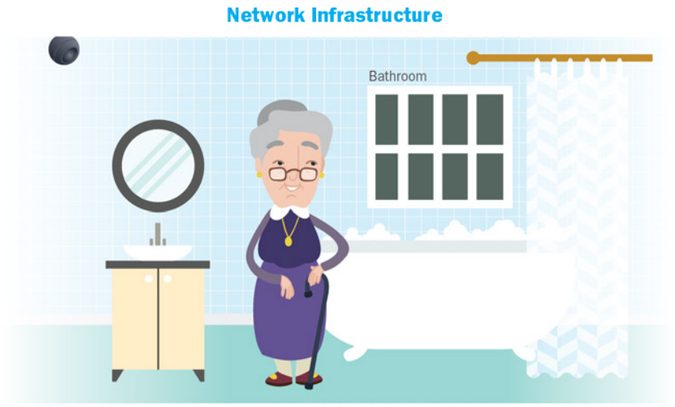
適用於長者的紅外線熱能感應安全警報系統

本中心的紅外線熱能感應安全警報系統是高度保障私隱的安全監察系統。系統會根據即時熱能數據，分析有關長者是否處於危險情況，例如：摔倒昏迷等。如果偵測到危險，系統便會向照顧者發出警報，使其作出相應行動。

此技術已在東華三院賽馬會復康中心試用。

將開發的新技術包括：

- ► 紅外線熱能感應監察系統



Service Logging and Information Kiosk System

The LSCM R&D Centre developed a Service Logging and Information Kiosk System which is suitable for using in elderly care centres and attention homes. The Kiosk is wall-mounted in each room. 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 eliminating the steps of paper recording. The Kiosk can also 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.

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

New technologies that will be developed include:

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

服務記錄及資訊查詢系統

LSCM研發中心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。該系統可裝設於每間房間之內，配合無線射頻識別技術，護理人員可於每次完成服務及工作後，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。而該系統亦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、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。

此技術已在元朗盲人安老院（賽馬會欣康樓）試用。

將開發的新技術包括：

- ► 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

Health and Community
醫療保健及社會服務

Smart Phonebook

Smart Phonebook resembles a traditional phonebook commonly used in the past. Elderly can flip to the page with the information of the person to be contacted with. By “Easy Touch” function (through RFID sensing), phone dialing and SMS sending can be done easily. The technology helps the elderly, who are not familiar with smartphones, to communicate with their family and friends in a simple way.

The technology has been pilot-run in Clague Garden Estate.

New Technology that will be developed includes:

- ► Smart Phonebook System

智能電話簿

智能電話簿的操作類似過去常用的傳統電話簿。長者可以翻到想要聯繫人的頁面，通過“Easy Touch”功能（由無線射頻識別感應），電話撥號和短訊接收便可以輕鬆完成。該技術能幫助那些不太熟悉運用智能手機的長者，以簡單的方式與家人和朋友保持聯絡。

此技術已在祈德尊新邨試用。

將開發的新技術包括：

- ► 智能電話簿系統

Health and Community
醫療保健及社會服務

An Affordable Location Tracking System that Benefits HK's People with Dementia Who May Wander Away

In collaboration with Wing Wah Love Technology Services Limited, the Centre is developing an affordable location tracking system for the local people with dementia who may wander away.

Most of the tracking products or services in the market are using GPS technology and cell tower signal triangulation to perform location identifying. However, the location data accuracy is low, especially in Hong Kong's crowded urban areas and indoor environment. By combining crowdsourcing wifi location with GPS and LBS technologies, a more accurate location can be retreived under the cloud based location management system in both outdoor and indoor environment.

With geofencing and notification functions, caregivers receive notification via apps once user is away from the geofencing area. Moreover, the system provides technological interfaces connecting health devices that the users' health measurements can be viewed by caregivers. In the long run, activity data collected in the tracking system can facilitate further studies to understand the behaviour and needs of elderly and people with dementia.

Service provisioning include:

- A cloud-based location tracking and management system
- GPS and WiFi Google service data ingest and processing sub-module
- Sensor service data ingest and processing sub-module
- Mobile apps (iOS and Android) for caregivers real time location tracking

為認知障礙症初期患者而設的實惠定位及防游走系統

本中心與榮華愛心科技服務有限公司合作，為本地基層和長者團體開發一套實惠的定位及防游走系統。市場上大多數追蹤產品或服務都是使用GPS技術和流動通訊基站訊號的技術來定位。然而，位置數據的準確度較低，特別是在香港擁擠的城市和室內環境中。通過將WiFi節點相關資訊與GPS和LBS技術結合在一起，無論長者處身於戶外或室內，都可以在雲端位置管理系統下取得準確的位置。特有預設安全區域及通知功能，當使用者離開安全範圍，照顧者即可透過手機程式收到通知。此外，該系統還提供技術終端接口，可以與健康儀器連接，照顧者可以了解使用者的健康數據。從長遠來看，經收集和存儲在定位系統中的活動數據可以進行研究，以了解腦退化患者和長者的行為和需要。

提供服務包括：

- 支持雲端的位置定位和管理系統
- GPS和Wifi數據的採集和處理模組
- 活動傳感監察數據採集和處理模組
- iOS及安卓版本的實時位置定位智能手機應用程式

Tracking and Lost Prevention Management
定位及防游走管理

Health Management
健康管理

Construction
建築

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

This RFID-enabled service-oriented BIM (Building Information Modeling) platform is built upon the research strengths of four departments at the University of Hong Kong and the Hong Kong Polytechnic University, with an aim to enhance prefabrication housing production in Hong Kong.

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 the Centre's 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.

New technologies that will be developed include:

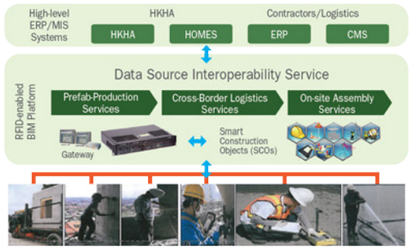
- System architecture design
- RFID-enabled Building Information Modeling Platform (RBIMP)
  - Smart Construction Objects (SCO) and RBIMP Gateway
  - Traceability and Visibility Tools
  - RBIMP Data Source Interoperability Services (RBIMP-DSIS)
- RBIMP Decision Support Services (RBIMP-DSS)
  - Prefab Production Service
  - Prefab Transportation Service
  - On-site Assembly Service

基於RFID的香港預製房屋建設信息平臺的核心技術研發

這項目結合了香港大學和香港理工大學的科研優勢，致力開發以RFID技術服務為導向的BIM平台，提高在香港生產預製房屋的效率。平台主要涵蓋：1）無縫溝通和協調多個項目成員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（LSCM）的可視化和可追蹤性技術；3）通過物流及施工現場的實時溝通和協調，實現JIT物流。

將開發的新技術包括：

- 系統架構設計
- 支持RFID的建築信息建模平台（RBIMP）
  - 智能建築對象（SCO）和RBIMP網關
  - 可追溯性和可見性工具
  - RBIMP數據源互用服務（RBIMP-DSIS）
- RBIMP決策支援服務（RBIMP-DSS）
  - 預製生產服務
  - 預製運輸服務
  - 現場組裝服務



Enabling Technology for IoT Mesh Network and Building Information Model for Building Life Cycle Management

The building industry in Hong Kong faces tremendous challenges in managing the progress of multiple major infrastructure projects, such as providing high quality building lifecycle management. Modern buildings have advanced facade designs, structures, and Mechanical, Electrical and Public Health (MEP) systems, which cater to energy-efficient operations. The increase in complexity calls for the use of more sophisticated Building Information Model (BIM) systems such as Autodesk Revit. The project purports to extend the current geometric information in BIM by including semantic information to enhance operations in construction and facility management. By integrating sensor location information, the inclusion of BIM allows for better facility management. Using a Bluetooth mesh network, sensors and facilities information can be mapped into the BIM model through the Bluetooth protocol. The latest upgrades to the Bluetooth standard have overcome current Bluetooth deficiencies in power consumption, data transfer rate and privacy settings. As such, the project is designed to provide a novel multi-sensor network based on Bluetooth technology to provide updated building facilities spatial location and their associated semantic attributes. Building facility managers can utilize the system to more effectively monitor the maintenance and sensors information via the online BIM portal.

Technologies ready to transfer include:

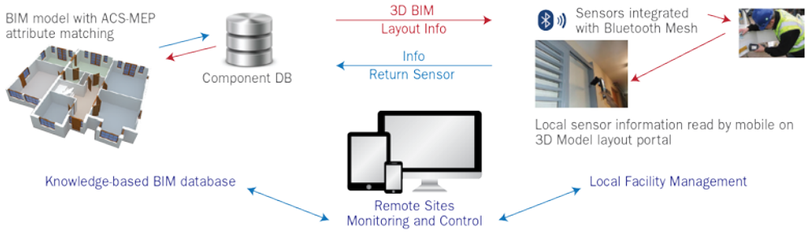
- A semantic knowledge based BIM system for building lifecycle management
- Integrated structural and mechanical BIM, electrical and pumping (MEP) design using semantic topological feature-based design and neutral file format (IFC)
- A portal of 3D BIM model integrated with Bluetooth sensor mesh network and RFID tagged building facilities for facility management

利用物聯網網絡和建築訊息模型支援建築生命週期管理的技術

香港建造業正面對同時實施多個大型基建項目及高質建築生命週期管理的巨大挑戰。現代建築具有先進外觀、結構和機械、電氣和公共衛生（MEP）系統設計，以滿足高效節能營運。提高設計複雜度推動更先進的建築訊息模型（BIM）的使用，如Autodesk Revit系統。這提案透過在BIM的幾何訊息附帶上語義訊息，以提高設計、建築和設施管理營運功能。語義訊息集成的結構和MEP BIM能夠更好地協調設計。建築和MEP元件可以利用藍芽網絡與附帶語義訊息的BIM系統進行定位，並測繪到BIM模型上。現方案將提出一種新穎的藍芽網絡通訊方法，以提供附有藍芽標籤的建築構件空間位置及其相關資料。使用藍牙網狀網絡、傳感器和設備的訊息可以通過藍牙協議被影射到BIM模型。最新升級藍牙標準在功耗、數據傳輸速率和私隱設置上，改善了目前藍牙技術的缺陷。該提案將基於一種新型的藍牙技術的多傳感器網絡，提供建築設施的空間位置及其關聯語義屬性更新。建築設施管理者可以通過已連線的BIM監控、維護和處理傳感器的訊息。

可供轉移的技術包括：

- 用於建築生命週期管理之帶語義知識庫BIM系統
- 使用語義拓撲技術的設計和中立的文件格式（IFC）整合水電氣（MEP）設計及不同結構和機械的BIM
- 集成了藍牙傳感器網狀網絡和RFID標籤的三維設施設備管理BIM



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

In order to minimize accidents at construction site, the LSCM R&D Centre and the Hong Kong Polytechnic University have developed a "Proactive Construction Management System" (PCMS) to enhance the management and reconnaissance of construction sites for better site safety. In collaboration with the Development Bureau, the project has been tested at various government sites.

PCMS is made up of two main components: Location Based Services (LBS) which consists of wireless location tag readers for recording the location of workers and mobile devices, and Building Information Management (BIM) which monitors the environment around workers. When life-threatening hazard from moving objects is detected, or if any worker enters a dangerous area, the transceiver installed inside the helmet will alert the worker through the system.

Technologies ready to transfer include:

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

應用於工地的實時風險警報管理系統

為了減少地盤意外，LSCM研發中心和理工大學合作，開發了一項名為「主控式建築管理系統」(PCMS)，來加強建造業工地的管理和偵察，提升工地安全。通過與發展局的合作，項目曾於多個政府工地進行測試。

PCMS由兩個主要部份組成，一是位置基礎服務技術（LBS），由無線定位標籤閱讀器來組成，用來記錄工人和移動設備的位置，二是建築信息模擬（BIM），用來對工人身邊的環境進行監測，當工人受到移動設備威脅或處於某危險區域內，系統會透過安裝在頭盔內的收發器提醒工人。

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）
- 追蹤及警示軟件
- 追蹤及警示裝置硬件設計

Construction
建築

Safety Belt Alarm System for Construction Safety

The Centre has developed a real-time sensing system to monitor the engagement of safety belts at 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.

Technologies ready to transfer include:

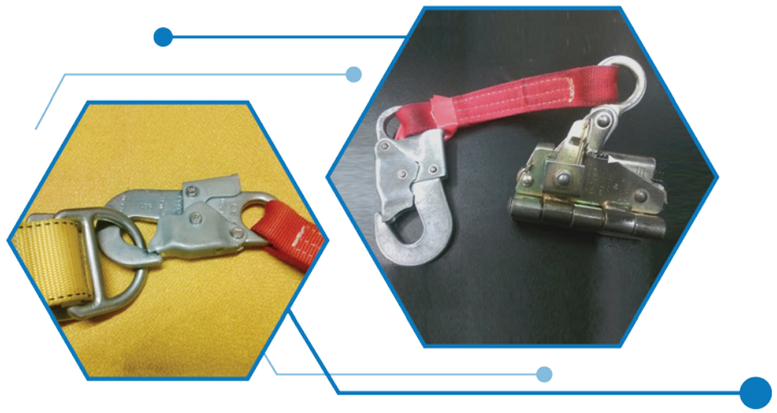
- ► Safety Belt sensing tag design
- ► Reader design
- ► Monitoring System Software
- ► Handheld Device Application
- ► Wireless charger design

應用於工地安全的安全帶警報系統

由本中心開發的實時感應系統，能加強在工地監察使用安全帶的情況，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。

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
- ► 手持設備應用程式
- ► 無線充電器設計



Construction
建築

Rear RFID Alarm Sensing System for Vehicle in Construction Industry

In response to the accidents caused by reversing vehicles, the LSCM R&D Centre has developed an RFID car reverse notification system that provides workers with RFID-tagged work vests and helmets. An 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. The system can be mounted easily, therefore modification on the vehicle is not required.

Technologies ready to transfer include:

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

應用於建築業的無線射頻識別（**RFID**）倒車警報系統

針對倒車所引起的意外，LSCM研發中心開發了一套倒車射頻識別警報系統，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感應系統就會對司機發出警告訊號，預防工業意外。此系統安裝容易，並不需要額外改裝車輛。

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
- ► 司機警報裝置設計

Construction
建築

Smart Construction Platform based on Cloud BIM and Image Processing

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

With the provision of a progress visualization platform, project stakeholders, including the public, can keep abreast of the progress of a project. The technologies to be developed will also mitigate project delays and improve the productivity of the industry.

New technologies that will be developed include:

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

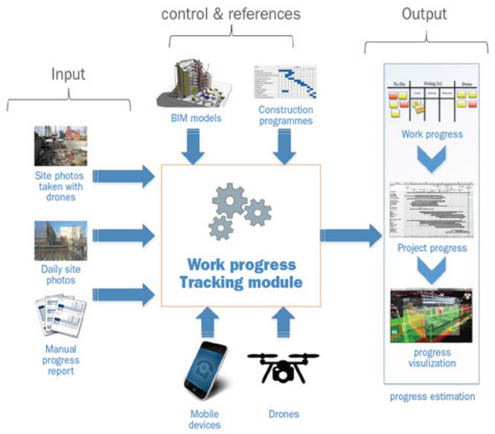
基於BIM雲和圖像處理技術的智慧建造管理平台

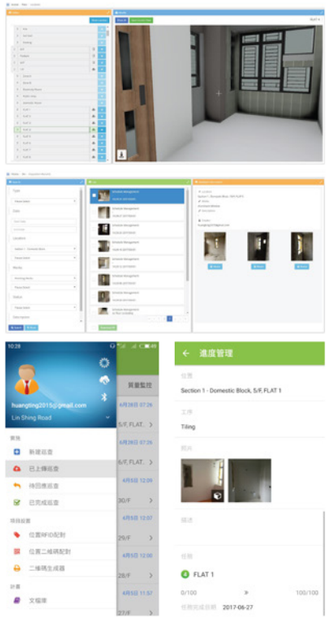
這項目發展的技術能根據施工計劃，有系統地將BIM資料提取和轉換到另一個施工管理平台中。它是一個基於BIM的任務分配和指派技術，使得BIM資訊和工作指令可以直接下達到工人；透過資訊索引和檢索，使工人可以方便及時地獲得與其工作相關的信息，並根據BIM模型和現場照片的圖像處理技術，實現自動的進度估計。

此研究提供了一個進度可視化的平台，使與項目有關的單位（包括公眾）能及時瞭解工程的進展情況，同時亦減少項目延遲和提高行業生產效率。

將開發的新技術包括：

- ► 基於BIM雲和圖像處理的智能建造平台，用於工作訂單生成和管理：
  - ◇ 基於BIM的工單生成模組
  - ◇ 工單訊息提取模組
  - ◇ 工作進度追蹤模組





Robotics Technologies
機械人技術

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. Recently, many applications require human interaction with robots to improve efficiency and productivity. To reduce the potential hazards arising from such interactions, this project aims to develop new sensors which can be deployed to ensure human safety when interacting with robots.

RGB (Red-Green-Blue) / thermal cameras, infrared & ultrasound sensors are widely used for many robotic applications. But these sensors have many restrictions and limitations. For example, infrared sensors are sensitive to specific light spectrum and must be applied under line-of-sight conditions. Ultrasonic sensors are usually having narrow area coverage. Visual RGB cameras are highly sensitive to external lighting conditions. Hence, these sensors confine robots to be used under uniform and controlled (or indoor) environments. Conventional sensors may not be suitable for human-robot interactive tasks in particular to outdoor settings. As such, this project aims to develop sensors and sensing systems that can overcome these deficiencies through the application of new cutting edge technologies which can facilitate the safe integration of robotics technology in local industries.

New technologies that will be developed include:

- ► A new multi-sense camera which is capable of working in different environments.
- ► A skin sensor which enables large area sensing in a robotic safety area.

協作機械人的傳感系統

機械人安全對於所有機械人的應用都是十分重要。在過去，機械臂必須安裝在封閉的環境中，以避免對人做成傷害。最近，許多機械人的應用都需要人與機械人互動，以提高效率和生產力。為了減少意外發生，一些新的傳感器將被安裝在機械人上以確保人與機器人進行互動時的安全。

本項目旨在研究和開發新的機械人傳感器，並將它使用在人機協作的任務中。RGB（紅--綠--藍）相機、紅外線和超聲波傳感器，已被廣泛用於許多機械人的應用中，然而它們有著許多的限制和局限，例如，紅外傳感器只對特定光譜敏感，同時必須在視線範圍下使用；超聲波傳感器一般只有較窄的覆蓋區域；視覺RGB相機對外部照明條件高度敏感。因此，這些傳感器限制了機械人只能在統一和控制的環境（或室內）中使用。傳統的傳感器不適合在人與機械人互動的任務中使用，尤其是在室外環境。此傳感器或傳感系統可提供新的尖端技術，以維持本地工業的市場競爭力。

將開發的新技術包括：

- ► 能夠在不同的環境中操作的多感官攝像鏡頭
- ► 皮膚傳感器能夠在較大面積的機械人安全區域內作出感應

Autonomous Guided Vehicles for Warehouse Management

The latest AGVs are able to navigate around the warehouses by following tags embedded on the floor of the warehouse with the deployment of Ultra-wideband (UWB) technologies, which ensure the navigation scope is within 10 cm and provide enhanced collision avoidance capability. These robots navigate around on a predetermined route and can assist in performing inventory stocktaking and move around with a maximum loading of 100KG. To keep pace with the fast development of worldwide e-commence, the demand on warehouse management to minimize processing time is extremely high, and the performance of the AGV allows for increased accuracy and efficiency. The AGV developed by LSCM R&D Centre is suitable for use in local warehouse, factory and mass retailing shop. The AGV is not only capable of carrying goods, but also can do inventory stocktaking tasks during closing time.

Technologies ready to transfer include:

- ► An AGV with built in agent based control
- ► A sensor fusion module for self-balancing, collision avoidance and inter-communication
- ► A software prototype of a multiple robots/AGVs planning system

自動導航搬運車（AGV）

AGV依據鋪設在倉庫地下的標籤，並配以超寬頻雷達（Ultra-wideband，UWB）技術作定位，可令準確範圍縮小至10厘米，同時可防止AGV互相碰撞。AGV能按預設路線行走、快速點算貨架上的物品及負重100公斤的貨品行走，就像一部於貨倉自動工作的「倉務員」。隨着全球的電子商貿日趨成熟，對倉存管理有極高要求，以減少訂單的處理時間。LSCM研發中心開發的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。

可供轉移的技術包括：

- ► 內置基於代理控制的自動導航搬運車
- ► 能自我平衡、避免碰撞和互相通信的傳感器融合模塊
- ► 機械人 / AGV規劃系統軟件

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

Automation and robotics technologies have been used and adopted in logistic and supply chain industries for a period of time. Nowadays, warehouses are facing new customer paradigm of “big demand for vast variety of products but all are in small quantity”. This becomes ineffective to use robot to handle such products because of high programming overhead and lack of flexible manipulator technologies for robotic hands.

To overcome aforesaid problem, an agility robotic system compiling with a hand (or end-effector) and eye (vision) co-ordination control is important to cope with different shape, size, colour, and stiffness objects in the same process.

In this project, it aims to carry out an explorative research investigation in designing a multi-camera vision coordination control system and a flexible end-effector applying to commercially available robotic arms. The deliverables are able to manipulate objects in different shapes, colours, sizes and surface textures moving along conveyor belts.

New technologies that will be developed include:

- ► A multi-camera vision module
- ► A hand and eye coordination prototype

應用於電商倉庫之智慧型手眼協調機械臂定位系統

自動化和機械人技術在物流與供應鏈行業上已使用了一段時間。現今，倉庫面臨著客戶「小批量生產、種類繁多的需求」。使用傳統機械人來處理這類生產已失去了優勢，因為它們需要較複雜的程式編寫架構，而且現時的機械人手缺乏柔性機械臂技術。

要處理不同形狀、大小、顏色和硬度的物體，便需要一種較為敏捷的機械人，配合一隻手（端部執行器）和眼（視覺）去編輯控制整個系統，以克服上述問題。

這個項目透過探索性研究，設計了一款多種影像協調控制系統，配合靈活機械人手臂，應用到商用性機械臂上，從而能處理輸送帶上不同的形狀、顏色、大小和表面紋理的物體。

將開發的新技術包括：

- ► 多攝像鏡頭視覺模組
- ► 手眼協調機械臂原型

Perception-Guided Robotic Arm Manipulation System

Automation and robotics technologies have been used and adopted in manufacturing industry. In particular, object detection is the first essential step for unmanned factory environments. For example, a robotic arm can successfully pick up a capacitor and install it on an integrated circuit card only when all corners and pins of the capacitor are accurately detected. In the past, the detection could be done by using special equipment, such as depth camera. However, these methods are expensive and time-consuming. To overcome the limitation of the previous systems, the proposed project aims to design an accurate and efficient object keypoint localization system for deployment in the challenging production-line-like conditions with low cost hardware equipment using deep learning methods.

New technologies that will be developed include:

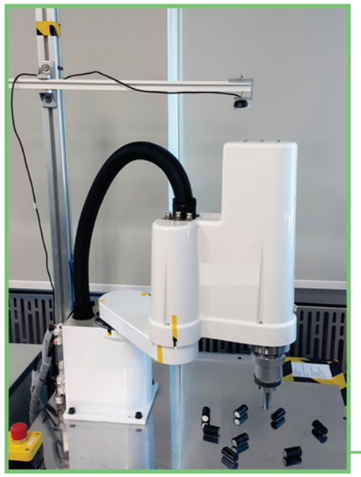
- ► An accurate and fast object keypoint localization system
- ► A complete perception-guided robotic arm manipulation system

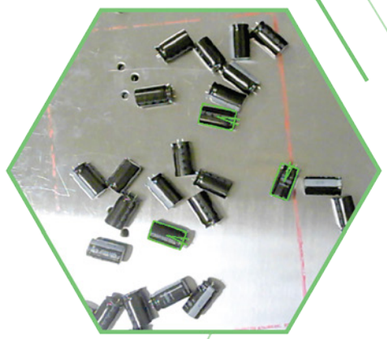
感知引導機械人手臂操縱系統

自動化和機械人技術已廣被製造業應用。尤其在無人工廠環境下，物件檢測是首要基本步驟。例如，要機械臂可以成功地拿起電容器，並將其安裝於集成電路卡上，便需要準確地檢測電容器的拐角和引腳。以往，這檢測需要使用特殊設備（如深度攝像機）才可進行的，然而，這些方法既昂貴且耗時。為了解決以上系統的局限性，本項目使用深度學習方法，以低成本的硬件設備，設計一個準確而有效的物件關鍵點定位系統，以應用在具挑戰性的生產線環境下。

將開發的新技術包括：

- ► 準確快速的物件關鍵點定位系統
- ► 完整的感知引導機械人手臂操縱系統





Meal Delivery Robot

In food & beverage industry, worker's safety is often ignored during meal delivery tasks. Skin burn by hot food (e.g. soup) is one major cause of injuries in central kitchens. In addition, workers may suffer from musculoskeletal disorders while carrying heavy food for a long time. Although dinning cart is sometimes provided for carrying heavy or hot food, it is very heavy to push when fully loaded with food, especially for those carts with temperature keeping functions.

The meal delivery robot is similar to a normal meal carrying cart, but it is able to move around autonomously or follows the worker behind. The worker acts like a pilot, with a specific mark put on his/her back, so that the robot follows him/her by recognizing and chasing the mark. The robot can keep a safety distance from the worker. Multiple sensors are installed for enhancing safety purposes.

Value added functions to the meal delivery robot can be implemented with minor modifications, e.g. a food temperature control cabinet can be installed onto its top.

New technologies that will be developed include:

- ► Multi-sensory fusion technology

Technologies ready to transfer include:

- ► Camera tracking technology
- ► Mobile robotic platform with 200KG+ payload capacity

送餐機械人

在餐飲行業，工人在送餐期間的安全往往被忽視。熱食（例如湯）引致的皮膚燒傷是中央廚房員工受傷的主要原因之一。此外，工作人員長時間遞送沉重的食物可能會患上肌肉骨骼疾病。雖然他們有時會使用能運送重物或熱食的餐車，但是當它裝滿食物時仍要用力推動，特別是那些具有保持溫度功能的餐車。

送餐機械人跟正常的餐車類似，但是它能夠自主或跟隨工作人員移動。工作人員就像一個領航員，當把一個特定的標記放在他/她的背部位置，機械人便會識別該標記並跟隨他/她。機械人能與工作人員保持安全的距離，更可安裝多個傳感器增強其安全性。

送餐機械人可以透過簡單的修改而實現其他增值功能，例如可以安裝食物溫度控制櫃於其頂部。

將開發的新技術包括：

- ► 多傳感器融合技術

可供轉移的技術包括：

- ► 相機追蹤技術
- ► 具有200KG+有效負載能力的移動機器人平台

Location-based Services (LBS) Technologies
位置基礎服務技術

Indoor Location Analytics System for Exhibition and Convention Industries

Hong Kong is a popular city for conventions and exhibitions in the region. With limited space available for these events, there is a need to maximise efficient usage of the available space within exhibition halls. The key underlying information required to optimise space usage is the knowledge of the detailed flow of visitors. This project is directed towards addressing the challenges of determining the dynamic flow of visitors to exhibition centres by developing an Indoor Location Analytics System (ILAS) that:

(1) tracks the movements of visitors via Wi-Fi and / or Femtocell technologies (Location-based System); and

(2) analyses the movement data for computing visitor preference profiles and makes recommendations of relevant booths for visitors (Location Analytics).

The prospective system brings new opportunities to different stakeholders in the exhibition and convention industries. Buyers and exhibitors will have their matchmaking costs reduced, resulting in an increased return from organising and participating in events. With the collected movement data stored at the backend analytics server, exhibition organisers will be provided with supportive information for better booth arrangement of exhibitors, and will be better able to focus resources on promoting exhibitors located in sub-optimal booth areas.

New technologies that will 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

適用於展覽及會議業的室內位置數據分析系統

香港是亞洲區內舉辦會議和展覽的主要城市之一。由於展覽場地有限，展覽業界積極尋求高效租用場地的最佳方法，而詳盡地掌握參與者的人流數據是當中的重要關鍵。因此，本項目通過開發一套室內定位分析系統（ILAS）以獲得展覽場地的人流數據。系統包括：

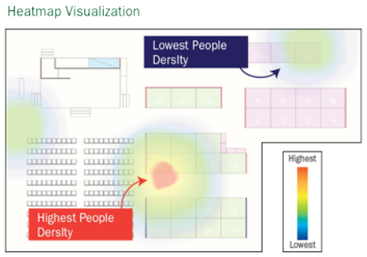
（1）通過Wi-Fi和 / 或Femotcell技術（定位系統）追蹤參與者的流動性；及

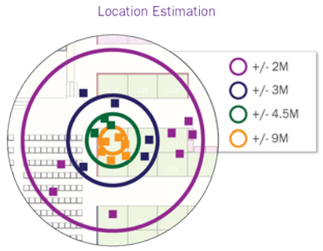
（2）分析人流數據並進行運算，預測參與者的喜好，並作出展位推介的建議（位置分析）。

此系統為展覽業界帶來新的機遇。就買家和參展商而言，系統能降低他們互相聯繫的成本，增加他們日後舉辦及參與展覽的機會。訪客流量數據及後端分析系統亦為主辦機構在展位安排和次優展台位置的推銷策略，提供有效的數據支持。

將開發的新技術包括：

- ► 基於Wi-Fi的室內定位系統
- ► 以Femtocell為基礎的室內定位系統
- ► 後端定位分析系統服務器
- ► 供移動應用程式使用的位置分析應用界面
- ► 快速校準系統





Location-based Services (LBS) Technologies
位置基礎服務技術

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

The Development of Hong Kong as a vibrant smart city with a high-quality Wi-Fi experience has been identified as an important strategic direction (The Digital 21 Strategy 2014). In addition to the installation of Wi-Fi access points (APs) on a large scale, a smart city calls for overcoming the current challenges with utilizing Wi-Fi by implementing intelligent algorithms.

Currently Wi-Fi service suffers from its lack of device tracking capability, high interference, AP load unbalancing and the absence of an easy-to-use cloud-based management tool. The Centre 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 AP to overcome the above limitations.

Features of new technologies include:

- ► Device (users or assets) tracking using our fingerprint-based sensor technology
- ► Low interference and good coverage of the network through intelligent channel and power assignments
- ► The clients are able to intelligently associate with an AP to achieve good load balancing and high throughput
- ► The AP network can be monitored and managed through our cloud-based management system

Technologies ready to transfer include:

- ► SmartAP Library
  - ◇ The SmartAP embedded software for OpenWRT router
  - ◇ Full installation kits for cloud based server, which include
    - Web-based management tool
    - Web-based visualization tool
    - Localization engine
  - ◇ Mobile app
    - Site survey app (Android)
    - Localization app (iOS + Android)
    - Smart Association App

智能接入點：智慧城市的無線Wi-Fi定位和系統優化

建立一個充滿活力的智慧城市及提供高質素的Wi-Fi體驗已確定為香港發展的一個重要方向（2014數碼21資訊科技策略）。要克服當前Wi-Fi所面對的困難和挑戰，除了大規模安裝 Wi-Fi 接入點（APs）外，還須依靠先進的智能算法。

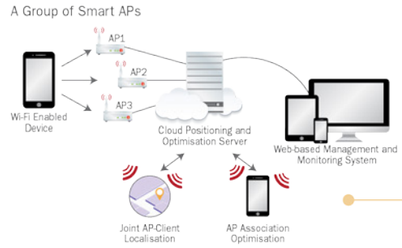
目前Wi-Fi服務缺乏設備跟蹤能力，易受干擾，AP負載不平衡和缺乏簡易的雲端管理工具。本中心聯同香港科技大學計劃開發創新的智能 Wi-Fi，通過AP上運行的智能嵌入式軟件系統來克服上述限制。

新技術的特點包括：

- ► 利用指紋傳感技術進行設備（用戶或物件）跟蹤網絡質量提升，通過智能信道和功率分配減低干擾和提供更好覆蓋
- ► 智能選擇AP入網，以達到良好的負載均衡，提高吞吐量
- ► 雲端網絡管理系統，對AP進行管理控制

可供轉移的技術包括：

- ► 智能接入點庫
  - ◇ 應用於OpenWRT路由器的SmartAP軟件
  - ◇ 雲端服務器的完整安裝工具包，其中包括：
    - 基於Web的管理工具
    - 基於Web的可視化工具
    - 本地化引擎
  - ◇ 手機應用
    - 網站調查應用程式（Android）
    - 本地化應用程式（iOS+Android）
    - 智能協作應用程式



Location-based Services (LBS) Technologies
位置基礎服務技術

Development of Hong Kong Indoor Positioning Infrastructure Based on GPS Technologies

This project is directed towards providing a new GPS positioning method for use in an indoor environment. The technology enables GPS signals to be received indoors using mobile devices and smartphones for positioning and navigation. The expected accuracy is about 2 to 5 meters. The seamless positioning achieved can be used to support applications within the Internet-of-Things (IoT).

New technologies that will be developed include:

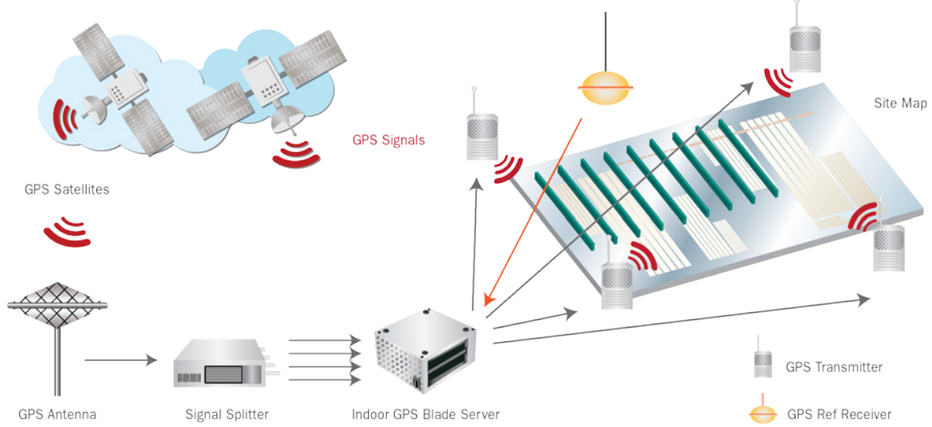
- ► System infrastructures including GPS signal receiving, signal processing and re-transmission system
- ► Software for indoor GPS correction engine, server, and user's mobile devices

基於GPS技術的香港室內定位基礎設施

這項嶄新技術是利用全球定位系統（GPS）訊號在室內進行定位。此技術使移動設備和智能電話能在室內獲取GPS訊號以進行導航定位，精確度達至2至5米。透過採用此項新技術，移動設備和智能電話可進行室內外定位、追蹤及導航，以及支援物聯網運作。

將開發的新技術包括：

- ► 系統平台，包括GPS衛星訊號接收、處理和轉發等系統
- ► 處理室內GPS定位修正引擎, 何服器和移動終端軟件



Location-based Services (LBS) Technologies
位置基礎服務技術

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. The system provides technological advancements in surveying, logistics operation, Geographic Information System (GIS) applications, and location-based services in Hong Kong. It also 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 survey and engineering applications. It further implements GNSS heighting in Hong Kong to improve engineering surveying efficiency. Last but not least, 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).

Technologies ready to transfer include:

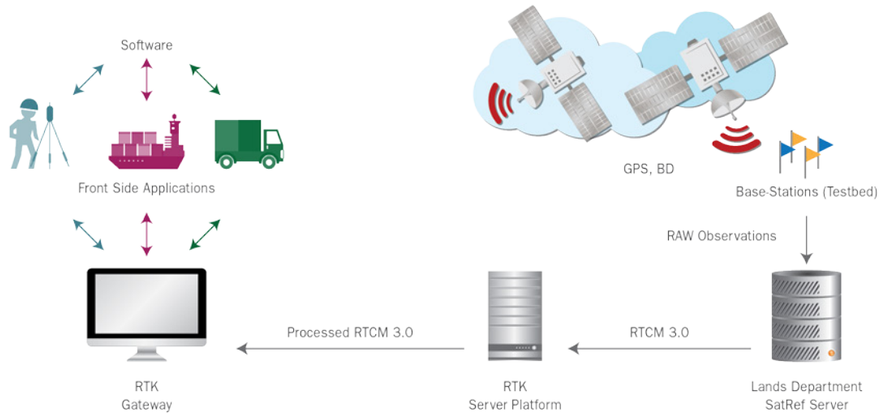
- ► DGNSS server platform
- ► Software to support metre level accuracy for smartphone and tablet users
- ► RTK server platform and high precision Hong Kong geoid model
- ► Software for RTK positioning to achieve centimetre level positioning accuracy

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，提供多種位基服務，以支持香港在測量、物流操作、地理信息系統（GIS）應用及位基服務的技術提升。這系統集成 了GPS和北斗網絡，進一步提高SatRef系統的表現，在測量和工程應用上實現更可靠的實時動態（RTK）定位至1厘米的精準度。它亦在香港實施GNSS高程模式以改善工程測量效果。最後，它以DGNSS差分術提供一個可靠的平台，為移動運營商在香港及周邊地區提供個人和車輛的定位及導航服務，並達至米級的準確度 (2 ~ 3米)。

可供轉移的技術包括：

- ► DGNSS服務平台
- ► 以米級定位支援智能電話及移動設備的應用軟件
- ► 網絡RTK服務平台和精準的香港大地水準面模型
- ► 以厘米級定位支援RTK的應用軟件



Location-based Services (LBS) Technologies
位置基礎服務技術

Indoor Localisation, Tracking and Navigation

Satellite-based global positioning technologies such as the GPS and the BeiDou are easy to use. They can easily locate and assist in navigation in the outdoor areas. However they are not suitable for indoor environments due to poor reception of satellite signals. In light of the challenge, the LSCM R&D Centre has collaborated with the HKUST to develop a WiFi positioning system, Wherami, for indoor localisation tracking and navigation.

This technology makes use of the widely available WiFi signals in indoor environments to develop an innovative and accurate indoor localisation tracking and navigation technology. Wherami has been on trial in the Hong Kong Airport, Cyperport and Olympian City, followed with the official launch in the campus of the HKUST, the Union Hospital and the Harbour City. Using any mobile device with WiFi signals, shoppers can locate their exact position on an indoor map. Take shopping mall as an example, by searching the shop name or selecting their destination, the system navigates the shoppers to their destination with the quickest route. In addition, the system assists shoppers to access all stores in the mall, such as restaurants, banks, etc. This value-added feature is important in strengthening Hong Kong's image as a world-class metropolis.

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

室內定位、追蹤和導向

衛星全球定位技術如GPS及北斗使用十分方便，在室外不同地方可以輕易定位及協助導航，但在室內環境中卻因為接收不到衛星訊號而變得不適用。有見及此，LSCM研發中心跟香港科技大學研發出「依道」WiFi網絡定位系統，利用了室內廣泛存在的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，曾在香港機場、數碼港及奧海城試行，並成功在科大校園、仁安醫院及海港城推行使用此定位系統。以商場為例，顧客只需使用個人的智能電話或平板電腦，即可知自己身在何處。如輸入商戶名稱或選擇目的地，系統的導航就可以帶領顧客以最快的途徑抵達目的地，快捷方便。除此之外，顧客更可以利用系統即時搜尋商場內的各類商戶及服務，例如酒樓、銀行等，令顧客感到賓至如歸，鞏固香港作為國際大都會的形象。

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

Location-based Services (LBS) Technologies
位置基礎服務技術

Coordinate-based Indoor Positioning System for Tracking and Finding Mobile Items in a Highly Dynamic Environment

The Centre's indoor positioning system is capable of both supporting the real-time tracking of a high volume of mobile items, circulating inside a large distribution centre, and providing on-demand assistance for finding a specific set of mobile items in ensuring the timely delivery of goods.

The coordinate-based positioning network infrastructure of the Centre's system leverages its existing TCP / IP network backbone in extending its coverage inside larger facilities enabling it to track goods spread out over the distribution facility, and provides visual assistance for effectively retrieving them from thousands of similar looking carts. The communications between the active RFID tags and the positioning network make use of a low-bandwidth and low-energy 2.45 GHz data communication protocol to reduce battery consumption and potential interference to the ISM band.

Technologies ready to transfer include:

- ► An indoor positioning system (active RFID tag, active RFID positioning reader, coordinate-based positioning software, tracking and finding mechanisms, customisation and consultancy, etc.)
- ► Antenna array positioning reader design
- ► Active RFID tag design with signal light and display
- ► Positioning software with angle of arrival triangulation engine
- ► Tracking and finding

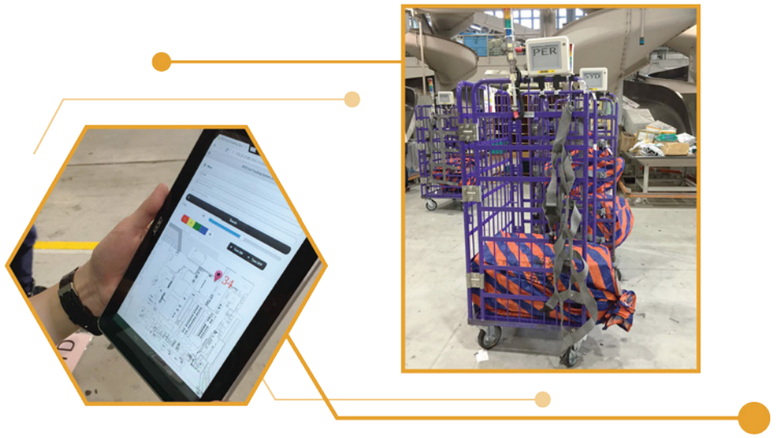
應用於高流動性環境的坐標室內定位系統（為高移動性的物件作追蹤及定位）

此室內定位系統能夠支援在大型配送中心內對大量移動物品的實時追蹤，並按需要尋找特定的移動物件，以確保及時派送貨物。

這坐標定位網絡基礎設施利用現有的TCP/IP網絡骨幹，延伸至大型設施內所需的覆蓋範圍，能夠追蹤貨物在配送設施內的位置，並為操作員提供視覺協助，從而在數千架外觀接近的裝載車中有效地作出分辨。有源RFID標籤和定位網絡之間的通訊，是利用低帶寬和低能量2.45GHz的數據通訊方法，減少電池消耗量和對ISM頻帶的潛在干擾。

可供轉移的技術包括：

- ► 室內定位系統（有源RFID標籤、有源RFID定位閱讀器、基於坐標定位軟件、追蹤和尋找機制、度身訂造技術和諮詢等）
- ► 天線陣列定位讀寫器設計
- ► 配有訊號燈及顯示器的有源RFID標籤設計
- ► 利用到達角度的三角定位軟件
- ► 追蹤和尋找應用軟件



Location-based Services (LBS) Technologies
位置基礎服務技術

Location-based System for Indoor and Outdoor Tracking

This solution leverages the strengths of different wireless technologies to realise a comprehensive positioning technology for both indoor and outdoor tracking. Compared with other existing technologies, the system enjoys better availability, and lower total costs of ownership, operation and maintenance. In addition, with innovative service-oriented architecture and web-service design, the tracking functionalities can be accessed through the Internet via a web browser. End-users can also track their cargo via mobile phones and other portable devices.

Technologies ready to transfer include:

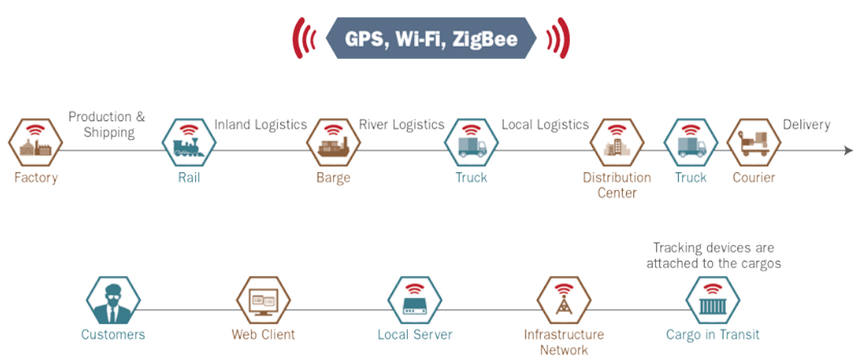
- ► Location-based system (tracking and locating software, tracking device design, customization and consultancy, etc.)
- ► Positioning software with triangulation engine
- ► Tracking application software (against map)
- ► Tracking devices design (Wi-Fi, Zigbee and GPS, etc.)

室內外追蹤之定位系統

此技術充分利用不同無線技術的特性，實現兼顧室內外的全面定位技術。與其他現有的技術相比，此系統不但可用性更佳，其實施、運作及維修成本亦較低。此外，系統配備特別設計的軟件系統架構與網絡服務設計，因此用戶可透過網絡瀏覽器在互聯網上使用其追蹤功能，而終端用戶亦可經由流動電話及其他手提裝置追蹤貨物位置。

可供轉移的技術包括：

- ► 定位系統（追蹤和定位軟件、追蹤儀器設計、度身訂造技術和顧問服務等）
- ► 三角定位軟件
- ► 追蹤應用軟件系統（對照地圖）
- ► 追蹤儀器設計（Wi-Fi、Zigbee和全球定位系統（GPS）等）



Location-based Services (LBS) Technologies
位置基礎服務技術

3D Geodatabase Framework for Hong Kong: A Lightweight 3D Seamless Spatial Data Acquisition System (SSDAS)

With the continuous urbanization of Hong Kong, the complexity and heterogeneity of spatial data in three- and temporal-dimensions raise new challenges to the traditional 2D geodatabases. Meanwhile, smart city has been identified as one strategically important area for Hong Kong, and there is an urgent need to innovate corresponding key technologies, including 3D spatial data infrastructure.

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. The key issue for implementing the proposed 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. The System synergizes progressive spatial information technologies, and a specialized software package for processing, generating and visualizing 3D spatial data.

The developed geodatabase and the corresponding data capture system, SSDAS, will be widely utilized in many fields that need spatial information infrastructure in Smart City, including lands and resources surveying and management, civil engineering, autopilot, intelligent transport, highways maintenance and urban planning.

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

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

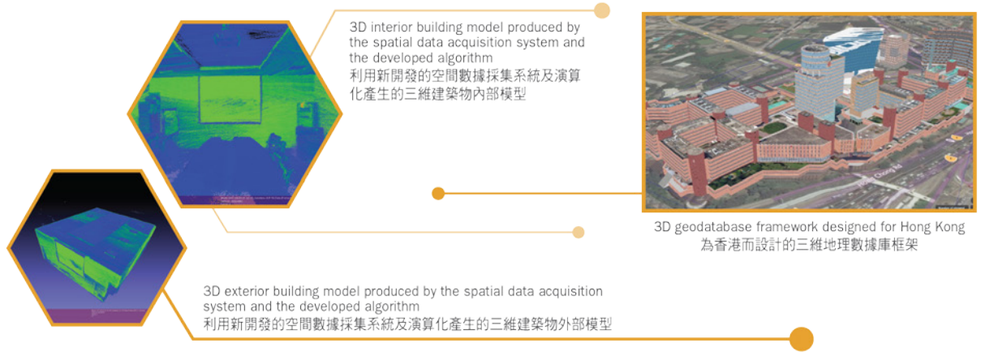
隨著香港城市化的持續推進，空間資訊在三維世界及時間上表現出的複雜性及異質性使傳統的二維地理數據庫面臨諸多新的挑戰。與此同時，智慧城市是香港一個重要的發展方向，所以開發與之相關的技術甚為迫切，包括三維空間數據基礎設施。

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以廣泛應用。本項目所提議之三維數據採集為一輕量化的三維無縫化空間數據採集系統（SSDAS）。此系統將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軟件集合起來。

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要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與管理、土木工程、自動駕駛、智能交通、道路養護及城市規劃等。

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



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 will be developed during the course of this project. A series of sensor modules designed to detect hazardous gases such as H2S, CO, explosive gas, along with water level sensors will be developed for the purpose of effectively monitoring water level changes and gas concentration changes within drainage and sewage manholes. Universal sensor interfaces, including software and hardware interfaces, an efficient data compression algorithm, and a low power consumption technique for real-time sensing will be developed to ensure a long period of operation. 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 areas such as flood blackspots, manholes with high density explosive gases and even areas at risk of landslides can be closely monitored. As such, many manmade and natural disasters can be effectively predicted and appropriate preventative measures can be enacted.

New technologies that will be developed include:

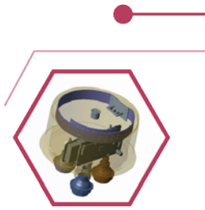
- ► An underground to above ground communication system will be developed
- ► An underground device with multiple sensors for detecting environmental changes within the sewage and drainage system will be developed
- ► A compact, conformal and adaptive antenna operating at lower frequency for minimising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

智能渠道管理中泛在無線傳感模組及網絡系統

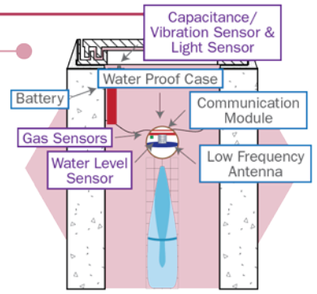
本項目旨在建立一個靈活高效、從地下到地面的無線傳感網絡，採集城市及周邊地區的排水渠及排污渠內的水位信息及有害氣體信息，實現對城市雨水及污水排放系統的實時監控。針對香港地區多雨、山體在暴雨季節容易出現滑坡的問題，結合採集數據以及後台軟件管理系統，雲計算及存儲系統，以及用戶自定義的報警機制，實現對城市洪水黑點、可能的山體滑坡區域、人為非法傾倒導致水渠淤塞、以及有害氣體有可能導致的危險地區的監控，及時地防範災害的發生。同時，根據所收集到的實時數據以及以往歷史數據分析，對可能發生的災害實現預警。

將開發的新技術包括：

- ► 一套用於地底到地面的無線數據傳輸網絡
- ► 開發工作於地底的無線通信模組及傳感器模組
- ► 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



Underground devices
with 4 sensors
配有四個傳感器的地下網絡設備



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

Innovative and Efficient Wireless Mesh Network for Outdoor Environment

As part of its ongoing collaborative efforts with academia and industry, the LSCM R&D Centre 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 utilizing multi-hop routing technology. The mesh network is a self-adaptive network with failure resilience that enables complete and high-speed connections. 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.

Products available include:

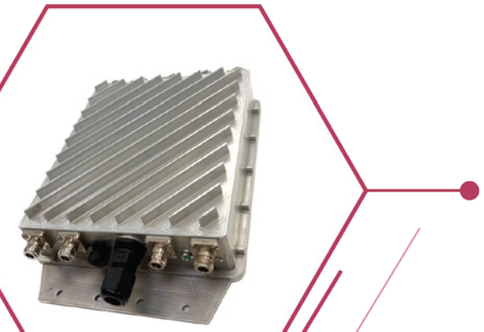
- ► Wireless mesh network system (software, hardware design, customisation and consultancy, etc.)
- ► Network design

創新高效的戶外無線網格網絡

LSCM研發中心一直與學術界及業界共同合作，今次與香港科技大學及資訊坊科技有限公司共同研發此項技術，利用多跳網格網絡技術伸延現有的Wi-Fi訊號，以擴展無線網絡的覆蓋範圍。這個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。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MRO(即保養、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設備進行定位，提升工作效率。

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



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

The Centre's 3-axis polarisation technology is a ground-breaking concept that overcomes the shortcomings of conventional reader antennas, which are generally configured using a 2-axis polarisation configuration. By applying a 3-axis polarisation approach, it is possible to ensure that each direction along the polarised tag antennas can be read, while maintaining a low profile feature.

Technology ready to transfer include:

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

近場天線系統的新型低尺度三軸極化技術

本中心的三軸極化技術突破了傳統讀寫天線二軸極化的局限，使置於任何方向的線性標籤均能被讀取。

可供轉移的技術包括：

- 薄型三軸極化近場UHF RFID天線原型

Passive UHF Detachable RFID Tag for Different Range Access

Apart from the more than 200 package-specific tag designs for product packages developed in the past couple years, the Centre has further developed separable-tag technology for specific applications, including passive UHF detachable tag in a card format. The short reading range (millimeters) of the card can be boosted for long range (up to several meters) applications simply by incorporating the card with a special antenna embedded in a card holder. The reading range can be controlled from millimeters to several meters by configuring the number of layers of holder. One application of such technology is to avoid false-reading, a card holder can only be accessed by an RFID reader installed at the access control point when the card is incorporated, otherwise, without the specific card holder, the card alone can only be accessed in a very short range.

Technologies ready to transfer include:

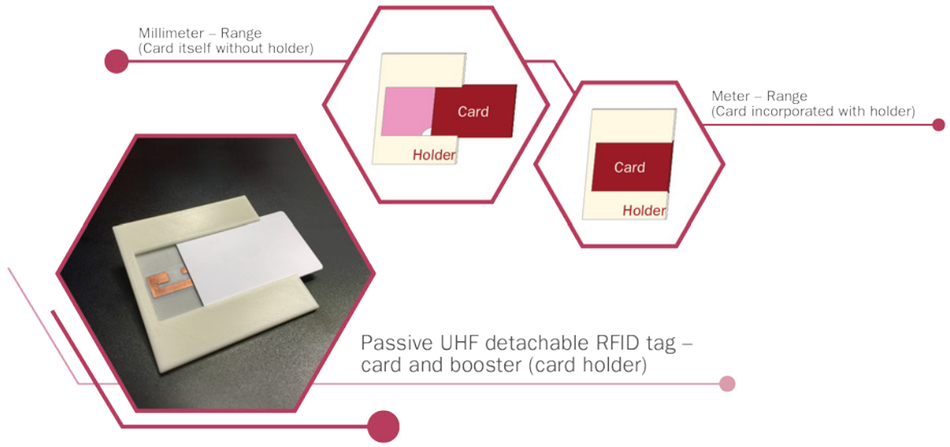
- Detachable tag design in different applications
- RFID tag antenna customisation
- Printed RIFD antenna technology

應用於不同讀取距離的可分體式無源超高頻（UHF）無線射頻識別（RFID）標籤

在過往數年，本中心已開發了超過二百款配合不同產品包裝的標籤，最近更進一步研發可作特別應用的分體式標籤技術，名為可分體式無源超高頻卡片標籤技術。只要將卡片輕輕插入配有內置特定天線的卡片套內，讀取範圍便可大大提升，由短短毫米的距離，即時伸延至幾米的範圍，正好配合某些特定的應用。讀取範圍的遠近取決於卡片套內的層疊數目。由於安裝在存取控制點的RFID閱讀器只能讀取插入特定卡片套的卡片，因此可避免誤讀的情況，這正因為卡片若沒有配上特定的卡片套，該卡片只能在非常短的範圍內被讀取。

可供轉移的技術包括：

- 可作不同應用的可分體式標籤設計
- 按顧客需求定義的RFID標籤天線設計
- 打印式RFID天線技術



Lightweight UHF RFID Gen2 (ISO18000-6C) Reader Chip

LSCM's low-cost and lightweight RFID reader IC chip (LS1001) is designed to address the market demand for a compact, low-power-consumption, and affordable RFID reading device. The RFID reader IC chip is compatible with ISO18000-6C and EPC GEN 2 standards, and delivers high performance for near field reading range.

The developed technology provides a UHF RFID interrogation capability for mobile devices and it facilitates widespread adoption of RFID in the market by greatly reducing initial investment costs.

In addition, the IC chip is an ideal gateway devoted to enabling different RFID devices designs in order to provide a diverse range of applications for use in retail and workplace environments, such as access control, asset management, product authentication, POS systems as well as item level identification.

Technologies ready to transfer include:

- ► RFID reader chip design
- ► RFID reader module design

輕量級超高頻無線射頻識別（UHF RFID）第二代（ISO18000-6C）閱讀器芯片

RFID閱讀器集成電路（IC）芯片（LS1001）成本低廉，適用於近場無線通訊（NFC）及流動平台。這芯片旨在迎合零售業的主要需求，兼容ISO 18000-6C第二代標準，適用於以NFC啟動的裝置。裝置能進行簡易的讀寫操作，適用於零售環境，亦可啟動創新應用程式，以支援手提電話的運作。技術的應用領域包括為消費者及物流服務供應商進行產品核證、查核及提供交易證明。

可供轉移的技術包括：

- ► RFID閱讀器芯片設計
- ► RFID閱讀器組件設計

UHF RFID Reader and Reader Module

The Centre's reader chip features low power consumption and small form factor and can be tailor-made for closed-loop applications in the Hong Kong and Mainland China markets. The IC chip design is created for mass production and as part of a low-cost RFID reader solution. As the retail price of the RFID reader is significantly lower than existing offerings and the size of the reader is smaller, enterprises can equip more staff with their own readers for anti-counterfeiting, product authentication, or stock-taking purposes.

Products available include:

- ► RFID reader chip
- ► RFID reader module
- ► RFID reader

無線射頻識別（RFID）閱讀器及模塊

本中心的閱讀器芯片耗電量低、外形小巧，適合香港及中國市場的閉環應用。此集成電路芯片設計可作大量生產及製成低成本RFID閱讀器。高產量使RFID閱讀器的零售價格大幅下調，加上閱讀器的外型輕巧，方便企業為更多員工分配閱讀器作防偽、核證、盤點之用。

可供出售的產品包括：

- ► RFID閱讀器芯片
- ► RFID閱讀器組件
- ► RFID閱讀器

4-Port RFID Reader

Owing to the R&D advancement, the well-developed light-weight reader chip and reader module are incorporated with the LSCM designed 4-Port RFID Reader for market adoption at affordable price.

The innovative 4-Port RFID Reader is designed in low profile and compact footprint, with reliable Read/ Write performance and supporting ISO 18000-6C (EPC Class 1 Gen 2) air interface protocol. It is powered by and communicated via a standard USB connection, providing a convenient connectivity that can be hosted by any desktop or laptop.

Equipped with LLC feature and 4-Port antenna connection capabilities, the reader not only provides greater coverage and reading distance at very low power consumption, but also facilitates the reduction of overall deployment cost of each read point. Moreover, it gives users flexibility to select antenna combinations in different application areas - from low gain proximity antennas to high gain far-field antennas.

Technologies ready to transfer include:

- ► Design of PCB Layout
- ► Firmware of 4-Port Reader

四端口無線射頻識別（RFID）閱讀器

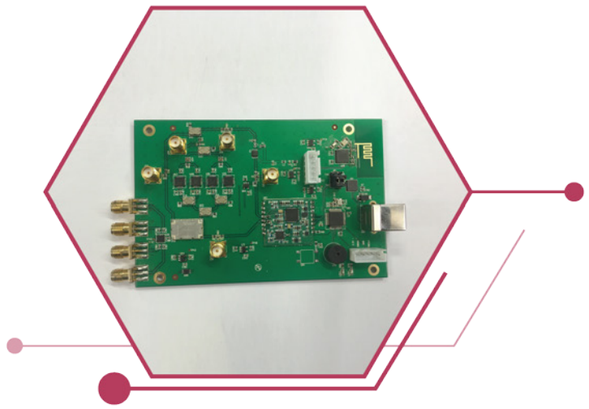
由於研發上的不斷進步，發展成熟的輕質量讀卡器芯片和讀卡模塊已可應用於LSCM設計的四端口RFID閱讀器上，以經濟的價格供市場採用。

嶄新的四端口RFID讀寫器的設計薄而小巧，具有可靠的讀寫性能，並支援ISO 18000-6C（EPC Class 1 Gen 2）空中接口協議。讀寫器提供標準USB接口供電和通訊，方便連接在任何桌面或手提電腦上使用。

配備LLC特性和四端口天線連接功能，此閱讀器不僅能以超低的耗電量提供更大的覆蓋範圍和閱讀距離，而且也有利於降低各讀取點的使用成本。此外，它為用戶提供了靈活性，可在不同的應用需求上選擇天線組合 - 從低增益天線到高增益遠場天線上。

可供轉移的技術包括：

- ► PCB佈局設計
- ► 四端口閱讀器固件



Optimal Design of Novel Reconfigurable UHF Antenna Systems for the Smart Shelf RFID Technology

The smart shelf system is a new RFID application concept for tracking RFID tagged items on smart shelves that aims to alleviate the challenges of optimising limited shelf space brought on by complex interference patterns, irregular shelf orientations and varying materials compositions of objects. The design of the UHF smart shelf antenna presents a promising future for tackling new technological challenges.

The Centre's novel UHF smart shelf reader antenna is suitable for scanning books, boxes, fabrics, and employs the travelling wave theory and planar antenna design principles to realise ultra-thin configurations. In addition to greatly reducing the manufacturing cost and increasing the flexibility of application, the novel antenna is designed to be reconfigurable. The Centre has also developed an advanced automatic optimisation design flow based on optimisation algorithms and computational electromagnetics tools, in order to address the interference issues that are inherent in smart shelf systems.

Technologies ready to transfer include:

- ► Reconfigurable smart shelf UHF antenna design
- ► Optimisation design software

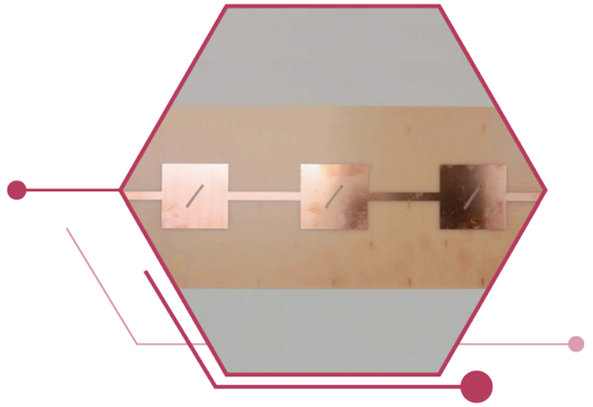
智能貨架射頻識別技術的可拼裝超高頻（UHF）天線系統之優化設計

此智能貨架是RFID技術的最新應用方案，主要用作自動追蹤貨架上附設RFID標籤的物品。受制於複雜性高、有限的空間、不同形狀的貨架，和不同物品的材料等因素，設計超高頻（UHF）智能貨架天線極具挑戰性。

這新穎的UHF智能貨架天線適合掃瞄書本、盒子及布料。此技術使用行波天線和平面天線的設計概念以達到低剖面要求。為了減低生產成本和增加應用的靈活性，天線設計是可重構的。此外，本中心亦會開發以優化算法和計算電磁仿真的自動優化設計流程，解決訊號互相干擾的技術難題。

可供轉移的技術包括：

- ► 可重構的智能貨架UHF天線設計
- ► 優化設計軟件



Integrated Barcode / RFID Reader for Retailing and Inventory

The Centre'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. 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 on the market. The omni-directional internal antenna design of the reader ensures the reader can read the RFID tag regardless of orientation.

The provision of self-service baggage check-in is an upcoming trend for most of the international airports in the Western world. While many of these airports employ 1D and 2D barcodes, the Hong Kong International Airport utilizes additional technologies which benefits from devices that can address RFID read / write requirements to provide enhanced services. LSCM's RFID reader module has been tested at HKIA for many of these applications and provides significant value in reducing cost and improving readability.

Technologies ready to transfer include:

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

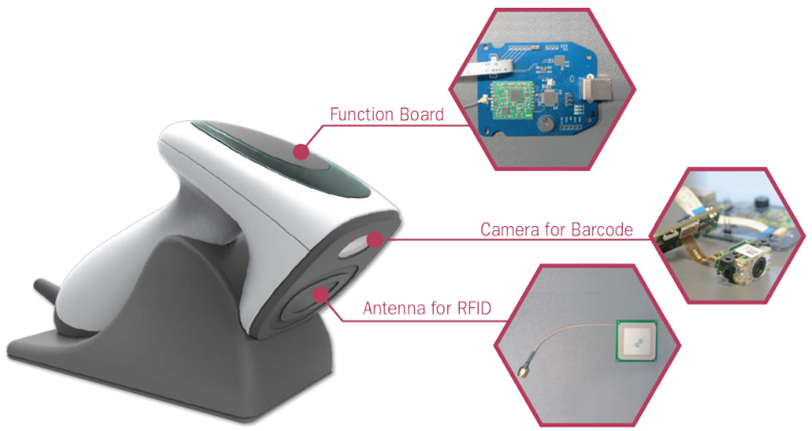
應用於零售及庫存的條碼 / 無線射頻識別（RFID）集成閱讀器

本中心研發的手持式閱讀器集結了二維條碼和RFID閱讀能力，而且外殼設計時尚輕巧。此閱讀器適用於零售和盤點；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，此閱讀器較現成產品更為纖巧、輕量，而最重要的是成本更低。而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。

自助行李托運是大多數西方國際機場的未來發展趨勢。當大多數機場仍只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。LSCM的RFID讀寫器在成本和可讀性方面非常適合這種應用。

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



Package-specific RFID Tagging and Embedding Technology

By leveraging the multitude of powerful tools at the Centre's disposal for assisting with antenna design and measurements, the Centre has developed more than 200 package-specific antennas and inlays for product packages. Each design is customised to overcome challenges in RFID labelling including ensuring compatibility with liquid, metal, and the like. Additionally, the Centre has developed technologies for embedding RFID tags into product packages and integrating them into the packaging manufacturing process.

Technologies ready to transfer include:

- ► Over 200 passive RFID tag antenna designs for different purposes (metal, wine bottle, soil and carton box, etc.)
- ► RFID tag antenna customisation
- ► Printed RFID antenna technology on paper and plastic surfaces

適用於產品包裝的無線射頻識別（RFID）標籤及嵌入技術

本中心開發了許多特別設計的天線，至今已成功研發超過200個配合產品包裝的天線與內嵌標籤。每項特別的設計也能解決RFID標籤的常見難題，例如不適用於液體及金屬產品等。此外，本中心亦研發了將RFID標籤嵌入產品包裝的相關技術，並將嵌入程序融入產品包裝生產的過程中。

可供轉移的技術包括：

- ► 超過200個針對不同設計要求的無源RFID標籤天線（金屬、酒瓶、泥土和紙箱等）
- ► RFID標籤天線的設計可按顧客需求訂造
- ► 可在紙張和膠面上打印RFID天線的技術

Tag antenna optimised for
lossy dielectrics with medium permittivity
(e.g. soil, wine bottle)

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