



Hong Kong R&D Centre for Logistics and
Supply Chain Management Enabling Technologies
香港物流及供應鏈管理應用技術研發中心

香港物联网技术发展： 从技术研发到民生应用

唐志鸿 博士 . Dr. Frank Tong

第六届粤港射频识别（RFID）技术应用高峰论坛

2011年9月23日 · 广州



- 成立於2006年
Established in 2006
- 香港政府資助
Funded by HKSAR Government
- 三所大學主持：
Co-hosted by 3 Universities
 - 香港大學 (HKU)
 - 香港中文大學 (CUHK)
 - 香港科技大學 (HKUST)

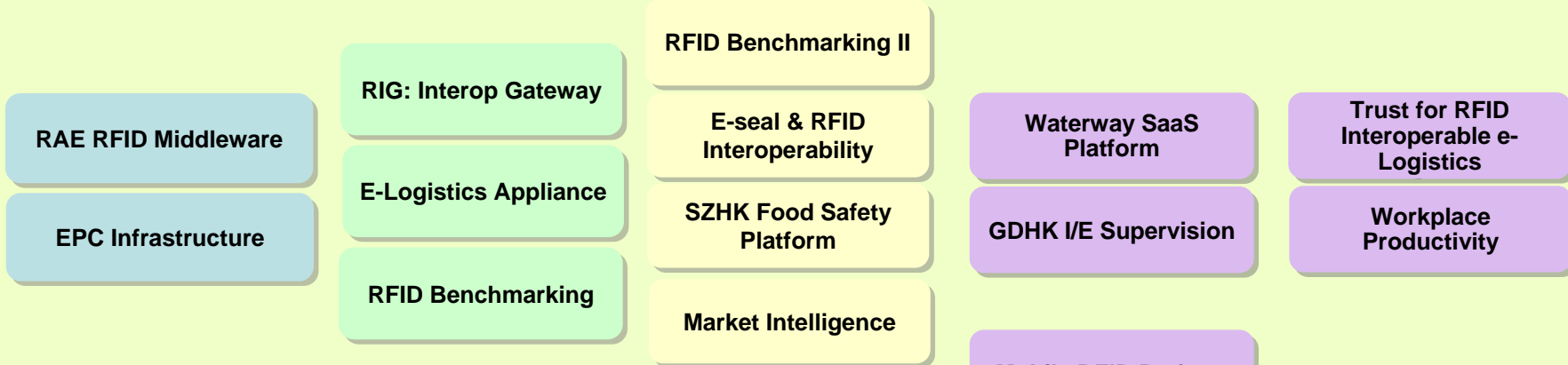
使命

1. 鼓勵和培育技術的研究及發展
Incubate technology R&D and talents
2. 作為科研成果商品化的支持中心
Facilitate intellectual property commercialization
3. 促進企業應用，提升競爭力
Promote adoption, enhance industry competitiveness

Applications & Decision Support Systems



Network & Infrastructure Technologies



Hardware & Systems





Applications & Decision Support Systems

Hospital Risk Mgmt	Food Quality Management
On-Target Visibility In Garment SC	E-lock for Transshipment

Trial Schemes Focused Projects Industry Collab

Correctional Service Tooling	Patients Mgmt	E-Lock Collaborative
Seizure Mgmt Tooling	Baby Tagging	Red Wine Collaborative
Retail Kiosk Tooling	Construct Workers Attendance Mgmt	Shop-Floor Collaborative
	E-Learning System in Shelter Workshop	

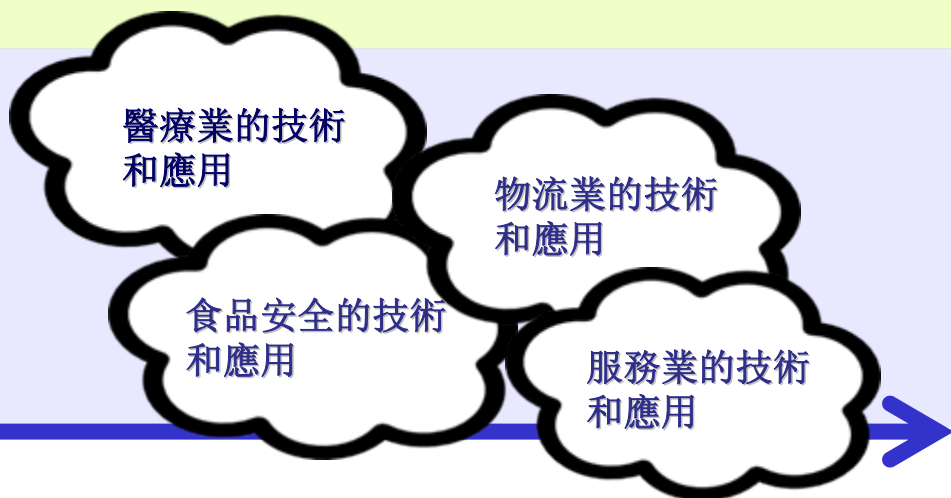
Network & Infrastructure Technologies

Waterway SaaS Platform	Trust for RFID Interoperable e-Logistics
GDHK I/E Supervision	Workplace Productivity

Software Service Tooling	Smart Ward Infrastructure
E-Lock/GPS Logistics Tooling	Product Authentication
Food Tracking Tooling	Bldg Component Lifecycle Mgmt

RFID Hardware & Systems

Mobile RFID Platform	
RFID Food Tagging	
Tracking Device	Printable Antenna
NFC/Mobile Reader Chip	



- Around 80,000 babies born per year in HK
- Baby management is an issue of concern by HA's Group Internal Audit
- United Christian Hospital is selected as the pilot to implement an active RFID system for better new born baby management
- System to be developed to monitor up babies and medical equipment/asset simultaneously using RFID and sensor technologies
- The RFID tag should securely and safely strapped to the baby's wrist or ankle with reasonable form factor and weight (avg. newborn baby is about 50cm long and weight 2.5kg)
- The system should integrate seamlessly with hospital operations with minimal impact to medical personnel's working practice and workflow
- The system should alarm if any of the tag is being cut or removed from the ward

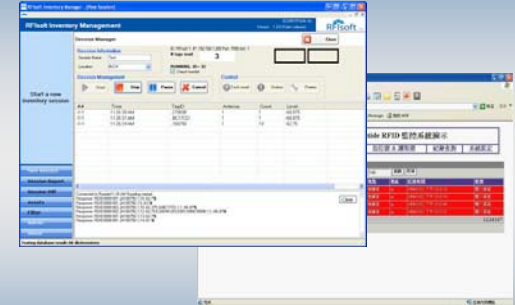
Specific Active RFID Solution: Baby management



Reader

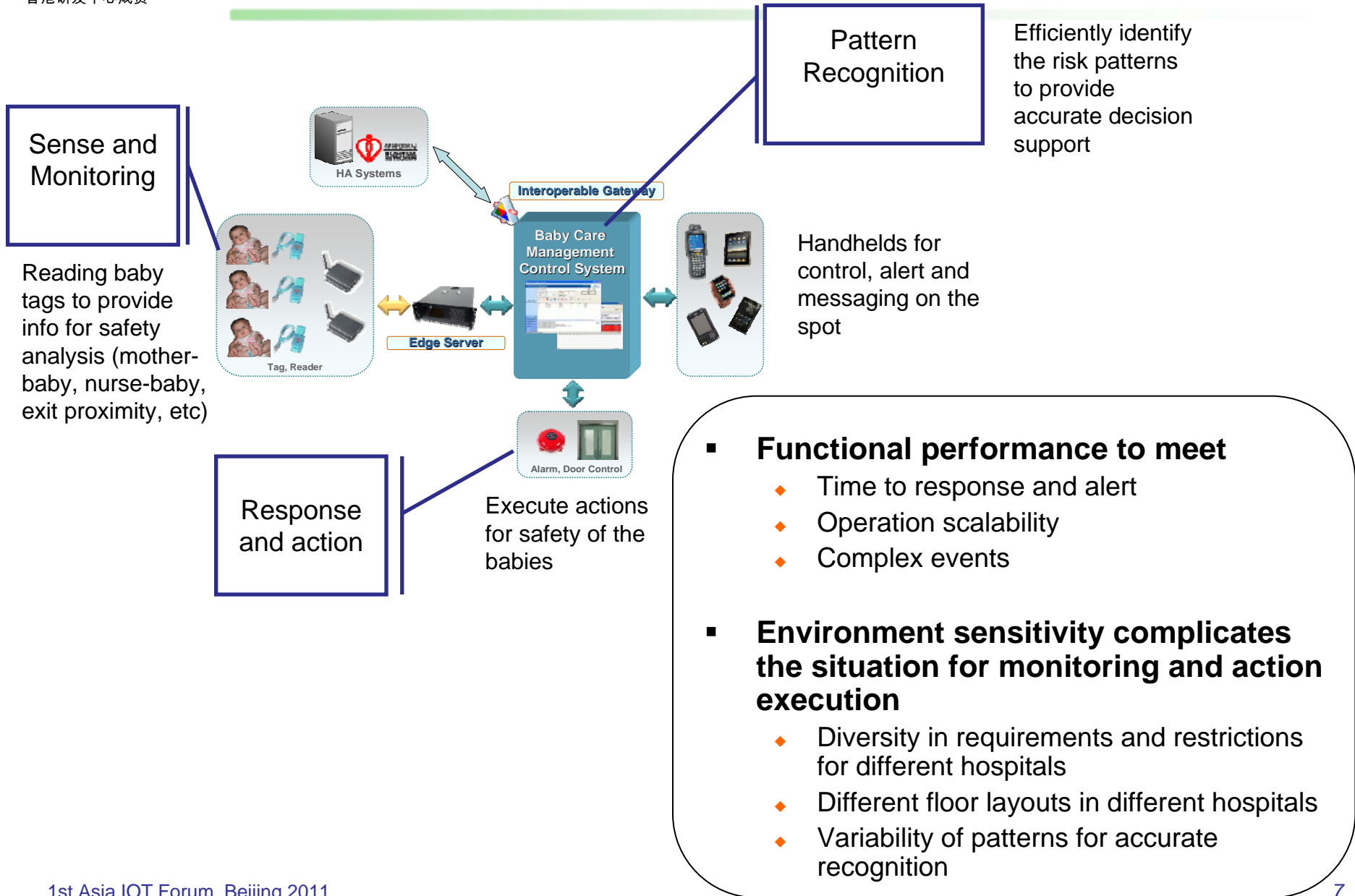


*Active Tag w/ reusable
tamper-resistant strap*



*Baby Case Management &
Control System*

1. No available tag on market that fit HA's requirements
2. Co-develop new enabling technologies for babies management in hospital environment with experienced medical personnel
3. Enable local vendors to provide affordable solutions and enter the healthcare market
 - Local active RFID manufacturers are interested to enter into the healthcare market but they lack product requirements and clinical trial opportunities
 - Local SI/software vendors are also interested but lack hardware products and clinical trial opportunities



Project: Low Cost Versatile Tracking Device for Logistics Operations

- R&D by LSCM and HKU EEE

Tracking as a Service

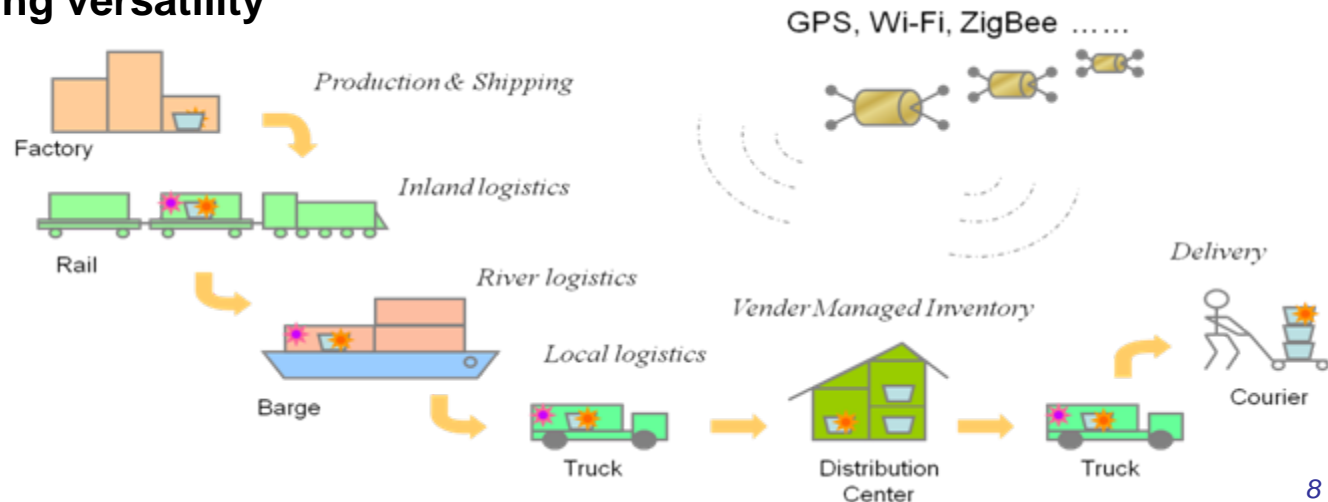
- Multimode cargo tracking
- Site and device provisioning, tracking data and events, edge and middleware services, positioning services
- Web service clients

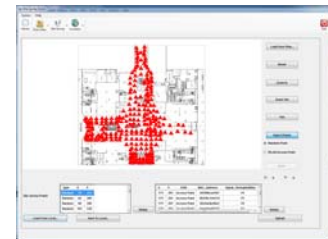
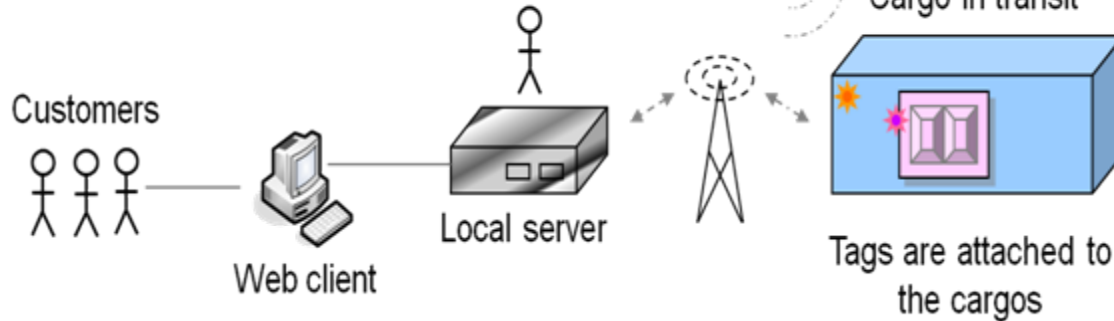
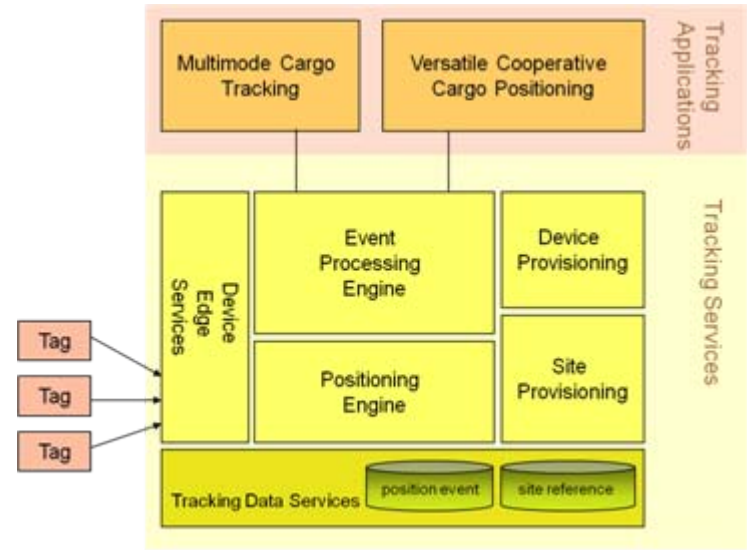
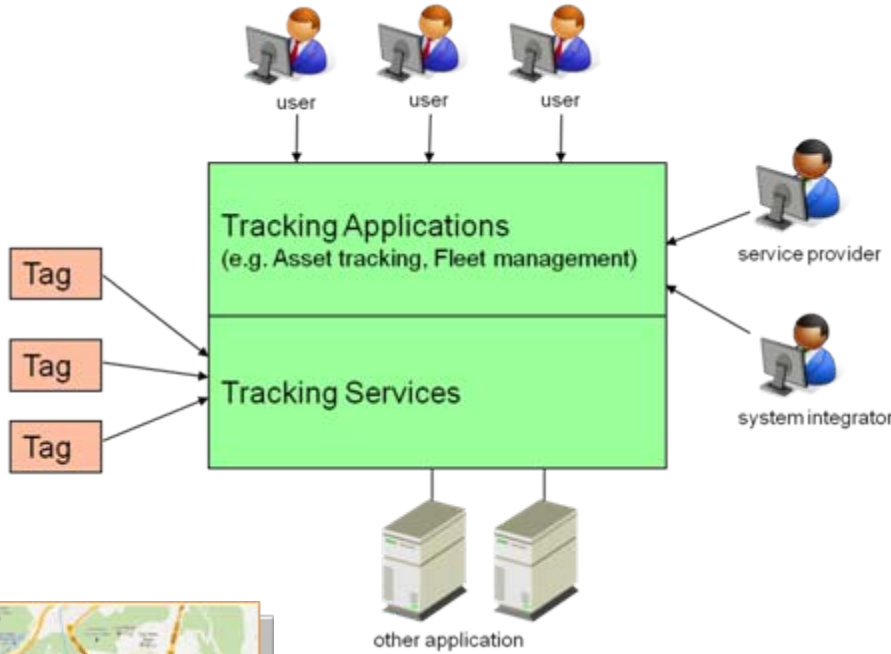
Ubiquitous tracking technologies

- Hybrid positioning
- Collaborative positioning

Device series for tracking versatility

- Carrier
- Operator
- Item










Ubiquitous tracking technologies

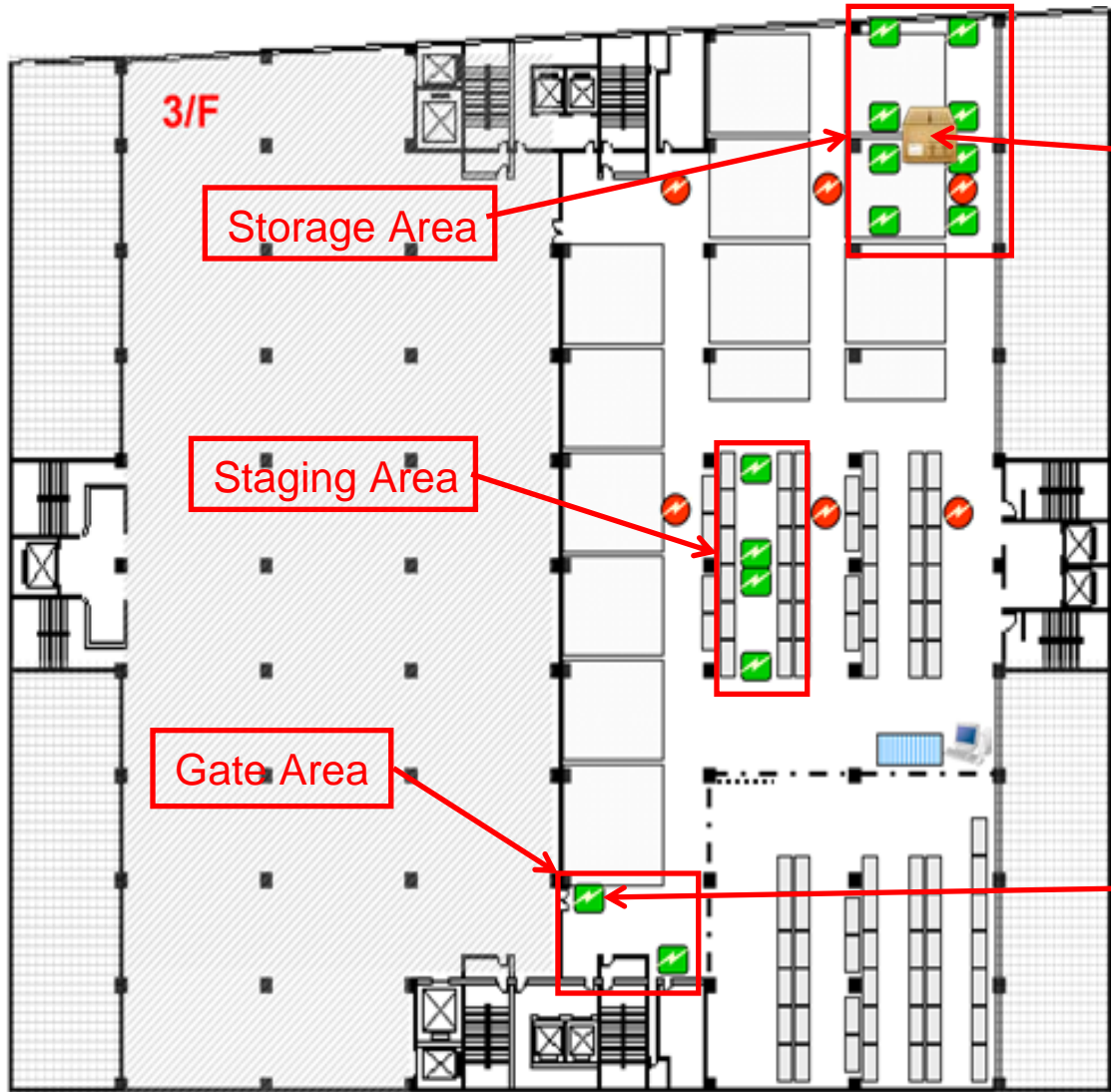
- Hybrid positioning
- Collaborative positioning

Device series for tracking versatility

- Carrier
- Operator
- Item

Positioning Tech	Indoor or Outdoor	Accuracy	Range & Coverage	Deployment Cost	Mobile Unit Cost	Op & Mtn Costs
GPS	Outdoor	Medium	Long Global	N/A	Low	Low
Wi-Fi	Indoor & Outdoor	Medium	Long	Medium	Low	Low
Cellular Network	Indoor & Outdoor	Low	Long	N/A	Medium	High
RFID	Indoor	High	Short Room level	Medium	Very Low	Low
ZigBee	Indoor & Confined Outdoor	High	Medium Enterprise Level	Medium	Low	Low
Hybrid	Indoor & Outdoor	High Adaptive	Long & Global	Low to Med	Low	Low

	PDA	Barcode reader Windows CE
	Item Tag	ZigBee
	Item Tag Reader	ZigBee Ethernet (100BaseT)
	Operator Tag	ZigBee WiFi 3G (GPRS)
	Vehicle Tag	3G (GPRS) GPS ZigBee



The Item Tag attached to the product item is detected in the storage area by the system



Item Tag Reader is installed into the different area

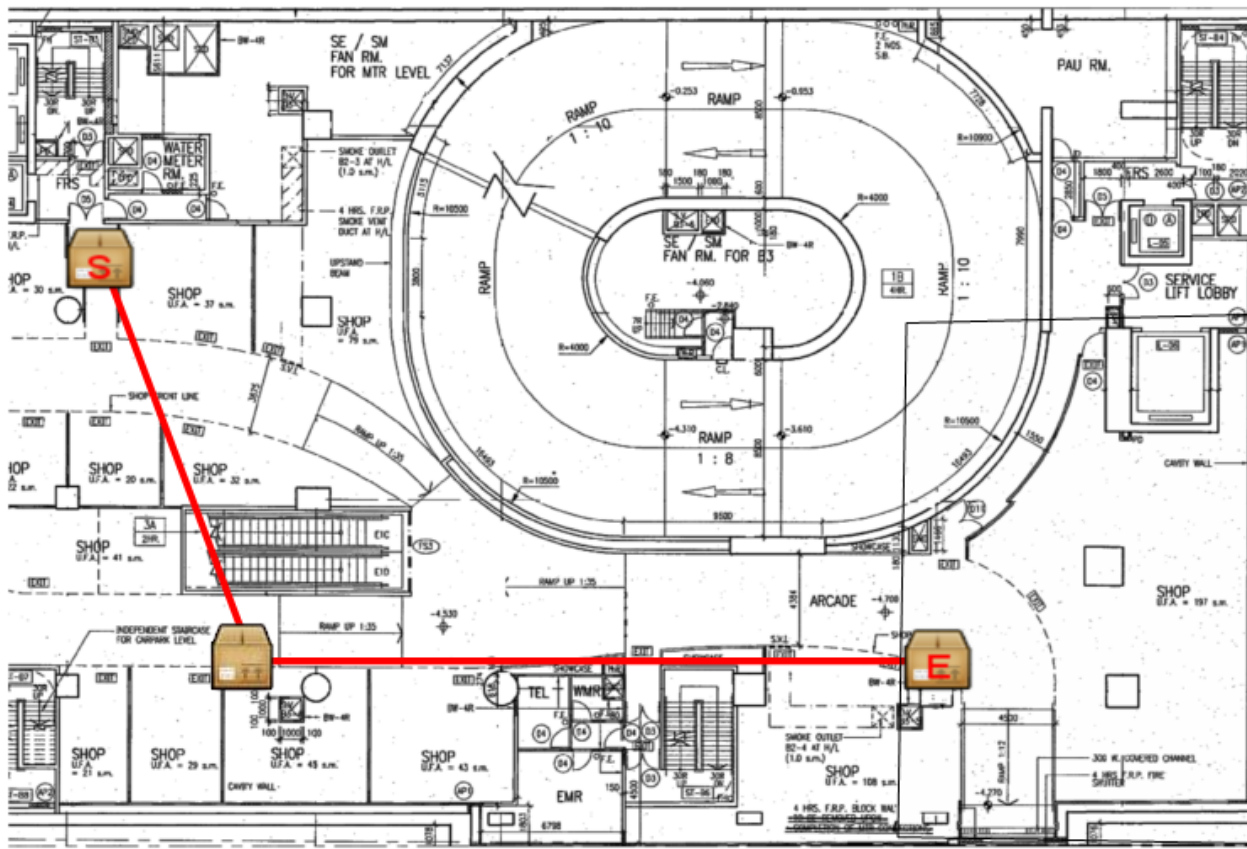


The vehicle tag is installed into the truck to support tracking

- The vehicle labeled with 'S' indicates the starting location, which is the warehouse
- The vehicle labeled with 'E' indicates the delivering location. In this case it is Taikoo Shing Shopping Arcade.

Indicator	Location	Time when the vehicle is located at
	Warehouse	5 Aug 2011 10:31:27
	Shopping floor	5 Aug 2011 15:11:45

Shopping Floor Tracking



Operator Tag

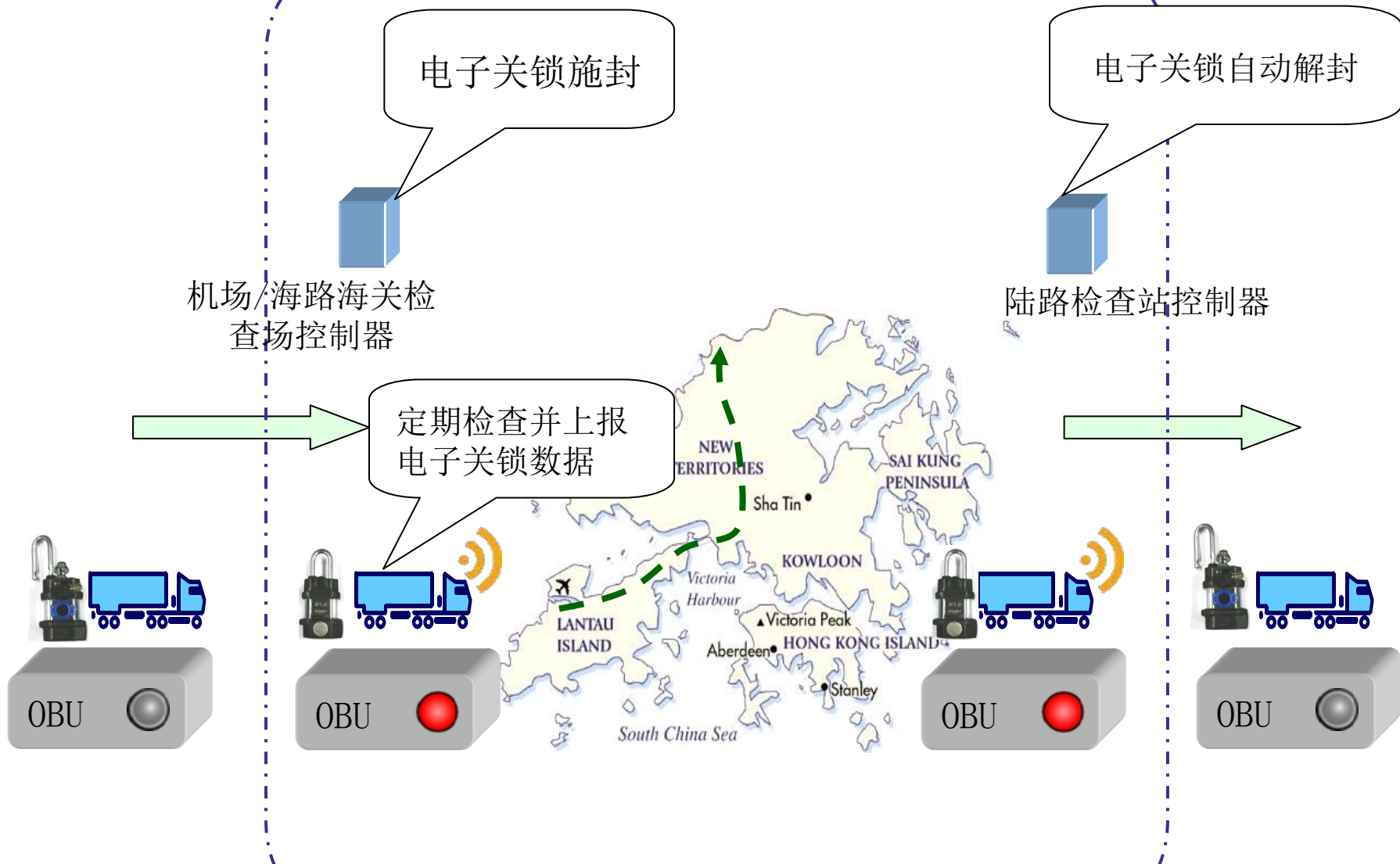
Indicator	Location	Time when the item is located at
	The location where the item firstly appeared at the shopping floor	5 Aug 2011 14:16:03
	The location where the item was in transit	5 Aug 2011 14:16:31
	The location where the item was delivered to the shop	5 Aug 2011 14:23:55

- ❖ 道路货物资料系统 (ROCARS)
- ❖ 多模式联运转运货物便利计划 (ITFS)
 - ❖ 目的：减少转运货物接受海关检查的次数，为运送空陆联运转运货物提供便利
 - ❖ 参与者及其车辆必须是道路货物资料系统及此计划的登记使用者
 - ❖ 载货车辆已安装香港海关认可的电子关锁及全球定位系统设备
- ❖ 电子封签应用的发展和延伸 \implies 电子关锁
- ❖ 电子封签技术的继承和提升

电子关锁施/解封操作流程流程图

香港机场/海路边境

香港陆地边境



国内出发南下行程



ITFS 车辆



数据交换接口
ROCARS 及 ACCS



陆地边境检查站

电子关锁自动施封

是否需要海关检查?

是



停车检查电子关锁

否

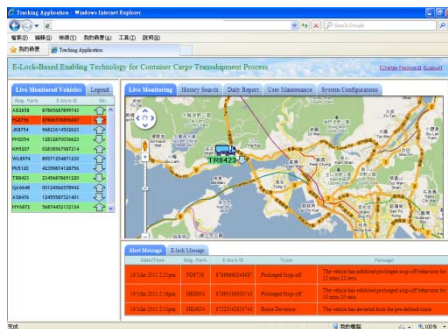


使用手持机扫描检查



检查内容包括:

- 电子关锁是否有效
- 发送SMS / email
- 禁止电子关锁自动解封



车辆异常

✓ 系统自动产生报警信息



机场装卸货区


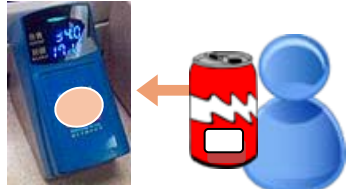

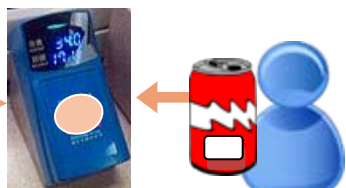

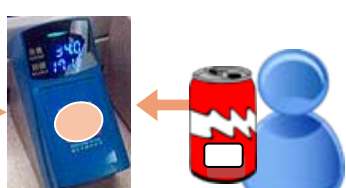

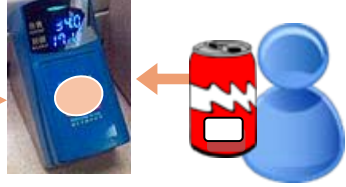
✓ 特别处理程序

✓ 卸货时执行货物检查

- ◆ 销费者：How can Consumers be assured of product authenticity at the retail point of purchase?
- ◆ 产品生产商：How do product Brand-Owners/ Traders/ Manufacturers ensure consumers of their product authenticity?
- ◆ 认证机构：How can Certification Bodies ensure that the certification mark not being abused by counterfeit products?

消费者核证产品的流程

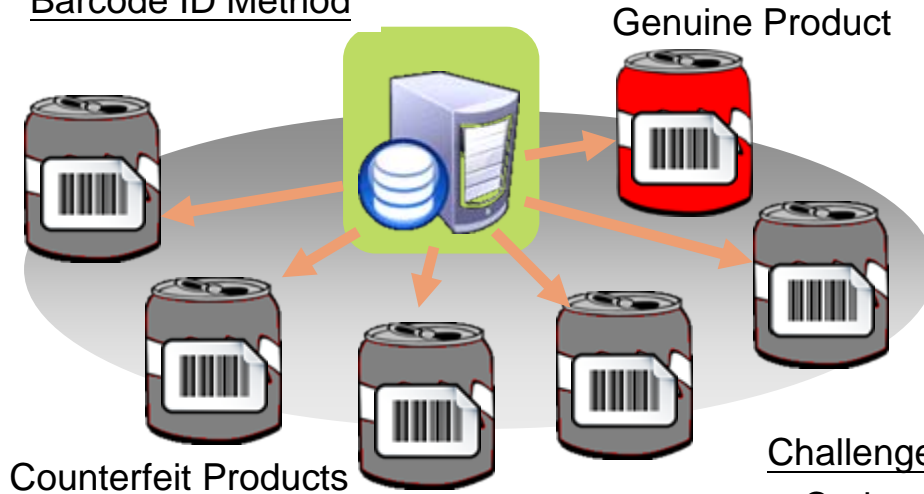
Production Authentication Scenario

	Product Authentication Process	Cert Body	Product Brand	Retail Store	Consumer
1	Consumer asks: "Is this a genuine product?"				
2	CB tells: "Yes, it is a genuine product, certified under the HK Product Cert"				
3	健宜堂 tells: "This 蟲草 imported from 西藏 by 健宜堂 in 2011. 健宜堂 knows that 蟲草 product is most (38%) asked about in 上環 district during the last 3 months"		 健宜堂		
4	上環泰康藥房 promotes: "健宜堂 蟲草 sold at 10% discount if purchasing 康華堂川貝 together"			 泰康藥房	

现行方案对防伪不足的地方

Existing Methods Inadequate in Combating Counterfeit

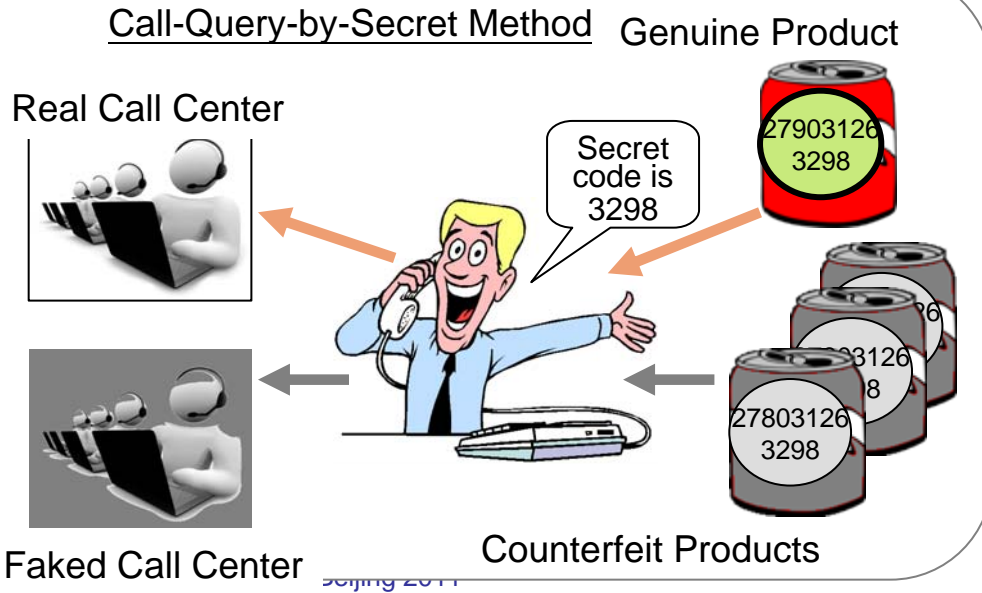
Barcode ID Method



Challenges

- Code valid for authentication over longest transaction chain until package gets opened
- Method to invalidate code upon replication
- Method to neutralize rogue authentication readers
- Method to combat counterfeiters along SC from stealing info and replicating product ID at:
 - ✗ Third-party logistics operations
 - ✗ Warehouse and Distribution Centers
 - ✗ Retailer stocking and shelving
 - ✗ RFID scanning upon authentication
- Use market available RFID and security tech while innovate in security models, protocols and processing methods
- Friendly operation and viable business models

Call-Query-by-Secret Method



Use-IT-Easy : A Low-Cost, High Performance Mobile RFID Platform

- R&D by LSCM and City University

- Adoption Barriers

- ◆ Cost – Readers and Tags
- ◆ Software – middleware and other licenses
- ◆ Lack of skilled labor
- ◆ Training on workflow changes
- ◆ Difficult to perceive ROI

- Develop cost-effective mobile RFID solution

- ◆ Reduce entry barrier for adoption
- ◆ A low-cost, light weight RFID reader
- ◆ Easily adaptable to present processes
- ◆ User friendly and easy to use

- RFID Market at Present

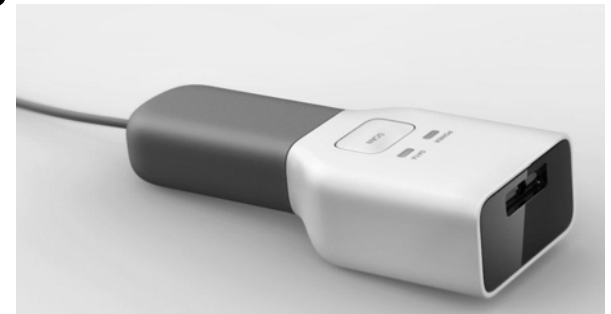
- ◆ RFID tag prices came down (US\$0.1 in volume)

However

- ◆ Reader price remains high (US\$2,500)
- ◆ Lack of skilled labor
- ◆ Limited number of trained professionals and training programs

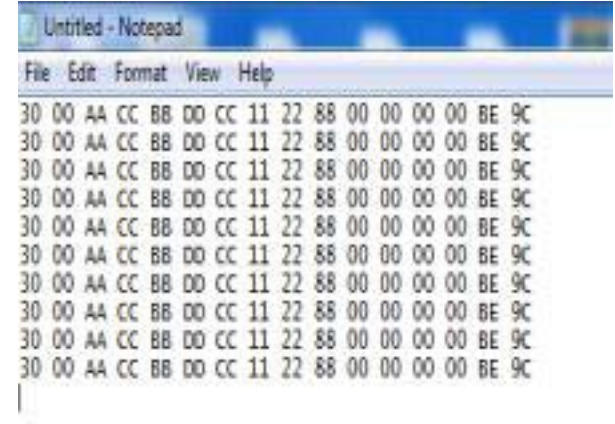
- Hardware Design
 - ◆ Designed with just required components for the basic functions

- Mobile RFID reader has two versions
 - ◆ USB Plug and play device connected with PC, MAC, laptops, embedded devices
 - ◆ USB snap on for mobile devices - mobile phones, Android phones, tablets



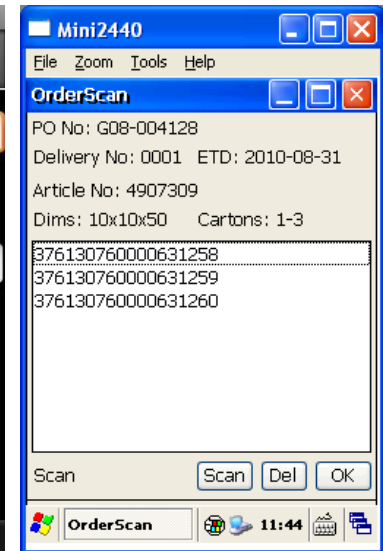
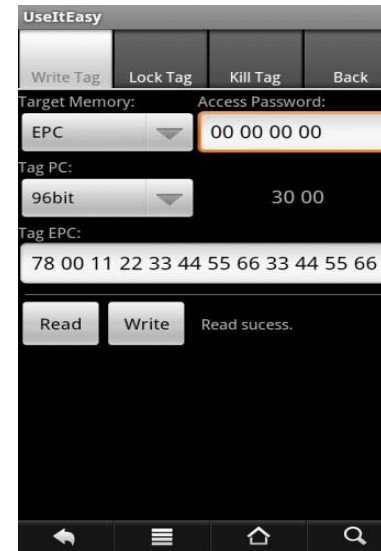
■ Data Interface

- ◆ Reader writes like a Human Interface Device input device
- ◆ Transfers scanned result to any app like notepad, word, text field etc.



■ SDK for all operating systems

- ◆ PC OS - MS Win, Mac OS, Linux
- ◆ Mobile OS – Android, .NET for CE



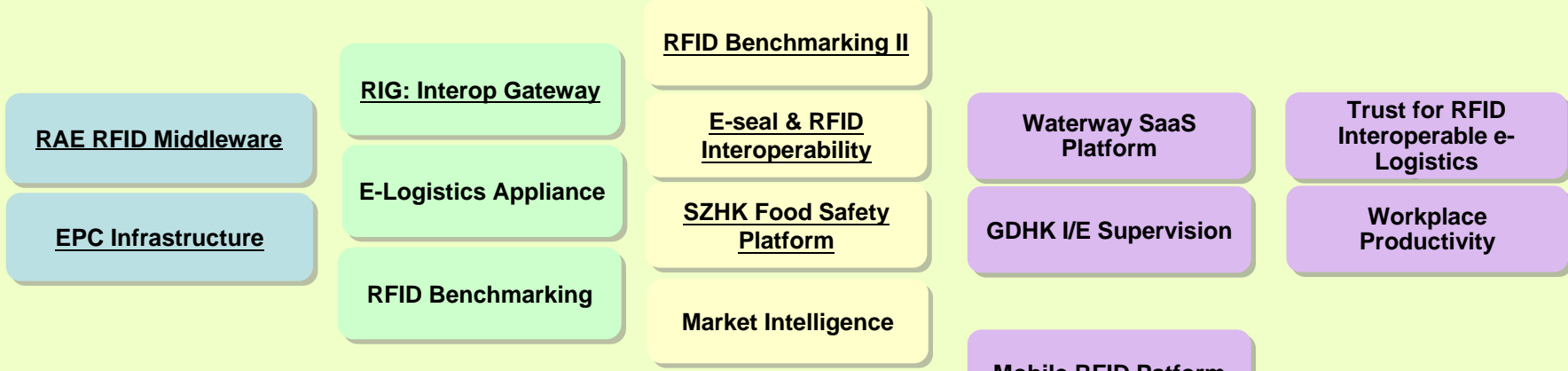
可授权及产业化转移的技术研发成果

R&D Deliverables available for Licensing

Applications & Decision Support Systems



Network & Infrastructure Technologies



Hardware & Systems



Anti-Counterfeit, Asset, Commercial Applications

Retail & Logistics

Real-Time Shop-Floor

Asset/ Personnel Tracking

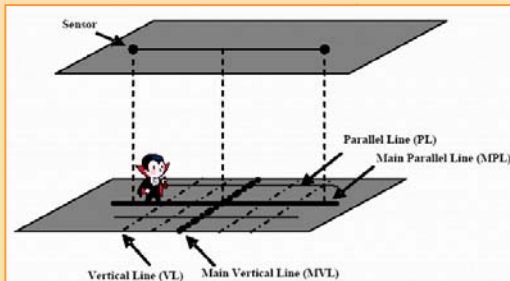
Hospital Risk Mgmt

Food Quality Management

On-Target Visibility In Garment SC

E-lock for Transshipment

Tracking in coal mines



Licensables:

- Zigbee-based communication platform
- Localization algorithm and implementation
- Routing scheme and implementation

Forwarding

marking II

RFID ability

SZHK Food Safety Platform

Waterway SaaS Platform

Trust for RFID Interoperable e-Logistics

GDHK I/E Supervision

Workplace Productivity

elligence

Mobile RFID Platform

ic Tagging

RFID Food Tagging

RFID Tech

Tracking Device

Printable Antenna

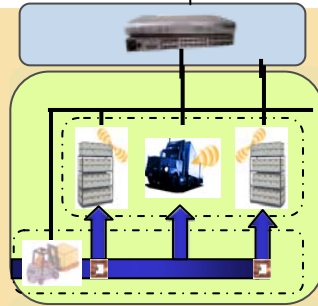
NFC/Mobile Reader Chip

Applications & Decision Support Systems

Network & Infrastructure Technologies

Hardware

RFID Manufacturing Shop Floor



Licensables:

- RFID Data Capture gateway
- Real-time work-in-progress shell
- Production scheduling shell

Anti-Counterfeit, Asset, Commercial Applications

Retail & Logistics

Asset/ Personnel Tracking

Real-Time Shop-Floor

Freight Forwarding

RFID Benchmarking II

E-seal & RFID Interoperability

SZHK Food Safety Platform

Market Intelligence

Package-Spec Tagging

Trustworthy RFID Tech

Hospital Risk Mgmt

On-Target Visibility In Garment SC

Food Quality Management

E-lock for Transshipment

Waterway SaaS Platform

GDHK I/E Supervision

Trust for RFID Interoperable e-Logistics

Workplace Productivity

Mobile RFID Platform

RFID Food Tagging

Tracking Device

NFC/Mobile Reader Chip

Printable Antenna

RFID Reader

Passive Tag & Reader IC

Applications & Decision Support Systems

Anti-Counterfeit, Asset, Commercial Applications

Retail & Logistics

Asset/ Personnel Tracking

Real-Time Shop-Floor

Air Freight Forwarding

Hospital Risk Mgmt

Food Quality Management

On-Target Visibility In Garment SC

E-lock for Transshipment

RFID Benchmarking Methodology



D Benchmarking II

E-seal & RFID Interoperability

ZHK Food Safety Platform

Market Intelligence

Waterway SaaS Platform

Trust for RFID Interoperable e-Logistics

GDHK I/E Supervision

Workplace Productivity

Mobile RFID Platform

RFID Food Tagging

Tracking Device

Printable Antenna

NFC/Mobile Reader Chip

Package-Spec Tagging

Trustworthy RFID Tech

Benchmarking Report

- Technical Guide Book
- Benchmarking Report

Tool Supports

- Three tool supports developed

Consultation Services

- Our expertise in benchmarking test
- The data collected during the project period

2006

2007

2008

2009

2010

E-seal / RFID for container logistics



RAE RFID Middleware

Licensables:

- E-seal track and trace application system
- RFID Container Management System for River Trade
- Interoperable Site Server

Single-Chip Passive Tag & Reader

Privacy and Security

RFID Reader

Passive Tag & Reader IC

Asset/ Personnel Tracking

I-Time Shop-Floor

Freight Forwarding

D Benchmarking II

E-seal & RFID Interoperability

ZHK Food Safety Platform

Market Intelligence

Package-Spec Tagging

Trustworthy RFID Tech

Hospital Risk Mgmt

Food Quality Management

On-Target Visibility In Garment SC

E-lock for Transshipment

Waterway SaaS Platform

Trust for RFID Interoperable e-Logistics

GDHK I/E Supervision

Workplace Productivity

Mobile RFID Platform

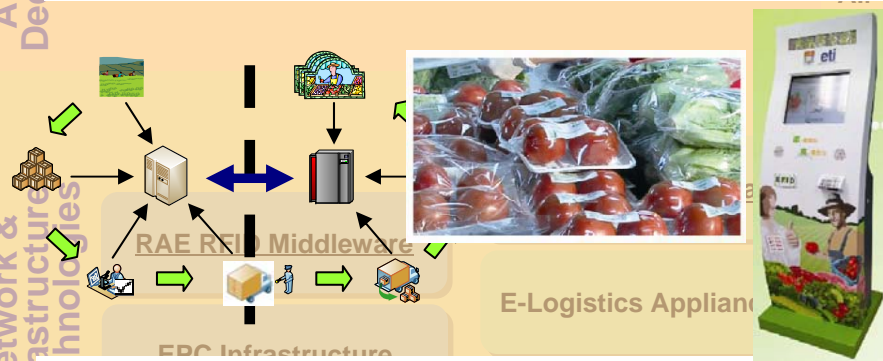
RFID Food Tagging

Tracking Device

Printable Antenna

NFC/Mobile Reader Chip

Food Safety Information Platform



- Licensables:
- Food safety platform
 - Enterprises application system
 - Re-packaging handheld
 - Information kiosk for consumers

Asset/ Personnel Tracking

- Hospital Risk Mgmt
- Food Quality Management
- On-Target Visibility In Garment SC
- E-lock for Transshipment

Real-Time Shop-Floor

Freight Forwarding

D Benchmarking II

E-seal & RFID Interoperability

- Waterway SaaS Platform
- Trust for RFID Interoperable e-Logistics
- GDHK I/E Supervision
- Workplace Productivity

ZHK Food Safety Platform

Market Intelligence

- Mobile RFID Platform

Package-Spec Tagging

- RFID Food Tagging

Sturdy RFID Tech

- Tracking Device

- Printable Antenna

- NFC/Mobile Reader Chip

Trustworthy RFID Technology



RAE RFID Middleware

Licensables:

- Advanced DFSA Algorithm
- Communication Protocol
- Reference Design of
 - Tag, Reader, Sensor Integration
 - GUI & Monitoring Software

Single-Chip Passive Tag & Reader

Privacy and Security

RFID Reader

Passive Tag & Reader IC

Asset/ Personnel Tracking

I-Time Shop-Floor

Freight Forwarding

RFID Benchmarking II

E-seal & RFID Interoperability

ZHK Food Safety Platform

Market Intelligence

Package-Spec Tagging

Trustworthy RFID Tech

Hospital Risk Mgmt

Food Quality Management

On-Target Visibility In Garment SC

E-lock for Transshipment

Waterway SaaS Platform

Trust for RFID Interoperable e-Logistics

GDHK I/E Supervision

Workplace Productivity

Mobile RFID Platform

RFID Food Tagging

Printable Antenna

Tracking Device

NFC/Mobile Reader Chip

Package specific tagging



RAE RFID Middleware

Licensables:

- Designs of package-specific antennas for product packages

Asset/ Personnel Tracking

I-Time Shop-Floor

Freight Forwarding

D Benchmarking II

E-seal & RFID Interoperability

ZHK Food Safety Platform

arket Intelligence

Hospital Risk Mgmt

On-Target Visibility In Garment SC

Food Quality Management

E-lock for Transshipment

Waterway SaaS Platform

Trust for RFID Interoperable e-Logistics

GDHK I/E Supervision

Workplace Productivity

Mobile RFID Platform

RFID Food Tagging

Tracking Device

NFC/Mobile Reader Chip

Printable Antenna

RFID Tag & Reader Tech

90nmUHFTag IC

Single-Chip Passive Tag & Reader

Privacy and Security

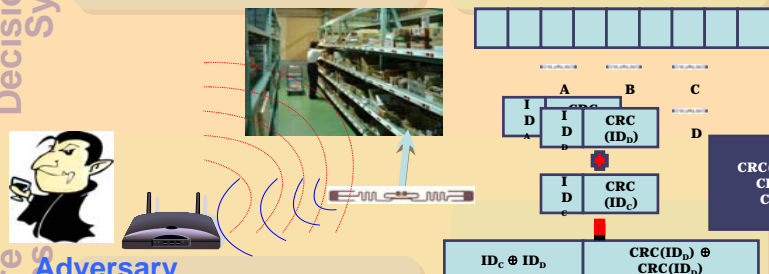
RFID Reader

Passive Tag & Reader IC

Package-Spec Tagging

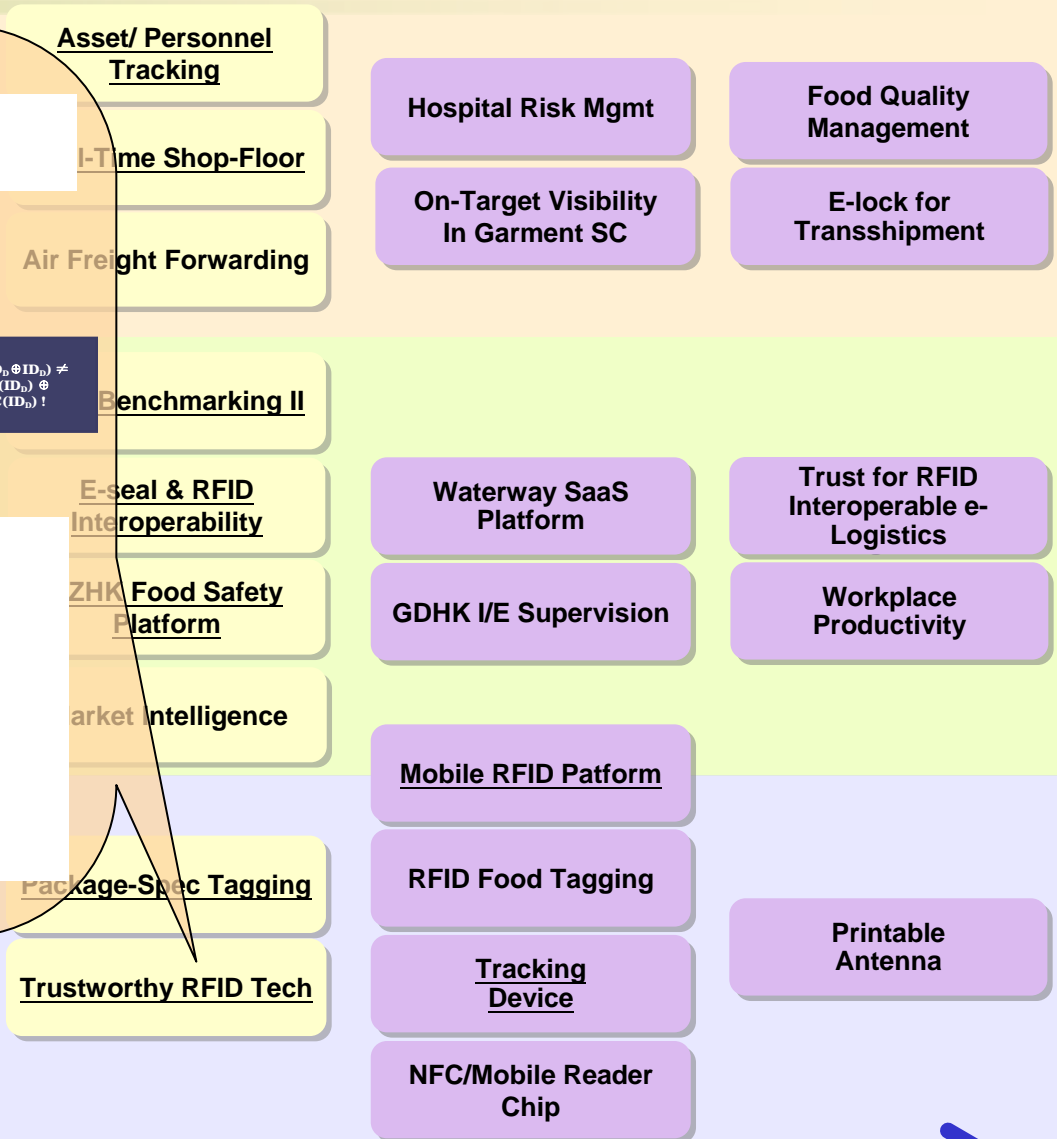
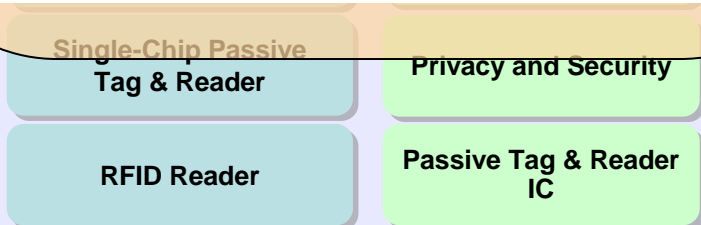
Trustworthy RFID Tech

Trustworthy RFID Technology



Licensables:

- Secured and privacy-preserving active UHF RFID tag design
- Authentication protocols
- Uniform platform for RFID Trustworthy Computing



可授权及产业化转移的技术研发成果

R&D Deliverables available for Licensing

Applications & Decision Support Systems

Network & Infrastructure Technologies

Hardware & Systems

USB Readers



Licensables:

- Hardware design
- Firmware
- SDK

Asset/Personnel Tracking

Hospital Risk Mgmt

Food Quality Management

On-Target Visibility In Garment SC

E-lock for Transshipment

Shop-Floor

Inventory Management

Parking II

Waterway SaaS Platform

Trust for RFID Interoperable e-Logistics

GDHK I/E Supervision

Workplace Productivity

E-seal & RFID Reliability

Product Safety Form

Intelligence

Mobile RFID Platform

RFID Food Tagging

Printable Antenna

Package-Spec Tagging

Single-Chip Passive Tag & Reader

Privacy and Security

Trustworthy RFID Tech

Tracking Device

RFID Reader

Passive Tag & Reader IC

NFC/Mobile Reader Chip

技术转移及商业应用的成功个案

Examples of Technology Transfer and Commercialization

Applications & Decision Support Systems

Anti-Counterfeit, Asset, Commercial Applications

Retail & Logistics

Asset/ Personnel Tracking



Hospital Risk Mgmt

Food Quality Management

On-Target Visibility In Garment SC

E-lock for Transshipment

Network & Infrastructure Technologies

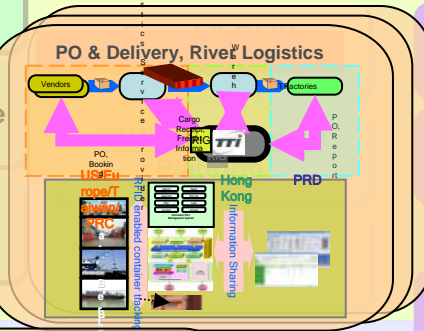
RAE RFID Middleware

RIG: Interop Gateway

EPC Infrastru



PO & Delivery, River Logistics



Waterway SaaS Platform

Trust for RFID Interoperable e-Logistics

GDHK I/E Supervision

Workplace Productivity

Hardware & Systems

RFID Tag & Reader Tech

Single-Chip Passive Tag & Reader

Privacy a

RFID Reader

Passive T



ec Tagging

RFID Tech

Mobile RFID Platform

RFID Food Tagging

Printable Antenna

Tracking Device

NFC/Mobile Reader Chip

2006

2007

2008

2009

2010

RFID應用：香港機場自動行李處理

RFID for Automatic Baggage Handling at HK Airport



RFID應用：香港機場自動行李處理

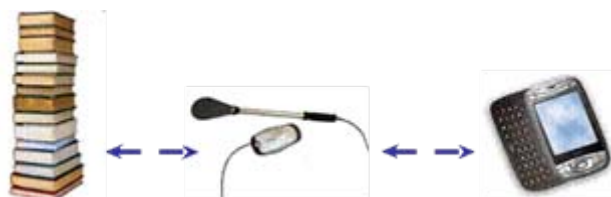
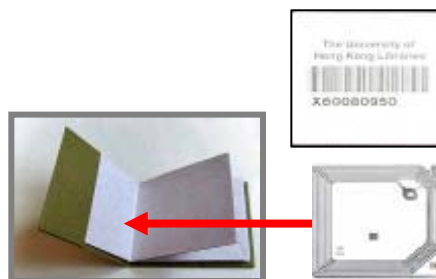


- *In 2003, HKIA adopted to apply RFID technology to improve the Baggage Handling and Management System*
- *In mid 2004, RFID equipment installation commenced at baggage handling areas*
- *In Aug 2005, over 20M RFID label used per year*

RFID應用：香港大學圖書館

RFID at HKU Main Library

- First RFID-enabled university library in HK
首個使用RFID的大學圖書館
- Tagging over 1 million circulating items
貼標數量超過一百萬冊
- Up to 11,000 loans per day, over 100,000 patrons
超過100,000讀者，每天11,000書流量
- Launched in October 2008
2008年10月開始使用



RFID应用于醫院管理局殮房服務

Use of RFID for Mortuary Services at Hospital Authority

Background (背景)

- HA decides to employ RFID in streamlining the operations and enhancing the management of bodies in HA mortuaries after the previous mortuary incidents to ensure correct identification and safeguard the loss of bodies

Objectives (目標)

- Real-time tracking and tracing of bodies in the mortuaries
- Streamlining stocktaking of bodies in various areas including body compartments, cold room, etc
- Enhance identification and verification of bodies
- Safeguard body collection and release procedures and prevent inadvertent egress of bodies

Pilot Hospitals (試點醫院)

- 九龍西瑪嘉烈醫院 Princess Margaret Hospital (PMH) in Kowloon West Cluster (KWC)
- 九龍東聯合醫院 United Christian Hospital (UCH) in Kowloon East Cluster (KEC)



From EPC Network to ezTRACK Solutions Offering



Tracking your goods, anytime, anywhere
貨品行蹤 掌握之中

How ezTRACK works to provide information visibility in your supply chain?



Also See:

- ✦ [What is ezTRACK?](#)
- ✦ [Benefits](#)
- ✦ [Features](#)
- ✦ [Business Scope](#)
- ✦ How ezTRACK works?
- ✦ [Solutions Available](#)
- ✦ [Enquiries & Subscription](#)

- WIP Track
- Inventory Track
- DataLink

Key Features

- Document movement tracing
- Document record retrieval
- Document search
- Work flow control / ownership transfer





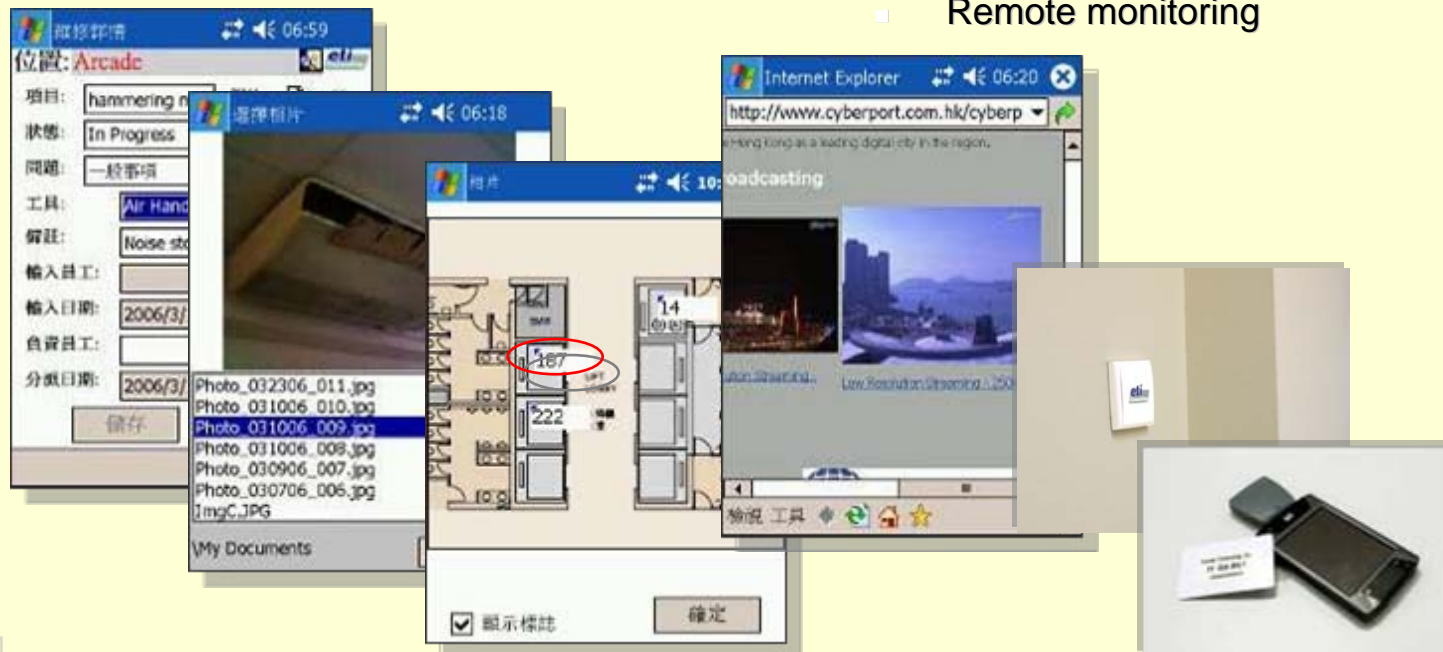
RFID showcased in HK Cyberport since May 2006

Property Management System enhanced with RFID and 3G

- Positioning
- Auto ID scanning
- Photo-documenting with location
- Maintenance Record
- Remote monitoring

Security and Patrol Solution

- Operational efficiency
- Patrol routing
- Real-time report



The collage illustrates the integration of RFID technology into property management. It shows a desktop environment with a project management application (Project: hammering n, Status: In Progress, Location: Arcade), a photo gallery window displaying several image files, a floor plan with room 167 highlighted in red, an Internet Explorer browser window showing the website <http://www.cyberport.com.hk/cyberp>, a physical RFID tag, and a mobile phone with a tag nearby, demonstrating the system's capabilities in data collection, location tracking, and remote monitoring.

— END —