Advance Truck Arrival Notification System to Airport Cargo Terminals

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LSCM Summit, 18th Sep 2014
LSCM R&D Centre
R&D Strategy
Industry Problem in Airport Air Cargo Services
Idea of Advance Notice of Truck Arrival for Improvement in Airport Cargo Handling

- Pre-arrival tracking on incoming trucks
  - CTO’s improved on productivity
    - Truck dock allocation
    - On-time staging cargoes for pickup
    - In-time availability of ULD for checkout
  - Trucks improved on queuing time
    - Truck dock available on arrival
    - ULD available on arrival
  - Forwarders improved on shipment efficiency
    - Trucking visibility
    - Better fleet management
To Establish the RFID Truck Tracking Infrastructure
Proposed Infrastructure and Operation

Advance arrival data-feed to CT data-port: (i) truck RFID, (ii) scan time stamped, (iii) scan location, by which arrival time is estimated.

Advance arrival info server

Internet connection

Public wireless WAN

Info scanned: (i) truck RFID, (ii) scan time

High-mount & Long-range UHF reader

CT Entrance Gate

CT operation

Internet connection

Advance arrival info server

CT operation

Advance arrival info server

Public wireless WAN

Info scanned: (i) truck RFID, (ii) scan time

High-mount & Long-range UHF reader

CT Entrance Gate

CARGO TERMINAL

25 km, 15 min away

50 km, 30 min away

Truck coming in to claim import cargo or to deliver export cargo.
Multi-Stop Inter-Terminal Visits

AAIS notifies Forwarder/Shipper when truck ID got scanned at LOC C, as truck leaving T2

AAIS notifies T1 & T2 when truck ID got scanned at LOC A as truck entering Airport Is.

AAIS notifies T2 when truck ID got scanned at LOC B, as truck approaching T2

Advance Arrival Info Server

SCAN LOC A

SCAN LOC B

SCAN LOC C

LEAVING AIRPORT IS.

(Visiting Terminal #2)

INTER-Terminal

(Visiting Terminal #1)
Trial of Solution with Stakeholders

A CLG members to join the trial program in the 1st round
B CLG members to be solicited for the 2nd round
C Depts / public bodies liaised for setting up RFID in public facilities
**How the Industry be Benefited from AAII Services?**

- As all parties have accurate truck arrival time, resources planning and utilization can be improved based on truck timing. Certainly, productivity gain achieved by air cargo operators will add to the general upgrading of the air cargo services industry. Advantage observed would encourage the industry to adopt the AAII tech.

<table>
<thead>
<tr>
<th>Cargo Terminals</th>
<th>Trucks</th>
<th>Forwarders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck A is 30min away, in-time of booking</td>
<td>Truck A arrives on-time</td>
<td>Informed Truck A left Cargo Terminal</td>
</tr>
<tr>
<td>✓ Allocate dock space</td>
<td>✓ Allocated truck dock immediately</td>
<td>✓ T&amp;T info to shipper/consignee</td>
</tr>
<tr>
<td>✓ (Import) Stage cargo for pickup</td>
<td>✓ (Import) Cargo avail immediately</td>
<td>✓ Ready warehouse to receive cargo</td>
</tr>
<tr>
<td>✓ (Export) Ready unloading equipment and prepare empty ULD to Truck A's request</td>
<td>✓ (Export) Unload cargo immediately and pick up empty ULD for next job</td>
<td>✓ Ready Truck A for next job</td>
</tr>
<tr>
<td>✓ Dock space released most efficiently</td>
<td>✓ Done and gone asap</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Benefits</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Docks max utilization, least idle time</td>
<td>✓ Minimize waiting time for truck dock, for cargo and ULD</td>
<td>✓ Better CRM services with T&amp;T</td>
</tr>
<tr>
<td>✓ Cargo transfer between aircrafts and trucks as efficient as possible</td>
<td>✓ Quicker turnaround time on airport trips, opportunity for more jobs</td>
<td>✓ Better utilize truck trips to airport</td>
</tr>
<tr>
<td>✓ Cycling ULD as efficient as possible</td>
<td>✓ Encourage truckers to be on time</td>
<td>✓ Better provision of ULD to warehouse for consolidation tasks</td>
</tr>
<tr>
<td>✓ Encourage truckers to be on time</td>
<td></td>
<td>✓ Responsive to fleet contingency</td>
</tr>
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## Project Implementation Plan

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Deliverables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 2014 ~ Mar 2014</td>
<td>- Site visit and approval process</td>
</tr>
<tr>
<td></td>
<td>- System Development</td>
</tr>
<tr>
<td>Apr 2014 ~ Jun 2014</td>
<td>- Roadside/Terminal RFID installation</td>
</tr>
<tr>
<td></td>
<td>- Tagging trucks and site test</td>
</tr>
<tr>
<td>July 2014 ~ Dec 2014</td>
<td>- Pilot run &amp; user feedback</td>
</tr>
<tr>
<td></td>
<td>- System enhancement</td>
</tr>
<tr>
<td>Sep 2014 ~ Dec 2014</td>
<td>- Data interoperability &amp; interface standards</td>
</tr>
<tr>
<td></td>
<td>- Public awareness &amp; promotion</td>
</tr>
</tbody>
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RFID Technology

“Passive RFID” infrastructure approach
- Minimal cost impact
- Least maintenance requirement
- Potential for expansion/scalability
- Achieve economy of scale
- Possible future new business model
RFID Reading under Highway Conditions

- RFID Reader-Tag System Configuration:
  - Tag placed behind a truck’s windscreen, or elsewhere on the truck
  - RFID reader installed at the road side or over-hanging on the highway
    - Truck traveling at 120km/h, equiv. 33 m/s, RFID tag needs 20ms to respond
  - Right tags of appropriate performance have to be sourced and designed

- Tag Performance

- RF Reading Geometry
Advance Trucks’ Arrival Notification System
for HK Air Cargo Industry
at Hong Kong International Airport

AAll video
The AAII System

- Advance notice system
  - Cloud-based advance notice server
  - Web Management Console
  - Notification engine
    - Email notification
    - SMS notification
    - System-to-system integration
  - Check-point reader system
Information Services Model to Users

- Truck Registration
- Monitoring Engine
- Arrival Event Engine

- Truck Arrival repository
- Cargo Operator Truck Profile
- Platform Configuration

Interoperable Middleware (SIM)

Cloud Computing Platform

Interoperable gateway

Web Application for Cargo Operator

- CPCT CTO System
- AAT CTO System
- Hactl CTO System
- Tradeport CTO System
- AFFC CTO System

Trucking to and from airport cargo terminal

Forwarder

Mobile Application For Forwarder

Site Server

RFID Reader

RFID Antenna
A Test-bed System at Cyberport

- A portable RFID system for site testing

- On the bridge

- Roadside
A Test-bed System at Cyberport
Full set of RFID data available for back-end system

- EPC:
- Timestamp:
- System Time:
- Signal Strength:
- TID:

### Roadside test result summary (Olympic City)

<table>
<thead>
<tr>
<th>Test</th>
<th>km/h</th>
<th>Signal Strength RSSI(average)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
<td>-68.9</td>
</tr>
<tr>
<td>2</td>
<td>70</td>
<td>-67.25</td>
</tr>
<tr>
<td>3</td>
<td>80</td>
<td>-67.5</td>
</tr>
<tr>
<td>4</td>
<td>90</td>
<td>-66.5</td>
</tr>
<tr>
<td>5</td>
<td>100</td>
<td>-69.5</td>
</tr>
</tbody>
</table>
A Cloud Implementation

• Enterprise grade of infrastructure (Data Center)
  – Resilience network connections
  – Redundant data storage
  – High availability server setup
  – Remote disaster recovery site
  – Firewall & Security patching

• Flexibility & Scalability
  – Rescale computer resources on demand
  – Different service level at different stages
    • Development, high availability and DR site support is not necessary
    • Trial and production operation, higher service level
Deployment Framework

Core Cloud Services & Applications
- Virtual Server
- Cloud Storage
- Cloud Applications Database / Web Site

Virtualized Cloud Platform
- Firewall & Security patching
- Resilience Network
- Redundant Storage
- High Availability
- Remote DR Site
- Monitoring & Maintenance

Hardware Infrastructure
- Product Site
- DR Site
Cyberport Community Cloud
Portal System for Easy Web Access
Trial Scheme Project with Air Cargo Industry Stakeholders

• Set up truck scanning RFID reader at the Tsing Ma Toll Plaza
• RFID reader systems will be installed at Cargo Terminals
• Putting RFID Tags on windscreen of trucks
• Test-bed system hosted at Cyberport
  ✓ Cloud platform under Cyberport IT Services for development and testing
  ✓ Portable RFID system as easy setup for roadside experiments and tests
• Data-Centre implementation for tech-transfer ready system
  ✓ Enterprise-grade service level
  ✓ Flexibility in resources, scalability to demand for business operation
• Pilot runs start from Sep thru Dec 2014
  ✓ CPCT, AAT, HACTL Airport Cargo Terminals, Forwarders, Trucks
  ✓ Feedback for improvement in operation model and usability
RFID Readers at Tsing Ma Toll Plaza

- Check-point (Toll Plaza)
Check point setup at Tsing Ma Toll Plaza
Check point setup at Tsing Ma Toll Plaza
RFID Reader System

- RFID reader + antenna on a stand for roadside installation
System integration with terminal system

- Asia Airfreight Terminal (AAT)
System integration with terminal system

- Cathay Pacific Cargo Terminal (CPCT)
System integration with terminal system

- Hong Kong Air Cargo Terminals Ltd (HACTL)
Road side testing with real truck
Road side testing with real truck

• 2 x Road side reader system can cover 3 lanes
  – Reader systems are installed at both sides
  – Optimized antenna position and angle

• Placing the tag in the middle of the windscreen
  – Giving the best performance
Tagging Trucks with Windscreen RFID

Tag is thinner than a 10 cents coin

- Antenna design – good read range for operation behind windscreen glass
- Size – simple and convenient
- Selected substrate – suitable thickness
Trial system test 12 Sep

• Testing configuration
  – Trial system installed at Tsing Ma Toll Plaza
  – Tagging AAII tag on the testing vehicle
  – Vehicle will pass the check-point at 70km/h

• Testing result
  – Truck Pass Display on Dashboard
  – SMS received
Trial system test on 12 Sep
## Technical Performance of Windscreen RFID

<table>
<thead>
<tr>
<th>RFID Tag Specification</th>
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</thead>
<tbody>
<tr>
<td>Operating Frequency</td>
</tr>
<tr>
<td>Standards</td>
</tr>
<tr>
<td>Read sensitivity</td>
</tr>
<tr>
<td>Write sensitivity</td>
</tr>
<tr>
<td>Memory</td>
</tr>
<tr>
<td>Extended temperature</td>
</tr>
<tr>
<td>Operating Life</td>
</tr>
<tr>
<td>Security</td>
</tr>
<tr>
<td>Dimension</td>
</tr>
<tr>
<td>Application environment</td>
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Tech Development Roadmap of AAll System

Q1’14 : Software development  
             Setting up cloud service platform

Q2’14 : RFID infrastructure installation  
             Data integration with stakeholders

Q3-Q4:  Trial program launched  
             Performance analysis and improvements

Q4’14 : Publicity and Promotion for Ongoing  
             Realization and Commercialization
~ Q&A ~

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