
PEOPLE & TECHNOLOGY

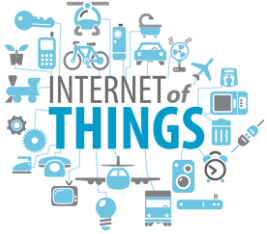
Real Time Location and Smart Sensing

Making IoT a Reality Today

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- 1. Introduction People & Technology**
- 2. Infrastructure**
- 3. Applications**
- 4. Example Cases – Forklift Tracking**
- 5. Conclusion & Next Steps**



Real Time Location & Smart Sensing End-to-End Solution Provider



Track Anything

Real-time Locating and Tracking Assets, Objects, People Vehicles

Sense Anything

Gathering environmental info like Temperature, Humidity, Bio-Signal, Movement, Vibration...

Create Insight

Data Analytics using fusion between location and smart sensing

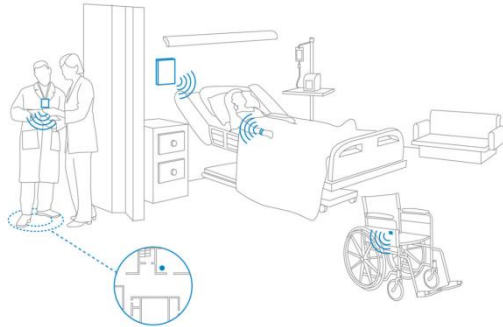
Create Instant Value

Prepackaged Solution bundles for rapid deployment and instant value

Real Time Location Systems (RTLS) become essential in many fields

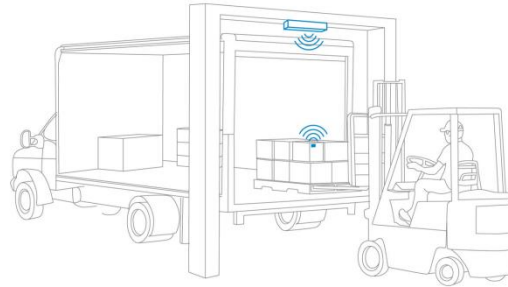
IDTechEx Research predicts \$10 billion market for real time locating systems

- Bluetooth Low Energy (BLE)-based RTLS highest growth rate in Location Market
- Strong needs in 90% of workflows



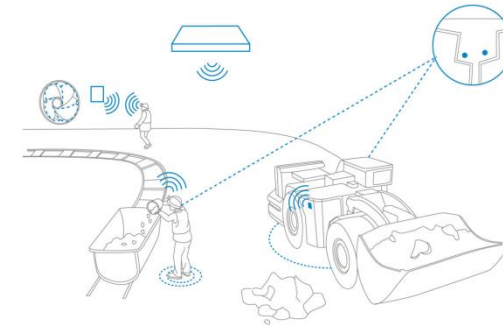
Hospital

- Tracking mobile assets in hospitals
- Monitoring of patients bio info
- Navigation & information push



Warehouse

- FIFO process for materials in warehouse
- Process efficiency and error prevention
- Automatic inventory and flow control



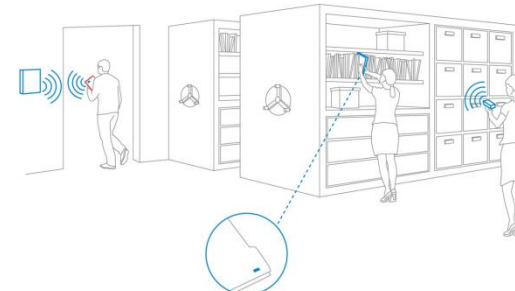
Safety

- Monitoring of workers' vital signs
- Precaution and Prevention of Hazardous Area Operations



Access Security

- Track visitor location real-time in enterprise
- Location based security levels / geo-fences



Asset Security

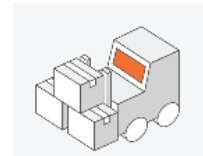
Tracking key items such as devices, confidential documents and prototypes

People & Technology

- **Established in 2013.** Headquarters in Seoul, Korea
- **Highly skilled core team** working for Mobile Embedded and Enterprise software companies
- **Subsidiary in Switzerland for EMEA** - Expanding partnership in EU and in Japan
- **End-to-end Real-Time-Location solution provider** based on Bluetooth-Low-Energy
- **30+ corporate customers / 5.5 Mio. private users**
- **High accuracy (1m-2m) with low infra invest**
- **High quality, fast delivery, low price**

Real-Time Location System (RTLS) & Location Based Service (LBS)

Asset Tracking



- Tracking of valuable assets and material flow
- Improvement of productivity in warehouse, intralogistics, production lines and healthcare

Process Optimization



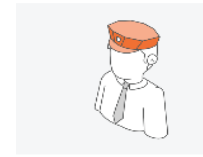
- Improvement of process flows, equipment usage
- Tracking quality sensors in production environment
- Push information/alerts for deviations from process flow & quality

Worker Safety



- Real-time locating of workers in emergencies
- Preventive sensing & alerting of hazards
- Instant response to workers & dispatch of rescue team

Access Security



- Smart zone based access control of visitors and staff
- Tracking of important assets
- Alerting of abnormal patterns to security personnel

Proven industry solutions in multiple large operational deployments

Corporate Customers



> 33

Indoor Customer Area monitored



> 2.371.670 m²

Objects / Assets tracked



> 99.382

Users (via LBS App)



> 5.650.000

Hospitals Healthcare

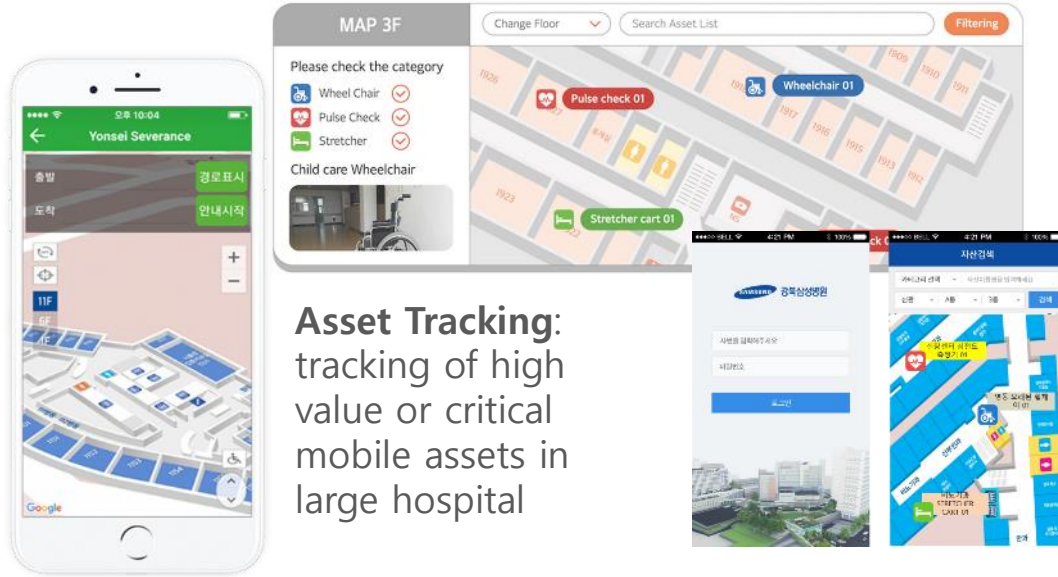


Smart Factories

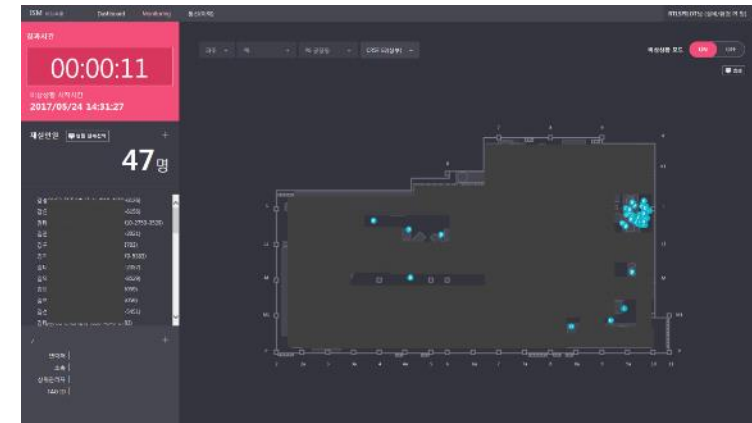
Services B2G

O2O Commerce

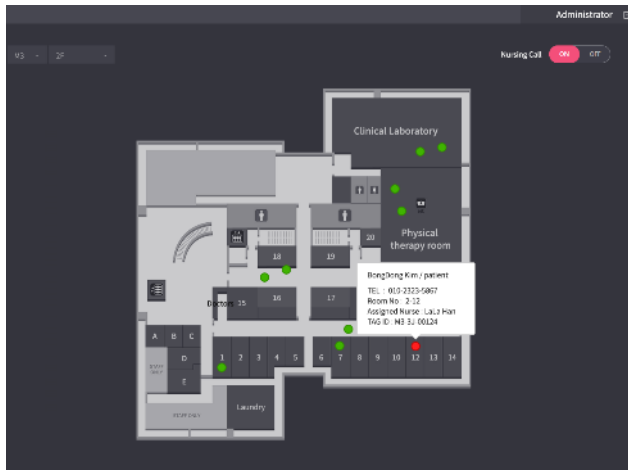
Examples of deployed solutions



Asset Tracking: tracking of high value or critical mobile assets in large hospital



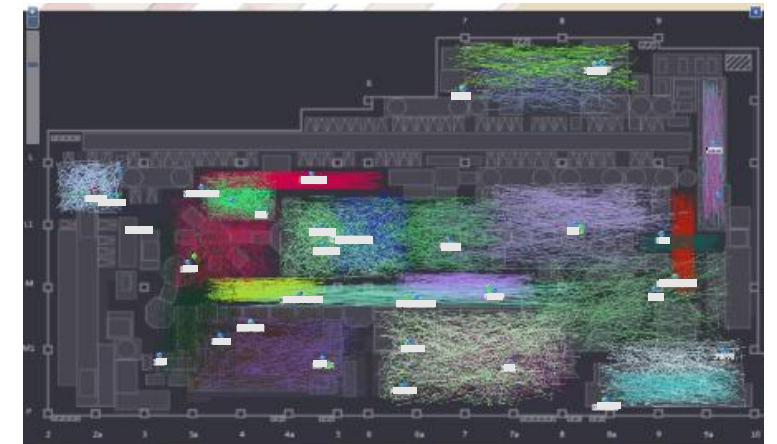
Worker safety: real time view of number of people and location in each floor of chemical factory in case of urgency



Senior Care: Monitoring calls from patient to nurses & anti-wandering



Security Control: Real time Monitoring of worker activities (Geolocation) in Datacenter



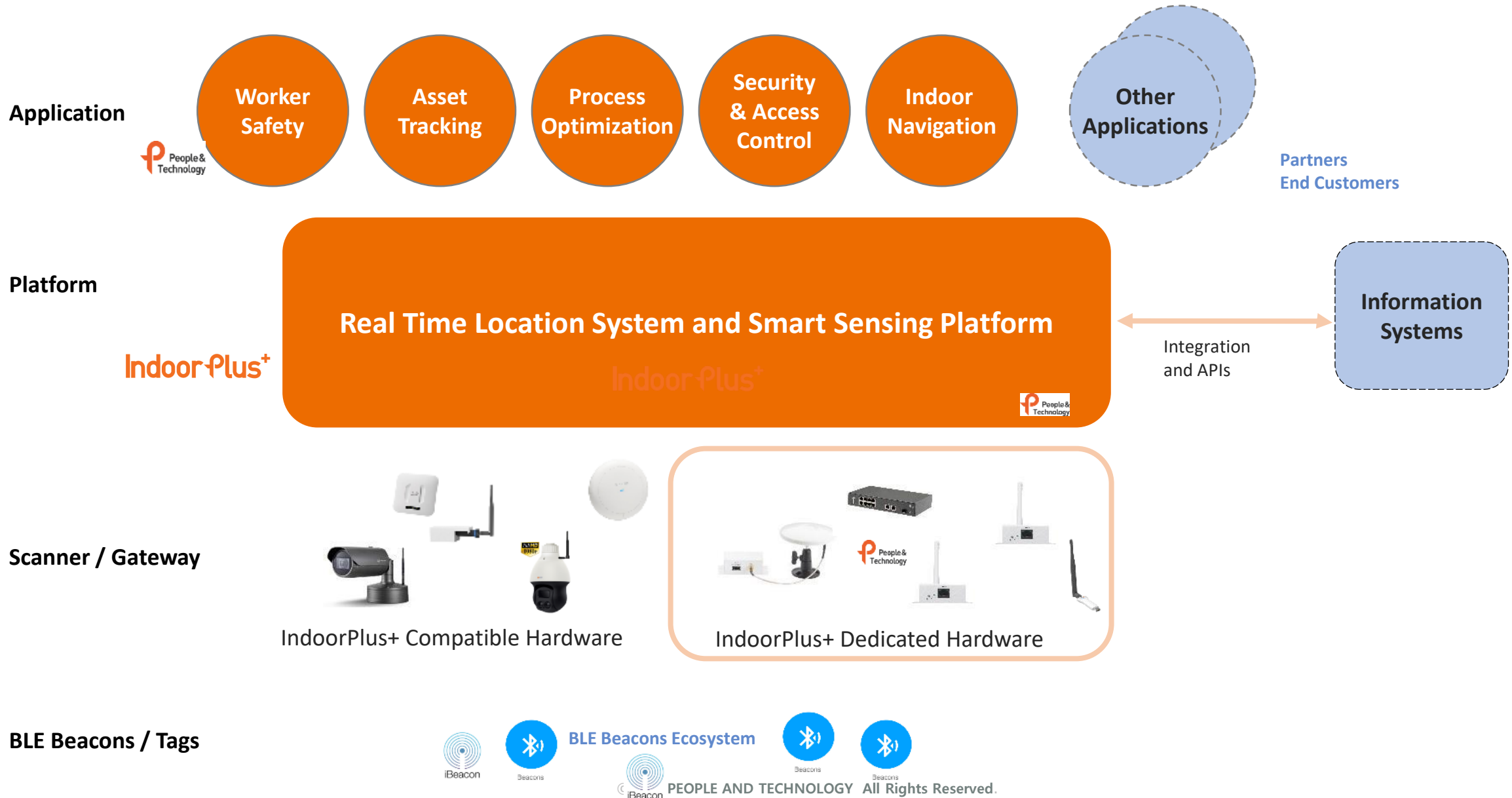
Process optimization: Monitoring assets in industrial environment

Our mission is to provide our customers with ...

- **Innovation and experience lead** in the optimal RTLS technology (BLE)
- **Solution platform provider** with core intelligence and ready-to-use applications
- **Immediate creation of added value**, yet flexibility, open interfaces
- **Low infrastructure investment** and low maintenance costs
- **Optimum cost position (TCO)**, limited incremental costs for scaling

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End-to-End solution platform with ready-to-use applications



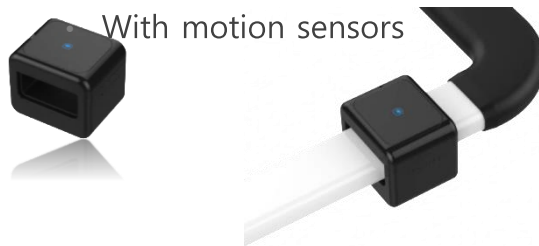
Examples of compatible Hardware BLE tags/beacons

Leveraging the ecosystem BLE Tags

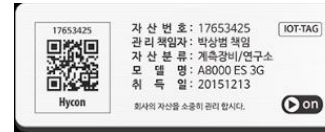


Vehicle Tracking

- Moving Objects and Vehicles



With motion sensors



Small and Thin BLE Tag

- Thin Tag, Solar Type, Charged Battery
- NFC & Barcode



Beacon Tag - Worker safety



Card Holder, Badge Type

- Card Holder
- With RFID TAG



Wearable Type

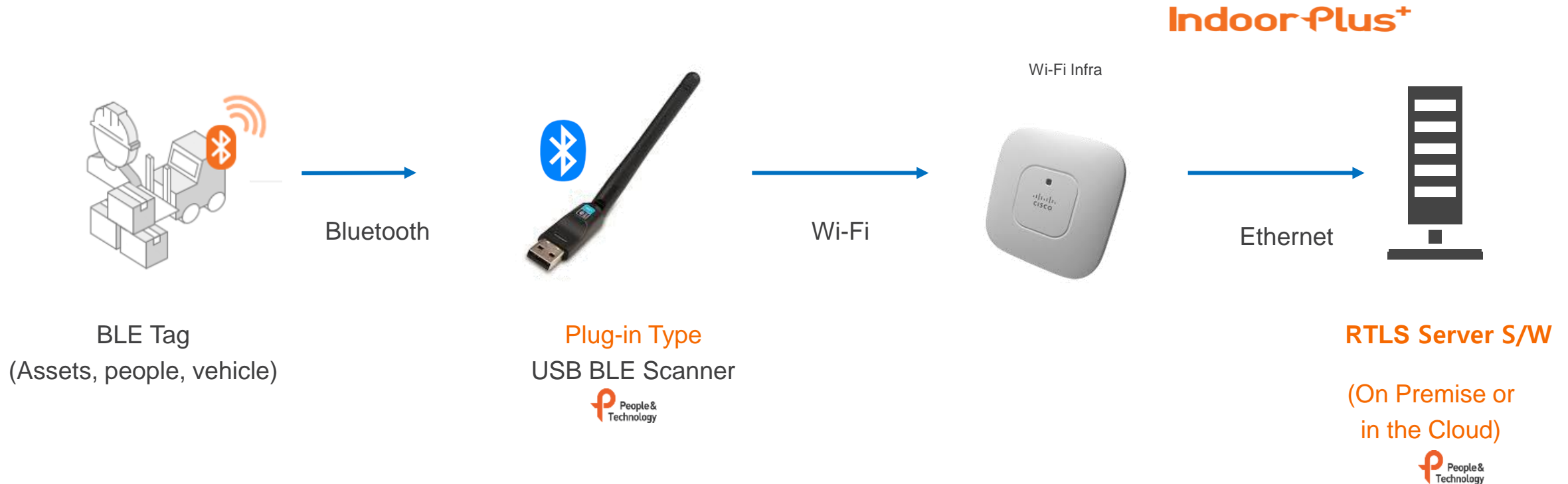
- Heart Beat, Temperature, Running
- 6 Axis Accelerometer + health checking sensors

Environment Checking

- Dust detection
- Co2, Temp, Humidity, Nox Gas

Based on use case, PnT can recommend particular tags and manufacturers

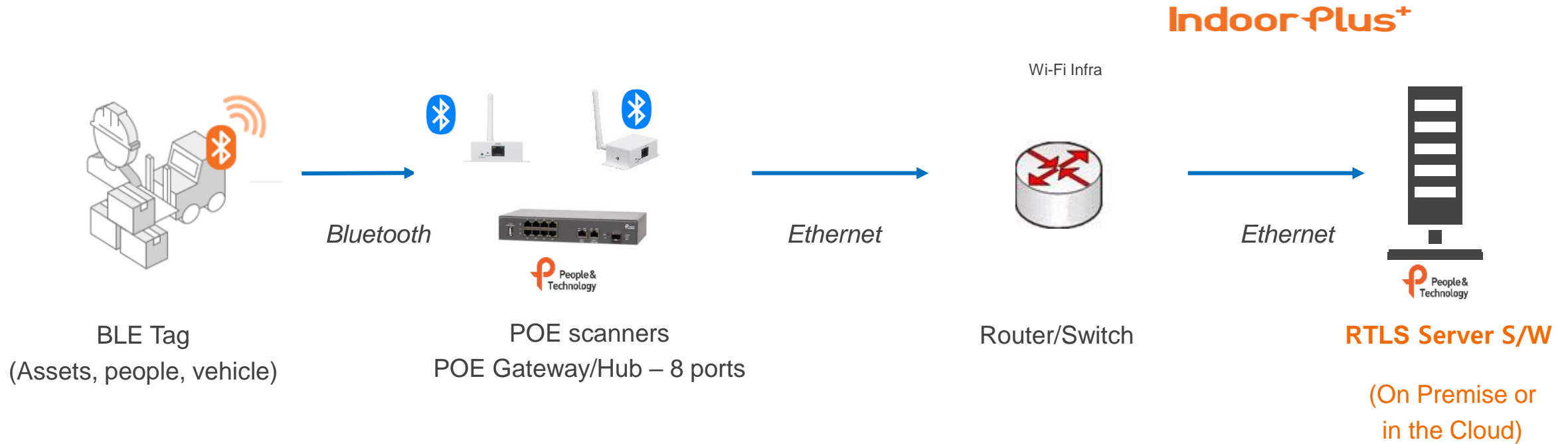
Typical physical deployment– Wireless option



USB BLE/Wi-Fi Scanner – concept all-in-1

- **Scanner** to collect BLE signals, pre-process them and send them to the central server for processing - **RTLS**
- **iBeacon Tag** - “**Advertise**” – plays the role of fixed beacon for geolocation of smartphones/smart tablets - **LBS**

Typical physical deployment – Wired option



POE scanner et Gateway/Hub

- **POE Scanner** powered via Ethernet cable - collects BLE signals, pre-processes them and sends them to the central server for processing
- **POE Gateway** - Gateway that supports up to 8 POE scanners and is connected to the company's Ethernet network

Both Wired and Wireless options can be combined on the same deployment

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Indoor geolocation applications used across many industries

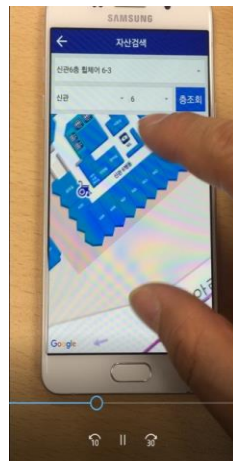
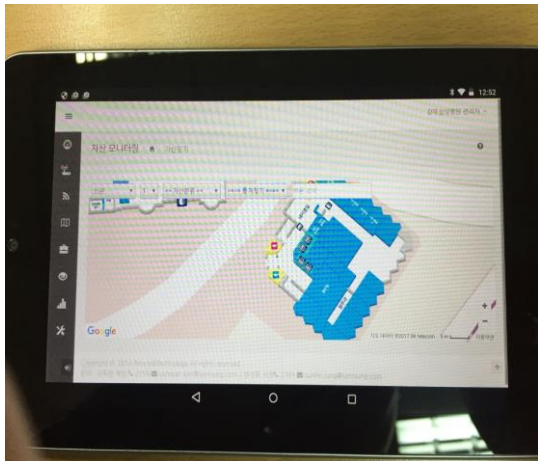
- | | |
|----------------------------|--|
| 1 Asset Tracking | Tracking of valuable assets and material flow in warehouse, intralogistics and in hospitals |
| 2 Worker Safety | Identify where workers are in case of urgency, monitor workers in sensible zone of the building |
| 3 Flow Optimization | Record, analyze and improve process flows within offices, factories – Re-arrange tasks, facilities |
| 4 Quality Control | Combine collection of various environmental sensors and location to address quality issue and timely response |
| 5 Productivity | Avoid wasting time to find assets, improve stock management, use location to monitor process |
| 6 Access Security | Track location and trigger actions based on location, prevent access to or exit from definable areas |
| 7 Indoor Navigation | Personalized precise Indoor-Turn-by Turn navigation with localized content or content push such as product information, offers, e-coupons etc. |

Asset Tracking

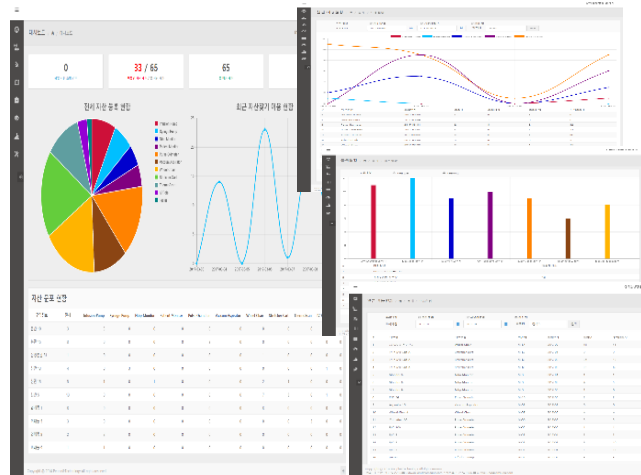
SAMSUNG
KANGBUK
SAMSUNG HOSPITAL

SAMSUNG
ELECTRONICS

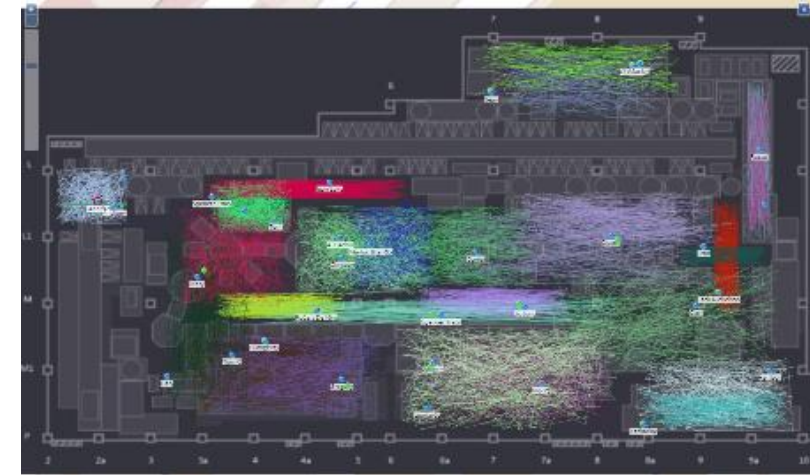
HYUNDAI



- Real-time search of moving / unmoving assets
- Self-registration of assets / by employees
- Web-based application and mobile application for employees



- Asset Tracking Data Analysis
- Dashboard



- Real-time visualization of moving objects
- Heatmap of the asset movement

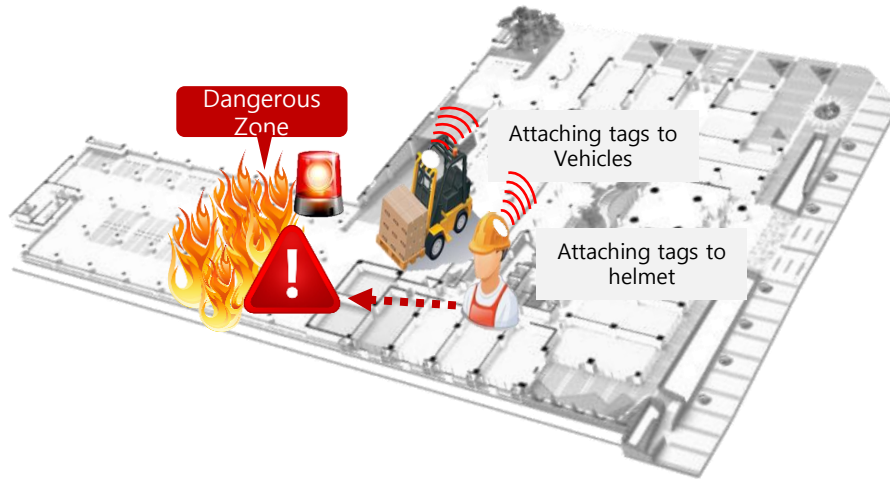
Typical Customer Questions

- How many times each asset is searched?
- When is an asset searched and/or moved?
- What is the "moving distance" for each mobile asset?
- Do we need more or less of a particular device?

Customer results

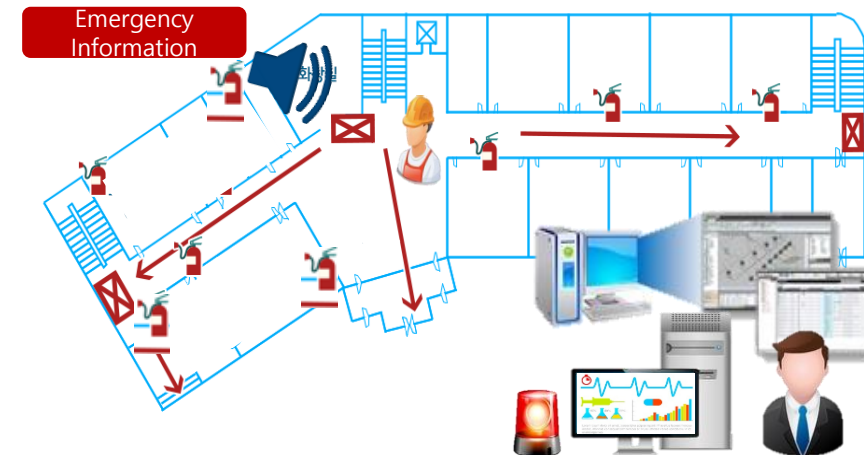
- ① Reduce non productive time from 1.5 hours to 0.5 hours
- ② Build Purchase Plan based on actual data from operations
- ③ Reduce the equipment maintenance fee based on actual data
- ④ Empowering staff to better use the assets

Control of dangerous zone



- Worker Position Tracking for Safety
- Real Time Scheduling of Workers
- Target : Worker (People)
- How to Manage
 - ① Installation of Beacon Scanners
 - ② Attachment of Beacon Tag (People – Helmet, Vehicle - inside)
 - ③ Arrangement of Workers
 - ④ Detection of Worker at Risk Area
 - ⑤ Alert to Operator for Safety Actions

Emergency people location, counting and evacuation & rescue support

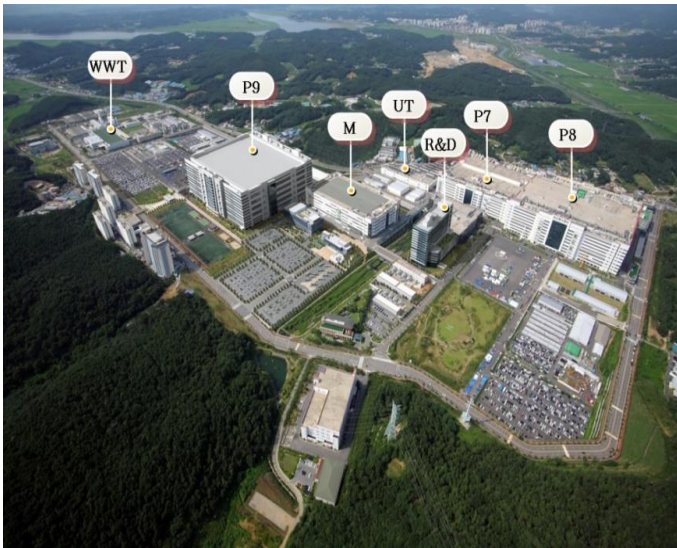


- Alarm/Messages when Worker enters Danger Zone
- Inform of Safe Escape Path when Emergency
- Target : Worker(People)
- How to Manage
 - ① Installation of Beacon Scanner and Attachment of Beacon Tags
 - ② Siren/Message/Alarm when Emergency
 - ③ Guide for Safe Escape Path by Broadcasting
 - ④ Setup Rescue/Risk management Plan with Data Gathered

Worker Safety – Example Consumer Electronics



- **LG Display** had human fatal accident in 2015 due to the leakage of Nitrogen gas.
- \$30M Loss due to factory line outage
- Factory very large and highly automated, it was not possible to locate rapidly workers and send in rescue team
- In early 2017, **LG Display chose IndoorPlus+ RTLS as Workers Safety Solution backbone engine.**
(1st factory deployment in April 2017, Expansion in 2018)

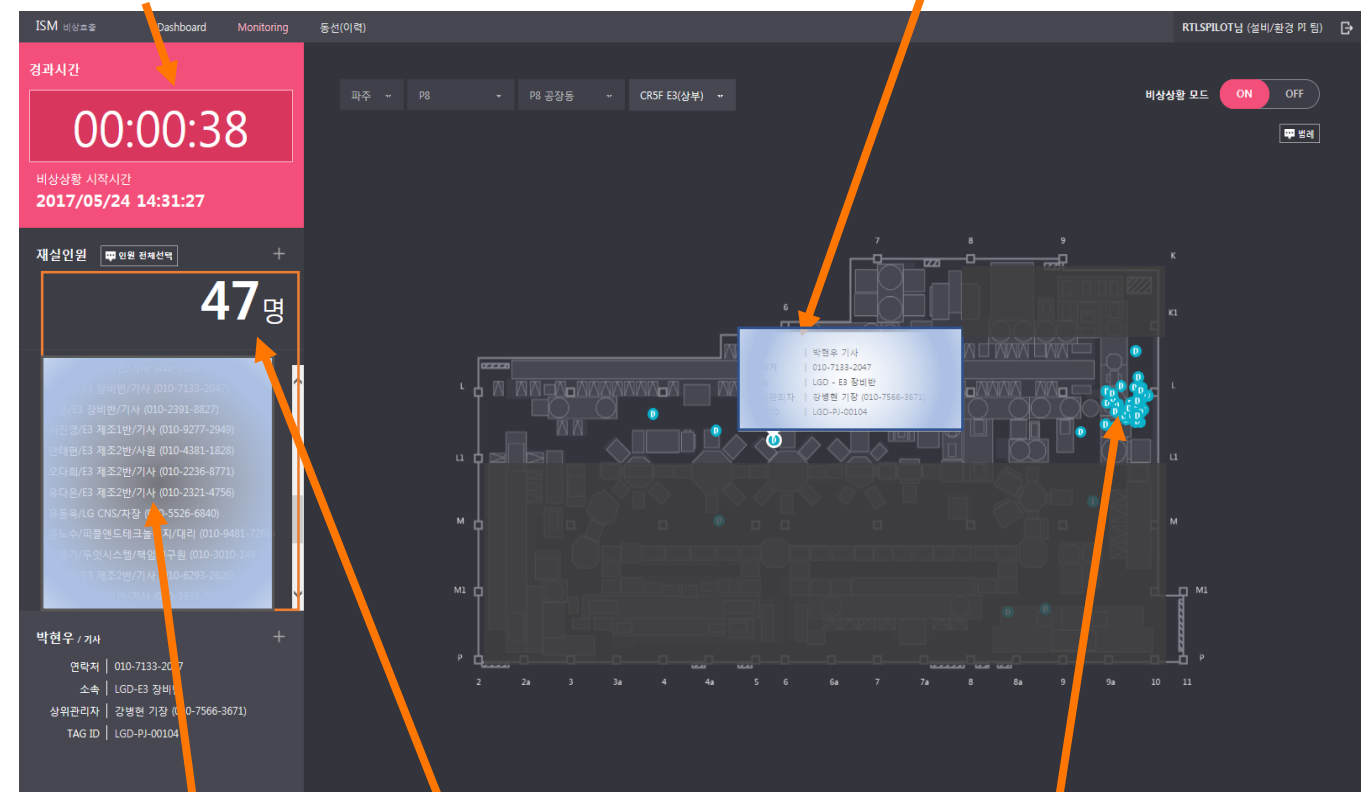


Nitrogen gas facilities during police investigation on leakage

P&T IndoorPlus Safety Application – Real Time Dashboard for LG

In case of urgency, the timer for rescue period is turned on

Quick identification of workers



List of workers and contacts

Number of workers on this floor: 47

Each blue dot is a worker

Process Flow Optimization – Example Engine Manufacturing



Produces major aircraft engine parts

- Constraints: Operation in various tough environments such as various iron structures, washing, gunpowder chemicals. RFID, a competitive technology, abandoned due to technical issue,
- Goal: Needs time check production across 36 processes, prevent human errors, identify process to re-arrange or relocate.
- Implementation: RTLS to check time each process need automatically (no human intervention) by tracking parts locations

VTL Process



IndoorPlus+ checks the IN-station and OUT-station to check automatic process starting time

Washing & FPI Process



For several sub-processes. IndoorPlus+ check each process starting and end time thanks to location



Materials, Semi-Finished Products, Finished Products should be tracked

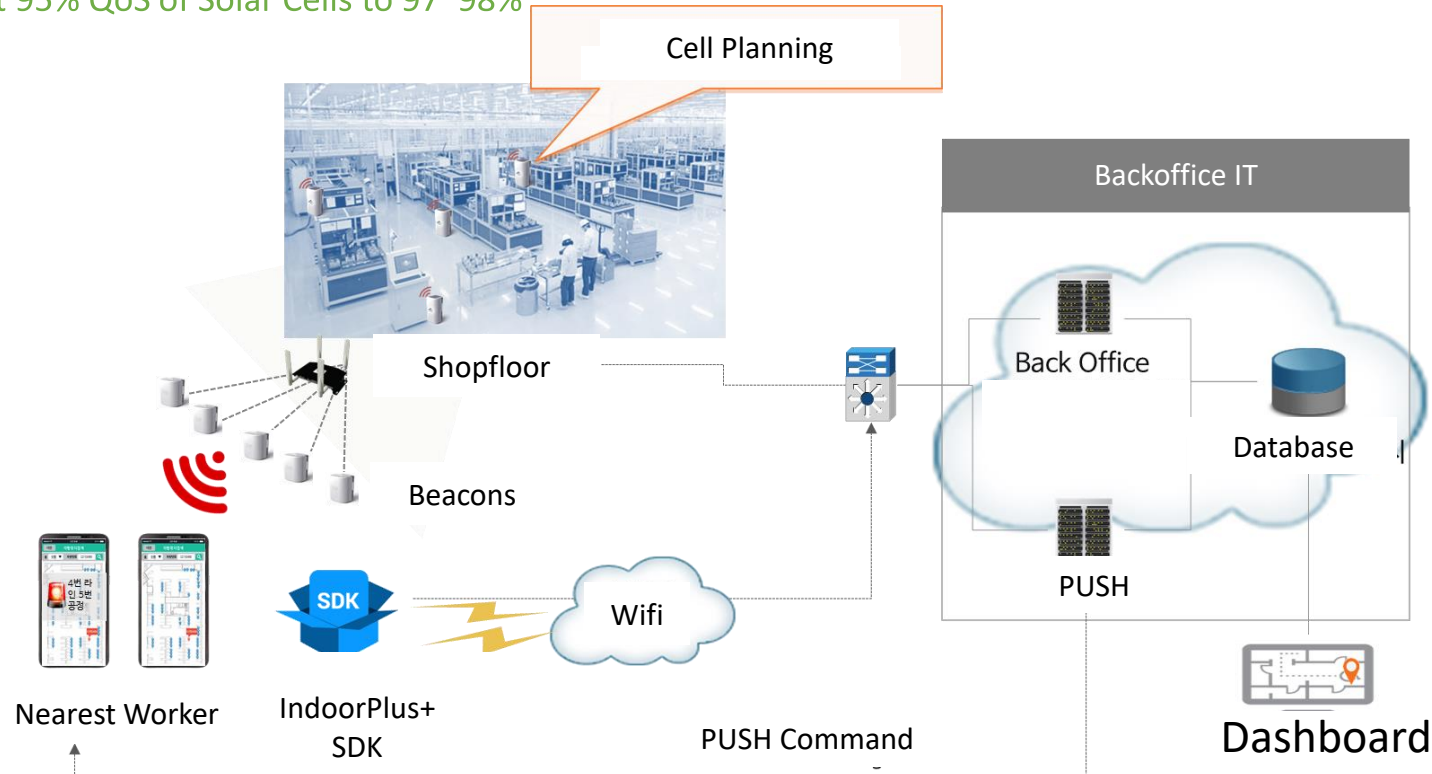
IndoorPlus+ is the only product that passes the Quality Audit (BMT)

Quality Control – Example Solar Cell Manufacturer



- Highly automated manufacturing with very few human operators (~100)
- Combination of geolocation of operators and Smart Sensing (e.g., Humidity, Temperature)
- Whenever something wrong happens in a certain facility, dispatch the nearest workers to check it → The faster, the more QoS

Results: Increase current 95% QoS of Solar Cells to 97~98%





Indoor-Plus⁺ Smart Warehouse

Datenanalyse

- Velocity, total operation hours
- Moving path for each assets ,
- Hours for loading and unloading

Task & Navigation App

- Real Time task allocation
- Item quantities
- Optimized route path

Asset Management

- Availability status of assets (e.g. pallet ready / package ready)
- Real-time location monitoring
- Confirm movement path

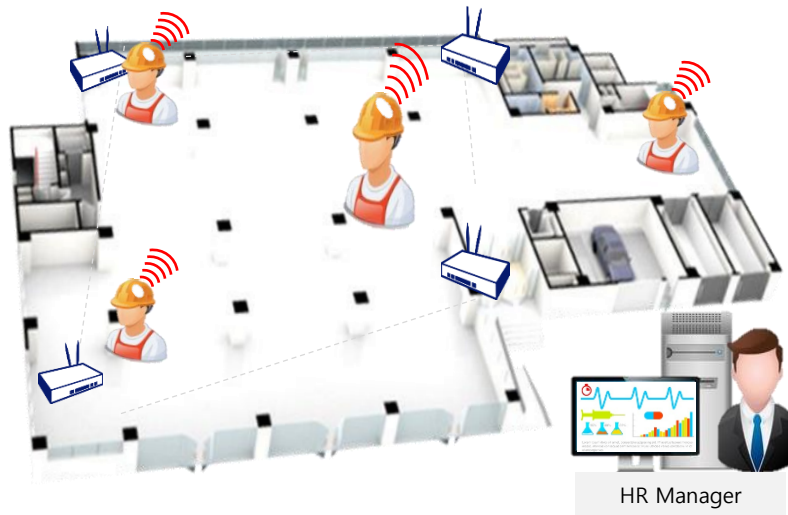
Error-Alarm

In case human error is detected



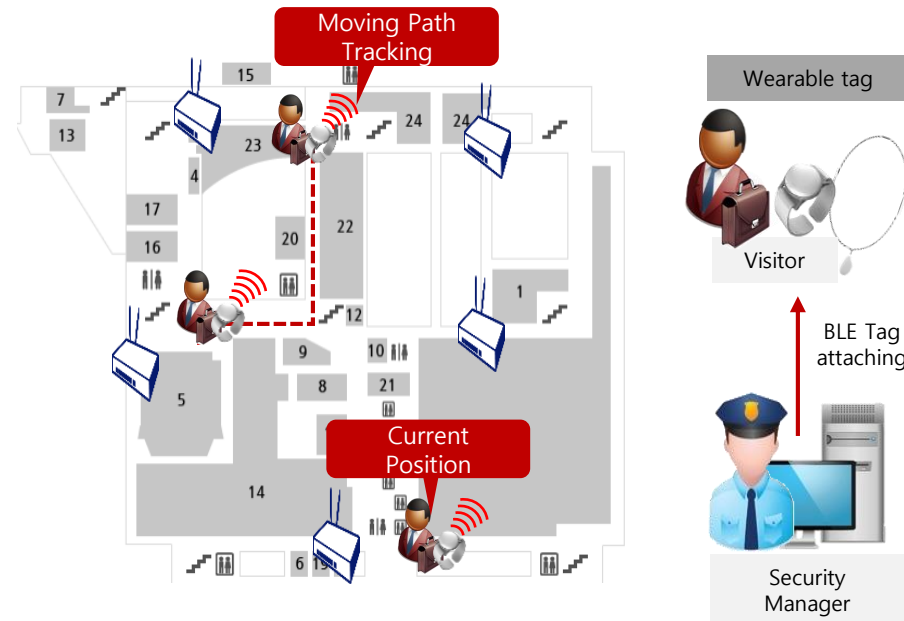
Automatic task assignment without manual assignment.
Increased productivity through optimized route guidance

Workers Attendance Management



- Worker Attendance management
- Target : Worker (People)
- How to Manage
 - ① Installation of Beacon Scanners
 - ② Distribution of Beacon Tag to Target
 - ③ Arrangement of Workers
 - ④ Tracking data to be used as administration datasdaten

Visitor Location Tracking



- Security/Safety management for Visitor
- Target: Visitor or Contractor (People)
- How to Manage
 - ① Distribute Beacon Tag to visitors and register to system
 - ② Tracking of Visitor
 - ③ Monitoring Visitor location with purpose of visit
 - ④ Alert Visitor at Risk area or area must not visit

Access Security – Example Data Center



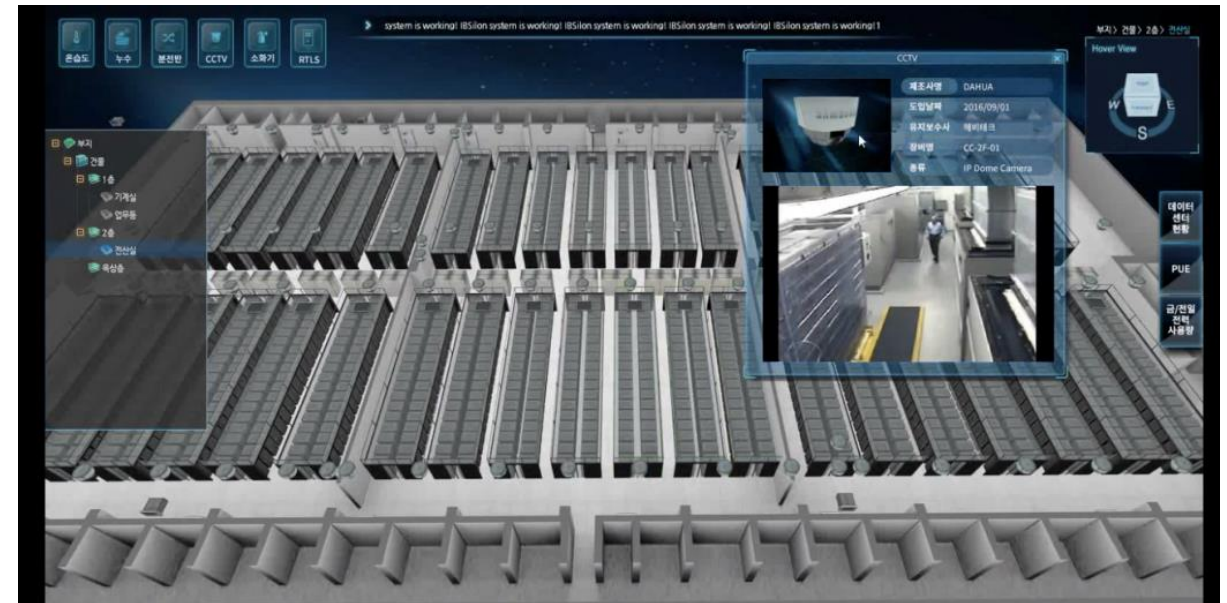
Requirement:

- Hyundai Finance Data Center: Track in real-time location of visitors, external workers or employees to trigger alarms on access to unauthorized area. Identify in real-time where workers are in case of emergency.
- Solution implemented in 2016 and complementing & utilizing existing CCTV infrastructure

P&T IndoorPlus Security Application - Real-Time Dashboard for Hyundai

Real-Time Tracking of Visitors & Workers
Movement Paths / Foot tracking Records / Geo-Fencing

When a certain worker enters into non-allowed area,
the CCTV screen pops up for security check



Indoor Navigation – Example Hospital



Customer & Objective



- Pusan National University Hospital is the 5th largest Hospital in Korea.
- Around 1,200 beds. 11 buildings, about 83,734 m2 size
- This hospital wants to provide more convenient services to visitors, patients and staff and optimize their outpatient flow through buildings.

Solution & Deployment

- 400 beacons deployed
- **IndoorPlus+ for Smartphone Solution + Analytic View** & Mobile Web Legacy integration
- Integration with HIS (Hospital Information System) for Automatic check-in of outpatients
- **Voice Navigation** for visually impaired people



Presence & Navigation View of Smart Phone App



Heat-map for flow of human traffic in hospital

<https://www.youtube.com/watch?v=eVChC5SPFvE>



Around 1.5m accuracy
Within 1 sec delay

Results

- Improved visitors and patients experiences (**31% up satisfaction index survey**)
- Systematic use of people flow analytics to make more efficient reshuffles and department layout
- Increased staff productivity - Step by step automatic navigation guide (with location and push system) **reduced about time spent by staff up to 20%**
- The PUSAN Hospital continue to be ranked **among best innovative leader with IT/Healthcare innovation**

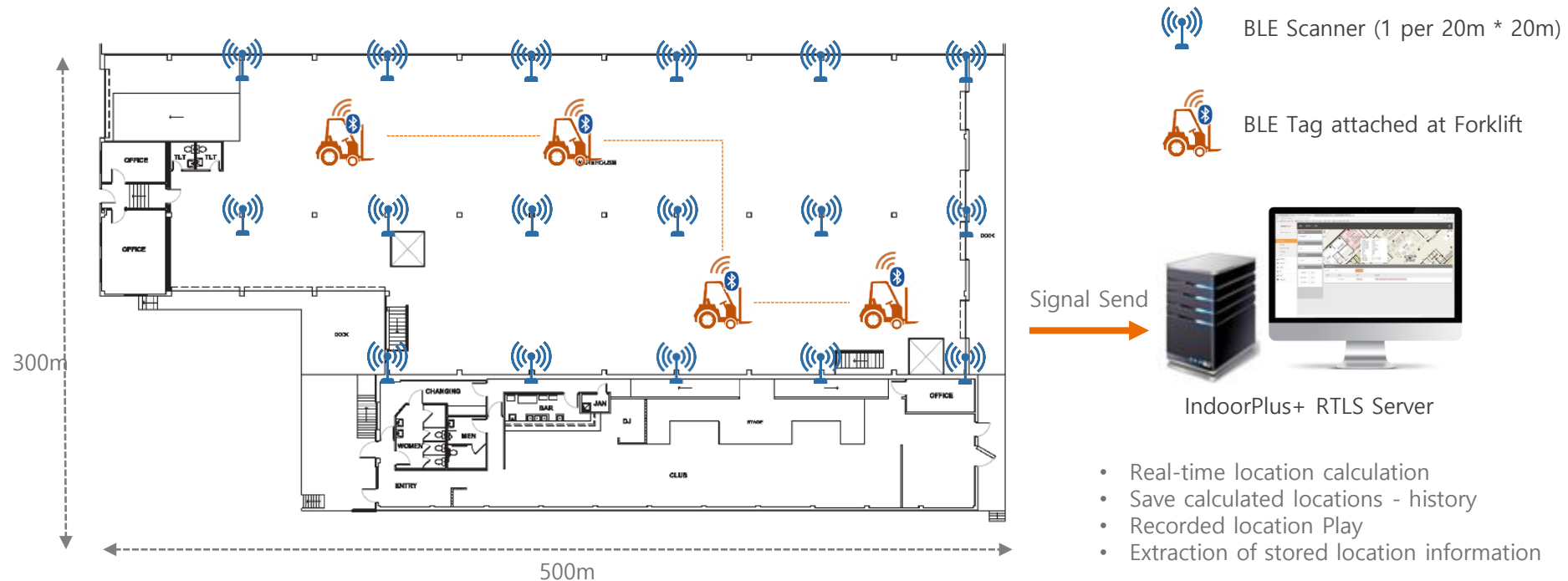
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Real-Time Recording of movement path of forklift (PoC)



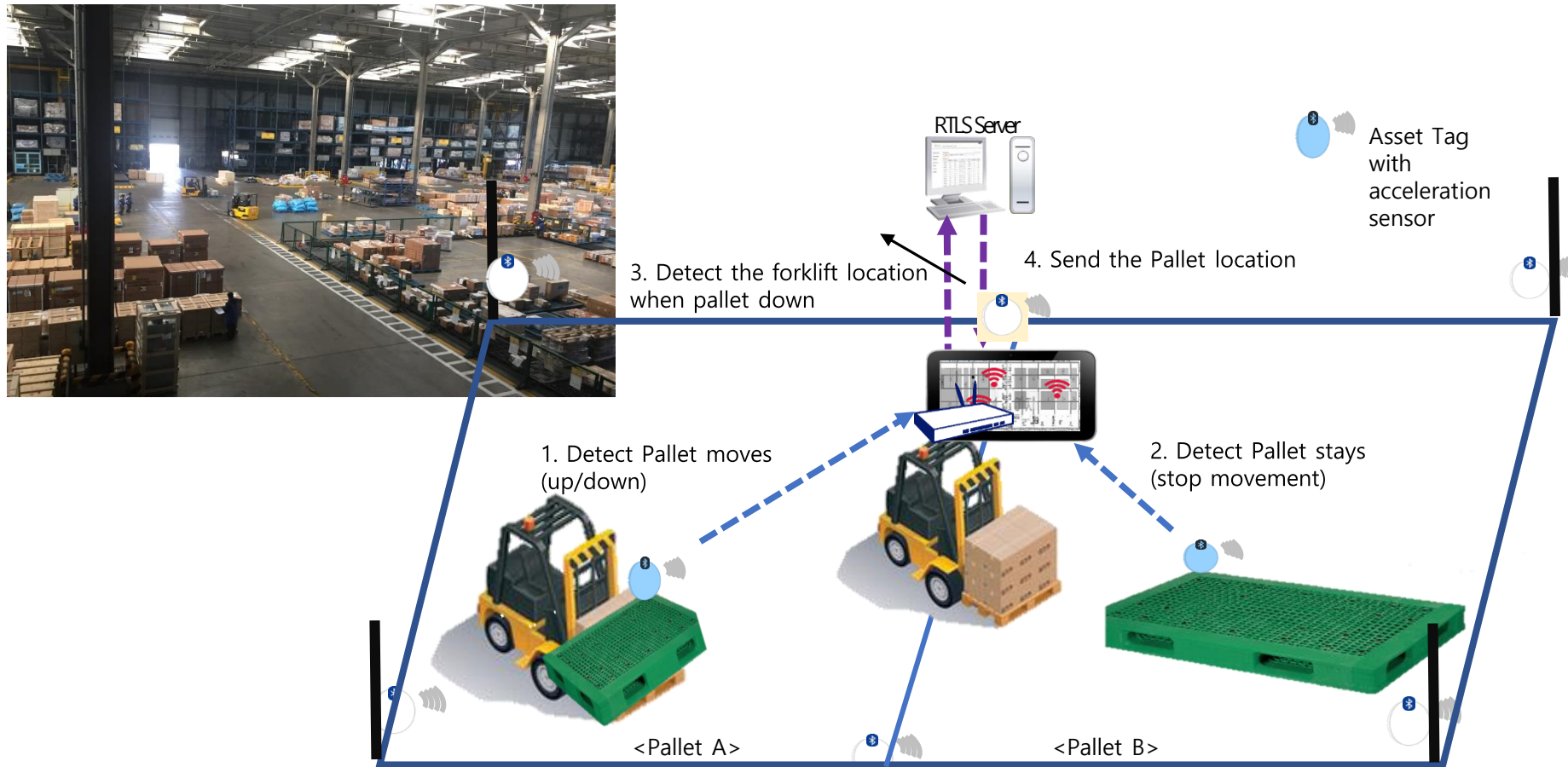
Rapid deployment by adopting HW and SW of IndoorPlus + RTLS solution

- ① Attach the Bluetooth Low Energy tag (BLE Tag) to the top of the forklift
- ② A Bluetooth scanner (hereinafter referred to as BLE Scanner) is installed in the factory space and a network (wired or wireless) connection
- ③ Transmit the signal collected by BLE Scanner to IndoorPlus + RTLS server
- ④ IndoorPlus + RTLS server for location calculation and storage of forklift path, Play-recording, Data extraction for path optimization analysis



Productivity – Example Warehouse management

- Pallet tracking (Up/Down) and Availability tracking (Stay)
- Workflow ptimization of pallet movement
- Next Phase: Propose next pallet to forklift driver



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- What are potential RTLS use cases that could create value for Partner and its customers?
- What could be a good Test-installation, Proof of Concept or Pilot to deploy so we can demonstrate the solution ?
- Next steps – Who, What, When?