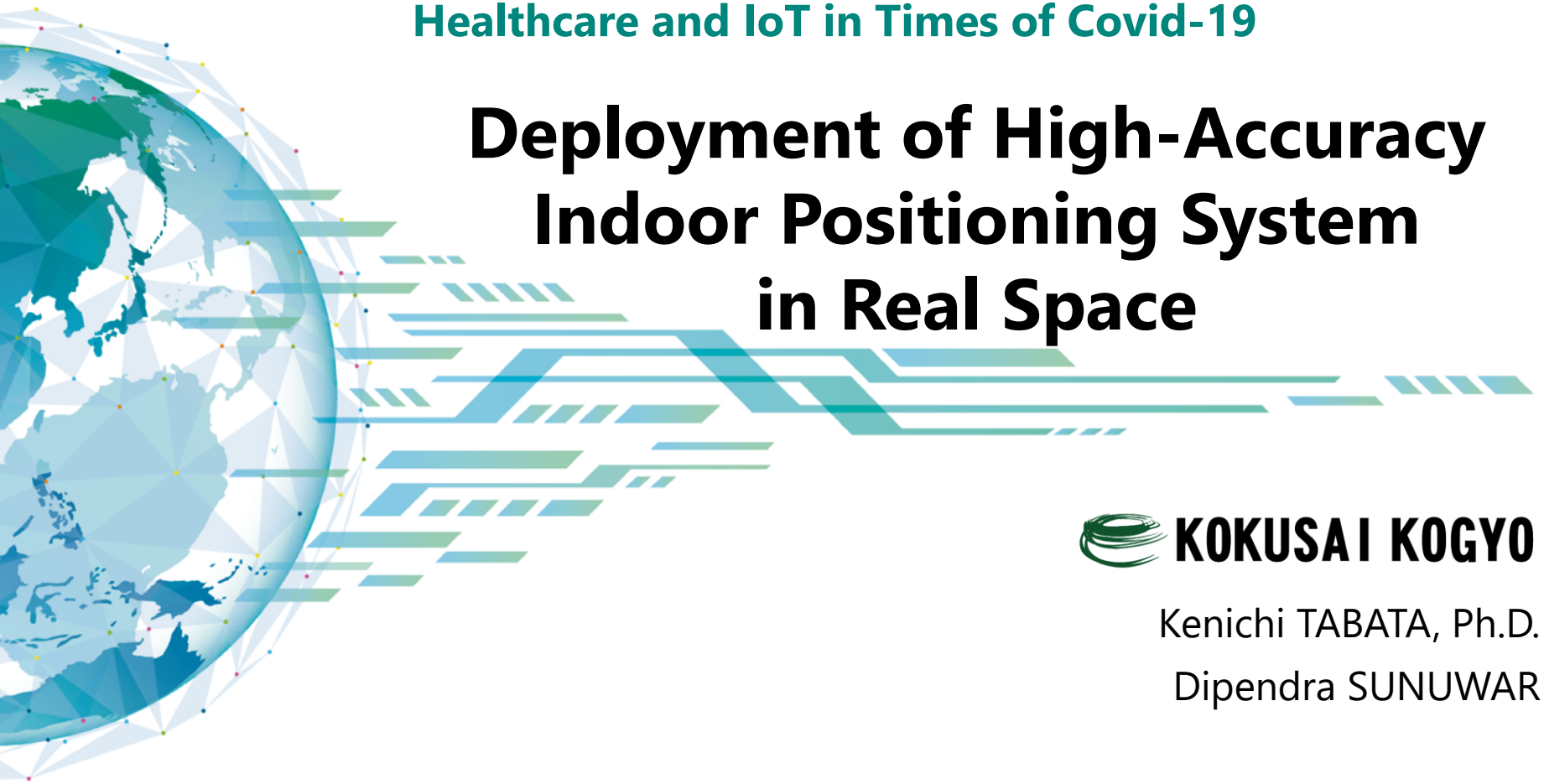
Healthcare and IoT in Times of Covid-19

Deployment of High-Accuracy Indoor Positioning System in Real Space



KOKUSAI KOGYO

Kenichi TABATA, Ph.D.

Dipendra SUNUWAR

November 22, 2021

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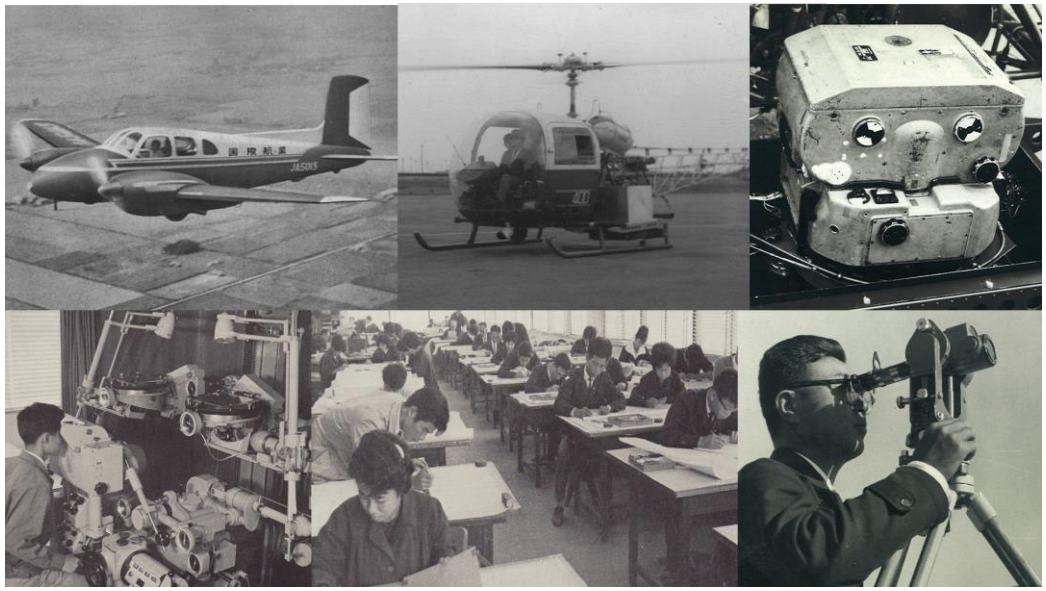
KKC at a Glance

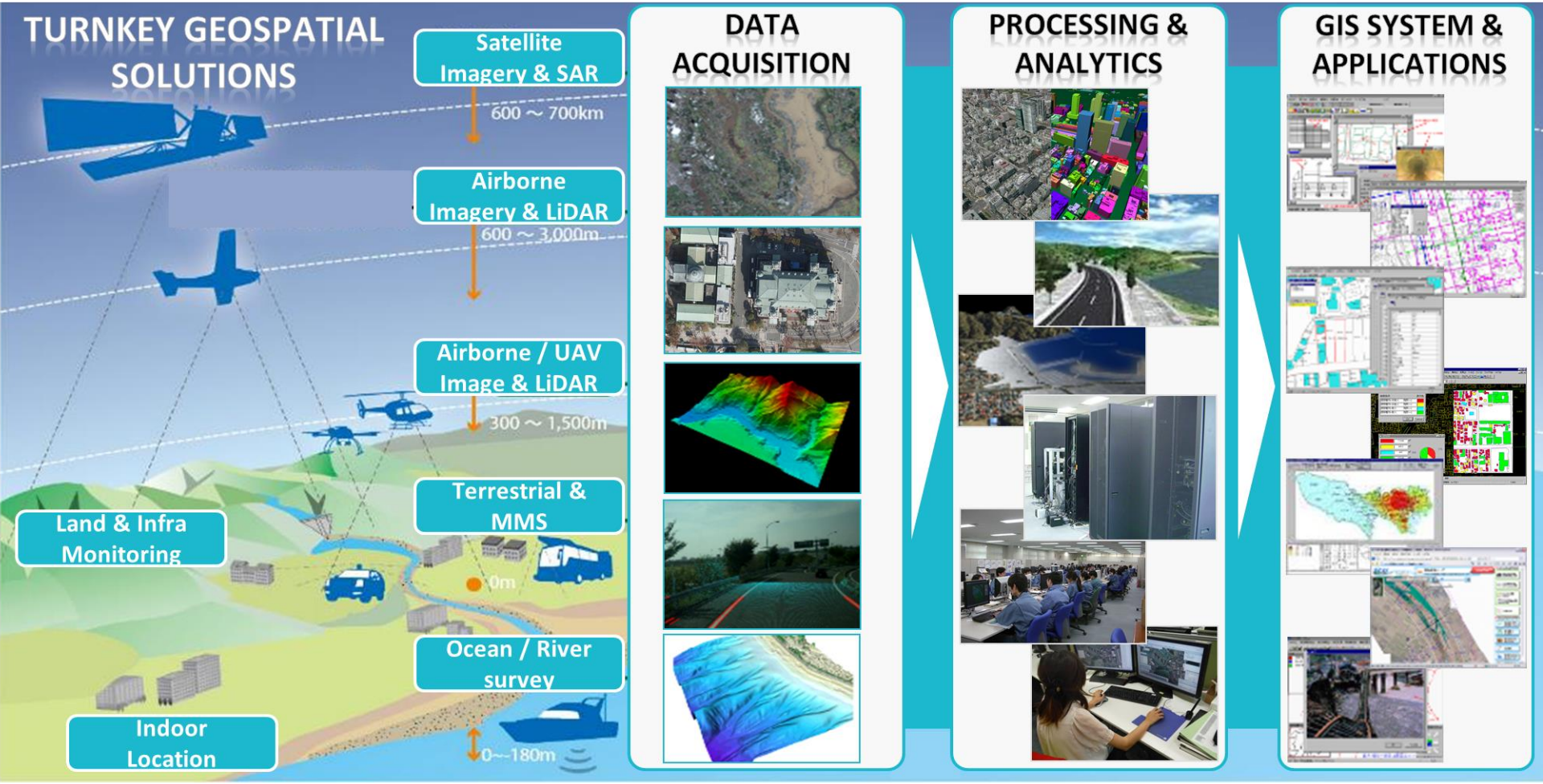
- **Year 1947** Founded
- **Tokyo, Japan** Headquarter
- **16,729 million yen** Capital
- **1,942** no. of employees (as of Mar. 2021)
- **6,000 +** annual projects
  (in Japan and worldwide)
- **Geospatial Centric Service**
  - ❖ Public Projects Consulting
  - ❖ Infrastructure Management,
  - ❖ Disaster Risk Reduction
  - ❖ Environmental Conservation
  - ❖ Remote Sensing
  - ❖ Renewable Energy



- **Corporate Philosophy**

  "Leading the way towards Green Communities from our unique geospatial information advantage"

Our Value Proposition



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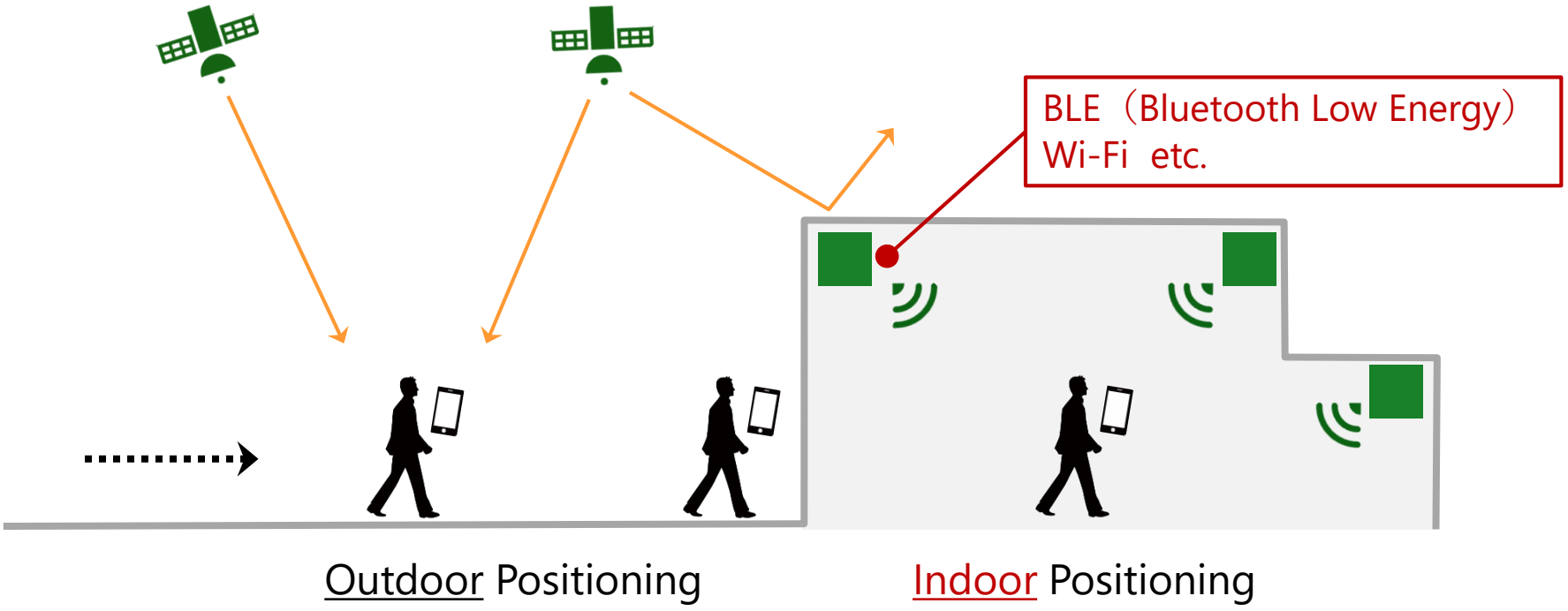
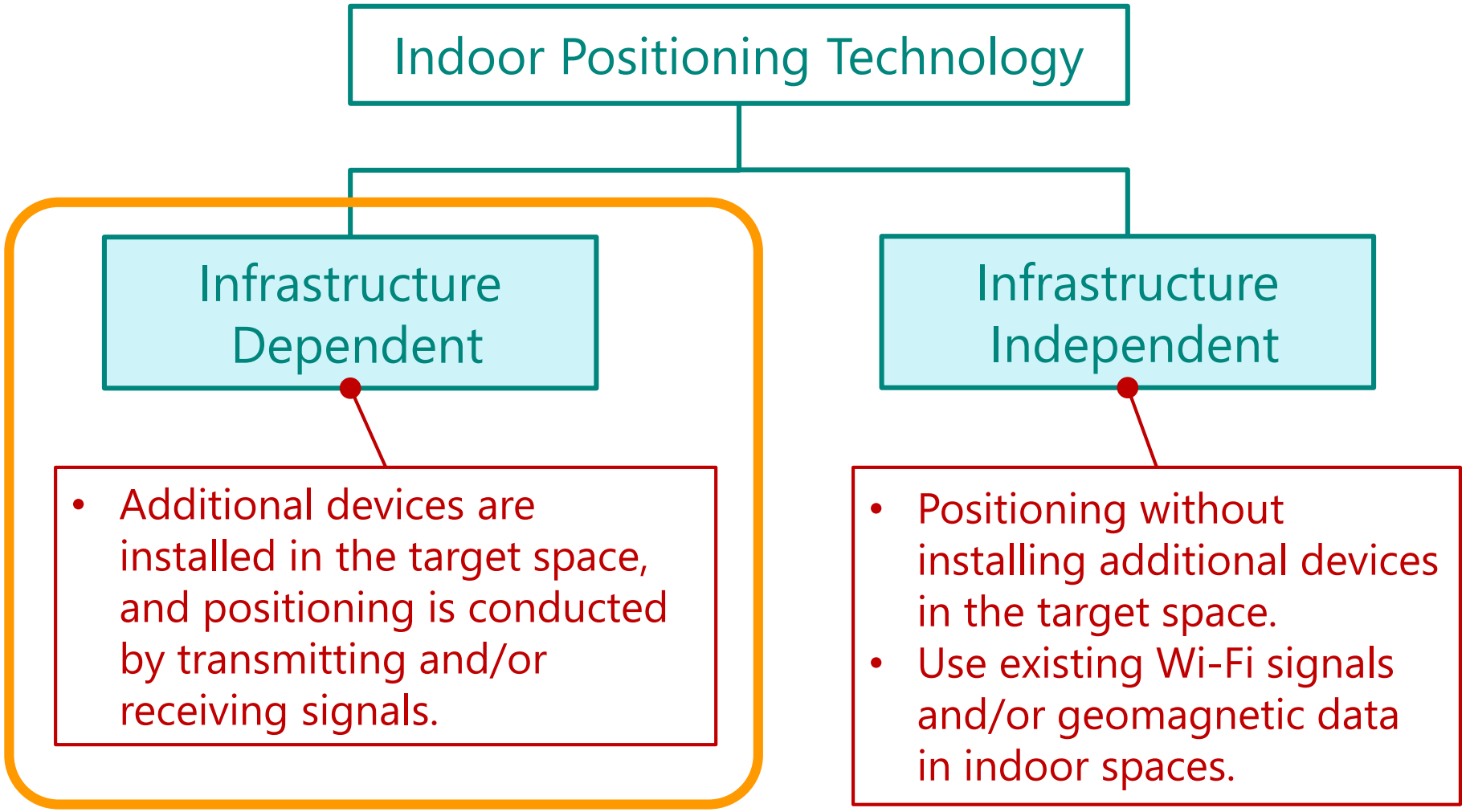
Background

- GPS signals cannot sufficiently reach to indoor spaces.
- To measure the position in indoor space, we need to deploy a different mechanism from GPS.



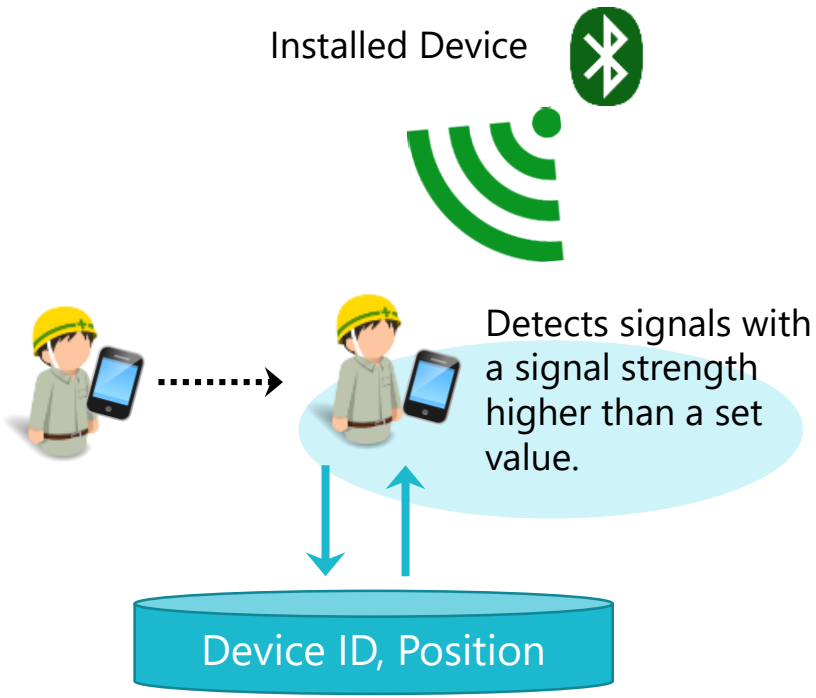
Classification of Indoor Positioning Technology



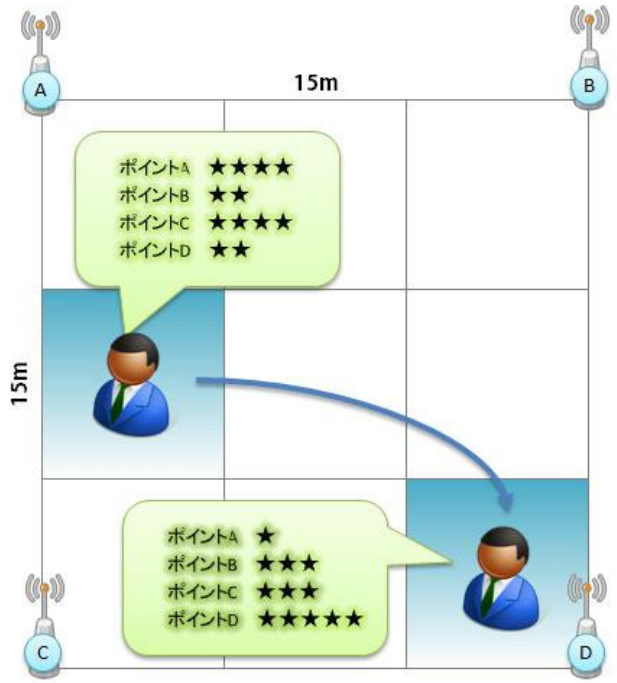
iBeacon Based Positioning Using RSSI

- Most famous indoor positioning method.
- Using RSSI (Received Signal Strength Indicator) of installed devices.

Proximity Positioning



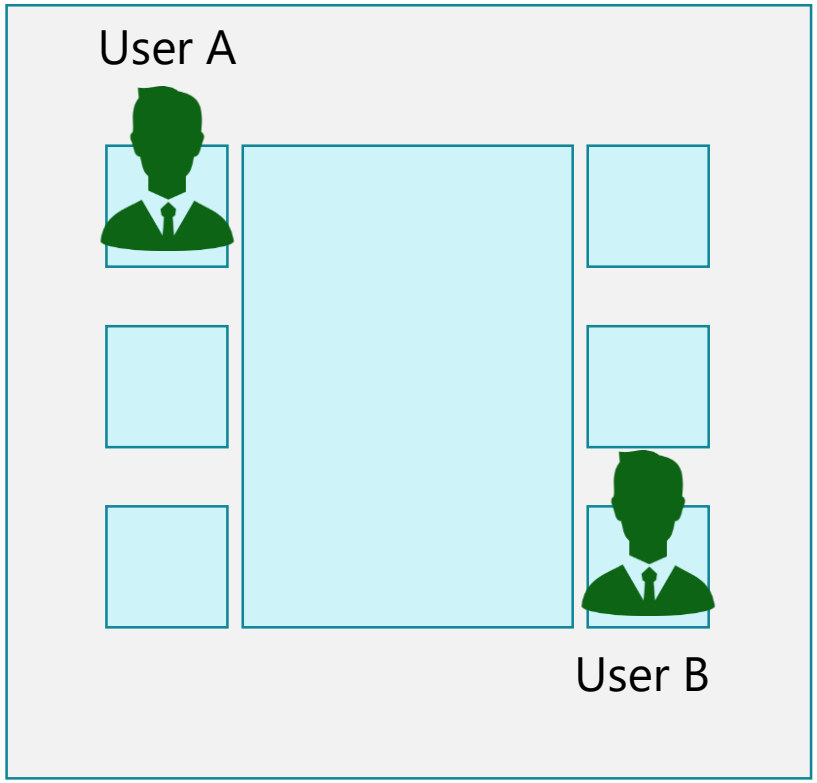
Triangulation Positioning



http://enterprisezine.jp/article/detail/2996

Positioning Accuracy in iBeacon Based Positioning

- The positioning accuracy of iBeacon based positioning method is about 2-5m.
- Difficult to locate in detail.



○ Detection of whether or not User A and User B are **in the same space (area).**

× Detection of whether User A and User B are **in the near distance.**

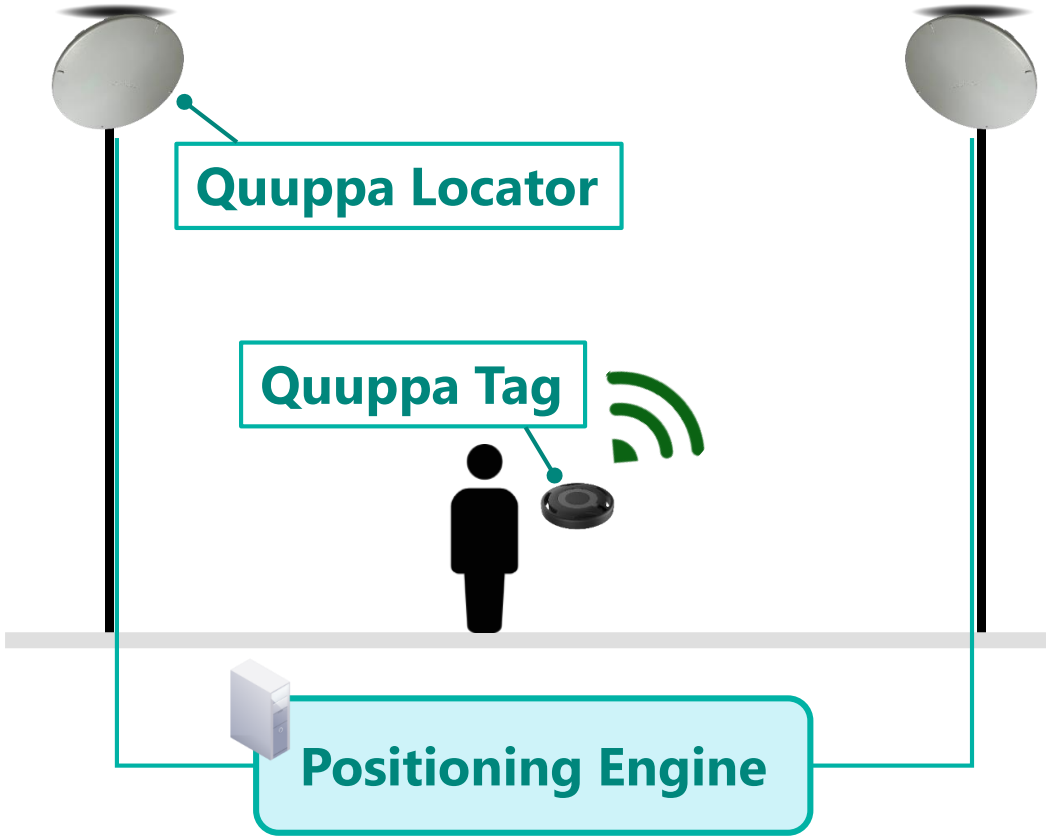
Comparison of Indoor Positioning Technologies

	Quuppa	Bluetooth (RSSI)	UWB	Wi Fi	RFID	GPS
Accuracy	<1m	2-5m	<1m	5-20m	1-5m	3-20m
Battery Consumption	☆☆☆☆☆ Low	☆☆☆ Medium	☆☆ High	☆☆ High	☆☆☆☆☆ Low	☆☆ High
Range	up to 300m	up to 300m	up to 200m	up to 150m	up to 5m	Global
IOT Gateway	○	○	×	○	×	×
Smartphone Compatible	○	○	○	○	×	○
Scalability	1000s of tags	unlimited	1000s of tags	100s of tags	1000s of tags	unlimited

This table was created with reference to https://www.quuppa.com/technology/overview/

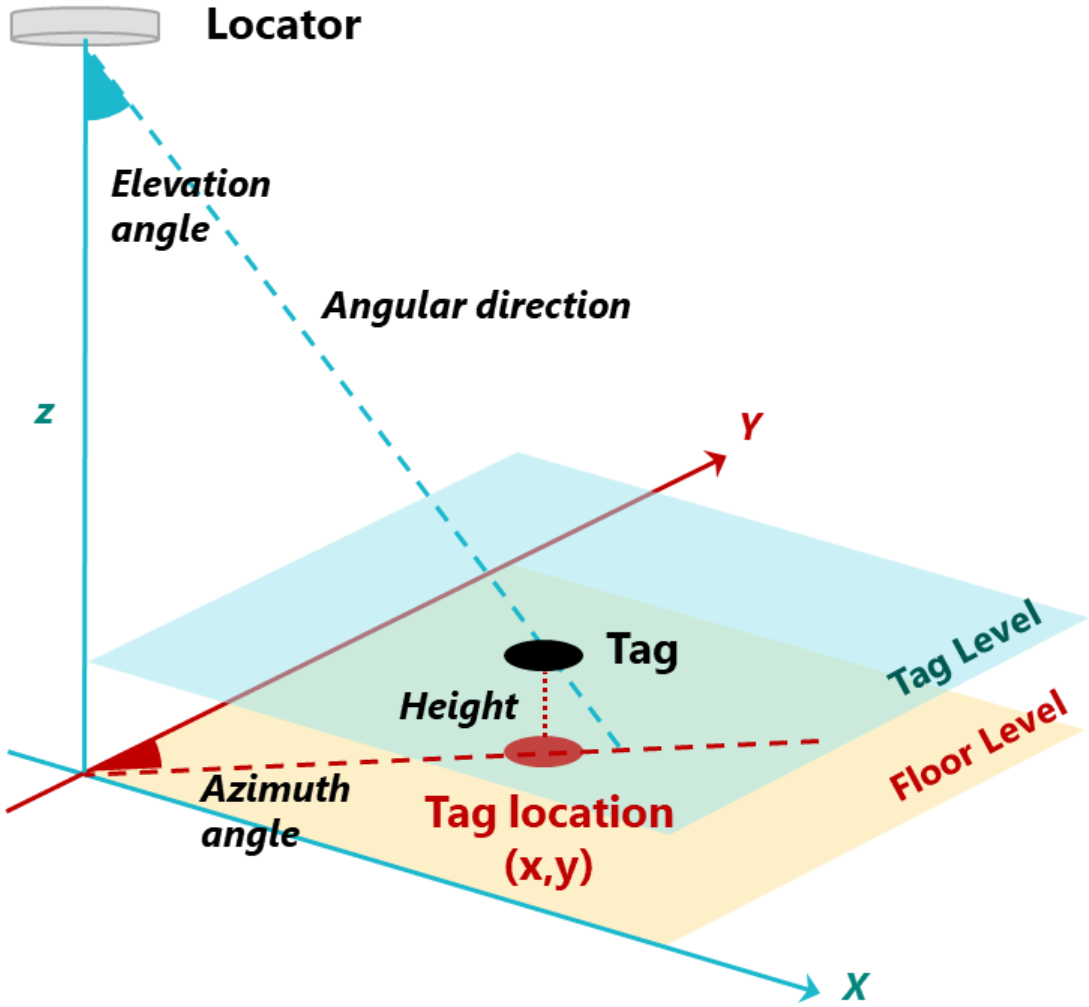
Quuppa Intelligent Locating System™

- Quuppa is one of the most high-accuracy indoor positioning systems.
- Developed by Quuppa Oy in Finland.



Angle of Arrival (AoA) Positioning

- The Quuppa system uses AoA as its indoor positioning technology.
- High-accuracy positioning is enabled by calculating the elevation and azimuth angles from the tag signals.



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- Company Overview
- Overview of High-Accuracy Indoor Positioning System
- **Introduction of Case Studies of High-Accuracy Indoor Positioning System in Real Space**

Major Fields of Utilization Needs

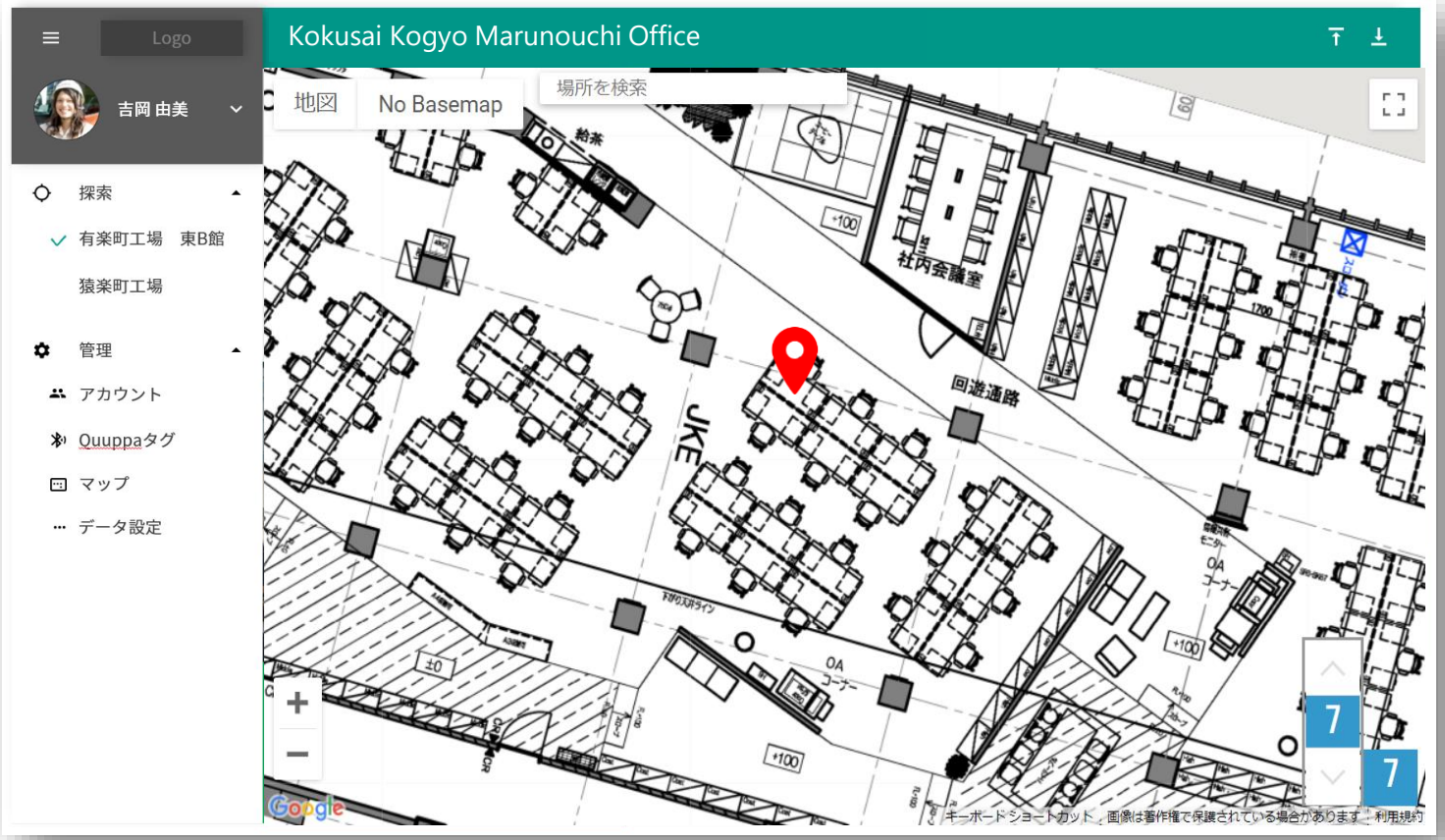
What is It Used for?

Productivity Improvement Support	Support productivity improvement by tracking the location of workers and assets in real time.		Real-time Location Tracking	*Reduce search time drastically by enabling search for the location of workers and assets.*
			Work Time Calculation	*Automatically measure the work time in each work area.*
			Real-time Alert	*Automatically generate alerts when work is not completed within a set time.*
			Automatic Navigation	*Automatic navigation for drones and AGVs in factories using high accuracy location information.*
Safety Management Support	Preventing accidents in factories by using location relationships between tags.		Collision Prevention	*Attach tags to both workers and moving objects and detect their proximity.*
			Ingress Detection	*Detect workers entering a hazardous area.*

What is It Used for? (for offices / hospitals)

Real Time Location Tracking

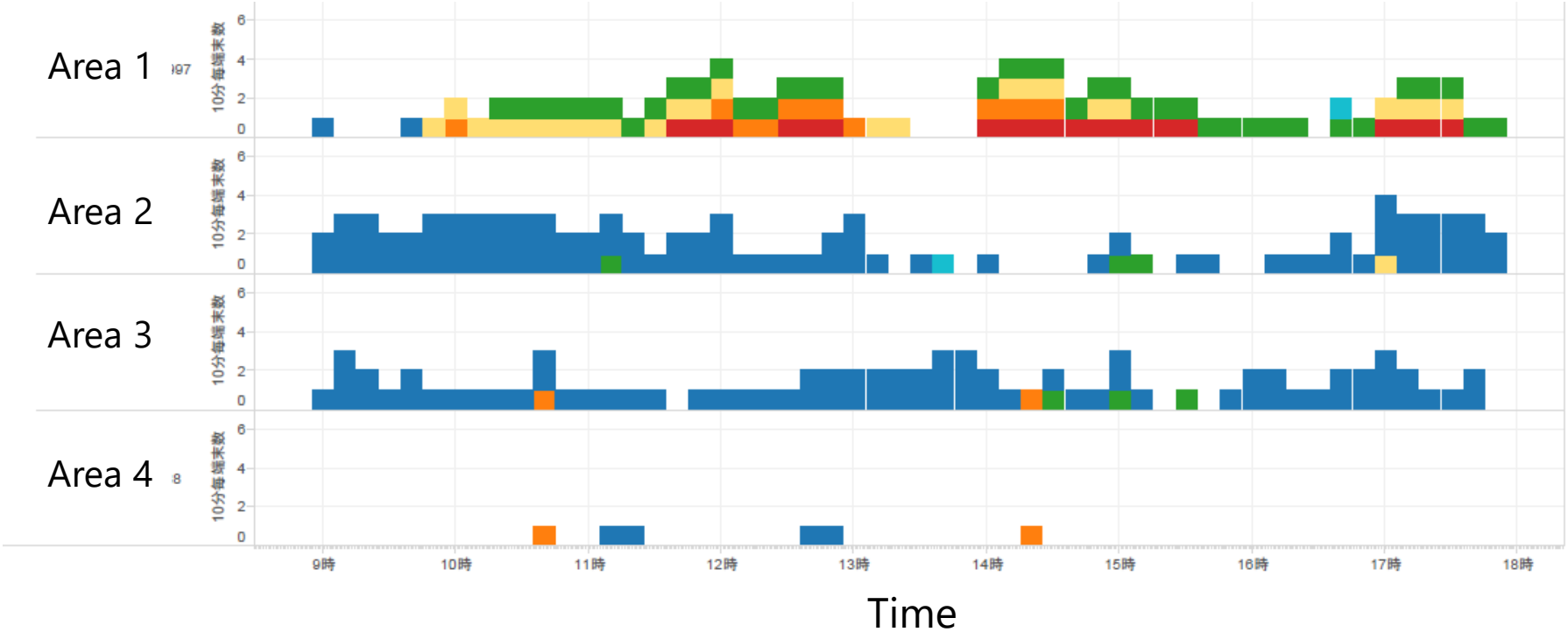
- Using a high-accuracy indoor positioning system, the current location of workers in an office or hospital can be accurately tracked.



What is It Used for? (for offices / hospitals)

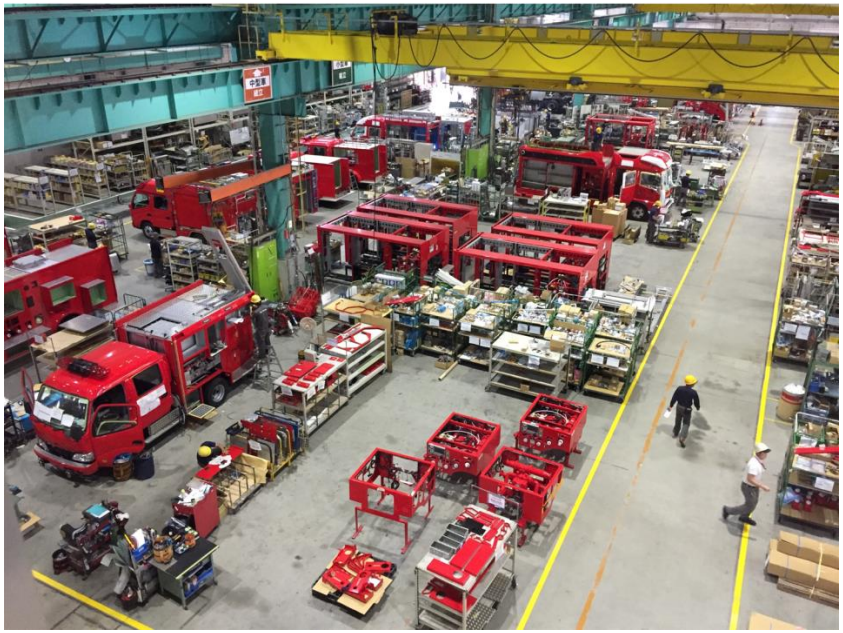
Workers Activity Analysis

- The high-accuracy indoor positioning system allows us to more accurately measure the stay time in each area and who was nearby in that area.



Case Study 1 : Fire Truck Factory

End User Name	MORITA HOLDINGS CORPORATION
Purpose	• Real-time location tracking of a manufacturing fire truck in a very large factory (about 60,000 m2)
Number of Locators	70



https://www.youtube.com/watch?v=mo9GCTP2dHc

Case Study 2 : Office

End User Name	Ricoh Company, Ltd.
Purpose	• Activity Analysis of Users in an Office Renovated from an Old Building • Measurement of conversation amount, etc. in addition to location information by the original device
Number of Locators	110

http://artandprogram.com/works/?project=3l

https://www.businessinsider.jp/post-223379

Case Study 3 : Entertainment

End User Name	Expo 2020 Dubai Japan Pavilion
Purpose	• Acquisition of visitors' movement history in the pavilion. • Providing content based on movement history
Number of Locators	47

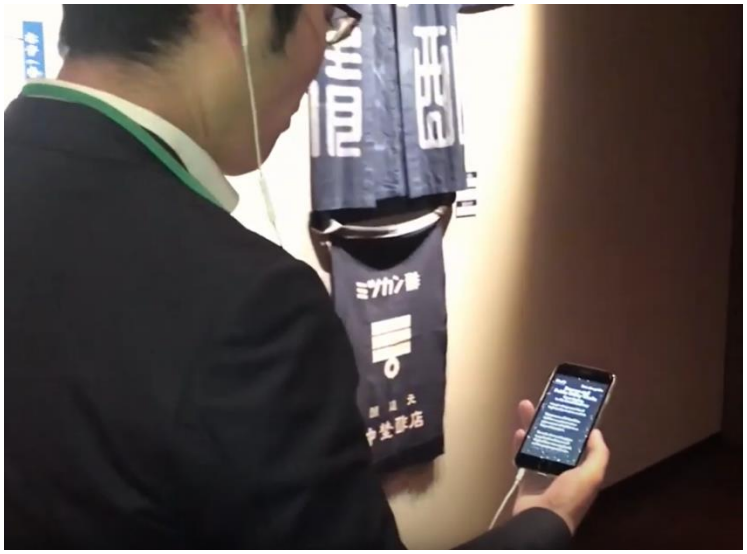
日本館の展示コンテンツイメージ
（2020 年 ドバイ国際博覧会 日本館　提供）

日本館に設置された高精度・
リアルタイム位置測位システム

https://www.kkc.co.jp/cms/detail/news/20211019

Case Study 4 : Museum

Use Case	Mizkan Museum
Purpose	• Providing content based on the user's current location in a guidance smartphone application.
Number of Locators	20



https://www.youtube.com/watch?v=k26ZsJ8rxkI

Case Study 5 : Events

Use Case	Business Networking Events
Purpose	• People Search in networking events. • Using indoor location information, it is possible to find the target person with high probability.
Number of Locators	70

Conclusion

- In recent years, the deployment of high-accuracy indoor positioning systems with positioning accuracy of less than 1 meter has begun to progress.
- High-accuracy indoor positioning systems are mainly used in the fields of factories, warehouses, offices, hospitals, and events.
- In the field of offices and hospitals, it can be used for real-time tracking and activity analysis of staff.

Designing the future of people, communities and planet by connecting the dots

KOKUSAI KOGYO