Towards Practical Deployment of RMF on Panasonic HOSPI Robot

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Panasonic

Panasonic Asia Pacific Co. Ltd

Panasonic Group

Headquarter	: Osaka, Japan
Foundation	: 1918
No. of Employees*	: 240,198
Sales (FY22)	: 7,389 bil JPY (82.2 bil SGD)

*as of 31st Mar.2022

Group CEO : Yuki Kusumi

Panasonic Group Business

Our New Brand Slogan

Live Your Best

In an ever-changing world, we continue our efforts to make life simpler, safer, healthier, more enjoyable, and more sustainable.
Efforts to help our customers live their best.

We will support the environment and well-being of lifestyle & workstyle

Robotics Ecosystem in Singapore

The National Robotics Programme (NRP) is a multi-agency national programme that looks at the end-to-end development of differentiating robotics enablers and solutions in Singapore, from funding R&D to facilitating partnerships for translation and adoption to maximise socio-economic impact.

Partners

Public Agencies & Offices

Institutes of Higher Learning (IHLs) & Research Institutes (RIs)

Robotics Ecosystem in Singapore – Industry

Panasonic's AMR (Autonomous Mobile Robot)

Indoor delivery AMR

HOSPI

Robotic mobility

PiMo

Wireless following

Semi autonomous

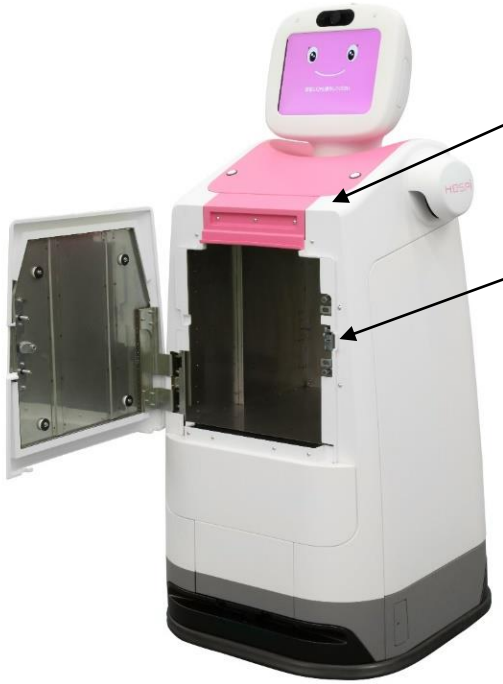
Auto pilot

Under Development

Full autonomous

Autonomous delivery robot “HOSPI”

This is our autonomous delivery robot, HOSPI. Example use cases include transporting drugs, specimens, materials, etc., at hospitals.



HOSPI(Normal type)

<Specification>
Size : W630mm×D705mm×H1,390mm
Weight : About 170kg
PayloadSize : W327mm×D446mm×H390mm
Capacity : About 20kg
MaxSpeed : 1.0m/sec
RunningTime : 7 hours / 2.5 hours for charging
(Subject to change according to operation environment)

Security

Authentication with an ID card is required for operation

Storage

By default, 3 trays can be stored

Standard tray

<Specification>
Payload Size : W548mm×D348mm×H197mm
Material : ABS

Storage can be customized freely

drugs	 Standard tray	 Customizable
specimens	 Test tube	 Urine examination

Strengths of Our Technology

Unique Value Propositions & Competitive Advantages

High safety technology

- ISO 13482* compliant robot 1st in the world

(*Safety requirements for personal care robots)

- HOSPI can safely operate in public areas with close human-robot interaction

Obtained the world's first ISO 13482 JIS standard certification for autonomous mobile robots

Reliable track record

- 9+ years of experience in providing robot solutions in Singapore
- Delivered 27 robots in 11 hospitals worldwide
- Earned the trust of customers by providing unfaltering robotic solution

Adapted RMF

- Panasonic is **Empaneled System Integrator (SI) of RMF**
- Lift & door integration
- Fleet management system

Integration with Auto door and lift

Panasonic

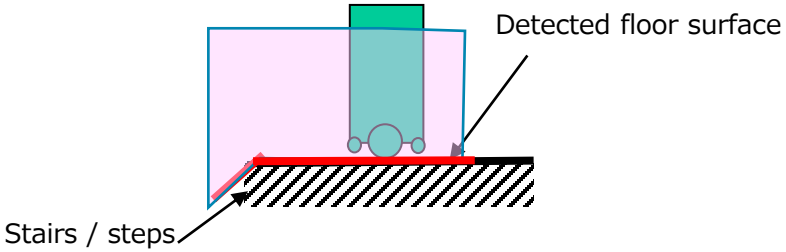
High Safety

HOSPI has never had an accident in 9 years since it started operation.
HOSPI will inform surrounding people by voice while moving.

Ledge-drop prevention

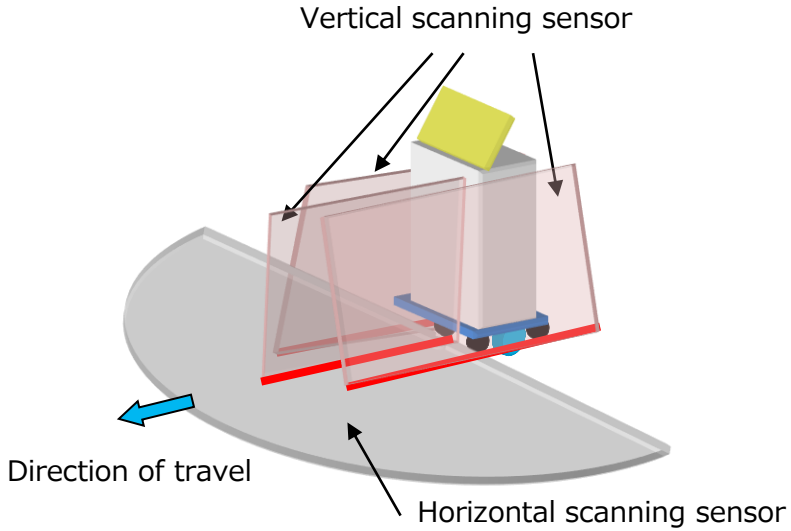
Dual preventive measures will be taken in places where there is a risk of falling from escalators, stairs, etc.

1	Register virtual wall in map (Recognize dangerous places)
2	Sensors detect stairs and escalators (Stop at a dangerous places)

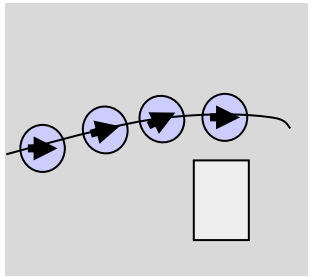


Obstacle avoidance

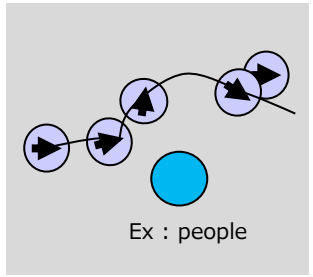
・sensor structure



・avoidance behavior



In case of static obstacle



In case of dynamic obstacle

Panasonic's Capability & Contribution to Singapore

Panasonic will contribute to the deployment of **RMF** to society through our robot business.

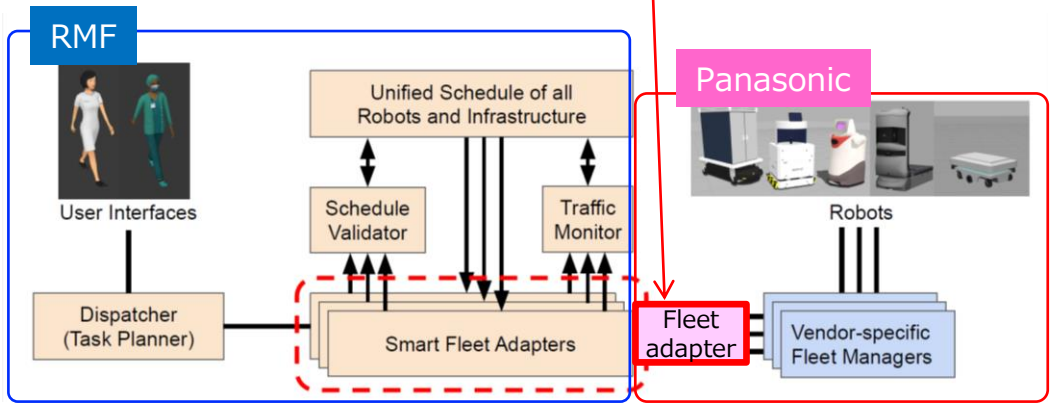
Panasonic's RMF capabilities

1: We have adapted RMF to commercialized AMR *(adapted level : Middle) ※Robot system using Windows*
We also adapted RMF to prototype AMR *(adapted level : High) ※Robot system using ROS2*
2: We can integrate many kinds of devices for RMF
3: We have capability of integrating robot system using RMF. We are one of the RMF empaneled SI vendor.
4: We have some experience integrating AMR to Xnergy(Singapore startup) contactless charger.

1:Commercialized AMR adapted to RMF

We have commercialized AMR

We are developing our own RMF-compatible fleet adapter



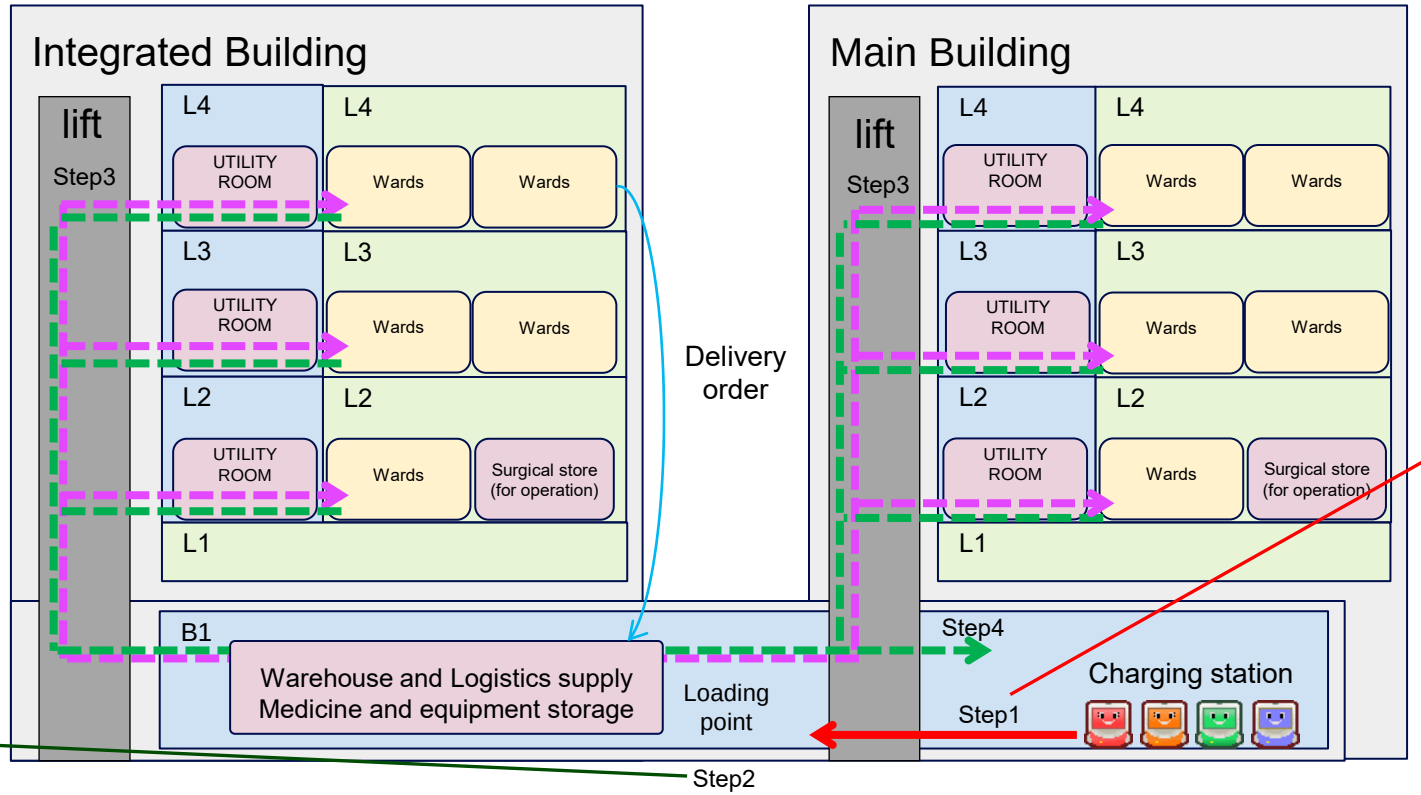
Using ROS2 system, we can adapt to Full Control level

Ad hoc delivery operation in Hospital

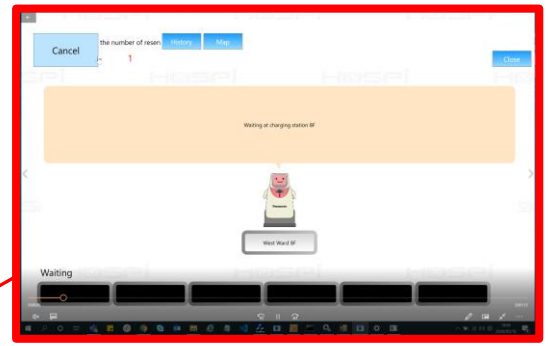
- **Regarding Ad hoc delivery, AMR delivery each items to a specific destination from ward, after receive delivery request from each Wards**
- **The destination is selected by the staff for each item when the robot is at the loading point**

Step1: Call the robot from the charging station or the nearest position to the loading point (Any robot will do)
Step2: Staff load the items to robot at Loading point and select a destination （The task done by the AMR which staff operated ）
Step3: Deliver the items to destination
Step4: After delivery, when the staff presses the return button, AMR moves to the charging station and charges

Staff select a destination after load items



Staff call the nearest robot



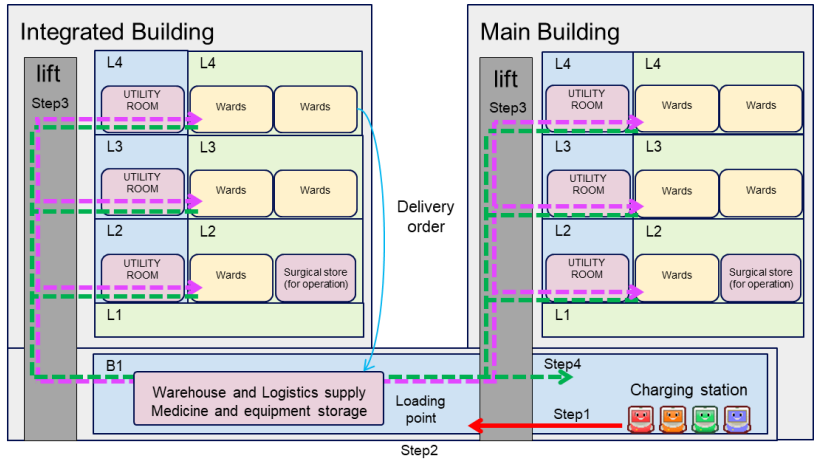
Required specification for RMF

Due to the AMR operation in hospital, the RMF should have the following function

1:Setting the direction facing at the destination

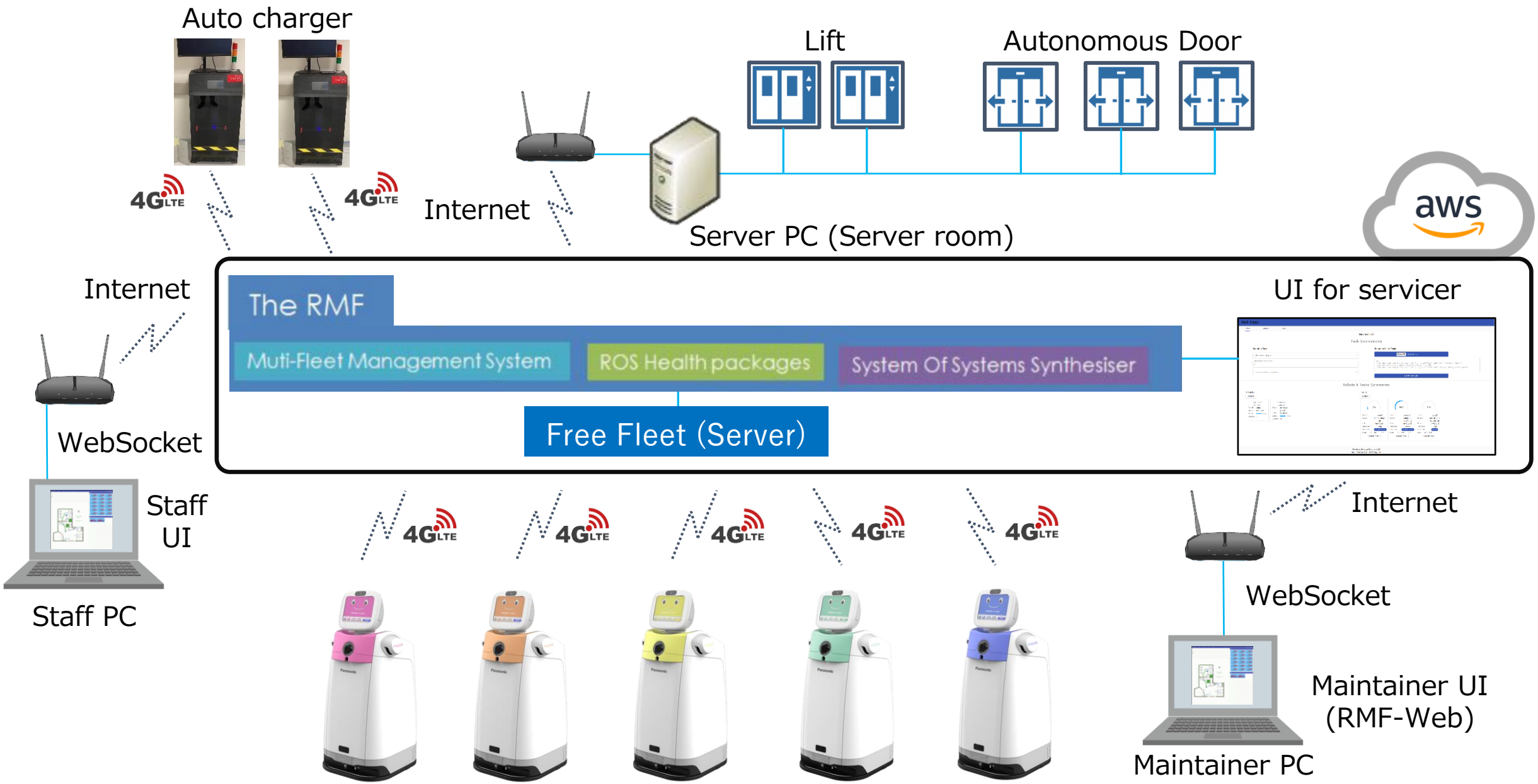
2:Speed setting for each lane (speed adjustment)

3:Allocating tasks to specific robots



4:Conduct Charging mode at Charger Locations

AMR System configuration diagram with RMF

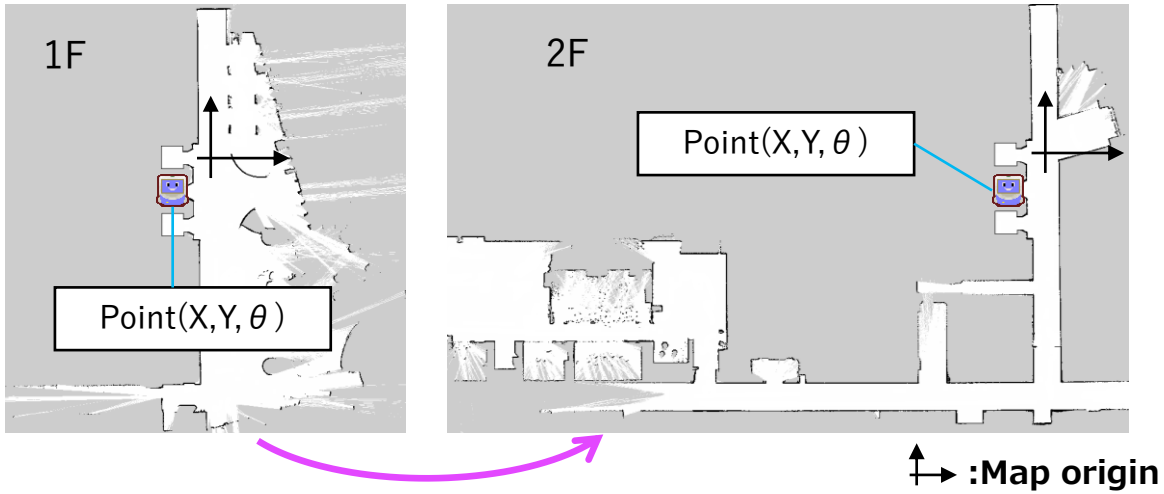


Preparation of AMR before using RMF

RMF maps are unified into one map for multiple Floors, but AMR only using 1 Navigation map
Because of this, AMR side need to add Change Floor function in ROS Navigation

- **Two Ideas for AMR to Switch Maps**

Switch Navigation map physically



Change Floor = Change map = Republish new map topic

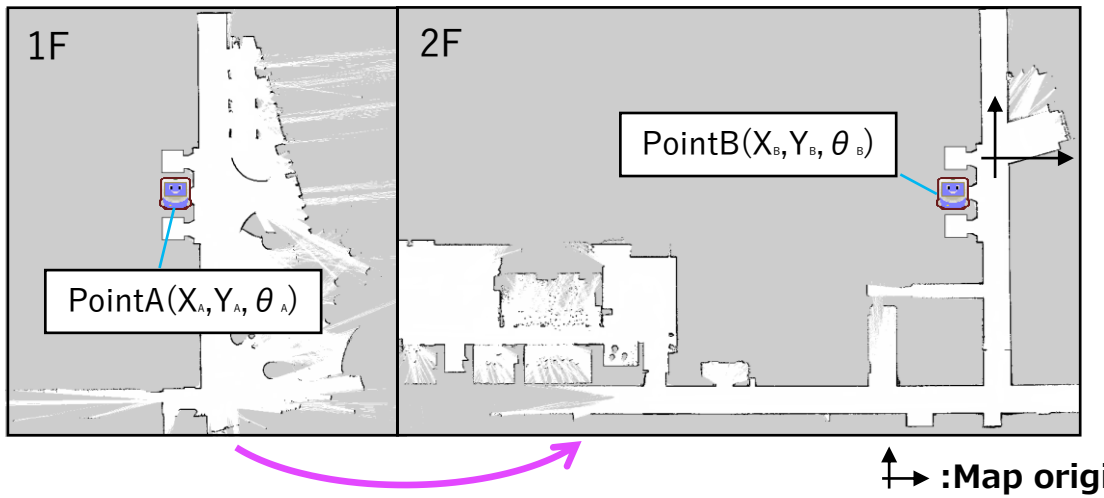
■ **Send coordinates to RMF**

(X,Y,θ) => (X,Y,θ) in 1F

(X,Y,θ) => (X,Y,θ) in 2F

Advantages	Disadvantages
Don't need map merging	Need to align map coordinates
Don't need offset parameter	Mapsever needs modification

Reteach the robot's position in Navigation map



Change Floor = Change position = Resend initial pose again

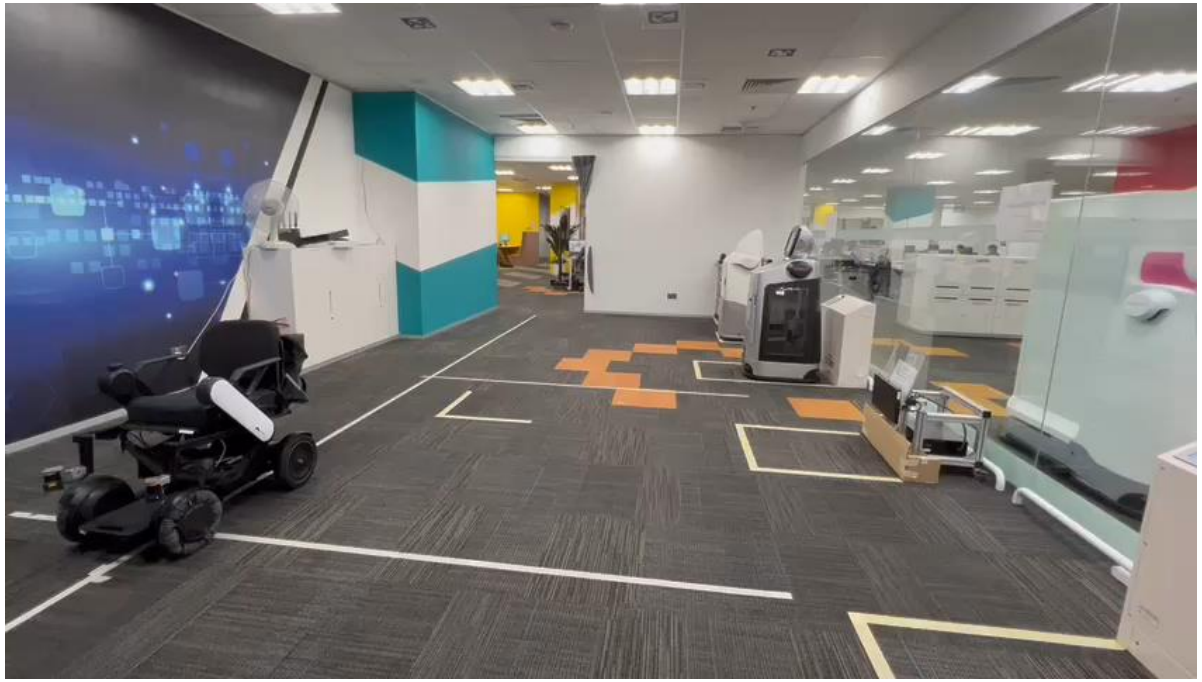
■ **Send coordinates to RMF**

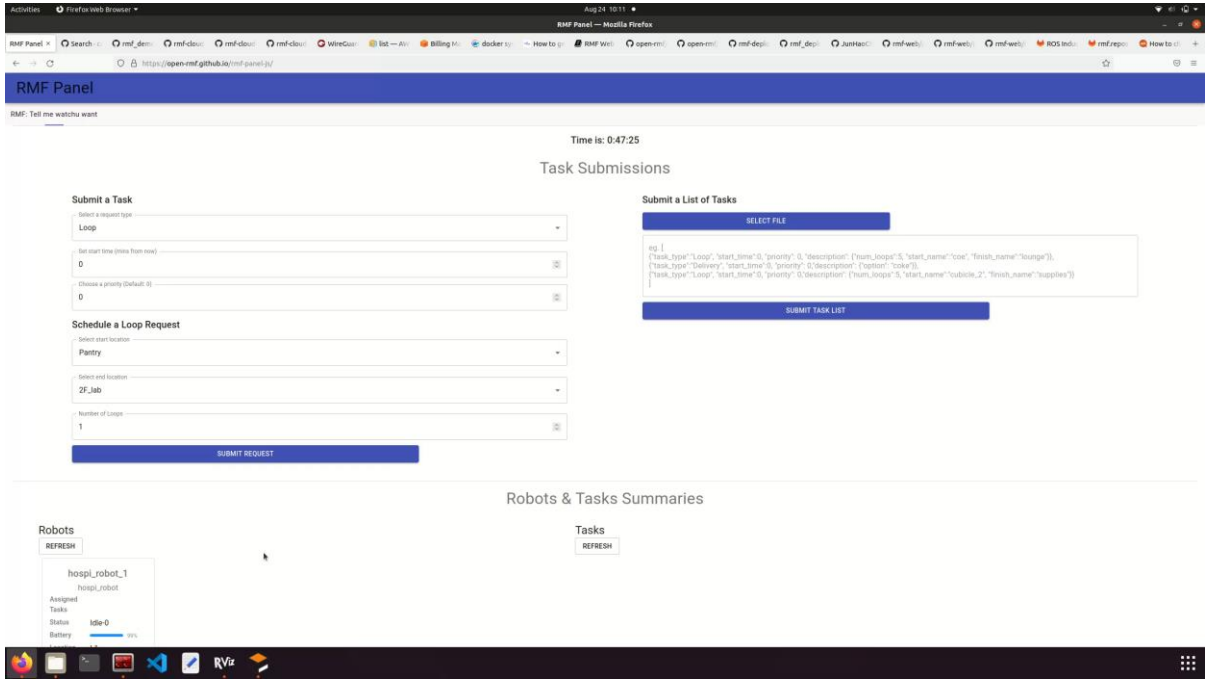
(X_A,Y_A,θ_A) => (X,Y,θ) in 1F

(X_B,Y_B,θ_B) => (X,Y,θ) in 2F

Advantages	Disadvantages
No need to align map coordinates	Need offset parameter for each floor
Mapsever don't needs modification	Require map merging

Demonstration of RMF





Pilot Trial at Galen, Smart Urban Co-Innovation Lab

2A: At Level 1 Lobby, HospiSignage offers concierge services to guests, indicates who and what are present

Demo of HOSPI and Lift Integration with RMF

Live Demo of HOSPI and Lift/Door Integration with RMF here at ARTC

Thank you for your attention!