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Voice Navigation Extension for IndoorGML and its Use-case

94th OGC Technical Committee

Barcelona Spain

Nobuo Kawaguchi

12 March 2015

OGC® Making location count.

Voice Navigation Extension for IndoorGML and its Use-case

Mar. 12, 2015, OGC IndoorGML SWG

Nagoya University/
Location Information Service Research Agency

Nobuo Kawaguchi

Big demand in Japan

- In 2020, we will have “Olympic” and “Pallalympic” in Tokyo.
- Tokyo is so complex city.
- We can’t fix all of the structures /signs for foreigners.

- We have a governmental project related to “Indoor Navigation for foreigners.”
  (by Ministry of Land, Infrastructure, Transport and Tourism)
  - More than **20** companies are joined **the “Experiment”**
  - **11 companies demonstrate their Indoor Location Service**

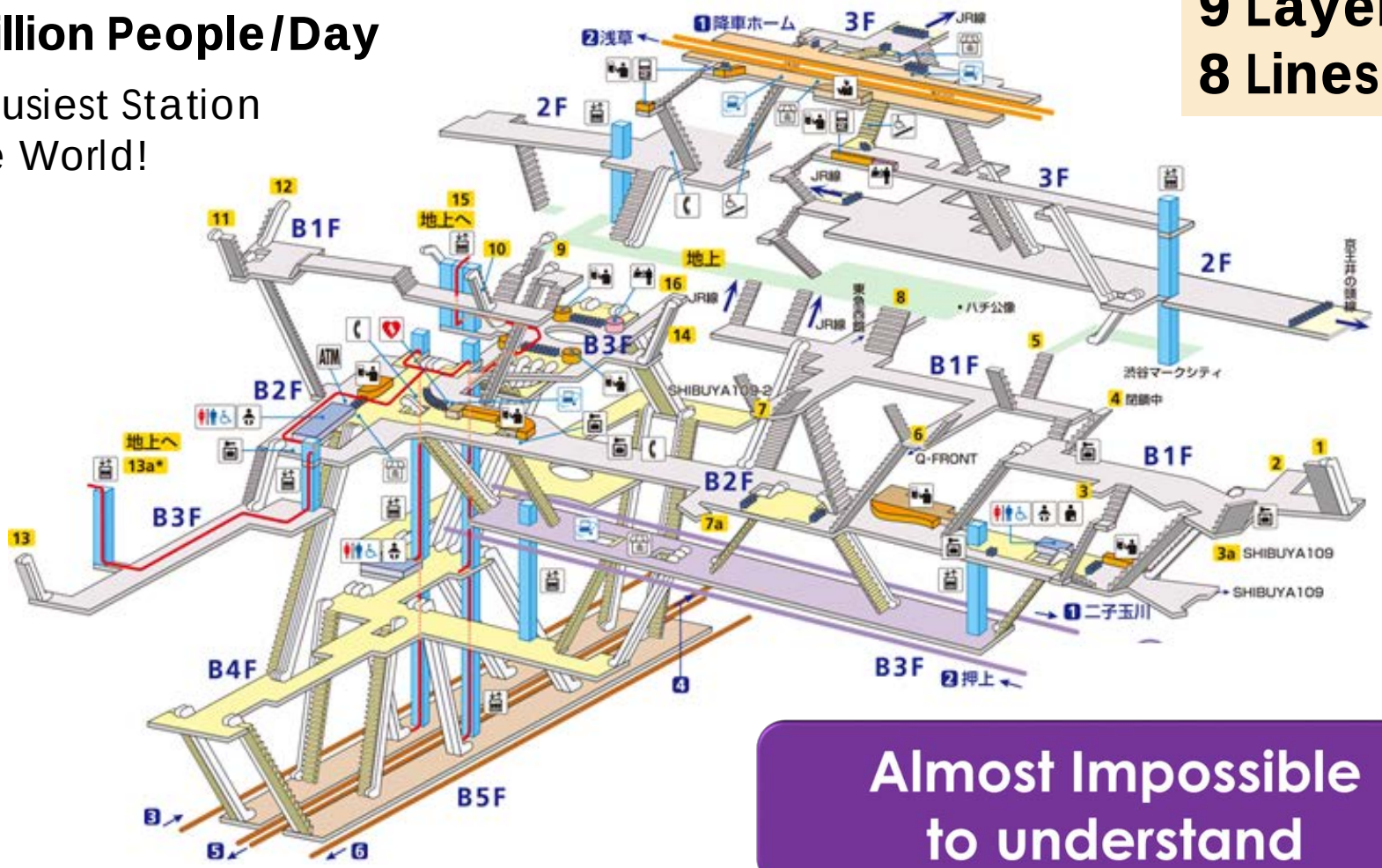
Complexity of Japanese Station

Shibuya Station

3 Million People/Day

2nd busiest Station
in the World!

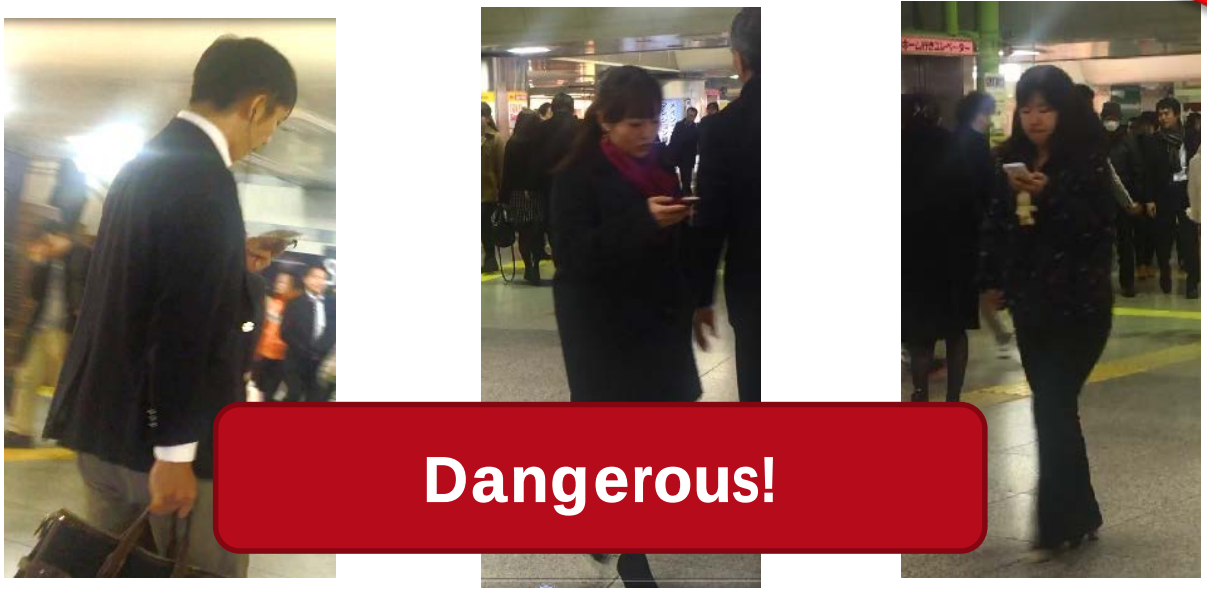
9 Layers
8 Lines



Almost Impossible to understand

Navigation in Indoor Environment

- Walking while watching SmartPhone



- Voice only Navigation is one of the solution.
  - However, navigation without map is not easy

Our Proposal

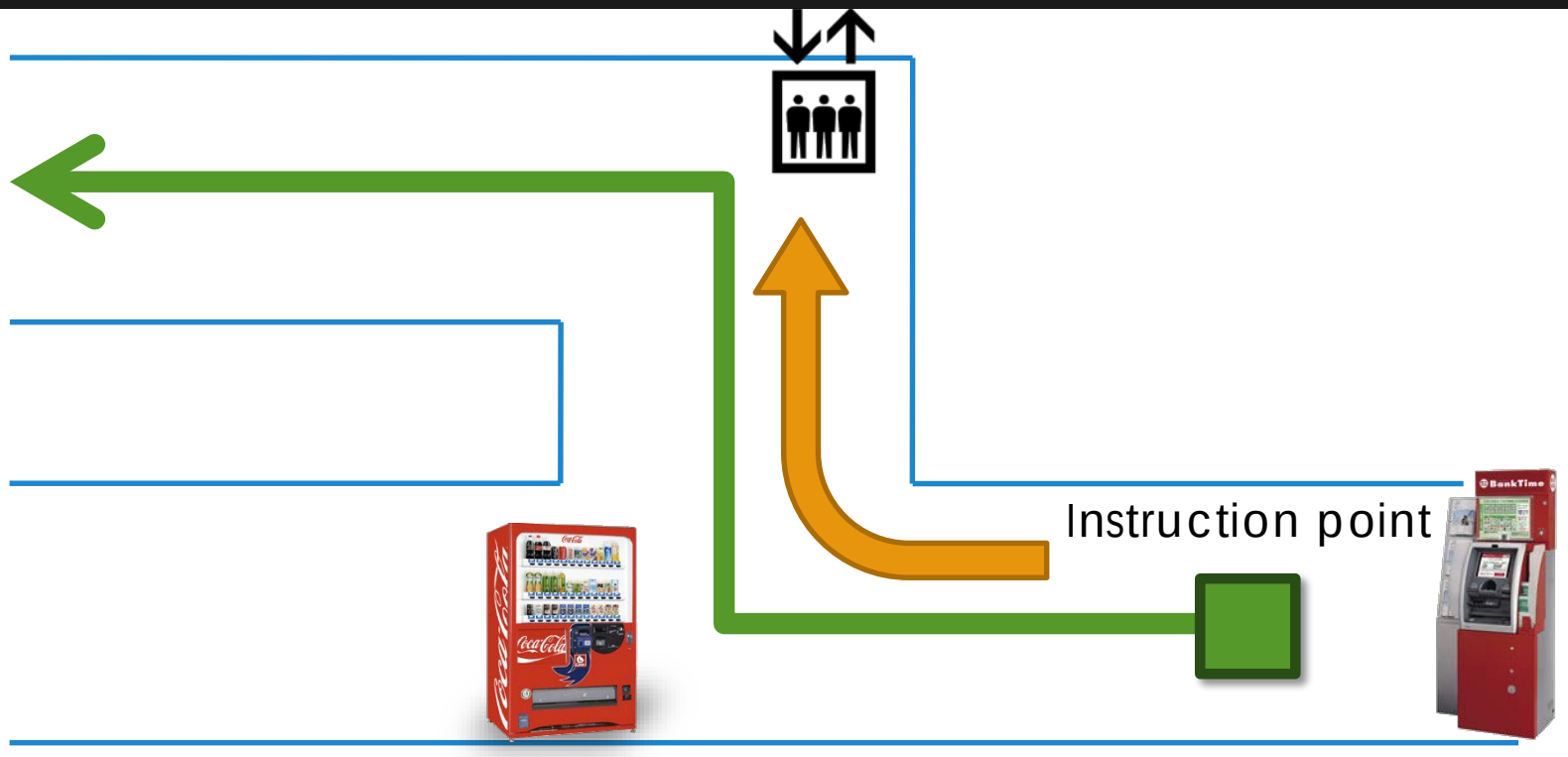
[Watanabe, et.al , ICMU 2012]

- Landmark-conscious Voice Navigation
  - System doesn't display a map
  - System explain landmarks and direction

Approach

- Use a highly-visible landmark for each instruction point
- Use landmarks to give the direction to go after action

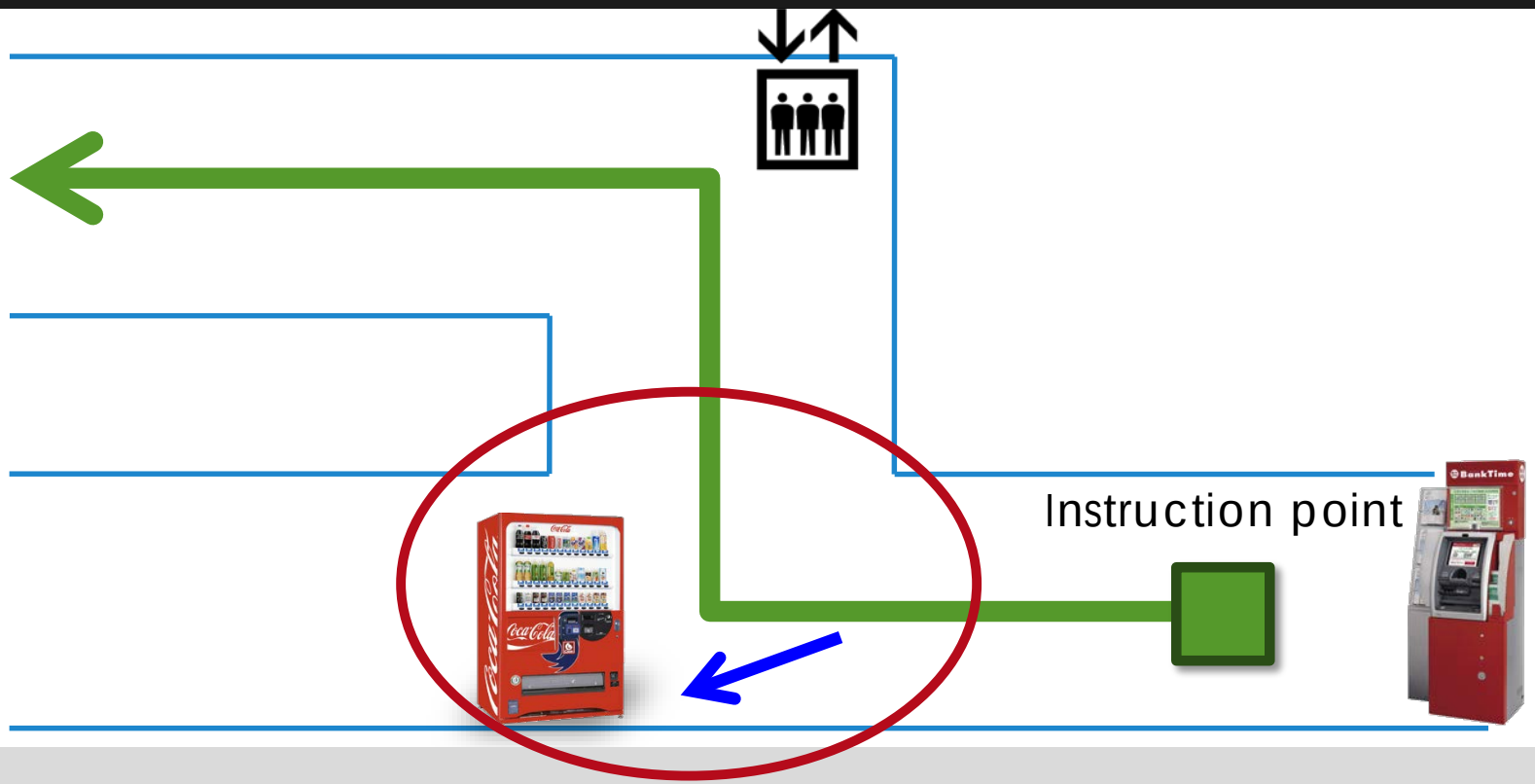
Navigation model



Guidance

"Please turn right at the T-junction of 10m ahead”

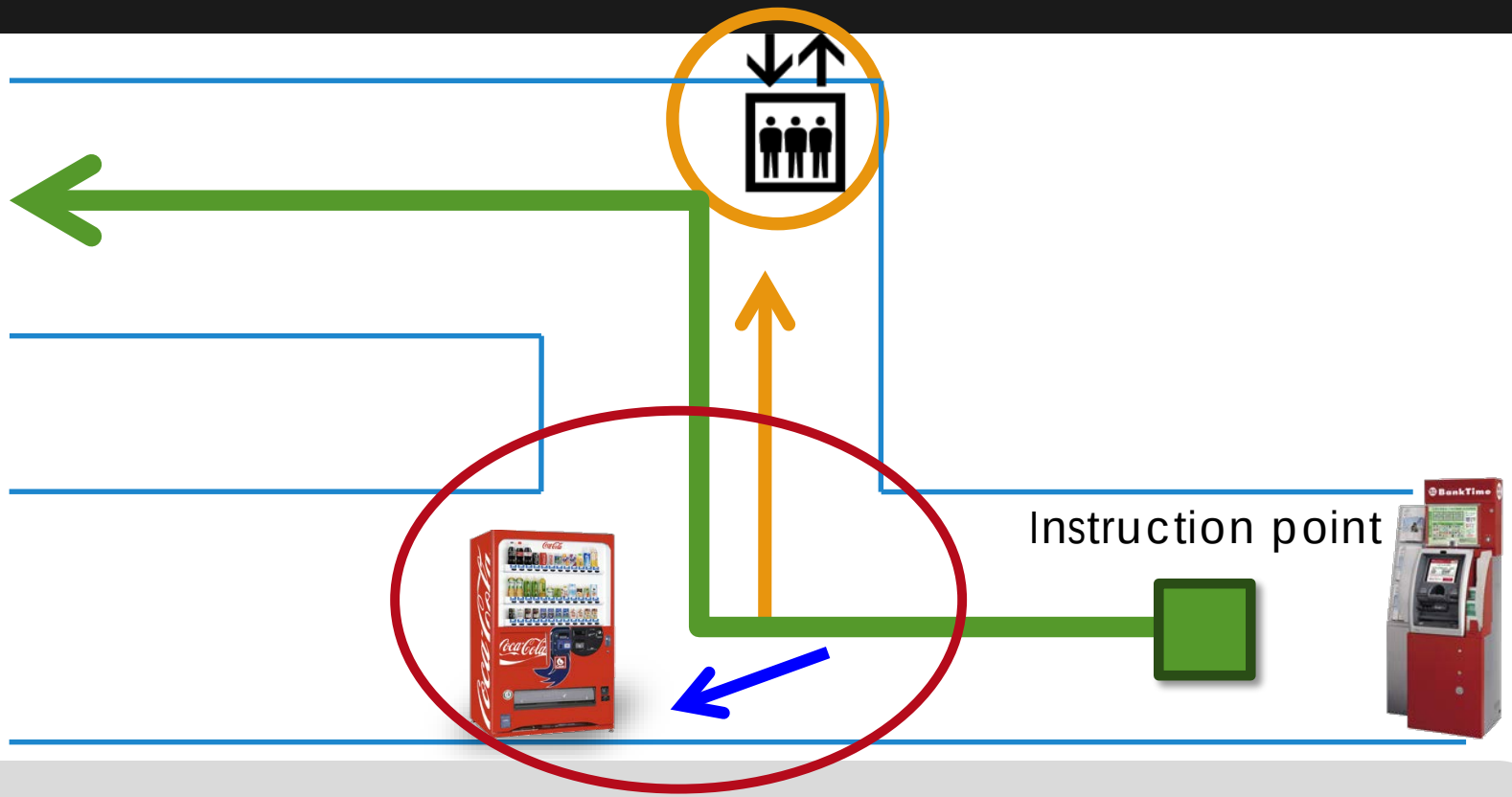
Navigation model



Guidance

"Please turn right at the T-junction
with the red vending machine on your left hand side of 10m ahead".

Navigation model



Guidance

"Please turn right at the T-junction with the red vending machine on your left hand side of 10m ahead"

+

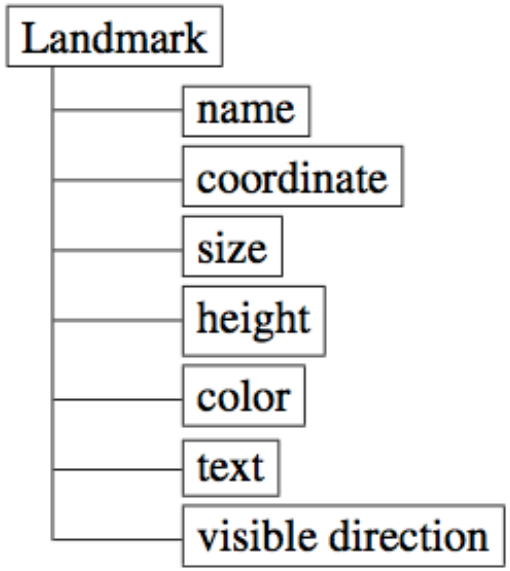
After that, please move directly towards the elevator in front of you.

Voice Navigation Extension for IndoorGML

- When we try to use IndoorGML for Voice Navigation, we need info. for "How to explain the route." (especially, for "Landmark based Voice Navigation")
- Most of difficulty comes from "How to express landmarks"
- Example of landmarks.
  - Signs
  - Vending Machines
  - Store icons

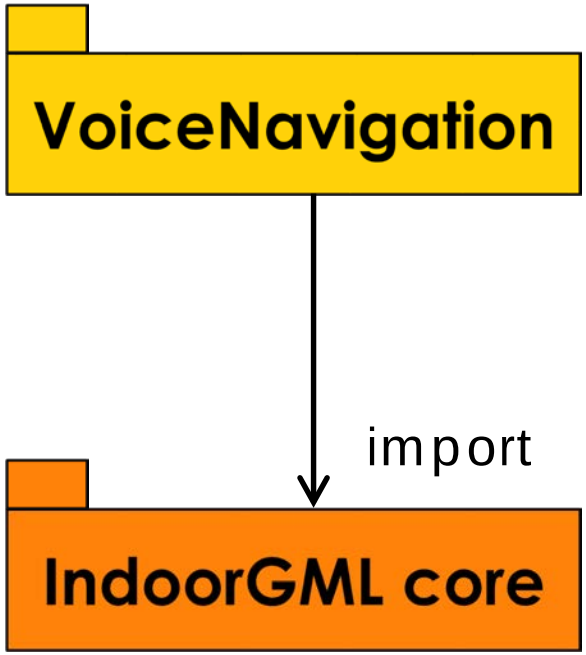
Required Info. for Voice Navigation

- Information for Landmark itself.
- "Visibility" information
  (may use/resolve from
  spatial information)
- Availability time
- How to explain it
  (Depends on different prerequisite)
  "Starbucks" or "Cafe" or "Twin tale mermaid"
  - Considering language/culture gap.

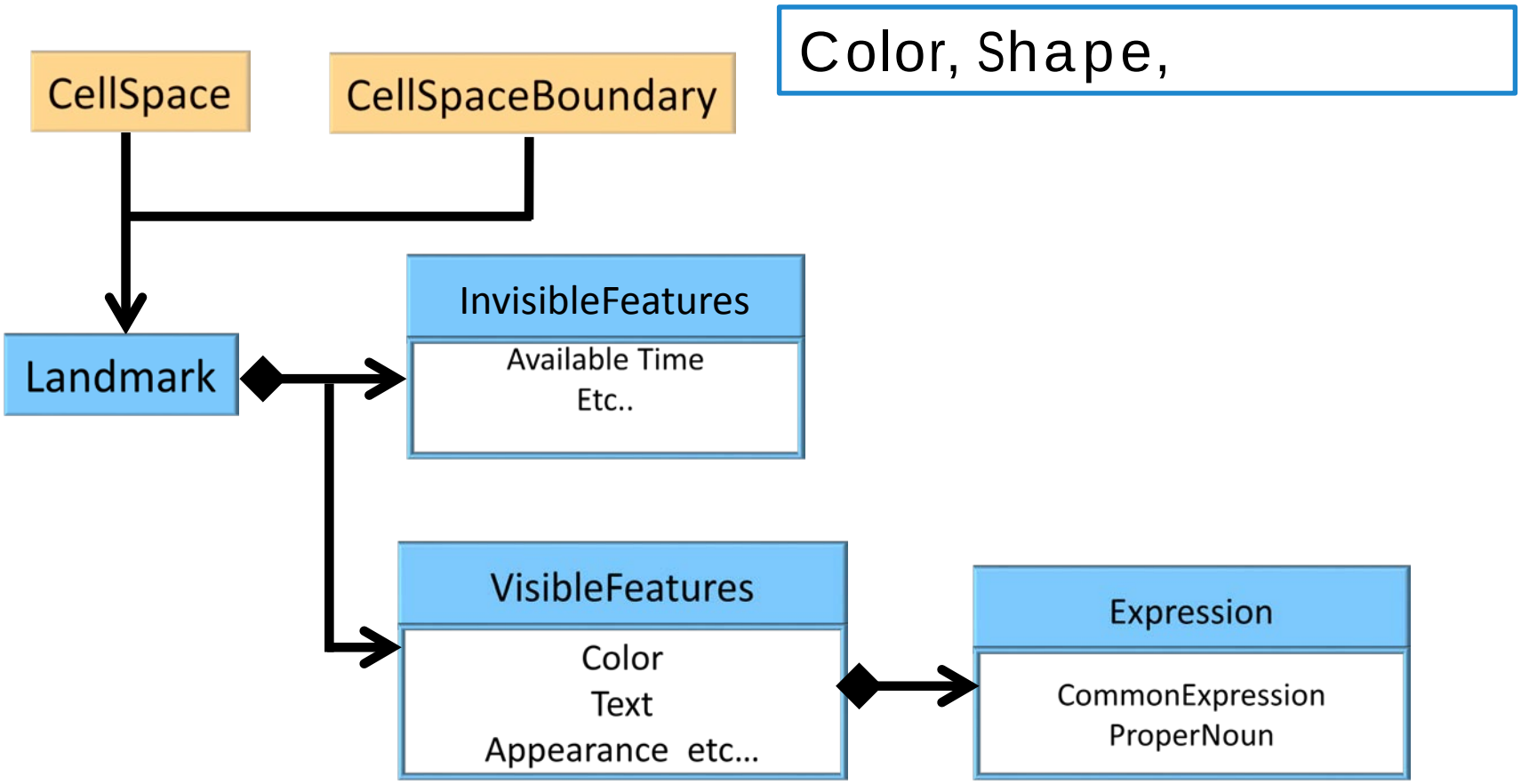


Questions / Discussions

- What is a most effective/appropriate way to extend IndoorGML?
  - Adding modules?
  - How to internationalize?



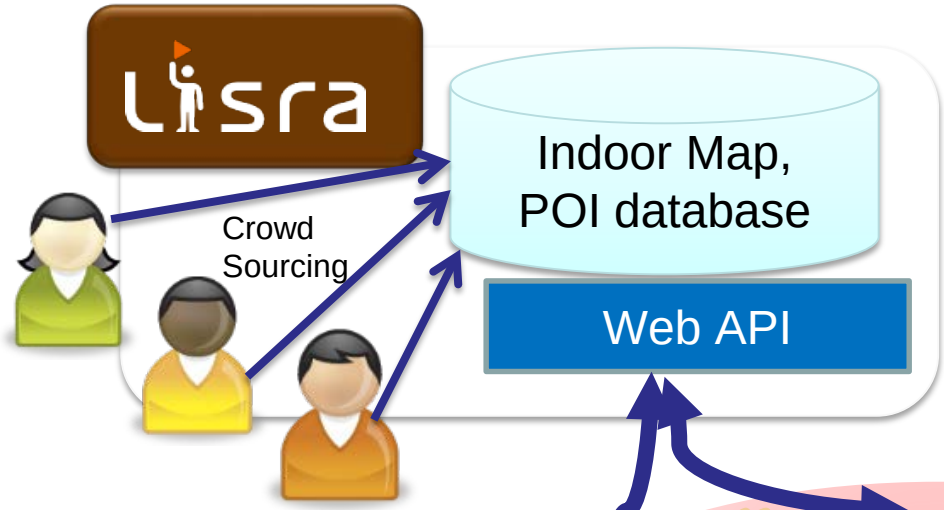
Sample Extension of IndoorGML



We have no confidence of this sample extension...

Voice Navigation Use-case in “Smart Station Nagoya”

Smart Station **Nagoya** Project



Nagoya Station

1.1 Million People/Day

6 Lines

7th Busiest Station in the World!

For Smart Station, we tried

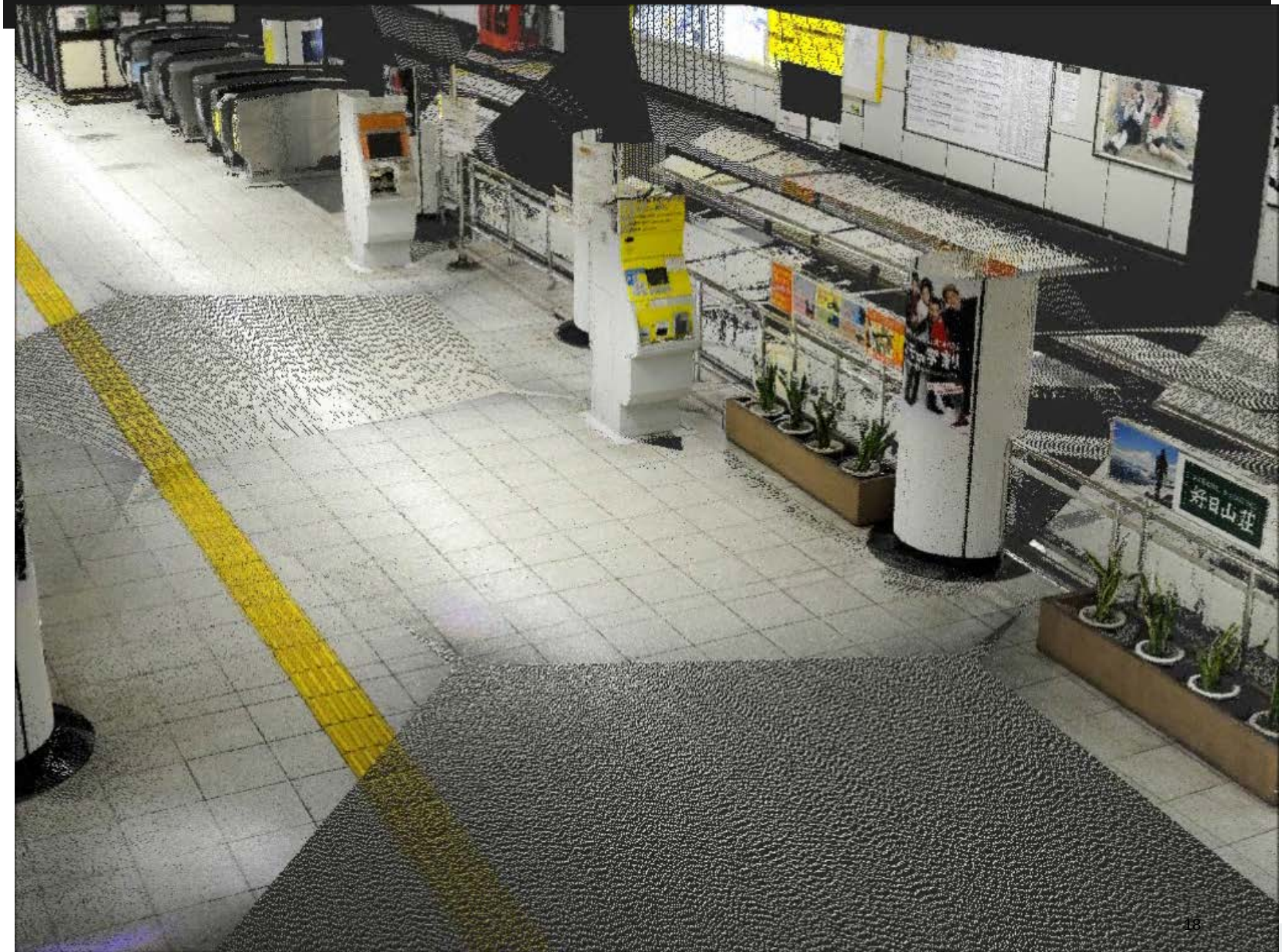
- **3D Indoor Map**
  - **Expensive Version**
  - **Cheap Version**
  - **Mid cost Version (and Fast)**
    - **Velodyne + LadyBug**
  - **Importance for “Visibility Info”**

- **Landmark-conscious Voice Navigation**
  - **Voice only pedestrian navigation**
  - **Using Landmark Map**
    (Extension Proposal for IndoorGML)

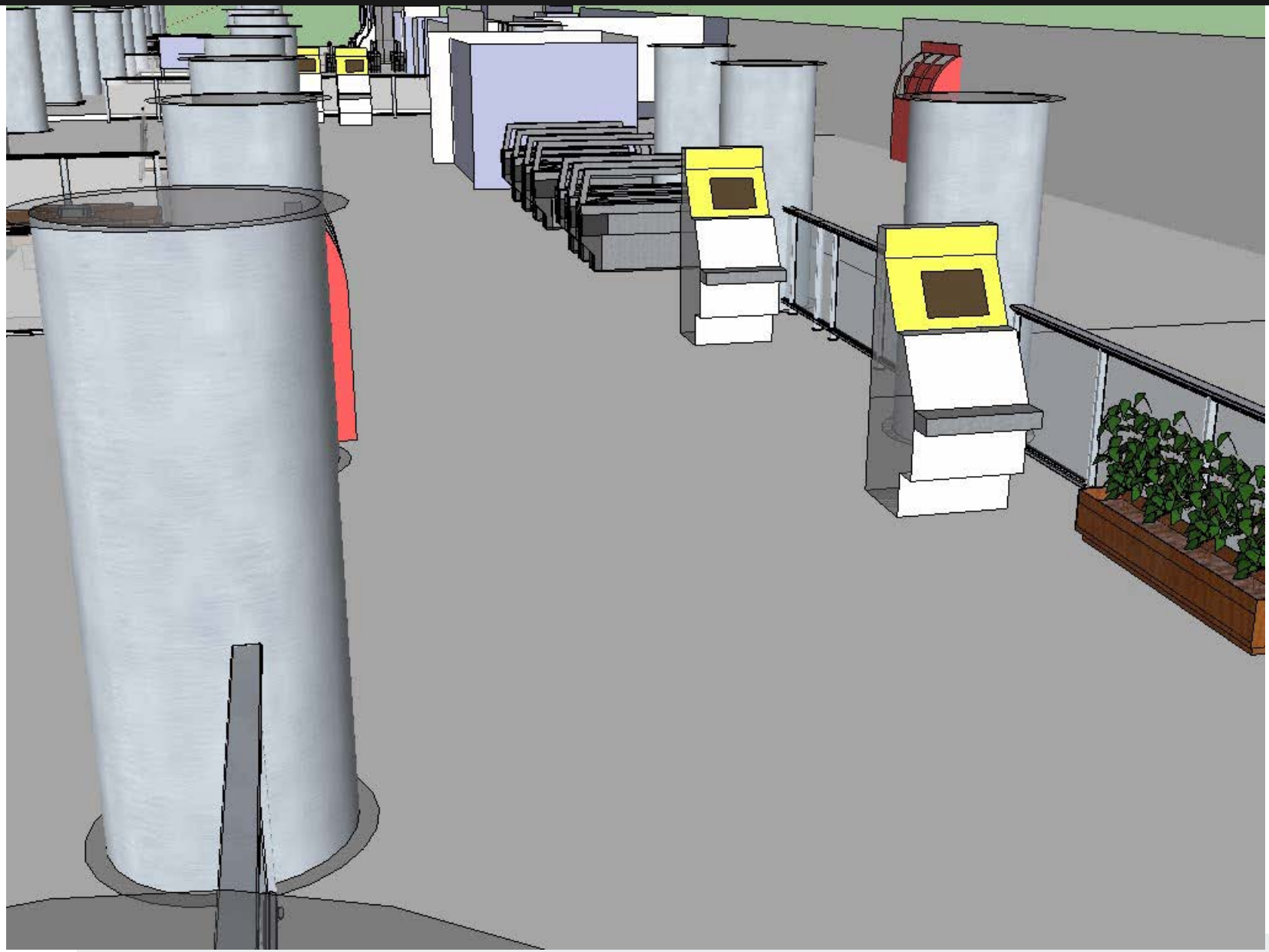
Spatial Data Collection by LIDAR

Using Laser Scanner RIEGL VZ-4000

Collected Colored Point Cloud



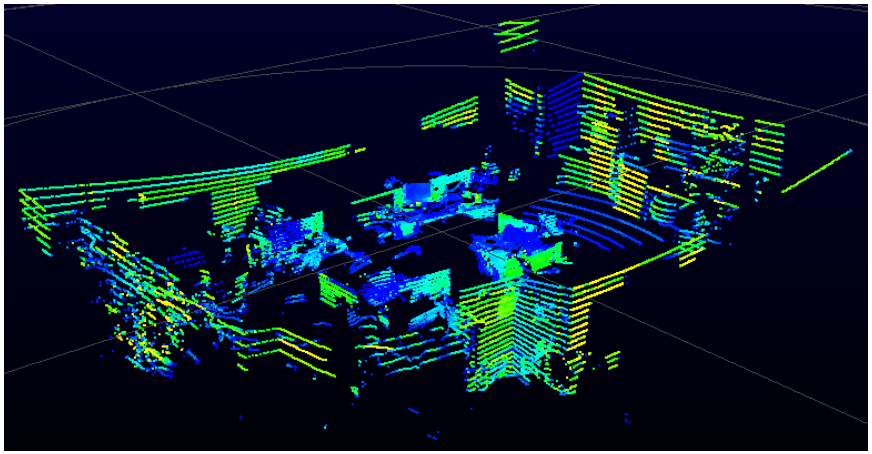
3D Model



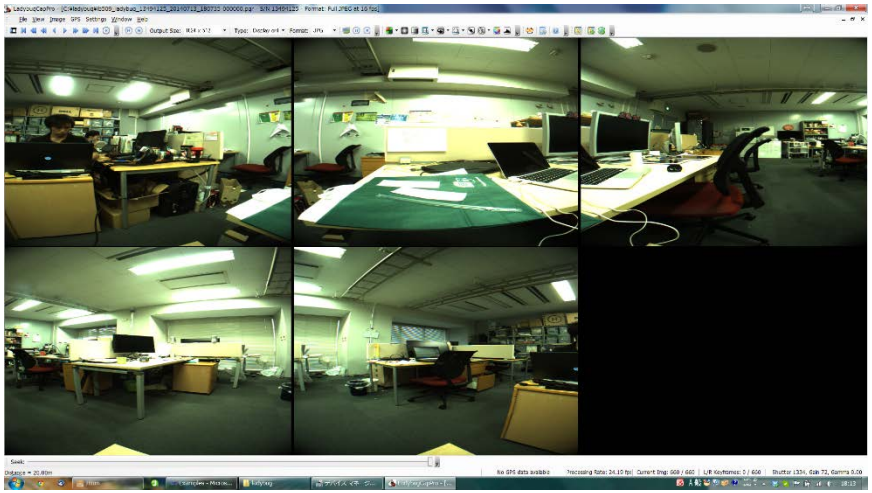
LIDAR+Omni Direction Camera

Velodyne HDL-32e (LIDAR)

32 Line Round laser



Point Grey Ladybug3 (5+1 Cams)



6 Camera → Omni

Approx. ~$70,000

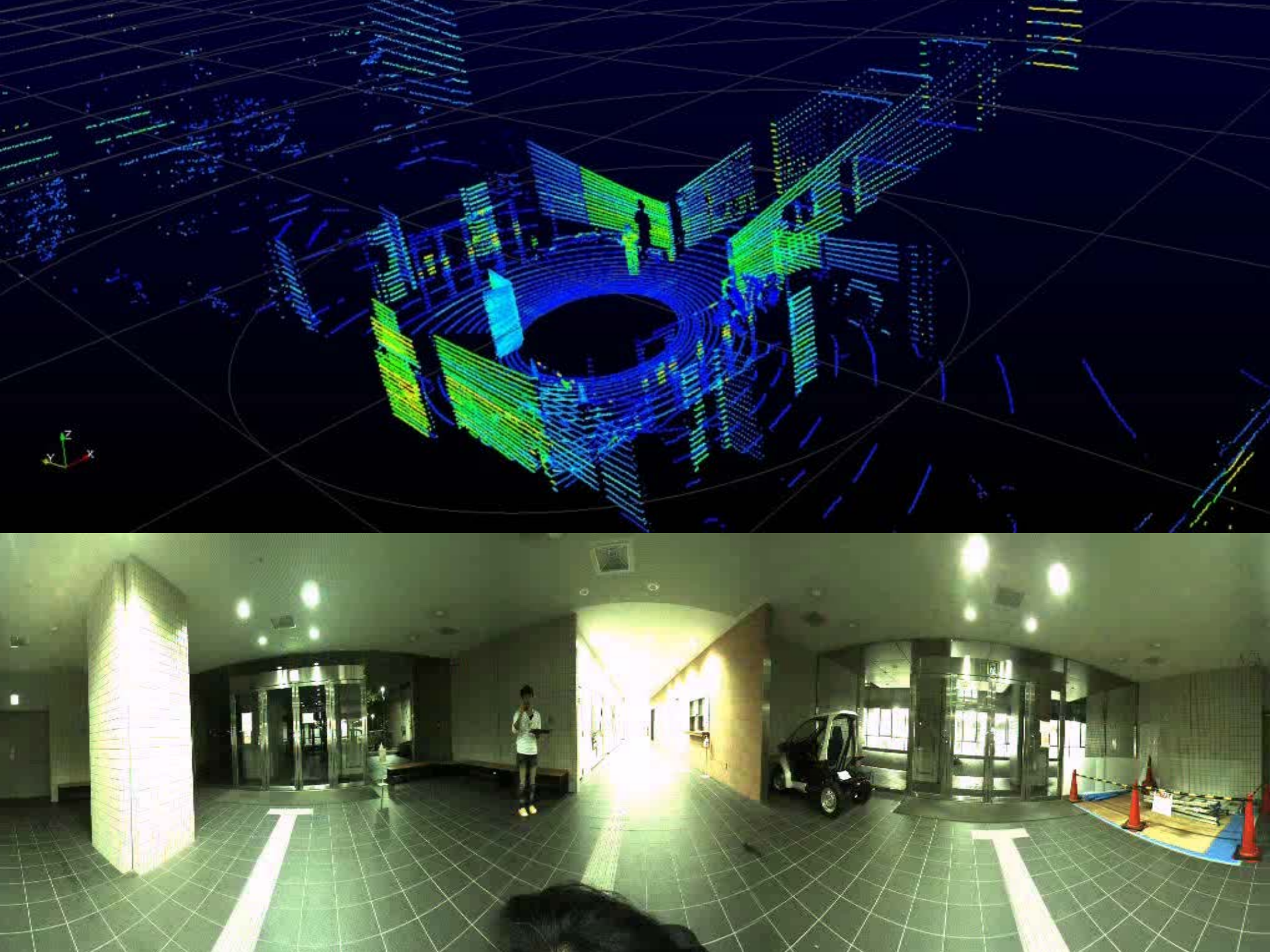
VeloBug (Velodyne + LadyBug)

Fully Mobile-Recordable

Laptop

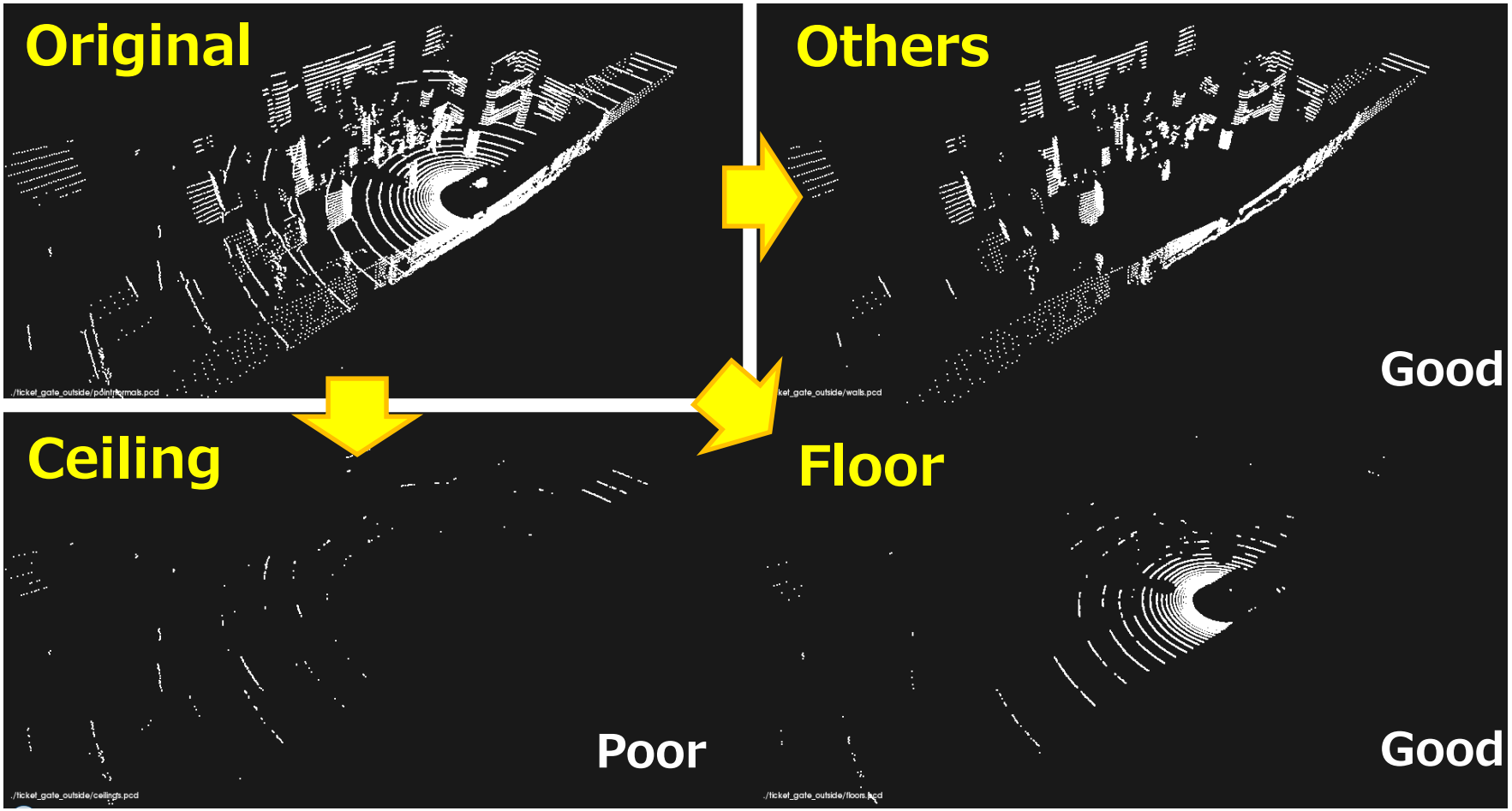
Batteries

Monitors

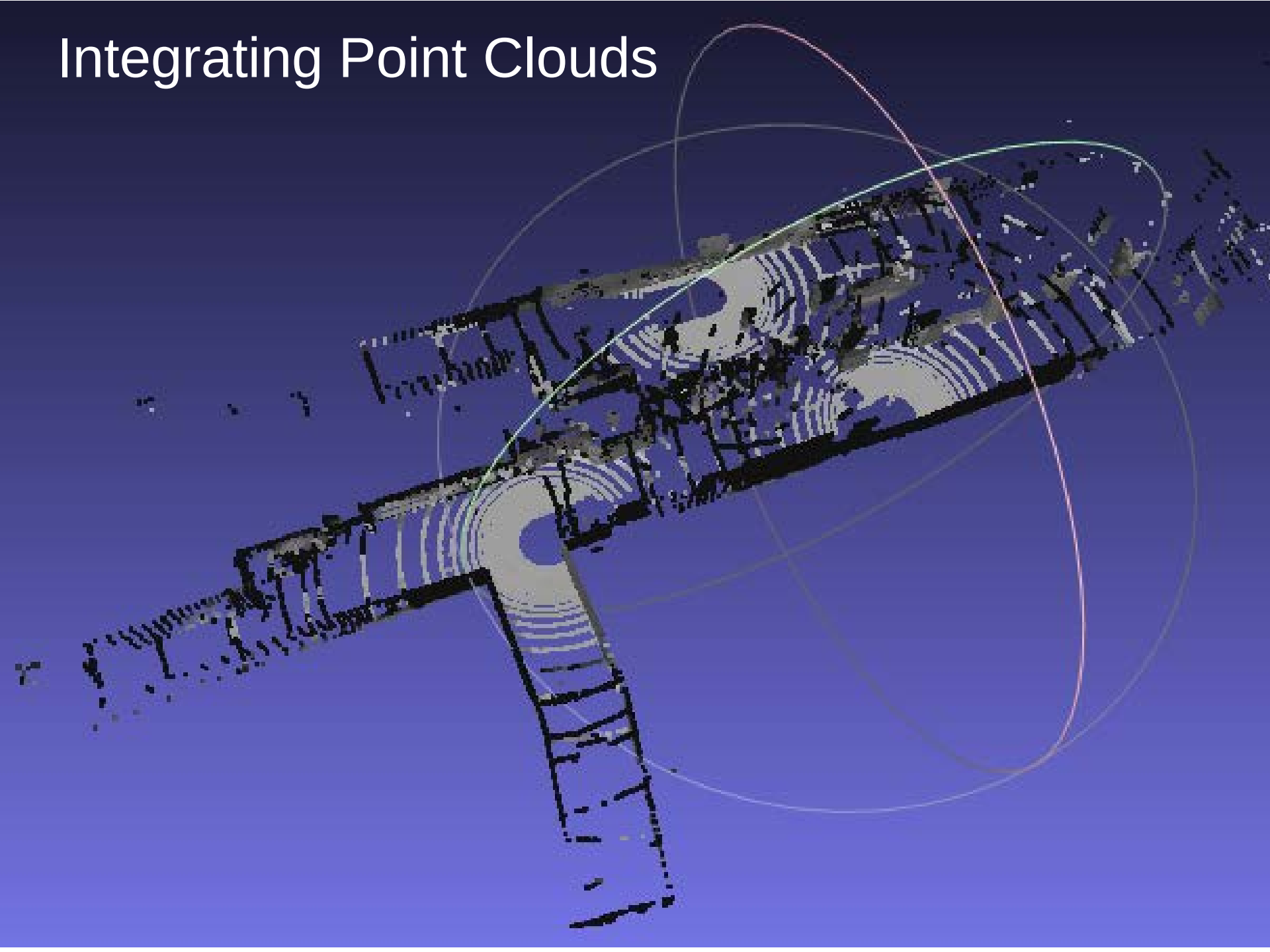


Filtering Using Normal Vector

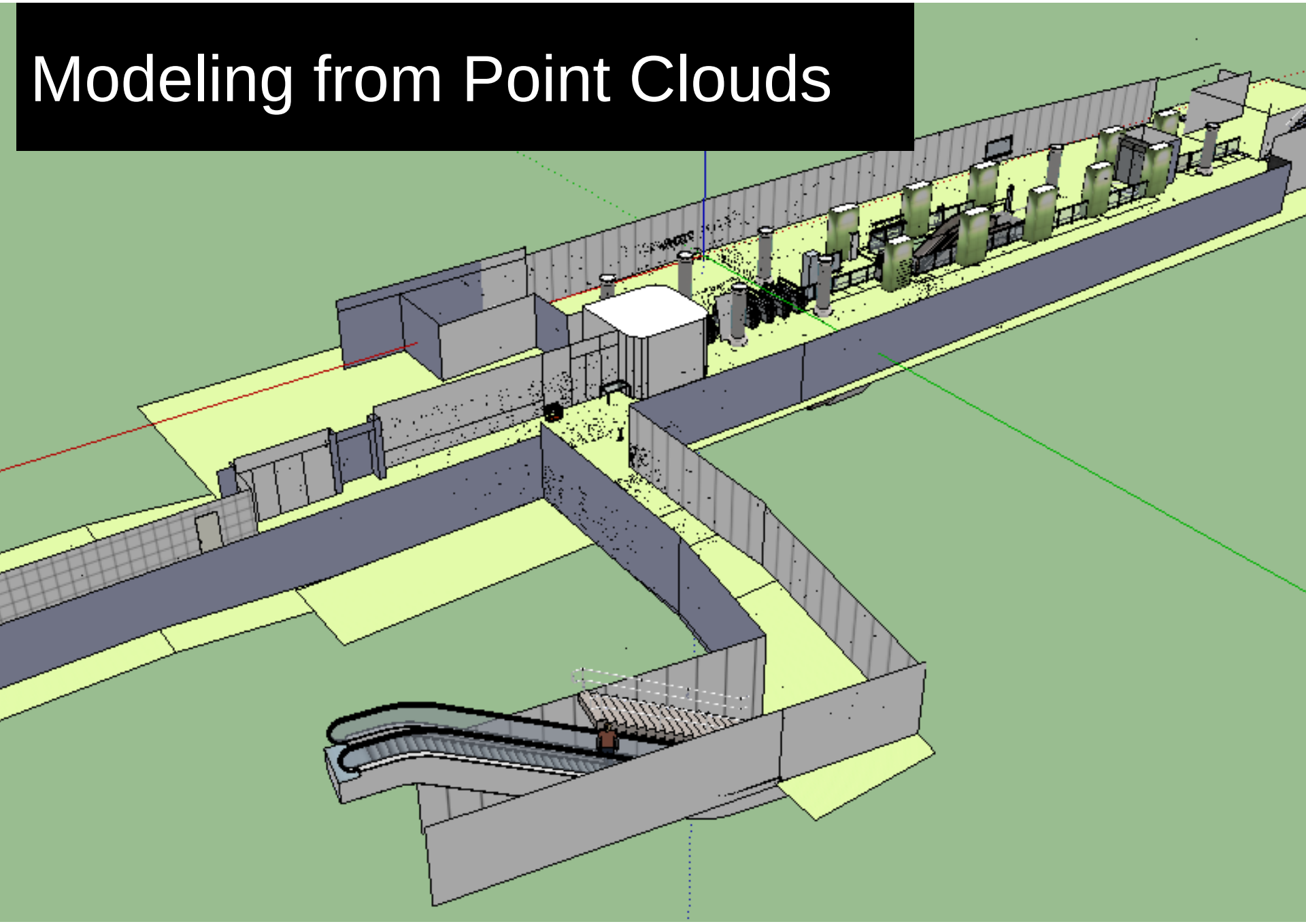
- Angle : 7°



Integrating Point Clouds



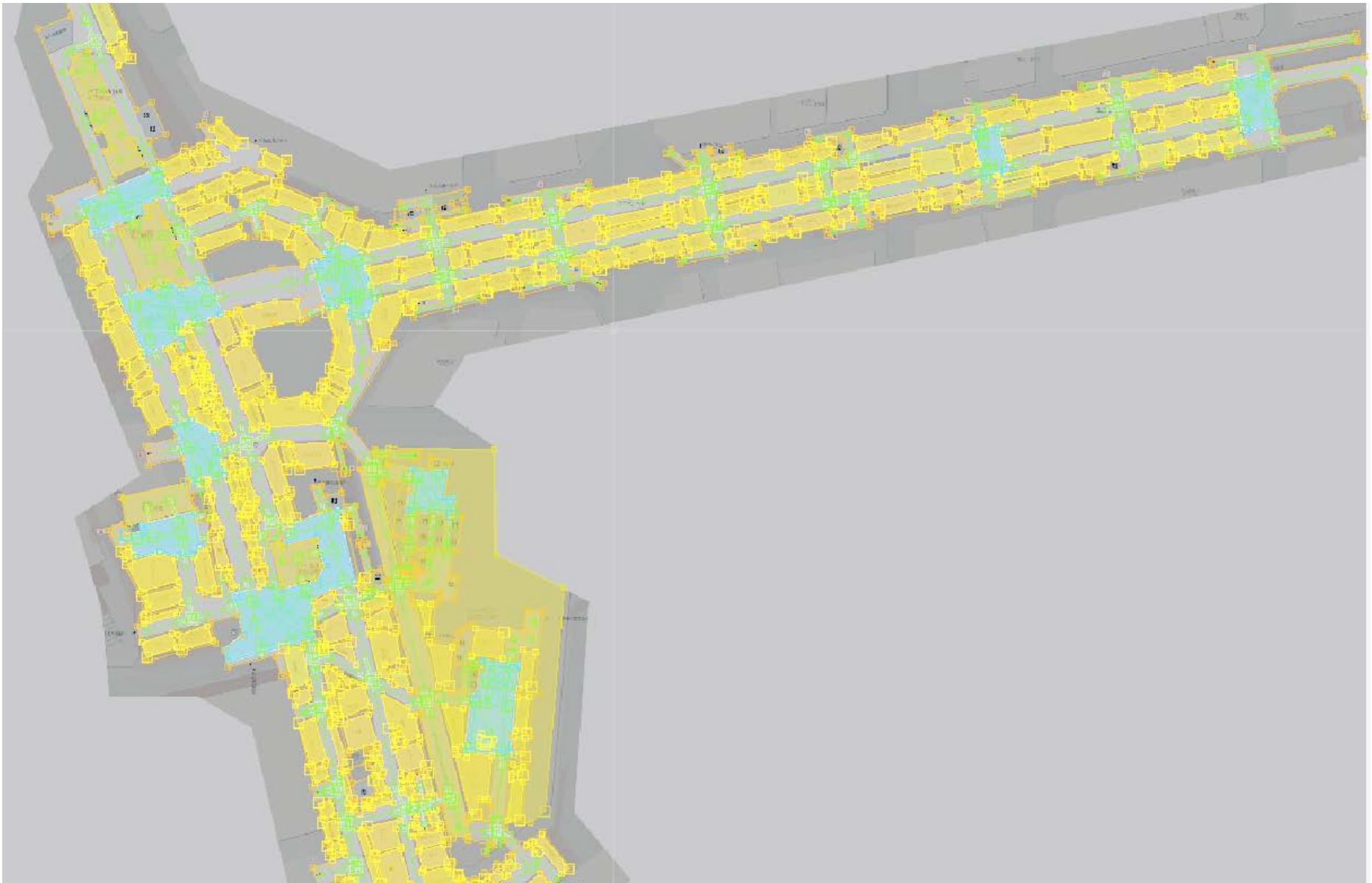
Modeling from Point Clouds



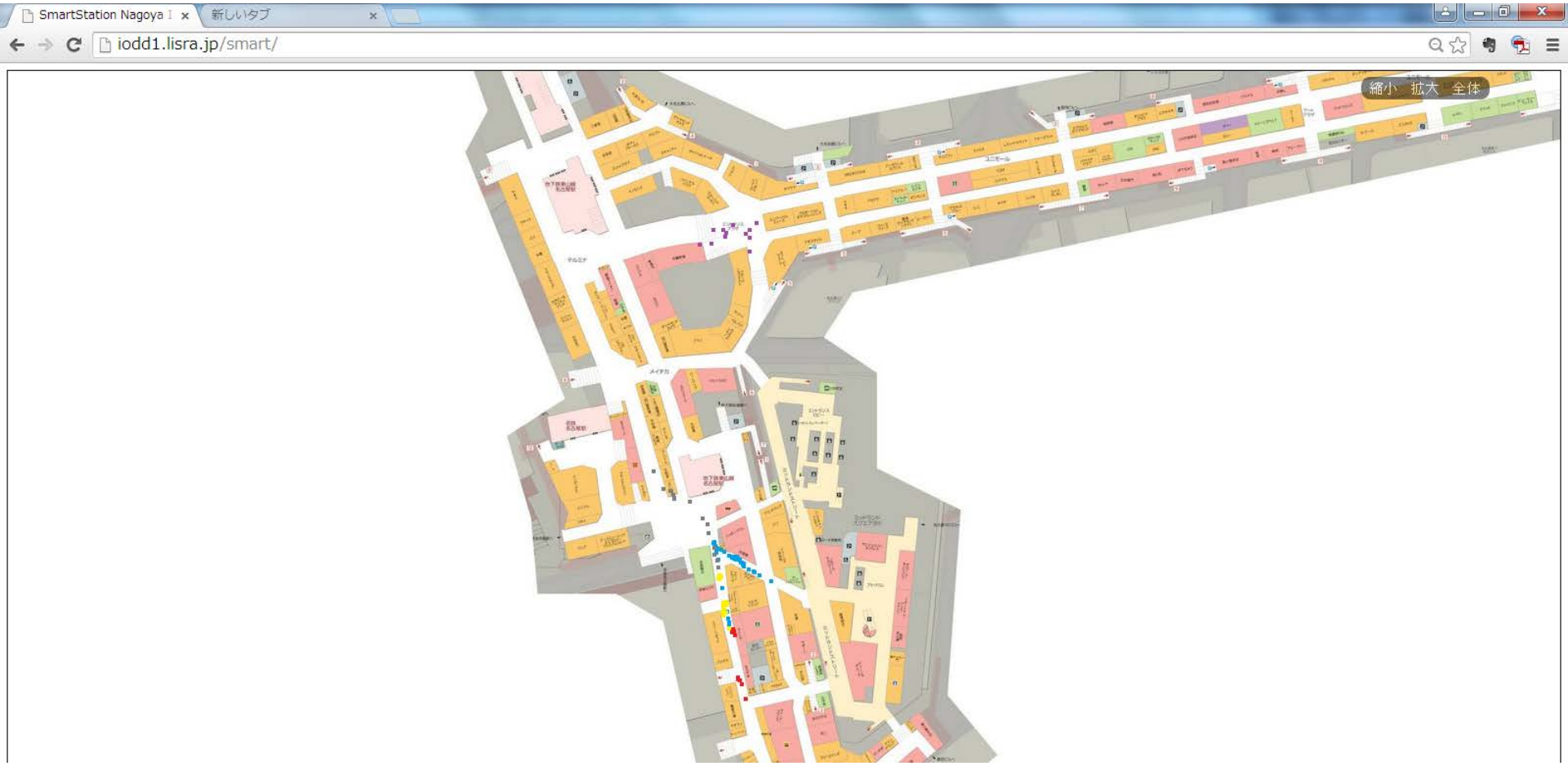
Saliency Map

Saliency Map

Current Status of Pedestrian Network in Nagoya Staiton

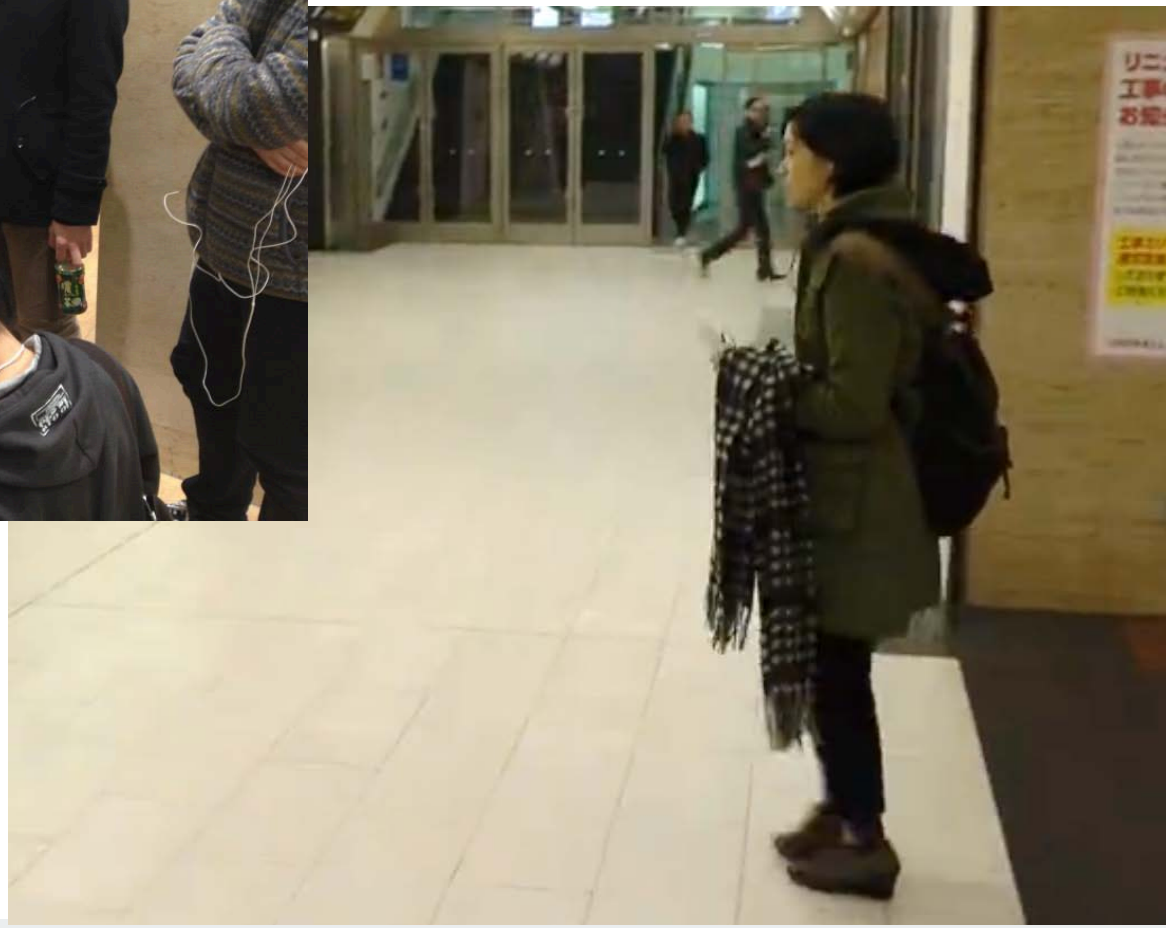


Experiment at Nagoya Station



Subjects Trajectory are monitored through the system.

Voice Navigation Experiment



Summary

- Importance of Voice Navigation
  - **Landmark**-conscious Voice Navigation
    - Proposal of Extension for **IndoorGML**
- Use case of Voice Navigation
  - Smart Station Nagoya Project