Kudan collaborates with NTT InfraNet to establish an innovative high-precision 3D point cloud mapping technology toward the realization of smart cities
~ Enabling Simple and Highly Efficient Mapping Even in GPS-Denied Urban Areas ~

Kudan Inc. (hereinafter "Kudan") has successfully conducted a field trial in collaboration with NTT Infrastructure Network Corporation (hereinafter "NTT InfraNet"), demonstrating a simple and highly efficient method for creating high-precision 3D maps in urban canyon environments - densely built-up areas where GPS/GNSS (hereinafter collectively referred to as "GNSS") signals are unavailable. This was achieved by combining Kudan's proprietary SLAM technology with NTT InfraNet's information assets. This technological breakthrough demonstrates the potential to easily generate high-precision 3D maps even in urban areas where GNSS signals cannot reach, contributing to the advancement of smart cities and the improved efficiency of urban infrastructure management.

Overview of the Initiative

High-precision point cloud maps are essential for the realization of smart cities, enabling the safe and accurate operation of autonomous mobile robots and self-driving vehicles. If map accuracy is insufficient, errors in vehicle localization and navigation can increase, significantly impacting safety and operational efficiency. Ideally, GNSS data would be used as correction data to create high-precision point cloud maps. However, in urban environments, the "multipath problem" occurs, where signal reflections from high-rise buildings cause inaccuracies in GNSS positioning. This makes it difficult to use high-precision GNSS data as correction data for map creation.

As a result, the implementation of measurement systems equipped with expensive sensors and the integration of advanced technologies for complex data acquisition and processing have posed significant technical and cost barriers. To address these challenges, there is a growing demand for methods that enable the efficient generation of high-precision 3D point cloud maps in urban areas by utilizing simpler and more cost-effective sensor configurations and positioning data, while minimizing complex setup and data processing. Through such initiatives, the advancement of digital infrastructure is expected to accelerate, contributing to the widespread adoption of smart cities while reducing associated costs.

News Release

![kudan logo]

Aerial photo of the target area for this PoC at Shinagawa Konan area

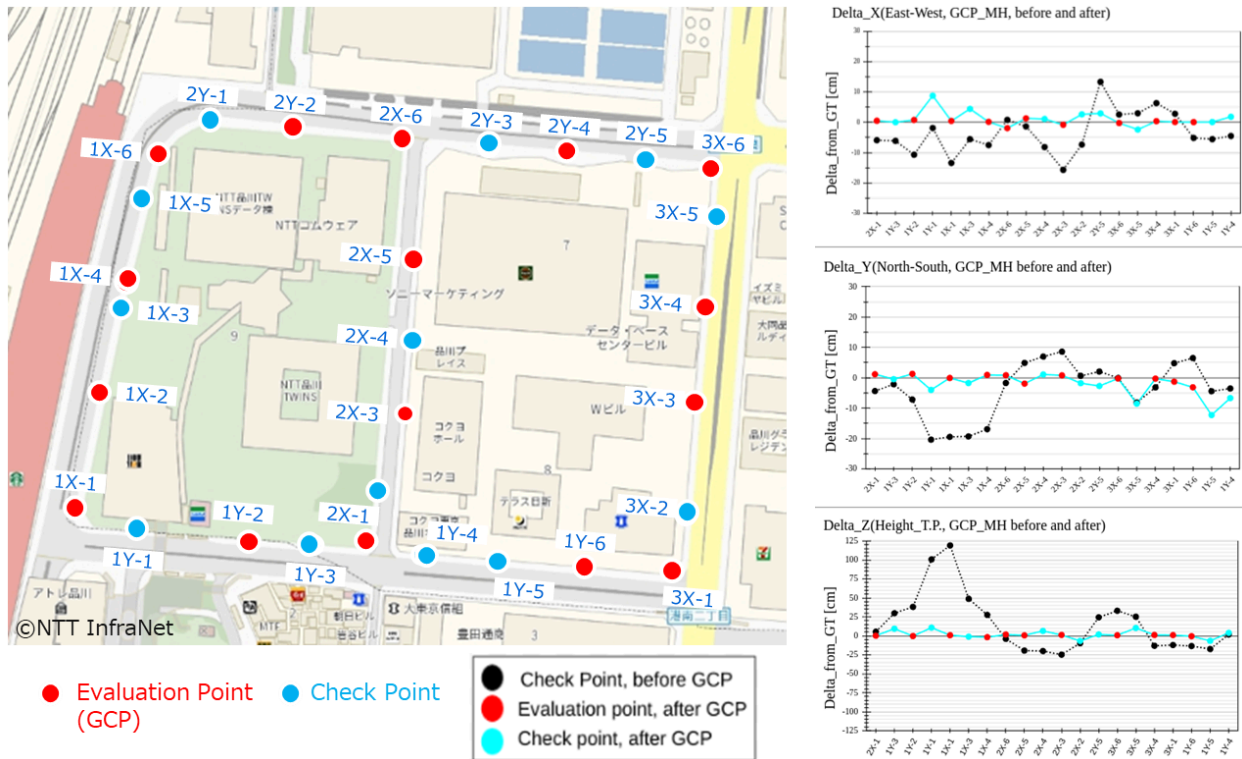**3D point cloud map generated in this PoC**
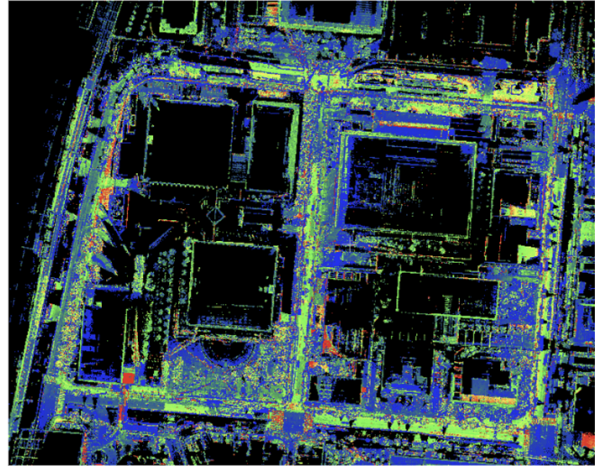
Kudan and NTT InfraNet have been working together to establish high-precision 3D mapping technology. As part of this initiative, Kudan conducted a proof-of-concept experiment to generate high-precision 3D maps in the densely built-up Konan area of Shinagawa, Tokyo. In this experiment, Kudan utilized its proprietary artificial perception technology, Kudan 3D-Lidar SLAM (KdLidar), and applied map correction techniques leveraging high-precision 3D spatial information (manhole location data) provided by NTT InfraNet. The results demonstrated the ability to efficiently generate 3D point cloud maps with a horizontal positional standard deviation within 12 cm and an elevation point standard deviation within 25 cm without relying on GNSS, even in urban canyon environments.

Advantages of the Demonstrated Mapping Technology and Method

This proof-of-concept experiment confirmed the following advantages by leveraging the technologies and information assets of both companies.

- **Efficient method for enhancing the accuracy of high-precision 3D spatial data using manhole position information:**
  - Application of Kudan's proprietary data fusion technology to the high-precision 3D spatial information (manhole location data) provided by NTT InfraNet successfully demonstrated that it could improve map accuracy to a horizontal positional standard deviation within 12 cm and a vertical positional standard deviation within 25 cm.
  - Furthermore, the introduction of a Graphical User Interface (GUI) into Kudan's data fusion process enabled intuitive operation, streamlined the information integration workflow, and improved operational efficiency.

Comparison results with evaluation points in this Proof-of-Concept experiment

- ● Evaluation Point (GCP)
- ● Check Point

- ● Check Point, before GCP
- ● Evaluation point, after GCP
- ● Check point, after GCP

Social Significance of This Initiative

This technological innovation enables the efficient creation of high-precision 3D point cloud maps even in urban areas where GNSS signals are unavailable, with the following expected societal contributions:

- **Promotion of smart cities**
    - Accelerating urban DX (Digital Transformation) as a foundation for supporting autonomous driving and robotics technologies
    - Enabling traffic optimization, efficient urban management, and the advancement of public infrastructure
- **Enhancing urban infrastructure management efficiency**
    - Easier acquisition of 3D data for infrastructure such as roads and bridges, improving the accuracy and speed of maintenance operations.
    - Utilization in national-level digital infrastructure development, such as the "Digital Lifeline Nationwide Comprehensive Development Plan"
- **Strengthening disaster prevention and mitigation measures**
    - Potential applications include disaster damage prediction, optimization of evacuation routes, and rapid recovery operations

- This technology, capable of providing accurate map data even in environments with poor GNSS reception, can serve as a critical information infrastructure during disasters
  - **Reducing environmental impact**
    - Utilizing high-precision 3D point cloud maps in urban areas to enable efficient urban planning and traffic management
    - Contributing to CO_2 emission reduction and the promotion of carbon neutrality

Future Outlook

Based on these results, Kudan will expand the scale of verification and conduct further testing in more complex environments, aiming to transition to full-scale operations for commercial use. In addition, by leveraging robotics and digital twin technologies, we will continue to support operational efficiency improvements across a wide range of industries while driving the development of innovative technologies that meet societal needs.

About Kudan Inc.
Kudan is a leading provider of Artificial Perception and Artificial Intelligence technologies, enabling next-generation solutions in mobile mapping, digital twins, robotics, and autonomous driving. With its advanced visual navigation, perception and spatial intelligence technologies, Kudan is at the forefront of digital transformation, empowering businesses to bridge the physical and digital worlds seamlessly, and ensuring scalable deployments of autonomous machines in dynamic environments with great accuracy and reliability.
For more information, please refer to Kudan's website at https://www.kudan.io/.

■Company Details
Name: Kudan Inc.
Securities Code: 4425 (TSE Growth)
Representative: CEO Daiu Ko

■For more details, please contact us from here.