1. What is “Dynamic Map”?  
2. Large-scale Field Operational Tests  
3. Utilization of Vehicle Probe Information  
4. Feasibility in Various Applications  
5. Prototyping and Verification of the Service Platform  
6. Standardization and International Cooperation  
7. Looking Ahead
1. What is “Dynamic Map”? 
Dynamic Map

API: Application Program Interface

OEM

Link

Base

API

Dynamic data
Movement of vehicles, status of pedestrians, traffic signals, etc.

Semi-dynamic data
Accidents, traffic jams, detailed weather, etc.

Semi-static data
Traffic regulation, road construction, weather, etc.

Static data
= High-definition 3D map
Road, lane, 3D shape of structures, etc.

Digital mapping

Platform

3D common platform data
Point clouds, graphics, probe data, etc.

Various uses

Combine various data

Dynamic data

Semi-dynamic data

Semi-static data

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Example of Application: Vehicle Position Detection

Sensed data

Compare to estimate the position

High-definition 3D map

GNSS  Laser Scanner (LiDAR)
Radar  Camera

Traffic Signs
Carriageway
Carriageway Line
Road Shoulder

Traffic Signs
Carriageway
Carriageway Line
Road Shoulder

Estimate the position of the vehicle
2. Large-scale Field Operational Tests
<table>
<thead>
<tr>
<th>Field Operational Test Participants</th>
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<tbody>
<tr>
<td>Daihatsu Motor Co., Ltd.</td>
</tr>
<tr>
<td>Continental Automotive Corporation</td>
</tr>
<tr>
<td>Meiji Logitech Co., Ltd.</td>
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<tr>
<td>Toyota Motor Corporation</td>
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<td>Pioneer Corporation</td>
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<tr>
<td>Suzuki Motor Corporation</td>
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<tr>
<td>BMW</td>
</tr>
<tr>
<td>Honda R&amp;D Co., Ltd.</td>
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<tr>
<td>Alpine Electronics, Inc.</td>
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<tr>
<td>Volkswagen Group</td>
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<tr>
<td>Calsonic Kansei Corporation</td>
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<tr>
<td>Mazda Motor Corporation</td>
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<tr>
<td>Mitsubishi Electric Corporation</td>
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<tr>
<td>Mercedes-Benz Japan</td>
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<td>Omron Corporation</td>
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<td>Subaru Corporation</td>
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<td>Robert Bosch GmbH</td>
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<tr>
<td>Nissan Motor Co., Ltd.</td>
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<tr>
<td>ZMP Inc.</td>
</tr>
<tr>
<td>Saitama Institute of Technology</td>
</tr>
<tr>
<td>Nagoya University</td>
</tr>
<tr>
<td>Valeo Japan Co., Ltd.</td>
</tr>
</tbody>
</table>

* Participants in the “dynamic map” or HMI FOT
Areas and Details of FOT

- Provision of map data for 758.7 km in total

(1) Dynamic data
- Information about current signals
- Information about crossing pedestrians
- Vehicle detection information

(2) Semi-dynamic data
- Regulation information by lane
- Traffic flow information by lane

(4) Static data
- Map update

- Shin-Tomei Expressway
- Joban Expressway
- Metropolitan Expressway
- Shinbashi, Toyosu, and Odaiba
- ITS Road Side Unit
- GSI Tiles
System Configuration

- **ETC 2.0 Wireless roadside equipment**
  - (2) Regulation information by lane

- **Advanced infrared beacons, ITS wireless roadside equipment**
  - (1) Information about current signals

- **FOT server DM, probe data**
  - (2) Traffic flow information by lane
  - (4) Map update data

**Advanced infrared beacon & ETC 2.0 in-vehicle equipment**

- 5.8 Hz DSRC and infrared beacon antenna

- **Smartphone**
  - 760 MHz antenna

- **PC**
  - 760 MHz receiver
Evaluation of Static Data

Result of checking the source information
- The signs existed in the source information.
  = Changes after preparing the static data
Evaluation of Semi-dynamic Data

Actual road condition

Tomei Kawasaki IC

Regulation start point

Distributed data

<table>
<thead>
<tr>
<th>Normal</th>
<th>Normal</th>
<th>Normal</th>
</tr>
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<tbody>
<tr>
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<tr>
<td>Normal</td>
<td>Restriction</td>
<td>Normal</td>
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</tbody>
</table>
Evaluation of Dynamic Data

Dashboard camera

Signal

Viewer image
3. Utilization of Vehicle Probe Information
Overall Configuration of the FOT

Preparation and construction based on this FOT

- Traffic flow information by road
- Pioneer commercial probe information
- Traffic flow information by lane
- Experimental data-gathering vehicle information

Probe information conversion server

JASPAR Dynamic Vehicle Information Sharing WG

Dynamic map large-scale FOT

- Dynamic map data linkage/distribution functions
- Dynamic map viewer

- Implementation of the draft version of the vehicle information-sharing specifications formulated at the end of FY2017
- Verification of the “traffic flow,” one of the contents defined in the vehicle information-sharing specifications
- Proposals for the vehicle information-sharing specifications Ver. 1.0 formulated in FY2018
4. Feasibility in Various Applications
## Summary of Study Outcomes (Outcomes in FY2017)

<table>
<thead>
<tr>
<th>Item implemented in this fiscal year</th>
<th>Outcome of this fiscal year and future outlook</th>
</tr>
</thead>
</table>
| **Study on application to public surveys** | ● A work manual (draft) applicable to public surveys was prepared based on measurements on prefectural and municipal roads in Gifu Prefecture.  
➢ A work manual (draft) that can be used in combination with a method indicated in the Standards for the Work Rules was prepared based on the dynamic map data improvement specifications for automated driving, etc. (This manual can be used to apply Article 17 of the Standards for the Work Rules.) A survey will be recognized as a “public survey” if an application is made based on the manual on the assumption that the survey receives the designation of Article 5, Item 2 of the Survey Act. (However, a precision verification report will be required if an entity other than the consortium serves as a surveying organization.) |
| **Study on utilization in various fields** | ● Improvement/update of the road ledger, support for snow removal, daily inspection of electric cables/utility poles, and usability for maintenance were verified based on the measurement results in Gifu Prefecture.  
● The requirements of dynamic maps were studied for utilization for infrastructure maintenance. (There were no changes from the requirements for automated driving in the desk study.)  
➢ It was found that there were potential applications without significantly changing the data improvement specifications, etc. of dynamic maps for automated driving.  
➢ To utilize data, it is necessary to actualize the mechanism and business model of providing data, etc. |
| **Cooperation with SIP agriculture** | ● A dynamic map was created for roads between farms of the Kitamura flood prevention reservoir in cooperation with SIP agriculture.  
➢ In SIP agriculture, the data will be integrated with farm data to conduct an FOT in FY2018. |

Source: Report on feasibility investigation study toward various applications of the dynamic map (March 2018)
5. Prototyping and Verification of the Service Platform
Verification of the Service Model FOT Environment

Study of specifications of API to acquire various kinds of information

Study of functions that are required to use various kinds of information in different fields

Study of specifications of API to output information upon request from service providers

Information providers

Dynamic map information
Information about the format that can be used by service providers

Dynamic map information
Information that requires processing to be used by service providers

Dynamic map service platform

API to acquire information

Dynamic map information management functions

Information from information providers is directly sent to service providers.

Dynamic map information visualization/cataloging portal

Dynamic map information primary storage area

Information processing (e.g., format conversion, addition of meta information)

Dynamic map information

Processing such as consolidation and analysis of various kinds of information

Service providers

Information providers

Source: Report on prototyping and evaluation of the dynamic map service platform (March 2018)
6. Standardization and International Cooperation
Participation in the Industry Standardization Activities

OPEN AUTO DRIVE FORUM (OADF)

Cross-domain discussion platform driving standardizations in the area of automated driving

- SENSORIS: The interface specification for vehicle sensor data. www.sensor-is.org
- ADASIS: The data exchange interface to support Advanced Driver Assistance Systems (ADAS) applications. www.adasis.org
- TISA: Traffic and travel information services and products based on RDS-TMC and TPEG™. www.tisa.org
- SIP-adus: Develops ITS as cross-ministerial collaboration, working on AD system implementation in Japan and next-gen urban transport. http://en.sip-adus.go.jp

Source: a document for ITS World Congress 2018 in Copenhagen
Main Activities in FY2018

◆ Promotion of items in ISO/TC204/WG3
  ▪ GDF5.1 DIS 20524-1, CD 20524-2
  ▪ Lane-level location referencing method: CD 17572-4
  ▪ Map data model for automated driving: NP22726-1, others

◆ Cooperation with industrial standards organizations
  ▪ Cooperative sessions at the ITS World Congress
  ▪ Formal participation in OADF, promotion to a Steering Committee member

◆ Promotion of dialogue and cooperation with domestic and overseas bodies using SIP-adus workshops and other opportunities
  ▪ Dynamic Map Platform Co., Ltd., JAMA, JASPAR
  ▪ Tri-lateral meetings: ART-WG, OADF, NDS, ADASIS, SENSORIS, TN-ITS, TISA, DI activities in the U.S., CICV in China, etc.
  ▪ Dialogue toward 2nd Phase activities, etc.
7. Looking Ahead
Looking Ahead

◆ Commencement of operation of dynamic maps
- Start to offer dynamic maps for expressways and limited highways (about 30,000 km) in Japan
- Acquisition of Ushr, Inc. (U.S.)

◆ Linkage and coordination of various kinds of information
- In the 2nd Phase FOT, signal information, merging/ETC gate support information, road traffic information by lane, etc. will be distributed.
- Utilization of various (international) standards is one of the key solutions (to ensure consistency).
- The method of implementing location referencing will be actualized based on the circumstances of roads and information in Japan.

◆ Advancement of map updating
- Information will be updated more quickly and in larger quantities. The border between static data and dynamic data will gradually become blurred.
- The method of evaluating the quality of dynamic maps will be actualized by taking into account the mechanism of updating.
  - There are difficulties in actualizing the method, but this is an important issue in maintaining Japan’s competitiveness in maps.
- The view of the future will be achieved eventually using AI, etc.
Thank you

snakajo@csis.u-tokyo.ac.jp