Cross-ministerial Strategic Innovation Promotion Program

Cross-ministerial Strategic Innovation Promotion Program (SIP) Phase 2 - Automated Driving (Expansion of Systems and Services)/ Operations of Planning and Deliberation Council for the Creation of Systems for Generating and Providing Lane-level Road Traffic Information Using Probe Information

FY2019 Report

Overview

Mitsubishi Research Institute

March, 2020

1. Background and objectives

Background

Lane-level road traffic information holds promise for use in predicting upcoming conditions which cannot be recognized by vehicle sensors. This can assist with automated driving and safe driving assistance. Roadside sensors can only perform fixed-point measurement, so there is a pressing need to consider systems for generating and providing lane-level road traffic information using vehicle probe information, which can assess traffic conditions over areas.

In order to tackle these issues, during SIP Phase 2, in 2019, technology specifications for FOTs related to lane-level road traffic information were created. In 2020, there are plans to conduct FOTs in which information from private-sector vehicle probes from motor vehicle and navigation system manufacturers is processed and supplied as lane-level road traffic information. Furthermore, the technology specifications will be reviewed and revised based on the issues and necessary improvements discovered through these FOTs, with the aim of establishing specifications for the provision of lane-level road traffic information.

Objectives

In this study, we investigated the current state of vehicle probe information through deliberation council meetings of public and private sector stakeholders with the aim of creating a system for generating and providing lane-level road traffic information using vehicle probe information to contribute to automated driving and safe driving assistance. We also deliberated regarding the direction to be taken in the future.

2. Study items

This study was performed over the course of two fiscal years, 2019 and 2020, and consisted of the following three study items.

Table. Study items

Item	Overview
1. Interview study	We conducted interviews with motor vehicle manufacturers and navigation system manufacturers that handle vehicle probe information. We confirmed the current state of affairs and the vehicle probe information that could be collected in the future. (1) Method of collecting data from vehicles (2) Statistical processing technologies (3) Method of providing generated road traffic information (4) Data usage conditions, licensing, and privacy protection
2. Deliberation regarding future direction	Through discussions with related government agencies (Cabinet Office, National Police Agency, Ministry of Land, Infrastructure, Transport and Tourism, etc.) and major related organizations (Japan Automobile Manufacturers Association, Japan Road Traffic Information Center, Vehicle Information and Communication System Center), we deliberated on the future direction of systems for generating and providing lane-level road traffic information. (1) Method of use of lane-level road traffic information by vehicles (2) Types of information from private-sector vehicle probes provided by motor vehicle manufacturers, navigation system manufacturers, etc. (3) Information generated from vehicle probe information and update frequency (4) Process of information sharing between public and private sector stakeholders and division of data aggregation functions
3. Holding of deliberation council meetings	Meetings of the deliberation council, composed of related government agencies and major related organizations, were held with the aim of forming a consensus regarding the practical implementation of lane-level road traffic information and the implementation of FOTs • Demonstration system development approach • Overall FOTs approach • Identification of practical implementation challenges • Report compilation

3. Interview study

We conducted interviews with motor vehicle manufacturers, navigation system manufacturers, etc., regarding the domestic and overseas measures related to the collection of vehicle probe information and the use of this information in automated driving. **Our objective was to assess current conditions and gathering basic information for use in deliberations regarding future direction,** with the ultimate aim of generating and providing lane-level road traffic information based on information from private-sector probes.

Table Interview items

Item	Interview item
(1) Hopes for lane-level road traffic information. Possibility of collaboration in FOTs.	• Needs and expectations for lane-level road traffic information • Content of possible collaboration in FOTs
(2) Method of collecting data from vehicles	• Content of data collected and gathered from vehicles • Frequency and conditions applying to the collection of data from vehicles by OEM centers (uplink) • Positioning accuracy • Transmission method
(3) Statistical processing technologies	• Contents of information generated through statistical processing • Processing contents and processing frequency • Existence of technologies for generating lane-level road traffic information
(4) Method of providing generated road traffic information	• Method for providing information generated at OEM centers to vehicles (transmission method, provision frequency) • Data items
(5) Data usage conditions, licensing, and privacy protection	• Data usage conditions and terms (data usage purposes, restrictions regarding whom data can be provided to, rights, etc.) • Privacy protection (technical measures and systems for anonymizing data, etc.) • Provision cost

3. Interview study

We conducted interviews with four companies collecting and using probe information: three motor vehicle manufacturers and one navigation system manufacturer.
We asked each company about their expectations for lane-level road traffic information. We confirmed that the information currently being collected from commercially sold vehicles, which could be provided for use in FOTs, is carriageway-level(not lane-level), statistically processed information.

- Needs and expectations for lane-level road traffic information
  - Respondents had high hopes for the use of information in reliable automated driving control and improved route guidance accuracy (one step before automated driving).
- Possibility of collaboration in FOTs
  - The information currently being collected from commercially sold vehicles, which could be provided for use in FOTs, is, as a rule, carriageway-level information.
  - From the perspective of protecting personal information as specified in agreements between service users and individual companies, the data that could be used would be statistically processed data*.
    * Statistically processed data: Anonymized data such as (1) link-specific average travel time, (2) the number of probe vehicles used to generate the data in (1), (3) the number of vehicles in each speed range, etc.
  - Map matching processing is performed by each company using propriety maps. To integrate data, it will be necessary to make advance arrangements regarding which map to use as the base map.

Issues to be considered based on the actual state of probe information collection, processing, and use by individual OEMs and other companies

Technologies for processing and integrating probe information in order to generate lane-specific information
Methods of processing probe information necessary for generating lane-specific information
Methods of integrating information collected by multiple OEMs, etc.

Technologies for delivering lane-level information
Methods for delivering generated lane-specific information

4. Deliberation regarding future direction

We organized key deliberation points and conducted an examination regarding the future direction with respect to ideals and desired functions in order to be able to generate and provide lane-level road traffic information based on information from private sector probes.

(1) Use cases and advantages of providing information

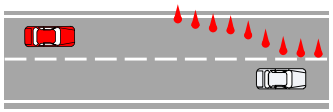
What is lane-level road traffic information that is necessary for automated driving?

Information to be provided to autonomous vehicles in order to make it possible for them to perform safe, smooth driving by assessing conditions in front of vehicles, etc., in locations where conditions cannot be detected by the autonomous vehicles' own mounted sensors, and using this information to make lane changes in advance, etc.

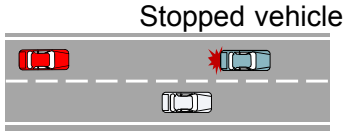
Use cases

We looked at the **three use cases** being considered by the Japan Automobile Manufacturers Association

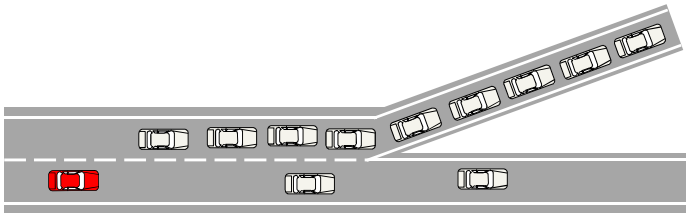
A: Lane restriction (construction, etc.)



B: Traffic accident, disabled vehicle, fallen object, obstacle, etc.



C: Tail end of traffic congestion

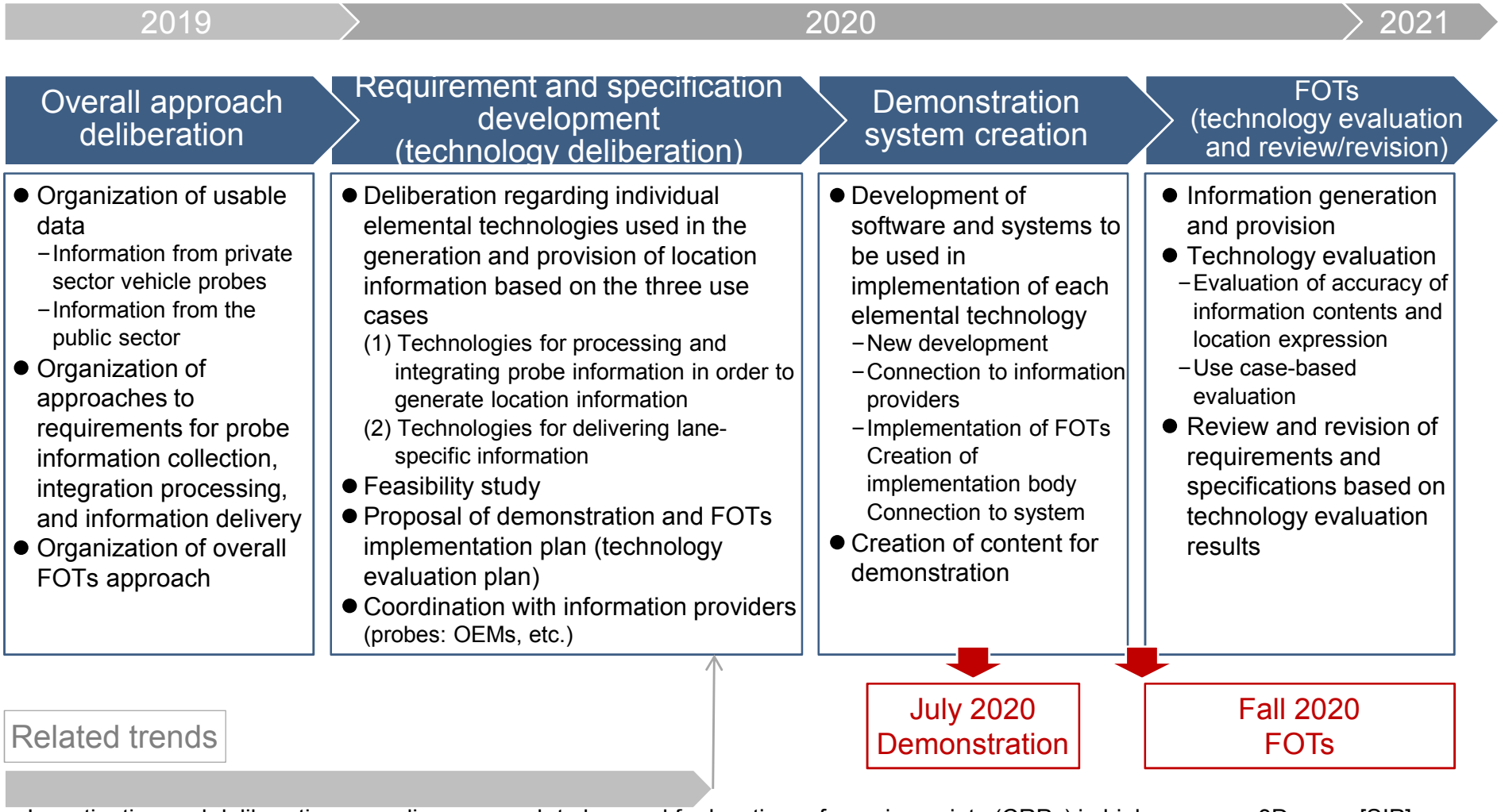


Advantages of providing information

This information has the **potential to improve safety** by preventing autonomous vehicles from suddenly decelerating, etc., and preventing rear-end collisions in the event of situations such as the indicated use cases. These outcomes can be prevented by changing lanes, etc., far in advance based on conditions ahead of the vehicle.

4. Deliberation regarding future direction

(2) Deliberation items and overall process



• Investigation and deliberation regarding approach to be used for location referencing points (CRPs) in high-accuracy 3D maps [SIP]

4. Deliberation regarding future direction

(3) Overall approach (draft)

Table Overall approach (draft)

Item		Overview
Requirement and specification development	Deliberation of individual elemental technologies	**The following technologies were considered** as elemental technologies for generating and providing lane-level road traffic information. **(1) Technologies for processing and integrating probe information in order to generate lane-level road traffic information** We considered methods of processing probe information necessary for generating lane-specific information and methods of integrating information collected from multiple OEMs, etc., based on three use cases. **(2) Technologies for delivering lane-level road traffic information** We considered technologies for providing generated lane-level road traffic information to test participants' vehicles or relay servers (technologies and delivered data formats, etc., for various location referencing methods).
	Feasibility study	For each elemental technology, **we performed a feasibility study of each technology, in advance, based on sample data from before the creation of the demonstration system**. **Based on the confirmation results, we reviewed and revised the technologies necessary for the FOTs**.
	Formulation of demonstration and FOTs implementation plan	We used the following policy to consider demonstration and FOTs implementation plans (overall process, technology evaluation indices and contents, procedures, process for reflecting in review of evaluation results, etc.). **(1) July 2020 demonstration** In the July 2020 demonstration, the feasibility study results will be used to **conceptualize the outcome of generating and providing lane-level road traffic information**, and will be conveyed through **data visualization and conceptual videos**. **(2) Fall 2020 FOTs** In the fall 2020 FOTs, actual **lane-level road traffic information will be generated and provided, and technology evaluation and review/revision will be performed**.
	Coordination with information providers	In order to receive probe information from each OEM, etc., during the fall 2020 FOTs, **we will indicate the requirements**[*1] **for the data we wish for information providers such as OEMs to supply, and will coordinate and negotiate**[*2] **regarding connections to demonstration systems**. * 1:Requirements for data to be submitted: Data items, data formats, etc. * 2:Coordination of data provision (consultation regarding data usage conditions, etc.), OEM-side system revision requests (when necessary) Furthermore, based on coordination results, we will adjust the demonstration system construction schedule.

4. Deliberation regarding future direction

Table Overall approach (draft) [continued]

Item		Overview
Demonstration system creation	Software and system development	Based on the results of coordination with information providers, we will carry out system development based on the adjusted schedule. Care will be taken to avoid having an impact on the existing systems of information providers such as OEMs.
	Creation of content for demonstration	Based on the demonstration implementation plan, we will use feasibility study results, etc., to create data visualization examples and conceptual videos that clearly explain the features of this effort.
FOTs	Information generation and provision	**With regard to the operational results of information generation and provision during the FOTs, logs will be constantly recorded**, and if system errors or other factors cause the generation and provision of information to be temporarily suspended, **it will be possible to use these logs to perform after-the-fact situational confirmation, verification, etc.**
	Technology evaluation	We will perform technology evaluation based on the FOTs implementation plan (technology evaluation plan). Evaluation items and evaluation indices will be defined for the technology evaluation in order to confirm the feasibility of elemental technologies.
	Requirement and specification review and revision	Based on the results of the FOT technology evaluation, we will **determine the need for the review and revision of the requirements and specifications of individual elemental technologies** used in the generation and provision of lane-level road traffic information. **We will review and revise the requirements and specifications of technologies requiring review and revision.** Whenever possible, **feasibility studies, etc. will be performed for reviewed and revised requirements and specifications to confirm the effectiveness of the improvements**.

5. Holding of deliberation council meetings, etc.

A deliberation council was established and deliberation council meetings were held with the aim of discussion and coordination between **related government agencies** (Cabinet Office, National Police Agency, Ministry of Land, Infrastructure, Transport and Tourism) **and major related organizations** (Japan Automobile Manufacturers Association, Japan Road Traffic Information Center, Vehicle Information and Communication System Center) with the ultimate aim of generating and providing lane-level road traffic information based on information from probes.

Table Deliberation council meetings

Session	Agenda
1st meeting June 26, 2019	• implementation plan • Issues to consider in preparation for the 2020 FOTs • Implementation approach for interviews regarding vehicle probe information collection and processing
2nd meeting August 6, 6019	• Reporting on the results of interviews • Handling approach and requirement approach for issues to consider in preparation for the 2020 FOTs
3rd meeting December 25, 2019	• Data that can be used in the 2020 FOTs • Overall 2020 FOTs approach (draft)
4th meeting March 26, 2020	• Status of technology deliberations in preparation for the 2020 FOTs • 2020 FOTs implementation approach and system development approach (draft)