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Intelligent transport systems — Service architecture of probe vehicle systems

Systèmes intelligents de transport — Architecture de services des systèmes de véhicules traceurs

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Contents

Page

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ISO 19414:2020
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Foreword

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This document was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

ISO 19414:2020

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

More and more attention has been paid to safety, comfort, mitigation of impacts on the environment, and energy efficiency in transport systems. The use of probe data (specified in ISO 22837) is considered to be a key factor of a solution for the above issues.

This document defines a service architecture of probe vehicle systems (PVS). PVS functionalities can be implemented in an ITS station unit specified in ISO 21217 applying applicable protocols specified in other standards. Examples of applicable protocols are the local dynamic map specified in ISO 18750 and generic ITS station facilities layer services specified in ISO/TS 17429. The service architecture classifies ITS services which using PVS. This classification defines service domains for cooperation between PVS.

This document does not prescribe a physical communication medium for transmitting data/information to or from vehicles. This document is intended to be independent of any particular communication medium and to be compatible with any medium that is selected by system developers.

This document focuses on services that can be developed using public sector probe data that are generated by vehicles. The private sector can offer additional applications that require sign-in and identification; however, this document focuses on public sector applications that can be developed using anonymous probe data (specified in ISO 24100).

This document is an extension towards more general and global applicability of FHWA-JPO-13-091.

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Intelligent transport systems — Service architecture of probe vehicle systems

1 Scope

This document specifies a service architecture that defines the framework and domain for classification of probe vehicle systems (PVS), which are systems that collect probe data from private vehicles and that process the probe data statistically towards useful information that finally can be provided to end users.

This document focuses on services that can be developed using public sector probe data that are generated by vehicles. It specifies the following items related to PVS:

— service framework of probe vehicle systems;

— definition of service domain of PVS.

2 Normative references

There are no normative references in this document.

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3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
personally identifiable information
information that can be used in a given context to identify, contact, or locate a single person, or to identify an individual in context

4 Abbreviated terms

DSRC	dedicated short range communications
IPR	intellectual property rights
PII	personally identifiable information
PVS	probe vehicle system
V2I	vehicle-to-infrastructure (communications)
V2V	vehicle-to-vehicle (communications)
Wi-Fi	wireless fidelity

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5 Service framework of probe vehicle systems

5.1 Basic concept of probe data

Probe data is data generated by vehicles (light duty, transit, freight and motorcycles, etc.) about their current position together with a time stamp. Probe data also include additional data elements provided by vehicles that have added intelligence, e.g. to detect traction information, brake status, hard braking, flat tyre, activation of emergency lights, anti-lock brake status, air bag deployment status, and windshield wiper status. Probe data from vehicles can be generated by devices integrated with the vehicles' computers, or nomadic devices brought into the vehicles.

Probe data does not include data that have been derived outside of the vehicle, even if these data were aggregated from data generated by vehicles. For example, travel times that are derived from position data (i.e. measurement from road–side equipment or gantry) are not classified as probe data.

Probe data can be generated or transmitted at various frequencies and trigger mechanisms using a range of wireless communication technologies, including dedicated short-range communications (DSRC)/ITS-M5 specified in ISO 21215, cellular network technologies, Wi-Fi using IEEE 802.11, worldwide interoperability for microwave access (WiMAX) standardized in IEEE 802.16, etc.

5.2 Concept of service architecture

Probe data can be collected from many vehicles. The ability to develop probe vehicle systems in a consistent and uniform manner reduces development time and cost. There are many ways that probe data elements and probe messages can be defined. In addition, system providers can select any system facility and communication medium.

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Figure 1 illustrates the high-level concept of the probe data service framework, defining a reference structure of service using probe vehicle systems and providing illustrative examples of applications. Probe data from vehicles will be processed, cleaned, and aggregated to generate information required by the applications. For example, probe data from vehicles can be used for a traveller information application. Instantaneous location and speed data collected from multiple vehicles that act as probes will be cleaned and aggregated to generate link travel times. Probe data from vehicles will also be used to generate origin-destination information (demand). The origin-destination information and link travel times will be used by the traveller information application to generate guidance on mode, route, and departure times, which will then be displayed on congestion maps, transmitted to vehicles for in-vehicle display, and transmitted to travellers on their personal communication devices.

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The service architecture focuses on services and applications that can be developed using public sector probe data that are generated by vehicles (see dotted box in Figure 1), i.e. by devices that are integrated with the vehicles' system or by nomadic devices brought in to the vehicle. At this stage, data from external sensors (e.g. weather stations), transit and freight-specific data (e.g. transit schedules, truck loads), private sector probe data, and data from travellers' personal communication devices are outside the scope of this document. This document focuses on applications that can be developed using probe data that are within the scope. A probe service provider that provides as a public sector shall consider any other stakeholders based on the concept of service framework and architecture.

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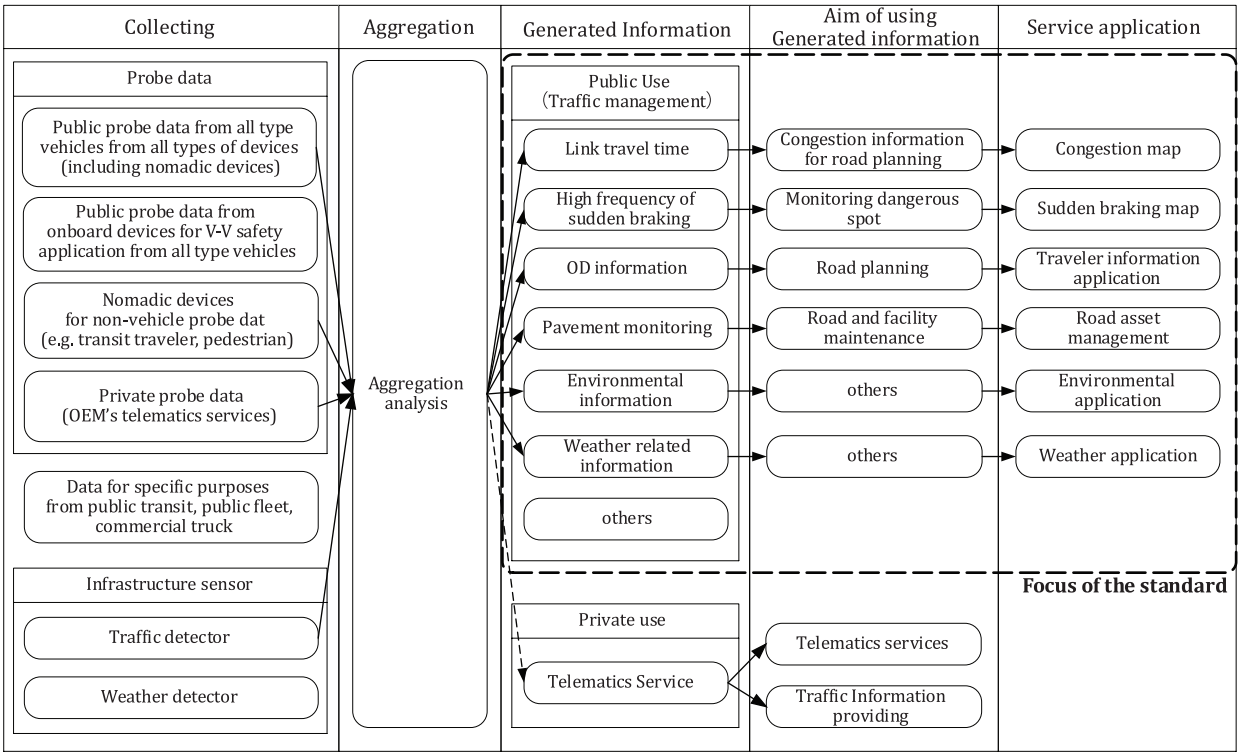

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Figure 1 — Concept of service framework and architecture

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A probe service provider should consider that probe data are collected from diverse sources and for diverse purposes and can be of lasting value to a broad range of researchers, private sector partners, and system operators, if the data:

a) are available;

b) are of sufficient quality and consistency required for the applications that are being developed;

c) are anonymized to protect the privacy of individuals whose trips constitute the probe data;

d) are formatted to comply with a standard to allow interoperability;

e) have supporting metadata to facilitate use of the data;

f) are easily accessible;

g) have clearly identified licensing and intellectual property rights (IPR) to enable use of the data without violating any rights.

5.3 Probe vehicle factors

5.3.1 General

The factors specified in 5.3 should be considered for cooperation between probe vehicle systems (PVS).

5.3.2 Quality assurance

The quality of policy and investment decisions is dependent on the quality of the data that informs the decision-making process. A review of the probe data sets reveals whether data have been verified for accuracy and consistency. However, none of the data sets identify the actual quality of the data. Agencies have their own internal procedures for performing quality control checks. When assessing if the data are of sufficient quality for conducting research, it is important to determine how the

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