Development of a processing system to enhance the utilization of ETC2.0 probe data

(Research period: FY 2021 - FY 2024)

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Key words: ETC2.0 probe data, system development, map matching

1. Introduction

The Ministry of Land, Infrastructure, Transport and Tourism obtains ETC2.0 probe data by recording travel history and behavior history in an ETC2.0 onboard device mounted in a vehicle and by means of bidirectional communication between the device and roadside units installed all over Japan (Fig. 1). This enables the ETC2.0 onboard device to be used for toll collection as well as for providing the driver with information and for the utilization of the obtained data in various road-related measures.

The ETC2.0 probe data provides positional information at each point of time, and the data all over Japan is collectively accumulated and processed by means of a processing system. Regarding the utilization of the ETC2.0 probe data, the range of utilization is required to be enlarged in the future, and it is necessary to create data that can meet a variety of needs.

The NILIM is developing a new processing system in order to address system problems and to meet new needs, aiming to make the ETC2.0 probe data have higher usage value. Specifically, it is engaged in increasing the efficiency of internal processing and changing the method of data accumulation in order to increase the accuracy of map matching. This paper presents, among other things, how to increase the accuracy of map matching.

2. What is map matching?

Map matching is a technology that corrects positional information according to the location of a road on a map, so that the obtained positional information can be utilized for summarization and analysis (Fig. 2). The ETC2.0 probe data is map matched to the road information in the Digital Road Map Database provided by the Japan Digital Road Map Association [1].

In the map matching of the ETC2.0 probe data, the accuracy of positional information after correction and the processing speed are important. Since the position of a road that has been traveled is identified by the positional information obtained by GPS, if the interval of obtaining the positional information is short, correction can be made relatively accurately. However, the ETC2.0 probe data has specifications such that the

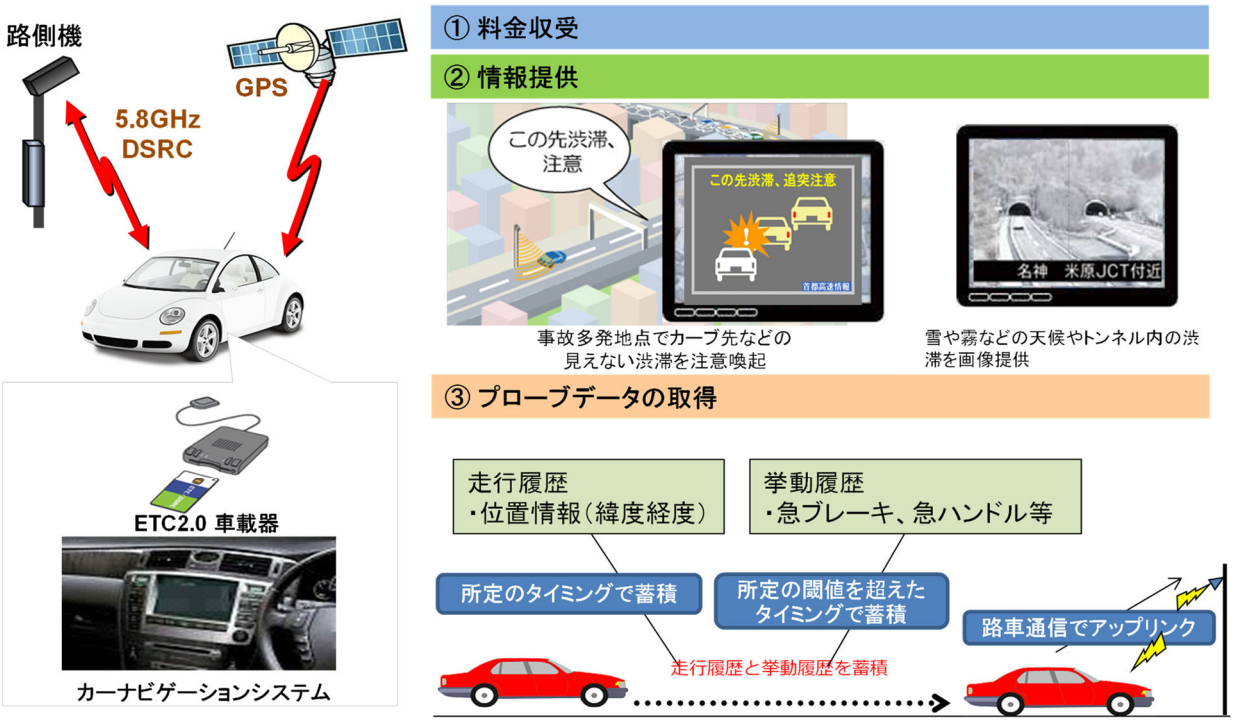

Fig. 1: Overview of ETC2.0

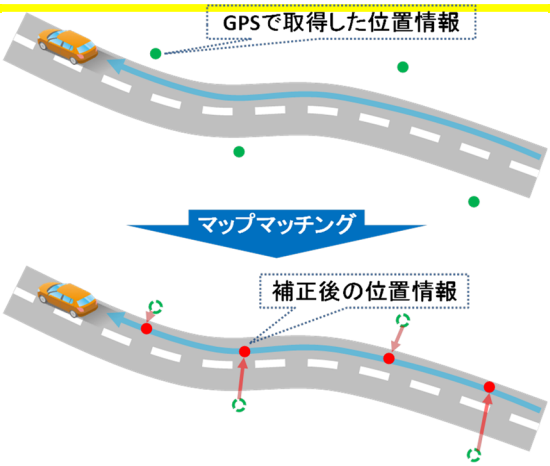

Fig. 2: Image of map matching

positional information recorded in an ETC2.0 onboard device is collected by a roadside unit, due to the constraints on capacity, the interval of obtaining positional information is set to about 200 m. Therefore, the accuracy of map matching greatly affects the accuracy of the time required for traveling the road, etc. In addition, since the information obtained from ETC2.0 onboard devices all over Japan (about 1 billion points/day: as of 2023) is processed collectively, high-speed processing is required to ensure immediacy of the data.

3. Map matching of detailed roads

When the current processing system was first developed, the system was intended to analyze roads considered in the Road Traffic Census, and so map matching is done by limiting the roads to the "basic roads" in the Digital Road Map Database [1]. Therefore, the travel data on roads not included in the "basic roads," map matching will be done to erroneous roads, or the data will be excluded from those to be analyzed. Also, where a high priority is placed on factors such as safety measures on residential roads, etc., an analysis of detailed roads is necessary. Taking that into consideration, the NILIM is developing map matching processing functions that are ready for use with roads including more detailed "small roads."

With a view to realizing map matching having high accuracy while securing the processing speed, we have developed a method for implementing the processing of highways and ordinary roads separately (Fig. 3). In the map matching processing, as the applicable road network becomes denser, more processing time is required and the accuracy decreases. Regarding the complexity of roads, the total length of ordinary roads is about 87 times that of highways. On the other hand, about half of the ETC2.0 probe data is the data of travel on highways. In addition, since the ETC2.0 probe data includes information on the roadside units that have obtained the data, it is possible to estimate whether the travel data came from a highway or an ordinary road. If the data being estimated is obtained by traveling on a highway, it can be expected that

Fig. 3: Classification of those subject to map matching

processing will be significantly reduced by limiting the roads to be map matched to highways. Concerning the challenges of processing of travel data when ordinary roads are included, further high-speed processing is being examined, utilizing the features of the ETC2.0 probe data and by dividing the processing at a position where the vehicle has turned to the right or left at an intersection, etc.

4. Conclusion

At present, we are building a test environment with the map matching technique that has been developed. In the future, we plan to collect data from all over Japan, and to verify the processing speed and accuracy. We will promote the development of an improved processing system, towards the broader utilization of the ETC2.0 probe data.

☞For detailed information, refer to the following:

1) Japan Digital Road Map Association: https://www.drm.jp/database/structure/