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Decision-Making of Lane Change Timing using Lane-Level Route Planning in Lv.2 Advanced Driver-Assistance Systems

Ryuta Hashimoto [1)] Takahiro Seta [1)] Ichi Gi [1)] Ryo Masutani [1)] Atsuki Kinoshita [1)]

1) Woven Core, Inc.
Nihonbashi Muromachi Mitsui Tower 3-2-1 Nihonbashi-Muromachi, Chuo-ku, Tokyo, 103-0033, Japan

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Technologies of advanced driver-assistance systems (ADAS) are rapidly developed, and Level 2 driver assistance systems, which is defined by the Society of Automotive Engineers (SAE), have already reached practical use. Technologies such as Lane Change Assist (LCA), which starts a lane change in response to the driver's winker lever operation on a motorway, have been productized, and more advanced driver assistance systems are required.

As the next step after starting lane change in response to driver operation, a form in which the ADAS starts a lane change by itself can be considered. In order to realize an ADAS which the system itself decides when to start lane change according to the surrounding situation, the technical challenge is how to select the assist to be provided by the system in a surrounding environment that includes multiple features. For example, in the situation shown in Fig. 1, it is not possible to simultaneously assist a left lane change to approach the destination and a right lane change to achieve an overtaking maneuver, so one or the other must be selected. As a way to resolve this technical challenge, this paper describes a technique for selecting the assist to be performed by the system and the timing of lane change when the system wants to perform conflicting assists which cannot perform simultaneously based on the characteristics of the surrounding environment, such as the terrain, surrounding vehicles, and the driver's intention.

In this paper, we assume that the ADAS performs 3 types of assist which are shown in Table1, and then introduce the concept of 3 types of “area” corresponding to each type of assists. The “area” requires the system to start corresponding assist when the ego vehicle enters the area. We describe a method that uses this "area" to represent the timing of lane changes tied to locations and uniquely selects the assist to be performed by the system depending on the surrounding environment which includes various characteristics of terrains (Fig.2). It is also shown that for lane change timing that cannot be tied to a location, such as an overtaking lane change, “area” can be used to select the assist while maintaining alignment with the characteristics of terrains in the surrounding environment. This paper also describes the issues for the future obtained as a result of the evaluation using a test vehicle equipped with these technologies.

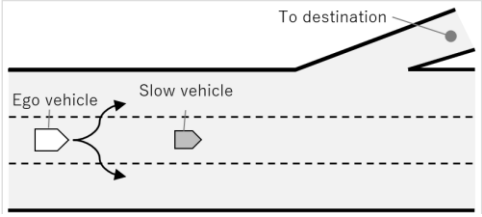

Fig.1 Mixed surrounding situation

Table1 The assists assumed in this paper

Assist	Characteristic
Auto-steer lane change	The system assists steering control of lane change.
Manual-steer lane change	The system notifies lane change timing, and driver manually controls the lane change steering.
Terminate the system control	The system terminates its own control.

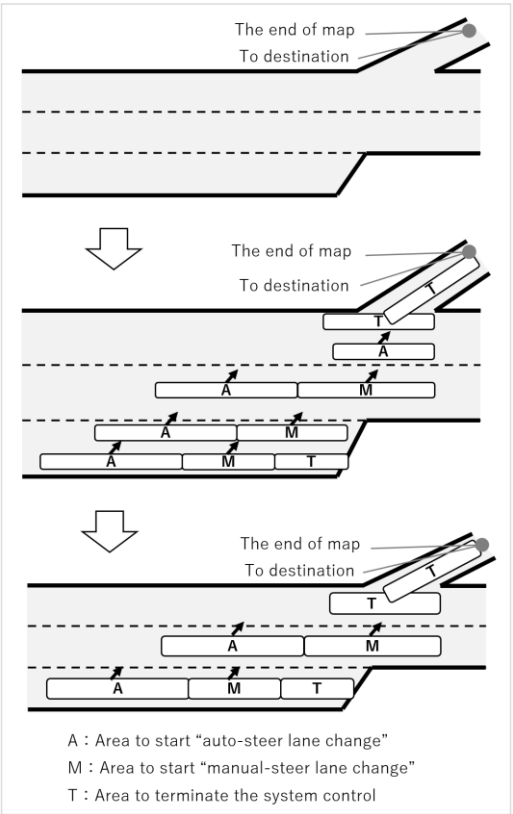

Fig.2 Select of the assist using “area” concept