Abstract

Study on Adaptive Driving Assistant System for the Elderly Driver Considering Individual Characteristics

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Focusing on traffic accidents in Japan and other countries, in particular the accident situation in the aging societies, we have conducted a study for evaluating the effectiveness of driving support for traffic safety. In the case of Japan, it have been reported that accidents during approaching the intersection had a higher risk. The intersection accidents have been caused by elderly drivers frequently. But, as an individual difference in the risk aversion or the attention behavior of the driver near the intersection is large, it is very difficult to know the causes. In order to warn of such danger, warning methods such as presenting visual information, warning sound, and also voice guidance have been proposed, but supports for the elderly drivers with consideration of each driver behavior is rare.

In this study, first, we focused on the braking behaviors of drivers at intersections, and investigated the characteristics of the deceleration behaviors and braking timing of elderly drivers. By comparing the brake behaviors in young drivers and the elderly drivers, it was found that 1) the time to a minimum vehicle speed of elderly drivers was lower, and 2) the maximum deceleration from the brake on and the jerk of deceleration direction of elderly drivers was higher. As a result, the driving behavior characteristics of elderly driver which is different form young drivers were clarified. From this result, a necessity for the construction of a driving support system to support the elderly driver was observed.

Next, assuming the support system utilizing audiovisual stimulation, and observing the driving behavior's changes after the support, the effect of them was investigated. On the city road, accidents caused by overlooking the stop signs and traffic signals have been occurred very often. Thereby a sequential driving supports consisted by a pause stop reminder (information of an intersection) and safety behavior (braking initiation) inducement were presented. And, aiming at developing optimal driving support system, the driving experiment was conducted by using a driving simulator driving support system equipped the support system. On the other hand, because objective indicators to capture the individual characteristics rather than those of subjective evaluation of the driver were required, in order to evaluate the effectiveness of the support system, objective indexes using a physiological signal were introduced. In addition, because the individual difference regarding the attitude and the experience to the driving and cognitive and judgment ability was large, elderly drivers cannot be expected to be effective in
a uniform warning system. Thereby, corresponding to the individual characteristics of the elderly driver, an audiovisual support system was constructed by using subsequent reminder warning and proximity warning with sound, voice and display methods. In other words, by using a driving simulator that assumes on a city road, the driving behaviors of elderly drivers after the various support alerts was observed, and the changes of a driving operation action were analyzed investigated. In addition, focusing on individual differences of elderly drivers, questionnaire surveys such as investigation of the vision or judgment ability as well as the interest, attitude and tendency to driving was conducted before the simulator experiment.

According to the driving behaviors of the drivers after the driving support system; in particular, the results of behavior’s changes of stopping and braking action during approaching intersection, there were significant individual differences in the acceptability by the cognitive and judgment ability in addition to the driving awareness and experience, therefore, the effects of support system for the elderly was enough was clarified.

Finally, for the verification of the driving support system’s effect in a variety of risky driving situation, in the actual driving environment which of no-signal intersections in the real driving course, the effects of the driving support system for elderly drivers using actual vehicle were verified, and confirmed. By developing this methodology, a fundamental design of the adaptive driving support system, with consideration of the individual characteristics, has become possible.

Fig. Structure of Driving Assistant System in this Study