講演番号	183

文献番号	20225183

Estimation of Readiness for Automated Driving (Second Report)

- Validation of Estimation Model -

Yasuo Sakaguchi [1)] Yuji Muragishi [1)] Hiroshi Kuroyanagi [1)]

Tsutomu Tamura [2)] Yuki Nakahara [2)] Toru Ono [2)] Robert Fuchs [2)]

1) Toyota Central R&D Laboratories, Inc.
41-1 Yokomichi, Nagakute, Aichi 468-0001, Japan
2) JTEKT Corporation.
333 Toichi-cho, Kashihara, Nara, 634-8555, Japan

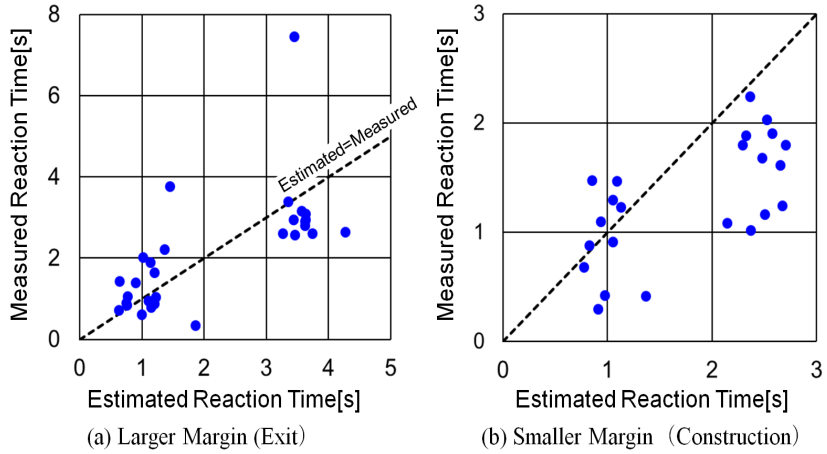
KEY WORDS: **human engineering, intelligent vehicle, cognitive reaction time,** distraction**,** driving ability [C2]

In level 3 autonomous driving, the driver is required to take over the driving within a certain time if necessary. In this paper, we validate readiness estimation model which we developed. This model estimates driver's reaction time from take-over requests, which is based on gaze behavior of the driver. The model is generated from the relationship between takeover reaction time and driver's gaze distribution during autonomous driving. The validation experiments are performed with both a driving simulator and actual vehicle.

In the driving simulator, simulated vehicle runs on highway automatically, and participants on the cockpit of the simulator are indicated to perform simple visual search task or free task (operation of a smartphone). Then, a takeover message is issued, the participants drive manually. Two types of time margin (Larger: indicated to exit from the highway / Smaller: indicated change lane to avoid the road construction area) are tested. The result of the simulator task is shown in fig.1. In the figure, estimated reaction time is including output of the estimation model as mentioned, hands-on time (if the participant's hands are not on the steering wheel when the takeover message is issued, 0.8s is added to the model time), and time margin to collision.

In the actual vehicle experiment, an autonomous vehicle runs on an oval course of a proving ground. Participants on the vehicle are indicated to perform simple visual search task or watch video clips on a tablet PC. Then, a take-over message is issued, by both sound and light. After the message, the participants stop the vehicle or lange change drive manually according to the light pattern. The result of the vehicle experiment is shown in fig.2. In the figure, estimated reaction time is including output of the estimation model and hands-on time (same as the simulator experiment).

As a result, we have confirmed validity of the models which is appended driver hands-on situation and take-over time margin.



(a) Larger Margin (Exit) (b) Smaller Margin (Construction)

Fig.1 Result of the Simulator Experiment.

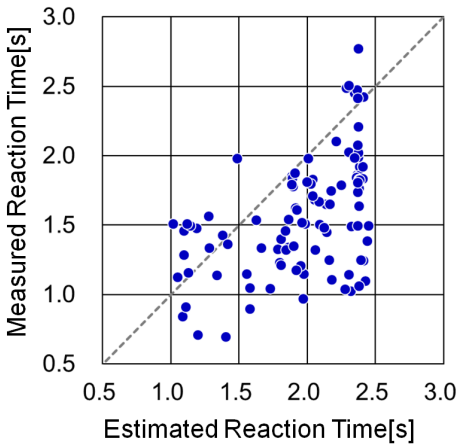


Fig.2 Result of the Actual Vehicle Experiment.