

A Study on the Evaluation Index of Driver's Condition for Automated Lane Keeping System

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KEY WORDS: Human engineering, Driver condition, Driver condition monitoring, Arousal [C2]

In SAE level 3 automated driving, although the operation is led by the system, it is necessary for a driver to monitor the surrounding environment, and the driver has to operate the driving on behalf of the system in case of the emergency. Therefore, the driver should always be awake and monitor the driving by the system. In recent years, UN Regulation No. 157 (Automated Lane Keeping System) required that a driver's operability must be judged by Driver Availability Recognition Systems. We conducted experiments for Level 3 automated driving and investigated the driver status using the criteria as evaluation items. We investigated the validity of Percentage of Eye Closure (PERCLOS) values as an evaluation of arousal state during the 30 s analysis intervals. In this research, we conducted a driving simulator experiment that simulated automated driving (100 km/h) on a midnight highway. PERCLOS used in this research, is the rate of long-term closed eyes per 30 seconds in the past. For comparison, we also used electroencephalography (EEG) assessment of arousal in the past minute. In this study, the low arousal criteria were set at 10% of PERCLOS and 30% of alpha wave appearing rate. Of the 16 participants in the experiment, the results of 4 participants were analyzed, but those of 13 participants were excluded from the analysis because their arousal time was less than 25 minutes. Figure 1 shows PERCLOS every 30 seconds, and Figure 2 shows the alpha wave appearing rate every minute. Figures 1 and 2 show that the PERCLOS value of participant A increased after 24 minutes, and the alpha wave appearing rate exceeded 30%. For participants B, C, and D, PERCLOS was less than 10 % at around 25 minutes, and the alpha wave appearing rate did not exceed 30 %. Table 1 shows the comparison of the average PERCLOS value in 30 seconds just before 25 minutes passed and the average of α wave appearing rate in 1 minute just before 25 minutes passed. The average rate of appearance of alpha waves in the 1 minute immediately preceding the experiment at 25 minutes elapsed time for each participant in the experiment. In the present analysis, no differences were found in the evaluation of each arousal state, suggesting that the PERCLOS measured in the last-30 seconds before the event occurred was useful as an index for evaluating the driver's driving potential.

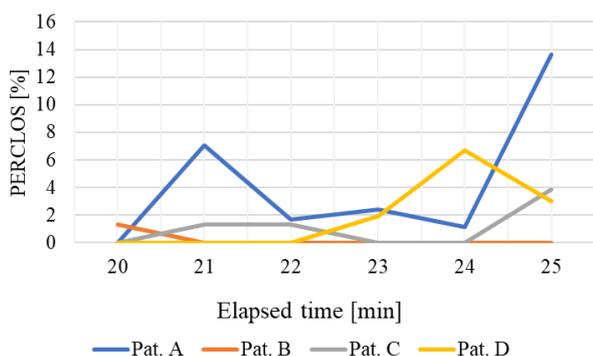


Fig. 1 PERCLOS

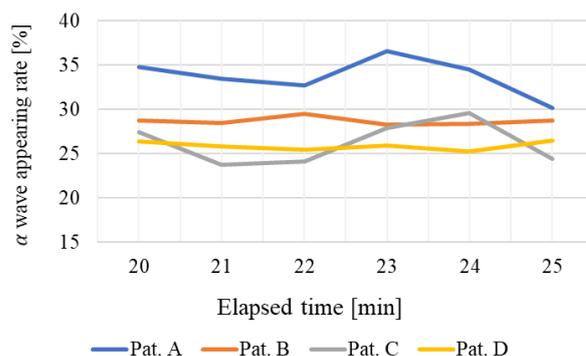


Fig. 2 α wave appearing rate

Table1 Comparison of PERCLOS and α wave appearing rate just before 25 minutes passed

Participants	PERCLOS [%]	α wave appearing rate [%]
A	13.6	30.2
B	0	28.8
C	3.9	24.4
D	3	26.4