

# The Investigation of Workload Management System based on Drivers' Driving Action

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## ABSTRACT

The purpose of this experiment is to estimate the drivers' workload based on drivers' action during performing driving task. In other words, we go into the study of the relation with the subjective workload and driving action. The number of participant in this simulator experiment is 30(male). They were asked to reply to the NASA-TLX and the DALI questionnaire, before starting the simulator experiment. The result of correlation analysis showed that their subjective workload is closely related to their driving action(visual and gas pedal action) in particular task condition. This result could be applied to development of drivers' workload estimation and management system.

## Keywords

Driver, Workload, Workload Management, System, Workload Estimation, Safe Driving, Workload Criterion

## 1. INTRODUCTION

With the advances of technologies and improved living standards, automobiles have become an indispensable part of our lives. Furthermore this have been led to the development of various systems which provide driving convenience and entertainment to the drivers. Such a system has two contrary aspects. The first one is to provide safety driving and driving convenience to the drivers. Another aspect is to increase the potential to cause an accident. The systems must be manipulated by drivers during driving and sometimes it provides a lot of information which drivers are not able to catch while they driving. This may be caused to drivers' distraction. Thus, the system needs to be developed that the only necessary information should provide to the driver at the appropriate time based on drivers' workload measurement and criterion. Accordingly, this study is a basic experimental research for the system that drivers' workload measurement and criterion. Furthermore this experiment will be on the driver's action analysis during driving.

## 2. EXPERIMENTATION & ANALYSIS

Thirty subjects are participate in this experiment. They are all male. They were asked to reply to the NASA-TLX and the DALI questionnaire before starting the simulator experiment. And then they were participated in normal driving condition composed of 8 driving tasks(U-turn, a sudden stop & start, left/right passing, left/right turning, left/right lane changing). The simulator collected vehicle information(such as vehicle

speed, brake action, gas pedal action and so on), and the eyetracking system collected drivers' fixation. We were analyzed the data of 28 participants( $M=25.43$   $SD=2.25$ ) through SPSS program to correlation. We were exclude two people data among the all participants, it is an unsuitable data for an analysis(one is sickness, the other is not extract).

## 3. RESULT

The result of correlation analysis for the drivers' action and the NASA-TLX was a significant positive correlation to the time of accelerator operation and close time, the number of accelerator operation and performance time in U-turn task(each,  $r=.57$ ,  $p<.01$ ,  $r=.49$ ,  $p<.05$ ,  $r=.54$ ,  $p<.01$ ,  $r=.55$ ,  $p<.01$ ). NASA-TLX and the percentage of drivers' distraction in a sudden stop & start task showed significant negative correlation( $r=-.44$ ,  $p<.05$ ). And the number of drivers' brake operation and close in a left turning task showed significant positive correlation(each,  $r=.39$ ,  $p<.05$ ,  $r=.39$ ,  $p<.05$ ). On a relation to the drivers' action and the DALI, the relation to the time/percentage of the distraction and the DALI in a sudden stop & start showed a significant negative correlation(each,  $r=-.45$ ,  $p<.05$ ,  $r=-.49$ ,  $p<.05$ ). And the percentage of drivers' attention was a significant positive correlation(each,  $r=.42$ ,  $p<.01$ ). Also, the time/percentage of the distraction in the right lane changing task showed a significant negative correlation, the percentage of the attention presented a significant positive correlation(each,  $r=-.67$ ,  $p<.01$ ,  $r=-.63$ ,  $p<.01$ ,  $r=.48$ ,  $p<.05$ ). The time of the distraction in the left lane changing task showed a significant negative correlation( $r=-.57$ ,  $p<.01$ ).

## 4. CONCLUSION

We have confirmed that the driver's visual and gas pedal action were the most closely related with their subjective workload assessment. Through this result, we can guess that the drivers' visual and the pedal action are possibly affected on their subjective workload. In the future, we will be scheduled to conducting a further analysis. And this result will be applied to the development of the system for drivers' workload estimating and management. We also need to consider other factors affecting drivers' workload such as drivers' physical status and vehicle location and so on.

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