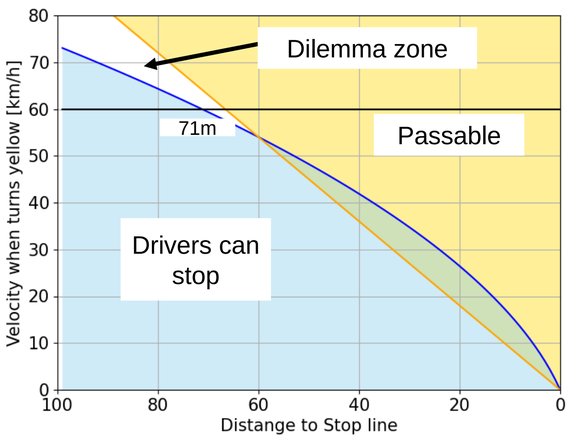
K. Nakano Lab

Driver Initiated Take-over during driver assistance with signal recognition

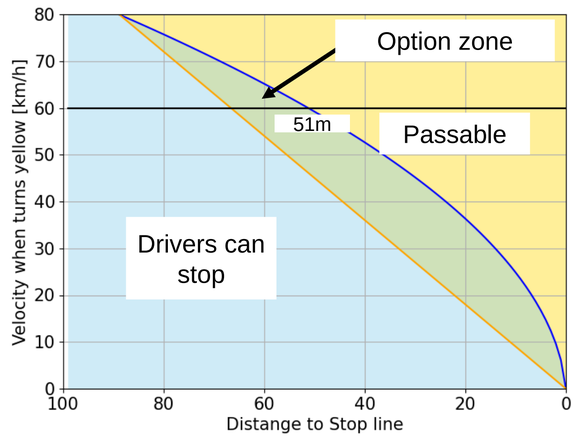
Introduction

When advanced driver assistance systems (ADAS) with signal recognition are used, the driver is requested to take over driving to avoid an accident when the system fails to detect a signal or detects a false signal. The purpose of this study is to evaluate the possibility of safe driver-initiated intervention in the event of undetected or false detection by the driver assistance system, and to propose and evaluate a human-machine interface that promotes appropriate intervention, through driving simulator experiments.

Passability of drivers and ADAS



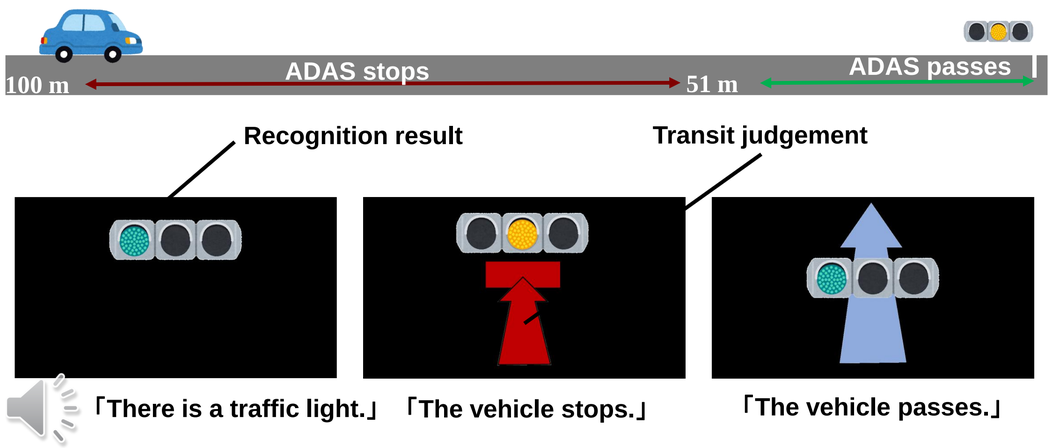
When Vehicle deceleration is 3.0 m/s^2 and driver reaction time is 1.5s are assumed, there are optional zones where the vehicle can stop and pass through at a yellow light, and dilemma zones where neither is possible.



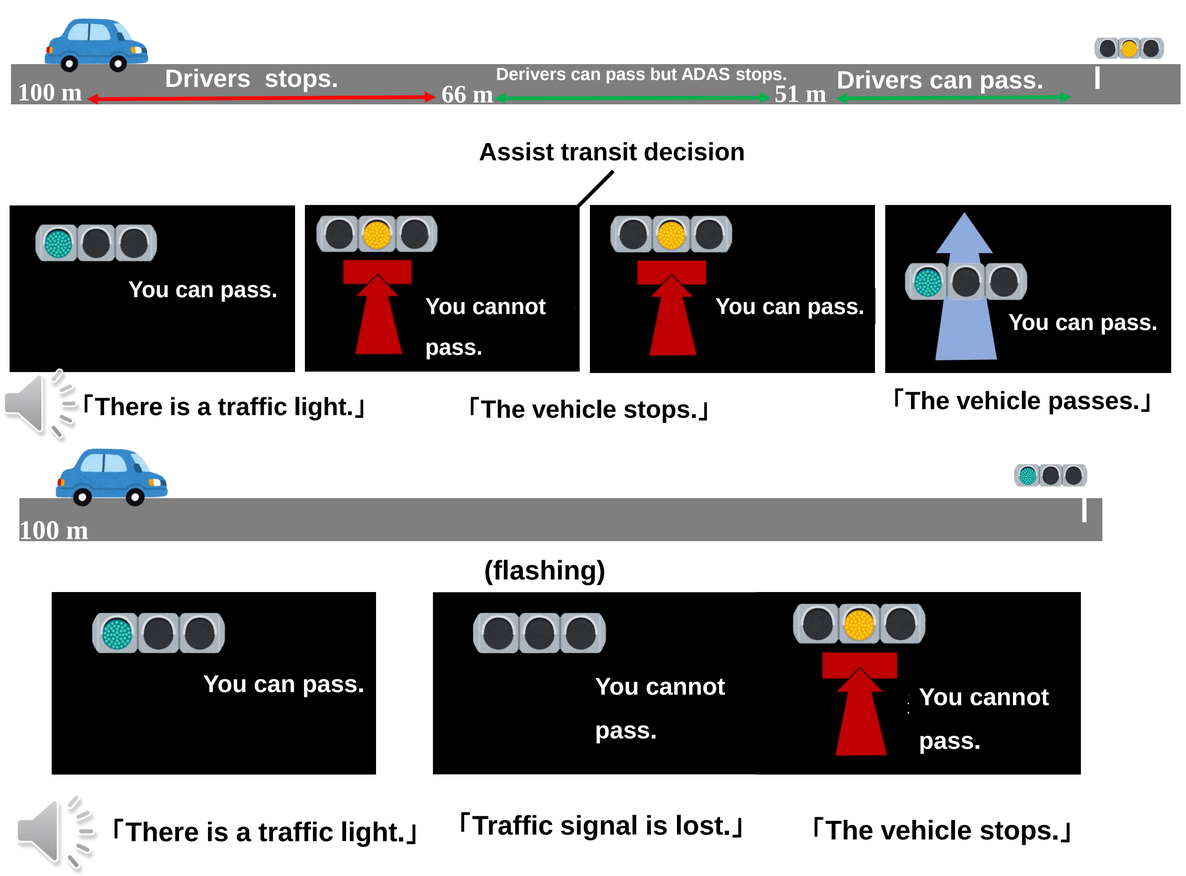
When Vehicle deceleration is 3.0 m/s^2 and ADAS reaction time is 0.3s are assumed, there are only optional zones where the vehicle can stop and pass through at a yellow light. There are cases where the ADAS judges the vehicle can stop, but the driver judges the vehicle can pass through.

Proposing HMIs

HMI 1: presenting the decision of the ADAS



HMI 2: presenting the feasible decision of the driver



HMI which cannot present the detection failure

（No sound）

Experimental results

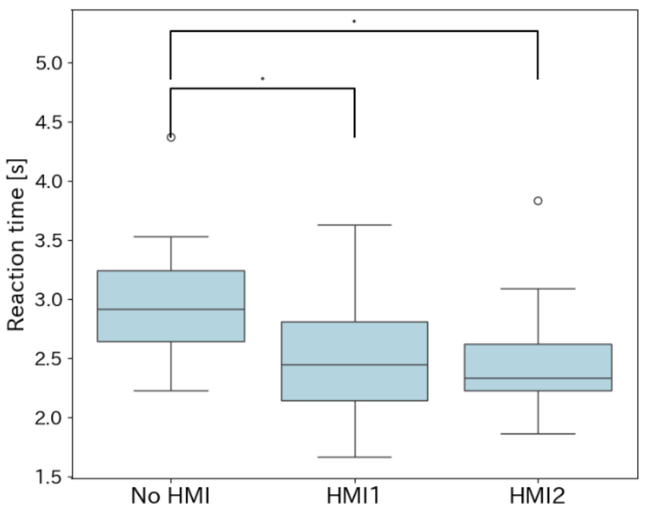
When signal recognition is normal

	No HMI	HMI 1	HMI 2
Number of unnecessary interventions	34	15	9
Number of signal ignorances	4	2	1
Number of Interventions in areas of divided judgment	0	0	0

When signal recognition is abnormal without error detection

	No HMI	HMI 1	HMI 2
Number of unnecessary interventions	16	21	17
Number of signal ignorances	7	8	9
Number of Interventions in areas of divided judgment	6	12	8

When signal recognition is abnormal with error detection



Friedman | p= 0.003
No HMI : HMI 1 | p= 0.005
HMI 1 : HMI 2 | p= 1.000
No HMI : HMI 2 | p= 0.003

Conclusions

If ADAS can indicate that a signal has not been detected, the driver can intervene appropriately.
The proposed HMI reduced the number of interventions by the driver when a signal was successfully detected and the associated ignoring of signals.

Publications

Sakaegi T., Yang B., Nakano K., 2023, Feasibility study on driver initiated takeover during driver assistance with signal recognition, Proc. of TRANSLOG2023, No.23-62, TL5-1.

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