Indicating GO/NOGO Indices on Road Ahead Virtually to Assist Driver’s Judgment at Signalized Intersection

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This study proposes the driver’s judgment assistance system at a signalized intersection ahead using the signal information. The proposed system informs a driver visually of the distance which the vehicle can forward by maintaining the present velocity until turning to the red signal. If the distance between the intersection and the vehicle is longer than the indicated distance, the system also indicates a stopping distance by assuming the ordinary deceleration. The driving simulator experiments are conducted to evaluate the proposed system. The assistance system encourages the earlier deceleration before turning to the amber signal and prevents the emergency braking behavior or the risky passage through the intersection.

Introduction

- Traffic accident situations in Japan in 2015
- Driver assistance at signalized intersection
- Countdown timer

Driving support system utilizing signal information

=> Onboard monitor may causes driver’s distraction

Evaluation Indices

- GO index
  - Entry possible distance:
    \[ d_e(t) = v(t) \times TTR \]
  - Passage possible distance:
    \[ d_p(t) = v(t) \times T TGC \]

- NOGO index
  - Stopping distance:
    \[ d_s(t) = v(t) \times T + \frac{v^2(t)}{2(-a_d)} \]

Driving Simulator Experiments

- Fixed-base driving simulator
- Indication image of GO/NOGO indices

In this study...

Proposing driver assistance system which indicates passage possibility on road ahead virtually

Experimental Results

- Velocity
  - With assistance system
  - Without assistance system

- Acceleration
  - With assistance system
  - Without assistance system

Vehicle states at amber signal onset

- \( x_s \): Passage
- \( x_s \): Stop

Effects of Indication Method

- Comparison between on-road and onboard indication

Drivers’ reaction to emergency deceleration

Experimental Results

- Velocity
  - Preceding vehicle
  - Own vehicle (on-road indication)
  - Own vehicle (onboard monitor)

- Reaction time
  - On-road indication
  - Onboard monitor

- Maximum deceleration
  - On-road indication
  - Onboard monitor

- Minimum TTC
  - On-road indication
  - Onboard monitor

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