Accepted Manuscript

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PII: S0167-739X(17)30712-4
DOI: https://doi.org/10.1016/j.future.2018.01.050
Reference: FUTURE 3957

To appear in: *Future Generation Computer Systems*

Received date : 19 April 2017
Revised date : 2 January 2018
Accepted date : 25 January 2018

Please cite this article as: C. Olaverri-Monreal, G.C. Krizek, F. Michaeler, R. Lorenz, M. Pichler, Collaborative approach for a safe driving distance using stereoscopic image processing, *Future Generation Computer Systems* (2018), https://doi.org/10.1016/j.future.2018.01.050

Collaborative Approach for a Safe Driving Distance Using Stereoscopic Image Processing

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Abstract

Disregard for the rules regarding the minimum safety distance can make the avoidance of a rear-end collision nearly impossible. In a joint effort to enhance safety and improve the decision making processes on an individual level, we contribute to the state of the art with an innovative and affordable system that identifies vehicles and provides a rear-end distance warning system capable of recognizing dangerous situations, and which can also inform other vehicles of the danger, independent of their communication capabilities or equipment. Vision sensors garner information through the stereoscopic capturing and processing of images by rear cameras to calculate the distance between the leading and following vehicles. Visual data related to the safety distance is provided to the following vehicle in real-time, relying on an asynchronous collaborative process. A detailed error analysis of the distance calculation is provided based on the measurement procedure and roadway geometry. Relying on the communication between the two vehicles, an in-vehicle system was compared to the rear-mounted distance warning system under lab-controlled conditions. Both human-machine interaction paradigms were evaluated in terms of their impact on driver response. Results showed that both systems influenced the driver in keeping a time gap of two seconds.

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