Vision-based Navigation of Autonomous Vehicle In Roadway Environments With Unexpected Hazards

Technology Transfer Activities

by

Mashrur Chowdhury, Clemson University
Mhafuzul Islam, Clemson University
Hongda Li, Clemson University
Hongxin Hu, Clemson University

Contact information

Mashrur Chowdhury, Ph.D., P.E., F. ASCE
Eugene Douglas Mays Chair of Transportation
Glenn Department of Civil Engineering, Clemson University
216 Lowry Hall, Clemson, South Carolina 29634
Tel: (864) 656-3313, Fax: (864) 656-2670
E-mail: mac@clemson.edu
September 2022

Center for Connected Multimodal Mobility (C²M²)

200 Lowry Hall, Clemson University
Clemson, SC 29634
DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein. This document is disseminated in the interest of information exchange. The report is funded, partially or entirely, by the Center for Connected Multimodal Mobility (C²M²) (Tier 1 University Transportation Center) Grant, which is headquartered at Clemson University, Clemson, South Carolina, USA, from the U.S. Department of Transportation’s University Transportation Centers Program. However, the U.S. Government assumes no liability for the contents or use thereof.

Non-exclusive rights are retained by the U.S. DOT.
ACKNOWLEDGMENT

This material is based on a study supported by a grant from the Center for Connected Multimodal Mobility (C²M²) (USDOT Tier 1 University Transportation Center) headquartered at Clemson University, Clemson, South Carolina, USA.
Table of Contents

DISCLAIMER .................................................................................................................. ii
ACKNOWLEDGMENT .................................................................................................... iii
1 Outputs .......................................................................................................................... 1
2 Outcomes ..................................................................................................................... 1
3 Impacts ......................................................................................................................... 1
Technology Transfer Activities

1 Outputs
The project output includes a journal paper, and data collected from autonomous vehicle simulator.

1.1 Output #1
We have also published the content of this report as a journal paper in the Transportation Research Record journal.


1.1 Output #2
Data about autonomous vehicle (AV) navigation and perception is generated from a robotics simulation software. We contribute this new dataset that can be used by the autonomous vehicle community to improve the driving model in unexpected hazardous roadway environment.

2 Outcomes
We assessed the Deep Neural Network (DNN)-based autonomous vehicle driving system that uses object detection and semantic segmentation to mitigate the adverse effect of this type of hazardous environment. The assessment is shown in the final project report.

Models were developed related to AV perception and navigation for decision making. More models of end-to-end AV driving can be developed using the data generated in this project.

3 Impacts
We find that our developed DNN-based autonomous vehicle driving system including hazardous object detection and semantic segmentation improves the navigational ability of an autonomous vehicle to avoid a potential hazard by 21% compared to the traditional DNN-based autonomous vehicle driving system. Our analysis results can guide AV industry to develop safe and efficient DNN models for AV navigations that can operate in challenging environments.