Tran-SET
Transportation Consortium of South-Central States

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Key Points

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Oklahoma State University

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$70,700

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Tran-SET
Oklahoma State University

Total Project Cost:
$141,400

Vehicle Sensing and Communications using LED Headlights to Enhance the Performance of Intelligent Transportation Systems: Proof of Concept, Implementation, and Applications

Brief Project Description

This project will investigate the use of vehicle light-emitting diode (LED) headlamp devices for improving the accuracy and reliability of traffic data measurements required for developing effective intelligent transportation systems (ITS) technologies and solutions. The research team considers utilization of vehicle's LEDs' lights as a complementary and/or an alternative technology to current radio frequency (RF) wireless communications and image-based data acquisition methods for ITS applications.

Problem Statement

Through the application of sensors, communications, and information technology, intelligent transportation systems (ITS) offer proven solutions and strategies for improving transportation safety, mobility, and environmental sustainability. However, existing vehicle-sensing/tracking and communications technologies suffer from certain limitations and disadvantages that can degrade the quality of information obtained from these systems in various environments.

One possible solution is to use light emitting diode (LED) headlights, which are increasingly common to most vehicle manufacturers, to transmit information without a notable effect on the visibility of objects or the human eye. This can be made possible through modulation, where LED headlights can be switched on and off fast enough to transmit data. Therefore, LED vehicle headlights have great potential for sensing and communication purposes in ITS applications due to: 1) availability of the LEDs (hardware) in vehicles, 2) unique properties of visible light optical propagation, 3) immunity to the electromagnetic interference, 4) operation in unlicensed bands, 5) inherent safety and security, and 6) high degree of spatial confinement that allows high reuse factor.

Objectives

This project will investigate the use of vehicle LED headlamp devices for improving the accuracy and reliability of traffic data measurements required for developing effective ITS technologies and solutions.

Intended Implementation of Research

Workforce Development

Two graduate students will be hired to conduct research with the PIs. In addition, the technical results will be published in journals and presented at conferences attended by representatives of industry and academia, as well as ad hoc seminar presentations by the investigators. The project's deliverables will be used to develop professional capacity building resources and seminars for training and education of transportation professionals.

Education

The experience and knowledge accumulated during this project will be incorporated into courses offered by the School of Electrical & Computer Engineering and the School of Civil & Environmental Engineering at OSU for both undergraduate and graduate students.

Outreach

The PIs expect to disseminate research results at OSU's annual National Lab Day, an event that aims to engage Oklahoma high school students to Science, Technology, Engineering, and Math (STEM) education.

Anticipated Impacts/Benefits of Implementation

The proposed work will provide a unique visible light-based sensing and communication system through the concept of Visible Light Detection and Ranging (ViLDAR) to increase the quality of information in ITS. This novel method is rooted in the philosophy of embracing and cleverly exploiting the working principles of the LED lights. The outcomes, in turn, will have the potential to 1) advance the state-of-the-art in vehicle sensing and communications technologies which are the building blocks of ITS applications, 2) improve the performance and reliability of ITS systems.

The results of this study will help planners, designers and operators of ITS systems in Region-6 improve the accuracy and reliability of the basic traffic parameters needed to improve transportation system performance in six key goal areas: safety, mobility, efficiency, productivity, energy and environment, and customer satisfaction. In addition, it is anticipated that the expected outcomes of this project will provide valuable benefits/recommendations to car manufacturer (auto industry), law enforcement entities, and ITS planners, designers and operators.

Weblinks:

http://transet.lsu.edu/research/research-in-progress/

https://rip.trb.org/View/1505433