Leveraging Artificial Intelligence on Things for Real-time Safety Notifications in High-Risk Regions of Collision

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22SAUTSA49

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Lead Institution:

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Tran-SET

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Total Project Cost:

$ 100,000

Using AI for Real-time safety notifications in high-risk collision areas

Each year, 90% of the roughly 36,000 traffic-related deaths in the U.S. are the result of human errors according to the Automobile Association of America. Keeping drivers alert with early safety notifications on potential risks is important to reduce human errors and improve public safety. Currently, navigation Apps can provide pre-announced construction locations, traffic delays, accidental cites, and weather alarming. However, there is a complete lack of real-time risk notifications. Existing databases such as Crash Reporting Information System (CRIS), and Pavement Management Information System (PMIS) have documented locations, time, road geometrics, weather conditions, and causes of accidents, allowing identifications of high-risk regions of collision. Further, the current Video Imaging Vehicle Detection System (VIVDS) of the Texas Department of Transportation (TxDOT) can take, store, and transmit traffic images and video to their data center in low frequency or on-demand real-time monitoring. However, the postcollection process from VIVDS is performed at the data center, imposing challenges on real-time traffic flow monitoring due to the limitations on storage, computational capability, communication bandwidth, energy consumption, and cost. There is also an urgent demand to enhance the VIVDS under visual limited scenarios such as nighttime and foggy weather leading to frequent human errors. Therefore, we propose to generate low-cost real-time early safety notifications by implementing artificial intelligence (AI) on existing road devices in all weather and light conditions. The proposed project will integrate the research activities with educational training by developing new course modules for AI and risk analysis, advising senior designs for undergraduates and thesis/dissertation projects for graduate students.

Problem Statement

Each year, 90% of the roughly 36,000 traffic-related deaths in the U.S. are the result of human errors according to the Automobile Association of America. Further, 85% of fatal crashes occur at the non-intersection road in rural areas while 68% of fatal crashes occur at the nonintersection area in urban areas. Keeping drivers alert with early safety notifications on potential risks is important to reduce human errors and improve public safety. Currently, navigation Apps can provide pre-announced construction locations, traffic delays, accidental cites, and weather alarming. There is a complete lack of real-time risk notifications. Existing databases such as Crash Reporting Information System (CRIS), and Pavement Management Information System (PMIS) have documented locations, time, road geometrics, weather conditions, and causes of accidents, allowing identifications of high-risk regions of collision. The current Video Imaging Vehicle Detection System (VIVDS) of the Texas Department of Transportation (TxDOT) can take, store, and transmit traffic images and video to their data center in low frequency or on-demand real-time monitoring. However, the post-collection process from VIVDS is performed at the data center, imposing challenges on real-time traffic flow monitoring due to the limitations on storage, computational capability, communication bandwidth, energy consumption, and cost. There is also an urgent demand to enhance the VIVDS under visual limited scenarios such as nighttime and foggy weather leading to frequent human errors.

Objectives

The objective of this project is to enhance road safety in high-risk regions by providing realtime safety notifications to drivers using the current VIVDS. To achieve this goal, we will enable the current VIVDS to process massive real-time data, extract real-time traffic information, and identify potential safety risks using the limited computational resources from VIVDS devices. Once the high-risk threshold is reached, the framework will generate safety notifications and show the notifications on a display panel powered by energy harvesting technology before the drivers enter the high-risk regions to minimize the potential for human errors.

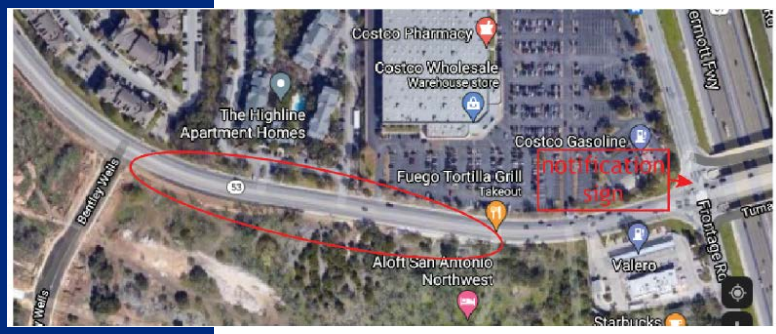

Figure 1. High-risk regions (circled in red) for collision around UTSA due to blocking of visions caused by road geometrics and surrounding environment. The red rectangle areas are proposed sites for safety notifications.

Intended Implementation of Research

Thesis for graduate student working on the project, journal papers, training and educational material for graduate and undergraduate students and interested researchers. Presentations in workshop organized on the proposed topic. Final Implementation Report, Tran-SET presentation, publications, presentations to outside agencies and future proposals for outside funding for project expansion.

Anticipated Impacts/Benefits of Implementation

This study will enhance the durability and service life of infrastructure by enhancing the capability of the current VIVDS in Texas to generate real-time traffic alarm and safety notification. The proposed research will also preserve the existing transportation system by reducing the collision-caused damage to the transportation systems. The research will lead to improved public safety with real-time driving safety notifications which address the region 6 transportation needs.

Web links

- Tran-SET's website https://transet.lsu.edu/research-in-progress/

Tran-SET

Tran-SET is Region 6's University Transportation Center. It is a collaborative partnership between 11 institutions (see below) across 5 states (AR, LA, NM, OK, and TX). Tran-SET is led by Louisiana State University. It was established in late November 2016 "to address the accelerated deterioration of transportation infrastructure through the development, evaluation, and implementation of cutting-edge technologies, novel materials, and innovative construction management processes".

Learn More

For more information about Tran-SET, please visit our website, LinkedIn, Twitter, Facebook, and YouTube pages. Also, please feel free to contact Dr. Momen Mousa (Tran-SET Program Manager) directly at transet@lsu.edu.