

0-7129: Working with Autonomous Trucks to Improve Routine Maintenance Operations

Background

Texas is at the forefront of innovative transportation technologies, actively piloting autonomous vehicle (AV) trucking operations. These AVs continuously gather extensive roadway data, positioning Texas to forge partnerships between AV trucking and ongoing TxDOT maintenance operations to prioritize maintenance events. Quality infrastructure is critical for current drivers' safety and the future growth of the connected and automated vehicle (CAV) market. Well-maintained roads with clear markings and signage enhance AV operations and overall road safety. Increasing TxDOT's response time to maintenance events will benefit all users. Project 0-7129 aims to create a streamlined prototype allowing AV trucks to identify maintenance issues and notify TxDOT representatives, modernizing maintenance operations from detection to resolution.

What the Researchers Did

The University of Texas at Austin Center for Transportation Research (CTR) collaborated with Texas public transportation agencies, private AV trucking companies, and third-party AI technology groups to develop the Intelligent Routine Maintenance Framework (IRMF). This project has four objectives: identify data gaps for public agencies, align private data collection capabilities with public needs, create a data-sharing prototype, and ensure the framework's future success and growth.

Initially, the research team conducted a literature review of TxDOT's maintenance documentation and worked with TxDOT representatives to assess current practices and data requirements. Maintenance was categorized into pavement, roadway, roadside, and hazardous events, leading to the development of a preliminary IRMF

workflow.

The team then engaged stakeholders to refine project needs and framework, hosting a workshop that brought together AV trucking companies, data organizations, and public transportation agencies. Six priority maintenance events were identified: potholes, roadway striping, pavement markers, signage, cable barriers and guardrails, and debris. Performance metrics and data standards were established for the IRMF prototype.

The IRMF was structured around three main components: data ingestion, dashboard analytics, and maintenance actions. Leveraging TxDOT's Nighttime Inspection Application, the research team integrated existing data-sharing practices into the IRMF. This integration supports dashboard analytics and maintenance reporting, enhancing the autonomous data ingestion process.

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Project Completed:
07-31-2023

To ensure ongoing success, the team developed essential project materials, including a catalog of AI solutions, a cost-benefit analysis, procurement documentation, and marketing materials that highlight the IRMF's needs and benefits. This groundwork will enable TxDOT to effectively scale the IRMF for Texas roadway maintenance.

What They Found

Project 0-7129 revealed significant opportunities for collaboration between public and private agencies to enhance Texas's roadway network. AV trucks can supplement TxDOT's data-sharing platform, improving routine maintenance.

In the initial gap analysis, public transportation agencies acknowledged the desire to improve real-time maintenance identification, including faster, more accurate, and proactive roadway condition insights. Upon initial outreach with state- and district-level leadership, representatives confirmed the value that an effective data-sharing framework could bring. The stakeholder workshop highlighted shared priorities among agencies, including the need to address striping, roadway markers, signage, potholes, guardrail damage, and debris. Currently, AV trucks rely on safety drivers to manually flag maintenance events, with aspirations for autonomous detection as the IRMF evolves. While data is available, challenges remain in its frequency and accuracy.

The research team proposed two key recommendations: expand the Nighttime Inspection Application to align with the IRMF's

capabilities and create a flexible framework adaptable to varying geographic and roadway infrastructure needs. Enhancing the Nighttime Inspection Application will facilitate IRMF integration into TxDOT's existing systems, reducing user training requirements. Future goals include identifying the severity of maintenance events and understanding user expectations across different geographic and infrastructure contexts.

What This Means

The aim of Project 0-7129 was to demonstrate that AV trucking data can be effectively ingested and reported to TxDOT maintenance personnel, improving operational efficiency. Texas leads the nation in AV testing and deployment, with significant stakeholder support for the IRMF's potential to reduce reporting latency and improve geographical and severity insights. Numerous ongoing initiatives in Texas, including the Nighttime Inspection Application and the CAV Task Force, present opportunities for the IRMF to successfully scale alongside these projects, leveraging the foundational work already completed.

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Keyword: Research

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