Leveraging Rideshare Electric Vehicle Data for Road Condition Monitoring: A Crowdsourcing and Machine Learning Approach

CTIPS-021 – UTC Project Information

Recipient/Grant Number:	North Dakota State University, Colorado State University Grant No. 69A3552348308
Center Name:	Center for Transformative Infrastructure Preservation and Sustainability
Research Priority:	Preserving the Existing Transportation System
Principal Investigator(s):	Gaofeng Jia, Ph.D.
Project Partners:	USDOT, Office of the Assistant Secretary for Research and Technology – $30,000
	Colorado State University – $30,000
Total Project Cost:	$60,000
Project Start and End Date:	7/16/2024 to 7/15/2026

Project Description

One key part of pavement management is to assess the road condition and identify pavement distresses such as cracks and potholes. These road distresses, if not identified and repaired timely, could compromise road safety, cause expensive damage claims, and also lead to more expensive later repairs. To assess pavement condition, pavement condition data need to be collected first. However, traditional pavement data collection still relies on manual or specialized vehicles equipped with expensive sensors and requires personnel driving along each road in the road networks. Therefore, traditional road inspection methods are often costly, labor-intensive, and sporadic with limited coverage, leading to delayed maintenance and compromised safety. Recent advancements in machine learning (ML) and the proliferation of electric vehicles (EVs) equipped with various sensors offer a promising avenue for revolutionizing road condition assessment practices. This project will establish a framework for collecting and processing rideshare crowdsourcing EV data, and develop machine learning algorithms that uses data from EVs to automatically assess road conditions and identify road damages such as cracks and potholes. The project has the potential to offer a more efficient, cost-effective, and real-time approach to road condition monitoring over large road networks and provide critical information for timely maintenance.

USDOT Priorities

This study will use sensors in EVs and crowdsourcing for pavement condition assessment, and develop AI enabled automated tools for accurate and robust pavement distress detection, mapping, and updating. The tools are expected to help enhance the capabilities of state DOTs and highway maintenance team in timely and cost-effective maintenance of highways and strengthen existing pavement asset management systems and practices by reducing costs for road condition monitoring. Hence the project directly contributes to USDOT strategic goal of Economic Strength and Global Competitiveness by helping "strengthen asset management systems and practices to reduce the costs of managing assets throughout their lifecycle."

Outputs

The developed automated tools will be presented to CDOT maintenance teams to promote the adoption of the developed tools. The research findings will also be disseminated through technical publications in conferences and journals as well as presentations in conferences and seminars (including virtual delivery via live webinars and in-person delivery).

Outcomes/Impacts

The expected outcomes include:

1. A set of procedures to collect and process image data from EVs to support pavement condition assessment.
2. A unique and valuable database of geotagged and labeled images from EVs for training pavement distress detection algorithms.
3. Performance and feasibility analysis of using crowdsourcing rideshare EV data and machine learning to improve the timeliness and coverage of pavement condition data collection and pavement condition assessment.
4. Automated tools for pavement distress detection, mapping, and updating for use by state DOTs and highway maintenance team.

Final Report

Upon completion, the final report link will be added to the [project page on the CTIPS website](#).