

Bridge Inspection Training and Enhanced Operations using Augmented Reality

Project Number:

22STUNM52

Start Date:

04/01/2022

Principal Investigator(s):

Fernando Moreu

University of New Mexico

Lead Institution:

University of New Mexico

Funding Source(s):

Tran-SET

University of New Mexico

Total Project Cost:

\$ 130,000



Implementing AR for bridge inspection training and operations

This research project addresses the one of the main concerns of infrastructure managers i.e., data access during field inspections by designing and implementing a database and developing a new method for connecting the inspector to the datacenter using Augmented Reality (AR). This method will provide inspectors with data in the field so they will be able to compare inspections over time and make more comprehensive decisions. This is in line with the interest of the New Mexico Department of Transportation (NMDOT) that observes performing frequent, thorough, and objective inspections of infrastructure as a crucial way of preventing bridge decay. The database and data connection method will be tested in field inspections in implementation phase and the limitations will be identified. Based on the assessment of the method in these infrastructure inspections the tools will be modified and improved for real-world field inspections. This research proposes a new method for accessing the bridge inspection manuals and procedures by developing a dropdown menu containing the bridge inspection instructions that can be accessed in the field. The menu will be based on the DOT bridge inspection procedures and the instruction will contain explanatory relevant figures and data about the inspection details such as types and criteria for defects on bridges. Then this menu will be assessed in real-world bridge inspections with NMDOT, and these evaluations direct the research team to the correct direction for improving the menu.

Problem Statement

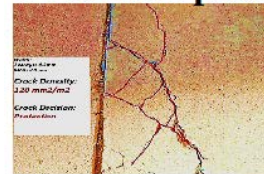
The collection of information of the decay of materials, the prioritization of repairs, and the need to increase efficiency of operations with low budgets motivates the need for research in faster and more efficient methods to inspect infrastructure. Additionally, the large backlog of inspection projects for the existing infrastructures necessitates the need for providing technological means and methods to implement a cost and time effective Structural Health Monitoring (SHM) system. Emerging technologies in construction monitoring and repairs as a solution to the

mentioned SHM challenge are of top interest the academic community and the infrastructure industry planners. According to the experts from the New Mexico Department of Transportation (NMDOT), AR technology has the potential for transforming bridge management, bridge inspection, and bridge inspection training.

Objectives

This research project will implement AR in real-world bridge inspection operations and training by exploring AR capabilities and attributes to enhance both the inspection missions and training. This research project will implement several AR tools developed for inspection following inputs from the NMDOT bridge bureau, such as accessing to the data from past inspections in the field through real-time deployment of data in the headset. Additionally, this research will test the ability of these AR interfaces for transforming the training process of new bridge inspectors, who can be the first adopters of this technology, and will be the ones that can adapt it best for the future of bridge field inspections. The research will include connecting the data of lidar, laser, or other spatial collection techniques obtained in the past inspections to the inspector.

Processed photo



Raw photo



Figure 1. Illustration of concrete crack characterization

Intended Implementation of Research

Workforce Development, Education, and Outreach: The involvement of precollege, undergraduate students, and inspectors and infrastructure owners will enable the training of students and existing inspectors in augmented reality technologies while developing them and testing them in their operations. We plan to intern both high school and undergraduate students and also recommend minority students to TRB scholarships and support to expose them to careers in transportation. The participation of a wide variety of transportation experts in the review panel will ensure significant outreach in this project. This research project will also be presented during Engineering Open House activities, high school meetings, and other community events like STEM that introduce young students to the importance of transportation engineering.

The results of this research will be tested by the researchers in real-world inspection missions. We have currently tested the AR application in a NMDOT bridge (December 2021, see photo below) and plan to conduct more inspections in New Mexico in the implementation phase of this research.

Anticipated Impacts/Benefits of Implementation

The efficacy of the proposed system is being evaluated by the inspectors and managers in NMDOT. The collaboration with NMDOT is current and ongoing. The hands off inspection and the ability to measure data in the field is already very positively assessed by the NMDOT and the inspection community already.

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.

