Remote Sensing with Mobile LiDAR and Imaging Sensors for Railroad Bridge Inspections

(*Safety IDEA Project S-26*)

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Problem Statement

In the United States, there are more than 76,000 railroad bridges that cover over 1,700 miles. Thousands of steel bridge spans currently in service are approaching 100 years of age. Visual inspections of railroad bridges are necessary to evaluate their structural health and ensure safety operations within the railroad system. A major concern from field experts is that visual inspections vary from inspector to inspector, and sometimes from inspection to inspection when performed by the same inspector under varying circumstances. These inspections are also very time consuming and often require inspectors to operate under high-risk settings. Therefore, there is a need to investigate ways that may lead to reliable, safe, and objective evaluations of the structural health of bridges.

Objectives

This research proposes an investigation into the applicability of using mobile Light Detection and Ranging (LiDAR) technology and image data for railroad bridge inspections. Key objectives are:

- Develop prototypes of **image processing algorithms** to detect and classify bridge defects (e.g., concrete cracks).
- Develop **3D bridge models from mobile LiDAR sensor data** to be used for detecting particular bridge defects such as structural deformations due to settlement.
- Attach the image and mobile LiDAR sensors to an **appropriate platform for remote sensing of bridge data**. The team anticipates this platform will be an unmanned aerial vehicle (UAV).

Solution Approach

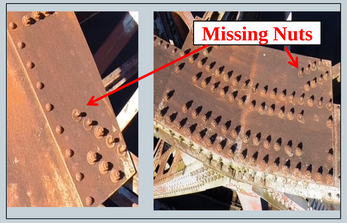
Systems Engineering

Stage 1:

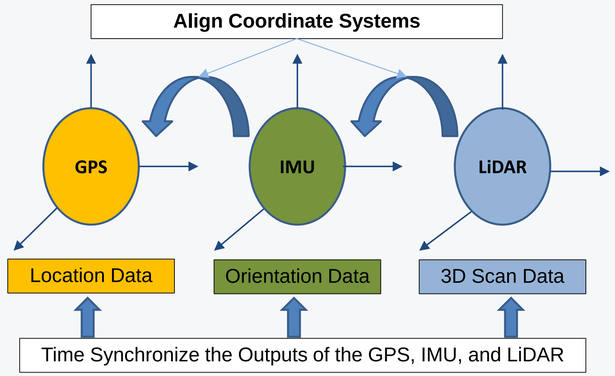
- Planning activities and field tests
- Develop prototypes of image processing algorithms for defect detection and classification
- Develop 3D models of bridge structures from LiDAR data

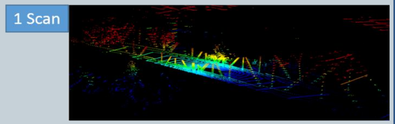
Stage 2:

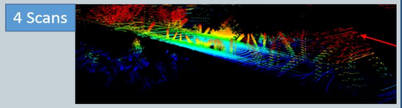
- Integrate image and mobile LiDAR sensors into an appropriate platform (e.g., UAV platform)
- Conduct field tests to collect data using the integrated platform

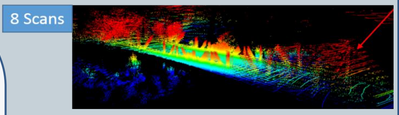


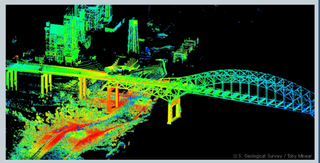
Geo-Referencing











Collaboration with Industry Practitioners

- CSX Transportation
- FDOT

Potential Payoff to Practice

- Improved safety and accuracy of inspections
- Reduced inspection costs

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