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RESEARCH BRIEF

LiDAR, Drones and BrIM for Rapid Bridge Inspection and Management

Yelda Turkan, Ph.D., Paolo Calvi, Ph.D.

Background

The Federal Highway Administration requires that all states perform biennial routine inspections of each bridge and recommends annual or twice-a-year inspections of bridges classified as structurally deficient. This element-based bridge inspection procedure typically takes several days depending on the size of the bridge and may impact traffic severely as it may require closure of lane(s). In addition, the current bridge inspection process requires that experienced inspectors record relevant data manually using checklists and paper notes, which is subjective and inefficient, especially for large and complex bridges. Besides, inspectors are exposed to a variety of safety risks while using lifting equipment. Also, such equipment is expensive and causes traffic interruptions. Bridge inspection reports include information regarding the condition of the bridge and are used for maintenance and preparing for subsequent inspections. These reports are typically stored in bridge management systems (BMSs) or in physical archives. With the increasing amount of information including digital images obtained from each bridge inspection, current BMSs are becoming inefficient. It becomes worse when different project teams input a large amount of inspection data to current BMSs, where key information can be obscured due to the low efficiency of these systems. This can often prevent engineers from fully understanding how the condition of a structure has changed over time.

Research Project

To overcome the challenges associated with the current bridge inspection and management approaches, a number of researchers have implemented a variety of technologies including unmanned aerial systems (UAS), a.k.a. drones and lidar for as-is rapid and accurate bridge data collection. However, processing this data is not fully automated and persists as an extremely time consuming and challenging task. Bridge Information Models (BrIM) is another technology that has been investigated in the context of bridge inspections and management. BrIM is an object-oriented database that enables storing all bridge data, including 2D drawings and 3D models, inspection notes, images and maintenance information.

Therefore, the main objective of this study is to develop a novel, systematic approach that implements UAS, lidar and BrIM technologies to improve the efficiency in current bridge inspection and management practices. It will enable rapid collection of 3D geometrical information from existing bridges in the form of digital images and 3D dense point clouds using drones and lidar equipment to identify, quantify and classify concrete cracks and spalling using computer vision algorithms and map them onto 3D BrIM in an automated and efficient manner. In summary, we will develop a framework to improve the current bridge inspection and management practice significantly in terms of efficiency and safety, thus improving public mobility.

ABOUT THE AUTHORS

The research team consisted of Yelda Turkan of Oregon State University, and Paolo Calvi of the University of Washington.

ABOUT THE FUNDERS

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EXPECTED DATE OF COMPLETION

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FOR MORE INFORMATION

https://depts.washington.edu/pactrans/research/projects/lidar-drones-and-brim-for-rapid-bridge-inspection-and-management/