Title:

Abstract:

1. Introduction
   1. Mid- to far-range spatial data collection methods for infrastructure and facility management are not 100% automated due to manual pre- and/or post-processing.
   2. Digital twin, which is a digital replica of a living or non-living physical entity in the built environment, can play a critical role in saving time and resources for maintaining existing infrastructure [01]. Singapore has developed and experimented with the entire city’s digital twin to improve city life and sustainability [02]. One of the digital twin core steps for the built environment is 3D modeling and digital mapping of existing infrastructure. The biggest challenge associated with the digital twin era is that there is the large number of built infrastructure systems that need to be identified, inspected, and digitally mapped. It is not possible to manually perform these steps. For instance, there are 130 million electricity poles around the United States [03]. There remains, therefore, a critical need to develop automated processing methods to identify correctly, rigorously inspect, properly map, and effectively store a digital replica of existing infrastructure toward the digital twin era. In the absence of such methods, the promise of restoring and upgrading of existing infrastructure through digital twin will likely remain problematic.
2. Background
   1. *Machine Learning for Infrastructure and Facility 3D Modeling*
      1. *Machine learning before constructing 3D modeling*
      2. *Machine learning for 3D modeling*
   2. *State of practice in spatial sensing for infrastructure and facility management*
   3. *Image reiteration using GPS coordination*
3. Methodology
   1. Overview of the Workflow
   2. Monocular video stream -> object detection (CNN) -> video cropping without detection boxes (coordination) -> save as image files (optimized # of images) -> GPS information integration -> create 3D sparse point cloud -> compare with 3D sparse point cloud which is constructed through circular data collection
4. Implementation and Results
   1. Implementation details
   2. Result comparison
      1. Visual comparison
      2. # of point clouds
      3. Blind spot
5. Conclusion and Future Work
   1. Summary
   2. Future work
      1. There is a connected 2nd camera automatically zoom object & captures the objects by automatically rotating toward the interested objects
      2. Better resolution -> better quality of 3D sparse point cloud?