

Implementation of Bridge Inspection Using In-House Drone

*Kuan Yen¹⁾ and Chia-Ming Chang²⁾

^{1), 2)} *Department of Civil Engineering, National Taiwan University*
¹⁾ d11521010@ntu.edu.tw ²⁾ changcm@ntu.edu.tw

ABSTRACT

Structural safety of bridges is a critical issue for transportation infrastructure. After construction is completed, bridge structures are recommended to be inspected every two years for the purpose of maintenance and repair. This inspection conventionally relies on professional engineers to detect and evaluate the current bridge conditions visually; however, this sort of inspection is error-prone and not cost-effective. In recent years, Unmanned Aerial Vehicles (UAVs), or drones, have gained a lot of popularity due to their capability of capturing spatial information and their high mobility. The objective of this study is to present an approach to bridge inspection that uses advanced UAV technology to enhance the inspection process. To avoid weak global navigation satellite system (GNSS) signals, the tight integration of ultra-wideband (UWB) range measurements with a real-time kinematic (RTK) method is proposed for the autopilot of UAVs. For damage assessment, the Mask R-CNN learning model is employed and trained to detect bridge defects. Subsequently, this combination is implemented and verified through field experiments. Two in-service bridges are selected as the test bed to evaluate an UAV in the GNSS-denied environment for bridge inspection, while the actual photos taken from the UAV's camera are used to identify multi-class defects.. As a result, the in-house drone significantly enhances the effectiveness and safety of bridge inspections by providing access to hard-to-reach areas. The recognition results from the AI-based detection models finally determine the current conditions of these two bridges.

¹⁾ Ph.D. Student

²⁾ Professor