

Enhancing Tower Crane Safety: A UAV-based Intelligent Inspection Approach

Authors : Xin Jiao, Xin Zhang, Jian Fan, Zhenwei Cai, Yiming Xu

Abstract : Tower cranes play a crucial role in the construction industry, facilitating the vertical and horizontal movement of materials and aiding in building construction, especially for high-rise structures. However, tower crane accidents can lead to severe consequences, highlighting the importance of effective safety management and inspection. This paper presents an innovative approach to tower crane inspection utilizing Unmanned Aerial Vehicles (UAVs) and an Intelligent Inspection APP System. The system leverages UAVs equipped with high-definition cameras to conduct efficient and comprehensive inspections, reducing manual labor, inspection time, and risk. By integrating advanced technologies such as Real-Time Kinematic (RTK) positioning and digital image processing, the system enables precise route planning and collection of safety hazards images. A case study conducted on a construction site demonstrates the practicality and effectiveness of the proposed method, showcasing its potential to enhance tower crane safety. On-site testing of UAV intelligent inspections reveals key findings: efficient tower crane hazard inspection within 30 minutes, with a full-identification capability coverage rates of 76.3%, 64.8%, and 76.2% for major, significant, and general hazards respectively and a preliminary-identification capability coverage rates of 18.5%, 27.2%, and 19%, respectively. Notably, UAVs effectively identify various tower crane hazards, except for those requiring auditory detection. The limitations of this study primarily involve two aspects: Firstly, during the initial inspection, manual drone piloting is required for marking tower crane points, followed by automated flight inspections and reuse based on the marked route. Secondly, images captured by the drone necessitate manual identification and review, which can be time-consuming for equipment management personnel, particularly when dealing with a large volume of images. Subsequent research efforts will focus on AI training and recognition of safety hazard images, as well as the automatic generation of inspection reports and corrective management based on recognition results. The ongoing development in this area is currently in progress, and outcomes will be released at an appropriate time.

Keywords : tower crane, inspection, unmanned aerial vehicle (UAV), intelligent inspection app system, safety management

Conference Title : ICCEACT 2025 : International Conference on Civil Engineering and Advanced Construction Technologies

Conference Location : New York, United States

Conference Dates : January 28-29, 2025