

Use of UAV to Facilitate Manual Inspection of Underground Support Works

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Extended Abstract

In traditional construction projects, on-site engineers need to carry out inspection tools such as tape measure, pencil and textbook, ruler, and camera, and judge the on-site construction status based on visual inspection and experience. When the site area is large, it takes a lot of time to check the construction progress. It is also sometimes necessary to temporarily stop operations due to construction inspections, and due to the large number of inspection items, inspection efficiency can't be improved. The lack of scientific means and tools impedes effective management of people, machines, materials, and construction environment.

Technology always comes from need. In recent years, due to the advent of unmanned aerial vehicles (UAV), construction companies have begun to adopt various information technology. UAVs are widely used to assist project management in the reduction of manpower requirement as well as to improve projects quality control [1-4]. The application of UAVs can expedite construction progress, also reduce labor cost.

Faced with the trend of aging and declining birth-rates, labor is in scarce supply; construction engineering manpower around the world is facing structural changes. This study uses UAV aerial images combined with ContextCapture modelling software to implement construction image size inspection and progress recording from bird's view, instead of traditional time-consuming and error-prone manual inspections.

An empirical case study is conducted to implement the proposed procedure and to assess the outcome. The project is a reinforced concrete building with a total area of 19,800 square meters, including 5 stories aboveground and 4 stories underground. The UAV selected is DJI Phantom 3 Advanced model. It is used to perform the inspection of underground support works. Using UAV combined with 3D modelling can indeed facilitate manual inspections, avoid accidents during manual inspections, and improve the efficiency of project management; it is more suitable for projects with large areas, and objects that are uncovered, uniform and arranged regularly. However, the inspection work is involved with more detailed observation on the assembly and locking components. In such cases, UAV may not fully replace manual inspection. The usefulness and accuracy of UAV images may be influenced by weather, environment, and hardware limitations. A better machine-human interface will be needed to reduce post-processing workload. It is hoped that the use of UAVs can be more popular in construction sites in the future.

Keywords: unmanned aerial vehicles, inspection, underground support, image processing

References

- [1] N. Hallermann, G. Morgenthal (2014). "Visual inspection strategies for large bridges using Unmanned Aerial Vehicles (UAV)." Proceedings of the 7th IABMAS, International Conference on Bridge Maintenance, Safety and Management; Shanghai, China. 7–11 July 2014, pp. 661-667.
- [2] Y. Ham, K. K. Han, J. J Lin and M. Golparvar-Fard. (2016). "Visual monitoring of civil infrastructure systems via camera-equipped Unmanned Aerial Vehicles (UAVs): a review of related works." Visualization in Engineering.

- [3] T. Narumi, S. Aoki and F. Muramatsub (2019). "Indoor visualization experiments at building construction site using high safety UAV", 36th International Symposium on Automation and Robotics in Construction, Canada, pp. 961-966.
- [4] W.W. Greenwood, J.P. Lynch, D. Zekkos (2019). "Applications of UAVs in Civil Infrastructure." Journal of Infrastructure Systems, 25, 04019002.