The Application of UAV Oblique Photography Technology in Architectural Design

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Abstract. It is difficult to realize the coordination analysis of the new building and the surrounding original buildings with the traditional architectural design method, in which the site survey often stays in 2-D stage. In order to solve these problems, we use various instruments and equipment to conduct experiments, such as Phantom 4 RTK. It is proved that using the Oblique photography technology to design 3-D real-time modeling auxiliary building helps to integrate the building and the surrounding environment during the design stage, thereby improving the efficiency and quality of the building design, and improving the harmonious between the architecture, human being and nature.

Introduction

With the acceleration of urbanization and the application of UAVs, the UAV Oblique photography has advantages in the field of architectural design. This paper introduces the characteristics of UAV Oblique photography and its advantages in the stage of architectural design. It also discusses the application of UAV Oblique photography in architectural design and construction related fields. It has great advantages in site survey, project scrutiny, building analysis and construction acceptance.

Features and Advantages of Drone Oblique Photography

UAV Oblique Photography Construction Workflow

The UAV Oblique photogrammetry will be equipped with multiple sensors on the same flight platform, and images will be acquired from five different angles, such as vertical and four tilts, and then processed by software to form a real-life 3D model. Its work is mainly divided into two parts: image acquisition (outside industry) and image processing (inside industry). The specific work flow can be divided into the following four stages: Stage 1: The UAV is commissioned before shooting. After reaching the measurement area, the ground phase control point is set in the measurement area, and its coordinates are collected. The phase control point can be painted or sprinkled. In the way of lime, etc., the layout should be controlled as a whole and evenly distributed. Phase 2: Data input and acquisition, assemble the aircraft, set the planned route in the intelligent flight terminal APP, and give the flight height and photo overlap. Stage 3: data sorting and model building. After the above stages, photos with certain overlap can be obtained. Then the photos are imported into the 3D modeling software for processing, and the coordinate system is selected to input the coordinates of the phase control points collected by the field into the software. Process it and finally model the output osgb model. Stage 4: Model application, the obtained model is conveniently used in common building design software such as sketchup, 3ds max, rhino and other building modeling software.
Advantages of UAV Oblique Photography

Compared with the traditional method, Oblique photography has the advantages of simple operation, high work efficiency, high timeliness and rich output. It can be applied to site investigation and analysis in the early stage of building design, environmental building data collection, zero-gap data of construction land, medium term can be used for construction management, engineering supervision; later can be used for inspection and acceptance, and the program is compared with examples[1]. The UAV Oblique photography technology has the following characteristics: Firstly, it reflects the real situation of the ground object, and objectively displays the historical data retention. Secondly, tilt photography can realize single image measurement. Third: the side texture of the building can be collected. Four: the fifth facade of the building can be collected. Five: the results of the aerial photogrammetry technology of the drone can be applied in all aspects.

Characteristics of Drone Tilt Photography in Architectural Design

The drone Oblique photography technology can reflect the environmental conditions of the building in a multi-level and wide angle in the architectural design. It allows the architect to observe the plots to be built and the surrounding environment from all angles. The tilt photography technology model and the actual error can be controlled within 2cm[2]. The architect can accurately measure the height, length, slope, area and other data based on the tilt photography model, making the design work more realistic and intuitive, thus improving the architect’s work efficiency. The use of tilted photography models can be used throughout the architectural design process. Efficient and seamless interoperability in program design, animation effects demonstration, BIM construction, and results acceptance.

The Use of Drone Tilt Photography in Architectural Design

The Use of Drone Tilt Photography in the Field Research Stage

Nowadays, in the field of pre-construction site research, field surveys are used, especially for large-scale buildings. Architects need to inspect a large area of construction site in a short period of time, as well as the environment and road conditions around the site. It influences the ability of architects to observe and judge, and it requires the team and the individual to spend a lot of time and energy on the site modeling and detail investigation, resulting in waste of time and energy, and there are many problems, such as it is easy to ignore the relationship between the surrounding building’s environment and the site, or people should research again and again. The UAV Oblique photography
can capture the factual material of a large area in a short time to provide real-life modeling needs. It only needs to combine the professional 3D modeling software for solid modeling after the investigation, and combine with the field research results to refine the model. It is convenient for the architect to check the traffic situation of the construction land and its surrounding environment at any time after the investigation, to solve the existing problems in the site in time, better adapt to the existing environment, minimize the time cost, and improve the efficiency of the architect.

**UAV Oblique Photography in the Program Stage**

In the preliminary formation and deliberation stage of the architectural plan, the architect can use the sketching, 3ds max, rhino and other modeling software to present the idea of the existing site and the idea of building construction as a 3D information model\(^3\). After detailed scrutiny, the import is not The site information model produced by the human-machine tilt photography overlaps the existing site with the architectural plan. By comparing the harmony and adaptability of the relationship with the surrounding buildings, it seeks a better way to construct a building with harmonious construction of the new building and the original building. relationship. It is necessary to find problems in time and make timely revisions to avoid problems such as problems found in the construction phase of the building and thus prolonging the construction period. UAV Oblique photography can be more directly and specifically communicated with the builder after it is applied.

**The Role of Drone Oblique Photography in Architectural Analysis**

The building analysis map is based on the current situation of the construction site and determines the direction of the building design in the architectural design. Aerial Oblique photography can assist in the establishment of the site and surrounding environment models for easy analysis and use of the building. Compared with the current common building analysis methods, the analysis using the Oblique photography model can be more intuitive in performance, more accurate in data, and more specific in results, especially in the analysis of solar radiation analysis and energy saving analysis of buildings. The data in the analysis scheme obtained by human-machine Oblique photography can more accurately and concretely describe the current conditions of the site. The current status model of Oblique photography avoids the problem of the differences between the current situation and drawings caused by extension and reconstruction, guarantees the accuracy of the analysis of new buildings, and indirectly guarantees the quality of new building design. At the same time, the establishment of the Oblique photography model can solve the problem of incomplete data collection caused by the short time of the designer's on-site investigation, and ensure the comprehensiveness of the building analysis.

**Application of Tilting Photography of Drones in Construction Process and Acceptance**

During the construction and acceptance process, the Oblique photography can be used to collect model information for the built or completed building. Comparing the collected information data model with the design data model makes it easier to assess the degree of construction completion and accuracy. At the same time, during the construction process, the design side, the construction side, and the owner can communicate through the oblique photography model and solve the partial construction problems. This measure can enhance the communication between the three parties and reduce the economic cost and time cost of the design side field service during the construction process. And the drone photography of the drone can play an important role in the construction project management, which can reduce the economic loss and time waste caused by human factors, and ensure the high quality of the project on time.
UAV Oblique Photography in the Construction Related Field

UAV Oblique Photography Ancient Construction Surveying and Mapping Application
The existing ancient surveying and mapping methods mainly include manual surveying and laser radar scanning. Most of the drawings with this method are matched with some pictures in order to show the color of ancient buildings. The Obliquing photography of the drone can accurately construct the outer contour shape and color of the ancient building, which greatly improves the efficiency and accuracy of the ancient building surveying and mapping. In the ancient surveying and mapping, the Obliquing photography of the drone can be accurate, fast and easy to operate in the surveying and mapping of the building\(^4\). It can be combined with manual surveying and mapping to quickly map the real ancient construction form and the surrounding environment.

UAV Oblique Photography Real-time Effect Map Production and Application
The actual renderings are mainly drawn by professional image processing software such as photoshop, which pays more attention to the architectural and aesthetics, and is not in line with the actual effect of building the building. Moreover, the current real-life renderings are mostly flat images with a single viewing angle, and the production time is longer and the technical requirements for personnel are higher\(^5\). The effect map created by the UAV Oblique photography modeling can truly and accurately show the relationship between the new building and the original site. The effect is more consistent with the real effect after the completion, and the 3D dynamic display effect can be produced. The production speed is shorter than the traditional method, and the operator is easy to use.

UAV Oblique Photography Urban Planning Application
The use of Oblique photography in urban planning can visualize the planning effect and assist the relevant government departments in the design, modification and final implementation of the planning plan. By superimposing the data of the planning scheme in the Oblique photography of the drone, the planning scheme and the environmental content can be made clearer, and the location of the construction project in the planning is facilitated\(^6\). It can help urban planning managers make scientific planning and decision-making on cities to jointly promote the healthy development of cities. At the same time, UAV tilt photography can be used to store urban data from different eras, visually display urban changes, and provide good evidence for the development of the city.
Conclusion

In summary, the UAV Oblique photography technology is used in architectural design, which is innovative and advanced. The use of drone tilt photography technology for architectural design is conducive to project conception, data collection, and communication and management in the architectural design process. Especially in the urban villages, the urban-rural junctions and the relatively messy areas of the building, the use of drone Oblique photography technology has obvious advantages in architectural design, which is convenient for optimizing the design and reducing the project cost.

At present, the application of Oblique photography technology in architectural design still has some defects, mainly reflected in the fact that there may be data model missing in the dense mixed area of the building, and the smooth surface of water surface and glass lacks texture features. With the gradual development of tilt photography, its role in architectural design will become more and more important, bringing revolutionary changes to architectural design, construction, engineering management, and completion acceptance.

References


