Future Prospects of UAV Tilt Photogrammetry Technology

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Abstract. In recent years, China's science and technology have developed rapidly, and the surveying and mapping industry has also made great breakthroughs. Traditional aerospace photogrammetry cannot collect more accurate information from modern surveying and mapping. In recent years, UAV tilt photogrammetry technology has been developed. UAV tilt photogrammetry technology can more realistically reflect the position and appearance of features. Traditional aerospace photogrammetry can only perform vertical data acquisition, but tilt photogrammetry can perform fast and efficient data acquisition from different angles. Not only that, tilt photogrammetry has greatly improved the image matching and measurement technology. This paper analyzes the future development trend and application fields of the development of tilt photogrammetry technology.

1. Application of tilt photogrammetry technology in 3D modeling

With the rapid development of surveying and mapping geographic information in China, 3D modeling technology is gradually integrated with UAV photogrammetry. Nowadays, 3D modeling has become the top priority of UAV tilt photogrammetry technology. The quality and shape of the model will directly affect the results of the later use. UAV tilt photogrammetry can obtain the most original geographic information data through image capture, but it is likely to be affected by temperature, light, wind and other factors during the shooting process, so that the color saturation of the original data changes, so it needs to pass Some modeling software processes the data. Traditional 3D modeling uses modeling software such as 3DMax and Auto cad. Although these modeling software can model image data, CAD plans, captured images, etc., to estimate the approximate contour and height of the building, the accuracy of the model data produced by this software is relatively low, and the modeling results are actually there is a big error. Moreover, it takes a lot of labor, and the production cycle of these software is long, so the timeliness of the data is low, and the user's needs cannot be truly met. Through the analysis of the above software's shortcomings, the most widely used is the Smart3D modeling software. Based on the UAV tilt photogrammetry technology, the Smart3D software can be used for image processing, joint area adjustment, multi-view intensive matching and Key technologies such as texture mapping enable fast and accurate construction of 3D models in experimental areas. The Smart3D automated modeling principle is shown in Figure 1.
Smart3D is a full-scale parallel software system based on image automation for 3D model building. Smart3D’s main tool modules are Smart3D Capture Viewer, Smart3D Capture Setting, Task Sequence Pointing Settings, and Smart3D Capture SceneComposer. The software can professionally process the collected data, and the software can generate high-density point clouds by using continuous stereo image pairs without human intervention and further generate a triangular grid. Finally, the model is built with a three-dimensional grid model of real texture. The specific operation process is shown in Figure 2.

Tilt photogrammetry technology can fully sense a variety of complex scenes, and tilt photogrammetry technology also has a wide range of high-precision, high-definition features, through the efficient data acquisition equipment and professional data processing process to generate 3D models can be more intuitive Reflecting the height, appearance, location and other attributes of the building, it provides a guarantee for subsequent use and measurement accuracy. Simultaneous tilt photogrammetry technology also greatly improves the production efficiency of the model. Traditional manual modeling takes one to two years to complete the modeling of a small and medium-sized city,
but tilt photography modeling takes only three months to five months. This can be done, greatly reducing the time and economic cost of 3D model data collection. At present, not only has the application of tilt photogrammetry technology been widely carried out in China, but most countries in foreign countries have also adopted tilt photogrammetry technology for modeling. Tilted photography modeling data has gradually become an important part of urban spatial data framework.

Not only that, tilt photogrammetry technology has overturned the traditional 3D modeling, low efficiency, high cost, labor, and other problems, only need to carry multiple sensors on the same flight platform, you can collect remote sensing images from different angles, collected data the world can be viewed more intuitively, with high precision and a strong sense of reality. The oblique photogrammetric data acquisition is shown in Figure 3.

Tilt photography uses five lenses mounted on the aircraft and simultaneously shoots in five different directions: front, back, left, right, and bottom, allowing the user to observe the objects from multiple angles and more realistically reflect the actual objects. Happening. The captured images can be directly measured in height, length, area, angle, slope, etc. In addition, the images taken by the drone tilting photogrammetry have the characteristics of real picture and high precision, which greatly improves the urban three-dimensional construction. The efficiency of the mold.

2. Application of UAV tilt photogrammetry technology in smart city

2.1. 3D real scene technology

Nowadays, with the rapid development of technology, 3D real-life technology has been applied to various fields. In modern society, multi-level 3D real-life technology is used to construct a new era of visible 3D smart city. Based on tilt photography, 3D design technology is used to fully demonstrate the true face of the city. It can bring about the protection of social traffic safety now and will have a certain positive impact on the safety of the current residents and the good operation of the public security system. In order to introduce merchant investment, increase urban tourism services, and improve the economic benefits of the entire city, digital forms are adopted. Show the spirit of the entire city and analyze the problems of the whole city more clearly. However, most application technologies use foreign technology and do not have their own technology, such as French modeling software. Technically, airborne LIDAR and tilt photography can be used to combine 3D modeling of the real world of the city. It can intuitively reflect the real situation of the city. This modeling method cannot only quickly acquire a wide range of spatial information and multi-angle image information. It
truly reflects the three-dimensional terrain of the city and can also establish a model with high positioning accuracy.

Secondly, after the software project is re-inspected, the encryption work is performed, the corresponding data is checked, and after checking that there is no corresponding error, the data in the software project is submitted to the empty three projects, and the technology is used for matching. And on the basis of computer operation, by calculation and subsequent adjustments and the like, until the empty three work satisfies the required conditions, the image is finally obtained to facilitate the use of the subsequent three-dimensional image.

Finally, the three-dimensional model reconstruction system is used to establish a triangulation model constructed by three-dimensional model combined with triangulation, and then through a series of image work to realize the clarity of the city's three-dimensional model, so that the 3D model is closer to the real image.

2.2. Planning and preparation

As one of the important geographic information in planning, digital topographic maps can provide more scientific geographic information products for planning and design departments. Combining GIS data with tilted photogrammetry can improve the accuracy of digital topographic maps, so modeling is highly efficient. Today, more and more construction companies are able to obtain slanted photogrammetry data during aerial photography using drones, but this approach has certain drawbacks. In this case, the construction company needs to introduce image positioning elements into the image to make the topographic map data more accurate. Technicians can collect several coordinate data by working in the test area and can detect the actual parameters of the tilt photogrammetry to plan the topographic map more scientifically.

2.3. Planning and management

In the planning and management of UAV tilt photogrammetry technology, the urban state model is established. The planning and approval links and the auxiliary planning and inspection links are different from the traditional modeling methods. The oblique photogrammetry method makes reasonable application of big data processing technology. Modeling is more efficient. For the whole city, the tilt photogrammetry system can establish a large-scale status model in the process of aerial photography and then complete the establishment of the city's three-dimensional model, which can update the digital city time and fully reflect the scientific nature of the urban geographic model. Due to the many structural features of the current building space, the analysis process has certain difficulties; at the same time, the building components are large in scale and various in variety. The traditional verification method is mainly based on chart information, and it is difficult to accurately reflect the spatial structure of the project construction and the actual situation of the project construction. In the development of tilt photogrammetry, by modeling the building, it can effectively compensate for the shortcomings in the traditional as-built measurement work. Compared with the design scheme, the parameters of the construction project can be optimized in time, so that the city-state model can update the model library online; for the planning and approval process, the technician needs to combine the feature editing environment in the 3D virtual city. When scientifically controlling multiple program indicators, technicians can handle the problems in the diagram. Since the construction index data based on building density can be directly measured, the efficiency of construction project approval is getting higher and higher. Providing more scientific reference and planning supervision for decision-making departments is of great significance to urban engineering construction. In some cities, planning and monitoring operations or traditional manual inspection methods not only reduce work efficiency but also ensure the accuracy of the data. Applying tilt photogrammetry technology to planning monitoring can not only establish a more accurate image map but also fully exploit the advantages of the 3D model to analyze common problems of the project.

The tilt photography technology adopts the new technology pioneered by the update, which is in line with the open mind of modern people and creates a new era of happiness and wisdom. From the
actual application status, most of the existing tilt photography technology and Lanwei image technology come from other countries, which gives us some incentives. We should try our best to develop our own application technology and use our own research and development technology to create a new smart city era.

3. Application of UAV tilt photogrammetry technology in large scale topographic map drawing

At present, the topographic mapping of cities mainly uses field digital measurement, which is not only inefficient but also labor intensive. With the rapid development of UAV tilt photogrammetry technology, the use of this technology to develop large topographic maps has become a hot topic of exploration and experimentation. Using digital orthophotos and real-world 3D model data, 2D and 3D integrated measurement software is used to map and update geographic features.

As a basic surveying and mapping work, large-scale topographic mapping plays an important role in urban planning and construction, cadastre and real estate measurement, and engineering construction measurement. At present, mainstream large-scale topographic mapping methods include full-field digital mapping methods and aerial photogrammetry methods. The whole field digital mapping method has a large amount of work on site, complicated internal data processing, resulting in short data operation cycle and slow update speed. Traditional aerial photogrammetry methods are mainly used for the mapping of 1:2000 scale topographic maps. For a topographic map of 1:500 scale, the accuracy of the results is difficult to control.

In recent years, the drone aerial photography system has been easy to operate, low in cost and strong in mobility, and has been rapidly popularized and applied. The drone aerial photography system is used for large-scale terrain mapping, inherits the characteristics of the aerial photography technology of drones, and greatly improves the update efficiency of large-scale topographic maps. It has become a hot topic in current research. At present, the aerial photography system of drones is mainly based on no Aerial view of man-machine, used for drawing of large topographic maps, complete internal editing. Due to the limitations of the two-dimensional image data itself, there is a large amount of uncertain information in the process of collecting data in the industry. The development of UAV tilt photography has enabled the achievement data to be upgraded from two-dimensional space to three-dimensional space, which can reduce various directions and three-dimensional features. The features further reduce the amount of work on site and speed up data collection.

The large-scale topographic mapping process based on UAV tilt photogrammetry technology mainly includes data collection and analysis, image control point layout, UAV aerial photography, real-world 3D modeling, and internal data acquisition based on real-world 3D modeling results. And the field work and mapping work. As shown in Figure 4.

![Figure 4](image_url)

**Figure 4**: Large scale topographic map drawing process based on UAV tilt photogrammetry technology
Through the analysis of the above mapping process, it is concluded that the UAV tilt photogrammetry technology can meet the accuracy requirements in the large-scale topographic map mapping, and the oblique photogrammetry technology has the following advantages:

1. High work efficiency and low labor intensity. UAV tilt photogrammetry technology responds quickly, data acquisition speed is fast, and work efficiency is improved. Compared with the traditional large-scale topographic mapping method, the application of the UAV tilt photogrammetry technology can greatly reduce the workload and work intensity in the field.

2. Data collection is intuitive and comprehensive. The distribution characteristics of 2D and 3D online objects are more intuitive through orthophoto data and real-time 3D model data. Operators can capture and edit data directly in a 2D work environment.

3. The data has high precision and few interference factors. When measuring topographic maps, it is often encountered that the scene is not suitable or the terrain is too complicated, so it is difficult to ensure the accuracy of the topographic map. UAV tilt photography is used for large-scale topographic maps. Through the non-contact two-dimensional environment operation, the feature points of the feature can be accurately located to ensure the accuracy and comprehensiveness of the data.

4. Conclusion
The above is the exploration of the future development of the UAV tilt photogrammetry technology. Although the tilt photogrammetry technology has been applied to most fields in modern society, the operation mode still has certain limitations, if the flight data acquisition time in the season when the vegetation is lusher, the features of the three-dimensional model that are difficult to express due to vegetation obstruction still need to be supplemented by artificial means. It is believed that in the near future, UAV tilt photogrammetry technology can be developed more and more.

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