Application of UAV Photogrammetry Technology in Airport Project

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Abstract. At present, UAV photogrammetry technology is gradually applied in the field of Airport project survey, which improves the efficiency and accuracy of measurement, and ensures the overall effect of airport construction. The traditional manual measurement method is inefficient and easy to be interfered by other factors, so it is difficult to meet the needs of large-scale, high-efficiency and high-precision measurement of airport construction. UAV photogrammetry improves the efficiency and accuracy of measurement, which can provide important reference for airport construction.

1. Introduction

Airport project survey refers to the investigation and summary of airport location, area, topography, landform, and the current situation of surrounding land use by various technical means. Airport project survey runs through the whole process of airport construction and is the most important link. With the development of technology, a variety of new measurement technologies have been applied to Airport project survey, which has made great contribution to improving the efficiency and accuracy of engineering measurement.

At present, China is vigorously carrying out airport construction in various complex environments. The traditional measurement technology needs to invest more resources in more complex terrain areas, and the measurement efficiency and accuracy are difficult to guarantee. However, UAV photogrammetry has low environmental requirements and high accuracy, so it has a broad application prospect.

2. UAV photogrammetry technology

UAV photogrammetry technology mainly relies on UAV as the main information receiving platform. Through UAV airborne information acquisition and processing equipment, it collects ground object information and forms a three-dimensional digital model through data technology processing, so as to meet the development needs of the industry. This technology can intuitively reflect the appearance, location, height and other factors of complex geographical environment, and provide scientific data basis for real and effective geographic mapping. For Airport project, it is of great significance for...
improving the quality and efficiency of engineering construction to obtain the corresponding information parameters before the airport construction, which can also promote the development of digitalization and informatization of Airport project.

3. Measurement methods of UAV photogrammetry technology

Compared with the traditional measurement technology, UAV photography technology has higher technology content, faster information processing speed, and larger photography angle and scope. It can obtain the real situation of the airport site topography from multiple angles, and can also greatly reduce the investment of human and material resources [1]. When using UAV photography technology to carry out the Airport project survey, the following steps should be completed:

3.1. On-the-spot investigation

When using UAV to carry out Airport project survey, field workers need to determine the airport range to be measured. We can mark and analyze the operation area on the satellite map, and then arrive at the scene to identify and investigate the scope of the operation area. In addition, in order to avoid that the later work can not be carried out normally due to incomplete information acquisition of the airport project, the shooting range of the airport is usually larger than the actual construction scope.

3.2. Weather investigation

If the UAV is equipped with visible light device for aerial survey, the weather directly affects the measurement effect. Therefore, before the actual measurement, it is necessary to investigate and select the appropriate weather, including light, cloud thickness, site wind, temperature, humidity, etc.

3.3. Layout and data acquisition of ground photograph control points

The photograph control points should be reasonably distributed in the survey area, usually around and in the middle of the survey area. Figure 1 shows the general layout of the control points in an airport runway.

![Figure 1. General layout of control points in airport runway.](image)

3.4. Aerial survey

Before the UAV takes off, it should check the signal of base station, the battery power of aircraft, camera and ground station, and the remaining capacity of camera memory card. After the pre flight inspection, the UAV route planning is carried out, the waypoint and regional route height are set, the route overlap rate is adjusted, and the camera parameters are set. After confirming that the flight working condition is stable and reliable, the aerial survey operation can be carried out. It is necessary to observe the working conditions of the aircraft and batteries in time. In case of any abnormal situation, the task should be manually terminated in time to be ready to deal with the emergency situation at any time.

3.5. Office data processing

After the UAV photogrammetry is completed, the data of SD card, base station and fuselage are imported into the computer, and the data are analyzed and processed by the office workers with the help of the corresponding data processing software, and the airport contour lines, orthophoto images, digital elevation model, three-dimensional model and other results are drawn for the specific analysis
of the work in the future. Figure 2 shows the contour lines of an airport generated by UAV aerial survey and data processing.

![Figure 2. Contour lines of an airport generated by UAV aerial survey.](image)

3.6. **Analysis and evaluation of measurement results**
After completing the information acquisition of UAV shooting, the office workers evaluate and analyze the measurement results of airport terrain, and the evaluation of its accuracy mainly depends on the accuracy of the checkpoint results. Therefore, in aerial photography with the help of UAV, all the acquired data should be screened by the qualification and completion degree of inspection points, only when the inspection point is located These data can only be applied when the requirements are met and the completion of aerial photography meets the expectation [2].

4. **Application advantages of UAV photography technology**

4.1. **Expand the measurement range**
In the traditional measurement work, mainly by the staff carrying instruments for field measurement, due to the limitations of the working mode, the measurement scope can not be well expanded, which has a certain impact on the improvement of the quality of measurement work. In the measurement work, the application of UAV measurement technology, the scope of monitoring has been well expanded, and the work efficiency and quality of measurement have been effectively improved. In UAV aerial survey, it can also accurately measure the geological environment in some blind areas, which ensures the authenticity and reliability of the measurement work [3]. UAV measurement can present the measured data information through three-dimensional model, which improves the intuitiveness of measurement data and provides accurate and real data for the design and construction of Airport project.

4.2. **Improve measurement efficiency**
In some areas with complex geological environment. If the traditional staff topographic survey method is adopted, not only the survey data has a certain lag, but also the surveyors are in dangerous work, which poses a certain threat to the personal safety of the surveying staff. If we adopt the working plan of UAV topographic survey, we can quickly send out the survey UAV to survey the geological terrain, and can use the network to quickly feedback the survey data information.

4.3. **Reduce measurement cost**
In the preparation of some large airport projects, the preliminary survey work needs to consume a certain amount of funds. The measurement range of these projects is large and the content is many. If the traditional manual measurement method is adopted, the investment budget will be over estimated before the construction starts, which will have a certain impact on the economy and security. In the measurement work, through the application of UAV measurement technology, a lot of labor costs are saved, and the loss of measurement equipment is also controlled. Measurement belongs to the early stage investment of airport project. The smaller the investment is, the more favorable it is for the
development of airport project. The UAV measurement work can minimize the investment and maximize the work quality.

4.4. Intuitive display of information
Compared with the traditional measurement, UAV photographing can show the terrain and landform of the airport to be measured in a real three-dimensional visualization way, which is of great help to the construction and operation management of the airport. In addition, UAV aerial photogrammetry can also display the airport area, elevation, construction status, construction progress and earthwork excavation and filling amount, which significantly improves the construction efficiency of the airport and reduces the investment of human and material resources.

4.5. Provide diversified data
The traditional measurement can only provide the two-dimensional data of the airport, but the UAV photography technology can not only obtain more kinds and more accurate airport two-dimensional data, but also can model the acquired images with the help of corresponding software to form a three-dimensional model [4].

4.6. Timely feedback
When the manual measurement is carried out, the measured data information can not be transmitted to the design department in real time, but the measurement staff are required to summarize and collate the equipment measurement data and the recorded information to the relevant design department, which delays the timeliness of data transmission and reduces the overall efficiency of project development. The UAV measurement work can achieve information linkage, that is, when the actual measurement work is carried out, the specific image information and coordinate data of measurement can be quickly transmitted to the relevant design units, and the measurement can be carried out when the measurement work is in progress. That is to use UAV to re-measure the measured area, not only can the accuracy of geological information measurement be calibrated, but also the missing area can be found, which effectively improves the overall quality and safety of surveying engineering work.

4.7. Provide management basis for Airport
UAV photography technology can provide a large number of high-definition images and multiple types of data for the airport management department, and can provide clearer and more overlapping airport image data. At the same time, with the help of three-dimensional imaging technology, the acquired data information of Airport project is more intuitive and vivid. All these can make the relevant departments of the airport have a more clear grasp of the terrain and terrain characteristics of the airport. In the later stage of airport construction and operation management, we can make targeted planning with the help of these intuitive data [5].

5. Conclusion
With the current development of China's economy and the promotion of international influence, China's airport construction field is also in full development. Airport project survey is the foundation of airport construction. The traditional manual measurement has the disadvantages of low efficiency and inaccuracy. Through the application of UAV photogrammetry technology, it can effectively reduce the labor workload, and improve the measurement efficiency and accuracy, which not only accelerates the work speed, but also reduces the cost. Therefore, with the increasing speed of airport construction in China in the future, UAV photogrammetry technology will be further developed and applied, so as to promote the digital development of airport construction and management.
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