Study on the Key Technology and Application of UAV Surveying and Mapping Data Processing

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Abstract. With the rapid development of computer technology, the development of UAV in China is faster and faster, which has become an important tool in modern surveying and mapping. Through the integrated system composed of remote sensing technology, UAV can more accurately map out the relevant data, which will better solve the data difficult to be measured manually, including land, mine, environment, emergency, urban construction, etc. By improving the key technology of UAV surveying and mapping data processing, we can improve the accuracy of measurement, which is the focus of this paper. Firstly, the composition and data processing flow of UAV are analyzed. Then, this paper analyzes the key technology of UAV surveying and mapping data processing. Finally, this paper puts forward the main application of UAV in surveying and mapping.

Keywords: Case Tm, Art Design, Computer Aided, Design Teaching

1. Introduction

UAV is a complex system with various technologies, including aerial measurement, power control, navigation system, data transmission, flight control and other systems. It is a remote control equipment based on radio. In surveying and mapping, we usually use fixed wing and multi rotor UAVs, which have higher stability and flexibility. With drones, we can reduce the cost of detection. At the same time, by reducing hazardous operations, we can increase the safety of personnel. UAVs can be equipped with high-resolution imaging equipment, which can quickly obtain high-definition quality images\textsuperscript{[1-2]}. Through computer technology, we can preprocess the image, which will restore the real image data. Therefore, UAV measurement has been applied to many major projects, such as disaster emergency and processing, resource development, land supervision and so on. This will reduce the cost of raw data processing through data processing and manual processing\textsuperscript{[3-4]}. Therefore, in the modern society, UAV has been applied to many digital surveying and mapping, which has been widely recognized by various industries\textsuperscript{[5-6]}. 
2. UAV mapping data processing

2.1. Main components of UAV mapping
UAV is an integrated system based on remote sensing technology, which is mainly divided into four parts: UAV platform, ground real-time data processing equipment, data link system and ground data processing center, as shown in Figure 1.

2.2. Remote sensing data processing
Digital photogrammetry is a measurement method based on digital image and photogrammetric principle, which combines a variety of technologies, such as image matching, image search, pattern recognition and so on. Digital photogrammetry is the basic submission of photogrammetry. Therefore, the image data measured by UAV needs data processing. Through the output of original data, such as POS data, image control point data, camera calibration parameters, we can carry out adjustment calculation, which will get DEM, DOM, DLG and other data. The flow chart of remote sensing surveying and mapping data processing is shown in Figure 2.
3. Research on key technology of UAV surveying and mapping data processing

3.1. Camera calibration
Camera calibration is the most important basic link in UAV mapping system. The most important part of Surveying and mapping equipment is non measuring camera, which determines the accuracy of Surveying and mapping results. However, in the actual surveying and mapping process, due to the movement and flight of UAV, the camera will produce certain error, which will produce certain error. Therefore, we must constantly improve the accuracy of data processing, which requires professional verification. Camera error is mainly caused by the following two aspects. First, there is a large distortion of the camera lens. Secondly, it is difficult to determine the specific coordinates of the photo center and camera main distance, which will affect the judgment of image coordinates.

3.2. Aerial triangulation
Aerial triangulation is a common technology of UAV surveying and mapping data, which mainly includes adjustment calculation, image point matching and electrical measurement. Through the control points of field survey, we can calculate all the required control points and the exterior orientation elements of each photo according to certain mathematical model adjustment solution. Image matching is usually done by computer. By setting the parameters, we can automatically complete the matching of each image point in the computer system. A kind of

3.3. DEM production
After kernel resampling and image matching, we can generate DEM. High precision DEM data has many uses, such as drawing contour, slope, aspect, perspective, landscape and terrain model. The main methods of DEM data acquisition are along the contour line, regular grid, scanning along the cross-section, progressive, selection, combination and so on. Automatic DEM data acquisition is one of the most efficient data acquisition methods, which is often used in orthophoto production. After collecting DEM data points, we can use interpolation method to generate DEM. Spatial interpolation is a data method to obtain the whole research area by exploring the known spatial point data rules and
extrapolating or interpolating. After DEM is generated, we can edit it by man-machine interaction mode. DEM mainly includes global smoothing, local smoothing, loading external vector data to assist editing, which can map DEM grid points or automatic matching results to image stereo model.

3.4. DOM production
DOM is a digital orthophoto technology. After DEM is generated, we can use DEM to make digital orthophoto, which mainly depends on single photo correction. In the specific surveying and mapping process, we need to make the most scientific and reasonable processing of the aerial photos. At the same time, we should make appropriate clipping according to the specific scope of the map, which will get a scientific DOM image set. Through DOM, we can measure the geometric accuracy of map very well. In the actual processing process, we need to process the DEM data, which will correct the image color blending. Therefore, the quality of DOM production will seriously affect the effect of DEM data processing, which needs our attention. In the DOM production process, we need a large number of staff participation, which will better avoid the occurrence of errors. By reducing the impact of artificial buildings, we can continuously improve the final production accuracy of DOM.

3.5. DLG Data Production
Since INPHO has no mapping module, the Featureone module of mapmatrix system is used in DLG production. Through the new DLG project, we can activate the stereo model. In the acquisition window, we can select the corresponding figure symbol. By moving the marker to the corresponding feature, we can verify the elevation of the figure contour. By collecting the points, we can collect all the nodes on the figure contour. Featureone module supports the collection and drawing of point, line, surface, text and other elements, which has perfect quality control functions, such as data check, precision analysis, topology check, etc.

4. Application of UAV surveying and mapping data products

4.1. Land surveying and mapping
China has a vast territory and abundant resources. But the actual utilization rate of land is very low, which has a negative impact on the development of national economy. Through the application of UAV surveying and mapping data to land surveying and mapping, we can help the surveying and mapping personnel to master the details of the survey area more accurately and quickly, which can be fully applied to various industries such as land and resources dynamic monitoring and investigation, feature analysis, etc. For example, for areas with relatively poor environment, we can use high-resolution aerial image acquisition data for regional planning, which will help us to obtain more accurate mapping data.

4.2. Mine surveying and mapping
When mining, in order to ensure safety, we need to use UAV for mapping. Only by understanding the terrain, environment and traffic conditions of the whole mine, can we make clear the area, height and other data of the area, which is the basis for mining. Through the integration and analysis of Surveying and mapping data, we can provide corresponding guidance for mining.

4.3. Environmental monitoring
In social development, environmental protection is very important. Therefore, UAV mapping products have great responsibility and wide coverage in the environment. At the same time, UAV can monitor environmental pollution. Through understanding and mastering the overall situation, we can formulate solutions, which will improve the convenience of governance work. Through UAV, we can better monitor water quality, solid pollutants in the region, marine monitoring, oil spill monitoring of ships on the sea, which will be of great help to environmental monitoring.
4.4. Emergency relief
When there are earthquakes, landslides, mudslides and other natural disasters, we can use UAV to shoot from multiple angles. Then, we can feedback the relevant data to the control center, which can quickly obtain the image data of the disaster area in a short time. Therefore, UAV mapping plays an important role in disaster relief deployment and post disaster reconstruction, which can ensure the safety of personnel.

4.5. Urban construction application
Traditional subway, railway, automobile tunnel or bridge pier detection needs a large number of inspectors, which need to go deep into the tunnel or under the bridge to check the abnormalities. Only by this dangerous manual way can we ensure the safety of tunnel structure. Traditional methods have many disadvantages, such as excessive dependence on human resources, low efficiency and high safety risk. However, UAV can acquire high-precision image data through surveying and mapping. By generating three-dimensional model, we can provide engineers with the ability to call analysis at any time, which improves the efficiency of application.

5. Conclusion
In the new era, many advanced technologies have been integrated into the development of Surveying and mapping industry. UAV mapping technology plays an important role in surveying and mapping industry, especially data processing, which can effectively collect data and information in special areas. Through UAV, we can greatly improve the overall efficiency of Surveying and mapping work. UAV remote sensing technology is one of the more advanced measurement technologies, which improves the measurement accuracy and efficiency of Surveying and Mapping Engineering in China. Through UAV mapping, we promote the development of digital surveying and mapping in China. Therefore, we need to study UAV remote sensing technology in-depth, which has a positive significance for the development of measurement technology in China.

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