

Application of unmanned aerial vehicle (UAV) remote sensing technology in mine geological

Monitoring and control

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Abstract: This paper introduces the composition and working process of the UAV remote Sensing system, analyzes the feasibility Advantages of application of the UAV remote sensing techniques, the UAV Remote Sensing system geological environmental re Mediation project in the high resolution image and high precision data acquisition and image processing methods, summarize s the current existence of the UAVs Remote Sensing Technology application in the project of mine geological environmental remed Iation problems and directions of data postprocessing technology is prospected.

Keywords: unmanned aerial vehicle; Mine geological environment; renovation; DEM; Remote Sensing

as our comprehensive national strength continues to strengthen , Our economic society has entered the unified Development Phase , to realize sustainable utilization of land resources around mining area ,- strong Mining Area Land use management , Increase Mining land utilization , reasonably and fully make every inch of land imperative .

This paper mainly introduces the composition and workflow of UAV Remote Sensing system , and Apply this technique to the feasibility and technology of mine geological Environment Renovation Project line , and point out the problems in it , and future research directions

1. work process for geo-environmental remediation projects around mining area

1.1 UAV Remote Sensing System introduction

UAV Remote Sensing system is transmitted by the UAV system and the remote sensing on which it is carried sensor composition , is using advanced Unmanned aerial vehicle technology , Remote Sensing sensor technology ,, Remote control technology , communication technology ,GNSS Differential positioning technology and remote sensing should be collect ground data with technology , Remote sensing data processing through post-processing , Application of modeling and application analysis . UAV systems mainly include aircraft body , Flight control system , Data Link system , Launch Recycle system , Security and maintenance system ^[2] .

1.2 Mining Area environmental remediation unmanned aerial camera operation Flow

Environmental Remediation Unmanned Aerial Vehicle mission operation process mainly includes preliminary preparation , base data check , UAV data acquisition and imaging production , Mining Geology Environmental Remediation Engineering Information Extraction , Results External industry verification and feedback key links . UAV Aerial photography is an important link , Before the drone takes off ,, First

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Introduction to authors : Zhang Liang , men , Was born 1979 Year , Han , Hebei Dingzhou , Undergraduate , Senior Engineer Research Direction : photogrammetry and remote sensing , Geographic Information System Engineering , Real Estate mapping , Engineering Measurement .

data collection and spatial coordination , Route design and planning for the shooting area , True set Take-off and landing site and time , Check UAV devices . This mine geology Environmental Remediation Remote Sensing Monitoring project using Ebee UAV and its own software system Postflightterra 3D Software obtains basic remote sensing data . Chart by Operation | navigation route , detect navigation Progress , and send instructions .

1.3 Inner Workflow

After the drone flight is over , Internal operators download and organize data . to monolithic original image data , workflows include camera default and distortion correction , image Matching , Add an aerial triangulation for a like handle , DEM build , orthographic projection like correction and mosaic and remote sensing monitoring of environmental remediation in mining areas . The specific process is as follows .

(1) to use a single remote sensing image and flight gesture data , Exposure Point coordinates and time data to correspond, tab spare .

(2) Stitching Remote sensing images , to stitch together multiple single images into one Complete Zone Remote sensing image , The image at this time has only a rough geographic attribute ;

(3) with " Aerial triangulation The principle is based on , Geometry School for images Positive , Generate remote sensing images with relative geographic meaning ,Submit Image Results .

The software can automatically handle the images that are taken , generates high quality amount , Space reference 2 D and 3D image and digital elevation model (DEM). Even if the user is in the wild , software can also analyze the images that were taken , and generates a simple Easy to understand reports , users can immediately know if the image they are shooting meets the requirements .

2. Job Results

This project is a major project of land development and consolidation in a mining area in a western province .

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The job area features mountainous terrain , With flat and hilly , arable land is extremely uneven ,, East Yellow River valley , is the province's agricultural area the best natural conditions , arable land collection region , Agricultural Advantage highlighting , is an important Valley agricultural area on the Qinghai-Tibet Plateau .

Aerial Work selection for the mining Area land consolidation Project Ebee drones to complete , project data getting to 2015 year 6 month , shared drone images data1042 Zhang , Its flight record is : relative to navigation i m, course overlap 65%-80%, side to overlap less than 40%, Design Route Bar , overrides floor area about 15000 mu .set with The record information for the time of the capture and implementation set The embedded remote Sensing index shows that the entire aerial area is not leaking Pat and aerial quality issues .

3. Conclusion

This mining area geological environment Renovation project lasted Day , image Data Acquisition with 7 Day , Data processing 5 Day . compared to traditional remote sensing monitoring methods , Unmanned aerial vehicle Remote sensing technology has the following advantages : ① drone flight condition requirements more Low , does not require specialized airports and runways , less affected by climate conditions . ② Nothing Man-Machine remote sensing technology obtaining data low cost . Complete System low price , and move assemble simple ,3 Staff 2 hours can be assembled . ③ UAV Remote Sensing quick access to remote sensing images , from preparing for flight to acquiring a short video period , To be processed immediately after image acquisition , timeliness Strong , for mining area The remote sensing base map production of the surrounding land renovation project can be fully filled with full . ④ UAV Remote sensing technology to meet the low altitude digital photogrammetry within the industry regulation fan , compared to traditional remote sensing technology , can have a

precision of 1:500, 1:1000,

on an image control point in the field, to be tested in accordance with the relevant external measurement specifications. The network cloth points of the area are laid out. The control points of the photo are laid out by the Aerial survey. Link implements smaller objects for target selection, Guarantee Photo image clear. ext., After the Thorn point to the spot and in the field of the mapping point and text description of The explicitly describe the point and the surrounding specific object relationship. second, Industry data Collection and mapping of topographic maps, Surveying and mapping major in terrain and geomorphology mainly with the manual jobs mainly, A method for implementing three-dimensional tracking and stereo measurements. on the industry way, mainly external mapping, Editing and so on map way, to collect data on objects and landforms by certain specifications, generates a standard image data File.

assistance with other mapping data processing software, To implement the as shown in the diagram Map Edit, and complete digital forward image production. the is generated from the spacing of the 5 net DEM Data Editing analysis, Can be based on the current aerial survey image inside and outside elements and DEM data is corrected for aerial photography, gets the forward Images.

mosaic based on different mapping images, Trimming and grooming are in place, Completing the mining area forward images DOM makes.

(2) accuracy Analysis of UAV Low-altitude aerial photography in digital mine construction. The analysis of the precision of the survey area for the with respect to consists mainly of digitized measurement accuracy analysis and positive projection. The two major aspects of quality analysis for the image are. in this area for example, The terrain of the mining area is basically for mountain terrain, for communication lines, low voltage power pipeline, flat position image, wide To field measurement point error 1.2Times, The encryption point for the industry in the nearest field Control Point Image dot error controls in 0.55mm, field precision measurement is 1.1 m, "" error control of field points for controls in 0.8mm, field

1:200 Large scale mapping precision requirements.

But the application of UAV remote sensing technology still has the following problems: ① no One machine system capture smaller image width, overlap and distortion greater, It is possible to Current leaks, cause late-air three automation and precision reduction, Department with increased workload. Design with an existing image or terrain in the job area diagram data for GCP number of points and distribution area, to improve the geometry correction of precision. ② UAV controlled by flight control system, plus small quality, Inertia small, Poor attitude stability results in irregular data collection, should be better, improved aircraft hardware platform, add stability to. ③ for UAV Remote sensing Data disadvantage, Unmanned aerial vehicle large number of image data automation and thematic processing soft research and development is an urgent problem.

4. Outlook

UAV Remote sensing technology can be full of from hardware conditions and subsequent processing Foot Remote sensing basic requirements, especially suitable for instant remote sensing data with high resolution get, available for mining engineering planning, Geological Resource Management, Environment Survey, and more Realm. is feasible in actual project production, Precision is also reliable. it as a new remote sensing method, is bound to be widely applied. solid

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