Research of UAV-borne Multispectral Camera System Based on Narrow Bandwidth Filter Array

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ABSTRACT

Remote sensing images of high-resolution multi-spectral provide explanations and observations from both the spatial and spectral features of images and provide more valuable informations. It has the potential and advantages in remote sensing applications such as vegetation, agriculture, forests, environmental protection and disaster response. With the deepening and refinement of remote sensing applications, more flexible remote sensing platforms, such as low-altitude unmanned aerial vehicles and airships, are becoming more and more concerned and it complements traditional remote sensing methods with each other, such as satellite and aeronautical remote sensing technology. At the same time, UAV remote sensing systems are becoming one of the important platforms for high-resolution remote sensing data compared to the high maintenance and transition costs of airships. Therefore, high-resolution remote sensing applications based on light and small unmanned aerial vehicles have become the hotspots of whole industry. High resolution multi-spectral remote sensing data based on light and small unmanned aerial vehicles are widely used in crop growth, yield assessment, geological hazard assessment and environmental monitoring.The high-resolution multi-spectral remote sensing based on light and small unmanned aerial vehicles has put forward urgent requirements and higher requirements for the development of multi-spectral camera systems from sensor designing and data processing and so on.

A multi-spectral camera system for light and small unmanned aerial vehicles (UAVs)is designed in this paper, which can be used in vegetation remote sensing, agricultural remote sensing and forest remote sensing. Considering the carrying capacity and task execution capability of the light and small UAV platform, the author adopts the different imaging principle with the traditional multi-spectral camera, and then installs the filter array accurately in front of the detector. The multi-spectral images of each band region are obtained by the forward motion of the flight platform,

and the high-resolution multi-spectral images of the objects are processed. Compared with the traditional multi-spectral camera, the platform of the camera system is forward motion instead of the rotation, scanning and other mechanical movement and have the characteristic of light weight, small size, and is suitable for small UAV platform. At the same time, due to the larger detection device, it can obtain more adjacent pixels and wider side of the width, improve system task execution efficiency compared with the current market unmanned multi-spectral camera. The At the same time, in order to adapt with the multi-spectral camera imaging characteristics designed in this paper, the author improved the current image registration SURF algorithm commonly used. The algorithm improves the efficiency of data processing without affecting the approval accuracy, and meets the task execution requirements. The main content and research results of this paper in several aspects:

(1) Based on the strategy of filter array spectroscopy, a small-scale unmanned aerial multi-spectral camera system was developed.

(2) A improved common SURF image registration algorithm was proposed, which improves the registration efficiency of mass continuous images and maintains the image registration accuracy.

(3) First-hand development of the camera original image was obtained in the Chinese Academy of Sciences Huailai Experimental Station in a number of camera system UAV flight test; according to the flight test and data processing results, suggestions was proposed in updating the camera system, processing method and the development of the road map was proposed; This paper lay the technical foundation for availability and industrialization of this camera.

Key words: light small unmanned aerial vehicle (uav); Multi-spectral camera; Filter array; Image registration