

An optoelectronic system for fast search of low-slow-small target in the air

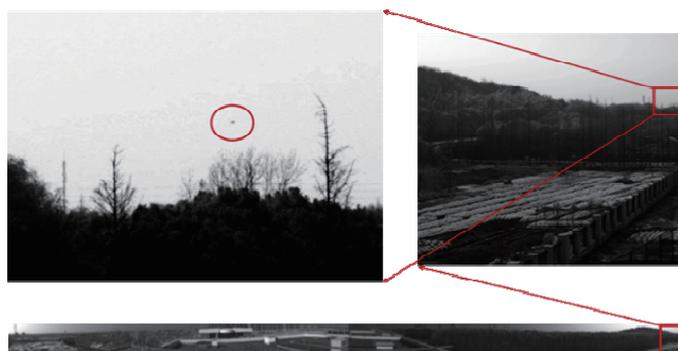
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UAV in panoramic images

Overview: With the development of technology, the maneuverability of all kinds of aviation aircraft are constantly enhanced. In recent years, low-altitude airspace has gradually opened up in our country, and man-kind low-altitude activities have increased, the management of aircraft in low-altitude airspace has become increasingly difficult. It has become a world-wide problem to prevent grand activities from the interference and damage of low slow small targets. At present, there are various methods to detect the flight targets in low altitude airspace, including radar detection, radio detection and photoelectric detection. Among them, the photoelectric detection method has the characteristics of strong anti-interference, intuitive and clear, flexible deployment and so on. Therefore, it is expected to play an important role in the search and discovery of low-slow-small targets in complex urban environment. In order to resolve the contradiction between the large field and the high resolution when using optoelectronic techniques to monitor small targets, Shanghai Astronomical Observatory developed an optical prototype system to search and find low slow small targets in low-altitude airspace. The system consists of a high-precision one-dimensional turntable platform, a large field-of-view refractor, a set of computers to control hardware and analysis images. Firstly, the linear CCD camera collects 360-degree panoramic images of low-altitude airspace in 8 seconds when the platform rotates continuously. Then the images are transferred to the computer through gigabit Ethernet slide ring and analyzed in real time. Due to factors such as human activity, trees shaking and illumination changes, it is difficult to detect slow small targets in the area below the skyline in one image. We extracted the skyline in the panoramic images and detect low slow small targets above the skyline by automatic program. Finally, the directions of targets are calculated so as to take further steps to them. And we developed a real-time display interface to show the panoramic images and the processing results. In order to achieve real-time detection of the target, two workstations are set up in the LAN and the panoramic images are processed in a distributed way. Observation experiment was carried out in July 2017, we flew an unmanned aerial vehicle (UAV) in size of 300 mm×300 mm×200 mm in different distance and in different weather in order to check the ability of the prototype system. The result shows that the prototype system can detect UAV at distance of 2.3 km when the weather is nice, the accuracy of the direction of UAV is about 1 arcminute.

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