EARTH OBSERVATION SYMPOSIUM (B1)
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A LIQUID LENS IMAGING SYSTEM FOR SPACE-BASED OBJECT MEASURING AND TRACKING

Abstract

SAIC(Shanghai key laboratory of Aerospace intelligent control technology) will present its patent-pending ops concept and supporting architecture for object observation and measurement in a relative close range and support information of positions and altitudes of the object, motion parameters of the object, and the ability to zoom and track the object and its feature modules. SAIC has implemented this architecture and verify it on ground. The essential part of the system, high zoom ration camera system, is now available to realize a 8 multiple zooming with a 15 degree FOV with an economic cost.

To achieve a high accurate relative measurement, it is essential to obtain a clear object image for position estimation. Thus the imaging system should have the quality of a wide working distance. Zoom system is often considered by its zoom capability. Machinery zoom system has been widely researched and applied, but it is not an appropriate way for space-based measuring and tracking.

The proposed imaging system is designed for space-based observation, which fully considered the particular space environment. To avoid the complicated structure and non-flexibility of usual mechanic zoom system, we use liquid lenses to change focal length. As liquid lenses are controlled by electric voltage, it is a more agile and convenient way to avoid mostly mechanic problems and largely narrow the system's volume. The imaging system was designed for space-based observation, which fully considered the particular space environment. To avoid the complicated structure and non-flexibility of usual mechanic zoom system, we realize zooming by liquid lens to change the focus length. As liquid lenses are controlled by electric voltage, it is an agile and convenient way to avoid mostly mechanic problems and largely narrow the image system's volume which is suitable for small satellite.

Compared to the commercial zoom image system based on liquid lenses in industrial application, we use larger aperture liquid lenses to observe moving objects. And with an image processing module, the system can automatic track the object and control liquid lenses. The entire process of recognize, control and zoom is completed within 10ms.

The imaging system and capabilities described above are supported by an imaging module, and image processing module, and an electricity control module. The architecture supports the implementation of

automatic zooming and focusing. And it is a more economical and robust way by electric control instead of complex mechanic movements.