Development of Omni-SLR System: (2) Tracking subsystem

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The small-size, low-cost Omni-SLR system is being developed by a multi-institute group in Japan. We are testing a commercially available telescope mount Vixen AXJ for satellite/aircraft tracking purpose.

The AXJ mount is designed to work as an equatorial mount in the latitude of 0 to 70 degrees. To avoid a flip and a resultant time loss, and also to simplify the mount model, we use it as an Alt-Az system, using a specially designed fork.

We have developed tracking software engine in Julia language. It can control the motor speed of the mount at the period of 60-70 milliseconds for smooth pointing/tracking. The engine is wrapped by a Python-based handler that can be accessible via Streamlit web UI.

Plate-matching software tool “solve-field” publicly provided by astrometry.net is used to observe a pointing (RA, Dec) direction. Without a procedure to move a star in the centre of the view field, it significantly reduces time and workload.

As the mount is driven by worm and wheel gears, a periodic motion error is inevitable. The RA=Azimuth axis is compensated at the stage of product check of Vixen, and therefore we developed a “solve-field”-based scheme for the Dec=Elevation compensation. The amplitude has been 15-20 arcseconds at the period of 1.875 degrees.

The star calibration for the whole sky is also based on the “solve-field” solutions. By applying 10- 15 parameters, we have got 10-25 arcseconds rms, depending on the sky conditions, etc. We are also testing a star image acquisition in daytime where the plate matching is of no use.

Although we have not tested SLR with the system yet, we have demonstrated the capability of satellite (low to high) and aircraft tracking, by communicating Raspberry PIs that provide the position or direction of the objects.

There is room for improvement and will continue the test.

Acknowledgement: This research was supported by JSPS KAKENHI Grant Number JP20H01993.