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Embodied Intelligence and Autonomous Operation of the Sun Yat-sen University 80 cm Infrared Telescope

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The Sun Yat-sen University (SYSU) 80 cm infrared telescope was commissioned in October 2024 at the Lenghu Observatory on the Tibetan Plateau, China. The telescope is equipped with J and K band cameras and is designed for time-domain observations in the near-infrared. Its primary scientific goals include follow-up observations of high-energy transients, such as gamma-ray bursts (GRBs) and supernovae, long-term monitoring of active galactic nuclei (AGNs), and variability studies of stellar objects like RR Lyrae stars and brown dwarfs. The project aims to achieve fully autonomous, embodied-intelligence-based operation of the telescope. In collaboration with the National Astronomical Observatories of China (NAOC), we integrated the TAOS control system to enable automatic scheduling and observation execution. Given that rapid transient follow-up is one of our core scientific objectives, we joined the telescope to the Einstein Probe (EP) and the Space-based multi-band astronomical Variable Objects Monitor (SVOM) "space-ground integrated alert network", enabling the real-time reception of transient alerts and the real-time feedback of telescope operational and observational status. Upon receiving transient alerts, the system autonomously evaluates the observing conditions, plans the observation, executes the task, and reports the results. Environmental perception plays a key role in this process: a weather station and an all-sky camera have been installed to provide real-time meteorological and sky condition data for the scheduler's decision-making. The system is further capable of dynamic scheduling to respond to target-of-opportunity (ToO) events that interrupt regular observation plans. Moreover, the telescope will perform real-time data reduction in the future, including photometric extraction and light-curve generation, and will feed these results back to the scheduler for adaptive decision-making. The synergy between the software architecture and hardware infrastructure forms the foundation for achieving a next-generation, fully autonomous, and intelligent infrared telescope.

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