Paper ID: 10286
oral
student

41st STUDENT CONFERENCE (E2)
Student Conference – Part 1 (1)

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DEVELOPING THE CONTROL SYSTEM FOR A MULTI-PURPOSE, ROBOTIC, ASTRONOMICAL TELESCOPE

Abstract

There are many advantages to robotic or automated telescopes as opposed to human-operated telescopes, but software limitations can also impose a significantly higher risk of damage if unanticipated operational conditions are encountered. The key to building and operating a robotic telescope is to have the software and hardware designed and built with system safety and long-term stability in mind and to have them working together in perfect unison. We present various aspects of the development of a robotic control system for the Alan Cousins Telescope (ACT), a 0.75m telescope of the South African Astronomical Observatory (SAAO) in Sutherland, South Africa. The requirements imposed on such software can be numerous and complex. Ideally, the system should be capable of operating for months or even years at a time without any external influence. This entails implementing a high level of automation, including appropriate responses to environmental stimuli, autodiagnosis and advanced error recovery. In the case of the ACT, the option of having a human operator controlling the telescope (either locally or remotely) was a prerequisite of the software, which further complicated the development of the software. Another major consideration is the intended applications of the telescope. The ACT's potential astronomical applications range from observing optical pulsars and pulsating stars on timescales of milli-seconds to days to monitoring variations in stars on timescales of days to decades and taking part in multi-site observing campaigns. However, given the emerging South African space programme and a renewed interest in space activites in South Africa, the scope of the system will likely be extended to include such applications as optical tracking of satellites and space situational awareness. As such, the software had to be designed in a very general manner wherever possible to allow for such expansion. A highly modular software design strategy was employed from the start. The result is a suite of programs that work in parallel and (as a whole) not only fulfills the design requirements, but also offers several interesting opportunities for future developments. For instance, programs may be added, removed and swopped out dynamically. As the telescope will only be active at night, the programs related to observational activities can be replaced with programs that do, for instance, computationally intensive data reduction during the day. The modular design also allows the telescope control system to serve as a testbed for future, related projects.