SOFTWARE AND HARDWARE UPGRADES FOR THE UNIVERSITY OF NORTH DAKOTA ASTEROID AND COMET INTERNET TELESCOPE (ACIT). M. T. Gerszewski[1], P. Cui[2] V. Kanupuru[3], and P. S. Hardersen[4], Department of Space Studies, University of North Dakota, Box 9008, Grand Forks, ND 58202-9008.
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Introduction: After an additional two years of work, the Asteroid and Comet Internet Telescope (ACIT) has finally reached an operational status. Most of the upgrades that were envisioned have been implemented [1]. Hardware upgrades to increase functionality and capabilities have been implemented, as well as software upgrades to increase usability and reliability. The overall software design has improved considerably since our initial implementation used from 1998-2001 [2]. Slight modifications have been made since 2002.

Hardware Upgrades: Four major hardware upgrades have been implemented over the past two years. These include upgrading our Crayford-style focuser's motor to one with a stepper motor and digital readout (Robofocus, by Technical Innovations) [3], adding a Dew-Zapper to reduce condensation on the corrector plate of the telescope, building a flat-field screen for image calibration, and introducing modules that operate under the X10 protocol to control power to the lights [4].

Robofocus. The advantages of using a focuser with digital readout and a stepper motor that can be controlled through a computer become apparent when used with focusing software such as FocusMax. Using the FocusMax software, which "is highly suitable for unattended all-night robotic-telescope operations," [5] allows users to reach near-perfect focus within two minutes of initiating the auto-focus routine, after initially focusing the system to a point where the Robofocus has enough travel to finish the focusing.

Flat Field Screen. Flat field calibration is a must for accurate photometric observations on any telescope system. A flat field image is a map of the relative sensitivities of pixels on an array when imaging a uniformly illuminated source and can correct images for pixel-to-pixel variations as well as dust on surfaces within the light cone. Setting up a flat field system to be used remotely, and within a small budget, was a small challenge. Professional flat-field systems with spectrally flat screens are prohibitively expensive, so efforts were made to construct an inexpensive version that is nearly as effective as a professional system. Inexpensive commercial fabric for the screen was selected for its ability to produce a "flat" image and a stand for the screen was fabricated out of PVC pipe. Control for the light source was implemented through the X10 protocol and X10 modules.

Software Upgrades: ACIT software has been upgraded to eliminate the need to use a screen share program such as VNC [6]. This was accomplished by creating a Dynamic Linked Library (DLL) to perform the hardware functions previously performed by a LabView Virtual Instrument [7]. The main control software was then updated to perform the same control functions that were originally performed by the Virtual Instrument. A DLL was also created to interface with the X10 hardware and allow control of the flat field light, and allows for future expansion if needed. These two upgrades have had a large impact on overall reliability and safety of the ACIT system. Since these upgrades were put into effect, the amount of downtime due to user errors has been greatly reduced to the point where the system can operate up to a week without administrator intervention.

Future Goals: ACIT is currently used as the main instrument for a 400-level undergraduate class on observational astronomy. A major goal for ACIT is to begin using the telescope for fundamental research activities such asteroid astrometry and light curve derivation, variable star photometry, and potentially stellar spectroscopy. Accomplishing these goals will allow the conduct of important, basic research that will also serve the pedagogical goal of showing students how to perform various types of astronomical research.

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