Automated Sky Search
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Abstract

Introduction

The goal of this project was to explore the feasibility of establishing remote controlled, computer-program driven telescopes to send CCD images to a central computer for analysis and archiving. The long-range implication is to allow for the simultaneous scanning of many sections of the sky over prescribed, extended periods of time. This would simplify and expedite the quest to fine cosmic objects from supernovae to rogue asteroids.

Accomplishing this would require the synergy of reliable software programs, a quality telescope, and a compatible CCD (charged coupling device) camera. My job was to familiarize myself with the aforementioned components and to attempt to put together some sort of working model.

Method

There were four procedural elements involved in start-up. I had to familiarize myself with The ‘SKY6’ format, including its peripheral elements for scripting, telescope linking, and picture taking. Secondly, I had to know how to set up the telescope, initialize the GPS unit, and create a situation where the telescope was receptive to input from the computer. The third element was the CCD camera – get it to work and attach it to the telescope. Finally, the program, telescope, and CCD had to work in concert to produce automated pictures based on a scripted itinerary.
Results

The first week introductory period was spent working with the ‘SKY6’ astronomy software by Software Bisque, Inc. This software provides an interface for programmed control of a telescope. In addition, it can be run using a telescope simulator, which utilizes the virtual sky presentation mode set to the coordinates of the user (or any other coordinates, for that matter). I joined the online support corner and corresponded with CEO Steve Bisque.

A Nexstar GPS equipped 1250mm focal length (5 inch diameter) Celestron telescope was to be used to establish a live link to the ‘SKY6’ program. Since it is a GPS device, it has to be initialized for location at the onset. The telescope determines the horizon by traveling to positions close to parallel with the horizon until a ‘level’ position is found. The unit then slews to stars normally visible to our location (Detroit). These are usually Vega and Capella. Since we are indoors and during daylight hours, we assume the positioning is correct and accept it as such. The telescope is then ‘Ready’, and we can proceed to establish a link to the ‘SKY6’ program. To do this, the NexStar must be connected to the computer serial port, and communication established. Next, the telescope is identified and a link established via the ‘SKY6’ program. At this point, crosshairs of the virtual sky telescope are synchronous with the actual telescope, and appear on the screen. If the viewing object position is changed on the virtual sky, the Celestron NexStar slews accordingly.

To have the telescope slew from one position to another, without my direct intervention, required an additional piece of software, called ‘Orchestrate’. Designed by
Software Bisque, it fully integrates into the ‘SKY 6’. This program worked one of two ways. Specified data could be exported using the ‘data wizard’ option from the Data Menu Bar. This could include object types, databases, filters (altitude, brightness, etc.), or specific objects. These data are sent as ‘script’ and imported by the ‘Orchestrate’ program, which formats them for use by the telescope. This way worked well for long lists of objects specified by type, and for consistent, repetitive time frames. However, for complex, variable slewing directions with specified target areas, the best method was to write the directly program into the ‘Orchestrate’ format, bypassing the exporting and importing of data from the ‘Sky6’ program. This way took more time and yielded the more controlled response I was looking for. I could now specify stars, galaxies, planets, or nebulae and have the telescope slew from one to another in any designated order and stay focused there for whatever time frame was needed. I could also follow the movements on the real-time virtual sky display on my computer monitor. Everything was coming together nicely. The next step was to take a picture!

The final hardware item we needed was the CCD camera. The initial choice was a small, simple unit called the SAC4-2 from SAC Imaging. It was by far the best fit size-wise, but the software interface was not compatible with the ‘SKY6’ program. Attempts were made to locate software that would be compatible, but the manufacturer had sold out to a European firm and the products were in the process of being redesigned.

The only reasonable option was to purchase a compatible camera, but this was not to be. Apparently lack of funds and time were the limiting factors, so the next best fit was to try to adapt the huge SBIG (Santa Barbara Instrument Group) model CFW-8 that
is currently used on the large, rooftop telescope. This turned out to be a colossal disaster from many fronts. First, the power supply was missing and it took about a week to locate it. Due to its size and weight, it was impossible to usefully mount it on the 5 inch Celestron. Another problem was that the required interface software (CCDSoft5) disc was nowhere to be found. Eventually, a copy of the disc was sent by the CCD manufacturer, and installed. In the meantime, it was suggested that the 8-inch Celestron NexStar might work with the SBIG CCD. That telescope, however, was not on site, and took several days to locate. In fact, it arrived the final day of the RET! Unfortunately, it too, was considerably smaller than we had hoped for. The CCD could not even clear the base when the telescope was slewing towards zenith! Even so, the ‘SKY6’ program did not acknowledge the SBIG CCD camera via the CCDSoft5 software. This was puzzling because the camera software was a joint product of Santa Barbara Imaging and Software Bisque, Inc.

Conclusion

The amount of information gathered so far indicates that the project is indeed feasible within limits. The ‘SKY6’ program with orchestrate worked well in controlling the telescope. Occasionally, when slewing from target to target, the telescope would be indicating that it was slightly (1-2 seconds of arc) out of alignment. This was easily seen on the virtual sky because all prospective target objects could be ‘framed’. When the telescope slews to an object, its crosshairs would overlap the frame. Without correction, this would hamper the imaging of some specific objects. However, for viewing some large galaxies, or sections of the sky, this may not be a significant problem. Also, some
cameras have their own guiding software for increased imaging precision. We now need to find a CCD camera that is a good fit with our existing software and telescopes.

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Resources

- Celestron, LLC. 2835 Columbia Street  Torrance, CA  90503  
  Web: [www.celestron.com](http://www.celestron.com)  
  Telephone:  310-328-9560

- SAC Imaging; division of Opticstar Ltd.  Vantage House, 26A Northenden Road, Sale, Chesire, M33 3BR, United Kingdom  
  Web: [www.opticstar.com](http://www.opticstar.com)  
  Telephone:  +44(0)161 969 9008

- Santa Barbara Instrument Group, 147-A Castilian Drive  Santa Barbara, CA 93117  
  Web: [www.sbig.com](http://www.sbig.com)  
  Telephone:  805-571-7244

- Software Bisque, 912 12th Street, Golden, Co  80401  
  Web: [www.bisque.com](http://www.bisque.com)  
  Telephone:  800-278-0045