Skynet 2: Expansion and Improvement of the Skynet Robotic Telescope Network

Andreas Buzan, Reece Clark, Donovan Schlekat
Department of Physics and Astronomy, University of North Carolina Chapel Hill

Abstract

The Skynet Robotic Telescope Network (Skynet) was originally built in 2004 to carry out rapid, multi-wavelength observations of gamma-ray bursts (GRBs) within seconds of their detection. We sought to completely overhaul Skynet's web-based user interface (UI), applied programming interface (API), and database in order to expand the network's campabilities. The new version of the platform, called Skynet 2, will allow for previously incompatible instruments, such as optical polarimeters, and the integration of at least four additional radio telescopes. We have made significant progress on the overhaul of the database, API, and UI, upgrading Skynet to be more user-friendly, powerful, and capable. We have also made a maintenance trip to our telescopes at Siding Springs Observatory (SSO), Australia, deploying the first CMOS camera on our network.

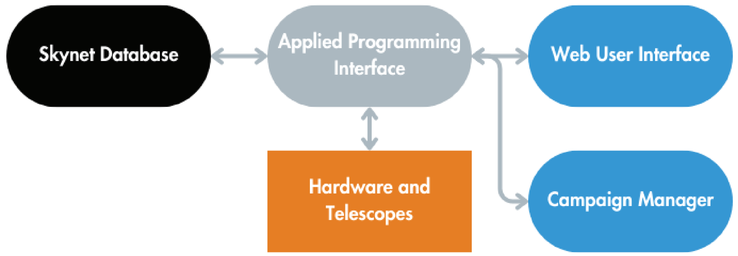
Above: The four 17-inch Skynet PROMPT-telescopes at Siding Spring Observatory, Australia. One has since been moved to Perth Observatory.

Background

Skynet first consisted of six instruments making up the Panchromatic Robotic Optical Monitoring and Polarimetry Telescopes (PROMPT) [1]. The network has now become a platform used by both professional astronomers and undergraduate students taking introductory astronomy courses, allowing students at institutions without dark skies or campus observatories to actually do astronomy themselves. Our overhaul will benefit both scientists and students, supporting a new course "The Multi-Wavelength Universe!" at UNC Chapel Hill.

Methodology

- Designed new UI pages with an Angular web page framework and PrimeNG UI components, written using Typescript
- Wrote programs to create database tables, schemas, and scripts using Python
- Implemented API functionality using FastAPI and SQLAlchemy, written in Python
- Maintained and upgraded Skynet telescopes and hardware



Above: Skynet's API takes commands from both programs, such as the Campaign Manager, and the UI. It then interacts with the platform's telescopes hardware, and database, before returning data.

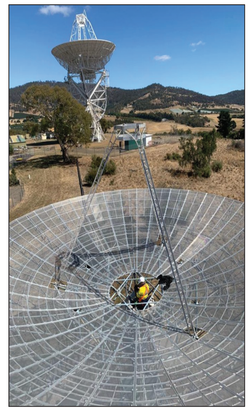
Results

- Designed developer tools that provide admins with the ability to quickly resolve difficulties with users' observations
- Set up a systems database that could effectively compile all devices connected to Skynet to accurately assess their status
- Created a system to delegate and manage telescope time to organizations, groups, and users
- Created new features to more efficiently and precisely add and edit telescope field-of-view parameters
- Designed systems for users to register professional and personal telescopes in the Skynet system
- Overhauled hardware database and device management tools to accommodate new instrument types, allowing for the future integration of additional radio telescopes and optical polarimeters
- Upgraded and repaired hardware devices to be installed on Skynet telescopes in Australia and Chile

Conclusion/Next Steps

With the new hardware database, API, and web interfaces, the telescope integration process has been greatly simplified. Once completed, the system will be pushed to our live production servers and the four new radio telescopes will be added to the network, permitting radio observations in both hemispheres through Skynet for the first time.

The changes to the Skynet web framework serve to further solidify Skynet's standing as both a scientific and educational tool. The recent changes to the hardware database, API, and web interfaces, have not only streamlined the process of integrating telescopes, but have also expanded the network's ability to accommodate previously incompatible instruments. Skynet's mission is to make science accessible to people from all levels of astronomy.



Above: The 14m (front) and 26m (back) radio telescopes in Hobart, Australia, which are scheduled for integration into Skynet in the coming years.

With the introduction of newer, more powerful tools and interfaces, astronomical research with Skynet becomes rapid and straightforward. With more robust visuals and simpler controls, not only does research become effortless, but teaching and learning astronomy becomes many times less stressful. Through these changes, Skynet 2 stands to demonstrate its potential to progress the frontiers of astronomy, and establish its power as a scientific and educational tool.

Additional work will be done to bring Skynet's optical transient observing mode, the Campaign Manager, into Skynet 2 [2]. This will allow all Skynet users, not just our research group, to use the mode as well as improving the observation and data-reduction process.

References

1. Reichart, D. E. et al. Nuovo Cim.C28:767-770, 2005
2. Dutton, D. et al. Publications of the Astronomical Society of the Pacific, Volume 134, 2022, Number 1031