A distributed system for collecting sky brightness data

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Abstract

The Dark Sky Protection Program (DSPP) aims to establish long-term monitoring of sky brightness at several sites of interest to NOIRLab.

- We present an open-source Python package for acquiring and managing data from SQM-LE and TESS-W4C devices.
- The system is designed for robust, unattended operation, with resilience to communication, hardware, and other causes of interruption.
- These capabilities provide a scalable infrastructure for long-term characterization of sky brightness.

Hardware

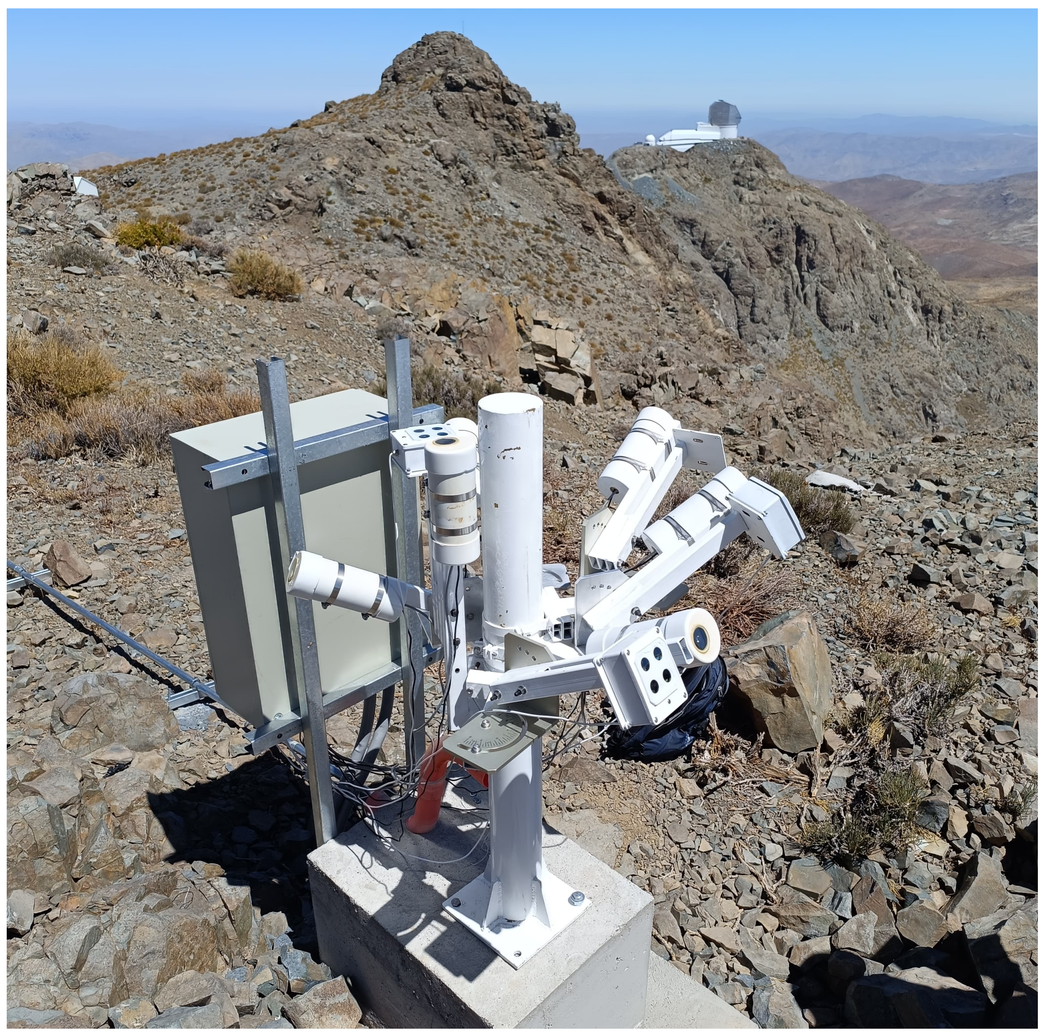


Figure 1. Arrangement of pairs of SQM-LE and TESS-W4C photometers aimed at several key locations.

- The photometers provide network interfaces over Ethernet (SQM-LE) and Wi-Fi (TESS-W4C), respectively, using TCP/IP.
- This allows us to set up nodes that request a reading from the photometers and then reliably send the data to a data center.
- Data is also saved to plain text files for redundancy.

The `dspp-reader` Python Package

Released as open-source software under the BSD 3-Clause License, the `dspp-reader` package provides command-line scripts for the supported photometers. Script behavior is set through a configuration file, used to set parameters such as the photometer's IP address or the data collection interval. It is possible to override the configuration file parameters by passing command-line arguments to the scripts. The same functionality is also available through a Python API, allowing for more advanced usage and integration with other software.

Deployment

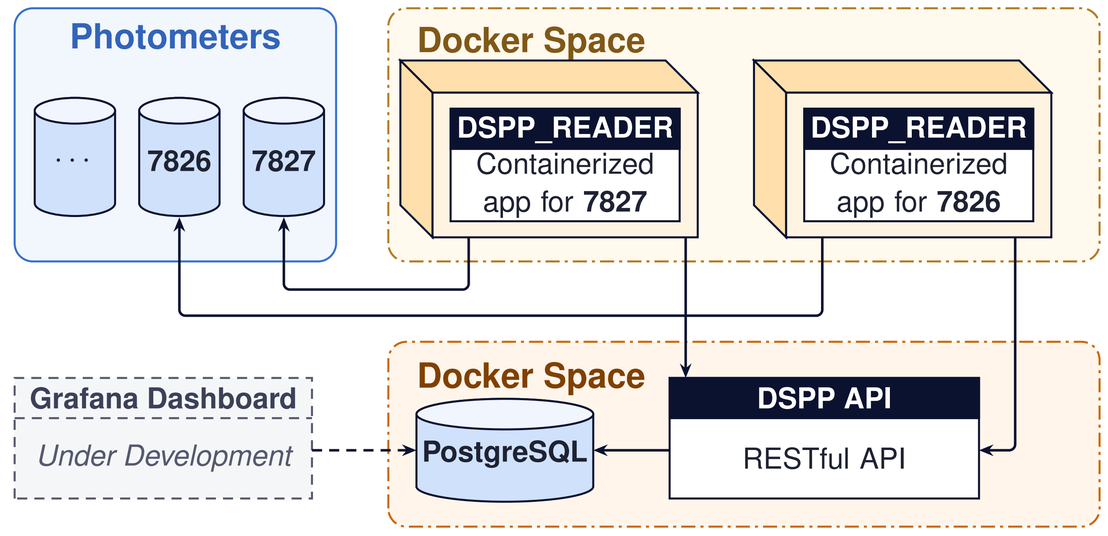


Figure 2. Arrows represent the direction of each request.

Using Docker containers, the system can be deployed on any machine with minimal setup. It allows for easy scaling, robust fault tolerance and recovery, and management of multiple photometers.

Conclusions & Future Work

We have successfully deployed an autonomous and failure-resistant system.

- The Python package `dspp-reader` has been released and we expect to release other components during 2027.
- We will review that the plain text file formats implemented are compliant with community standards, such as Kyba & Lolkema (2012)
- We plan to study if the photometers' calibration drifts after long-term operation.

Source code
github.com/dark-sky-protection/dspp_reader

Documentation
dspp-reader.readthedocs.io

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