Skyviewer Investigations for LSST EPO

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Introduction

LSST Education & Public Outreach (EPO) reports on the early investigations of using and implementing a skyviewer across its software systems. We research available open-source skyviewer software and identify requirements and possible features for our implementation. Over the summer we prototyped an implementation of this using Aladin and Aladin-lite. Independent of the prototyping we contracted design work and user experience testing from Theresa Neil: Strategy & Design (TNSD) which resulted in user interface features.

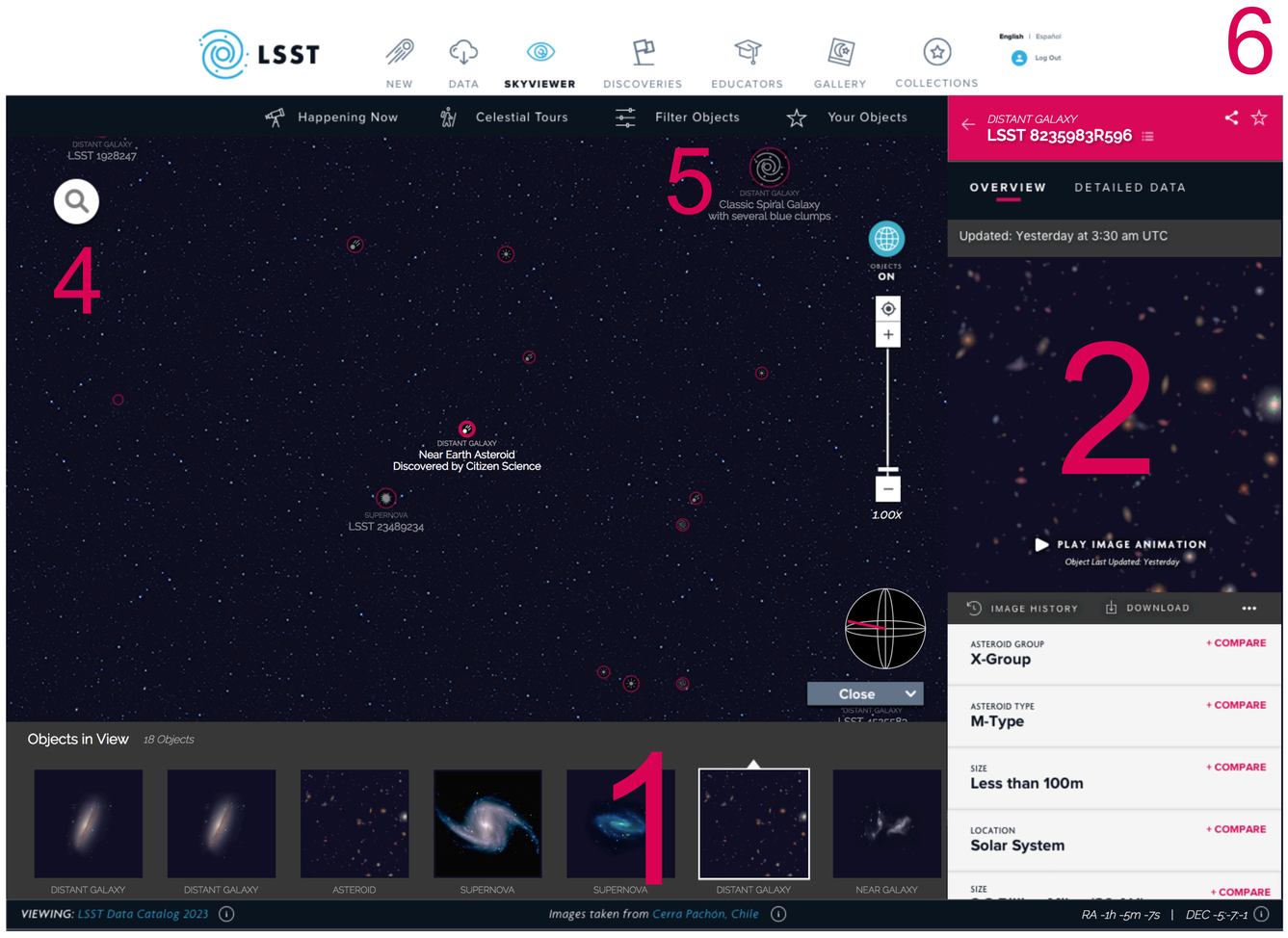
Requirements

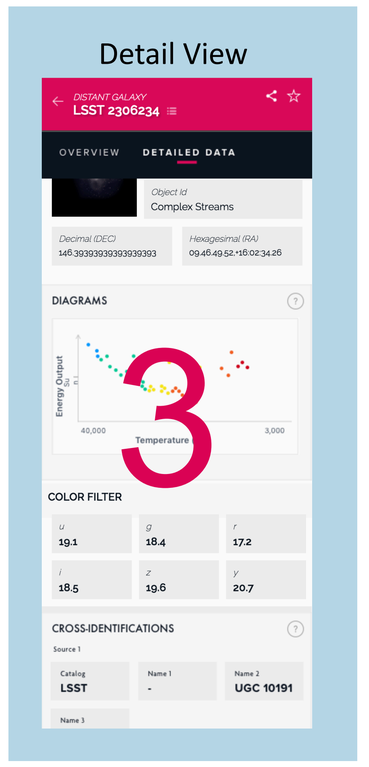
The skyviewer has three software engineering requirements.

1. Build on an existing sustainable open-source project.
2. Simple to extend and integrate with existing tools and libraries.
3. Usable in multiple contexts.

Implementation

Aladin v10.009 and Aladin Lite were used to create a prototype survey with HSC Public Data Release 1 UDEEP data (3.5 sq. deg.). This was reprocessed by the LSST DM team using the LSST DM pipeline. It took 16 hours using 8 vCPUs and 16 GB of RAM to process 127 GB of calibrated exposure fits images across three bands (*irg*) into 16.7 GB HiPS color png image survey (Norder=3,12).
Aladin and Aladin Lite use HEALPix. It is supported in multiple libraries in Python 3, which has seen extensive use at LSST and is used in our science notebook investigations. HiPS and MOC, which use HEALPix, are IVOA standards we plan to support. Finally, HEALPix is acceptable for use with the LSST science platform and our formal education teams.





User Interface

EPO contracted design work and user experience testing from TNSD. Through this user experience testing TNSD identified weaknesses with existing Skyviewer design and iteratively improved the design. The above mockup is the result. Some specific features are a gallery, object and detail slider, search, filters and the ability to create collections.

Comparison

We investigated using three types of skyviewers. Aladin and Aladin Lite, World Wide Telescope (WWT) and Leaflet based skyviewers.

	Aladin & Aladin-lite	Leaflet based skyviewers	World Wide Telescope
Projection	HEALPix	Mercator	TOAST
Tile Manager	HiPS	Leaflet	WWT
Tile Creation	Aladin	ImageMagick, custom	Montage
Examples	ESA[1], CDS[2], DES[3], LIGO	DECaLS[4], CFHTLS[5], HSC-SSP[6], NASA, SDSS	WWT web client

1. *ESA, European Space Agency*
2. *CDS, Centre de Données astronomiques de Strasbourg*
3. *DES, Dark Energy Survey*
4. *DECaLS, DECam Legacy Survey*
5. *CFHTLS, Canada-France-Hawaii Telescope Legacy Survey*
6. *HSC-SSP, Hyper Suprime-Cam Subaru Strategic Program*

Features

1. **Gallery**
2. **Object slider**
3. **Detail slider**
4. **Search**
5. **Filters**
6. **Collections**

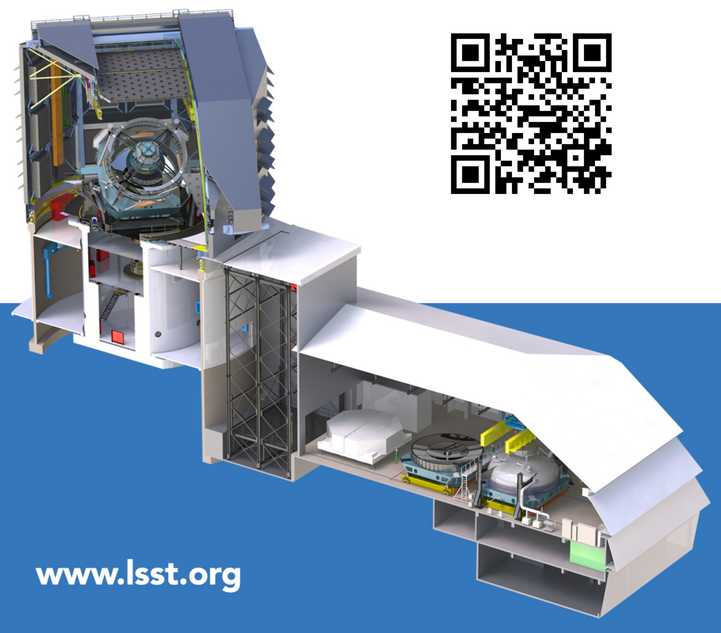
Conclusion

EPO plans to implement this as modular open-source software components. Components should be reusable for different audiences through configuration and extension. Components will be used by our portal and science notebook systems. Since our science notebook system will extend the LSST DM science platform, our components will be available to LSST scientists.
Though we plan to use Aladin and Aladin Lite, some improvements are required. Aladin Lite and HiPS do not support dynamic image creation using individual bands.

More Information

1. LSST Science Book, *arXiv:0912.0201*
2. LSST EPO Design LEP-31, http://ls.st/7ex
3. Science Platform Design, https://ldm-542.lsst.io/
4. Aladin Lite, Bibcode:*2014ASPC..485..277B*
5. HEALPix, Bibcode:*2007MNRAS.381..865C*
6. IVOA HiPS Standard, *http://www.ivoa.net/documents/HiPS/*
7. IVOA MOC Standard, *http://www.ivoa.net/documents/MOC/*
8. HSC Data Release 1, arXiv:1702.08449

⁺ Theresa Neil: Strategy + Design, http://www.theresaneil.com/



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This material is based upon work supported in part by the National Science Foundation through Cooperative Agreement 1258333 managed by the Association of Universities for Research in Astronomy (AURA), and the Department of Energy under Contract No. DE-AC02-76SF00515 with the SLAC National Accelerator Laboratory. Additional LSST funding comes from private donations, grants to universities, and in-kind support from LSSTC Institutional Members.