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The Importance of Mid-Range Telescope Data Archives - an Example of Ondřejov Observatory 2-meter Telescope

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Abstract. We present a data archive which is under development at the Stellar Department of the Astronomical Institute in Ondřejov. The archive will provide for an easy access to the electronic spectra obtained by the Reticon and CCD detectors of the Ondřejov 2-meter telescope. The system is based on a cheap relational database management system Adabas D (Linux Edition) for handling the observing logs and file headers. The data are presented on an Apache web server by the WDBI form interpreter which uses the Perl DBI interface for communication with the database. The design goals, user requirements and necessary trade-offs are discussed as well as the possibility of future improvements.

1. The Importance of Astronomical Archives

Some of the principal discoveries in astronomy were based on the long term observational monitoring of selected objects by simple means and using the data by someone else (e.g. formulation of Kepler laws using the observing log of Tycho de Brahe).

In present astronomical research, however, the shift of interest seems to be quite common towards the huge telescopes allowing (due to great oversubscription) only short glimpses of a usually extremely faint target. To allow more people to use these very expensive data, a public archive with a nice, mostly WWW-based, front-end becomes an integral part of such a huge telescope (or space mission) project. By deep searching of many sites mentioned in AstroWeb metaindex[1] we have found only several ground based optical telescopes with at least a list of observations published on the Web: La Palma data archives of ING telescopes[2], CFHT archive[3], Anglo-Australian Telescope archive[4], ESO

[1] `http://cdsweb.u-strasbg.fr/astroweb.html`

[2] `http://archive.ast.cam.ac.uk/ingarch/`

[3] `http://www.cfht.hawaii.edu/ObsInfo/Archive`

[4] `http://site.aao.gov.au/arc-bin/wdb/aat_database/observation_log/make`

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NTT and VLT archives[5], UK Schmidt Telescope plate archive[6], UKIRT archive[7] and Japanese Mitaka-Okayama-Kiso observatories archives[8].

On the other hand, there are plenty of smaller telescopes placed at various observatories all over the world - some of them are used for long-term monitoring campaigns (e.g. to investigate Be stars, recurrent novae, cataclysmic variables or other types of relatively bright objects with unpredictable behavior). The data secured here are mostly given only to a visiting astronomer and saved somewhere on tapes but nobody else can see them even after a proprietary period. The main reason is simply the absence of any archiving and presentation facilities - often even observing logs are available only in the hand-written form.

Such a subsidiary telescopes have any sort of a public electronic archive very seldom. We have found only the list of observing logs of the 182cm telescope of Asiago Observatory[9] and a static list of spectra secured by the Elodie system at OHP[10] on the Web. There are usually no spare money and/or skilled database specialists for building a perfect archive system from the scratch. The valuable data may thus be effectively lost for the wide astronomical community.

The way out of this sad perspectives may be a simple public data archiving system based on small SQL databases that will allow at least querying of the observing log to get an information whether the particular object was observed, in which instrumental setup and where to obtain the datafile (e.g. contact to the data owner during and/or after the proprietary period, the internal file ID, the tape or optical media name, etc.). The more sophisticated engines may be able to handle the requests automatically and prepare the data on a some staging disk area for a FTP transfer. They will also notify the archive user by an e-mail message when the data are prepared for the transfer. The user may be asked to register prior to archive usage obtaining a password for further access to the raw data. A problematic situation may exist in observatories that have not established any fixed rules for releasing their data to the public or even have no proprietary period. Some principal investigators do not want to release the observations which are more than five or even ten years old into public use. The setup of a public archive is then a good reason to establish the institutional data politics.

Such a well established data archive may also help in saving of the valuable data from closed telescopes or abandoned research programs by adopting them and making accessible for interested public (e.g. students and post-docs).

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[5] `http://archive.eso.org/eso/archive.html`

[6] `http://www.aao.gov.au/local/www/apmcatbin/ukscat.html`

[7] `http://archive.ast.cam.ac.uk/ukirt_arch/`

[8] `http://moka.nao.ac.jp/index.html`

[9] `http://leda.pd.astro.it/asiago/tel182/archive/log182.html`

[10] `http://www.obs-hp.fr/~vin/ar1996.html`

2. Ondřejov Observatory 2-m Telescope

The 2-m telescope built by Carl Zeiss, Jena, was put into operation in 1967 and since the beginning it was devoted to the spectroscopy of early-type (mainly Be) stars in the 64-m coudé focus. Its plate archive contains almost 6000 spectral plates exposed till the beginning of 1993.

At the end of the 1992, the photographic plates were replaced by the Reticon AF1872 detector. Using this detector almost 3650 stellar spectra were secured, giving with calibrations the total of 15000 frames up to date.

The observing conditions in the low altitude and in the vicinity of Prague as well as the local weather (about 130 partly clear nights per year with average seeing of about 2–4 arcsec) are incomparable with the world largest telescopes in high altitudes. The advantage of the 2-m telescope in Ondřejov consists in its ability of continuous long-term monitoring (as the weather permits) of a number of stars. The observing program contains more than 200 stars, and there are time series of some stars larger than 200 spectra over the span of 3-5 years.

3. Reticon Data Archive Requirements and Design Goals

From the specific assignation of the telescope as given above also the main goal of the archive follows. At present the most important for the research are the Reticon electronic spectra. As we did not have any experience with SQL and databases at all, we refused the cheap public domain systems like MySQL or PostgreSQL (partly also due to the lack of some SQL features) and from the commercial world we have chosen the cheap ADABAS-D for Linux Entry Edition[11].

There exists even a free Personal Edition version with restriction of the database size and number of users. The database is a modern robust system with the features like transactions, triggers and even with syntax emulation of Oracle and ANSI SQL standards. It is well supported by Perl DBD: and DBI: modules as well as by PHP3.0.

The online tutorials, HTML documentation and the FAQ with detailed examples were very helpful during the setup phase. Adabas-D has also a nice table importer (can import from a fixed format by stating the range of columns with particular data or by giving the separator between values). There is also a nice graphical (Tk based) query and administration tool and the SQL console tools that can be started from a UNIX shell or various other shells like Tcl/Tk, Perl and Java. The distribution also includes ODBC drivers. The commercial version, in addition, contains the dynamic HTML generating tool called WebDB with example forms.

After testing all available web presentation tools (WebDB, PHP3 and WDBI) we have chosen the WDBI[12]. The setup is quite smooth on the RedHat5.2 distribution and Adabas 10 (the necessary DBI and DBD:Adabas modules work quite well).

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[11] `html://www.adabas.com/`

[12] `http://www.wdbi.net/`

The Reticon log file contains an 80 byte long ASCII row for each observation, with the values at fixed positions. So it is quite simple to create one table (called RETLOG) and import all rows by the Adabas importer called `xdbload`.

As there is only very small number of target stars and their names are written in a unified way by the data acquisition SW (choosing them from the observing program catalog), we can provide the user with a scroll list of all stars instead of some sort of name resolver like SIMBAD. The same feature can be applied to the image type, the position number of of spectral filters and dichroic mirrors or the type of image slicer. All this can be handled automatically by the WDBI with the help of its `makelist` attribute.

The number of exposures is quite small so the database will work nicely even on small computers, and the data may be quickly reloaded from the original ASCII tables in case of a database failure.

In the near future, we plan to add more columns of general interest computed from the present ones with the Adabas internal SQL/PL language (e.g. JD, HJD and heliocentric correction) and then we would like to prepare a simple processing pipeline. It should choose according to the JD difference the nearest calibration with the same spectrograph setup (flat, offset, arcs) and then run the reduction producing the output picture directly on the screen. The more complicated task will be the setup of an archive of exposures taken by the new CCD camera (FITS headers, large disk space area needed - about 4 MB/frame).

4. Conclusions

The smaller telescopes at most observatories may have been producing quite valuable data by providing long-term coverage of a small number of brighter objects (especially variable stars). On the other hand, the data are not stored in publicly available archives. In best case they are only backed to a tape or CD and the external user cannot check whether the observation of particular object is available.

In case of economical difficulties the instrument may be decommissioned and the data are thus effectively lost. To prevent this quite simple data archives may be built using cheap SW tools without large demand on administration and programming skills of a database experts. With WDBI form interpreter even a skilled astronomer may prepare working archive of basic exposure information in several days. Such an archive may then adopt the observing logs of a decommissioned device or even data.

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