Modern geodetic control in the Czech Republic based on the densification of EUREF network

Jan Pytel

Jan Kostelecky

Content

• information about densification of EUREF in the Czech Republic

• the GPS observation data model

• software background

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Densification of EUREF in the Czech Republic

In the Czech Republic there was process called "GPS densification" from 1995 until 2003.

• 174 sites of national GPS reference network DOPNUL represents the national reference frame

• the coordinates of DOPNUL stations were determined by a combined processing based on the data from several national densification capaigns (NULRAD, ...)

• since 1995 this national reference frame has been densified in two parallel ways: "selective maintenance" and "densification"

"Selective maintenance"

Densification carried out by the Land Survey Office.

• based on the national GPS reference network DOPNUL

• the total number of the of GPS stations is 3500 (final density is 1 station per 24 km sq)

• all stations are identical with the triangulation stations of the national terrestrial triangulation network, their coordinates are available in ETRF89 and in both the official national user system S-JTSK and an improved user system S-JTSK/95

"Densification"

• parallel to the "selective maintenance"

• other large scale of the GPS based densification

• implemented by the regional cadastral offices

• GPS campaigns are carried out within the existing triangular network

• established large number ot the new densified stations (3000), the new stations include GPS observations

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GPS observations

• data from both densifications are achieved in the form of "database" files of observation vectors

• this form is not suitable for the final users

• demands to create database of GPS observations and internet (www) access to the database

• database will serve as:

    • revision of observations

    • archive of observations

    • provision of free access of observations for all users

The GPS observation data model

Each item of "data" files represents one vector with this information:

campaign number; project number; pair of observations; coordinate diff. dx, dy, dz; name of coordinate system; name of fieldworker; code of used software, code of used efemerid
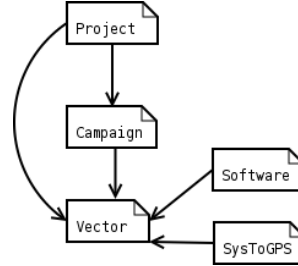
The data model consists of five tables:
- table Project – general information about projects
- table Campaign – cover data about campaigns
- table Vector – main table, including observed vector data
- tables SysToGPS and Software

The GPS observation data model

```
CREATE TABLE vektory (
    project  int REFERENCES projects,
    kampan   int, -- REFERENCES kampane
-- FOREIGN KEY (project, kampan)
-- REFERENCES kampane (projekt, kampan)
    epocha  real,
    seance  char(1),
    from_id  varchar(16),
    to_id  varchar(16),
    dx    double precision,
    dy    double precision,
    dz    double precision,
    sdx   real,
    sdy   real,
    sdz   real,
    systgps  varchar(30) REFERENCES systgps,
    pracovnik varchar(20),
    software  int REFERENCES software,
    kef    int,
    epomer  varchar(5)
);
```

Project → Campaign → Vector; Software → Vector; SysToGPS → Vector

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Software background

- used only software released under GPL licence
- object-relational database management system PostgreSQL (robust, transactional integrity, triggers, SQL 92 support)
- library Gowl – C++ object library for creating CGI, released under GPL licence
- library libpgxx – C++ frontend to the database PostgreSQL
- whole project is written in C++ language and is available for OS GNU/LINUX
- GGI scripts generate html pages which are valid XHTML 1.0

WWW interface

http://www.vugtk.cz/gpsdb

- viewing of GPS observations
- editing of GPS observations
- adding of GPS observations
- deleting of GPS observations
- create XML input data format (selected observations) for adjustment programs
- browsing GPS campaign

Viewing of GPS observations

Editing of GPS observations

Adding of GPS observations

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Deleting of GPS observations

14/18

Viewing of projects

15/18

Viewing of campaigns

16/18

Creating XML input data format

17/18

Conclusions

WWW interface is very intuitive and simple to use. Using language C++ instead of pure "web" languages, like PHP, decreases requirements on software equipment dramatically.

The database system and any support programs are released under the GNU General Public Licence. Althrough this database application is tailored to the specific Czech needs, it is a Free software and it is available to the whole FIG community.

http://www.vugtk.cz/gpsdb