Activity of Faculty of Technical Science in Realization GPS Permanent Stations Networks

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Center for Geoinformation Technologies and Systems (1)

- Founded in 2003, within Faculty of Technical Sciences in Novi Sad
- Major activities:
  - Remote sensing
  - Photogrametry
  - GPS technology and applications
  - GIS and SDI design and implementation
  - Spatial data visualization
  - Education
Center for Geoinformation Technologies and Systems (2)

- Projects:
  - Detection and GPS survey of underground gasoline and other underground objects
  - Land cover classification using remote sensing in Vojvodina
  - Developing GIS for various users
  - Orthophoto plans in different scales of Fruska gora and Novi Sad city area
  - Digital terrain and surface modeling
  - Surface objects modeling and visualization
  - Laser Scanning
  - Etc.

Study program Geodesy and GEOMATIC

- Founded in 2007, within Faculty of Technical Sciences in Novi Sad
  - Bachelor
  - Master
Center for Geoinformation Technologies and Systems (3)

- Memberships in international organizations:
  - Open GIS Consortium
  - EUPOS

- Educational activities
  - Center is involved in educating experts in geodesy and geomatics, at bachelor and master studies.
  - Different user courses are also organised

GPS Permanent Stations Network (1)

- One of the major activities of the Center is developing and operating GPS permanent stations network
- Development started in year 2003.
- First four stations were in Novi Sad, Indija, Srbobran and Zitiste, with control center in Novi Sad
GPS Permanent Stations Network (1)

Network became fully operative in December 2004.

It consisted of 9 stations with control center in Novi Sad, on Faculty of technical sciences.

Entire territory of Vojvodina was covered.
GPS Permanent Stations Network (3)

- In November 2005, in cooperation with the Republic geodetic authority of Serbia, a network for the entire country was developed.
- Control center was in Novi Sad.
- It was one of the first networks in the region.

Network structure

- GPS permanent stations network was based on VRS concept.
- Used hardware:
  - Trimble Zephyr geodetic antennas
  - Trimble 4400 and 5700 receivers
- Used software:
  - Trimble GPS Net
- Data transfer:
  - Frame relay
Network services

- Network provided three types of services:
  - RTK, providing accuracy of up to 2cm, using RTCM message format
  - PP, providing accuracy of up to 1cm, using RINEX data format
  - DGPS, providing accuracy of up to 50cm

- Using standard data formats enabled usage of receivers of any manufacturer within the network

Current networks in Serbia (1)

- Network in Vojvodina
  - GPS permanent stations network in Vojvodina is now developed by Center for geoinformation technologies and systems
  - It is planned that network consists of 9 permanent stations and one control center
  - Four stations are mounted, while mounting of other five is underway
Current networks in Serbia (2)

Structure of network in Vojvodina

- GPS permanent stations network is based on VRS concept
- All antennas are mounted on points with low radio interference and low signal reflections
- Used hardware:
  - Trimble Zephyr geodetic antennas
  - Trimble 5700 receivers
- Used software:
  - Trimble GPS Net
- Data transfer:
  - IP
  - ADSL

Current networks in Serbia (3)

- VECOM NET GPS network
  - Covers territory of Serbia, without Vojvodina
  - Consists of 17 permanent stations, with control center in Belgrade
  - 7 more stations are planned
  - Network is based on MAC concept
  - Hardware:
    - Leica 500 and Leica GRX 1200 Pro GPS receivers
    - Leica AT504 Choke ring and AX1202 antennas
  - Software:
    - Leica GPS Spider
Current networks in Serbia (4)

- AGROS (Active Geodetic Network of Serbia)
  - Network ran by Republic geodetic authority of Serbia
  - Covers territory of Serbia, currently without Vojvodina
  - Mounting of stations in Vojvodina is underway
  - Total number of 32 stations is planned
  - Three services:
    - RTK
    - DGPS
    - PP

Network connections

- It is planned that network in Vojvodina will cooperate with other networks in Serbia. Cooperation is supposed to be done in different ways:
  - Control center in Novi Sad will be used as backup center for other networks
  - Data exchange, which will provide uniform accuracy on entire territory of Serbia
  - Connecting with VEKOM GPS network, will provide usage of both network concepts – VRS and MAC
International cooperation (1)

- Center for geoinformation technologies and systems took part in EUPOS (European Position Determination System) initiative.
- 15 Central and East European countries are involved in EUPOS.

**EUPOS**

- Aim of this European initiative is to promote a technical system which allows the improvement of satellite positioning using a network of terrestrial reference stations.
- The establishment of such a system in Europe requires an international co-operation of implementing and operating public bodies.

International cooperation (2)

- EUPOS initiative applied for EU funding in the framework of INTERREG III C. In 2006, the project EUPOS-IRC was launched.

- EUPOS-IRC is supported by public administrations in the EU from Germany, Hungary, Latvia, Lithuania, Poland, Bulgaria, Romania and Serbia.

- Aim of EUPOS-IRC is to promote the use of the satellite positioning and geo-information services of EUPOS for all regional development tasks that need a highly precise position.
International cooperation (3)

- In EUPOS-IRC project, each country participated with its DGNSS application.

- Applications were ranked by experts.

- Center for geoinformation technologies and studies participated with GNSS application: Detection of Underground Facilities using Ground Penetrating Radar and DGNSS.

- Application received a high regional policy ranking.