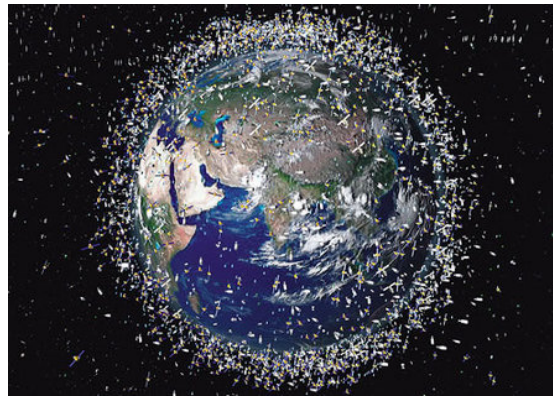


TUC-N Research on Space Surveillance and Tracking – SST

The Earth is surrounded by a swarm of satellites and associated debris known as resident space objects (RSOs). Crucial for keeping an eye on RSOs, the Surveillance of Space (SofS) comprises detection, tracking, propagation of orbital parameters, cataloguing and analysis of these objects. TUCN develops stereovision-based image processing methods for automatic detection, accurate position determination and precise orbit estimation of RSOs.

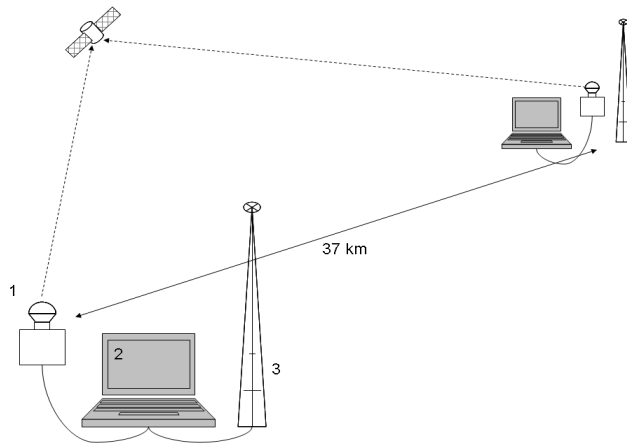


1. Objectives

- Development of cost-effective imaging systems for observation of the Earth orbits (from LEO to GEO and beyond);
- Development of systems for automatic recognition of Earth orbiting objects from the acquired images;
- Development of automatic systems for 3D coordinates reconstruction and orbital parameters estimation for the detected objects.

2. Available infrastructure and technology

- Two ground-based sky observation systems:
 - Canon EOS 50D camera
 - Celestron CG5 equatorial mount
 - Two optical systems: 20mm Sigma EX 20mm lens, for LEO observation, and a Newton D=150mm/ F=750mm telescope, for MEO observation
 - GPS-based devices for simultaneous image capture control, built by TUCN
- Software for camera calibration, automatic streak detection, automatic computation of 3D coordinates, built by TUCN.



3. Related research projects, past and present

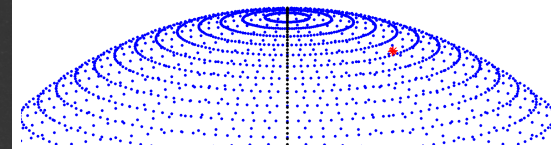
- “[Experimental Low Earth Orbit Surveillance Stereoscope – LEOSCOP](#)”, project funded by Romanian Ministry of Education and Research, CNMP: 82-093 / 2008, (2008-2011).
- “[Automatic Medium and High Earth Orbit Observation System Based on Stereovision](#)”, project funded by the Romanian National Authority for Scientific Research, CNDI–UEFISCDI, project code PN-II-PT-PCCA-2011-3.2-0651, (2012-2015)

4. Research partners

- BITNET CCSS, a small private enterprise specialized in space related research
- Astronomic Institute - Cluj Observatory, a space research institute of the Romanian Academy

5. Results

- A technical solution for capturing synchronized images from locations tens of kilometers apart
- Solutions for automatic streak detection in long exposure images: image difference analysis and classification, and oriented filter response analysis and classification
- Stereovision-based solutions for automatic computation of the 3D coordinates of the objects detected as image streaks



6. Publications

- O. Cristea, P. Dolea, V. Turcu, R. Danescu, “[Long baseline stereoscopic imager for close to Earth objects range measurements](#)”, *Acta Astronautica*, accepted 2012, DOI 10.1016/j.actaastro.2012.10.007.
- R. Danescu, F. Oniga, V. Turcu, O. Cristea, “[Long Baseline Stereovision for Automatic Detection and Ranging of Moving Objects in the Night Sky](#)”, *Sensors*, vol. 12, No. 10, October 2012, pp. 12940-12963.
- F. Oniga, M. Miron, R. Danescu, S. Nedevschi, “[Automatic Recognition of Low Earth Orbit Objects From Image Sequences](#)”, *International Conference on Intelligent Computer Communication and Processing*, 2011, pp. 335–338.

7. Contact

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The AMHEOS project website: <http://cv.utcluj.ro/amheos/>

The Image Processing and Pattern Recognition Group website: <http://cv.utcluj.ro>