

# AVIRO - Modular Perception System for Space Robotics

The effective control of robots needs an exact environment model together with a current state description. The aim of AVIRO is the development of such a system. To generate a robust three dimensional model of the environment, the system can be mounted with modular sensor devices. A multi-sensorfusion combines the data of several connected units in real-time. Parallel to this, position, attitude and speed of the system are determined continuously.

For the recognition of the surroundings we use laser-scanning in combination with the images of multiple cameras. The pose is given by high precise microelectromechanical (MEMS) and fiber optical inertial measurement units (IMU). One major challenge is the automatic online recalibration of the complete system. Because of aging and thermal or mechanical stress the position and orientation of the mounted sensors could change. To detect and compensate this a comparison between the IMU and an environment sensor based odometrie estimation is made.

The processing part of AVIRO consists of two systems. With a field programmable gate array (FPGA) the incoming sensor data are preprocessed. In this step computationally intensive calculations, especially in the field of digital image processing, is done in real-time. Finally an embedded computer generates the environment model and state description.

Unfavourable conditions such as those prevailing in space impose special challenges to the electronic components. Our system will be tested and qualified with technology readiness level 5 (TRL5). The project AVIRO is founded by the german aerospace center (DLR).

## I Project Management and Execution

Management:  
Univ.-Prof. Dr.-Ing. Klaus-Dieter Kuhnert

Contact:  
Prof. Dr.-Ing. Klaus-Dieter Kuhnert  
Dipl.-Inf. Marc Steven Krämer  
M.Sc. Simon Hardt

Chair of Real-Time Learningsystems  
Fak IV, University of Siegen  
Hölderlinstr. 3  
D-57076 Siegen

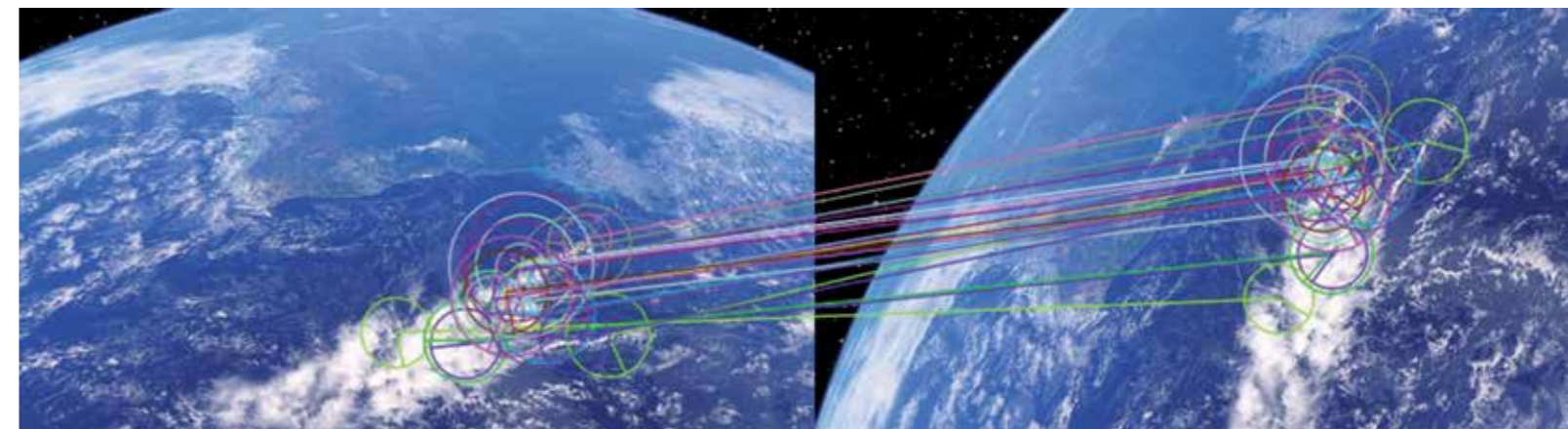
E-Mail: [kuhnert@fb12.uni-siegen.de](mailto:kuhnert@fb12.uni-siegen.de)  
web: <http://www.uni-siegen.de/fb12/ezls/>

Telefon: +49 (0)271 740-4779  
Fax: +49 (0)271 740-4421

Supported by:



on the basis of a decision  
by the German Bundestag



Feature detection and matching between image pairs of a virtual space scene

