

Thesis and Internship Opportunities

for students in

Computer/Electrical Engineering, Microsystems Engineering, Computer Science or similar fields

Orientation Estimation Algorithms for Embedded Platform and Low Cost Sensor Systems

The Institut für Mikro- und Informationstechnik of the Hahn-Schickard-Gesellschaft develops miniaturized sensors and actuators in the field of inertial sensors and systems. The research activities in Villingen-Schwenningen started in 1997. Since then several silicon-based micromachined sensors have been built that can either measure acceleration (accelerometers) or rotation velocity (gyroscopes). Silicon based micromachining makes it possible to produce low-cost and small size sensors for a variety of applications, e.g. navigation and stabilization systems for automotive industry or hardware for low-cost virtual-reality systems.

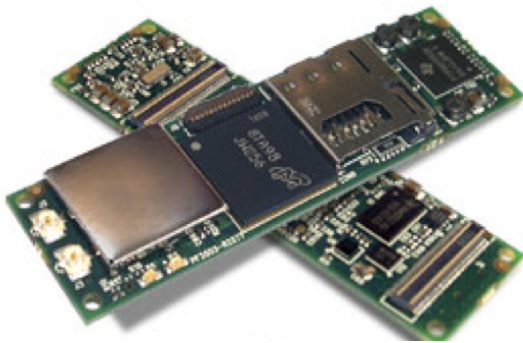


Fig. 1 Example of the OMAP3530 application processor module for sensor system development.

The performance of the system consisting of low-cost inertial and magnetic sensors can be significantly improved via a proper design of the fusion filter. The filter combines the outputs of the different sensors in a way that overall system performance is better than the one based on the expensive sensors of single measurement type. Typically some version of nonlinear Kalman filter (Extended (EKF) or Unscented (UKF)) is employed for orientation estimation. Although being computationally intensive, the filter can be easily realized on some modern advanced platforms such as OMAP35x from TI for low-power applications to perform the calculations locally rather than on host PC.

Currently available work includes:

Development of sensor electronics and orientation estimation algorithms for OMAP35x platform. The system should be able to read sensor data from custom developed sensor board and estimate orientation via fusion algorithms running on OMAP. The estimation results can be potentially visualized on the additional LCD or transferred to PC for further analysis.

Tasks for the student:

- Development sensor module readout and real-time data transfer from IMU to OMAP platform.
- Implementation of the state-of-the-art orientation EKF/UKF for OMAP35x.
- Evaluation of influence of different application scenarios, sensor parameters, filter implementation (floating-point vs. fixed-point) on estimation performance.
- System performance evaluation using available measurement equipment.

Requirements:

- Interest in the state-of-the-art inertial sensor systems and advanced estimation algorithms.
- Good knowledge in the digital electronics and data interfaces.
- Solid background in mathematics (familiarity with statistical signal processing is an advantage).
- Very good knowledge of C/C++ with emphasize on embedded platforms, basic Linux experience.

Basic experience with Matlab and conventional DSP and low-level microcontroller programming can be helpful for preliminary algorithm testing. The students can make advantage of HSG-IMIT experience in developing sensor electronics and fusion algorithm. Additionally, the content of the thesis or internship thesis can be adapted to the specific interests of the applicant. We would be very pleased to welcome You as a new student co-worker of HSG-IMIT. Further information and details can be obtained from the contact listed below.

Facts about HSG-IMIT:

- Located since 1990 in the new facilities in Villingen-Schwenningen
- Currently more than 90 employees in research and development
- Typically 10-20 student co-workers per semester
- Approximately 700 m² of laboratory space with state-of-the-art equipment
- Approximately 600 m² of cleanroom classes 10-1000, solely dedicated for the production of microstructures

Benefits for our students:

- Involvement in an up-to-date and application-oriented field of research
- State-of-the-art software and equipment
- A highly motivated and interdisciplinary work environment
- A competitive compensation to which a rent subsidy can be granted
- Support in finding an appropriate room during the stay at HSG-IMIT

Your contact:



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Inertial Sensors and Systems

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