

## Thesis and Internship Opportunities

For the students in  
Computer/Electrical Engineering, Microsystems Engineering, Computer Science or similar fields

### Development of the System for the Combined Indoor/Outdoor Localization

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. navigations and stabilization systems for automotive industry or hardware for low-cost virtual-reality systems.

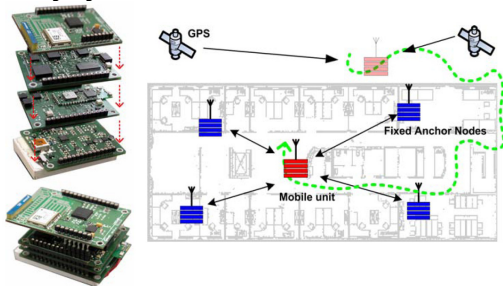


Fig. 1. Existing hardware realization of the sensor stack (left) and the system setup for combined indoor/outdoor localization (right).

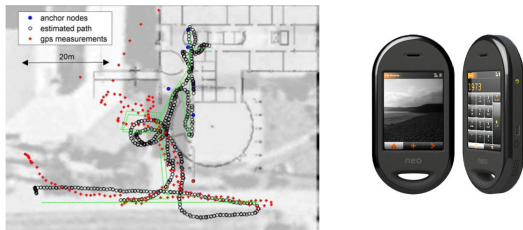


Fig. 2 Results of combined indoor/outdoor localization using Particle Filtering (left) and Openmoko open source phone platform for the embedded algorithm development and visualization (right).

Although outdoor navigation can be easily accomplished using satellite based navigation system, the indoor or combined indoor/outdoor (Fig.1) navigation still possess significant difficulties.

#### 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 m<sup>2</sup> of laboratory space with state-of-the-art equipment
- Approximately 600 m<sup>2</sup> of cleanroom classes 10-1000, solely dedicated for the production of microstructures

The preliminary work using GPS, inertial sensors and radio time-of-flight measurements (Fig.1) has shown promising results (Fig. 2), but certain technical difficulties have to be solved for the so-called collaborative localization, where the position is fused from both fixed and moving anchors. Currently the fusion is done on the host PC using sequential Monte-Carlo Methods such as Particle Filtering, but has to be extended to run on the embedded platform for enabling distributed localization and direct position visualization.

#### Currently available work includes

Development of combined indoor/outdoor localization system for running on open source Openmoko platform (Fig.2). The system will fuse the available sensor data using Particle Filtering and present the results to the user using the map and known anchor position information.

#### Tasks for the student:

- Develop Openmoko interface to existing sensor stack system for fast and reliable communication.
- Implement existing Particle Filtering to run on Openmoko platform.
- Visualize the position results using map information and implement basic GUI for the user to interact with the system.

#### Requirements:

- Interest in localization systems and advanced estimation algorithms.
- Basic knowledge in electrical engineering.
- Solid background in mathematics (familiarity with statistical signal processing is an advantage).
- Deep knowledge of C/C++ and Linux OS for Openmoko application development with experience in embedded systems.

The students can make advantage of HSG-IMIT experience in developing sensor electronics and algorithm development. 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.

#### 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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