

Master Thesis:
Ultra-Low-Power Sensor System for Tree Motion Analysis

A master thesis opportunity is available in cooperation between Karlsruhe Institute of Technology and University of Freiburg in the field of embedded sensing systems for environmental monitoring.

Background:

Tree movement under wind excitation contains valuable information about the mechanical properties and physiological condition of trees. Changes in water content influence the structural dynamics of branches and trunks and can therefore be analyzed through vibration behavior.

The goal of this thesis is to develop an ultra-low-power embedded sensor system capable of measuring and analyzing tree motion using inertial sensing techniques.

The system will acquire motion data, perform onboard signal processing and frequency analysis, and wirelessly transmit extracted vibration characteristics and statistical information.

Your Tasks:

1. Develop a motion sensing system based on an existing wireless sensor node platform
2. Select suitable low-power acceleration and IMU sensors
3. Integrate sensors into the existing embedded hardware and firmware framework
4. Implement embedded data acquisition and signal-processing pipelines
5. Perform onboard numerical and frequency-domain analysis
6. Transmit processed data wirelessly for further evaluation
7. Evaluate system behavior under realistic environmental conditions

We are looking for someone who:

1. Good knowledge of embedded C programming
2. Experience with ARM microcontrollers (good to have)
3. Interest in embedded systems, sensor systems, and signal processing or FFT-based analysis
4. Independent and structured working style

What We Offer:

1. Research-oriented thesis with strong practical relevance
2. Hands-on work with real environmental sensing systems
3. Opportunity to contribute to ongoing research activities in embedded sensing and environmental monitoring

If you are interested, please send:

- CV
- Short statement of interest

To: Uttunga Shinde/ uttunga.shinde@imtek.de