Networked Embedded Systems

Term and Master Thesis Topics 2012

• Jan Beutel
Topics for Student Theses

In accordance with the orientation of our group, we offer projects in the domain of networked embedded systems and software. Our ideal candidate has attended the lectures Computer Engineering, Embedded Systems, and HW/SW Co-Design, is proficient in C/C++, Java, and Matlab, and works 40+ hours a week. Meanwhile, we found out, however, that also with a working knowledge of C/C++ and a moderate effort of 20 hours per week for semester theses, good results can be achieved.

We offer projects in all of our main research domains. You might refer to Research to get a big picture about these areas. If you are interested, do not hesitate to contact the advisor for an informal meeting (see Getting Started).

Note: Within the D-ITET regulations, you are allowed to write a semester thesis and/or your master thesis at our group. This is independent from your previous or planned future theses with other groups of the TIK institute.

Networked Embedded Systems

- A Gigapixel Camera for the Mountains [D-ITET/D-INFK, MA, ]
- Differential GPS processing for Wireless Sensor Networks [D-ITET/D-INFK, SA/MA, ]
- Micro Energy Scavenging for WSNs [D-ITET/D-INFK, SA/MA, ]
- Real-Time Processing of Sensor Data Streams with Complex Operators [D-ITET/D-INFK, SA, ]
- Route Selection for Mobile Sensors Under Uncertainties [D-ITET/D-INFK, SA/MA, ]
- Spatio-Temporal Sensor Data Classification [D-ITET/D-INFK, SA/MA, ]
- Timetable Network Simulator Based on Real Driving Traces [D-ITET/D-INFK, SA/MA, ]

Embedded System Design

- Advanced Features for a Software Development Environment for Many-Core Systems [D-ITET/D-INFK, SA/MA, ]
- Fault Tolerant Many-Core Systems [D-ITET/D-INFK, SA/MA, ]
- Performance Analysis of Dynamic Applications on a Many-Core System [D-ITET/D-INFK, SA/MA, ]
- Throughput Optimization by Task Migration [D-ITET/D-INFK, SA/MA, ]

Performance Evaluation

- An Approach for the Analysis of Dynamic Applications in Many-Core Systems [D-ITET/D-INFK, SA/MA, ]
- Performance Evaluation of Dynamic Applications on Many-Core Systems [D-ITET/D-INFK, SA/MA, ]
- A Survey of Many-Core System Performance Evaluation Techniques [D-ITET/D-INFK, SA/MA, ]
Networked Embedded Systems

A GigaPixel Camera for the Mountains [D-ITET/D-INFK, MA, 1]
Differential GPS processing for Wireless Sensor Networks [D-ITET/D-INFK, SA/MA, 1..2]
Micro Energy Scavenging for WSNs [D-ITET/D-INFK, SA/MA, 1..2]
Real-Time Processing of Sensor Data Streams with Complex Operators [D-ITET/D-INFK, SA, 1..2]
Recipes for Wireless Sensor Network Structures [D-ITET/D-INFK, SA/MA, 1]
Route Selection for Mobile Sensors Under Uncertainties [D-ITET/D-INFK, SA/MA, 1]
Spatial and Temporal Sensor Data Classification [D-ITET/D-INFK, SA/MA, 1]
Timetable Network Simulator Based on Real Driving Traces [D-ITET/D-INFK, SA/MA, 1]

Topics listed on the web are not exhaustive...

COME AND TALK TO US
Remote gigapixel panoramas as time-lapse movies
400’000-500’000 pixel (Nikon D300s @ 300mm)
Meet CamZilla
Integration with Data Management

GSN Private
- RAW Data Storage
- High Availability
- Full Backup
- Administrator Access only

GSN Public
- Position Mapping
- Sensor Mapping
- Data Conversion and Processing
- Public Access

CoreStation
- Vaisala Plugin
- GPS Plugin
- System Plugins
- Camera Plugin

SQLite

MySQL

SenorNode

AccessNode
Task – CamZilla Panorama Control & Automatic Stitching

- 360° high resolution shots
- Adjustable camera settings
- Completely remote controlled
- Picture tasks schedulable
- Duty-Cycling ready
- Camera box heating facility
Monitoring Air Pollution in Zurich

**OpenSense Project:** Obtain high resolution maps of air pollution for Swiss cities with low-power wireless sensors.
Motivation and Approach

• Measurement Networks in Zurich:
  – NABEL (1 Station in Zurich) – national net
  – OstLuft (4 Stations in Zurich) – cantonal net
  ➢ Zurich is one point on the pollution map!

• Goals:
  – High resolution maps for cities
  – Low cost measurement stations
  – Raising public awareness and involvement

• Approach:
  – Sensors on top of public transport vehicles
  – VBZ supports installation in Zurich
Current Status

- 3 measurement stations:
  - 1 station @ NABEL Dübendorf
  - Sensor calibration, reference measurements
  - Sensors: O3, NO2
  - 1 station @ VBZ Tram @ NABEL Dübendorf

![Image of a tram](image-url)
Task – Spatial and Temporal Sensor Data Classification
FlockLab Testbed

- Replacement for DSN and FlockLab Prototype
- ~30 nodes in-/outdoor around ETZ
- 4 target architectures
- Fast, distributed tracing (actuation) of logic (GPIO/serial) and physical properties
Task – Recipes for Wireless Sensor Network Structures
Job Opening

• (Part-time) tech-staff
  – For supporting environmental sensing projects
  – Design and implement experimental platforms
  – Embedded programming, hardware design, server-side applications
  – Motivation, interdisciplinary team, possibly with outdoor skills…

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