Energy Informatics Seminar WS16/17
Schedule and Requirements

Thomas Kriechbaumer, Victor del Razo,
Matthias Kahl, Anwar Ul Haq

TUM Department of Computer Science
Chair of Application and Middleware Systems
(I13, Prof. Dr. Hans-Arno Jacobsen)
Contact: thomas.kriechbaumer@in.tum.de

Schedule

- Topic presentation and allocation (the first week of the semester)
  - One session at the end of the previous semester for topic presentation
  - One session at the beginning of the semester for topic presentation
  - Final topic allocation via Moodle in the first week of the semester
- Final submission deadline for research proposal (~4 weeks into the semester, early submission possible)
  - Related work, research approach
  - Receipt of comprehensive feedback via email and possibility of personal tutoring
- Final presentations (starting 3-N weeks before the end of the semester, depending on participation)
  - Results, demonstration, conclusions
- Submission of final report and software (end of the semester)

Workload

- Seminar has 4 ECTS points ➔ 120 h (officially)
- Higher if this is the first time doing academic research
- Lower if you have already done so in the past

Requirements

- Fit of student and advisor interest
- Scientific research method
- Publicity of data and analytical code
- Communication with advisor
- Deliverables
- Citation and anti-plagiarism rules
- Language
- Group work

Fit of Student and Advisor Interest

- Enables effective support of student research
- Motivates both sides

Scientific Research Method

- Contribute to answering an innovative research question
  - Cite related research
  - Justify research gap
- Research results based on actual data
  - Documentation of data origin
  - Documentation of data transformations
- Description of method
- Implications and limitations of results

Research Methods

- Prototyping
  - Provide solution for a relevant research problem
  - Runnable code (Java, Python, etc.)
- Empirical/Statistical
  - Collect/consolidate data
  - Conduct statistical analysis
- Literature research
  - Analyze state-of-the-art of research in a particular field
  - Requires clear description of data collection and review method (Which databases? Which key words? Etc.)
  - Summarize and compare paper topics, methods, results

Publicity of Data and Method

- Data and code provided together with final documents
- Use of open-source tools (Octave, R, gnuplot, Java, LaTeX, etc.)

Communication with Advisor

- Proactive, continuous communication
- Response to emails within 2 work days (both sides)
- Presence at all scheduled seminar meetings required (forms part of the grade)

Deliverables & Deadlines

- Research proposal
  - ~ 1 page (use of LaTeX and ACM proceedings style mandatory!)
  - Upload pdf on Moodle
  - Deadline: 2016-11-16, **check Moodle for updates!**
- Presentation
  - Strict time limit: 15 minutes per student (practice!)
  - MS Powerpoint or LaTeX (use of new TUM template mandatory!)
  - Exact time announced via Moodle
  - Upload on Moodle 24h before the talk
- Final Report
  - ~ 10 pages (use of LaTeX and ACM proceedings style mandatory!)
  - Upload pdf via Moodle, for other deliveries follow your tutor's advice
  - Deadline: 2017-03-05 23:55, **check Moodle for updates!**

- https://www.acm.org/publications/proceedings-template
- https://portal.mytum.de/corporatedesign/index_html/vorlagen/index_praesentationen

Grading

- Proposal: 20%
  - ideas, motivation, clarity of description, formal requirements
- Presentations: 20%
  - style, slide structure, comprehensibility, formal requirements
- Report: 60%
  - scientific quality and contribution, formal requirements

All deliverables are mandatory to pass the course!
Presence on presentation sessions mandatory!

Research Proposal

1. Introduction to research topic
2. Statement of concise research question
3. Preliminary literature review
4. Description of data source or collection method
5. Description of statistical method to be applied
6. Results outlook
7. Timeline

Citation and Language

- Base your contribution on scientific literature only
  - Learn to use scientific search engines, e.g., Science Direct, IEEE Explorer, Google Scholar, etc.
  - May require campus access or VPN for authentication
  - eaccess.ub.tum.de
- Respect common citation rules
- Plagiarism won’t be tolerated

Group Work

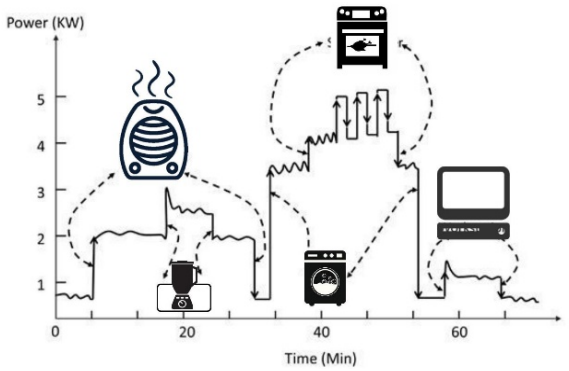
- Working on one topic in a group is preferred
- Final grade will be the same for all group members
- Time and page limit will be multiplied by group size
- No support for group management!
- We are not your nanny!

Topic Allocation

- Follow instructions for group and topic assignment in Moodle
- Google Forms for group registration
- Will be announced via Moodle later this week

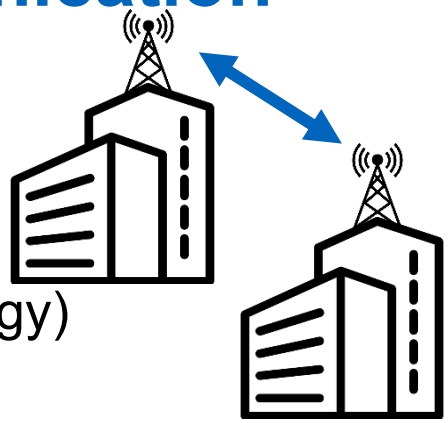
Energy data compression (high frequency)

- **Type of Research:** Prototype Research
- **Research Problem:**
  - Aim: Detect appliance signatures
  - General characteristics (periodic, 50 Hz)
  - Processing requirements (time, complexity)
  - Benefits
    - Reduced transmission time? Increased reliability?
    - Reduced storage requirement?



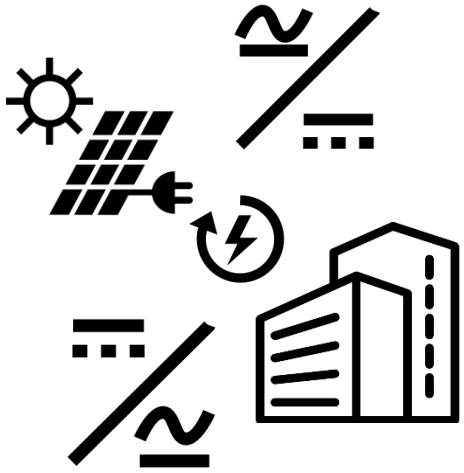
- **Method:**
  - Review relevant literature on compression (esp. energy related)
  - Music compression techniques
  - Lossless compression techniques comparison

Building to Building (B2B) Communication



- **Type of Research:** Literature Research
- **Research Problem:**
  - Making building independent (in terms of energy)
  - Role of buildings as aggregator
  - Benefits
    - Energy optimization? DSM? Voltage regulation?
    - Efficient utilization of local renewables? Storage?
- **Method:**
  - Review relevant literature on
    - Micro grid
    - Smart grid standards
    - Communication technique (wired, wireless, power-line)

Net-Zero Energy Buildings (NZEB)

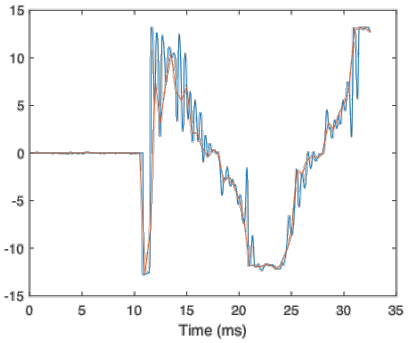


- **Type of Research:** Literature Research
- **Research Problem:**
  - Self generation through renewables
  - Power available at outlet (AC)
  - Most appliances work on DC internally
  - Benefits
    - Conversion losses? Renewable resources & Storage (DC)?
    - Use case: Datacenter? Office Buildings?
- **Method:**
  - Review relevant literature on
    - Annual energy balance for NZEB
    - Reducing conversion losses through DC-Powered buildings

Feature extraction from existing datasets using openSMILE ☺

openSMILE:) by audEERING™

- **Type of Research:** Prototype Research
- **Research Problem:**
  - Detect appliance signatures from existing energy dataset
  - openSMILE- a modular and flexible feature extractor
  - Supported formats (PCM WAVE, CSV, ARFF, HTK)
  - Benefits
    - FFT to extract appliance features?
    - Build appliance feature database?
- **Method:**
  - Review relevant literature on openSMILE
  - Check if usable with energy signals



Interactive Front-End for EV Traffic Simulation in Highways

- Type of research: prototyping

- Research question
  - How does a graphic interface for showing the progress of the simulation should look like?
  - What tools, paradigms, etc. should be used?
  - What are the existing standards for integration to vehicle bus?

- Method
  - Define and understand requirements
  - Analyze functionality architecture and data-structures of the simulation tool
  - Plan, design, implement. (Simulation tool is Python-based)

Refactoring EV Highway Traffic Simulation for Efficient Parallel Computation

- Type of research: prototyping

- Research question
  - What is the potential improvement?
  - Which parts can be refactored?
  - What method, paradigms, strategies should be used?

- Method
  - Define and understand requirements
  - Understand advantages and limitations on parallel computing and Python
  - Analyze functionality architecture and data-structures of the simulation tool
  - Plan, design, implement

Wireless EV Charging in Roads

- Type of research: literature research

- Research question
  - What are the main characteristics, parameters and limitations of wirelessly charging EVs while moving
  - Which technologies are available, what are their constraints?
  - List existing, planned pilot projects

- Method
  - Deep literature research on different scientific and engineering sources
  - Research on commercial/scientific pilots
  - Classify technologies, tools, and pilot projects
  - Generate a sustained statement on the status, drawback, advantages and opportunities of on-movement EV wireless charging

Python Interface and integration of GridLAB-D to a Python-based controller

- Type of research: prototyping

- Research question
  - Can we integrate GridLAB-D to an existing Python-based framework?
  - What are the limitations regarding this integration?
  - Can the integration be implemented such that the choice of the simulator (GLD or Power Factory) is transparent to the user?

- Method
  - Research and understanding on GLD functionality and integration alternatives
  - Analyzing and understanding existing Python-based framework
  - Define a strategy, design, architecture and implement it

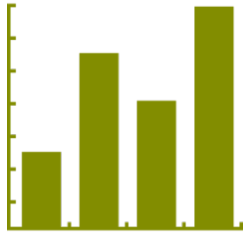
Adaptation of EV Highway Simulation for Heavy Vehicles (LKW)

- Type of research: prototyping with a bit of lit. review

- Research question
  - Can we use existing simulation tool to simulate LKW traffic and rest-stops?
  - What are the location and capacities of these stops?
  - What are the resting requirements according to German/European law for truck drivers?
- Method
  - Identify potential sources of information for the last two questions
  - Literature research on the work on this area (resting stations, trucks, highway)
  - Analyze functionality architecture and data-structures of the simulation tool
  - Plan, design, implement

Occupancy Detection with Electrical Signals

- **Type of Research:** Literature Research
- **Research Questions:**
  - Which a appliances correlate to user behaviour?
  - What are significant usage patterns?
  - What other side-channel information can be used?
    - Light? Room temperature? WiFi devices?
- **Method:**
  - Review relevant literature on occupancy detection
  - Derive a common set of available characteristics



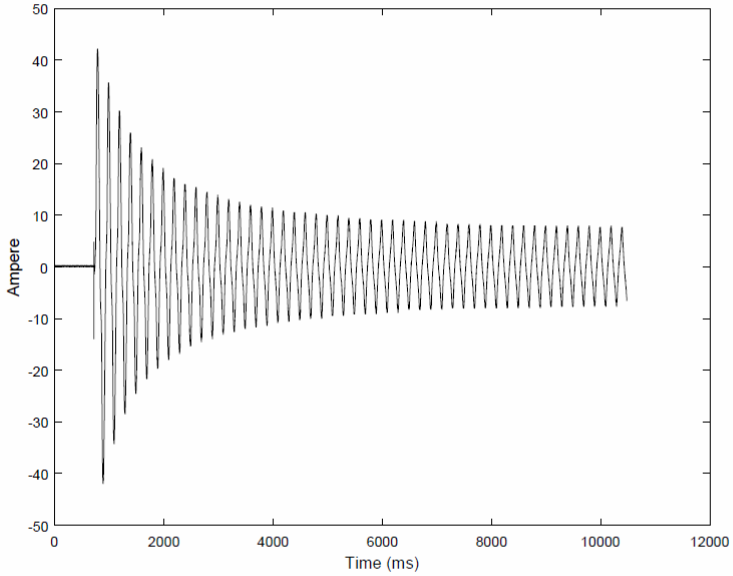
Electric Mains: High Frequency Measurements

- **Type of Research:** Literature Research
- **Research Questions:**
  - Compare energy measurement systems
  - Frequency, Resolution, Accuracy?
  - Data acquisition, storage, and processing?
- **Method:**
  - Research of data acquisition systems
  - Compare against low-frequency systems
  - Define comparable metrics: voltage & current

Matthias Kahl <matthias.kahl@tum.de>

On/Off-switch detection of electrical appliances

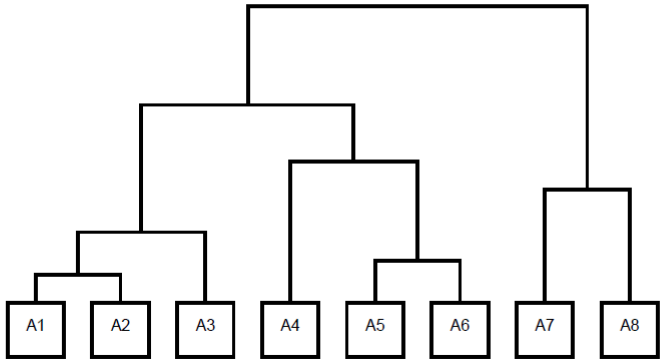
- **Type of research:** literature review and prototyping
- **Research Questions:**
  - What is the state of the art in applianc switch detection?
  - How to distinguish between appliance state and switch?
- **Method:**
  - Show the state of the art in appliance switch detection.
  - Show problems in case of multi state appliance.
  - Implement an own switch detection approach.



Matthias Kahl <matthias.kahl@tum.de>

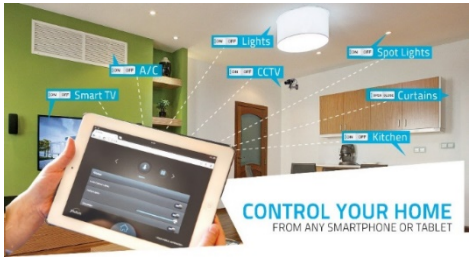
A household and industrial appliance taxonomy for NILM purposes

- **Type of research:** literature review /data analysis
- **Research Questions:**
  - Which appliance taxonomies exist?
  - Based on which perspective were these taxonomies composed?
  - Which taxonomy best fits to household and industrial appliances for NILM purposes?
- **Method:**
  - Show existing relevant taxonomies
  - Compose a taxonomy based on NILM needs
  - Run a Cluster analysis on a bunch of appliances
  - State out the best taxonomy for NILM



Home Automation – *past, present & future*

- **Type of Research:** Literature Research
- **Research Questions:**
  - Overview about recent Home automation systems
  - Currently used in private and industrial purposes?
  - Future scenarios in terms of automation?



- **Method:**
  - Review relevant literature on home automation
  - Show vivid examples, technical issues
  - Show safety dis/advantages

DALI BACnet OpenTherm CAN EtherCAT

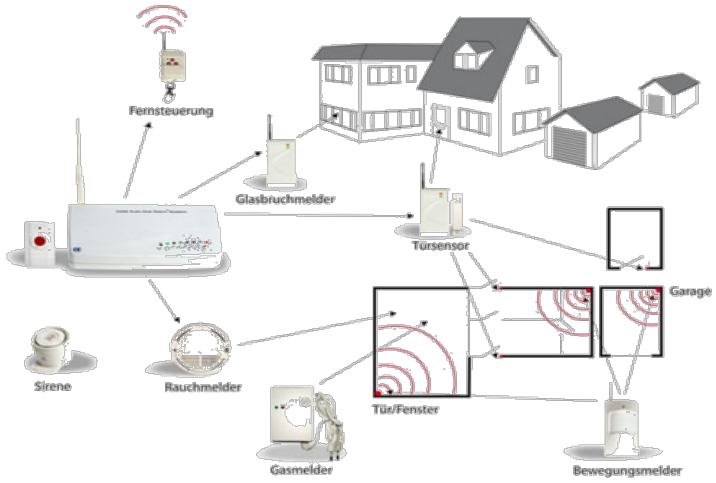
Smart Buildings, a solution for nursing homes and patient care?

- **Type of Research:** Literature research
- **Research Questions:**
  - Overview about problems in nursing homes and patient care?
  - How can smart systems help in those cases
  - What are useful future scenarios?

- **Method:**
  - Show vivid examples
  - Show technical issues
  - Show dis/advantages

Safety in Buildings with smart components

- **Type of Research:** Literature Research
- **Research Questions:**
  - Overview about safety issues in homes or industry buildings
  - Show components that ensure privacy, prevents force of nature, fire, burglary aso.
  - What can be future scenarios?
- **Method:**
  - Show vivid examples
  - Show technical issues
  - Dis/Advantages



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