19589 - PS Telematik-Projekt: Wireless Embedded Systems

Course Introduction

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1. About the Course

2. Course Requirements

3. Required Skills and Knowledge

4. Schedule

5. Wireless Sensor Networks

6. Task 1

7. Task 2

8. Detailed Schedule

9. Equipment and Documentation

10. What you will learn
About the Course

- Prerequisite: Bachelor or Vordiplom
- Supervised lab course
- Half of work to be done outside of lab hours
- Projectseminar → Choose the type of your “Schein”
- ECTS-Credits: 10
- Task given at start of term
- Two students per team

Michael Faraday in his laboratory at the Royal Institution. From a painting by Harriet Moore.
Course Requirements

- No exam
- No talk/presentation
- Develop software to solve task
- Evaluate software via experiments
- Two written technical reports, each 6 pages
- Mandatory attendance in lab hours
- Minimum of 150 work hours ($150 \text{ h}/17 \approx 8.83 \text{ h}$)
- Meet deadlines
- Revision of reports as necessary
- Collaborative milestone talks
Required Skills and Knowledge

- Lecture *Telematics*
- Lecture *Mobile Communications*
- Protocols and Protocolstacks
- Basic OS related knowledge
- Programming in C
- Doxygen
- Subversion
- \LaTeX2e
- October 8th, 2008
  - Course introduction
- October 15th, 2008
  - Team forming
  - Introduction to the ScatterWeb² firmware
- October 22nd - December 17th, 2008
  - Supervised lab hours
- December 17th, 2008
  - First deadline
  - First technical report
- January 7th - February 11th, 2008
  - Supervised lab hours
- February 11th, 2008
  - Second deadline
  - Second technical report

Time: 17 weeks total
Wireless Sensor Networks

- Spatially distributed autonomous devices
- Equipped with various sensors
- Cooperative monitoring and computation
- Origin: military
- Embedded systems: pervasive, ubiquitous
- Wireless ad-hoc networks
- Network size: from a dozen to 10,000 nodes

Sorry, no Linux based mesh routers this term.
Routing layer

- Implement a (simple) routing protocol
  - DSDV,
  - OLSR,
  - or DSR
- Develop test scenario to evaluate implementation
- Measure throughput and delay
- Write first technical report
  - Description of routing protocol
  - Test scenario description and discussion
  - Data evaluation
- Document source code

Time: 8 weeks
Transport layer

- Implement a (simple) transport layer protocol which ensures
  - acknowledged end-to-end communication,
  - reliability,
  - flow control,
  - and order of data

- Develop test scenario to evaluate implementation

- Measure throughput and delay

- Write second technical report
  - Description of transport protocol, RFC-style
  - Test scenario description and discussion
  - Data evaluation

- Document source code

Time: 6 Weeks
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<th>3 Weeks</th>
<th>08.10.</th>
<th>15.10.</th>
<th>22.10.</th>
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<tr>
<td>First Meeting</td>
<td>First Steps</td>
<td>C Programming, Subversion</td>
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<td>8 Weeks</td>
<td>29.10.</td>
<td>05.11.</td>
<td>12.11.</td>
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<td>Task 1</td>
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<td>Routing P.</td>
<td>Testing</td>
<td>Writing</td>
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<td>6 Weeks</td>
<td>07.01.</td>
<td>14.01.</td>
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<td>Task 2</td>
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<td>Transport P.</td>
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**Introduction** | **Collaborative Talk** | **Programming** | **Writing** | **Experiments** | **Other**
- Barebone ScatterWeb\textsuperscript{2} operating system
- Open source compiler toolchain (MSPGCC)
- Sensor nodes, cables, and flash interface
  - Lent for the whole semester
  - Do not lose!!
- Protocol specifications, introductory documents
What you will learn

- Embedded system programming
- Routing protocol implementation
- Transport protocol implementation
- Evaluation by experiment using test scenarios
- Technical writing

→ Preparation for your Diploma/Master thesis.
Thank you for your attention.

Questions?
Tools and Documents

Tools
- Doxygen
- \texttt{\LaTeX}TEX
- MSPGCC
- Subversion

Documents & Papers
- Building Protocol State Machines in UML 2 (UML 2 For Dummies)
- Highly Dynamic Destination-Sequenced Distance-Vector Routing (DSDV) for Mobile Computers
- Mobile Communications Script
- RFC 793 (TCP)
- RFC 3626 (OLSR)
- RFC 4728 (DSR)
- RFC 4960 (SCTP)
- ScatterWeb API
Books and Articles

Books
- C - kurz & gut (ISBN-13 978-3897212381)

Articles (online)
- ANSI C Reference Card
- The C Book
- C Elements of Style
- Everything you need to know about pointers in C
- Frequently Asked Questions in comp.lang.c (C FAQ)
- FMM - Frequently Made Mistakes [in technical writing]
- Memory Management in C
- William Strunk, Jr. - The Elements of Style [in technical writing]
- Byun - A Tool Support for Design and Validation of Communication Protocol using State Transition Diagrams and Patterns
- Darroch - Implementing Protocol State Machines
- Schmidt, et al - \LaTeX2e-Kurzbeschreibung
- McKinney - TCP/IP State Transition Diagram