FEO3260 Machine-to-Machine Communication 7.5 credits

Maskin till maskin kommunikation

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for FEO3260 valid from Spring 2014

Grading scale

Education cycle

Third cycle

Specific prerequisites

Participants are recommended to have basic knowledge in wireless communications and networks. However, this is not mandatory and interested students should discuss their background with the instructor at the beginning of the course.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

PhD students will acquire the following skills in the course:

- Identify the main challenges associated with machine-to-machine communications with respect to the status quo in networking today.

- List the main standards/protocols/algorithms/research activities which address these challenges as of today.

- Describe how these standards/protocols and algorithms solve the challenges at hand.

- Dimension either local or wide-area networks for machine-to-machine applications with respect to the standard/protocol chosen.

- Identify limits of standards/protocols and algorithms with respect to machine-to-machine applications

- Analyze a selected application scenario for machine-to-machine communications and demonstrate the interrelationship between the different components (capillary, widearea and auxiliary functions) with respect to the application scenario chosen.

- Identify the most important research problems in the different areas of machine-to-machine communications and current approaches to overcome them.

- Combine different standards/protocols/approaches of different areas (capillary, wide area, auxiliary) into a single system conceptually and identify performance bottle-necks.

- Summarize, explain and apply the most important models underlying the major technical solutions developed in the different areas of machine-to-machine communications to obtain performance metrics.

- Summarize state-of-the-art in the field of machine-to-machine communications.

- Mathematically prove structural properties of systems/protocols/networks in the domain of machine-to-machine communications.

- Reason about the modification impact to these systems/protocols/networks based on mathematical derivations.

Course contents

The course introduces the main challenges, solutions and application fields of of machine-to-machine communications. As an emerging networking paradigm, machine-to-machine communications spans all communication processes that do not involve humans and which are designed to pursue tasks of automation in the most general sense. This enables completely new application areas but introduces several novel and severe challenges. These have been addressed by research industry over the last couple of years and have initiated new standardization activities as well as significant research findings. This course deals with these new insights and technologies and puts them in relation to the new emerging application fields. In particular, the course is divided into several different blocks: Traditional automation systems, capillary networking, cellular & wide-area networking, and application scenarios (Internet-of-things, smart grid, vehicular networks). Each block is accompanied by a mandatory assignment for students to be worked on individually as well as in groups. Assignments that have to be worked on in groups are afterwards presented in front of class.

In addition, special sessions for PhD students will be organized which deal with selected research papers in the field of machine-to-machine communications

The course consists of the following units with the respective contents:

· Unit 1: Introduction to Machine-to-Machine communications (M2M)

· Unit 2: Automation Systems & Networks for Automation

o Basics of Control Theory, Architectures of Automation Systems, Traffic characteristics and requirements of automation systems

o Wired networks for automation systems (HART, CAN, PROFIBUS, Industrial Ethernet)

o Wireless networks for automation systems (Wireless HART, ISA 100)

· Unit 3: M2M & Capillary Networking

o Power and traffic requirements of M2M applications

o Wireless systems for M2M capillary networking: 802.15.4, Lower-Power Bluetooth, 802.11ah, Wireless M-Bus)

· Unit 4: M2M & Cellular Networks

o Scalability issues of M2M applications over cellular networks

o Solutions for GSM and LTE networks

· Unit 5: M2M & Internetworking

o IP and power consumption / computational burden on constrained devices

o 6LowPAN and CoAP

· Unit 6: M2M and Vehicular Networks

o Traffic safety application requirements

o Car-to-X communication solutions and their performance

Disposition

See further about the examination requirements and the course main content.

Course literature

Läsanvisningar (forskningsartiklar) lämnas ut till studenterna en vecka innan föreläsningen.

Reading assignments (research papers) are passed to the students one week before class.

Examination

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Other requirements for final grade

Students pass if they fullfill the following three criteria:
1. Turn in all homework assignments.
2. Reach 75 % of the points in at least three out of four homework assignments.
3. Reach 75 % of the points of the final exam

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.