



Are you ready to r'loT'?

Lecturers

Name: German Corrales Madueno

Background:

- Ph.D. in Wireless Communication from Aalborg University
- M.Sc. in Mobile Communication from Aalborg University

Specialization:

- Senior Research Engineer at Keysight
- External Associate Professor at Aalborg University

Contacts:

Email: german.madueno@keysight.com

Name: Rasmus Krigslund

Background:

- Ph.D. in Wireless Communication from Aalborg University
- M.Sc. in Wireless Communication from Aalborg University

Specialization:

- Senior Specialist, Wireless Communication at Kamstrup
- External Associate Professor at Aalborg University

Contacts:

Email: rkl@kamstrup.com

Name: Jimmy Jessen Nielsen

Background:

- Ph.D. in Wireless Communication from Aalborg University
- M.Sc. in Networks and Distributed Systems from Aalborg University

Specialization:

- Associate Professor at Aalborg University

Contacts:

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Are you ready to r'IoT'?

Name: Rene Brandborg Sørensen

Background:

- M.Sc. in Wireless Communication from Aalborg University

Specialization:

- Ph.D. student at Aalborg University specializing in wireless communication

Contacts:

Email: rbs@es.aau.dk

Name: Josefine Holm

Background:

- M.Sc. in Mathematical Engineering from Aalborg University

Specialization:

- Ph.D. student at Aalborg University specializing in wireless communication

Contacts:

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Name: Alexandru-Sabin Bana

Background:

- M.Sc. in Wireless Communication from Aalborg University

Specialization:

- Ph.D. student at Aalborg University specializing in wireless communication

Contacts:

Email: asb@es.aau.dk

Name: Anders Ellersgaard Kallør

Background:

- M.Sc. in Wireless Communication from Aalborg University

Specialization:

- Ph.D. student at Aalborg University specializing in wireless communication

Contacts:

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Course Description

Title: Are you ready to r'IoT'

Fields of activity:

- Computational sciences
- Computer engineering
- Computer science/Automatic control/informatics
- Control engineering/systems engineering
- Electrical/electromechanical engineering
- Electronic/electrotechnical engineering
- Mathematics
- Telecommunications/Electronics

Examination type: Oral exam, in groups

Number of ECTS credits issued: None

Learning Goals and Objective: During this course, you will be introduced to the world of IoT, and how relatively little it takes to get started. You will build your own IoT application, from the hardware, through connectivity, to an application running in the cloud, and thus become familiar with the most element of any common IoT application.

Syllabus

Name of activity	Introduction to the IoT Ecosystem
Number of working hours	3
Type of activity	Lecture and group exercises
Lecturer	German Madueno Rasmus Krigslund
Short summary of content	General introduction to the IoT world, including the different elements in the chain, the type of verticals and the projects available for the course.
Bibliography	Already available in the pre-materials.
Expected effect	The basic understanding of the IoT world and the potential applications will help students to choose the most relevant project for their interests and start to form the groups.

Name of activity	Introduction to Problem Based Learning (PBL)
Number of working hours	3
Type of activity	Lecture and project work
Lecturer	Jimmy Jessen
Short summary of content	Introduction to project management (in small scale), with inputs on how to structure a development project, time planning and conflict handling.
Bibliography	Will be made available at the course.
Expected effect	The students are able to drive their own development project throughout the entire course, and manage the process from idea to working prototype.

Name of activity	Wireless Connectivity for IoT Devices
Number of working hours	3
Type of activity	Lecture and project work
Lecturer	Rasmus Krigslund (Second lecturer not selected yet)
Short summary of content	Introduction to the main candidates in the plethora of wireless technologies targeting the IoT space.
Bibliography	Will be made available at the course.
Expected effect	The students will have an overview of the advantages and disadvantages of the different technologies as well as their technical differences. Moreover, the students will be able to select the most suitable technology for fulfilling a set of application and hardware requirements from a given IoT application.

Name of activity	IoT Hardware: Design and Considerations
Number of working hours	3
Type of activity	Lecture and project work
Lecturer	German Madueno Rasmus Krigslund
Short summary of content	General introduction to a selected hardware platform and sensors for IoT prototyping; How to set get the hardware up and running, and what to consider when designing battery driven hardware for a specific IoT application.
Bibliography	Will be made available at the course.
Expected effect	The students will have experience with the selected hardware platform and gain insights into the inherent trade-offs and compromises between application requirements and what is realizable in the hardware.

Name of activity	Analytics and Machine Learning
Number of working hours	3
Type of activity	Lecture and group exercises
Lecturer	Rene Brandborg Sørensen
Short summary of content	General introduction to cloud services and their offerings within machine learning toolboxes and data analytics in the cloud.
Bibliography	Will be made available at the course.
Expected effect	The students will be able to create their own cloud application receiving and analyzing the data from their IoT device.

Name of activity	Introduction to Lab Testing
Number of working hours	3
Type of activity	Laboratory work and project work
Lecturer	German Madueno Rasmus Krigslund
Short summary of content	General introduction to lab tools, such as the power analyzer, the base station emulator and the oscilloscope.
Bibliography	Will be made available at the course.
Expected effect	The students will have experience with lab equipment and to learn to test and debug the device under development.

Name of activity	Requirements and Challenges of IoT Systems
Number of working hours	4
Type of activity	Lecture and project work
Lecturer	Rasmus Krigslund German Madueno
Short summary of content	Explanation of the challenges of connectivity and how to design your system accordingly to meet your customer expectations in terms of reliability and lifetime.
Bibliography	Will be made available at the course.
Expected effect	The students will have experience with lab equipment and to learn to test and debug the device under development.

Name of activity	Exam Preparation
Number of working hours	2
Type of activity	Project work
Lecturer	Rasmus Krigslund German Madueno
Short summary of content	Students will work in a group doing research based on the knowledge they gathered during the laboratories and lectures and they will prepare their final presentation of their work.
Bibliography	N/A
Expected effect	To assimilate the knowledge gathered during the lectures and project work.

Name of activity	Exam
Number of working hours	3
Type of activity	Project presentation
Lecturer	Rasmus Krigslund German Madueno
Short summary of content	Students will present the final project on which they worked on and answer questions.
Bibliography	N/A
Expected effect	To apply the knowledge gathered during the course and practice the presentation and discussion skills.

Name of activity	Industry Talks
Number of working hours	3
Type of activity	Other Methods
Lecturer	German Madueno (Acting as moderator)
Short summary of content	In a series of talks, representatives from the Danish IoT industry will provide insights to the type of tasks and projects given to electrical engineers in their respective companies.
Bibliography	None
Expected effect	The students will gain an overview of what to expect in their first job after finalizing their studies.

Pre-materials

The purpose of these pre-materials is to get you familiar with the basic concepts of IoT, including the development of prototypes and the different technologies to connect your device to the Internet. A basic understanding of the terms and concepts discussed in this material will help you to follow the lectures in the course.

Name	What Is The Internet of Things (IoT)
Topic/field	Introduction to IoT
Short description (optional)	A brief overview of the Internet of Things.

Name	Protocols for IoT
Topic/field	IoT Protocols
Short description (optional)	This whitepaper provides a brief overview of the different communication technologies and the different protocols used to communicate between devices and the cloud.

Name	A comparative study of LPWAN technologies for large-scale IoT deployment
Topic/field	Low Power Wide Area Networks
Short description (optional)	Once, you are aware of what's IoT and the different connectivity technologies, it comes the big question: which technology to use?. This link provides a brief comparative study of the main technologies for enabling connectivity for the IoT.
Professor/Author	Kais Mekki et al., Research Centre for Automatic Control of Nancy, Campus Sciences, BP 70239, Vandoeuvre, 54506, France.

Name	Nokia LTE Evolution for IoT Connectivity
Topic/field	Evolution of Cellular Networks for IoT
Short description (optional)	This white paper written by Nokia provides a nice overview of the different enhancements done to cellular networks to properly support IoT. Some of these features will be essential for making your IoT device battery friendly and last for a long time.

Name	Adafruit's Arduino Guide
Topic/field	Get started with the Arduino Uno
Short description (optional)	One of the many tutorials available online, for getting started with the Arduino platform.



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For books/articles:

Name	PBL - Problem Based Learning
Topic/field	Problem Based Learning
Chapter/Section (for books)	Entire booklet
Short description (optional)	This booklet is published by the administration at Aalborg University, and describes how their studies uniquely combines theoretical knowledge with practical experience. This summer course is designed with inspiration from this exact template to give the participants a taste of Aalborg University.
Professor/Author	Aalborg University