Technology
Arts Sciences
TH Köln

Course
ES - Embedded Systems

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General information

Long name	Embedded Systems
Approving CModule	ES_BaET, ES_BaTIN
Responsible	Prof. Dr. Tobias Krawutschke Professor Fakultät IME
Level	Bachelor
Semester in the year	winter semester
Duration	Semester
Hours in self-study	78
ECTS	5
Professors	NF Hartung
Requirements	basic knowledge in computer engineering FSA and FSM Microcontroller structure and function Imperative Programming language (pref. C) Experiences in Program development using program development environments, e.g. Eclipse
Language	German
Separate final exam	No

Lecture

Learning goals

Knowledge

analysis and specification methods
functional decomposition
behavior description
object oriented description
description of parallel behavior with Petri nets
engineering of embedded systems
hardware aspects
Microcontroller
SOC system on (programmable) chip
use of I/O controllers
serial interface
parallel interface
DMA
energy awareness
software aspects
choice of programming language
Assembler
C
C++
andere
software system architecture
singletasking
Implementing a FSM (finite state machine)
table based static function scheduling
multitasking
RTOS with an example
Embedded Linux
timing requirements
Distributed embedded systems
Basics of distributed systems
communication system levelling
basics of field busses
basics of Internet of Things (IoT)
programming distributed embedded systems

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Lecture	2
Tutorial (voluntary)	2

Separate exam

Exam Type

solving exercises within limited functional / methodical scope under examination conditions

Details

Check of knowledge and understanding of the course content

Minimum standard

Correct answer of at least 50% of the questions

Project

Learning goals

Skills

Teamwork: Development of an embedded system with dedicated function, e.g. control of a mechanical model, environmental sensor etc. Aim: building a prototype

Steps
1. Description/Specification
Task description taking the client's view in communication with client (= docent)
2. Hardware architecture
recherche of suitable modules in technical documents
3. Modelling the solution
4. Implementation using modern PDE and standards, especially RTOS

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mastering complex tasks with the team
project planning and steering
fulfilling tasks on time

Presentation of Development
Task description
Project intermediate presentation
Result
Documentation in project report
Project description
Project implementation
User documentation
Experiences

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Project	1

Tutorial (voluntary)	2

Separate exam

Exam Type

working on projects assignment with your team e.g. in a lab)

Details

Grading of presentations, contribution to discussions, result and report

Minimum standard

Delivery and presentation of milestones in time, solution of parts of the overall project task

Exercises

Learning goals

Skills

Modelling of an Embedded System using well-known design methods for reactive systems

Writing Software for an embedded system using C
on base of a HAL (hardware abstraction layer) or by using a RTOS

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Exercises (whole course)	1
Exercises (shared course)	0
Tutorial (voluntary)	0

Separate exam

Exam Type

solving exercises within limited functional / methodical scope under examination conditions

Details

tasks from the fields of ES modelling and programming. The students should proove that they got the ability to use the methods and tools

Minimum standard

Reaching at least 50% of the grading points