Technology
Arts Sciences
TH Köln

Course Manual FG

Introduction to Fieldbus Systems

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General information

Long name	Introduction to Fieldbus Systems
Approving CModule	FG_BaTIN, FG_BaET
Responsible	Prof. Dr. Rainer Bartz Professor Fakultät IME
Valid from	winter semester 2022/23
Level	Bachelor
Semester in the year	summer semester
Duration	Semester
Hours in self-study	78
ECTS	5
Professors	Prof. Dr. Rainer Bartz Professor Fakultät IME
Requirements	basic programming skills, incl.: for, while, if, switch data types in programming languages
Language	German
Separate final exam	Yes

Literature

- eigenes Skript
- Schnell, G.: Bussysteme in der Automatisierungstechnik, Vieweg
- Zimmermann, W.; Schmidgall, R.: Bussysteme in der Fahrzeugtechnik, Vieweg

Final exam

Details	written exam
Minimum standard	50%
Exam Type	EN Klausur

− Lecture / Exercises

Learning goals

Goal type	Description
Knowledge	topologies in communication networks: point-to-point, line, ring, star
Knowledge	notations in communication standards: service description, sequence diagram, state chart (Mealy-type)
Knowledge	ISO/OSI reference model: layer, encapsulation, functionality, service types (peer-to-peer, local), PDU-SDU-PCI-ICI, connection-oriented and connectionless communication
Knowledge	bit coding: digital (NRZ, PRZ, BiPhase-L, DPLM,...), analog (ASK, FSK, PSK, ...)
Knowledge	physical layer definitions of RS-232, RS-485
Knowledge	error detection: parity, block codes, checksum, CRC, ...
Knowledge	media access schemes: master/slave, token, CSMA/CD, CSMA/CA, ...
Knowledge	PhL and DLL of CAN (controller area network): content-based adressing, arbitration, error detection, standard vs. extended CAN, bit timing, fault management, acknowledge mechanism, services and protocols
Skills	students acquire fundamental knowledge on industrial communication systems
Skills	they understand how communication standards are specified and can apply them to given tasks
Skills	they understand fundamental concepts in the physical layer and can apply coding standards to create and analyze corresponding signal traces

Special requirements

none

Accompanying material	theoretical contents is available as accompanying script additional presentation slides electronically available, exercises and solutions electronically available
Separate exam	No

Skills	they understand data link layer functionality and can explain media access and error correction algorithms
Skills	they know about all relevant aspects of CAN as a representative for industrial communications
Skills	students can apply widespread error detection algorithms
Skills	they can specify functionality and services of layers, using standard notation
Skills	they are able to analyze protocols and extract information from data streams
Skills	they are able to create protocol compliant data streams for transmitting specific information

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Lecture	2
Exercises (whole course)	1
Exercises (shared course)	0
Tutorial (voluntary)	0

− Practical training

Learning goals

Goal type	Description
Knowledge	microcontroller platform for fieldbus implementation (TI F28335 based)
Knowledge	development tools for embedded systems (CCS: Code Composer Studio)
Knowledge	programming in C language for systems without OS
Knowledge	performing CAN communication from a microcontroller program
Knowledge	F28335 microcontroller architecture and register model; programmed interaction
Skills	students can develop programs for an embedded system
Skills	they know how to use a development toolchain to test, analyze, and debug their code
Skills	they have experience in using CAN register-based communication interfaces to send and receive information
Skills	they can determine relevant communication parameters and configure a system accordingly
Skills	students can use embedded systems to implement industrial communication
Skills	they are able to implement software to send information over a communication channel
Skills	they are able to implement software to receive information over a communication channel
Skills	they can specify system behavior using state charts

Special requirements

programming language C

Accompanying material	complete description of lab systems available electronically, project task specifications are available electronically, development toolchain is available (in lab)
Separate exam	Yes

Separate exam

Exam Type	EN Projektaufgabe im Team bearbeiten (z.B. im Praktikum)
Details	team based project tasks
Minimum standard	assigned project tasks must be completed

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Practical training	1
Tutorial (voluntary)	0