HKA

2.4.3   Microcontroller Systems

Microcontroller Systems

Module Summary
Module code: EEIB430
Module coordinator: Prof. Dr. Christian Langen
Credits (ECTS): 6 Points
Semester: 4. Semester
Pre-requisites with regard to content: Knowledge and skills learned in lectures and laboratories Computer Programming (EEIB141). Computer Programming Lab (EEIB142). Digital Electronics (EEIB241) and Digital Electronics Lab (EEIB242).
Pre-requisites according to the examination regulations: Regarding to the examination regulations no pre-requisites are required
Competencies: Students know specific design and performance characteristics of microcomputer architectures and systems and can evaluate their usability to solve given problems in areas of electrical engineering and information technology. In the module Microcontroller Systems design of embedded systems is learned in combination of hardware and low-level programming skills.
Assessment: Students' theoretical skills acquired in the lecture Microcontroller Systems are evaluated by a written examination (duration time of 120 minutes). Practical skills in use of the development system and results of laboratory experiments are evaluated with colloquiums to each laboratory experiment.
Usability: The module covers specific requirements on programming of microcontrollers in embedded systems. Feasibility of a microcontroller system is judged in accordance to the requirements (specifications) for a given problem set. Relationships are to the classes Computer Programming (EEIB141) and Computer Programming Lab (EEIB142) where fundamental knowledge of the C/C++ programming language are taught as well as Digital Electronics (EEIB241) and Digital Electronics Lab (EEIB242) that are updated and augmented in associated chapters (computer arithmetic, peripheral interfaces).

Course: Microcontroller Systems
Module code: EEIB431
Lecturer: Prof. Dr. Christian Langen
Scope of weekly semester hours (SWS): 4
Semester of delivery: Summer semester

Type/mode: Lecture with integrated exercises, Compulsory subject
Language of instruction: English
Content: • Introduction – Embedded Systems   • Processor Architectures and Instruction Sets   • ARM Assembly Language Programming   • The ARM Architecture   • ARM-Organization and Implementation   • The ARM Instruction Set   • Architectural Support for High-Level Languages   • Memory Hierarchy, Cache Architectures   • Architectural Support for Operating Systems   • Real-Time Systems Concepts   • Peripheral Interfaces, PWM and Analogue-to-Digital Converters (ADCs)
Recommended reading: • Abbot, Doug: Embedded Linux Development Using Eclipse. Newnes 2009.   • Cockerell, Peter: ARM Assembly Language Programming. M.T.C. 1987   • Furber, Steve: ARM System-on-Chip Architecture. Addison-Wesley, 2000   • Gibson, J. R.: ARM Assembly Language – an Introduction (Second Edition). J.R. Gibson 2011   • Hohl, William: ARM Assembly Language. Fundamentals and Techniques. CRC Press 2009.   • Labrosse, Jean J.: MicroC/OS-II, CMP Books, Second Edition 2002   • Smith, Warwick A.: C Programming for Embedded Microcontrollers, Elektor 2008   • Sloss, Andrew N.; Symes, Dominic; Wright, Chris: ARM System Developers Guide. Designing and Optimizing System Software. Morgan Kaufman, 2004.   • Van Someren, Alex; Atack, Carol: The ARM RISC Chip. A Programmers Guide, Addison-Wesley, 1994

Course: Microcontroller Systems Lab
Module code: EEIB432
Lecturer: Prof. Dr. Christian Langen
Scope of weekly semester hours (SWS): 2
Semester of delivery: Summer semester
Type/mode: Lecture, Compulsory subject
Language of instruction: English
Content: • Computer Arithmetic   • Modular Programming, Usage of Memory Stack

- Parallel Input/Output (I/O) by Peripheral Interfaces
- Serial Data Communication (RS232)
- Low-Level C-Programming, Interrupts, Timers
- Configuration of an Analogue-to-Digital Converter (ADC)
  Real-Time Operating System Application

Recommended reading:

- Abbot, Doug: Embedded Linux Development Using Eclipse. Newnes 2009.
- Cockerell, Peter: ARM Assembly Language Programming. M.T.C. 1987

- Furber, Steve: ARM System-on-Chip Architecture. Addison-Wesley, 2000
- Gibson, J. R.: ARM Assembly Language – an Introduction (Second Edition). J.R. Gibson 2011
- Hohl, William: ARM Assembly Language. Fundamentals and Techniques. CRC Press 2009.
- Labrosse, Jean J.: MicroC/OS-II, CMP Books, Second Edition 2002
- Smith, Warwick A.: C Programming for Embedded Microcontrollers, Elektor 2008
- Sloss, Andrew N.; Symes, Dominic; Wright, Chris: ARM System Developers Guide. Designing and Optimizing System Software. Morgan Kaufman, 2004.
- Van Someren, Alex; Atack, Carol: The ARM RISC Chip. A Programmers Guide, Addison-Wesley, 1994.