Digital electronics

Number of ECTS credits: 6
Coefficient: 6

Description:
Development on 8-32-bit microcontrollers under GNU / Linux in C, estimation of the resources required for various tasks, understanding of the compilation chain and associated tools
Deepening of synthesizable VHDL and time simulation of the description

Pedagogical objectives:
Knowledge to be acquired:
- Unix commands, interaction with the command line system
- Architecture of a microprocessor (arithmetic and logical unit (ALU), registers)
- Reading of the assembly code containing the opcodes executed by the ALU, study of the execution time, consequence of the optimization options of gcc
- Specificities of C on embedded systems: volatile, const, * (type *) addr = val
- Working methods: code portability, code analysis tools
- Arithmetic of computers: adapting an algorithm developed in floating point to integers
- Use of a microcontroller simulator
- CPLD / FPGA structures and performance
- Advantages / disadvantages between microcontrollers and CPLD / FPGA
- Synthesizable VHDL Skills to be acquired:
- Compile a program in C (cross-compilation gcc, Makefile)
- Reading of datasheet, identification of opcodes and their execution times, flags managed by a given instruction,
- Implementation of some devices on 8-bit processor (USART, timer)
- Analysis of the codes and causes of their malfunctions according to the optimizations
- Introduction to the GNU Debugger gdb
- Compile its cross-compiler: the trio gcc, binutils and newlib, how to compile these tools to generate a cross-compilation string for any processor supported by gcc

Bibliography:
Pages of Unix manual

Prerequisite:
Counting, combinational and sequential logic, C programming on operating system

Lectures Hours: 14
Tutorials Hours: 7
Labs Hours: 36

Knowledge monitoring modalities: 100% continuous assessement
Assessement: 1 exam, reports of labs and 1 practival exam eventually

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