



Universitat de Lleida

DEGREE CURRICULUM
SYSTEMS INTEGRATION II

Coordination: Marcel Tresanchez Ribes

Academic year 2015-16

Subject's general information

Subject name	SYSTEMS INTEGRATION II
Code	102131
Semester	2nd Q. Continued evaluation
Typology	Optative
ECTS credits	6
Groups	1
Theoretical credits	2
Practical credits	4
Coordination	Marcel Tresanchez Ribes
Office and hour of attention	Robotics Lab (2.04-EPS building). Monday 10:00-11:00 AM.
Department	Computer Science and Industrial Engineering
Modality	Presencial
Important information on data processing	Consult this link for more information.
Language	Speaking: As required (Catalan, Spanish or English). Materials and resources: English. Student workload: English.
Degree	Degree in Automation and Industrial Electronic Engineering
Distribution of credits	Theoretical sessions: 2 ECTS Experimental training sessions: 2 ECTS Practical sessions: 2 ECTS
Office and hour of attention	Robotics Lab (2.04-EPS building). Monday 10:00-11:00 AM.
E-mail addresses	mtresanchez@diei.udl.cat

Marcel Tresanchez Ribes

Subject's extra information

It is mandatory to have coursed previously Systems Integration I subject. Also, it is very recommended to extend this optative subject to the third part (Systems Integration III) due to the complementary and shared content.

As the previous part of this optative module, to follow this subject properly previous knowledge on C programming, digital electronics design and signal processing are recommended.

Learning objectives

Acquire knowledge to be able to develop integrated systems with more complexity and automation.

Learn to develop embedded low-cost integrated systems for signal audio processing.

Master the peripheral interfaces for advanced communication of multimedia embedded devices.

Know how to integrate wireless transceivers for remote automation and control systems.

Competences

Strategic Competences of the UdL

UdL2 Command of a foreign language.

UdL3 Mastering ICT's.

Cross-disciplinary competences

EPS4. To have the skills required to undertake new studies or improve the training with self-direction.

EPS9. Capacity for unidisciplinary and multidisciplinary teamwork.

Specific competences

GEEIA21. Knowledge of the basics and applications of the digital electronics and microprocessors.

GEEIA25. Knowledge and capacity for modelling and simulation of systems.

GEEIA27. Knowledge of principles and applications of robotic systems.

Subject contents

1. Introduction to USB hardware
2. USB OTG interfaces on microcontrollers
3. Introduction to Keil MDK-ARM
4. Digital audio processing on embedded systems
5. MMC and SD Card interfaces

6. Wireless connectivity on embedded systems

Methodology

Learning systems integration will be carried out by STMicroelectronics development tools, mainly with STM32F4-Discovery that includes an ARM Cortex-M high performance 32 bit microcontroller.

Development kits will be provided entirely by the school where each student will work individually.

The student assessment will take place continuously and will be based on the weighted evaluation of the reports of the activities undertaken throughout the course. The practical exercises, as far as possible, have to be carried out individually both in class and at home. These practices will be based on microcontroller programming using C language and application digital integrated circuits on microcontrollers.

Evaluation

The workload assessed consist in the enforcement of three main consistent practical works based on the development of integrated applications using microcontrollers. Specifically, the issues will be:

P1: Design an USB mouse peripheral with an accelerometer

P2: Implementaion of an integrated system for audio processing

P3: Developement a bidirectional wireless walkie-talkie device

At this way, the course qualification (NC) will be calculated as:

$$NC = P1*0.3 + P2*0.3 + P3*0.4$$

If **NC** is lower than 5.0 there will be an optional exam with a weight of 8 points, the final mark will be computed with:

$$NF = NR + (NC \times 0,2)$$

Bibliography

- Reference manuals and application notes from manufacturers
- STM32F4Discovery from STMicroelectronics
<http://www.st.com/web/catalog/tools/FM116/SC959/SS1532/PF252419>
- STMicroelectronics development boards
<http://www.st.com/web/catalog/tools/FM116/SC959/SS1532/PF252419>
<http://www.st.com/web/catalog/tools/FM146/CL1984/SC720/SS1462/PF255417>
- Jan Axelson (2009) USB Complete: The Developer's Guide, Fourth Edition, Lakeview Research LLC. Madison, WI 53704.
- Jonathan W Valvano (2015) Embedded Systems: Introduction to Arm® Cortex(TM)-M Microcontrollers , Fifth Edition. ISBN: 978-1477508992
- Joseph Yiu (2013) The Definitive Guide to ARM® Cortex®-M3 and Cortex®-M4 Processors. Elseiver. Cambridge, UK.
- Donald Reay (2015) Digital Signal Processing and Applications Using the Arm Cortex M4. Wiley. ISBN: 978-1118859049.
- Warwick A. Smith (2009) C Programming for Embedded Microcontrollers. Publitronic-Elektor. ISBN: 978-

0905705804.