



Universitat de Lleida

DEGREE CURRICULUM

SYSTEMS INTEGRATION III

Coordination: Marcel Tresanchez Ribes

Academic year 2015-16

Subject's general information

Subject name	SYSTEMS INTEGRATION III
Code	102132
Semester	2nd Q. Continued evaluation
Typology	Optative
ECTS credits	6
Groups	1
Theoretical credits	1
Practical credits	5
Coordination	Marcel Tresanchez Ribes
Office and hour of attention	Robotics Lab (2.04-EPS building). Thursday 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: 1 ECTS Experimental training sessions: 1 ECTS Practical sessions: 4 ECTS
Office and hour of attention	Robotics Lab (2.04-EPS building). Thursday 10:00-11:00 AM.
E-mail addresses	mtresanchez@diei.udl.cat

Marcel Tresanchez Ribes

Subject's extra information

It is mandatory to have completed or be attending the previous subjects (Systems Integration I and II) relating to this optional module.

Learning objectives

Acquire knowledge to design integrated solutions with screen displays and touch panels.

Know how to develop low cost integrated systems based on computer vision with image processing techniques.

Master the Ethernet TCP/IP communications in microcontroller based systems.

Experiment with the design of new systems and new applications of automation and control with industrial level validity and application.

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. Advanced development solutions for systems integration
2. Embedded displays and touch systems
3. CMOS image sensors and image processing
4. Real-Time Operation Systems (RTOS)
5. Ethernet TCP/IP communication on microcontrollers

Methodology

The subject is focused on continuous practical work in the embedded systems integration. All these practical work will be developed distributing jobs in work teams where each project will include part of knowledge acquired in previous work in order to accomplish complex integrated systems.

Learning of 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.

The development kits and other materials will be provided entirely by the school.

The practical works will be focused on the application of hardware peripherals managed by microcontrollers where the automation and control will be done using C programming language.

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 a graphical interaction device with a TFT display and a touch panel

P2: Implementation of an image processing embedded system

P3: Development of a video surveillance system with intrusion detection

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

$$NC = P1 \cdot 0.3 + P2 \cdot 0.3 + P3 \cdot 0.4$$

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.