Universidad Zaragoza

Academic Year/course: 2021/22

30240 - Embedded Systems II

Syllabus Information

Academic Year: 2021/22
Subject: 30240 - Embedded Systems II
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 439 - Bachelor's Degree in Informatics Engineering
ECTS: 6.0
Year: 4
Semester: First semester
Subject Type:
Module:

1. General information

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The learning process designed for this course relies on lectures, problems, assignments and computer lab sessions.

Subject overview and theoretical foundations are introduced in lectures, closely referred to case studies.

Problems sessions foster the participation of the students.

Lab sessions are organized in reduced groups, where the student sets up, program and checks the systems.

In order to foster continuous and autonomous learning, there can be additional learning activities throughout the course's period.

4.2. Learning tasks

The course includes the following learning tasks:

1. On-site activities: 2.4 ECTS (60 hours)

a) Regular classes and lectures (30 h)

Presentation of theoretical and practical contents illustrated with case studies and fostering the participation of the students.

b) Problem-solving sessions (12 h)

The students will get involved in problem-solving related to the theoretical contents. The students will usually have to prepare the problems in advance. Part of the time could be devoted to learning activities that can be graded, as specified in each course.

c) Lab sessions (18 h)

The student will install, set up and make modifications and measurements on two different operating systems, a classic RTOS and a general-purpose OS leveraged for the purpose of an embedded system. The student will have a laboratory guide and will have to prepare the activity in advance. Each practice will be graded on-site.

2. Off-site activities: 3.6 ECTS (90 h)

a) Assignments (30 h)

Activities the student will do individually or working in a group and that the instructor will propose throughout the course's time. In this course, every student will have to complete the proposed assignments.

b) Study (54 h)

Student's personal time for studying the subject and for problem-solving. This encompasses office hours to assist the student to identify learning problems and provide advice on the course and its activities.

c) Assessment tasks (6 h)

In addition to the grading role, evaluation constitutes a learning tool that the student checks how much she/he has learned and understood.

4.3. Syllabus

The course will address the following topics:

Embedded Systems II

1. Real-Time Operating Systems
    1. Overview
    2. Preemptive real-time scheduling on mono processors
    3. Synchronization, priority inversion, and inheritance
    4. Case Study: TI SYS/BIOS and POSIX (pthreads)
2. System Architecture
    1. Case study: ARM
    2. Exception management
    3. Factors involved in the interruption latency
3. Linux/ARM for embedded systems
    1. Linux Kernel basics
    2. Preemption models and their consequences in embedded systems
    3. Kernel synchronization
    4. Exceptions. Interruption latency in Linux
    5. Callouts. Case study: tasklets, softirqs?
    6. Task scheduling and RT scheduling in Linux
    7. Kernel memory management
    8. Files and I/O subsystems
    9. Linux Drivers. The Linux Device model

- Lab sessions
    - RT programming on SYS/BIOS and POSIX
    - Design of a Linux distribution for an embedded system
    - Kernel programming and configuration
    - Interruption Latency measurement
- Course projects

4.4. Course planning and calendar

Classes, problems, and laboratory sessions are scheduled according to EINA's calendar (check EINA's website at http://eina.unizar.es).

The instructor's office hours are available at the EINA's website and Moodle (http://moodle.unizar.es).

The remaining activities will be scheduled according to the number of students, will be announced well in advance, and will appear on the course site on Moodle.

4.5. Bibliography and recommended resources

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=30240&Identificador=14705