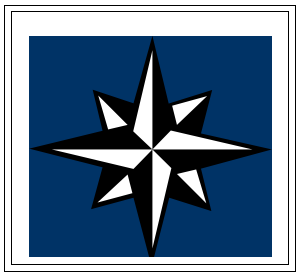

Subject syllabus

Learning plan
Activity plan

The Internet of Things

Learning plan

1. Descriptive information on the subject

- **Academic year:** 2012 – 2013
- **Subject name:** The Internet of Things
- **Subject code:** 22580
- **Subject type:** elective
- **Degree:** Grau en Enginyeria Telemàtica
- **Number of credits:** 5
- **Number of ECTS:** 4
- **Total number of hours to be dedicated:** 100
- **Timing:**
  - Year: 1st year
  - Type: quarter
  - Period: 3rd quarter
- **Coordinator:** Rafael Pous
- **Teaching staff:** Rafael Pous, Raschid Zulqarnain
- **Department:** Dept. de les Tecnologies de la Informació i les Comunicacions
- **Groups:** see ESUP website
- **Teaching language:** English (classroom), Catalan, Spanish or English (labs)
- **Location:** see ESUP website
- **Schedule:** see ESUP website

2. Subject presentation

The Internet of Things (IoT) is a course about the new paradigm of objects interacting with people, with information systems, and with other objects. The course will focus on creative thinking and on hands-on project development. The students will learn:

- IoT concepts
- IoT technologies
- Creative thinking techniques
- Co-creation techniques

This subject does not have the intention of being a comprehensive course about the technologies involved in IoT. The focus will be more on the possibilities offered by the different technologies, and on the creative thinking techniques to find innovative applications of combinations of such technologies in real-life scenarios.

Several presentations will also be scheduled in which people from industry will make presentations about selected topics related to the IoT.

3. Prerequisites of the subject

The students will be require to participate actively in creative thinking exercises. A willingness to be creative and participate in open discussions is a must.

For the lab project the students will have to be able to develop a simple 3-layer web application (web interface, functionality layer, persistence layer) in any computer language (Java, PHP, etc.) with any database (MySQL, etc).

4. Evaluation

There will be a single evaluation itinerary for this subject based on:

- Laboratory (60%): there will be three lab assignments. The lab assignments will be done in groups of three students, and there will be a single qualification for all group members (only in exceptional circumstances will this principle be changed). Each lab assignment may consist of one or more deliverables (e. g. pre-lab, and post-lab). All assignments will be turned in in PDF format and through the Aula Global e-learning platform. No assignments will be accepted in other formats, through other channels, or delivered after the deadline (as enforced by the Aula Global). An assignment not delivered, delivered not according to the above requirements, or delivered late, will be graded with a 0/10. Attendance to the laboratory sessions is a strict requirement. More than two unjustified missed laboratory sessions will be a cause for a 0/10 laboratory grade. A minimum average laboratory grade of 4/10 is required to pass the course. A laboratory grade lower than 4/10 will mean that the student will have to take the class all over again, since laboratories cannot be passed in the July examination.
- Mid-term exam (10%): a mid-term exam, covering the topics taught in the classroom and laboratory sessions will be scheduled towards the middle of the subject.
- Final exam (10%): a final exam, covering the topics taught in the classroom and laboratory sessions will be scheduled during the official exam period of the University. The final exam will cover all the topics of the subject, including all those covered in the mid-term exam. A minimum average grade between midterm and final of 4/10 is required to pass the course. A grade lower than 4/10 will mean that the student will have to take the July exam (given that the laboratory grade is 4/10 or higher). In this case, the July exam will have a weight of 20% (the combined weight of the mid-term and final exams).
- Class participation (20%): a grade given by the course teachers, evaluating the degree of participation and involvement of the student in the the classroom and laboratory sessions. Asking questions, answering the questions posed by the teachers, attending the conferences by invited speakers, making contributions to the brainstorming sessions, and a general positive attitude will all count towards this evaluation criteria. No minimum grade is required for class participation.

5. Contents

5.1. Content blocks

The subject is organized around 6 content blocks, each content block being discussed in one or two 2-hour classroom sessions:

- **Content block 1. - Introduction – Concepts behind the Internet of Things.**
  - The IoT paradigm
  - Smart objects
  - Bits and atoms
  - Goal orientation
  - Convergence of technologies

- **Content block 2. - Technologies behind the Internet of Things.**
    - RFID + NFC
    - Wireless networks + WSN
    - RTLS + GPS
    - Agents + Multiagent systems
- **Content block 3. - Creative thinking techniques.**
    - Modifications
    - Combination scenarios
    - Breaking assumptions
    - Solving problems
- **Content block 4. - Internet of things in retail.**
    - A presentation by Ramir De Porrata-Doria, CEO of Keonn Technologies.
- **Content block 5. - NFC applications for the IoT.**
    - Presentation by Pedro Martínez, CEO at NXP m-Knowledge Center.
- **Content block 6. - Livinglab cocreation for the IoT.**
    - A presentation by Heiner Lehr, Partner at Syntesa.

6. Methodology

Internet of Things will be based on a hand-on methodology that will keep classroom sessions to a minimum, and will base most of the learning activities on laboratory work, following the "learning by doing" principle.

6.1. Classroom sessions

There will be only 8 classroom session, some to introduce the basic concepts of the IoT, some to learn and practice creative thinking techniques applied to the IoT, and some presentations by external speakers (see the activity planning below). Attendance and active participation by the students is mandatory, and will be evaluated.

6.2. Laboratory sessions

The laboratory sessions will be used to complete the three laboratory assignments. Laboratory sessions will be two-hour long. There will be 9 laboratory sessions in which a professor will be present. The laboratory session will be organized in smaller groups, to be able to have a higher degree of interaction between the professor and the students. The students are welcome to use the lab in the sessions for which a different group is scheduled, in an "open lab" mode, during which the professor will give priority to the students of the groups scheduled for that session.

During the laboratory sessions there will be work on using RFID and other technologies to build simple IoT scenarios. The teacher will pose questions to the students. Active participation by the students is expected, and will be evaluated. As mentioned above, attendance is not only expected, but required, and more than two unjustified missed laboratory session will entail failing the course, even in July, and having to take it all over again the following year.

6.3. Invited speakers and visits

During the course several speakers, chosen among the most relevant professionals in the field, will be invited to give a presentation to the class. Attendance and active participation by the students is expected, and will be evaluated.

Additionally, one visit may be organized to a company or site relevant for the course. Given that a maximum number of visitors is usually imposed, only those student with a higher grade in the mid-term exam will be allowed to participate. Attendance to this visit will be optional, and it will not be evaluated.

6.4. Office hours

The teachers will publish the office hours during which the students will be able to resolve questions or difficulties encountered during the course.

7. Bibliography

No specific bibliographic references are given for this course. During the sessions, selected chapters and websites will be recommended.

8. Activity planning

The following is a plan of activities for the course, detailing, session by session whether there is a classroom session, a laboratory session, an open lab, or a quiz, and its content. Next to each classroom session, there is the recommended reading. The plan also details when the lab assignments will be published, and when they are due. At the end, the total number of hours to be dedicated to this course are detailed, totalling 100, out of which only 36 are of mandatory attendance.

Week	Day	Time	Code	Group	Type	Topic	Recommended reading	Lab report Published	Lab report Due
1	Monday, 08 Apr, 2013	1 08:30-10:30	P	101	Laboratory	Lab 0 - Introduction to RFID		Lab1	
	Wednesday, 10 Apr, 2013	2 10:30-12:30	T	101-2	Classroom	Introduction – Concepts behind the Internet of Things			
	Friday, 12 Apr, 2013	3 12:30-14:30	P	102	Laboratory	Lab 0 - Introduction to RFID			
2	Monday, 15 Apr, 2013	4 08:30-10:30	P	102	Laboratory	Lab 1 (1/2) – RFID inventorying			
	Wednesday, 17 Apr, 2013	5 10:30-12:30	T	101-2	Classroom	Technologies behind the Internet of Things			
	Friday, 19 Apr, 2013	6 12:30-14:30	P	101	Laboratory	Lab 1 (1/2) – RFID inventorying			
3	Monday, 22 Apr, 2013	7 08:30-10:30	P	101	Laboratory	Lab 1 (2/2) – RFID inventorying		Lab 2	
	Wednesday, 24 Apr, 2013	8 10:30-12:30	T	101-2	Classroom	Creative thinking techniques – Brainstroming Scenario 1			
	Friday, 26 Apr, 2013	9 12:30-14:30	P	102	Laboratory	Lab 1 (2/2) – RFID inventorying			
4	Monday, 29 Apr, 2013	10 08:30-10:30	P	102	Laboratory	Lab 2 (1/3) – RFID with I/O controls			
	Wednesday, 01 May, 2013	11 10:30-12:30							
	Friday, 03 May, 2013	12 12:30-14:30	P	101	Laboratory	Lab 2 (1/3) – RFID with I/O controls			
5	Monday, 06 May, 2013	13 08:30-10:30	P	101	Laboratory	Lab 2 (2/3) – RFID with I/O controls			
	Wednesday, 08 May, 2013	14 10:30-12:30	T	101-2	Classroom	Creative thinking techniques – Brainstroming Scenario 2			
	Friday, 10 May, 2013	15 12:30-14:30	P	102	Laboratory	Lab 2 (2/3) – RFID with I/O controls			
6	Monday, 13 May, 2013	16 08:30-10:30	P	102	Laboratory	Lab 2 (3/3) – RFID with I/O controls		Lab 3	
	Wednesday, 15 May, 2013	17 10:30-12:30	T	101-2	Classroom	Internet of things in retail – Presentation by Ramir de Porrata			
	Friday, 17 May, 2013	18 12:30-14:30	P	101	Laboratory	Lab 2 (3/3) – RFID with I/O controls			Lab1
7	Monday, 20 May, 2013	19 08:30-10:30							
	Wednesday, 22 May, 2013	20 10:30-12:30	E	101-2	Quiz				
	Friday, 24 May, 2013	21 12:30-14:30							
8	Monday, 27 May, 2013	22 08:30-10:30	P	101	Laboratory	Lab 3 (1/3) – Object triggered events			
	Wednesday, 29 May, 2013	23 10:30-12:30	S	101-2		NFC applications for the IoT – Presentation by Pedro Martínez			
	Friday, 31 May, 2013	24 12:30-14:30	P	102	Laboratory	Lab 3 (1/3) – Object triggered events			
9	Monday, 03 Jun, 2013	25 08:30-10:30	P	102	Laboratory	Lab 3 (2/3) – Object triggered events			
	Wednesday, 05 Jun, 2013	26 10:30-12:30	S	101-2		Livinglab cocreation for the IoT – Presentation by Heiner Lehr			
	Friday, 07 Jun, 2013	27 12:30-14:30	P	101	Laboratory	Lab 3 (2/3) – Object triggered events			Lab 2
10	Monday, 10 Jun, 2013	28 08:30-10:30	P	101	Laboratory	Lab 3 (3/3) – Object triggered events			
	Wednesday, 12 Jun, 2013	29 10:30-12:30	S	101-2		Project presentations			
	Friday, 14 Jun, 2013	30 12:30-14:30	P	102	Laboratory	Lab 3 (3/3) – Object triggered events			
11	Monday, 17 Jun, 2013	31 08:30-10:30							
	Wednesday, 19 Jun, 2013	32 10:30-12:30							
	Friday, 21 Jun, 2013	33 12:30-14:30							Lab 3

T	10	(Teoria) Classroom
P	18	(Pràctiques) Laboratory
S	6	(Seminaris) Presentations by guest speakers.
E	2	(Examen) Quizzes.
Subtotal	*36*	*Mandatory attendance hours*
R	30	Project hours at home
L	10	Open lab sessions (during the other group's lab)
Q	24	Quizz and exam study hours
Total	**100**	**Total effort in hours**