



Academic year	2016-17
Subject	11559 - Sensor Networks
Group	Group 1, 2S
Teaching guide	C
Language	English

### Subject identification

<b>Subject</b>	11559 - Sensor Networks
<b>Credits</b>	0.72 de presencials (18 hours) 2.28 de no presencials (57 hours) 3 de totals (75 hours).
<b>Group</b>	Group 1, 2S (Campus Extens)
<b>Teaching period</b>	Second semester
<b>Teaching language</b>	English

### Professors

Lecturers	Horari d'atenció als alumnes					
	Starting time	Finishing time	Day	Start date	Finish date	Office
Sebastián Galmés Obrador <a href="mailto:sebastia.galmes@uib.es">sebastia.galmes@uib.es</a>	You need to book a date with the professor in order to attend a tutorial.					

### Contextualisation

Sensor networks have become the most attractive information and communication technology for those applications where interaction with physical world is essential. This technology, which emerged in the beginning of 90s, allows for the high-resolution real-time monitoring of a wide set of environmental variables, either physical or chemical.

Sensor networks exhibit very intrinsic features. Probably the most significant ones are the limited capabilities and shortage of energy resources of participant nodes, which are thus enforced to rely on cooperation if the functional and non-functional system requirements are to be fulfilled. These specificities have posed new research challenges claiming for novel mechanisms and protocols in contrast to those used in conventional networks.

Currently, the technology of sensor networks has achieved a high degree of maturity, fact that has driven research towards more specific aspects, like the development of new models of interaction with other element types such as actuators and robots, the analysis of new deployment scenarios such as underground and underwater sensor networks, or the consideration of more complete information formats, involving video and audio, as it happens with multimedia sensor networks based on CMOS cameras and audio micro-sensors.

This subject is intended to provide a broad view of current state-of-the-art of sensor networks, with special emphasis on the mechanisms and protocols that have reached more widespread use, as well as the software-related aspects which are of more concern to application development and testing. A revision of new topics and application scenarios is also provided.

### Requirements



### Recommendable

It is recommended that the student has basic knowledge on computer networks (data communications, architectures, protocols, etc.). Programming skills are also recommended.

### Skills

#### Specific

- \* CE5. Ability to understand and apply the operation and organization of Internet, the technologies and protocols for new generation networks, the component models, intermediate software and services..
- \* CE11. Ability to design and develop applications and computer services for ubiquitous embedded systems..

#### Generic

- \* CG4. Ability to mathematical modelling, evaluation and simulation in technological centres and engineering companies, especially in research, development and innovation tasks in all areas related to computer engineering..
- \* CG5. Capacity for the preparation, strategical planning, coordination and technical and financial management of projects in all areas of computer engineering, according to environmental and quality criteria..
- \* CG8. Ability to integrate and apply acquired knowledge and to solve problems in new or little-known scenarios within broader and multidisciplinary contexts..

#### Basic

- \* You may consult the basic competencies students will have to achieve by the end of the Master's degree at the following address: [http://estudis.uib.cat/master/comp\\_basiques/](http://estudis.uib.cat/master/comp_basiques/)

### Content

#### Theme content

- Chapter 1. Fundamentals of sensor networks
  - \* Concept, types and applications.
  - \* Data flow models.
  - \* Design factors.
  - \* Architecture.
  - \* Hardware and software platforms.
- Chapter 2. Mechanisms and protocols
  - \* Physical, MAC and network layers.
  - \* Physical standards.
  - \* MAC protocols.
  - \* Routing protocols.
  - \* Cross-layering.
- Chapter 3. Application development and testing
  - \* Software for sensor networks
  - \* TinyOS.

- \* Middleware.
- \* Simulation tools.

#### Chapter 4. Current challenges

- \* New scenarios: underground and underwater sensor networks.
- \* New traffic components: multimedia sensor networks.
- \* Sensor and actor networks.

## Teaching methodology

This section describes the on-site and off-classroom activities aimed at covering the competencies to be achieved in this subject. Regarding the off-classroom ones, the fact that this subject is part of the online Campus Extens educational system contributes to make it easier the autonomous labour of students.

The classroom activities combine lectures, seminars as well as discussions in the context of proposed tasks. The assessment is based on personalized assignments that involve some of the following components: readings, research and/or development tasks and oral presentations. Exams are excluded.

### In-class work activities

Modality	Name	Typ. Grp.	Description	Hours
Theory classes	Lectures	Large group (G)	The initial chapters are covered via traditional theoretical sessions that are intended to describe the essential aspects of sensor networks. The objective is to provide a global perspective of the discipline while highlighting the outstanding contributions with to mechanisms and protocols.	9
Seminars and workshops	Seminars	Medium group (M)	Seminars are on-site activities targeted to enhance student participation. This includes both discussion sessions as well as presentations given by external experts. The topics are directly related with the contents of the subject, but they are addressed in a more informal way than lectures.	9

At the beginning of the semester a schedule of the subject will be made available to students through the UIBdigital platform. The schedule shall at least include the dates when the continuing assessment tests will be conducted and the hand-in dates for the assignments. In addition, the lecturer shall inform students as to whether the subject work plan will be carried out through the schedule or through another way included in the Campus Extens platform.

### Distance education work activities

Modality	Name	Description	Hours
Individual self-study	Assignment 1	A first assignment will be targeted to enhance the abstraction-level capabilities of students by including some of the following elements: <ul style="list-style-type: none"> <li>* Readings.</li> <li>* Bibliographic search.</li> <li>* Research.</li> </ul>	20

Modality	Name	Description	Hours
Individual self-study	Assignment 2	The second assignment will consist of a small project where the student is entailed to solve a real-world problem by applying the acquired knowledge as well as appropriate tools.	25
Individual self-study	Self-learning	Every student leads his/her own learning process on the basis of the classroom contents, the suggested readings and other referenced material.	12

### Specific risks and protective measures

The learning activities of this course do not entail specific health or safety risks for the students and therefore no special protective measures are needed.

### Student learning assessment

#### Assignment 1

Modality	Individual self-study
Technique	Student internship dissertation ( <b>non-retrievable</b> )
Description	A first assignment will be targeted to enhance the abstraction-level capabilities of students by including some of the following elements: *Readings. *Bibliographic search. *Research.
Assessment criteria	<ul style="list-style-type: none"> <li>* Contents organization.</li> <li>* Quality of proposed solution.</li> <li>* Quality of presentation (written and/or oral)</li> </ul>
Final grade percentage:	40%

#### Assignment 2

Modality	Individual self-study
Technique	Student internship dissertation ( <b>retrievable</b> )
Description	The second assignment will consist of a small project where the student is entailed to solve a real-world problem by applying the acquired knowledge as well as appropriate tools.
Assessment criteria	<ul style="list-style-type: none"> <li>* Appropriateness of procedures.</li> <li>* Correctness of solution.</li> <li>* Quality of presentation (written and/or oral).</li> </ul>
Final grade percentage:	60%

### Resources, bibliography and additional documentation

Currently there exist many textbooks on sensor networks that offer a global and updated perspective of the discipline. They constitute a solid source of selected and organized information. Some of the main sources are highlighted below. In addition, the learning process relies also on suggested paper readings that will be announced over the term.

#### Complementary bibliography



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- \* Ian F. Akyildiz and Mehmet Can Vuran: Wireless Sensor Networks. Wiley, 2010.
- \* Amiya Nayak and Ivan Stojmenovic: Wireless Sensor and Actuator Networks. Algorithms and Protocols for Scalable Coordination and Data Communication. Wiley, 2010.
- \* Ibrahim M. M. El Emary and S. Ramakrishnan: Wireless Sensor Networks. From Theory to Applications. CRC Press, 2014.
- \* V. Çagri Güngör and Gerhard P. Hancke: Industrial Wireless Sensor Networks. Applications, Protocols, and Standards. CRC Press, 2013.

#### Other resources

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- \* Papers announced on-the-fly.

