

Connected Objects and the Internet of Things (with project)

Subject area: Computer Science/ICT

University:	L'X
Level:	BA all years, MA1, MA2
Teaching mode:	completely online, at specific time
Instructor(s):	Thomas Heide Clausen

Short description

In the 21st century, a company developing a product either: has a strategy for rendering the product somehow connected; or is completely disconnected from reality. If you are, or want to be, in the first category, then this course is for you – regardless of your previous experience. The course will be completed an independent project, allowing the student to demonstrate their ability to put into practice what they've learned.

Full description

During this course, your teaching staff will be accompanying you in discovering how to conceive, and construct, "IoT systems".

This course will consist of 3 parallel activities, through which your teaching staff (which you can see to the right) will accompany you:

- Basic video modules, which introduce key technological concepts for conceiving IoT systems
- Lab Exercises, which will take you "from neophyte" to a competent IoT Engineer, and which will teach you how to build electronic objects, and how to make them talk to each other across the Internet.
- An independent project, allowing the student to demonstrate their ability to put into practice what they've learned

The key activities of the course will be as follows:

-Video modules and accompanying quizzes serve to provide an abstract "programmers overview of computer network principles and architectures", and will cover topics such as:

How a micro controller works, and how to build intelligent objects with it?

How to (efficiently) use WiFi, Bluetooth, Bluetooth/LE, IEEE 802.15.4, and other "IoT Interconnect" to connect your intelligent object to the Internet

How to "communicate to the cloud" from your connected object – in passing, understand things such as CoAp, and REST. How to design energy-efficient, hybrid, IoT systems

What LPWANs, and things such as LoRa, SIGFOX, etc., are all about

...

- Lab Exercises, which serve to give you practical experiences in building IoT systems, and in writing the accompanying software. They will be of one of two distinct forms:

Tutorials serve to help you acquire a certain set of skills, in a very guided step-by-step fashion. This may be, for example, how to construct a particularly energy efficient circuit, or how to programmatically use interrupts to duty-cycle your IoT device

Assignments are (graded) more independent and less guided activities, where you will be told what the end-result of your work should be, but not be given a step-by-step tutorial to follow. While you will be working independently, of course your teachers will be present to help you in your design, and implementation, of an IoT system. Assignments will be graded.

- The Final Exam is, in part, a way to evaluate what you have retained from the course, and to give you a final grade. However more significantly, it is also there to aid your revising of the course material, and thus to reinforce your learning process. The final exam will be a multiple-choice questionnaire, and will - in a nutshell - be a longer version of the quizzes that you have seen during the lab exercise sessions. Thus, if you've prepared continuously for the weekly quizzes, if you've done well in those, and you review the course material diligently, then you should be well prepared also for the final exam.

- The independent project, which allows you to demonstrate their ability to put into practice what you've learned - and your completion, and presentation, of this project will contribute significantly to your final grade

The course will be available asynchronously, fully on-line, or on-site, through learning flows with short videos, quizzes, homework, lab exercises.

Learning outcomes

The course will provide students with both a theoretical and a practical understanding of the design criterion and approaches, when developing IoT systems, as well as a solid understanding of the tools (interrupt-driven programming, energy budgets, ...) technologies (microcontrollers, IEEE802.15.4. Bluetooth, LoRa, ...) and architectural frameworks (Publish-subscribe architectures, MQTT, ...) that are used.

The lab exercises and the independent project will give students experience in conceiving of, designing, and implementing, complex, real-world IoT systems.

General information

Contact hours per week: 6 hours

Total workload: 60 + personal work (in student hours for the whole course)

ECTS credits: 6

Language: English

Course start date: 03 January 2023

Course end date: 03 June 2023

Add. info about start date: Individualised, can be any date, between Jan 3 and April 1, 2023. Please note that the intended start-date must be communicated to Ecole

Polytechnique at the time of registration. The course end date should be exactly 10 weeks after the start-date.

Weekly teaching day/time:

Time zone: CET (Denmark, Germany, France, Netherlands, Switzerland, Czech Republic)

Further information: EuroTeQ students are welcome to join a dedicated WebEx space <https://eurl.io/#fCk0f6iWF> to discuss their course choices at any time — we're available in chat, or in visio.

An Arduino kit is required to follow this course. We can provide one kit per student considering that the kit will be sent to one of the EuroTeQ partner universities in Europe only. The student should be able to pick it up at the start of the course and return it at the end of the course.

Prerequisites: Any "introduction to computer programming" course.

Please note that the courses on Connected Objects and the Internet of Things with and without project are not compatible. This course is not compatible with the course title "IoT Workshops (without project)".

Activities and methods: The course will be available asynchronously, fully on-line, or on-side, through learning flows with short videos, quizzes, homework, lab exercises / tutorials — as well as office-hours via Webex with professors and instructors. While being asynchronous, each student is expected to check in with an instructor over Webex, weekly, following the chosen start-date.

Presence on campus: no

Final examination

Form: Individual project

Date:

Location/format: online

Re-sit possibility: no

Transcript available: end of the semester and generally 8 weeks after the exam.

Add. info/requirements:

Registration

To register for this course, follow the registration requirements of your **home university** as specified here: www.euroteq.eu/courses-registration.

Administration

Number of places: 24-30

Minimum participants:

Internal course code:

Contact: euroteq-mobility@polytechnique.fr

This course is part of the EuroTeQ Engineering University joint course catalogue 2023. This is a collaborative activity of the partner universities DTU, L'X, TU/e, TalTech, CTU, TUM as well as Technion. Students from these universities can participate in the offered courses. It is the responsibility of the student to check if you fulfil the requirements to participate in a specific course. Students are also advised to check with their home institution how to get recognition of the ECTS credits gained in courses of the EuroTeQ course catalogue. For further information about EuroTeQ Engineering University, visit www.euroteq.eu or get in touch with the above-mentioned point of contact.