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# A PROPOSAL FOR AN OPEN WIRELESS SENSOR NETWORK ON-LINE COURSE

UNIVERSITAT POMPEU FABRA

# *Contents*

# *List of Figures*

*List of Tables*

# *Introduction*

It is a commonplace that the Internet is changing our lives. It is changing the way we learn and also the way we contribute to our communities and organize ourselves. In this course we will explore the bottom-up creation of a wireless sensor network that can be used to gather and share data. This gathering and sharing of data empowers the citizenship to monitor and interact with the environment.

We are interested in the bottom-up models. We use the terms peer-to-peer, do-it-ourselves and bottom-up interchangeably. The idea that we want to transmit with bottom-up is that the participant takes an active role and contributes to the community rather than being a mere consumer. For this reason, we teach the first simple steps to build, configure and program a sensor that uploads the gathered data to the Internet to make it publicly available to those that are interested in.

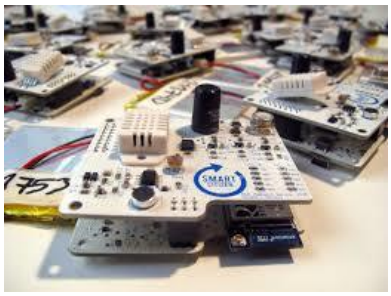

Figure 1: Smart Citizen Kit units. These are wireless nodes with multiple sensors.

# *Methodology*

The course is organized in different units. Each of the units is a basic ingredient in the construction of a bottom-up wireless sensor networks. For each of the units, we will follow the same class dynamics.

## *Class dynamics*

The participants will watch a motivation video and a video tutorial. The tutorial will describe how to complete a simple project and will be complemented. Then, the participants have to collaborate to solve a challenge. The teachers offer a suggested challenge, but the participants are free to take other challenges that are relevant to them and to the course. Finally, the participants have to carefully document their works so that it can be evaluated, reproduced and discussed by the other participants.

The first and the last unit are slightly different. In the first unit there is no project as the focus is on the presentation of the participants, the course itself and the discussion of the expectations on the course. The last unit is also special because the participants design, plan, execute and document their own project. The courses finishes with an exhibition of the personal projects.

## *In-class courses*

Besides the online offering, the course will also offered in-class for students registered at Universitat Pompeu Fabra. Furthermore it will be possible to use the material for Summer Schools to promote the University and Bottom-up Initiatives.

## *Resources*

The course will be offered in the P2P University course platform. The students will be offered the videos, a lab assignment guide with all the details of the different projects, and the discussion and feedback tools of the P2P university platform. The guide will be adapted from

the current guide for the existing in-class course on wireless sensor networks.

Figure 2: The motto of the P2P University is “Learn Anything with Your Peers”

### *Additional Material*

- Robert Faludi “Building Wireless Sensor Networks”
- Alejandro Andreu “Open Sensor Network”

# *Working Plan*

- Scripting of the course: Preparation of detailed scripts of the content of the videos, the guide and the requirements for the online platform.
- Shooting and producing the videos: The videos will be shooted and produced according to the script.
- Preparation of the written guide: There is already a guide for the in-class course, but it needs to be adapted to the on-line course.
- Setting up the P2P University on-line platform: This task involves the actual creation and configuration of the online course.

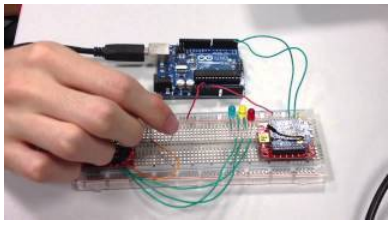

Figure 3: It is necessary to shoot videos with step-by-step instructions to build the pilots.

# *Results and Impact*

This course builds upon successful experiences. There is already an existing course that received very good feedback from the students. There is also a degree thesis by one of the students that was presented in Battlemesh, Aalborg University, and attracted the attention of the P2P Foundation.

The idea of bottom-up smart cities implemented by Smart Citizen was applauded in kick starter and received over $60,000 in crowdfunding. The hardware used in the course is the XBee that was also used in the best-selling book by Rober Faludi âĂIJBuilding Wireless Sensor NetworksâĂİ. More than one million Arduino have been sold confirming the success of their open business model.

The main goal of this course is to strengthen the community by teaching very basic skills to a large audience. After completing the course, the participants will be able to continue on their own with more advanced projects. It is a basic digital education for everyone. People with no or little background in technology will be do the first steps in programming, electronics, and sensing projects.

People that have taken the course will be able to contribute to the creation of bottom-up smart cities.

# *Teaching Plan*

Concepts and competences acquired in the course:

- Bottom-up, peer-to-peer and community-oriented collaboration models
- Sensors, actuators, sensor networks, open data, smart cities
- Very basic electronics
- Very basic microprocessor programming
- Configuration of Digi XBee
- ZigBee communication

Weekly organization:

1. Presentation of the participants, presentation of the course, motivation to take the course, dream about a personal project.
2. introduction to arduino. Arduino IDE. Input/output. Blinking LED project.
3. Introduction to XBee. Basic configuration of AT mode. ZigBee chat project.
4. Basic interaction. Make a measurement and react. Wireless Sunset Sensor project.
5. Open data. The importance of sharing the data. Open data platforms. Taking measures with a sensor and uploading them to the Internet.

Motivating videos:

- Bottom-up, Sensors, Smart Cities: Michel Bauwens, Tiberius Brastaviceanu, Tomas Diez
- Arduino (Blinking LED): Massimo, (Jaume)
- XBee (Chat): Robert Faludi (Luis)

- Interaction design (Sunset Sensor): Alex Posada (Luis)
- Open Data, Open Data platforms (Internet thermometer): Albert Domingo, Manuel Palacin, (Alejandro Andreu)

# *Team*

Figure 4: Luis Sanabria-Russo currently teaches a course on Wireless Sensor Networks at Universitat Pompeu Fabra

- Lead teacher: Luis Sanabria-Russo (Universitat Pompeu Fabra)
- Other members of the team:
  - Laia Albo (Universitat Pompeu Fabra)
  - Alejandro Andreu (Universitat Pompeu Fabra)
  - Massimo Banzi (Arduino)
  - Jaume Barcelo (Universitat Pompeu Fabra): He is a lecturer at Universitat Pompeu Fabra where he takes part in the Wireless Sensor Network course. He has also taught at Universidad Carlos III de Madrid were he took part in the opencourseware experience that published the class materials online. ÂăTogether with Luis Sanabria, he has prepared the basic laboratory guide for the WSN course that has been shared with the community in GitHub. Jaume has taught more than 20 courses at the graduate and undergraduate level at two universities.
  - Michel Bauwens (P2P Foudation)
  - Tiberius Brastaviceanu (Sensorica)
  - Tomas Diez (FabLab Barcelona)
  - Albert Domingo (Universitat Pompeu Fabra)
  - Robert Faludi (Digi International)
  - Manuel Palacin (Universitat Pompeu Fabra)
  - Alex Posada (Media Interaction Design Lab)

Figure 5: Jaume Barcelo currently teaches a course on Wireless Sensor Networks at Universitat Pompeu Fabra