DTC-SAP-247 Internet of Things (IoT): Basics and Practical Approach

SEMESTER: Summer

CREDITS: 3 ECTS (Theory 16 hrs + Lab 14 hrs)

LANGUAGE: English

DEGREES: SAPIENS program

Course overview

This course is an introduction to the Internet of Things concepts and paradigm including from the current state of the art to future expansion and development lines. Hence, it is based on an end-to-end approach considering the most used architectures, components as well as business and industrial practical applications. This course uses both a theoretical and practical approach based on master classes as well as labs. Thereby, at the end of the course, the student will be able to understand the application of IoT-based systems, define and design high level approaches and architectures as well as design and develop such systems.

Prerequisites

Having passed a first year Bachelor in Engineering

Course contents

Theory:

1. **Introduction**. In this module, approaches and basic concepts regarding IoT are shown.
2. **Stakeholders**. It explains the landscape, approaches and roles to be played by the different stakeholders and vendors.
3. **Continuous Engineering**. It shown the different uses and concepts regarding continuous engineering and IoT, emphasizing the CLM (Collaborative Lifecycle Management) project approach.
4. **Internet of Things Solutions: Concepts, architecture and components**. This module deals with the most common IoT architectures also considering all their different components.
5. **Physical devices, nodes and endpoints**. This module deals with the main concepts regarding the hardware layer from the device and node point of view. Also, it deepens into the case of open hardware used for this purpose.

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6. **Communication layers**. Deep dive and explanation of this architecture layer regarding the communication requisites to support IoT implementations.
7. **Backend**. Introduction to backend systems and applications which support IoT projects.
8. **Standards overview**. This module shows the different standards and scope regarding IoT as well as deepens specifically in the case of MQTT.
9. **Smart cities**. Specific case study of common IoT projects and approaches.
10. **Industry 4.0**. Specific case study of common IoT projects and approaches.

Laboratory:

The labs are split into the following main modules:

P1. Continuous Engineering and CLM approach.
P2. Open hardware management.
P3. Internet of things end-to-end practical applications.

Final Project:

All students should set a final project up which includes most of the concepts given in the course. This project will be practical and also defended by the students.

Textbook

- McEwen, A., Cssimally H. (2014). *Designing the Internet of Things*. Wiley.
- Bahga, A., & Madisetti, V. (2014). *Internet of Things: A Hands-On Approach.* Arsdepp Bahga & Vijay Madisetti.
- Slama, D., Puhlmann, F., Morrish, J., Bhatnagar R. M. (2015). *Enterprise IoT: Strategies and Best Practices for Connected Products and Services*. O'Reilly.
- Balani, N. (2015). *Enterprise IoT: A Definitive Handbook.* CreateSpace Independent Publishing Platform.
- Greengard, S. (2015). *The Internet of Things (The MIT Press Essential Knowledge series)*. MIT Press.
- Hersent, O., Boswarthick, D., Elloumi, O. (2012). *The Internet of Things: Key Applications and Protocols*. Wiley.
- Uckelmann, D., Harrison, M., Michahelles, F. (2011). *Architecting the Internet of Things*. Wiley.
- Chaouchi, H. (2010). *The Internet of Things: Connecting Objects*. Wiley.
- Lampkin, V., Leong, W. T., Olivera, L., Rawat, S., Subrahmanyam, N., Xiang, R. (2012). *Building Smarter Planet Solutions with MQTT and IBM WebSphere MQ Telemetry*. IBM Redbooks.

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- Margolis, M. (2011). *Arduino Cookbook*. O'Reilly.

Grading

The following conditions must be accomplished to pass the course:

- A minimum overall grade of at least 5 over 10.

The overall grade is obtained as follows:

- Exams: 25%. Typically 2 short exams regarding IoT basic concepts.
- Labs: 35%.
- Final Project: 40%.