

A Wireless Sensor Network PBL Lab for the Master in Telecommunications Engineering

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Abstract—The new concept of Smart Cities creates the paradigm of the integration of Information and Communication Technologies (ICT) with the services of the cities, such as the management of the electric and water distribution systems or the traffic lights control. In this sense, the Wireless Sensor Networks are taking their positions and foresee a good alternative that is being introduced in the cities for the realization of these jobs. This communication presents a lab with the objective of introducing and performing the development of a Wireless Sensor Network application based on the Contiki OS, the COOJA and MSPSim simulator as well as the CM5000 platform.

Index Terms—Project Based Learning (PBL), Wireless Sensor Networks, Smart Cities, Master in Telecommunications Engineering.

I. INTRODUCTION

This lab is part of the “Smart Cities” subject included in the Master in Telecommunication of the School of Engineering of the University of Navarra (TECNUN) in Donostia-San Sebastián. This subject is included in the Networks, Systems and Services scope.

II. WORK DESCRIPTION

This lab is a Contiki programming course based on the Contiki COOJA Hands-on Crash Course [1]. Contiki is a state-of-the-art, open source operating system for sensor networks and other networked embedded devices. Contiki OS [2] was the first operating system for sensor networks to provide TCP/IP communication (with the uIP stack [3]), loadable modules, threading on top of its event-driven kernel, Protothreads, protocol-independent radio networking (with the Rime stack), cross-layer network simulation (with COOJA [4] and MSPSim [5]), and software based power profiling. It also includes a networked shell and the memory efficient flash-based Coffee file system.

The objective of the WSN Lab practice is to perform and introduce the development of Wireless Sensor Networks applications using the Contiki Operating System, the COOJA and MSPSim simulators as well as the CM5000 platform. With this aim, this paper intends to provide a guide to be followed and offer the following information:

- Description of the material to be used in the Lab practice.
- Introduction to the tools with the necessary steps to getting started.
- Description exercises about working with a single node
- Network simulation with several nodes.

III. RESULTS AND CONCLUSIONS

After following the instructions and completing the lab, students should already be able to code new programs for the nodes using Contiki OS, simulate the programs before loading them into the nodes, simulate network of nodes, and finally deploy the applications in real nodes.

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