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A Modular Architecture for Energy Efficient Wireless Sensor Networks Nodes: Extended Abstract

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The current evolution of Wireless Sensor Networks (WSN) has led us towards real world problems such as the power supply of network nodes in an efficient and sustained way. The actual implementation of these networks calls for perpetually powered devices, since the constant changing of the batteries is not a realistic scenario. That is the main motivation behind the proposal of this new architecture, having the low power consumption as a key objective and an intelligent interaction with power supply modules.

The energy efficiency of this platform comes from three different factors: the use of a last generation ultra low-power microcontroller, the use of different communication modes and the intelligent interaction with a harvesting module able to perpetually supply energy to the network nodes. Hence, the modularity of this platform, allowing for independent development of its components, is a very important characteristic. The block diagram of the proposed architecture can be seen in Figure 1:

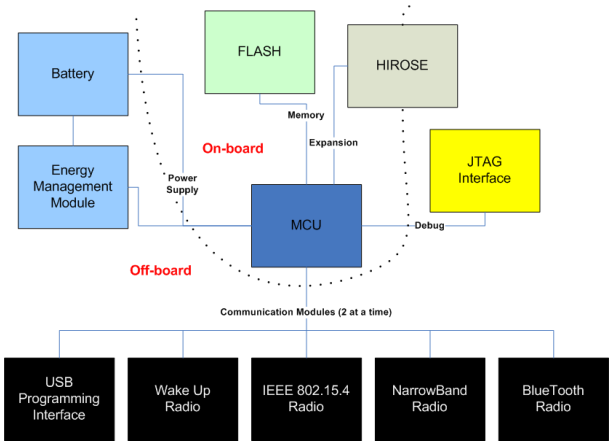

Figure 1. Block Diagram

Apart from the reduction of power consumption achieved through the use of last generation microcontrollers, the whole platform architecture is thought to guarantee energy saving mechanisms, which are basically twofold: the modularity of the communication interfaces makes it possible to work with high throughput and low consumption radios, simultaneously, and also the development of wake-up radio solutions to minimize even further the power requirements by reducing listening times; the use of an intelligent power supply, whose main idea is to retrieve energy from the environment to supply the platform. Additionally, it contributes to the power management with information about the current status and evolution of the batteries as well as the energy sources, allowing for a better power consumption profile and the development of highly energy-efficient network algorithms.

In order to evaluate the proposed architecture, the following prototypes have been implemented: the main board and the ZigBee communication board for IEEE 802.15.4 communication using a CC2420 radio transceiver. Although our first choice for the micro controlling unit was a MSP430F5438, the software compatibility requirements – our applications are implemented using TinyOS framework, which calls for Texas Instruments' MSP430 or Atmel's ATMega series – forced us to build a board with a MSP430F2419. This was due to the fact the MSPGCC compiler used by TinyOS still does not support the fifth series of these microcontrollers.

The work to be done consists on implementing the designed power supply module after studying the environmental sources available to harvest, such as solar power, vibrations, radio frequencies and thermal energy. The devices used to retrieve the energy will be integrated in the project after the prototyping and testing phases of the system blocks shown in Figure 1 are complete.