PHYSICAL MODELLING OF WIRELESS SENSOR NETWORKS FOR THEIR POWER CONSUMPTION OPTIMIZATION

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The effectiveness of wireless sensor networks (WSN), which are usually designed for gathering environmental information, its preprocessing and broadcasting on wireless channels, depends on many factors. The majority of tiny WSN nodes distributed over large area have their independent supply sources, thus low power consumption is one of the strong demands.

The amount of energy consumed by a node generally depends on two main factors: hardware implementation and computer algorithm of the node. Low-consumption microcontrollers (MC) and radio transceivers are being rapidly improved nowadays by a number of hardware vendors. Meanwhile, the problem of power-effective algorithms can be solved only by WSN architects using the following methods: minimizing computational resources for solving an urgent problem, effective usage of MC sleep and idle modes, switching off unnecessary MC peripherals and even software management of MC frequency and supplying voltage. However, the most effective way to save node battery charge is to abate the quantity and the duration of communication sessions inside the network. Analog radio transceiver is usually the main power consumer within a node and while operating, it increases input current in times.

Practically, architects try to follow Zigbee/IEEE 802.15.4, which is the only world recognized standard in the field of WSN. However, Zigbee stack limits the effectiveness of the described power-saving methods. This means that one has to process constant measurements of energy, consumed by a node as well as by its blocks and separate electric circuits in order to track the practical effect gained by implementation of power-saving software approaches.

It can be achieved by physical modeling of WSN segment. However the toolkits recommended by Zigbee vendors are usually designed to connect Zigbee radios to PC. This recommendation contradicts the given concept, as the model designed in such a way does not contain MC, whose software is being optimized. In contrast to this, wireless modem XBee Microlab for Zigbee networks, designed by the author, can be used as a transceiver block in any MC system based on 5V logic. XBee Microlab supports the concept of assembling WSN nodes from primitives and enables to measure precisely the power consumption for each separate block.

As a result, a set of the most effective power-saving techniques can be figured out and implemented, that leads to augmentation of the battery lifetime and thus diminishes the costs needed for maintenance of WSN.