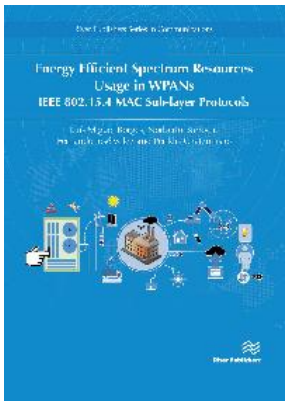

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Energy Efficient Spectrum Resources Usage in WPANs

IEEE 802.15.4 MAC Sub-layer Protocols

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Description:

Wireless Sensor Networks (WSNs) and the Internet of Things are facing tremendous advances both in terms of energy-effciency as well as in the number of available applications. Consequently, there are challenges that need to be tackled for the future generation of WSNs. After giving an overview of the WSN protocols and IEEE 802.15.4 standard, this book proposes IEEE 802.15.4 Medium Access Control (MAC) sub-layer performance enhancements by employing not only RTS/CTS combined with packet concatenation but also scheduled channel poling (MC-SCP). Results have shown that the use of the RTS/CTS mechanism improves channel effciency by decreasing the deferral time before transmitting a data packet. Furthermore, the Sensor Block Acknowledgment MAC (SBACK-MAC) protocol enables more efficiency as it allows the aggregation of several acknowledgement responses in one special Block Acknowledgment (BACK) Response packet. The throughput and delay performance have been mathematically derived under both ideal conditions (a channel environment with no transmission errors) and non-ideal conditions (with transmission errors). Simulation results successfully validate the proposed analytical models. This research reveals the importance of an appropriate design for the MAC sub-layer protocol for the desired WSN application. Depending on the mission of the WSN application, different protocols are required. Therefore, the overall performance of a WSN application certainly depends on the development and application of suitable e.g., MAC, network layer protocols.

Keywords: Wireless Sensor Networks, WSN applications, RF energy harvesting, MAC sub-layer protocols, BACK mechanism, RTS/CTS, Packet Concatenation, multi-channel, enhanced two-phase contention window, simulation