Research on building an energy-aware IPv6 routing protocol for wireless sensor networks

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Abstract: This thesis investigates the design and development of an energy-aware IPv6 routing protocol for Wireless Sensor Networks (WSNs). The integration of IPv6, particularly through the 6LoWPAN adaptation layer, enables direct internet connectivity for sensor nodes but introduces significant energy consumption challenges due to the overhead of routing headers and neighbor discovery. Existing routing protocols often fail to balance network lifetime with Quality of Service (QoS) requirements. This research proposes a novel routing protocol that leverages IPv6 neighbor discovery mechanisms and cross-layer information to make energy-efficient forwarding decisions. By incorporating residual energy levels, link quality, and hop count into the routing metric, the protocol dynamically selects optimal paths to prolong network longevity. Simulation results demonstrate that the proposed protocol significantly reduces average energy consumption and extends network lifetime compared to standard RPL and AODV-based approaches, while maintaining acceptable packet delivery ratios and end-to-end delay. The findings contribute to the advancement of sustainable and scalable IoT deployments.

Keywords: IPv6 routing protocol, energy-aware, wireless sensor networks, routing protocol