

# Bachelor Thesis

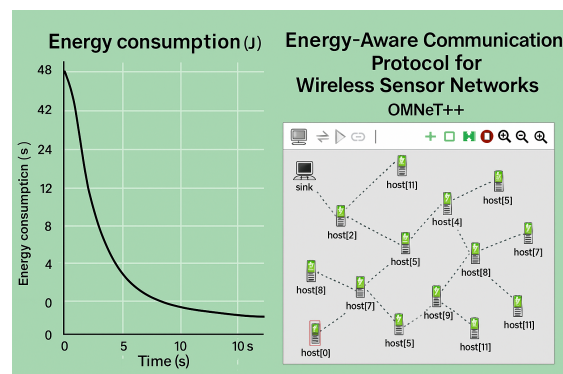
## Design and Simulation of an Energy-Aware Routing Protocol for Wireless Sensor Networks

### Motivation

Wireless Sensor Networks (WSNs) play a critical role in many modern applications, ranging from environmental monitoring and precision agriculture to disaster response and industrial automation. These networks consist of numerous small sensor nodes that collect and transmit data through wireless communication. In many cases, data must travel across multiple hops—moving from one node to another—before reaching a central base station for processing.

A major limitation of these sensor nodes is their reliance on limited battery power. In large-scale deployments or remote environments, physically replacing or recharging batteries is not only impractical but often impossible. As a result, energy efficiency becomes a fundamental concern when designing communication protocols for WSNs. Without careful energy management, nodes may deplete their batteries quickly, leading to communication breakdowns and reduced network coverage.

This is why energy-aware routing protocols are essential. These protocols aim to optimize how data is transmitted across the network, reducing unnecessary transmissions and balancing energy usage among nodes. Ultimately, the goal is to extend the operational lifetime of the network while still ensuring reliable data delivery. This thesis explores such energy-aware communication strategies, focusing on simulation and analysis of their effectiveness in practical scenarios.



WSNs rely on energy-aware routing protocols to optimize data transmission across the network. Nodes collaborate to balance energy usage and extend the network's operational lifetime.

**Project type** Bachelor Thesis  
**Duration** 1 Semester  
**Language(s)** English  
**Field** Computer Science

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## Objective

The goal of this thesis is to study and simulate an energy-aware routing protocol for multi-hop WSNs. The focus will be on reducing energy consumption while maintaining reliable data transmission.

### Steps to be completed:

- **Step 1 – Literature Review:** Investigate existing energy-aware routing protocols such as LEACH, TEEN, and Energy-Aware AODV.
- **Step 2 – Protocol Implementation:** Implement a simple energy-aware extension of AODV or similar protocol in a simulation environment (OMNeT++).
- **Step 3 – Evaluation:** Simulate different network scenarios to analyze the impact on energy consumption, packet delivery ratio, and latency.

## Prerequisites

- Basic knowledge of computer networks (e.g., Computer Networks I+II)
- Familiarity with C++ programming and simulation tools (e.g., OMNeT++)
- Optional: Experience with Linux and working in a research environment

## References

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- [3] **M. Güneş, U. Sorges, and I. Bouazizi**, "ARA – The Ant-Colony Based Routing Algorithm for MANETs," *Proceedings of the International Conference on Parallel Processing Workshops (ICPPW)*, 2002.
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- [6] **INET Framework for OMNeT++**, "INET 4.4 Documentation," <https://inet.omnetpp.org>, 2023.

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