# Master Thesis Ideas

**Title: Adaptive Friend Selection and Communication Optimization in Bluetooth Mesh Networks**

In Bluetooth Mesh (BM) networks, Low Power Nodes (LPNs) are designed to conserve energy by remaining in sleep mode for most of their lifetime. To receive messages, they rely on Friend nodes, which buffer and forward data. While this mechanism significantly reduces energy consumption, it introduces latency and depends heavily on the performance of the selected Friend node.

Existing approaches primarily focus on optimizing communication between LPNs and a single Friend node, often assuming static conditions. However, in practical deployments such as smart environments and industrial monitoring systems, multiple candidate Friend nodes may be available. Their performance can vary over time due to network congestion, interference, and link quality fluctuations. As a result, a fixed Friend selection may lead to suboptimal performance in terms of latency, reliability, and energy consumption.

This thesis explores an adaptive approach in which an LPN dynamically selects the most suitable Friend node and adjusts its communication strategy. The goal is to improve reliability and latency while maintaining low energy consumption. The approach considers both Friend selection and communication parameters (e.g., polling interval, transmission strategy), enabling more efficient operation under changing network conditions.

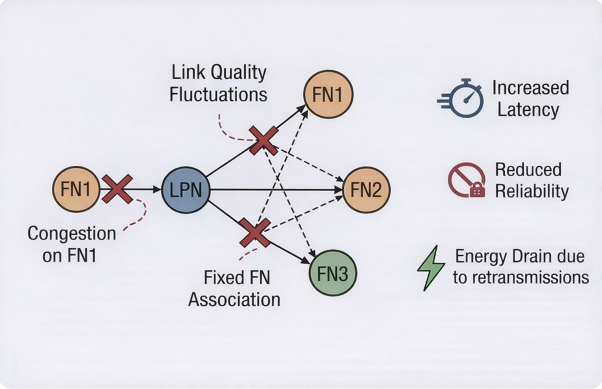


*Figure: Friend selection and communication strategy in Bluetooth Mesh network*

- Analyze limitations of static Friend selection and fixed communication strategies in Bluetooth Mesh LPNs
- Design a joint framework for adaptive Friend selection and communication strategy
- Define key metrics: link quality, latency, packet delivery ratio, congestion, and energy
- Develop a lightweight learning-based decision mechanism (e.g., contextual bandits)
- Incorporate switching cost and hysteresis to avoid frequent Friend changes
- Compare with standard friendship and existing optimization approaches
- Evaluate under dynamic conditions with multiple Friend candidates and varying traffic

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