Middle East Technical University

Computer Engineering Department

CNG 476 System Simulation
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Proposal Report
Smart Small Grid Management System

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1 Project Explanation

This project simulates an IoT-based smart small grid management system that uses LoRa communication within OmNet++ and the FLoRa framework. The system consists of multiple houses equipped with smart sensors that monitor power availability and communicate directly with a central monitoring system. These sensors detect power outages and send real-time alerts to the system using LoRa's long-range, low-power communication capabilities. The monitoring system processes the received data, analyzes the outage patterns, and coordinates the distribution of energy among multiple providers to ensure efficient power restoration. It also notifies the technical team, who are then dispatched to fix the issue on-site.

The simulation incorporates Random Number Generation and Monte Carlo simulation to model uncertain factors such as sensor failures and varying network conditions. Probability models are used to predict power outage frequencies, while the Poisson process is used as a stochastic process to analyze the random occurrence of outage events and data transmission reliability under different network loads. To efficiently handle multiple simultaneous outage reports, the system employs queues, sorting outage reports by time, and processing them in a FIFO (First-In-First-Out) manner to ensure the earliest reported outages are addressed first.

For performance evaluation, key metrics include the number of outages detected, the average arrival time of the technical team after notification,and the time taken to resolve the outages. These metrics help assess the efficiency of outage detection, communication latency, responsiveness of the technical team, and overall grid resilience, ensuring optimal performance in real-world scenarios.

2 Diagrams and Visuals

A diagram of our system can be seen in Figure 1.

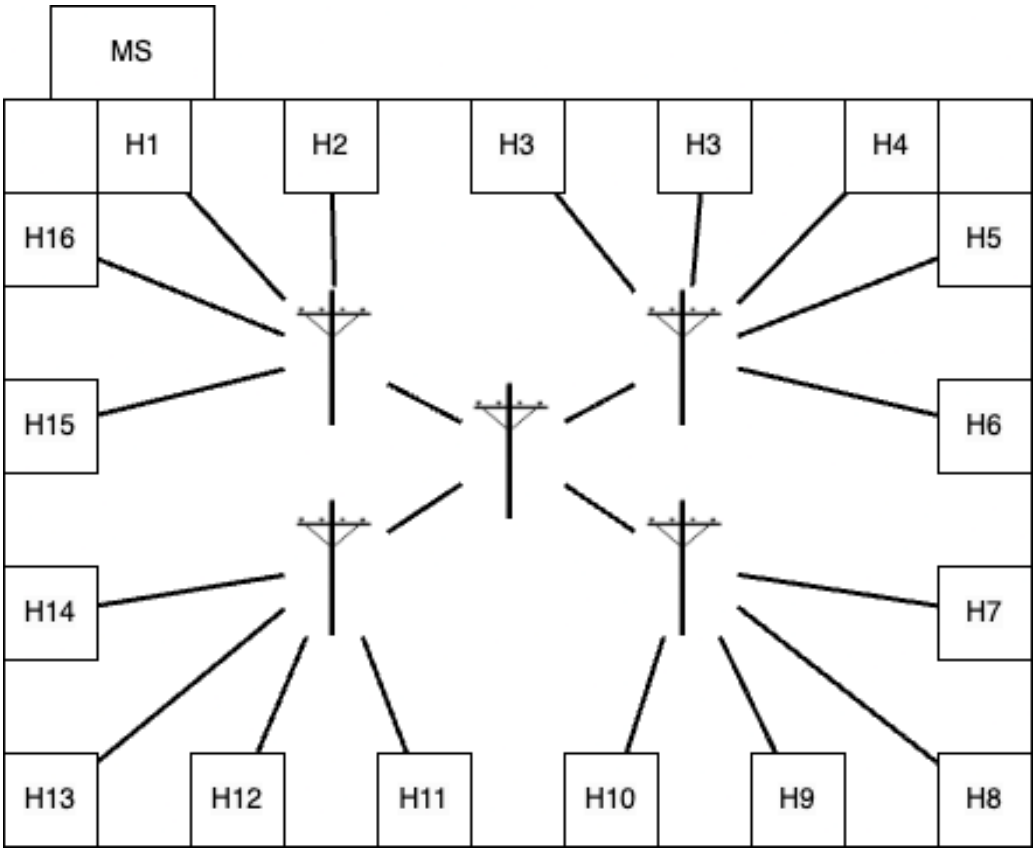

Figure 1: Smart Small Grid Management System