

Bachelor/Master Thesis

Design and Implementation of a Web-Based Mesh Topology Visualization

Motivation

The Magdeburg Internet of Things Laboratory (MIoT-Lab) is a testbed for the research on wireless communication and embedded systems [1][2]. In the future, it will consist of 200 computer nodes distributed around the campus.

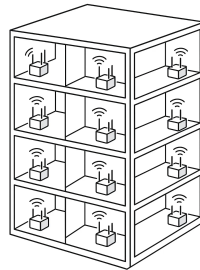


Figure 1. AI-generated sketch showing a building and positions of nodes.

To be able to visualize its complex topology over multiple rooms, floors, buildings, position on campus et cetera, and to get an idea about the characteristics of the node's wireless connectivity, it would be helpful to have a tool that renders a three-dimensional representation of the campus and the distributed nodes. Buildings would be modeled as kind of a digital twin to show the outlines of buildings, rooms and floors. Depending on the extent wanted by the student(s), a virtual walkthrough similar to walking through a level of a video game is also imaginable. Figure 1 roughly sketches the idea, however the building and the node's topology is a lot more complex than that.

Such an application would extend the existing Testbed Management System (TBMS) website to aid users with getting an understanding of the topology, and also to offer easy access to interact with nodes by spacial selection. However, it could also be used for evaluations of research done on the testbed, to better visualize metrics such as signal strength, latencies, network utilization et cetera in an intuitive manner.

Goal

The goal of this thesis is to design, implement and evaluate a web-based application for the visualization of the MIoT-Lab's topology. It shall render three-dimensionally and contain models of relevant buildings, so some experience in 3D modeling is either needed or needs to be acquired.

A specific scope (features to be implemented et cetera) can be set depending on the project type and number of students.

Project type Bachelor/Master Thesis
Duration 1 Term
Language(s) English, German
Field Computer Science



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Tasks

- get familiar with the MIoT-Lab and its architecture
- design and implement a web-based application for topology visualization
 - modern technologies of your choice (e.g. HTML5 & TypeScript)
 - simple 3D modeling of few relevant buildings
 - rendering of node's position & status
 - visualization of connectivity (other nodes in range)
 - interaction by clicking on nodes and/or links
- evaluate user experience with user surveys (don't worry!)

References

- [1] *Communication and Networked Systems (ComSys) - MIOT-Lab*, Mar. 2025. [Online]. Available: https://comsys.ovgu.de/MIOT_Lab.html.
- [2] K. Kientopf, M. Buschsieweke, and M. Güneş, "Technical report: Designing a testbed for wireless communication research on embedded devices," *18. GI/ITG KuVS Fachgespräch Sensornetze-FGSN 2019*, pp. 41–44, 2019.

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