

Bachelor Thesis

Simulative Evaluation of Optimal Placement algorithms of Mobile Mesh-Nodes in Networked Robotic Use Cases

Mesh networks offer a decentralized approach that is often used in conjunction with centralized network approaches to provide network connectivity in poorly served areas in a flexible and timely manner. This is all the more true for use cases where the nodes are mobile. In such cases, the mobility of mesh nodes can further increase the available network coverage. However, the decentralized nature of mesh networks raises the question of the placement of nodes for optimal network coverage.

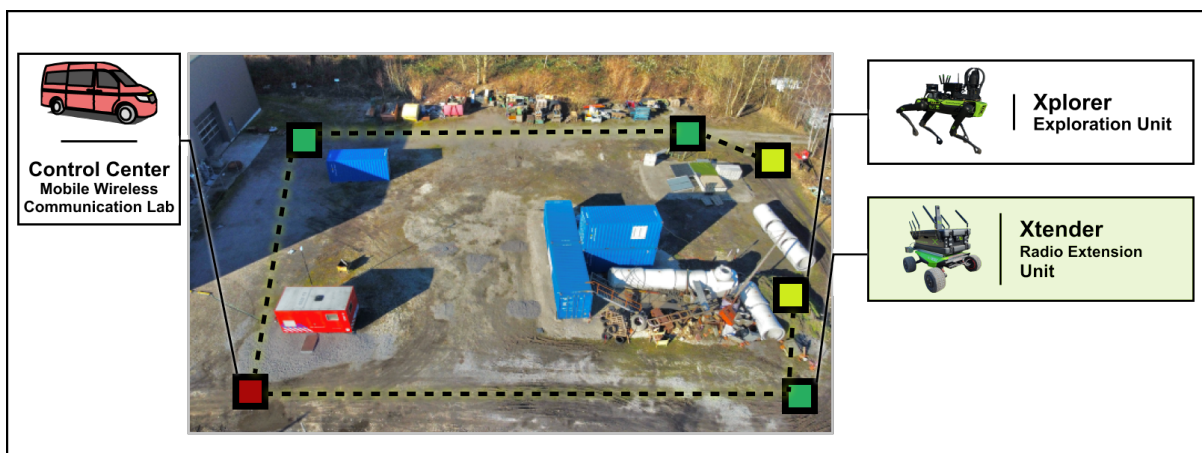


Figure 1: Envisioned use case – Network coverage extension during rescue robotic mission

Goals

During the thesis, optimal placement algorithms for mesh nodes in a networked robotics real-world inspired use case will be evaluated and a practical solution will be designed and evaluated in a simulation.

Possible work steps

- Compile a selection of practical optimal mesh node placement algorithms which are also compatible with the envisioned use case.
- Compare and evaluate the algorithms within the selection in a simulation with static nodes.
- Design an optimal placement solution based on the evaluation results.
- Implement use case scenario: Basic exploration mission with poor connectivity.
- Evaluate the connectivity enhancement through the optimal node placement.

Requirements

- General knowledge and interest in communication networks and robotics
- C++ and LaTeX skills.
- Basic experience with Linux and software development tools (git, etc.)
- Participation in KN lecture highly desirable & other CNI lectures are a plus.
- Excellent English skills, willingness to write thesis in English highly desirable.

References

- [1] N. Goddemeier, K. Daniel and C. Wietfeld, "Role-Based Connectivity Management with Realistic Air-to-Ground Channels for Cooperative UAVs," in *IEEE Journal on Selected Areas in Communications*, vol. 30, no. 5, pp. 951-963, June 2012, doi: 10.1109/JSAC.2012.120610.
- [2] Wzorek, M., Berger, C. & Doherty, P. "Router and gateway node placement in wireless mesh networks for emergency rescue scenarios" in *Autonomous Intelligent Systems* 1, 14 (2021). <https://doi.org/10.1007/s43684-021-00012-0>
- [3] Seetha, S., Anand John Francis, S., Grace Mary Kanaga, E. "Optimal Placement Techniques of Mesh Router Nodes in Wireless Mesh Networks" in *2nd EAI International Conference on Big Data Innovation for Sustainable Cognitive Computing*. Springer, Cham. https://doi.org/10.1007/978-3-030-47560-4_17