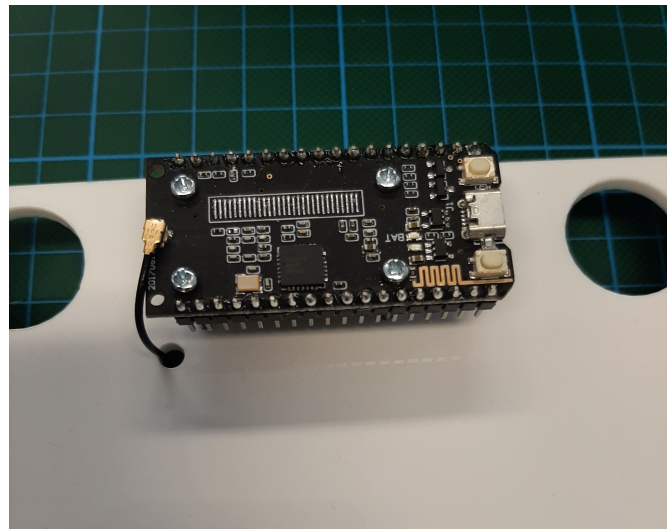


# Bachelor/Master Thesis

## Design and Implementation of a LoRa-Based Reset Solution

### 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.** The ESP32 Microcontroller Unit (MCU) used for the reset solution.

Occasionally, nodes become unresponsive or are not booting correctly. For this reason, a reset switch solution based on an ESP32 MCU, as can be seen in Figure 1, exists already. All reset switches expose a Constrained Application Protocol (CoAP) endpoint via the university's WiFi network. The Testbed Management System (TBMS) can interact with the endpoint in order to hard-reset a node. While the solution mostly works, the WiFi coverage is sometimes spotty due to lack of Access Points (APs) or (sometimes intentionally, sometimes not intentionally) heavily obscured positioning of nodes.

To break the dependency on the university WiFi network, to lower maintenance work (certificate renewal, coverage testing et cetera) and to prepare for potential mobile nodes that might not be coverable via WiFi at all, it makes sense to use other means of wireless communication for resetting the nodes. Coincidentally, the ESP32 MCUs used for the reset switches already have a LoRa transmitter on board.

**Project type** Bachelor/Master Thesis  
Software Project  
**Language(s)** English, German  
**Field** Computer Science



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## Goal

The goal of this thesis is to design, implement and evaluate a LoRa-based reset solution for the MIoT-Lab nodes.

Depending on the type of the module (thesis or software project), the scope can be adjusted (reliable transmissions, multi-hop communication, ...).

## Tasks

- get familiar with the MIoT-Lab and its architecture
- design and implement a LoRa-based reset solution
  - centralized (LoRaWAN) vs. decentralized (own protocol?)
  - conformity to radio regulations
  - reliable communication (retransmissions, error detection et cetera)
  - consideration of security (encryption & authentication)
- evaluate and compare solution with status quo
- write a thesis about it

## References

- [1] *Communication and Networked Systems (ComSys) - MIoT-Lab*, Mar. 2025. [Online]. Available: [https://comsys.ovgu.de/MIOT\\_Lab.html](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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