

Open Thesis / Project

Extending the Communication Capabilities of Nano-Drones

Thesis Type

Master Project / Master Thesis

Motivation

Robot vehicle platforms, often called “drones”, offer exciting new opportunities for mobile computing applications, as they allow computer systems to actively control the device location, allowing a more efficient and precise interaction with the physical world. While larger drones can easily weigh more than 1 kg and may require a certified operator, nano-drones are sold as toys, weigh only tens of grams, and have much less restrictions. An example of such a nano-drone is the open-source Crazyflie platform, which has been used widely in the past.

Unfortunately, the radio communication protocol of the Crazyflie is proprietary and based on relatively outdated chips (e.g., the drone itself relies on a chip released in 2012 and an even older chip is used for the communication to the remote). While the nRF51 chip embedded in the Crazyflie supports Bluetooth Low Energy (BLE), the current implementation does not make use of it and does not support any autonomous flight capabilities. For this reason, we would like to extend the communication capabilities of the Crazyflie, such that multiple drones can be controlled from the same remote, and such that multiple drones can autonomously interact with each other.



Goals and Tasks

Within this context, the student can explore several directions and perform different tasks, such as:

- Implement a robust BLE mesh protocol like BlueFlood on the existing nRF51 CPU;
- Design an external radio interface based on an ESP32 (WiFi+BLE) or nRF52840 (low-power BLE only) and integrate it into the existing Crazyflie client stack (ZeroMQ based);
- Design and implement a new radio driver for nRF52840 devices to be able to communicate with a swarm of Crazyflie drones using their existing radio firmware;

Target Group

- Students of ICE/Telematics;
- Students of Computer Science;
- Students of Electrical Engineering.

Required Prior Knowledge

- Knowledge of networked embedded systems;
- Excellent C programming skills;
- Experience with embedded platforms and drones or drone networks is a plus.

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