Open Thesis / Project

# Centimeter-Accurate Navigation of Nano-Drones using UWB Technology

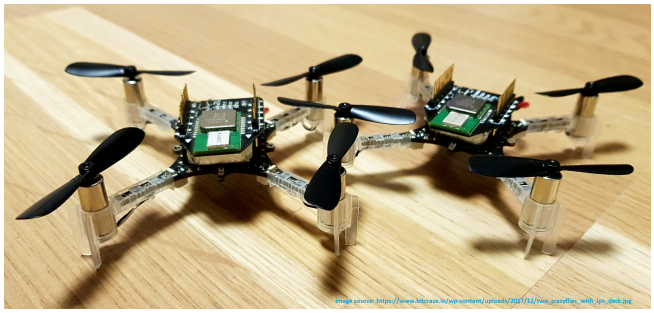
## Thesis Type

Master Project / Master Thesis

## Motivation

Robot vehicle platforms, often called "drones", offer exciting opportunities for mobile computing applications, as they allow computer systems to actively control the device location for a more efficient and precise interaction with the physical world. While larger drones may weigh more than 1 kg and require a certified operator, *nano-drones* weigh only tens of grams, are sold as toys, and can be flown by everyone. An example of nano-drone is the *Crazyflie*, which is open source, weighs $\approx 25$ grams only, and has quickly gained popularity in the last years.

We have recently equipped the Crazyflie with an ultra-wideband (UWB) shield on top based on the MDEK 1001, similar to the Loco Positioning system by `bitcraze`. Such shield allows the Crazyflie to communicate with surrounding UWB devices and obtain accurate distance information. Our goal is to accurately navigate a swarm of Crazyflies through the hallways of our institute, possibly by incorporating UWB-based algorithms and protocols designed in our group, such as SnapLoc. To this end, we have deployed a testbed with more than 50 UWB devices across a hallway as well as a drone cage that can be used to experiment with the Crazyflie.



## Goals and Tasks

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

- Implement localization techniques based on two-way ranging directly on the Crazyflies;
- Enrich the Crazyflies with SnapLoc, so to enable a fully-passive localization of nano-drones;
- Design a hybrid solution making use of the Crazyflie's embedded *crazyradio* for communication and of the UWB shield for localization;
- Fly the nano-drones through the hallway and experimentally measure the localization accuracy that can be achieved with the UWB shield.

## Target Group

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

## Required Prior Knowledge

- Knowledge of networked embedded systems;
- Excellent low-level C programming skills;
- Basic signal processing knowledge is beneficial;
- Experience with embedded platforms, UWB technology, and drones is of advantage.

## Contact Person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