# Lehrstuhl für Bildverarbeitung

## **Master/- Bachelor Thesis**

Development of a Framework for Real-Time Synchronization of multiple Microcontrollers in Distributed Low-Field MRI Control Systems

#### Keywords

Low-Field MRI | Microcontroller | Realtime Synchronization | Embedded Systems

#### Background

Magnetic resonance imaging (MRI) is an imaging technique that uses magnetic fields and radio waves to create detailed images of the inside of the body. Low-field MRI systems work with a weaker magnetic field. In the DeLoRi project, together with the Fraunhofer MEVIS Institute, we are developing a low-field MRI device to support cancer diagnostics. To control the various coils and RF readout electronic in the MRI system, different hardware and software components must be synchronized with each other and supplied with the respective MRI sequence data to be able to reproduce them in a targeted manner.



RNTHAAC

Univ.-Prof. Dr.-Ing. Volkmar Schulz

Lehrstuhlinhaber

Raum 140 Kopernikusstr. 16

52074 Aachen

08.01.2025

Marcel Ochsendorf

Wissenschaftlicher Mitarbeiter

Telefon: +49 241 80-27864 ochsendorf@lfb.rwth-aachen.de

#### Tasks

The aim of this work is to develop a framework for synchronizing different microcontroller-based digital-analog controllers to control different gradient coils of the MRI system.

The work can be adapted to your interests and ideas. On the one hand, there is the possibility to create a case study on how useful the network-based PTP protocol is to provide microcontroller systems with precise time stamp information, on the other hand, the development of a real-time streaming framework between a control PC and the microcontroller platform to stream waveforms to the DAC cards.

### Your Profile

For the successful implementation of the project, you should have an interest in one or more of the following subject areas:

- C++ ARM or RISC-V based Microcontroller Firmware development
- FPGA Development | Streaming Protocols
- Linux PTP, Realtime Kernel

#### Our Offer

The call for applications is aimed at master's students with a technical background

(e.g. electrical engineering or technical computer science) and is carried out in cooperation with Fraunhofer MEVIS. A workstation can be provided at the Chair of Image Processing, includes modern IT infrastructure, includes access to modern IT infrastructure, a workshop and rapid prototyping facilities.