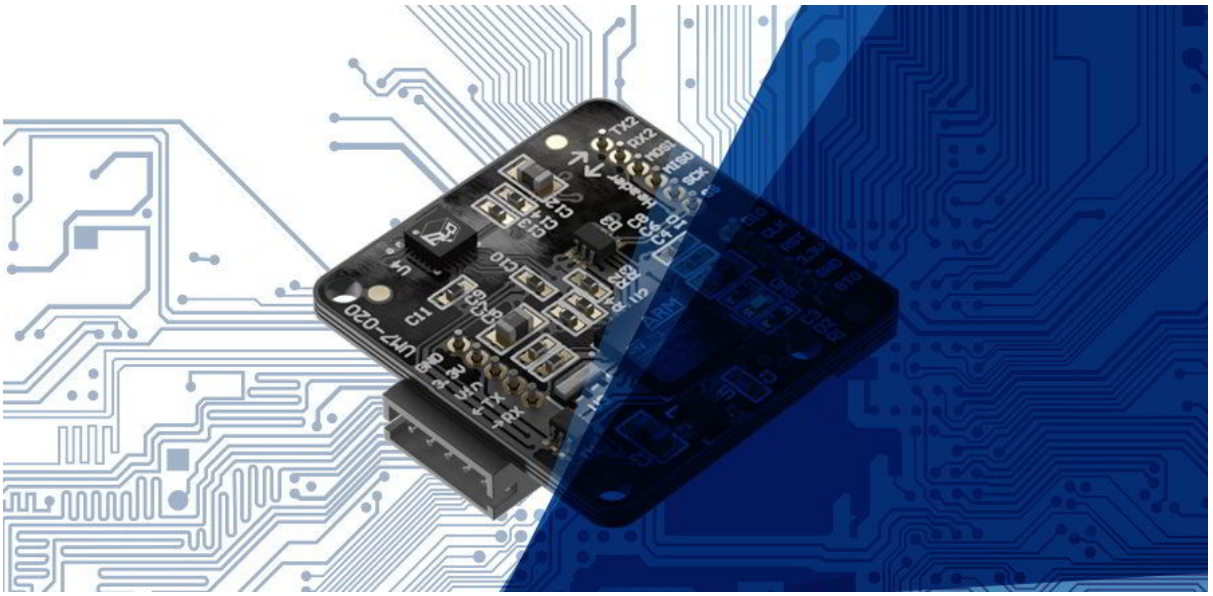
**[Forschungspraxis/Internship] Embedded software features development for custom BLDC motor driver**



[2]Picture only for representation purposes, source: IMU and Robotics

*Brushless motors are growing in popularity for Robotics applications. They are particularly interesting due to their power density and availability. A good example of its abilities is MIT mini cheetah success with the Proprioceptive Actuator concept [1]. There, leveraging low gear ratio, back-drivability, high torque(power) density, they have been able to develop a powerful enough and stable actuator even for acrobatic maneuvers.*

*We are working on our own solutions for BLDC actuation. For that purpose, we have developed controllers that are the heart of all recent hardware developments [2] We are looking to enhance them and better integrate them within other projects.*

Student will need to help first with IMU embedded software integration and further help with algorithms for controlling the regular DC motors using our board. Expected results are successful completion of IMU test via a simple Teapot Demo[3]. For DC motor control a simple PD speed and position controller should be implemented.

To achieve this, student should be already familiar with the basics of Microcontroller programming, working with Reference Manuals and Data Sheets. Big plus is some knowledge of using and writing code for Arduino.

[2] Dummy Load for BLDC controller testing https://youtu.be/n16nrkDgMSA?si=UvVKYjV67vnbA-1a
[3] Teapot demo for Arduino MPU-6050 https://youtu.be/nlXqIe9-R7s?si=bBgLrNOLeH0RdZro

**What you will gain:**

- Hands-on experience and in-depth understanding of IMU
- Understanding Motor Control and various aspects of DC motors
- Best practices for Embedded software development
- Working with DataSheets and Documentations of various Devices
- Hacking electronic signals (via oscilloscope, etc.)
- Insights in our System Development and access to our community

**Requirements from candidates:**

- Knowledge of C
- Basics of Microcontroller programming
- Basics in Electronics and Mechanics
- Proficiency in English C1, reading academic papers
- Plus are:
    - Arduino programming
    - Familiarity with GIT

We are welcoming initiative and always aiming to support new ideas. This internship is great opportunity to get familiar with our work and gain a lot of knowledge in hands-on Embedded system development.

To apply, you can send your CV, and short motivation to the Supervisors (with the Senior Supervisor in cc)


Supervisors

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[1] P. M. Wensing, A. Wang, S. Seok, D. Otten, J. Lang and S. Kim, "Proprioceptive Actuator Design in the MIT Cheetah: Impact Mitigation and High-Bandwidth Physical Interaction for Dynamic Legged Robots," in *IEEE Transactions on Robotics*, vol. 33, no. 3, pp. 509-522, June 2017, doi: 10.1109/TRO.2016.2640183.

[2] Fortunić, E. P., Yildirim, M. C., Ossadnik, D., Swikir, A., Abdolshah, S., & Haddadin, S. (2023). Optimally Controlling the Timing of Energy Transfer in Elastic Joints: Experimental Validation of the Bi-Stiffness Actuation Concept. *arXiv [Eess.SY]*. Retrieved from http://arxiv.org/abs/2309.07873