TUM

M.Sc. Thesis

**IDP**

Emulation of a Robust Two-Wheeled Inverted Pendulum

Motivation

The performance of systems can be defined by a set of key performance indicators (KPI). A benchmarking methodology defines a relevant set of KPIs to comprehensively evaluate different systems. The Chair of Network Architectures and Services developed a benchmarking framework for Cyber-Physical Systems (CPS) which is able to compare different CPS based on a common benchmarking methodology and a common set of KPIs. This platform is based on a two-wheeled inverted pendulum robot (TWIPR) — a common experimental setup for control design. The benchmarking framework is called NCSbench defining standardized KPIs and measurement setups for the TWIPR.

During this thesis, a digital twin of this real system shall be created behaving like the original robot.
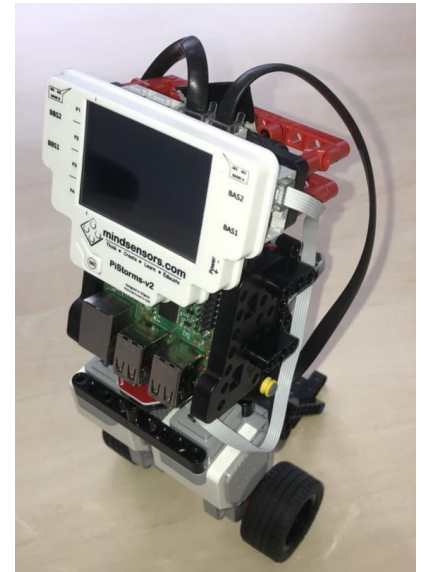
The thesis is embedded in the DFG-MOONSHINE project part of the priority programme 1914 on "Cyber-physical networking". This thesis will be done in collaboration with Prof. Matthias Althoff (Chair of Robotics, Artificial Intelligence and Real-time Systems).

Your Task

- Familiarize yourself with the control theory behind the TWIPR
- Replicate the TWIPR of NCSbench platform
- Create a emulator replicating the TWIPR
- Compare both systems - emulated and real utilizing the NCSbench framework

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https://net.in.tum.de/projects/dfg-moonshine/