

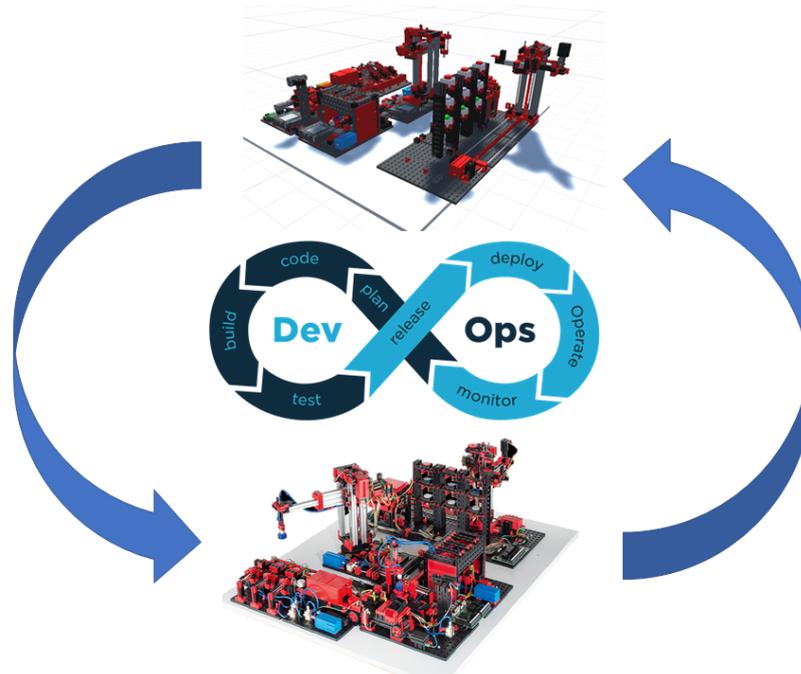
## Master thesis assignments at ICT Group

The Hightech Business Unit consists of about 100 professionals specialised in software solutions for high-tech equipment, such as electron microscope, lithography machine, pick-and-place machines, packaging, etc. We are offering supervised projects to passionate and enthusiastic master students for their final assignment.

### Research and Innovation Platform

Our platform for research and innovation is based on the simulation factory from Fisher Technic. This platform allows us to combine theory and practice. It is our playground. It is an effective way to experiment and show-case our results. As illustrated in the picture below, we are focussing on the broad field of *digital engineering*. We want to understand the relation between digital artefacts and their physical counterparts. We want get grip on how can these digital objects be used in practice to improve the way we create software. The main research questions we are currently addressing are:

- How can Digital Twins be practically used in the software life cycle ?
- How can AI/ML impact the way we develop software ?



Addressing these research questions touch upon many aspects of software engineering, among others, software architecture, security and safety, model driven approaches, CI/CD pipelines, system engineering, ...

### Recently completed master theses at ICT Group

To give an idea about the kind of projects you could execute, here is a list of some recently completed research projects:

- 3D Unity GameObject recognition using geometric characteristics by Faustine Michel and Gael Miramon (Polytech'Grenoble, France): use of machine learning to recognise 3D objects in Unity scenes. (See [LinkedIn](#))

- Checking Equivalence of Digital Twins Using Model-Based Testing by Xuanying Cheng (Eindhoven University of Technology): mathematical definition of equivalence for digital twins and a method to check equivalence using model-based testing. (See [LinkedIn](#))
- Edge AI Learning in a Digital Twin and deploying in the real world by Reinier Joosse (Radboud University): applying machine learning on Unity models to learn collision detection and control, final deployment on a Beckhoff soft PLC. (See [LinkedIn](#))

## Possible topics for 2021

Depending on your interest and skills, we can adapt or create an assignment. Here is a list of possible assignments at ICT Group:

- **Combining Model Based Testing and Digital Twin for Exceptions Handling:** Exceptions are critical for production software. It is in general very difficult to test all possible combinations of exceptions, because of the huge number of possibilities or because of safety reasons. In this project, we would like to explore the use of models to represent exceptional behaviours and use a Digital Twin to develop and test software for handling these exceptions.
- **Digital Software Engineering:** this goal of this project is to explore the required software architecture to enable the use of Digital Twins in software engineering. The work would include defining a software architecture that can be instantiated for controlling our Digital Twin and controlling our Beckhoff soft PLC. Possibly, you will look at Domain Specific Languages and code generation as well as CI/CD and technology like Docker to automate the software engineering process.
- **AI for digital simulation of cyber-physical systems:** creating a realistic Digital Twin of cyber physical systems require us to model continuous phenomenon, for instance, temperature changes or pressure modification. Creating models of these continuous quantities is difficult and time consuming. Machine learning and AI can be used to learn approximations and then simulate these processes without explicitly model them.
- **AI for learning control software:** we would like to explore the possibilities of using machine learning techniques to develop controller for our factory. The objective is to research how to set rewards and cost functions to learn supervisory tasks, for instance.

These are some examples. We are happy to discuss with you about your interests and create a topic that would fit your and our expectations.

Do not hesitate to contact me (see email below) for an informal chat !

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