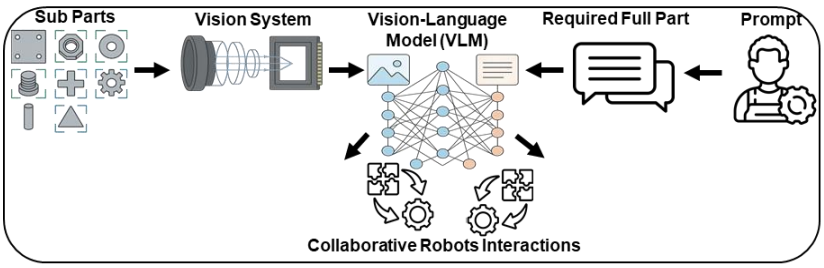
Karlsruhe Institute of Technology

Institute for Automation and Applied Informatics (IAI)

Master Thesis

Embodied AI for Collaborative Robots Interaction in Self-Driving Labs

Self-driving laboratories and flexible manufacturing systems (FMS) are becoming increasingly important in modern smart manufacturing because they enable faster adaptation, higher levels of automation, and continuous process improvement. From a robotics perspective, collaborative robots offer strong potential in such environments, particularly for safe and flexible product assembly. However, a major challenge is that cobots still struggle to adapt quickly to new parts, changing product variants, and uncertain assembly conditions without extensive reprogramming, large annotated datasets, or manual tuning. This challenge becomes even more critical in FMS, where robots must not only detect unfamiliar objects, but also localize them accurately, plan suitable manipulation actions, and coordinate their behavior in real time.



This thesis aims to address these challenges by developing an embodied-AI-enabled collaborative robotic framework that combines vision-language models (VLMs) with few-shot object detection. The proposed method is intended to enable robots to recognize, localize, and manipulate new assembly components using only a limited number of training examples.

This sounds exciting? Then get in touch!

We are happy to answer any questions you might have. If you are interested, please send us an email including your current transcript of records and academic CV.

Advisor:
M.Sc. Mahmoud Salem
Prof. Dr.-Ing. Markus Reischl

Requirements:
- Basic experience with C++ and/or Python programming.
- Experience with or interest in robotics.
- Experience with or interested in machine learning and computer vision.
- Analytical thinking, ability to work independently.

Language:
English

Starting date:
As soon as possible

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