

# Cognitive Products – Open Student Topics

Cognitive products are products that **perceive** their environment, **analyze** it, make well-informed **decisions**, **adapt** to the situation and **learn & evolve** from past experience to fulfill a higher goal. This requires technologies that are dependable but low-cost and low-power, and involves sensing, networking, SW- and HW platforms, as well as infrastructures with industrial-grade robustness and performance. **We explore and research** these **technological building blocks** required for **future products and production systems**, and demonstrate them by **realizing case studies** and prototypes **together with our industry partners**.

## Open Topics (Seminar/Project/Bachelor/Master):

- 1. Autonomous RC-Car with UWB Localization**  
Localize and steer an RC-Car through unknown terrain and obstacles.
- 2. Understanding Safety through Image-to-Text LLM**  
Teach an AI to read figures and schematics and create text-description based on that.
- 3. Radar Camera Fusion**  
Fuse radar and camera sensor data on an RC-Car to improve detection of the environment.
- 4. Object Tracking for Conveyor Belts in Sorting Sites**  
Detect, track, and classify objects on conveyor belts to support sorting and manipulating.
- 5. Tactile Internet and Haptic Feedback for Hand-Gesture Recognition**  
Control a robotic arm and give haptic feedback to the user.
- 6. Exploring the Learning Factory for Automation and Process Optimization**  
Retrofit our learning factory and upgrade the components to do experiments for safety, optimization, and dynamic adaption in factories.
- 7. Acoustic Anomaly Detection for Machine Condition Monitoring**  
Use sensors like microphones and cameras for anomaly detection in drilling and milling machines to predict the condition, health, and lifetime of the tools and the machine.
- 8. Semantic Monitoring and Digital Copilot for Automotive Test drives**  
Develop applications for recognizing the environment using cameras and sensors.
- 9. Cognitive Safety for Dynamic Industrial Environments**  
Develop automatic mechanisms and tools for creating safety concepts in the industry.
- 10. Data Analysis / Processing / Algorithms for Weather and GHG reduction**  
Implement, Upgrade, and Adapt physical particle and gas simulation models to calculate weather predictions and green-house-gas reduction potentials.
- 11. Generating Safety Concepts with Large-Language-Models**  
Apply Large-Language Models to evaluate and generate hazard- and risk analyses (HARA), as well as FMEA and other safety-related documents.



If you have a **creative and growth mindset**, you are a **maker**, a **creator**, or a **builder**, then we happily invite you to join us in **bringing cognition to the world of products and production systems** – let us **make products that think**. If you are interested, simply contact me:



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