



Ferienakademie 2025

# Context-based mixed reality support for production

In this course we will build two prototype for a failure management system. We plan to address two domains: dynamic parking and digital health.

The first project caused puzzle parking adressess the problem of bin packing - how can you arrange parking space in an optimal, similar to valet parking, but in 3D - the parking project consist of several use cases:

describe parking lot: each parking lot consists of moving platforms, which can be rearranged in 3D space to minimize the amount of space taken.

Current developments of AI have already protrudet well into personal lives and are starting to influence the way we work. The goal of this Ferienakademie is to investigate different inovations in the realm of maintainance for industrial inspections.

Visual Twin Generation	Remote Maintenance Planning	Real Time Quality Control	Predictive maintainance
Especially in remote operations of equipment, keeping an eye on the state of the equipment is crucial. One can imagine i.e. a wind turbine or a puzzle-parking environment. The goal of this use case is to generate a visual twin of different environments using a combination of 3D-files (i.e. CAD models used to design the equipment) and images recorded by autonomous remote drones to create a virtual representation of the environment, which allows it to be monitored using VR. Further, changes to the equipment, such as damages or planned changes should be recorded.	Planning maintainance procedures for remote equipment can be challenging when different factors are unknown. In this use case, a process should be designed, in which information from different stakeholders, such as a digital twin, expert engineering knowledge and local stakeholders is combined to create a repair plan for a broken piece of equipment.	When performing repairs, it is common that the 4-eye principle needs to be applied as a quality control measure. The goal of this use case is to replace two of those eyes with AI-powered cameras, that create the needed records and documentation of the repair process. The documentation should further be compared to the repair plan to evaluate the repair	Especially for large, moving machines, different parts wear out in different intervals. The aim of this use case is to combine different data sources, such as machine logs, repair documentation and reports of previous failures to predict future damages and to avoid down-time by applying patches beforehand.

## Remote inspection

Drone creates digital map of the puzzle parking lot using SLAM technology. Due to failures the map needs to constantly updated and compared with a 3D model which then gets updated. Similarly, planned changes to the parking box should be visualized beforehand. For any unplanned changes notifications will be send to the specific users. The people affected by the changes are notified automatically. (for both planned and unplanned changes)

## Remote management and Maintenance planning

In this use case the actor is a manager for several puzzle-parking lots. The parking manager has a 3D digital twin of the real parking lot to get an overview on possible bottlenecks and necessary repairs. The manager needs to manage failures within the system

Visionary scenario: the manager receives a notice about a malfunction in a parking system. A remote Maintenance worker and manager can then inspect the failure of the system using augmented reality remotly to plan the repair. A repair plan is devised, consisting of navigation to the site, a material list and an estimated time to repair, all of which is optimized using previous failures.

(Translate use case to medical issues)

## Tumor conference

We model the repair process similar to a tumor conference known from medicine. The purpose of the tumor conference is to plan a operation involving several stakeholders. Several specialists are required.

The stakeholders for the puzzle parking could be:

- The house inhabitants and their time constrains
- Mantanance workers that have their time constraints
- Mobile platform manager to supervise the process
- Availability of engineering professionals to help in case of unforeseen platforms

## 4 eyed repair inspection

Automized creation of repair protocol which gets incorporated into the inspection map

## Prediction of maintanance

Based on the live data of the environment, we want to predict failures before they happen

## Rearangement of available space in real time

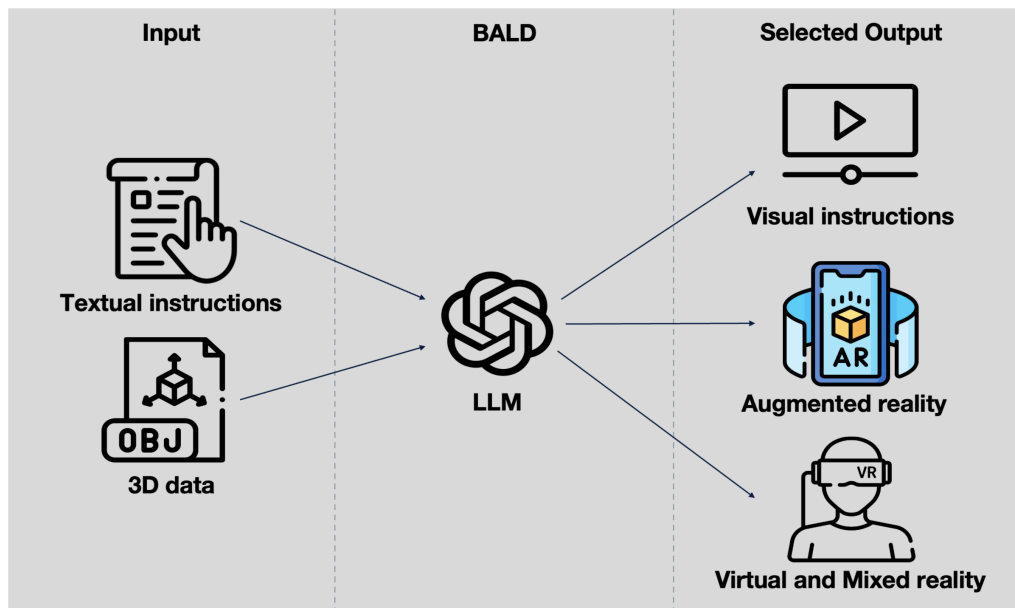
The goal of the Ferienakademie 2025 is to develop a flexible application which visualizes work instructions.

*Input:* Textual instructions, 3D data, construction data, component plan

*Output:* Video, cinematics model for AR & VR applications

The goal is to flexibly generate a visualized output form based on the given inputs and an appropriate GenAI solution to enable industry 5.0 guidance in real world troubleshooting scenarios and manual work in production environments.

## Course description



The solution can be applied in the following areas:

- Manual workplaces for complex tasks
- Maintenance actions during unplanned downtimes
- Work scheduling to enable flexible task switching
- Spontaneous handovers during shift changes
- Remote training

## Customers

TODO: add customers

## Course Team

### Instructors

- **Prof. Dr. Bernd Brügge**  
Technical University of Munich  
Applied Software Engineering
- **Prof. Dr. Jörg Franke**  
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### Guest Lecturers

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## Fertigungsautomatisierung und Produktionssystematik

### Research Associates

- **Leander Pfeiffer, B.Sc.**  
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