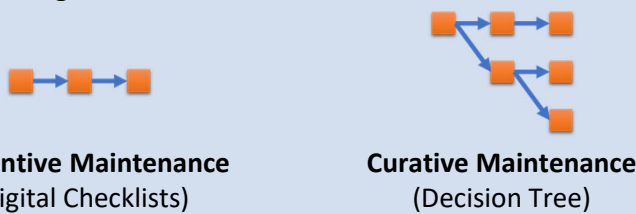


Interactive Augmented Reality-guided Maintenance Operation (IARMO) – Call 4

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1 Abstract

Training employees to troubleshoot, repair and maintain trains is a highly demanding and critical process, which requires profound technical knowledge of the train's systems and how they interact. As **infrastructure equipment and maintenance processes become more sophisticated**, working with paper manuals and data sheets becomes **increasingly challenging**. Augmented Reality (AR) offers novel possibilities for assisting operators during manual tasks by making relevant information accessible in an intuitive manner and by reducing the complexity to manageable increments. In the proposed project we will investigate **preventive maintenance tasks** based on digital checklists and guidance, as well as **curative maintenance** for unforeseen cases of damage that require efficient identification of the problem and the right measures.

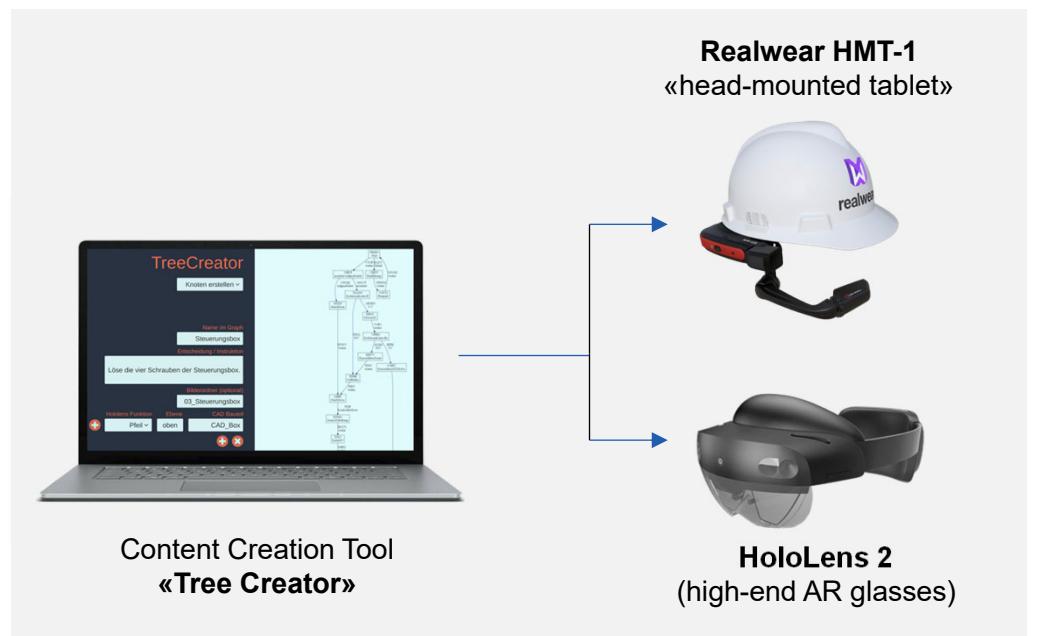


In addition, we will investigate a new generation of **context-aware AR support system** that combines AR instructions with real-time behavior recognition to provide optimal support. **Our proposed system can understand and instinctively react as the operator progresses** through the maintenance process and, for example, display the next step if a step has been completed or display additional information if the user struggles to complete a step.

2 Project Plan (simplified)

Work package	2022				2023			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
WP1 Knowledge Transfer								
Implement and test AR instructions	[Progress bar]							
On-site documentation & annotation tool			[Progress bar]					
WP2 Process Monitoring								
Data Recording & Model Implementation	[Progress bar]							
Publication in progress								
WP3 Context-aware AR support								
Implement and test Adaptive AR guides					[Progress bar]			
Publication in progress								

3 Apparatus



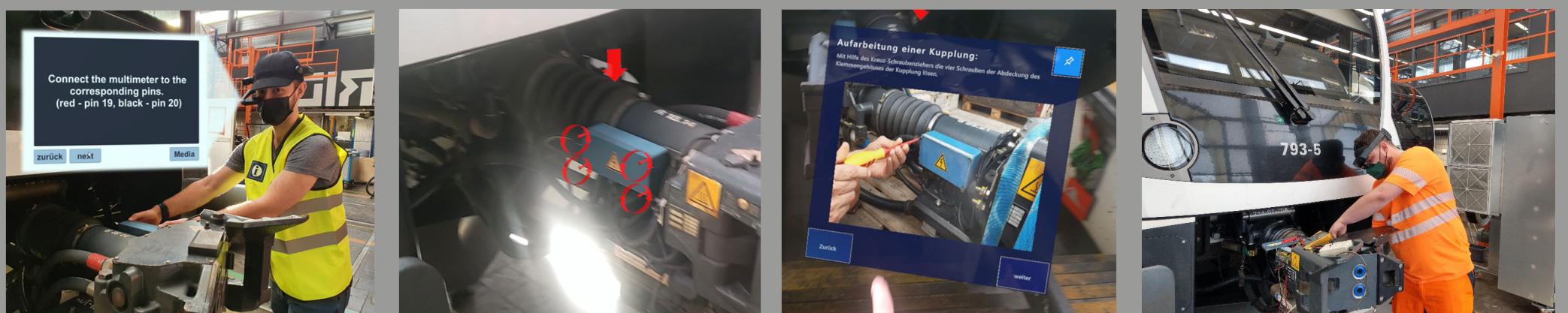
4 Pilot Studies

Study 1: Hardware comparison

- 6 technicians performing preventive clutch checkup
- 1/3 of task with paper documents, Realwear (RW), HoloLens 2 (HL2)
- ✓ HL2 best rated, no increase in cognitive load (NASA TLX)
- ✓ Participants welcome regular work with HL2, but not permanently (as paper documents are also not permanently used)
- ✓ Suggested for training and safety critical tasks

Study 2: Transferring Expert knowledge

- Clutch failure diagnosis for simulated error
- 2 experts using paper documents vs. 6 technicians without clutch qualification using AR instructions
- ✓ 100% success rate
- ✓ Time: experts (10min) vs. novices (15-20min)



*Images recorded at SBB RICO maintenance facility (Oberwinterthur)