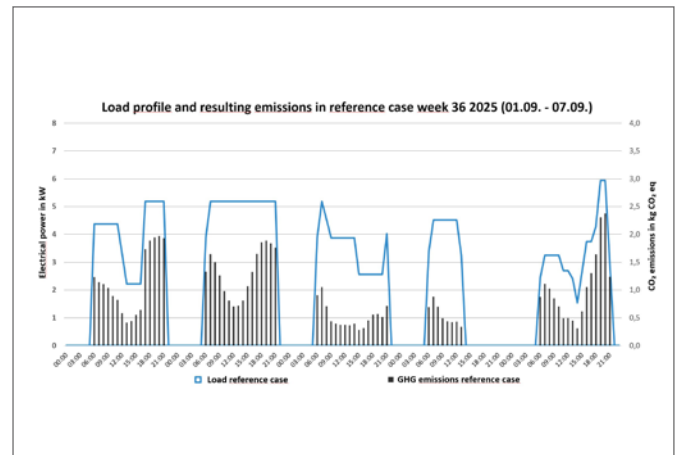
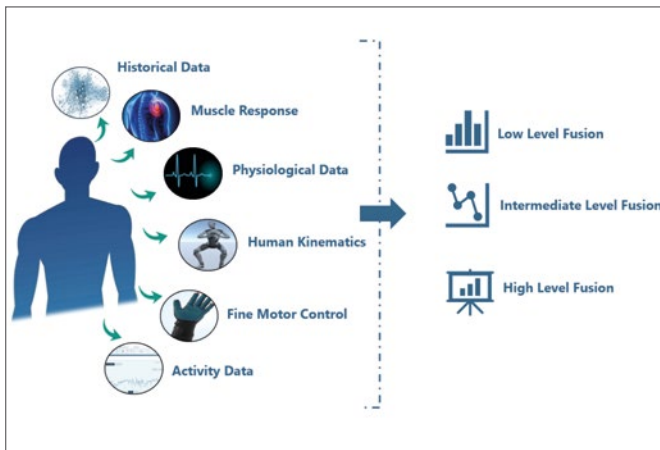


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### Immersive Human Digital Twins for Industry 4.0

Immersive human digital twins integrate physical and cognitive data to create a new paradigm in automation. Through multimodal sensors, biomechanics, and state models, systems are developed that specifically improve safety, ergonomics, and productivity.

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### Digital Twins for Emission Reduction

Digital twins promise lower emissions in production, but there is a lack of robust real-world evidence. A case study of a hydraulic pump test bench shows that CO<sub>2</sub> emissions can be reduced by using rule-based rescheduling to move energy-intensive tests to time slots with lower emissions.

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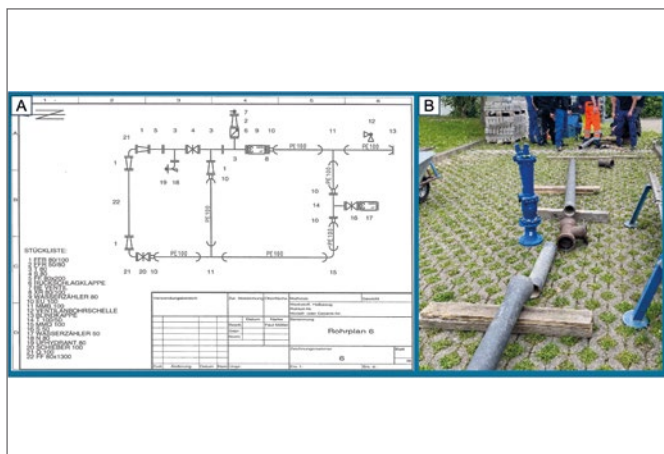
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### Developing Virtual Reality in Learning Contexts

Virtual reality holds great potential for academic and professional training, but its implementation remains complex, costly, and difficult to scale. Case studies on production processes demonstrate how these challenges can be overcome.

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### VR Training for Multimodal Cobot Interaction

The successful use of collaborative robots in assembly depends less on the technology than on the design of the work system. By employing appropriate forms of interaction, decisions regarding task allocation can be justified, evaluated, and applied in practice.

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