ADAPTIVE COBOT INTEGRATION

High-Flexible Workplace Design with Collaborative Robots for Low-Occupational Stress Assembly Operations

Pro²Future

Markus Brillinger[1], Konrad Diwold[1], Amer Kajmakovic[1], Dominik Leder[1], Samuel Manfredi[1], Rudolf Pichler[2]
Pro2Future GmbH[1], TUG-IFT (Institute for Production Engineering)[2]
[1] Pro2Future GmbH, Inffeldgasse 25F, 8010 Graz
[2] Graz University of Technology, Kopernikusgasse 24/I, 8010 Graz

MOTIVATION & GOALS

The goal of the research project "Adaptive Cobot Integration (**ACTION**)" is **to design high-flexible but low occupational stress workspaces** for assembly operations based on the use-case of **riveting operations**. In this context following research questions will be answered:

How can manual work processes be supported by **using cobots** and sensor technology?
How can workplaces be designed **flexible and worker-friendly with low occupational stress**?
What added value do such technologies offer in the context of **occupational safety** and quality improvement?
How must the **safety concept** be designed?

Project FactBox

Project Name ACTION 2
Project ID MFP II 4.2.3-2
Duration 24 Months

Area 4.2 & 4.1
Cognitive Production Systems
Cognitive Products

Project Lead
Dr. Markus Brillinger
Dr. Konrad Diwold

METHOD

Hypothesis: Two **simple KPIs** are related to physical and cognitive load as well as flexibility which can be used in workplace design phase.

$$PLR_i = \frac{WL_i}{HM}$$

$$CLR_i = 1 - \frac{N_{Ai} * n_A + N_{Bi} * n_B}{\sum_{i=1}^{10}(N_{Ai} * n_A + N_{Bi} * n_B)}$$

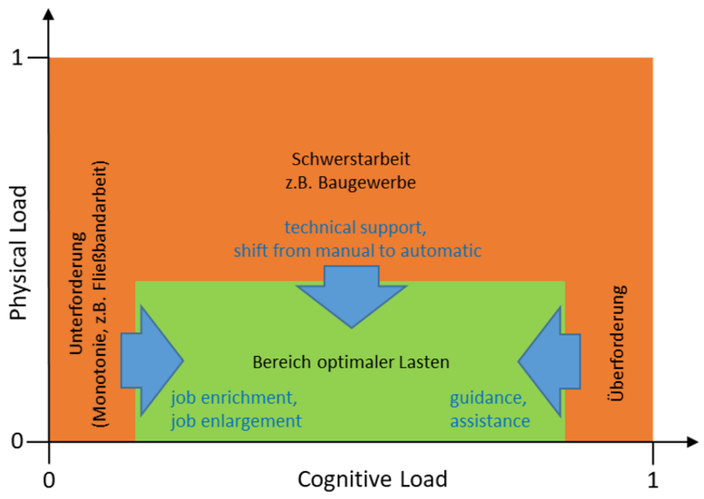

Figure 1: Load Matrix for workspace design.

CONTRIBUTION

Scientific contribution
- New hypothesis about worker-friendly workplace design
- Guidelines for high-flexible lead time calculation
- Influence of human-cobot collaboration on human's stress
- Pulse and heart variability rate as stress indicator

Economic contribution
- Use-case for human-cobot enabled digitalization
- Contribution to low-stress work
- Support to workplace design for sliver society
- Enhancement of existing safety concepts

SYSTEM ARCHITECTURE

To **validate the hypothesis**, a set-up is designed, where a human and a cobot **assemble and rivet parts together**. The human uses **wearable sensors** which detect pulse and heart variability rate. This data are used to analyse human's vital state and **controls cobot's velocity** as well as suggested breaks during work to avoid low performance and part defects.

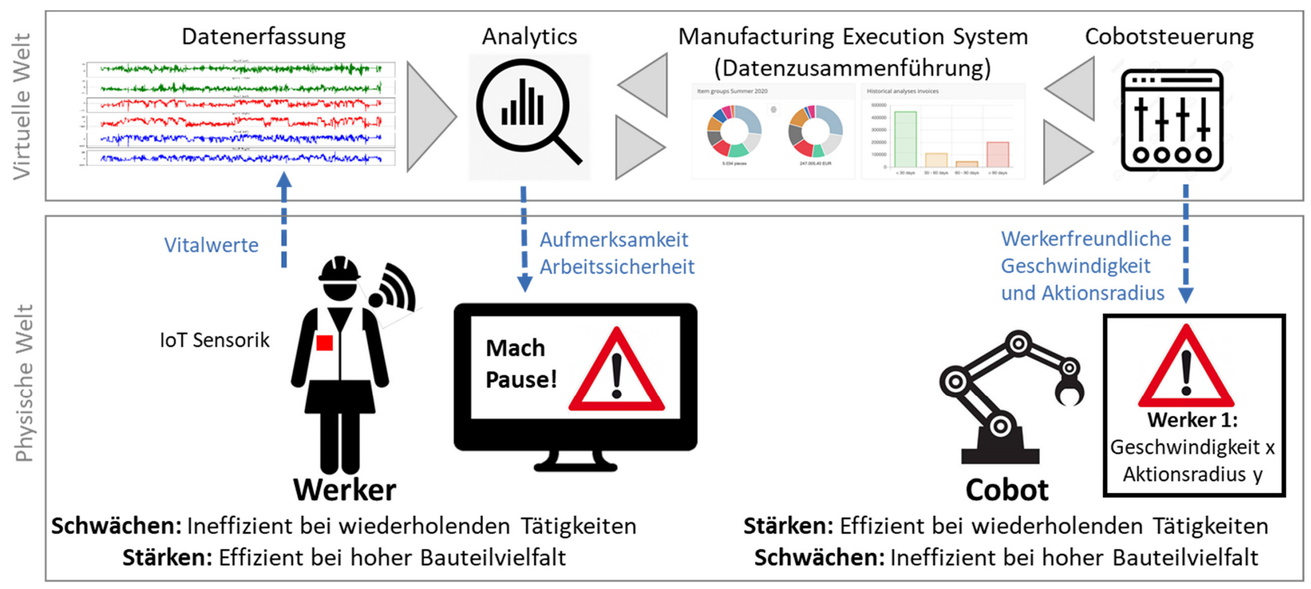

Figure 2: System architecture to elaborate occupational stress in human-cobot interaction.

Contact: DI Dr. Markus Brillinger, Pro2Future GmbH, markus.brillinger@pro2future.at, +43 664 1507593
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