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Integrating simulation modelling for sustainable, human-centred Industry 5.0: ESG-based evaluation in collaborative workplaces

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ABSTRACT

This research explores the role of simulation modelling in the development of human-centred, sustainable manufacturing processes in the context of Industry 5.0. We analyse collaborative workplaces where humans and collaborative robots (CR) work together, emphasizing the environmental, social, and governance (ESG) criteria. The research work focuses on how personalized CR parameters and optimized work environments contribute to improved productivity, well-being, and sustainability. Through simulations, the paper evaluates the operational efficiency of both manual assembly and human-robot collaborative (HRC) setups, providing insight into the economic, environmental, and social impacts of Industry 5.0 manufacturing systems. The results show significant improvements in sustainability, productivity, and worker well-being achieved through adaptive CR integration and ESG-driven engineering practices.

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