D4.1 SMARTHANDLE reconfigurability enablers – First prototypes

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Name of the Deliverable	SMARTHANDLE reconfigurability enablers – First prototypes
Number of the Deliverable	D4.1
Related WP Number and Name	WP4: Planning and monitoring of handling operations for reconfigurable manufacturing systems
Related Task Number and Name	T4.1: Part handling sequence generator based on CAD models T4.2: Feature and capability-based AI process planning T4.3: Production line digital twin modelling and simulation environment setup T4.4: Production line controller for task execution and monitoring
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Keywords

artificial intelligence, interconnectivity, software architecture, robotic planning, smart robotic grasping, multi-level reconfiguration, systems optimization

Abstract

This document details the technological advancements achieved in Work Package 4 (WP4) of the SMARTHANDLE project (within the first reporting period), which focuses on designing and developing tools for offline planning and real-time orchestration of handling operations. WP4 aims on deploying a comprehensive suite of solutions including part handling sequence generators using data driven techniques from CAD models, AI-driven process planning, a digital twin for simulation, and real-time digital scene reconstruction, and a robust production line controller for process orchestration and reconfiguration. These developments intend on enhancing the flexibility and efficiency of manufacturing operations, providing scalable solutions for complex industrial environments with application paradigms within the project's three use cases.

Executive summary

The primary goal of WP4 is to enhance the efficiency and adaptability of production lines through advanced planning and orchestration tools. These enabling technologies result from the activities of 'Task 4.1: Part handling sequence generator based on CAD models,' 'Task 4.2: Feature and capability-based AI process planning,' 'Task 4.3: Production line digital twin modeling and simulation environment setup,' and 'Task 4.4: Production line controller for task execution and monitoring.' This report outlines the main activities of the partners under these tasks and continues by showcasing each enabling technology. The developed prototypes are described in detail within dedicated sections, where the state of the art, industrial challenges, methodologies, and implemented prototypes for the SMARTHANDLE use cases are presented. The report concludes with useful insights from the overall WP activities and future directions towards the delivery of the next prototypes.