

**CDP / DP 2/ JUC 2
 Austrian Center for Digital
 Production / Demonstrator
 Project 2 / Adaptive Loading
 Station**

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 Programme (CRP), 4 Years, MFP DP2

In cooperation with the K1 Centre
 “Pro²Future”



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ADAPTIVE LOADING STATION

FULLY AUTOMATED LOADING OF PARTS BY COMBINING
 INTERDISCIPLINARY RESEARCH RESULTS TO A SHOW CASE FOR A
 BROAD AUDIENCE WITH INDUSTRY RELEVANCE



The *Common Research Program (CRP)* of the *Austrian Center for Digital Production (CDP)* and *Pro²Future (P2F)* is a joint research program conducted by the two Austrian competence centers, funded by the FFG, dedicated to topics in the broad perspective of Industrie 4.0. Within the CRP several demo cases, that act as technological building blocks, are developed. One of those is the “*Adaptive Loading Station*”, an interdisciplinary showcase carried out by the participating scientific and company partners.

The Loading Station (Figure 1) tackles one of the most significant bottlenecks when it comes to fully automated night shifts in production companies. Typically, the loading process is done by shop floor employees, that have process and manufacturing knowledge about how to load raw parts the correct way. The presented “*Adaptive Loadings Station*”

presents a fully automatic solution for placing raw parts for turning machines on pallets. The station consists of an UR10 of the e-Series and a pair of cameras, one for 3D and one for 2D visual recognition. Additionally, an Autonomous Guided Vehicle (AGV) by Neobotix is used to automatically transport the loaded pallet to the tooling center.

A worker can simply prepare the needed raw parts and corresponding trays to the robot loading area. Thanks to visual recognition the parts and trays can be placed anywhere within the designated area. The trays function as mini pallets with form closure. The robot is hovering above the parts and the cameras check for the correct tray and raw parts. Once the parts for the next manufacturing order are identified, the robot checks for the AGV and detects its exact position with the cameras. As soon as the position is

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determined, and a correction matrix calculated (the AGVs have a high position tolerance), the loading starts. First the trays for the order get loaded onto the pallet. Next the raw parts are placed on the trays on top of the pallet, carried by the AGV. The whole visual recognition is handled by the “XRob” software developed by the scientific partner *Profactor*.

Once the loading process is completed the AGV is sent to the next manufacturing process according to the workplan. Later in the shift the machined parts return on their specific trays on the AGV and the robot starts with unloading, basically inverting the loading steps, freeing the trays, and loading new parts for the next manufacturing round. The orchestration of the whole process is done by “Centurio” a BPMN (Business Process Model and Notation) based process engine, developed by the CDP and scientific partners. “Centurio” connects to MES or ERP and the field level services and executes the work steps. “Centurio” can load any CAD-model of a raw part into the “XRob” software for increased adaptability.

Impact and effects

The “Adaptive Loading Station” greatly reduces the amount of part carriers (pallets) needed during ghost shifts, as the trays and pallets can easily be reused because the parts are loaded and unloaded

automatically. Especially for a High-Mix production system the combination of varying and specialised trays as carriers of the parts on a pallet works very well. In this case the trays are produced by FDM 3D Printers.

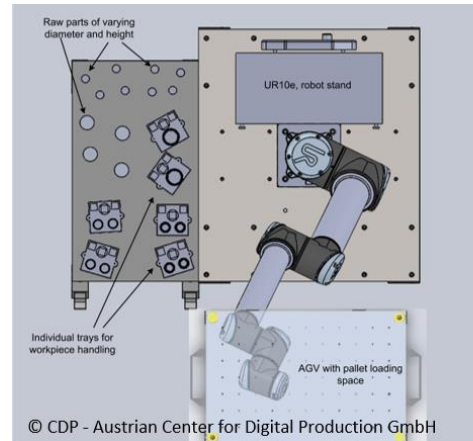


Figure 1: Adaptive Loading Station description

The *Adaptive Loading Station* was presented during the year 2019 and will continue to be a show case within the TU Wien Pilotfabrik Industrie 4.0 in Vienna in the future. It is fully integrated into the Pilotfabrik’s manufacturing network and is thereby presented to the numerous interested people that visit the Pilotfabrik each year.

Project coordination (Story)

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- Hoerbiger, AT
- Plasmo, AT

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