

**Pro2Future  
Products and Production  
Systems of the Future**

Programme: COMET – Competence Centers for Excellent Technologies

Programme line: COMET-Centre K1

Type of project: Adaptive Smart Production, MFP 4.2.2, 2 years, single-firm



## COGNITIVE ELEMENTS AS ENABLERS FOR FLEXIBLE AND ADAPTIVE PRODUCTION SYSTEMS

COGNITIVE ELEMENTS SUPPORT THE FLEXIBILITY OF ASSEMBLY WORKERS AND ASSURE HIGH FLEXIBILITY WITH BEST PRODUCT QUALITY

In many cases, products manufactured in low-wage countries cannot compete with those from Europe in terms of price. However, --to counterbalance with the increased production costs in Europe to the customer, additional benefits must be generated for the customer, such as: high quality, shorter delivery times, etc. Flexible production systems can be one such approach to reduce the production costs. They make it possible to manufacture different types of products with the same production equipment at relatively low costs.

In this project, a novel, highly flexible assembly system was developed for various electric drive systems to manufacture them inexpensively and with high precision. The strengths of man and machine

have been optimally combined. While the assembly worker can act instantly with smartness and flexibility as the changes in product occur, machines such as robots on the other hand, are very well suited for repetitive tasks. In this project, the best of these two sides were combined so that the varying activities can be implemented quickly by the worker on the operating robot.

Equipping the assembly line with cognitive features allows the inexperienced workers to be quickly trained. This is achieved by analysing the assembly activities that are and will be performed by workers in the vicinity (assembly stations) and, if required, support them with informative and assistive systems.

## SUCCESS STORY

These informative and assistive systems are for example pick-to-light, pick-to-voice, screens, etc.

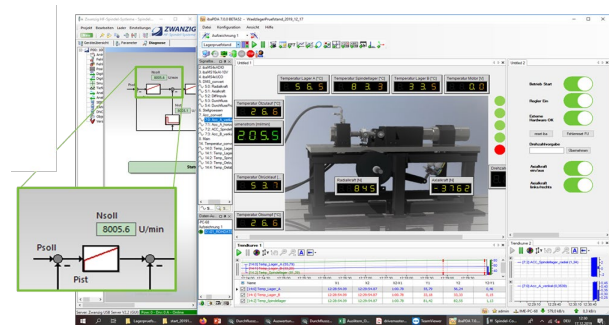
To quickly and reliably identify the quality-reducing factors in an assembly process for small batch size, an end-of-line (EOL) test bench is installed in the assembly line to test the fully assembled products. The product characteristics of the electric drive system (e.g. temperature development, life cycle, etc., at high speeds) extracted from the EOL test bench are linked to the assembly parameters (e.g. bearing pre-load due to manufacturing inaccuracies) by means of statistical methods ("machine learning"). Based on these correlations, product characteristics can be predicted with a high degree of accuracy at an early stage through the detailed recording of assembly parameters.

In addition, possible quality changes in the assembly of electric drive systems can be observed more quickly. Hence, flexible in-line correlations can be created, and the necessary reaction is initiated.

### Impact and effects

Firstly, the novel, test bench-coupled assembly system approach has a positive influence on the

product quality and costs of electric drive systems. This is also due to the man/machine collaboration and the increased flexibility associated with it, which contributes to economically sustainable production in Europe. Secondly, the error rate in the activities carried out by the worker is significantly reduced by the informative and assistive systems. This has also been validated with the help of an FMEA which was carried out by the experts.



Pro2Future: Innovative testbed extracting critical assembly parameters for increasing product quality.

### Project coordination (Story)

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