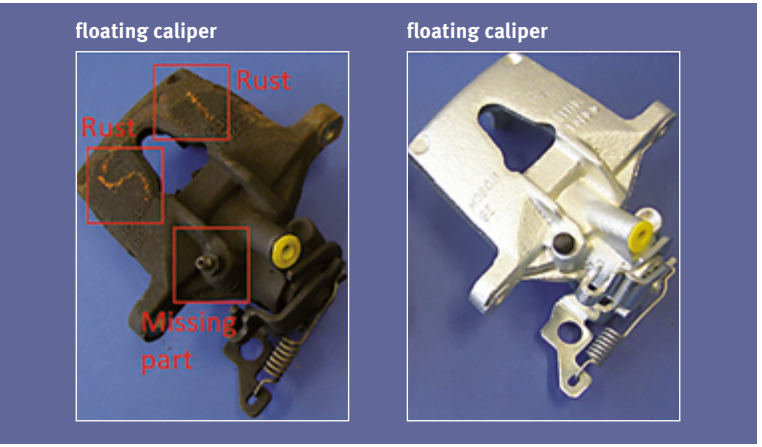
ReziProK
Resource-efficient Circular Economy – Innovative Product Cycles

EIBA

Sensory acquisition, automated identification and evaluation of used parts on the basis of product data as well as information about previous deliveries



Resource-efficient Circular Economy – Innovative Product Cycles (ReziProK)

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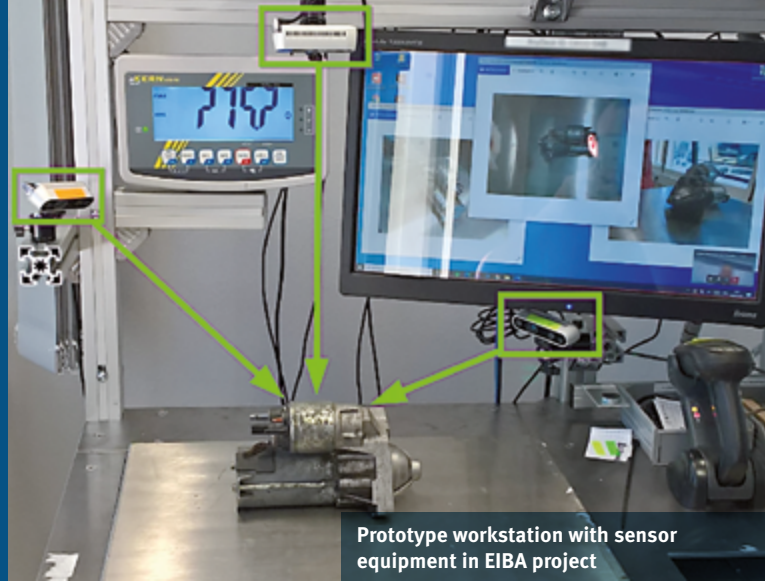
The transition to a circular economy and the reuse of products requires an efficient collection and identification of used products. What do they consist of? What is usable? Every product is unique due to its history. Nevertheless, it is often similar to its successors. To facilitate the process, an artificial intelligence (AI) supports the identification of the product in the "EIBA" project.


Prototype workstation with sensor equipment in EIBA project

Teamwork with artificial intelligence

At the end of a product's use phase, there are various disposal or processing strategies. Products can be recycled or processed and reused, depending on their type and condition. For this purpose, they must be clearly identified and evaluated. The challenge is that many product models differ only slightly from one another and are difficult to identify due to contamination and wear. In addition, the professional personnel has only a few seconds to identify and evaluate them.

In order to support people in their work, the "EIBA" project consortium wants to develop a system to assist them in identifying and evaluating the products. Sensor-based data is evaluated with the help of artificial intelligence in combination with other information and formulated into a decision recommendation. Thanks to the dual control principle of man and machine, both the error rate during identification and the strain on people are to be reduced.

Self-learning technology

The aim of the "EIBA" project is to develop a system for the identification and condition assessment of used parts. This will make an important contribution to closing the cycle through digital technologies. By using methods of artificial intelligence – such as machine learning as well as deep learning – the system should be able to identify products and compare them with other available information. By continuously expanding the data, it should also be able to adapt to new products and requirements.

One innovation of the project is to complementary combine the competences of man and machine to enable higher process security and efficiency. The resulting system will be analysed according to sustainability aspects: What has changed for the worker? What additional environmental burdens are initially caused by the use of machines, and how great are the environmental benefits gained through increased efficiency?

First results

The development of the system is based on the example of used car parts (cores). In order to include also challenges and requirements of other products in the development-process, extensive interviews with companies of other industries such as textiles, printer cartridges or semiconductors were conducted. Another important focus in the project is machine vision in which some very promising first results were achieved. Based on image data of approx. 1400 different used parts the AI was able to identify 85% correctly in performance tests. By using a hierarchy of specialized neural networks, the recognition rate could even be improved to more than 90%. As these performance tests have been conducted in controlled conditions, a validation facing the challenges in real industrial environment is pending. For that purpose, all workstations in one C-ECO location have been equipped with cameras and digital scales which have been connected to the identification-software.

Humans and artificial intelligence complement each other in the project "EIBA".

With this setting, data availability will be enhanced to generate further training data to improve the AI's capabilities and to adapt better to „real life" conditions. An additional challenge is the efficient integration of the sensors and AI in the working process. For that the current process has been analyzed in detail to create a concept for the adaption. Here the focus is on the presentation of the AI results in the human-machine-interface and on restructuring process steps using the new available data.

Interdisciplinary teamwork

The challenges in the "EIBA" project are a result of the complex combination of the latest information technology, application-oriented process know-how and knowledge of market requirements for an efficient circular economy which can be globally scaled. To address that, engineers from different disciplines work together to look at the challenges from different perspectives and make the best possible use of the potentials.

Funding measure
Resource-efficient Circular Economy – Innovative Product Cycles (ReziProK)

As part of the FONA Field of action 6:
The circular economy – efficient use of raw materials, avoiding waste.

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EIBA – Sensory acquisition, automated identification and evaluation of old parts on the basis of product data as well as information about previous deliveries

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Cover-Picture: "Turn old into new": old part and refurbished part, ready for a second life in the vehicle.

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"ReziProK" is part of the research concept "Resource-efficient Circular Economy"" of the Federal Ministry of Education and Research (BMBF) as part of the FONA Field of action 6: "The circular economy – efficient use of raw materials, avoiding waste" and supports projects that develop business models, design concepts or digital technologies for closed product cycles.

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