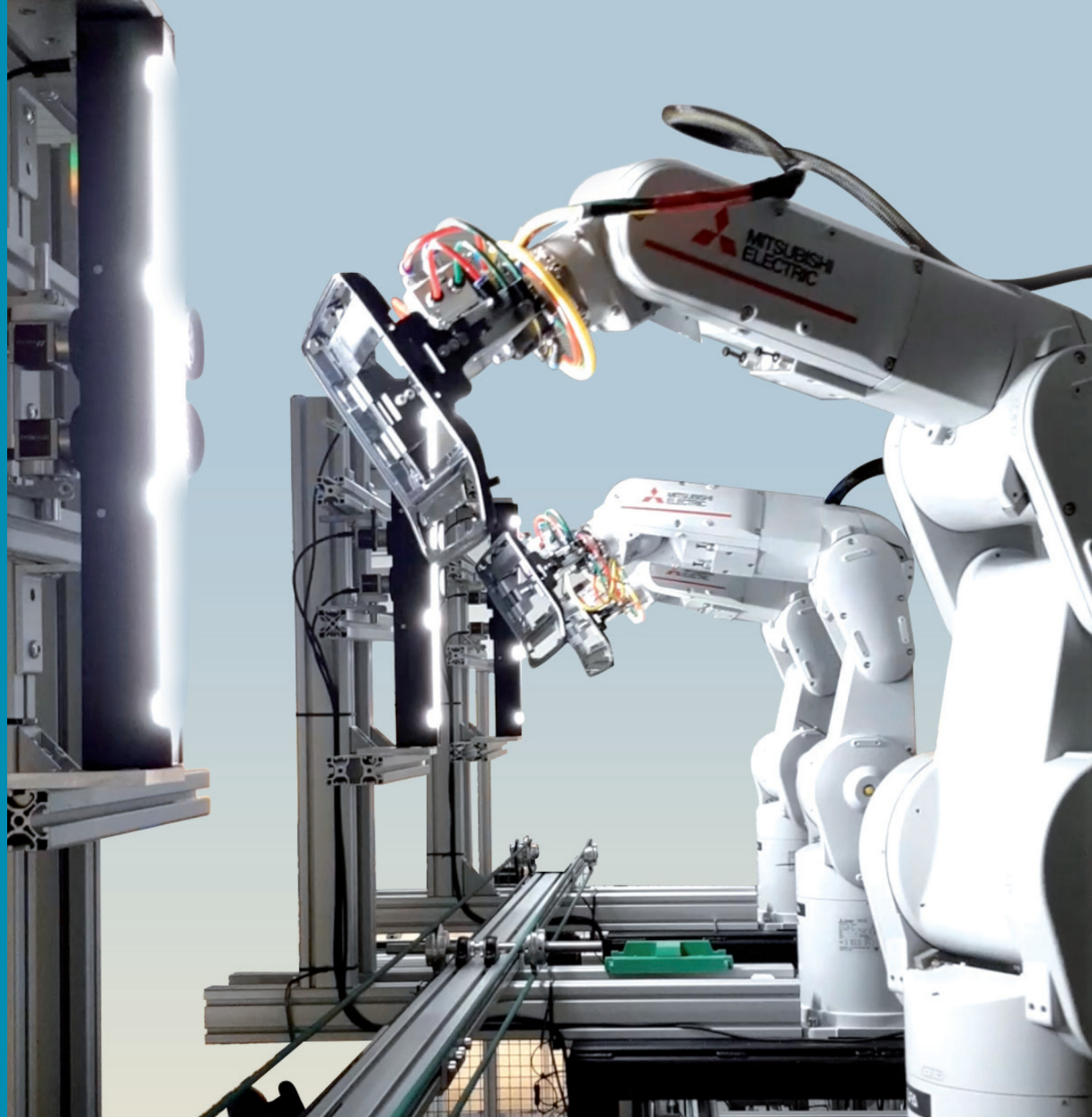


AI aided inspection of a free-form high-gloss polymer part

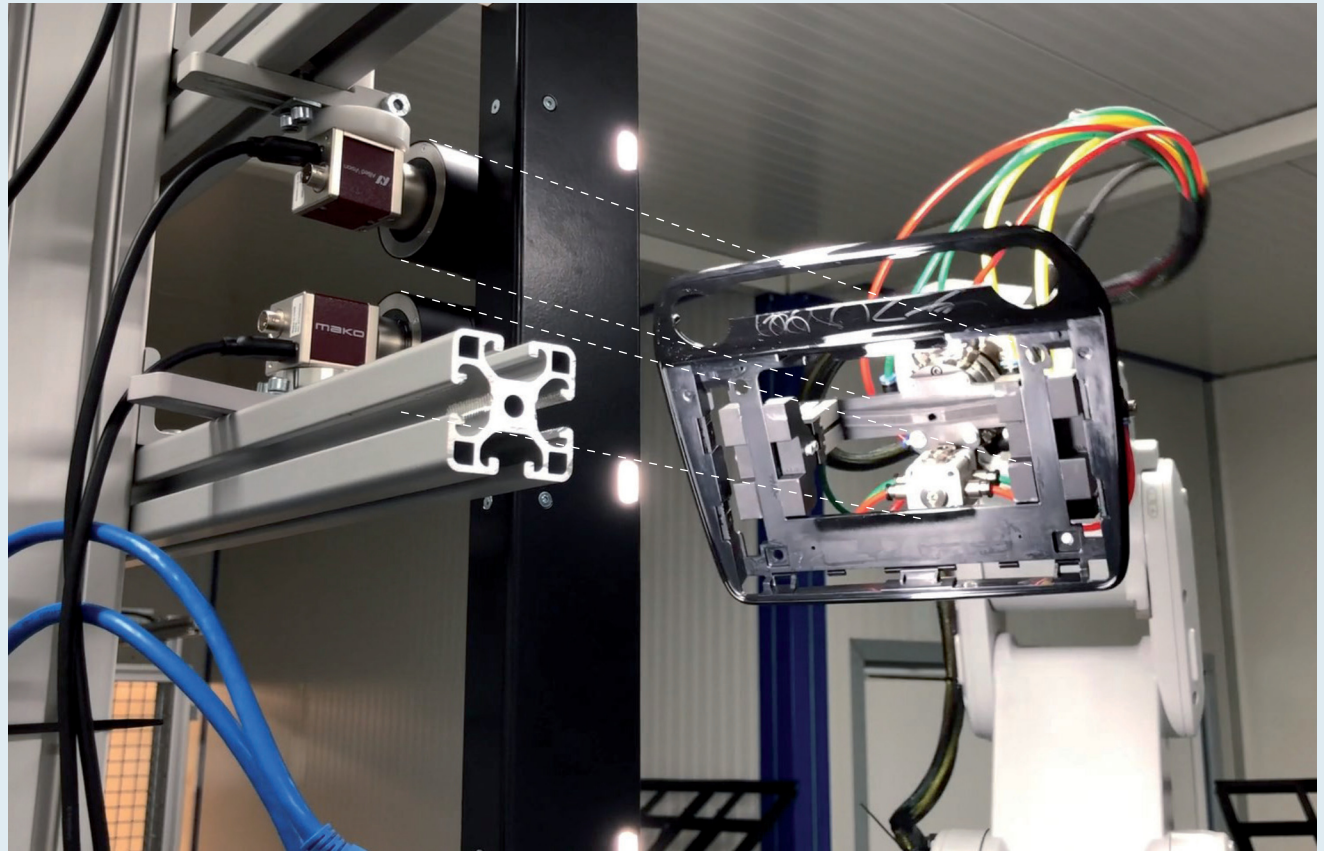
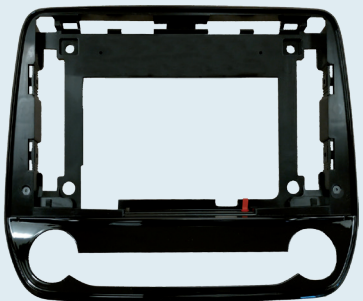
COMET Competence Centers for Excellent Technologies



The aim of the project

The objective of the project was a new defect inspection system that enables an **inspection of the entire component surface** within the production cycle time.

It was necessary to carry out a full surface inspection **within 10 seconds**.

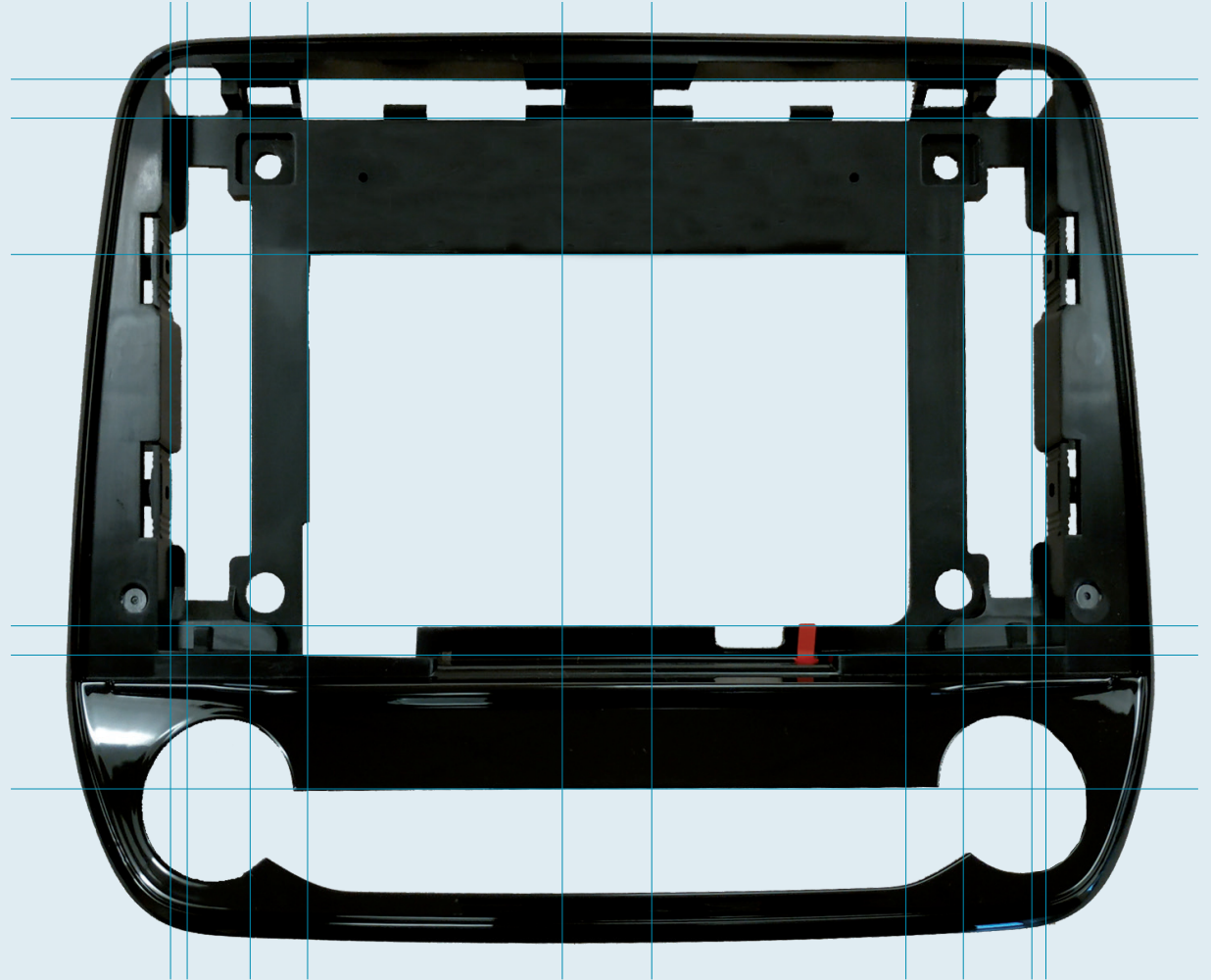
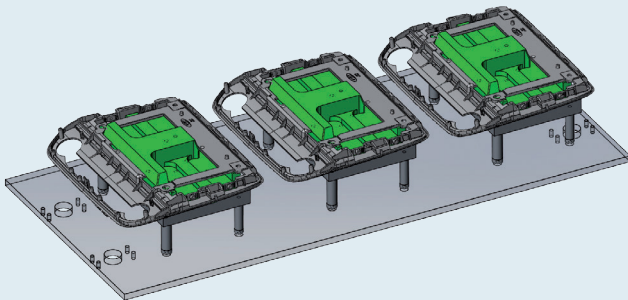


📷 Experimental PCCL inspection robot in cooperation with Flextronics International kft at the site in Sarvar (Hungary)

Attributes of the inspected part

The part has a complex shape and a **free-form surface**.

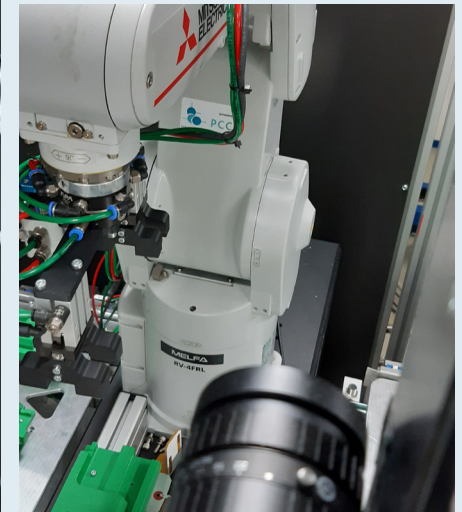
It is **high-gloss** and **painted black**, which makes its automatic inspection unique and challenging.



The inspection system

The automated optical inspection system demonstrator consists of **three cells**, each equipped with a **deep learning pipeline** developed by PCCL, used to detect and classify the surface defects.

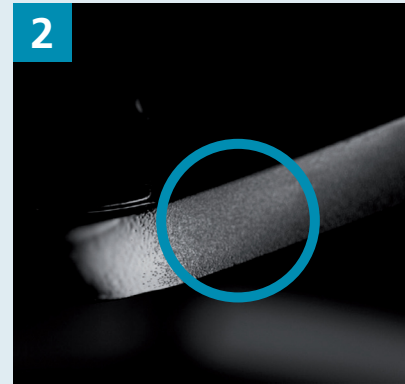
The system uses **industrial robots** for picking and handling the parts during the inspection.



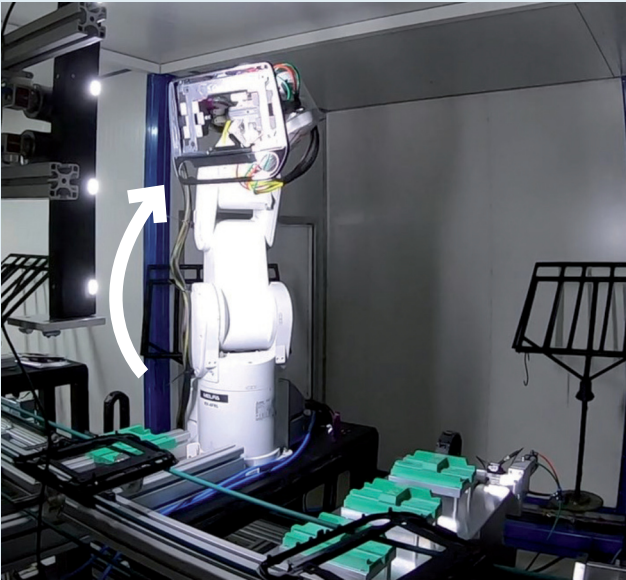
Detectable defect types

Currently, the 3D-shaped components are tested for 6 different defects (can be extended).

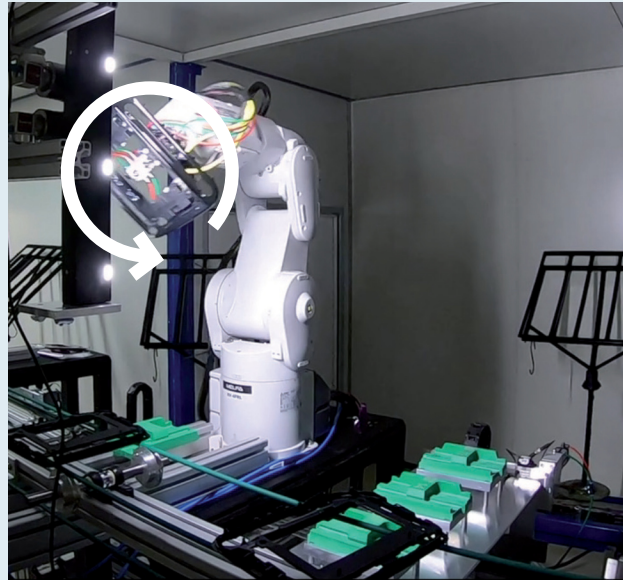
- 1 Craters
- 2 Foggy areas
- 3 Orange skin effects
- 4 Paint dots
- 5 Paint flows
- 6 Scratches



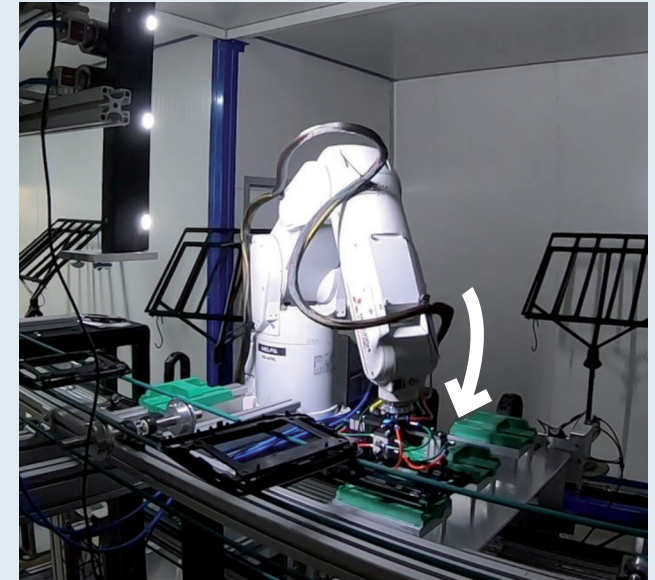
The procedure



1 The robots grab the parts from the trays.



2 The robots perform the full surface inspection in 10 seconds.



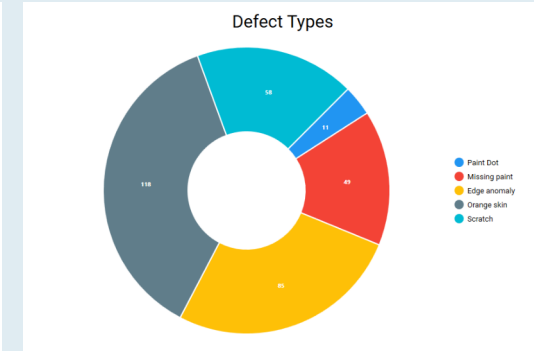
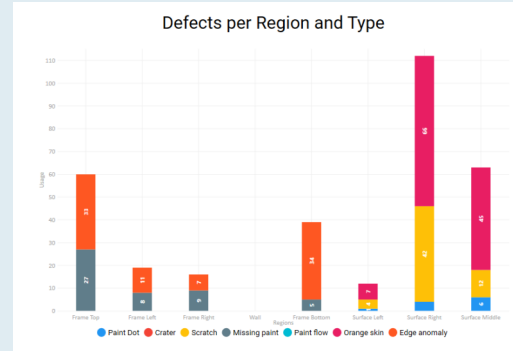
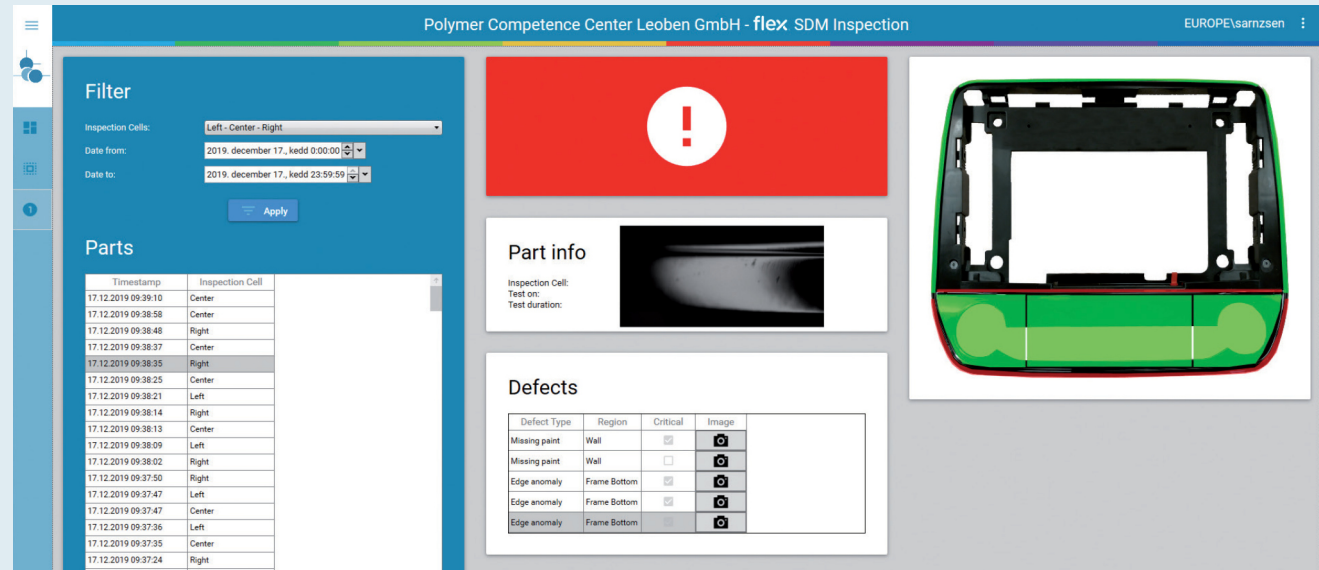
3 The parts are put back (OK part), or are sent to scrap (NOK).

The GUI

The graphical user interface (GUI) of the inspection system is **comprehensive and user friendly**.

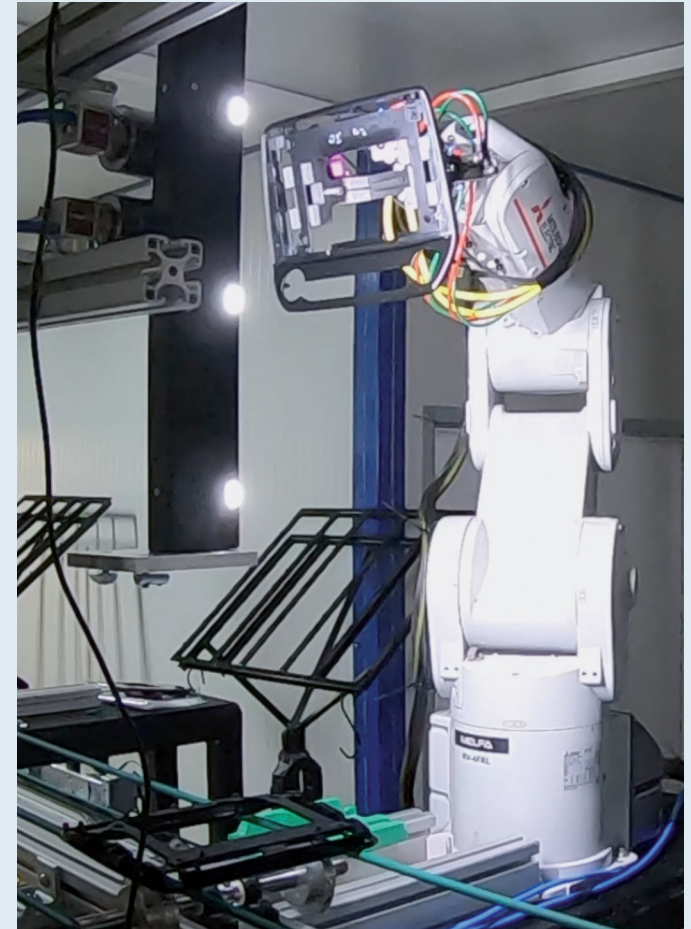
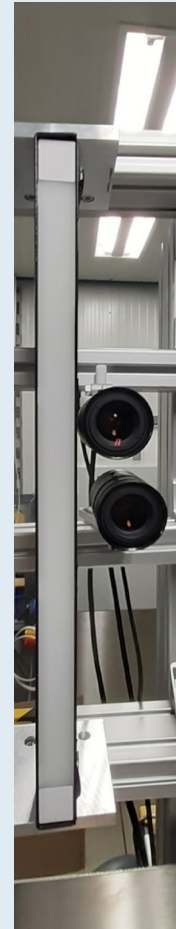
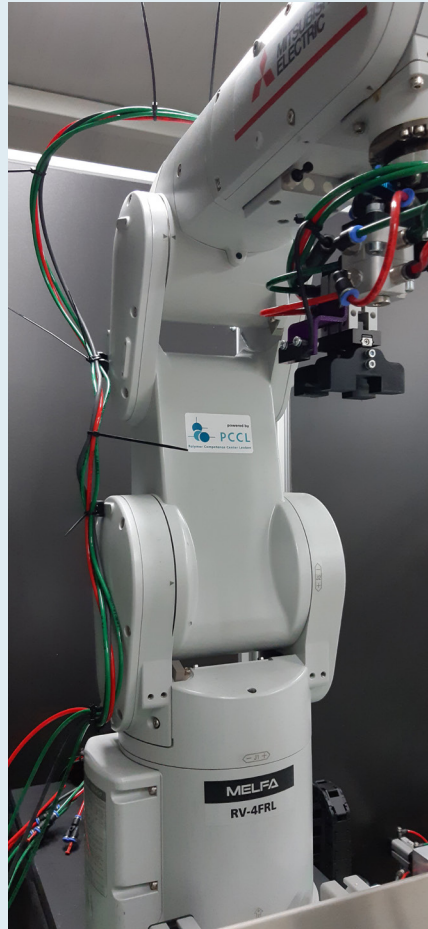
After inspection of each part, **images** of the detected defects can be viewed on the GUI.

Statistics provided by the system (e.g. region of the defect, robot number, criticality of the defect) can point out **recent problems** on the production line.



System advantages

- 1 Full inspection **within the cycle time** of the production of the part is possible (~10 seconds).
- 2 The system **can be integrated into the production line**.
- 3 Inspection is fast, robust and reliable. Its performance is **more accurate than that of human inspectors**.
- 4 **The system is flexible**, new defect types can also be added for detection and classification.
- 5 **The system can be extended** to inspect other similar parts.

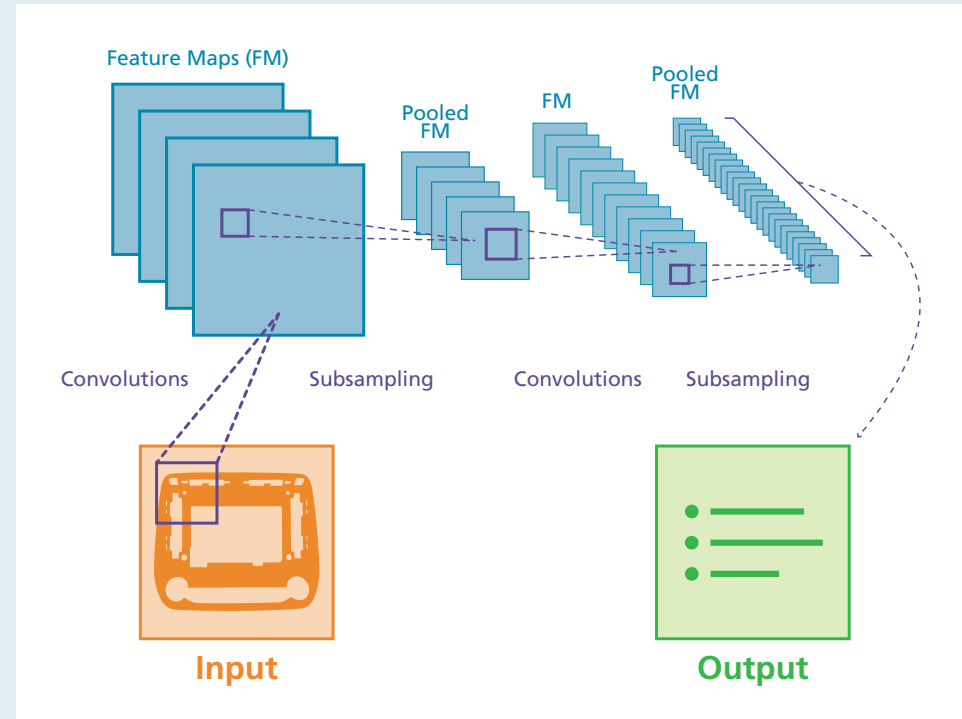


Speed and adaptability

Image acquisition and image analysis are fully **parallelized**.

This allows the system to detect all defects **within the cycle time** of the production line.

The inspection software uses **multiple independent neural networks** responsible for different regions and defect types. When characteristics of a defect change, a single neural network can be **re-trained** without affecting the performance of the rest of the system.



Basic functionality of a convolutional neural network

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Innovation Award 2013



Partners



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