Results in Brief

AI delivers smart skills and zero-defect manufacturing

Researchers in the EU have demonstrated that zero-defect manufacturing architecture incorporating artificial intelligence can bring real benefits across a range of different sectors. Feedback from the industrial partners involved has been very positive, and two patent applications for smart inspection tools have been filed.
AI in industrial processes

Multi-stage manufacturing is the most common modern production system structure. This involves numerous processes that are run in series, sometimes in parallel, to perform a sequence of operations necessary to produce or assemble a product. This is typical of many sectors, from automotive to appliance manufacturing and from
The overall quality of any final product depends on the performance of each of these individual processes. Moreover, the performance of downstream processes can be affected by deviations upstream. Modern manufacturing plants therefore need to be understood not just in terms of individual processes, but also in terms of how these processes relate to each other.

“The good news is that modern digitalised factories create a huge amount of real-time data,” says Cristalli. “We can observe process correlations and build up data models to implement innovative control strategies based on artificial intelligence, to prevent defects and maintain overall system performance. However, even if these concepts are being widely discussed at the academic level, there is still a lack of evidence that such an approach can be effectively implemented.”

The aim of the EU-funded GO0D MAN project was therefore to move this academic discussion into industrial applications. “From the beginning, we were very clear about end user requirements,” adds Cristalli. “We invested a lot of effort and time in developing technologies that are ready to be generalised and easy to be deployed in the manufacturing environment.”

**Smart tools for skilled manufacturing**

Another key aspect was the integration of different developed technologies, to deliver the GO0D MAN architecture and methodology as a new approach to quality control. Real-time data collection and defect diagnosis were carried out at every single process level, as well as between processes to gain a better picture of inter-stage correlations. This was achieved through combining process and quality control in a distributed system architecture thanks to Multi-Agent Systems (MAS), which allows for distributing intelligence and data analysis algorithms by a network of distributed intelligent nodes.

Several smart inspection tools were also developed during the 3-year project. “Two have led to two patent applications by the Università Politecnica delle Marche,” notes Cristalli. One relates to a smartphone-based portable laser scanner to support operators during the assembly of car bodies. This enhances their measuring capacity and fully integrates them into the production line.

“This realises the concept of the man-in-the-loop, which is important to prevent automation negatively impacting on the workforce,” explains Cristalli. The second innovation is about a telecentric vision system for burr detection in turned metal parts. Both systems have met the requirements for industrial implementation.
GOOD MAN, AI, manufacturing, zero-defect, MAS, automotive, automation, quality control

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