Dynamic laser projection optimizes processes in the finishing booth

The automobile industry is increasingly relying on highly automated production processes. However, many manual tasks will remain in parallel, especially in quality assurance. A laser projection method already being used in the finishing booth of one automobile manufacturer improves precisely those activities – with numerous benefits.

Manufacturers have to bring innovations to market ever more rapidly today and need to produce a wide variety of individual products. These abilities, which require highly adaptive processes, set manufacturers apart from the competition. Networked production is therefore indispensable in the automobile industry. The desired customization of vehicle models cannot be achieved without it.

Yet there are still tasks in assembly and quality assurance that require positioning or inspection templates, or in rework where manual intervention by the employees is unavoidable. But this approach is laborious, expensive, and complicated.

Today, dynamic laser projection supports digital templates and other visualizations to optimize manual process steps and link to industry 4.0 applications. A look into the finishing booth in a Bavarian automaker's paint shop reveals the extent to which this method has already been perfected.

Read data, align to camera image, and project

The paint shop PC runs the Werklicht 3D software from Extend3D, which reads the digital 3D plan and position data. For model-based tracking, the software continually compares the geometry to an image of the car body, generated by the cameras on the five projectors.

An interface connects to the image recognition system that analyzes the painted body with AI support in an upstream process step.

Sensors and cameras deliver the data for the algorithm to identify the locations where the coating has to be reworked or fails to meet the high quality standards.

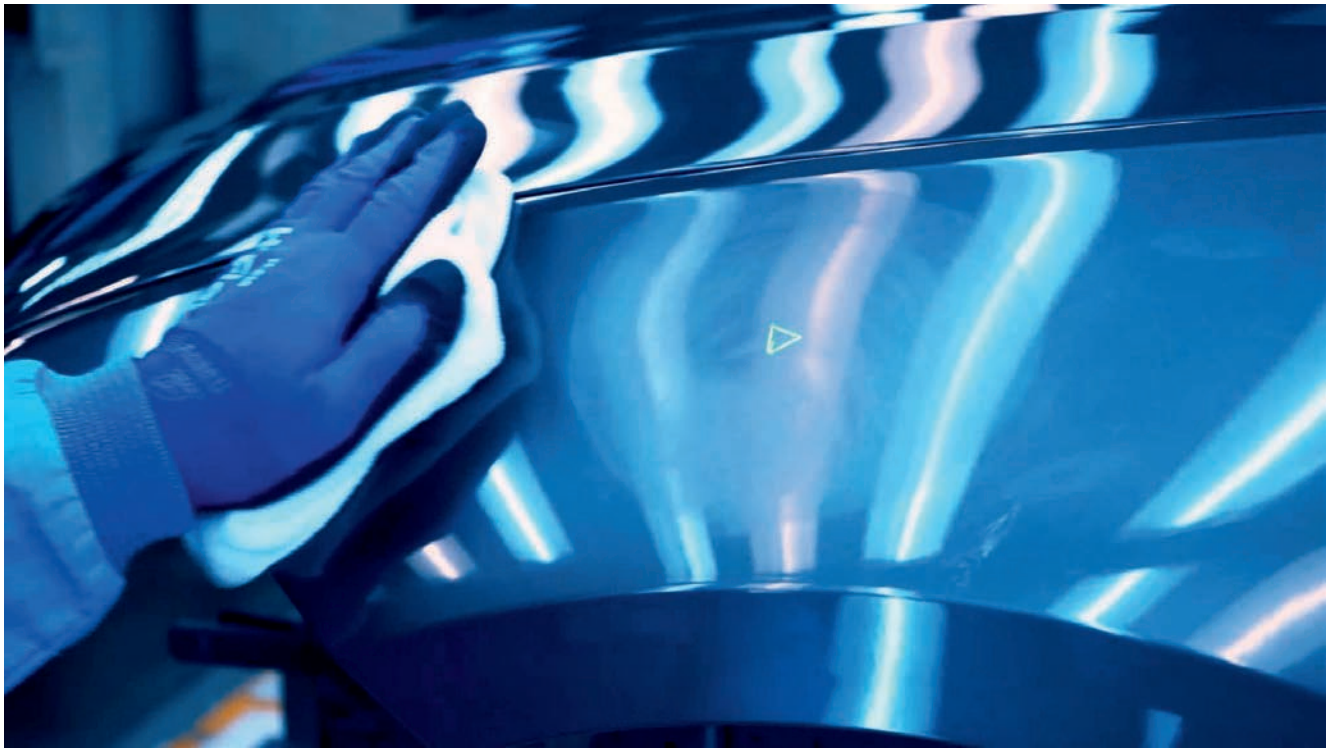

Figure 1. The laser projection shows the worker exactly where polishing is needed © Extend3D

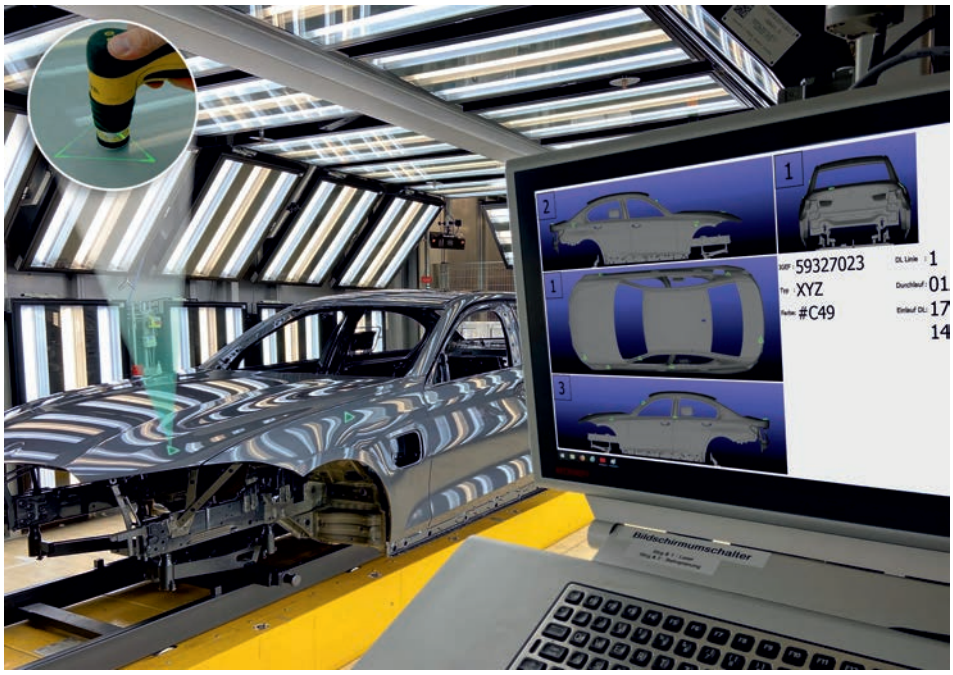

Figure 2. A butterfly view of the car body improves the overview. © Extend3D

This may be caused, for example, by an embedded dust particle. The image recognition system transmits the exact position and attributes to the projection technology's 3D software.

A conveying system then moves the body to a starting position in the finishing booth, which only needs to be reproducible to an accuracy of several centimeters. Model-based tracking is engaged under these conditions and the projection automatically appears on the car body.

The five lasers respectively mark the rework areas on the part of the body they cover. They also project information about the required process steps directly onto the component. The engaged projections dynamically follow movements of the car body. Aside from the projections on the car body, the software visualizes a butterfly view on two screens for a clear overview, with a top view, left and right side view, and rear view.

Production workers set the height of the rework areas to the position that is most ergonomic for them. The projections show them directly where sanding or polishing is required, eliminating the time-consuming localization of features and ensuring that nothing is missed.

Rework usually begins on the horizontal surfaces, such as the hood, roof, and top of the trunk lid, with the lifting table of the finishing booth lowered to the floor level. Raising the car body by 80 to 100 centimeters has proven itself for the vertical surfaces such as the side walls, doors, and bottom of the trunk lid.

Potential for projections in prototyping and assembly

This automated surface inspection delivers an optimized template that, with laser-assisted visualization, can be used for quality assurance in an automobile manufacturer's paint shop. Process times are reduced as a result while quality is improved and the ergonomics for the work of employees are significantly improved.

The principle can also be transferred to other quality assurance processes, such as inspecting and reworking welding seams on unfinished car bodies. But the approach also has far more potential than that: The projection of digital templates from plan and measurement data directly onto the work piece makes labor-intensive activities and coordination in prototyping and assembly simpler, more effective, and less costly. ■

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