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How connectivity and visual servo technology enable the flexible deployment of sensors in cell-wise vehicle production

Ready for INDUSTRIE 4.0: Flexible sensor technology in autonomous mobile platforms for automotive manufacturing

INDUSTRIE 4.0 is coming, and production on clocked assembly lines will soon be a thing of the past in the automotive industry. This will be replaced by highly cost- and time-efficient autonomous and modular manufacturing, in which flexible manufacturing cells adapt to new tasks within seconds and are automatically equipped with the tools they need to perform them. Accordingly, manufacturing steps are no longer located behind one another in a linear fashion, but are instead distributed throughout a production hall. Here, a car body is only taken to the cells required for the respective vehicle type by means of an automated transporting system. Highly flexible sensor technology makes a key contribution toward realizing this vision while meeting stringent quality and efficiency requirements.

With SHAPEMATCH3D, BestFit, MONO3D, IntelliPICK3D and many more sensors, ISRA VISION already supports automotive manufacturers all over the world in efficient automated production. To continue helping supporting efficient automated processes on the road to autonomous and modular production, ISRA places special emphasis on giving providing its sensors a high degree of connectivity. Equipped with embedded technology, Wi-Fi, and the OPC/UA protocol, this

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versatile generation of sensors directly adapts to process changes and changing tasks. As such, all required information on a car body or component can be transmitted directly to the sensor. In combination with visual servo technology, every inspection or process step can be performed during constant movement, thus making stop phases in production a thing of the past. This is the key requisite mandate for agile matrix production in the automotive industry. Transported by automated guided vehicles, car bodies and almost finished vehicles only visit those robot cells that are necessary for the respective vehicle type, thereby accelerating throughput times so significantly that production yield immediately increases.

Visual servo enables sensor-guided assembly on-the-fly

To also inspect a moving object reliably while guiding robots safely, the visual servo technology offers the ideal solution. It allows the use of sensors and automatic assembly while the car body is moving. Until now, synchronization between the conveyor system and the robot movement could lead to positioning problems that considerably limit flexibility. Through its work on visual servo sensors, ISRA is developing a method for using sensors while the body is moving, such as for removing components, assembling windshields, roofs, wheels and doors, or for inspecting fully painted bodies or components. Alongside flexible automated guided vehicle systems and adaptable sensors, the technical prerequisite for achieving this is complete communicative networking.

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Expansions for autonomy: Smart sensor networks, production analytics and absolute IMT

It is not currently known how the information on a produced vehicle will be made available. One possibility here is direct sensor communication in a smart sensor network, in which Wi-Fi connected sensors connected via Wi-Fi share information with one another and with a database. Inspection results, acquired images, event logs, and process information can then be exchanged directly between the cells. Thanks to the direct communication with a database, all available information can later be used for process analyses. With a superordinate software architecture such as ISRA's ^EPROMI (Enterprise PROduction Management Intelligence), this data can be analyzed quickly in individual e-cockpits, ^EPROMI's quickly adaptable user desktops, that can easily be modified to meet a user's exact requirements and prepared to ensure sound decision-making. This is the key to a high level of transparency and end-to-end process control and optimization. Within the production cell, the dual-sensor systems ensure a high level of precision. High-resolution cameras mounted on a temperature-independent frame capture the robot movements and sensor positions within a higher-level coordinate system. Thanks to this absolute precision, the sensors fulfill their task reliably on a permanent basis and without frequent calibration. The interplay of autonomous and highly connective sensor technology, visual servo, and technologically optimized framework conditions is a key element in making the vision of autonomous and agile manufacturing a reality in the automotive industry and beyond.

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Images



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The technical capabilities of INDUSTRIE 4.0 will outrun clocked assembly lines in the long term. Highly flexible sensor technology will become essential for realizing a changeable and autonomous production that's able to meet even highest demands in quality.



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Automated guided vehicles (AGV) supply the necessary assembly tools for the respective tasks, like wheel assembly – enabling maximum changeability.

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Production analytics tools like ISRA's ^EPROMI combine data from various sources along the production line in clearly arranged e-cockpits to efficiently support well informed decision making.

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