Wheel Assembly System

Using manual assembly methods to mount wheels onto cars in continuous operation is extremely costly for automotive manufacturers. This is mainly because several assembly workers are required to perform the work.

An automation solutions provider has designed a sophisticated assembly system for the automotive industry that automatically fits and mounts wheels onto car bodies moving continuously along the line. This highly flexible system can be used for a variety of vehicles and wheel types. By automating this process, automotive manufacturers not only see labour costs drastically reduced, but overall manufacturing quality improve as assembly errors are eliminated.

Figure 1: The assembly system mounts wheels onto the continuously moving vehicles

Two six-axis Kuka industrial robots—one located on each side of a car body—gather wheel bolts and rims from their supply stations and screw them onto the car. The robots are synchronized with the conveyor and follow the car's movement during assembly. Attached to each robot is specialized lighting with polarized and infrared filters. A Matrox Iris GT smart camera is also attached to each robot. The smart camera locates the rim's centre point and calculates its position (x, y), rotation (Rz) of the bolt circle, and distance to the camera (z) in calibrated coordinates. Before these coordinates are given to the robot, the smart camera checks to see whether the rim design that it has located matches the rim that is expected to be given by the PLC. This last test prevents the wrong rim design from being mounted on the vehicle. Thirteen different wheel combinations—seven rim designs and four types of lacquer (white, silver, anthracite, and black)—are identified. The entire automated wheel assembly process has a cycle time of only 54 seconds.

Smart camera-based image processing

The image processing system is based upon the Matrox Iris GT smart camera. The application was developed with Matrox Design Assistant, an integrated development environment (IDE) that is bundled with the camera. The IDE lets users create machine vision applications by constructing a flowchart instead of coding programs or scripts using languages like C++. Once development is finished, the project (or flowchart) is uploaded and stored locally on the Matrox Iris GT. The project is then executed on the smart camera and monitored from the web-based Human Machine Interface (HMI) running on a PC.

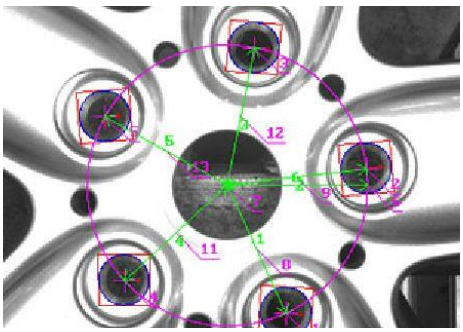

Figure 2: Efficient edge based tools, courtesy of Matrox Imaging Library

A number of Design Assistant tools or flowchart steps are used. Image acquisition and processing are triggered by a command from the network link, which contains information about the measurement job and the expected rim type. Several Model Finder steps are used to locate the wheel's bolt circle and to verify the expected type of design. The Metrology step then calculates the rim's position and orientation based on data provided by the Model Finder occurrences. A TCP/IP connection ensures communication between the smart cameras and the PLC. Results and images are logged to a shared network folder—using TextWriter and ImageWriter steps—and can be downloaded by remote maintenance staff for fault analysis.

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Original article courtesy of Matrox Imaging.