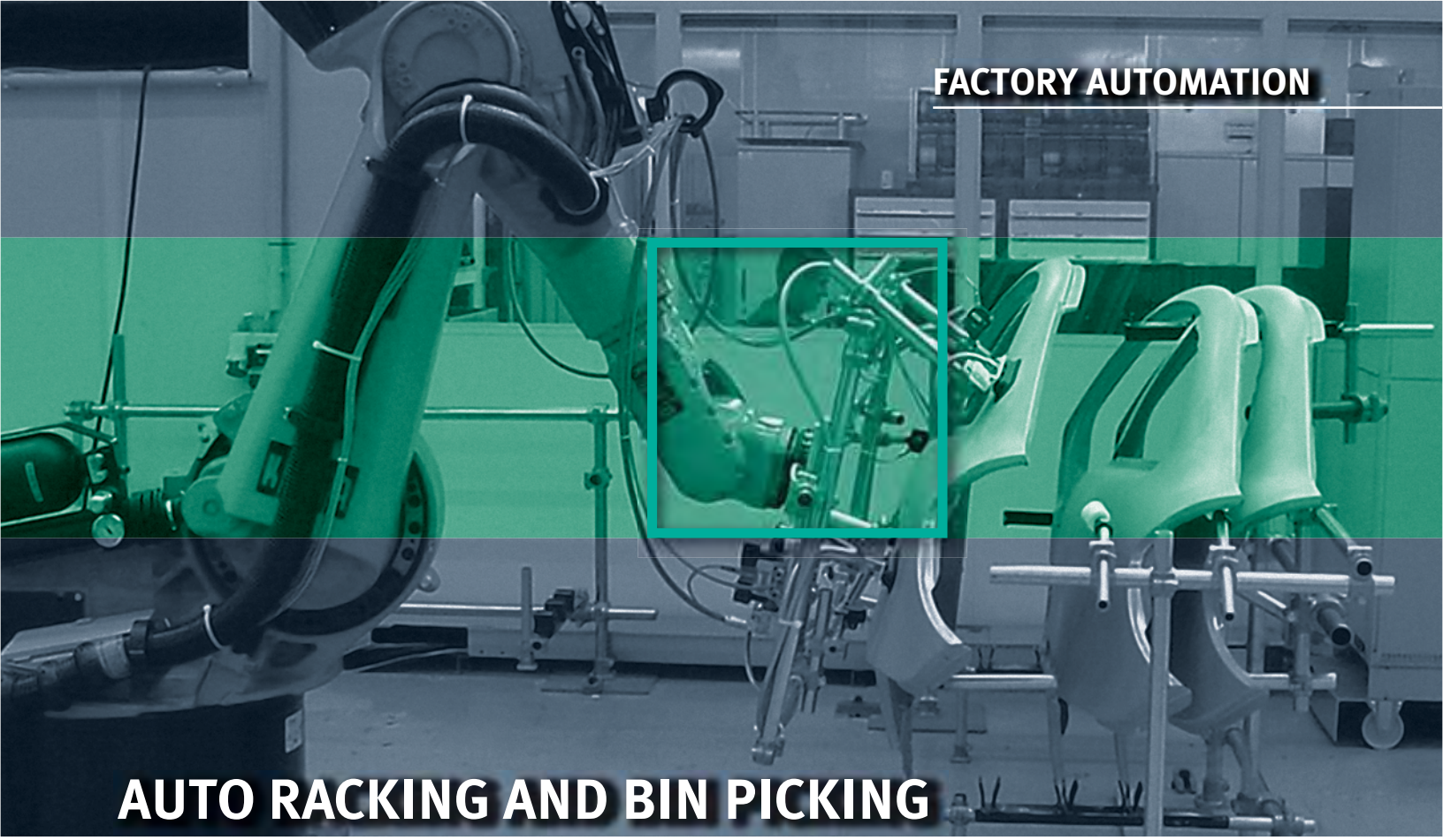

AUTO RACKING AND BIN PICKING IN THE AUTOMOTIVE INDUSTRY

Auto racking and bin picking are two common applications in the automotive industry for automating production sequences and as a result, increase capacity, safety, and reduce costs. Project engineers now have more possibilities to use optical systems for their applications. Choosing the right sensor is critical.

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Part No. SDOCT-1526_US

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AUTO RACKING AND BIN PICKING IN THE AUTOMOTIVE INDUSTRY

Auto racking and bin picking are two common applications in the automotive industry for automating production sequences and as a result, increase capacity, safety, and reduce costs. It's for this reason that VMT, part of the Pepperl+Fuchs Group, has directed its focus in recent years on developments in these areas. The cornerstone of this focus was the ability to use the best sensor for every test. The VMT system provides project engineers with the possibility of selecting the most suitable sensor out of a large number of possibilities that can be linked to the software VMT developed in-house. In addition to the image-processing sector (typically area and line scan cameras), it also covers laser triangulation, sensor technology, laser time-of-flight sensors, and the latest generation of ultrasonic sensor technology.

The requirements for auto racking and unloading items from bins and pallets and of handling different parts and different bins, are generally very complex. The important challenges of these tasks are represented by:

- Item complexity and variability
- Very different surfaces of the objects to be processed
- Recognition of bins, intermediate layers where applicable, and also foreign objects and disruptive contours
- Influence of external light

In order to fulfill the demands for trouble-free operation and a process-stable system, VMT also decided, in addition to proven image processing systems, to use laser triangulation and laser time-of-flight sensor technology. This kind of sensor technology provides not only significant freedom from external light interference for the testing process, but also provides the requisite speed and fulfills the requirements for accuracy. Additional information is also available, for example, to determine the stack height and recognize foreign bodies; this is often not available when using traditional image processing.

Two applications that follow meet the above requirements and have improved and increased production capacity on the plant floor.

Application 1: Robot-supported removal of untreated brake disks

This example describes an application with a leading global automotive group in which untreated brake disks from a bin had to be fed to another machining process. Until a short time ago this activity was carried out by employees who would manually pick the brake disks out of the bin.
The task had the following conditions and complexities:

- Untreated brake disks whose appearance varied widely. This ranged from varying degrees of dirtiness, to spots of rust, and different surfaces
- Incorrectly positioned brake disks had to be recognized since they could not be gripped mechanically
- The possible collision points with the bin walls had to be recognized and a removal specification sent to the robot together with the position data
- The bins had different shapes (some were damaged) and colors owing to their handling and robust usage in the production process
- The bin positions and deformations that influenced the removal of the brake disks had to be recognized and provided as information for removal by the robot
- The fill level was variable from bin to bin
- There could be undefined objects in the bin that represented a collision hazard with the robot gripper: recognition of these objects had to be guaranteed.

Sequence of the application

After setting the bin in the removal station, a laser run-time sensor is guided into position above the bin. During this measurement movement, all the objects located in the uppermost bin layer are recorded as a 3D data record and evaluated by the VMT image processing system. In doing so, the 3D positions of the objects and their free accessibility are determined. These data are provided to the robot via a standardized interface. Based on these data, the

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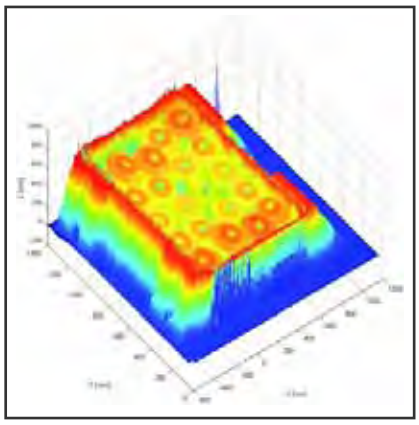
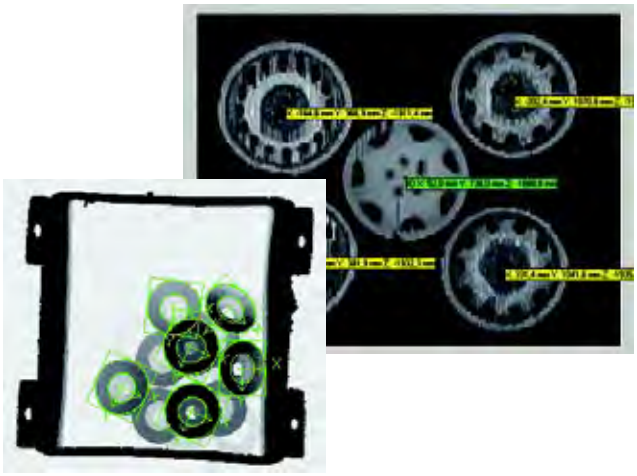
robot carries out a position correction and removes the first object from the bin. Since, during removal, slipping of the remaining brake disks can occur, the measurement is repeated for every cycle. The measurement itself is not timing-cycle relevant, since it takes place during the time when the robot is feeding the gripped object to the machining process. During every measurement movement, the shape of the bin is also checked and the data for avoiding collision is integrated into the communication with the robot or the handling unit.



Objects that do not belong in the bin are also acquired in 3D during these measurements. If something is recognized, a message is immediately sent to the controller to facilitate operator intervention. Owing to the accuracy requirement, a solution using a magnetic gripper could not be considered.

Application 2: Depalletization of unsorted tire rims



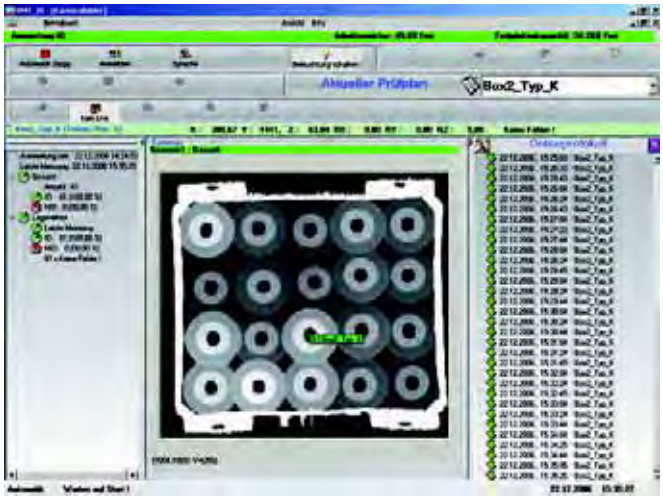
This application involved the depalletization of tire rims and their inflow to an upstream production process. Tire rims of different types, present on a pallet in several layers, are recognized by means of the same process described in the preceding application, and the position corrections determined for the robot or the handling unit. In both applications, processes and tools specially developed and patented by VMT are used that are suitable for the very complex tasks and the prevailing boundary conditions.

VMT is currently working on additional projects similar to these applications. They relate especially to tire handling, the food industry, the packaging industry, and bearing technology, as well as others.

The VMT image-processing system

The image-processing computer is based on a high-performance industrial PC with the Windows XP operating system. Since it can be coupled to the robotic control or the PLC, the VMT system offers almost all the usual interfaces available to the industry. These include: PROFINET, Ethernet IP, DeviceNet, OPC, digital I/Os, Serial, Interbus, PROFIBUS, TCP/IP and CANbus. The complete system including visualization on a TFT screen is built into a PC cabinet according to customer requirements.

But the actual heart of the system is the VMT IS software, which was developed during years of cooperation with customers in the automotive and automotive vendor industries during more than 600 projects. A great deal of value is placed on simple and intuitive operator guidance, which makes it possible for the operator to carry out tests in just a few days. The system setup and operation takes place without programming using a graphical interface and is completely uniform for the most varied applications like robot visual guidance, completeness testing, and plain text reading. The user language (thirteen in total, including English and German) can be switched online at any time and is open for expansion to other languages.



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