

Stereo 3D camera supports
automated storage of packaging

Out of the box

IDS It's so easy!



The automation of pick and place processes is one of the things that 3D machine vision does best. After all, fast and reliable identification of parts is the starting point for the use of robots in handling processes. Cameras detect the shape, size and position of the objects, and pass this information on to the robot controller. This allows the robot to pick parts out of a box or storage bin in a process known as "bin picking". Magazino GmbH integrates a stereo 3D camera from IDS into its automated pick and place systems to pick randomly positioned packages directly from the storage bin and to place these into storage automatically.



The automatic picking system Maru offers the storage of up to 15,000 packages of medication in an area of only 7 square meters, depending on the systems' height.

Pick and Place with Maru and Ensenso N10

The company, which has its headquarters in Munich, develops and builds robot solutions for storage and logistics applications, as well as space-saving pick and place systems. The solutions enable extremely efficient, high-precision picking and placing of a wide range of items. In September of last year, Magazino launched Maru, an automatic picking system that offers pharmacies a completely revolutionary design. Depending on the height of the system installed, up to 15,000 packages of medication can be stored in a space of just 7 square meters. That means up to 80% more packages per square meter compared with conventional high-bay racking systems. This efficient use of space is based on the use of round discs for storage – these also enable fast retrieval of stock. The packages are sorted by height and stored on discs that are spaced at irregular distances from one another. The system needs much less space than a conventional drawer system, and also enables a significant reduction in the amount of time spent putting medication into storage and managing stock. However, it is still compatible with all standard warehouse managing systems.

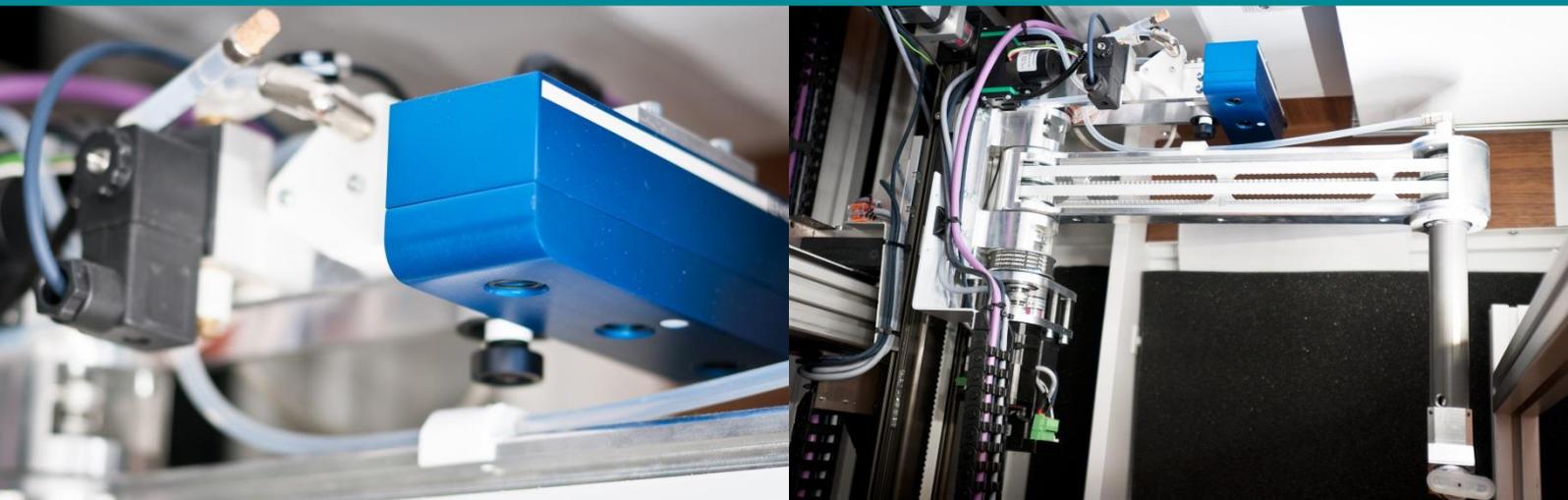
Another special feature of this system is that it can transfer packages directly from the box delivered by the wholesaler, and can independently recognize barcodes and expiry dates while doing so. All of this is made possible by the integrated camera technology and gripper technology.

A suction gripper, developed in-house by Magazino, is used to pick randomly positioned packages from a storage bin. The gripper is controlled by means of 3D images captured by a stereo camera. Nikolas Engelhard, Head of Software Development at Magazino, explains how the company selected the camera as follows: "As an alternative, we could have used structured light sensors, which would have been much more costly. Another option would be sheet-of-light sensors. However, these would have to be moved over the bin first in order to deliver a complete 3D image. That's why we chose IDS' Ensenso N10 stereo 3D cameras."

The camera's technological design is every bit as clever as the automatic picking system itself.

The Ensenso integrates two global shutter CMOS sensors, powerful software and even a texture projector in a very compact housing. It projects a random pattern of dots onto the object to be captured, allowing structures that are not visible or only faintly visible on the surface to be enhanced or highlighted. This is necessary because stereo matching requires the identification of "interest points" in an image.

The object is then captured by the two image sensors in accordance with the stereo vision principle. Finally, 3D coordinates are reconstructed or calculated for each and every pixel using geometric relations based on the triangulation principle.



This means that, even if parts with a relatively homogeneous surface are placed in the bin, a virtually seamless and detailed 3D image of the entire surface can be generated without additional technical effort.

The camera is available with a USB 2.0 or a Gigabit Ethernet interface. Magazino uses the USB model N10. Despite having two sensors and an integrated projector, this version of the Ensenso only measures approx. 150 x 45 x 45 mm, and weighs just 400 g.

Thanks to its robust aluminum housing and GPIO connector for 12-24 V hardware triggers, input and output, it is perfectly equipped for industrial applications.

In Magazino's automatic picking system, the stereo camera is placed in a central position above and relatively close to the bin from the wholesaler that is to be emptied. From there, it captures images of the contents of the bin.

The ability to adjust the Ensenso's field of view to suit the specific application (in this case, distance from the storage bin, bin size) while maintaining the smallest possible distance from object to camera was a key selling point for Magazino. Engelhard explains: "The dispenser needs to be as compact as possible. All of the bin picking technology is installed below a workbench with a working height of 1.1 m. The bin that comes from the wholesaler has a height of around 20 cm, and we need to pick packages with a height of up to 15 cm from that bin. That means we can't use a conventional axis system.

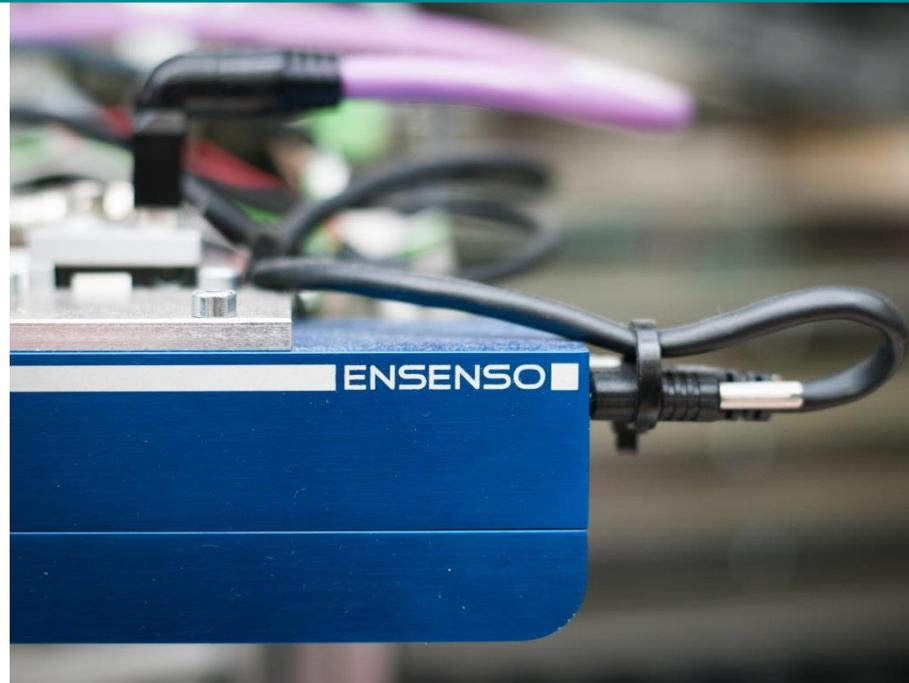
"However, the Ensenso is available with various focal lengths, and so we were able to choose the perfect model for our application."

From the point cloud delivered by the 3D camera, levels are then extracted and the best possible gripping position for the suction gripper is determined.

The suction gripper then retrieves the individual package (typically with a size of 100 x 50 x 20 mm) and places it on a measuring surface, where its exact dimensions are determined (the height of the package, for example, cannot be measured in the storage bin).



“The camera is the perfect compromise between compactness, precision and price.” - Nikolas Engelhard



These precise measurements are required in order to select the ideal storage location for the box. In addition, a 2D camera records a reference image, which can be used later to locate the package in the disc storage area, for example in order to guide the gripper or to perform a fully automated stock-take. The gripper then picks up the package again and holds it against an illumination unit. This detects the package's barcode and the expiry date that has been stamped onto its surface. To pick out this stamped-on information, several individually controlled LEDs generate shadows from various directions which are then combined. Finally, the package is placed on a buffer washer and, from there, is picked up by another suction gripper and brought to its defined storage location.

For OEMs like Magazino, the camera software is just as important as the hardware because it plays a crucial role in determining integration costs. The Ensenso package includes an interface to the HALCON machine vision library and an extensive software development kit, which is identical for the GigE and USB models.

Magazino also uses this Software Development Kit to exchange the image data with other programs within this application. Nikolas Engelhard explains: "We used the Ensenso SDK (NxLib Api) to write our own interface with the robot operating system (ros.org). This interface makes the point clouds available to the other programs."

Thanks to the extensive software support, which was specially optimized for robot vision applications, the integration has proven to be very simple and to save on time. In addition, the Ensenso provides 3D data "out of the box", and can be installed straight away.

All that remains is for the robots to be calibrated for working with the camera. This is very easily done using a calibration plate mounted on the robot gripper. The software uses this plate to calculate the mounting position of the camera, and the 3D data is immediately represented in the robot's coordination system.



It really couldn't be much simpler

Until now, the potential offered by 3D machine vision has been hardly tapped due to the complexity and relatively high costs of the technology.

However, its current application by Magazino demonstrates that the Ensenso stereo 3D camera is capable of meeting the most challenging of requirements, including bin picking, while remaining cost-efficient.

Ensenso N10 at a glance:

752 x 480 Px 1/3"	Plug M8 "PLUSCON" SAC
Wide VGA sensor	Dimensions: ca. 150 x 45 x 45 mm
Global shutter	Weight: ca. 400 g
USB 2.0 interface	Power consumption: ca. 2.5 W
Screw-on connectors	Focal number: 1.8
12-24V GPIO	Calibration plate (optional)
	Pre-calibrated

Customer:

www.magazino.eu