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FANUC Robot CR-7iA/L

Top benefits of integrated robotic machine vision

TOP VIEW

n today's highly flexible manufacturing environment, automation is the key to success. Whether it is in a large automotive factory or a small fabrication shop, automation is an ideal way to improve quality while reducing labor. Whenever parts are run in a batch, whether its thousands at a
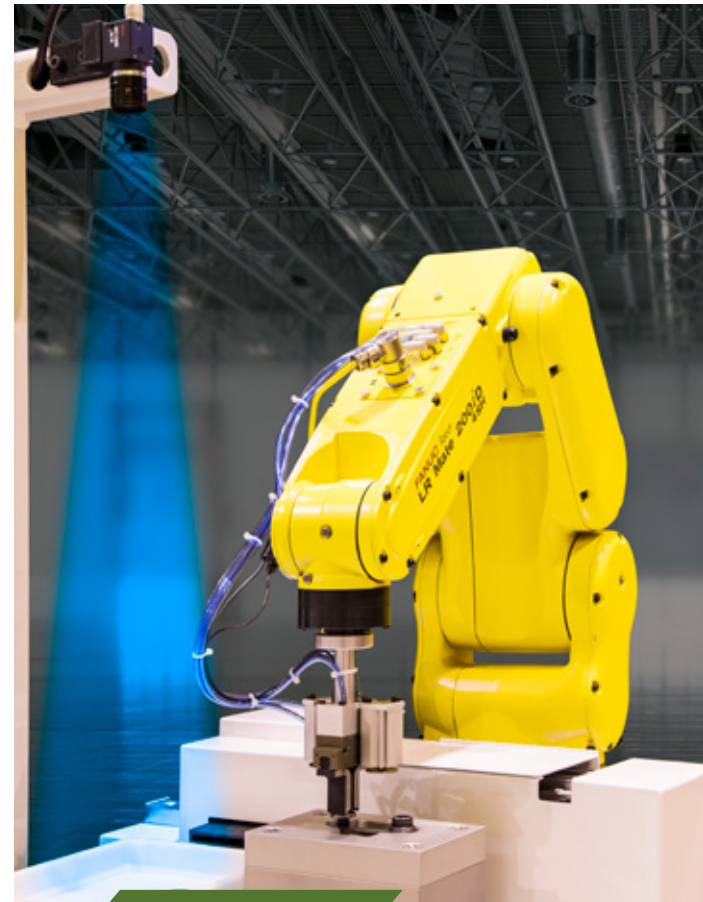
time or ten at a time, automation can perform the task.

One great way to add intelligence to a robot is to use machine vision. Giving the robot "eyes" provides many advantages that help reduce costs, including reduced fixturing, increased efficiency for part changeover, minimal system rework needed to introduce new products and the ability to do error proofing during the manufacturing process.

Adding machine vision can help improve the process and add flexibility to the operation, even for smaller batches. For example, instead of the operator having to load a bracket part into a machine, a robot with machine vision can be set up to do it. This frees up the operator to do more value-added tasks. And with the introduction of collaborative robots, in many cases the robot does not have to be isolated from the operator.

There are many ways to add machine vision to a robotic system. Standalone vision system suppliers offer products that can communicate with the robot.

↑ *A Fanuc CR-7iA/L cobot equipped with machine vision technology inspects car bumpers for defects working alongside an operator.*

Some robot manufacturers partner with vision system suppliers to offer solutions. Others, like Fanuc, develop complete products in-house, such as Fanuc's suite of fully integrated 2-D and 3-D vision solutions under the nameplate of iRVision.

For many robotic workcells, the robots are the focal point of the system. Therefore, it makes sense the robot

can reliably make its own decisions. Integrated machine vision allows the robot to decide for itself which part to interact with and where that part is located.

Successful vision

When it comes to a successful automated manufacturing operation, reliability is important. With an integrated vision solution, there is no ›

↑ *Fanuc's LR Mate 200iD robot performs high-speed assembly using iRVision machine vision technology.*

> Integrated machine vision allows the robot to decide for itself which part to interact with and where that part is located.

PC or smart camera required. All of the vision algorithms run on the same robot control CPU that controls the rest of the robot, like motion and logic. There is no worry about the reliability of a PC that is critical to production. The camera, 2-D or 3-D, plugs directly into the robot controller's main CPU. The Fanuc-supplied camera and robot controller are connected by Fanuc-supplied cables.

Nobody knows how to control a robot better than the robot manufacturer, and Fanuc is no exception. iRVision can utilize all of Fanuc's advanced motion algorithms. The automatic calibration, capability to take a picture on the fly, robot- or fixed-mount camera support and through arm vision cables are some advantages that an integrated vision system has over a third-party vision system.

Another advantage is having the vision setup and runtime display directly on the teach pendant. The ability to see what the vision system is seeing without requiring another mechanism for display is huge on a production floor. With an integrated vision

↑ *Fanuc's R-1000iA robot uses iRVision's 3-D Area Sensor for bin picking parts.*

solution, the same teach pendant is used to interact with the robot and the vision system.

Integrating two pieces of equipment from two different sources is often a challenge. By selecting an integrated ⟩

vision solution, there aren't any issues with getting two different pieces of equipment to communicate. With iRVision, because the camera is plugged directly into the camera port in the robot controller's main CPU, there is nothing to do to get the vision system talking to the robot.

Another requirement for a successful automated workcell is support. Every system, even the most reliable, has the potential to go down. A system with machine vision is no exception and may need support from time to time. With quality support, the impact downtime has on production can be minimized. If a vision-guided robot is not interacting properly with a part, it's important to determine if it's the robot or the vision system that needs attention. Would the end user call the robot manufacturer or the vision system supplier? Would it take support from both to solve the problem?

With iRVision, the vision system is part of the robot, so there is only one place to go for support. Fanuc's 24-hour support applies to the robot and all of its components, including the vision

portion. Other vision system suppliers may not have the infrastructure to provide around-the-clock support. Fanuc's Service First concept to support the robot for life includes the vision system.

Fanuc is able to leverage its expertise in many different applications and develop a vision solution for each. For nearly 40 years, Fanuc has developed vision solutions to meet a wide range of applications, such as:

- 2-D single view – one image finding the location of a part in 2-D

- 2-D multi-view – multiple images together to find the location of a part in 2-D

- 3-D single view – one 3-D camera finding the position of a part in 3-D

- 3-D multi-view – multiple 2-D or 3-D images together to find the location of a part in 3-D

- Depalletizing – one image finding a part in 2-D at varying heights

- Bin picking – finding a part in 3-D and guiding the robot to pick it while avoiding obstacles, such as bin walls ›
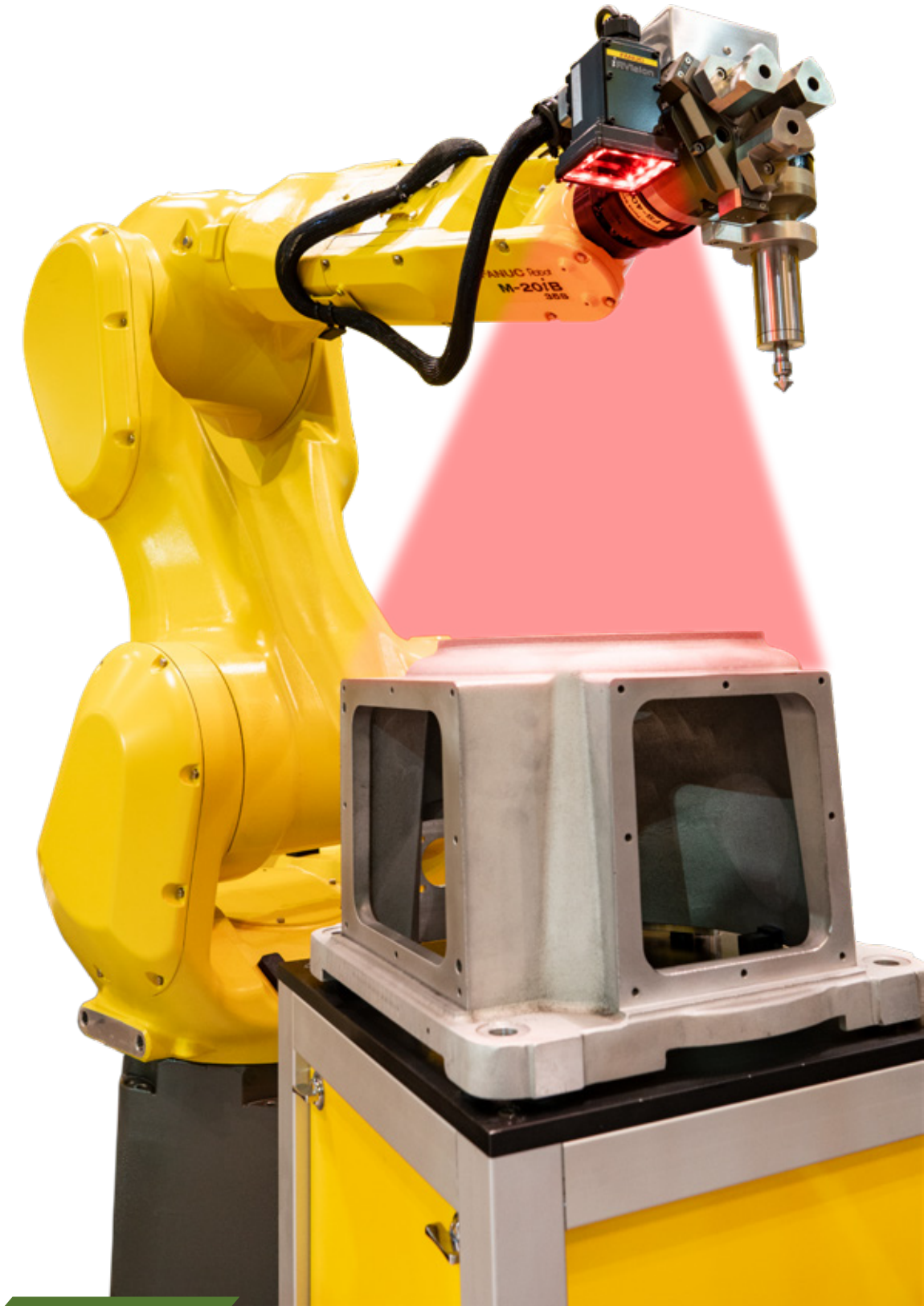
↑ *Fanuc's M-20iB-35S robot uses iRVision to perform a deburring application.*

> The ability to see what the vision system is seeing without requiring another mechanism for display is huge on a production floor.

- Visual tracking – finding the location of a part on a moving conveyor for a robot or multiple robots to pick

- Inspection – inspecting the part to make sure it is not a reject; options include simple inspection to find flaws or defects or error proofing to find more general failures

Integrated answer

Many applications can benefit from the flexibility that a robot-mounted camera provides. For instance, a robot-mounted camera means that the robot can position the camera anywhere in the workcell. A single robot-mounted camera can take the place of multiple fixed cameras. Whether it is 2-D, 3-D or inspection, a robot-mounted camera is a great option when using machine vision in a robotic system.

Part of the key to success of a robot-mounted camera system is for the vision system to know where the robot is each time it snaps a picture. With an integrated vision system like iRVision, the vision system is part of the robot so it always automatically knows the robot's location when it snaps a picture. During calibration, the camera location on the robot is automatically determined; because the robot knows its own position at all times, it also always knows the position of the camera.

Machine vision is part of the solution for many robotic applications. Selecting an integrated vision solution provided by the robot manufacturer can save time and money during setup as well as increase reliability during production and increase the efficiency of part changeover. ■

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