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Considering a Smart Camera? Keep These Five Key Features in Mind

Unlike PC-based vision systems—with their distinct cameras, frame grabbers, and I/O boards—today's smart cameras incorporate embedded lenses, processors, software, I/O capabilities, and sometimes even lighting in an "all-in-one" package that can simplify and streamline the integration and deployment of machine vision systems. Combine this with a small form factor and cost-effective price point, and it is easy to see why smart cameras are being used in many new application deployments, as well as in existing machine vision processes, from barcode reading to object recognition, and process monitoring to quality control.

Before you invest in a smart camera solution, however, it is critical to understand how you'll use the data the application provides; the environment in which your vision system will operate; the expertise level of the team that will program, use, and maintain the system; and even the budget available to invest in the system and its deployment. Some applications are better suited to one type of vision system versus another. Once the goals for the application you are planning to deploy have been clearly established, you can refine your thinking about which camera solution will be most ideally suited to achieving your goals.

There are five important criteria to keep in mind as you consider whether a smart camera system is the solution you need.

1. Will a smart camera meet the processing speed and throughput requirements of your application?

It's important to say at the outset that smart cameras, in general, do not offer the throughput and processing speeds delivered by PC-based machine vision systems. However, achieving exceptionally high processing speeds may not be what is most important with your application. Determining whether any machine vision system, even a PC-based system, can deliver the throughput you need will depend on the content and quality of the images the camera must capture, the inspection area a system's software tools will need to process, and the types of software tools available.

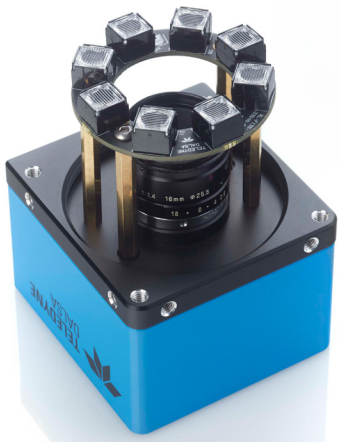
2. Will the smart camera deliver the image sensor resolution needed for your application?

Like PC-based machine visions systems, smart cameras are available in a range of resolutions, and it is critical that you select a camera that can provide the right resolution to capture product details across the inspection area needed for your application. Teledyne DALSA's BOA2, for example, uses CMOS sensors with resolution up to five pixels, which allows for a larger area to be inspected at once and enables the camera to capture even the smallest detail.

3. Does the smart camera offer the software tools required by your application, and once deployed, will the smart camera system be easy to program and maintain?

Embedded vision software is a key component of every smart camera system and is essential in determining how easy it will be to set up and program the camera. Different vendors offer different tools, and the same vendor may even offer multiple collections of tools. These tools are usually targeted at the most common inspection tasks, including pattern matching, precision measurements, flaw detection, robot guidance, and optical character recognition. Determining whether a smart camera system provides the software needed for your application is a key factor in your choice of camera or system.

A smart camera's user interface minimizes the knowledge needed to program and deploy the system and should be easy to use, even by someone who is not a software engineer or a trained integrator. This is a key differentiator between smart camera and PC-based camera systems. While a smart camera system may be deployed initially by someone with expertise, making changes to accommodate new application requirements or creating a new application from scratch should ideally be accomplished by an operator with just basic knowledge, without the need to write code.



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Ideally, the smart camera you choose will have a graphical user interface that allows you to specify operations, parameters, and program flows simply. Modifying or deploying a new application on PC-based systems may require the services of a trained engineer or support from an integrator, which could be costly.

With software embedded into the camera, applications can be configured, monitored, and accessed easily using a web browser on a remote PC. Then, after a smart camera is programmed, it can run on its own, without a connection to a client PC. This is particularly valuable to those users who prefer not to have PC-related hardware on the factory floor or in organizations where security policies limit remote access to systems.

For those applications that can be completed with a smart camera yet require more flexible software, some vendors also offer software options that have the flexibility and tools needed to accommodate changing conditions. It is important to note, however, that software that offers greater flexibility might also require greater expertise for the developer and take more time to set up and deploy.

4. Does the smart camera system support your required communication protocols?

When evaluating camera systems in general and smart cameras in particular, it is easy to focus solely on the processes required to capture an image and the types of data the software tools can deliver about each image, but it is equally important to consider how and where you'll use this information once you have it. Any smart camera you choose should provide standard communication protocols so that it can integrate seamlessly—and with minimal integration work on your part—into your network.

PC-based machine vision systems transmit captured images to host computers to be analyzed, but smart cameras process images in-camera. Results can be transmitted easily using the smart camera's low-cost Ethernet interface, which can accommodate long distances. This can speed the rate at which data is delivered to your application running on a PC, shared with other steps in a production line, or logged and archived for future analysis.

It is important to remember that with their small size and fully embedded systems, smart cameras do not usually have a native display, so images are not typically output to a monitor. Images can be sent easily to a connected HMI device, laptop, or tablet, but this process should be tightly controlled to avoid potential bottlenecks.

5. Does the smart camera system make it simple to migrate my application to a more powerful camera if needed?

As your inspection process evolves, you may look for ways to enhance or change elements of the inspection process. It is possible for example, that you may be satisfied with the resolution delivered by your smart camera, but require a faster processing speed to meet new production requirements. Choosing a smart camera that is part of a "family" of cameras will simplify the migration process; in many cases, a camera with a faster processor will be "plug and play," allowing you to transition your application seamlessly.

While it isn't as simple to migrate from a smart camera that delivers the required throughput to one with the same throughput but a higher resolution, it is still possible with a smart camera. This type of migration is accomplished by transitioning the solution file and making some adaptations to the tool set used for the application.
What if you're forced to replace your smart camera due to damage? First of all, as you decide whether or not to choose a smart camera system and which system to choose, look for a smart camera designed for the harsh environment common in industrial deployments. If damaged, keep in mind that smart cameras are less expensive and easier to replace than traditional PC-based machine vision systems.

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Thanks to embedded lenses, sensors, processors, software, and I/O capabilities, smart cameras simplify the deployment of machine vision systems as they lower system cost overall. Since smart cameras take some of the guesswork out of component selection and system design, they allow users to focus on what is most important: the requirements of the application itself. Keep the application goals you've defined top of mind, share them with your vendor or integrator partner, and test, test, test. Only with this approach will you ensure that you're investing in the machine vision solution that is right for you.

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