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## Machine Vision: Now is the Time

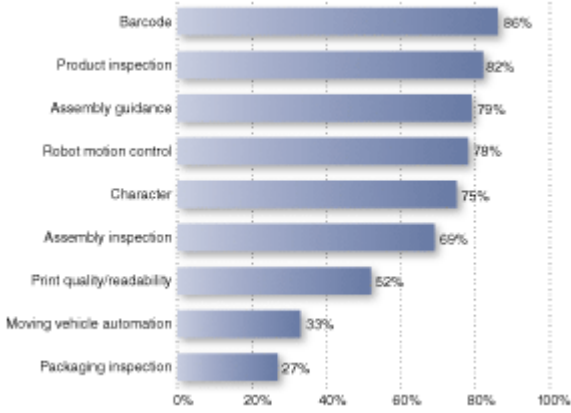
Ease of implementation creates a good user experience survey respondents say. Don't wait. One user wishes he started using machine vision years ago.

Mark T. Hoske, Control Engineering  
Control Engineering -- May 1, 2007

Envision this: Hardware and software that excludes rejects at high speed, guides robotics, and reads characters on parts and labels for error-free handling. Many subscribers are employing machine vision technologies for these and other purposes—many with success, some with setup challenges, according to the latest research from *Control Engineering* and Reed Research Group. A full 94% expect to spend as much or more on machine vision in the next 12 months; 52% said they expect to spend more. One survey respondent noted: "Use of vision systems has eliminated costly defects to our customers and is a tool that, in hindsight, should have been easily implemented years ago." (Two exclusive product introductions follow below, along with other new products from leading vendors.)

Machine vision extends well beyond quality control. Among respondents, barcode, product inspection, assembly guidance, and robot motion control were the leading applications, as the bar chart shows. Results of the 2007 survey show increasing use of machine vision technologies, with main frustrations related to setup and installation. Not surprisingly, 30% of respondents use machine-vision system integrators to help with installations, and 15% who do not already use system integrators plan to do so in the next year. In related findings, many of the latest machine vision products from leading vendors (see below) emphasize ease-of-use features.

### Primary applications for machine vision



Quality, assembly, and motion are leading application areas for machine vision systems. For more details on each application area, with 31 more data points, read this article online at May 2007, [www.controleng.com/archive](http://www.controleng.com/archive).

Limitations to using machine vision, in order of importance, are: capital budget, priority relative to other automation projects, engineering resources, acceptance by factory personnel, understanding of vision technology, and difficulty of use.

Among respondents buying machine vision in the past year, 20% purchased one or two units, 38% 3-6 units, 22% 7-15 units, and 19% more than 16 units. Among respondents, 44% used what they consider "smart vision sensors," and 82% felt the sensor met their requirements. Less than half, 42%, were concerned that machine vision is too complex or costly to implement.

### Users like easy set-up

Respondents were asked why the machine vision met requirements. Among comments, 14 could be characterized as application related and four of those noted that machine vision was better than other sensors for that particular implementation. Eight had to do with configuration or accuracy; and another eight with ease of use.

Configuration comments included:

- Can integrate entire systems on the camera.
- Eliminated false positives due to lighting or color.
- Fast, repeatable, accurate on measurements and able to handle a wide variety of inspections.
- Smart sensor was used for a quality assurance (QA) color check. Setup was a bit touchy, but it has been reliable.
- The vision system relieved the PC of the burden of de-mosaicing, color correction, and other trivial operations.

Users said their machine vision was easy to implement and change, met or exceeded expectations, was comfortable for maintenance people, and showed good return on investment (ROI).

Specific applications mentioned include: filling and packing systems, conveyor system to trigger timers, and process control. Other advice included:

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#### Being good and done

About ten years ago, I had an engineer working for me who had come out of the aerospace industry. He was careful, complete, and thoughtful, but missed every deadline ever given to him. Fred (not his real name, of course) had developed an amazing ability to turn even the simplest project into a never-ending stream of revisions, changes, and upgrades. Control Engineering

#### World's fair of engineering

Germany's Hannover Messe—known better by its English title, Hannover Fair—is the single biggest showcase of new technology for manufacturing and automation in the world. The U.S. has nothing like it—and the U.S. manufacturing industry is the worse for it. This year's 60th anniversary fair attracted more than 230,000 visitors to the 5-day April event. Control Engineering

### Engineering Discussions

- [Re: TDC3000/TPS Honeywell DCS - PLC Nonsynch Error \(reply posted by John Beck\)](#)
- [Modbus Distributed I/O \(posted by Anonymous\)](#)
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- "We know the vision limitations with the sensors; they do very well in the recommended areas."
- "We needed a really good photoeye and found that a smart sensor was more reliable."
- "Vision sensors are a good cheap solution to complex sensor requirements."

#### Avoid these errors

In an effort to help others, respondents shared reasons why a vision system didn't meet their requirements:

- 3D rendering was unsuccessful.
- Could not acceptably recognize pattern in product.
- Failed to select options with multiple parts running on same machine.
- Insufficient tools.
- Needed a higher-end system.
- Operators required real-time view.
- Requires too much training for an operator to integrate new products.
- The sensors never seem to be repeatable at a high level.
- Vision sensor does not provide time-out function or cancellation function for inspection in progress.

More positive comments were received than negative, however. One survey respondent wondered why machine vision isn't used more often, calling it the "simplest, most flexible, most tolerant, and ultimately the most reliable means of solving the problem."

#### Machine vision vendors

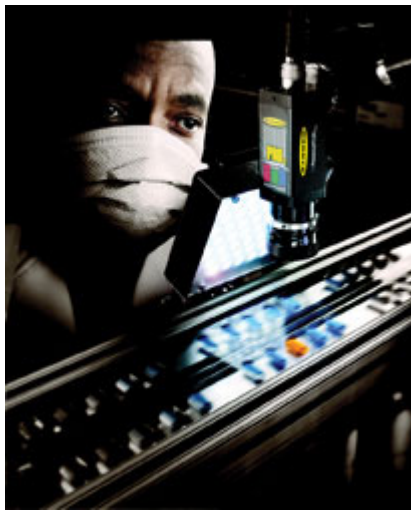
Using a list, survey respondents identified machine vision vendors they purchased from in the past 12 months. In descending order, these include: Cognex (DVT), Banner Engineering; Keyence; National Instruments; Omron Electronics; Matrox Imaging; ipd, a group of Dalsa Digital Imaging; PPT Vision; Siemens (RVSI Acuity CiMatrix); Systech International; JAI Pulnix; and Toshiba. "Other" was selected by 19% of respondents. American Eltec, Panasonic, Sick, and other vendors and distributors are listed at [www.cesuppliersearch.com](http://www.cesuppliersearch.com) under machine vision. Find system integrators with a vision system engineering specialty at [www.controleng.com/integrators](http://www.controleng.com/integrators).

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#### Smallest, high performance ID reader

High-performance DataMan 100 fixed-mount ID readers from Cognex recognize a wide range of targets, from printed barcodes to the most challenging 2D direct-marked codes. The readers are said to provide unmatched code-reading performance and simplicity in a package that's smaller than a flip phone. It uses IDQuick software, a new Cognex decoding tool for ultra-fast reading of well-formed codes. A model with award-winning IDMax software is also available for reading the most challenging direct part mark (DPM) codes. All DataMan 100 readers offer easy set up with integrated illumination, beeper, adjustable optics, a built-in aimer and a push-button trigger. The readers are suitable for identifying items marked with 1D or 2D codes in the automotive, packaging, electronics, medical device, and pharmaceutical industries. They support an expanding list of 1D and 2D codes including UPC/EAN/JAN, Code 39, Code 128, Code 93, Interleaved 2 of 5, Data Matrix, QR Code, and microQR Code. [www.cognex.com](http://www.cognex.com) **Cognex**



#### Color vision sensors: 1 piece or separate

Banner Engineering now offers two models of vision sensors that detect colors: the one-piece PresencePlus P4 Color Omni and PresencePlus Pro Color sensor, which has a compact camera and separate controller that can mount to a DIN rail. Both use the Color Match tool to inspect for the specific color taught to the sensor and can detect unlimited color variations. They feature a 752 x 480 pixel resolution color and CMOS imager and include all the PresencePlus vision tools: locate, pattern find and count, geometric find and count, edge, object, blob, average gray scale, and measure. The sensors solve application challenges when color is the distinguishing feature, such as automotive fuse verification, pharmaceutical tablet color matching, correct LED placement, and color consistency monitoring. [www.bannerengineering.com](http://www.bannerengineering.com) **Banner Engineering Corp.**

#### Multi-camera high-speed vision system

Keyence CV-3000 Vision System is a new platform design providing multiple color and monochrome camera connectivity using up to 4 cameras from a selection of 8 models. Triple-processors provide software tool processing times up to 10 times faster than conventional systems, even when using 2 mega-pixel color cameras. Flexible memory and new software tools handle applications that previously required application specific vision systems. Built upon an Advanced Color extraction Engine (ACE), with 16.7 million "auto-teach" color filters, the CV-3000 provides precise color differentiation, high contrast and easy to process images. The CPU handles up to 20,000 parts per minute; 16 inspection tools are available. [www.visionsystem.com](http://www.visionsystem.com) **Keyence**



#### More flexibility, less vision software complexity

National Instruments announced NI Vision Builder for Automated Inspection (AI) Version 3.0, the latest upgrade to the interactive software for configuring, benchmarking, and deploying complete machine vision applications without programming. This version introduces a new state-machine process model said to provide engineers with one of the most flexible environments available for configuring vision systems. Engineers can customize the execution flow of inspections to meet challenges, such as component alignment, part inspection, and verification. With state machines, Vision Builder AI combines the flexibility of a programming language with the ease of use of a configuration environment. Acquire images from thousands of off-the-shelf cameras, including Camera Link, IEEE 1394, and GigE Vision, and process images with more than 100 machine vision tools, including geometric matching, OCR, and particle analysis. Inspections can run on any PC, the NI Compact Vision System, or the Sony Smart Camera. A free evaluation version is available. [www.ni.com/vision/vbai](http://www.ni.com/vision/vbai). **National Instruments**

#### EXCLUSIVE: Easier color vision

Omron's new FZ color vision sensor makes it possible to automate inspection of low contrast color objects at high speed with reliable results by using true color technology and intelligent cameras. Omron's Advanced Real Color Sensing (ARCS) engine captures and processes 16.77 million colors, approaching human color perception, and out-performs systems that use monochrome or false color contrast conversion and analysis methods. The company claims it is the industry's only system with up to four-camera capability and true color conversion. Controller is built into a touch screen LCD monitor to reduce panel space or into a conventional box-type unit. Images and tool sets are presented onscreen for easy drag-and-drop setup. On-line editing functions allow changes to be made without stopping the line. Simulation software is embedded. [www.omron247.com](http://www.omron247.com) **Omron Electronics**



#### Imaging library with metrology module

Matrox Imaging Library (MIL) 8.0 with Processing Pack 3 features the new metrology module. Leveraging MIL's feature-based image processing technology, developers now have a robust tool for geometric dimensioning and tolerancing applications. The metrology module calculates the measured and constructed geometric features that are derived from a template, and also validates tolerances based on a template. The module can measure arcs, circles, line segments, and points; these same features can also be constructed within the image. Tolerances can be determined from dimensions, positions, and

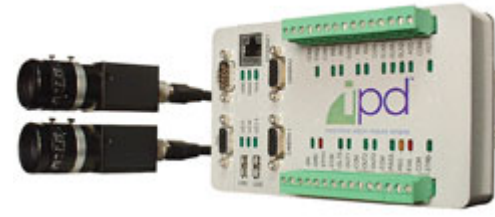


shape, and can involve distances and length, coordinates, angularity, parallelism, and perpendicularity.

[www.matrox.com](http://www.matrox.com) **Matrox Imaging**

#### EXCLUSIVE: Improved vision appliances

VA3X Vision Appliance from ipd, a Dalsa Group, is housed in compact, DIN mountable enclosures, provides quick user setup, has factory friendly wiring, and supports one or two cameras with choice of sensor resolution. It offers more than twice the performance of popular VA2X products, with same footprint, software, and an upgraded processor and system resources to support applications that demand higher throughput or greater image resolution. VA30 includes easy-to-use, connect-and-go iNspec software, while VA31 version also includes Sherlock, said to be the ultimate machine vision software for industry. The user interface, performance, and flexibility satisfy diverse requirements of end users and machine vision integrators. They incorporate the "smarts" inside the camera controller, as opposed to the camera head. This allows positioning alongside other automation controllers for easy interfacing with small camera heads for easy mounting. Dual camera capability provides significant cost savings in multi-camera applications. Gigabit-compliant network connection allows a real-time image feed to the Web browser. VA31 can connect to keyboard, mouse, and monitor directly. I/O connections are on front, status lights for each help with application debugging. Resolutions are 640 x 480, 1,024 x 768, and 1,600 x 1,200 pixels. [www.goipd.com](http://www.goipd.com) **ipd**



#### Software provides more usability, tools

Impact Software release 7.1 from PPT Vision continues significant usability improvements begun with previous releases. Setup functionality has been added to many more tools (currently 23), which streamlines inspection configuration. Four new tools have been added: an enhanced data matrix tool, character contour match tool, binary image filter tool, pass/fail tool, and pixel fill tool. The new tools, along with other speed, display, and use enhancements, helps ease implementation of complex and simple inspection tasks. [www.pptvision.com](http://www.pptvision.com) **PPT Vision**

#### Stationary data matrix, bar code reader

Simatic VS130-2 stationary Data Matrix reader from Siemens delivers the most powerful reading performance available for capturing two-dimensional data matrix codes and one-dimensional bar codes, the company says. It reliably captures printed, lasered, drilled, punched and dot-peen codes on a variety of different surfaces. With a wide range of communication options available and a browser-based application setup interface, the VS130-2 makes it simple to integrate the reading system into an automation solution. Siemens acquired assets of RVSI Acuity CiMatrix in October 2005. [www.sea.siemens.com](http://www.sea.siemens.com) **Siemens**

#### Next-generation character inspection tool

Systech International's next-generation Optical Character Verifier 2 (OCV2) improves character inspection accuracy and reliability by incorporating machine vision expertise into the product's functionality. Plant operators can realize multiple benefits with OCV2, which the company says is more tolerant of normal acceptable manufacturing variances such as part presentation, rotation, and material finish. Verification has been optimized for rapid classification of acceptable, damaged, or inappropriate components. Training and inspection procedures have been streamlined, increasing plant personnel productivity and overall equipment efficiency by maximizing quality, performance, and availability. New features and functions include more robust font model recognition engine, 360° rotation support, and streamlined font training for easy development of robust character libraries. [www.systech-tips.com](http://www.systech-tips.com) **Systech International**

#### RGB color camera gets GigE Vision interface

JAI says its digital 3CCD industrial progressive scan RGB color camera (CV-M9 GE) is the first industrial camera to combine advanced 3CCD RGB color vision technology with the easy-to-use GigE Vision standard interface. It is suitable for use in semiconductor production, food sorting, print inspection and flat panel quality verification, as well as in medical devices for patient diagnostics. The GigE Vision standard interface and programmable GPIO (General purpose input/output ports) make it easier to integrate advanced 3CCD prism color technology into most demanding applications. GigE Vision cameras use standard Cat5e or Cat6 cabling and do not require a dedicated frame grabber in the PC, saving money and decreasing time to market when developing advanced machine vision inspection systems. [www.pulnix.com](http://www.pulnix.com) **JAI Inc. (formerly JAI Pulnix)**

#### Cameras: FireWire-B, 800 Mbps transfer

Toshiba Teli America Inc. introduces its FireDragon line of progressive scan cameras, among the vision industry's first to utilize FireWire-B (IEEE-1394.b) technology, resulting in transfer rates of 800 Mbps, twice that of FireWire-A or USB 2.0 cameras. Manufacturing label inspection and microscopy applications benefit, company says. Eight camera modes are available offering outstanding imaging results with less signal distortion, increased throughput, and added versatility afforded by its backwards compatibility with conventional 1394.a. Monochrome and color vision versions are available. Many models deliver full-frame images up to 90 frames-per-second and resolutions ranging from VGA (640 x 480) to UXGA (1,600 x 1,200). SDK and Viewer software for FireDragon cameras and all other IEEE-1394.b cameras can be downloaded free. [www.toshiba-teli.com](http://www.toshiba-teli.com) **Toshiba Teli America**

#### 3D cameras are high speed, IP65

Ranger and Ruler series of 3D cameras from Sick Inc. are said to be ideal for in-line inspection machines used in the electronic, semiconductor, wood, robot vision, plastic, rubber and food industries. The Ranger, according to the company, is the world's fastest for three-dimensional vision inspections—up to 35,000 profiles per second. It also has high flexibility and MultiScan functionality, serving as a key vision component for 3D scanner manufacturers and vision integrators. It has interchangeable optics and can be combined with light sources. The Ruler E at 10,000 profiles/s provides real world calibrated data. Lighting and the camera are integrated into a robust IP65 housing. [www.sick.com](http://www.sick.com) **Sick Inc.**

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