Official sponsor of

AUGUST 2009

Smart Cameras
Embedded software eases applications

Wind Power
Thermography inspects turbine blades

Defect Detection
Automating automotive glass inspection

Camera Standards
Making Camera Link faster

Barcode Reading
Vision checks pesticide packages

 contents | Zoom in | Zoom out | For navigation instructions please click here | Search Issue | Next Page

www.vision-systems.com
HALCON 9.0 is the cream of machine vision.

It’s the sweet somethings on top that makes life richer and more enjoyable. That’s why we’ve enriched HALCON 9.0 with lots of special treats: enhanced performance, a completely new matching technology, processing of extremely large images and much more. Yummy!

For more information: [www.halconists.com](http://www.halconists.com)

A product of MVTec
Falcon cameras feature true global shutter and DALSA’s own sensor technology for the best CMOS image quality in the industry. Falcon cameras provide solutions for high speed, high resolution systems, through fast frame rates and multi-megapixel imaging.

**Falcon 1.4M100**
- > 1400 x 1024 resolution @ 100 fps
- > Compact body (44mm x 44mm x 44mm)
- > Excellent Near-Infrared Response

**Falcon 4M60 Color**
- > 2352 x 1728 resolution @ 60 fps
- > Vertical windowing for higher frame rates
- > Folded optics adapter available for closer spacing of multiple camera fields of view

Discover the innovation of **DALSA machine vision**

Download product specifications and white paper: “Electronic Shuttering for High Speed Machine Vision Applications”
[www.dalsa.com/falcon/v8](http://www.dalsa.com/falcon/v8)

Falcon™ cameras are fully compatible with DALSA’s Sapera Essential Vision Software.
[www.dalsa.com/mv](http://www.dalsa.com/mv)
High-end Performance Meets Mainstream Pricing!

- One megapixel CCD sensor at 120 fps for high-speed throughput
- Two megapixel CCD sensor variants (4:3 and HDTV aspect ratios) available soon
- Basler’s unique tap balancing technique yields brilliant image quality
- A CameraLink® interface for fast data transmission
- Sets a new price/performance ratio standard

See the entire range of Basler area scan cameras. Discover the unique “Made in Germany” superior Basler quality.
features

23 INDUSTRIAL AUTOMATION PRODUCTS

Eye Defense
Robots and linescan-based vision system team for automated inspection of protective eyewear

Andrew Wilson

31 INDUSTRY SOLUTIONS PROFILE

Bright Light
Inspection system uses multiple Camera Link linescan cameras and brightfield illumination to boost production of automotive glass

Winn Hardin

35 SPOTLIGHT

Blade Scanner
Lock-in thermography system finds cracks and delaminations inside fiber-reinforced plastic wind-turbine blades

C.G. Masi

43 PRODUCT FOCUS

Embedded Intelligence
Smart camera vendors are leveraging embedded processors and on-board software to increase the ease of use of their products

Andrew Wilson

departments

7 Snapshots
Vision measures diesel engine injectors
New CMOS sensor aimed at scientific applications

11 Technology Trends
IMAGE CAPTURE
Vision system reads pesticide packages

INTERFACE STANDARDS
Future Camera Link standards emerge

TRADE SHOW REVIEW
Lights, cameras, and action highlight Robots & Vision Show

49 Vision+Automation Products

55 Ad Index/Sales Offices

columns

5 Inside Vision • Gearing up

56 My View • A glowing future

www.vision-systems.com

• Complete Archives
• White Papers
• Industry News
• Feedback Forum
• Buyers Guide
• Free e-newsletter
• Webcasts
• Video Library
Vision Systems Design is pleased to present Application and Implementation of Vision, the fifth in its series of Webcasts on The Fundamentals of Machine Vision. Archived on vision-systems.com, and currently available On Demand, this Webcast provides an unbiased, objective look at the basics of machine vision with real-world examples of how machine-vision systems can be implemented.

The Fundamentals of Machine Vision
Application and Implementation of Vision

This is the fifth Webcast in the series Fundamentals of Machine Vision. This Webcast describes the steps necessary to implement a machine-vision system in a real-world environment. These steps include: determining system requirements and assessing technology such as cameras, lighting, software, and network interfaces; selecting suppliers; and machine acceptance, launch, and debugging of vision systems in different applications. The speaker will also describe some of the lessons learned from installing systems, and will show how to use statistics and Six Sigma tools for vision system acceptance.

Who Should Attend: Engineers and system integrators responsible for developing, designing, specifying, or reviewing machine vision components and systems

Valerie Bolhouse, well-known machine-vision expert and former vision specialist at Ford Motor Company, presents a series of Webcasts on the fundamentals of machine vision. Designed to provide developers with an overview of the critical design and performance aspects of machine-vision components and systems, these Webcasts also give experienced engineers and integrators new insights into solving system design challenges.

Register for FREE on www.vision-systems.com
Gearing Up

Every year, the show organizers at Messe Stuttgart hold a press conference to promote the world’s largest machine-vision exposition, VISION, which will be held November 3–5, 2009. Leading off last month’s press conference, Thomas Walter, director of the industrial solutions division of Messe Stuttgart, spoke of new incentives to attract visitors. These will include a three-day series of talks featuring more than 40 speakers, tutorial workshops to introduce engineers to machine-vision technology, a system integration area showing machine-vision systems in action, and an area devoted to automotive applications.

Thinking about the future, VISION will now include a youth research competition that will provide 17–20-year-old students an exhibition stand for their machine-vision projects. Moreover, innovative German startup companies will be provided 80% of the funds needed for an exhibition booth by the German government. Topping this off, the show organizers expect more than 6000 attendees to visit the 300 exhibitors—roughly the same as in 2008.

After Walter’s positive outlook, however, Dietmar Ley, chairman of the VDMA Machine Vision Group, brought a dose of reality by predicting that if the current business trend continues, turnover in the German machine-vision industry will probably fall in 2009 by 30%, to €854 million—the same level of 2003. The glimmer of hope in Ley’s presentation related to new opportunities for machine vision in areas outside of industrial production, specifically security, agriculture, biomedical fields, and traffic monitoring.

Winds of change

Some of the new applications covered in this issue as well as traditional applications of machine vision in manufacturing bode well for the machine-vision industry as global markets begin to recover from recession. For example, wind turbine power has been expanding at double-digit rates and has been identified in a recent study by the Automated Imaging Association as a growth opportunity for machine vision. In this issue, an article by contributing editor Charlie Masi describes how a thermography-based automated inspection system is being used to find cracks and delaminations in turbine blades and keep wind turbine power systems in operation.

Machine vision in traditional manufacturing continues to improve product quality as shown in an article by contributing editor Winn Hardin on automotive glass inspection. Another by editor Tom Cintorino describes how a robotic work cell for inspecting military protective eyewear. Finally, in this issue, an article by contributing editor Charlie Masi describes how a thermography-based automated inspection system is being used to find cracks and delaminations in turbine blades and keep wind turbine power systems in operation.
The current factory machine vision, high-speed research, and military applications market often requires mobility and massive storage. This means that high-speed cameras that can be integrated with laptops or small computers are increasingly desirable. This feature enables capturing data from assembly lines on the factory floor or in the field. Thus cameras that can do in-camera processing or real-time compression are becoming more popular and are being increasingly adopted.

The main impediment to deployment of these portable vision systems has been the lack of real-time processing or massive data storage which is light-weight, flexible, and self-contained. FastVision has developed their FastCamera Series to achieve these goals. The 1.3 megapixel, 500 frames per second FastCamera13 can be purchased with up to one gigabyte of memory and a camera link or USB interface. A higher resolution camera is the FastCamera40 which has a four megapixel sensor, and can also record at 195 frames per second. Our newest camera, the FastCamera34 is a 200 frame per second VGA resolution smart camera at a price comparable to similar non-smart cameras. All these cameras can achieve real-time compression or use the new FastVault-FL, an 800 MBytes/sec flash recorder that stores up to 320 Gbytes of data. Also data reduction can be achieved by real-time, in-camera processing of images.

The FastCamera13, FastCamera40, and FastCamera34 also can be fitted with image intensifiers, providing up to a 70,000 to 1 gain. The spectrum coverage is quite wide, from UV into NIR. All of these cameras are priced competitively.

**UNIQUE FEATURES OF THE FASTCAMERA SERIES**

- Unparalleled in-camera memory for processing or storage
- Large Programmable FPGA for custom, in-camera applications.
- Lossless real-time, in-camera image compression of 1.5 – 2.1 for reduced download overhead and storage
- Lossy JPEG real-time in-camera compression which enables 20-30 seconds of storage, real-time USB 2.0 or basic camera link download using PCMCIA cards.

131 D.W. Highway #529, Nashua, NH 03060
Tel. 603-891-4317 • Fax: 603-891-2745
Email: sales@fast-vision.com • www.fast-vision.com
In the automotive market, dimensional problems during production of diesel engine injectors may cause problems in engine performance or fuel consumption. During production, injectors pass through several shaping operations before reaching the burr removal station, which is the last phase before packaging.

Traditionally, the injectors are manually inspected by operators, which is not cost effective and is subject to human error. Consequently, an industrial vision system was developed by Vistek (Istanbul, Turkey; www.vistekas.com) for Bosch Sanayi ve Ticaret to automate dimensional measurements with 50-μm precision. The burr removal station was the most suitable point to install the vision system and execute dimensional controls. Since the dimensional control operations are performed concurrently with the burr removal process, the system does not require additional time in the production cycle.

To achieve the desired precision of nine height and diameter measurements, the injectors are divided into eight subsections. The system captures one image for each section with a high-resolution camera from IDS (Obersulm, Germany; www.ids-imaging.de) and then performs image processing separately. The camera is mounted on a vertically moving platform to image different sections of each injector. The vision software was developed using the Halcon interactive development environment (IDE) HDevelop from MVTec Software (Munich, Germany; www.mvtec.com). Total inspection time for each injector is 7–9 s. A more complete system description is available on the Vision Systems Design web site.

New CMOS sensor aimed at scientific applications

Researchers from three imaging companies announced development of the Scientific CMOS (sCMOS; www.scmos.com) during Laser World of Photonics, held in Munich, Germany in June 2009. The new device offers a number of features that operate simultaneously: extremely low noise, rapid frame rates, wide dynamic range, high quantum efficiency, high resolution, and a large field of view.

The sensor was cooperatively developed by Andor Technology (Belfast, UK; www.andor.com), Fairchild Imaging (Milpitas, CA, USA; www.fairchildimaging.com), and PCO (Kelheim, Germany; www.pco.de), and has applications in biomedical research, astronomy, and security and defense.

The researchers said that sCMOS can be considered unique in its ability to concurrently deliver on several key parameters. Performance highlights of the first sCMOS technology sensor include 5.5-Mpixel (2560 × 2160 pixels) format; read noise of <2 e- rms @ 30 frames/s and <3 e- rms @ 100 frames/s; maximum rate; 6.5-mm pixel size; dynamic range of >16,000:1 @ 30 frames/s; QE max of 60%; and rolling or global shutter.


High Quality Digital Cameras for Vision Applications:

**Your Imagination is our challenge**

IDS GmbH is a manufacturer of high quality USB and Gigabit Ethernet industrial cameras. They’re headquartered in Obersulm, Germany and have a staff of approx. 80 employees. IDS Inc, their US subsidiary is located in Woburn, Massachusetts. The company also has a worldwide presence through a network of distributors.

They offer cameras for both interfaces under the well-known uEye® camera series which currently includes seven camera families and over 100 models. They cater not only to industrial vision markets such as automation and quality assurance, but also to new vision markets, such as security technology and non-industrial segments.

**The uEye® Industrial Camera Series**

uEye cameras are designed to meet all requirements a customer may have, from a physical standpoint where small form-factor is required, to a financial standpoint, where a low-cost solution is needed while still maintaining high standards in quality and performance. Rugged camera models compliant with the IP65/67 standards and designed for rough environments are also available in the uEye cameras series. IDS Imaging cameras are available with CCD and CMOS sensors and come with resolutions ranging from VGA up to 10 Megapixel, color and monochrome.

**Custom-Made Cameras for Special Requirements**

IDS Imaging offers over 100 different camera models that meet the requirements most customers may have. However, sometimes a custom design is needed. IDS Imaging employs a team of engineers that specialize in the customization of existing models and on the design of brand-new models designed around the custom requirements a customer may have.

**Optimum Software Support – The Second Half of the Camera**

To complement their lines of high-performance USB and GigE cameras, IDS Imaging offers a comprehensive SDK and drivers to ensure their cameras can be easily integrated into an application. More than two dozen sample programs are included with their SDK along with 3rd party drivers for VisionPro from Cognex, LabVIEW, Halcon, Neurocheck and Common Vision Blox. For those customers who want to use a standard interface to achieve camera interoperability, IDS Imaging offers DirectShow and GenICam support.

IDS Imaging Development Systems GmbH
Dimbacher Straße 6-8
74182 Obersulm
Phone +49(0)7134/96196-0
Fax +49(0)7134/96196-99
sales@ids-imaging.com

IDS Imaging Development Systems, Inc.
400 West Cummings Park, Suite 3400
Woburn, MA 01801, USA
Phone +1(781)787-0048
Fax +1(781)287-1258
usasales@ids-imaging.com

www.ids-imaging.com
Harsh Environment? uEye®!

USB uEye® RE
- Cable length up to 10 m
- Up to 10 Megapixel
- Stability up to 4 kV
- CE class B
- M8 connector
- M3 and M5 mounting threads
- Easiest integration with uEye® SDK and GenICam™

* with original accessories from IDS

USB
Board-level and housed models, including IP65/67. Maximum flexibility with long term availability.

GigE
Plug & Play with small form factor or built-in pre-processing.

www.ids-imaging.com
Phone: USA (781) 787-0048  Europe +49 7134/96196-0
INTEGRATION MADE EASY

ORCHESTRATE YOUR MACHINE VISION WITH maestro™

CONNECT, CONFIGURE, CONDUCT.
Power, safety, and trigger over a single 100m CAT5e cable for cameras and lights.

CONNECT
- GigE Vision®, FireWire®, USB® and CameraLink® cameras
- LED + laser light sources
- Encoders and automation I/O

CONFIGURE
- Setup over a web browser or using TCP/IP and XML
- Specify event timing to a microsecond

CONDUCT
- Trigger outputs by time or position
- Synchronize camera data with event stamps
- Queue numerous requests to activate downstream hardware
technology trends

Andrew Wilson, Editor, andyw@pennwell.com

Future Camera Link standards emerge

In an exclusive video interview with Vision Systems Design, Steve Kinney, chairman of the Automated Imaging Association (AIA) Camera Link committee and director of technical pre-sales and support with JAI (San Jose, CA, USA; www.jai.com) outlined two new proposals that will substantially increase the bandwidth of camera-to-computer interfaces.

“Recent advances in high-speed CMOS imagers,” says Kinney, “will demand interfaces that are far faster than the existing 6.25 Gbits/s currently supported by the Camera Link standard.” To accomplish this, the committee is now studying two proposals. CoaXPress, proposed by Adimec (Eindhoven, the Netherlands, www.adimec.com) and based on a high-speed line driver and equalizer chipset from Eqcologic (Brussels, Belgium; www.eqcologic.com) was mounted to the camera.

To track the millions of bottles of pesticides it produces per year, a global chemical manufacturer required a system to confirm the traceability of its products after they were packed into cases. After each bottle is filled and sealed, an inkjet printer applies a Data Matrix code on the top of each cap.

Once the open cases are packed, batches of cases move along a conveyor for palletizing at 70 ft/min. To read the Data Matrix codes of these bottles before palletizing, the company called upon Matrix Systems and Solutions (Sanborn, NY, USA; www.matrix-ssi.com) to develop an automated machine-vision system.

Instead of using multiple cameras, a single, monochrome 16-Mpixel GE4900 4872 × 3248-pixel CCD camera from Prosilica (Burnaby, BC, Canada; www.prosilica.com) running at 3 frames/s was selected because of its Gigabit Ethernet output, resolution capabilities, and speed. To capture a wide field of view, a Planar T* 1.4/50 ZF 35-mm lens from Carl Zeiss (Maple Grove, MN, USA; www.zeiss.com) was mounted to the camera.

With a focal length of 51.7 mm, an aperture range of f/1.4–f/16, and a focusing range of 0.45 m to infinity, the lens was selected instead of a telecentric lens to reduce cost.

Since more than one type of product needed to be inspected, the application required a relatively large field of view with the dimensions of the largest case being 397 × 320 mm and the smallest being 271 × 205 mm.

In the initial system design, Matrix tested Smart Vision Lights’ (SVL; Muskegon, MI, USA; www.smartvisionlights.com) Adjustable Dark Field Light (DFL). Since the swivel mounts on the DFL allow the lights to be adjusted, it was thought that this would provide a good overhead lighting array. However, initial testing of the DFL showed that the amount of glare or reflection from the white caps on the pesticide bottles

Pesticide continued on page 12

FIGURE 1. SVL’s backlight was customized as a large diffuse ringlight, or tent light, by cutting a hole in the center for camera placement.
failed to provide a useful image.

To overcome this problem, SVL customized its Large Light Panel (LLP) backlight as a large diffuse ringlight, or tent light, by cutting a hole in the center of the light for camera placement (see Fig. 1). After the LLP-2 was laser cut with a 30-mm hole in the center, it was shipped and tested, virtually eliminating the glare issues associated with the DFL (see Fig. 2).

As the cases of product move into the inspection station, a CMOS GV-H450 laser sensor from Keyence (Woodcliff Lake, NJ, USA; www.keyence.com) triggers the lighting and camera system to capture an image. After the image is captured, it is transferred via the camera’s Gigabit Ethernet interface to a quad core processor with 8 Gbytes of RAM running Linux.

Custom software is then used to unskew the large image captured by the lens, locate different quantities and orientations of bottles, and to read the Data Matrix code printed on each cap. Where this data can be read, cases are then moved along the production line, sealed, picked by a robot, and placed in cases.

If this data is unreadable, then stack lights strobe and the CPU controls a printer to produce a serialized rejection label that is later placed on the case to prevent untagged bottles from leaving the facility.

**FIGURE 2.** Using an adjustable darkfield light in a chemical manufacturer’s Data Matrix code recognition system resulted in a large amount of reflection from bottle caps (top). To reduce the effect, a large backlight was customized as a tent light to virtually eliminate glare (bottom).

**Camera Link continued from page 11**

Camera Link continues from page 11

Camera Link continued on page 15

**Pesticide continued from page 11**

failed to provide a useful image.

To overcome this problem, SVL customized its Large Light Panel (LLP) backlight as a large diffuse ringlight, or tent light, by cutting a hole in the center of the light for camera placement (see Fig. 1). After the LLP-2 was laser cut with a 30-mm hole in the center, it was shipped and tested, virtually eliminating the glare issues associated with the DFL (see Fig. 2).

As the cases of product move into the inspection station, a CMOS GV-H450 laser sensor from Keyence (Woodcliff Lake, NJ, USA; www.keyence.com) triggers the lighting and camera system to capture an image. After the image is captured, it is transferred via the camera’s Gigabit Ethernet interface to a quad core processor with 8 Gbytes of RAM running Linux.

Custom software is then used to unskew the large image captured by the lens, locate different quantities and orientations of bottles, and to read the Data Matrix code printed on each cap. Where this data can be read, cases are then moved along the production line, sealed, picked by a robot, and placed in cases.

If this data is unreadable, then stack lights strobe and the CPU controls a printer to produce a serialized rejection label that is later placed on the case to prevent untagged bottles from leaving the facility.

**FIGURE 2.** Using an adjustable darkfield light in a chemical manufacturer’s Data Matrix code recognition system resulted in a large amount of reflection from bottle caps (top). To reduce the effect, a large backlight was customized as a tent light to virtually eliminate glare (bottom).

**Camera Link continued from page 11**

Camera Link continues from page 11

Camera Link continued on page 15

**Pesticide continued from page 11**

failed to provide a useful image.

To overcome this problem, SVL customized its Large Light Panel (LLP) backlight as a large diffuse ringlight, or tent light, by cutting a hole in the center of the light for camera placement (see Fig. 1). After the LLP-2 was laser cut with a 30-mm hole in the center, it was shipped and tested, virtually eliminating the glare issues associated with the DFL (see Fig. 2).

As the cases of product move into the inspection station, a CMOS GV-H450 laser sensor from Keyence (Woodcliff Lake, NJ, USA; www.keyence.com) triggers the lighting and camera system to capture an image. After the image is captured, it is transferred via the camera’s Gigabit Ethernet interface to a quad core processor with 8 Gbytes of RAM running Linux.

Custom software is then used to unskew the large image captured by the lens, locate different quantities and orientations of bottles, and to read the Data Matrix code printed on each cap. Where this data can be read, cases are then moved along the production line, sealed, picked by a robot, and placed in cases.

If this data is unreadable, then stack lights strobe and the CPU controls a printer to produce a serialized rejection label that is later placed on the case to prevent untagged bottles from leaving the facility.

**FIGURE 2.** Using an adjustable darkfield light in a chemical manufacturer’s Data Matrix code recognition system resulted in a large amount of reflection from bottle caps (top). To reduce the effect, a large backlight was customized as a tent light to virtually eliminate glare (bottom).

**Camera Link continued from page 11**

Camera Link continues from page 11

Camera Link continued on page 15

**Pesticide continued from page 11**

failed to provide a useful image.

To overcome this problem, SVL customized its Large Light Panel (LLP) backlight as a large diffuse ringlight, or tent light, by cutting a hole in the center of the light for camera placement (see Fig. 1). After the LLP-2 was laser cut with a 30-mm hole in the center, it was shipped and tested, virtually eliminating the glare issues associated with the DFL (see Fig. 2).

As the cases of product move into the inspection station, a CMOS GV-H450 laser sensor from Keyence (Woodcliff Lake, NJ, USA; www.keyence.com) triggers the lighting and camera system to capture an image. After the image is captured, it is transferred via the camera’s Gigabit Ethernet interface to a quad core processor with 8 Gbytes of RAM running Linux.

Custom software is then used to unskew the large image captured by the lens, locate different quantities and orientations of bottles, and to read the Data Matrix code printed on each cap. Where this data can be read, cases are then moved along the production line, sealed, picked by a robot, and placed in cases.

If this data is unreadable, then stack lights strobe and the CPU controls a printer to produce a serialized rejection label that is later placed on the case to prevent untagged bottles from leaving the facility.

**FIGURE 2.** Using an adjustable darkfield light in a chemical manufacturer’s Data Matrix code recognition system resulted in a large amount of reflection from bottle caps (top). To reduce the effect, a large backlight was customized as a tent light to virtually eliminate glare (bottom).

**Camera Link continued from page 11**

Camera Link continues from page 11

Camera Link continued on page 15

**Pesticide continued from page 11**

failed to provide a useful image.

To overcome this problem, SVL customized its Large Light Panel (LLP) backlight as a large diffuse ringlight, or tent light, by cutting a hole in the center of the light for camera placement (see Fig. 1). After the LLP-2 was laser cut with a 30-mm hole in the center, it was shipped and tested, virtually eliminating the glare issues associated with the DFL (see Fig. 2).

As the cases of product move into the inspection station, a CMOS GV-H450 laser sensor from Keyence (Woodcliff Lake, NJ, USA; www.keyence.com) triggers the lighting and camera system to capture an image. After the image is captured, it is transferred via the camera’s Gigabit Ethernet interface to a quad core processor with 8 Gbytes of RAM running Linux.

Custom software is then used to unskew the large image captured by the lens, locate different quantities and orientations of bottles, and to read the Data Matrix code printed on each cap. Where this data can be read, cases are then moved along the production line, sealed, picked by a robot, and placed in cases.

If this data is unreadable, then stack lights strobe and the CPU controls a printer to produce a serialized rejection label that is later placed on the case to prevent untagged bottles from leaving the facility.

**FIGURE 2.** Using an adjustable darkfield light in a chemical manufacturer’s Data Matrix code recognition system resulted in a large amount of reflection from bottle caps (top). To reduce the effect, a large backlight was customized as a tent light to virtually eliminate glare (bottom).

**Camera Link continued from page 11**

Camera Link continues from page 11

Camera Link continued on page 15

**Pesticide continued from page 11**

failed to provide a useful image.

To overcome this problem, SVL customized its Large Light Panel (LLP) backlight as a large diffuse ringlight, or tent light, by cutting a hole in the center of the light for camera placement (see Fig. 1). After the LLP-2 was laser cut with a 30-mm hole in the center, it was shipped and tested, virtually eliminating the glare issues associated with the DFL (see Fig. 2).

As the cases of product move into the inspection station, a CMOS GV-H450 laser sensor from Keyence (Woodcliff Lake, NJ, USA; www.keyence.com) triggers the lighting and camera system to capture an image. After the image is captured, it is transferred via the camera’s Gigabit Ethernet interface to a quad core processor with 8 Gbytes of RAM running Linux.

Custom software is then used to unskew the large image captured by the lens, locate different quantities and orientations of bottles, and to read the Data Matrix code printed on each cap. Where this data can be read, cases are then moved along the production line, sealed, picked by a robot, and placed in cases.

If this data is unreadable, then stack lights strobe and the CPU controls a printer to produce a serialized rejection label that is later placed on the case to prevent untagged bottles from leaving the facility.
concentrated performance

**GC-Series: Ultra-compact GigE Vision™ cameras**

Our cameras are designed and manufactured in-house to deliver a more robust and integrated product that meets the highest quality standards. Our products are noted for their high performance, ultra-compact size, light weight, fast frame rates, wide range of resolution, advanced triggering, sophisticated controls, industrial ruggedness, rich set of camera features and extreme versatility.

www.prosilica.com
Our Company

Silicon Software GmbH was founded 1997 in Mannheim. The company produces off-the-shelf as well as customized OEM solutions by hardware and software developments. The hardware spectrum is focussed on development and production of industrial FPGA based technology products. Main application focus in Machine Vision is the industrial automation and quality inspection.

Our Product Range

Base products are the series of intelligent image acquisition and processing boards. These products cope with complex visual tasks and high speed applications in real time. Advantage of this technology is the programmability of the on-board vision processors allowing a broad possible field of applications. Complex functional units are replaced with completely different functions in fractions of seconds.

Further focus is the VisualApplets product series. This graphical software tool dramatically eases the programming of vision processor hardware. Even software programmers and application engineers will be able to generate demanded and time-critical applications on hardware in a few minutes.

Our Concept

Increasing requests for improvements in Machine Vision require advanced, flexible and high performance solutions. Silicon Software is one of the international technology leaders with innovative product lines for a broad range of applications and as service provider for customized solutions.

For this purpose Silicon Software produces image processing boards with FPGA vision processors for standard-PCs, as well as individual OEM products. Based on these products, solutions are realized for industrial Machine Vision applications with requirements on reliability, flexibility and efficiency and high demand for real-time image processing.

Your Applications

Image processing products of Silicon Software are successfully integrated in various fields of applications and industry sectors since years. The advanced flexibility and scalability of our product line and the option of subsequent adaptations and enhancements, which are realized by customized implementations as well as implementation by customers themselves, are competitive advantages in the market. The use of VisualApplets, which enables a transfer of image processing tasks on FPGA hardware and the release of CPU load at the same time, enables our customers to design smaller, more reliable, more efficient and less expensive systems.

The development services will help to realize applications and systems in an advantageous short time with a Time-to-Market at optimal costs. A broad range of workshop and coaching offers will accompany our customers during the implementation phase.

OEM solutions of Silicon Software are installed in Machine Vision applications as well as in applications of medical technology, video and network technology and as programmable image processor accelerators in Machine Vision cameras.

Our Partners

Products of Silicon Software are internationally distributed by our sales partners. Our experienced partners will offer excellent service and comprehensive support for all your application requirements.

http://www.silicon-software.com/sales.html
Camera Link continued from page 12

ing the company claimed that 40 m might be possible with a custom cable.

“By adopting this standard,” says Kinney, “system designers could use InfiniBand host bus adapters and chipsets that are widely available from a number of vendors. If adopted, the interface could be incorporated into an FPGA within the camera or frame grabber interface, lowering the cost of implementation.”

The CoaXPress demo system shown by Adimec also incorporates an FPGA to format data; however, this is not a specific benefit for HSLINK. Such a standard has yet to be adopted by any Camera Link camera or frame grabber vendor.

At the Robots & Vision show, Adimec did show a working implementation of a coaxial interface based on the Eqcologic chipset (see Fig. 1). “CoaXPress offers higher speeds than Camera Link and is a cost-effective solution for customers who want longer, flexible cables and simple connectors,” says Jochem Herrmann, CTO at Adimec. “Many applications already use coaxial cable as the physical layer with which to transfer image data since it is relatively inexpensive and easy to install. By using the same physical layer, these systems can be upgraded from low-resolution analog to high-resolution digital systems.”

Adimec’s system uses Eqcologic’s EQCO62T20 high-speed line driver with integrated low-speed receiver within the Adimec OPAL camera to transmit data at an equivalent 3.125-Gbit/s Camera Link Base bandwidth to an EQCO62R20 high-speed equalizer with integrated low-speed receiver (see Fig. 2). Later this year, Adimec expects an increase to 6.25 Gbit/s to support its higher-speed cameras.

The demonstration shown at Robots & Vision used a small converter box to reformat the CoaXPress data into Camera Link format and transferred the data to a Phoenix Camera Link frame grabber from Active Silicon (Iver, UK; www.activesilicon.com). At the VISION Show taking place in November 2009 (Stuttgart, Germany), Active Silicon plans to show a frame grabber board with a mezzanine interface especially designed to interface to the CoaXPress interface. In the same period, Adimec expects its full range of digital cameras to be offered with the CoaXPress interface.

“Because this implementation uses coaxial cable, it is easy to install and has inherent flexibility,” says Herrmann. “Furthermore, power can also be transmitted over the same cable.” A single coaxial cable can be used to transfer data, camera control signals, and power over 50 m.

While currently available integrated serializers/deserializers also allow CX1 or CX4 cables to transfer data over copper cables, it remains to be seen how the Camera Link committee will address the issue of power transmission if this standard is adopted. Likely as not, the approach taken will be similar to that of the current Camera Link implementation.

FIGURE 2. In the design of the interface, an Eqcologic EQCO62T20 high-speed line driver with integrated low-speed receiver within the Adimec OPAL camera transmits data to an EQCO62R20 high-speed equalizer with integrated low-speed driver.

The World of Image Processing

Competence • Innovation • Reliability

> Processing image data of FULL Configuration cameras in real-time
> Acquiring image data from GigabitEthernet cameras with less interrupt load and protocol overhead
> Processing GigabitEthernet cameras without CPU load
> Connecting Power over CameraLink cameras
> Using enhanced functionalities of VisualApplets
> Realizing image processing on hardware with VisualApplets by yourself

www.silicon-software.com | info@silicon-software.de | +49 (0) 621.789 507 0
LightWise
Smart Camera Series

• Line Scan cameras
  o LW-ELIS-1024A-1394
    • 10K lines per sec, 10MHz
    • 7.8 x 125 Micron Pixels
  o LW-SLIS-2048A-1394
    • 28K lines per sec, 60MHz
    • 7 x 7 Micron Pixels
  o LW-PE-2048-1394
    • 19K lines per sec, 40MHz
    • 14 x 14 Micron Pixels

Area Cameras

o LW-WVGA-G-1394
  • 72fps. Full Frame Global Shutter
  • 768 x 480 Mono & Color
  • 110db Dynamic Range!

o LW-1.3-S-1294 or LW-3-S-1394
  • 30fps@1.3MP, 12fps@3MP
  • Synchronous Shutter
  • 1280 x 1024 or 2048 x 1536
  • Color (-C) or Mono (-M)

o LW-1.3-G-1394-M
  • 30fps, Full Frame Global Shutter
  • 1280 x 1024 Mono only

o LW-5-S-1394
  • 5Mp 12fps@5MP, 30fps@VGA
  • 5Mp 2592 x 1944
  • Color (-C) or Monochrome (-M)
  • Synchronous Shutter
  • 1944a (400) or 1394b (800)

NEW 10 MP

o LW-10-S-1394
  • 10Mp 11fps@5MP, 30fps@VGA
  • 10Mp 3856 x 2764
  • Color (-C) or Monochrome (-M)
  • Synchronous Shutter

Programmable Color Image Path
  w/ Digital Pan & Zoom + JPEG options,
External Trigger & Strobe I/O,
On-Board Image Buffer & FPGA’s

LOW-COST for OEM’s!

Custom Camera Design

• ISG Custom Camera and Imaging Design Services for OEM’s throughout the world.
• Experience with all camera interfaces including
  GigE Vision, 1394, CameraLink, etc.
• Smart Cameras using, High-Performance CPU’s,
  DSP’s, On-Board Memory & FPGA’s
• ISG Image Pipeline for Integrated Image Processing
  and customer specific Algorithms.
• Full Custom IC Design and ASIC design services for
  Imaging Applications.
• Low-Cost Manufacturing based in the USA.

Introducing the
Octopus

• 8 Remote Sensor Heads
  • Any sensor of your choice
  • Can be a variety of different sensors
  • Each head can be up to 50 feet long
• 3 different I/O combinations
  • GigE Plus CameraLink
  • GigE Plus (2) 1394b (800) ports.
  • GigE Plus Monitor I/O
• USB2 Port
• Triggers & Strobes
• Linux CPU & Large FPGA
• Very Low Cost

For more detailed specifications visit or call:

http://www.isgchips.com/vsd

If you register at this page and mention this advertisement ISG will send
you a free gift.

Sales-VSD@ISGChips.com
585-388-5220
TRADE SHOW REVIEW

Lights, cameras, and action highlight Robots & Vision Show

Despite the currently dire economic landscape, exhibitors at the June 2009 International Robots, Vision & Motion Control Show (Rosemont, IL, USA) were pleasantly surprised at the number and quality of the attendees. In the space of three days, more than 4000 visitors managed to visit some of the 140 exhibitors on the floor and attend tutorials and application sessions on robotics, machine vision, and motion control.

Reflecting the vibrancy of the industry, several companies used the show to announce new products targeted firmly toward developers of machine-vision systems. For example, as a first-time exhibitor at the show, Vieworks (Gyeonggi-do, South Korea; www.vieworks.com) displayed a range of high-speed Camera Link and GigE-based megapixel cameras.

Using image sensors from Kodak and Aptina, Vieworks currently offers 15 different cameras ranging from the VH-V264, a 640 × 480-pixel, 264-frame/s Camera Link camera to the VC-IM160C-MC10, a 2352 × 1728-pixel, 160-frame/s Camera Link camera based on an Aptina CMOS imager. According to sales manager Peter Lee, the company is currently looking for distributors in both the United States and Europe.

Like many GigE-based cameras, the GigE cameras offered by Vieworks must be powered over a separate power cable. To reduce the interface to just one cable, Artur Didyk, engineering manager at Components Express Inc. (CEI; Woodridge, IL, USA; www.componentsexpress.com) showed how CEI’s Power over Ethernet Plus (PoE+) adapter could be used to allow non-PoE cameras to operate with a Power over Ethernet switch. “Some systems require more than the 12.95 W supported by the current IEEE 802.3af (PoE) standard,” says Didyk, “but by using the new IEEE 802.3at (PoE+) standard, the BIT MAXX adapter extends the power delivered through Ethernet cables to 24 W, nearly doubling the power that can be delivered to a PoE system.”

“By using the BIT MAXX splitter, system developers can eliminate lengthy power cables, power supplies, and AC outlets they may be using since the BIT MAXX splitter recovers both power and data signals from the attached PoE+ hub.

Using image sensors from Kodak and Aptina, Vieworks currently offers 15 different cameras ranging from the VH-V264, a 640 × 480-pixel, 264-frame/s Camera Link camera to the VC-IM160C-MC10, a 2352 × 1728-pixel, 160-frame/s Camera Link camera based on an Aptina CMOS imager. According to sales manager Peter Lee, the company is currently looking for distributors in both the United States and Europe.

Like many GigE-based cameras, the GigE cameras offered by Vieworks must be powered over a separate power cable. To reduce the interface to just one cable, Artur Didyk, engineering manager at Components Express Inc. (CEI; Woodridge, IL, USA; www.componentsexpress.com) showed how CEI’s Power over Ethernet Plus (PoE+) adapter could be used to allow non-PoE cameras to operate with a Power over Ethernet switch. “Some systems require more than the 12.95 W supported by the current IEEE 802.3af (PoE) standard,” says Didyk, “but by using the new IEEE 802.3at (PoE+) standard, the BIT MAXX adapter extends the power delivered through Ethernet cables to 24 W, nearly doubling the power that can be delivered to a PoE system.”

“By using the BIT MAXX splitter, system developers can eliminate lengthy power cables, power supplies, and AC outlets they may be using since the BIT MAXX splitter recovers both power and data signals from the attached PoE+ hub.

FIGURE 1. System developers can effectively eliminate any lengthy power cables they may be using with GigE cameras since CEI’s BIT MAXX splitter recovers both power and data signals from the attached PoE+ hub.

Using image sensors from Kodak and Aptina, Vieworks currently offers 15 different cameras ranging from the VH-V264, a 640 × 480-pixel, 264-frame/s Camera Link camera to the VC-IM160C-MC10, a 2352 × 1728-pixel, 160-frame/s Camera Link camera based on an Aptina CMOS imager. According to sales manager Peter Lee, the company is currently looking for distributors in both the United States and Europe.

Like many GigE-based cameras, the GigE cameras offered by Vieworks must be powered over a separate power cable. To reduce the interface to just one cable, Artur Didyk, engineering manager at Components Express Inc. (CEI; Woodridge, IL, USA; www.componentsexpress.com) showed how CEI’s Power over Ethernet Plus (PoE+) adapter could be used to allow non-PoE cameras to operate with a Power over Ethernet switch. “Some systems require more than the 12.95 W supported by the current IEEE 802.3af (PoE) standard,” says Didyk, “but by using the new IEEE 802.3at (PoE+) standard, the BIT MAXX adapter extends the power delivered through Ethernet cables to 24 W, nearly doubling the power that can be delivered to a PoE system.”

“By using the BIT MAXX splitter, system developers can eliminate lengthy power cables, power supplies, and AC outlets they may be using since the BIT MAXX splitter recovers both power and data signals from the attached PoE+ hub.
KNOCKS OUT YOUR TOUGHEST APPLICATION

A champion for 15 years, the Matrox Imaging Library just can’t be beaten! MIL 9’s image processing tools give you the agility, power and speed to come out on top... in every round.

Get with the MIL 9 program to:
- Solve applications with field-proven tools
- Harness the full power of multi-core CPUs, GPUs, and distributed processing
- Obtain live images from any interface
- Maintain flexibility with support for a wide range of computing platforms

TRY MIL FREE FOR 30 DAYS
www.matroximaging.com/mil
required a light that could read a glossy label on the disk, inspect the surface of the disk for defects, and inspect for the existence of a center clamping ring on the disk.” Unfortunately, there was no space in the production line to build up three control stations; thus, all three tests needed to be performed at one workstation.

To achieve this, Latab’s Super Dome is a combination of three types of illumination: a diffuse domelight to illuminate the glossy label, a darkfield ringlight composed of satellite LEDs that is used for highlighting surface defects, and a ringlight that is used to increase the contrast of the center ring on the disk. “Using just a single multifunctional light allowed a single work-cell inspection system to perform all three tests,” says Schumann.

Although hardware was very much the highlight of the show, one of most interesting demonstrations was the RecogniSense software being demonstrated by Recognition Robotics (Westlake, OH, USA; www.recognitionrobotics.com). Simon Melikian, company president, demonstrated how within a few seconds the software could be used to recognize images somewhat regardless of their size and orientation.

Once recognized, coordinates of the object were then transferred to a robot controller, translated into real-world coordinates, and used by a robotic pick-and-place system. Although Melikian was somewhat reticent to explain the algorithms used to perform this recognition, saying only that they were based on “how the visual cortex of the brain works,” the results were very impressive. According to Melikian, two robotics-based systems that use the software are already in use at Chrysler car body plants.
SONY VISUAL IMAGING PRODUCTS, a division of Sony Electronics Inc., is a world renowned leader in camera technology. Sony’s high quality, industrial CCD video cameras include GigE, Smart Cameras, IEEE 1394.b, Camera Link®, analog B/W, high-speed progressive scan, high-definition, color, network, block and video conferencing cameras. From machine vision and factory automation to inspection and process control, Sony cameras offer value, choice and flexibility.

FEATURED PRODUCTS
NEW! Sony’s New Line Up of GigE Vision® Cameras
Sony recently introduced its new line up of GigE cameras. The XCG Series incorporates the GigE Vision interface which is specifically standardized for machine vision applications based on Gigabit Ethernet technology.

The XCG Series consists of four models:
- XCG-V60E – 1/3-type PS CCD, VGA resolution at 90 fps
- XCG-SX97E – 2/3-type PS CCD, SXGA resolution at 16 fps
- XCG-U100E – 1/1.8-type PS CCD, UXGA resolution at 15 fps
- XCG-5005E – 2/3-type PS CCD, 5 Mega Pixel at 15 fps

The use of an Ethernet cable and availability of a wide variety of peripheral devices contribute to significant cost-cutting benefits when designing a complete vision system. These C mounted cameras measure 44 × 33 × 67.5mm, deliver a resolution depth of up to 12 bits per pixel with a shutter speed of 1/100,000s. These cameras are ideally suited for a wide range of machine vision, factory automation, security and quality control applications.

High Definition, It’s in our HDNA.
Sony, a leader in HD technology, has expanded its popular block series with a new HD color camera, the FCB-H11. With its high sensitivity, multi-format video outputs (1080i/720p, and NTSC/PAL) and auto ICR for day/night function, the FCB-H11 is ideal for inspection, security, broadcast, traffic and IP monitoring applications.

Seeing is Believing With Sony’s 5 Mega Pixel and Ultra-Compact, High-Resolution PoCL Cameras.
Designed to capitalize on all the benefits of digital technology and to minimize the connectivity challenges, Sony’s XCL-5005CR color and XCL-5005 monochrome cameras boasts more than 5 million effective pixels for demanding industrial inspection applications.

Both the XCL-5005 and XCL-5005CR cameras incorporate a 2/3-type progressive scan IT CCD that produces ultra-high resolution images at 15 fps. The XCL-U100 is equipped with a 1/1.8-type progressive scan IT CCD that captures outstanding UXGA resolution images (1,600 × 1,200 pixels) at 15 frames per second. In addition, these cameras employ the standard Camera Link with PoCL (Power over Camera Link) interface enabling users to simplify connections to various machine-vision systems and are compatible with standard C-mount lenses adding to their cost-effectiveness.

Sony’s comprehensive XCL series also includes digital cameras with a choice of resolutions from VGA, XGA to UXGA.

MARKETS SERVED
Sony customers include system integrators, OEMs, end-users, and developers involved in the following applications:
- Machine Vision
- Factory Automation
- Bioscience / Microscopy
- Robotics
- Pharmaceutical
- Security and Defense
- Traffic/Mobile Police Monitoring

New 2009 Catalog
Request a free copy today!

Sony Visual Imaging Products
One Sony Drive, Park Ridge, NJ 07656
Tel: 201-930-7000
Fax: 201-358-4401
Email: sony.cameras@am.sony.com
www.sony.com/videocameras
Cameras with far-reaching effects.

Sony XCG Series GigE Vision® Cameras

Experience the ultimate enhancements in machine vision with Sony’s new line up of GigE Vision cameras. Extend your reach with long range Ethernet cabling. Capture more details with resolution options of up to 5 megapixel. Extend the dynamic range with Sony’s Sequential Trigger feature. Camera choices include the flexibility of near-IR capability and speeds of up to 90 frames per second. Best of all, all these cameras deliver the amazing sensitivity and picture quality you’d expect from the world leader in CCD image sensors: Sony.

System Applications:
• 1D/2D Readers
• Biomedical and Bioscience
• High-end Security
• Part Inspection
• Pattern Recognition
• Pharmaceutical

XCG Series: XCG-5005E, XCG-U100E, XCG-SX97E and XCG-V60E

🔗 click: sony.com/gige
Prosilica manufactures high performance digital cameras for machine vision and industrial applications. Prosilica’s Gigabit Ethernet cameras are used in a wide variety of applications including industrial inspection, machine vision, semiconductor imaging, food processing, traffic and security, as well as a wide range of test and measurement applications.

**High Performance**

Our cameras are designed and manufactured in-house to deliver a more robust and integrated product that meets the highest quality standards.

Our products are noted for their high performance, ultra-compact size, light weight, fast frame rates, wide range of resolution (from VGA to 16 megapixel), advanced triggering, sophisticated controls, industrial ruggedness, rich set of camera features and extreme versatility. They feature the latest progressive scan CCD and CMOS sensors for high image quality. Capable of streaming image data at a sustained 125MB/s transfer rate, the Prosilica Gigabit Ethernet interface is the fastest in the industry, 25% faster than our nearest competitor.

**FEATURED PRODUCTS:**

**GE4900: 16 Megapixel GigE camera**

The 16-megapixel GE4900 is a very high-resolution CCD camera with Gigabit Ethernet output. The GE4900 incorporates the 35 mm format Kodak KAI-16000 CCD image sensor that provides exceptionally high resolution, high sensitivity, low smear and precise exposure control to provide excellent image quality and performance.

**GE4000: 11 Megapixel GigE camera**

The 11-megapixel GE4000 features the 35 mm format Kodak KAI-11002 progressive scan CCD sensor. Two high-speed outputs allow up to 5 frames per second at full resolution and even faster using Area of Interest Readout (ROI). The 12-bit A-to-D provides high-quality images to meet the most demanding applications.

**COMING SOON:**

**New GX-Series Double the Speed of GigE through Link Aggregation**

The GX-Series feature two Gigabit Ethernet ports configured as a Link Aggregation Group (LAG) to provide a sustained data rate of up to 240 MB/s. Link aggregation is a technology that groups multiple Ethernet ports so that they act as a single port. The host computer sees a GX-Series camera as though there is only one GigE cable connected.

Three models will initially be released: GX1050 (1 Megapixel, 120fps), GX1660 (2 Megapixel, 60fps) and GX1910 (2 Megapixel HD resolution, 60fps). The GX-Series include unique features such as 3-axis motorized lens control and video-autoiris controls.
Protective eyewear destined for military use must withstand the effects of different types of munitions and be free of defects such as scratches, pits, or bubbles. The eyeglasses are molded from impact-resistant polycarbonate that is covered with a scratch-resistant coating. In addition to inspecting these eyeglasses for defects within the polycarbonate itself, any drips or runs caused by the application of the scratch-resistant coating must also be detected during the manufacturing process.

To ensure its product has no such defects, a US-based eyewear manufacturer called upon AV&R Vision & Robotics to develop an automated inspection system capable of analyzing surface defects.

“Usually,” says Michael Muldoon, business solutions engineer with AV&R, “surface imperfections on the eyeglasses are inspected manually and compared to a scratch and dig paddle.” The paddle, available from Edmund Optics and other suppliers, is a means by which any scratch or dig in the surface can be compared.

Using the paddle, any defect is defined by a scratch number followed by the dig number. This standard was developed during World War II from Frankford Arsenal in Philadelphia, PA, and is based on the appearance of a scratch. Because different scratch structures could have the same appearance, it is difficult to determine the physical size of these standards. But they are still in use for optical quality requirements. In highly demanding optical quality, as in the defense industry, the biggest crack acceptable in the viewing area is a scratch-dig of 20-10, which roughly corresponds to 2-μm width scratch and 1-μm diameter dig.

Rack them up
After each individual lens blank is molded and coated, it is placed in a rack that can contain between 6 and 24 pieces, depending on the type of lens being manufactured. This rack is then manually placed inside...

FIGURE 1. To perform automatic surface inspection of military eyewear, AV&R has developed a robotic-based work cell that uses robots and vision to inspect eyeglass blanks at a rate of approximately 15 parts per minute.
General Company Description
Fiberoptic Systems, Inc. was established in 1982 beginning with large-scale production runs of reflective, randomized multi channel read heads as well as miniature light integrators for blood gas analyzers. In 1998, FSI expanded to a larger facility and purchased a state of the art drawing tower for production of high transmission optical fiber. This allowed FSI to stay competitive and assure the quality of standard fiber optic illumination products. Our experience and expertise allows us to make recommendations regarding feasibility, choice of fiber material, layout and interface with electro optical devices.

Chief Spectroscopic Techniques Supported
FSI has designed and manufactured fiber assemblies for applications including: oximetry, brain probes, muscle probes, catheters, fluorescence studies, temperature sensing, and bioluminescence, among others.

Markets Served

Major Products/Services
From prototype to production, UV to IR, cryogenic to high temperature, our engineering staff will be glad to design a solution to fit your budgetary, delivery, and quality requirements. Available fiber types include: Fused Silica, Borosilicate, Plastic, Fluoride, Chalcogenide, Silver Halide and Sapphire. Standard products include: Single and Multi-Branch Light Guides, Spot to Line Converters, Digital Fiber Links, Fiber Optic Illuminators, Ring Lights, and Gooseneck Light Guides.

Facilities
FSI is the only fiber optics manufacturer on the West Coast producing high transmission glass fiber. The 10,000 square foot facility houses corporate, sales and marketing, engineering, and all production disciplines.

FIBEROPTIC SYSTEMS, INC.
60 Moreland Road, Unit A
Simi Valley, CA 93065
Tel: 800-995-8016 / 805-583-2088
Fax: 805-583-4018
Email: Sales@fiberopticsystems.com
www.fiberopticsystems.com
Looking for the brightest, most reliable light sources in the world? Look no further. Our ring lights, line light converters, and fiberoptic illuminators provide you with rugged, low-power solutions for any machine vision or image processing application.

For complete details go to: www.fiberopticsystems.com
CAD software eliminates manual testing of samples

A machine-vision system usually requires a human operator to train the regions of interest to be inspected and the types of defects to be detected. Once analyzed, the data are compared with data obtained by a human operator. However, difficulties arise when guaranty must be given about the inspection coverage, especially when complex shapes occur. "To eliminate this process," says Michael Muldoon, business solutions engineer with AV&R, "AV&R created a surface-inspection development environment (SIDE) that allows CAD models of each part to be used in a virtual simulation environment."

SIDE was developed using LabVIEW and is currently an internal tool that enables AV&R’s engineers to be more efficient in deploying and designing systems as well as in working remotely with customers to train new part numbers and validate inspection routines.

During the robotic surface inspection of an aircraft engine turbine airfoil, for example, more than 100 images may need to be analyzed, all taken from different positions. In the past, the training of the inspection routine was all done manually using the teach pendant of the robot and separate vision software. The coverage capability was estimated based on received samples and tests. This type of training can be tedious, time consuming, and risky from a performance standpoint.

Using SIDE, the system developer can simulate in 3-D the vision system, lighting, how the robot manipulates the part, and the part-light-camera interaction during inspection. "In this way," says Muldoon, "part defects can be simulated and the results of any light reflected from them can be used to control the position of a simulated robotic-based vision system."

Then, before any system or new part number is deployed into production, the system developer will have developed the entire inspection routine offline, including the robot path and required vision tools. The software seamlessly performs a robot simulation to test each position, ensuring the robot can reach every point safely. This routine is then downloaded to the system for validation. SIDE also features a reverse engineering routine that takes the configuration files from a system in the field and performs a validation on the entire sequence.

Using modeling techniques, SIDE ensures all areas of the part have been inspected and for each area the correct angles of inspection have been established. This ensures all the defect types and orientations have been accounted for, which is critical for components destined for the aerospace and medical industries.
Intelligent OEM Camera

Intelligent components by VRmagic feature an autonomous Linux operating system. Algorithms can be transferred to the camera using a cross-compiler.

- 300 MHz ARM9 processor
- 800 MHz DSP, 4800 MIPS
- optional FPGA
- 128 MB RAM
- 512 MB flash-memory
- Standard Debian Linux
- UBIFS filesystem
- GCC cross compiler
- Resolutions from VGA to Megapixel
- 100 Mbit Ethernet
- Trigger und Strobe
- USB Host and RS232
- General Purpose I/Os
- Analog video output

All VRmagic components are controlled by the same API.

For more information on streaming, smart, and intelligent components by VRmagic please contact:

VRmagic GmbH
Augustaanlage 32
68165 Mannheim
Germany

Phone  +49 621 400 416 - 20
Fax    +49 621 400 416 - 99
www.vrmagic-imaging.com
info.imaging@vrmagic.com

FIGURE 2. In operation, a robot is used to pick eyeglass blanks from a rack and mount them onto an optical inspection system where they are rotated in front of a linescan camera.

FIGURE 4. Defects such as scratches are classified according to a standard scratch and dig test while defects such as pits must be rejected if they are larger than 20-μm diameter.

is found in an area close to the rim of the eyewear, then the part may be passed. If such a defect is found toward the center of the eyewear, then the part may be classified as faulty.

“The operator can control the defect detection and segregation algorithms to define the types of defects and set specific pass/fail thresholds based on their size, shape, and location,” says Muldoon (see Fig. 3). After an image of the eyewear is captured, these defects are located by first performing a threshold operation and then performing blob analysis on the thresholded image. By comparing each scratch to those specified on the scratch and dig paddle, each scratch can be classified. Depending on the width of each scratch, the part is classified good or bad. Similarly, any bubble or pit greater than 0.15 mm within a critical area of the eyeglasses is also classified as a defect (see Fig. 4).

After this inspection is complete, pass/fail data generated by machine-vision software running on the PC is used to actuate the gripper releasing good parts onto a conveyor. Should the part be bad, the rotary arm is moved 45° and the part released into a reject bin. At the same time, the Fanuc robot loads the next lens pair onto a second robot gripper located opposite the first.

“In this way,” says Muldoon, “the system can inspect a single lens blank once every 3.5 s.”

The human touch

“In the development of the system,” says Muldoon, “it is vital that the machine be capable of performing equally well as a fully trained operator.” To ensure this, the test protocol involves a random sampling of 100 eyeglass molds to be cycled through the system three times. After the image data are analyzed, they are compared with results obtained by a human operator and a Kappa test is used to determine the degree of agreement between the two results.

“By performing this test, the system can be adjusted so that the agreement between the human operator and the automated inspection is acceptable,” says Muldoon. “In this way, our customer is assured that the system is capable of performing at least as well and often better than a human operator.”
HALCON 9.0 is good for you.

People who meet industrial challenges every day need something to feel more comfortable. This is our contribution: HALCON 9.0. Its new formula contains lots of vitamins like enhanced performance, a completely new matching technology, processing of extremely large images and much more. Apply every day – and feel healthy.

For more information: www.halconists.com
A product of MVTec
DISCOVER THE POWER OF BLUE
FULLY INTEGRATED TECHNOLOGY — FROM SENSORS TO SOLUTION

DALSA is the only industrial imaging company in the world to offer a **fully integrated technology** path.

- a secure and dependable supply of image sensors from our wholly-owned and operated semiconductor foundry
- a single source for your system build – from image sensors to fully integrated solutions – with service and support for image capture, analysis, processing and vision software
- coherent, synergistic technology design and development across our suite of products to allow ease of integration and performance optimization.

**SENSORS**

**CAMERAS** Unmatched speed, responsivity, and dynamic range; 8,10, and 12 bit output, programmability, flat field correction, and on-board camera diagnostics.

**FRAME GRABBERS** The industry’s most reliable and versatile family of frame grabbers. Acquire images from multiple cameras and formats, with on-board processing, and programmability.

**IMAGE PROCESSORS** Our image processing technology integrates high-bandwidth acquisition, real-time scalable processing, embedded FPGA-based programming and autonomous operation.

**VISION SOFTWARE** DALSA bundles image acquisition and control with image processing tools to provide developers with the critical functionality to design, develop, and deploy high-performance vision systems.

**VISION SOLUTIONS** Our vision solutions package image capture, acquisition and processing to meet a variety of demanding applications – from positioning robotic handlers to complete assembly inspection and verification.

Discover the Power of **DALSA’s Integrated Technology**

Download our Machine Vision Products Overview to learn more.

[www.dalsa.com/mvb/v8](http://www.dalsa.com/mvb/v8)
The recession presents a number of challenges for the automotive industry. Just two years ago, automotive glass manufacturers were adding capacity, particularly in China. The picture has changed dramatically. Now there is over-capacity. As suppliers fight for orders, manufacturers feel pricing pressure. Therefore, factory productivity is a key strategy as the automotive glass industry emerges from this recession.

The use of automated optical inspection is one of the tools that can be employed to improve factory productivity and guarantee higher quality. Recently, one of the world’s largest manufacturers of automotive glass, Saint-Gobain, looked to glass inspection machine-vision specialist, SynergX Technologies to develop a system that could inspect both the surface and edges of automotive glass.

SynergX developed a brightfield inspection system that uses eight linescan cameras: one to determine the position of the glass as it enters the inspection station, another four cameras with laser line generators and movable targeting optics to inspect the edges, and another three cameras with red LED line generators to inspect the surface of the glass. Initial results show that the system is able to detect 100% of automotive glass with defects, allowing the customer to sort between glass that can be reworked and glass that needs to be returned to the supplier (see Fig. 1).

Bright to dark
SynergX originally designed its Auto Glass Inspection (AGI) system using a combination of brightfield and darkfield imaging. Brightfield detects intensity changes caused by defects absorbing transmitted light passing through the glass, while darkfield imaging finds defects that reflect off-axis illumination rather than absorb it.

By moving from laser line generators to red LED lights with special optics and improving noise filtering via dedicated image-processing

FIGURE 1. The Auto Glass Inspection system, developed by SynergX, uses eight linescan cameras to inspect glass panel edges and surfaces for a variety of defects.

In a highly price-sensitive business, the Auto Glass Inspection system provides quality information for incoming windows so that glass window manufacturers can go back and get credit from suppliers for defective glass.

“The SynergX autoglass inspection systems have become an integral part of our production processes. The systems not only improve our product quality but increase our production line yields. Just as important is the service and support that SynergX provides our factories worldwide.”

—Stephane Artaud, Engineering Director
Saint-Gobain Sekurit International
The AGI system is installed after the cutting of glass, grinding of edges, and subsequent washing station but before paint bands are applied. The glass window is run under the edge inspection machine created excessive amounts of defects, thus cutting down on waste and boosting productivity.

Because the glass is not stamped with a serial number, the easiest solution was to connect an operator interface to the vision system that tracked defective parts. The system showed the operator where defects are located on each window and allowed the operator to determine whether the glass can be reworked or not.

Before an inspection routine begins, the operator creates a computer model of the glass to be inspected. The glass window is run under the first of AGI’s cameras, which collects an image of the glass and presents it to the operator on a nearby desktop PC. The operator can segment the glass into different sections, each with its own maximum, borderline, and minimum defect size, as well as determine what types of defects are acceptable and which are not.

For instance, a shiner (a missed area of grinding) on the edge of a window is unacceptable, but it may be possible to repair the edge and save the glass, a bubble or stone in the middle of the glass is scrap. When the operator initiates the inspection system, the model identifier for that particular product is sent from the PLC to the vision system. The PLC also operates the vision station’s conveyor so that the line can be run in bypass mode should the vision system require maintenance.

Light on the edge

As a window exits the washing station, it passes under the AGI’s first DALSA Piranha2 2000-pixel Camera Link linescan camera. This “squaring camera” is mounted above the conveyor line and collects an image of the glass as it moves underneath at constant speed. The images are passed along a Camera Link cable to one of two custom-made I/O boards inside the Pentair compactPCI industrial computer, which performs all the processing for the machine-vision system.

The image passes through an Altera FPGA mezzanine board attached to the GE Fanuc single-board computer with an Intel dual-core processor. The FPGA performs filtering functions on the image and then runs blob analysis to determine the x, y position of the glass on the conveyor. This information will be used to split the window into four quadrants for edge inspection.

The glass continues into the AGI inspection enclosure. In each corner of the enclosure, SynergX mounted a 6000-pixel Piranha2 Camera Link linescan camera with Fresnel lens so that...
they are aligned parallel to the glass edge. A laser line generator illuminates the edge of the window as it passes through the inspection station.

Each camera will inspect a portion of the edge for shiners, chips, and other defects. The portion is determined by the AGI system based on information collected by the squaring camera.

Since the edge detection creates a surface map based on how the laser light deflects from the edge, the distance between laser light, glass edge, and camera must be known. To stay within a set area, mirrors are mounted on four vertical towers placed in each corner of the AGI inspection station. Based on the window’s edge location—as determined by the squaring camera—the mirrors are moved up and down to maintain an equal distance between laser, edge, and camera (see Fig. 2).

**Clearer now**

While the edge inspection is in process, three red LEDs with Fresnel lenses from Edmund Optics turn the diffuse LED light into a bright line that shines down on the glass as it passes below on the conveyor. Below the conveyor, SynergX mounted three more 2000-pixel Piranha2 Camera Link cameras to capture the transmitted light.

Each camera/LED pair can inspect an area up to 400 mm across, hence the need for three cameras to capture the entire window as it moves through the inspection zone. Above each camera is another Fresnel lens that collects the light and focuses it onto the linear array.

Again, images are sent line-by-line to the compactPCI computer and filtered for noise on the FPGA mezzanine board. Using pixel-intensity information, the AGI system searches pixels for values that fall within three ranges: acceptable, defective, and borderline.

When potentially defective values are located, the FPGA performs a blob analysis and histogram of the blob to determine whether the defect is large enough to be a defect and, if so, what type of defect. Based on the size, type of defect, and location within the window, AGI makes a final determination whether the defect is acceptable, failed, or borderline (see Fig. 3).

The vision system stores defect statistics and images locally on a hard drive and displays them on a separate operator’s PC located next to the reject station. The display shows each window in the defect accumulator in order, with defects highlighted in green for acceptable, yellow for borderline, and red for fail.

**Company Info**

- **Altera**, San Jose, CA, USA, [www.altera.com](http://www.altera.com)
- **DALSA**, Waterloo, ON Canada, [www.dalsa.com](http://www.dalsa.com)
- **Edmund Optics**, Barrington, NJ, USA, [www.edmundoptics.com](http://www.edmundoptics.com)
- **GE Fanuc**, Charlottesville, VA, USA, [www.gefanuc.com](http://www.gefanuc.com)
- **Pentair Electronic Packaging**, Schaumburg, IL, USA, [www.pentair-ep.com](http://www.pentair-ep.com)
- **SynergX Technologies**, Laval, QC, Canada, [www.synergx.ca](http://www.synergx.ca)
The company, with its 300 employees, has more than 20 years of experience in image processing. Product designs are driven by industry requirements and offer excellent image quality, easy interfacing, compact size, and a strong price/performance ratio. Customers can choose from a broad portfolio of over 200 different camera models. Basler’s product portfolio includes line scan and area scan cameras. Customized capabilities and individual camera development are available based on customer requirements.

Technological Leadership

Basler was a forerunner in the development of user-friendly, high-performance interfaces and in the establishment of interface standards. We are active in several committees that expand existing standards and develop new ones. GigE Vision in particular has established itself as a powerful, capable interface technology. Several thousand delivered scout, pilot, and runner cameras have been integrated into many different applications, demonstrating a high level of customer acceptance and underlining Basler’s pioneering role in Gigabit Ethernet based industrial imaging. At the same time, Basler’s successful IEEE 1394a/b and Camera Link™ cameras have been around since the market introduction of these technologies.

High Quality and an Excellent Price/Performance Ratio - Basler’s Mainstream Camera Portfolio

<table>
<thead>
<tr>
<th>Camera Series</th>
<th>Sensor Type</th>
<th>Resolution</th>
<th>Speed / Line Rate</th>
<th>Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>runner</td>
<td>Line scan CCD mono and color</td>
<td>1024 pixels, 2048 pixels, 2098 pixels x 3 lines</td>
<td>Up to 56.1 kHz</td>
<td></td>
</tr>
<tr>
<td>pilot</td>
<td>Area scan CCD mono and color</td>
<td>VGA, 1, 2, and 5 megapixels</td>
<td>32 to 210 fps</td>
<td></td>
</tr>
<tr>
<td>scout</td>
<td>Area scan CCD/CMOS mono and color</td>
<td>VGA, CCIR, XGA, 1.4, and 2 megapixels</td>
<td>14 to 100 fps</td>
<td></td>
</tr>
<tr>
<td>scout light</td>
<td>Area scan CCD mono</td>
<td>VGA, 1, and 2 megapixels</td>
<td>14 to 60 fps</td>
<td></td>
</tr>
<tr>
<td>aviator</td>
<td>Area scan CCD mono and color</td>
<td>1 megapixel</td>
<td>Up to 120 fps</td>
<td></td>
</tr>
</tbody>
</table>

NEW High-End Performance Meets Mainstream Pricing – The Basler aviator

The Basler aviator is a new series of high-speed mainstream cameras. Based on Kodak’s new KAI-1050 CCD sensor with a resolution of 1024 x 1024 pixels, the first models of the aviator series push the speed barrier to a new height of 120 frames per second. Progressive scan readout and global shutter technology combined with a Camera Link data interface make the aviator camera well suited for various application areas such as semiconductor and electronics manufacturing, metrology, and medical imaging. Two additional models with two megapixel resolution will be available in Q4/2009.

The Solution for Maximized Throughput – The Basler sprint

The Basler sprint is a newly developed high-speed line scan camera family in the Camera Link arena. Its sensor was specifically developed for Basler and is designed to run at the highest possible speed, to be very light sensitive, and to have an outstanding signal-to-noise ratio (SNR) under low light conditions. The new Basler sprint line scan family includes models with resolutions from 2k to 8k pixels and line rates from 20 kHz to 140 kHz. This means that the sprint is currently the fastest line scan camera in its class.

Quick Integration and Easy Operation – The Basler pylon Driver Package

The comprehensive Basler pylon driver package integrates both a GigE Vision and an IEEE 1394 interface. The free pylon software package provides drivers, a C++ camera API, a viewer tool, comprehensive documentation, and code samples to make it easy to start using and integrating Basler cameras.

www.baslerweb.com

Basler Vision Technologies
Germany Headquarters
Phone +49 4102 463-500
Fax +49 4102 463-550
bc.sales.europe@baslerweb.com

USA
Phone +1 610 280 0171
Fax +1 610 280 7608
bc.sales.usa@baslerweb.com

Asia
Phone +65 6425 0472
Fax +65 6425 0473
bc.sales.asia@baslerweb.com
Finding flaws inside fiber-reinforced plastic (FRP) wind-turbine blades is important to organizations charged with keeping wind turbines running and making electricity. They can be owners of wind farms, wind-turbine producers and installers, or even specialized crews providing turbine-blade inspection as a service. To meet this need, Automation Technology (AT) has developed a lock-in thermography imaging system for nondestructive testing (NDT) of these composite structures.

FRP is a composite material in which highly inelastic fibers, oriented to resist tensional loads, are “laid up” in layers held together by a thermosetting plastic (such as epoxy resin) matrix. Fibers in various layers have different orientations to resist differently oriented stresses. For example, there will be layers with fibers running directly from a wind-turbine blade’s root to tip to resist centrifugal forces. Other layers will have fibers running diagonally to resist twisting forces. The plastic matrix carries compression and shear stresses between fibers, forcing them to work together to achieve the desired mechanical properties.

Delaminations arise when the plastic matrix fails under shear loads between fiber layers. This may be caused by the matrix failing directly, or by fibers failing and increasing the shear stress on the matrix surrounding them, which causes it to fail in turn. In any case, the result is a flat crack parallel to and at some depth beneath the blade’s surface.

These flaws form weak spots that cause stress to concentrate in the unbroken plastic at their margins, so they tend to grow over time. Each time the load peaks—for example, due to a wind gust—the crack advances into previously unbroken material, further weakening the blade. After many load cycles, the blade weakens to the point where it fails catastrophically.

AT’s customers use the company’s lock-in thermal-wave inspection system to evaluate the FRP skin’s condition on an ongoing basis and as a failure-analysis tool.

The technique utilizes a phenomenon called thermal waves, which can be set up by depositing heat at the material surface in a time-varying fashion. The thermal-wave phenomenon exploits a similarity between the general diffusion equation

\[ u_t = D u_{xx} \tag{1} \]

and the wave equation

\[ w_{tt} = c^2 w_{xx} \tag{2} \]

where subscripts refer to partial differentiation. Thus \( u \) is the first partial derivative of \( u \) with respect to time, and \( w_{xx} \) is the second partial derivative of \( w \) with respect to position. In the diffusion equation, \( u \) represents the concentration of whatever is diffusing (such as heat), so in Eqn. 1, it represents temperature.
STEMMER IMAGING is Europe’s largest imaging technology provider with subsidiaries in Germany, United Kingdom, France and Switzerland. The parent company was formed in 1987 in Puchheim and expanded in 2004/05 by combining the expertise of the companies formerly known as FIRSTSIGHT VISION Ltd. (UK), IMASYS S.A.S. (France) and OmniRay (Switzerland).

STEMMER IMAGING customers have access to a wide variety of imaging products from the world’s leading manufacturers, carefully selected and evaluated by our experts. In combination these manufacturers provide cutting edge vision technology across all product segments, something that is unique in Europe.

STEMMER IMAGING are the developers of the world’s leading independent, modular programming library for imaging applications, Common Vision Blox (see www.commonvisionblox.com), and also manufacture application-specific products to enable complex solutions to be realised easily. We have extensive in-house expertise to draw on with a high percentage of engineers, allowing us to supply the best possible service to our customers when choosing an imaging solution. STEMMER IMAGING does not install end user solutions - instead, using our close partnerships with a large number of experienced system integrators, we can provide expert technical know-how for the planning, integration and realisation of complete solutions.

In fact, the services provided by STEMMER IMAGING go far beyond just this: with more than 30 years of imaging experience and a staff of more than 120 employees, we are able to offer comprehensive support services to all of our customers. Our experts can support you from A to Z - finding the best technical solution and the most cost effective combination of components for your imaging task - assisting you in a solution-oriented and reliable way, before, during and also after the project. Feasibility studies, training and direct customer support are just some of the examples of the value add we give you.

As Europe’s largest imaging technology supplier our customers not only benefit from our knowledge when specifying a solution but also from extremely competitive pricing due to our purchasing volume and fast delivery from our stock of over 3 million €.

This broad range of components and solutions, plus our experience and our comprehensive support allows us to offer you everything you need to solve your imaging task. This fact helped our customers to successfully build many thousands of imaging applications throughout the world.

STEMMER IMAGING -
Imaging is our passion!

G E R M A N Y

STEMMER IMAGING GmbH
Gutenbergstraße 9–13
82178 Puchheim
Phone: +49 89 80902-0
Fax: +49 89 80902-116
info@stemmer-imaging.de
www.stemmer-imaging.de

U N I T E D K I N G D O M

STEMMER IMAGING Ltd.
The Old Barn, Grange Court
Tongham, Surrey GU10 1DW
Phone: +44 1252 780000
Fax: +44 1252 780001
info@stemmer-imaging.co.uk
www.stemmer-imaging.co.uk

F R A N C E

STEMMER IMAGING S.A.S.
23 bis, rue Edouard Nieuport
92150 Suresnes
Phone: +33 1 45069560
Fax: +33 1 40991188
info@stemmer-imaging.fr
www.stemmer-imaging.fr

S W I T Z E R L A N D

STEMMER IMAGING AG
Rietbrunnen 48
8808 Pfäffikon SZ
Phone: +41 55 4159090
Fax: +41 55 4159091
info@stemmer-imaging.ch
www.stemmer-imaging.ch
In the wave equation, \( w \) represents whatever is waving, such as water depth or sound pressure. Both \( D \) and \( c \) are scalar constants, and both equations refer to plane waves.

Both equations have solutions when driven by a sinusoidal forcing function

\[
f = A \sin(\omega t)
\]

where \( A \) is a scalar amplitude, \( \omega \) is the angular frequency in radians per second, and \( t \) is time. The difference is that the solution for Eqn. 1 is an ordinary wave, which has a constant amplitude as it moves along, whereas the solution to Eqn. 2 is an evanescent wave whose amplitude decreases exponentially with distance from the surface (see Fig. 1). While an ordinary wave carries vibrations through the material, like a sound wave through FRP, the oscillations in an evanescent wave are trapped in a layer about a wavelength thick below the material’s surface.

Thus, a sinusoidally varying source depositing heat on the surface of a turbine blade will set up evanescent heat waves. When the heat deposition is high, the surface temperature rises rapidly and heat soaks into the material, raising the temperature beneath. As the heat source cools, however, the temperature at the surface cools rapidly, pulling heat back out of the interior and setting up a heat wave.

**Evanescent waves**

If it were an ordinary wave, over time a standing wave would build up with constant amplitude through the material’s thickness. Being an evanescent wave, however, by the time it has reached one wavelength in, its amplitude is drastically reduced. Should the wave encounter a crack or delamination, its penetration is even more drastically reduced because the heat cannot penetrate past the broken surface.

AT uses high-powered halogen lights to deposit heat on the turbine blade’s surface at a constant rate depending on the lamps’ power level, the area illuminated, and the surface material’s infrared emissivity. The system sinusoidally modulates the light amplitude to excite a heat wave. The heat-wave amplitude...
depends on power rate, the material’s specific heat, and the amount of material in the affected zone.

While heat continually soaks in, raising the average temperature of the blade material, the heat wave is a disturbance riding on top of that average level. So, the temperature measured at the surface becomes the sum of a monotonically increasing function of time and a sinusoid with constant amplitude.

When a delamination or crack is buried less than one wavelength below the surface, the heat wave is blocked and thus affects less material. Its amplitude therefore becomes larger. This effect can be measured at the surface.

A thermal imaging camera mapping the surface temperature at a frame rate much faster than the light modulation rate will see a delamination “shadow” as an area where the temperature-oscillation amplitude is higher than that of the surrounding area. The relative amplitude increase provides a measure of the depth of the delamination. A similar technique called transient thermography uses a pulsed heat source to excite heat waves but is more susceptible to interference from environmental effects.

AT has developed software to compare thermal images in a long sequence to map the temperature-oscillation amplitude as a function of position over the inspection area and convert that amplitude to depth below the surface. The system’s final output is an image showing any delaminations within the measurement range, with the delamination depth coded by either color or gray level. Cristian Ferber, applications engineer at AT, says he personally prefers grayscale displays, but many of his customers expect pseudocolor images.

If there are no delaminations in the imaged area, the image shows a uniform light gray. If the measurement range is, say, 2 cm, delaminations appearing farther in will be indistinguishable from solid material. A delamination at a depth of, say, 1.5 cm will appear as a slightly darker patch of gray. A delamination only 1.0-cm deep will appear much darker, and one only 0.5-cm deep will appear darker still.

As one can imagine, however, for thermal waves attempting to penetrate FRP, frequencies are down in the submillihertz region. At such frequencies, it makes more sense to think in terms of the period $(2\pi/\omega)$. The period of a 1-mHz wave is about 15 minutes, which provides a penetration depth of only a few millimeters. To reach penetration depths of many centimeters requires very long test periods.

The penetration depth attainable in a test is thus constrained by how much time can be practically devoted to making the test. To reach greater depths requires spending more time acquiring data.

Noise, noise, noise
On time scales of tens of minutes and longer, the outdoor thermal environment is fairly noisy. Wind gusts, heating from direct solar irradiation, and solar heating variations due to intermittent cloud cover all add significant noise to the sinusoidal forcing function. To maximize the signal-to-noise ratio (SNR), AT engineers have employed a signal-analysis technique called lock-in detection, which they implemented in software.

How deep into the material the technique can see depends, of course, on the wavelength, which equals the product of the wave speed in the material and the heat source’s variation (i.e., the forcing function) frequency. The wave speed in turn depends on the ratio of the material’s thermal conductivity to its specific heat, which are both constants for the material. The wave speed is thus also a material constant. To look more deeply into the material, engineers need only lower the frequency.

FIGURE 2. Pseudocolor lock-in thermography images show subsurface delaminations and flaws as areas of heightened thermal-wave amplitude. Flaws closer to the surface cause greater thermal-wave amplitude increases.

FIGURE 3. Automation Technology designed custom interface electronics (the IrX-Box) to coordinate image acquisition from the IR camera with a thermal forcing signal from the halogen lamp array. The company’s IrNDT software running on a host computer performs lock-in detection of thermal waves in the image sequence.
Lock-in detection relies on the fact that if you multiply two sinusoidal signals together, then integrate their product over an infinite time, the resulting signal amplitude is a Dirac delta function (also called an impulse function) of the difference in frequency between the two signals. This technique, called convolution, makes it possible to pick out a particular signal in a noisy environment. The convolution integral equals the product of the two signals multiplied by a delta function.

Scientists and engineers have used the convolution integral as the basis for (among other things) Fourier transforms, resonant filters, heterodyne and superheterodyne radio receivers, and lock-in detectors. Practical implementations generally combine an incoming signal (such as a thermal-wave signal) and a locally synthesized comparison signal at the frequency of interest. Lock-in detection’s ability to separate waves at the forcing-function frequency from out-of-band noise makes it possible to improve lock-in thermography’s SNR.

In AT’s turbine-blade inspection application, the lock-in detector is implemented in software. An infrared camera collects thousands of images of the surface temperature pattern in an approximately 1-m² area on the turbine blade during a test session. The frame rate is typically on the order of 1000X the forcing function frequency, so the total number of images is roughly the number of forcing cycles in the test times 1000. The amount of image-storage memory is thus another practical constraint on how deeply engineers can look into a turbine blade and how precisely they can pinpoint a defect’s depth.

The AT software, named IrNDT, multiplies the temperature of each pixel in each image times the forcing function value at the instant the image was taken, then adds the result to a memory location for that pixel. After repeating the process for every image in the data set, the computer holds a map of the convolution integral for each pixel in the image.

Random environmental influences do not correlate well with the forcing function, so they have little influence on the map. Thermal waves, however, correlate strongly with the forcing function and thus strongly influence the map. Stronger thermal waves produce larger integral values.

After subtracting a gray level and rescaling to fill the dynamic range, the result is an image of the turbine blade with a more-or-less uniform background level and darkened islands outlining cracks and delaminations. The closer a flaw is to the surface, the darker it appears. Gray-scale levels can also be translated into false color maps coding depth against a spectrum (see Fig. 2).

**Making it real**

The technique starts with engineers specifying approximately seven test areas at critical positions on the turbine blade. They predetermine test parameters, such as modulation periods, frame rates, and acquisition durations, tailored to each particular area to be inspected. If these sample areas show no defects, the blade passes. If any defects are found, additional inspections covering more of the blade might be called for. Damage severity depends on the size and location of defects found. For example, a small delamination at the blade root, where both flexural

**Get a clearer look at your most demanding imaging applications**

The new 16 megapixel CCD camera series from JAI offers a unique combination of high resolution, advanced pre-processing functions and industrial grade reliability for highly predictable performance.

Pre-processing functions include programmable look-up tables, blemish compensation and automatic channel balancing. A specialized internal heat sink and a ridged housing design deliver excellent thermal management and low noise operation for superior image quality.

Contact JAI today to hear more about how these new 16 megapixel cameras can give you a clearer, more detailed look at your most demanding megapixel imaging applications.
moments and tensile forces are highest, might be more serious than a much larger void at the tip, where stresses are relatively small.

Wind turbine blades are made by encasing a relatively light core, which determines the overall blade shape, in a sheath or skin made of FRP, which carries the bulk of the stresses. This skin tends to be thicker near the blade root, where forces and momentum are largest, and thinner farther along the blade. Thus, modulation periods and acquisition times tend to be longest near the root. Frame rates, however, tend to be controlled by the available image-acquisition memory. Generally, engineers want to acquire as many images as possible at each test location, so they usually fill up the available memory for each test. So longer acquisition times call for lower frame rates.

The InNDT software allows engineers to load the entire test procedure, including sample-area locations and the test parameters for each area, into computer memory. Technicians can then mount the test set, consisting of the computer, halogen lamp assembly, infrared camera, and support electronics onto a movable platform attached to the wind turbine (see Fig. 3). The platform provides 360° access around the blade. Moving the platform up and down the turbine...
support mast allows them to reach the entire blade length (see Fig. 4).

To set up the test, they aim the lamp assembly at an angle to the blade surface and aim the camera normal to the blade. Thus, the camera has a direct view of the blade with no projection effects and avoids specular reflections of the lamp from the blade’s smooth surface. This arrangement allows the camera to monitor surface temperatures across the test area while the lamp assembly heats it more or less uniformly. The slight variation in heat rate caused by blade-surface curvature is predictable and easily compensated by the IrNDT software.

The software controls the acquisition through a proprietary interface called the IRX-Box. It generates trigger signals for the camera, and an illumination power-level signal for the lamp-assembly power supply (PowerBox). The camera returns acquired images through a standard digital video interface such as GigE or FireWire.

Because wind-turbine installations vary so much, AT builds what amounts to a semi-custom system for each installation. They have designed the IRX-Box, for example, to accommodate most IR camera models and specify the camera interface to match the camera selected. The company so far has more than 200 installations in the field.

“This method works very well for detecting defects near the surface,” Ferber points out. “Users typically detect defects as deep as 10–15 mm below the surface. If you want to see defects that are deeper into the material, you have to do measurements over a longer period of time. At some point, the measurement time becomes so long that it’s not worth doing. For lock-in measurements, typical measurement times would be between 30 sec to 5 min depending on what you want to achieve. You can do measurements over a half hour and you would see defects that are deeper in, but imagine if you have to cover an area of so many square meters! With 5 min you could reach about 10 mm.”

The technique’s main advantage is that it can cover large areas in one measurement and routinely check condition of many blades rapidly. Also, the equipment is easily transportable from one turbine to another. A third advantage is that lock-in thermography is less affected by external influences such as sun and wind, so blades can be checked in situ, with no need to dismount them and bring them into a shop.

Finally, software control allows engineers to predefine a test procedure for a given blade type, then have technicians use it for routine monitoring of many blades of that type. The engineers can then concentrate on failure analysis of blades found to be running into trouble.
Grasshopper®: high performance, compact size, big value

Every little Grasshopper is full of big features. Big resolutions (11 CCD models, up to 5MP). Big sensitivity (EXview HAD CCD™). And big performance (2MP at 30FPS over FireWire, 14-bit A/D). Get a big bite of value (USD $1195 to $3195)

Join the pack: www.ptgrey.com/thinkbig
Embedded Intelligence

Smart camera vendors are leveraging embedded processors and on-board software to increase the ease of use of their products

Andrew Wilson, Editor

Leveraging the developments in digital signal processors (DSPs), RISC-based processors, and low-cost CPUs, smart camera vendors are now offering relatively low-cost products that can replace host-based machine-vision systems. Embedding image capture, processing capability, on-board memory, and standard camera interfaces, these autonomous networked smart camera systems dramatically reduce the final cost of machine-vision and image-processing systems.

In the development of smart cameras, vendors have recognized the need to provide system integrators with products that can be easily tailored for specific machine-vision applications. Encompassing a number of different image sensors, processors, and I/O interfaces, many of today’s smart cameras are bundled with software packages that range from basic compiler support to sophisticated machine-vision software capable of performing functions such as geometric pattern matching and color analysis.

Selecting software

Although currently available smart cameras can be differentiated by their hardware functions, the choice of which camera to purchase may be more dependent on the software that is offered by each manufacturer. Cameras can be classified as those that offer basic software development tools and low-level development libraries, those that can be configured to perform machine-vision tasks such as gauging and image analysis, and those that are offered with full software development packages. The sophistication of the developer, time to market, and cost of deploying the systems is of paramount importance.

Programmers who wish to implement relatively low-cost smart camera systems may only require products such as the leanXcam smart camera from Supercomputing Systems, a Blackfin DSP-based camera that runs under μClinux. The camera is supplied with the freely available Open-Source Camera (OSCar) Software Framework that provides a library of programs together with source code.

Although low-cost hardware may be more difficult to program, it does allow system developers to build more sophisticated machine-vision cameras. FiberVision, for example, offers a number of smart cameras based around camera modules from Vision Components. In its latest Caminax smart camera, FiberVision’s software allows developers to graphically edit machine-
Expanding the NI Smart Camera Product Family

Higher Performance and Resolution

- Three new models for embedded machine vision applications
- New DSP coprocessors for pattern matching, OCR, and data matrix reading
- Built-in industrial connectivity

> Read the whitepaper at ni.com/smartcamera

800 891 2755

FIGURE 1. FiberVision’s software allows developers to graphically edit machine-vision programs without programming or using script code. Here, the gradient manager tool is being used to search for dark objects on a bright background.

vision programs without programming or using script code (see Fig. 1). In addition to allowing up to 250 regions of interest to be monitored, the camera’s on-board software allows programs to be configured as images are acquired.

Graphical development

To rapidly configure machine-vision applications more easily, companies such as PPT Vision and Soliton Technologies offer software developers graphical development tools with their smart cameras. At present these software tools can only be used with each company’s smart camera, forcing system integrators into adopting a single development environment when developing a machine-vision system.

Despite this limitation, the software tools do supply developers with an easy method to deploy machine-vision functions. Included in PPT Vision’s IMPACT Software Suite, for instance, the company’s IMPACT Vision Program Manager (VPM) features approximately 120 tools including OCR, blob analysis, circle gauge, circular pattern find, line find, and subpixel gauging. A preconfigured operator panel is built within VPM so inspection data and pass/fail results can be displayed within the same software application.

For its Digital Spot-It smart camera, Soliton supplies software that enables the developer to develop custom image-processing routines without programming. The company’s Vision Artist (SVA) package allows system integrators to develop an image-processing script that includes image acquisition, image-processing functions, and I/O control (see Fig. 2). Using SVA, various image-processing algorithms can be applied to the images acquired from Digital Spot-It and tested to ensure that the script produces the correct results for each of the test images.

FIGURE 2. Soliton’s Vision Artist package allows system integrators to develop an image-processing script for its Digital Spot-It smart camera. Functions include image acquisition, image-processing functions, and I/O control.
Time to market
The trend toward faster time to market has also been recognized by those companies that have traditionally been associated with offering sophisticated machine-vision and image-processing software. Both Matrox Imaging and National Instruments, for example, have tailored their software as easy to configure GUI-based development packages that can be used with their smart camera offerings.

With the introduction of its Iris GT smart camera, Matrox offers an integrated development environment (IDE) called the Matrox Design Assistant, in which machine-vision applications are created by constructing a flowchart instead of writing code. This IDE also enables users to directly design a graphical operator interface to the application (see Fig. 3).

Similarly, for its range of smart cameras, NI offers its Vision Builder for Automated Inspection (AI) software, a configurable machine-vision development environment that requires no programming. With Vision Builder AI, developers can build machine-vision applications without the use of a programming language. Interestingly, both the Matrox Image Library (MIL) and NI LabView are also available on other smart cameras, most notably those from Sony Electronics.

Companies that in the past only offered software products for use with their own smart cameras are now beginning to recognize the importance of establishing a broad

FIGURE 3. For its Iris GT smart camera, Matrox offers an IDE called the Matrox Design Assistant in which machine-vision applications are created by constructing a flowchart instead of writing code.

FIGURE 4. Halcon machine-vision software from MVTec runs on multiple smart cameras including Sony’s XCI-V100/C and XCI-SX100/C. By using Windows XP Embedded in the camera, application development can be performed either in the smart camera or on PC using the company’s IDE.
product focus Smart Cameras

Do you want your production processes to be faster and more secure? Do you want to reduce your error ratios and minimise rejects? Do you want to manufacture at a more reasonable cost and improve your products?

Then you are a VISIONARY, too!

Optimise your quality assurance by using intelligent machine vision systems. VISION, the world’s leading trade fair for machine vision and identification technologies, will be presenting solutions for a number of industries such as machine building, the automotive industry, the packaging and food industry, transport and logistics, security technology and much more. In the Application Park and the VISION Integration Area, we will be showcasing state-of-the-art system solutions and innovative machine vision applications.

base for their products. Acknowledging that time to market is important, companies such as Cognex have begun strategic alliances with camera manufacturers.

Started in January this year, the Cognex alliance now has 10 members including Allied Vision Technologies, DALSA, Point Grey Research, and Sony. While many of these companies do not (yet) offer smart cameras, Sony now offers VisionPro from Cognex as an option on its XCI series.

Embedded solutions

Capitalizing on the growing trend toward embedding software in smart camera products, companies that presently only develop machine-vision software have also ported their software to smart cameras. Halcon 9.0 software from MVTec Software also runs on Sony’s XCl-V100C and XCl-SX100C and, by using Windows XP Embedded in the camera, application development can be performed either in the smart camera or on a PC. This can be done using MVTec’s Integrated Development Environment (IDE) that allows developers to build image-processing solutions fast while acquiring images (see Fig. 4).

In addition to running on Sony smart cameras, Halcon is supported on the eXcite camera from Basler Vision Technologies, the SM2-D1024-80/VisionCam PS intelligent camera from Photonfocus, and the eneo SC Series from Videor. MVTec has also performed initial performance measurements of Halcon 9.0 running on smart cameras from Vision Components.

Despite the large number of cameras available, the number of companies currently offering smart camera products is still relatively small. Perhaps the main reason for this is the cost of embedding sensors, FPGAs, on-board processors, memory, and interfaces into standalone systems. However, with miniaturization on the upswing, it will become increasingly easy for camera manufacturers to develop ever smaller smart cameras at lower cost.

To compete, companies that currently support limited software capability with their camera offerings may be forced to develop more sophisticated programs. Those companies that only offer machine-vision software on their own camera products may also move toward deploying this software across cameras from multiple vendors. Likely as not, a meeting of both of these approaches will occur, providing a boon for software developers and system integrators alike.
Point Grey offers more than 75 different imaging, stereo, and 360-degree spherical digital cameras, with a variety of monochrome and color CCD and CMOS image sensors from VGA to 5 megapixels. Many product families also offer board-level or customized options for specific OEM applications. In addition, Point Grey has introduced its FirePRO™ line of professional FireWire hubs, repeaters and host adapter cards, which are designed to maximize the effectiveness and reliability of the entire imaging pipeline.

Point Grey Research, Inc. is a worldwide leader in the development of advanced digital camera technology products for machine vision, industrial imaging, and computer vision applications. Based in Richmond, BC, Canada, Point Grey designs, manufactures and distributes IEEE-1394 (FireWire) and USB 2.0 cameras that are known for their excellent quality, performance, and ease of use.

A broad range of hardware, software, and mechanical engineering skills has allowed Point Grey to successfully bring innovative and groundbreaking products to market. This drive for innovation has led to many industry firsts, including both the first and the world's smallest 1394b digital camera.

Since being founded in January of 1997, the company's approach to product pricing, quality control, and customer service has attracted thousands of customers worldwide, and its organic growth through product sales has enabled the company to expand significantly without any outside investment. Point Grey currently employs more than 80 people worldwide, and has a wholly-owned German subsidiary that provides sales and support services to customers in Europe, Africa and Israel. The company has also established a strong network of distributors in Japan, Korea, China, and Singapore.

All Point Grey cameras and FirePRO products are built using state-of-the-art manufacturing facilities, located in the company's 41,000 squarefoot (3,800 sq m) corporate headquarters. These facilities include a dedicated SMT line, AOI and X-ray machines, industrial clean room, and automated test stations.

The "Seal of Quality" label that is applied to each Point Grey camera cannot be printed until the camera has been 100% inspected and tested. This rigorous quality testing, together with hassle-free product warranties, ensures that customers can rely on Point Grey cameras for their demanding vision applications.

Point Grey is also proud to offer world-class support on installation, configuration, customization and trouble-shooting, so that customers derive significant value from their camera systems. Quick response email and phone support, online user manuals and knowledge base articles, and regular software and firmware updates are designed to deliver a superior ownership experience.

Contact us for pricing and information on our camera evaluation program!

www.ptgrey.com

POINT GREY RESEARCH, INC.
12051 Riverside Way, Richmond, BC, Canada V6W 1K7
T: +1.604.242.9937 T: +1.866.765.0827 (toll free)
F: +1.604.242.9938 E: sales@ptgrey.com

POINT GREY RESEARCH GMBH
Schwiebertinger Strasse 60, 71636 Ludwigsburg, Germany
T: +49 7141 488817-0 F: +49 7141 488817-99
E: eu-sales@ptgrey.com
Microscan Precision Data Acquisition and Control Solutions

Machine Vision, Precision Lighting and Auto ID
Microscan is a global technology leader focused on precision data acquisition and control solutions serving a wide range of automation and OEM markets.

Track, Trace, and Control Solutions
We help thousands of manufacturers around the world to drive down cost and waste, automate processes, and increase yields.

What We Do
Microscan helps manufacturers around the world drive down cost and waste, automate critical manufacturing processes, and increase yields through Track, Trace, and Control Solutions.

Technology Leadership
Microscan has a strong history of technology innovation. We are the inventor of the laser diode barcode scanner, and the 2D symbology, Data Matrix. Today, Microscan continues to be a recognized technology leader within the machine vision and auto ID industries.

Applications
We enable critical production level applications such as:
- Quality control
- Work-in-process monitoring
- Guiding the movement of goods
- Component level traceability
- Sortation
- Lot tracking
- Quality inspection
- Verification
- Gauging
- Measurement

Our Products
Microscan has an extensive product portfolio of machine vision and barcode auto ID products.

- Barcode Auto ID
  - Fixed readers
  - Handheld readers
  - Verifiers

- Machine Vision
  - Hardware
  - Software
  - Lighting

FREE trial version of Visionscape® software:
www.microscan.com

Contact us:
Tel: 800.762.1149
Fax: 425.226.8250
Email: info@microscan.com
www.microscan.com
Camera Link units come in two- or four-tap models

The AViVA II camera series features sensors with resolution up to 4k pixels with various pitches. Available with Camera Link interface in either four or two taps, the camera delivers 68-dB dynamic range with up to 160-MHz operation in standard format (higher speeds available for custom versions). The first releases will be the EM2 CL series two-tap Camera Link and the EM4 CL series four-tap Camera Link models. They maintain the mechanical footprint of the current AViVA models—specifically the 56 × 60-mm front face.

Schneider Optics, Hauppauge, NY, USA, www.schneideroptics.com

Sensor available with advanced object recognition

The SVS2 vision sensor is available in two different versions according to the installed control tools: Object Recognition (OJR) and Advanced Object Recognition (AOR). It is a completely embedded device with optics, red LED illuminator, and electronics included. The sensor is configured via PC through Ethernet communication. Available control typologies include brightness, contrast, position, width, count, pattern match, contour match, and 360-degree pattern match (available only in AOR models).

Datalogic
Bologna, Italy
www.automation.datalogic.com

Lens optimized for use with up to 1.3-in. sensors

The APO-Xenoplan 2.0 24-mm lens is designed to perform with Kodak 4-Mpixel micro lens-based sensors. The angle from light farther and farther from the sensor’s center will strike the micro lenses at nearly the same angle and produce equal illumination across the entire sensor. This eliminates off-axis shading caused by employing conventional C-mount lenses. The 24-mm lens is optimized to cover the 1.3-in. C-mount format and can be used on smaller formats that do not contain the microlenses.

Schneider Optics, Hauppauge, NY, USA, www.schneideroptics.com

Video microscope stores images without PC

The FlyInspector is a standalone system for rapid online inspection and image storage. Equipped with a full high-definition autofocus camera (2.1-Mpixel), the video microscope delivers 1920 × 1080 pixels. The drift-free, self-balancing arm with six axes of movement stays where placed and allows inspection and documentation within a 1-m radius. The integrated lighting permits exact illumination of the inspected area and can be widely adjusted. Image storage is available with one click without requiring an additional PC.

Technolab, Berlin, Germany, www.technolab.com

E-mail your product announcements, with photo if available, to vsdproducts@pennwell.com | Compiled by Carrie Meadows
Founded in 1987 SVS-VISTEK can look back on more than 20 years of experience in the professional machine vision branch. Since 1999 the company has been developing and manufacturing its own cameras – until today at 100% in Seefeld, Germany, in their own clean rooms and by means of state of the art testing technology. Today, we are one of Germany’s leading manufacturers of industrial cameras, a reliable supplier of components for machine vision purposes and a specialist for highly integrated systems and solutions.

SVCam – high-performance CCD cameras made by SVS-VISTEK
“SVCam” stands for high-performance CCD cameras developed and manufactured in a modular design and a high degree of taylorability. Three camera lines, representing high-end solutions ensure matching exactly the specific needs of our customers: Be it minimum size (SVCam-ECO), highest frequencies (SVCam-CF) or maximum resolution (SVCam-HR). SVS-VISTEK cameras are more than just highest-level technology. Efficient, lean and customer-oriented processes in production, administration and service ensure our clients full satisfaction. Maximum quality is obtained by a careful selection of our suppliers and by a constantly constructive dialogue with our partners.

Know-how Transfer
Camera development & production, distribution of components, system solutions development: Combining these three core competences of SVS-VISTEK and many years of experience leads to synergistic effects we place at our customers’ disposal. Our detailed knowledge and understanding of diverse branches of trade are the basis for the development of our cameras, for our efficient service and for competent customer support.

Global presence
SVS-VISTEK makes use of a world-wide network of efficient partners and experts who are responsible for the dialogue with our customers, the service and the support of our SVCam camera line on site.

Be it with competent advice, the flexible composition of our products or simply by prompt reactions and deliveries on time: For SVS-VISTEK it is always the customer who is in the focus of action since we strive to contribute to his success with our products and services.
Metrology system captures 500 million pixels in 3 s

NxtGen-Wash, a metrology technique for washed panel applications, is part of the new NxtGen family of inspection and metrology systems. Darkfield optics detect defects smaller than the optical pixel. The technique achieves high throughput rates and large depth of field. It has the ability to measure panel warp/thickness or concentration profile ±15 μm. More than 500 million pixels are captured and analyzed in 3 s.

Dark Field Technologies
Orange, CT, USA
www.darkfield.com

USB camera acquires VGA images at 60 frames/s

The Firefly MV model FMVU-1352C camera is designed around the color version of the 1/3-in. Sony IMX035 CMOS image sensor, which features a 1328 × 1048 square pixel array, high signal-to-noise ratio, high color fidelity, rolling shutter, and no smear. The camera’s USB 2.0, 480-Mbit/s digital interface transfers both data and power and allows full 1328 × 1048-pixel raw Bayer images to be acquired at 23 frames/s or VGA at 60 frames/s using either of the sensor’s 2 × 2-pixel binning or region of interest modes. It complies with the IIDC v1.31 specification. A board-level option, which measures 40 × 25 mm, is available for qualified OEMs.

Point Grey Research
Richmond, BC, Canada
www.ptgrey.com

X-ray camera uses VLA CMOS sensors

The portable SkiaGraph® PT camera supports x-ray energies of 10–160 kVp, appropriate for medical and veterinary applications as well as industrial inspection applications. The cameras build upon a tiled configuration of RadEye100 very large area (VLA) CMOS image sensors to achieve a total active sensing area of 8 × 8 in. (20 × 20 cm). Real-time imaging occurs at up to 1.4 frames/s (5.3 frames/s in binned mode). Pixel size is 96 μm (5 lp/mm spatial resolution), with more than 4 million pixels overall. A choice of scintillators provides sensitivity as high as 500 ADU/mR.

Rad-icon Imaging
Santa Clara, CA, USA
www.rad-icon.com

PoCL cable assemblies enable smaller camera designs

High-speed 0.8-mm cable assemblies for power over Camera Link (PoCL) are based on the PoCL Base configuration for machine-vision applications. PoCL cables mate to industry-standard shrunk delta ribbon (SDR) 26-position PoCL camera connections, enabling machine-vision cameras to be powered through the data cable rather than a separate power cable, which potentially eliminates the need for a power connector.

SVS-VISTEK GmbH
82229 Seefeld, Germany
Tel: +49-(0) 81 52-99 85-0
info@svs-vistek.com
www.svs-vistek.com

Inspiration for CEOs, CFOs, CVOs, CTOs, CQOs, CDOs: the new SVCam-ECO

Convincing benefits regardless who is making the decision. Learn more at:

www.svs-vistek.com/eco
Intercon 1, a division of Nortech Systems specializes in Machine Vision technology and is the premier producer of camera cable assemblies in the United States. Since 1988 it has led the market in serving Machine Vision customers by providing sophisticated engineering, specialized tools and methodologies to support ground breaking vision technology. By helping to develop critical commercial standards it has also remained a conceptual leader within its industry.

Featured products

**CCXC Specialty Adapters (“Oops” cables)**

Sometimes known as the “Oops” cable series, these unique 8” adapter cables allow you to change the gender and/or connector type of a cable end or connect two cables in the middle. Extension cables for CCXC and related applications that will meet your changing needs are offered in your choice of lengths through this series.

**Remote Head Cable Assemblies**

Intercon 1 offers Remote Head cables to interface between camera heads and control units. Most configurations are available in high flex, Teflon, and Right Angle versions. Simply provide Intercon’s knowledgeable staff with the name of the camera manufacturer and model number and Intercon will provide you a solution specifically designed for that system. Intercon offers remote head cables for manufacturers such as JAI Pulnix, Sony, Toshiba, Hitachi, Panasonic and others. Many lengths are available for same day shipment. In addition, this product line includes specialty adapters which allow you to change the gender and/or connector type of a cable end or connect two cables in the middle.

**Camera Link® Cable Assemblies**

With the industries most complete selection of Camera Link® cable, connector and orientation options Intercon 1 has a tailored solution for your specific application. Whether it be right angle up, down, right or left, low profile, clasp, ribbon cable, round cable, Infini Flex cable featuring Gore™ Hi Flex Camera Link® cable, or assemblies with video or camera control breakouts, Intercon has the options at hand to provide the optimal solution for your application.

For more information on these or other Intercon products visit [www.intercon-1.com](http://www.intercon-1.com).

---

Intercon 1
(a Division of Nortech Systems)
7746 Goedderz Rd. Suite 110
Baxter, MN 56425
Tel: 218.828.3157
Fax: 218-828-1096
www.intercon-1.com
Vision + Automation Products

Embedded vision system features multicore processing for multiple cameras

The NI EVS-1464RT embedded vision system is a multicore controller capable of processing images from multiple IEEE 1394 and GigE Vision cameras. The EVS-1464RT features an extended temperature range, real-time operating system, solid-state hard drive, and fanless design suitable for harsh industrial environments. Various connectivity options allow engineers to use many different types of cameras to perform simultaneous inspections. The system can be configured with NI Vision Builder for Automated Inspection (AI) and also can integrate with NI LabVIEW graphical system design software and the NI Vision Development Module.

National Instruments
Austin, TX, USA
www.ni.com

Washdown light has 5x intensity of standard high-current LEDs

The Brick spotlight, a high-output washdown light, has six high-current LEDs. The housing is built with 316 stainless steel and is compliant for use in the food industry. The light meets IP68 standards and is corrosion resistant. It is available in white, red, amber, blue, green, cyan, UV, and IR outputs. The light includes an integrated constant-current driver with a built-in strobe input with option for PNP or NPN trigger control. An external driver is not required. The integrated driver also includes variable light intensity control.

Smart Vision Lights
Muskegon, MI, USA
www.smartvisionlights.com

Network camera achieves 30 frames/s in H.264 format

The i-Pro WV-NP502 Super Dynamic 3-Mpixel network camera performs in virtually any lighting condition. With streaming H.264, MPEG-4, and JPEG compression formats available, it achieves 30 frames/s in H.264 format (in 1.3-Mpixel mode). It offers face detection, adaptive black stretch technology, and adaptive digital noise reduction. Auto back focus positions the CCD for accurate focus in both color and black-and-white modes. Minimum illumination is 1.0 lux color and 0.08 lux B/W (at f/1.4 in 1.3-Mpixel mode). The camera features IPv4/IPv6 compatibility and Power over Ethernet (PoE).

Panasonic System Solutions
Secaucus, NJ, USA
www.panasonic.com/i-Pro

Camera captures two exposures within one frame

The Phantom v310 camera offers a top speed of 3400 frames/s at maximum resolution of 1280 x 800 pixels. At reduced resolution, it can record at speeds up to 500,000 frames/s. The wide aspect ratio afforded by the proprietary CMOS sensor allows users to keep moving subjects in-frame longer. Available in color or monochrome, the camera's CMOS sensor features an active pixel size of 20 μm. Exposure times as fast as 1 μs help eliminate blur and accentuate detail. The unit supports 8- and 12-bit pixel depth and incorporates Extreme Dynamic Range (EDR) technology, which allows users to capture two different exposures within a single frame.

Vision Research
Wayne, NJ, USA
www.visionresearch.com

Choose from our wide selection of in-stock cables, or contact us in regard to your custom application.
Latest Piranha HS delivers highest speed and responsivity for high volume production

Piranha HS features 4k resolution with 14 × 14 micron pixels and an incredible 110 kHz line rate with throughput of 640 MPixels/s. Featuring proprietary TDI technology, the Piranha HS delivers responsivity of 11,800DN/(nj/cm²) at 0dB gain, 12 bit with 100x anti-blooming.

www.dalsa.com/piranahs/v8

PixeLINK’s Full Line of Machine Vision Cameras

- Monochrome & Color Digital Cameras
- CMOS and CCD technology
- XGA to 6.6 MP
- 3 configurations (Straight, Right-Angled, Board Modules)
- Gigabit Ethernet, FireWire or USB 2.0 Interface
- Low noise, excellent anti-blooming and low-light sensitivity
- Easy to use Software Development Kit with full support

www.pixeLINK.com

RCX C-Link Coax2 expands EDIT’s line of compact long-range adapters to include Camera-Link-to-coaxial. This adapter is ideal for retrofitting high-resolution cameras in aircraft, ships, and other sites that already have coax runs, or for supporting new coax applications. Most base-mode Camera Link cameras are supported. Contact 503-690-1234 / 800-435-4320.

www.edt.com

www.vision-systems.com

Bringing the latest news, technology and opinions in machine-vision and image-processing to engineers and engineering managers everyday.

www.vision-systems.com

VC Solar Solution provides the user with the ideal solution for all inspection tasks in the solar cell production. All components are standardized and offer a cost-efficient machine vision solution easily to integrate into production lines. VC Solar Positioner provides for the wafer’s positioning with accuracies under 2μm and VC Solar Edge detects defects smaller than 1/10mm at the wafer’s edge. Processing time under 100ms is guaranteed.

www.vision-components.com

www.vision-components.com
### Advertisers Index

<table>
<thead>
<tr>
<th>Advertiser / Page no.</th>
<th>Advertiser / Page no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basler AG 2, 34</td>
<td>National Instruments 44</td>
</tr>
<tr>
<td>DALSA 1, 30, 54</td>
<td>Opto Engineering srl 19</td>
</tr>
<tr>
<td>Edmund Optics 26, 27</td>
<td>P.E. Schall GmbH &amp; Co. KG 40</td>
</tr>
<tr>
<td>EDT 54</td>
<td>PixelINK 54</td>
</tr>
<tr>
<td>FastVision LLC 6, C3</td>
<td>Point Grey Research 42, 47</td>
</tr>
<tr>
<td>Fiberoptic Systems 24, 25</td>
<td>Prosilica 13, 22</td>
</tr>
<tr>
<td>Imaging Solutions Group 16, 17</td>
<td>Schaefer &amp; Kirchhoff GmbH 54</td>
</tr>
<tr>
<td>IMI - North America 19</td>
<td>Silicon Software GmbH 14, 15</td>
</tr>
<tr>
<td>Intercon 1, Nortech Systems 52, 53</td>
<td>Sony Electronics 20, 21</td>
</tr>
<tr>
<td>JAI 39</td>
<td>SVS-Vistek GmbH 50, 51</td>
</tr>
<tr>
<td>Landesmesse Stuttgart GmbH 46</td>
<td>Vision Components GmbH 33, 54</td>
</tr>
<tr>
<td>LMI Technologies 10</td>
<td>VRmagic GmbH 28</td>
</tr>
<tr>
<td>Matrox Imaging 18, C4</td>
<td>International</td>
</tr>
<tr>
<td>Microscan 41, 48</td>
<td>IDS Imaging Development Systems GmbH 8, 9</td>
</tr>
<tr>
<td>Migtex Systems 41</td>
<td>Rauscher 45</td>
</tr>
<tr>
<td>MV Tec Software GmbH C2, 12, 29</td>
<td>Stemmer Imaging GmbH 36, 37</td>
</tr>
</tbody>
</table>

This ad index is published as a service. The publisher does not assume any liability for errors or omissions.

### Sales Offices

**Main Office**
98 Sip Brook Road, LL-1
Nashua, NH 03062-5737
(603) 891-0123
FAX: (603) 891-0574

**Group Publisher**
Kathy Bush
(603) 891-9434
FAX: (603) 891-0574
E-mail: kathyb@pennwell.com

**Senior Executive Assistant**
Sharon A. MacLeod
(603) 891-9224
FAX: (603) 891-0574
E-mail: sharonm@pennwell.com

**Digital Media Sales Operations Manager**
Tom Markley
(603) 891-9128
FAX: (603) 891-0574
E-mail: thomasm@pennwell.com

**Ad Services Manager**
James Kirkland
(918) 891-9271
FAX: (918) 891-9415
E-mail: jamesk@pennwell.com

**List Rental Sales Manager**
Bob Dromgoole
(603) 891-9128
FAX: (603) 891-9341
E-mail: bobb@pennwell.com

---

**North America**

USA/East, Eastern Canada
Judy Leger
(603) 891-9113
FAX: (603) 891-0574
E-mail: judyl@pennwell.com

USA/West, Western Canada
Bill Healey
(415) 247-8200
FAX: (415) 247-8240
E-mail: wjhealey@infoasis.com

**Product Showcase / Inside Sales**
Judy Leger
(603) 891-9113
FAX: (603) 891-0574
E-mail: judyl@pennwell.com

**Reprints**
The YGS Group
(800) 290-5460
or (717) 399-1900
FAX: (717) 399-8900
E-mail: vsd@theygsgroup.com

---

**International**

UK, Sweden, Denmark, Finland, Norway
Tony Hill
TEL/FAX: 44-1442-239547
E-mail: tonyh@pennwell.com

France, Netherlands, Belgium, Spain, Portugal, Southern Switzerland, Greece
Luis Matutano (Paris)
33-1-3076-5543
FAX: 33-1-3076-5547
E-mail: luism@pennwell.com

Germany, Austria, Northern Switzerland, Eastern Europe
Johann Bylek, Munich
49-89-904-80-143
FAX: 49-89-904-80-145
E-mail: johannb@pennwell.com

Hong Kong, China
Adonis Mak
852-2-838-6298
E-mail: adonism@actcom.hk

---

**India**

Kathy Bush
(603) 891-9434
FAX: (603) 891-0574
E-mail: kathyb@pennwell.com

Israel
Den Aronovic (Tel Aviv)
972-9-899-5813
E-mail: aronovic@actcom.co.il

Japan
Manami Konishi
81-3-5645-1271
FAX: 81-3-5645-1272
E-mail: manami.konishi@express.jp

Taiwan
Cindy Yang
886-2-2396-5128 #246
E-mail: cindy@arco.com.tw

---

Vision Systems Design, Vol. 13 No. 9, Copyright 2009 (ISSN-1089-3709) is published 12 times a year, monthly, by PennWell Corp., 1421 S. Sheridan, Tulsa OK 74112. Periodicals postage paid at Tulsa, OK 74112 and additional mailing offices.

Subscription rate in the USA: 1 yr. $89, 2 yr. $152, 3 yr. $184, Buyers Guide $37; Canada: 1 yr. $105, 2 yr. $184, 3 yr. $226, Buyers Guide $42; elsewhere via Int’l Air: 1 yr. $121, 2 yr. $210, 3 yr. $268, Buyers Guide $47. Digital edition $47 yr.

Subscription inquiries:
(847) 559-7520 7:30 AM – 6 PM CST.

Postmaster:
Send change of address form to Vision Systems Design, PO Box 122, Northbrook, IL, USA 60065-3285.
Return undeliverable Canadian addresses to PO Box 122, Niagara Falls, ON, Canada L2E 6S4.
PRINTED IN THE USA
GST NO. 126813153
Publications Mail Agreement No. 1421727
Ever since I was young, I have always liked taking things apart, and my father, being a mechanical engineer, was only too willing to encourage me in my endeavors. And so in 1979 when his expensive wooden cabinet-sized tube-based stereo system failed, I decided to attempt to repair it.

After my brother and I lifted the cabinet to the center of the living room, I unscrewed the stiff card backing of the machine and peered inside. There, in a large metal chassis was an array of valves that stood proudly in shiny round sockets.

I instructed my brother to turn the equipment on while I watched to see what happened. During the next few moments, the glass valves began to warm up and emit their eerie orange glow. That is, of course, all but one. This, I thought must be the culprit so, after turning off the stereo system and letting it cool down for ten minutes, I removed the valve in question.

Being a member of the press, I then tried to leverage my contacts at Philips to obtain a free sample of the Mullard valve in question. After being informed that Philips had not made the product for more than ten years, I was told that they could be obtained from a small company in India. My contact generously offered to obtain the product for me and ship it to my dad’s house. I was delighted.

Several weeks later, a package arrived at the door from Philips. Excitedly, I opened the package and gazed upon the shiny new device. Following the same procedure as before, I located the socket of the defunct tube and placed in the new one.

To my delight, after switching the stereo system on, the voice of a BBC newscaster sprang from the speakers. Without engineering drawings, signal generators, or oscilloscopes, I had brought the stereo back from the dead. Even my old man could not believe it. In the decades that followed, valves were replaced by discrete transistors, transistors by TTL logic, and TTL logic by microprocessors, VLSI devices, and gate arrays. And, of course, everything is now smaller. In the machine-vision industry, for example, system integrators can now purchase a smart camera replete with sensor, CPU/DSP, memory, interface, and on-board software for less than $2,500.

System integration par excellence
Nowhere, however, has this level of integration been more significant than in the development of consumer products. To develop products such as mobile telephones, MP3 players, and portable televisions, engineers use sophisticated electronic and mechanical CAD packages rather than data sheets and drawing boards.

Using these packages, it is possible to cram more technology into a single square inch than ever before. And, if well designed, these products are less expensive, more reliable, and longer lasting than any valve-based system could ever expect to be. For those tasked with repairing such devices the task is more complex. More than likely, should the devices fail under warranty, they are replaced free of charge by the manufacturer.

Today, it has become more expensive to repair these devices than replace them with new ones. Although this is not yet the case in much of the machine-vision industry, those developing products for this market are also concerned with reducing cost and size.

To gain an advantage in this area, inquisitive engineers may want to take a look at what their counterparts have accomplished in the consumer market. Although purchasing every latest miniature device, tearing it apart, and characterizing each design may not be a wise idea, companies such as Portelligent (Austin, TX, USA; www.teardown.com) have emerged that can provide this data for you.

Replete with external and internal photographs, parts lists, component counts, and a manufacturing cost analysis, the reports could provide you with just the edge you need when developing your next product. And you will not need a screwdriver, signal generator, or an oscilloscope—just a check or credit card.
SUFFERING STICKER SHOCK FOR AN EXPRESS BUS CARD?

Get the facts and see the differences!

Call Alacron and find your solution!

Alacron introduces the most complete line of cost effective Express Card solutions for your notebook. If we can’t solve your problem, nobody can.

See us at: www.Alacron.com

or call us at 603-891-2750

71 Spit Brook Road, Suite 200, Nashua, NH 03060
Tel. 603-891-2750 • Fax: 603-891-2745

*Data as of 12/8/08
Matrox Iris GT defines a new era in smart camera technology:

- **rugged**: sturdy, dust-proof and water-resistant IP67-rated casing
- **fast**: powered by 1.6GHz Intel® Atom® processor
- **connected**: EtherNet/IP™, MODBUS®, TCP/IP, integrated I/Os and serial port
- **intuitive**: flowchart-based integrated development environment

Matrox Imaging Authorized Integrators: Find one. Become one.
www.matroximaging.com/buy

Lens sold separately.