Coming up roses

As predicted, Matrox Imaging is coming out of this latest semicon hibernation well ahead of the pack in terms of increased revenues. We are meeting our forecasts and, while continuing to cater to our traditional customers, we are branching out into new areas and diversifying our product line.

This issue’s product feature, Inspector 4.0, is a perfect example of this. The new tools we’ve added to our popular prototyping tool are decidedly machine vision oriented, thereby significantly reducing time-to-market for the developer and taking Inspector into a realm other than the traditional scientific market.

As you’ll also see in this issue, PCI-X is poised to take the industry by storm (see page 6). This new bus technology addresses the demanding I/O requirements of a new generation of high-bandwidth technologies, including cameras with data-generation rates of hundreds of megabytes per second. Matrox Imaging will be taking full advantage of these advancements in its upcoming product releases, to be announced at the Semicon West, AIA Vision West and Vision 2002 (Stuttgart) shows in July and November. See you there!

François Bertrand
Director, Sales & Marketing
Matrox Imaging

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Rapid prototyping
with Matrox Inspector 4.0

Featuring new ActiveMIL Builder, Relative Region and Model Finder tools

When it comes to developing and test-driving applications, the latest version of Matrox Imaging’s prototyping tool for scientific and industrial imaging gets the job done quickly and efficiently.

Now shipping, Matrox Inspector 4.0 features the new Relative Region tool that simplifies multi-step inspections by creating automatic and intelligent links between the results of location operations and subsequent measurement operations. For example, object location information (position, angle and/or scale) gathered by Inspector’s new Geometric Model Finder tool can be used to automatically determine and place a search region for the Edge & Stripe measurement tool.

And when it comes to building and testing an application, Inspector 4.0’s new ActiveMIL Builder (AMB) tool enables OEMs and integrators to fast-track. AMB is a code generation tool that builds an inspection application in the shortest time possible. With the click of a button, AMB translates Inspector activities into Visual Basic code that proceeds to perform the same operations using ActiveMIL. Bundled with the Matrox Imaging Library (MIL) software toolkit, ActiveMIL is a collection of ActiveX controls for managing image capture, processing, analysis, display and archiving. When all the actions needed for an inspection application have been added to the project list, AMB builds a Visual Basic project that will execute without the user having to write a single line of code!
Aerotech's history of designing and manufacturing motion controllers, motors and drives began with its establishment in 1970. Today, hundreds of thousands of Aerotech components are used worldwide in factories and production facilities. Aerotech also manufactures a broad array of linear and rotary stages as well as advanced positioning mechanics for such industries as fiberoptics, semiconductor, imaging, laser machining and medical.

"A large number of our customers integrate our motion products with machine vision for robotic guidance, fiberoptic component alignment, seam tracking, finding objects for laser welding, quality control inspection of parts and automated part alignment," says Product Manager Tom Markel from Aerotech's headquarters in Pittsburgh, Pennsylvania.

"Typical systems require machine vision resolution at or below a micron per pixel. This year, we decided to offer our customers a set of machine vision tools for prototyping and implementing machine vision that worked with our motion toolkits," he adds.

Aerotech developed two software toolkits, called AeroVision and Nview, to integrate with two of its motion controllers – the Unidex 500 (a PCI motion controller) and the Automation 3200 software-only controller that runs in a real-time operating system with Aerotech's new Firewire digital drives. Both toolkits integrated the Matrox Imaging Library (MIL) with its own motion libraries for customer applications. This required customers to use Matrox Inspector 3.1 for vision prototyping. Customers grabbed images of the part being inspected, under various lighting conditions, and tested different methods for locating and inspecting the object. Once customers determined the proper inspection sequence for their application, they coded the process in Visual Basic or 'C' with MIL and then tested the application combined with motion.

With the recent release of the latest version of Inspector, Aerotech is currently upgrading its toolkit to take advantage of Inspector 4.0's new machine vision tools, such as Geometric Model Finder, Relative Region and the ActiveMIL Builder code generation tool, says Markel.

"With ActiveMIL Builder, we can bring code development down from a week to a day. We can build a new application and then add it to an existing MMI (man-machine interface) so that previous coding will not be lost in new developments. Rapid prototyping is truly what you get with Inspector."

– Tom Markel, Product Manager, Aerotech Inc.

With Inspector, Aerotech customers are able to focus on the application instead of the programming, says Markel. "Having the vision tools and frame grabber controls readily available to experiment with – in a drag-and-drop, easy-to-use environment – not only speeds up the entire process but also helps the users quickly learn the different methods available for inspection.

"Inspector is a great tool. There are a large number of features available and the user can very quickly determine what works and what doesn't. Rapid prototyping is truly what you get with Inspector," adds Markel.

For more information on Aerotech products, visit http://www.aerotech.com.

INSPECTOR 4.0

Matrox Inspector 4.0's new Model Finder tool for geometric pattern recognition quickly and accurately locates a model, or multiple models, at any position, angle and at any scale from 50-200 percent, under such harsh conditions as occlusion and non-uniform changes in contrast.
Meteor-II/Display for CompactPCI®

Everyone needs a companion – even the Meteor-II for CompactPCI® frame grabber family from Matrox Imaging. Well look no further than our new Meteor-II/Display graphics card for CompactPCI®. Ideal for industrial applications, this companion board is based on the Matrox Millennium G550 graphics controller which boasts third-generation DualHead® display technology, 32 MB high-speed double data rate memory, UltraSharp 360 MHz primary RAMDAC, TV output and resolutions up to 2048 x 1536 in 32-bit colour. With support for Windows® XP, 2000, NT, Me and 98, the new Meteor-II/Display for CompactPCI delivers exceptional graphics performance and product stability.

MIL 7.0 under Windows XP

Did you know that MIL/MIL-Lite 7.0 has been successfully tested under Microsoft Windows XP? Contact your local representative or Matrox Imaging at 1-800-804-6243/+1-514-822-6020 or email: imaging.info@matrox.com for more details.

Linux support for Meteor-II

Emlix GmbH of Germany has released version 0.9 of its Video for Linux Two (V4L2) driver for the Meteor-II and Meteor-II/Multi-Channel. This driver supports continuous streaming. For more information, please visit http://www.emlix.com/meteor2.

4Sight-II with 1 GHz Pentium-III

The 1 GHz Pentium-III has been successfully validated as a new option for the Matrox 4Sight-II industrial computer. Please contact your local representative or Matrox Imaging at 1-800-804-6243/+1-514-822-6020, or email imaging.info@matrox.com for more details.

<table>
<thead>
<tr>
<th>Product</th>
<th>Pentium® III @ 1 GHz/100 MHz FSB</th>
<th>Celeron® @ 850 MHz/100 MHz FSB</th>
<th>Pentium® III @ 600 MHz/100 MHz FSB</th>
<th>Celeron® @ 566 MHz/66 MHz FSB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image Processing (point-to-point)</td>
<td>Add two 8-bit images and store results in an 8-bit destination image.</td>
<td>1.7 ms</td>
<td>2.3 ms</td>
<td>1.7 ms</td>
</tr>
<tr>
<td>Image Processing (convolution, 3 x 3)</td>
<td>Perform a general 3 x 3 convolution with arbitrary coefficients on an 8-bit source image and store results in an 8-bit destination image.</td>
<td>2.8 ms</td>
<td>3.2 ms</td>
<td>4.3 ms</td>
</tr>
<tr>
<td>Image Processing (compression JPEG Lossy)</td>
<td>Perform lossy JPEG compression on an 8-bit source image and store results in an 8-bit destination image.</td>
<td>4.9 ms</td>
<td>5.9 ms</td>
<td>7.6 ms</td>
</tr>
<tr>
<td>Pattern Matching (find a model)</td>
<td>Find a 128 x 128 model in an 8-bit grayscale image. The whole image is searched for a model that is not rotated.</td>
<td>2.2 ms</td>
<td>2.6 ms</td>
<td>2.6 ms</td>
</tr>
<tr>
<td>Geometric Model Finder (find a model)</td>
<td>Find a single 128 x 128 model in an 8-bit image (1 model, 1 occurrence, very high speed, limited scaling). The whole image is searched for a model rotated within 0-360° and scaled within 90-110% using the highest speed (lowest robustness and accuracy) setting.</td>
<td>12.4 ms</td>
<td>15.6 ms</td>
<td>16.6 ms</td>
</tr>
<tr>
<td>OCR Reading (full read)</td>
<td>Read an unknown string of twelve 33 x 21 characters (no grammar rules) within a 404 x 54 image region.</td>
<td>65.3 ms</td>
<td>83.9 ms</td>
<td>107.8 ms</td>
</tr>
</tbody>
</table>

Please note that these benchmarks assume full CPU and memory bandwidth (i.e., no other system activity) and include system overhead. Operations were executed on 512 x 512 images, under Windows NT and MIL 7.0.
A watchful eye
New ball-tracking technology from Roke Manor Research takes sports – and possibly umpiring – to a whole new level.

By Kelly Davis, Matrox Imaging

The game of cricket has been governed by a series of Codes and Laws for over 250 years, often subject to additions and alterations recommended by the ruling authorities of the time. And, like numerous other sporting activities, the game of cricket is not immune to current technological advancements. In fact, the International Cricket Council (ICC) is presently deliberating the use of a new ball-tracking system from Roke Manor Research that would aid umpires in making correct LBW (Leg Before Wicket) decisions.

The LBW ruling has caused as many controversial moments in cricket as the offside ruling in football, the forward pass in rugby and line-call decisions in tennis. In fact, the LBW result determines a batsman’s innings and often the outcome of the game.

For a batsman to be given out LBW, an initial call of ‘How’s that?’ must be given by a fielding player to the umpire, who in turn must decide whether or not the ball was travelling at such an angle that it would have hit the stumps, and whether or not it hit the pads before hitting the bat. The batsman would not be given out LBW if the point of contact between the pads and the ball was outside the line of off-stump or if the ball was pitched outside the leg-stump.

This complicated ruling is not made any easier for the umpire by the fact that the average ball is travelling at 80mph from the bowler’s hand. It is no wonder that this is one of the trickiest decisions made in cricket and one that leaves plenty of room for uncertainty.

Enter Hawk-Eye
However, if adopted, a new technology called Hawk-Eye could erase all doubt from the minds of umpires, players and spectators by providing an analysis of the ball and wicket to within an accuracy of 5mm.

Invented by Dr. Paul Hawkins, a 27-year-old British scientist with Roke Manor Research near Southampton, Hawk-Eye incorporates image analysis and missile tracking technology. Six fixed JAI monochrome cameras, with a 120Hz frame rate, are placed around the playing field at key vantage points – two at each end at a 30° angular displacement, and two side cameras (see diagram). These synchronized cameras track the ball’s entire trajectory – at intervals of every 1/100ths of a
second – from the moment it leaves the bowler’s hand until it stops.

The six cameras are gen-locked into two sets of three cameras, each set being captured by a Matrox Meteor-II/Multi-Channel frame grabber and the Matrox Imaging Library (MIL-Lite) software. The resulting images are processed into a 3D image by the Hawk-Eye system which then calculates – in a split second – where the ball pitched, the extent of its lateral movement in the air and off the wicket, its velocity and bounce, and – if applicable – exactly where it contacted the batsman’s pad.

The future path of the ball is also extrapolated by fitting the trajectory of the ball into a parametric model, thereby determining whether or not the ball would have carried on to hit the stumps, bounce over, or go past the wicket, Hawk-Eye then uses a Matrox Orion frame grabber to overlay a graphical representation of this trajectory onto a video image, which is encoded and transmitted to a video bank accessed by television producers.

“A major challenge for us was transmitting the analog signal down the long cable lengths (ranging from 250-650 meters) of high-quality triax cable to the capture cards, without losing the signal,” says Hawkins. “However, the MIL-Lite software was able to cope with the resultant signal degradation.”

All of the information calculated by Hawk-Eye is available within 1-2 seconds of the ball being bowled. This data could then be sent to umpires on the field using a transmission technology similar to local pagers or mobile telephones. Each umpire would carry a small, hand-held receiver with a display window that – within four or five seconds – would give the umpire all the information he needs to make the LBW decision: whether the ball pitched outside the leg stump; whether the ball hit the batsman in line with the wickets; and whether the ball would have hit the stumps. Unlike the third umpire that is brought in to make a final decision when the first two umpires cannot agree, Hawk-Eye would not slow down the game, as it would determine the correct answer in less time than it would take for an umpire (or umpires) to make a decision.

However, Hawkins stresses that Hawk-Eye “is being presented as an aid to the umpire, not as a threat to him. Umpires quite rightly will always be required.”

In-depth coverage
Although not yet in the hands of umpires, Hawk-Eye is already on the television screens and computer monitors of cricket fans around the world. Developed in conjunction with Channel 4, Hawk-Eye is credited with having revolutionized the way live cricket coverage is transmitted. In fact, Channel 4 competitor Sky Sports has already adopted the technology.

Hawk-Eye information is being used by television broadcasters to present more in-depth coverage of cricket. It also allows cricket commentators to support their assessment of a batting or bowling performance with graphs and statistics. This will hopefully make cricket easier to understand and thus make it more attractive to a wider audience, says Hawkins.

Hawk-Eye’s information is not only broadcasted to a television viewing audience but it is also uploaded to the cricket4.com web site. With this information, which is packaged as an interactive analysis tool (http://www.channel4.com/sport/cricket/analyst/hawkeye/about.html), users can produce their own data on how cricket’s top players are performing in the heat of Test cricket. With this technology, users can view where each ball pitched and passed the stumps, as well as analyze which areas have been most productive for each batsman and bowler. These statistics can be extended to cover the entire team’s performance, in any match.

Not only cricket
In partnership with Sunset + Vine, the television production company that produces Channel 4’s cricket coverage, Roke Manor Research has recently established Hawk-Eye Innovations Ltd., an organization entirely dedicated to the development of similar technologies for wider sporting activities and applications. Games such as tennis, football, baseball and snooker can also be recreated on wireless devices, allowing viewers to watch a game from any location without the need for the large bandwidth requirements of video broadcasting.

In the meantime, as fans continue to enjoy this new perspective on cricket, the ICC has a tricky decision of its own to make – whether or not to bring this technology onto the cricket field and provide umpires with Hawk-Eye’s vision.

For more information, visit:
http://www.roke.co.uk/technology/innovations/Hawk_Eye.htm
PCI-X is a high-performance enhancement to the conventional PCI bus specification. This technology, with its increased performance, addresses the demanding I/O requirements for a new generation of high-bandwidth applications like Gigabit Ethernet and high-speed CameraLink™ cameras. Version 1.0 of PCI-X specifies a 64-bit connection running at speeds of 66, 100 or 133 MHz, resulting in a peak bandwidth of 528, 800 or 1064 Megabytes per second, respectively.

Equally important, PCI-X provides backward compatibility by allowing devices to operate at conventional PCI frequencies and modes when installed in such systems. PCI-X peripheral cards can operate in a conventional PCI slot, although only at PCI rates and may require a 3.3 V conventional PCI slot. Similarly, a PCI peripheral card with a 3.3 V or universal card edge connector can operate in a PCI-X slot, however the bus clock will remain at a frequency acceptable to the PCI card.

However, as with many technologies, there is a trade-off. In the case of PCI-X, speed is sacrificed as the number of slots per bus segment increases. A bus segment is loosely defined as the number of slots emanating from or between bridges. A 66 MHz operation allows a maximum of four slots per bus segment (compared with a maximum of two slots for 66 MHz conventional PCI). A 100 MHz operation allows a maximum two slots per bus segment, while a 133 MHz operation allows a maximum of one slot per bus segment.

Server and workstation class systems and motherboards are starting to make their appearance with PCI-X equipped core logic chipsets such as the ServerWorks™ Grand Champion™ series, Intel® E7500 and the soon-to-arrive AMD-8000™ Series. The ePCI-X specification from the PCI Industrial Computer Manufacturers Group (PICMG) will pave the way for industrial PCs with PCI-X slots.

PCI-X doesn’t stop at Version 1.0. Version 2.0 is currently being drafted by the PCI Special Interest Group (PCISIG) – the organization that created and now maintains PCI-X and conventional PCI – and this version promises to double and quadruple the current bandwidth allowances.

And stay tuned as Matrox Imaging will soon be announcing an exciting new generation of frame grabbers and vision processors that take advantage of PCI-X technology!
Matrox Imaging introduces its new Matrox Imaging Library (MIL) Pattern Recognition Training. This 3-day intensive training teaches you how to select the best technology for your application, whether it be normalized greyscale correlation or geometric pattern recognition, and how to use the chosen algorithm to its full potential.

This training includes a general introduction to the MIL/MIL-Lite environment, in-depth training on MIL's normalized greyscale correlation pattern matching module and its new Geometric Model Finder module. "Hands-on" workshops and Question & Answer periods with the scientists that developed these algorithms will ensure that you leave the training with the knowledge needed to solve real-world applications!

For more information on this or our MIL/MIL-Lite Environment training seminar, email imaging.training@matrox.com, call 1-800-804-6243 or visit: http://www.matrox.com/imaging/training/mil-lite/home.cfm

Matrox Imaging
Demonstration Days in Europe

WHAT: Matrox Inspector 4.0 Demonstration Day
WHERE: Matrox Imaging UK headquarters, Sefton Park, Stoke Poges, Buckinghamshire, UK
WHEN: Wednesday, June 12, 2002, 10h00-13h00, free buffet included
WHY: Discover how to prototype and develop your application in record time using Inspector 4.0 software, including the new ActiveMIL Builder tool. All attendees will have a chance to win a FREE copy of Inspector 4.0!

HOW TO REGISTER:
Visit http://www.matrox.com/imaging/inv/uk/
E-mail image.info.emea@matrox.com
Call +44 (0)1753 665511
Fax +44 (0)1753 665597

WHAT: Matrox Imaging Technology Day
WHERE: Munich, Germany
WHEN: Friday, June 14, 2002, 09h30-14h30, free lunch included
WHY: Learn how Matrox Imaging technology can help you develop your next-generation vision system. The day will include demonstrations of our latest hardware and software products, plus an opportunity to speak one-on-one with our engineers.

HOW TO REGISTER:
Visit http://www.matrox.com/imaging/inv/de/
E-mail technology.day@matrox.com
Call +49 (0) 89 62170 520
Fax +49 (0) 89 6149 743
Inspector 4.0 evaluation CD now available

In tandem with the release of the Matrox Inspector 4.0 software, Matrox Imaging has created a 30-day evaluation CD for Inspector 4.0. Copies of this evaluation CD may be ordered by visiting http://www.matrox.com/imaging/reg/inspdemo.

Tracking RMAs online

Canadian and US customers can now request and track their RMAs (Return Merchandise Authorizations) on-line. Requests for returns or exchanges of Matrox Imaging products can now be submitted via an on-line RMA form, located at: http://rma.matrox.com. After customers request their RMA numbers, these numbers, along with instructions explaining how to return the merchandise, are e-mailed to them 24-48 business hours after receipt of their on-line requests. Customers may also track the progress of their RMA requests on-line. Currently, the on-line RMA procedure is available to Canadian and US customers only; however, we do offer on-line RMA support information to our international customers which can be accessed through the support page of the Imaging web site: http://www.matrox.com/imaging/support/.

New application notes available

Be sure to check out our new application notes under the Interfacing Cameras section of our website at http://www.matrox.com/imaging/cameras/appnotes.cfm. These include notes on the CIS VCC-265ER camera for the Matrox Corona-II and Matrox Meteor-II/Multi-Channel, the BASLER A202b for the Matrox Meteor-II/Camera Link and the BASLER A202bc for the Matrox Meteor-II/Camera Link.

Show Time

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July 17-19, 2002
San Jose, CA

'02 Exhibition on Sensing via Image Information
July 17-19, 2002
Yokohama, Japan
Rep: Sumitomo Metal System Solutions CO., Ltd.

Go.Automation.Days
Sept. 3-Sept. 9, 2002
Basel, Switzerland
Rep: Fabrimex AG

Opto / Physique / Capteurs
October 22-24, 2002
Paris, France
Rep: 125

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Nov. 6-9, 2002
Beijing, China
Rep: Beijing Microview Electronic Technology Co., Ltd.

Vision 2002
November 12-14, 2002
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Applications engineer Jon Abitz helps out a visitor to the Matrox Imaging booth at IPOT 2002 in Birmingham, UK.

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