When 3 Dimensions Are More Useful Than 2!

3D cinema films, 3D TV and 3D gaming consoles are all familiar concepts in the world at large, but now 3D machine vision imaging is increasingly having a major impact in a wide range of industries and applications from volumetric measurements, to inspection for packaging and robot vision.

In this issue of Vision in Action we investigate the emergence of 3D technology, take a look at the different techniques on offer and highlight just a sample of the applications that have been addressed by our members. Many UKIVA members offer the cameras, software and/or structured light sources needed for 3D imaging and measurement. This, combined with the fact that ‘3D Machine Vision’ is the most visited page in the ‘What is Vision?’ section of the UKIVA website, is a strong indication of the growing importance of the technique in the UK.

The biggest challenge for 3D machine vision imaging is time. Creating complex 3D images is computationally intensive and therefore time consuming. So it has been the emergence of processors capable of handling the computational overhead required at production line speeds that has been the key to establishing true 3D measurement techniques and made it a credible alternative to 3D contact measurement and metrology.

2D or 3D?

However, because 3D imaging is so processor intensive, it is important to be able to assess whether an application really needs 3D measurements or whether conventional 2D imaging is more appropriate. Looking at the component in the picture, if you just want to measure the inner or outer diameter, 2D imaging is more than adequate, but if you want to be able to measure the defect in the surface, 3D imaging is needed. In the same way, using 3D robot vision to pick unordered parts enables manufacturers to save a lot of time and resources shifting or organising parts in the manufacturing process.

Just as no single imaging configuration is suitable for every possible 2D application, the same holds true for 3D applications. A number of different 3D imaging techniques have evolved with different capabilities, and there is plenty of choice of components and systems from different suppliers. These measurement techniques are highlighted in our special centre page spread, which also looks at issues such as calibration, shadowing effects and applications of 3D measurements, including inspection and robot vision.

We are grateful to UKIVA members Clearview Imaging, Lambda Photometrics, Matrox, Multipix Imaging, Olmec UK, Scandinavian Machine Vision, Scorpion Vision, Sick (UK) and Stemmer Imaging who have all contributed to the technical and applications content for these articles.
Welcome to the largest ever issue of ‘Vision in Action’, which is packed with more editorial content than ever before. The particular focus on 3D imaging and applications in this issue is a direct result of the growing interest in and improving affordability of 3D technology. Whilst many ‘3D’ problems can still be readily solved using 2D methods, the use of genuine 3D imaging solutions is definitely on the increase. We hope you enjoy this special feature.

We are delighted to welcome Acrovision, AlphaChase, IDS Imaging Development Systems and Scandinavian Machine Vision as new members to the Association. Growth in UKIVA membership is generally a positive indicator of the strength of the vision market in the UK, and indeed IDS has recently set up a dedicated UK office.

New UKIVA Statistics

As an Association, however, we are keen to quantify UK market trends, and although sources such as the AIA, VDMA and Frost & Sullivan all predict growth in machine vision sales worldwide, there are no hard and fast statistics available that relate solely to the vision market in the UK. To address this shortfall, we are in the process of collecting and collating sales data from UKIVA members, using a completely independent consultant in order to maintain data integrity for each member. This process has been undertaken for some time for BARA (British Automation and Robot Association), providing participating BARA members with an invaluable quarterly and annual benchmark of how the robotics industry in the UK is performing against their own sales. Providing equivalent information for the UK vision market will greatly benefit UKIVA members.

Mark Williamson, UKIVA Chairman
systems, the high speed and depth analysis of the products automated quality inspection resolution of 10GigE cameras comprehensively meet all the requirements of modern, high performance industrial image-being inspected.

For high-speed CMOS sensors imaging and industrial inspection. The IC-X25CXP offers 25 Mpixel (5120 x 5120) resolution, machine vision, robotics, packaging inspection, quality control, medical imaging, industrial imaging and industrial inspection. The IC-X25CXP offers 25 Mpixel (5120 x 5120) resolution, operating at 72fps with ZERO-ROT function at 8bit/10bit CXP-6 4CH. The IC-X12CXP offers 12 Mpixel (4096 x 3072) resolution operating at 168 fps @ 8bit CXP-6 4CH or 148 fps @ 10bit CXP-6 4CH.

The Cyton-CXP4 can acquire from one quad link CXP-6 camera (total data rate: 25 Gb/S) or four single link CXP-6 cameras, or anything in between. When acquiring from multiple cameras, each camera is attached to its own virtual frame grabber for independent camera control. The Cyton-CXP also contains a fifth CXP high-speed uplink connector that can run the full 6.25 Gb/S from the frame grabber to the camera for bulk uploads to the camera, and precise trigger accuracy.

Validator series

Validator has created the Validator suite of in-line Package and Label Inspection Systems to monitor and control production lines to ensure 100% correct product in the correct packaging with the correct data. Developed for packaging/production lines in food, drink and tobacco, pharmaceuticals/healthcare, beauty products, household goods etc. Validator offers a more or less “off-the-shelf”, cost-effective solution.

Validator can check for correct and readable barcodes, correct and readable batch codes or serial numbers, whether a label is applied and if it is in the correct position and alignment. It can also evaluate packaging parameters such as fill-level and cap detection with the flexibility to be customised to each customer’s specific needs, Validator can be supplied as a stand-alone single system or as a complete networked array of systems on multiple lines, controlled from a central location.

New CoaXpress Products

Alrad has added the ISVI IC-X25CXP and IC-X12CXP high resolution, high-speed cameras and the BitFlow Cyton-CXP4 frame grabber to its range of CoaXpress products. Both cameras are available in colour and monochrome versions and have applications in machine vision, robotics, packaging inspection, quality control, medical imaging, industrial imaging and industrial inspection. The IC-X25CXP offers 25 Mpixel (5120 x 5120) resolution, operating at 72fps with ZERO-ROT function at 8bit/10bit CXP-6 4CH. The IC-X12CXP offers 12 Mpixel (4096 x 3072) resolution operating at 168 fps @ 8bit CXP-6 4CH or 148 fps @ 10bit CXP-6 4CH.

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First 10 Gigabit Ethernet cameras with high-speed CMOS sensors

Framos has exclusive rights to market high speed, 10 Gigabit Ethernet (10GigE) cameras from Canadian manufacturer, Emergent Vision Technologies, across Europe. These are currently the only industrial cameras in the world which offer this high-speed IT standard for data transfer, and a bandwidth greater than that of CoaXpress and CameraLink. The camera series currently encompasses a total of 9 models based on CMOS sensors with Global Shutter technology and a resolution of 2, 4 or 12 megapixels in monochrome and colour variants and with enhanced near infrared (NIR) sensitivity.

The cameras deliver respectively an impressive 338, 179 and 87 frames per second at full resolution. By restricting the region of interest (ROI), the image rate can be further increased many times. The universal input/output interface with trigger functions, on-board image processing on the FPGA, SFP+ data output, C-mount or F-mount and rugged enclosure comprehensively meet all the requirements of modern, high performance industrial image-processing systems. For automated quality inspection systems, the high speed and resolution of 10GigE cameras allows faster inspection and in-depth analysis of the products being inspected.

New UKIVA members

UKIVA welcomes Acrovision, AlphaChase, IDS Imaging Development Systems and Scandinavian Machine Vision who have all become Association members in the last couple of months.

Acrovision is a systems integrator of vision inspection and barcode reading systems. Acrovision’s Validator series is used to carry out End of Line Packaging validation and inspection to ensure the correct product is in the correct packaging and to the correct level of quality.

AlphaChase is a British company specialising in conveyor systems from design to commissioning for handling a wide range of package types in a host of different industries. The company has developed a reputation for providing innovative solutions for the most challenging product handling problems.

IDS Imaging Development Systems, based in Germany, has recently opened an office in the UK. IDS has more than a decade of experience in the development and sale of USB 2.0 cameras, and is also among the pioneers in the development of digital USB 3.0 industrial cameras. The company has also manufactured cameras with GigE interfaces since 2007.

Scandinavian Machine Vision is an independent machine vision integrator, providing inspection and measurement solutions and services for manufacturing and process industries in the UK, Sweden and internationally.

‘BEST’ initiative to help address skills shortage

The PPMA Group has established a new division called ‘PPMA Business Education, Skills and Training’ (PPMA BEST), which will be funded through profits from the PPMA Show. The PPMA’s Marketing Manager, Grant Collier, said: “As a group of trade associations which includes UKIVA, our members have highlighted the skills gap in the areas of industrial vision, robotics and automation, particularly in the food processing sector and vertical markets where these technologies are increasingly being used. Initially, we are running a series of roadshows to try to encourage school leavers into the food manufacturing sectors by putting them in direct contact with engineers and managers. This will help dispel myths about pay levels, career progression and job satisfaction. We are also setting up a group to investigate how we can either increase or engage with apprenticeship schemes. By using profits from our trade show, we are funding this initiative directly from the people who are ultimately most likely to benefit.”
**IDS IMAGING DEVELOPMENT SYSTEMS**  
[www.ids-imaging.com](http://www.ids-imaging.com)

**IP camera with onboard video server**

The new VSE IP cameras from IDS are standalone camera systems with an integrated video server for applications within process monitoring, logistics and ITS. The browser-based VSE Control Centre offers simple camera configuration and interactive operation. A variety of display options range from full-screen to snapshots, from instant recordings to various streaming modes. MJPEG and H.264 data compression with MJPEG and H.264 streaming results in significantly lower data volume, requiring less memory.

All image and video data from the cameras’ e2v 1.3 MP or Aptina 5 MP CMOS sensors are stored directly in the camera for easy access and all recorded events are fully traceable. Several processes can be monitored simultaneously using the unique ‘Remote View’ feature. Live videos from multiple VSE cameras are displayed in one single browser window. For remote monitoring, ‘IDS Remote View’ apps are available for android and iOS tablets and smartphones. The VSE also features integrated and interactively controllable motion detection triggering, instead of using conventional light barriers.

**IMPERX**  
[www.imperx.com](http://www.imperx.com)

**Bobcat 2.0 cameras**

Imperx’s Bobcat 2.0 cameras are perfect for the most demanding industrial vision application. They feature sensors ranging from 29 Megapixel CCDs to VGA from Sony and Truesense. Bobcat 2.0 cameras include many programmable triggering and strobe options available from the 4 inputs and 2 outputs. The robust pre-processing engine includes features such as multiple ROIs, multiple image corrections, enhancements, overlays, and many automatic features such as exposure, gain, white balance, tap balance and more.

The Bobcat 2.0 includes support for motorised and auto-iris lenses, 128 Mbytes of internal memory and other new features. Built to meet the demanding imaging requirements, all Imperx fully programmable cameras are designed for an extended operating temperature range of -40°C to +85°C and a high MTBF > 660,000 hours; @ 40°C. The Bobcat 2.0 series is available with GigE, PoE, CameraLink, CoaXPress and HD-SDI output.

**LAMBDA PHOTOMETRICS**  
[www.lambdaphoto.co.uk](http://www.lambdaphoto.co.uk)

**3D-PIXA: High-Resolution Colour Camera for 3D Capture**

Lambda can offer the Chromasens 3D-PIXA stereo camera system for fast 3D imaging and inspection which make it ideal for inspecting moving objects and for web applications. Unlike other 3D imaging approaches - laser line projection or fringe projection with matrix cameras - the stereo system 3D-PIXA is based on the use of powerful colour line scan cameras. Having an optical resolution of 10µm and an amplitude resolution of up to 1µm, the high-resolution colour camera enables 3D surface inspection with outstanding resolution and accuracy.

The simultaneous acquisition of 2D images and 3D data provides additional information of the object surface, which can also be useful for detecting defects. Two versions are available: a compact system with a resolution of 15µm and a line frequency of up to 22 kHz, and a dual system with an optical resolution of 10µm and a line frequency of up to 50 kHz. The dual 3D-PIXA achieves a transport speed of up to 500mm/s.

**MATROX IMAGING**  
[www.matrox.com](http://www.matrox.com)

**20 years for Matrox Imaging Library**

Matrox Imaging’s core software product, Matrox Imaging Library (MIL), has reached its 20th anniversary. MIL provides a complete set of tools for the entire process of imaging application development, including feasibility testing, prototyping, application creation and deployment.

A team of highly skilled computer scientists, mathematicians, software engineers and physicists work diligently to foresee new industry requirements and offer timely enhancements to MIL to simplify and accelerate application development. The comprehensive software development tools continue to reduce time and effort required to bring machine vision, image analysis and medical imaging applications to market. More than 14,000 development seats and over 300,000 systems deployed using Matrox Imaging Library.
MORE CHOICE
World’s Largest Selection. CCD & CMOS. Shipping since 2011.

In addition to a camera portfolio that ranges from 1.3 to 9.1 MP, Point Grey and ClearView Imaging have an in depth knowledge of USB3.0 and can offer practical information on setting up and getting the most from USB3.0 imaging.

www.usb3imaging.co.uk
Browse our range of USB3.0 imaging products.

ClearView Imaging
Sole distributor for Point Grey in the UK
Mettler-Toledo’s White Paper ‘Measuring with Vision Inspection in Plastic Bottle Manufacturing’ outlines how vision technologies can measure and detect a range of product defects to maximise quality. The paper gives a technical overview of sophisticated software and image processing systems. It explains how they maintain accurate measurements across a range of container types and sizes.

By inspecting quality parameters such as thread formation, sealing or capping defects, labelling irregularities and surface contamination, manufacturers can eliminate out of specification bottles and containers from the manufacturing process. This reduces costly losses in production and achieves greater product quality and customer satisfaction.

Ensenso N10 3D stereo camera

The Ensenso N10 3D stereo cameras use a new procedure called “projected texture stereo vision”. They feature two global shutter CMOS sensors and a pattern projector, which projects a random dot pattern onto the object to be captured. The key advantage of the pattern is that it also works in multi-camera operation and is ideal for capturing unstructured surfaces. The system works with pulsed infrared light and is highly resistant to external light influences. As the Ensenso N10 is factory calibrated, installation of the camera for 3D surface matching using the MVTec Halcon interface takes less than ten minutes out of the box. The software interface allows easy integration of the camera into user application programs.

Unlike other 3D recording procedures, the camera can capture both static and moving objects at up to 30 frames per second. Working with multiple cameras simultaneously enables scenes to be captured synchronously from different sides, thus reducing shadowing effects and extending the field of view. A single 3D point cloud containing the data from all the cameras used can be output. Applications include medical engineering, robotics and gripping technology, logistics, completeness checking, rapid volume measurement, as well as measurement technology and safety engineering.

Patient leaflet inspection system

Olmec UK has designed and installed an end of line patient leaflet inspection system to be used with a new OTC decongestant product. The patient leaflets are hand-inserted into the product carton and Olmec has worked in close collaboration with the
supplier to develop an extremely simple user-interface. Patient leaflets are dispensed from a friction feeder and a simple code-reading system reads the pharmacode and compares it to the code in a database to confirm that it is the correct leaflet. An interface with the leaflet feeder ensures that incorrect leaflets are automatically rejected and do not reach the packer. The user interface is designed so that the operator simply has to select the correct recipe for the product and the system does the rest. The packing line has several operators working together and great care has been taken to optimise the read-rate of the leaflets to ensure that there is no delay in their delivery to the operators.

RNA AUTOMATION www.rnaautomation.com

Vision system on show

At the recent UPAKOVKA 2014 exhibition held in Moscow, RNA Automation showed an automated vision inspection system inspecting 50mm diameter electrical caps discharged from a vibratory bowl feeder. RNA automated vision inspection systems are designed to cater for a wide range of components to meet high speed quality control. The company also presented a new sachet and pouch conveyor in partnership with BB Verpackungsmaschinen. This provides the ability to singulate and equally pitch odd-shaped products such as pouches, sachets, cereal bars, salted snacks and bagged toys at a rate of up to 300 products per minute.

SCANDINAVIAN MACHINE VISION www.scanmv.co.uk

Press Vision 3.0

Press Vision 3.0 is an industry standard solution for hot stamping presses, eliminating the need for manual surveillance of the process. Without affecting cycle time, the system check blank position and double blanks and stops the press if parameters are out of range.

Version 3.0 is expandable with a multitude of new measurement and control modules especially developed for press hardening lines, including accurate blank positioning for robots and IR camera temperature measurement of both blanks and pressed product. The new version is based on an entirely new platform utilising Power over Ethernet cameras with enhanced IR sensitivity and improved PLC integration. It is sold around the world as an OEM solution to press manufacturers and as turnkey systems to customers with existing presses.

SCORPION VISION www.scorpionvision.co.uk

3 Mpixel and 5 Mpixel zoom cameras

Scorpion Vision can now offer monochrome 3 megapixel and 5 megapixel zoom cameras from The Imaging Source.

The cameras, which ship with Gigabit Ethernet interfaces, feature an integrated motorised zoom lens, iris and focus. They are ideally suited to a wide range of applications in the fields of industrial automation, quality assurance, traffic (ITS), surveillance and medicine.

SICK (UK) www.sick.com/uk/en-uk

ColorRanger enables 3D colour imaging

The ColorRanger E from Sick (UK) enables high-speed 3D scanning and colour imaging in parallel. It offers the functionality of a 3D camera with a line-scan colour camera, to provide two modes of quality inspection within a single unit, which can significantly improve the ease, reliability and speed of the quality control process. It can measure colour, shape, contrast, volume and height, to ensure product quality. It is ideal for use in applications including food processing, electronics, pharmaceutical, cosmetics and building material production.

The ColorRanger E provides high-resolution RGB colour, up to 3,072 pixels per channel. Using MultiScan technology the camera can deliver simultaneous 3D colour information at more than 11 kHz. A Gigabit Ethernet communication interface facilitates convenient remote PC access for quality monitoring. Multiple inspections can be performed in parallel, at full production speed, reducing the need for multiple cameras. This can save investment, maintenance and labour costs, as well as time, and makes it easier to combine data for analysis.
IMPERX Cameras
More features
More options
More rugged

IMPERX UK Distributor: MultiPix imaging
**MEMBERS NEWS**

**STEMMER IMAGING** [www.stemmer-imaging.co.uk](http://www.stemmer-imaging.co.uk)

**All-in-one 3D smart snapshot scanner**

The new Gocator 3100 series of 3D smart snapshot sensors are ideal for a wide variety of non-contact, in-line inspection applications where objects must remain stationary. They combine 3D point cloud acquisition with a rich set of volumetric and specific 3D feature measurement tools and can be used in inspection applications from automotive to reverse engineering.

Gocator 3100 features an integral structured blue LED light projection illumination source with stereo scanning technology that allows 3D point clouds to be captured in a single snapshot, even under challenging ambient light conditions. It performs high-resolution non-contact measurement at up to 5Hz. The Gocator 3100 is ideal for dimensional measurement of many features such as holes, slots, studs and gap and flush.

The unique all-in-one design puts everything needed for set up, measurement, and control in one web-enabled, pre-calibrated package. Powerful built-in tools provide a full suite of measurement capabilities to turn 3D data into real-time measurements to solve most inspection challenges.

**UPM CONVEYORS** [www.upmconveyors.co.uk](http://www.upmconveyors.co.uk)

**Automated handling system delivers product for vision inspection**

UPM Conveyors has installed its third automated product handling system at the Plastek UK factory in Mansfield, UK. Winner of ‘Processor of the Year 2013’ by the PIA, Plastek UK focuses on the design, manufacture and decoration of packaging solutions for the personal care; cosmetics; pharmaceutical and food markets using a range of injection and injection blow moulding machines.

The UPM system provides HMI touch screen control to allow all products from injection moulding machines to be transferred to the fully automatic assembly and packaging machines without any manual involvement. This is achieved by the incorporation of multi-way diverters based on the unique conveyor design developed by UPM. Under press reversing reject belt conveyors operate via the machine SPC control to ensure only good product is transported via swan neck belt conveyors to high level conveyors to minimise floor area occupied then through a fire wall to 5 High Speed Assembly Cells where Plastek have 100% Vision Check operating at speeds from 280 to 320 parts per minute with over capacity storage facility subject to high level detectors.

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Comprehensive solutions for inspection, quality control, packaging and logistics.
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<td>Baumer Ltd</td>
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## VISION SYSTEM INTEGRATORS & CONSULTANTS

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## PROVIDERS OF SOLUTIONS THAT UTILISE MACHINE VISION

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## Additional Information

Multivac UK is a wholly-owned subsidiary of Multivac Sepp Haugenmüller GmbH & Co, the world’s leading supplier of packaging machines.

ClearView Imaging is a supplier of vision components, including a wide range of cameras, frame grabbers, software, embedded systems, smart cameras, vision processors, lighting and optics.

Baumer is one of the leading global manufacturers of innovative image processing components and offers an extensive product range of high quality industrial cameras and vision sensors.

Framos is a specialist distributor of digital and electronic imaging devices and complete cameras. Both area and linear CCD and CMOS devices are offered with full technical support for design and integration.

ClearView Imaging is a leader in the design and manufacture of PC-based hardware and software for machine vision, image analysis and medical imaging. The company has the remit to promote, advise and manage sales and support of Scorpion Vision Software.

Sick offers a wide range of vision products to help solve your vision applications. Applications range from part presence and positioning with vision sensors, to full 3D scanning and measurement using 3D cameras, allowing SICK to help at nearly every stage of the automated production line.

Sick Vision Ltd is the UK representative of Tordvill AS of Norway. Founded in January 2006, the company has the remit to promote, advise and manage sales and support of Scorpion Vision Software.

Delta Vision is a leading designer and manufacturer of PC-based hardware and software for machine vision, image analysis and medical imaging on an unparalleled 25 years of industry experience.

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The premier UK machine vision components distributor providing leading vision technology, advice and development services to OEMs, integrators and corporate customers.

Scandinavian Machine Vision Ltd is an independent machine vision integrator providing complete solutions and tailored services for a wide range of manufacturing and process industries.

IDS Imaging Development Systems is a global leader in medical vision and machine vision technology, offering industrial cameras with USB 2.0, 3.0 and GigE interface and OEM plus customised solutions.

Impex designs, develops and manufactures state-of-the-art imaging products for a variety of markets.

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IDSVision develops and integrates solutions for automated processes involving machine vision systems and/or vision control systems. They produce automation systems for the electronics, automotive, printing and packaging industries.

Olimec supply, install and integrate vision systems into existing, new and OEM machinery processes.

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Sigma Vision is a leading designer and manufacturer of PC-based hardware and software for machine vision, image analysis and medical imaging on an unparalleled 25 years of industry experience.

Fisher Smith is a UK specialist in machine vision. Our product range covers, Vision and Control machine vision components, and GenVIs and RoboVIs PC-based vision systems and vision training.

Loop Technology Ltd provides development and integration services for automated processes involving machine vision systems and/or vision control systems. They produce automation systems for the electronics, automotive, printing and packaging industries.

Leuze electronic ‘the sensor people’ are the experts for sensors. They also specialise in smart cameras and identification products.

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Imaging is our passion.
Making measurements
The major imaging toolkits that are available from a number of different vendors, offer a multitude of 3D measurement and image manipulation and presentation capabilities. Vision tools are available for registration and triangulation of point clouds, calculation of features like shape and volume, segmentation of point clouds by cutting planes, and many more. It is possible to make a 3D surface comparison between the expected and measured shape of a 3D object surface. ‘Golden template’ matching is also possible in 3D with deviations between the template and test part identified in real time using real 3D point clouds and automatically adjusted for variations in orientation in all 3 axes. With 3D ‘smart’ cameras, however, acquisition, measurement, decision and control are all performed within the unit, although data can be output for further processing, if required.

Calibration
Many 3D applications can work reliably with non-calibrated images, while others do need calibrated images and measurement data. Since the calibration process can be demanding, it is worth making sure that having real world corrected units is really necessary. The easiest calibration set-up comes using 3D smart cameras, where the laser, camera and lens are housed in a single housing. Making sure that having real world corrected units calibration process can be demanding, it is worth images and measurement data. Since the

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3D Imaging Methods

Laser profiling
Laser profiling using triangulation is one of the most popular 3D techniques. The object to be measured passes through a line of laser light and a camera mounted at a known angle to the laser records the resulting changing profile of the laser line. These 3D profiles deliver high measurement resolution with good measurement range. They produce a point cloud that when projected onto a designated plane creates a depth map that is conveniently analysed using well-known 2D vision tools like blob analysis, pattern recognition and optical character recognition. This technique relies on the object moving relative to the laser line so this configuration is particularly popular on production and packing lines where the product moves on a conveyor. The system can be configured using individual laser sources and cameras, or integrated systems where the source and camera are housed in a single enclosure. Care must be taken to avoid shadowing, where higher regions of the object block the view of the laser line so that data from the structures behind cannot be obtained. One solution is the use of several cameras which track the laser line from different angles and then merge the different data sets to a single height profile using sophisticated software tools.

Stereo imaging
Another common 3D method mimics nature by using a binocular stereo set-up where two cameras are used to record 2D images of an object. A 3D image can then be calculated using triangulation. This technology also allows for movement of the objects to be measured during recording. A random static illumination pattern can be used to add arbitrary texture to plain surfaces and objects that do not have the natural edges (texture) information which the stereo reconstruction algorithms require. This technology has proved very successful in applications such as volumetric measurements and robot bin-picking. Some systems are available which utilise line scan cameras instead of area scan cameras and are particularly useful for fast moving objects or web applications. Photometric stereo uses a number of images to reconstruct the object surface. Here a single camera and the object are fixed, while the scene is illuminated from different known orientations taken in consecutive images. This method gives only relative height measurements, making it an excellent choice for 3D surface inspection.

Fringe projection
Light stripe projection requires static objects. Here, the whole surface of the sample is acquired at once by projecting a stripe pattern to the surface, typically at an angle of 30˚ and recording the resulting image with a camera perpendicular to the surface. The large number of points acquired simultaneously gives height resolution up to two orders of magnitude better than with laser profiling. The measuring area can be scaled from less than a millimetre up to more that one metre so suits small as well as large samples.

Time of flight
Time of flight cameras measure the time taken for a light pulse to reach the object and return for each image point. Since the time is directly proportional to the distance of each image point, this provides height information at each point.
3D Inspection

3D imaging has opened up a host of opportunities for manufacturing industry. The ability to make real time measurements in the X, Y and Z axes at production line speeds not only allows volumes of product to be calculated and defects to be detected but also pass/fail decisions to be made on far more parameters than would be possible for traditional 2D measurements. 3D imaging is providing automated inspection solutions for both simple and complex objects and gives the user all of the traditional benefits associated with 2D inspection, such as reduced reliance on manpower for quality control; availability of live production data for monitoring systems; improved consistency of product; increased throughput and reduced wastage, as well as 100% inspection. Decisions can be made on product shape, proportions and even surface quality (indentations scratches, dents etc). The use of 3D matching tools enables 3D models to be compared to a known 3D or ‘golden’ template for product verification.

Not surprisingly, 3D inspection has applications in industries as diverse as food and beverage, pharmaceutical, automotive, packaging, electronics, transport, logistics and many more. In the food industry, 3D measurements have been utilised for applications, such as portion control and potato sorting by shape. They have also been used extensively in the baking industry on product such as pizza, pies, bread, pasties, cakes and biscuits to check for shape, size, edge defects and thickness, for example.

Assembly verification, especially of metal or plastic parts is critical in many industries and especially in the automotive industry. For example checking the height of components can be used to verify assemblies such as bearings, and 3D matching can confirm the surface integrity of parts. In final vehicle assembly, making gap and flush measurements on automotive panels allows correction and even rejection of the vehicle if the panels are badly misaligned.

In the pharmaceutical industry, 3D inspection can be used to detect shape defects in tablets including chips as well as reading embossed details on the tablet. Tablets can be checked in blister packs, with the 3D offering benefits for low contrast imaging to recognise grey products in aluminium foil as well as recognising deformations and tablet fragments. Height measurement allows the detection of tablet capping and upright tablets.

There are a host of applications for 3D inspection in general packaging applications from measuring the height of items in the packaging before it is closed to make sure that it is not too high, to checking that final packages are properly closed, with no flaps sticking out, or dents in the packaging. Rims of containers that will have foil lids applied can be checked for defects in the surface that would affect seal integrity.

3D Robot Vision

Automation is a key factor in improving productivity and competitiveness in world markets and the use of 3D vision to guide robots (pick and place) is key in maximising this competitiveness, particularly in the automotive and pharmaceutical industries, where 100% inspection is critical. Using 3D robot vision to pick unordered parts enables manufacturers to save a lot of time and resources shifting or organising parts in the manufacturing process or feeding robots and machines with parts.

The challenge lies in acquiring images in 3D, building a mathematical model and analysing the position of something in 3D space and then transmitting 3D picking coordinates to a robot, all in just a few seconds to meet the cycle time of the robot and avoid it having to wait for the next set of coordinates. Fortunately, complex 3D images do not necessarily have to be created to achieve this feat. It is possible to do this using stereo vision imaging techniques, where features are extracted from 2D images that are calibrated in 3D.

As a rule of thumb, if there are a minimum of 4 recognisable features on an object, it is possible to create 3D measurements of the object and therefore generate the X, Y and Z coordinate of any part of the object, with a level of accuracy that allows the robot to grip it without causing any damage. If however, there are not enough features, or no features at all that can be used for the 3D calibration, features can be ‘created’ using laser lines or dots to illuminate the area.

A good example of this is 3D de-palletising of sacks, which could contain anything from concrete to grain or tea. As the sacks are rather featureless, the whole pallet is illuminated with lasers and the laser lines located in 2D images. The sacks are also recognised in the 2D images and all the information is combined to get 3D picking data - all well within the cycle time of the robot. So most of the work is done in 2D, with far fewer pixels to process, yet a high level of accuracy is maintained due to the lens and camera calibration that can achieve sub-pixel measurements.
Dual-camera packaging inspection in the food industry

A multi-national organisation in the food industry had ongoing, but intermittent, issues with their multi-slot packs being only part-filled. Although there was a manual check on the line to catch these discrepancies, at 150 packs per minute, there was the inevitable non-compliant pack that slipped through the system at this point, to be isolated further down the production line at a greater reject cost. There was also a problem with the date code not being applied correctly to the packs from time to time. In order to ensure product acceptability in the market place, both these issues needed to be captured and either rectified, or rejected before end of line packaging.

AlphaChase designed a Reject Station incorporating two cameras; one to inspect the contents of each pack; the other to check the date code, along with an adjoining accumulation/rework table. In order to guarantee that the inspection was conducted correctly it was necessary to ensure that the gapping between each pack was sufficient. Using a combination of spindle-band belt conveyor and single-lane modular conveyor, the packs were precisely positioned to allow both inspection cameras to perform the necessary check in line; with a top-positioned flighted servo-reject conveyor being activated in the event that either check signalled non-compliance.

The rejected pack was passed to a further single-lane modular conveyor, accumulated to a defined number of packs and then pushed towards the operator for manual checks and filling of empty slots as required. In this way, rejects were kept to a minimum with only those with incorrect date codes or bad packaging being discarded. The Accumulation Table could accommodate up to 100 packs which was deemed more than adequate and allowed for operator absence without the need to stop the line.

High speed process troubleshooting

It takes just a blink of an eye for a packaging line to jam. But in that split second, a plant can lose valuable time, costing the company heavily in production and revenue. Alrad Imaging can offer the new Hindsight 20/20CAM from Monitoring Technology, a high speed camera designed to allow problems in high speed packaging machines to be
identified. 20/20CAM's high speed video is continually stored internal to the camera “engine” with a massive storage capacity. The “engine” offers full network capability, thus offering a complete camera and event history control from the plant floor or an office PC on the corporate internet. 20/20CAM integrates camera, XP embedded computing, a high-speed field programmable gate array (FPGA) and patent-pending software technology into a single package.

The ability to preserve the last 2 to 64 hours of video memory permits slow-motion replays and concurrent recording of current events in real time while reviewing past incident events. A multiple-camera version allows a process to be viewed from up to 8 camera angles. In many cases the cameras are small enough to be placed inside a machine in operation, providing views otherwise unattainable due to safety restrictions. Frame-by-frame advancing helps to determine a problem’s root cause.

In a recent application in a beer canning line in the USA, cans were getting dented at the discharge of the seamer. The only way to prevent this was to slow the filler down from 2000 cans per minute to 1,800 per minute. However, by slowing the line down output was reduced by about four truckloads of beer every eight hours. The Hindsight system, mounted on a moveable cart was positioned to examine the line. The unit was run at 2,000 frames/sec and within 15 minutes it was determined that a faulty bearing was causing the conveyor chain to jump. This caused excessive movement of the cans, which in turn caused the denting. The fault was repaired and the conveyor movement checked again using the cameras system to confirm that the abnormal conveyor movement had been removed.

CLEARVIEW IMAGING www.clearviewimaging.co.uk

3D imaging of tyres

ClearView are using 3D imaging techniques to extract information from automotive tyres. This data can include the DOT code, tyre model, and tyre specification. Reading the text on the tyre wall presents a number of challenges, the main one being that they are black-on-black and inherently very low contrast.

Conventional imaging techniques can struggle in this environment so 3D laser line profiling was used. Rather than a traditional grayscale image, this technique returns a 3D depth map. It is well suited to extracting the kind of moulded features typically used to create text on tyres. It is also inherently less susceptible to the surface reflectance of the object.

Using the PhotonFocus camera (MV1-D2048x1088-3D03-760-G2-8) gives high frame rates (~2000 fps), simple GigE cabling and offloads the line extraction from the host CPU to the camera's FPGA. This allows the processor to be used for more complex tasks such as segmentation and string reading. The camera is specifically developed for laser triangulation systems with high triangulation rates, as the CMOSIS CMOS sensor CMV2000 (with a full well capacity of 11 ke-) is optimised to deliver high sensitivity. Using the PhotonFocus camera (MV1-D2048x1088-3D03-760-G2-8) gives high frame rates (~2000 fps), simple GigE cabling and offloads the line extraction from the host CPU to the camera's FPGA. This allows the processor to be used for more complex tasks such as segmentation and string reading. The camera is specifically developed for laser triangulation systems with high triangulation rates, as the CMOSIS CMOS sensor CMV2000 (with a full well capacity of 11 ke-) is optimised to deliver high sensitivity. This, combined with a robust algorithm for line determination, made it an ideal choice for this application.

COGNEX www.cognex.co.uk

Cognex Vision ensures production quality of vehicle parts

Trax JH Ltd based in Wales is a leading manufacturer of automobile wheel weights, with OEM customers, such as Jaguar and Land Rover. These parts form a vital element in vehicle manufacture and the need for 100% accuracy in production is paramount for vehicle safety. To identify a potential solution for the existing production process, Trax JH contacted Acrovision, one of the UK’s leading suppliers of Automatic Identification solutions, who suggested using Cognex Vision to ensure complete part production accuracy.

Two Cognex In-Sight 7050 cameras operate on each of the two lines to inspect the correct orientation and size of the part, of which there are approximately 30 variants. Placed initially in a bowl feeder, the wheel weights are automatically positioned on a conveyor, which are then ‘flipped’ onto their side before being presented to the camera to check for the correct orientation and size.

One of the In-Sight cameras is placed above the line and inspects the length and width of each part to check it falls within pre-determined parameters, therefore, ensuring the same sized parts are all contained within a single batch ready to be shipped. The second In-Sight camera is positioned on the side of the conveyor to check the orientation of the part. This inspection process is vital to ensure that the adhesive tape applied at the next stage of production will be positioned correctly to ensure product quality. Once the adhesive tape is applied, the parts are collected in a box ready for dispatch. The reporting for each part inspection is collated and available for operators via Cognex’s VisionView visualisation tool used for analysing and managing the production processes for ongoing quality control. The inspection system ensures each part is 100% accurate prior to shipment and has significantly increased process repeatability and decreased PPM failures from the two production lines.

Hindsight 20/20CAM Remote Head

Dot code reading on automotive tyre

Automobile wheel weight inspection
IDS IMAGING DEVELOPMENT SYSTEMS

Vision combines with radar to prevent collisions

Pratt & Miller Engineering in the USA have used a machine vision camera from IDS Imaging Development Systems GmbH and a long range radar sensor from Bosch Automotive Technology to develop a collision avoidance system for use in endurance racing to allow drivers to visualise what is happening behind their cars in even the most demanding weather conditions. The system was first deployed on Pratt & Miller’s two Corvette Racing C6.R cars at the ‘12 Hours of Sebring’ endurance sports car race in Florida in 2013.

The system needs to be capable of operating both in daylight and at night as well as in weather conditions such as rain and fog. A custom built unit houses the radar sensor and camera on the back of the car and radar and visual data is transferred to a custom-built Linux PC with integrated LCD screen inside the vehicle. The radar sensor detects objects and measures their velocity and position relative to the motion of the car.

The vision system uses a 1024 x 600 pixel GigE UI-5240RE camera from IDS. Its rugged IP65/67 rated housing not only prevents the ingress of dust and water but can withstand the 4-5G vibration loads experienced during the race. The camera is operated in global shutter mode in order to eliminate smear in the images of the other fast moving vehicles and at 30 frames/sec, the low latency of the camera allows the images of the vehicles behind to be displayed in real time. Using data from the radar system, the system can calculate the absolute speed of the cars behind it and create a 3D ‘augmented reality’ display with colour coded 3D chevrons hovering over the visual images of the cars behind, to indicate how close the cars behind actually are and whether they are gaining, falling behind or travelling at the same speed. The data can be transformed to display exactly how far behind a car is in terms of seconds. A large flashing warning arrow indicates whenever another car attempts a passing manoeuvre.

The system also records real time video which can be downloaded after the race for analysis. On the system’s first race outing in Florida, neither car suffered any passing-related incidents and one of the cars won first place in the GT class.

(Original article by Dave Wilson, published in Vision Systems Design, September 2013)

OLMEC UK

Woundcare product packaging inspection using infrared imaging

Olimec UK has recently designed and installed an End of Line inspection system at a leading manufacturer of woundcare products. The inspection system utilises infrared (IR) imaging technology and links directly to the outfeed of the existing packaging machine which seals the woundcare product into a 4 sided pouch. It has been designed to inspect for empty pouches; pouches with the incorrect amount of dressings and dressings trapped in seals.

The new system has been introduced to replace human inspection, which has proved to be unreliable. The vision system is mounted between two conveyor belts and features a single, 2048 pixel line scan camera equipped with IR Lens pass filters mounted above the line and an IR light mounted underneath. The movement of packages along the belt below the high resolution line scan camera results in high quality images.

At an IR wavelength of 880nm the paper packaging material transmits far more light than the products inside, allowing the presence and position of the product to be easily verified including whether it is trapped in the seal. The system is capable of inspecting the 100 products per minute arriving from the packaging machine.

Image processing is carried out on a PC mounted within the system, with results displayed on a 19” industrial touch screen. All products that are ‘out of spec’ are automatically rejected, while ‘good’ product is transferred to an existing collator where the products are positioned in an easy way for the operators to gather them up and package them. Provision is made to stop the line in the event of a false reject or false acceptance.

As a turnkey package for the final inspection of product, the system features full validation documentation, including IQ/OQ and functional testing. This level of documentation ensures that the transition from commissioning to production has a minimal disruption and forms a core part of the customer’s sign-off for the inspection system.
To combat the growing and substantial threat of falsified medicines penetrating the European market, the European Stakeholder Model (ESM) (www.esm-system.eu) has developed an end-to-end medicine verification solution, consisting of four key data elements. This is key to aiding manufacturers to adhere to the 2011 EU Falsified Medicines Directive (FMD) which requires manufacturers to apply safety features to verify the authenticity and identity of individual packs of medication rather than batches. This will be mandatory by 2017.

To drive implementation of the FMD, a consultation has been undertaken to define the characteristics and specifications of a unique authentic pack identifier. It is highly predicted that it will include the adoption of a 2d DataMatrix barcode on each pack of medicine. The verification system proposed by the ESM features a 2d DataMatrix code carrying four key data elements (manufacturer product code, randomised unique serial number, expiry date, and batch number) which will also be required in a human readable format. The definitive way to read this system is through machine vision. This system would allow each individual pack to be tracked from point of manufacture through to distribution (end to end) using scanners, software and databases allowing pharmacies to verify the authenticity of the medicines at the final point when it is dispensed to the patient. By simply scanning the barcode on the packaging, any unregistered code will immediately alert the pharmacist to the possibility of a falsified product. Much of the coding equipment implemented today is not capable of 2d DataMatrix serialisation and many manufacturers will need to upgrade their coding kit. However, a significant challenge arising from the proposed 2d DataMatrix code is with regard to the data management of the randomised unique serial number and the synchronisation of data between the printing device and verification system.

A resolution to this would be the integration of flexible vision solutions which are built on IPC technology to provide the flexibility to cope with a wide range of data management requirements and allow for interfacing with 3rd party devices such as printers. These superior specification vision solutions can interface with high level production management software to request the data required and verify the unique serial number, whether through database integration or simple manipulation of .csv data files.

OMRON www.industrial.omron.co.uk

Machine vision for combating falsified medicines

FH Compact Vision System

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WHAT’S NEW IN INDUSTRIAL VISION?

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Pleat detection in aluminium bottles

With shaped aluminium bottles increasing in popularity in the packaging industry, the demands to eliminate defects during manufacture are similar to those made from other materials. With the shaped bottles being made in stages, one common defect that can arise is a pleat, or fold in the material. Because of the high contrast colours and complex print, and the often small size of these defects, traditional imaging inspection methods are not particularly effective to differentiate defects from print features.

Vision systems integrator, Scandinavian Machine Vision, has developed a system based on 3D imaging using Sick Ranger cameras in conjunction with laser light sources using the triangulation method. A laser in the near IR range is utilised to reduce the influence of different colour in the print. The pleats are most frequently found on the neck or the shoulder of the bottle. The imaging system consists of 2-4 cameras looking at different fields of view and recording 15,000 scans/second.

The capability of the system is illustrated in the images, which show a 3D reconstruction of the top of the bottle. The left hand image is colour coded according to the absolute radius of the bottle ranging over a scale from 10 - 35mm. A small defect is visible on the shoulder of the bottle. The right hand image, however, is colour coded according to variations in the surface where the red mark indicates the detected defect. Of course the system delivers exact, calibrated data for each pixel so that the measurement can be made precisely. The measurement resolution is better than 0.0mm and defects with a depth and length greater than 0.1mm x 2.0mm can be detected.
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APPLICATION ARTICLES

SCORPION VISION www.scorpionvision.co.uk

Dog meat robot picking system

Scorpion Vision has worked with automation partner Dynatec from Askim, Norway to develop an innovative 3D Bin Picking solution for dog food packaging using an ABB robot. This is a 3D robot guidance system that has to work in real time as the sausage-shaped dog meat is rolling about as each one is picked. The system utilises the new Scorpion 3D Stinger MLaser Camera in conjunction with Scorpion Vision Software Version X. The 3D Stinger contains stereo vision cameras and multi-line laser for locating moving objects in real-time in 3D.

This is a fast, real time application where "featureless" objects are illuminated using laser lines to create the 3D model. The shape of the sausage is generated using the deflection of the laser lines by extracting 3D data from 2D images, a well-established technique that has been used in a variety of applications. The use of structured light creates contrast on the sausages making it possible to use a 3D Cylinder fit to locate the dog food with the required robustness. The cycle time of the system is less than 2 seconds leaving less than 500 ms for 2D and 3D image processing. The system handles three different sausage sizes. Since the scene is dynamic, with constantly moving objects, resampling is required just before the robot goes to pick again.

STEMMER IMAGING www.stemmer-imaging.co.uk

100% testing of metal-plastic composite parts

Swoboda KG (Wiggensbach, Germany) is a leading manufacturer of high precision metal-plastic composite parts used in car steering controls and numerous other car components. Automated inspection of these components and assemblies using conventional 2D imaging systems is difficult since the surface finish of the metal parts varies from matt to polished giving differing light reflections. This leads to increased false rejects requiring additional manual inspection and additional costs. Following a successful stand-alone trial period, Stemmer Imaging has delivered a trevista system to Swoboda for integration into the production line.

The trevista system features a domed structured diffuse illumination source in combination with patented ‘shape from shading’ technology which allows problem-free inspection of not only shiny metallic components with varying reflections but also of black plastic material. The components, protected from interfering ambient light by the dome, are evenly illuminated with diffuse light from four different directions and individual images recorded. A special algorithm processes these input images and creates four high value synthetic event images from them: the first two represent the local slope of the surface in x and y directions. The third, the so-called curvature image records the topography of the surface independently from the direction. The fourth image records the pure texture of the surface and can be compared to a conventional 2D image without irritating reflections.

This approach allows topographic shape characteristics to be reliably distinguished from brightness characteristics of the material or strains caused by lubricants and corroded areas. Defects down to a depth of just a few micrometres can be located and classified quickly, reliably and free from interference.
Images are acquired using Common Vision Blox, the imaging toolkit from Stemmer Imaging. Input image data are then transferred into the Sherlock software platform from Teledyne DALSA for preprocessing and subsequent analysis.

Stemmer Imaging worked closely with Swoboda to integrate the trevista system into the line by mechanically adapting the trevista base plate and linking into the existing software system. The new system has reduced false rejects by nearly two thirds at an early stage and has led to a considerable reduction in additional manual inspection.

Stemmer Imaging: UK Vision Technology Forum, May 22nd 2014
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www.stemmer-imaging.co.uk/page/forum-uk

FORUM

Matrox:
‘Introduction to the MIL/MIL-Lite Environment’, April 7-8 2014
‘Matrox Imaging Library (MIL) Processing’, April 9-11 2014
Both courses in Montreal, Canada
www.matrox.com/imaging/en/support/training

Stemmer Imaging (in association with the European Imaging Academy):
‘3D Image Processing with the LMI Gocator’, March 18th 2014
‘Machine Vision Solutions from Teledyne DALSA’, April 15-6 2014 and July 8-9 2014
All courses at Tongham, UK
www.stemmer-imaging.co.uk/en/support/training

FORUM & TRAINING

INSPECTOR VISION SENSORS: POSITION, INSPECT, MEASURE

This is SICK
Sensor Intelligence.

Easy to use, simple to integrate and straightforward to maintain; the Inspector vision sensor will help to save you money, increase your quality levels and improve your production processes. All of the range include the tools for high speed object location and feature detection; the new PIM60 has the additional capability to measure diameters, angles and variable distances. In-built illumination, and accessory options make the Inspector a tough and flexible solution.

We think that’s intelligent. www.sick.co.uk
 EVENTS

MILITARY ROBOTICS
21-22 May, 2014
Holiday Inn Regents Park, London

UKIVA is a partner to the Military Robotics 2014 conference and exhibition. This is an industry in which there is a growing use of vision systems.

www.smi-online.co.uk/military-robotics2.asp

PPMA SHOW
30 September – 2 October, 2014
NEC, Birmingham

More vision companies exhibit at the PPMA Show than ever before.

www.ppmashow.co.uk

PHOTONEX
15 – 16 October, 2014
Ricoh Arena, Coventry

UKIVA will once again be presenting an educational seminar program on imaging at the Photonex Exhibition.

www.photonex.org

VISION
4 – 6 November, 2014
Messe Stuttgart, Germany

This will be the first VISION Show since it moved on to a biennial cycle.

www.vision-fair.de

PPMA Show
30 September – 2 October,
NEC, Birmingham
www.ppmashow.co.uk

There is considerable excitement surrounding the forthcoming PPMA Show, which is the first since the exhibition returned to PPMA control. The increasing importance of industrial vision in processing and packaging applications is reflected in the considerable commitment of UKIVA members to exhibit at the PPMA Show. The PPMA Show doesn’t disappoint with an expected 8000 visitors to see 320 exhibitors in 2014!

Vision technology and equipment on show will cover a multitude of applications, ranging from the measurement of product and components during the manufacturing process, to the inspection of the integrity of packaging to the reading and verification of print, barcodes and labels.

Machine Vision Award

The presentation of the PPMA Group Industry Awards is the highlight of the gala dinner on the first evening of the PPMA Show. The awards will be presented by Rory Bremner this year. In the UK vision industry, the Award for the ‘Most Innovative Machine Vision Project’ provides public recognition of achievement and is highly sought after, particularly as it is not restricted to UKIVA members. The award is open to all vision equipment suppliers, system integrators or end users that have installed an innovative vision system in the period between January 2013 and June 2014. All parties involved in the project are recognised by the award, so if you are an end user benefiting from a successful, innovative vision solution, you are eligible to apply as well!

For the first time this award will be sponsored by a UKIVA member, Stemmer Imaging. Mark Williamson, Director – Corporate Market Development at Stemmer Imaging, said:

“We were fortunate enough to win the award ourselves last year and were finalists the year before. We, and previous award winners, would agree that holding the award has raised our profile in the industry in general, in our local communities, and helped give prospective new customers an extra confidence in our capabilities. We, therefore, felt that the time was right to support the Association by providing sponsorship.”

www.ukiva.org and www.ppma.co.uk
Out of the box and straight onto your production line with the minimum time, cost and effort, this is what the new In-Sight® 7010 vision system delivers:

- **Simple setup** – integrated autofocus, optics and lighting
- **Fast installation** – compact, rugged, IP67 rated package
- **Easy configuration** – with EasyBuilder application software
- **Flexibility** – interface to any automation with Cognex Connect®

For manufacturers, the In-Sight 7010 opens up a wide range of new applications where vision is now highly cost-effective.
Here’s to 20 years of vision

With more than 14,000 development seats and over 300,000 systems deployed¹, Matrox Imaging Library (MIL) has something to celebrate. Companies around the world have made MIL their vision tool of choice and our commitment to innovation will ensure that it stays that way.

“In 2009, we decided to evolve our semiconductor back-end handler’s vision system and sought a well-established vision library supplier with proven technology. Now, as we deploy this more powerful next-generation vision system, MIL continues to impress.”

Ismeca Semiconductor SA, Switzerland

“Mettler Toledo CI-Vision is a world leader in turnkey vision systems for two primary reasons: ease of use and exceptional quality. MIL has been a foundation for building these two assets into our products for over 10 years.”

Mettler Toledo CI-Vision, USA

“As a technology leader in FPD inspection (LCD/OLED), we need comprehensive, powerful and field-proven tools for machine vision. MIL is the right choice for us.”

Samsung Electronics Co., Ltd., Korea

Learn more about MIL: www.matrox.com/mil/ukiva

¹. Figures do not include the MIL-Lite video capture SDK and deployments without actual MIL vision tools.

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