UKIVA

VISION IN ACTION

Editor: Dr Denis Bulgin
Advertising Sales & Production: Chris Valdes

Autumn 2017

Industry update from the UK Industrial Vision Association

Seeing the invisible!

Machine vision is an incredibly powerful measurement technique that can be configured to reveal information not easily observed using the human eye. Many methods are available.

These could include choosing between colour or monochrome imaging, making use of optical filters to modify the wavelength of light reaching the object or using polarisers to eliminate glare. The actual type or angle of illumination used is also very important.

Another important technique to emerge recently has been that of 'computational imaging' where multiple images of an object are obtained by illuminating from different directions and computationally combining the images to reveal surface information that otherwise could not have been seen.

All of these (and many more) are highly effective techniques that allow 'hidden' details to be imaged, but all make use of light in the visible spectrum. However, by using light outside the visible region, information that is normally completely invisible to the human eye can be seen!

UKIVA machine vision conference & EXHIBITION

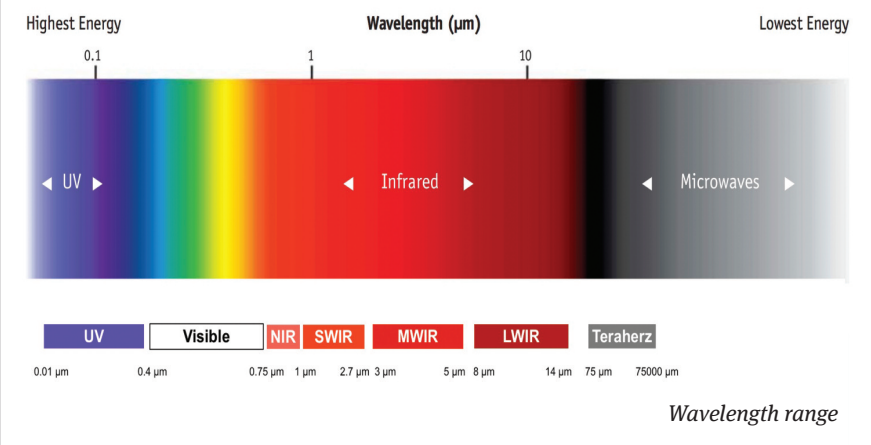
16 May 2018

Following the success of UKIVA's first Machine Vision Conference in April this year, we are proud to announce the next MVC will be held on Wednesday 16 May 2018, at the Arena MK, Milton Keynes, England.

Please ensure you save this date in your diary as the organising committee are again planning a comprehensive seminar programme supported by live exhibits from leading manufacturers and distributors.

www.machinevisionconference.co.uk

Using light of different wavelengths



Wavelength range

There are many useful imaging possibilities provided from using light (electromagnetic radiation) at either longer or shorter wavelengths than visible light. At longer wavelengths we have infrared imaging and the more recently introduced Teraherz imaging, while at shorter wavelengths we have UV and even X-ray radiation. Infra red imaging itself can be divided into three regions, near infrared (NIR), short wave infrared (SWIR) and long wave infrared (LWIR) which each have their own characteristics.

The NIR region has also given rise to the technique of 'hyperspectral' imaging where images can be produced with details colour coded according to the chemical composition of the material being imaged. **Find out more about these and other techniques for 'seeing the invisible' in a special 4-page insert in this issue of Vision in Action.**

VISIONARY-T VISION SENSOR: 3D SNAPSHOT - FOR VERSATILE INDOOR USE

THIS IS SICK

Sensor Intelligence.

The SICK Visionary-T is a robust, industrial imaging camera used to capture high-resolution 3D data with a single ‘snapshot’, whether the object is stationary or moving. The SICK Visionary-T uses high-resolution Time-of–Flight (TOF) technology to achieve superior quality 3D imaging for vision applications. Unlike 3D vision systems based on laser triangulation, the 3D image is captured with one shot of light, without the need to profile a moving object.
We think that’s intelligent. www.sick.com/Visionary-T

FOREWORD by Paul Wilson

Without doubt the high spot of the Association's year to date was our first Machine Vision Conference and Exhibition which took place on April 27 at the Arena MK in Milton Keynes. This event was incredibly well received by not only more than 300 visitors, but also by the press and the participants themselves – the presenters and exhibitors, without whom the event would not have been possible. A huge amount of effort went into staging this first event and great credit must go to the team behind the scenes who made everything happen with the minimum of fuss.

I would like to take this opportunity to thank our two Keynote speakers, Dr. Mike Aldred from Dyson Ltd and Dr. Graham Deacon from Ocado Technology. Both of their stimulating presentations attracted huge audiences with standing room only and got the morning and afternoon sessions off to a flying start! I am delighted to say that next year's event will take place on Wednesday May 16, 2018, once again at Arena MK. Bookmark www.machinevisionconference.co.uk in your browser to keep in touch with all of the latest announcements.

Before that, however, is the PPMA Show, which will take place on the 26 – 28 September at the NEC in Birmingham. With over 17% of visitors to the last PPMA show having registered vision as being at least one of their interests, no less than 15 UKIVA members will be exhibiting. I am also delighted that PPMA BEST will have a stand presence there, just by the main entrance to Hall 5. PPMA BEST (www.ppmabest.org.uk) is a charity that was established in 2014 to encourage young people to enter and develop a career in engineering within the processing, packaging, robotics, automation and industrial vision supply industries through education, training and support. During the coming academic year, PPMA BEST is implementing a very welcome initiative that will provide an organised pathway to show young students just what a career in the vision and related industries has to offer. You can find out more about this elsewhere in this issue of Vision in Action.

Paul Wilson, UKIVA Chairman

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Free subscription contact
Christine Valdes
T: +44 (0) 20 8773 5517
E: chris.valdes@ppma.co.uk

We are always looking to improve Vision in Action, for comments and feedback please email the editor
Denis Bulgin, In Press PR Ltd
E: denis@inpress.co.uk

Design and Artwork: Barry Heath
E: bmh@btinternet.com

MEMBERS NEWS

PPMA BEST
INITIATIVE FOR VISION AND RELATED INDUSTRIES

In the 2017 – 18 academic year, PPMA BEST (Business Education, Skills and Training) will be running a programme of STEM (Science, Technology, Engineering and Maths) taster days and work experience opportunities. The aim is to help inspire the next generation of potential engineers and highlight the opportunities available within PPMA, UKIVA and BARA member companies. PPMA BEST (www.ppmabest.org.uk) is an independent charity that was set up by the PPMA Group of Trade Associations to address the on-going skills shortage in within the industries served by the Associations and to tackle short and longer term recruitment needs.

The STEM activity day will be run at 5 schools for all Year 10 students. They will have the opportunity to meet with engineers from member companies, take part in relevant tasks and receive expert careers advice. The activities are being organised by Danny Reed from PPMA - BEST (danny.reed@ppma.co.uk) and will be run by the Education Development Trust's FIRST Edition Team or Smallpeice Trust STEM Days team depending on the activity.

Work experience will be offered to Year 10 and Further Education, 6th Form students. It is hoped that the students at the STEM days will be inspired to participate. All of the activities will be accredited with the Industrial Cadets award. This is an industry standard qualification that is recognised UK wide. The aim of this programme is to build relationships between PPMA members and education and support interested young people to pursue a career with PPMA member companies through Apprenticeship or Graduate routes. PPMA – BEST is also currently investigating the apprenticeship training offer available to members nationwide.

PPMA SHOW 2017

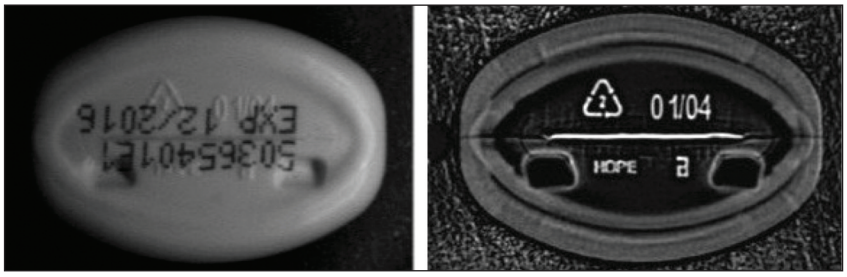
The PPMA Show will be taking place at the NEC on 26 -28 September 2017. UKIVA members Acrovision, Alrad Imaging, Bytronic Automation, Clearview Imaging, Cognex UK, Crest Solutions, IFM Electronic, Leuze Electronic, Mettler Toledo, Multipix Imaging, Omron Electronics, Sick (UK), Stemmer Imaging, UPM Conveyors and Wenglor Sensoric will all be exhibiting at the show. PPMA - BEST will also have a stand there, near the entrance to Hall 5.

Editorial material in this section is provided by UKIVA Members.
Content accuracy is the responsibility of individual UKIVA Members.

ACROVISION www.acrovision.co.uk

SurfaceFX - seeing things other cameras cannot see!

A new verification tool is now available that can detect small flaws, pick out difficult to read engraved, embossed, or stamped items and remove ambient light or glare. Acrovision, the UK's Automation Solutions Provider for Cognex Vision Systems, introduces the Cognex SurfaceFX tool, that works alongside an In-Sight Camera and sees things other cameras cannot see – picking up very small defects.



Shampoo bottle before and after using SurfaceFX

SurfaceFX operates with photometric stereo. It uses surface reflections and shadows from different angled lights to determine the surface structure, and combines images from different light sources to create the result. Possible applications for the SurfaceFX would include; detection of chips, dents, wrinkles, punctures, and tears; adding contrast to engraved, embossed, stamped, etched, or raised codes and removing light noise from either ambient light or glare.

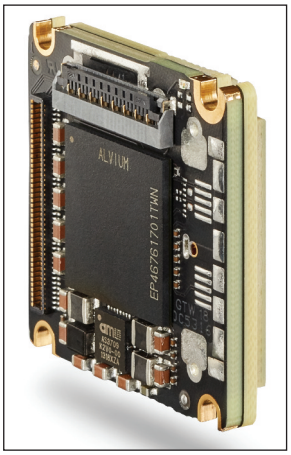
ALLIED VISION www.alliedvision.com

Innovative camera platform brings machine vision performance to the embedded world

Allied Vision's new proprietary ALVIUM® system on chip is optimised for advanced digital imaging combined with a comprehensive image processing library (IPL).

ALVIUM® technology has been used in the new 130 and 140 series of cameras, building a bridge between the embedded and the machine vision world. They provide a wealth of on-board image pre-processing functions in a small form factor, with intelligent power management and at a lower cost than conventional FPGA-based machine vision cameras. Using the ALVIUM® IPL system for image correction and optimisation frees CPU capacity on the processor for alternative processing tasks.

The 130 series is available in a single board design (26 x 26) or with a robust 29 x 29 front flange with various lens mount options. Four sensor choices provide resolutions from 0.5 to 5 megapixels. The 140 series has a choice of eight sensors offering 0.5 to 18 megapixel resolution. A more advanced feature set allows for more complex on-board pre-processing. Both series are available with MIPI CSI-2 and USB3 Vision interfaces.



Board level camera with Alvium vision processor

ALRAD IMAGING www.alrad.co.uk

SWIR imaging from Alrad

The new NIT WiDy SWIR 640V-ST camera from Alrad Imaging uses a TEC stabilised InGaAs SWIR sensor (NSC1201T-SI): 1in format, with 640 x 512 resolution and 15 microns pixel pitch. The camera is available in USB2.0, USB3.0 and Camera Link options. Featuring an ultra compact shockproof housing and very low power consumption, the camera offers an impressive QE (>70%), a wide dynamic range (>140dB) and logarithmic response.

This easy to use camera provides stable and reproducible behaviour without complex calibration and/or look up tables. Featuring "Plug and Play" operation, this camera is delivered calibrated and with proprietary WiDyVISION TEC Software and cables.

The software features advanced image processing including Non Uniformity Correction, bad pixels replacement, image enhancement and zoom, as well as control of sensor temperature and many other features. Lower cost uncooled 640x512 and 320 x 256 versions are also available. Alrad also offers the new Kowa HC-SW 1" format megapixel SWIR lens series with high transmission from 800 nm to 2000 nm.

WIDy SWIR 640 camera

BAUMER **www.baumer.com**

Baumer CX - the first Sony Pregius CMOS cameras with a 1 µs exposure time

CX cameras

Baumer has introduced the first industrial CMOS cameras with an exposure time down to 1 µs. The CX models, including the second generation of Sony Pregius sensors, feature exposure times ranging from 1 µs to 60 s. Available with up to 12 megapixel resolution, they are ideal in high light intensity tasks such as laser welding and will minimise blur in high-speed applications such as pick and place. These new CMOS cameras close the gap where previously CCD sensors were required.

The CX cameras feature a 29 x 29 housing and can withstand operating temperatures up to 65°C. Additionally, they feature an excellent dynamic range of 71 dB and can achieve 1000 fps on selected regions. The high resolution combined with excellent image quality allows these GigE and USB 3.0 cameras to be used in various industries that place the highest demands on image details and throughput.

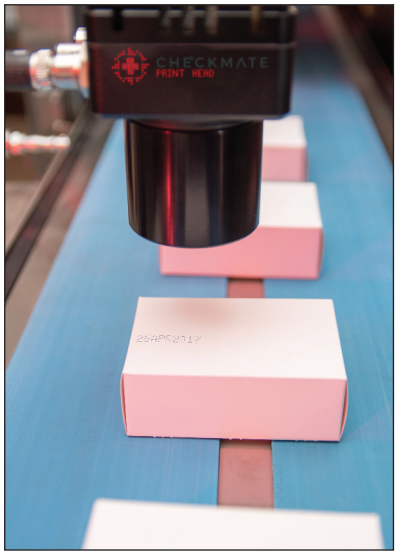
CLEARVIEW IMAGING **www.clearviewimaging.co.uk**

CheckMate Print Head meets supermarket demand for reliable code legibility

ClearView Imaging is launching the CheckMate Print Head, an affordable on-line batch verification print and vision solution for food manufacturing, at PPMA 2017, stand G44.

The CheckMate Print Head unit is able to verify legibility rather than simple comparison of continuous ink-jet (CIJ) codes. It is based on industrial grade, IP67 smart camera technology and proven, patented algorithms built around dot matrix printing. This revolutionary technique offers greater readability of the codes – even if they vary from the target norm – which makes for a robust manufacturing operation by reducing spurious rejects.

As important, the system is the only in-line print and verification solution (comprising the CheckMate Print Head and a Linx 10 CIJ printer) available for £10,000, including installation and commissioning – making it affordable to food manufacturers with already tight margins. The CheckMate Print Head will also work with any CIJ printer, making it an attractive retrofit option.



CheckMate Print Head

SUCCESSFUL MACHINE VISION CONFERENCE AND EXHIBITION

The first UKIVA Machine Vision Conference and Exhibition held in April was a dynamic event attended by over 300 visitors from industry and academia. Two keynote addresses, a comprehensive conference program and an exhibition by 57 of the world's leading manufacturers and suppliers of machine vision systems and components combined to create an informative and educational environment. Keynote addresses from Dr Mike Aldred from Dyson Ltd and Dr Graham Deacon from Ocado Technology both attracted more than 100 people to hear how vision technology is being utilised in vacuum cleaning and robotic picking of items for home grocery delivery.

The conference was hugely popular with 55 technical seminars held over 7 presentation theatres offering varied content for both newcomers to the technology and experienced vision users. There was a great synergy between the conference and exhibition. Located centrally with respect to the presentation theatres, the exhibition was readily accessible to visitors throughout the day and provided the opportunity to see a rich selection of the latest vision technology. Many speakers reported that delegates at their seminars subsequently visited them at their exhibition stands for further discussions. The 2018 event is scheduled for May 16, 2018, again at Arena MK, Milton Keynes, UK.

NEW MEMBERS

UKIVA is delighted to welcome 3 new members:

Hikvision is a provider of video surveillance and industrial cameras. These include area scan cameras, line scan cameras, smart cameras, 3D cameras, vision boxes, vision software and accessories.

Sony Image Sensing Solutions division offer an in-depth range of component cameras and image sensing products. These include 4K and full high definition cameras; CCD cameras for analogue and digital (IEEE 1394, GigE and CameraLink) vision systems and the latest global shutter CMOS cameras.

Datalogic specialises in the design and production of bar code readers, mobile computers, sensors for detection, measurement and safety, RFID vision and laser marking systems. These are used in the retail, manufacturing, transportation & logistics and healthcare industries, along the entire value chain.

COGNEX www.cognex.com

Cognex Introduces second generation In-Sight 7000 vision system

The second generation In-Sight® 7000 series performs fast and precise inspections that keep pace with increasing line speeds, while its compact form factor easily fits into space-constrained production lines. Its unique, modular design offers over 400 different field configurations making it fully customisable.

The rugged In-Sight 7000 is IP67-rated and includes Flexible Image Technology™. This complete vision system features a patent-pending LED ring light that produces even, diffused illumination across the entire image, eliminating the need for costly external lighting. A variety of light colours, optical filters and polarisers can easily be swapped in to meet specific application requirements. The wide range of field-changeable C-mount and S-mount lenses and industrial, mechanical autofocus lens options enhance versatility. Like all Cognex In-Sight vision systems, the In-Sight 7000 uses In-Sight Explorer™ to set up and monitor machine vision inspections.

Second generation IS7000 vision systems

CREST SOLUTIONS www.crestsolutions.ie

Crest Solutions' partner wins new technology development grant from EU

Antares Vision has been awarded a highly prestigious grant through the EU Horizon 2020's Small and Medium Enterprises (SME) instrument framework to develop new technology for the inspection of injectable lyophilised pharmaceutical products. Antares Vision is the world's leading provider of serialisation-based track and trace solutions for the pharmaceutical industry. Their solutions are delivered and supported by Crest Solutions in the UK.

The new Lyo-Check Project will see the development of a fully automated industrial machine for 100% inspection of lyophiles based on innovative vision architecture. A dedicated software and optical layout will be combined with ancillary technology together with Headspace Gas Analysis for testing product sterility via container integrity inspection. The SME instrument framework is part of the largest EU Research and Innovation Program ever, which aims to promote breakthroughs, discoveries and world-firsts by funding promising ideas from concept to lab to market.

FRAMOS www.framos.co.uk

ON semiconductor launches RGB+IR AR0237 image sensor for surveillance

The AR0237 sensor from ON Semiconductor is designed for applications needing both visible and near infrared light. With full HD resolution, this CMOS sensor is ideal for home security and other monitoring applications where lighting conditions can change drastically while the camera is in use. All ON Semiconductor image sensors are available through Framos.

The AR0237 features a 1928 x 1088 active-pixel array and captures images in 2 megapixel Full-HD resolution in either linear or high dynamic range modes with a rolling-shutter readout. It includes functions such as in-pixel binning, windowing, and both video and single frame modes. This image sensor combines low light and high dynamic range scene performance with daytime colour imaging and nighttime near-IR imaging in one sensor, eliminating the need for a mechanical IR-cut filter shuttle. The sensor is optimised for use in both stereo and 3D cameras and includes interfaces like HiSPi, SLVS, HiVcm, and a parallel data interface.

ON Semi AR0237 RGB IR and Bayer format

MEMBERS NEWS

29 MP high resolution camera

Ensenso X stereo cameras

SureDotOCR™

SureDotOCR

HIKVISION www.hikvision.co.uk

29 MP high resolution GigE vision camera

Hikvision Machine Vision has developed a new GigE 29 MP high resolution camera with image acquisition, storing, and processing capabilities. The high resolution CCD sensor (6576 x 4384 pixels) provides outstanding image quality and is equipped with a global shutter to minimise smear in images of fast moving objects. The 5.5 um pixels provide high sensitivity with low noise. A high dynamic range of 64 dB allows low contrast details to be revealed.

The large 2 Gb on-board memory ensures stability of the system and can be used to buffer images. This more effective memory management mechanism can temporarily break the 1000 Mbps image transfer bottleneck. A built-in image signal processor can process HD images with high performance. The 29 MP cameras can be used in large size and high precision processes and finished products' inspections, including monitors, colour sorting, flat panel displays, solar panels and PCBs.

IDS IMAGING DEVELOPMENT SYSTEMS www.ids-imaging.com

Flexible 3D camera system with 100 W projector and gigabit ethernet connector

The Ensenso X30 and X36 are new 3D camera systems that comprise a powerful 100 W projector unit and two 1.3 megapixel IDS GigE uEye CP industrial cameras mounted on brackets with a choice of lengths. This allows working distances of up to around five metres and adjustment of the angle of view of both cameras for image capture of larger objects such as whole pallets or entire rooms. The range of applications includes anything from bin picking to warehouse and logistics automation.

The random pattern of dots projected on the object surface allows image capture even when surfaces have almost no texture. The Ensenso X36 'FlexView2' projector can be moved to several preset 'levels' using a piezo-mechanical process to capture image pairs with an offset projection pattern. Individual images are combined to form a single image of the 3D point cloud with higher resolution. This makes object contours more precise, images more detailed, and 3D data more robust.

MATROX IMAGING www.matrox.com

Matrox announces major update to dot-matrix OCR tool

Matrox® Imaging has announced a major update to its SureDotOCR™ dot-matrix OCR tool for MIL 10 users to improve both reading speed and robustness. SureDotOCR can generally now read two times faster than before, which translates to a speed of over 2000 ppm when using an Intel® Core™ i5-6500TE platform. In specific circumstances, read speeds have been increased by up to four times.

Matrox SureDotOCR is a proven tool for tracking and tracing of human-readable text produced by dot matrix printers—the most common printing technology in use today. SureDotOCR's enhancements introduce the possibility to specify the expected italicisation and strings angles of dot-matrix text. This update further boosts reading robustness and speed and offers major throughput advances for those looking to provide dependable tracking and tracing in the food, beverage, pharmaceutical and healthcare sectors. The free update is available at no additional charge to Matrox Imaging Library users with a valid maintenance subscription.

MULTIPIX www.multipix.com

20 high resolution models added to ace camera range

Twenty new high-resolution Basler ace cameras feature Sony's Pregius and STARVIS sensors. The ace L product line contains 12 new models with Sony's Pregius IMX253, IMX255, IMX267 and IMX304 sensors. With resolutions of 9 and 12 megapixels, a pixel size of 3.45 µm and frame rates of up to 40 fps, these cameras provide outstanding image

continued on page 11

Bytronic VISION

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- Reduce defects
- Increase yield
- Avoid adding value to bad parts

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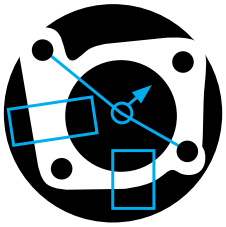

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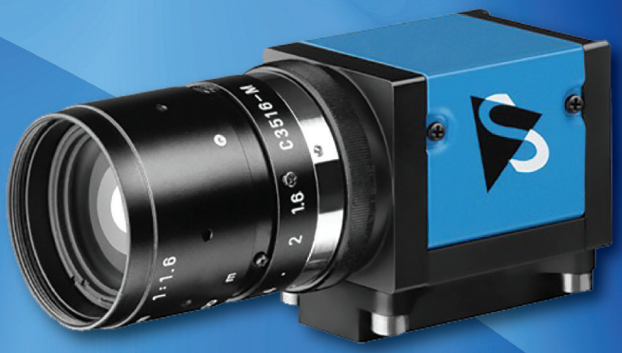
Machine Vision Components

NIT WiDy SWIR cameras incorporate ultra wide dynamic range InGaAs sensors which provide a high QE signal response in the 900nm to 1700nm SWIR range. The cameras deliver > 140 dB dynamic range in a single image without any external control. QVGA and VGA models with USB2.0, USB3.0, Cameralink or analogue interface can be synchronised externally at up to 200Hz. All cameras come with custom software.

The **KOWA** HC-SW-series is especially designed for near-infrared and short wavelength infrared (SWIR) applications. Incorporating Kowa's special coating technology, the 1 inch format HC-SW lens series will maintain high transmission from 800nm to 2000nm with sharp pictures from the centre to the corner.

The Imaging Source USB 3.0 monochrome industrial cameras feature the latest in CCD and CMOS technology. These cameras offer a variety of input/output strobe and trigger options. A highly versatile imaging solution, these cameras are competitively priced and available with resolutions from VGA to 42 Megapixels and frame rates up to 160fps.



DCM Sistemes is a high technology company designing and manufacturing LED lighting systems for machine vision. Having more than 15 years experience in this sector and international presence, they are experts in offering optimal solutions for many industrial vision applications.

See us at PPMA (NEC) 26-28 SEPTEMBER STAND J92
and PHOTONEX (RICOH-COVENTRY) 11-12 OCTOBER STAND C22

ALRAD IMAGING

Telephone: 01635 30345
Email: sales@alrad.co.uk
Web: www.alrad.co.uk
Mobile: www.alrad.mobi

quality. State-of-the-art global shutter technology ensures distortion-free images, even at high speeds. They are ideally suited for applications in highly automated 3D inspection systems.

A further 8 models with Sony's STARVIS IMX178 and IMX226 sensors will form the ace U product line. Equipped with the latest rolling shutter technology and featuring resolutions of 6 and 12 megapixels with up to 59 frames per second, they are especially suited to microscopy applications and less complex automation tasks in the electronics industry. Innovative back-illuminated sensor technology provides outstanding sensitivity at the small pixel sizes and offers excellent image quality even in low light conditions.

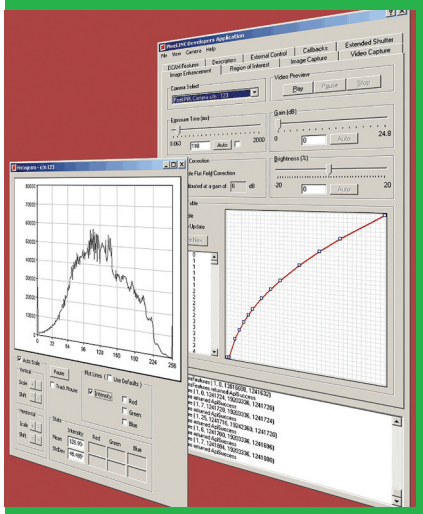
New ace GigE+USB3 cameras

SCORPION VISION **www.scorpionvision.co.uk**

New PixeLINK Capture camera

PixeLINK Capture from Scorpion Vision is a real-time, interactive, multi-camera application that offers tremendous flexibility and is fully integrated with PixeLINK SDK R10.2. This software is compatible with all PixeLINK's PL-B and PL-D cameras. PixeLINK Capture has a built-in autofocus application and streams real-time, high-quality video that can be viewed in a multi-window environment. This includes a preview window, configuration window, and a real-time graphical histogram on a monitor providing the ability to adjust image size, colour and exposure interactively prior to image or video clip capture.

In addition to PixeLINK Capture, the PixeLINK SDK R10.2 software release includes updates to video recording capabilities, multi-camera support, and a fully integrated autofocus application. The video capture engine is now capable of encoding compressed video (using H.264) contained in either .AVI or .MP4 files. New sample applications include C# programs built using (.NET) WPF. PixeLINK SDK is now available for several platforms running the Linux operating system, as well as Windows.



PixeLINK SDK

MEMBERS NEWS

Visionary-T time of flight cameras

SICK (UK) LTD **www.sick.co.uk**

SICK's Visionary camera takes 3D images in a snapshot

The rugged, IP67-rated SICK Visionary-T camera uses high-resolution Time-of-Flight technology to capture 3D image data with a single 'snapshot', whether the object is stationary or moving. Applications include obstacle recognition for automated vehicle or robot navigation, intrusion detection, parcel quality checking or gesture recognition.

The Visionary-T builds up a real-time 3D image of fixed or moving objects within a range of up to 7 metres, with excellent results regardless of angle, surface finish, material or shape of object. Using Time-of-Flight measurement, the CCD/CMOS imager develops a pixel matrix containing depth and intensity information. The camera can capture more than 25,000 distance and intensity values to create 3D images at up to 30 frames per second.

The Visionary-T CX model delivers raw data for in-house processing and program formulation, while the AG model outputs filtered data in formats pre-selected by the integrator, OEM or other user.

Gocator-2410

STEMMER IMAGING **www.stemmer-imaging.co.uk**

New Gocator intelligent 3D line profilers measure down to micron levels

New LMI Gocator 2410 and Gocator 2420 intelligent line profile sensors for 3D measurement feature 2 megapixel sensors and a new embedded processor. They allow the measurement of micron level features at high speed over a large field of view. High precision measurements of small gaps and features are guaranteed with a resolution of 6 µm in the X direction with results repeatable to 0.2 µm in height.

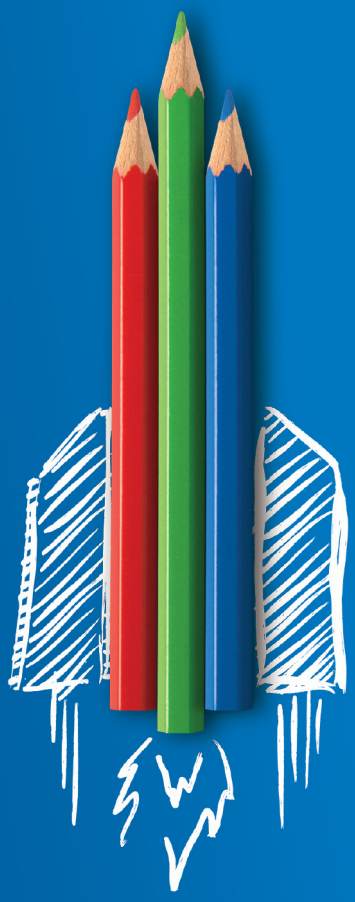
Designed for 3D inspection of high volumes of small parts at high speed in the consumer electronics and medical component industries, the new models utilise a blue laser line to produce 'cleaner' data and highly reliable results even on shiny surfaces such as glass and assemblies requiring glue.

Gocator 3D Smart Sensors are supplied precalibrated, with a built-in web-based browser user interface and powerful 3D measurement tools. Multiple sensors can easily be linked together. A Gigabit Ethernet interface and PLC connectivity facilitate integration into a factory environment.

Baumer
Passion for Sensors

See the right colours even faster.

Colour inspections with *Color FEX*® – a mere child's play.



3-2-1-launch. New *VeriSens*® vision sensors with *Color FEX*®: revolutionarily easy set-up with reliable colour inspection.

Ready for take-off?
www.baumer.com/ColorFEX

Vision Systems Design 2015 Innovators Awards SILVER

Allied Vision

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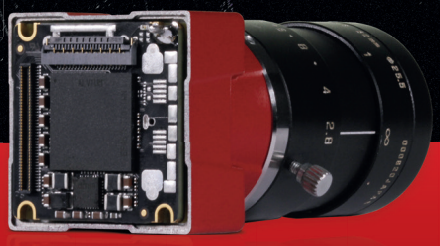


Allied Vision 1 Product Line

UKIVA
VISION IN ACTION
Editor: Dr Denis Bulgin
Advertising Sales & Production: Chris Valdes
Autumn 2017 | Industry update from the UK Industrial Vision Association

Seeing the invisible

This special four-page feature takes a look at machine vision techniques used to reveal information that cannot be seen in a traditional image and their applications. We look at methods that achieve this by manipulating visible light and others where light (electromagnetic radiation) outside of the visible spectrum is used to 'see' otherwise invisible detail and even reveal information about the chemical composition of the object being imaged. Imaging of radiation outside of the visible range may well require specialist cameras and other optical components. Thanks are due to to Acrovision, Allied Vision, Alrad Imaging, Framos, Multipix Imaging, Sick-UK and Stemmer Imaging for their extensive contributions to this special feature.

MANIPULATING VISIBLE LIGHT

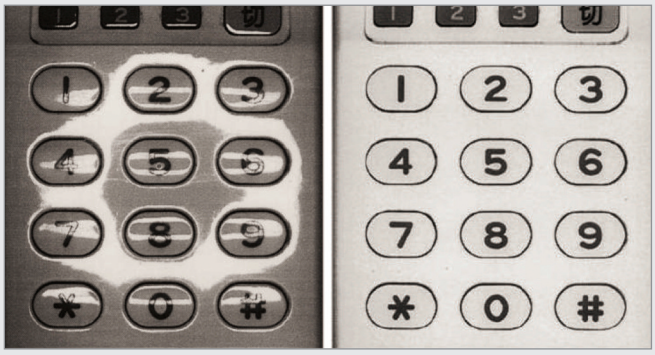
Cameras are much less versatile than the human eye. They do not see objects, only the light reflected from the objects, so illumination must be optimised to allow the camera to accurately detect details that can be seen by the human eye even in poor conditions. There are many ways that illumination can be controlled to influence how an object appears to the camera.

Illumination methods

Most lighting for machine vision applications is delivered using LEDs. Two of the most important factors that affect how the captured image appears are the angle of illumination used, and whether the object is illuminated from the front or behind. The surface finish of the object to be imaged is also particularly important in choosing the optimum illumination since there are huge differences between matt and shiny surfaces. There are a multitude of lighting schemes available for both front and back illumination. These include ring lights, collimated lights, diffuse lighting and dome lights. Choosing the appropriate type and angle of illumination can often reveal detail that cannot be seen in ambient light.

Filtering techniques

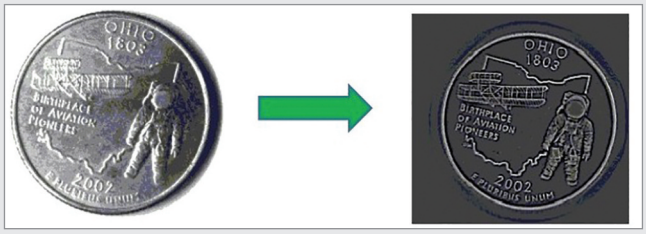
Filters can dramatically alter the characteristic of the light that enters a lens. They can have a wide variety of uses such as restricting certain wavelengths from reaching the camera or polarising the light to restrict glare and reveal more detail in the image. Daylight cut filters can block visible light allowing only IR light to reach the sensor. This is a good way of avoiding fluctuations in an image due to changes in ambient light conditions.



Polarising filter removes glare on keypad image (Courtesy Stemmer Imaging)

COMPUTATIONAL IMAGING

Processed metal components can have varying surface finishes depending on the processes they have undergone, such as milling, turning, grinding, punching or stamping. Inspecting these types of components for surface texture and small 3 dimensional defects such as chips, dents, wrinkles, punctures, and tears or reading engraved, embossed, stamped, etched, or raised text or codes can often be difficult. This is because of the varying reflections that they can produce, especially in a conveyor belt environment where the part feeding may lead to random orientations. The problem is increased if there are reflective areas directly adjacent to dark areas. The technique of computational imaging, or shape from shading relies on multiple illuminations and sophisticated image processing algorithms.



Improved surface detail from image calculated from different illumination angles (Courtesy Acrovision)

Lighting the way

Key to the technique is the use of an illumination method that allows both texture and topology information to be extracted from the images. Structured diffuse lighting offers a good solution to this and the system is constructed so that four sequential images of the part can be obtained, each illuminated from a different direction. Dome shaped illumination can help minimise any effects from ambient lighting.

Image processing

Sophisticated algorithms are then used to extract both textural and topographic information from the images. Topographic images allow defects down to a depth of just a few micrometres to be located and classified quickly, reliably and free of interference. Conventional imaging tools can then be used to make measurements, read codes etc. Typical applications in the automotive industry include: turned parts for injection, fuel injectors, piezo injection, pump membranes, gear boxes, sealing surfaces, piston valves, stamped parts and decorative components. In the electronics industry applications include the inspection of contacts, galvanised surfaces, welding joints, bond pads and circuit boards. Systems can also be set up to inspect curved surfaces, using a line scan camera and capturing four images at different rotations.

NIR

Near infrared (NIR) and multispectral imaging

The near infrared (NIR) runs from wavelengths of around 750 nm to 1 µm. While conventional CMOS and CCD sensors have some sensitivity in this region, there are a number of cameras available with CMOS sensors enhanced to provide increased sensitivity above 850 nm. NIR radiation allows subsurface features of an object to be viewed, revealing otherwise unobservable defects. Since some dyes and inks appear transparent to NIR illumination, it can be possible to inspect products through printed packages. NIR illumination may also be used reduce the effects of fluctuations in ambient light.

Detecting subsurface defects using NIR radiation (Courtesy Allied Vision)

NIR applications

NIR-optimised area scan and line scan cameras can be used in many different industries, including, food, healthcare, wood, textiles, paper, glass, tiles, electronics and for the inspection of cylindrical items such as cans, bottles, pens etc. or even rotating objects. NIR inspection of foods such as fruit, vegetables, nuts and meat allows checks to be made for signs of decay, mechanical bruising and pest damage below the surface. In the electronics industry NIR can reveal imperfections in circuit layout between board layers. Flat panels and displays can be inspected for scratches and defective screen pixels. Web inspection applications include the inspection of imperfections in the glaze on tiles, or for foreign threads and other impurities in textiles. Woundcare products can be inspected through their paper packaging at high speed using IR wavelengths.

Multispectral imaging

It may be important to simultaneously image an object using colour and NIR imaging to obtain complementary information. Where exactly the same field of view is required for both images, so called 'multispectral' cameras can be used. These dual channel cameras feature two sensors and a single lens. The light from the sample is separated into a visible wavelength channel and an NIR channel using a special prism and directed to the corresponding sensor. This approach is particularly useful when the product is moving past the camera in a random fashion during inspection.

Multispectral applications

NIR can often distinguish between defects and natural colour variation. For example, coffee beans can be sorted by size and colour while simultaneously singling out poor moisture content, stones or other foreign objects using the NIR image. Since the NIR channel detects subsurface information, it can be useful to image through some packaging materials at the same time as inspecting the print on the packaging itself.

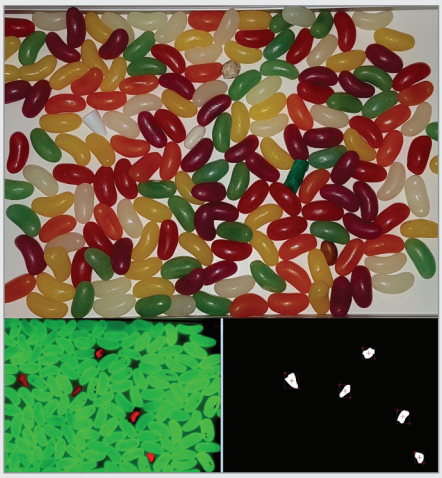
HYPERSPECTRAL IMAGING

Hyperspectral imaging

Hyperspectral imaging combines infrared spectroscopy with machine vision to produce images which are colour coded according to the chemical composition of the objects being imaged. It has applications in industries as varied as food, pharmaceutical, medical, timber and recycling. It makes use of the fact that organic materials selectively absorb light at different wavelengths in the infrared region of the spectrum depending on their composition. This gives distinctive 'fingerprints' which can be used to uniquely identify them. Recent developments in image acquisition and data processing have led to affordable systems that operate in real time, allowing them to be used on high speed production lines.

Creating hyperspectral images

A series of images are built up by sequentially allowing narrow wavelength bands of infrared light reflected from the sample to fall on the sensor. These images are combined to form a three-dimensional hyperspectral data cube, where each pixel contains full spectral information. In general a spectrograph is used to divide the light into its constituent bands, but new sensors are emerging with narrow-band spectral filters at the pixel level. Flexible, high-speed data processing software can extract data from this data cube in real time to produce an image where each pixel is colour coded according to the chemical composition of the material it is looking at. It is then possible to use standard machine vision colour sorting solutions. By 'turning into' just a few key wavelengths it may be possible to distinguish between specific materials or identify known contaminants that could arise from a production processing stage.



Hyperspectral imaging of jelly beans (Courtesy Stemmer Imaging)

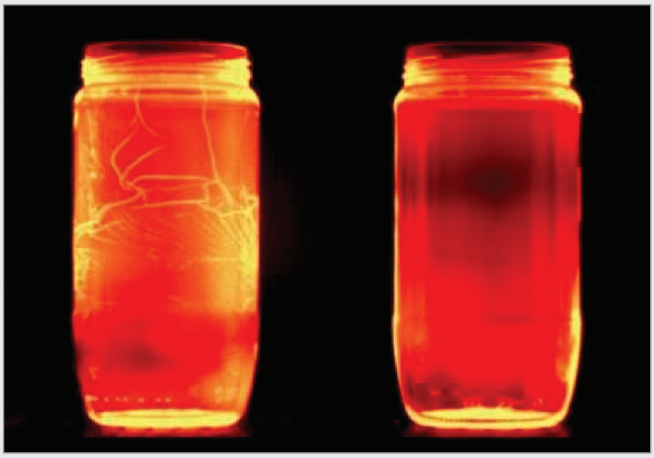
Applications

Hyperspectral imaging can provide a robust and reliable method of foreign body detection in foodstuffs. Applications include: the detection of fat and bones on chicken; distinguishing between sugar/salt and citric acid; identifying bruising in oranges, apple sorting, coffee bean inspection, turkey and pork differentiation, raisin sorting, pistachio shell identification, pet food inspection (differentiating stones/clay from dog food pellets) and many more. In the pharmaceutical industry it can be used for the Inspection of pills for content concentration uniformity, particle sizing and moisture content analysis. In the recycling industry bales of plastic waste can be monitored to identify non-recyclable plastics. In wood processing it can differentiate between resin and wood knots in timber products whilst monitoring moisture content. It can also be used to identify plastics, metals and other impurities in wood recycling. Another major benefit of hyperspectral imaging is that a lot of packaging material is transparent to the IR light meaning that the technique can be used to examine product inside its packaging and still reveal its chemical composition.

SWIR

Short wavelength infrared (SWIR)

Short wavelength infrared (SWIR) imaging takes place in the 0.9 µm - 1.7 µm wavelength range. SWIR imaging can measure temperatures above 250°C and up to 800°C. Although infrared radiation in the short wave infrared region is not visible to the human eye, it interacts with objects in a similar manner as visible wavelengths. Therefore, images from an SWIR sensor are comparable to visible light images in resolution and detail although they are only displayed in monochrome. SWIR radiation, like NIR radiation will pass through glass. This means that special and expensive lenses are generally unnecessary. SWIR cameras are available for a wide variety of applications and industries. Since silicon is transparent to these wavelengths SWIR cameras are useful in semiconductor applications where they can 'look through' silicon layers. Water, however, strongly absorbs infrared light in this region, making it appear opaque in the image.



SWIR detection of cracks during glass jar manufacture (Courtesy Alrad Imaging)

SWIR sensor technology

SWIR cameras use sensors made from materials such Indium Gallium Arsenide (InGaAs) or Mercury Cadmium Telluride (MCT - HgCdTe). These sensors are generally cooled using built-in Peltier cooling, enabling longer exposure times which in turn allows temperature measurements to be more precise and low light levels to be detected. Lower cost uncooled detectors can be used in some applications.

SWIR applications

The strong IR absorption by water in SWIR imaging allows easy checking of fill levels of water-based liquids in bottling applications. Another interesting application area is that of identifying water distribution in plants in order to improve crop yields. The transparency of silicon to SWIR radiation facilitates semiconductor and solar cell inspection. Impurities in semiconductor crystal ingots and cracks in polycrystalline material can be detected. 3D wafer inspection or dicing, microscope inspection of structures or wafer alignment and BGA soldering checks through silicon are other typical applications.

High temperature imaging makes SWIR very useful in the inspection of hot glass materials early in fabrication. This includes control of temperature uniformity during forming and cooling and the detection of defects such as cracks, breakage, tamper, contaminants and chips. SWIR can also be used in welding applications, since neither the weld pool and solidified melt (at 1.2 µm) are obscured by plasma and metal vapour (at 600 nm).

LWIR

Long wavelength infrared (LWIR)

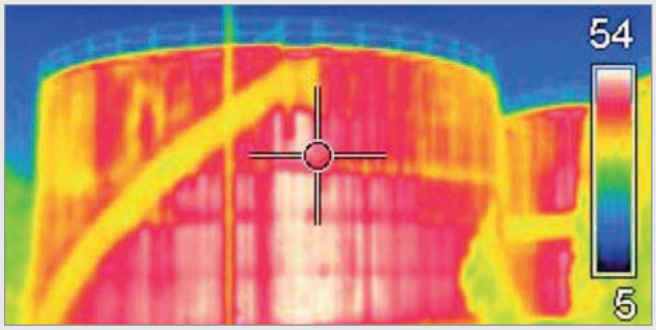
Long wavelength infrared (LWIR) covers the 8 µm – 14 µm wavelength region of the spectrum. LWIR cameras are mainly used to measure surface temperature profiles of objects with high accuracy (thermography). They can typically detect and measure temperatures between -70°C and +250°C. In addition, they make heat radiation visible even at great distances, in total darkness, or through visibility restricted conditions such as fog, dust, rain and smoke. Since LWIR cameras detect naturally emitted radiation, they are particularly popular for surveillance, security and rescue applications. However they can be used to perform non-destructive and in-process testing in a host of different industries.

LWIR cameras and optics

The most popular sensors for LWIR cameras are uncooled amorphous silicon (ASi) or vanadium oxide (VOx) microbolometers. Due to their complex structure and internal and external temperature effects, the sensors require real time image correction to produce a homogeneous image. For thermography applications, the sensors are calibrated to make temperature measurements. Alternative cooled cameras tend to give better spatial and temperature resolution, but are more bulky, heavier, use more power and add complexity, making the uncooled sensors the preferred choice. LWIR cameras are available in area scan and line scan formats and various resolutions. Cameras are available with standard machine vision interfaces such as Camera Link and GigE Vision making it easy to integrate them into industrial processes. Since glass absorbs in this wavelength range, optics are generally made from germanium or chalcogenide glass.

LWIR applications

LWIR is used for non-destructive testing and thermography in applications that include industrial processes, recycling, medical, chemical reactions and electrical and electronics inspection. For example changes in surface texture may affect the emissivity of a material, allowing a difference in thermal output to be identified. This could include a poorly adhered surface (e.g. paint or coating). On a larger scale thermal imaging also allows management of heat distribution in process plants and any kind of heat-formed material such as glass or steel. In electrical applications, excess current, damage or failure can lead to changes in the heat distribution image detected using LWIR. In the electronics industry poor connections from faulty solder joints may get hotter than other areas of a PCB. In mechanical inspection excess friction, bearing wear and component misalignment can all lead to abnormal temperature profiles. The plastics industry can use thermal imaging to view the internal structure of plastic devices and the quality of plastic welding. Heat absorption at the beginning of the paper recycling process allows identification of the paper quality for recycling. Changes in human or animal skin temperature can indicate disease, inflammation or infection.



Thermographic LWIR detection of chemical levels in storage tanks (Courtesy Allied Vision)

UV

UV imaging

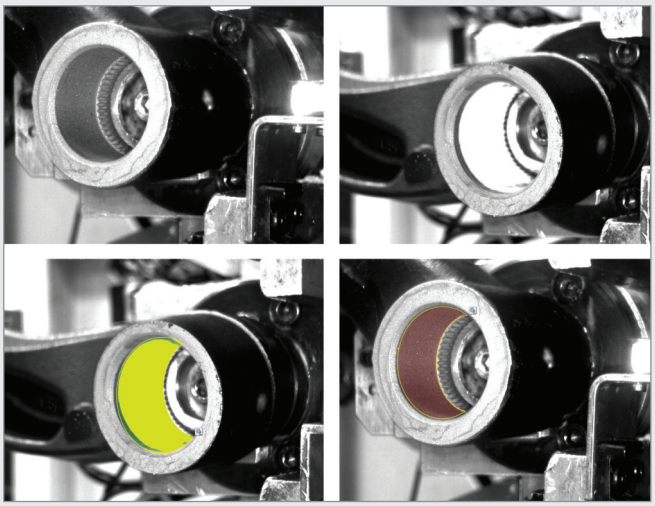
UV light is invisible to the human eye (and most CCD/CMOS cameras). It has wavelengths in the range between 400 nm and 10 nm which is shorter than that of visible light but longer than X-rays.

Direct UV imaging

Standard imaging techniques using visible light make it possible to recognise and resolve features down to approx. 0.5µm (500nm). To accurately visualise smaller features, however, the visible light spectrum is no longer sufficient. To resolve smaller structures, the reduction of the wavelength is the most practical and effective solution. Using ultraviolet illumination in conjunction with a UV sensitive camera/sensor allows ultrafine resolution images to be captured in applications where submicron features need to be resolved. UV industrial cameras typically have either glassless CCD or CMOS imagers to enable sensitivity below 400 nm, or quartz-covered sensors to provide both extended sensitivity and better protection against damage. However, to detect wavelengths below 320 nm, special imagers such as specially thinned sensors or sensors coated with a wavelength-shifting layer are required. For shorter wavelengths, special lenses made of materials such as sapphire (Al_2O_3) or magnesium fluoride are needed. High brightness, high current LEDS that emit at 365 or 395 nm are available as UV illumination sources. These provide sufficient power for the longer working distances to be used than with the more traditional gas discharge UV lights. Appropriate safety precautions must be taken when working with UV radiation. Typical applications for direct UV imaging include detection of scratches and digs on optical surfaces such as lenses or windows or detection of small amounts of surface contamination since the shorter UV wavelengths tend to scatter more strongly off surface features. UV light also tends to be absorbed by organic materials, making it possible to detect traces of oil or grease on many surfaces, especially using shorter UV wavelengths.

Fluorescence imaging

A completely different approach to UV imaging is fluorescence imaging. Here, a UV sensitive dye is used to mark a component. These markings cannot be seen under visible lighting, but when they are illuminated in the UV, the dye fluoresces, giving a strong emission in the visible region of the spectrum which can be readily imaged using a conventional machine vision camera and lens. This is particularly useful when the aesthetic design of a component requires visible marking to be kept to a minimum.

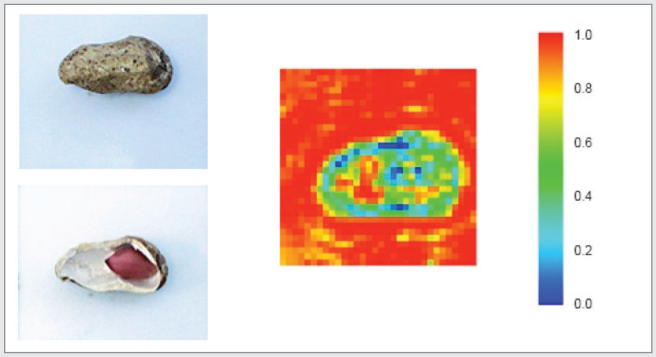


Automotive gasket coated internally with UV fluorescent adhesive. Top right image shows the fluorescence. Bottom images show gaskets with sufficient and insufficient adhesive (Courtesy Sick (UK))

THz

Terahertz imaging

THz imaging is a new technique for machine vision applications. The terahertz (THz) frequency range (0.1 THz – 3 THz) extends beyond the infrared, covering wavelengths from 75 µm to 75. It is only just beginning to be utilised for industrial inspection applications. THz radiation is non-ionizing, is able to penetrate clothing, polyethylene, polyester and other types of covers and enclosures made of various opaque materials and is selectively absorbed by water and organic substances.



Terahertz image through peanut shell. Higher transmission on the left indicates a nut is missing. This is confirmed when the shell is opened (Courtesy Alrad Imaging)

Thz imaging systems

Key to the emergence of THz imaging has been the development of gallium arsenide (GaAs) sensors for use in Thz cameras. Silicon-based detectors are planned for the future. Typical sensor sizes are 16 x 16, 32 x 32 and 64 x 64 pixels for area scan cameras and 256 x 1 and 256 x 4 line scan versions. The long wavelengths of this radiation limits the spatial resolution achievable to around 1mm, so the technique produces much lower resolution images compared to those obtained in the infrared, visible and UV regions of the spectrum. THz cameras are generally sensitive to frequencies of 0.05 – 0.7 THz, where most common materials are transparent. THz cameras must be used in conjunction with a THz generator. Generators are available with a choice of output frequencies, typically 100 GHz, 140 GHz or 300 GHz. The generators and cameras are lightweight and can easily be set up in a conveyor belt arrangement for industrial inspection applications. Objects are imaged in transmission. Optical components such as lenses are made from PTFE or TPX (polymethylpentene).

THz applications

THz has applications in a number of different areas including medical diagnostic imaging, homeland security (non-harmful to humans) and scientific research. There are also many industrial inspection applications in the food, packaging, agriculture, pharmaceutical, ceramic, wood processing and automotive industries. The ability of THz radiation to penetrate many types of food packaging including cardboard makes it well suited to checking that the entire contents of a packet are present, such as packets of chocolate bars or the presence of foil sauce sachets in ready meals. Food products can also be checked for foreign bodies such as insects, plastic debris, metal, stones and soil. THz imaging can also be used to evaluate density and humidity variations in pressed powders such as those used in ‘green tiles’ and kiln fired tiles in the ceramic industry, and pills, caplets, and tablets in the pharmaceutical industry. In the automotive industry, THz technology shows promise for the detection of disrupted steel and nylon reinforcement and foreign inclusions inside rubber parts and the detection of corrosion in coated metal parts.

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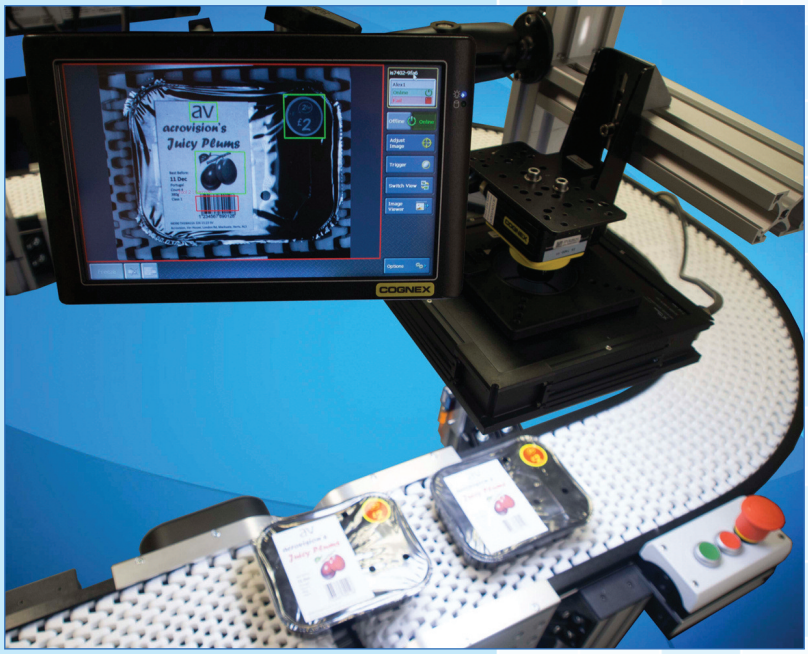

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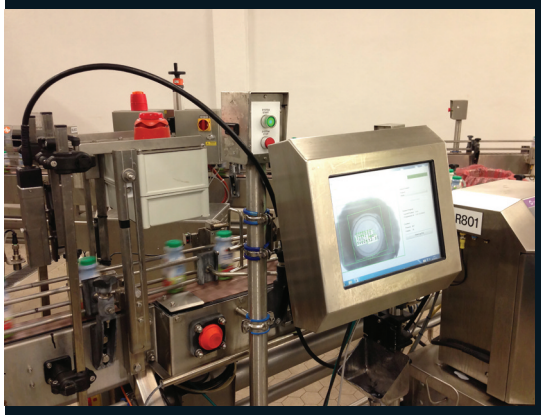
100% correct OCV inspection on milk bottle caps

A large UK dairy company produces milk in 250ml bottles for sale to multiple retailers. The 'Use By' date and other production line details are printed on to the bottle cap during production. Occasionally this information would fail to print, or the print would be incorrectly located on the cap causing some of the information to be missing. Also, as the printer was configured by hand, the actual date information printed could potentially be incorrect.

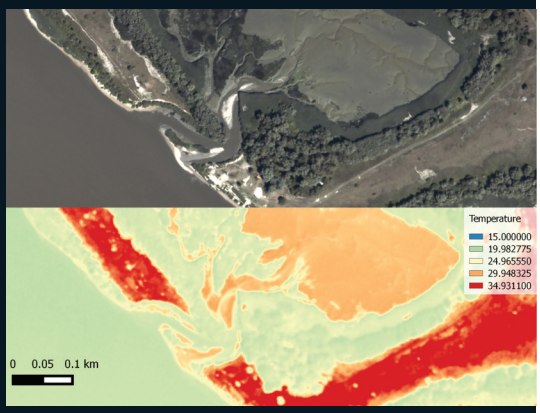
Acrovision devised a solution capable of verifying the printed data, and also programming the printer to prevent human error. The 'Validator' end of line verification solution includes a Cognex In-Sight Camera (with appropriate lighting) and a stainless steel touch screen PC. As the caps are a dark green colour, the text did not stand out clearly. In order to enhance the contrast of the text, a polarising filter was applied to the camera lens and light. In addition, the layout of the text on the lid was altered to give improved spacing between characters to make the optical character verification task easier.

Another problem was that the lines of text were curved due to the bottles rotating slightly when they passed under the print head. Altering the layout of the printed information to shorten the lines of information made them less affected by the rotation. The number of optical character recognition tools was increased to one per section of the data (e.g. use by date, line code, product code) resulting in greater robustness. The Validator system automatically programs the printer when a product is selected, rather than this being done manually. System variables for each product are stored on the PC, which is connected to the printer as well as to the camera. When an operator selects a product, both the printer and camera are programmed with the date and code information. Therefore, the printer information is correct and is then double-checked (and checked for completeness/legibility) by the camera. A reject mechanism is triggered for fails.



OCV bottle cap inspection

APPLICATION ARTICLES



Temperature differences in the water, according to the soil condition of the tidal zones and tide levels.

ALLIED VISION www.alliedvision.com

Thermal aerial images reveal oxygen deficiencies in water bodies

The Application Centre for Multimodal and Airborne Sensor Technology has initiated a project to help identify oxygen deficient areas in water bodies, in cooperation with the German Federal Institute of Hydrology in Koblenz. Rising oxygen deficiency (hypoxia) in water bodies is a concern both for fishermen and environmental protection groups. The project involves measuring the water or surface temperature of water bodies, an important parameter for determining oxygen content and, in turn, water quality.

Using a gyrocopter equipped with a Pearleye P-030 (640 x 480 pixel) LWIR thermal imaging camera and a high resolution (2048 x 2048 pixel) Mako G-419 Gigabit Ethernet camera camera from Allied Vision, a pilot project was undertaken during the summer of 2015 on the Tidal Elbe between Hamburg and Stade. The goal was validating mathematical and physical models of temperature development as well as the definition of measures to prevent and improve aquatic hypoxia.

Gyrocopters equipped with cameras offer a much cheaper way of obtaining aerial images than using aircraft or helicopters. The gyropcopter flew over the area as often as possible at an altitude of 1,300 metres (4265 ft.), taking a total of 276 images which were then stored together with GPS data so that they could be reassembled afterward into a seamless image mosaic. The Pearleye thermal imaging camera is sensitive in the long-wave spectral range from 8,000 to 14,000 nm and features an uncooled microbolometer sensor. Equipped with a temperature reference element as well as Peltier temperature stabilisation, the camera produced temperature recordings of all 276 image rasters at a resolution of 1.8 x 1.8 m per pixel.

In order to be able to precisely correlate recordings and details to the exact ground locations, the Mako G-419 Gigabit Ethernet CMOS camera simultaneously produced high quality, high-resolution images in the visible spectrum. On the ground, the acquired images were superimposed using the GPS data with the aid of characteristic landmarks and fixed control points. Maps with the superimposed temperature data demonstrated, for instance, clear temperature differences in the water, according to the soil condition of the tidal zones and tide levels. Significant temperature differences could also be observed between fields with varying vegetation or uses.

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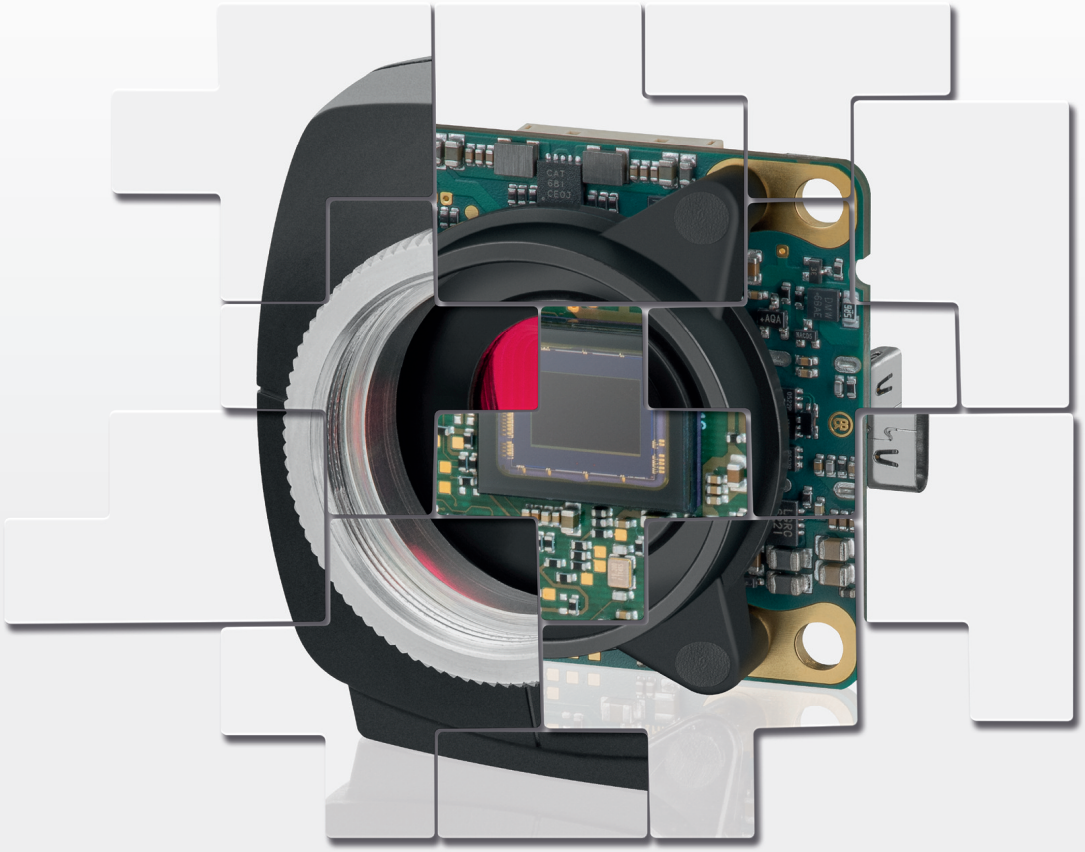

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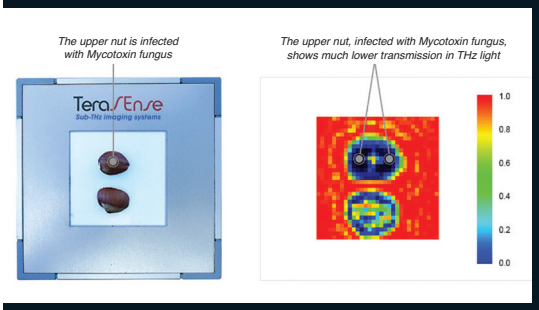
Teraherz detection of fungus in food

An important issue in food manufacturing is the non-invasive detection of fungus such as Mycotoxins which are capable of causing disease and death in humans and other animals. Teraherz imaging systems can reveal the carcinogenic Mycotoxin fungus that contaminates peanuts, corn, hazelnuts, and other grain crops and oil plants. It is critical for quality control and nondestructive testing to avoid the usage of ionising radiation (X-rays) due to its detrimental effect on biological agents. The teraherz food scanner from Terasense, available in the UK from Alrad Imaging, utilises non-ionising teraherz radiation for imaging. It features both a fast imaging speed of 5000 frames per second and ease of integration into any industrial process. The scanner fits most conveyors with a belt speed up to 15 m/s.

The food scanner system consists of an ultrafast linear terahertz imaging camera and a Terahertz generator at 100 GHz. Both parts are optimised and synchronised to each other. THz radiation power is properly delivered from the generator onto the camera sensor. The camera pixel size provides an image resolution of 1.5. In the example shown, two hazelnuts are inspected in transmission mode at a frequency of 0.1 THz. The colour coding ranges from 100% transmission (red) to 20% transmission (blue). The upper image shows a detectable defect – the dark image is due to a fungus infection. The system can detect any sign of infections such as Aspergillus flavus and Aspergillus parasiticus, which exude the extremely dangerous carcinogen Aflatoxins B1.



Detection of fungus in nuts by teraherz imaging

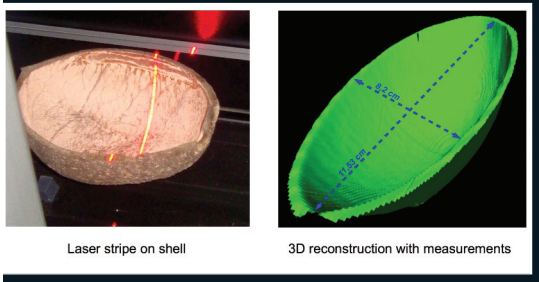
CLEARVIEW IMAGING www.clearviewimaging.co.uk

3D coconut shell classifier

Natural coconut shells are fully biodegradable, yet durable and robust enough to be used in the freezer. Shell halves have been used commercially to package ice-cream. Automatic inspection of the natural shells to make sure that they are suitable for filling and measure the volume to avoid overfilling has been made possible using the InsidE 3D inspection system from Braixat Vision.

The shells pass along a conveyor belt to the inspection station for 100% inspection using laser triangulation and two cameras supplied by Photonfocus AG, represented in the UK by ClearView Imaging. As the shells move under the laser line, the two cameras image the line profiles of the shells. The powerful internal line finder of these cameras, together with perspective distortion correction, calibration and 3D reconstruction algorithms, are applied to the profile images to obtain a uniform point cloud. This allows measurements to be made of the length, width and the internal volume of the shells to allow them to be sorted into quality classes. A large colour touchscreen provides control of the system and display of the depth map of the shells as well as visualisation of each of the captured profiles. Statistical data related to the analysis can also be displayed.

Solenoid valves are automatically actuated to transfer the shells to collection boxes at exit gates according to the quality class. The entire measurement and sorting process is controlled by the system. The control cabinet contains the PC and display and a PLC that manages the movement of the conveyor, the ejection solenoid valves and the box change gates (when it detects that the collection box at an exit gate is full). A measurement precision of 2% volume is achievable on shells up to 120 x 120 in size, at a rate of 1 shell/second.



3D measurement of coconut shells

IDS IMAGING DEVELOPMENT SYSTEMS www.ids-imaging.com

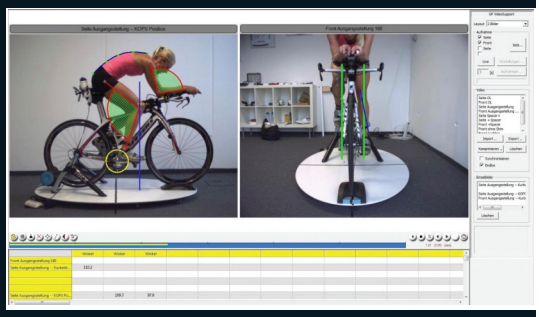
The perfect fit for cyclists!

Bike fitting is hugely important in the world of cycling. Optimising a cyclist's posture and riding position can achieve decisive performance improvements, particularly in competitive sports, and can make all the difference between success and failure. The targeted use of specially adapted training bikes also promises greater chances of recovery in rehabilitation. Bike fitters pinpoint any problem areas, which may lead to discomfort or pain in the back, legs or hands, and make sure that the bike and rider are in perfect unison. Video analysis plays an important role in this.

GeBioM mbH Münster has embraced this issue under its gebioMized brand. The GP BikeView system has been specially developed to analyse body posture and pedaling motions. The rider pedals on a fixed bike in the usual way and two 1.3 MP USB 3 uEye 3240LE cameras from IDS record the cyclist from the front and side. The camera at the

continued on page 26

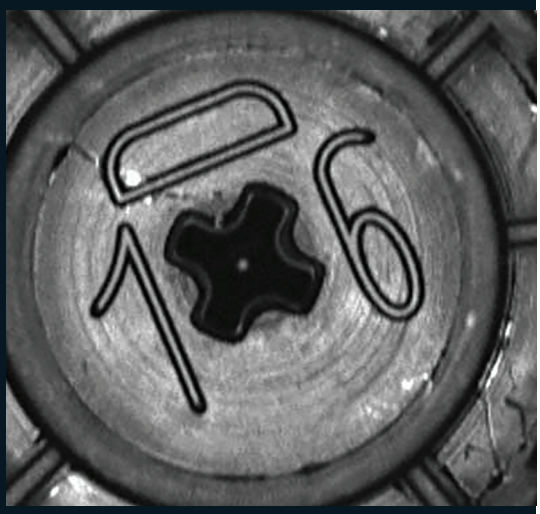
APPLICATION ARTICLES



Cycling posture analysis

front identifies knee displacements, while the camera at the side highlights poor back posture. The video material is analysed, taking any physical requirements into account, such as pre-existing or orthopedic conditions. Proprietary software developed by gebioMized shows analysis modules directly on the video. Up to four videos or individual images can be shown simultaneously to compare different perspectives or adjustments. Based on the results, the fitter adjusts the height and tilt of the saddle and/or handlebars until the optimal ergonomical seating position is found.

Anyone wishing to build a new bike can also use the gebioMized bikefitting system. Fit bikes are used for this, which enable the biomechanically optimal seating position to be found without the limitations set by the bike frame or components. The USB 3 uEye LE camera from IDS is straightforward to operate and was extremely easy to integrate into the gebioMized system. Since the IDS Software Suite provides the same functionality for all IDS cameras irrespective of their interface, gebioMized had been able to switch seamlessly from previously used USB 2.0 uEye cameras to the more powerful uEye 3240LE model with a USB 3.0 interface in order to improve the overall system performance through higher data transfer rates.



Measuring alphanumeric cavity numbers in plastic mouldings (Courtesy Machine Vision Technology)

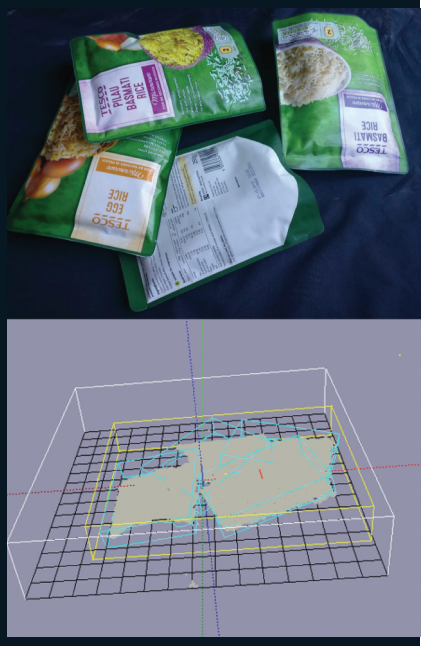
MULTIPIX **www.multipix.co.uk**

Plastic mouldings for food industry inspected using Halcon imaging software

Disposable plastic mouldings used in the food industry are often produced in high volumes, requiring systems that can operate efficiently at very high speed without causing any damage. Machine Vision Technology have developed an automated quality control and inspection system to handle and inspect these disposable plastic mouldings at rates as high as 1200 parts/min.

Utilising three camera systems to inspect from below, above and horizontally, the system first inspects the top of the moldings for damage and performs optical character recognition (OCR) on the cavity number at the bottom of the part. A second camera then inspects the bottom of the part, measuring its diameter and if any damage has occurred. A third, horizontally mounted camera measures the height and profile and any damage to the side of the part.

One of the challenges in measuring the cavity number from the top of the part was that the 3mm high alphanumeric cavity numbers are moulded in the plastic at the bottom of a 6mm diameter hole, 5mm deep. Passing the camera system at 600 parts/min, the position of these characters can be anywhere within 360°. Performing the required measurements and reading these characters at high data rates was accomplished using the Halcon OCR machine vision software.



The blue rectangular boxes in the lower image define the product for picking

SCORPION VISION **www.scorpionvision.co.uk**

Improving efficiency in robot picking and packing

Fast 3D robot vision from Scorpion Vision has been introduced on a line packing food pouches for supermarket distribution. The pouches arrive at the packing station on a conveyor belt in a random orientation. Packing the pouches into cartons for delivery to retailers was previously carried out partly by human operators and partly by robots. The random orientation of the pouches meant that attempts to pick a pouch by the robot were not always successful if it was partially overlaid by another pouch. Scorpion Vision has addressed this by designing and successfully implementing a 3D vision guidance system for the robot, which determines the size, shape and position in space of the pouches so the robot is always sent to the most convenient pouch for picking. This has significantly improved the picking efficiency.

The system features a Scorpion 3D Stinger active stereo vision camera in an IP rated housing with integrated white and IR high power LEDs and structured random pattern projection using an eye safe IR laser. The random pattern projection generator creates a pattern of dots on the pouches to add texture to the images and increase the depth sensing resolution since the surfaces of the pouches are very smooth. The white and IR LEDs allow additional 2D images to be captured.

The camera builds a clean, well defined 3D point cloud from multiple images produced using the different illumination sources. This is used to model the pouches for the robot to pick. Scorpion Vision software extracts all of the data required to calculate the size, shape and position of the pouches in the image. Calculations are performed in around 200 – 300 milliseconds. This is much faster than the robot moves, so the 3D system does not slow down the picking rate, which is determined entirely by the speed of the robot.

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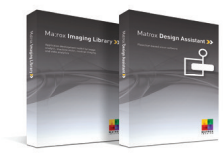

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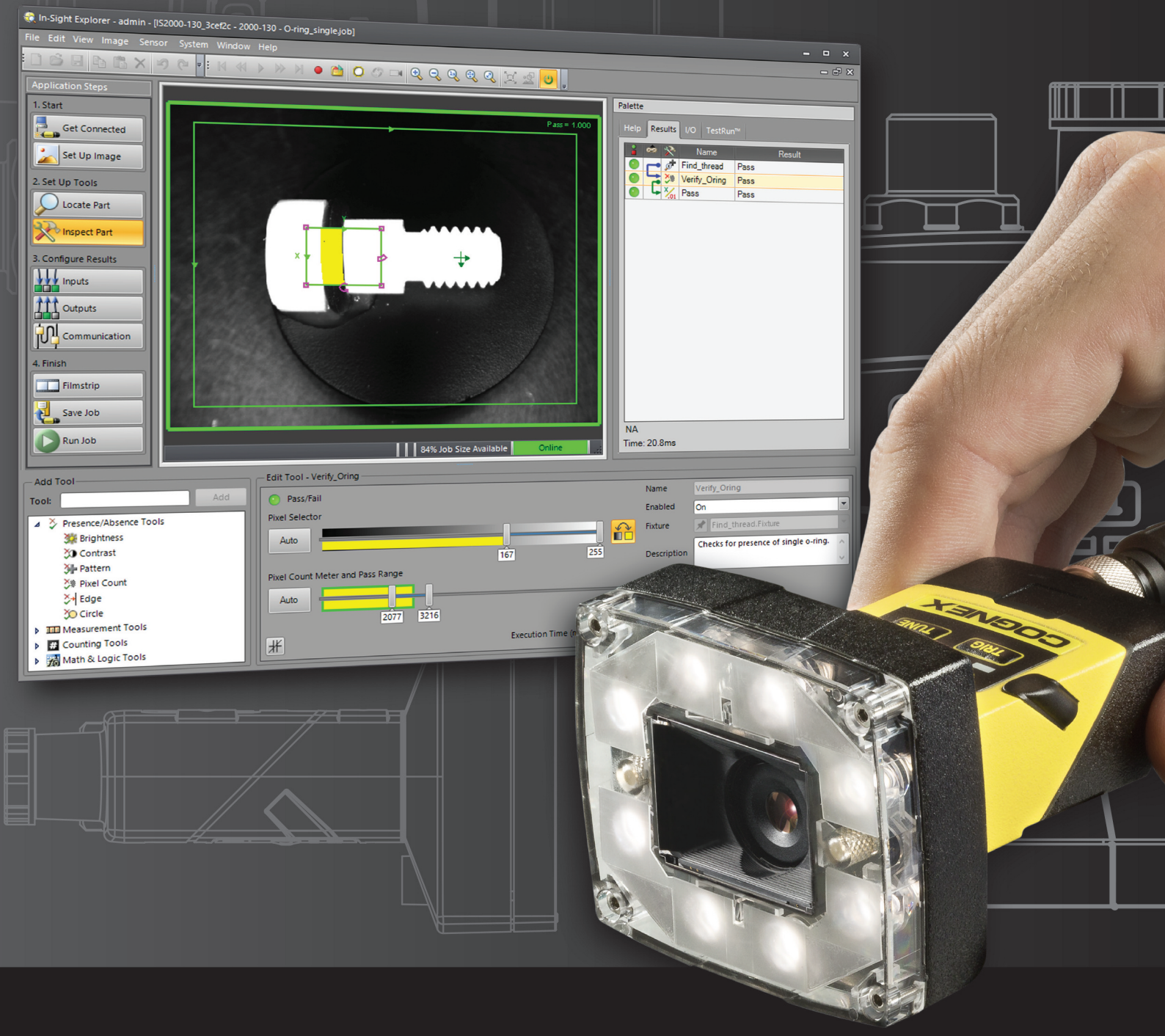

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SICK (UK) LTD www.sick.co.uk

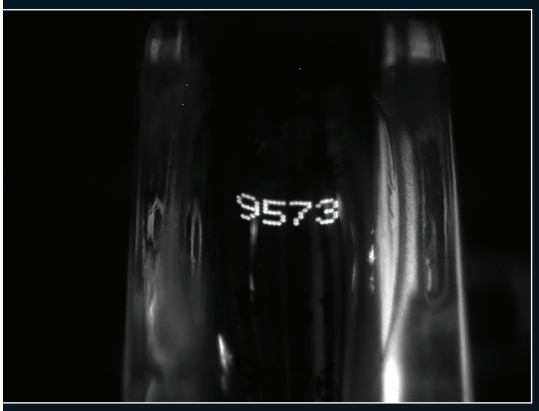
The sweet smell of invisible success

The fight against counterfeiting is an ongoing challenge for leading cosmetic brand manufacturers. To combat the threat of cheap imitations, fragrance bottles can be marked with the product LOT code as proof that the product is legitimate. Quality can be guaranteed to the customer, whilst fake products can be easily identified as lacking the required mark. Equally, the bottle can be traced back to the place and production line where it was manufactured.

Vision specialists from Sick were called to find the best way of marking a glass fragrance bottle for a well-known perfume brand. The design of the bottle is integral to the brand value and kudos of the product, so using a solution invisible to the human eye was essential to protect the aesthetic appeal. An ultra violet tracer ink mark is inkjet printed on the underside of the bottle after it is filled with fragrance. The UV-based solution was selected as it provided the best contrast for Sick's UV version of its Inspector PIM60 2D vision system. The mark could be detected reliably on the clear glass bottle in a location that has curved contours, causing other lighting reflections.

The UV Inspector PIM60 has an in-built UV LED at 395 nm and an IP67-rated housing and is configured using Sick's SOPAS software platform. After the bottles are inkjet marked they pass under the field of the view of the Inspector which activates a Sick photocell trigger sensor. The PIM60 UV then acquires the illuminated image and the in-built processing tools use search algorithms and pixel identification tools to detect the brightness of the text of the code.

The code fluoresces well with the UV lighting from the vision sensor, so the contrast of the text against the background of the bottle is very bright. The processing tools easily see there is a code there and all the characters are present. The inbuilt digital outputs are then configured to signal a good inspection or to provide a separate output if the inspection is deemed unsatisfactory, so the bottle can be rejected from the line and the line operator alerted.



UV fluorescent LOT code on fragrance bottle

STEMMER IMAGING www.stemmer-imaging.co.uk

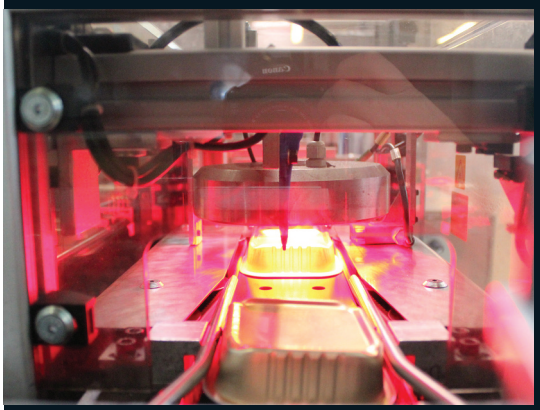
Machine vision delivers defect-free aluminium containers for pet food

Switzerland-based Leuthold Mechanik AG (HLM) builds machines for manufacturing thin-walled aluminium containers used for packaging pet food and other foodstuffs. Embedded machine vision solutions from Stemmer Imaging help control the quality of each container.

Four pet food containers are stamped out from rolls of high quality aluminium foil with each stroke of a press at a rate of 480 containers per minute. These are then blown out onto a conveyor and transported to modular built-in inspection and stacking machines. The container size can vary from 60 -120 in width and 60 - 200 in length. Aluminium is relatively expensive, so the container walls must be as thin as possible but reduced material thickness increases the risk of holes occurring during the forming process. Every container is inspected using machine vision and defective ones removed before they leave the factory. Machine vision also helps identify any trends in defect formation.

Stemmer Imaging has been advising HLM on this technology for around 20 years. The latest system has replaced individual intelligent cameras with cameras connected directly to an embedded industrial PC in the machine. This makes it quicker and easier to display images of defects or undertake statistical evaluations such as frequency of a defect type or whether more defects arise on one of the lines. Oher statistical information can also be viewed to allow faster rectification of defects by making adjustments to the machine. There is also improved connection to the user's MES (Manufacturing Execution System).

Four parallel lines are equipped with offset inspection stations. Each features a Genie Nano camera from Teledyne DALSA equipped with optics from Lensation mounted below the transport track to inspect the containers using transmitted light from customised LED illumination. High quality images, produced at a rate of 120 images/minute per track, are evaluated by the embedded PC using Common Vision Blox, Stemmer Imaging's programming library, with results transferred to the discharge station for removal of defective containers and subsequent stacking of 'good' containers. A second machine is due to be completed shortly.



Inspection of aluminium food containers from below

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STEMMER IMAGING T: 01252 780000	**www.stemmer-imaging.co.uk**
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EVENTS

UKIVA Machine Vision Conference and Exhibition 2018
16 May, 2018, ArenaMK, Milton Keynes, UK
Keynote addresses, educational technical seminars and machine vision exhibition www.machinevisionconference.co.uk

PPMA Show 26 - 28 September, 2017, NEC, Birmingham, UK
Many UKIVA members will be exhibiting www.ppmatotalshow.co.uk

Photonex 11-12 October, 2017, Ricoh Arena, Coventry, UK
www.photonex.org

Multipix WiseUp – Embedded Vision Solutions
2 November, 2017,
Advanced Manufacturing Technology Centre, Coventry, UK
A look at the ever growing area of embedded vision solutions and associated products http://multipix.com/events/embedded-vision-solutions/

Stemmer Imaging Vision Technology Forum
15 - 16 November, 2017, Silverstone Wing Exhibition and Conference Centre, Towcester, Northants, UK
www.stemmer-imaging.co.uk/en/technology-forum/
Day 1 - Hands on training. Day 2 - Multi-track technical sessions, integrator zone, hands-on workshops and machine vision exhibition

TRAINING

Training courses offered by UKIVA members:

Stemmer Imaging
(in association with the European Imaging Academy)
'Machine Vision Solutions' - September 14
'Machine Vision Solutions From Teledyne DALSA' - September 20 – 21 and November 29 - 30
'Optics & Illumination' – October 12
'LMI 3D Sensor' – October 26
'Hyperspectral Imaging' – November 16
'Common Vision Blox' – December 12
'Line Scan Technologies' – January 18, 2018
All courses at Tongham, UK
www.stemmer-imaging.co.uk/en/events/ training-events

TECHNICAL TIPS

Some useful technical tips from UKIVA members

Short Wave infra red applications (Allied Vision)
www.alliedvision.com/fileadmin/content/documents/products/cameras/various/appnote/various/Short-Wave-Infrared-Applications.pdf

Terahertz technology – basics (Alrad Imaging)
http://terasense.com/terahertz-technology/

Using adaptive hot pixel correction
(IDS Imaging Development Systems)
http://en.ids-imaging.com/tl_files/downloads/techtip/TechTip_adaptive-hotpixel-correction_EN.pdf

Round consumer packaging - vision inspection technology options (Mettler Toledo)
www.mt.com/uk-round-packaging

Identifying the correct lighting technique (Multipix Imaging)
http://multipix.com/machine-vision-lighting/

Getting more from GigE Vision system architecture (Stemmer Imaging)
www.stemmer-imaging.co.uk/en/knowledge-base/innovative-camera-features-part-1/

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