UKIVA

VISION IN ACTION

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

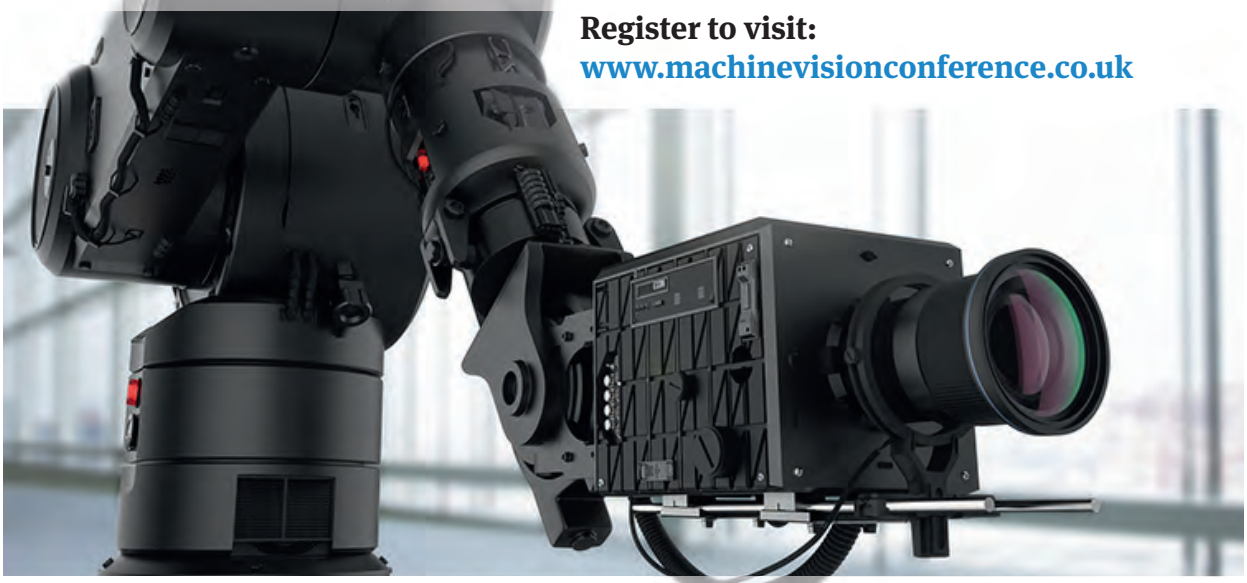
Spring 2019

Industry update from the UK Industrial Vision Association

MVC goes from strength to strength

More technical seminars, more exhibitors and more visitors are set to make the 2019 Machine Vision Conference and Exhibition the biggest and best so far. Find out what's encouraging more and more people through the doors in our special centre page feature.

Register to visit:
www.machinevisionconference.co.uk



First Conference keynote announced

Dr Luca Benedetti from Kudan will deliver a Conference keynote entitled 'Visual SLAM in the Wild', examining practical usage of Simultaneous Localisation and Mapping technology. With eight different technology themes, the 2019 Conference will be the most diverse yet.

The wide-ranging program will feature around 60 speakers and include a new 'Vision in Robotics' theme, which reflects the importance of this combination in factory automation processes and in Industry 4.0. Insightful and thought-provoking content throughout the program explores the benefits of industrial vision together with advancements of vision technology on a broader scale.

Bigger international exhibition

The biggest exhibition to date includes over 15 new exhibitors compared to 2018. An even more impressive international line-up showcases companies from Belgium, Canada, Germany, Ireland, Korea, Italy, Norway, Slovakia, USA, as well as the UK.

The exhibition provides an excellent cross-section of the industrial vision industry, including vision component manufacturers, vision component and system distributors, and systems' integrators.

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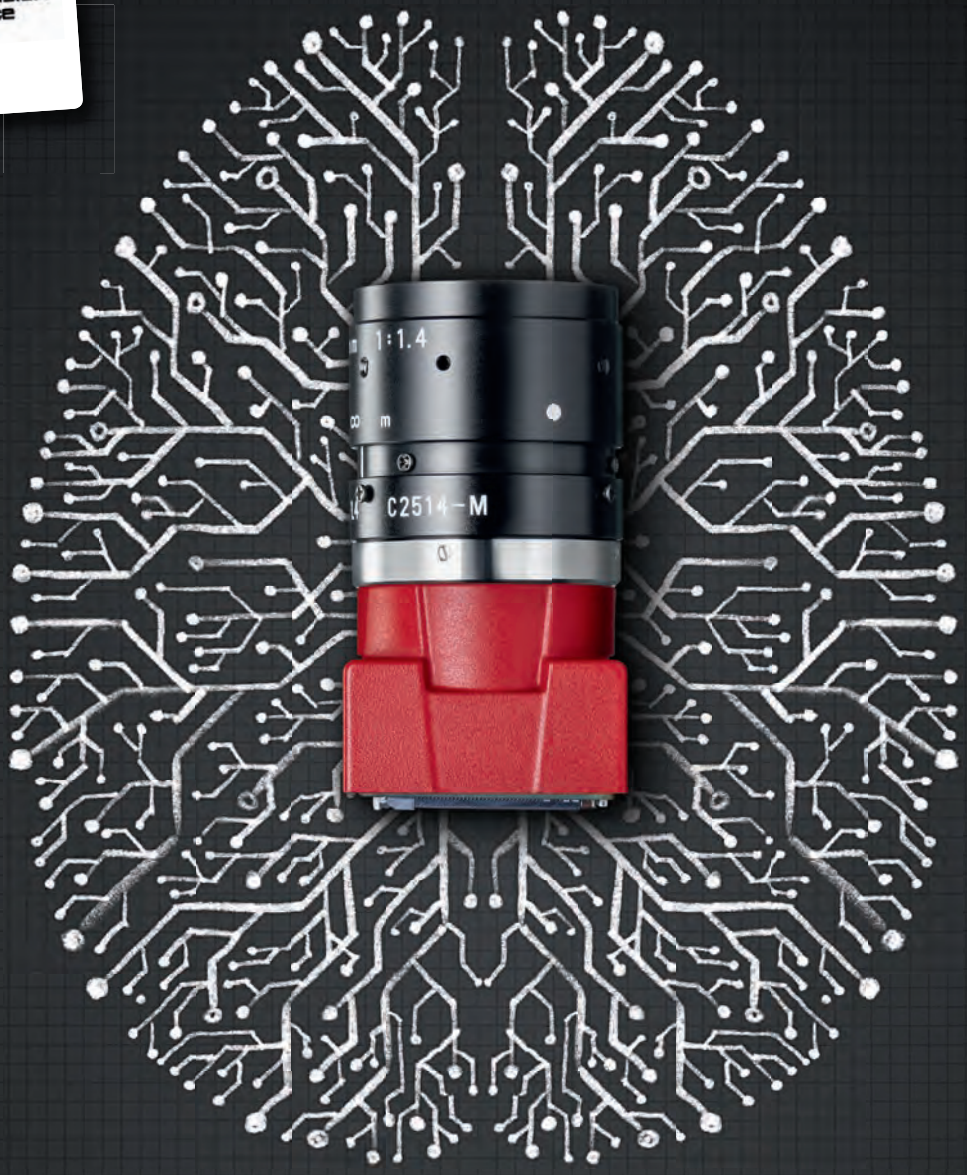
June 6, 2019



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FOREWORD by Allan Anderson

I am delighted to be writing my first foreword for 'Vision in Action' as the new UKIVA Chairman. I would like to thank outgoing Chairman, Paul Wilson, for his many achievements. We have worked closely together over the past two years and we both have a great sense of pride in helping to make UKIVA's Machine Vision Conference & Exhibition a reality, with the backing of the team at the PPMA, especially event organiser, Chris Valdes. This year's event will take place at the Marshall Arena, Milton Keynes on June 6th and all of the indications are that it will be bigger and better than ever. I'd also like to welcome Neil Sandhu from Sick (UK) as UKIVA's new Vice-Chairman.

At the recent UKIVA members' meeting, many reported a growing number of enquiries over recent months rather than the slump that might have been expected given the continuing uncertainty over Brexit. The consensus of opinion was that UK firms, who have been behind the curve in terms of investment in automation and Industry 4.0, are now pushing ahead with plans for automation and embracing Industry 4.0. They have realised that to not invest would be more risky compared with the possibility of having insufficient labour as a consequence of the change in migration patterns to the UK since 2016. These show a downturn in migration from Europe and an increase in migration from Asia. The UK has a high overall level of employment, so this change in demographic could affect the available workforce pool for manufacturing. Even a small change in this may impact the opportunities for UK manufacturing to grow, or even just maintain status-quo based on current working practices. Moving towards increased automation and preparing for Industry 4.0 would not only improve productivity in the short term but also stand us in good stead for whatever markets the UK operates in post-Brexit. These preliminary indications look good for the UK machine vision industry to help UK manufacturing continue to grow in the coming years.

Allan Anderson, UKIVA Chairman

CONTENTS

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ASSOCIATION NEWS

NEW TEAM AT THE TOP

Allan Anderson was confirmed as the new chairman of UKIVA at the recent Annual Members' Meeting. Allan, managing director of ClearView Imaging, previously held the position of vice-chairman of UKIVA and now takes the chair for the next two years. Neil Sandhu from Sick (UK) was elected to the position of vice-chairman. During his time as vice-chairman, Allan has been extremely pro-active in the creation of the Machine Vision Conference and Exhibition. Allan paid tribute to outgoing chair, Paul Wilson, who has just completed his four-year cycle as vice-chair and chair. "Paul has overseen a significant period of growth for the Association", he said. "Member numbers have gone up during his tenure and the Machine Vision Conference and Exhibition has become established in the vision industry calendar, with the 2019 event promising to be the biggest ever." The Association wishes both Allan and Neil every success for the future.

OAL WIN 2018 PPMA VISION AWARD

For the second year in a row, a solution featuring artificial intelligence has won the 'Most Innovative Vision Solution' category of the PPMA Group Awards. The winner for 2018 was OAL, based in Peterborough, for their APRIL Eye date code reading and verification system. Its patent pending technology automates the reading and verifying of date codes to prevent errors slipping through due to human intervention. For the first time, artificial intelligence and machine vision are combined for date code verification in order to help prevent product recalls and emergency product withdrawals. The technology was developed in conjunction with the University of Lincoln who put together a team of global experts in the subject of AI including Professor Stefanos Kollias, the founding professor of machine learning.

APPLICATION ARTICLES

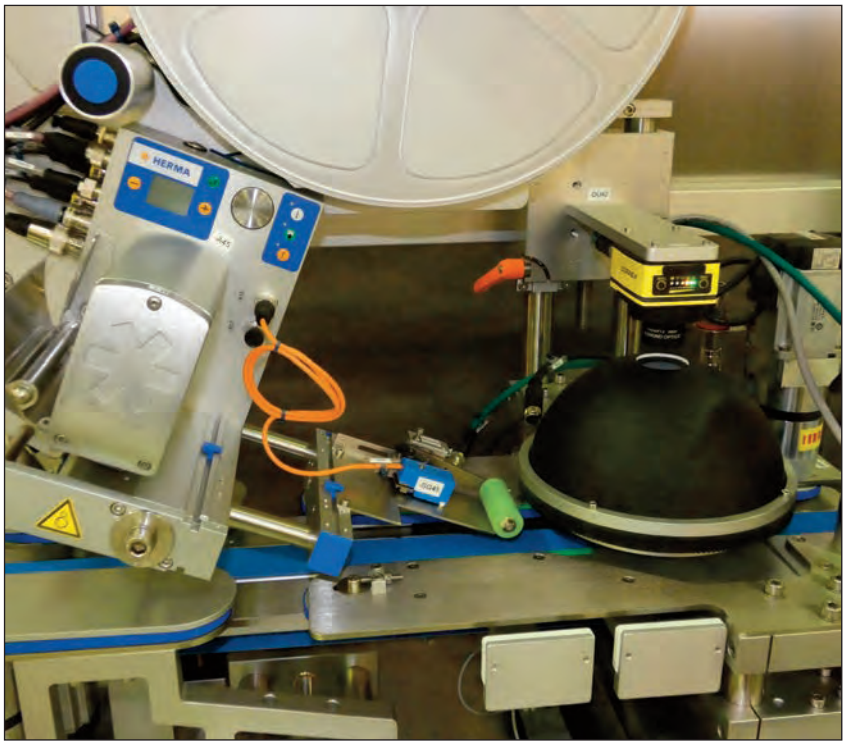
Editorial material in this section is provided by UKIVA Members.
Content accuracy is the responsibility of individual UKIVA Members.

ACROVISION www.acrovision.co.uk

Automatic vision solution for Herma Labelling Systems

Herma Labelling Systems is a world leading manufacturer of self-adhesive label application systems for a broad spectrum of markets and industries, including food & beverage, healthcare, toiletry and cosmetics. HERMA approached Acrovision to provide a validation system to determine the correct positioning and specification for a top labelling application project for one of their end customers. The requirements of the validation system were to automatically inspect up to 175 products per minute, validate the correct label by a unique pattern/colours and calculate and adjust label placement accordingly.

Acrovision designed a bespoke version of its Validator range, consisting of a Cognex camera, the In-Sight 7801C 1.3mp colour vision system, which inspects up to 175 products per minute, while checking that the top label is not only correct but also central to the customer's product. These products are then inspected by the Cognex Vision System to ensure no labels are misplaced, missing, damaged or incorrect. An average of good label placement is then calculated and at this point the X- and -Y plane adjusts accordingly. Should the vision system identify an out of tolerance/incorrect/missing label, the product is immediately discarded into the reject facility by an air blast.



Validation system at Herma

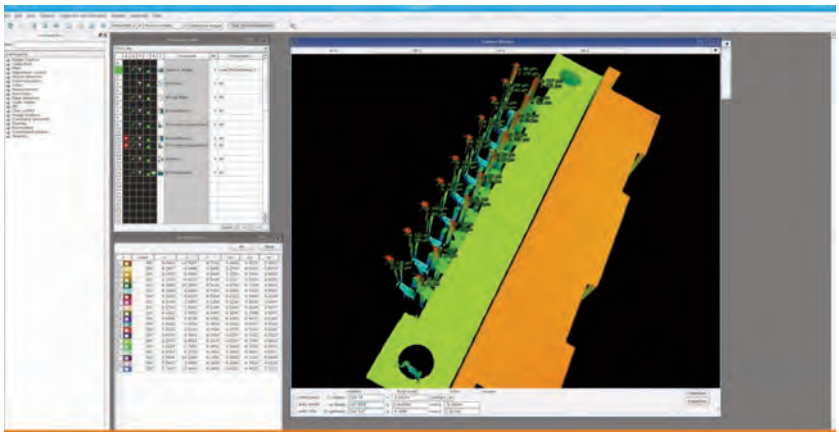
The system ensures a good product flow throughout the application process. However, should a product jam occur at the outfeed of the machine, the functional standby mode is activated automatically, causing products to halt at the infeed belt until the queue is released. This enables the handlers to meet the required product feeding speeds and avoids any non- conforming products to hit the stores. The final solution has already undertaken successful factory and site acceptance tests with the end user, and feedback suggests that the solution provides great quality control, correct label placement and assurances that the product labels are 100% correct. Based on initial testing and results this application has been selected for an ongoing project with HERMA to include the supply of a further 15 systems which are currently being commissioned and installed globally. In addition, Acrovision are now implementing a further 4 machines for another manufacturer as well as quoting further systems within the market sector.

APPLICATION ARTICLES

ALRAD IMAGING www.alrad.co.uk

3D Pin-inspection

Checking the pins is an important part of the quality control process for electrical connector manufacturers. An EyeScan AT 3D laser triangulation sensor from EVT has been used in conjunction with the PinInspector 2.0 to measure the height and position of the pins. PinInspector has been developed by EVT using the versatile EyeVision software platform which allows complex image processing solutions to be solved quickly and easily. The software runs on an industrial PC. A 3D image is acquired by moving the connector through the laser line projected by the camera to build up a series of line profiles. Up to 4096 points/profile can be acquired and profile speeds up to 25 kHz can be achieved depending on the model. The software extracts a 3D point cloud for the measurements.



3D pin inspection

A number of measurements are possible with the system. 'True point' measurements evaluate connector tolerances and staggering of the pins. The software also can measure the depth that the pins are embedded in the connector, since the 3D inspection makes it possible to measure the height of the pin tips. Those are not only measured in their x- and y-direction but also the z-direction. In addition the system can detect flaws on the connector. Examples include bent connector pins, and pins that are either stuck too deeply into the housing or protrude too far out of the housing.

Additionally EyeVision provides users with detailed statistics with all result values in the supplied SQL database or transferred into a database of choice. Complete administration of all measured and inspected characteristics in a data base is possible for production tracking.

Scanner systems for RFID or code readers (bar code, DMC, QR, OCR) for product tracing and mapping can be integrated. Direct integration of Profinet, Modbus, Ethercat PLCs and others is also possible.

IDS IMAGING DEVELOPMENT SYSTEMS GmbH www.ids-imaging.com

3D bin-picking of veterinary catheters boosts productivity

Pose Automation GmbH, based in Germany, is a system integrator who develops high-tech systems for machine vision and robotics. This includes a robotic cell utilising an Ensenso 3D camera from IDS for a bin picking application in the veterinary medicine sector. Veterinary medicine catheters are gripped and sorted into a packaging machine. Following production, the catheters are transported on a conveyor belt in large quantities in a random manner to the gripping area of the robot arm. The Ensenso 3D camera detects the catheters lying in random orientations and delivers a three-dimensional point cloud.

The system's image processing system uses this information to calculate the position and alignment of the objects to be gripped. The robot controls them in a targeted manner, grips 2 pieces per cycle and inserts them individually into format tubes. The

ASSOCIATION NEWS

SPREADING THE WORD FOR UKIVA

UKIVA is delighted at the continuing growth in interest being shown in this publication. Vision in Action is made available at all of the major exhibitions in which the PPMA and UKIVA are involved. This includes the PPMA Show, VISION, Stuttgart and of course the UKIVA Machine Vision Conference and Exhibition. Over 600 copies were taken from the literature stands at Vision Stuttgart alone, indicating the international appeal of our members' contributions.

VISION AND INDUSTRY 4.0

Industry 4.0 continues to be an important focus for the vision industry. An integral requirement for smart factories is seamless communication and data transfer between various parts of the system, including, of course, all of the sensors and other modules used. A vision system captures more information than any other aspect of the production line and generates much larger quantities of data than other sensors. For example, a line scan camera with a 16K sensor operating at 120 kHz line rate produces data at 2 GBytes/s. A communication standard for vision systems is therefore of huge importance. To help with this, the VDMA (the Mechanical Engineering Industry Association in Germany) has introduced the OPC UA Companion Specifications for Machine Vision. OPC UA is a platform-independent, open standard for machine-to-machine communications that has been developed by the OPC Foundation and is an essential part of Industry 4.0. The Companion Specification for Machine Vision is due for initial release in Q1 2019. It provides a generic model for all machine vision systems - from simple vision sensors to complex inspection systems. It handles the management of recipes, configurations and results in a standardised way, whereas the contents stay vendor-specific and are treated as black boxes.

WELCOME TO KEYENCE

UKIVA is delighted to welcome Keyence as a new member. Keyence is a leading supplier of sensors, measuring systems, laser markers, microscopes and machine vision systems worldwide. The company is at the forefront of factory automation. Keyence machine vision systems allow their customers to accurately and instantaneously perform visual quality control inspections that were not previously possible. For high precision measurement applications, they offer a variety of measurement systems to quickly communicate whether manufactured parts are acceptable or not. Keyence code readers can scan 2D or 1D codes at extremely fast speeds with excellent accuracy.

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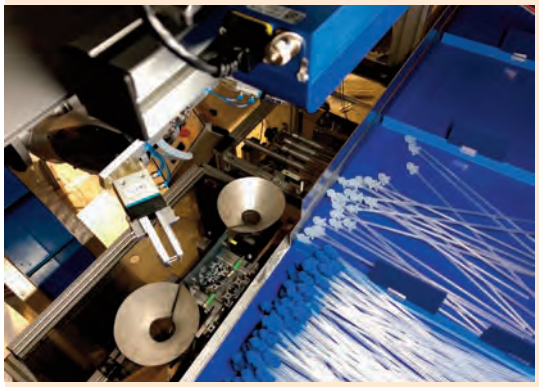
recognition and gripping of different catheter designs are possible as well as further assembly steps, such as the attachment of hose pieces. In this way, different catheters from different production lines can be packed on the same packaging machine. The delivery of goods can be adapted exactly to the customer's needs and storage of the finished products can be minimised, increasing productivity.

The Ensenso N35 3D camera with GigE interface and Power-over-Ethernet meets IP65/67 requirements and is therefore protected against dirt, dust, splash water and cleaning agents in the production environment. The camera also features FlexView technology which allows a moveable random light pattern to be projected onto the test object, thus generating a series of images with different surface texture structures. In-built sequence correlation algorithms then calculate the 3D object data from up to 16 pairs of these images to increase accuracy. This approach allows even transparent object parts to be reliably detected. Detailed 3D image data is delivered at high speed allowing the position of the catheters on the conveyor belt and the gripping path of the robot to be determined quickly and precisely. Pose Automation has used the HALCON image processing package from MVTec in its software for this system. The cell is designed for harsh environmental conditions and contains interfaces to various other common systems with a view to the requirements of industry 4.0.



3D veterinary catheter inspection

LEUZE **www.leuze.co.uk**

Safe use of automated guided vehicles in warehouses

Automated guided vehicles (AGVs) used in warehouses must be protected with safety sensors to monitor people and objects in their transportation path. Flexible adaptation of the protective fields is important for this. When the triangulation principle is used for navigation, AGVs are usually equipped with two different sensors: one for safety and one for navigation. The RSL 400 safety laser scanner merges safety technology and high-quality measurement value output for AGV navigation software in a single device. The high angular resolution of 0.1 degrees makes the scanner particularly suitable for applications in the areas of natural navigation and SLAM (simultaneous localisation and mapping). The small measurement error and high quality of the data is achieved through the narrow laser spot that maintains its perpendicular shape over the entire scanning angle.

Combined sensor and navigation capabilities

The entire transmitter/receiver system rotates. Each revolution of the deflection unit last 40 milliseconds and 2700 light pulses are emitted. These are scattered in all directions on obstacles. Parts of the scattered light are transmitted back to the scanner and used to calculate the distance to the obstacle. Similar to a map, the navigation software contains an image of the respective room, including all fixed boundaries. The current position of the AGV is then calculated by comparing the measurement values to the map. The more detailed and exact the measurement values of a scanner are, the more precisely the AGV can navigate.

In addition to the angular resolution, the distance values are also important to determine where obstacles are. These are highly precise and the values are not affected by the reflectance of the object, whether it is a reflector or a black wall. 100 switchable field pairs or 50 switchable 4-field sets offer optimum adaptation to changing movement conditions and various loads. With a scanning angle of 270°, the RSL 400 can also cover the front and side areas of AGVs at the same time, i.e., around the corner. With these features and a maximum operating range of 8.25 metres, even large AGVs can be fully safeguarded with only two of these laser scanners.

MATROX IMAGING **www.matrox.com/imaging**

Suntory PepsiCo bottles perfection

One of the largest producers and distributors of beverages in Vietnam, Suntory PepsiCo, uses a vision controller and OCR software from Matrox Imaging to power critical production-line identification verification of the mandatory manufacturing (MFD) and expiration (EXP) dates and lot codes on the product packages. These codes identify exactly where and when the product originated, and demand cost-effective systems that can report clear and reliable results to prevent packaging errors. As an added challenge, these lines often involve the scanning of multiple types of products simultaneously.

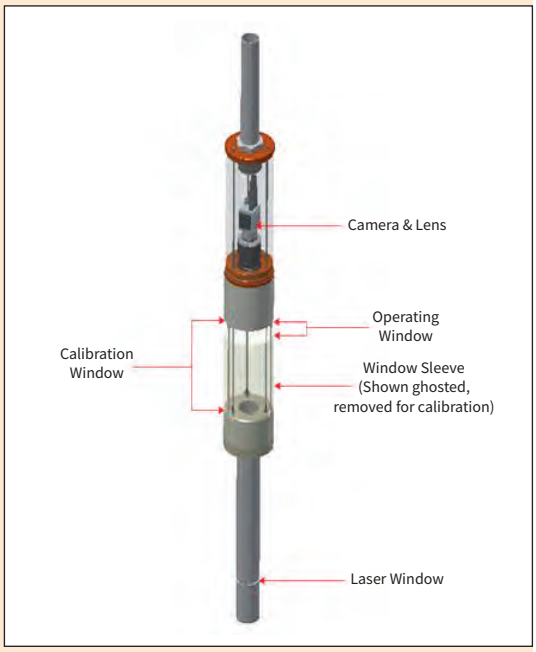
continued on page 8

APPLICATION ARTICLES

MFD and EXP code reading

Specialist production-line solution provider, Pacific Hi-Tech, also based in Vietnam, has developed a system for Suntory PepsiCo that can readily detect missing code or incorrect MFD and/or EXP date code on products. With many types of products, each with different sizes, properties, and components, the position of the printed code on the packaging may be restricted due to registered copyrights on the shape and location of print code. The system therefore has to account for every possible product permutation. In addition, the production lines pose continual challenges due to the stability of the conveyor belt as well as restrictions in its length; this results in inconsistent uniformity of the inkjet printing. Moreover, the liquid inside the product can blur the distinction between the image background and the foreground where the identification information is printed.

The system designed by Pacific Hi-Tech features a Matrox 4Sight GPm vision controller with a FLIR USB 3.0 camera, a detection sensor, and LED lighting. The camera takes images of each MFD and EXP code, while Matrox Design Assistant software checks for illegible code —whether smudged, obscured, missing strokes, or absent entirely. If the code is sub-optimal for any reason, the product is automatically ejected from the line. When the code position on the product is optimally clear, the vision system uses the String Reader algorithm within Matrox Design Assistant to detect the wrong code or expiry date that the customer has set. String Reader handles text strings with a known or unknown number of characters, accommodating changes in character angle with respect to the string, aspect ratio, scale, and skew, as well as contrast reversal.



Assystem Omnidirectional Laser Probe

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

Advanced remote inspections for UK nuclear industry

Multipix and Basler have been supporting Assystem (www.assystem.com/en) in the development of an innovative 360 degree laser scanning device, for obtaining high accuracy scans of the internal faces of channels, vessels and pipework. The Assystem Omnidirectional Laser Probe produces high resolution 3D visualisations, allowing for accurate measurements to be taken from the derived point cloud data.

The collected data allows the clients to assess the condition and structural integrity of their plants at a level of detail which was previously not possible. What were once subjective visual inspections, can now be highly detailed metric scans. The cylindrical scan outputs are unwrapped to allow for viewing and analysis. Using bespoke data fusion techniques, the data will allow for long term trending and automated defect detection. Initial development of the device has been for applications in the UK nuclear industry, where the equipment will be required to operate in a variety of harsh environments – temperature, humidity and radiation.

The devices use a variety of Basler CMOS cameras and a laser diode selected to suit the likely conditions of the surface requiring inspection. Image data is all processed in MVTec HALCON using a combination of standard functions, supplemented by bespoke code algorithms developed by Assystem.

Pick and place mozzarella packet

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

3D smart camera solves a cheesy challenge

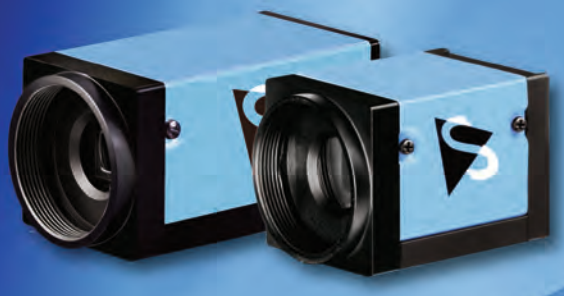
Automating the secondary packaging of delicate individual portions of soft mozzarella cheese balls in a brine-filled, sealed, glossy tubular bag presents a tough challenge. German packaging machinery manufacturer A&F, Automation & Fördertechnik, worked with specialists at SICK to develop a reliable high-speed 3D vision-guided solution, based on SICK's IVC-3D smart camera and A&F's popular FlexoPac solution using 4-axis Delta 3 pick-and-place robots. It handles 150 mozzarella bags per minute on two synchronised conveyors.

With rapidly-growing consumer demand, the manual process traditionally used to transfer the delicate bags of mozzarella into secondary packaging was becoming too slow. Alternatively, dropping them in bulk from the end of a conveyor into a cardboard box, not only risked product damage and leakage, but resulted in highly inefficient use of the available packing space. Initial testing soon demonstrated that the glossy packaging material and the irregular shape - the mozzarella balls do not always lie in the middle of the bag - was too challenging for 2D vision guidance. However, using the IVC-3D enabled height-based detection of the varying 4 to 44 mm profile of the bags. The

continued on page 11

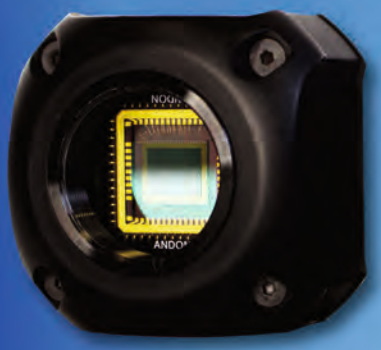
Machine Vision Components

Ricoh's 9 Mega-Pixel Lens is optimised to guarantee a wide range of applications can be covered by just one lens. Featuring a manual iris which is compatible with 1" format cameras up to 9 megapixels and a floating mechanism that ensures high-resolution and low-distortion images at all ranges (from infinity right down to 80mm). All of this contained in a competitively priced, compact design (Φ42mm) which makes them ideal for installation in high performance equipment to further enhance production line operating efficiency.



The Imaging Source offer a comprehensive range of cameras, including these outstanding new 20MP cameras. These feature the Sony IMX183 CMOS sensor which offers fantastic image quality, making it a very versatile camera for a wide variety of applications. These cameras offer a variety of input/output strobe and trigger options. A highly versatile imaging solution which is competitively price with resolutions from VGA to 42 Megapixels and frame rates up to 160fps.

TechniQuip have been supplying medical and industrial customers with reliable and cost-effective lighting and vision related products for over 40 years. Thousands of high-quality uniquely designed solutions have been produced for a wide range of customers in this time. As shown in the image (right), with multiple fiber channels TechniQuip allow a fully customizable, bespoke setup further emphasizing that they are uniquely qualified to overcome your challenges to meet your precise lighting needs.



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 with custom software all included.

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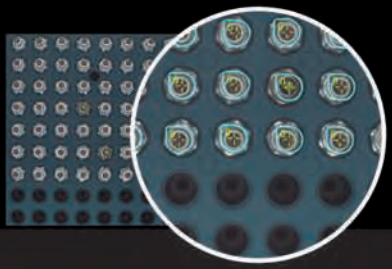

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COGNEX

IVC-3D is a smart camera that measures height, volume, and shape independent of contrast and colour, using the laser triangulation principle. The camera sends data sets including the object centre, orientation and height to the FlexoPac's robot controller, which calculates where to pick up the mozzarella bags on the moving conveyer.

The gripper arm always reliably moves to the correct point of the product. Since the camera reports the height, the gripping position can be adapted to take account of the mozzarella ball not being in the centre of the bag and guide the gripper to pick it gently every time, without risking a collision. The 125, 250- or 400-gram packs are fed randomly onto the conveyor. Identified according to their 3D measurements, they can then be sorted into three different box types and placed according to five pre-determined packaging plans. The IVC-3D delivered a quick return on investment for A&F not only due to its measurement performance, but also because the camera's ease of configuration and integration into the machine and factory network meant the project could be delivered using A&F's in-house know-how and resources.

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

Hyperspectral imaging inspection of heat-sealed cheese packaging

Bergader Privatkäserei, based in Bavaria, Germany, has a new production line for its 'Bergader Edelpilz' blue cheese. It is thought to be the first food production plant in the world to use hyperspectral imaging for the inspection of heat-sealed packaging joints. This forms part of a 3-stage inspection process. The calculated "best-before date" can only be accurate if the packaging is absolutely airtight. Even the tiniest contamination or damage to the seal can cause leaks leading to deterioration of the cheese inside.

Hyperspectral inspection of heat-sealed cheese packets

The inspection system was developed in conjunction with Minebea Intec in Aachen, a leading manufacturer of industrial weighing and inspection technologies. When initial testing using an X-ray system proved unsatisfactory, the team in Aachen worked closely with Stemmer Imaging to develop a solution based on hyperspectral imaging. This combines infrared spectroscopy with machine vision to produce images which can be colour coded according to the chemical composition of the objects being imaged. The resulting colour images can be processed and analysed using standard machine vision tools. The short wave infrared light used passes through the packaging even though it is overprinted, allowing any defects to be found.

The system features a Specim FX17 hyperspectral camera, halogen line lighting and an Teledyne DALSA Xtium-CL MX4 frame grabber to capture the HSI images. The spectral images captured are pre-processed on the PC GPU using Perception Studio hyperspectral software from Perception Park. CVB GigE Server, a module of Stemmer Imaging's Common Vision Blox (CVB) imaging library then feeds the pre-processed data to Sherlock machine vision software from Teledyne DALSA, where further processing takes place. The HSI system can check up to 145 cheese packets per minute.

After the HSI inspection the cheese packets enter an X-ray system to check for foreign bodies within the packaging. A further vision system designed by Stemmer Imaging uses a line scan camera and Sherlock software to read the labels applied to each cheese packet. This detects the 'best-before date printed on them as well as an ID integrated in the label.

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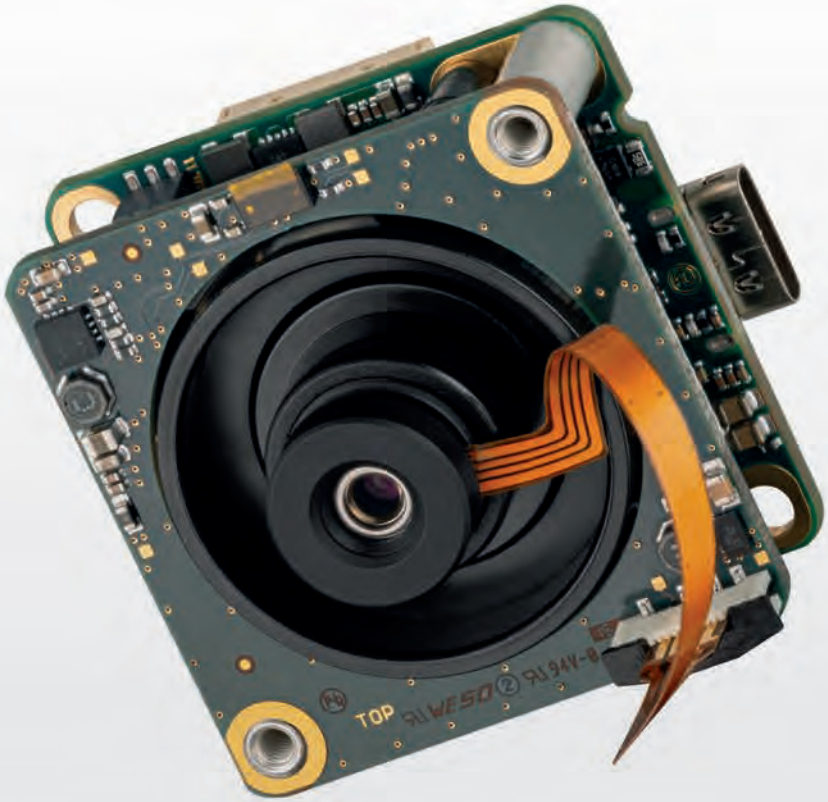

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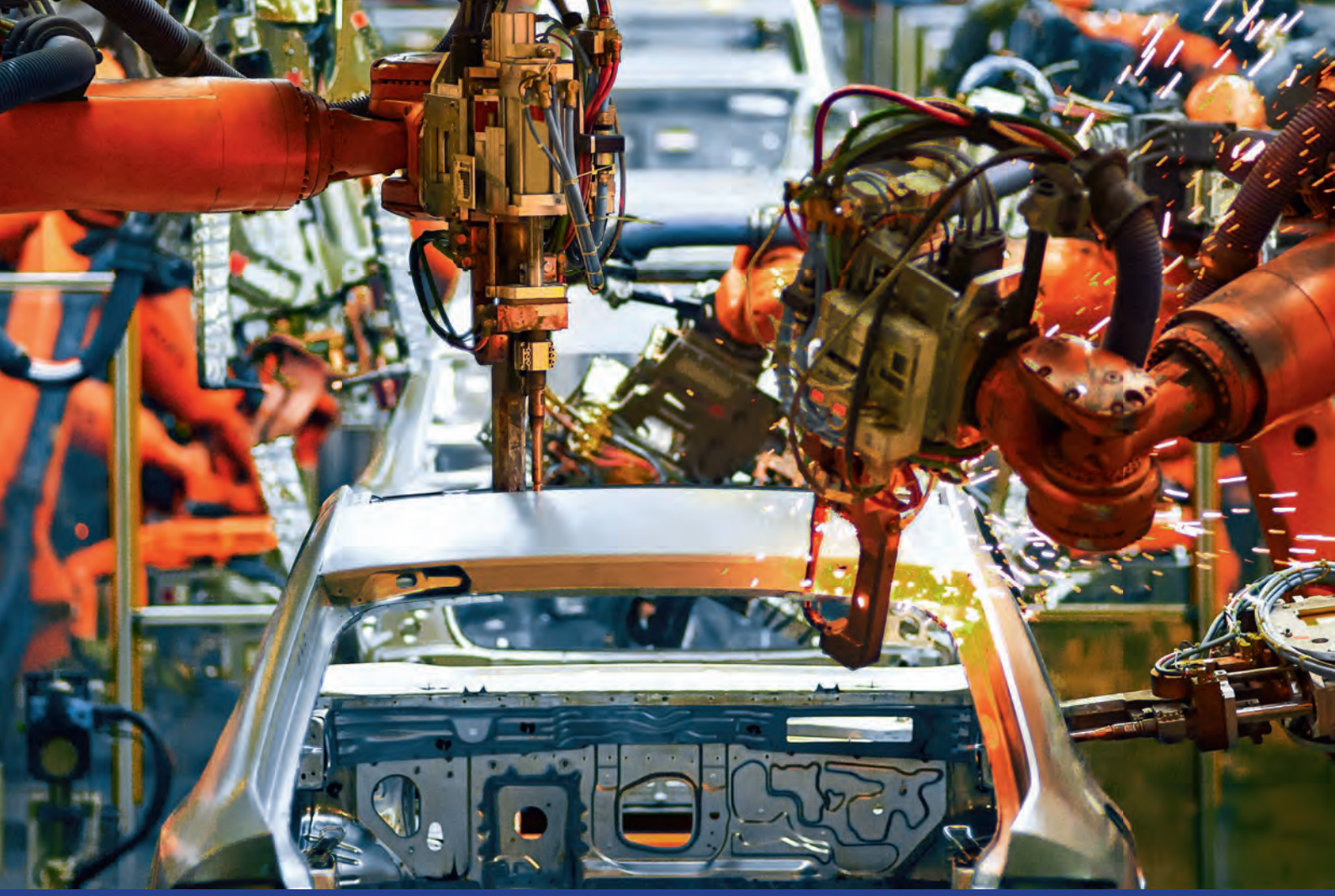

What automotive vision teams **have been looking for all along.**

Matrox Design Assistant software offers an intuitive, flowchart-based approach to machine vision application development. Hardware flexibility and effective vision tools make this software the right choice for error proofing and tracking applications encountered in vehicle assembly and propulsion systems at major automotive manufacturers and similarly demanding manufacturing sectors.

An efficient and powerful integrated development environment, it can deploy applications to various platforms—including the Matrox Iris GTR smart camera and Matrox 4Sight EV6 vision controller.

New
Matrox Design Assistant X

Here is what's new in Matrox Design Assistant X:

- Inspection using classification based on deep learning technology
- Photometric stereo tool to spot hard-to-see surface irregularities
- Dedicated shape finding tools to locate circles, ellipses, rectangles, and line segments
- 3D sensor interfacing for processing and analyzing depth map data
- Ability to run multiple independent projects on the same platform[1]

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MATROX IMAGING

1. Platform permitting

UKIVA machine vision conference & EXHIBITION

6 June 2019
Marshall Arena, Milton Keynes, UK

New for 2019

www.machinevisionconference.co.uk

A new technical seminar theme of 'Vision in Robotics' has been added to the 2019 UKIVA Machine Vision Conference program. For many years both robotics and vision have made massive contributions to the automation of manufacturing processes. Now, especially with the emergence of collaborative robots (cobots) and rapid developments in 3D image processing, their combined use is growing dramatically. Not only that, the recent developments in communication standards for machine vision and robots for use in Industry 4.0 and smart factories further extend the range of automation applications.

VISUAL SLAM KEYNOTE ANNOUNCED

With Simultaneous Localisation and Mapping (SLAM) gaining traction in the world of industrial vision, UKIVA is delighted to welcome Dr Luca Benedetti from Kudan to deliver a keynote address at the 2019 UKIVA Machine Vision Conference. This is entitled: '*Visual SLAM in the Wild*' and will describe the real-world challenges of deploying a SLAM system across a variety of applications as well as designing a SLAM system that's versatile both in terms of hardware and software.

Artificial perception technology and Kudan

Over the years, Artificial Intelligence (AI) has become the backbone technology as the brain for machines. However, it only consists of functionality for learning semantic extraction. Kudan is accelerating the evolution of Virtuality (AR/MR/VR) and Robotics (automobile/drone/robot) by developing computer software algorithms classified as Artificial Perception (AP). Kudan's AP algorithms are the machine equivalent of human eyes. With the combination of AP and AI, machines are getting closer to sensing and interacting with the world like human do, utilising both eyes and brain. Kudan has been developing SLAM algorithms that can be deployed on a variety of different products that use different sensors, such as drones, robots, vehicles, and mobile devices.

SLAM technology

SLAM refers to the process of determining the position and orientation (localisation) of a sensor with respect to its surroundings, as well as simultaneously building a map of the surrounding environment. Over the years, various SLAM algorithms have been developed to solve this problem (at least approximately), which typically use either a combination of a camera and a depth sensor, or two cameras together (stereo vision) embedded on the device. Most modern SLAM systems used today are based on vision, as they use one or more cameras as the main sensing device. Using cameras gives many advantages to SLAM due to the inherent richness of the image data. Any visual SLAM system has to extract the depth of the feature points in the image. 3D vision can perform location and mapping functions when neither the environment nor the location of the sensor is known.

MEET THE EXPERTS

As part of this new initiative on Vision in Robotics, a number of experts on robots and their use from our sister organisation, BARA (British Automation and Robot Association), will be available throughout the day. They will be happy to discuss all aspects of the integration of robots and vision systems to improve the automation of processes. You can find these specialists on the BARA stand, which will feature a working robot cell, put together for the event by specialists at MTC (the Manufacturing Technology Centre). MTC is an independent Research & Technology Organisation which can help British manufacturers to develop the manufacturing system solutions needed to meet their particular challenges. After the event, the robot cell will be put on permanent display at MTC's headquarters in Ansty Park, Coventry, UK.

BARA British Automation & Robot Association

Vision guided robots

Here the vision system acts as the 'eyes' for the robot. Both 2D imaging and increasingly 3D imaging are being used in these applications as the acquisition and processing of 3D data can now be achieved at production line speeds. The vision system identifies the precise location of the object and these coordinates are transferred to the robot. Massive strides in vision-robot interfaces make this process much easier. Vision guided robots are used in applications such as pick and place, or to guide a robot in a executable task such as in an assembly process.

Robot guided vision

With robot guided vision, the robot facilitates the inspection of a component. This could involve picking a part from one location and presenting it to a remotely positioned camera for inspection and then placing the part in the appropriate location as a result of the inspection. An alternative approach is to mount the camera on a robot arm and move it around a component to allow imaging at a number of different positions. This is particularly useful for inspecting large items, such as engine blocks and can remove the need for multiple cameras, saving cost.

2019 CONFERENCE

The 2019 Conference program provides an even greater choice for visitors with 8 discrete technical themes, supported by two keynote addresses. In addition to the brand new 'Vision in Robotics' theme, profiled on the previous page, the topics are: Understanding Vision Technology, Deep Learning & Embedded Vision, 3D Vision, Optics & Illumination, Camera Technology, Systems & Applications and Vision Innovation.

Artificial perception technology keynote

Dr Luca Benedetti from artificial perception technology specialists, Kudan, will deliver a keynote address entitled 'Visual SLAM in the Wild'. Visual SLAM is quickly becoming an important advancement in embedded vision with many potential applications. This fascinating presentation will cover real-world challenges of deploying a Simultaneous Localisation and Mapping (SLAM) system across a variety of use-cases, and designing a SLAM system that's versatile in terms of hardware and software.

Understanding Vision Technology

This will cover some of the fundamentals of industrial vision and provides a good grounding for visitors who are new to the subject. Importantly, it will give a useful insight into both what is and what is not possible using vision techniques.

Deep Learning & Embedded Vision

With deep learning methodolgy moving into mainstream vision applications, many of the various options that are now commercially available will be explored, including the deployment of deep learning on a camera itself, and applications in Industry 4.0. Embedded vision is another area where rapidly developing technolgy is influencing costs, performance and time to develop application solutions.

3D Vision

3D Vision is another fast moving subject where developments in sensor technology, processing power, software and even embedded systems are opening up new application opportunities. A direct cross-over into the world of robot vision makes this an even more facinating subject.

Optics & Illumination

Optics and illumination are essential components in achieving high quality images for measurement. Illumination geometry, wavelength and intensity control must be given careful consideration as well as matching the lens to the camera sensor being used.

Camera technology

Attendees can find out what's behind the latest cameras appearing on the market. Evolving camera standards, improved sensor technology and the increasing use of light outside the visible region of the spectrum ensure that this is a dynamic subject.

Systems & Applications

Vision technology is ultimately used in real-life applications and this track highlights some of the systems that have been used to provide solutions and to improve automation efficiency. These presentations celebrate the diversity of industries and applications in which vision is used.

Vision Innovation

Presentatons here provide the opportunity to find out about some emerging vision technology as well as innovative applications of current vision systems.

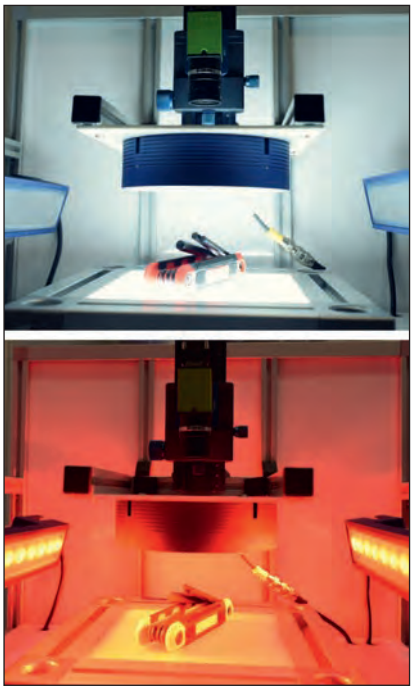
WHY ATTEND?

The UKIVA Machine Vision Conference and Exhibition creates an informative and educational environment. It is also a showcase for the latest vision technologies and services from the leading companies from the world of industrial vision and imaging and provides outstanding networking opportunities.

A perfect learning environment

These events attract large numbers of people who want to learn more about the fundamentals of vision technology, as well as those who are keen to explore the latest developments. The Conference provides a program of around 60 technical seminars. This offers something for everyone, ranging from basic understanding of vision technology to the complexities of deep learning and machine learning and other leading edge vision technologies. With 8 different technical themes, visitors can tailor a program that matches their precise interests.

World class exhibition



The exhibition represents an excellent cross-section of the industrial vision industry. A large number of vision component manufacturers will be showing products such as cameras, optics, illumination, controllers, frame grabbers, software, 3D systems, cables and components. Many of the UK's leading vision technology suppliers and distributors for these and other vision systems and components will also be exhibiting. Visitors to the event will therefore have a great opportunity to see some of the latest vision products. A number of vision systems integrators will also be available to discuss how their specialist expertise can help integrate vision inspection systems in to existing or new production lines or OEM equipment.

Talk to the experts

There will be an impressive array of very experienced and knowledgeable vision specialists gathered under one roof. Visitors, presenters and exhibitors come together in an environment where discussions about any aspect of machine vision are welcomed. Many of the presenters are also exhibitors, and they will be happy to expand on any aspect of their seminars at their exhibition stands afterwards or over a coffee! There is bound to be someone attending who can provide advice on any vision challenge faced by a visitor.

Everything in one place

The Conference theatres are located around the exhibition meaning that there is plenty of opportunity for visitors to see all of the stands either during the official Conference breaks or if they have a vacant slot in their personal seminar itinerary.

WHO SHOULD ATTEND?

This Conference and Exhibition is a must-attend event for anyone who is actively involved in the design and/or implementation of a vision system, or who has a problem that might be solved using vision. So if you're an end user, or a systems integrator, machine builder, or OEM looking to incorporate vision into your product, here is a perfect opportunity to investigate the latest technology on offer. But even if you don't have a current vision project, the opportunity to meet with so many different suppliers and listen to presentations from many of the world's leading vision experts is a truly valuable experience.

New to vision or experienced?

This event will have something for everyone – from those wanting to learn the basics of vision to experts in their own right and all points in between. By choosing as many or as few presentations as appropriate and spending some time investigating the technology on show, everyone can tailor their day to their own requirements and expectations. Visit the exhibition during a quiet time when not attending seminars to avoid the busier official break periods!

All industries covered

Vision solutions have been applied in almost any industry you can think of. Food, beverage, pharmaceutical, healthcare, automotive, aerospace, medical devices, packaging, solar energy, electronics, semiconductor, sport, traffic & transport are just some of the

industries that have benefited from the use of vision. Visitors from any of these sectors and more will find something to interest them. Many of the presenters and exhibitors will have extensive experience in these fields, so make sure that you engage with them!

Academia

Whether you are involved in research or teaching or both, this event offers an ideal platform to keep up to date with the latest vision technology available.

Need a problem solved?

Vision technology continues to develop at an extraordinary rate. This means that applications previously considered impossible, either through performance or cost, may now be achievable. Not only that, vision sometimes offers a realistic alternative to other 'tried and trusted' methods. Whatever sector you work in, if you think that vision might be the solution that you're looking for, then come along to Milton Keynes on June 6th and talk to the experts – they might just provide you with the answers you need!

VIEWS FROM THE FLOOR

There was a real buzz around the previous events which have attracted extremely positive comments from attendees, speakers, the press, UKIVA members and exhibitors alike.

View from the UKIVA

Neil Sandhu, UKIVA Vice Chairman, commented: "The reason why people come to this event is to learn, and I believe that the ability to give people the opportunity to sit in the seminars and listen to the keynotes is a key factor why this show is such a success. There's something for everybody; you can learn about some of the basics, you can learn about the latest advanced technologies and you can see a lot of the advanced technologies available today and how they can be used and benefit industry."

Professor Tony Pipe speaks at the event in 2018

View from visitors

A Senior Industrial Engineer from the engineering industry said: "I found the event extremely useful. I had the opportunity to meet potential new suppliers at the exhibition and picked up some useful hints and tips from the seminars that I attended". A business owner from the communications sector remarked on the choice offered by the Conference program and the opportunity to network. "I especially liked being able to match talks from different threads in the Conference to my particular interests", he said. "It was also great to be able to spend the rest of the time checking out the technology on show and talking to so many knowledgeable people".

View from the media

A leading editor from the imaging and machine vision media observed how well the seminars were attended. He was keen to interview one particular speaker after his presentation but had to wait until the individual had finished talking to the large number of people who had come for further discussions after the talk!

View from a speaker

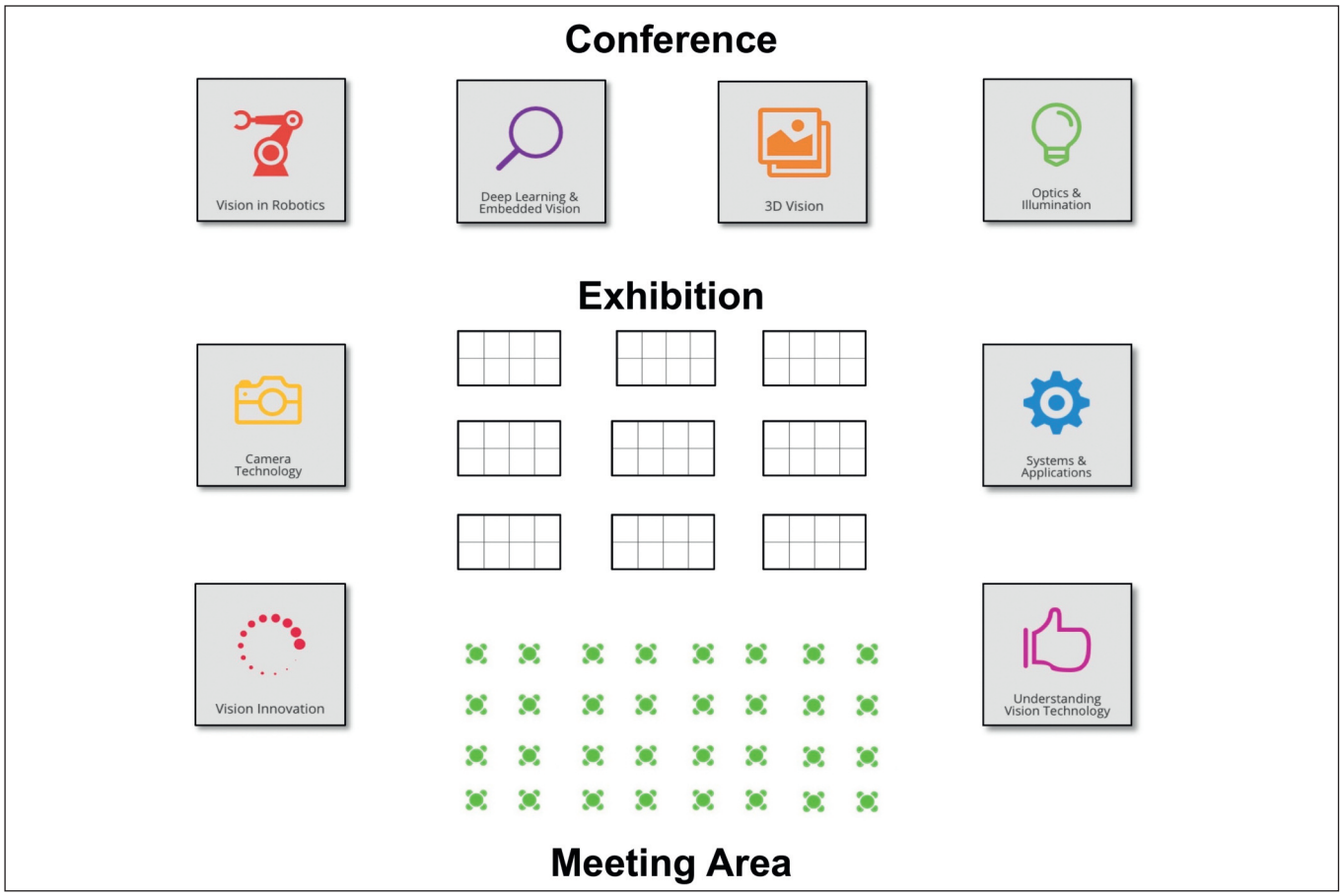
This pattern of engagement after the presentations was reinforced by many of the speakers. One commented that his audience was extremely attentive and said: "Although there was only one question from the floor at the end of my talk, many delegates approached me afterwards with really detailed questions on how they might implement vision solutions."

View from exhibitors

Exhibitors were pleased with the event because they had the opportunity to talk to many visitors who were actively involved in a wide variety of different vision projects. As one exhibitor observed: "I have had some very specific discussions with the visitors to my stand and it is clear that not only are they facing real challenges but many of them are actively prepared to invest in vision systems to solve those problems."

WORLD CLASS EXHIBITION

The Exhibition features world-class cross section of companies that serve the machine vision industry. These include vision component manufacturers, vision component and system distributors and systems integrators. Visitors to the event will have a great opportunity to see some of the latest vision products and talk to experts about any aspect of machine vision.



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ACROVISION www.acrovision.co.uk

Acrovision introduces new 12MP In-Sight 9000 Smart Camera

The Cognex In-Sight 9912 ultra-high resolution, IP67 rated, standalone vision system offers exceptional image clarity and large field of view. Not only does this camera provide crystal clear images over large working distances, but it is also program free and easily configurable in various environments. This self-contained, 12MP vision system provides a cost effective and convenient alternative to the multi-camera installations and PC (or controller)-based systems previously required to balance resolution needs and large fields of view. The 9902L line scan model also offers a self-contained, ultra-high resolution vision system with area and line scan image capture options.

Customers can readily build their applications using Easybuilder. The IS9912 offers the capability of solving a wide range of applications, featuring PatMax RedLine for pattern matching, and HDR+ advanced algorithms to increase contrast and provide a more uniform image from a single acquisition.

Cognex IS9912

ALLIED VISION www.alliedvision.com

New features for Mako GigE cameras with Sony IMX sensors

Mako G-040, G-158, G-234, G-319 and G-507 GigE cameras equipped with Sony Pregius CMOS sensors now support IEEE 1588 Precision Time Protocol (PTP) and action commands for triggering the camera via the Ethernet connection (ToE). These cameras also offer a more comprehensive feature set and support for popular C- and CS-Mount lenses in an ultra-compact housing (29 mm × 29mm).

IEEE 1588 PTP enables precise synchronisation of multiple cameras and devices within an Ethernet network. This feature is often used for recording sports events or objects in motion in order to record them from different angles at the same time. Because all cameras capture an image synchronously at exactly the same moment, a clear 3D image of the situation or object can be displayed.

Using Action Commands or the Trigger over Ethernet function, one or more cameras can be triggered simultaneously via the Ethernet connection. The ToE function is particularly useful for event-driven applications. If, for example, a ball passes the goal line or an object on the assembly line passes a control threshold, a trigger signal can be sent via Ethernet to the camera or, if necessary, several cameras.

Mako_G-camera

ALRAD IMAGING www.alrad.co.uk

New 20 MP GigE and USB 3 Cameras

The Imaging Source has expanded its product portfolio with four new camera models featuring the Sony 20 MP IMX183 sensor. The Sony IMX183 is a back-illuminated, 1" rolling-shutter sensor with high sensitivity, outstanding image quality and excellent colour reproduction. The monochrome models perform very well even in poor lighting conditions, especially in the near infrared range.

The new camera models are available with a USB 3.0 or GigE interface and are USB3 Vision and GigE Vision standard-compliant, ensuring compatibility and simplifying integration with image-processing software. The cameras' compact form factor and robust industrial design are ideally suited for applications in microscopy and a variety of inspection and measurement tasks. Combining the cameras with The Imaging Source 1" lenses results in a high-resolution camera system with a particularly attractive price to performance ratio.

The Imaging Source 20 MP cameras

MEMBERS NEWS

CX.I camera

BAUMER www.baumer.com

Baumer wins the inspect award 2019 with its CX.I cameras

The Baumer CX.I cameras were awarded 1st prize in the Vision category of the inspect awards 2019. The prize is awarded annually by Wiley-VCH publishers and recognises special innovation in the area of industrial image processing. An expert panel selected the best 10 products in the category and then more than 45000 readers of the magazines inspect and messtec drives Automation as well as from other online portals were invited to select their favourite in an online voting process.

The CX.I cameras offer excellent performance. Thanks to an expanded operating temperature range of -40 °C to 70 °C, no additional cooling or heating devices are necessary, allowing rapid and cost-effective system integration. 4 power outputs with pulse width modulation allow direct lighting control and make additional components unnecessary. With exposure times from 1 µs and frame rates of up to 1000 fps, the cameras can be deployed across industries flexibly and in demanding applications. A patented modular tube system allows rapid and easy protection against dust and dirt for lenses of different lengths by using a variable number of extension rings.

FLIR Firefly

CLEARVIEW IMAGING www.clearviewimaging.co.uk

Machine vision and big data focus at MVC

ClearView Imaging will give a presentation at the UKIVA Machine Vision Conference and Exhibition on the subject of machine vision and big data. Even the best vision systems are often used in isolation to identify issues and problems on the individual production line they are installed on. To embrace the Industry 4.0 era, Allan Anderson from ClearView Imaging, will explore how to combine machine vision with big data to create a truly smart and far more powerful system.

At the exhibition, ClearView Imaging will be demonstrating a range of exciting new technologies, with highlights including 3D cameras and 3D vision systems based on a range of technologies, including structured light, stereo vision and laser triangulation. Deep learning will also be a key focus, with live demonstrations showcasing Matrox Imaging's latest classification tool, in addition to FLIR's Firefly camera with on-board deep learning inference.

3D-A5000

COGNEX www.cognex.com

3D-A5000 series area scan 3D camera

Cognex's 3D-A5000 series is a factory-calibrated, IP65-rated area scan 3D camera designed to capture high-resolution 3D images. It features patent-pending 3D LightBurst™ technology which rapidly acquires images to maximise throughput. The camera offers a variety of fields of view and measurement ranges to accommodate applications in the automotive, consumer goods, and logistics industries.

The 3D-A5000 delivers a full field-of-view (FOV) 3D point cloud image as fast as 100 milliseconds, allowing higher throughput and shorter cycle times for time-critical in-line applications. The high-resolution 3D point cloud images are constructed from over 1.5 million 3D data points. They are combined with powerful 3D vision tools including PatMax 3D™ to enable reliable and accurate solutions to applications such as assembly verification, in-line measurement, and robotic guidance.

FRAMOS www.framos.co.uk

Security applications with Sony's high sensitivity IMX335 sensor

The new Sony STARVIS IMX335 image sensor available from FRAMOS, is ideally suited to security applications. The 1/2.8" imager offers a resolution of 5 megapixels at a pixel size of 2µm. This sensor has a backside illuminated pixel architecture which allows for high sensitivity in the visible light and near infrared spectrums making it ideal for

continued on page 25

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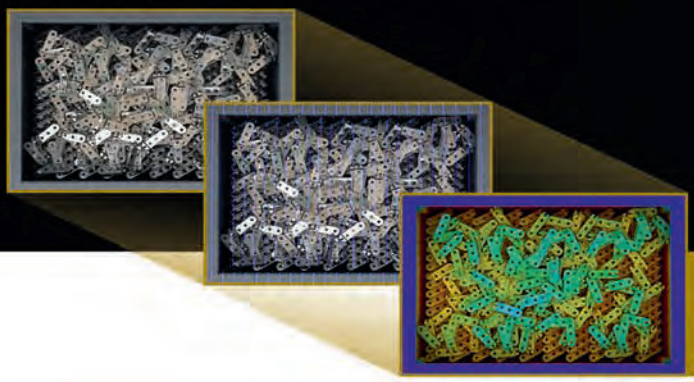


Top Performance in Three Dimensions

Digitalization of Shape Changes

Already during the prototype design phase, changes can be immediately digitalized and imported as a data record into 3D design engineering programs such as CAD.

The 3D sensors included in the ShapeDrive series offer a high dynamic range with reference to the object's color and brightness. The sensors deliver reliable results even for metallic and glossy surfaces. ShapeDrive sensors detect even the smallest component features thanks to their extremely high resolution, as well as large measuring volumes – for example, the entire content of Euro boxes and Euro pallets can be quickly scanned.

Bin Picking

Large bins such as a Euro pallets are recorded along with their content as a 3D point cloud. Even extremely small objects in large containers can be reliably detected in this way.

Quality Assurance for PCBs

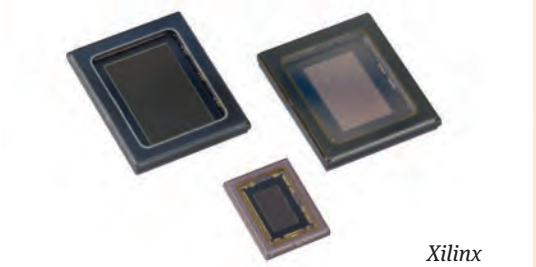
ShapeDrive 3D sensors are highly effective for inspecting the quality of PCBs because they capture the entire object with just a single image recording.

wenglor sensoric ltd.

Unit 2, Beechwood | Cherry Hall Road, Kettering Business Park |
Kettering, Northants NN14 1UE | Tel. +44 (0)1536 313580 | info.uk@wenglor.com

security and surveillance applications. It also offers frame rates of up to 60 frames per second through a MIPI interface giving the excellent image quality and speed needed for embedded vision integration.

Different readout modes support advanced surveillance options and further improved picture quality. Features such as a dynamic range up to 72dB, advanced HDR functions and digital overlap HDR further improve the image quality and contrast behavior, allowing for more detailed image analysis. Industry and product experts at FRAMOS are available to support customers with the integration of these new sensors into their applications and projects.



Xilinx

IDS IMAGING DEVELOPMENT SYSTEMS GMBH

www.ids-imaging.com

AI-ready industrial cameras

Artificial intelligence opens up new application fields in machine vision. The new IDS NXT rio and rome cameras provide a flexible embedded solution for industrial applications. An AI vision app transforms these robust, powerful standard industrial cameras into high-performance inference cameras. Hardware and software are designed to allow AI-based vision tasks to be performed directly on the camera. Inference times of only a few milliseconds are possible, making the cameras comparable to modern desktop CPUs in terms of accuracy and speed.

By installing vision apps, users can configure the camera for different image processing tasks. This principle also enables the use of neural networks for, say, object recognition or classification. The IDS AI vision app reconfigures the embedded hardware so that, for example, the FPGA serves as an AI accelerator. At the same time, it ensures that users can load pre-trained artificial neural networks of different architectures onto the cameras and execute them. In the future, it will also be possible to install several neural networks in parallel, which could cover successive work steps.

nxtrome app-based camera

MATRIX VISION

www.matrix-vision.de

New cameras and software on show at MVC

Matrix Vision will be showing additional camera models with Sony Pregius sensors up to 31 Mpixel for Gigabit Ethernet, Dual Gigabit Ethernet and USB 3.0 at the UKIVA Machine Vision Conference and Exhibition. The intuitive 2-in-1 mvBlueGEMINI smart camera will also be on show. This camera allows end users and system integrators to implement applications more efficiently. Applications can be solved without programming because it covers all basic functions. Industrial image processing becomes quicker and more productive.

The standalone PC version of the mvIMPACT Configuration Studio (mvIMPACT-CS), which is the software core of the mvBlueGEMINI, will also be on show. This makes intelligent inspection set-up possible. Neither programming expertise nor image processing knowledge is required. A scene taken by a camera is automatically evaluated. The appropriate algorithms and, if necessary, filters are independently selected by the software and automatically parameterised correctly. The tools supplied use simple language for users who typically have no prior knowledge of image processing. These allow visual, quick and cost-effective implementation of inspection tasks in just a few minutes.

mvIMPACT CS Cameras

MATROX IMAGING

www.matrox.com

Major software update includes deep learning and 3D sensor interfacing

Matrox Design Assistant X, the flowchart-based vision application software now features CNN (convolutional neural network)-based image classification, a photometric stereo tool, support for 3D sensors, and multiple run-times. The classification tool leverages deep learning, specifically CNN technology, to categorise images of highly textured, naturally varying, and acceptably deformed goods. All inference is performed on a mainstream CPU, eliminating dependence on third-party neural network libraries and the need for specialised GPU hardware.

continued on page 26

Design Assistant

MEMBERS NEWS

A new registration tool features photometric stereo technology. This creates a composite image from a series of images taken with light from different directions to highlight surface irregularities such as embossed or engraved features, scratches, or indentations. It is also now possible to capture and process depth-map data by interfacing with third-party 3D sensors such as LMI Gocator® line profilers and snapshot sensors, and Photoneo® PhoXi® scanners, with more to follow.

Other updates and additions include multiple run-times for running multiple independent projects simultaneously on the same platform; dedicated shape-finding tools for locating circles, ellipses, rectangles, and line segments; and the addition of a code-grading step.

NIT WiDy SWIR camera

MULTIPIX www.multipix.com

See beyond the visible with Short-Wave Infrared (SWIR) imaging

The new NIT Wide Dynamic SWIR camera is now available from Multipix. It is designed to face highly challenging environments, robustly dealing with applications where there is a level of vibration, as well as a wide range of temperatures. The WiDy SWIR camera series covers a wide wavelength range. All cameras are supplied with application software enabling live image acquisition, Raw and AVI video recordings and ease-of-use camera synchronisation. They can be readily combined with MVTec's HALCON imaging software to create a powerful automation solution.

SWIR radiation (900nm to 1700nm) goes beyond the visible spectrum and provides the ability to image objects/scenes otherwise invisible to standard cameras and the human eye. It differs from thermal imaging which relies on radiated photon detection. Industries benefiting from this technology include Security & Surveillance, Food and Agriculture, Night Vision, Object/Material sorting, Textiles and much more.

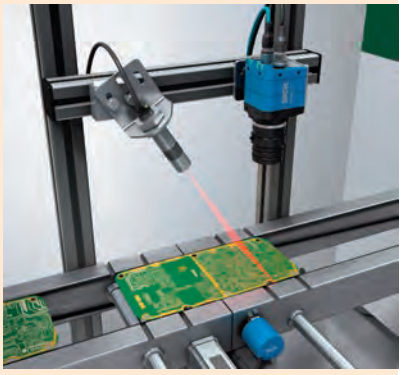
M12 Lenses

SCORPION VISION www.scorpionvision.co.uk

New M12 Lenses Keep Up With The Latest Sensors

Scorpion Vision has introduced a new range of M12 lenses that can support the latest cameras that use Sony Exmor and Pregius CMOS sensors. Although the latest generation of Sony CMOS image sensors offer superb image quality, the larger sensor size may make it difficult to find a suitable lens. The newer, larger IMX sensors start at 1/1.8" format and can be as large as 1.1". This can be a problem in applications requiring the use of M12 lenses, such as the rapidly growing autonomous platform (drones, AUVs and robots), where small format cameras often play a critical role.

Due to their very small size, S-Mount or (M12) miniature lenses generally have a narrow aperture compared to that of the much larger C-mount lenses. The new range of 1/1.8" and 2/3" M12 lenses are designed specifically for use with Exmor and Pregius sensors. With near-field and far-field objectives, there are lenses available for macro/microscopy type applications as well as telephoto M12 lenses and high resolution sensors.



Ranger3

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SICK's Ranger3 high-definition streaming camera is the first to be powered by SICK's innovative Imager with ROCC (Rapid On-Chip Calculation technology). Faster than any comparable device on the market, its next-generation technology is capable of capturing 7000 profiles/s at full sensor acquisition. The Ranger3 extracts the true 3D shape of an object, regardless of its contrast or colour.

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continued on page 29

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The camera delivers a continuous stream of GigE and GenICam-compliant data with a wide variety of 2D and 3D data generation options, as well as measuring reflectance and scattered light. Compact and rugged, the Ranger3 is easily built into standalone inspection units or integrated into automatic quality control systems with other sensing devices, such as encoders, photoelectric switches, light curtains and scanners.

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

'Human assistance' camera improves manual assembly

The Ricoh SC-10 camera inspection system is designed to both provide assembly instructions to operators and verify that each step has been completed correctly. A set of work instructions are loaded into the camera and displayed on a monitor while the camera scans the work piece. The human operator follows the on-screen assembly instructions and after every action the system compares the result to the correct stored image before the next step can be taken. This reduces errors, helps operators learn new tasks and provides a digital audit trail of all operations.

The camera features in-built software, which automatically checks the assembly status and identifies incorrect or missing items by using either pattern matching, colour verification or identifying the presence of textures. No PC is required. Each completed step is recorded in a CSV file including the time spent. An image of the inspection can optionally be saved. This means that it can be used for assembly work analysis and traceability. The addition of a high magnification lens allows smaller parts to be inspected, for example on PCBs, and the inspection of a wider field of view.

Ricoh SC-10

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EVENTS

IDS UK Roadshow
14 May 2019,
National Space Exhibition Centre, Leicester, UK
16 May 2019,
HMS Belfast, London, UK
https://en.ids-imaging.com/ids-industrial-vision-days-2019.html

FRAMOS Tech Days
22-23 May, 2019
Europe, Munich, Germany
https://imaging.framos.com/en/techdays-2019/

UKIVA Machine Vision Conference & Exhibition
6 June, 2019,
Marshall Arena, Milton Keynes, UK
www.machinevisionconference.co.uk

PPMA TOTAL Show
1-3 October, 2019,
NEC, Birmingham, UK
www.ppmatotalshow.co.uk

STEMMER IMAGING -
Machine Vision Technology Forum
13-14 November, 2019,
Birmingham, UK
www.stemmer-imaging.com/en-gb/technology-forum/

TRAINING

Training courses offered by UKIVA members:

STEMMER IMAGING
(in association with the European Imaging Academy)
'Machine Vision Solutions' – April 10-11, 2019; May 01-02, 2019
'Hyperspectral Imaging' – April 23, 2019; September 05, 2019
'Optics & Illumination' – June 13, 2019
'Common Vision Blox' – June 20, 2019
'Line Scan Technologies' – July 25, 2019
'LMI 3D Sensor' – August 08, 2019
All courses at Tongham, UK
www.stemmer-imaging.co.uk/en/events/training-events/

TECHNICAL TIPS

Some useful technical tips from UKIVA members

AI by Vision App
(IDS Imaging Development Systems)
https://en.ids-imaging.com/technical-article/en_nxt_ki.html

Helping Food Manufacturers Derive Best Value From Vision Systems
(Mettler Toledo)
www.mt.com/us/en/home/library/know-how/product-inspection/vision-inspection-reduces-errors.html

Which camera sensor is the right one for my application?
(Multipix Imaging)
https://multipix.com/knowledgebase/comparison-of-cmos-sensors/

Colour line scan cameras
(Stemmer Imaging)
www.stemmer-imaging.com/en-gb/knowledge-base/cameras-colour-line-scan-cameras/

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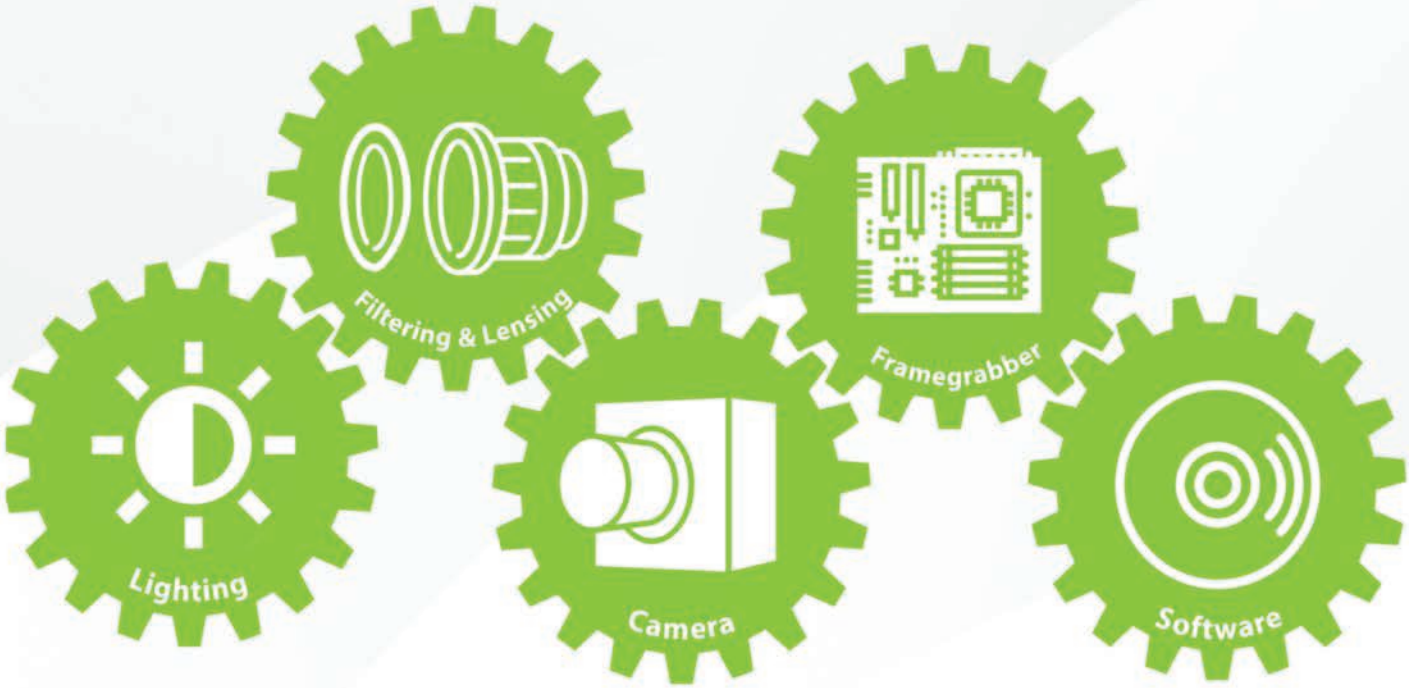

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