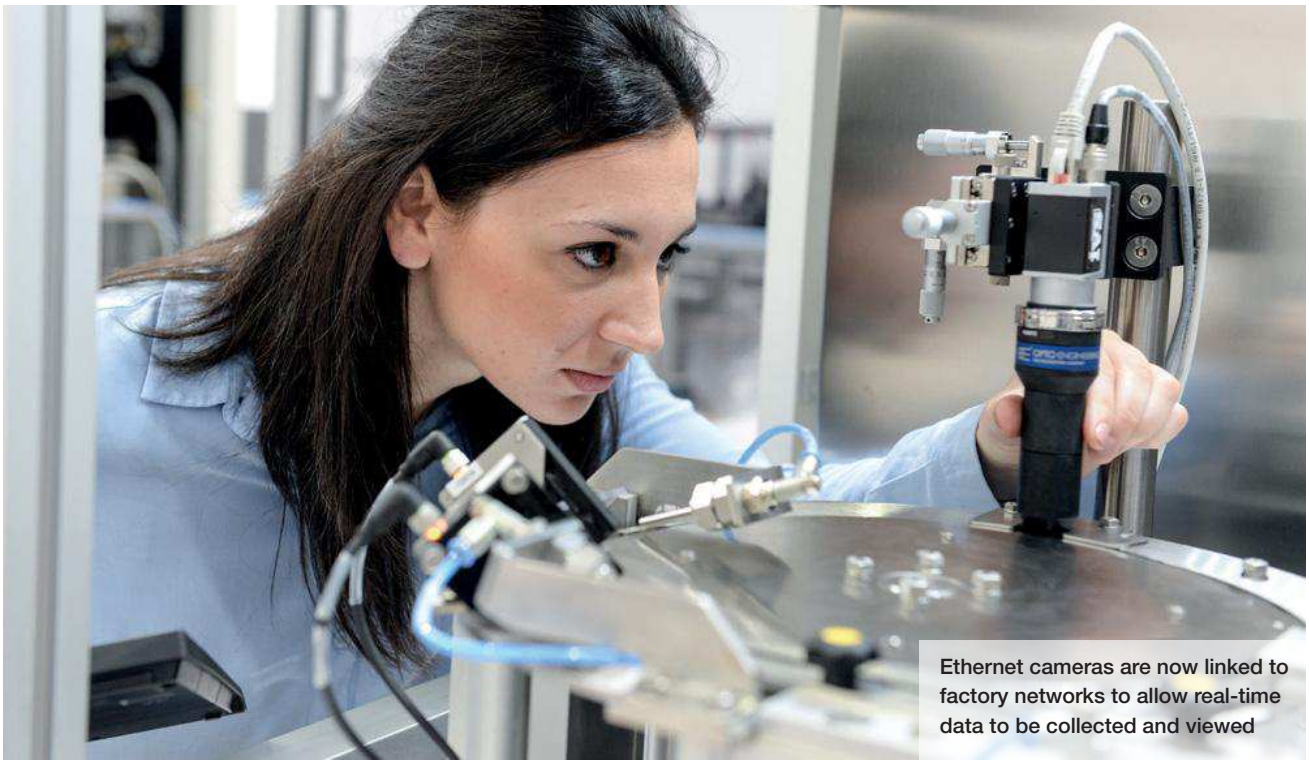
Case study

INDUSTRIAL VISION SYSTEMS LTD



Ethernet cameras are now linked to factory networks to allow real-time data to be collected and viewed

VISION SENSORS AND INDUSTRIAL NETWORKS COMBINE TO CREATE THE FACTORY OF TOMORROW

BY **EARL YARDLEY**, DIRECTOR AT INDUSTRIAL VISION SYSTEMS

On September 2015, the European Parliament issued a briefing paper in which it summerised that the "ubiquitous use of sensors, the expansion of wireless communication and networks, the deployment of increasingly intelligent robots and machines have the potential to transform the way goods are manufactured in Europe". Since then, industry hasn't looked back. Now, Industry 4.0 is seen to hold the key to increased flexibility in manufacturing, mass customisation, increased speed, better quality and improved productivity. It is expected to shape both the UK and global economy for generations to come.

Technology improvements continue to unlock new markets and applications, increasing productivity, safety, reliability and flexibility. Factories, where machines in the production process communicate with each other – both internally and externally, are being created.

The revolution will also result in a change in the required skill-set for shopfloor workers and maintenance staff, and will increase the amount of important predictive maintenance carried out and its accuracy; this will inevitably lead to lower employment costs.

Across the world, manufacturers are now embracing the vast array of benefits that vision systems can deliver to the factory floor. In turn, they are combining these with major factor information system networks to create 'big data' throughout the factory environment, paving the way for further revolution and evolution in Industry 4.0.

Sensor Placement

For industrial applications, the precise placement of a sensor or control points in Industry 4.0 is crucial. Wireless technology promises no-wires communication, but if a wireless node needs to be powered by being plugged in, or recharged every so often, the cost and impracticality of deployment become prohibitive.

For example, adding sensors to rotating equipment to monitor conditions is not possible with wires, but the knowledge gained from in-service monitoring can allow customers to predicatively maintain this critical equipment, thereby avoiding unwanted and expensive downtime.

Vision systems help create the foundations for these new flexible factories. Typical projects include the integration of cameras into new production lines, combining vision systems with ancillary equipment such as conveyors for product rejection, pick and place, robotics or the provision of standalone inspections, separate to the process, as well as full track-and-trace of products through flexible cells. This requires expertise in fields as diverse as mechanical design and handling, and transport systems, software, electronics, robotics, control systems and factory networks.

The combination of vision systems and networks gives added peace of mind to manufacturers since it provides full traceability across the factory for serial number tracking. This of course aids quality control, meaning packaging faults can easily be pinpointed, labels checked, dates inspected and so on, all at high speed at any location in the factory.

Vision systems are placed onto the network, situated at various critical points throughout the factory. This then allows for immediate feedback to the engineering managers and factory controllers, who are working side by side with factory information systems and flexible MRP systems.

Product Tracking

Combining the ability to trace products throughout their life-cycle on the factory floor with unique device identifiers (UDIs) means the necessary quality control procedures are in place to trace individual products.

Historically, individual products wouldn't be tracked via an individual serial number. That has now changed, even in the most diverse industry sectors. For example, from strawberry punnets in the food industry through to pipe fittings in the plumbing industry, single products are carefully monitored and inspected. Manufacturers can gather enhanced data whilst getting real-time control via networked cameras and serial-number-tracking systems thus improving productivity, the bottom line and business performance.

Industry 4.0 requires more flexible manufacturing lines and systems such as these achieve that. Automation is often behind the scenes and "just works", without being obvious. Wireless and Internet technologies will link machines, products, systems and people within the manufacturing plant, but also at suppliers and distributors. As a result, we will see greater flexibility and smaller batch runs, rapid design and prototyping with increased customer involvement, real-time error detection and correction, predictive maintenance and 'lights out' factories, where automated robots continue production without light or heat – indeed this might see a reversal of the practice of exporting jobs to low labour-cost countries, too.

New Directives

The US Food and Drug Administration (FDA) released a final ruling requiring that most medical devices distributed in the US must carry an UDI. With the directive now started, it has become increasingly important for device manufacturers of all industries to put the necessary quality control procedures in place, to confirm that the UDI is both legible and traceable to its roots in manufacturing. As the FDA sees it, "a unique device identifier system has the potential to improve the quality of information in medical-device adverse event reports, which will help the FDA identify product problems more quickly, better target recalls and improve patient safety".

This directive has implications for any electrical manufacturer but, at a fundamental level, during the production of the device or product, the UDI needs to be applied and quality checked to confirm it meets the necessary specification.

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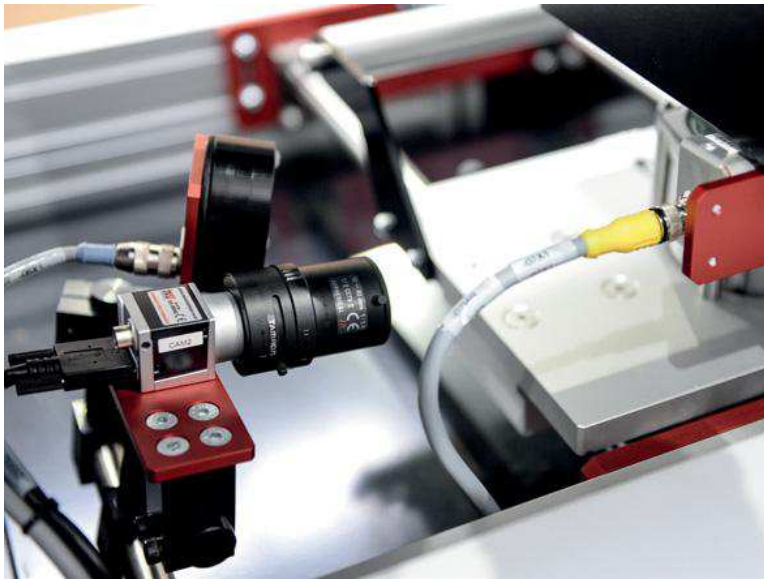
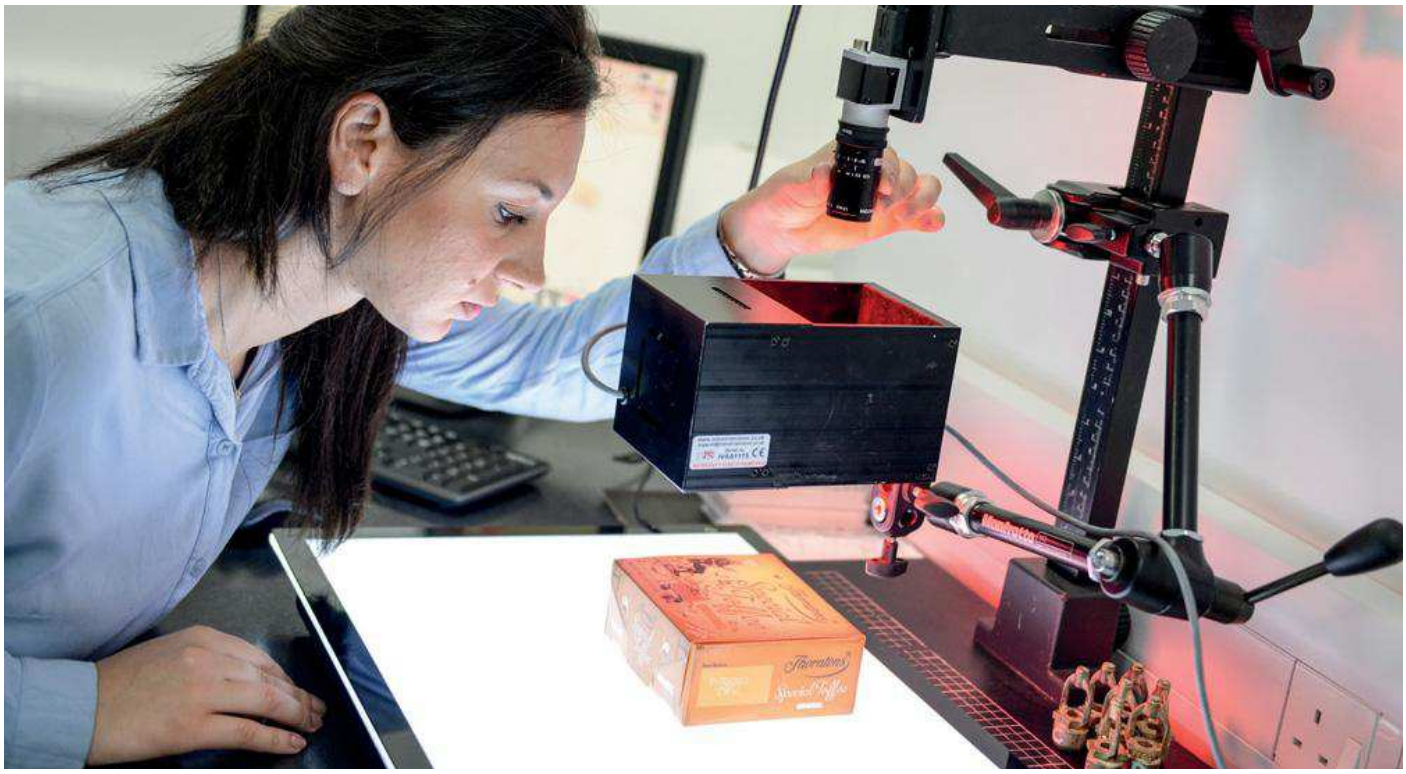
Industrial Vision Systems (IVS) has been working with many companies to tackle problems in manufacturing through using ever-more sophisticated, automated, machine vision systems and processes. So, when a UK medical manufacturer recently decided to automate the inspection of its part labels, it turned to engineers at IVS to build an automated label inspection system specifically for the purpose, including full validation to GAMP5 (Good Automated Manufacturing Practice) pharmaceutical regulations.

IVS camera sensor scans components for data-matrix code tracking for communication with the factory information system, enabling flexible manufacturing lines to switch production cycles





The system designed at IVS consisted of two digital vision systems viewing two areas of the label, housed in a custom, stainless-steel enclosure, mounted in front of the label-printing equipment. The vision system communicated with the line PLC, printer and factory information system to receive and confirm the relevant part codes, matching them where needed and printed in a legible format. The labels were indexed every second for inspection prior to being applied to boxes, housing various medical devices.

The FDA demands that automatic identification and data capture (AIDC) technology is used for the inspection process, imperative for the quality of products leaving the factory. By combining Optical Character Recognition/Optical Character Verification with print-quality inspection and ID/code reading, the labels were checked in real time through the whole production cycle to confirm compliance to the FDA specifications. Typically, a UDI can be applied to labels, boxes, products, components and devices, therefore a generic approach to the quality inspection had to be constructed.

The UDI directive also states that all devices that will be implanted or sterilised must have permanent marks so any vision inspection system must cope with confirming marks on varying material types. Typically, a code would be applied to include both a human-readable and a machine-readable mark, be it a 1D or 2D/data-matrix code. Both need to be inspected to confirm they meet the quality standards. For symbols, this is according to the ISO standards 15415 and 15416.

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Digital cameras are used throughout the production process, connected to a central IVS vision system, which then communicates to the Factory Information System database to provide historical information and conformance.

Full track-and-trace is now seen as the ideal solution. Most medical device companies run varied quality systems, data management and IT applications for their UDI requirements. The flexible user interface allows data and image storage and historical statistical process control (SPC) data to be easily managed, independent of the background IT infrastructure. These latest-generation vision systems provide full-audit logging and traceability to allow systems to be validated to GAMP standards.

The UDI quality can be tracked through the process to make sure that it has not degraded through the production cycle, and that multiple elements (e.g. inserts and instructions) have gone together correctly.

The UDI program will provide consumers with a better-quality product, increased traceability against forgery and assurance that the product has been through the necessary production cycle and checks. In addition, the program offers improvements across other industry sectors, most importantly to the food and beverage industry, where date and price strings and livery quality are increasingly inspected in real time due to government guidelines and the supermarkets introducing ever-stricter requirements.