

Smart sensors

Making the right choice

Machine vision products are becoming increasingly popular in the food, pharmaceutical and packaging industries, wherein the inspection of goods play an important role. Of these, smart sensors are experiencing fast-paced growth, as they address specific classes of applications. However, for the inspection process to be infallible, one has to make the right choice.



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The food, pharmaceutical and packaging industries have several inspection needs that can be addressed using machine vision (MV). A new category of MV products called smart sensors is coming into the market to address specific classes of applications. These products share the characteristics of both single function photoelectric sensors (ease-of-use) as well as the more general-purpose smart cameras (image sensors combined with powerful processing capability). Smart sensors are powerful, reliable, compact, cost-effective and most importantly, easy to set-up & use. However, choosing the right smart sensor and MV approach for an application is critical for its success.

The need for inspection

The food, pharmaceutical and packaging industries are governed by regulatory bodies to follow certain norms. These rules are enforced to ensure manufacturing traceability and communication of correct instructions to the customer on the use of the product. To meet these norms, 100 per cent inspection becomes necessary during manufacturing and packaging. Inspection needs include defect identification for ensuring the quality of products, label print verification, serial number logging for traceability, barcode and pharma code reading & validation for part tracking, etc. Many of these requirements cannot be addressed using normal photoelectric or optical sensors. Manual inspection could be expensive in addition to reduced throughput and highly subjective nature of inspection. To meet inspection requirements and match the high throughputs that these industries demand, an MV-based inspection system is the most reliable and cost-effective solution.

Shift towards smart sensors

During the last decade, the MV industry had already begun the transition from utilising PC-based vision systems to general-purpose smart cameras, thereby reducing the size & cost and improving ease-of-use. While the smart cameras brought about tremendous simplification in the set-up of a vision system by integrating all the hardware & software components required into a single package, it still required a reasonable level of machine vision algorithm development knowledge to address applications.

Hence, the next step taken by the MV industry was to identify classes of applications where the set-up could be simplified even further. This was fulfilled by the new category of MV systems called smart sensors, which are compact standalone

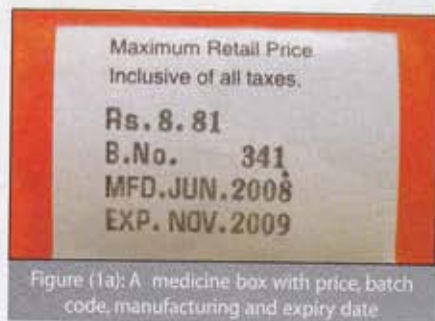


Figure 1(a): A medicine box with price, batch code, manufacturing and expiry date



Figure 1(b): Print blot mark on expiry year

devices designed to address a specific requirement and easy-to-configure because they require no image processing knowledge for set-up. These smart sensors offer numerous MV approaches that are prevalently used to address visual inspection requirements. Each approach is suited to a specific set of applications and designed to perform well for them. However, the sensors may show poor results when used for other applications even though they might appear related. Thus, manufacturers must be careful to choose the right sensor for their application in order to ensure consistent results.

Types and applications of smart sensors

Smart sensors typically provide a hand-held controller and user interface to configure the system and observe the runtime status without using a PC. For this purpose, the controllers are rugged, compact and sometimes provide integrated displays that show the image of the part being inspected and have only the necessary amount of buttons to train the system to inspect a new part. Some smart sensors might also include various interface points like digital input and output lines.



Figure 2(a): Usage warning symbols on electronic product



Figure 2(b): Partial printing of warning symbol

Following include some smart vision sensors and their application areas:

OCR sensors: Optical character recognition (OCR) sensors are used for serial number reading & logging for product tracking; sorting based on part number/model number; and label data inspection.

Feature inspection sensors: Equipped with a pattern match tool, these sensors find applications in areas including defect identification, product classification, presence/absence check and product mix-up identification.

Barcode sensors: These types of sensors are primarily used for barcode reading & verification, product tracking, classification and barcode & human readable character cross checking.

Colour sensors: Colour sensors have the ability to identify parts/features using a colour locator tool. These can also carry out the colour shade inspection of a part/feature.

Case in point

One of the regulatory directives emphasises on the accurate printing of relevant information about the product on all packaged consumer goods. This may include manufacturing/packaging date, expiry date and price as well as product tracking information like batch code, barcode, etc. Equally important as the data is the quality of print, which implies the legibility of the printed characters. Apart from non-compliance of the defined standards, poor print quality & defects might even lead to an expensive law suit and draw negative publicity.

The quality of the printed characters has to be verified, for which the user might unknowingly tend to use an OCR smart sensor. Based on a pre-trained and classified

character set, OCR is a tool that tries to read the characters in the image. The reading is carried out by comparing the extracted character with the pre-trained character set and classifying it as that character with which it has the closest match. The characteristics of the tools are such that it makes the best effort to read the characters in spite of variations and defects in them. This will cause it to overlook minor print defects that may be of importance for proper legibility.

The right tool for this print verification requirement is optical character verification (OCV), which has the potential to identify even minor defects in printed characters including alphabets, numbers, special characters and even symbols that might be a part of the statutory warning or usage instruction labels. The list of defects that the system can identify include missing characters/symbols, wrong characters/symbols, faded characters/symbols, blotted prints, extraneous marks, skewed prints and scaled up/scaled down prints, among others.

Conclusion

It is important to verify the suitability of a particular MV product for a requirement before actually installing the system because a wrong choice could be an expensive deal. Contrary to the common notion that MV products/consultation would be an expensive affair, there are several pioneering companies that provide free application engineering support directly and through their channel of system integrators to help customers find the right product for their requirement. Moreover, with smart vision sensors providing a range of image processing tools and MV companies building smarter sensors with features that optimise it for specific industry and inspection needs, it is not so hard after all, to make the smart choice! 



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