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Sensor Intelligence.

Easily Solve Three Common Quality Control Problems in Packaging with Vision Sensors

In the high-speed packaging industry the most common quality issues can easily be resolved with automated quality checks using vision-sensor technology. Three of the most common are:

- Missing caps, lids or open containers;
- Misapplied labels;
- Incorrect labels.

Vision sensors are specialized quality-control tools that combine a machine-vision camera with on-board intelligence optimized for optical-inspection tasks. For example, a vision sensor optimized for package inspection includes hardware with performance characteristics designed to meet high-speed packaging inspection needs, and the software tools needed to perform the image-processing algorithms most often needed for package-inspection. They would not, however, include overly high-performance hardware that drives up costs or complex software options. This contrasts with smart cameras, which also combine machine-vision hardware with on-board image-processing software tools. Smart cameras include a larger set of software tools to give vision engineers greater application-programming flexibility. However, this greater flexibility comes at the cost of greater programming effort. Using them requires the packaging engineer to also be a machine-vision expert.

Incorrect Caps, Missing Lids, and Open Containers

Containers with liquids must be capped or sealed or leaks could occur. Leakage can cause production problems, contaminated content and dissatisfied customers. The critical moment is when the lid or cap is attached to the container after it is filled. A cost-efficient way to eliminate the problem is to automatically verify the lid's integrity on the production line and to reject any faulty products. Vision sensors provide a simple and cost-effective solution.

To check for unsealed or damaged containers, a vision sensor can be taught to look at the container's overall size and shape. If the container is undamaged and properly sealed, the size and shape will be within tolerances of the known-good container. If not, the result will trigger an output to reject the container. Setting up a vision sensor is not so much a programming exercise, as a teaching exercise. The engineer presents the vision sensor with examples of how the package *should* look. If the package being inspected meets specs, then it passes. If not, an output is triggered and the package is flagged as defective.

The engineer can also teach the sensor to look for specific defects by presenting it with examples of those defects. To determine if bottle cap's safety seal is intact, the engineer can teach the sensor to look for a dark horizontal line at the safety seal's location. Simply present a bottle to the vision sensor with the line visible then associate the image showing the dark line with a defect. The sensor would then flag any bottles coming down the line that had that characteristic.

To check for a missing cap or lid after the filling process, simple tools like a pixel counter can be used. Say that a bottle cap is red and it's placed on a white plastic bottle. Using a pixel counter tool, the engineer can select a region of interest somewhat larger than the cap. The sensor counts the number of grayscale pixels in that region. If the cap is present, the number will be correct. If it's not, the wrong number will appear, signaling a defect.

Detect Missing or Misapplied Labels

A product's brand identity is often on the label. A cost-efficient way to ensure that expectations will be met is to automatically check for missing or misapplied labels. To check for a missing label, the vision sensor counts the number of pixels of the correct grayscale level in the area of interest. If the label is missing, or out of position the pixel count will be off. When looking at the position of a label, use tools that rely on relative positioning, such as edge-finding, blob, and pattern tools. An edge-finding tool reports the position via serial or Ethernet and also triggers a pass or fail digital signal to the PLC. A pattern-matching tool searches for a taught-in pattern. If the label is correct, it passes. If it is the incorrect label or missing, the tool does not find anything like the pattern and sends a failing signal. Many times these tools can be used in combination to help determine the actual pass/fail state of the output. A blob tool could be used to check for presence and a pattern tool could verify if it is indeed the correct label. This combination gives information that using just one tool does not.

Detect Wrong Labels

Similarly, to check if the label is incorrect, a vision sensor does not need optical character recognition to tell the difference between a box of breakfast pastries marked "APPLE" and one marked "BLUEBERRY." Much simpler, faster, and more easily programmed tests will do. The use of advanced pattern matching tools allows users to check the label to make sure it matches the type of pastry being produced. This type of check can be very important when dealing with products that could contain allergens. A product with the wrong label could be a health risk to a customer. Other label-marking errors are similarly easy to detect; missing bar codes, or date codes can be found by counting pixels in known regions of the label that are set relative to the edge tool or pattern tools, making small changes in product position less of an issue

Conclusion

More cost effective than traditional smart cameras, vision sensors are becoming more common even on OEM packaging machines, where cost is key. They are easier for packaging companies to deploy and use than more traditional machine-vision platforms. The software is designed to be intuitive even for users who are not vision experts. To keep cost down, vision sensors are often specialized for applications like inspection, positioning, or code reading.

In the end, vision sensors are now the best choice for most common packaging-quality applications, leading to lower costs, higher speeds, and faster setup compared to other technologies. Their simple, intuitive interfaces make customers more comfortable with vision-based solutions.

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