Case study

Vision System Inspects Automotive Door Handles

Machine vision provides the guarantee that automotive components are at the right quality build and reduces customer returns to zero

Automobile door handles are becoming increasingly more sophisticated as a greater need for operator assistance and intelligence is built into each unit, coupled with the increased demands for quality from automotive manufacturers driven by the need to provide consumers with higher specifications and performance.

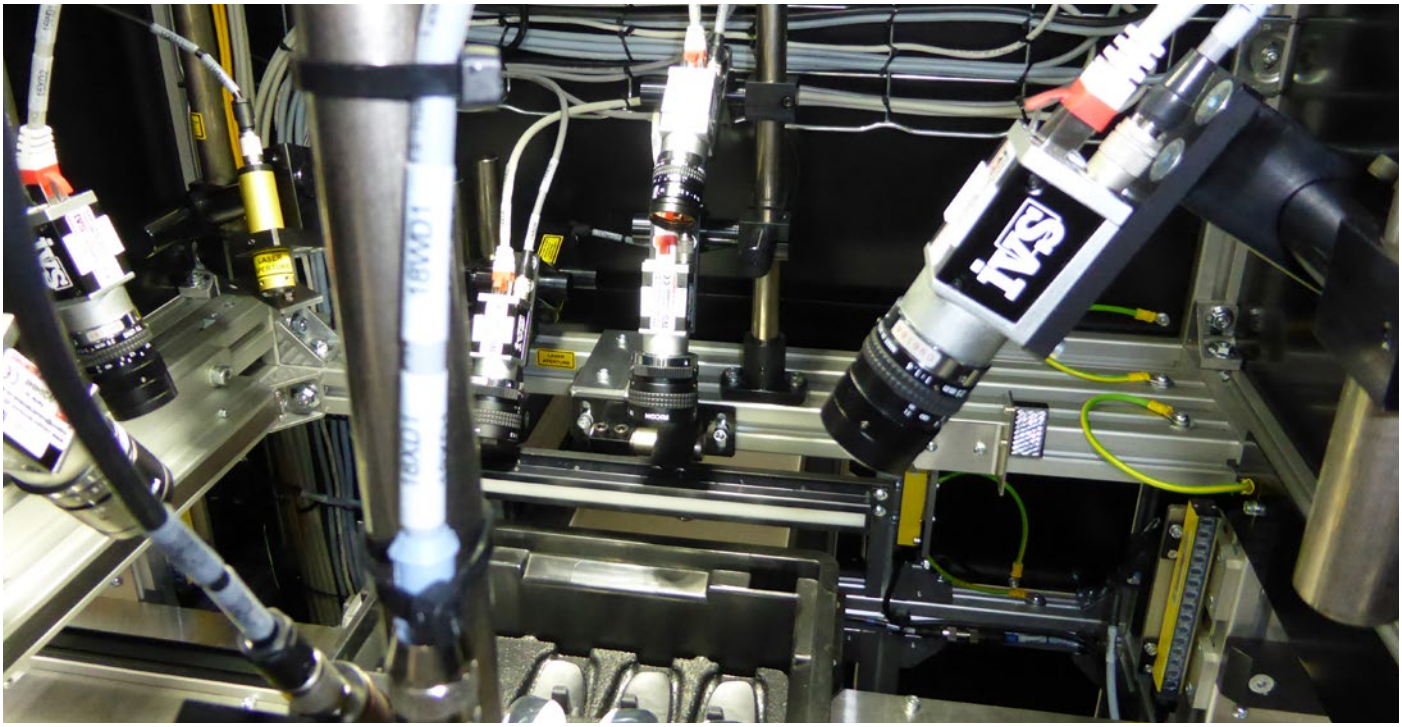
The build of an automotive handle comprises of many differing production processes including pressure die casting, injection moulding, painting and assembly of the final unit. All of these processes require careful planning to achieve the quality levels expected of a Tier 1 automotive supplier. The final inspection of the assembled unit and kit of handles which make up a complete car is critical prior to the product leaving the factory.

Because of this, one large UK-based OEM manufacturer of automotive door handles approached Industrial Vision Systems Ltd (IVS) to automate the process for inspection of these parts. IVS designs and manufactures machine vision systems for many industries including the electronics, pharmaceutical, medical devices, food and printing, as well as the automotive industry.

The manufacturer produces an average of 100,000 keys or ID-devices, 60,000 door handles and 24,000 steering column locks each day and the quality of the products manufactured is critical to their success.

Inspection Machine

The manufacturer required a machine to perform a number of inspection tasks as part of the final automatic quality control of the product. An automotive handle is made up of a number of constituent parts including the main body of the handle, closure and cap – all these parts are critical to the effective operation of the handle in the application. Add to this the number of colour variants of each handle available along with the variations in 2 door/4 door left hand/right hand which go up to make a complete car handle pack; and it can be seen that the final inspection is critical to guarantee the correct components reach the customer.



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The vision system was required to check for a number of key criteria:

1. The correct combination of parts is present in terms of left hand/right hand handles, and 2 door and 4 door sets as required.
2. Confirmation of chrome or standard paint finish on the parts.
3. Check of the individual components of the handle to confirm they are seated correctly in the handle and have not deviated out of position, including the closure and cap.
4. Check of the correct type against the manifest sheet.
5. Check the handles are correctly seated in the inserts before final delivery.

The automotive handles are sent to the customer in specific rigid boxes with an ESD polystyrene in-fill designed to take a combination of handle types. These boxes are returned to the supplier once the handles have been used on the car and the box re-used again.

System Design

The machine design was based on a manually loaded station with an automatic conveyor feed to present the boxes to the vision system cameras, a conveyor area for re-work, and an out feed for good products. For the inspection process the box was required to stop in the centre of the machine where the barcode manifest situated on the side of the box was read via the vision system. This gave the settings of the current type to the machine PLC, which in turn switched the correct check routine within the vision system for inspection of the particular type.

Vision System Inspection Process

In the design of its vision system, IVS chose a standard conveyor system which was built into a custom designed framework. The design of the machine had to take in account the loading and unloading by operators along with all the required tooling and fixtures for holding the vision system components and associated LED line lighting. The vision inspection area was purposely designed to stop the ingress of ambient light; therefore lighting levels could be controlled by automatic switching of the machine vision lighting arrays as required. Six cameras were mounted into the canopy over the conveyor - five medium resolution digital cameras and one high resolution digital camera. The medium resolution cameras were used for the general inspection processes including the overall correct presence of the handle and deviations of sub components within the handles – whilst the high resolution camera was used for label inspection and reading of the bar code relating to the manifest sheets.

Four high intensity white LED line lights and lasers were mounted obliquely to the box requiring inspection. Following the inspection process the machine automatically marks a good part with an ink marking system on the label. This is then verified to check it has been marked correctly by the vision system before final release to travel down the pass conveyor area. The manifest is also logged to the factory information system so it has been recorded as passing final inspection.

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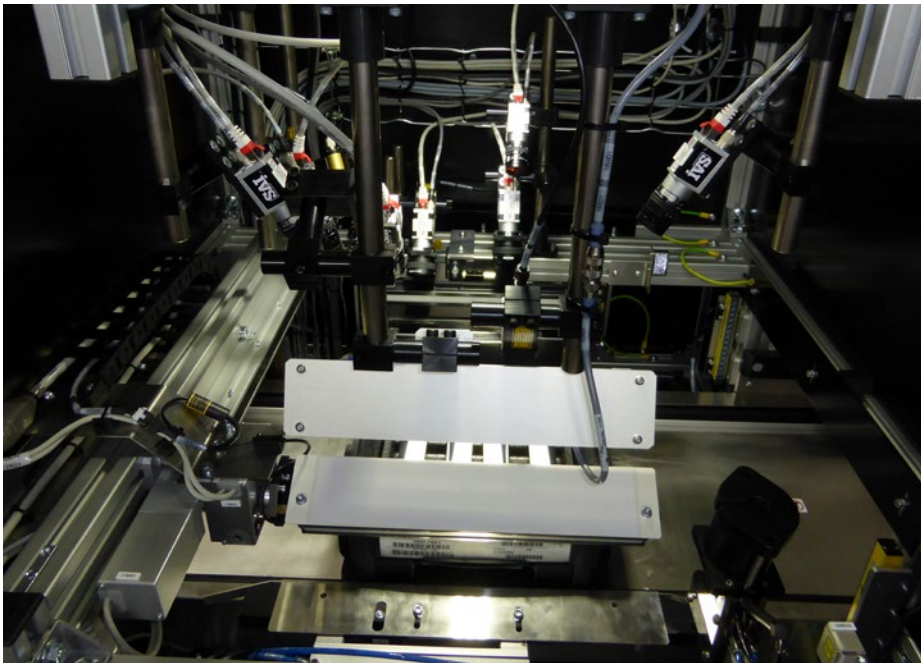
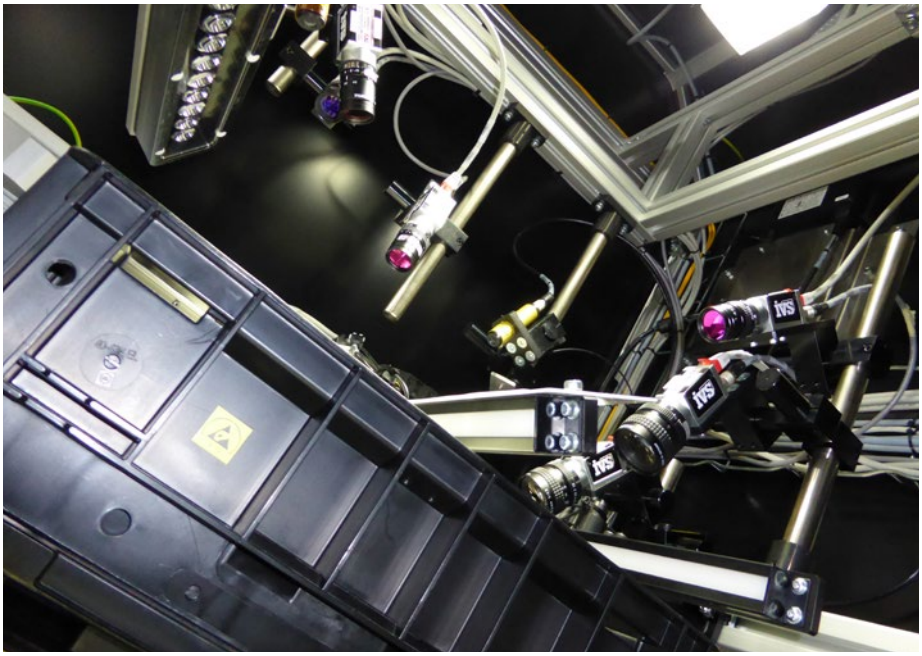
The whole vision system is controlled by the standard IVS machine vision software which communicates with the cameras, completes the entire industrial image processing to confirm the acceptance or rejection of the part – and finally communication with the internal machine PLC and the factory information system. Two industrial PC units are integrated into the machine, with one being the master which is used in day to day operation of the machine – the second industrial PC is present purely as an available backup in case of failure of the master PC.
A PLC is used to communicate with the vision system, conveyor control, sensors, and the ink marking system used to confirm a good box. A PLC HMI interface is also integrated into the front panel of the machine to offer overall control to the engineers for the ongoing maintenance of the machine.





Human Machine Interface

To supply the system's operator with information regarding each box inspected, IVS developed a graphical user interface to display images and the results of each inspection. As each box is inspected, the operator is presented with an image of the box and the highlighted search regions. The results of each pass or fail on each box is displayed as well as a running total of the number of handles inspected and passed by the software. Information is stored in a standard database format, it can be networked to existing database systems to provide management about the integrity of each system in the production process. This information is transferred from the system's PC using a standard Ethernet interface.

Conclusion

The machine offers a robust method for automatic final inspection of every automobile handle leaving the factory thus guaranteeing the quality for the manufacturer. Every box is logged against the factory information system so an historical database of information relating to quality and on-going statistical process control has been gained. Ultimately the Tier 1 manufacturer can offer a cast iron guarantee of the quality of products leaving the factory to their customer.

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