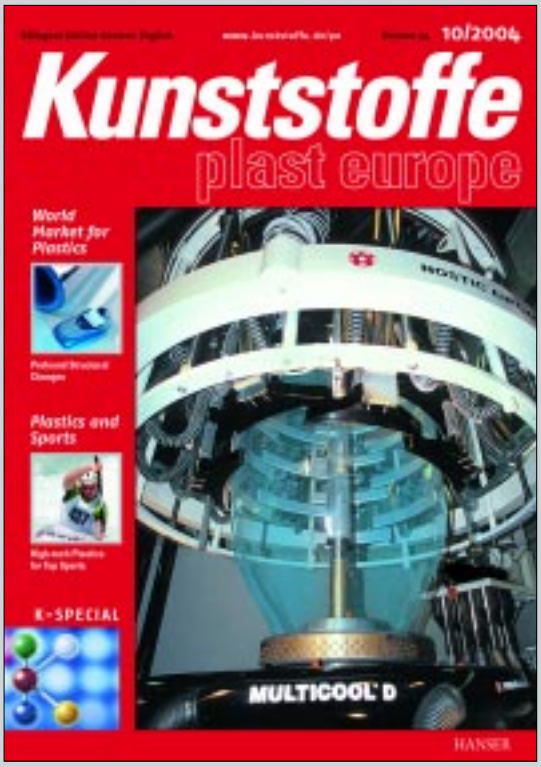
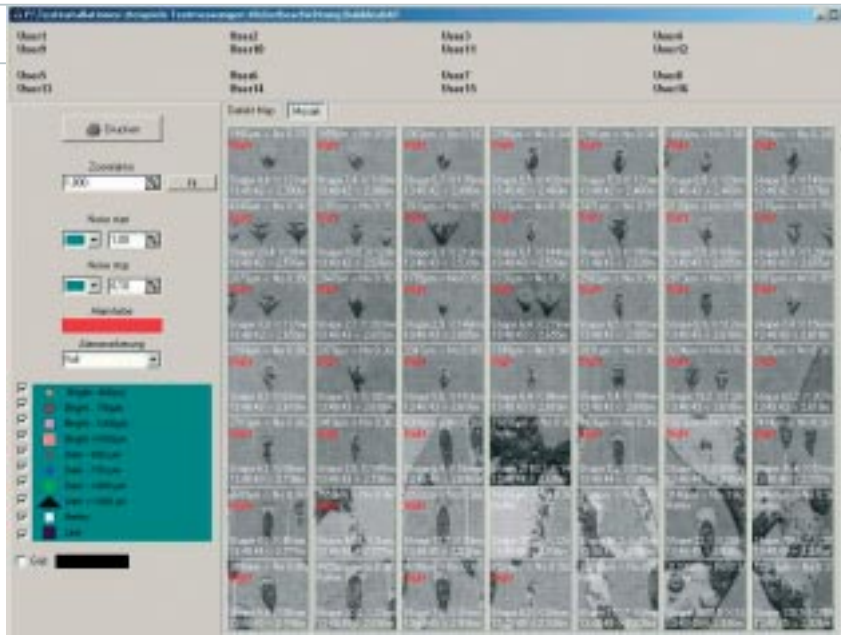
Special reprint from Kunststoffe 10/2004

HANSER

The Embedded Solution as a Symbiosis of Intelligent Hardware and Software



Film Inspection. The concept of the embedded solution combines the advantages of CCD line-scan cameras with those of traditional client/server systems, while offering greater standardisation, better performance and lower costs. Along with practical examples, a cost estimate for successful integration of inspection systems is given.



Errors must be classified once by the operator on the basis photos; afterwards the system recognises the errors automatically

The Embedded Solution as a Symbiosis of Intelligent Hardware and Software

OLIVER HISSMANN

Intelligent camera systems are characterised by the fact that the evaluation unit is integrated into the housing. Thus results a compact component that is connected to the server by an ethernet bus. A distance of 100 m between the camera system and the server (industrial PC) can be bridged with this concept. The server visualises the errors, documents them in memos and/or a data base and gives alarms (control alarm lamp/horn or labelling machine). Data evaluation takes place via programmable hardware components, e. g. flex design or digital signal processors (DSP). This makes these camera systems relatively inflexible in relation to specific customer requirements. At the same time the cameras also have only limited calculation capability and thus make buffering of only a few defect patterns possible, for instance, whereas with other concepts up to 1000 such patterns can be buffered per second. Finally, special cameras are involved that are built only in small numbers for this area. The development pace for these systems is accordingly low. This shows for instance in the availability of data rates and line lengths. The camera systems used are only 40 MHz and have at most 4096 pixels; current standards are 120 MHz and 6144 to at most 8192 pixels.

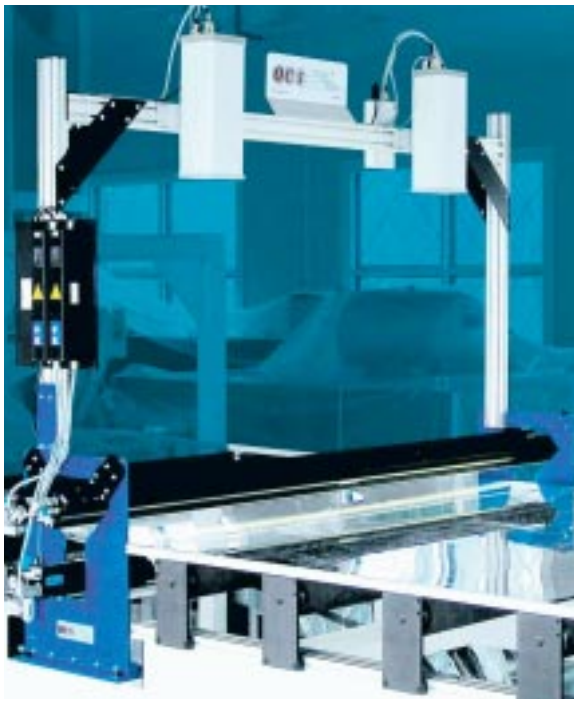


Fig. 1. PC disk inspection

Translated from Kunststoffe 10/2004, pp. 246–248

The Classical Solution: Client/Server Systems

The "classical solution for inspection systems" uses standard CCD line-scan cameras (Fig. 1). Each camera supplies the raw data – previously analogue, today digital – to a workstation (client). There the data are evaluated and the error information for visualisation and alarming transferred to a server. Using this concept results in substantially more available calculation capability, e.g. for buffering defect patterns without pattern and/or information loss. These systems are usually software-based and thus more flexible regarding specific customer requirements. Commercial standard hardware components and cameras are used that are more efficient due to substantially shorter development cycles. The disadvantages of the client/server concept are the short distance between camera and client of at most 20 m and the necessity of more industrial PCs when using a multi-camera system.

The Embedded Concept has the Advantages of Both Solutions

The embedded solution concept unites the advantages of intelligent cameras with those of client/server systems. Long distances between the camera system and the server can be bridged while maintaining very high calculation capability and thus a great number of defect pattern presentation performances. Standardised components from a growing mass-market are applicable. Such a foil inspection system works with software support and integrates standard CCD line-scan cameras with modern standard hardware. Depending upon the application high-speed line-scan cameras with 2048, 4096, 6144 or 8192 pixels and data rates of 80 or 120 MHz are used. Consider, however, that the more pixels a CCD line has, the slower a camera works depending on the data rate. Thus a producer of foils with relatively low haul-off speeds (less than 100 m/min) can use few cameras with many pixels. In this way a high resolution can be reached both along the production line and in the transverse direction. This reduces costs, start-up and maintenance.

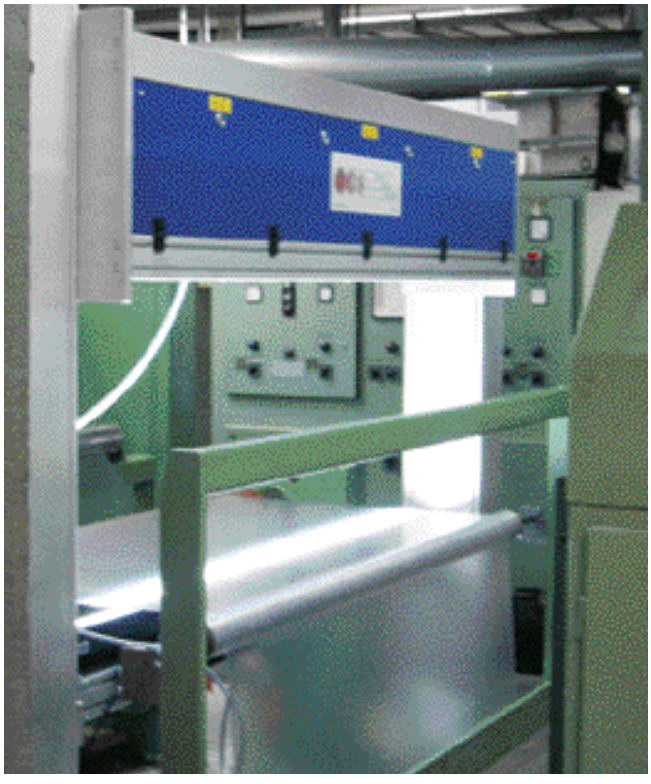


Fig. 2. Closed inspection bridge

Practical Examples: Foil Plants

Fig. 3. Embedded solution at a roll slitter

and Roll Slitters

The flat tube in a foil blowing plant with a width of 2600 mm and a haul-off speed of at most 120 m/min is controlled with a resolution of 170 µm using transmitted light. For this two CCD line-scan cameras each with 8192 pixels and a data rate of 80 MHz are necessary. Since for white foils an opacity of up to 70 % must be transilluminated, special focusing lenses

Subordinate Work Procedures for Error Free Inspection

Learning new errors and prescriptions for different products, specifications or customers depends on the extent of the product range. A basis configuration is provided in cooperation after start-up of the system. On this basis generation of a new prescription is possible for the administrator in a few minutes. It is important that each prescription be specified only once. If system validation is necessary, for instance according to FDA, it can take up to six months. This depends on the availability of the responsible co-worker and the capability of the system manufacturer to make available e.g. validation protocols or validation tools. Off-line analysis by the development or QA department can be expanded at will. Here definition of specifications for sales including analysis of new raw materials and/or prescriptions is possible, e.g. by summation and simultaneous evaluation of several rolls.

The costs arising in these areas depend on the type of error, the degree of integration and the variety of the products. A stand-alone solution with network access, alarms, quality protocols and compact information for the production manager is included in modern systems and can be realised through the training courses mentioned above. With these "intelligent" systems the administrator inserts the types of error automatically according to the defect patterns (teach-in) with a classifier.

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The Cost of Integration

Integration of a foil inspection system into a production line entails the following costs:

Training of the administrator before start-up (1–2 working days (WD))
Pre-schooling for 1-2 working days at the developer for the system administrator, becoming acquainted with the new system outside of daily business; providing a pre-configuration for the production line.

Start-up and training (administrator + operator: 3 WD)
The system administrator assists with the start-up of the inspection system. The plant operators are trained afterwards.

Training (administrator + operator: 1 WD)
4 to 10 weeks after start-up follow-up training by technicians. Fine tuning of the system and answering questions in addition to telephone consultation and/or remote maintenance.

Integration in the network/BDE connection across interfaces
Costs dependent on the kind of the interface, etc., network connection possible due to client/server architecture. Systems based on Windows, therefore problem-free training of the co-workers is possible.

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