

VITRONIC GmbH

White Paper

The Advantages of Camera Systems for the Data Acquisition in Intralogistics

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Summary

In intralogistics, customer-related and object-related data of goods is acquired and processed at various locations. Laser scanners and camera systems are currently used for this purpose. While the former already are widely used, camera-based systems still play only a minor role on a global scale.

Camera systems provide significant advantages in comparison with conventional technology: they increase the degree of automation, accelerate processes, increase the efficiency and productivity in personnel placement and reduce the logistics costs per article.

Camera systems

- acquire images and obtain more usable information therefrom,
- register objects with a higher read rate (registered objects per total number of objects) and produce fewer non-readable objects (NoReads),
- immediately display the read result and the image of the object and thusly allow an evaluation in real time,
- make it possible to acquire additional data such as the volume and the weight of the object and to use this data for storage and logistics processes,
- read more data types such as diverse 2D-codes and plain text (OCR),
- allow read rates of 100% due to the utilization of video coding (supplementing missing information based on the evaluation of the images by employees),
- are able to read several different code types at once
- also register the smallest or damaged codes, codes under foil and on the underside of goods,
- register colored and low-contrast codes (only when using white LED lighting),
- make it possible to archive and purposefully evaluate the images for process optimizations,
- produce documented evidence for customers in the form of images with all data for the archive.

The sum of all advantages of camera systems in intralogistics leads to sustained efficiency gains and cost reductions over the entire process chain, as well as to a faster amortization of investments.

How does camera technology increase productivity and lower costs?

In order to realize flows of goods in intralogistics flexibly and cost-efficiently, customer-related and object-related information on goods needs to be acquired and processed in a largely automated fashion - easily, efficiently and transparently, as well as with the fewest manual manipulations possible. In contrast to conventional laser scanner technology, high-performance camera systems meet these requirements.

The functional principle is simple: cameras produce high-resolution gray-scale images of the entire object surface. High-performance machine vision recognizes, analyzes and evaluates not only barcodes in this image, but also 2D-codes and plain text (OCR) - namely even different code types in one image. Furthermore, important additional information such as the volume and the weight of the object can be registered in the same process step and information on the condition or the position of the article can be derived. This information is directly incorporated, e.g., into connected inventory control systems or CRM- solutions, in which they can automatically trigger other customer-related or object-related processes.



Cameras produce an image and also scan all barcodes, 2D-codes and plain writing (OCR) therein.

The advantages of camera systems in terms of the efficiency are quite obvious: cameras provide significantly higher read rates than conventional technologies. Employees no longer have to subsequently supplement non-readable data manually in a time-consuming and cost-intensive fashion. The manual scanning stations and additional conveyor technology required for this purpose can also be eliminated. Since not only barcodes, but also 2D-codes and plain text (OCR) are automatically read, all sorting processes can be accelerated, throughput times can be reduced and the productivity can be increased. The operating costs are also lowered because cameras have very long service lives and require extremely low maintenance due to the small number of moving parts.

Another advantage is attained due to the fact that the images of the article and the information contained therein are archived and can be evaluated at any time. This makes it possible to immediately reconstruct why information could not be automatically read. This in turn makes it possible to quickly react to errors and to optimize intralogistics processes. The efficiency is once again improved and the costs are once again lowered in these processes.

The archived images also provide the highest possible transparency when dealing with customers or suppliers. Non-readable codes that are created, for example, due to errors at the suppliers can be detected, verified and prevented and create a solid base for improving the cooperation.

In this white paper, you can find out more on how camera-based machine vision systems contribute to optimizing intralogistics processes, to lowering costs and to improving the competitiveness of the respective companies.

What is camera-based identification technology used for?

One essentially distinguishes between three applications for camera-based data acquisition:

- **Manual:** in this case, an employee manually enters data into a computer or identifies the data with a hand-held scanner.
- **Semi-automatic:** the article to be registered is manually supplied and removed. The read result is also manually evaluated and additionally processed.
- **Fully automatic:** permanently installed Auto-ID systems are integrated into the automated process at fully automatic stations. There is no manual intervention and no manual evaluations of the reading results.

Camera-based solutions exist for all three applications and make it possible to acquire and utilize the data in a simpler, more efficient and cost-saving fashion. In this case, the data is acquired in intralogistics along the entire process chain such as:

- returns management
- incoming goods control
- commissioning and shipping
- outgoing goods control

The advantages of camera-based systems in terms of efficiency, productivity and costs can be noticed in each individual process step. A company-wide configuration of cameras along the entire process chain therefore opens up enormous optimization potentials.



Example for manual data acquisition: the code is identified with a hand-held scanner



Example for semi-automatic data acquisition: codes are read while the article is moved underneath the camera



Example for fully automatic data acquisition: codes are read without manual intervention by an operator

Example: automatic data acquisition in incoming goods departments

Order processing data is acquired in the incoming goods department. The cameras read barcodes, 2D-codes and plain text, and an incorporated device measures the volume in order to correctly store the goods or detect defects/deformations on boxes that make storage impossible. Consequently, they provide significant information that is required for follow-up processes, e.g., in accounting and inventory management.

Example: automatic data acquisition during commissioning

In this case, complete shipping units (cardboard boxes) are assembled from various individual packages. Cameras identify the article to be commissioned (codes, text, the volume and optionally the weight with the aid of a scale), as well as the completely assembled shipping unit. Goods can furthermore be located and displayed to the operator. Delivery receipts, invoices, shipping papers and routing plans can be prepared in a largely automated fashion with the aid of the acquired data.

Reading and evaluating barcodes, 2D-codes and plain text (OCR)

The universal application possibilities of camera systems in intralogistics are reflected, in particular, in the variety of acquirable information on goods and packages:

Barcodes

Cameras read barcodes with higher read rates than conventional scanning technology. Practical experience has shown that the read rates of camera systems are on average at least 0.5 to 1 percent higher, frequently even more than 5 percent higher, than those of laser scanners.

The dimensions of the barcode are also very important for the read rate. While laser scanners frequently encounter problems when scanning small codes, cameras also read even the smallest codes in an extremely reliable fashion. This also applies to small codes that are very densely arranged.

The following example demonstrates the cost savings that can be achieved when using camera systems rather than laser scanners.



Cameras even read several codes at once.

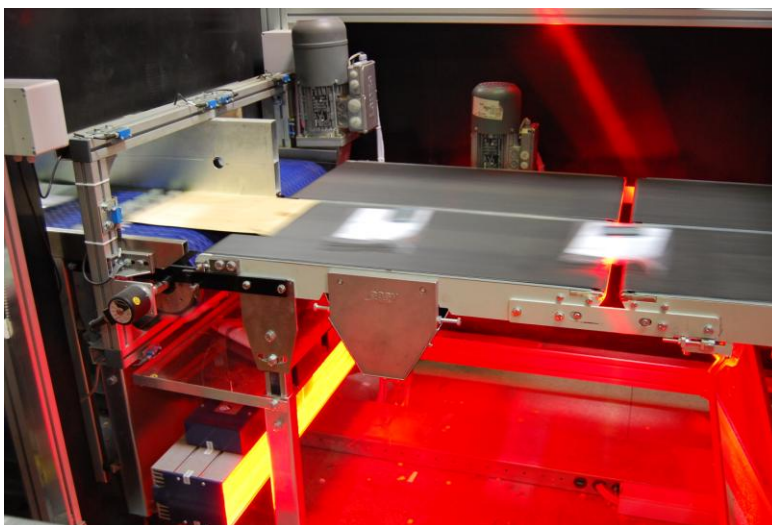
**Exemplary calculation:
Annual savings potential with permanently
installed camera system instead of laser scanner**

Number of objects per day	50.000
Handling time per object with scanner	6 sec.
Handling time per object with camera	3 sec.
Time savings per object	3 sec.
Time savings per day	3 sec. x 50.000 objects ~ 42 h
Time savings per year	42 h/d x 210 d = 8.820 h

This does not include the **elimination of manual identification stations and conveyor technology**, as well as **higher productivity**.

Calculate your concrete savings potential with our online calculator at:
www.vitronic.de/logistic

Another advantage: camera technology makes it possible to acquire information on all six object sides. For this purpose, another camera is installed underneath the conveyor belt in addition to the top and side cameras and reads arriving objects through the gap between two conveyor belt elements.



Cameras also read the underside through a gap in the conveyor belt.

2D-codes

Camera systems also read 2D-codes (such as, e.g., PDF 417 or DataMatrix codes), namely even if several codes are arranged adjacent to or on top of one another.

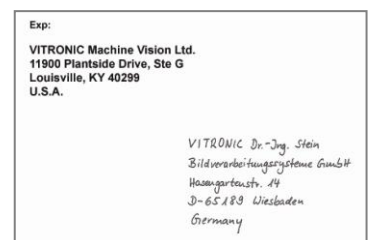


Cameras also read several and different 2D-codes.

Plain text (OCR)

In combination with powerful OCR software, cameras even make it possible to automatically read handwritten and machine written text (OCR). It is possible to read, e.g.,

- address: zip code, city, street, house number
- product numbers
- quantitative information
- supplier numbers.



Cameras read handwritten and machinewritten plain writing (OCR)

In addition to a plain writing, it is also possible to simultaneously read barcodes as well in this case.

Images as basis for video coding

The most important applications for video coding are the registering of returned goods and the completing of information in plain text that cannot be read with machines (such as, e.g., addresses, batch numbers and the like). The goal in this case always is a seamless and fully automatic acquisition of all relevant data without interrupting the sorting process.

Registering of returned goods

In many instances, returned goods needs to be once again registered in the inventory control system and stored. With conventional scanning technology, this would have to be carried out in a time-consuming fashion at a manual identification station. When using cameras, however, the image of the article is directly sent to a video coding workstation. At these workstations, trained employees directly enter all required information into the inventory control system.

Completing read information

Due to external influences such as damages, addresses or other information on goods also can no longer be read 100% automatically by camera-based identification systems. However, integrated video coding allows a read rate of 100 percent. In this case, the images with non-readable or incompletely identified information captured by

the camera are transmitted to video coding workstations via a network. Since it is possible to rotate and zoom in on the images, employees at these workstations can easily determine and manually supplement the missing information in the system - either online or offline.

Online video coding: the information is entered within a defined period of time and immediately made available for sorting and additional processing.

Offline video coding: the employees subsequently supplement information that is not required for the sorting process, but for the delivery. For example, data can also be transmitted to central processing stations for several distribution centers for video coding purposes.

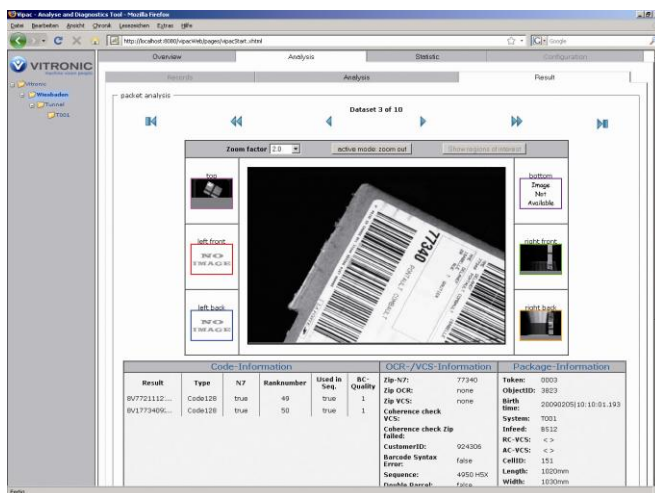


At a video coding workstation, the image of the object is displayed to the employees and they add information or enter object-related data into an inventory control system.

All data is matched with a customer database in order to maximize the data quality. Videocoding stations can be installed at a central location in the company or directly on the conveyor belts in the form of manual work stations. Depending on the qualifications of the employee and the number of data fields to be supplemented, it is possible to achieve coding rates of up to 500 objects per hour and per station. This significantly accelerates, for example, the processes in the incoming goods department, reduces the handling costs per article and increases the productivity of the employees.

Process optimization & monitoring: a picture is worth a 1000 words

In contrast to barcode scanners, camera-based identification systems can archive and make available important information for evaluation purposes, wherein this information can subsequently be used for purposeful process optimizations. This makes it possible, e.g., to subsequently analyze and eliminate the causes for unidentified objects (NoReads). For example, if goods are frequently placed on the conveyor belt with the code side facing downward and the camera only reads the upper side, the employees can be instructed accordingly and the read rate immediately increases. Furthermore, it is possible to easily locate, e.g., suppliers who used incorrect or non-readable codes and the cause for the NoReads can be verified and eliminated.



Stored images show why data could not be automatically read. The cause can then be eliminated.

Web-based monitoring software makes it possible to archive read results (codes and plain writing), object information (such as volume and weight), image information (name, size/number of pixels) and system information (camera station, video coding station).

Such a monitoring system makes it possible to determine if the codes of the labels exceed the specification, if wrapping straps interfere with the reading process or if barcodes are covered. The results of the analysis can then be made available to the code supplier in order to correct the problem. In order to perform the analysis and evaluation, image searches can be carried out with filters that can be freely defined or simply based on the code type or certain time periods. All this enables the company to optimize external and internal processes, to minimize errors, to reduce throughput times and to additionally lower the handling costs.

Other advantages of camera systems

Camera-based identification systems furthermore offer a number of special functions that can be randomly combined with one another and implemented at a single location, e.g.,

6-side reading: an additional camera is arranged on the underside between two conveyor belts. This additional camera reads data on the underside of the object.

Volume measurement: in semi-automatic or fully automatic identification stations, the volume of the article can also be determined - and serve as an optimal basis for optimizing storage, loading and transport management.

Weight determination: the weight of individual objects can also be determined with a scale integrated into the conveyor belt such that the planning of storage and transport capacities can also be optimized in this respect.

How to find the appropriate supplier of camera-based data acquisition systems

A number of suppliers offer camera-based data acquisition systems. Aspects to keep in mind when making your choice are listed below.

Complete solutions from one source, namely from one supplier that develops the camera hardware as well as the software solutions (e.g., for reading plain text/OCR). This ensures that all system components are optimally adapted to one another. The integration of complete systems into existing facilities and processes also provides advantages in that tasks can be implemented in a bundled fashion and therefore more efficiently.

One responsible contact person at the supplier minimizes adaptation efforts and guarantees optimal quality of advice.

Modular systems, in which individual modules are used in a task-oriented fashion and additional modules can be subsequently integrated. In case your data acquisition needs increase, a quick expansion can be easily implemented.

Simple integration into existing facilities, as well as connection to inventory control systems and other process-relevant applications.

Minimal space requirement due to compact camera systems that can be easily installed at manual, semi-automatic and fully automatic identification stations.

Intuitive operation of the software solutions with minimal training effort.

Comprehensive advice from the planning phase to the implementation, as well as for retrofitting, reconstruction and expansion projects.

About the author

Dipl.-Ing. Gerhard Bär: After studying electrical and control engineering at Darmstadt Technical University and graduating in medical image processing, he began as project manager at Carl Schenck AG in Darmstadt/Germany. He switched to VITRONIC in 1984. In 1986, he pioneered the development of identification technology by means of machine vision. In 1999, he was also appointed vice president of VITRONIC Machine Vision Ltd., USA. Since 2003, he is one of the managing directors of VITRONIC Dr.-Ing. Stein Bildverarbeitungssysteme GmbH and senior executive of the logistics department. Since 2010, he is chief operating officer. He has been working with camera-based Auto-ID in the field of intralogistics for more than 25 years.

Company profile

VITRONIC is one of the world's leading industrial machine vision companies. Since 1984, the company develops and produces machine vision solutions, amongst others for the automobile and automobile supply industry, photovoltaics and medical engineering, the pharmaceutical and packaging industry, mail order companies and logistics sector. VITRONIC offers turn-key systems from hardware to software - namely in the form of standard products with modules that can be expanded in accordance with customer specifications, as well as special solutions customized in accordance with individual requirements.

In the field of intralogistics, VITRONIC has successfully implemented numerous sophisticated systems for renowned logistics companies in the past years. The product series VIPAC by VITRONIC provides a fully automated identification solution for warehousing, distribution and logistics. High-resolution line-scan cameras and powerful software solutions that include video coding and monitoring acquire all relevant information and allow read rates of up to 100 percent - as basis for a higher degree of automation, more efficient processes and reduced costs. VITRONIC currently has more than 350 employees worldwide.

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