

Automated Optical Sorting of Small Particles for Recycling

Customer

MSS, Inc. (www.magsep.com) is located in Nashville, TN and has been designing and manufacturing automated optical sorting equipment for the recycling industry (paper, plastics, glass, metals, electronic scrap) for more than 35 years. One of their recent development projects for color and shape sorting of small particles using high-resolution color cameras will be completed in 2010.

Application

The main challenge for any optical identification and sorting technology in recycling applications is that the processed particles are of highly irregular shape and size (Picture 1). For example, when sorting shredded electronic scrap particles, a long, thin, single-stranded copper wire needs to be identified just as correctly as “copper” as does a randomly shaped piece of flat copper plate. Or, a heavily populated piece of a circuit board needs to be correctly identified even though proper identification is based on the specific color of the board (green, beige, blue, red, etc.) and not much surface area is available for inspection.



Picture 1: Unsorted material



In addition to the performance of hardware components such as the camera, a large burden is placed on proprietary image processing software that is much more complex than an off-the-shelf machine vision software package for conventional inspection/sorting processes.

Solution and Benefits

The basic setup of the MSS optical sorting machine for small particles is:

- The incoming mixed material stream is sized and metered properly, and then spread over the full width of the optical sorter in a single-layer configuration. In most cases, a vibratory feeder is used to help pre-accelerate the particles.
- Depending on the application, the material stream either enters a fast-moving conveyor or a steep slide, which accelerates the particle flow to about 100 inches per second (2.5 meters per second). At that speed, the particles travel through the sensing zone, sometimes thousands of them per second over the full width of the machine.



Picture 2: Sorted material

- Immediately following the sensing zone, one or two rows of air ejectors are used to divert the targeted materials/ colors away from the main material stream. Depending on the material stream, a “positive” sort (ejecting the desired fraction) or a “negative” sort (ejecting the non-desired fraction) is performed (Picture 2).
- Optionally, a high-resolution color camera system can be paired with other sensor types such as a metal detector.
- Depending on the types of material processed and sorted, the actual sensor geometry configuration of the MSS optical sorters is available in several different varieties. For example:
 - Identification on a dark/black background (“reflection”).
 - Identification on a white/clear background (“transmission” or “transflectance”).
 - Identification on a fast-moving conveyor; steep slide, or in mid air.
 - Different illumination sources can be employed, such as LEDs, halogen lights, etc.

Technologies Used

For several compelling technical reasons, MSS is using the Basler ruL2098-10gc camera. The MSS optical sorting machine requires precise spatial alignment, a high data acquisition rate, high color bit depth, and ultra-fast, real-time numerical processing. The ruL2098-10gc has helped MSS to exceed performance requirements via several key features:

■ Precise spatial alignment

The Basler camera is manufactured to stringent tolerances regarding the mechanical location of its tri-linear sensor in relation to the lens mount and the critical camera mounting surfaces, thus ensuring the required optical precision.

■ High data acquisition rate

The optical sorting requires the acquisition of approximately 10 million color pixels per second. The pylon GigE Vision Performance Driver easily supplies this amount of data with minimal loading of CPU resources.

■ Difficult real-time numerical processing

This is achieved through the combined numerical pre-processing performed within the Basler camera and the use of a multi-core industrial PC executing MSS proprietary algorithms.

■ pylon API

This powerful application programming interface has made the camera features very easy to use, thereby allowing the MSS engineers to focus on the application.

■ Application development support

Engineer-to-engineer application support has been outstanding on this project, helping MSS to keep the design process moving forward on schedule.

More Information

<http://www.magsep.com>



The Basler runner GigE camera is a perfect fit for this application

Basler AG

Germany, Headquarters

Tel. +49 4102 463 500

Fax +49 4102 463 599

bc.sales.europe@baslerweb.com

www.baslerweb.com

USA

Tel. +1 610 280 0171

Fax +1 610 280 7608

bc.sales.usa@baslerweb.com

Asia

Tel. +65 6425 0472

Fax +65 6425 0473

bc.sales.asia@baslerweb.com

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