

Identification of Blooms with Optical Character Recognition (OCR)

To improve the quality of the manufacturing process a Bloom Identification System was installed at China Steel Co., Kaohsiung, Taiwan. The purpose of the system is to check paint marked bloom identifications at the transfer beds in front of the reheating furnaces.



Fig.1: Camera installation at bloom marking machines, camera with cooling and laser trigger in the foreground

■ **Image Processing Systems** are becoming more and more important for industrial automation. Even difficult applications like OCR of material identifiers in steel plants can be realized today with robust high resolution cameras in combination with high performance PC's and sophisticated software.

The Production Environment

The China Steel Corporation (CSC) is the biggest steel company in Taiwan. With an annual production volume of 11 Mio. tons of pig iron CSC belongs to the biggest steel companies in Asia, and is among the top 30 steel companies in the world. CSC has always taken special care for industrial automation and material tracking, and therefore it was a logical step to introduce new technology for material tracking at the Bloom Casting Department W3.

At W3 blooms are produced at 3 continuous casters with 4 strands each. The annual production is nearly 2 Mio. tons. Blooms are marked with painted IDs, after that they are temporarily stored in the warehouse before being reheated for rolling. Most of the blooms are later rolled to billets that are used for production of rods and wire coils.

The Requirement

To ensure a permanent high quality it is absolutely necessary that only correct material qualities are rolled. The blooms are delivered by cranes to the charging beds at the preheating furnaces. Due to the fact that the cranes are manually controlled, and there is no material tracking system, it sometimes happens that wrong blooms are charged. To control this situation CSC decided to install a bloom recognition system that is able

to check the identifiers that are printed on the bloom surface. The effort for such a system is small compared with a complete gapless tracking solution in the whole bloom manufacturing area. Installation is relatively easy and with an identification rate of nearly 100% the reliability of such a solution is sufficient to solve the problem of wrong blooms on the charging bed.

The LogoTek Solution

LogoTek was selected as supplier and main contractor of identification system and marking machines. Altogether the system incorporates following components:

- 3 paint marking machines
- 3 camera systems / identification stations at the bloom marking machines
- 3 camera systems / identification stations at the bloom charging beds
- 5 HMI-Station with a client software to check the identified blooms
- HMI of the marking machines (showing the marking machine status)
- Server with bloom database and communication software
- Network components

As supplier of the Paint Marking Machines the Austrian company Lenzing Marking Systems was selected. Lenzing has supplied various paint marking machines for the marking of hot and cold steel material to steel plants world wide.

The image processing of steel products can cause several difficulties. Firstly there are the very rough environmental conditions in a steel plant, with high temperature, dust and vibration. Furthermore the material itself has changing surface conditions and the quality of the ID on the surface may be varying. It depends signifi-

cantly on continuous maintenance of the machine. The image processing solution therefore must be independent of changing illumination conditions, it must be able to handle different code appearances, and it should withstand high temperatures and rough environmental conditions. The LogoTek-Solution for Bloom identification consists of:

- Cameras in a very robust protection housing with Vortex cooler and dust protection tube
- Illumination by flash light or HQL lamps, in protection housings with Vortex cooler
- Illumination controller to control the flash light and allow online system checks
- Image Processing PC with high performance (Quad Core Pentium) in robust industrial housing and with possibilities for remote maintenance and system check

- Software for image processing and communication to the server

The image processing software is based on LogoTek's Image Processing Framework IPA which incorporates modules for camera control, image pre-processing, OCR, logging and archiving, as well as a sophisticated user interface and communication functions for the communication to other systems. The IPA allows an online system check, it is possible to change camera parameters, trigger manual image capturing and check the identification results.

Important for a sufficient identification is the training of sample characters. At least one sample of each character is recommended. Due to the fact that in this project alphanumeric characters are used, it needed a longer time to get enough samples of all characters. The IPA contains tools to support the training process, but nevertheless the

training requires the biggest part of the project work.

An important improvement of the reading rate can be achieved by comparing reading results with available bloom identifications. The number of produced blooms is far smaller than the number of possible combinations of the characters on the bloom. Therefore it is very helpful if impossible/not produced recognition results can be eliminated.

The installation of the bloom identification system started in November 2008. After training most of the characters the identification rate of the reading system was between 95% - 99%, varying widely because of the changing marking quality. After activating the server correction of identification results the identification rate could be stabilized very near to 100%.

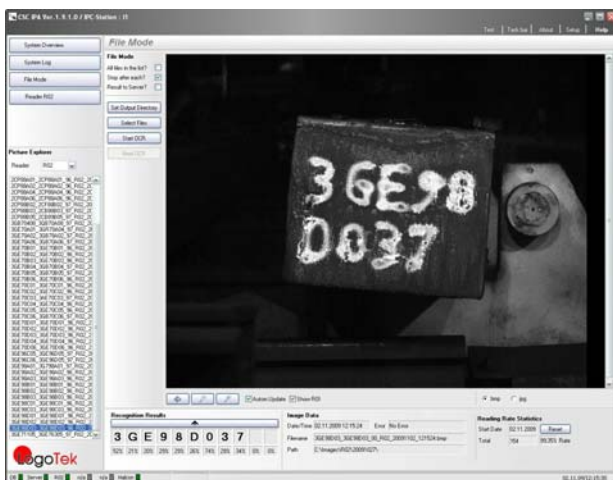


Fig.2: The IPA program with OCR, camera control, communication and archiving functions

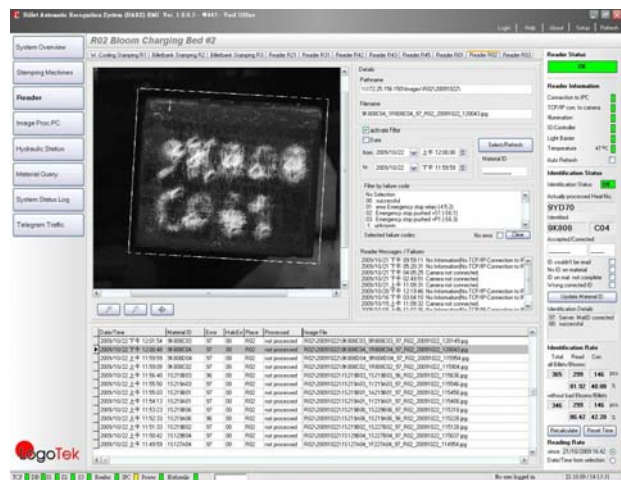


Fig.3: Bad marking quality isn't a problem for the OCR. A bloom with nearly unreadable ID can be identified by the OCR system. The picture shows the HMI program.

Logotek is supplier of Material Tracking and Image Processing Solutions for the Steel Industry. We deliver turnkey solutions for all tasks of warehouse logistics and identification, including industrial automation with Siemens PLCs, Crane Tracking Systems, Warehouse Management Systems and component sales.

References can be found in steel plants worldwide. Please contact us if you need more information. Our sales team will be pleased to assist you.



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