ALPING ASIA

AlpSDDS

SURFACE DEFECTS DETECTION SYSTEM

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AlpSDDS

ARTIFICIAL INTELLIGENCE IN INDUSTRIAL PROCESS

The detection of defects is an essential requirement in the industrial framework, both to ensure product quality and, where there is a need for processes aimed at eliminating or reducing the quan- tities of non-compliant materials.

The identification of surface defects is an activity performed by experienced skilled operators who can visually distinguish between the sections of non-compliant surfaces and the respective faultless characteristics of the relevant material. In addition, the activity of manually identifying and highlighting individual defects requires a considerable amount of time.

AlpSDDS is a system that automates visual inspection, using Artificial Intelligence. Due to the inconstancy in their appearance and complexity, the surface defects are not readily identifiable through normal uniquely defined logical criteria, such as shape, colour, or extension. Hence the need to resort to a

computational model based on "artificial neurons" that reflect the learning processes that are characteristic of the human brain.



Identification of defects on a surface with temperatures below 100° C using the **AlpSDDS-C system**.



AlpSDDS-C can scan surfaces up to 700 mm in width



Identification of defects on a surface with temperatures higher than 750° C using the **AlpSDDS-H system**.



AlpSDDS-H can detect defects on materials that are moving at speeds of up to 10 m/s.

FRAMEWORK, INSTALLATION AND COMPONENTS

AlpSDDS comes completed with a processing unit and a graphical user interface. It is available in two versions in accordance with the usage requirements.

USER INTERFACE

ENTRY VERSION

The *ENTRY* version features only the display function. The system automatically generates a sequence (for each installed camera) of the images in which defects have been detected. Specially colored fields outline the length of the inspected material by concisely reviewing the types of defects and respective quantities that have been identified.



A screen shot of the ENTRY user interface on the AlpSDDS-H system.



ADVANCED VERSION

The *ADVANCED* version, over and above the features of the ENTRY version, allows the user to interact with the images acquired by the system. This way, individual frames can be selected, and entries can be made about the type and position on any of the defects that have been detected.

A screen shot of the *ADVANCED* user interface on the **AIpSDDS-C system**. Notice the interactive functionality.

AlpSDDS

FRAMEWORK, INSTALLATION AND COMPONENTS

AlpSDDS has a modular design. It can manage up to a maximum of 4 cameras, to ensure the inspection of all surfaces of the material.

AIpSDDS-H Suitable for products with surface temperatures above 750° C.

The equipment is housed inside reinforced and liquid-cooled protective cases. The glow of the material at elevated temperatures is exploited as a natural source of light, thus making the use of auxiliary illuminators superfluous.







AlpSDDS-H: to achieve the best possible results, we urge to position the camera as perpendicular as possible to the surface of the product.

AlpSDDS-H: it is highly advisable the use of a pyrometer or a thermal imager to detect the actual surface temperature of the material to effectively adjust the time exposure during image acquisition.

AlpSDDS-C Suitable for products with surface temperatures below 750° C.

The equipment, consisting of two cameras and two illuminators, is housed inside a protective container to ensure controlled and continuous operation. The system is then installed in a location set above the conveyor system and aligned to a transit point along which the product passes through.





AlpSDDS-C: we recommend the use of an encoder to record speeds feedback of the product conveying process. To maximize the accuracy of the data acquisition, it is crucial that the speed at the inspection portal must be kept constant.

ARTIFICIAL INTELLIGENCE - MACHINE VISION - MACHINE LEARNING

HOW IT WORKS

AlpSDDS is a system based on a neural network that analyses the images acquired by the onsite devices and detects the presence of defects on the surface of the material.

TRAINING



Installation is preceded by a preliminary phase levelled at training the neural network. It is in fact essential to make the system ready for specific conditions of use, in line with

with the intrinsic characteristics of the material and the possible types of defects to be identified. The task consists in fine-tuning the built-in working parameters and it is performed by Alping Italia's specialists, who in turn use the information provided by the operators in charge of the detection of defects or in quality control. Compared to common neural networks it is possible to significantly reduce the times of these preliminary phases because of the technology employed in AlpSDDS system. For each type of defect, it is sufficient to provide a reasonable quantity of image samples featuring one or more occurrences of the specific type of defect and an equally practical number of samples where any type of defect is absent.



An optional software application lets the user combine a series of individually acquired images into a single file, furthermore, merging them into one photograph that spans the entire selection. This enables

the user to inspect the surface's chosen portion of the product under consideration thus facilitating the analysis of the defects.

USER INTERACTION



The user interface displays the results of the elaboration process; the defects identified by the system are highlighted

by specially coloured fields subdivided into categories. An interactive interface, by means of which the user instructs the system to identify the defects, is also available for the initial training phase of the neural network and for any subsequent adjustments. The system then provides the position of each defect detected along the length of the product. This enables feedback systems, such as ,for example, the targeted grinding in correspondence of specific portions of material.



DATA LOGGING SYSTEM

The outcome of the processing, containing the number and type of defects, is stored on a database, together with the respective images, to ensure unlimited access to the

data history for statistical purposes, to analyse the quality of the production process and the final product.

INTEGRATION WITH SYSTEM AUTOMATION



Through interfacing with the plant automation, the system receives the start/stop signals relevant to the acquisition and performs the analysis of the images in real-time. AlpSDDS stores each image with the

respective unique ID after receiving the product's identification data either automatically or from the plant's level 2 software systems, thus allowing easy and immediate tracing of the files of a particular production batch at any given time.

EXPANSION PACK



An optional software application lets the user combine a series of individually acquired images into a single file, furthermore, merging them into

one photograph that spans the entire selection. This enables the user to inspect the surface's chosen portion of the product under consideration thus facilitating the analysis of the defects.

AlpSDDS

SURFACE DEFECTS DETECTION SYSTEM

The system detects the presence of defects on the surface of moving materials, pinpoints their position along the length of the product to further enable automatic positioning at the identified areas; it also makes information about the defects available for statistical purposes, analysis of the process and quality.

OVERVIEW

- Built on Artificial Intelligence
- Modular design, it can inspect from 1 to 4 surfaces
- Works on materials with temperatures up to 1200° C
- High-speed scanning of materials
- Minimum size of defects
- Real-time exchange with automation systems and plant surveillance
- Data logging on a database and image archiving



Labels applied to incandescent billets.



TECHNICAL SPECIFICATIONS		
	AlpSDDS-H	AlpSDDS-H
Maxium number of cameras	4	2
Liquid-cooled camera housing	Capacity 2 I/min (single housing)	-
LED Illuminator	-	Panel 300x300 mm Panel 450x450 mm Panel 600x600 mm
Image resolution	1280x1024	1280x1024 1936x1216
Optics	8 mm 12 mm 16 mm 25 mm 35 mm	8 mm 12 mm 16 mm 25 mm
Minimum size of defect	5 mm	5 mm
Product conveying speed at detection point	max 10 m/s	max 1,4 m/s
Distance from surface	800 ÷ 3000 mm	500 ÷ 1500 mm
Maximum width of surface	200 mm	700 mm
Product temperature	< 1200 °C	< 100 °C
Number of surfaces	1÷ 4	1
Mounting angle	Perpendicular to the surface	Perpendicular to the surface
Housing dimensions (L x H x W)	165x210x390 mm (single housing) – IP67	900x350x720 mm - IP53



AlpSDDS-H system in use.



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