Robotic Tagging Applications

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INTRODUCTION

This paper presents automation solution to automatically tag bundles of profiles, sections and rebars in long product rolling mills. Main benefits of the systems are increase of safety and productivity, costs reduction, efficient and consistent utilization of the equipment and a full finished product tracking system at site with the automatically printing of tags.
The topics are:

- Layout of the robotic island
- 3D Vision system
- Material tracking
- Solutions for Billet / Bundles / Coils tagging

DISCUSSION

Manual tagging of semi-finished or finished products always leads to errors while identifying the right piece to be tagged, material tracking if not directly bind to devices that can automatically tag products is limited to an approximate identification of pieces without feedback from production plants. That's where the necessity of an accurate **Automatic tagging system** is required. Automatic tagging system directly connected to material tracking in plant completely delete the percentage of error in mixing heat numbers at the production plant. Automatic tagging system is required as well to keep operators away from difficult positions and task, such as tagging material at high temperatures or where cranes are handling heavy products, eliminating these tasks contributes as well to have more skilled personnel that is involved in maintenance of systems and not only for operations. **Manual tagging island** from data collected on plants typically brings to an average of:

- 5% bundles not tagged or tagged with wrong tag, measured on an average of 600 bundles per working shift, means an average of n°30 bundles missing or tagged wrong per shift, measured at stock area, when manual tagging is performed.

Fig. 1 – Manual tagging area, all tags are pre-printed, percentage of human error is present

Automatic tagging island is mainly composed by an anthropomorphic robot 6-axis, a 3D vision system installed on the robot wrist, set of printers for the identifying tags, machine to create the tags support or a machine to distribute tags support, a welding machine and an electrical panel that commands the complete island and includes the relevant HMI's for diagnostics and alarms. The island is installed in limited space at site and completely contained in an industrial container properly designed and engineered to include all the machine in a conditioned and protected area.

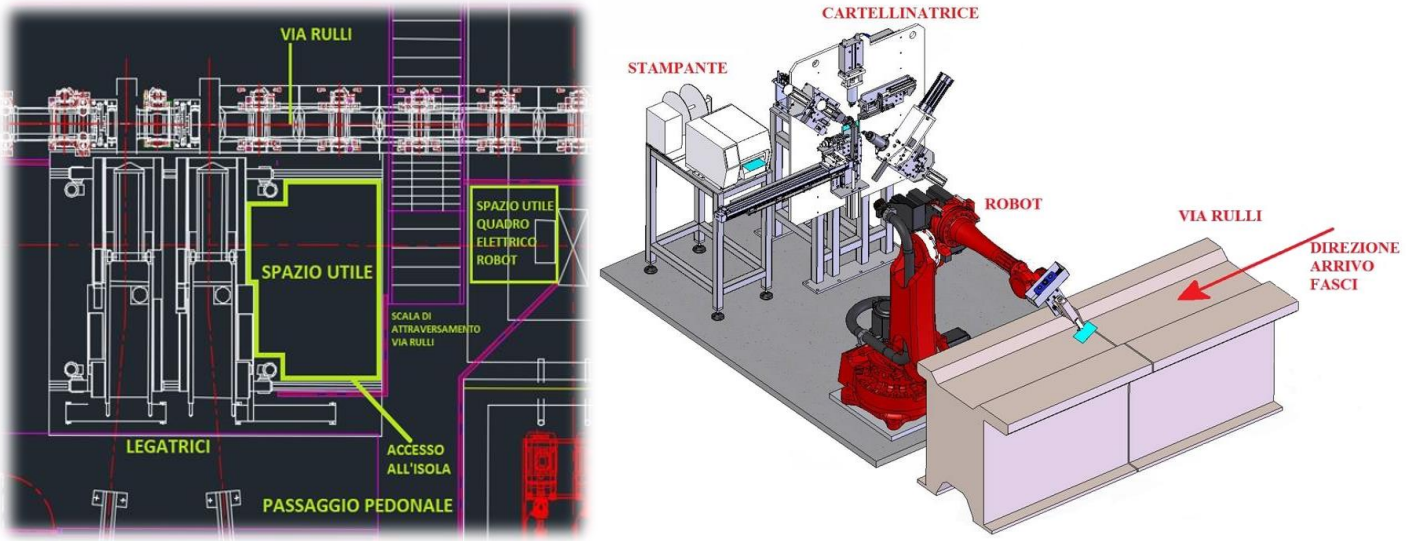


Fig. 2, 3 – Typical area necessary for the island installation and its engineering

Anthropomorphic robots are nowadays well proven devices and can be inserted in steel industry in several different applications, are available "foundry" models that are specifically designed to work in harsh environments and that are versatile to be used, even the same robot itself, for different applications. **3D vision system** adopted by **AIC**, in cooperation with **Halley** Machine Vision that develops all the algorithms for imaging analysis, is a double camera vision system without using the laser beam, specifically engineered for harsh environments, with this system there is no need to "scan" the product in order to create the cloud of 3D points but a simple acquisition, similar to a picture is enough in order to recreate the 3D profile of the product; the sensor used is a matrix sensor and not a profilometry, in this way no special movements of the robot are needed to finalize the material scan but only positioning the bundle on the conveyor is required. Scanning time is about **1.2 seconds** and thanks to this timing the robotic island works in plant with production up to **180 tph**. 3D vision system can detect automatically the kind of product without any specific setting thanks to advanced analysis algorithms.

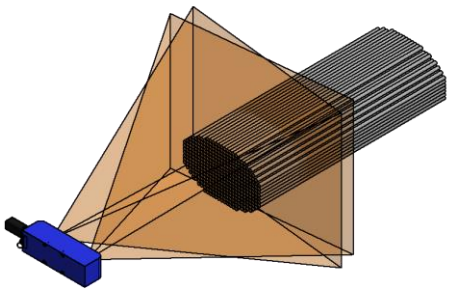
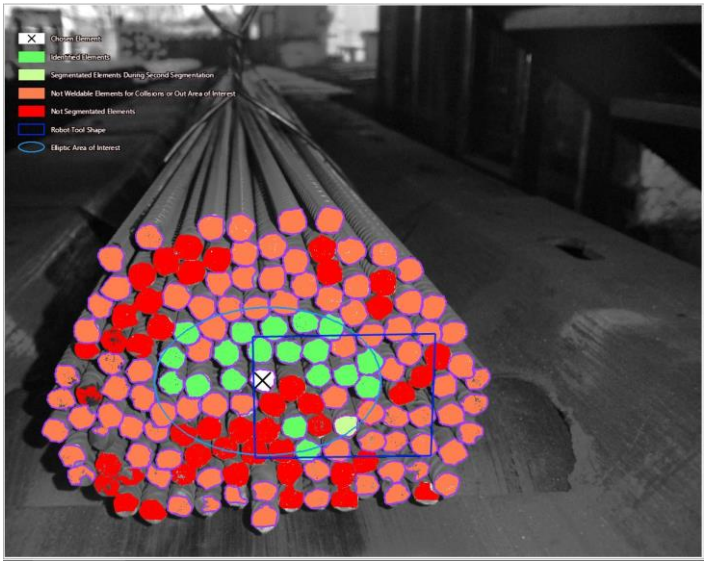


Fig. 4, 5 – 3D vision system during acquisition



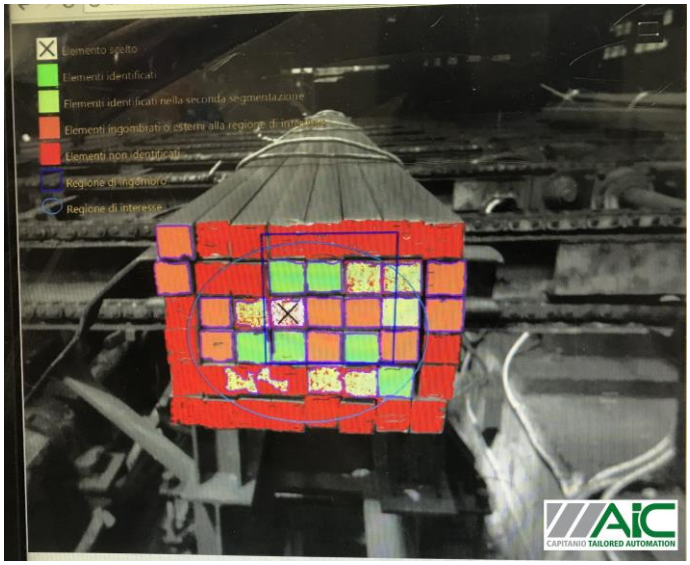
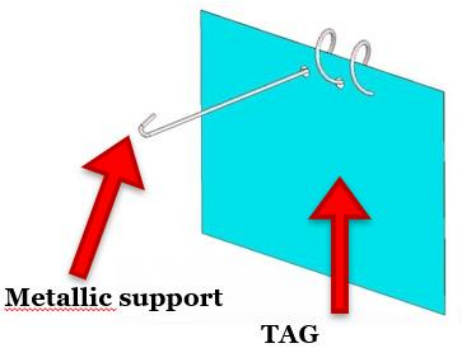
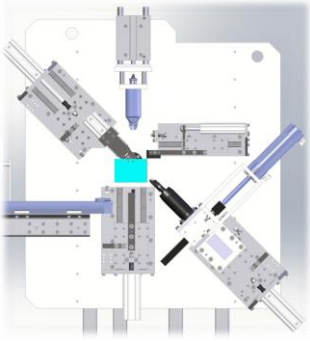


Fig. 6, 7 – Example of result of 3D vision system

Printers installed inside the tagging island are thermal transfer printers and designed with an external tag charger to handle up to 10.000 tags, able to cover one full week of production at site without the need of replacing the tags and ribbon. **Tags** can be applied using a **metallic support** built inside the island by a specific engineered machine or can be applied by the use of a **stud**. Metallic support is used to keep the printed tag far away from the head of the bundle in case the application is done when material temperatures are still high, studs are used when the application is done on relatively cold material where it's not a problem to keep the printed tag to minimum distance between the head of the bundle and the tag itself; for this purpose a welding machine is used.





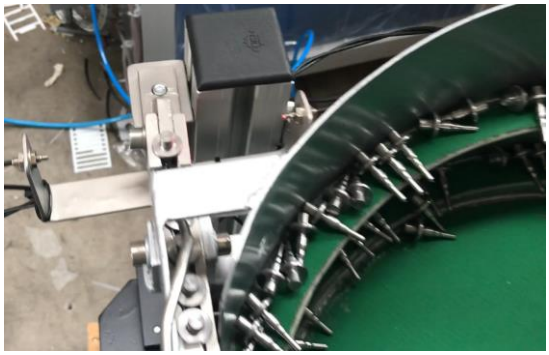


Fig. 8, 9 – Metallic support, machine for metallic support, stud dispenser


Fig. 10, 11 – Metallic support on bundles

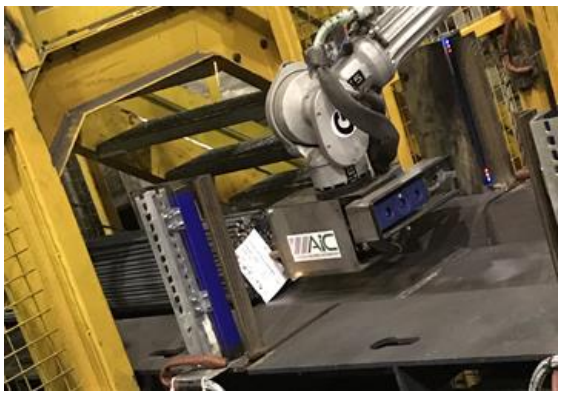



Fig. 12, 13 – Stud application and tag with stud on bundles

CONCLUSIONS

Material tracking system directly connected with Automatic tagging systems assures the tagging of each single product with the right identification data, improving traceability of finished product. Data connection to database makes the traceability complete following the product in all the production sequence until the end user. Automatic tagging reduces the number of bundles not tagged to a 0.2% of the produced bundles, measured on a shift production of 600 bundles, that means 1 bundle not tagged per shift as average. Measures have been taken on a rebar rolling mill plant where the robotic tagging application is running at **180 tph** with a cycle time of **8 seconds** where the bundle is stopped on conveyor for tagging; **1.2 seconds** is the timing dedicated to 3D scan of the bundle.