imec

An imec.icon research project | project results

MANUFACTURING

iXCon

Industrial (X-ray) CT for high-throughput quality control

Currently, volumetric quality control happens sample-based and offline. The lack of in-line solutions causes batches of products to be taken out of the production process as a quality precaution, and as such a significant waste cost occurs in many sectors. To overcome challenges related to process control and false rejects (for which off-line checks are often applied today) iXCon has developed a breakthrough in non-destructive in-line detection of product defects. The solution that was developed for high-throughput, industrial quality control allows for fast 3D volumetric evaluation of each product on the conveyor belt by means of X-ray imaging. The smart combination of flexible hardware and intelligent software has resulted in three successful use cases and a step-up technology for implementation in sectors such as: agro-food, product manufacturing, process monitoring, 3D printed materials etc. While demonstrated with attenuation-based X-ray tomography setups, the technology may in the future also be integrated together with other imaging solutions such as phase-shift X-ray, multispectral, THz...

THE OUTCOMES

1. Robotized rooting of agricultural products that have irregular structures - Robovision

Thanks to the ability of verifying the internal structure and quality of flower bulbs, the efficiency of automated plating can be drastically increased, e.g. by eliminating dried-out bulbs and by planting the good seeds with the correct side upward.

2. Internal quality inspection of fresh fruit by 3D non-destructive imaging - MeBioS

Fast 3D volume inspection of whole fruits (pears in this use case) supports the automated sorting after harvesting, leading to more homogeneous batches ánd less waste.

3. Quality control of small medical devices - Terumo

For mass production of medical devices, the technology developed in the iXCon project has proven its capabilities to be used as fast and qualitative inline inspection system. The technology can now be further developed to be added to the various visual-camera inspection techniques already in place.

4. Enabling technologies

- A flexible hardware platform speeds up industrial implementation: A dedicated hardware setup has been built which allows three degrees of freedom in the individual movement of source, detector and sample/stage. This is particularly useful in an R&D context or to test a myriad of configurations in the development of a dedicated industrial setup.
- Self-learning software decreases ramp-up time: By feeding the software with existing knowledge of the inspected product (material properties, CAD information...), it can self-learn in an automated way and thereby decrease the time that is needed to set-up and validate the detection system for a given industrial application.
- Image reconstruction with minimal amount of data allows for realtime in-line monitoring: Thanks to the smart interaction between hardware and software, the technology developed within iXCon allows to reduce the usual amount of up to 1500 scans needed for quality inspection with offline monitoring to only 50 scans or less. This efficiency gain now also allows for realtime in-line monitoring of products passing by on a conveyor belt.

NEXT STEPS

Luc Machiels, responsible for research and development of production technology at Terumo Europe: "In the medical-device sector, there is no room for error. Within iXCon, we have purposely challenged the technology to explore the limits of its capability. And it passed with honors. We do not yet have X-ray based inspection tools in our portfolio. We will now explore if we can develop the iXCon technology into an industrially compatible tool and integrate it in our processes to take our automated quality control to the next level."

Jelle Vlassenbroeck, general manager at XRE: "We are specialized in tools for 3D dynamic imaging. In this sector, the time aspect is crucial: how can you extract valuable information with as little scans as possible. Although further development is needed, we see value in the iXCon technology to strengthen this aspect of our core business. Also, it might open up new market segments for XRE."

Dirk Hamelink, strategic valorization manager at imec: "The iXCon impact does not stop at the end of the project. Imec is looking into further valorization of the results towards other industrial applications. As a first step, VisionLab will set up a flexible hardware platform that will enable X-Ray experiments with virtually every industry sector that has an interest. For this, a Flemish living lab project (Dutch: proeftuin) has been submitted recently to support the outreach to the local industry."

iXCon project partners:

ROBOVISION TERUMO XRE

FACTS

NAME	iXCon
OBJECTIVE	Realtime in-line monitoring of complex, high-quality products
TECHNOLOGIES USED	Attenuation-based X-ray tomography, using ASTRA toolbox image recognition software complemented by neural-network algorithms ánd a dedicated flexible hardware platform
TYPE	imec.icon project
DURATION	01/10/2016 – 30/09/2018
PROJECT LEAD	Denis Van Loo, XRE nv
RESEARCH LEAD	Jan De Beenhouwer, imec Vision Lab (UAntwerpen)
BUDGET	1,745,723 euro
PROJECT PARTNERS	Robovision, Terumo Europe, XRE nv
RESEARCH PARTNERS	UGent, Radiation Physics, KU Leuven, MeBioS
IMEC RESEARCH GROUPS	Vision Lab, an imec research group at UAntwerpen

WHAT IS AN

IMEC.ICON PROJECT?

The imec.icon research program equals demand-driven, cooperative research. The driving force behind imec.icon projects are multidisciplinary teams of imec researchers, industry partners and/or social-profit organizations. Together, they lay the foundation of digital solutions which find their way into the product portfolios of the participating partners.

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