



ARIA

Augmented Reality for Industrial Maintenance Procedures

In recent years, large chemical plants have seen a shift in the demographics of their personnel, with many experienced employees retiring and taking their knowledge and expertise with them. Especially for technical profiles this leads to a brain drain for the company as many of the installations are older, highly specialised and come with little documentation. Passing on knowledge to a younger generation of employees proves to be difficult since it does not happen spontaneously and starters usually have a higher job turnover. On top of that, it is no easy task to find skilled technical staff, frequently leading to the hire of over- or underqualified personnel.

At the same time, display technologies are taking a leap forward in the evolution towards miniaturisation of screens and devices. Smart glasses and tablets now provide information on-the-spot and make interaction possible. This opens possibilities for the industrial sector where all information about company equipment can be readily made available in small portable devices, such as headsets, to younger technicians and people in training.

The ARIA project aims to restore and enhance the competitiveness of industries in Flanders by optimizing communication, support and training initiatives through the use of Augmented Reality (AR). AR superimposes an instantly adapting projection of digital information as an additional layer on top of the real world. The implementation of wearable AR — to convey instructions, guide employees and teach skills — will reduce costs in terms of time and resources, while allowing lower-trained employees to perform more complex tasks.

ARIA works with a number of partners to develop a complete industrial AR system. Each partner specializes in different applications of technology related to AR use in the workplace. While the project has studied all aspects of AR application in

industrial settings, it focused specifically on the use case of modular industrial cooling installations, as they are a crucial element of most chemical plants.

The ARIA consortium consists of a multidisciplinary team of experts from areas as diverse as IT, research and market integration. It intends to play a key role in the development of AR/VR applications in Flanders and make a significant contribution to the Industry 4.0 policy — a global initiative that encourages the application of new technologies and processes to optimize data exchange and industrial processes in the digital age.

AR technology has the ability to revolutionize industry, ultimately empowering an agile workforce by providing access to synchronized intelligence, learning on-the-job like never before and receiving reactive, on-the-spot support in the performance of complex procedures.

THE OUTCOMES

1. The localization software accurately positions the employee relative to the installations

When a trainee puts on a headset or picks up a tablet, the device needs to be aware of its environment and know at any point in time where it is located in the plant. Traditional localization algorithms are based on GPS, but such a system would not function adequately for this application. First of all, the device is designed for inside use causing GPS signal attenuation. Moreover, inside the plant are many reflective metal surfaces which can interfere with the reception of the signal. Finally, an accuracy in the range of meters is not sufficient for a technician servicing an installation.

Rather, the ARIA-project proposes a visual software solution. The newly developed algorithms locate the device based on visual information in the surroundings, such as a set of pipes or certain machines or installations.

2. The ARIA-device features a state-of-the-art object recognition algorithm

Knowing the device's exact location in the plant alone is not sufficient. When new objects appear in the environment or when they are moved to a different location, the device also needs to be able to handle this new information.

Therefore, the ARIA-consortium developed an object recognition algorithm based on artificial intelligence that searches through a database of objects. It can identify objects from different view angles, even when there is a mere family resemblance.

By extension, in combination with the localization algorithm, this algorithm can also be used to verify the correct location of equipment and installations, or even in other sectors. Think about an AR-experience in tourism when visiting a historical building or an unexplored city.

3. The ARIA-project integrates different technologies offering a customized semi-automatic solution for industrial applications

The ARIA-project built a concrete interface for maintenance procedures in a chemical plant. Using existing hardware (Microsoft's HoloLens), ARIA developed state-of-the-art algorithms and integrated them into a working proof-of-concept, diversifying the skillset of personnel dramatically.

Additionally, the concept can be seamlessly integrated into the existing maintenance procedures in the plant. Typically, this involves a great deal of paperwork logging the intervention. ARIA offers a semi-automatic solution. The maintenance technician now follows the correct procedure on the headset or tablet, while the device logs every action. This makes the intervention at the same time a whole lot safer, as the device follows up on the steps and safety procedures. Something that is easily overlooked on paper.

NEXT STEPS

The ARIA-consortium will continue to improve on the basic techniques while adding new functionalities to the device. First, they will continue their work on the object recognition algorithm, which is already very good, but still has difficulty identifying small details. Secondly, they will add an augmented support function. This functionality allows the user of the device to contact a specialist in real time while operating or servicing installations. The partners strongly believe in the potential of AR for industrial applications.

FACTS

NAME	ARIA
OBJECTIVE	Introducing augmented reality into industrial maintenance procedures
TECHNOLOGIES USED	Microsoft's HoloLens, Quasar GPU-accelerated image/video processing, deep learning frameworks Caffe and YOLO
TYPE	imec.icon project
DURATION	01/04/2016 – 31/03/2018
PROJECT LEAD	Benny Lauwers, Viu More (Impala)
RESEARCH LEAD	Jan Van Looy, mict, an imec research group at Ghent University
BUDGET	2,126,881 euro
PROJECT PARTNERS	Evonik Degussa Antwerpen, Neopica, Viu More (Impala)
RESEARCH GROUPS	mict and IPI, two imec research groups at Ghent University; ETRO, an imec research group at VUB

ARIA project partners:



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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