

Brief approach to the applicability of Augmented Reality to the maintenance function

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1. INTRODUCTION

In an increasingly digital world, where access to information or the most varied services is quickly guaranteed through a device with an internet connection, we notice a greater need to obtain answers in almost real-time when performing simple day-to-day tasks.

In a professional context, we experience the need for shorter response times to the challenges we face, and there is a natural propensity to equip ourselves with emerging technology.

Consequently, the rapid technological development that we have been witnessing has brought us face to face with a new reality, Industry 4.0, which aims for a set of technologies - such as Artificial Intelligence, Machine Learning, the Internet of Things, the Point Cloud or Augmented Reality (AR), devices and processes to be able to operate in an integrated manner throughout the various stages of the production process and the various levels of the value chain, allowing for self-sufficient production, integrated operations, decentralized decisions and minimal human intervention [1].

This article will focus precisely on Augmented Reality. It will expose this technology, its presence in our daily routines and the impact it has been having in several industries, specifically in the Maintenance sector.

2. WHAT IS AUGMENTED REALITY?

Augmented Reality, one of the biggest trends in technology today, with a huge growth potential, consists of adding virtual elements, interactive or not, to the real world. Naturally, this potential will depend on the hardware required to materialize this technology.

Augmented Reality images can be accessed in a variety of ways, either through glasses designed for its use or other devices (such as displays built into helmets), although the most common way today is through a smartphone where we can immerse ourselves in a wide variety of applications and games. However, some programs of a more technical nature are beginning to emerge in various sectors such as the military, automotive, scientific and industry. Here are some examples:

- Navigation systems use AR to overlay a route and provide virtual cues to the driver in the real world;
- Military pilots use AR projections on their helmet displays to monitor data such as altitude and speed, thus avoiding taking their eyes off the control panels;
- Neurosurgeons use this technology for three-dimensional mapping of brains to assist them during surgery;
- In historical sites, AR can project scenarios depicting ancient civilizations overlaying the ruins;
- This technology is used by the aircraft manufacturer Boeing in the installation of electrical cabling in their airplanes, allowing technicians to visualize three-dimensional assembly diagrams interactively in real time and in a hands-free system [2].

3. AUGMENTED REALITY IN MAINTENANCE

Augmented Reality applications are taking their first steps in industries around the world, although they are present in large companies, usually leaders in various sectors, they are not yet utilized in smaller companies. However, the growing interest in this technology is beginning to be noticed.

Augmented Reality is a technology that focuses on the visual interaction between the real environment and digital information that can be superimposed on it, and it has been tested in several applications in industrial environments. Next, we highlight some usage scenarios in this context.

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Training new employees

The training of new collaborators is normally performed by an experienced employee. Training people reduces their availability for other important tasks. This process can, however, be carried out using equipment that supports Augmented Reality. With Augmented Reality, technicians can learn skills quickly. The interactive nature of AR allows for a deeper understanding of tasks. Augmented Reality can provide a safe and autonomous learning environment. This tool allows experienced employees to spend less time training, and more time providing valuable effort to important tasks in the company.

Better training using Augmented Reality reduces the chances of accidents. This technology allows employees to be better equipped with the knowledge needed to reduce equipment errors.

With three-dimensional modulation of equipment and visualization of assembly locations of the various components of a machine, a new employee can simulate real maintenance situations in a safer environment and practice error analysis so that they are prepared for any future equipment complications.

Highly specialized technical services provided remotely

In the equipment pool of the most diverse companies, in most cases, equipment from suppliers are spread across different parts of the world. In a scenario where the technical assistance of one of these devices requires the presence of a brand specialist, the need to travel between countries for assistance can be time consuming, and potentially cause complex logistics and higher costs.

Thus, using Augmented Reality devices, the technical specialist can intervene remotely to complete the task. They can assist the local operator in real time and indicate on the video image graphical indications of the necessary procedures and equipment components that need intervention.

Hands-free mode interventions

Better accessibility to technical material necessary in an intervention is a need that has been noted in the context of maintenance.

Using Augmented Reality to carry out maintenance work, technicians can use specialized glasses, through which they can easily access maintenance plans, technical manuals for the equipment or safety notes specific for each piece of equipment. These instructions are projected directly into their field of vision, allowing them to free their hands for the tasks they must perform.

All this information can now be transmitted through videos, photos, or even three-dimensional modeling that will allow them to see the various components that will be subject to intervention, for example, the disassembly steps of an oil filter in preventive maintenance, as well as its location in the equipment.

4. EXPECTED IMPACTS OF THE APPLICABILITY OF AUGMENTED REALITY IN MAINTENANCE

In the scenarios described above, the aim is, through their implementation, to reduce costs and increase process efficiency.

The cost reduction will result from the mitigation of human error caused by lack of experience, whether in training production operations or maintenance tasks. Through Augmented Reality, technicians will be able to simulate normal maintenance tasks in a controlled environment, thus avoiding immediate contact with equipment for which they are not yet qualified.

As already mentioned, specialized technical services provided remotely can reduce the costs of previously necessary trips by the technician(s) to the installation site. This dramatically reduces travel costs.

Regarding gains in productivity and efficiency, we can understand the fact that more experienced technicians, who previously would need to spend their time training new colleagues, can with this new tool dedicate themselves exclusively to their productive tasks.

The new employees can simulate scenarios of breakdowns or preventive maintenance tasks related to the components of each piece of equipment, allowing them to repeat each training scenario as many times as necessary.

In this way, they circumvent time constraints in a real world context, as they do not need to wait for the planned date for these tasks (in the case of preventive maintenance) or unpredictable breakdown scenarios (corrective maintenance).

5. CHALLENGES OF AUGMENTED REALITY APPLICABILITY IN MAINTENANCE

Despite all the potential that has been seen in the application of Augmented Reality, it is not immune to the challenges inherent in any change, especially when we talk about a standardized type of work and with ingrained tasks and behaviors such as those found in the maintenance area.

One of the most common challenges is the technicians lack of confidence when confronted with this new technology, due to the need to adapt to new equipment and learn new procedures.

Another constraint that has been observed in the field is related to the fact that Augmented Reality is a technology that combines gestural interaction with vocal commands, a feature that can be difficult in an industrial context. Equipment noise is one difficulty technicians may face when using this technology.

Also, the mandatory use of personal protective equipment such as helmets, gloves or goggles in certain contexts presents a difficulty in the operation of this technology, making it more challenging to adapt devices that support Augmented Reality to safety equipment, ensuring the functionality of both.

The models of this technology equipment used, if not suitable for the type of work for which they will be required, can also be uncomfortable which might cause the operators to reject this equipment.

5. FINAL CONSIDERATIONS

The current applications of Augmented Reality to the maintenance function hold great potential for replacing or improving methods that are beginning

to be inefficient, making this technology (among the technologies that are part of Industry 4.0) probably the one that is at a more advanced stage of development. The easy adaptability of this technology to various scenarios has contributed to the development and evolution of the capabilities of the equipment.

Despite the current challenges presented, Augmented Reality is a technology that revolutionizes the way information on terrain is accessed. However, this information needs to be documented, accurate and easy to interpret. As mentioned above, the devices used and the necessary training for users will also have to be considered.

These are some of the fundamentals that will make this technology an indispensable tool for the maintenance of the future.

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