EXECUTIVE SUMMARY

Real World, Augmented Reality, Augmented Virtuality, Virtual Reality . . . How Many Realities Can You Have in Industrial Automation?

Simone Gianotti, Business Development Manager, Digital Offer Industry, USA, Schneider Electric

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KEY TAKEAWAYS

• We have entered a fourth industrial revolution, the Industrial Internet of Things (IIoT).

• Virtual reality, augmented reality, and other realities are a big part of this revolution.

• Reducing maintenance costs is one of the main use cases for AR.

• AR captures institutional knowledge and helps new employees get up to speed.

• Today the most common AR implementations involve goggles or tablets/smartphones.

• AR and VR are not passing fads. They are here to stay.
OVERVIEW
The fourth industrial revolution is well underway. It focuses on digital transformation and creation of the Industrial Internet of Things (IIoT). A key part of this revolution is technology that enables new realities—including virtual reality (VR), augmented reality (AR), and mixed reality (MR).

These new realities are already being applied in industrial settings and are poised to grow exponentially in the next few years. Common use cases include deploying augmented reality to dramatically decrease maintenance costs and rapidly expedite the learning curve of new hires.

Those companies that adopt these new technologies have the potential to realize significant financial benefits, to differentiate themselves, and to create competitive advantage.

CONTEXT
Simone Gianotti described what virtual and augmented reality are and discussed the role they are already playing in industrial automation.

KEY TAKEAWAYS
We have entered a fourth industrial revolution, the Industrial Internet of Things (IIoT).

Humanity has previously gone through three industrial revolutions:

- First industrial revolution was based on steam power and mechanization.
- Second industrial revolution was driven by electricity and mass production.
- Third industrial revolution was based on computers, robotics, and the introduction of automation.

This fourth industrial revolution also involves digital transformation. It includes smart production, empowered users, optimized assets, and creation and use of digital products.

Virtual reality, augmented reality, and other realities are a big part of this revolution.
Throughout the first three industrial revolutions the only type of reality was the real reality. But this has changed, as technologies now enable new types of realities.
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The lines between augmented and mixed reality are blurred. For simplicity, people in industrial automation refer to all mixed and augmented reality as “augmented reality.”

The four most common ways in which industrial automation uses AR are:

- **Variables monitoring** to show how well assets are working. Includes key performance indicators (KPIs), assets status, warnings, and alarms.
- **Maintenance documentation and tasks.** AR can be used as a documentation repository and can store step-by-step maintenance processes and procedures. It can also enable safe maintenance solutions by virtual access to a system that would otherwise require strict safety processes.
- **Operation using standard sequences that can be visualized to drive quality, efficiency, and accountability.**
- **Training through how-to-videos and operational sequences that can be followed safely and securely.**

Reducing maintenance costs is one of the main use cases for AR.

AR addresses one of the biggest maintenance challenges companies have: reducing the time and cost spent on the maintenance process.

Today, before maintenance is performed on a piece of industrial equipment, significant time must be spent finding information about the equipment, such as electrical schematics that should be attached to the equipment door but have been removed. By offering these schematics in AR, workers no longer waste time hunting down schematics and can, instead, start working on problem solving. This use of AR can potentially reduce maintenance costs by 50%.

### New Types of Realities

<table>
<thead>
<tr>
<th>Reality Type</th>
<th>Description</th>
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| **Virtual Reality (VR)**     | - VR is a complete immersion experience that puts people in a fully digital world and shuts out the physical world.  
                               | - An example is a game where participants use a light saber. (See video)   |
| **Augmented Reality (AR)**   | - AR is an overlay of content on the real world, but the real-world content and the computer-generated content are not able to respond to each other. An example is Pokémon Go. |
| **Mixed Reality**            | An overlay of computer-generated content on the real world. The real-world content and computer content are able to react to each other in real time. An example from a televised football game is the computer-generated yellow first down line that appears on the screen (but not on the actual field). |
| **Augmented Virtuality**     | - Predominantly virtual space, where real-world elements can be dynamically integrated. An example is a VR experience that involves other senses like touch or smell. |
Augmented reality can reduce by a lot and potentially completely eliminate the time wasted looking for information.

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**AR captures institutional knowledge and helps new employees get up to speed.**

Industrial workforces are aging and workers are retiring. When workers retire, their knowledge leaves with them. A challenge is capturing this knowledge and transferring it to new hires. Augmented reality provides a solution.

Augmented reality cannot do much about aging, but can help with the transfer of knowledge.

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One Schneider Electric customer is solving this problem by providing cameras to its experienced maintenance people. Every time an experienced person maintains equipment, they record a video. These videos are compiled in a “how to” database. Videos in the database can be accessed as needed. Also, the company has linked alarm conditions to associated videos. When a specific alarm occurs, AR can immediately find the right content for an employee to troubleshoot and solve the problem.

AR solutions can significantly decrease the learning curve, providing new employees with the information they need when they need it.

**Today the most common AR implementations involve goggles or tablets/smartphones.**

When implementing AR, today’s users are most likely to use a tablet/phone or goggles. The needs of the business and users, as well as costs, will typically drive which AR solutions are put in place.

### Pros and Cons of AR Implementation Solutions

<table>
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<tr>
<th>Goggles</th>
<th>Tablet/smartphone</th>
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<tbody>
<tr>
<td><strong>Pros</strong></td>
<td><strong>Cons</strong></td>
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<tr>
<td>- Hands free allows user to perform tasks with hands while looking at information in real time.</td>
<td>- Safety concerns as some goggles impair lateral vision, and real-time information or videos in direct line of sight can be distracting.</td>
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<tr>
<td>- Easier to use for remote assistance. Built-in headphones/microphone allow user to talk with a remote operator; camera allows remote operator to see what user is seeing.</td>
<td>- Ergonomics; head movements are often awkward, which can cause discomfort.</td>
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<tr>
<td><strong>Cost</strong> can be prohibitive at $3,000 to $5,000.</td>
<td>- Not hands free, which means device must be put down to perform an operation.</td>
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<td><strong>Safety</strong>. The device needs to be put down when performing a task, which allows worker to focus on the task at hand.</td>
<td>- Remote assistance is more complicated. User needs to hold tablet in the right place to show remote operator what they are seeing.</td>
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<td><strong>Cost</strong> can be low, especially if refurbished devices are used.</td>
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AR and VR are not passing fads. They are here to stay.

AR and VR are still early in their adoption phase for industrial automation, but research indicates that the VR and AR markets will grow significantly over the next five years.

<table>
<thead>
<tr>
<th>Projected VR and AR Markets ($ billions)</th>
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<tr>
<td>2018 (actual)</td>
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<tr>
<td>VR</td>
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<tr>
<td>AR</td>
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AR and VR are still early in their adoption phase for industrial automation, but research indicates that the VR and AR markets will grow significantly over the next five years.

In addition to the use of the new realities by end users, there are also significant opportunities for original equipment manufacturers (OEMs). OEMs can leverage AR for internal production lines, reaping the same benefits as end users in optimizing machine production, minimizing maintenance costs, and increasing profitability.

Jumping into AR and VR also allows OEMs to differentiate from competition by selling innovative services and technologies. And, providing these new technologies helps increase customer satisfaction.

Both VR and AR are going to become more important in the market. This is the right time to take the first step and become one of the early adopters.

Simone Gianotti

ADDITIONAL INFORMATION

To learn more about industrial automation and opportunities in AR and VR, contact Simone Gianotti at simone.gianotti@schneider-electric.com.

Also, connect with Simone about visiting Schneider Electric's Lexington Smart Factory in Lexington, Kentucky.

BIOGRAPHY

Simone Gianotti

Business Development Manager, Digital Offer Industry, USA, Schneider Electric

Mr. Gianotti’s professional experience started as an application engineer for Motion and Automation, working with customers on the factory floor to help develop and commission the software for machines in the material working, material handling, and packaging segments. Moving into a position as a Trainer brought Simone to acquire international experience traveling to Europe, Asia and eventually to America where he moved in 2009.

As the next step, Mr. Gianotti moved to Product Management and Marketing, first as responsible for the Safety offer and then as Offer Manager for Motion. As Motion Product Manager, Simone has witnessed the development of the first Smart Machines, and joined the Schneider Electric’s Global group in charge to develop that concept for the Machine Builders. The activity as a member of the Smart Machine group brought Simone to explore more and more the IIoT and the Industry 4.0 worlds, leading to the new role within Schneider Electric as Business Development Manager for the Industry Digital Offer for the US.