Closing the gap between engineering practice and augmented reality

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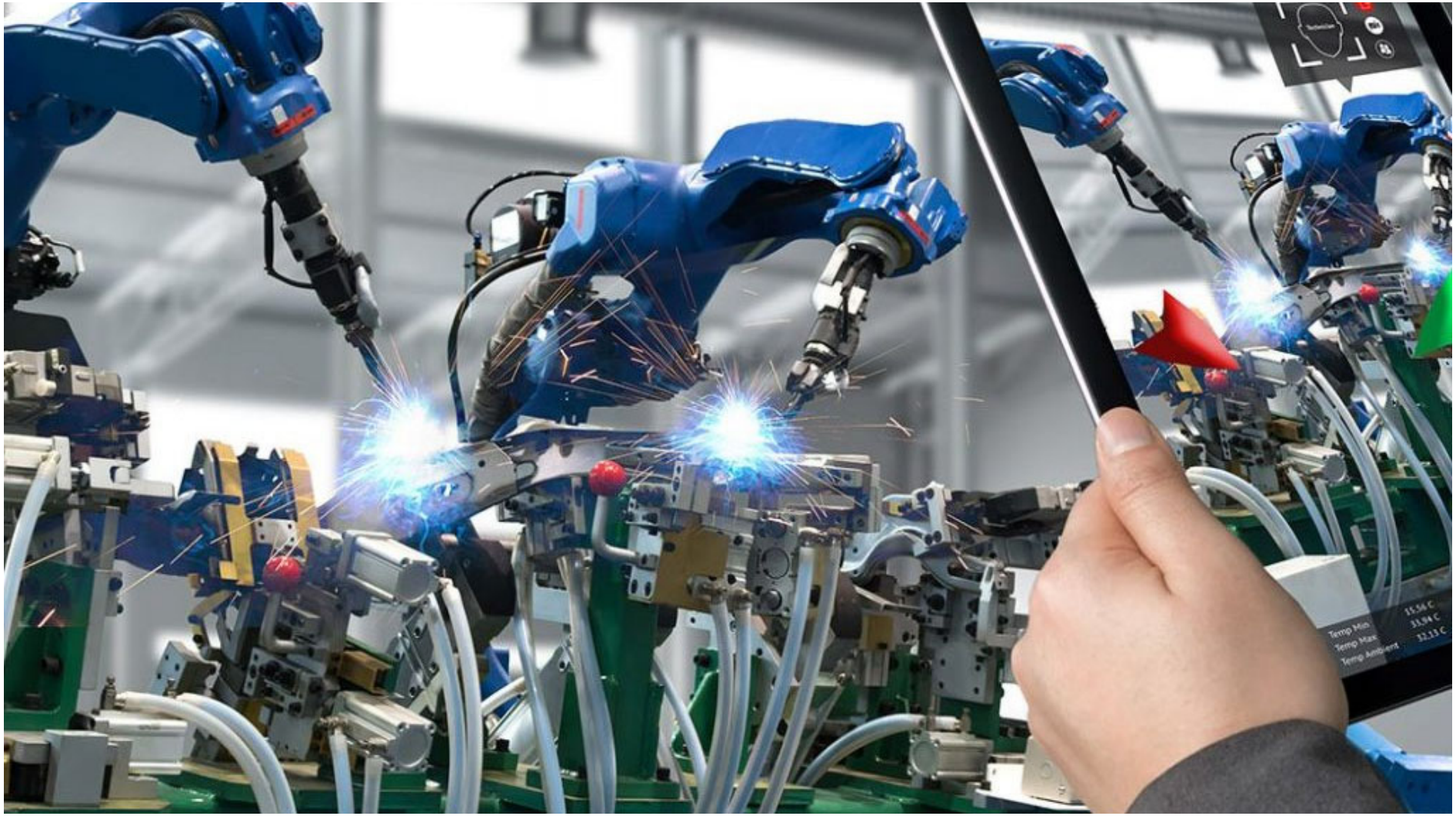


What's holding up the proliferation of industrial AR to the depths of manufacturing supply chains? William Bernstein and Christine Perey from the Augmented Reality for Enterprise Alliance (AREA) argue it's all about a lack of interoperability.

Augmented reality (AR) has arrived. If you recently purchased a smartphone, all the technology necessary to construct and interact with a meaningful virtual scene likely sits in your pocket.

Recent advancements in camera technologies, computer vision techniques, AR software development kits, and digital content availability, to name a few examples, have nearly made AR ubiquitous in consumer markets.

Early AR adopters in manufacturing, for example, have already demonstrated the value of AR in an industrial setting. In one study, Boeing reported a 30% reduction in the time required to build an aircraft wing with AR.

Past articles in *The Manufacturer* magazine have featured the use of AR and have quoted experts in automotive such as Bertrand Felix from Volvo Group in May 2021.

Such victories have caught the eyes of corporate boardrooms. IDC projects a 78.5% global spending increase on AR/VR in 2021. So, what's holding up the proliferation of Industrial AR to the depths of manufacturing supply ch including small-sized contractors? In one word, interoperability. Or, more precisely, the lack thereof.

Interoperability

For decades, the engineering design and manufacturing communities have tussled with one another. These “battles” have mostly centered around appropriately describing design requirements in formal documentation and, more recently, through validated, computer interpretable models.

To avoid rework and back and-forth communication across the “wall” between engineering and fabrication, standards development organisations (SDOs) continue to focus on holistic and persistent descriptions of design and fabrication requirements.

In complex assemblies, dealing with engineering change across a distributed production network remains a challenge. Engineering software platforms have made significant progress in addressing interoperability in their own suite of tools.

However, as the manufacturing industry continues to trend towards more distributed operations, many of these efforts fail when developers must work across platforms.

Image courtesy of XR Expo/Unsplash

For Industrial AR, the interoperability challenge is compounded. Similar to the incompatibility of tools for engineering design and fabrication, AR authoring suites often force developers into a silo, which can lock the customer into a particular platform and framework.

The lack of suitable interoperability for AR in Industry 4.0, and manufacturing in particular, is costly. For example, recreating the same virtual scene in two different game engines requires significant rework or manual labour.

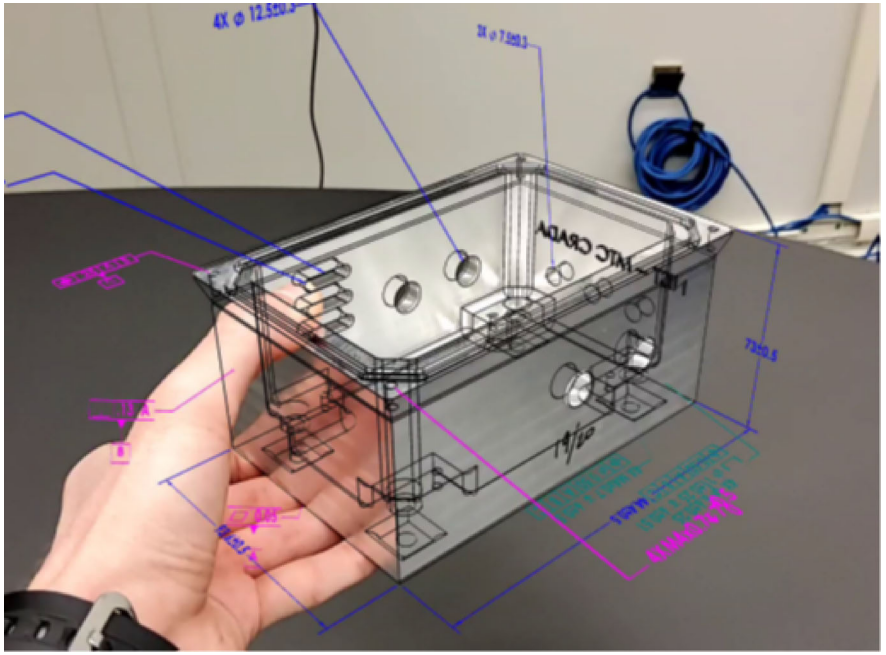
Connecting these two software-based “worlds” of engineering practice and AR development is the moat. Take the two popular manufacturing-specific Industrial AR use cases: Maintenance and assembly instructions.

Both use cases often require detailed animations to provide task instructions to workers on the production floor or at a job site.

The digital thread

As described earlier, one-off AR installations have already demonstrated significant value. Unfortunately, the fragility of such installations is apparent and often acknowledged by their developers.

If the reference data and models change and the use of AR is to continue, the assets of the AR experience must also be modified. However, automated and persistent data linking, often referred to as the “digital thread,” has not yet been realised.



Maintenance and assembly instructions are two popular manufacturing-specific industrial AR use cases

As a result, the skills of software engineers are required again to debug and address any broken relationships between the source material, e.g., design models and process plans, with AR presentation objects.

This barrier also affects the reproduction of practically the same AR interactions in a similar (but different) product system.

A coalescence of standards will help overcome this moat. Adhering to the same analogy, the drawbridge between engineering practice and augmented reality must be automated. A recent workshop held at IEEE ISMAR 2020 aimed to bring both communities together to understand the key pain points.

Workshop participants represented diverse expertise, including geospatial information scientists, AR software architects, and manufacturing engineers. Outcomes suggest that much of what's needed to realise an AR-capable digital thread is already underway across a number of SDOs, including but not limited to the Khronos Group, International Organisation of Standardisation (ISO), and the Open Geospatial Consortium (OGC).

The future of AR and manufacturing

For example, efforts of particular note include neutral data formats for:

- Linking rich reference data to lightweight presentation modalities, such as Khonos's glTF

- Describing engineering design, execution, and inspection data, such as STEP and QIF, which are all ISO recognised, and

- Representing and messaging spatial information, such as OGC's SensorThings API, IndoorGML, and GeoPose efforts.

In reality, these standards efforts, and many others not mentioned here remain disconnected from each other and have yet to be adopted in the manufacturing and digital design tools.

Moving forward, manufacturing industry stakeholders and standards working groups must plan for adoption of emerging technologies, such as Industrial AR.

Without proper planning, achieving interoperability between domain-specific models, such as those used in manufacturing, and advanced presentation systems, such as AR, will remain locked up in testing facilities, prototypes and pilot projects that never reach scale and deliver on the promises they hold.

And, without interoperability, manufacturers will continue to struggle with improving the maintainability, reproducibility, and scalability of Industrial AR installations.

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