WEBINAR

Augmented Reality in Future Factory

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FutureBridge

What We Do

FutureBridge tracks and advises on the future of industries from a 1-to-25-year perspective

How we do it?

- Proprietary platforms, data, global ecosystems and player relationships
- Data and analysis driven actionable Insights and strategy
- Technology adoption facilitation frameworks and models
- Global start-ups, technology partners and developers' network

Future of

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01 Key technologies impacting the factory domains

Factories of the Future – Key Domains

Tasks in manufacturing can be broadly classified into three categories – Unified Business Platforms, Process Monitoring and Control, and Handling and Manipulation; Cutting across all these tasks are the exponential & converging technologies like AI, XR, Robotics and IoT

Transformation	Business Platform	Process Monitoring and Control	Handling and Manipulation
Augmented Reality			
Industrial IoT	▪ ERP, MES and operations planning ▪ Product development and prototyping ▪ Logistics, warehouse & inventory management ▪ Knowledge management ▪ Training and support	▪ Machine monitoring and maintenance ▪ Quality control and advance sensors ▪ Machine operation and process control ▪ Health, safety and environment management ▪ Physical security, record keeping and data entry ▪ Traceability	▪ Loading, unloading, stacking ▪ Conveying and warehousing ▪ Segregation, mixing, manipulation, pick and place ▪ Cleaning, washing, painting ▪ Labor intensive tasks ▪ Repetitive desk tasks
Robotics			
AI & ML			

02 Augmented Reality – Elements and Types

Augmented Reality Technology: Types

Augmented Reality technology can basically be divided into three types – digital on digital, digital on real and real on real.

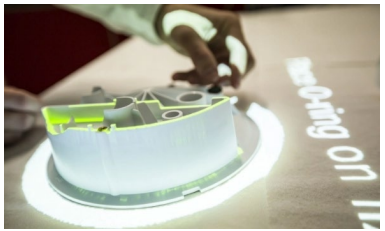
Digital on Digital

- Digital augmentation on digital world
- Interaction via a tablet or smartphone
- Easy to implement
- Limits user's dexterity

Digital on Real

- Digital augmentation on real world
- Interaction through headsets, glasses or HUDs
- No need of handheld device or controller
- Allows simultaneous performance of tasks

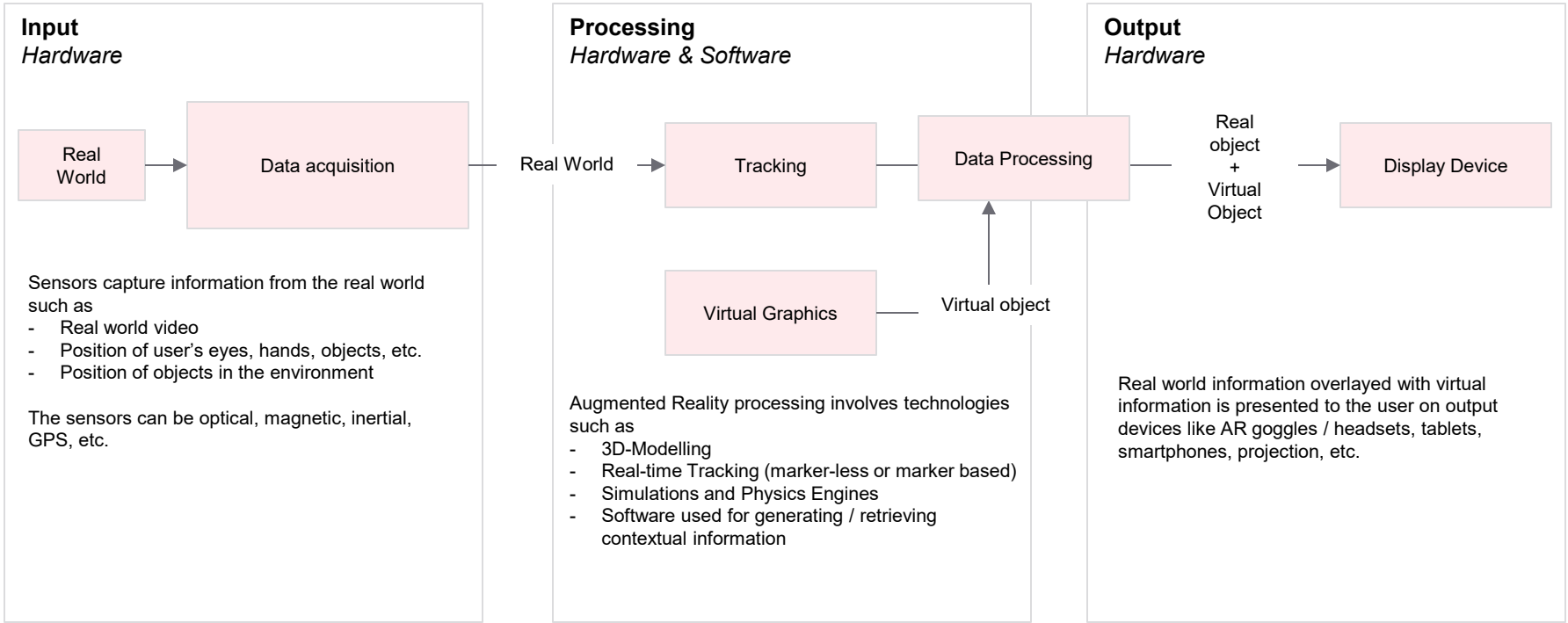
Real on Real



- Interactive AR object is displayed on a surface.
- Can be viewed by multiple people at the same time.
- The technology is used for purposes like testing, training, inspection, and maintenance.

Augmented Reality Technology: Process

Augmented Reality superimposes digital visuals over a user's view of the real world, allowing images, sound, video, animation, text and many other data types to surround a user in a responsive way.

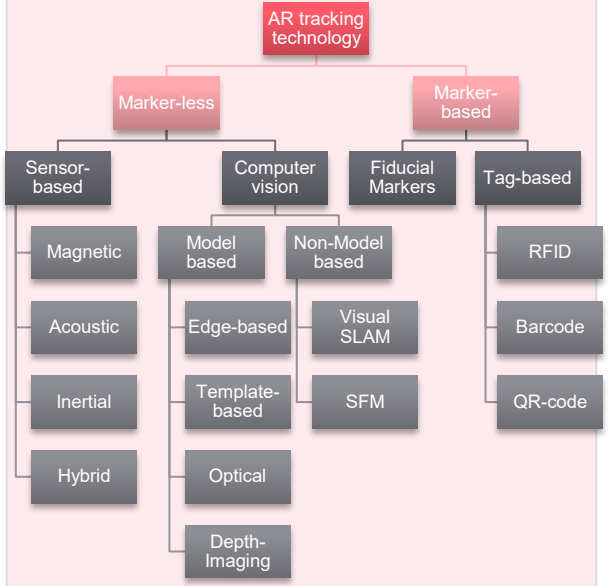


Augmented Reality Technology: Components

Augmented Reality superimposes digital assets over a user's view of the real world, allowing images, sound, video, animation, text and many other data types to surround a user in a responsive way.

Input Devices and Technology

In AR, tracking is required for placing virtual objects in the real environment and display of the virtual content to the user.



Software

AR Devices require software to project computer-generated objects into the real world and generating contextual information.

Few examples of AR software are presented below

- Frontline
- Manifest
- smartAR
- acty
- Vuforia
- FactoryOptix
- SARA
- Plantweb Optics
- TeamworkAR

Output Devices

Output devices are used for presenting the augmented reality content. The devices are of three types

	Camera equipped display devices like mobile phones, tablets are one category of output devices.
	Specially designed AR glasses and headsets worn by users for viewing the AR environment.
	AR content is projected over a surface.

03 Augmented Reality – Use cases

How is AR helping the future factories

Work Assistance

Digital Work Instructions
Extending the real world with digital 3D models, images, and text to guide user in executing instructions

Workflow Improvement
Removing or streamlining tasks (e.g., logging, lookup tasks etc.)

Work progress Monitoring
Displaying annotations and graphics related to state of process, component or operations to enable global understanding of facilities and processes

Maintenance, Quality and Inspection

Repair and Maintenance Operations
Analyzing the quality of equipment and Process therefore aiding by following consecutive instructions

Quality and Inspection
Assisting operators to quickly get information on equipment or product status or classification

Preventive Maintenance
Providing instruction to guide the technician to aid in the maintenance by displaying corrective inputs

Remote assistance and training

Learning and Training
Enhances the learning and evaluation by creating Virtual environment

Troubleshooting
Guiding the operator through the issues and assist the workers with item identification and labeling.

Remote Assistance and Expert Support
Helping technicians gain immediate access to remote experts when necessary to streamline the field service process

Product design and Assembly

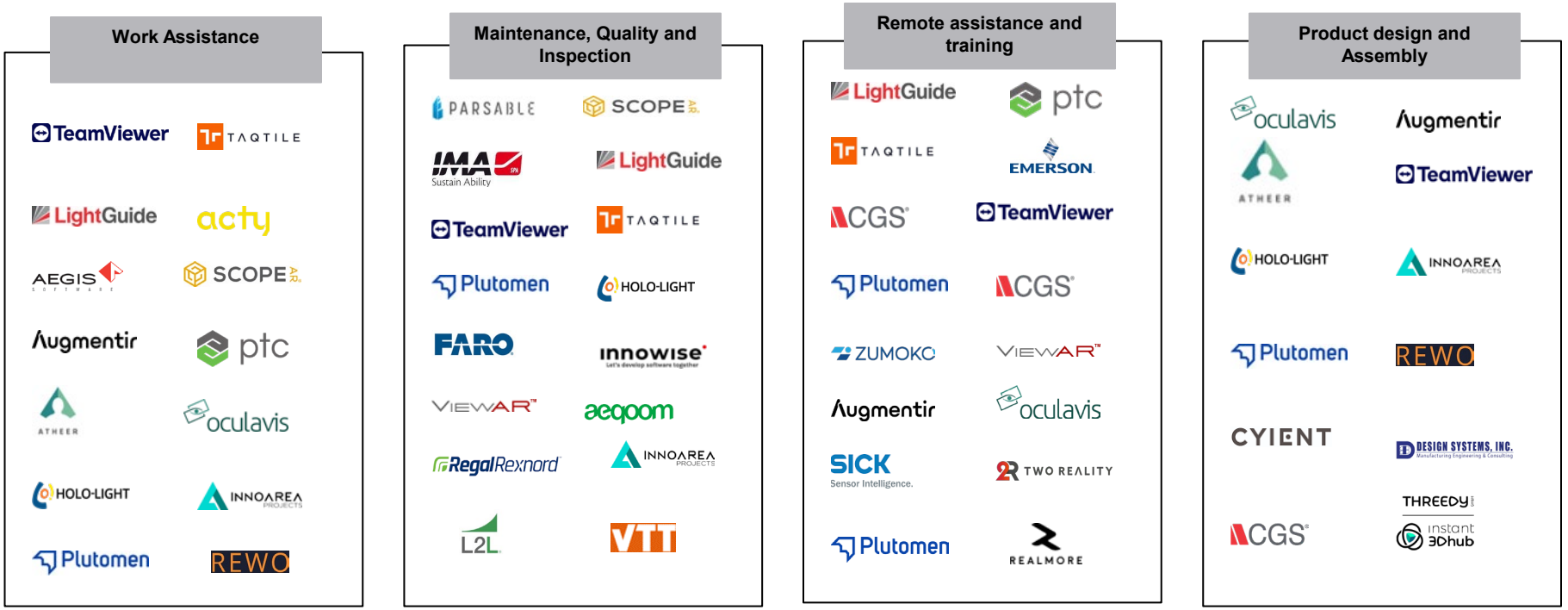
Assembly Operations
Identifying items and automatically calling the appropriate job instructions

Product design
Modeling and visualizing the designs relative to real or virtual backdrop

Inventory Management
Extending the view with detailed information about quantity, criticality or other details of raw or finished stocks

AR Solution Providers

Multiple players are developing AR applications for different factory operations. The infographic below captures few key players proving solutions for different categories.



Work Assistance

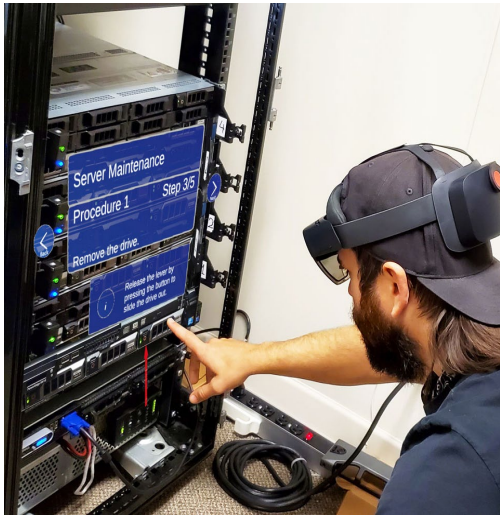
AR based work instructions provide guidance through standardized processes allowing better performance of workers and improved workflow.

Uses

- Improving operating time and operator efficiency through step-by-step manufacturing work instructions
- Assists on-site technician and expert to work together in a live, real-time context for equipment repair, training, or support
- Encourages peer-to-peer collaboration
- Allows working without the need to leave the workstation

Advantages

- ✓ Real-time access to work instructions and contextual knowledge
- ✓ Improved efficiency and faster decision making
- ✓ Improving service quality & time
- ✓ Hands-free voice-controlled viewing



Industry Implementations

Rockwell Automation — Uses PTC Vuforia's software to eliminate mistakes through the modernization of traditional training and instruction techniques. Real time access, CAD based work instructions.

CATERPILLAR® — Augmented reality smart instructions and live support video calling solutions in collaboration with Scope AR.

Maintenance, Quality and Inspection

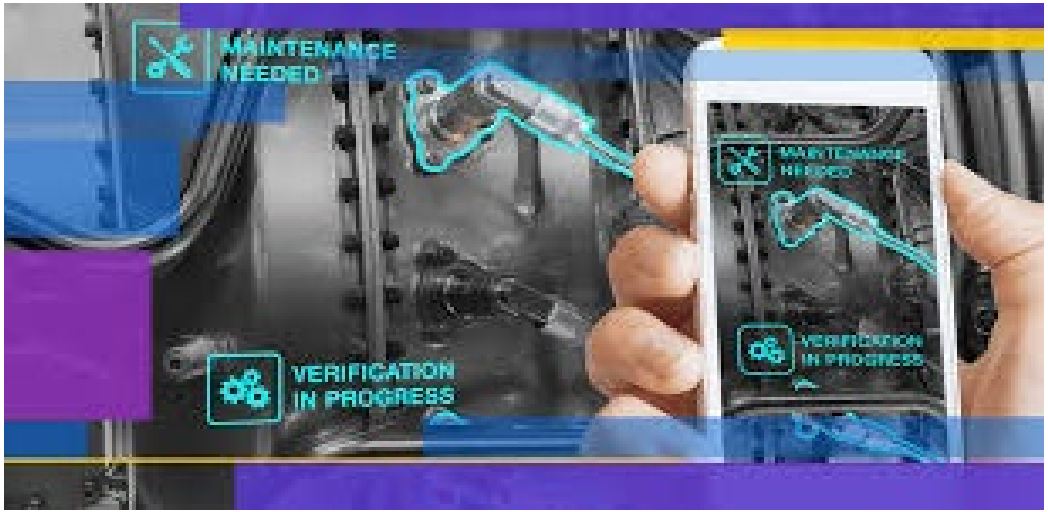
AR assisted maintenance and quality assurance is a quick and efficient solution and ensures that complex processes are smoothly taken care of.

Uses

- Integrate with 3D vision cameras and AI / ML to identify errors.
- Automated logging during maintenance process
- Consistent execution of standard maintenance, quality and inspection procedures
- Augmented reality maintenance-support system reduces effort and eliminates entry mistakes because information can be submitted by speech, even in noisy surroundings

Advantages

- ✓ Predictive Maintenance
- ✓ Hands-free task monitoring
- ✓ Instant report creation
- ✓ Quality ensured at each step thereby resulting in a completely error free product.
- ✓ Consistency ensured across different models.



Industry Implementations

thyssenkrupp

Partnership with Microsoft, predictive elevator maintenance. Thyssenkrupp has been able to cut the time of typical service calls by 4 times.

AIRBUS

Airbus developed MiRA to achieve standardize quality assurance. Examination of 60,000–80,000 brackets on an A380 fuselage in three days as opposed to three weeks.

Remote assistance and training

AR can prove to be extremely helpful in training new employees through necessary procedures, protocols, and equipment. AR powered training provides step-by-step guidance along with documentation and additional resources.

Uses

- Real-time, hands-free, interactive 3D schematics for upskilling
- Receive remote support from any location
- Creation of new training programs
- Access to scale models of factory equipment for learning purpose
- Allows assess to ergonomics of simulations in real-world
- Enables real-time cooperation with other immersion rooms that can access the 3D models

Advantages

- ✓ Reduction in mistake rates in remote collaboration
- ✓ Improved training of workers through close to real experience
- ✓ Increased workforce effectiveness and efficiency
- ✓ Reduced travel burdens

Industry Implementations

BOEING

Receive real-time, hands-free, interactive 3D wiring schematics utilizing Google Lens and upskill software. Mistake rates reduced to zero.

JAPAN AIRLINES

The Microsoft HoloLens virtual reality headset has been used by Japan Airlines (JAL) to create new training programs for trainee engine maintenance and flight crew.

Product design and Assembly

AR simplifies the product design phase and makes multiple revisions of product design. Further, AR assist in streamlining the assembly process.

Uses

- Allows creation of comprehensive 3D models, as well as prototypes.
- Allows actual geometries to be overlaid with true-to-scale holographic 3D models, allowing a variety of concept variants and assembly procedures.
- Each component design and functionality may be evaluated in the AR model itself by simulating different situations.
- Receive fully contextualized work instructions for complex assembly tasks

Advantages

- ✓ Better collaboration between the engineers
- ✓ Save research and development costs by avoiding redesigns
- ✓ Reduce development time
- ✓ Consistency in the products manufactured

Industry Implementations

Improved quality of early concepts in design phase. Create a comprehensive 3D automotive model, as well as prototype and experience.

BMW employs Holo Light's AR 3S to accelerate processes from individual car pieces to complicated production stages for series production.

04 Cross technology trends

Augmented Reality and Technology Trends

Augmented Reality enhances the use cases with the help of other key technology trends like Robotics, Industrial IoT, AI & ML.

Robotics

Emerging trends:

- Robot training and programming using AR
- Using AR to understand the human robot interaction or factory implementation before investing in costly robots
- Control of obscured robot e.g., endoscopic surgeries, etc.
- Control of Collaborative and Swarm robots with AR

- **ABB's RobotStudio® Augmented Reality viewer** application enables its users to **visualize robotic solutions** in 3D mode or on shopfloor, speeding up design and commissioning.
- The app helps to increase collaboration in teams that are working in the plan & design phase based in various locations.

Industrial IoT

Emerging trends:

- Operations & Maintenance functions lead usage of AR to analyse and illustrate machine data
- Industrial Metaverse / integration with digital twins
- Increasing addition of QR code reading, RFID, and BLE capabilities in AR devices to communicate directly with physical asset

- **Intelligent maintenance** applications are now being developed by Valmet and tested at a mine site and a power plant in Finland.
- They support Valmet's strategy to make maintenance activities more effective and lower cost by utilizing intelligent products, tools and services

AI & ML

Emerging trends:

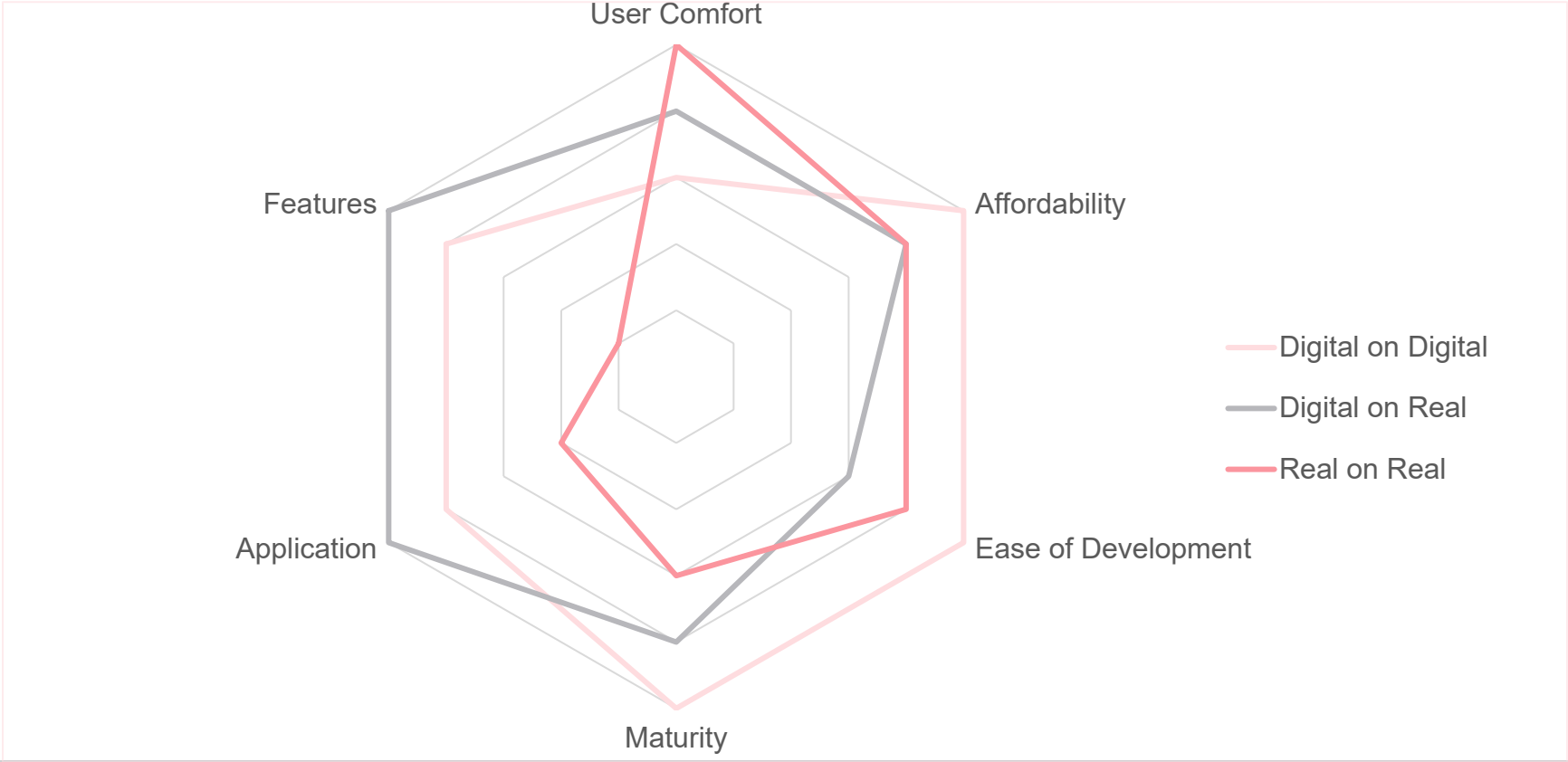
- Identification and labeling without the needs of IoT using machine vision AIs
- Physics simulation
- Using Generative AI technologies with AR
- Conversational AI getting integrated to AR headsets to provide a more seamless and productive AR application

- Digital work instruction software from Augmentir improves standardization and quality for inspection, setup, changeover, and maintenance procedures.
- **AI-based smart insights** identify productivity opportunities across work processes and the workforce.

05 FutureBridge Viewpoints

Types of AR technology: Comparative Analysis

The three types of AR technology i.e., Digital on digital, Digital on real and Real on real have been evaluated on five parameters.



AR use cases comparison

The 12 use cases of AR for future factories discussed previously have been evaluated based on their usefulness and technology readiness.

Recommendations for manufacturing companies to maximize value through AR

Augmented reality is an evolving technology and holds great potential for factory of the future.

Develop a digital manufacturing strategy	•Understand technology capability in the coming years and potential impact on industry and competition •Define broader vision
Find opportunities	•Value stream analysis - analyse tasks rather than processes or roles • Map need, potential impact or value created with augmentation (information, visual)
Imagine new workflows	•Reconsider existing processes in context of emerging technology capability and PESTLE scenario
Leverage convergence	•Using other technologies like machine vision, NLP, knowledge management etc. along with augmented reality will lead to powerful use cases.
Fail fast	•High speed implementation of MVP •Build using available AR hardware and software
Investment in skills	•AI, ML, data analytics teams •3D modelling, simulation, computer graphics, etc.

Q&A