

Status of the AR in Enterprise Ecosystem and What Can We do to Improve it!

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The AREA is...

...the only global, membershipfunded non-profit alliance dedicated to helping accelerate the adoption of Enterprise Augmented Reality (AR) by supporting the growth of a comprehensive ecosystem



66 members – 2 Dec '19



Augmented **Reality and the Gartner Hype** Cycle



Gartner Hype Cycle Curve for Emerging Technologies





2004 Hype Cycle AREA

2005 Hype Cycle



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2007 Hype Cycle



Hype Cycle for Emerging Technologies, 2007



2008 Hype Cycle







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2010 Hype Cycle

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2012 Hype Cycle

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Figure 1. Hype Cycle for Emerging Technologies, 2013



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2015 Hype Cycle

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Hype Cycle for Emerging Technologies, 2018



Time





augmented reality Best articles market

Augmented reality is reaching a mature state according to Gartner

🗂 September 4, 2019 🛔 Skarredghost 👒 AUGMENTED REALITY

According to the very famous market analysis company Gartner, Augmented Reality is no more an "emerging" technology, but it has graduated as a mature one.

This news comes one year later than a similar one regarding Virtual Reality: in a popular post of mine of 2018, I highlighted how in that year VR had disappeared from the Gartner Hype Cycle (the curve showing the current maturity status of all emerging technologies). This meant that for Gartner, VR was not an emerging

Improving Performance



Increasing Efficiency



Enterprises...

What are the current problems?

- Unable to find vendorneutral information
- Difficult to evaluate the tools available
- Lack of confidence in implementing new technologies
- Lack of insight and information to support ROI decisions

Providers...

What are the current problems?

- Difficult to access customers with an awareness of AR terminology
- Limited understanding of customer requirements
- Lack of awareness of other opportunities within the AR sector



Logistics Warehouse picking DHL - 25% productivity gains with fewer errors and moreengaged worker

Training Instruct and guide Boeing - 35% less time to train new staff than using traditional 2-D drawings Field Services Remote Assistance Xerox – 76% technical problems resolved without any on-site help

Inspection Final sign off Newport News - 96% reduction in inspection time (36 hours to 90mins) Field Engineers On site repairs KPN – **11%** reduction in overall costs for service teams use AR smart glasses

Medical Vascular procedures AccuVein - 45% less doctor escalations (calling for assistance)

Source - WHY EVERY ORGANIZATION NEEDS AN AUGMENTED REALITY STRATEGY





Manufacturing / Assembly

Description

AR-assisted assembly supports users in accomplishing manufacturing activities and product assembly processes, by augmenting key workflows and procedures using, where possible, existing technical publication repositories.

Benefits

- Reduction in errors
- Increase in completion time
- Highly skilled operatives
- Lower costs

Examples

- Perforation of steel plates in preparation for assembly
- Positioning and attachment of wire harness
- Welding of two or more parts in specific angles



Boeing Tests Augmented Reality in the Factory

January 19, 2018 in Innovation, Technology







Remote Assistance

Description

Remote Assistance enables field service personnel to effectively communicate with experts. Leveraging graphical overlays, work instructions, inspection sites and collaborative solutions can be simultaneously displayed between multiple parties.

Benefits

- Lower costs
- Less downtime
- Highly skilled operatives

Examples

- Real time collaboration between onsite and offsite expert.
- Real time direction, no need for time-delayed sending and receiving of images.
- Shared display of repair instructions





Maintenance

Description

AR-assisted article inspection and maintenance permits users to efficiently assess the quality of goods produced in manufacturing processes, or to assess the condition of assets as part of maintenance.

Benefits

- Lower costs
- Less downtime
- Highly skilled operatives

Examples

Using model-based object recognition, graphical overlays display the correct or optimal state of objects (as designed or planned) for purposes of comparison with the real world objects.







Inspection

Description

AR remote visualization processes personnel to more effectively communicate with experts. Leveraging graphical overlays, work instructions, inspection sites and collaborative solutions, simultaneously displayed between multiple parties, regardless of their locations

Benefits

- Lower costs
- Less downtime
- Highly skilled operatives

Examples

- Real time collaboration between expert maintenance personnel
- Real time display of approved modification to repair instructions for an onsite maintenance technician.



Supporting technologies

Supporting technologies

Gesture Control



Content development / extraction



How is the AREA helping to overcome barriers to enterprise AR adoption

Reducing Barriers to adoption - AREA Committees



Members only research

Research

Funds and organizes research programs that are defined and agreed upon by its members

- .. Security in wearables
- 2. Enterprise AR Calculator
- 3. Framework for AR Technology Safety and Human Factors

- 4. Overcoming Barriers to AR Adoption in Manufacturing Environments
- 5. Best Practices when Merging IoT, AI and AR in the Workplace
- 6. WebAR The benefits, challenges and next steps

member only research – wearable enterprise AR security





Technical Report:

Wearable Enterprise AR Security -Risks and Management





Technical Report:

Wearable Enterprise AR Security -Security Framework and Test Protocol **AREA** member quotes

"Security is forefront in today's world, and it's one of the areas that I get asked about most frequently."

"Good framework to specific challenges of bringing AR technology into the enterprise. Useful to guide for internal discussions with our customers & partners."

'Extremely in-depth look at both known and new areas when dealing with security in wearables." "Thorough analysis of what can go wrong in an AR system, along with direct recommendations to mitigate risks. Must-read for anyone working in this space!"

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"The AREA have begun the conversation about the mitigation steps that all players in the AR space can take."

"Key information from experts that I can apply to my business in real-time. They afford me a working team to forward think issues that may not even be on the business' radar."

Enterprise AR ROI Research



Member exclusive benefits

- Enterprise AR ROI Calculator
- Best Practice Report Public-released benefits
- AR ROI Case Study
- Best Practice Report Abstract

- Defines and answers common questions about how to measure
 ROI for enterprise AR projects in order to demystify ROI across industry and ecosystem
- By following the **best practices** and **guidelines** when **developing ROI estimates**, this supports internal decision makers, and assists customers and partners in the **development of ROI estimates for their AR projects**

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Overview of ROI Calculator





Technology ROI Increasingly Difficult



- Framework to aid in the assessing AR solutions for safety and human factors in industrial use-cases
- Generate **assessment tools** as part of the framework
- Promote a consistent
 approach to assessing safety
 and human factors of AR
 solutions across the AREA
 members and the wider AR
 community

Safety & Human Factors Framework



Framework - Mapped to conventional project cycle





Device Hardware Assessment - To Aid Device Selection

1. Assess Device for Environment		Notes	Device Safety Considerations	Main AR Risk/Hazard
1.1 What environment will the device be used in? Select from the f	ollowing:	Hazardous areas are defined as places where concentrations of flammable gases, vapors, or dusts may occur. Prevent sparks, discharges and self-ignition i.e. Zone 0, Zone 1, Zone 2	Device will require relevant hazardous environment protection rating	Device not certified for environment
Explosive gas area	P	Explosive gas area classifications are Class 1 Division 1, Zone 0, Zone 1, Class 1, Division 2 or Zone 2 (see ISO/EU regulations for full classifications)	Protection rating for explosive gas area for relevant environment of intended use (ATEX for EU, NRTL for US) Equipment may need to be flameproof (e.g. EX code d)	Device ignition/explosion
Explosive dust area	V	Explosive dust area classifications are Class II Divistion 1, Class II Division 2, Class III Division 1, Class III Division 2 (zone 20, 21, 22 and unclassified for USA)	Protection rating for explosive dust area for relevant environment of intended use (ATEX for EU, NRTL for US) Equipment may need to be flameproof (e.g. EX code d)	Device ignition/explosion
High tempature	×	The surface temperature or any parts of the electrical equipment must be lower than the ignition temperature of the ambient atmosphere.	Protection rating for temperature T1, T2, T3, T4, T5, T6	Device malfunctioning/overheating
Low temperature		The normal minimum ambient temperature according to IEC 60079-0 and standards adopted by US and Canada is -20 degrees celsius	Check manufacturer's advice on using device in extreme cold temperatures	Device malfunctiong/overheating
Energised environment		Working on or near live electrical equipment	Check Conductive properties of the device	Shock/Electrocution
Confined Environment	×			
Humidity/Moisture in environment	N		Level of moisture/humidity of environment and Ingress Protection rating of device	Shock/Device Malfunction
Cleam/sterile environment			Does the device meet clean room standards? Can the device be wriped clean/sterilised?	Device contamination. Shock/malfunction from sanitising device
Construction site	M		Typical Hazards such as slips, trips and falls and working at height - Does the device obstruct peripheral vision?	Situational Awareness/Distraction, Falls/trips, working at height
Warehouse	V		Typical Hazards such as moving vehicles, machinery and automation.	Moving vehicles, machinery and automation

Design Assessment - To Aid in the Safe and User-Centric design

1. Design for Environment	Notes	H&S Considerations	Design Safety Considerations	Main AR Risk/Hazard
1.1 Will the user be vorking in a hazardous environment?	₽	Hazardous areas can contain mobile vehicles, working near or on energised equipment, flammable environments, working at height, working near operating machinery, near hazards resulting in trips and falls etc.	Consider visual cues to alert user to hazardous materials or resouces within their device's FDV as they move around. Visual cues to remind user of safety protocols or capture user's attention.	duced situational awarness. Technology over-relia
1.2 ls the environment noisy?	v			
1.3 Is there a risk of damaging assets in the environment?	¥			
1.4 What are the current environmental risks and controls in place?	¥			
2. Design for User		H&S Considerations	Design Safety Considerations	Main Risk/Hazard
2.1How long will the device need to be worn at a time?	R			
2.2 Is the user prone to motion sickness?	×	Motion sickness is a risk with API. Some users may feel nausea and disorientation on first use of API/MR devices. This can go away after a few users as the user adjusts to wearing the device.	Communicate this and all risks to end-user. Ensure other device fuy Translating virtual movement into physical i.e. using haptics may relieve symptoms of motion sickness.	Motion Sickness
2.3 Does the user have a history of photosensitivity seizures?	×			
2.3 Does the user have any underlying vision impairments?	×			
2.2 Does the user need to work with others in a collaborative way?	el.			

4th AREA-directed Research Project

- Identification of and Strategies for Overcoming Barriers to AR Adoption in Manufacturing Environments
- Deliverables
 - Comprehensive report
 - Framework tool (using Excel)
 - Case study

Research Overview





Identification of **43 barriers** to AR adoption in manufacturing.

Next to strategic issues, i.e.

- Lack of Vision for AR
- Corporate Culture & Change
 Management
- Legal (workers rights)
- IT Resources

Worker Acceptance has been identified as highly relevant.

Quantitative Study

amongst workers AR user & non-user

STAGE 1

STAGE 2

Quantitative Study

Correlation – Relevance & Performance





Framework tool

AREA Member	AREA Member	AREA		
Bechmark Group (changes are visible in the graphs only)	All Workers Workers without AR experience Workers with AR experience	~		
	totally disagree	totally agree	SCORE	
AR RISK FACTORS				
AR devices are psychologically damaging.	<	>	5.0	
Using AR devices at work often strains me mentally.	<	>	5.0	
AR devices cause additional stress at work.	<	>	5.0	
Working with AR devices gives me the feeling of being controlled all the time.	<	>	5.0	
I have doubts as to how well my privacy is protected while using AR devices.	<	>	5.0	
I have doubts as to how well my workmates' privacy is protected while using AR devices.	<	>	5.0	
COVER COPYRIGHT WELCOME! ASSESS YOURSELF WITH SLIDERS VIEW	W ASSESSMENT OF BARRIERS VIEW	ASSESSMENT OF DRIVERS ' (+) :		

5th Research Project Topic

Best Practices when Merging IoT, AI and AR in the Workplace



Merging IoT, AI and AR





Merging IoT, AI and AR

- Connected workplaces produce copious real time data
- Few people are qualified to discuss state of the art in all three of these fields (what is the state of the art?)
- Not all "raw" data is appropriate for AR viewing
- Not all users should get real time data
- What are the best practices/recommendations to (begin to) sort this out?



Merging IoT, AI and AR

Stages of Machine Intelligence Source: AREA Research



Evolution of the IoT-AI-AR convergence Source: AREA Research



Use Cases and Companies Involved

Source: AREA Research

6th Research Project Topic

WebAR The benefits, challenges and next steps

Reducing Barriers to adoption - AREA Committees



Requirements

Owns and manages the global set of Enterprise AR requirements 1. Ecosystem Use Cases

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2. Schema of Needs

AR AT WORK

Use Cases

Ecosystem use cases

Enterprises around the globe are deploying Augmented Reality solutions to bring new productivity to a wide range of tasks and organizations.

We invite you to explore our growing catalog of use cases to learn how AR is helping companies today - and how it might be applied to your organization.

SEARCH BY:

SELECT INDUSTRY

SELECT TECHNOLOGY...

SELECT BENEFIT...



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DAMAGE ASSESSMENT (UTILITIES)

Use case and image contributed by Micah Tinklepaugh. Description When assessing damage from a storm, earthquake or other disaster, utility workers must estimate the time required to fully restore services. This estimate is based on: Pinpointing locations of service degradation Estimating damage to assets and...

VIEW MORE +



WORK ORDER CREATION (UTILITIES)

Use case and image contributed by Micah Tinklepaugh. Description In work order creation in utilities (electrical, water, natural gas and sewage), workers request, assign and track field service work by: Planning work scope Obtaining and scheduling resources Assembling needed documentation such as work instructions, forms...

VIEW MORE +



Reducing Barriers to adoption - AREA Committees



Safety

Identifying, classify and prioritize AR **safety risks** and developing risk reduction recommendations

Security

Identifying, classify and prioritize AR **security risks** and developing risk reduction recommendations



AR SAFETY RISKS IN INDUSTRY







New initiatives

- **1. Measuring Enterprise AR interest group** that will focus on developing the AREA ROI Calculator and develop more accurate enterprise AR industry analysis / figures
- 2. Interoperability and Standards Policy a process to help develop and support these important areas
- 3. AREA Increase Pool of Trained AR Professionals (Educate) Policy – supporting educational organisation to help educate the next skilled workers in AR
- 4. Development of the AREA Marketplace a tool to provide all the information needed to help enterprises develop AR solutions and connect them with the right providers



What Next?

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