DSC 2024 EUROPE VR
23rd Driving Simulation & Virtual Reality Conference & Exhibition

XR Trends: Challenges and Opportunities in the Automotive Industry

19 September 2024

James Oliver

Iowa State University

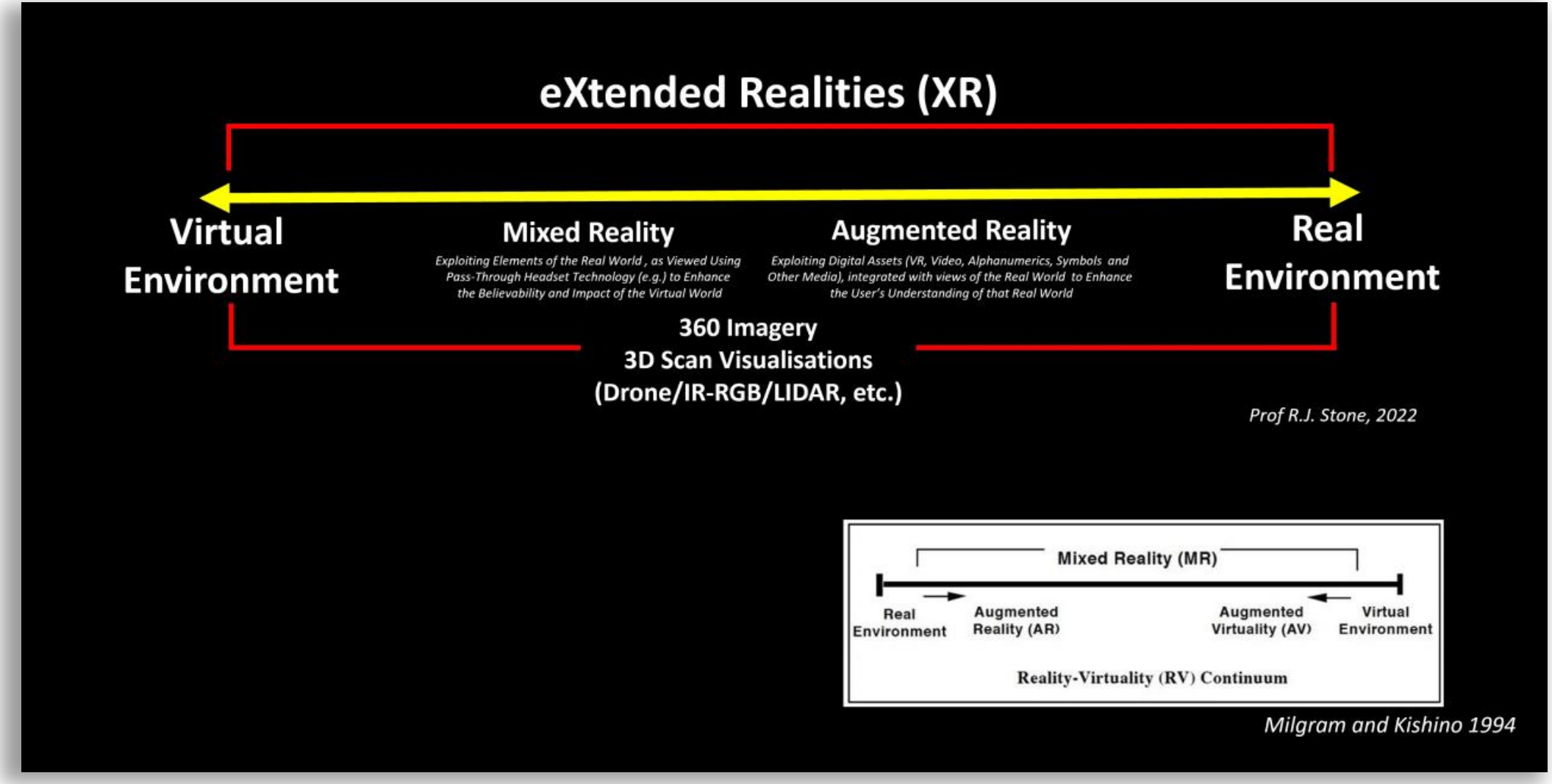
Virtual and Augmented Reality: from Promise to Productivity

7 September 2018

James Oliver, Director
Virtual Reality Applications Center
Human Computer Interaction Graduate Program
Iowa State University

Terminology

XR Definition



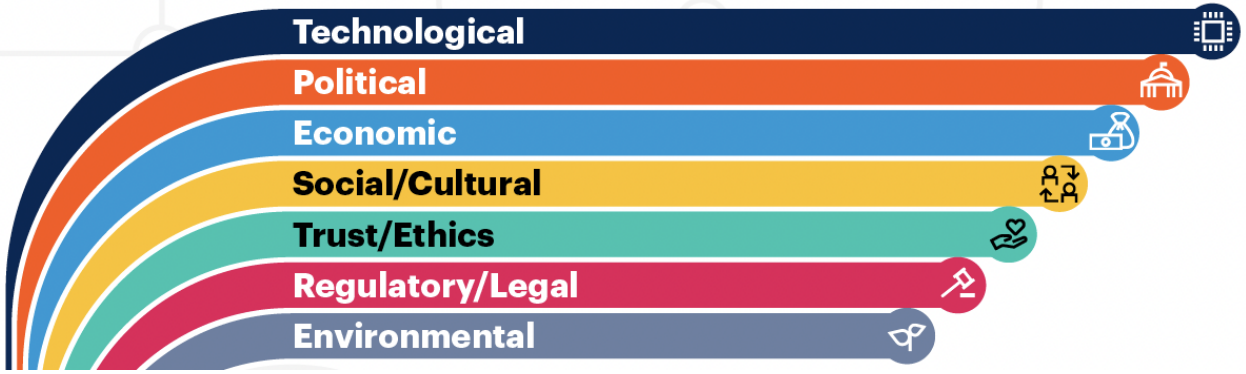
https://www.linkedin.com/pulse/virtual-augmented-mixed-reality-basic-definitions-bob-stone/

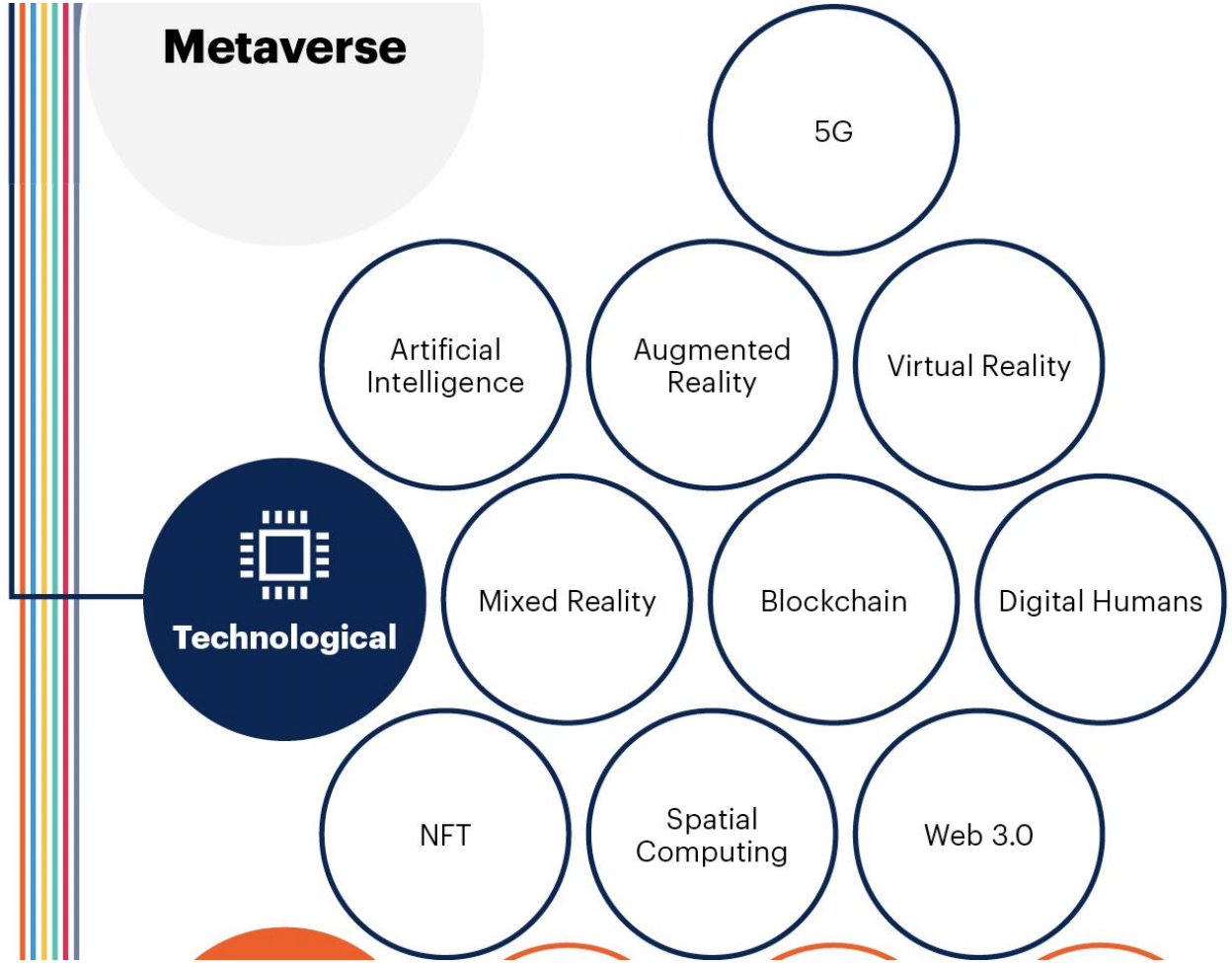
Metaverse?

Gartner

Map of the Metaverse

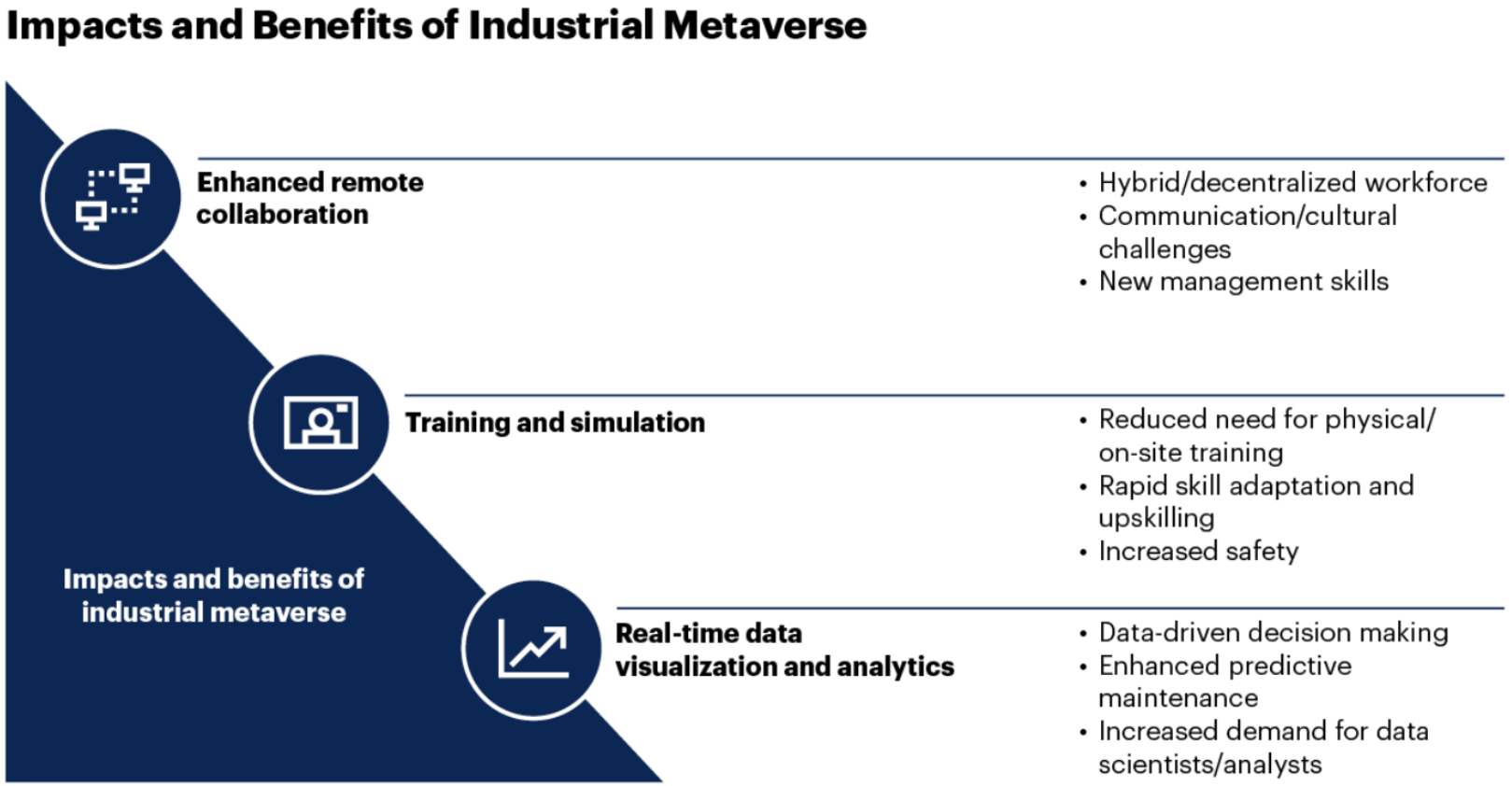
The Metaverse is much more than a single, or even list of technologies. Technology innovation leaders should use this impact map infographic when considering the interdependent concepts that enable or inhibit the realization of the Metaverse.





Industrial Metaverse (Gartner)

Industrial metaverse is defined as a **convergence of the physical and digital world** for industrial applications, where people interact and collaborate with machines to design, build and optimize systems in an immersive environment.



Market Trends

VR's Hype Cycle

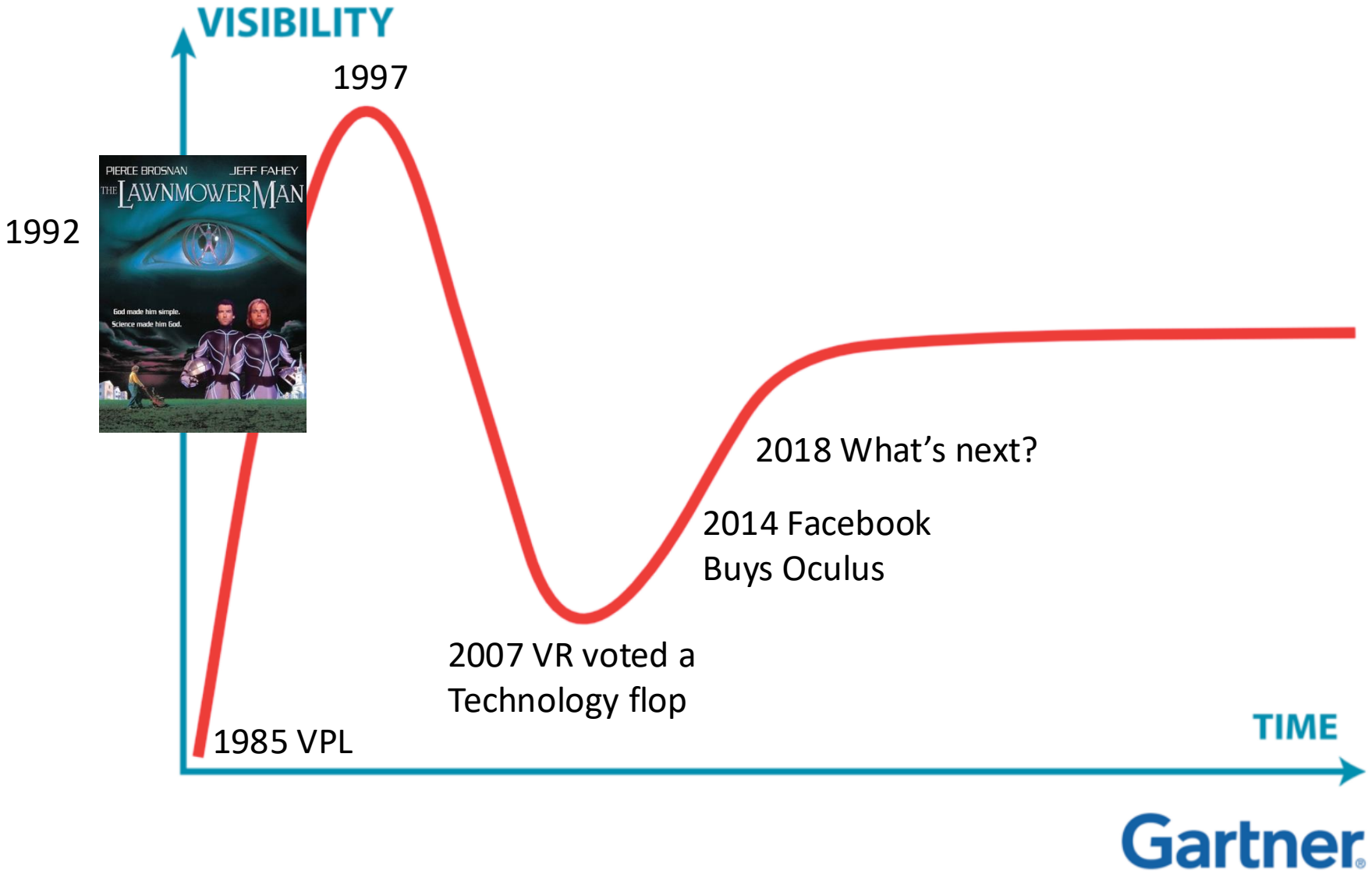
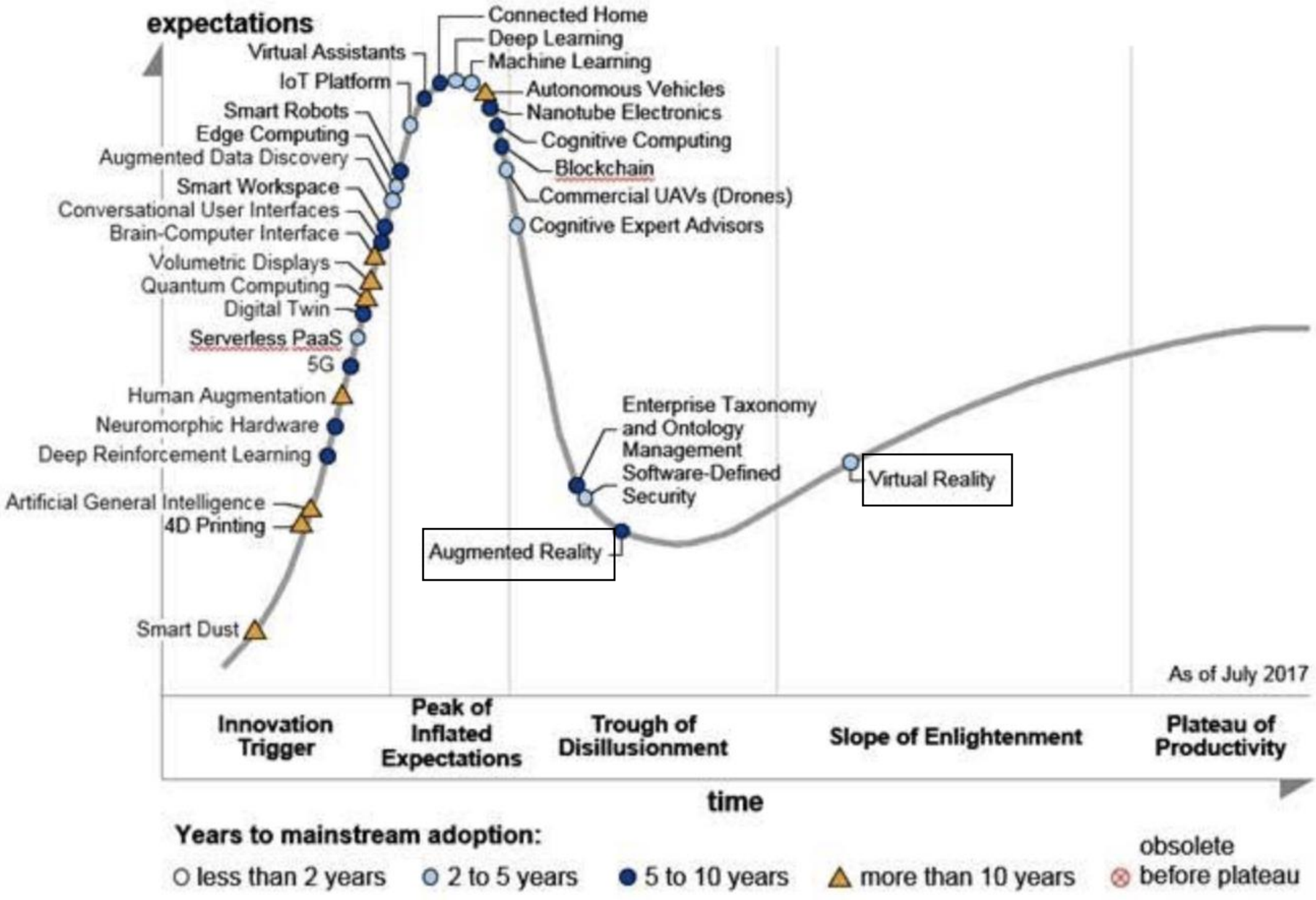
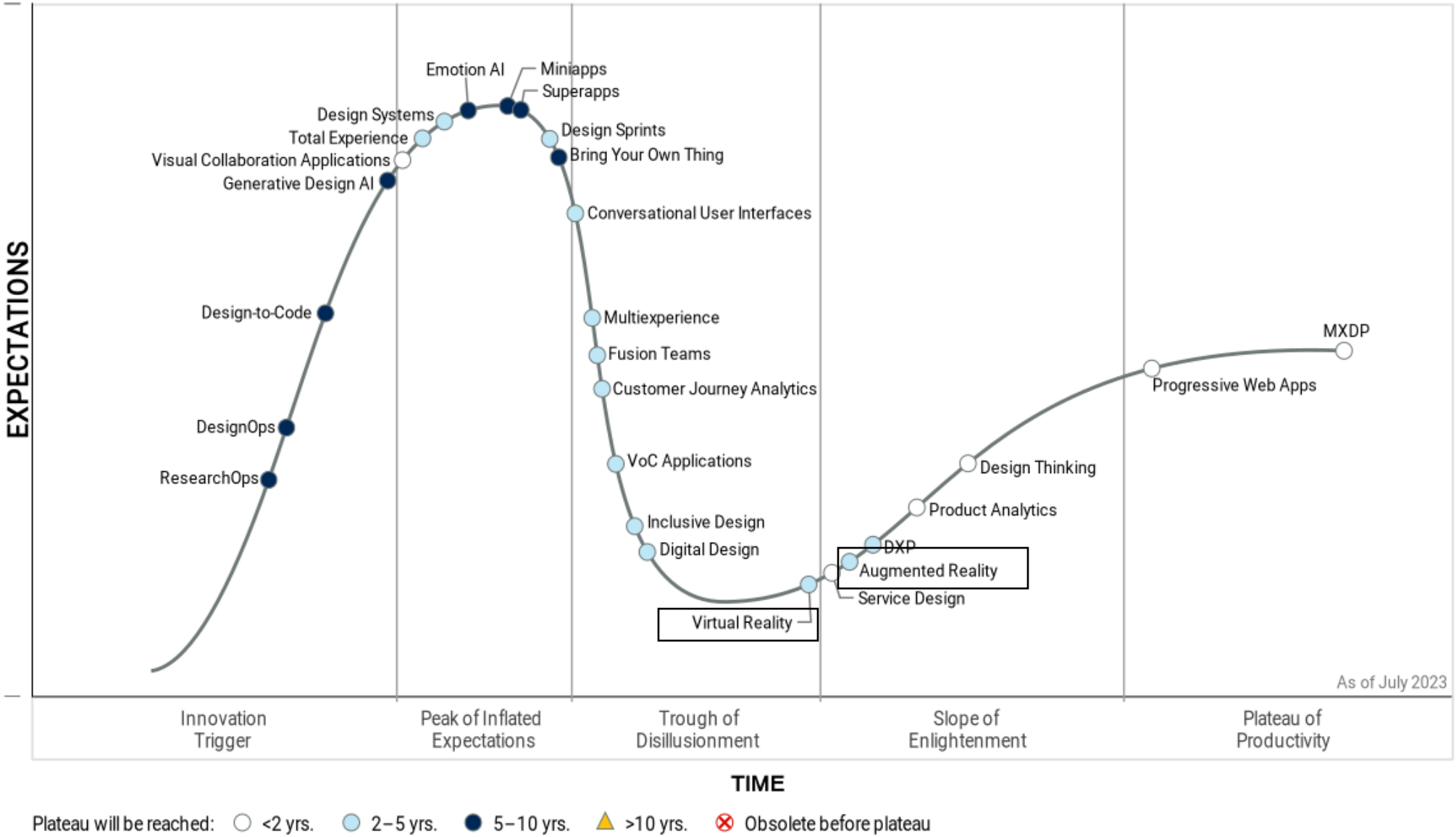


Figure 1. Hype Cycle for Emerging Technologies, 2017



Hype Cycle for User Experience, 2023



Gartner

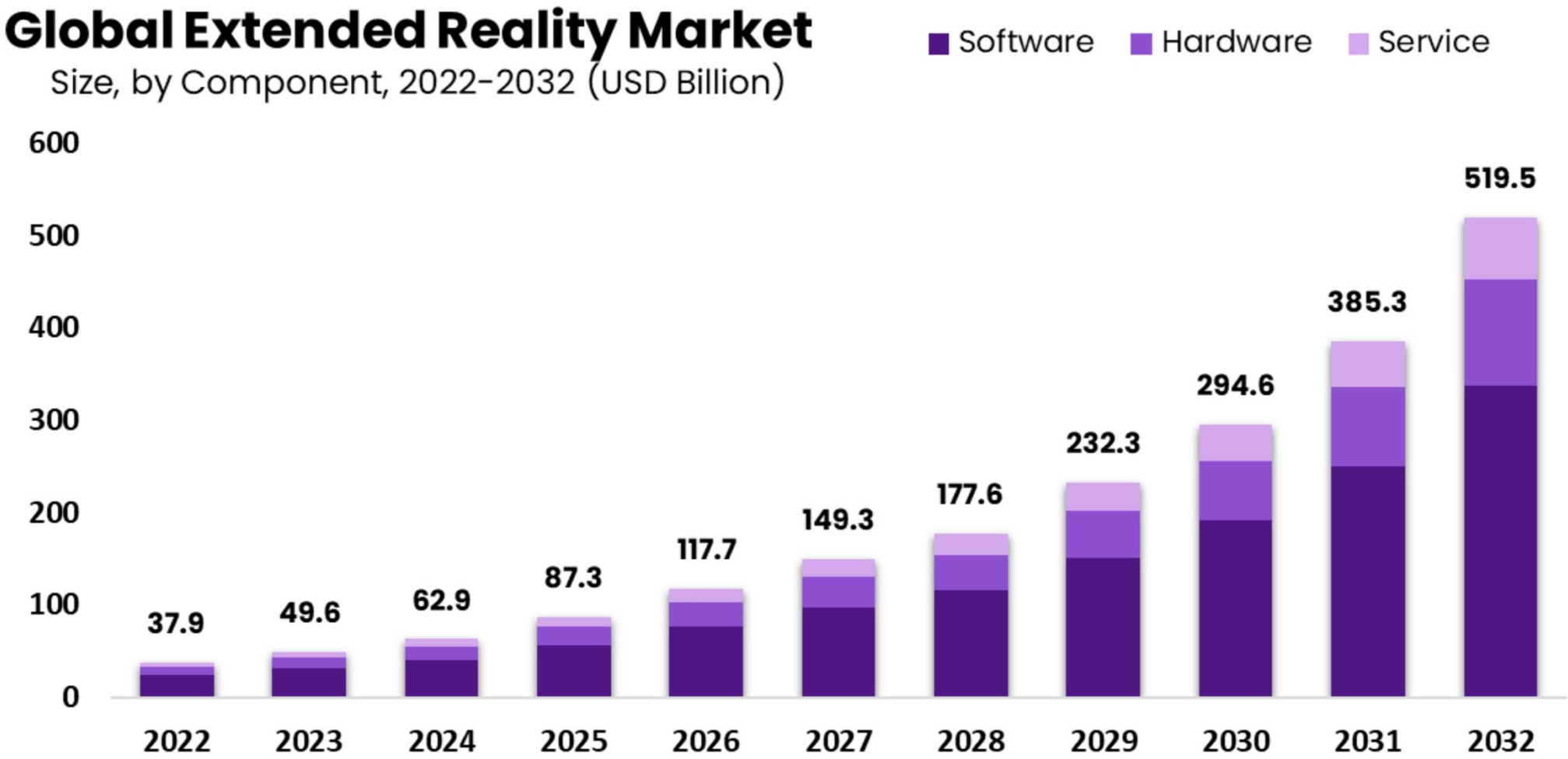
Applications/markets (2016)

2025 total addressable market

Games -	$11.6B	Consumer Markets 59%
Live events -	$4.1B	
Video entertainment -	$3.2B	
Retail -	$1.6B	
Real estate -	$2.6B	Enterprise Markets 41%
Education -	$0.7B	
Health care -	$5.1B	
Military -	$1.4B	
Engineering -	$4.7B	

Software TAM	$35.0B
Hardware TAM	$45.0B

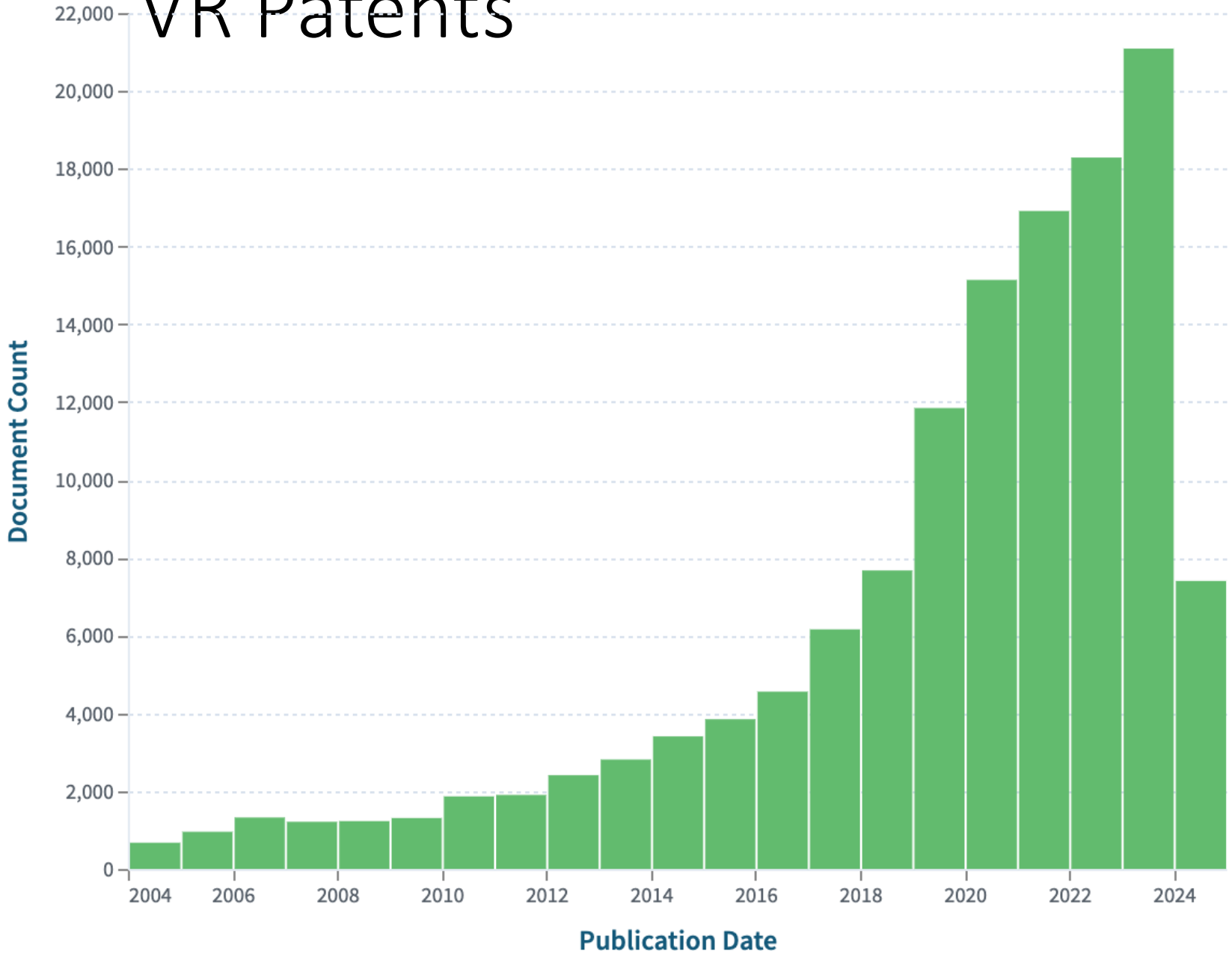
XR Market Projected Growth



CAGR: 31%

https://market.us/report/extended-reality-market/

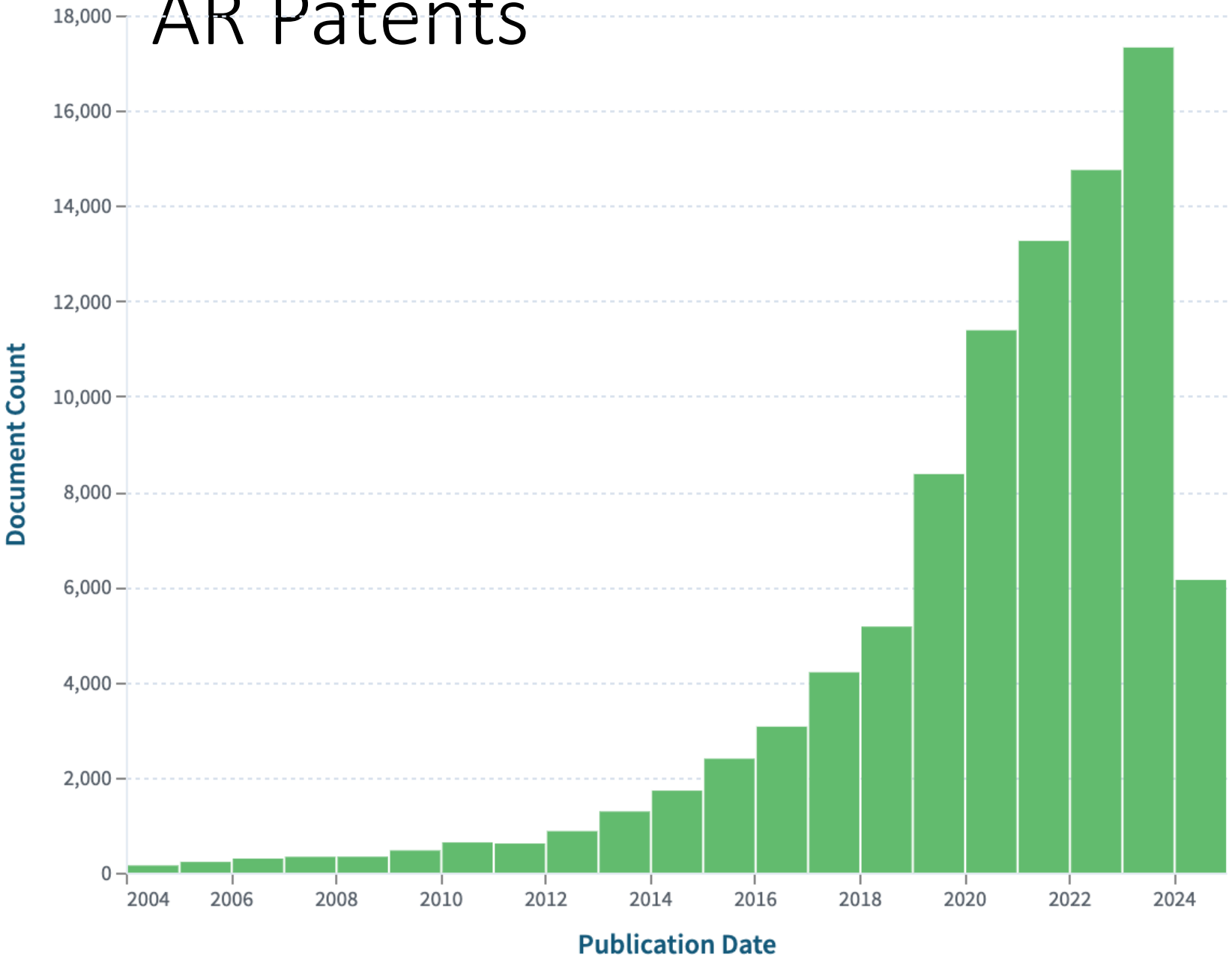
VR Patents



Microsoft Technol… 5,491	Intel Corp 3,543	Samsung Electron… 3,114	Ibm 2,830	Lg Electronics Inc 2,776
Apple Inc 2,705	Qualcomm Inc 2,386	Huawei Tech Co Ltd 1,898	Facebook Tech Llc 1,842	At & T Ip I Lp 1,838
Google Llc 1,649	Sony Corp 1,580	Magic Leap Inc 1,526	Microsoft Corp 1,522	Amazon Tech Inc 1,122

131,873 patents awarded

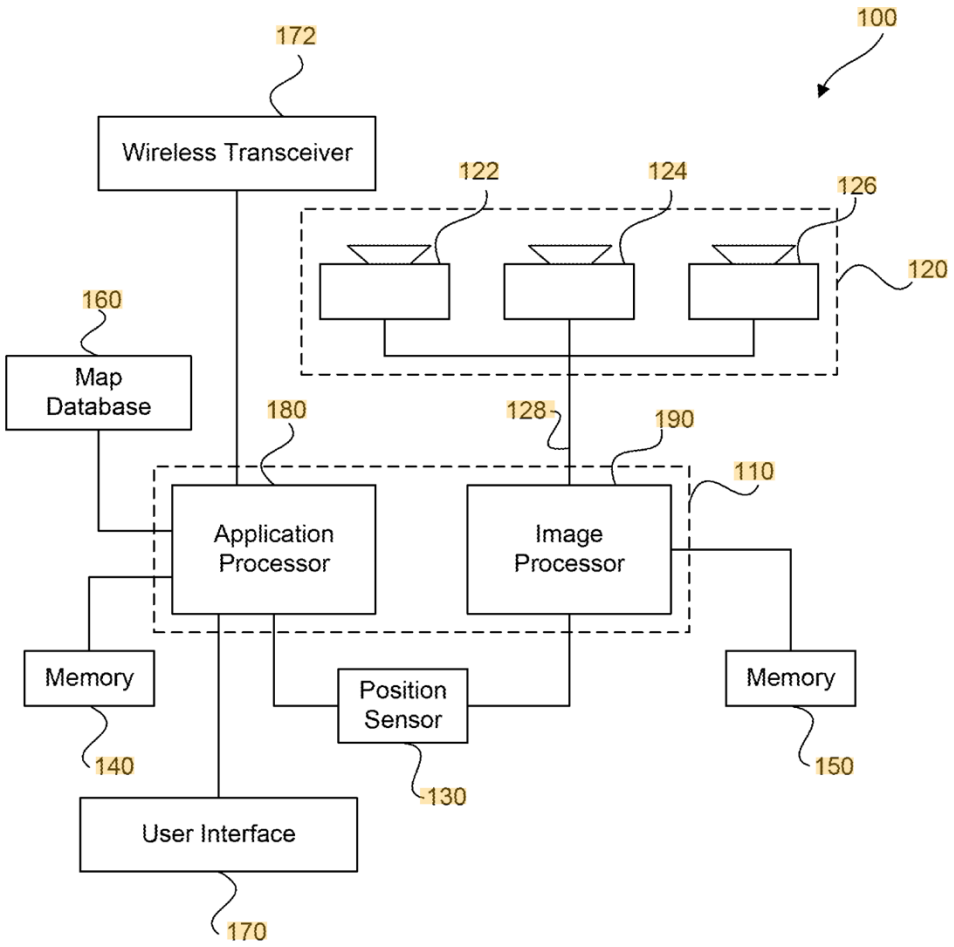
AR Patents



Microsoft Technol… 4,474	Intel Corp 3,080	Lg Electronics Inc 2,542	Samsung Electron… 2,510	Apple Inc 2,174
Facebook Tech Llc 1,768	Qualcomm Inc 1,674	Magic Leap Inc 1,555	Huawei Tech Co Ltd 1,517	Google Llc 1,374
Ibm 1,289	Sony Corp 1,042	Snap Inc 1,023	Meta Platforms Te… 975	Microsoft Corp 897

92,968 patents awarded

Navigation Based on Detected Size of Occlusion Zones– US20230347877A1 (Mobileye Vision, 2023 pending)



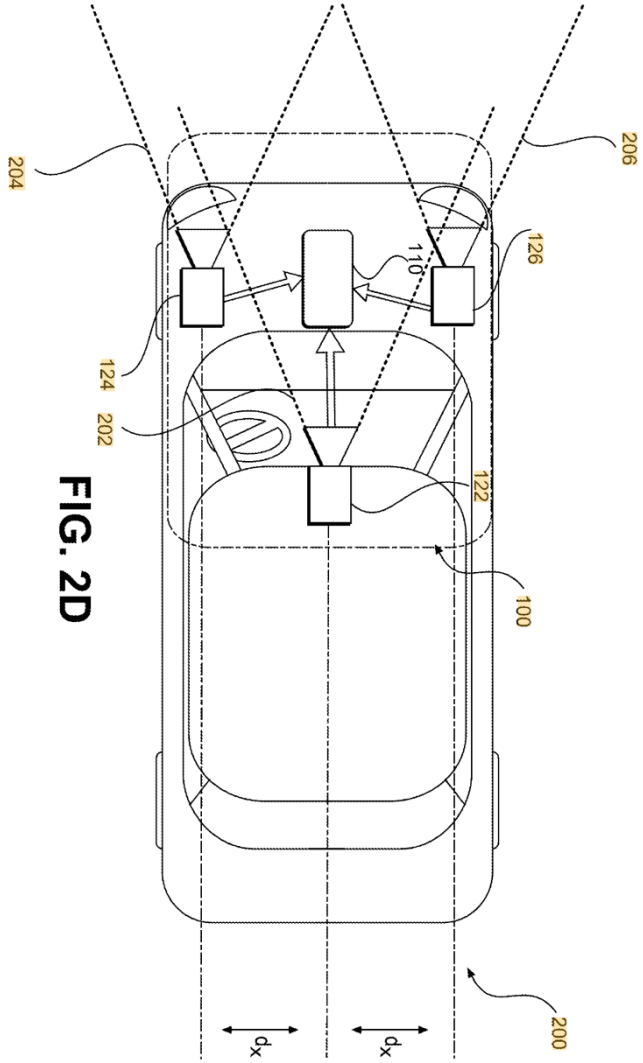
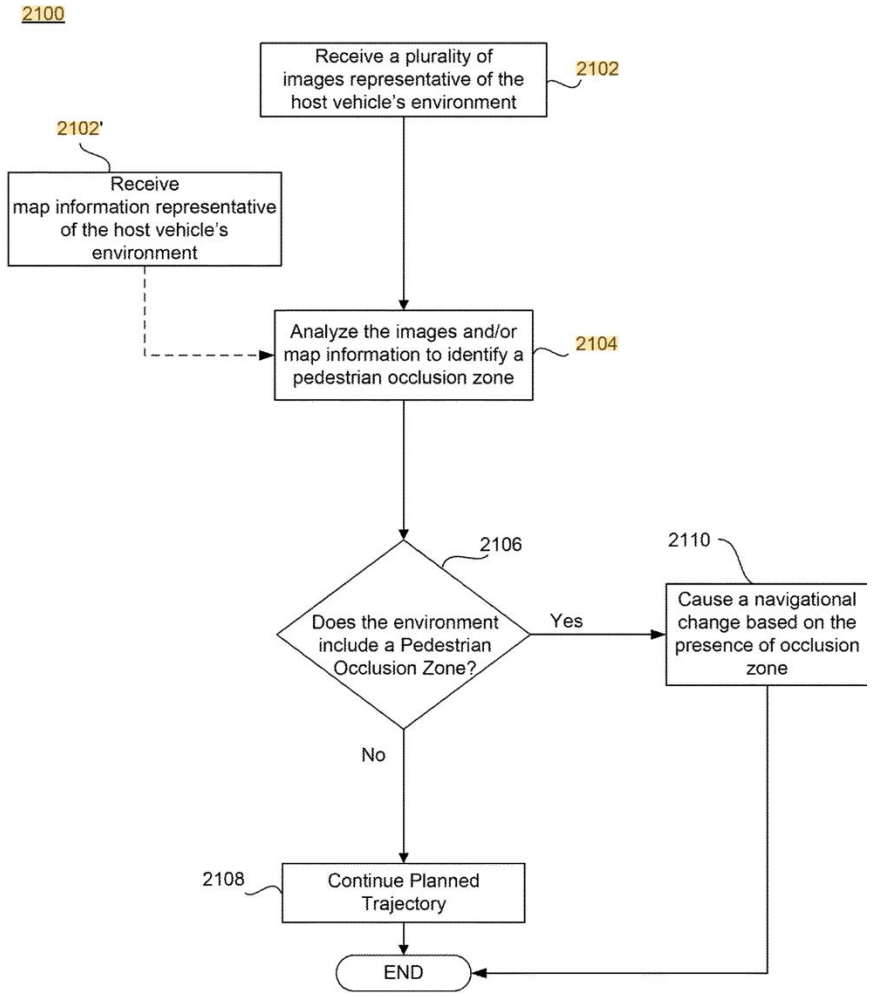
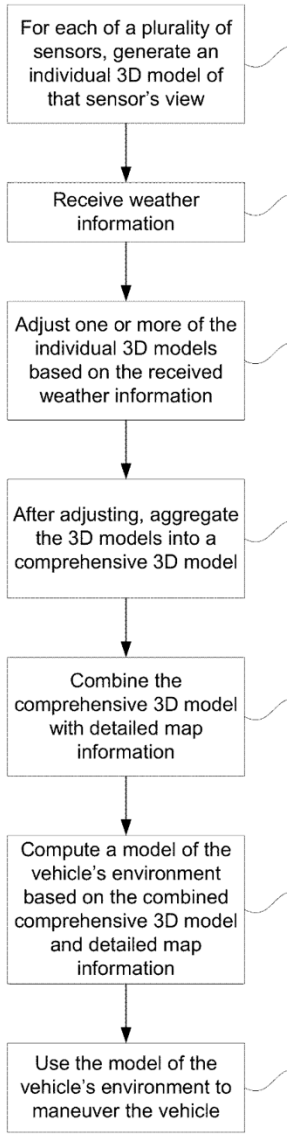
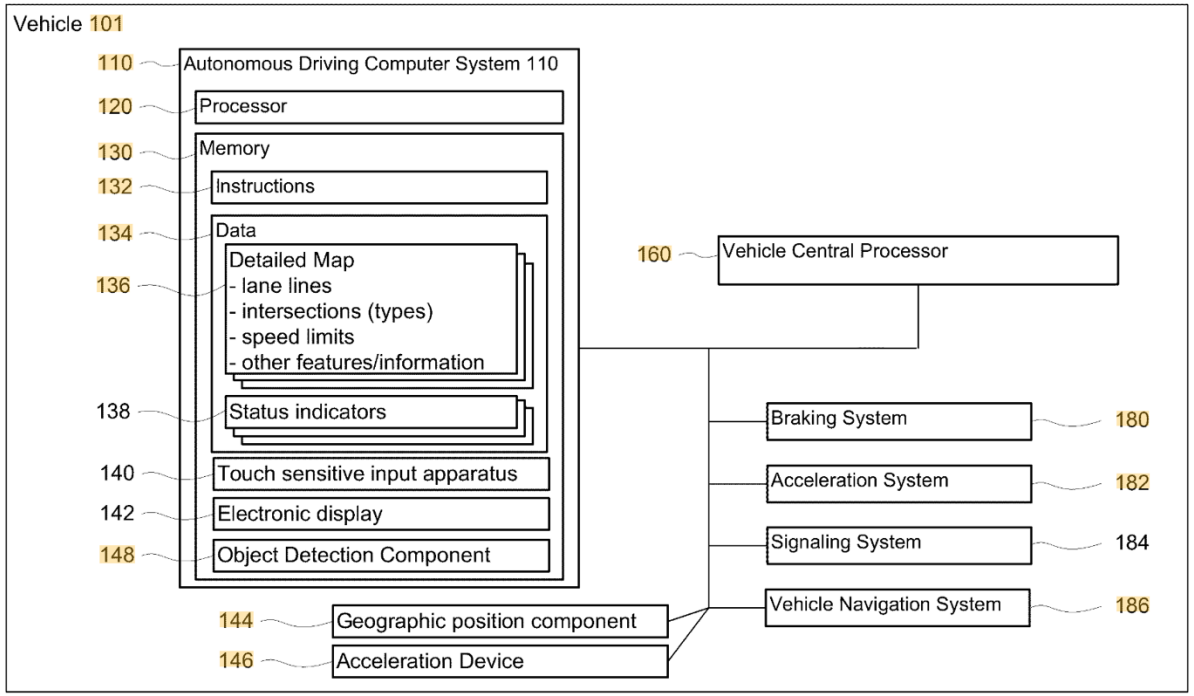


FIG. 2D



Modifying Behavior of Autonomous Vehicles Based on Sensor Blind Spots and Limitations – US20230341871A1 (Waymo, 2021)





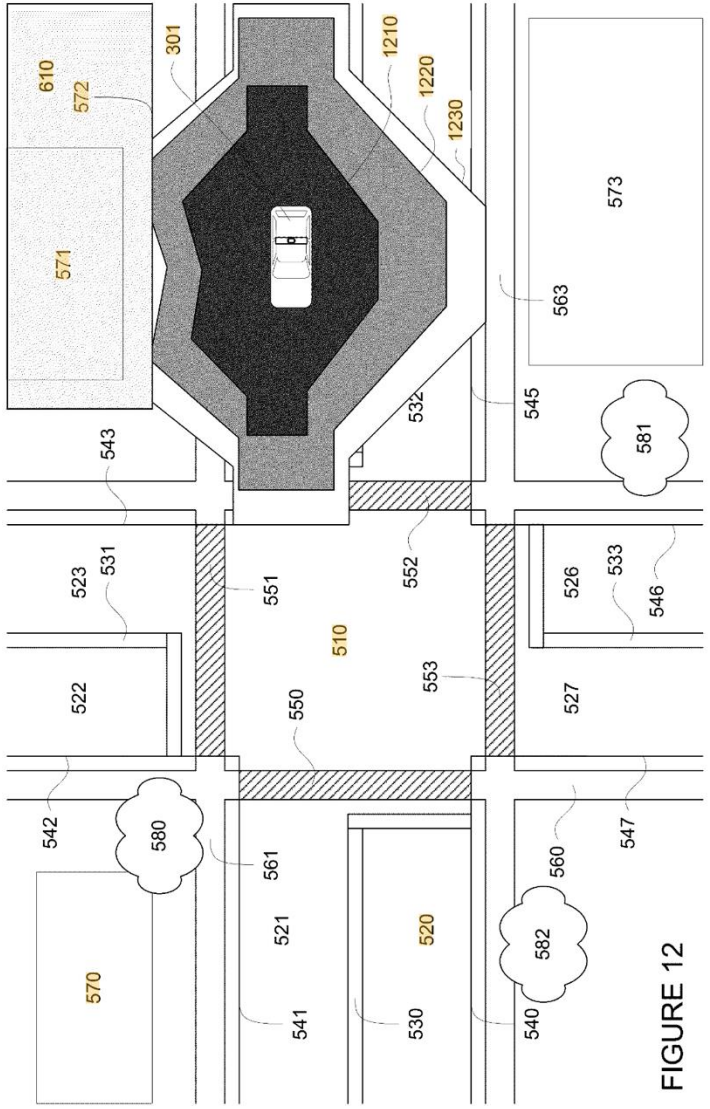
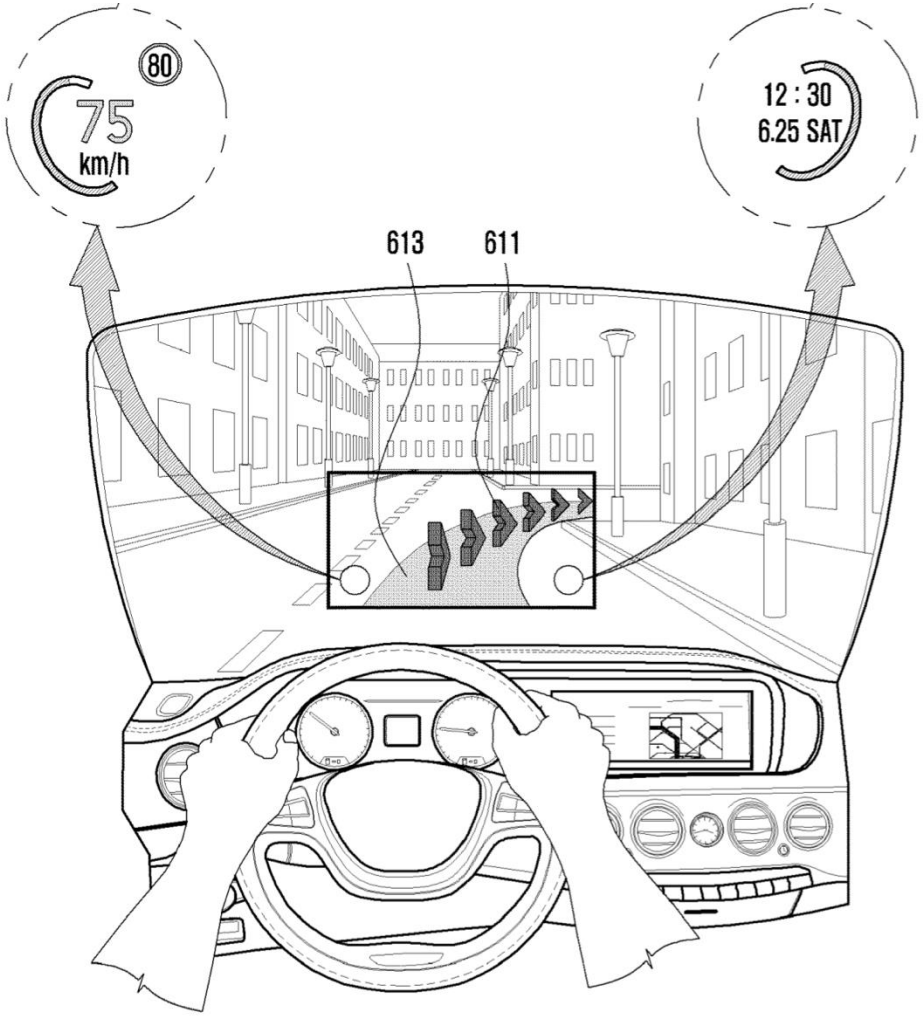
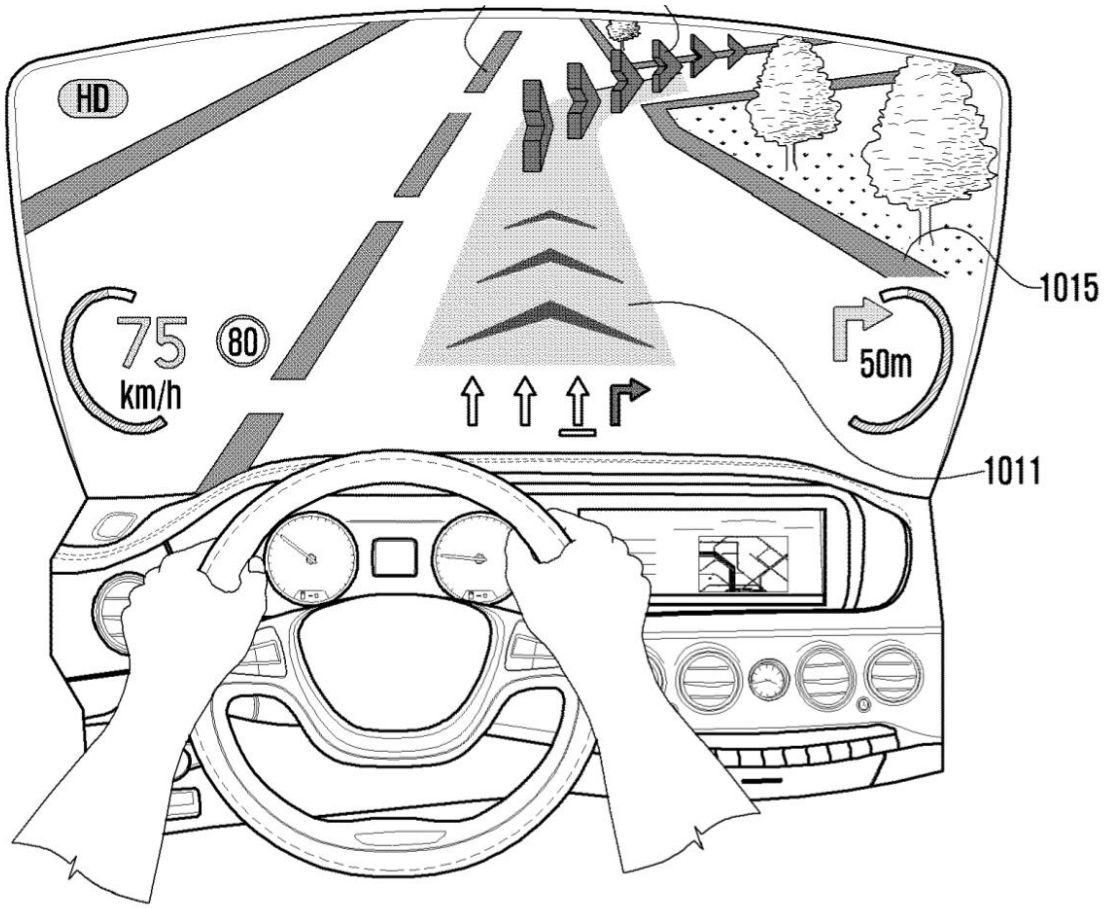


FIGURE 12

Method and Device for Displaying 3D Augmented Reality Navigation Information – EP 3 845 861 B1 (Samsung, 2024)





Remote operation of vehicles using immersive virtual reality environments – US11099558B2 (Nvidia, 2021)

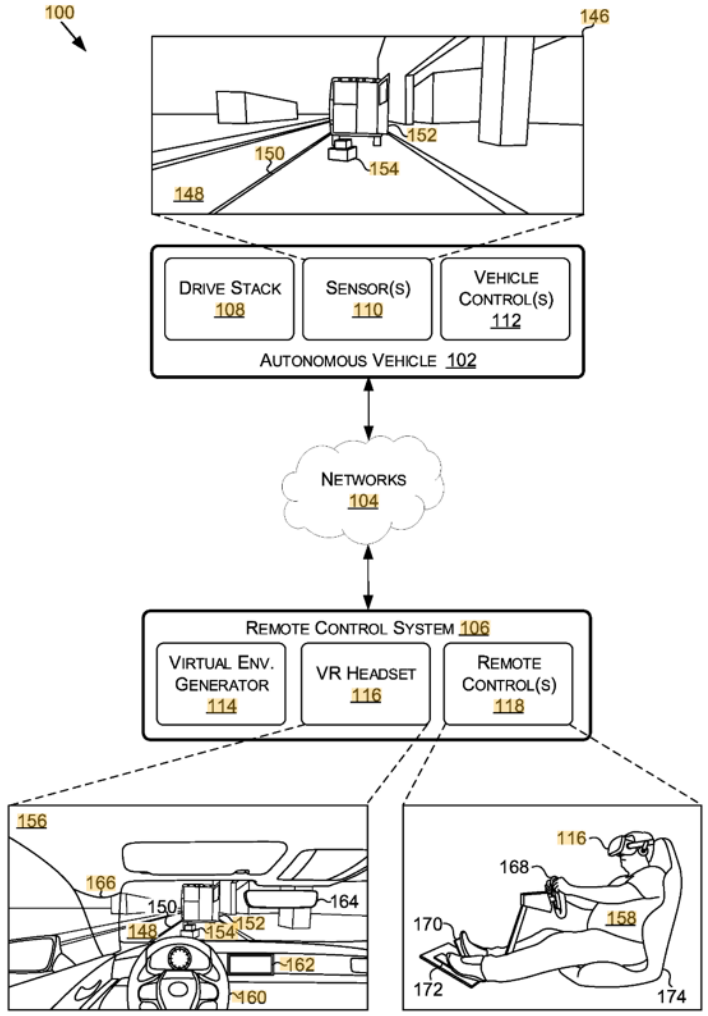
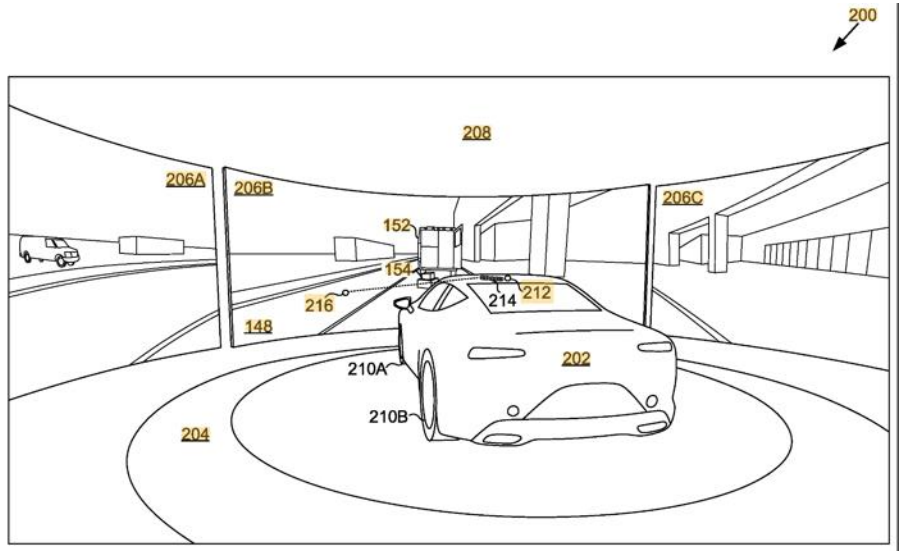
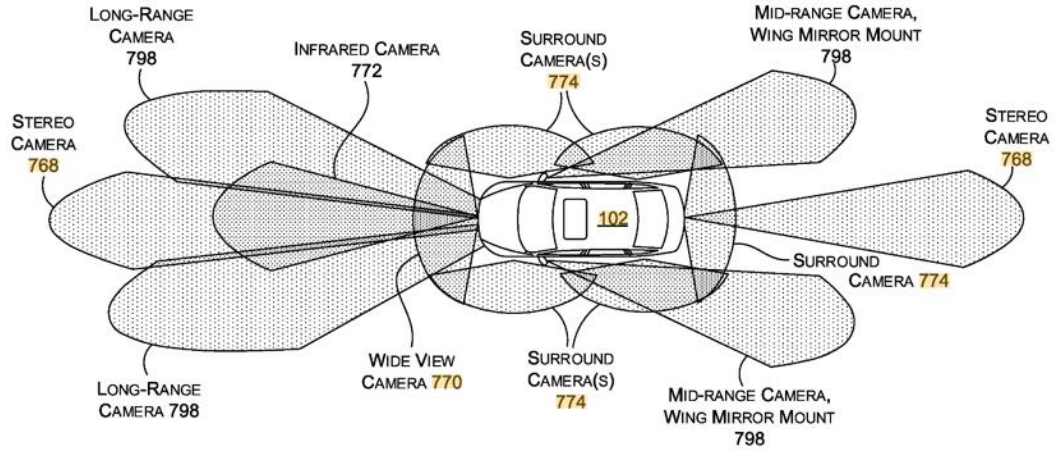


FIGURE 1A





Technology Trends

Enterprise? or Entertainment?

MS HoloLens 2

Tethered
vs
Untethered?

Meta Quest Pro

Magic Leap 2

Video see-through
vs
Optical see-through?

HTC Vive XR Elite

A “Killer” Application?

The Verge / Tech / Reviews / Science / Entertainment / AI / More +

POLICY / TECH / MICROSOFT

Congress says the Army can’t spend $400 million buying Microsoft HoloLens headsets

A soldier wearing an IVAS headset. Image: US Army

/ But it can spend millions on a new version to fix the problems that made soldiers sick.

By Mitchell Clark

Jan 12, 2023, 1:42 PM CST

8 Comments (8 New)

Apple Vision Pro – spatial computer?

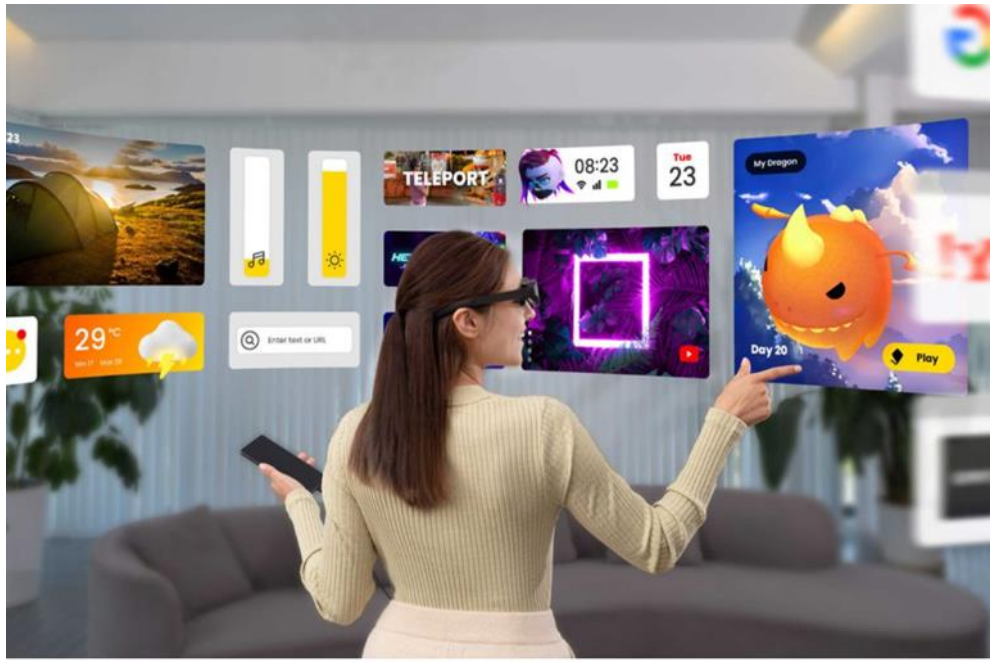
- VR or AR
- $3,500

Features

- 4K micro OLED displays with 23 million pixels combined
- Eye and gesture tracking for navigation and control
- More than a dozen cameras
- 3D photo and video capture
- Built-in spatial audio
- Optic ID iris scanning
- visionOS operating system
- External battery w/ 2hr battery life

“Smart Glasses” – are they really AR?

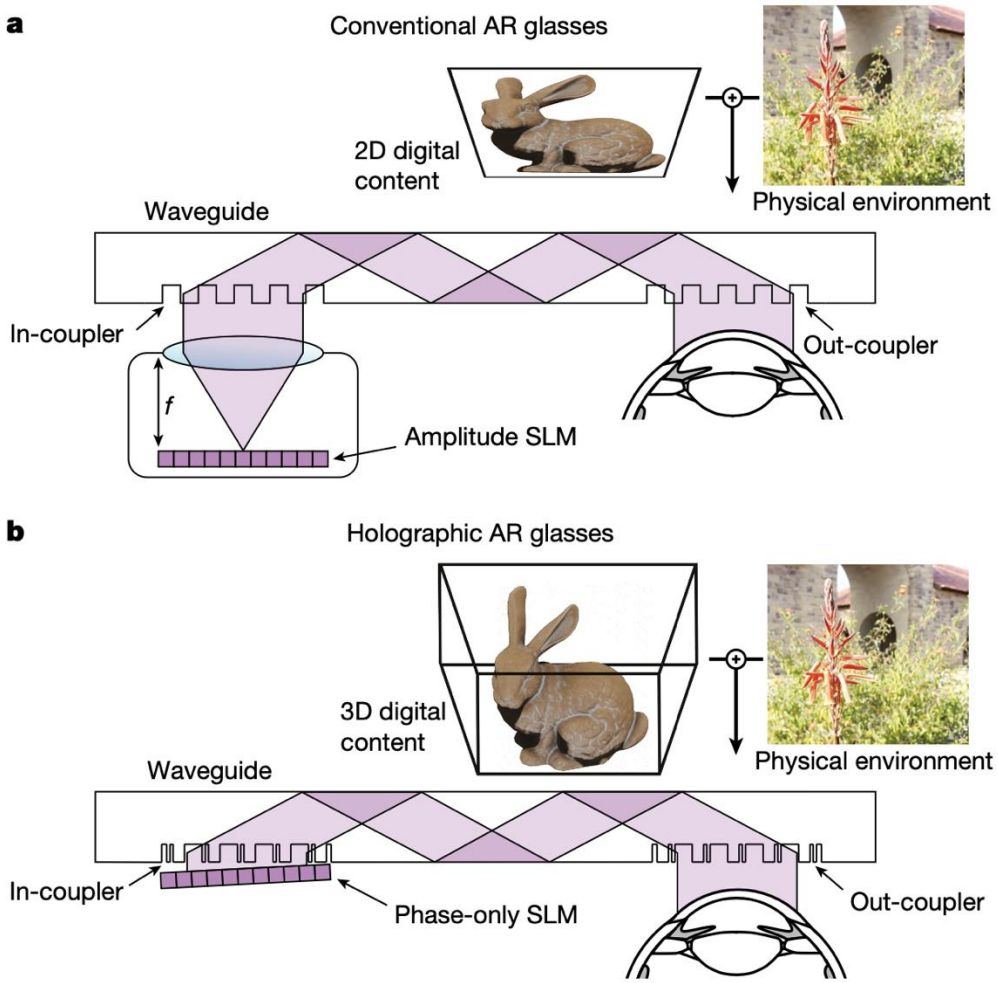
- Capture photo/video (e.g., Ray-Ban Meta) and/or display text, or…
- Project 2D virtual workspace or theater-sized screen over real-world
- Relatively inexpensive ($100 – $500), USB-C connectivity



Article

Full-colour 3D holographic augmented-reality displays with metasurface waveguides

Nature | Vol 629 | 23 May 2024



https://doi.org/10.1038/s41586-024-07386-0

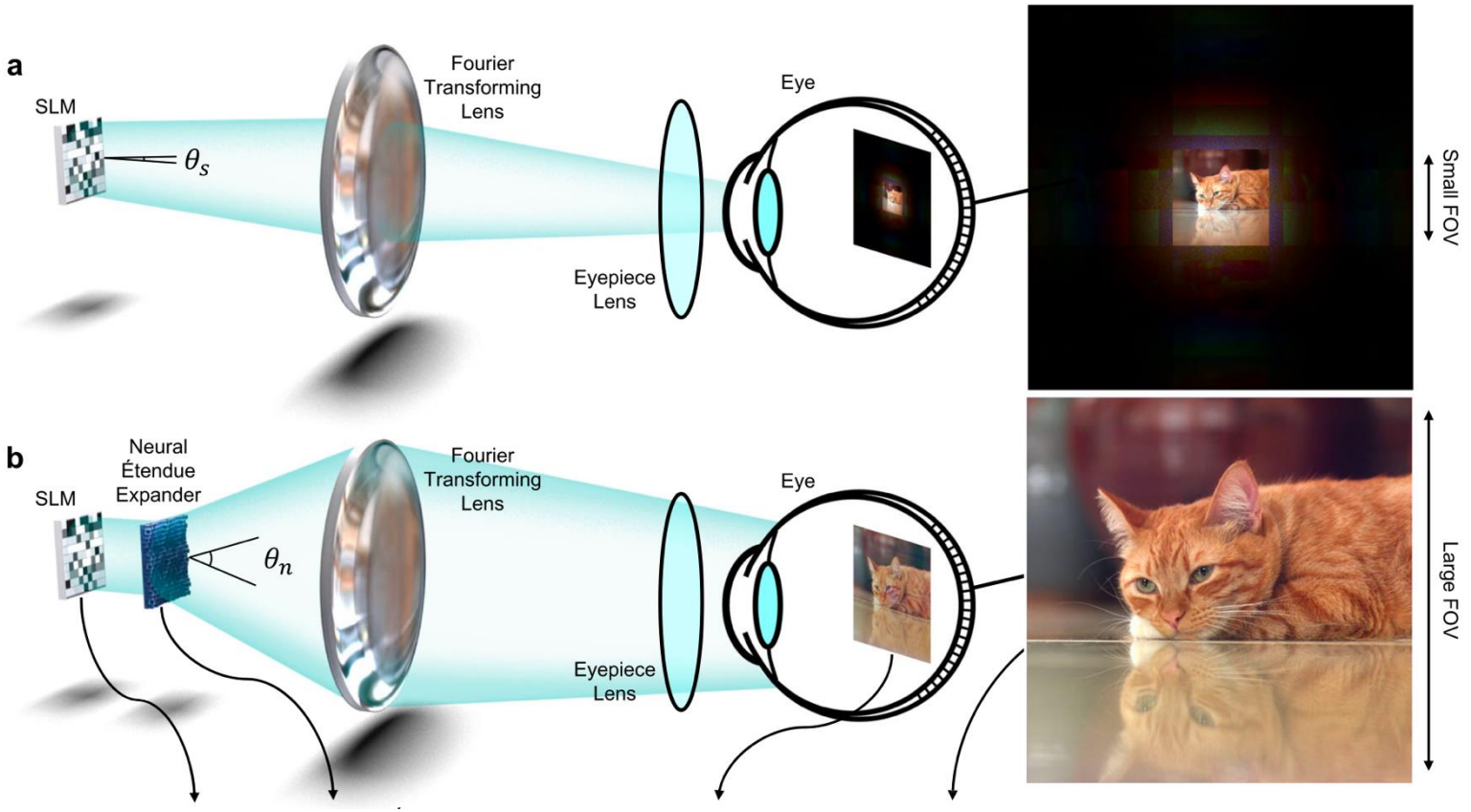
April 2024

nature communications

Article

https://doi.org/10.1038/s41467-024-46915-3

Neural étendue expander for ultra-wide-angle high-fidelity holographic display



https://doi.org/10.1038/s41467-024-46915-3

Content Creation

3D Gaussian Splatting for Real-Time Radiance Field Rendering

SIGGRAPH 2023
(ACM Transactions on Graphics)

Bernhard Kerbl[*,1,2] Georgios Kopanas[*,1,2] Thomas Leimkühler[3] George Drettakis[1,2]

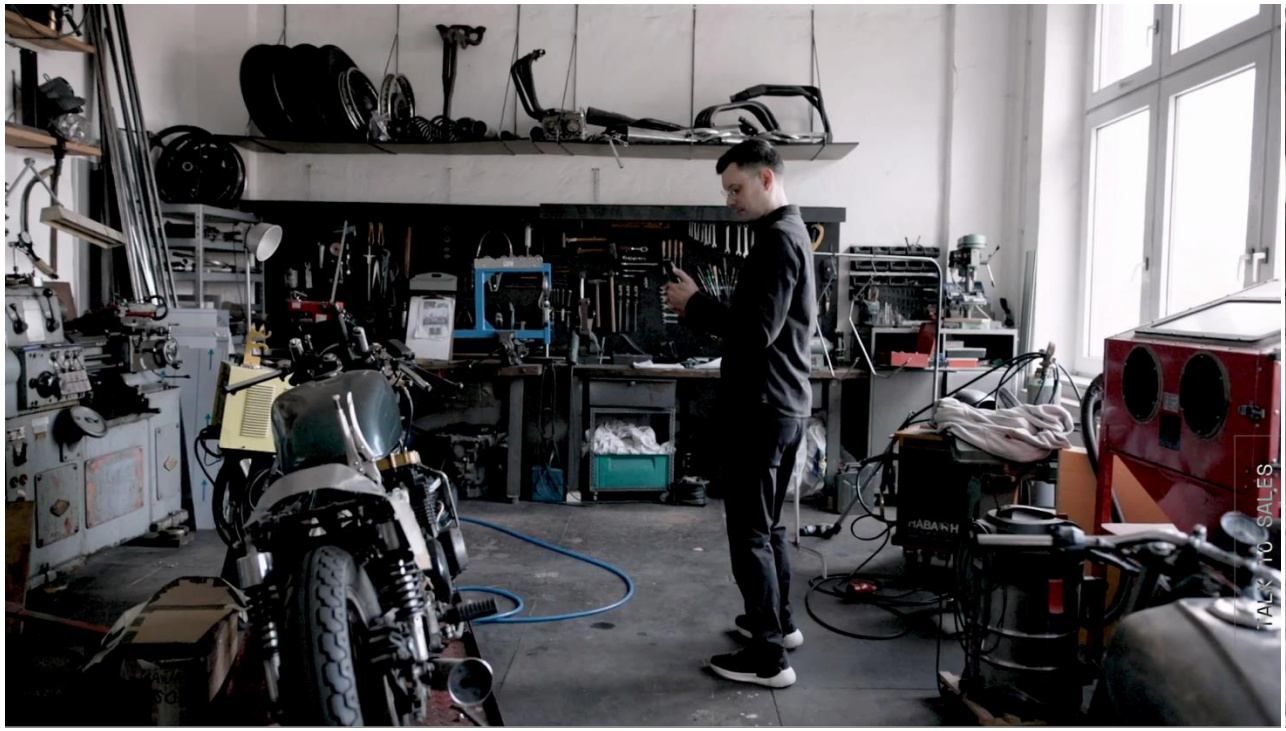
[*] Denotes equal contribution

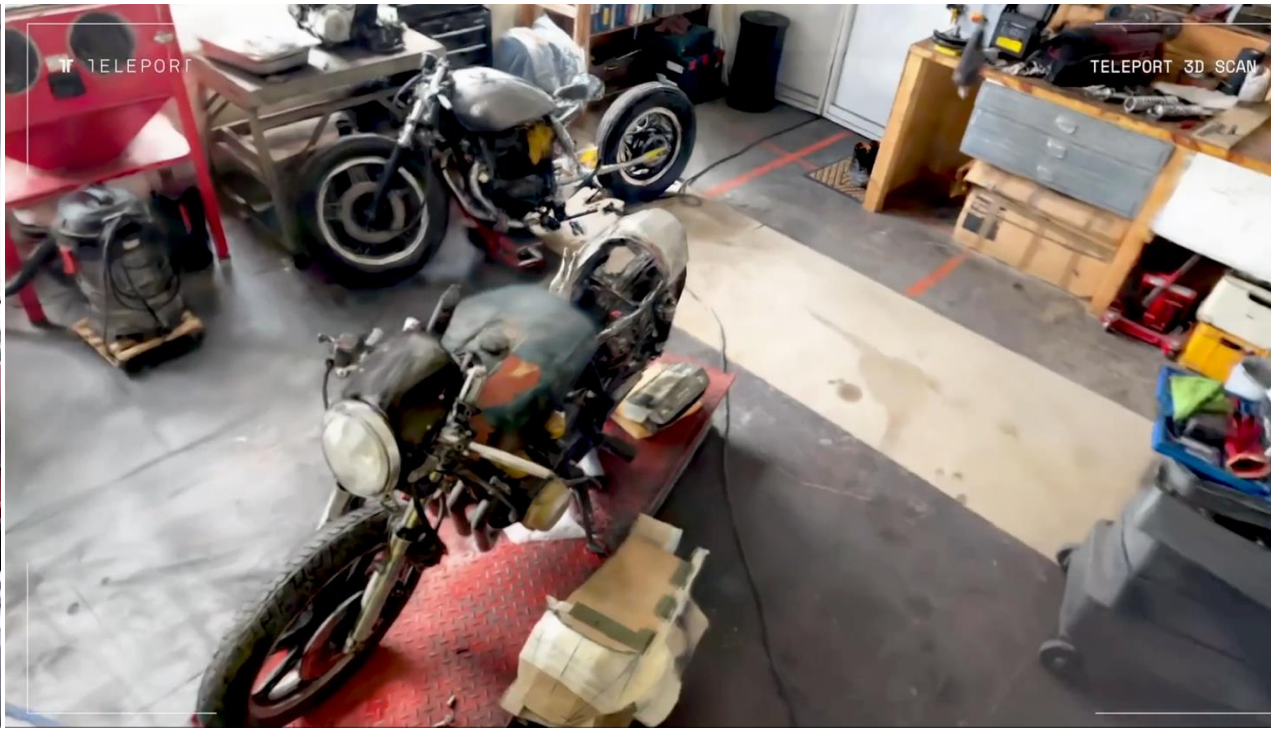
[1]Inria [2]Université Côte d'Azur [3]MPI Informatik

Video from iPhone 13 4K, 30 fps → Machine Learning (training & optimization) → Interactive render @ 60+ fps

https://repo-sam.inria.fr/fungraph/3d-gaussian-splatting/

One year later…





SuGaR: Surface-Aligned Gaussian Splatting for Efficient 3D Mesh Reconstruction and High-Quality Mesh Rendering

Antoine Guédon Vincent Lepetit
LIGM, Ecole des Ponts, Univ Gustave Eiffel, CNRS, France

https://anttwo.github.io/sugar/

Figure 1. We introduce a method that extracts accurate and editable meshes from 3D Gaussian Splatting representations within minutes on a single GPU. The meshes can be edited, animated, composited, etc. with very realistic Gaussian Splatting rendering, offering new possibilities for Computer Graphics. Note for example that we changed the posture of the robot between the captured scene on the bottom left and the composited scene on the right. The supplementary material provides more examples, including a video illustrating our results.

IEEE / CVF Computer Vision and Pattern Recognition Conference (CVPR) – June 2024

A Hierarchical 3D Gaussian Representation for Real-Time Rendering of Very Large Datasets

SIGGRAPH 2024
(ACM Transactions on Graphics)

Bernhard Kerbl* [1, 2, 3] Andreas Meuleman* [1,2] Georgios Kopanas [1,2] Michael Wimmer [3] Alexandre Lanvin [1,2] George Drettakis [1,2]

* Both authors contributed equally to the paper.

[1]Inria [2]Université Côte d'Azur [3]TU Wien

Fig. 9. Left: Our 6-GoPro HERO6 camera helmet rig. Middle: We performed captures on foot and (Right) on a bicycle at 6–7 km/h.

The New York Times 6 May 2024

Wayve, an A.I. Start-Up for Autonomous Driving, Raises $1 Billion

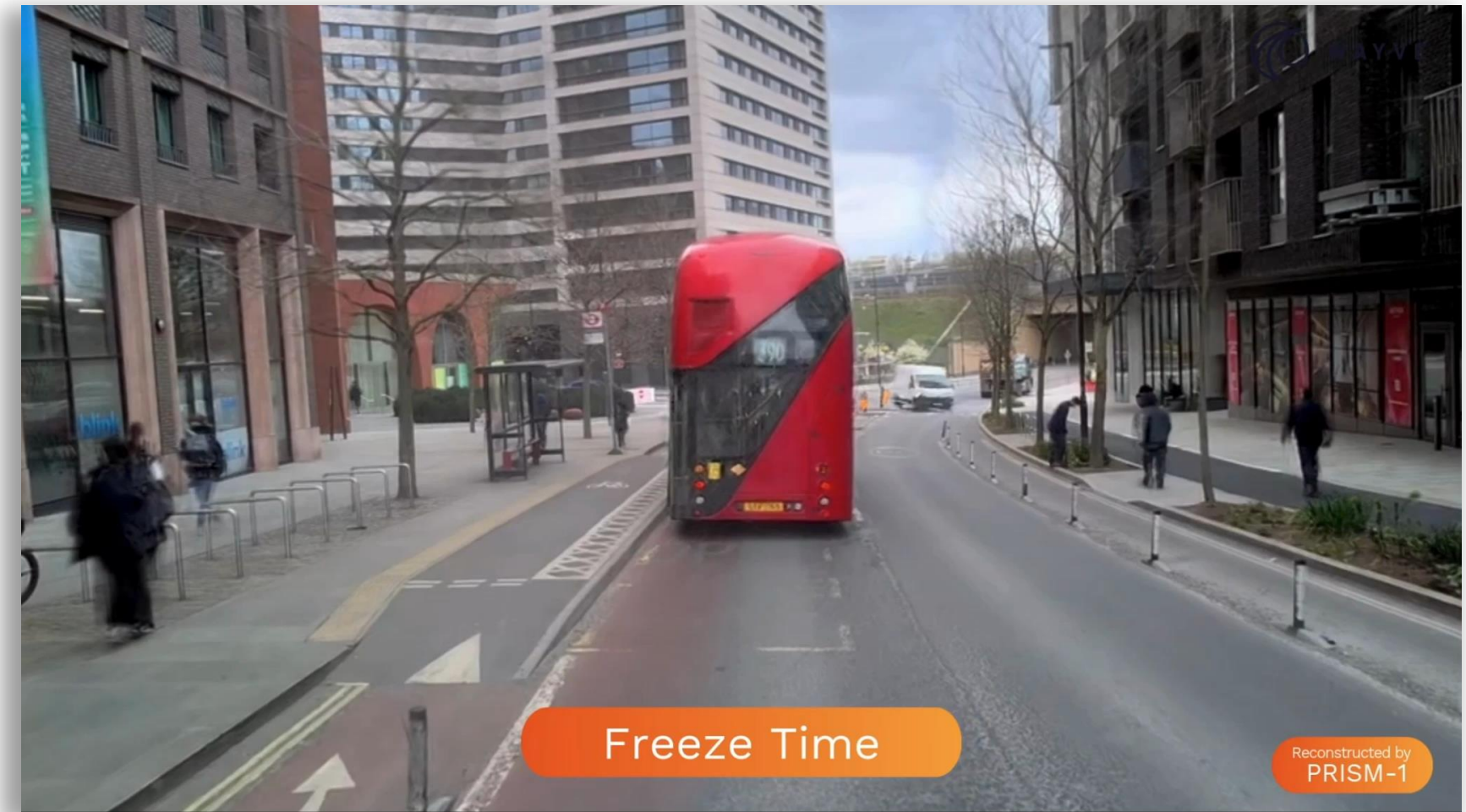
The London-based developer of artificial intelligence systems for self-driving vehicles raised the funding from SoftBank, Nvidia, Microsoft and others.

Embodied AI:

Wayve said its technology doesn't rely as heavily on high-definition maps or lidar sensors. Tesla has used an approach similar to Wayve in recent years.

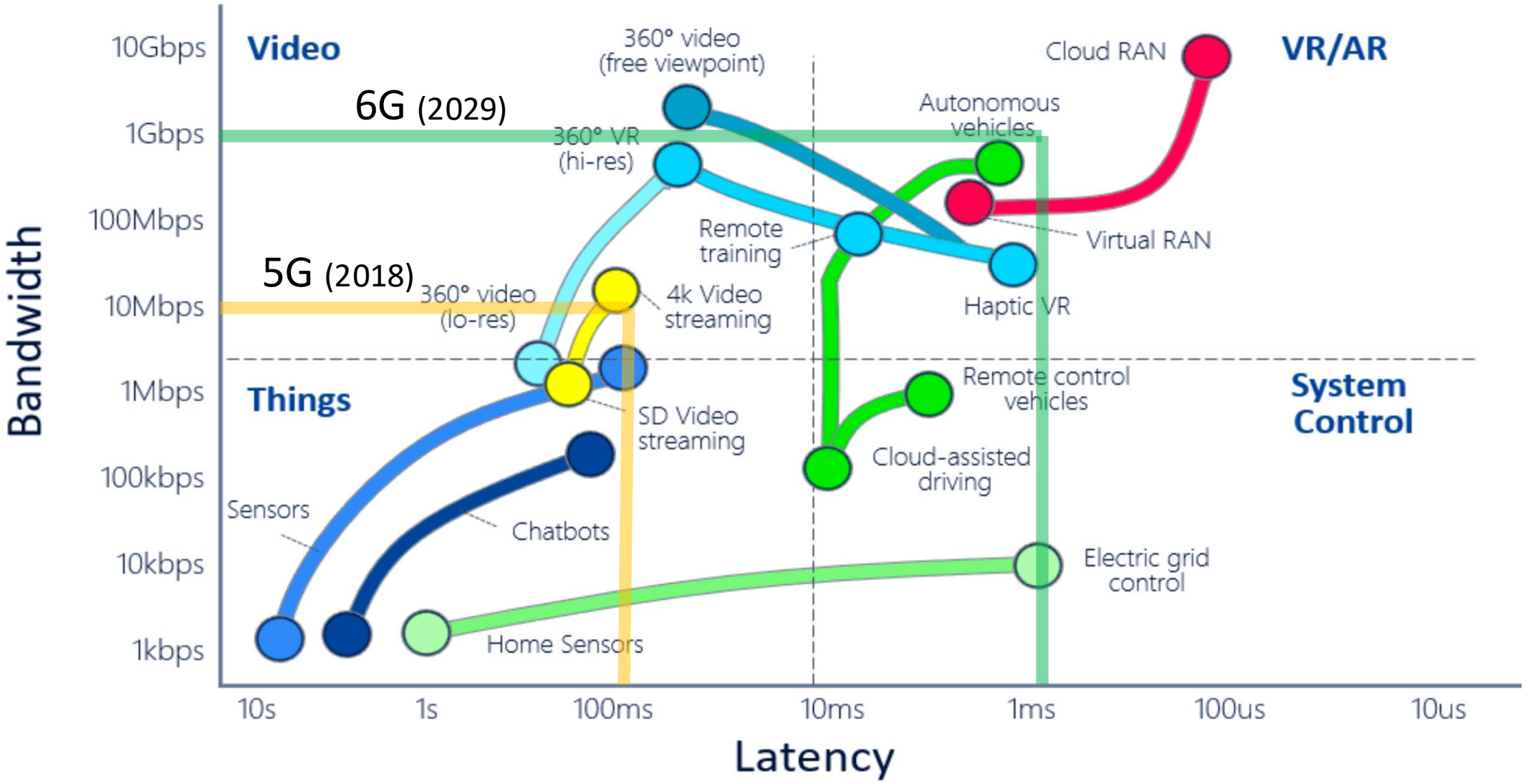
WAYVE

Introducing PRISM-1: Photorealistic reconstruction in static and dynamic scenes

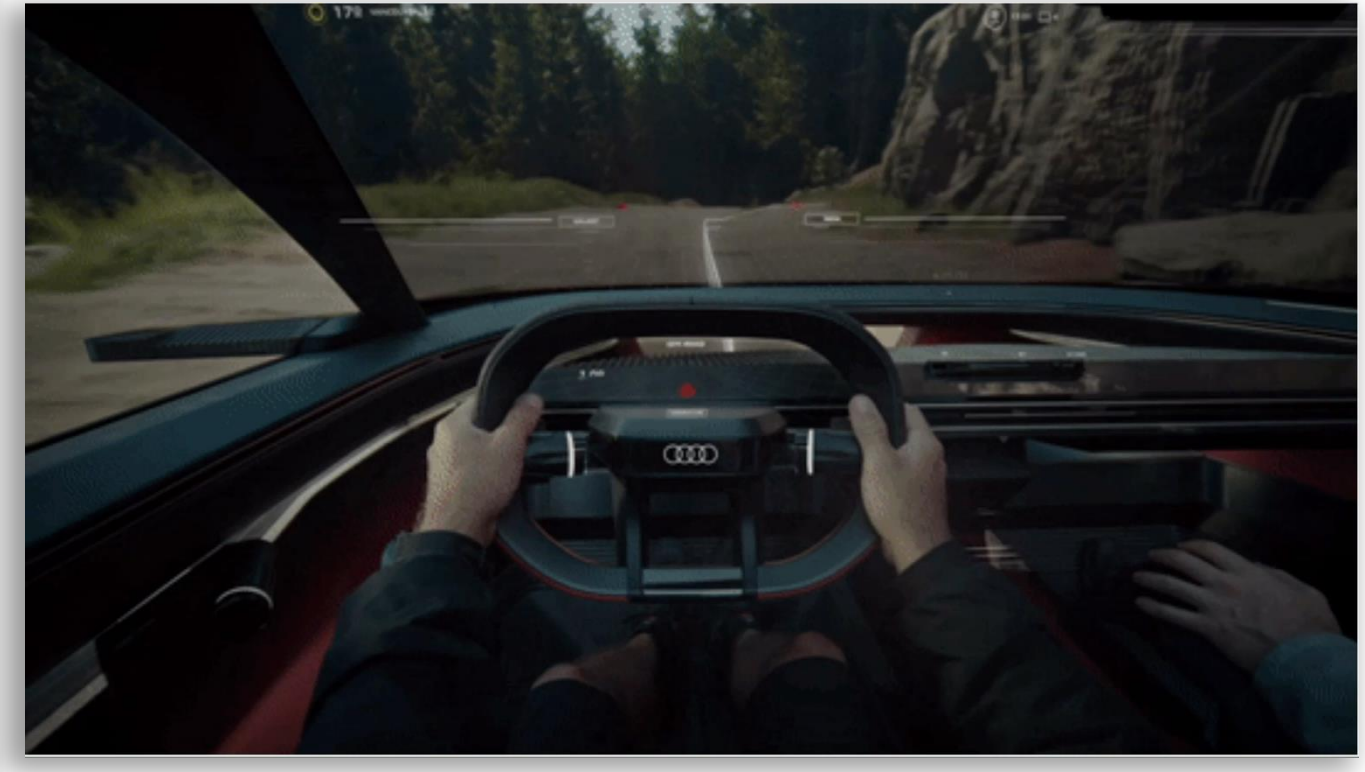


https://wayve.ai/thinking/prism-1/

Telecommunication Trends

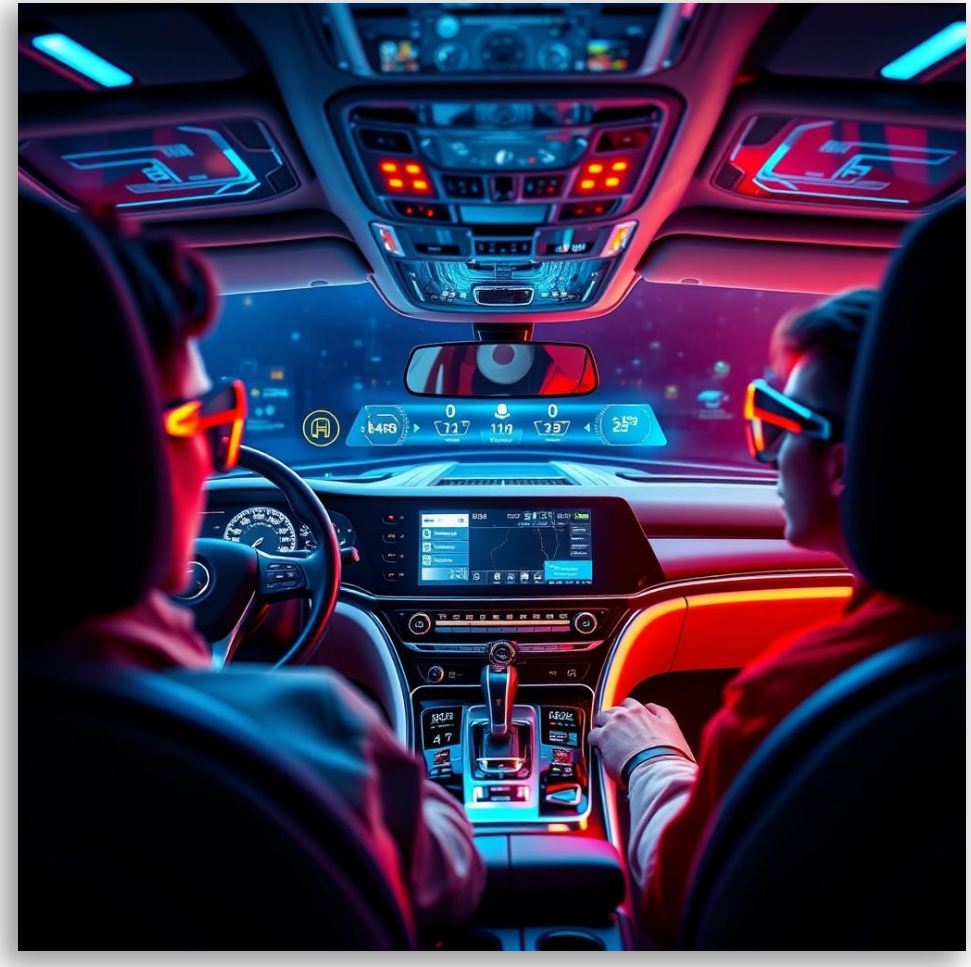


Audi Activesphere (concept)



Take aways…

- AR will dominate
- Thin, lightweight XR glasses coming soon
- AI-enabled XR will expose new applications
- Content creation is changing fast
- Mobile XR via 6G telecommunications
- Leading to more AD/ADAS advances



FluxAI prompt: Future of automotive HMI featuring thin augmented reality glasses, and advanced 6G telecommunications with an enthusiastic driver

Questions?


6G
6G
6G