



A virtual tour to Augmented and Virtual Reality

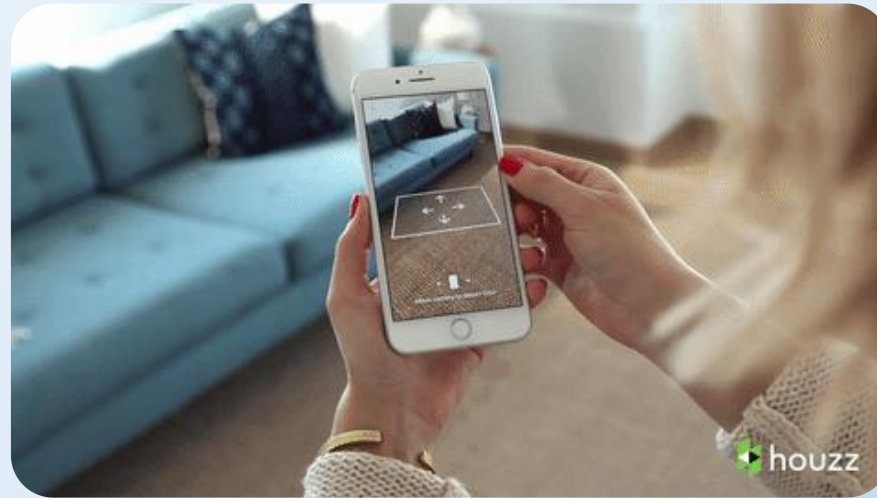
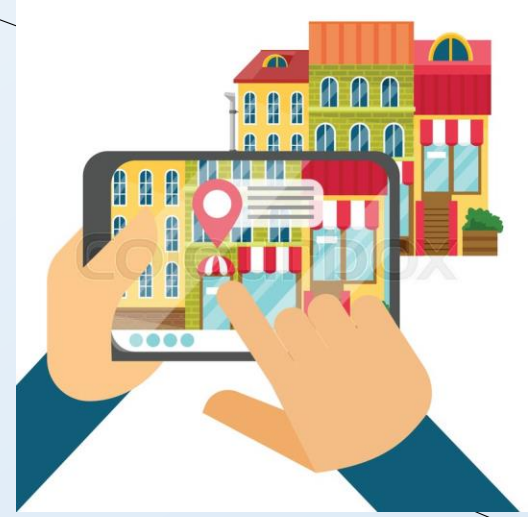
Dr. Sarwan Singh
NIELIT Chandigarh





Agenda

- AVR – Introduction, Evolution
- application areas,
- Hardware-software

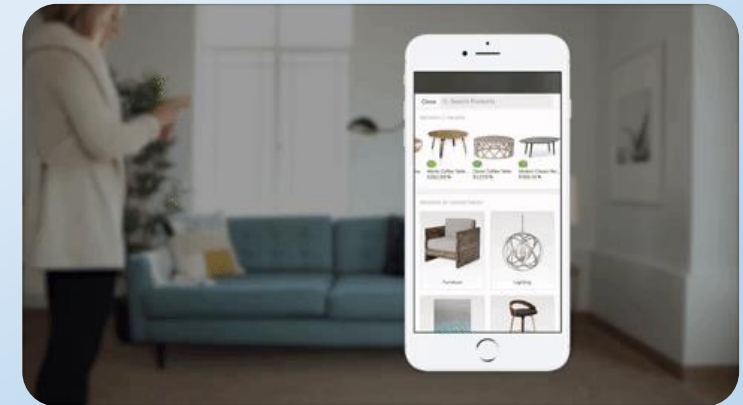




Augmented and Virtual Reality Government officials Training (GoT)

Inaugural session – 28th February, 2022 (1.30PM onwards)

- Welcome address
 - Dr Sarwan Singh Dy. Director
- About the “FutureSkills PRIME–AVR” scheme
 - Dr. Manish Arora, Addl. Director (PI – FutureSkills PRIME–AVR)
- About NIELIT Chandigarh
 - Sh. Gurjit Singh, Scientist ‘F’ (HoD – Training division)
- Address by Director
 - Ms. Sunita Goyle, Director NIELIT Chandigarh
- Vote of thanks
 - Ms Suman TO





References

Websites :

- developers.google.com/ar,
- dev.to/arunkumarvallal, mobidev.biz,
gerardfriel.com/ar/the-history-of-ar
- Harvard Business Review – “*Managers-Guide-to-AR*”
- “Virtual Reality/Augmented Reality White Paper”
CAICT, Huawei Technologies Co.

Books

- “Theory and applications of marker-based augmented reality” – Sanni Siltanen
- “Computer graphics” - Hearn and Baker





Augmented Reality

AR is both a disruptive technology and an exciting vision of the future.

- A combining **real scene view by a user** and **a virtual scene generated by computer** is known as Augmented reality.
- Augmenting the scene with additional information
- AR system, adds **virtual computer generated objects**, **audio** and other **sense enhancements** to a real-world environment in real time.
- Goal is *to enhance a person's performance and perception of the world.*



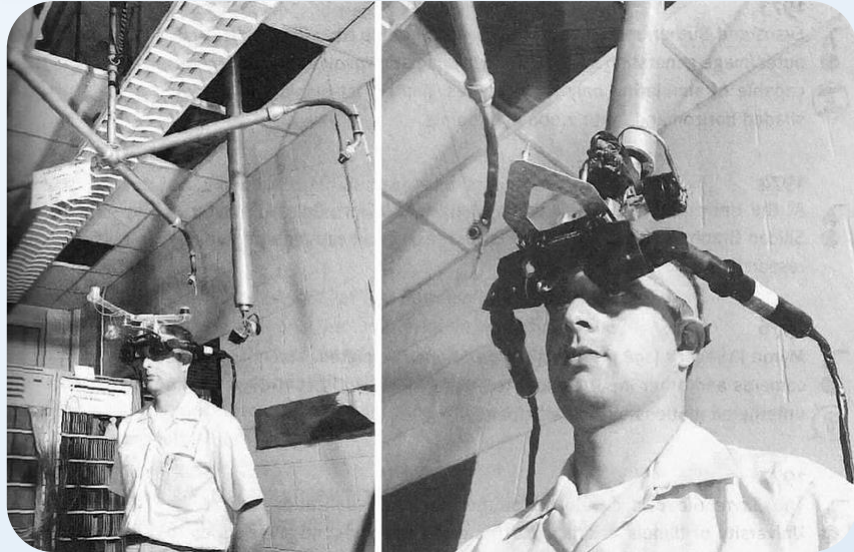


Augmented Reality

- “Augmented reality, in computer programming, a process of **combining** or ‘**augmenting**’ video or photographic displays by overlaying the images with useful computer-generated data.”
- Augmented reality research combines the fields of **computer vision** and **computer graphics**.
- The research on computer vision as it applies to AR includes among others marker and feature detection and tracking, **motion detection and tracking**, image analysis, **gesture recognition** and the construction of controlled environments containing a number of different sensors.
- **Computer graphics** as it relates to AR includes for example photorealistic rendering and interactive animations.

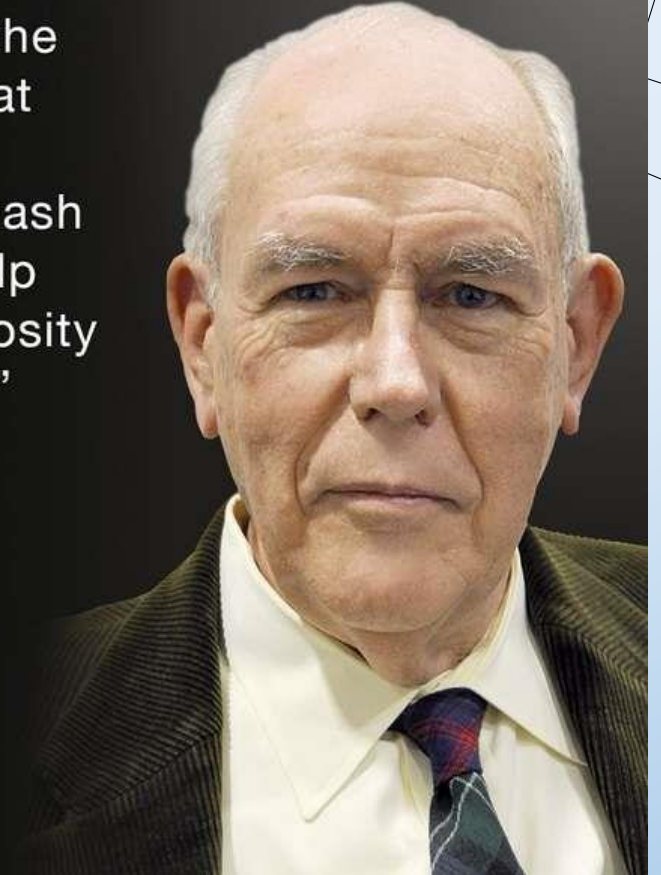


Father of Computer Graphics



“And so it seems to me the most important thing that adults need to do with young people is not squash their curiosity, but to help them exercise their curiosity and learn how to use it.”

Ivan Sutherland
*Inventor of the Display
Window by Clipping*

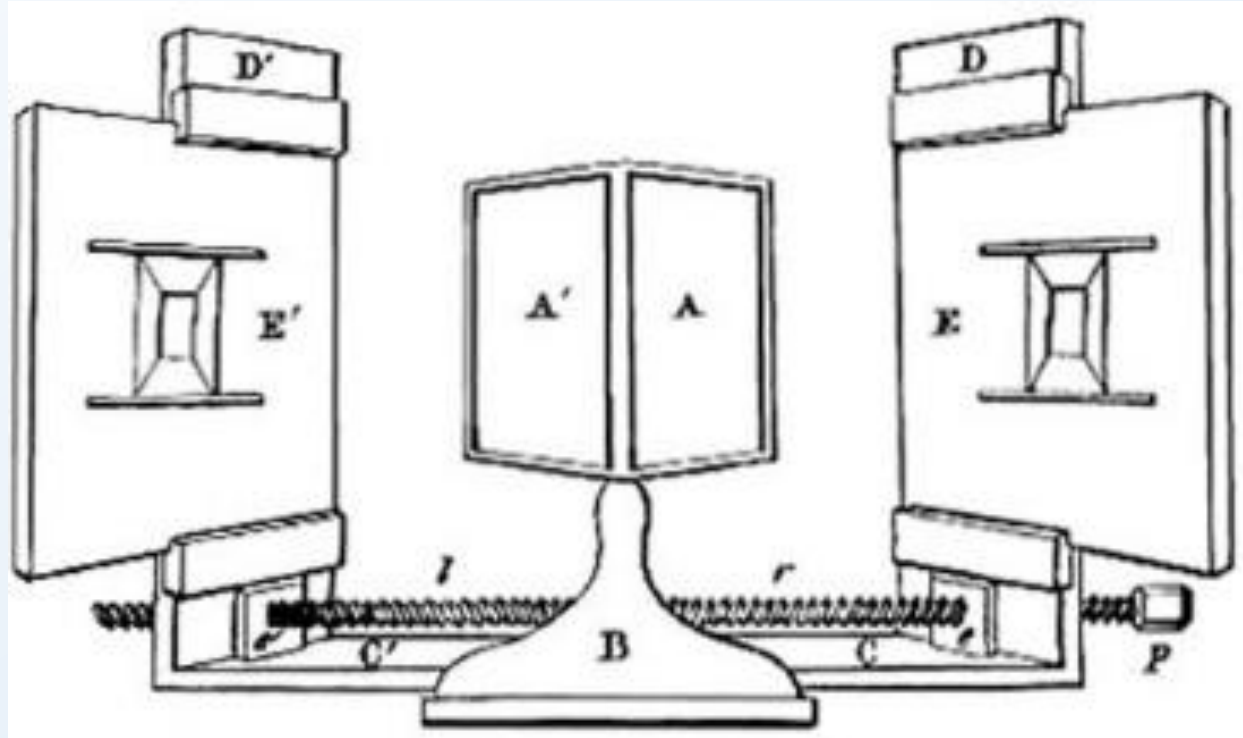




History

- 1838 – invention of Stereoscope by Sir Charles Wheatstone
- 1968 – Ivan Sutherland at MIT
 - Sword of Damocles

A Short History of VR





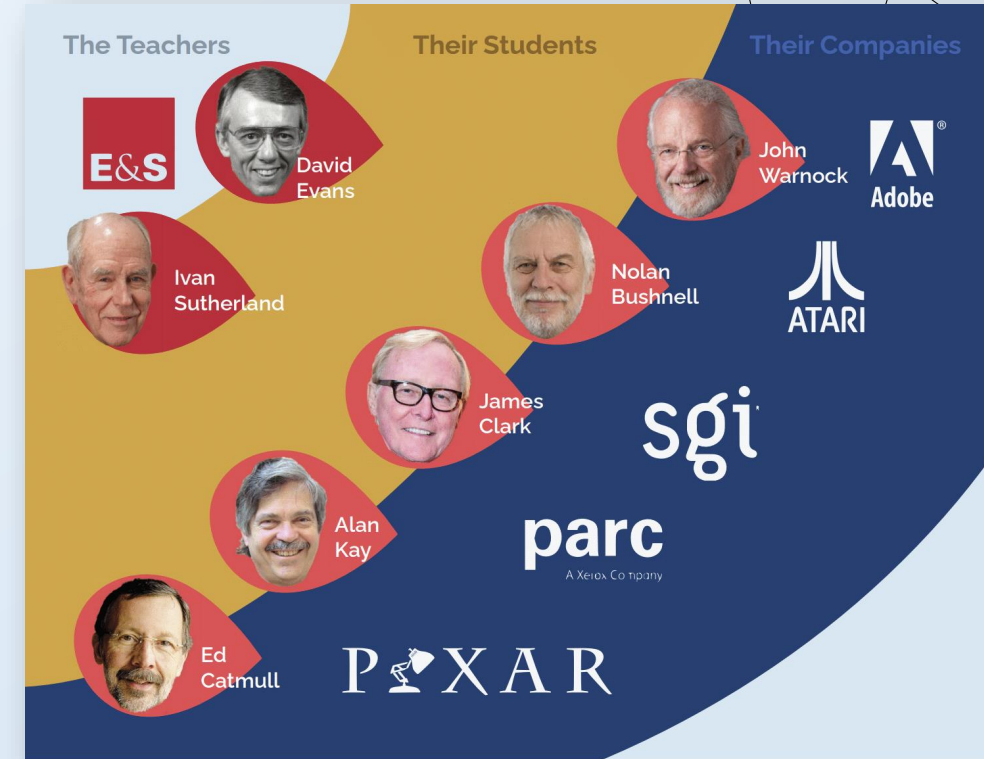
Did You Know that the Computer Graphics Revolution Began in Utah?

Two men who stand out as the foremost Tech Pioneers in Utah are without a doubt David Evans and Ivan Sutherland.

In 1965, the University of Utah recruited Evans to establish a state of the art computer science program.



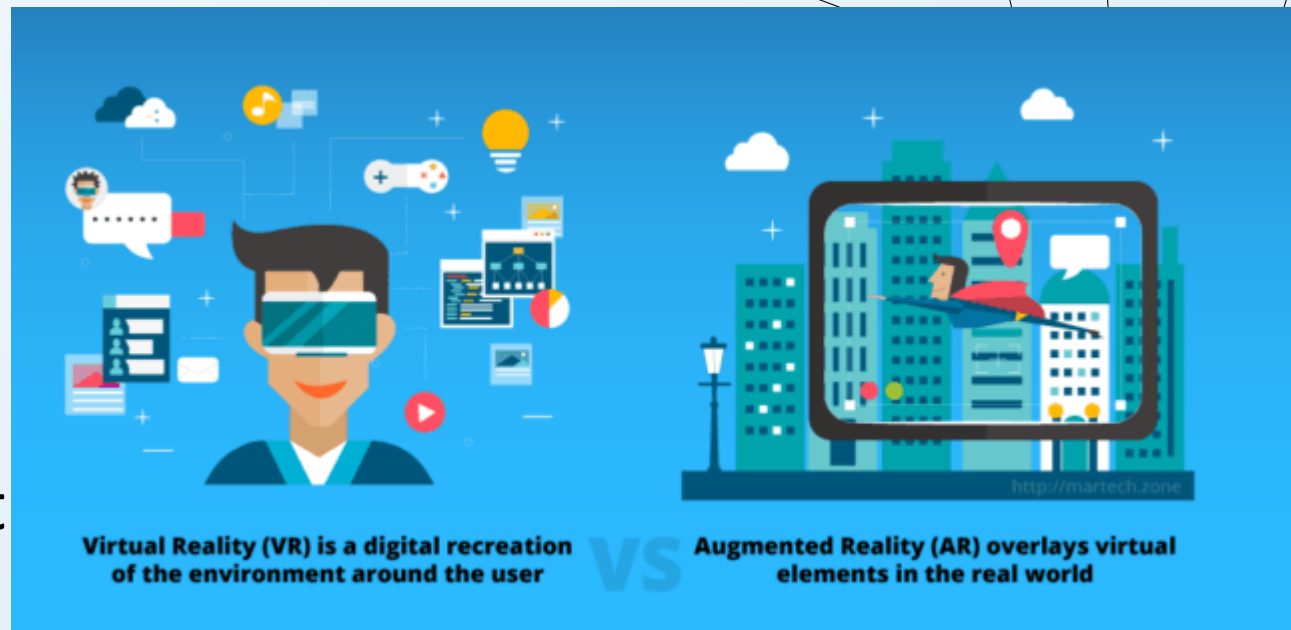
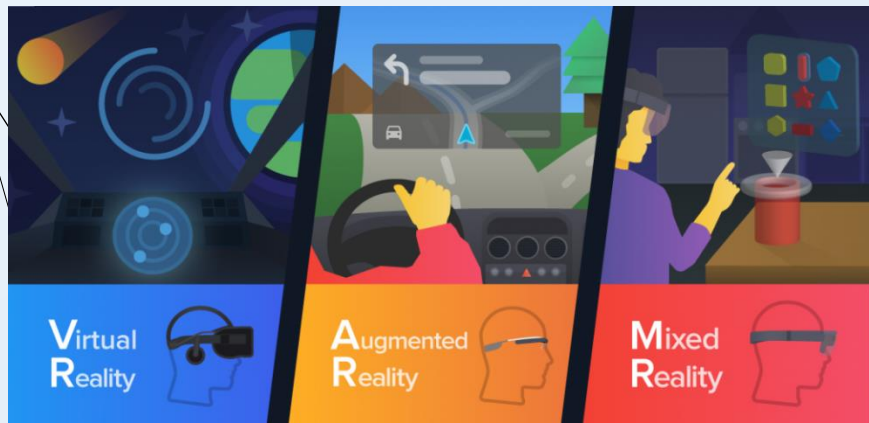
- In 1968, he convinced his friend from Berkeley, Ivan Sutherland, to leave his teaching position at Harvard and move to Utah, which he agreed to do under the condition that they would eventually launch a computer graphics company together.
- This dynamic duo used their math, physics and electrical engineering skills to revolutionize computer graphic imaging technology. They literally built the first **computer graphics simulation engines**, and they and their students pioneered the field of CGI (Computer Graphics Imagery). Out of their labs came **Adobe**, **Pixar**, **Atari**, **Xerox**, and **PARC**, a subsidiary of Xerox, which invented the first GUI (graphical user interface, and which Apple copied and built into the Macintosh), and a host of graphic simulation engines used by the U.S. Military.





AR vs VR

- VR technologies completely immerse a user inside a **completely artificial environment**, where user cannot see the real world around him
- In AR, user see the real world, with **virtual objects** superimposed upon or composited with the real world.





Virtual Reality	Augmented Reality
something that doesn't physically exist, but is made to appear so	something that has been made greater by adding to it
VR immerses you in a virtual representation of an environment	AR adds digital layers to the real world around you
	sitting at home and be transported to Taj with a VR headset, or see how a piece of furniture might fit into your living room

Minecraft





Virtual Reality	Augmented Reality
Totally immersive environment	System augments the real world scene
Visual senses are of under control of system(sometimes aural and proprioceptive senses too)	User maintains a sense of presence in real world
	Needs a mechanism to combine virtual and real worlds



Augmented Reality in India

- FlippAR works with the government of Karnataka and has put 70 monuments and statues in Bengaluru in an AR app.

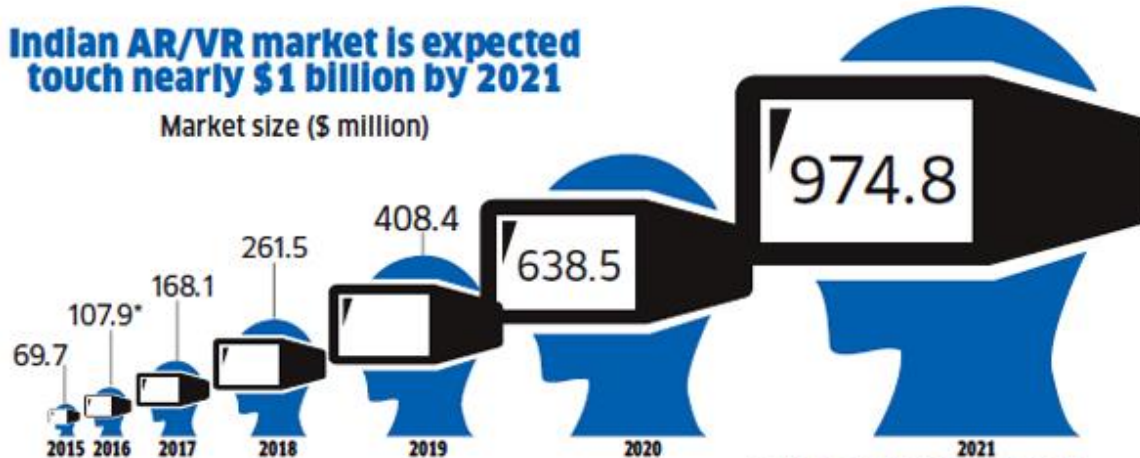


ANI @ANI · Jul 13

Kerala: Shyam Vengalloor (pic 4), a social science teacher at a school in Malappuram has introduced augmented reality to online classes for students. He says, "It took around 2 months to get it done. The online lessons were otherwise dull and needed more effort." (12.07.2020)

Indian AR/VR market is expected touch nearly \$1 billion by 2021

Market size (\$ million)



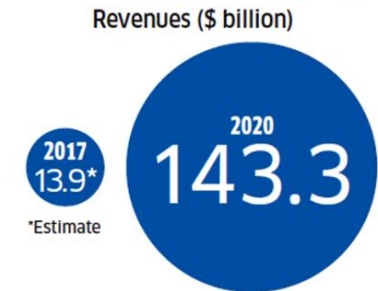
Source: TechSci Research | *Estimate



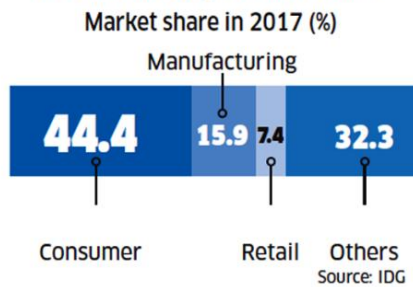


Augmented Reality around the World

Global AR/VR revenues are set to grow rapidly



Consumer segment accounts for nearly half of total AR/VR market



➤ IDC says the **consumer segment** accounts for over 44% of the global AR/VR market.

➤ The **enterprise market**, though fragmented among manufacturing, retail and other sectors, has a lot of potential, too.

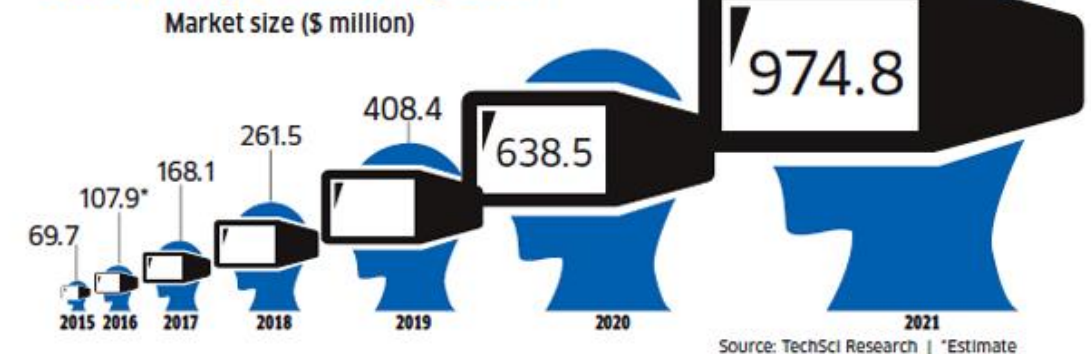
Recent Acquisitions in AR

Buyer	Acquired Company	Cost (\$ million)	When
Apple	SensoMotoric Instruments	Undisclosed	Jun, '17
Snapchat	Cimage	30-40*	Dec, '16
Google	Eyefluence	Undisclosed	Oct, '16
Upskill	Pristine	Undisclosed	May, '16
Magic Leap	Dacuda (3D division)	Undisclosed	Feb, '16

*Reported

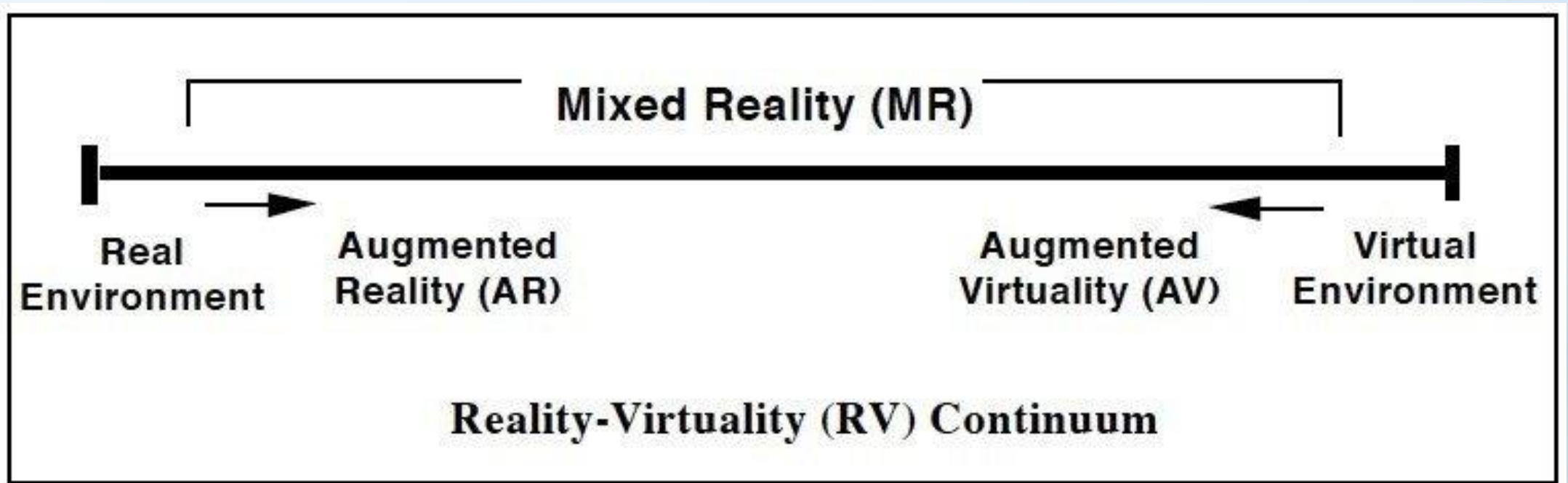
Apple embraces a technology only when it sees a big market for it. CEO, In-Gage Technologies

Indian AR/VR market is expected touch nearly \$1 billion by 2021





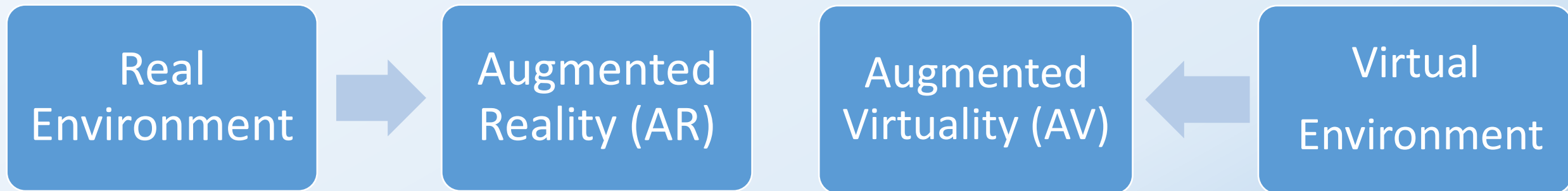
- In 1994 Paul Milgram and Fumio Kishino defined a mixed reality as *“anywhere between the extrema of the virtual continuum”* where the *Virtuality Continuum* extends from completely real through to the completely virtual environment with augmented reality and augmented virtuality ranging between .





Miligram's Reality- Virtuality Continuum

Miligram coined the term “**Augmented Virtuality**” to identify systems which are mostly synthetic with some real world imagery added such as texture mapping video onto virtual objects.





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VIRTUALITY CONTINUUM

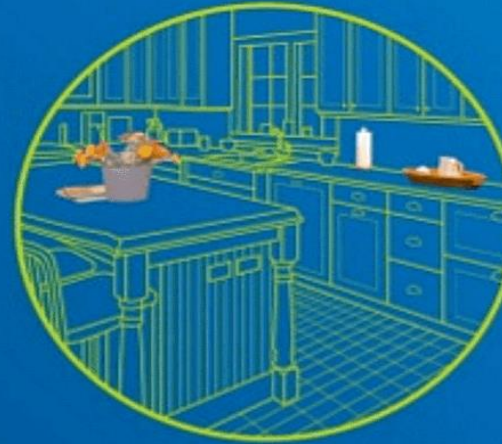
MIXED REALITY



REALITY



**AUGMENTED
REALITY (AR)**



**AUGMENTED
VIRTUALITY (AV)**



VIRTUAL REALITY

REAL
ENVIRONMENT

MIXED REALITY (MR)

VIRTUAL
ENVIRONMENT

Tangible User Interfaces (TUI)

A TUI uses real physical objects to both represent and interact with computer-generated information (Ishii & Ullmer, 2001).

Augmented Reality (AR)

AR 'adds' computer-generated information to the real world (Azuma, et al. 2001).

Augmented Virtuality (AV)

AV 'adds' real information to a computer-generated environment (Regenbrecht, et al. 2004).

Virtual Reality (VR)

VR refers to completely computer-generated environments (Ni, Schmidt, Staadt, Livingston, Ball, & May, 2006; Burdea & Coffet 2003)

Projection Augmented models (PA model) are a type of Spatial AR display, and are closely related to TUIs.

Spatial AR

Spatial AR displays project computer-generated information directly into a user's environment (Bimber & Raskar, 2005).

'See-through' AR (either optical or video)

A user wears a head-mounted display, through which they can see the real world with computer-generated information superimposed on top (Cakmakci, Ha & Rolland, 2005; Billinghamurst, Grasset & Looser, 2005).

Semi-immersive VR

A semi-immersive VR display fills a limited area of a user's field-of-view.

Immersive VR

Immersive VR, which uses either a head-mounted-display or a projection-based system, completely fills the user's field-of-view.



Using physical objects to create a virtual model (Ichida, Itoh, & Kitamura, 2004). As a user adds a physical 'ActiveCube' to the construction, the equivalent virtual model is automatically updated.



The 'Bubble Cosmos' - 'Emerging Technology' at SIGGRAPH'06. The paths of the smoke-filled bubbles are tracked, and an image is projected into them as they rise.



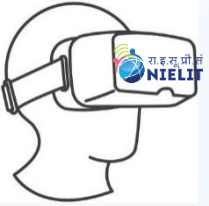
See-through AR: the butterfly is computer-generated, and everything else is real (Fischer, Bartz & Straßer, 2006; Kölsch, Bane, Höllerer, & Turk, 2006).



Semi-immersive VR using the Barco Baron workbench (Drettakis, Roussou, Tsingos, Reche & Gallo, 2004).

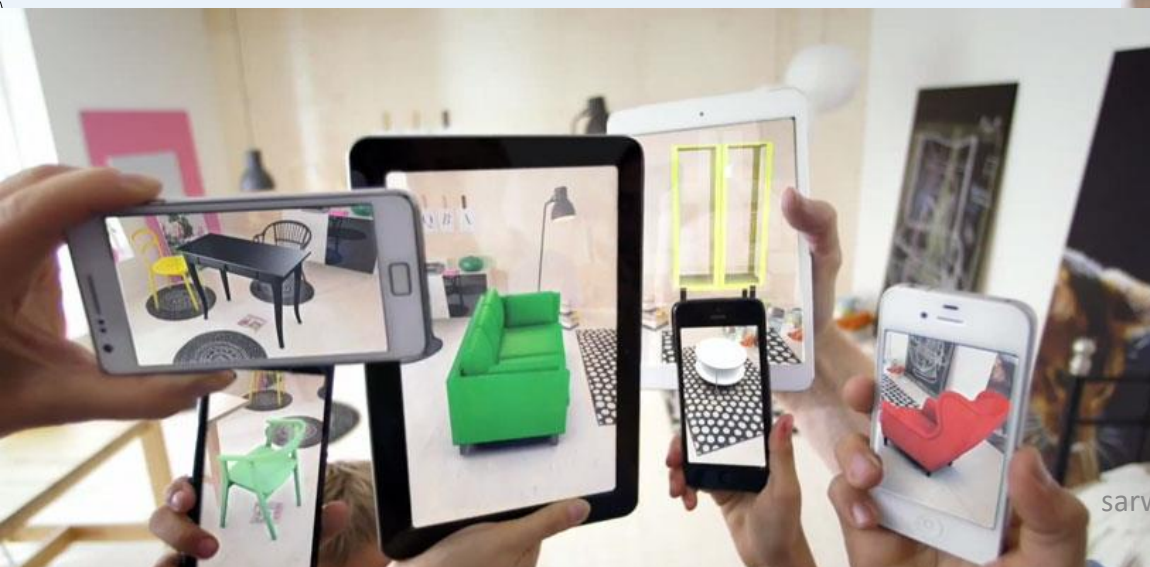


Projection-based immersive VR. The users are fully immersed in the 'CAVE' (FakeSpace, 2006; Cruz-Neira, Sandin & DeFanti, 1993).



	VR	AR/MR
 PC	 	 
 Standalone	 	 
 Smartphone	 	 

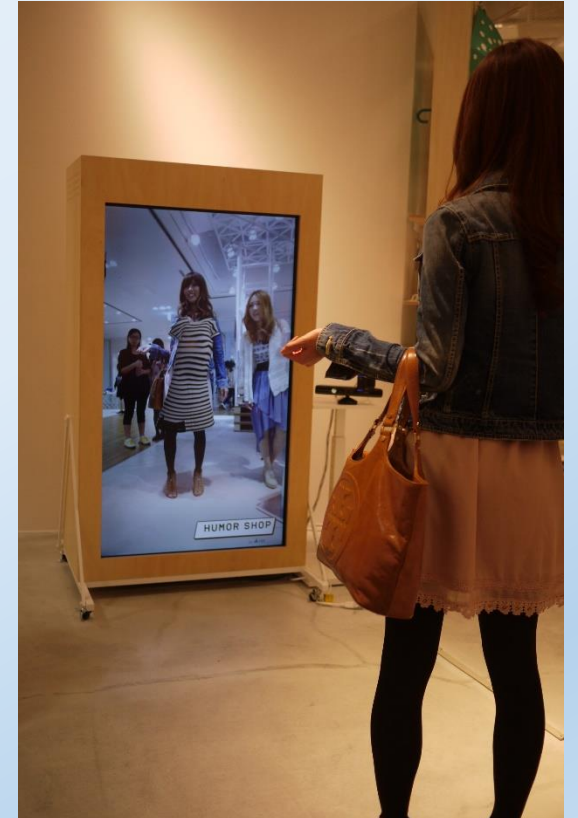
AR apps in Interior Designing





Display

- Head-mounted Display(HMD)
- Eye Glasses
- Contact Lenses
- Virtual Retina Display
- Handheld
- Spatial

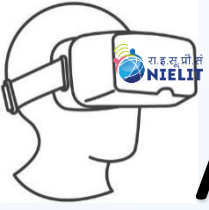




Applications

- Medical
- Entertainment
- Military training
- Engineering Design
- Robotics and Telerobotics
- Manufacturing, Maintenance and Repair
- Consumer Design
- Hazard Detection
- Audio





Augmented Reality SDKs

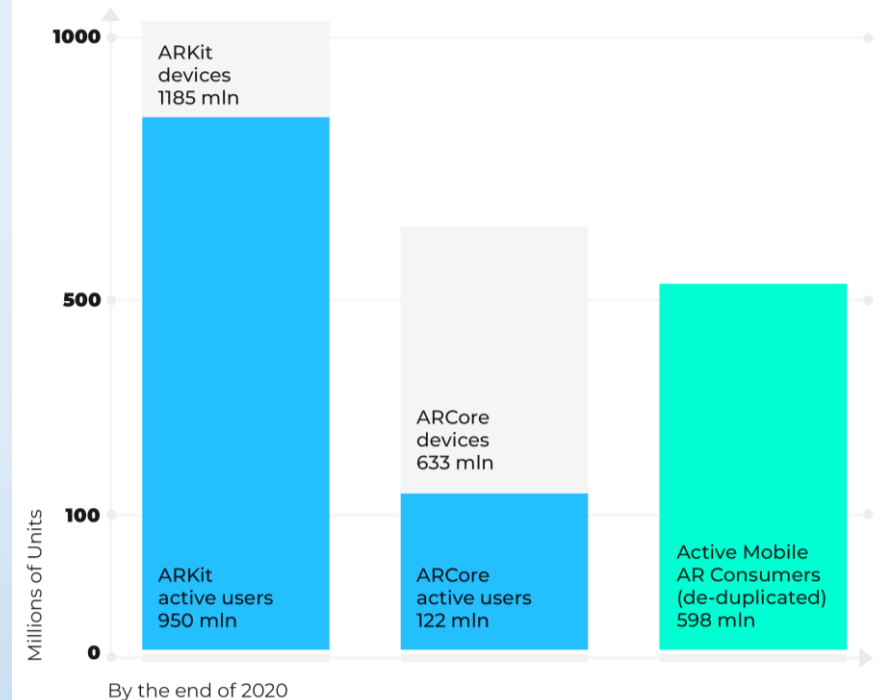
- There are hundreds of AR SDKs available to develop AR apps for Mobile devices, Holo Lens, AR Glasses, Web

- Popular AR SDKs:

1. [Vuforia - PTC](#)
2. [ARCore - Google](#)
3. [ARKit - Apple](#)
4. [Wikitude](#)
5. [Kudan](#)
6. [8th Wall](#)
7. [A-Frame](#)



Mobile AR 2020: ARKit +ARCore



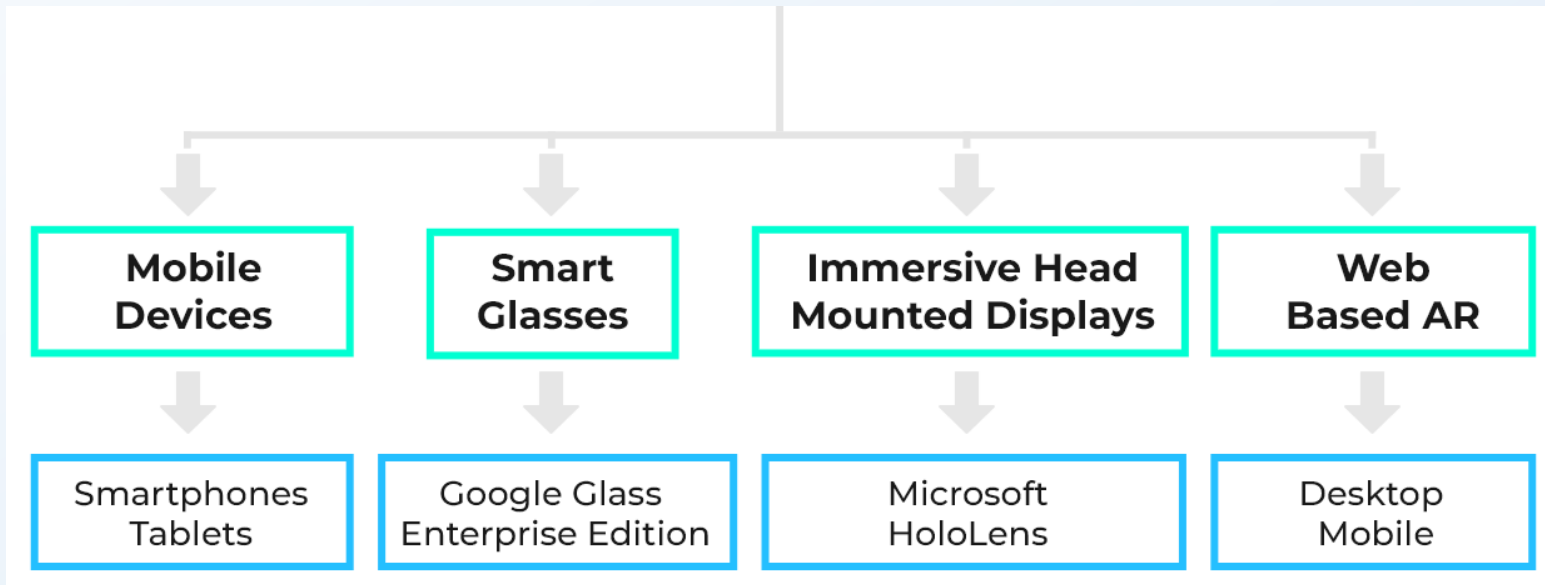


AR Frameworks / Libraries

- AR Frameworks / Libraries can help you build your AR application for both iOS and Android with a single codebase!
- Even for other devices such as Holo Lens, AR Glasses, etc.,
- Popular AR Frameworks:
 1. [AR Foundation](#)
 2. [Vuforia Fusion](#)

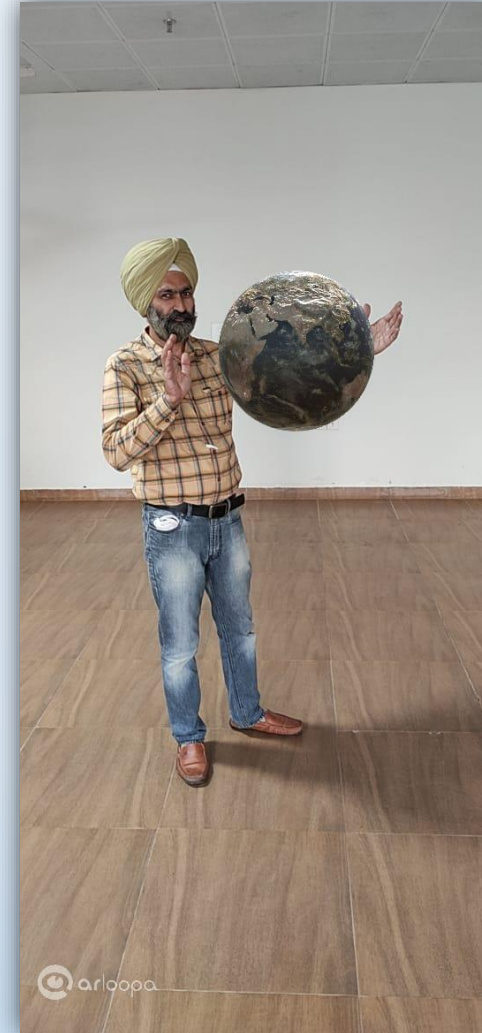


Augmented Reality Hardware



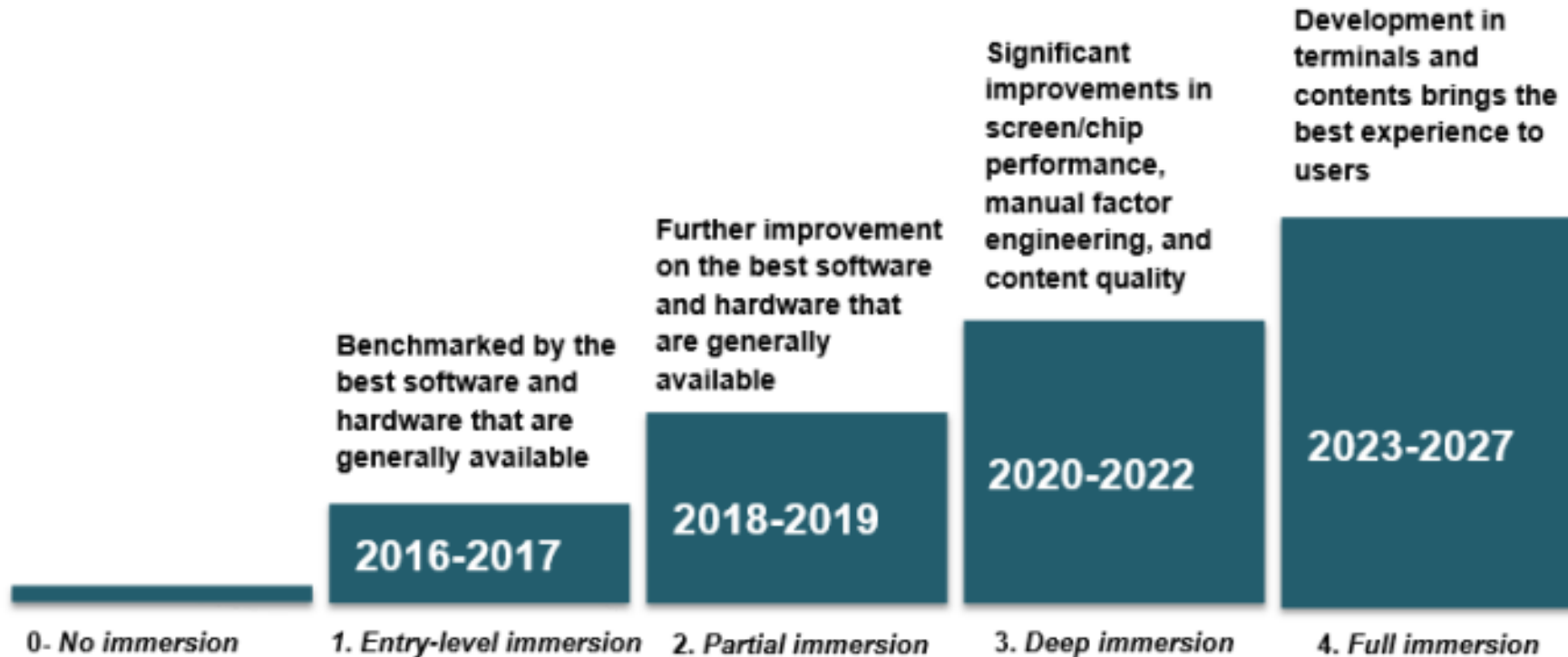


E.g. of arloopa AR app





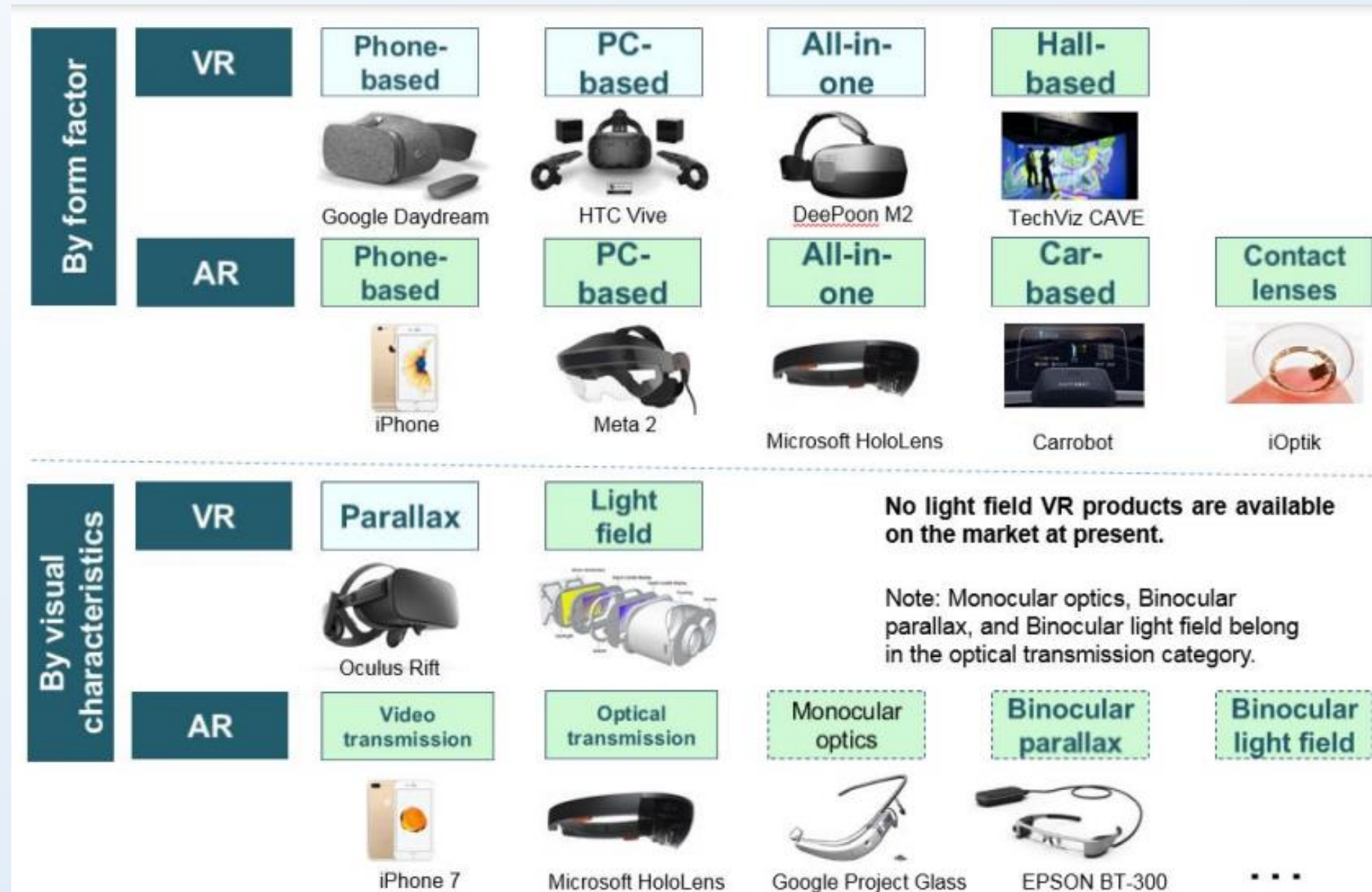
Levels of VR immersive experience



Source: CAICT

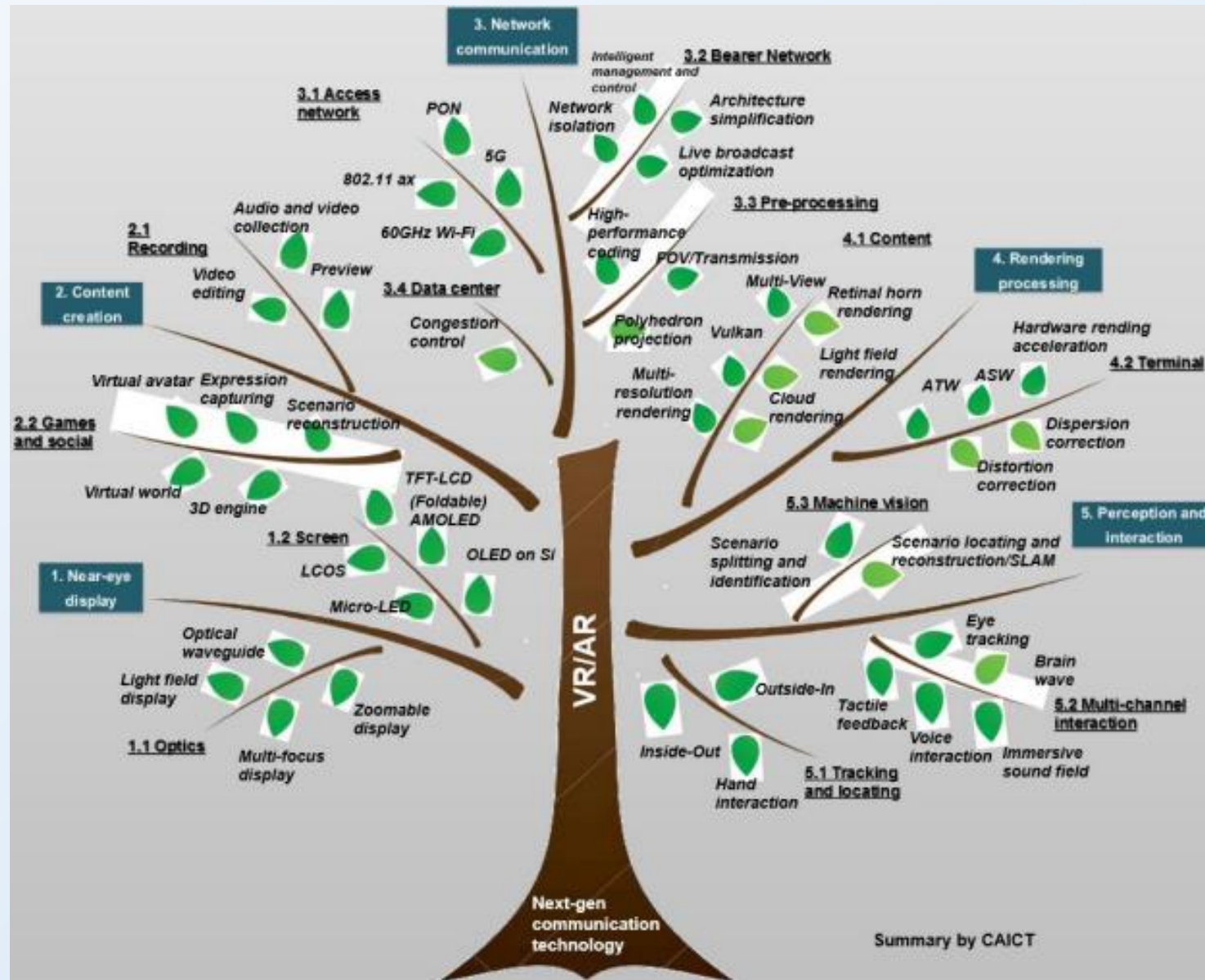


Categories of VR products





Hierarchy of VR technologies





A
R
@
2
0
1
1



- <https://www.youtube.com/watch?v=nxUwJSnbIbQ&feature=youtu.be>



Oracle IoT Connected Worker With Augmented Reality



<https://www.youtube.com/watch?v=4b47-n3pQII>

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Kinect for Windows Retail Clothing Scenario Video



<https://www.youtube.com/watch?v=Mr71jrkzWq8&t=58s>

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<https://www.youtube.com/watch?v=nWcGhuX6N7w>

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