

Augmented Reality

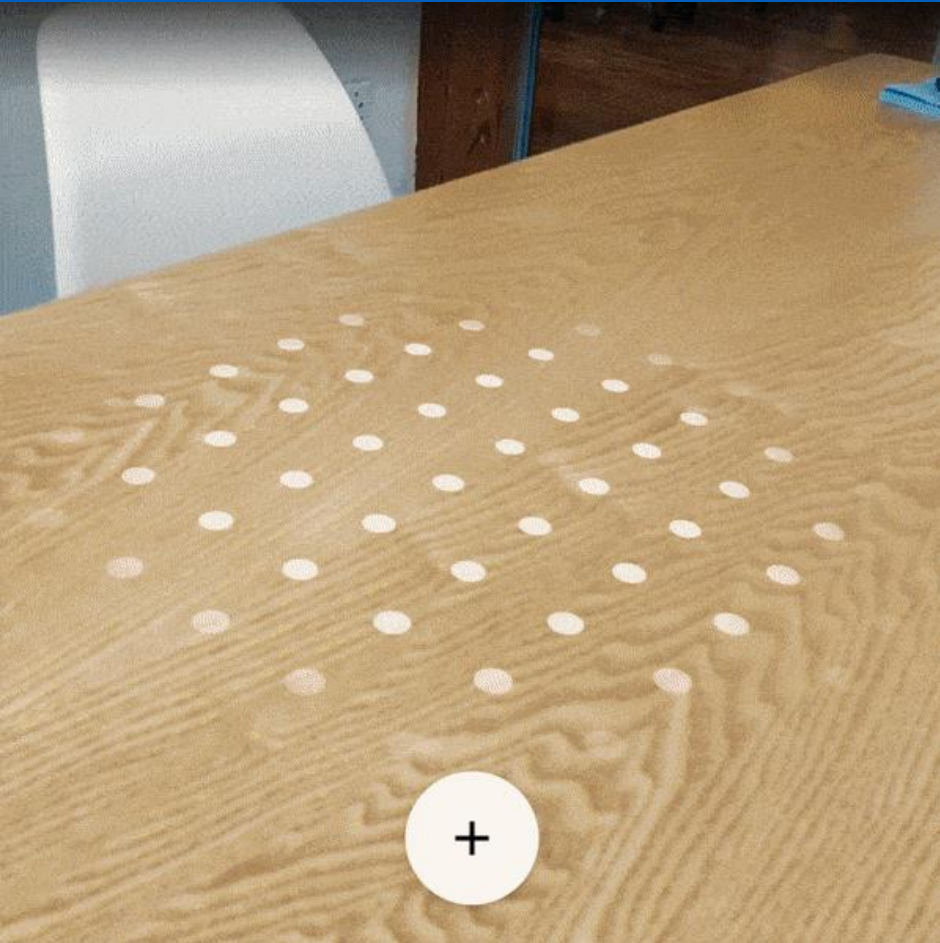
2020.11.15

Overview

- **Concept**
- **AR vs. VR**
- **How does AR work?**
- **Types of AR**
- **AR Development**
- **Future of AR**



What is Augmented Reality?



- ? Interactive experience of a real-world environment with virtual objects are enhanced by computer-generated perceptual information, sometimes across multiple sensory modalities, including visual, auditory, somatosensory, and olfactory.
- AR research is currently concerned with the use of video imagery which is digitally processed and augmented by adding computer-generated graphics.
- 1990: The term Augmented Reality was coined by Boeing researcher Tom Caudell

What is AR? (cont.)

- Augmented reality system defines as follows:
 - Combines real and virtual world aspects
 - Is interactive in real-time
 - Is registered in three dimensions



Augmented vs. Virtual Reality

- AR adds digital elements to a live view often by using the camera on a smartphone. In Augmented Reality, the user must still be aware that users are present in the “real world.”
- VR implies a complete immersion experience that shuts out the physical world.

Reality-Virtuality-Kontinuum

Real World



Augmented Reality



Augmented Virtuality



Virtual World

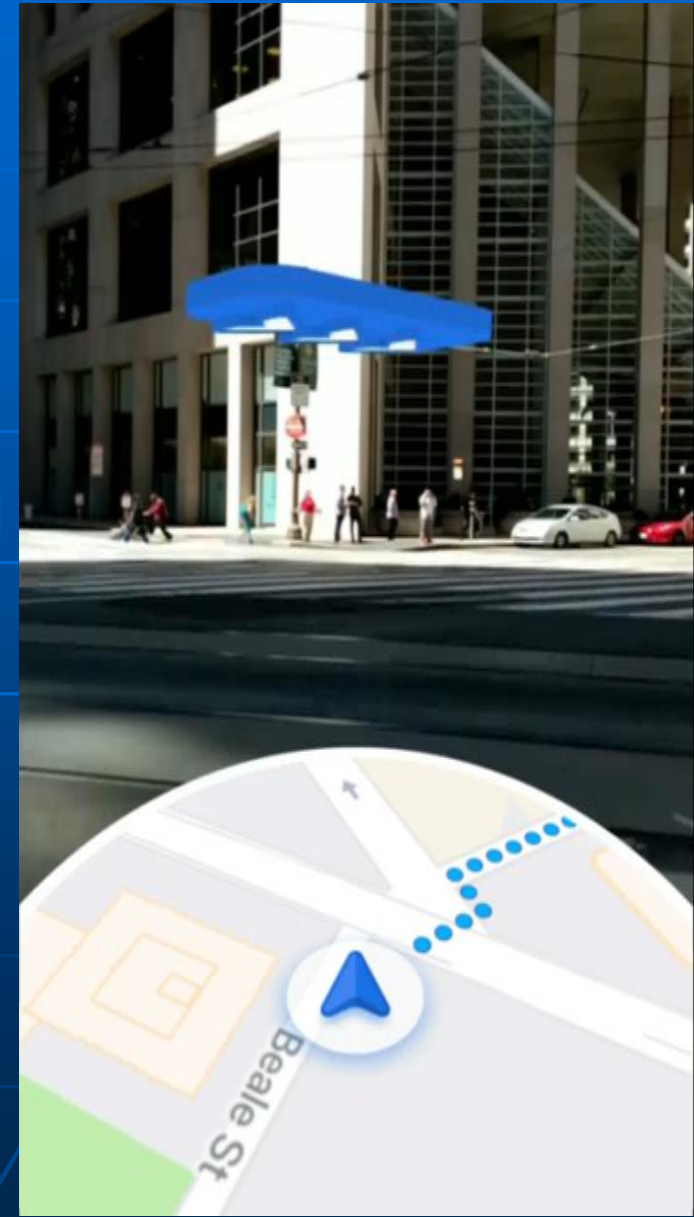


Mixed Reality

How does AR Work?



- The basic idea of augmented reality is to superimpose graphics, audio and other sense enhancements over a real-world environment in real-time.
- The graphics will then change to accommodate the user's eye or head movements.



What is needed?

Three components needed to make an AR system work:

- Head-mounted display
- Tracking system
- Mobile computing power



What is needed?

- **Cameras and sensors.**

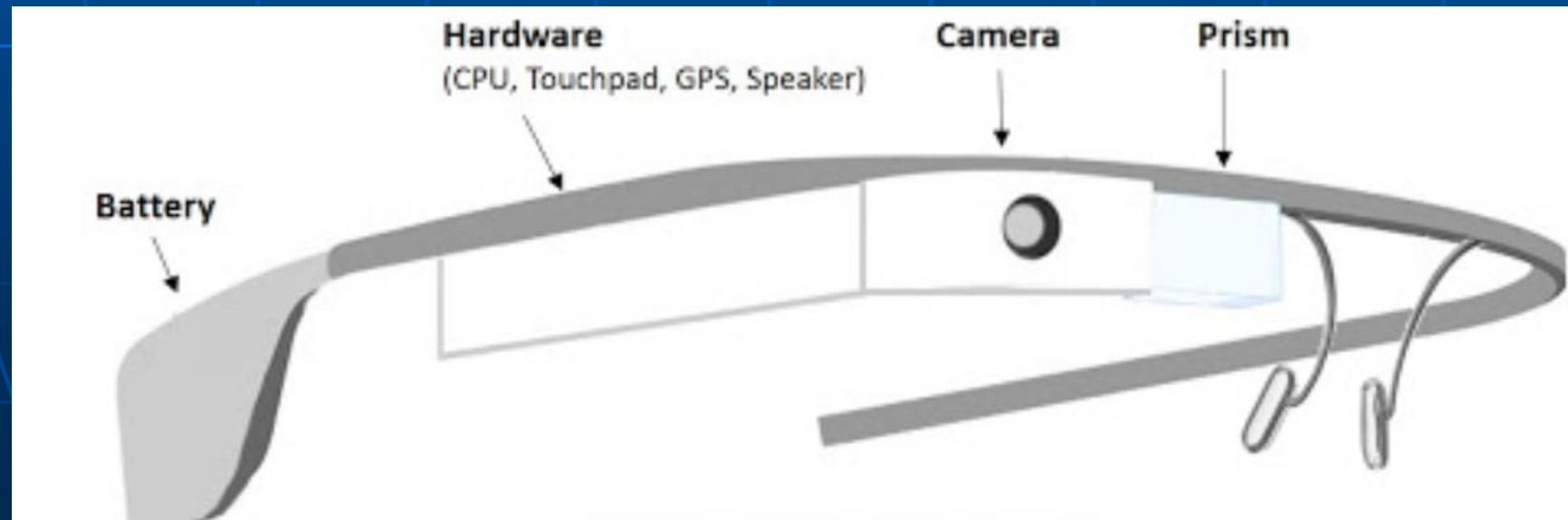
- Collecting data about user's interactions
- Scanning the surroundings model

- **Processing.**

- AR devices eventually should act like little computers, something modern smartphones already do.
- A CPU, a GPU, flash memory, RAM, Bluetooth/WiFi, a GPS, etc.
- To be able to measure speed, angle, direction, orientation in space, and so on.

- **Projection.**

- Miniature projector



AR Devices

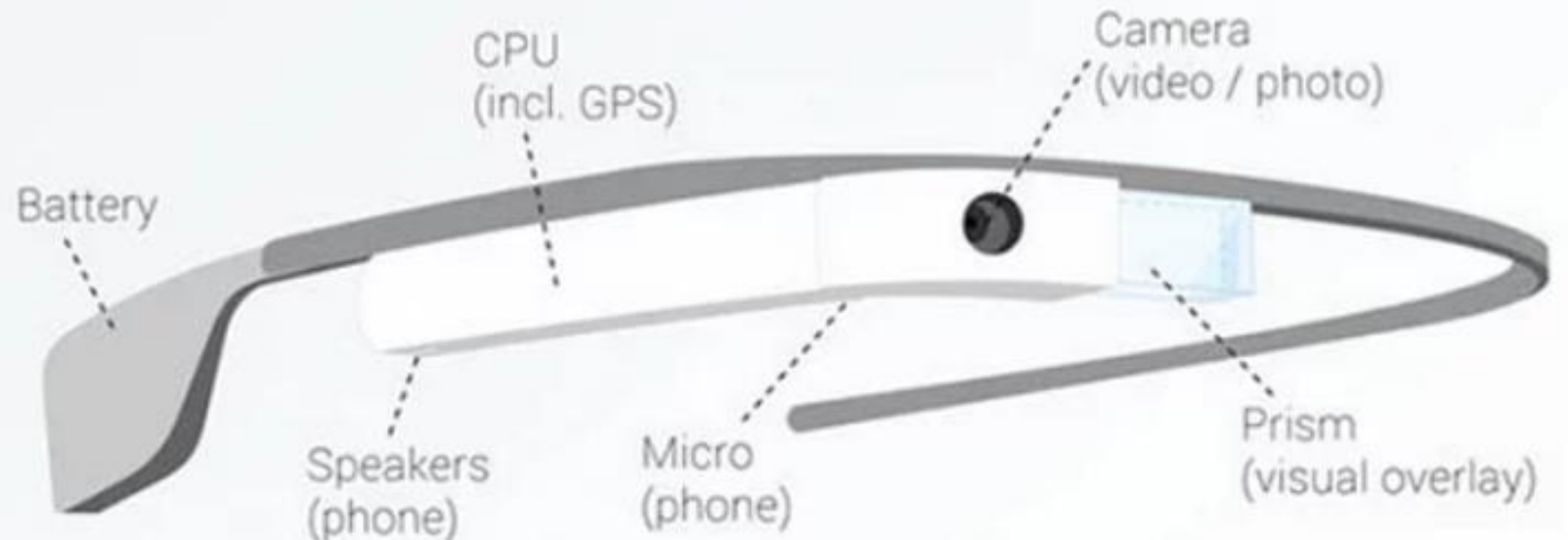
- Google Glass (released developer version on 2013.2)



How Google GLASS works

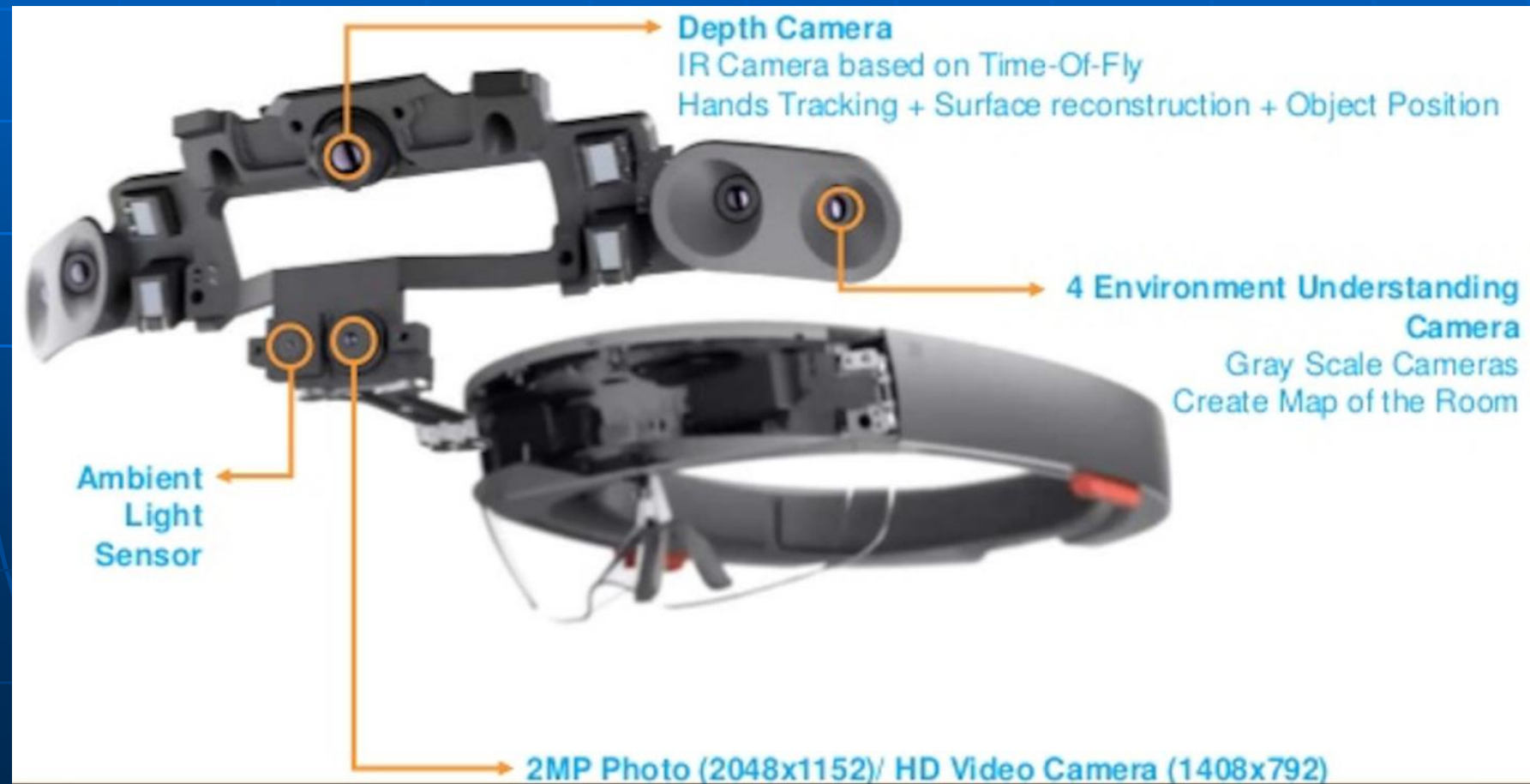
Why can you see a sharp image?

Infographic by M. Missfeldt
www.brille-kaufen.org



AR Devices

- Microsoft HoloLens (released developer version on 2016.3)

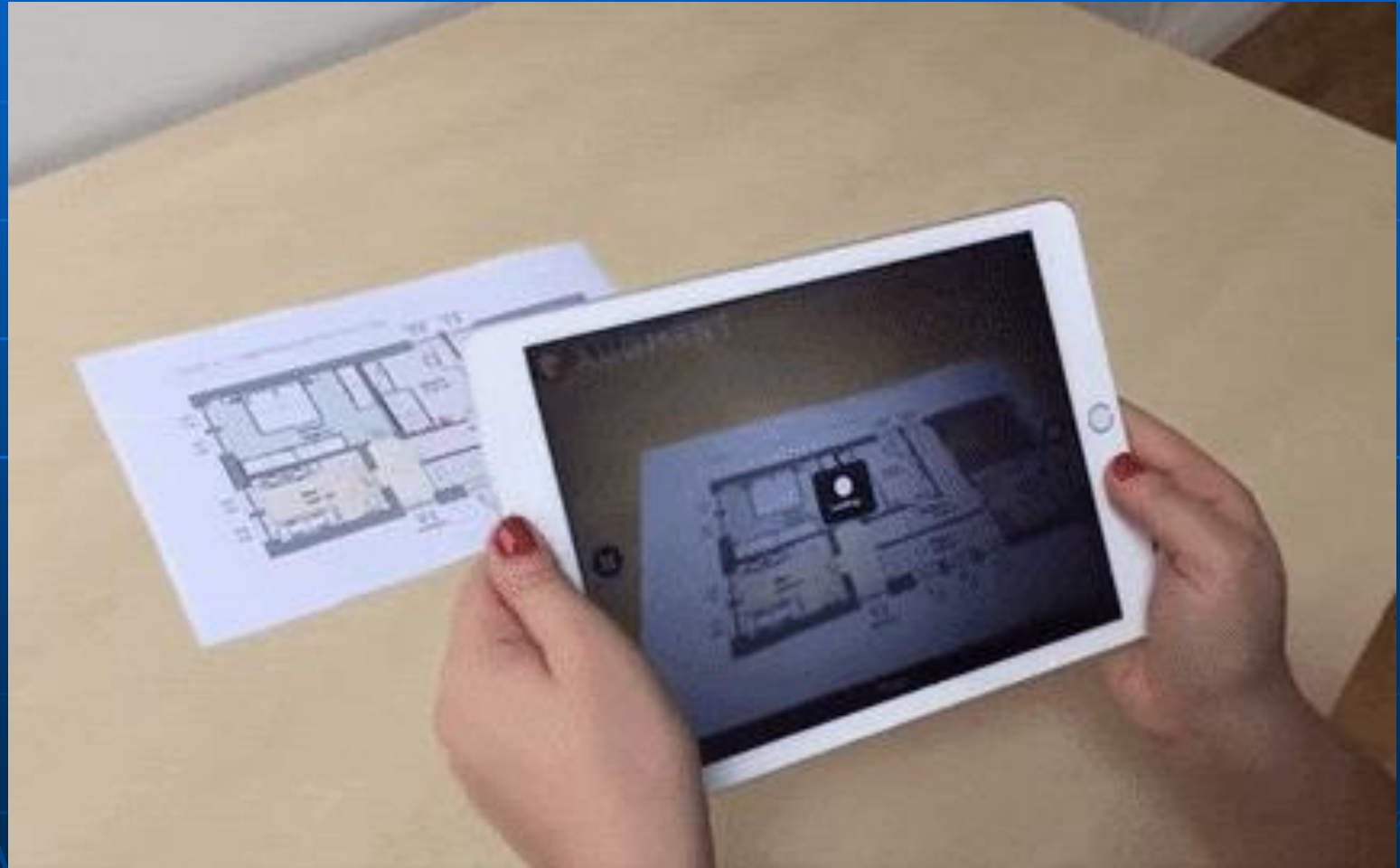


Type of AR(1)

- **Marker-based AR.**

Some also call it to image recognition, as it requires a special visual object and a camera to scan it.

May be anything, from a printed QR code to special signs.



Type of AR(2)

■ Markerless AR.

- Location-based or position-based augmented reality,
- It utilizes a GPS, a compass, a gyroscope, and an accelerometer, etc
- This data determines what AR content you find or get in a certain area.



Type of AR(3)

■ Projection-based AR.

- Projecting synthetic light to physical surfaces
- In some cases allows to interact with it.
- These are the holograms



Type of AR(3)

■ Superimposition-based AR.

- Replaces the original view with an augmented, fully or partially.
- Object recognition plays a key role, without it the whole concept is simply impossible.



ARCore in Unity(Development)

Installing ARCore XR Plugin

Download ARCore XR plugin and install in Unity 3D

Link: <https://developers.google.com/ar/develop/unity>

Supported Features:

- Device tracking - Track the device's position and orientation in physical space.
- Raycast - Commonly used to determine where virtual content will appear
- Plane detection - Detect the size and location of horizontal and vertical surfaces
- Reference points - Track the positions of planes and feature points over time.
- Face tracking - Access face landmarks, a **mesh** representation of detected faces
- 2D image tracking - Detect specific 2D images in the environment.
- Environment probes - Detect lighting and color information in specific areas of the environment

Reference: <https://docs.unity3d.com/Manual/AROverview.html>

Libraries

- **ARCore** Plug-in on Android
- **ARKit** Plug-in on iOS
- **Magic Leap** Plug-in on Magic Leap
- **Windows** Plug-in on HoloLens

Unity's AR Foundation Supported Features

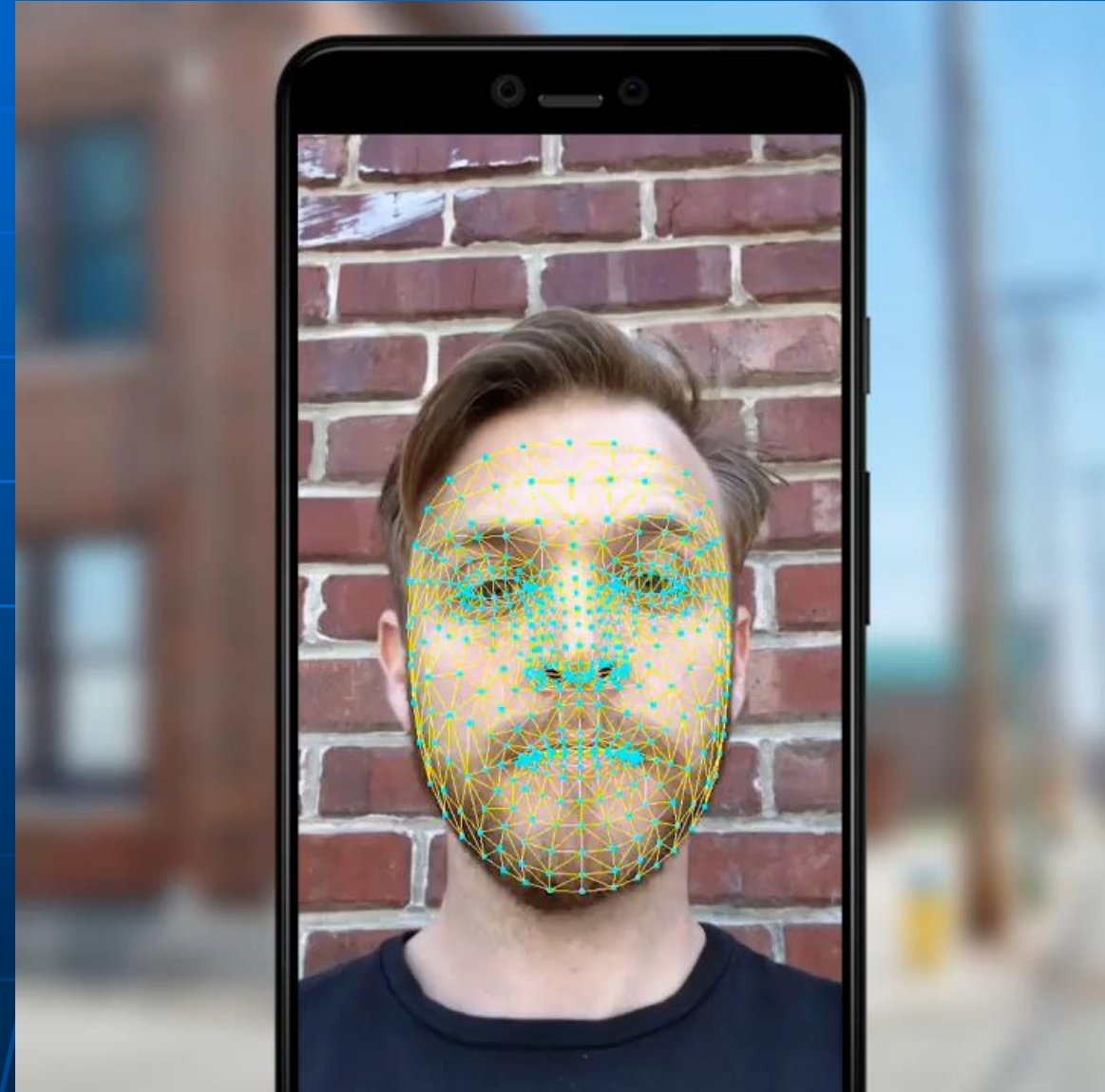
● — Supported
● — Pending

Functionality	ARKit	ARCore	Magic Leap	HoloLens
Pass-through video	●	●		
Device tracking	●	●	●	●
Raycast	●	●	●	●
Plane tracking	●	●	●	●
Reference points	●	●	●	●
Point cloud detection	●	●	●	
Gestures			●	●
Face tracking	●	●		
2D image tracking	●	●	●	
3D object tracking	●			
Environment probes	●	●	●	
Meshing			●	●
2D & 3D body tracking	●			
Human segmentation and occlusion	●			
Collaborative participants	●			

Future of AR

- **AR's close relationship with Artificial Intelligence (AI)**

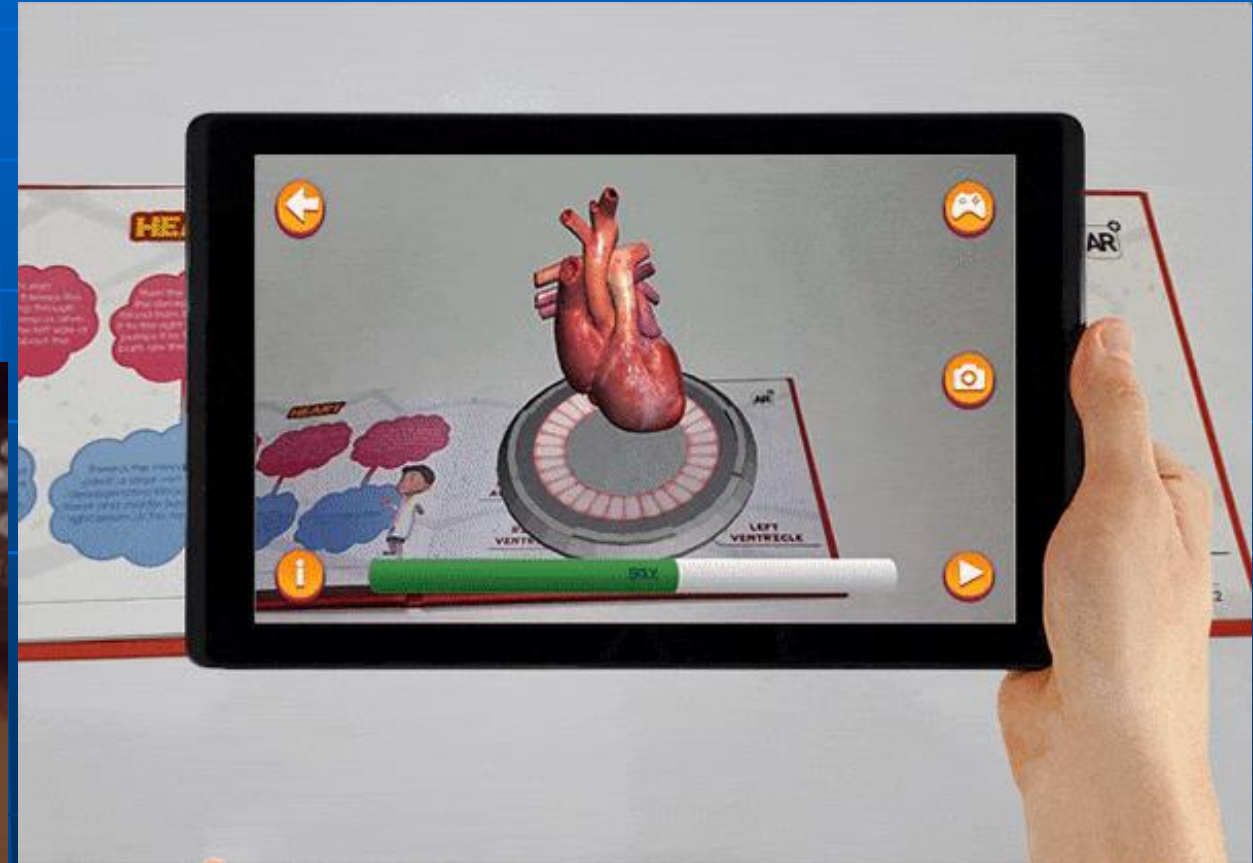
Artificial Intelligence is very much essential for the operations of augmented reality.



Future of AR

- **AR in terms of Teaching and Training**

By using augmented reality technology, any information or data can be passed to a learner in real-time.



Future of AR

- **AR is overtaking the Automobile Industry**

Automobile companies are currently working in dashboard-mounted display graphics from around a vehicle with the help of camera footage.



Future of AR

- **AR welcomes Extended Reality (XR)**

Extended reality is a form in which we can alter reality digitally. XR comprises of mind reality, virtual reality and augmented reality.



Thank you