



Augmented Reality glasses

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Introduction

- What if, by wearing a pair of glasses, you could see information superimposed on the real world?
- Similar in appearance to regular glasses, AR smart glasses contain powerful computers.
- Provide an overlay of virtual data and enable a new level of portable functionality.
- AR smart glasses allow people to receive audio prompts, take pictures, make phone calls, and even record speech.





AR glasses: The future

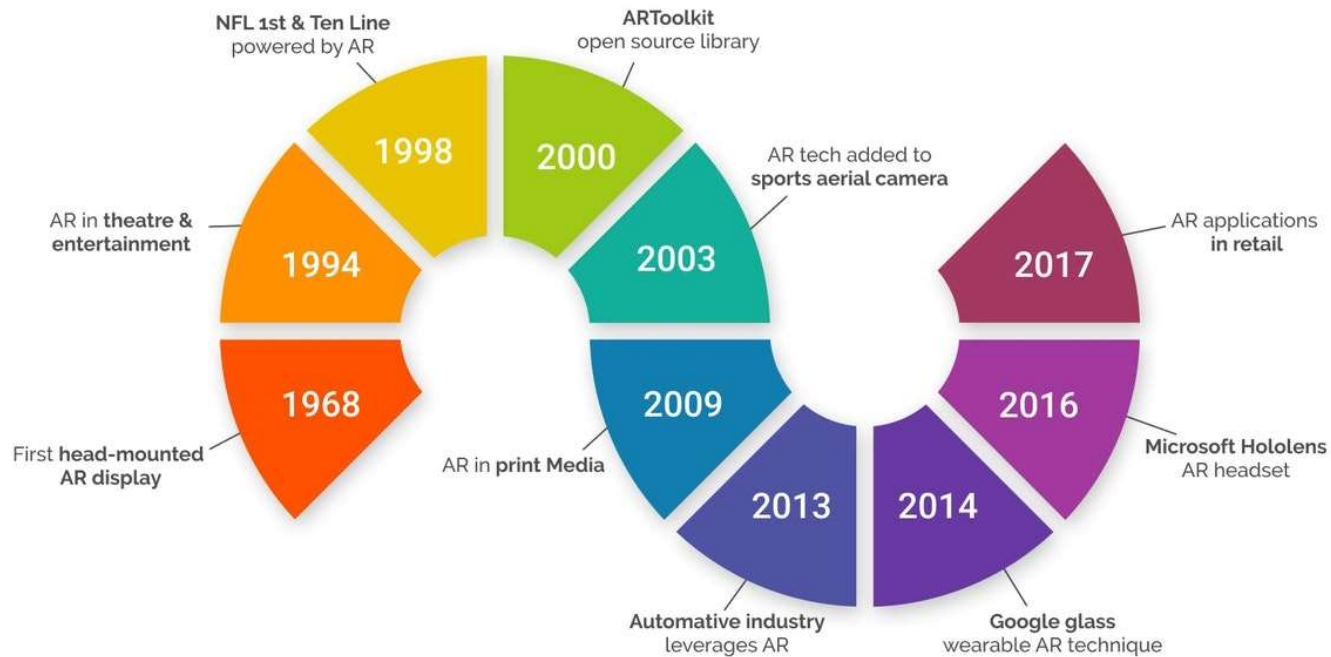
Apple Apparently Wants to Replace iPhones with AR Glasses in 10 Years – Cnet, December 2, 2021





AR Glasses and their history

• History of **AUGMENTED REALITY** •





How AR is different from VR ?



VS



AUGMENTED REALITY

- Overlays computer generated 3D content on the real world
- User is able to interact with real world and virtual world
- User can clearly distinguish between both the worlds.
- It is achieved by smartphones, tablets or AR wearables.

VIRTUAL REALITY

- Visually immerse the user with simulated objects and environment.
- Completely shut down the real world and make user think that they are really in the virtual world.
- User finds it hard to differentiate between virtual and real world.
- It is achieved by VR headsets.

(c) i-Boson innovations



Applications of AR glasses





Applications of AR glasses...





Pokemons appear in different real-life locations



Pokémon Go users

Year	Users
2016	232 million
2017	65 million
2018	147 million
2019	153 million
2020	166 million

Note: 2019 and 2020 values are estimates

Sources: Niantic, Superdata <https://www.businessofapps.com/data/pokemon-go-statistics/>



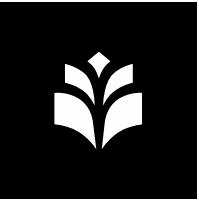
Basic principle





lens with gratings

projector



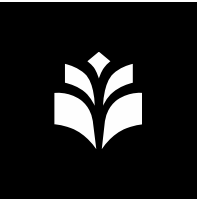
3) project the light to the eye

2) carry light in front of the eye

1) bring light to lense

projector

lens with gratings



total manufacturing cost: 200€



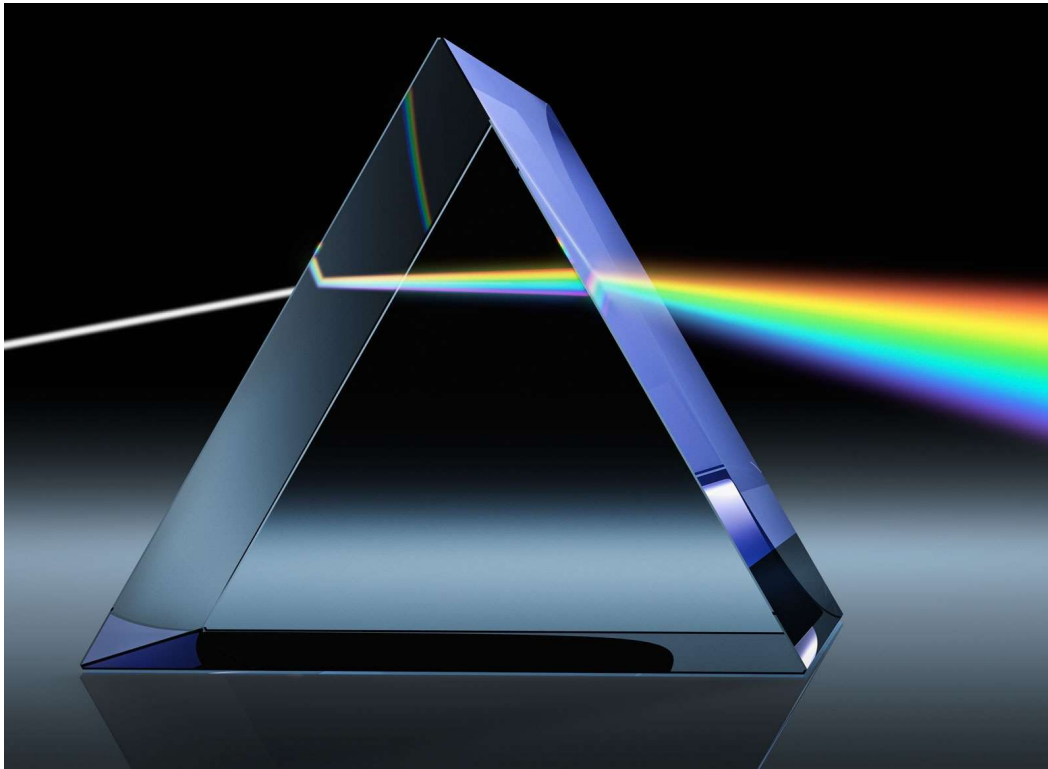
lens with gratings 50€

projector

50€



Challenges



- Needed colors R,G,B behave differently

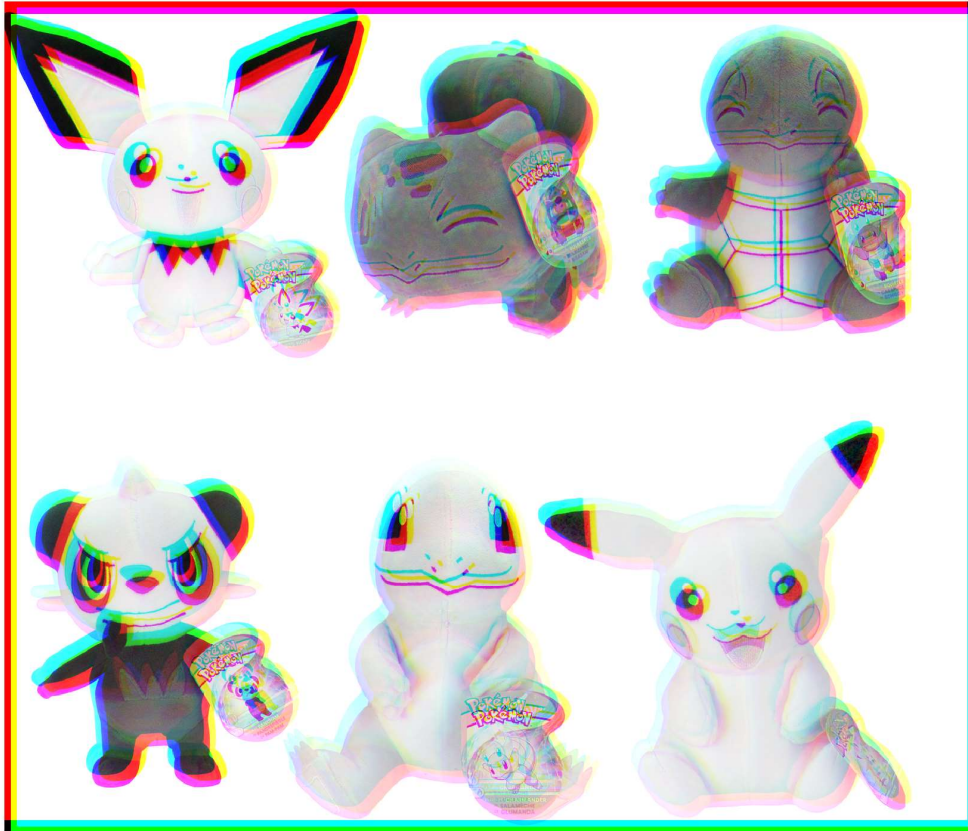


Correct colors... good experience





Incorrect colors... horrible!





Bullet proof solution (Microsoft HoloLens)





If the design is smart, 1 layer is enough (Dispelix)





Challenge: limited resources... limited resolution
how to optimize?





We think we see everything sharply... it is not true





We see sharply only the place we focus at





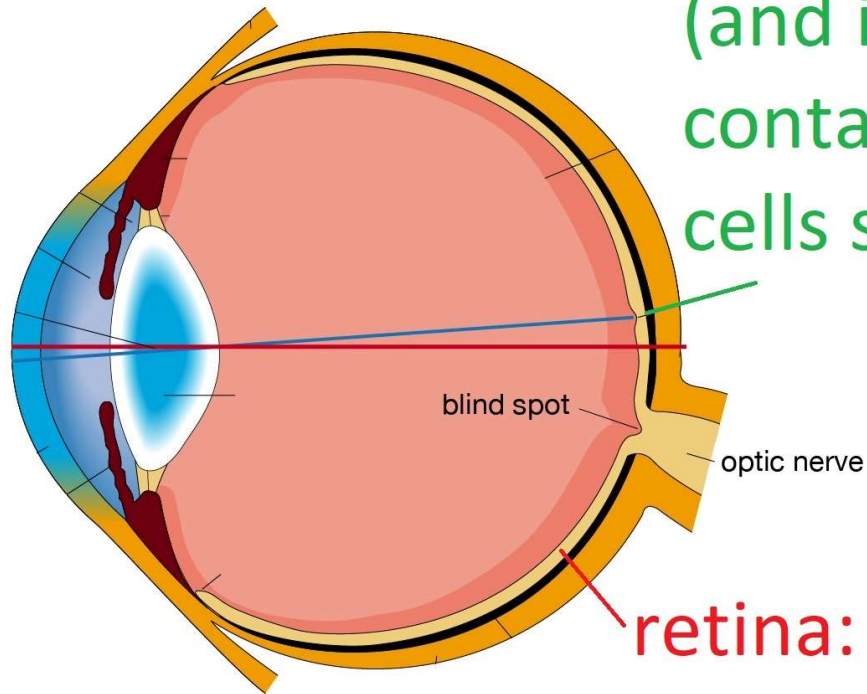
The place of focus varies





Sharp vision – at where macula points

macula
(and its center, fovea)
contain many cone
cells sensitive to colors



retina: contains cells
sensitive to light

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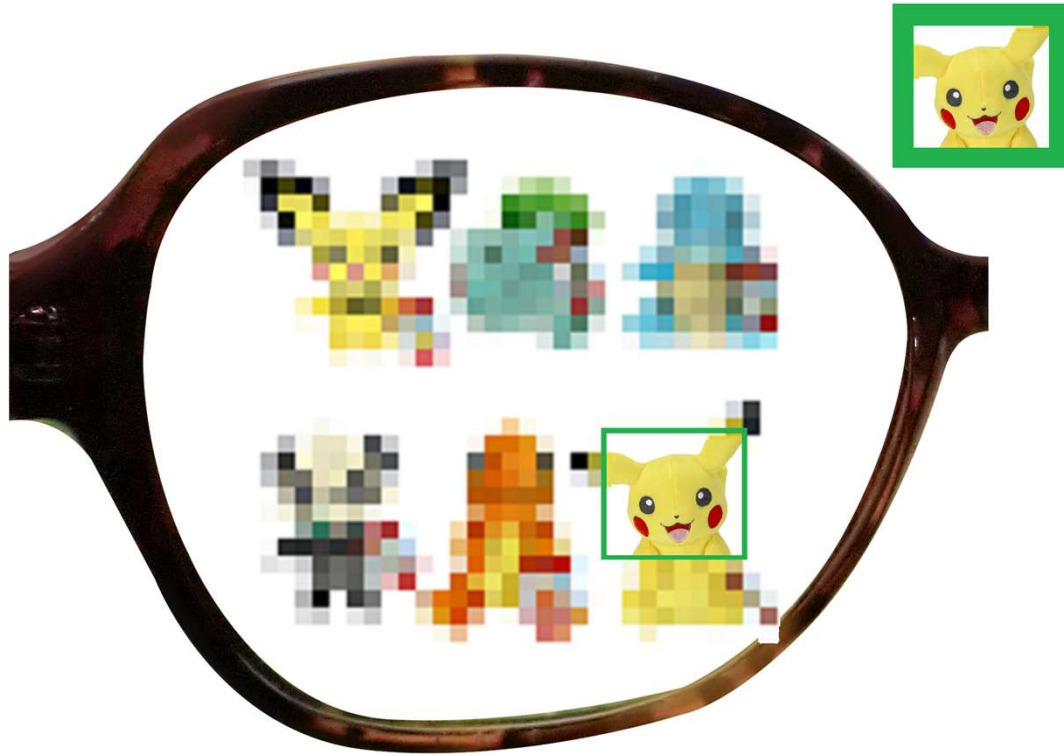


Blurry ambient and clear focus area is OK





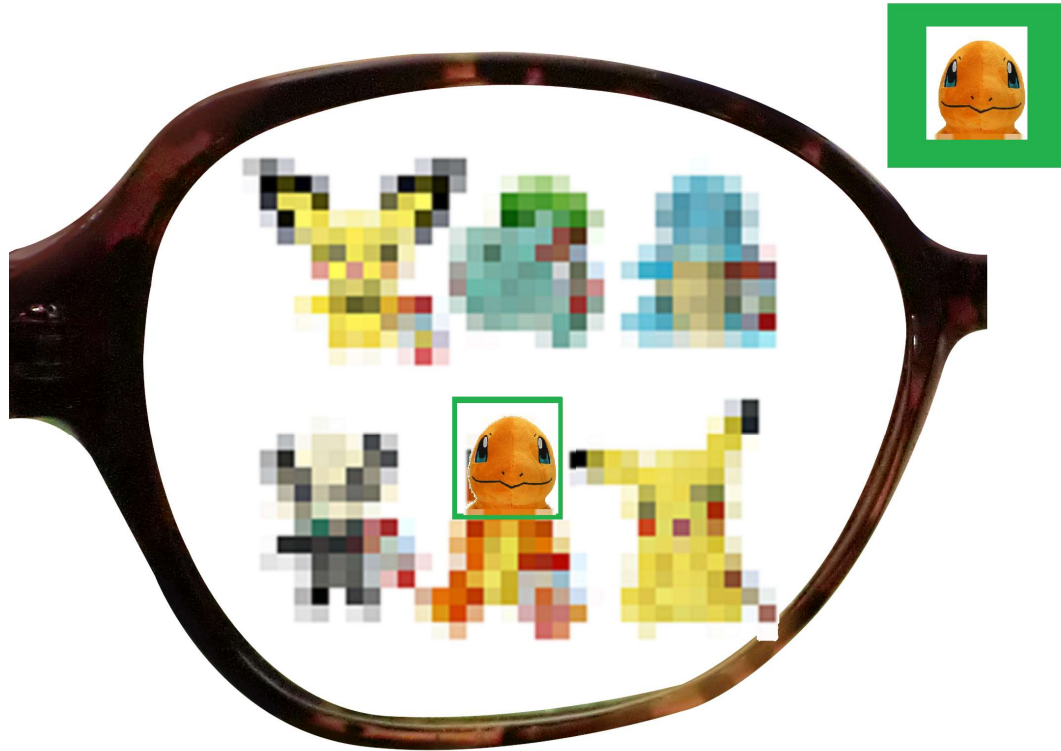
Create the focus area image with separate display (Varjo)



- The ambient image is created in the lens (the main display)
- The powerful display is kept in some place outside
- The focus area image is mirrored to the lens



Create the focus area image with separate display (Varjo)



- Based on eye tracking it can be determined what the user is looking
- Produce that image in the powerful display
- Rotate the mirrors to put the image to the correct place



What features to include?

+++ AR features

++ anti UV coating, sunglasses

prescription lenses to correct eyesight?

+ very important!

- varies from person to person

- sharing glasses in laboratory / home ?

=> a feature which can be ordered

+ eyetrack camera

+ gesture camera

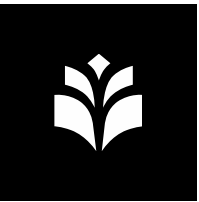
+ speakers, microphone





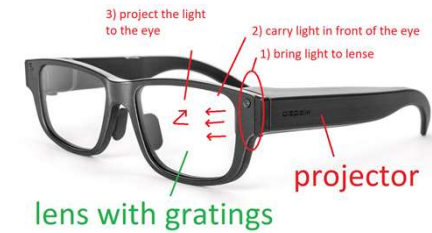
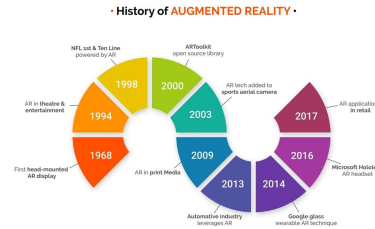
References (facts and images)

- Augmented vs Virtual: <https://www.iboson.io/augmented-reality-vs-virtual-reality-what-is-the-difference>
- Pokemon Go: https://fi.wikipedia.org/wiki/Pok%C3%A9mon_GO
- Pokemon Go statistics: <https://www.businessofapps.com/data/pokemon-go-statistics/>
- Dispelix glasses: <https://tech.eu/brief/finland-based-augmented-reality-glasses-maker-dispelix-secures-e10-million/>
- Prism: <https://www.britannica.com/technology/prism-optics>
- Pokemons: <https://www.k-ruoka.fi/kauppa/tuote/pokemon-pehmolelu-20-cm-0889933952118>
- Microsoft Hololens: <https://kotimikro.fi/oheislaitteet/wearables/microsoftin-hololens-lasit-esittavat-lisatty-todellisuutta>
- Human eye: <https://www.britannica.com/science/human-eye>
- Multiple glasses: <https://www.essilor.com.sg/blog/why-you-need-more-than-one-pair-of-glasses>



Take away

- future
- history
- AR vs VR
- Applications
- Basic principle
- Challenges (color, 2 display)
- What features to include?



total manufacturing cost: 200€



- | | |
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| <p>AUGMENTED REALITY</p> <ul style="list-style-type: none"> Overlays computer generated 3D content on the real world User is able to interact with real world and virtual world User can clearly distinguish between both the worlds. It is achieved by smartphones, tablets or AR wearables. | <p>VIRTUAL REALITY</p> <ul style="list-style-type: none"> Visually immerse the user with simulated objects and environment. Completely shut down the real world and make user think that they are really in the virtual world. User finds it hard to differentiate between virtual and real world. It is achieved by VR headsets. |
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