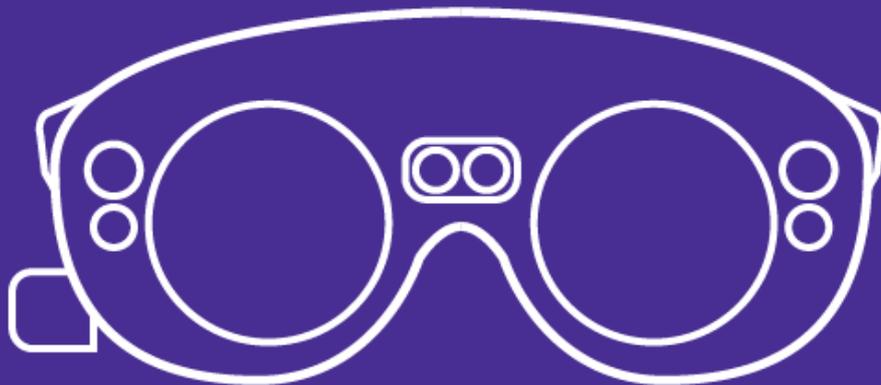


# Literature Research

What is AR used for at the moment and what might be future uses?



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# What is Augmented Reality (AR) & Mixed Reality (MR)?

## AR and MR

Augmented reality (AR) overlays virtual objects on the real-world environment. Mixed reality (MR) not just overlays but anchors virtual objects to the real world. (Tukoreva, 2018) This anchoring means that the object will hold the same position on the real world when moving the AR device around. This makes the digital object feel more real, because real life objects also stay where a person put them. In conclusion, mixed reality is a more advanced form of augmented reality and for the sake of readability augmented reality will be used to encompass both.

## How does it work?

Sensors and cameras are usually situated on the outside of an Augmented Reality device. These are used to gather data of the user's surroundings and interactions. The device can then act accordingly on how the augmented world is viewed by the user.

A projector is often found in augmented reality devices. It is mostly an outward facing miniature projector that can turn the surface into an interactive environment. The sensors and cameras examine the world, the projector projects the digital world on top of the real world. Because of this, screens might become obsolete in the future.

The data given by the sensors and the digital world needs to get processed. Devices need a lot of processing power to cope with all these elements. For smartphones, the AR uses a lot of components already inside, like CPU, GPU and RAM. For wearables, the processing power can be used from a computer, or in the case of the Magic Leap, from a small computer that is attached to the wearers pocket or belt.

In AR wearables, mirrors are used to view the virtual image. Incoming light from a side-mounted display is used to cast light through these mirrors, which then beam the light into the viewers eyes. This light is sent through three layers of glass consisting of the different primary display colors (red , green, blue), which in turn cast an image on the viewers eye retina.

## Types of Augmented Reality

There are multiple forms of Augmented Reality.

- Marker-based AR
- Markerless AR
- Projection-based AR
- Superimposition-based AR

Marker-based AR, also known as image recognition, works with pre-printed visual objects for a camera to scan. The AR device calculates the position of the objects and knows how to put the AR on top of that.

Markerless AR is AR you get in a certain area. This area is determined by GPS, compass or gyroscope.

Projection-based AR is the projection of synthetic light to physical surfaces and allows for interaction.

Superimposed-based AR is the replacement of the original view with an augmented one. Object recognition is required for this to work. An example of this is the IKEA Catalog application.

## What is AR used for now and what could be future uses?

AR technology already used in a lot of fields.

## Work



According to Shaham (2018) Augmented Reality is changing the field service industry. AR can help in multiple fields, making work easier. For instance, technicians can execute field repairs, consult colleagues and be better prepared. It could extend expert reach and simplify training for new technicians.

## Education



Visual learning is known to help children learning some things better. With AR this visual learning can be brought to a next level. This can help to give children a better idea about things that are hard to visualize from just learning out of a book, like chemistry. There is already an AR app called elements 4d that lets students combine elements and see what happens.

## Sport



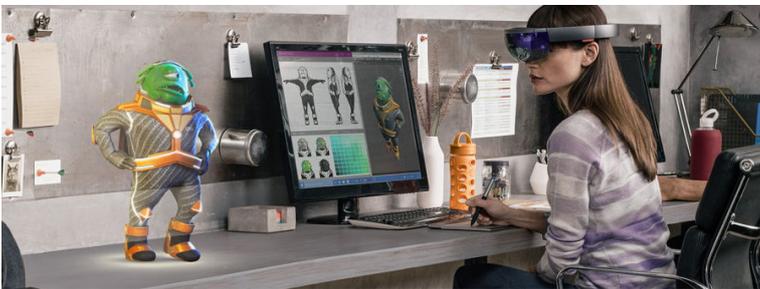
Nowadays, people want to learn a lot about their performance and health when sporting. There are already a lot of mobile apps and watches that monitor every step the user takes. AR can enhance this even further. The user can wear AR glasses to continuously see all the stats. On the AR glasses market, some are already released just for professional cyclists so they can see all information they need, including navigation, without having to move an arm, making it almost like a videogame. (Eversight)

## Healthcare



Healthcare is an interesting topic for AR. There are a lot of start-ups looking into this field. (Sanchez, 2018) Surgery can be made easier when surgeons can study the anatomy of their patients in 3d. This can allow surgeons to visualize internal organs bones and muscles without having to cut open a body. But for less invasive tasks, like donating blood, AR could make life easier. With an AR overlay, the veins can be found a lot easier by nurses, making the chance of a needle going wrong much smaller. Also, for education in the medical field, AR can become very big. It can be used to study anatomy without books or real bodies.

## Creative



With AR, things can be painted without using real materials. The users just use their hands and imagination. On mobile, this has been possible for some time now. People can paint things in AR and send it to friends. But with AR wearables, it could become even more intuitive. The user could paint, or even sculpt things.

## Marketing

There are ideas of implementing AR in advertisement banners. London based BlippAr has launched an AR ad campaign where users can tap on the banner with a mobile phone and observe the inside of a car. But the most promising thing is that users do not need an application for this to run on their device, making it a lot more interesting by not having that extra step that a lot of people do not want to make.

## Future?



In the future, AR could provide even more business opportunities. One of those is 3D printing. This could be made a lot easier when using AR to build the object, then 3d print it. (Matyunina, 2018)

AR can be used for military ends too. AR glasses are being made that can relay all sort of information to a soldier. This lets the wearer maintain situational and environmental awareness. This environmental awareness can also be used in vehicles, letting the people inside look outside without having to stick their heads out. (Lynch, 2017)

## Sources

Islam, A. (2018, December 11). The Future of Augmented Reality. Retrieved from <https://www.pluginandplaytechcenter.com/resources/augmented-reality-healthcare/>

Lynch, G. (2017, September 16). AR warfare: How the military is using augmented reality. Retrieved from <https://www.techradar.com/news/death-becomes-ar-how-the-military-is-using-augmented-reality>

Reality Technologies. (2018, October 4). The Ultimate Guide to Understanding Augmented Reality (AR) Technology. Retrieved from <https://www.realitytechnologies.com/augmented-reality/>

Sanchez, J. (2018). Augmented Reality in Healthcare. Retrieved from <https://www.pluginandplaytechcenter.com/resources/augmented-reality-healthcare/>

Tokareva, J. (2018, January 5). What is the difference between virtual reality, augmented reality and mixed reality? - Quora. Retrieved from <https://www.quora.com/What-is-the-difference-between-virtual-reality-augmented-reality-and-mixed-reality/answer/Julia-Tokareva-3>

Kumar, S. (2018, March 16). 6 Ways Augmented Reality Is Disrupting The Sports Industry : ARP. Retrieved from <https://www.augrealitypedia.com/augmented-reality-sports/>

