RV - AULA 09 - PSI3502/2018

Augmented Reality

Outline

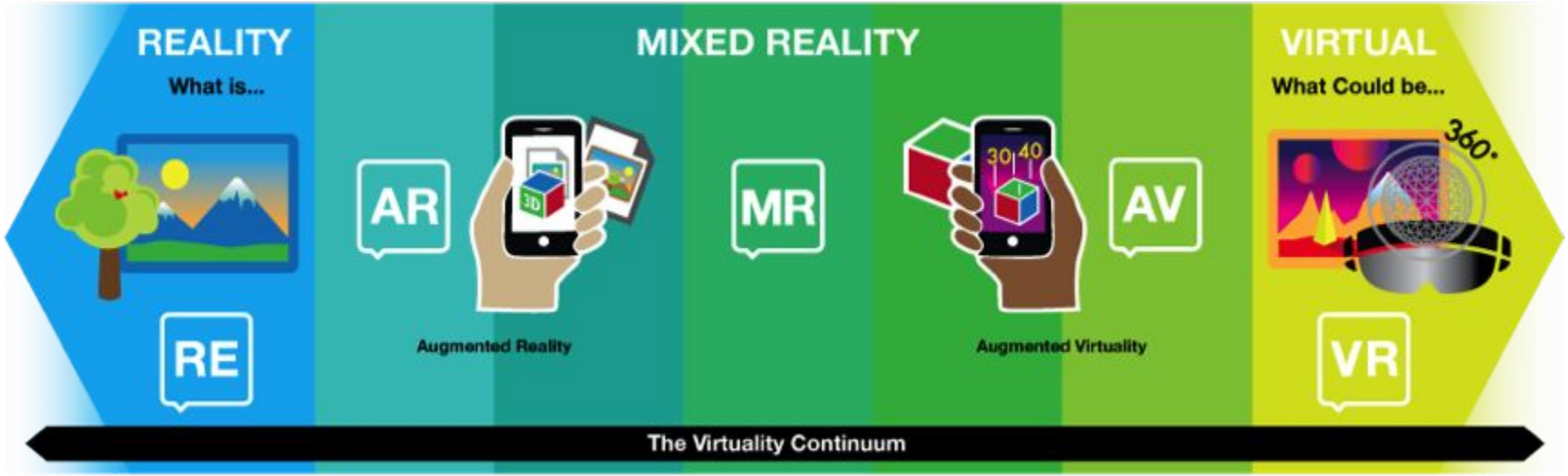
Examine the relationship between Virtual Reality and Augmented Reality.

Present the general principle of operation of all augmented reality systems and examine some examples of such systems.

Give a quick overview of historical development of augmented reality.

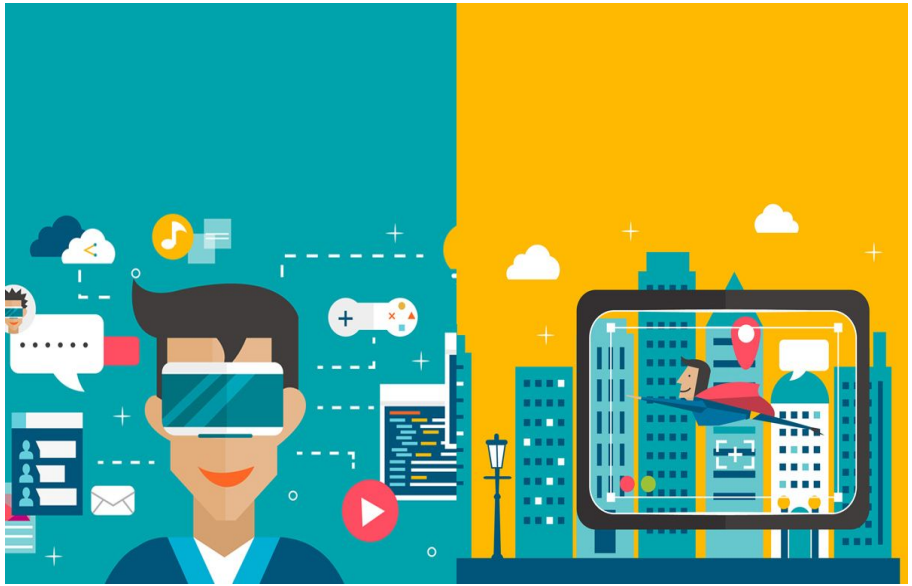
Explore some of the future trends of development of augmented reality.

Augmented vs. Virtual Reality



https://www.trekk.com/insights/augmented-or-virtual-how-do-you-your-reality

Augmented vs. Virtual Reality



http://www.yantramstudio.com/blog/virtual-reality/augmented-reality-vs-virtual-reality-what-are-the-differences/

Both VR and AR are based on artificial computer-generated stimuli. However, the function of these stimuli is significantly different.

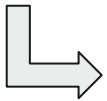
The goal of VR is to create the perfect illusion.

AR systems do not interfere with the perception of the real world.

Basic Principle of Operation

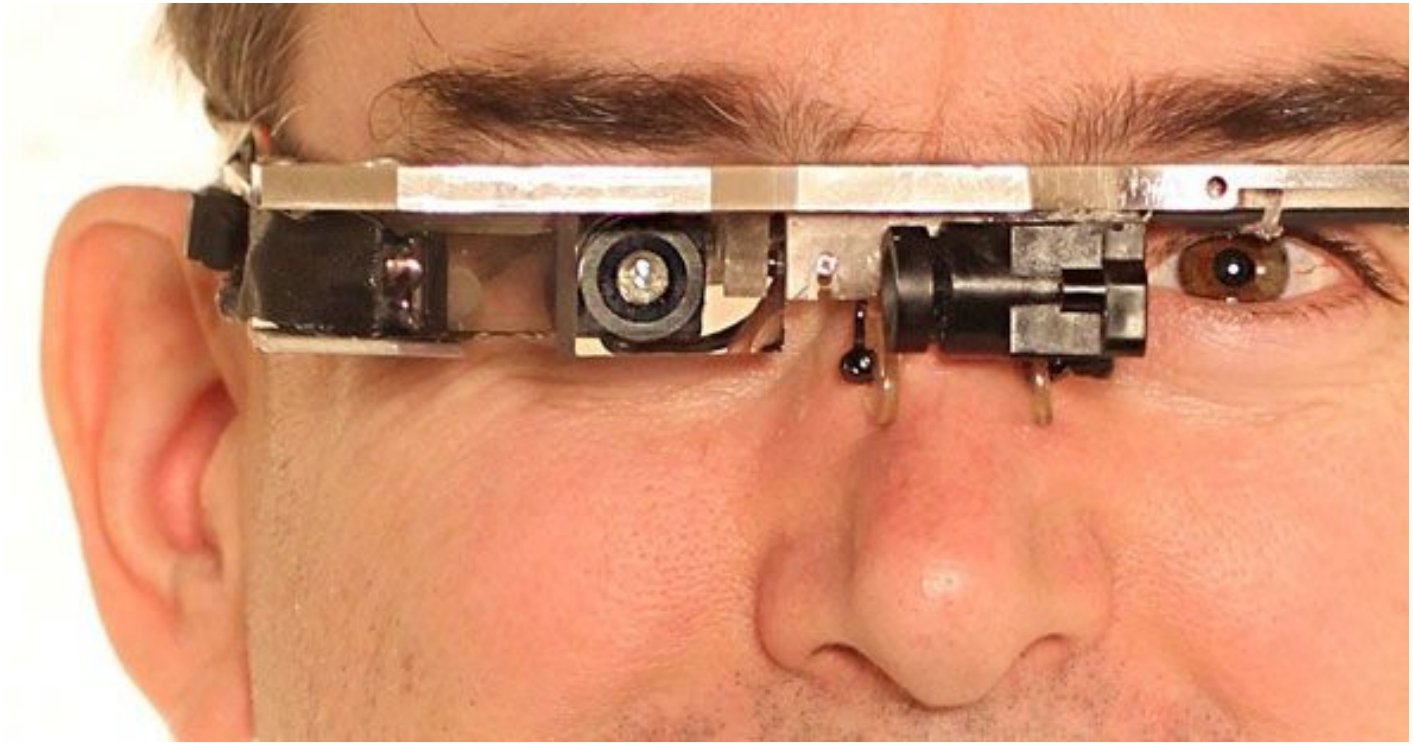
The common basic principle of operation of AR systems has three distinct steps:

1) The AR system captures some sort of signal from the real world.
2) This signal is analyzed by the system and appropriate virtual content is generated.
3) The system **aligns** the virtual and real signal.



registration

History of Augmented Reality



http://www.yantramstudio.com/blog/virtual-reality/augmented-reality-vs-virtual-reality-what-are-the-differences/

History of Augmented Reality

AR first appeared in works of fiction (*The Master Key* - L. F. Baum)

The term **augmented reality** was coined in 1992 by T. Caudell, researcher at Boeing Inc.

One of the most important early steps that made AR possible was the development of the first HMD by I. Sutherland and B. Sproull in 1966.

One of the first recognizably AR devices was the EyeTap,

History of Augmented Reality

Early 80s: first commercial applications of AR in the form of satellite and meteorological radar.

J. Rekimoto and K. Nagao - NavCam.

1997: Touring Machine
https://www.youtube.com/watch?v=M7VM200Escw

1998: *spatial AR* - *https://spatial.is/*

https://www.manifest-tech.com/society/augmented_reality.htm

AR Hidden in Real Life

https://www.techleer.com/articles/190-sygic-uses-augmented-reality-in-their-gps-navigation-app/

Visual Augmented Reality

Visual AR systems can use

- *marker-based* registration methods,
- *markerless* registration, or even
- *non-visual* registration.

Visual AR systems differ in type of display that they use to present the artificial graphic elements to the user. AR systems can use *HMDs*, *projectors* or even standard *screens* for this purpose.

Image Registration

Image registration is a process of aligning artificial visual stimuli to real-life images and video.

This process is equivalent to real-time optical motion tracking.

Precision of alignment is very important for the quality of end user experience.

Alignment errors can be static or dynamic.

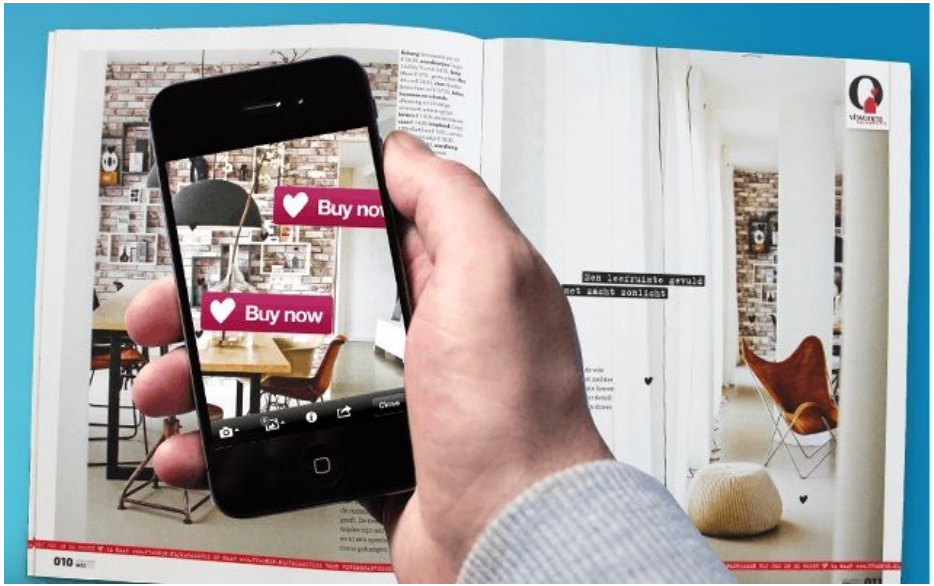
Marker-Based Image Registration

In order to increase robustness of operation and simplify the image registration process, some systems make use of special visual markers.

https://www.nintendo.com/3ds/ar-cards

Markerless AR Systems

These systems try to detect and track easily identifiable features which are already present in the real world.



http://www.daydev.com/developer/s6-programming-language/diy-augmented-reality-layar-creator.html

Non-Optical Image Registration

Non-Optical AR systems align computer-generated visuals to some sort of signal that is not visual in nature.

Google Sky

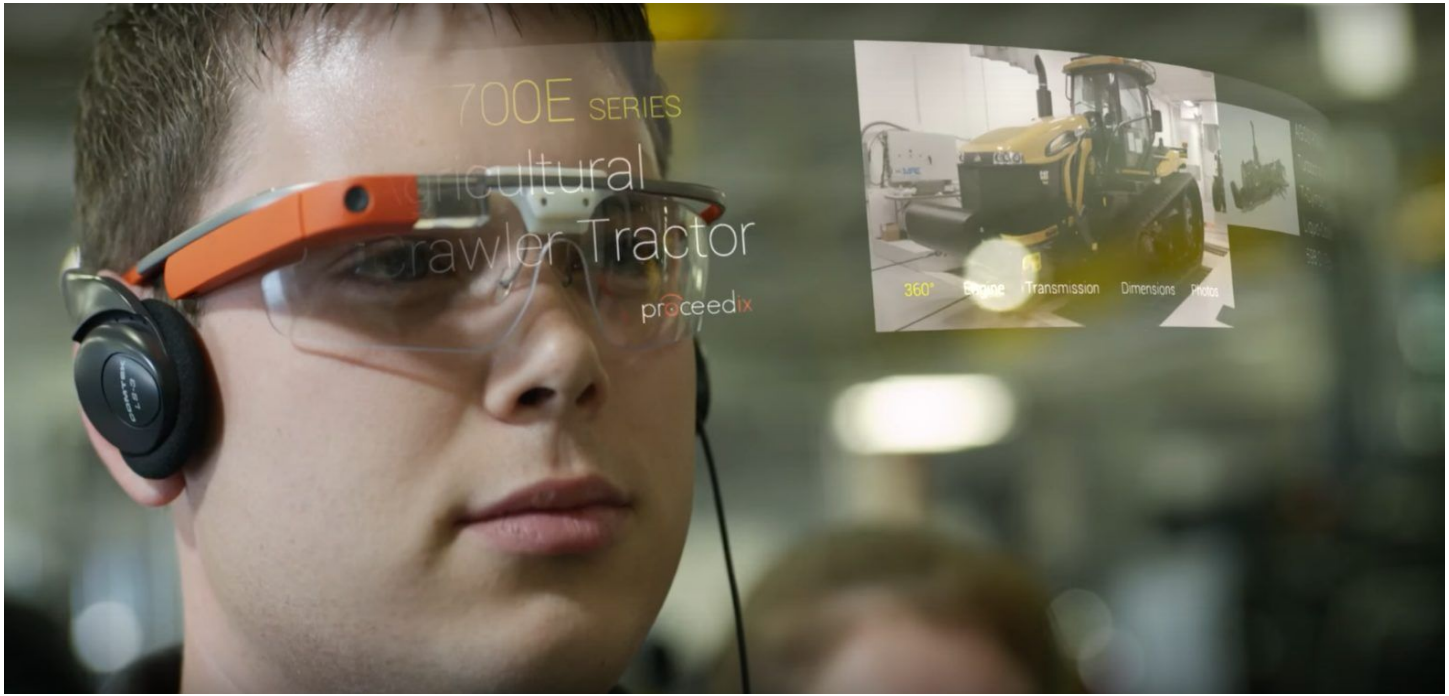
HMD Based AR Systems and Video AR Systems

All HMD systems employ head-tracking methods. Image is rendered to match the orientation of a user's head.

Video HDM AR systems make use of video cameras. Computer-generated images are overlaid onto a video signal taken by the camera.

These systems block the user's direct view of the physical world, and replace it with the combination of the video signal taken from the camera and artificial rendered content. In this respect, video AR systems are close to HMD-based VR systems.

Optical AR Systems



https://edgylabs.com/google-glass-back-enterprise-edition

Monitor-Based and Projector-Based AR Systems

Monitor-based AR systems make use of the standard 2D display technology, including PC and laptop monitors, TVs, and small screen of mobile devices. The majority of current mobile AR applications belong to this category of AR systems.

Some AR systems use one or more projectors as output devices. The major advantage of these systems is that they can project the computer-generated images onto any surface in the physical world.

Vein Viewer

3D Projection Mapping

https://www.youtube.com/watch?v=vULthsMkI7s

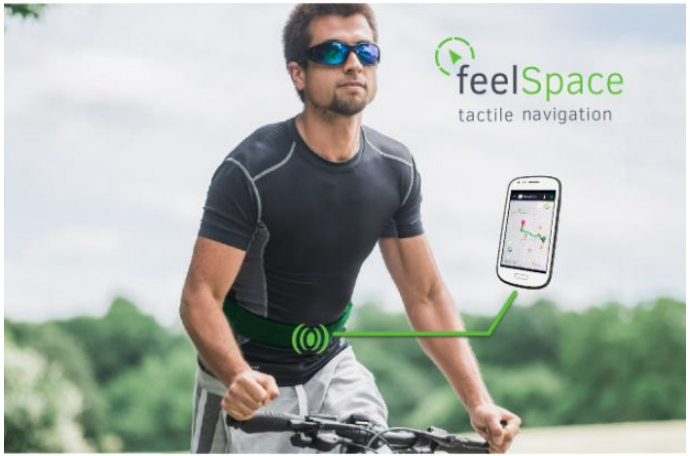
Mobile AR

https://techcrunch.com/2018/11/06/photomath-raises-6-million-for-its-math-solving-app/

Audio AR Systems

https://zombiesrungame.com/

Haptic AR

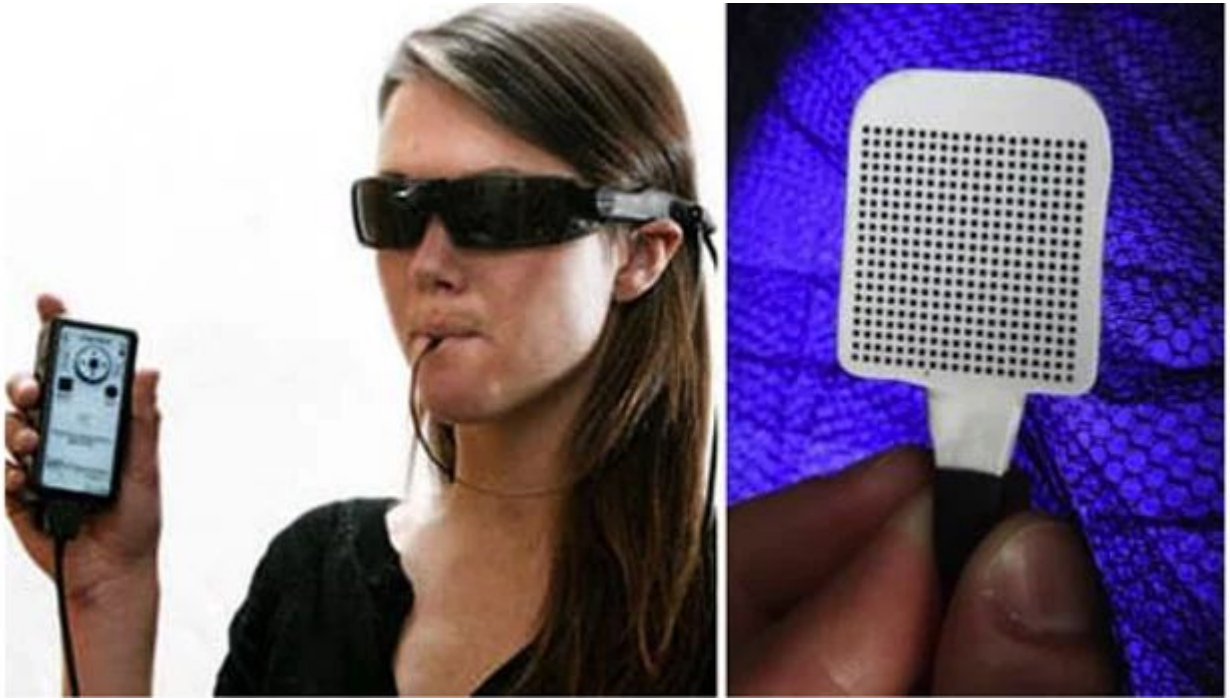


http://feelspace.cogsci.uni-osnabrueck.de/

Inter-Modal AR Systems

Inter-modal systems substitute one kind of physical stimuli for another. Such systems are often used as a sensory aid for handicapped people. Operation of such a system often relies on phenomena like sensory substitution and *brain plasticity*.

Inter-Modal AR Systems



Brain-Port
https://www.youtube.com/watch?v=xNkw28fz9u0

https://newatlas.com/brainport-sight-device/12551/

Ubiquitous/Wearable Computing

AR and Gaming

https://www.youtube.com/watch?v=wKXncqEYk9g

Referências

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J. Loomis, R. Golledge and R. Klatzky, “Personal guidance system for the visually impaired using GPS, GIS, and Vr technologies,” *Proceedings of Conference on Virtual Reality and Persons with Disabilities*, 1993.

R. Raskar, G. Welch, H. Fuchs, “Spatially Augmented Reality,” *First International Workshop on Augmented Reality*, November 1998.

I. Sutherland, “A Head-Mounted Three Dimensional Display,” *Proceedings of Fall Joint Computer Conference*, 1968, pp. 757-764.