

Augmented Reality & Video Service Emerging Technologies

AR Applications, Products & Business

Prof. Jong-Moon Chung

AR Applications, Products & Business

AR Introduction

AR Introduction

❖ AR (Augmented Reality) Definition

- AR is a technology that superimposes a user's real world view with a computer-generated virtual text or image in real-time

- AR UI types
 - Screen, monitor, helmet, facemask, glasses, goggles, HMD (Head-Mounted Display), window, windshield, etc.

AR Introduction

❖ Handheld AR Displays → Smartphones

- Initial commercial success of AR models
- Powerful computing capability, good camera & display, and portability make smartphones a great platform for AR
 - Example: Retailers Affinity Boosts Mobile AR



Source: Flickr: UAR NAI Best Practice Poster

AR Introduction

❖ AR Eyeglasses

- Example: Google Glass, Vuzix M100, Optinvent, Meta Space Glasses, Telepathy, Recon Jet, Glass Up
- Google Glass example



Source: Flickr: Loïc Le Meur on Google Glass

AR Introduction

❖ AR HMD (Head-Mounted Display)

- HMD is a mobile AR device that can provide an immersive AR experience
- Example:
Aircraft
Maintenance
& Aviation



Source: Creative Commons
Attribution-Share Alike 3.0 Unported

AR Introduction

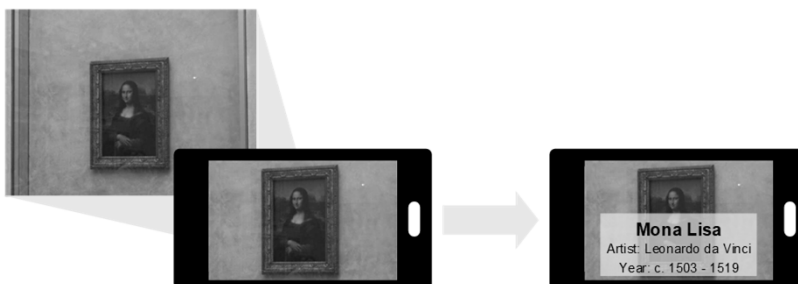
❖ AR (Augmented Reality) Description

- Virtual text or image can be superimposed on selected objects in the real world view of the user
- AR generated superimposed virtual text or image is about the selected object

AR Introduction

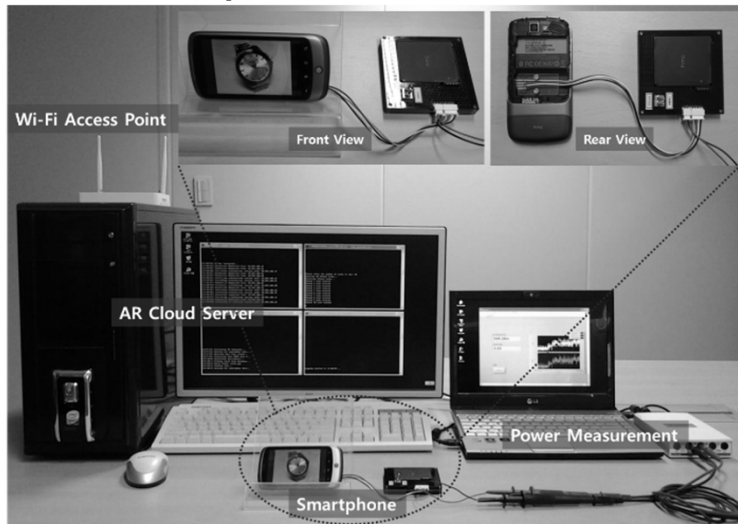
❖ AR Description

- AR is based on Context Aware Computing
- For an AR user, the Real World & Virtual Objects coexist on the same view



AR Introduction

❖ AR Development Environment



AR Introduction

❖ Short History of AR and VR

- In 1901, author L. Frank Baum first mentions the idea of 'character marker' which is an electronic display overlaying on real life (people)
- In 1989, Jaron Lanier coins the phrase 'Virtual Reality' (VR) and its concept model

AR Introduction

❖ Questions on AR

- In 1990, Thomas P. Caudell creates the concept and phrase 'Augmented Reality' (AR)
- What is the difference of VR (Virtual Reality) and AR (Augmented Reality)?
- AR (Augmented Reality) seems like a very old technology. So why learn about it now?

AR Introduction

❖ Why is AR important now?

- Higher resolution cameras on smart devices enable accurate image and object identification
- Enhanced processing capability of CPUs and GPUs on smart devices enable fast and reliable image processing, object identification, and feature extraction

AR Introduction

❖ Why is AR important now?

- Large memory and fast input/output memory access enables large amounts of AR object information to be stored and quickly used
- HD (High Definition) displays on smart devices enable sharp virtual text and images to be superimposed in an elegant and easy-on-the-eye fashion

AR Introduction

❖ Why is AR important now?

- Broadband wireless and wired networking enables AR servers/database information to be quickly retrieved

AR Introduction

❖ Future of AR

- New AR Platforms → More Smart Device Types
 - Smartphones, Smart Devices, Smart Glasses, Smart Watches, Wearable IoT Devices, etc.
- AR will only get better!
 - Faster, More Accurate, More Informative
 - Lower Power Consuming → Longer Lifelines
 - Easier to Use, More Portable, Cheaper
 - More Functions/Features, More Reliable
 - More Durable, etc.

AR Applications, Products & Business

AR vs. VR

AR vs. VR

❖ Questions on AR and VR

- What is the difference of VR (Virtual Reality) and AR (Augmented Reality)?

AR vs. VR

❖ VR (Virtual Reality) Characteristics

- VR user will be fully immersed into an artificial (animated) environment
 - Game playing spaces are commonly VR spaces
 - User/player will commonly use an avatar to exist and interact inside the VR space
 - User's view in VR is different from the real environment → Fantasies & illusions are easy to create in the virtual world

AR vs. VR

❖ AR (Augmented Reality) Characteristics

- AR is a mixture of Real Life and VR (Virtual Reality)
- AR users are able to obtain useful information about a location or objects, and can interact with virtual contents in the real world
- AR users can distinguish the superimposed virtual objects

AR vs. VR

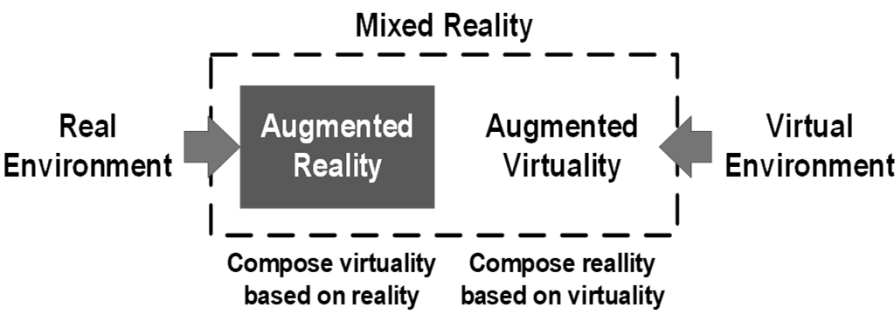
❖ AR (Augmented Reality) Characteristics

- AR users may be able to turn on or turn off selected AR functions (which may be related to certain objects)
- In comparison to VR, AR users commonly feel less separated from the real world
- Fantasies & illusions can be created and superimposed on a real world view

AR vs. VR

❖ AR Definitions

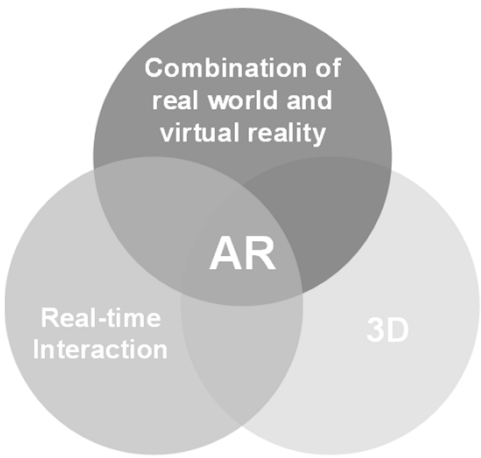
- Definition by Paul Milgram



AR vs. VR

❖ AR Definitions

- Definition by Ronald Azuma



AR vs. VR

- Sensor based AR
 - GPS, Gyro sensor, Accelerometer
 - Example: Layar, Wikitude, Sekai Cam
- Vision based AR
 - Computer vision, OpenGL (Open Graphics Library)
 - Example: Vuforia, Metaio, Total Immersion ARToolKit
- Hybrid Tracking based AR
 - Vision + Sensor
 - Example: Outdoor AR

AR Applications, Products & Business

References

References

- T. Olsson and M. Salo, "Online User Survey on Current Mobile Augmented Reality Applications," Proc. IEEE International Symposium on Mixed and Augmented Reality, pp. 75-84, Oct. 2011.
- K. Kumar and Y. Lu, "Cloud Computing for Mobile Users: Can Offloading Computation Save Energy?," IEEE Computer, vol. 43, no. 4, pp. 51-56, Apr. 2010.
- B. Girod, V. Chandrasekhar, R. Grzeszczuk, and Y. Reznik, "Mobile Visual Search: Architectures, Technologies, and the Emerging MPEG Standard," IEEE Multimedia, vol. 18, no. 3, pp. 86-94, Mar. 2011.
- D. Lowe, "Distinctive Image Features from Scale-Invariant Keypoints," International Journal of Computer Vision, vol. 60, no. 2, pp. 91-110, Nov. 2004.
- H. Bay, A. Ess, T. Tuytelaars, and L. Van Gool, "Speeded-Up Robust Features (SURF)," Computer Vision and Image Understanding, vol. 110, no. 3, pp 346-359, Jun. 2008.

References

- P. Drews, R. de Bem, and A. de Melo, "Analyzing and Exploring Feature Detectors in Images," Proc. IEEE International Conference on Industrial Informatics, pp. 305-310, Jul. 2011.
- L. Juan and O. Gwun, "A Comparison of SIFT, PCA-SIFT and SURF," International Journal of Image Processing, vol. 3, no. 4, pp. 143-152, Aug. 2009.
- D. Jin, K. Um, and K. Cho, "Development of Real-Time Markerless Augmented Reality System Using Multi-thread Design Patterns," Computer Graphics and Broadcasting Communications in Computer and Information Science, Multimedia, vol. 262, pp. 155-164, Dec. 2011.
- M. Satyanarayanan, "A Brief History of Cloud Offload: A Personal Journey from Odyssey Through Cyber Foraging to Cloudlets," GetMobile, vol. 18, no. 4, pp. 19-23, Oct. 2014.
- Y. Zhang, H. Liu, L. Jiao, and X. Fu, "To offload or not to offload: an efficient code partition algorithm for mobile cloud computing," Proc. IEEE International Conference on Cloud Networking, pp. 80-86, Nov. 2012.