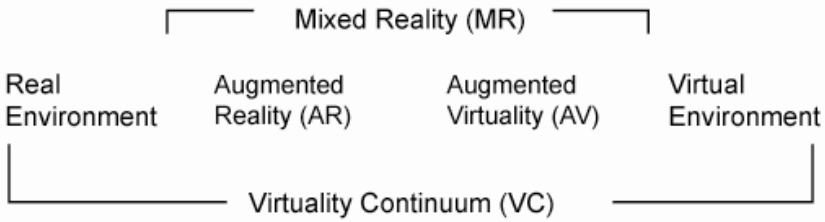
COMPSCI 705 - SOFTENG 702 Lecture 2

Virtual Reality
Mixed Reality
Augmented Reality

Virtuality Continuum

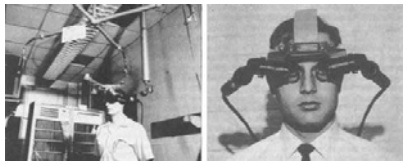
- Consider potentials and issues for each technology

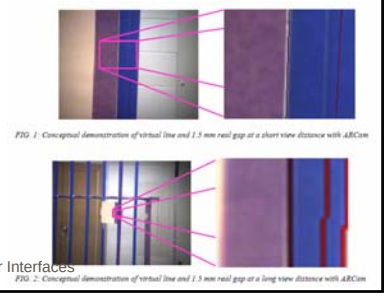


WordLens

Augmented Reality

- Definition
  - Combines real and virtual objects in a real environment
  - Registers (aligns) real and virtual objects with each other
  - Runs interactively, in 3D, in real time



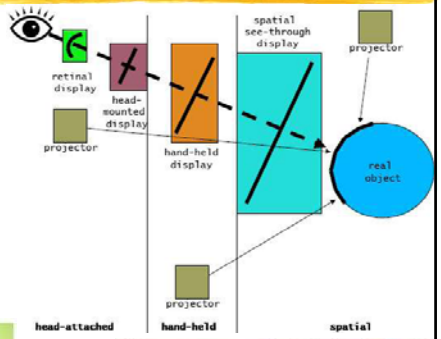


40 best AR iPhone apps

(www.iphoneness.com)

Enabling Technologies

- Displays
  - Aural display
  - Visual display
    - Video see-through
    - Optical see-through
    - Projective
  - Display positioning
    - Head worn
    - Hand-held
    - Spatial



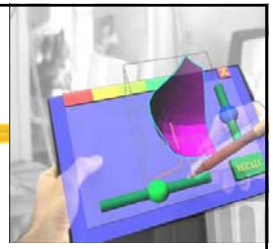
Enabling Technologies

- Tracking sensors and approaches
  - Modelling environments
  - User movement tracking
    - Mechanical, ultrasonic and magnetic
    - GPS
    - Radio
    - Inertial
    - Optical
    - Hybrid

Technology	Range (m)	Setup time (hr)	Precision (mm)	Time (s)	Environment
Optical: marker-based	10	0	10	∞	in/out
Optical: markerless	50	0–1	10	∞	in/out
Optical: outside-in	10	10	10	∞	in
Optical: inside-out	50	0–1	10	∞	in/out
GPS	∞	0	5000	∞	out
WiFi	100	10	1000	∞	in/out
Accelerometer	1000	0	100	1000	in/out
Magnetic	1	1	1	∞	in/out
Ultrasound	10	1	10	∞	in
Inertial	1	0	1	10	in/out
Hybrid	30	10	1	∞	in/out
UWB	10–300	10	500	∞	in
RFID: active	20–100	when needed	500	∞	in/out
RFID: passive	0.05–5	when needed	500	∞	in/out

Enabling Technologies

- User interface and interaction
  - New UI paradigm
  - Tangible UI and 3D pointing
  - Haptic UI and gesture recognition
  - Visual UI and gesture recognition
  - Gaze tracking
  - Aural UI and speech recognition
  - Text input
  - Hybrid UI
  - Context awareness
  - Human-machine symbiosis
    - Biometric devices



Applications

- Personal information systems
  - Personal assistance and advertisement

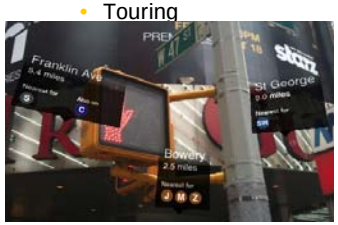
Names & faces
cued by conversation

Applications

- Personal information systems
  - Navigation

Applications

- Personal information systems
  - Touring

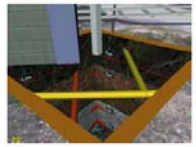


Applications

- Industrial and military applications
  - Design

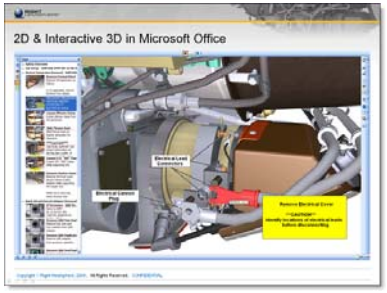
Applications

- Industrial and military applications
  - Assembly



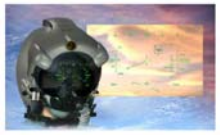
Applications

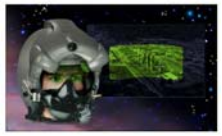
- Industrial and military applications
  - Maintenance



Applications

- Industrial and military applications
  - Combat and simulation





http://www.freefalcon.com/

Applications

- Medical applications

Applications

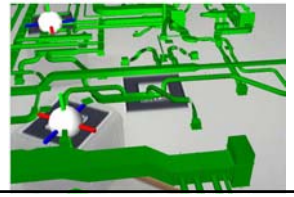
- Entertainment
  - Sports broadcasting

Applications

- Entertainment
  - Games

Applications

- In the office
  - Collaboration



Applications

- In the office
  - Education and training

Limitations

- Portability and outdoor use
- Tracking and (auto)calibration
- Depth perception
- Overload and over-reliance
- Social acceptance

Virtual Reality

- Humans immersed in a virtual world
  - Achieved with either:
    - Immersive environment
    - Non-immersive environment

Immersive Environments

Non-immersive Environments

Applications

- Simulation

Applications

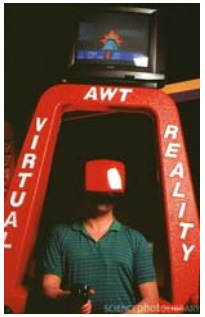
- Social media/Communication

SecondLife

Applications

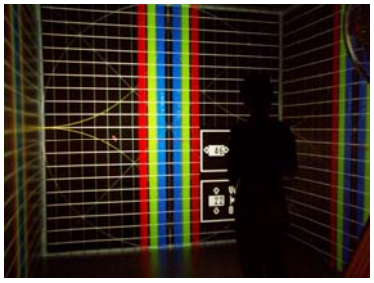
- Games

World of Warcraft



Limitations

- Maintenance of the illusion
- Immersion time (sea sickness)
- Portability
- Tracking and Calibration



References

- Carmigniani, J., Furht, B., Anisetti, M., Ceravolo, P., Damiani, E. and Ivkovic, M. (2011) Augmented reality technologies, systems and applications, Multimed Tools Appl, 51, pp. 341–377.
- Costanza, E., Kunz, A. and Fjeld, M. (2009) Mixed Reality: A Survey, Human Machine Interaction, LNCS 5440, pp. 47–68.
- Dünser, A., Grasset, R. And Billinghurst, M. (2008) A Survey of Evaluation Techniques Used in Augmented Reality Studies, SIGGRAPH Asia '08, pp. 5:1-5:27.
- Schall, G. (2009) Handheld Augmented Reality in Civil Engineering, In proceedings of Rosus09, pp. 19-25.
- Shin, D.H., Jung, W. And Dunston, P.S. (2008) Camera Constraint on Multi-Range Calibration of Augmented Reality Systems for Construction Sites, Itcon, 13, pp. 521-535.
- van Krevelen, D.W.F. and Poelman, R. (2010) A Survey of Augmented Reality Technologies, Applications and Limitations, The International Journal of Virtual Reality, 9(2), pp. 1-20.
- Wang, X. and Dunston, P.S. (2006) Usability Evaluation of a Mixed Reality Collaborative Tool for Design Review, CGIV'06, pp. 1-4.
- Wikimedia Commons: http://commons.wikimedia.org/
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