

Topics

02 December 2023 15:32

① what is AR ?

what is VR ?

what is MR ?

what is XR ?

② McLagan's Reality-virtuality continuum

③ key aspects of augmented reality
characteristics that define AR :

- 1) combines real & virtual
- 2) interactive in real time
- 3) registered in 3D

④ 2 basic modes : digital world and physical world can be merged.

- 1) gather & meld
- 2) project

⑤ Registration with the real world
annotation

(5) registration with ...

- 1) close registration
- 2) temporal registration

3) spatial registration :

- (i) absolute
- (ii) relative

(6) realistic merging

(7) relationship between AR and other media, technologies and ideas

(8) working of AR

(9) Augmented reality application consists of :

- (i) Augmented reality Application
- (ii) content
- (iii) interaction
- (iv) technology
- (v) physical world
- (vi) participants

⑩ primary steps in AR application

⑪ Hardware components

- 1) sensors
- 2) processor
- 3) display
- 4) input devices

⑫ sensors : 3 categories

1) for tracking - camera, GPS,
gyroscopes, accelerometers &
compasses

2) for gathering environmental
information

3) for gathering user input

⑬ tracking - camera

location & orientation :

- 1) absolute
- 2) relative

fiducial markers : convey 2 info

Fiducial

to the AR system :

- 1) what obj to display
- 2) what pov

Fiducial markers : static / mobile

usage :

- 1) encode URL
- 2) embed info eg QR
- 3) attached to physical objects
- 4) dynamic marker eg laptop screen
- 5) real world objects like human face

NFT → natural feature tracking

⑭ Tracking - GPS

⑮ Tracking - Gyroscopes, Accelerometers and compasses

⑯ sensors for gathering information environmental

Types

- 1) passive
- 2) active

17) sensors for gathering user - input

18) Processor

19) Display Device

1) visual display (vision)

2) Audio display (hear)

3) olfactory signals (smell)

4) Gustation (taste) AND

5) Haptics (touch)

20) Display Devices

1) Monitor Based

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graph LR; A[Monitor Based] --> B[Laptops]; A --> C[cell phones]; A --> D[projector]
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2) Head Mounted Displays

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graph LR; A[Head Mounted Displays] --> B[video see through]; A --> C[optical see through]
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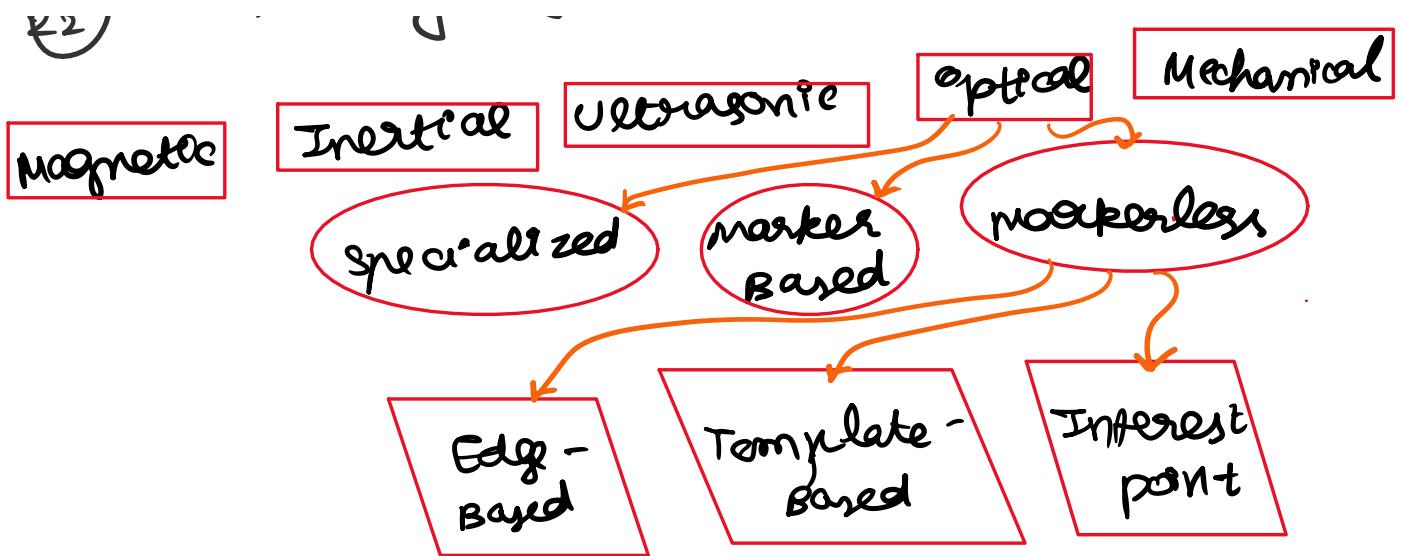
21) Input Devices

22) Tracking types

infrared

optical

Mechanical



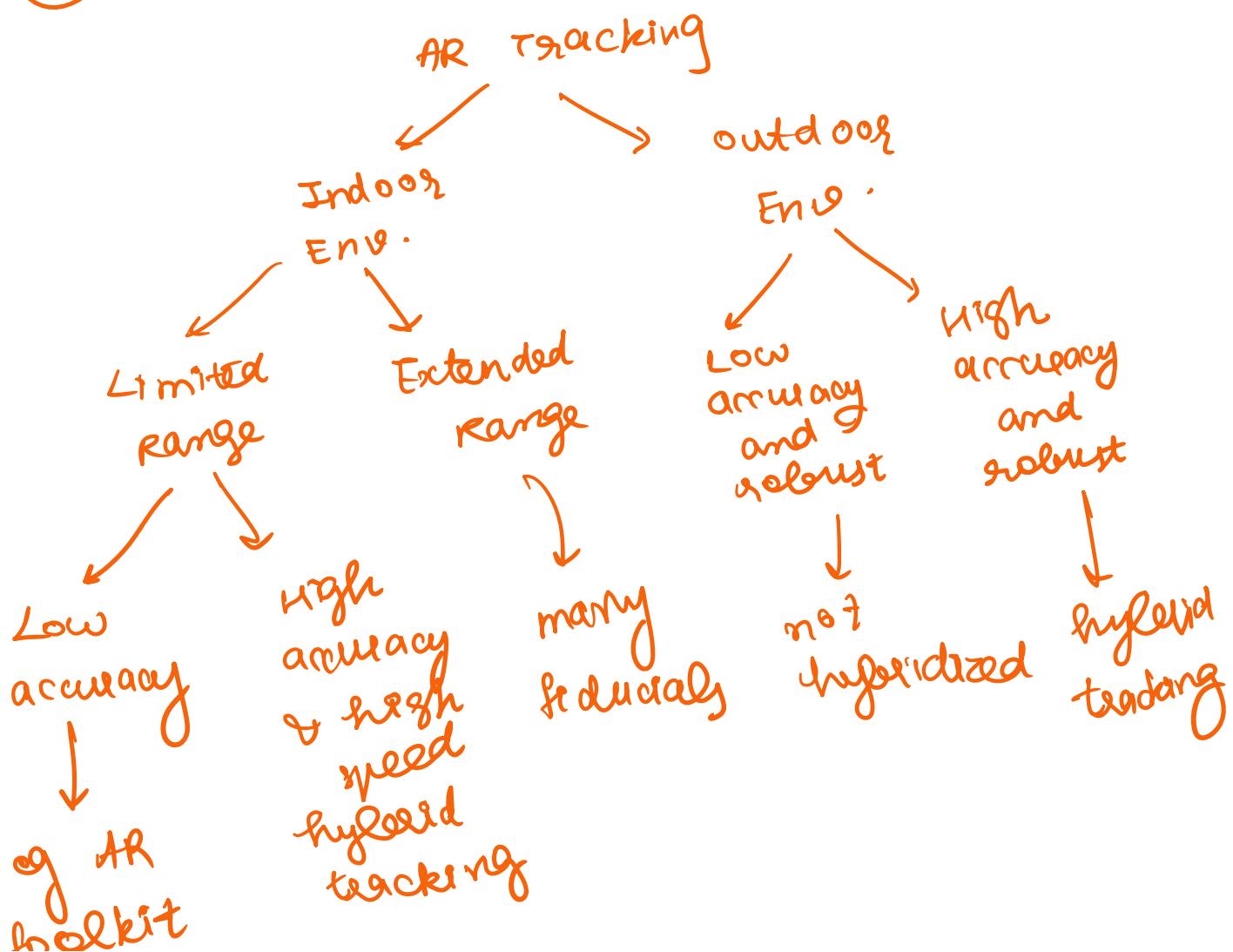
23

optical tracking

sensors, cameras, Advantages, Disadvantages

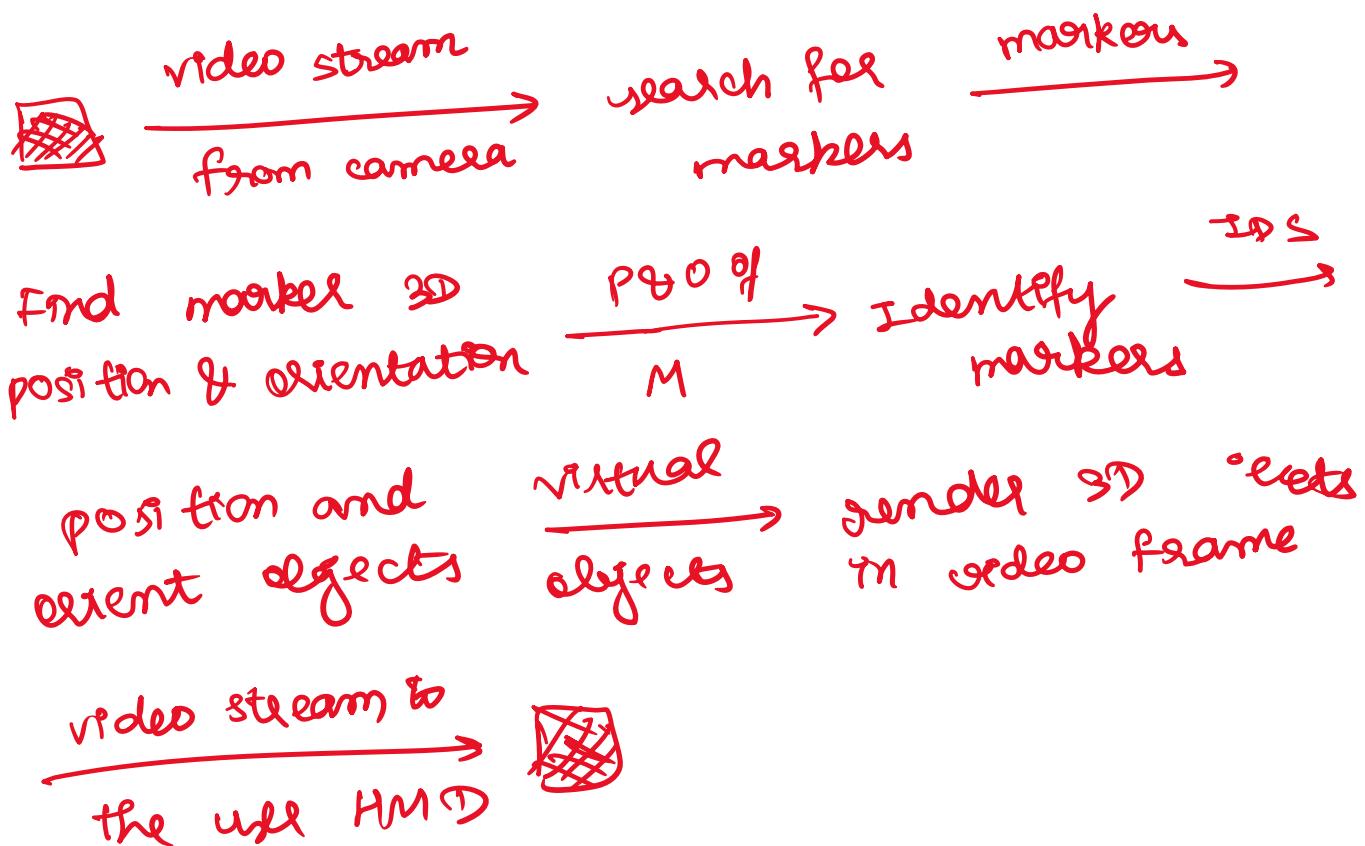
24

AR Tracking Taxonomy



Toolkit tracking

- 25 AR Toolkit : Marker Based Tracking



Limitations of AR Toolkit

- 26 Acoustical Tracking

- 27 Electromagnetic tracking

- 28 Mechanical tracking

- 29 Depth sensor

- 30 Multiple sensors

- 31 Other sensors

.. ..

(31)

other sensors

GPS receiver, compass,
gyroscope

(32)

Processors

processing system in AR :

- 1) one / more general - purpose microprocessors as the CPU → central processing unit.
- 2) one / more special - purpose graphics processing units (GPUs)

(33)

Processor system architectures

Application run on

- 1) handheld system such as smartphone
- 2) handheld system connected to remote server(s)
- 3) desktop / laptop computer
- 4) desktop / laptop computer connected to remote server(s)
- 5) .. a web application

- - -

- 5) as a web application
- 6) a cloud with a thin client
- 7) other combinations of local and remote systems

③ choosing the most appropriate architecture for application

Trade-offs :

- 1) portability vs power
- 2) portability vs need for network access
- 3) cross platform performance vs need for network access

④ processor specifications

- 1) Number of processors
- 2) Processor speed
- 3) Available Memory
- 4) Available storage
- 5) Graphics accelerator(s)
- 6) Network bandwidth

- 6) network bandwidth
- 7) network latency

(36) Displays

- 1) visual displays
- 2) Audio displays
- 3) Haptic displays
- 4) other sensory displays
- 5) stereo displays (stereoscopic & stereophonic)

(37) visual Displays

Types :

- 1) stationary visual displays
- 2) visual displays that move with the participant's head
- 3) visual displays that move with the participant's hand or other parts of his or her body.

(38) stationary visual displays

- 1) kiosks

• - unmounted

1) KIOSKS

2) Projection - based augmented reality

- a) Front projection
- b) Rear projection

(39) visual displays that move with the participant's head

2 types of Head Mounted Devices (HMDs):

- 1) optical see - through type
- 2) video see - through type

Head worn / Eye worn / stationary

(40) visual displays that move with the participant's hand or other parts of his or her body

- 1) mobile / portable projectors
- 2) Head mounted projector
- 3) projection based systems

(41) Audio Displays

- 1) stationary audio displays
- 2) audio displays that move with the participant's head
- 3) audio displays that move with the participant's hand or other parts of his / her body.

(42) Haptic Displays

components :

- 1) skin sensations (taction)
- 2) forces (kinesthetics)

Types :

- 1) passive
- 2) Active

[PHANTOM
omni]

(43)

other sensory displays

- 1) smell (olfaction)
- 2) taste (gustation)
- 3) vestibular sense

44

software - AR

classification of software :

- 1) software involved directly in the AR application
- 2) software used to create the AR application
- 3) software used to create the content for the AR application
- 4) other software related to AR

45

software involved directly in the AR application

functional components :

- 1) Environmental Acquisition (sensors)
- 2) sensor integration
- 3) Application engine
- 4) Rendering software (visual, audio, etc)

[use of AR libraries]

46

software used to create the AR application

1) Eclipse SDK

2) Apple Xcode

3) Sony playstation

47

software used to create content for
AR application

1) software for creating and editing
3 dimensional graphics

2) software for creating and editing
2 dimensional graphics

3) software for creating and editing
sound

48

software for creating and editing
3 dimensional graphics

1) from scratch

2) import real world objects
eg Blender

3D scanner, motion capture

49

software for creating and editing
2 dimensional graphics

- 1) vector graphics programs
- 2) raster graphics programs

(50) software for creating and editing sound

- 1) monophonic (single channel) sound
- 2) stereophonic sound (2 channels)
- 3) multichannel sound

(51) steps for applying AR to a problem

(52) interaction

some of the actions in the real world

3 primary categories of interaction:

- 1) Manipulation
- 2) Navigation
- 3) communication

(53) Manipulation

selection + action

ways :

- 1) direct user control
- 2) physical control
- 3) virtual control
- 4) agent control

54

Navigation

components : 1) travel
2) way finding

55

communication (multi - persons)

56

Basic points of view of participants in augmented reality applications

1) subjective point of view
↳ subjective view AR / first person AR

2) objective point of view
↳ objective view AP / second person AR

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..... or no :

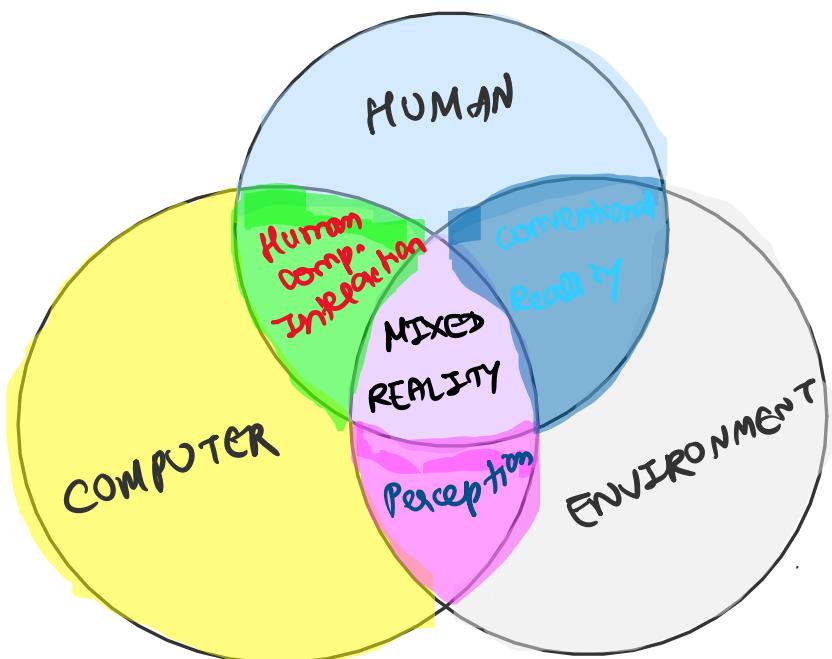
57

Types of AR :

- 1) portable augmented reality
- 2) mobile augmented reality

58

Mixed reality



- 1) Environment understanding
- 2) Human understanding
- 3) spatial sound
- 4) Locations & positioning
- 5) collaboration on 3D assets

59

physical reality
digital reality

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digital reality
Mixed reality + devices

⑥

AR, VR, MR, XR