SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF INFORMATION TECHNOLOGY

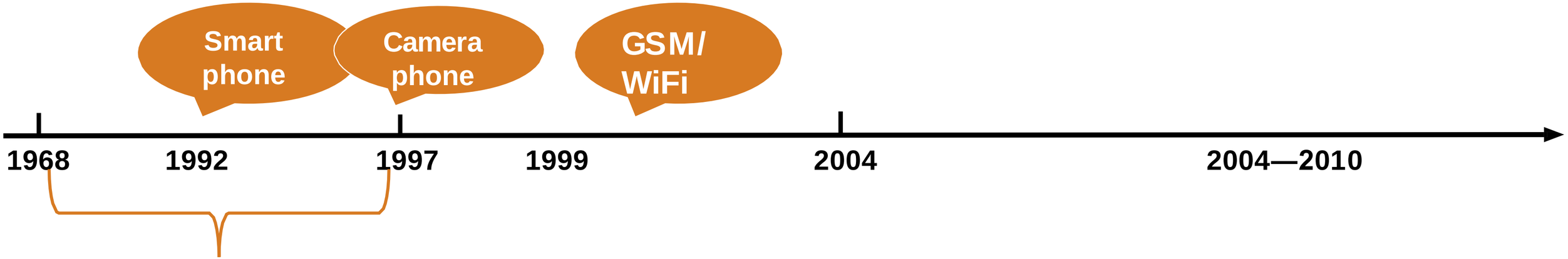
16IT AUGMENTED REALITY AND VIRTUAL REALITY

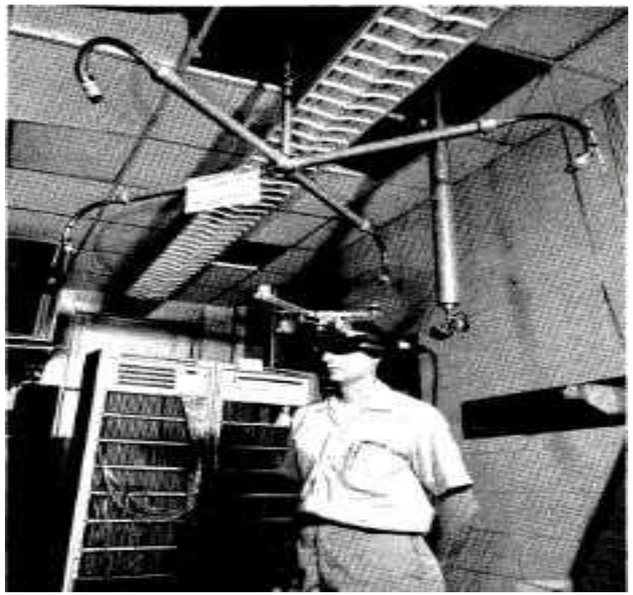
III YEAR – V SEM

UNIT 2 – INTERACTION AND MOBILE AUGMENTED REALITY

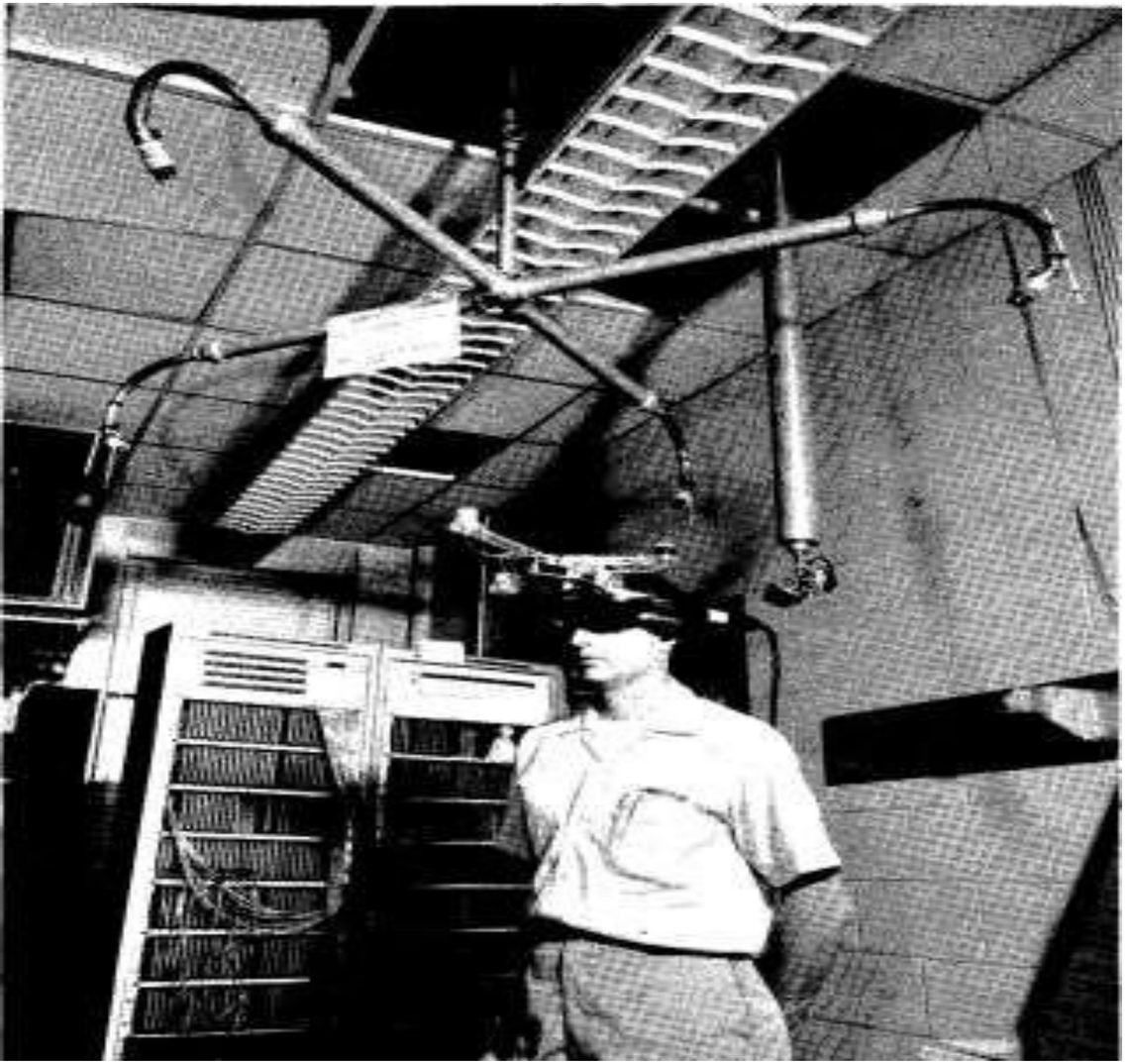
TOPIC 2 – Mobile Augmented Reality Systems

History of Mobile AR





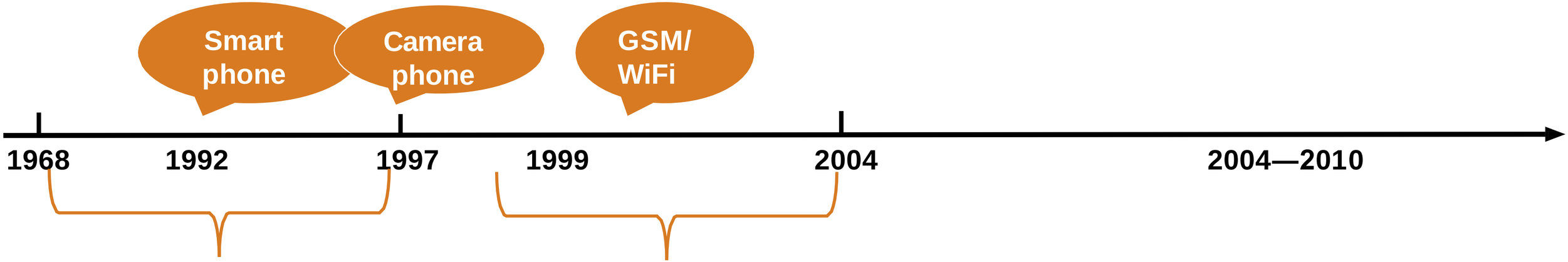
1st AR System

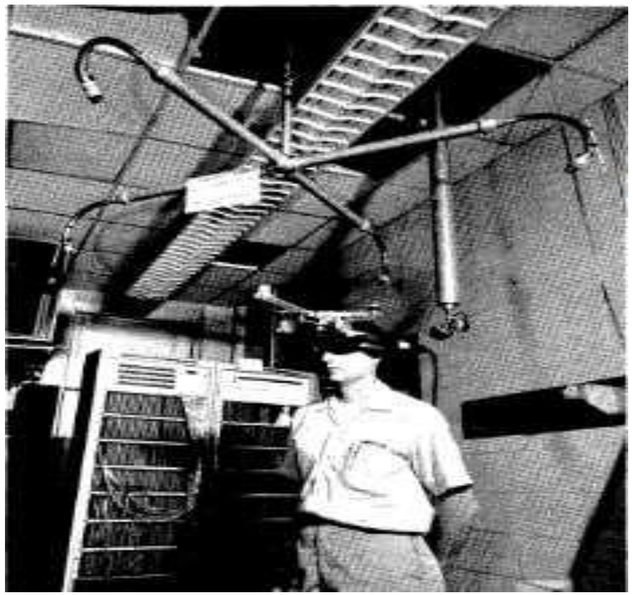


- Optical see-through HMD
- Two different 6 DOF trackers

(1968)

History of Mobile AR





1st Mobile AR System

- 1st Mobile AR System
- See-through head-worn display with integral orientation tracker
- Backpack holding computer & hand-held computer

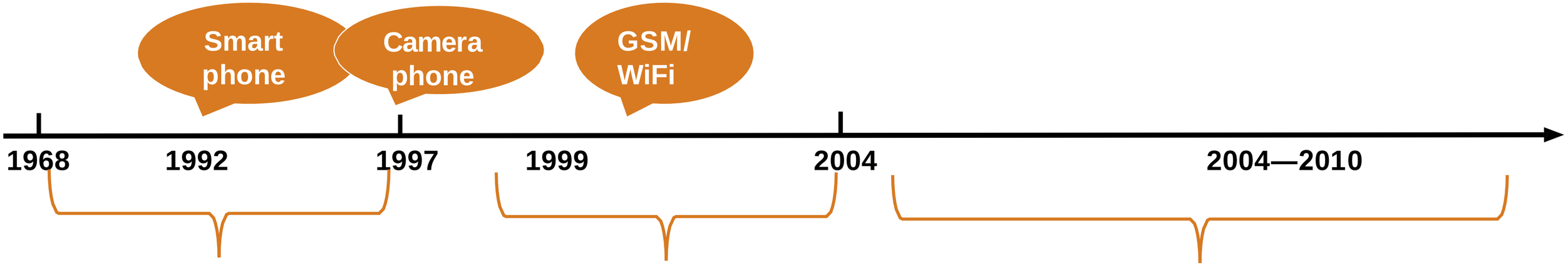
(1997)

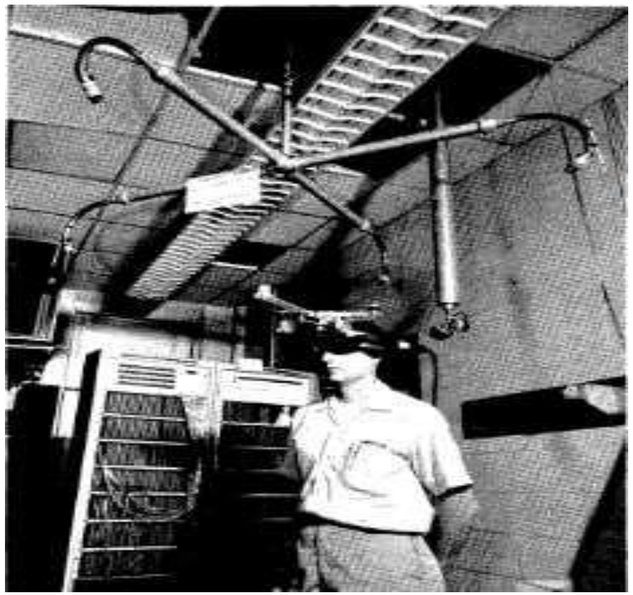
Multi-User AR

- A mobile, multi-user AR system
- Collaborate in augmented shared space

(2001)

History of Mobile AR





Mobile Phone AR

- A system for tracking 3D markers on a mobile phone
- 1st Video see-through AR system

on consumer cell phones (2004)

PDA AR

- 1st multi-user AR application for PDAs
- video see-through

(2004)

Better Graphics…Better AR!

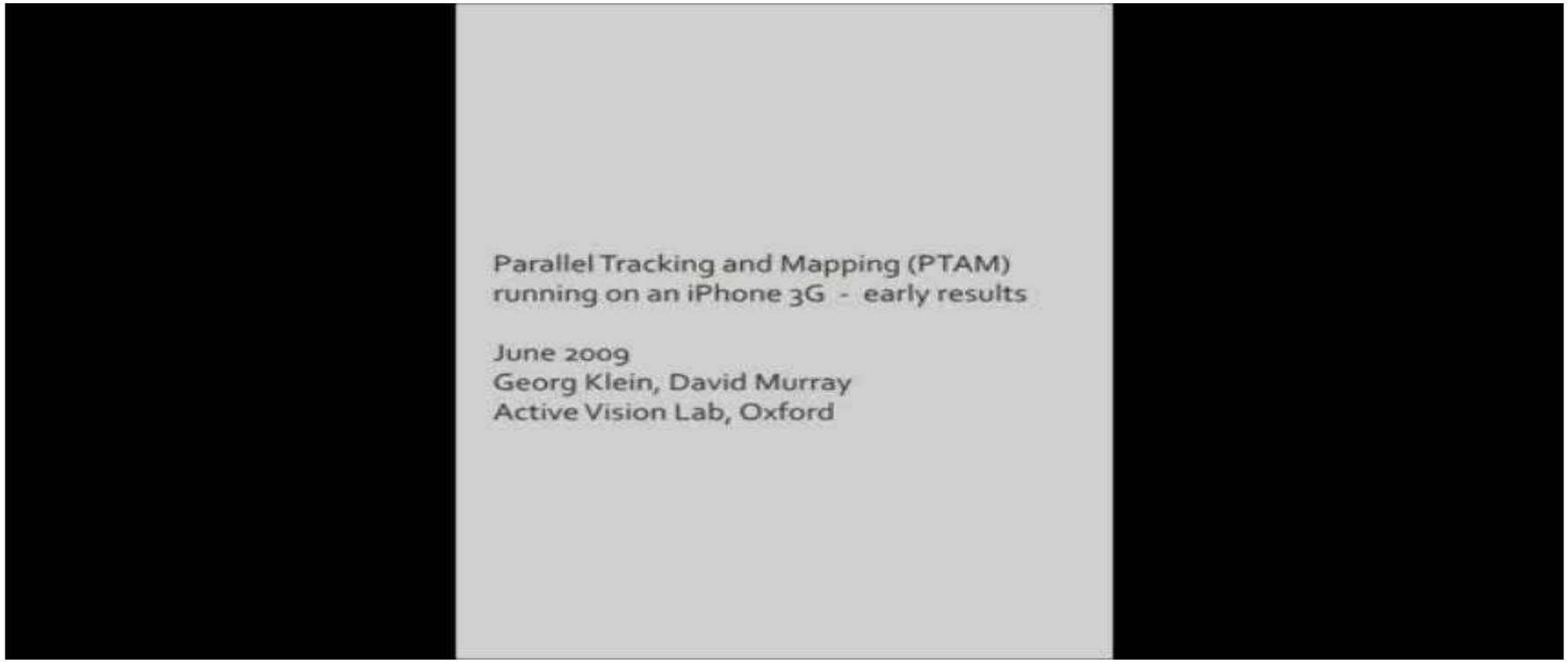
ARhrrrrr!

- A mobile AR game with high quality content

(2009)

Markerless Mobile AR - PTAM

- **PTAM system running in real-time on an iPhone (2009)**



Challenges & Issues

Photorealistic Rendering Of Virtual Objects

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

Challenges & Issues

User-Perspective Rendering (Phone/Tablet as Transparent Glass)

https://www.youtube.com/watch?v=C9UgJmmE7xk

Challenges & Issues

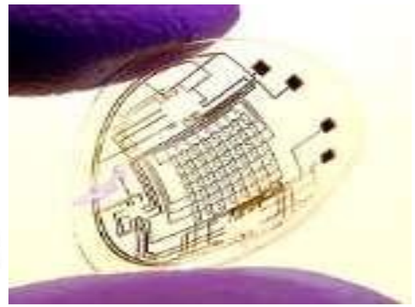
Occlusion Handling
(Depth Camera, Real Time)

Combines Real World & Virtual Objects

Allows Real-Time Interaction

3D Registration using Tracking

Display Technology



Currently:

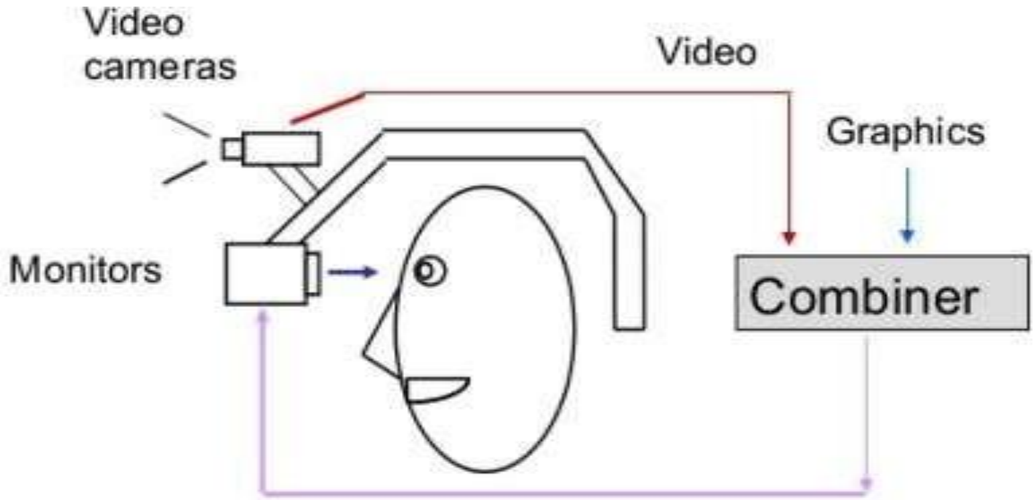
- Handheld
- lightweight head-mounted

Future:

- Projected AR
- Virtual Retinal Displays
- Contact Lens

Video-See Through HMD

- Camera Captures Real scene
- Digital content is added
- Better registration
- Wide FOV (depends on cameras)

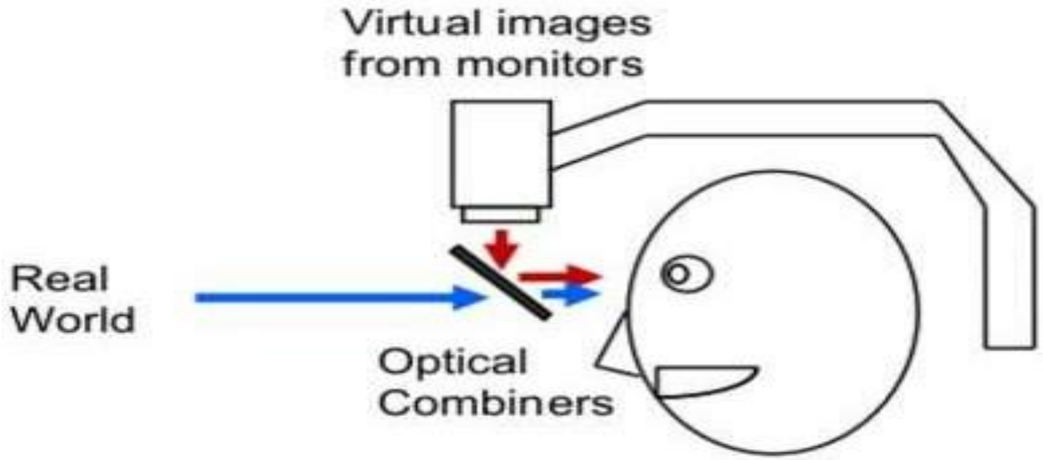


Handheld Displays

Optical See-Through HMD

User sees directly through display

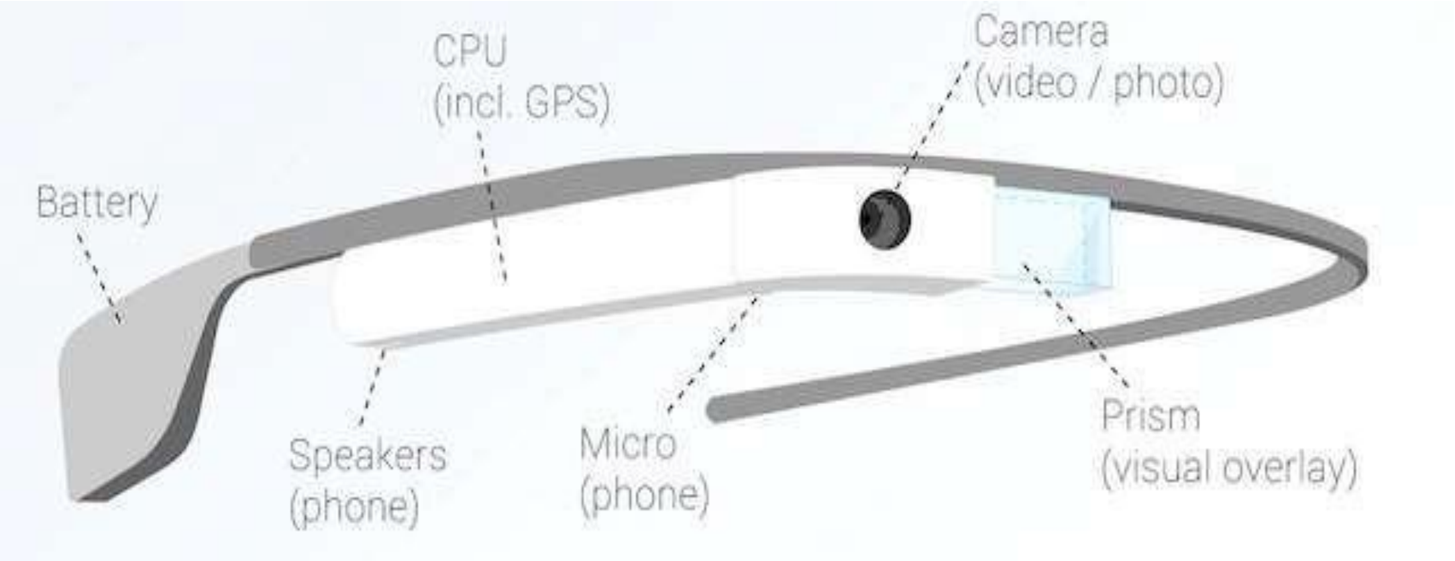
- Direct view of the world
- Full resolution, no time delay



- Safer
- Lower distortion
- No eye displacement

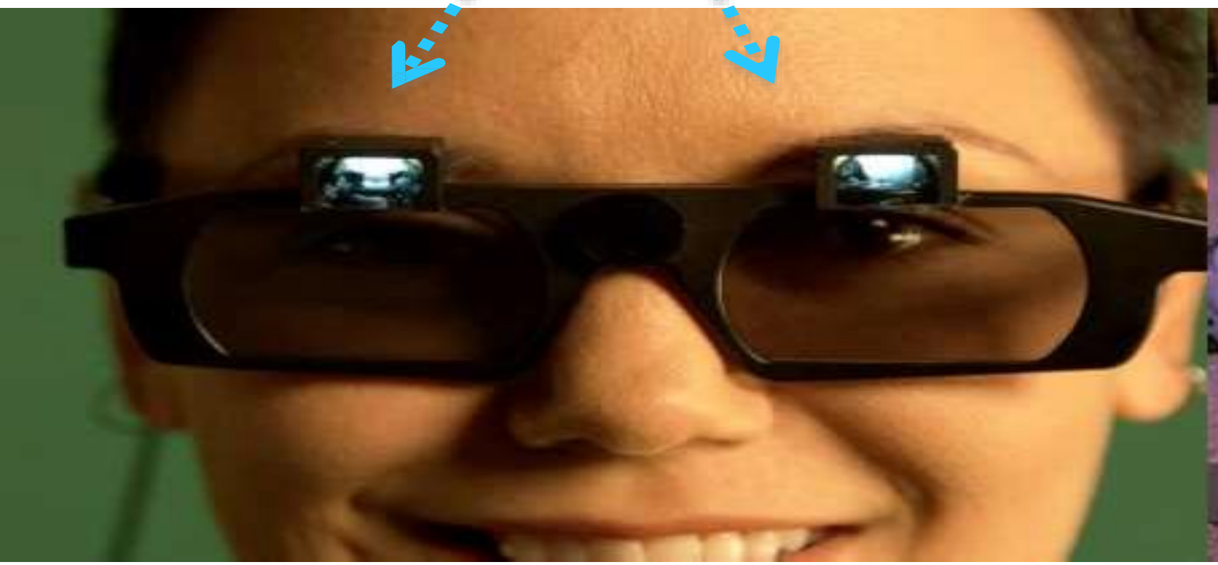
See-Through Multiplexed Display

- Above or below line of sight
- Unobstructed view of real world



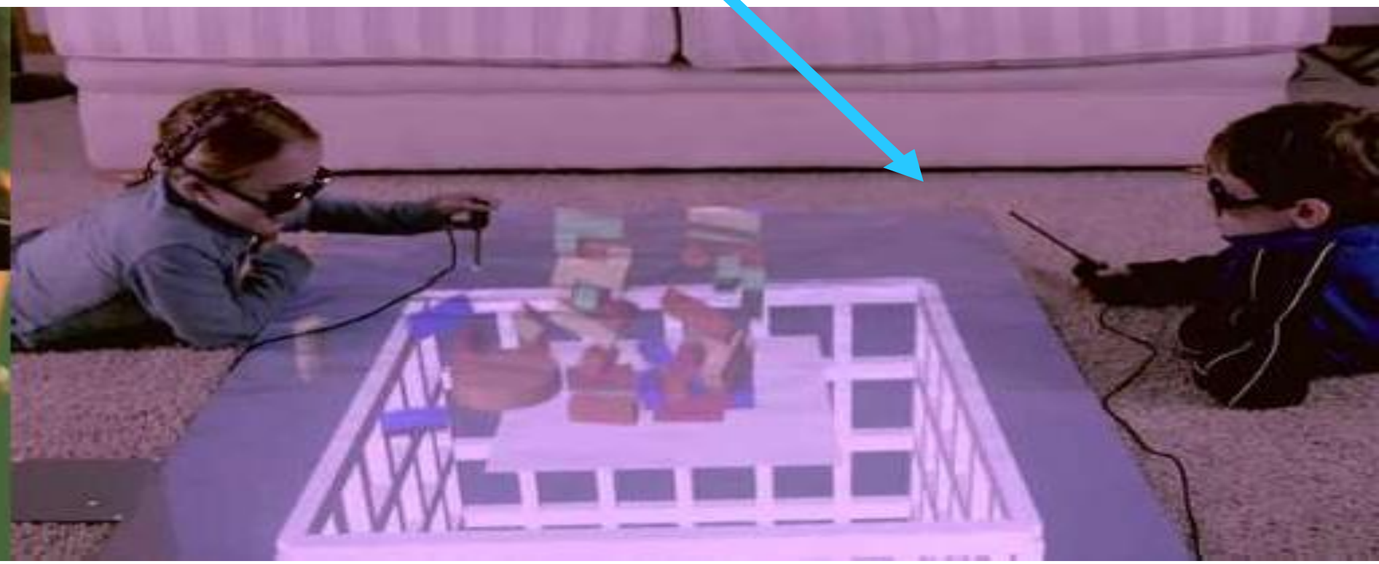
Projected AR

Stereo Head-Mounted Projectors



Wide FOV

Rollable retro-reflective Sheet



Shared Interaction

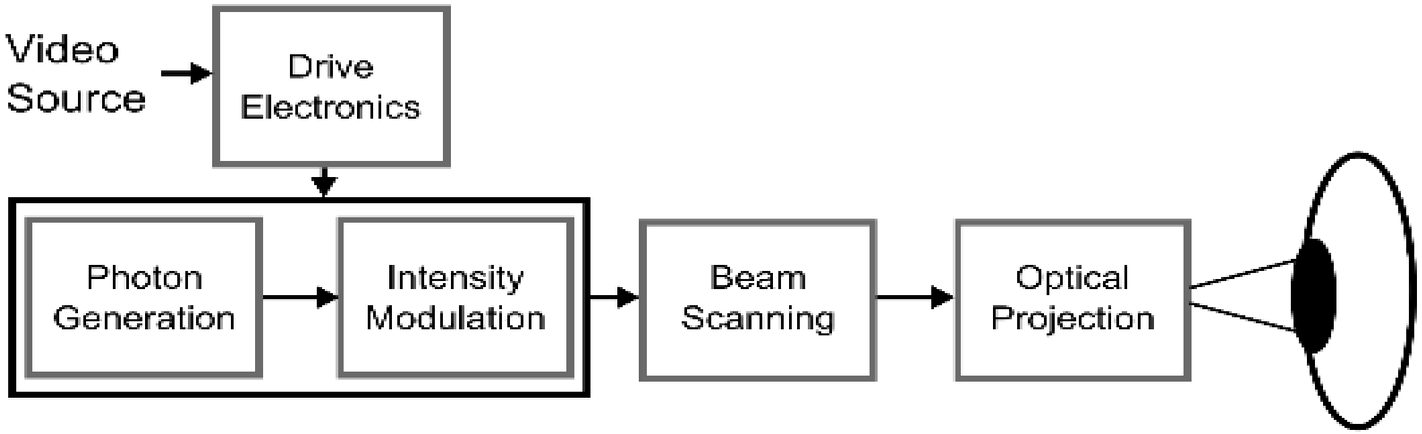
CastAR – http://technicalillusions.com

Virtual Retinal Displays

Everything we see is reflected light!

- Projects light directly into eyes
- Smaller size (no intermediate screen present)
- Highly portable
- Less power

magic leap



We can see virtual objects registered in space...

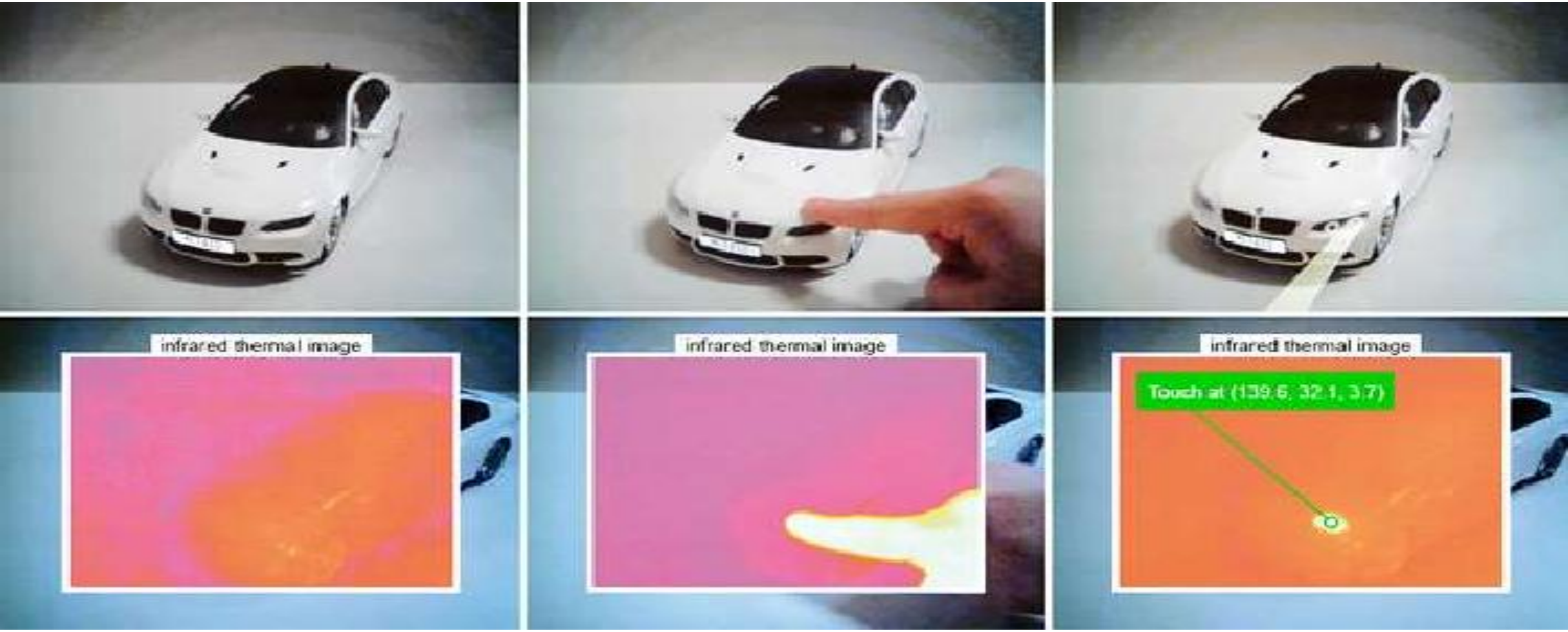
…but how can we interact with them?

Touch Gestures

Natural Gestures

Tracking the user's hand(s) can provide a 6DOF interaction technique.

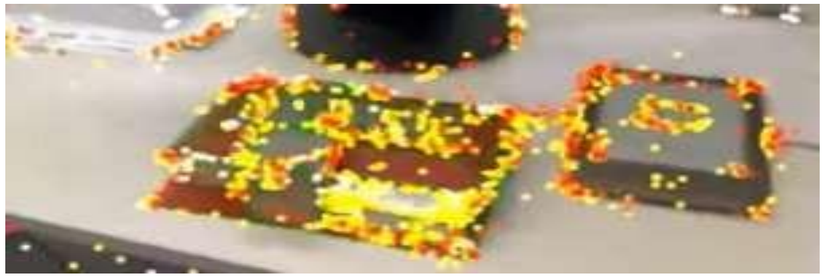
Thermal Touch



Thermal Touch: Thermography-Enabled Everywhere Touch Interfaces for Mobile Augmented Reality Applications Kurz, ISMAR 2014

Tracking

Recover position and orientation of viewpoint at each frame.



Past:

- Location Based (GPS)
- Marker based
- Magnetic, etc.

Currently:

- Image based
- Hybrid Tracking

Future:

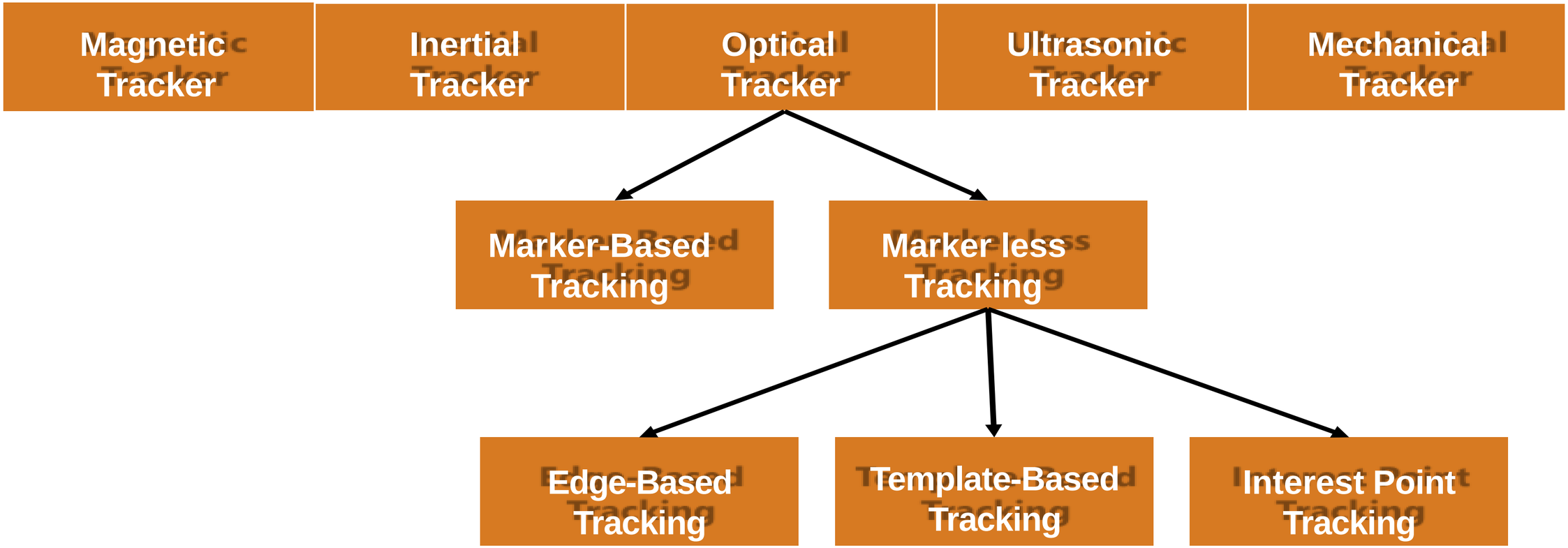
- Model-based
- Environmental

Optimal Tracking System

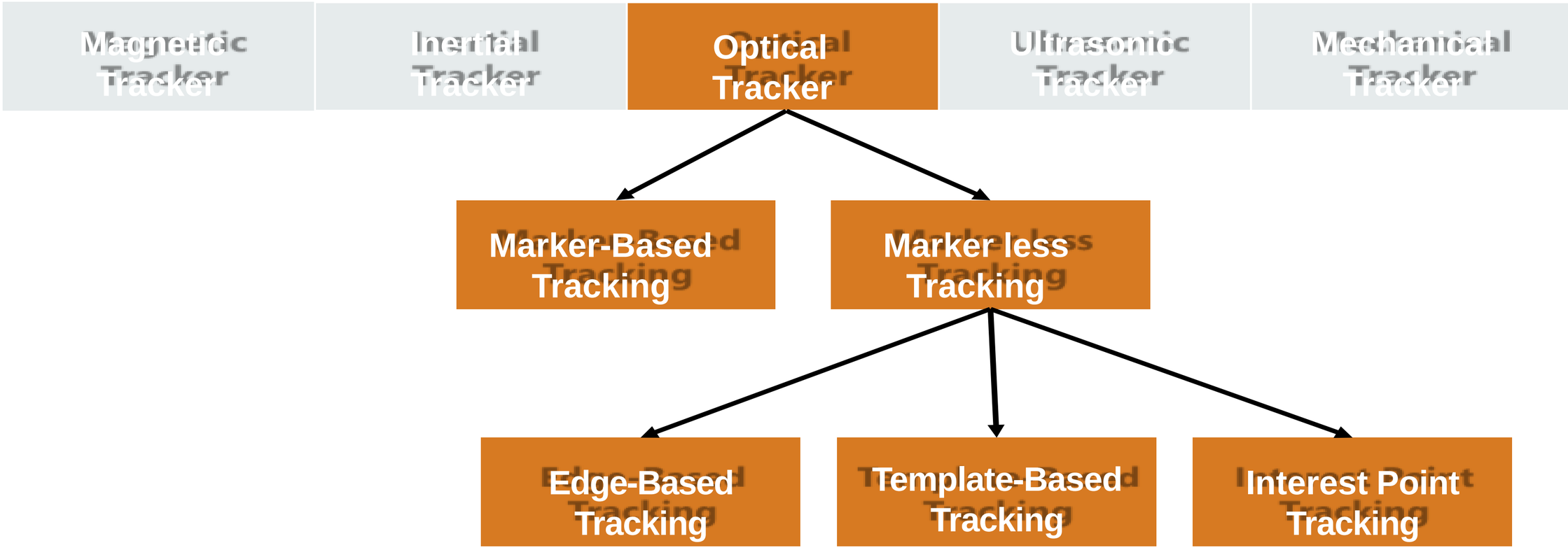
An ideal tracking system should have:

- **perfect instantaneous 6 DOF measurements of the sensor pose in any environment and under any motion.**
- **Robustness against observation from different viewing angles.**
- **Robustness w.r.t changing lighting condition.**
- **Low cost, be fast and reliable**

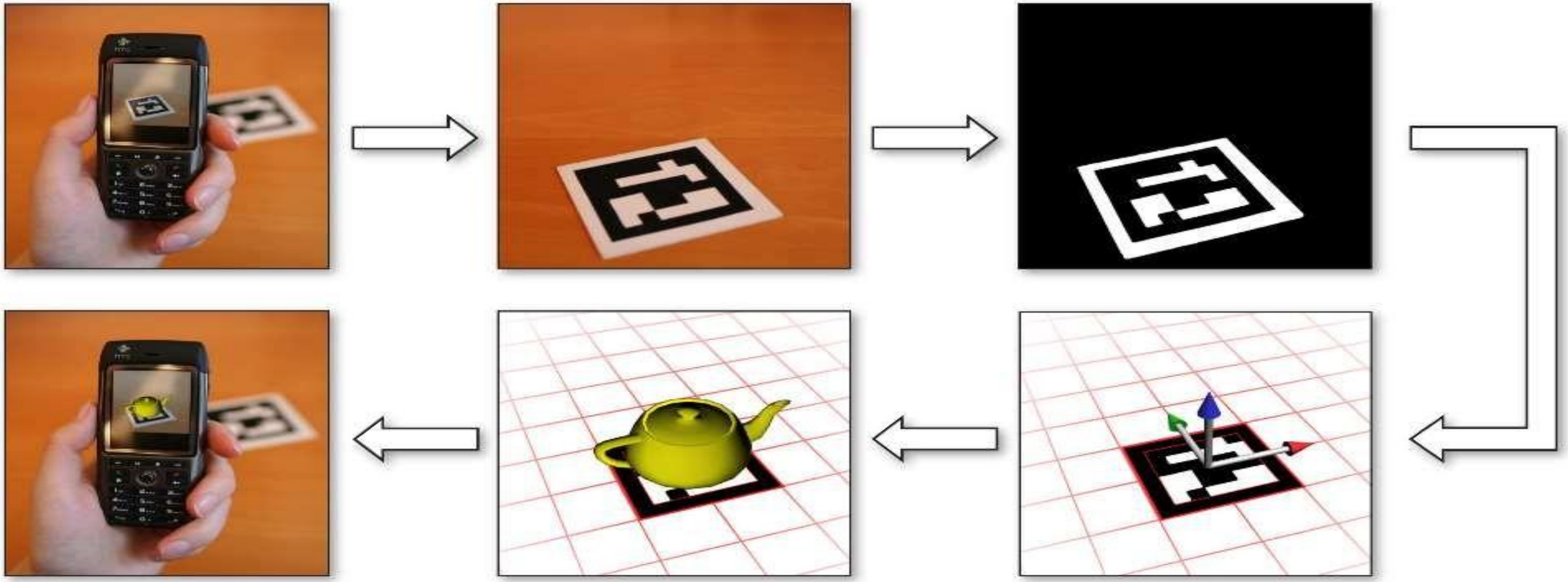
Tracking Types



Tracking Types



Marker Tracking



Markerless Tracking

- **3D tracking techniques that tracks natural features.**
- **It extracts features from the surrounding environment (i.e. corners, edges, textures).**
- **Markerless AR system use natural features instead of fiducial markers in order to perform tracking.**

Main techniques used are:

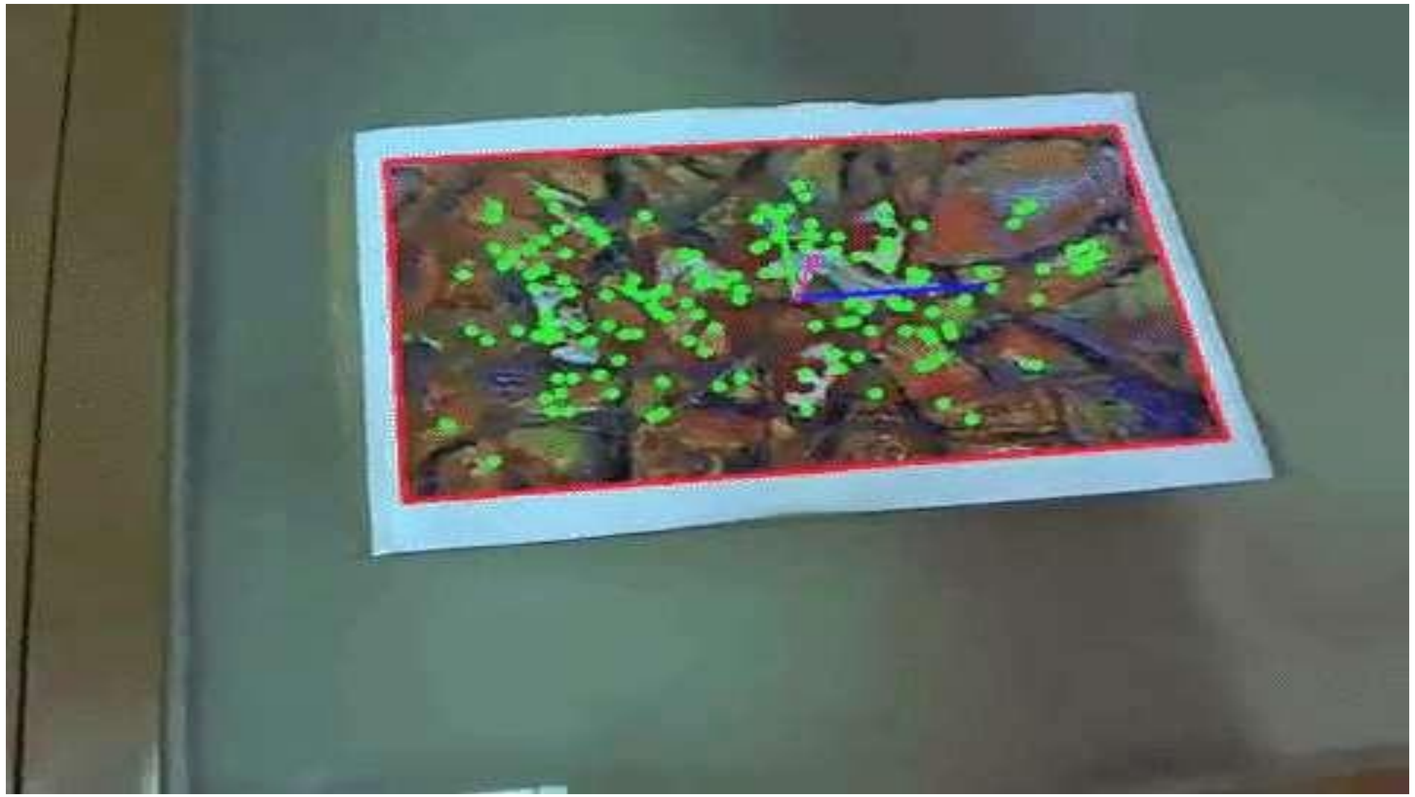
- **Template based tracking.**
- **Edge based tracking.**
- **Tracking by object detection.**

Template-based Tracking

- Also called Texture Tracking.
- Looks for features in images.

With enough features it can be highly accurate.

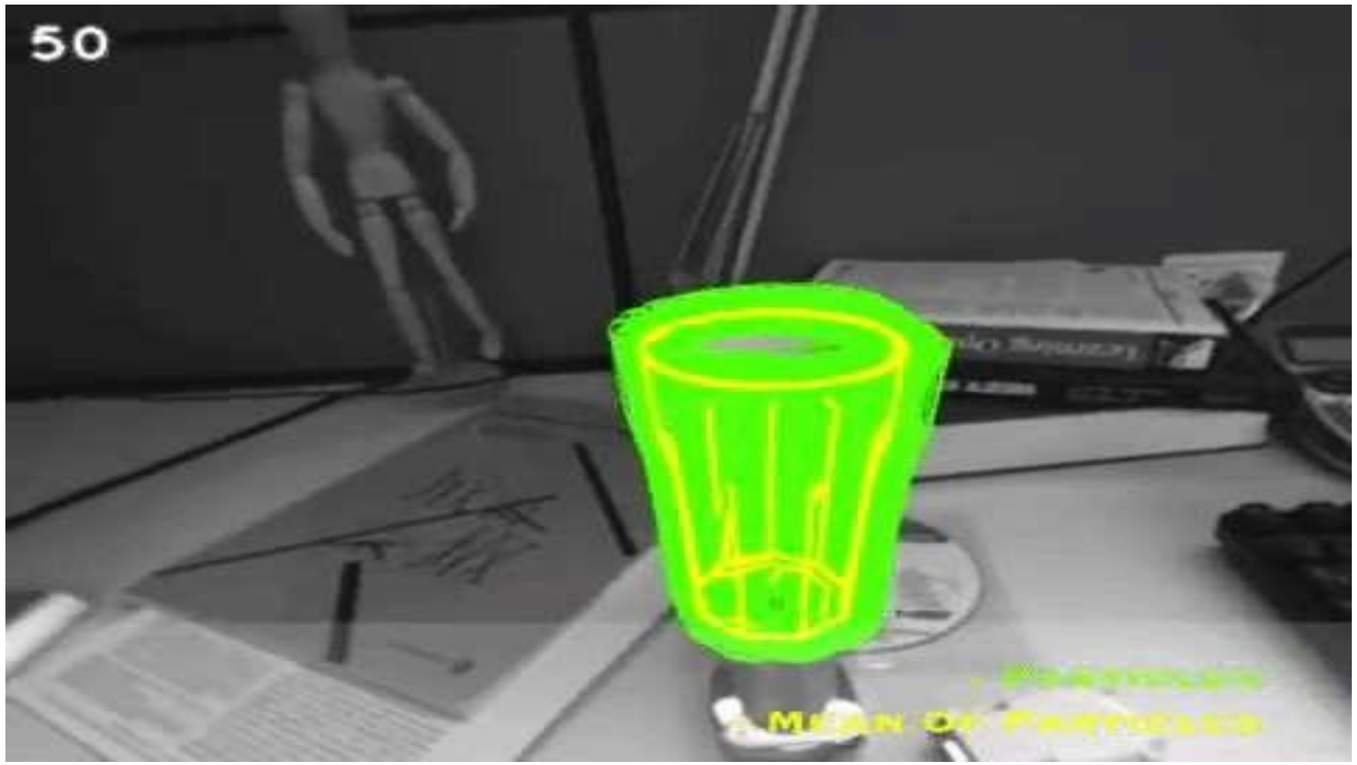
- Sensible to fast camera movements.
- Sensible to light changes.
- Sensible to occlusion.



Multi-Texture Tracking AR

Edge-based Tracking

- It requires depth cameras.
- Sensible to fast camera movements.
- Cluttered background.
- Tracking accuracy is jitter.



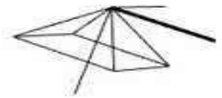
3D Texture less Tracking - AR

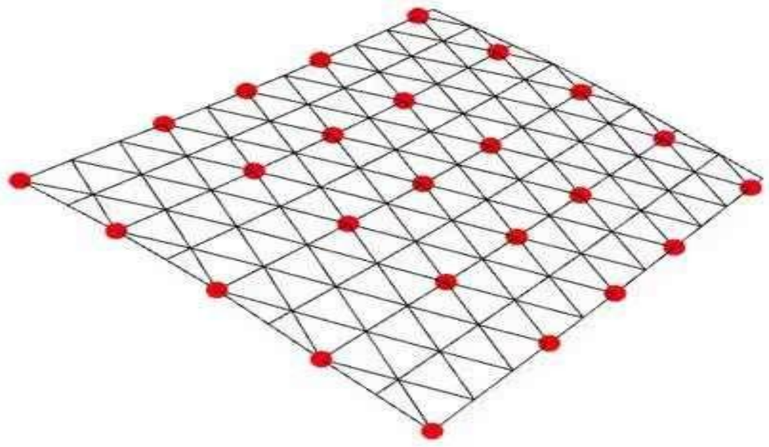
Object-based Tracking

- **Tracking might be restricted to limited range of poses.**
- **Stable tracking under fast motion.**

Object Recognition - AR

Track from Deformable Objects





Parallel Tracking & (Multiple) Mapping (PTAM – PTAMM)

- **Estimating camera pose in an unknown scene.**
- **Tracking and Mapping are 2 separate tasks.**
- **Produces detailed maps which can be tracked at frame-rate.**

Parallel Tracking and Mapping (PTAM - PTAMM)

Current Products

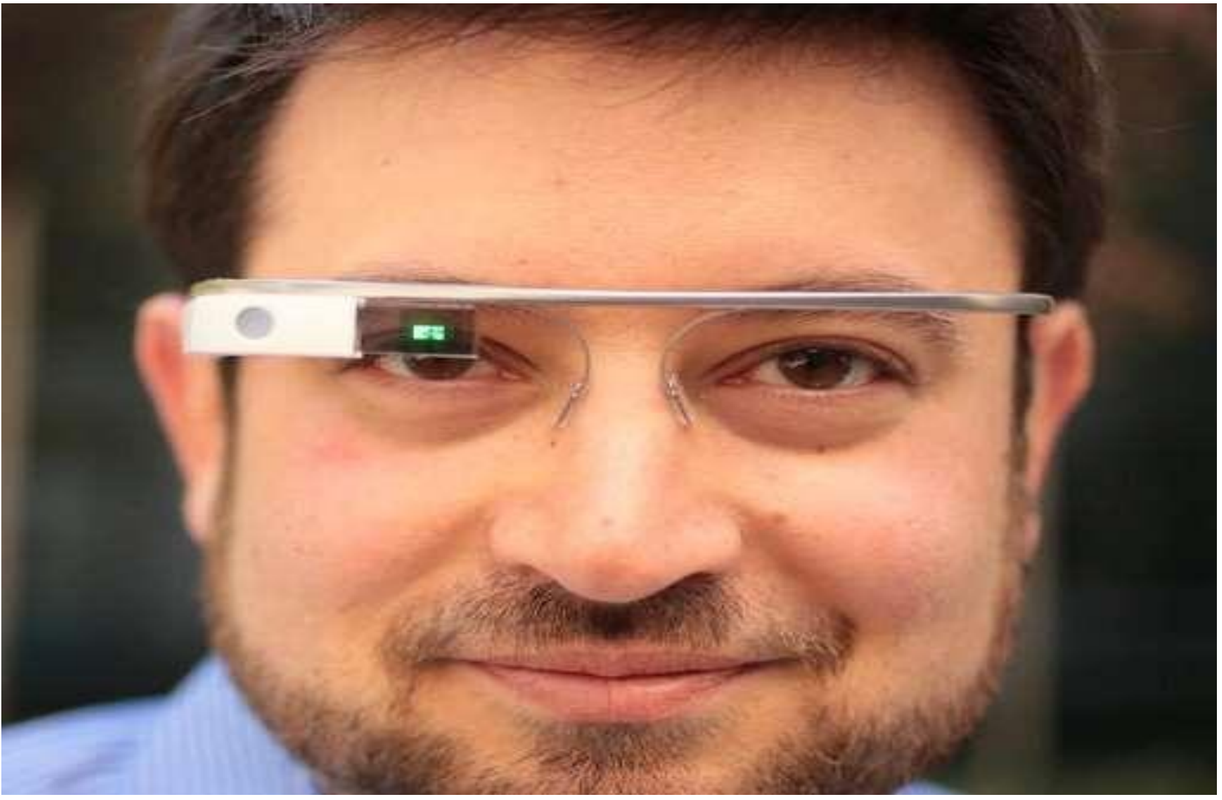
EPSON Moverio

- Binocular see through display
- Camera, gyroscope, GPS, accelerometer, and microphone.
- £519.99
- Optical See-Through

CastAR

- **Projected AR**
- **$400**
- **Q1 2016**

Google Glass



- Touchpad
- Camera – record 720p video
- Single screen
- $1,500
- Version 2 ~ 2016
- Optical see through

Meta Spaceglasses+Meta Pro

- 3D See-through Display
- 3D depth Camera-320x240 + RGB Camera-1280x720
- Head tracking
- 23-35º FOV
- 9-axis accelerometer
- $667, $3000

- 40º FOV
- Comes with sidekick PC with a 1.5GHz Core i5 processor, 4GB of RAM, and a 128GB SSD

Microsoft Hololens

Microsoft Hololens

- Expected 1st quarter 2016
- 3 Processors - CPU, GPU, HPU
- $3,000

Vuzix AR Glasses

- Several Different products.
- Stereo video see through
- $1500

DAQRI Smart Helmet

- AR for the construction industry
- With developers already
- 4D display
- $ “thousands”
- Optical see through AR

RideonVision Ski Goggles

https://www.youtube.com/watch?v=EL4zvDcpIMc

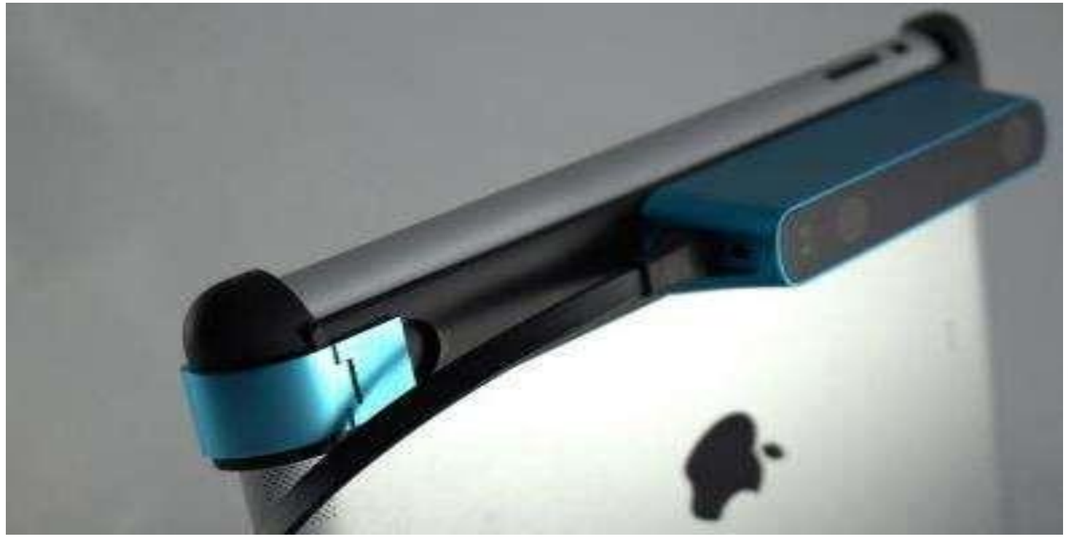
- AR Ski Goggles
- $899
- Uses smartphone
- See through AR screen.

All Smartphones

- Camera
- GPS
- Accelerometer
- Everyone has one
- Handheld – Video see- through

Structure Sensor for Tablets

- 3D scanner for



Arachnophobia Treatment

- **Uses Microsoft Kinect**
- **Treats arachnophobia**

From Devices…

..to Deviceless!