

VIRTUAL REALITY: “technology framework and case studies”

Konstantinos Loupos, MSc, MEng (ICCS)
kloupos@iccs.gr



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I-SENSE GROUP

- ▶ National Technical University of Athens
 - Department of Electrical Engineering
 - Microwave and Fiber-Optics Laboratory
 - I-SENSE Group
 - VR Lab

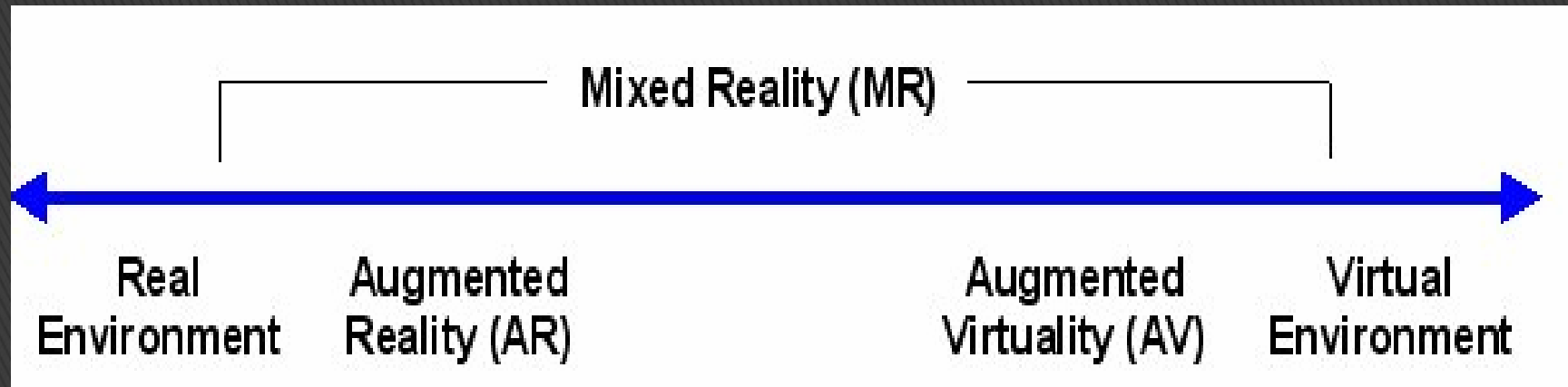
VR LAB

- ▶ ICIDO PowerWALL
 - Passive Stereo
 - Infrared Tracking
 - Hornet (interaction)
- ▶ Mobile System
 - PS Tracker (opt. tracking)
- ▶ HMD
- ▶ Data Glove





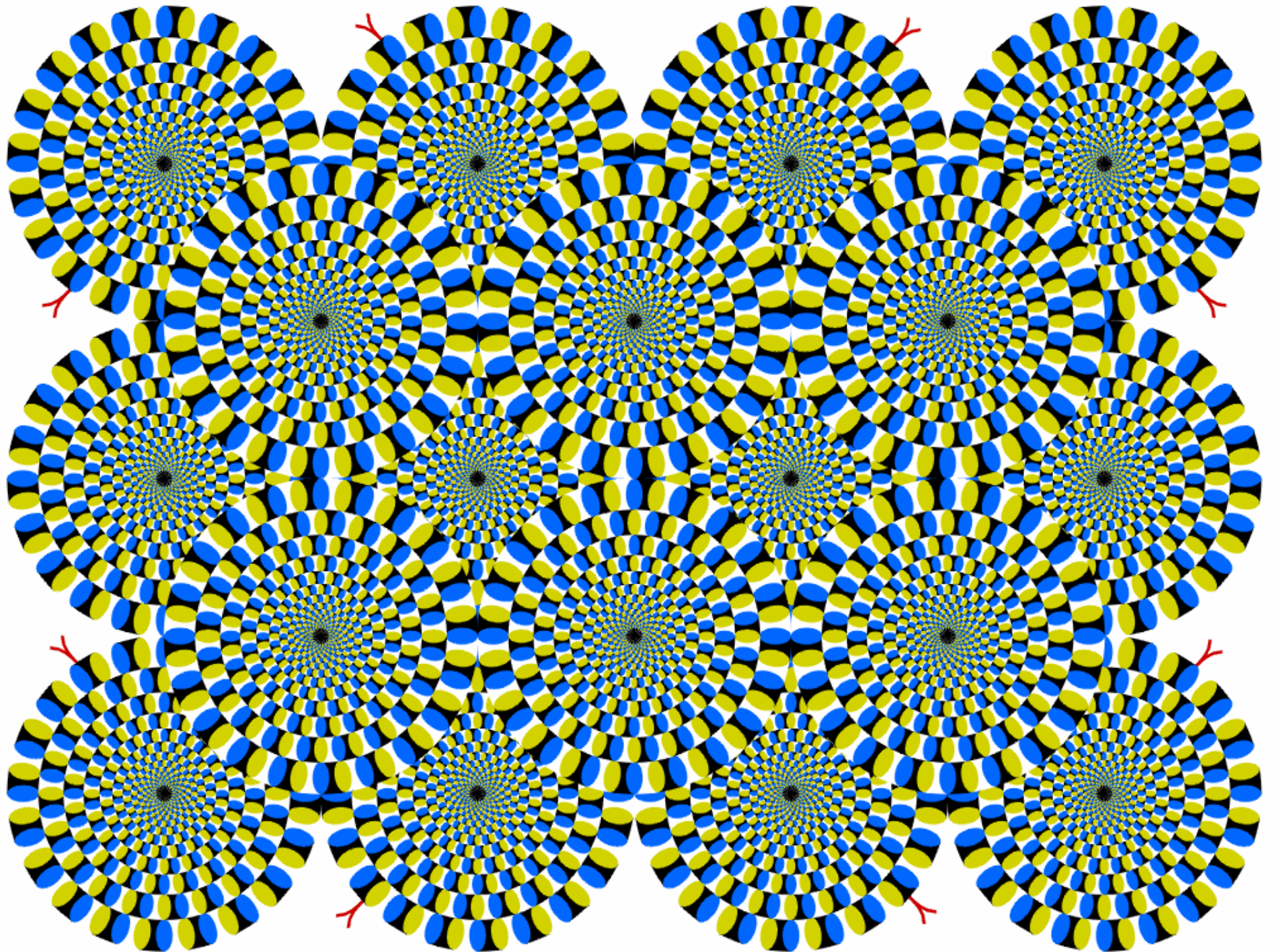
VIRTUALITY vs REALITY



Reality-Virtuality continuum : Paul Milgram

Augmented Reality: virtual augments the real

Augmented Virtuality: real augments the virtual





Definition of Virtual Environment

A virtual environment is an interactive, virtual or real image displaying, enhanced by special processing to convince its users that they are directly immersed into it



Components of a VR System



Projection

Glasses / Stereo Vision



Screen



Interaction



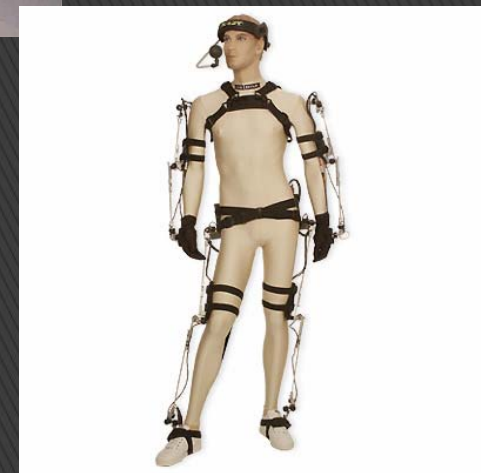
Body Tracking



Haptic Device



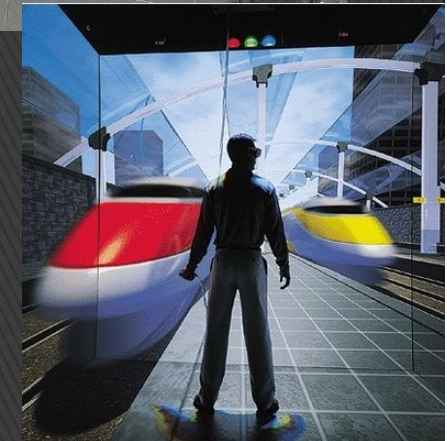
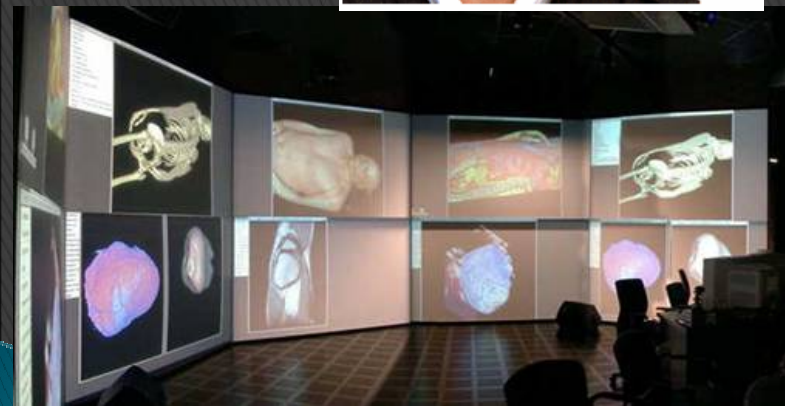
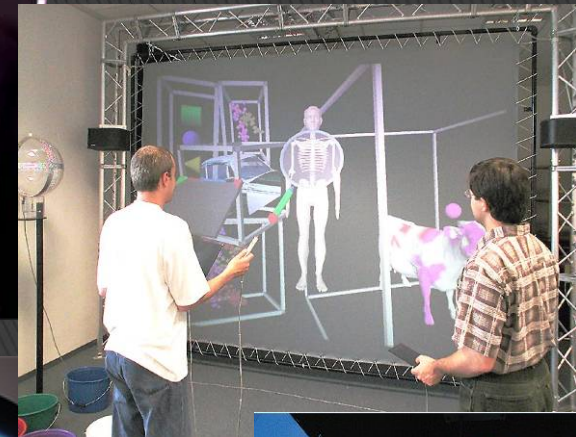
Surround Sound



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Virtual Reality Systems



Images of Virtuality:
Conceptualizations and
Applications in Everyday Life

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Case Studies

- ▶ VIRTUALIS (IP)
 - Industrial Safety using VR (petrochemical)
- ▶ MANUVAR (CP-IP)
 - Lean Manufacturing using VR
- ▶ INTUITION (NoE)
 - Structuring ERA
 - Bringing Together Knowledge in VR



VIRTHUALIS

Virtual RealiTy and Human factors AppLications for Improving Safety

- ▶ Project Type: IP
- ▶ Duration: 4 years (from May 1st 2005)
- ▶ Budget: 9 M€ Project



Industrial Safety

- ▶ Huge Industrial Spending to:
 - Improve safety
 - Reduce risks of causing damage to equipment and human injuries



Industrial Safety ..more



- ▶ Typical and practical safety issues in industrial sites:
 - Training for control room operators
 - Emergency response teams training
 - Assessment of the impact of plant modifications
 - Managers' assistance in defining the impact of their decisions on operators' work
 - Coordination between safety management functions
 - Increase Risks awareness
 - Accident Analysis and "what if" scenarios



VR for Safety Actions

- ▶ **VR in Training Simulators**
 - Provides Realistic Behavior of the Training Task
 - Imposes Related Psychological Stress
 - Attains Realistic Training Conditions
 - Exposes Trainee to full complexity of the task
- ▶ **VR for Risk Assessment & Accident Investigation**
 - Familiarization with Plant Layout
 - Real-time Response of Fully Emulated Plant (linking to process simulators)
 - Examine “what-if” Scenarios
 - Identification of Ignition Sources
 - Error Detection and Classification
 - Investigation of correctness of Planned Procedures
- ▶ **VR for Safety Management**
 - Accident Prevention
 - Handling of emergencies
 - Identifying Countermeasures
 - Familiarizing with Critical Plant Points



Areas of applications

- ▶ **Design stage**

- ▶ **Operational stages**

- ▶ **Emergency stage**

- ▶ Exploration & Drilling
- ▶ Construction
- ▶ Commissioning
- ▶ Operation
- ▶ Maintenance, Repairs & Modifications
- ▶ Decommissioning

Practical RA Use-Case



- ▶ Site:
 - Chemical Plant

- ▶ Actors:
 - Field Operator
 - Control Room Operator

- ▶ Scenario:
 - Familiarization With Plant And Emergency Procedures
 - Locate Gas Leakage
 - Perform Corrective Actions/Maintenance



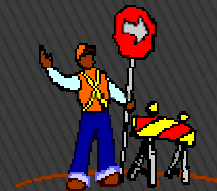
Practical RA Use-Case



- ▶ Beginning of scenario:
 - Leakage alarm in Control Room

- ▶ Execution of protocol procedures
 - CR communicates/cooperates with F.Op. to execute emergency procedures
 - F.Op. locates leakage (if real)
 - Takes measures (if real)

- ▶ Simulation Execution
 - F.Op. navigates inside real plant
 - Communicates with CR
 - Interacts with environment
 - Performs safety tasks and/or corrective actions



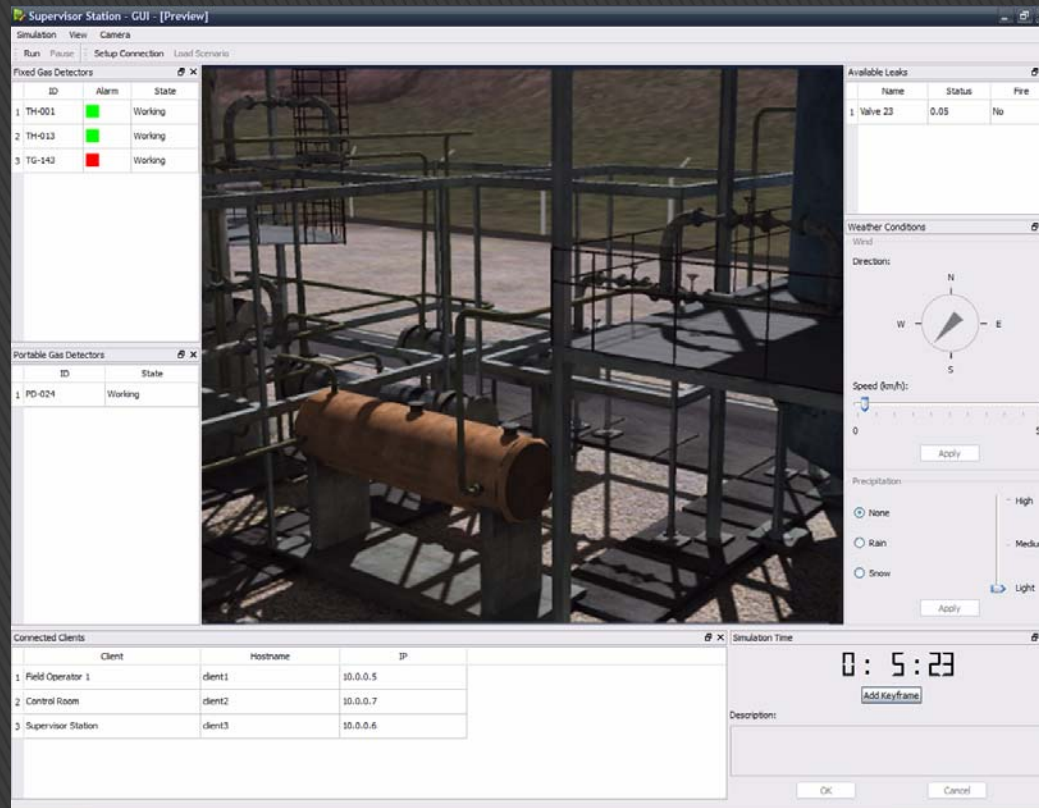


Practical RA Use-Case

- ▶ Benefits from simulation
 - Simulation of hazardous procedures
 - Familiarization with plant components/procedures
 - Interaction with Virtual plant
 - Replication of the real plant and its processes
 - Decision making support
 - Post analysis of simulation
 - Check performance
 - Validate procedures



The Applications



Supervisor Station



Industrial Plant

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I-SENSE Role in VIRTUALIS



- ▶ Member of the Executive Board
- ▶ VR Expert
- ▶ Main developer for VR applications
- ▶ Technical Responsible for VR Developments
- ▶ Leader of the Development WPs
- ▶ Key-Role in Testing and Training tasks

ManuVAR



Manual Work Support throughout System Lifecycle by Exploiting Virtual and Augmented Reality

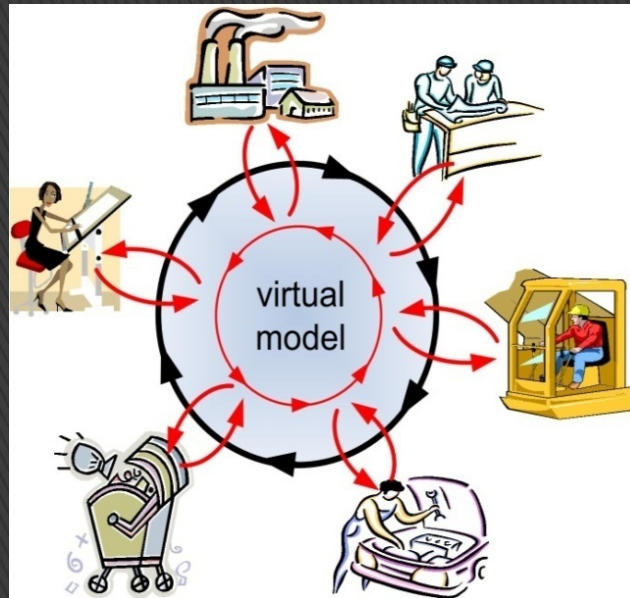
- ▶ Project Type: CP-IP
- ▶ Duration: 4 years (from May 1st 2009)
- ▶ Budget: ~7 M€ Project



ManuVAR Aims

- ▶ Increase productivity and quality and reduce cost of high value manual work in the whole lifecycle;
- ▶ Facilitate adaptation to product customization and changes;
- ▶ Support efficient knowledge and skill management through the lifecycle;
- ▶ Help companies to improve their business models and competitiveness and to move up the value chain by exploiting the strengths of high value, high knowledge manual work.

ManuVAR concept



- ▶ Prototype manual work
- ▶ Capture feedback
- ▶ Accumulate, transform, update and reuse knowledge
- ▶ Optimization of the entire lifecycle
- ▶ Bi-directional flows of information
- ▶ Reference to VM (DMU, PDM/PLM)

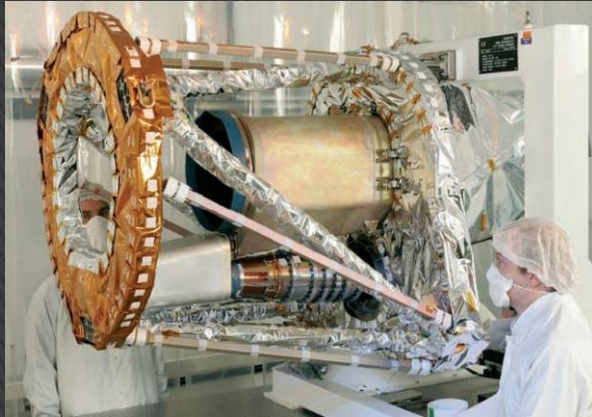
- ▶ Virtual/Augmented Reality Technologies
- ▶ Employ advanced HMI
- ▶ Natural medium for the communication between the human and the complex VM (DMU, PDM/PLM data and models)

ManuVAR – 3 Dimension Spanning



- ▶ Technology
 - Placing VM in the core of lifecycle!
 - Technology Platform
- ▶ Methodology
 - Considering all aspects of ergonomics!
 - Methodological Framework
- ▶ Business and Policy
 - Enabling lead users to take up project results and launch business beyond ManuVAR
 - Business & Policy Framework:

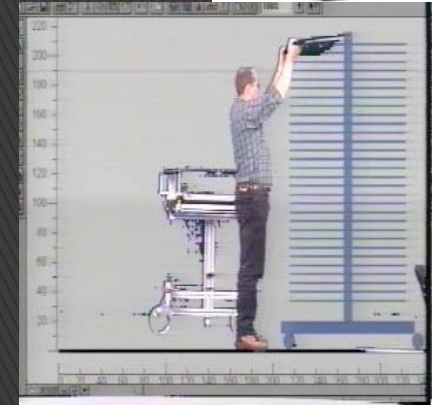
Industrial Sectors



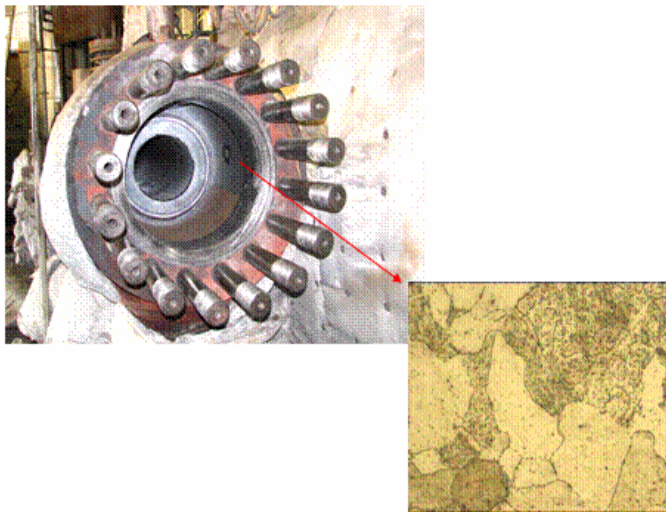
Satellite assembly



Remote training



Manufacturing design



Nuclear plants maintenance

Maintenance of heavy machinery



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ManuVAR Applications

- ▶ VR platform
- ▶ AR applications for maintenance
- ▶ VR applications for training

- ▶ Suitable HMI interface
- ▶ High level of interaction with VM



I-SENSE Role in ManuVAR

- ▶ VR Expert
- ▶ Technical Responsible for VR Developments
- ▶ Leader of the Development WP

INTUITION NoE

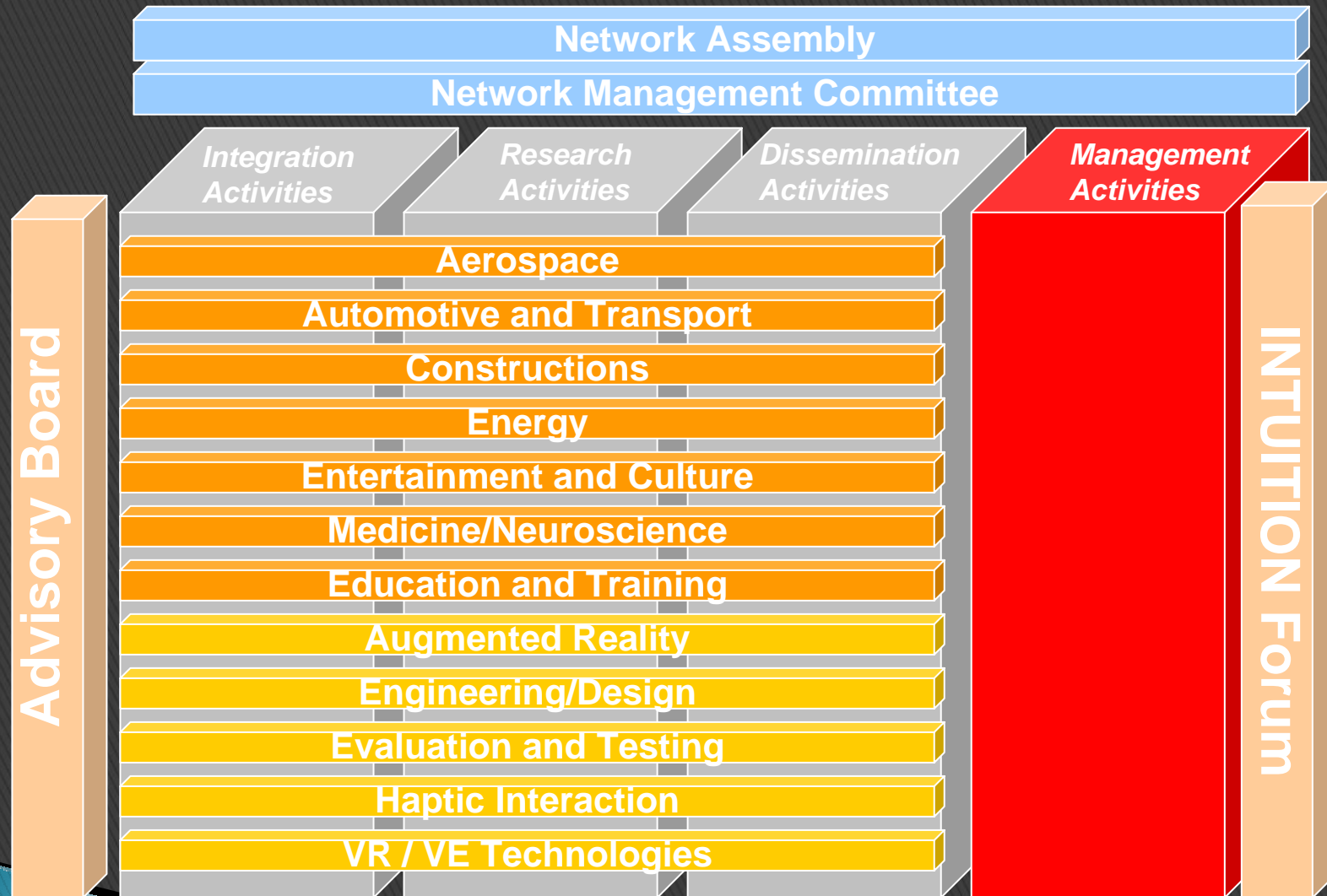


Network of Excellence on Virtual Reality aNd VirTUal Environments ApplIcaTIONs for Future Workspaces

- ▶ EC co-funded project (IST)
- ▶ 60 contractual partners
- ▶ Funding: Up to 6M€
- ▶ Duration of EC Funding: 4 years



Structure of INTUITION





Integrating activities in INTUITION

▶ Needs:

- User requirements collection and analysis
- Synthesis of VR/VE skills in Europe and worldwide
- Consolidation of research activities – Projects resource tool
- Increase in external participation through INTUITION forum
- Highlight levels of use and best practices

▶ Resources:

- European Virtual Lab
- Virtual Employment Office
- Technological Observatory
- Mobility schemes activated

▶ Knowledge:

- Identifying education and training courses available
- Discussions with Universities about EU PhD programme
- Defining key actors and topics within the EU PhD programme
- Knowledge management through a knowledgebase system
- Internal and external projects



Networking in INTUITION

- ▶ Internal Projects
 - Short term projects between INTUITION partners
 - Focused on integration activities

- ▶ Preparation of new research initiatives
 - Strong participation in FP6 and in National Programmes
 - A comprehensive strategy has been designed towards FP7

- ▶ Meetings and workshops
 - Regular Working Groups meetings
 - Annual Workshops
 - E-Forum

I-SENSE Role in INTUITION



- ▶ Project Coordinator
- ▶ Leadership and Participation into various WGs

Euro VR



European Commission
DG Information Society
FP6-funded Project



The European Virtual Reality And Augmented Reality ASSOCIATION



Images of Virtuality:
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Euro-VR

- ▶ Association on Virtual Reality
- ▶ Non-profit organization
- ▶ Gathering of:
 - Academia
 - Institutes
 - Companies and other
- ▶ Vision emerged from INTUITION NoE
- ▶ Target: Promotion of Virtual, Augmented and mixed Reality in Europe

Needs for research



- ▶ **Information:**
 - Quality access to other research
 - Practical information for implementation of:
 - On different level: student, user, expert
 - Free or as inexpensive as possible !

- ▶ **Exchange:**
 - Workshops, Conferences, etc.
 - Publication platform
 - Special Interest Groups
 - Finding research partner
 - Finding exploitation/dissemination partner

- ▶ **Organizational Support:**
 - Funding schemes
 - Project management information
 - Contact points for above
 - Contact points for support
 - Lobbying for set-up of VR/AR research programmes
 - IT Platform for all the information
 - Knowledge-Base

Association Objectives



- ▶ To promote Virtual, Augmented and Mixed Reality in Europe and beyond;
- ▶ To come up with a research oriented program and plan future research activities;
- ▶ To facilitate VR implementation in future workspaces;
- ▶ To best serve its members by providing them with relevant services and events.



Association Services

- ▶ Networking with the VR and AR Stakeholders
- ▶ Access to the European VR knowledge base
- ▶ Information on opportunities of collaboration
- ▶ Research of Exploitation of Projects
- ▶ Access to the Virtual Employment Office
- ▶ Discount prices for International Workshops
- ▶ Access to organized Training Courses
- ▶ Access to VR platforms
- ▶ Consultancy in VR project management

How to get involved?



Angelos Amditis
a.amditis@iccs.gr

The End



Thank you for your attention !

Konstantinos Loupos

kloupos@iccs.gr

