VR, AR technologies and METAVERSE

Mario Covarrubias Rodriguez

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POLITECNICO MILANO 1863

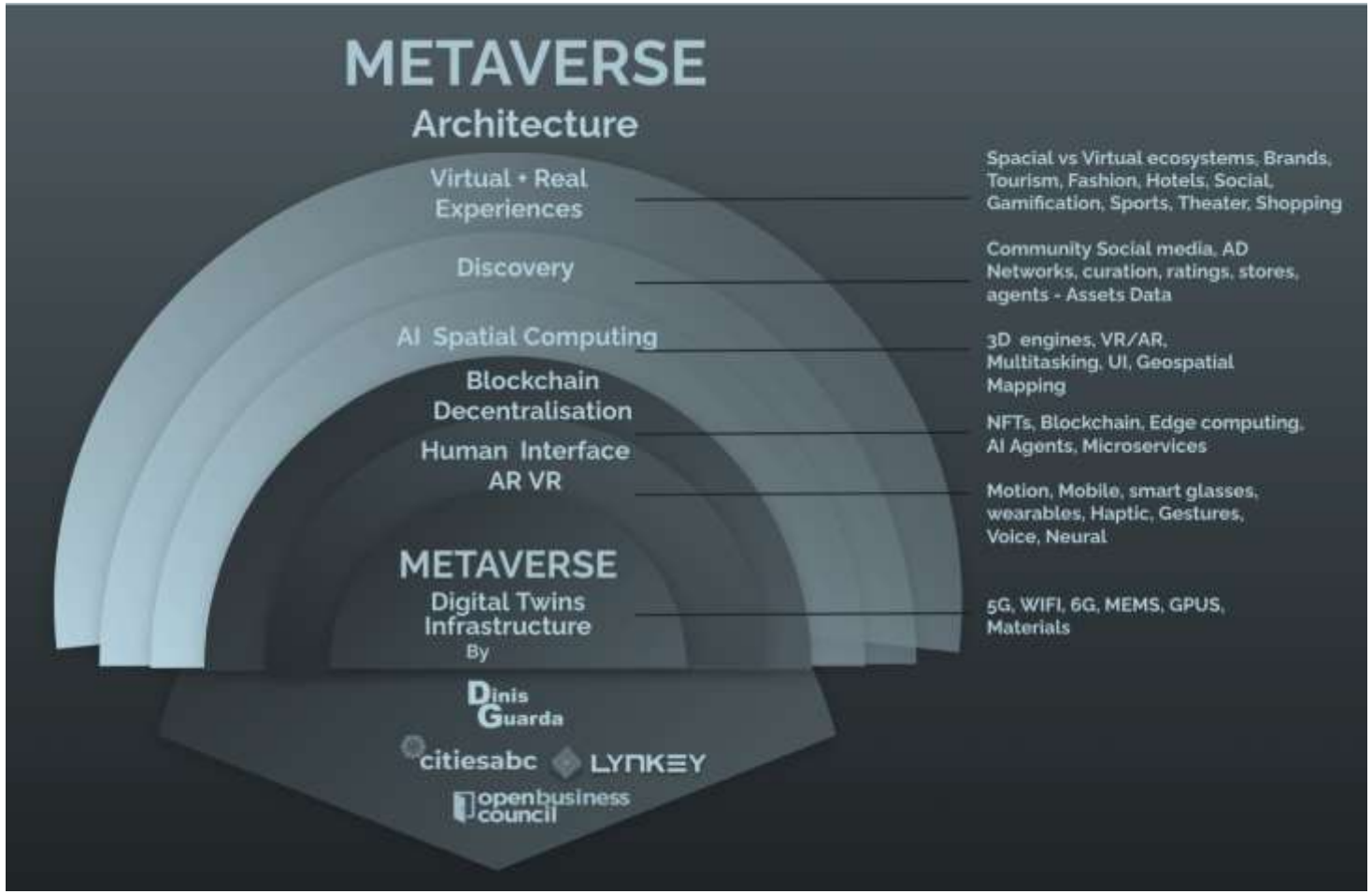
ER Applications

Learn the ecosystem

The Metaverse concept can then be simply defined as a digital twin of our world to

- Live in,
- Operate in,
- Communicate in,
- Learn in,
- Research in,
- Play in ,
- Entertain,
- Buy and sell things.

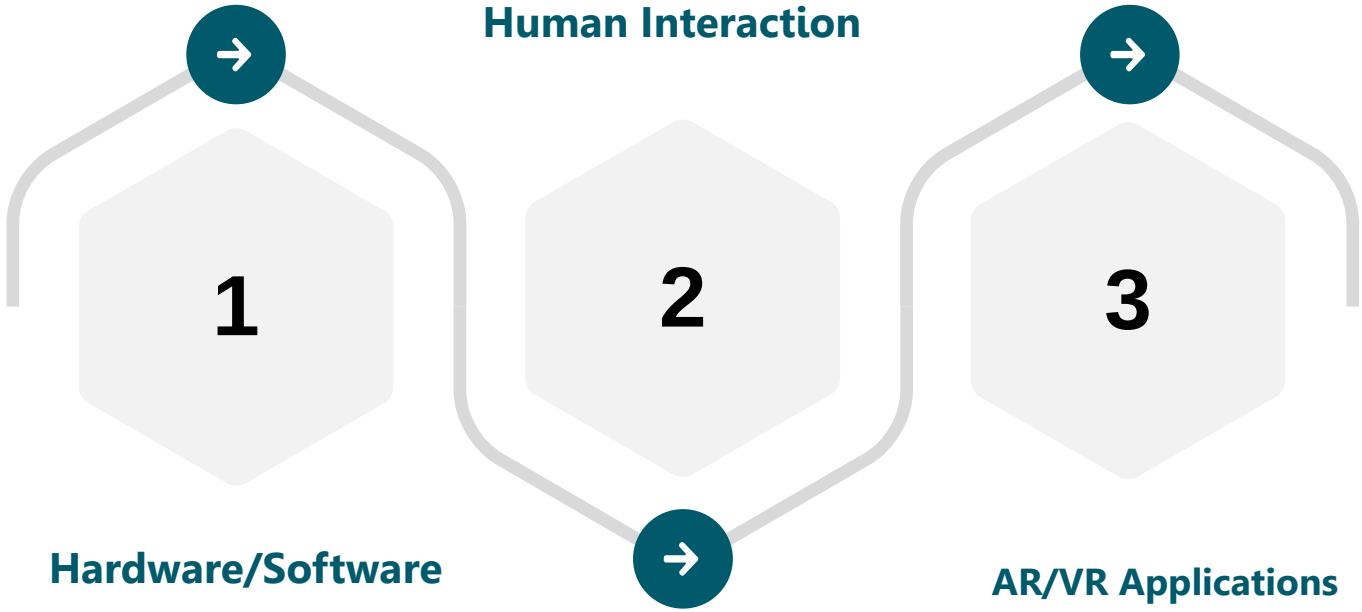
The Metaverse is now the sum of our digitization and the mainstream creation of digital twins of everything in our cities and lives.



Source: https://dinisguarda.medium.com/decomposing-the-metaverse-cbcd43ec5064

ER Applications

Presentation Structure



ER Applications

Hardware

1

Hardware

- 3D immersive
- Virtual Environment
- Real World / **Safety**

Oculus Quest 1

Oculus Quest 2

VIVE Flow

Oculus Rift S

Oculus Rift 1

VIVE Pro

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ER Applications

Hardware

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Human Interaction

2

Human Interaction

Controller

- Hand Presence
- Manipulation
- Low mental load
- Communicative gestures
- Traditional inputs
- Lightweight

Real Hands

ER Applications

Human Interaction




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Human Interaction

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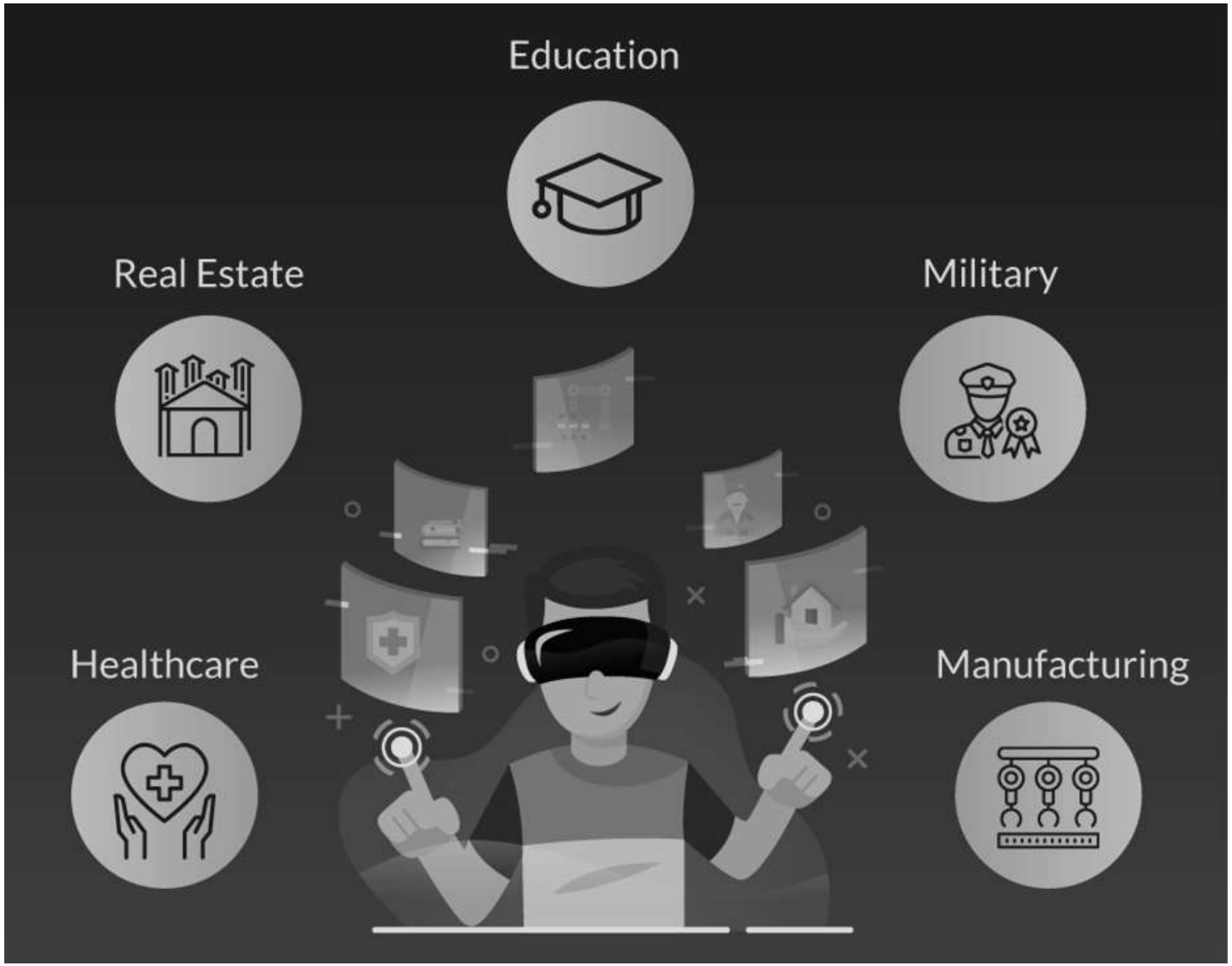
Applications

3

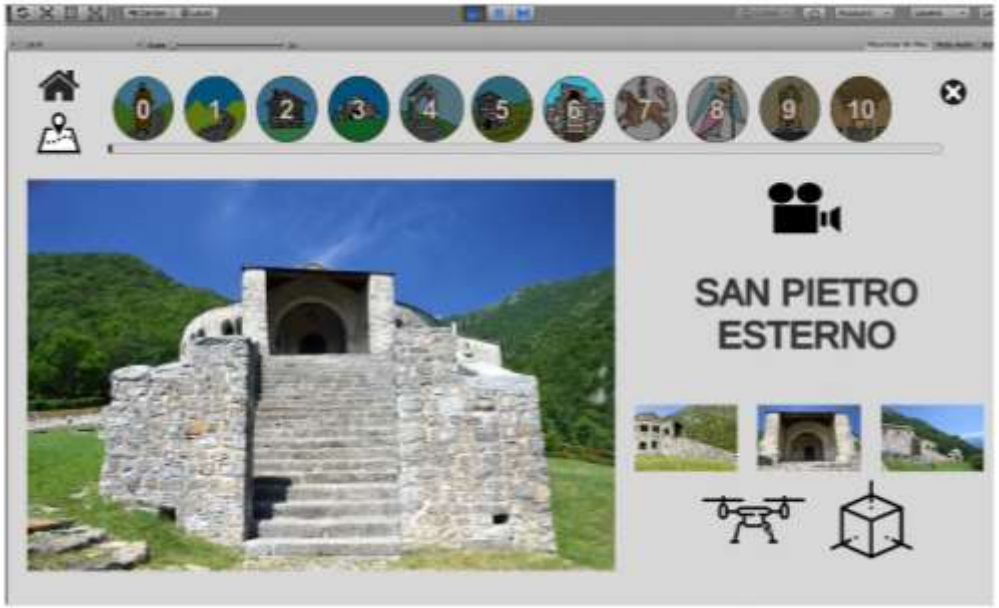
Applications



ER Applications

Real State and Cultural Heritage

For example, real estate agents can leverage the power of VR for offering immersive virtual tours of properties to buyers.



San Pietro al Monte Abbey, an inclusive Virtual Tour

Fig. 1. Example of screenshot of the application when the visitors arrive at the 7th stage of the tour

ER Applications

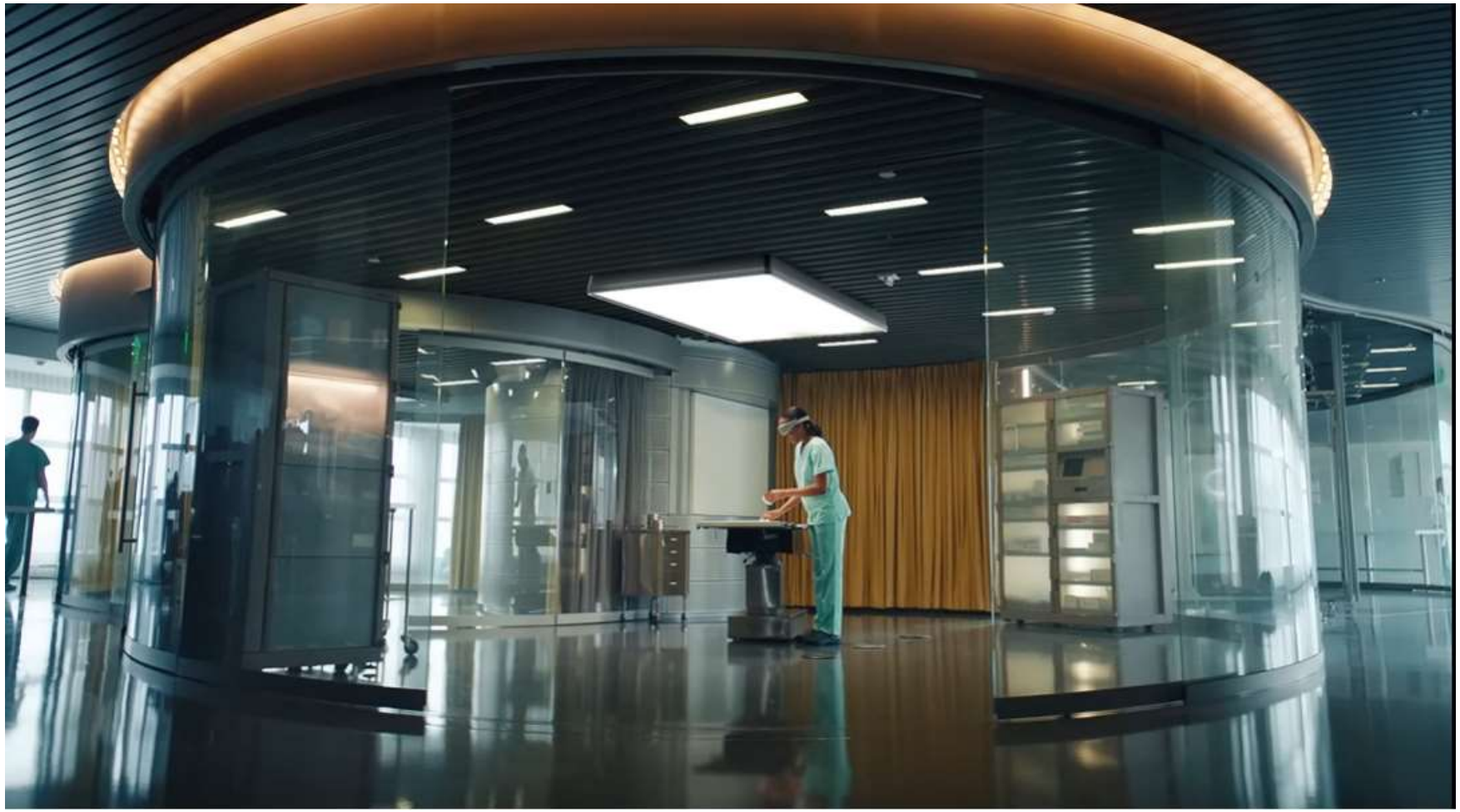
Real State and Cultural Heritage

Polyptych in Saint George's church, an inclusive Virtual Tour

ER Applications

Healthcare

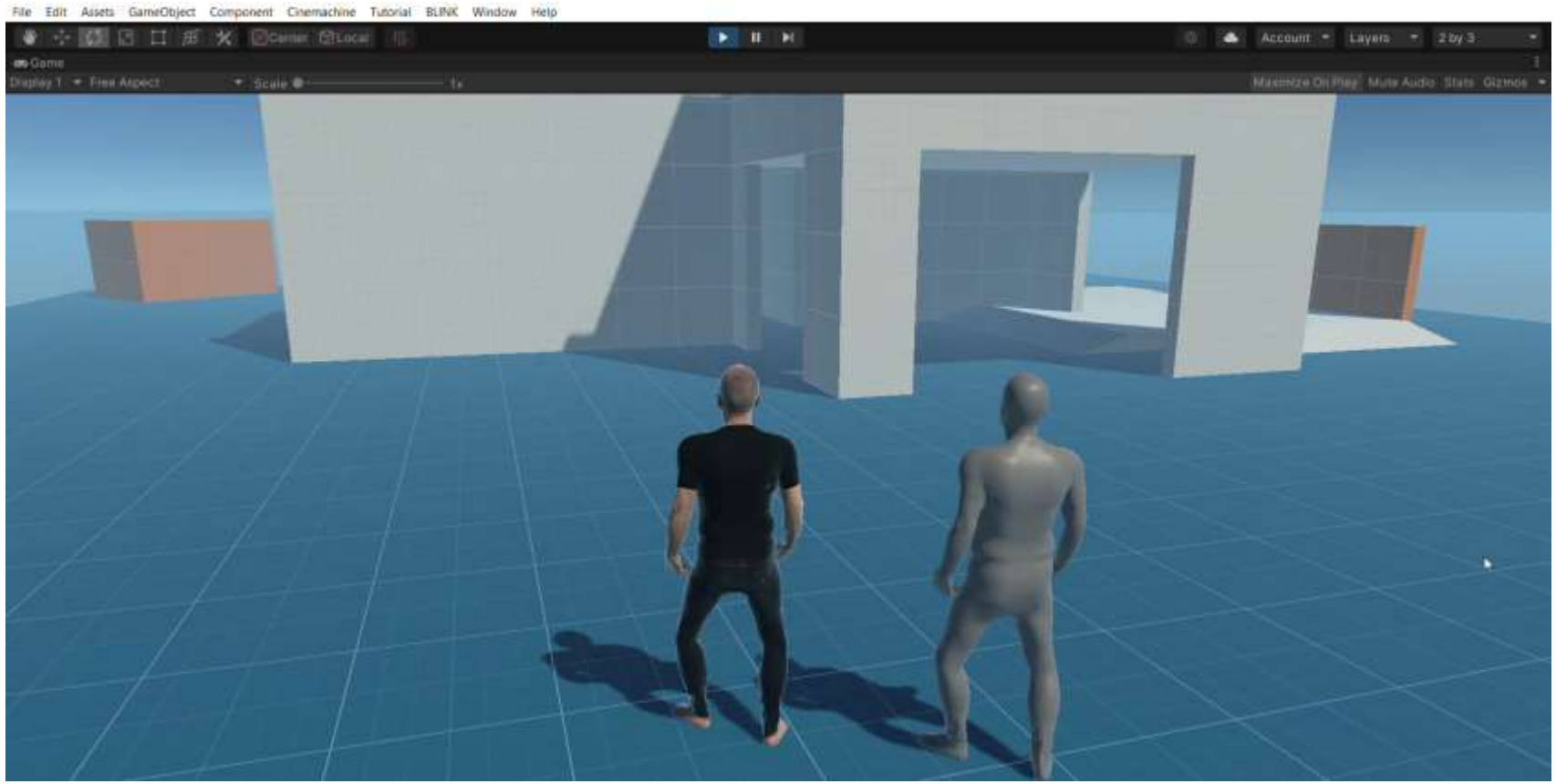
- Surgeon's training
- Dentist’s training
- Nurse's training
- Caregiver’s training



ER Applications

Healthcare

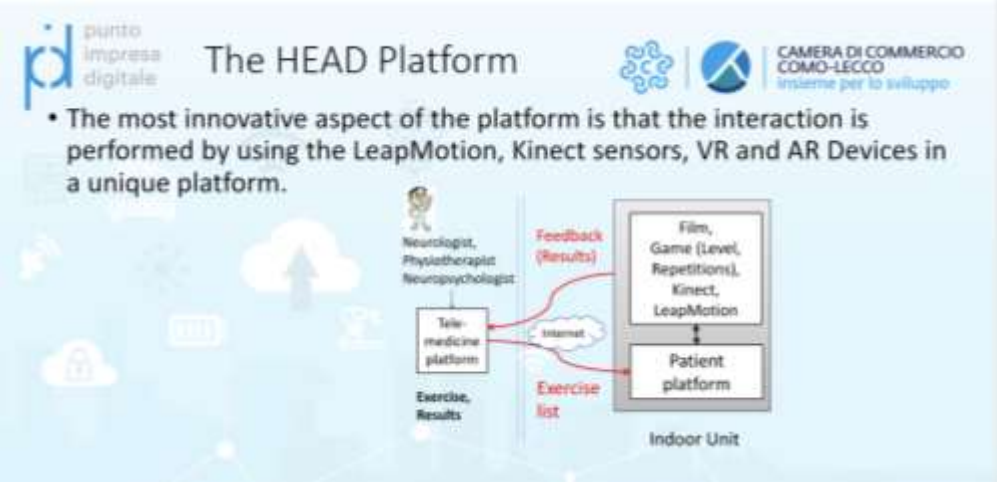
Dr. Luigi Piccinini Avatar, Color and Textures

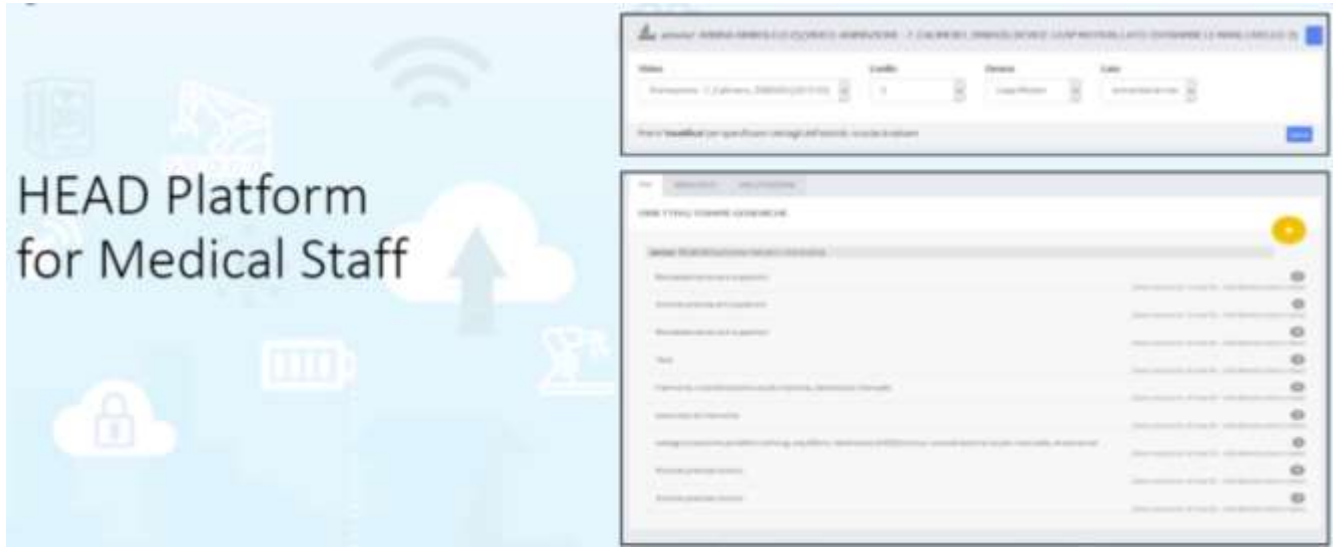


Further Improvements

ER Applications

Healthcare





[HEAD project (Human Empowerement Aging And Disability)]

Titolo: Cancella e vai – Leap Motion –

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Titolo: Cancella e vai – Kinect –

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Titolo: Svela e vai – Leap Motion –

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Titolo: Svela e vai – Kinect –

Titolo: Nuota e vai – Leap Motion –

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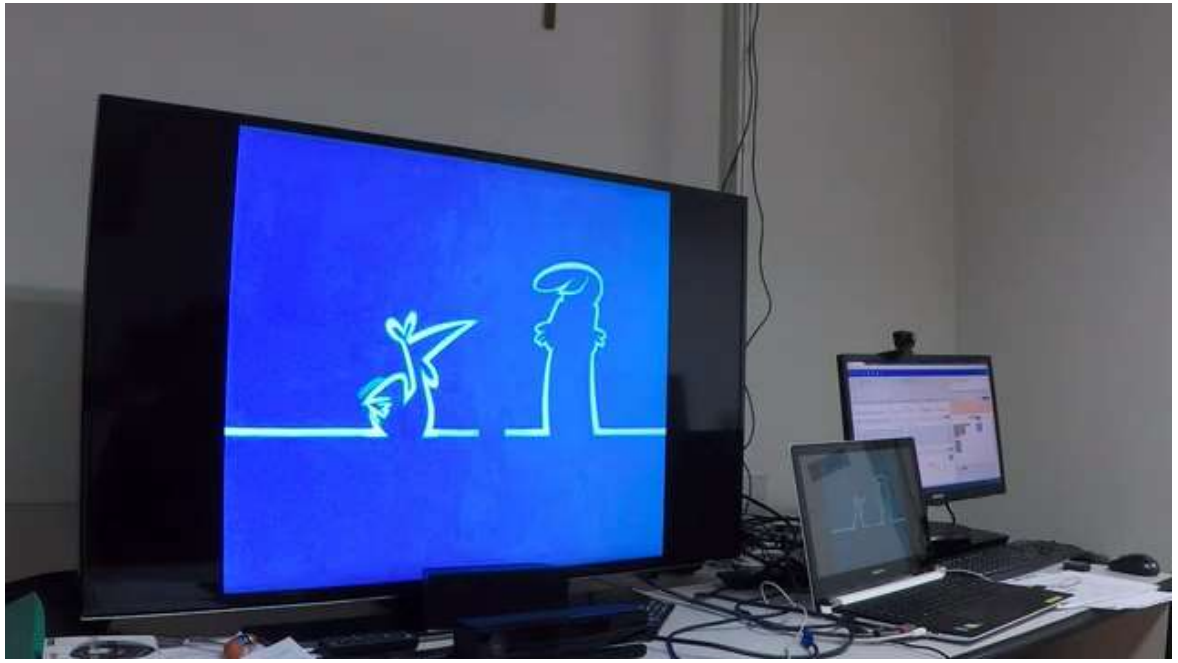
Titolo: Sali e vai – Kinect –

Titolo: Goal e vai – Kinect –

Titolo: Prendi e sposta – Leap Motion –



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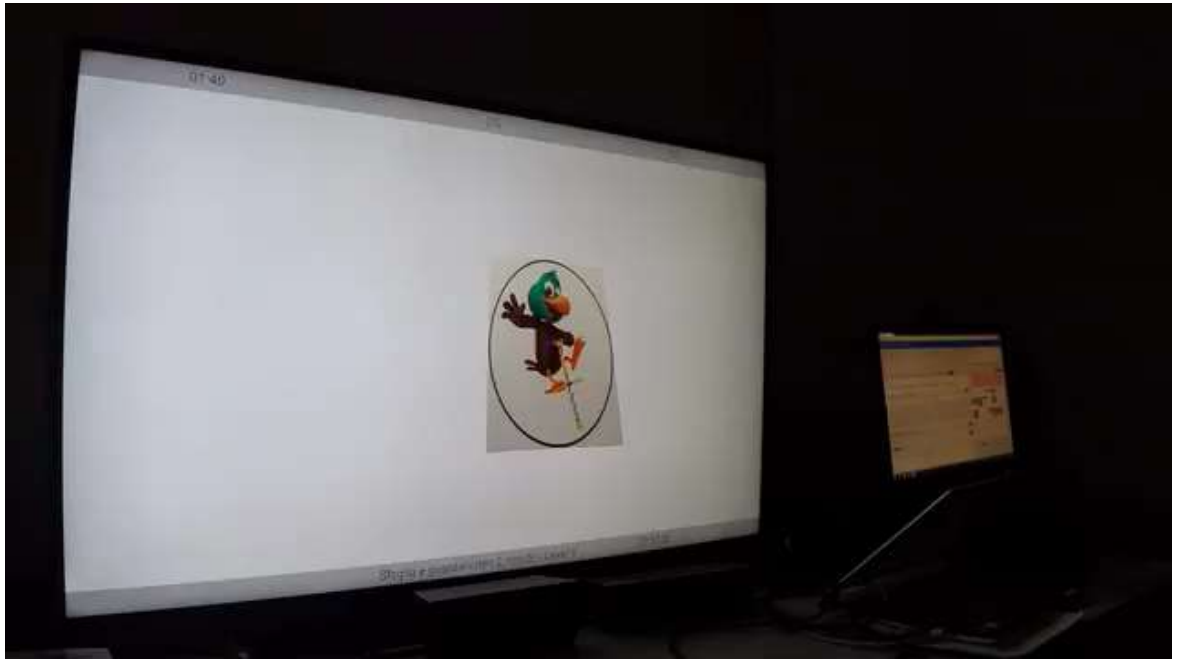
Titolo: Sfoglia e guarda – Leap Motion –



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Titolo: Pinza e prendi – Leap Motion –

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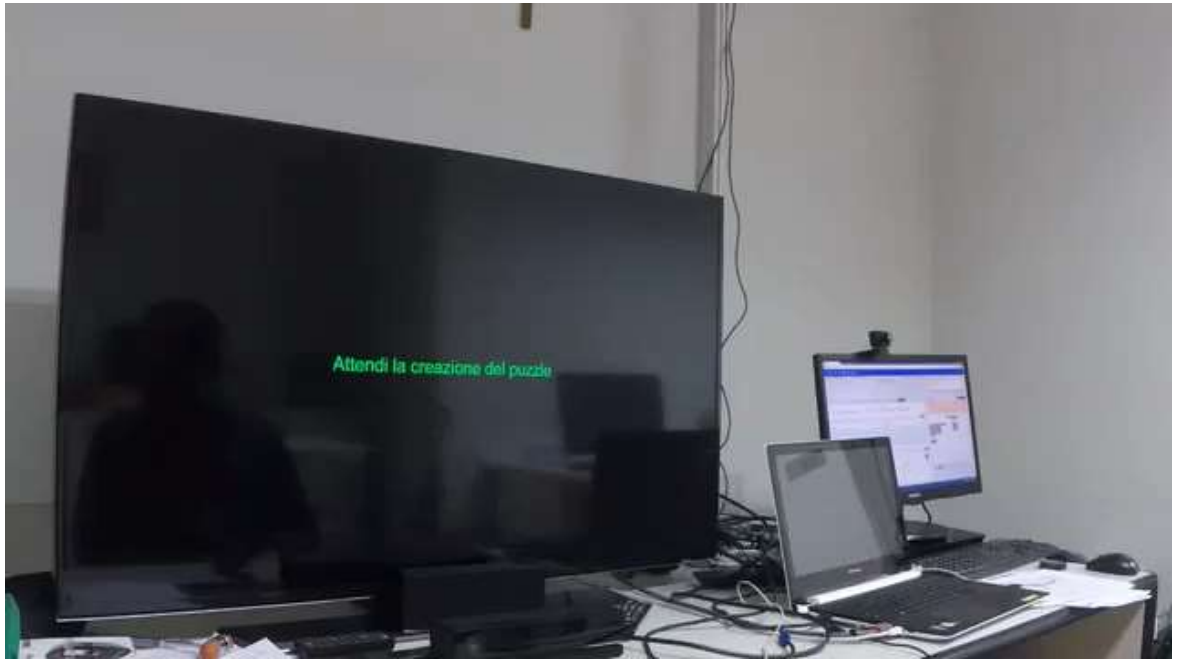
Titolo: Puzzle – Leap Motion –



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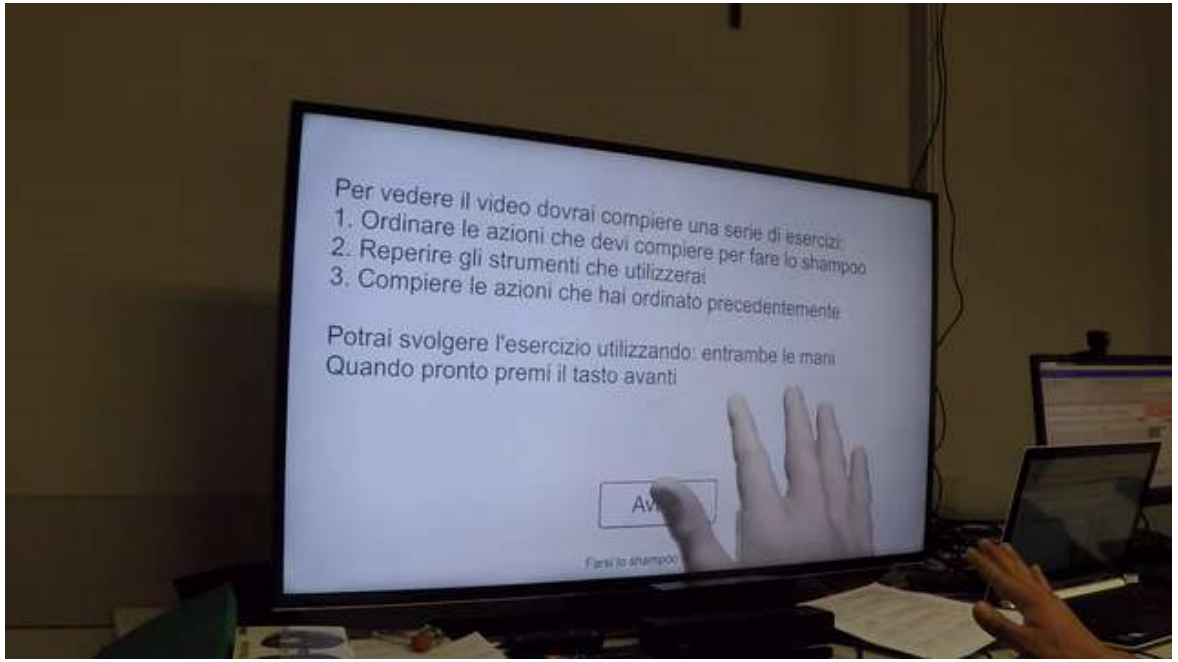
Titolo: Farsi lo shampoo – Leap Motion –



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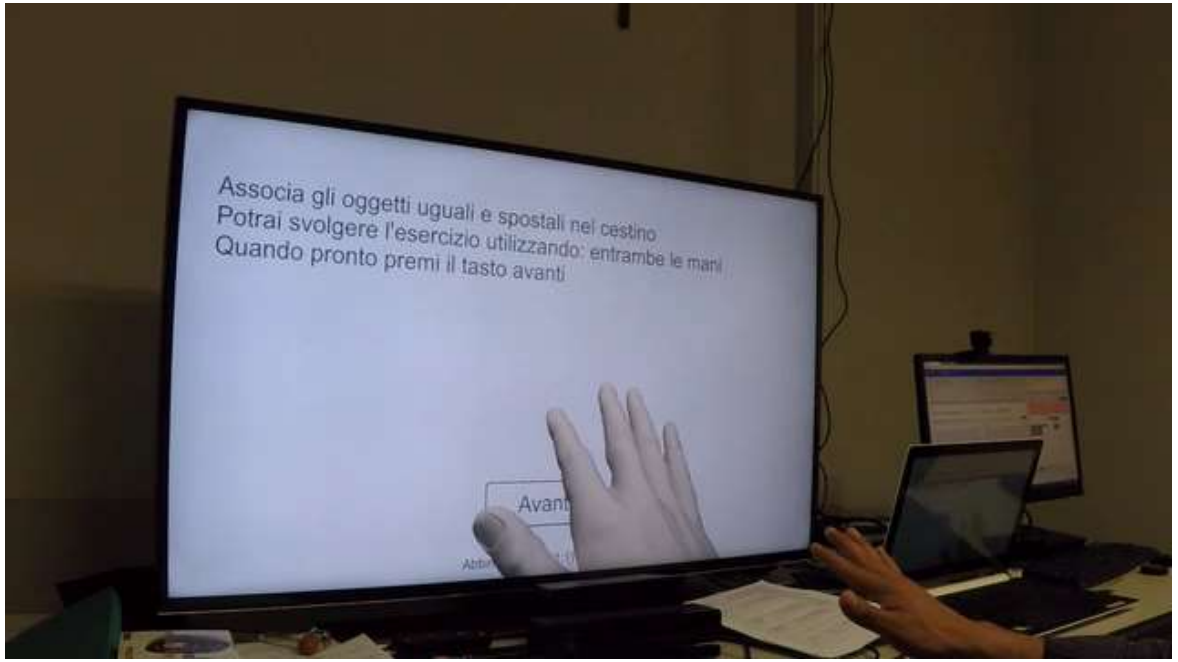
Titolo: Abbina simbolo 1:1 – Leap Motion –



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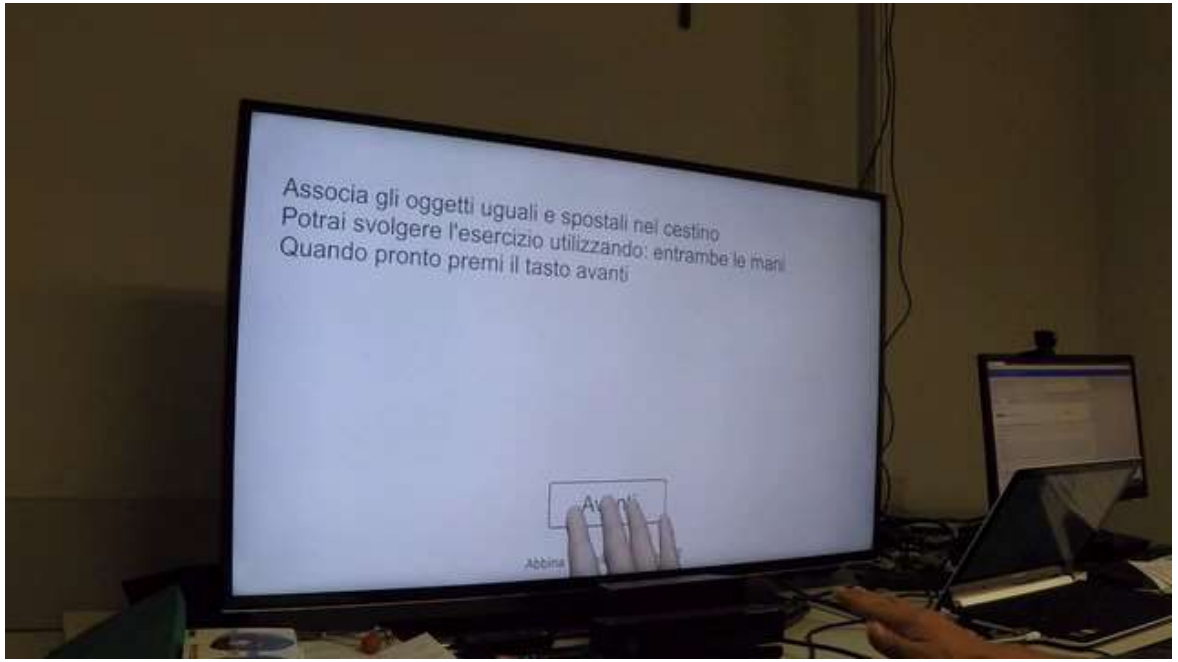
Titolo: Abbina simbolo 1:2 – Leap Motion –



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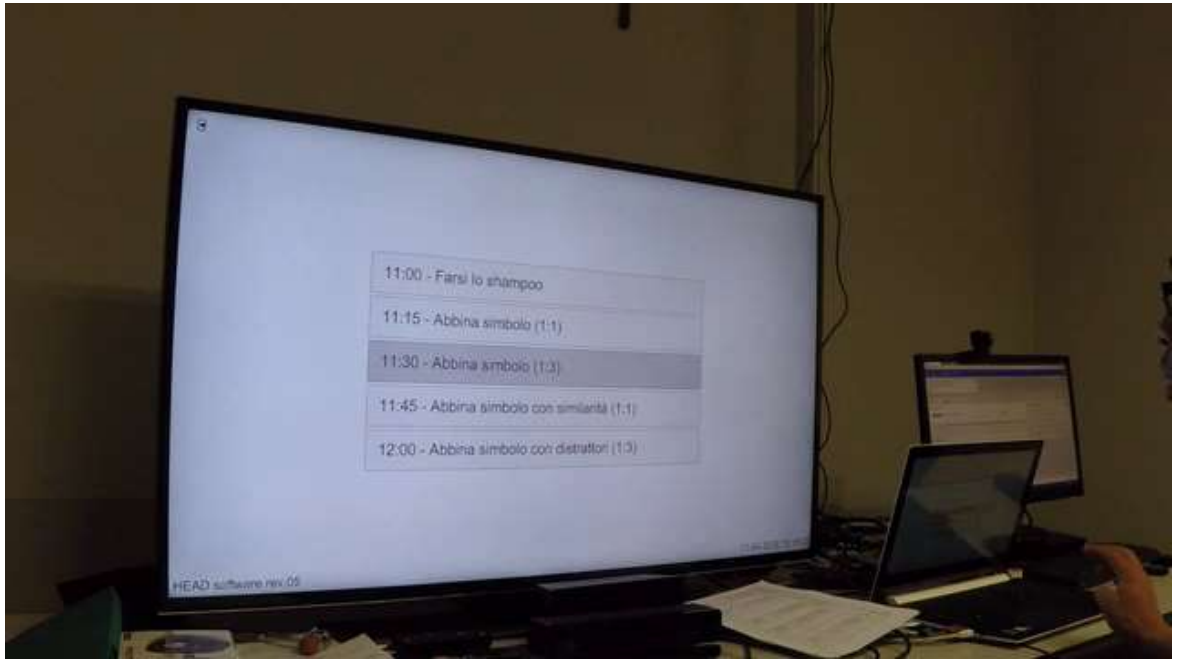
Titolo: Abbina simbolo 1:3 – Leap Motion –



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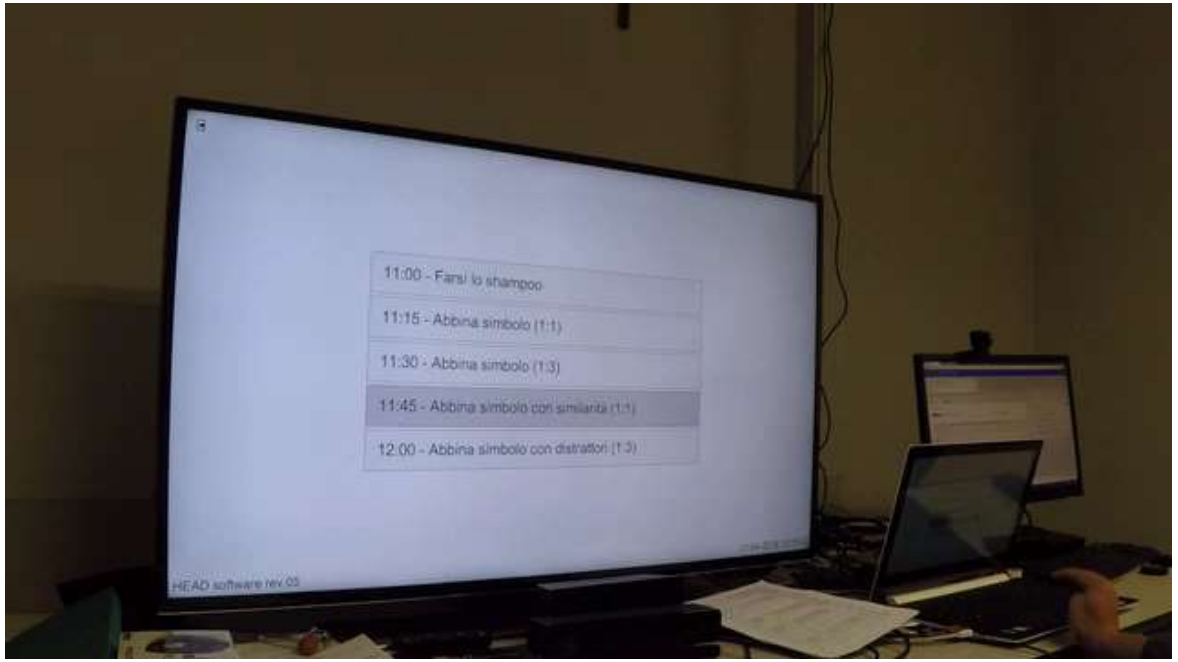
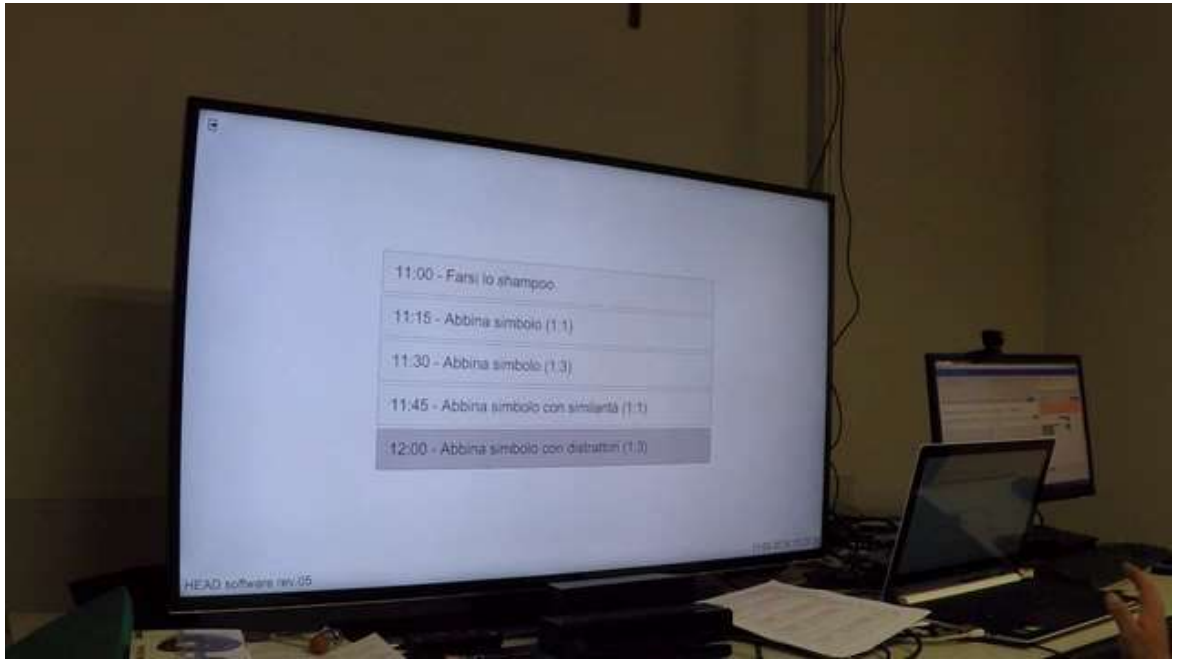
Titolo: Abbina simbolo con similarità (1:1) – Leap Motion –



Titolo: Abbina simbolo con distrattori (1:3) – Leap Motion –



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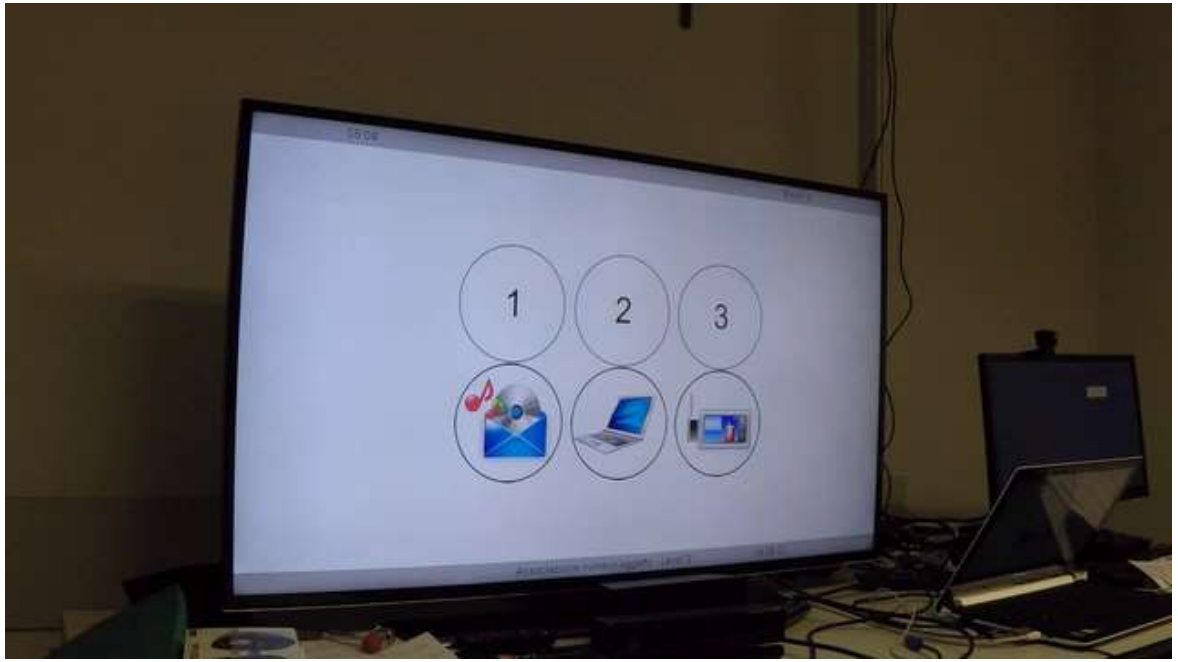
Titolo: Associazione numero-oggetto – Leap Motion –



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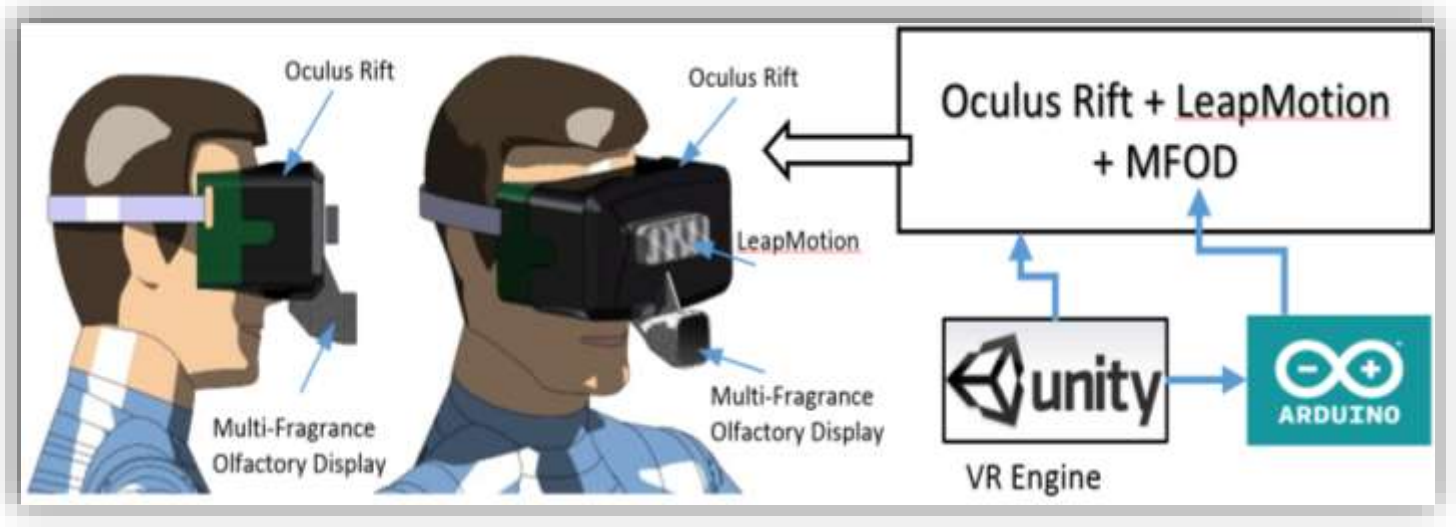
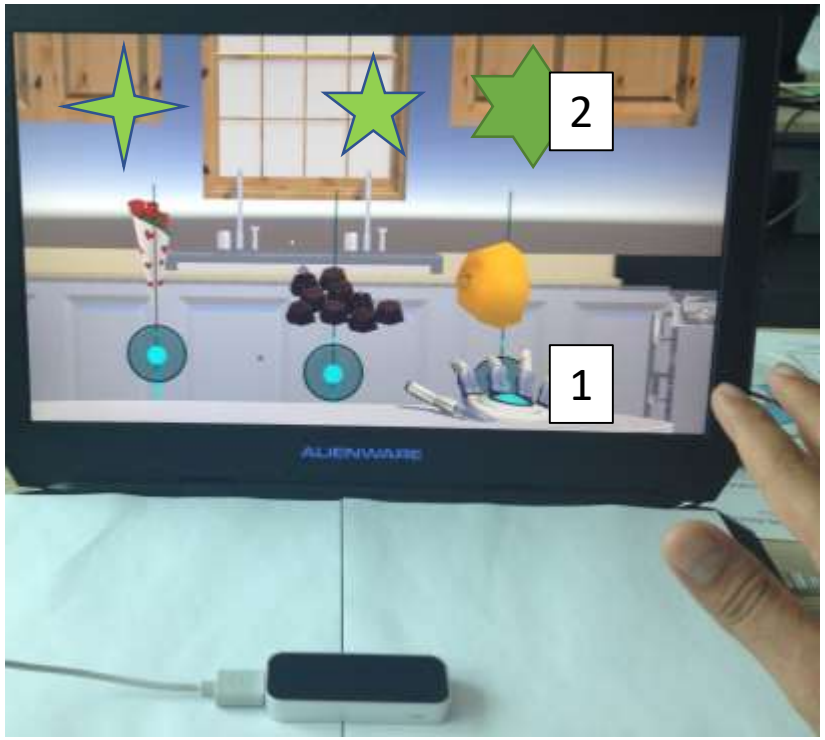
A3-Rehab in Olfactory-VR

- **Mini Olfactory Display (MOD) integrated with the Oculus Rift Head Mounted Display**
- Virtual objects are displayed on the screen, and the user can interact with them through hand gestures. The interaction can trigger the delivery of odours associated with the objects.



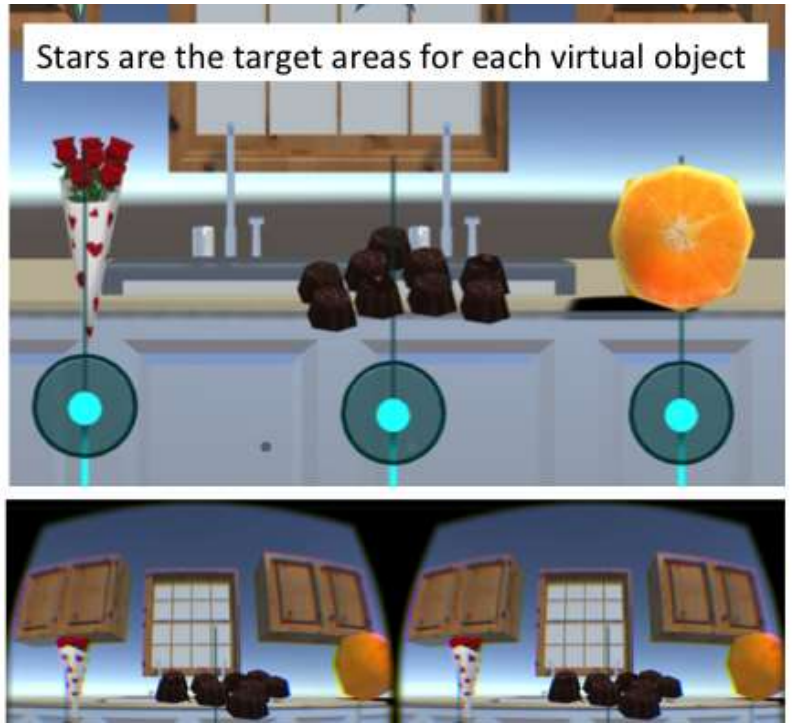
A3-Rehab in Olfactory-VR



Starting to grab the object (1)

Moving the object (From 1 up to 2)

A3-Rehab in Olfactory-VR



Training Factory 4.0

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ER Applications

Training – Special Education, Improving Manual Skills

ASPOC Students and Polimi Students.

Virtual Reality to Improve Cognitive and Manual Skills….while 3D Printing!! ☺

ER Applications

Training – Special Education, Improving Manual Skills

ASPOC Students and Polimi Students.

Japanese Cuisine at Politecnico di Milano Polo Territoriale di Lecco

ER Applications

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ER Applications

Training – Special Education, Improving Manual Skills

ASPOC Students
and
Polimi Students.

Cooking Mexican Food and Improving Cognitive and Manual Skills ☺ ☺

Google Earth in VR

Fig. 2. Google Earth in Virtual Reality

Fig. 3. ASPOC students while using Google Earth VR supported by Polimi Volunteer Students

System Usability Scale (3 of 10 questions)

1.- I think that I would like to use this system frequently

2.- I found the system unnecessarily complex

3.- I thought the system was easy to use

Cybersickness (3 of 10 questions)

1.- General Discomfort

2.- Fatigue

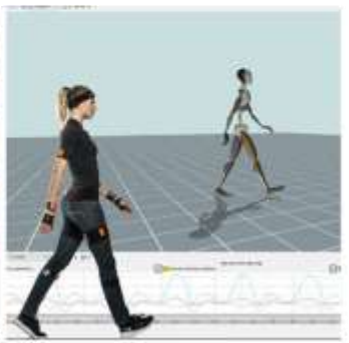
3.- Eyestrain

Aspoc Students @ WEMSY LAB - WIRELESS EMBEDDED SYSTEMS

Aspoc Students @ CONCRETE MATERIALS AND STRUCTURES LAB

Aspoc Students @ Human Vibration Laboratory

Aspoc Students @ Engineering for Sport. Human Performance Lab.



Aspoc Students @
CARPENTRY AND
PROTOTYPING LABS,
POLIMI LECCO CAMPUS

Aspoc Students @ COSMOS LAB - COMB ASSISTED MOLECULAR
SPECTROSCOPY LABORATORY

Extended Reality

Industrial Applications

ER Applications

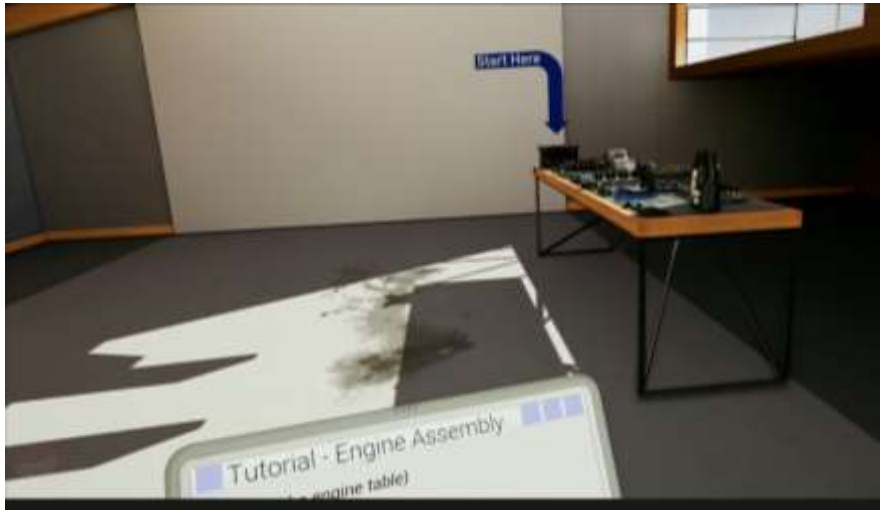
Human Interaction

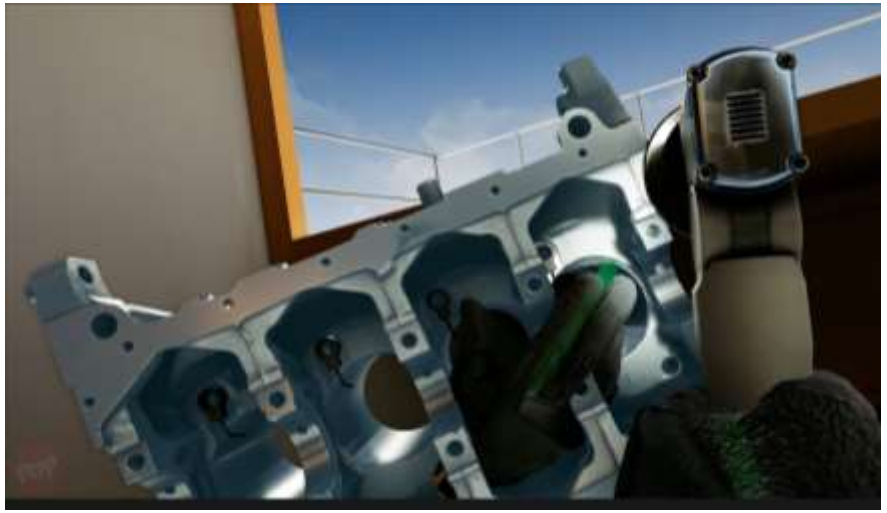
- Pinch
- Grasp
- Virtual Buttons
- Virtual Sliders
- Virtual Objects

Realtà Virtuale Covarrubias

Human Interaction

- Teletransportation
- Menu Interaction
- Two hands interaction





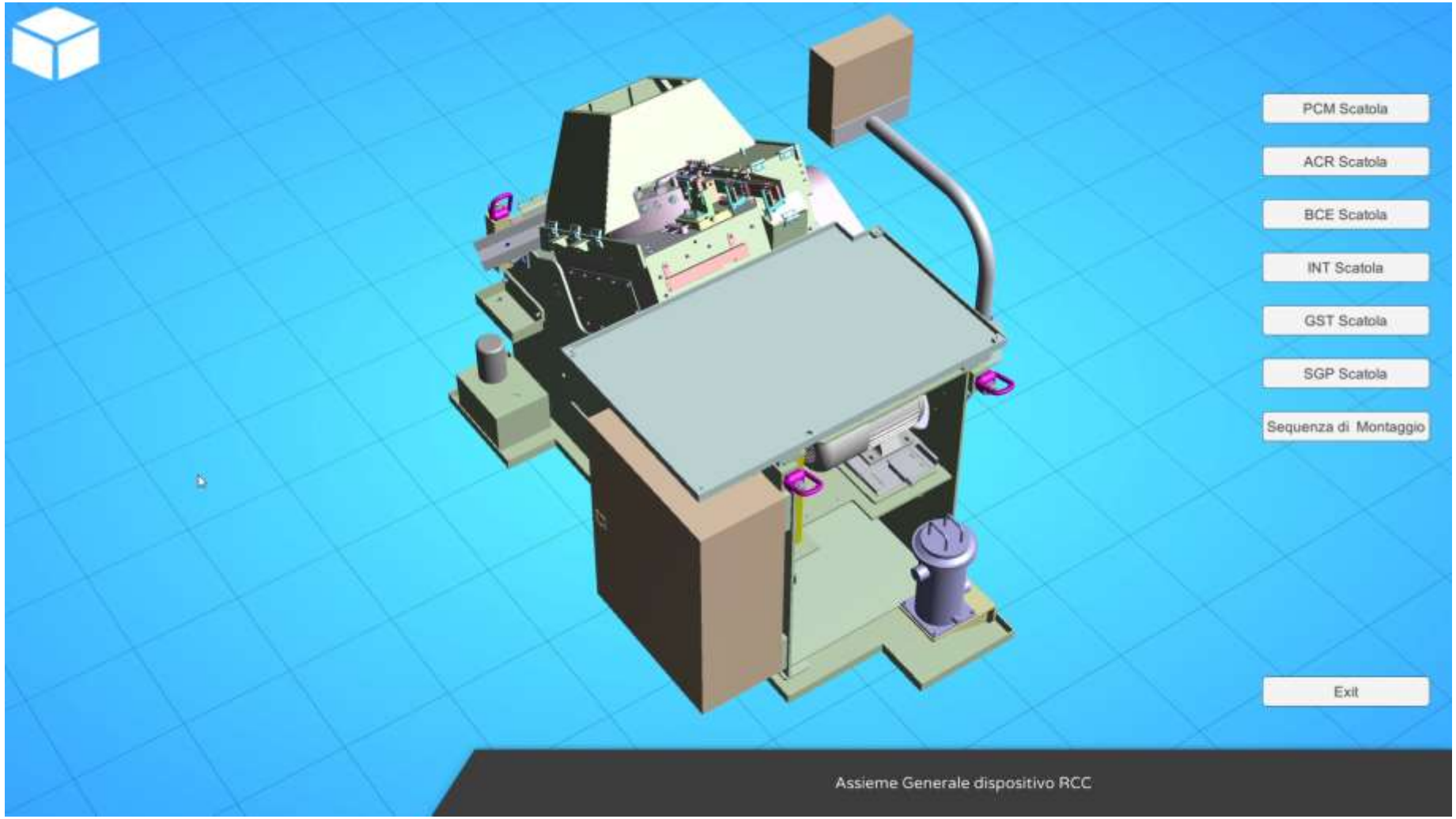
ER Applications

Education

Virtual reality is a promising tool for transforming traditional teaching approaches by emphasizing learning concepts through visuals. The top metaverse applications in the education sector can help in creating engaging and immersive learning environments for students in different learning institutions.

ER Applications

Training – Assembly Instructions, Technical Drawings



ER Applications

Manufacturing

- Virtual Tour
- Assembly process
- Marketing
- Distance maintenance

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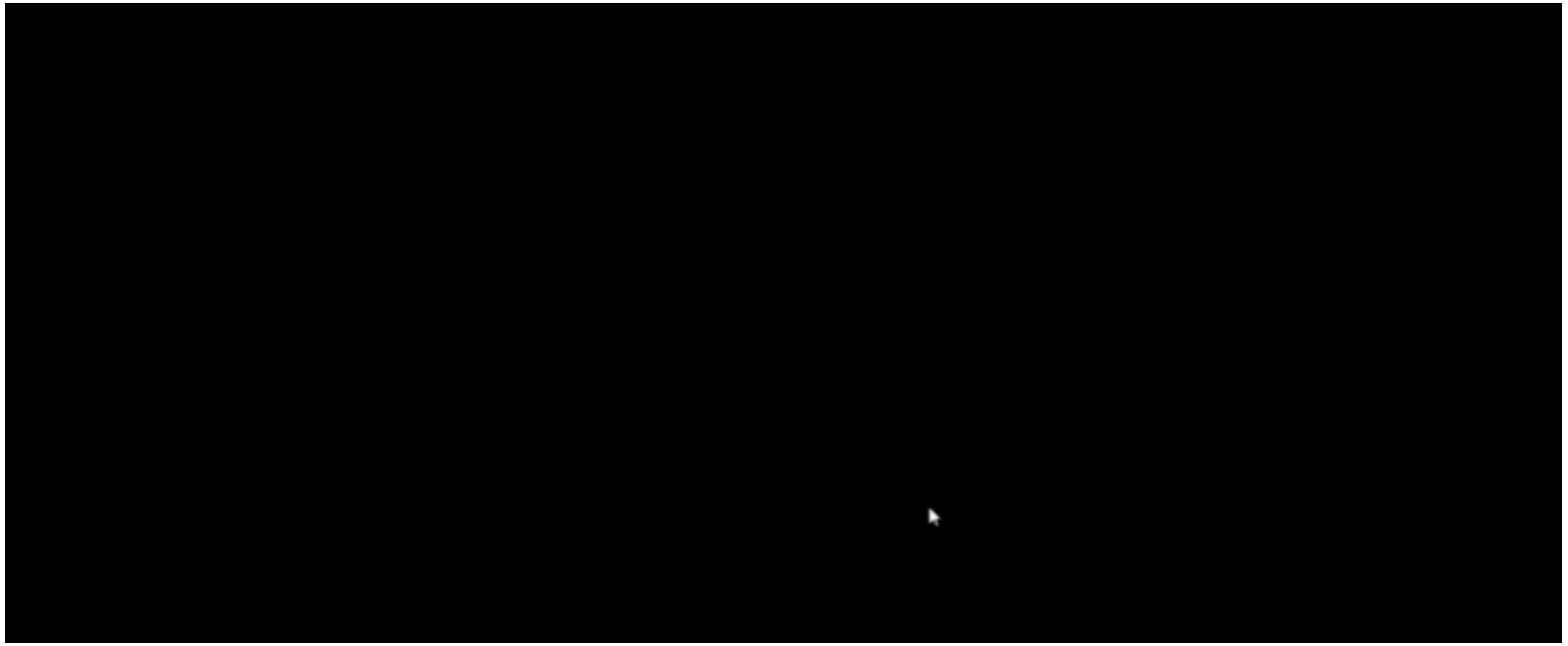
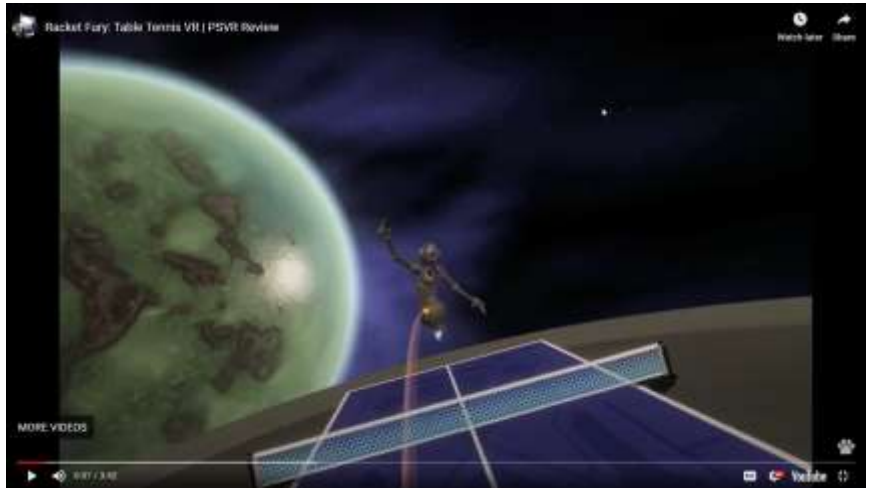
CNC Milling device Training APP

ER Applications

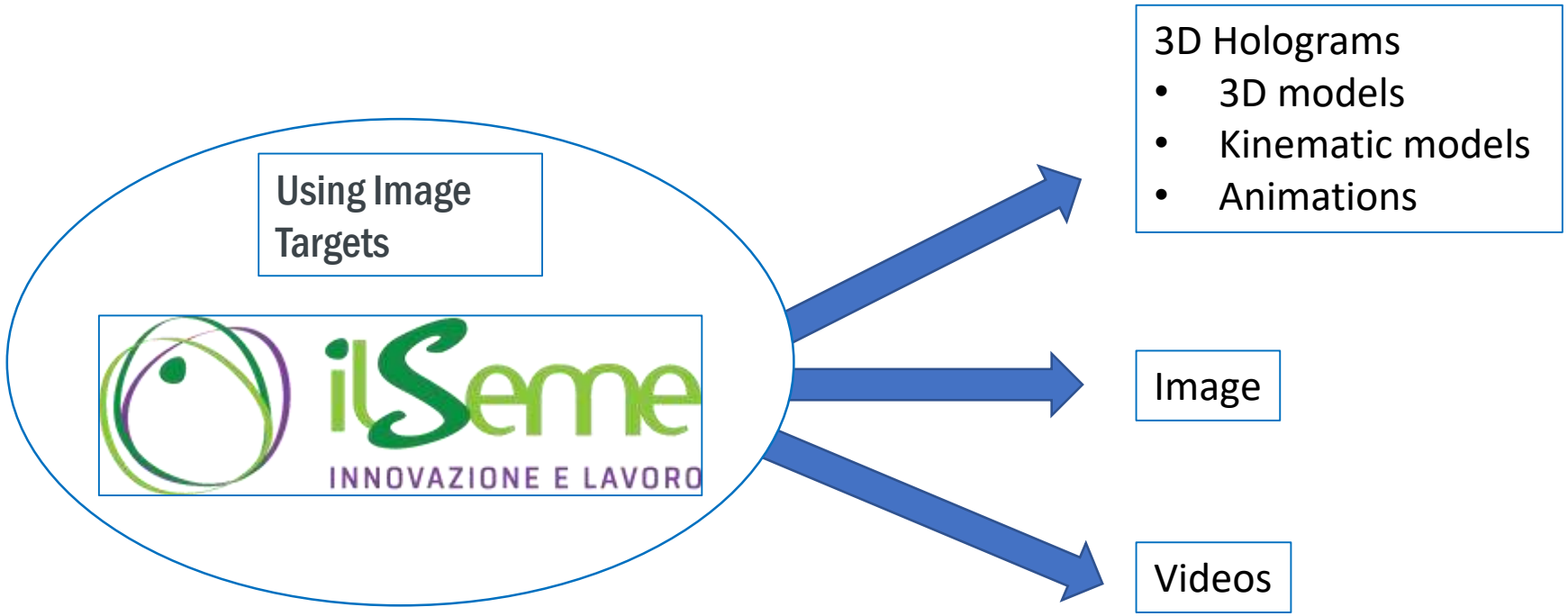
Sport





- Ping Pong
- Tennis
- Climbing
- Soccer
- …….

Augmented Reality to support training (Cleaning services) for Il Seme Association.



ER Applications

Real World Results

Visita multisensoriale al museo Palazzo delle Paure grazie al Politecnico di Milano – Lecco Campus

https://thehapticeye.art/

Far percepire un'opera d'arte in maniera inclusiva, mettendo a frutto le potenzialità che la ricerca e la tecnologia mette oggi a disposizione. È questa la novità alla quale hanno lavorato in questi mesi l'Associazione culturale Madonna del Rosario, promotrice dell'evento insieme al Comune di Lecco, e il Politecnico di Milano – Polo Territoriale di Lecco, attraverso il Laboratorio di prototipazione virtuale e realtà aumentata del Dipartimento di Ingegneria Meccanica.

Thank you
for your attention

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