Virtual and Augmented Reality in the service of Cultural Heritage

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empowering the factories of the future

Introduction

What is (and isn't) Virtual and Augmented Reality

Virtual Reality:

• Οπτικοακουστικό τρισδιάστατο περιβάλλον κατασκευασμένο **εξολοκλήρου** σε υπολογιστή, όπου ο χρήστης έχει «φυσική διάδραση» με εικονικά αντικείμενα

• Ο χρήστης αποκόπτεται από το φυσικό περιβάλλον και υπάρχει αναντιστοιχία των λοιπόν αισθήσεών του (γεύση, όσφρηση, αφή) από αυτό που βλέπει και ακούει στον εικονικό κόσμο. Περιορισμένη κίνηση

Επαυξημένη Πραγματικότητα:

• Ο χρήστης μέσω υπολογιστικής συσκευής λαμβάνει για το περιβάλλον γύρω του επιπρόσθετη πληροφορία που εντοπίζεται στο φυσικό χώρο

• Η διάδραση με την πληροφορία γίνεται μέσω της συσκευής, γιατί δεν αποτελεί μέρος του φυσικού κόσμου

VR/AR Application types for Cultural Heritage

Virtual Reality:
- Virtual Walkthroughs
- Virtual Museums
- Simulations
- Creative Applications

The Purpose:
- To promote a country, an area, a museum or exhibition of high cultural heritage importance to prospective visitors **BEFORE** they visit **IN ORDER** to visit.
- To allow persons unable to physically visit a cultural heritage exhibits (e.g. persons with disabilities) to experience said exhibits in virtual form

VR/AR Application types for Cultural Heritage

Augmented Reality:

- Localization of Information / Virtual Guide
- Augmenting sites / exhibits
- On-site Simulations (e.g. Reconstruction of ancient building ruins to their original form)

The purpose:

- To increase visitor count
- To add value to the experience

Virtual Reality Display Technologies

Stereoscopic Head-Mounted VR Displays

This technology allows the development of first-person immersive CH applications based on actual locations or artifacts (e.g Virtual Walkthroughs, Virtual museums etc.) but also imaginary settings like a 3D representation of a work of art.

Their implementations range from simple mobile phones attached to specialized mounts with stereoscopic lenses to high-end VR headsets like Oculus Rift and HTC Vive that require powerful PCs to run

The environment can either be 360° image/video of actual locations or 3D synthetic recreation of them

Augmented Reality Display Technologies

Mobile devices as windows to AR experiences

Through the camera of a mobile device and using its on-board sensors, users can experience overlayed 3D experiences and information regarding artifacts and locations of CH interest.

Their biggest advantage is the ubiquity and low cost, but this limits their capabilities.

3D Head-Mounted AR Displays

One of the most promising new technologies is the use of see-through Augmented Reality glasses like Microsoft Hololens and Magic Leap.

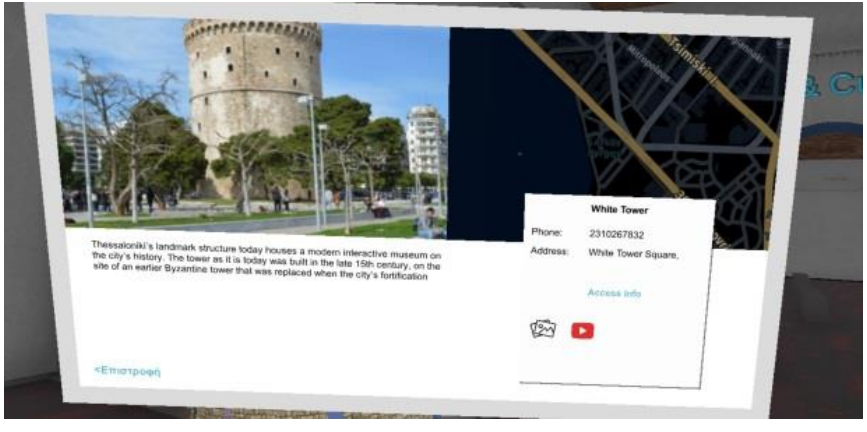
These devices allow the users to experience virtual objects integrated into their physical environment and interact with them in a natural manner. Still a bit expensive though.

CERTH/ITI VR/AR Apps in CH

Municipality of Thessaloniki Tourist Information Kiosk

We developed a VR Museum application using Oculus Rift that allows visitors to

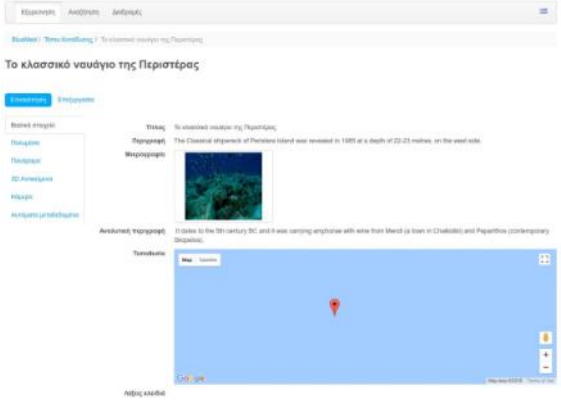
- Check out 3D reconstructions of Thessaloniki's most famous monuments
- Immerse in 360º images and videos of several locations of CH importance around the city
- View 3D scans of artifacts in some the city's museums



CERTH/ITI VR/AR Apps in CH

BlueMed

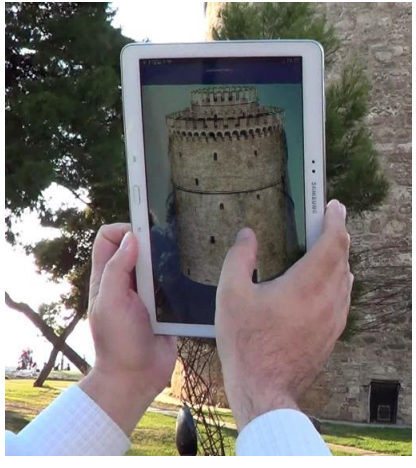
Sustainable tourism in coastal areas and islands of the Mediterranean for the valorisation of **underwater** natural and cultural **heritage.** VR visit application in underwater 3D-scanned and reconstructed locations (.e.g shipwrecks, sunken ruins)



Παραδείγματα Εκθεμάτων/Διαδραστικών Εφαρμογών ΙΠΤΗΛ

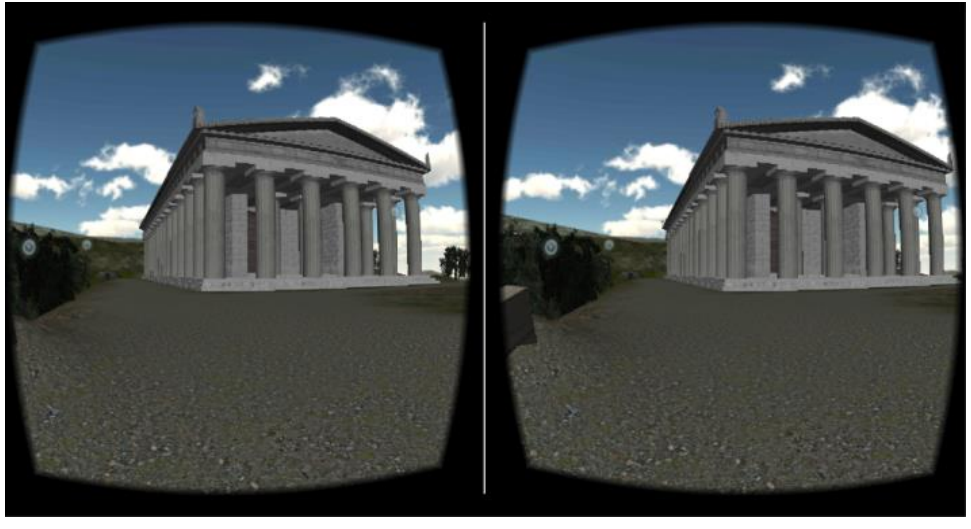
Mobile Search

An advanced search engine and AR presentation application for mobile devices to promote cultural heritage through the matching of keywords and images captured by the mobile device camera to an extended 3D model repository.



Appollo

Stereoscopic virtual walkthrough of the Temple of Apollo Epicurius in Peloponese on Android και iOS using Google Cardboard



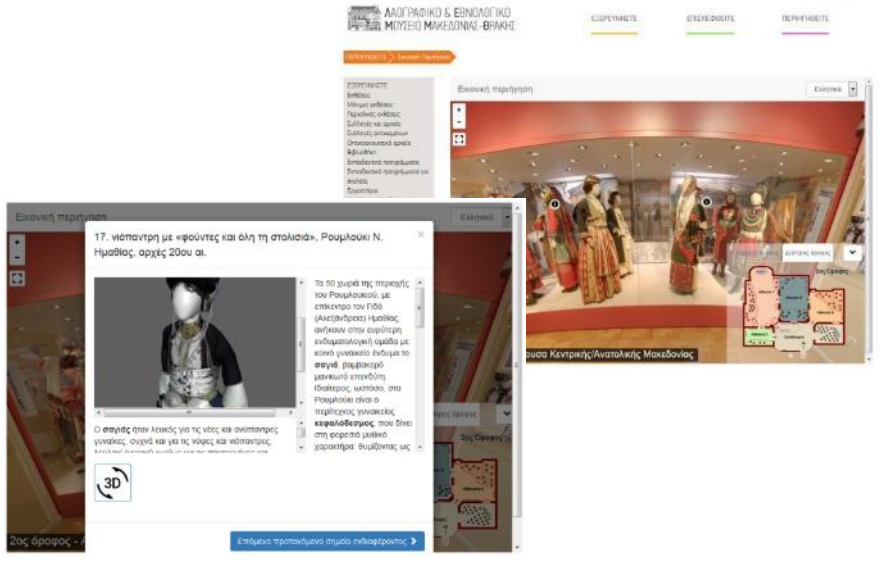
CERTH/ITI VR/AR Apps in CH

APEIRO (NOESIS – Ancient Greek Technology Exhibition)

3D Stereoscopic VR Simulation of tools and equipment used in ancient Greece through force-feedback natural interaction

Folkore Museum of Thessaloniki Virtual Walkthrough

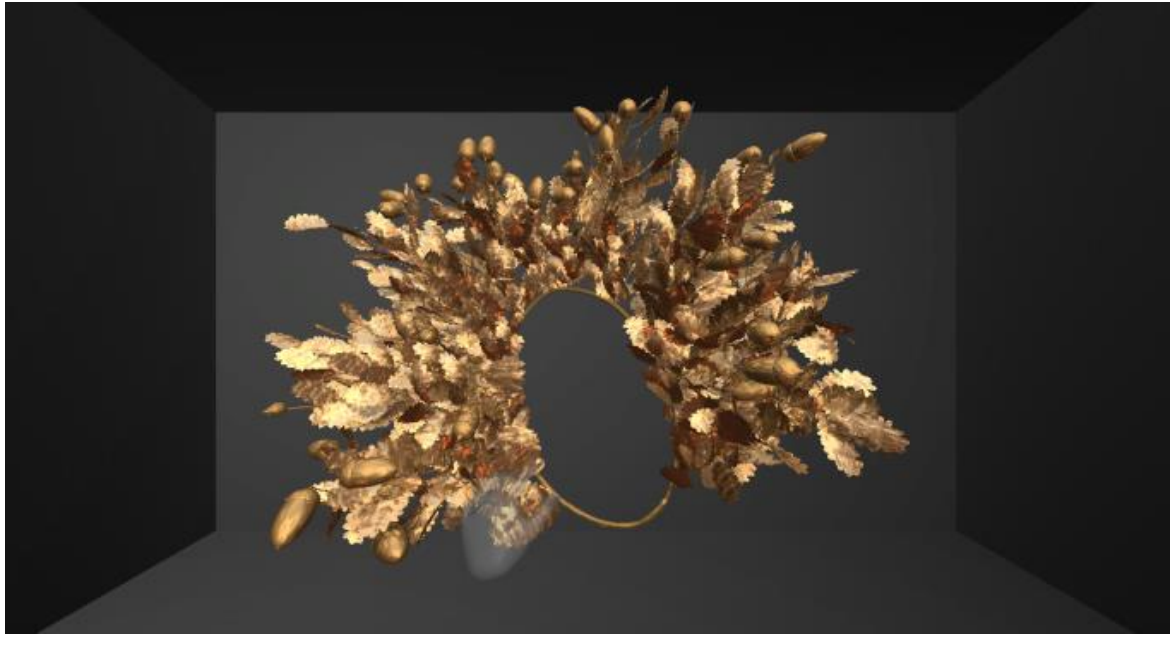
360° Virtual walkthrough of the premises of the museum and viewing of 3D modelled and animated artifacts of the museum



CERTH/ITI VR/AR Apps in CH

Virtual Showcase of the Wreath of Filippos of Vergina (Tellogleion Foundation of Arts Museum)

3D Reconstructed model of the wreath and VR application where the user can manipulate the model of the wreath using their hands through a depth camera set up



CERTH/ITI VR/AR Apps in CH

Russian Avant Garde
(State Museum of Modern Art)

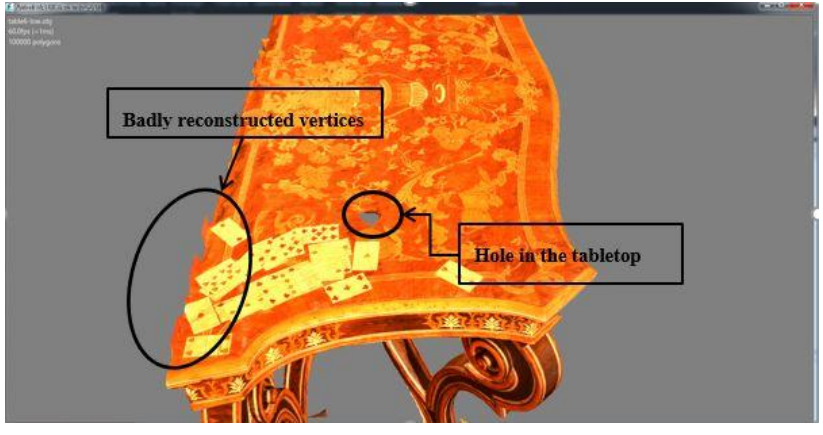
Virtual Exhibit using stereoscopic VR projection to demonstrate the artwork, artists and concepts behind the Russian avant garde and the Kostakis collection

CERTH/ITI VR/AR Apps in CH (Ongoing)

5G Mobile Network Architecture for diverse services, use cases, and applications in 5G and beyond. Deployment and experimental implementation of the architecture in Palazzo Madama in Torino as a testbed VR Museum combining live 360° video over 5G network and 3D artifacts and avatars

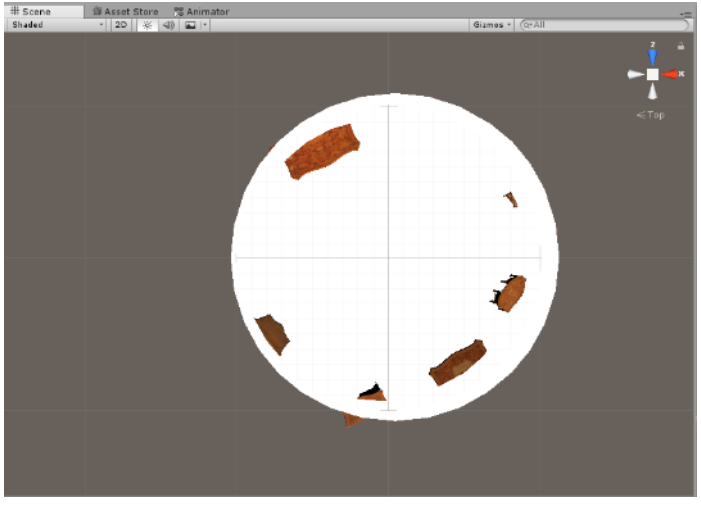
CERTH/ITI VR/AR Apps in CH (Ongoing)

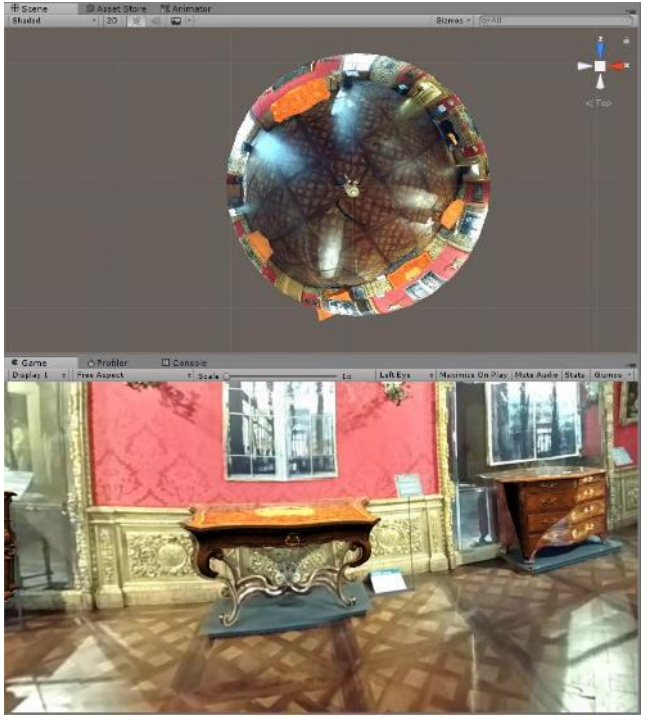
3D Reconstruction of artifacts



CERTH/ITI VR/AR Apps in CH (Ongoing)

Recreation of Palazzo Madama room using the recorded 360º video and 3D reconstructed artefacts.





CERTH/ITI VR/AR Apps in CH (Ongoing)

Realistic Avatar movement and interaction with objects and other users in the virtual environment

Movement

Inside room scale

Grabbing an object, interacting with another user

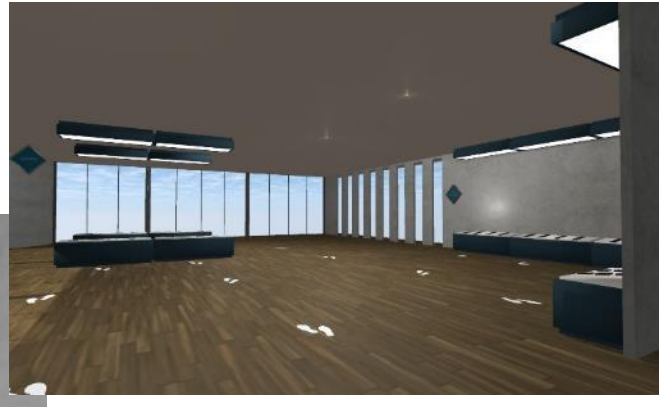
CERTH/ITI VR/AR Apps in CH

Scan4Reco

- Creation of a 3D **Virtual Museum**
- Integration of **3 Rooms**
- Integration of **6 cultural assets** and **87 material sample panels** (10 Bronze, 17 Silver, 60 Egg Tempera)

Room 1

HD Reconstructions room



Samples room

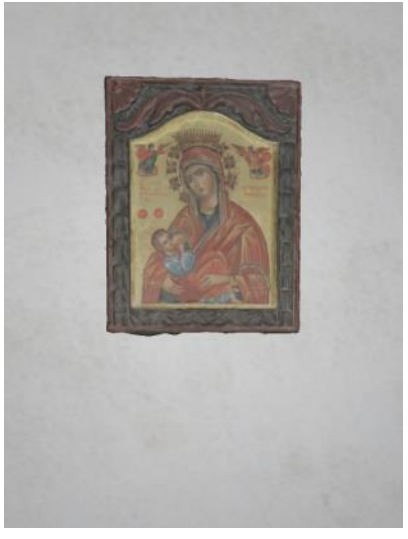
CERTH/ITI VR/AR Apps in CH

Scan4Reco

Room 1 artifacts

San Giorgio statue

Bronze panel with a female figure



Icon of Lactans

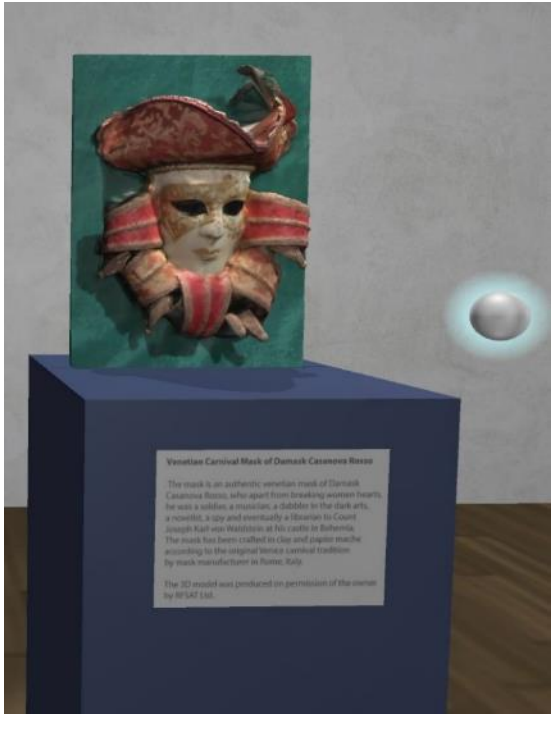
Icon of Hodegetria

CERTH/ITI VR/AR Apps in CH

Scan4Reco

HD Reconstruction artifacts

Venetian Carnival Mask
of Arlecchino



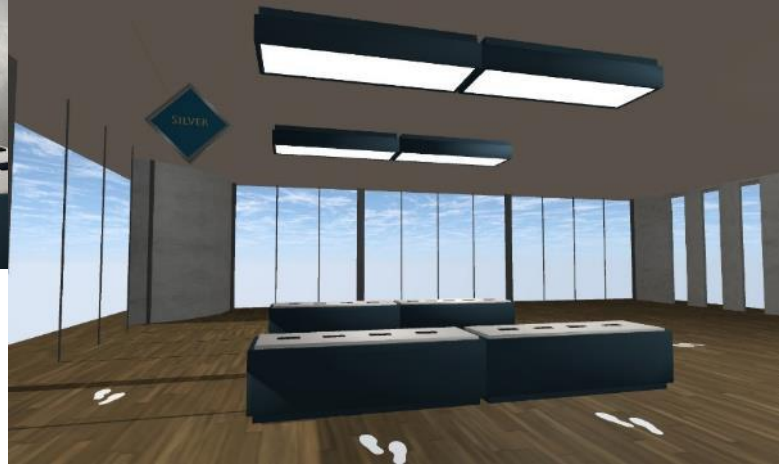
Venetian Carnival Mask
of Damask Casanova Rosso

CERTH/ITI VR/AR Apps in CH

Samples areas

Bronze samples area

Egg Tempera samples area



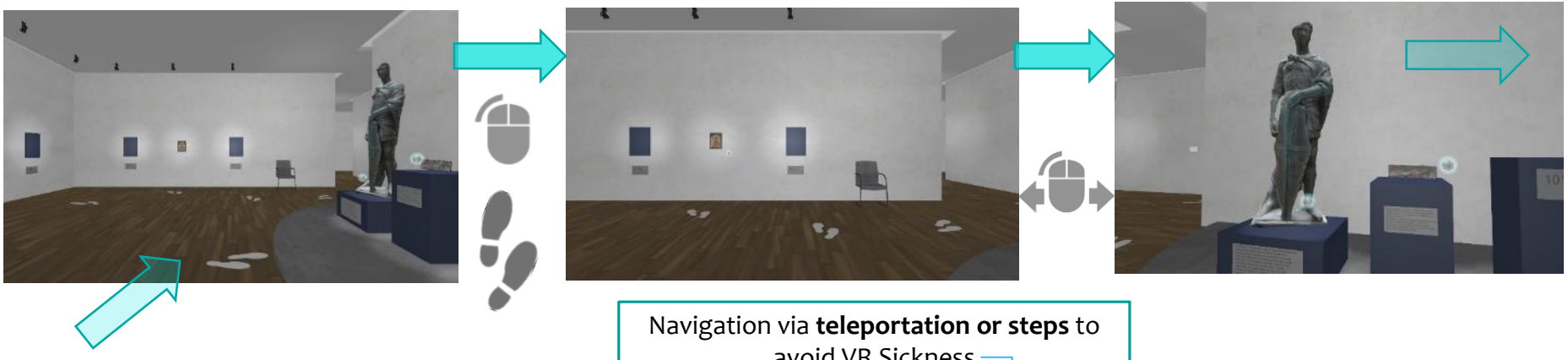
Silver samples area

Scan4Reco

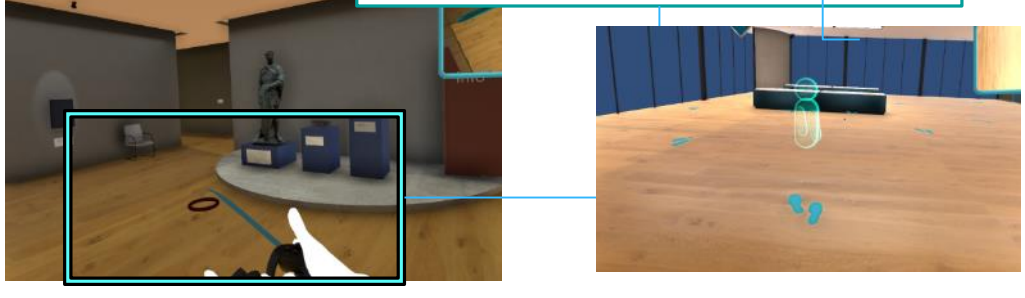
Navigation

Click on One of Visible Steps for transition

Click and Drag anywhere to look around



Navigation via **teleportation or steps** to avoid VR Sickness



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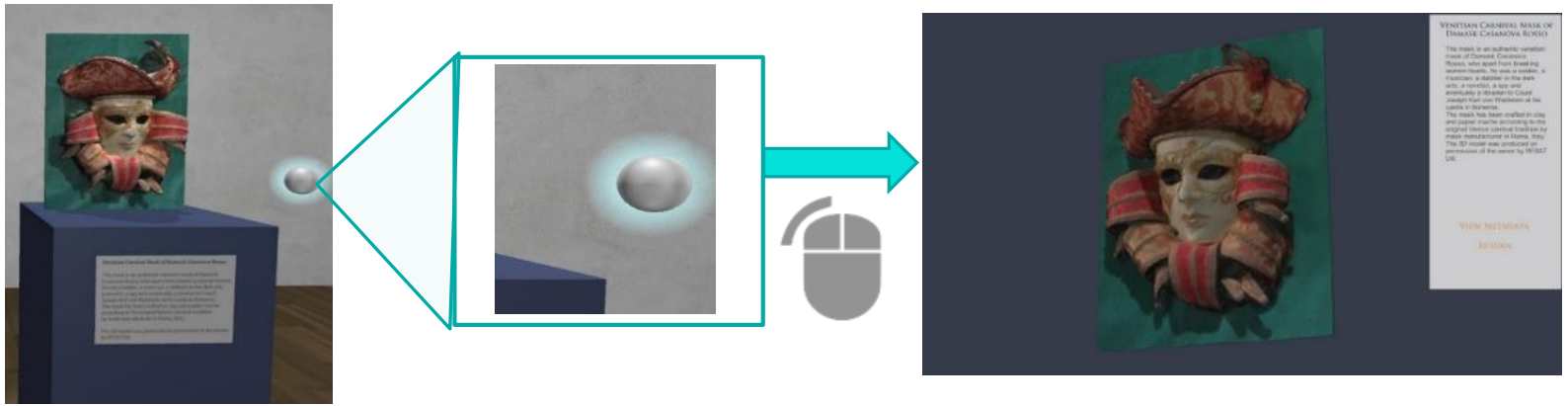
3D Artifacts Viewer



- Interaction with cultural heritage assets in 3D viewer

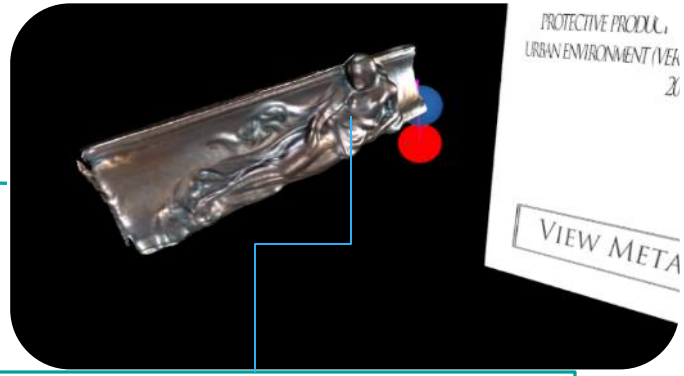
Rotation Drag Zoom

CERTH/ITI VR/AR Apps in CH

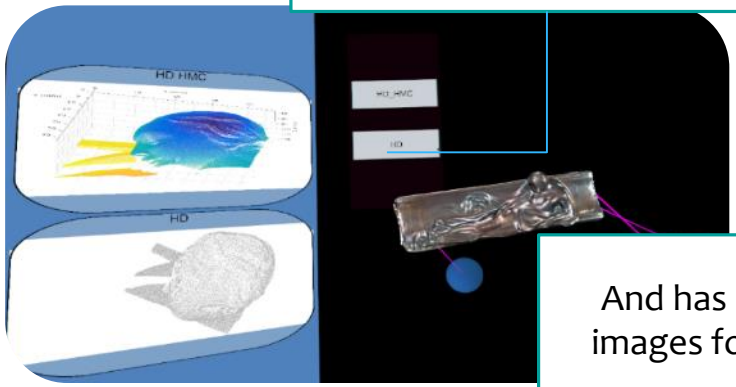
Scan4Reco

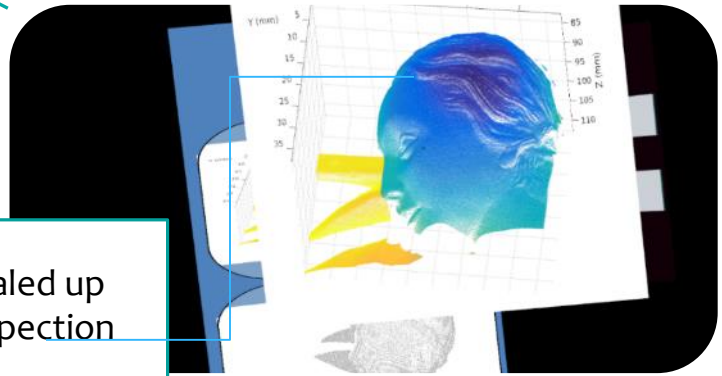
Extra Information

The user can click to view the measurements of each measurement



Interactable Markers show the position of the scannings

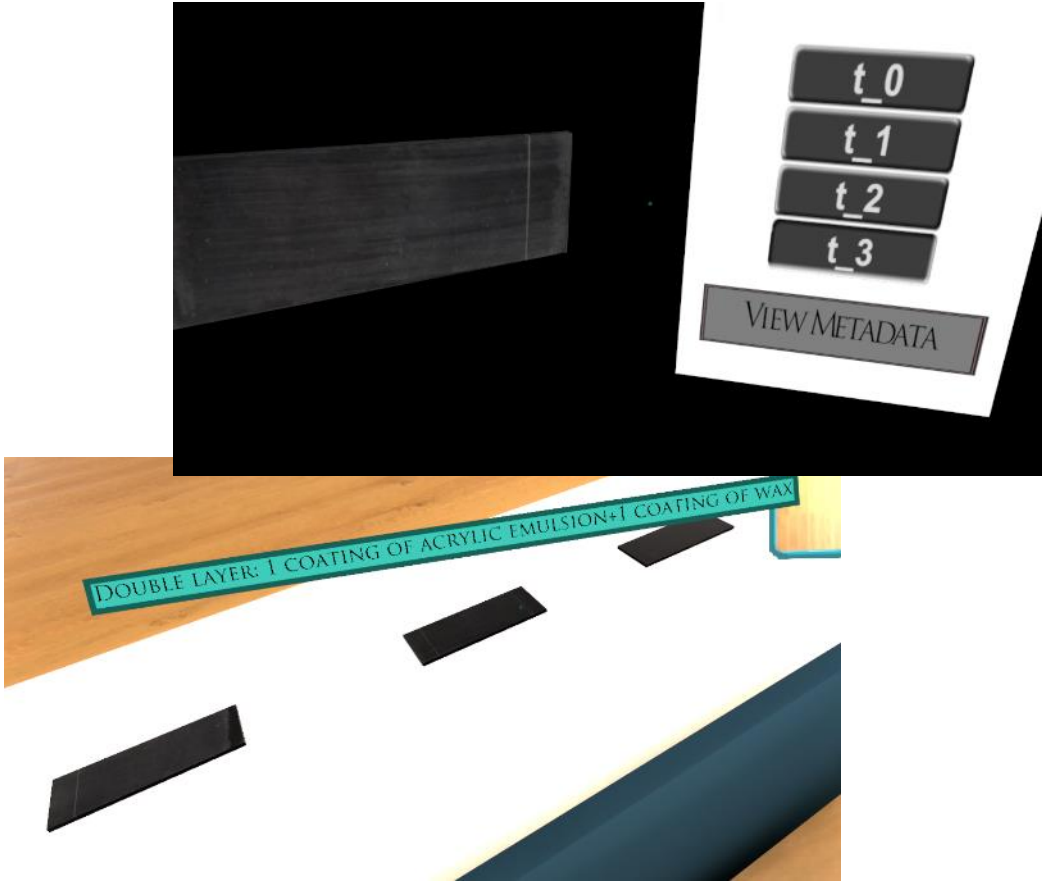




And has access to scaled up images for careful inspection

CERTH/ITI VR/AR Apps in CH

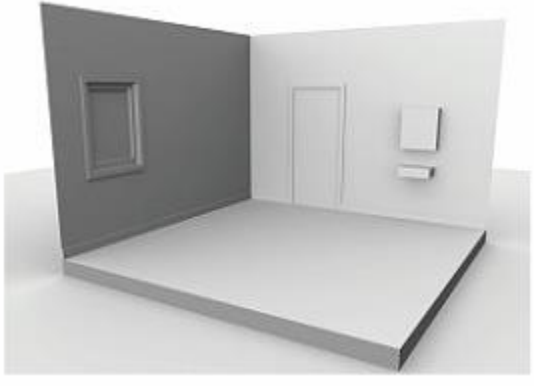
Users can view procedurally aged silver/bronze alloys and temperas in different time points

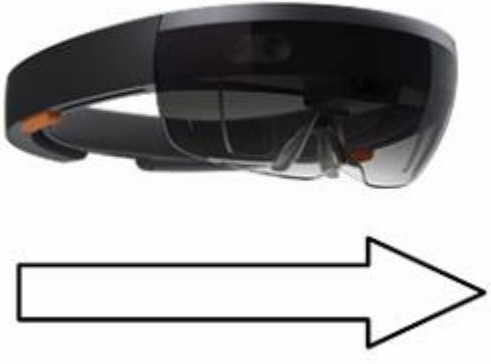


CERTH/ITI VR/AR Apps in CH (Upcoming)

TheARtro

- AR Supertitling of theatre performances.
- AR Reconstruction of Theatre stage to overlay virtual props, animated sequences and avatars during live performance especially in Ancient Greek theatre performances and venues
- Integration of AR in the set production and direction of the performances
- Increasing foreign visitor attendance to greek-language theatrical performances through non-intrusive live personalized multi-language translation





CERTH/ITI VR/AR Apps in CH (Upcoming)

ActiVatoR

Development of personal force-feedback and 6DoF motion platform for VR applications using HMDs to promote CH in museums and education. One use case will be the technology in ancient Greece with the cooperation of NOESIS (continuation of APEIRO)