



Collaboration with other projects



Publications and events

- Graphene Week 2013
- Graphene 2013 Imagenenano
- European Microwave Week 2013
- 2014 International Telecommunications Symp.
- ICEAA 2014/ IEEE APWC 2014
- Research*EU Results Magazine (April 2013)
- "Success stories" - Enterprise Europe Network
- Archeomatica (www.archeomatica.it)
- DigitalMeetsCulture (www.digitalmeetsculture.net)
- EuroVision. Museums Exhibiting Europe
- ICT 2013 - Lithuania
- Living Labs: Technologies for Cultural Heritage
- Museum Exhibition Fair (MEF) - Bulgaria
- Press, radio, TV

Consortium

Coordinator

Technical Manager



@insidde_EU
www.insidde-fp7.eu

The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 600849.

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The Project

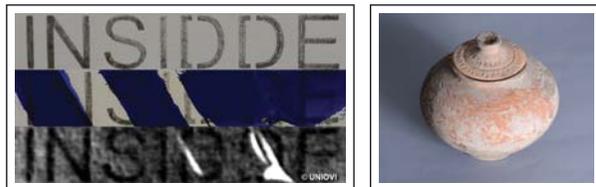
INSIDDE is aimed at **unveiling unknown features** - hidden paint layers, overpaintings, possibly underdrawing steps, brushstroke textures, sealed contents - **of both 2D and 3D artworks** for enhancing the knowledge-sharing of and the access to the digitised surrogates of the original cultural resources.

The combination of **terahertz technology, image processing techniques, and 3D high-resolution scanning** is the basis for the development of an **innovative Augmented Reality (AR) application for smartphones** to be used at museums and the **integration of the digital models into Europeana**.

Terahertz technology

Being **non-ionising and non-harmful**, the capability of terahertz waves to **penetrate non-metallic materials and retrieving information from inner layers** makes them **suitable in the field of cultural heritage**.

Graphene-based transmitters and receivers have been designed and fabricated to be integrated into a terahertz scanner that works in multiple bands **from 0.2 to 1.1 THz**. The system also incorporates a **focusing system** and a laser sensor **to improve spatial resolution and accuracy**, allowing the consortium to scan paintings and pottery in **reflection mode**.



Preliminary tests are being currently performed **on ad hoc reproductions**. Original artworks will be studied in the **last phase of INSIDDE**.

3D high-resolution scanning

First step deals with **creating high-resolution models of ceramics** from the 2nd and 3rd centuries **using a structure light scanner**. In this context, removing baked-in illumination from 3D scans is essential by **reconstructing the material's albedo**.

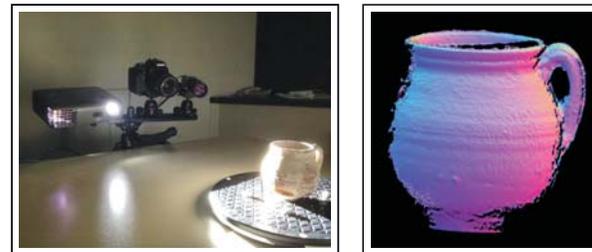
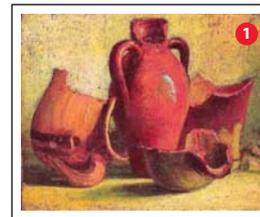
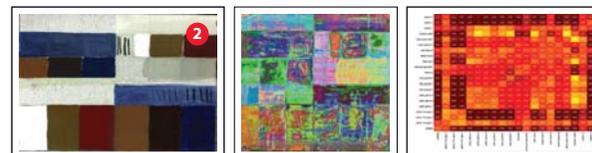


Image processing techniques

Taking the **genuine still life** (1) as reference, two **main objectives** are being pursued: identification of pigments and brushstrokes and distinction between layers. To this end, different **samples** (2) are being **prepared and scanned**.



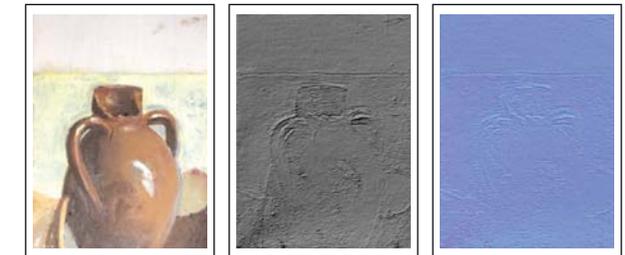
Filtering and pre-processing **techniques**, image modelling software, independent component analysis, supervised machine learning and others are being **applied to examine the information contained in the THz images** for a **better understanding** of the artwork and the creative process.



Then, these **models** will be **merged with THz scans**, enabling the **visualisation of both interior and exterior**. Moreover, the **content of sealed objects** will be **studied by means of spectroscopy**.



Experiments to **measure 3D painting textures** have also started to complement 2D processing techniques.



Innovative applications and Europeana

Previously described research efforts are culminated with the development of an **AR-based application for smartphones/tablets**. This will satisfy visitors' curiosity at museums by **interactively showing the scene** - THz, infrared, ultraviolet, X-ray images - **beneath the painting** and displaying information about other relevant (and unknown) characteristics and details. Besides, the **3D models and THz images** will be **uploaded to Europeana** to be shared with the citizens through the internet.

