MOSCARDO

TECHNOLOGIES FOR THE CONSERVATION OF HISTORIC BUILDINGS

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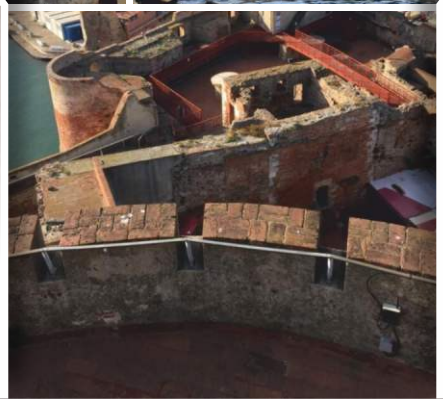
Regione Toscana

FAS Fondo Aree Sottoutilizzate 2007-2013

REPUBBLICA ITALIANA



MOSCARDO

is a **system for the structural monitoring of ancient constructions** that integrates ICT technologies (wireless sensor networks, signal processing coming from sensors, computer vision and photogrammetry on the footage captured by unmanned aerial vehicles) with expertise and methodologies coming from both structural sciences and computational mechanics, making use of operational modal analysis and structural analysis tools.

WHO IT IS TARGETED AT

The MOSCARDO project provides **historical building management tools** that allow to gain further knowledge of the static and dynamic behaviour of historical buildings, to assess their conservation status, to provide information on any damage during normal conditions and in the presence of events of significance.

MOSCARDO is therefore targeted at: Local Agencies of the Ministry of Cultural Heritage and Activities, Local and Regional Administrations, Civil Protection and to all the **authorities and state bodies responsible for the architectural heritage safeguard**.

MOSCARDO is a scalable and flexible system, which can be easily deployed also in the case of more recent infrastructures.

HOW IT WORKS

MOSCARDO provides a Monitoring Control Centre (MCC) collecting the data coming from the sensor networks deployed on the building of interest for analysis purposes, thus allowing authorities to plan the appropriate safeguard measures and actions. Unmanned Aerial Vehicles (UAVs) are also used for visual inspection, providing a dedicated video feed to both close and remote operators.

In particular, MOSCARDO is an innovative system composed of:

- **Integrated Wireless Sensor Networks (WSNs)** for the acquisition of structural and environmental data, providing a low cost, high resolution, low energy consumption, and of limited visual impact monitoring system, which allow a long-term and widespread monitoring
- Flexible and reliable IoT **communication infrastructure** built upon a publish / subscribe communication paradigm
- **Unmanned aerial vehicle** (by National Research Council, Pisa), for acquisition of video feeds: thanks to analysis techniques, it can be used for artifacts recognition (such as cracks), and for creating virtual 3D models of the buildings (3D reconstruction)
- **MCC** designed according to a cloud architecture that provides services for storage, processing, and interpretation of data coming from the WSNs and from the aerial vehicle
- **Multi-channel and multi-platform interfaces** for the consultation and for the use of analysed data, images and videos, so to promptly notify any trespassing of the alert thresholds or any other events of interest captured by the monitoring system.
- **Front-end** Augmented Reality (AR) for the interactive display of video streams and data collected by the deployed sensors day by day, during UAV inspections, and for offline playing, displaying the 3D model of the structure in an immersive setup, with the possibility to also showing historical data stored at the MCC.

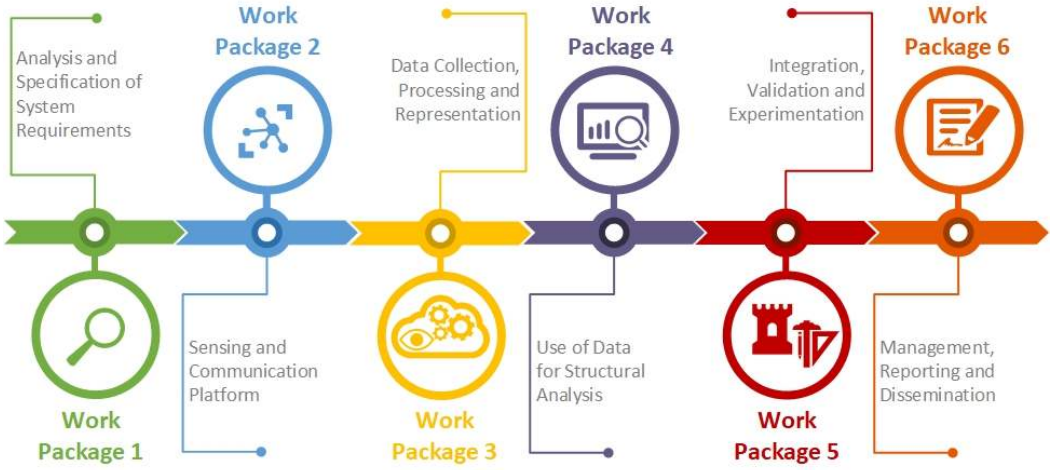
USEFULNESS

In the field of monitoring and structural analysis of ancient buildings, the monitoring system developed within the MOSCARDO project allows to:

- Check the *health status* of the monitored structures at any time and from anywhere
- Collect and store large amounts of data to historically monitor the structure under observation, to develop complex predictions and to promptly operate if needed
- Obtain an in-depth and consistent knowledge of historical construction
- Reduce management costs and security risks for authorities thanks to the use of the proposed system to support their institutional maintenance and safeguard activities
- Simplify the operations of monitoring and maintenance or restoration works to specialized operators

WORK PACKAGES

MOSCARDO project is structured in 6 Work Packages:



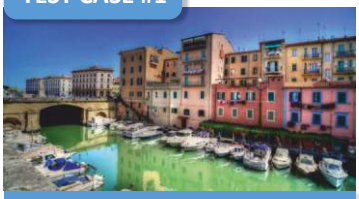
The main project results are what follows:

- Wireless sensor networks for structural monitoring of historic buildings.
- Cloud platform for the management of the collected data and images.
- Software for image recognition and 3D reconstruction based on the videos acquired by the UAVs
- Software for static, dynamic and modal analysis of masonry constructions
- Prototype of the integrated MOSCARDO system

TEST CASES

The Project Test Cases are three installations in historical interest sites, which have allowed the experimentation and validation of the integrated MOSCARDO System:

TEST CASE #1



The **"Voltone"** under Piazza della Repubblica in Livorno

TEST CASE #2

The **"Torre Grossa"** of San Gimignano

TEST CASE #3

The **"Old Fortress"** standing at the edge of the Medici Port of Livorno

ACKNOWLEDGMENTS

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- Municipality of Livorno
- Municipality of San Gimignano
- Civic Museums of San Gimignano
- Ministry of Cultural Activities and Heritage - Superintendency of Archeology, Fine Arts and Landscape for the Siena, Grosseto and Arezzo provinces
- "Il Parago" and "G. Garibaldi" Nautical Clubs of Livorno

PROJECT PARTNERS: infomobility · ISTI · Università degli Studi Firenze DICEA · eisolutions

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