CULTURE FOR ALL

TRADITIONAL AND MODERN SURVEYING TECHNIQUES MET GAMING TECHNOLOGY AND MOBILE APPS IN A PROJECT TO DIGITALLY PRESERVE AND DISSEMINATE INFORMATION ABOUT THE UNESCO WORLD HERITAGE SITE, THE ROYAL PALACE OF CASERTA IN ITALY

Our cultural heritage is inevitably subject to the decay caused by time, catastrophes and human intervention. Its documentation, best possible conservation and monitoring is one of our most important duties. At the same time, a modern vision of cultural heritage cannot ignore the new market and social needs necessary to provide the financial resources necessary to promote ambitious projects cataloguing and disseminating this culture. It must also break down 'architectural barriers' to enable everyone to enjoy this heritage.

Technological advances are revolutionising our life by nullifying distances and abolishing physical obstacles to the direct, accurate and immediate divulgence of knowledge. In this new era, cultural heritage receives immense benefits, becoming totally accessible to people living far away, differently abled or even just too busy to find the time for a traditional visit. In particular, the combination of high-resolution optical images and the measuring accuracy of traditional surveying with an integrated video gaming environment enables an interactive model that can simulate reality in a unique virtual experience.

CSI Management, an Italian dynamic IT enterprise based in Rome, proposes a systemic approach that integrates technologies, tools and human resources to monitor works of art, as well as catalogue and disseminate them. Geomatics, innovative data processing, historical research, and historical cartographic, iconographic and photographic documents, all combined with 3D virtual reality, can create a highly accurate, complete and reliable result that meets market needs.

CSI Management applied this approach at the Royal Palace of Caserta in Italy to create a virtual museum, following a scientific agreement between the UNESCO World Heritage site and TEMOTEC laboratory (TEcnologie e MOdelli per la Tutela degli Ecosistemi Culturali), a European commission PF7 project concerned with the definition of models and methodologies for the protection, documentation and valorisation of cultural ecosystems. The project started in spring last year as part of a wider four-year European programme monitored by the Italian Ministry for Education (MIUR) involving universities, research organisations and industry.

The first step was to create a standard GNSS-NRTK network of the site made up of more than 67,000 points, with around 100 ground control points (GCP) needed to describe the dynamics of the local territory. The network was divided into areas according to the landscape of the royal park with the objective of generating a systemic temporal input for artificial adaptive systems and change detectors able to describe and simulate innovative change detection for critical events such as landslides, possible flooding and earthquakes. Two Topcon Hyper SR GNSS receivers connected in NRTK mode were used with one of the local permanent stations of the NetGeo private network. Sampling measurement has been set to 1s while horizontal and vertical precision were both under 2mm; a 2.5mm limit was set to exclude any inaccurate measurement.

The terrain at the site is complicated, with tall vegetation completely occluding a great part of the sky in some cases. An accurate surveying plan was combined with adequate cut-off angles to exclude satellites with bad visibility and non-optimal satellite distribution.

Using this approach, the description and simulation of any critical phenomenon can be identified and its particular dynamic mechanism better understood. It also permits the installation of specialised sensors in the most efficient way.

Both traditional and modern techniques were used to accurately survey the structures of the site, in order to feed the virtual reality environment and create a complete geometrical documentation of all the buildings. For this reason, adequately projected terrestrial photogrammetric surveying provided the needed photograms. All photograms were visually inspected and their sharpness corrected using Agisoft Photoscan. Camera calibration and image masking were needed to obtain even better quality in the final models.

The generated point clouds were georeferenced using GNSS ground control points present in the surrounding areas, co-registered when needed in order to merge them with other point clouds and finally textured using the created photograms. Finally, some parts of the structure with less detail were modelled using CAD software and then integrated to the whole model in a visual reality engine (Unity).

Adding history

The next step was to add information about the Royal Park. Iconographic studies, bibliographic research and even folk information needed to be integrated in 'heritage documentation'. In this way, we should achieve a complete and deep enough level of knowledge that can defeat time to achieve everlasting life for these collective memories, traditions and monuments that humanity has created – successfully accomplishing the duty to conserve these memories and bestow them on their true owners, the future generations.

Especially important were the studies on 'allegories' contained in the work Iconologia by Cesare Ripa (Perugia 1555, Rome 1622). In this work are described and evaluated all 164 statues of the Royal Park, and it has been possible to classify them by age, material, technique and use destination.

Finally, ontological cards containing the entire existence of each artwork were produced and combined with each model for a digital environment interpretation that includes a 3D artwork representation. These interpretations can be disseminated through multiple channels, such as web sites and mobile applications.

The new era of cultural heritage

The realised ontology can be used in multiple and very different communication channels, especially social networks. CSI's belief is that the right culture must be a viral culture.

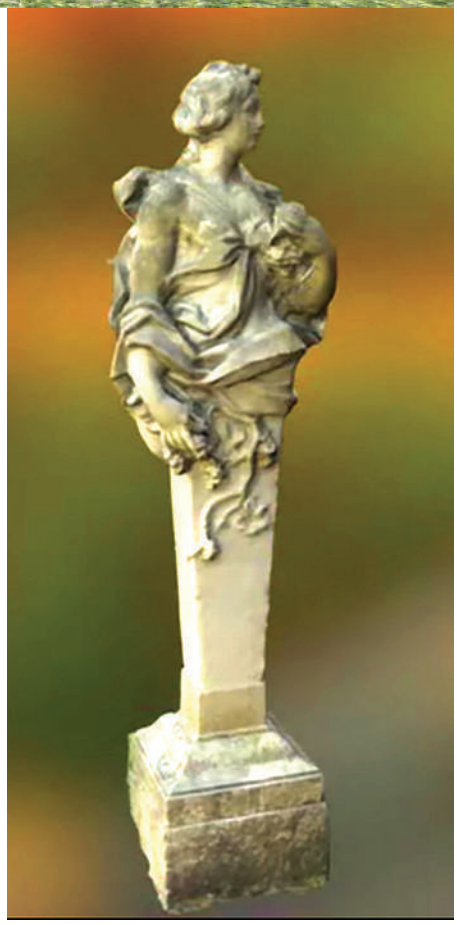
The first effort addressed was the creation of a database capable of generating an open-museum modular system – incremental, but at the same time self-consistent, in every component that binds to the classical mode of cultural dissemination.

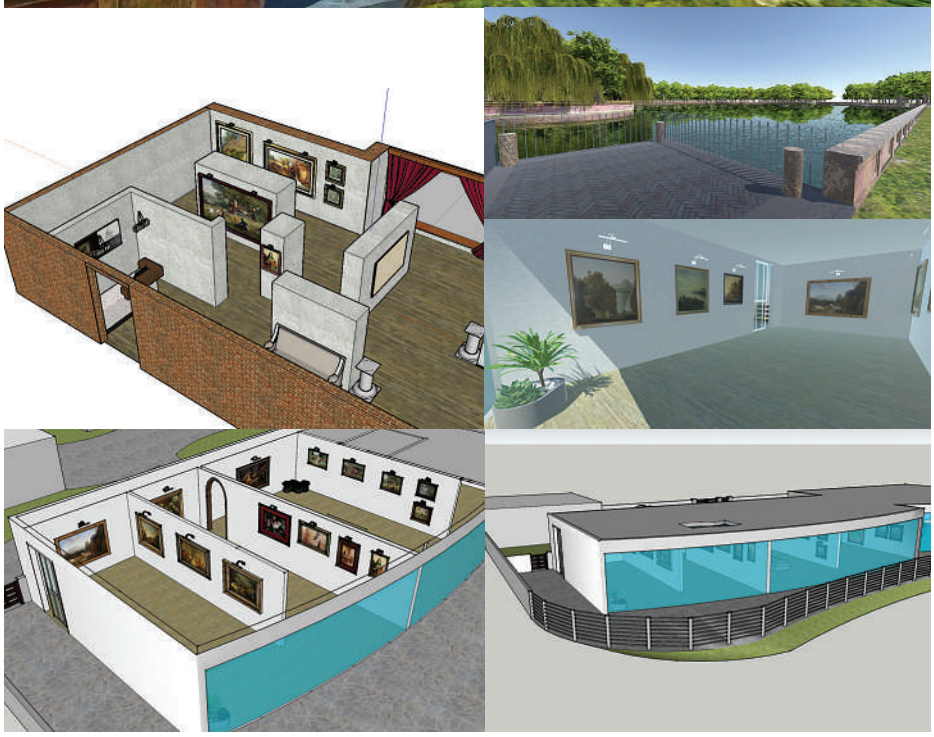
Here, there is wide use of both virtual and augmented reality.

The digital terrain models built from the terrain survey constitute the necessary background to the construction of virtual museum paths, realised using video game techniques. Where it is possible to access the artwork and artefacts of the Royal park, historical, geographical and multimedia information are provided using QR codes.

Beyond the provision of information, augmented reality is practicable through the provision of audio, which can be used by people with visual disabilities without the need for bulky audio guides. There are also videos that use sign language for people with hearing difficulties.

To assist the traditional visit, an innovative mobile application has been designed and created evidencing the hidden beauties of the Royal Park and palace. One of the most innovative parts of this application is the active interaction between the visitor's device and the various artworks. The application can be downloaded and installed on any mobile platform; it immediately integrates the navigation with a variety of pre-designated itineraries using augmented reality, providing historical and geographical information, as well as highly detailed 3D models of any statue or fountain in the park. The application uses GNSS positioning and the QR codes near





and the QR codes near artefacts to interact with the site, providing viewing suggestions and completing the overall navigation experience.

The application was developed using the Apache Cordova development environment and a WebApp architecture running on the device. The connection and interface with the database uses REST web services, while mapping information is retrieved from Google Maps to visualise the selected itinerary. The Wikitude SDK was used to create the augmented reality.

The complete virtual museum is available online and contains all the ontological information that someone can enjoy in a traditional visit, in a complete virtual environment that enables individual and social enhancement.

The project has evidenced the need to see our future in a smarter, complete and systemic way, considering all citizens equally, enabling anyone to enjoy culture, considering documentation in all its dimensions, exploiting advantages and solutions given by new technologies in a more anthropocentric society where culture represents the main source of inspiration and where people are learning from the past to design their future.

The project is expected to end in December, but TEMOTEC's work will continue to deal with new initiatives and challenges connected with the preservation and management of our cultural heritage through the use cutting edge technologies such as the Internet of Things, virtual and immersive reality, and new technological scenarios.

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VIEW THE MUSEUM ONLINE

You can view some of the work at https://www.youtube.com/channel/UCOxT2Qm-Fd1O3UpiCX1zRfFQ

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