Digital & Documentation

V5
From virtual space to information database

edited by
Francesca Picchio

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From Virtual space to Information database

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The volume consists of a collection of contributions from the seminar "Digital & Documentation: From Virtual space to Information database", realized at the University of Pavia on the day of September 19th, 2022. The event, organized by the experimental laboratory of research and didactics DAda Lab. of DICAr - Department of Civil Engineering and Architecture of University of Pavia, promotes the themes of digital modeling and virtual environments applied to the documentation of architectural scenarios and the implementation of museum complexes through communication programs of immersive fruition. The fifth Digital and documentation conference was also the inaugural event of the first Pavia DigiWeek, held from 19 to 23 September 2022 in Pavia.

The event has provide the contribution of external experts and lecturers in the field of digital documentation for Cultural Heritage. The scientific responsible for the organization of the event is Prof. Francesca Picchio, University of Pavia.

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DIGITAL DOCUMENTATION FOR THE ENHANCEMENT OF BRAZILIAN CULTURAL HERITAGE:
Museo Do Ipiranga, Parque da Independência and Monumento à Independência

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Abstract

For this year's bicentenary of Brazil's independence, the DIAPReM research centre and the TekneHub laboratory of the University of Ferrara present the results of the digital documentation of one of the most important monumental complexes in the state of São Paulo: Museo Do Ipiranga, Parque da Independência and Monumento à Independência.
The application of integrated three-dimensional survey protocols and scan-to-HBIM procedures currently provides technicians, researchers, public administration, and citizens with the most complete digital memory of the monumental complex built by Italian architects and engineers in 1922, on the occasion of the centenary of the country's independence. Moreover, the database represents the documentation of the state of the museum before the recent restoration work. The survey databases and HBIM models are finally an inherent part of the valorisation and dissemination project, intended for an audience of non-professionals only, IpirangaDigital.

Introduction

The importance and value of the digital memory of heritage assets has been highlighted, over the last few years, by the increasing dissemination, accessibility, and usability of integrated digital technologies for surveying and representation, particularly three-dimensional, of the cultural heritage as well as the built heritage. Moreover, the digital memory of cultural heritage has emerged into a resource for communication to a large audience as well as for purposes of conservation and maintenance.

As the experience detailed here illustrates, interest in the study topic of integrated digital heritage survey and representation protocols with a view to valorisation and communication to a non-expert audience is expanding both internationally and inside the European Community. Despite the fact that the definition of clear-cut digital documentation protocols appears to be hampered by the uniqueness of cultural heritage, both tangible and intangible, the rapid adoption of key enabling technologies, collaborative visualisation platforms, and machine learning protocols are encouraging studies and applications aimed at involving a large audience. Applications include, among other topics: integrating VR, AR, and

Fig. 1 – Enhancing Brazilian cultural heritage through integrated digital platforms. Monumento à Independência do Brasil, São Paulo, Brasil.
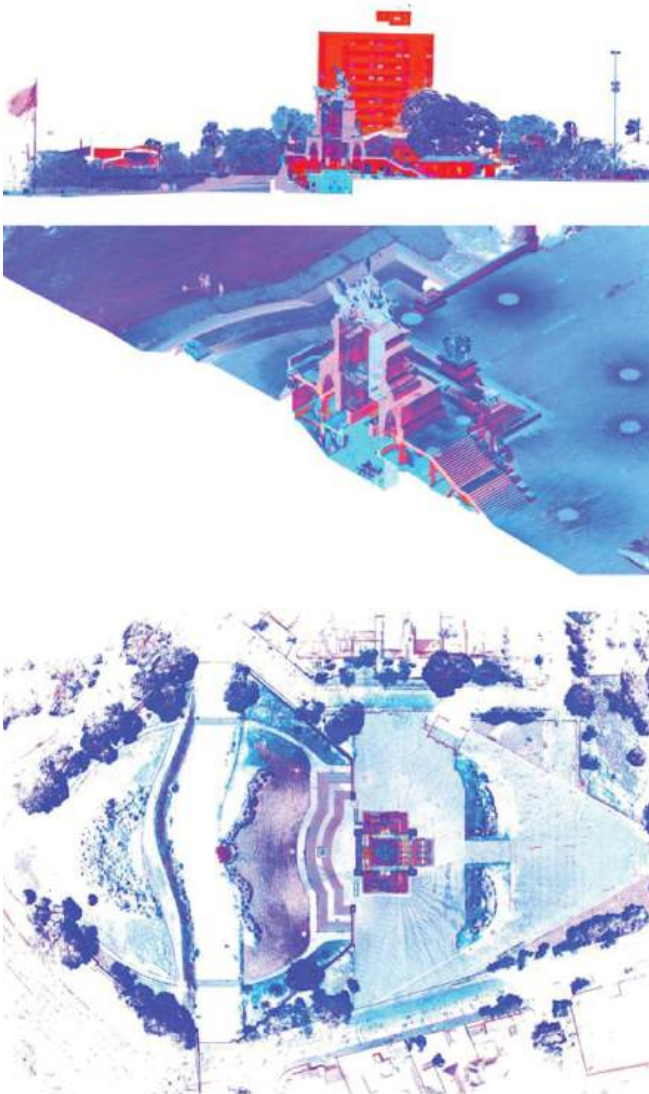
Fig. 2 – 3D integrated digital survey of Museu do Ipiranga, Parque da Independência, and Monumento à Independência, São Paulo, Brasil.

mixed reality technologies to engage a variety of target audiences; integrating digital technologies to support greater accessibility and as a response to fragilities of the target audience; enhancing through gaming activities implemented through digital interfaces and media.

The primary goal of the research project is to pursue an interdisciplinary, integrated, and systematic approach to documenting and enhancing cultural heritage. However, the goal of this study is to define a shared protocol for international and interdisciplinary collaboration for the digital documentation of Brazilian cultural heritage from an architectural and urban scale perspective to support preservation and value-adding initiatives in accordance with a variety of approaches to cultural heritage.

Urban Memorial Landscapes

The Museu do Ipiranga, Parque da Independência, and the Monumento à Independência stand on an area of more than 160,000 square metres that stretches from south-east to north-west along the path of the old Ipiranga river. Overall, the project aimed at building a collective memory around the declaration of Brazil's Independence from Portugal proclaimed by D. Pedro I in 1822.

On the centenary of Independence, in 1922, as part of the celebrations, the Monument à Independência do Brasil was inaugurated, although not yet completed, designed by Ettore Ximenes and Manfredo Manfredi. The completed project had won an international competition
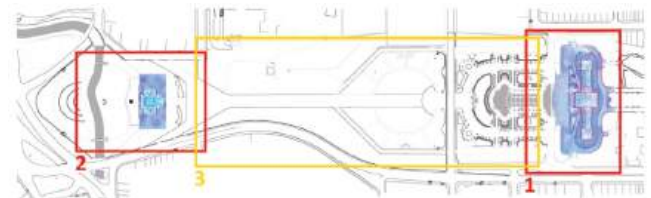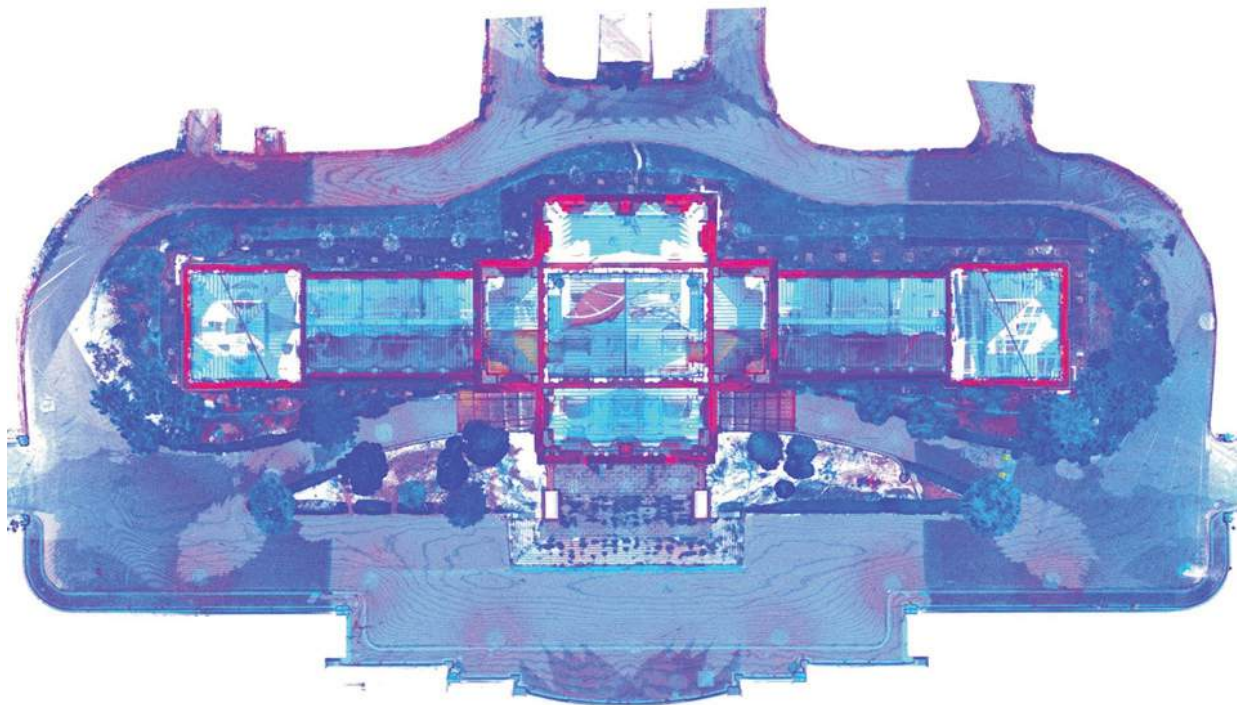
Fig. 3 - (Above and in the next page) Scan to HBIM protocols: Museu do Ipiranga São Paulo, Brasil.

for a monument to Brazilian independence. Completed a few years after its inauguration, the monument underwent major transformations that still characterise it today. In 1952, the crypt was inaugurated, effectively changing the monument into a cenotaph of Emperor Dom Pedro I. Later, in the second half of the 1980s, the monument underwent an initial restoration, following which the interior exhibition space was inaugurated. Prior to the digital documentation campaign carried out by the DIAPReM/TekneHub laboratory in 2018, two further restoration works are carried out.

The construction of the monument completes the landscaping and urban work of the entire area begun in 1884 with Tommaso Gaudezio Bezzi's project for the Museu do Ipiranga. The museum represents the first, in chronological order, architectural landmark in the area.

The museum, which currently houses a collection of over 125,000 artefacts of Brazilian history from the 16th to the mid-20th century, represents, as stated in the preliminary report and recommendations for the Museu Paulista conservation project of 2013, a unique testimony of the irreplaceable values of Brazilian history, architecture and engineering. The Museum is certainly the repository of the national memory linked to São Paulo, built through the epic expeditions of the various local explorers and the pioneering vocation of São Paulo, since colonial times, as testified by the objects, documents, iconography and specimens in the collection.

The building, bound by Brazilian law through the Instituto do Patrimônio Histórico e Artístico Nacional - IPHAN, was closed to the public from 2013 until 2022 to allow for its
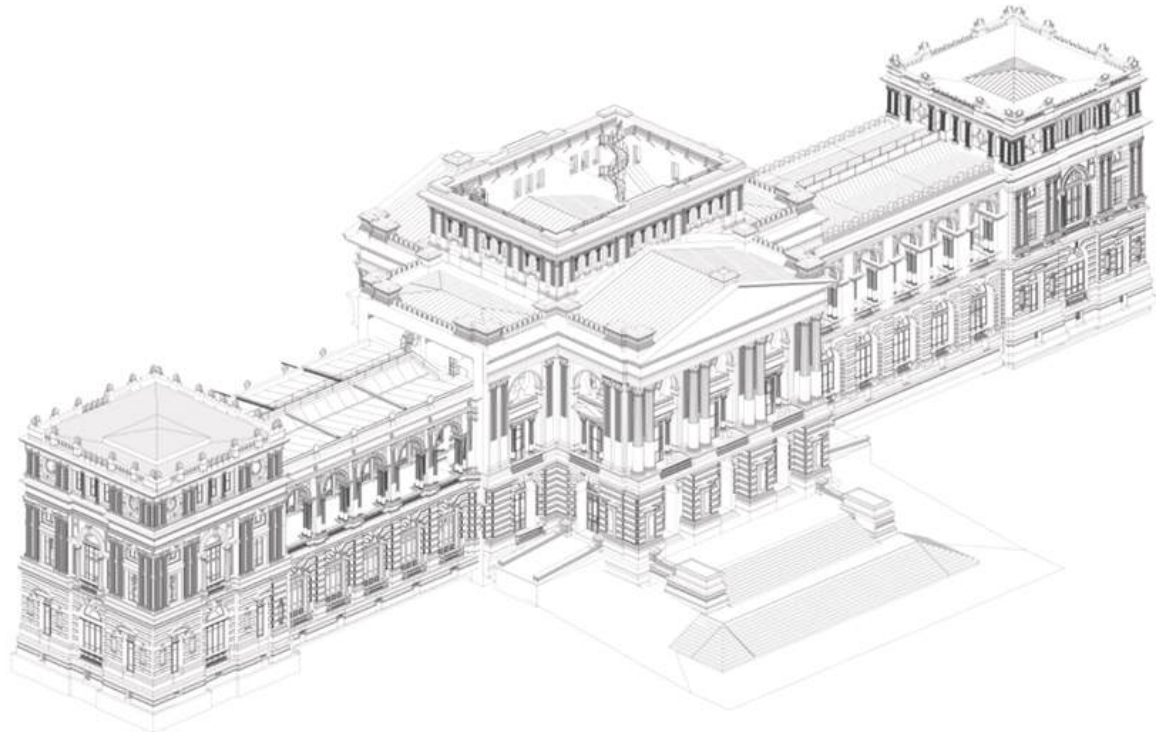
total restoration, the purpose of which is, among other things, to preserve the important functions performed by this outstanding architectural example. The inauguration of the new Museo do Ipiranga took place on 7 September 2022 on the occasion of the bicentenary of Brazilian Independence.

The integrated digital documentation provided as a result of the survey campaign conducted in 2018 allowed the management, during the construction phase, of the new entrance built as an hypogeum structure on the south-east front that provided the museum with an access and services area of over 6,800 square metres.

The three-dimensional database developed as a result of the survey campaign therefore remains the digital memory of the museum prior to the restoration and recovery work.

Related Works

The integrated digital survey activity Museu do Ipiranga, Parque da Independência, and Monumento à Independência is part of a broader context of research and technology transfer activities carried out in collaboration with the FAU-USP Faculdade de Arquitetura e Urbanismo da Universidade de São Paulo.

One of the most important places in the history of the State of São Paulo Independence is represented by the monumental and urban complex, which is the focus of the integrated HBIM survey and modeling methodology described. Definitely, the goals of valorizing and understanding the multiple narratives associated

Fig. 5 - 3D integrated digital survey of Monumento à Independência do Brasil, São Paulo, Brasil.

Fig. 4 - Museu do Ipiranga – USP main façade. View of the central projecting pronaos from the monumental gardens overlooking the main building (left). View of the perspective axis in the direction of the Monumento à Independência from the roof of the Museu do Ipiranga (right).

to the cultural heritage under examination combine with objectives of memory conservation, restoration and adaptation efforts, accessibility, and security of the buildings and urban spaces as well.

Moreover, the areas and settings of both the Monumento à Independência and the Museo Do Ipiranga have changed throughout time due to functional adaption needs. Therefore, in order to manage the sites and their changes over time, engineers and architects were the primary target audience for the integrated digital record of the current status of the sites. The digital survey protocols that were implemented were intended to offer, at the same time, sufficient documentation support in order to express the technical and figurative, as well as literary and historical content, related, for instance, to the complex reading of the monument. Moreover, the monument is distinguished by decorative equipment while also exhibiting dimensions like those of monumental architecture. Over time, the monument has undergone incongruous plant and functional interventions that have worsened the internal micro-environmental conditions that are no longer

suitable for the preservation of the emperors' remains. The convergence of the described elements today inhibits the accessibility and usability of a history that is often unknown to the population of São Paulo State.

Then, the implementation of the overall database has made it feasible to carry out training and technology transfer initiatives for regional technicians. In fact, technicians from the H+F Arquitetos studio, which won the open competition for the Museo do Ipiranga restoration, attended a course in Italy in 2018 that was put on by the DIAPReM Laboratory and TekneHub of the University of Ferrara and focused on using the three-dimensional database to verify the various stages of the project and construction site.

The subsequent pandemic crisis postponed the completion of the survey of the park, which will be the subject of a subsequent, although not conclusive, survey campaign during 2021.

Digital Documentation of Brazilian Cultural Heritage

The integrated digital survey and documentation protocol implemented took into account, first and foremost, the conservation and restoration purposes associated with a cultural heritage such as the one described. The monumental dimension on the one hand and the richness of the ornamental and sculptural apparatuses on the other make it necessary, both for conservation purposes and for communication and valorisation, to conduct multi-scalar analyses, from urban scale to architectural detail. The resulting integrated digital survey data must therefore allow the transition to widely different scales of understanding, firstly, and representation, secondly.

Therefore, it was chosen to implement a survey protocol that, based on more than twenty years of experience in the digital documentation of Cultural Heritage, allows the geometric and angular control appropriate to the
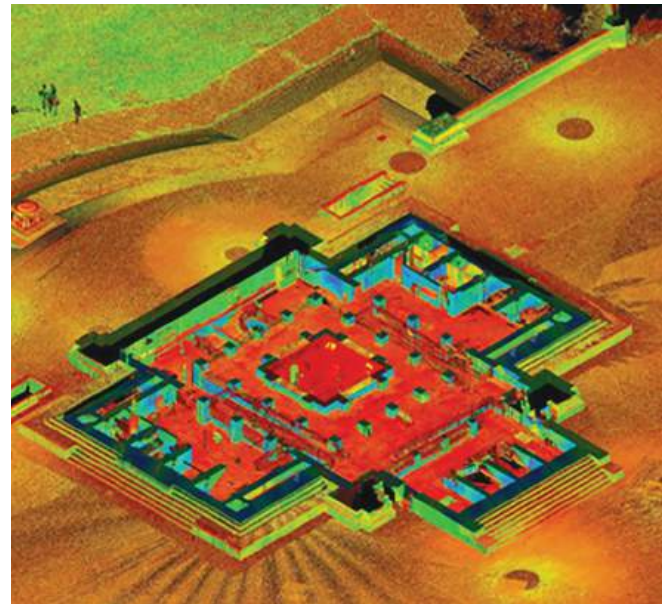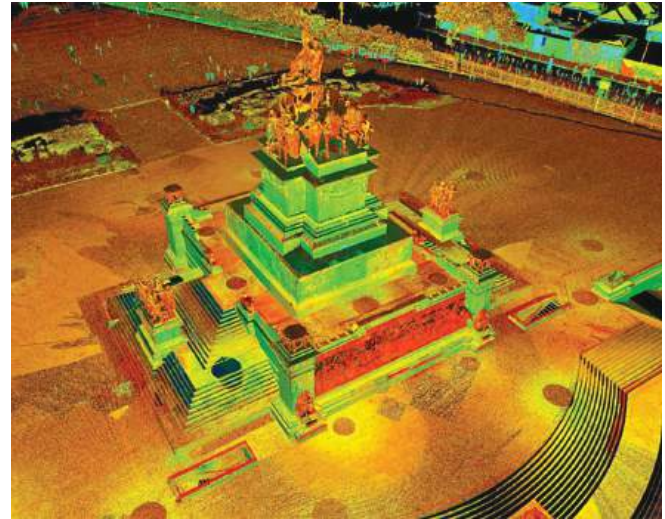

Fig. 6 - Views of the overall point cloud data model of the Monumento à Independência do Brasil, São Paulo, Brasil.

Fig. 7 - Scan to 3D photo modelling procedures: Monumento à Independência do Brasil, São Paulo, Brasil.

accuracy required and at the same time the optimisation of the quality of the digital data in terms of redundancy. To a morphological approach, today favoured by the greater usability of terrestrial laser scanner technologies, an integrated topographical approach was therefore preferred.

The protocol used for the surveys calls for the development of a first-level topographic network, second- and third-level target networks, normalization, and registration of the overall point cloud model to regulate angular accuracy and elevation deformations, segmentation of the overall data model by areas related to the purposes of use, and visualization of data and information within a digital portal. The present use of digital platforms to combine various non-digital and digital data sources is encouraging further experimentation with the dissemination and enhancement of tangible and intangible cultural heritage. However, there are still a great deal of challenges. A purpose of this effort and related work has been identified as improving and promoting the usability of the whole point cloud model as source of data. The developed survey technique is used to verify the accuracy of the digital data in respect to the information system as a whole and the associated two- and three-dimensional forms of representation.

The size and quality of the same information through the various visualisation supports that are currently available and which can be integrated in complex information systems does not yet make it possible to transfer the value of the 3D data source to a wide audience, especially in a dynamic manner. This is true even if the accessibility of the overall cloud database is still guaranteed both within native and open-source environments, even if supported by suitable calculation infrastructures. Consequently, to preserve the multiscalar information content, integration with non-dynamic contents seems to be essential.

Conclusions

Since 2016, interdisciplinary research has been conducted to consolidate integrated digital survey and scan to HBIM protocols of complex architectures subject to restoration interventions as well as enhancement and communication activities. In this regard, the integrated three-dimensional survey, digital modelling, and visualization project of the Museu do Ipiranga, Parque da Independência, and Monumento à Independência exemplified an interesting area of investigation of data and information acquisition
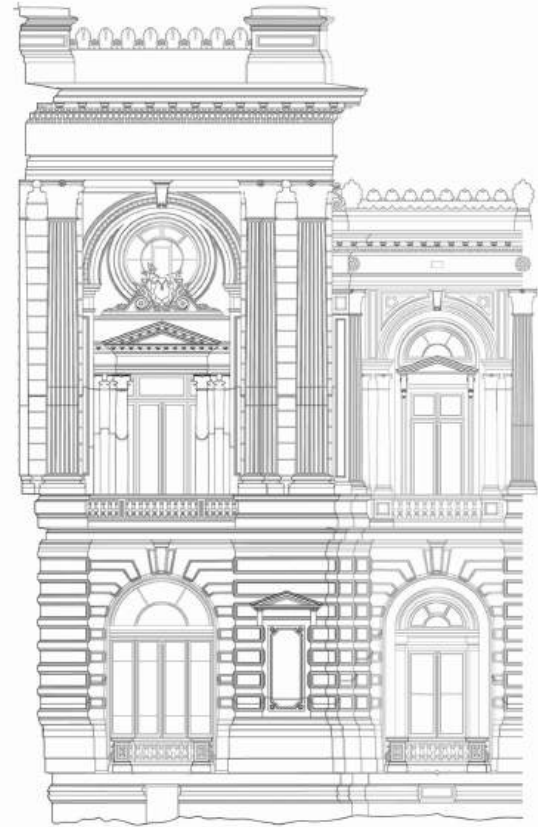
Fig. 8 - Some images of the training and technology transfer activity and results carried out to support the development of the restauration project made by the architects Pablo Herenu and Eduardo Ferroni (selected from the 13 proposals received by invitation) The collaboration with the DIAPReM centre took the form of a period of face-to-face training, at the University of Ferrara, of some of the architects of the firm.

and processing to support processes of modification of urban space as well as conservation and protection of the heritage of memory.

When employed in conjunction with quick surveying techniques, integrated digital surveying technologies, in particular indirect surveying, enable the current situation to allow the capture of large amounts of data in a short amount of time with acceptable levels of accuracy. In a while, as this documentation effort indicates, control and geometric precision are needed for multi-scalar studies related to the conservation, valorisation, and communication of cultural assets and cannot be obtained

merely through indirect surveys and a morphological approach. Moreover, the use of the topographic survey along with the Terrestrial Laser Scanner (TLS) survey pursues multiple objectives: first, the verification and control of the geometric and morphological characteristics, from the architectural scale to the detailed scale, with a view to the accessibility and usability of the database created and the subsequent implementations, also carried out with various survey instruments and techniques. The division of the models that follows subsequently aims to provide database accessibility, usefulness in scan to BIM processes, and eventually visualization in integrated digital platforms for communication.

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