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ISTANBUL - TURKEY

ABSTRACTS BOOK

Message from the President of the Conference

Welcome to the 1th **World Conference on Information Technology,** which is hosted by Bahcesehir University in Istanbul, Turkey. This privileged scientific event has contributed to the field of information technology and research for a year. It has created the opportunity to bring together academicians, researchers, engineers, system analysts, software developers, graduate and undergraduate students with government and non-government organizations to share and discuss both theoretical and practical knowledge about information technology in the scientific environment.

The scope of the conference covers the major topics of the information technology: Algorithms, Artificial Intelligence, Biometrics, Biosensors, Cellular, Automata, Computer Architecture, Computer Graphics, Computing Methodologies, Data Mining, Data Warehouse and Applications, Database Systems, Decision Support Systems, Digital Ecosystems, Digital Forensics, Distance Learning, Distributed Learning Environments, E-business, E-commerce, Educational Applications, Educational software, Educational Technologies / Educational Computing, E-government, E-marketing, E-publishing, Expert systems, Fuzzy Logic, Genetics Algorithms & Programming, Hardware Design, Human Computer Interaction, Human Tracking Technologies, Industrial Applications, Information Policy Making, Information Retrieval Systems, Information Systems Engineering, Information technology & Agriculture, Information technology & Arts and Design, Information technology & Commerce, Information technology & Health, Information technology & Languages, Intelligent and Fuzzy Information Processing, Intelligent Tutoring Systems, Interactive Learning Environments, Internet Applications, Internet Security, Knowledge Engineering, Knowledge Management, Learning Management Systems, Medical Informatics, Mobile Computing, Mobile Devices, Mobile learning, Multimedia Applications, Networked Tools, Parallel Computing, Programming Languages, Remote Laboratories / E-lab, Social computing, Software / Distributed Systems, Software Engineering, Sport Applications, Tele-learning, Video Conferencing, Wearable Computing, Web Based Language Development, Web Services, Wireless and ad-hoc Networks and etc.

Furthermore, the conference will be gotten more international each year, which is an indicator that it is getting worldwide known and recognized. Scholars from all over the world contributed to this unique event. We would like to express our sincere thanks to all involved in the organization of this International event. Special thanks are to all the reviewers, the members of the international editorial board, the publisher, and those involved in technical processes. We would like to thank all, who contributed to the organization and helped to realize the conference with their generous intellectual support. A total of 528 abstracts or full papers were submitted for the conference and each paper has been peer reviewed by the reviewers specialized in the related field. At the end of the review process, a total of 431 high quality research papers were selected and accepted for paper presentation.

I would like to express my appreciations to the Board of Trustees of Bahcesehir University, Enver Yücel who is an important leader in education in Turkey. He has given full support and encouragement to us to organize this conference at Bahcesehir University. I would also like to thank to the Rector of Bahcesehir University, Prof.Dr. Yılmaz Esmer, who allowed us the opportunity to organize our conference at Bahcesehir University. Also many thanks to Dean of the Engineering Prof. Dr. Süleyman Demokan, General Secretary of Bahcesesir University Ziya Alpay. Special thanks to Ahmet Yücel, who played an active role in the organization of this event at Bahcesehir University.

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3D modeling and remote rendering technique of a high definition cultural heritage artefact

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Abstract

Recent improvements in 3D laser scanning technology allow to reliably and accurately digitize the external shape of many physical objects with high definition and accuracy. Moreover the resulting 3D models can be used for digital documentation as well as to perform different analysis such as measurements, conservation monitoring, feature extractions and possibly virtual restoration.
In recent years, the number of range scanners has been growing rapidly and surface reconstruction algorithms have been developing by the open-source community. This diffusion among cultural heritage institutions gives the scientific society a wide range of 3D hardware capturing devices and software solutions.
Many researchers, however, do not have access to scanning facilities or dense polygonal models.
In this paper is presented the whole pipeline from the creation of a high resolution 3D model of an "Acquasantiera" to its Remote Rendering on the world wide web without any loss of details or accuracy.

Keywords: Laser Scanner, 3D Modelling, Remote Rendering, HPC, Parallel Computing

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Real and OPNET modeling and analysis of an enterprise network and its security structures

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Abstract

In this research study, first, a prototype network design as real modeling and using the OPNET software as virtual modeling of a typical enterprise network are constructed and analyzed. On these real and virtual network models, the affects of Firewall and VPN (Virtual Private Network) on network performance are studied. Then a more complex and realistic model than the first simple OPNET model is designed, and on this second model similar analysis work is performed. In this study, another research topic is to investigate application areas and uses of OPNET in communication networks education.
What we have done different than the previous research studies and projects in our study is constructing both a real enterprise network prototype and virtual OPNET simulation model, and comparing network models and network analysis results. The affects of Firewall and VPN on these models are studied in both real network devices and virtual OPNET environments. Additionally, practical use of both developed real and virtual models in university education is also taken into consideration.

Keywords: social network site; architectural platform

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Decision-support tools for municipal infrastructure maintenance management

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Abstract

Sewers, water pipes, and streets are elements of our civil infrastructure, the supporting structure of society. Infrastructure is a complex technical system that provides us with a varied range of essential services; a storehouse of resources and wealth that each generation inherits, uses, and passes on to succeeding generations.
The asset management has a big influence on infrastructure development and use: undertaken and executed without fully recognizing the complexity, diversity, and social and technological evolution of the system almost inevitably squander economic, environmental, social, and cultural resources.
The challenges of managing these assets most effectively are substantial: the inefficiencies are widespread and really easy to see: jammed traffic on roads designed to carry only a fraction of the current demand, newly-resurfaced city streets open to repair aged subsurface pipes, basements flooded in case of insistent heavy rain, etc.
In existing asset management systems often information is not efficiently used in decisional process, which results in much waste in time and effort. It is necessary to develop life-cycle management systems of infrastructure to overcome this problem. The system must integrate geographic information, design data, inspection and maintenance data. Emphasis is placed on development of decision-support tools for municipal infrastructure management. The study identifies the challenges for maintenance, repair and renewal planning faced by asset owners and managers. Integration with existing systems such as Computerized Maintenance Management Systems, Geographic Information Systems, is seen as the largest challenge for developing and using decision-support tools in the area of asset management.

Keywors: Infrastructures, asset management, maintenance, decision-support tools, Computerized Maintenance Management Systems, Geographic Information Systems, integration, interoperability.

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Information technology and management of diagnostics for analysis of seismic vulnerability in buildings

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Abstract

Ensuring the safety of a building in the event of an earthquake requires analysis of its vulnerability. The analysis is undertaken to evaluate the damage expected in the building for a possible earthquake of pre-established energy. To achieve this, a calculation model has to be prepared, referred to structural and typological characteristics in order to define a cause and effect relationship. This is possible either with in-depth design details or by undertaking diagnostic investigation of existing constructs. At the moment, state-of-the-art technology offers detectors, instruments and diagnosis methods, above all for non-destructive testing, which is user-friendly and will produce extensive information and large amounts of data in a short time. The risk is that excessive amounts of data produced by cutting-edge technology are not followed up with a useful and adequate interpretation of the actual data. It is clear that digital support for optimizing the diagnostic process and, simultaneously, meeting the three fundamental requirements of a diagnostic campaign for the assessment of seismic vulnerability in buildings must:

gather and systemize a large number of data;

put together a reasoned collection of recorded data and decisions applied that will be useful in the future;

guide diagnostics towards the most appropriate investigation method for the specific case.

In short, the use of a digital platform for managing and interpreting recorded data appears applicable to the quality system for a diagnostic campaign, above all if considering the non-destructive type that allows for methodical, systematic knowledge of building heritage so as to obtain the model's timely correspondence with the real world.

A digital platform will be useful in the management of a quality system when applied to action planning (that is to say a set of methods and instruments) within the system, aimed at its definition, achievement, substantiation, demonstration and maintenance.

Keywords: construct, diagnostics, safety, seismic, software, quality, vulnerability

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Comparison of usability evaluation methods for mobile application anddevices in term of test factors

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Abstract

Usability evaluation of mobile application is still difficult because of the context of use. Many evaluation methods for mobile application and devices have been discussed in literature. Those methods are classified into user base, inspection base and inquiry base evaluation methods. By taking different test factors like cost effectiveness we first have defined different mobile evaluation methods. Then comparison study is done with each other methods and the relationship is one to one and one to many. It is concluded that the heuristic evaluation method is the most cost effective as compare to others one.

Keywords: Usability, usability evaluation methods, test factors

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Design time, run time and artificial intelligence techniques for mobility of user interface

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Abstract

Advancement in technology provides opportunities to user as well as challenges for application development organization. User interfaces which were design for specific device tend to be developed for various devices. Users are busy people, when they move among different context would like to move application with them. The current trend of users demanding mobile graphic user interface to support their daily life and work has led to a new generation of techniques. Design time technique provides better usability as compare to run time technique. On the other hand artificial intelligence technique like agent provides better flexibility and usability as compare to others. In this paper we have compared these three techniques in the context of mobility of user interface.

Keywords: Design time technique, run time technique, mobile agent technique

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Information technology and management of diagnostics for analysis of seismic vulnerability in buildings

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Abstract

Ensuring the safety of a building in the event of an earthquake requires analysis of its vulnerability. The analysis is undertaken to evaluate the damage expected in the building for a possible earthquake of pre-established energy. To achieve this, a calculation model has to be prepared, referred to structural and typological characteristics in order to define a cause and effect relationship. This is possible either with in-depth design details or by undertaking diagnostic investigation of existing constructs. At the moment, state-of-the-art technology offers detectors, instruments and diagnosis methods, above all for non-destructive testing, which is user-friendly and will produce extensive information and large amounts of data in a short time. The risk is that excessive amounts of data produced by cutting-edge technology are not followed up with a useful and adequate interpretation of the actual data. It is clear that digital support for optimizing the diagnostic process and, simultaneously, meeting the three fundamental requirements of a diagnostic campaign for the assessment of seismic vulnerability in buildings must:

- gather and systemize a large number of data;
- put together a reasoned collection of recorded data and decisions applied that will be useful in the future;
- guide diagnostics towards the most appropriate investigation method for the specific case.

In short, the use of a digital platform for managing and interpreting recorded data appears applicable to the quality system for a diagnostic campaign, above all if considering the non-destructive type that allows for methodical, systematic knowledge of building heritage so as to obtain the model's timely correspondence with the real world.
A digital platform will be useful in the management of a quality system when applied to action planning (that is to say a set of methods and instruments) within the system, aimed at its definition, achievement, substantiation, demonstration and maintenance.

Keywords: construct, diagnostics, safety, seismic, software, quality, vulnerability

1. Seismic vulnerability and diagnostic procedure

The safety of a building in the event of an earthquake disaster relies on the analysis of its vulnerability. The analysis is undertaken to predict building damage subsequent to a possible earthquake of pre-established energy and it is quantified as a value known as "Index of Seismic Vulnerability." The assessment of seismic vulnerability, independently of the interventions that will subsequently be performed, serves as a survey of existing buildings to forecast the results of a telluric event. To obtain an Index of Seismic Vulnerability a calculation model has to be prepared, applicable to both structural and typological characteristics, to define a cause and effect relationship. The

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calculation model can be obtained either by using technical drawings or by conducting diagnostic[b] observations of buildings by means of destructive or non-destructive tests[c]. Data obtained with destructive tests are more directly related to quantity parameters of structural behaviour, while data obtained with non-destructive tests are not directly comparable to these parameters.

Fig. 1. Castelnuovo di San Pio delle Camere, L'Aquila, Italy (image by author).
(a) Effects of the earthquake on the façade of a residential building in stone and masonry; (b) Effects of the earthquake on the façade of a residential building in stone and masonry.

Fig. 2. San Pio delle Camere, L'Aquila, Italy (image by author).
(a) Effects of the earthquake on the side wall of a stone church; (b) Effects of the earthquake on the end wall of a stone church.

In existing constructs, knowledge of the structure (geometry and construction details) and the building materials (concrete, steel, bricks, mortar) is crucial, and that is why current Italian legislation introduces the concepts of Confidence Factor (FC) and Level of Knowledge (LC)[d].

The Confidence Factor is a safety coefficient that modifies potential parameters according to the level of knowledge of materials properties: the lower the level of knowledge, the greater the weaknesses noted in materials resistance during site testing, reduced because of these factors.

The Level of Knowledge is related to geometry, construction details and materials, classified as:

- LC1, limited knowledge, with typically limited site testing.
- LC2, adequate knowledge, with typically extensive site testing.
- LC3, precise knowledge, with typically exhaustive site testing.

Knowledge levels vary according to available information (readings, crack and deformation situation, load analysis, original structural designs, simulations, visual checks, construction details, etc) and are related to the building materials, which may be in brick, reinforced concrete, or steel.

The LC and FC concepts are aimed at achieving a preliminary reduction of average materials resistance values in

[b] The term "diagnostic" derives from the Greek "dia-ghighnosko", meaning "I recognize by means of.
[c] There are also "slightly destructive" surveys that include surface penetrometer tests, flat jacks and endoscopy, in other words the tests that require small interventions on existing structures.
[d] Chapter 11 of Ministerial Ruling for Civil Protection (OPCM) nos 3274 and 3431, Annex 2.

the existing construct, to be applied in the design or in the verification; they are closely connected and are obtained by diagnostic investigation.

The main feature of a diagnostic test on existing buildings is an analysis using technological equipment to acquire knowledge of material and component performance disruptions. After obtaining this information, and applying a need/performance methodological approach, the building's state of preservation can be linked to the diagnostic investigation (both destructive and non-destructive types).

Fig. 3. Ignazio Silone School, Pescara, Italy (image by author).
(a) External masonry of a combined-structure school; (b) Survey using an IR thermal camera on the same combined-structure masonry.

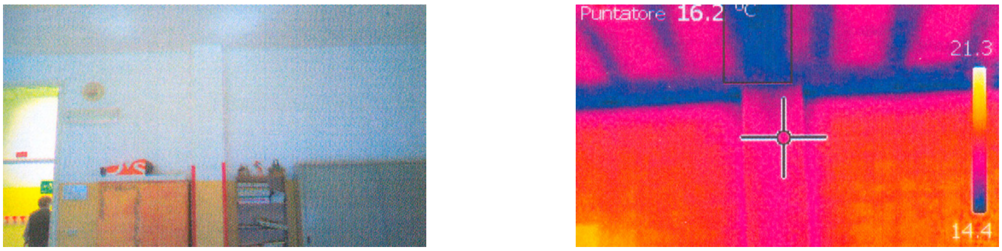

Fig. 4. Ignazio Silone School, Pescara, Italy (image by author).
(a) Floor of a school building in combined structure; (b) Survey using an IR thermal camera on the same combined-structure floor.

Supported by recent technological equipment enhancement, the current trend is to use non-destructive investigations, which may be less invasive on one hand, leaving no traces on the structures (preferable above all when dealing with buildings of historical and artistic significance); on the other hand, the result may be an unmanageable quantity of recorded data or – worse still – misinterpretations of actual data if reviewed in an unsuitable manner. A further issue is the lack of direct correlation between data obtained through non-destructive investigations, referred to quality, and structural behaviour parameters, referred to quantity. The assessment of seismic vulnerability in buildings in conformity with the three levels of knowledge is conducted using both non-destructive and destructive tests, applied respectively and for the following reasons:

- rapid intervention;
- building integrity is safeguarded;
- collected data is easily illustrated in graphs;
- quantity and quality data can both be obtained.
- identification of structural elements not directly visible;
- identification of discontinuities in structural elements;
- verification of physical and mechanical materials properties;
- quantification of damages in affected structures;
- charting of building materials and typologies in areas lacking homogeneity;
- checking typology and quality of recovery interventions.

Fig. 5. Ignazio Silone School, Pescara, Italy (image by author).
(a) Combined Survey: hammer and ultrasonic method; (b) Combined Survey: hammer and ultrasonic method. Detail.

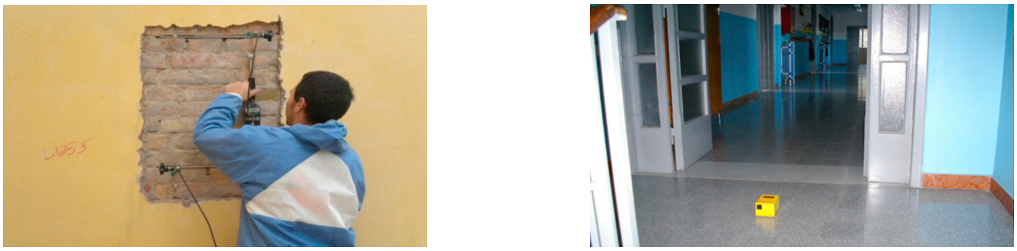

Fig. 6. Largo Madonna School, Pescara, Italy (image by author).
(a) Flat-jack test; (b) Monitoring internal seismic vibrations.

Furthermore, after processing data obtained from non-destructive tests it will be possible to guide any destructive testing that may be required, optimizing the identification of areas for sample taking, thus avoiding the risk of investigating areas that are not typical of the diagnostic scenario envisaged. Moreover, when dealing with an excess of data population deriving from a non-destructive campaign, there is often a failure to follow up with useful and adequate interpretation of this data, so a quality system for diagnostic processes must be adopted to achieve a useful interpretation of recorded data. Thus a campaign of diagnostic investigations must be planned, pursuing a Quality Assurance System, in order to acquire not only organic and systematic knowledge of buildings that offers an accurate association of the model with reality, but also reliable parameters. This will then reduce the various uncertainties and contradictions arising precisely when investigating existing buildings.

The development of a Quality System for diagnostic processes whose aim is to make proper use of data for the assessment of seismic vulnerability is tied to the application of new IT methodologies and solutions for planning and normalized management of the diagnostic campaign.

2. Diagnostic investigation and it support

The preceding arguments make it clear that IT support for optimizing the diagnostic process and, simultaneously, meeting the four fundamental requirements of a diagnostic campaign for the assessment of seismic vulnerability in buildings must:

- gather and systemize a large number of data;
- organize a database of collected results that will be available for consultation at a later date and always be up-to-date;
- assemble a feasible collection of decisions applied that will be useful in the future;
- guide the diagnostician[e] towards the most appropriate investigation method for the specific case.

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[e] At the moment, the figure of the "diagnostician" has still to be officially defined and is usually the engineer appointed to perform vulnerability assessments, while restoration experts are beginning to call in this professional figure.

IT support will serve the application of correct procedures and methodologies intended to reinstate seismic safety in the construct[f], occurring in two ways: the assessment of seismic vulnerability and the structural intervention plan. The intervention plan starts from the vulnerability index of the building, intending to enhance or adjust its seismic resistance[g]. The diagnostic investigation is preliminary to the seismic vulnerability analysis, which is the starting datum for any structural operation: unless there is effective, timely handling of diagnostic data, the seismic vulnerability analysis will be not very reliable or accurate. At the moment, the diagnostic sector makes sporadic, occasional use of IT, while it is to be hoped that this becomes consistent, systematic and standardized, thereby sustaining sector operators requiring storage and management of data related to diagnostic activities and the enhancement/adjustment of the construct's seismic qualities. The first important result of the recourse to IT is precisely the preservation of data. In fact, it is usually very difficult to retrieve information on the diagnostic investigations and structural interventions undertaken in the recent past from the owners or managers of the properties.

Fig. 7. Largo Madonna School, Pescara, Italy (image by author).
(a) Instrument for endoscopic investigation; (b) Extraction of sample cylinder of cement (coring) for laboratory analysis.

To be effective, IT support must first of all be structured in such a way as to distinguish the diagnostic project from the intervention project, as they are distinct in reality, both in timescale and in finance requirements. Moreover, information technology must also embrace historical and static knowledge of the building, and therefore take into account the construction stages, analysis of the original plans, variations in use, morphological modifications (demolitions, superfetations and reconstructions) and detailed surveys (architectural, photographic, material and structural).

Considering the stages of a diagnostic project to be: identification of scope, type of test to conduct, survey campaign, processing of data collected, the IT support must allow optimization of manual procedures and reduction of choice in operations decisions. In particular the support must allow:

- increased efficiency, in other words targeted diagnostic campaigns;
- time saving, in other words faster performance of the survey campaigns;

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[f] In Italy Circular 617 of 2 February 2009 “Istruzioni per l’applicazione delle Nuove norme tecniche per le costruzioni”, pursuant to Ministerial Decree dated 14 January 2008, classifies seismic safety interventions for buildings as “improvement, adjustment, local intervention or repair”.
[g] In Italy Circular 617 of 2 February 2009 “Istruzioni per l’applicazione delle “Nuove norme tecniche per le costruzioni”, pursuant to Ministerial Decree dated 14 January 2008 states "In particular, it is envisaged that assessment of safety will be undertaken each time structural interventions are performed and the assessment will define the construct’s safety level before and after the intervention. The engineer will draw up a specific report to describe existing safety levels and those obtained with the intervention, as well as any ensuing limitations to apply to the use of the building.”

- saving on resources, in other words avoid duplicating existing research traceable in archives[h];
- optimization of operations, in other words avoid futile research unsuited to the problem in hand;
- optimization of solutions, in other words development of mindful, verified actions.

These objectives can be achieved if the IT platform is given a methodological structure, which is to say a trail that excludes casual improvisation and includes self-correcting mechanisms to optimize use. The platform database, which will always be accessible and updatable, must comprise data families that communicate amongst themselves "intelligently" via algorithms and matric formulas that interrelate the different variables that characterize a diagnostic investigation. These variables include the type and quantity of material to analyse, the cost of the surveys required, the complexity of the analysis operations, the issues to be faced, the type of construct and the material used to build it.

In the case of diagnostic investigation for assessment of the seismic vulnerability of a reinforced concrete building, the software will consider financial and instrument resources, and connect the following three data matrices:

- reinforced concrete investigation/residual mechanical characteristics
- reinforced concrete/methods for structural recovery
- residual mechanical characteristics/structural recovery methods.

The implementation of seismic safety measures for the building involves multidisciplinary expertise[i], so it is extremely helpful to be able to use IT support to create a virtual workplace network that fosters cooperation and exchange of information amongst the various figures involved, and where the diagnostic campaign plays a decisive and key role.

At this point there is no doubt that a web-based digital platform is necessary and would serve a dual function as a DP tool and a system tool for managing the intervention.

2.1. It support as a data processing tool

This function meets the needs of the diagnostician (or the professional undertaking the seismic vulnerability analysis) for recording survey data, optimizing survey operations, analyzing possible operating scenarios and assessing alternative procedures, in line with the financial and instrument resources available, as well as the conditions[j] of the construct being analyzed. The software must foresee an updatable database containing:

- the various construction components in different materials (reinforced concrete, various types of masonry, steel etc);
- specifications for survey methods and procedures, with reference to anti-seismic regulations applicable to buildings and public works enforced in the country of reference;
- methods and procedures specifications applicable to structural interventions required as safety measures for the building's seismic risk.

The software should use mathematical functions to interconnect the information stored in these databases, and to connect it to other information including types of innovative materials, diagnostic methods for in-depth investigations, costs for in situ and laboratory tests, preferences for appointed professionals, and the building's social and economic significance. Once these relationships have been developed, the IT support will provide the appointed consultant with indications for choosing the most suitable intervention, which may be accepted, rejected or applied with slightly modified parameters for the overall context. Of course the final choice will be saved in the software and become stored data that is very important for the construct's on-going life cycle.

2.2. It support as an intervention management system

This function meets the needs of various players for managing the diagnostic and intervention project, from the

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[h] Traceability of previous surveys, moreover, also affects research and technological innovation, fostering cultural and teaching exchange.
[i] In these operations, above all when dealing with public buildings, a geologist, structural engineer, diagnostician, specialist and other enterprises, works accountant, engineering management figures from public authorities, site engineers, etc, will all be involved.
[j] Taken to be the state of deterioration or preservation, economic and artistic significance, ease and safety of accessibility.

initial site surveys to the architectural and structural readings, the diagnostic campaign and the completion of works. Thus all the professionals appointed and other staff involved will be informed of decisions taken and kept informed of the tasks they are required to perform.

The software will be web-based and represent an open, implementable system, useful for storing and monitoring past decisions and procedures crucial to the diagnostic campaign and applicable safety measures for the construct, so as to manage the decision-making flow for the entire sequence of operations, as follows:

- site survey reports;
- strategic meeting minutes;
- diagnostic plans;
- intervention plans;
- documents and technical drawings required by current regulations;
- organization of site surveys.

3. It support structure in accordance with the quality system

Having agreed that an organic and systematic knowledge of buildings is needed if a timely correspondence with reality is to be achieved, the next step is to implement a diagnostic campaign that complies with a quality system, avoiding overproduction of analytical data that will never be used as they are not specific to the targeted requirement.

The IT support structure that guarantees the application of a quality system should be arranged in the actual stages of operation shown below:

- survey protocol;
- diagnostic process;
- restitution of data;
- diagnostic assessment.

The quality of the diagnostic process is not composed simply of the sum of these stages, but derives from an integrated system, which is to say the architectural unit. The diagnostic process with IT support can be directed towards a systematic approach in order to develop a transdisciplinary concept for the choice of the typology of testing to be undertaken, the position and type of samples to be analyzed, the instruments to be used and the technological solutions that should meet not only function logic needs but also those of the future relationship with the design, regulatory framework, economic resources, timeframes and the characteristics of the building. Therefore the software must be streamlined and simple so that it serves as a reliable support to a diagnostic process of a systematic type.

3.1. Survey Protocol

This protocol is the means by which a coordinated system of surveys and diagnostic tests is formalized and managed in order to discover the state of performance for the materials and components that make up the building. The development of a diagnostic protocol is essential for understanding the building because, in addition to further information obtained during a preliminary diagnosis, it also enables programming of the diagnostic campaign's quality system. In other words, this procedure will support the selection of appropriate technological instruments and types of analysis for avoiding duplication and overlaps that create confusion in the data, with erroneous results, as well as wasting time and economic resources. Finally, since the protocol is a tool for managing and controlling performance characteristics information, it should permit agile communication between the various figures involved, contributing to quality management, not only for the diagnostic investigation, but for the entire operation that follows.

3.2. Diagnostic process

This process comprises there substages: exploratory, pre-diagnostic and diagnostic. The data and information collected during each step will be used to evaluate the building's residual performance capabilities, allowing recognition and quantification of the relationship between performance loss and causes.

The exploratory substage is a joint inspection conducted by the engineers and the client, to note the initial impressions, existing documents and limitations, and is useful for understanding how the building operates as an entity, as well as planning subsequent stages. In the event of an earthquake, vulnerability assessment will be required and this inspection is extremely important.

The pre-diagnostic substage is a survey performed by a diagnostician with the assistance of technicians who conduct the elementary building surveys useful for preparing an initial performance quality finding.

The diagnostic substage is a task performed by survey technicians for exploring the performance analysis and retrieving more detailed quantity data for preparing a survey protocol.

3.3. Restitution of data

This operation involves all the transcription of information acquired during the diagnostic campaign to correlate symptoms, seen as visible manifestations of a pathology, with the underlying causes. As far as the quality and quantity assessment of symptoms is concerned, the acquired data play a key role for negating or affirming the pathological nature of a phenomenon observed during pre-diagnosis. It is evident that during this stage it is very important to proceed with a clear and immediate graphic rendering, comparable to that produced according to the investigation protocol. To foster data readability and avoid ambiguity and difference in interpretations, the graphic rendering must be characterized by colours and symbols normed as required by UNI and Normal technical standards.

3.4. Diagnostic assessment

This operation is the set of considerations and interpretations of data gathered during the survey campaign, as determined by the diagnostic protocol, and recorded with the help of graphics. The assessment begins with the selection of information relevant to determining the performance status of materials and systems involved in the construct, whose characteristics and anomalies were found during pre-diagnosis. The assessment procedure varies depending on the type of building information requested, including:

- analysis of building system deterioration;
- determination of the causes of damage and anomalies;
- determination of the level of damage subsequent to an earthquake;
- planning support for structural recovery;
- determination of seismic vulnerability.

Given the importance of assessing the seismic vulnerability of architectural structures in terms of saving lives and protection of artistic heritage, the use of information technology to promote the adoption of quality systems in diagnostic studies is extremely desirable.

4. Conclusions

Obtaining data that will be useful for assessing the seismic vulnerability of buildings can be achieved through safe, coordinated and combined actions performed by the body appointed to conduct the research, with meticulous planning and management of the diagnostic campaign. This pathway should be undertaken bearing in mind the end result, compliance with timeframes, resources available and reliability of results. The last aspect is of fundamental importance because when assessing seismic vulnerability of buildings and developing an intervention plan, a datum misrepresented by a technical error caused by a person or a procedure can lead to inaccurate prediction of a building's reactions to an earthquake, which would pose a high risk for public safety. So, obviously, it is important to control the diagnostic process, not only for precise assessment of seismic vulnerability, but also for timely implementation of building safety measures.

IT support must be able to guide appointed professionals in the direction of optimal choices and proceed with the most suitable solutions for each case under examination, sidestepping habitual procedures which tend to consider only what is already familiar. The entire diagnostic investigation, from the survey to the variations during work in progress, will be considered, assessed and shared with all the players involved, who will be checking the advancement of operations, verifying that the diagnostic campaign is conducted appropriately for theses aspects: samples taken in situ, laboratory tests, compliance with current legislation, technical operations, contingency controls, data handling, etc.

In short, the use of a digital platform for managing and interpreting recorded data is applicable to the quality system for a diagnostic campaign, above all in consideration of the non-destructive type that allows for methodical, systematic knowledge of building heritage so as to allow for the model to be consistent with reality. A digital platform will be useful in the management of a quality system when applied to action planning (that is to say a set of methods and instruments) within the system, aimed at its definition, achievement, substantiation, demonstration and maintenance.

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