

## MONITORING AND PREDICTION OF CULTURAL HERITAGE ARTIFACTS CONSERVATION STATUS

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### ABSTRACT

*This paper presents the development of multi-dimensional data mining algorithms for condition monitoring and decision support in evaluating the status of a historical building. It presents a complex network of sensor and data collection over a period of time in order to describe the evolution of the material and object's structure, in terms of microclimate conditions on the material, as well as induced changes. The investigation puts together several specific signal/image processing techniques in order to extract relevant measurements/features from the raw data.*

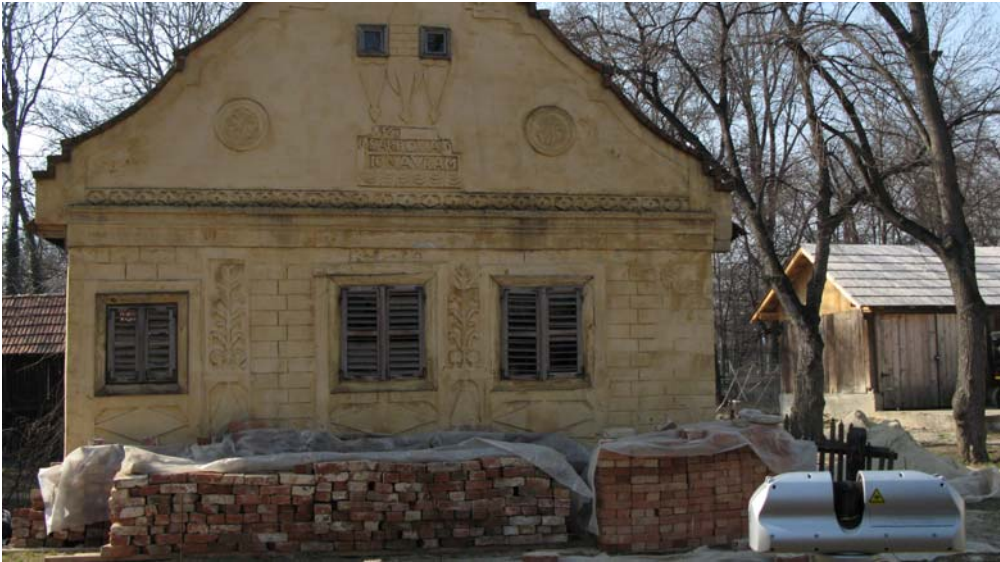
The work presents the implementation of a complex system of imaging techniques applied as an integrated structure for the first time. This techniques are: *Infrared Thermography* – for the identification of the variation of emissivity of the surfaces offering information regarding the variations of plaster structures, the lack of cohesion of layers or the presence of water in the walls, *Laser Induced Fluorescence Surface Scanning* – for the molecular characterization of different materials from the composition of the colored plasters, *3D Laser Scanning* – for the high definition 3D reconstruction of surfaces, *GPR - Ground Penetrating Radar* – for the structural and material characterization of the foundations and structures of masonry and for the identification of the artefacts from the ground and monitoring of microclimate factors performed by emplacing the monitoring networks for RH and temperature. The results of this complex system will be interpreted for the first time using a unitary method of investigation, analysis and diagnosis which will allow the establishment of prediction criteria regarding the evolution of the conservation status of a monument or an object having a heterogeneous multilayer structure depending on the environmental factors and his physical and chemical and structural composition.

The results of this complex system will be interpreted for the first time using a unitary method of investigation, analysis and diagnosis which will allow the establishment of prediction criteria regarding the evolution of the conservation status of a monument or an object having a heterogeneous multilayer structure depending on the environmental factors.

These applications can be applied on different areas, industrial medicine or biology. Can also be used for identification in the production process. The following advantages have be emphasized: no remarkable intrusivity, remote measurements, high sensibility and portability. The application to historical buildings is more recent and looks like a promising domain. Some methods can also detect humidity on large surfaces that is of fundamental importance for understanding the environment driven deterioration processes.

The direct beneficiary of this project is any operator from the cultural heritage conservation area and even the monuments subjects to experiments during the project. The purpose of the project implies taking the heritage conservation techniques on a superior level, offering this way a balanced way of redundancy and measurement errors elimination, a precise mode of order through hierachization of advanced and traditional techniques for putting in correspondence the initial conservation status of an object, the status expected to be obtained

after the intervention and application of the methods and instruments in order to achieve the expected status. The project proposes a set of the latest new technologies international wide available as transferable services through a specialized training to the final user. More than that, it offers their integration in an innovative system of management for the entire process. This system adds value to the project, granting also a final result estimation using logical complex methods of prediction, estimation made before the intervention to eliminate the risk situations. Therefore the project proposal considers the optimization of the interventions by lowering the risk at which a monument is exposed to and improves the quality of decision.



*3D laser scanning of the main facade of Sarbova House, National Village Museum "Dimitrie Gusti"*



*a)*

*b)*

*Digital representation the main facade, a) mesh representation, b) Cloud of points representation*



*A detail from the upper part of the facade, mesh visualization, medium resolution: 1 mm*

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