The Role of Digital fixation of Monuments in the Management of Museum Documentation

Malkhaz Lekveishvili [1], Nino Chachava [2], Aleksandre Giorgobiani [3], Nana Lekveishvili [4]

1 – President of NINCLP Engineering Idea; info@e-idea.ge
2 – Architect, Associate Professor of Georgian Technical University; n_chachava@gtu.ge
3 – Architect, Restorater, 3D Scanner Engineer; alexandregiorgobiani@gmail.com
4 – Chief Architect, Ministry of Defense; naniko.lekveishvili@gmail.com

In the given research, we attempted to describe our experience in the field of fixing, processing and transferring information regarding a monument by using digital technologies, to demonstrate its significance in the context of functioning of museums, their future development and safety.

Since a scanned document represents indexed and coordinated unison of points, in the essence, it embodies digital archive and its analogue can be used among the methods of maintaining museum exhibition units.

Several key components are involved in the process of scanning: a 3D laser scanner, a high resolution digital camera, a monument, a station of copying, environment, etc (Pic.1,2).

Pic. 1. Scanning Process. Oshki, Turkey.
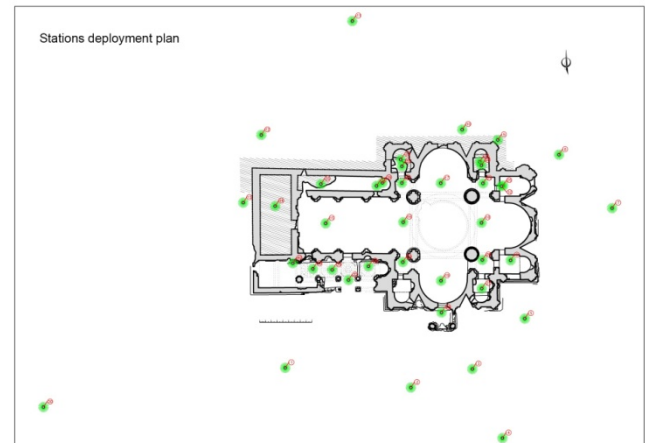
Pic.2. The scheme of stations and their distribution

The environmental component includes conditions of temperature, shading, air freshness, and maximum visibility; a monument represents the most important object of information research; with the high resolution digital camera, the monument is fixed photo-realistically on a flat surface in a bitmap format, while with the 3D laser scanner, the information is fixed in a way of vectors in the X, Y, Z coordination space of the points determining the visual of the monument.

During the digital fixation of the monument, a station of copying represents a place, which determines the angle, informationality, and quality of copying. The more such stations, the more the information about the research object becomes.

Documental material received by the way of digital fixation of documents represents a cloud of points, which is interesting for the museum space in its own accord, since it represents descriptive information about the object (Pic.3,4).
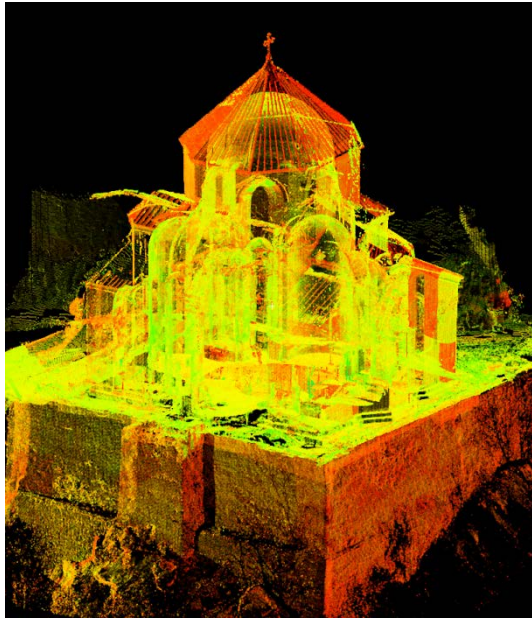
Pic.3. Point Cload. Full Registration.
Ateni Sioni,
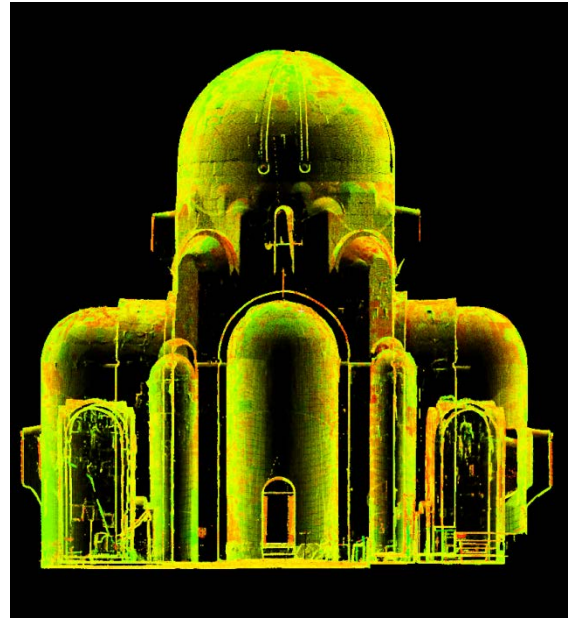
Pic.4 Point Cload. Interier.
Ateni Sioni.

This process may be represented as fragmented information, which is systematized after processing.

As a result of systemizing scanned and photographed material, it becomes possible to receive a three-dimensional model of the monument.

Throughout the time, the monument changes its appearance, due to its age, environmental conditions (such as fire, earthquake, climate changes, erosion, tornados, etc.) and human impact. Therefore, the scanned material represents a unique document, since it captures the state and appearance of a monument in a specific moment of time.

As a result of ten-year experience, we have accumulated vast informative material concerning digital fixation and processing of received information, established a system of making catalogues and searching information, which made it possible to store, systemize, fragment and identify information received by laser scanning – cloud of points, photo materials and other information related to the process (Pic. 5,6,7).

Pic.6. Raster Image . Sheki, Azerbaijan

Pic.7. Vector Image. Sheki, Azerbaijan
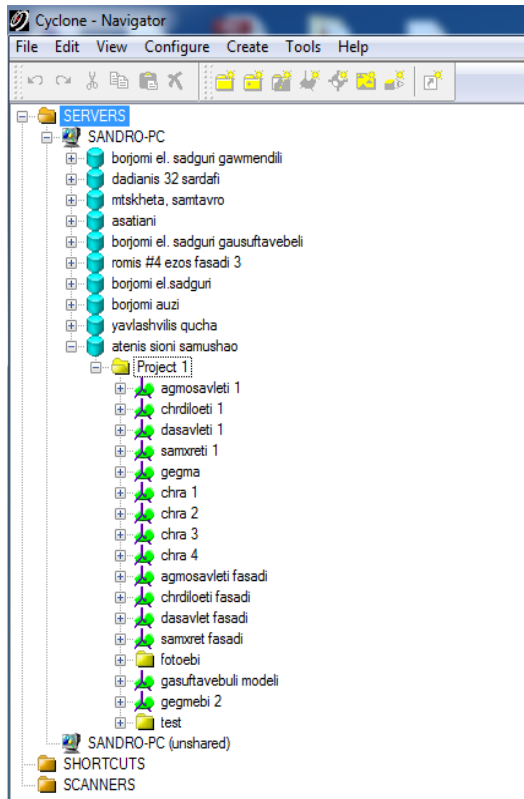
Pic.5. Database of Point Cloud Information,
Cyclone application.

Scanned material covers vector and bitmap types of information which is processed by different programs (Pic. 6,7). Therefore, for such situations, it is possible to use AutoCAD working interface as a draft platform for such system, since the former provides the best access to the above-mentioned information and various types of files (Pic.8.).
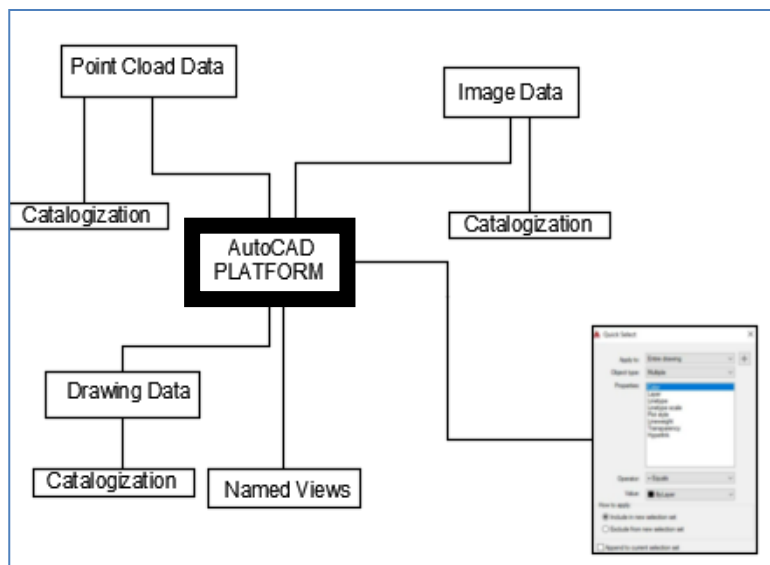

Pic.8. AutoCAD Platform for metadata organization

It is to be noted that organizations such as ours use only the part of scanned information which concerns our research object. The remaining information, which stays out of register and can be environment-describing factors or artifacts, stays unused or is fully lost or deleted from the database.

In case of interest from the museums, stations of copying and information attached to them can be identified and handed in as a complete archive material.

Therefore, the necessity of cooperation is evident between museums and such kind of professional organizations that are linked to the collection of information concerning historical monuments and artifacts, such as – scientific-educational institutions, photo laboratories, monument protection organizations, etc. This process creates the Interactive collaboration model (Pic.9).
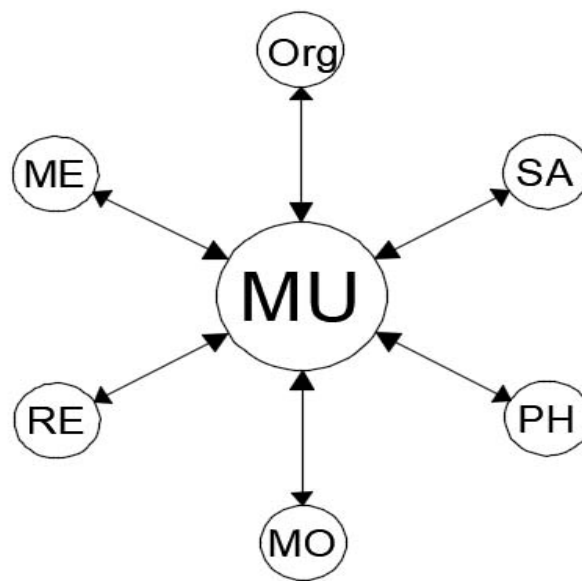
MU – Museums
Org – Organizations collecting the Information about the Monuments
SA – Scientific-Educational Institutions
PH – Photo labs
MO –Monuments protection Governmental Organizations
RE – Organizations working in Reconstruction, Rehabilitation and Restoration Works
ME – Media Sources, TV
It is to be noted, that previously it posed a great difficulty (or was impossible) to transfer information acquired by various organizations to the museums. As a result of development of digital technologies, it became possible and became easier to share and transform information within museum space and archives.

Pic.9. The Scheme of Possible Interactive Collaboration.

At the stage following fixation, systemized information is modeled and photo-realistic processes is modeled by special computer programs, where cloud of points is garmented with existing texture, facture and color, enables fixed information about monument to be transferred to and exhibited in the museum space (Pic.10).
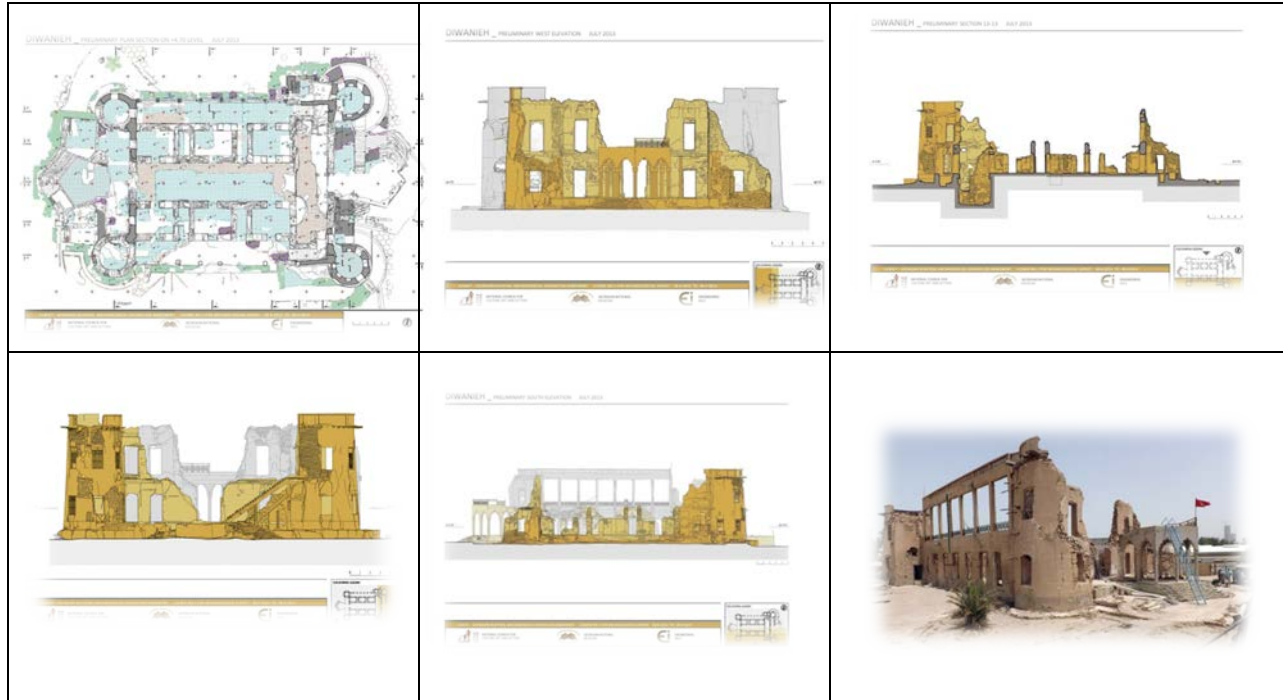
Pic. 10. Secondhand usage of Drawings, for museum archives., El Diwait. Kuwait.

At the final stage, we make a digital reflection of the model of the monument in its natural environment. This way, access to the museum space can be increased, which implies its virtual transfer in the authentic location of the monument.

The generated digital documentation can be used in various ways, including for structuring and expanding digital archive; i.e. storing of generated digital documents in possible in three positions – initial information, systematized information, reproduced photo-realistic information (Pic.11,12,13).

Pic.11. Virtual, digital Copy of Wall Painting.   Point cloud. Vardzia, Georgia

Pic.12. Virtual, digital Copy. Fragment. Point cloud

Pic.13. Pint cloud. Elavation of the Drum Surface. Patara Sameba. Tbilisi.

Pic. 14. Point cloud. Photorealistic image,. Holy Mother Georgian Monastery. Cyprus.

At the last stage the virtual model is fulfilled with the landscape and its components. Which shows the possibility of monuments virtual placement to their native location, as the pattern of   mobile museum (Pic.15).
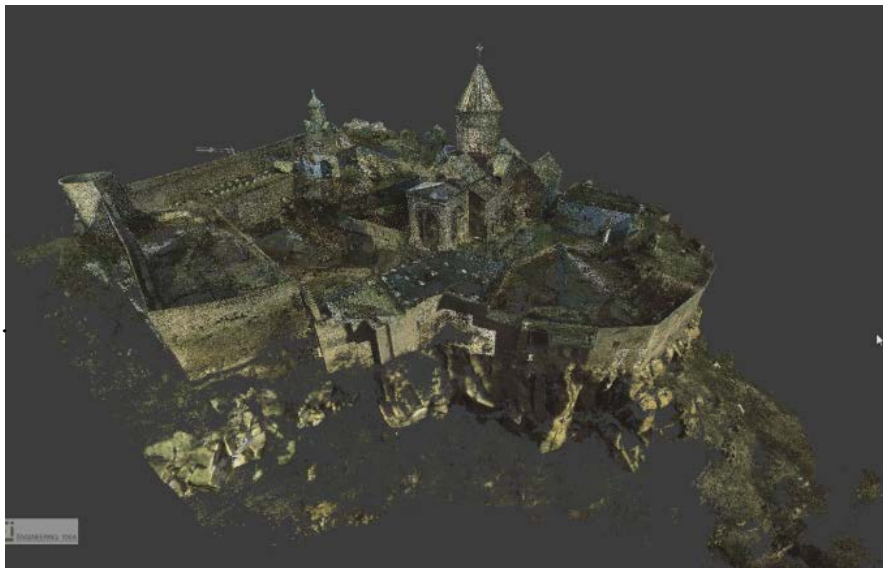
Pic. 15. 3D Vector Image. Point Cloud. Model of Mobile Museum.
Tatev Monastery, Armenia.

The digital documentation can be used in other directions of museum work:

- Scientific work
- Educational work
- Communication with scientific and educational systems
- Advertising, commercial work
- Monument catalogue-making and works on their improvement
- Management of restoration works
- Research-demonstration works
- Mobile museum.

Complex usage by museums of the archives of presented organizations and co-sharing strategy will take museum work on a new level of development, will increase its potential, will support expansion of museum space, as well as information exchange and collaboration, expansion of target groups, work planning and management.