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## **SECTION: ARCHITECTURE AND CONSTRUCTION**

### **PRESERVATION OF THE ARCHITECTURAL HERITAGE OF UKRAINE USING 3D SCANNING METHODS**

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The problem of preserving Ukraine’s architectural heritage is more urgent than ever before. As of July 26, 2023, UNESCO confirmed the destruction or damage to 281 cultural heritage sites in Ukraine: 118 religious buildings, 103 historical buildings and cultural institutions, 19 monuments, 27 museums, 13 libraries, and one archive.

The criteria for the degree of destruction of architectural monuments include the following:

Destroyed – those that require construction work, new design of the building, reconstruction of the institution on another territory, on the basis of another building.

Partially destroyed – those that require major repairs, restoration of the façade, and re-roofing.

Damaged – those that continue to function, with some damage repaired; have retained their integral appearance and interior content; need restoration and cosmetic repairs.

If the second and third criteria can be solved by restoration and recovery methods, what about the first? Given the current trends in technology, it is advisable to use new methods of preserving architectural monuments. It is important to document important Ukrainian monuments in time so that in case of their destruction, they can be restored using 3D models.

What are the methods of realizing reproducing architectural heritage in digital format? There are two main ones. Laser 3D scanning is a surveying system that measures the distance from the scanner to the points of an object at a fairly high speed and registers the corresponding directions, followed by the creation of a three-dimensional image in the contour of a point cloud. The advantages of laser scanning include high measurement accuracy and fast data collection: the scanner can capture large amounts of data. Among the disadvantages is the cost of the necessary equipment to perform this technique. Photogrammetry is a technology for obtaining

geometric information about objects and surfaces from images taken with cameras or other sensors. When scanning using this method, special programs are used that analyze a set of photos and automatically determine the points of common orientation used to create three-dimensional models. Among the advantages are relatively low costs – photogrammetry can be performed with a regular camera, unlike laser scanning. Also, instead of transporting scanners, all you need is a camera and a tripod.

These technologies help to measure and reproduce physical objects in a digital format. Of course, each of them has its own advantages and disadvantages, so when choosing a method, you need to take into account specific requirements. The best result is obtained by combining both methods and using all possible advantages. This option is the best because it allows you to get results that display detailed and accurate geometry with high resolution textures.

Successful examples of the use of 3D scanning techniques:

The team of the Lviv-based Skeiron bureau has been digitizing Ukrainian heritage for more than eight years, and during this time they have managed to digitize St. Sophia Cathedral, St. Nicholas Church, Chernivtsi University, the Golden Gate, the Energetik Palace of Culture in Prypiat, and more.

The team initiated two heritage preservation projects — #SaveUkrainianHeritage and #SaveMariupolHeritage.

The goal of the #SaveUkrainianHeritage project is to 3D scan cultural monuments throughout Ukraine, wherever circumstances allow, to preserve and conserve heritage. As part of the project, such sites as the Dominican and Armenian Cathedrals, St. George's Cathedral in Lviv, Chernivtsi National University, and many other sites have been scanned.

#SaveMariupolHeritage – as part of the initiative, the team is developing 3D models of damaged buildings in the city of Mariupol, including the Mariupol Drama Theater. These models will help preserve information about the condition of the monuments and support restoration work in the future.

To summarize, laser scanning and 3D scanning techniques are currently the most advanced technologies in the field of restoration and renovation of architectural heritage. Supporting initiatives that contribute to the preservation and popularization of architectural monuments is quite relevant in today's environment.

### References

1. #Save Ukrainian Heritage. Support 3D scanning Ukrainian monuments. URL: <https://skeiron.com.ua> (date of application: 10.05.2024).
2. Damaged cultural sites in Ukraine verified by UNESCO URL: <https://www.unesco.org/en/articles/damaged-cultural-sites-ukraine-verified-unesco> (date of application: 10.05.2024).
3. В Україні створили «Мапу культурних втрат» під час війни URL: <https://cases.media/news/v-ukrayini-stvorili-mapu-kulturnikh-vtrat-pid-chas-viini> (date of application: 10.05.2024).