



INNOVATIVE USE OF MOBILE LASER SCANNING IN DESIGN AND RECONSTRUCTION OF OBJECTS

Kubaymurodov Davron Ilyasovich

Master

Iskandarov Erkin Burievich

Associate Professor

Tulyaganov Zafar Sunnatovich

Tashkent University of Architecture and Civil Engineering

<https://doi.org/10.5281/zenodo.14759936>

Abstract. The article discusses the application of mobile laser scanning (MLS) technologies in the design and reconstruction of construction industry facilities. The main stages of MLS operation, its advantages and areas of application, as well as the prospects and challenges associated with the implementation of this technology are discussed.

Keywords: mobile laser scanning (MLS), design, reconstruction, architectural heritage, point clouds, 3D modeling, technology, automation, monitoring, photogrammetry, digital models, data, innovation, construction industry, urbanization

Introduction . Modern technologies significantly change the approach to designing and reconstructing objects in the construction industry. One of the most promising areas is mobile laser scanning (MLS), which ensures high accuracy and efficiency in collecting data, analyzing it and modeling. MLS is used in designing new objects, reconstructing buildings and restoring architectural monuments.

How Mobile Laser Scanning Works

MLS is based on the use of laser pulses to measure distances between the scanner and the object. Devices such as the SinoLs300 are equipped with lasers, GPS sensors, and inertial systems (INS) to scan objects in high detail and link the data to coordinates. The main steps of MLS include generating a laser pulse, measuring the response time to calculate distances, and creating a point cloud that describes the shape of the object (Zhang & Li , 2017).

Benefits of MLS for the Construction Industry

One of the main advantages of MLS is the increased accuracy of design. Point clouds form the basis for the creation of highly accurate 3D models, which allows errors in design documentation to be identified before construction begins. In addition, MLS helps save time and resources by quickly processing large volumes of data and reducing the costs of automating routine tasks (Vosselman & Maas , 2010).

Applications of MLS

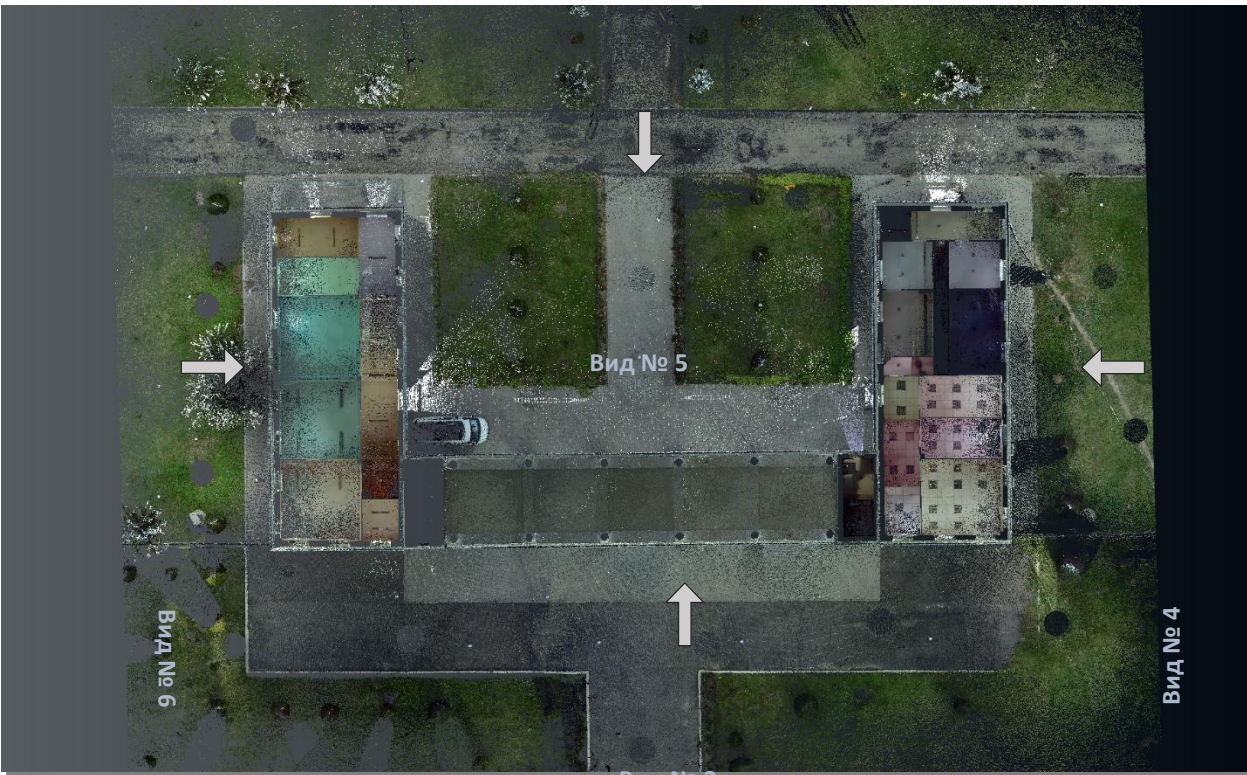
MLS is widely used in various fields. In the design of new objects, technologies allow the creation of digital models of sites and territories. In the reconstruction and restoration of historical monuments, MLS is used to accurately record the current state of objects and analyze their deformations (El-Mekawy & Khedher , 2018). Mobile laser scanning technologies are also used in monitoring construction sites and cartography (Rutzinger & Soergel , 2011).

Innovative technologies and MLS functionality

MLS integration with photogrammetry allows combining laser scanning data with aerial photography to create textured models. Cloud technologies provide processing and storage of large volumes of information, which allows project participants to access data in real time.



View No. 1. Axonometry of the building



View No. 2. Plan





View #3. Front facade of the building, created using 3D results scanning



View #4. Side facade of the building, created based on 3D results scanning

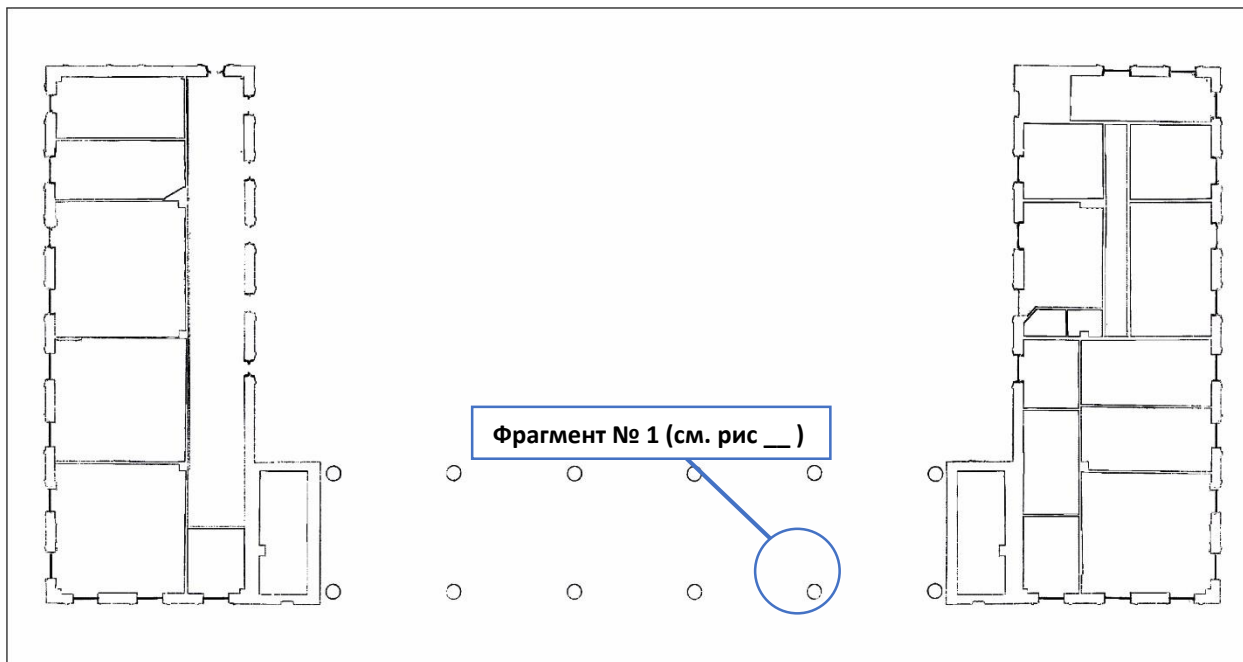


View #5. Rear facade of the building, created using 3D results scanning

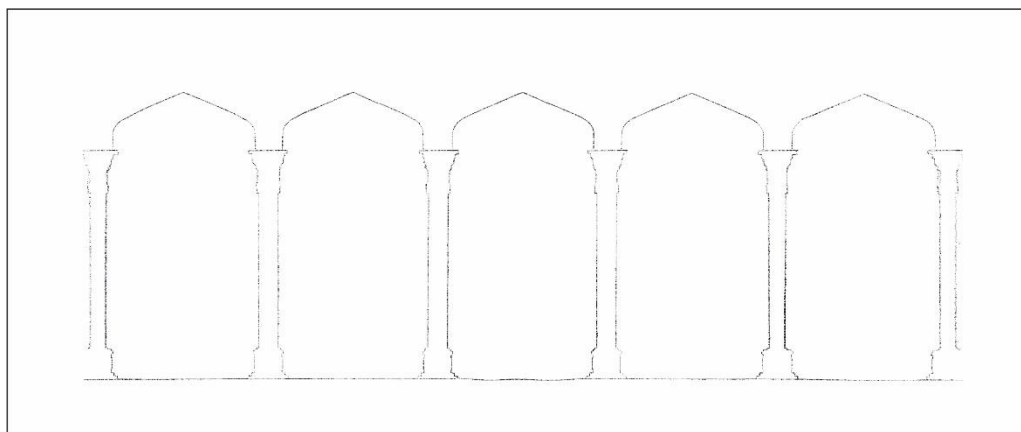




View No. 6. Side facade of the building created using 3D results scanning

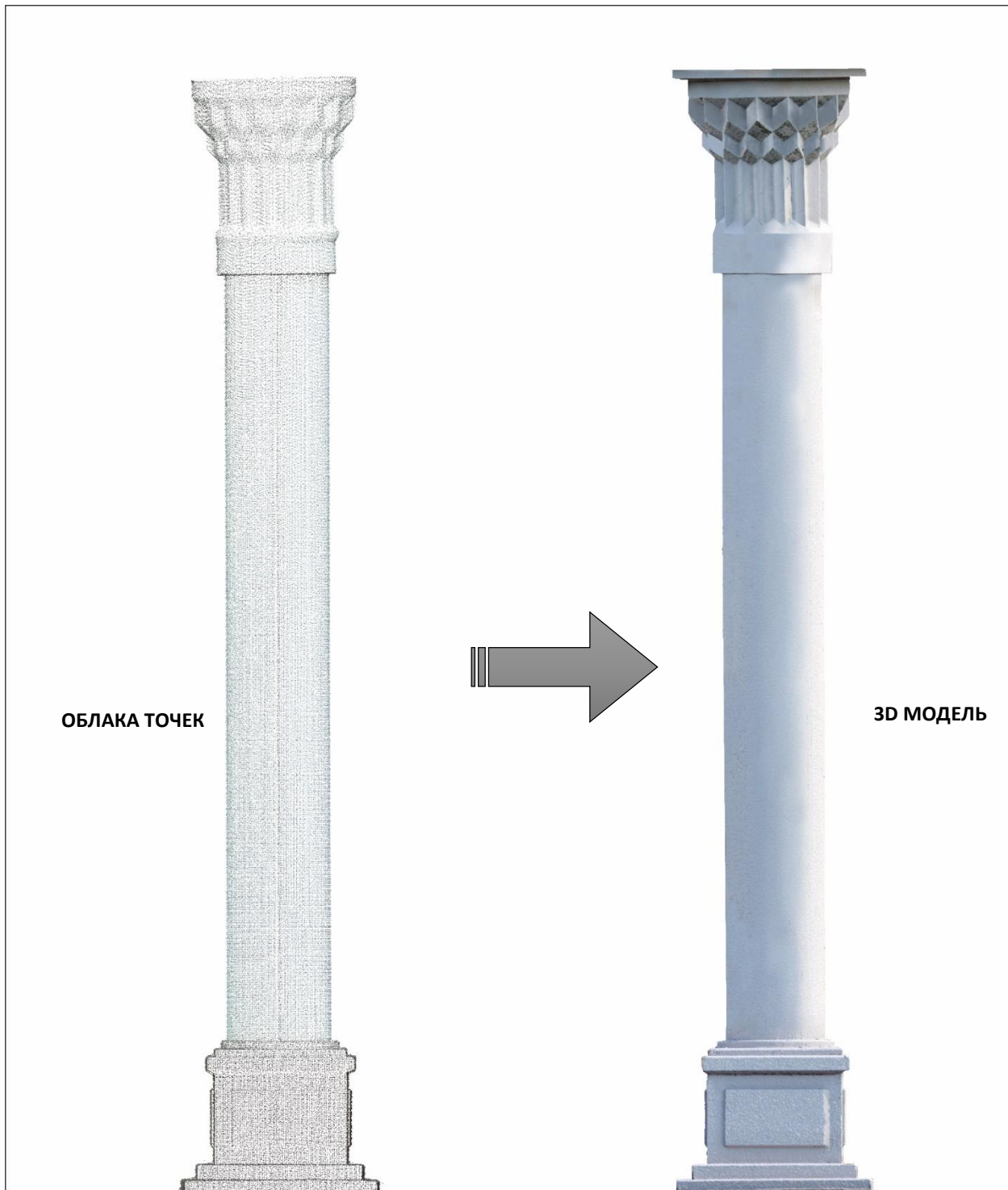


Orthomosaic at elevation. 2500 mm. (floor level ±0.000 mm). M 1 :300



Section of arches created from point cloud based on 3D results scanning





Fragment No. 1. Construction of a 3D model of a column from a point cloud based on laser scanning results

Limitations and challenges of MLS implementation

Despite its many advantages, MLS implementation is associated with certain limitations. The high cost of hardware and software, as well as the need for staff training, can be significant barriers to its use. In addition, MLS requires large amounts of data and complex information processing systems to operate accurately.

Conclusion. Mobile laser scanning (MLS) is a revolutionary technology that can significantly improve the design and reconstruction processes of objects in the construction industry. The use of MLS allows achieving high accuracy and efficiency in collecting and

analyzing data, which in turn contributes to the creation of detailed 3D models and minimization of errors at the design stage.

Despite its many advantages, such as saving time and resources, and the ability to integrate with other technologies, the implementation of mobile laser scanning faces certain challenges. The high cost of equipment, the need for training specialists, and the requirements for processing large amounts of data may become obstacles to its widespread adoption.

However, given the increasing urbanization and increasingly complex engineering challenges, the use of MLS is becoming not only relevant but also necessary for the successful development of the construction industry. The future of mobile laser scanning technologies promises new horizons in design and reconstruction, making them an important tool in the hands of modern architects and engineers..

References:

1. Zhang, J., & Li, Y. (2017). "A review of mobile laser scanning technology and its applications in civil engineering." *Automation in Construction*, 76, 1-12.
2. Vosselman, G., & Maas, H.-G. (2010). "Airborne and Terrestrial Laser Scanning." Whittles Publishing.
3. El-Mekawy, M., & Khedher, L. (2018). "Integration of mobile laser scanning and photogrammetry for 3D modeling of complex structures." *International Journal of Advanced Computer Science and Applications*, 9(5), 345-352.
4. Rutzinger, M., & Soergel, U. (2011). "Mobile laser scanning for the documentation of cultural heritage." *ISPRS Journal of Photogrammetry and Remote Sensing*, 66(6), 781-790.
5. Kato, H., & Billingham, M. (1999). "Marker tracking and HMD calibration for a video-based augmented reality conferencing system." *Proceedings of the 2nd IEEE and ACM International Workshop on Augmented Reality*, 85-94.
6. Кубаймуродов, Д., Искандаров, Э. Б., & Тулаганов, З. С. (2025). ТЕОРЕТИЧЕСКИЕ ОСНОВЫ ИННОВАЦИОННОГО ПРОЕКТИРОВАНИЯ В СТРОИТЕЛЬНОЙ ОТРАСЛИ. В *INTERNATIONAL BULLETIN OF APPLIED SCIENCE AND TECHNOLOGY* (Т. 5, Выпуск 1, сс. 38-41). Zenodo.

