PRACTICAL APPLICATION OF 3D SCANNING TECHNOLOGY IN THE VIRTUAL EDUCATION AND MAINTENANCE TRAINING OF MARINE EQUIPMENT

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ABSTRACT

3D scanning is an advanced technology that enables precise digital representation of physical objects and environments in three-dimensional form. By collecting spatial data from object surfaces and generating point clouds, it allows the creation of accurate digital 3D models suitable for analysis, inspection, and manufacturing applications. Compared to traditional measurement methods, 3D scanning provides higher precision, faster data acquisition, and non-contact digitization, which is especially important for sensitive or complex structures.

This paper presents the fundamental principles of 3D scanning technology and examines its application in modern engineering and industrial processes. Special emphasis is placed on quality control, reverse engineering, product development, predictive maintenance, and integration with CAD/CAM systems and additive manufacturing technologies. The role of 3D scanning in digital twin implementation and production process optimization is also discussed.

The idea of this work is the application of the Spider 3D scanner and Artec Studio software for the digitalization of large and complex ship equipment, enabling students to virtually study maintenance, servicing, and measurement procedures without physical access to the equipment. Such a system ensures continuous availability, requires minimal physical space, does not demand specialized tools, and reduces training costs. Its main limitations include the initial system setup and the number of available VR headsets.

The study highlights the advantages of 3D scanning in improving product quality, reducing development time, and increasing manufacturing flexibility and competitiveness. Despite initial investment costs, 3D scanning represents a key technology of Industry 4.0 with significant potential for further development and industrial integration.

Keywords: 3D scanning, reverse engineering, quality control, CAD/CAM, digital twin, Industry 4.0, virtual training.