SOME ASPECTS OF 3D SCANNER DEVELOPMENT

Nosyk A. M.
National Technical University «Kharkiv Polytechnic Institute», Kharkiv

A 3D scanner is a device that analyzes a real-world object or environment to collect data on its shape and, if possible, color. The collected data is then used to build digital three-dimensional models (3D models) [1].

This report discusses a list of technical problems that arise when creating a 3D scanner to accurately display the geometry and texture of real objects in three-dimensional space.

When creating a 3D scanner, the following should be considered:

1. Choosing equipment. Selecting the appropriate sensors and equipment (cameras (RGB, depth measurement, or stereo), laser scanners, structured light systems, or ultrasound), depending on the application requirements;

2. Calibration. Ensuring accurate alignment and calibration of all components for accurate reconstruction, which includes calibration of internal parameters (such as focal length, lens distortion) and external parameters (position and orientation relative to each other);

3. Data collection. Development of algorithms that are designed to determine the best scanning strategy when scanning from one or more angles, as well as to reduce the effects of occlusion, reflection, and noise;

4. Depth estimation. Estimating the depth or distance to points on the surface of an object. For this purpose, 3D scanning methods such as triangulation, time-of-flight, structured light or stereo vision are used;

5. Surface reconstruction. Converting the acquired point cloud or depth data into a coherent 3D representation of the surface by

6. Displaying texture. Information about the color or texture of a 3D model can be obtained by integrating texture data onto the reconstructed surface and using methods of ultraviolet reflection or image projection onto it;

7. Leveling noise and artifacts. Application of filtering methods, algorithms for removing outliers or surface reconstruction methods;

8. Selecting computer hardware (computational efficiency). Development of algorithms sufficient for processing large data sets in real or near real time during 3D scanning and prototyping;

9. Developing a user interface and its integration. Integration of the scanner with other software or hardware systems, depending on the application.

In general, creating a 3D scanner involves a combination of hardware expertise, mathematical algorithms, and software development skills to meet these challenges and create accurate, reliable, and user-friendly scanning solutions.

References:

1. Nosyk A. M., Tieploukhov D. E. Some aspects of contactless 3D scanning of objects // XI International scientific conference "Information Problems of Acoustic, Radioelectronic and Telecommunication Systems Theory (IPST-2022)". – Kharkiv, 2022. – pp. 17–20 (in Ukrainian).