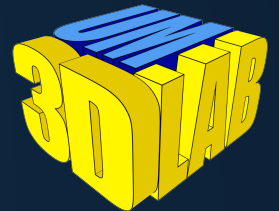


3D Scanning

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What is a 3D Scanner?



A 3D scanner is a device that analyzes real-world objects to collect data on its shape and possibly its appearance (wiki). The scan data can then be used to construct a digital 3D computer model with measurable properties such as length, width, height, volume, feature size and location, surface area, color, and density.

3D Scanner Technology



3d scanners come in a wide variety of shapes and sizes, each with unique capabilities and limitations. 3d scanners can be broken down into 3 basic types:

- Contact
- Non-Contact Active
- Non-Contact Passive

Contact 3D Scanners



Contact 3D scanners use a probe to physically touch points of interest on the objects surface. The scanner is mounted to a fixed surface, while the object it is in contact with rests on a flat surface or is held firmly in place by a fixture. The manufacturing industry uses highly accurate contact scanners known as coordinate measuring machines (CMM).

Non-Contact Active



Active scanners emit some kind of radiation or light and detect its reflection or radiation passing through object in order to probe an object or environment. Possible types of emissions used include light, ultrasound or x-ray (wiki).

Non-Contact Active Types



Time of Flight (TOF)- Resolves the distance to a point based on the speed of light. Light Detection and Ranging (LiDAR) is a common TOF 3d scanner that quickly measures the distance to millions of laser emitted points.

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Triangulation

Conoscopic Holography

Structured Light

Modulated Light

Computed Tomography

Microtomography

Non-Contact Passive



Passive 3D imaging solutions do not emit any kind of radiation themselves, but instead rely on detecting reflected ambient radiation (wiki).

Photogrammetry, a solution that uses visible light, is an example of a passive 3D imaging. Computers use 2D digital photos to reconstruct an object in 3D by comparing common points taken from different angles. Other types of radiation, such as infrared, could also be used.

Non-Contact Passive Types

- Stereoscopic
- Photometric
- Silhouette

3D Scanner Application

Construction and Civil Engineering



The construction and civil engineering sector uses 3d scanners to document changes for final as-built drawings. 3d scan data can also be used to monitor structure deformations and movement.

3D Scanner Application

Quality Assurance and Industrial Metrology



3d scanners can be used to ensure parts are within tolerance. Manufacturers will use 3d scanners to capture millions of points of interest and compare that to the original CAD data.

3D Scanner Application

Entertainment Industry



In a process known as photogrammetry, an ultra realistic animated game teaser for Cyberpunk 2077 was created by 3d scanning actors using an array of high resolution digital cameras. The 3d scans were modified in a modeling and animation application to fit the games theme.

3D Scanner Application

Reverse Engineering



Designers and engineers can use 3d scanners to capture the shape of an object. Highly accurate 3d scan data is used to design new parts with very tight tolerances, such as the yellow protective cover in the pelican case, to keep the harsh elements of Greenland away from sensitive electronics.

3D Scanner Application

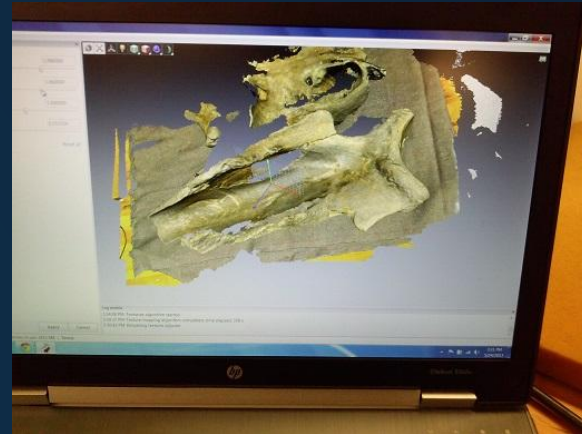
Medical / Dental



In the medical field 3d scanners are used to capture the geometry of complex structures in the human body. The data can be used for surgical planning, evaluation of medical procedures, or the custom fabrication of patient specific medical apparatuses, such as this 3d printed bronchial stent used to save the life of an infant at the University of Michigan Mott's Children's Hospital.

3D Scanner Application

Digital Preservation



3d scanners can be used to digitally reconstruct fragile objects, such as fossil remains, and to document historical sites. 3d scan data can then be used to analyze complex surface structures without damaging the original object.

Construction of a 3D Model

- From point clouds
- From models
- From a set of 2D slices
- From laser scans

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