

# 3D Scanning Technology



A 3D scanner in action (source: Artec)

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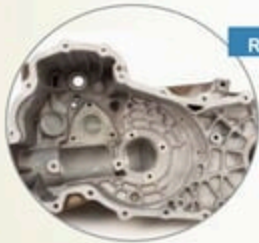


## 3D scanning

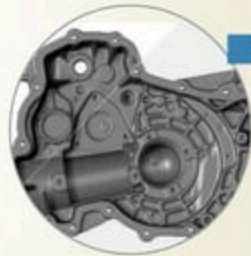
- **3D scanning is a technique used to capture the shape of an object using a 3D scanner. The result is a 3D file of the object which can be saved, edited, and even 3D printed.** Many different 3D scanning technologies exist to 3D scan objects, environments, and people. Each 3D scanning technology comes with its own limitations, advantages, and costs.
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## Bridging Physical and Digital world

- 3D scanners are tri-dimensional measurement devices used to capture real-world objects or environments so that they can be remodeled or analyzed in the digital world. The latest generation of 3D scanners do not require contact with the physical object being captured.



Real Object

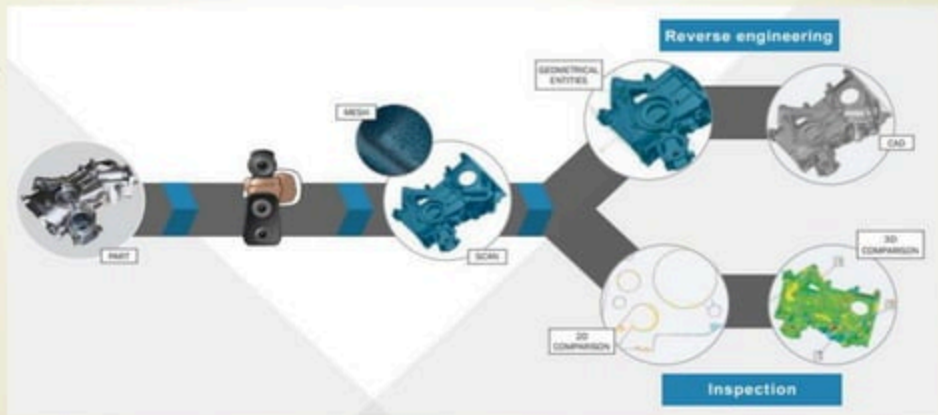


3D Model

3D scanners can be used to get complete or partial 3D measurements of any physical object. The majority of these devices generate points or measures of extremely high density when compared to traditional "point-by-point" measurement devices.

# OBJECTS ARE USUALLY SCANNED IN 3D FOR 2 PURPOSES

- Extracting dimensions to reconstruct a CAD reference file for Reverse Engineering or Rapid Prototyping
- Measuring the object itself for analysis and documentation. This is done for applications such as computer – Aided Inspection (CAI) and analysis (CAE)



# Applications

**3D scanners are powerful tools for professionals in several industries, such as**

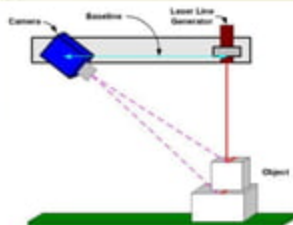
- ▶ automotive,
- ▶ aeronautics,
- ▶ dental,
- ▶ jewelry,
- ▶ video games,
- ▶ special effects,
- ▶ animation movies.

## 3D scanning technologies rely on different physical principles and can be classified in categories:

- **Laser triangulation 3D scanning technology**, as illustrated on the image, projects a laser beam on a surface and measures the deformation of the laser ray.
- **Structured light 3D scanning technology** measures the deformation of a light pattern on a surface to 3D scan the shape of the surface.
- **Photogrammetry**, also called 3D scan from photographs, reconstructs in 3D a subject from 2D captures with computer vision and computational geometry algorithms.
- **Contact-based 3D scanning technology** relies on the sampling of several points on a surface, measured by the deformation of a probe.

## Laser triangulation 3D scanning technology

**Laser triangulation-based 3D scanners use either a laser line or a single laser point to scan across an object.** The laser is first cast by the 3D scanner. As the laser light reflects off the 3D scanned object, its initial trajectory is modified and picked up by a sensor. From the modification of the laser trajectory and trigonometric triangulation, the system can discern a specific deviation angle. The calculated angle is directly linked to the distance from the object to the scanner. When the 3D scanner collects enough distances, it is capable of mapping the surface's object and of creating a 3D scan.



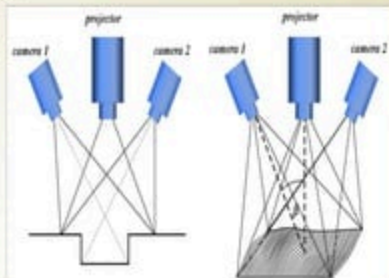
its resolution and accuracy.

Very shiny or transparent surfaces are particularly problematic

# Structured light 3D scanning technology

Structured light 3D scanners use trigonometric triangulation but do not rely on a laser. Instead, the structured light 3D scanning technology works with the projection of a series of linear patterns onto an object. The system is then capable to examine the edges of each line in the pattern and to calculate the distance from the scanner to the object's surface. The structured light used for 3D scanning can be white or blue

its speed, resolution and ability to 3D scan people



its sensibility to lighting conditions and issues to work outside



## Photogrammetry 3D scanning technology (photography)

Photogrammetry is the science of making measurements from photographs, especially for recovering the exact positions of surface points. The principle of photogrammetry is to analyze several photographs of a static subject, taken from different viewpoints, and to automatically detect pixels corresponding to a same physical point. The data input required from the user are the parameters of the camera such as focal length and lens distortion.

its precision and acquisition speed

its sensitivity to the resolution of the input photographs and the time it takes to run the algorithms.



# Contact-based 3D scanning technology

Contact-based 3D scanning is also known as digitizing. The contact technology for 3D scanning implies a contact based form of 3D data collection. Contact 3D scanners probe the subject through physical touch, while the object is firmly held in place. A touching probe is moved on the surface to various points of the object to record 3D information. The probe is sometimes attached to an articulated arm capable of collecting all its respective configurations and angles for more precision. Some specific configurations of contact-based 3D scanners are called Coordinated Measuring Machines (CMM).



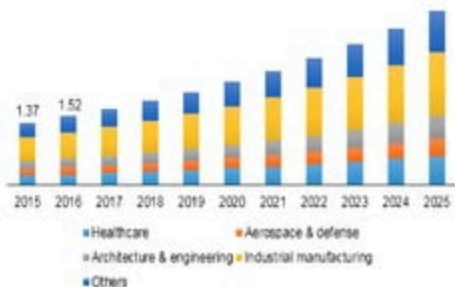
its precision and ability to 3D scan transparent or reflective surfaces.

its speed and inadequacy to work with freeform shapes.



This chart shows the projected growth (in millions) for the 3D scanning market by product.  
(Image courtesy of Radiant Insights.)

Global 3D scanner market size, by application, 2015 - 2025 (USD Billion)





***Thank you***