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3D printing technologies in forensic sciences

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DESCRIPTION

Three-dimensional (3D) scanning and printing technologies has proved to be a boon and revolutionized Indian society in recent years. 3D is slowly gaining popularity in the fields of forensics due to its capability to provide information in all three axis (x, y and z) when compared to 2D photographs. The technology is actively being used in the fields of forensic medicine, anthropology, ballistics and odontology.3D printing allows better visualization, interpretation, preservation and analysis of the evidence. The present article highlights the applications of 3D printing and presents current needs to develop and incorporate 3D printing technology in Indian forensics.

Three-dimensional (3D) printing is a technique used to create realistic 3D physical structures from CAD (Computer Aided Design) models or 3D digital models. The term behind "3D printing" can be applied to several processes that grind, formulate, or solidify materials under computer control to build 3D objects, usually assembling materials layer by layer. 3D printing technology was introduced by engineers dedicated to developing structural models with simple and efficient performance. Over the last decade, there has been a rapid development of 3D printing technology and materials. This technique was introduced into health sciences to improve the fields of medicine and dentistry, especially in the fields of maxillofacial surgery, radiation / imaging, and anatomy. However, while satisfactory results have been obtained in the fields of medicine and dentistry, few cases using 3D printing have been reported in forensic medicine. This paper deals with 3D printing technology and describes the application of medico legal's 3D printing technology.

Digital Imaging and Communications in Medicine (DICM) images are used to create 3D printed models that provide both tactile feedback and tactile depth information about the anatomical and pathological state of an object. 3D printers usually accept the STL (Standard Tessellation Language) file format. It defines a surface as a collection of triangles (called facets) that fit together like a puzzle. In general, 3D models can be printed from any volume imaging or surface scan dataset, such as: Laboratory computer tomographic scans, intraoral or optical surface scan data. A new format called the Additive Manufacturing File Format (AMF) was introduced in June 2011 by the American Society for Testing and Materials ASTM International to overcome many of the limitations of the plain STL format, including incorporating textures, colors, and material properties into each Approved by Department. The 3D printing process can be divided into three parts: image acquisition, image processing, and 3D printing. The quality of 3D printing models includes Fused Deposition Modeling (FDM), Stereo Lithography (SL), Digital Light Processing (DLP), Photo Polymer Injection (PPI), Powder Binder Printer (PBP), Selective Laser Sintering (SLS), etc. Depends on the technology of FDM is one of the earliest technologies in which 3D printers either have a robot extruder that moves within a stationary frame, or have a stationary extruder and a movable frame.

Biodegradable polymer acid is commonly used material. Alternatively, similar materials such as Polyvinyl Chloride (PVC), nylon, Acrylonitrile Butadiene Styrene (ABS), and investment casting wax are used as key components of scaffolding structures. The SLA provides better resolution and uses a scanning laser to build a layer-by-layer section on a curable photopolymer resin. Here, the photosensitive polymer is cured layer by layer and then cured in a UV oven. DLP uses the light source of the projector to cure the liquid resin layer by layer at a resolution of 35-100 microns. SLS uses a scanning laser that fuses powders of fine material to create high resolution (60 μm) layer-by-layer structures. Allows for complex shapes and very fine details-resolutions of only 16 microns. PBP uses an inkjet head that has been modified for printing. Basically a liquid droplet that penetrates a layer of powder layer by layer. The accuracy and strength achieved will be lower.

Applications of 3D printing in Forensic Science

- Documentation
- Human Identification
- Dental Anthropology and Comparative Dental Anatomy
- Pattern analysis, Forensic facial reconstruction
- Crime and Accident Scene Reconstruction
- Ballistic Reconstruction
- Disaster Victim Identification (DVI)
- Forensic Medicine
- Forensic Anthropology and Archaeology.