

# 3D PRINTING

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**Abstract-** 3D printing is a form of additive manufacturing technology where a three dimensional object is created by laying down successive layers of material. It is also known as rapid prototyping, is a mechanized method whereby 3D objects are quickly made on a reasonably sized machine connected to a computer containing blueprints for the object. The basic principles include materials cartridges, flexibility of output, and translation of code into a visible pattern.

**Index Terms-**rapid prototyping, material cartridges.

## I. INTRODUCTION

The 3D printing concept of custom manufacturing is exciting to nearly everyone. This revolutionary method for creating 3D models with the use of inkjet technology saves time and cost by eliminating the need to design; print and glue together separate model parts. Now, you can create a complete model in a single process using 3D printing. The basic principles include materials cartridges, flexibility of output, and translation of code into a visible pattern.

3D Printers are machines that produce physical 3D models from digital data by printing layer by layer. It can make physical models of objects either designed with a CAD program or scanned with a 3D Scanner. It is used in a variety of industries including jewellery, footwear, industrial design, architecture, engineering and construction, automotive, aerospace, dental and medical industries, education and consumer products.

## II. HISTORY OF 3D PRINTING

The technology for printing physical 3D objects from digital data was first developed by Charles Hull in 1984. He named the technique as Stereo lithography and obtained a patent for the technique in 1986.

While Stereo lithography systems had become popular by the end of 1980s, other similar technologies such as Fused Deposition Modelling (FDM) and Selective Laser Sintering (SLS) were introduced.

In 1993, Massachusetts Institute of Technology (MIT) patented another technology, named "3 Dimensional Printing techniques", which is similar to the inkjet technology used in 2D Printers.

In 1996, three major products, "Genisys" from Stratasys, "Actua 2100" from 3D Systems and "Z402" from Z Corporation, were introduced.

In 2005, Z Corp. launched a breakthrough product, named Spectrum Z510, which was the first high definition colour 3D Printer in the market.

Another breakthrough in 3D Printing occurred in 2006 with the initiation of an open source project, named Reprap, which was aimed at developing a self-replicating 3D printer.

## III. MANUFACTURING A MODEL WITH THE 3D PRINTER

The model to be



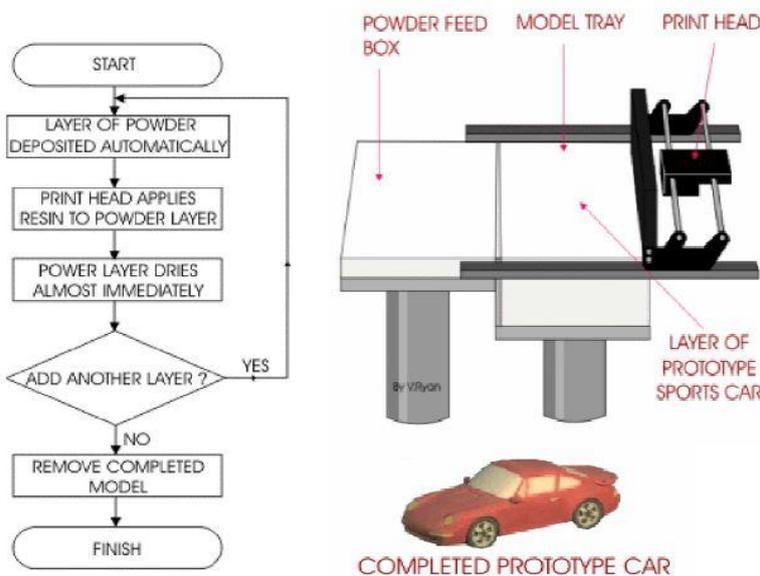
manufactured is built up a layer at a time. A layer of powder is automatically deposited in the model tray. The print head then applies resin in the shape of the model. The layer dries solid almost immediately. The model tray then moves down the distance of a layer and another layer of powder is deposited in position, in the model tray. The print head again applies resin in the shape of the model, binding it to the first layer. This sequence occurs one layer at a time until the model is complete.

Very recently Engineers at the University of Southampton in the UK have designed, printed, and sent skyward the world's first aircraft manufactured almost entirely via 3-D printing technology. The UAV dubbed SULSA is powered by an electric motor that is pretty much the only part of the aircraft not created via additive manufacturing methods.

Created on an EOS EOSINT P730 nylon laser sintering machine, its wings, hatches and control surfaces basically everything that makes up its structure and aerodynamic controls was custom printed to snap together. It requires no fasteners and no tools to assemble.

#### IV. CURRENT 3D PRINTING TECHNOLOGIES

**Stereo lithography** - Stereo lithographic 3D printers (known as SLAs or stereo lithography apparatus) position a perforated platform just below the surface of a vat of liquid photo curable



polymer. A UV laser beam then traces the first slice of an object on the surface of this liquid, causing a very thin layer of photopolymer to harden. The perforated platform is then lowered very slightly and another slice is traced out and hardened by the laser. Another slice is then created, and then another, until a complete object has been printed and can be removed from the vat of photopolymer, drained of excess liquid, and cured.

**Fused deposition modelling** - Here a hot thermoplastic is extruded from a temperature-controlled print head to produce fairly robust objects to a high degree of accuracy.

**Selective laser sintering (SLS)** - This builds objects by using a laser to selectively fuse together successive layers of a cocktail of powdered wax, ceramic, metal, nylon or one of a range of other materials.

**Multi-jet modelling (MJM)** - This again builds up objects from successive layers of powder, with an

inkjet-like print head used to spray on a binder solution that glues only the required granules together.

The **VFlash printer**, manufactured by Canon, is low-cost 3D printer. It's known to build layers with a light-curable film. Unlike other printers, the VFlash builds its parts from the top down.

**Desktop Factory** is a startup launched by the Idealab incubator in Pasadena, California.

**Fab@home**, an experimental project based at Cornell University, uses a syringe to deposit material in a manner similar to FDM. The inexpensive syringe makes it easy to experiment with different materials from glues to cake frosting.

The **Nanofactory 3D printing** technologies are introduced that are related to the nanotechnologies.

#### V. 3D PRINTING CAPABILITIES

As anticipated, this modern technology has smoothed the path for numerous new possibilities

in various fields. The list below details the advantages of 3D printing in certain fields.

1. Product formation is currently the main use of 3D printing technology. These machines allow designers and engineers to test out ideas for dimensional products cheaply before committing to expensive tooling and manufacturing processes.

2. In Medical Field, Surgeons are using 3d printing machines to print body parts for reference before complex surgeries. Other machines are used to construct bone grafts for patients who have suffered traumatic injuries. Looking further in the future, research is underway as scientists are working on creating replacement organs.

3. Architects need to create mockups of their designs. 3D printing allows them to come up with these mockups in a short period of time and with a higher degree of accuracy.

4. 3D printing allows artists to create objects that would be incredibly difficult, costly, or time intensive using traditional processes.

#### VI. 3D SAVES TIME AND COST

Creating complete models in a single process using 3D printing has great benefits.

This innovative technology has been proven to save companies time, manpower and money. Companies providing 3D printing solutions have brought to life an efficient and competent technological product.

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