



A Review on 3D Printing Technology

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ABSTRACT:

3D Printing Technology is also known as rapid prototyping where a 3 dimensional object is created by lying down the successive layers of material. Here in this technology 3 steps are included such as designing, printing & finishing. In 1st step we use any CAD software to create 3d design. In 2nd step 3D printer create an object using this design. And 3rd step finished object is removed from printer. This technology save time & cost. It saves wastage of material. It is very useful in industries for give the demo of any product. By using this technology we can turn our ideas into the physical object. It very flexible technology, no skilled person required to handle the printer. It is very useful to one & all who have an idea to create something.

Keywords: Rapid Prototype, CAD, Flexible, 3D, Successive layer.

I. INTRODUCTION

3D Printing Technology means 3 dimensional physical object creating process also known as additive manufacturing processes. Here in this technology 3D Printer creates an object by lying down the material on the platform of printer until the desired object is formed. In this melted material or powder use to create object. Printing is nothing but the process of producing text or images. In 2D Printing can be done using paper & ink but in 3D there is various material used to print an object. This technology mostly use in industry to turn ideas into reality. This is the leading technology now a day's which attracts the educated students & industries. We can create a whole model at once using 3d printer. If we use another method then it takes more time & cost to design, creates separate part and then joined all the parts by glue. The basic principal of this technology is material cartridge, flexibility of output, & converting code into visible manner. The printer is a machine which is convert digital data or simply the design into physical object. This 3D design creates by using CAD software. It is used in various industries such as footwear, jewellery, dental, aerospace, automotive etc.

II. HISTORY

3D Printing technology was first invented by Charles Hull in 1984; he gives the name to this technique as stereo lithography. This technology had become popular in 1990s. And others technology were introduced like Fused deposition moulding and selective laser sintering. In 1993 MIT institute of technology was change the name from stereolithography to 3D Printing Technology. In 1996 three major products were introduced by three different companies such as "Genisys" from stratasys, "Actua 2100" from 3D system, and "Z402" from Z Corporation[2].

In 2005 Z Corporation were launched 1st 3D HD colour printer in the market named as Spectrum Z510[2]. Another 3D printer introduced in 2006 named as Riprap which was aimed at self replicating 3D printer. In 2007 Z450 were introduced with the focus of ease of use & office compatibility. Likewise in 2008 Z650 with increase size & performance and in 2009 Z350 with a new level of 3d printing affordability [2].

III. TYPES OF PRINTING

HERE ARE THE 3 TYPES OF PRINTING TECHNOLOGY WHICH ARE AS FOLLOWS:

1. Selective laser sintering (SLS)
2. Fused deposition Moulding (FDM)
3. Stereo lithography (SLA)

1. Selective Laser Sintering: This is an additive manufacturing process which uses high laser to fuse the material which is going to be use in printer to create an object. In this technology material is in powder form. Material such as plastic, metal, ceramic, glass etc. The selective laser fuses the powder by scanning the digital data on the surface of powder bed. The powder bed is lowered by thickness of one layer after completed the scanning of all cross-section and a new layer of powder is applied on the top and process is repeated until the product is completed. [3]. Most of the machine use two type of powder coated powder or mixture of powder because in single component powder laser melts only the outer surface of the particles, fusing the solid state non melted core into each other.

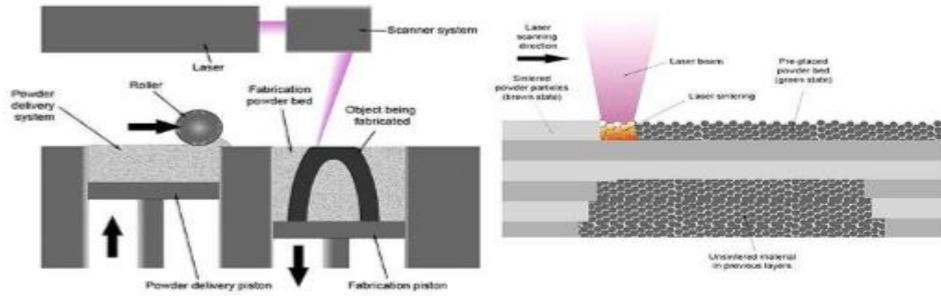


Fig.1.1 Selective Laser Sintering [4]

1. **Fused Deposition moulding:** This is an additive manufacturing process used to moulding prototype & production of applications. [4]. It works on additive principle in which by laying down the material layer by layer we can create an object. Here plastic filament or metal wire uses. This filament is connected to the extrusion nozzle. Nozzle is heated for melting the filament, it is moved both horizontal and vertical direction by using controlled mechanism. This mechanism controlled by using the reference of CAM (Computer Added Manufacturing). Stepper motor or servo motor is used to move the extrusion head [4]. When we send the CAD design to the printer, extrusion nozzle heated to melt the plastic filament or metal wire and it moves horizontally and vertically to form the object layer by layer. The material hardens immediately after extrusion from nozzle.

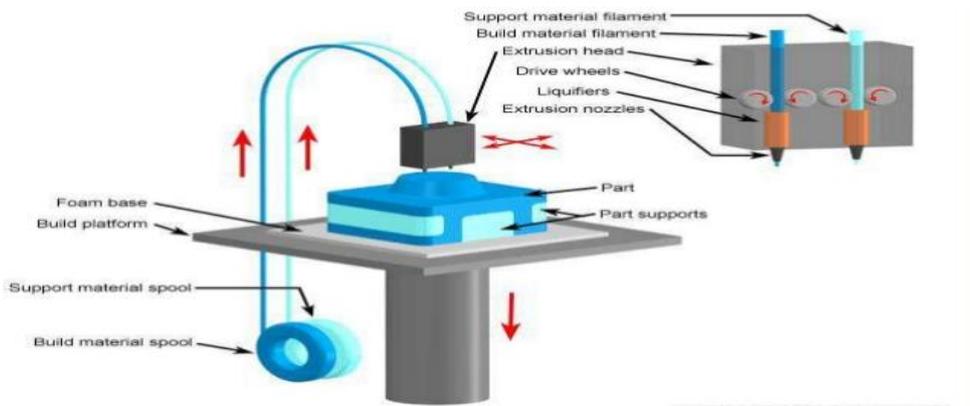


Figure 2.1: Fused Deposition modelling [4]

2. **Stereolithography:** In stereolithography liquid photopolymer and ultraviolet laser used to build the object layer by layer. For each layer laser beam traces a cross-section of the part pattern on the surface of the liquid resins [4]. Exposure to the ultraviolet laser light cures and solidifies the pattern traced on the resins and joins it to the bellowed layer. After that SLA's elevator platform moves downward by a distance equal to the thickness of single layer, typically 0.05 mm to 0.15 mm and the process is repeated until the object is completed. After the completion of this process object throws into the chemical bath in order to clean excess resins and subsequently cured in an ultraviolet oven [4].

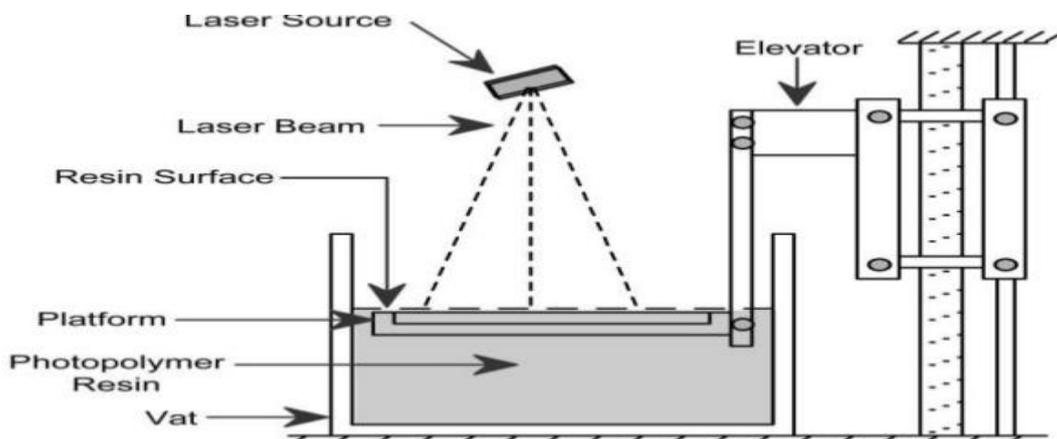


Figure 3.1: Stereolithography [4]

III. WORKING

3D printing is a Adaptive manufacturing process whereby lying down the material layer by layer object can be created. 3D printing is done in three steps which are follows:

1. CAD DESIGN
2. PRINTING PROCESS
3. FINISHING

Step1: In the first step design of object is created by using the computer. It required special type of software such as CAD. Any person can design object who well known about that software. There are many types of softwares are available which type of software is good it's totally depends on the requirement of what you are designing. I this step the person who design is must well known about that software. After designing this file send to the printer.

Step2: Printer slices that design into the number of layers of 0.1 mm thickness. Printer is used to create the object from that design. Print head moves over a bed of powder where print the cross-sectional data send from the computer. Here the scanner scan the design and the laser beams fall onto the powdered bed surface it create the crosssectional area upon that layer after completing the first layer platform lowered by 0.1 mm and the another layer of powder is to be distributed over it and the process is repeated until the object is created.

Step3: After the completion of the object extra powder removes from platform by applying vacuum pressure and vibration to the bottom of the build chamber. Removed powder is conveyed through the system, filtered, and return to the hopper for the reuse. Next, you open the front of the the machine and remove the object from platform.

IV. ADVANTAGES

1. Less wastage of raw material [2].
2. Easy to use.
3. No skilled person required.
4. Cheaper process than any other process.
5. Reduce design complexity [2].
6. Lighter, stronger and less assembly is required.

V. DISADVANTAGES

1. Cost of raw material is high[2].
2. 3d Printer is also expensive.
3. It takes more time to create a single object.

VII. APPLICATIONS

1. In manufacturing: who needs to develop better product in less time the can use it.
2. It is used for architecture to design full colour model.
3. It is used in medical field to improve preparation of student.
4. In geospatial colourful 3D maps more impactful & understandable than traditional paper maps.
5. In marketing 3D colour model more impactable than brochures for the customers.

VIII. FUTURE SCOPE

Today's 3d printer can make only the remote battery cover but in future we can make the whole TV remote also in future we can make body parts or organs for people in need of transplant [4]. In becoming few years 3D printer will become common on all places. Benefits of 3D printing technology are endless so that it is more useful. In future size of object will be increase, cost will decrease, and number of material will be use in same printer. In future 3D printer will become more advance.

IX. CONCLUSION

3D printer is the method of converting 3D design into the reality by using 3D printer. After the arrival of few years we can see 3d printer in every home if they want to make any toy or anything then they will buy the 3d file instead of the product. One day printer will make human organs for the need of peoples. Now days this technology is to be implemented in industries. Advantages of 3D printer are endless therefore it is most preferable technology.

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