

Design and Development of CNC based 3D Object Printer

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Abstract: This is a research paper on design and development of CNC based 3D object printer and the various materials used in 3D printing as well as its basic basic. In this paper we will deal with the term Additive Manufacturing. Its various applications along with the type of materials used in the 3-D are also described. 3d printing has been replaced the entire manufacturing firm/system with its improved version of building parts layer by layer using additive approach and new trends. In the present article, a comprehensive study has been carried out for comparing it with traditional manufacturing method for production of components, complex objects for hundreds of different applications.

Keywords: 3D printer, Additive manufacturing, printing technology, software.

1. Introduction

3D printing or additive manufacturing is a process of making three dimensional solid objects from a digital file. In the manufacturing area a new technology has proven to be very promising and is called rapid prototyping also called as additive manufacturing technology. The creation of a 3D printed object is achieved using additive processes. In an additive process an object is created by laying down successive layers of material until the entire object is created.

2. Basic principles of 3D printing

- **Fused Deposition Modeling (FDM):** In this process, filament of plastic modeling material and soluble support material are fed from auto-loading carries in the material up to the extrusion head. The materials are heated to a semi-liquid state, forced through dual up to the extrusion tips and precisely deposited onto the modeling in extremely fine layers. The print head moves in X-Y direction and the modeling base moves in the Z-axis.
- **Melting of filament:** In this process the PLA filament material used in the printer is melted instead of combining them.
- **Printing:** Printing a 3D model from .STL file, it must be processed by a software called a "Print Run" which converts the 3D model into a layer and produces a G-code file from .STL file containing instructions to a printer.

- **Finishing:** While the printer produced resolution is workable for various type of application printing to standard resolution. Its only possible for higher resolution. Once printed completely used to overhanging feature during constant.

3. Hardware and software controlling of 3d printer

3d Printer with filament uses command for printing called G-code. It is an interfacing of Hardware and software. It is a combination mechanical setup as well as electronic component. G-Code is provided through computers USB port. 'Print Run' software is used for G code command. The temperature required for melting the filament is set by using software. Which operates the Hardware like x,y,z axis movement, Temperature of extruder.

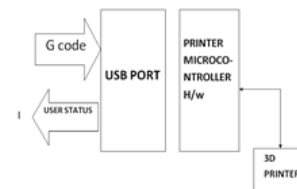


Fig. 1. Block diagram

4. 3D printing processes

Expansive number of added substance forms are accessible. The fundamental contrasts between procedures are standing out layers are saved to make parts and in the materials that are utilized. Every technique has its very own favorable circumstances and disadvantages, which is the reason a few organizations offer a decision of powder and polymer for the material used to construct the object. Others once in a while utilize standard, off-the-rack business paper as the assemble material to create a solid model. The principle contemplations in picking a machine are by and large speed, expenses of the 3D printer, of the printed model, decision and cost of the materials, and shading capacities. Printers that work legitimately with metals are commonly costly. Anyway more affordable printers can be utilized to make a form, which is then used to make metal parts.

5. 3D printer construction and working

A. CNC Machine Hardware

The 3D printers essentially rely upon the development and guideline of CNC machine. A large portion of the 3D printers are costly, however there are some ongoing patterns in 3D printer which causes decrease in the cost of 3D printer. For the most part 3D printer are use for more in leisure activities as opposed to modern application. Organizations have likewise understood the capability of a buyer showcase for 3D printers and in that capacity have been forcefully seeking devotees with less expensive and better models.

- 1x Desktop Computer Power Supply
- 3x Stepper Motor Drivers (Easy driver)
- 1x Arduino UNO
- Wires
- Various screws/nuts/bolts
- Soldering Iron
- 2x rectangular casing for printing
- 2x metallic square plate
- M-M/M-F wires
- Drill.

6. Advantages

- *Save money:* Prototyping infusion shape devices and creation runs are costly speculations. The 3D printing process permits the formation of parts and additionally apparatuses through added substance producing at rates much lower than customary machining.
- *Faster Idea developer:* 3D printing enables thoughts to grow quicker. Having the capacity to print an idea around the same time it was structured contracts an improvement procedure from what may have been months to various days, helping organizations remain one stage in front of the other.
- *Fail fast, fail cheap:* 3D printing permits an item engineer to make achievements at beginning periods that are moderately economical prompting better items and less costly impasses.
- *Personalization:* With standard large scale manufacturing, all parts fall off the mechanical production system or out of the shape the equivalent. With 3D printing, one can customize, tweak a section to particularly fit their necessities, which takes into account custom fits in the therapeutic ventures and causes set individuals to expound their thought in new world.

7. Various challenges while incorporating 3d printing

- *Restriction in Speed:* For substantial amounts of products, AM would be troublesome and require an impressive increment in speed of 3D printing.
- *Materials:* Research on the sort of material to be

utilized in 3D printing is still in procedure in this way there is a constraint in the assortment of materials that can be utilized.

- *Genuine world sealing:* Changes in temperature and climatic conditions can influence the 3D printing procedure. It might likewise require a gifted staff to run the 3D printer.
- *Post-processing:* It is done physically and is an extraordinary procedure. If there should arise an occurrence of medium or high generation volume this may turn into a critical issue.

8. Environmental aspects

Two central point influencing the Cumulative Energy Demand (CED) of 3D printed Products are: Choice of the material for printing and the measure of material utilized in assembling an item. Perceptions demonstrates that 3D printed items devour less vitality as they require less material. A move to plastics and metals may happen bringing about conceivably higher vitality requests. 3D printer uses a material which is basic for the development of the item, in this manner unimportant or less waste is delivered. The item shaped is lighter in weight and in this manner less fuel is required. There is a network called RepRap which makes self-repeating printers and are centered around chiefly reused waste materials and are monetarily less expensive.

9. Application

- *Restorative industry:* The viewpoint for therapeutic utilization of 3D printing is developing at an amazingly quick pace as masters are using 3D imprinting in further developed ways. Patients around the world are encountering improved nature of consideration through 3D printed inserts and prosthetics at no other time seen.
- *Bio-printing:* As of the mid two-thousands 3D printing innovation has been considered by biotech firms and the scholarly world for conceivable use in tissue building applications where organs and body parts are assembled utilizing inkjet methods. Layers of living cells are saved onto a gel medium and gradually developed to frame three dimensional structures. We allude to this field of inquire about with the term: bio-printing.
- *Aviation and flight enterprises:* The development in use of 3D imprinting in the aviation also, aeronautics ventures can, for a substantial part, be gotten from the advancements in the metal added substance producing segment. NASA for example prints ignition chamber liners utilizing specific laser liquefying and as of walk 2015 the FAA cleared GE Aviation's first 3D printed motor part to a laser sintered lodging for a blower bay temperature sensor.

10. Conclusion

Presentation part is about the short history of 3D printing, in the following segment we have portrayed the 3D-printing and the forms utilized in 3D-printing and the properties of the 3Dprinter materials. In the third area, we have featured the principle favorable circumstances and impediments of the 3D printing innovation. One can presume that the 3-D printing innovation's significance and social effect increment step by step and impact the human's life, the economy, and present day society. 3D Printing innovation could reform the world. Advances in 3D printing innovation can altogether change furthermore, improve the manner in which we make items and produce products around the world. An item is checked or planned with PC Aided Design programming, at that point cut up into slight layers, which would then be able to be printed out to frame a strong three dimensional item. As appeared, 3D printing can have an application in practically the majority of the classifications of human needs as portrayed by Maslow. While it may not fill a void disliked heart, it will give

organizations and people quick and simple producing in any size or scale restricted just by their creative ability. 3D printing, then again, can empower quick, dependable, and repeatable methods for creating customized items which can in any case be made modestly due to computerization of procedures and dispersion of assembling needs.

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