Design and Manufacturing of 3D Printer

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Abstract— In this manuscript, 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 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. Additive manufacturing process or 3D printing process is now becoming more popular because of its advantages over conventional processes. A 3D printer is a machine that create objects out of plastic, nylon like many other materials.3D printers now days available are not so portable and also they are very costly. By analyzing this problem, we are trying to make a portable 3D printer the cost of this printer will be very less compared to other 3D printers. Making low cost 3D printer with price 15% lower than market.

Keywords: 3D, Printer, Material Technology

I. Introduction

A 3d printer is an additive manufacturing technique where 3D objects and parts are made by the addition of multiple layers of material. It can also be called as rapid prototyping. It is a mechanized method where 3D objects are quickly made as per the required size machine connected to a computer containing blueprints of any object. The additive method may differ with the subtractive process, where the material is removed from a block by sculpting or drilling. The main reason to use 3d printer is for 90% of material utilization, increase product life, lighter and stronger. 3D printing is efficiently utilized in various fields such as aerospace, automobile, medical, construction and in manufacturing of many household products.

II. Future perspective

3D printing is a new and promising technology, and as with all developing fields the Scope for improvement and advancement are definitely infinite. NASA Nothing incorporates innovation and advancement like our space program. , NASA designed, printed, and tested rocket engine injectors by subjecting them to challenging pressures and temperatures of over 6,000 degrees F. In fall, NASA has devised to launch and deliver a 3-D printer to the International Space Station, which will help astronauts to print replacement tools in space BIOTECHNOLOGY In 2012, an elderly woman in Belgium proclaimed a 3-D printed jawbone, transplanted and specially tailored to her facial structure. This year, engineers at Princeton were able to produce an ear imprint, applying a culture of animal cells and silver nano particles; the experimental version was able to read audio beyond the limit of human levels, making this a "bionic" ear. Using this method, leather could be manufactured and even meat. Engineers are working on producing non-perishable foods from powder (liquidfree) cartridges; imagine the effect that developments like these could have on global sustainability process in the future.

III. Component of 3D printer:

1) *Control Unit*
   - Power Unit
   - Servo Motor
   - Temperature Sensor
   - Extruder
   - Rams 1.5 Shield
   - Arduino
2) *Aluminum Structure*
3) *Heating Eliminate*

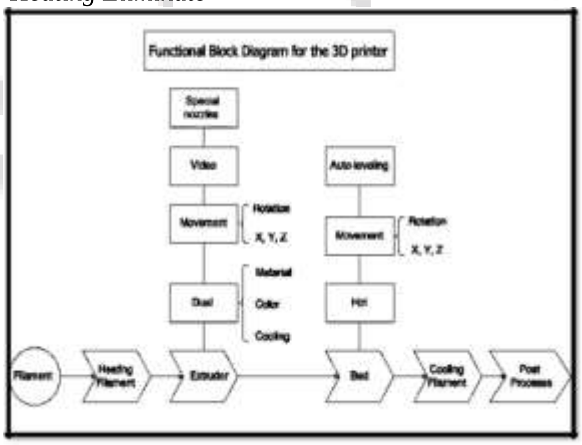

Fig 1.Component Setup 3d printer

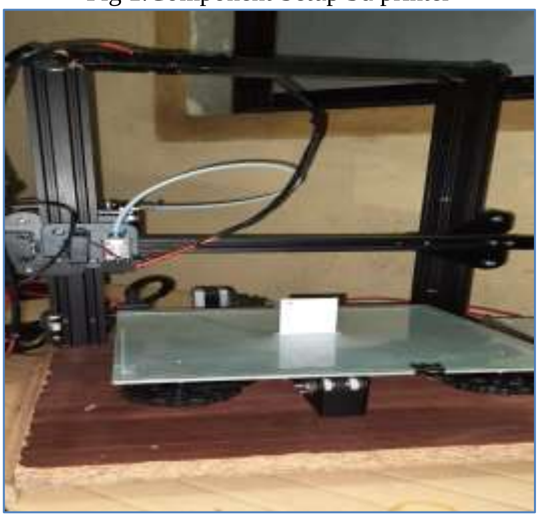

Fig. 2: Actual setup of 3d printer

IV. WORKING

Additive manufacturing technology comes in many shapes and sizes, but no matter the type of 3D printer or material you are using, the 3D printing process follows the same basic steps.

It starts with creating a 3D blueprint using computer-aided design (commonly called CAD) software. Creators are only limited by their imaginations. For example, 3D printers have been used to manufacture everything from robots and prosthetic limbs to custom shoes and musical instruments. Oak Ridge National Lab is even partnering with a company to create the using a large-scale 3D printer, and America Makes -- the President's pilot manufacturing innovation institute that focuses on 3D printing Once the 3D blueprint is created, the printer needs to be prepared. This includes refilling the raw materials (such as plastics, metal powders or binding solutions) and preparing the build platform (in some instances, you might have to clean it or apply an adhesive to prevent movement and warping from the heat during the printing process).

Once you hit print, the machine takes over, automatically building the desired object. While printing processes vary depending on the type of 3D printing technology, material extrusion (which includes a number of different types of processes such as fused deposition modeling) is the most common process used in desktop 3D printers.

Material extrusion works like a glue gun. The printing material -- typically a plastic filament -- is heated until it liquefies and extruded through the print nozzle. Using information from the digital file -- the design is split into thin two-dimensional cross-sections so the printer knows exactly where to put material -- the nozzle deposits the polymer in thin layers, often 0.1 millimeter thick. The polymer solidifies quickly, bonding to the layer below before the build platform lowers and the print head adds another layer. Depending on the size and complexity of the object, the entire process can take anywhere from minutes to days.

After the printing is finished, every object requires a bit of post-processing. This can range from unsticking the object from the build platform to removing support structures (temporary material printed to support overhangs on the object) to brushing off excess powders.

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A. NASA

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VI. TEMPERATURE DURING WORKING OF 3D PRINTER

Sr No.	Part Name	Min Temp	Max Temp	observation
1	Bed Temperature	60C	110C	At Max Temperature Abs Material Use
2	Nozzle	160	200	At Max Temp We Get Good Quality Of Object

VII. 3D PRINTER SPECIFICATION

Build Volume	200L x 180W x 180H mm3
Method	Fused Deposition Modeling
Layer Resolution Height	55 microns
Number of Extruders	One
Machine Size	380mm(L) x 550mm(W) x 610mm(H)
Machine Weight	8Kg
Power Supply	24V 10AMP
Power Consumption	250v, 50-60Hz, 5amp, 600W
Filament Diameter	USB

VIII. ADVANTAGES

Advantages of 3D Printer

- Flexible Design: 3D printing allows for the design and print of more complex designs than traditional manufacturing processes. More traditional processes have design restrictions which no longer apply with the use of 3D printing.
- Rapid Prototyping: 3D printing can manufacture parts within hours, which speeds up the prototyping process. This allows for each stage to complete faster. When compared to machining prototypes, 3D printing is inexpensive and quicker at creating parts as the part can be finished in hours, allowing for each design modification to be completed at a much more efficient rate
- Print on Demand: Print on demand is another advantage as it doesn't need a lot of space to stock inventory, unlike traditional manufacturing processes. This saves space and costs as there is no need to print in bulk unless required.

- The 3D design files are all stored in a virtual library as they are printed using a 3D model as either a CAD or STL file, this means they can be located and printed when needed. Edits to designs can be made at very low costs by editing individual files without wastage of out of date inventory and investing in too
- Strong and Lightweight Parts: The main 3D printing material used is plastic, although some metals can also be used for 3D printing. However, plastics offer advantages as they are lighter than their metal equivalents. This is particularly important in industries such as automotive and aerospace where light-weighting is an issue and can deliver greater fuel efficiency. Also, parts can be created from tail ored materials to provide specific properties such as heat resistance, higher strength or water repellency.
- Minimising Waste: The production of parts only requires the materials needed for the part itself, with little or no wastage as compared to alternative methods which are cut from large chunks of non-recyclable materials. Not only does the process save on resources but it also reduces the cost of the materials being used.

IX. Disadvantages

Disadvantages of 3d printer

- It is expensive. While widely available, it is expensive.
- To print take more time

X. Application

1) Education ·
2) Prototyping and Manufacturing ·
3) Medicine
4) Construction ·
5) Art and Jewellery.

XI. Conclusion

In this paper From above we conclude that the outcome of this project was to build a portable 3D Printer which has been successfully completed. The design of the frame is made robust and compact using aluminium sections. The material selection of the various elements is economical. Using a double motor for vertical movement along with a proximity sensor makes bed levelling easy and the bed movement is monitored with resolution in microns. The drawback in few of the 3D Printer which uses bed movement in Y axis has distortion of the printed layer at high rates of printing. To overcome this drawback, a new mechanism has been developed which uses bed movement in Z. The control synchronization can be achieved using this new 3D printer technique it was concluded that among various printing techniques available for additive manufacturing like fused deposition modelling, selective laser sintering, stereo lithography etc., fused deposition modelling is the most feasible and can be easily implemented without much complexity. fdm method is economical method to build a low cost 3D printer

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