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Design and Development of 3D Printer with Auto-Eject Printing

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Abstract - 3D printing is an additive manufacturing technique in which 3D objects are printed with the help of CAD (computer-aided design) software. Different processes are available in 3D printing technology such as (1) FDM (fused deposition method), (2) SLS (selective laser sintering), (3) EBM (electron beam machining), (4) LOM (laminated object manufacturing), (5) DLP (digital light processing), etc.
In this Project, we have focused on the design and fabrication of a portable 3D printer of bed volume (220 x 220 x 250 mm) which can be constructed economically. We are using 4 axis mechanisms where 3 axes are x-y-z and the fourth axis is an extruder.
The process we added in this 3d printing is that we will remove the printed object after the completion of every printing process automatically. This will same very much time and also we will able to mass production of any model.
This research paper on 3D printing and the various material used in 3D printing and their properties wich become a notable topic in technological aspects.

Key Words: 3D Printing, Automatic, Additive Manufacturing, Auto-Eject, Engineering and Technology.

1.INTRODUCTION

A 3D printing is an additive manufacturing technique in which 3D objects are printed with the help of CAD (computer aided design) software like FUSION360, solid works, CATIA, etc.
3D objects and parts are made by the addition of multiple layers of material.
It can also called as rapid prototyping. It is a mechanized method where 3D objects are quickly made as per the required size by machine connected to a computer containing blueprints of any object.
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 households products.

3D printing is a new emerging technology which had a wide scope in near future. As many of the companies now a days had 3d printers in their R & D department it is becoming an essential tool of design and development industry.

Now, rapid prototyping of any object has a wide range of Applications in various fields of human activity: engineering, research, medical industry, military, construction, architecture, fashion, education, the computer industry and many others. The plastic extrusion technology most widely associated with the term "3D printing" was invented in 1990 by Stratus's by name fused deposition modeling (FDM). There has been a large growth in the sales of 3D printing machines and their price has been dropped gradually, after the start of the 21st century. By the early 2010s, the terms additive manufacturing (AM) and 3D printing evolved senses in which they were alternate umbrella terms for AM technologies, one being used officially by industrial AM end use part producers, AM machine manufacturers, and global technical standards organizations, and the other used in popular vernacular by consumer - maker communities and the media. Both terms reflect the simple fact that the technologies all share the common theme of sequential-layer material

We are designing the 3D printer where we do not have to stop the printer for removing of printed part it will automatically done.

2. RESEARCH AND BACKGROUND

Even though 3D printing is a very newly rising technology, it become popular very rapidly in the field of education, manufacturing and many other industries. 3D printers allow user to easily generate any complex parts.
However, these printers have one critical flaw. After a 3D printer has completed printing of object, a individual must physically come to the printer and remove the object from the printer. A 3D printer cannot continue its next print work, until the previous part is removed. This restriction decrease the efficiency of 3D printers. If 3D printers could do this jobs automatically, then they could print out a continuous stream of parts. The productivity of the machine would dramatically increase.
Many R & D departments already use 3D printers to manufacture products. Presently, their manufacturing capabilities are restricted by the need to manually remove and start print jobs. If this role was automated, it would be easier for more businesses to complete volume manufacturing with 3D printers.
Me, myself work in a 3D printing lab that prints hundreds of parts for many university students. From my position, it is obvious that this restriction significantly constraint the number of print jobs our lab can finished per day.

3. OBJECTIVE

The objective of this project is to design an automated 3D Printer: The Auto-Eject 3D Printer. The Auto-Eject 3D Printer has a conveyor belt module that automatically ejects completed print jobs from the printer. With this prime feature, the 3D Printer is able to print a continuous stream of print jobs with no human intervention. This is a development for the 3D printing industry. Automatic print ejection will improve the performance and capability of 3D printers. Within the next ten years, autonomous part ejectors will be as common to 3D printers as paper ejectors are to paper printers.

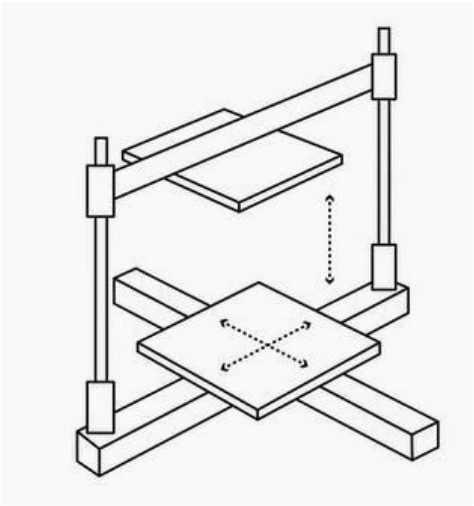
Moreover, the custom conveyor belt allows users to print infinitely in the y axis. This allows users to create a more wider range of variety of parts. The Auto-Eject 3D Printer can monitors print jobs with a computer vision program and a series of webcams. In the unlikely event that a print part fails, the machine will automatically eject the failed print and restart the job.

4.METHODS AND MATERIAL

Different processes are available in 3D printing technology such as

- FDM (fused deposition method)
- SLS(selective laser sintering)
- EBM (electron beam machining)
- LOM(laminated object manufacturing)
- DLP (digital light processing), etc.

There are different methods of 3D printing, but the most widely used is a process known as Fused Deposition Modelling (FDM).
FDM printers use a thermoplastic filament, which is heated to its meltingpoint and extruded, layers by layers, to create a three dimensional object.
In FDM technology different materials like PLA (polylactic acid), ABS (acrylonitrile butadiene styrene), HIPS (high impact polystyrene), etc are
used to 3D print.
Cartesian configuration: - Cartesian 3D printers are pretty much named after the coordinate system the X Y & Z axis which is used to find where and how to maneuver in three dimensions and the Cartesian 3D printers
which have a heated bed which moves only in the Z axis. The extruder sitson the X-axis and Y-axis, where it can move in three directions on a gantry.



5.CONSTRUCTION & WORKING

The Printing process is as follows:

1] Material Filament is the material that is used for printing, material like PLA
(Polylactic Acid), ABS(Acrylonitrile butadiene styrene), etc.
2] Power Intake and Data Interface is provided to control system.
3] When we provide Data Interface to the control system in the form of gcode
(geometric code) then control system give command for preheating to printing
table and heater.
4] Material Filament is extracted by extruder via material conveyer then it is
passed on to heater and starts melting and melted material gets out from nozzle
head.
5] As we provide gcode, movable platform starts moving according to x, y and z
axis.
There are three different methods for generating 3d printing files:
1] Using Computer Aided Design (CAD):-

- We use CAD for designing the model.
- The model is saved in CAD file format that is .stl (standard triangular
- language)
- Then we have to use file formatting software to convert the CAD file
- format to g-code.
- After this the g-code is applied to printer and printing process starts.

2] Using 3D scanner:-

- Using scanner machine the object is scanned and generated a .stl (standard
- triangular language) file in CAD.
- G-code is generated of this .stl file in slicer.
- After this the g-code is applied to printer and printing process starts.

3] Using other Applications:-
We can also generate 3D model using other applications.

Design

- **Dimensions**
- **L x B x H = 220mm x 220mm x 250mm**

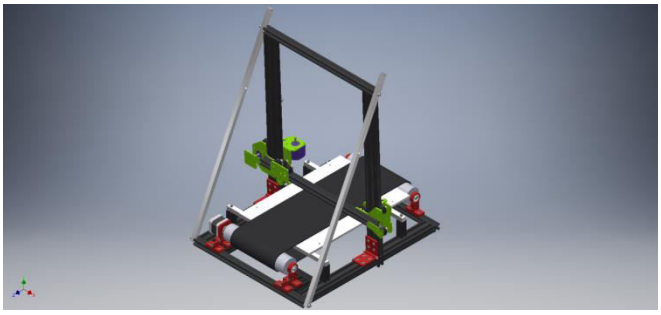


Figure 1.1 CAD Design

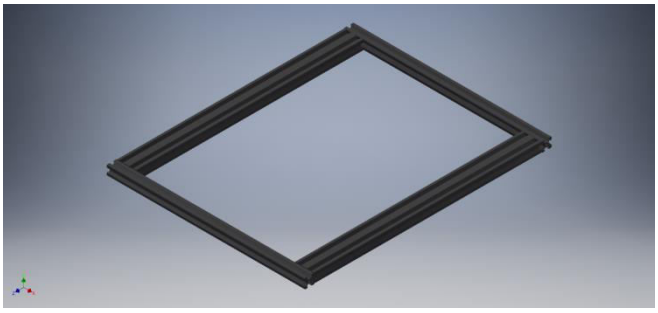


Figure 1.2 Base of Printer

6. CONCLUSIONS

Generally it is accepted that the 3D printing will become a revolutionary force in manufacturing field, where positive or negative despite concerns over counterfeiting, many of the companies are already using the 3D printing technology. 3D printer spreading broadly in an assortment of utilizations, from the basic residential use to entangled mechanical applications with the diminishing expense and expanding productivity in market. A few specialists contend that these printers will be the drive of a coming upset that will change the entire essence of the industry and that it will be a fundamental piece of each home as per the abatement in cost. Usage of PLA tends to develop the social responsibility of the printer as PLA being bio degradable helps to reduce environment waste related to 3D printing process, this makes the 3D printing is eco-friendly.

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