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Research Paper Fabrication of 3D Printer

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Abstract: ***3D printing is called as desktop fabrication. It is a process of prototyping where by a structure is synthesized from a 3d model. The 3d model is stored in as a STL format and then forwarded to a 3D printer. It can use a good range of materials like ABS, PLA, and composites also .3D printing may be a rapidly developing and price optimized sort of rapid prototyping. The 3D printer prints the CAD design layer by layer forming a true object. 3D printing springs from inkjet desktop printers during which multiple deposit jets and therefore the printing material, layer by layer derived from the CAD 3D data. 3D printing significantly challenges production processes within the future. This type of printing is predicted to influence industries, like automotive, medical, education, equipment, consumer products industries and various businesses.***

Keywords: 3d printing, Rapid Prototyping, ABS, PLA.

I. INTRODUCTION

3D printing called as desktop fabrication. It is a rapid prototyping process whereby a real object can be created from a 3D design. A 3D printer machine uses a CAD model for rapid prototyping process. [1]

3D printing is called as desktop fabrication which is a process of prototyping where by a structure is synthesized from its 3d model. The 3d design is stored in as a STL format and after that forwarded to the 3D printer. It can use a wide range of materials such as ABS, PLA, and composites as well.3D printing is one kind of rapidly developing and cost optimized form which is used for rapid prototyping. The 3D printer prints the CAD design layer by layer forming a real object. 3D printing process is derived from inkjet desktop printers in which multiple deposit jets and the printing material, layer by layer derived from the CAD 3D data.3D printing is diversifying and accelerating our life, letting various qualities of products to be synthesized easier and faster[2].Three dimensional (3D) printing has the ability to impact the transmission of information in ways similar to the influence of such earlier technologies as photocopying. This identifies sources of information on 3D printing, its technology, required software and applications. Along 3D printing, companies are able to extract and innovate new ideologies and various design replications with no time or tool expense. 3D printing possibly challenges mass production processes in future. 3D printing influences many industries, such as automotive, architecture, education, medical, businessand consumer industries [3].

II. EXPERIMENT AND METHODOLOGY

Our objective was to study, design and fabrication of a 3d printer. First we ordered the whole tool-kit including all the parts and components those are used to manufacture a 3d printer. It took a while to procure the whole kit. In the meanwhile a CAD model of a 3d printer has been created using. First we designed all the parts required for the assembly and dimensions were strictly taken from internet as we didn't have the kit or manual to find out the original dimensions. Then all the parts are assembled in the software to create the 3d printer assembly. Here are the real life pictures, designed modelof individual parts and their working process.

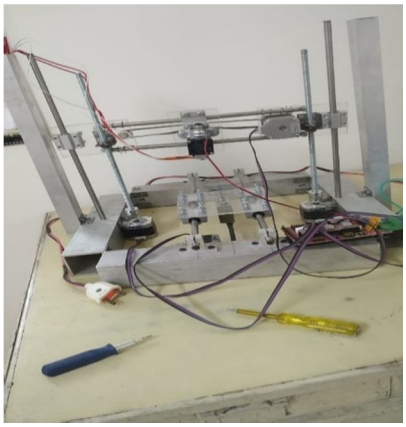


FIG 1: Assembled working printer

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III. DIFFERENT PARTS OF 3D PRINTER

Various components of 3D printers are: Frame, Y-axis and bushing, Extruder, printplate, stepper motors, Z-axis and Y- axis, X-carriage, Electronics parts, stepper motor controllers and end-stops [42].

A. Description of Each parts

Frame: The frame provides the printer its property regarding stiffness. The three axes of the printer are added to frame. The frame consists of threaded rods, Aluminium channel and smooth rods.

B. Y-axis and Bushings

In Figure 2 we can see the print base plate is collected on the Y-axis smooth poles. The Y-axis has one degree of freedom i.e. it can move between the front and back of the casing. The Y-axis is controlled by a belt drive appended to a stepper motor with pulley. The print base plate has four bushings joined to it. Bushings are only plain bearing. They slide over smooth bars and give right around zero rubbing when going here and there the poles. On the 3d printer, the bushings climb and down the smooth poles taking after a virtual line on the bars. Linear Bearing has little balls inside and gives free and smooth movement in one course just. Metal bushings are by and large comprised of metal which have low erosion and is self- greasing up too. 3D printer outline utilizing direct course by and large favour SC8UU metal orientation. The standard 3D printer utilizes bushings [4].

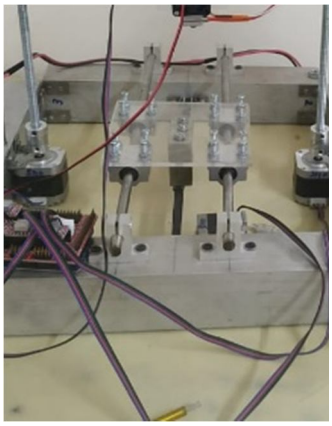


FIG 2: Y-axis and linear bushings

C. X- axis and Z- axis

In figure 3 we can see 3D printer frame with X-, Y- and Z-axis assembled and installed. The Z-axis and Y-axis follow the identical construction process. The Z-axis moves the X-axis up and down the frame. The X-axis traverses the extruder left and right within the frame. The Z-and-X axis development utilizes Acrylic sheet frame with SC8UU called the X-end idler as indicated in the figure. The stepper motor will turn the Nut and 'L' bracket assembly around its own particular pivot which thus will permit the X-end idler climb and down. Collected X-end idler is indicated in figure 4. The X-end motor is assembled of the comparable two areas and is assembled in a comparative manner. As we can see from the figures, Z-axis is controlled by 2 stepper motors. It results out to be less expensive and improvement of precision to have 2 stepper motors on the Z-axis rather than one motor and a belt, on the grounds that the later one requests an extremely complex development and an extravagant belt too.

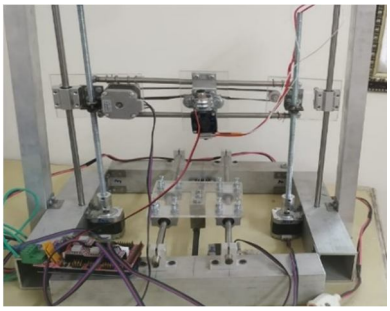


FIG 3: X, Y & Z axis installed

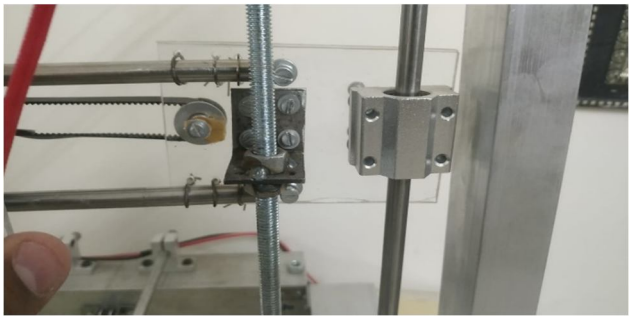


FIG 4: X idler assembly on RHS

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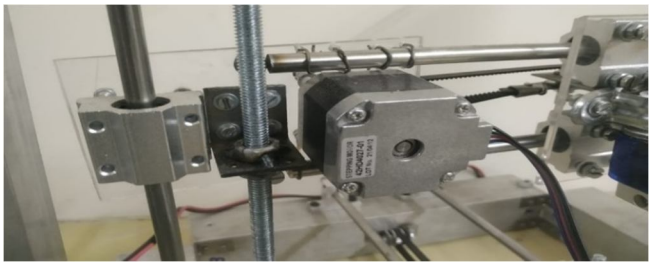


FIG 5: X axis Motor assembly on LHS

D. Extruder

The 3D printer is generally assembled with a extruder. This extruder contains a cold top part which feeds or provides the plastic filament. The extruder is driven by small teethed gear which is driven by a stepper motor. This gear in combination with pulley extracts the plastic filament and pushes it into the hot-end where the plastic starts melting.

The hot-end is generally a bolt made up of metal with a gap penetrated down the vertical pivot. This screw, otherwise called a heater barrel. At the tip of the heated barrel, the way out opening diminishes down to under 1mm from 3mm [4].



FIG 6: Extruder Assembly

Print plate: Printed parts are intended to be imprinted on the print plate. The three axes move with respect to one another so that the nozzle can be set simply over the print plate for the printing reason in a range given by the particular of the print plate.

The print plate for the most part constitutes two plates: the print base plate which is fitted and mounted on the X-pivot smooth poles by utilizing a bushing or a direct bearing and the print top plate which is mounted on the base plate and in this way, shapes the print surface.

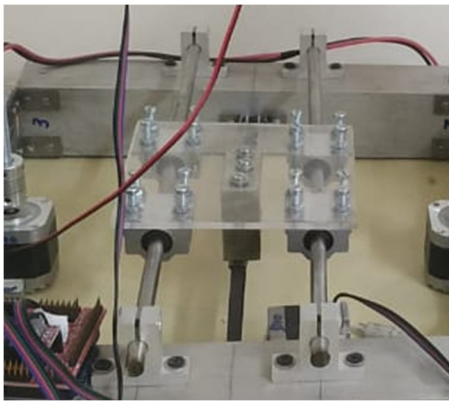


FIG 7: Print plate

E. Electronics

The electronics board known as microcontroller controls the entire printing process. Several electronics options do available for 3D printers which are all open-source. Presently the most popular are:

1) RAMPS, a DIY shield board for Arduino MEGA
2) Sanguinololu, a DIY board with microprocessor on board

Functions of a 3d printer electronics board:

a) Processes G-code instructions.
b) Controls and regulates the four stepper motor controllers where both Z-axis motorsare essentially connected to the same stepper motor controller.
c) Monitors the end-stops
d) Controls the temperature of the heated bed

The electronics board is connected to the PC using a USB-to-serial converter.

F. Stepper Motor

Five 4.2Kg-cm Nema 17 with 1.8* step angle.
Two for Z-axis, one for X and Y axis each and one for extruder.

G. Stepper Motor Controller

Controlling a bipolar stepper motor is truly muddled, particularly in the matter of smaller scale venturing mode. Unipolar stepper motors are much simpler to control however theygive lesser torque given the motor size is same. Exceptionally outlined stepper motor controllers are being utilized to assume control over the troubles of directing a stepper motor.
With the assistance of such controller stand out small scale step can be made. Consequently controlling of a stepper motor has been rearranged.

H. End Stops

While printing an object, all three axes need to be altered the initial position to their starting one. This is known as the zero position of any Cartesian robot. The axes can't move any further than zero.
To acquire this, three end stops are to be installed one for each axis. An end stop needs to be mounted at such a position where the axis shouldn't go beyond.

I. SMPS

12v 20Amps 240watt switch mode power supply required for powering all the components which is attached to ramps board for accurate control.

IV. CONCLUSIONS

A. The part made of our 3D printer are rigid in strength.
B. Various parameters have to be altered to get the right output.
C. Parts have higher mechanical property as well as aesthetic wise is nice too.
D. The means of motion can be changed experimentally to see which output is more feasible.
E. Accuracy is not the best but its still better then most printers out there.

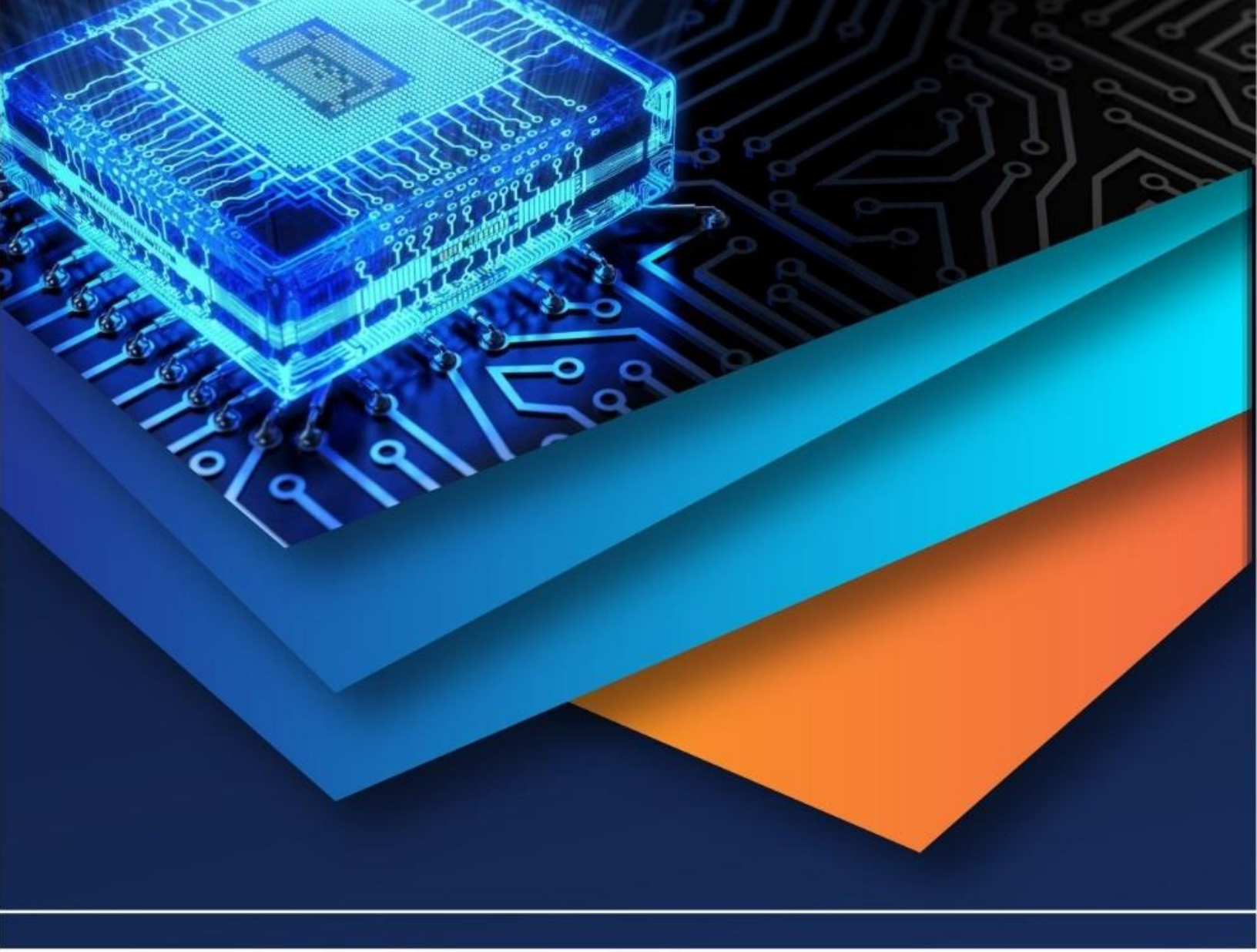
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