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Design & Fabrication of Low cost Portable 3D Printer

Chhotelal Chafle[1],Abhishek Chamat[2], Abhishek Waghmare[3],Bhushan Wanjari[4],

Prajwal Sakharwade[5], Shahidkhan Pathan[6]

[1]AssitantProfessor, [2-6]Scholors

Department of Mechanical engineering, MIET Shahapur, Bhandara - 441904

Abstract-*Nowadays 3D printer has become a big boom. This technology is not only used in industries but also used at those places where the prototyping is an important constraint. This project aims to develop a 3D printer that not only counts for a cost effective output but a product that can be used by each and every one. After this project gets a final touch it will benefit the common people where the cost effective is very crucial. Many 3D printing technologies are available to build a 3D object but this project aims to use that 3D manufacturing process that gives a cost effectiveness solution at a low wastage of printing material.*

Keywords- ***3D-printing Technology, Materials, AutoCAD, Fabrication.***

I. INTRODUCTION

History of printing starts from the duplicate of images by means of stamps followed by the flat bed printing process in 18th century. In mid-19th centuries color printing called as chromolithography became very popular. A revolution occurred when the printing workings, specifically a 2D printer was used as peripheral device, which made a persistent human readable representation of the graphics a text in paper. After some year the concept of 3D printer starts evolving a new way look at the past printing technologies. Printing is a process for reproducing text & images typically with ink on paper using a print process. It is a printing in a form of additive manufacturing technology where a three dimensional object is created by laying down successive layers of materials. It is also known as rapid prototyping is a mechanical method where 3D objects are quickly made on responsible size when it is connected to the computer & it is also called BLUE PRINT of the object. The main aim of this project is to make the 3D printer available to a common man making this equipment easy to operate and automate working once the command and specific design is given to the device so operating time will automatically decreases as it can handle the task without any human intervention. This also makes this device reasonable and approachable to everyone this project. This project deals or in other targets the people who cost as a main constrain and thus making a 3D printer useful in school laboratories, making imitation jewelry for women, automobile industries, making a prototype material in industries etc.

II. WORKING PRINCIPLE OF FUSED DEPOSITION MODELING

Fused Deposition Modeling (FDM) technology was developed and implements in 1980's. By using this method not only functional prototypes can be printed but also concept models and final end use product is implemented. What is good about this technology is that all parts printed with FDM can go high-performance which is highly beneficial for mechanic engineers and manufactures. FDM is the only 3D printing technology that builds parts with production grade thermoplastics, so things printed are of excellent mechanical, thermal and chemical qualities. This method does not waste plastics so this method is widely uses more over this method does not uses lasers.

The nozzle of FDM printers is attached to a mechanical chassis which uses belt or lead screw system to move it.The entire process extrusion assembly is allowed to move in X, Y & Z dimensions by a motorized system. A fourth motor is used to advance the thermoplastic material into the nozzle. All the movements of the head and the raw material are controlled by a computer.

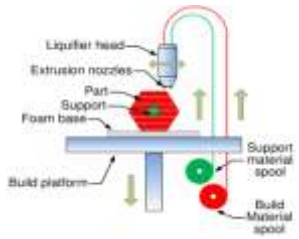

Fig 1: Fused Deposition Modeling

III. MATERIALS AND ITS SPECIFICATIONS

Sr.no	Items	Specifications
1.	Arduino	It has 54 Digital input/output pins. It has 16 analog inputs.

2.	Ramps 1.4	Controlling Stepper motor for easy operation.
3.	Stepper Motor (NEMA 17) [National Electrical Manufacturers Association]	A stepper motor is an electromagnetic device that converts digital pulses into mechanical shaft rotation. It has 200 steps/revolution.
4.	End Stops	Axis cannot move any further than zero.
5.	Extruder	Left hand (reverse) + motor
6.	PLA Filament	It has 1.75mm of Diameter
7.	Teak Wood	Dimensions 350mm*400mm*50mm
8.	GT2 PulleyBelt	GT2 pulley having length 2000 mm and width 6 mm.
9.	Flexible Shaft Coupling	Inner hole size is 5mm*8mm, outside diameter is 19mm and length is 25mm.

IV. FABRICATION OF 3D PRINTER AND WORKING

- In AutoCAD we design the product (like cube, Spur gear etc.) with dimensions which is in the format of .STL file after that .STL file of product is converted into G-code by using Slicer software.
- G-Code is used because it helps the printer to print the design part by part which very essential in 3D printing because 3D printing is an additive process not the subtractive process.
- A program of instruction is uploaded into the Arduino which is interface between communication channel that allows a computer to operate the printer and the mechanical parts of the printer.
- Arduino is well suited to the task, since it can be easily read programmed to drive and sense the machinery performance (i.e. stepper motor, end stops, extruder).
- This project involves five stepper motors, one to control Y-axis, the other to control X-axis & two to control Z-axis which is then lift or drop the extruder assembly from which the PLA filament is get converted into thin layer which form the given product design which is given through a Pronterface software.
- Pronterface software control all the motion produce by stepper motor, temperature of extruder, temperature of heat bed, end stops and rotation of stepper motor.
- The programmed uploaded to Arduino is run by Pronterface and product design (with dimensions) is given to the Pronterface so that it reads data and makes the extruder to run and find the center of product so that it can start designing and makes the perfect product.

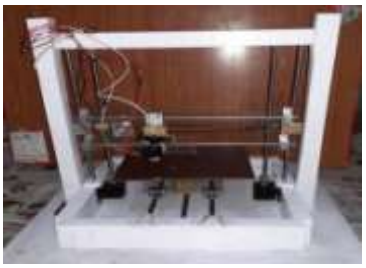

Fig 2: Complete Assembly

V. CONCLUSION

As the 3D printer is a device, it should be analyzed with the advantages and disadvantages, how the device can change the society and engineering etc. in mind. The very nature of 3D printing, creating a part layer by layer, instead subtractive methods of manufacturing lead themselves to lower costs in raw material. With so many potential benefits of 3D printing, there's no surprise that this method is making its ways through a diverse number of industries a quickly becoming a favorite tool of progressive marketers. Comparing the numerous advantages, application so we can conclude that the 3D printer and its technology is able to create next industrial revolution.

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