



# Enhanced 3D Printer for Medium Size Objects

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**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.

3D printing significantly challenges mass production processes in 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 Technology, Materials, AutoCAD, Fabrication.

## I. INTRODUCTION

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. 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. The printing process usually start with the making of a 3D model .This model can be created using any 3D software programmer. The model is layered into slices and is converted into a file which is understandable by a 3D Printer. 3D printing possibly challenges mass production processes in future. 3D printing influences many industries, such as automotive, architecture, education, medical, business and consumer industries.

## II. RELATED WORK

3D printing was known as "rapid prototyping". Charles Hull, of 3D Systems Corporation, created the first working 3D printer in 1984. Later in the 80's, Selective Laser Sintering (SLS) technology was developed by Dr. Deckard at the University of Texas at Austin during a project sponsored by Defence Advanced Research Projects Agency (DARPA). In the 1990s, the technology was further improved with the development of a method that used ultraviolet light to solidify photopolymer, a viscous liquid material. In the late 20th century, 3D printers were extremely expensive and could only be used to print a limited number of products. The majority of the printers were owned by scientists and electronics enthusiasts for research and display. Although it was still in limited development, the printing technology was a combination of modelling both science and construction technology, using some of the newest technological advancements of the time. Consequently, 3D printing began to lead a worldwide manufacturing revolution. In the past, surface design was mainly dependent on the production process. However developments in the field of 3D printing have allowed for the design of products to no longer be limited by complex shapes or colours[2].

Technology there is a plastic filament or a metal wire which is unwound from a coil and supplying material to an extrusion nozzle which can turn the flow on and off. The nozzle is heated to melt the material and can be moved in both horizontal and vertical directions by a numerically controlled mechanism, directly controlled by a computer-aided



manufacturing software. The object is produced by extruding melted material to form layers as the material hardens immediately after extrusion from the nozzle. This technology is most widely used with two plastic filament material types: ABS (Acrylonitrile Butadiene styrene) and PLA (Polylactic acid)[5].

Different method of 3D Printing :

- selective laser sintering (SLS)
- photo polymerization
- fused deposition modelling
- stereo lithography

### III. PROPOSED ALGORITHM

The Electronics board controls the printing process. Here in Electronics board the microcontroller we are using is ARDUINO MEGA 2560 and a RAMP 1.4. ARDUINO MEGA 2560 has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. RAMP 1.4 mainly designed for the purpose of using stepper driven board.

In our 3D model maker we are using Fused Deposition Modeling (FDM). In FDM technology there is a plastic filament or a metal wire which is unwound from a coil and supplying material to an extrusion nozzle which can turn the flow on and off. The nozzle is heated to melt the material and can be moved in both horizontal and vertical directions by a numerically controlled mechanism, directly controlled by a computer-aided manufacturing software. The object is produced by extruding melted material to form layers as the material hardens immediately after extrusion from the nozzle. This technology is most widely used with two plastic filament material types: ABS (Acrylonitrile Butadiene styrene) and PLA (Polylactic acid).

#### I. FEATURES

1. Standard interfaces (as that of extruder)
2. Support 5 stepper drive board
3. Use the interface of servo motor to adjust the level of printing platform automatically
4. Stepper motor for X,Y,Z axis in parallel.

The Arduino board has several functions:

1. Process code instructions.
2. Control the four stepper motor controllers
3. Control the temperature of the hot end and monitor the hot end
4. Monitor the end stops (End stops are used for homing the three axis).

The Arduino board is connected to the PC using a USB to serial converter. The Arduino used with the RAMPS has a converter built in. The RAMPS board is a shield board that needs to be connected to an Arduino MEGA 2560 board.

The RAMPS has some additional features:

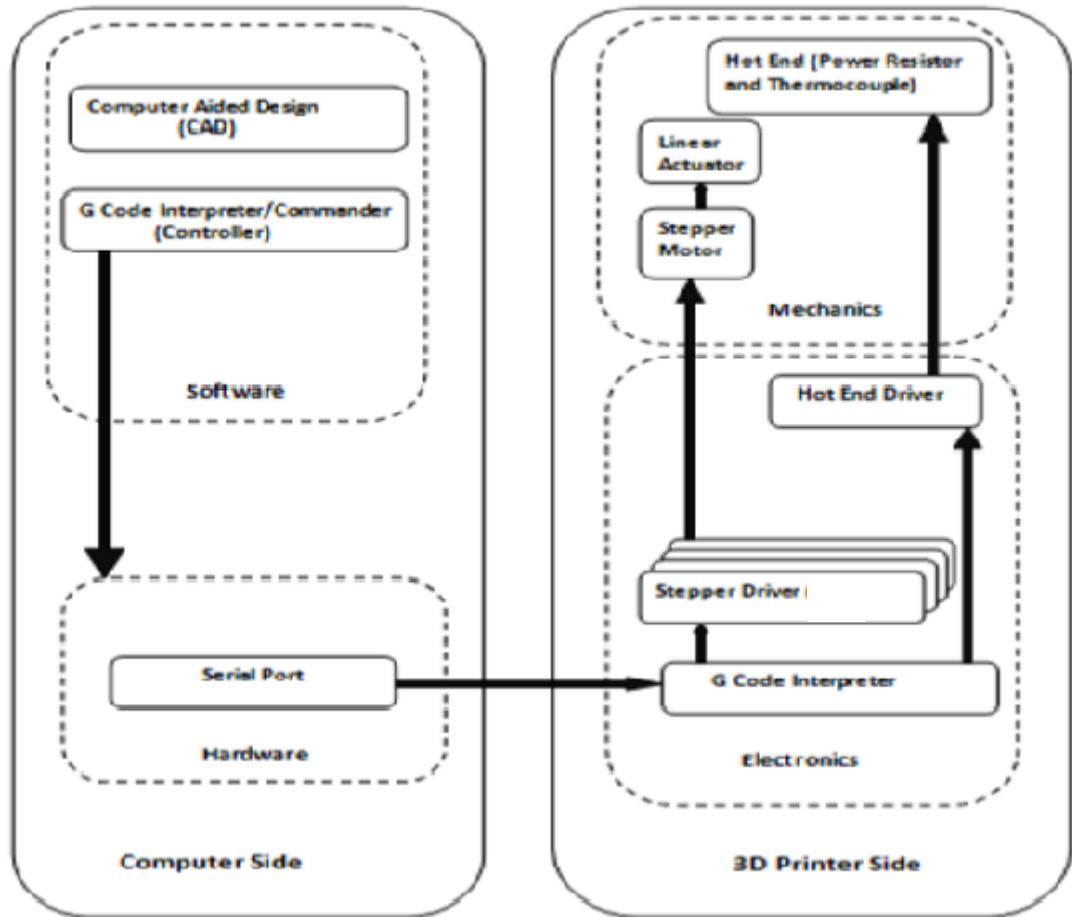
- One extra heater
- Optional SD card reader

There are 5 stepper motors we are using:

1. One to control the X-axis
2. One to control the Y-axis
3. Two to control the Z-axis
4. One for extruder.



Block Diagram of 3D PRINTER



This above block diagram describes the basic working of the product. As shown in above block Diagram Firstly a 3D object is designed using a CAD Tool and then is converted in such a file format specifically a G –Code using software's like that is understandable by the electronics that mainly includes the Microcontroller.

#### 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.



## V. CONCLUSION

It is concluded from this paper that it is possible to build a low cost 3D Model Maker with relatively same performance than the existing technologies. The microcontroller (MEGA 2560 and RAMP 1.4) was the key to enabling the project to come together, meaning that with the functions specified and programmed into it, the 3D Model Maker is able to accomplish the specified goal.

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