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Development of Cost Effective 3D Printer

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***Abstract*---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. 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, 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 .The process adopted by us is FDM technology, in which different the materials like PLA (polylactic acid), ABS (acrylonitrile butadiene styrene), HIPS (high impact polystyrene), etc. By heating any of the filament material to its melting point and it is deposited layer by layer. Combination of many layers of such type will give us a final 3D model.**

***Keywords*: 3 dimensional, FDM, prototype, inkjet, ABS, HIPS.**

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.3Dprinting is efficiently utilized in various fields such as aerospace, automobile, medical, construction and in manufacturing of many household products. Three-dimensional (3D) printing can impact the transmission of information in ways like 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 can 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, business and consumer industries. Since over a century the visual world of printed scriptures has been dominated by the 2-D printing methods. Be that easy to read or comprehend but when it comes to imaging of definite and real-life models it is sorely outsourced. Any 3-D model cannot be represented and displayed easily in a 2-D workplace. The only thing worth mentioning for likable perception is the rendering of the image. This ushered in the era of the much-needed idea of “3-D” printing.

The 3D printing innovation is not a new concept as many think. When FDM (fused deposition modeling) licenses had expired in 2009, the 3D printing became a new innovation topic. What's more, because of which it turned out to be more mainstream, individual senvisioned that FDM was the just a single added substance producing system. Be that as it may, the initial 3D printing procedure was SLA not FDM, and its first patent was recorded in 1980's.Here is the historical backdrop of 3D printing innovation, from 1980 to today. In 1980's there was the introduction of 3 primary 3D printing systems. Dr. Kodana was the first person to present layer by layer approach for assembling and furthermore he was the principal individual to create fast prototyping strategy. What's more, he made a progenitor for SLA. He polymerized a photosensitive gum with the assistance of UV light, however, did not succeed. Shockingly for Dr. Kodana, the full patent detail was not recorded by him before the one-year due date after the application. the causes of 3d printing innovation can be followed from 1983.In 2009, was the year where the FDM patents fell into the public domain, giving an expansive wave for the development in FDM printers and due to the drop of the price of desktop3D printers, the technology was more accessible and increased visibility.

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A French company named Sculpted was started in this year which had offered 3D printing cloud and online printing Services using stereo lithography or laser sintering.As the various additive processes developed. It is said that soon metal removal will no longer be the only metal removal process done through a moving head through a 3D work envelope converting the mass of raw material into desired shape layer by layer. In 2010 there was a first decade in which metal end use parts like engine brackets and large nuts would be made by printing instead of machining.

II. PRINCIPLE

1. Modelling

The object or the model which must be printed first it has to designed or model edusing a CAD (computer aided drawing) tool like solid works etc. By the 3D scanner or by the digital camera and a unique photogrammetry software. These 3D printed models were created with help of the CAD results in the reduction of errors which were found and can be corrected before printing. In manual modelling process of preparing geometric data for 3d computer graphics is like plastic arts such as sculpting. Based on this data 3-dimentional models of the scanned object can be produced. After modelling in CAD tool, the model often be (in. skp,dae, .3ds or some other format) then it needs to be converted to either a. STL or OBJ format, to allow the printing software to be able to read it.

2. Printing

In most of the cad applications produce errors in output STL files errors like self-intersection, improper holes, face normal must be corrected. Once the file is converted to STL, the file must be processed by Software called “slicer ”which will convert the model into series of layers and produces a G-code file containing instructions to a specific type of 3D printer. This G-code file can be printed by using 3D client software (which loads the G-code and uses it to instruct the 3D printer during printing. In practice the client software and the slicer program exist, including Cura, Slic3r, repeat erhost,pronter fac eand skein forgears well as closeds our ceprograms like simplify 3D and SIicer 3D.The method of Construction of models can take away from several hours to several days, depending how big the model is, method used, printing speed, and complexity of the model. Typically, the time can be reduced to few hours depending on the type of machine used and size. 3D printers give designers and concept models using a desktop size of 3D printer.

3. Finishing

The printer produced resolution is very much sufficient for many of the applications, but the printing will be a slightly oversized version of these desired object which can be the standard resolution and then the process of removing material can give greater precision.

Some printable polymers allow the surface finish to be smoother and improved using chemical vapor processes.

There are some of the additive manufacturing techniques which are very capable of using multiple materials in these courses of constructing parts. These techniques are very much able to print in multiple colours and colour combinations simultaneously. Some printing techniques require internal supports to be built for overhanging features during construction. These supports must be mechanically removed or dissolved after completion of the printing. The commercialized metal 3D printers which very much likely to involve in cutting the metal component of the metal substrate after deposition. The very new process for the GMAW 3D printing which will allow for substrate surface modifications to remove many aluminum components manually with hammer.

III. SOFTWARE REQUIREMENTS

1. Firmware

Firmware is the actual code that runs your printer. It starts as human-readable code, which defines the logic (i.e., how the printer is supposed to act given certain circumstances), is compiled into machine-readable code, then is uploaded to the memory on the controller board where it senses input and reacts according to the logic defined in the code. It’s very complex and takes a lot of smart people a long time to develop.

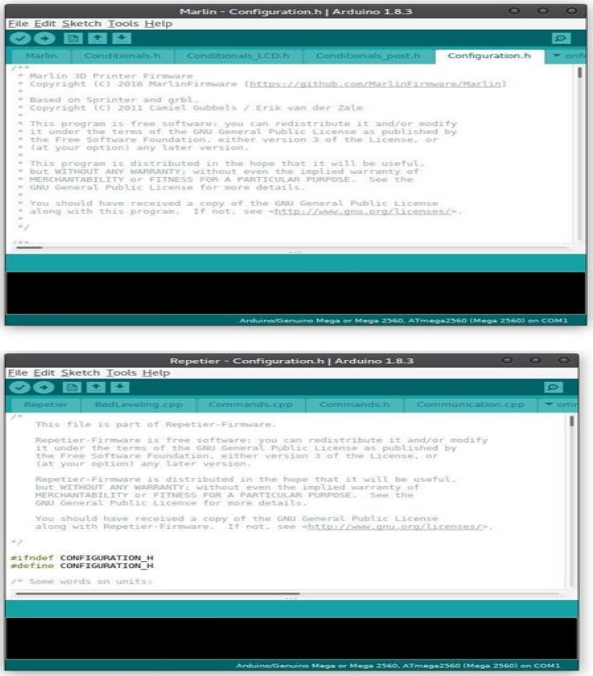

Figure 1: Firmware

2. Slic3r Software

A slicer is 3D printing software that converts digital 3D models into printing instructions for your 3D printer to create an object. The slicer cuts your CAD model into horizontal layers based on the settings you choose and calculates how much material your printer will need to be extrude and how long it will take to do it. All this information is then bundled up into a G Code file which is sent to your printer. Slicer settings do impact the quality of your print so it’s important

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to have the right software and settings to get you the best quality print possible.

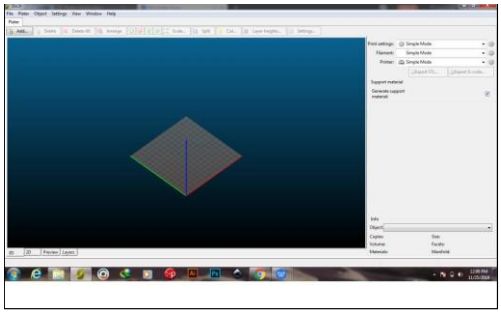

Figure 2: Slic3r Software

2.1 Procedure For Slic3r

Step 1: Click on Add then select. stl format of your CAD Design.
Step 2: Then click on Settings and Go to Print Settings
Step 3: Set the parameters as per your requirement based on information mentioned above, then click on Setting-> Filament Settings.
Step 4: Set the parameters as per your requirement based on information mentioned above, and then click on Setting-> Printer Settings.
Step 5: After Configuring about printer please click on Export G Code in next widow to generate the. Gcodefile.

IV BLOCK DIAGRAM

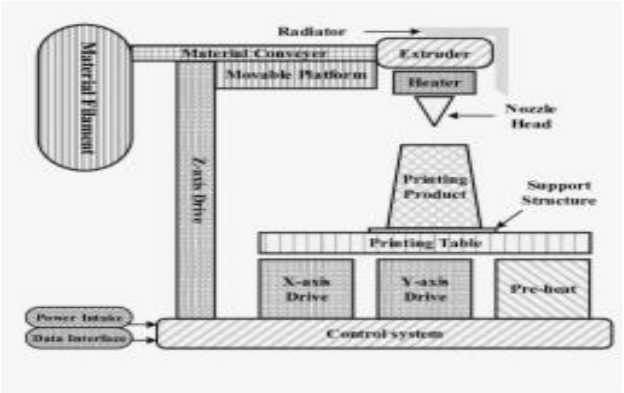

Figure 3: Block Diagram

- The filament is first extruded by the extruder and melted by the heater.
- The stepper motors are guided by the motor drivers so deciding the position of printing.
- The motors are fixed to the supports and movable conveyers are connected to the stepper motors.
- The filament is printed on the Printing table (Hot bed).
- Power intake is taken to the Control system. Data interface is done with the Control System.
- The printed model is obtained on the hot bed.

V IMPLEMENTATION

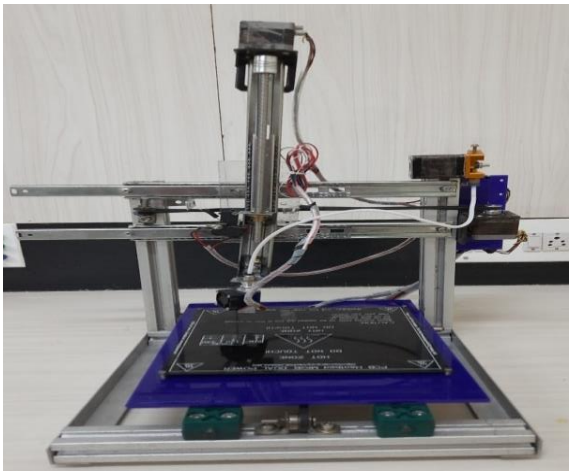

Figure 4: Proposed Model

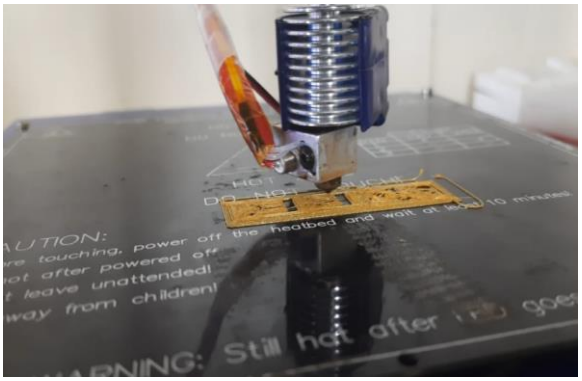

Figure 5 :Working 3D model

VI TESTING

When supply is given to the model, The Ramp board is powered up from this supply. Which in further gives supply to the motors, extruder, and Hot End. The Arduino board is powered up from the laptop itself. The model to be printed is first designed using Tinker CAD Software and exported in. stl format. This design is fed into slic3r software. The slic3r software slices the 3D design into thousands of 2D layers in G-Code format. This G-Code format file is fed to Print Run Software. Print Run Software controls the movement of all 3 stepper motors attached to the 3 axes and Extruder.
Print Run Software also controls the temperature of Hot End and Heated bed. The motors and extruder run according to the directions given by the Print Run software. The filament is first extruded by the extruder and melted by the heater. The printing starts layer-by-layer on the heat bed. The printing process continues until it reaches the final layer, and the printing of the model is completed. The printed model is taken out from the heat bed.

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VII CONCLUSION

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 modeling, selective laser sintering, stereo lithography etc., fused deposition modeling 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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