

DESIGN & DEVELOPMENT LOW COST OPEN SOURCE 3D PRINTER

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ABSTRACT

3D printers are another era of machines that can make regular things. They're amazing on the grounds that they can deliver various types of items, in various materials, all from a similar machine. A 3D printer can make basically anything from clay containers to plastic toys, metal machine parts, stoneware vases, favor chocolate cakes or even (one day soon) human body parts. They supplant customary processing plant generation lines with a solitary machine; simply like home inkjet printers supplanted jugs of ink, a printing press, hot metal sort and a drying rack. 3D printing is a kind of added substance fabricating innovation where a three dimensional question is made by setting down progressive layers of material which frames the last object. 3D printers offer item creators the capacity to print parts and segments that are produced using diverse materials which have different mechanical and physical properties in a solitary form handle.

Keywords: stoneware vases, solitary machine, 3D printers etc.

1. INTRODUCTION

3D printing is a procedure for making objects straightforwardly, by including material layer by layer in an assortment of courses, contingent upon the innovation utilized. Disentangling the belief system behind 3D printing, for anybody that is as yet attempting to comprehend the idea (and there are numerous), it could be compared to the way toward building something with Lego squares naturally. 3D printing is an empowering innovation that energizes and drives advancement with phenomenal plan opportunity while being an apparatus less process that decreases restrictive expenses and lead times. Segments can be composed particularly to maintain a strategic distance from gathering prerequisites with mind boggling geometry and complex elements made at no additional cost. 3D printing is additionally developing as a vitality effective innovation that can give natural efficiencies as far as both the assembling procedure itself, using up to 90% of standard materials, and all through the item's working life, through lighter and more grounded plan.

There are various confinements to customary assembling, which has broadly been founded on human work and "made by hand" belief system attaching back to the etymological roots of the French word for assembling itself. In any case, the universe of assembling has changed, and computerized procedures, for example, machining, throwing, framing and embellishment are all (moderately) new, complex procedures that require machines, PCs and robot innovation. For some applications customary outline and generation forms force various unsuitable limitations, including the costly tooling as said above, installations, and the requirement for get together for complex parts.

2. LITERATURE SURVEY

Analysis of Dimensional Performance for 3D Open-Source Printer Based On Fused Deposition Modelling Technique: L. M. Galantuccia, methodology clarify the intricate building component, additionally speaks to in detail the impact of process parameters on yield reactions, particularly for the part quality. A scientific dimensional execution assessment and correlation is shown, done on benchmarks made utilizing two distinctive 3D FDM printers: a modern framework, and an open-source.

A Personal Desktop Liquid-Metal Printer as a Pervasive Electronics Manufacturing Tool for Society in the Near Future: Jun Yang¹ clarified fundamental components and vital specialized systems in this paper, alongside exhibitions of a few conceivable purchaser end-utilizes for making practical gadgets, for example, light-transmitting diode (LED) shows. This fluid metal printer is a programmed, easy to utilize, and ease individual hardware fabricating instrument with numerous conceivable applications.

Low cost production of 3D-printed devices and electro stimulation chambers for the culture of primary neurons: Wardyn et al. has investigated the Low cost production of 3D-printed devices and electro stimulation chambers for the culture of primary neurons. They tried to highlight the also describe how to use these devices to grow and stimulate neurons within geometrically constrained compartments. Experimental verification of design automation methods for robotic finger was explained good. Dixit et al. led the comparative study between the two different rapid prototyping systems on dimensional performance using Grey Relational Grade Method. Their investigation concluded that the low cost 3D open source printer showed better results in part accuracy when compared with the industrial based fused deposition modelling machine.

3. REQUIRED INSTRUMENTS & SOFTWARES

- Arduino uno - 1
- Breadboard - 1
- L293D ICs Motor driver - 3
- Moving platforms - 3
- ATmega328p (with Arduino Bootloader) - 1
- USB to Serial adapter - 1
- 2pins Screw Terminal Connector (or 2x 4 pins Screw Terminal Connector) – 4
- Stepper/servo motors (depending upon availability & cost) – 3
- Adjustable mechanism - 2
- Structure
- Connection cables & other electronics
- Grbl Controller
- Maker CAM

4. DESIGN & MANUFACTURING

4.1 Creating CAD Model:

Computer aided design innovation is imperative while outlining framework. Solidworks 2013 Student Version has been utilized for demonstrating. The CAD Model comprises of 7 sections i.e. base, structure, stepper motor, jolts, L clips, 3d pen, external Structure and cut. The snapshot of the model after assembling the sections is as shown:-

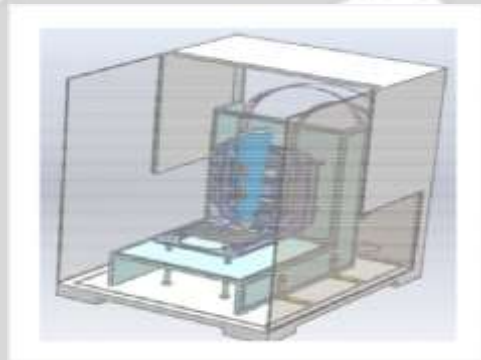


Fig.1: Assembly in CAD Model

4.2 Construction:

Step 1: Disassembling the Optical Drives



Fig. 2: Disassembly of Optical Drives

Step 2: Mounting the Motor Trays



Fig. 3: Motor Tray Arrangement

Step 3: Finishing the Stand



Fig. 4: Stand of the Model

Step 4: Mounting & Hacking the 3D Pen



Fig. 5: Disassembly of 3D Pen

Step 7: Creating a Switching Circuit: The following stride is to make a circuit that we can control from an Arduino that mimics exchanging the forward expulsion catch on and off. The key to make the circuit work is known as a transistor.

4.3 Calculations

The counter weight & the weight on Z- axis motor are balanced with a double pulley arrangement. Thus it reduces the unnecessary burdan of weight on motor causing it to move freely.

Now, Weight of 3d pen = 75gm & Weight of Assembly parts = 15gm Therefore, Weight carried by X-axis stepper motor = weight of pen + assembly

$$= 90\text{gm}$$

So, value of counter weight is equal to **90gms**.



Fig. 6: Counterweight arrangement

5. WORKING OF MECHANISM

In Maker Cam, you can create a test image by following these steps:

1. Insert a new basic image by going to “Insert” and selecting a shape. Using the Arrow tool (from top left toolbar), select your entire image.
2. Move it to the bottom left corner of the grid.
3. You can pan around the grid by selecting the Hand tool from the toolbar. Use it to drag the image back to the centre of the screen.
4. From the upper right corner of the page, change the measurements to cm.
5. Using the scale option from “Edit > Scaled Selected”, scale the object down and move it so that it fits within the single square that is in the corner of the grid (use the picture to the left as reference).
6. With the image still selected, go to “Cam > Follow Path Operations” and use these values as a test basis:
 - a. The “target depth” will be the height of your object. I used -1.
 - b. “Safety Height” and “Stock Surface” are set to 0.
 - c. “Step Down” will be the height each layer of filament will be. For starters, I set mine to 0.2, but if you want thinner layering, you can make it lower.
 - d. “Feed Rate” is the speed at which the print goes. Setting it to 50 worked will with my 3D pen at its lowest extrusion speed.
 - e. The “Plunge Rate” is the speed at which the nozzle moves up and down. This doesn’t really matter, but I set mine to 50.
7. Then go to “Cam > Calculate Selected” to calculate the path.
8. Lastly, go to “Cam > Export G-code” to save the G-Code of your image.

Before we can run this G-code through GRBL Controller, we need to make a few edits to ensure that it works with our 3D printer. So open up the file that you saved from makercam.com in a text editor such as Notepad. You should see a bunch of different lines of letters and numbers. These are the G-Code coordinates that are sent to the machine that tells it what to do. We want to add “M3” and “M5” commands to tell the filament extruder when to extrude and when to stop extruding. Here’s what you need to do:

1. Below “G17” is the first “M3” command. Since this starts the extruder way too early (at the beginning of the script), we want to move it until after the nozzle has moved to its starting position, which is immediate after the first “F50” (feed rate 50) command on the next line.
 2. Throughout the rest of the code, every time you see an “F50” command, place an “M3” command immediately after it on the next line.
 3. Next, look for the first Z0 command. Z0, moves the nozzle to 0mm, which we do not want. That would push it down to the base platform and ruin our print. Instead of moving the Z axis at this point, we want to just stop the extrusion motor. So every time you see a Z0 command, delete it and replace it with an M5 command.
 4. At the very end of the script, after the final M5 command, we want to move the Z axis so that it is above our final print. Since I set my print height to be -1, I’m going to set the final Z axis height to be -2 (G0 Z-2)
 5. After setting the final Z height, a helpful thing to do would be to move the X and Y axis back to their original starting positions. So right below the Z axis movement, put “G0 X0 Y0” to move them.
- Save your code and then you’re ready to print.

6. ADVANTAGES

1. Simple in construction.
2. Easy to assemble & carry
3. The cost of production is comparatively less. The components used are available at low cost
4. It takes less working time. It reduces the time consuming procedure of programming as it is done Maker cam software. We have to open it another software Grbl controller which implement the file with extension g-code.
5. Use of open source software's makes it comfortable.

7. CONCLUSION

The 3-D printer can produce multiple copies just like a photocopy machine. All sorts of goods, from jewellery to mobile phones, auto and aircraft parts, medical implants, and batteries are being printed out . As the new 3-D technology becomes more widespread, on site, just in time customized manufacturing of products will also reduce logistics costs with the possibility of huge energy savings. There are so many 3D printers on the market that it is really hard for users to make a decision, So the main problem is cost. That is why we decided to develop a new printer integrated with stable structure, friendly interface, easy operation and affordable price.

This project describes the design of a very low budget 3D Printer that is mainly built out of recycled electronic components. This 3D Printer is built with about an 70% of recycled components, which gives it a great potential and helps to reduce the cost significantly.



Fig. 7: Created 3D Component

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