



Three Dimensional Model Maker

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ABSTRACT: 3 dimensional printing is a technique to make a 3 dimensional object in which layers of material are made using computer control to melt the material and make the object hence it is also known as additive manufacturing technique and is reverse of the Reductive manufacturing technique in which we start from the block of a material and remove the part which is not needed. The objective of our project is to make a 3D printer which is cheaper than the 3D printer already available in the market. The main way this can be achieved is by using old electronic parts for example:-Stepper motors from the used printers. This also involves making the body of the 3D printer using the available material.

Keywords: 3D, Stepper motor, RAMPS 1.4, motor driver

I. INTRODUCTION

3 Dimensional printing is a technique to make a 3 dimensional object in which layers of material are made using computer control to melt the material and make the object hence it is also known as additive manufacturing technique and is reverse of the Reductive manufacturing technique in which we start from the block of a material and remove the part which is not needed.

The object made using 3D printing can be of any shape or geometry and are much simpler and faster to make as compared to the other techniques. This technique also help to use the material in the controlled manner and avoid wastage.

The process of printing involves these steps:

1. Making a model of the desired object in a 3D modelling software.
2. Slicing the model using software(as the printing is going to be done layer by layer) so that it could be given to the printer for the printing process.
3. Giving the required object to the printer so that printing can be done.
4. Printing the model/object.

II. OBJECTIVE

The objective of our project is to make a 3D printer which is cheaper than the 3D printer already available in the market. The main way this can be achieved is by using old electronic parts for example:-Stepper motors from the used printers. This also involves making the body of the 3D printer using the available material.

The cheapest printer available in Indian market cost around Rs.30000 and as such is unavailable for the use

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by common people. But there is a way to make a cheap 3D printer using old electronics component, such as
1-Stepper motors from printers and CD drive.
2-power supply from computer.
3-carriage of printers to make the axis of the printer.
In this way we can a build a cheap 3D printer that can be used to affordably print 3D models.

III. METHODOLOGY

There are 7 methods to do 3D printing such as:

1. Vat Photo polymerisation
2. Material Jetting
3. Binder Jetting
4. Material Extrusion
5. Power Bed Fusion
6. Sheet Lamination
7. Directed Energy Deposition

In our 3D model maker we are using Material Extrusion Method. The most commonly used technology in this process is 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).

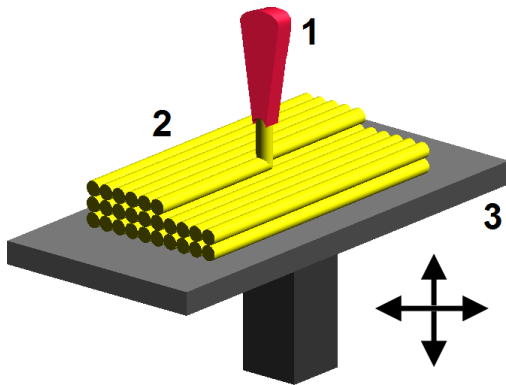


Fig. 1. Filament extruding from the extruder.

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.

FEATURES

1. Standard interfaces (as that of extruder)
2. MOSFET are applied to the heater/ fan and thermistor circuit.
3. Support 5 stepper drive board
4. All the MOSFET can be controlled by PWM
5. Use the interface of servo motor to adjust the level of printing platform automatically
6. LED can indicate the status of the heater (the open and close of MOS).
7. Stepper motor for X,Y,Z axis in parallel.

The Arduino board has several functions:

- Process code instructions.
- Control the four stepper motor controllers
- Control the temperature of the hot end and monitor the hot end
- 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

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There are 4 stepper motors we are using:

- One to control the X-axis
- One to control the Y-axis
- One to control the Z-axis
- One to control the extruder

IV. BLOCK DIAGRAM AND CIRCUIT DISRIPTION

The block diagram of the circuit we are using our project is given in figure 2.

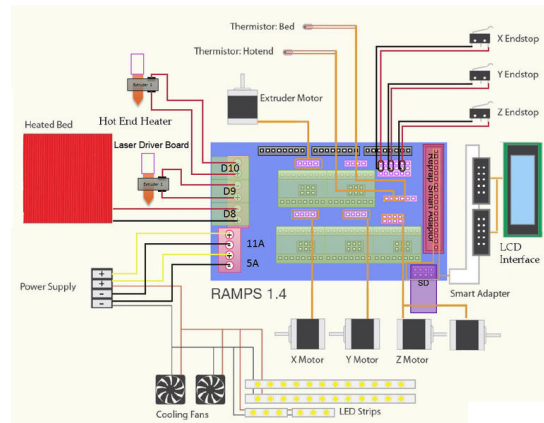


Fig. 2. Block diagram 3D printer.

Arduino Main Board: The Arduino Uno is a microcontroller board based on the ATmega328 . It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. The Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into **DFU mode**

The board has the following new features:

- 1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible both with the board that use the AVR, which operate with 5V and with the Arduino Due that operate with 3.3V. The

second one is a not connected pin, that is reserved for future purposes.

- Stronger RESET circuit.
- Atmega 16U2 replace the 8U2.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0.

The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards

The Arduino Uno SMD Edition (R3) is also available. Specification:

- Microcontroller: ATmega328
- Operating Voltage: 5V
- Input Voltage (recommended): 7-12V
- Input Voltage (limits): 6-20V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 40 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB (ATmega328) of which 0.5 KB used by bootloader
- SRAM: 2 KB (ATmega328)
- EEPROM: 1 KB (ATmega328)
- Clock Speed: 16 MHz

Physical Characteristics: The maximum length and width of the Uno PCB are 2.7 and 2.1 inches respectively, with the USB connector and power jack extending beyond the former dimension. Four screw holes allow the board to be attached to a surface or case. Note that the distance between digital pins 7 and 8 is 160 mil (0.16"), not an even multiple of the 100 mil spacing of the other pins.

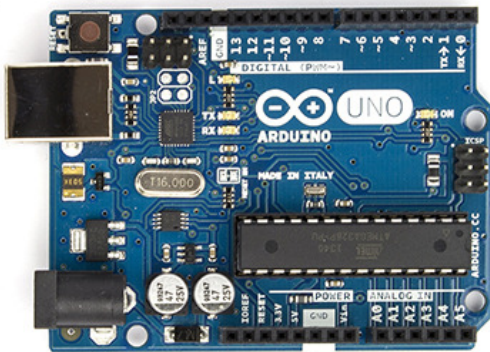


Fig. 3. Arduino board.

RAMP 1.4:

Ramps mainly designed for the purpose of using stepper driven board (similar to 4988 driven board). Ramps can only work when connected to its mother board Mega 2560 and 4988/DRV8825. Owing to its stability in operation and great compatibility with most 3Dprinter (all -model such as i2 and i3).

The combination of Ramps1.4+MEGA2560 +A4988/DRV8825 is becoming a mainstream of DIY 3D printer control board.

Features

1. Standard interfaces (as that of extruder)
2. Reserved GCI like I2C and RS232
- 3 MOSFET 3 MOSFET are applied to the heater/ fan and thermistor circuit.
4. Adding another 5A to protect the component parts.
5. An 11A fuse is added to the hotbed
6. Support 5 stepper drive board
7. The adoption of Pin Header as pololu makes it more convenient to repair or change.
8. I2C and SPI are reserved for expanding
9. All the MOSFET can be controlled by PWM
10. Use the interface of servo motor to adjust the level of printing platform automatically.
11. Adding a SD module for SD ramps module.
12. LED can indicate the status of the heater (the open and close of MOS).
13. 2 stepper motor for Z axis in parallel.

V. ADVANTAGE OF 3D PRINTING

1. Time-to-Market: 3D printing allows ideas to develop faster than ever. Being able to 3D print a concept on same day and present it in market removed the development process from what might take days or months helping companies stay one step ahead of the competition.

2. Save Money: Prototyping injection mold tools and production runs are expensive investments. The 3D printing process allows the creation of parts and/or tools through additive manufacturing at rates much lower than traditional machining.

3. Mitigate Risk: Being able to verify a design before investing in an expensive molding tool is worth its weight in 3D printed plastic, and then some. It is far cheaper to 3D print a test prototype then to redesign or alter an existing mold.

4. Clear Communication: A conceptual picture of the product is better than the description since it is worth 1,000 words, but getting to hold the tangible product-to-be, in hand, clears all lines of communication. There is no ambiguity when holding the exact, or at least a very close, representation of the product.

5. Feedback: Because it is 3 D MODEL and the concept is clear to people/senior authority so the feedback is good and clear.

6. Get the Feel: One thing you can't get from a picture or virtual prototype on the computer screen is the way something feels in your hand or 3D model. If you want to fit of a product are just right, you must actually hold it, use it and test it.

7. Personalize It: With standard mass-production, all parts come off the assembly line or out of the mold the same. With 3D printing, one can personalize, customize and tweak a part to uniquely fit their needs, which allows for custom fits in the medical and dental industries and helps set people apart in the fashion and jewelry world.

8. Build your Imagination: In the modern boom of digital art and design, the possibilities are not only accelerating but limitless. One can now 3D print almost anything they imagine after drawing it up virtually. In a relatively short time, an idea, concept, dream or invention can go from a simple thought to a produced part that you can hold.

VI. 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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