

Original Article

# Multi-Functional Integrated 3D Printer

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**Abstract** - The original intention of a 3D printer is to show the design idea more concretely and vividly, but there are still some defects in the actual use process, such as unable to print objects of sufficient volume, unable to print models with more colorful colors, etc. Therefore, our team tried to design a multi-functional integrated 3D printer to expand the printing area and enrich the printing model colors. Project Leader: Liao Jing; Project participants: Ma Zheng, Qian Baohui, Yang Xiaoying; Instructor: Lu Chenhui. This project is to optimize and improve the structure and function of 3D printers on the market and design a 3D printer that can be more intuitive and complete (infinite, multi-color, laser engraving, etc.) to realize the designer's idea. Traditional 3D printers often have a space utilization rate that is not high, only in the frame of the printer, which means that to print larger or longer models will have to switch to a larger size of 3D printers, and the traditional 3D printers on, the appearance of the model less color these important design elements, and can't completely according to the designer's idea for printing. In addition, the molding scope of a 3D printer is a THREE-DIMENSIONAL space, and other functions, such as laser engraving, writing and CNC engraving, can be realized on the two-dimensional plane. Therefore, adding these functions to 3D printers can increase the utilization rate of 3D architecture and make the best use of things. In addition, the functions mentioned above can make designers' ideas more rich and diversified, realize users' ideas more concretely, promote the popularity of 3D printers, stimulate people's creative desire, and improve people's creativity.

**Keywords** - 3D printing technology, Wireless Z-axis 3D printing technology, 3D multi-color printing technology, 3D printing technology expansion.

## 1. Introduction

With the improvement of contemporary people's life, 3D printing technology is more widely used. The original intention of the 3D printer is to show the design idea more concretely and vividly, but there are still some defects in the actual use process, such as unable to print objects of sufficient volume, unable to print models with more colorful colors, etc. Therefore, our team tries to design a multi-functional integrated 3D printer that can expand the printing area and enrich the printing model colors to express the model further vividly and improve the design efficiency.

Now on the market, traditional 3D printers often have low space utilization and can only be formed in the printer frame, which means that to print larger or longer models, 3D printers have to change to a larger size. In addition, traditional 3D printers can only print monochrome, and color, an important design element, is missing in the appearance of models. It does not print exactly as the designer intended. In addition, the molding scope of a 3D printer is a THREE-DIMENSIONAL space, and other functions, such as laser engraving, writing and CNC engraving, can be realized on the two-dimensional plane. Therefore, adding these functions to 3D printers can increase the utilization rate of 3D architecture and make the best use of things.

In view of the problems existing in the current market, this project is to optimize and improve the

structure and function of 3D printers on the market and design a 3D printer that can be more intuitive and complete (infinite, multi-color, laser engraving, etc.) to realize the designer's idea. In addition, the above functions can enrich and diversify designers' ideas, realize users' ideas more concretely, promote the popularity of 3D printers, stimulate people's creative desire and improve people's creativity.

## 2. Systems Composition

### 2.1. General Structure

The multi-functional integrated 3D printer project mainly consists of five parts:

1. Adjustable Angle 3D printed cantilever;
2. Movable caterpillar printing plane;
3. The special nozzle that can mix three primary colors consumables;
4. The mechanical structure design of the replaceable operating head;
5. Electric control system.

### 2.2. Mechanical Structure

Adjustable Angle of 3D printing cantilever: through mechanical structure makes, the 3D printing cantilever in the Z direction perpendicular to the ground at 90 ° and adjusted into a 45 ° Angle with the ground in the vertical ground can be used, similar to a traditional 3D printer and a 45 ° Angle with the ground with a caterpillar on the plane can be printed on the X direction of infinite printing.



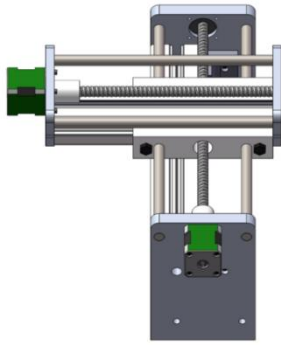


Fig. 1 3D-printed operation cantilever

Moving caterpillar printing graphic: when vertical cantilever, in print after the completion of the crawler print flat rolling model, can be completed by the method of the curved surface and plane incompatible print objects fall off to the next print so that the same model can be installed on the program, the number of print to batch print and do not need to manually modulus, improve efficiency.

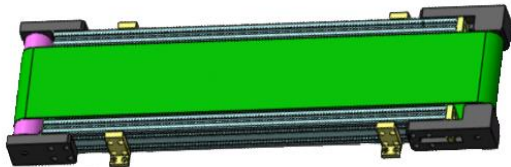


Fig. 2 Movable caterpillar print plane

The special nozzle can mix three primary colors consumables: the three primary colors consumables through the control of three extruders, through the relative extrusion rate of the extruder can control the use proportion of three kinds of consumables, concentrated in the same container for heating and mixing, and then screw extrusion.



Fig. 3 Custom hybrid 3D printing nozzle

The mechanical structure design of replaceable operating head: design a buckle structure of replaceable operating head at 3D nozzle position, which can be replaced quickly and stably when different operations are carried out. Replacing the laser head, pen tip, and engraving drill bit while the cantilever is vertical enables more functions of the 3D printer architecture.

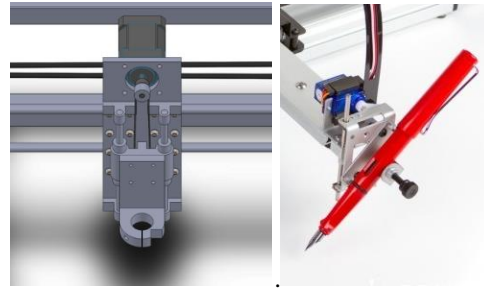


Fig. 4 Mechanism design of the replaceable operating head

Learn from the latest Marlin firmware of the open-source 3D printer, then understand and apply it to achieve the desired effect. Finally, a touch screen is added to the device for remote and local printing. Users in modeling, after the completion of slice-by-slice software, choose print patterns and color through the U disk or through a local transmission network transmission to the 3D printer. The cantilever is perpendicular to the ground state (traditional) and can be set up to print the number; after when printing a model, the crawler for rotation makes the model off automatically and second printing, This cycle can complete a batch of printing. If you need to print large-size models, you need to adjust the cantilever to an Angle of 45 degrees with the ground (infinite mode) for printing. Suppose the operating head needs to be replaced. In that case, the operating head module needs to be manually replaced; the cantilever is adjusted to be vertical with the ground. Then the objects that need to be processed are fixed, and other additional operations, such as laser engraving, can be completed.

### 3. Conclusion

This design is to optimize and improve the structure and function of 3D printers on the market and design a 3D printer that can realize the designer's idea more intuitively and completely (infinite, multi-color, laser engraving, etc.). Its molding scope is not limited to the printer frame and improves the space utilization of 3D printer; At the same time can meet the appearance of the color requirements; In addition, the function of laser engraving, writing and CNC engraving can be realized on the two-dimensional plane is added to this product, which greatly increases the utilization rate of 3d architecture and makes the best use of everything. Combined with the above functions, this product can enrich and diversify designers' ideas and realize users' ideas more concretely. It has a broad application prospect in promoting the popularization of 3D printers, stimulating people's creative desire and improving people's creativity.

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