

Design of Multiple Mailboxes

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Abstract. In today's world the design of multiple mailboxes comes to cover the evolution of logistics in delivering mail where the postman is not required to visit every user. In this research the 3D visualization is used for the design of multiple mailboxes for domestic use. It concerns the design of mailboxes in ergonomic building blocks and apartment complexes in 3D design so that they can be easily manufactured. Between the advantages of this design will be rapid production of ready-made products production of prototypes that enables testing at the design stage and reduces the time and the cost of production. The design when done with 3D CAD can be manufactured with modern machine tooling methods. In this paper after an extensive Literature Review the postal multiple mailboxes is used as a case study in the use of 3D CAD for 3D printing. A methodology is proposed that enables the examination of prototypes at the design stage according to specifications and allows the manufacturing department of a company to prepare the right tools and begin installing production lines. Conclusively this method gives the advantage of designing the product and supporting the production of scaffolds that can be functionally and ergonomically tested before finalizing the production.

1 Introduction

3D printing group can be utilized to rapidly create a scale model of a physical assembly utilizing three-dimensional Computer Aided Design (CAD) information. This is effectively done using computer aided design (CAD) for 3D printing [1]. 3D printing is an innovation that empowers people all over the world to plan custom items. Advertising effectiveness, customizability, and availability to reasonable generation, 3D printing is changing the flow of how we make things [2]. Nowadays, computer aided design (CAD) can design imaginative 3D printed items in a way that designers and engineers could previously only dream of producing [3].

The final thirty years 3D printing has been recognized as an effective and feasible innovation within the areas of advanced manufacturing. A recent research about of 3D CAD is conducted to advance 3D printing for a better performance of a companies' manufacturing and fabricating is presented in Figure 1 [4].

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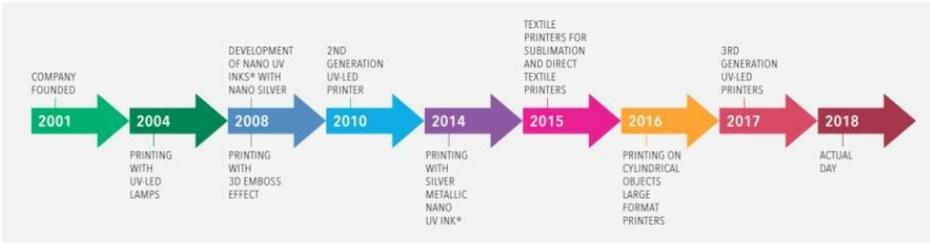


Fig. 1. Development of 3D printing for UV-LED Lamps[4]

This paper examines the application of 3D CAD to 3D printing in manufacturing. In order to understand the contribution of 3D CAD to 3D printing in the next paragraph few selected characteristics of 3D printing are described. Then the methodology used is described followed by a case study- A multiple mailboxes design to provide a comprehensive understanding of pairing 3D CAD to 3D printing.

2 3D Printing

At an essential level, 3D printing takes advanced representations of objects and makes them in physical shape by building up different layers of plastics, metals, powders, liquid resins, and other materials [5]. Individuals frequently allude to 3D printing as additive manufacturing to differentiate it with conventional “subtractive” fabricating methods, which include cutting, processing, or removing material to create an object [4].

A major portion of 3D printing’s offer is that it permits for an exceptional degree of fast prototyping and mass customization [6]. Whereas media scope of 3D printing has regularly centered on cheap plastic 3D printed products — such as smart phone cases— a few of the foremost critical progresses in 3D printing are taking put in trade applications 3D printing encourage openings for mass customization, perfection, and efficient flawlessness [7]. Already, major international breakthroughs in additive manufacturing are accelerating these trends leading to convergent applications.

Since late 1984 the first 3D printing appears. In 1988 it is available to the public after been patented in 1986 (Fig. 1). Stereo Lithography Apparatus (SLA) machine was developed and a sustainable resolution to reduce waste and production cycle has come around [8]. From the fabrication of complicated jet engine parts to simple cups, 3D printing is being regarded as an alternative and more efficient way to develop new product. Statistics show that the global market for 3D printing will be worth \$16.2 billion by 2018, which is four times larger than that of 2014 [8].

Taken as a whole, 3D printing is transforming manufacturing and reconfiguring supply chains around the world. It is changing the way consumers get the products they need and shifting power to individuals with unique preferences [8].

3 Methodology

A framework for utilizing 3D CAD using a commercial computer-aided design (CAD) and drafting software application is proposed. The framework is a decision making tool presented in Figure 2. The basic steps of the procedure are:

- Step 1** 2D Sketches Considering Design Specifications
- Step 2** Creation of Technical Drawings
- Step 3** Creation of Technical Drawings Mesh & Files in AutoCAD
- Step 4** Modelling 3D Objects
- Step 5** 3D Printing Process using either Polymer Ceramic or metal
- Step 6** Production of Scaffolds
- Step 7** Execute functional and ergonomic tests.
- Step 8** If the tests are satisfactory proceed to the applications (**Step 9**). Otherwise go to step 4
- Step 9** Application - Production

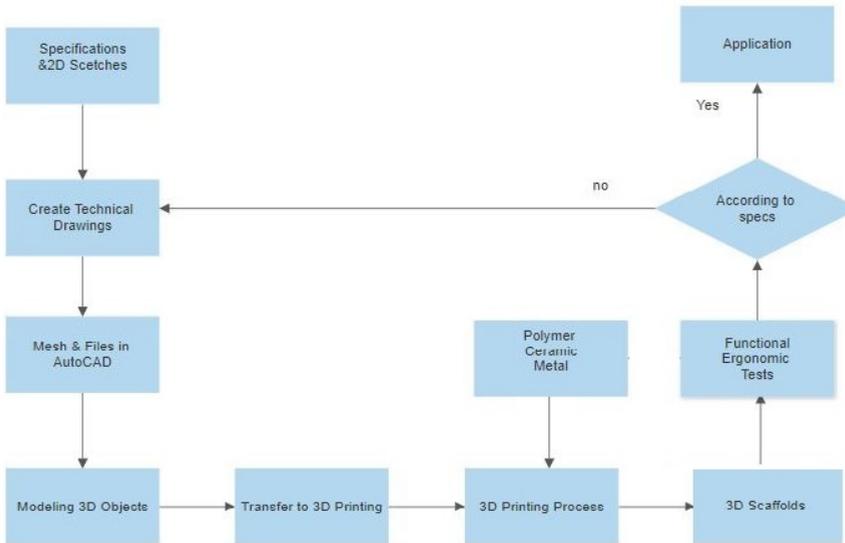


Fig. 2. CAD procedures in 3D printing for the case of multiple mailboxes.

4 Case Study - Multiple Mailboxes

Postal operators and nearly every organization that works in shipping, delivery, or other aspects of logistics should keep a very close eye on it. One of the uses of a multiple mailbox post relates to community housing, where there may be estates with multiple homes and there is no need to install individual mailbox posts for each house. Alternatively, one might own or lives in a property where one building is divided into several apartments or flats. In this case, multiple mailbox posts outside the building are ideal for ensuring that everybody can receive and access their own mail.

A multiple mailbox is installed into the ground and can withstand almost all weathers. On each side of the cast iron post are two mailboxes – securely fixed and with the respective neighbors’ house numbers painted or identified in another way.

In urban areas the boxes are numerous but in rural areas the design works well if there are five to ten homes situated in a remote area or in a location that is difficult to access. Rather than forcing couriers and the mailman to come all the way to your front door, you can position a multiple mailbox post at the end of the road and affix several boxes to it.

The Postal Service has an unmatched last-mile conveyance arrange — no other organization covers as much domain as often as possible and frequently as the Postal

Service. It is regularly not fetched compelling for private conveyance firms to form partitioned stops to provide little, moderately cheap bundles, especially in rural zones.

However, the Postal Service visits these locations nearly every day. Accordingly, other delivery firms often use the mailboxes for final delivery of many packages. The Postal Service delivers nearly two-thirds of lightweight, commercial packages to their final destination [9]. Holding a competitive advantage in materials efficiency and less processing procedures, the technological and economic benefits of 3D printing has been widely reported and documented, and it became especially popular in the United States in the last decade Web of Science suggests that more than 12 papers have been published from 2005-2015 within the US, and it still presents a trend of fast increase in the basic theory exploration and technology development. Although several survey about 3D printing have been documented , almost all of them are written on behalf of its categories, processes, quality and cost benefits or focus on environmental impact of rapid prototyping technologies before 2006. The multiple mailbox concepts in delivering may be benefiting from the growth of 3D printing. Being different from traditional manufacturing processes, 3D printing going from designing to finishing, it saves the traditional processes of casting, forging and rough machining without reducing the final part quality. Difference of processes in 3D printing and traditional manufacturing is shown in Table 1.

Table 1. Comparison of 3d Printing and Traditional Manufacturing in Multiple Mailboxes

Items	3D printing	Traditional manufacturing
Manufacturing	Additive	Subtractive
Efficiency	higher	Lower
Production Waste	less	More
Built time	hours to days	Days to months
Cost	higher	Lower
Life cycle	Shorter	Longer

Besides the multiple mailboxes application of 3D printing is leading to dramatic changes in the fields of manufacturing and logistics of postal services, with major implications for postal operators and other transportation and delivery companies. In a July 2014 white paper, *If It Prints, It Ships: 3D Printing and the Postal Service* [10] it is described how the rise of 3D printing could significantly benefit the Postal. The Postal Service describes the developments in 3D printing and the logistics marketplace and examines what these changes could mean for the Postal Service that some parts used to assembly the final solution of a single mailbox. Multiple mailbox installations must meet the same criteria as single mailbox. The requirement precludes the use of heavy case and supporters that are based on the ground and consists the support system (Figure 3). In terms of the design of multiple mailboxes study results concerning details based on ergonomic study are as follows: The house number on a mailbox must be at least 3cm tall and positioned on the front or flag side of the mailbox (Figure 4). A lower section incorporates newspaper delivery box. The door or slot must be at the level of 41 to 45 inches from the ground. The final output of the design conducted by the authors of mailboxes is shown in Figure 3 together with a prototype of a commercial company for comparison (Figure 4).

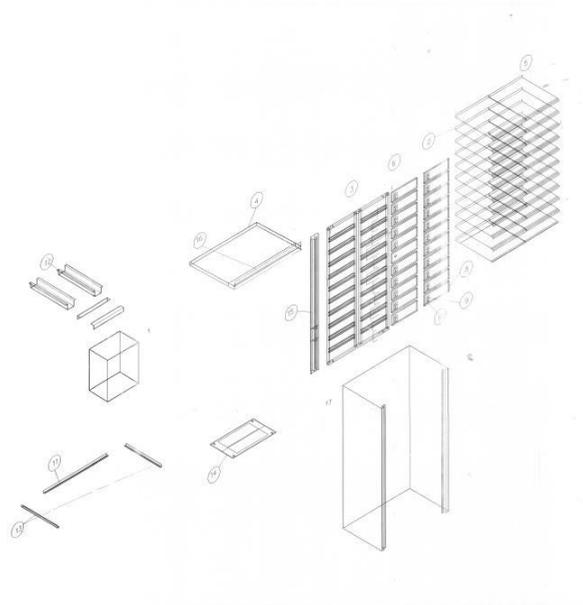


Fig. 3. Components of mailboxes produced designed in 3D CAD .



Fig. 4. Multiple mailboxes [9]

5 Conclusions

Construction of the part or assembly of multiple mailboxes is easily done using computer aided design (CAD) for 3D printing. It is used to create prototypes, models for plastics and metals. The information collected from comparison of tests and related references are at that point utilized to alter the model models and make strides the item or plan. CAD models are a significant instrument for quickly making cost-efficient plan adjustments some time before an item goes to fabricating where these changes will be greatly costly. Since the multiple mailboxes is state-of-the-art in keeping with usefulness and aesthetics and gotten from surveys custom-made to the necessities of inhabitants to coordinate single-family homes to expansive complexes of buildings 3D CAD gives the interesting advantage of creating autonomous geometry in terms of its versatility in utilize. The results have shown that 3D CAD is utilized to select variety of materials. The great advantage of this method is that checks requirement together with functionality and ergonomic tests as well as materials examined.

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