Making Details of a 3D Printer from Another 3D Printer

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Abstract. This report describes the capabilities with an already available additional manufacturing technique to construct a budget equivalent of this technique with a small investment in electronics and hardware. Described is the construction of details for the 3D printer Prusa Mendel. ABS and PLA plastic were used.

Keywords: 3D printer, print settings, rate of filling.

1. INTRODUCTION

With the advancement of technology and the development of new methods for making and processing of details, models and prototypes, just to name a few examples, 3D printing technology is determined in the principle of the additive production. The first materials and equipment that were used for additive production (AP) is said to have been produced in 1981 (Kodama, 1981).

During the same period, two methods for AP manufacturing of three-dimensional plastic models had been developed. These models were the use of photo-hardening polymer and the control over the exposed ultra-violet ray zone which was controlled with the use of a template or a scanned optical transmitter.

The technology which was used by most 3D printers and also to this date, especially by lovers and models, are orientated towards its users. The process is done by sampling by the deposition of material (Fused Deposition Modeling/ FDM), a special annex of plastic which was developed in 1988 (Amon, 1998; Prinz, 1997).

Today, 3D printing comprises of the making of a three-dimensional object. Here, the process is a forming of layers from materials and this is done with the help of a computer control using CAD (Computer Aided Design) model being processed, most of the time in a STL (StereoLithography) file.

All of this leads to the production of specialized machinery that can complete such operations – 3D printers.

2. TYPES OF 3D PRINTERS AND 3D PRINTING

These can be divided based on their principle of work, printing technology and their use. Based on their Construction they are classified to Deckard 3D printer (Fig. 1), Delta 3D printer (Fig. 2), Polar 3D printer (Fig. 3), SCARA 3D printer.

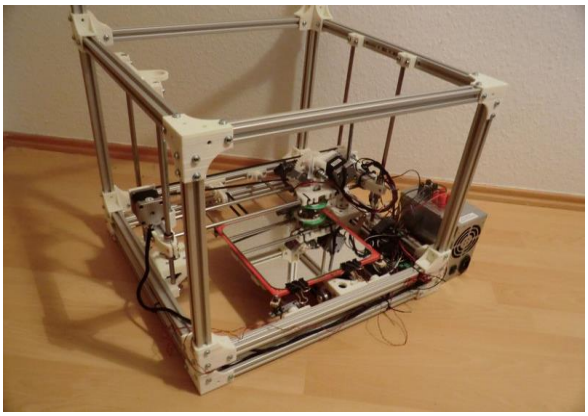

Fig. 1 Deckard 3D printer.

Based on the printing technology, the main difference between these types is the way in which the layers develop in order to create the object and the materials that are used:

- Extruding;
- Lightly polymerized;

- With a dust bed;
- Laminating;
- With a powder feed;
- With a wire feed.

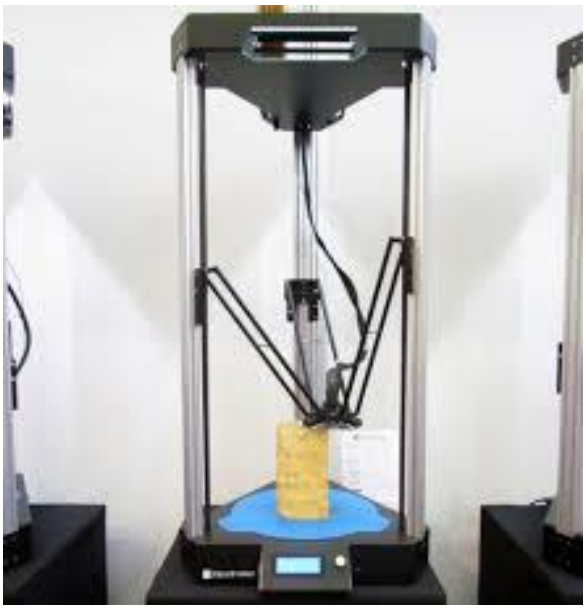

Fig. 2 Delta 3D printer.

Fig. 3 Polar 3D printer.

Based on their use, the 3D printers are:

Industrial Use. With the minimum price of $2000 and a maximum price of $500 000, these printers can be found in industries such as space, architecture, automobile, defence and medicine.

Consumer Use. A lot of 3D printers are available in the consumer market. With prices ranging from a couple of hundred dollars to thousands of dollars. Every one of them also offers additional functions apart from their main purpose. The most emphasis that can be seen here is on their speed and the accuracy of printing.

Big 3D Printers. These types of printers were developed for industrial, educational and demonstrational applications.

Micro and Nano 3D Printing. These were developed to be used for production methods of microelectronic devices, for the creation of 3D printing of objects with nanoscale sizes.

3D printers and technologies offer a wide range of variations for their use fulfilling the needs of their users. With a big range of models and technology they can satisfy a wide range of people – from the ordinary user to the industrial clients.

3. A FURTHER STUDY INTO THE 3D PRINTER PRUSSA MENDEL

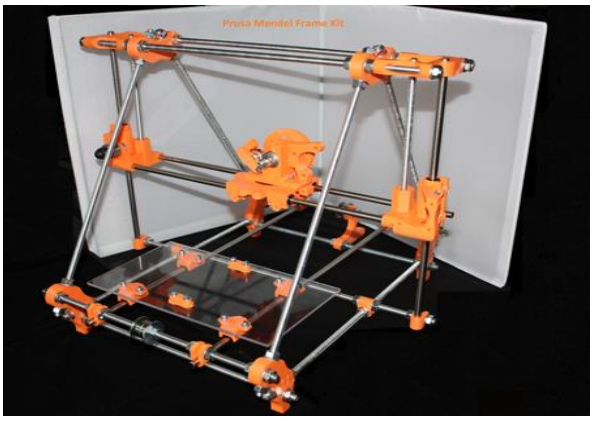

Fig. 4 Deckard printer on the basis of FDM for consumer purposes – Prusa Mendel.

This printer (Fig. 4) was designed on the basis of the RepRap project. The aim of this project was spare parts for a 3D printer to be made using another 3D printer. The assembling of a clone of the printer, was then assigned to be able to begin printing parts for other printers.

Prusa Mendel is from the type XZ head. What this means is that the overlapping head would move along the X and Z axles. The printer uses a simple construction from M8 metal studs that are joined together with the help of parts that were created using a 3D printer. They are then tight up with the help of the M8 screws. With the risk of loosening of the

screws due to the vibrations created from the stepping motors, instant glue can be used for their fixture or just to select any locking screws. According to the setting of the distance of each axle, the printer has the ability to print details of sizes up to 22 x 22 x 15cm.

The Prusa Mendel is a Deckard printer, with a XZ head. Its construction is simple, created from easily accessible elements such as studs, screws and bolts. Its assembling would also not be problematic for people that are well informed with technology.

4. PRODUCING DETAILS FOR THE 3D PRINTER PRUSA MENDEL

This would be done with the help of the 3D printer Flashorge Creator Pro (Fig. 5).

User class 3D printer from the XY head type, which has two heads for printing. Printing of details with combining two materials would therefore be possible.

3D models of the details are available on the RepRap community website. There they are uploaded, available with free access and they constantly improve the models and projects in general.

According to the analyzed types of printers, the details are produced using two types of materials. The first type is ABS plastic, which has the characteristics of strength and flexibility and withstands temperature differ-rences from –20 to 80 °C. From this type, ele-ments are produced, which are part of the bearing construction and therefore would need to be more durable.

The other type of material used is PLA plastic. The holsters, replacing the linear bearings, are built from it. This type of plastic consists of high hardness and a low degree of wear which makes it a good choice for them.

The features are built over a grill which serves as their easier removal from the printing bed and for the knocking of any pumps of the bed. They also have thickness on the walls, equal to two times the height of the layer of printing (0.27 mm). In other words, the reso-lution of the detail. They have a percentage of filling from 5 to 60 percent, depending on their load and purpose.

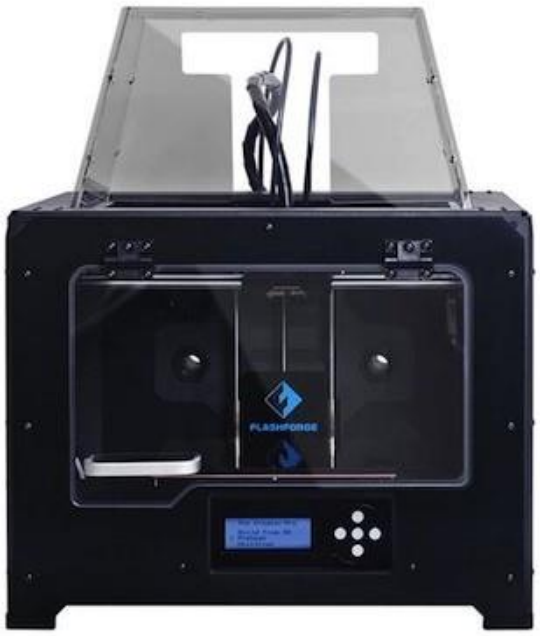

Fig. 4 Flashorge Creator Pro.

5. CONCLUSION

What was looked in this report was the history and the technology of the additive production and more specifically, 3D printing. What was then discussed were the main types of 3D printers and also some of the technologies used for printing. On the basis of the collected information regarding the technologies for additive production through 3D printing an analysis was made which promoted the making of details for a 3D printer with the help of another printer like that. Consequently, a functioning printer could be built.

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