

3D Printer — The Technology of the Future

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Abstract: This article will discuss a new technology for creating objects and items — a 3D printer. The history of its origin is described, the basic principles and technologies of the device are indicated. A study of the use of a 3D printer is conducted, and the problems and prospects of using this technology in various areas of life are highlighted.

Keywords: 3D printer, 3D printing, stereolithography, SLA technology, SLS technology, DLP technology, EBM technology.

3D came to our everyday life at the beginning of the new millennium. Naturally, we associate this definition with cinema or animation. But this technology covers much more spectrums of our life. So, what is a 3D printer, and what is printing on such a device? A 3D printer is a device that creates an image in three dimensions. But first, let's look at the history. History of origin 3D printing technology has existed since 1984. Charles Hull developed a three-dimensional printing technology for creating objects using digital data. In 1986, this technique was patented and given the name stereolithography. The same company, Charles Hull, developed the first industrial 3D printer. And in 1988, 3DSystem developed a 3D printer for home printing - SLA-250. In 1993, Solidscape began its life. It began serial production of inkjet 3D printers, at low cost. And finally, in 2005, the first color 3D printer appeared - Spectrum Z510. The merit of this advancement in the development of 3D printers belongs to ZCorporation (ZCorp). How 3D printing works The principle of forming a figure with 3D printing is called additive (from the word Add (English) - to add). First, a computer model of the future object is created. This can be done either using a 3D graphics editor CAD system (3D Max, SolidWorks, AutoCAD), or by scanning the entire object in 3D. Then, using a special software product, the scanned object is divided into layers and a set of commands is generated that will determine the sequence in which the layers of material will be applied during printing. Next, the 3D printer forms the object layer by layer, gradually applying portions of material. Placing the print head in a system of two coordinates X and Y, the printer applies the material layer by layer according to the simulated electronic circuit. When the platform is moved one step along the Z axis, the construction of a new level of the object begins. Printing with a 3D printer Metal alloys, plastic, paper, photopolymers, mineral mixtures can be used as a material in additive manufacturing for printing.

Some types of 3D printers are capable of working simultaneously with different materials, both in properties and in color. There are quite a few 3D printing technologies. They differ in the principle of layer formation and their connections. Let's consider the main production technologies. Main technologies (SLA, SLS, DLP, EBM, HPM) Printing on 3D printers can be carried out in different ways, depending on the material used. SLA technology. This technology allows for the fastest construction of objects. The technology uses a photopolymer, to which a

laser beam is directed, after which the material hardens. After hardening, the product can be easily processed (glued, painted, etc.). SLS technology. It is the sintering of powder reagents under the influence of a laser beam. This is one of the technologies that allows the manufacture of molds for metal and plastic casting. DLP technology. This is a relatively new technology, for the implementation of which stereolithographic printing machines are used. Printers of this type use digital light processing. To create three-dimensional figures, this technology uses photopolymer resins and a DLP projector. EBM technology. This technology uses electron beam melting to create three-dimensional objects. A special material, metal clay, was developed for layer-by-layer fusion of high-precision parts. This material is made from a mixture of organic glue, metal shavings, and water. HPM technology. Allows you to obtain final models from structural and high-performance thermoplastics. This is the only technology that provides mechanical, thermal, and chemical strength of parts. Nowadays, another interesting device used for manual printing has appeared - pens for drawing 3D objects. The pens are made according to the same scheme as printers. The plastic thread is fed into the pen, where it melts to the desired temperature and is squeezed out through a small nozzle. Applications of 3D printing Construction. There is an assumption that in the future, the process of building will be much faster thanks to 3D printing. Medicine. Thanks to 3D printing, doctors have the opportunity to create copies of the human skeleton. 3D printers are widely used in dental prosthetics. Architecture and design. Creating models of interior elements, buildings and districts allows you to evaluate the ergonomics, functionality and appearance of the prototype. Marketing and advertising allow you to demonstrate the advantages of a new product. Education. 3D models are excellent visual materials for training at all levels of education. Automotive industry. Such a method as 3D modeling allows you to test a car at the development stage. Modeling. Manufacturing of packaging materials, toys and souvenirs. Light industry. Manufacturing of a wide variety of consumer goods. Manufacturing of clothes and shoes. Such clothes and shoes are used only at fashion shows. The materials used here are polyurethane, rubber and plastic. Jewelry. 3D modeling technologies allow you to create full-fledged products from metal powder. History and anthropology. Models are created on the basis of archaeological finds and allow you to evaluate the reliability of scientists' guesses. In all other areas not listed above, 3D modeling is gradually finding its application. Slowly but surely, it is replacing other methods of representing an object. Research of 3D Printer Use in Rostov-on-Don We conducted a market research on 3D printing services in Rostov-on-Don. Here are the results: There are about 10 points of 3D printing services in this city, as well as several 3D scanning points. About 80% of customers come with tasks for the production of accessories, parts for personal projects. 8% try this technology "by tooth", the remaining 7% use 3D printing directly for work. There is also another group that uses 3D printing to create global personal projects. This group makes up only 5%. This percentage includes such a project as a "touching museum". A group of students plans to create a network of museums using 3D printing and crowdfunding. The idea is to print world works of art on a 3D printer that can be touched with their own hands not only by ordinary people, but also by those with visual impairments.

Literature

1. Rawan Allouzi, Wael Al-Azhari, Rabab Allouzi, "Conventional Construction and 3D Printing: A Comparison Study on Material Cost in Jordan", Journal of Engineering, vol. 2020, Article ID 1424682, 14 pages, 2020.
2. Yin Hongxi, Qu Ming, Zhang Haiyan & Lim YeChan. 3D Printing and Buildings: A Technology Review and Future Outlook. Technology|Architecture + Design, 2:1, 94-111. ISSN: 2475-1448 (Print) 2475-143X (Online) Journal.
3. Thabiso Peter Mpofu, Cephas Mawere, Macdonald Mukosera, "The Impact and Application of 3D Printing Technology", International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064, Impact Factor (2012): 3.358, Volume 3 Issue 6, June 2014.

4. Alimbabaeva, Z.L., Bektemirov, B. Sh. Composite materials production technology for machining materials. Lityo i metallurgiya 2020: sbornik nauchnih rabot III Mejdunarodnoy nauchnoprakticheskoy internet konferenciy studentov i magistrantov, 18-19 noyabrya 2020 g./sost. AP Bejok.–Minsk: BNTU, 2021.–S. 92-93.
5. Musaevich, S. S., Shukhratugli, B. B., Latipovna, A. Z., & Kh, T. T. (2020). Formation of Structure at Thermo-diffusion Chroming of Porous Permeable Materials Based on Iron Powder.
6. Bektemirov, B. S. Advanced ceramic coating methods B. Sh. Bektemirov, R. Kh. Saydakhmedov, A. Kh. Alikulov Tashkent State Technical University named after Islam Karimov, Tashkent, Uzbekistan The article is dedicated to put together on data associated with researches.