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3D Printing Additive Manufacturing

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Abstract: *In the recant years a new generation of machine is developed that can make everyday things, these machines are called 3D printers. They're remarkable because they can produce different kinds of objects, in different materials, all from the same machine. 3D printing, also known as additive manufacturing (AM), in this process layers of material are formed under computer control to create an object. In 3D printing unlike material removed from a stock in the conventional machining process, 3D printing or AM builds a three-dimensional object from computer-aided design (CAD) model successively adding material layer by layer of material until the entire object is created. Each of these layers can be seen as a thinly sliced horizontal cross-section of the eventual object. To prepare a digital file for printing, the 3D modeling software "slices" the final model into hundreds or thousands of horizontal layers. When the sliced file is uploaded in a 3D printer, the object can be created layer by layer. The 3D printer reads every slice (or 2D image) and creates the object, blending each layer with hardly any visible sign of the layers, with as a result the three-dimensional object.*

Keywords*-3DP (Three-Dimensional Printing), additive manufacturing (AM)*

I. INTRODUCTION

Additive Manufacturing (AM) refers to a process by which digital 3D design data is used to build up a component in layers by depositing material (from the International Committee F42 for Additive Manufacturing Technologies, ASTM). The term "3D printing" is increasingly used as a synonym for AM. However, the latter is more accurate in that it describes a professional production technique which is clearly distinguished from conventional methods of material removal. Instead of milling a work piece from solid block, for example, AM builds up components layer by layer using materials which are available in fine powder form. A range of different metals, plastics and composite materials may be used. It is also known as rapid prototyping, is a mechanized method whereby 3D objects are quickly made on a reasonably sized machine connected to a computer containing blueprints for the object. The 3D printing concept of custom manufacturing is exciting to nearly everyone. This revolutionary method for creating

3D models with the use of inkjet technology saves time and cost by eliminating the need to design; print and glue together separate model parts. Now, you can create a complete model in a single process using 3D printing [16]. The basic principles include materials cartridges, flexibility of output, and translation of code into a visible pattern. The inception of 3D printing can be traced back to 1976, when the inkjet printer was invented. In 1984, adaptations and advances on the inkjet concept morphed the technology from printing with ink to printing with materials. In the decades since, a variety of applications of 3D printing technology have been developed across several industries. The following is a brief history of the major milestones along the way. Originally developed at

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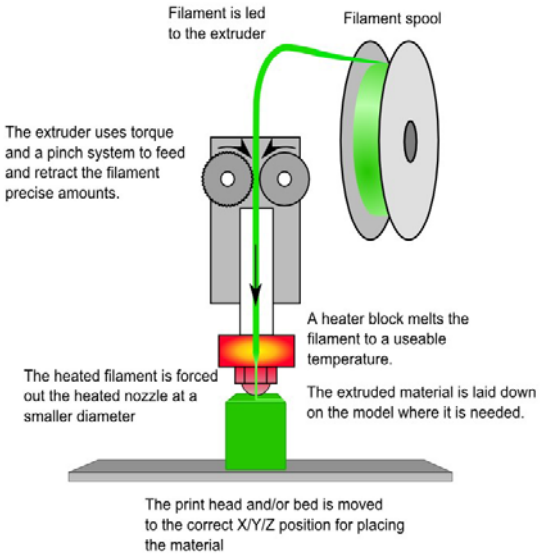
the Massachusetts Institute of Technology (MIT) in 1993, .3DP technology creates 3D physical prototypes by solidifying layers of deposited powder using a liquid binder.

II. WORKING OF 3D PRINTING

Generalized Additive Manufacturing Process.

The process of 3D printing starts with making a virtual design of the object you want to create. This virtual design is for instance a CAD (Computer Aided Design) file. This CAD file is created using 3D modeling application or 3D scanner (for replicating an object). 3D scanners use different technologies to generate a 3D model. Examples are: time-of-flight, structured / modulated light, volumetric scanning and many more.

We have to prepare a 3D model produced by 3D modeling or by 3D scanning before it is ready to be printed. This is call slicing. Slicing is dividing a 3D model into hundreds or thousands of horizontal layers and needs to be done with the help of specialized software. Sometimes a 3D model can be sliced from within a 3D modeling software application. After slicing operation the on the 3D model, it is feed to a 3D printer. This can be done via USB, SD or Wi-Fi. When a file is uploaded in a 3D printer, the object is ready to be 3D printed layer by layer. The 3D printer reads every slice (2D image) and creates a three-dimensional object.



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III. RESULTS AND ANALYSIS

Before printing a 3D model from an STL file, it must first be examined for "manifold errors". This step being called the "fix up." Generally, STLs that have been produced from a model obtained through 3D scanning often have many manifold errors in them that need to be rectified. Examples of these errors are surfaces that do not connect, or gaps in the models. Once that is done, the. STL file needs to be processed by a piece of software called a "slicer," which converts the model into a series of thin layers and produces a G-code file containing instructions tailored to a specific type of 3D printer (FDM printers). This G-code file can then be printed with 3D printing client software (which loads the G-code, and uses it to instruct the 3D printer during the 3D printing process). Printer resolution describes layer thickness and X-Y resolution in dots per inch (dpi) or micrometers (µm). Typical layer thick- ness is around 100 µm (250 DPI), although some machines can print layers as thin as 16 µm (1,600 DPI). X-Y resolution is comparable to that of laser printers. The particles (3D dots) are around 50 to 100 µm (510 to 250 DPI) in diameter. Construction of a model with contemporary methods can take anywhere from several hours to several days, depending on the method used and the size and complexity of the model. Additive systems can typically reduce this time to a few hours, although it varies widely depending on the type of machine used and the size and number of models being produced simultaneously. Traditional techniques like injection molding can be less expensive for manufacturing polymer products in high quantities, but additive manufacturing can be faster, more flexible and less expensive when producing relatively small quantities of parts. 3D printers give designers and concept development teams the ability to produce parts and concept models using a desktop size printer.

Advantages of 3-D Printing in Comparison to Other Technologies

- Improved working capital management as goods are paid for before being manufactured
- According to one source, 3-D printing is cost effective with plastic injection molding on production runs of 50 to 5,000 units
- Ability to easily share designs and outsource manufacturing
- Speed and ease of designing and modifying products

Industries: Automotive, Manufacturing,

Medical, Recreational Jewelry, Aerospace, Education, Dental, architecture, construction (AEC), industrial design, military, biotech (human tissue replacement), fashion, footwear, eyewear, geographic information systems, food, and many other fields.

IV. CONCLUSION

3D printing can offer benefits across the entire creation process from initial concept design to final manufacturing and all steps in between. Different applications have unique needs and understanding those application requirements is critical when choosing a 3D printer. Multiple systems may offer broader use opportunities than a single system. Thus, identifying your unique requirements.

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So, we studied the process of 3D printing technologies and the process involved in manufacturing a 3D model from a simple CAD design to a full actual 3D Object.

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