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3D PRINTING

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ABSTRACT
3D Printing as a newly emergent technique, has now been widely known as the most significant technological invention of the twenty-first century. This research paperconsiders 3D printing as a recently emerging technology and examines its utilisation into a number of fields. The well-wishers of authentic material cultures, in spite of worrying the widespread of hyper-real reproduction culture caused by 3D printing, showing enthusiastic adoption of this new technology that brings back materiality to the society. Hence, this paper discusses how 3D printing is beneficial to different fields like automobile, apparel, construction, computers, medical etc. This paper also shows how much economical it is to adopt 3D printing instead of using the conventional methods of production and manufacturing.
Key words: 3D Printing Technology.

I. INTRODUCTION
3D printing is any of the various processes used to make a three-dimensional object. In 3D printing, additive processes are used, in which successive layers of material are laid down under computer control which result in producing a three dimensional object of required specifications. These objects can be of almost any shape or geometry, and are produced from a 3D model or other electronic data source. A 3D printer is a type of industrial robot used for laying the successive layers of material in a definite pattern.

3D printing in the term's original and technically precise sense refers to processes that sequentially deposit material onto a powder bed with inkjet printer heads. During the recent times, the meaning of the term has expanded to encompass a wider variety of processes such as extrusion and sintering based processes. For this broader sense, Technical standards use the term additive manufacturing (AM).

II. HISTORY
Early AM equipment and materials were developed in the 1980s. In 1981, Hideo Kodama of Nagoya Municipal Industrial Research Institute invented two AM fabricating methods of a three-dimensional plastic model with photo-hardening polymer, where the UV exposure area is mainly controlled by the scanning fiber transmitter or a mask pattern . After that in 1984, Chuck Hull of 3D Systems Corporation, developed a prototype system which was based on this process of Stereo-lithography, in which layers are added one over the another by curing photopolymers with the use of UV lasers. Hull has defined the process as a "system for generating three-dimensional objects by creating a cross-sectional pattern of the object, but this theory had been already invented by Kodama. The contribution made by Hull in the design of STL (StereoLithography) file format is accepted by 3D printing software as well as the digital cutting and the strategic infill,which are common to many processes used today. The term 3D printing is originally given to a process of employing the standard and custom inkjet printing devices. The technology used by most of the 3D printers till date, especially hobbyist and consumer-oriented models, is fused deposition modelling which is termed as a special application of plastic extrusion.

III. APPLICATION
Additive Manufacturing technologies found applications started from the 1980s in product development field, rapid prototyping, data visualisation and specialised manufacturing. Their expansion into production has been under development during the decades since. Industrial production roles within the metalworking industrial achieved significant scale for the first time in the early 2010s. Since the starting

time of the 21st century there has been a large increase in the sales of Additive Manufacturing machines, and their prices have dropped significantly. As per the opinion of Wohlers Associates, a consultancy, the market for 3D printers and services was worth $2.2 billion worldwide in 2012, up 29% from 2011. There are many applications for Additive Manufacturing technologies, including construction, industrial design, architecture, automotive, aerospace, engineering, military, dental and medical industries, biotech, footwear, fashion, jewelry, education, eyewear, geographic information systems, food, and many other areas.

In 2005, a rapidly expanding hobbyist and home-use market place was created with the inauguration of the open-source RepRapand Fab Home projects. Generally, all the 3D printers made for home-use released till date have their technical bases in the on-going RepRap Project and the initiative of associated open-source software. In case of distributed manufacturing, studies have found that 3D printing is able become a mass market product allowing consumers to save money related to purchasing common household objects. For example, in spite of going to a store for buying an object which was made in a factory by using injection moulding process, consumer might print it at home from a 3D model which can also be downloaded from internet.

Model of a turbine showing benefits of 3d printing in industry

IV. INDUSTRIAL APPLICATIONS OF 3D PRINTING:

Apparel

The 3D printing technology has become known to the world of clothing with fashion designers experimenting with 3D-printed dresses, apparels, and shoes. In the field of commercial production, sports accessories manufacturing company Nike is using 3D printing technology for prototyping and manufacturing the 2012 Vapour Laser Talon football shoe for American football players, and New Balance is making custom-fit shoes for athletes using 3D manufacturing.

The 3D printing technology has come to the point where companies are printing consumer grade eyewear with custom fit according to the demand of the consumers. Rapid prototyping makes the on demand customization of glasses possible.

Automobiles

During the early 2014, the Swedish supercar manufacturer company, Koenigsegg, announced the One:1, a supercar many components of which were 3D printed. In the limited duration of vehicles manufacturing company Koenigsegg produces the One:1 has titanium exhaust components, side-mirror internals, turbocharger and even complete air ducts assemblies that have been 3D printed as part of the manufacturing process.
An American manufacturing company, Local Motors is working with Oak Ridge National Laboratory and Cincinnati Incorporated for the purpose of development of large-scale additive manufacturing processes which

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may be suitable for printing a car body entirely. The company's plan is to print the vehicle live in front of an audience in September 2014 at the International Manufacturing Technology Show. 3D printing enables Production of components from a new fiber-reinforced thermoplastic strong enough for use in an automotive application, the chassis and body without drivetrain, wheels and brakes weighs a scant 450 pounds and the completed car is comprised of just 40 components, a number that gets smaller with every revision process of manufacturing.

Urbee is the name of the first car in the world which was manufactured using the 3D printing technology. It was manufactured in year 2010 by the combination of the company Stratasys, which is a manufacturer of printers "Stratasys 3D" and US engineering group Kor Ecologic. This car is a hybrid vehicle which has a futuristic physical look.

Construction

An additional use of 3D printing technology is developed in building manufacturing. This could allow us to construct faster at lower costs, and has been investigated for construction ofhabitates which are off-earth. For example, the Sinterhab project is in research for a lunar base which is constructed by using3D printing having lunar regolith as a base material. In spite of adding a binding agent to the regolith, researchers are performing experiments with microwave sintering for the manufacturing of solid blocks from the raw material.

Medical

3D printing has been used to print patient specific implant and device for medical use. Successful operations include a titanium **pelvis** implanted into a British patient, titanium lower **jaw** transplanted to a Dutch patient,and a plastic **tracheal** splint for an American infant.The dental and hearing aid industries are expected to be the biggest area of future development of 3D printing technology by using the customised 3D printing technology.In March 2014, surgeons in Swansea used 3D printed parts for rebuilding of the face of a motorcyclist who had met a road accident and had been seriously injured.Scientists are also conducting a research on methods for bio-printing replacements of tissue lost due to arthritis and cancer.

In October 2014, a five-year-old girl who was born without fully formed fingers on her left hand became the first child in the UK who had a prosthetic hand made by using 3D printing technology. US-based Enable designed her hand, which is an open source design organisation known for having a network of volunteers to design and make prosthetics mainly for children. The prosthetic hand was based on a plaster cast which was made by the parents of the girl.

These kinds of printed prosthetics have also been used in rehabilitation of crippled animals. In 2013, a 3D printed foot let a duckling walk again which early used to cripple.In 2014 a Chihuahua which was born without front legs was fitted with a harness and wheels created using a 3D printer. Moreover,3D printed hermit crab shells let hermit crabs inhabit a newly styled home.

As of year 2012, the 3D bio-printing technology has been studied by biotechnology firms and academia for its possible uses in applications of tissue engineering in which organs and body parts are built using inkjet techniques. In it, the layers of living cells are basically deposited onto asugar matrix or gel medium and slowly built up to form 3D objects including vascular systems.The first production system for 3D tissue printing was delivered in 2009, which was based on the technology ofNovoGen bio-printing. Variousterms have been used to show this field of research: bio-printing, organ printing, , body part printing, and computer-aided tissue engineering etc. The possibility of using 3D tissue printing for manufacturing the soft tissue architectures for reconstructive surgery is also being studied.

China has contributed almost $500 million for the establishment of 10 national 3-D printing development institutes. In 2013, Chinese scientists started printinglivers, earsand kidneys by using living tissue. Researchers in China have also been able to print organs successfully using specialised 3D bio printers that use living cells instead of any synthetic material. Researchers at Hangzhou Dianzi University actually went for inventing their own 3D printer for the complex task and they dubbed the "Regenovo", a "3D bio printer." XuMingen, Regenovo's developer, toldthat it requires an hour for the printer to produce either a mini liver sample or a10 to12 centimetre of ear cartilage sample. Xu also predicted that fully functional printed organs may be manufactured possibly in the next decade. In the same year, scientists at the University of Hasselt,

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in Belgium had printed a new jawbone successfully for an 83-year-old Belgian woman. The woman is now able to chew, speak and breathe normally again after a machine printed a new jawbone for her.

Computers

3D printing can be used for the manufacturing of laptops and other computer equipment, including the cases, asNovena and VIA OpenBook standard laptop cases. Likewise, a Novenamotherboard can be bought and it can be easily used in a printed VIA OpenBook case.

V. IMPACT OF 3D-PRINTING

The Additive Manufacturing, starting with today's infancy period, requires flexible manufacturing firms and ever-improving users of all available technologies to remain competitive with each other. Advocates of additive manufacturing also predict that this arc of technological development will oppose globalisation, as end users will manufacture most of their products on their own rather than buying products from other people and manufacturing firms. The actual integration of the latest additive technologies into commercial production, however, is more a matter of complementing conventional subtractive methods rather than wiping them out entirely.

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