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MANUFACTURING AND TESTING OF WIRELESS 3D PRINTER

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Abstract - 3D printing technologies (3DP) influence the benefits of cumulative manufacturing across numerous areas including electronics, food, drug and optics. These technologies allow varying accoutrements to be perfection deposited, forming structures ranging from simple to complex mixes similar as organs and satellites. One important operation for 3D Printing is published electronics which is anticipated to exceed 10 billion US dollar in request value by 2030. In the EM sphere, affiliated work for 3DP encompasses interrelated EM studies of accoutrements, processes and erected structures and examines material characteristics including permittivity, permeability, electrical conductivity, which are foundational to 3D published electronics design and fabrication. This thesis presents a comprehensive report of 3D Printing technologies as applied to EM exploration and development (R&D) and end operations in order to inspire exploratory work in affiliated areas by furnishing sufficient breadth for beginners and depth for experts.

The paper benefactions include summarization of the major R&D and operations areas for 3DP, thereby quantifying the frequency of EM affiliated work; examination of mainstream 3DP technologies applied to EM related R&D and end operations grounded on their accoutrements, technology highlights and known issues; examination of applicable exploration which incorporates traditional printing, personal styles and compound 3DP styles and bracket of 3DP erected EM structures as reported by exploration brigades. Eventually, the crucial challenges and openings for unborn exploration are linked and bandied.

This is an exploration paper on 3D printing and the colourful accoutrements used in 3D printing and their parcels which come a notable content in technological aspects. First, define what's meant by 3D printing and what's significant of 3D printing. We'll go into the history of 3D printing and study about the process of 3D printing and what accoutrements used in the manufacture of 3D published objects and elect the stylish accoutrements among them which are suitable for our 3D publishing machine. Also, see the advantages of 3D printing as compared to cumulative manufacturing.

***Key Words*:** 3D Printing, Arduino Mega, Raspberry Pi, G-code, 3d-Printing, Pdditive Manufacturing

1. INTRODUCTION

3D printing or accretive manufacturing (AM) is a process for making a 3D object of any shape from a 3D model or other electronic data sources through accretive processes in which material of successive layers are laid down under computer controls. Hideo Kodama of Nayoga Municipal Industrial Research Institute is generally regarded to have published the first solid object from a digital design. Charles a Hull was a settler of the solid imaging process known as stereolithography and the STL (stereolithographic) train format which is still the most considerably used format habituated moment in 3D printing. He is also regarded to have started marketable rapid-fire- fire prototyping that was concurrent with his development of 3D printing. Presently, rapid-fire- fire prototyping has a wide range of operations in various fields of mortal exertion disquisition, engineering, medical sedulity, service, construction, architecture, fashion, education, the computer sedulity and multitudinous others. In 1990, the plastic extrusion technology most considerably associated with the term" 3D printing" was constructed by Stratasys by name fused deposit modelling (FDM). By the early 2010s, the terms 3D printing and accretive manufacturing evolved senses in which they were alternate marquee terms for AM technologies, one being used in popular conversational by consumer- maker communities and the media, and the other used officially by artificial AM end use part directors, AM machine manufacturers, and global technical morals associations. Both terms reflect the simple fact that the technologies all partake the common theme of successive- caste material addition/ joining throughout a 3D work envelope under automated control.

Other terms that had been used as AM synonyms included desktop manufacturing, rapid-fire- fire manufacturing, and nimble tooling on- demand manufacturing. The 2010s were the first decade in which substance end use corridor analogous as machine classes and large nuts would be grown (either before or rather of machining) in job product rather than obligatory being machined from bar stock or plate. Relating these progressions in 3D printing accoutrements the compass of development of multifunctional bias, biomedical implants, factors and indeed mortal organs can be 3D published. This study means to give a far- reaching review of 3D printing of food accoutrements. There's an adding marketable sector demand for aliment products, in present a large portion of which are structured and made by uncommonly set people. Using 3D printing for getting ready aliment 3D published customized food is better volition. 3D printer can publish with no mortal intervention. Final item is ingrained in customized shape, design, color and supplement content.

2. OBJECTIVE

The objective of a 3D printer is to create physical objects from digital designs or 3D models. The printer uses additive manufacturing technology to deposit layers of material, such as plastic, metal, or resin, on top of each other to gradually build up the object. This allows for the creation of complex and intricate shapes that may be difficult or impossible to produce with traditional manufacturing methods.

Some of the key objectives of 3D printing include:

1. Rapid prototyping: 3D printing allows for the quick and cost-effective production of prototypes, enabling designers to test and refine their ideas before committing to large-scale production.
2. Customization: 3D printing enables the creation of highly personalized and customized products, such as medical implants, prosthetics, and orthotics.
3. Small-scale production: 3D printing is ideal for small-scale production runs, such as creating replacement parts or producing limited edition products.
4. Reduced waste: Unlike traditional manufacturing methods that generate significant amounts of waste material, 3D printing is a more sustainable process, as only the required amount of material is used to produce the object.
5. Education: 3D printing is also used in education to help students learn about design, engineering, and manufacturing processes, as well as to create physical models for a range of subjects.

3. LITRATURE REVIEW

T. Prabhu et. al., [1]: - A 3D printer is a type of additive manufacturing technology that enables the creation of physical objects from digital models by laying down successive layers of material. The technology has revolutionized various industries, including engineering, architecture, medicine, and fashion, by enabling rapid prototyping, customization, and the production of complex geometries. The process involves slicing a digital model into thin layers, sending the data to the printer, which then creates the object layer-by-layer using materials such as plastics, metals, and ceramics. With the ability to produce intricate shapes and designs that are difficult or impossible to create using traditional manufacturing methods, 3D printing has the potential to transform the way we design, manufacture, and consume products.

Jabbar Qasim et. al., [2]: - 3D printing is an innovative manufacturing technology that has rapidly gained popularity in recent years. A 3D printer is a machine that can create three-dimensional objects by building them up layer by layer from a digital model. This technology has revolutionized the way we manufacture products by enabling rapid prototyping and the production of complex geometries. 3D printing has the ability to produce objects made from a wide range of materials, including plastics, metals, and even living tissues. The process involves slicing a digital model into thin layers, sending the data to the printer, which then creates the object layer-by-layer. This technology has numerous applications in industries such as aerospace, architecture, automotive, fashion, and healthcare, and has the potential to transform the way we design and manufacture products. With the ability to produce intricate shapes and designs that are difficult or impossible to create using traditional manufacturing methods, 3D printing has the potential to change the face of manufacturing as we know it.

Vishal N. Patel et. al., [3]: - A 3D printer is an additive manufacturing technology that creates three-dimensional objects by adding material layer by layer. It has the ability to produce complex geometries and customized designs, making it a valuable tool in various industries such as aerospace, automotive, and healthcare. The process involves creating a digital model of the object, slicing it into thin layers, and sending the data to the printer, which then builds the object layer by layer. 3D printing has the potential to revolutionize the manufacturing industry by reducing waste, speeding up the design and production process, and allowing for greater design flexibility. The technology has expanded to include a wide range of materials, including plastics, metals, and even living tissues. As 3D printing continues to advance, it has the potential to transform the way we think about and approach manufacturing.

Kaufui V. Wong et. al., [4]: - A 3D printer is a machine that can create three-dimensional objects by layering materials such as plastic, metal, or even biological materials, based on a digital model. The process is also called additive manufacturing, as the printer adds material layer by layer until the object is complete. To use a 3D printer, a digital model of the object to be printed is created using computer-aided design (CAD) software or obtained from an online repository of 3D models. The digital model is then sliced into thin layers, and the printer uses these slices as a guide to deposit material in the correct positions.

Helena N Chia et.al., [5]: - The most common type of 3D printer uses a process called fused deposition modelling (FDM), where the printer melts and extrudes a plastic filament that hardens into the desired shape. Other types of 3D printers include stereolithography (SLA), which uses a liquid resin that is cured by a laser, and selective laser sintering (SLS), which uses a laser to fuse powdered material into a solid object. 3D printing has a wide range of applications, from prototyping and manufacturing to medical and dental applications, art and design, and even food production. As the technology continues to advance and become more affordable, it is likely to have an increasingly significant impact on many industries and fields.

4. BLOCK DIAGRAM

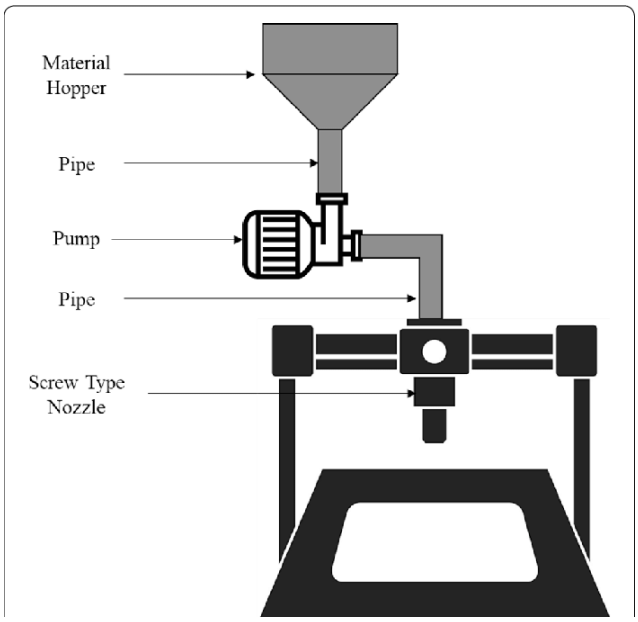

Fig: - Schematic of a printing process for the 3D printer.

5. WORKING MODEL

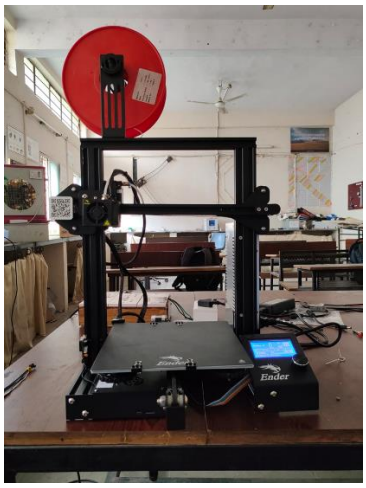

Fig: - Working Model

6. WORKING

A 3D printer is a machine that creates three-dimensional objects by laying down layers of material until the desired shape is achieved. The process typically involves the following steps:

1. Designing the object: The first step is to design the 3D object on a computer using 3D modelling software.
2. Preparing the file: Once the design is complete, the file needs to be prepared for 3D printing. This involves converting the 3D model into a format that the 3D printer can read.
3. Setting up the printer: The 3D printer needs to be set up with the appropriate material and settings for the object being printed. This typically involves loading the material into the printer, setting the temperature and speed settings, and levelling the print bed.
4. Printing the object: Once everything is set up, the 3D printer begins to print the object. The printer works by melting the material (usually plastic or resin) and depositing it layer by layer to build up the final shape.
5. Finishing the object: Once the printing is complete, the object may need to be cleaned up or postprocessed to remove any excess material or improve the surface finish.

Overall, 3D printing is a complex process that requires a combination of hardware, software, and materials to create a final 3D object.

7. COMPONENT

There are several components that make up a typical 3D printer, including:

1. Frame: The frame provides the structure and support for the printer.
2. Motors: The motors move the print head and build platform, allowing the printer to create the 3D object.
3. Print head/extruder: The print head or extruder is responsible for melting the printing material, such as plastic filament, and depositing it layer by layer to create the object.
4. Build platform: The build platform is where the object is created. It is typically a flat surface that can be moved up and down, allowing the printer to build objects of varying heights.
5. Filament: The filament is the material used to create the object. It is fed through the extruder and melted to form the layers of the object.
6. Software: 3D printers require software to control the printing process. This software typically includes a slicing program, which takes the digital 3D model and converts it into layers that the printer can print.
7. Control board: The control board is the brain of the printer, controlling the motors, heating elements, and other components to ensure that the printer creates the object accurately and reliably.
8. Power supply: The power supply provides the energy needed to run the printer and its components.
9. Cooling system: Some 3D printers also have a cooling system to help solidify the printing material after it is deposited, preventing it from deforming or warping.

8. ADVANTAGES

- Cost reduction: - Less machine, material and labor costs.
- Less waste, more sustainable.
- Reduce time.
- Provides an enhanced competitive advantage.
- Reduce errors.
- Production on demand.

9. DISADVANTAGES

- Initial costs of printer
- Post processing
- Printing time
- Special skill required for 3D models
- Manufacturing Job Losses

10. APPLICATION

1) Medical and Dental: -

The medical sector is viewed as being one that was an early adopter of 3D printing, but also a sector with huge potential for growth, due to the customization and personalization capabilities of the technologies and the ability to improve people's lives as the processes improve

and materials are developed that meet medical grade standards.

2) Aerospace: -

Like the medical sector, the aerospace sector was an early adopter of 3D printing technologies in their earliest forms for product development and prototyping. Because of the critical nature of aircraft development, the R&D is demanding and strenuous, standards are critical and industrial grade 3D printing systems are put through their paces. Process and materials development have seen a number of key applications developed for the aerospace sector-and some non-critical parts are all-ready flying on aircraft.

3) Automotive: -

Another general early adopter of Rapid Prototyping technologies the foremost manifestation of 3D printing was the automotive sector. numerous automotive companies particularly at the cutting edge of motor sport and F1 have followed a analogous line to the aerospace companies. First (and still) using the technologies for prototyping operations, but developing and conforming their manufacturing processes to incorporate the benefits of bettered accoutrements and end results for automotive corridor. numerous automotive companies are now also looking at the eventuality of 3D printing to fulfil after deals functions in terms of product of spare/ relief corridor, on demand, rather than holding huge supplies.

4) Jewellery: -

Traditionally, the design and manufacturing process for Jewellery has always needed high situations of moxie and knowledge involving specific disciplines that include fabrication, mould-making, casting, electroplating, forging, tableware/ gold smiting, stonecutting, drawing and polishing. Each of these disciplines has evolved over numerous times and each requires specialized knowledge when applied to Jewellery manufacture. Just one illustration is investment casting the origins of which can be traced back more than 4000 times.

5) Architecture: -

Architectural models have long been a chief operation of 3D printing processes, for producing accurate demonstration models of a mastermind's vision. 3D printing offers a fairly fast, easy and economically feasible system of producing detailed models directly from 3D CAD, BIM or other digital data that engineers use. numerous successful architectural enterprises, now generally use 3D printing (in house or as a service) as a critical part of their workflow for increased invention and bettered communication. More lately some visionary engineers are looking to 3D printing as a direct construction system. Research is being conducted at a number of associations on this front, most specially Loughborough University, Contour Crafting and Universe Architecture.

11. RESULT AND CONCLUSION

3D printers have numerous promising areas of implicit unborn operation. New 3D printing processes have reduced the time it takes for contrivers and masterminds to conceptualize, produce, and test prototypes. But for 3D printing to catch on the fleetly changing manufacturing assiduity, it'll have to be seen by companies less as a fascinating technological upgrade and further as an everyday business decision. Some of the most promising areas include medical operations, custom corridor relief, and customized consumer products. As accoutrements ameliorate and costs go down, other operations we can slightly imagine moment will come possible. maybe the topmost area of implicit growth for 3- D printing is in the medical field. As mentioned over, experimenters are just starting to experiment with the idea of creating artificial bones with 3- D printers.

REFERENCE

1. T. Prabhu (2016), Modern Rapid 3D printer- A Design Review, International Journal of Mechanical Engineering and Technology, pp. 29–37.
2. Jabbar Qasim Al-maliki, Alaa Jabbar Qasim Al-Maliki (2015), The Processes and Technologies of 3D Printing, International Journal of Advances in Computer Science and Technology, pp. 161–165.
3. Vishal N. Patel, Kamlesh P. Kadia (2014), Parametric Optimization of the process of Fused Deposition Modelling in Rapid Prototyping Technology –A Review, International Journal for innovative Research in Science and Technology (IJIRST), pp. 80–82.
4. Kaufui V. Wong and Aldo Hernandez (2012), A Review of Additive Manufacturing, International Scholarly Research Network, pp 1–10
5. Helena N Chia, Benjamin M Wu (2015), Recent advances in 3D printing of biomaterials, Journal of Biological Engineering, pp. 1–14
6. Wenyong Liu, Ying Li, Jinyu Liu, Xufeng Niu, Yu Wang, and Deyu Li (2013), Application and performance of 3D printing, Journal of Nano materials, pp. 1–7.
7. Deepa yagnik (2012), Fused Deposition Modelling – A Rapid Prototyping technique for Product Cycle Time Reduction cost effectively in Aerospace Applications, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), pp. 62-68.
8. CH. Venu Madhav, R. Sri Nidhi Hrushi Kesav, Y. Shivraj Narayan (2016), Importance and Utilization of 3D Printing in Various Applications, International Journal of Modern Engineering Research (IJMER), pp. 24–29.
9. Zeina Malaeb, Hussein Hachem, Adel Tourbah, Toufic Maalouf, Nader El Zarwi and Farook Hamzeh, 3d Concrete Printing: Machine and Mix Design.

International Journal of Mechanical Engineering and Technology, 6(6), 2015, pp. 14–22.

10. Q. Yan, H. Dong, J. Su, and J. HanB. Song and Q. Wei, ""A review of 3D printing technology for medical applications," Engineering, vol. 4, no. 5, pp. 729–742, 2018