Design and Fabrication of multipurpose 3D-Printing Machine

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ABSTRACT

3D Printing is another type of additive manufacturing technology in which objects are made by laying down the successive layers. Rapid prototyping is another name of 3D printing.It has the mechanism in which 3D objects are created with the help of machine based on blueprints contained in a computer. 3D printing is becoming trending topic for all sectors.This 3D printing saves the cost and time for the material design.So there is a need to fabricate multipurpose 3D printing machine which is cost effective and servs the multipurpose.

Key words: CAD model, STL Format, Rapid prototyping, Laser engraving, Pen writing.

1.INTRODUCTION

3D printing called so-called desktop state. It is a fast printing process where the real object is usually constructed from 3D architecture. The 3D printer uses a CAD model with a fast prototyping process. 3D printing is referred to as a desktop design that may be a modeling process in which a structure is assembled starting its 3D model. The design is saved as a STL format and transferred to a 3D printer. It can use a good range of materials such as ABS, PLA, and combinations and 3D printing is one of the fastest and most cost-effective formats to be used for faster prototyping. The 3D printer prints a layer of CAD design with a layer that makes it a real thing. 3D printing sources from desktop inkjet printers where many jets of deposit and therefore print materials, layer by layer based on CAD 3D data. 3D printing separates and speeds

up our lives, allowing for a variety of product qualities to be simplified and faster. dimensional (3D) printing has the potential to influence the transmission of information in ways such as the influence of old technologies such as photocopying. This identifies data sources in 3D printing, its technology, required software and applications. In conjunction with 3D printing, companies are ready to come up with and design new ideas and various design solutions at no cost of time or tool. 3D printing may present challenges for future production plans. 3D printing has an impact on many industries.

2. LITERATURE REVIEW

When this issue came up many people, universities and companies started creating 3D printed parts. The high availability of 3D printed desktops and expiration of patents and lowering prices in last decade leading to open source projects. In this situation additive manufacturing as an immediate alternative for production of innovative devices and parts to fight the COVID-19 pandemic. The lack of PPE and other medical devices and inhabitancy of new things like maintaining social distance wearing face masks demanded an instantaneous response for providing these items to all the countries. One of the known example was 3D printed connecter and valve named Charlotte and Dave in Italy .these parts are fabricated by fused filament fabrication (FFF) method. Other type of inhabitancy 3D printed materials like Venturi valves ,face masks ,ear savers etc were manufactured by using 3D printing technology. All these materials played a crucial role for fighting against the global pandemic. In the beginning of pandemic many companies had tie up to fight against the COVID -19.Many used 3D printing as rapid prototype tool for achieving optimal product which was then choose for mass production. Selective laser sentering machines are used for part therefore FFF and SLS are different processes in 3D printing. The COVID-19 pandemic clearly says that the conventional method of manufacturing is fragile. In this regard we can clearly says that the 3D printing is highly flexible. As it is a new technology the reach of 3D printing didn't get it's full potential. For this government should provide guidance and special laws for emergencies and to protect and encourage people. The 3D printing particularities such as layer by layer ,thermal cycle residual stress summoned it's freedom of design helps in advance of additive manufacturing company.The advantage of this 3D printing technology like freedom of design ,quick and rapid manufacturing of prototypes and even final products summed to it's accessibility and open design made it an essential feature for fighting against the worldwide pandemic.In this context we

strongly believe that it gained notoriety and every one the present developments in 3D printing field will make it skilled manufacturing technique in industry and can be a powerful ally to fight against future emergencies[1].Explained about the 3d printing technology. And the various types of material which can be used for 3d printing, and the different type of properties of material that which material is used in printing objects. 3D printing is additionally referred to additive manufacturing equipment because it uses layer by layer material build up approach for creating objects. It is a tool less manufacturing method. It is a high precision & less cost process for making objects. There are different fields where we use 3d printing like medical, automobile, aerospace and manufacturing etc. Advances in 3D printing design can completely change, improve the way we do things and produce sales around the world. The article is tested or edited by Computer Aided Design, at the same time, divided into smaller layers, which can be printed to form a solid three-dimensional object. Right now we all see that 3D printing has an application at all stages of human need. 3D printing incorporates almost 100 items now days and testing continues to increase the size of the materials used in this process [2]. View all entries and offer production strategies and printing materials. This paper examines the recent developments in 3D printing that have been used in medical applications. With the proliferation of patient-specific strategies, high sensitivity, good profitability, and financially savvy design techniques, 3D printing has long been recognized as an innovation in clinical practice. The major uses of 3D implants in medical contain tissue design models, anatomical models, medical techniques and authorization and integration of medical equipment. Muscle health is probably the most advanced field that incorporates 3D printing to create end-of-life materials, for example, retrieval, spinal models, and alert track sheets. Muscle health is a pioneer in clinical gadgets. Currently, there are a wide variety of 3D printed clinical materials available, including craniofacial implants, acetabular cups, knee implants, spinal cords, and monitoring instruments. Increasingly, about 99% of auxiliary hearing aids are specially designed for 3D printing. Pre-published medical procedures anatomical models changed the way in which specialists and clinical subjects were prepared for the treatment process. To date, analysts have printed around 16 tissue types, providing tissue models for advanced testing of new drugs. It is widely accepted that 3D printing contributes to basic clinical and progressive testing [3] .Work on 3d printers and what processes have occurred in 3d printing layouts and where they are used. The Aerospace and Defence sector must advance the use of 3D printing, and there is still great potential for

openness. However, some sectors are far behind .In health care, 3D printers have transformed the handicraft industry, requiring more workers to become automated. The food industry explores printed products ranging from complex chocolate designs to a vegetable-based vegetable market.3d printing market plays an important role in the industrial sector, specialized 3d printing retailers, top retailers, professional service providers. This is one of the potential applications in this magazine for 3d printers [4] .Using the CAPES Sucupira platform, selected 124 high-value articles published between 2014 and 2018. Each of these topics is divided into 9 categories: types of study, participation, methodology, research background, scope of place, study area, size, benefits and unenthusiastic points. With the results obtained, it was confirmed that the number of 3D-printed articles increased by the year, indicating their value and respect. finally, the quote numbers associated with the benefits of 3D printing are greater than the number of quotes on the negative points of the process. 3D printing is slowly being considered, reflecting the importance and popularity of the topic. Finally, with the advantages and disadvantages of 3D printing, the features were the highest (38.7%) item and the largest cost and limit in relation to high-quality creation, by 30.8% for each item [5].The paper has been classified into the four sections based on the research that deals with the design phase, pre-processing phase, process phase and post process phase. This paper also presented the required background information about additive manufacturing to help new readers. The conclusion includes an overview of open research directions and challenges within the field of additive manufacturing from a computer and knowledge science perspective. All the research papers presented in this review paper have the potential to turn into opportunities if either the proposed theory is produced experimentally or if the experimentally proven ideas are further expanded upon through the already established logic of completing a process. Beginning from the design phase, naturalization of CAD software interface is an opportunity for computer scientists to work on UI/UX design that could lead additive manufacturing to turn into a ubiquitous production method that can be used by professionals and non-professionals alike. Algorithms for artificial neural networks can be developed that help aid in providing the right settings for the print to be fabricated precisely despite the environmental condition. CAD software can also be used to provide simulations for the objects being designed where they can be tested within various environments to make sure their designs work as intended. The simulations can help make changes to better optimize a model's design. CAD software also can be wont to design various medical implants. Egger et. al

describe how computer aided design helps in the position planning of facial implants.As the challenge of printing fine details that are of nanometres in length gets solved, additive manufacturing could be used to design circuit boards to human tissues on a very precise and detailed scale. With almost endless opportunities, additive manufacturing has a bright future outlook and would benefit heavily by the involvement of computer scientists in the development of computational power of the additive manufacturing system which includes the CAD software to the machine language of the printers which is currently in Gcode[6].Explained Current Biomedical Performance of 3D Printing. Types of 3D Printing for Biomedical Applications: 1) Powder-Based Printing - The use of a powder bed as a basis for its design. However, they converted the powder in several ways to detect the composite structure. In Binder Jetting, this method involves the injection of droplets of the binding material over the powder bed. Once the bond is pumped over the flour bed, a new layer of flour is spread over the bed and therefore the next layer of bond is used. InPowder Bed Fusion, powder is something that can be dissolved using lasers. Once the powder layer has melted, a new layer of flour is placed on top and the process is repeated. 2) Placement of Materials - These methods use microphones to insert printing materials into layers. At Direct Power Storage, the microphone inserts a continuous metal into the print area, and the thermal energy source, such as a laser, melts it continuously, layering it with a layer. they are dissolved in a liquid form and are continuously placed on a printing bed with layers.In Material Jetting (MJ), this method uses jets to spray a layer of liquid resin while simultaneously treating the layer with UV light before printing the next layer. Name Print Bio incorporates the use of different AM technologies in live 3D printing cells, and is not considered a specific AM alone. The basic premise consists of the placement of bio ink-fixed molecules by microscopic techniques, such as extraction or jetting, as described above, or non-laser-assisted nozzle techniques. , metal) is cut either with a laser or a blade, and each sheet represents a piece of computer-assisted model (CAD). After all the sheets have been cut, assembled and tied using a bond, so the cut parts are removed, revealing a structure within three dimensions. suitable for use in a variety of fields including electronics and medicine. Although not known as a standard AM procedure, nanofabrication methods can apply many of the same principles [7] .Each year, 3D printing offers more and more applications within the healthcare field that help save more and improve lives in ways that have never been thought of. In fact, 3D printing has been used in fine health care frames. In tissue printing and transplantation, the 3D

printing method for building tissue building blocks is micropores. Lung structures made like these allow both body fluids and other fluids to circulate and mark the strength of the laboratory-made tissues of blood vessels. In the case of artificial insemination, the 3D Systems printer currently uses a stereolithography process in which the UV laser interacts with a collagen dam, producing solid collagen when the two interact. The trachea and bronchi were formed during a flat process that lasted about 12 hours. It can take about a year to get a complete set of lungs this way. Additionally, the current printer has a resolution of 20 micrometers. To match the actual lung weight, the machine would have to reduce this resolution to one micrometer in size. selected patient. Patient-oriented (or patient-centred) devices are created specifically for patient-supported factors, such as anatomy. They can be supported by a patient-centred template model using medical imaging. Patient comparisons are often accomplished with techniques such as device measurements using one or more anatomic features from patient data. The FDA regulates 3D printed medical devices using the same methods as traditional medical devices; they are therefore tested in accordance with the safety and performance standards submitted to us by the manufacturer. While traditional medical devices are available in a variety of sizes, patient-modified devices are often made between a continuous range of shapes with less predefined specifications and sizes that we will use to update devices in the same way as standard devices. For example, a specification may describe the minimum and maximum weight of a wall or how sharp a curve is to maintain the performance of a device in its intended use. 3D printing in the field of medicine and style should think beyond the norm of changing health care. The three main pillars of this new technology are the ability to treat more people where previously it would not have been possible, to get patient results and less time required under the direct supervision of medical professionals. In short, 3D printing consists of "empowering physicians to treat more patients, without sacrificing results". Therefore, like all new technologies, 3D printing has brought many benefits and advantages to the medical field. Each specific case where 3D printing received the application displayed in the middle of this analysis could be a reflection of this. However, it must comply with the revised and current legislation in order to ensure its fair use [8]. Additional production (AM) has been a major development in recent years. The evolution of AM was accepted as a powerful permitting technology during the selection of many programs, many of which involved the medical, aerospace, and automotive industries. All the advances associated with modern electronics are driven by two vital factors[9].There are details of the

current state of 3D-Printing regarding various processes and technologies and their possible uses in the production and packaging of electronic materials. This paper also introduces building and modelling techniques and toolkit details and details on how often this is to understand the performance of an asset during the 3D printing process to reduce the magnitude of pressures. This paper then provides a summary of the key challenges that need to be overcome before 3D printing can become commonplace in the industry. The study concluded that 3D-Printing sees significant improvements. At the moment most of this depends on the display of the object, however high-quality manufacturing is currently possible. Areas with low volume targets after a higher overtime value, for example, on airplanes and medical facilities. Some of the current developments in Hardware and bundling manufacturing in the area and various organizations including 3D-Printer providers, building materials suppliers, EDA vendors and computer-based organizations see 3D hardware printing of the hardware as an important opportunity. Be that as it may, challenges regarding ethics, performance, reliability and configuration devices still need to be addressed [10].

3. METHODOLOGY

3.1. Procedure

In the process first step is to create model by designing software. Then the created model is converted into STL(stereolithography) format. The converted format is sliced and converted into G code. Then successive layers are laid down according to G code and final 3D model output is obtained.

3.2 Fused Deposited Modeling

The Fused Deposition Modeling (FDM) process falls under the add-on process. It is one of several additional procedures such as Stereo lithography (SL), Selective Laser sintering (SLS) etc. Additional Production follows the construction components by inserting fabric.

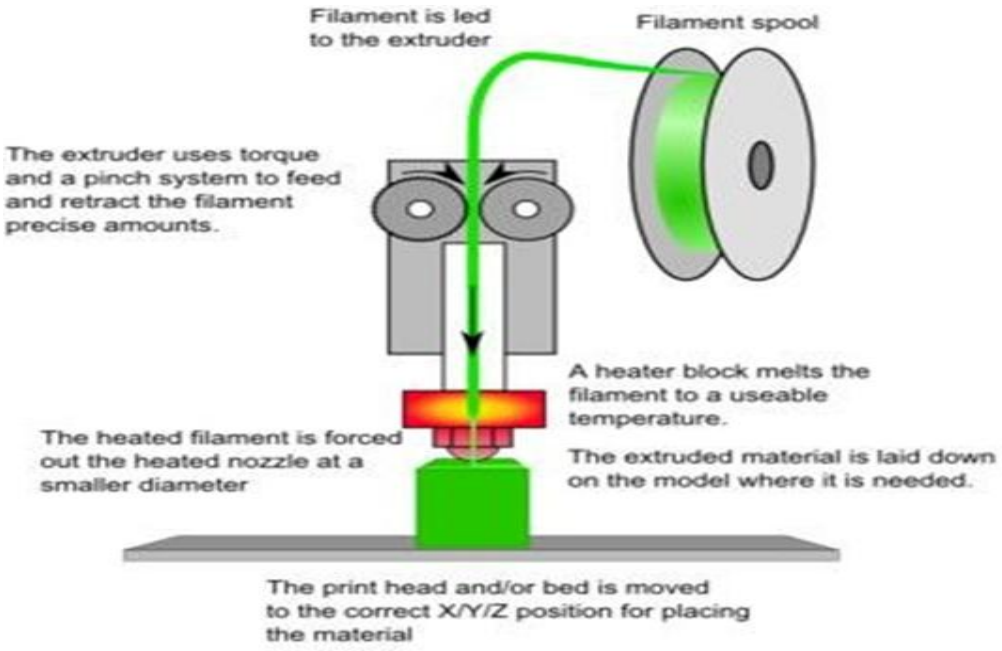

Figure 1.Fused deposited modeling.

To determine the method used, inserting a package of cards is often regarded as an example.FDM, the word itself gives the impression that parts are made by inserting material into layers. This RP method is used for modeling, prototyping and production applications. FDM was founded by S. Scott Crump in the late 1980s and was sold in 1990 by Stratasys.In the FDM process, extruder head moves in the X & Y directions. The table moves vertically to the Z-axis. When a layer is placed on a table, it descends to match the size of the layer and therefore the following layers.

3.3 Components

The parts contained in this model are idler and hobbed gear, Bed, Threaded rod, Stepped motor and driver, Extruder, Thermistor, Nozzle, Filament, Cooling fan, writing pen and Laser engraver.

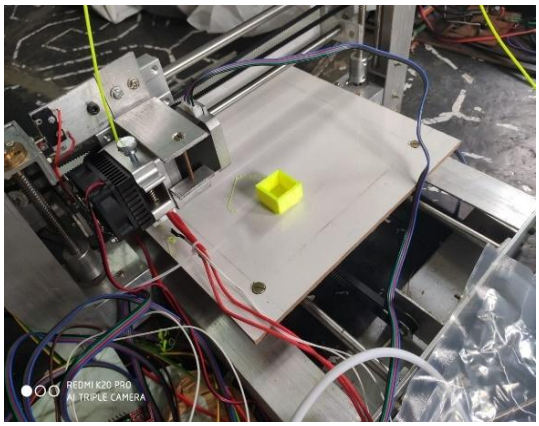

Figure 2. Overview of model

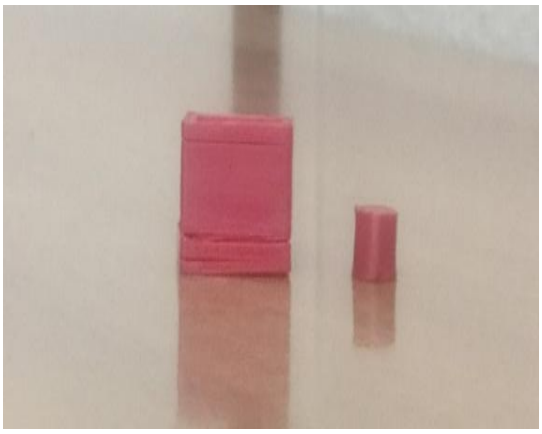

Figure 3. 3D printing

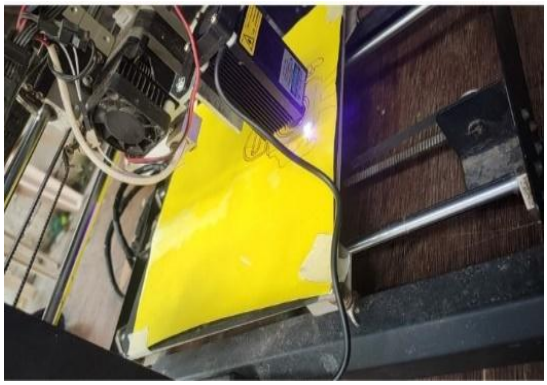

Figure 4. Laser engraving

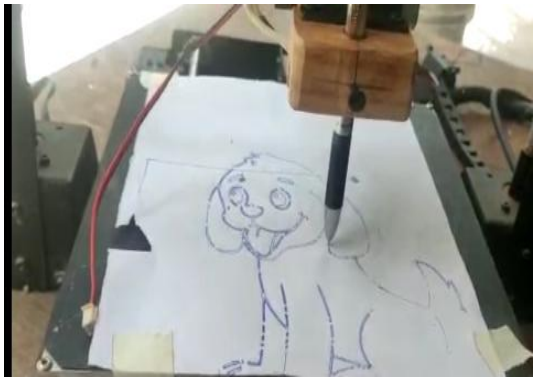

Figure 5.Pen writing

This 3D printing machine is made with the above mentioned parts. It serves multipurpose i.e 3D printing, writing pen tool and laser engraver. This has also the features of Bluetooth module which can be operated with computer and memory card slot for storage of pre defined programs which helps in saving the time.

5. RESULTS

Generally 3D printers has wide range of applications in medical,dental,architecture,industrial design,automotive design,aircraft design etc.3D printer is economical,sustainable,design flexibility.It leads to reduction of manufacturing jobs.To make this 3D printer more economical,we are designing a multipurpose 3D printing machine which prints the 3D components,writing purposes and laser engraving.

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