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A Review Paper on 3D Printing Technology and Implementation for Gaming

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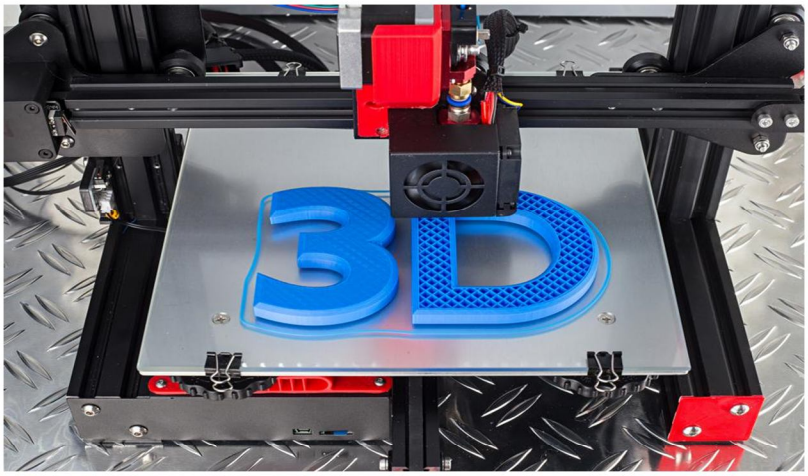
***Abstract:** In this article we will provide the reader the over view of 3D printing technology. Process used for 3D printing. What are the types of printer used in printing industry and how 3D printing is playing important role in Gaming Industries and manufacturing of 3D toys.*
***Keywords:** Additive Manufacturing, 3D Printing Technology, Gaming, FDM, SLA, SLS, DLP, SLM,3D printing Types.*

I. INTRODUCTION



Picture Courtesy: Forbes

3D Printing is also called additive manufacturing is a process of developing 3d Models in three dimensional having X,Y,Z axis solid objects From the software digital files .In this system the 3D object is created layer by layer using a computer generated digital design.[2]
3D Printing is opposite to traditionally manufacturing methods as it develops complex models in less time and more efficiently.[2]
Over last few years, technology got advanced for the manufacturing of sold product in which 3D printing revolutionizing the design and manufacturing of new products. Earlier this technology was based on producing prototyping of a product but these days 3D Printing is producing a product from initial concept design to production of final product to be marketed. There are many 3d Printers available in the market which tends to produce highly complex 3D solid products. [1]
This technology emerged in 1980 and very few professional designers with limited application created concept models. But now the 3D printing has proven to be long term, having more applications printers and software's to build high end production in short period of time. Many companies have adopted this 3D printing technology having exciting new ways to improve product development process and enhance profitability.[1]

II. PROCESS FOR 3DP TECHNOLOGY

3D modeling is required for developing 3D products. Many 3D modelling software's are available such as AutoCAD, 3DS MAX, Solid works, Maya in which you can create your high Polly 3D models, these software helps you creating object In 3 dimensional X,Y,Z, axis and you can export your printable like in STL or OBJ file extensions. There are many 3DP processes available in market which uses material like metals, plastics, wax and many more. But widely used 3Dp process is SLA, SLS and FDM (these process we will be discussing further in our paper) [1]

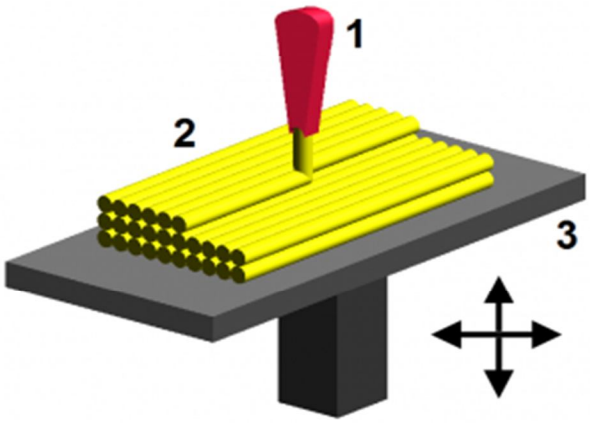
The process is follows

1) Create a solid model into 3D software's like CAD, 3D MAX, MAYA software's. [1]
2) Converts the 3D generated model into OBJ. or STL file format which is supported by 3D Printing machines.[1] As many software's uses different algorithms for the representation of solid model. So STL format is chosen for standard file extension for all the software's. The STL format contains the information of solid model in respect to X, Y, Z Planar triangles. It contains the coordinates of the vertices, edges and the direction of each triangle for slicing algorithms STL format is the best format to represent surfaces. [1]
3) Slicing of the STL files with slicing software's- In third step the STL file is sliced in 2D cross sectional layer using proper software programme of the 3DP machine in which model is to be produced rock machine has its own programmed software's for slicing STL files and start orienting and adjusting the size and thickness of layer with respect of model. The layer thickness may vary from 0.01mm to 0.70mm according to the size of the machine. To produce highly detailed 3D model the slice thickness should be kept low but it increase the time of built. For making 3D model before printing the machine algorithms tells how much material is required to build the model.[1]
4) Once the STL file is processed and saved the file is sent for printing to 3DP machine. 3DP machine stars the printing layer by layer to form prototype 3D model. [1]
5) Once the printing is done the prototype model is removed from the machine and cleans it before use. This step is also called post processing process in which the model is painted brushed and surface is polished for its better appearance and durability. [1]

III. TYPES OF 3D PRINTING

There are many 3D printing technology machine available at market today like SLA, SLS, FDM,DLP,MJF etc and each 3D printing machines varies in printer cost, material that printers is using, quality of printer, time taken by that printer to print prototype printer speed. Although now 3d printers are no longer difficult to operate it can print in home only if u grasps the basic knowledge of printing. The most common 3d printing is used these days are- [3][5]

A. FDM- Fused Deposition Modelling



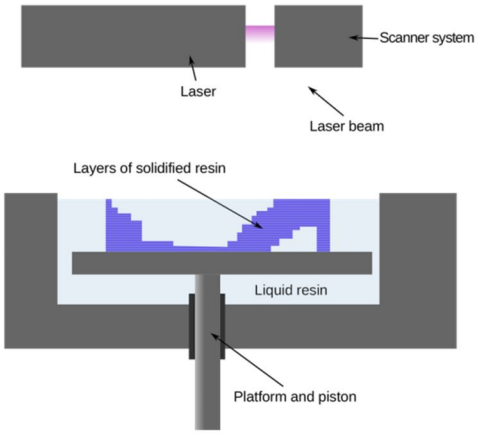
Picture Courtesy: https://3dinsider.com/3d-printer-types/

Fused deposition modelling was developed by Scott crump in 1980. Which uses thermal plastic materials for the production of 3D objects? It uses the simple process as we discussed earlier. First we have to model the 3D objects in 3D software then we have to slice the 3D CAD data into multiple layers using particular software's. The slice data goes to the 3D machine for printing where the thermoplastic material is heated and extrudes with the help of the nozzle on the base of the printer layer by layer to form 3D object after the object is made then it is sent for cleaning and painting for a final touch.[3][5]

Some 3D FDM printers

1) ALUNAR high resolution desktop FDM 3D printer
2) Power spec 3D Pro.
3) JGAURORA 3D desk to PFDM Printer.

B. (SLA) Stereo lithography Technology

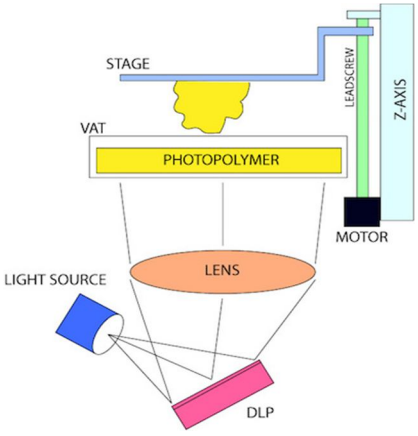


Picture Courtesy: https://3dinsider.com/3d-printer-types/

3D models developed by this process are highly complex and detailed. This system produces the object with accuracy and precision with fast prototyping process. Special types of plastic is used called photo polymers liquid which is heated and converted to 3D objects one layer at a time. In this process first the plastic is heated to form semi liquid glue the harden to base layer by layer with the help of ultra violet laser, directed by X and Y scanning mirror from bottom to top once the object get completed and from 3D object. It is carefully detached and extra resin is removed through chemical bath. SLA technology is now widely used in variety of industries like aerospace, automotive, entertainment, military etc. to create exclusive products some SLA printers.[3][5]

1) SUNLO SLA desktop 3D printer
2) Form 1+SLA 3D printer

C. (DLP) Digital Light Processing Technology



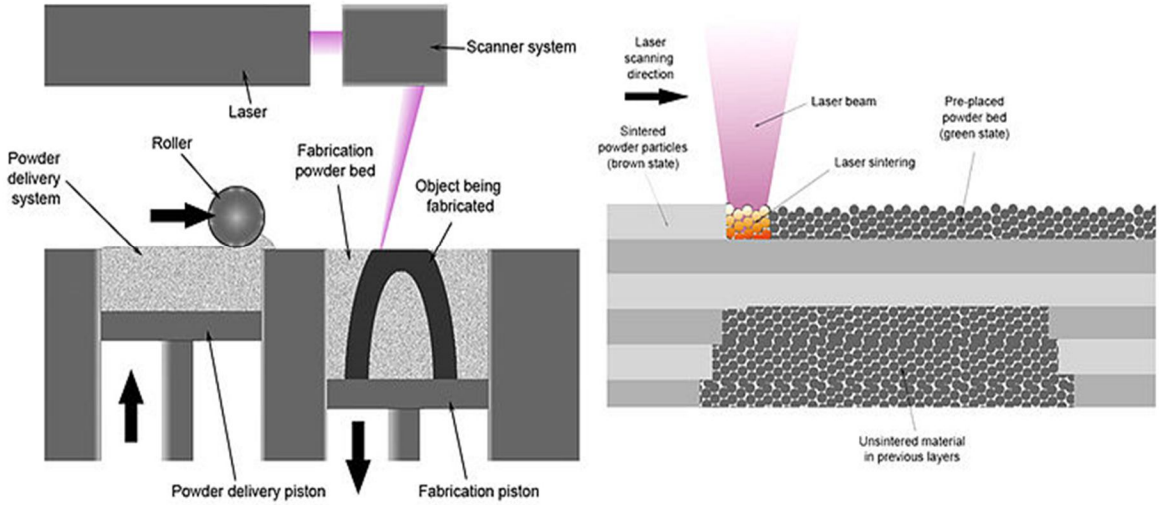
Picture Courtesy: https://3dinsider.com/3d-printer-types/

This technology come in work 1987**.**DLP Printing is more like SLA printing technique because both the technology uses liquid plastic resin (Photo Polymers) which goes into transparent resin containers to from 3D object. But one major difference between the two SLA uses Ultra violet rays to diffuse the single layer whereas DLP Uses traditionally light lamps source which reduces the time of production. It exposes entire lasers at once. DLP is much faster technology the SLA as it produces high end resolution models with low production cost. [3][5]

DLP Printers

1) Desktop UVDLP
2) Solus PLP 3D printer

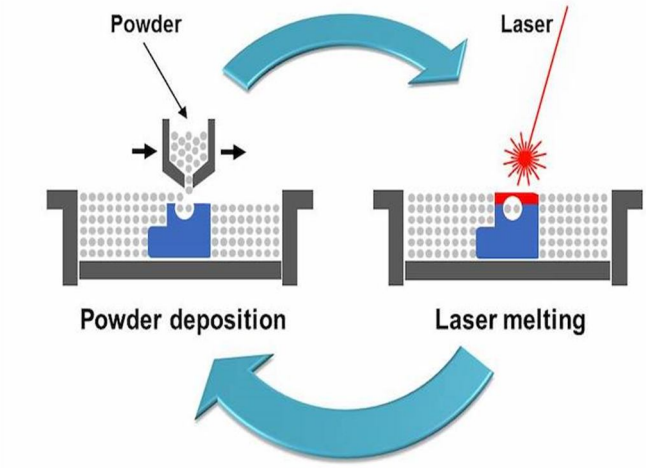
D. (SLS) Selective Laser Sintering Technology



Picture Courtesy: https://3dinsider.com/3d-printer-types/

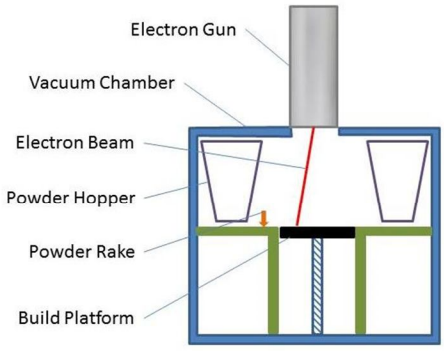
This technology came in 1980 this technology is more like SLA technology. With regards to it speed and accuracy but the major difference is it uses powered substance instead of liquid resins which is used by SLA technology. This technology used high power Co2 laser to fuse the powered material, (it can be metal material ceramics material, glass material etc.) this process is done layer by layer until the object height is reached to its maximum, once the structure is built, It is removed and un-sintered powder manually.[3][5]

E. (SLM) Selective laser Melting Technology



This technology came in around 1995. Which also uses same technology as SLA uses a high powered laser beam to print 3D objects. This process involves powdered material + Laser beam + Precision + structured layer bed – complex highly detail 3D model. In this process the laser beam melts the powdered material which forms laser on bed according to given dimensions. Then this layer is welded to another coming successive layer to form the 3D object. The object mode is removed and cleared after words. The major difference between SLS and SLM is SLS partially melts the powder material but SLM completely melts the powder material. SLM products are stronger.[3][5]

F. (EBM) Electronic Beam Melting



Picture Courtesy: https://3dinsider.com/3d-printer-types/

This technology came in 1997. This process is similar to SLM technology but this process uses electron beam instead of a high powered laser. For melting the powdered material electron beam is used inside the vacuum chamber. Where the 3D structure is built layer by layer. This process takes less time to produce object with stronger durability and generates complex geometries 3D design. [3][5]

IV. 3D PRINTING FOR GAMES

Picture Courtesy : https://thetechinfluencer.com/best-3d-printers-for-gaming-miniatures/

3D printing technology is considered to be boom in gaming industry as it helps to customize your own created 3d model prototype. It gives a creator a freedom to develop their own unique design character, props, accessories and consoles.[2]
This technology has proven of giving gaming new experience of developing games in less period of time with low cost production and highly detailed prototype model. Many companies which produce toys have adapted this technology which delivers games in physical form like plastic bats, plastic ball, 3D miniature ji-jo toys, and modular plastic robot toys with the help of additive manufacturing. Earlier traditional manufacturing was done with lack of detailing in shapes and tend to be costlier. Additive manufacturing is a digital process which has literally grown from feed of plastic.[2]

V. IMPLEMENTATION OF 3D PRINTING TECHNOLOGY IN GAMING INDUSTRY

A. Create and Develop your own Table top Games

With the help of 3DP you can develop your own Table Top role playing games, strategy games, tile based games, board games, dice games, card games etc. The game creator has to develop his/her own original physical game concept with extra level of creativity to enhance the playing experience. Game Design Documents are made and approved by the game creators/companies. The game goes through game production life cycle process.[4]

B. Design your own 3D miniature Toys

3D printing allows you to make your own unique prototype 3d models which are not available in the market .You can design your own character and sell to the market having detail finishing and different colour models with copyright to major gaming toys companies for distribution and marketing holding a profit sharing between the organisation.[4]

C. Create 3D printing Accessories, Gadgets and Consoles

Develop your own remote, play button and arcade joysticks to experience the old style retro console games. Many companies are developing desktop arcade machine alternatives. You can create your own controllers and change the play buttons you feel like giving better and fancy look.[4]

D. Create original game with 3D Prototype

In pre-production of gaming process many concept ideas are generated .In this production phase many changes occur time to time for the better of the game. 3D character, environment, assets and props prototype is developed in physical form to give vision how the game play will look like. Art design department of gaming companies develops this 3D prototype to visualize and create the game from scratch models to high end complex models.[4]

VI. CONCLUSION

3D printing technology not only allows boundless customization but also helps gamers to produce and develop unique games having their own ideas in short period of time and cost effective. Many large companies are seeing 3D printing technology as an opportunity to enhance their production power. Small scale industries also got benefits by using 3DP technology by creating new business game models which are more sustainable to the local market as this technology require less man power, less space for production, less cost of production and provide easy customization

Gaming is one of the major sources of entertainment to the people today and always will be and there will always be a space for 3D additive manufacturing.[6]

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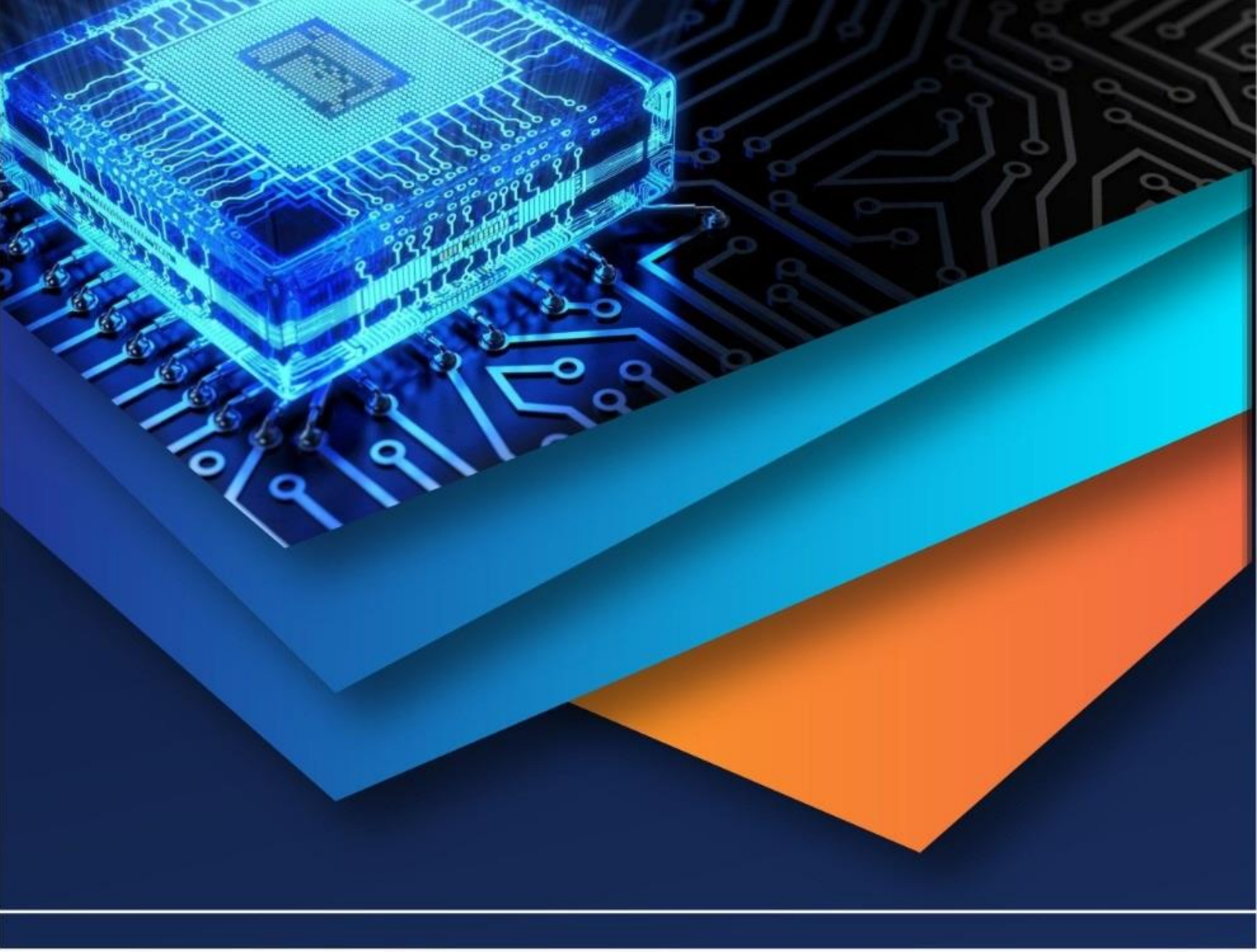

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