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Design and Assembly of 3D Printed Robot

Varsha Rani Yadav*, Sankalp Verma**
*(Mechanical, Mtech scholar, Shri Shankaracharya Technical campus ,Bhilai(C.G.)
Email:varsharaniyadav9@gmail.com)
** (Mechanical ,Senior associate Professor,Shri Shankaracharya Technical campus ,Bhilai(C.G.)
Email:sankalpv.07@gmail.com)

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Abstract:
Automation is creating revolution in the present industrial sector, as it reduces manpower and time of production. This paper include the Design & 3d printed Pick and Place robot. The 3d printed robot is to be developed for a pick and place application which would function in manual mode by taking inputs from a user.It would be further developed to operate in automatic mode that would allow it to undertake repetitive tasks.

Keywords **—SCARA, CAD , SLA, FDM, SLS**

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I. INTRODUCTION

The 3D printing process can builds a three-dimensional object from a computer-aided design (CAD) model, usually by successively adding material layer by layer, which is why it is also called additive manufacturing, unlike conventional machining, casting and forging processes, where material is removed from a stock item (subtractive manufacturing) or poured into a mould and shaped by means of dies, presses and hammers. the 3D printing techniques covers a various processes in which material is joined or solidified under a computer-aided design to create a three dimensional object, with material being added together(such as liquid molecules are fused together),typically layer by layer. one of the key advantages of 3D printing is the ability to produce very complex shapes and geometries also producing any 3D Printed part in a digital 3D model or a cad file.3D printing can produce rapid prototype with in a specific time because it have print it.3D printing technology is very ease to operate and also it is safety. Print direction can be xyz directions and also fill in and hallow objects are basic of 3d printing. GENERAL EXPLANATION OF 3D-PRINTING A method of manufacturing known as „Additive manufacturing‟. Due to the fact that instead of removing material to create apart, the process adds material in successive patterns to create the desired shape. 3D Printing uses software that slices the 3D model into layers by layer and its thickness(0.01mm thick or less in most cases).Each layer is then traced onto the build plate by the printer,0nce the pattern is completed, the build plate is lowered and the next layer is added on top of the previous one. Typical manufacturing techniques are known as „Subtractive manufacturing „because the process is one of removing material from performed block. processes such as milling, drilling and cutting are subtractive manufacturing techniques this of process creates a lot of waste since the material that is cut off generally cannot be used for anything else and is simply sent out as scrap or it can be waste material. 3D Printing can eliminates such waste since the material is placed in the location that it is needed only, the rest will be left out as empty space In 1984 year 1st working 3d printer was introduced by Charles W.Hull then he named it as a machine sterolithgraphy. The technology was very expensive and not suitable for the general market in the early days. As we moved into the 21th century, however, costs drastically decreased, allowing 3-dprinters to find their way into many industries.

- **TYPES OF 3D-PRINTING TECHNOLOGIES**

There are various types of 3d printer mainly they are-

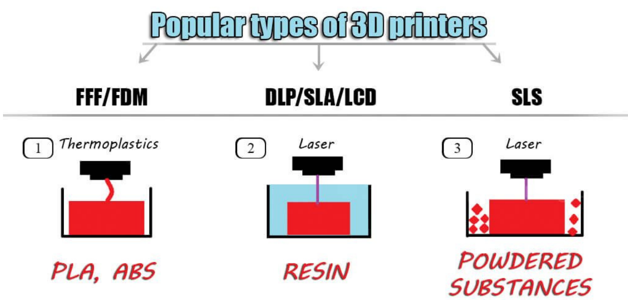

Fig 1- Types of 3d printing

1. STEREO-LITHOGRAPHY(SLA)

It was introduced in 1988 by Charles hull with 3d systems inc., company. .it was the first rapid prototyping process. Stereo-lithography is the most widely used prototyping technology. it can produce highly accurate and detailed polymer parts stereo-lithography contains two main families

a. Projet

b. Ipro

Stereo-lithography can break off the thin plastic lattice. Stereo-lithography can builds a plastic parts or objects one layer at a time by tracing a laser beam on the surface of a vat of liquid photopolymer quickly solidifies wherever the laser beam strikes the surface of the liquid and resins. The platform is lowered by a distance equal to the layer thickness (typically0.003-0.002 in) and a subsequent layer is formed on top of previously completed layers. Resolution up to 0.05mm.The self-adhesive property of the material causes each succeeding layer to bond to the previous one and thus forma complete, three-dimensional object out of many layers. Objects which have over hangs or undercuts must be supported during the fabrication process by support structures. These are either manually or automatically designed with a computer program specifically developed for rapid prototyping. Once complete the part is elevated above the vat and drained. Excess polymer is swabbed or rinsed away from the surfaces. In many cases a final cure is given by placing the part in a uv oven. After the final cure, supports are cut off the part and surfaces are polished, sanded or otherwise finished. Resolution up to 0.05mm

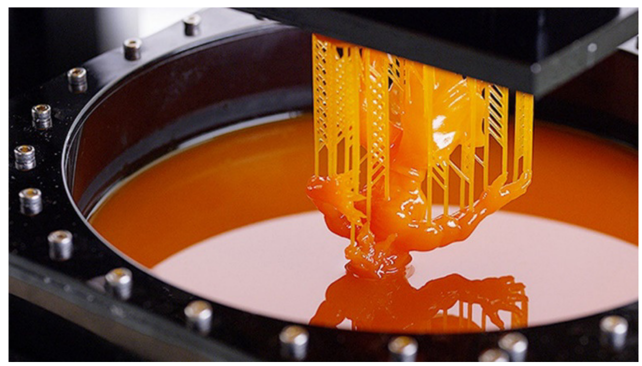

Fig 2- SLA working

2. FUSED DEPOSITION MODELING (FDM) It was developed by Scott and Lisa crump"s in late 80"s century. Fused deposition modelling was trademark by stratasys and developed in Eden Prairie, Minnesota. In this process material is extruded through a nozzle that traces the parts cross sectional geometry layer by layer. Material can be a form of a plastic (or) wax material FDM is the one of the most widely used additive manufacturing processes for fabricating a rapid prototyping technology and functional parts in common engineering plastics, after stereo lithography. FDM is made up of thermoplastic material, ABS and PLA. Fdm is a material extrusion process. A plastic filament is unwound from a coil and supplies material to an extrusion nozzle. The nozzle is heated to melt the plastic and has a mechanism which allows the flow of the melted plastic to be turned on and off. The nozzle is mounted to an x-y plotter type mechanism which traces out the part contours, there is a second extrusion nozzle for the support material. As the nozzle is moved over the table in the required geometry, it deposits a thin bed of extruded plastic to form each layer. The plastic hardens immediately after being squirted from nozzle and bonds to the layer below. The object is built on a mechanical stage which moves vertically downward layer by layer as the part is formed. The entire system is contained within a chamber which is held at a temperature just below the melting point of the plastic. Support structures are automatically generated for overhanging geometries and are later removed by breaking them away from the object. FDM will have a traversal speed of 4000mm/min. extruding a layer 0.5 mm wide and 0.2mm thick would allow a build rate of 400 or 1.5 mm3/min a water-soluble support material is also available for ABS parts. A range of materials are available including ABS Polyamide, polycarbonate, polypropylene, and investment casting wax. A large FDM machines have been developed that directly extrude thermoplastic pellets to print larger parts and structures.

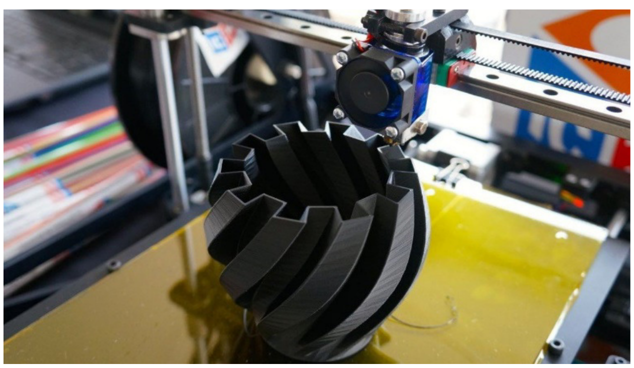

Fig 3- FDM working

3. SELECTIVE LASER SINTERING (SLS) This selective laser sintering (SLS) technology was conspicuous in year 1989 and was originally sold by Dtm Corporation. DTM was acquired by 3d systems in 2001.it is similar to SLA but laser is more powerful. SLS is an additive manufacturing method that uses a powder bed fusion process to build 3d parts. The Thermoplastic powder is spread across a roller over the surface of a build cylinder. The piston is move from one position to another position .A piston cylinder is moving into downward direction then an object layer thickness to accommodate the new layer of powder. A piston moving into upward direction then it results into an incrementally to supply a measured quantity of powder for each layer. A laser beam is target over the surface of this tightly compacted powder to selective melt and joining the grains together to form a layer of the object. The fabrication chamber is maintained at a temperature slightly to a cause sintering-the grains are not entirely melted, just their outer surfaces-which greatly speeds up the process. The process is several times repeated then the layer by layer, will remain until the entire object is formed. After the object is fully formed. The piston is raised. Excess powder is simply brushed away and final manual finishing may be carried out. Machining can be done once at a time.

Fig 4- SLS working

II. DESIGN & 3D PRINTING

- **Base Design**

The very first part need to be visualized and designed is base. It should be strong sturdy and dimensionally stable in order to support the whole design.

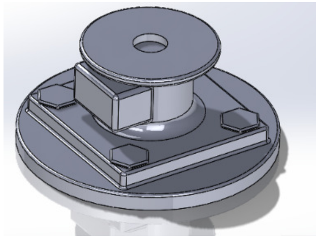

Figure 5: Base

- ## Cylindrical rotary joint

After base of the pick and place robot has been put on place there should be cylindrical rotary joint need to be designed to perform whole 360^0 movement action.

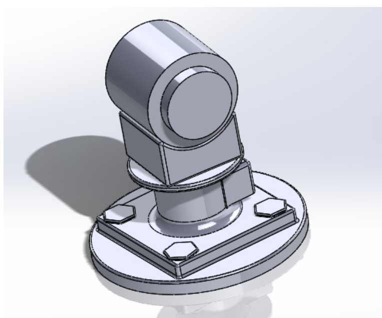

Figure 6: Cylindrical rotary joint

- ## Arm joint

Arm of the robot is one of the crucial part of whole assembly. It carries the job of accurately performing vertical and horizontal position of end effecter to carry out pick and place operation.

Figure 7: Arm joint

- ## End effector

End effector used to perform end operation and make it flexible to choose according to application robot going to perform.

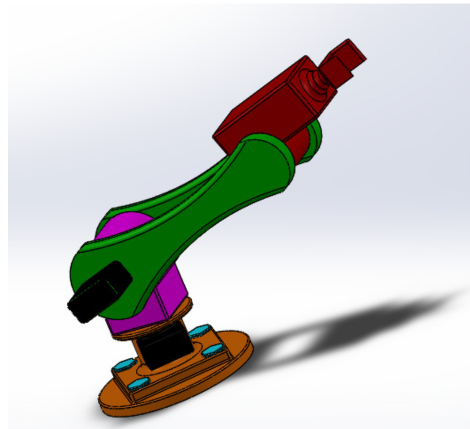

Figure 8: End effector with Assembly

- ## 3D-PRINTING PROCESS

After completion cad model.it can be converted into a stl file for a printing we must use slicers software which is discussed early topic. There are different types of 3d-printer in world. Depending on our ability we must selected a dual extruder machine.

- ## MATERIALS

a) Filament diameter:1.75 mm
b) Works with ABS,PLA AND OTHER MATERIALS

- ## SELECTED MATERIAL ACRYLONITRILE-BUTADIENE-STYRENE (ABS)

ABS is a common material for 3d-printing.ABS means Acryonitrile-butadiene-styrene is widely used and versatilethermoplastics. ABS is a light weightmaterial.ABS is anamorphous blend

consisting of threemonomers;acrylonitrile, butadiene, and styrene.
1. Acrylonitrile adding thermal and chemicalenhancements.
2. Butadiene donate impact strength and toughnessto the plastic.
3. Styrene will added a sleek, glossy surface to theplastic.

ABS formula ((C8H8)X(C4H6)Y(C3H3N)Z)

IV. ACKNOWLEDGMENT

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