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Amalgamation of 3D Printing with Fabrication Robotics

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Abstract: ***3D printing has always been a matter of curiosity to layman. But for engineers and innovators, 3D printer is viewed as a machine of additive manufacturing domain. It is definitely revolutionary in that area but if we remove such a myopic vision, we can say that a 3D printer is devise giving relative motions in 3 directions. Taking the advantage of this, we can assign multiple roles to 3D printer. In normal product building process, raw materials are converted and processed with subtractive manufacturing processes. Than they are treated with number of fabrication processes for final end product. On this journey, they pass through different layouts and machines. But if we develop a single unit machine where raw product is processed and also fabricated on single bed resulting in end product, than we can bring a paradigm shift in manufacturing technology in prevailing world.***

Keyword: 1. Additive manufacturing, 2. 3D printing, 3. Digital manufacturing, 4. Rapid prototyping, 5. Industrial engineering.

I. INTRODUCTION

Before advent of assembly line manufacturing by Henry Ford in 1913 through his Model T car. It was such a revolution at that time required to complete the product was drastically reduced. Moreover, quality was also uplifted. Seeing this success, whole manufacturing realm adopted this methodology.

Soon production rate escalated inn whole world. Then came the robotics. They were assigned the task which were too dangerous for humans to work or the tasks which were monotonous in nature. A whole field dedicated to it was set up under domain of robotics. But still line assembly process continued.

Robots were placed in line at their respective positions. Moreover, raw materials which were initially processed are majorly done by subtractive manufacturing processes.

Subtractive manufacturing incurs great loss of materials, labour & time. Than material is further transported to fabrication machines for fabrication process.

Instead, we can build product from 3D printer by raw material using additive manufacturing. This has any advantages such as cost reduction, labour reduction, etc. And integrating new idea with this is of mounting fabrication tools on same gantry on which 3D part was printed. So now, whole product would be resultant end product on same unit.

II. METHODOLOGY USED

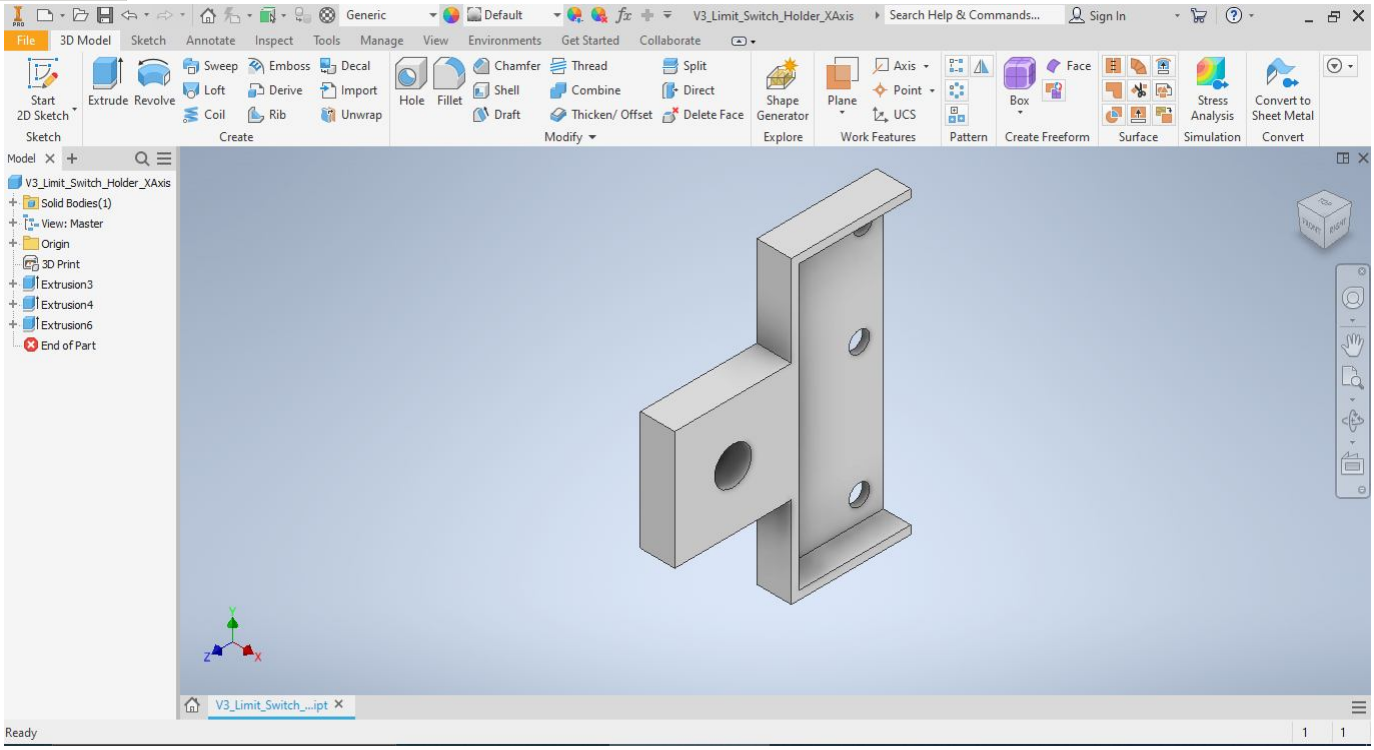
Before we started building our prototype, we deduced to as what manufacturing process and which fabrication processes we should use. Both are major processes containing many minor processes. So from additive manufacturing, we have selected 3D printing and from fabrication processes we have opted for drilling. Changing of modules / heads on 3D printer which we built by our own selves plays a key role.

III.BUILDING THE PROTOTYPE

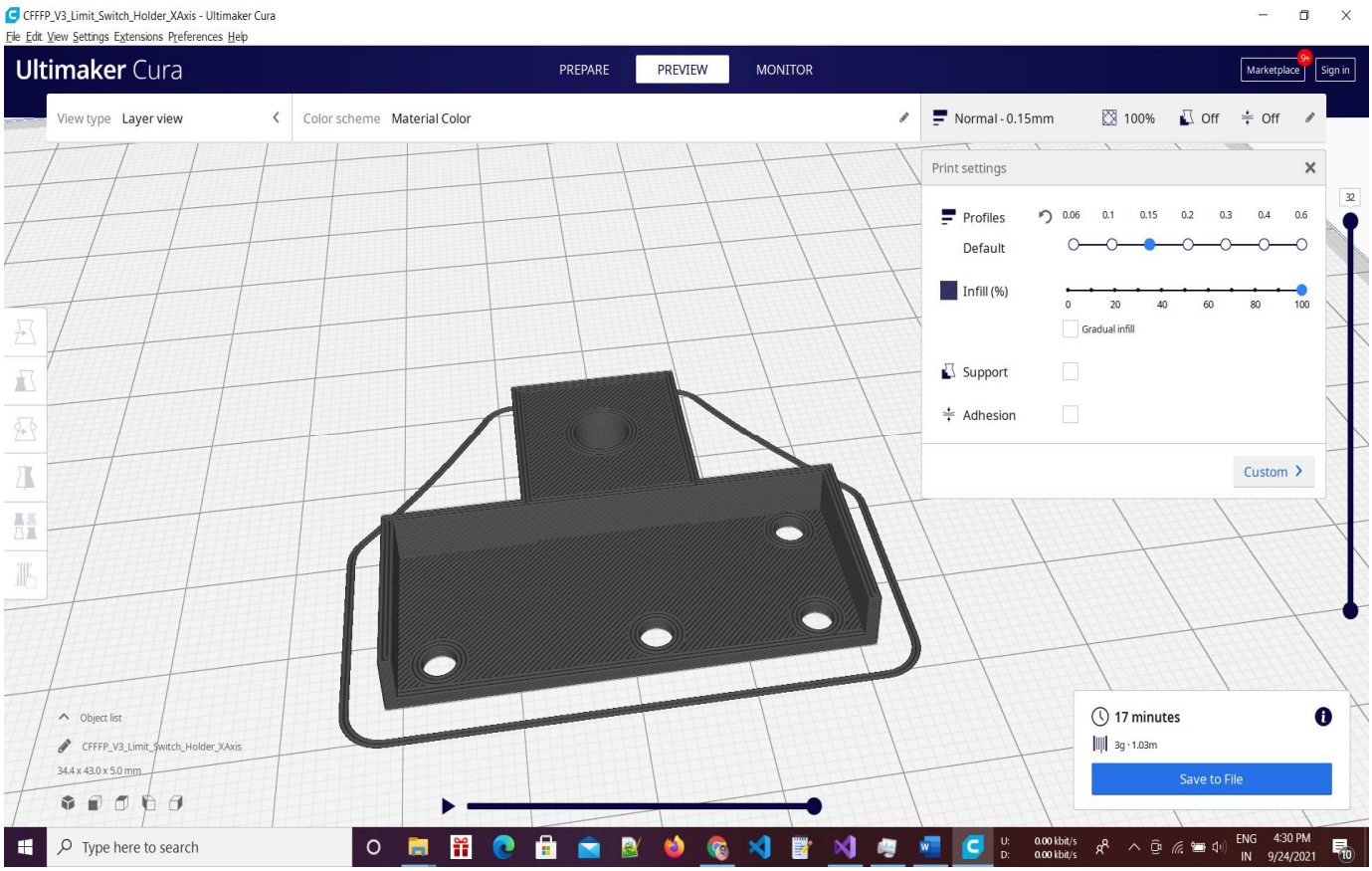
For building our own 3D printer which can give movement in 3 directions by carrying a module which can replace or switched with no. of other modules / heads. We made basic frame from aluminum extrusion. Belt drive was used to give movement in X & Y direction while Z was given movement with lead screw. SKR board was used as controlling unit. PLA material was used as printing material. PLA was chosen because it is having enough strength, durability, resistance to corrosion, easy availability and many such factors.

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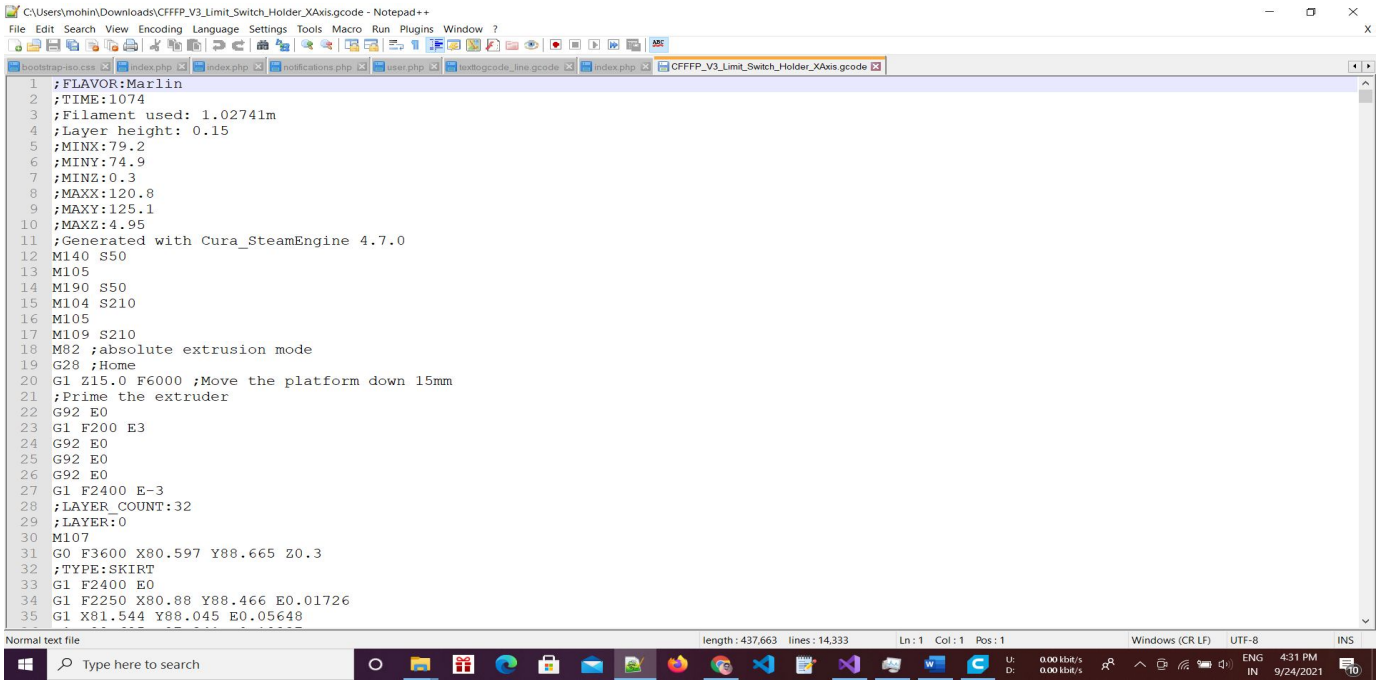


1.) Modelling component in AutoCAD.



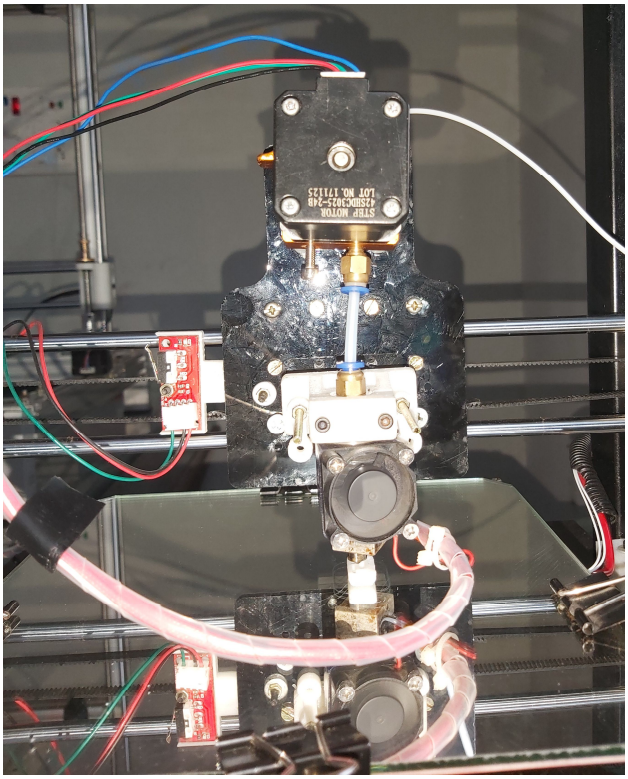
2.) Slicing the object in slicing software.

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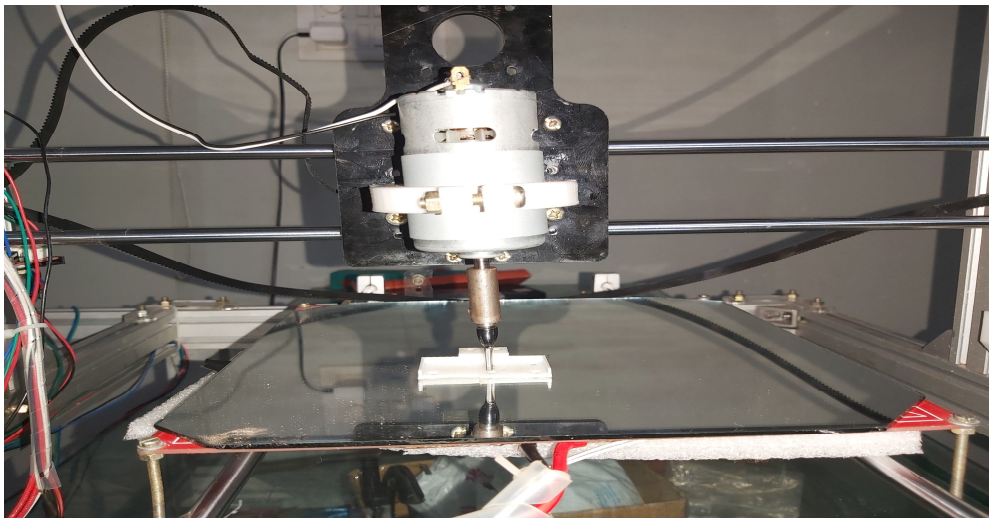
3.) Gcode for component.

We decided to make a lead screw holder used in 3D printers to hold lead screw. It is perfect testing model as it involves both manufacturing process as well as a fabrication process. In orthodox manufacturing, a cubical piece was to be taken than it had to be given shape with hacksaws. Holes were to be drilled out by a separate drilling machine which would be in another area of workshop. Moreover post processing is still left. In this whole chaos, due subtractive manufacturing approach, material wastage is immense. Time taken is also ample. Labour has to do huge amount of hard work.



3.) 3D printing of component.

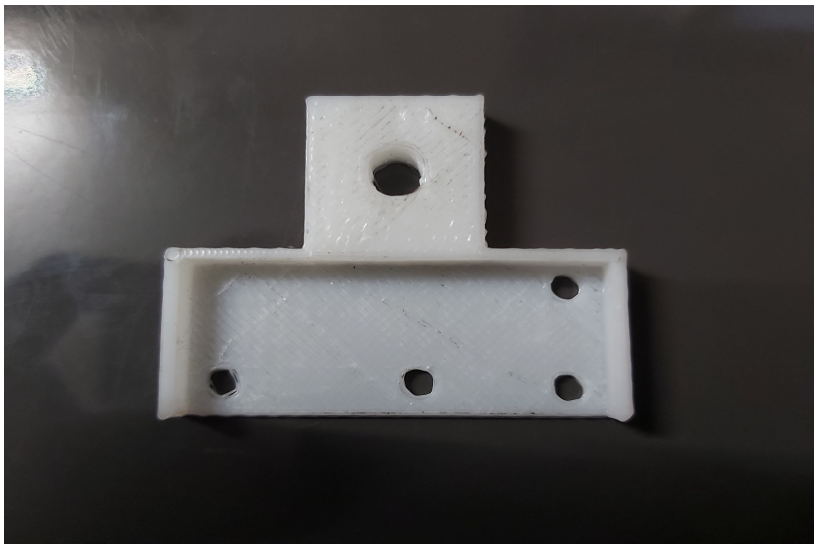
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4.) Drilling head switching the 3D printer head.

IV. CONCLUSION

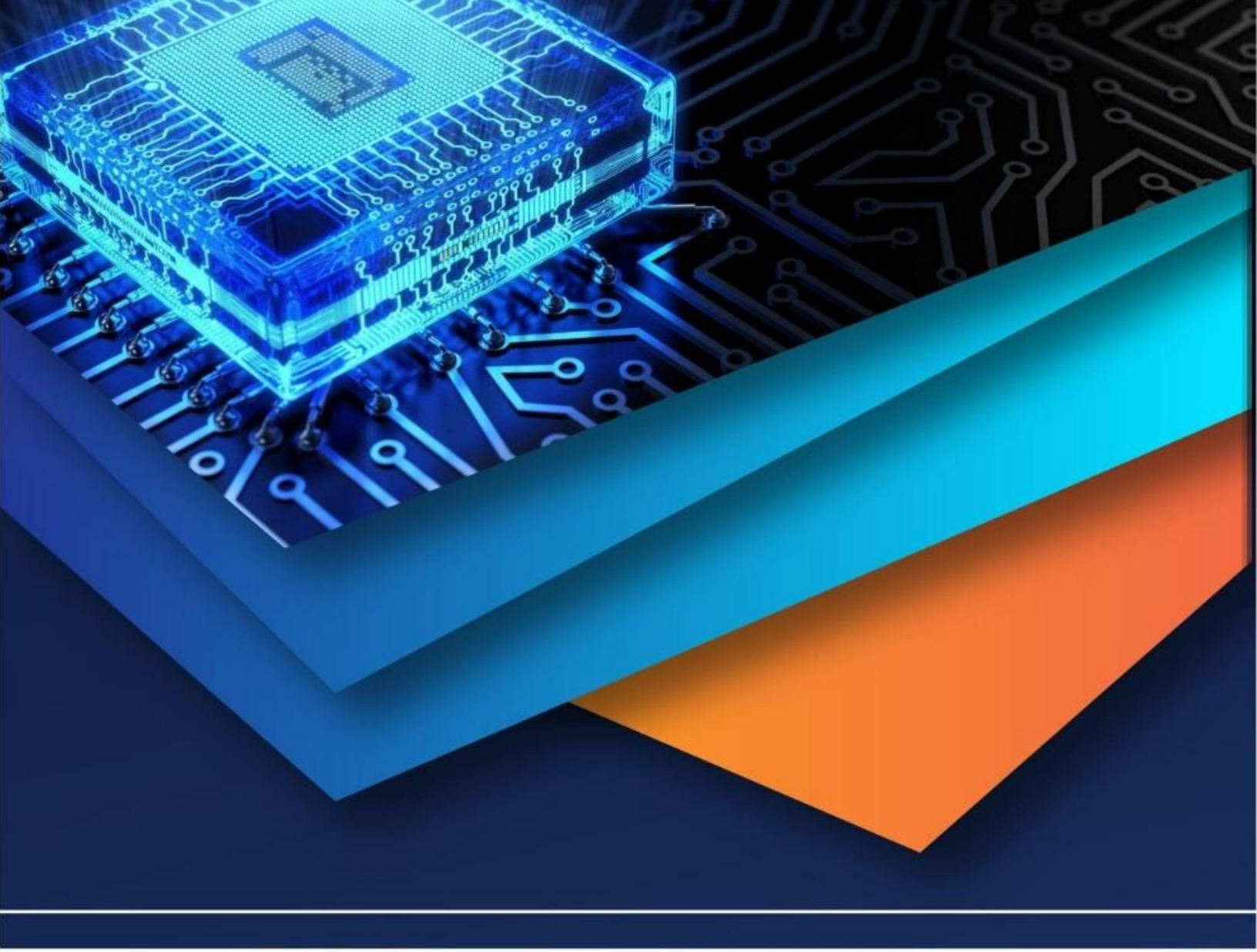
On contrary to this, lead screw holder can 3D printed with PLA. Due to additive manufacturing approach, we can have negligible amount of material wastage. Moreover, it is light in weight. We can control its infill volume. It eliminates labour work as it is automatic process. Once file is inserted and run, printer will do its work. Secondly, for drilling, instead of going to drill machine, we can insert drill head/ module in place 3D printer head/module. This reduces transportation time thus reducing Lead time. Even small saving of Lead time in factory is worth of large sum of money. Further more research and development is required as we can have a turret mechanism holding multirole including 3D printer head with other fabricating tools. Moreover, actuators and robotics arms can also be mounted on this gantry to join or weld parts and thus make more complex products end use ready.



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